Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Radiofrequency electromagnetic fields in public spaces in Ireland

Results of the RF EMF Monitoring Programme 2021-2022

Office of Radiation Protection & Environmental Monitoring
Environmental Protection Agency (EPA)
Johnstown Castle Estate, Co Wexford

June 2023

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/04	15 June 2021	J Vila

1. Measurement survey characteristics

Measurement date:	16th April 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	The Liberty Tree, Kennedy Avenue, Carlow, Co Carlow
GPS coordinates:	52°50'07.0" N; 6°55'46.5" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Carlow town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

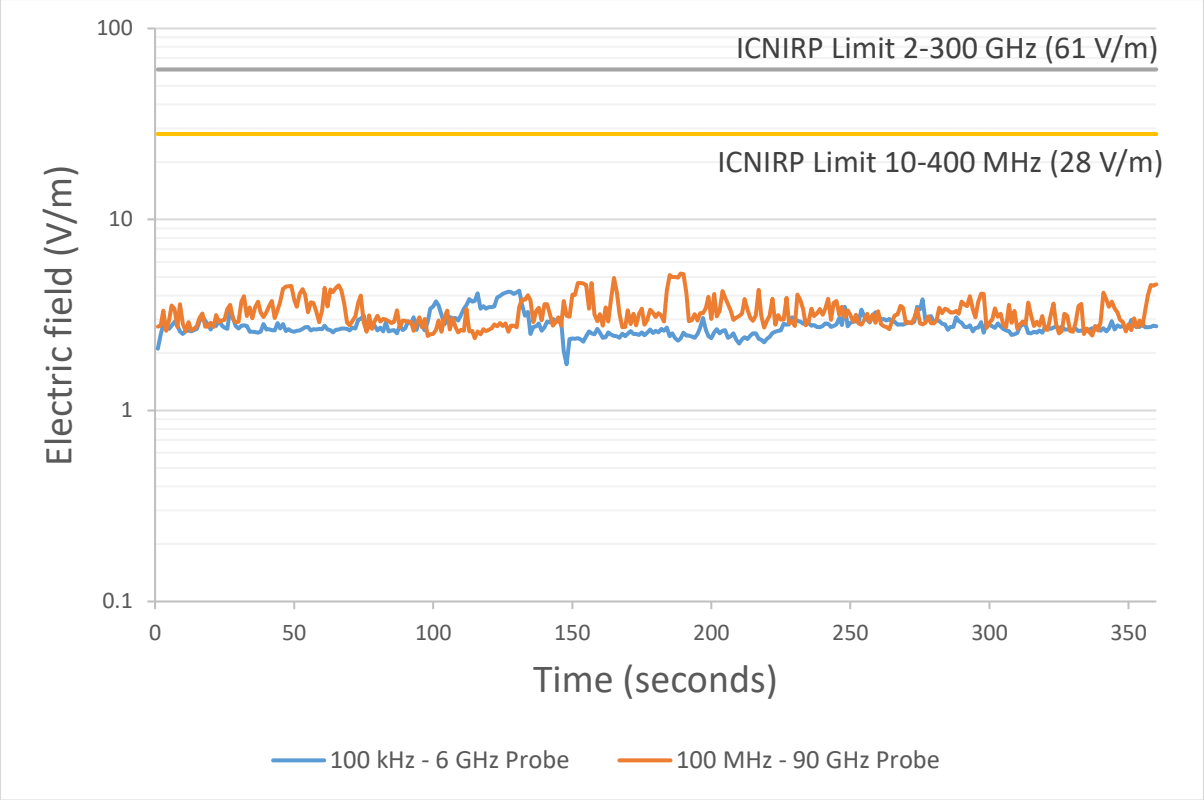
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.79 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, FM Radio 2G (GSM), 3G (UMTS), 4G (LTE), 5G (3.6 GHz band) and Wi-Fi
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Carlow town (The Liberty Tree, Kennedy Avenue) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



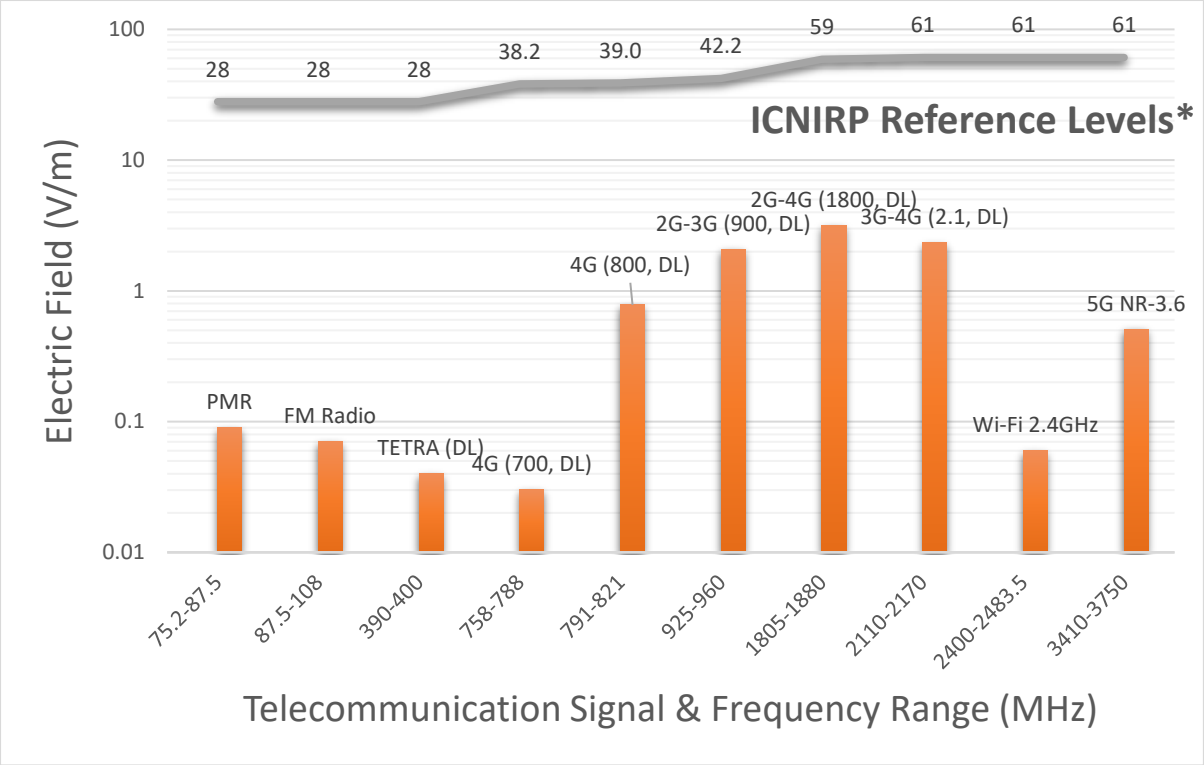
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	2.79	0.021	4.24	0.048	28*	2*
100 MHz - 90 GHz	3.24	0.028	5.21	0.072	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; PMR: Professional Mobile Radio; NR: New Radio; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
PMR	75.2-87.5	0.09	0.000021	0.04	0.000004	28	2
FM Radio	87.5-108	0.07	0.000013	0.06	0.000010	28	2
TETRA (DL)	390-400	0.04	0.000004	0.03	0.000002	28	2
4G (700, DL)	758-788	0.03	0.000002	0.02	0.000001	38.2	3.87
4G (800, DL)	791-821	0.78	0.00161	0.63	0.001053	39.0	4.04
2G-3G (900, DL)	925-960	2.08	0.01148	1.70	0.007666	42.2	4.72
2G-4G (1800, DL)	1805-1880	3.15	0.02632	1.43	0.005424	59.0	9.23
3G-4G (2.1, DL)	2110-2170	2.33	0.01440	1.11	0.003268	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.06	0.00001	0.04	0.000004	61	10
5G NR-3.6GHz	3410-3750	0.51	0.00069	0.21	0.000117	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; PMR: Professional Mobile Radio; NR: New Radio; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.79 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 6 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (3.15 V/m) is likely to correspond to the emission (downlink) from nearby 2G/4G antennas. A 3.6 GHz band 5G signal was detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/16	19 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	29th March 2022
Measurement time (approx.):	11:00 am – 12:00 pm
Measurement point & location:	Market Square, Cavan, Co Cavan
GPS coordinates:	53°59'28.0"N; 7°21'37.7"W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Cavan town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

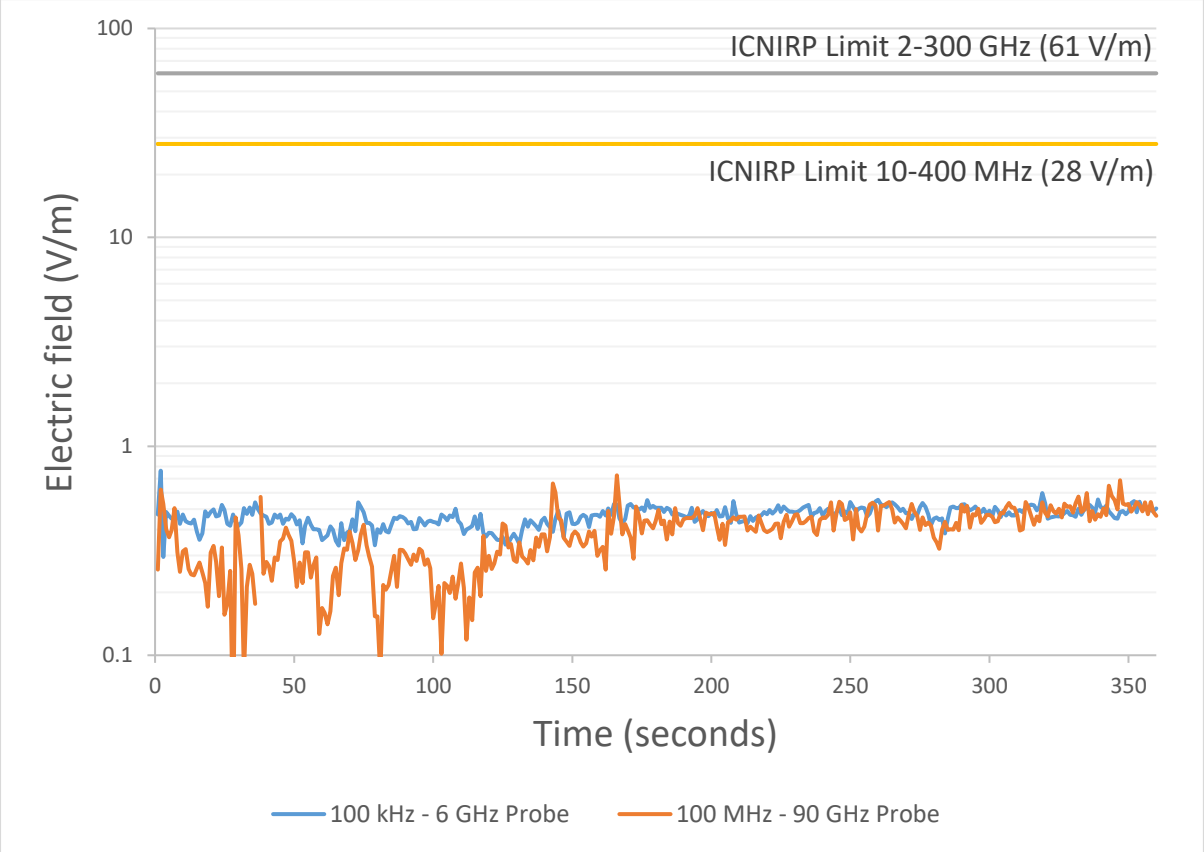
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.46 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	PMR, TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Cavan town centre (Market Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



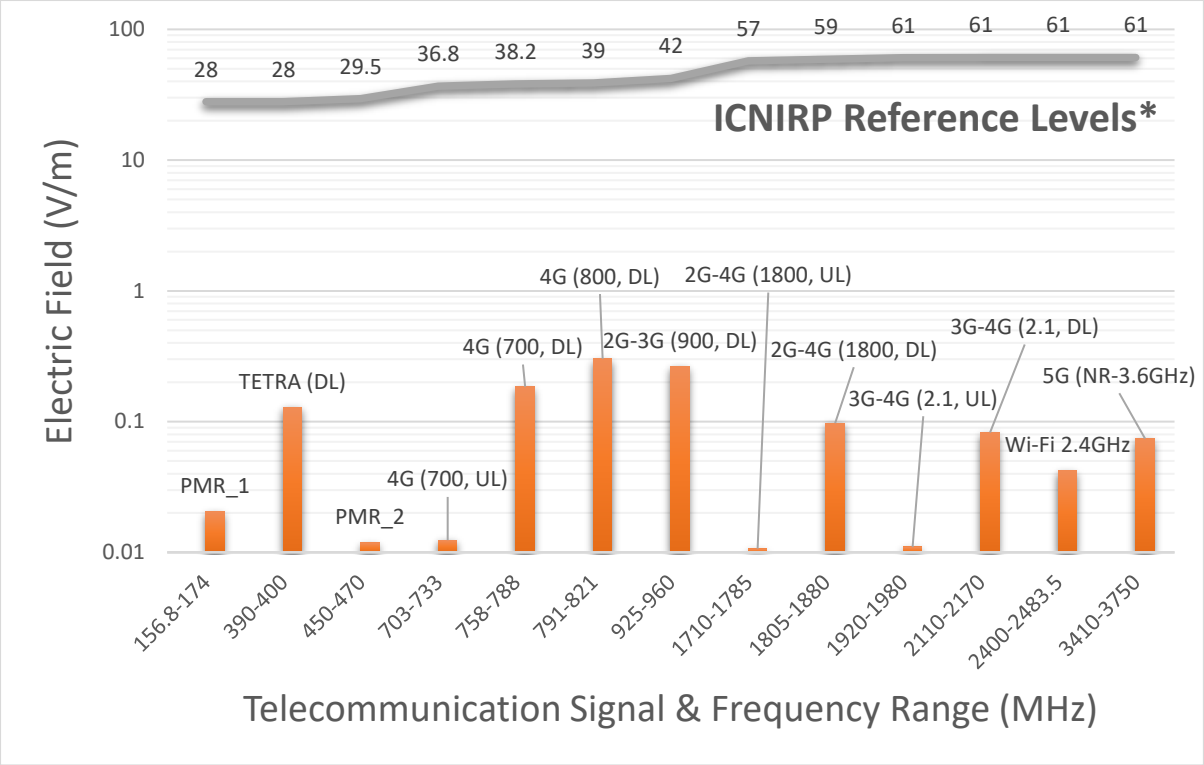
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.46	0.001	0.76	0.002	28*	2*
100 MHz - 90 GHz	0.38	0.000	0.73	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

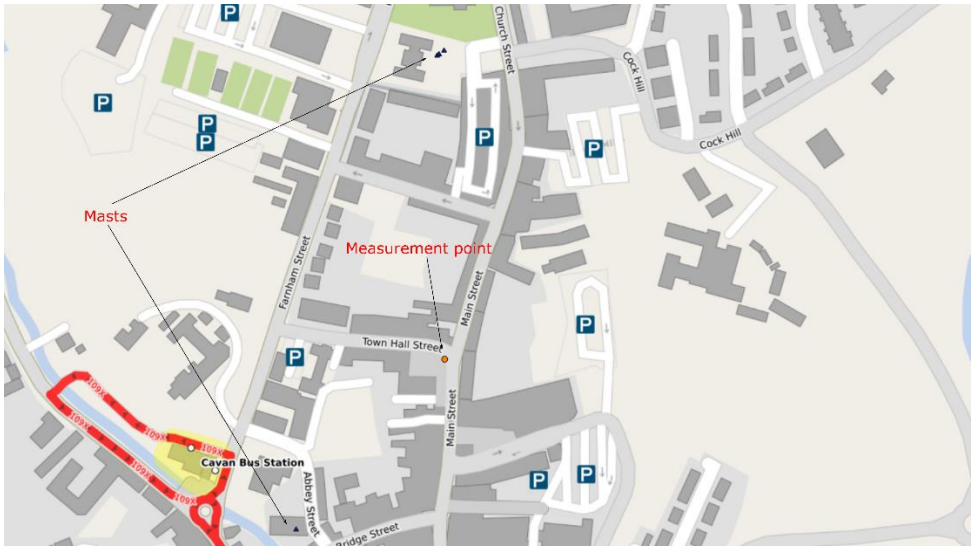
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
PMR_1	156.8-174	0.02	0.000002	0.02	0.000001	28.0	2.0
TETRA (DL)	390-400	0.15	0.00006	0.13	0.00004	28.0	2.0
PMR_2	450-470	0.01	0.0000004	0.01	0.0000004	29.5	2.3
4G (700, UL)	703-733	0.02	0.000001	0.01	0.0000004	36.8	3.6
4G (700, DL)	758-788	0.26	0.0002	0.18	0.00009	38.2	3.9
4G (800, DL)	791-821	0.38	0.0004	0.30	0.0002	39	4.0
2G-3G (900, DL)	925-960	0.33	0.0003	0.27	0.0002	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.03	0.000002	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.14	0.00005	0.10	0.00003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.06	0.000009	0.01	0.0000003	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.13	0.00004	0.08	0.00002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.31	0.0003	0.04	0.000005	61	10
5G (NR-3.6GHz)	3410-3750	0.19	0.00009	0.07	0.00001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.46 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.38 V/m) is likely to correspond to the emission (downlink) from nearby 4G (800 MHz) antennas. 5G signals were detected at the point of measurement, with a maximum level of 0.19 V/m (without data traffic) and 0.23 V/m (with data traffic, making a video call with a 5G mobile phone connected to an available 5G network)

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/22	15 Nov 2021	J Vila

1. Measurement survey characteristics

Measurement date:	29th October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	O'Connell Square, Ennis, Co Clare
GPS coordinates:	52°50'40.0" N; 8°58'58.5" W
Survey staff:	Javier Vila, David Fenton
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Ennis town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

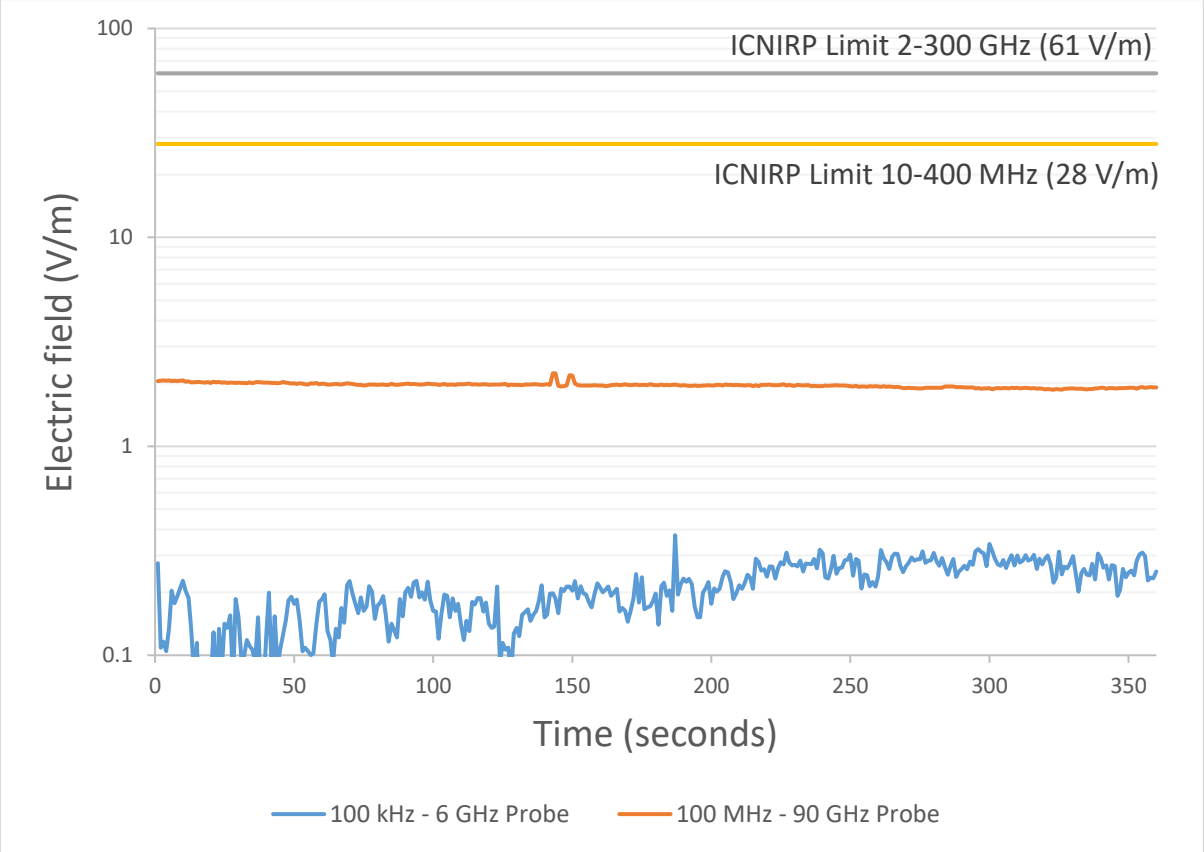
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.21 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), 5G (3.6GHz), Wi-Fi (2.4GHz)
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Ennis town centre (O'Connell Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



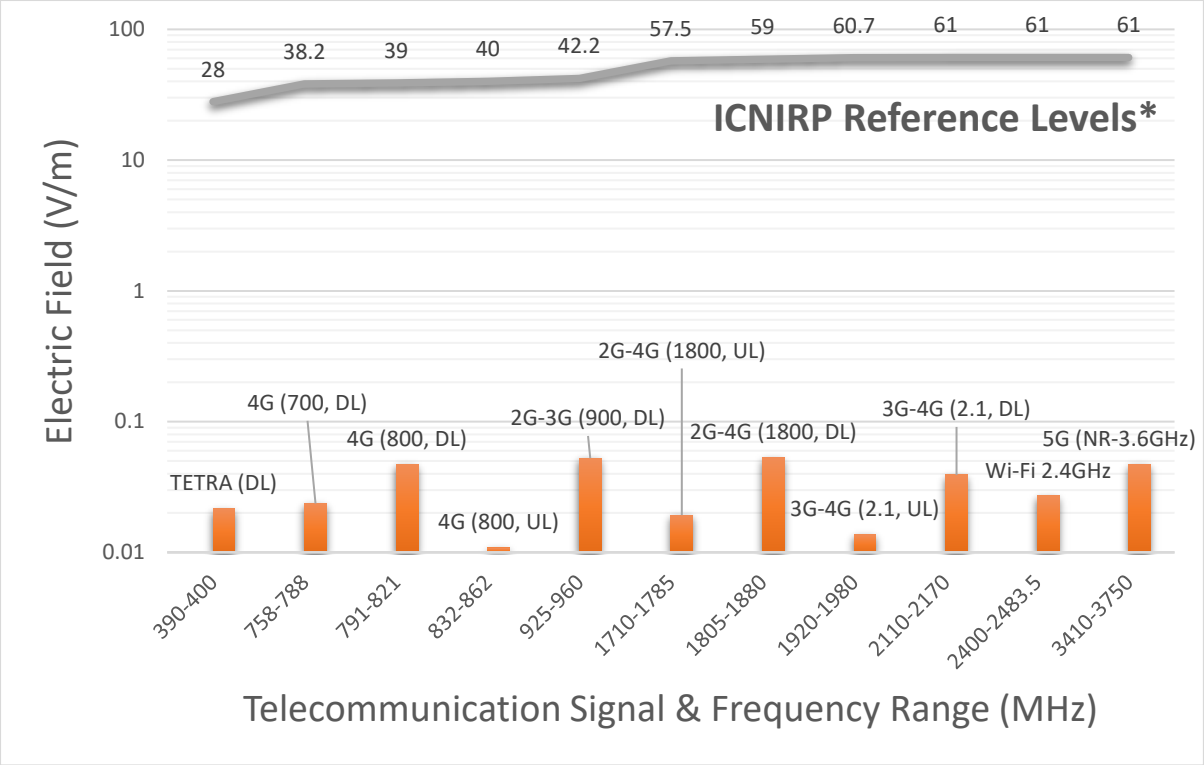
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.21	0.0001	0.38	0.0004	28*	2*
100 MHz - 90 GHz	1.96	0.01	2.24	0.013	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. [*]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

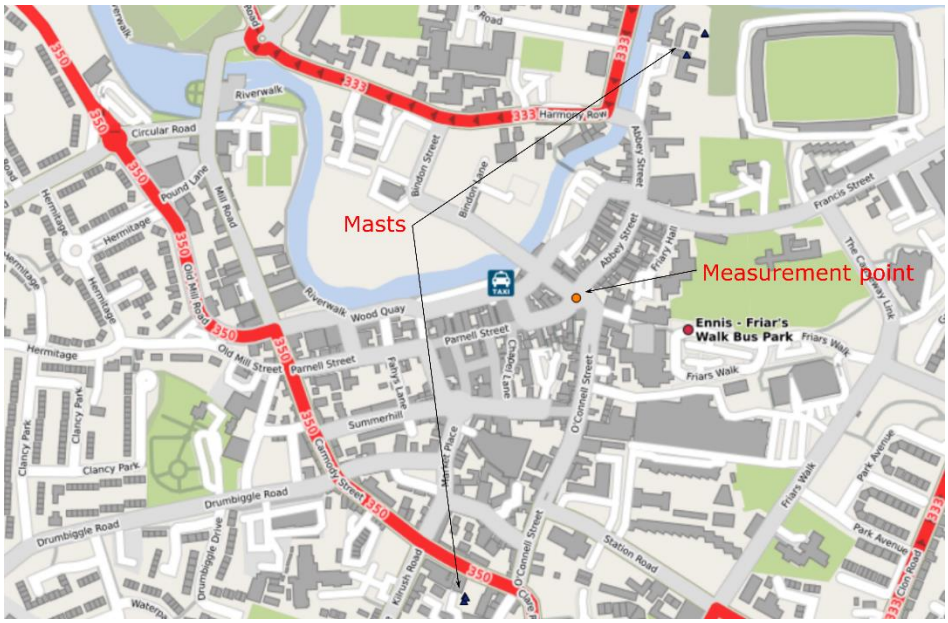
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.03	0.000002	0.02	0.000001	28.0	2.0
4G (700, DL)	758-788	0.04	0.000004	0.02	0.000001	38.2	3.9
4G (800, DL)	791-821	0.06	0.00001	0.05	0.000006	39	4.0
4G (800, UL)	832-862	0.02	0.000001	0.01	0.0000003	39	4.2
2G-3G (900, DL)	925-960	0.07	0.00001	0.05	0.000007	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.19	0.00009	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.09	0.00002	0.05	0.000007	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.14	0.00005	0.01	0.0000005	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.06	0.00001	0.04	0.000004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.19	0.00010	0.03	0.000002	61	10
5G (NR-3.6GHz)	3410-3750	0.11	0.00003	0.05	0.000006	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.21 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.19 V/m) is likely to correspond to the emission from nearby Wi-Fi (2.4 GHz) signals. 5G (3.6 GHz band) signals were detected with a maximum (pilot signal) level of 0.11 V/m at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

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The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/07	12 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	3rd March 2022
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Main Street, Carrigaline, Co Cork
GPS coordinates:	51°48'48.3" N; 8°23'31.7" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Carrigaline town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

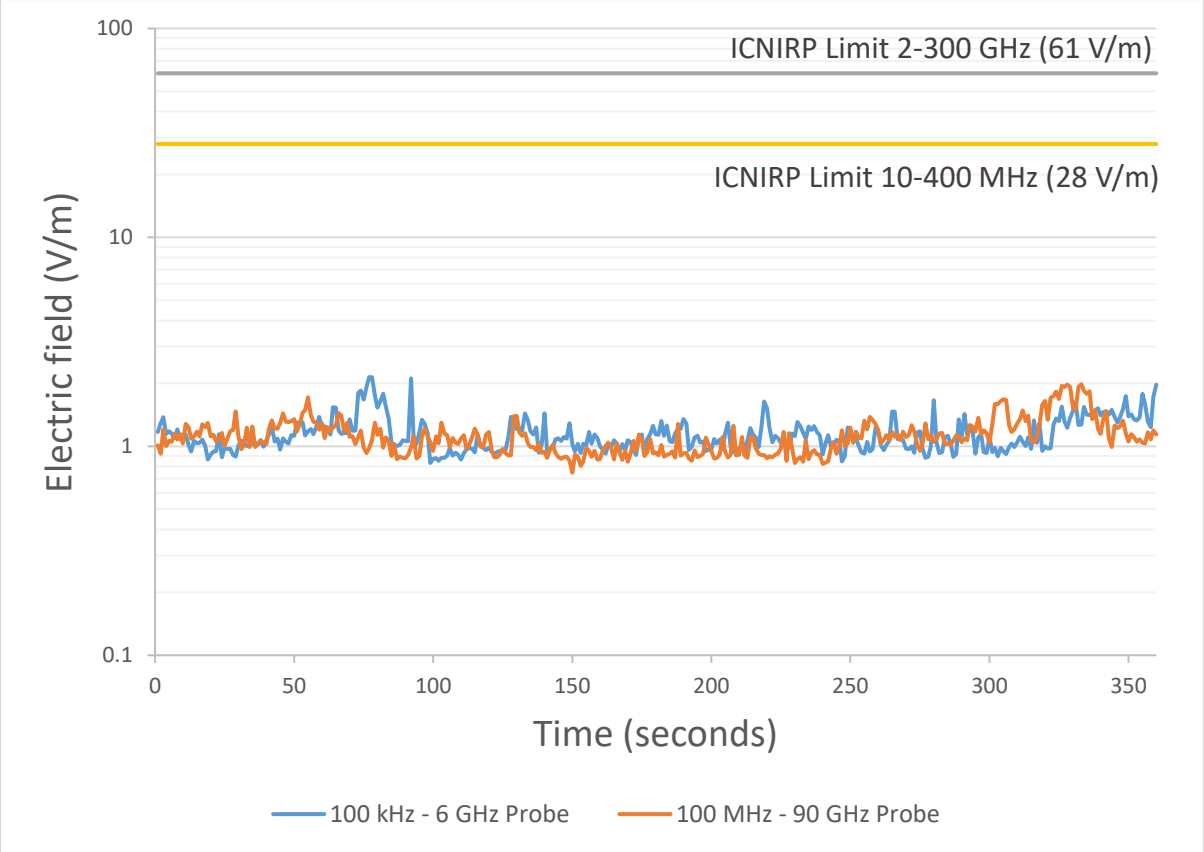
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.14 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	1 nearby site (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Carrigaline town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



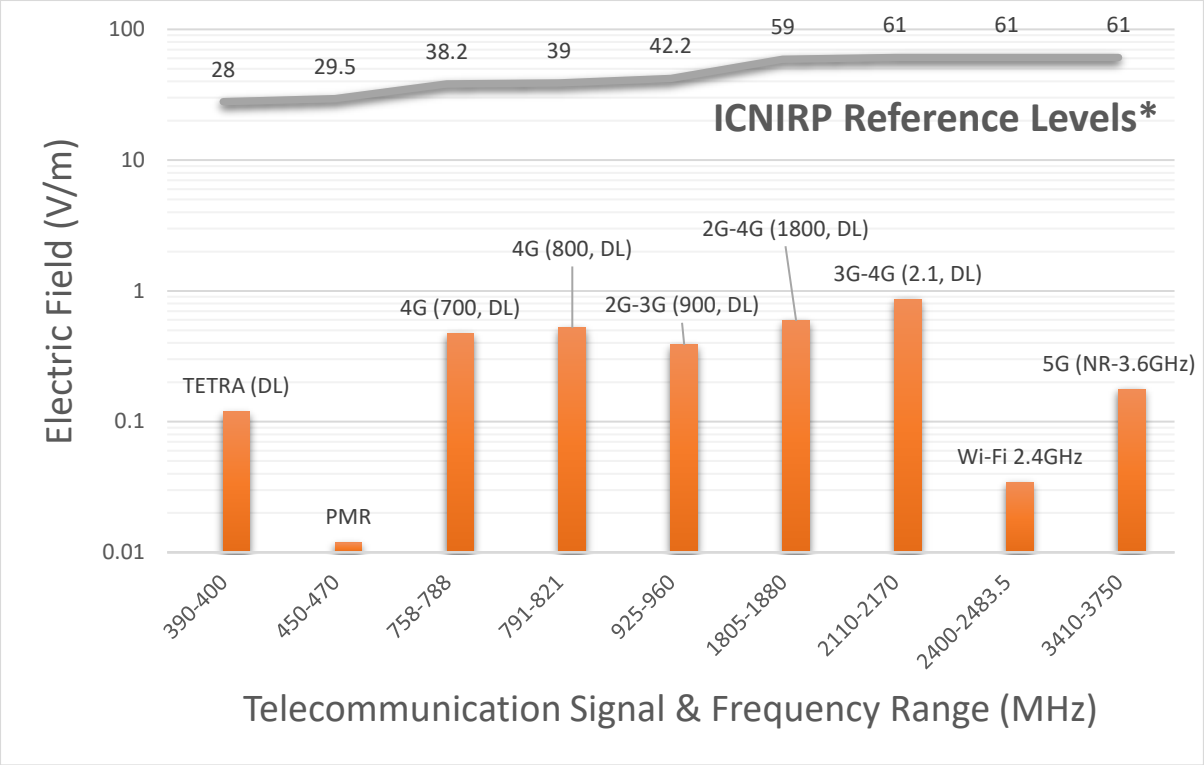
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.14	0.003	2.14	0.012	28*	2*
100 MHz - 90 GHz	1.12	0.003	1.98	0.010	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

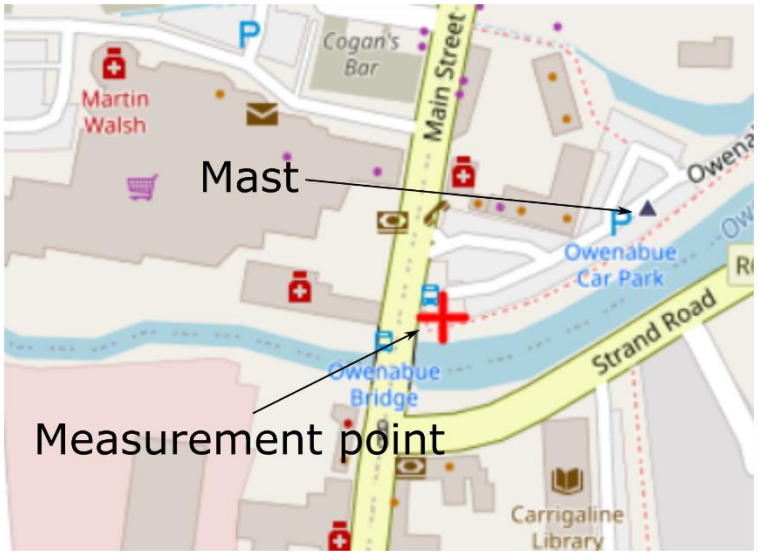
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.16	0.00007	0.12	0.00004	28.0	2.0
PMR	450-470	0.01	0.000001	0.01	0.0000004	29.5	2.3
4G (700, DL)	758-788	0.83	0.002	0.47	0.0006	38.2	3.9
4G (800, DL)	791-821	0.90	0.002	0.52	0.0007	39	4.0
2G-3G (900, DL)	925-960	0.51	0.0007	0.39	0.0004	42.2	4.7
2G-4G (1800, DL)	1805-1880	1.01	0.003	0.59	0.0009	59.0	9.2
3G-4G (2.1, DL)	2110-2170	1.45	0.006	0.86	0.002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.05	0.000007	0.03	0.000003	61	10
5G (NR-3.6GHz)	3410-3750	0.36	0.0003	0.18	0.00008	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.14 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.45 V/m) is likely to correspond to the emission (downlink) from nearby 3G-4G (2.1 GHz) antennas. 5G signals were detected at the point of measurement with a maximum level of 0.36 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/08	12 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	3rd March 2022
Measurement time:	14:30 pm – 15:30 pm
Measurement point & location:	Sandymount St, Cobh, Co Cork
GPS coordinates:	51°51'08.6" N; 8°17'40.5" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Cobh town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

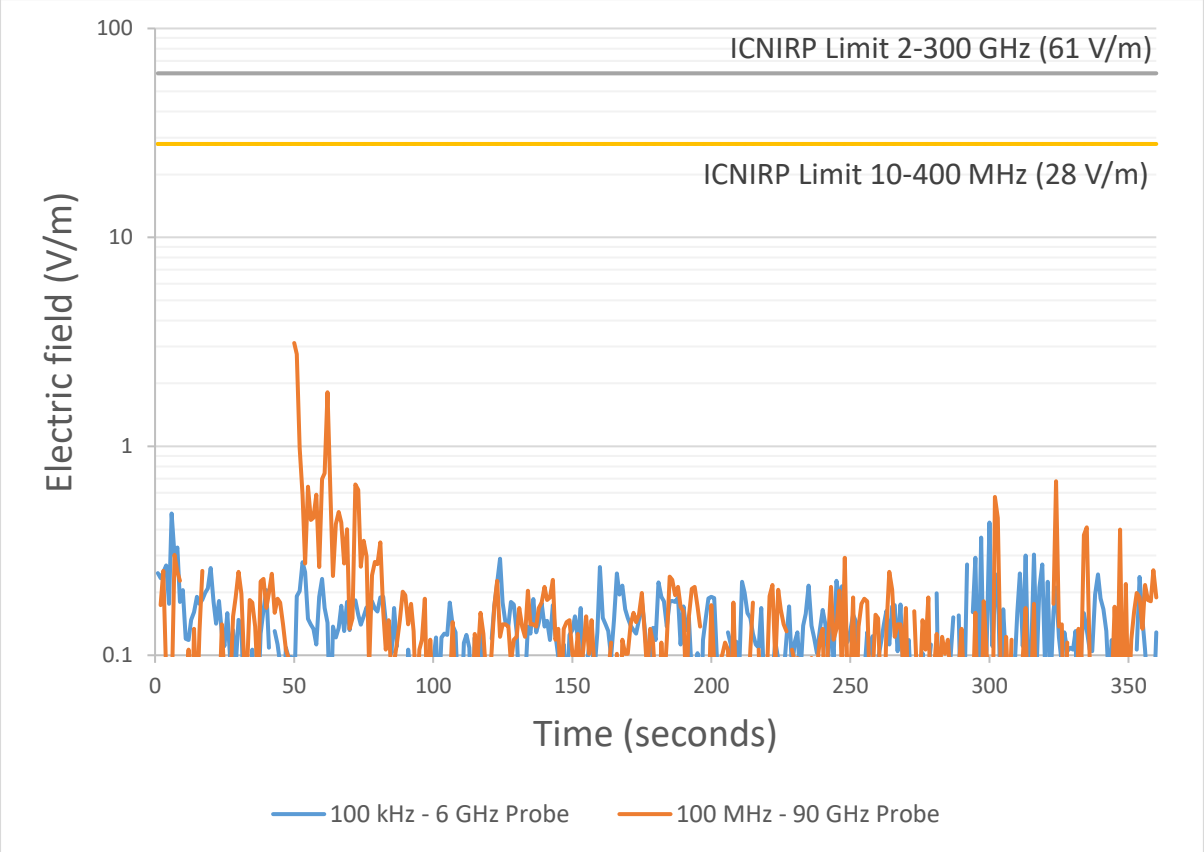
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.13 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, PMR, DVB_T, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), FWALA
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Cobh town centre (Sandymount Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



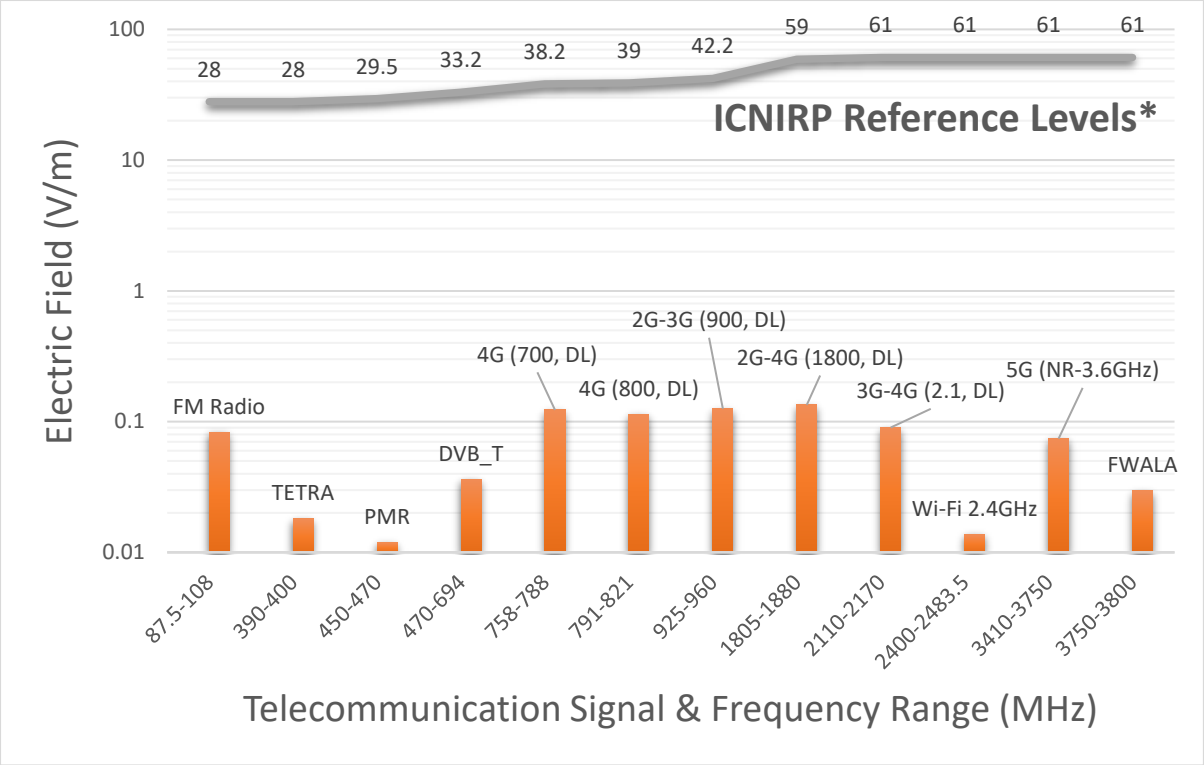
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.13	0.00005	0.48	0.001	28*	2*
100 MHz - 90 GHz	0.16	0.0001	3.12	0.026	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB_T: Terrestrial Digital Video Broadcasting; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

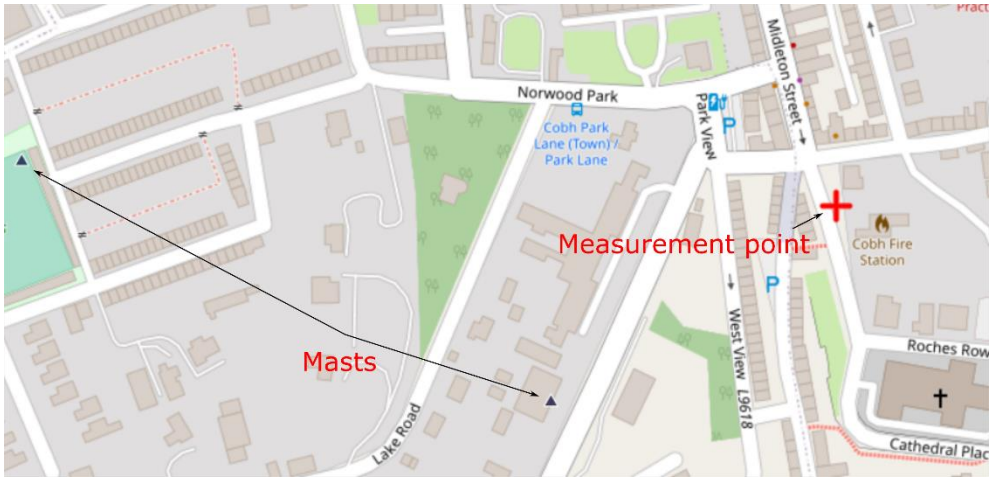
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.09	0.00002	0.08	0.00002	28	2
TETRA	390-400	0.02	0.000002	0.02	0.000001	28	2
PMR	450-470	0.02	0.000001	0.01	0.0000004	29.5	2.3
DVB_T	470-694	0.04	0.000005	0.04	0.000003	33.2	2.9
4G (700, DL)	758-788	0.18	0.00008	0.12	0.00004	38.2	3.9
4G (800, DL)	791-821	0.14	0.00005	0.11	0.00003	39	4
2G-3G (900, DL)	925-960	0.15	0.00006	0.13	0.00004	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.16	0.00007	0.13	0.00005	59	9.2
3G-4G (2.1, DL)	2110-2170	0.14	0.00005	0.09	0.00002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.03	0.000002	0.01	0.0000005	61	10
5G (NR-3.6GHz)	3410-3750	0.14	0.00005	0.07	0.00001	61	10
FWALA	3750-3800	0.04	0.00001	0.03	0.000002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB_T: Terrestrial Digital Video Broadcasting; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.13 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.18 V/m) is likely to correspond to the emission (downlink) from nearby 4G (700 MHz) antennas. 5G signals were detected at the point of measurement with a maximum level of 0.14 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/04	22 April 2022	J Vila

1. Measurement survey characteristics

Measurement date:	2nd March 2022
Measurement time (approx.):	14:00 pm – 15:00 pm
Measurement point & location:	Grand Parade, Cork city, Co Cork
GPS coordinates:	51°53'49.7" N; 8°28'30.1" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Cork city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

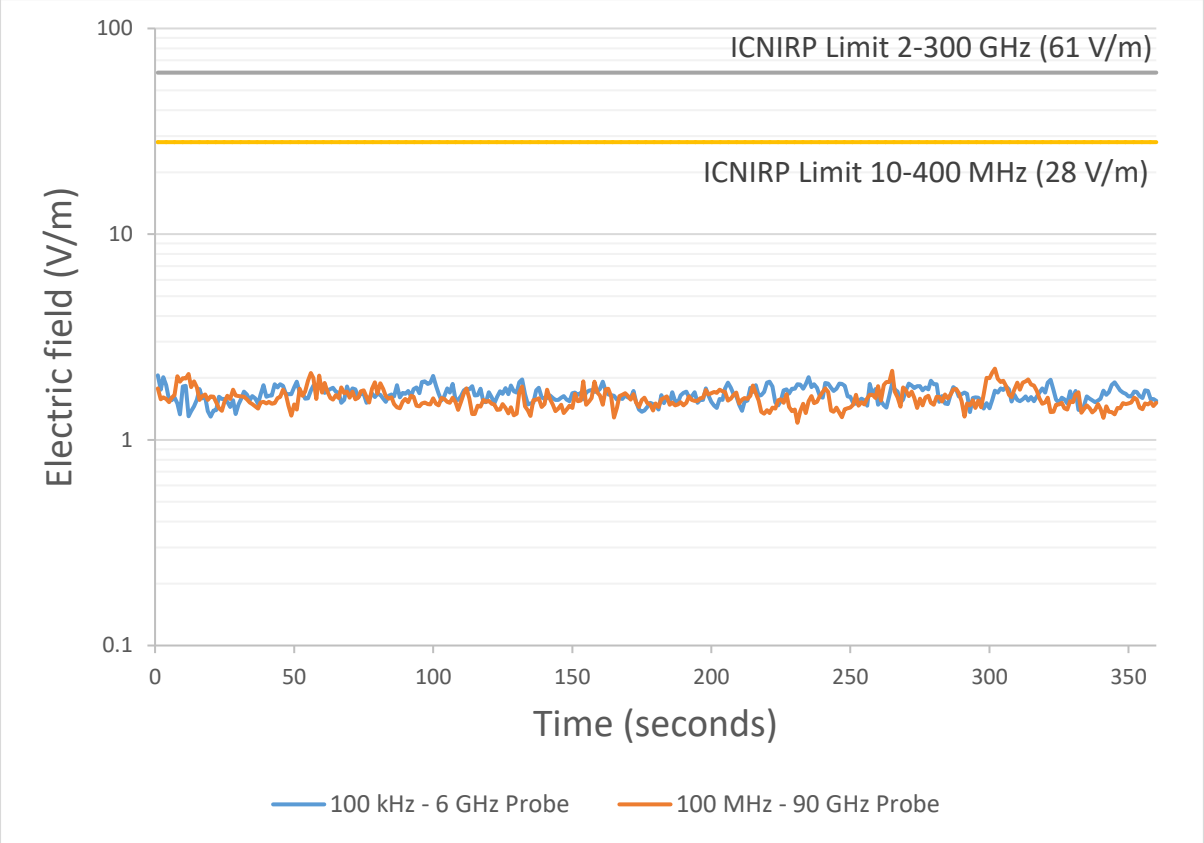
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.66 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4Gz, 5G (NR-3.6GHz), FWALA
Number of nearby telecommunication sites:	9 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Cork city centre (Grand Parade) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



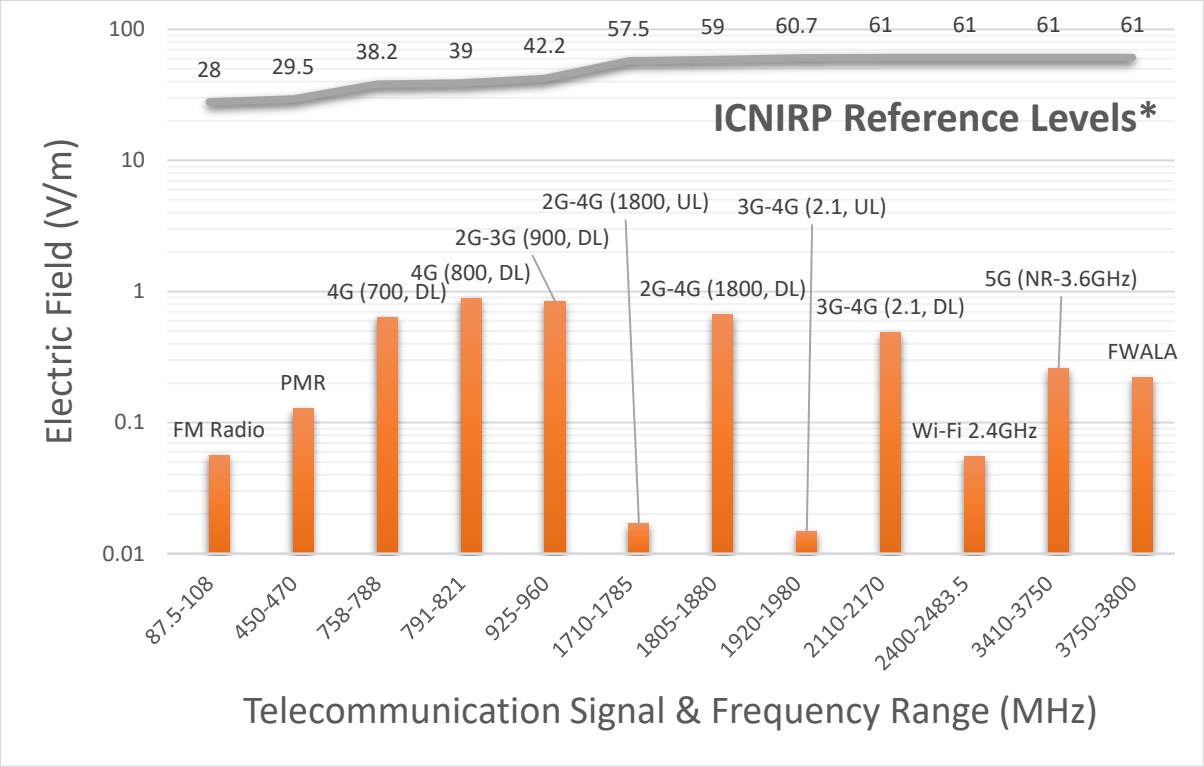
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.66	0.007	2.06	0.011	28*	2*
100 MHz - 90 GHz	1.59	0.007	2.22	0.013	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; FWALA: Fixed Wireless Access Local Area; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

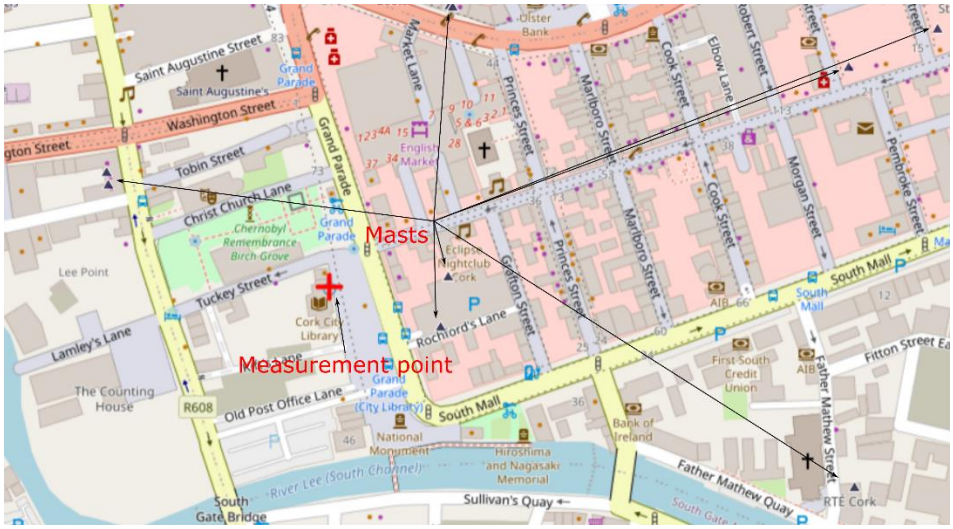
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.62	0.000002	0.06	0.000002	28	2
PMR	450-470	0.24	0.0002	0.13	0.00004	29.5	2.3
4G (700, DL)	758-788	0.98	0.003	0.64	0.001	38.2	3.9
4G (800, DL)	791-821	1.43	0.005	0.89	0.002	39	4.0
2G-3G (900, DL)	925-960	1.04	0.003	0.84	0.002	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.92	0.002	0.67	0.001	59	9.2
3G-4G (2.1, UL)	1920-1980	0.03	0.000002	0.01	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.64	0.001	0.49	0.0006	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.20	0.0001	0.06	0.000008	61	10
5G (NR-3.6GHz)	3410-3750	0.66	0.001	0.26	0.0002	61	10
FWALA	3750-3800	0.83	0.002	0.22	0.0001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; FWALA: Fixed Wireless Access Local Area; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.66 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.43 V/m) corresponded with emissions (downlink) from nearby 4G (800 MHz) antennas. 5G signals were detected at the point of measurement with an average level without data traffic of 0.26 V/m and a maximum level of 1.55 V/m with data traffic (making a 5G video phone call at around 1 m from the measurement probe).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

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The following EMF measurement equipment was used:

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- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/05	10 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	2nd March 2022
Measurement time:	15:00 pm – 16:00 pm
Measurement point & location:	Patrick Street, Cork city, Co Cork
GPS coordinates:	51°53'55.1" N; 8°28'19.2" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Cork city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

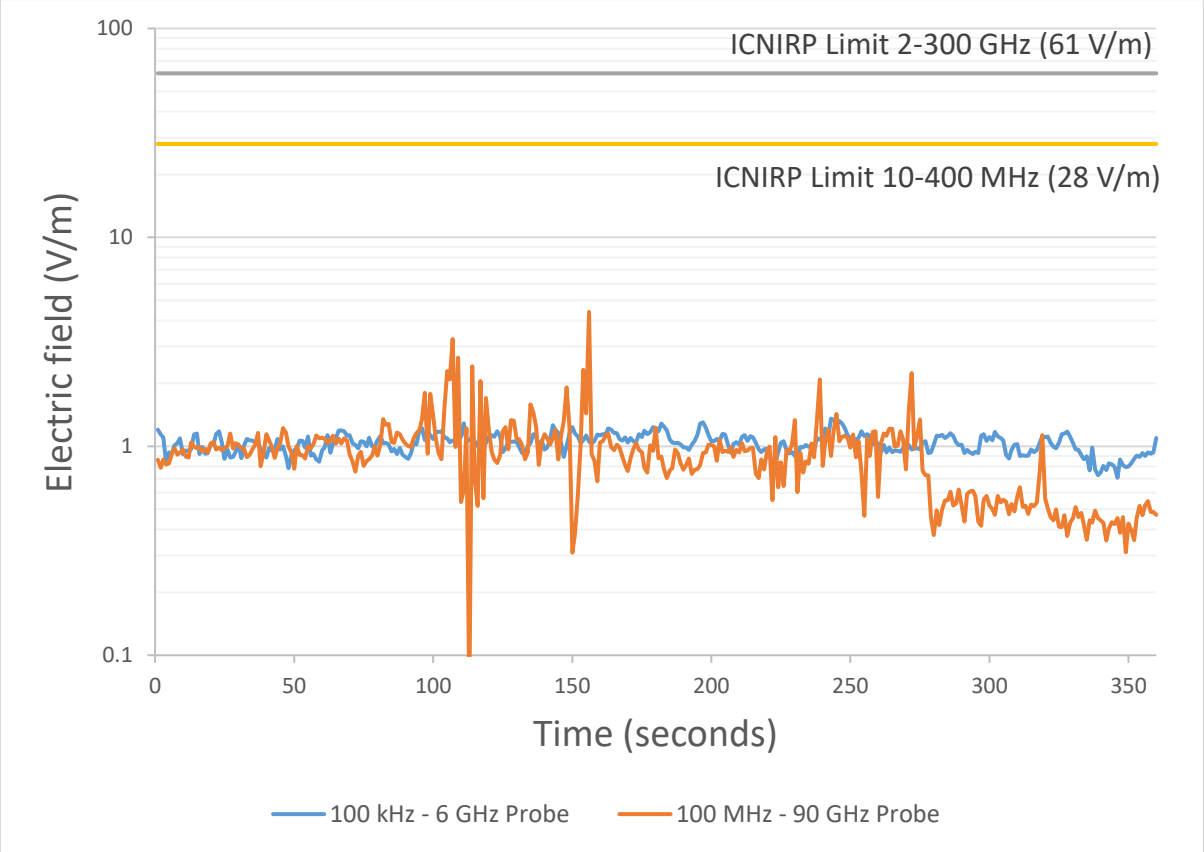
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.03 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, PMR, DVB_T, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), FWALA
Number of nearby telecommunication sites:	8 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Cork city centre (Patrick Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



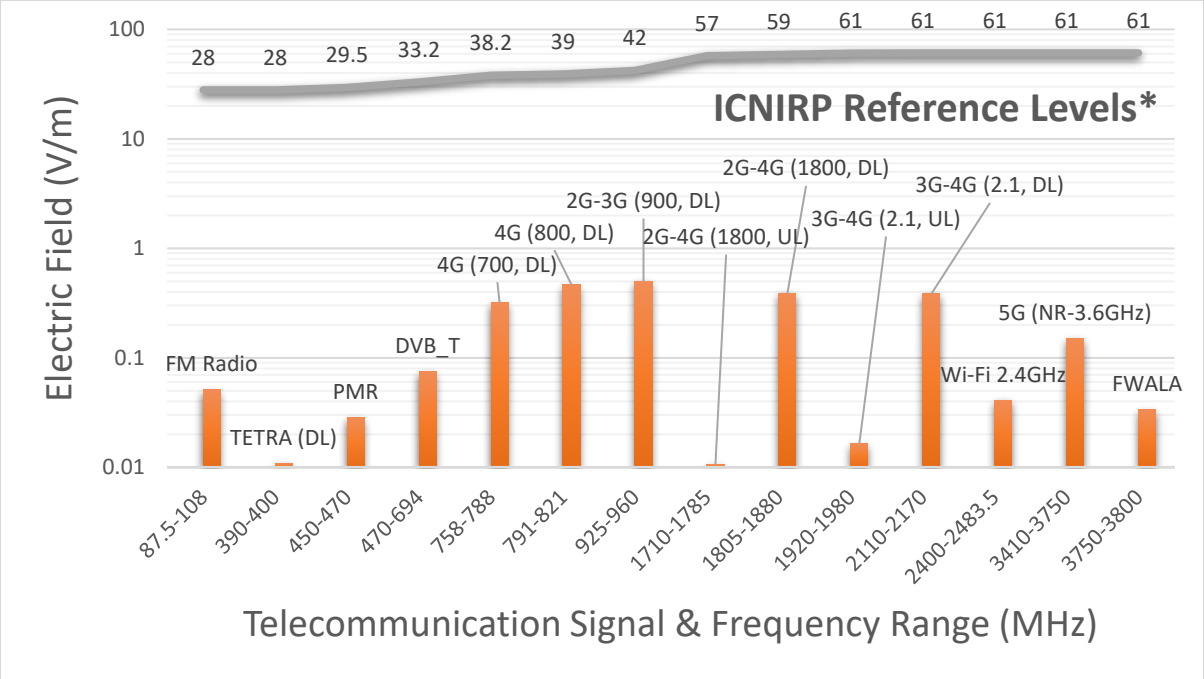
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	1.03	0.003	1.36	0.005	28*	2*
100 MHz - 90 GHz	0.92	0.002	4.40	0.051	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB_T: Terrestrial Digital Video Broadcasting; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

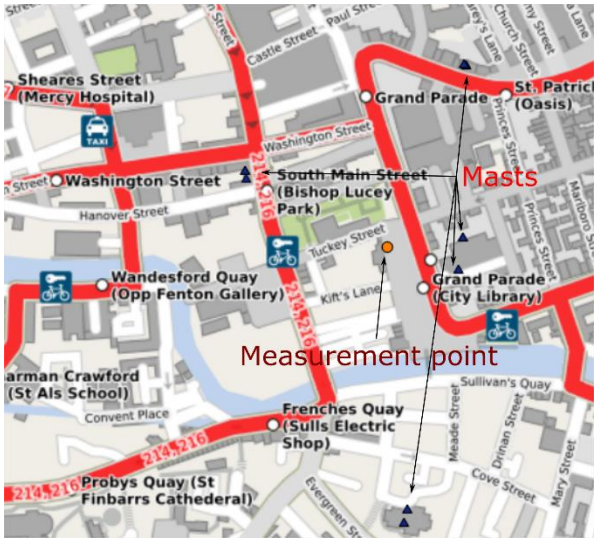
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.05	0.000008	0.05	0.000007	28.0	2.0
TETRA (DL)	390-400	0.01	0.0000004	0.01	0.0000003	28.0	2.0
PMR	450-470	0.08	0.00002	0.03	0.000002	29.5	2.3
DVB_T	470-694	0.08	0.00002	0.08	0.00001	33.2	2.9
4G (700, DL)	758-788	0.49	0.0006	0.32	0.0003	38.2	3.9
4G (800, DL)	791-821	0.67	0.001	0.46	0.0006	39	4.0
2G-3G (900, DL)	925-960	0.58	0.0009	0.50	0.0007	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.0000004	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.56	0.0008	0.39	0.0004	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.13	0.00004	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.58	0.0009	0.38	0.0004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.24	0.0001	0.04	0.000004	61	10
5G (NR-3.6GHz)	3410-3750	0.31	0.0003	0.15	0.00006	61	10
FWALA	3750-3800	0.10	0.00003	0.03	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB_T: Terrestrial Digital Video Broadcasting; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.03 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.67 V/m) is likely to correspond to the emission (downlink) from nearby 4G (800 MHz) antennas. 5G signals were detected at the point of measurement. The maximum 5G levels were 0.31 V/m without data traffic and 0.71 V/m with data traffic (i.e. making a video call using a 5G mobile phone connected to one of the 5G networks available near the measurement point).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/06	11 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	3rd March 2022
Measurement time:	11:30 am – 12:30 pm
Measurement point & location:	Market Square, Mallow, Co Cork
GPS coordinates:	52°8'15.2" N; 8°38'29.1" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Mallow town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

