

**Electromagnetic Emission Survey**  
**at the**  
**Wave Telecom Shop**

Report details:

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## 1 Introduction

This report contains results of an electromagnetic (EM) exposure survey conducted at the Wave Telecom Shop, High Street, St Peter Port, Guernsey on the 18/04/2008 at 2:54pm by Red-M on behalf of the Office of Utility Regulation (OUR) of the Bailiwick of Guernsey.

The report also includes a discussion of relevant scientific information and comparison of the measured field levels with ICNIRP recommendations.

The survey was requested by OUR in order to ascertain licensee compliance with international standards on electromagnetic emissions from radio sites.

## 2 EM Exposure Background

All radio waves are electromagnetic waves, which are composed of electric and magnetic fields. These waves are referred to as 'non-ionising radiation' as distinct from the ionising radiation produced by radioactive sources. We are all regularly exposed to EM radiation from a variety of sources.

Exposure to EM waves is measured in terms of the electric and magnetic field strengths, which are produced by a transmitter at locations, which could be accessed by the public. The electric field strength, E, is measured in volts per meter [ $V.m^{-1}$ ]. The power that could be absorbed by an object at a given location is proportional to the area of the object multiplied by the square of the electric field strength.

In this report, the Exposure Quotient (EQ) is calculated to express the ratio of the measured power density levels (expressed in  $W/m^2$ ) to the ICNIRP Reference power density levels (derived from the Reference field strength levels). The EQ is then summed over all the frequencies in each of the surveyed bands to yield the band exposure quotient as shown in the Survey Results section of this document. A band EQ of 1 (unity) means that the cumulative radiation levels at the surveyed frequency bands has reached or exceeded the ICNIRP Reference level.

The potential health impact of EM fields has been studied for many years by both civil and military bodies. The increase in the usage of mobile phones has caused an increased public concern in this area, with the result that a number of bodies have been set up and tasked with overseeing research into such effects. The conclusions from these investigations are used to set regulatory limits on field exposure which reflect a precautionary principle based on the current state of knowledge.

The key findings of the International Committee on Non-Ionizing Radiation Protection (ICNIRP) are reviewed in the next section.

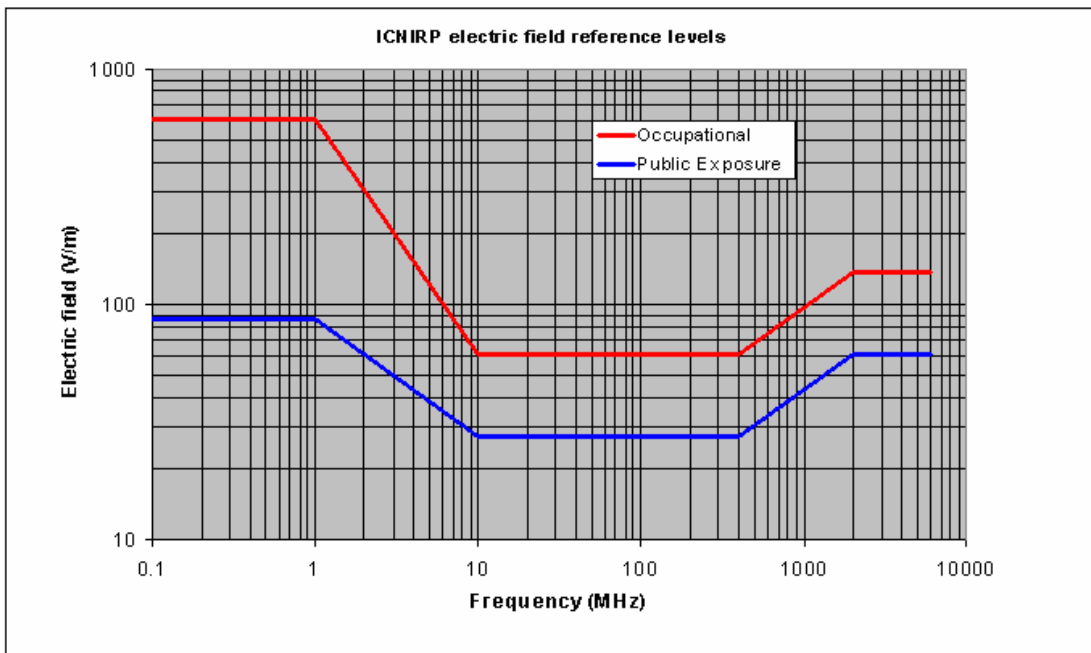
**3 The ICNIRP Guidelines**

ICNIRP is an independent non-governmental scientific organization, for the World Health Organization and the International Labour Office, responsible for providing guidance and advice on the health hazards of non-ionizing radiation exposure.

