Commission for
Communications Regulation

Report

2009 Programme of Measurement of Non-Ionising Radiation Emissions

Second Interim Report

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1. Executive Summary

The Commission for Communications Regulation (ComReg) currently arranges for Non-Ionising Radiation (NIR) surveys to be conducted near a sample number of licensed transmitter sites nationwide. Each survey involves measurement of NIR emission levels at the point of highest emissions (in a public area), associated with the transmitter. Sites are surveyed in order to assess compliance on the part of transmitter operators with their licence conditions relating to NIR emissions.

This report forms part of an ongoing series of interim reports which outline ComReg's programme of measurements, and presents the results of the second set of site surveys (25 sites) undertaken during the 2009 programme.

The site surveys were conducted in the period April – June 2009 by engineers of Vilicom Engineering Ltd which was contracted by ComReg to assist it with the programme.

On the basis of this work, ComReg has concluded that the NIR emissions measured from all of the 25 sites were below the relevant ICNIRP guideline limits for general public exposure[1]. The results of the measurements taken at all the sites are presented in this report.

[1] See Annex 2

2. Introduction

The Commission for Communications Regulation (ComReg) is the licensing authority for the use of the radio frequency spectrum in Ireland. The frequency spectrum is a valuable national resource which has been used for communications purposes for over 100 years. Applications which make use of the radio spectrum include a wide range of services such as radio and television broadcasting, mobile telephony and other telecommunications services such as internet connection.

It is a condition of various licences[2] issued by ComReg that licensees must ensure that non-ionising radiation[3] (NIR) emissions from each transmitter operated under the licence must be within the limits set down in the guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[4]. Levels of NIR emissions from a licensed transmitter must not exceed the ICNIRP limits in any part of the site or surrounding area to which the general public has access.

In order to assess compliance on the part of transmitter operators with their licence conditions relating to NIR, ComReg currently arranges for NIR surveys to be conducted near a sample number of licensed transmitter sites nationwide. Each survey involves measurement of NIR emission levels at the point of highest emissions (in a public area), associated with the transmitter.

This report presents the results of measurements taken at the second set of 25 sites chosen as part of the 2009 Programme of Measurement of Non-Ionising Radiation emissions. The site surveys were conducted during the period April - June 2009 by engineers of Vilicom Engineering Ltd which was contracted by ComReg to assist it with the programme.

[2] Issued pursuant to the Wireless Telegraphy Act, 1926 (No. 45 of 1926) e.g. for services such as GSM & UMTS Mobile Telephony, Radio & TV Broadcasting, MMDS, Wireless Broadband etc.

[3] Non-ionising radiation is that part of the electromagnetic spectrum below 3 x 10^{15} Hz (3000 million MHz). Radio waves, infrared radiation and visible light are examples of NIR. (see Annex 1)

[4] See Annexes 1& 2 for further details.

Abbreviated versions of the individual site survey reports are available on the ComReg website[5] as well as on Siteviewer[6], an on-line facility provided by ComReg, which allows the public to view details of GSM and 3G mobile telephony base stations throughout Ireland. Copies of the full site reports are available on request.

[5] www.comreg.ie
[6] www.siteviewer.ie

3. Measurement Results

3.1 Explanatory Note

At the point of highest emissions[7] associated with each site, the engineers measured the electric field strength (or electric field voltage)[8] of emissions in the relevant radio frequency bands.

The tables which follow in the next sub-section present the levels measured at each site. The sites are listed in order by county.

The tables show the measured levels alongside the relevant ICNIRP limits for general public exposure. They include levels measured in respect of emissions from the transmitter site, along with the levels for emissions from nearby sites, if particularly high at the location.

The tables present the measurements for each site under the following headings:

1. Signal Type
2. Frequency
3. Measured Level V/m
4. Adjusted Level V/m
5. ICNIRP guideline limit
6. Total Exposure Quotient

A brief explanation of each of the headings follows:-

[7] See Annex 3 for an outline of the site survey methodology.

[8] See Annex 4 for an outline of how electromagnetic fields are measured.

Signal Type

The type of signal to which an emission on a particular frequency relates e.g. **GSM** (2nd generation mobile phone system), **UMTS** (3rd generation mobile phone system), **FM Radio**, **TV PAL** (analogue television), **FWALA** (wireless broadband) etc.

Frequency (MHz)

Various radio services are transmitted in predefined frequency ranges. For example 3G (or UMTS) mobile telephony base stations transmit signals on a frequency somewhere in the range 2110 – 2170 MHz. At each site transmitting a 3G signal, measurements were taken in that frequency range and the results of those measurements are presented in the tables. Other services such as GSM 900, GSM 1800, TETRA, Television etc. are presented in similar manner in the tables, if applicable. The frequencies of emissions associated with some services (e.g. emergency services) are not shown in the interests of confidentiality and security.

Measured Level V/m

The tables show the electric field strength levels measured for each emission (signal) type from the designated site, along with the levels for emissions from nearby sites, if particularly high. In many instances more than one measured level is shown for each emission type. This is due to the fact that different mobile operators often transmit signals from the same site on different frequency channels.

Adjusted Level V/m

For some emission types an adjusted level has been calculated from the measured level for any or all of the following reasons:

- to compensate for the limited measurement resolution of the spectrum analyser[9]. For example, a measurement of a digital television signal performed with at a resolution of 5 MHz needs to be adjusted upwards

[9] Spectrum analysers are used to measure individual emissions at specific frequencies (see Annex 4).

using a correction factor in order to account for the energy present within the full 7.6 MHz bandwidth of the signal.

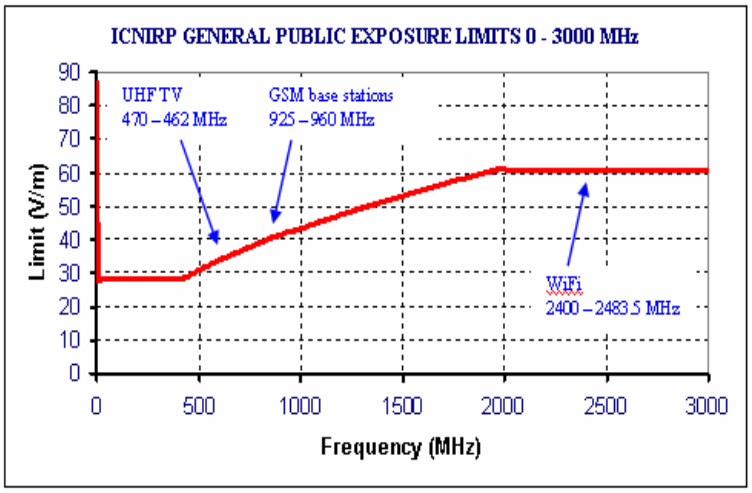
- to extrapolate to an estimate of the level under maximum traffic from the transmitter. For example, the base stations of mobile telephone networks produce emissions which vary according to the changing volume of calls or data traffic over the course of the day. The levels measured for the always-on pilot channels of the base stations can be used to extrapolate to a level which would be expected if all voice and data channels were in operation.

- to account for the characteristics of certain complex signal types (e.g. analogue PAL TV).

For further details concerning the calculation of Adjusted Levels, please refer to Annex 5.

ICNIRP guideline limit

For each site the table shows the measured and adjusted electric field strength levels in Volts per metre (V/m) alongside the relevant ICNIRP general public guideline limits. It should be noted that the ICNIRP guideline limits vary according to frequency as illustrated:



For example, for a GSM mobile signal on a frequency of 940.050 MHz, the relevant limit is 42.158 V/m, while for a 3G mobile signal on a frequency of 2147.2 MHz the relevant limit is 61 V/m. Thus the limits for the different measurements presented in the tables will vary as the measurements have been performed at different frequencies.

For further details concerning the ICNIRP Limits, please refer to Annex 2.

Total Exposure Quotient

For each site, Total Exposure Quotients are calculated, in accordance with mathematical formulas specified in the ICNIRP Guidelines in order assess the cumulative effect of emissions from multiple transmitters. The quotients in this report are calculated from the Adjusted Levels rather than from the Measured Levels, in order to account for total potential public exposure under maximum traffic conditions.

In order to satisfy the criteria of the ICNIRP Guidelines, the Quotients must be less than or equal to 1.

The two quotients are as follows:

Quotient for Electrical Stimulation Effects (1 Hz to 10 MHz)

This quotient is calculated only in a small number of cases where strong emissions in the frequency range between 1 Hz and 10 MHz are present at the survey location (e.g. near a long wave radio transmitter site).

