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**Report No. 141207-1a**

**Compliance Testing Report of the  
“E10G” Microwave Communications Transceiver to  
FCC Part 15, (ANSI C63.4:2003)**

for

**EMClarity Pty Ltd**

Prepared by: \_\_\_\_\_

Michael Matevski

Reviewed by: \_\_\_\_\_

Geoff Garrett

Date: 19<sup>th</sup> June 2015

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## 1. Client Information

Company: EMClarity Pty Ltd  
55 Curzon St, Tennyson,  
Qld, 4105, Australia  
Tel: +61 (0) 7 3123 2388  
Web: www.emclarity.com.au

## 2. Equipment Under Test (EUT)

### 2.1 Identification of EUT

Equipment Description: A microwave point to point link telecommunications transceiver. The wideband telecommunications signalling is within the E-band (70-76GHz, and 81-86GHz). The antenna dishes are aligned by low power narrowband and wideband tracking and alignment signals within the ISM band (24.0 -24.25GHz).

Models: E10G-7282-2506 (0.6m diameter antenna dish)  
E10G-7282-2512 (1.2m diameter antenna dish)

Make: EMClarity  
Supply: 48 VDC (Battery). The EUT is to be supplied without an external 48 VDC power source. The EUT was tested as a battery powered device.

### 2.2 Auxiliary Equipment

Nil

### 2.3 Operating Conditions of EUT

The tests were performed with the EUT powered by 48 VDC. The EUT was orientated and operated to create the condition that produced the maximum emissions as required by the standard

### 3. Test Specifications

#### 3.1 Standard Selected

ANSI C63.4:2003 was selected to demonstrate compliance with the applicable EMC requirements of FCC Part 15, as the EUT is within the scope of this standard, and ANSI C63.4 is the preferred method of compliance with 47CFR Part 15 rules.

#### 3.2 Changes from the Selected Standard

None

#### 3.3 Test Facility

All radiated tests reported within this document were performed by EMC Services Pty Ltd measurement facility located at the following location:

Laboratory and Open Area Test Site: Hampton Grove  
Rydal Road  
Hampton, NSW,  
Australia, 2790

10m open area test site (OATS), equipped  
with 360 degree remote control turntable and  
6 metre remote control antenna mast.

A description of the test facility is on file with the FCC under Registration # **480861**

The tests in Section 4.3 requiring temperature and input power supply voltage variation were performed in an environmental chamber.

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### 3.4 Test Equipment

Test equipment used is from the list below. All equipment was within the current calibration period and/or confirmed to be within the specified uncertainty.

Description	Model number
Spectrum analyser	HP 8591EM
Spectrum analyser	E4407B
Spectrum analyser	R&S FSU43
Antenna 30 MHz to 2 GHz	CBL6141A
Double Ridged Horn Antenna	BBHA9120
Standard Gain Horn Antenna	61932500
Standard Gain Horn Antenna	861A/599
Standard Gain Horn Antenna	27240-20
Standard Gain Horn Antenna	25240-20
Microwave Amplifier	AHP-83062120-01
Microwave amplifier	CMB02183030-01
Low noise amplifier	HP8447E
RF cable	EMCS 01
RF Cable	955604/4

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## 4. Test Summary

### 4.1 Emissions FCC Part 15

EMC Tests	FCC Part Rule	Result	Note
Radiated Emissions, (1.2m dish)	15.109	<b>Pass</b>	Modification as detailed in Section 5.1
Radiated Emissions, (0.6m dish)	15.109	<b>Pass</b>	Modification as detailed in Section 5.2
Conducted emissions, (1.2m dish)	15.207	N/A	Battery powered
Conducted emissions, (0.6m dish)	15.207	N/A	Battery powered

### 4.2 Radiated Emissions Tests at OATS to FCC part 15

Parameter	FCC Rule Part	Limit	Measured	Result
Frequency:	15.249(a)	24.0 to 24.25 GHz	24.2061 GHz (1.2m dish)	<b>Pass</b>
			24.0630 GHz (1.2 m dish)	<b>Pass</b>
			24.2100 GHz (0.6m dish)	<b>Pass</b>
Modulation/20 dB bandwidth TX signal	15.215(c)	-	CW/ <100 Hz	<b>Pass</b>
Field Strength:	15.249(a)	250mV/m at 3m	40mV/m at 3m (1.2m dish)	<b>Pass</b>
			90mV/m at 3 m (0.6m dish)	<b>Pass</b>
Spurious:	15.249(d)	54 dBµV/m at 3m	47 dBµV/m at 3m (1.2m dish)	<b>Pass</b>
			46 dBµV/m at 3m (0.6m dish)	