After examining available research, ICNIRP issued guidelines for exposure limits. The ICNIRP guidelines for the public have been used as a basis for a European Council recommendation on limiting exposure of the public to electromagnetic fields<sup>1</sup> and have been approved by the UK's Health Protection Agency (HPA) in its board recommendation. Reference field strength limits for typical cellular frequencies are shown in the table below. The variation of the reference levels with frequency is shown in the diagram.

ICNIRP Reference Field Strengths, [V <sub>m</sub> <sup>-1</sup> ]	900 MHz	1.8 GHz	>2GHz <300GHz
Field Workers	90	127.3	137
General Public	41.25	58.3	61

**Table 1 – ICNIRP Reference field Strengths**



**Figure 1 - ICNIRP Reference Field Strength Levels versus frequency for public and occupational exposures**

<sup>1</sup> European Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz). *Official Journal of the European Communities*.



## 4 Survey Methodology

EM field levels have been measured in this survey using a carefully designed and controlled methodology. Elements of this methodology include:

1. A peak search around the site performed in order to determine with accuracy the location where the maximum radiation levels are being received. To achieve this, the survey engineer walks in the area surrounding the site along a pre-defined template path, using the hand-held probe and notes the location of maximum reading.
2. Subject to accessibility, walks are limited to a nominal 100m from the site. Generally, stretching up to the point (and slightly beyond) where the peak values are measured.
3. A note of the peak position is made by the engineer.
4. The probe is then positioned on a tripod at the exact location of the maximum radiation level readings and the measurement taken. The height of the probe is approximately 1.5m above the ground.
5. The exact measurement position is recorded using a GPS receiver and photos of the site are taken.

### Equipment detail

The measurements are performed using:

- an isotropic field probe, which reacts to all polarisations (directions) of the electric field, in a similar way to biological tissue.
- a carefully calibrated exposure level meter for all cellular frequencies to ensure that that the measurements are meaningful and accurate.

Description	Type	Barcode ID
Isotropic probe	SRM-3000	H-01016
Spectrum Analyser	SRM-3000SA	K-0019

**Table 2 – Equipment Details**

In instances where field strengths at given frequency bands known to be transmitting at the site were found to be lower than the sensitivity of the probe, Red-M will provide an estimation of the field strength based on the geometry of the antenna location, the transmitter parameters provided by the operator and a theoretical assumption on how the electromagnetic waves would propagate to the ground. This theoretical assumption will consist of a worst-case scenario and would therefore yield the highest possible field strength levels under those assumptions.



## 5 Survey Results

### 5.1 Site Details



**Figure 2 - Map of the Site Area**

<b>Operators</b>	Wave
<b>Site name/ ID</b>	Wave Shop
<b>Site address</b>	High Street, St Peter Port
<b>Site Location</b>	N49.45606 W02.53642
<b>Configuration</b>	Indoor microcell
<b>Approximate height</b>	3.5m
<b>Site type</b>	Indoor
<b>Survey date</b>	18/04/2008
<b>Survey time</b>	2:54pm

The site at the Wave Telecom Shop in the High Street, St Peter Port, Guernsey is in the form of two ceiling mounted microcells and were designed to provide coverage primarily inside the store. The site's antennas are approximately 3.5m high and are Omni directional.

Access to the vicinity of the antennas is open to the public.

