Commission for
Communications Regulation

Report

Programme of Measurement of Non-Ionising Radiation emissions

03132 - Golden

Site Measurement Dates:	**28th July 2003** **23rd August 2003** **24th October 2003**

An Coimisiún um Rialáil Cumarsáide
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Contents

1 Introduction

The Commission for Communications Regulation (ComReg) is the licensing authority for the use of the radio frequency spectrum in Ireland. This spectrum is a national resource which has been used for communications purposes for over 100 years. Applications of radio spectrum, today, include the transmission of a wide range of services, including 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 communications sites must be within the levels set down in the latest international guidelines.

The full programme consists of the measurement of Non-Ionising Radiation emissions at 400 sites throughout the country. The programme is being carried out by Mason Communications in conjunction with Radio Frequency Investigations on behalf of ComReg.

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 where the general public have access. Non-ionising radiation is that part of the electromagnetic spectrum below 2420 million MHz. Radiowaves, infra-red radiation and visible light are examples of NIR. (See Annex 1)

This report is arranged as follows:

The first section outlines the role of the ComReg in the area of NIR. It also outlines Mason Communications role in the programme.

The second section is Mason Communications' report on the measurement programme for the site. The site report contains a conclusion on the extent of compliance of the site with the general public exposure limits of the ICNIRP Guidelines 1998.

The Annex section contains two sections which are as follows:

1. An explanation of Non-Ionising Radiation and an explanation of the International Committee for Non-Ionising Radiation Protection and the guideline limits associated with that body.
2. A guide to the methodology used in the site measurements.

There is also a glossary explaining each of the terms used though the report.

2 Background

2.1 Role of the Commission for Communications Regulation

In 2003/2004 measurements of Non-Ionising Radiation emissions are being taken at 400 sites throughout the country in a programme agreed with the Minister for Communications, Marine and Natural Resources, and the Minister for the Environment and Local Government. The programme is being carried out by Mason Communications in conjunction with Radio Frequency Investigations (RFI) on behalf of ComReg.

The aim of the programme is to ensure that emissions from communications sites comply with the general public exposure limits set down by the International Commission for Non-Ionising Radiation Protection (ICNIRP). Some sites have been nominated by the public and the other sites are chosen by Mason/RFI, based on population coverage. Currently, radiation emissions from communications sites must be within the levels set down in the ICNIRP guidelines.

At the outset of the programme, ComReg invited nominations from the interested parties for telecommunication masts to be included. Some thirty sites have been nominated by the public and 25 by the Minister's department. The other sites are chosen on a random basis by Mason/RFI. Both methods of chosing sites are based on population distribution.

2.2 Role of Mason Communications Ltd.

Following a competitive tender process held in early 2003, Mason Communications in conjunction with Radio Frequency Investigations Ltd. were chosen to carry out the site measurements and to produce a report on each site. Mason Communications Ireland Ltd. is a wholly owned subsidiary of Mason Group Ltd. Mason advises many of the leading organisations in the Ireland on converging markets and converging technologies. The management of this programme by Mason Communications involved the services of Radio Frequency Investigations (RFI) Ltd. RFI has been performing Non-Ionising Radiation site surveys since it's formation in 1987. RFI is accredited to ISO

17025, which ensures independence from other bodies that may be involved directly or indirectly in this programme.

3 NIR Site Measurements Conclusion and Results

ComReg has commissioned Mason Communications, as an independent consultancy service, to conduct a survey of 400 sites. Mason Communications and their measuring sub-contractor "Radio Frequency Investigation (RFI) Ltd" will work on the programme throughout 2003 and 2004.

Mason/RFI engineers measure the power density of transmissions in the various radio bands to be surveyed[1]. The results, derived from electric field voltage measurements, are referenced to and presented alongside the relevant International Commission on Non-Ionising Radiation Protection (ICNIRP) recommended public maximum exposure levels.

Section 3.2 provides a set of graphs and tables for each location where measurements were made.

At each location electric field strength measurements, conducted in the frequency bands of interest, are recorded and converted to power density levels for direct comparison with the ICNIRP guideline levels. These power density levels are tabulated alongside the relevant ICNIRP limits. The tables present the highest emission level readings recorded within a band. To the left of each of the results tables, a graphical snapshot of the radio spectrum being analysed is presented.

The power density and the quotient contained in these graphs are given in exponential (E) format. The reason for this is that the value is too long to be represented as a decimal number in the tables. An example of this is as follows:

$3.61469E\text{-}09 = 3.61469 \times 10^{-9} = .00000000361469$

It is therefore very important to note the values after E to identify the highest reading at any site. For each table at each position the highest reading is at the top of the relevant list.

[1] See Annex 2 for the site measurement methodology

3.1 Conclusion of site report results

This site was measured on three different occasions. On the first occasion, 28th July 2003, measurements were taken in the 300MHz – 2GHz frequency range including the GSM readings. On the second occasion, 23rd August 2003, readings were taken in the 10-18Ghz frequency range including the microwave point to point readings. On the third occasion, 24th October 2003, readings were taken in the 30MHz-40GHz frequency range including the GSM and microwave point to point readings. .

The following table is a summary of the highest readings taken at this site on the first occasion:

Site	Frequency Range	Highest reading W/m^2	ICNIRP guideline Limit W/m2
Golden 28/07/2003	300MHz – 1GHz	1.01779×10^{-04}	4.781
	GSM 900	1.17939×10^{-04}	4.75965
	GSM 1800	5.44075×10^{-08}	9.16
	1GHz – 2GHz	5.50375×10^{-08}	9.175

The following table is a summary of the highest readings taken at this site on the third occasion:

Site	Frequency Range	Highest reading W/m^2	ICNIRP guideline Limit W/m2
Golden 24/10/03	30MHz – 300MHz	1.68911×10^{-5}	2
	300MHz – 1GHz	6.00701×10^{-5}	4.79
	GSM 900	5.21986×10^{-5}	4.75965
	GSM 1800	3.24085×10^{-5}	9.7725
	1GHz – 2GHz	1.41143×10^{-7}	9.6

As can be seen from the tables above on no occasion were the emissions from the site above the ICNIRP guideline limits for Non-Ionising Radiation.

3.2 Golden

3.2.1 Introduction

Measurements were taken at the site in Golden on three separate occasions. The first set of results as shown below were taken on the 24th October 2003. These measurements ranged from 30MHz to 40GHz and took place in three different positions in the vicinity of the mast and dwellings in the area. The second set of measurements took place on the 23rd August 2003. These measurements ranged from 10 GHz to 18GHz and were taken near the mast. The third set of results given below pertain to the tests taken on 27th July 2003. These results ranged from 300MHz to 2 GHz.

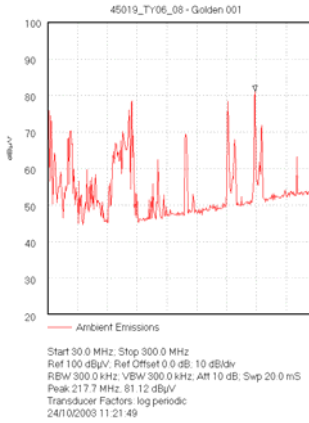
Measurements in frequencies above 2GHz were made to check for emissions above the GSM frequencies bands. These measurements are presented as copies of the output of the spectrum analyser and are shown in section 3.2.4. Mason/RFI has provided an explanation of the output as shown on the analyser for each diagram.

3.2.2 Detailed Results (Frequency range 30MHz – 2GHz) – 24th October 2003

3.2.2.1 Position 8. Golden. Outside House, approximately 100 m South East of mast.

Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 8**		
NGR:	**S04134**	**36337**	**Antenna:** Manufacturer: EMCO Model: 3146A Serial Number 3993
Date:	**24/10/03**		
Officer:	Dan Smith		

30MHz-300MHz



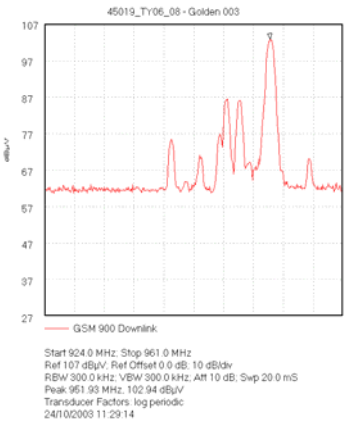
Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
217.7	3.43288E-07	1.0885	3170806.82	3.15377E-07
30.7	2.80969E-07	0.1535	546323.3088	1.83042E-06
106.3	1.91716E-07	0.5315	2772328.05	3.60708E-07
193.4	1.79332E-07	0.967	5392222.749	1.85452E-07
103.6	1.06576E-07	0.518	4860389.903	2.05745E-07
32.7	7.37324E-08	0.1635	2217476.914	4.50963E-07
223.7	3.97794E-08	1.1185	28117541.1	3.5565E-08
50.9	2.81617E-08	0.2545	9037101.017	1.10655E-07
154.9	2.32091E-08	0.7745	33370504.49	2.99666E-08
			Total Quotient	3.52485E-06

300 MHz to 1 GHz

Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
958	6.00701E-05	4.79	79740.11609	1.25407E-05
550.3	1.76872E-07	2.7515	15556463.25	6.4282E-08
945.7	8.33026E-08	4.7285	56762921.99	1.76171E-08
515.3	7.42435E-08	2.5765	34703357.72	2.88157E-08
490.8	4.50463E-08	2.454	54477341.85	1.83563E-08
963.2	2.84223E-08	4.816	169444637.3	5.90163E-09
545	5.19587E-09	2.725	524454549.1	1.90674E-09
496	4.55679E-09	2.48	544243224.5	1.83741E-09
520.5	4.47362E-09	2.6025	581744235.3	1.71897E-09
			Total Quotient	1.26812E-05

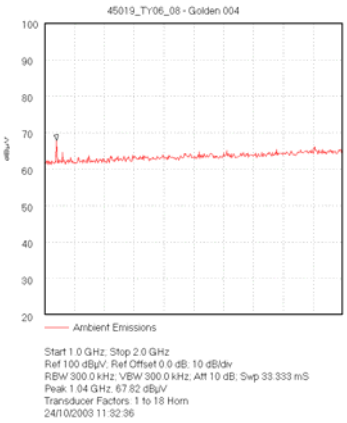
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 8**		
NGR:	**S04134**	**36337**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**24/10/03**		
Officer:	Dan Smith		

GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
951.93	5.21986E-05	4.75965	91183.52312	1.09669E-05
946.66	1.17397E-06	4.7333	4031859.424	2.48025E-07
948.23	1.0781E-06	4.74115	4397694.394	2.27392E-07
939.72	9.23972E-08	4.6986	50852209.15	1.96648E-08
943.24	3.36247E-08	4.7162	140259912.7	7.12962E-09
956.84	2.72683E-08	4.7842	175448911	5.69966E-09
			Total Quotient	1.14748E-05

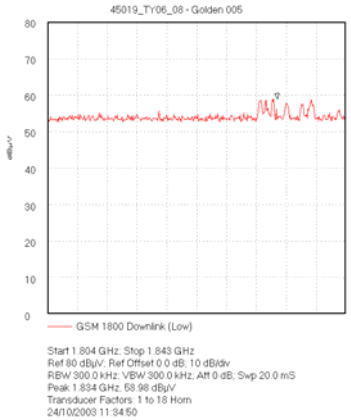
1GHz to 2GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.04	1.60568E-08	5.2	323850590.9	3.08784E-09
			Total Quotient	3.08784E-09

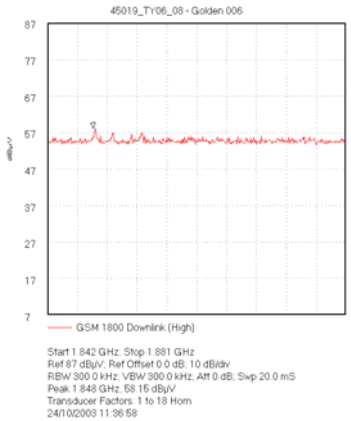
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 8**		
NGR:	**S04134**	**36337**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**24/10/03**		
Officer:	Dan Smith		

1805 – 1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.834	2.09729E-09	9.17	4372307379	2.28712E-10
			Total Quotient	2.28712E-10

1843 – 1880Mhz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.848	1.73244E-09	9.24	5333512551	1.87494E-10
			Total Quotient	1.87494E-10

3.2.2.3 Position 9. Golden. In Field of Transmitter mast, approximately 80 m North West of mast. In line of Sight with Microwave Fixed Link Dish.

Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 9**		
NGR:	**S03888**	**36620**	**Antenna:** Manufacturer: EMCO Model: 3146A Serial Number 3993
Date:	**24/10/03**		
Officer:	Dan Smith		

30MHz – 300MHz

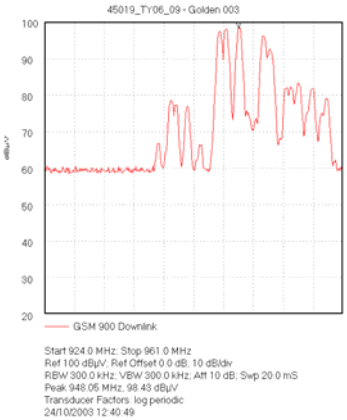
Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
106.3	1.16054E-05	2	172334.1498	5.80268E-06
217	5.30467E-08	2	37702603.94	2.65234E-08
193.4	4.07999E-08	2	49019778.65	2.03999E-08
100.2	1.89958E-08	2	105286174.4	9.49792E-09
102.2	1.78098E-08	2	112297825.3	8.90489E-09
90.7	1.25216E-08	2	159724429.6	6.26078E-09
154.9	9.11294E-09	2	219468070.7	4.55647E-09
223.1	5.87028E-09	2	340699382.1	2.93514E-09
185.3	3.44079E-09	2	581261215.7	1.7204E-09
			Total Quotient	5.88348E-06

300 MHz to 1 GHz

Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
952.7	2.29434E-05	4.7635	207619.2031	4.81651E-06
944	1.79332E-07	4.72	26319846.3	3.79941E-08
513.5	1.63553E-07	2.5675	15698270.29	6.37013E-08
490.8	9.00863E-08	2.454	27240552.3	3.671E-08
902	3.06661E-08	4.51	147067900.3	6.79958E-09
520.5	1.03671E-08	2.6025	251033735.4	3.98353E-09
496	6.81803E-09	2.48	363741648.8	2.7492E-09
			Total Quotient	4.96845E-06

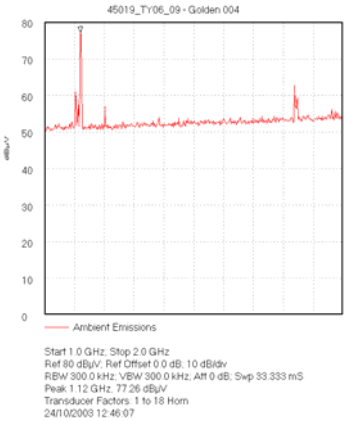
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 9**		
NGR:	**S03888**	**36620**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**24/10/03**		
Officer:	Dan Smith		

GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
948.05	1.84782E-05	4.74025	256532.6202	3.89814E-06
946.48	1.70474E-05	4.7324	277602.1312	3.60228E-06
945.64	1.50196E-05	4.7282	314801.7869	3.1766E-06
951.1	1.1083E-05	4.7555	429079.2731	2.33057E-06
955.45	5.81646E-07	4.77725	8213330.885	1.21753E-07
957.21	4.04258E-07	4.78605	11839097.08	8.44659E-08
958.87	2.166E-07	4.79435	22134569.8	4.51782E-08
939.63	1.91716E-07	4.69815	24505762.99	4.08067E-08
941.67	1.34171E-07	4.70835	35092159.07	2.84964E-08
			Total Quotient	1.33283E-05

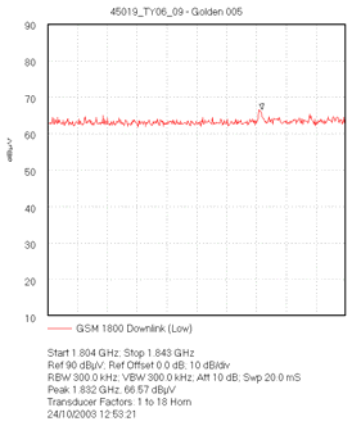
1GHz – 2GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.12	1.41143E-07	5.6	39676136.64	2.52041E-08
1.838	4.95061E-09	9.19	1856337174	5.38695E-10
1.103	3.34702E-09	5.515	1647733104	6.06894E-10
1.203	1.35101E-09	6.015	4452223749	2.24607E-10
			Total Quotient	2.65743E-08

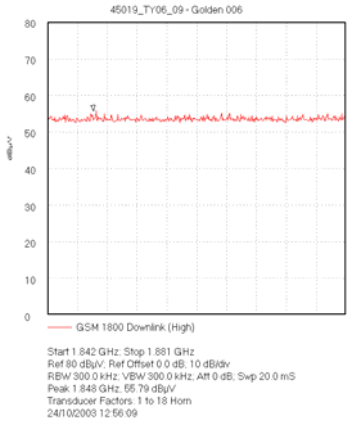
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 9**		
NGR:	**S03888**	**36620**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**24/10/03**		
Officer:	Dan Smith		

1805 – 1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.12	1.41143E-07	5.6	39676136.64	2.52041E-08
			Total Quotient	2.52041E-08

1843 – 1880Mhz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.848	1.00614E-09	9.24	9183607656	1.0889E-10
			Total Quotient	1.0889E-10

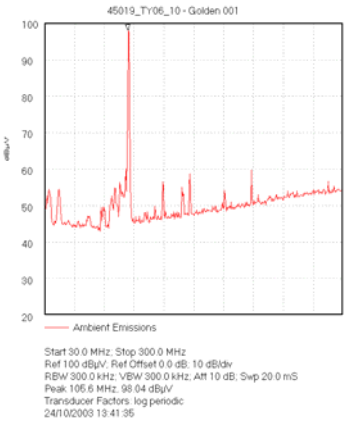
3.2.2.4 **P**osition 10. Golden. In Field, approximately 600 m North West of Mast, in direction of link dish.

Site:	**Golden**	
Location:	**Position 10**	
NGR:	**S03463**	**37218**
Date:	**24/10/03**	
Officer:	Dan Smith	

Receiver:
Manufacturer: Hewlett Packard
Model: 8594A
Serial Number 3108U00205

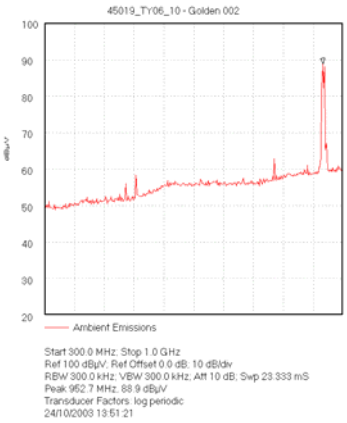
Antenna:
Manufacturer: EMCO
Model: 3146A
Serial Number 3993

30MHz – 300MHz



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
105.6	1.68911E-05	2	118405.3554	8.44556E-06
103.6	2.65863E-09	2	752265848.1	1.32932E-09
217	2.49838E-09	2	800518450.1	1.24919E-09
161.6	1.98453E-09	2	1007793019	9.92267E-10
136.7	1.21244E-09	2	1649572264	6.06218E-10
154.2	8.46562E-10	2	2362497436	4.23281E-10
93.4	8.3111E-10	2	2406419543	4.15555E-10
42.8	7.66759E-10	2	2608382909	3.83379E-10
			Total Quotient	8.45096E-06

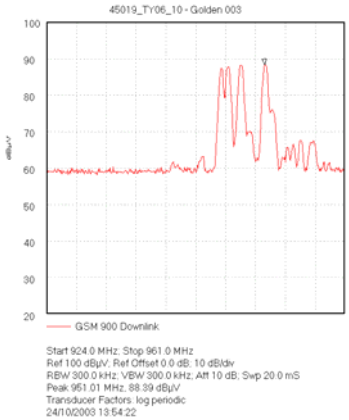
300 MHz to 1 GHz



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
952.7	2.05901E-06	4.7635	2313489.431	4.32247E-07
			Total Quotient	4.32247E-07

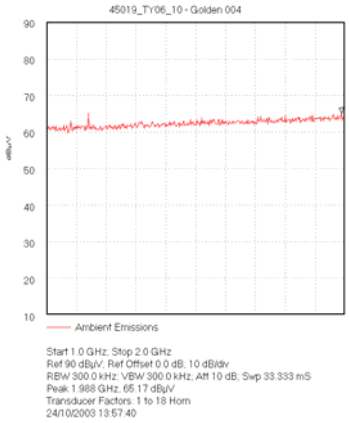
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 10**		
NGR:	**S03463**	**37218**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**24/10/03**		
Officer:	Dan Smith		

GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
951.01	1.83087E-06	4.75505	2597146.441	3.85038E-07
948.05	1.7525E-06	4.74025	2704846.333	3.69707E-07
946.57	1.61309E-06	4.73285	2934026.896	3.40829E-07
945.64	1.47116E-06	4.7282	3213935.738	3.11145E-07
955.45	1.54404E-08	4.77725	309399294.7	3.23207E-09
957.02	1.50542E-08	4.7851	317857430.6	3.14606E-09
954.62	1.2293E-08	4.7731	388277194.9	2.57548E-09
			Total Quotient	1.41567E-06

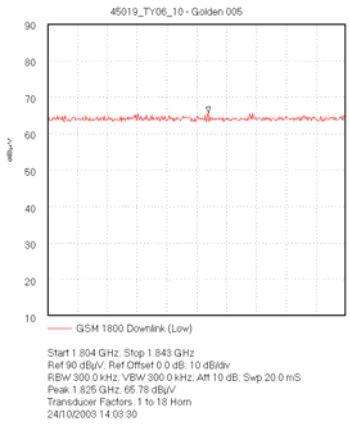
1GHz – 2GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.988	8.72285E-09	9.94	1139535173	8.77551E-10
			Total Quotient	8.77551E-10

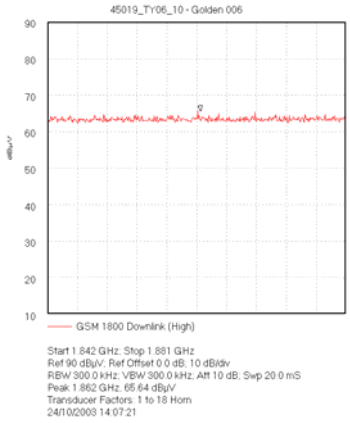
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 10**		
NGR:	**S03463**	**37218**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**24/10/03**		
Officer:	Dan Smith		

1805 – 1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.825	1.00383E-08	9.125	909021642.6	1.10008E-09
			Total Quotient	1.10008E-09

1843 – 1880Mhz



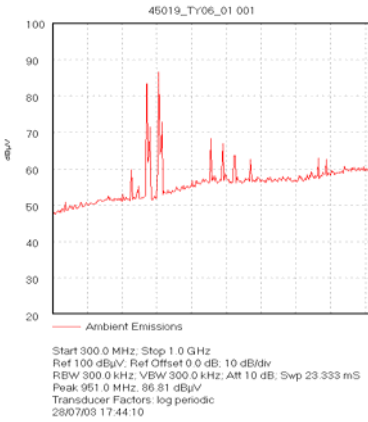
Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.862	9.71983E-09	9.31	957835725.1	1.04402E-09
			Total Quotient	1.04402E-09

3.2.3 Detailed Results (Frequency Range 300MHz – 2GHz) – 28th July 2003

3.2.3.1 Position 1. Golden. Tipperary. 15 m North West of mast. In direction of Microwave Dish.

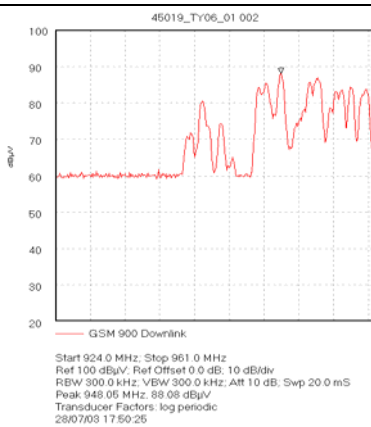
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 1**		
NGR:	**S03946**	**36564**	**Antenna:** Manufacturer: EMCO Model: 3146A Serial Number 3993
Date:	**28/07/03**		
Officer:	Dan Smith		