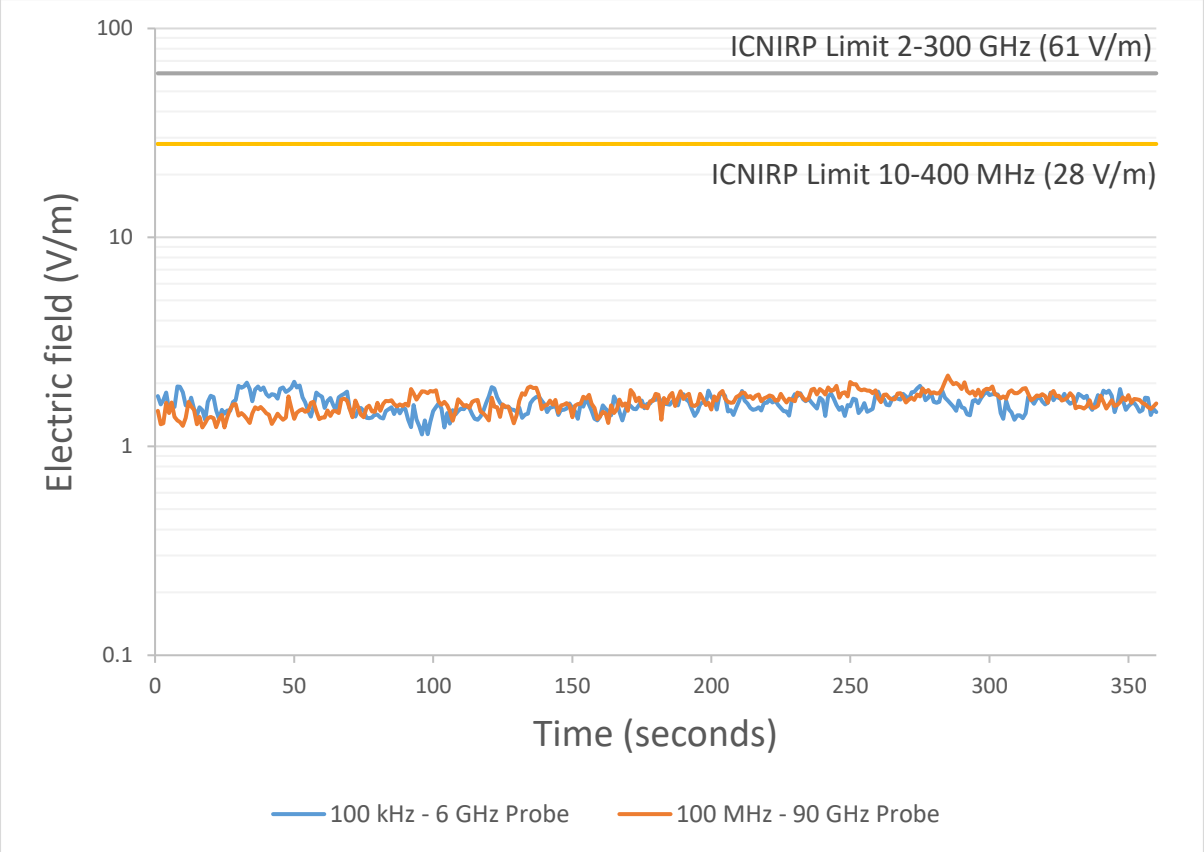
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.60 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G Rail, 2G (GSM), 3G (UMTS), 4G (LTE), 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Mallow town centre (Market Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



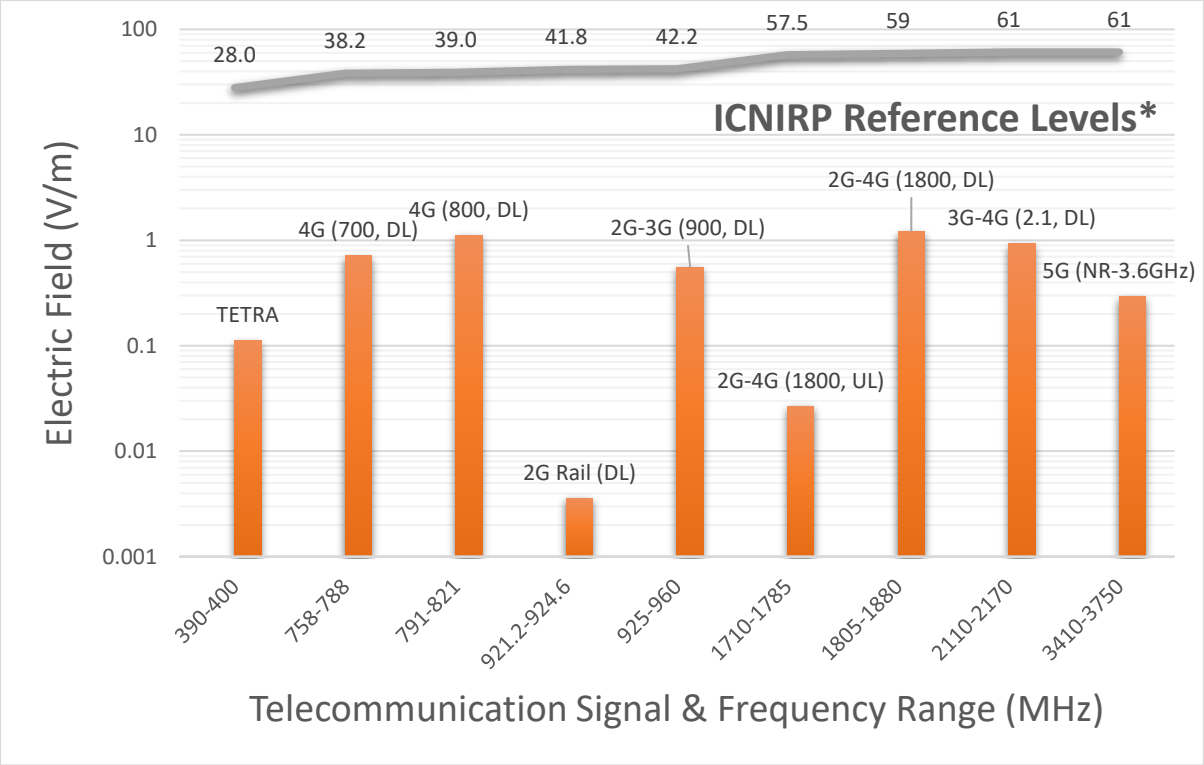
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.60	0.007	2.04	0.011	28*	2*
100 MHz - 90 GHz	1.64	0.007	2.18	0.013	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

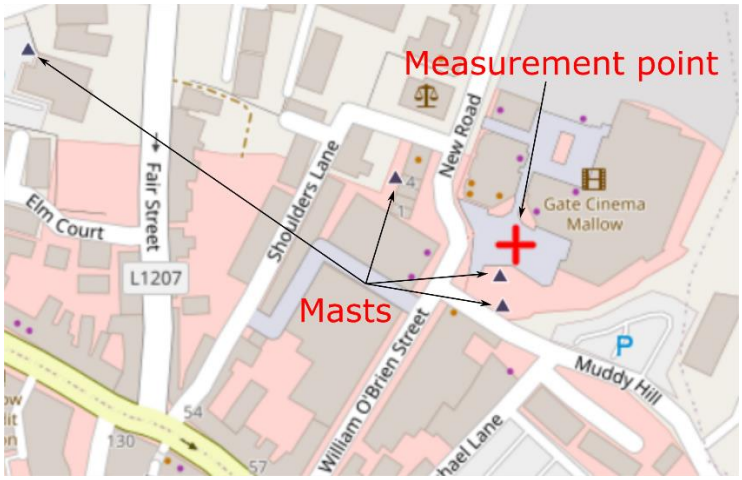
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA	390-400	0.14	0.00005	0.11	0.00003	28.0	2.0
4G (700, DL)	758-788	0.99	0.003	0.72	0.001	38.2	3.9
4G (800, DL)	791-821	1.54	0.006	1.11	0.003	39	4.0
2G Rail (DL)	921.2-924.6	0.004	0.00000004	0.004	0.00000003	39	4.6
2G-3G (900, DL)	925-960	0.70	0.001	0.55	0.0008	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.05	0.00001	0.03	0.000002	57.5	8.7
2G-4G (1800, DL)	1805-1880	1.62	0.007	1.21	0.004	59.0	9.2
3G-4G (2.1, DL)	2110-2170	1.58	0.007	0.92	0.002	61	10
5G (NR-3.6GHz)	3410-3750	0.61	0.001	0.29	0.0002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.60 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.62 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement. The maximum 5G levels were 0.61 V/m without data traffic and 0.91 V/m with data traffic (i.e. making a video call with a 5G mobile phone connected to one of the 5G networks available in the area at around 1m away from the measuring probe).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/09	12 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	4th March 2022
Measurement time:	10:30 am – 11:30 am
Measurement point & location:	Main Street, Midleton, Co Cork
GPS coordinates:	51°54'59.0"N; 8°10'27.9"W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Midleton town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

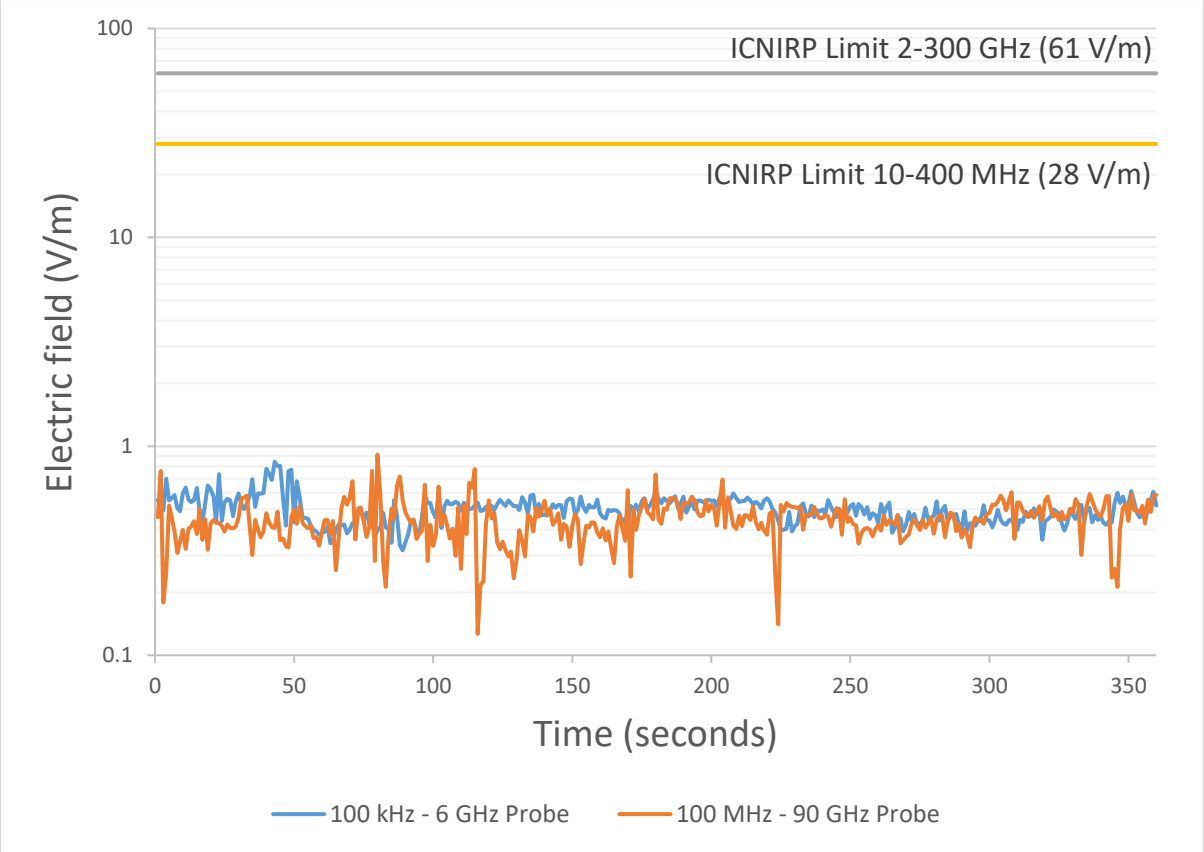
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.50 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, FWALA, BWA
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Midleton town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



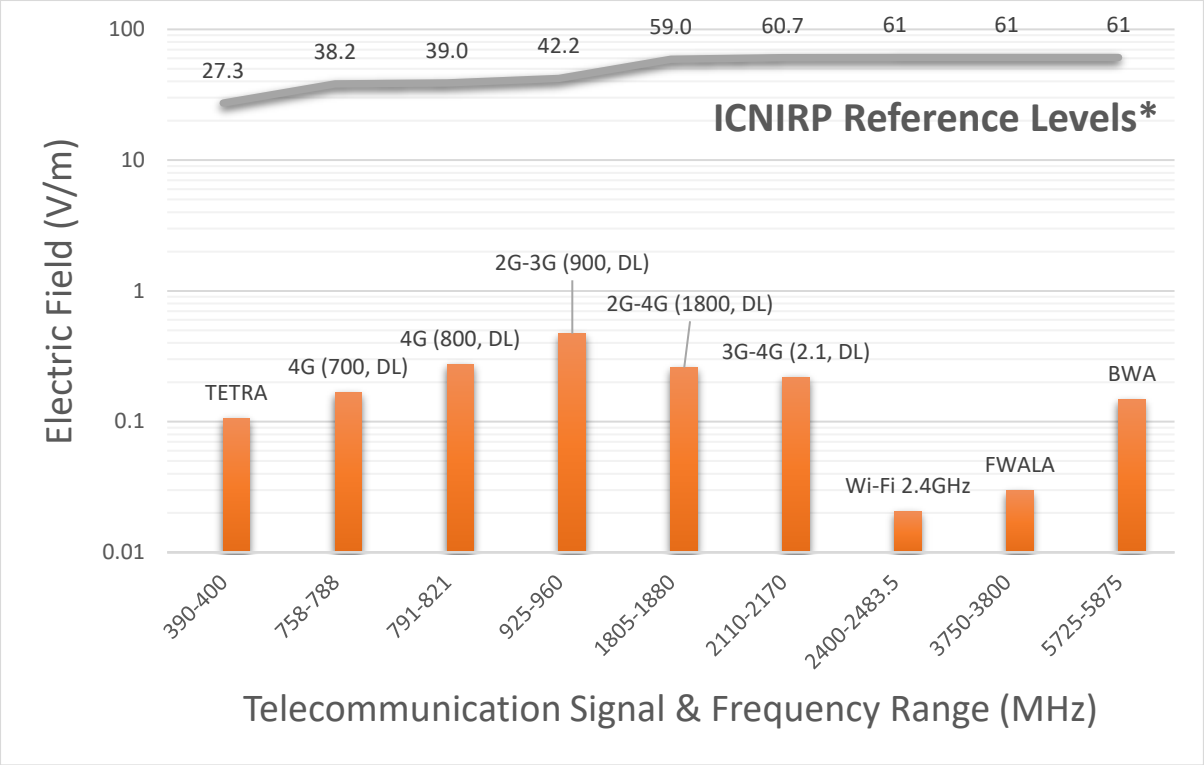
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.50	0.001	0.84	0.002	28*	2*
100 MHz - 90 GHz	0.45	0.001	0.91	0.002	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; FWALA: Fixed Wireless Access Local Area; BWA: Broadband Wireless Access.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

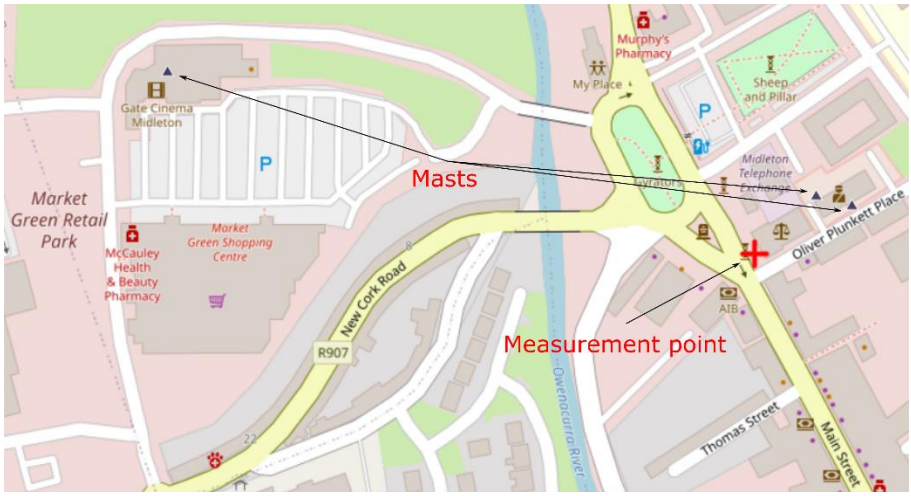
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA	390-400	0.13	0.00005	0.11	0.000030	28.0	2.0
4G (700, DL)	758-788	0.31	0.000259	0.17	0.00007	38.2	3.9
4G (800, DL)	791-821	0.41	0.0004	0.27	0.0002	39	4.0
2G-3G (900, DL)	925-960	0.63	0.001	0.47	0.0006	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.46	0.0006	0.26	0.0002	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.35	0.0003	0.22	0.0001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.13	0.00004	0.02	0.000001	61	10
FWALA	3750-3800	0.03	0.000003	0.03	0.000002	61	10
BWA	5725-5875	0.36	0.0003	0.15	0.0001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; FWALA: Fixed Wireless Access Local Area; BWA: Broadband Wireless Access.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.50 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.63 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

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The following EMF measurement equipment was used:

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- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/01X	24 June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	2nd March 2022
Measurement time:	13:00 pm – 14:00 pm
Measurement point & location:	Q-Park carpark (on roof), Grand Parade, Cork, Co Cork
GPS coordinates:	51°53'47.9" N; 8°28'27.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location near a telecommunication site. 2) To determine potential maximum RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space near a telecommunication base station placed on a building roof with public access.

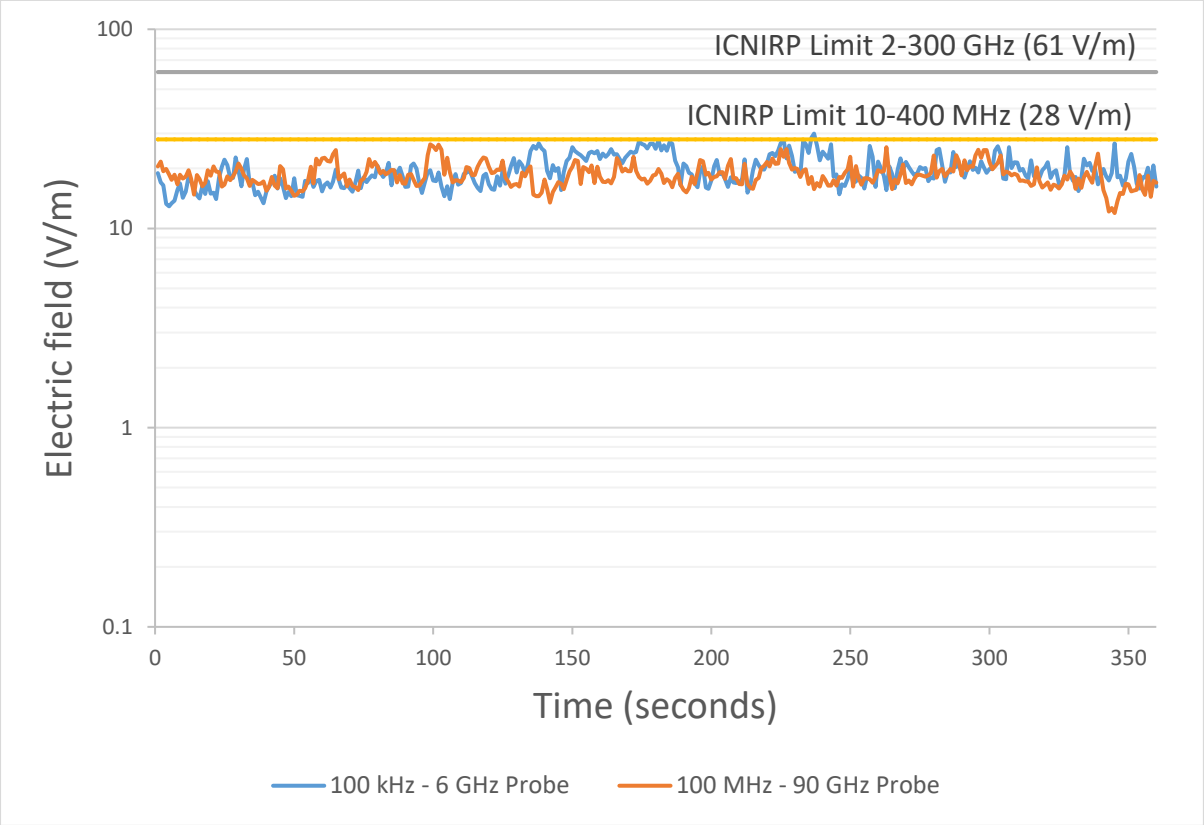
2. Summary of survey results

Measurement result:	The average and maximum total RF levels measured were 19.5 V/m and 29.9 V/m, respectively. The maximum value was above the recommended limit for radiofrequencies < 400 MHz (28 V/m) but it was below the recommended limit for radiofrequencies > 2 GHz (61 V/m). Results for individual signals were all below the corresponding recommended limits.
Measured RF sources/signals:	FM Radio, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), 5G (3.6GHz), FWALA
Number of nearby telecommunication sites:	12 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Cork city centre near a telecommunication base station placed on a building roof with public access (on roof of the Q-Park carpark, Grand Parade). The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



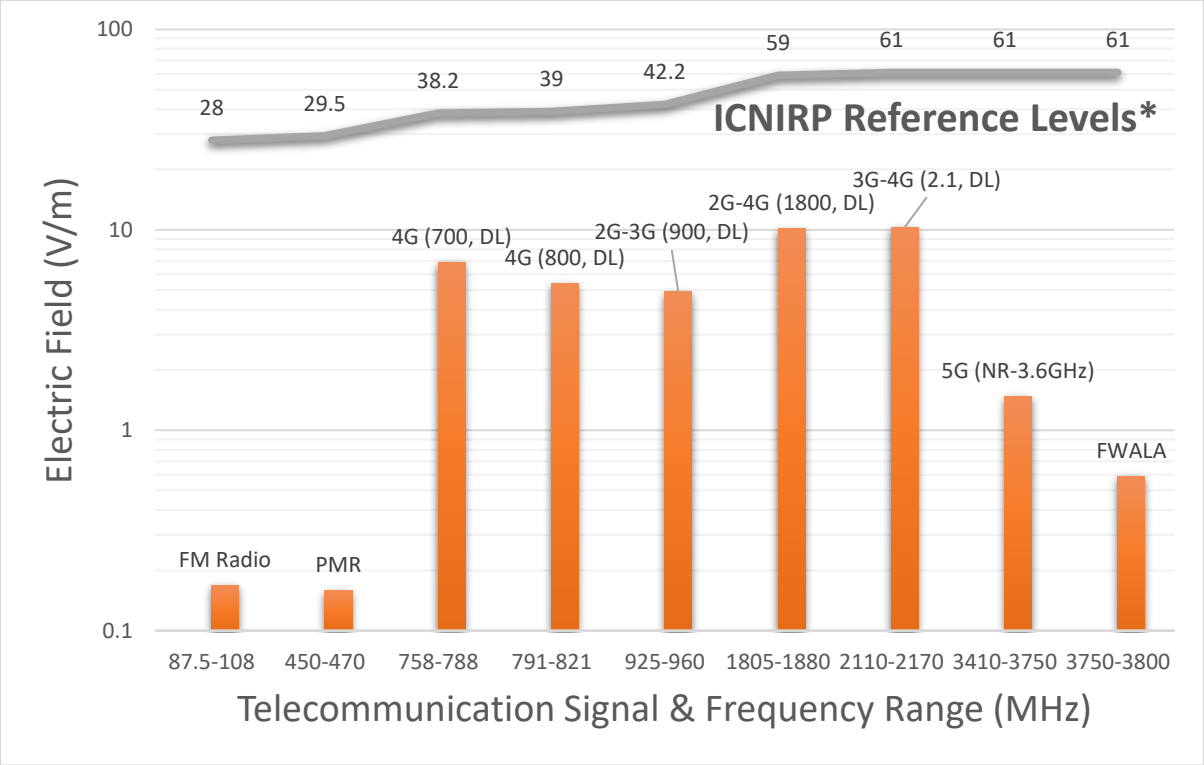
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	19.5	1.01	29.9	2.38	28*	2*
100 MHz - 90 GHz	18.5	0.91	26.4	1.85	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

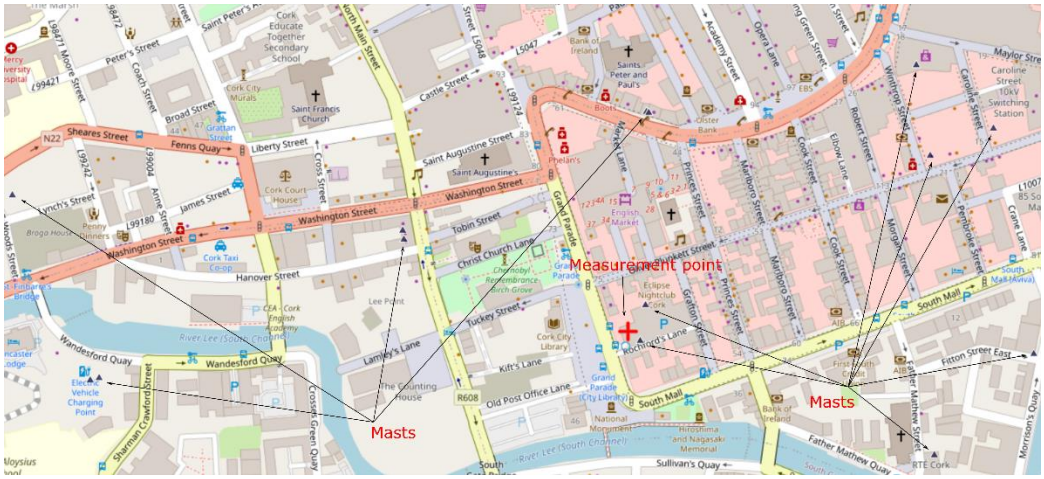
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.20	0.0001	0.17	0.0001	28.0	2.0
PMR	450-470	0.27	0.0002	0.16	0.0001	29.5	2.3
4G (700, DL)	758-788	10.9	0.3	6.89	0.1	38.2	3.9
4G (800, DL)	791-821	7.82	0.2	5.41	0.08	39	4.0
2G-3G (900, DL)	925-960	7.15	0.1	4.90	0.06	42.2	4.7
2G-4G (1800, DL)	1805-1880	17.8	0.8	10.2	0.3	59.0	9.2
3G-4G (2.1, DL)	2110-2170	18.3	0.9	10.3	0.3	61	10
5G (NR-3.6GHz)	3410-3750	4.50	0.1	1.48	0.006	61	10
FWALA	3750-3800	3.04	0.02	0.59	0.001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; FWALA: Fixed Wireless Access Local Area.

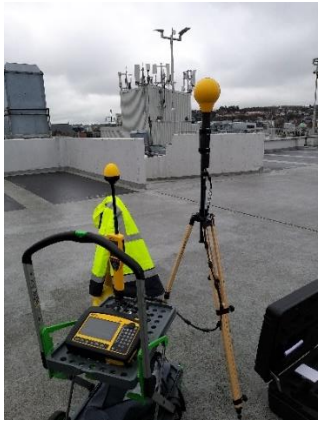
5. Conclusion – Total & Frequency-Specific RF field levels

RF-EMF measurements were carried out near a telecommunication site to assess potential maximum public exposure levels. The average and maximum total RF levels measured were 19.5 V/m and 29.9 V/m, respectively. The maximum value was above the recommended limit for radiofrequencies < 400 MHz (28 V/m) but it was below the recommended limit for radiofrequencies > 2 GHz (61 V/m). Measured (average and maximum) frequency-specific RF electric field levels for all detected signals were below the corresponding recommended limits (Figure 2 & Table 2). The highest RF electric field level at the point of measurement (18.3 V/m) is likely to correspond to the emission (downlink) from nearby 3G-4G (2.1 GHz) antennas. 5G signals were detected at the point of measurement, with a maximum level (no data traffic) value of 5.04 V/m. This value increased to 12.3 V/m when using a 5G mobile phone (making a video call) in the proximity (~ 1 meter apart) of the measurement equipment.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/25	9th June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	24th May 2022
Measurement time (approx.):	18:30 pm – 19:30 pm
Measurement point & location:	Upper Main Street, Letterkenny, Co Donegal
GPS coordinates:	54°57'02.7" N; 7°44'12.9" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Letterkenny town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

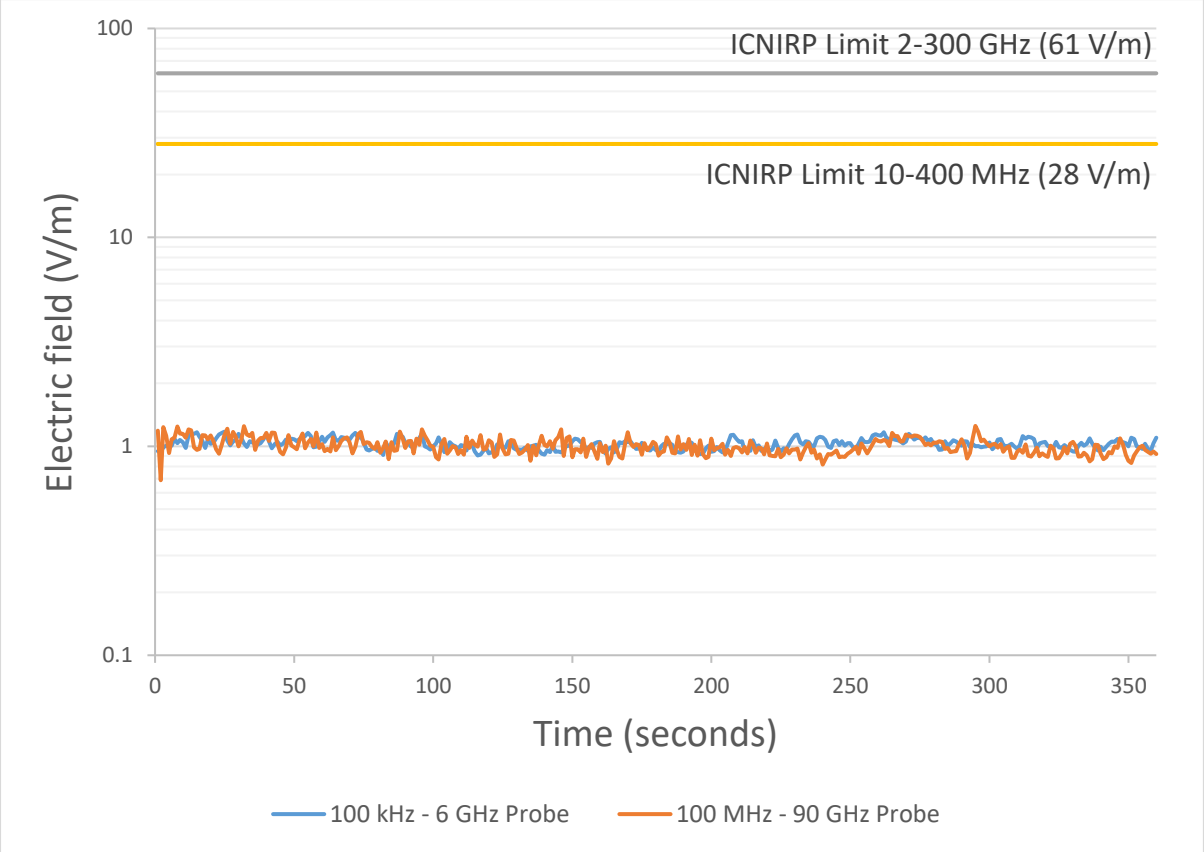
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.03 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	PMR, TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), BWA
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Letterkenny town centre (Upper Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



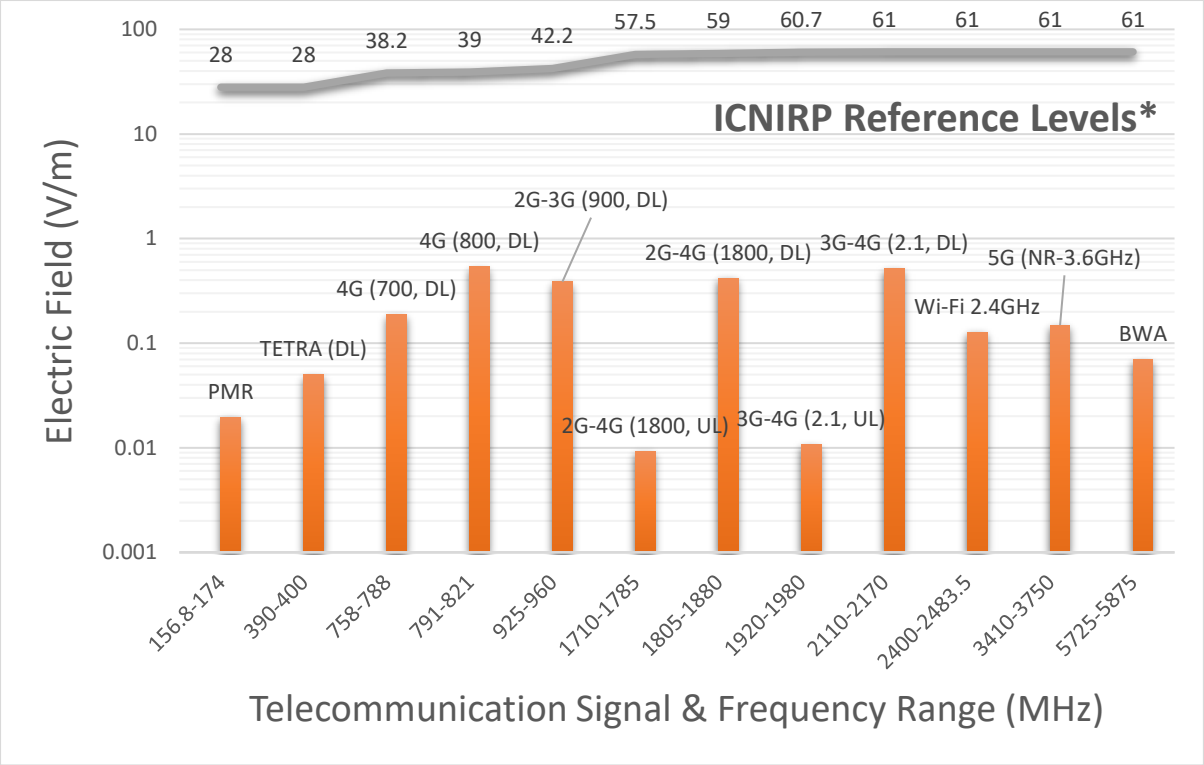
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.03	0.003	1.17	0.004	28*	2*
100 MHz - 90 GHz	1.00	0.003	1.25	0.004	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio; BWA: Broadband Wireless Access.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

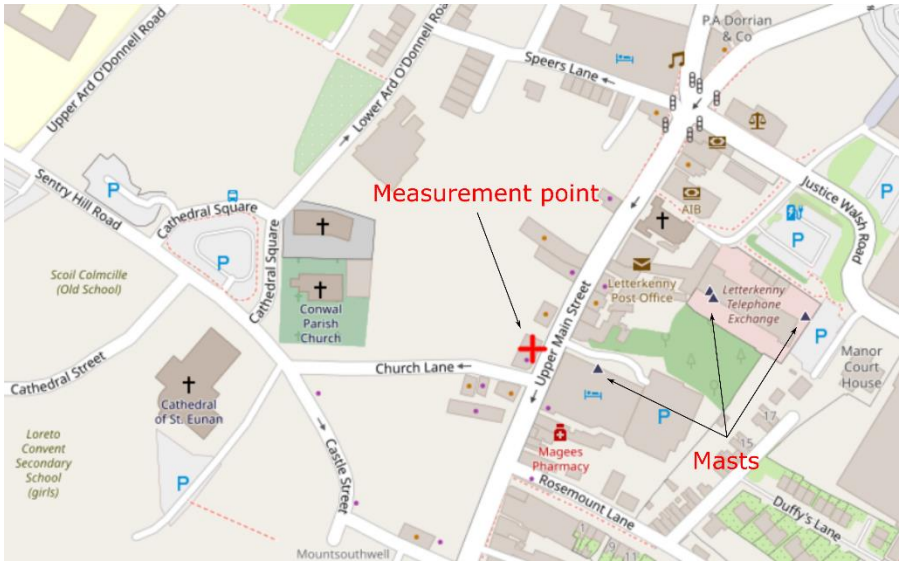
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
PMR	156.8-174	0.03	0.000002	0.02	0.000001	28.0	2.0
TETRA (DL)	390-400	0.10	0.00003	0.05	0.000007	28.0	2.0
4G (700, DL)	758-788	0.21	0.0001	0.19	0.00009	38.2	3.9
4G (800, DL)	791-821	0.67	0.001	0.54	0.0008	39.0	4.0
2G-3G (900, DL)	925-960	0.56	0.0008	0.39	0.0004	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.04	0.000004	0.01	0.0000002	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.62	0.001	0.42	0.0005	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.07	0.00001	0.01	0.0000003	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.66	0.001	0.52	0.0007	61.0	10.0
Wi-Fi 2.4GHz	2400-2483.5	1.03	0.003	0.13	0.00004	61.0	10.0
5G (NR-3.6GHz)	3410-3750	0.72	0.001	0.15	0.00006	61.0	10.0
BWA	5725-5875	0.38	0.0004	0.07	0.00001	61.0	10.0

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio; BWA: Broadband Wireless Access.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.03 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.03 V/m) is likely to correspond to the emission from nearby Wi-Fi devices. 5G signals were detected at the point of measurement, with maximum levels of 0.72 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/17	21 Oct 2021	J Vila

1. Measurement survey characteristics

Measurement date:	15th October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Drogheda St-Railway St, Balbriggan, Co Dublin
GPS coordinates:	53°36'38.6" N; 6°11'04.2" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Balbriggan town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

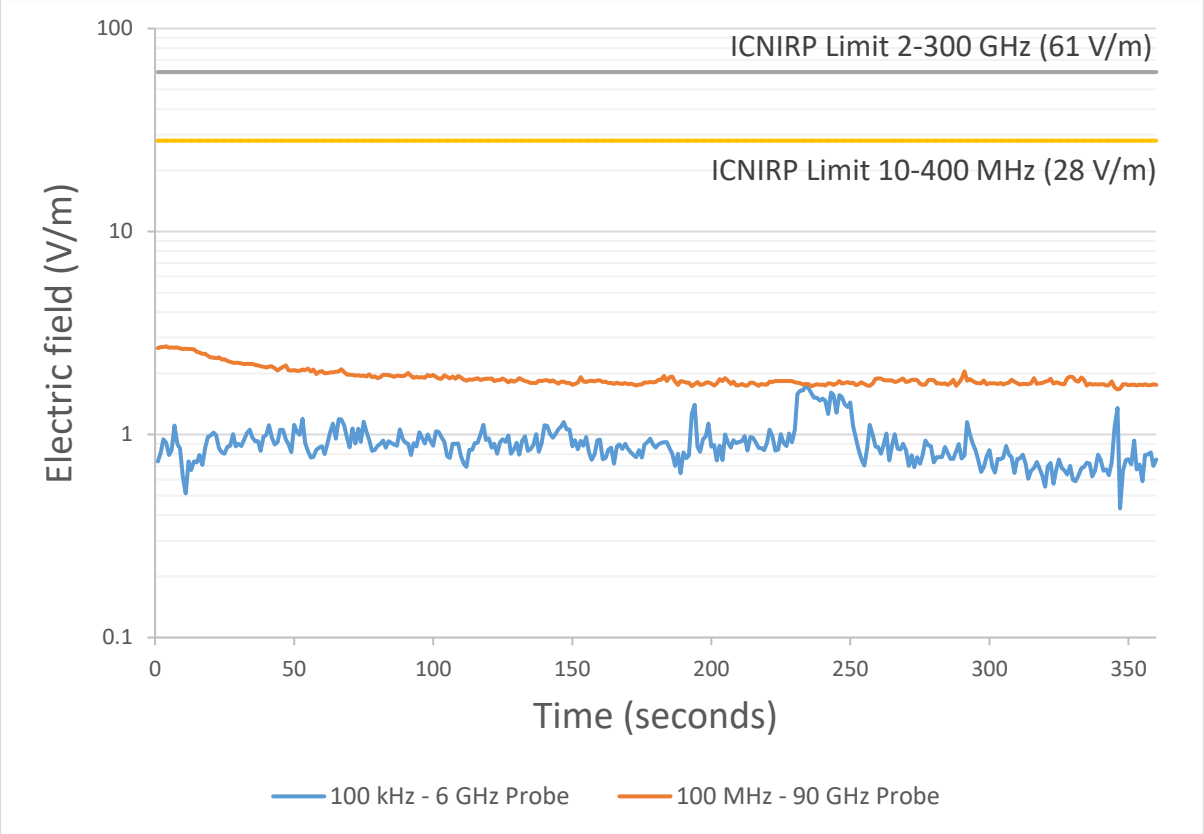
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.90 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	PMR, TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Balbriggan town centre (Drogheda St-Railway St) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



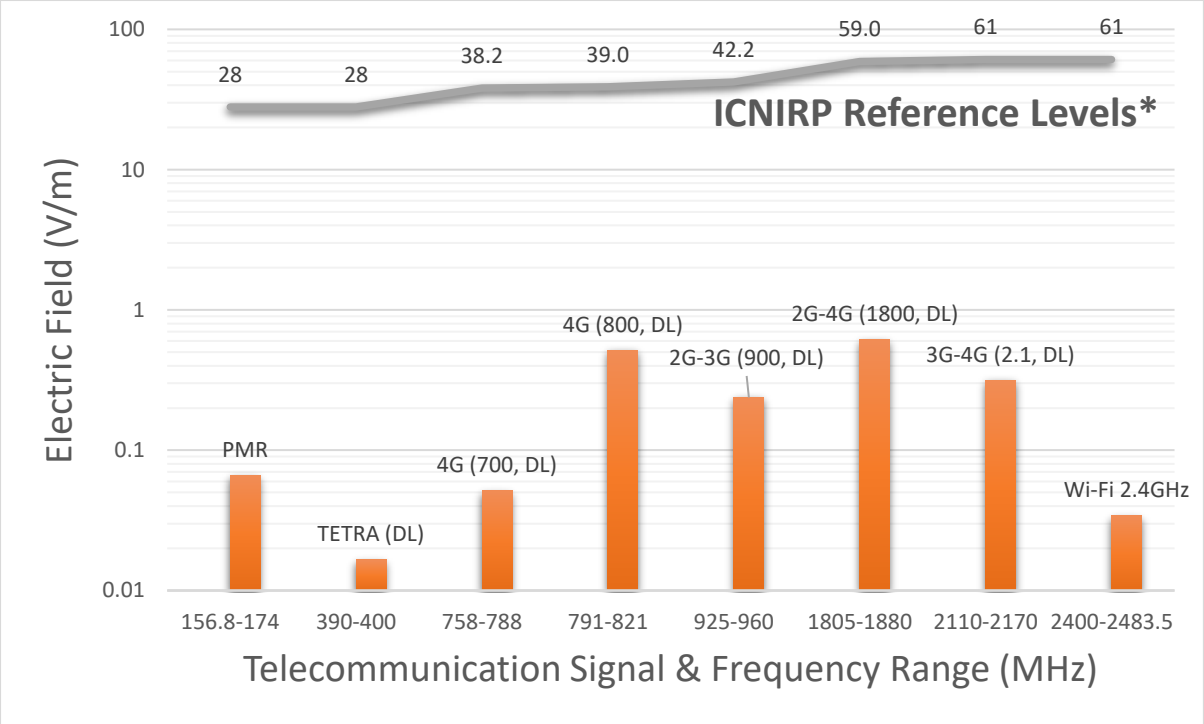
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.90	0.002	1.74	0.008	28*	2*
100 MHz - 90 GHz	1.91	0.010	2.72	0.020	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

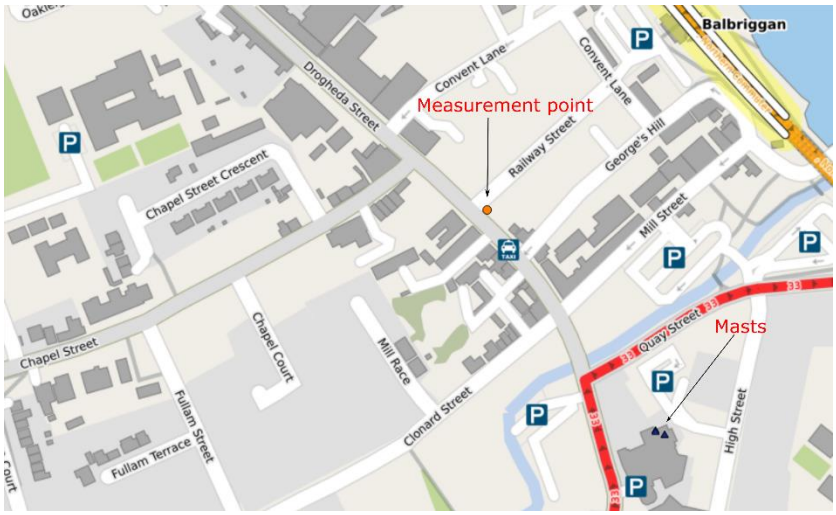
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
PMR	156.8-174	0.43	0.00048	0.07	0.00001	28	2
TETRA (DL)	390-400	0.02	0.000001	0.02	0.000001	28	2.0
4G (700, DL)	758-788	0.12	0.00004	0.052	0.000007	38.2	3.9
4G (800, DL)	791-821	0.83	0.002	0.52	0.0007	39	4.0
2G-3G (900, DL)	925-960	0.33	0.0003	0.24	0.0002	42.2	4.7
2G-4G (1800, DL)	1805-1880	1.46	0.006	0.61	0.001	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.78	0.002	0.32	0.0003	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.07	0.00001	0.03	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.90 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.46 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

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A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/13	11 Oct 2021	J Vila

1. Measurement survey characteristics

Measurement date:	1st October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	The Mill Shopping Centre – at carpark, Clondalkin, Co Dublin
GPS coordinates:	53°19'24.8" N; 6°23'50.2" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Clondalkin town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

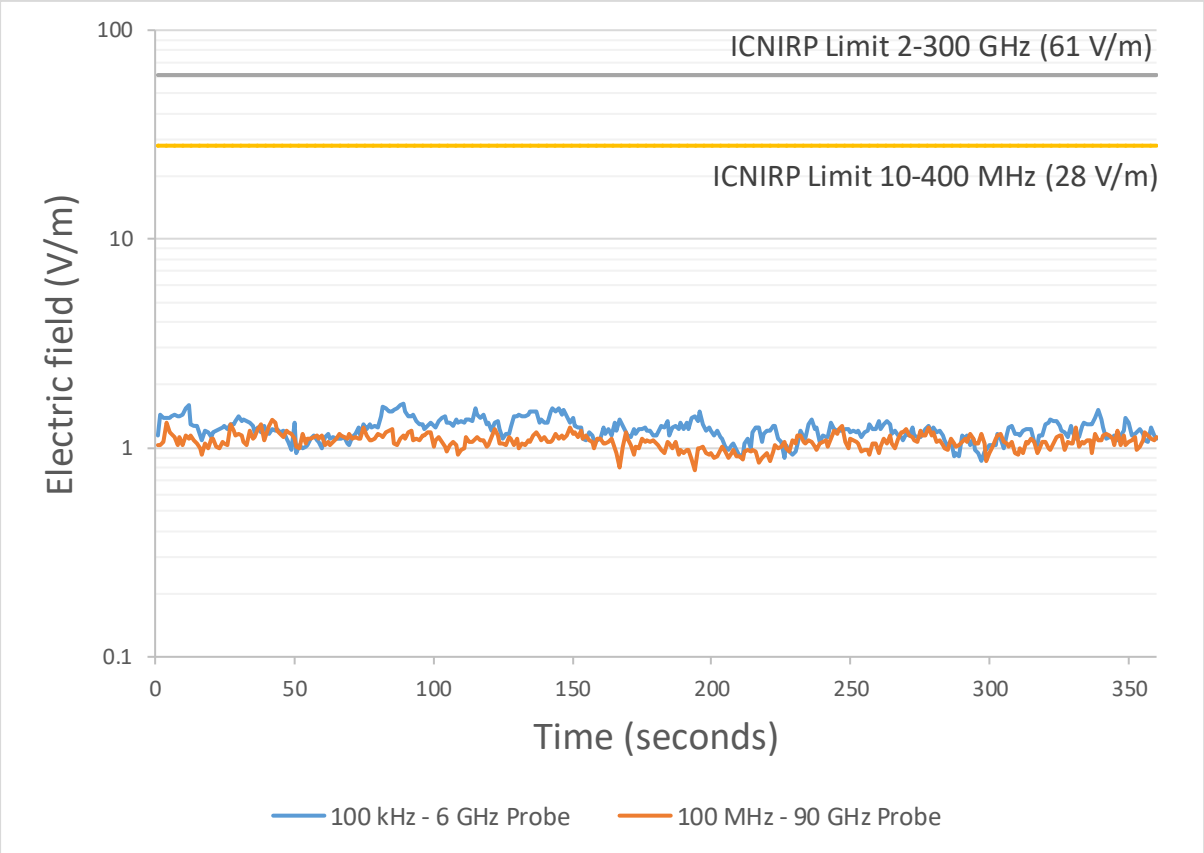
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.23 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, DVB-T, 2G (GSM), 3G (UMTS), 4G (LTE), TETRA, Wi-Fi, FWALA
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Clondalkin town centre (The Mill Shopping Centre – at carpark) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



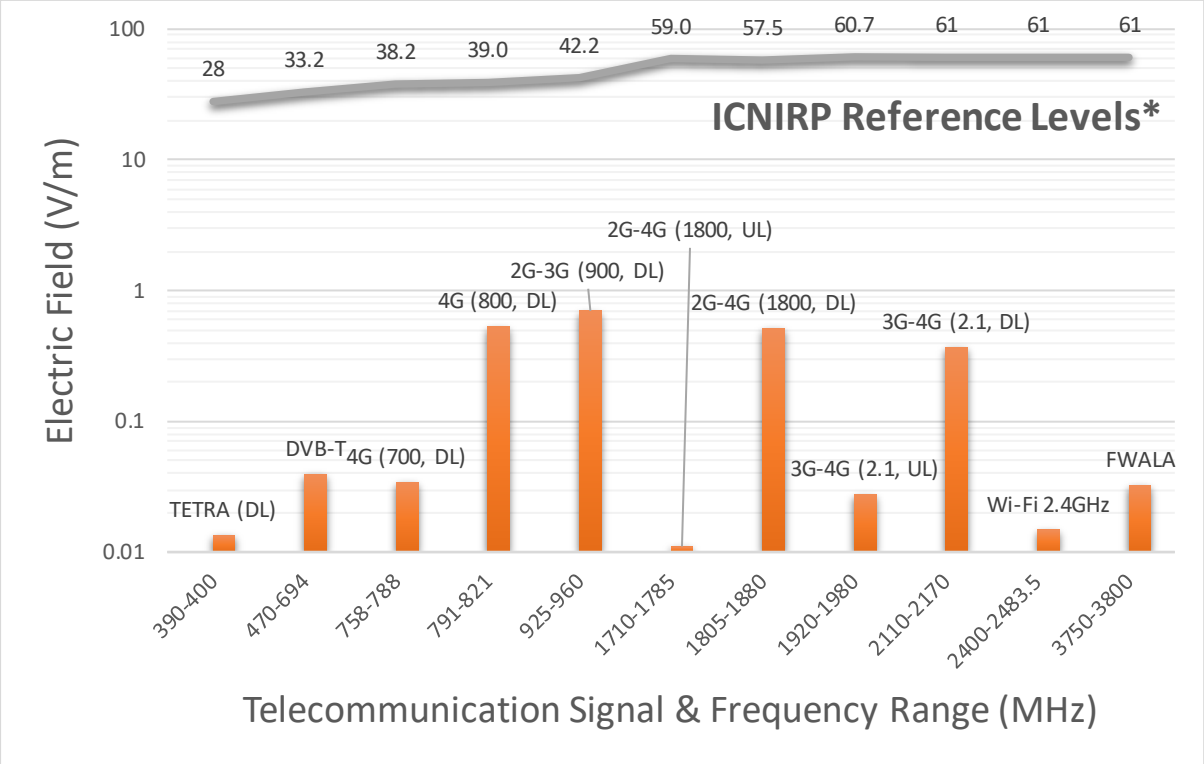
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.23	0.004	1.63	0.007	28*	2*
100 MHz - 90 GHz	1.07	0.003	1.36	0.005	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; DVB-T: Digital TV; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

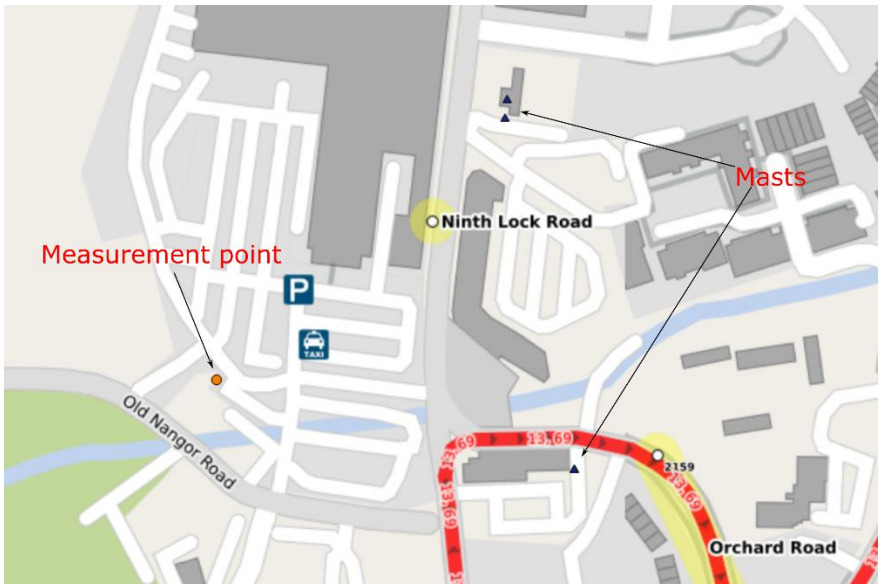
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.02	0.000001	0.01	0.0000005	28.0	2.0
DVB-T	470-694	0.04	0.000005	0.04	0.000004	33.2	2.9
4G (700, DL)	758-788	0.05	0.000007	0.03	0.000003	38.2	3.9
4G (800, DL)	791-821	0.70	0.001	0.53	0.0007	39	4.0
2G-3G (900, DL)	925-960	0.97	0.002	0.70	0.001	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.04	0.000003	0.01	0.0000003	59.0	9.2
2G-4G (1800, DL)	1805-1880	0.78	0.002	0.51	0.0007	57.5	8.7
3G-4G (2.1, UL)	1920-1980	0.32	0.0003	0.03	0.000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.52	0.0007	0.37	0.0004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.02	0.000002	0.01	0.000001	61	10
FWALA	3750-3800	0.04	0.000005	0.03	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; DVB-T: Digital TV; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.23 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.97 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/12	04 Oct. 2021	J Vila

1. Measurement survey characteristics

Measurement date:	16th September 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Castle Street, Dalkey, Co Dublin
GPS coordinates:	53°16'41.2" N; 6°6'24.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Dalkey town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

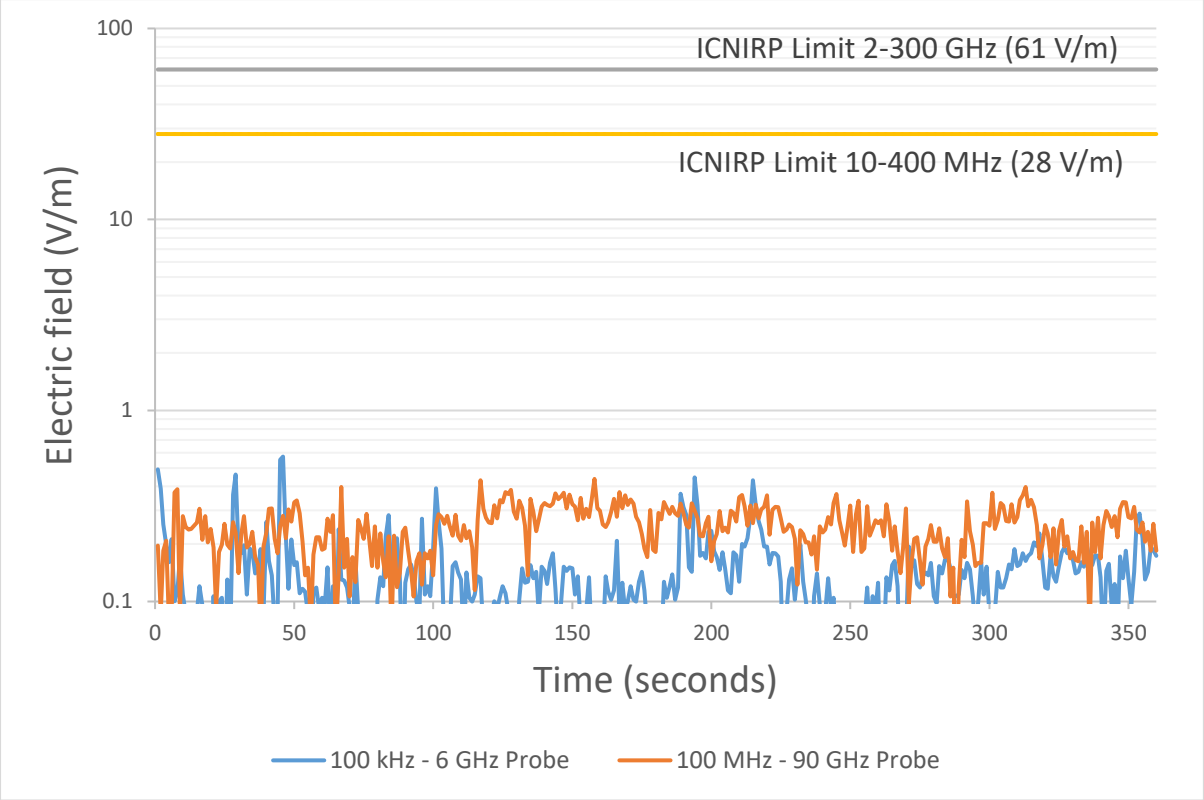
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.27 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, PMR, DVB-T, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Dalkey town centre (Castle Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



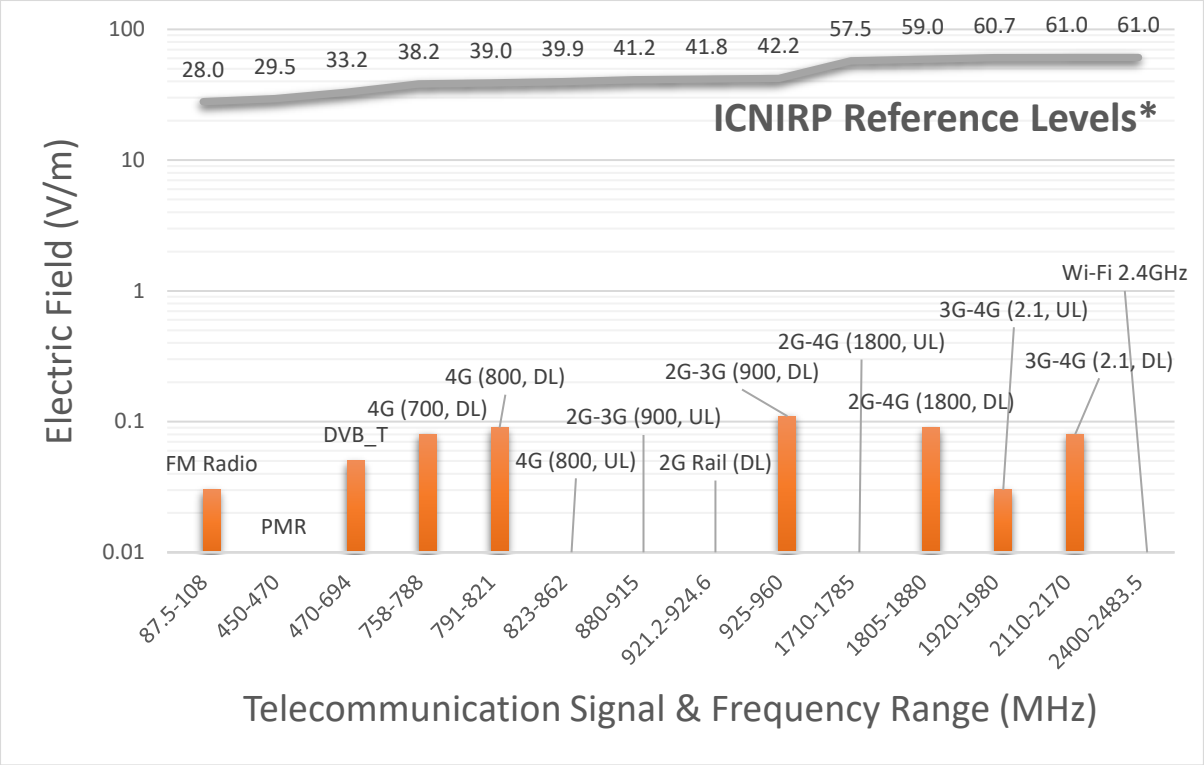
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.27	0.0002	0.41	0.0004	28*	2*
100 MHz - 90 GHz	0.26	0.0002	0.94	0.0024	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; DVB-T: Digital TV.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