Quotient for Thermal Effects (100 kHz and above)

The measurements of any emissions above 100 kHz are used to calculate a Quotient to assess any thermal (heat) effects.

Please refer to Annex 2 for further information concerning the calculation of the Quotients.

3.2 Measurement Results by Site

3.2.1 Cavan: Cootehill - Magheranure

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004831	0.004831	28.0	5796
PMR	Not disclosed	0.003963	0.003963	28.0	7066
GSM 900	947.750	0.534564	1.069129	42.3	40
GSM 900	952.533	0.030374	0.060748	42.4	699
GSM 900	939.700	0.026946	0.053893	42.1	782
UMTS FDD	2146.433	0.130467	0.843695	61.0	72
UMTS FDD	2114.000	0.004198	0.027145	61.0	2247

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000833	1

3.2.2 Clare: Scarriff - Coillte Offices

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004487	0.004487	28.0	6240
FM Radio	98.433	0.007718	0.007718	28.0	3628
FM Radio	88.730	0.007674	0.007674	28.0	3649
TV PAL	183.600	0.029546	0.037442	28.0	748
TV PAL	207.280	0.027353	0.034663	28.0	808
TV PAL	847.627	0.011066	0.014024	40.0	2855
TV PAL	831.947	0.007499	0.009503	39.7	4173
TV DVB-T	746.360	0.001551	0.004078	37.6	9210
TV DVB-T	689.520	0.001517	0.003990	36.1	9049
GSM 900	939.933	0.588844	1.177687	42.2	36
GSM 900	947.517	0.281514	0.563028	42.3	75
GSM 900	954.633	0.021330	0.042661	42.5	996
UMTS FDD	2147.367	0.006405	0.041418	61.0	1473
UMTS FDD	2167.433	0.006202	0.040104	61.0	1521

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000963	1

3.2.3 Cork: Bweeng Mountain

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004300	0.004300	28.0	6511
FM Radio	97.408	0.089228	0.089228	28.0	314
FM Radio	103.763	0.008194	0.008194	28.0	3417
TETRA	Not disclosed	0.048084	0.083284	28.0	336
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	724
GSM 900	939.233	0.024774	0.049548	42.1	850
GSM 900	946.817	0.008640	0.017279	42.3	2449
GSM 900	954.400	0.006668	0.013336	42.5	3185
GSM 1800	1837.000	0.006252	0.012503	58.9	4713
UMTS FDD	2114.000	0.009036	0.058437	61.0	1044
UMTS FDD	2117.500	0.007439	0.048104	61.0	1268
FWALA	3528.900	0.000564	0.001423	61.0	42853
WiFi	5660.400	0.002270	0.008807	61.0	6926
FWA (Lic-exempt)	5790.000	0.001361	0.003434	61.0	17761
FWA (Lic-exempt)	5835.000	0.001122	0.003079	61.0	19814

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000024	1

3.2.4 Cork: Carrigaline - TV Deflector Transmitter Site

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004683	0.004683	28.0	5979
FM Radio	107.863	0.010435	0.010435	28.0	2683
PMR	Not disclosed	0.009649	0.009649	28.0	2902
PMR	Not disclosed	0.007998	0.007998	28.0	3501
TETRA	Not disclosed	0.002630	0.004556	28.0	6146
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	4406
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	7377
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	15360
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	10456
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	16548
TV PAL	639.867	0.326964	0.414347	34.8	84
TV PAL	607.853	0.189234	0.239808	33.9	141
TV PAL	623.533	0.071614	0.090754	34.3	378
TV PAL	687.560	0.365595	0.463302	36.1	78
TV DVB-T	746.860	0.003560	0.009365	37.6	4013
TV DVB-T	664.713	0.003512	0.009236	35.5	3838
GSM 900	955.100	0.026062	0.052123	42.5	815
GSM 900	946.000	0.021232	0.042465	42.3	996
GSM 900	940.983	0.018621	0.037242	42.2	1133
GSM 1800	1845.000	0.010990	0.021980	59.1	2687
GSM 1800	1857.500	0.009977	0.019954	59.3	2970
UMTS FDD	2111.900	0.010703	0.069213	61.0	881
UMTS FDD	2132.200	0.007934	0.051308	61.0	1189
UMTS FDD	2128.700	0.006668	0.043121	61.0	1415
UMTS FDD	2146.200	0.005572	0.036032	61.0	1693
UMTS FDD	2166.267	0.004983	0.032224	61.0	1893
FWA (Lic-exempt)	5767.000	0.002101	0.005301	61.0	11507
FWA (Lic-exempt)	5745.000	0.001122	0.004697	61.0	12986

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000371	1

3.2.5 Cork City: Glen Avenue

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004597	0.004597	28.0	6091
FM Radio	94.812	0.117220	0.117220	28.0	239
FM Radio	96.383	0.071121	0.071121	28.0	394
FM Radio	102.602	0.028151	0.028151	28.0	995
FM Radio	106.155	0.026062	0.026062	28.0	1074
FM Radio	93.103	0.017358	0.017358	28.0	1613
FM Radio	107.863	0.009441	0.009441	28.0	2966
PMR	Not disclosed	0.016014	0.016014	28.0	1748
PMR	Not disclosed	0.011548	0.011548	28.0	2425
PMR	Not disclosed	0.002252	0.002252	28.0	12435
PMR	Not disclosed	0.001930	0.001930	28.0	14510
T-DAB	227.573	0.010245	0.012106	28.0	2313
TETRA	Not disclosed	0.044978	0.077904	28.0	359
TETRA	Not disclosed	0.033381	0.057818	28.0	484
TETRA	Not disclosed	0.028510	0.049381	28.0	567
TETRA	Not disclosed	0.006831	0.011832	28.0	2366
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	1008
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	2113
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	3939
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	10507
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	20779
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	22449
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	14816
GSM 900	954.983	0.106537	0.213074	42.5	199
GSM 900	939.817	0.096716	0.193433	42.2	218
GSM 900	948.333	0.041020	0.082041	42.3	516
GSM 1800	1834.000	0.165386	0.330773	58.9	178
GSM 1800	1845.750	0.037111	0.074222	59.1	796
GSM 1800	1865.000	0.027290	0.054580	59.4	1088
UMTS FDD	2168.833	0.114156	0.738220	61.0	83
UMTS FDD	2146.900	0.081003	0.523824	61.0	116
UMTS FDD	2112.833	0.022004	0.142294	61.0	429
UMTS FDD	2127.067	0.006237	0.040335	61.0	1512
UMTS FDD	2132.667	0.005922	0.038299	61.0	1593
FWALA	3528.300	0.010691	0.026968	61.0	2262
FWALA	3582.300	0.001122	0.016363	61.0	3728
FWALA	10232.910	0.002226	0.007941	61.0	7682

Continued overleaf…..

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000354	1

3.2.6 Cork: Kinsale Garda Station

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004340	0.004340	28.0	6451
FM Radio	105.267	0.008670	0.008670	28.0	3230
TETRA	Not disclosed	0.343954	0.595745	28.0	47
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	6244
GSM 900	949.383	1.352073	2.704145	42.4	16
GSM 900	953.933	0.849180	1.698361	42.5	25
GSM 900	937.833	0.031732	0.063464	42.1	663
GSM 1800	1857.500	0.021380	0.042759	59.3	1386
UMTS FDD	2111.200	0.059979	0.387870	61.0	157
UMTS FDD	2166.500	0.053703	0.347285	61.0	176
UMTS FDD	2148.300	0.041831	0.270511	61.0	225
WiFi	5691.850	0.001206	0.004681	61.0	13032
WiFi	5703.750	0.001122	0.004379	61.0	13931

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.006221	1

3.2.7 Cork: Mallow Train Station

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.003972	0.003972	28.0	7049
FM Radio	105.745	0.008166	0.008166	28.0	3429
TETRA	Not disclosed	0.033884	0.058690	28.0	477
TETRA	Not disclosed	0.031586	0.054709	28.0	512
TETRA	Not disclosed	0.002710	0.004694	28.0	5965
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	133
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	193
TV PAL	519.653	0.009966	0.012629	31.3	2482
TV PAL	551.013	0.006375	0.008079	32.3	3995
GSM 900	951.833	0.693426	1.386852	42.4	31
GSM 900	940.283	0.017599	0.035199	42.2	1198
GSM 1800	1832.000	1.017419	2.034839	58.9	29
GSM 1800	1855.500	0.011143	0.022286	59.2	2658
UMTS FDD	2147.600	0.193197	1.249354	61.0	49
FWALA	3518.100	0.000595	0.001501	61.0	40642
FWALA	3735.800	0.000835	0.002105	61.0	28972
WiFi	5488.700	0.001545	0.005996	61.0	10174