300 MHz to 1 GHz



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
951	1.2725E-06	4.755	3736731.314	2.67614E-07
513.5	1.20132E-06	2.5675	2137232.661	4.67895E-07
490.8	5.81646E-07	2.454	4219062.011	2.3702E-07
944	5.03105E-07	4.72	9381739.046	1.0659E-07
520.5	5.00793E-08	2.6025	51967531.55	1.92428E-08
496	3.68688E-08	2.48	67265601.65	1.48664E-08
618.5	1.76465E-08	3.0925	175247188.2	5.70623E-09
643	1.29318E-08	3.215	248612137.5	4.02233E-09
665.8	6.04865E-09	3.329	550370497.2	1.81696E-09
			Total Quotient	1.12477E-06

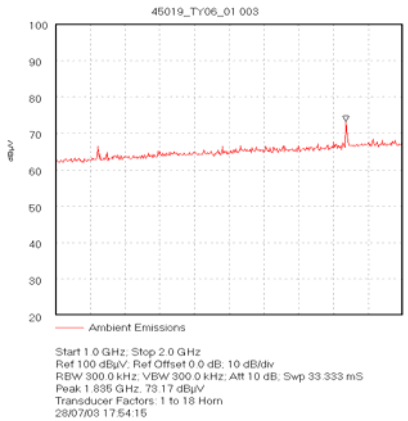
GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
948.05	1.70474E-06	4.74025	2780626.114	3.59631E-07
951.93	1.3233E-06	4.75965	3596800.652	2.78025E-07
946.38	9.15501E-07	4.7319	5168647.426	1.93474E-07
955.36	7.44147E-07	4.7768	6419163.069	1.55784E-07
957.02	6.37762E-07	4.7851	7502955.461	1.33281E-07
954.52	6.1328E-07	4.7726	7782092.473	1.285E-07
939.63	2.98991E-07	4.69815	15713329.91	6.36402E-08
941.57	7.23867E-08	4.70785	65037519.22	1.53757E-08
938.34	3.98711E-08	4.6917	117671579.9	8.49823E-09
			Total Quotient	1.33621E-06

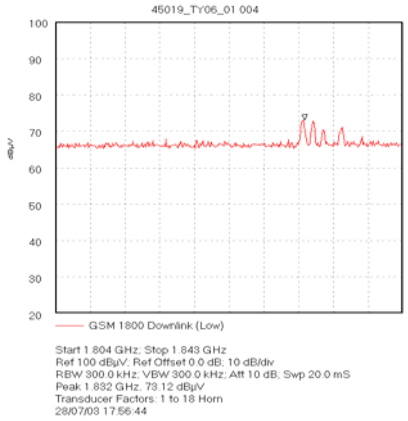
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 1**		
NGR:	**S03946**	**36564**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1GHz to 2 GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.835	5.50375E-08	9.175	166704538.3	5.99864E-09
			Total Quotient	5.99864E-09

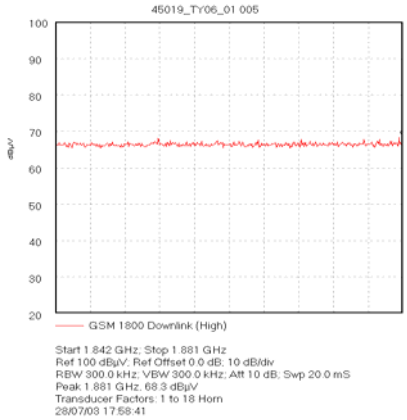
1805-1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.832	5.44075E-08	9.16	168359188.5	5.93968E-09
1.833	5.04265E-08	9.165	181749748.9	5.50207E-09
			Total Quotient	1.14418E-08

Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 1**		
NGR:	**S03946**	**36564**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1843 – 1880MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.881	1.79332E-08	9.405	524445242.5	1.90678E-09
			Total Quotient	1.90678E-09

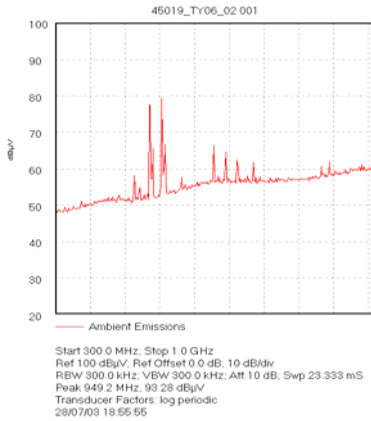
3.2.3.2 Position 2. Golden. Tipperary. Centre of field on top of hill. Approx 50m north-west of mast.

Site:	**Golden**	
Location:	**Position 2**	
NGR:	**S03899**	**36614**
Date:	**28/07/03**	
Officer:	Dan Smith	

Receiver:
Manufacturer: Hewlett Packard
Model: 8594A
Serial Number 3108U00205

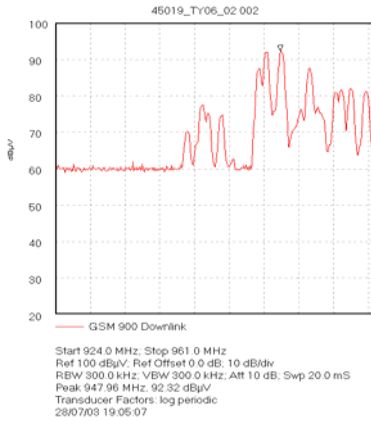
Antenna:
Manufacturer: EMCO
Model: 3146A
Serial Number 3993

300 MHz to 1 GHz



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
949.2	5.64493E-06	4.746	840754.2747	1.18941E-06
954.5	3.99631E-06	4.7725	1194228.104	8.37361E-07
513.5	2.337E-07	2.5675	10986308.82	9.10224E-08
489	1.52988E-07	2.445	15981598.42	6.2572E-08
520.5	1.25504E-08	2.6025	207363392	4.82245E-09
618.5	1.1958E-08	3.0925	258613420.5	3.86678E-09
496	9.54242E-09	2.48	259892071.7	3.84775E-09
643	7.57982E-09	3.215	424152789.4	2.35764E-09
665.8	4.7278E-09	3.329	704133724.5	1.42018E-09
			Total Quotient	2.19668E-06

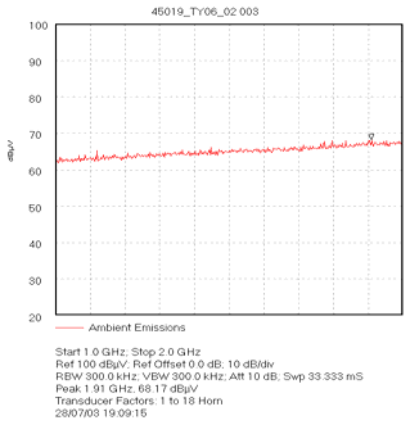
GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
947.96	4.52542E-06	4.7398	1047372.982	9.5477E-07
946.48	4.20396E-06	4.7324	1125700.336	8.88336E-07
951.1	1.5476E-06	4.7555	3072822.939	3.25434E-07
955.36	4.25264E-07	4.7768	11232551.24	8.9027E-08
954.43	3.95967E-07	4.77215	12051897.69	8.29745E-08
957.11	3.52906E-07	4.78555	13560422.11	7.3744E-08
939.63	1.49506E-07	4.69815	31424489.33	3.18223E-08
941.76	7.97368E-08	4.7088	59054309.38	1.69336E-08
938.06	2.80323E-08	4.6903	167317733.2	5.97665E-09
			Total Quotient	2.46902E-06

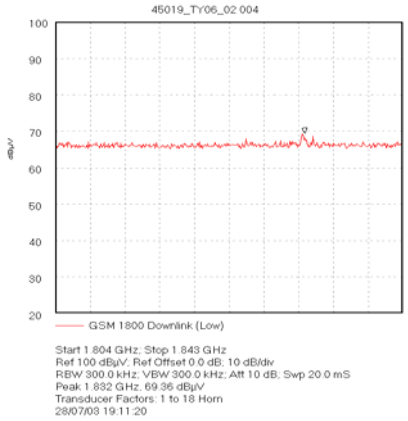
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 2**		
NGR:	**S03899**	**36614**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1GHz to 2 GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.91	1.74044E-08	9.55	548712333.2	1.82245E-09
			Total Quotient	1.82245E-09

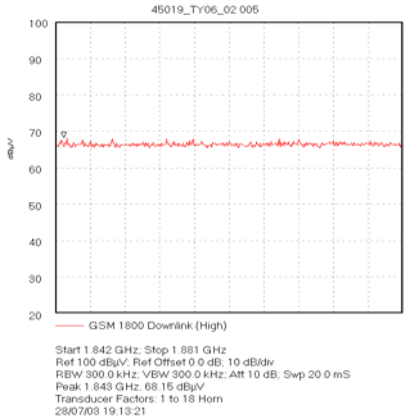
1805-1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.832	2.28907E-08	9.16	400162902	2.49898E-09
			Total Quotient	2.49898E-09

Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 2**		
NGR:	**S03899**	**36614**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1843 – 1880MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.843	1.73244E-08	9.215	531908205.2	1.88002E-09
			Total Quotient	1.88002E-09

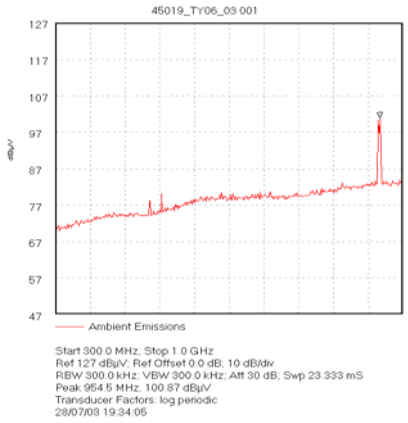
3.2.3.3 Position 3. Golden. Tipperary. Towards bottom of field approx 200m north-west of mast.

Site:	**Golden**	
Location:	**Position 3**	
NGR:	**S03861**	**36672**
Date:	**28/07/03**	
Officer:	Dan Smith	

Receiver:
Manufacturer: Hewlett Packard
Model: 8594A
Serial Number 3108U00205

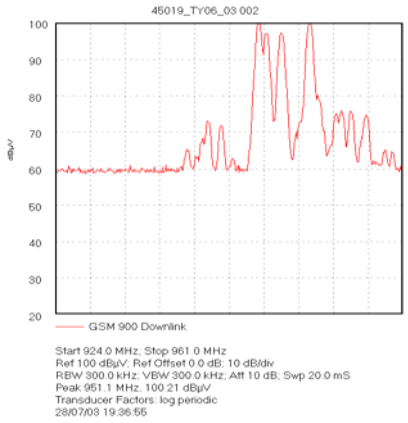
Antenna:
Manufacturer: EMCO
Model: 3146A
Serial Number 3993

300 MHz to 1 GHz



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
954.5	3.24085E-05	4.7725	147260.8447	6.79067E-06
			Total Quotient	6.79067E-06

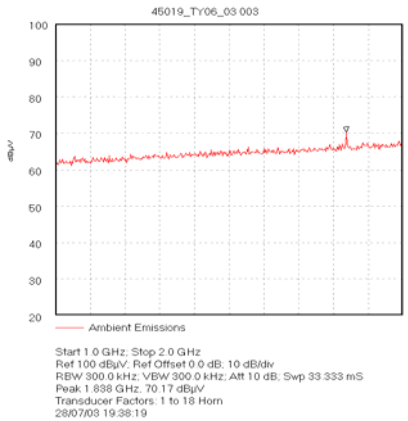
GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
951.1	2.78393E-05	4.7555	170819.5354	5.85413E-06
945.55	2.74574E-05	4.72775	172185.2135	5.8077E-06
947.96	1.40494E-05	4.7398	337366.0426	2.96414E-06
954.43	1.06331E-07	4.77215	44880267.45	2.22815E-08
955.45	1.03195E-07	4.77725	46293425.66	2.16013E-08
957.02	7.90057E-08	4.7851	60566484.78	1.65108E-08
940.19	5.41575E-08	4.70095	86801450.43	1.15205E-08
941.67	4.07999E-08	4.70835	115401137.4	8.66543E-09
			Total Quotient	1.47066E-05