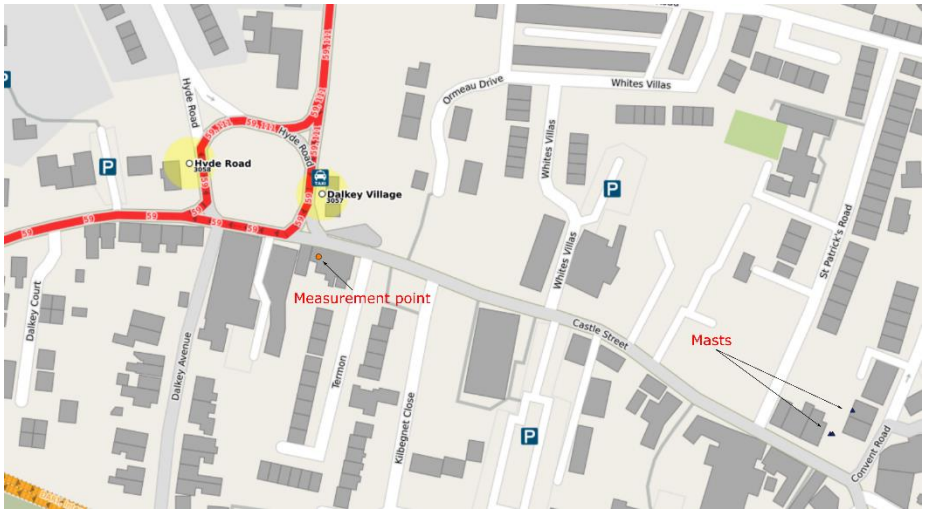
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.04	0.000004	0.03	0.000002	28.0	2.0
PMR	450-470	0.02	0.000001	0.01	0.0000003	29.5	2.3
DVB-T	470-694	0.05	0.000007	0.05	0.000007	33.2	2.9
4G (700, DL)	758-788	0.18	0.00009	0.08	0.00002	38.2	3.9
4G (800, DL)	791-821	0.12	0.00004	0.09	0.00002	39	4.0
4G (800, UL)	823-862	0.03	0.000002	0.01	0.0000003	40	4.2
2G-3G (900, UL)	880-915	0.02	0.000001	0.01	0.0000003	41	4.5
2G Rail (DL)	921.2-924.6	0.01	0.0000003	0.01	0.0000003	42	4.6
2G-3G (900, DL)	925-960	0.15	0.00006	0.11	0.00003	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.0000003	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.13	0.00004	0.09	0.00002	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.19	0.00010	0.03	0.000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.17	0.00008	0.08	0.00002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.04	0.000004	0.01	0.000000	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; DVB-T: Digital TV.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.27 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.19 V/m) is likely to correspond to the emission (downlink) from nearby 3G-4G (2.1 GHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites



7. Photo of measurement point (Castle Street)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

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- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/09	13 Sept. 2021	J Vila

1. Measurement survey characteristics

Measurement date:	7th September 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	King Street – Grafton Street, Dublin, Co Dublin
GPS coordinates:	53°20'25.1" N; 6°15'39.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Dublin city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

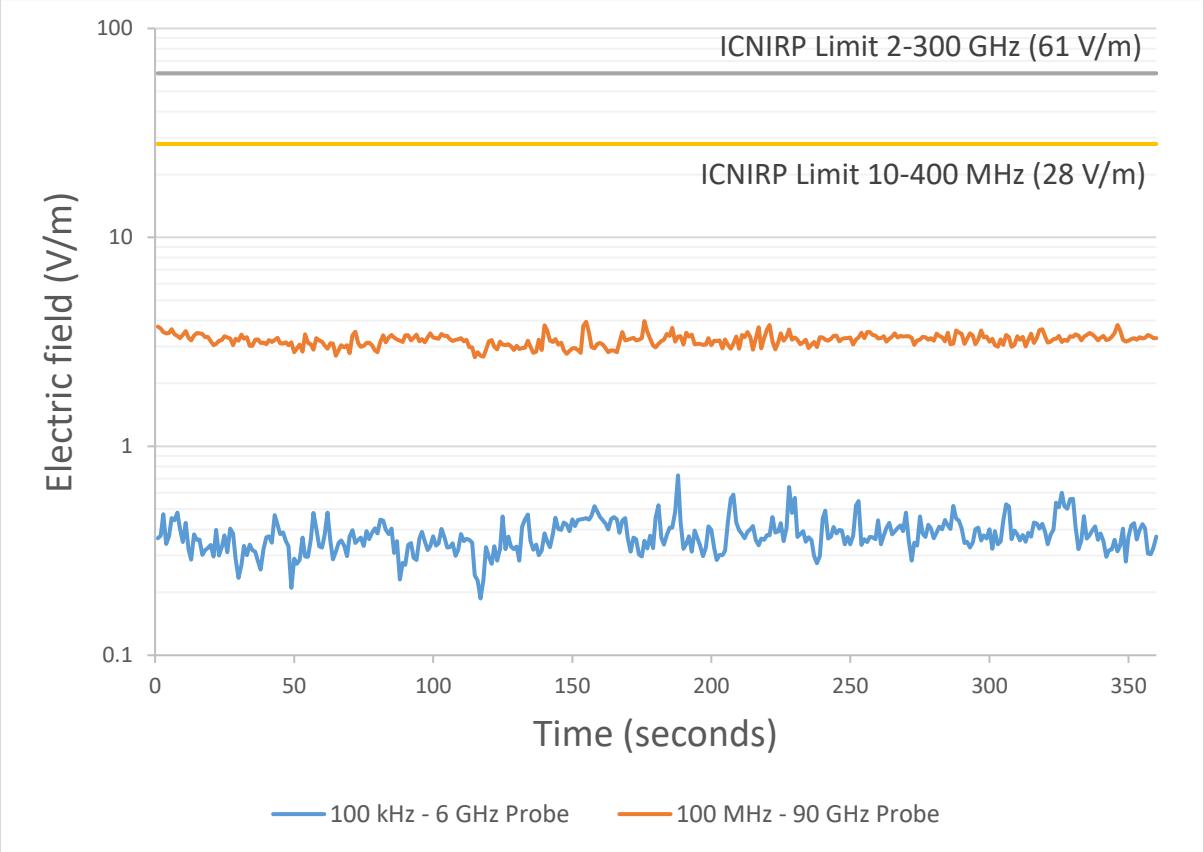
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.38 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), 5G (NR-3.6), PMR, TETRA, FWALA, Wi-Fi
Number of nearby telecommunication sites:	6 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Dublin city centre (King Street - Grafton Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



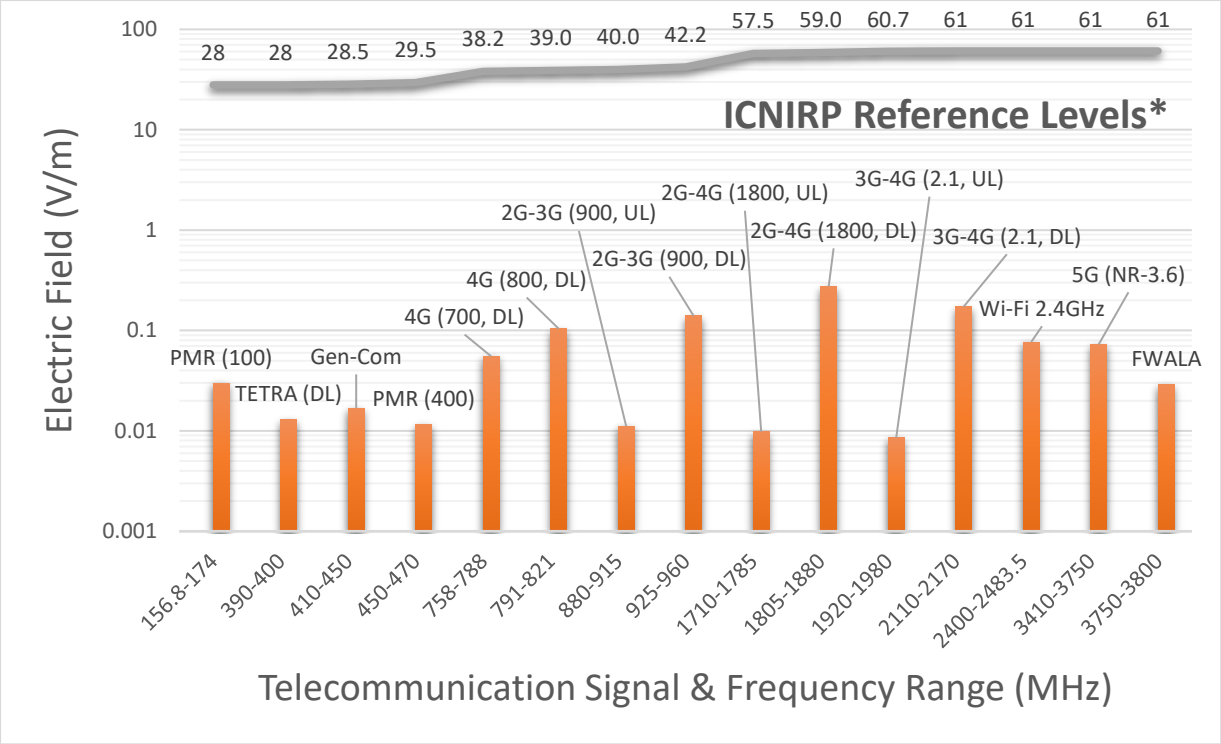
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.38	0.0004	0.73	0.001	28*	2*
100 MHz - 90 GHz	3.23	0.028	3.98	0.042	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink. Gen-Com: This freq. range includes a mixture of amateur, PMR and land mobile signals; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

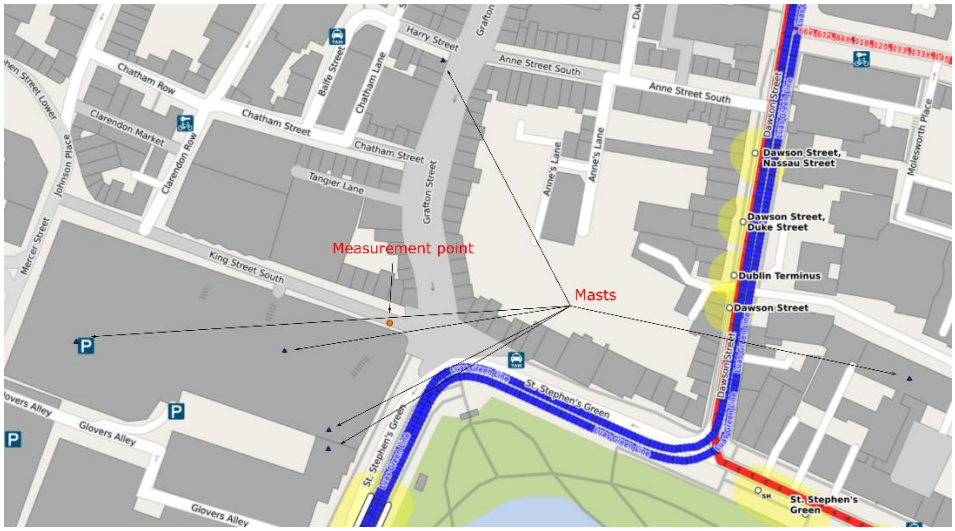
RF Source / Telecom. Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
PMR (100)	156.8-174	0.1	0.00003	0.03	0.000002	28	2.0
TETRA (DL)	390-400	0.01	0.000001	0.01	0.0000004	28	2.0
Gen-Com	410-450	0.02	0.000001	0.02	0.000001	28.5	2.2
PMR (400)	450-470	0.02	0.000001	0.01	0.0000004	29.5	2.3
4G (700, DL)	758-788	0.09	0.00002	0.06	0.000008	38.2	3.9
4G (800, DL)	791-821	0.15	0.00006	0.10	0.00003	39.0	4.0
2G-3G (900, UL)	880-915	0.04	0.000004	0.01	0.0000003	40.0	4.5
2G-3G (900, DL)	925-960	0.16	0.00007	0.14	0.00005	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.39	0.0004	0.27	0.0002	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.04	0.00001	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.29	0.00022	0.17	0.00008	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.66	0.0012	0.08	0.00002	61	10
NR-3.6	3410-3750	0.17	0.00008	0.07	0.00001	61	10
FWALA	3750-3800	0.09	0.00002	0.03	0.000002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink. Gen-Com: This freq. range includes a mixture of amateur, PMR and land mobile signals; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.38 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.66 V/m) corresponded to emissions from nearby Wi-Fi equipment. 5G signals were detected at the point of measurement, with a maximum (rms) level of 0.17 V/m. Measurements carried out while streaming video on a 5G phone did not change the readings.

6. Map of measurement point and nearby telecommunication sites



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/16	13 Oct. 2021	J Vila

1. Measurement survey characteristics

Measurement date:	7th October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	New Street, Malahide, Co Dublin
GPS coordinates:	53°27'03.6" N; 6°9'13.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Malahide town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

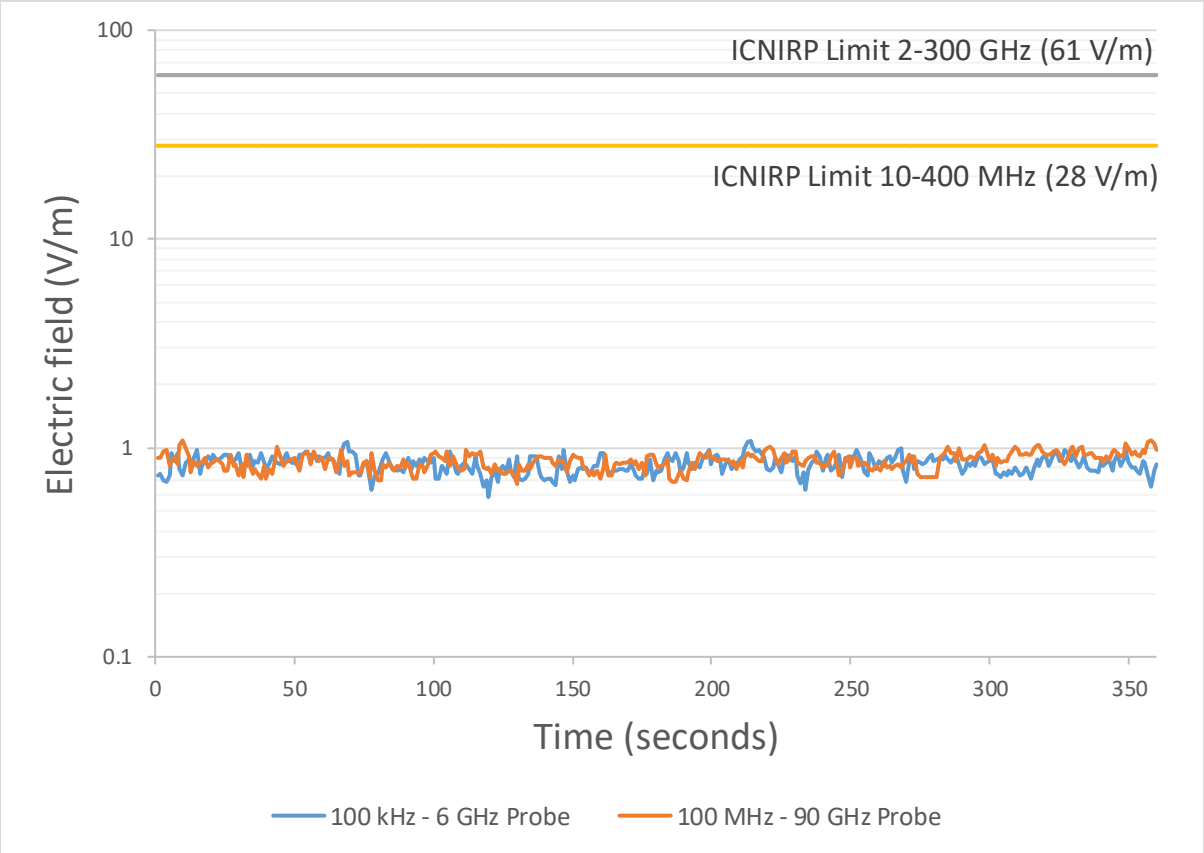
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.84 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, 2G Rail, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, Wi-Fi 5GHz
Number of nearby telecommunication sites:	1 nearby site (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Malahide town centre (New Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



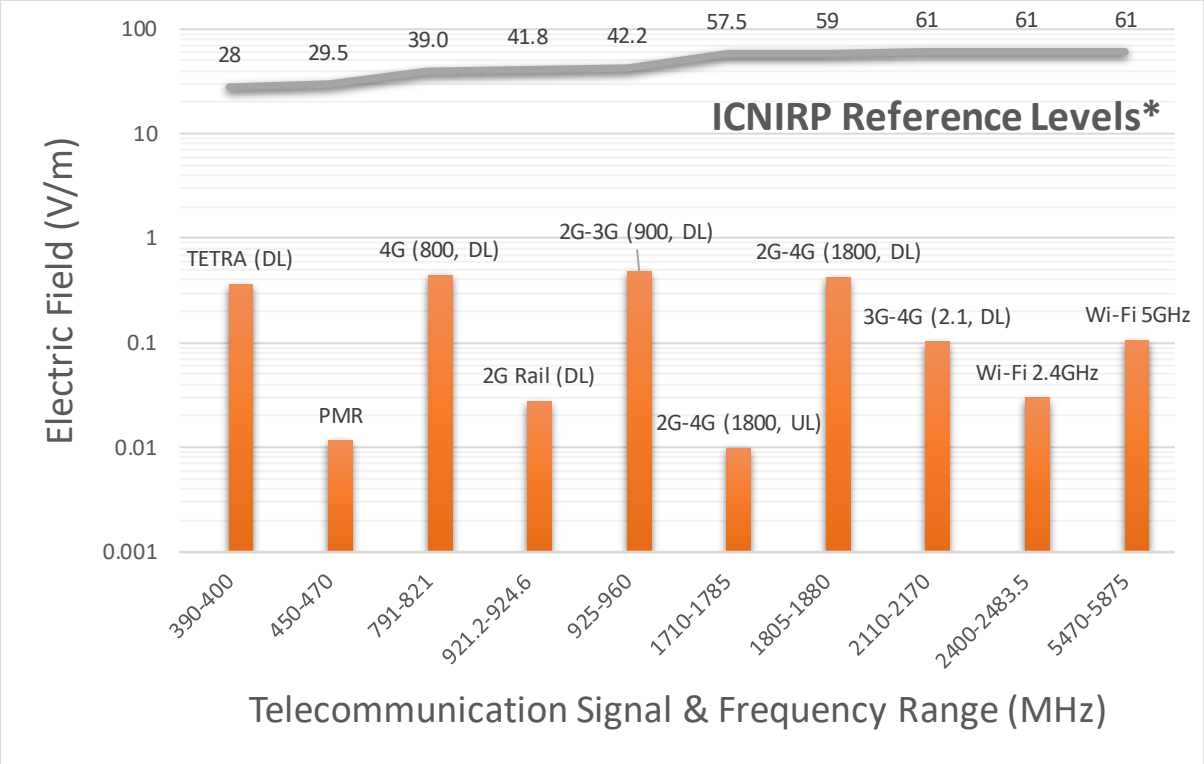
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.84	0.002	1.08	0.003	28*	2*
100 MHz - 90 GHz	0.86	0.002	1.09	0.003	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

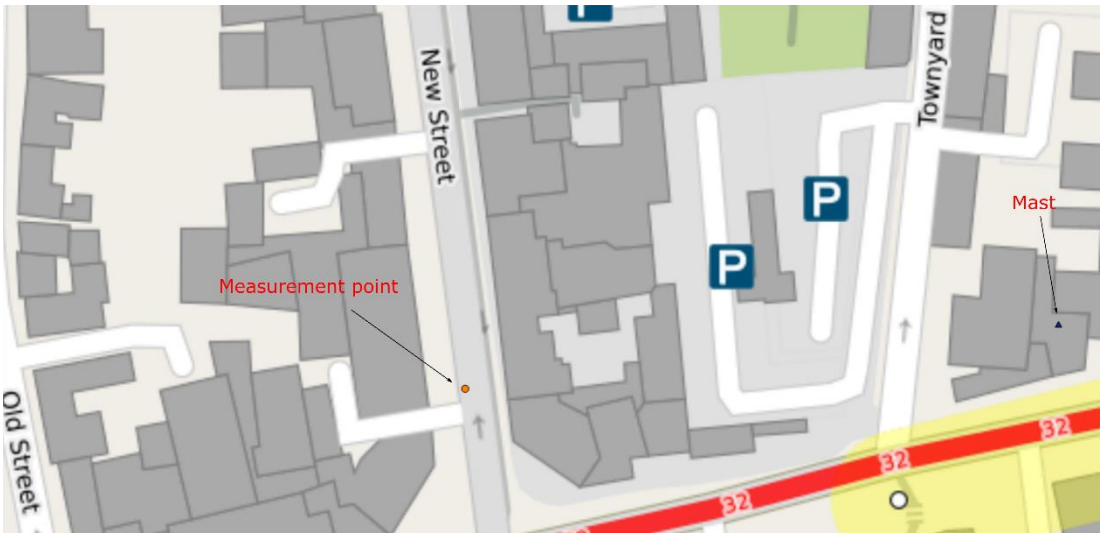
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.44	0.0005	0.36	0.0003	28.0	2.0
PMR	450-470	0.01	0.0000004	0.01	0.0000004	29.5	2.3
4G (800, DL)	791-821	0.72	0.001	0.45	0.0005	39	4.0
2G Rail (DL)	921.2-924.6	0.04	0.000004	0.03	0.000002	39	4.6
2G-3G (900, DL)	925-960	0.58	0.0009	0.48	0.0006	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.03	0.000002	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.57	0.0009	0.42	0.0005	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.19	0.00009	0.10	0.00003	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.17	0.00008	0.03	0.000002	61	10
Wi-Fi 5GHz	5470-5875	0.13	0.00004	0.11	0.00003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.84 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.72 V/m) is likely to correspond to the emission (downlink) from nearby 4G (800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/18	21 Oct 2021	J Vila

1. Measurement survey characteristics

Measurement date:	15th October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Strand Street, Skerries, Co Dublin
GPS coordinates:	53°34'43.5" N; 6°6'23.8" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Skerries town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

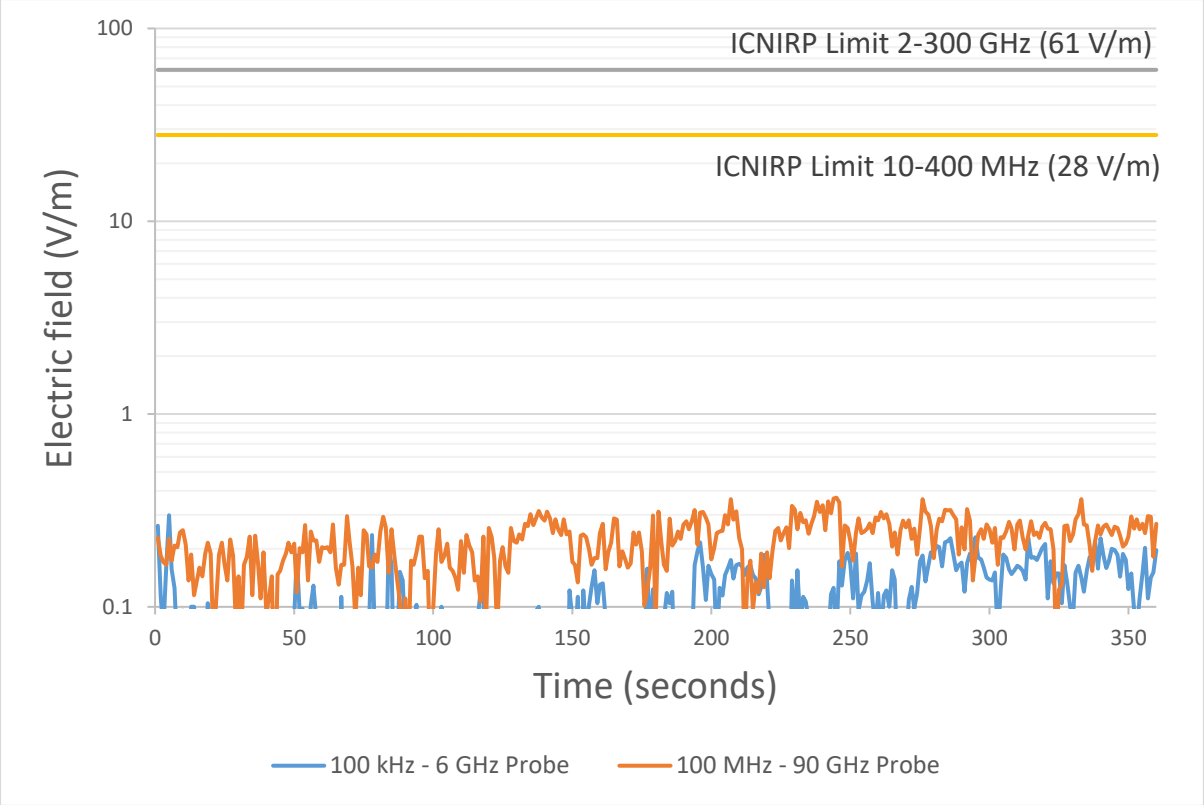
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.10 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Skerries town centre (Strand Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



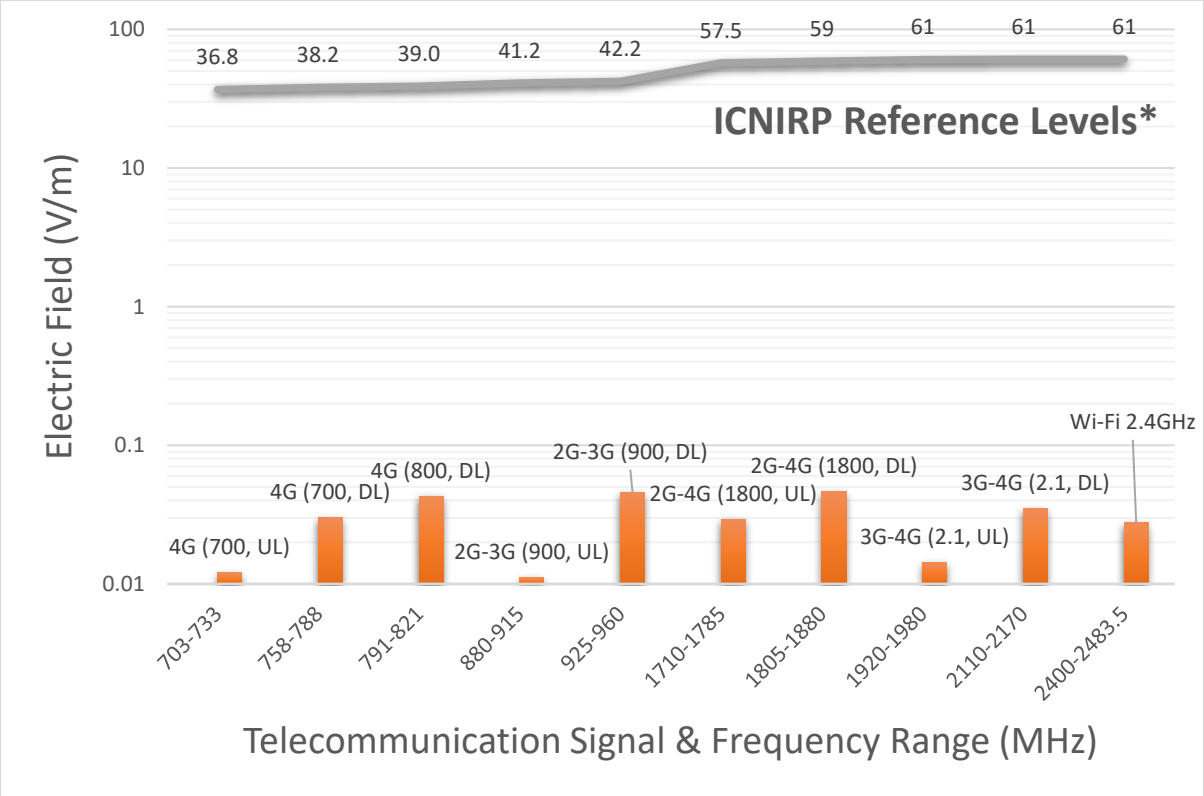
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.10	0.00003	0.30	0.0002	28*	2*
100 MHz - 90 GHz	0.22	0.0001	0.37	0.0004	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
4G (700, UL)	703-733	0.04	0.000004	0.01	0.0000004	36.8	3.6
4G (700, DL)	758-788	0.05	0.000007	0.03	0.000002	38.2	3.9
4G (800, DL)	791-821	0.06	0.00001	0.04	0.000005	39	4.0
2G-3G (900, UL)	880-915	0.01	0.000001	0.01	0.0000003	41.2	4.5
2G-3G (900, DL)	925-960	0.06	0.00001	0.05	0.000006	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.19	0.00009	0.03	0.000002	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.07	0.00001	0.05	0.000006	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.13	0.00004	0.01	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.05	0.00001	0.04	0.000003	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.12	0.00004	0.03	0.000002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.10 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.19 V/m) is likely to correspond to the emission from a nearby mobile phone (uplink) 2G-4G (1800 MHz). No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/15	13 Oct. 2021	J Vila

1. Measurement survey characteristics

Measurement date:	7th October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Main Street, Swords, Co Dublin
GPS coordinates:	53°27'21.8" N; 6°13'16.9" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Swords town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

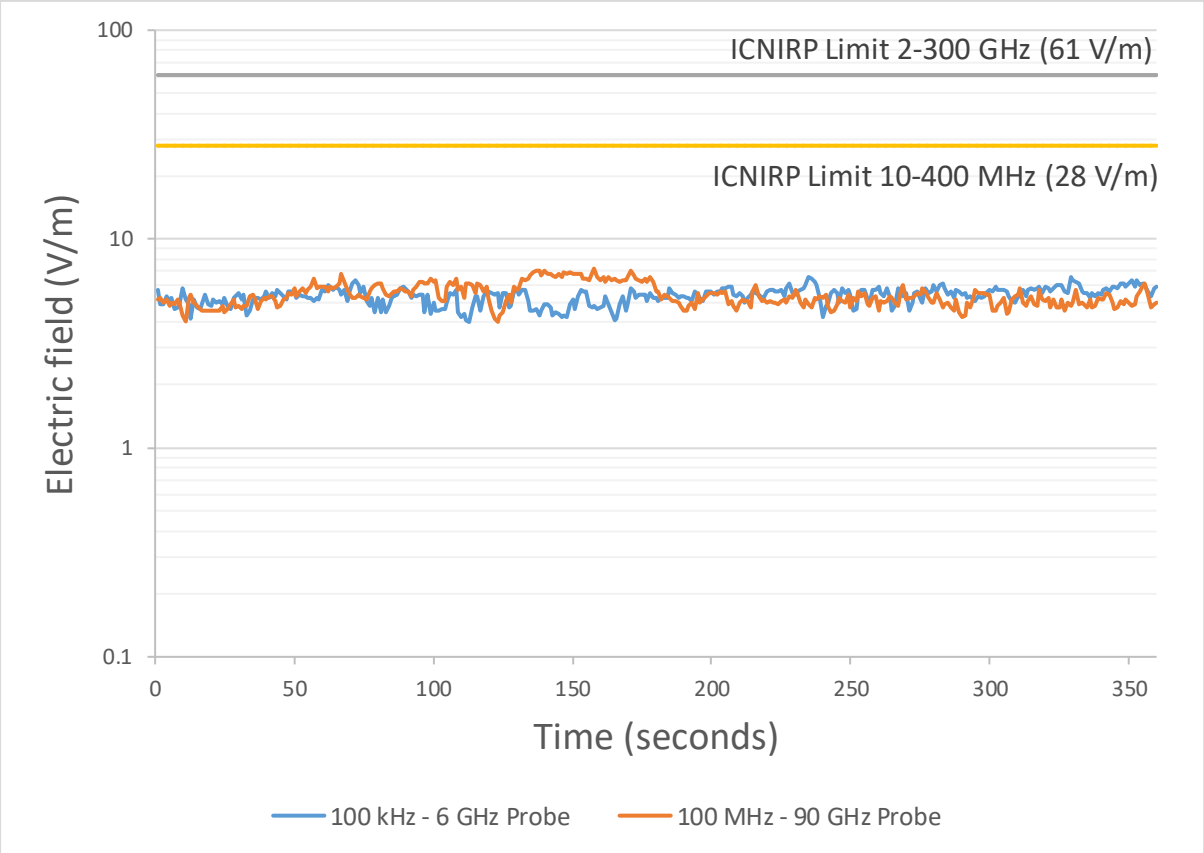
2. Summary of survey results

Measurement result:	The average total RF level measured was 5.34 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G NR 3.6GHz
Number of nearby telecommunication sites:	7 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Swords town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



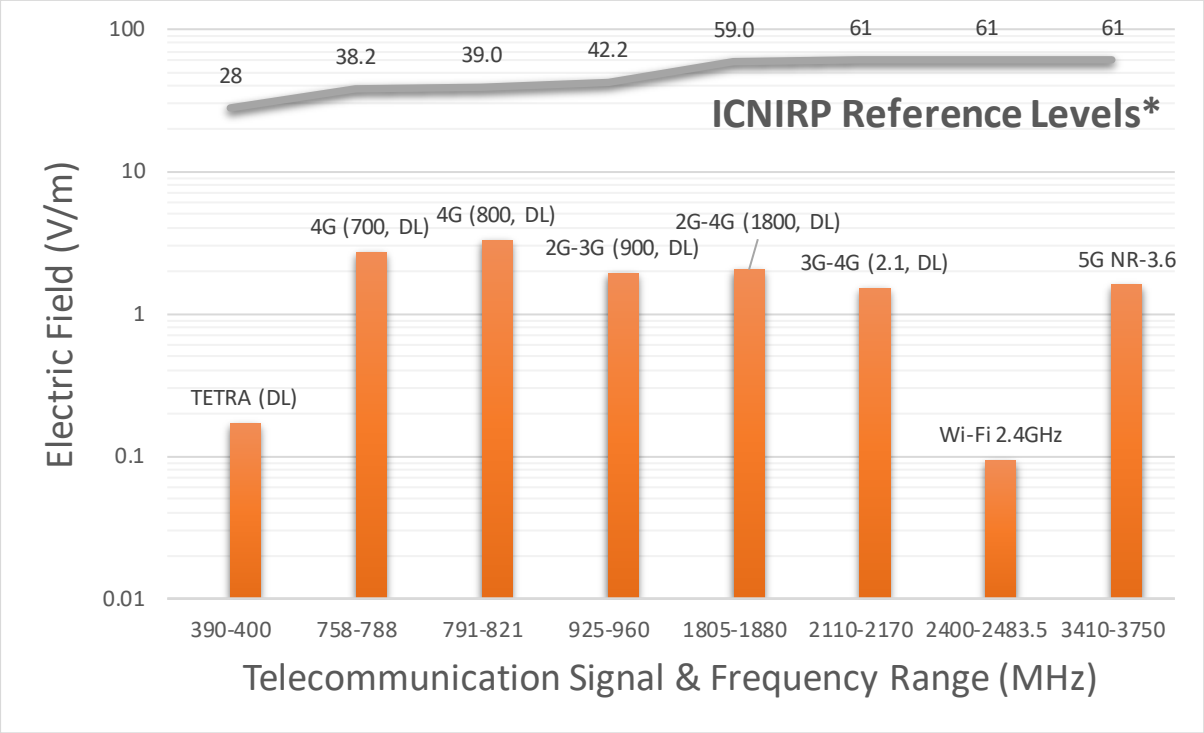
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	5.34	0.076	6.58	0.115	28*	2*
100 MHz - 90 GHz	5.41	0.078	7.22	0.138	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.21	0.0001	0.17	0.00008	28.0	2.0
4G (700, DL)	758-788	3.99	0.04	2.71	0.02	38.2	3.9
4G (800, DL)	791-821	4.13	0.05	3.29	0.03	39	4.0
2G-3G (900, DL)	925-960	2.40	0.02	1.93	0.01	42.2	4.7
2G-4G (1800, DL)	1805-1880	4.34	0.05	2.05	0.01	59.0	9.2
3G-4G (2.1, DL)	2110-2170	2.89	0.02	1.51	0.006	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.10	0.00003	0.09	0.00002	61	10
5G NR-3.6GHz	3410-3750	6.02	0.1	1.60	0.007	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 5.34 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 7 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (6.02 V/m) is likely to correspond to the emission (downlink) from nearby 5G NR 3.6GHz antennas. Measurements carried out while using a 5G mobile phone in the proximity of the measurement equipment did not change the measurement results.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites

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- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/14	12 Oct 2021	J Vila

1. Measurement survey characteristics

Measurement date:	1st October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	The Square Shopping Centre, Tallaght, Co Dublin
GPS coordinates:	53°17'10.3" N; 6°22'13.3" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Tallaght with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

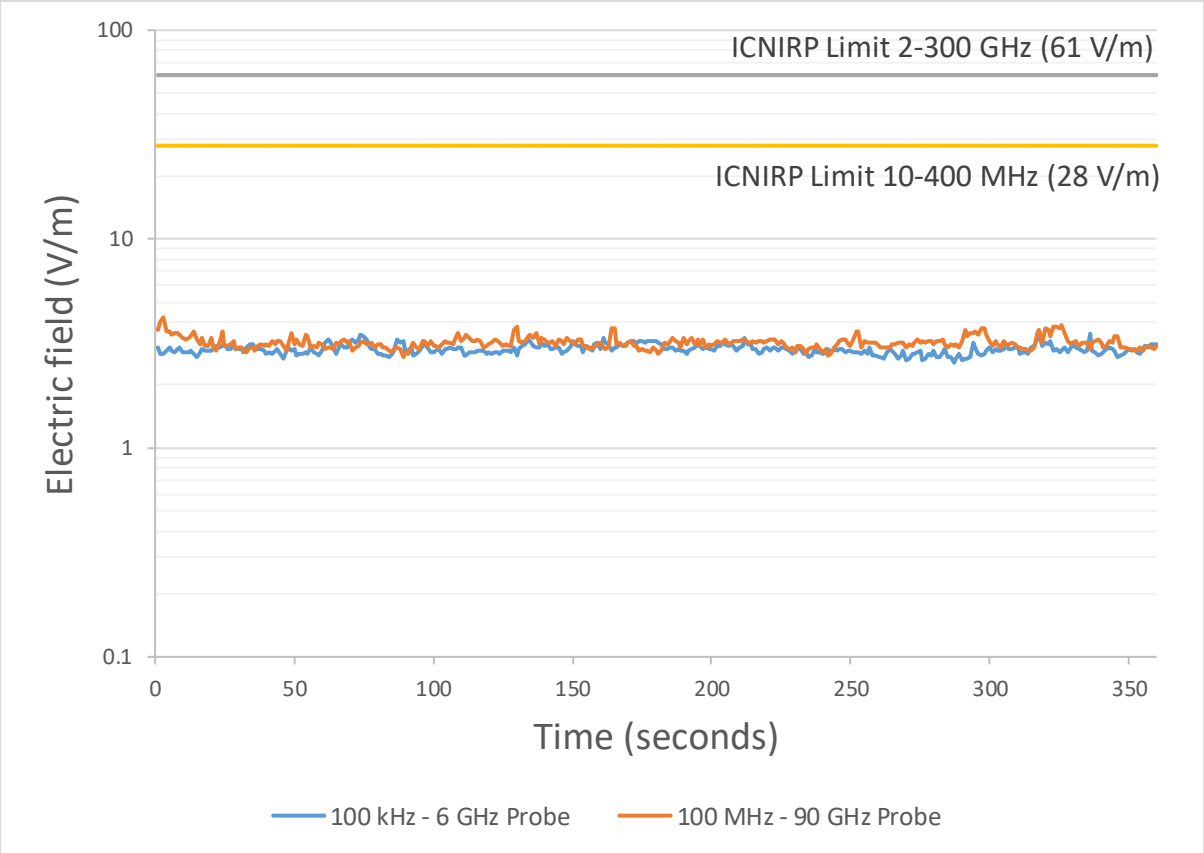
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.97 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, PMR, DVB-T, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi
Number of nearby telecommunication sites:	5 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Tallaght centre (The Square Shopping Centre) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



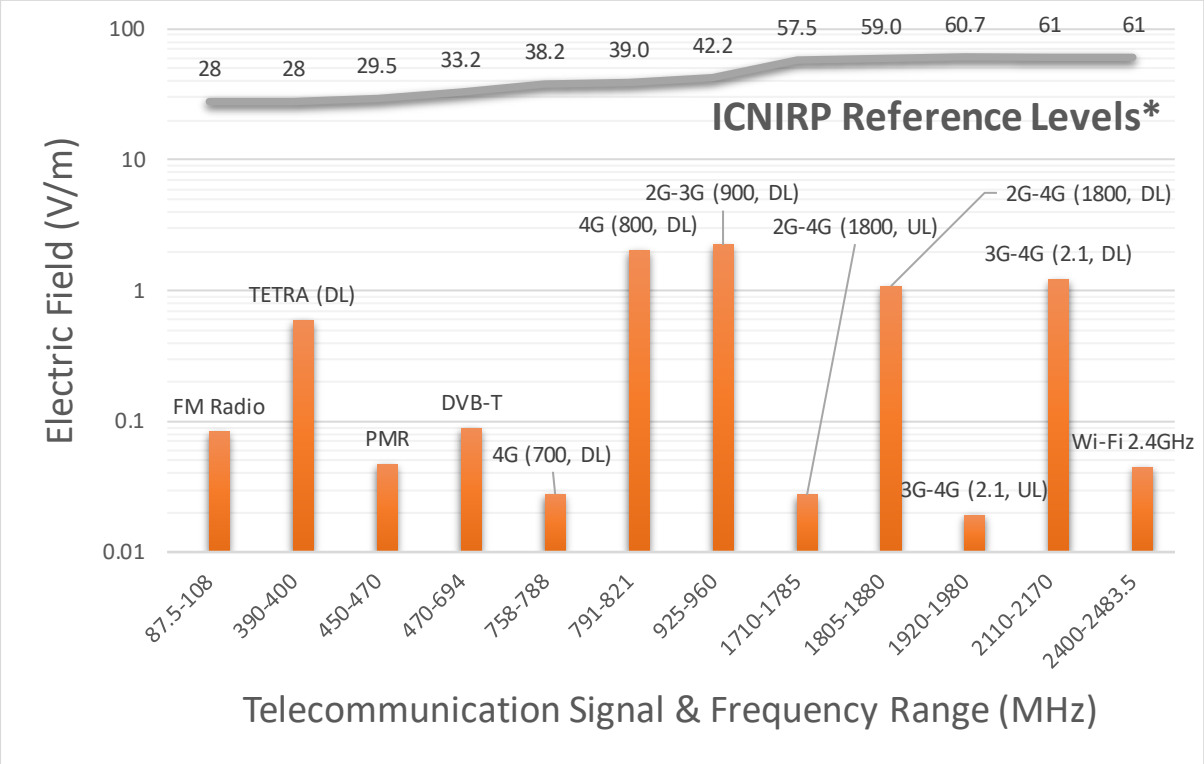
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	2.97	0.023	3.52	0.033	28*	2*
100 MHz - 90 GHz	3.19	0.027	4.22	0.047	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB-T: Digital TV.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

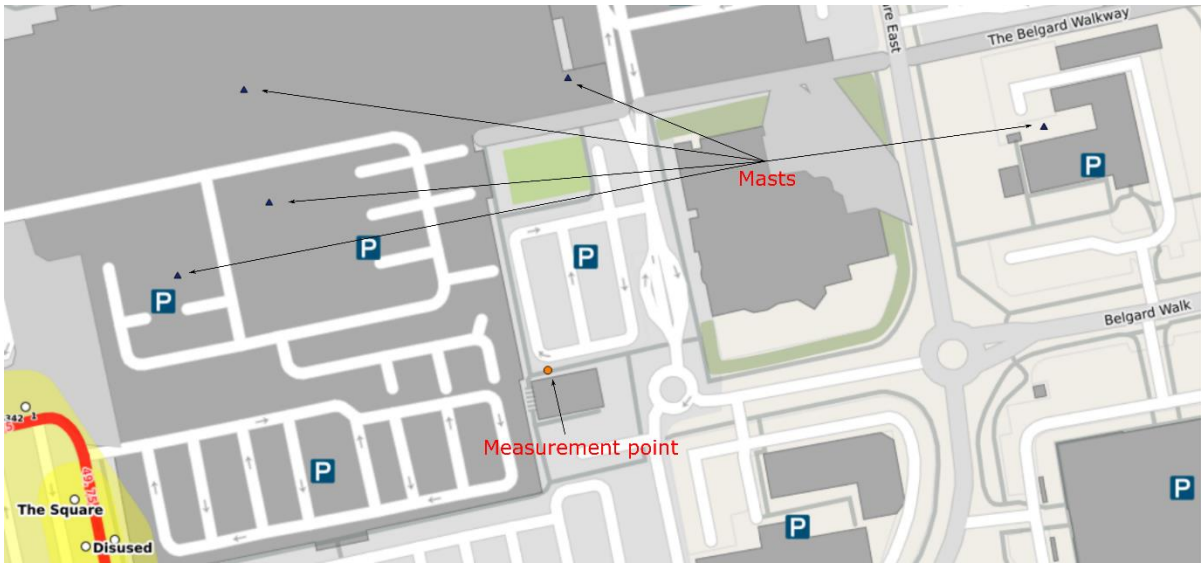
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.09	0.00002	0.08	0.00002	28.0	2.0
TETRA (DL)	390-400	0.77	0.002	0.59	0.0009	28.0	2.0
PMR	450-470	0.08	0.00002	0.05	0.00001	29.5	2.3
DVB-T	470-694	0.10	0.00003	0.09	0.00002	33.2	2.9
4G (700, DL)	758-788	0.03	0.000003	0.03	0.000002	38.2	3.9
4G (800, DL)	791-821	2.54	0.02	2.02	0.01	39	4.0
2G-3G (900, DL)	925-960	3.45	0.03	2.24	0.01	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.20	0.0001	0.03	0.000002	57.5	8.7
2G-4G (1800, DL)	1805-1880	1.73	0.008	1.08	0.003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.11	0.00003	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	1.58	0.007	1.21	0.004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.19	0.00009	0.04	0.000005	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB-T: Digital TV.

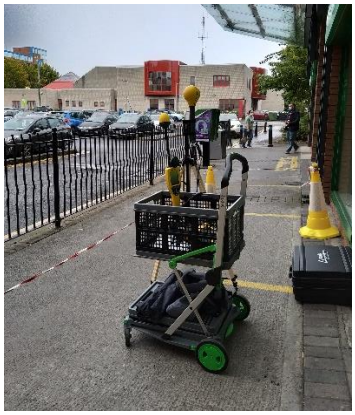
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.97 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 4 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (3.45 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference#	Issue Date	Issued by
	1.0	2021/10	10th Sept. 2021	J Vila

1. Measurement survey characteristics

Measurement date:	7th September 2021
Measurement time:	13:45 am – 15:00 pm
Measurement point & location:	Westmoreland Street-Fleet Street, Dublin, Co Dublin
GPS coordinates:	53°20'45.6" N; 6°15'34.2" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Dublin city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

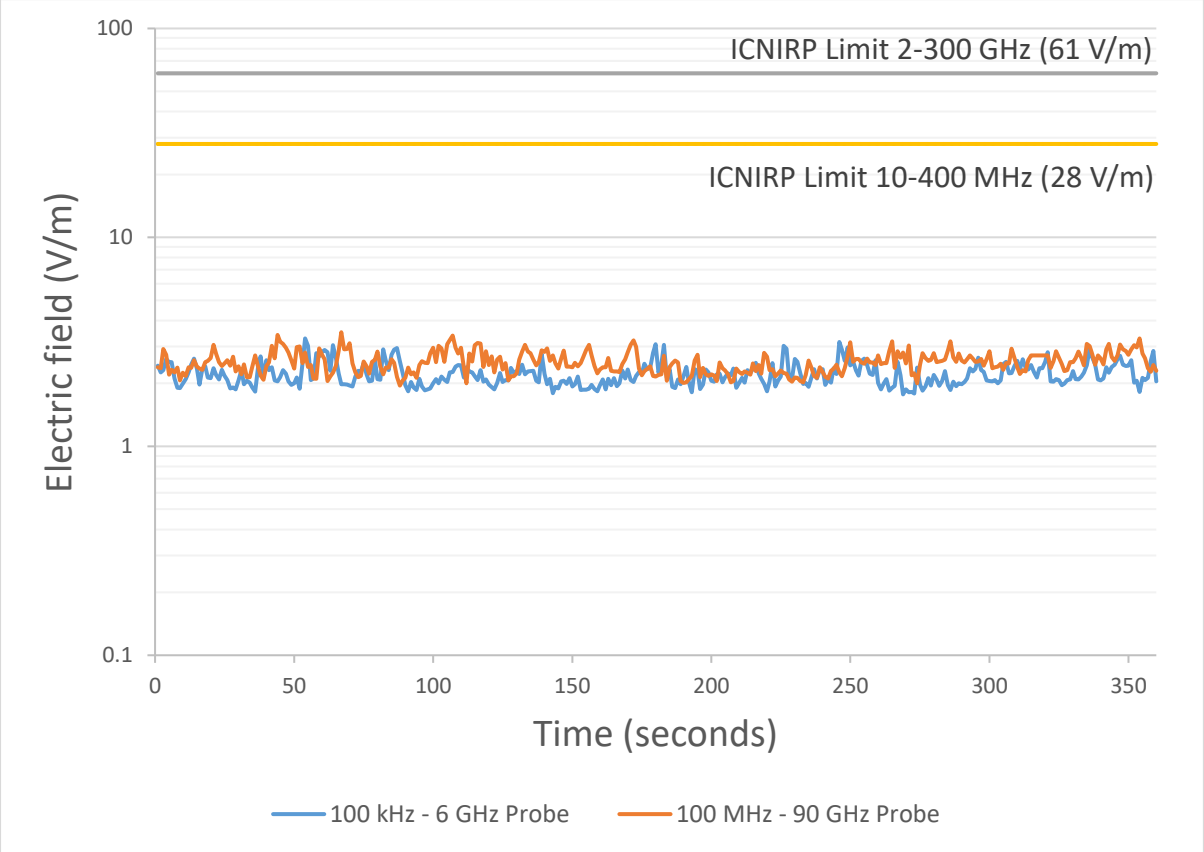
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.22 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), 5G (NR-3.6), FWALA, TETRA, Wi-Fi
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Dublin city centre (King St-Grafton St) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



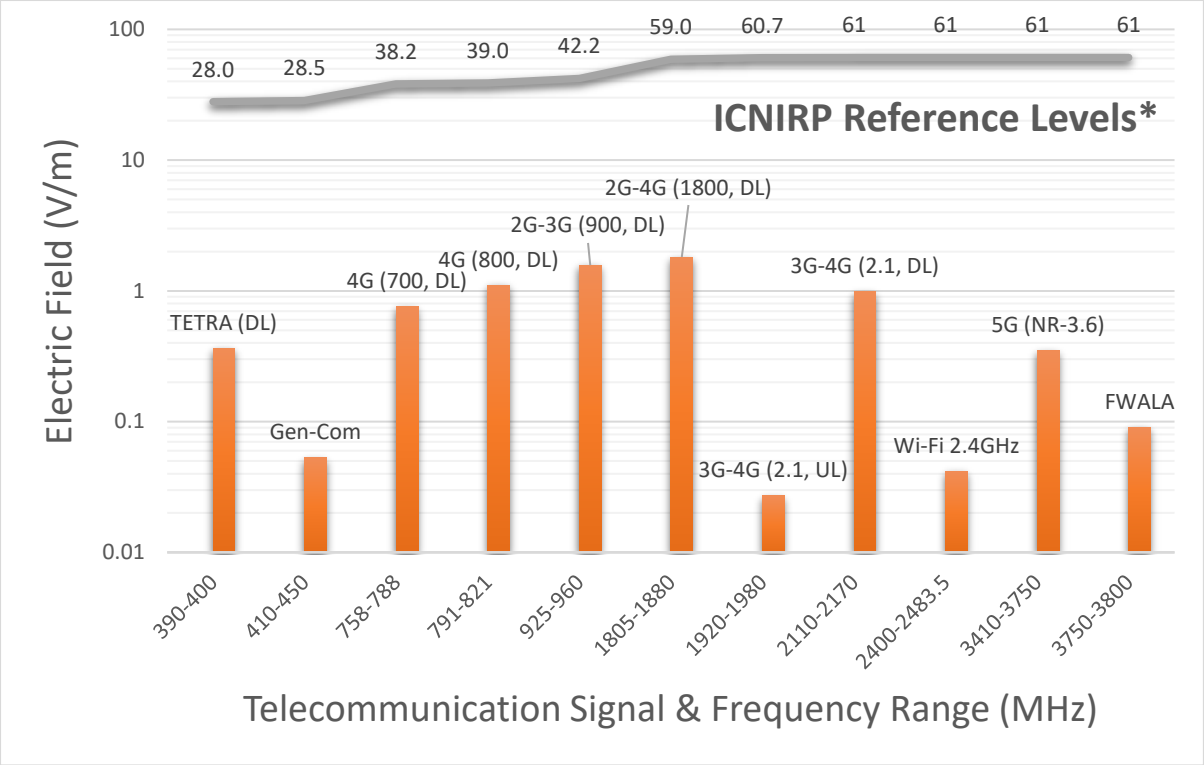
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	2.22	0.013	3.28	0.029	28*	2*
100 MHz - 90 GHz	2.52	0.017	3.52	0.033	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; Gen-Com: This freq. range includes a mixture of amateur, PMR and land mobile signals; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.51	0.00068	0.36	0.000347	28.0	2.0
Gen-Com	410-450	0.25	0.00016	0.05	0.000007	28.5	2.2
4G (700, DL)	758-788	1.41	0.00524	0.76	0.001518	38.2	3.9
4G (800, DL)	791-821	2.14	0.01215	1.10	0.003233	39	4.0
2G-3G (900, DL)	925-960	2.08	0.01142	1.57	0.006555	42.2	4.7
2G-4G (1800, DL)	1805-1880	3.57	0.03381	1.82	0.008738	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.05	0.00001	0.03	0.000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	1.66	0.00734	0.99	0.002577	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.10	0.00003	0.04	0.000005	61	10
5G (NR-3.6)	3410-3750	1.36	0.00487	0.35	0.000320	61	10
FWALA	3750-3800	0.35	0.00032	0.09	0.000022	61	10

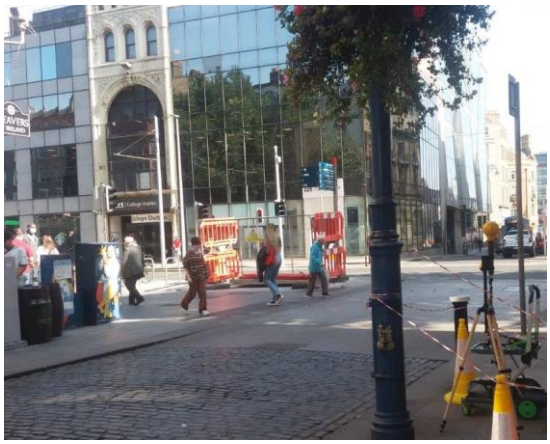
Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; Gen-Com: This freq. range includes a mixture of amateur, PMR and land mobile signals; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.22 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 4 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (3.57 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz band) antennas. 5G signals were detected at the point of measurement, with a maximum level of 1.36 V/m. Measurements carried out while streaming video on a 5G phone did not change the readings.

6. Map of measurement point and nearby telecommunication sites

7. Photo of measurement point (Westmoreland St - Fleet St)



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/10	30 Sept. 2021	J Vila

1. Measurement survey characteristics

Measurement date:	16th September 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Georges Street Lower, Dun Laoghaire, Co Dun Laoghaire-Rathdown
GPS coordinates:	53°17'33.2" N; 6°8'11.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Dun Laoghaire town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

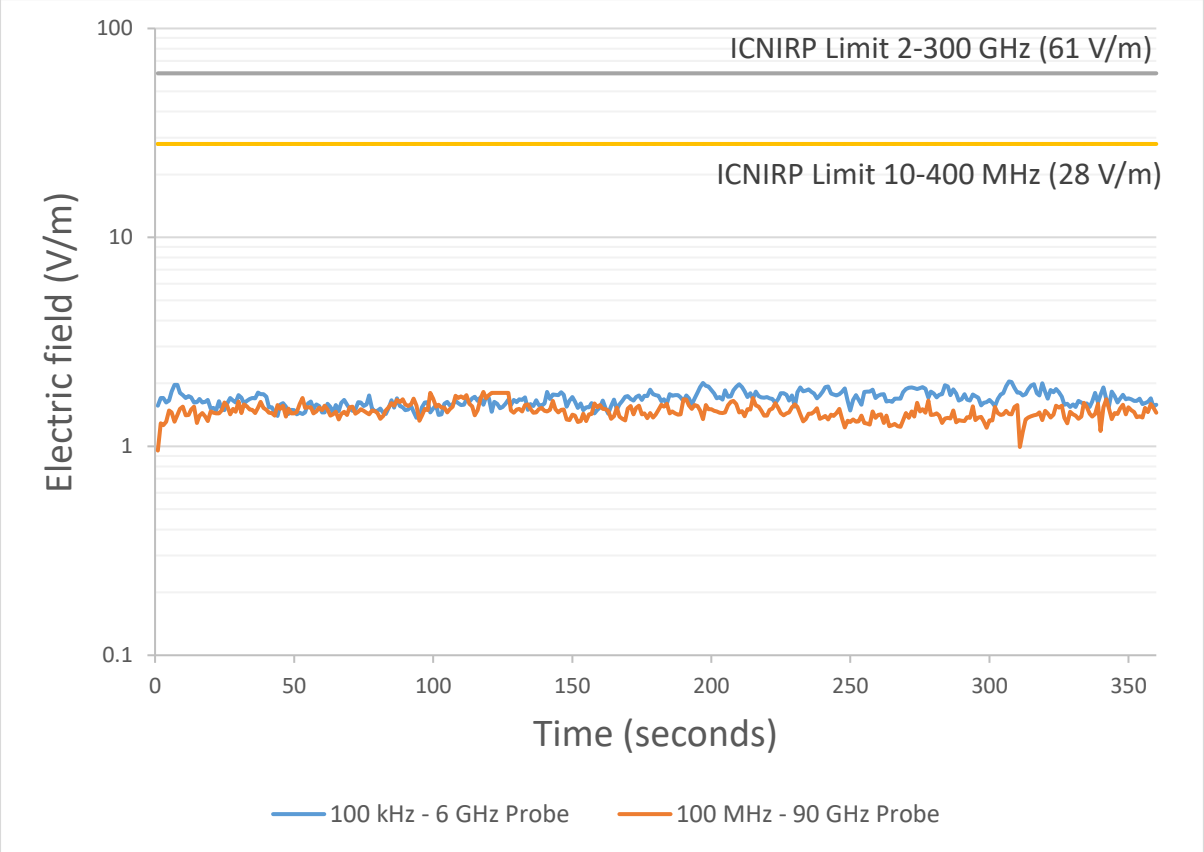
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.68 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi (2.4GHz), 5G (NR-3.6 GHz)
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Dun Laoghaire town centre (Georges Street Lower) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



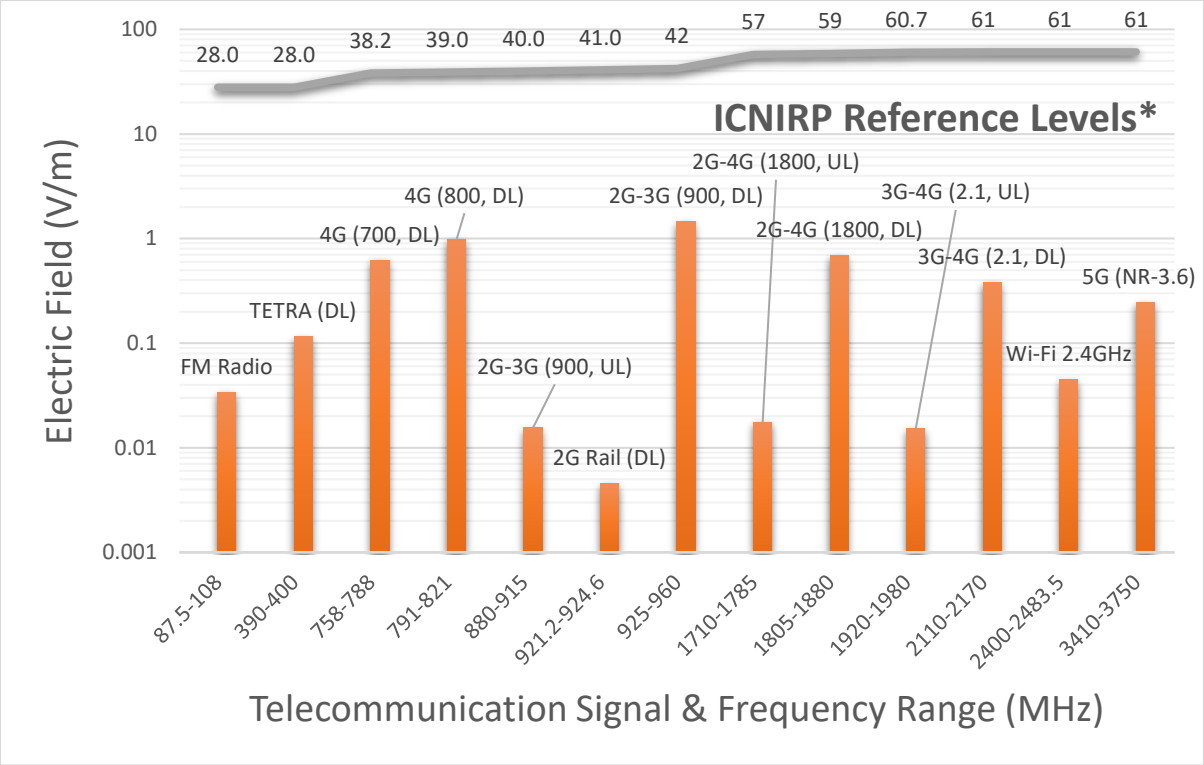
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.68	0.007	2.04	0.011	28*	2*
100 MHz - 90 GHz	1.47	0.006	1.82	0.009	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.03	0.000003	0.03	0.000003	28	2
TETRA (DL)	390-400	0.17	0.00007	0.12	0.00004	28.0	2.0
4G (700, DL)	758-788	1.12	0.003	0.62	0.001	38.2	3.9
4G (800, DL)	791-821	1.28	0.004	0.97	0.003	39	4.0
2G-3G (900, UL)	880-915	0.09	0.00002	0.02	0.000001	40	4.5
2G Rail (DL)	921.2-924.6	0.02	0.000001	0.01	0.0000001	41	4.6
2G-3G (900, DL)	925-960	2.05	0.01	1.46	0.006	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	1.20	0.004	0.68	0.001	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.02	0.000001	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.55	0.0008	0.38	0.0004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.33	0.0003	0.04	0.000005	61	10
5G (NR-3.6)	3410-3750	0.85	0.002	0.24	0.0002	61	10

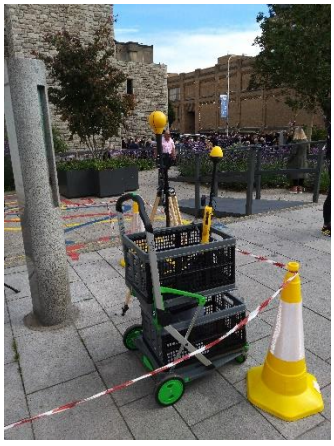
Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.68 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 3 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (2.05 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. 5G signals were detected at the point of measurement, with a maximum measured level of 0.85 V/m.

