Commission for
Communications Regulation

Report

2007 Programme of Measurement of Non-Ionising Radiation Emissions

First Interim Report

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1 Executive Summary

This report is the first 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 first 25 sites 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 25 sites in April 2007. 15 of the site surveys were conducted by CEI engineers and 10 by ComReg engineers. On the basis of this work, both CEI and ComReg have concluded that the NIR emissions measured at all of the 25 sites were significantly below the 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 first 25 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 the 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: The Annex section contains two elements which are 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.

[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 reports on 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.

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[6]

The tables which follow over the next several pages show the highest readings measured in the relevant radio frequency bands at each site surveyed.

For each site the tables show the highest electric field strength measured in each frequency band (such as GSM 900, 3G etc) along with the ICNIRP limit which applies to the particular frequency at which the measurement was taken.

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.

[6] See each individual site report for the full set of measurement results

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Bishopstown Co. Cork *Curraheen Road*	30 to 300 MHz	0.0148	28.00
	300 to 1000 MHz	0.0996	42.17
	GSM 900 (925 to 960 MHz)	0.1518	42.19
	1000 – 3000 MHz	0.0811	59.30
	GSM 1800 (1805 to 1880 MHz)	0.1204	59.49
	3G (2110 – 2170 MHz)	0.0005	61.00
Charleville Co. Cork *Rathgoggan Middle*	30 to 300 MHz	0.00036	28.00
	300 to 1000 MHz	0.19411	42.52
	GSM 900 (925 to 960 MHz)	0.03506	42.50
	1000 – 3000 MHz	0.08158	58.98
	GSM 1800 (1805 to 1880 MHz)	0.00982	58.96
	3G (2110 – 2170 MHz)	0.01955	61.00
Mayfield Co. Cork *Old Youghal Road*	30 to 300 MHz	0.0117	28.00
	300 to 1000 MHz	0.3241	42.48
	GSM 900 (925 to 960 MHz)	0.3120	42.46
	1000 – 3000 MHz	0.0011	58.38
	GSM 1800 (1805 to 1880 MHz)	0.0014	58.98

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Mitchelstown Co. Cork *The Square*	30 to 300 MHz	0.00035	28.00
	300 to 1000 MHz	0.40355	42.17
	GSM 900 (925 to 960 MHz)	0.29387	42.17
	1000 – 3000 MHz	0.01477	59.22
	GSM 1800 (1805 to 1880 MHz)	0.00260	59.23
	3G (2110 – 2170 MHz)	0.00107	61.00
Balbriggan Co. Dublin *Garda Station*	30 to 300 MHz	0.00288	28.00
	300 to 1000 MHz	0.32584	42.21
	GSM 900 (925 to 960 MHz)	1.41628	42.17
	1000 – 3000 MHz	0.08663	59.22
	GSM 1800 (1805 to 1880 MHz)	0.16045	59.06
	3G (2110 – 2170 MHz)	0.04743	61.00
Castleknock Dublin 15 *St. Brigid's Church*	30 to 300 MHz	0.00379	28.00
	300 to 1000 MHz	0.62726	42.44
	GSM 900 (925 to 960 MHz)	0.44942	42.55
	GSM 1800 (1805 to 1880 MHz)	0.37484	59.10
	3G (2110 – 2170 MHz)	0.04990	61.00

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Upper Churchtown Road Dublin 14	**GSM 900** (925 to 960 MHz)	0.0238	42.174
	GSM 1800 (1805 to 1880 MHz)	0.0155	59.368
	3G (2110 – 2170 MHz)	0.2965	61.000
Drumcondra Dublin 9 *Skylon Hotel*	30 to 300 MHz	0.0165	28.00
	300 to 1000 MHz	0.0938	42.52
	GSM 900 (925 to 960 MHz)	0.1177	42.47
	1000 – 3000 MHz	0.2057	59.06
	GSM 1800 (1805 to 1880 MHz)	0.1719	59.87
	3G (2110 – 2170 MHz)	0.1277	61.00
Greenhills Industrial Estate Dublin 12	**GSM 900** (925 to 960 MHz)	0.0175	42.439
	GSM 1800 (1805 to 1880 MHz)	0.4479	59.069
	3G (2110 – 2170 MHz)	0.7515	61.000
Monkstown Community Centre Co. Dublin	**GSM 900** (925 to 960 MHz)	1.4305	42.158
	GSM 1800 (1805 to 1880 MHz)	0.0219	59.145
	3G (2110 – 2170 MHz)	0.0047	61.000
Newlands Cross Dublin 22	**GSM 900** (925 to 960 MHz)	0.7384	42.181
	GSM 1800 (1805 to 1880 MHz)	0.8733	58.949
	3G (2110 – 2170 MHz)	0.4216	61.000