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**4.3 Conducted tests in the laboratory environmental chamber to FCC part 15**

<b><i>Parameter</i></b>	<b><i>FCC Rule Part</i></b>	<b><i>Limit</i></b>	<b><i>Measured</i></b>	<b><i>Result</i></b>
<i>Emissions(20 dB bandwidth) are within 24.0 to 24.25 GHz</i>	15.215(c) 15.31(m)	24.0 to 24.25 GHz	24.04085 to 24.245 MHz (see Figure 9a)	<b>Pass</b>
<i>Output power variation with frequency supply voltage (DC) varied between 85% and 115% of the nominal rated DC supply voltage</i>	15.31(e) 15.31(m)	As per 15.249(a)	<i>A variation of &lt;+/- 2.5 dB of the radiated readings in Section 4.2. See Figure 9b</i>	<b>Pass</b>

The results in this report apply only to the tested sample described in Section 2 and depicted in the photographs attached.

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## 5. Modifications :

### 5.1 E10G-7282-2512 (1.2m Dish), refer section 10 – photos 5 and 6

- Clip on ferrite fitted to the control module PCO cable, next to the panel connector, make - Ferroxcube, part number - CSA26/13/29-4S2F-EN.
- Solid ferrite ring fitted to the control module PIN cable, next to the panel connector. Quantity 2 (2 turns) of ferrite, supplier – Wurth Electronics, part number – 7427015.
- Clip on ferrite fitted to the ENC cable on the control module next to the panel connector, make - Richco, part number – MTFC 231114T.
- Conductive braid fitted to the length of the ME and Ma cables on the control module.

### 5.2 E10G-7282-2506 (0.6m Dish), refer section 10 – photo 10

- The following two clips on ferrites fitted to the control cable connected between the control module and the antenna. The two ferrites were fitted next to the panel mounted connector on the control module. Make - Ferroxcube, part number - CSA26/13/29-4S2F-EN and make - Richco, part number - MTFC 231114T.



## 6. Test Results

### 6.1 Test Conditions

Date of test:	20 <sup>th</sup> March 2015, 15 <sup>th</sup> to 19 <sup>th</sup> June 2015
Temperature:	21°C to 29°C
Humidity:	51% to 56%
Supply Voltage:	48 VDC

Emissions tests were performed in accordance with the standard referenced in Section 3.

Where the spectrum was occupied by other transmissions (i.e. ambient signals that approached or exceeded the limit), 'close-up' probing and similar investigative procedures were executed to establish the emission signature of the EUT and whether masked emissions would approach or exceed the limit at these frequencies. The EUT was operated to produce maximum emissions at all times.