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.002777	1

3.2.8 Donegal: Bundoran - Station Rd

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004421	0.004421	28.0	6334
FM Radio	88.183	0.034634	0.034634	28.0	808
FM Radio	100.005	0.032285	0.032285	28.0	867
FM Radio	92.557	0.030095	0.030095	28.0	930
FM Radio	90.370	0.026424	0.026424	28.0	1060
FM Radio	97.818	0.020253	0.020253	28.0	1382
FM Radio	107.453	0.017120	0.017120	28.0	1636
TV PAL	199.600	0.262422	0.332556	28.0	84
TV PAL	215.600	0.169239	0.214469	28.0	131
TV PAL	783.600	0.041879	0.053072	38.5	725
TV PAL	807.773	0.025061	0.031759	39.1	1231
TV DVB-T	718.920	0.009247	0.024322	36.9	1516
TV DVB-T	753.547	0.005489	0.014438	37.7	2614
GSM 900	937.833	0.936483	1.872966	42.1	22
GSM 900	954.050	0.539511	1.079021	42.5	39
GSM 900	947.400	0.059088	0.118176	42.3	358
GSM 1800	1842.750	0.358509	0.717018	59.0	82
GSM 1800	1835.750	0.245471	0.490942	58.9	120
GSM 1800	1856.000	0.209170	0.418341	59.2	142
UMTS FDD	2166.967	0.124308	0.803870	61.0	76
UMTS FDD	2146.200	0.062302	0.402889	61.0	151
UMTS FDD	2111.900	0.058412	0.377734	61.0	161

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.003363	1

3.2.9 Donegal: Killybegs - Bay-View hotel

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004836	0.004836	28.0	5790
FM Radio	100.005	0.020773	0.020773	28.0	1348
FM Radio	88.183	0.019409	0.019409	28.0	1443
FM Radio	92.625	0.018302	0.018302	28.0	1530
FM Radio	90.370	0.018072	0.018072	28.0	1549
FM Radio	107.453	0.015959	0.015959	28.0	1755
FM Radio	97.818	0.013536	0.013536	28.0	2069
PMR	Not disclosed	0.003859	0.003859	28.0	7255
PMR	Not disclosed	0.005553	0.005553	28.0	5043
PMR	Not disclosed	0.004345	0.004345	28.0	6444
PMR	Not disclosed	0.002126	0.002126	28.0	13172
TV PAL	215.600	0.087398	0.110755	28.0	253
TV PAL	199.440	0.072527	0.091910	28.0	305
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	5514
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	7449
PAL	783.600	0.242382	0.307160	38.5	125
TV PAL	807.773	0.126474	0.160274	39.1	244
TV DVB-T	728.720	0.020394	0.053641	37.1	692
GSM 900	955.800	2.254239	4.508478	42.5	9
GSM 900	945.300	0.195659	0.391318	42.3	108
UMTS TDD	1911.267	0.009204	0.059523	60.1	1010
UMTS FDD	2111.433	0.325087	2.102256	61.0	29
UMTS FDD	2147.133	0.065163	0.421391	61.0	145
FWA (Lic-exempt)	5778.500	0.002751	0.006940	61.0	8790

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.012682	1

3.2.10 Galway City: Quay St - Jurys Inn

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004236	0.004236	28.0	6609
FM Radio	98.433	0.008740	0.008740	28.0	3204
FM Radio	90.985	0.007807	0.007807	28.0	3586
FM Radio	100.620	0.007482	0.007482	28.0	3742
TV PAL	183.440	0.031046	0.039343	28.0	712
TV PAL	207.600	0.025061	0.031759	28.0	882
TETRA	Not disclosed	0.007447	0.012899	28.0	2171
TETRA	Not disclosed	0.004786	0.008290	28.0	3378
TETRA	Not disclosed	0.004164	0.007212	28.0	3882
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	17762
TV PAL	831.947	0.016387	0.020767	39.7	1910
TV PAL	847.627	0.014405	0.018254	40.0	2193
GSM 900	939.233	0.405509	0.811017	42.1	52
GSM 900	955.683	0.342373	0.684747	42.5	62
GSM 900	951.600	0.022105	0.044211	42.4	959
GSM 1800	1838.750	0.135207	0.270415	59.0	218
GSM 1800	1856.500	0.084333	0.168667	59.2	351
GSM 1800	1863.500	0.008590	0.017180	59.4	3455
UMTS FDD	2147.133	0.033574	0.217113	61.0	281
UMTS FDD	2114.233	0.017539	0.113419	61.0	538
UMTS FDD	2168.833	0.015776	0.102020	61.0	598
FWALA	3576.300	0.001169	0.002950	61.0	20677
FWALA	3525.000	0.001122	0.001458	61.0	41829
FWALA	3720.200	0.000913	0.002303	61.0	26484

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000684	1

3.2.11 Galway: Tonabrocky

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004395	0.004395	28.0	6370
PMR	Not disclosed	0.046720	0.046720	28.0	599
PMR	Not disclosed	0.044978	0.044978	28.0	623
PMR	Not disclosed	0.037154	0.037154	28.0	754
PMR	Not disclosed	0.034198	0.034198	28.0	819
FM Radio	103.353	0.450817	0.450817	28.0	62
FM Radio	101.303	0.340800	0.340800	28.0	82
FM Radio	95.837	0.305492	0.305492	28.0	92
TETRA	Not disclosed	0.002911	0.005042	28.0	5554
TETRA	Not disclosed	0.002014	0.003488	28.0	8028
TV PAL	486.987	0.013443	0.017036	30.3	1781
TV PAL	535.333	0.011776	0.014923	31.8	2132
TV PAL	567.346	0.011246	0.014252	32.8	2298
TV PAL	847.627	0.006753	0.008558	40.0	4678
TV PAL	831.947	0.004656	0.005900	39.7	6722
GSM 900	937.717	0.889201	1.778402	42.1	24
GSM 900	946.817	0.298538	0.597077	42.3	71
GSM 900	955.567	0.079708	0.159415	42.5	267
GSM 1800	1840.750	0.890225	1.780451	59.0	33
UMTS FDD	2146.200	0.034954	0.226040	61.0	270
UMTS FDD	2168.133	0.006288	0.040662	61.0	1500
UMTS FDD	2114.000	0.004340	0.028066	61.0	2173
WiFi	2441.193	0.004753	0.018443	61.0	3307
MMDS (DVB-T)	2658.720	0.013599	0.035768	61.0	1705
MMDS (DVB-T)	2642.600	0.001122	0.032508	61.0	1876
MMDS (DVB-T)	2606.020	0.001122	0.018260	61.0	3341
MMDS (DVB-T)	2524.800	0.001122	0.017742	61.0	3438
MMDS (DVB-T)	2562.620	0.001122	0.017061	61.0	3575
MMDS (DVB-T)	2627.100	0.001122	0.015831	61.0	3853
FWALA	3591.300	0.046291	0.116776	61.0	522
FWALA	3598.500	0.001122	0.001815	61.0	33611
FWALA	3716.300	0.000836	0.002108	61.0	28939
FWALA	3721.700	0.001122	0.001911	61.0	31914
WiFi	5566.900	0.001279	0.004964	61.0	12288
WiFi	5694.400	0.001122	0.004768	61.0	12794
FWA (Lic-exempt)	5803.000	0.001305	0.003291	61.0	18534
FWA (Lic-exempt)	5797.000	0.001122	0.003235	61.0	18857

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Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.003463	1

3.2.12 Kerry: Tralee Business Park (Clash Industrial Estate)

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004325	0.004325	28.0	6474
FM Radio	90.575	0.008110	0.008110	28.0	3453
FM Radio	92.830	0.007595	0.007595	28.0	3687
PMR	Not disclosed	0.003034	0.003034	28.0	9229
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	5674
TV PAL	519.000	0.008463	0.010724	31.3	2921
TV PAL	551.667	0.007638	0.009680	32.3	3336
TV PAL	759.427	0.015794	0.020015	37.9	1893
TV PAL	727.413	0.011574	0.014668	37.1	2528
TV PAL	807.773	0.008531	0.010811	39.1	3615
GSM 900	952.650	0.389942	0.779884	42.4	54
GSM 900	947.283	0.014555	0.029109	42.3	1454
GSM 900	940.050	0.011402	0.022805	42.2	1849
GSM 1800	1856.250	0.677642	1.355283	59.2	44
GSM 1800	1865.250	0.016014	0.032028	59.4	1854
UMTS FDD	2166.267	0.240436	1.554840	61.0	39
WiFi	2473.758	0.018793	0.072918	61.0	837
FWALA	3578.100	0.001495	0.003770	61.0	16180
FWALA	3518.400	0.001122	0.001407	61.0	43349
FWALA	3737.300	0.000709	0.001788	61.0	34117