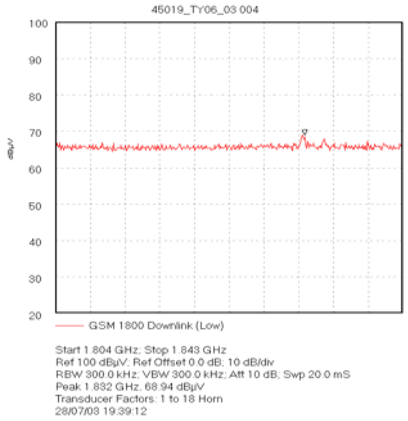
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 3**		
NGR:	**S03861**	**36672**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1GHz to 2 GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.838	2.75841E-08	9.19	333163074.8	3.00153E-09
			Total Quotient	3.00153E-09

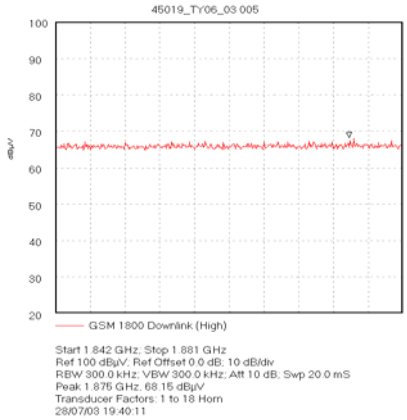
1805-1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.833	5.04265E-08	9.165	181749748.9	5.50807E-09
			Total Quotient	5.50807E-09

Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 3**		
NGR:	**S03861**	**36672**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1843 – 1880MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.875	1.73244E-08	9.375	541143724.7	1.84794E-09
			Total Quotient	1.84794E-09

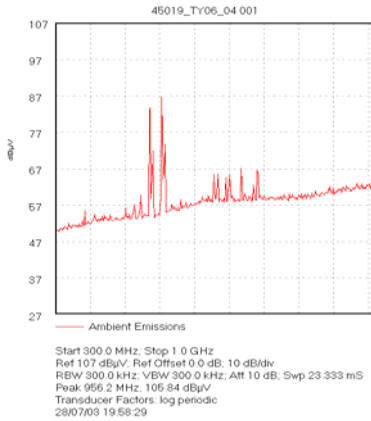
3.2.3.4 Position 4. Golden. Tipperary. Top of field approximately 40m east of mast.

Site:	**Golden**	
Location:	**Position 4**	
NGR:	**S03998**	**36554**
Date:	**28/07/03**	
Officer:	Dan Smith	

Receiver:
Manufacturer: Hewlett Packard
Model: 8594A
Serial Number 3108U00205

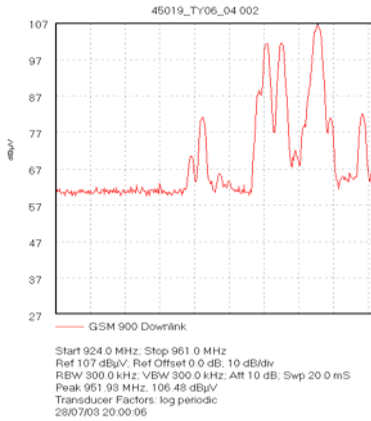
Antenna:
Manufacturer: EMCO
Model: 3146A
Serial Number 3993

300 MHz to 1 GHz



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
956.2	0.000101779*	4.781	46974.27586	2.12882E-05
513.5	1.25794E-06	2.5675	2041041.346	4.89946E-07
490.8	6.37762E-07	2.454	3847830.286	2.59887E-07
944	3.54535E-07	4.72	13313227.36	7.51133E-08
520.5	6.33372E-08	2.6025	41089616.55	2.4337E-08
496	4.16542E-08	2.48	59537834.02	1.6796E-08
674.5	1.35412E-08	3.3725	249053878	4.0152E-09
706	1.20132E-08	3.53	293843477.9	3.40317E-09
627.3	9.67517E-09	3.1365	324180316.6	3.0847E-09
			Total Quotient	2.21648E-05

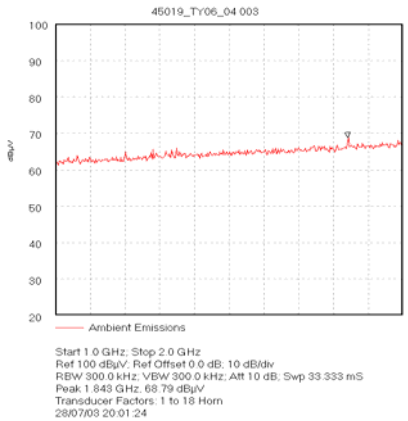
GSM 900



Frequency (MHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
951.93	0.000117939*	4.75965	40356.76709	2.4779E-05
948.05	3.74678E-05	4.74025	126515.1682	7.90419E-06
946.48	3.53719E-05	4.7324	133789.7357	7.47441E-06
956.65	4.26244E-07	4.78325	11221849.25	8.91119E-08
939.63	3.41711E-07	4.69815	13748908.72	7.2733E-08
938.52	2.97618E-08	4.6926	157672112.5	6.34228E-09
			Total Quotient	4.03258E-05

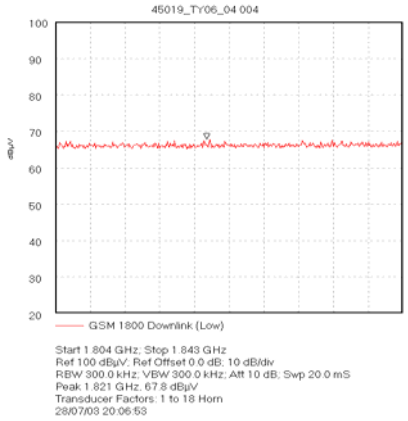
Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 4**		
NGR:	**S03998**	**36554**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1GHz to 2 GHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.843	2.00751E-08	9.215	459025370.4	2.17853E-09
			Total Quotient	2.17853E-09

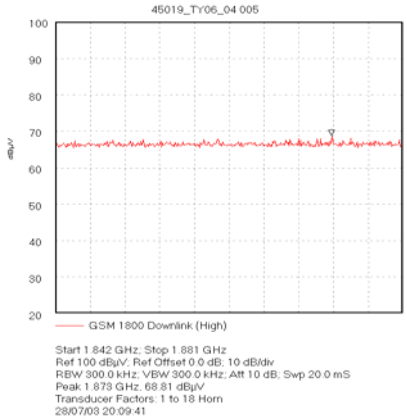
1805-1842 MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.821	1.5983E-08	9.105	569667312.5	1.75541E-09
			Total Quotient	1.75541E-09

Site:	**Golden**		**Receiver:** Manufacturer: Hewlett Packard Model: 8594A Serial Number 3108U00205
Location:	**Position 4**		
NGR:	**S03998**	**36554**	**Antenna:** Manufacturer: EMCO Model: 3115 Serial Number 1203
Date:	**28/07/03**		
Officer:	Dan Smith		

1843 – 1880MHz



Frequency (GHz)	S (power density)	ICNIRP Limit	Times less than ICNIRP	Quotient
1.873	2.01678E-08	9.365	464353936.9	2.15353E-09
			Total Quotient	2.15353E-09

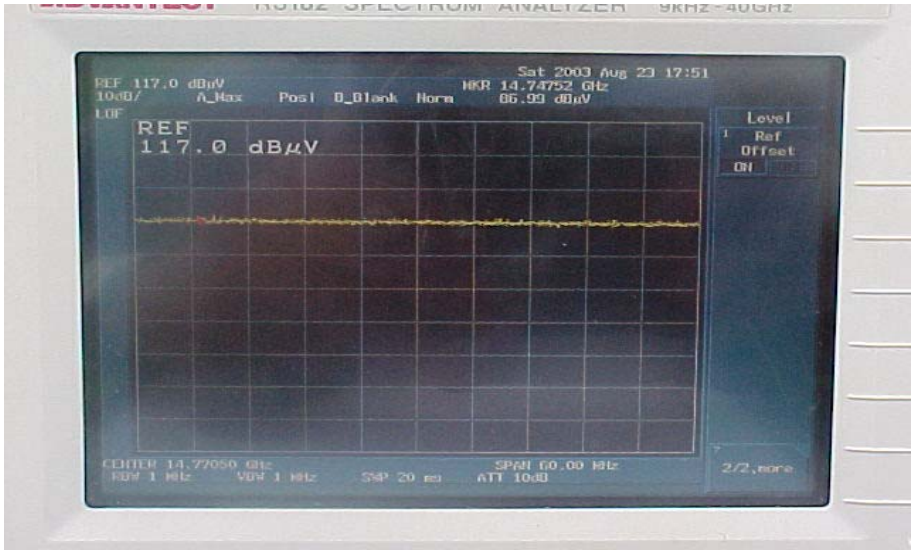
3.2.4 Results of Measurements in 2GHz to 40GHz Range

The plots in this section are copies of the output of the spectrum analyser in the 2GHz to 40GHz band. The fuzzy line across the centre of the plot is what is known as the measurement noise floor. The measurement noise floor is the level of ambient noise that is in the atmosphere. From the plots it can be clearly seen that there are no emissions from any source greater that the ambient noise in the atmosphere.

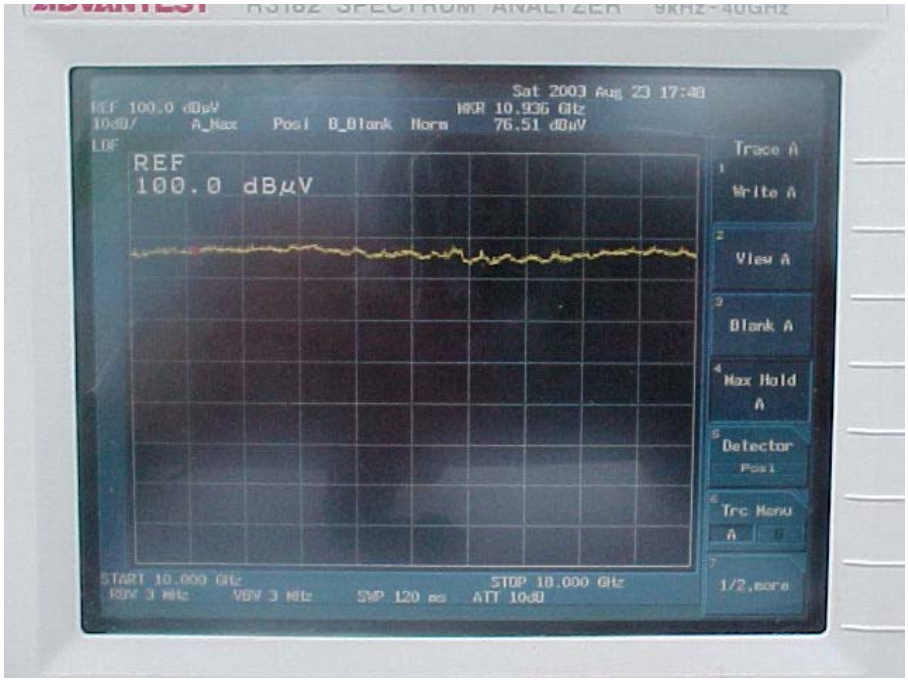
3.2.4.1 Position 5. Golden. 700m Northwest of Mast – 23rd August 2003

Site: **Golden** **Location:** **Position 5** **NGR:** **Date:** **23/08/03** **Officer:** Dan Smith	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000 **Antenna:** Manufacturer: Model: Serial Number