### 6.2 Radiated Emissions

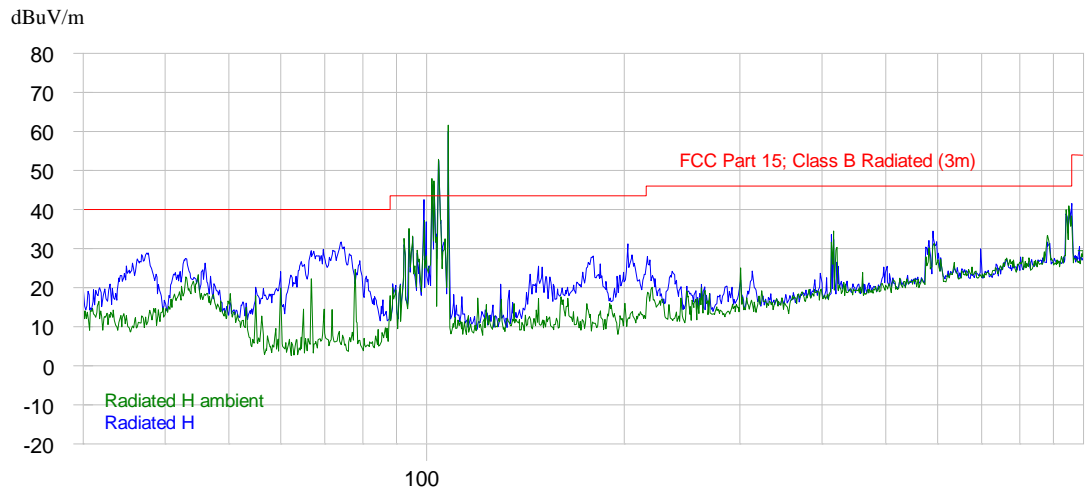
The radiated peak emission trace results are shown in Figures 1a to 8b. The radiated testing was performed at an antenna-to-EUT distance of 3 metres. Peak values only were measured, except where the disturbances approached the limit. At these points, the QP detector was used. The resolution bandwidth was 120 kHz and the video bandwidth was 300 kHz for measured emissions from 30 MHz to 1 GHz. The resolution bandwidth was 1 MHz and the video bandwidth was 1 MHz for measured emissions above 1 GHz.

## 7. Measurement Uncertainty

The uncertainty of the quantities measured or applied were within the tolerances described below:

<i>Radiated Emissions:</i>	$\pm 6$ dB
<i>Conducted Emissions:</i>	$\pm 2$ dB

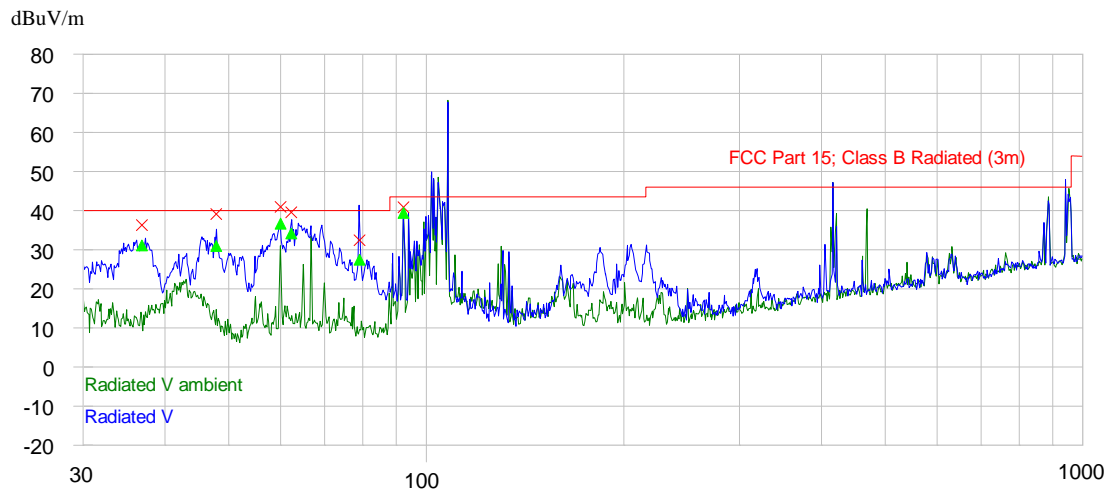
## 8. Test Plots



(Start = 30.00, Stop = 1000.00) MHz

Note: Signals exceeding the limit level in the plot were ambients.