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.001514	1

3.2.13 Kilkenny City: O'Loughlin Rd – ESB

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.005018	0.005018	28.0	5580
FM Radio	96.588	0.013366	0.013366	28.0	2095
TV PAL	190.960	0.022856	0.028964	28.0	967
TV PAL	486.987	0.011079	0.014040	30.3	2161
TV PAL	511.160	0.008185	0.010372	31.1	2997
TV DVB-T	666.060	0.002183	0.005741	35.5	6181
GSM 900	941.333	0.834642	1.669283	42.2	25
GSM 900	955.567	0.352371	0.704742	42.5	60
GSM 900	949.967	0.068391	0.136782	42.4	310
GSM 1800	1864.750	0.412572	0.825144	59.4	72
GSM 1800	1856.750	0.074559	0.149118	59.2	397
GSM 1800	1832.750	0.023067	0.046135	58.9	1276
UMTS FDD	2113.300	0.214536	1.387349	61.0	44
UMTS FDD	2166.500	0.049659	0.321134	61.0	190
UMTS FDD	2148.067	0.011628	0.075194	61.0	811
FWALA	3592.500	0.000745	0.001879	61.0	32470
FWALA	3558.600	0.001122	0.001592	61.0	38325
FWALA	3734.000	0.000564	0.001423	61.0	42853
FWA (Lic-exempt)	5791.000	0.002432	0.006136	61.0	9942
FWA (Lic-exempt)	5784.500	0.001122	0.005186	61.0	11762

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.002599	1

3.2.14 Leitrim: Manorhamilton - Church Rd Exchange

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004759	0.004759	28.0	5884
FM Radio	100.005	0.026577	0.026577	28.0	1054
FM Radio	97.818	0.020091	0.020091	28.0	1394
FM Radio	92.557	0.019838	0.019838	28.0	1411
FM Radio	107.450	0.016051	0.016051	28.0	1744
FM Radio	88.183	0.013583	0.013583	28.0	2061
FM Radio	104.447	0.011311	0.011311	28.0	2475
TV PAL	215.600	0.037801	0.047903	28.0	585
TV PAL	199.280	0.035934	0.045537	28.0	615
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	1214
TV PAL	783.600	0.012720	0.016120	38.5	2388
TV PAL	807.773	0.009162	0.011611	39.1	3366
TV DVB-T	720.227	0.001932	0.005082	36.9	7262
TV DVB-T	750.933	0.001786	0.004699	37.7	8019
GSM 900	948.217	0.559758	1.119515	42.3	38
GSM 900	938.300	0.090365	0.180730	42.1	233
GSM 900	953.817	0.067764	0.135528	42.5	313
UMTS FDD	2146.200	0.114948	0.743337	61.0	82
UMTS FDD	2113.067	0.009988	0.064593	61.0	944
UMTS FDD	2168.833	0.005123	0.033127	61.0	1841

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000887	1

3.2.15 Limerick City: Dublin Rd - Parkway Shopping Centre

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004498	0.004498	28.0	6225
FM Radio	95.017	0.014338	0.014338	28.0	1953
FM Radio	103.012	0.013916	0.013916	28.0	2012
FM Radio	107.043	0.008943	0.008943	28.0	3131
FM Radio	101.235	0.007490	0.007490	28.0	3738
FM Radio	99.048	0.007236	0.007236	28.0	3870
T-DAB	227.093	0.017080	0.020184	28.0	1387
TETRA	Not disclosed	0.003846	0.006661	28.0	4203
TETRA	Not disclosed	0.003016	0.005225	28.0	5359
TV DVB-T	678.413	0.002835	0.007456	35.8	4803
GSM 900	955.683	1.008092	2.016183	42.5	21
GSM 900	941.217	0.803526	1.607052	42.2	26
GSM 900	951.600	0.278292	0.556583	42.4	76
GSM 1800	1866.500	0.425598	0.851197	59.4	70
GSM 1800	1857.250	0.255564	0.511128	59.3	116
GSM 1800	1831.500	0.122039	0.244079	58.8	241
UMTS FDD	2166.033	0.105925	0.684992	61.0	89
UMTS FDD	2113.300	0.056559	0.365751	61.0	167
UMTS FDD	2145.967	0.040785	0.263746	61.0	231
FWALA	3565.500	0.715319	1.804483	61.0	34
FWALA	3547.200	0.001122	0.040027	61.0	1524
FWALA	3763.400	0.009441	0.023815	61.0	2561
FWALA	3748.700	0.001122	0.018045	61.0	3380
FWALA	3777.800	0.001122	0.016325	61.0	3737
FWALA	3739.700	0.001122	0.012327	61.0	4949
FWALA	3731.300	0.001122	0.006432	61.0	9484
WiFi	5505.700	0.001988	0.007715	61.0	7907

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.005228	1

3.2.16 Limerick City: Ennis Rd - Strand Hotel

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004651	0.004651	28.0	6021
PMR	Not disclosed	0.028609	0.028609	28.0	979
PMR	Not disclosed	0.022856	0.022856	28.0	1225
T-DAB	227.547	0.022961	0.027133	28.0	1032
TETRA	Not disclosed	0.035318	0.061173	28.0	458
TETRA	Not disclosed	0.033612	0.058218	28.0	481
TETRA	Not disclosed	0.030655	0.053096	28.0	527
TV DVB-T	654.893	0.002084	0.005483	35.2	6418
TV DVB-T	637.253	0.001791	0.004710	34.7	7370
TV DVB-T	711.080	0.003122	0.008213	36.7	4464
TV DVB-T	683.640	0.002377	0.006252	36.0	5751
GSM 900	938.533	0.648634	1.297269	42.1	32
GSM 900	947.517	0.042364	0.084729	42.3	500
GSM 900	953.000	0.020773	0.041546	42.4	1022
GSM 1800	1867.500	0.050641	0.101281	59.4	587
GSM 1800	1832.000	0.026577	0.053153	58.9	1107
GSM 1800	1857.750	0.022516	0.045033	59.3	1316
UMTS FDD	2147.367	0.017258	0.111606	61.0	547
UMTS FDD	2111.200	0.007771	0.050256	61.0	1214
UMTS FDD	2167.433	0.005333	0.034489	61.0	1769
FWALA	3524.700	0.002550	0.006432	61.0	9484
FWALA	3571.200	0.001122	0.002041	61.0	29887
FWALA	3591.000	0.001122	0.001650	61.0	36981

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000978	1

3.2.17 Longford Town: Richmond St

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004608	0.004608	28.0	6077
PMR	Not disclosed	0.022208	0.022208	28.0	1261
FM Radio	89.823	0.007145	0.007145	28.0	3919
FM Radio	103.148	0.006707	0.006707	28.0	4175
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	4796
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	16864
TV PAL	647.707	0.023741	0.030086	35.0	1163
TV PAL	623.533	0.017539	0.022226	34.3	1545
TV PAL	671.227	0.019521	0.024738	35.6	1440
TV PAL	703.240	0.019077	0.024175	36.5	1508
GSM 900	938.767	0.834642	1.669283	42.1	25
GSM 900	947.983	0.161065	0.322129	42.3	131
GSM 900	954.400	0.133660	0.267319	42.5	159
GSM 1800	1834.000	0.359749	0.719499	58.9	82
GSM 1800	1832.250	0.323966	0.647933	58.9	91
GSM 1800	1855.750	0.096939	0.193879	59.2	306
UMTS FDD	2166.500	0.178033	1.151292	61.0	53
UMTS FDD	2112.133	0.109270	0.706620	61.0	86
UMTS FDD	2148.067	0.029512	0.190847	61.0	320
FWALA	3711.200	0.000600	0.001515	61.0	40270