6. Map of measurement point and nearby telecommunication sites

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/21	2nd June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	19th May 2022
Measurement time (approx.):	16:00 pm – 17:00 pm
Measurement point & location:	William Street, Galway, Co Galway
GPS coordinates:	53°16'25.5" N; 9°3'05.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Galway city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

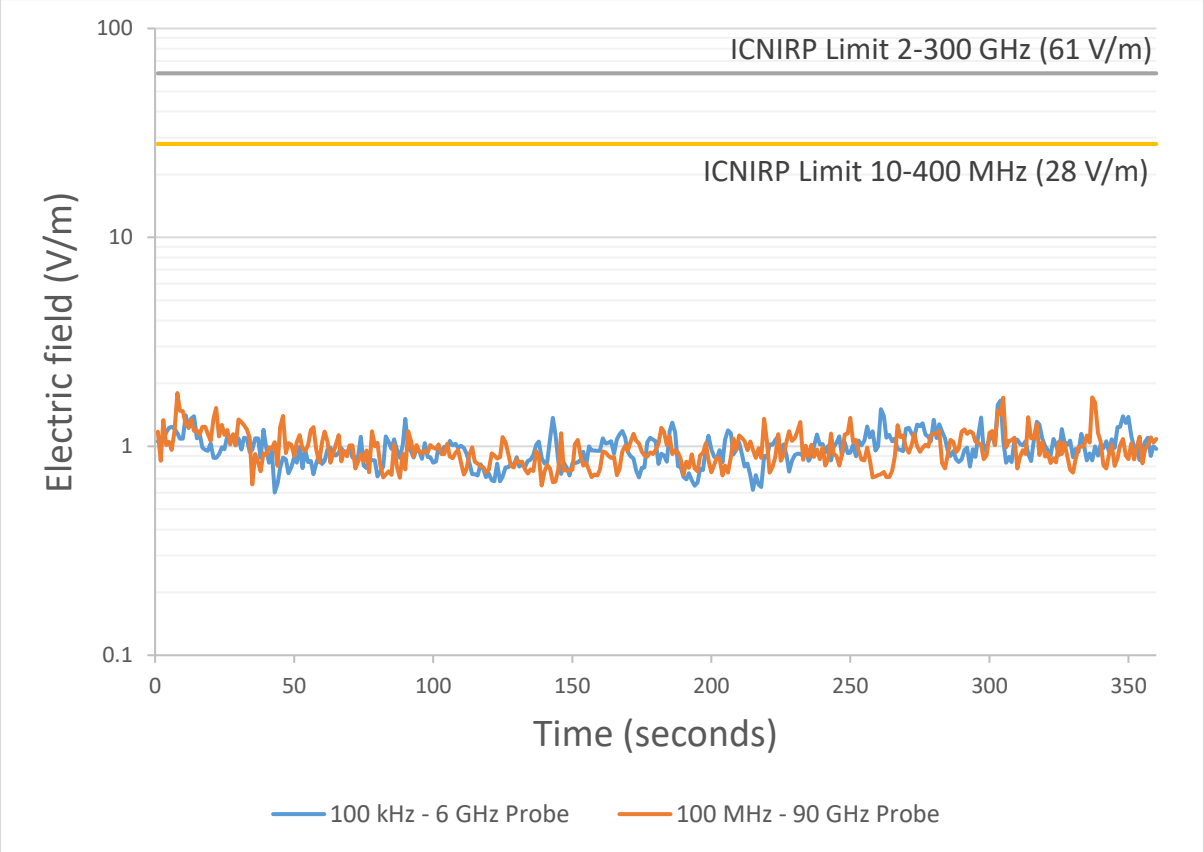
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.97 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4G5G (NR-3.6GHz), FWALA
Number of nearby telecommunication sites:	9 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Galway city centre (William Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



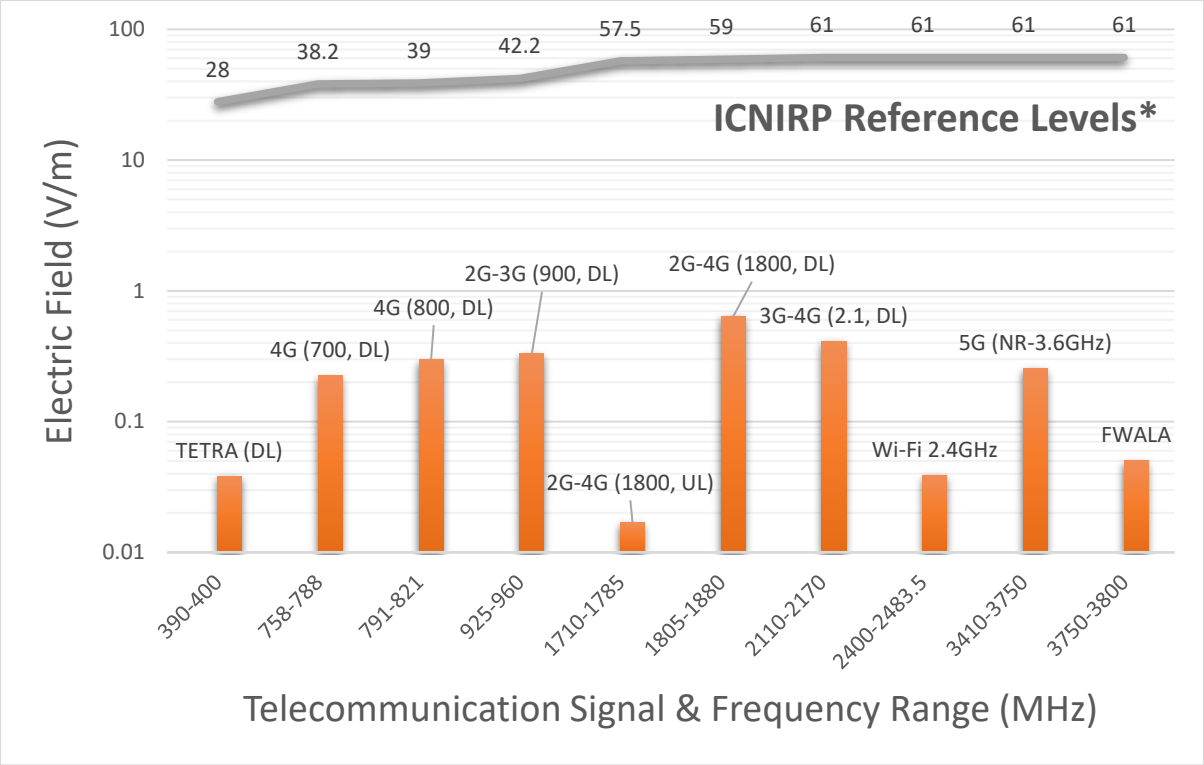
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.97	0.003	1.66	0.007	28*	2*
100 MHz - 90 GHz	0.98	0.003	1.80	0.009	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. [*]ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

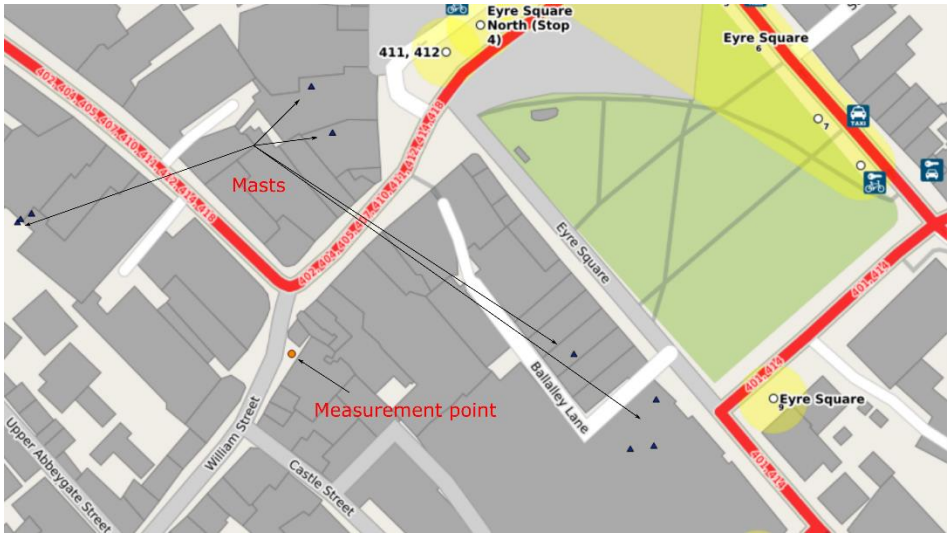
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.05	0.000007	0.04	0.000004	28.0	2.0
4G (700, DL)	758-788	0.41	0.0005	0.22	0.0001	38.2	3.9
4G (800, DL)	791-821	0.47	0.0006	0.30	0.0002	39	4.0
2G-3G (900, DL)	925-960	0.46	0.0006	0.33	0.0003	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	1.13	0.003	0.64	0.001	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.66	0.001	0.41	0.0004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.10	0.00003	0.04	0.000004	61	10
5G (NR-3.6GHz)	3410-3750	0.76	0.002	0.26	0.0002	61	10
FWALA	3750-3800	0.12	0.00004	0.05	0.000007	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.97 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.13 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.76 V/m (without data traffic) and 1.06 V/m (while making a video call using a 5G mobile phone connected to an available 5G network).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/18	01 June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	18th May 2022
Measurement time (approx.):	14:00 pm – 15:00 pm
Measurement point & location:	High Street, Killarney, Co Kerry
GPS coordinates:	52°3'33.6" N; 9°30'34.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Killarney town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

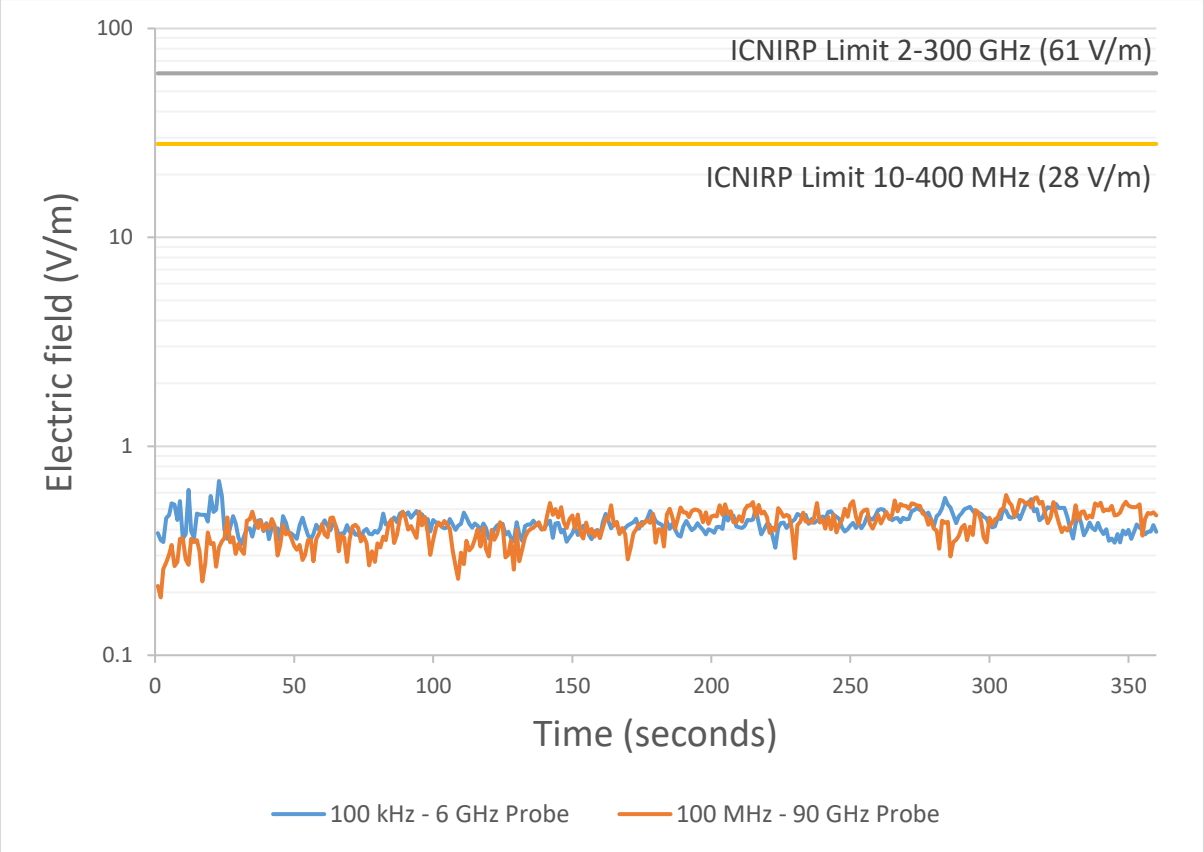
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.43 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), Wi-Fi 5GHz, BWA
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Killarney town centre (High Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



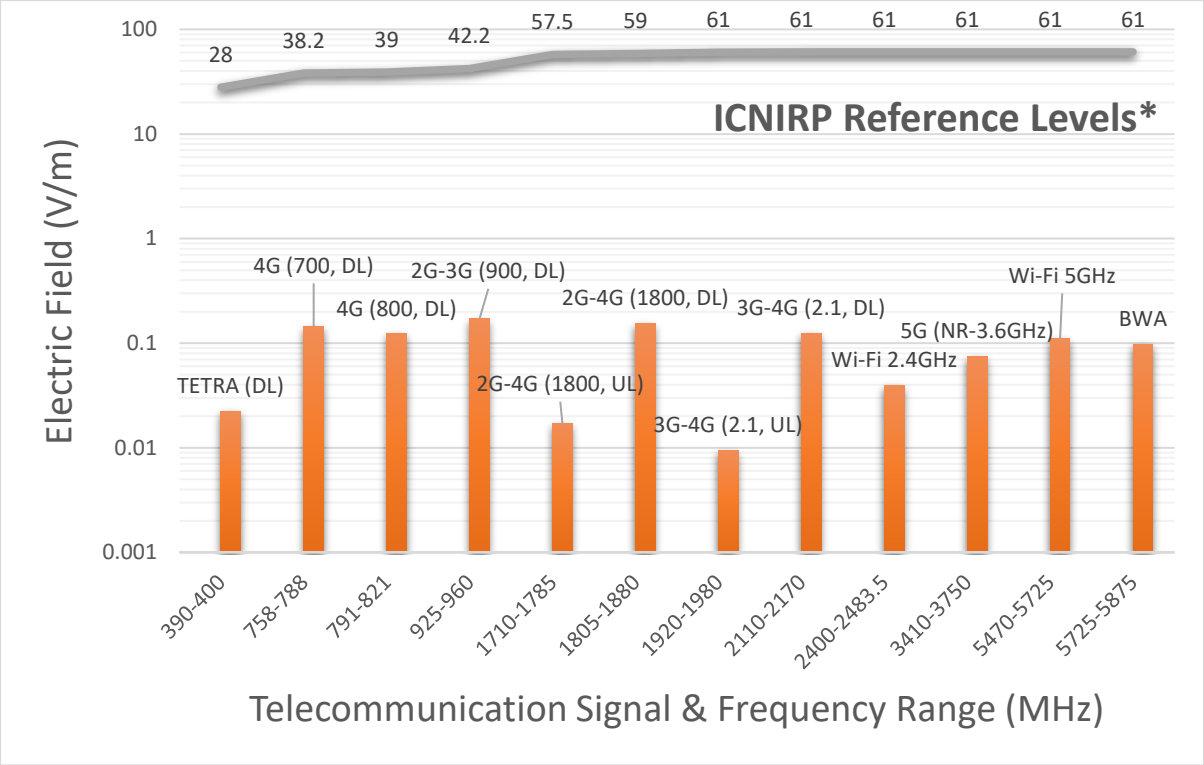
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.43	0.0005	0.68	0.001	28*	2*
100 MHz - 90 GHz	0.42	0.0005	0.58	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; BWA: Broadband Wireless Access.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

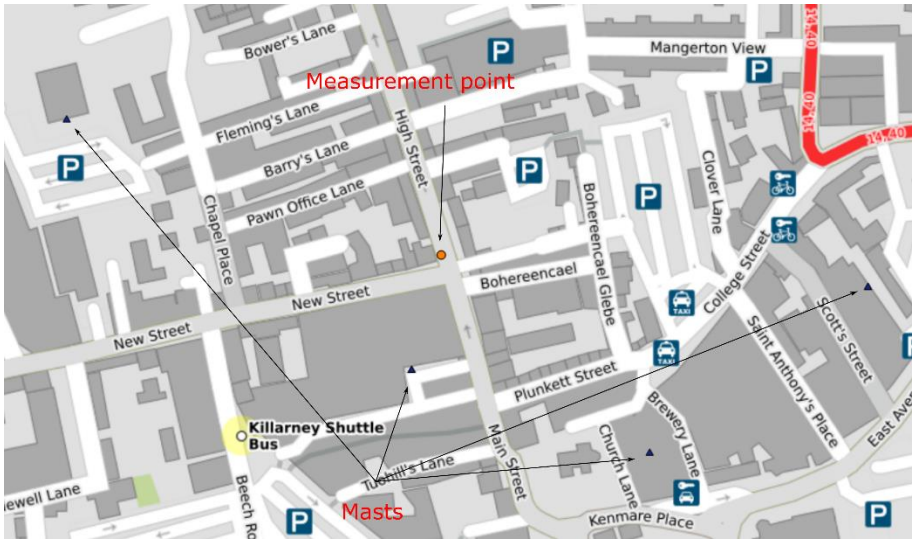
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.03	0.000002	0.02	0.000001	28	2
4G (700, DL)	758-788	0.22	0.0001	0.14	0.00006	38.2	3.9
4G (800, DL)	791-821	0.17	0.00007	0.12	0.00004	39	4
2G-3G (900, DL)	925-960	0.22	0.0001	0.17	0.00008	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.10	0.00002	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.23	0.0001	0.15	0.00006	59	9.2
3G-4G (2.1, UL)	1920-1980	0.04	0.000003	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.18	0.00008	0.12	0.00004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.10	0.00002	0.04	0.000004	61	10
5G (NR-3.6GHz)	3410-3750	0.14	0.00005	0.07	0.00001	61	10
Wi-Fi 5GHz	5470-5725	0.12	0.00004	0.11	0.00003	61	10
BWA	5725-5875	0.10	0.00003	0.10	0.00003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; BWA: Broadband Wireless Access.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.43 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.23 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.14 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

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The following EMF measurement equipment was used:

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- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/19	2nd June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	18th May 2022
Measurement time (approx.):	16:00 pm – 17:00 pm
Measurement point & location:	Russell Street, Tralee, Co Kerry
GPS coordinates:	52°16'12.9" N; 9°42'28.8" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Tralee town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

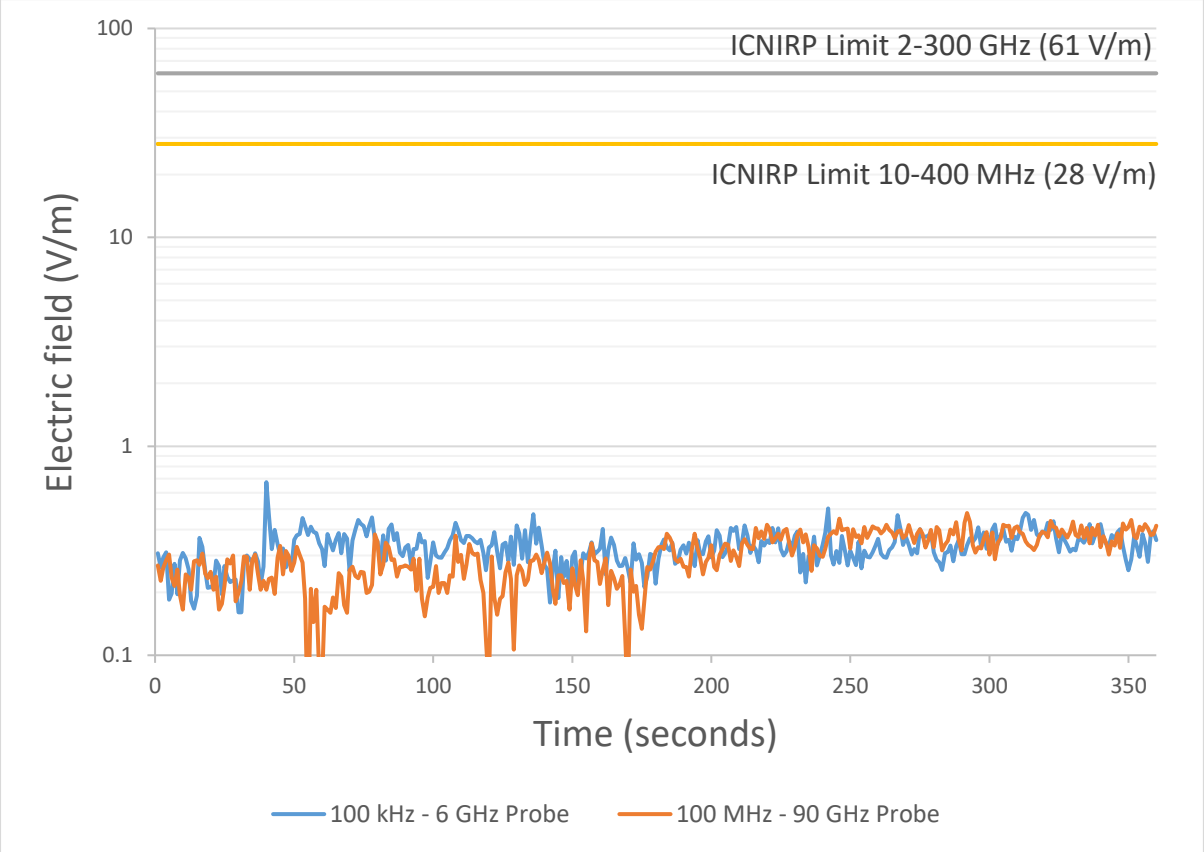
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.30 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Tralee town centre (Russell Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



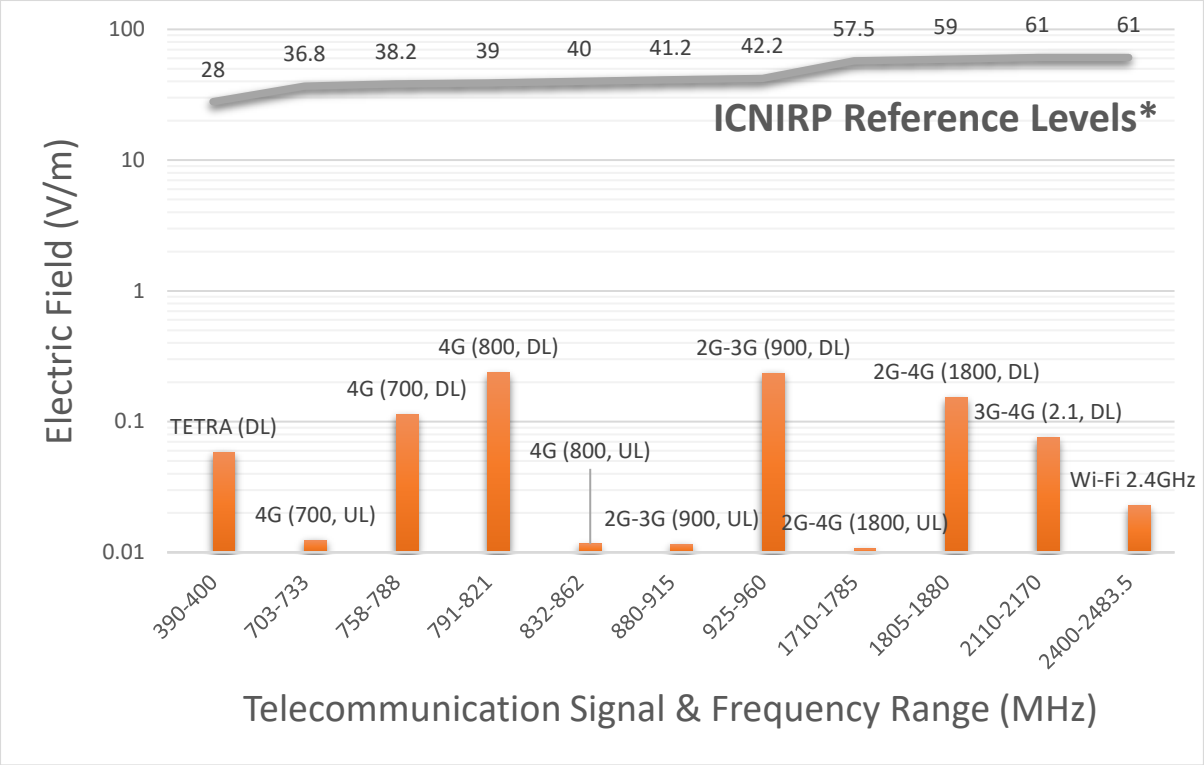
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.33	0.0003	0.67	0.001	28*	2*
100 MHz - 90 GHz	0.30	0.0002	0.48	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

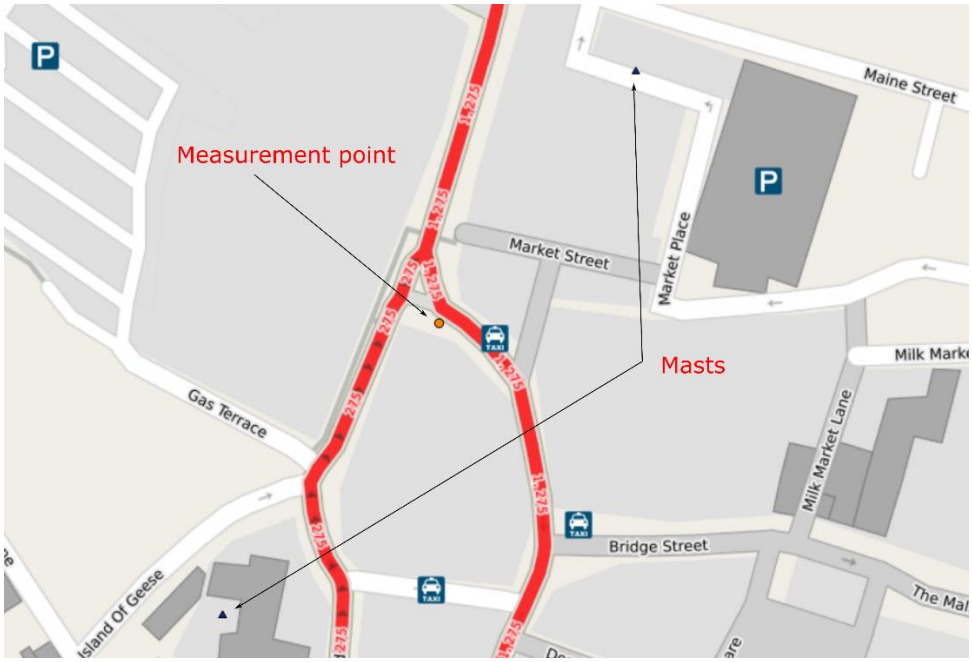
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.09	0.00002	0.06	0.000009	28.0	2.0
4G (700, UL)	703-733	0.01	0.000001	0.01	0.0000004	36.8	3.6
4G (700, DL)	758-788	0.16	0.00007	0.11	0.00003	38.2	3.9
4G (800, DL)	791-821	0.28	0.0002	0.24	0.0001	39	4.0
4G (800, UL)	832-862	0.05	0.00001	0.01	0.0000004	39	4.2
2G-3G (900, UL)	880-915	0.03	0.000003	0.01	0.0000004	41.2	4.5
2G-3G (900, DL)	925-960	0.29	0.0002	0.23	0.0001	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.04	0.000005	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.20	0.0001	0.15	0.00006	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.10	0.00003	0.08	0.00002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.05	0.000008	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

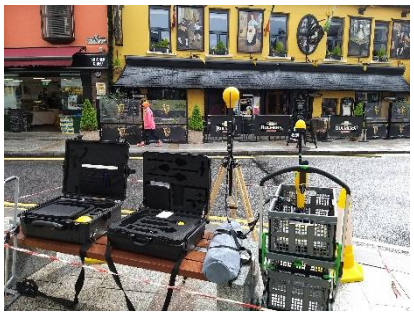
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.30 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.29 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/22	17 Nov 2021	J Vila

1. Measurement survey characteristics

Measurement date:	5th November 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Maynooth Road, Celbridge, Co Kildare
GPS coordinates:	53°20'38.0" N; 6°32'31.5" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Celbridge town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

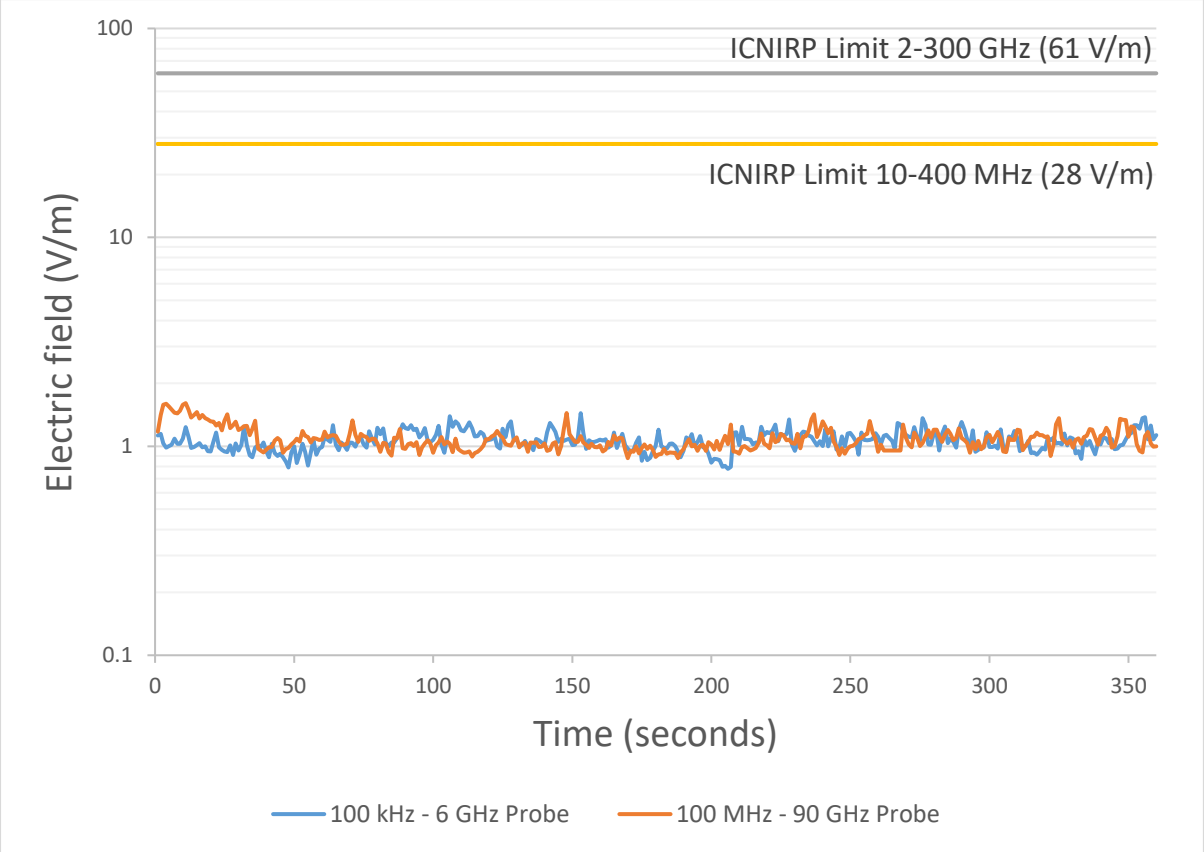
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.06 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, DVB_T, 2G (GSM), 3G (UMTS), 4G (LTE), 5G (NR 3.6GHz)
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Celbridge town centre (Maynooth Road) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



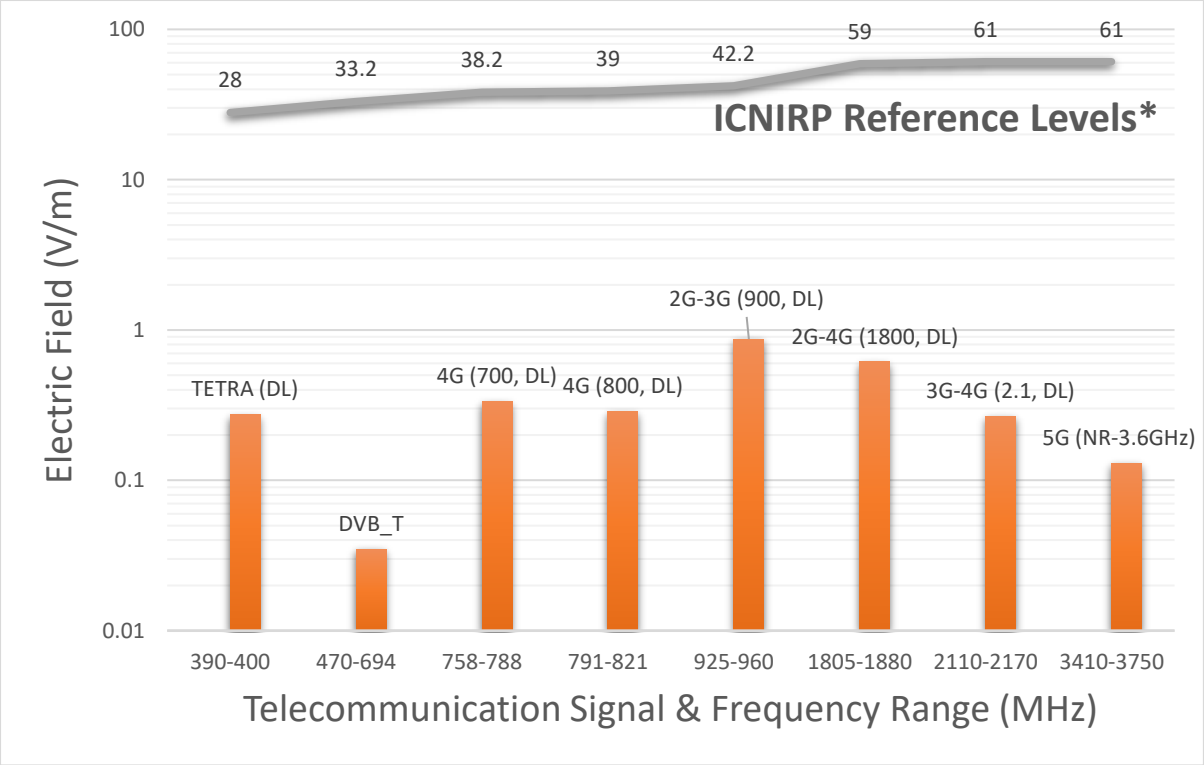
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.06	0.003	1.44	0.006	28*	2*
100 MHz - 90 GHz	1.09	0.003	1.61	0.007	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; DVB_T: Terrestrial Digital Video Broadcasting; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

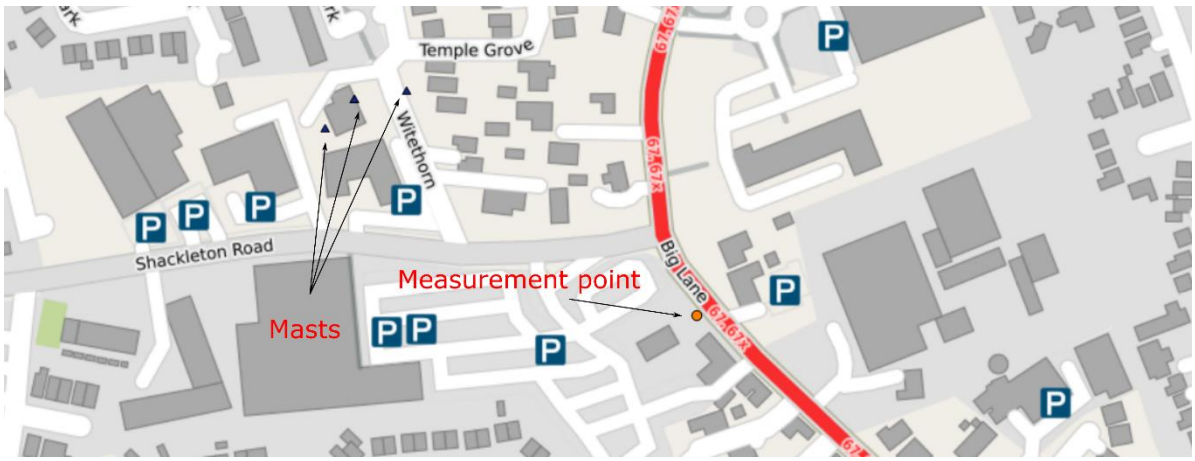
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.37	0.0004	0.27	0.0002	28.0	2.0
DVB_T	470-694	0.04	0.000004	0.03	0.000003	33.2	2.9
4G (700, DL)	758-788	0.64	0.001	0.33	0.0003	38.2	3.9
4G (800, DL)	791-821	0.40	0.0004	0.29	0.0002	39	4.0
2G-3G (900, DL)	925-960	1.18	0.004	0.87	0.002	42.2	4.7
2G-4G (1800, DL)	1805-1880	1.10	0.003	0.61	0.001	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.66	0.001	0.27	0.0002	61	10
5G (NR-3.6GHz)	3410-3750	0.49	0.0006	0.13	0.00004	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; DVB_T: Terrestrial Digital Video Broadcasting; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.06 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.18 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. 5G signals were detected at the point of measurement with a maximum (rms, pilot) level of 0.49 V/m. 5G levels did not change when streaming video on a 5G mobile phone connected to a 5G network.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/23	17 May 2021	J Vila

1. Measurement survey characteristics

Measurement date:	17th May 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Main Street, Leixlip, Co Kildare
GPS coordinates:	53°21'49.7" N; 6°29'24.3" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Leixlip town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

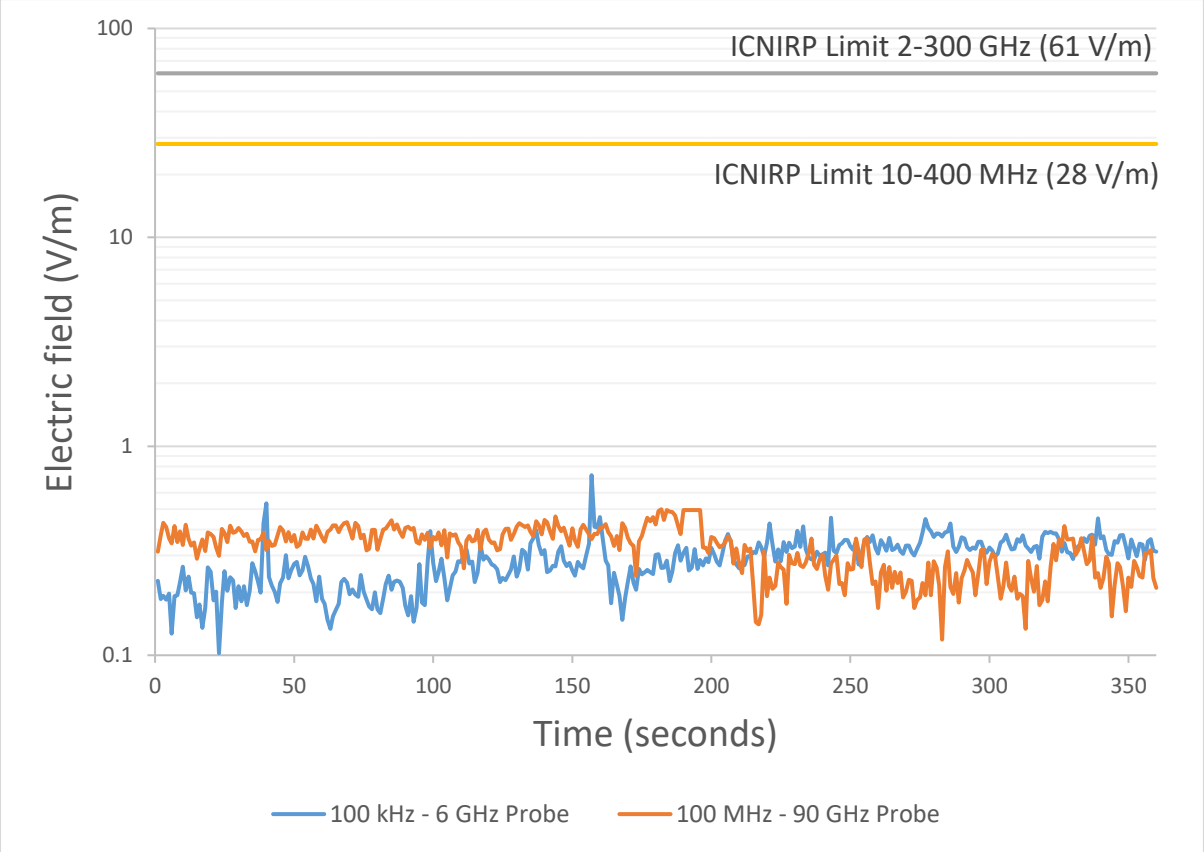
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.29 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi (2.4GHz)
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Leixlip town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



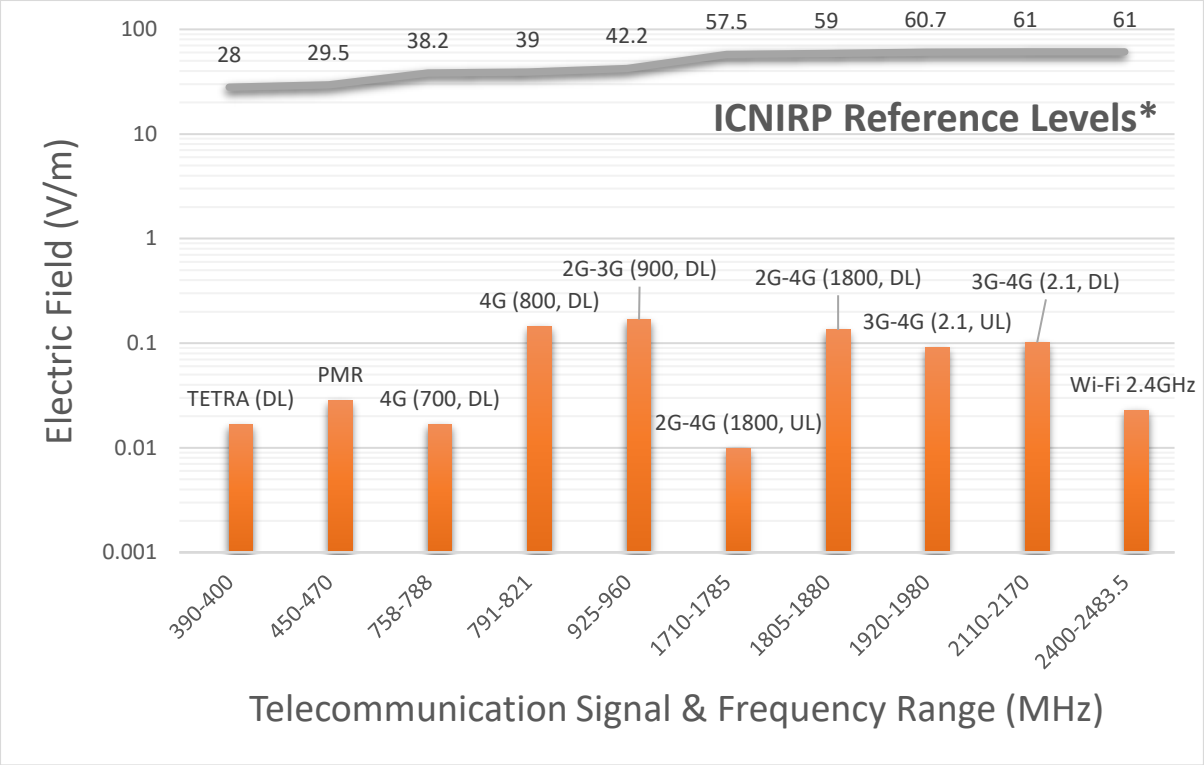
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.29	0.0002	0.73	0.001	28*	2*
100 MHz - 90 GHz	0.33	0.0003	0.50	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

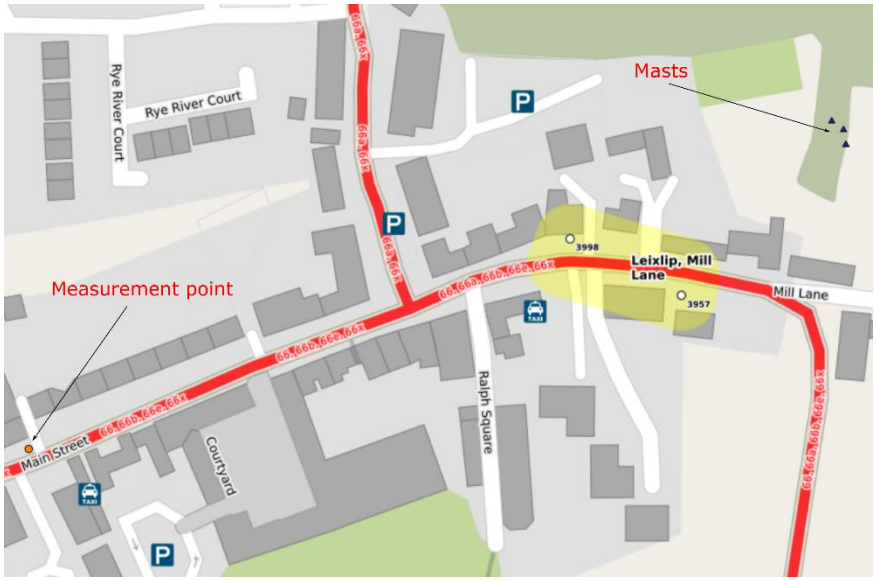
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.02	0.000001	0.02	0.000001	28.0	2.0
PMR	450-470	0.09	0.00002	0.03	0.000002	29.5	2.3
4G (700, DL)	758-788	0.04	0.000005	0.02	0.000001	38.2	3.9
4G (800, DL)	791-821	0.21	0.0001	0.14	0.00005	39	4.0
2G-3G (900, DL)	925-960	0.23	0.0001	0.17	0.00008	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.0000004	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.22	0.0001	0.13	0.00005	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.88	0.002	0.09	0.00002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.16	0.00007	0.10	0.00003	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.13	0.00004	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.29 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.88 V/m) is likely to correspond to the emission (uplink) from nearby 3G-4G (2100 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

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- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/24	22 Nov 2021	J Vila

1. Measurement survey characteristics

Measurement date:	5th May 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Main Street, Maynooth, Co Kildare
GPS coordinates:	53°22'56.1" N; 6°35'19.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Maynooth town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

2. Summary of survey results

Measurement result:	The average total RF level measured was 0.88 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G Rail, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Maynooth town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

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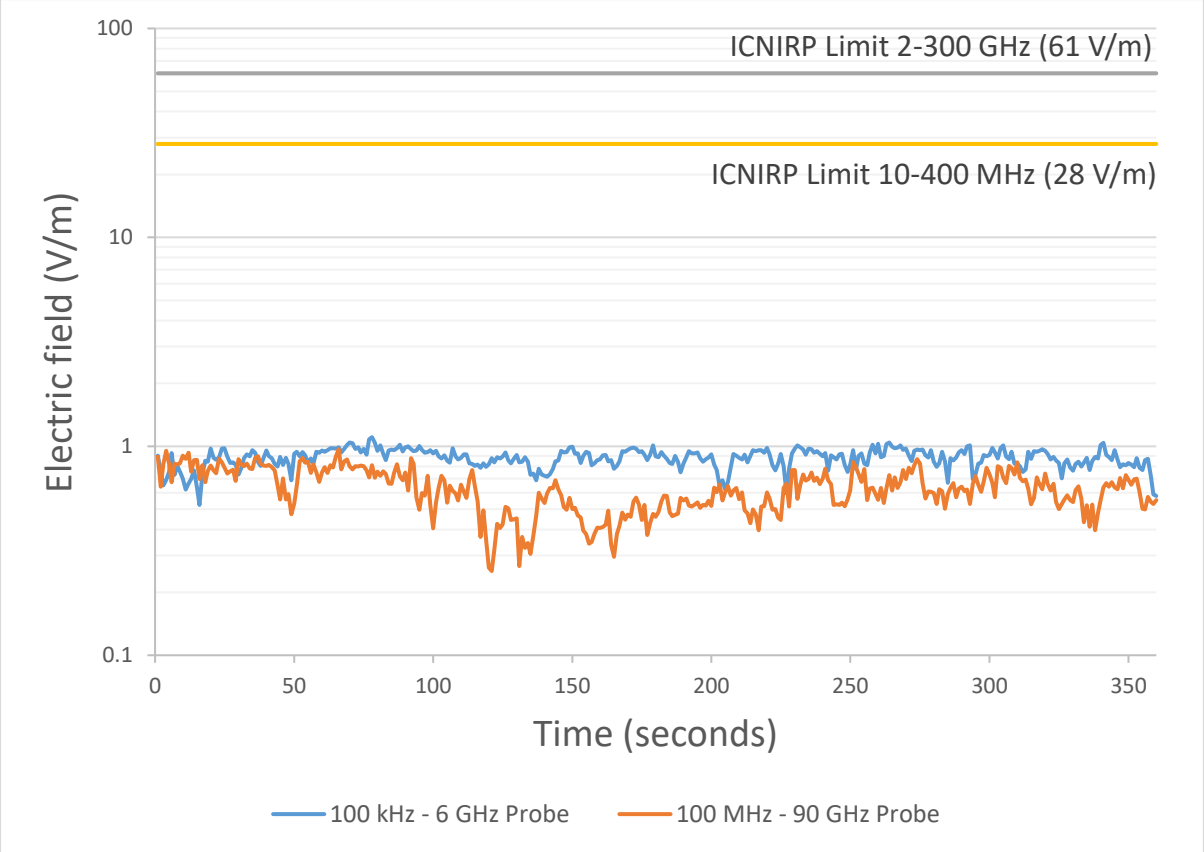


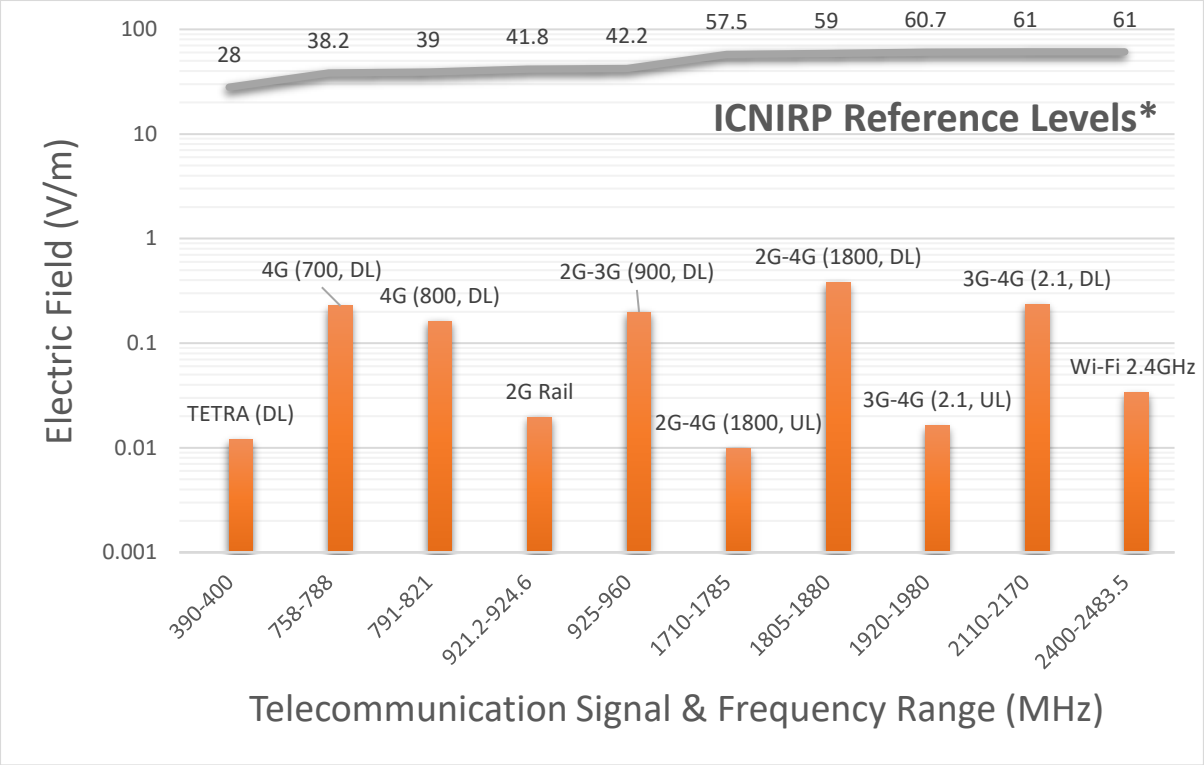
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.88	0.002	1.11	0.003	28*	2*
100 MHz - 90 GHz	0.63	0.001	0.97	0.002	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

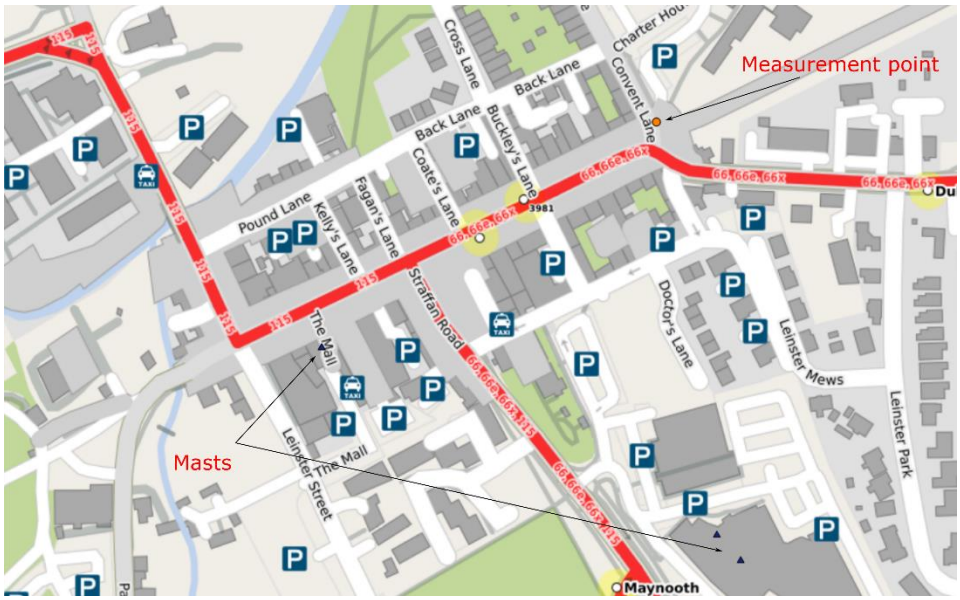
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.02	0.000001	0.01	0.0000004	28	2.0
4G (700, DL)	758-788	0.33	0.0003	0.23	0.0001	38.2	3.9
4G (800, DL)	791-821	0.23	0.0001	0.16	0.00007	39	4.0
2G Rail	921.2-924.6	0.02	0.000001	0.02	0.000001	41.8	4.6
2G-3G (900, DL)	925-960	0.29	0.0002	0.20	0.0001	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.0000003	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.56	0.0008	0.38	0.0004	59	9.2
3G-4G (2.1, UL)	1920-1980	0.14	0.00005	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.50	0.0007	0.24	0.0001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.18	0.00009	0.03	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.88 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.56 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/19	28 Oct 2021	J Vila

1. Measurement survey characteristics

Measurement date:	22nd October 2021
Measurement time:	10:30 am – 13:00 pm
Measurement point & location:	Main Street, Naas, Co Kildare
GPS coordinates:	53°12'59.9" N; 6°39'53.3" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Naas town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

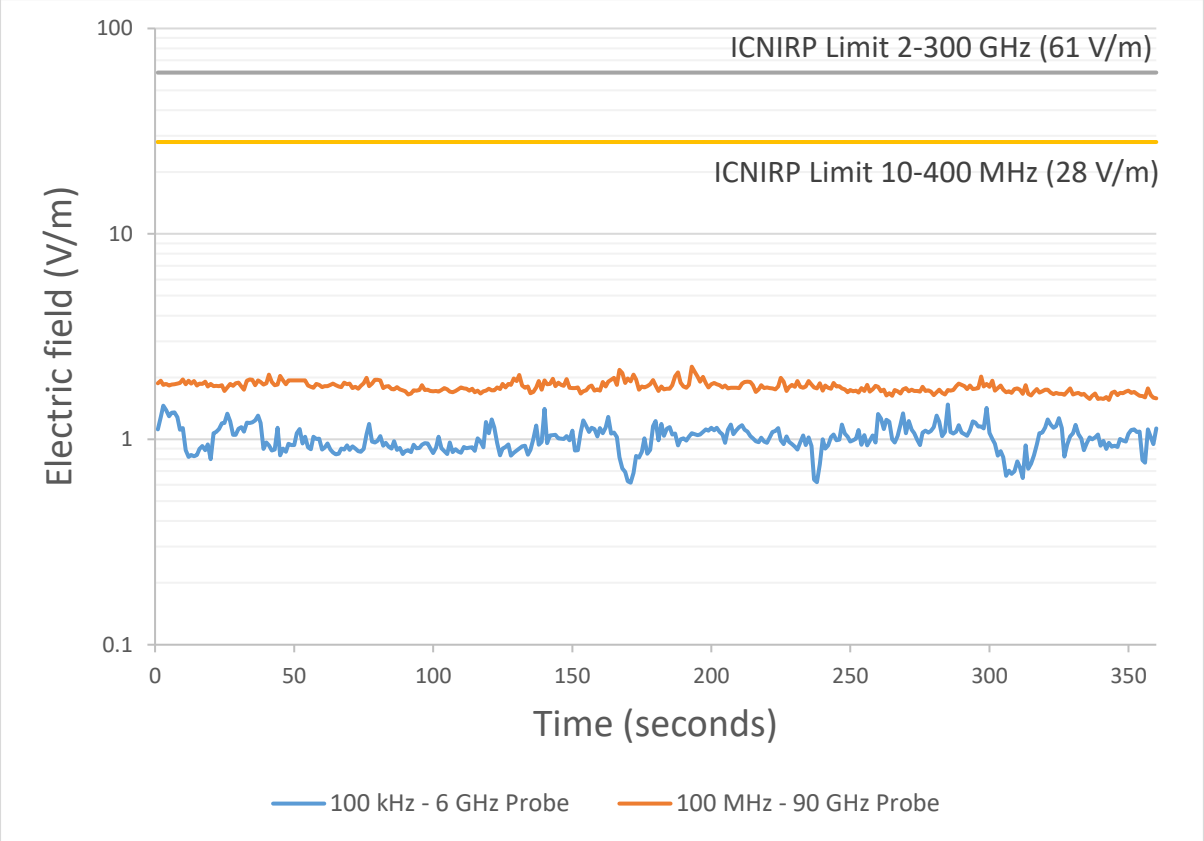
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.01 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Naas town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



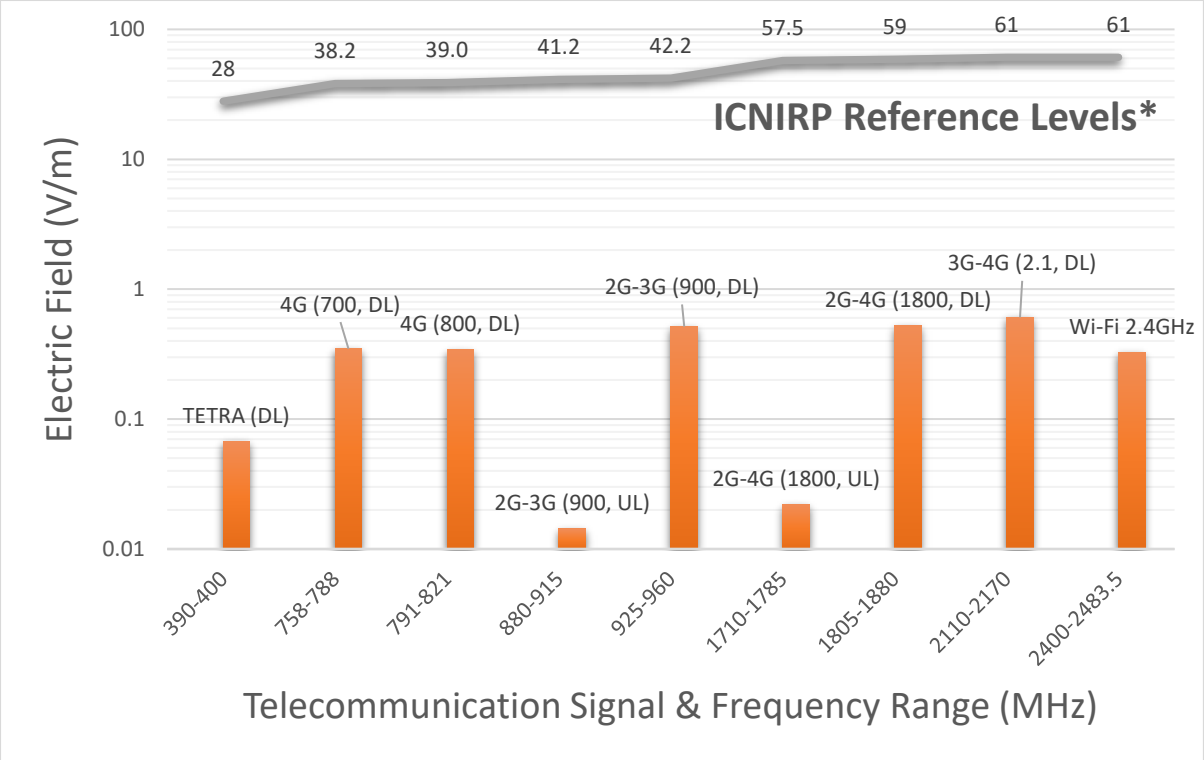
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.01	0.003	1.48	0.006	28*	2*
100 MHz - 90 GHz	1.80	0.009	2.26	0.014	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

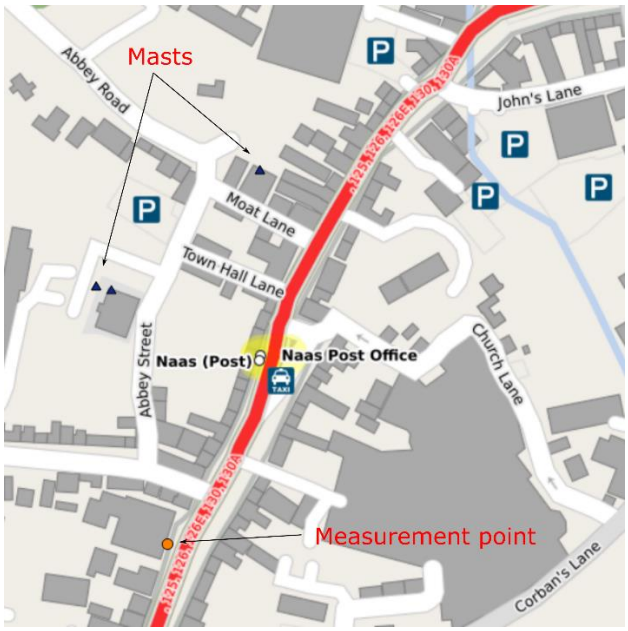
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.09	0.00002	0.07	0.00001	28	2.0
4G (700, DL)	758-788	0.68	0.001	0.35	0.0003	38.2	3.9
4G (800, DL)	791-821	0.57	0.0009	0.34	0.0003	39.0	4.0
2G-3G (900, UL)	880-915	0.10	0.00003	0.01	0.0000	41.2	4.5
2G-3G (900, DL)	925-960	0.77	0.002	0.52	0.000704	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.04	0.000004	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	1.21	0.004	0.52	0.0007	59.0	9.2
3G-4G (2.1, DL)	2110-2170	1.62	0.007	0.61	0.001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.19	0.0001	0.33	0.0003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.01 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.62 V/m) is likely to correspond to the emission (downlink) from nearby 3G-4G (2100 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
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A2. References