**Figure 1a. Radiated Emissions, 0.6m dish - 30 MHz to 1000 MHz (Horizontal)**



(Start = 30.00, Stop = 1000.00) MHz

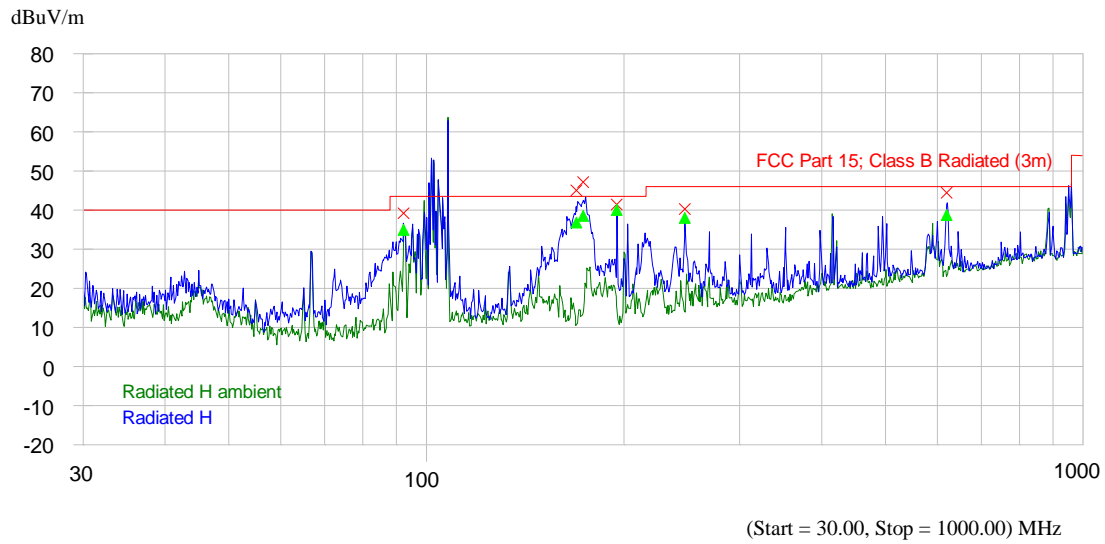
Frequency MHz	Peak dBuV/m	QP dBuV/m
36.871	36.3	31.1
47.879	39.1	30.9
59.978	40.9	36.6
62.293	39.5	34.2
79.082	32.4	27.4
92.295	40.8	39.4

Note: Signals exceeding the limit level in the plot were ambients.

**Figure 1b. Radiated Emissions, 0.6m dish - 30 MHz to 1000 MHz (Vertical)**

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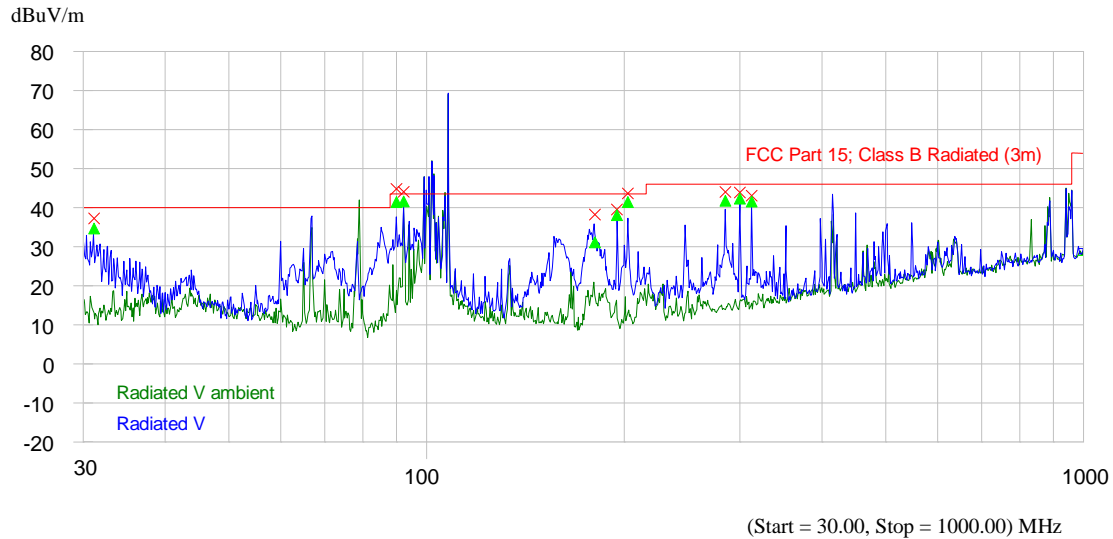
Frequency MHz	Peak dBuV/m	QP dBuV/m
169.199	45.0	36.8
173.337	47.1	38.5
194.989	41.4	40.0
247.493	40.2	38.0
92.325	39.2	34.9
619.901	44.4	38.7

Note: Signals exceeding the limit level in the plot were ambients.

