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EMC-EMF Safety Approvals

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**RADIO TEST REPORT  
CERTIFICATION  
to  
FCC PART 90**

**Test Sample:** Slope Stability Radar (excluding power  
generator and power supply)

**Model:** SSR-FX

**FCC ID:** S491014SSRFX

**Tested for:** GroundProbe Pty Ltd

**Report Number:** M140935-2b  
(Supersedes M140935-2a)

**Issue Date:** 20 November 2014

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**RADIO TEST REPORT FOR CERTIFICATION  
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FCC Part 90**

**EMC Technologies Report: M140935-2b**

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**RADIO TEST REPORT FOR CERTIFICATION**  
**to**  
**FCC PART 90**

**Report Number:** M140935-2b  
(Supersedes M140935-2a)

**Test Sample:** Slope Stability Radar (excluding power generator and power supply)  
**Model Number:** SSR-FX  
**Serial Number:** 1406-002

**Equipment Type:** Intentional Radiator


**Manufacturer/ Tested for:** GroundProbe Pty Ltd  
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**Standard:** FCC Part 90 - Private Land Mobile Services

**Test Dates:** 8<sup>th</sup> & 9<sup>th</sup> October 2014

**Attestation:** *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

**Test Officer:**   
\_\_\_\_\_  
**Mahan Ghassempouri**  
**Radio Test Engineer**

**Authorised Signatory:**   
\_\_\_\_\_  
**Rob Weir**  
**Facility Manager, Melbourne**  
**EMC Technologies Pty Ltd**

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## EMI TEST REPORT FOR CERTIFICATION to FCC PART 90

### 1.0 INTRODUCTION

This report details the results of RF tests and measurements performed on the Slope Stability Radar, model: SSR-FX.

Test results were obtained using procedures in accordance with the following Federal Communications Commission (FCC) standards/regulations:

Title 47: Telecommunication  
Part 90 — Private Land Mobile Radio Services

### 1.1 Summary of Results

Title 47	Test Performed	Result
<b>Part 90</b>	Private Land Mobile Radio Services	
<b>Subpart F</b>	Radiolocation Service	<b>Applied</b>
<b>Subpart I</b>	General Technical Standards	<b>Applied</b>
<b>Part 2</b>	Frequency allocations and radio treaty matters; general rules and regulations	
<b>2.1046</b>	Power Output	<b>35 dBm</b>
<b>2.1047</b>	Modulation	<b>Pulse</b>
<b>2.1049</b>	Bandwidth	<b>84 MHz</b>
<b>2.1051</b>	Conducted Spurious	<b>&lt; -13 dBm</b>
<b>2.1053</b>	Radiated Spurious	<b>Part 15B Class A</b>
<b>2.1055</b>	Frequency Stability	<b>&lt; <math>\pm</math> 1MHz</b>
<b>2.1057</b>	Frequency Range	<b>Applied</b>

### 1.2 EUT – Voltage Power Conditions

Measurements were performed at a voltage of 24 VDC.

### 1.3 Modifications

The following modifications were implemented inside the REM Box prior to testing:

Ferrites were added:

- 1x Ferrite Wurth Elektronik 7427155 on GP35924, Power Cable.
- 1x Ferrite Wurth Elektronik 7427246 on GP34088, Up LO Control and GP34134, RF Up Converter Mixer.
- 2x Ferrites Wurth Elektronik 7427154 on each UI Signal cable.

The following modifications were implemented to the REM Power supply cable prior to testing:

- Power supply cable shielded and grounded up to the battery point.

## 2.0 GENERAL INFORMATION

### 2.1 Test Sample Description

(Information supplied by the Client)

#### Radar Nominal Specifications

Model	SSR-FX
Centre Frequency	9552.5MHz
Max Bandwidth	105 MHz
Antenna Gain	30dBi
Effective Radiated Power (ERP)	306W
Antenna Type	Slotted waveguide
Peak Transmit Power	35 dBm
Mean Transmit Power	27 dBm
Transmitter Pulse Repetition Frequency	29.69 kHz
Transmitter Pulse Width	16.45 $\mu$ s
Transmitter Duty Cycle	48.8%

#### High Power Amplifier Nominal Specifications

Model	0337
RF Frequency	9.25-9.75 GHz
Gain	30 dB
DC input voltage	10-30 V

### 2.2 Test sample configuration

Radiated measurements were performed while EUT was sitting on the trailer. The EUT was powered via its own 24VDC battery bank. Only front side of the EUT was measured as it was determined to produce the highest levels of emissions. The EUT was set up to perform a 180° azimuth scan. All the equipment within the EUT was set up as per normal use. RF output of the radar was connected to the antenna representing its normal operation.

Conducted measurements were performed while radar was connected to a computer. A computer software program was used to put the EUT into continuous operating mode. The output of the amplifier was connected to the measuring instrument using a suitable waveguide to coaxial adapter with known insertion loss.

A stable power supply was used to adjust the supply voltage during the tests.

## 2.3 Test Facility

### 2.3.1 General

EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies open area test site (OATS) & indoor open area test site (iOATS) have been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada OATS number - IC 3569B-1 & Industry Canada iOATS number - IC 3569B-2**

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

### 2.3.2 NATA Accreditation

EMC Technologies is accredited in Australia to test to the following standards by the National Association of Testing Authorities (NATA).

***“FCC Part 15 unintentional and intentional emitters in the frequency range 9kHz to 18 GHz excluding TV receivers (15.117 and 15.119), TV interface devices (15.115), cable ready consumer electronic equipment (15.118), cable locating equipment (15.213) and unlicensed national information infrastructure devices (Sub part E).”***

The current full scope of accreditation can be found on the NATA website: [www.nata.asn.au](http://www.nata.asn.au)  
It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

NATA is the Australian national laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A<sup>2</sup>LA).

## 2.4 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI). All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NMI and the working antennas (bi-conical, log-periodic and horn) calibrated by EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A.

### 3.0 RF MEASUREMENTS

#### 3.1 Output Power, Section 2.1046

The conducted RF power output of the radar module (under normal pulse radar operation) was measured using the power measurement function of the spectrum analyser. Measurements were performed through the 85 MHz (nominal 99% occupied bandwidth) bandwidth.

Measurements were performed at -25 °C to +55 °C with 10 °C steps and  $\pm 15\%$  variation of supply voltage was applied at each temperature.

Following spectrum analyser setting were used:

Centre Frequency	:9.5525 GHz
Span	:200 MHz
RBW	:1 MHz
VBW	:3 MHz
Sweep time	:Auto
Channel Bandwidth	:85 MHz

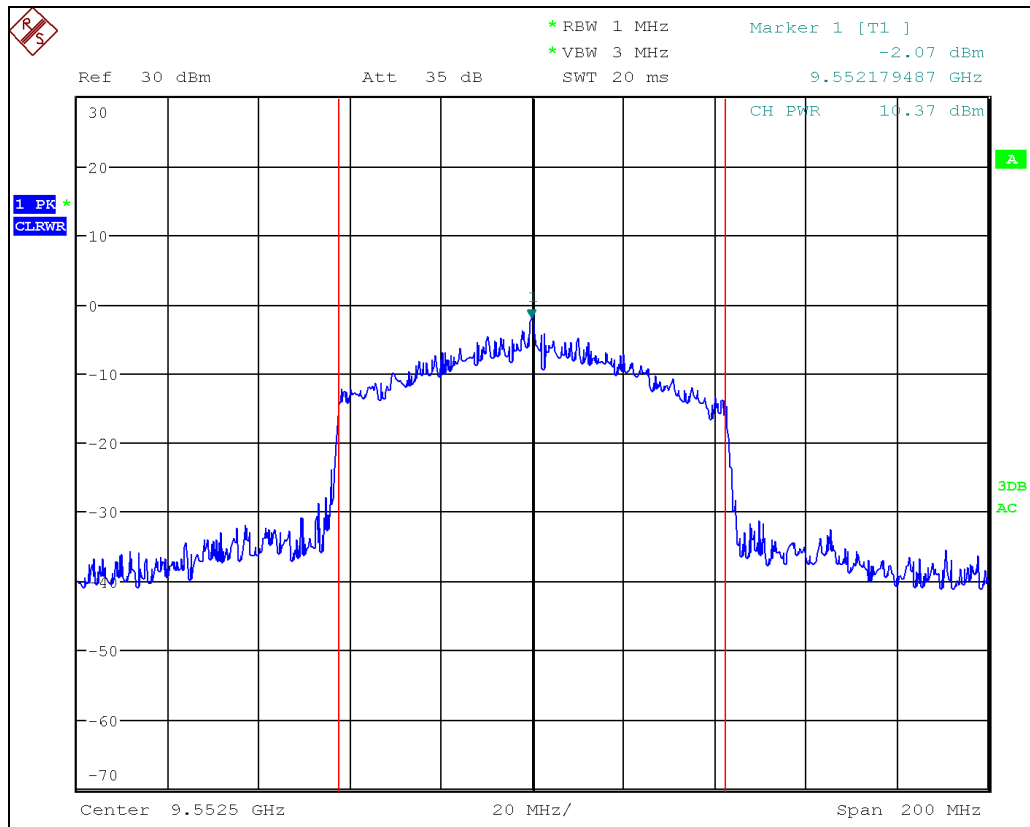
A correction factor of 24.5 dB was applied to the spectrum analyser reading, this value included cable lose and external attenuation used at the input of spectrum analyser.

Measurement results are shown in below table.

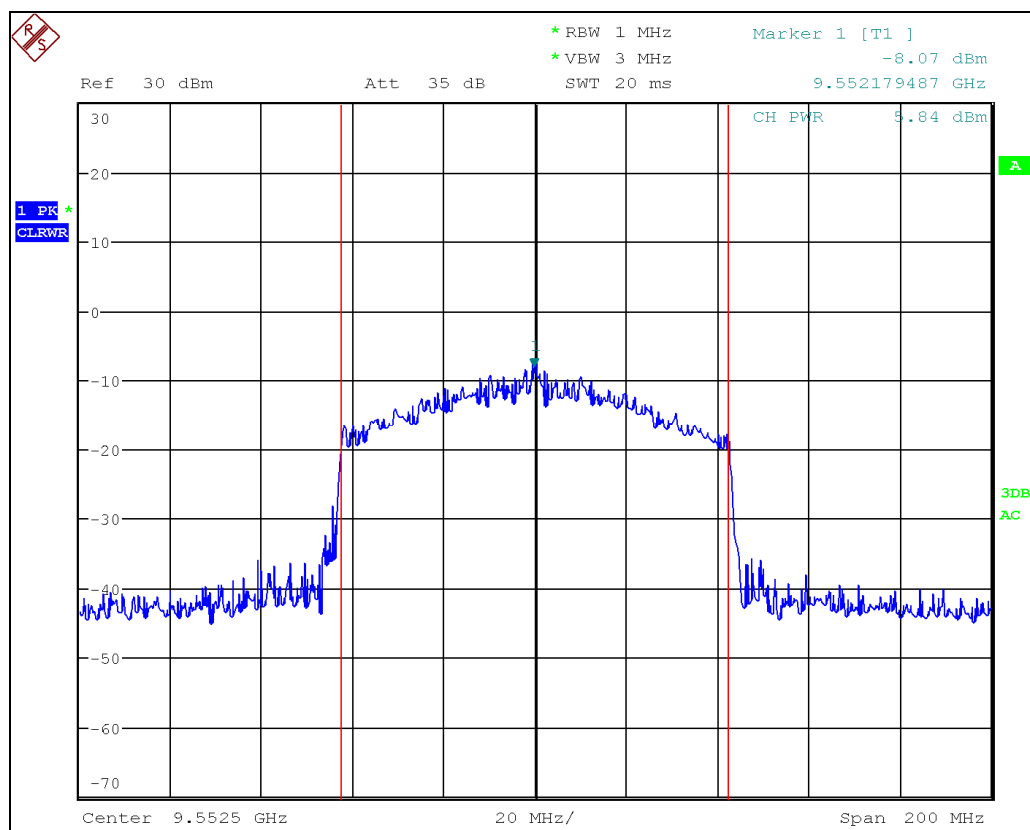
Temperature °C	Output Power (dBm)		
	20.4 VDC	24 VDC	27.6 VDC
-25	34.80	34.87	34.85
-15	34.02	33.95	33.91
-5	33.57	33.58	33.58
5	33.06	33.05	33.00
15	32.50	32.49	32.53
25	31.88	31.79	31.82
35	31.56	31.57	31.63
45	31.24	31.22	31.16
55	30.34	30.37	30.41

**Limits:** Clause 90.205(m) of Part 90 specifies that the maximum allowable effective radiated power will be determined on case by case basis for transmitters not in defined bands.

