Commission for
Communications Regulation

Report

2007 Programme of Measurement of Non-Ionising Radiation Emissions

Third Interim Report

Document No:	07/87
Date:	31st October 2007

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
Abbey Court Irish Life Centre Lower Abbey Street Dublin 1 Ireland
Telephone +353 1 804 9600 *Fax* +353 1 804 9680 *Email* info@comreg.ie *Web* www.comreg.ie

Contents

1 Executive Summary

This report is the third 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 third set of sites (40 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 40 sites during the third 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 40 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 second set of 40 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 are being 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 x 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 has 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
Carrigaline Co. Cork *Briarfield*	**GSM 900:** 920-960 MHz	0.1473	0.2946	42.3
		0.1342	0.2683	42.1
		0.1309	0.2618	42.5
	GSM 1800: 1805-1880 MHz	0.0859	0.1718	58.9
		0.0614	0.1229	59.3
	3G: 2110-2170 MHz	0.2114	0.6684	61
		0.2028	0.6413	61
		0.1581	0.5000	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00044**
Cobh Co. Cork *Cathedral View*	**GSM 900:** 920-960 MHz	0.1692	0.3385	42.4
		0.1659	0.3317	42.1
		0.1416	0.2832	42.5
	GSM 1800: 1805-1880 MHz	0.0061	0.0121	58.9
	3G: 2110-2170 MHz	0.1550	0.4901	61
		0.1306	0.4129	61
		0.0041	0.0130	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00028**
Fermoy Co. Cork *Woodlawns*	**GSM 900:** 920-960 MHz	0.2522	0.5045	42.4
		0.2139	0.4279	42.3
		0.0097	0.0193	42.5
	GSM 1800: 1805-1880 MHz	0.0849	0.1699	58.9
		0.0130	0.0260	59.2
	3G: 2110-2170 MHz	0.2211	0.6993	61
		0.0058	0.0183	61
		0.0040	0.0126	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00038**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Mahon Cork *Avenue des Rennes*	**GSM 900:** 920-960 MHz	0.2555	0.5110	42.3
		0.0121	0.0242	42.1
	GSM 1800: 1805-1880 MHz	0.1389	0.2778	58.9
		0.0062	0.0124	59.3
	3G: 2110-2170 MHz	0.1432	0.4527	61
		0.0207	0.0656	61
		0.0165	0.0523	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00023**
Lisdoonvarna Co. Clare	**GSM 900:** 920-960 MHz	0.3841	0.7682	42.5
		0.0280	0.0560	42.3
		0.0280	0.0560	42.4
	Total Exposure Quotient *(Adjusted Level)*			**0.00033**
Buncrana Co. Donegal *St. Oran's Road*	**GSM 900:** 920-960 MHz	0.1196	0.2392	42.5
		0.0095	0.0189	42.3
	GSM 1800: 1805-1880 MHz	0.1055	0.2110	59.3
		0.0808	0.1616	59.1
	3G: 2110-2170 MHz	0.0060	0.0188	61
		0.0037	0.0116	61
		0.0031	0.0098	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00005**
Milford Co. Donegal	**GSM 900:** 920-960 MHz	0.1138	0.2275	42.5
	GSM 1800: 1805-1880 MHz	0.0165	0.0331	59
		0.0103	0.0207	59
	Total Exposure Quotient *(Adjusted Level)*			**0.00003**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Clondalkin *Dublin 22* *Garda Station*	**GSM 900:** 920-960 MHz	0.2011	0.4022	42.6
		0.1356	0.2712	42.4
		0.0377	0.0754	42.1
	GSM 1800: 1805-1880 MHz	0.2680	0.5360	59.2
		0.2663	0.5326	59.1
		0.0147	0.0294	59.4
	3G: 2110-2170 MHz	0.0631	0.1995	61
		0.0400	0.1264	61
		0.0349	0.1102	61
		0.0027	0.0084	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00031**
Clonskeagh Dublin 14 *Roebuck Road*	**GSM 900:** 920-960 MHz	0.3454	0.6908	42.4
		0.3407	0.6814	42.3
	GSM 1800: 1805-1880 MHz	0.3864	0.7728	58.9
		0.3710	0.7420	59.1
		0.0226	0.0452	59.3
	3G: 2110-2170 MHz	0.3421	1.0817	61
		0.0059	0.0187	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00117**
Glasnevin Dublin 9 *Enterprise Ireland Building*	**GSM 900:** 920-960 MHz	0.0073	0.0146	42.1
		0.0070	0.0140	42.5
		0.0055	0.0110	42.6
	GSM 1800: 1805-1880 MHz	0.0266	0.0532	58.9
		0.0155	0.0310	59
		0.0030	0.0059	59.3
	3G: 2110-2170 MHz	0.0981	0.3102	61
		0.0459	0.1452	61
		0.0030	0.0096	61