**Figure 2a. Radiated Emissions, 1.2m dish - 30 MHz to 1000 MHz  
(Horizontal)**

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Frequency MHz	Peak dBuV/m	QP dBuV/m
31.178	37.2	34.6
92.286	44.1	41.6
89.975	44.8	41.4
180.389	38.2	31.1
194.982	39.5	38.1
202.484	43.6	41.4
284.983	44.0	41.8
299.988	43.9	42.3
312.492	43.1	41.6

Note: Signals exceeding the limit level in the plot were ambients.

**Figure 2b. Radiated Emissions, 1.2 m dish - 30 MHz to 1000 MHz (Vertical)**

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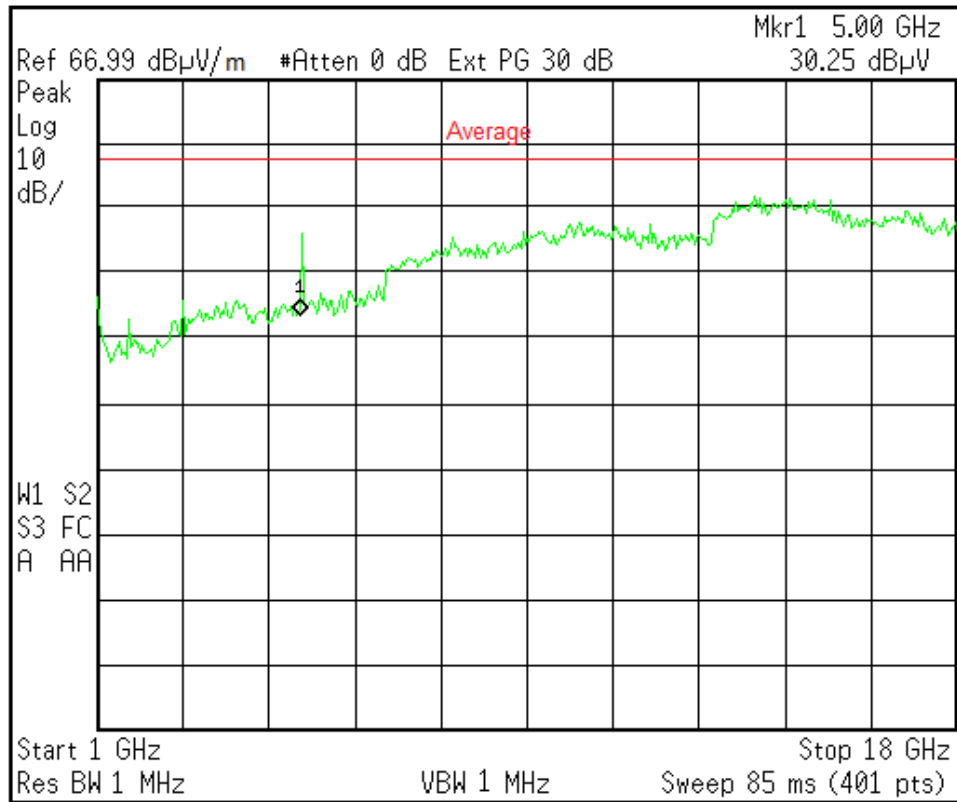


Figure 3a. Radiated Emissions, 1.2m dish - 1 GHz to 18 GHz (Vertical)

