Report

2007 Programme of Measurement of Non-Ionising Radiation Emissions

Fourth Interim Report

Document No:	08/14
Date:	4th February 2008

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1 Executive Summary

This report is the fourth of four interim reports which outline the programme to measure Non-Ionising Radiation (NIR) at 130 sites nationwide during 2007 and covers the results of the fourth set of sites (35 in total) measured under that programme. Abbreviated versions of the individual site reports are available on the ComReg website[1] as well as on Siteviewer[2], 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.

The programme involves measurement of emission levels at the point of highest emission associated with antenna sites and is fully coordinated and funded by ComReg.

In April 2007, following a competitive tender process, Compliance Engineering Ireland Ltd (CEI) were contracted by ComReg to assist it with its programme of measurements by carrying out Non-Ionising Radiation emission measurements at 120 sites throughout the country.

ComReg arranged for NIR measurements to be conducted at 35 sites during the final quarter of 2007. All of the site surveys were conducted by CEI engineers. On the basis of this work, both CEI and ComReg have concluded that the NIR emissions measured at all of the 35 sites were below the relevant ICNIRP guideline limits[3]. The measurements taken at all the sites are summarised in this report.

[1] www.comreg.ie
[2] www.siteviewer.ie
[3] See Annex 1

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.

As the licensing authority for radiocommunications in Ireland, ComReg is responsible for ensuring that communications operators comply with their licence condition relating to non-ionising radiation. The radiation emissions from licensed radiocommunications sites must be within the levels set down in the latest guidelines issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

This report represents the results of Non-Ionising Radiation measurements taken at the fourth set of 35 sites chosen as part of the current Programme of Measurement of Non-Ionising Radiation emissions. The full programme consists of the measurement of Non-Ionising Radiation emissions at 130 sites throughout the country during 2007. The major part of the programme is being carried out by Compliance Engineering Ireland Ltd on behalf of ComReg.

Sites were surveyed during four periods as follows:

Period	Dates	No. of Sites
First	April 2007	25
Second	May & June 2007	30
Third	July, August & September 2007	40
Fourth	October, November & December 2007	35

For each site, ComReg requires that the measured levels of non-ionising radiation emissions should not exceed the ICNIRP limits in any part of the site or surrounding area to which the general public has access.

The remainder of this report is arranged as follows:

Section 3 outlines the role of ComReg in the area of NIR. It outlines the appointment of Compliance Engineering Ireland Ltd in the programme.

Section 4 contains summaries of the results for each site surveyed as part of the measurement programme. Each site report contains a conclusion on the extent of the compliance of each site with the general public exposure limits of the ICNIRP Guidelines 1998. Abbreviated versions of the individual site reports are to be found on the ComReg website[4]. Copies of the full site reports are available on request.

Section 5 contains the overall conclusions.

Annexes: There are four Annexes as follows:

1. An explanation of Non-Ionising Radiation and an explanation of the International Commission on Non-Ionizing Radiation Protection and the guideline limits associated with that body.

2. A guide to the methodology used in the site measurements.

3. An explanation of the calculation of adjusted field strength levels.

4. An explanation of the Total Exposure Quotient.

[4] www.comreg.ie

3 Background

3.1 What is NIR?

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

3.2 Role of the Commission for Communications Regulation

In 2007 measurements are being taken at 130 sites throughout the country as part of ComReg's Programme of Measurement of Non-Ionising Radiation emissions. The programme is carried out by for the most part by Compliance Engineering Ireland Ltd on behalf of ComReg.

The aim of the programme is to ensure that emissions from radiocommunications sites comply with the general public exposure limits set down by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). A sample of sites is chosen by ComReg, based on population coverage. Some sites nominated by the public have been included if the location is consistent with population coverage. Currently, radiation emissions from communications sites must be within the levels set down in the ICNIRP guidelines.

3.3 Role of Compliance Engineering Ireland Ltd

Following a competitive tender process held in March 2007, Compliance Engineering Ireland Ltd (CEI) was chosen to assist ComReg in carrying out the site measurements. CEI is an Irish registered company which operates an electrical test laboratory in Co. Meath and offers a range of certification services and compliance testing, as well as services such as the monitoring of NIR emissions. CEI will be surveying 120 of the 130 sites in total which are being selected as part of the programme.

