



Commission for  
**Communications Regulation**

## Report

### **2007 Programme of Measurement of Non-Ionising Radiation Emissions**

**0753 / 6 – Ballyjamesduff, Co. Cavan**

***Waterworks***

<b>Site Measurement Date:</b>	<b>31st May 2007</b>
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# 1 SITE DETAILS

Site: Ballyjamesduff Waterworks

Location: At the entrance to Ballyjamesduff Water works

Measurement location details:

Latitude: 53° 52.307'

Longitude: 07° 10.807'

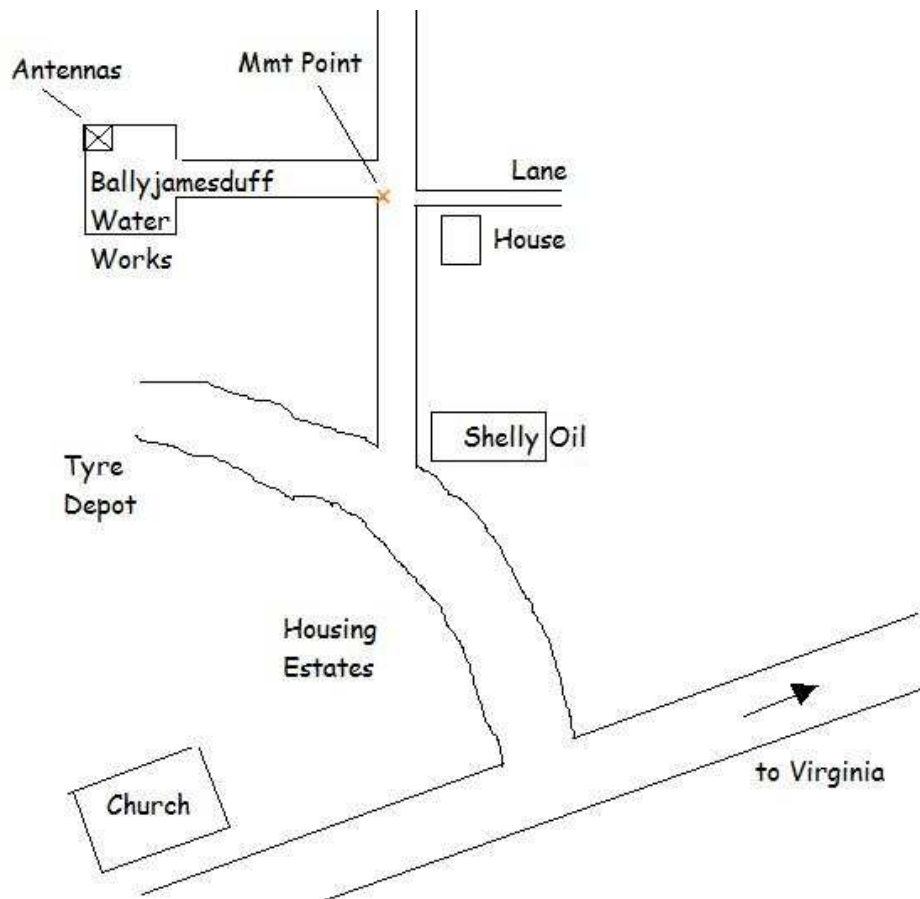
Conditions: Cloudy, Overcast, Raining

Temperature: 15°C

Relative Humidity: 39%

Date: 31<sup>st</sup> May 2007

Engineer: Paul Reilly



Map 1: Sketch of Measurement Location

## **2 INITIAL SITE SURVEY**

An initial survey was carried out in the area around the designated site to determine the point of maximum non-ionizing radiation (NIR). All areas recorded low levels of NIR.

For this initial survey a calibrated field strength meter fitted with a 3 GHz isotropic probe was used.

The location for the EMF survey was chosen at the entrance to Ballyjamesduff waterworks.

## **3 FULL SURVEYS**

Broadband and narrowband surveys were conducted at this location. The measuring instruments, antennas and probes used in the survey were mounted on non-metallic supports for the duration of the survey.