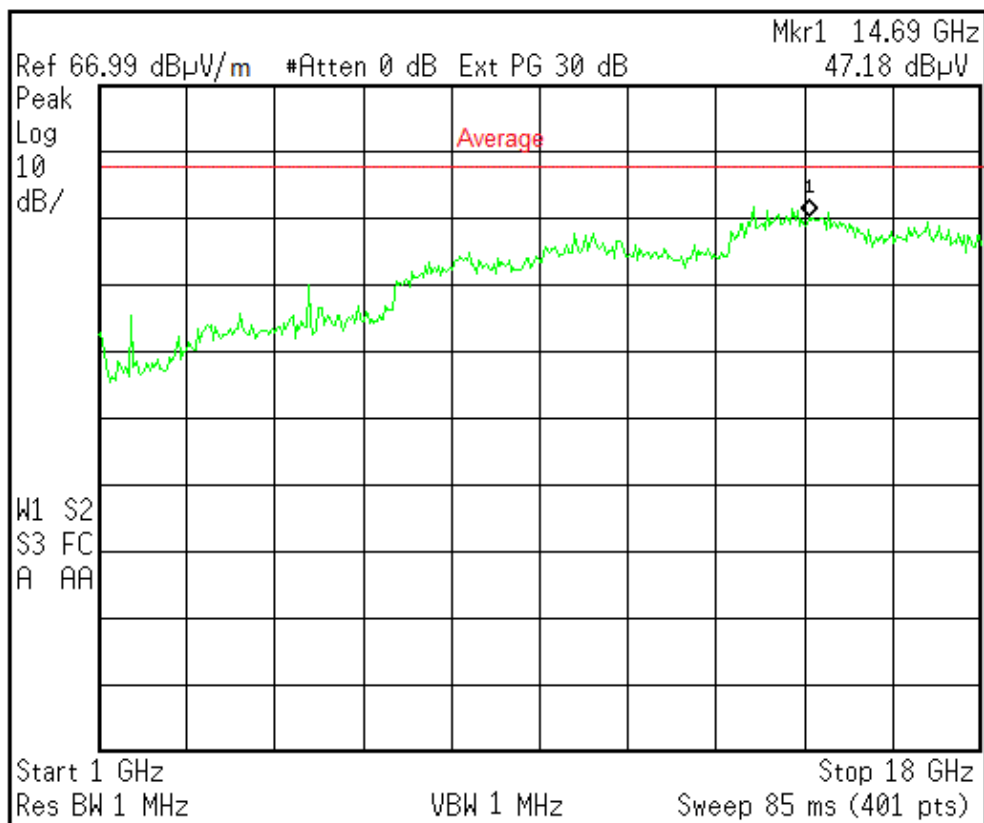


Figure 3b. Radiated Emissions, 1.2m dish - 1 GHz to 18 GHz (Horizontal)

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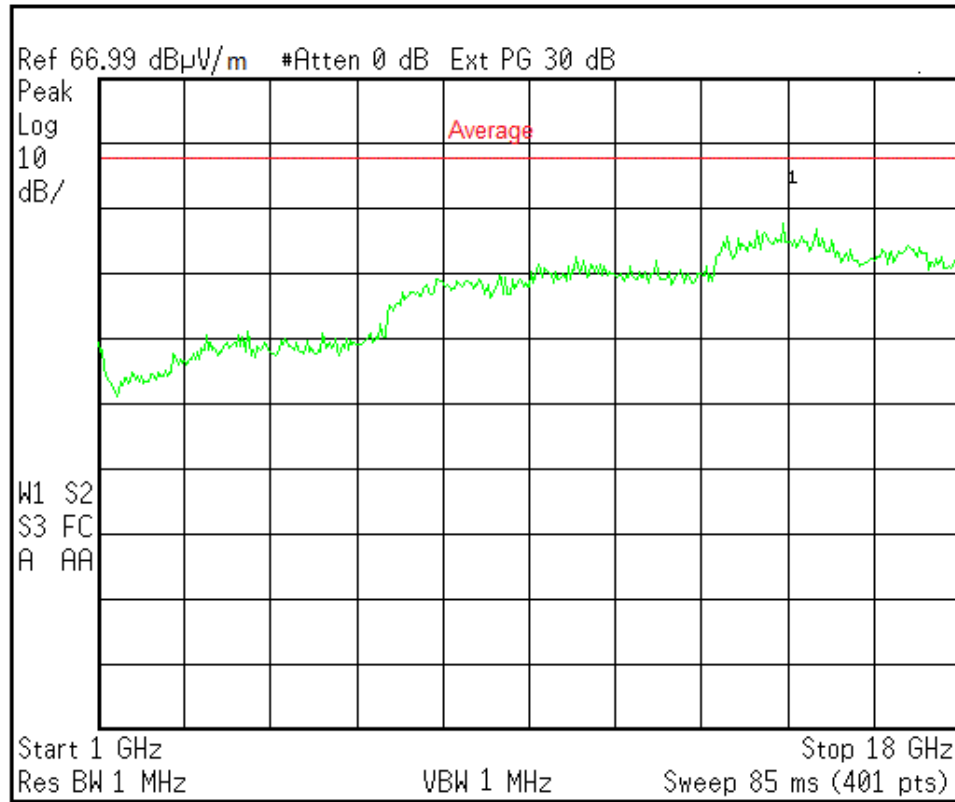