The highest and the lowest measured power are shown on the following page in graphs 1 & 2.



Graph 1: Output power at -25 °C, 24 VDC

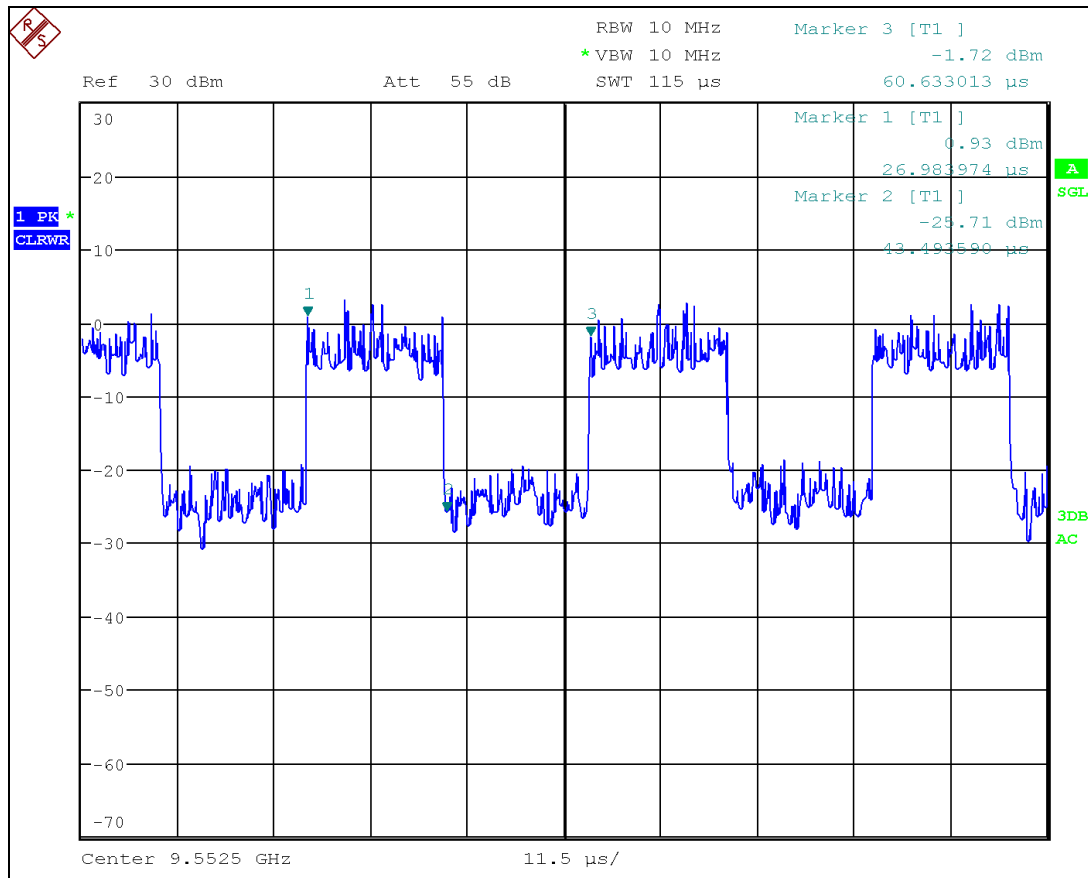


Graph 2: Output power at -55 °C, 20.4 VDC



### 3.2 Modulation Characteristic, Section 2.1047

The duty cycle of radar output was measured in time domain. Result shown in graph 3.



Graph 3: Duty cycle

Result:

- Pulse width = 16.51 μs.
- Duty cycle = 49.06%.

### 3.3 Occupied Bandwidth (Section 2.1049) and Frequency Stability (Section 2.1055)

The occupied bandwidth (OBW) was measured using 99% bandwidth function of spectrum analyser. Measurements were performed at -25 °C to +55 °C with 10 °C steps.  $\pm 15\%$  variation of supply voltage was applied at each temperature.

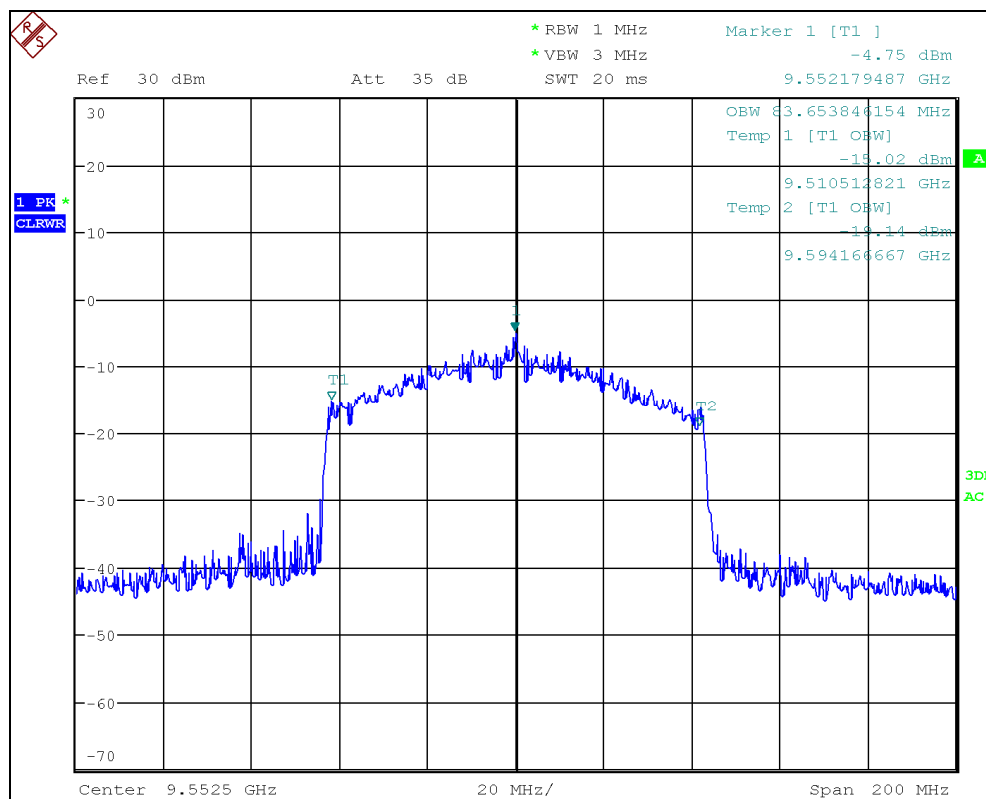
Following spectrum analyser settings were used.

Centre Frequency :9.5525 GHz  
 Span :200 MHz  
 RBW :1 MHz  
 VBW :3 MHz  
 Sweep time :Auto  
 Channel Bandwidth :85 MHz

Measurement results are shown in below table.

Temperature °C	20.4 VDC			24 VDC			27.6 VDC		
	F <sub>L</sub> (GHz)	F <sub>H</sub> (GHz)	OBW (MHz)	F <sub>L</sub> (GHz)	F <sub>H</sub> (GHz)	OBW (MHz)	F <sub>L</sub> (GHz)	F <sub>H</sub> (GHz)	OBW (MHz)
-25	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
-15	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
-5	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
5	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
15	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
25	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
35	9.51051	9.59449	83.97	9.51051	9.59417	83.65	9.51051	9.59417	83.65
45	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65
55	9.51051	9.59417	83.65	9.51051	9.59417	83.65	9.51051	9.59417	83.65

Measurement at 25 °C, 24 VDC is shown in graph 4.



Graph 4: Occupied bandwidth

### 3.4 Conducted Spurious Emissions, Section 2.1051

The conducted spurious emissions were measured using Rohde & Schwarz ESU-40 connected to the antenna port of the radar.

Following spectrum analyser settings were used.

Frequency	RBW	VBW	Detector
9 kHz-150 kHz	1 kHz	1 MHz	QP
150 kHz-30 MHz	100 kHz	1 MHz	QP
30 MHz-1GHz	120 kHz	300 kHz	QP
1 GHz-40 GHz	1 MHz	10 Hz	AV
1 GHz-40 GHz	1 MHz	3 MHz	PK

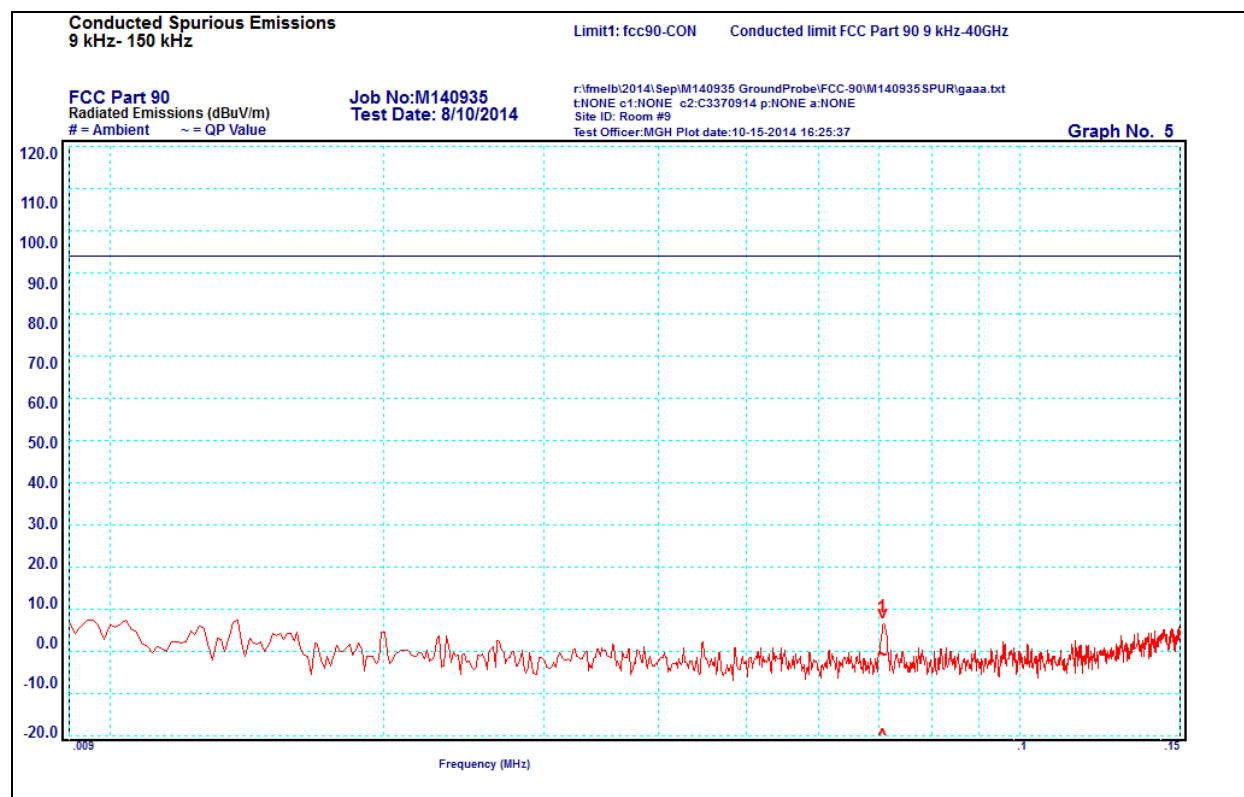
All pre-scans were performed with peak detector. During pre-scans sweep time was set to a value long enough to charge the detector.