14.755GHz



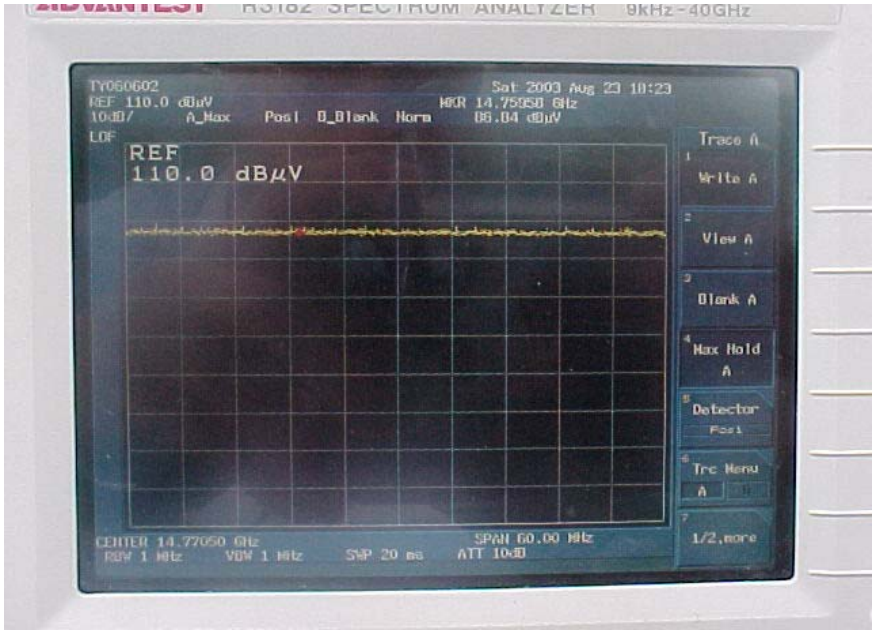
10 - 18GHz



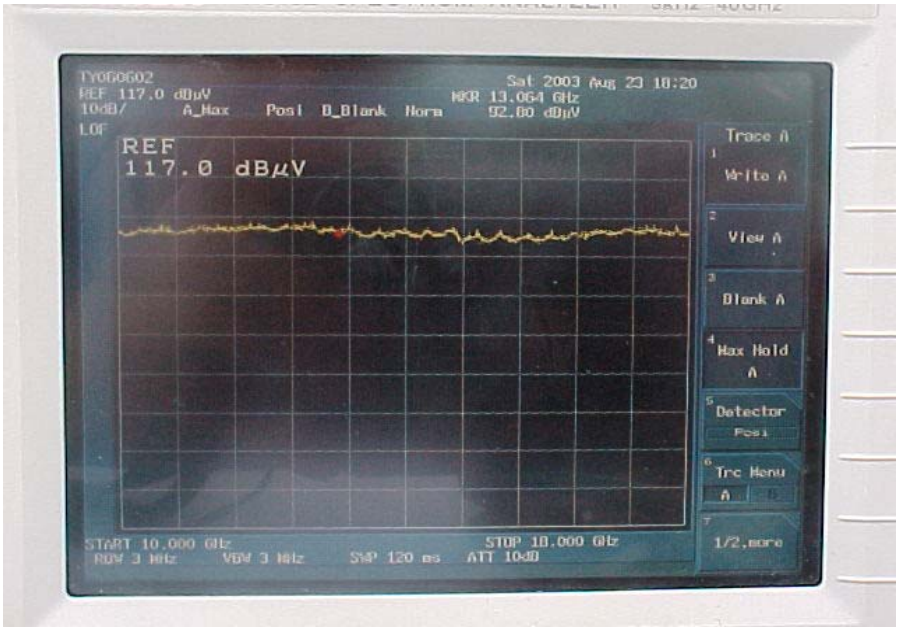
3.2.4.2 Position 6. Golden.500m Northwest of mast. 23rd August 2003

Site: **Golden** **Location:** **Position 6** **NGR:** **Date:** **23/08/03** **Officer:** Dan Smith	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000 **Antenna:** Manufacturer: Model: Serial Number

14.755GHz



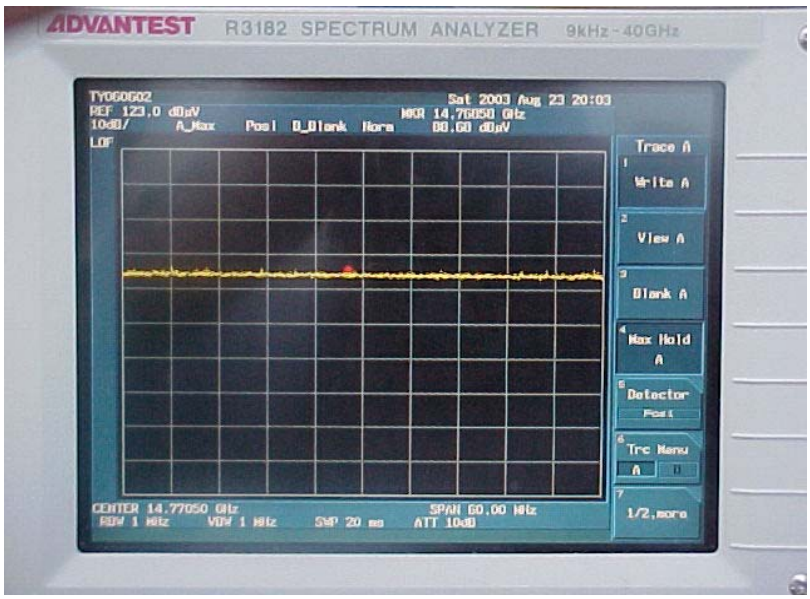
10 - 18GHz



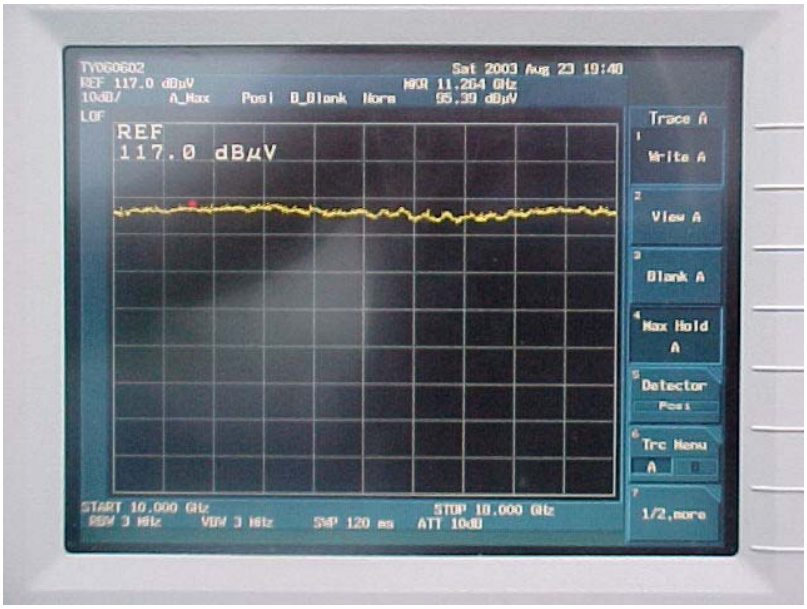
3.2.4.3 Position 7. Golden. 200m Northwest of mast - 23rd August 2003

Site:	**Golden**	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000
Location:	**Position 7**	**Antenna:** Manufacturer: Model: Serial Number
NGR:		
Date:	**23/08/03**	
Officer:	Dan Smith	

14.755GHz



10 - 18GHz

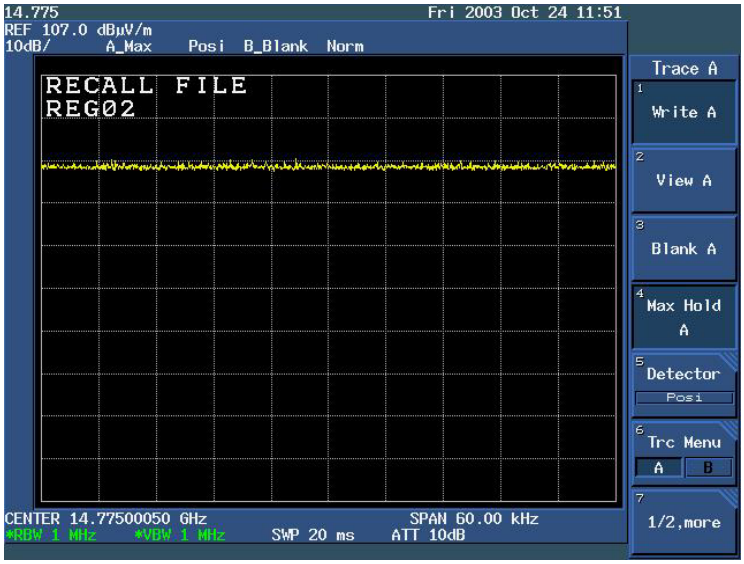


3.2.4.4 Position 8. Golden, Outside House, approximately 100 m South East of mast. - 24th October 2003

Site:	**Golden**	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000
Location:	**Position 8**	**Antenna:** Manufacturer: Model: Serial Number
NGR:		
Date:	**24/10/03**	
Officer:	Dan Smith	

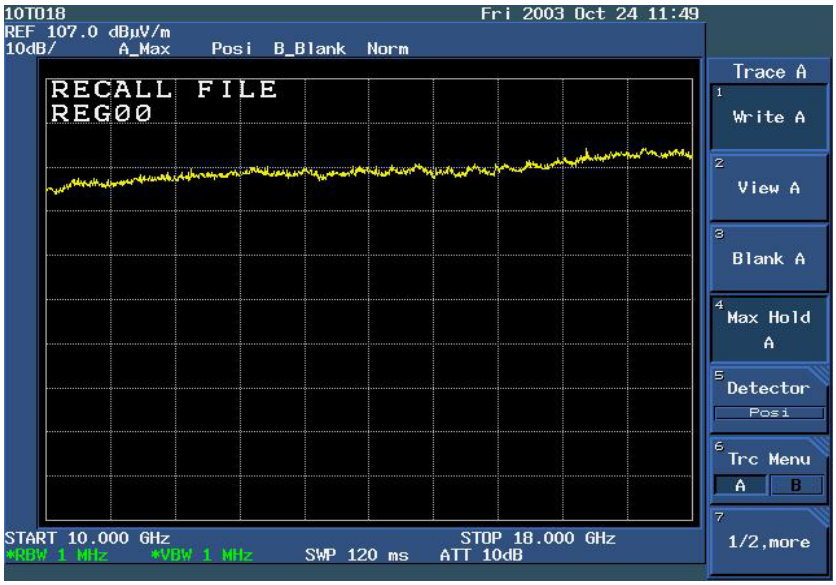
2 – 10GHz

14.755GHz



Site:	**Golden**	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000
Location:	**Position 8**	
NGR:		**Antenna:** Manufacturer: Model: Serial Number
Date:	**24/10/03**	
Officer:	Dan Smith	

10 - 18GHz



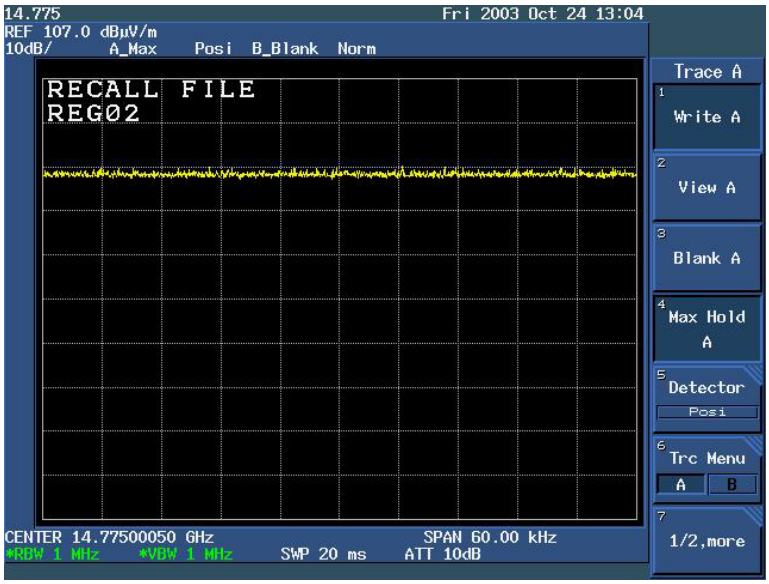
18 - 40GHz

3.2.4.5 Position 9. Golden, In Field of Transmitter mast, Approximately 80 m North West of mast. In line of Sight with Microwave Fixed Link Dish - 24th October 2003

Site:	**Golden**	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000
Location:	**Position 9**	
NGR:		**Antenna:** Manufacturer: Model: Serial Number
Date:	**24/10/03**	
Officer:	Dan Smith	

2 – 10GHz

14.755GHz



Site: **Golden** **Location:** **Position 9** **NGR:** **Date:** **24/10/03** **Officer:** Dan Smith	**Receiver:** Manufacturer: Advantest Model: R3182 Serial Number 9737981000 **Antenna:** Manufacturer: Model: Serial Number