Figure 4a. Radiated Emissions, 0.6m dish - 1 GHz to 18 GHz (Vertical)

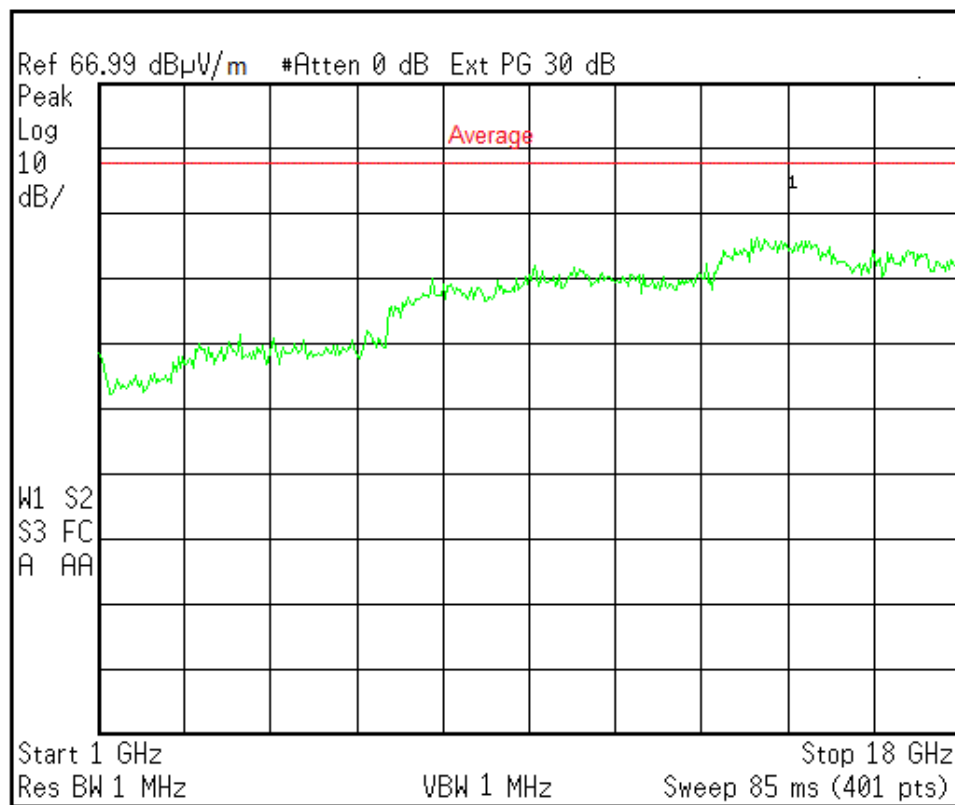
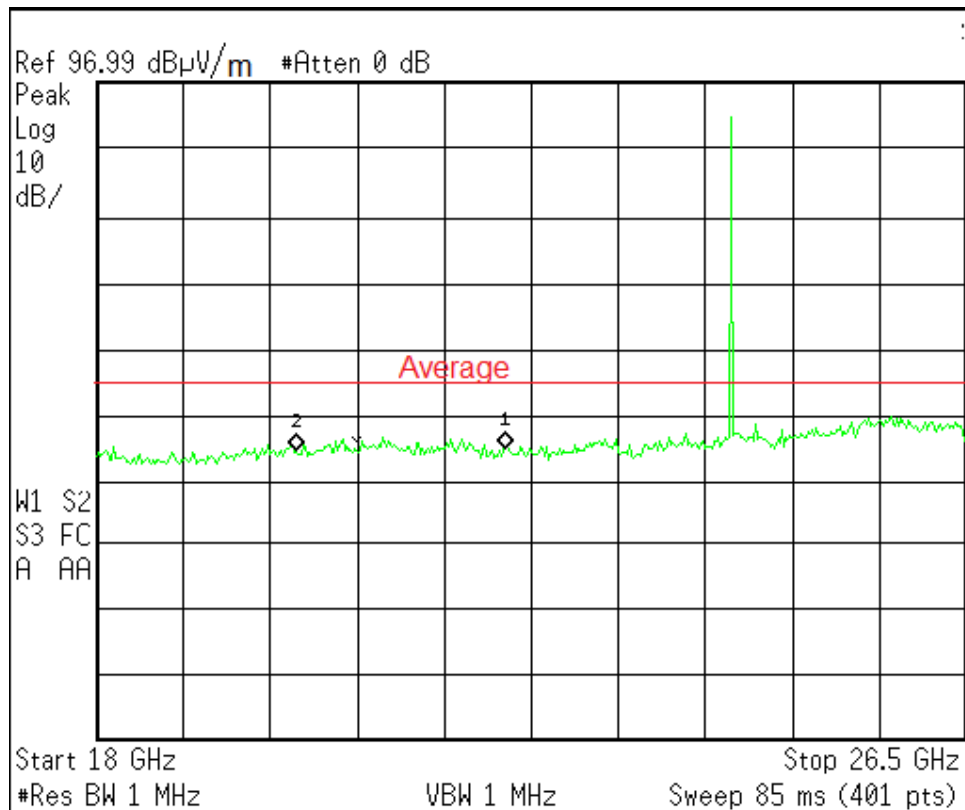