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Sandymount Green Dublin 4	155 to 174 MHz	0.00255	28.000
	450 to 470 MHz	0.00481	29.242
	GSM 900 (925 to 960 MHz)	1.41602	42.481
	GSM 1800 (1805 to 1880 MHz)	0.26882	59.484
	3G (2110 – 2170 MHz)	0.08060	61.000
Swords Co. Dublin	30 to 300 MHz	0.01097	28.00
	300 to 1000 MHz	0.18963	42.21
	GSM 900 (925 to 960 MHz)	0.27469	42.17
	1000 – 3000 MHz	0.00724	59.22
	GSM 1800 (1805 to 1880 MHz)	0.04311	59.16
	3G (2110 – 2170 MHz)	0.00147	61.00
Wainsfort Manor Crescent Kimmage Dublin 12	**GSM 900** (925 to 960 MHz)	1.71922	42.187
	GSM 1800 (1805 to 1880 MHz)	0.31912	59.109
	3G (2110 – 2170 MHz)	0.26984	61.000
Courtown Road Kilcock Co. Kildare	30 to 300 MHz	0.00637	28.00
	300 to 1000 MHz	0.00671	29.41
	GSM 900 (925 to 960 MHz)	0.00735	42.37
	1000 – 3000 MHz	0.00396	59.78
	GSM 1800 (1805 to 1880 MHz)	0.00052	59.09
	3G (2110 – 2170 MHz)	0.00187	61.00

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Newbridge Co. Kildare *Highfield Estate*	30 to 300 MHz	0.01097	28.00
	300 to 1000 MHz	0.16079	42.48
	GSM 900 (925 to 960 MHz)	0.16197	42.42
	1000 – 3000 MHz	0.11900	59.38
	GSM 1800 (1805 to 1880 MHz)	0.16644	59.48
	3G (2110 – 2170 MHz)	0.01942	61.00
Sallins Co. Kildare *Train Station*	**GSM 900** (925 to 960 MHz)	0.01752	42.21
	GSM 1800 (1805 to 1880 MHz)	0.28160	59.00
	3G (2110 – 2170 MHz)	0.13457	61.00
Cresent Shopping Centre Dooradoyle Limerick	30 to 300 MHz	0.00882	28.00
	300 to 1000 MHz	0.04924	42.60
	GSM 900 (925 to 960 MHz)	0.05031	42.50
	1000 – 3000 MHz	0.01210	58.90
	GSM 1800 (1805 to 1880 MHz)	0.01187	59.23
	3G (2110 – 2170 MHz)	0.00253	61.00
Garryowen Limerick *Claughan Road South*	30 to 300 MHz	0.08934	28.00
	300 to 1000 MHz	0.15520	42.48
	GSM 900 (925 to 960 MHz)	0.15864	42.44
	1000 – 3000 MHz	0.07966	59.14
	GSM 1800 (1805 to 1880 MHz)	0.02216	59.22
	3G (2110 – 2170 MHz)	0.00780	61.00

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Ashbourne Garda Station Co. Meath	30 to 300 MHz	0.00322	28.00
	300 to 1000 MHz	0.66184	42.32
	GSM 900 (925 to 960 MHz)	0.44751	42.30
	1000 – 3000 MHz	0.07080	58.98
	GSM 1800 (1805 to 1880 MHz)	0.09506	58.96
	3G (2110 – 2170 MHz)	0.06363	61.00
Dunboyne Co. Meath *Kilbrana Rd*	**GSM 900** (925 to 960 MHz)	0.14980	42.328
	GSM 1800 (1805 to 1880 MHz)	0.08240	58.885
	3G (2110 – 2170 MHz)	0.09912	61.000
Dunshaughlin Co. Meath *Garda Station*	30 to 300 MHz	0.00231	28.00
	300 to 1000 MHz	0.13524	42.40
	GSM 900 (925 to 960 MHz)	0.26678	42.41
	1000 – 3000 MHz	0.02889	58.06
	GSM 1800 (1805 to 1880 MHz)	0.01224	59.35
	3G (2110 – 2170 MHz)	0.08203	61.00
Bray Dart Station Co. Wicklow	155 to 175 MHz	0.00258	28.000
	450 to 470 MHz	0.03717	29.366
	GSM 900 (925 to 960 MHz)	0.54321	42.432
	GSM 1800 (1805 to 1880 MHz)	0.19584	58.865
	3G (2110 – 2170 MHz)	0.17880	61.000

Site	Frequency Range	Highest reading V/m	ICNIRP guideline Limit V/m
Enniskerry Garda Station Co. Wicklow	**GSM 900** (925 to 960 MHz)	0.75973	42.465
	GSM 1800 (1805 to 1880 MHz)	0.01345	58.937
	3G (2110 – 2170 MHz)	0.01712	61.000
Tobar Bán Estate off Mulgannon Rd Wexford Town *Eircom Site*	30 to 300 MHz	0.02300	28.00
	300 to 1000 MHz	0.10242	42.40
	GSM 900 (925 to 960 MHz)	0.12374	42.39
	1000 – 3000 MHz	0.04948	58.14
	GSM 1800 (1805 to 1880 MHz)	0.05097	58.85
	3G (2110 – 2170 MHz)	0.01432	61.00

5 Conclusion

The conclusion of the site measurements undertaken is that emission levels at all the sites measured fall significantly below the international ICNIRP general exposure levels. In some cases the levels are in fact less than one thousandth of the ICNIRP limits.

Annex 1

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