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.002452	1

3.2.18 Mayo: Castlebar - Garda Station

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
FM Radio	101.098	0.016162	0.016162	28.0	1732
FM Radio	93.718	0.014571	0.014571	28.0	1922
FM Radio	89.277	0.012417	0.012417	28.0	2255
FM Radio	98.912	0.010520	0.010520	28.0	2662
FM Radio	102.943	0.007980	0.007980	28.0	3509
FM Radio	103.695	0.006324	0.006324	28.0	4427
PMR	Not disclosed	0.217270	0.217270	28.0	129
PMR	Not disclosed	0.189017	0.189017	28.0	148
PMR	Not disclosed	0.030374	0.030374	28.0	922
PMR	Not disclosed	0.003243	0.003243	28.0	8633
TETRA	Not disclosed	0.123453	0.213826	28.0	131
TETRA	Not disclosed	0.113240	0.196137	28.0	143
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	125
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	5520
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	759
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	101
TV PAL	486.987	0.014322	0.018149	30.3	1672
TV PAL	535.333	0.010174	0.012893	31.8	2467
TV PAL	475.880	0.009943	0.012600	30.0	2381
TV PAL	567.347	0.006368	0.008070	32.8	4058
GSM 900	948.100	0.099770	0.199540	42.3	212
GSM 900	953.000	0.055463	0.110925	42.4	383
GSM 900	943.317	0.043752	0.087504	42.2	483
GSM 1800	1842.500	0.158125	0.316250	59.0	187
GSM 1800	1857.750	0.033845	0.067691	59.3	876
UMTS FDD	2114.423	0.030761	0.198923	61.0	307
UMTS FDD	2148.300	0.009977	0.064519	61.0	945
UMTS FDD	2166.967	0.007880	0.050955	61.0	1197
FWALA	3515.100	0.003232	0.008154	61.0	7481
FWALA	3543.300	0.001122	0.001492	61.0	40877
FWA (Lic-exempt)	5727.500	0.029107	0.073426	61.0	831
FWA (Lic-exempt)	5735.500	0.001122	0.005344	61.0	11415
FWA (Lic-exempt)	5868.000	0.001122	0.003494	61.0	17457
FWA (Lic-exempt)	5872.000	0.001122	0.003490	61.0	17477
FWA (Lic-exempt)	5771.500	0.001122	0.003462	61.0	17619
FWA (Lic-exempt)	5832.000	0.001122	0.003272	61.0	18641

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Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000456	1

3.2.19 Monaghan: Clones Garda Station

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004375	0.004375	28.0	6400
PMR	Not disclosed	0.003819	0.003819	28.0	7331
GSM 900	939.000	0.917276	1.834552	42.1	23
GSM 900	954.400	0.182180	0.364359	42.5	117
GSM 1800	1854.000	0.081190	0.162379	59.2	365
GSM 1800	1840.750	0.012036	0.024073	59.0	2451
UMTS FDD	2166.500	0.112720	0.728930	61.0	84
UMTS FDD	2112.133	0.037584	0.243044	61.0	251
UMTS FDD	2147.367	0.004618	0.029867	61.0	2042
WiFi	2443.977	0.008861	0.034382	61.0	1774
WiFi	2467.078	0.001122	0.007405	61.0	8238

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.002136	1

3.2.20 Roscommon: Frenchpark

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
TV PAL	671.227	0.005395	0.006837	35.6	5210
TV PAL	703.240	0.004534	0.005746	36.5	6346
TV PAL	783.600	0.004093	0.005186	38.5	7421
TV PAL	807.120	0.003758	0.004763	39.1	8202
GSM 900	949.617	0.988553	1.977106	42.4	21
GSM 900	940.750	0.028973	0.057947	42.2	728
GSM 900	952.883	0.016904	0.033809	42.4	1255
UMTS FDD	2148.533	0.077446	0.500825	61.0	122

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.002247	1

3.2.21 Sligo: Truskmore

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004566	0.004566	28.0	6133
PMR	Not disclosed	0.004431	0.004431	28.0	6319
FM Radio	88.183	0.136301	0.136301	28.0	205
FM Radio	104.447	0.128825	0.128825	28.0	217
FM Radio	102.533	0.107275	0.107275	28.0	261
FM Radio	90.370	0.097387	0.097387	28.0	288
FM Radio	92.625	0.074046	0.074046	28.0	378
FM Radio	97.818	0.072028	0.072028	28.0	389
TV PAL	199.600	0.259418	0.328749	28.0	85
TV PAL	215.600	0.077625	0.098370	28.0	285
TV PAL	783.600	0.075858	0.096131	38.5	400
TV PAL	807.773	0.038107	0.048291	39.1	809
TV DVB-T	732.640	0.014338	0.037713	37.2	987
GSM 900	942.617	0.021208	0.042416	42.2	995
GSM 900	951.367	0.011442	0.022884	42.4	1853
GSM 900	953.233	0.009583	0.019166	42.5	2215
UMTS FDD	2114.000	0.007586	0.049055	61.0	1243
UMTS FDD	2146.200	0.004013	0.025953	61.0	2350

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000247	1

3.2.22 Tipperary: Fethard - St Patricks Place

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
GSM 900	946.000	0.187715	0.375431	42.3	113
GSM 900	949.033	0.126038	0.252075	42.4	168
GSM 900	940.167	0.044668	0.089337	42.2	472
UMTS FDD	2110.967	0.010852	0.070176	61.0	869

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.00012	1

3.2.23 Tipperary: Thurles Garda Station

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004487	0.004487	28.0	6240
PMR	Not disclosed	0.045342	0.045342	28.0	618
TETRA	Not disclosed	0.120365	0.208478	28.0	134
TETRA	Not disclosed	0.109270	0.189261	28.0	148
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	5266
GSM 900	947.983	1.491077	2.982154	42.3	14
GSM 900	955.100	1.038724	2.077447	42.5	20
GSM 900	939.350	0.156856	0.313711	42.1	134
GSM 1800	1854.500	0.980618	1.961237	59.2	30
GSM 1800	1832.000	0.152405	0.304811	58.9	193
UMTS TDD	1903.267	0.005260	0.034016	60.0	1763
UMTS FDD	2148.767	0.324340	2.097421	61.0	29
UMTS FDD	2114.000	0.261517	1.691164	61.0	36
UMTS FDD	2166.967	0.257336	1.664124	61.0	37
FWALA	3519.000	0.008861	0.022354	61.0	2729
FWALA	3749.300	0.003420	0.008627	61.0	7071
FWALA	3757.700	0.001122	0.007102	61.0	8590

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.011331	1

3.2.24 Waterford: Portlaw - Main St

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004694	0.004694	28.0	5966
GSM 900	946.000	0.279254	0.558509	42.3	76
GSM 900	953.583	0.014825	0.029650	42.5	1432
UMTS FDD	2147.600	0.148252	0.958706	61.0	64
UMTS FDD	2112.600	0.009572	0.061899	61.0	985
WiFi	2410.855	0.005236	0.020316	61.0	3003

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.000423	1

3.2.25 Westmeath: Mullingar - Friars Mill Rd – Eircom

Table of Frequency Selective Measurement Results					
Signal Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Limit (V/m)**	**Times below limit** (of adjusted values)
PMR	Not disclosed	0.004380	0.004380	28.0	6392
FM Radio	96.520	0.132739	0.132739	28.0	211
PMR	Not disclosed	0.008082	0.008082	28.0	3465
PMR	Not disclosed	0.006622	0.006622	28.0	4228
PMR	Not disclosed	Not disclosed	Not disclosed	Not disclosed	6250
TV PAL	671.227	0.004467	0.005661	35.6	6293
GSM 900	953.583	0.441062	0.882125	42.5	48
GSM 900	951.600	0.346338	0.692676	42.4	61
GSM 900	938.183	0.272898	0.545796	42.1	77
GSM 1800	1855.750	1.113012	2.226025	59.2	27
GSM 1800	1832.250	0.826990	1.653979	58.9	36
GSM 1800	1865.500	0.265155	0.530310	59.4	112
UMTS FDD	2166.967	0.196562	1.271117	61.0	48
UMTS FDD	2146.900	0.178238	1.152619	61.0	53
UMTS FDD	2114.000	0.067066	0.433696	61.0	141
FWA (Lic-exempt)	5728.000	0.001387	0.003498	61.0	17437

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects	**1 Hz to 10 MHz**	n/a	1
Thermal Effects	**100 kHz and above**	0.004013	1

4. Conclusion

The conclusion of this report is that at all 25 licensed transmitter sites surveyed on behalf of ComReg during the period April - June 2009 as part of the 2009 Programme of Measurement of Non-Ionising Radiation Emissions:

(1) Measurements undertaken of non-ionising radiation emission levels on individual frequencies were found to fall below the international ICNIRP reference levels for general public exposure.