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- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/20	04 Nov 2021	J Vila

1. Measurement survey characteristics

Measurement date:	22nd October 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Main Street, Newbridge, Co Kildare
GPS coordinates:	53°10'42.6" N; 6°48'00.7" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Newbridge town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

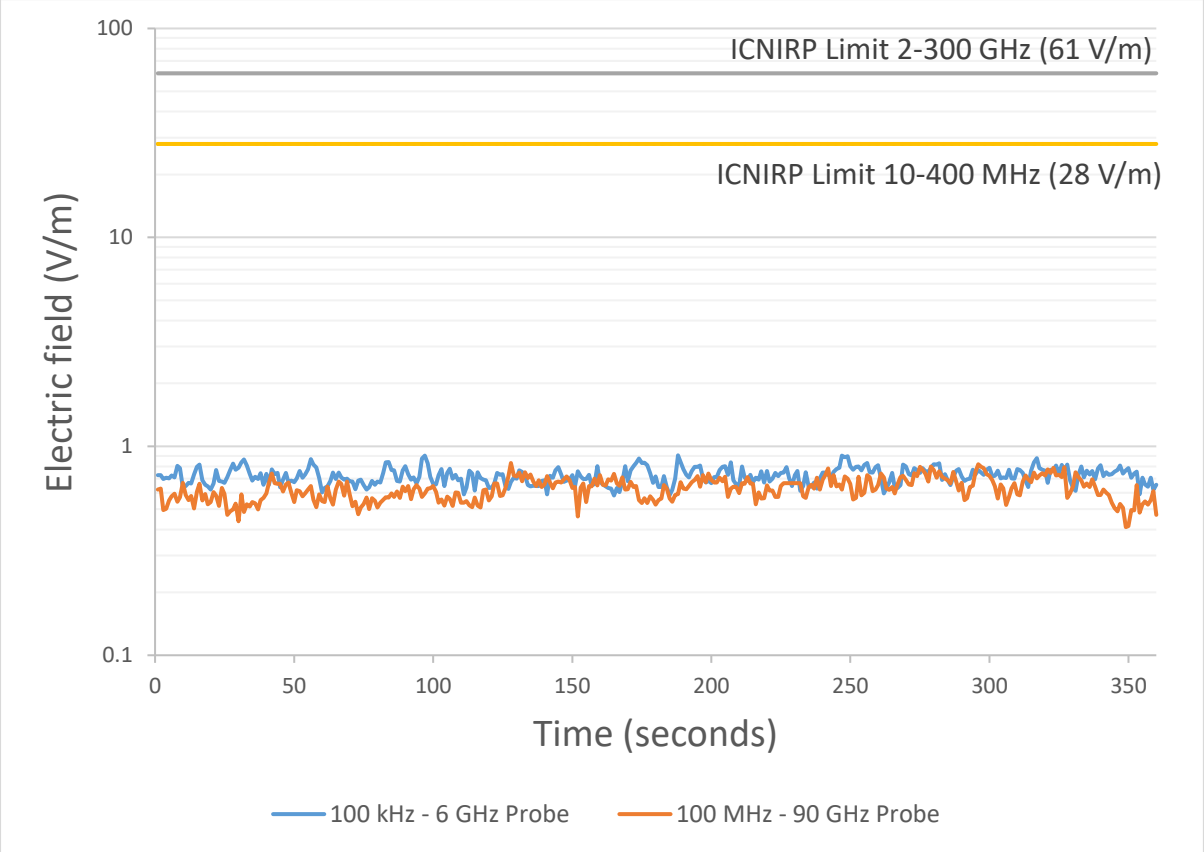
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.72 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz, 5G (NR 3.6 GHz), FWALA
Number of nearby telecommunication sites:	7 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Newbridge town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



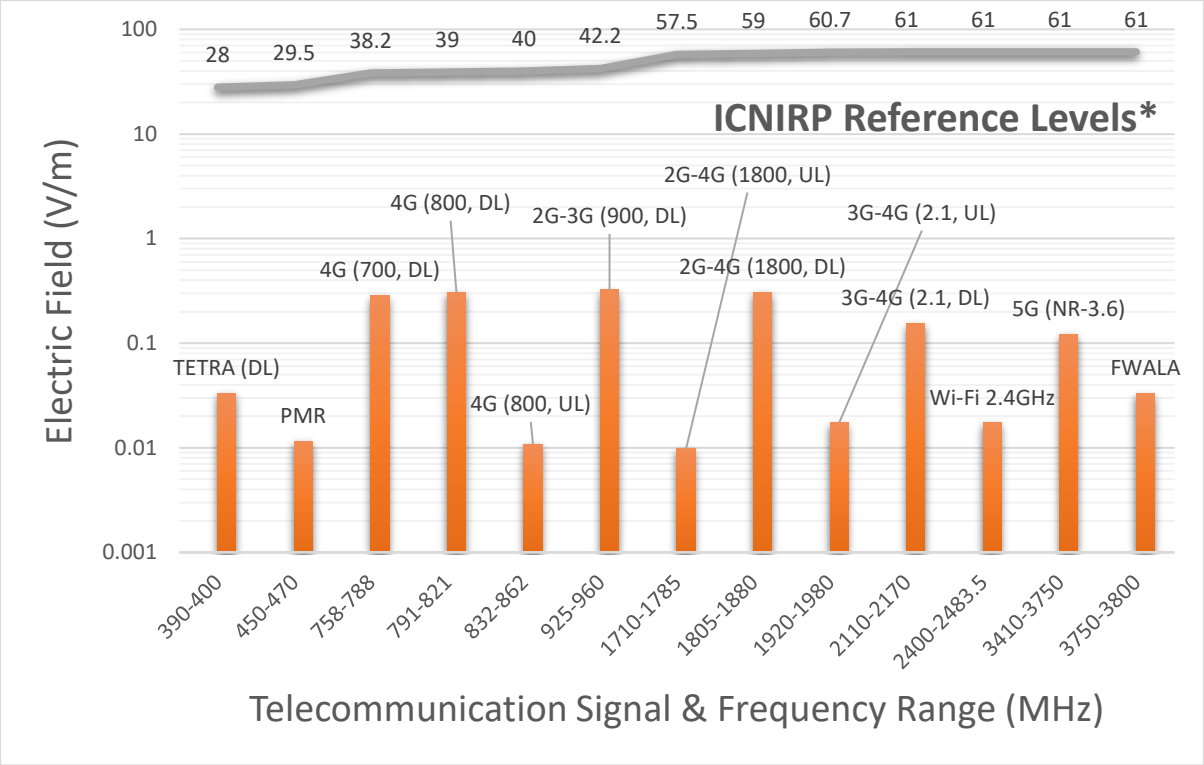
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.72	0.001	0.91	0.002	28*	2*
100 MHz - 90 GHz	0.63	0.001	0.83	0.002	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Private Mobile Radio; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

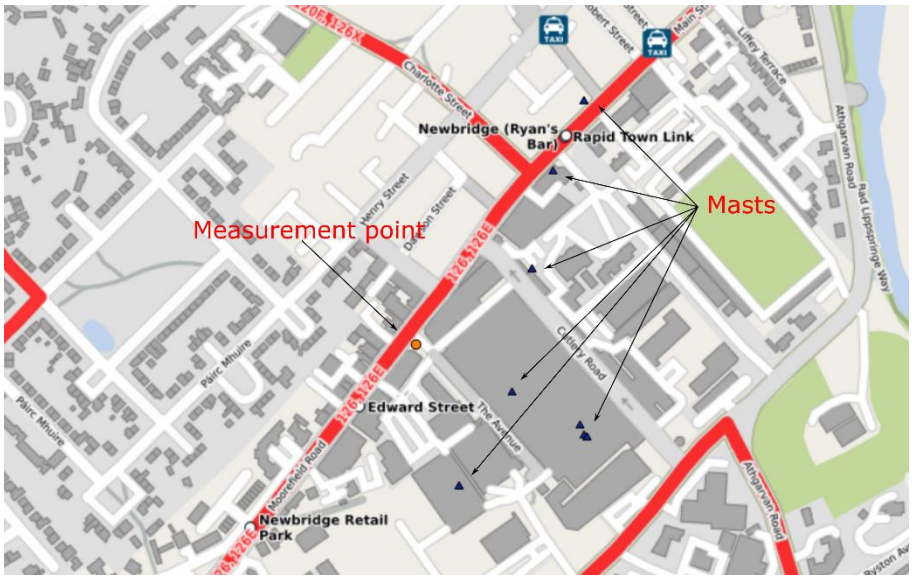
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.04	0.000005	0.03	0.000003	28.0	2.0
PMR	450-470	0.01	0.0000004	0.01	0.0000004	29.5	2.3
4G (700, DL)	758-788	0.44	0.0005	0.28	0.0002	38.2	3.9
4G (800, DL)	791-821	0.44	0.0005	0.30	0.0002	39	4.0
4G (800, UL)	832-862	0.02	0.000001	0.01	0.0000003	39	4.2
2G-3G (900, DL)	925-960	0.44	0.0005	0.32	0.0003	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.000001	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.47	0.0006	0.31	0.0003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.16	0.00006	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.26	0.0002	0.15	0.00006	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.06	0.00001	0.02	0.000001	61	10
5G NR-3.6	3410-3750	0.31	0.0003	0.12	0.00004	61	10
FWALA	3750-3800	0.13	0.00005	0.03	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Private Mobile Radio; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.72 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.47 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals measured at the point of measurement had a maximum level of 0.31 V/m.

6. Map of measurement point and nearby telecommunication sites (masts)



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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/03	15 June 2021	J Vila

1. Measurement survey characteristics

Measurement date:	7th April 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	The Parade, Kilkenny Castle, Kilkenny, Co Kilkenny
GPS coordinates:	52°39'02.9" N; 7°15'05.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Kilkenny town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

2. Summary of survey results

Measurement result:	The average total RF level measured was 1.13 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), 5G NR-3.6, Wi-Fi and TETRA
Number of nearby telecommunication sites:	5 antennas within 3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Kilkenny (The Parade, Kilkenny Castle) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

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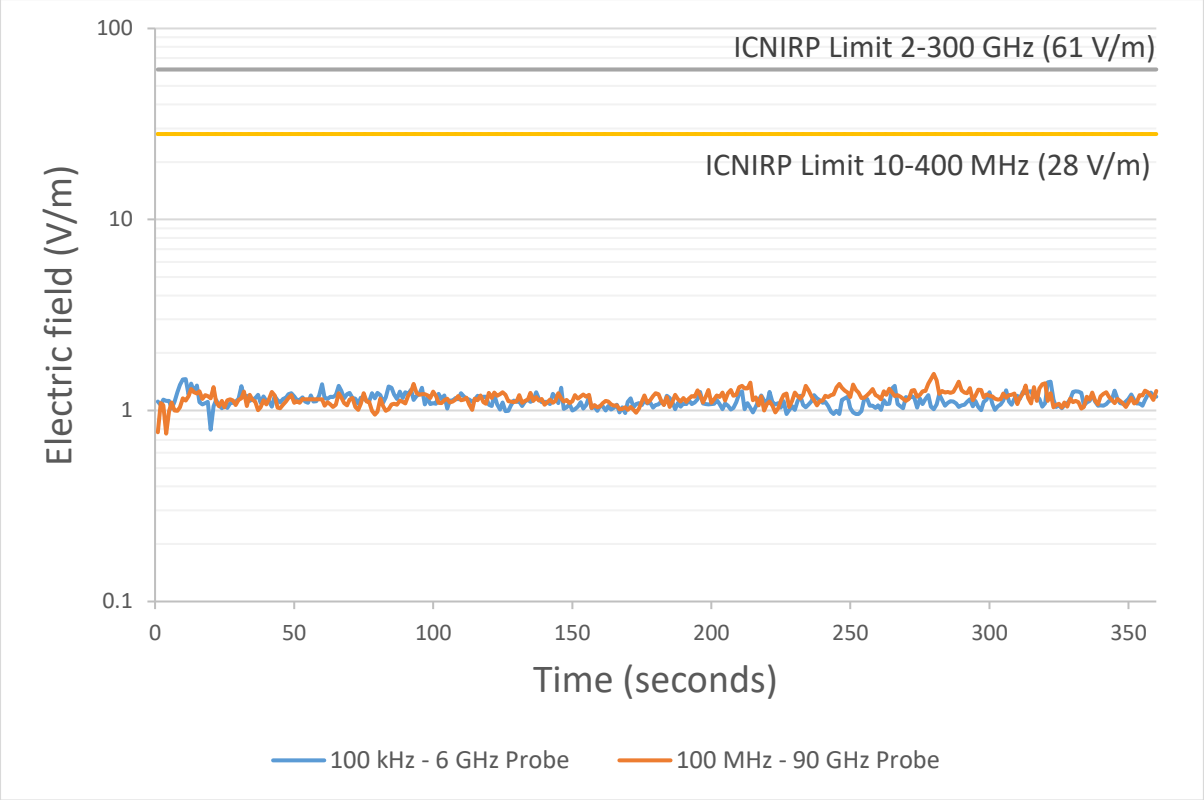


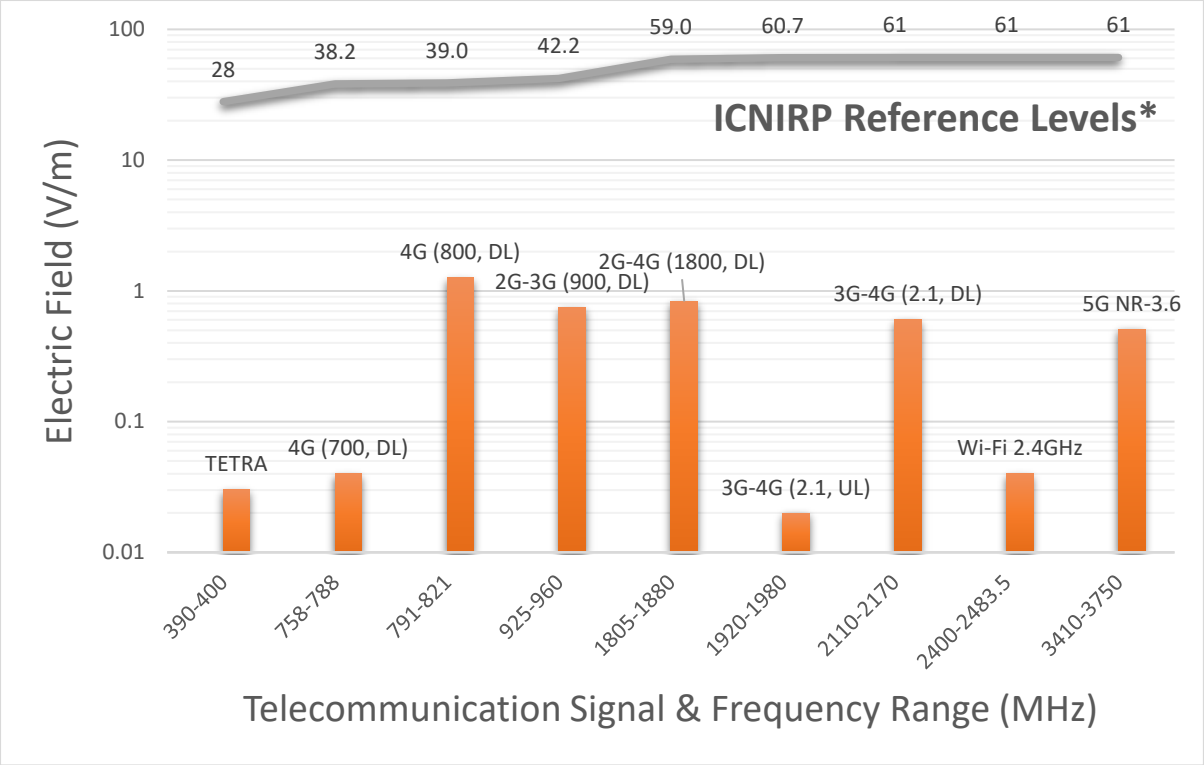
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.13	0.003	1.46	0.006	28*	2*
100 MHz - 90 GHz	1.16	0.004	1.56	0.006	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

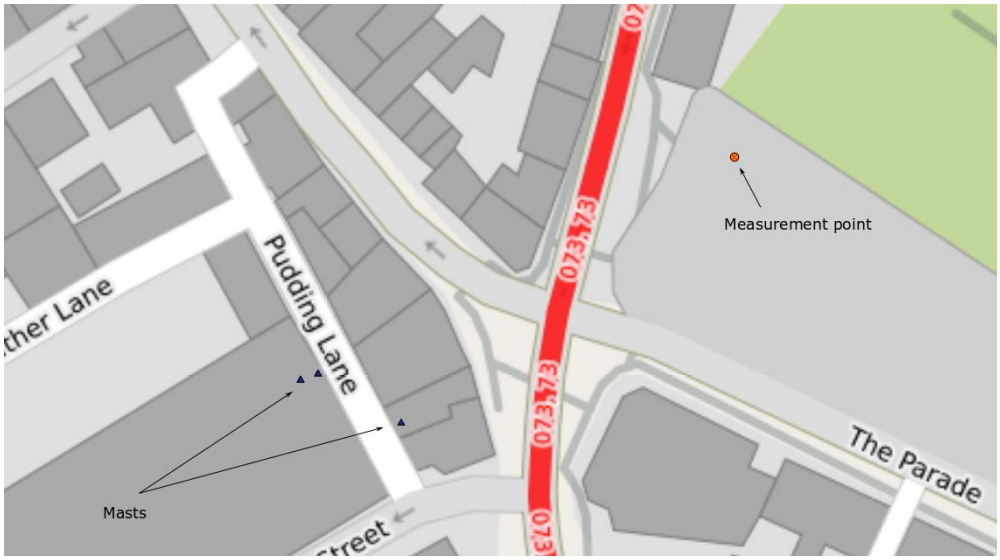
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA	390-400	0.03	0.000002	0.02	0.000001	27.3	2
4G (700, DL)	758-788	0.04	0.000004	0.03	0.000002	38.2	3.87
4G (800, DL)	791-821	1.26	0.00421	0.92	0.002245	39.0	4.04
2G-3G (900, DL)	925-960	0.75	0.00149	0.54	0.000773	42.2	4.72
2G-4G (1800, DL)	1805-1880	0.83	0.00183	0.43	0.000490	59.0	9.23
3G-4G (2.1, UL)	1920-1980	0.02	0.000001	0.02	0.000001	60.7	9.87
3G-4G (2.1, DL)	2110-2170	0.60	0.00095	0.45	0.000537	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.04	0.000004	0.02	0.000001	61	10
5G NR-3.6	3410-3750	0.51	0.00069	0.17	0.000077	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; NR: New Radio; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.13 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.26 V/m) is likely to correspond to the emission (downlink) from nearby 4G/LTE antennas. A 3.6 GHz band 5G signal was measured at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/30	16 Dec 2021	J Vila

1. Measurement survey characteristics

Measurement date:	3rd December 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Main Street, Portlaoise, Co Laoise
GPS coordinates:	53°2'02.8" N; 7°17'49.6" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Portlaoise town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

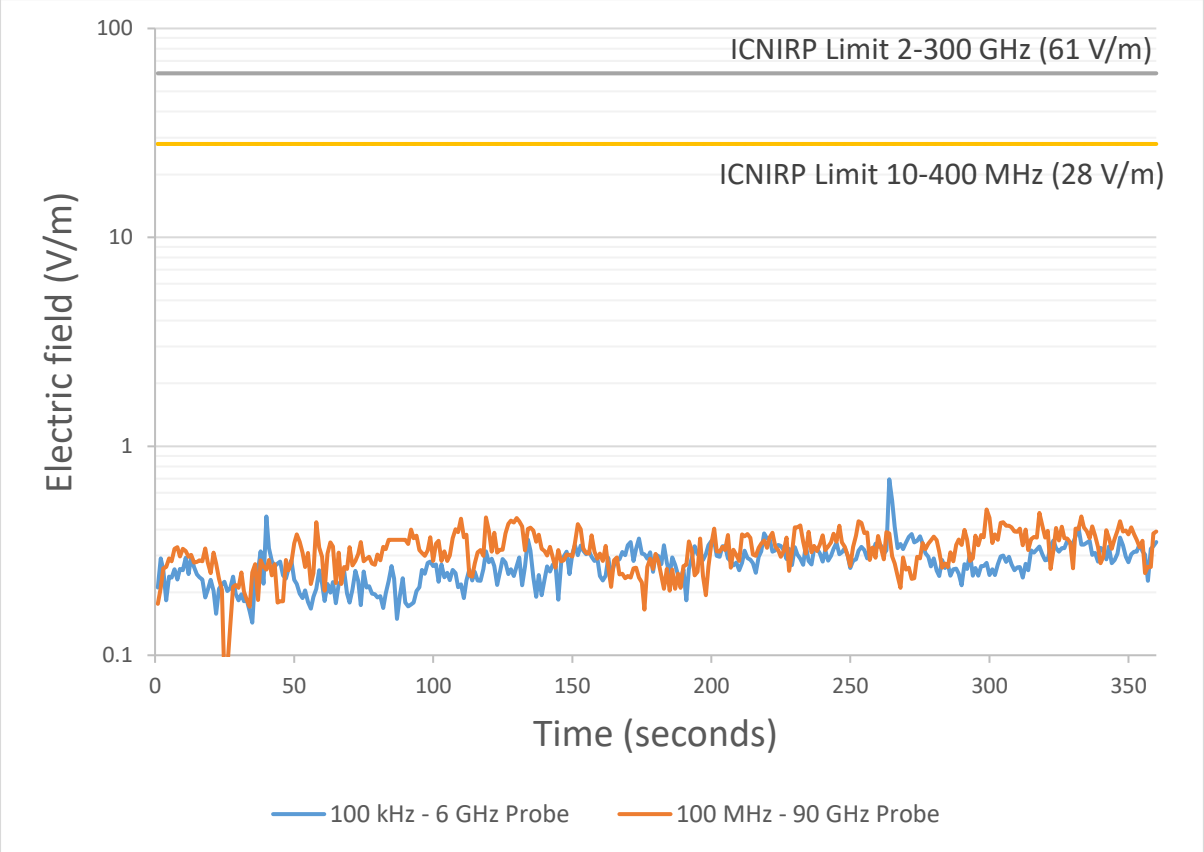
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.28 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Portlaoise town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



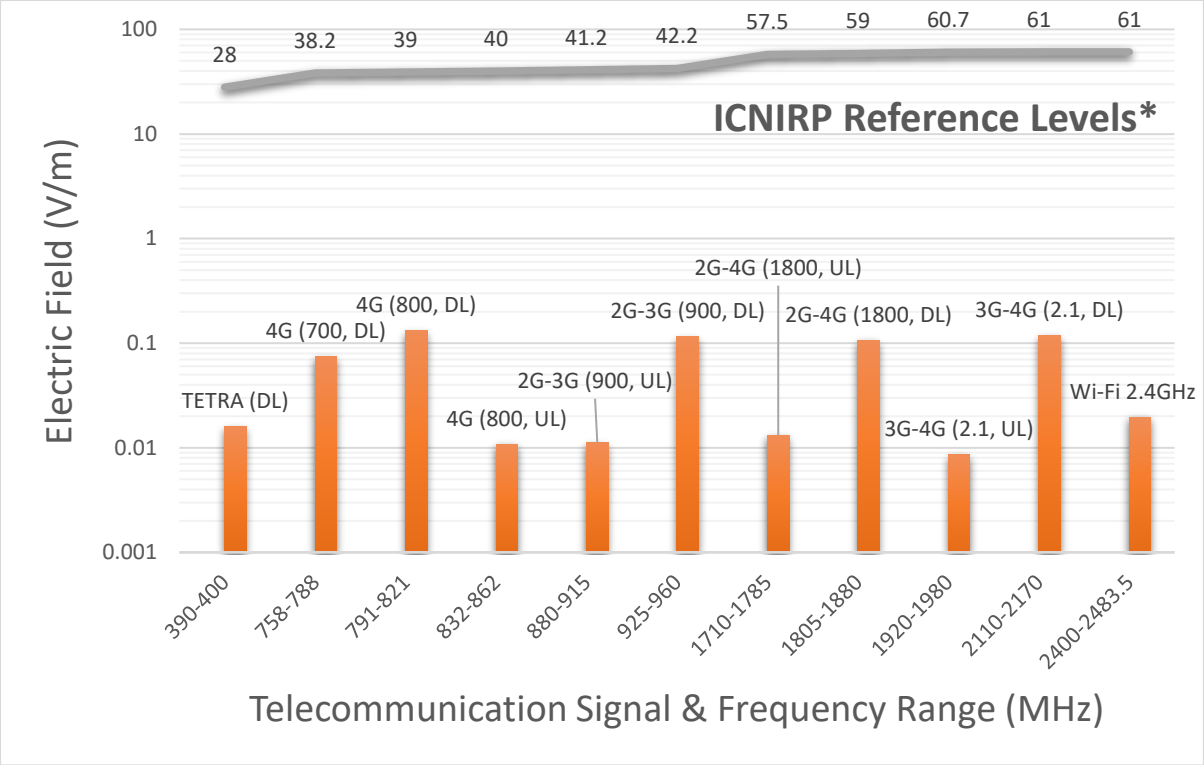
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.28	0.0002	0.69	0.001	28*	2*
100 MHz - 90 GHz	0.32	0.0003	0.50	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

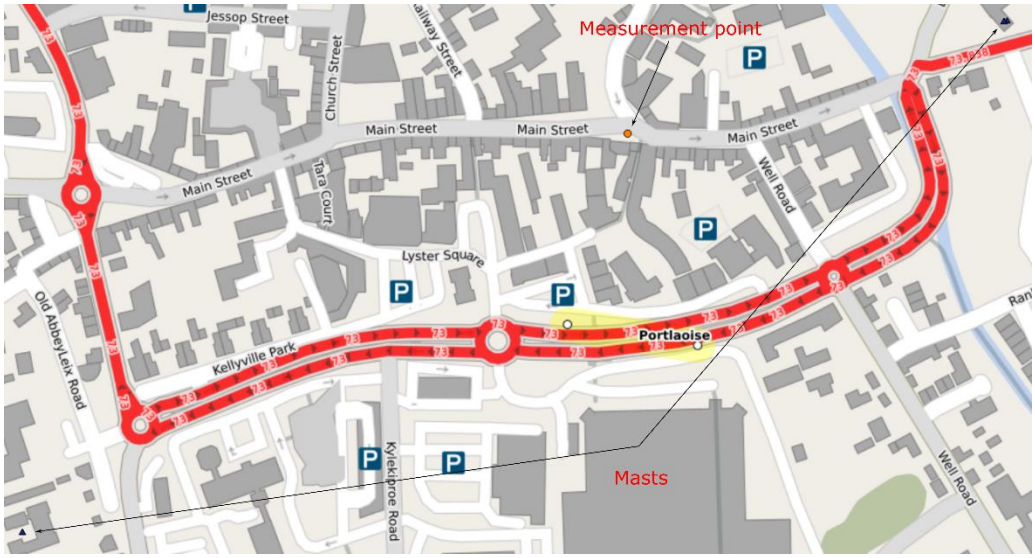
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.02	0.000001	0.02	0.000001	28.0	2.0
4G (700, DL)	758-788	0.18	0.00009	0.07	0.00001	38.2	3.9
4G (800, DL)	791-821	0.18	0.00008	0.13	0.00005	39	4.0
4G (800, UL)	832-862	0.02	0.000001	0.01	0.0000003	39	4.2
2G-3G (900, UL)	880-915	0.02	0.000001	0.01	0.0000003	39	4.5
2G-3G (900, DL)	925-960	0.15	0.00006	0.12	0.00004	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.11	0.00003	0.01	0.0000005	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.14	0.00005	0.11	0.00003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.02	0.000001	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.19	0.0001	0.12	0.00004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.05	0.000007	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.28 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.19 V/m) is likely to correspond to the emission (downlink) from nearby 3G-4G (2,100 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/15	17 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	29th March 2022
Measurement time (approx.):	09:00 am – 10:00 am
Measurement point & location:	Main Street, Carrick-On-Shannon, Co Leitrim
GPS coordinates:	53°56'43.3"N; 8°05'44.5"W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Carrick-On-Shannon town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

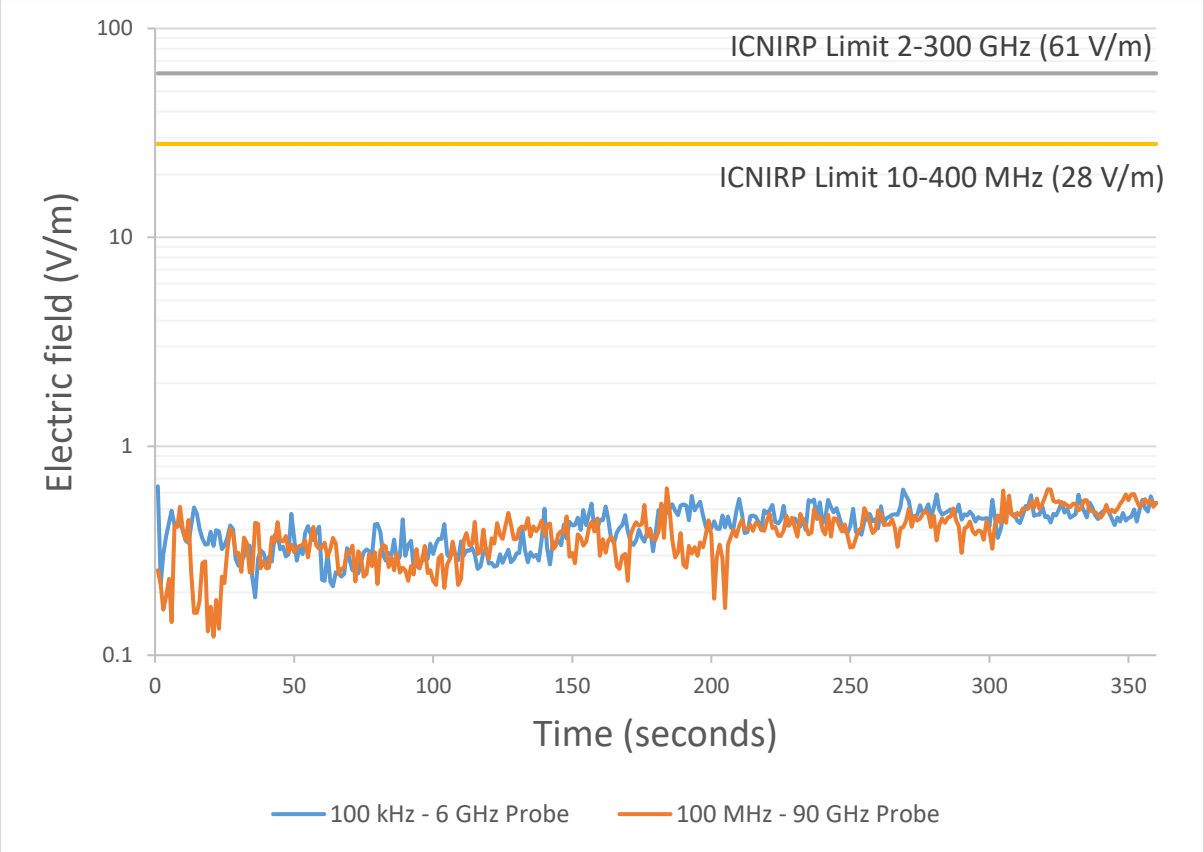
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.41 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), Wi-Fi 5GHz
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Carrick-On-Shannon town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



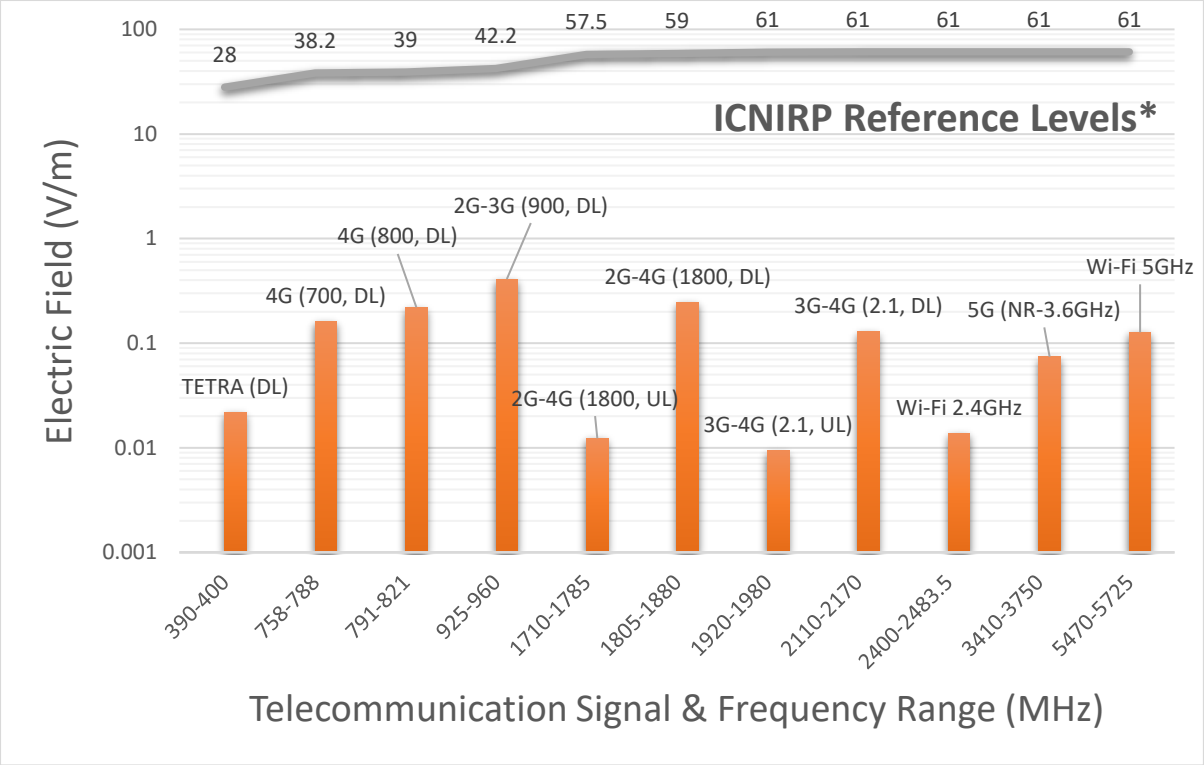
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.41	0.000	0.64	0.001	28*	2*
100 MHz - 90 GHz	0.38	0.000	0.63	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. [*]ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.03	0.000003	0.02	0.000001	28.0	2.0
4G (700, DL)	758-788	0.27	0.0002	0.16	0.00007	38.2	3.9
4G (800, DL)	791-821	0.38	0.0004	0.22	0.0001	39	4.0
2G-3G (900, DL)	925-960	0.60	0.001	0.41	0.0004	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.11	0.00003	0.01	0.0000004	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.43	0.0005	0.24	0.0002	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.03	0.000002	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.25	0.0002	0.13	0.00004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.05	0.000007	0.01	0.0000005	61	10
5G (NR-3.6GHz)	3410-3750	0.09	0.00002	0.07	0.00001	61	10
Wi-Fi 5GHz	5470-5725	0.20	0.0001	0.13	0.00004	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.41 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.60 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. 5G signals were detected at the point of measurement with maximum levels of 0.20 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/20	2nd June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	19th May 2022
Measurement time (approx.):	12:00 pm – 13:00 pm
Measurement point & location:	O'Connell Street, Limerick city, Co Limerick
GPS coordinates:	52°39'47.3" N; 8°37'37.8" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Limerick city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

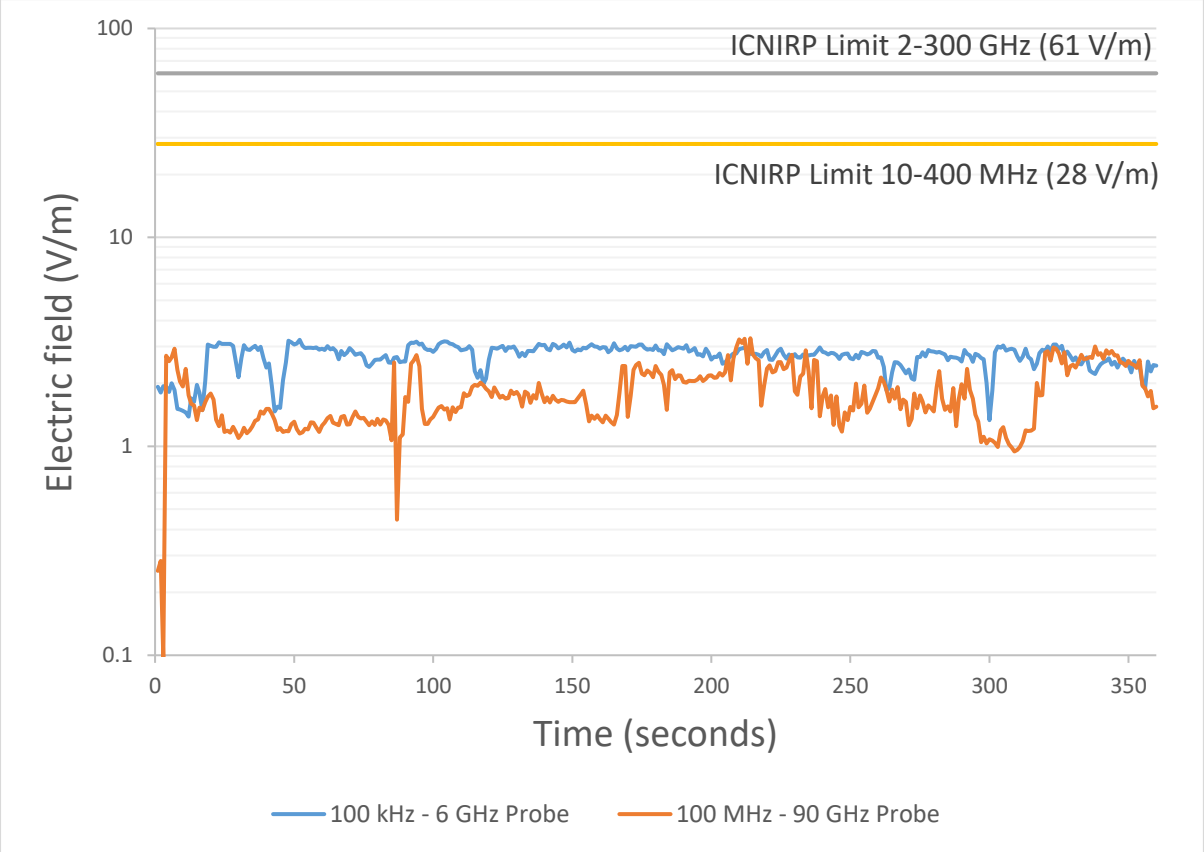
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.70 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz, 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	11 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Limerick city centre (O'Connell Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



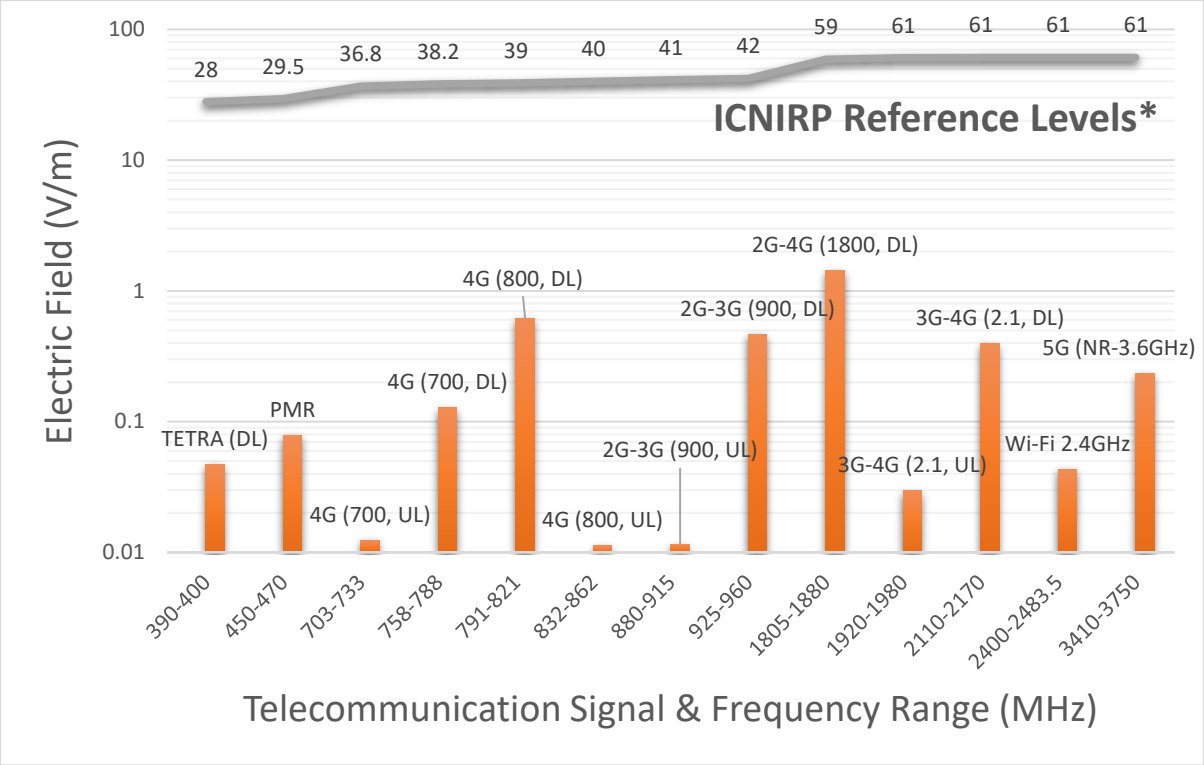
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	2.70	0.02	3.23	0.03	28*	2*
100 MHz - 90 GHz	1.79	0.01	3.29	0.03	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

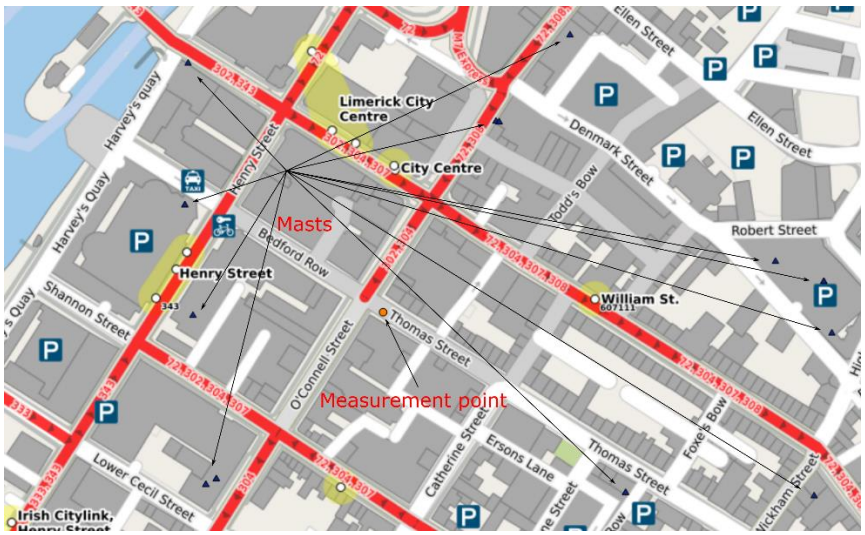
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.06	0.00001	0.05	0.000006	28.0	2.0
PMR	450-470	0.10	0.00003	0.08	0.00002	29.5	2.3
4G (700, UL)	703-733	0.06	0.00001	0.01	0.0000004	36.8	3.6
4G (700, DL)	758-788	0.20	0.0001	0.13	0.00004	38.2	3.9
4G (800, DL)	791-821	0.90	0.002	0.62	0.001	39	4.0
4G (800, UL)	832-862	0.01	0.000001	0.01	0.0000003	39	4.2
2G-3G (900, UL)	880-915	0.03	0.000003	0.01	0.0000004	39	4.5
2G-3G (900, DL)	925-960	0.57	0.0009	0.47	0.0006	42.2	4.7
2G-4G (1800, DL)	1805-1880	1.97	0.01	1.44	0.006	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.09	0.00002	0.03	0.000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.56	0.0008	0.40	0.0004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.09	0.00002	0.04	0.000005	61	10
5G (NR-3.6GHz)	3410-3750	0.98	0.003	0.23	0.0001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

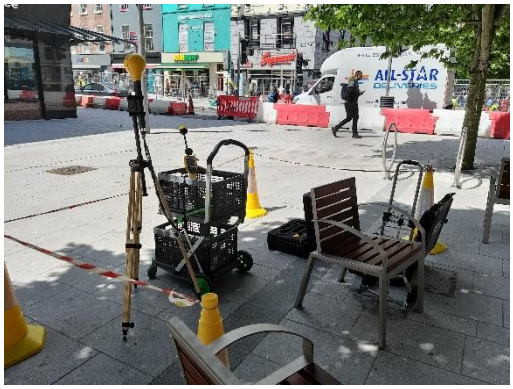
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.70 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.97 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.98 (without data traffic) and 1.11 V/m (while making a video call with a 5G mobile phone connected to an available 5G network).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/13	16 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	28th March 2022
Measurement time (approx.):	16:00 pm – 17:00 pm
Measurement point & location:	Market Square, Longford, Co Longford
GPS coordinates:	53°43'32.6" N; 7°47'56.8" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Longford town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

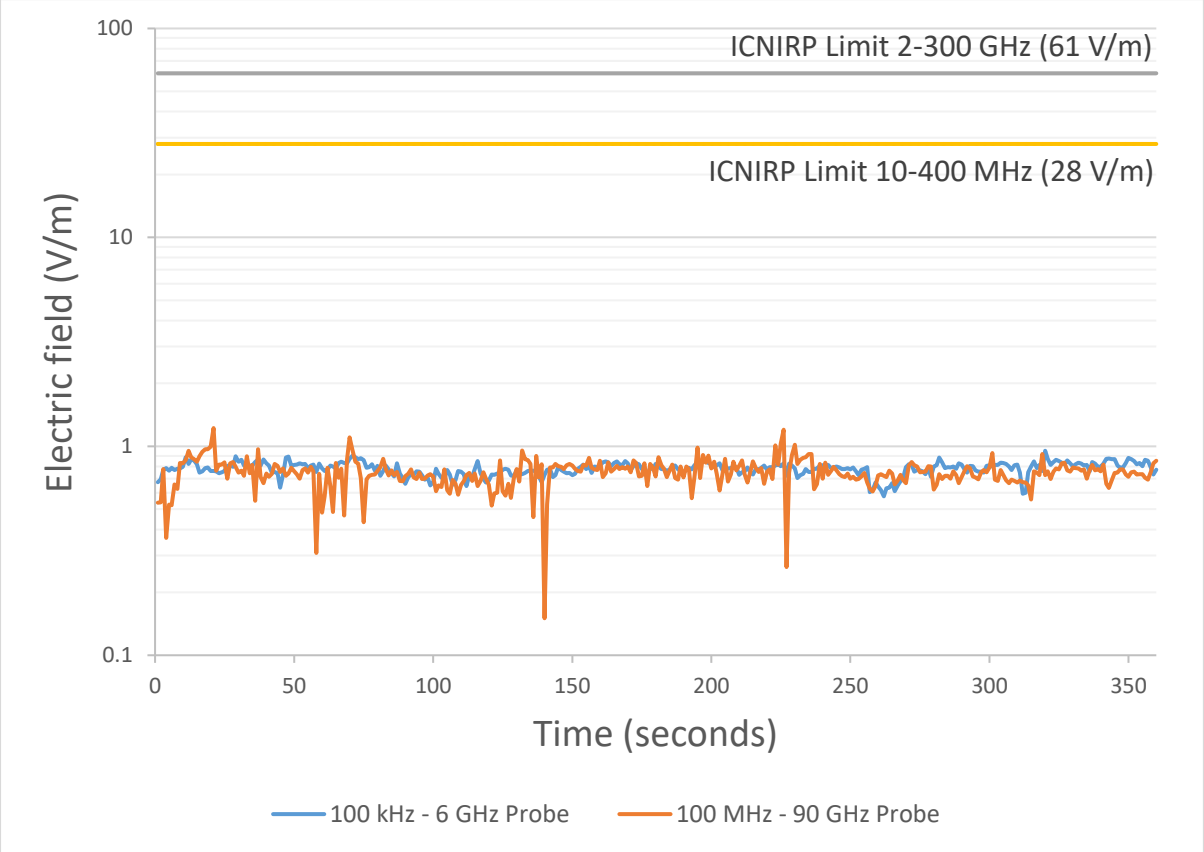
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.78 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, PMR, DVB_T, 2G Rail, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), FWALA, BWA
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Longford town centre (Market Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



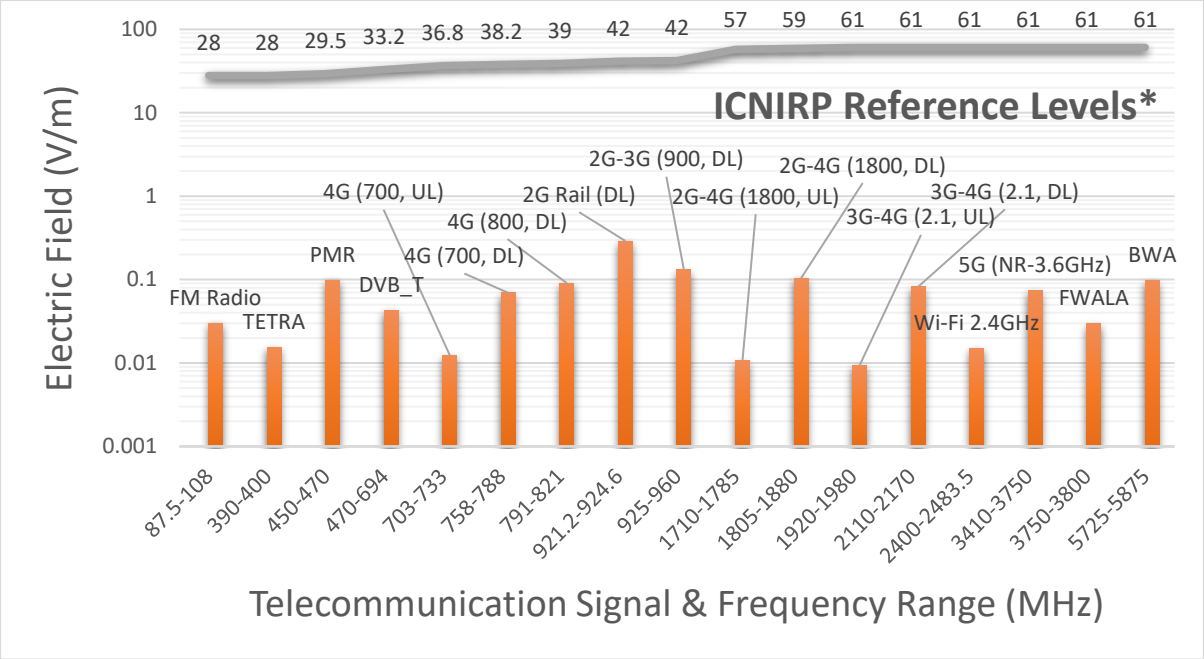
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.78	0.002	0.95	0.002	28*	2*
100 MHz - 90 GHz	0.75	0.001	1.22	0.004	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB_T: Terrestrial Digital Video Broadcasting; FWALA: Fixed Wireless Access Local Area; BWA: Broadband Wireless Access.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

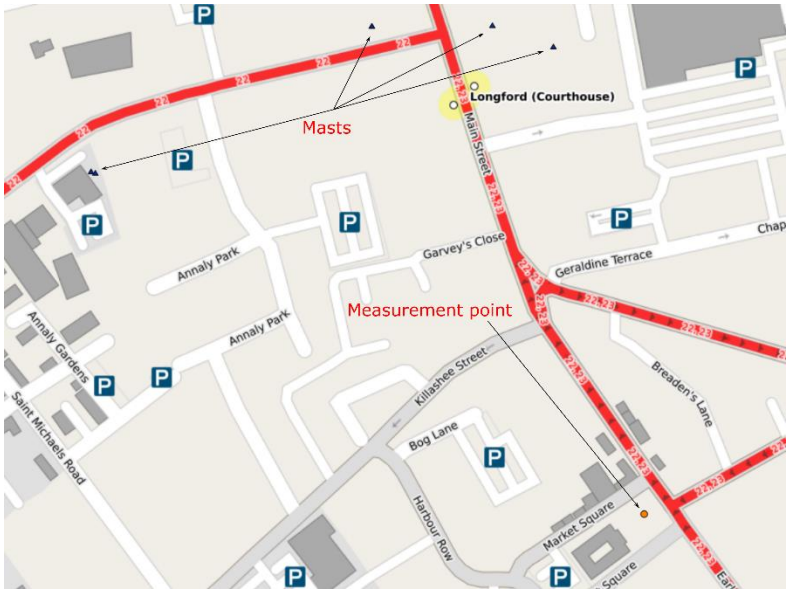
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.03	0.000003	0.03	0.000002	28	2
TETRA	390-400	0.02	0.000001	0.02	0.000001	28.0	2.0
PMR	450-470	0.12	0.00004	0.10	0.000026	29.5	2.3
DVB_T	470-694	0.05	0.00001	0.04	0.000005	33.2	2.9
4G (700, UL)	703-733	0.02	0.000001	0.01	0.0000004	36.8	3.6
4G (700, DL)	758-788	0.09	0.00002	0.07	0.00001	38.2	3.9
4G (800, DL)	791-821	0.11	0.00003	0.09	0.00002	39	4.0
2G Rail (DL)	921.2-924.6	0.38	0.0004	0.29	0.0002	39	4.6
2G-3G (900, DL)	925-960	0.19	0.00009	0.13	0.00005	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.17	0.00007	0.10	0.00003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.01	0.0000004	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.11	0.00003	0.08	0.00002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.04	0.000004	0.02	0.000001	61	10
5G (NR-3.6GHz)	3410-3750	0.08	0.00002	0.07	0.00001	61	10
FWALA	3750-3800	0.12	0.00004	0.03	0.000002	61	10
BWA	5725-5875	0.11	0.00003	0.10	0.00003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; DVB_T: Terrestrial Digital Video Broadcasting; FWALA: Fixed Wireless Access Local Area; BWA: Broadband Wireless Access.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.78 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.38 V/m) is likely to correspond to the emission (downlink) from nearby 2G Rail antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.08 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/28	29 Nov 2021	J Vila

1. Measurement survey characteristics

Measurement date:	18th November 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	West Street, Drogheda, Co Louth
GPS coordinates:	53°42'54.4" N; 6°21'09.5" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Drogheda town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

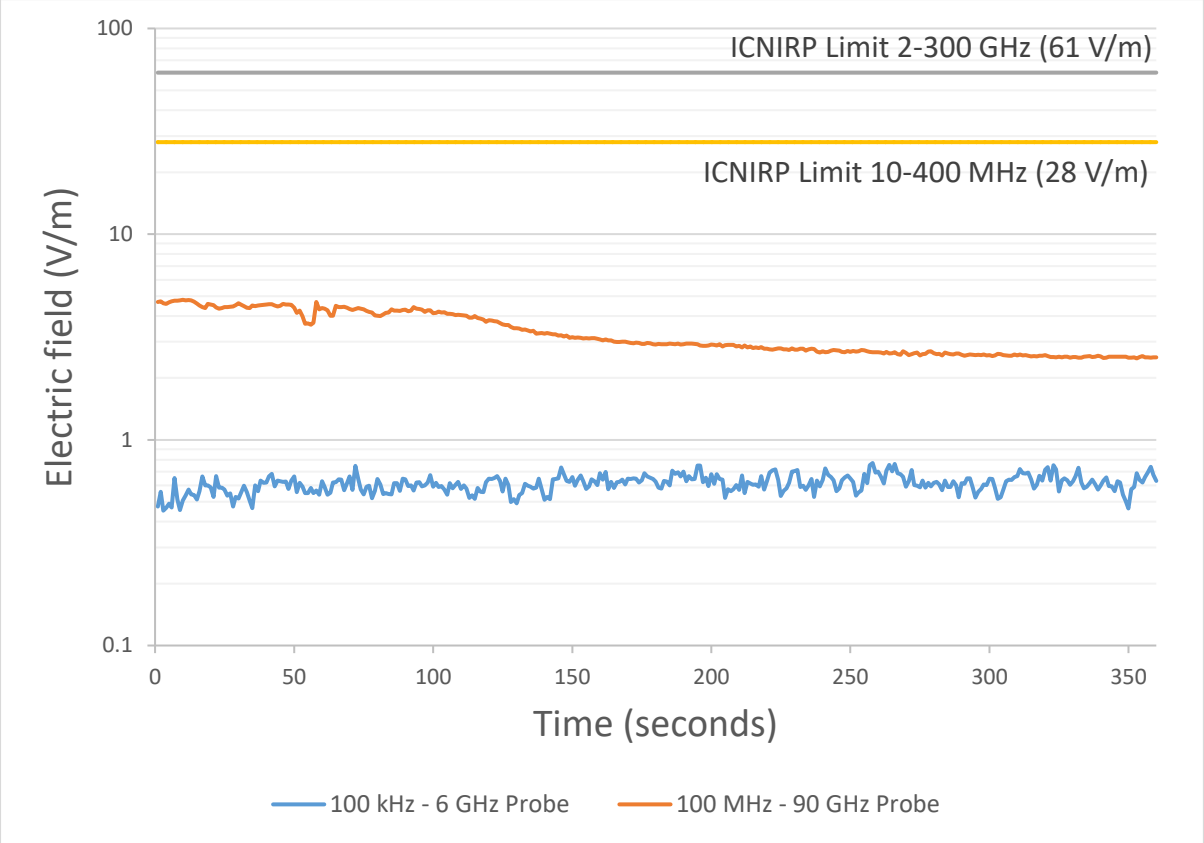
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.61 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	PMR, TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), 5G (3.6GHz), Wi-Fi (2.4GHz), FWALA
Number of nearby telecommunication sites:	6 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Drogheda town centre (West Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



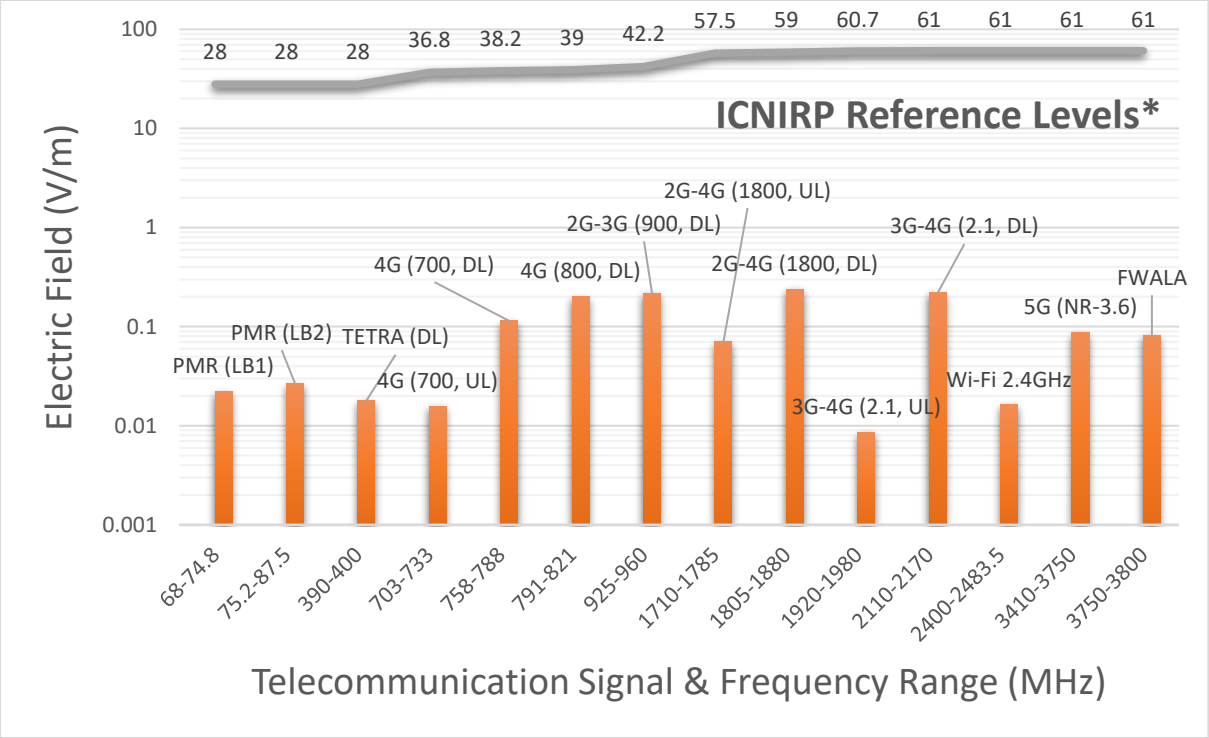
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.61	0.001	0.77	0.002	28*	2*
100 MHz - 90 GHz	3.31	0.029	4.79	0.061	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; LB: Low Band; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
PMR (LB1)	68-74.8	0.09	0.00002	0.02	0.000001	28	2
PMR (LB2)	75.2-87.5	0.09	0.00002	0.03	0.000002	28	2
TETRA (DL)	390-400	0.02	0.000002	0.02	0.000001	28	2
4G (700, UL)	703-733	0.09	0.00002	0.02	0.000001	36.8	3.6
4G (700, DL)	758-788	0.18	0.00009	0.11	0.00003	38.2	3.9
4G (800, DL)	791-821	0.29	0.0002	0.20	0.0001	39	4
2G-3G (900, DL)	925-960	0.28	0.0002	0.22	0.0001	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.51	0.0007	0.07	0.00001	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.36	0.0003	0.24	0.0002	59	9.2
3G-4G (2.1, UL)	1920-1980	0.01	0.0000003	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.31	0.0003	0.22	0.0001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.05	0.000008	0.02	0.000001	61	10
5G (NR-3.6)	3410-3750	0.32	0.0003	0.09	0.00002	61	10
FWALA	3750-3800	0.34	0.0003	0.08	0.00002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; LB: Low Band; FWALA: Fixed Wireless Access Local Area.

Table 3. Measured RF electric field level from 5G signals in two different measurement scenarios.