10 - 18GHz

18 - 40GHz

3.2.5 SITE SKETCH MAP

3.2.5.1 Position 1. Golden. Tipperary. 15 m North West of mast. In direction of Microwave Dish.

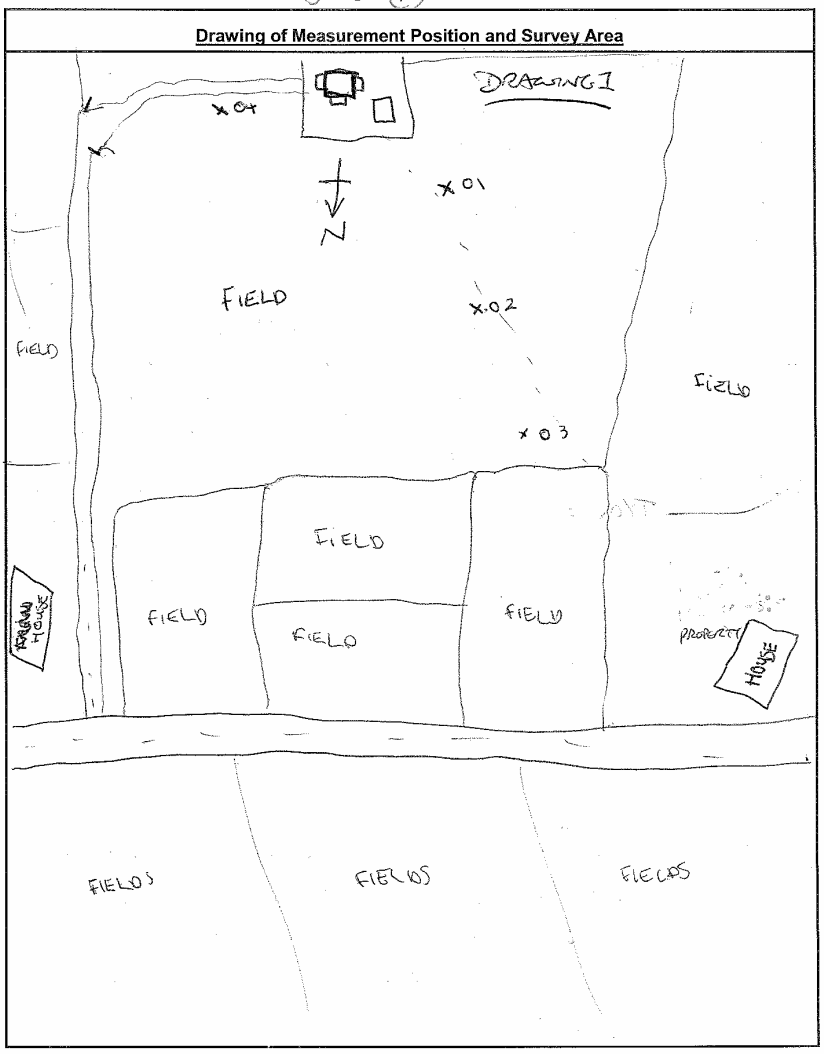
RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

TY 06 (A)

Drawing of Measurement Position and Survey Area



3.2.5.2 Position 2. Golden. Tipperary. Centre of field on top of hill. Approx 50m north-west of mast.

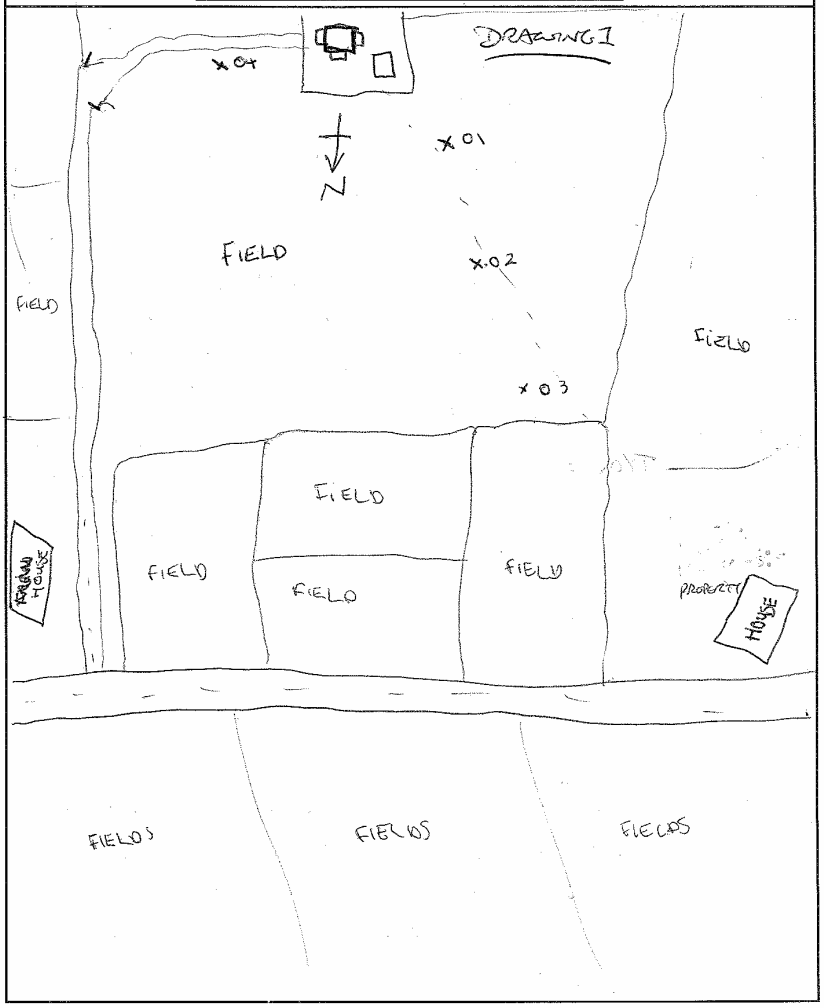
RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

TY 06 (A)

Drawing of Measurement Position and Survey Area



3.2.5.3 Position 3. Golden. Tipperary. Towards bottom of field approx 200m north-west of mast.

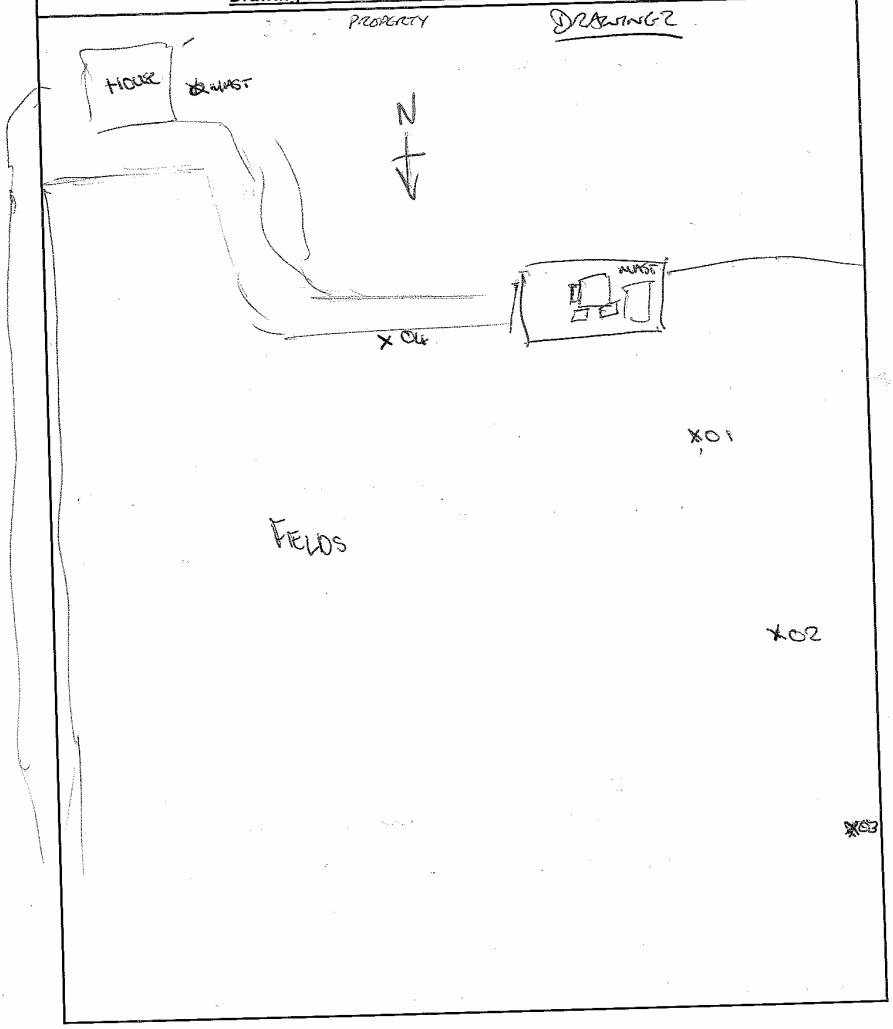
RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

TY06 (B)

Drawing of Measurement Position and Survey Area



3.2.5.4 Position 4. Golden. Tipperary. Top of field approximately 40m east of mast.

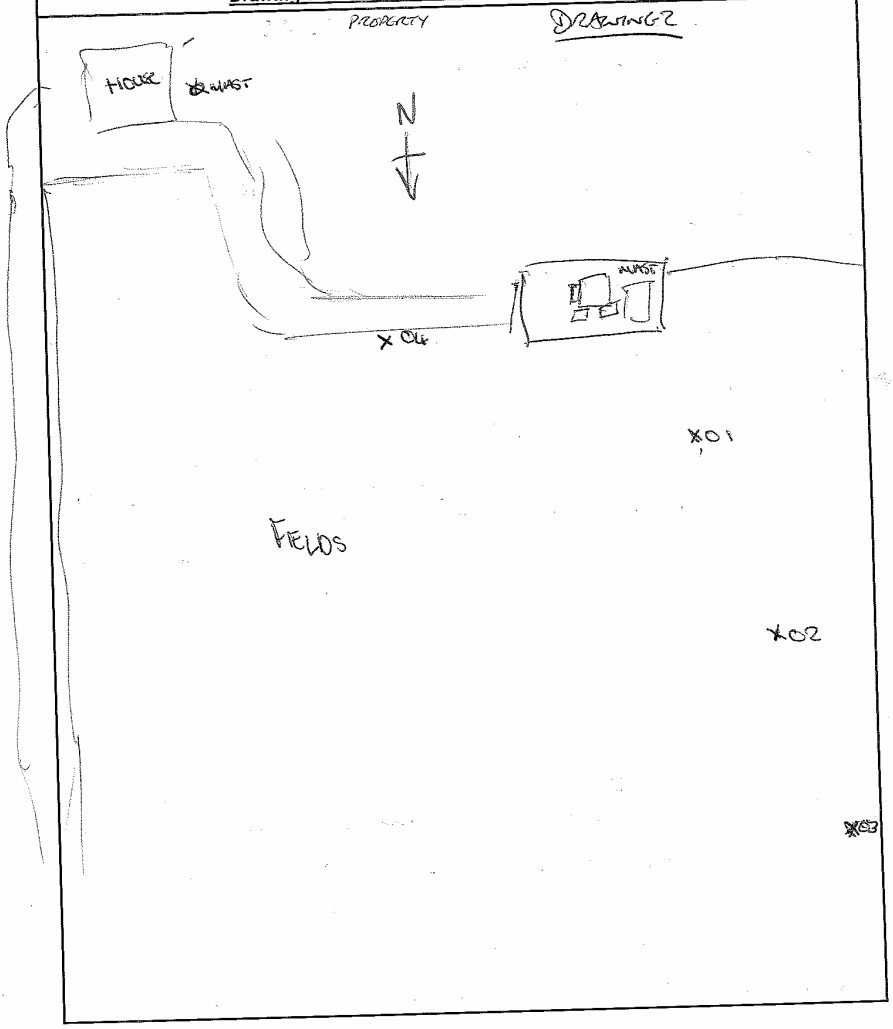
RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

TY06 (B)