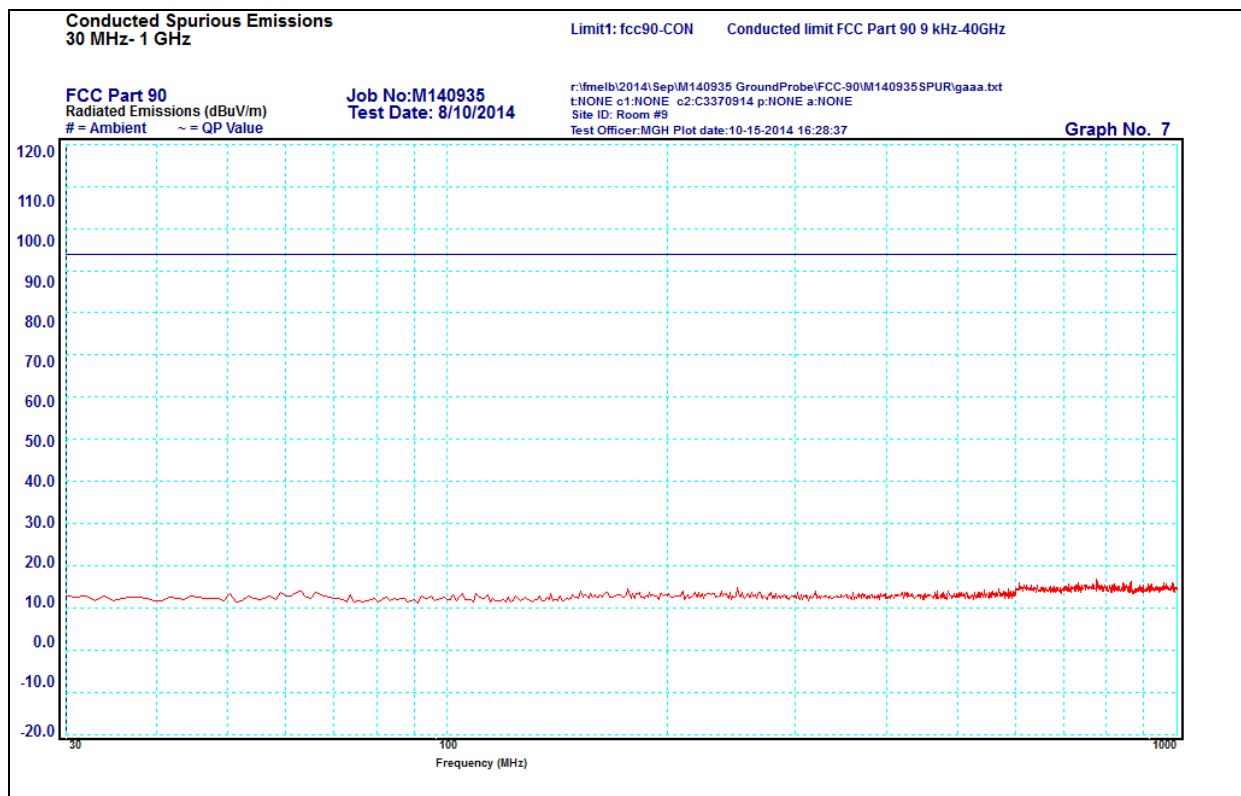
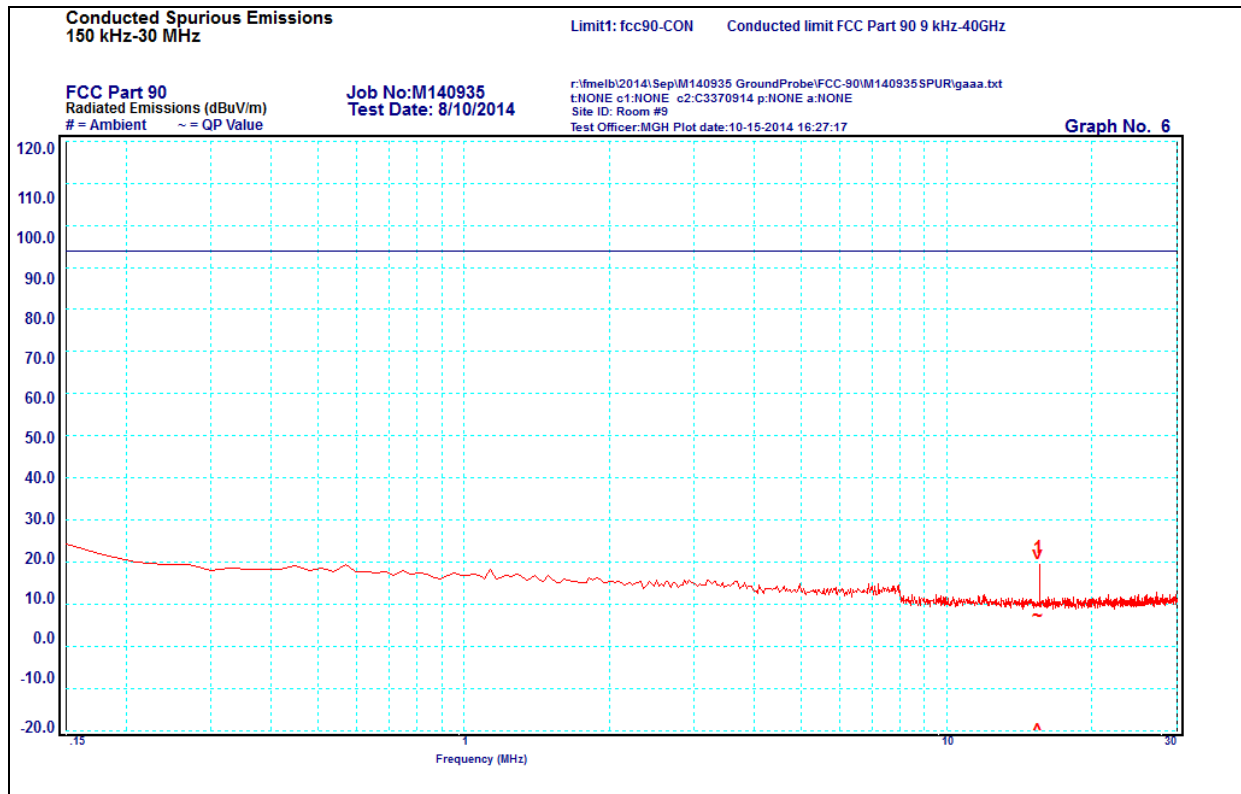
The permissible spurious levels are:

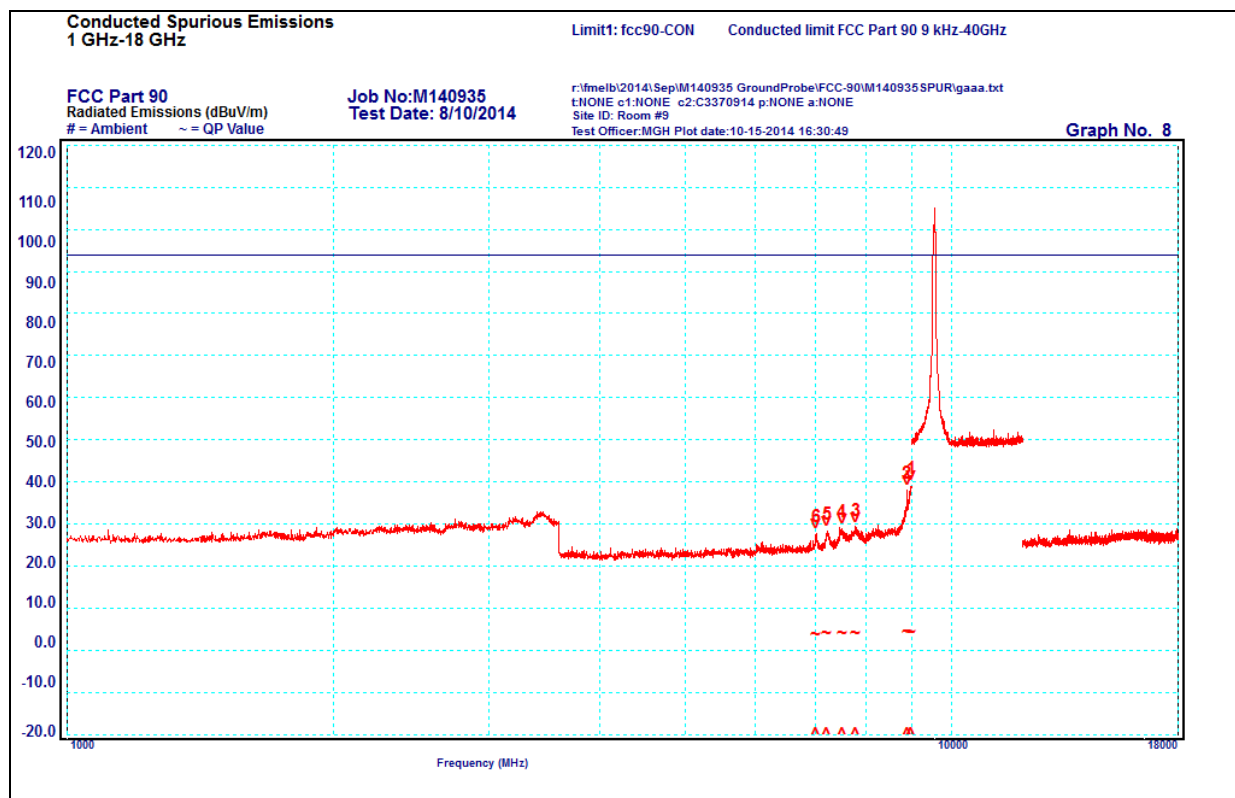
Frequency Range (MHz)	Limit (dBm)	Limit (dBuV)
0.009-30	-13	94
30-9500	-13	94
10000-40000	-13	94

The lowest limit from section 90.210 was applied,  $43+10\log(P) = 48$  dB. The difference between the peak transmitted level (35 dBm) and 48 dB was the limit = -13 dBm.

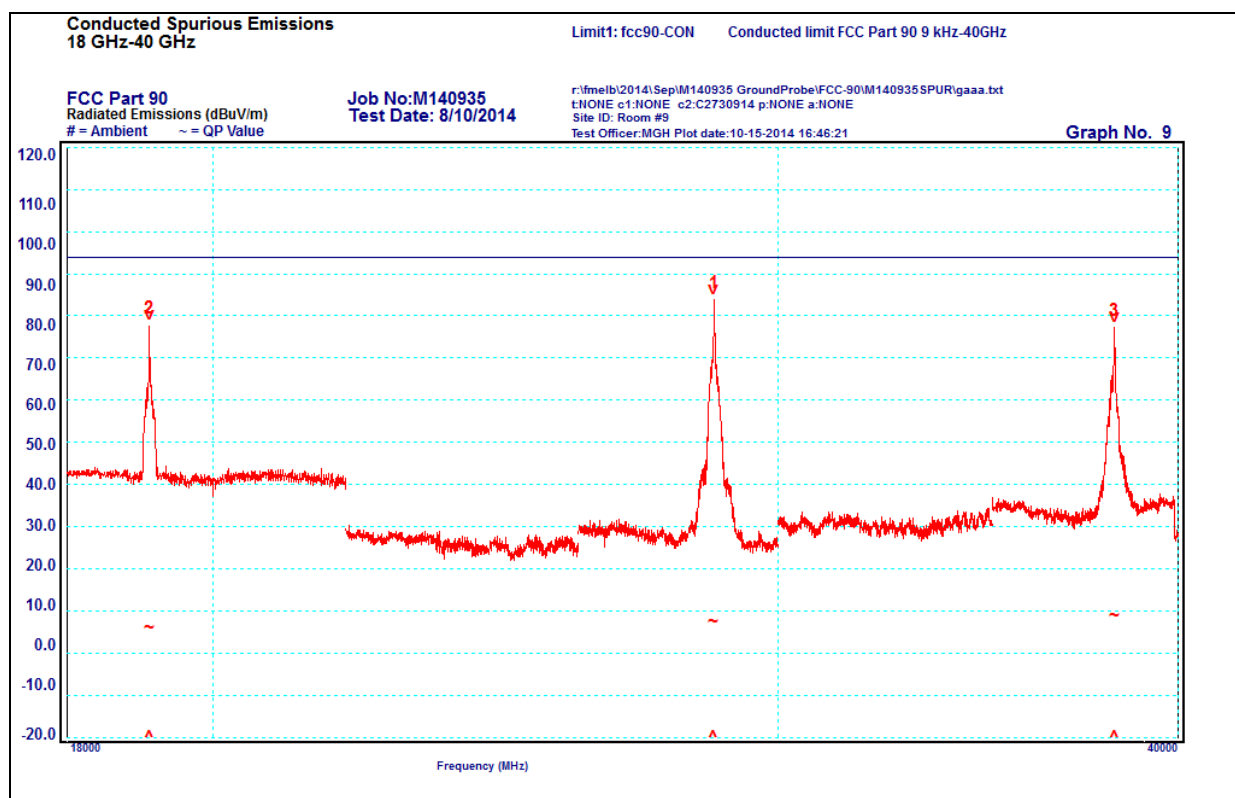
Results are shown in graph 5 to 9.