**Table 3 – Site Details**

5.2 Photographs



Figure 3 – Antenna Installations on the ceiling



Figure 5 – EM Probe at the Wave Shop – Loc 3 (all peaks)



5.3 Site Sketch

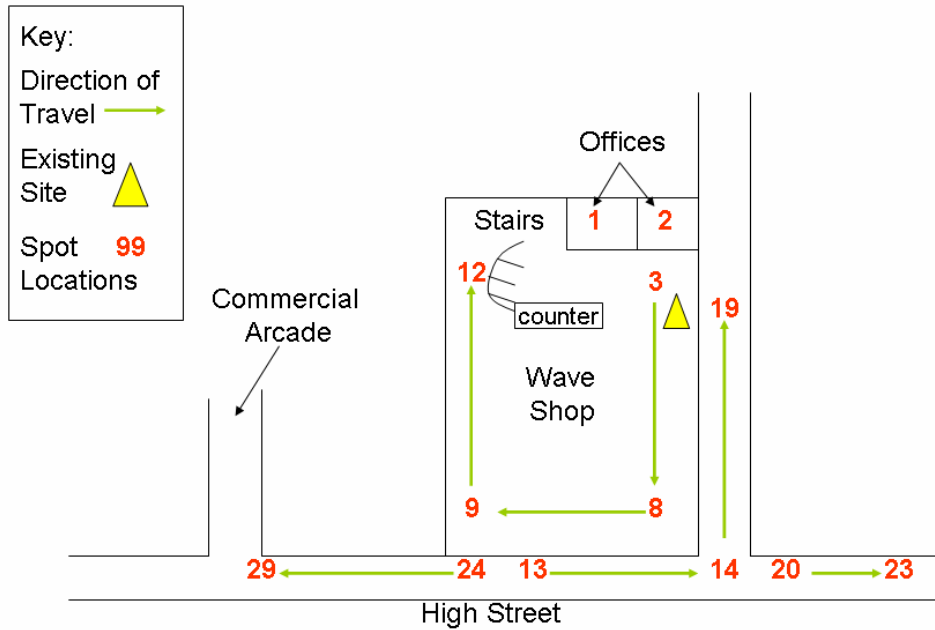


Figure 7 – Survey Area with Spot Measurement Markers

The Peak readings for GSM900, DCS1800, and UMTS were recorded at location 3. The following spectrum scans were taken from this location.

5.4 Results of the electromagnetic exposure survey per operator

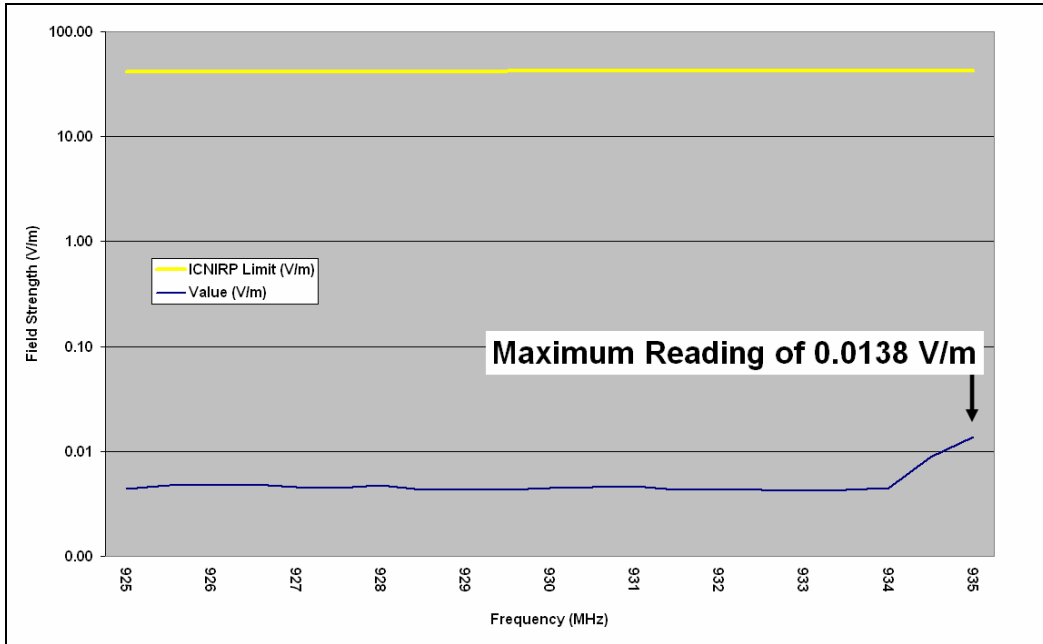
A single operator uses the site: Wave (on 900MHz, 1800MHz, and 2140MHz). Surveys were nonetheless conducted at all three frequency bands (GSM900, DCS1800 and UMTS) and for all three cellular operators as a routine procedure. Only the results for the operators/frequency bands that showed radio signal levels above the metre’s sensitivity are shown in this section.