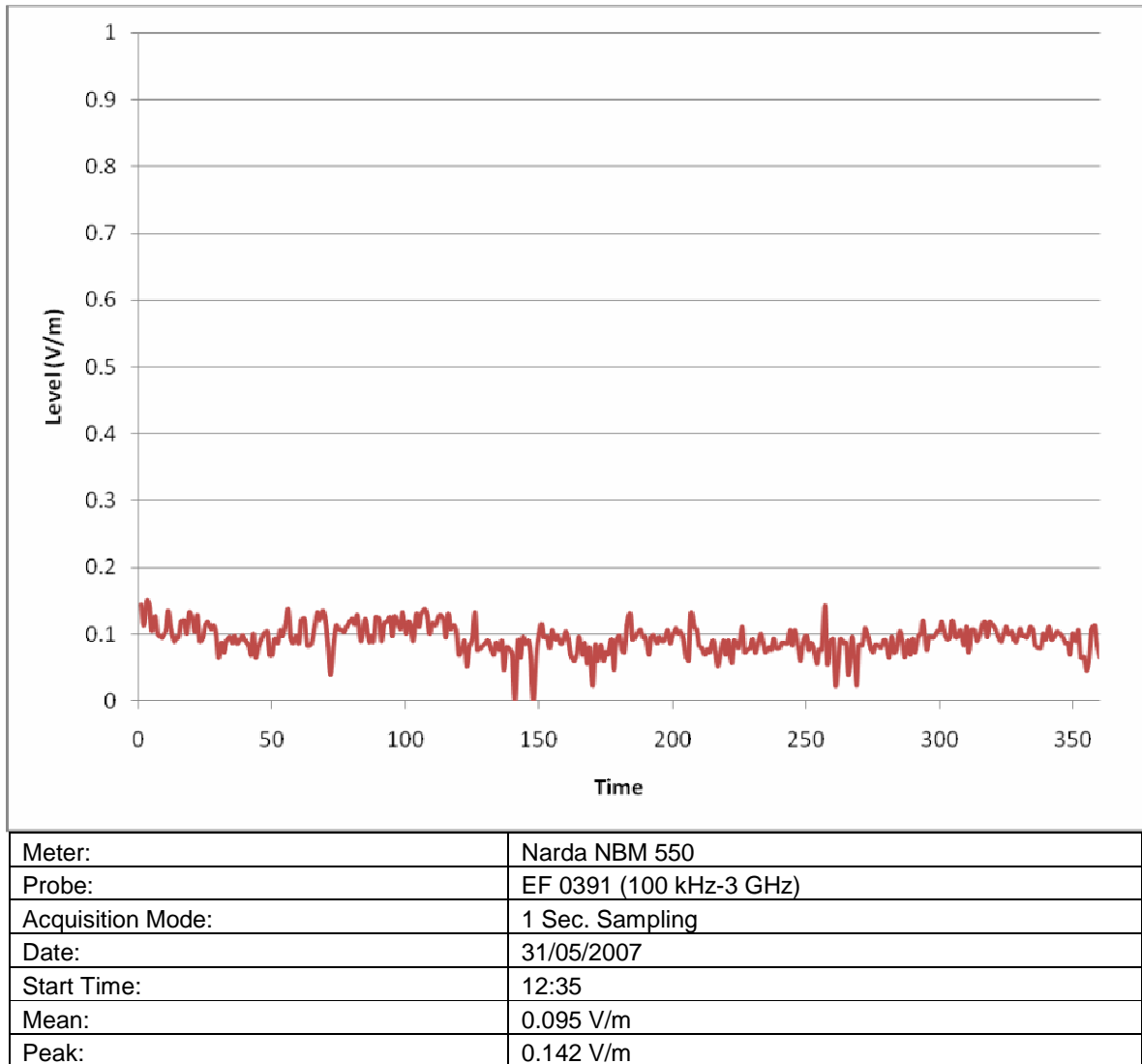
The broadband survey results using the 3 GHz probe include the maximum and average levels in Volts per metre (V/m) recorded in the course of the survey. The ICNIRP guideline limits are frequency dependent so the average and maximum levels can be compared to the lowest maximum general public guideline limit which is 28 V/m.