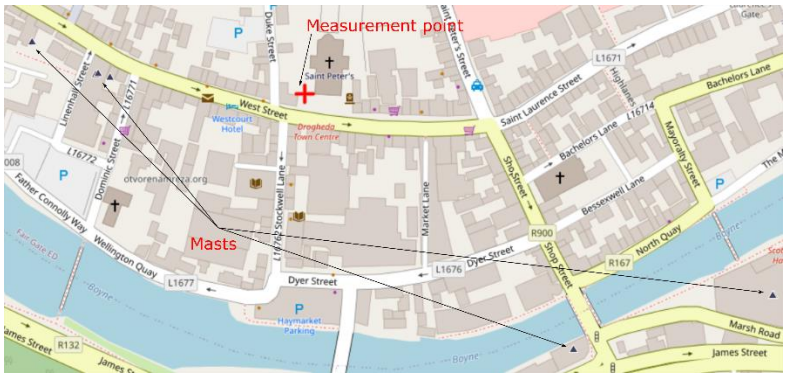
Measurement scenario	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
	(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
Pilot 5G signal	0.56	0.0008	0.10	0.00003	61	10
Traffic 5G signal (*)	1.31	0.0045	0.27	0.0002	61	10

*Note: Using a 5G-enabled mobile phone >1 metre from the probe (e.g. streaming video or making a video phone call).

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.61 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.51 V/m) is likely to correspond to the emission (uplink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement, with maximum level of 0.32 V/m. The maximum 5G level while using a 5G-enabled mobile phone was 1.31 V/m (see Table 3 for more details).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/29	15 Dec 2021	J Vila

1. Measurement survey characteristics

Measurement date:	24th November 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Market Square, Dundalk, Co Louth
GPS coordinates:	54°0'15.2" N; 6°24'10.3" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Dundalk town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

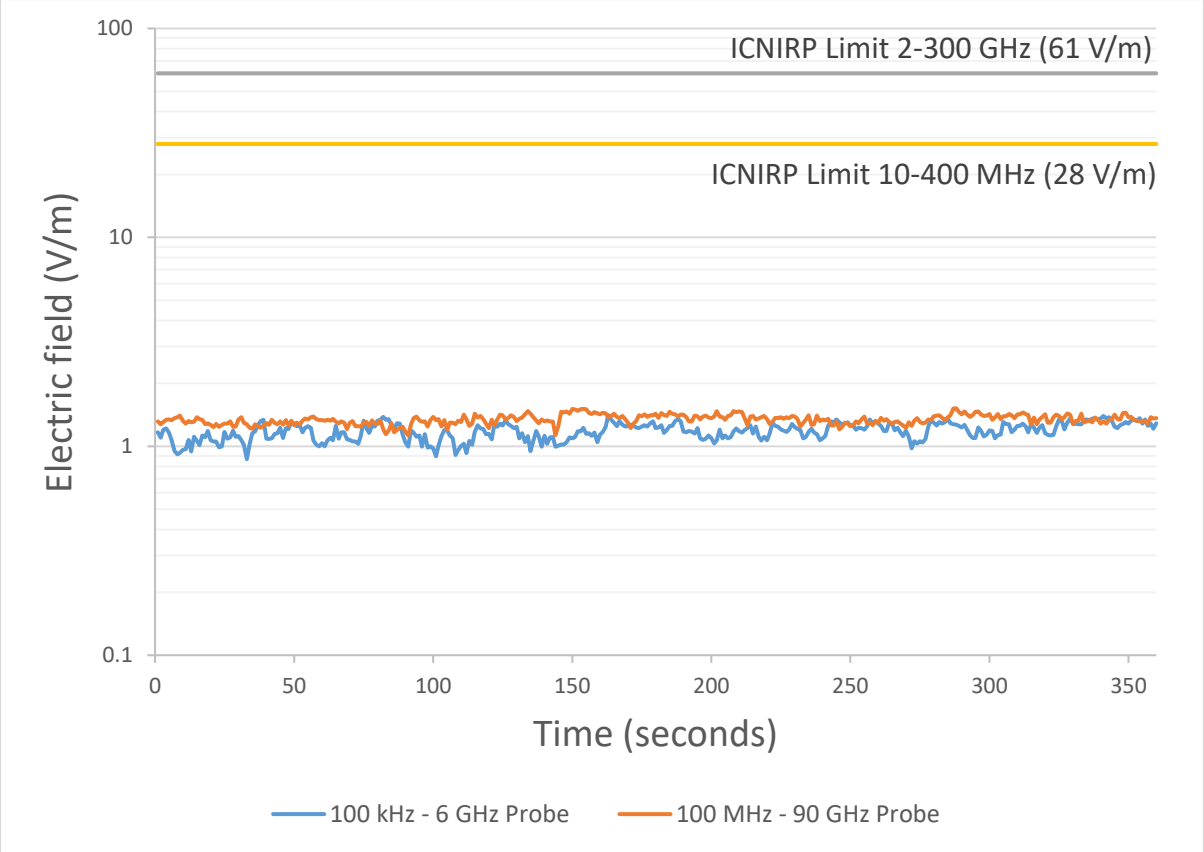
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.18 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, 2G Rail, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz, 5G (3.6 GHz), FWALA
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Dundalk town centre (Market Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



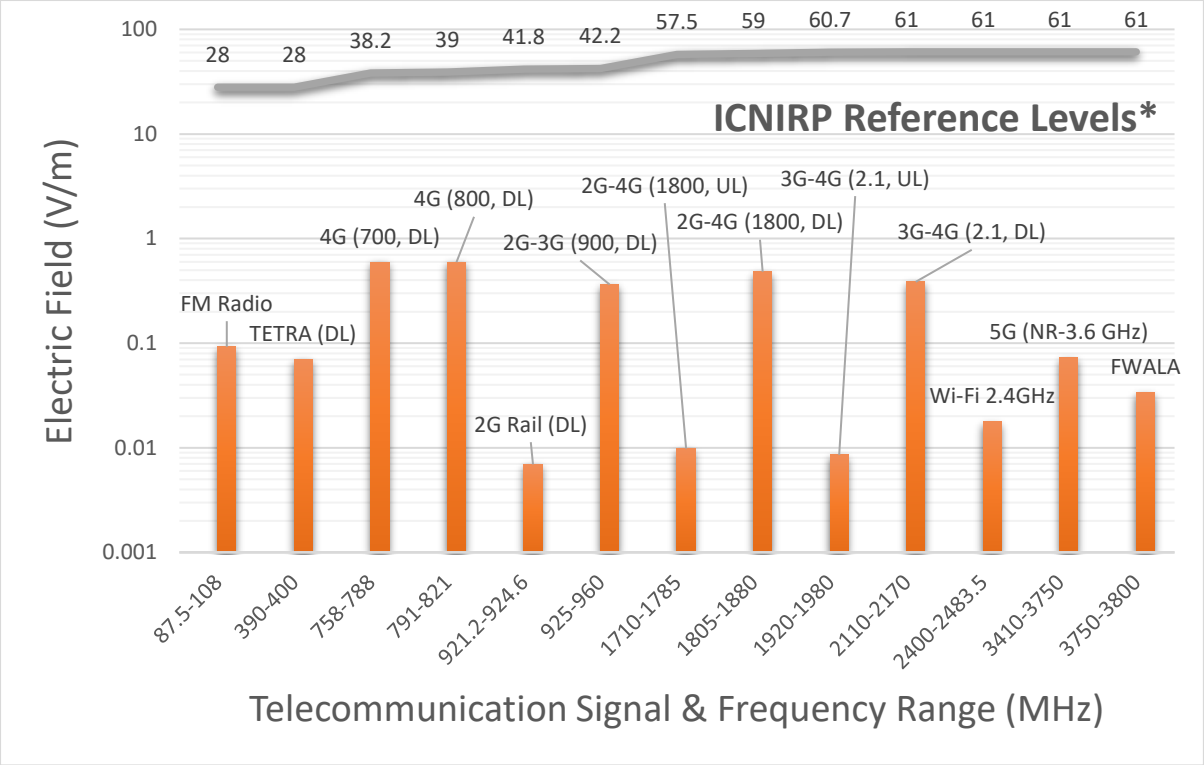
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.18	0.004	1.41	0.005	28*	2*
100 MHz - 90 GHz	1.34	0.005	1.52	0.006	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

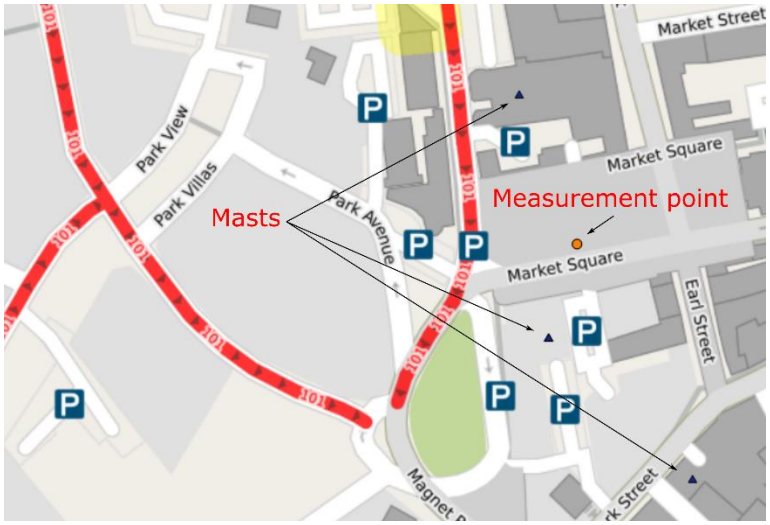
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.10	0.00003	0.09	0.00002	28	2
TETRA (DL)	390-400	0.10	0.00002	0.07	0.00001	28	2
4G (700, DL)	758-788	0.74	0.001	0.59	0.0009	38.2	3.9
4G (800, DL)	791-821	0.76	0.002	0.59	0.0009	39	4
2G Rail (DL)	921.2-924.6	0.01	0.0000001	0.01	0.0000001	39	4.6
2G-3G (900, DL)	925-960	0.46	0.0006	0.36	0.0004	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.0000003	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.61	0.0010	0.48	0.0006	59	9.2
3G-4G (2.1, UL)	1920-1980	0.05	0.000006	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.50	0.0007	0.39	0.0004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.06	0.00001	0.02	0.000001	61	10
5G (NR-3.6 GHz)	3410-3750	0.23	0.0001	0.07	0.00001	61	10
FWALA	3750-3800	0.11	0.00003	0.03	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.18 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.76 V/m) is likely to correspond to the emission (downlink) from nearby 4G (800 MHz) antennas. 5G signals were detected at the point of measurement, with a maximum pilot level of 0.23 V/m and a maximum traffic (making a video call with a 5G mobile phone) of 1.42 V/m.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/23	8th June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	23rd May 2022
Measurement time (approx.):	17:00 pm – 18:00 pm
Measurement point & location:	Pearse Street, Ballina, Co Mayo
GPS coordinates:	54°6'51.6" N; 9°9'14.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Ballina town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

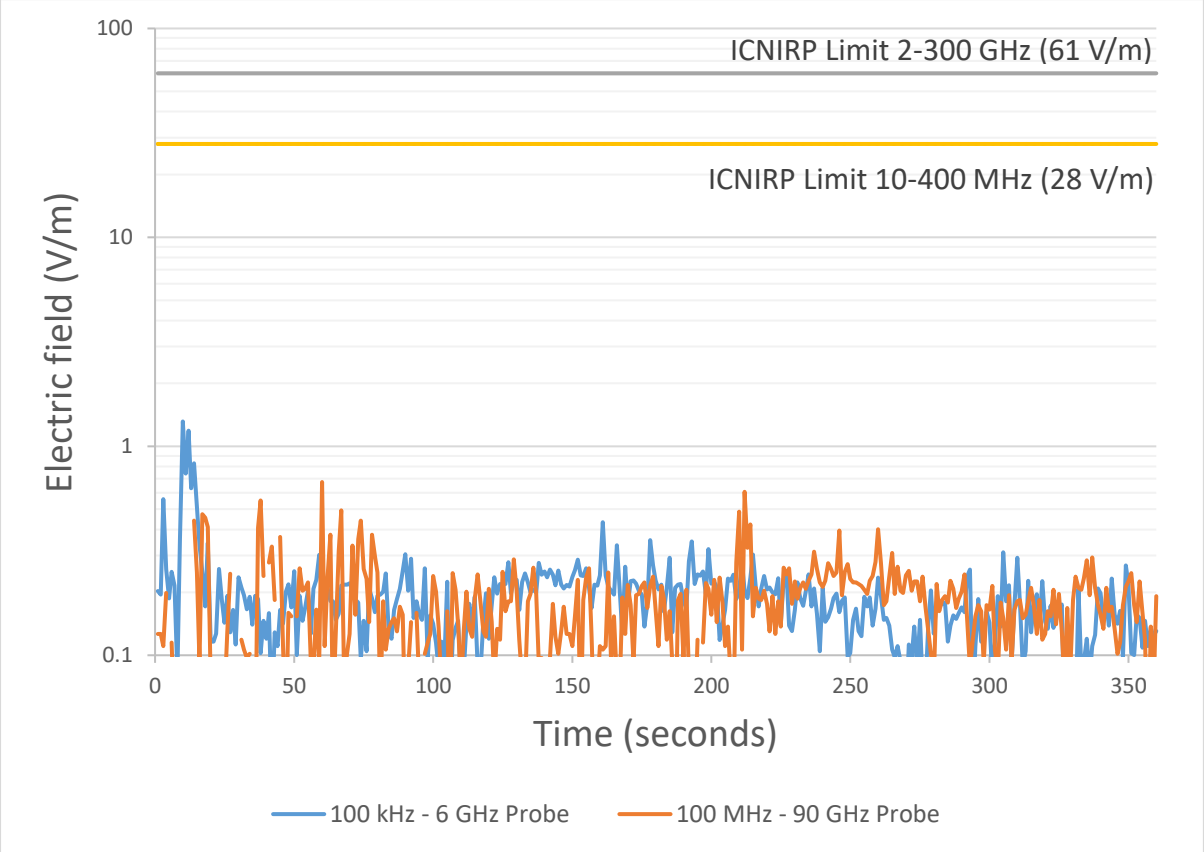
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.19 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz, BWA
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Ballina town centre (Pearse Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



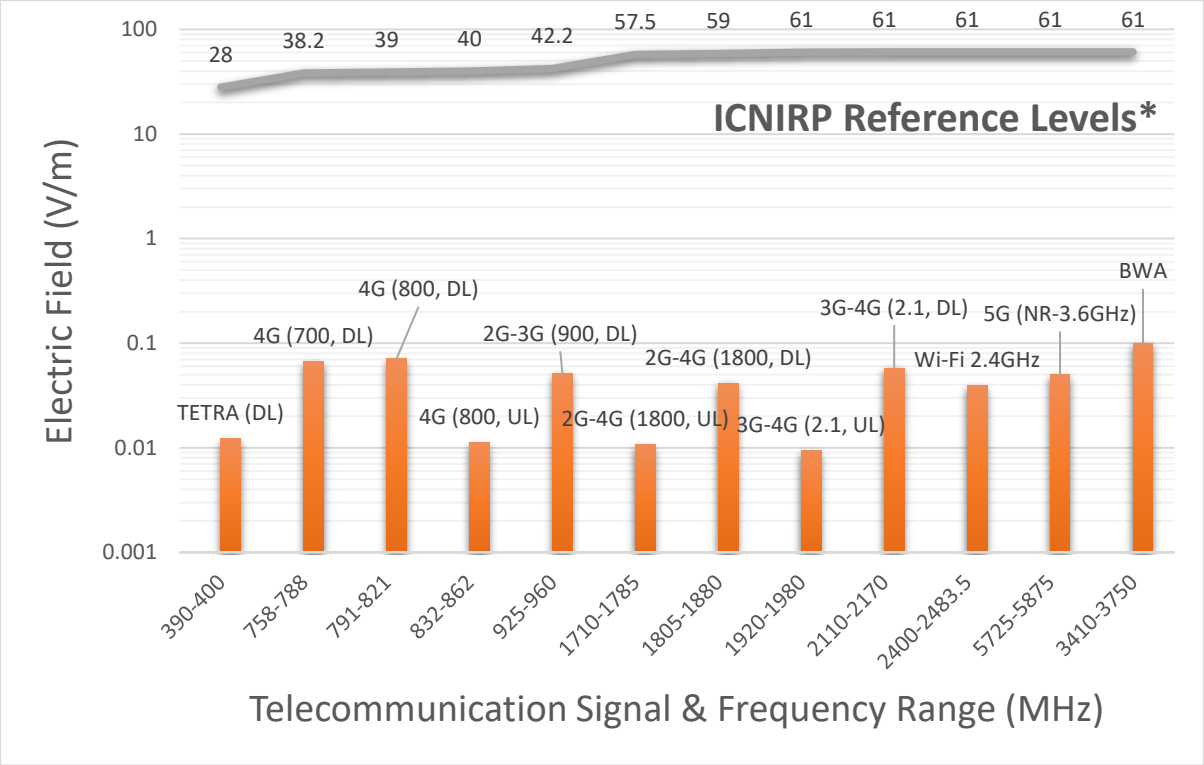
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.19	0.0001	1.32	0.005	28*	2*
100 MHz - 90 GHz	0.17	0.0001	0.67	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; BWA: Broadband Wireless Access; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.02	0.000001	0.01	0.0000004	28.0	2.0
4G (700, DL)	758-788	0.09	0.00002	0.07	0.00001	38.2	3.9
4G (800, DL)	791-821	0.08	0.00002	0.07	0.00001	39	4.0
4G (800, UL)	832-862	0.01	0.0000004	0.01	0.0000003	39	4.2
2G-3G (900, DL)	925-960	0.06	0.00001	0.05	0.000007	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.06	0.00001	0.04	0.000005	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.04	0.000004	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.08	0.00002	0.06	0.000009	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.11	0.00003	0.04	0.000004	61	10
5G (NR 3.6GHz)	3410-3750	0.06	0.00001	0.05	0.000007	61	10
BWA	5725-5875	0.35	0.0003	0.10	0.00003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; BWA: Broadband Wireless Access; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.19 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.35 V/m) is likely to correspond to the emission from nearby BWA antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.06 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/22	8th June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	23rd May 2022
Measurement time (approx.):	15:00 pm – 16:00 pm
Measurement point & location:	Market Street, Castlebar, Co Mayo
GPS coordinates:	53°51'23.2" N; 9°18'02.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Castlebar town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

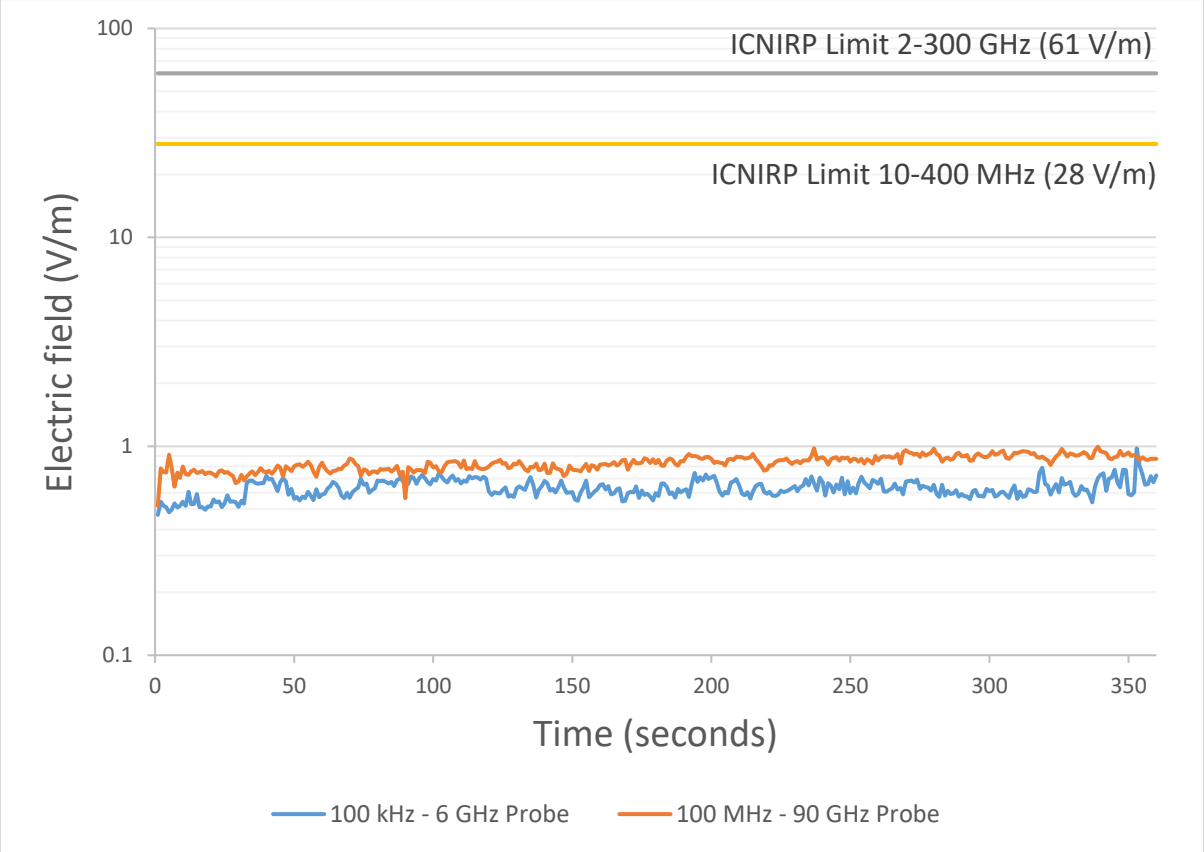
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.63 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz), BWA
Number of nearby telecommunication sites:	1 nearby site (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Castlebar town centre (Market Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



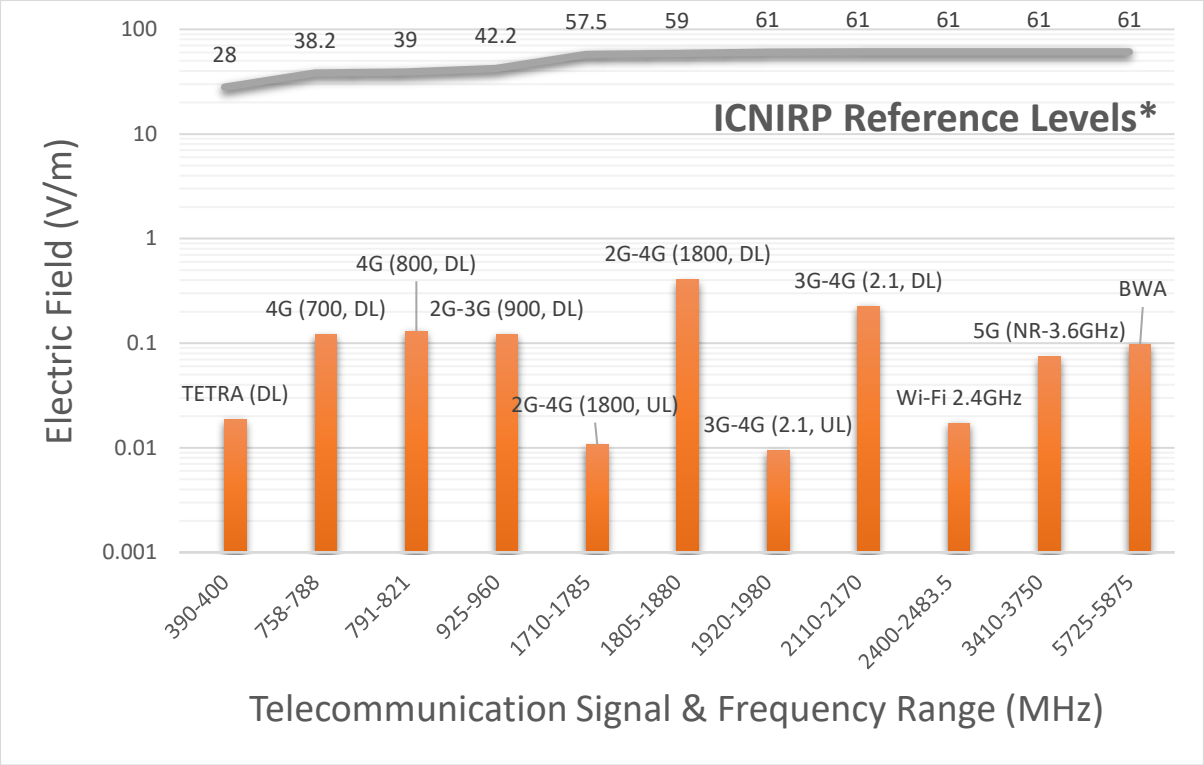
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.63	0.001	0.98	0.003	28*	2*
100 MHz - 90 GHz	0.83	0.002	0.99	0.003	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.02	0.000002	0.02	0.000001	28.0	2.0
4G (700, DL)	758-788	0.15	0.00006	0.12	0.00004	38.2	3.9
4G (800, DL)	791-821	0.16	0.00007	0.13	0.00005	39	4.0
2G-3G (900, DL)	925-960	0.15	0.00006	0.12	0.00004	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000002	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.57	0.0009	0.40	0.0004	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.05	0.000007	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.32	0.0003	0.23	0.0001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.07	0.00001	0.02	0.000001	61	10
5G (NR-3.6GHz)	3410-3750	0.13	0.00004	0.07	0.00001	61	10
BWA	5725-5875	0.14	0.00006	0.10	0.00003	61	10

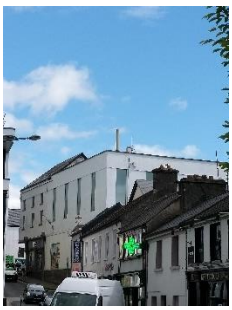
Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; BWA: Broadband Wireless Access.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.63 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.57 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.13 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/25	13 Dec 2021	J Vila

1. Measurement survey characteristics

Measurement date:	11th November 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Killegland Street, Ashbourne, Co Meath
GPS coordinates:	53°30'37.4" N; 6°23'56.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Ashbourne town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

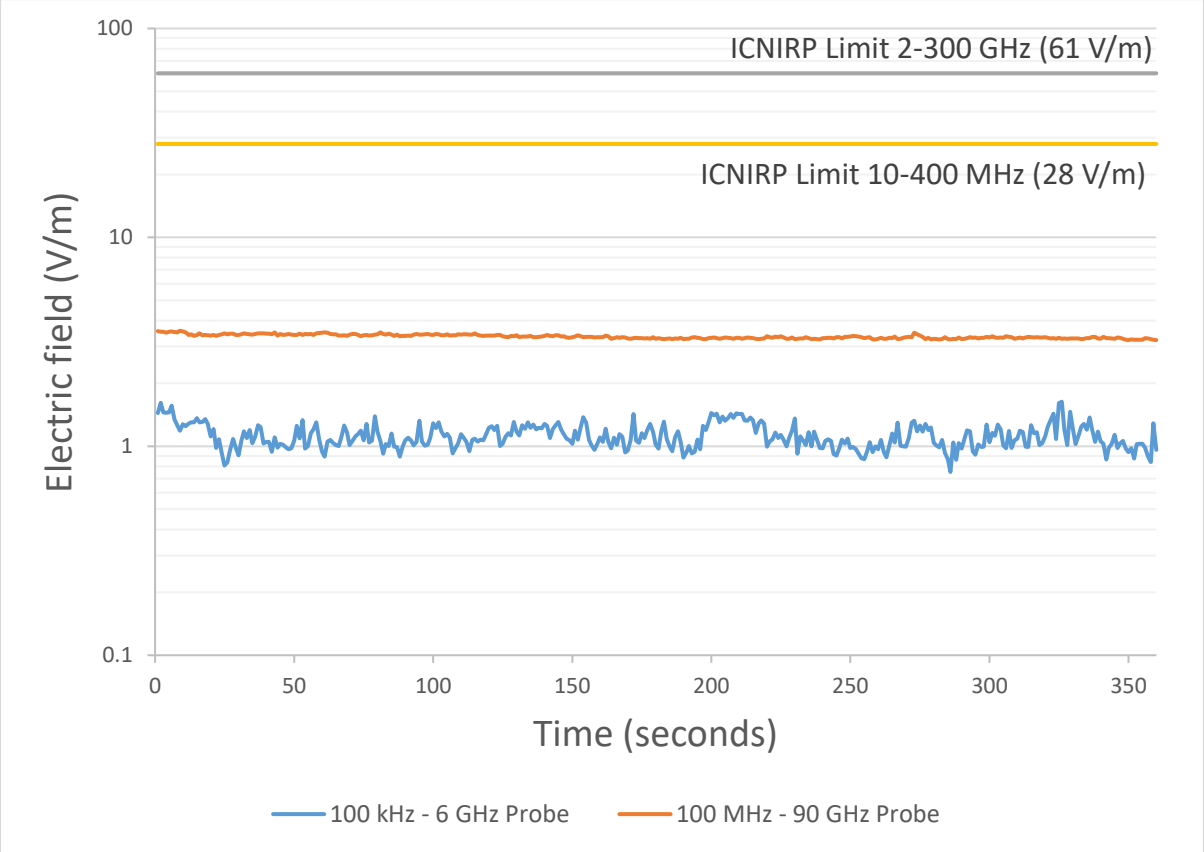
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.12 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA (DL), 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz, 5G (NR 3.6GHz), FWALA
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Ashbourne centre (Killegland Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



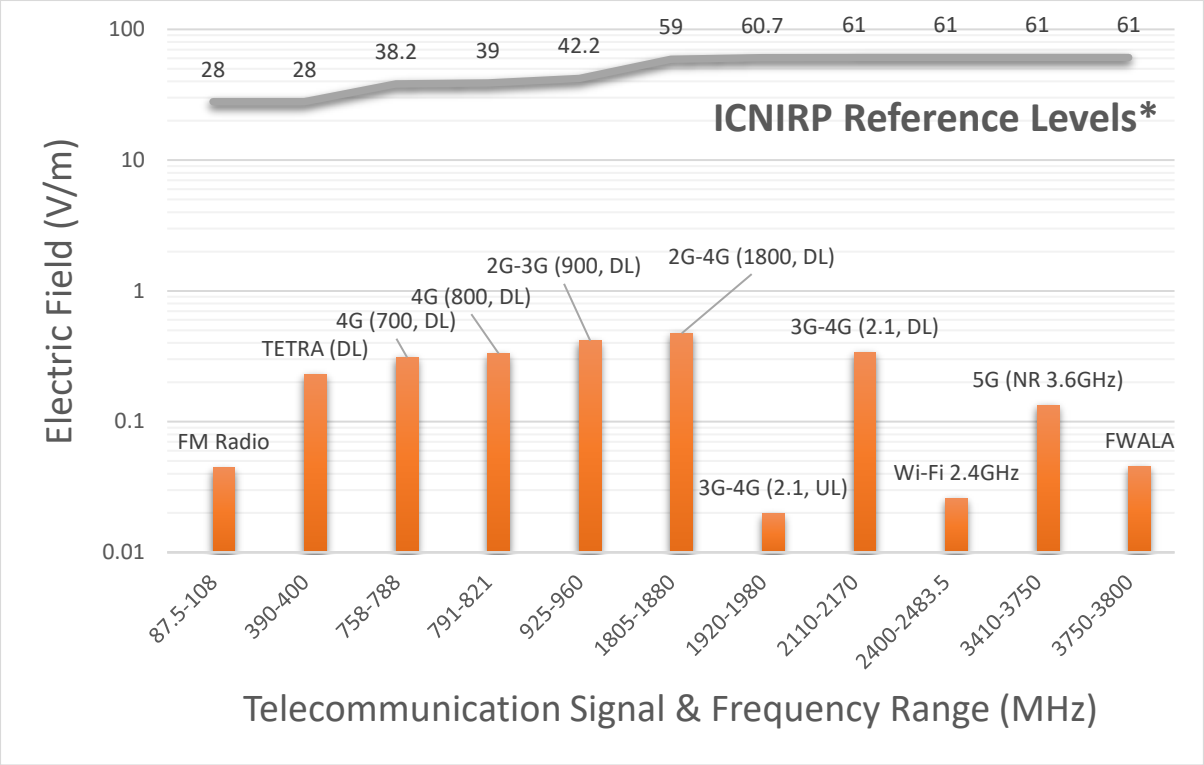
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.12	0.003	1.63	0.007	28*	2*
100 MHz - 90 GHz	3.35	0.030	3.58	0.034	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.05	0.000007	0.04	0.000005	28	2
TETRA (DL)	390-400	0.32	0.0003	0.23	0.0001	28.0	2.0
4G (700, DL)	758-788	0.52	0.0007	0.31	0.0003	38.2	3.9
4G (800, DL)	791-821	0.67	0.001	0.33	0.0003	39	4.0
2G-3G (900, DL)	925-960	0.54	0.0008	0.42	0.0005	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.95	0.002	0.47	0.0006	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.18	0.00008	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.55	0.0008	0.34	0.0003	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.06	0.00001	0.03	0.000002	61	10
5G (NR-3.6GHz)	3410-3750	0.38	0.0004	0.13	0.00005	61	10
FWALA	3750-3800	0.22	0.0001	0.05	0.00001	61	10

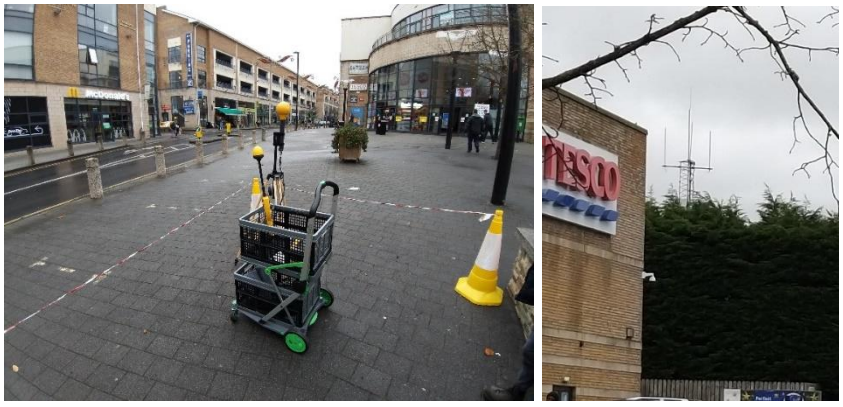
Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.12 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.95 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement, with a maximum pilot (no traffic) level of 0.38 V/m and a maximum traffic level (streaming with a 5G mobile phone) of 0.88 V/m.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication site



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/27	15 Dec 2021	J Vila

1. Measurement survey characteristics

Measurement date:	18th November 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Coast Road, Bettystown, Co Meath
GPS coordinates:	53°41'54.9" N; 6°14'39.1" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Bettystown with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

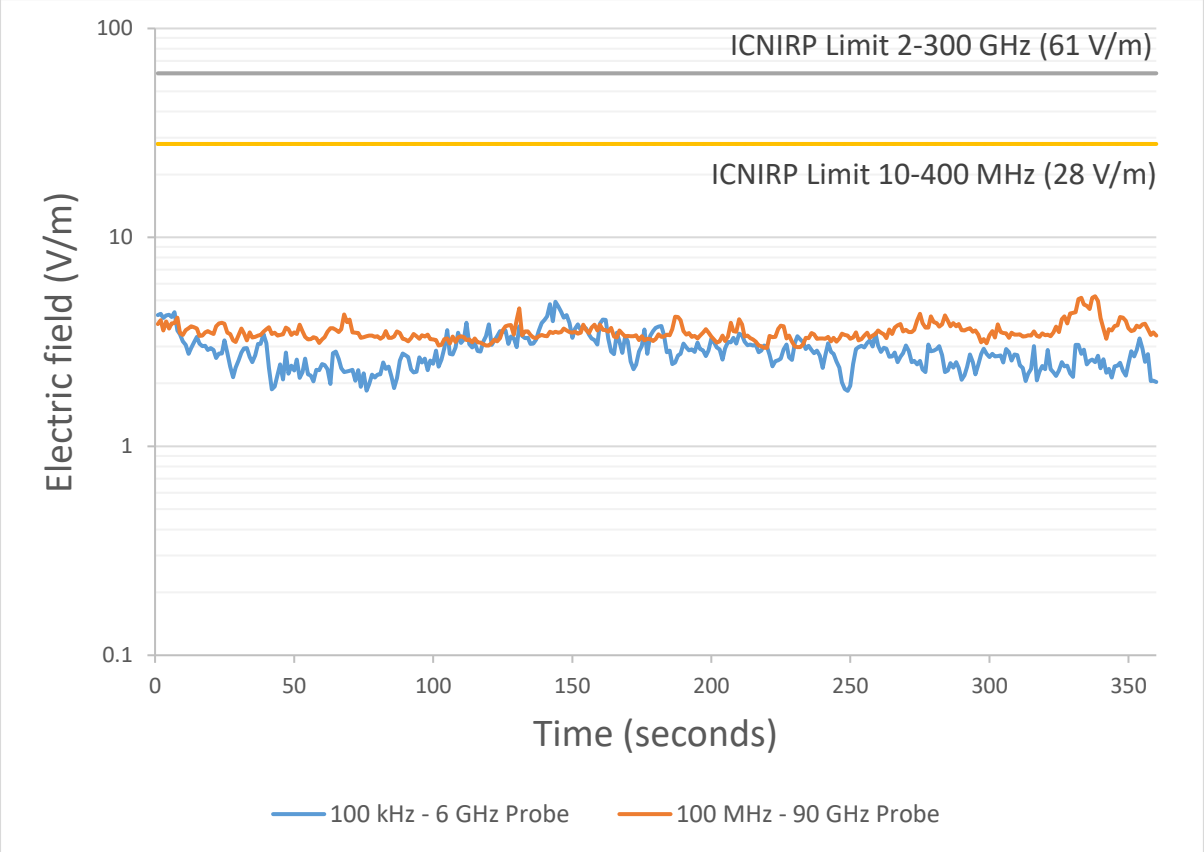
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.85 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Bettystown centre (Cost Road) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



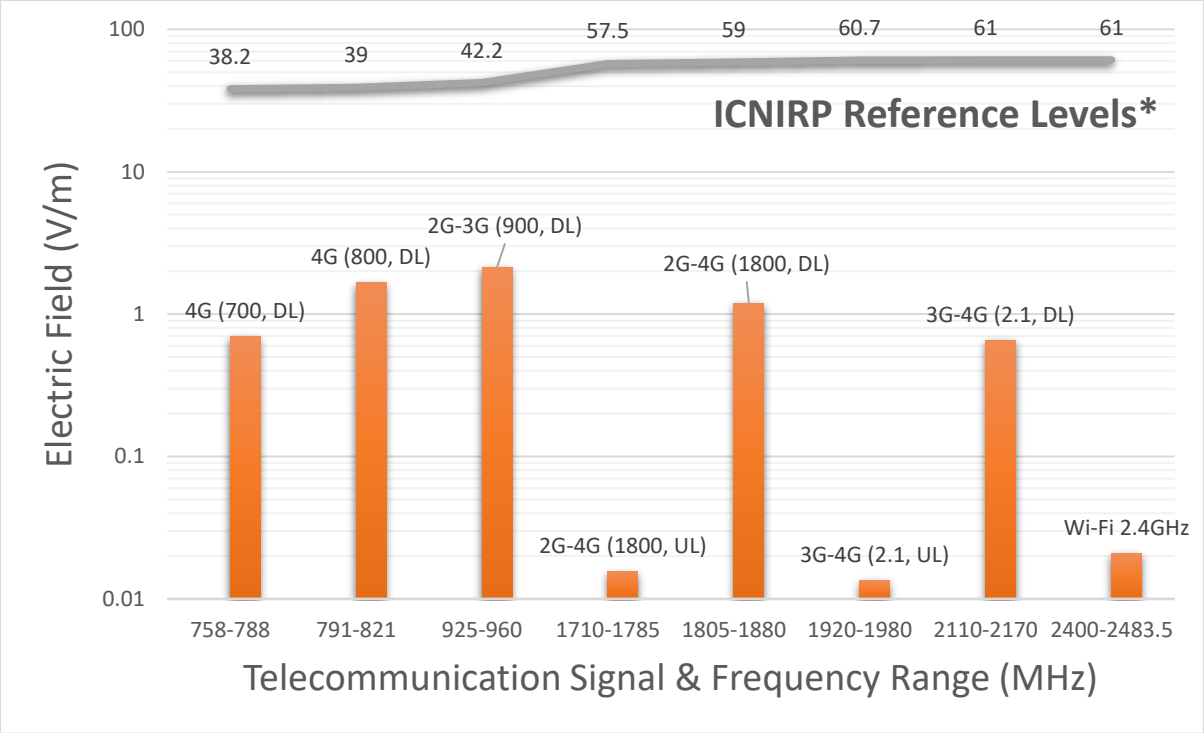
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	2.85	0.02	4.92	0.06	28*	2*
100 MHz - 90 GHz	3.53	0.03	5.23	0.07	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

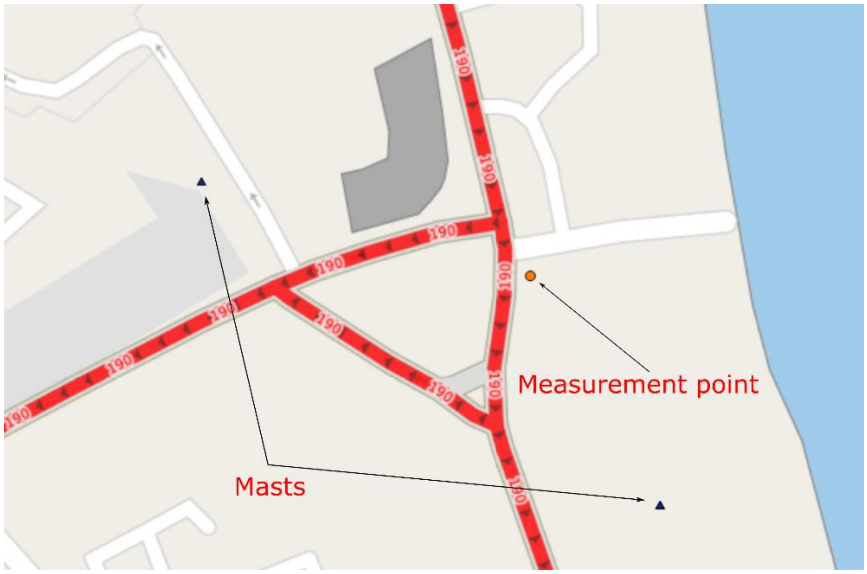
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
4G (700, DL)	758-788	1.39	0.005	0.70	0.001	38.2	3.9
4G (800, DL)	791-821	2.55	0.02	1.67	0.007	39	4.0
2G-3G (900, DL)	925-960	2.83	0.02	2.13	0.01	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000001	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	1.81	0.009	1.20	0.004	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.02	0.000001	0.01	0.0000005	60.7	9.8
3G-4G (2.1, DL)	2110-2170	1.28	0.004	0.66	0.001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.17	0.00007	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.85 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 3 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (2.83 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/27	13 Dec 2021	J Vila

1. Measurement survey characteristics

Measurement date:	11th November 2021
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Market Square, Navan, Co Meath
GPS coordinates:	53°39'11.2" N; 6°41'02.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Navan town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

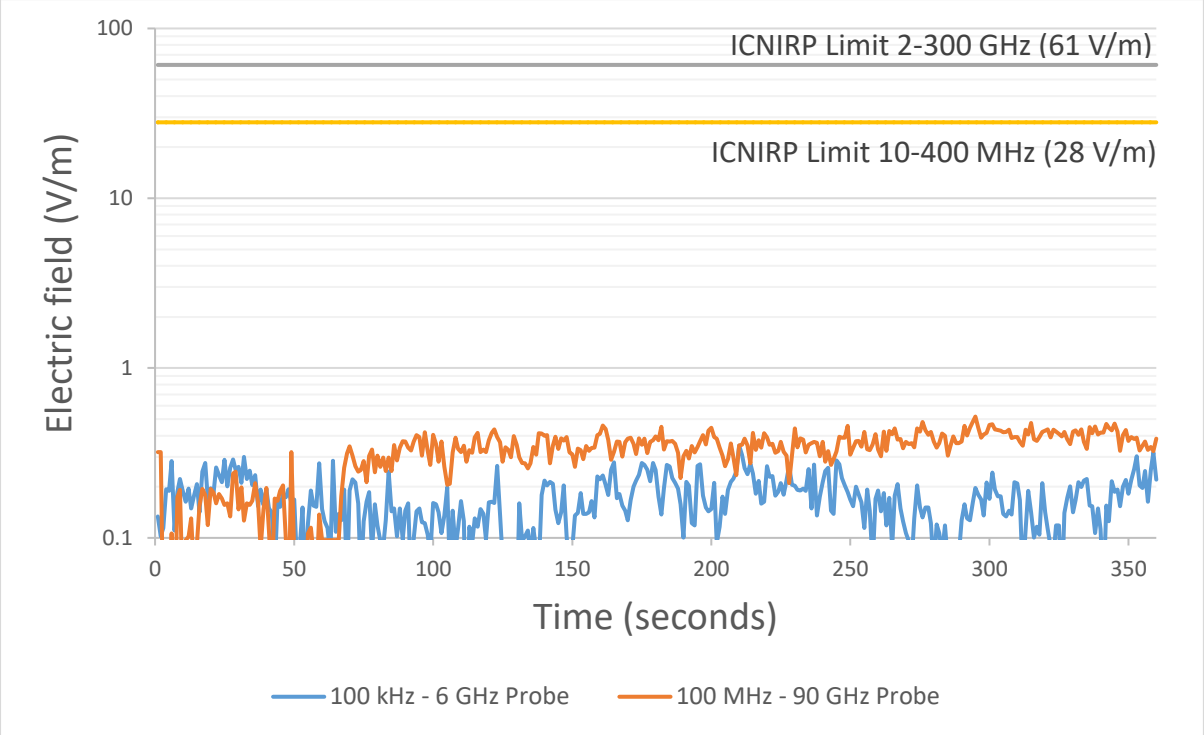
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.17 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 GHz
Number of nearby telecommunication sites:	4 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Navan town centre (Market Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



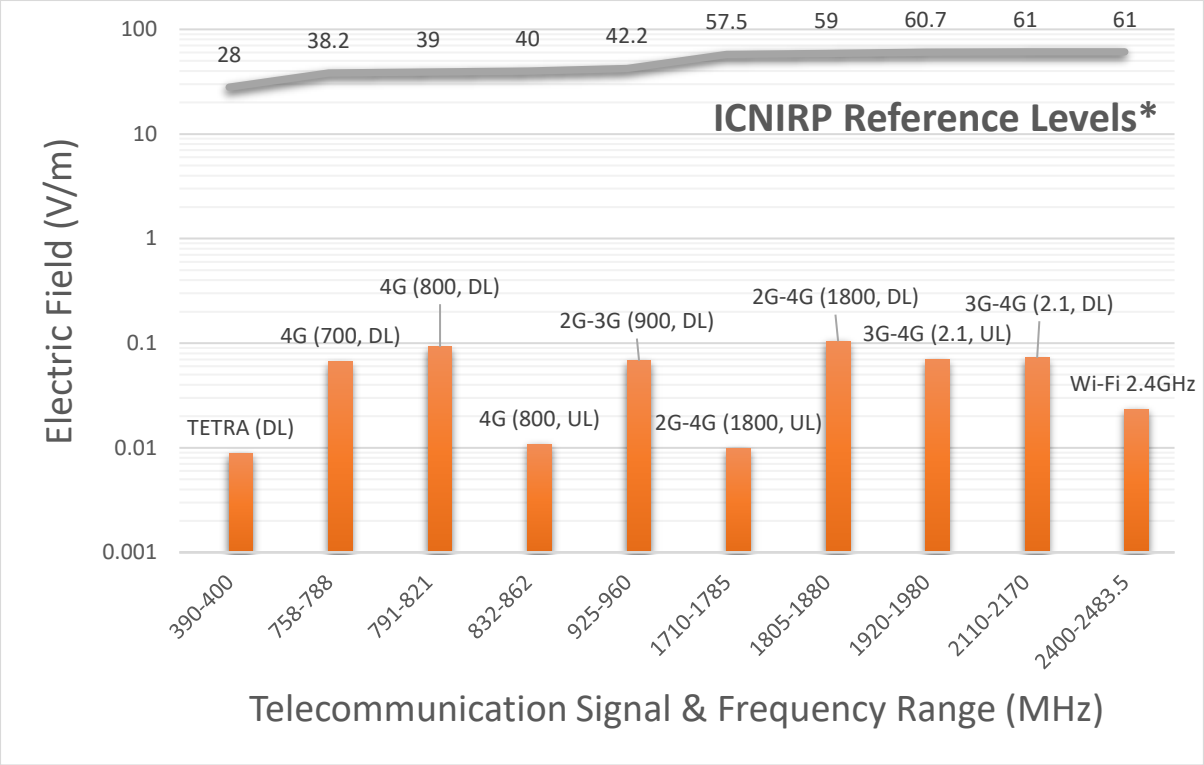
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.17	0.0001	0.35	0.0003	28*	2*
100 MHz - 90 GHz	0.32	0.0003	0.52	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

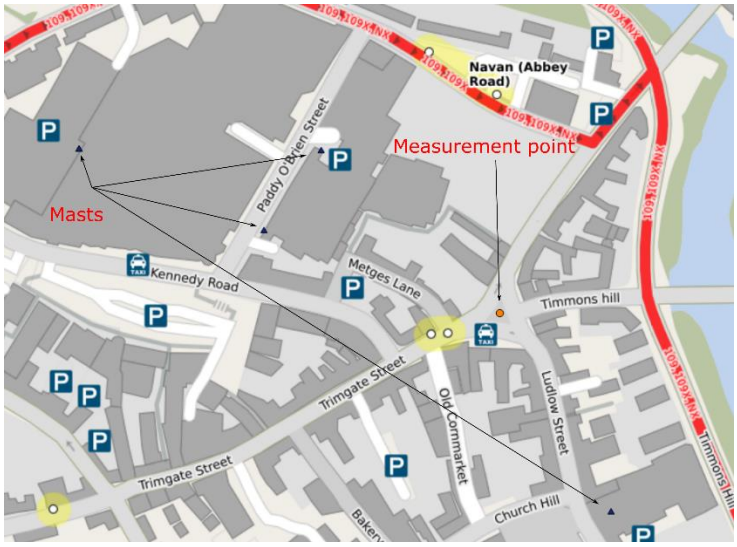
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.01	0.0000002	0.01	0.0000002	28.0	2.0
4G (700, DL)	758-788	0.11	0.00003	0.07	0.00001	38.2	3.9
4G (800, DL)	791-821	0.12	0.00004	0.09	0.00002	39	4.0
4G (800, UL)	832-862	0.02	0.000001	0.01	0.0000003	39	4.2
2G-3G (900, DL)	925-960	0.08	0.00002	0.07	0.00001	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.05	0.00001	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.15	0.00006	0.10	0.00003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.61	0.001	0.07	0.00001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.13	0.00005	0.07	0.00001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.07	0.00001	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.17 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.61 V/m) is likely to correspond to the emission (uplink) from nearby 3G-4G (2100 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication site

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The following EMF measurement equipment were used:

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- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

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- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/17	31 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	29th March 2022
Measurement time (approx.):	14:00 pm – 15:00 pm
Measurement point & location:	Church Street, Monaghan, Co Monaghan
GPS coordinates:	54°14'52.9" N; 6°58'12.8" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Monaghan town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

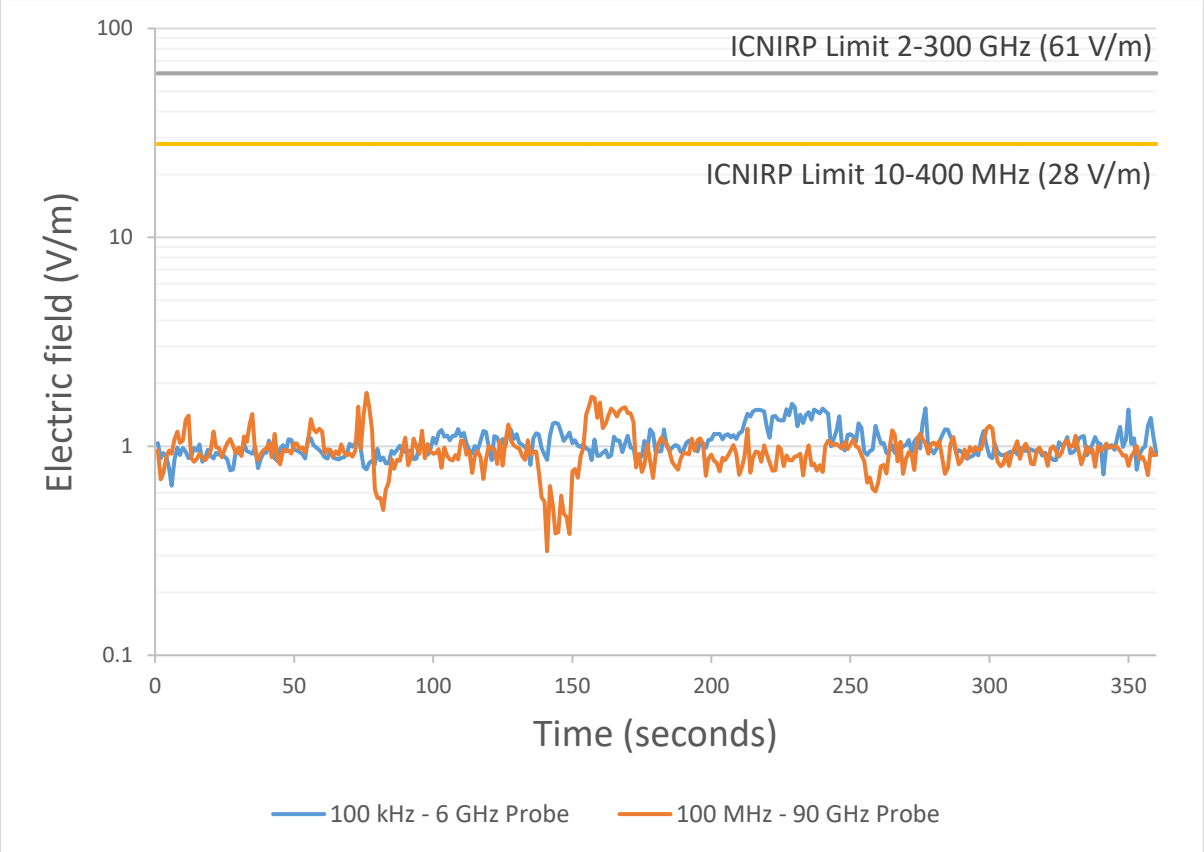
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.04 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz
Number of nearby telecommunication sites:	1 nearby site (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Monaghan town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



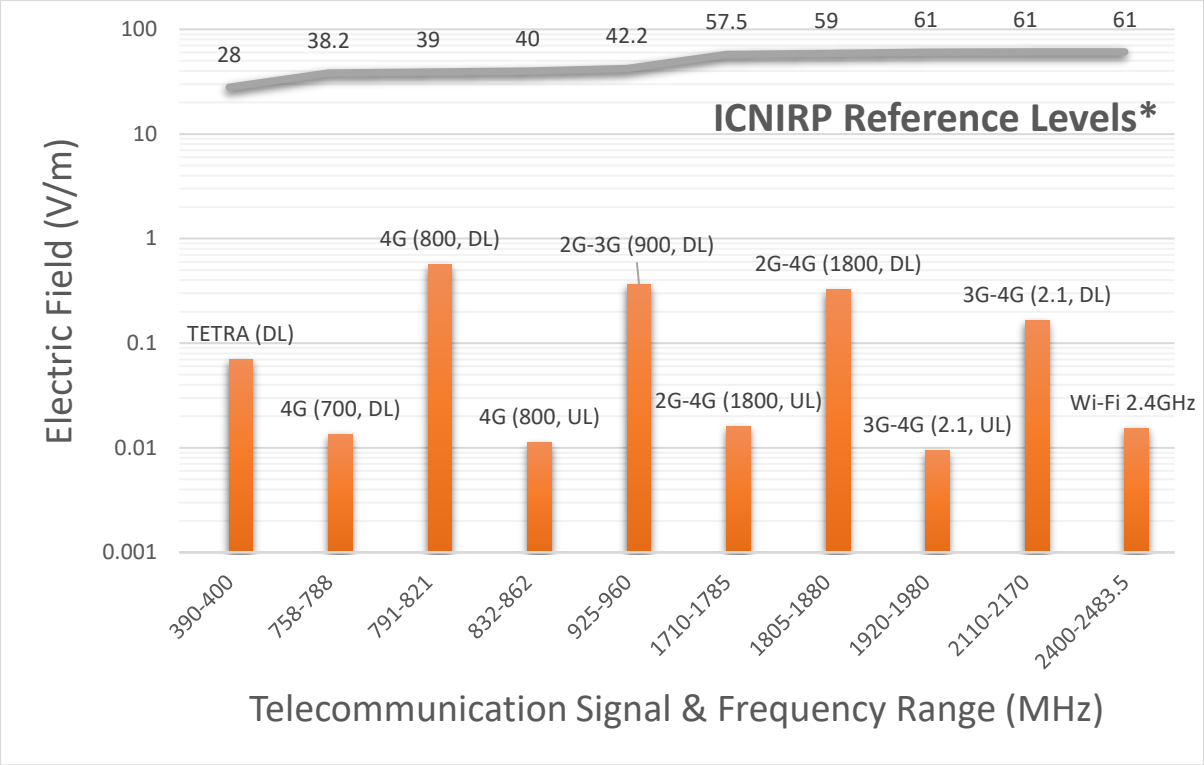
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.04	0.003	1.60	0.007	28*	2*
100 MHz - 90 GHz	0.96	0.002	1.80	0.009	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. [*]ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.09	0.00002	0.07	0.00001	28.0	2.0
4G (700, DL)	758-788	0.02	0.000001	0.01	0.0000005	38.2	3.9
4G (800, DL)	791-821	0.94	0.002	0.56	0.0008	39	4.0
4G (800, UL)	832-862	0.01	0.0000004	0.01	0.0000003	39	4.2
2G-3G (900, DL)	925-960	0.59	0.0009	0.36	0.0004	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.12	0.00004	0.02	0.000001	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.69	0.001	0.32	0.0003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.02	0.000001	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.27	0.0002	0.16	0.00007	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.04	0.000004	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.04 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.94 V/m) is likely to correspond to the emission (downlink) from nearby 4G (800, DL) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/10	13 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	11th March 2022
Measurement time:	12:30 am – 13:30 pm
Measurement point & location:	O'Connor Square, Tullamore, Co Offaly
GPS coordinates:	53°16'28.3"N; 7°29'32.5"W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Tullamore town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

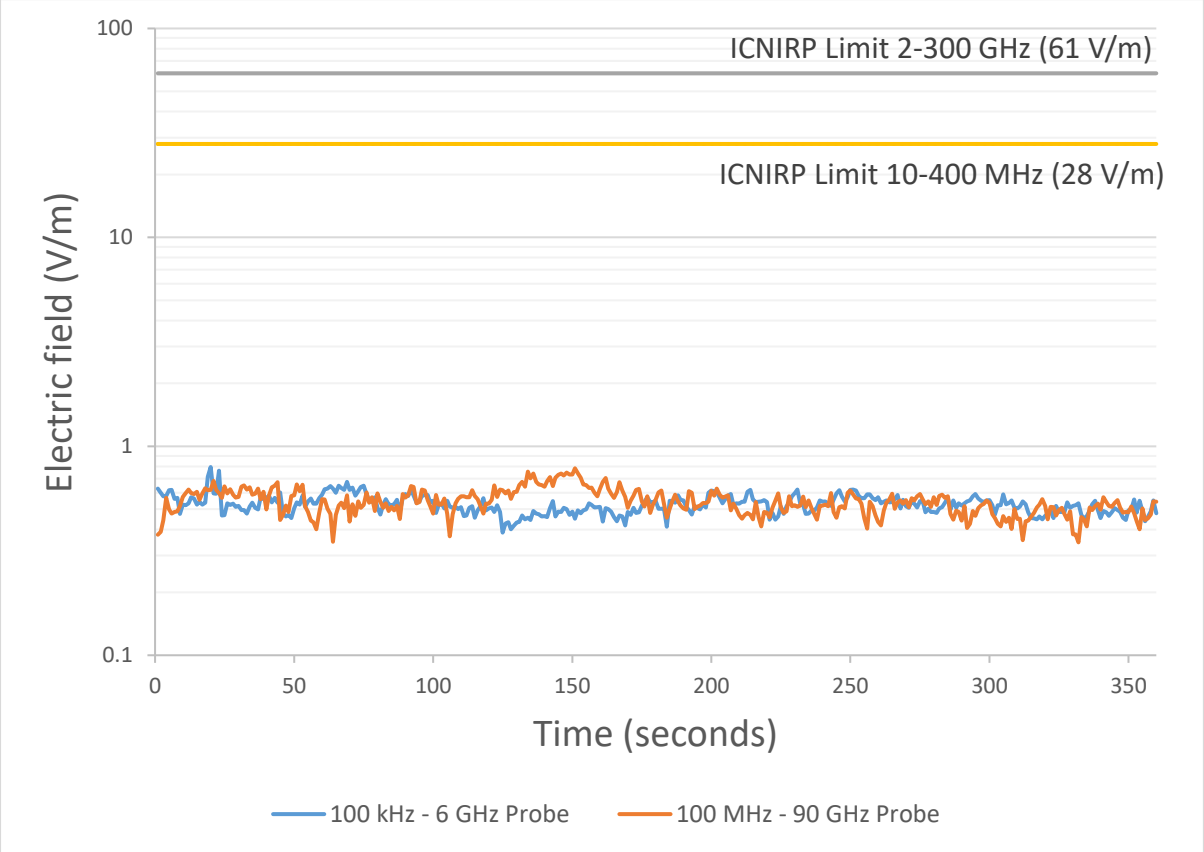
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.53 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Tullamore town centre (O'Connor Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



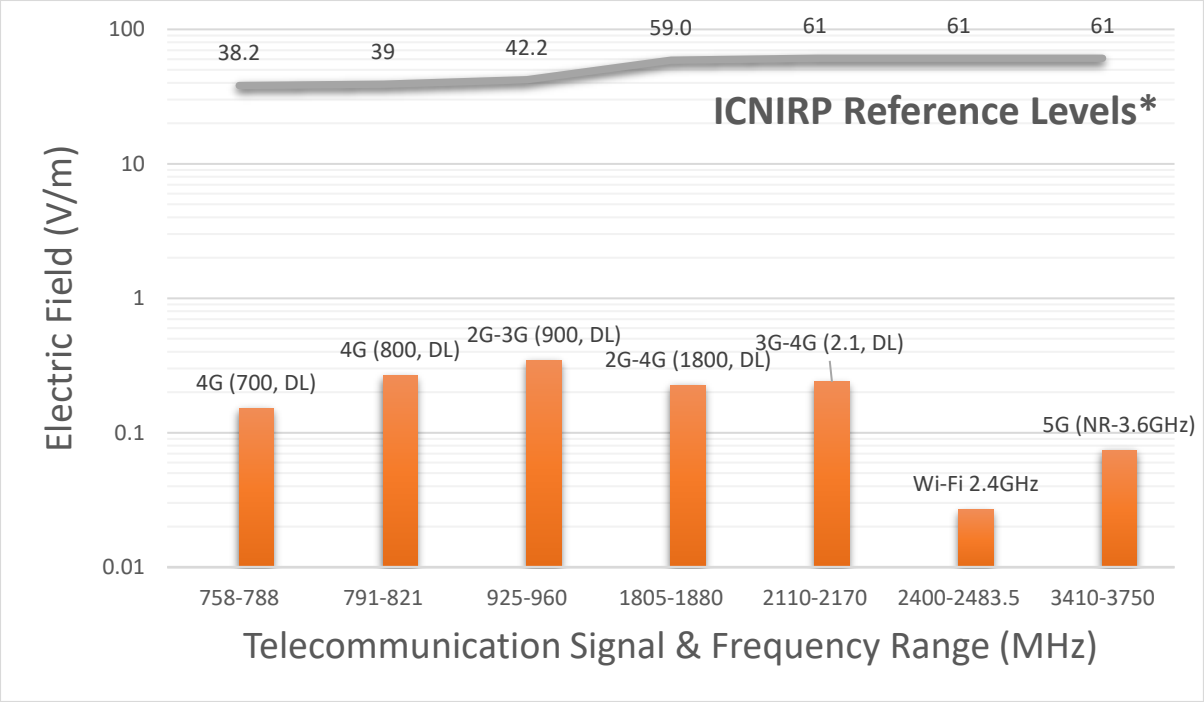
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.53	0.001	0.80	0.002	28*	2*
100 MHz - 90 GHz	0.54	0.001	0.78	0.002	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

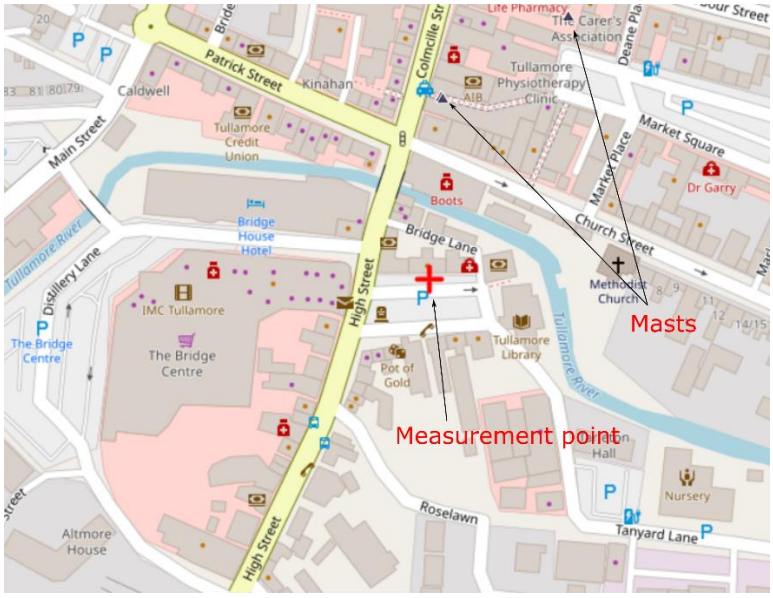
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
4G (700, DL)	758-788	0.24	0.0001	0.15	0.00006	38.2	3.9
4G (800, DL)	791-821	0.34	0.0003	0.27	0.0002	39	4.0
2G-3G (900, DL)	925-960	0.41	0.0004	0.34	0.0003	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.30	0.0002	0.23	0.0001	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.37	0.0004	0.24	0.0002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.13	0.00005	0.03	0.000002	61	10
5G (NR-3.6GHz)	3410-3750	0.14	0.00005	0.07	0.00001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio.