Intentional transmitter at 9.5525 GHz was excluded from measurement



**Emission results table:**

Peak	Frequency MHz	Measured Peak dB $\mu$ V/m	Measured Average dB $\mu$ V/m	Limit dB $\mu$ V/m	$\Delta$ Peak $\pm$ dB	$\Delta$ Average $\pm$ dB
1	38209.93	83.9	8.8	94	-10.1	-85.2
2	28654.51	77.2	7.4	94	-16.8	-86.6
3	19104.89	77.9	5.8	94	-16.1	-88.2

**Result:** Complied. Spurious emissions were > 10 dB lower than the permissible levels.

## 4.0 RADIATED EMISSION MEASUREMENTS

### 4.1 Test Procedure

The EUT was set up on the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated BiConiLog antenna was used for measurements between 30 MHz and 1000 MHz. A calibrated double-ridged horn antenna was used for measurements over 1000 MHz.

Testing was performed at a distance of 10 metres for the frequency range 30 to 1000 MHz, 3 metres for 1 GHz to 18 GHz and 1 metre for 18 GHz to 40 GHz

The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

The measurement of emissions above 1000 MHz was measured with the resolution bandwidth of 1000 kHz and the video bandwidth of 10 Hz for average readings and 1000 kHz for peak readings.

The receiver bandwidth was set to 6 dB.

Measurement was performed on one side of the EUT which was determined to produce the highest emission level.

### 4.2 Plotting of Measurement Data for Radiated Emissions

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges. The accumulated EMI (EUT ON) was plotted as the Red trace.

The highest recorded EMI signals are shown on the Peaks List on the bottom right side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, quasi-peak field strength and the margin relative to the limit in dB. A negative margin is the deviation of the recorded value below the limit.

At times, the quasi peak level may appear to be higher than the peak level. This happens because the individual peak is further maximised with the QP detector. This will be apparent when the peaks list at the foot of the graphs shows the quasi peak level higher than the peak level.

Radiated emission measurements were plotted against FCC Part 15 B, Class A limits.

Measurement was performed only on front side of the EUT as it was determined to be the worst case.

### 4.3 Calculation of Field Strength

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

$$E = V + AF - G + L$$

Where:

- E** = Radiated Field Strength in dB $\mu$ V/m.
- V** = EMI Receiver Voltage in dB $\mu$ V. (measured value)
- AF** = Antenna Factor in dB(m<sup>-1</sup>). (stored as a data array of factor versus frequency)
- G** = Preamplifier Gain in dB. (stored as a data array of gain versus frequency)
- L** = Cable insertion loss in dB. (stored as a data array of insertion loss versus frequency)

- **Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dB $\mu$ V is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20.0 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20.0 = 25.1 \text{ dB}\mu\text{V/m}$$

### 4.4 Radiated EMI Results

Measurement results are shown on the following pages in graphs 10 to 19.

Ground Probe-SSR-FX  
Below 1 GHz Front Side Vertical Emissions

Limit1: FCC-A10

FCC CLASS A 10M LIMITS

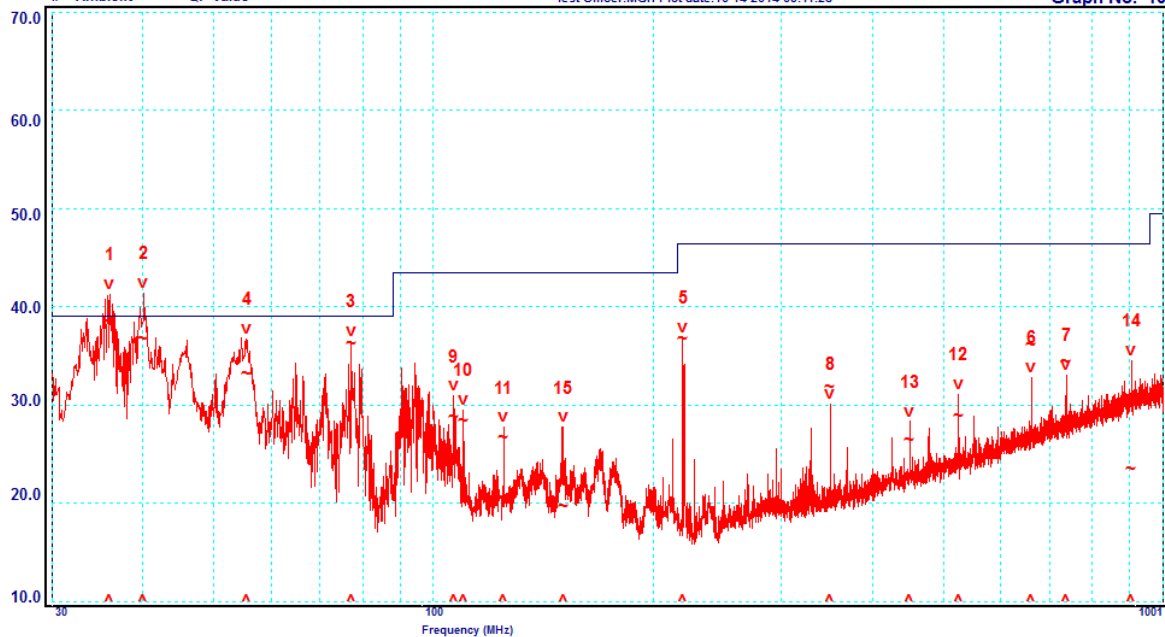
FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

Job No: M140935  
Test Date: 2/10/2014

## Trace 2: Vertical Emissions

r:\fme\2014\20140935 GroundProbe\Radiated Files\M140935R\GraphV.bmp  
LA3630516 c1:NONE c2:M140710 p:NONE a:NONE  
Site ID: Room#12\OATS\, 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 09:11:28

Graph No. 10



Peak	Frequency MHz	Polarisation	Measured QP Level dBuV/m	QP Limit dBuV/m	$\Delta$ QP $\pm$ dB
1	36.06	Vertical	38.4	39.1	-0.7
2	40.08	Vertical	36.8	39.1	-2.3
3	77.20	Vertical	36.3	39.1	-2.8
4	55.55	Vertical	33.1	39.1	-6.0
5	220.00	Vertical	36.8	46.4	-9.6
6	660.00	Vertical	36.1	46.4	-10.3
7	737.34	Vertical	34.4	46.4	-12.0
8	349.99	Vertical	31.8	46.4	-14.6
9	106.71	Vertical	28.8	43.5	-14.7
10	110.00	Vertical	28.4	43.5	-15.1
11	125.01	Vertical	26.6	43.5	-16.9
12	525.03	Vertical	28.8	46.5	-17.6
13	450.01	Vertical	26.6	46.5	-20.0
14	905.78	Vertical	23.5	46.5	-22.9
15	150.65	Vertical	19.7	43.5	-23.8



Ground Probe-SSR-FX  
Below 1 GHz Front Side Horizontal Emissions

Limit1: FCC-A10

FCC CLASS A 10M LIMITS

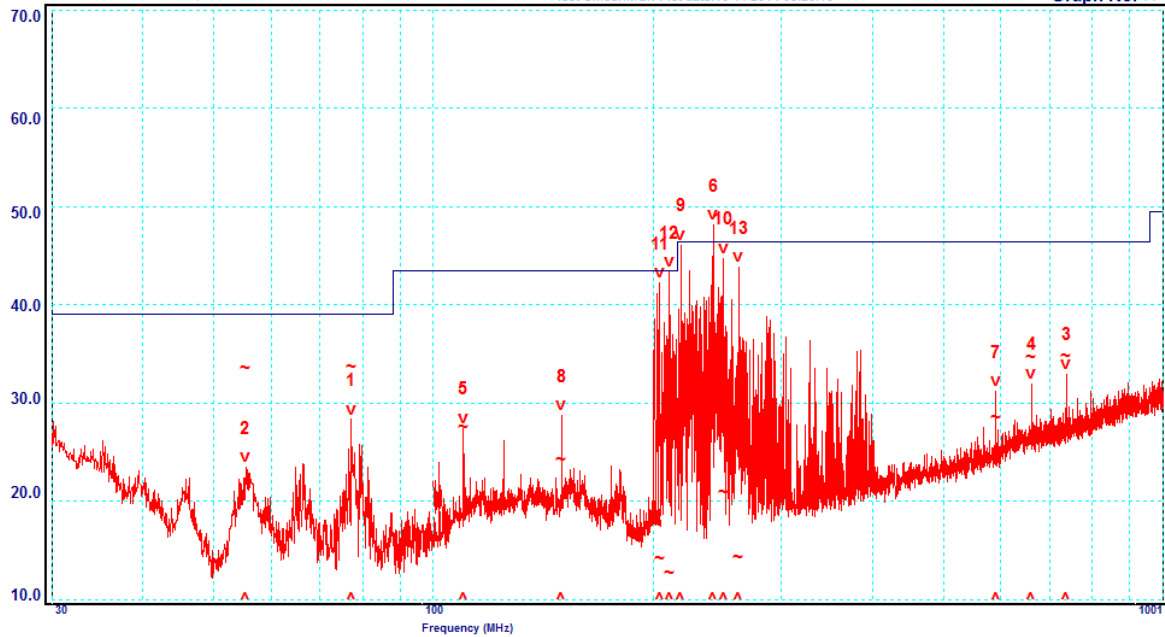
FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

Job No: M140935  
Test Date: 2/10/2014

## Trace 2: Horizontal Emissions

r:\fme\2014\20140935 GroundProbe\Radiated Files\M140935R\GraphH.bmp  
LA3630516 c1:NONE c2:M140710 p:NONE a:NONE  
Site ID: Room#12(OATS), 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 09:25:15

Graph No. 11



Peak	Frequency MHz	Polarisation	Measured QP Level dBuV/m	QP Limit dBuV/m	$\Delta$ QP $\pm$ dB
1	77.20	Horizontal	33.6	39.1	-5.5
2	55.30	Horizontal	33.5	39.1	-5.6
3	737.33	Horizontal	34.7	46.4	-11.7
4	660.00	Horizontal	34.7	46.4	-11.7
5	110.00	Horizontal	27.5	43.5	16.0
6	241.87	Horizontal	29.9	46.4	-16.5
7	589.88	Horizontal	28.5	46.4	-17.9
8	150.00	Horizontal	24.2	43.5	-19.3
9	218.54	Horizontal	26.7	46.4	-19.7
10	249.99	Horizontal	20.9	46.4	-25.5
11	204.43	Horizontal	14.1	43.5	-29.4
12	210.57	Horizontal	12.7	43.5	-30.8
13	262.05	Horizontal	14.2	46.4	-32.2