(2) The levels measured were not found to cause the aggregate of non-ionising radiation emissions to exceed the criteria for simultaneous exposure to multiple frequency fields specified in the guidelines published by ICNIRP.

Annex 1 - NIR and Emissions Standards

Definition

Non-ionising radiation (NIR) is that part of the electromagnetic spectrum below 3000 million MHz (3 x 10^{15} Hz). Non-ionising radiation includes all radiations and fields of the electromagnetic spectrum that do not normally have sufficient energy to produce ionisation in matter and is characterised by energy per photon of less than about 12 eV and wavelengths greater than 100 nm. Radio waves, infrared radiation and visible light are examples of NIR. Electromagnetic waves at frequencies above 3000 million MHz are known as ionising radiation and this includes X-rays and Gamma rays as well as some Ultraviolet radiation.

Standards for limiting exposure to non-ionising radiation

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an independent, scientific organisation established in 1992. The ICNIRP was established for the purpose of advancing Non-Ionising Radiation Protection and in particular to provide guidance and recommendations on protection from NIR exposure. ICNIRP operates in co-operation with the Environmental Health Division of the World Health Organisation and the United Nations Environment Programme.

In 1998 ICNIRP published guidelines[10] for limiting exposure to NIR (up to 300 GHz). Many countries have adopted the 1998 ICNIRP document as the reference for setting emissions limits. It should be noted that in 1999 the Council of the European Union issued a recommendation[11] to limit exposure of the general public to electromagnetic fields 0Hz - 300GHz

[10] "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)", Health Physics, vol 74, no. 4, April 1998

Available on the Web at www.icnirp.de.

[11] Recommendation of the European Council 1999/519/EC of July 12, 1999

based on a set of basic restrictions and reference levels developed internationally under the advice of the International Commission on Non-Ionizing Radiation Protection. In relation to emissions within the radio spectrum, these limits are equivalent to the ICNIRP guideline limits. An outline of the ICNIRP Guidelines is presented in Annex 2.

Non-ionising radiation licence conditions

It is a condition of various licences[12] issued by ComReg pursuant to the Wireless Telegraphy Act, 1926 (No. 45 of 1926) that licensees must ensure that NIR emissions from each radio installation operated thereunder must be within the limits specified in the guidelines published by ICNIRP.

[12] e.g. GSM, 3G Mobile, Radio and TV Broadcasting, MMDS, FWA (Wireless Broadband), among others.

Annex 2 – The ICNIRP Guidelines

SUMMARY OF THE ICNIRP GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC, AND ELECTROMAGNETIC FIELDS (UP TO 300 GHz)

In 1974, the International Radiation Protection Association (IRPA) formed a working group on non-ionising radiation (NIR), which examined the problems arising in the field of protection against the various types of NIR. In 1977, this working group became the International Non-Ionizing Radiation Committee (INIRC).

In cooperation with the Environmental Health Division of the World Health Organization (WHO), the IRPA/INIRC developed a number of health criteria documents on NIR as part of WHO's Environmental Health Criteria Program, sponsored by the United Nations Environment Program (UNEP). Each document includes an overview of the physical characteristics, measurement and instrumentation, sources, and applications of NIR, a thorough review of the literature on biological effects, and an evaluation of the health risks of exposure to NIR. These health criteria have provided the scientific database for the subsequent development of exposure limits and codes of practice relating to NIR.

At the Eighth International Congress of the IRPA, a new, independent scientific organization—the International Commission on Non-Ionizing Radiation Protection (ICNIRP)—was established as a successor to the IRPA/INIRC. The functions of the Commission are to investigate the hazards that may be associated with the different forms of NIR, develop international guidelines on NIR exposure limits, and deal with all aspects of NIR protection.

ICNIRP has defined two guideline exposure limits, one for members of the general public and one for people classified as occupational (e.g. telecommunication engineers). The occupationally exposed population consists of adults who are generally exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions. By contrast, the general public comprises individuals of all ages and of varying health status, and may include particularly susceptible groups or individuals. In many cases, members of the public are unaware of their exposure to EMF. Moreover, individual members of the public cannot reasonably be expected to take precautions to minimize or avoid exposure. It is these considerations that underlie the adoption of more stringent exposure restrictions for the public than for the occupationally exposed population.

ICNIRP has defined basic restrictions and reference levels. Depending on frequency, the physical quantities used to specify the basic restrictions on exposure to electromagnetic fields (EMF) are current density, specific absorption rate (SAR), and power density. SAR is not easily measurable in living people therefore reference levels have been obtained from the basic restrictions by mathematical modelling and by extrapolation from the results of laboratory investigations at specific frequencies.

The reference levels are provided for comparison with measured values of physical quantities; compliance with all reference levels given in these guidelines will ensure

compliance with basic restrictions. If measured values are higher than reference levels, it does not necessarily follow that the basic restrictions have been exceeded, but a more detailed analysis is necessary to assess compliance with the basic restrictions.

Frequency Range	E – Field Strength (Vm^{-1})	H – Field (Am^{-1})	B – Field (μT)	Equivalent plane wave power S (Wm^{-2})
up to 1 Hz	-	1.63×10^5	2×10^5	-
1 – 8 Hz	20,000	$1.63 \times 10^5/f^2$	$2.5 \times 10^5/f^2$	-
8 – 25 Hz	20,000	$1.63 \times 10^5/f$	$2.5 \times 10^4/f$	-
0.025 – 0.82 kHz	$500/f$	$20/f$	$25/f$	-
0.82 – 65 kHz	610	24.4	30.7	-
0.065 – 1 MHz	610	$1.6/f$	$2.0/f$	-
1 – 10 MHz	$610/f$	$1.6/f$	$2.0/f$	-
10 – 400 MHz	61	0.16	0.2	10
400 – 2000 MHz	$3f^{1/2}$	$0.008f^{1/2}$	$0.01f^{1/2}$	$f/40$
2 – 300 GHz	137	0.36	0.45	50

Table 1: Reference levels for <u>occupational exposure</u> to time-varying electric and magnetic fields (unperturbed rms values). f in units as indicated in the Frequency Range column.

Frequency Range	E – Field Strength (Vm^{-1})	H – Field (Am^{-1})	B – Field (μT)	Equivalent plane wave power S (Wm^{-2})
up to 1 Hz	-	3.2×10^4	4×10^4	-
1 – 8 Hz	10,000	$3.2 \times 10^4/f^2$	$4 \times 104/f^2$	-
8 – 25 Hz	10,000	$4{,}000/f$	$5000/f$	-
0.025 – 0.8 kHz	$250/f$	$4/f$	$5/f$	-
0.8 – 3 kHz	$250/f$	5	6.25	-
3 – 150 kHz	87	5	6.25	-
0.15 - 1 MHz	87	$0.73/f$	$0.092/f$	
1 – 10 MHz	$87/f^2$	$0.73/f$	$0.092/f$	-
10 – 400 MHz	28	0.16	0.092	2
400 – 2000 MHz	$1.375f^{1/2}$	$0.0037f^{1/2}$	$0.0046f^{1/2}$	$f/200$
2 – 300 GHz	61	0.16	0.20	10

Table 2: Reference levels for <u>general public exposure</u> to time-varying electric and magnetic fields (unperturbed rms values). f in units as indicated in the Frequency Range column.

Simultaneous Exposure to Multiple Frequency Fields (Total Exposure Quotients)

ICNIRP has specified a means of assessing additivity of exposures in situations of simultaneous exposure to fields of different frequencies. Additivity is examined separately for the effects of electrical and thermal stimulation, and ICNIRP has set out basic restrictions which should be met for both considerations.

For practical application of the basic restrictions, ICNIRP has advised that the following criteria[13] regarding reference levels of field strengths should be applied:

Induced Current Density and Electrical Stimulation

For induced current density and electrical stimulation effects, relevant up to 10 MHz, the following two requirements should be applied to the field levels:

$$\sum_{i=1\ \mathrm{Hz}}^{1\ \mathrm{MHz}} \frac{E_i}{E_{L,i}} + \sum_{i>1\ \mathrm{MHz}}^{10\ \mathrm{MHz}} \frac{E_i}{a} \leq 1,$$

and

$$\sum_{j=1\ \mathrm{Hz}}^{65\ \mathrm{kHz}} \frac{H_j}{H_{L,j}} + \sum_{j>65\ \mathrm{kHz}}^{10\ \mathrm{MHz}} \frac{H_j}{b} \leq 1,$$

where

E_i = the electric field strength at frequency i;

$E_{L,i}$ = the electric field reference level from Tables 1 and 2;

Hj = the magnetic field strength at frequency j;

$H_{L,j}$ = the magnetic field reference level from Tables 1 and 2;

a = 610 V m^{-1} for occupational exposure and 87 V m^{-1} for general public exposure; and

b = 24.4 A m^{-1} (30.7 μT) for occupational exposure and 5 A m^{-1} (6.25 μT) for general public exposure.