		0.0021	0.0068	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00003**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Harold's Cross	**GSM 900:** 920-960 MHz	1.5776	3.1552	42.3
		1.3248	2.6495	42.3
		0.0752	0.1505	42.5
Greyhound Stadium	**GSM 1800:** 1805-1880 MHz	0.2212	0.4423	59
		0.0695	0.1390	59.2
		0.0550	0.1100	59.4
	3G: 2110-2170 MHz	0.3839	1.2140	61
		0.3510	1.1098	61
		0.2664	0.8424	61
		0.0468	0.1479	61
	Total Exposure Quotient *(Adjusted Level)*			**0.01049**
Howth Co. Dublin	**GSM 900:** 920-960 MHz	0.4309	0.8617	42.2
		0.2594	0.5189	42.3
		0.1029	0.2057	42.5
Harbour Road	**GSM 1800:** 1805-1880 MHz	0.2165	0.4330	59.3
		0.1097	0.2194	59.4
		0.0077	0.0153	59.1
	3G: 2110-2170 MHz	0.4092	1.2939	61
		0.3214	1.0165	61
		0.1726	0.5457	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00147**
Lucan Co. Dublin	**GSM 900:** 920-960 MHz	1.8222	3.6444	42.5
		0.7024	1.4048	42.2
		0.2770	0.5540	42.3
Superquinn	**GSM 1800:** 1805-1880 MHz	0.3627	0.7253	59.4
		0.3221	0.6441	59
		0.2183	0.4367	59.2
	3G: 2110-2170 MHz	0.3964	1.2534	61
		0.0081	0.0256	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00938**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Marino Malahide Road *Cherrymount Crescent*	**GSM 900:** 920-960 MHz	0.8641	1.7282	42.5
		0.0971	0.1942	42.6
	GSM 1800: 1805-1880 MHz	0.0128	0.0255	59
		0.0086	0.0172	58.8
		0.0039	0.0078	59.4
	3G: 2110-2170 MHz	0.0129	0.0407	61
		0.0054	0.0171	61
		0.0033	0.0104	61
		0.0032	0.0010	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00168**
Navan Road Dublin 7 *Garda Station*	**GSM 900:** 920-960 MHz	4.1031	8.2062	42.2
		2.8942	5.7884	42.4
		1.4536	2.9072	42.6
	GSM 1800: 1805-1880 MHz	0.4109	0.8218	59.2
		0.4009	0.8017	59.1
		0.2486	0.4972	58.9
	3G: 2110-2170 MHz	0.4291	1.3571	61
		0.2047	0.6473	61
		0.1541	0.4873	61
	Total Exposure Quotient *(Adjusted Level)*			**0.06223**
Rathfarnham Dublin 14 *Garda Station*	**GSM 900:** 920-960 MHz	0.3172	0.6344	42.3
		0.2946	0.5893	42.5
		0.016	0.0319	42.2
	GSM 1800: 1805-1880 MHz	0.3274	0.6548	58.9
		0.3116	0.6232	59
		0.0152	0.0304	59.5
	3G: 2110-2170 MHz	0.2114	0.6684	61
		0.2028	0.6413	61
		0.0495	0.1564	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00089**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Rush Co. Dublin	**GSM 900:** 920-960 MHz	0.3501	0.7003	42.3
		0.0342	0.0684	42.4
		0.0104	0.0208	42.1
	GSM 1800: 1805-1880 MHz	0.0074	0.0147	59.2
	3G: 2110-2170 MHz	0.0327	0.1036	61
		0.0075	0.0237	61
		0.0060	0.0189	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00028**
Salthill Galway *Pearse Stadium*	**GSM 900:** 920-960 MHz	0.0179	0.0358	42.1
		0.0132	0.0263	42.3
		0.0059	0.0118	42.4
	GSM 1800: 1805-1880 MHz	0.0860	0.1721	59
		0.0550	0.1101	58.9
	3G: 2110-2170 MHz	0.1464	0.4630	61
		0.0131	0.0413	61
		0.0019	0.0061	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00007**
Spiddal Co. Galway *Radharc na Rún*	**GSM 900:** 920-960 MHz	0.1854	0.3708	42.1
		0.1470	0.2940	42.4
		0.1369	0.2739	42.4
	3G: 2110-2170 MHz	0.1418	0.4483	61
		0.1254	0.3966	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00026**
Allenwood Co. Kildare	**GSM 900:** 920-960 MHz	4.4572	8.9144	42.1
		0.3314	0.6629	42.5
	3G: 2110-2170 MHz	0.2785	0.8809	61
		0.0503	0.1591	61
		0.0034	0.0107	61
	Total Exposure Quotient *(Adjusted Level)*			**0.04529**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Thomastown Co. Kilkenny	**GSM 900:** 920-960 MHz	0.0473	0.0946	42.4
		0.0125	0.0251	42.5
	3G: 2110-2170 MHz	0.1788	0.5654	61
		0.0081	0.0256	61
Reservoir	**Total Exposure Quotient** *(Adjusted Level)*			**0.00009**
Kenmare Co. Kerry	**GSM 900:** 920-960 MHz	0.1350	0.2700	42.5
		0.0085	0.0169	42.1
		0.0069	0.0138	42.3
Garda Station	**GSM 1800:** 1805-1880 MHz	0.0006	0.0012	59.4
	3G: 2110-2170 MHz	0.0031	0.0098	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00004**
Listowel Co Kerry	**GSM 900:** 920-960 MHz	0.1218	0.2436	42.5