4 Summary of Site Reports from the Site Measurement Programme

4.1 Introduction

ComReg arranged for measurements of Non-Ionising Radiation (NIR) to be taken at 130 sites nationwide during 2007.

At each site engineers measure the field strength (electric field voltage) of transmissions in the various radio bands to be surveyed[5] .The results are referenced and presented alongside the relevant International Commission on Non-Ionizing Radiation Protection (ICNIRP) recommended public maximum exposure levels. A summary of the measurements is presented in *subsection 4.3*.

Abbreviated versions of the reports for each site are available in the Non-Ionising Radiation section of the ComReg website as well as on the Siteviewer website, mentioned above. The full versions of the reports are available on request.

[5] See Annex 2 for the site measurement methodology

4.2 Summary of site report results – Explanatory Note

The tables which follow in the next sub-section present a summary of the electric field strength levels measured in the relevant radio frequency bands at each site surveyed. The sites are presented in order by county.

For each site surveyed, the tables show the levels measured in respect of each service (e.g. GSM, UMTS, television etc.) at the point of highest emissions, along with the levels for services from nearby sites, if particularly high.

The tables summarise the results for each site under the following headings:

Frequency Range

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.

Measured Level V/m

The tables show the electric field strength levels measured for each service from the designated site, along with the levels for services from nearby sites, if particularly high. In many instances more than one measured level is shown for each service. 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

In the case of some services, such as GSM and 3G mobile telephony, an Adjusted Level is calculated from the measured electric field strength level. The adjustment is performed in order to account for the characteristics of certain signal types or to extrapolate to an estimate of the level under maximum traffic conditions (e.g. when a mobile phone base station is serving its maximum number of calls). For example, in the case of GSM, the Adjusted Level is extrapolated from the level measured for the always-on 'pilot' channel. For further details concerning the calculation of Adjusted Levels, please refer to Annex 3.

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. 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.

Total Exposure Quotient

In the case of each site, the Total Exposure Quotient is shown. At many sites there is simultaneous exposure to fields of different frequencies (e.g. a GSM900 signal on 953.5 MHz, a GSM1800 signal on 1839.0 MHz and a UMTS signal on 2113.73 MHz). The Total Exposure Quotient is calculated in order to determine whether the combined effect of emissions from multiple licensed radiocommunications installations measured at a particular location satisfies the criteria of the ICNIRP guidelines.

The Quotient is calculated from the electric field strength at each frequency shown in the table and from the relevant ICNIRP Guideline Limit for the particular frequency. The Quotient as shown in the tables is calculated from the Adjusted Levels rather than the Measured Levels, in order to account for total exposure under maximum traffic conditions. In order to satisfy the criteria, the Quotient must be less than or equal to 1. Please refer to Annex 4 for further information concerning the calculation of the Quotient.