Ground Probe-SSR-FX  
1 GHz-18 GHz Front Side Vertical Emissions  
Peak Detector

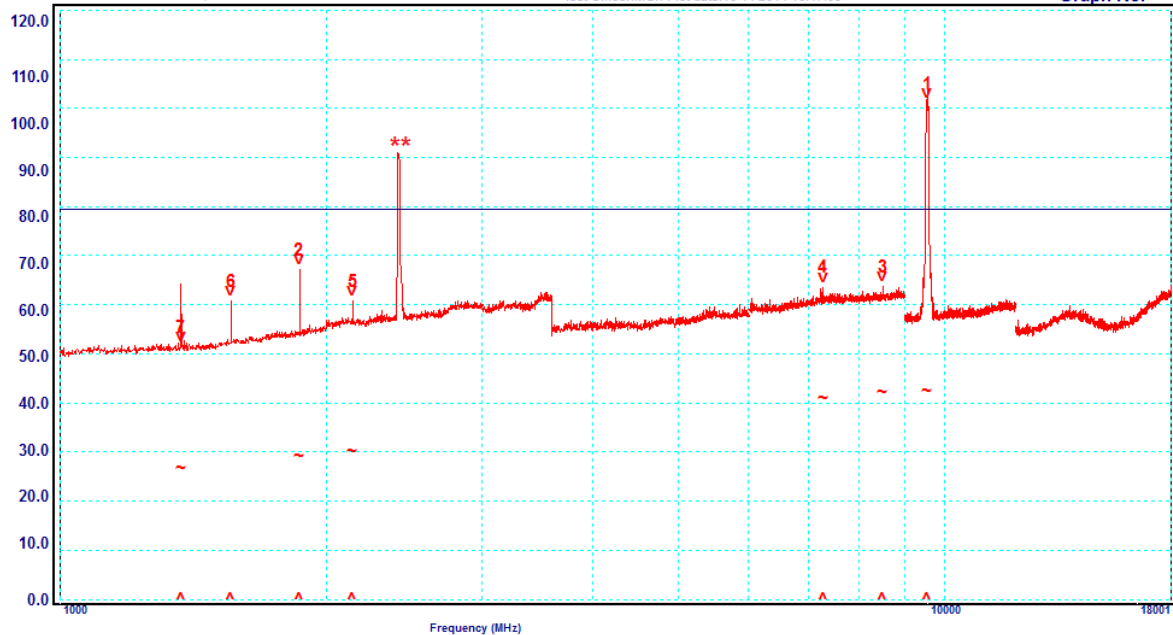
Limit1: FCC-A3 Peak FCC CLASS A RAD 3M LIMITS Peak

FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

Job No: M140935  
Test Date: 2/10/2014

Trace 2: Vertical Emissions  
r:\fmeib\2014\Sep\M140935 GroundProbe\Radiated Files\M140935G\GraphV.bmp  
t:A0040516 c1:C3370914 c2:p:NONE a:NONE  
Site ID: Room#12(OATS), 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 10:47:03

Graph No. 12



Peak	Frequency MHz	Polarisation	Measured Peak Level dBμV/m	Peak Limit dBμV/m	ΔPeak ±dB
1*	9552.48	Vertical			
2	1863.1	Vertical	67.1	79.5	-12.4
3	8509.31	Vertical	63.7	79.5	-15.8
4	7278.25	Vertical	63.6	79.5	-15.9
5	2141.59	Vertical	60.8	79.5	-18.7
6	1560.85	Vertical	60.8	79.5	-18.7
7	1371.41	Vertical	51.4	79.5	-28.1

\* This is the frequency that the EUT operates (intentional transmitter) and should not be taken into account.

\*\* 2.4 GHz emission is representative of the WiFi function of the EUT (intentional transmitter) and should not be taken into account.

Ground Probe-SSR-FX  
1 GHz-18 GHz Front Side Vertical Emissions  
Average Detector

Limit1: FCC-A3

FCC CLASS A RAD 3M LIMITS

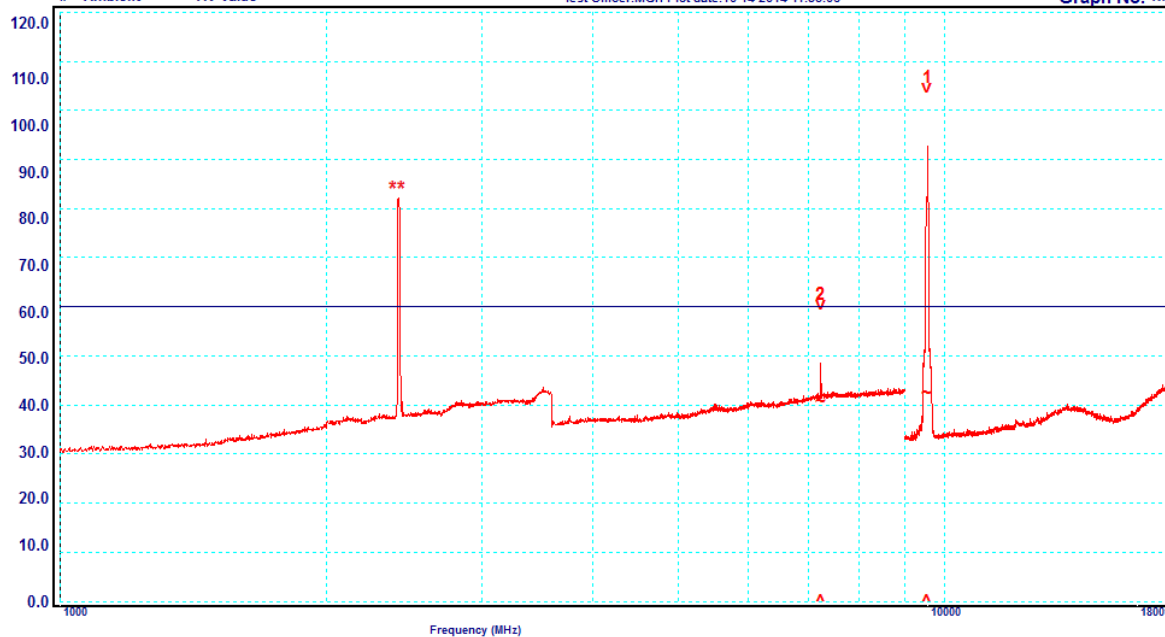
FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = AV Value

Job No: M140935  
Test Date: 2/10/2014

Trace 2: Vertical Emissions

R:\FMELB\2014\SEP\M140935 GROUNDPROBE\RADIATED FILES\M140935G\GraphV.bmp  
LA0040516 c1: C3370914 c2: p: NONE a: NONE  
Site ID: Room#12(OAT3), 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 11:35:06

Graph No. 13



Peak	Frequency MHz	Polarisation	Measured Average Level dBuV/m	Average Limit dBuV/m	$\Delta$ Average $\pm$ dB
1	9552.48	Vertical			
2	7234.08	Vertical	40.7	60	-19.3

\* This is the frequency that the EUT operates (intentional transmitter) and should not be taken into account.

\*\* 2.4 GHz emission is representative of the WiFi function of the EUT (intentional transmitter) and should not be taken into account.

Ground Probe-SSR-FX  
1 GHz-18 GHz Front Side Horizontal Emissions  
Peak Detector

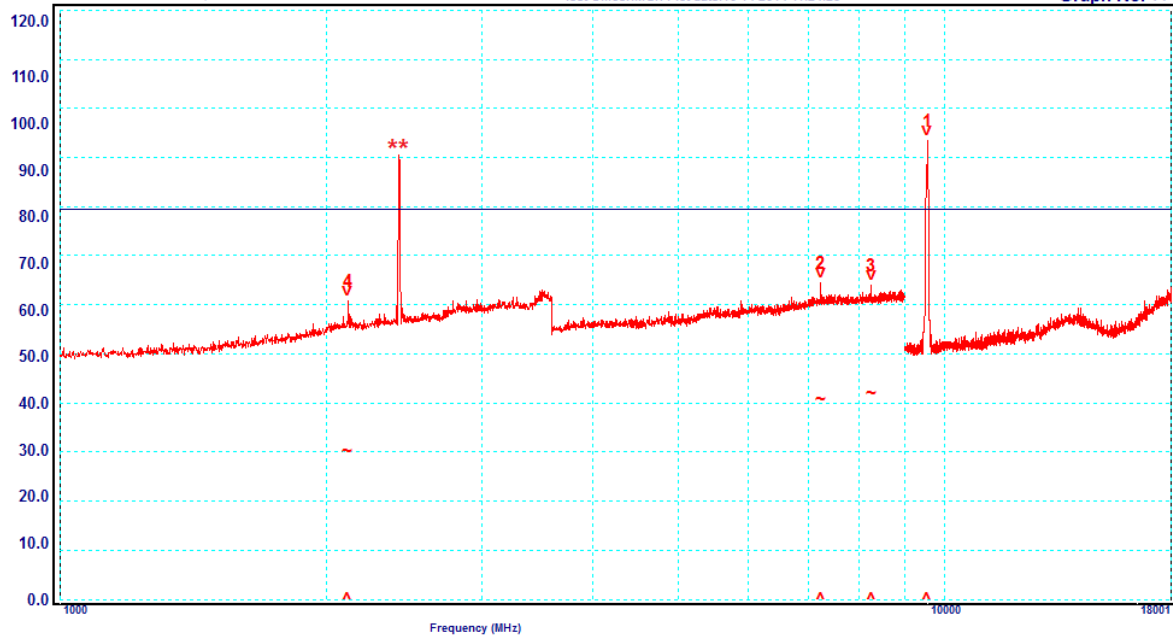
Limit1: FCC-A3 Peak FCC CLASS A RAD 3M LIMITS Peak

FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

Job No: M140935  
Test Date: 2/10/2014

Trace 2: Horizontal Emissions  
r:\fmeib\2014\Sep\M140935 GroundProbe\Radiated Files\M140935G\GraphH.bmp  
LA0040516 c1: C3370914 c2: p: NONE a: NONE  
Site ID: Room#12(OATS), 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 11:24:25

Graph No. 14



Peak	Frequency MHz	Polarisation	Measured Peak Level dBuV/m	Peak Limit dBuV/m	ΔPeak ±dB
* 1	9551.64	Horizontal			
2	7233.64	Horizontal	64.4	79.5	-15.1
3	8251.24	Horizontal	63.9	79.5	-15.6
4	2116.84	Horizontal	60.8	79.5	-18.7

\* This is the frequency that the EUT operates (intentional transmitter) and should not be taken into account.

\*\* 2.4 GHz emission is representative of the WiFi function of the EUT (intentional transmitter) and should not be taken into account.

Ground Probe-SSR-FX  
1 GHz-18 GHz Front Side Horizontal Emissions  
Average Detector

Limit1: FCC-A3

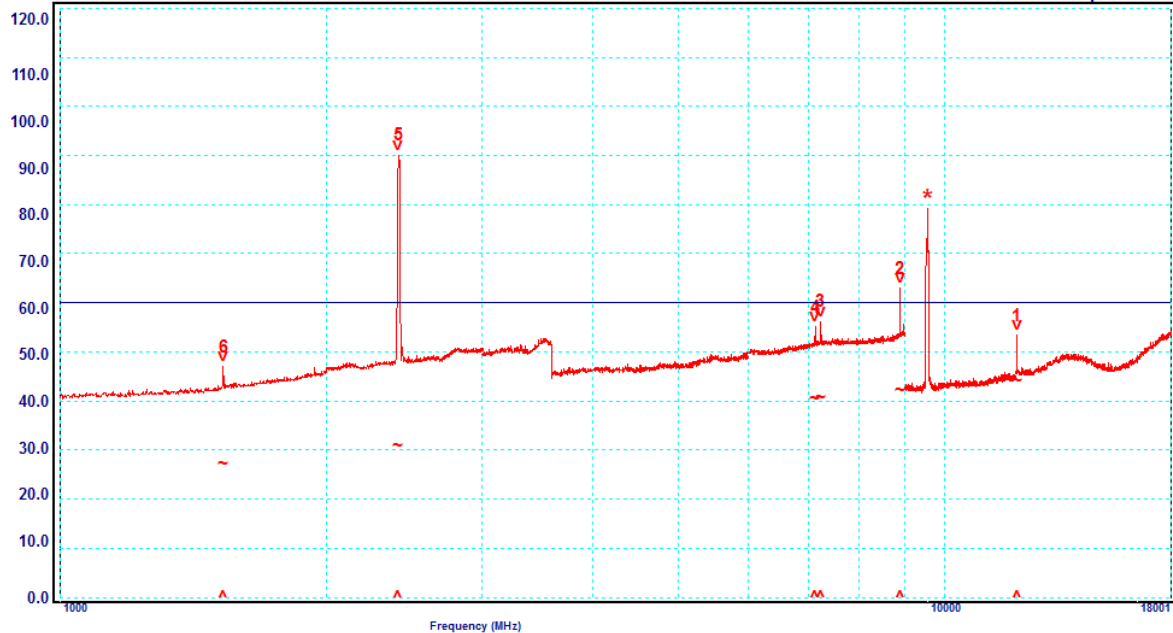
FCC CLASS A RAD 3M LIMITS

FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = AV Value

Job No: M140935  
Test Date: 2/10/2014

Trace 2: Horizontal Emissions  
R:\FMELB\2014\SEP\M140935 GROUNDPROBE\RADIATED FILES\M140935G\GraphH.bmp  
LA0040516 c1: C3370914 c2: p: NONE a: NONE  
Site ID: Room#12\OATS\, 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 11:44:49

Graph No 15



Peak	Frequency MHz	Polarisation	Measured Average Level dBuV/m	Average Limit dBuV/m	$\Delta$ Average $\pm$ dB
1	12056.31	Horizontal	44.1	60.0	-15.9
2	8892.49	Horizontal	42.2	60.0	-17.8
3	7235.46	Horizontal	40.7	60.0	-19.3
4	7134.04	Horizontal	40.5	60.0	-19.5
** 5	2413.43	Horizontal			
6	1531.25	Horizontal	27.2	60.0	-32.8

\* This is the frequency that the EUT operates (intentional transmitter) and should not be taken into account.