		0.0097	0.0194	42.3
		0.0090	0.0180	42.2
Garda Station	**GSM 1800:** 1805-1880 MHz	0.1527	0.3053	59.2
	3G: 2110-2170 MHz	0.1436	0.4541	61
		0.0228	0.0720	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00012**
Granard Co. Longford	**GSM 900:** 920-960 MHz	0.3560	0.7121	42.5
Garda Station	**3G:** 2110-2170 MHz	0.1224	0.3870	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00032**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Drogheda Co. Louth *Duleek Street*	**GSM 900:** 920-960 MHz	0.3832	0.7664	42.3
		0.3673	0.7346	42.3
		0.0999	0.1998	42.4
	GSM 1800: 1805-1880 MHz	0.1191	0.2381	58.9
		0.0675	0.1349	58.8
		0.0147	0.0294	59.2
	3G: 2110-2170 MHz	0.2214	0.7001	61
		0.0384	0.1214	61
		0.0093	0.0293	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00081**
Abbeyfeale Co. Limerick *Garda Station*	**GSM 900:** 920-960 MHz	0.1486	0.2972	42.5
		0.1443	0.2887	42.1
		0.1227	0.2454	42.4
	GSM 1800: 1805-1880 MHz	0.1241	0.2482	59
		0.0938	0.1875	59
	3G: 2110-2170 MHz	0.1242	0.3928	61
		0.0081	0.0257	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00020**
Thomond Park Limerick	**GSM 900:** 920-960 MHz	0.1718	0.3436	42.2
		0.1272	0.2545	42.5
		0.1159	0.2317	42.1
	GSM 1800: 1805-1880 MHz	0.2062	0.4124	59.1
		0.2031	0.4062	58.9
		0.1547	0.3095	59.3
	3G: 2110-2170 MHz	0.2672	0.8451	61
		0.2232	0.7059	61
		0.0236	0.0746	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00058**
Drumshambo Co. Leitrim *near Carraig Beag*	**GSM 900:** 920-960 MHz	0.1165	0.2329	42.4
		0.0702	0.1404	42.1
		0.0659	0.1317	42.4
	3G: 2110-2170 MHz	0.1402	0.4433	61
		0.1291	0.4083	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00015**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Ballylynan Co. Laois	**GSM 900:** 920-960 MHz	3.0546	6.1091	42.5
		0.0185	0.0371	42.3
		0.0013	0.0026	42.2
	GSM 1800: 1805-1880 MHz	0.0013	0.0027	58.9
	3G: 2110-2170 MHz	0.0635	0.2008	61
		0.0029	0.0093	61
		0.0021	0.0067	61
	Total Exposure Quotient *(Adjusted Level)*			**0.02067**
Claremorris Co. Mayo *Garda Station*	**GSM 900:** 920-960 MHz	0.1257	0.2515	42.3
		0.0804	0.1608	42.4
	3G: 2110-2170 MHz	0.1245	0.3936	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00009**
Westport Co. Mayo *Monastery View*	**GSM 900:** 920-960 MHz	0.1417	0.2835	42.5
		0.0945	0.1891	42.4
		0.0927	0.1854	42.2
	GSM 1800: 1805-1880 MHz	0.0833	0.1667	59.1
		0.0700	0.1401	58.9
		0.0684	0.1367	58.8
	3G: 2110-2170 MHz	0.1258	0.3979	61
		0.1048	0.3315	61
		0.0718	0.2269	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00019**
Clara Co. Offaly	**GSM 900:** 920-960 MHz	0.1969	0.3937	42.4
		0.1263	0.2526	42.2
		0.1273	0.2546	42.1
	3G: 2110-2170 MHz	0.0576	0.1822	61
		0.0555	0.1755	61
		0.0408	0.1289	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00018**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Roscommon Town *Garda Station*	**GSM 900:** 920-960 MHz	0.1294	0.2587	42.4
		0.0861	0.1722	42.2
	GSM 1800: 1805-1880 MHz	0.0042	0.0084	58.9
	3G: 2110-2170 MHz	0.1278	0.4041	61
		0.0388	0.1228	61
		0.0086	0.0273	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00010**
Clonmel Co. Tipperary *Davis Road*	**GSM 900:** 920-960 MHz	0.0295	0.0589	42.1
		0.0198	0.0396	42.4
		0.0046	0.0092	42.5
	GSM 1800: 1805-1880 MHz	0.0074	0.0149	58.9
		0.0074	0.0148	59.2
	3G: 2110-2170 MHz	0.0831	0.2628	61
		0.0663	0.2098	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00003**
Thurles Co. Tipperary *Train Station*	**GSM 900:** 920-960 MHz	0.1936	0.3873	42.9
		0.1302	0.2605	42.1
		0.1429	0.2858	42.3
	GSM 1800: 1805-1880 MHz	0.1262	0.2524	59
	3G: 2110-2170 MHz	0.0967	0.3059	61
		0.0078	0.0246	61
		0.0035	0.0112	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00021**
Lismore Co. Waterford *Garda Station*	**GSM 900:** 920-960 MHz	0.1629	0.3257	42.5
		0.0104	0.0208	42.1
		0.0069	0.0137	42.4
	3G: 2110-2170 MHz	0.0038	0.0119	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00006**