Note that the results presented in the following tables are accurate to within the rounding precision of the last digit.



**Operator 1: Wave (900MHz)**

The results of the survey at 900MHz (Wave) are given below.



**Figure 8 – Wave Spectrum Scan Graph (900MHz)**

Field strength levels measured at the site are shown on a logarithmic scale in the figure above. The yellow line on the graph represents the ICNIRP Reference levels for the general public for the frequency band under consideration. No field level recorded across the band was higher than 0.0138 V/m, which is 3051 times smaller than the ICNIRP Reference level.

Site name	Max measured field strength [V/m]	ICNIRP Reference Level Relative to Max measured field strength	Band Exposure Quotient	Band Exposure Quotient Relative to ICNIRP
Wave Shop	0.013779	3051	0.000000369	1/ 2711897

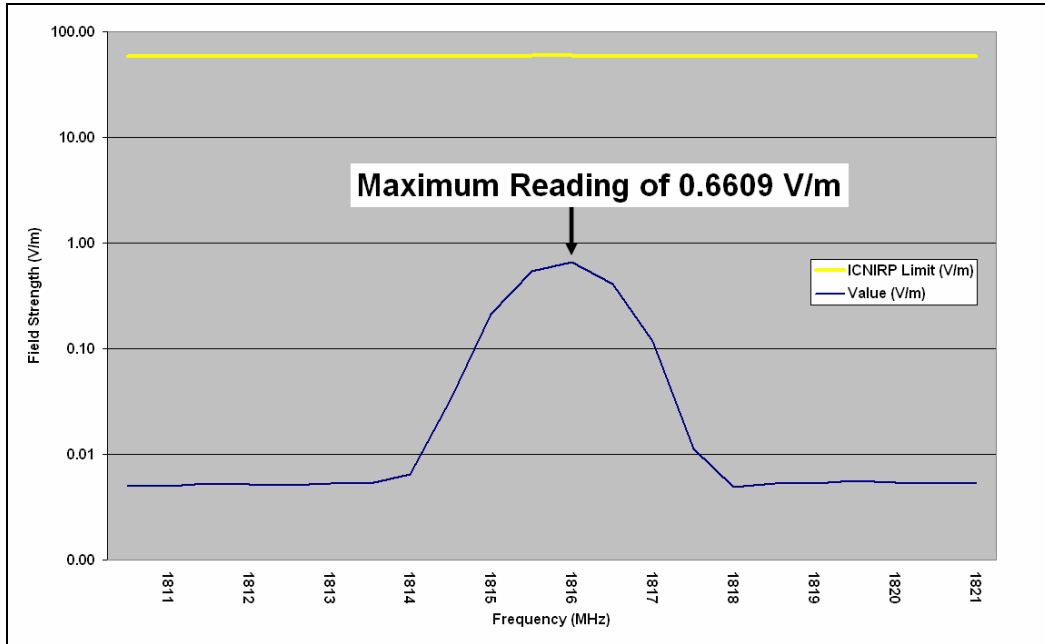
**Table 4 – Wave Spectrum Scan Table (900MHz)**

The exposure quotient over the 900MHz band was calculated from the survey data and found to be equal to 0.000000369, effectively representing a value 1/2711897 times the recommended ICNIRP levels over the band.



**Operator 1: Wave (1800MHz)**

The results of the survey at 1800MHz (Wave) are given below.



**Figure 9 - Wave Spectrum Scan Graph (1800MHz)**

Field strength levels measured at the site are shown on a logarithmic scale in the figure above. The yellow line on the graph represents the ICNIRP Reference levels for the general public for the frequency band under consideration. No field level recorded across the band was higher than 0.6609 V/m, which is 89 times smaller than the ICNIRP Reference level.