\*\* 2.4 GHz emission is representative of the WiFi function of the EUT (intentional transmitter) and should not be taken into account.

Ground Probe-SSR-FX  
18 GHz-40 GHz Front Side Vertical Emissions  
Peak Detector

Limit1: FCC-A1pk

FCC CLASS A RAD 1M Pk LIMITS (18 - 40 GHz)

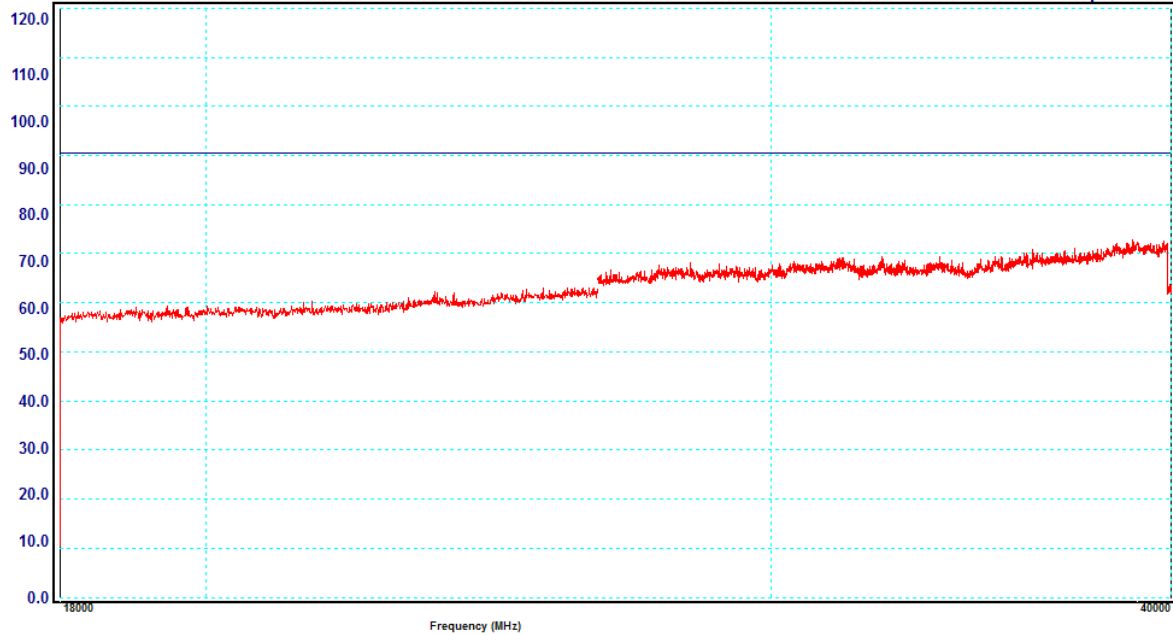
FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

Job No: M140935  
Test Date: 2/10/2014

Trace 2: Vertical Emissions

R:\FMELB\2014\SEP\M140935 GROUNDPROBE\RADIATED FILES\M140935G\GraphV.bmp  
LA3061115 c1: C2730914 c2: p: NONE a:  
Site ID: Room#12(IQAT3), 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 12:50:15

Graph No. 16



Ground Probe-SSR-FX  
18 GHz-40 GHz Front Side Vertical Emissions  
Average Detector

Limit1: FCC-A1

FCC CLASS A RAD 1M Av LIMITS (18 - 40 GHz)

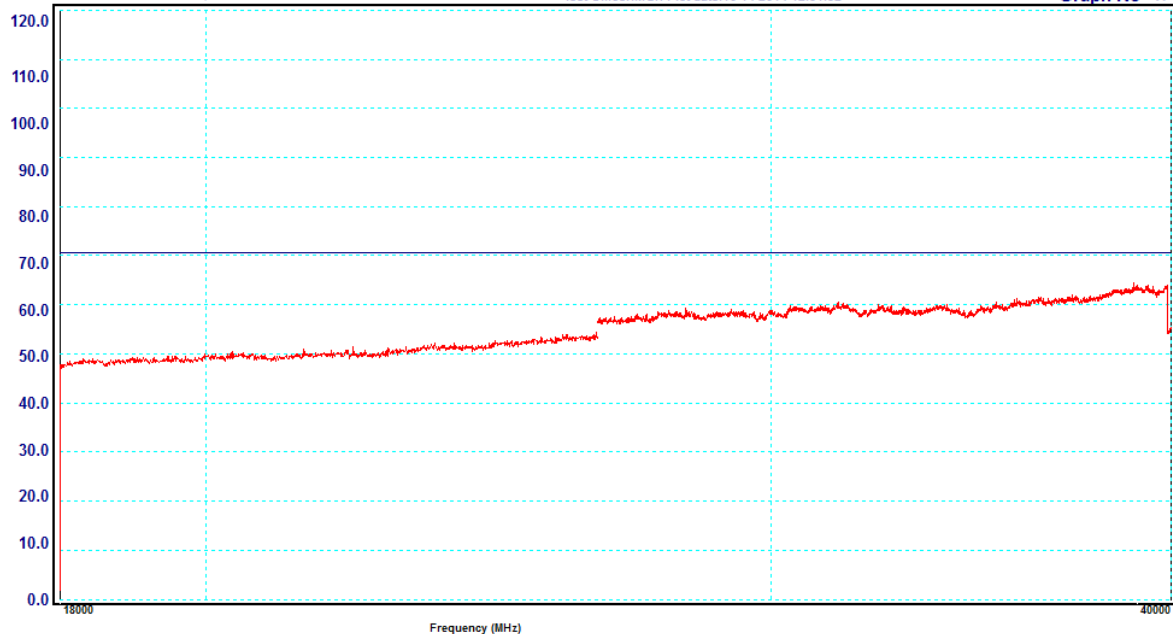
FCC Class A  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

Job No: M140935  
Test Date: 2/10/2014

Trace 2: Vertical Emissions

R:\FMELB\2014\SEP\M140935 GROUNDPROBE\RADIATED FILES\M140935G\GraphV.bmp  
LA3061115 c1: C2730914 c2: p: NONE a:  
Site ID: Room#12(IQAT3), 176 Harrick Rd, Keilor Park, Vic  
Test Officer: MGH Plot date: 10-14-2014 12:51:52

Graph No. 17



**Ground Probe-SSR-FX**  
**18 GHz-40 GHz Front Side Horizontal Emissions**  
**Peak Detector**

Limit1: FCC-A1pk

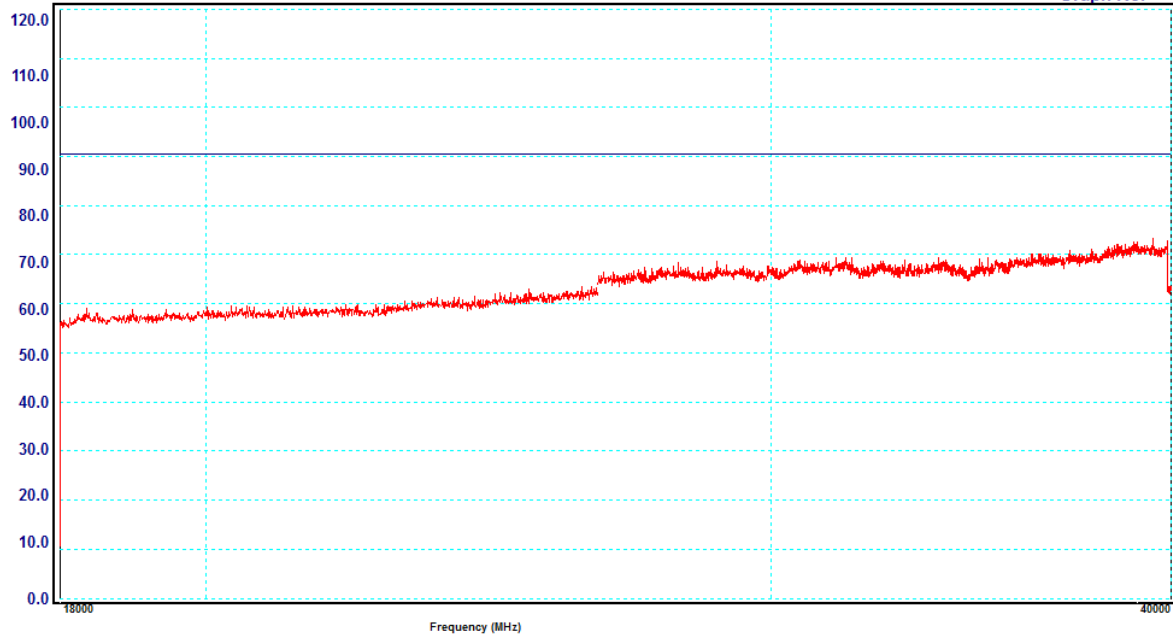
FCC CLASS A RAD 1M Pk LIMITS (18 - 40 GHz)

**FCC Class A**  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

**Job No: M140935**  
**Test Date: 2/10/2014**

**Trace 2: Horizontal Emissions**  
R:\FMELB\2014\SEP\M140935 GROUNDPROBE\RADIATED FILES\M140935G\GraphH.bmp  
LA3061115 c1:C2730914 c2: p:NONE a:  
Site ID: Room#12(IQATS),176 Harrick Rd, Keilor Park,Vic  
Test Officer:MGH Plot date:10-14-2014 12:54:24

Graph No. 18



**Ground Probe-SSR-FX**  
**18 GHz-40 GHz Front Side Horizontal Emissions**  
**Average Detector**

Limit1: FCC-A1

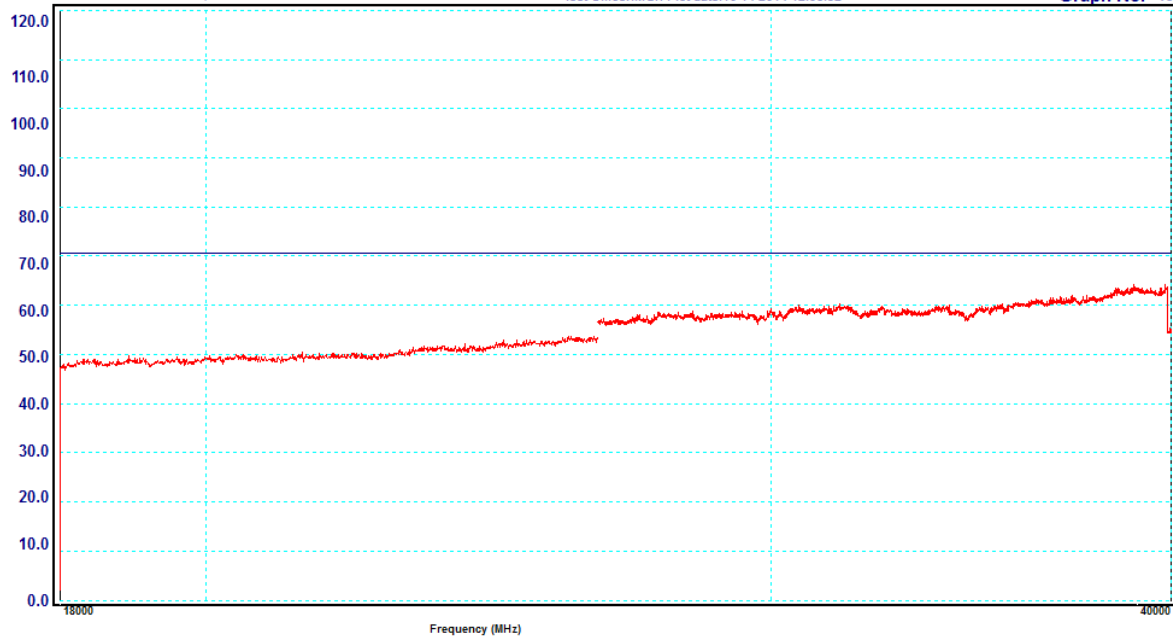
FCC CLASS A RAD 1M Av LIMITS (18 - 40 GHz)

**FCC Class A**  
Radiated Emissions (dBuV/m)  
# = Ambient ~ = QP Value

**Job No: M140935**  
**Test Date: 2/10/2014**

**Trace 2: Horizontal Emissions**  
R:\FMELB\2014\SEP\M140935 GROUNDPROBE\RADIATED FILES\M140935G\GraphH.bmp  
LA3061115 c1:C2730914 c2: p:NONE a:  
Site ID: Room#12(IQATS),176 Harrick Rd, Keilor Park,Vic  
Test Officer:MGH Plot date:10-14-2014 12:58:32

Graph No. 19



## 5.0 COMPLIANCE STATEMENT

The Slope Stability Radar (excluding power generator and power supply), Model: SSR-FX tested on behalf of GroundProbe Ltd, against the requirements of 47 CFR, FCC Part 90 - Private Land Mobile Services.