Site	Frequency Range	Measured Level V/m	Adjusted Level V/m	ICNIRP guideline Limit V/m
Rockfield Pk Waterford	**GSM 900:** 920-960 MHz	0.1381	0.2761	42.4
		0.0368	0.0737	42.1
		0.0316	0.0631	42.2
	GSM 1800: 1805-1880 MHz	0.1700	0.3400	59.2
		0.0368	0.0737	58.9
		0.0021	0.0042	59.4
	3G: 2110-2170 MHz	0.1586	0.5016	61
		0.1299	0.4107	61
		0.1158	0.3662	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00023**
Rockfortbridge Co. Westmeath *Rhode Road*	**GSM 900:** 920-960 MHz	0.3582	0.7164	42.3
		0.0830	0.1660	42.4
		0.0279	0.0558	42.4
	3G: 2110-2170 MHz	0.1224	0.3870	61
		1.1583	3.6630	61
		0.8507	2.6902	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00590**
Bray Co. Wicklow *Garda Station*	**GSM 900:** 920-960 MHz	0.6717	1.3434	42.2
		0.1586	0.3173	42.5
		0.0989	0.1979	42.1
	GSM 1800: 1805-1880 MHz	0.1301	0.2601	59.2
		0.1140	0.2280	59.2
		0.0051	0.0103	58.9
	3G: 2110-2170 MHz	0.3372	1.0664	61
		0.0064	0.0202	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00143**
New Ross Co. Wexford *Chambersland Road*	**GSM 900:** 920-960 MHz	0.0848	0.1696	42.1
		0.0121	0.0243	42.4
		0.0087	0.0174	42.6
	GSM 1800: 1805-1880 MHz	0.0859	0.1718	59.1
	3G: 2110-2170 MHz	0.1233	0.3899	61
		0.0489	0.1546	61
		0.0035	0.0112	61
	Total Exposure Quotient *(Adjusted Level)*			**0.00007**

5 Conclusion

The conclusion of the site measurements undertaken is that emission levels at all the 40 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:

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

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.