[13] The calculated values are referred to as '**Total Exposure Quotients'** elsewhere in this report.

Thermal Considerations

For thermal considerations, relevant above 100 kHz, the following two requirements should be applied to the field levels:

$$\sum_{i=100\ \mathrm{kHz}}^{1\ \mathrm{MHz}} \left(\frac{E_i}{c}\right)^2 + \sum_{i>1\ \mathrm{MHz}}^{300\ \mathrm{GHz}} \left(\frac{E_i}{E_{L,i}}\right)^2 \leq 1,$$

and

$$\sum_{j=100\ \mathrm{kHz}}^{1\ \mathrm{MHz}} \left(\frac{H_j}{d}\right)^2 + \sum_{j>1\ \mathrm{MHz}}^{300\ \mathrm{GHz}} \left(\frac{H_j}{H_{L,j}}\right)^2 \leq 1,$$

where

E_i = the electric field strength at frequency i;

$E_{L,i}$ = the electric field reference level from Tables 1 and 2;

Hj = the magnetic field strength at frequency j;

$H_{L,j}$ = the magnetic field reference level from Tables 1 and 2;

c = $610/f$ V m^{-1} (f in MHz) for occupational exposure and $87/f^{1/2}$ V m^{-1} for general public exposure; and

d = $1.6/f$ A m^{-1} (f in MHz) for occupational exposure and $0.73/f$ for general public exposure.

Annex 3 – Survey Methodology

The purpose of the surveys was to quantify the electromagnetic field (EMF) present at each area and to identify the frequency and intensity (or level) of the principal emissions contributing to the field. The locations of the survey were chosen by ComReg.

Some of the typical emission types encountered when measuring EMF are AM and FM broadcast radio, broadcast television signals, wireless CCTV, mobile radio, emergency services radios, pager base station radios, taxi base station radios, mobile phone base station signals and wireless broadband signals.

Measurements of the non-ionising radiation emissions from the site were conducted in accordance with the methodology outlined in document ComReg 08/51[14], which incorporates many of the measurement methods and procedures outlined in ECC Recommendation (02)04[15].

Surveys were, in most cases, conducted in three stages as follows:

1 Initial Site Survey

At all sites surveyed, initial investigations were carried out using a field strength meter and a broadband probe to find the position of the maximum field strength. The probe used for the initial investigation measured and summed all emissions present in a broad frequency range (typically 100 kHz to 3 GHz).

2 Broadband Measurements

Once the location was identified, the field strength meter and broadband probe were mounted on a non-conductive tripod and the aggregate field strength in Volts per meter was recorded over a period exceeding six minutes.

[14] http://www.comreg.ie/_fileupload/publications/ComReg0851.pdf

[15] ECC REC (02)04 (revised Bratislava 2003, Helsinki 2007), "Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz), published by the European Communications Committee on www.ero.dk.

3 Frequency Selective Measurements

Measurements of emissions at specific frequencies were then carried out at the same location using a spectrum analyser and a range of antennas matched to the frequencies being measured. The spectrum analyser was set to sweep a frequency range continuously for a period of up to six minutes and the results were stored in the spectrum analyser.

This procedure was repeated at different frequency ranges until the electromagnetic fields at all relevant frequencies were recorded. The results were later transferred to a computer for analysis and comparison with the ICNIRP general public guideline levels.

Annex 4 – Measurement of Electromagnetic Fields

Electromagnetic fields can be sub-divided into two components:

(1) Electric field **E** [measured in Volts per metre or V/m]

(2) Magnetic field **H** [measured in Amperes per metre or A/m]

The E-field and the H-field are mathematically interdependent[16] in the **far-field** which is the region[17] where the distance from the radiating antenna exceeds the wavelength of the radiated electromagnetic field. The measurement locations for most transmitter installations lie well within the far-field, as the wavelengths of the transmitted signals are relatively short and the antennas are typically located many metres from any public area. The following table shows wavelengths for commonly transmitted signals:

Transmitter Type	Frequency	Wavelength
PMR Low Band VHF	68 MHz	4.41 m
UHF TV	470 MHz	0.64 m
GSM 900 (mobile phone base)	925 MHz	0.32 m
GSM 1800 (mobile phone base)	1805 MHz	0.17 m
UMTS (mobile phone base)	2110 MHz	0.14 m

In the far-field only one component needs to be measured, as the other component can be easily derived from it. Normally it is only the electric field which is measured in this region.

In the case of transmitters of very long wavelength signals, such as long wave radio (1.19 km wavelength), the H-field and E-field must be measured separately as the point of measurement will most likely lie within the **reactive near-field** region. This is the region located less than one wavelength from the radiating antenna. Here, the

[16] $E = H \times Z_0$ where Z_0 (characteristic impedance of free space) $\approx 377\ \Omega$

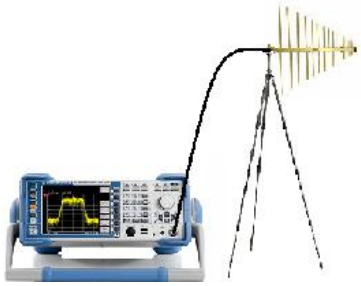
[17] Beyond a distance of $\lambda + 2D^2/\lambda$ where λ is the wavelength and D is the antenna's largest dimension

relationship between E and H becomes very complex and there is no direct correlation between both components of the electromagnetic field.

Measurement Equipment

The measurement of electromagnetic fields is a complex process which involves the use of various meters, spectrum analysers, probes and antennas, which are appropriate to the frequencies of the emissions being measured.

The table below shows examples of equipment typically used to measure electromagnetic fields in non-ionising radiation surveys.

<table>
<tr><th>Initial Site Survey and Broadband Measurements</th><th colspan="2">Frequency Selective Measurements</th></tr>
<tr><td> 
</td><td>SPECTRUM ANALYSER WITH TRIPOD MOUNTED ANTENNA CONNECTED
  </td><td>PORTABLE SPECTRUM ANALYSER WITH ANTENNA DIRECTLY CONNECTED
  </td></tr>
<tr><td>Used to measure the overall electric or magnetic field present over a range of frequencies. (e.g. 100kHz to 3GHz)</td><td colspan="2">Spectrum analysers are used to measure individual emissions at specific frequencies. The individual emissions contribute to the overall electromagnetic field. Examples of individual emissions are a TV signal and a mobile phone signal for a particular mobile operator. There may be a number of emissions from different transmitters contributing to the overall electromagnetic field at a particular location.</td></tr>
</table>

Annex 5 – Derivation of Adjusted Levels

In the case of some services an adjusted level is calculated from the measured electric field level and is presented in the relevant frequency selective measurement table for comparison with the applicable emission limit. For a particular measurement, the adjustment may be performed for any or all of the following reasons

(a) to compensate for when the bandwidth of the emission exceeds the maximum resolution bandwidth (RBW) of the spectrum analyser used.

(b) to extrapolate to an estimate of the level of emissions from a transmitter under maximum traffic conditions (e.g. when a mobile phone base station is serving its maximum number of calls and data clients).

(c) to account for the characteristics of emissions with complex signal structures (e.g. PAL TV)

Compensating for the limited measurement resolution of the spectrum analyser

In many cases it is necessary to compensate for the limited measurement resolution of the spectrum analyser, as the bandwidth of the signal measured may be greater than the resolution bandwidth (RBW) of the analyser. For example, a measurement of a digital television signal performed with at an RBW setting of 5 MHz needs to be adjusted upwards by multiplying it by a correction factor in order to account for the energy present within the full 7.61 MHz bandwidth of the signal.

The correction factor is derived as follows:

RBW CORRECTION FACTOR: $K_{RBW} = 10 \times \log_{10} (B_{Signal} / B_N)$ Where B_{Signal} is the signal/emission bandwidth B_N is the noise bandwidth of the analyser filter (for a Gaussian Filter: $B_N \approx 1.1 \times B_{3dB}$)
Example: Measuring a 7.61 MHz DVB-T signal with 5 MHz RBW: B_{Signal} = 7.61 MHz B_{3dB} = RBW = 5 MHz => $B_N = 1.1 \times 5 = 5.1$ $K_{RBW} = 10 \times \log_{10} (7.61 / 5.1) = 1.74$ dB

Extrapolation to Max Traffic Signal Level

In the case of some networks it is necessary to extrapolate to an estimate of the level under maximum traffic from the transmitter. For example, the base stations of mobile telephone networks produce emissions which vary according to the changing volume of calls or data traffic over the course of the day.