4.3 Summary of site report results - Tables

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Douglas Road South Cork	**GSM 900:** 920-960 MHz	0.5405	1.0811	42.5
		0.0036	0.0073	42.1
		0.0032	0.0064	42.3
	GSM 1800: 1805-1880 MHz	0.0139	0.0279	59.7
		0.0028	0.0056	59
		0.0025	0.0049	59.3
	3G: 2110-2170 MHz	0.3580	1.1322	61
		0.2298	0.7266	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00113**
Fermoy Co. Cork *Strawhall*	**GSM 900:** 920-960 MHz	0.3969	0.7938	42.2
		0.2616	0.5232	42.4
		0.0099	0.0198	42.5
	GSM 1800: 1805-1880 MHz	0.2256	0.4512	58.9
		0.0884	0.1768	59
		0.0034	0.0069	59.1
	3G: 2110-2170 MHz	0.2998	0.9481	61
		0.0516	0.1632	61
		0.0046	0.0146	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00082**
Holyhill Cork	**GSM 900:** 920-960 MHz	0.0848	0.1696	42.5
		0.0224	0.0449	42.4
		0.0201	0.0402	42.3
		0.0022	0.0044	42.1
	GSM 1800: 1805-1880 MHz	0.0212	0.0423	58.8
		0.0170	0.0339	59.1
		0.0024	0.0049	59.3
	3G: 2110-2170 MHz	0.0686	0.2171	61
		0.0355	0.1122	61
		0.0059	0.0187	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00003**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Kilrush Co. Clare *Kilkee Rd*	**GSM 900:** 920-960 MHz	0.4436	0.8873	42.1
		0.1321	0.2643	42.5
		0.1095	0.2189	42.4
		0.0888	0.1776	42.2
	3G: 2110-2170 MHz	0.2733	0.8641	61
		0.1593	0.5037	61
		0.1880	0.5944	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00089**
Shercock Co. Cavan *Garda Station*	**GSM 900:** 920-960 MHz	0.0779	0.1558	42.3
		0.0669	0.1339	42.4
		0.0078	0.0155	42.5
	Total Exposure Quotient *(Adjusted Level)*			**0.00002**
Carlow Town Co. Carlow *Strawhill Industrial Estate*	**GSM 900:** 920-960 MHz	0.2048	0.4097	42.3
		0.1474	0.2949	42.4
		0.0044	0.0089	42.1
		0.0043	0.0086	42.5
	GSM 1800: 1805-1880 MHz	0.1711	0.3422	58.9
		0.1710	0.3419	58.9
		0.0113	0.0227	59.6
		0.0031	0.0062	59
	3G: 2110-2170 MHz	0.2919	0.9231	61
		0.0084	0.0266	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00044**
Ballyshannon Co. Donegal *Imperial Hotel*	**GSM 900:** 920-960 MHz	0.4384	0.8767	42.2
		0.4099	0.8198	42.3
		0.3255	0.6510	42.4
		0.3001	0.6003	42.5
	3G: 2110-2170 MHz	0.0860	0.2719	61
		0.0498	0.1575	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00127**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Mountcharles Co. Donegal	**GSM 900:** 920-960 MHz	0.4799	0.9598	42.5
		0.0102	0.0205	42.3
		0.0061	0.0122	42.4
		0.0018	0.0035	42.1
	3G: 2110-2170 MHz	0.0141	0.0446	61
		0.0056	0.0178	61
		0.0042	0.0134	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00051**
Artane Dublin 5 *Malahide Road*	**GSM 900:** 920-960 MHz	0.2159	0.4318	42.3
		0.1077	0.2154	42.4
		0.0753	0.1505	42.1
		0.0071	0.0143	42.5
	GSM 1800: 1805-1880 MHz	0.1101	0.2201	58.9
		0.0795	0.1589	58.9
		0.0289	0.0578	59.4
		0.0266	0.0532	59.3
	3G: 2110-2170 MHz	0.4053	1.2817	61
		0.1802	0.5699	61
		0.0080	0.0253	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00069**
Ballymun Road Dublin 9 *Glasnevin Tennis Club*	**GSM 900:** 920-960 MHz	1.3972	2.7943	42.5
		0.3822	0.7643	42.1
		0.1363	0.2727	42.2
	GSM 1800: 1805-1880 MHz	0.0834	0.1669	58.9
		0.0473	0.0945	58.9
	3G: 2110-2170 MHz	0.9538	3.0160	61
		0.1321	0.4178	61
		0.0061	0.0192	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00720**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Crumlin Dublin 12 *Star Bingo*	**GSM 900:** 920-960 MHz	0.4888	0.9776	42.2
		0.2077	0.4155	42.4
		0.1755	0.3511	42.3
		0.0059	0.0118	42.5
	GSM 1800: 1805-1880 MHz	0.1547	0.3093	59.5
		0.1093	0.2186	58.9
		0.0061	0.0123	59.2
	3G: 2110-2170 MHz	0.3533	1.1172	61
		0.2325	0.7352	61
		0.1836	0.5807	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00131**
Drimnagh Dublin 12 *Halfway House*	**GSM 900:** 920-960 MHz	0.2639	0.5279	42.2
		0.1890	0.3780	42.2
		0.0076	0.0152	42.4
		0.0063	0.0125	42.5
	GSM 1800: 1805-1880 MHz	0.0048	0.0095	58.9
		0.0040	0.0080	59
		0.0038	0.0076	59.2
	3G: 2110-2170 MHz	0.1270	0.4015	61
		0.0927	0.2931	61
		0.0106	0.0336	61
		0.0086	0.0271	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00030**
Finglas Dublin 11 *Northern Cross Business Park*	**GSM 900:** 920-960 MHz	0.0170	0.0339	42.1
		0.0160	0.0320	42.3
		0.0151	0.0301	42.6
	GSM 1800: 1805-1880 MHz	0.0215	0.0429	59
		0.0102	0.0205	59.4
		0.0085	0.0169	59.5
	3G: 2110-2170 MHz	0.8159	2.5801	61
		0.2988	0.9450	61
		0.0071	0.0225	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00203**