Drawing of Measurement Position and Survey Area



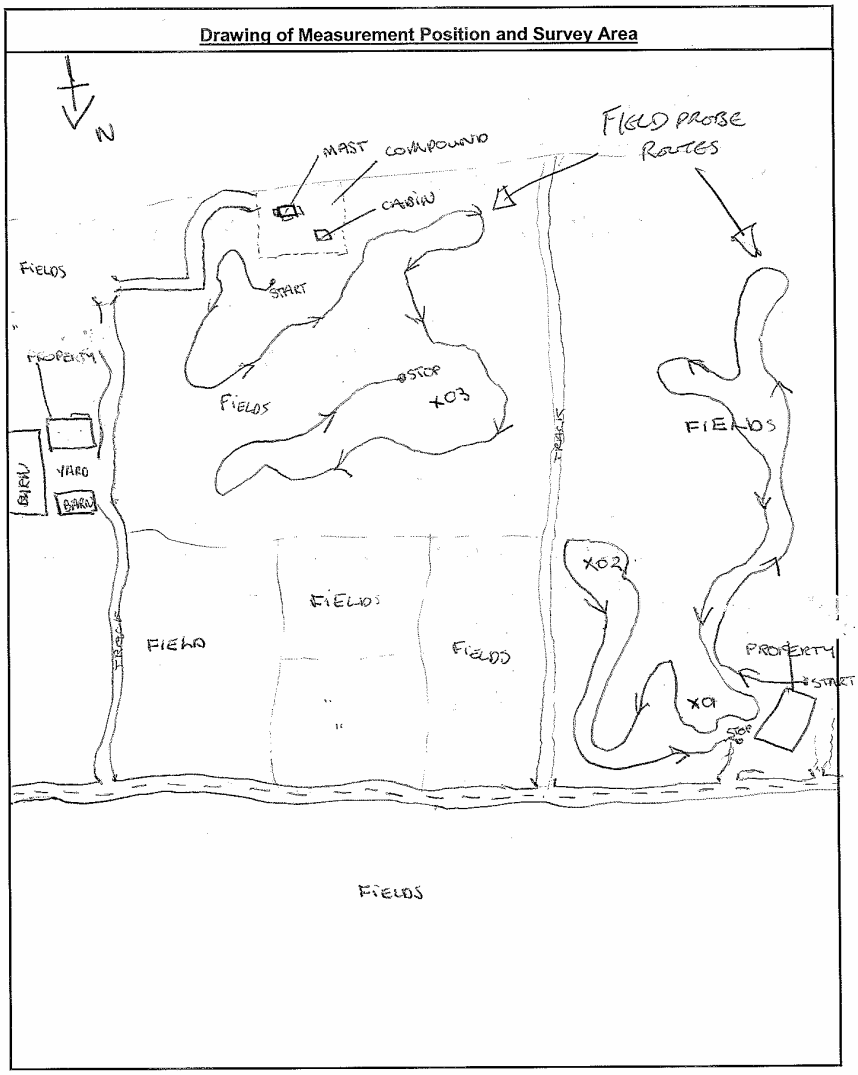
3.2.5.5 Position 5 (X01). Golden. Tipperary. 700m Northwest of Mast. 20m from property.

RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

Drawing of Measurement Position and Survey Area



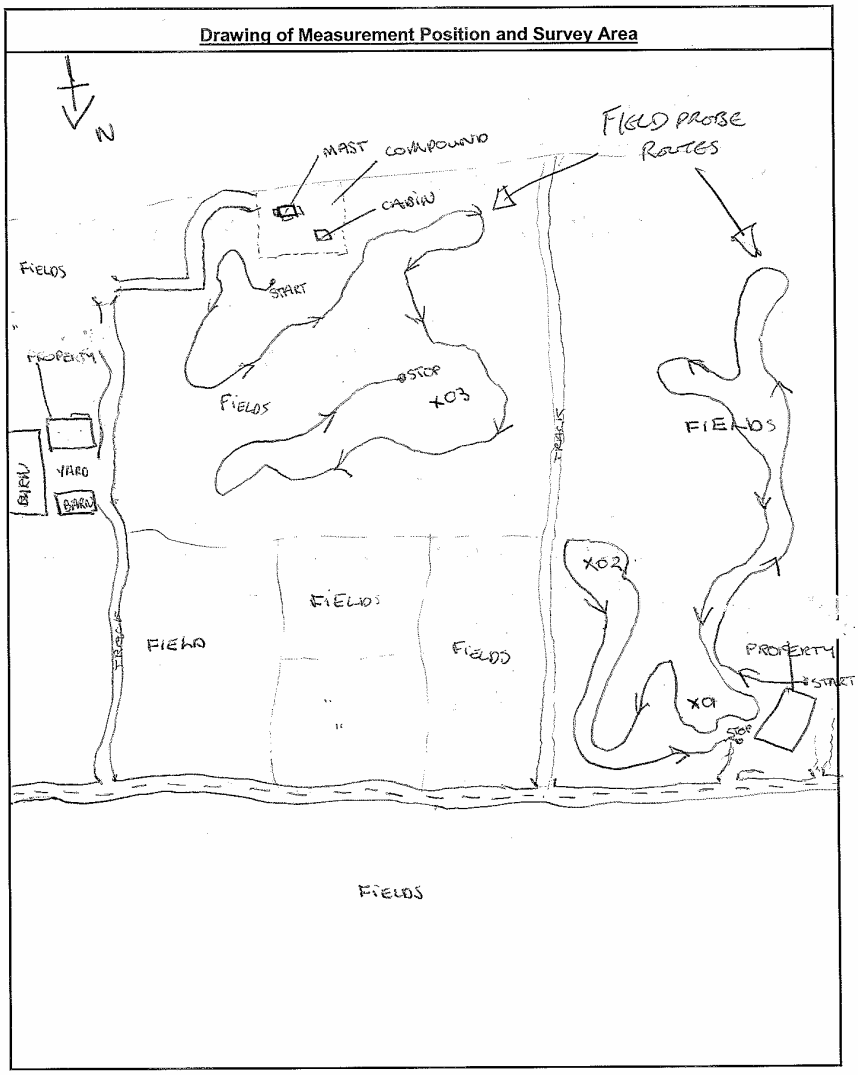
3.2.5.6 Position 6 (X02). Golden. Tipperary. 500m Northwest of mast (Facing dish).

RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

Drawing of Measurement Position and Survey Area



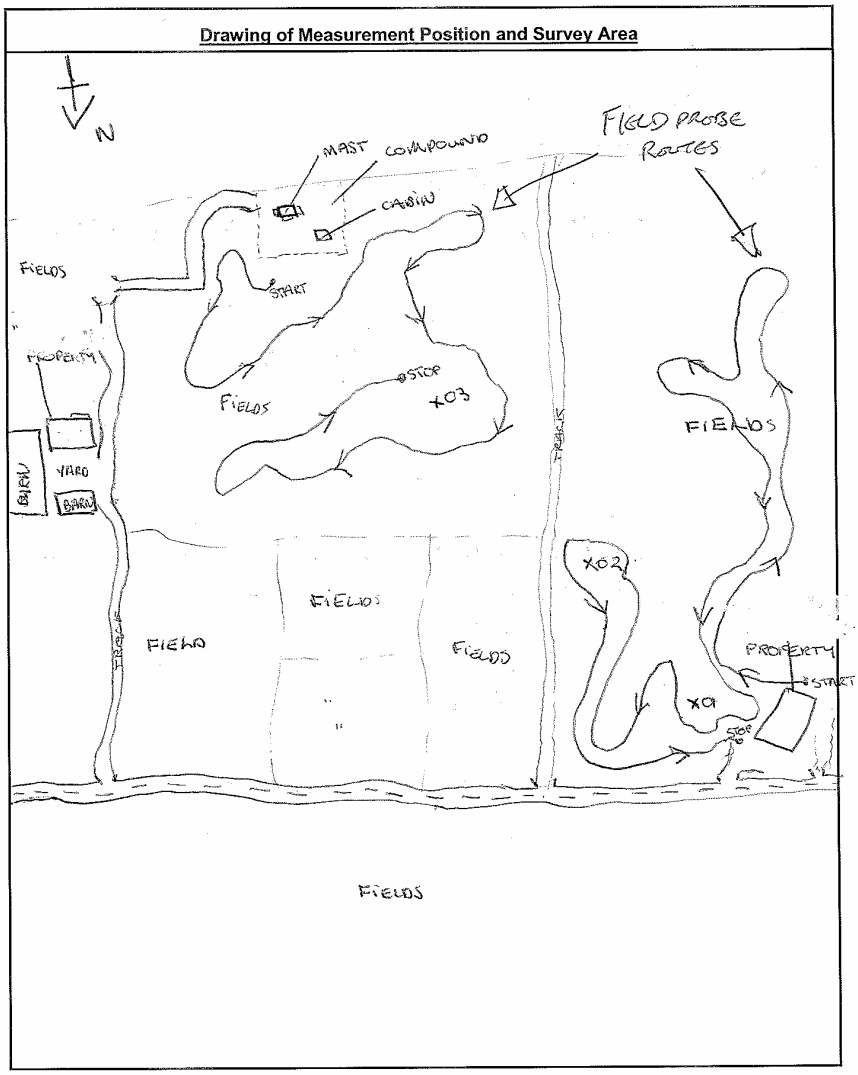
3.2.5.7 Position 7 (X03). Golden. Tipperary. 200m Northwest of mast (Facing dish).

RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

Drawing of Measurement Position and Survey Area



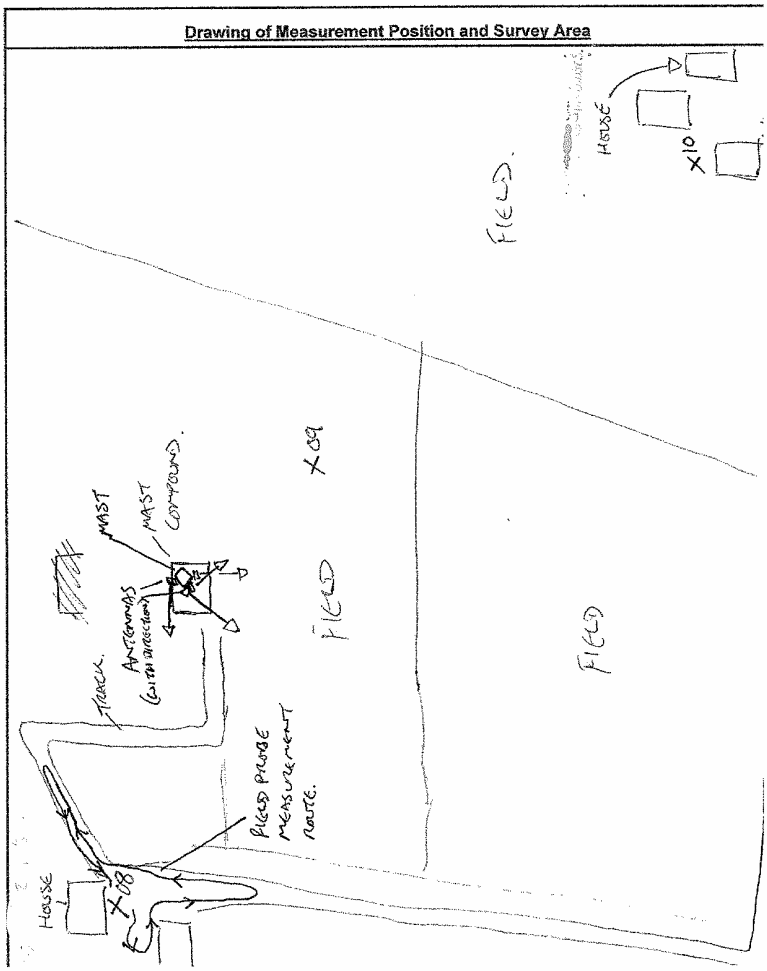
3.2.5.8 Position 8. Golden, Outside House, approximately 100 m South East of mast.

RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

Drawing of Measurement Position and Survey Area



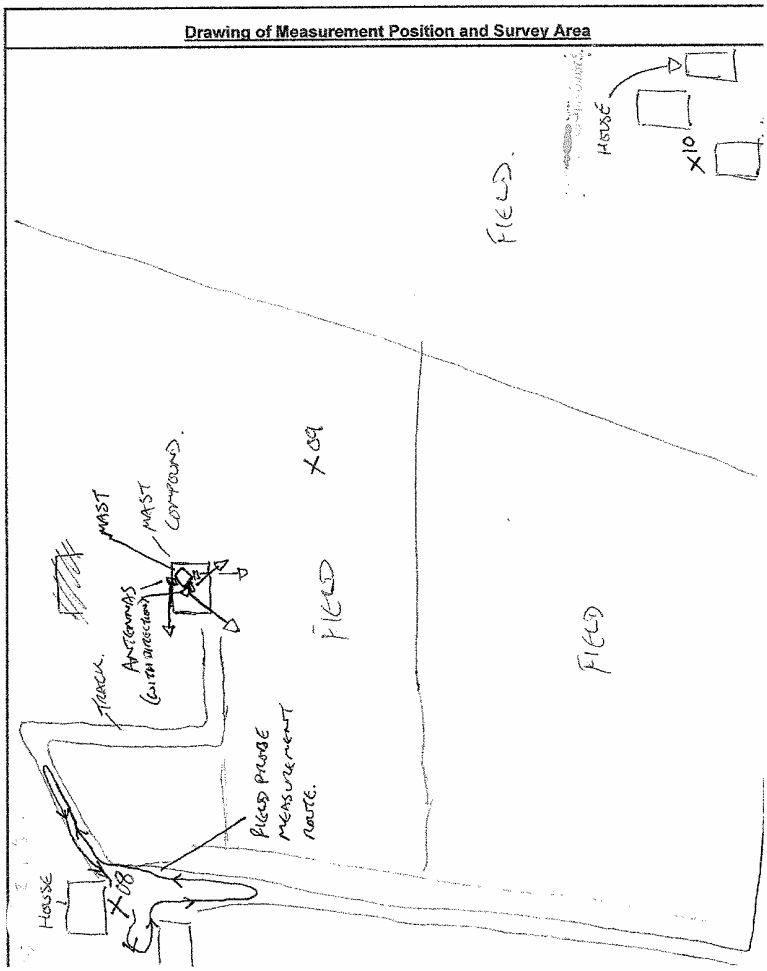
3.2.5.9 Position 9. Golden. In Field of Transmitter mast, approximately 80 m North West of mast. In line of Sight with Microwave Fixed Link Dish.

RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

Drawing of Measurement Position and Survey Area



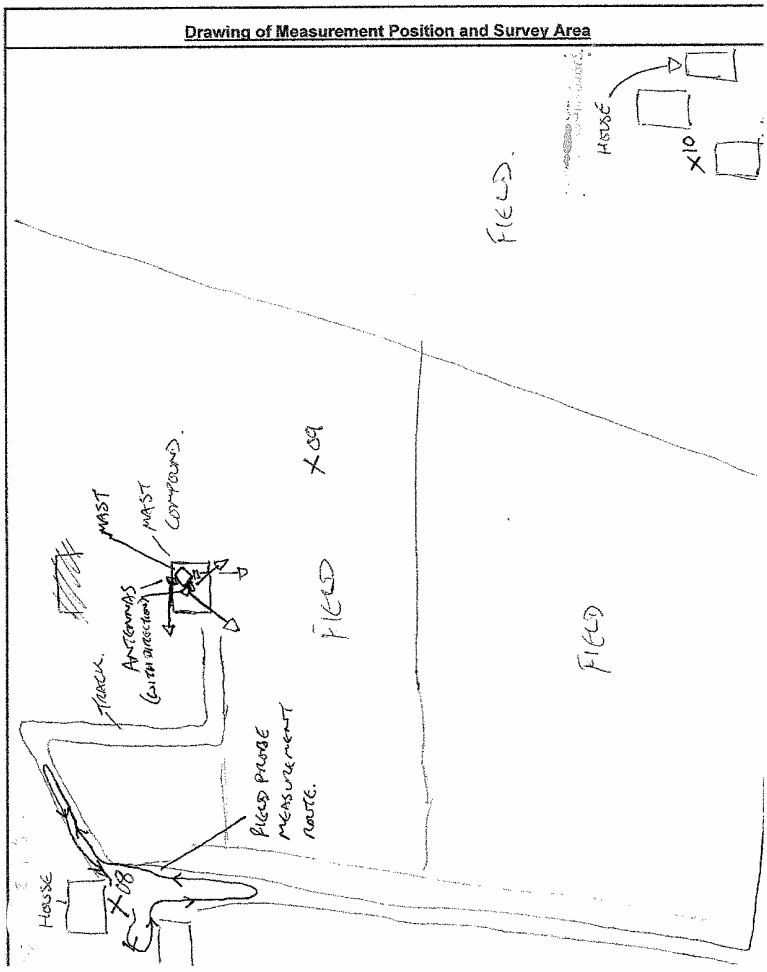
3.2.5.10 Position 10. Golden, In Field, approximately 600 m North West of Mast, in direction of link dish.

RADIO FREQUENCY INVESTIGATION LTD

OFF-SITE WORKBOOK
Test No. 45019

For: Mason Communications
Survey Of:
Location:

Drawing of Measurement Position and Survey Area



3.2.6 SITE PHOTOGRAPHS

3.2.6.1 Position 1. Golden. 15 m North West of mast. In direction of Microwave Dish.

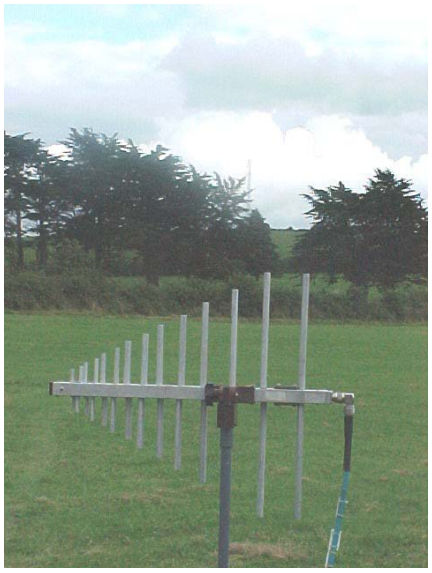
3.2.6.2 Position 2. Golden. Centre of field on top of hill. Approx 50m north-west of mast.

3.2.6.3 Position 3. Golden. Tipperary. Towards bottom of field approx 200m north-west of mast.

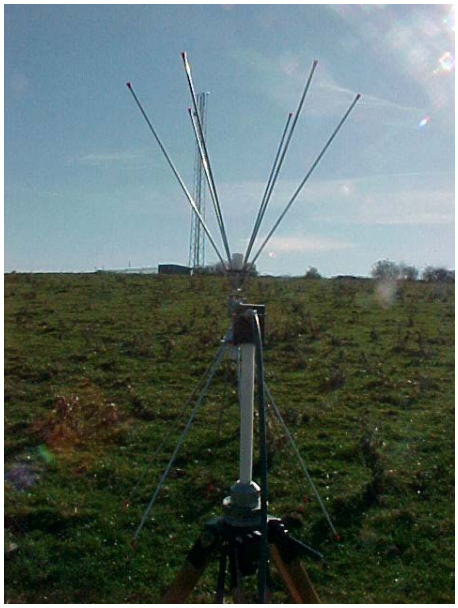
3.2.6.4 Position 4. Golden. Tipperary. Top of field approx 40m east of mast.

3.2.6.5 Position 5. Golden. Tipperary. 700m Northwest of Mast. 20m from property.

3.2.6.6 Position 6. Golden. Tipperary. 500m Northwest of mast (Facing dish).



3.2.6.7 Position 9. Golden, In Field of Transmitter mast, Approximately 80 m North West of mast. In line of Sight with Microwave Fixed Link Dish.



Annex 1

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

Non-ionising Radiation (NIR) Definition

Non-ionising radiation is that part of the electromagnetic spectrum below 2420 million MHz. Radiowaves, infra-red radiation and visible light are examples of NIR. Electromagnetic waves at frequencies above 2420 million MHz (2.4THz) are known as ionising radiation and this includes X-rays and Gamma rays.

Standards for emissions limits for non-ionising radiation

The International Commission for Non-Ionising 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 IRPA.

This programme required 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. It should be noted that in 1999 the European Commission put out a recommendation[2] which proposed to limit exposure of the general public to electromagnetic fields 0 Hz-300 GHz based on a set of basic restrictions and reference levels developed internationally under the advice of the International Commission on Non-Ionising Radiation Protection. In relation to emissions within the radio spectrum, these limits are equivalent to the ICNIRP guideline limits used by the ODTR.

[2] Recommendation of the European Council 1999/519/EC of July 12, 1999

ICNIRP limits

In 1998 ICNIRP produced "Guideline 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 "Guideline 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 heath 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).However, only power density in air, outside the body, can be readily measured in 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 ICNIRP Guidelines: 1998 reference levels appropriate to the frequency range 100 kHz to 40GHz, covered by this report are given in the table:

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	$1.375f^{1/2}$	$0.0037xf^{1/2}$	f/200	UHF Television Broadcasting and Mobile Telephony Systems
2000 - 300000	61	0.16	1	Microwave Links, and MMDS

Note: "f" represents the frequency taken from the first column above

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 GSM sites and Mixed Use sites.

Cellular/GSM sites

Cellular/GSM 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.

Mixed use site

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.

Methodology

An initial survey of the area was conducted to determine the location(s) of highest non-ionising radiation emissions. At the GSM only site this was done by using a broadband probe and an engineering mobile phone, in conjunction with the appropriate software, to identify the position of maximum field strength. The engineering mobile phone provides an indication of the field strength levels from the GSM channels in use in the vicinity of the site.

Once the locations of the highest field strength emissions were identified, a series of narrowband measurements were taken at these locations. These measurements were taken using a spectrum analyser and associated antennas.

At GSM only sites, measurements were performed over the following frequency range from 300MHz – 2GHz. This range includes both the GSM900 and GSM1800 bands.

For mixed use sites, measurements were performed over the following frequency ranges 30MHz – 40GHz. These measurements included all radio services which are present at these sites. These services include, GSM, Broadcasting, fixed links, MMDS, FWA. Point to Point links, amongst others.

At both GSM only sites and Mixed Use sites, electric field strength measurements conducted in the frequency bands of interest, are recorded and converted to power density levels for direct comparison with the ICNIRP guideline levels. These power density levels are tabulated alongside the relevant ICNIRP limits. The tables present the highest emission level readings recorded within a band.

Glossary

Antenna:
An antenna transmits energy to or receives energy from space.

Broadband Measurement:
Measurements carried out using a broadband probe measures the maximum power density at the site and compares it to the power density guideline limit in the ICNIRP guidelines. The probe reading is displayed as a percentage ratio of one to the other. In this project, the combined signal strengths of all radio transmissions in the area that is taken over the total range of frequencies between 100kHz to 40GHz is measured. The minimum sensitivity on the probe is 0.3% of the ICNIRP guideline limit, this means the probe will only pick up NIR levels when the level is equal to or greater than 1/3333 of the ICNIRP limit. As most measurements taken at sites using the probe are much less than 1/3333 of the ICNIRP limit, then the reading on the probe is generally zero.

Electric field strength:
This is a quantitative expression of the intensity of an electric field at a particular location. This is measured in volts per metre (V/m)

EMF:
Electric, magnetic, and electromagnetic fields.

Exposure:
This is the highest measured electric field strength converted to a power density equivalent.

Frequency:
The number of sinusoidal cycles completed by electromagnetic waves in 1 s; usually expressed in hertz (Hz).

Frequency Band:
A specific range of frequencies in the radio frequency spectrum, where each band has a defined upper and lower frequency limit.

ICNIRP:
International Commission for Non-Ionising Radiation Protection.

ICNIRP Limit:
This is the reference level, provided by the International Commission for Non-Ionising Radiation Protection (ICNIRP), for the maximum permitted non-ionising radiation emission levels for public exposure.
Reference Levels are frequency dependent and are currently defined as follows:

Frequency	**ICNIRP Limit**
10 – 400MHz	$2W/m^2$
400 MHz – 2GHz	((frequency in MHz)/200)W/m^2
2GHz – 300GHz	10 W/m^2

Narrowband Measurement:
Measurements carried out in specific frequency bands using a spectrum analyser and suitable antennas. The analyser is set up to measure one frequency band at a time to provide accurate readings over the particular range chosen.

Non-Ionizing 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 about 12 eV, wavelengths greater than 100 nm, and frequencies lower than 3×10^{15} Hz.

Power Density:
This is the radiant power incident perpendicular to a surface, divided by the area of the surface and is expressed in watts per square metre.

Quotient:
This is the ratio of the ICNIRP Limit to the maximum measured power density at a particular frequency. If the ratio is equal to or less than 1, then exposure levels are equal to or less than the ICNIRP Limits for the measured frequency.

Total Quotient:
This is the sum of the Quotients for a particular frequency band, or all measured bands, at the location of highest emissions at the site being measured.