**Results were as follows:**

<b>Title 47</b>	<b>Test Performed</b>	<b>Result</b>
<b>Part 90</b>	Private Land Mobile Radio Services	
<b>Subpart F</b>	Radiolocation Service	<b>Applied</b>
<b>Subpart I</b>	General Technical Standards	<b>Applied</b>
<b>Part 2</b>	Frequency allocations and radio treaty matters; general rules and regulations	
<b>2.1046</b>	Power Output	<b>35 dBm</b>
<b>2.1047</b>	Modulation	<b>Pulse</b>
<b>2.1049</b>	Bandwidth	<b>84 MHz</b>
<b>2.1051</b>	Conducted Spurious	<b>&lt; -13 dBm</b>
<b>2.1053</b>	Radiated Spurious	<b>Part 15B Class A</b>
<b>2.1055</b>	Frequency Stability	<b>&lt; <math>\pm</math> 1MHz</b>
<b>2.1057</b>	Frequency Range	<b>Applied</b>



## 6.0 MEASUREMENT UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

<b>Power Output:</b>	$\pm 0.5$ dB
<b>Modulation Characteristic:</b>	$\pm 0.5$ dB
<b>Occupied Bandwidth:</b>	$\pm 5\%$
<b>Conducted Spurious:</b>	$\pm 1$ dB
<b>Frequency Stability:</b>	$\pm 2.83$ MHz
<b>Radiated Spurious:</b>	
0.09 kHz to 30 MHz	$\pm 4.1$ dB
30 MHz to 300 MHz	$\pm 5.1$ dB
300 MHz to 1000 MHz	$\pm 4.7$ dB
1 GHz to 18 GHz	$\pm 4.6$ dB
18 GHz to 40 GHz	$\pm 4.9$ dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

## APPENDIX A MEASUREMENT INSTRUMENT

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	LAST CAL. DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
<b>EMI RECEIVERS</b>	R&S ESU40 Sn: 100182 (R-037)	30/01/14	30/01/15	1 YEAR *2
	R&S ESCI Sn: 100011 (R-028)	23/05/14	23/05/15	1 YEAR *2
<b>ANTENNAS</b>	SUNOL JB6 BICONILOG (A-363) 30 - 6000 MHz Sn. A012312	16/05/14	16/05/15	1 YEAR *3
	EMCO 3115 Broadband Horn (A-004) 1 – 18 GHz	16/01/12	16/01/15	3 YEAR *1
	ETS-Lindgren 3160-09 Standard Gain Horn (A-307) 18-26.5 GHz	12/11/12	12/11/15	3 YEAR *1
	ETS-Lindgren 3160-10 Standard Gain Horn (A-306) 26.5-40 GHz	12/11/12	12/11/15	3 YEAR *1

Note \*1. In-house calibration. Refer to Quality Manual.

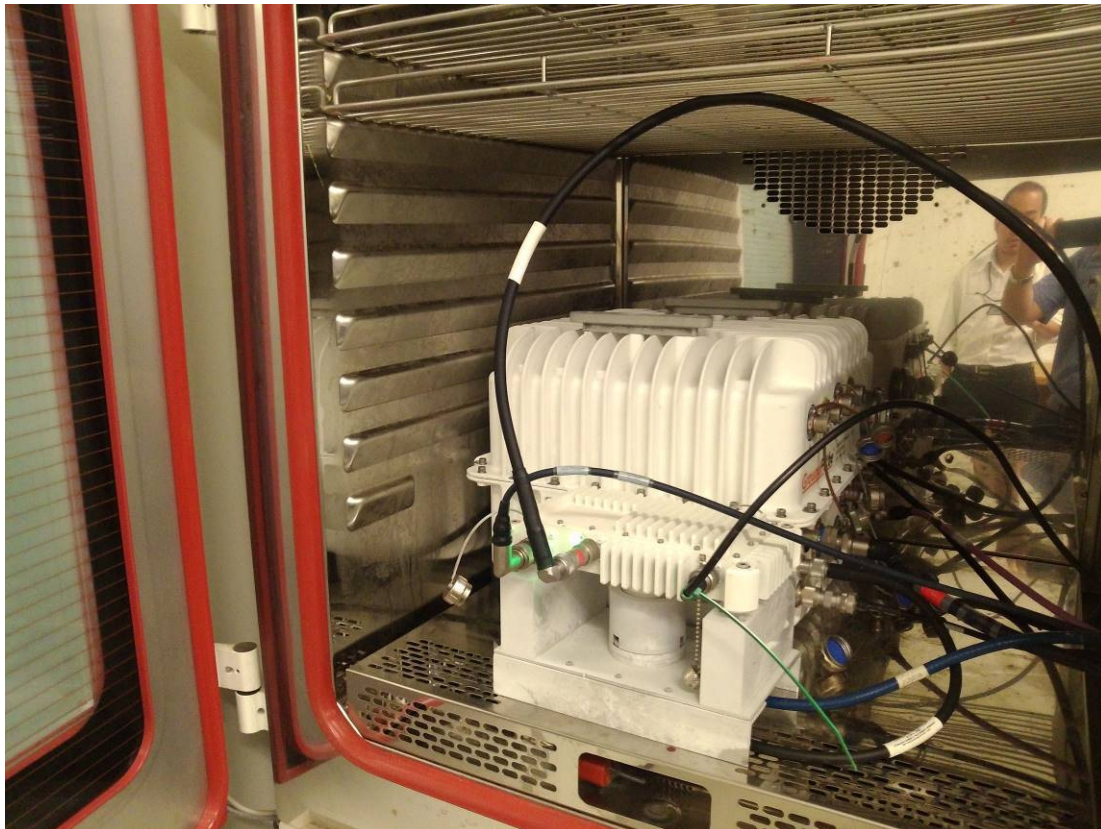
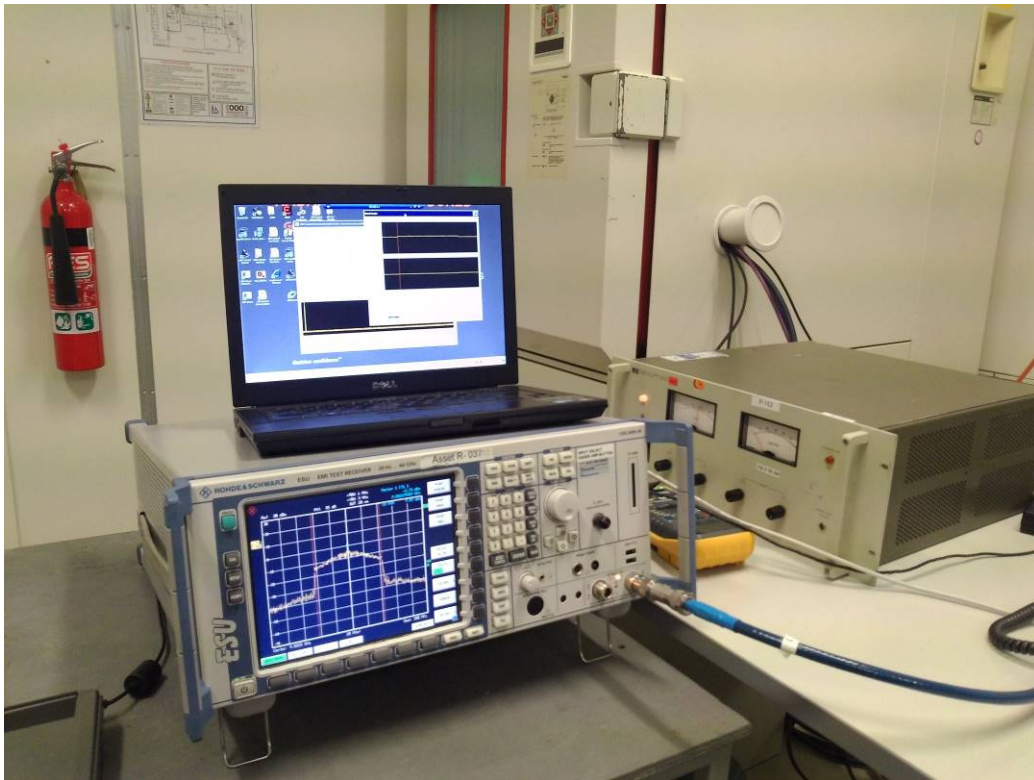
Note \*2. NATA calibration by VMS

Note \*3. A2LA Accredited calibration by Liberty Labs, Inc.

Laboratory 12: Indoor Open Area Test Site 22m × 13.4m × 9.8m Semi-Anechoic Chamber