Site	Frequency Range		Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Fitzgibbon Street Dublin 1 *Garda Station*	**TETRA**		0.0040	0.0070	28
			0.0022	0.0038	28
	GSM 900:	920-960 MHz	0.6543	1.3086	42.5
			0.0116	0.0231	42.3
			0.0079	0.0159	42.1
	GSM 1800:	1805-1880 MHz	0.2995	0.5990	59.4
			0.1065	0.2130	59.1
			0.1019	0.2037	59.2
	3G:	2110-2170 MHz	0.0422	0.0843	58.9
			0.6236	1.9719	61
			0.4829	1.5270	61
	Total Exposure Quotient *(Adjusted Level)*				**0.00275**
Rathmines Dublin 6 *Garda Station*	**GSM 900:**	920-960 MHz	0.4969	0.9938	42.3
			0.4099	0.8197	42.5
			0.3933	0.7865	42.4
			0.2904	0.5807	42.1
	GSM 1800:	1805-1880 MHz	0.1056	0.2113	59.3
			0.1044	0.2088	59.1
			0.1006	0.2012	58.8
			0.0061	0.0122	59.3
	3G:	2110-2170 MHz	0.3522	1.1136	61
			0.1839	0.5816	61
			0.0258	0.0817	61
			0.0180	0.0570	61
	Total Exposure Quotient *(Adjusted Level)*				**0.00192**
Shankill Dublin 18 *Garda Station*	**TETRA**		0.2252	0.3900	28
			0.0003	0.0005	28
	GSM 900:	920-960 MHz	0.2422	0.4844	42.4
			0.2144	0.4288	42.5
			0.0157	0.0314	42.3
	GSM 1800:	1805-1880 MHz	0.2209	0.4418	59.1
			0.2136	0.4271	59.2
			0.0064	0.0128	58.9
	3G:	2110-2170 MHz	0.2929	0.9264	61
			0.0099	0.0313	61
	Total Exposure Quotient *(Adjusted Level)*				**0.00077**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Ballinfoyle Galway	**GSM 900:** 920-960 MHz	0.0154	0.0309	42.3
		0.0096	0.0191	42.2
		0.0061	0.0121	42.6
	GSM 1800: 1805-1880 MHz	0.0043	0.0087	59.1
		0.0040	0.0081	59.3
		0.0035	0.0069	58.9
		0.0025	0.0050	59.5
	3G: 2110-2170 MHz	0.0120	0.0381	61
		0.0114	0.0361	61
		0.0076	0.0240	61
	WiFi: 2400 – 2483.5 MHz	No Signal Detected		
	FWALA 3 GHz: 3510 – 3600 MHz	0.0132	0.0132	61
	FWALA 3 GHz: 3710 – 3800 MHz	No Signal Detected		
	FWALA 10 GHz: 10.154 – 10.287 GHz	No Signal Detected		
	Total Exposure Quotient *(Adjusted Level)*			**0.000002**
Clarinbridge Co. Galway	**GSM 900:** 920-960 MHz	0.0075	0.0151	42.1
		0.0068	0.0136	42.3
		0.0055	0.0110	42.4
		0.0036	0.0071	42.5
	WiFi: 2400 – 2483.5 MHz	No Signal Detected		
	WiFi: 5150 – 5350 MHz	No Signal Detected		
	WiFi: 5470 – 5725 MHz	No Signal Detected		
	Licence-exempt FWA: 5725 – 5875 MHz	No Signal Detected		
	Total Exposure Quotient *(Adjusted Level)*			**0.0000003**
Athy Co. Kildare *Athy Business Campus*	**GSM 900:** 920-960 MHz	0.2387	0.4774	42.3
		0.1111	0.2222	42.4
		0.0902	0.1803	42.1
	GSM 1800: 1805-1880 MHz	0.0803	0.1606	58.9
		0.0180	0.0361	59.1
		0.0154	0.0309	59.4
	3G: 2110-2170 MHz	0.2894	0.9152	61
		0.1756	0.5552	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00049**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Castledermot Co. Kildare *Ard á Laoi*	**GSM 900:** 920-960 MHz	0.2653	0.5306	42.5