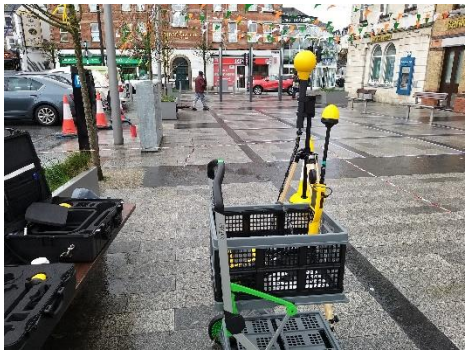
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.53 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.41 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. 5G signals were detected at the point of measurement with a maximum level of 0.14 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

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- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/14	17 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	28th March 2022
Measurement time (approx.):	14:00 pm – 15:00 pm
Measurement point & location:	Main Street, Roscommon, Co Roscommon
GPS coordinates:	53°37'53.2" N; 8°11'27.1" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Roscommon town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

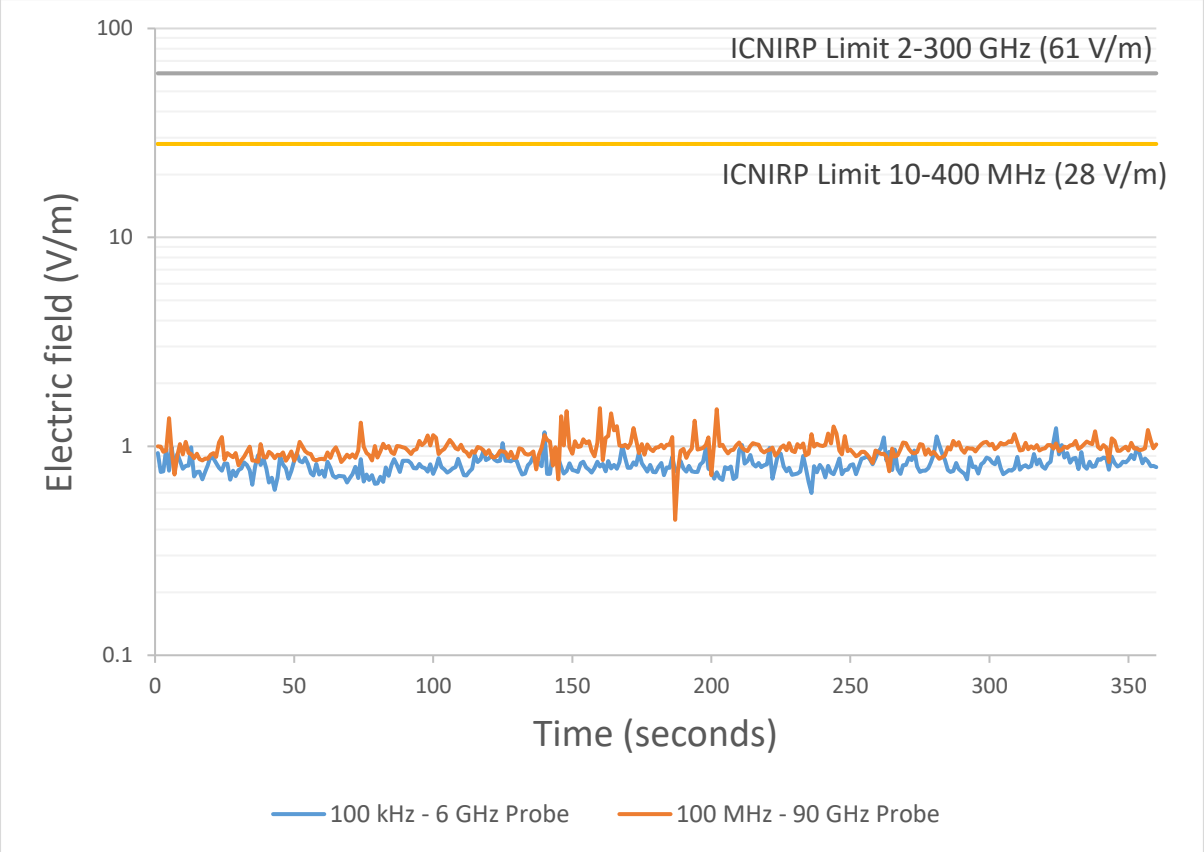
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.81 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Roscommon town centre (Main Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



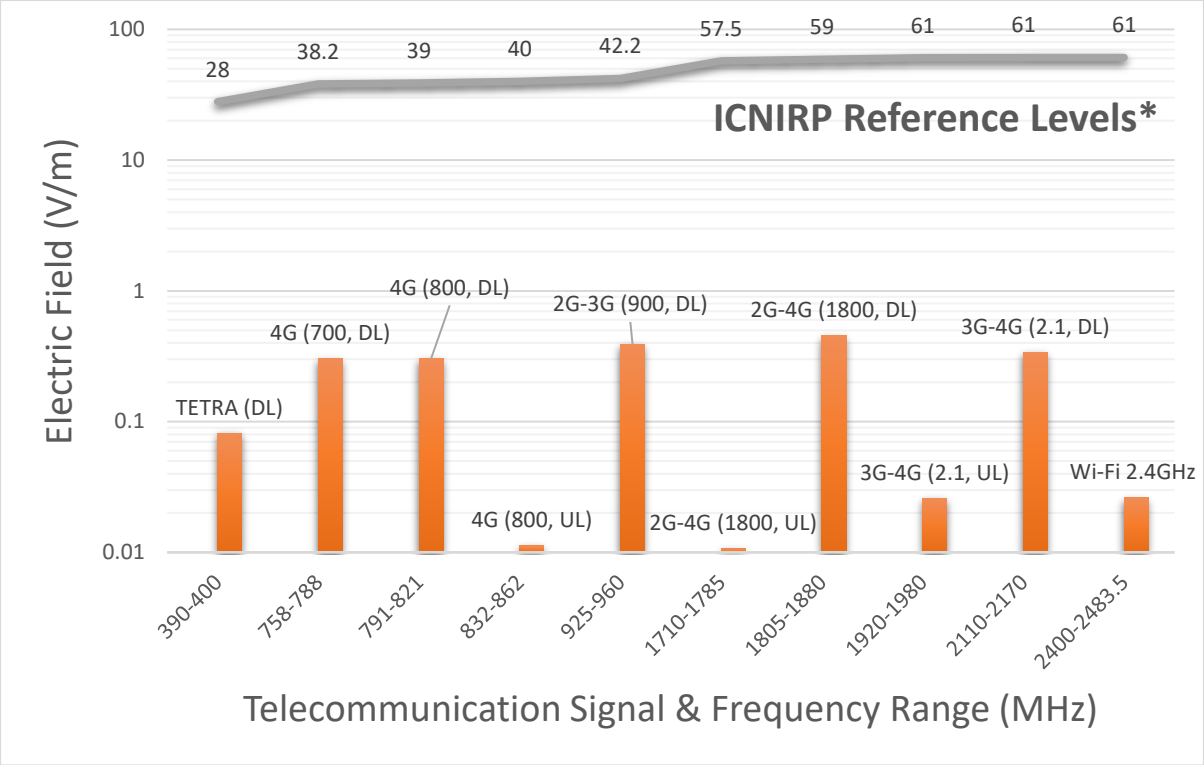
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.81	0.002	1.22	0.004	28*	2*
100 MHz - 90 GHz	0.98	0.003	1.52	0.006	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
TETRA (DL)	390-400	0.10	0.00003	0.08	0.00002	28.0	2.0
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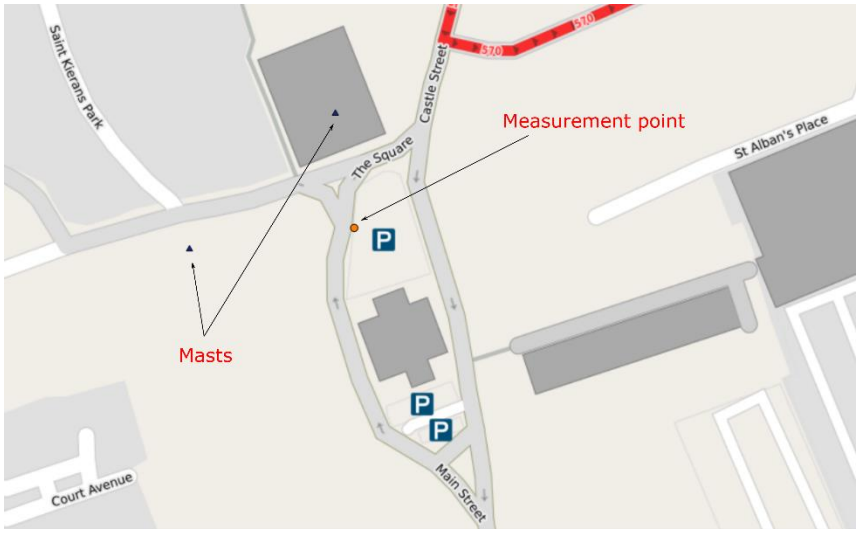
Wi-Fi 2.4GHz	2400-2483.5	0.19	0.0001	0.03	0.000002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.81 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.81 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

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The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
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- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/24	8th June 2022	J Vila

1. Measurement survey characteristics

Measurement date:	24th May 2022
Measurement time (approx.):	15:30 pm – 16:30 pm
Measurement point & location:	Wine Street, Sligo, Co Sligo
GPS coordinates:	54°16'20.5"N; 8°28'41.7"W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Sligo city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

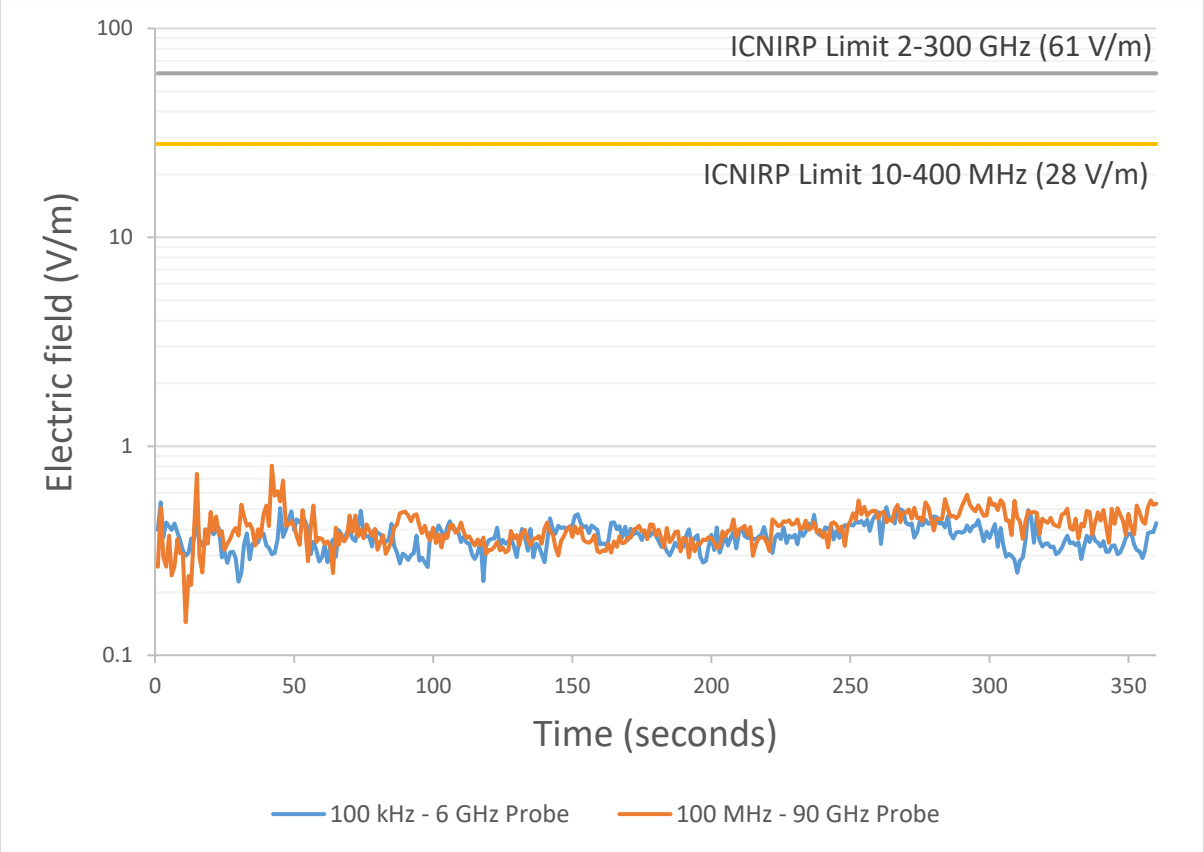
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.37 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	5 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Sligo city centre (Wine Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



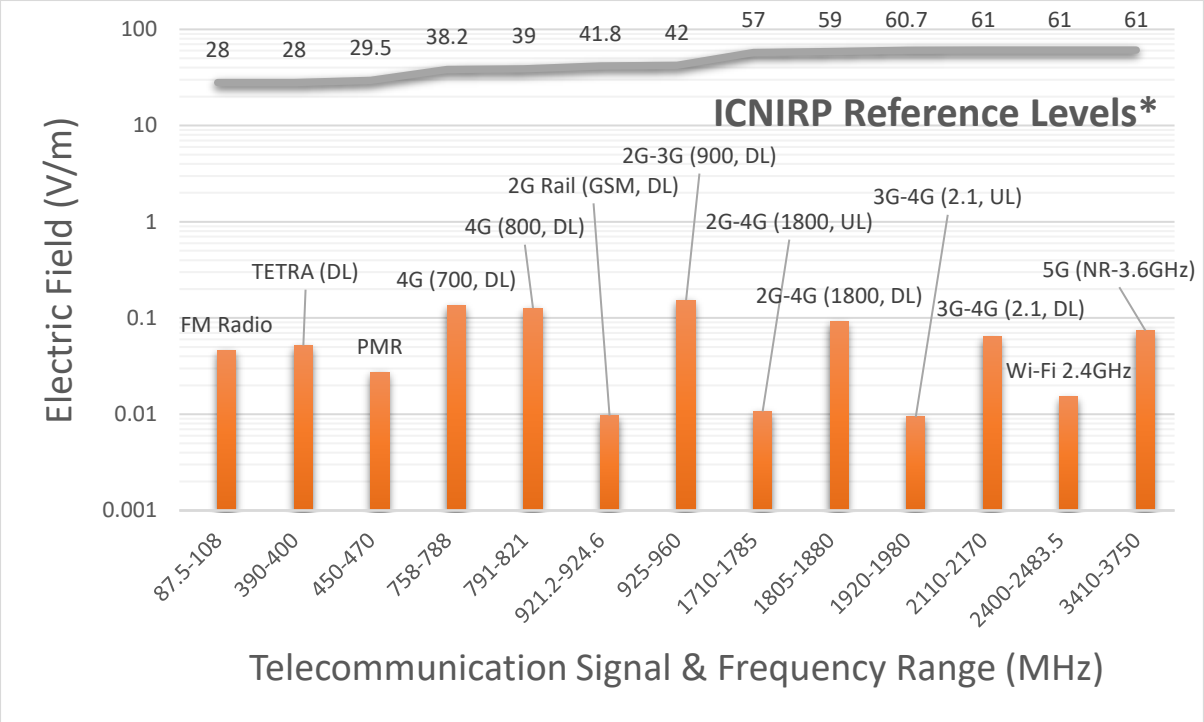
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.37	0.0004	0.54	0.001	28*	2*
100 MHz - 90 GHz	0.41	0.0004	0.81	0.002	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for the midpoint of each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.05	0.000007	0.05	0.000006	28	2
TETRA (DL)	390-400	0.07	0.00001	0.05	0.000007	28	2.0
PMR	450-470	0.03	0.000003	0.03	0.000002	29	2.3
4G (700, DL)	758-788	0.18	0.00009	0.13	0.00005	38.2	3.9
4G (800, DL)	791-821	0.17	0.00007	0.13	0.00004	39	4.0
2G Rail (GSM, DL)	921.2-924.6	0.01	0.000001	0.01	0.0000002	41.8	4.6
2G-3G (900, DL)	925-960	0.18	0.00009	0.15	0.00006	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.000001	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.11	0.00003	0.09	0.00002	59	9.2
3G-4G (2.1, UL)	1920-1980	0.02	0.000001	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.10	0.00002	0.06	0.00001	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.03	0.000002	0.02	0.000001	61	10
5G (NR-3.6GHz)	3410-3750	0.16	0.00006	0.07	0.00001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.37 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.18 V/m) is likely to correspond to the emission (downlink) from nearby 4G (700, DL) and 2G-3G (900, DL) antennas. 5G signals were detected at the point of measurement, with maximum levels of 0.16 V/m (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/03	10 March 2022	J Vila

1. Measurement survey characteristics

Measurement date:	11th February 2022
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Mitchell St, Oldbridge, Clonmel, Co. Tipperary
GPS coordinates:	52°21'11.0" N; 7°42'05.1" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Clonmel town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

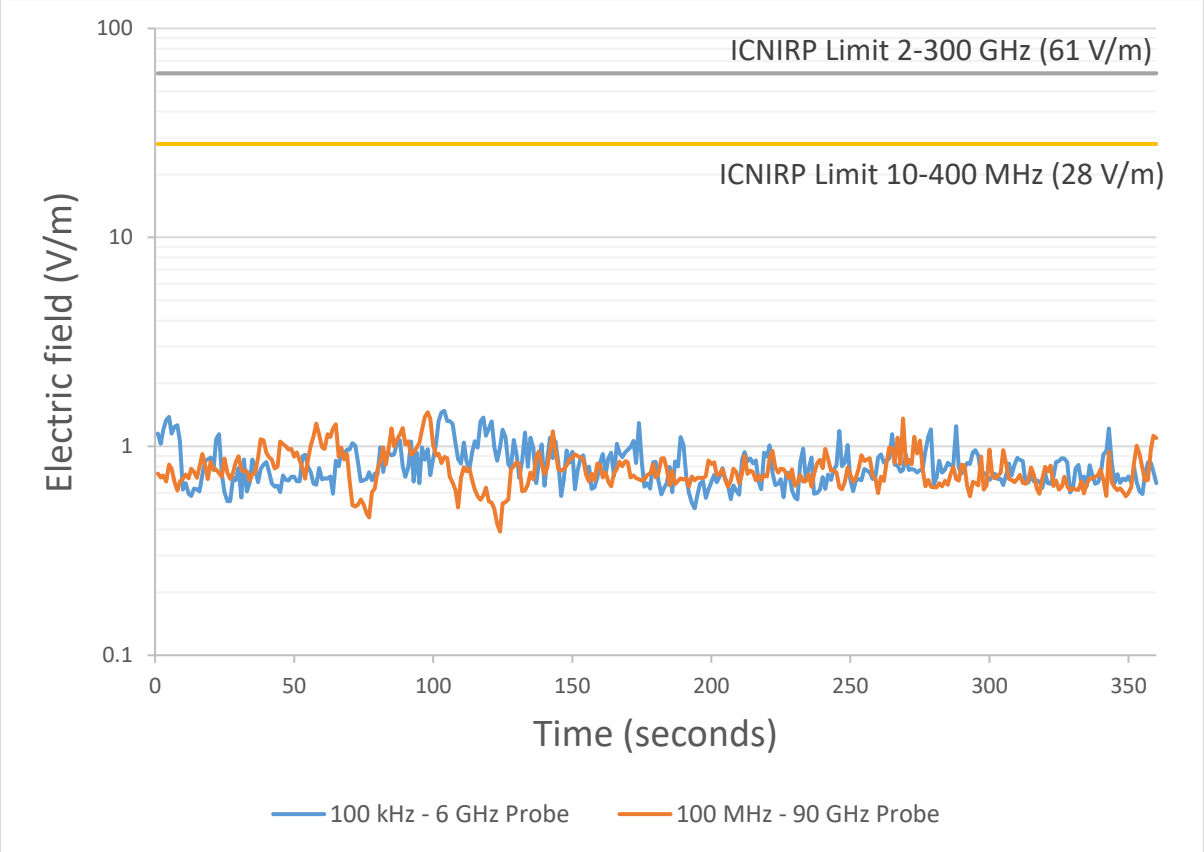
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.82 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, Wi-Fi 5GHz
Number of nearby telecommunication sites:	5 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Clonmel town centre (Mitchell Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



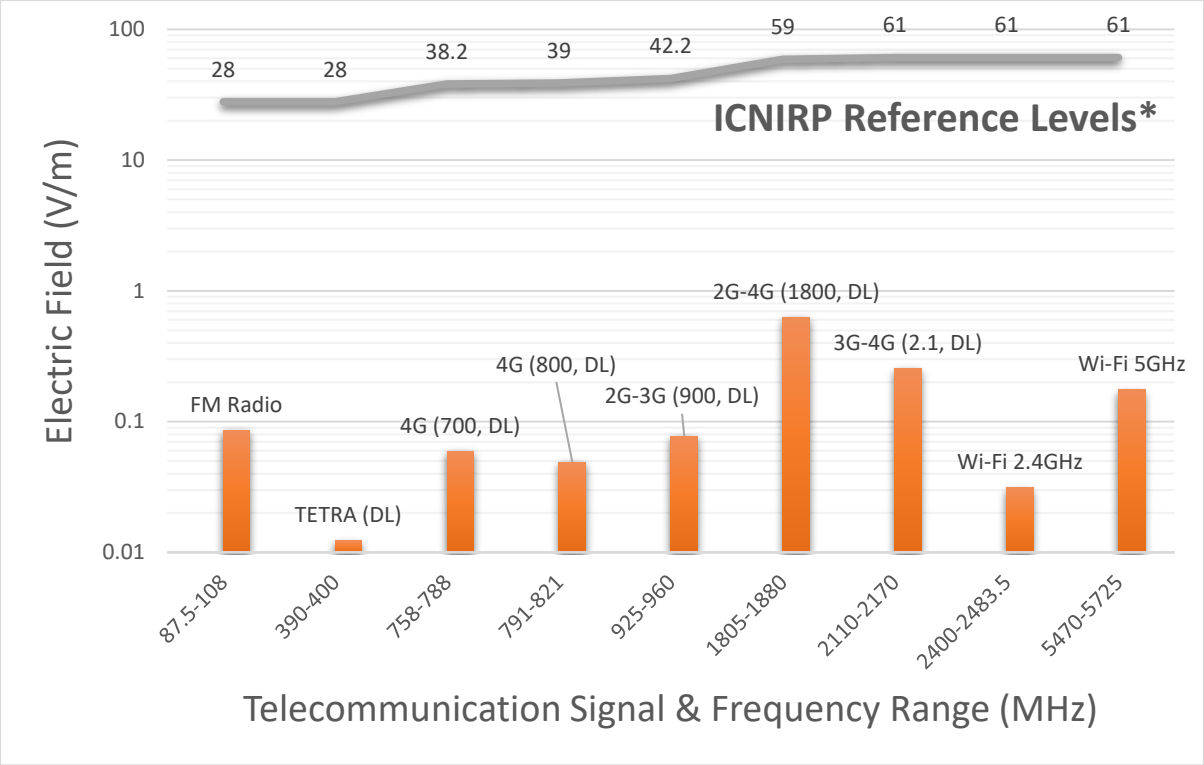
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.82	0.002	1.48	0.006	28*	2*
100 MHz - 90 GHz	0.78	0.002	1.46	0.006	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

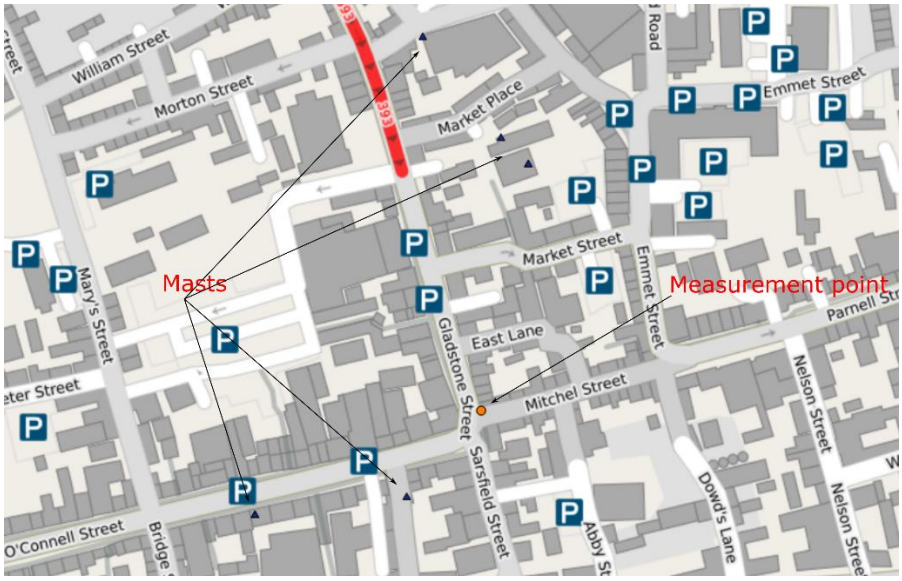
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.10	0.00003	0.09	0.00002	28.0	2.0
TETRA (DL)	390-400	0.02	0.000001	0.01	0.0000004	28.0	2.0
4G (700, DL)	758-788	0.10	0.00003	0.06	0.000009	38.2	3.9
4G (800, DL)	791-821	0.06	0.00001	0.05	0.000006	39	4.0
2G-3G (900, DL)	925-960	0.10	0.00003	0.08	0.00002	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.78	0.002	0.63	0.001	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.32	0.0003	0.26	0.0002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.03	0.000003	0.03	0.000003	61	10
Wi-Fi 5GHz	5470-5725	0.24	0.0001	0.17	0.00008	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.82 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.78V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/01	01 March 2022	J Vila

1. Measurement survey characteristics

Measurement date:	10th February 2022
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Great George's Street, Waterford city, Co Waterford
GPS coordinates:	52°15'39.8" N; 7°6'42.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Waterford city with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

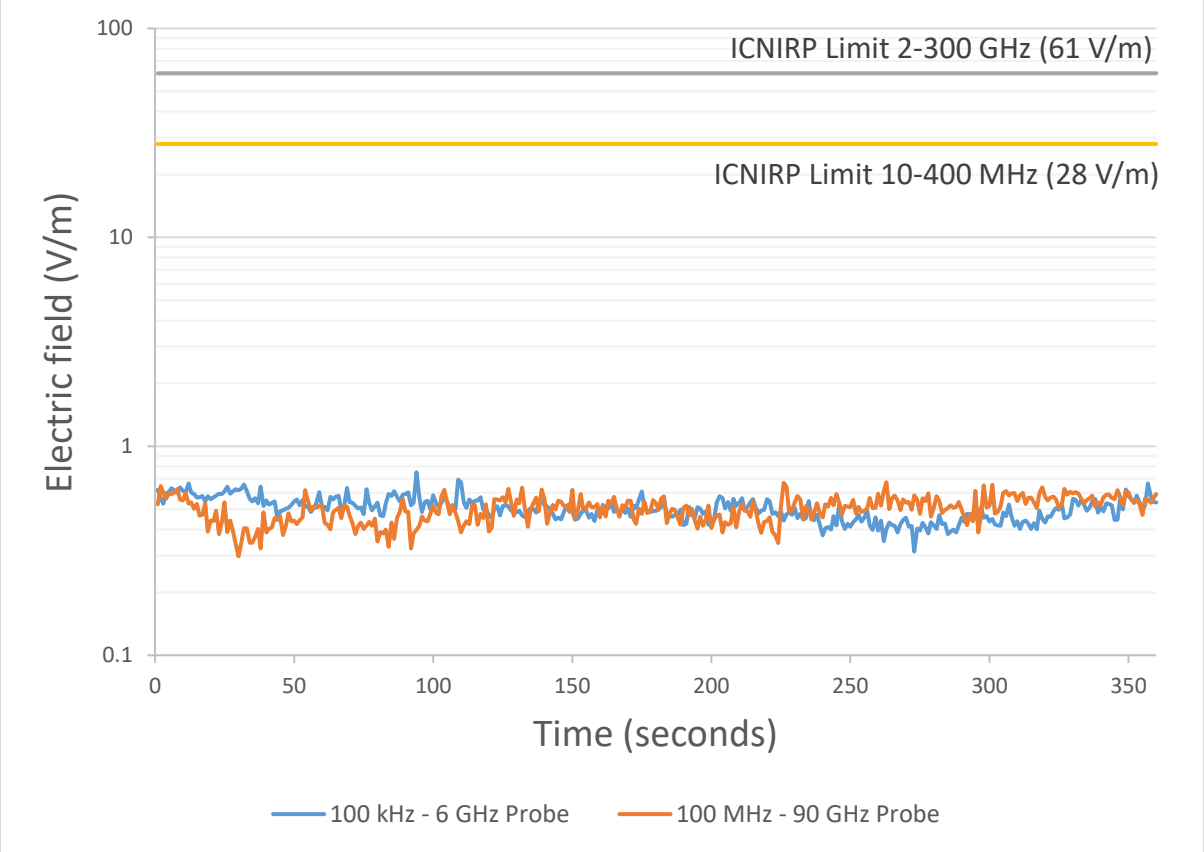
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.50 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4 & 5; 5G NR-3.6; FWALA; WiMAX-BWA
Number of nearby telecommunication sites:	7 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Waterford city centre (Great George's Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



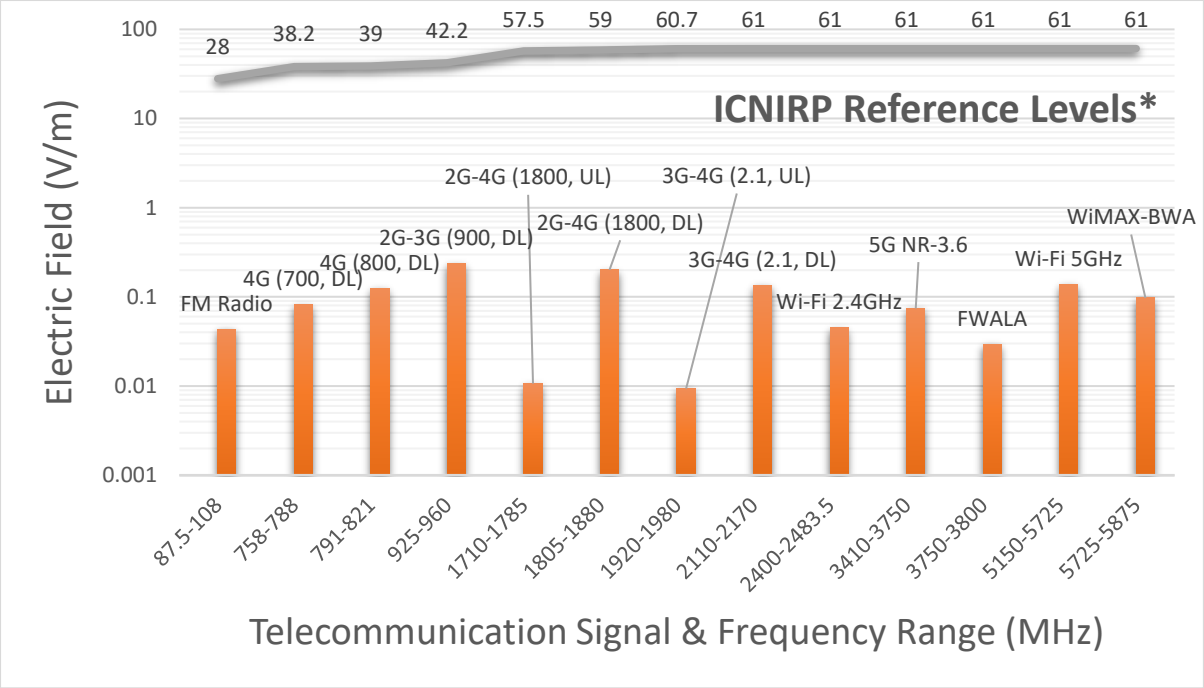
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.50	0.0007	0.75	0.0015	28*	2*
100 MHz - 90 GHz	0.50	0.0007	0.67	0.0012	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area; WiMAX-BWA: Worldwide Interoperability for Microwave Access-Broadband Wireless Access.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

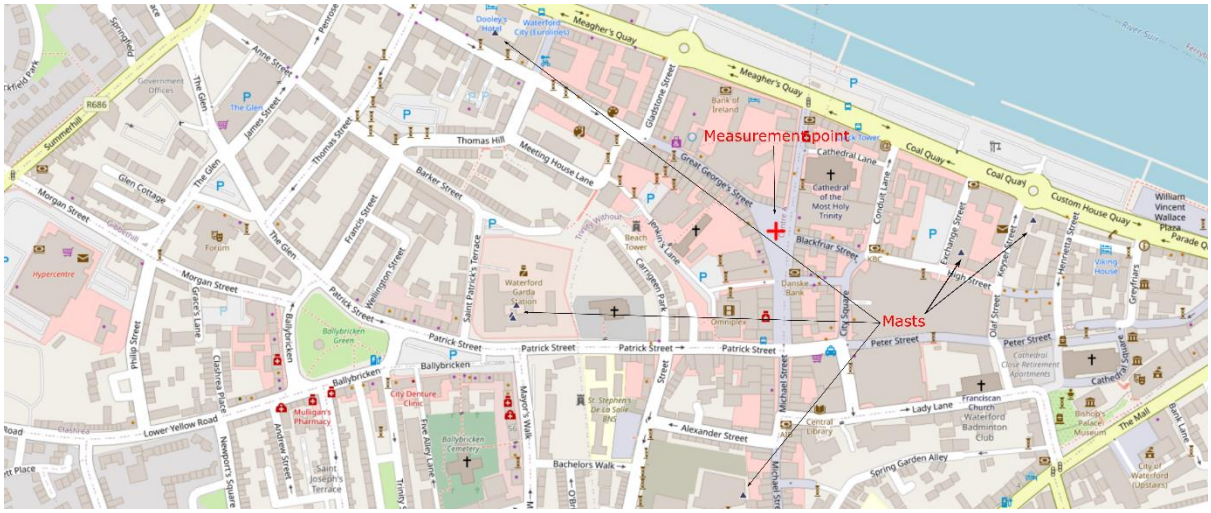
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
FM Radio	87.5-108	0.05	0.000006	0.04	0.000005	28.0	2.0
4G (700, DL)	758-788	0.18	0.00009	0.08	0.00002	38.2	3.9
4G (800, DL)	791-821	0.18	0.00009	0.12	0.00004	39	4.0
2G-3G (900, DL)	925-960	0.24	0.0002	0.24	0.0001	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.02	0.000002	0.01	0.0000003	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.48	0.0006	0.20	0.0001	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.08	0.00002	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.22	0.0001	0.14	0.00005	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.06	0.00001	0.05	0.000005	61	10
5G NR-3.6	3410-3750	0.19	0.0001	0.07	0.00001	61	10
FWALA	3750-3800	0.05	0.00001	0.03	0.000002	61	10
Wi-Fi 5GHz	5150-5725	0.17	0.0001	0.14	0.00005	61	10
WiMAX-BWA	5725-5875	0.12	0.00004	0.10	0.000025	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area; WiMAX-BWA: Worldwide Interoperability for Microwave Access-Broadband Wireless Access.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.50 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.48 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. 5G signals were detected at the point of measurement. The highest level measured (without nearby data traffic) was 0.19 V/m. The maximum level with data traffic (making a videocall on a 5G phone about 1m from the measurement equipment) was 0.64 V/m.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/02	10 March 2022	J Vila

1. Measurement survey characteristics

Measurement date:	10th February 2022
Measurement time:	11:30 am – 16:00 pm
Measurement point & location:	Strand Road, Tramore, Co Waterford
GPS coordinates:	52°9'38.8" N; 7°8'54.4" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Tramore town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

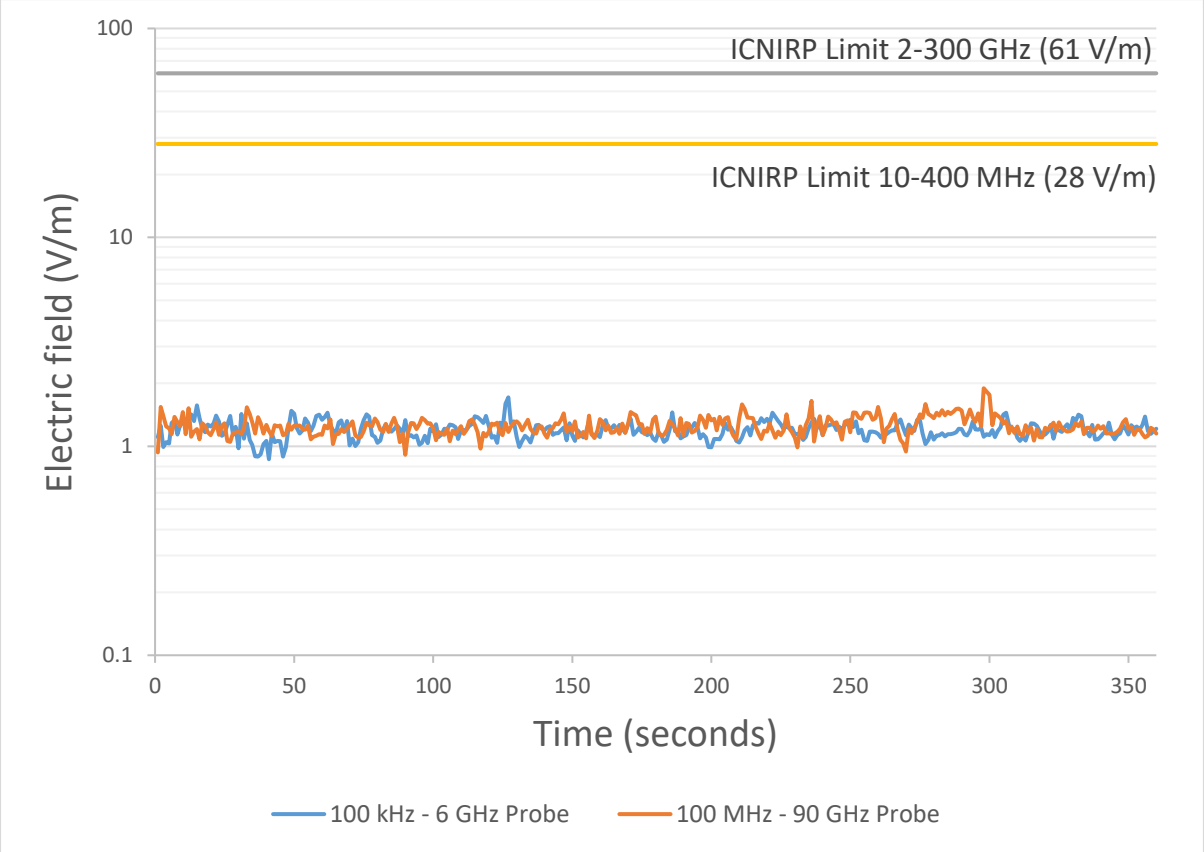
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.20 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G 3.6GHz, FWALA
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Tramore town centre (Strand Road) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



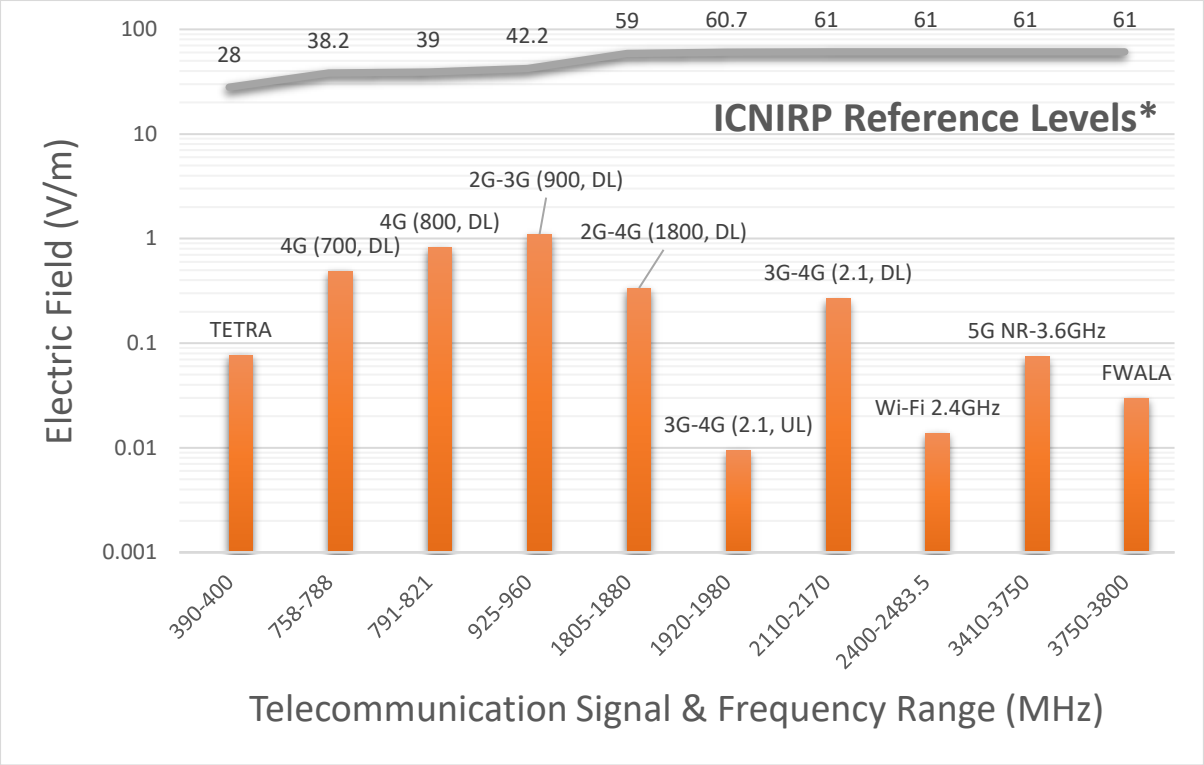
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.20	0.004	1.72	0.008	28*	2*
100 MHz - 90 GHz	1.25	0.004	1.90	0.010	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA	390-400	0.11	0.00003	0.08	0.00002	28.0	2.0
4G (700, DL)	758-788	0.63	0.001	0.49	0.0006	38.2	3.9
4G (800, DL)	791-821	0.96	0.002	0.82	0.002	39	4.0
2G-3G (900, DL)	925-960	1.38	0.005	1.10	0.003	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.72	0.001	0.34	0.0003	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.06	0.00001	0.01	0.0000002	60.7	9.8
3G-4G (2.1, DL)	2110-2170	0.35	0.0003	0.27	0.0002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.03	0.000003	0.01	0.0000005	61	10
5G NR-3.6GHz	3410-3750	0.16	0.00007	0.07	0.00001	61	10
FWALA	3750-3800	0.21	0.0001	0.03	0.000002	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; NR: New Radio; FWALA: Fixed Wireless Access Local Area.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.20 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.38 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz) antennas. 5G signals were detected at the point of measurement with a maximum value of 0.16 V/m.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/12	16 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	28th March 2022
Measurement time:	11:30 am – 12:30 pm
Measurement point & location:	Dublin Gate Street, Athlone, Co Westmeath
GPS coordinates:	53°25'24.4" N; 7°56'15.2" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Athlone town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

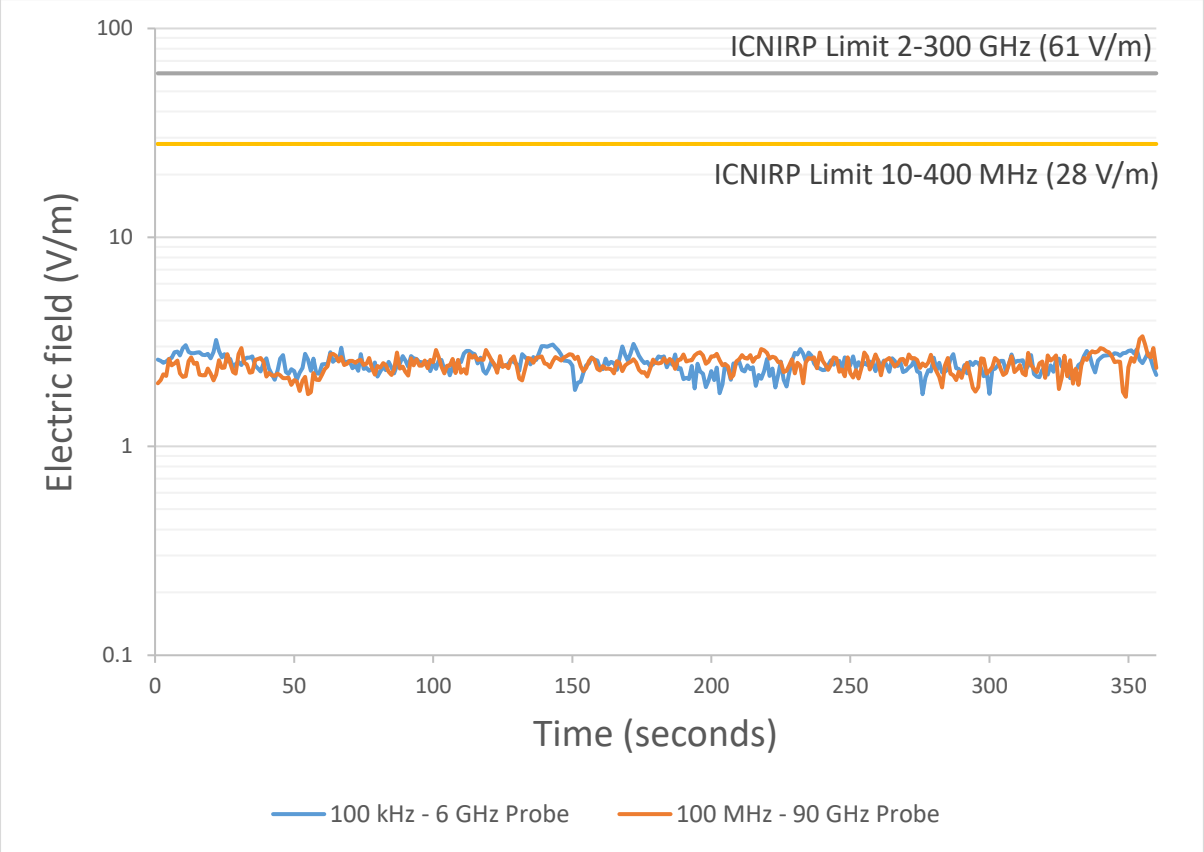
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.49 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	FM Radio, TETRA, PMR, 2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi 2.4GHz, 5G (NR-3.6GHz)
Number of nearby telecommunication sites:	7 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Athlone town centre (Dublin Gate Street) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



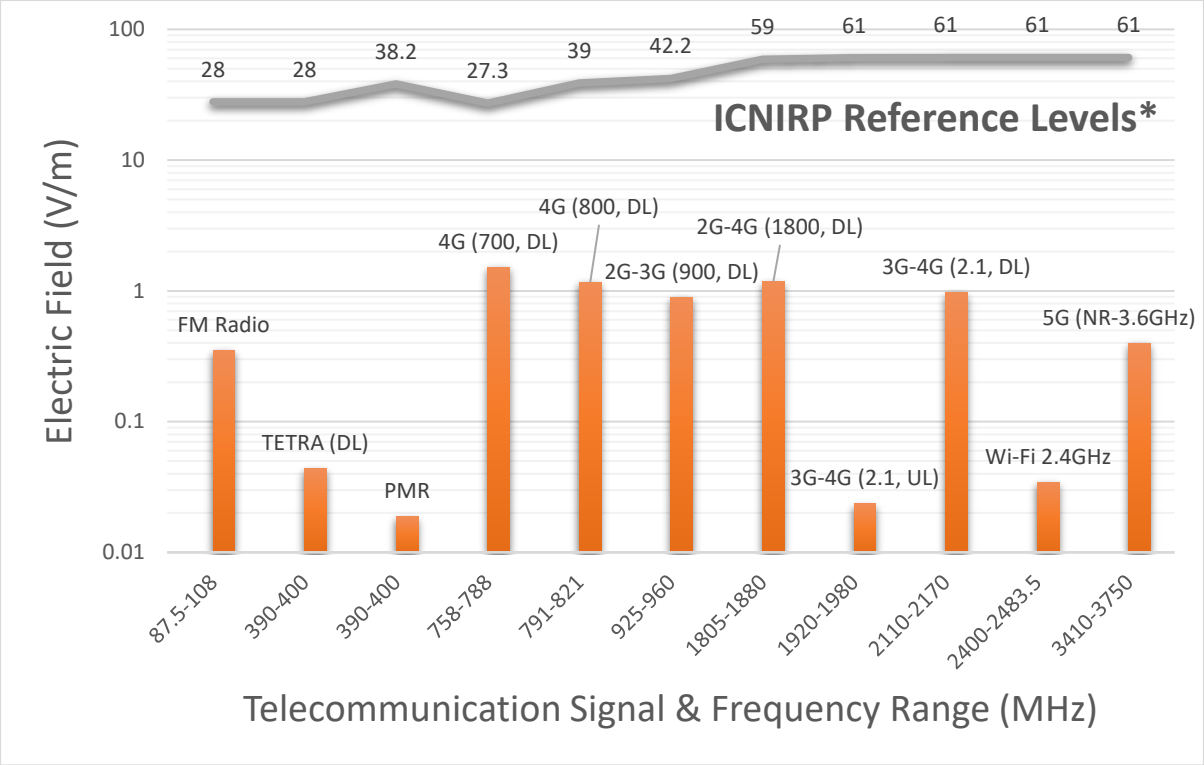
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	2.49	0.016	3.23	0.028	28*	2*
100 MHz - 90 GHz	2.46	0.016	3.36	0.030	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

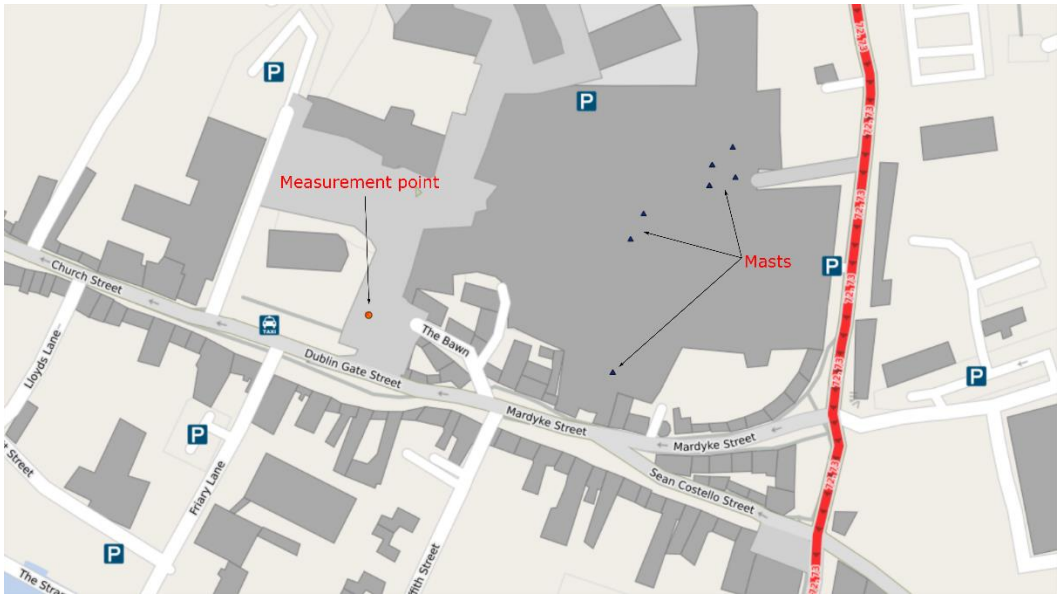
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
FM Radio	87.5-108	0.39	0.0004	0.35	0.0003	28	2
TETRA (DL)	390-400	0.06	0.000009	0.04	0.000005	28.0	2.0
PMR	390-400	0.04	0.000004	0.02	0.000001	38.2	3.9
4G (700, DL)	758-788	2.20	0.01	1.51	0.006	27.3	2.0
4G (800, DL)	791-821	1.72	0.008	1.17	0.004	39	4.0
2G-3G (900, DL)	925-960	1.28	0.004	0.90	0.002	42.2	4.7
2G-4G (1800, DL)	1805-1880	1.70	0.01	1.18	0.004	59.0	9.2
3G-4G (2.1, UL)	1920-1980	0.03	0.000003	0.02	0.000001	60.7	9.8
3G-4G (2.1, DL)	2110-2170	1.35	0.005	0.96	0.002	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.14	0.0001	0.03	0.000003	61	10
5G (NR-3.6GHz)	3410-3750	1.97	0.01	0.40	0.0004	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio; NR: New Radio.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.49 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 3 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (2.20 V/m) is likely to correspond to the emission (downlink) from nearby 4G (700 MHz) antennas. 5G signals were detected at the point of measurement, with maximum levels of 1.97 (without data traffic).

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2022/12	16 May 2022	J Vila

1. Measurement survey characteristics

Measurement date:	11th March 2022
Measurement time:	14:00 pm – 15:00 pm
Measurement point & location:	Blackhall Place, Mullingar, Co. Westmeath
GPS coordinates:	53°31'25.9"N; 7°20'36.4"W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Mullingar town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

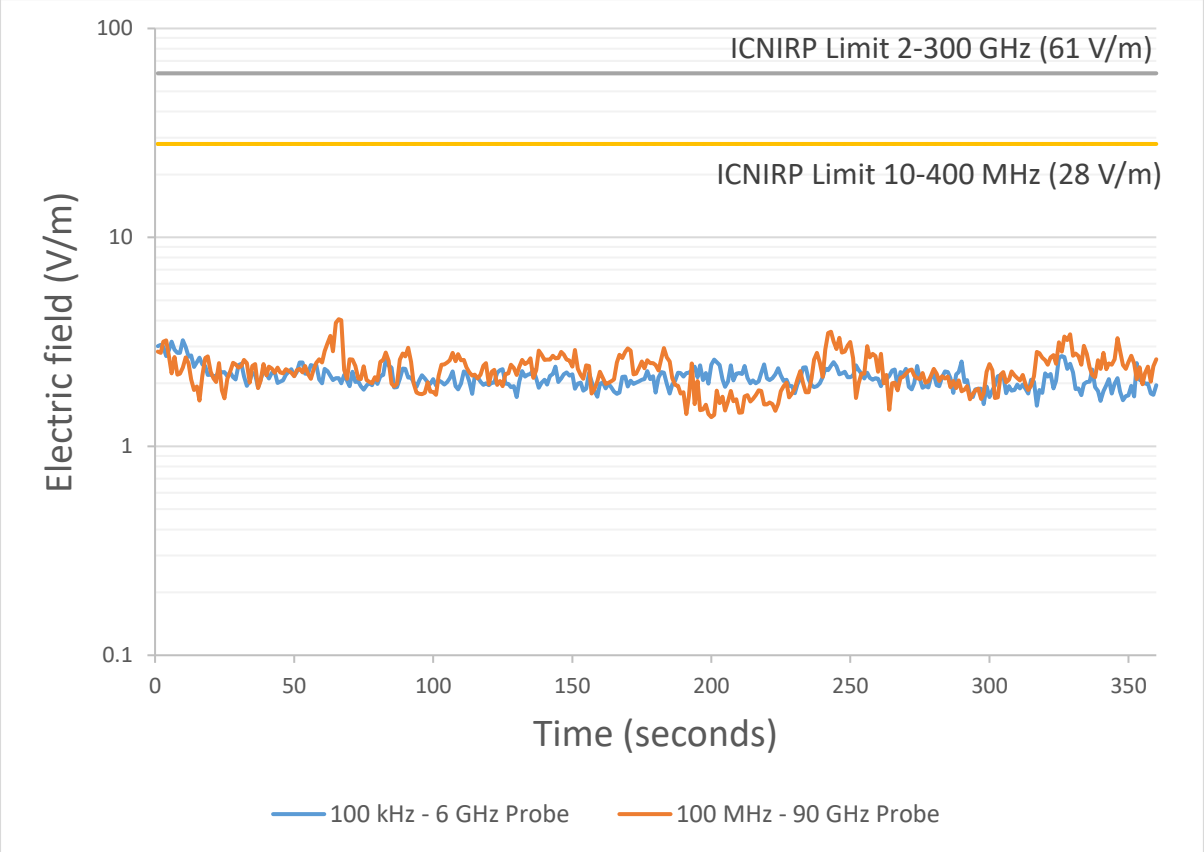
2. Summary of survey results

Measurement result:	The average total RF level measured was 2.14 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	TETRA, PMR, 2G Rail, 2G (GSM), 3G (UMTS), 4G (LTE)
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/ (November 2020)

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Mullingar town centre (Blackhall Place) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



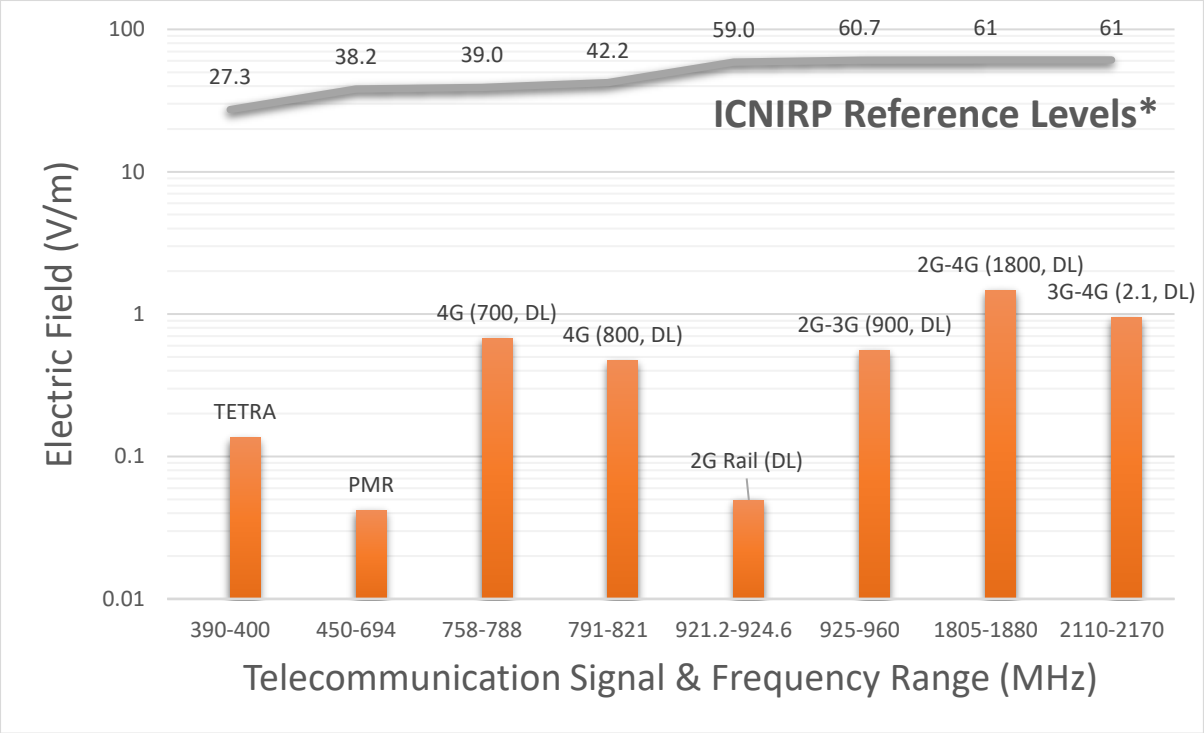
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes as described on the graph legend. Total RF fields include exposures from all RF sources (signals) depending on the probe(s) used. ICNIRP reference levels between 400 MHz and 2 GHz are frequency specific (see EC 1999 for details).