## APPENDIX B TEST SETUP PHOTOGRAPHS

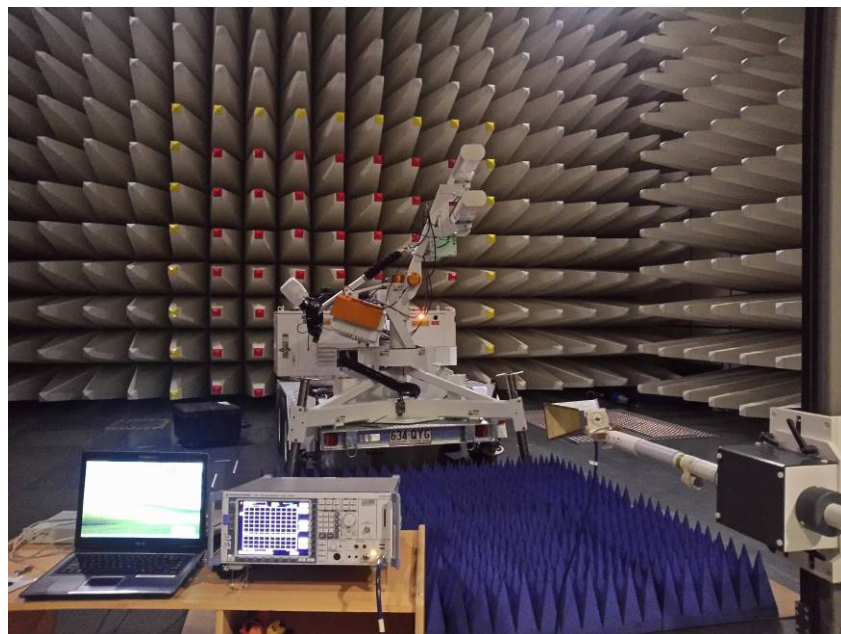
### Conducted measurement setup



## Radiated measurement setup 30 MHz-1 GHz

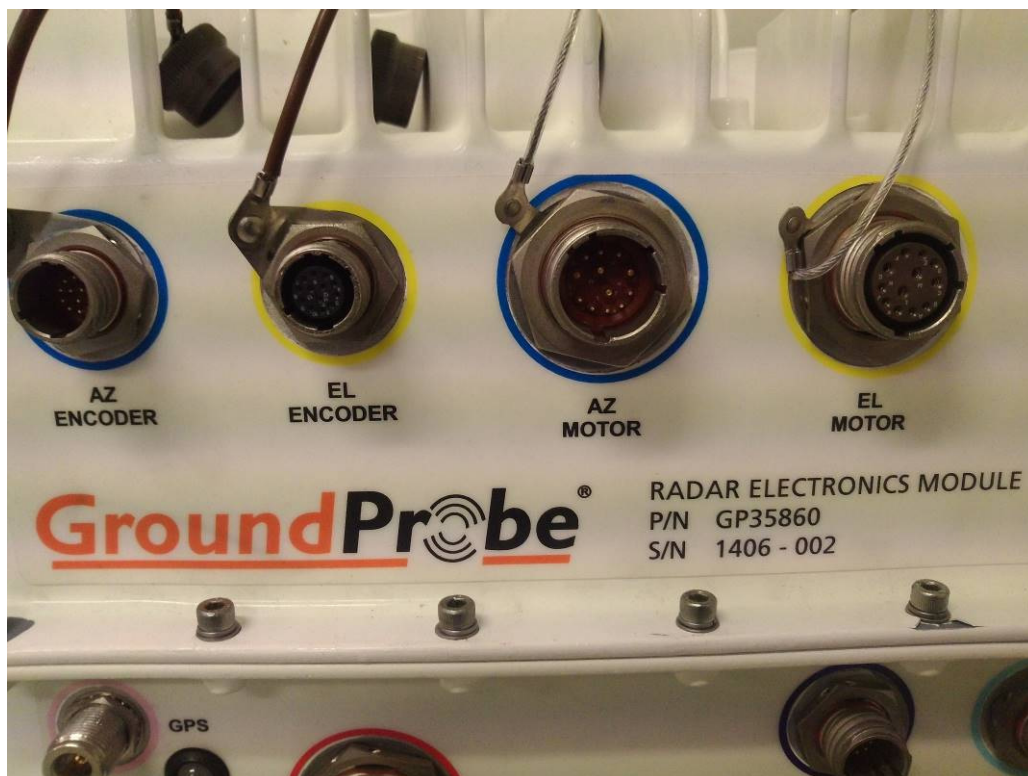
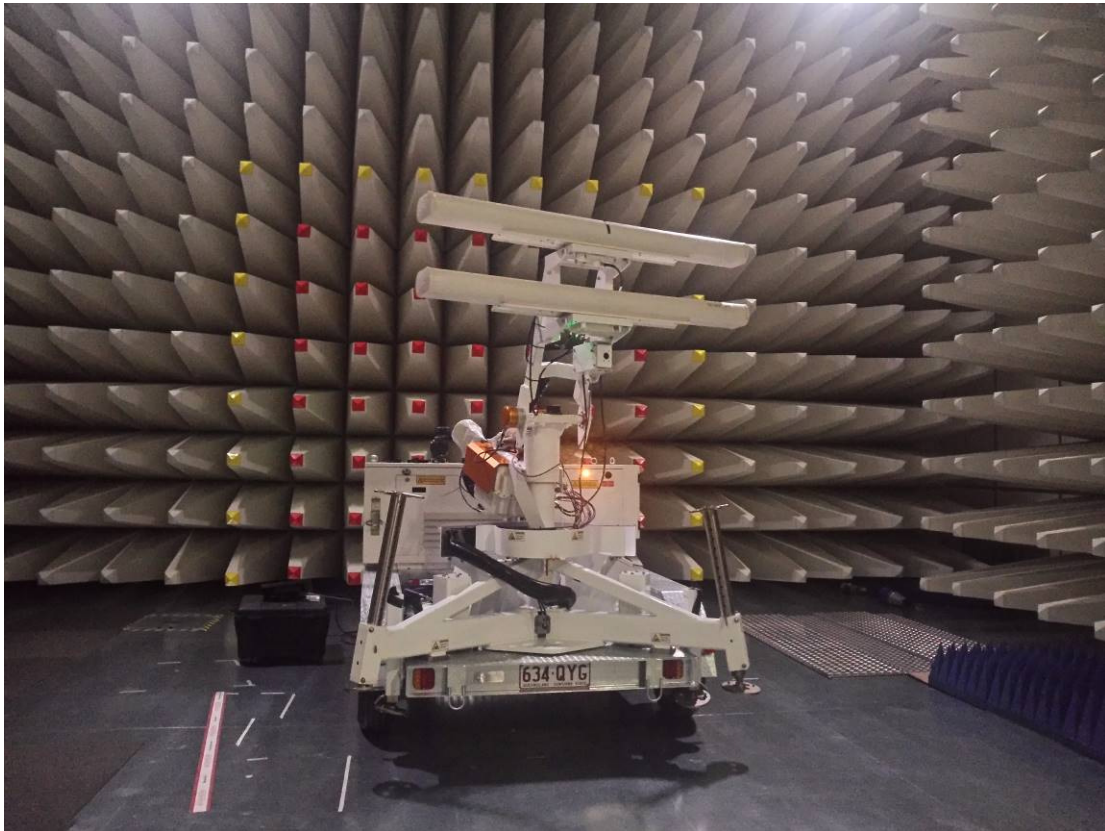


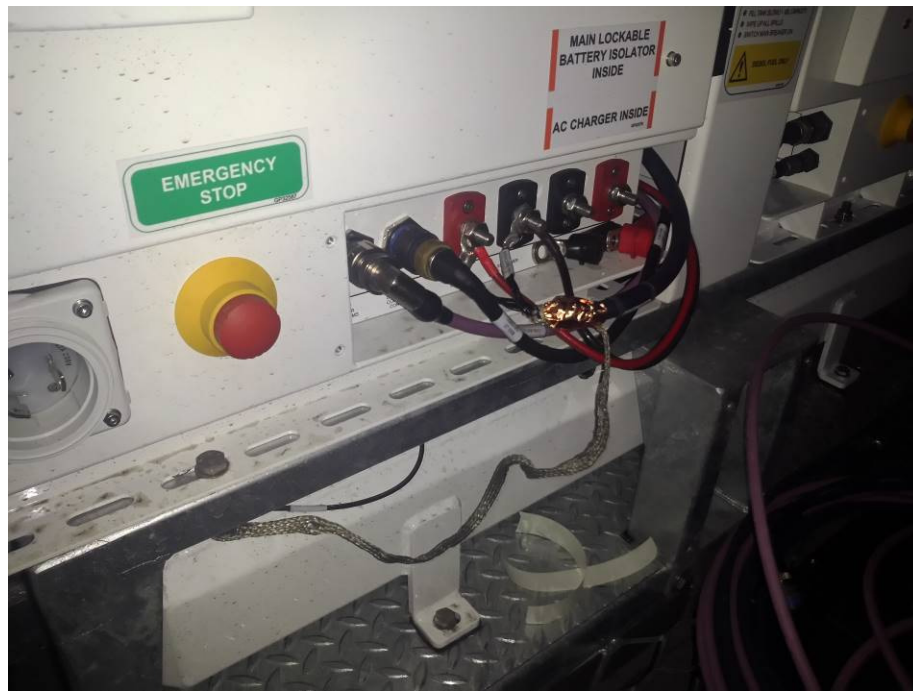
## Radiated measurement setup above 1 GHz





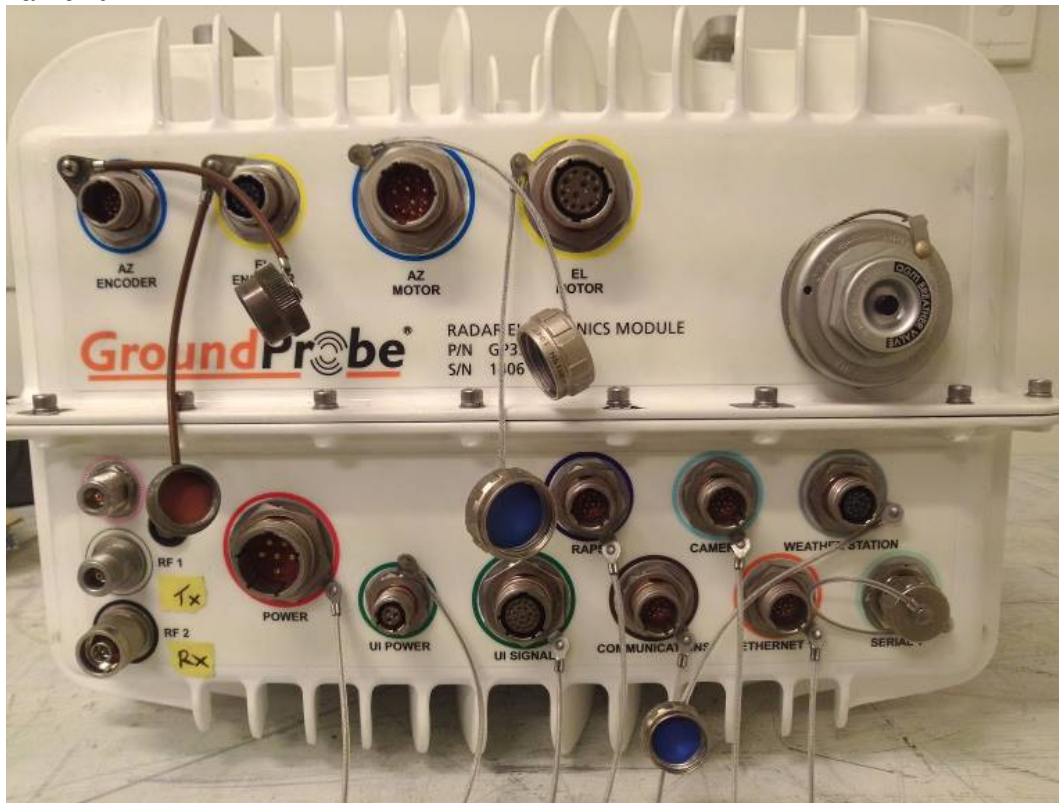
## APPENDIX C EUT PHOTOGRAPHS



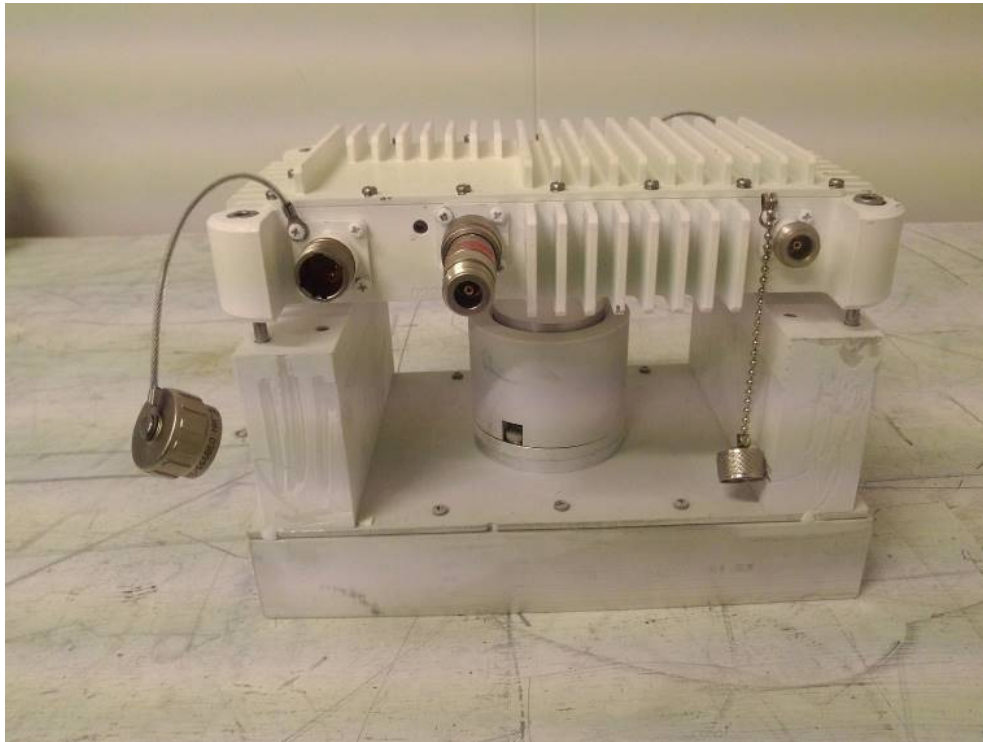




## Radar main unit



## Amplifier &amp; waveguide to coaxial adapter



## Waveguide to coaxial adapter