		0.0476	0.0953	42.1
		0.0045	0.0091	42.3
	3G: 2110-2170 MHz	0.0452	0.1431	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00017**
Kilkenny Co. Kilkenny *Freshford Road*	**GSM 900:** 920-960 MHz	0.0104	0.0208	42.4
		0.0082	0.0163	42.2
		0.0039	0.0078	42.3
	GSM 1800: 1805-1880 MHz	0.4868	0.9737	59
		0.2804	0.5608	58.8
		0.0090	0.0179	59
	3G: 2110-2170 MHz	0.8313	2.6287	61
		0.6320	1.9984	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00329**
Tuosist Co. Kerry	**GSM 900:** 920-960 MHz	0.1020	0.2041	42.4
		0.0022	0.0045	42.3
		0.0018	0.0036	42.1
	Total Exposure Quotient *(Adjusted Level)*			**0.00002**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Dundalk Co. Louth *Old Dublin Road*	**GSM 900:** 920-960 MHz	0.2938	0.5876	42.5
		0.2117	0.4235	42.2
		0.0873	0.1745	42.1
		0.0703	0.1407	42.4
	GSM 1800: 1805-1880 MHz	0.0470	0.0939	58.8
		0.0421	0.0843	58.9
	3G: 2110-2170 MHz	0.1605	0.5074	61
		0.1186	0.3750	61
		0.0944	0.2987	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00046**
Patrickswell Co. Limerick	**GSM 900:** 920-960 MHz	0.4695	0.9390	42.5
		0.0089	0.0177	42.4
		0.0044	0.0087	42.2
	GSM 1800: 1805-1880 MHz	0.0039	0.0079	59
		0.0038	0.0077	58.9
		0.0032	0.0064	59.1
	3G: 2110-2170 MHz	0.1010	0.3193	61
		0.0092	0.0290	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00052**
Portlaoise Co. Laois *Railway Street*	**GSM 900:** 920-960 MHz	0.3112	0.6225	42.2
		0.2386	0.4772	42.1
		0.0031	0.0063	42.6
		0.0027	0.0055	42.4
	GSM 1800: 1805-1880 MHz	0.1210	0.2421	59.3
		0.1067	0.2133	59.5
		0.0759	0.1517	58.9
		0.0028	0.0057	59
	3G: 2110-2170 MHz	0.1518	0.4802	61
		0.0052	0.0165	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00044**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Ballinrobe Co. Mayo *Garda Station*	**GSM 900:** 920-960 MHz	0.3495	0.6989	42.2
		0.1299	0.2598	42.4
		0.1270	0.2540	42.6
	GSM 1800: 1805-1880 MHz	0.0585	0.1170	58.9
	3G: 2110-2170 MHz	0.2701	0.8543	61
		0.1393	0.4406	61
		0.0945	0.2987	61
		0.0099	0.0315	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00062**
Slane Co. Meath *Garda Station*	**GSM 900:** 920-960 MHz	0.1082	0.2164	42.4
		0.0931	0.1862	42.5
		0.0032	0.0064	42.1
		0.0028	0.0057	42.3
	GSM 1800: 1805-1880 MHz	0.0783	0.1566	59.2
		0.0733	0.1467	59.1
		0.0028	0.0057	58.9
	3G: 2110-2170 MHz	0.4419	1.3975	61
		0.2557	0.8087	61
		0.1192	0.3769	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00080**
Castleblaney Co. Monaghan *Garda Station*	**GSM 900:** 920-960 MHz	0.5255	1.0509	42.4
		0.1051	0.2102	42.3
		0.0876	0.1753	42.5
		0.0167	0.0334	42.2