In the cases of GSM, TETRA and UMTS (3G), the estimated electric field levels for maximum traffic conditions are extrapolated from the constant pilot channels (BCCH for GSM and TETRA and P-CPICH for UMTS) as follows:

GSM and TETRA:

V/m Calculation	**dB Calculation**
$\mathbf{E_{MAX}} = E_{BCCH} \times \sqrt{n_{channels}}$	$\mathbf{E_{MAX}} = E_{BCCH} + 10\mathrm{Log}_{10}(n_{channels})$
$n_{channels}$ includes the BCCH plus the number of traffic channels. If the Number of traffic channels per BCCH is not known, $n_{channels}$ is taken as: **GSM:** 4 **TETRA (Emergency):** 3 **TETRA (Civil):** 2	

UMTS:

V/m Calculation	**dB Calculation**
$\mathbf{E_{MAX}} = E_{UMTS} \times \sqrt{R_{P\text{-}CPICH}}$	$\mathbf{E_{MAX}} = E_{UMTS} + R_{P\text{-}CPICH}$
$R_{P\text{-}CPICH} = P_{MAX} / P_{P\text{-}CPICH}$ The P-CPICH transmits with a constant power typically 10 dB below the maximum possible power (P_{MAX}) for a UMTS signal. Therefore $R_{P\text{-}CPICH}$ = 10 dB $\sqrt{R_{P\text{-}CPICH}} = \sqrt{10} = 3.1623$	

If necessary, as in the case of GSM and TETRA, the frequencies of the pilot channels present have been identified prior to recording the standard frequency selective scan of the band.

Accounting for characteristics of certain complex signals:

In the case of some signals with a complex structure, such as analogue PAL television, it is necessary to apply a correction factor for reasons such as the following:

- to take into account characteristics of the signal shape, which make it difficult to measure an RMS level directly, which is indicative of worst case exposure.

- to derive a level more indicative of the aggregate of emissions attributable to the individual signal components.

Analogue PAL TV

The peak field strength caused by the synch pulses of the picture (luminance) carrier is measured. The field strength from the picture signal is at its highest when a synch pulse is being transmitted.

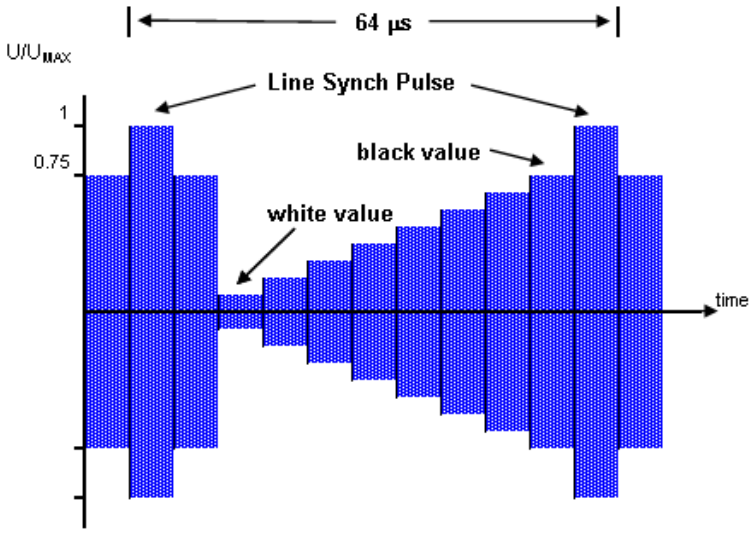


Figure 1: Luminance Signal in the Time Domain

For a black picture, the mean power is 2.5 dB below the peak power (i.e. for a synch pulse). It is assumed that 100% black picture is transmitted permanently for worst case exposure evaluation. The mean (RMS) level for a black picture is then calculated from the peak synch pulse level by applying a correction factor to the peak synch pulse level. The value of this **correction factor** is **-2.3 dB** rather than -2.5 dB, in

order to take into consideration the small contributions of the FM and NICAM sound signal components.

The level for the full PAL signal is thus derived by applying the correction factor to the measurement for the peak luminance signal:

$$\mathbf{E_{PAL}} = E_{LUM} \times k \qquad \text{corr factor } k = -2.3 \text{ dB} = 0.767$$

Annex 6 – Glossary

Antenna: - A conductive structure specifically designed to couple or to radiate electromagnetic energy.

BCCH: - Broadcast control channel. BCCH is a constant carrier on GSM base stations. Essentially it is the 'always on' pilot channel. The constant signal level of the BCCH allows for extrapolation to a maximum traffic signal level for a base station.

Broadband Measurement: - A measurement carried out using a meter and probe combination that simultaneously measures and sums all received signals within the frequency range of the probe. Generally this meter and probe combination is not as sensitive as the equipment used for narrowband measurements but is useful for getting an overall picture of the level of electromagnetic fields present at a site.

ComReg: - The Commission for Communications Regulation. ComReg is the statutory body responsible for the regulation of the electronic communications sector (telecommunications, radiocommunications and broadcasting transmission) and the postal sector in Ireland.

Electric Field Strength: - Electric field strength is a quantitative expression of the intensity of an electric field at a particular location. The standard unit is the Volt per meter (V/m). A field strength of 1 V/m represents a potential difference of one volt between points separated by one meter.

Electromagnetic Field (EMF): - Combined electric and magnetic fields, in this case radiating from an antenna.

Electromagnetic Spectrum: - The complete range of the wavelengths of electromagnetic radiation, beginning with the radio waves and extending through microwaves and visible light (a very small part of the spectrum) all the way to the extremely short gamma rays that are a product of radioactive atoms. The electromagnetic spectrum contains both non-ionizing and ionizing radiation

Frequency: - The number of cycles completed in one second by an electromagnetic wave. It is expressed in Hertz (Hz) or a multiple of Hertz, e.g. kHz (kilohertz, 1,000 Hertz), MHz (MegaHertz, 1,000,000 Hertz) and GHz (GigaHertz, 1,000,000,000 Hertz).

Frequency Range: - A group of frequencies between a selected start and stop frequency. E.g. the frequency range of the FM broadcast band includes all frequencies between 88 and 108 MHz.

Frequency Selective Measurement: - A measurement carried out using a receiver and an antenna which measures the received signal strength at specific frequencies. A spectrum analyser is usually used as the receiver, and a range of antennas is used which are suitable for reception of all the frequencies to be measured.

ICNIRP: - The International Commission on Non-Ionizing Radiation Protection.

Ionising radiation: - Ionising radiation, also called radioactivity, is electromagnetic (EM) radiation whose waves contain energy sufficient to overcome the binding energy of electrons in atoms or molecules, thus creating ions. It occurs at frequencies higher than ultraviolet light and includes x-rays and gamma rays. The sources of electromagnetic fields measured in this survey do not produce any ionising radiation.

Isotropic probe: Receives electromagnetic signals regardless of polarisation or direction of travel. An isotropic probe is designed to give the same reading, no matter which way it is pointed.

Non-ionising radiation (NIR): - Includes all radiations and fields of the electromagnetic spectrum that do not normally have sufficient energy to produce ionization in matter; characterized by energy per photon less than approximately 12 electron Volts, wavelengths greater than 100 nm, and frequencies lower than 3×10^{15} Hz.

Occupational Exposure: - All exposure to EMF experienced by individuals who are exposed under known conditions in the course of performing their work and who are trained to be aware of potential risk and to take appropriate precautions.

Public Exposure: - All exposure to EMF experienced by members of the general public, excluding occupational exposure and exposure during medical procedures.

P-CPICH: - Primary Common Pilot channel. P-CPICH is a downlink channel broadcast by UMTS Node-Bs (i.e. 3G base stations) with constant power. It allows extrapolation to a maximum traffic signal level for a UMTS channel.

Radiofrequency (RF): - For this survey any radio signals between the frequencies 100 kHz to 40 GHz.

Spectrum analyser: - An instrument that displays signal amplitude (strength) as it varies by signal frequency. The frequency appears on the horizontal axis, and the amplitude is displayed on the vertical axis. It can be set to sweep a frequency band where the amplitude of the received signals show up as spikes on the recorded trace.