Site name	Max measured field strength [V/m]	ICNIRP Reference Level Relative to Max measured field strength	Band Exposure Quotient	Band Exposure Quotient Relative to ICNIRP
Wave Shop	0.660889983	89	0.000277165	1/ 3608

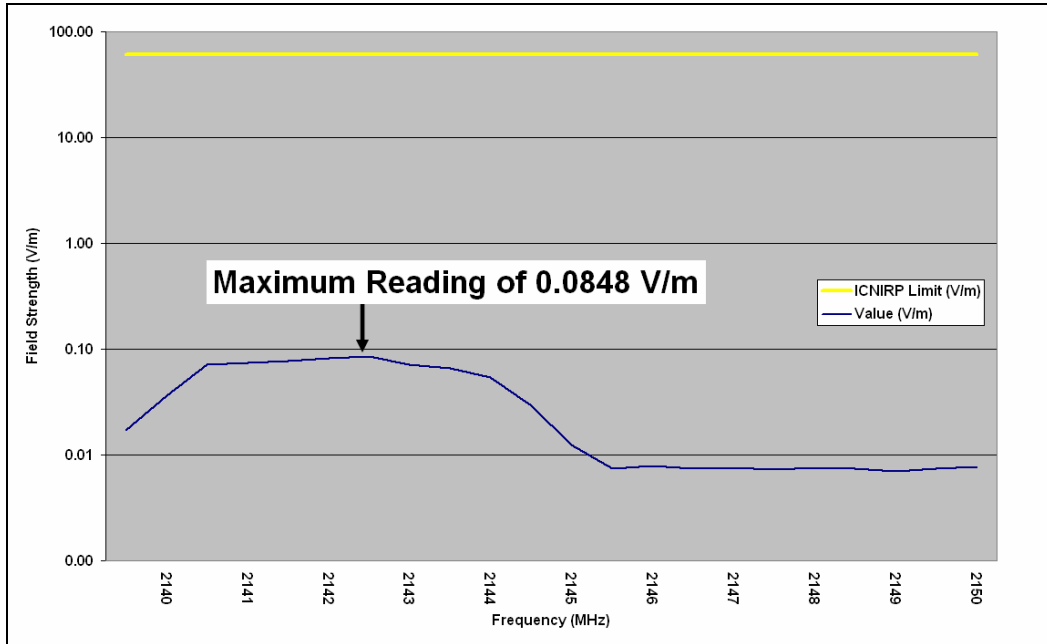
**Table 5 - Wave Spectrum Scan Table (1800MHz)**

The exposure quotient over the 1800MHz band was calculated from the survey data and found to be equal to 0.000277165, effectively representing a value 1/3608.



**Operator 1: Wave (UMTS)**

The results of the survey over the UMTS band (Wave) are given below.



**Figure 10 - Wave Spectrum Scan Graph (UMTS)**

Field strength levels measured at the site are shown on a logarithmic scale in the figure above. The yellow line on the graph represents the ICNIRP Reference levels for the general public for the frequency band under consideration. No field level recorded across the band was higher than 0.0848 V/m, which is 719 times smaller than the ICNIRP Reference level.

Site name	Max measured field strength [V/m]	ICNIRP Reference Level Relative to Max measured field strength	Band Exposure Quotient	Band Exposure Quotient Relative to ICNIRP
Wave Shop	0.084826998	719	0.000012396	1/ 80669

**Table 6 - Wave Spectrum Scan Table (UMTS)**

The exposure quotient over the UMTS band was calculated from the survey data and found to be equal to 0.000012396, effectively representing a value 1/80669.



## 6 Cumulative electromagnetic exposure

The cumulative Exposure Quotient recorded across all detected cellular frequency bands present at the site is given at the bottom of the summary table below.

Frequency band	Operator	Total EQ	Total EQ relative to unity
GSM900	Wave	0.0000004	1/ 2711897
DCS1800	Wave	0.0002772	1/ 3608
UMTS	Wave	0.0000124	1/ 80669
Cumulative EQ		0.0002899	1/ 3449

**Table 9 - Cumulative Exposure Quotient**

The results show that the cumulative EQ was measured at 1/3449 and therefore remains well below the ICNIRP guidelines.

The values shown are the maximum levels that were recorded around the site following a peak search. In most other locations, the levels were lower but it must be stressed that the recorded values are only true at the time of testing.