	GSM 1800: 1805-1880 MHz	0.1962	0.3924	59.2
		0.0795	0.1590	59.3
		0.0037	0.0074	59.7
	3G: 2110-2170 MHz	0.4808	1.5205	61
		0.2874	0.9087	61
		0.2726	0.8621	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00175**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Birr Co. Offaly *Town Centre*	**GSM 900:** 920-960 MHz	0.2151	0.4302	42.2
		0.1060	0.2120	42.4
		0.0526	0.1053	42.5
	GSM 1800: 1805-1880 MHz	0.0507	0.1013	58.9
	3G: 2110-2170 MHz	0.2983	0.9434	61
		0.1140	0.3606	61
		0.0767	0.2425	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00043**
Sligo Town *Eircom Site*	**GSM 900:** 920-960 MHz	0.0721	0.1442	42.3
		0.0592	0.1183	42.4
		0.0053	0.0106	42.5
		0.0041	0.0082	42.2
	GSM 1800: 1805-1880 MHz	0.0508	0.1016	58.9
		0.0466	0.0933	59.1
		0.0429	0.0857	59
	3G: 2110-2170 MHz	0.1991	0.6297	61
		0.0697	0.2204	61
		0.0066	0.0208	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00015**
Cahir Co. Tipperary *Clonmel Road*	**GSM 900:** 920-960 MHz	0.4864	0.9729	42.2
		0.2366	0.4731	42.4
		0.1631	0.3262	42.5
	3G: 2110-2170 MHz	0.6818	2.1559	61
		0.3417	1.0804	61
		0.1474	0.4660	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00234**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Templemore Co. Tipperary *Main Street*	**GSM 900:** 920-960 MHz	0.8474	1.6948	42.1
		0.4524	0.9047	42.2
		0.3406	0.6811	42.4
		0.0118	0.0237	42.5
	3G: 2110-2170 MHz	0.7369	2.3302	61
		0.0234	0.0741	61
		0.0100	0.0315	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00380**
Ardkeen Waterford *Dunmore Rd*	**GSM 900:** 920-960 MHz	0.5448	1.0896	42.4
		0.2954	0.5908	42.1
		0.1400	0.2800	42.2
	GSM 1800: 1805-1880 MHz	0.1647	0.3295	59.2
		0.0141	0.0281	58.9
		0.0138	0.0276	59
		0.0010	0.0019	59.5
	3G: 2110-2170 MHz	0.1354	0.4283	61
		0.0941	0.2975	61
		0.0608	0.1923	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00102**
Athlone Co. Westmeath *St. Mary's Place*	**GSM 900:** 920-960 MHz	0.1246	0.2493	42.5
		0.1212	0.2424	42.4
		0.0975	0.1950	42.5
		0.0556	0.1111	42.1
	GSM 1800: 1805-1880 MHz	0.0823	0.1646	58.9
		0.0424	0.0848	59
		0.0279	0.0558	59.2
		0.0030	0.0059	59.3
	3G: 2110-2170 MHz	0.3226	1.0201	61
		0.1350	0.4271	61
		0.0702	0.2219	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00045**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Gorey Co. Wexford *Fire Station/ Garda Station*	**GSM 900:** 920-960 MHz	0.0532	0.1064	42.5
		0.0253	0.0507	42.1
		0.0174	0.0348	42.3
	GSM 1800: 1805-1880 MHz	0.0124	0.0248	58.9
		0.0116	0.0232	59
	3G: 2110-2170 MHz	0.9080	2.8714	61
		0.0753	0.2383	61
		0.0121	0.0384	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00224**