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	2.14	0.012	3.22	0.027	28*	2*
100 MHz - 90 GHz	2.30	0.014	4.06	0.044	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: Average RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA	390-400	0.16	0.00007	0.14	0.00005	28.0	2.0
PMR	450-694	0.05	0.00001	0.04	0.00000	32.9	2.9
4G (700, DL)	758-788	0.78	0.002	0.68	0.001	38.2	3.9
4G (800, DL)	791-821	0.86	0.002	0.47	0.0006	39.0	4.0
2G Radio (DL)	921.2-924.6	0.06	0.00001	0.05	0.00001	39.0	4.6
2G-3G (900, DL)	925-960	0.70	0.001	0.56	0.0008	42.2	4.7
2G-4G (1800, DL)	1805-1880	3.47	0.03	1.48	0.006	59.0	9.2
3G-4G (2.1, DL)	2110-2170	1.60	0.007	0.94	0.002	61.0	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional Mobile Radio

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 2.14 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 4 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (3.47 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and nearby (line-of-sight) telecommunication sites (masts)

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment was used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 wideband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in December 2021.

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- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/02	11 June 2021	J Vila

1. Measurement survey characteristics

Measurement date:	31th March 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	Market square, Enniscorthy, Co Wexford
GPS coordinates:	52°30'06.6" N; 6°34'08.3" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Enniscorthy with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

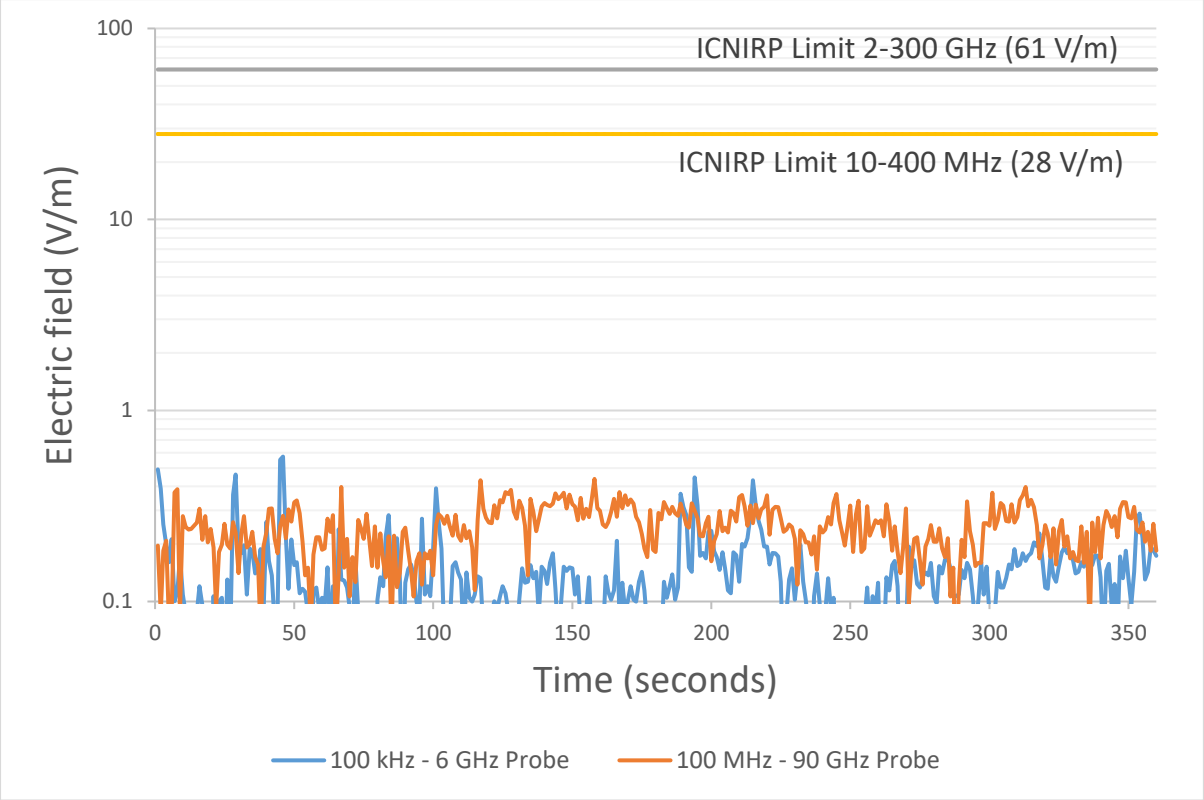
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.14 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi and 2G Rail
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Enniscorthy town centre (Market square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



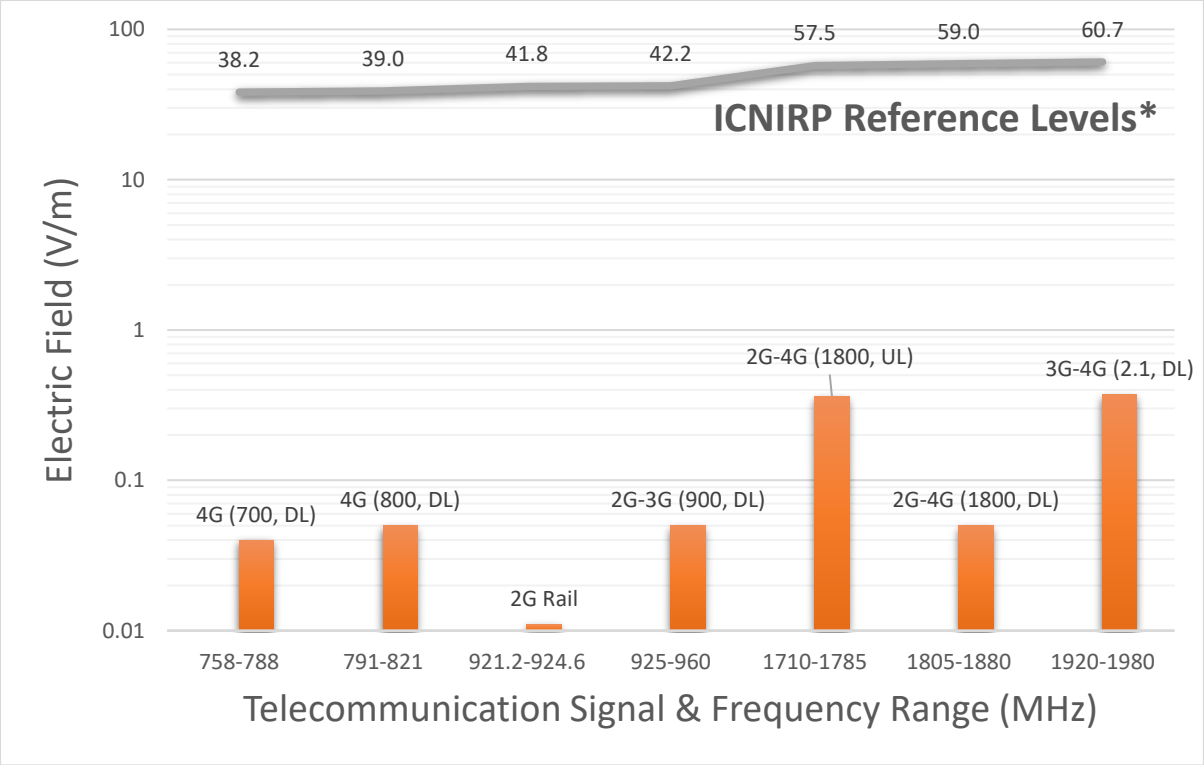
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	**Average electric field (V/m)**	**Average power density (W/m^2)**	**Maximum electric field (V/m)**	**Maximum power density (W/m^2)**	**ICNIRP reference level**	
					(V/m)	**(W/m^2)**
100 kHz - 6 GHz	0.14	0.0001	0.57	0.001	28*	2*
100 MHz - 90 GHz	0.24	0.0002	0.44	0.001	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

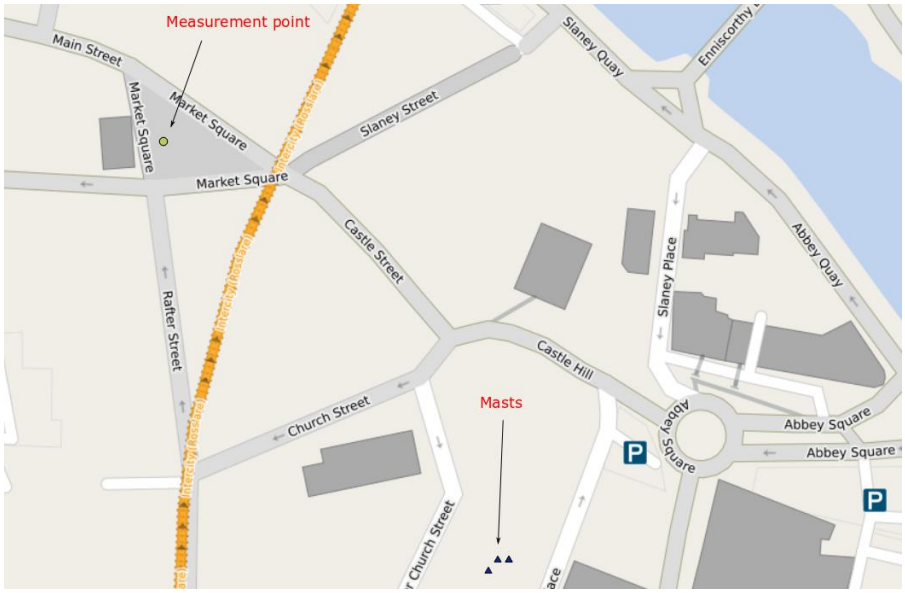
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
4G (700, DL)	758-788	0.04	0.000004	0.02	0.000001	38.2	3.87
4G (800, DL)	791-821	0.05	0.000007	0.03	0.000002	39.0	4.04
2G Rail	921.2-924.6	0.01	0.0000003	0.01	0.0000003	41.8	4.61
2G-3G (900, DL)	925-960	0.05	0.00001	0.04	0.000004	42.2	4.72
2G-4G (1800, UL)	1710-1785	0.36	0.00034	0.05	0.000007	57.5	8.76
2G-4G (1800, DL)	1805-1880	0.05	0.00001	0.03	0.000002	59.0	9.23
3G-4G (2.1, UL)	1920-1980	0.37	0.00036	0.03	0.000002	60.7	9.87
3G-4G (2.1, DL)	2110-2170	0.07	0.00001	0.04	0.000004	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.06	0.00001	0.02	0.000001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

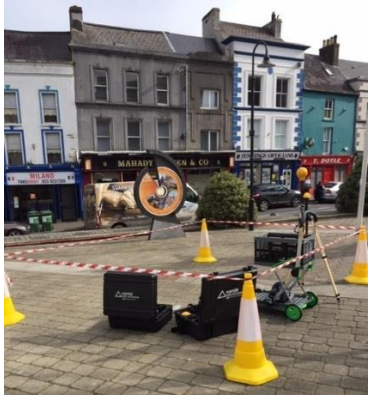
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.14 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.37 V/m) was likely to correspond to the emission (uplink) from nearby mobile phone handset from a passer-by. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

A2. References

- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

- I.S. EN 62232-2017. Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure. NSAI Standards; CENELEC 2017 https://shop.standards.ie/en-ie/

- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/01	15 Apr 2021	J Vila

1. Measurement survey characteristics

Measurement date:	11th March 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	Bull Ring square, Wexford town, Co Wexford
GPS coordinates:	52° 20' 23.5" N; 6° 27' 44.7" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Wexford town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available shops and other amenities in the area.

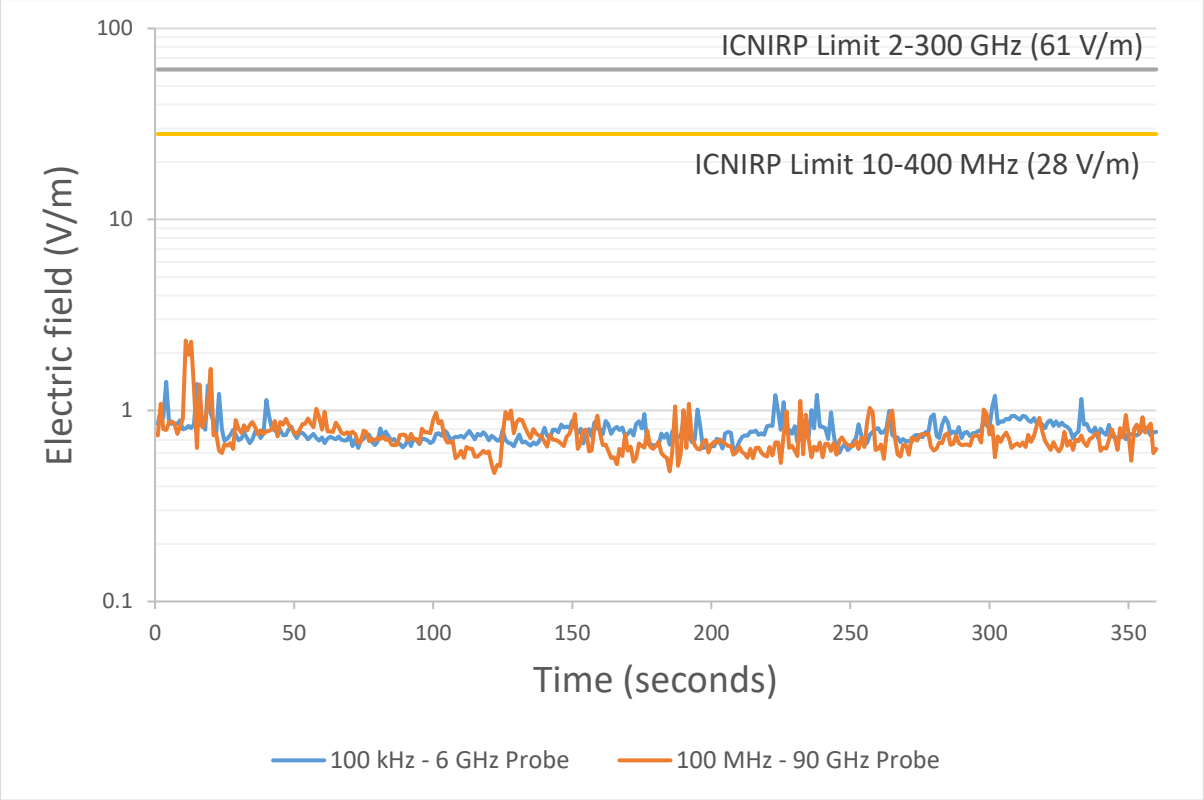
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.78 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Wexford town centre (Bull Ring square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



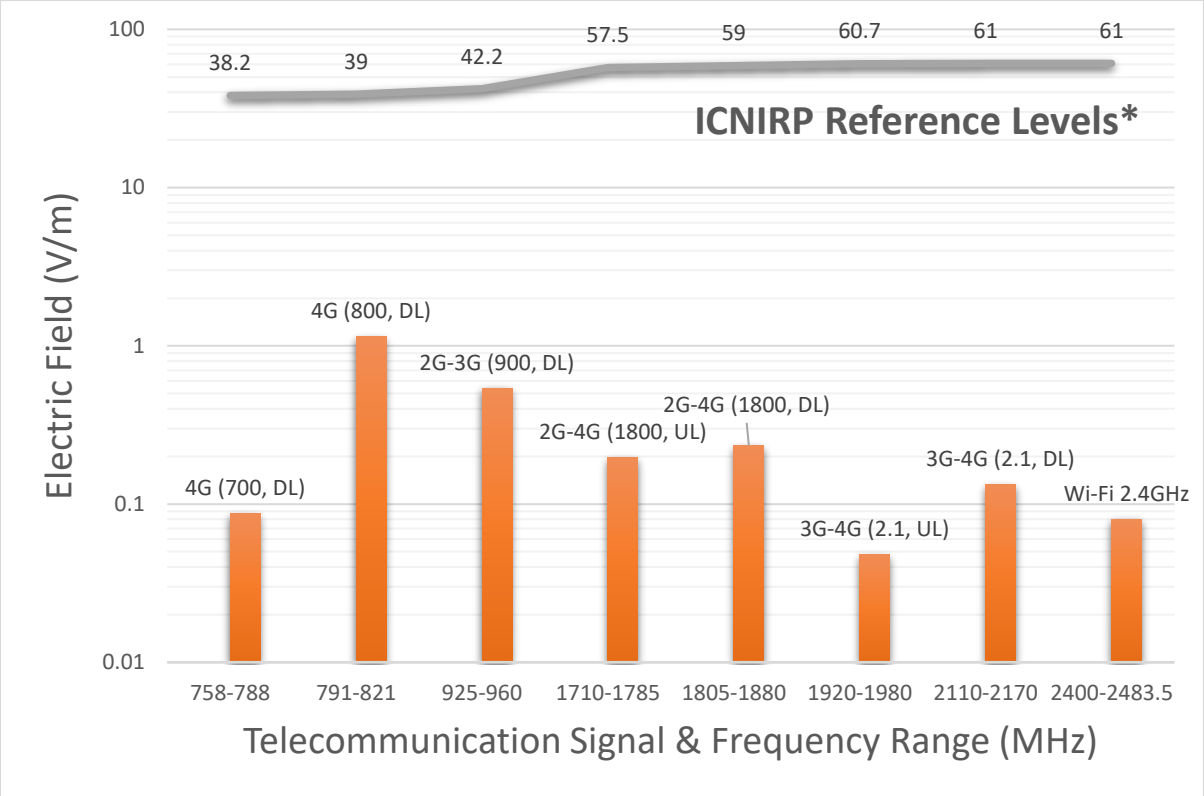
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.78	0.002	1.41	0.005	28*	2*
100 MHz - 90 GHz	0.74	0.001	2.32	0.014	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

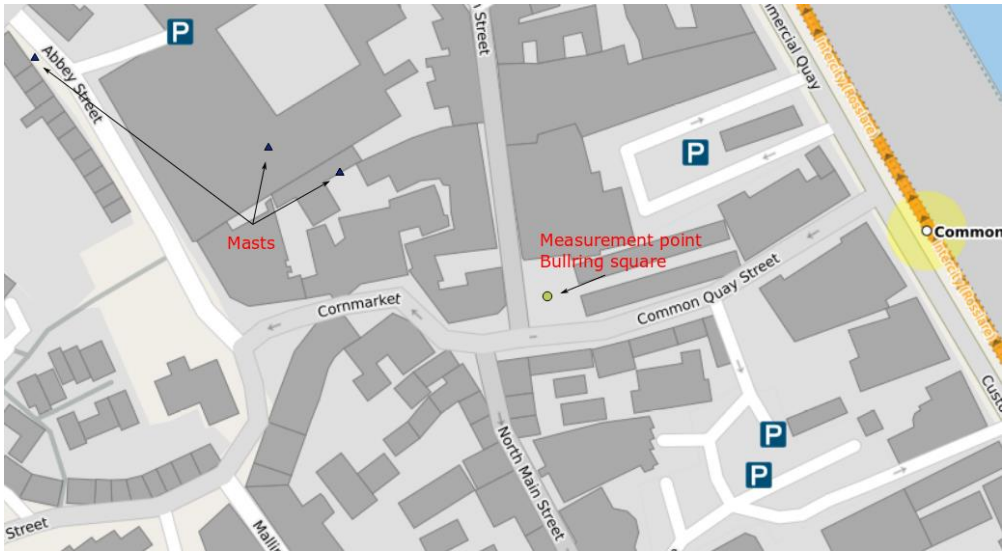
RF Source / Telecommunication Signal	Frequency Range (MHz)	Maximum Electric Field/ Power Density		Average Electric Field/ Power Density		ICNIRP Reference Level[b]	
		(V/m)	(W/m^2)	(V/m)	(W/m^2)	(V/m)	(W/m^2)
4G (700, DL)	758-788	0.09	0.00002	0.06	0.000009	38.2	3.87
4G (800, DL)	791-821	1.15	0.00348	1.03	0.002814	39.0	4.04
2G-3G (900, DL)	925-960	0.54	0.00077	0.41	0.000450	42.2	4.72
2G-4G (1800, UL)	1710-1785	0.20	0.00010	0.05	0.000006	57.5	8.76
2G-4G (1800, DL)	1805-1880	0.23	0.00014	0.18	0.000086	59.0	9.23
3G-4G (2.1, UL)	1920-1980	0.05	0.00001	0.04	0.000005	60.7	9.87
3G-4G (2.1, DL)	2110-2170	0.13	0.00004	0.08	0.000018	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.08	0.00002	0.06	0.00001	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

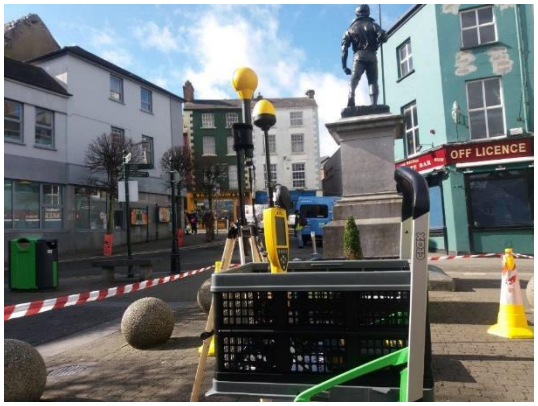
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.78 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.15 V/m) is likely to correspond to the emission (downlink) from nearby 4G/LTE antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)



7. Photo of measurement point



Appendix

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The following EMF measurement equipment were used:

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- All equipment was calibrated in July 2019.

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/05	16 June 2021	J Vila

1. Measurement survey characteristics

Measurement date:	29th April 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	Saint Mary's Park, Main Street, Arklow, Co Wicklow
GPS coordinates:	52°47'55.0" N; 6°9'22.0" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Arklow with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

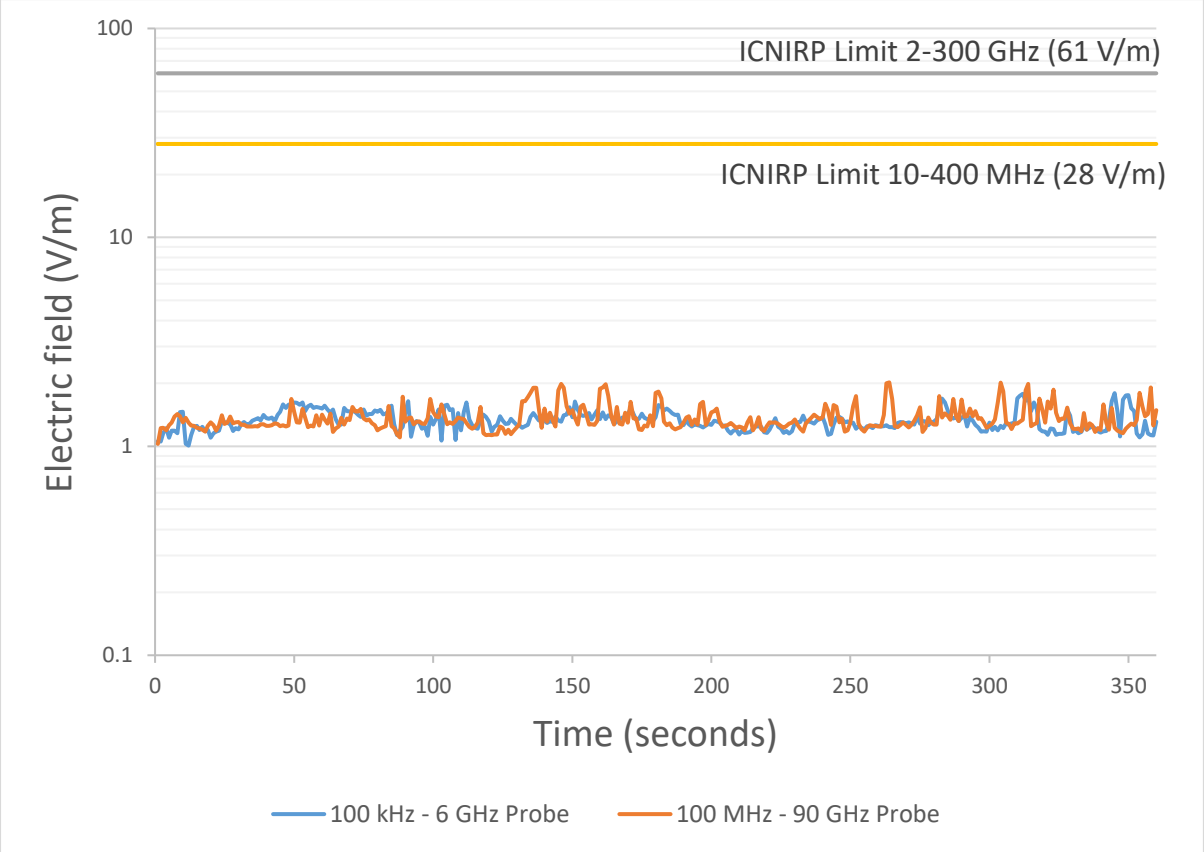
2. Summary of survey results

Measurement result:	The average total RF level measured was 1.33 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Arklow (Saint Mary's Park) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



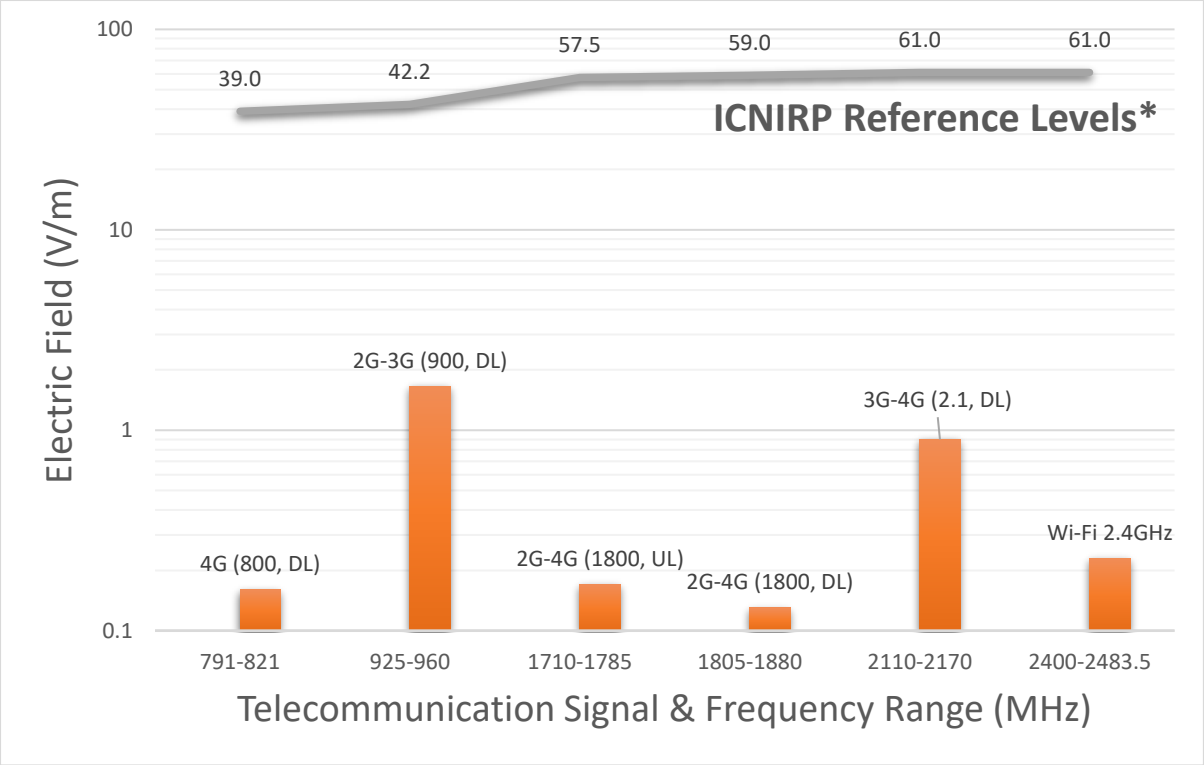
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	1.33	0.005	1.80	0.009	28*	2*
100 MHz - 90 GHz	1.36	0.005	2.02	0.011	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
4G (800, DL)	791-821	0.16	0.00007	0.12	0.000038	39.0	4.04
2G-3G (900, DL)	925-960	1.66	0.00731	0.98	0.002547	42.2	4.72
2G-4G (1800, UL)	1710-1785	0.17	0.00008	0.03	0.000002	57.5	8.76
2G-4G (1800, DL)	1805-1880	0.13	0.00004	0.10	0.000027	59.0	9.23
3G-4G (2.1, DL)	2110-2170	0.90	0.00215	0.59	0.000923	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.23	0.00014	0.05	0.000007	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 1.33 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 2 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (1.66 V/m) is likely to correspond to the emission (downlink) from nearby 3G antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites

7. Photos of measurement point and nearby (line-of-sight) telecommunication sites

Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
- Narda NBM-550 broadband survey meter.
- Narda probes covering a frequency range between 100 kHz and 90 GHz.
- All equipment was calibrated in July 2019.

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- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

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- European Commission (EC) 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) https://op.europa.eu/en/publication-detail/-/publication/9509b04f-1df0-4221-bfa2-c7af77975556/language-en

- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/07	31 May 2021	J Vila

1. Measurement survey characteristics

Measurement date:	28th May 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	Near band stand, Promenade, Bray, Co Wicklow
GPS coordinates:	53°12'07.5" N; 6°5'50.5" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Bray with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

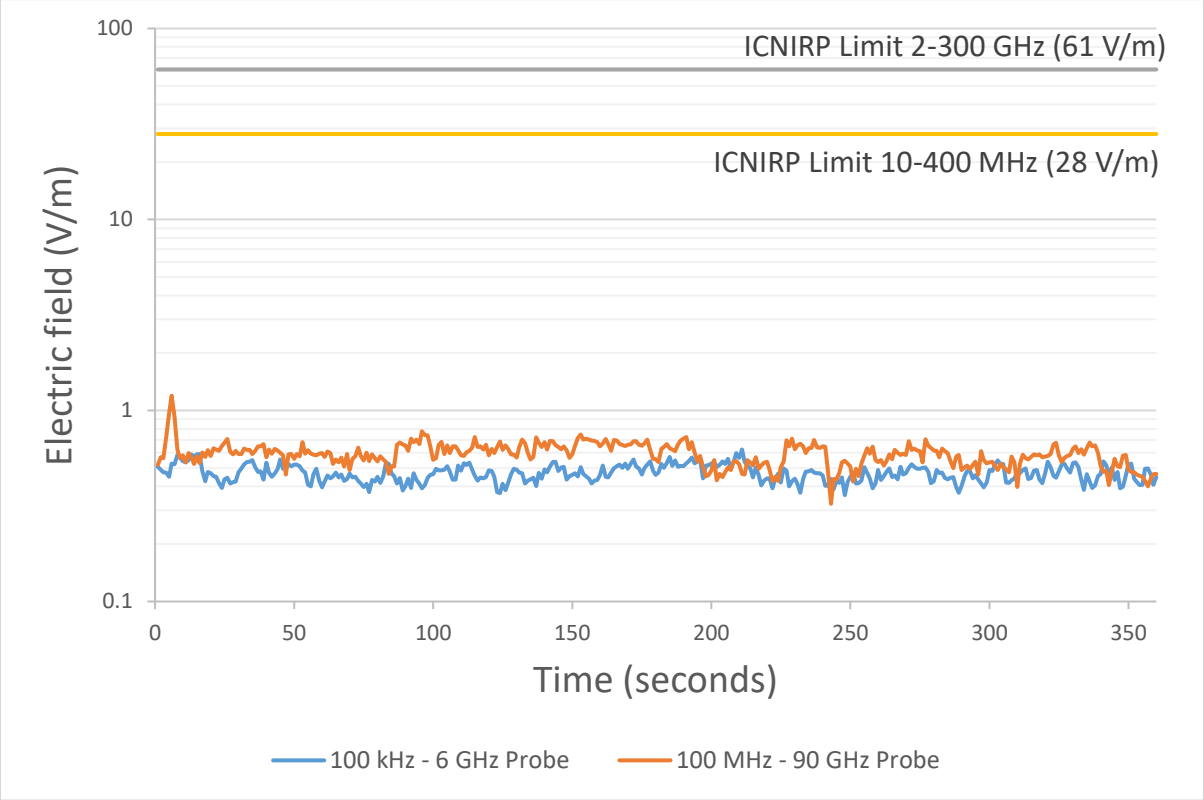
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.47 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), 2G Rail, Professional mobile radio (PMR), Wi-Fi
Number of nearby telecommunication sites:	2 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in, Bray (Band stand, Promenade) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations. If 5G signals were detected during the initial measurements, a 5G-enabled mobile phone handset was used in the proximity of the measurement point while streaming video in the attempt to capture 5G traffic beams.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



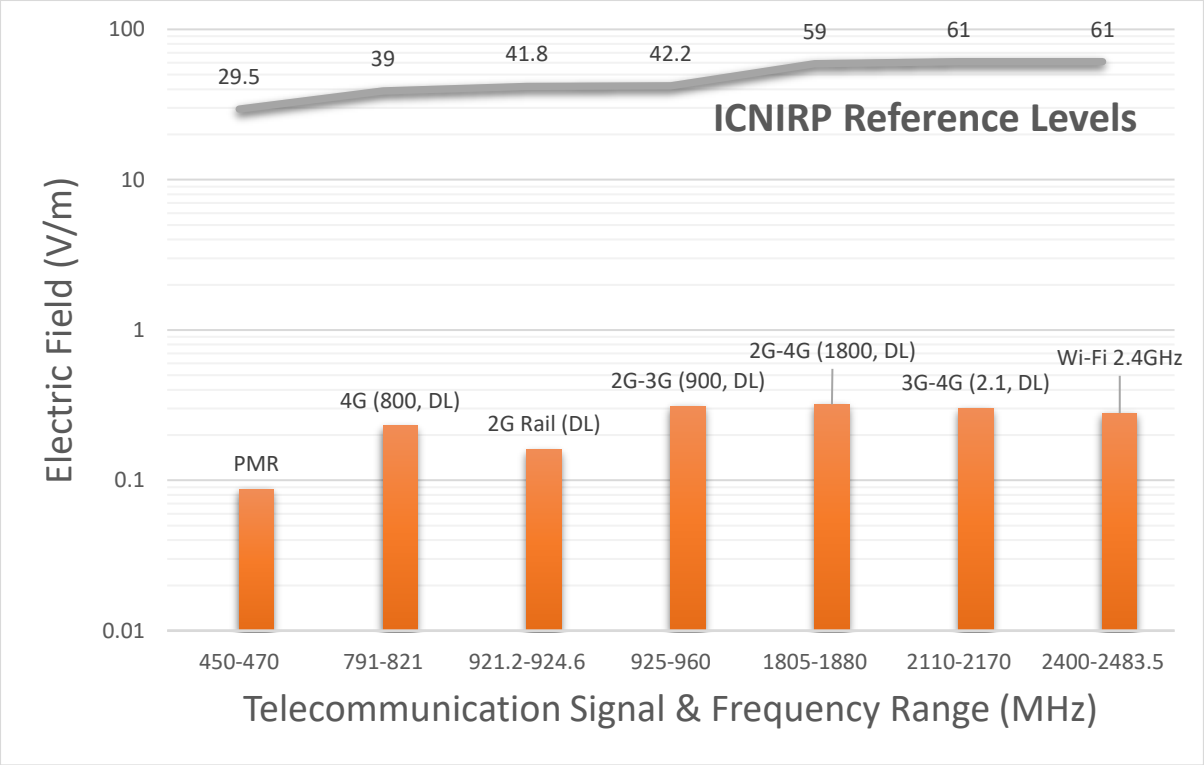
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.47	0.001	0.59	0.001	28*	2*
100 MHz - 90 GHz	0.62	0.001	1.20	0.004	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. Note: PMR: Professional mobile radio (e.g. walkie talkie); 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
PMR	450-470	0.09	0.00002	0.08	0.000017	29.5	2.3
4G (800, DL)	791-821	0.23	0.00014	0.17	0.000077	39	4
2G Rail	921.2-924.6	0.16	0.00007	0.14	0.000052	41.8	4.6
2G-3G (900, DL)	925-960	0.31	0.00025	0.23	0.000140	42.2	4.7
2G-4G (1800, DL)	1805-1880	0.32	0.00027	0.15	0.000060	59	9.2
3G-4G (2.1, DL)	2110-2170	0.30	0.00024	0.17	0.000077	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.03	0.000002	0.01	0.000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. Note: PMR: Professional mobile radio (e.g. walkie talkie); 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level (up to 6 GHz) was 0.47 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.23 V/m) is likely to correspond to the emission (downlink) from nearby 2G-3G (900 MHz band) signals. No 5G signals (3.6 GHz band) were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites (masts)

7. Photo of measurement point and line-of-sight telecommunication site

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The following EMF measurement equipment were used:

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- EPA 2020. EMF Monitoring Programme 2021-2023. https://www.epa.ie/radiation/emf/emfmonitoringprogramme/

- ECC RECOMMENDATION (02)04. Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz) (Bratislava 2003, Helsinki 2007) www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

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- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Physics 2020 May;118(5): 483-524 https://pubmed.ncbi.nlm.nih.gov/32167495/

	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/08	30th June 2021	J Vila

1. Measurement survey characteristics

Measurement date:	25th June 2021
Measurement time:	11:00 am – 13:00 am
Measurement point & location:	Outside Dart station (at bike stand), Greystones, Co Wicklow
GPS coordinates:	53°8’38.1" N; 6°3'39.6" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Greystones with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA’s national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

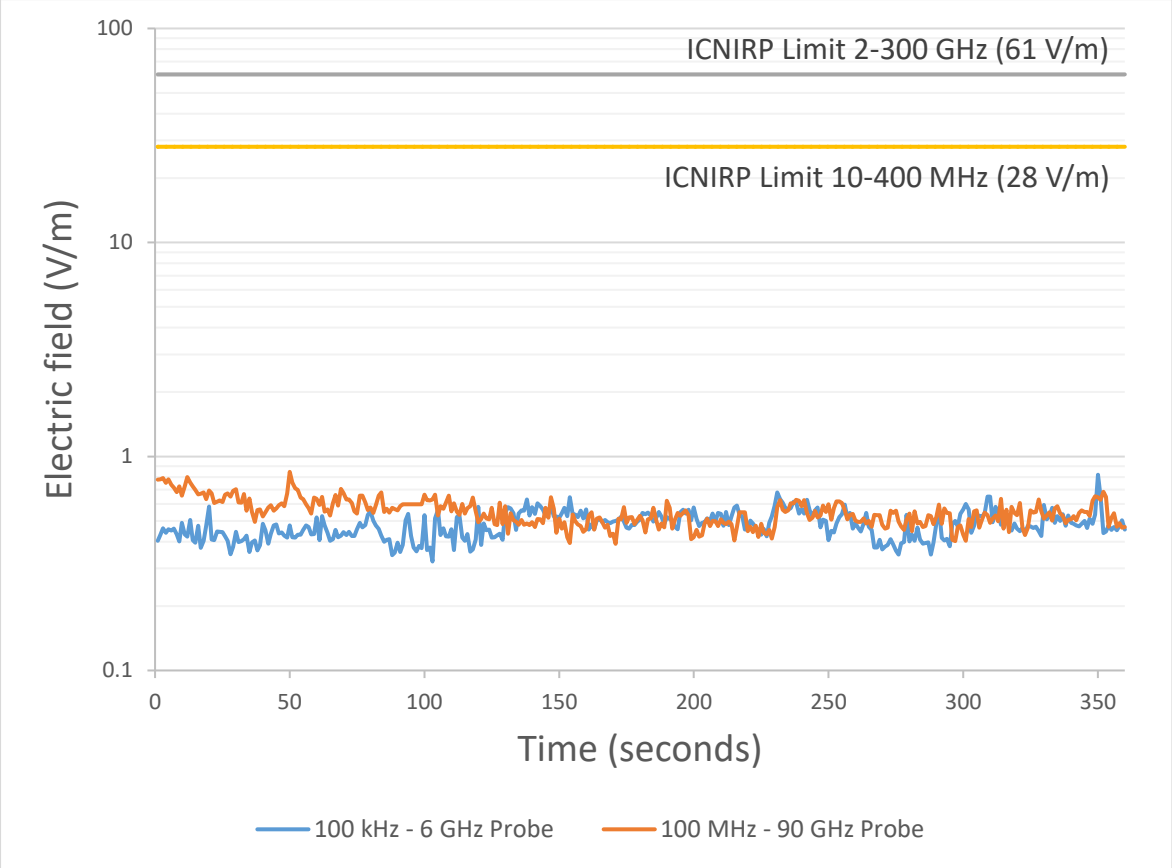
2. Summary of survey results

Measurement result:	The average total RF level measured was 0.48 V/m. This value is below ICNIRP’s recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), PMR, TETRA, 2G Rail, Wi-Fi
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg’s website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Greystones (Dart station bike stand) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

Figure 1. Total RF electric field levels at measurement point using two broadband probes.



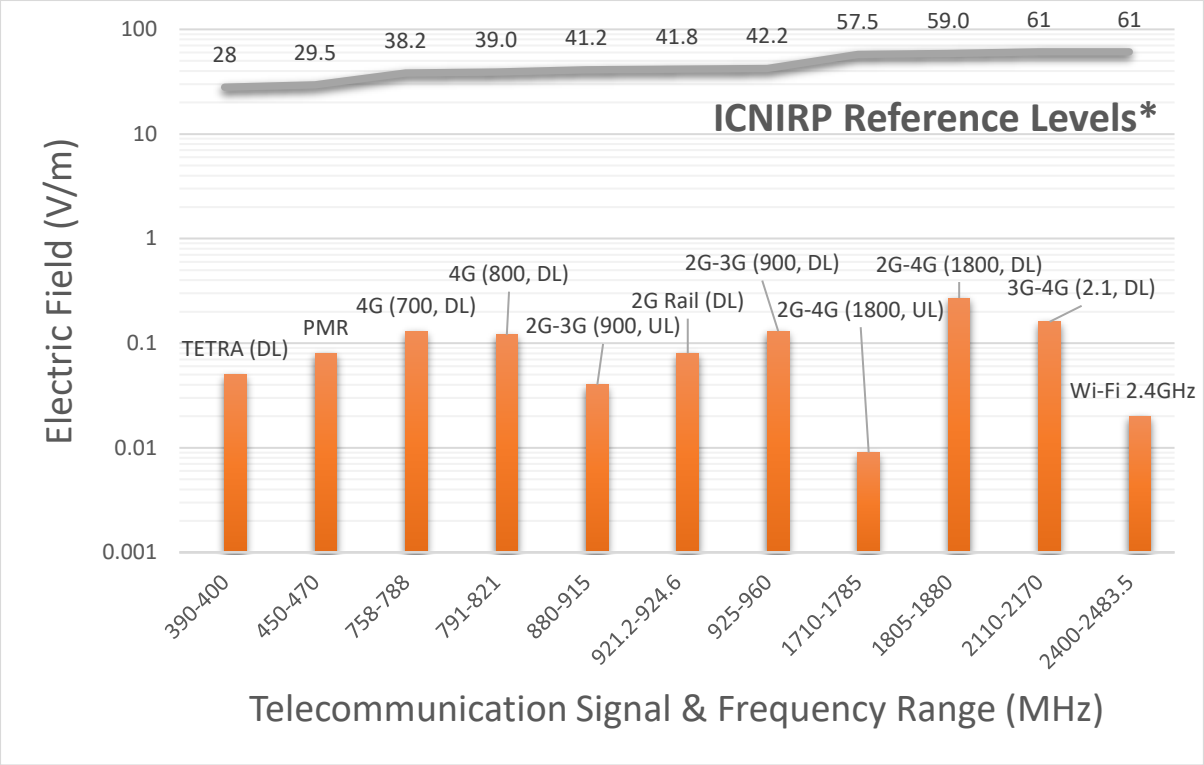
Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

Table 1. Summary of total RF fields at measurement point using two broadband probes.

Probe Frequency Range	Average electric field (V/m)	Average power density (W/m^2)	Maximum electric field (V/m)	Maximum power density (W/m^2)	ICNIRP reference level (V/m)	ICNIRP reference level (W/m^2)
100 kHz - 6 GHz	0.48	0.001	0.82	0.002	28*	2*
100 MHz - 90 GHz	0.55	0.001	0.85	0.002	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

Figure 2. Frequency-specific radiofrequency electric field level by telecommunication signal



Note: RF electric field data above the noise threshold for 6-min average (rms) obtained with SRM-3006 meter/spectrum analyser using 3501/03 and 3502/01 probes. *ICNIRP reference level for each corresponding frequency range. 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink; PMR: Professional mobile radio.

Table 2. Measured average and maximum frequency-specific field level by RF source/signal.

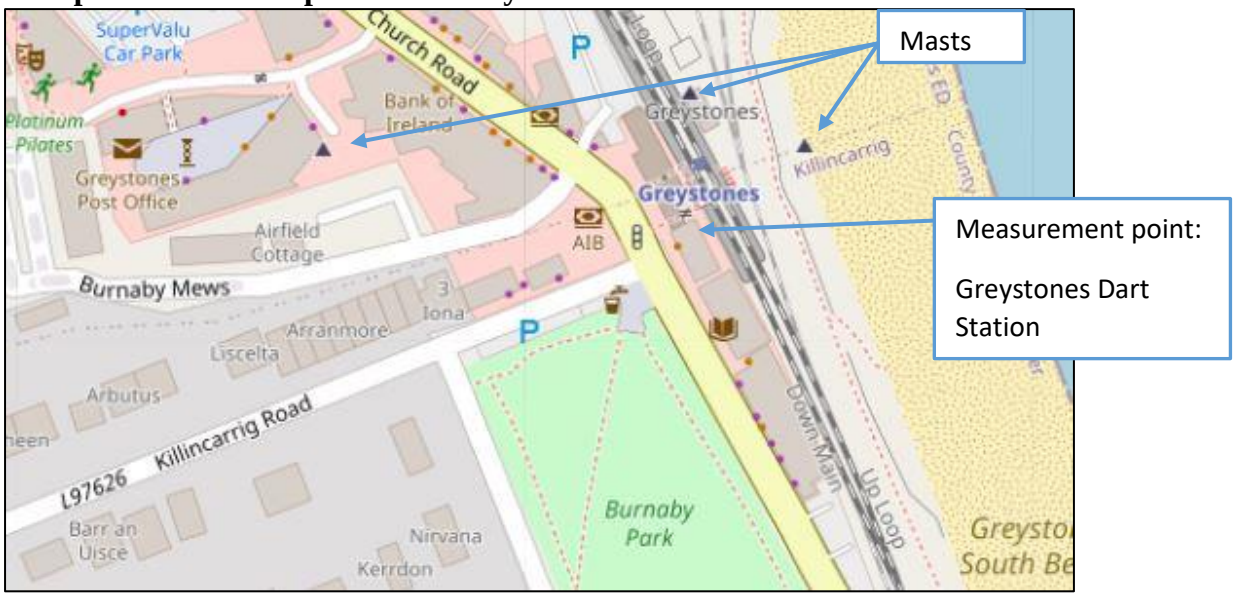
RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
TETRA (DL)	390-400	0.07	0.000013	0.05	0.000007	28	2.0
PMR	450-470	0.11	0.000032	0.08	0.000017	29.5	2.3
4G (700, DL)	758-788	0.28	0.000208	0.13	0.000045	38.2	3.9
4G (800, DL)	791-821	0.3	0.00024	0.12	0.000038	39.0	4.0
2G-3G (900, UL)	880-915	0.24	0.00015	0.04	0.000004	40.0	4.5
2G Rail (DL)	921.2-924.6	0.1	0.00003	0.08	0.000017	41.0	4.6
2G-3G (900, DL)	925-960	0.17	0.00008	0.13	0.000045	42.2	4.7
2G-4G (1800, UL)	1710-1785	0.01	0.0000003	0.009	0.0000002	57.5	8.7
2G-4G (1800, DL)	1805-1880	0.42	0.00047	0.27	0.000193	59.0	9.2
3G-4G (2.1, DL)	2110-2170	0.23	0.00014	0.16	0.000068	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. Note: PMR: Professional mobile radio; 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

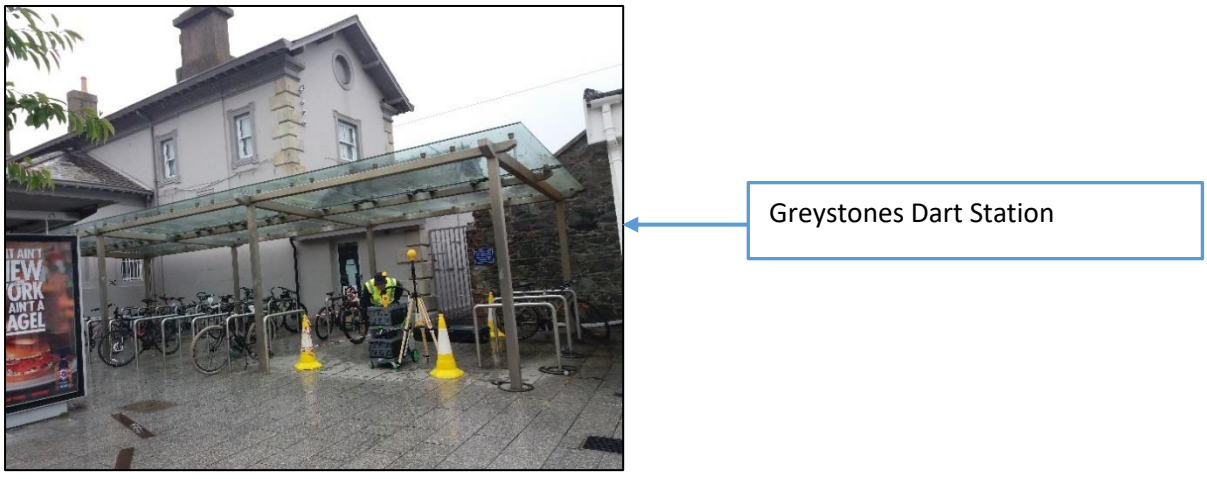
5. Conclusion – Total & Frequency-Specific RF field levels

Measured (average and maximum) total RF electric field levels (Figure 1 & Table 1) were below the strictest ICNIRP recommended exposure limit for the entire RF frequency range (i.e. 28 V/m). The average total RF level was 0.48 V/m. Measured (average and maximum) frequency-specific RF electric field levels for all detected signals (Figure 2 & Table 2) were low (< 1 V/m). All the signals measured were below the corresponding ICNIRP recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz. The highest RF electric field level at the point of measurement (0.42 V/m) is likely to correspond to the emission (downlink) from nearby 2G-4G (1,800 MHz) antennas. No 5G signals were detected at the point of measurement.

6. Map of measurement point and nearby telecommunication sites



7. Photo of measurement point



Appendix

A1. Equipment characteristics and calibration

The following EMF measurement equipment were used:

- Narda SRM-3006 frequency-selective meter and spectrum analyser.
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- All equipment was calibrated in July 2019.

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	EMF/NIR Report	Radiofrequency electromagnetic fields measurement survey		
	Version	Reference #	Issue Date	Issued by
	1.0	2021/06	21 June 2021	J Vila

1. Measurement survey characteristics

Measurement date:	14th May 2021
Measurement time:	11:30 am – 13:00 pm
Measurement point & location:	Fitzwilliam Square, Wicklow, Co Wicklow
GPS coordinates:	52°58'50.5" N; 6°2'35.2" W
Survey staff:	Javier Vila, Michael Murray
Purpose of the survey:	1) To carry out measurements of radiofrequency (RF) electromagnetic fields (EMF) at a location within Wicklow town with high daytime population. 2) To determine typical RF EMF levels and compare them with relevant exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This survey is part of the EPA's national EMF monitoring programme (see reference EPA 2020 for more details).
Measurement point description:	Outdoor public space typically busy due to available amenities in the area.

2. Summary of survey results

Measurement result:	The average total RF level measured was 0.32 V/m. This value is below ICNIRP's recommended exposure limits of 28 V/m for radiofrequencies < 400 MHz and 61 V/m for radiofrequencies > 2 GHz.
Measured RF sources/signals:	2G (GSM), 3G (UMTS), 4G (LTE), Wi-Fi, PMR, FM Radio
Number of nearby telecommunication sites:	3 nearby sites (see map on page 4 for details). This information was obtained from the ComReg's website https://siteviewer.comreg.ie/

3. Measurement methodology and results

Broadband and frequency-selective EMF measurements were performed at a location in Wicklow town centre (Fitzwilliam Square) known to have a high daytime population. The charts and tables below contain the summary results for total RF electric fields (Table 1 & Figure 1) and frequency-specific RF electric fields (Table 2 & Figure 2) for the selected location and time of the day using various configurations, including the use of a 5G-enabled mobile phone handset in the proximity of the measurement point while streaming video to identify any potential nearby 5G signals.

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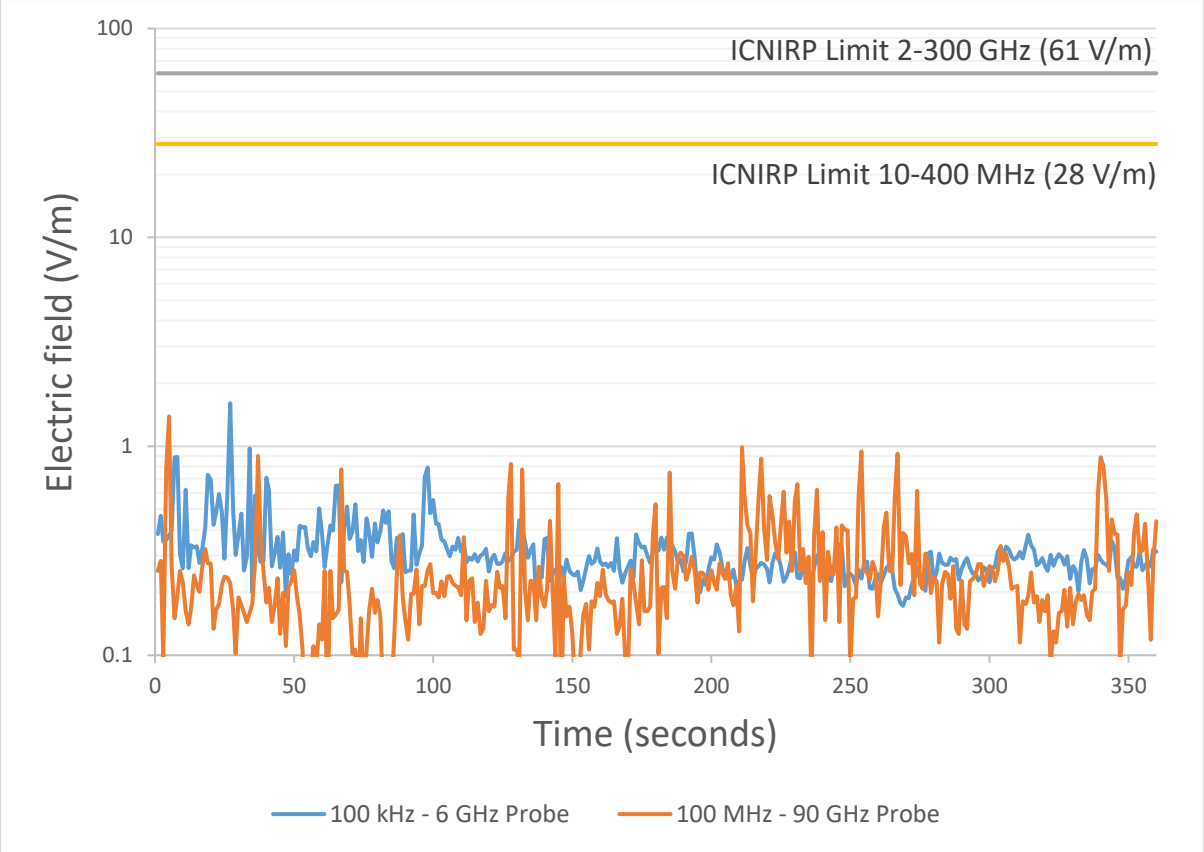

Note: This graph represents total average (rms) RF electric fields measured for 6 minutes (360 seconds) using two different RF probes (100 kHz - 6 GHz and 100 MHz – 90 GHz) as described on the graph legend. Total RF fields include exposures from all RF sources (signals), depending on the probe used. *Strictest ICNIRP reference level for the entire RF range.

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100 kHz - 6 GHz	0.32	0.0003	1.61	0.007	28*	2*
100 MHz - 90 GHz	0.25	0.0002	1.39	0.005	28*	2*

Note: RF electric field data obtained with Narda NBM-550 meter with EF0691 and EF9091 probes. *Strictest ICNIRP reference levels for the entire RF frequency range. These data have a maximum overall uncertainty around ±41% (±3 dB).

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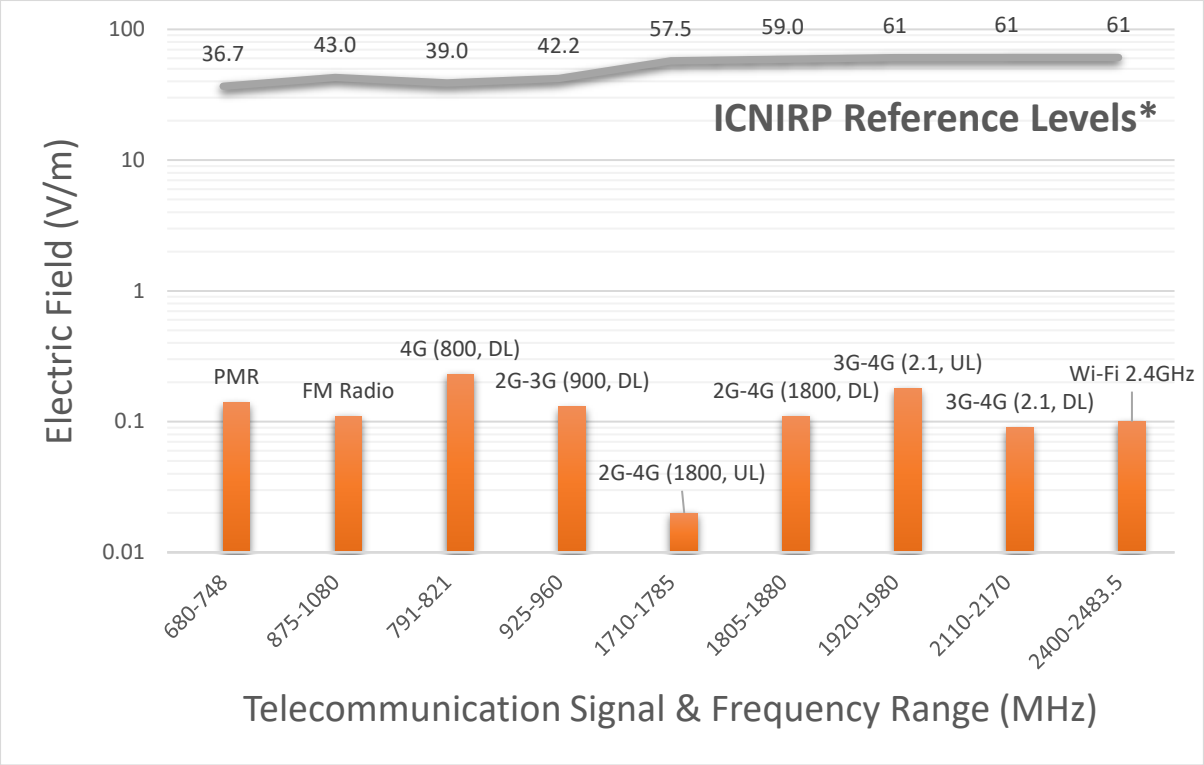

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RF Source / Telecommunication Signal	**Frequency Range (MHz)**	**Maximum Electric Field/ Power Density**		**Average Electric Field/ Power Density**		**ICNIRP Reference Level[b]**	
		(V/m)	**(W/m^2)**	**(V/m)**	**(W/m^2)**	**(V/m)**	**(W/m^2)**
PMR	680-748	0.14	0.00005	0.02	0.000001	36.7	3.6
FM Radio	875-1080	0.11	0.000032	0.1	0.000027	43.0	4.9
4G (800, DL)	791-821	0.23	0.00014	0.16	0.000068	39	4.0
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3G-4G (2.1, DL)	2110-2170	0.09	0.00002	0.05	0.000007	61	10
Wi-Fi 2.4GHz	2400-2483.5	0.1	0.00002	0.01	0.0000003	61	10

Note: RF electric field data above the equipment noise threshold for 6-min average (rms) obtained with SRM-3006 meter using 3501/03 and 3502/01 probes. These data have a maximum overall uncertainty around ±41% (±3 dB). [b]ICNIRP reference level for each corresponding frequency range. PMR: Professional mobile radio; 2G: GSM; 3G: UMTS; 4G: LTE; DL: Downlink; UL: Uplink.

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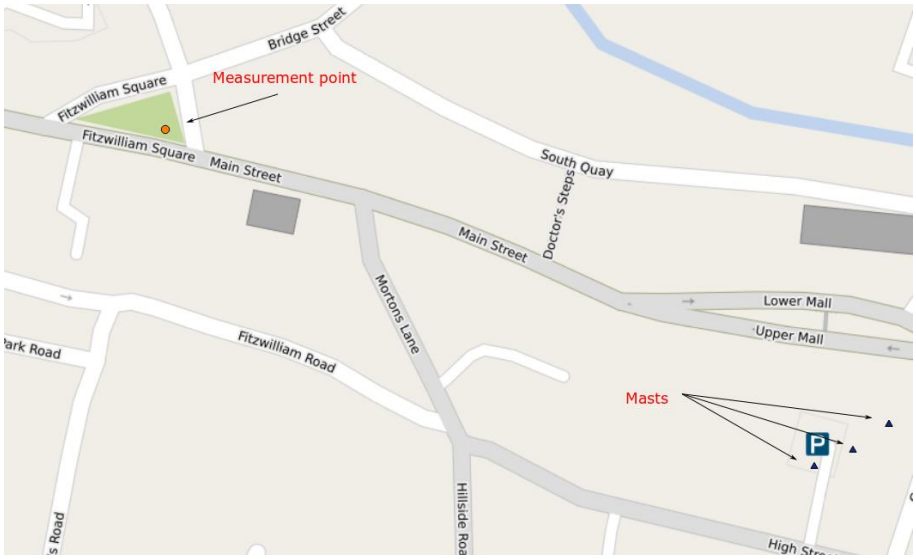
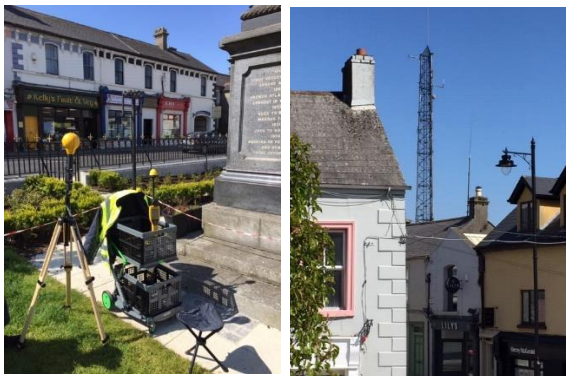


7. Photo of measurement point nearby (line-of-sight) telecommunication sites



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