The narrowband survey results show the NIR levels by frequency in V/m and include the number of times they are below the ICNIRP general public guideline limits which, as already stated, are frequency dependent.

Each measurement was recorded over a six minute period as required by the ICNIRP guidelines.

The results of these surveys are included in this report.

#### 4 BROADBAND SURVEY RESULTS



**Figure 1:** Field strengths recorded over a 6 minute period using the 3 GHz probe at location of full survey.

The average and peak readings were below the ICNIRP general public guideline limit for all frequencies. The lowest maximum ICNIRP guideline limit is 28 V/m.

## 5 NARROWBAND SURVEY

A more detailed survey was performed at the same location. The purpose of this survey was to identify the transmit frequencies and signal strengths of the contributors to the fields at this location. For this survey a spectrum analyser was used with a range of antennas to match the frequencies that were measured.

The table below shows the highest reading measured within each frequency range.

Site	Frequency Range	Highest Reading V/m	General Public Limit
Ballyjamesduff Waterworks	30 to 300 MHz	0.0021	28.00
	300 to 1000 MHz	0.0461	34.30
	925 to 961 MHz	0.0259	42.30
	1000 – 3000 MHz	0.0166	61.00
	2110 to 2170 MHz	0.1567	61.00

**Table 1. Highest readings in each measured frequency range.**

All measurements performed at this site showed that levels of non-ionizing radiation were below the ICNIRP general public guideline limits.

## **Annex**

### **Survey Methodology**

The purpose of this survey was to quantify the electromagnetic fields (EMF) present at an area and to identify the frequency and signal level of the main contributors to these fields.

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

Measurements were carried out in accordance with ECC recommendation (02)04, "Measuring non-ionizing electromagnetic radiation (9 kHz – 300 GHz)".

The locations where the surveys were to be performed were provided by ComReg. Most of the locations were in close proximity to mobile phone base station sites.

#### **Initial survey**

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

#### **Broad band survey**

Once the location was 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 on a laptop computer for a period exceeding six minutes.

The field strength meter was then fitted with a 300 kHz to 40 GHz probe and measurements were recorded at the same location for a further 6 minutes. This probe measured the field strength as a percentage of the permitted exposure allowed by ICNIRP occupational guideline limits. The results were multiplied by a factor of 5 to get the percentage exposure allowed by the ICNIRP general public guideline limits.

#### **Narrow band survey**

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.

## Equipment Details

### Field Strength Meter

Manufacturer: Narda Safety Test Solutions  
Model: NBM-550  
Serial Number: A-0068  
Calibration Date: 15/02/2007

### 3 GHz Probe

Manufacturer: Narda Safety Test Solutions  
Model: EF 0391  
Serial Number: A-0060  
Calibration Date: 21/02/2007

### Spectrum Analyser

Manufacturer: Agilent  
Model: E4408B  
Serial Number: MY41440842  
Calibration Date: 28/04/2006

### Antenna *(30 to 300 MHz)*

Manufacturer: Schwarzbeck Mess-Electronik  
Model: VHA9103 Biconical  
Serial Number: 610

### Antenna *(300 to 1000 MHz)*

Manufacturer: Chase Electronics Ltd  
Model: UPA6108 Log Periodic  
Serial Number: 1072

### Antenna *(1 to 18 GHz)*

Manufacturer: EMCO  
Model: 3115  
Serial Number: 8812-3056

## GLOSSARY

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

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

**ComReg:** - The Communications Regulator for the Republic of Ireland.

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

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

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

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

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

**General Public:** - Individuals of all ages and of varying health status, and may include particularly susceptible groups or individuals.

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

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

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

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

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

**Occupational Exposure:** - Adults who are exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions.

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

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