5 Conclusion

The conclusion of the site measurements undertaken is that emission levels at all the 35 sites surveyed fall significantly below the international ICNIRP reference levels for general public exposure. Emissions measured from the licensed radiocommunications installations surveyed were found to satisfy the criteria of the ICNIRP Guidelines.

Annex 1 - NIR and ICNIRP

Non-Ionising Radiation (NIR) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP)

Definition

Non-ionising radiation 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.

Standards for emissions limits for 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 for the benefit of people and the environment 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 issued a position paper on the health and safety aspects of NIR. This reviewed both thermal and athermal effects and its conclusion endorsed the 1988 guidelines produced by the International Radiation Protection Association (IRPA).

ComReg's current programme of NIR measurements requires sites to be in compliance with the ICNIRP (1998) guidelines. A summary of the maximum public exposure levels in the ICNIRP Guidelines for the radio systems in this audit are shown in Table 1[7]. It should be noted that in 1999 the Council of the European Union issued a recommendation[8] to limit exposure of the general public to electromagnetic fields 0Hz - 300GHz

[7] See page 20

[8] 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 used by ComReg.

ICNIRP limits

In 1998 ICNIRP published “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz)”. ComReg and a large number of international regulators have adopted the 1998 ICNIRP document as the reference for ensuring that NIR levels do not cause an adverse health effect.

The main purpose of the “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz)” is to provide guidelines for limiting Electromagnetic Field (EMF) exposure that will provide protection against known adverse health effects. An adverse health effect causes detectable impairment of the health of the exposed individual or his or her offspring.

Two classes of guidance are presented:

- Basic Restrictions
- Reference Levels

Basic Restrictions

Restrictions on exposure to time-varying electric, magnetic and electromagnetic fields that are based on health effects are termed “basic restrictions”. Depending upon the frequency of the field, the physical quantities used to specify these restrictions are current density (J), Specific Absorption Rate (SAR), and power density (S). Of these, only power density can be readily measured. Measurement of power density is performed in air, outside the human body, rather than within the living tissue of exposed individuals.

Reference Levels

These levels are provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded. Some reference levels are derived from basic restrictions using measurement and/or computational techniques, and some address perception and adverse indirect effects of exposure to EMF.

Compliance with the reference levels will ensure compliance with the relevant basic restriction. If the measured or calculated value exceeds the reference level, it does not necessarily follow that the basic restriction will be exceeded. However, when a reference level is exceeded, it is necessary to test compliance with the relevant basic restriction and to determine whether additional protective measures are necessary.

The reference levels, taken from the ICNIRP Guidelines[9], appropriate to the frequency range 100 kHz to 40GHz, covered by this report are given in *Table 1* on the following page.

[9] International Commission on Non-Ionizing Radiation Protection,
"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

Table 1: GUIDELINE LIMITS OF NIR FOR MEMBERS OF THE GENERAL PUBLIC

Frequency f (MHz)	Unperturbed RMS Electric Field Strength E (V/m)	Unperturbed RMS Magnetic Field Strength H (A/m)	Equivalent Plane Wave Power Density (mW/cm^2)	Radio Service
0.003 -0.15	87	5	-	
0.15- 1	87	0.73/ f	-	LW and MW Radio Broadcasting
1 - 10	87/ f$^{1/2}$	0.73/ f	-	
10 - 400	28	0.073	0.2	VHF Radio and Television Broadcasting
400 - 2000	1.375f$^{1/2}$	0.0037f$^{1/2}$	f/2000	UHF Television Broadcasting and Mobile Telephony Systems
2000 - 300000	61	0.16	1	Microwave Links, and MMDS

Note: f denotes frequency in MHz

The guideline levels are lowest in the 10 MHz to 400 MHz frequency range as at these wavelengths resonance in parts or all of the body may occur resulting in optimum coupling of the radio frequency energy.

The ICNIRP guidelines require that in instances of simultaneous exposure to multiple sources, the sum of the exposure levels should be considered. In the case of the frequency range 30 MHz to 40 GHz, covered by the narrowband equipment used to generate this report, both the electric field strength and the magnetic field strength at each frequency should be expressed as a fraction of the limit at that frequency and both the sum of the electric field strength fractions squared and the sum of the magnetic field strength fractions squared should not exceed unity.

Annex 2 - Methodology and Measurements

Introduction

Measurements of the non-ionising radiation emissions from each site were conducted in accordance with ECC Recommendation (02) 04. Some departure from this prescribed methodology was taken, but only in order to take into account the particular signal characteristics of certain services (e.g. UMTS and GSM signals having different bandwidths require different measurement bandwidths to be employed in each case)[10]. This is in order to provide a more accurate picture of the signal levels present.

For the purposes of this programme, measurements were carried out at Cellular (Third Generation and GSM Mobile Telephony sites), as well as at Mixed Use sites.

Cellular sites

Cellular sites are sites and locations in Ireland at which electronic communications network transmission facilities and/or infrastructure are located, the primary purpose or sole use of such facilities/infrastructure being to facilitate the provision of mobile telephony services in Ireland. Measurements at these sites were conducted in both the GSM900 and GSM1800 bands as well as the 2110-2200 MHz band currently in use for Third Generation Mobile Telephony.

Mixed use sites

Mixed use sites are sites and locations in Ireland at which electronic communications network transmission facilities and/or infrastructure are located and where such facilities and or infrastructure is not primarily or solely used to facilitate the provision of mobile telephone services in Ireland. The measurements conducted at these sites included all radio

[10] *For example:* ECC REC (02)04 recommends a measurement bandwidth of 100 kHz for both GSM and UMTS. However, measurement bandwidths more appropriate to the actual signal bandwidths of 200 kHz and 5 MHz respectively have been employed.

services which are present at these sites. These services include, GSM, 3G Mobile, Broadcasting, fixed links, MMDS, FWA and Point to Point links, among others.

Methodology

An initial survey of the area was conducted to determine the location(s) of highest non-ionising radiation emissions. This was done by using a broadband probe attached to a field strength meter to identify the position of maximum field strength. The probe used for this initial investigation measured and summed the contributions of all signals in the frequency range 100 kHz to 3 GHz.

Once the locations of the highest field strength emissions were identified the field strength meter and broadband probe were mounted on a non-conductive tripod and the field strength in Volts per meter was recorded for a period exceeding six minutes.

A narrowband survey was 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 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 to the ICNIRP general public guideline levels.

Annex 3 - Calculation of Adjusted Levels

In the case of some services an Adjusted Level is calculated from the measured electric field level. The adjustment is performed in order to account for the characteristics of certain signal types and or to extrapolate to an estimate of the level under maximum traffic conditions (e.g. when a mobile phone base station is serving its maximum number of calls).

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

GSM (dB Calculation)

E_{max} (maximum traffic) = Signal Level (BCCH max) + 10Log(No of channels per sector*)

*number of channels per sector, if not known, should be taken as 4.

UMTS (dB Calculation)

E_{max} (maximum traffic) = Signal Level (P-CPICH) + Extrapolation Factor (=10 dB*)

*The P-CPICH transmits with a constant power typically 10 dB below P_{MAX}. The signal level measured is taken as an estimate of the P-CPICH level.

If necessary, as in the case of GSM, the frequencies of the pilot channels present have been identified prior to recording the standard six minute narrowband scan.

Details concerning the calculation of adjusted electric field levels for other services are available on request from the Commission for Communications Regulation.

Annex 4 - Total Exposure Quotient

A calculation is made of the total quotient for simultaneous exposure to multiple frequency fields at each location where measurements were taken.

At a particular location there may be several services (e.g. GSM and UMTS) operating on different frequencies. In situations of simultaneous exposure to fields of different frequencies, these exposures are additive in their effects. For thermal considerations (as per the ICNIRP Guidelines), in order to make an assessment of these multiple exposures, the total exposure quotient is calculated as follows:

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

where

E_i = the electric field strength at frequency i;

$E_{L,i}$ = the electric field reference limit (ICNIRP) for general public exposure at frequency i;

c = $87/f^{1/2}$ V/m for general public exposure at frequency f.

The Total Exposure Quotient must evaluate to less than or equal to 1, in order to be compliant with the ICNIRP Guidelines.

For further information concerning the assessment of simultaneous exposure to multiple frequency fields, please consult the ICNIRP Guidelines.