Figure 4b. Radiated Emissions, 0.6m dish - 1 GHz to 18 GHz (Horizontal)

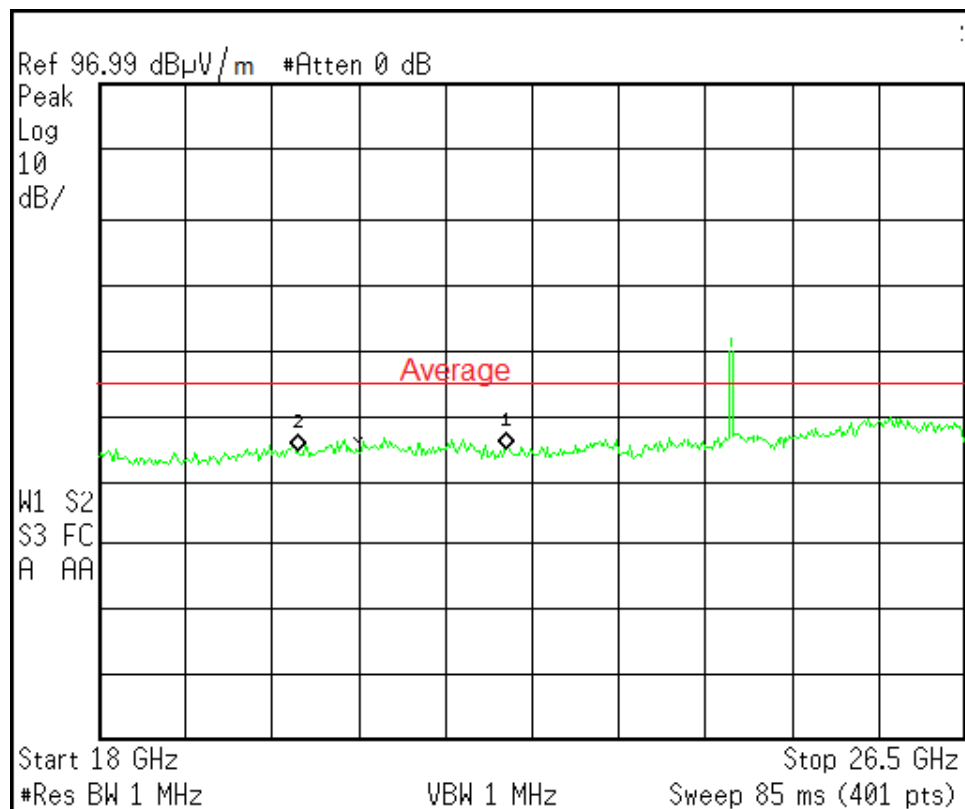
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**Figure 5a. Radiated Emissions, 1.2m dish - 18 GHz to 26.5 GHz (Vertical)**

*Note: The signal exceeding the limit at 24 GHz is the intentional emitter*

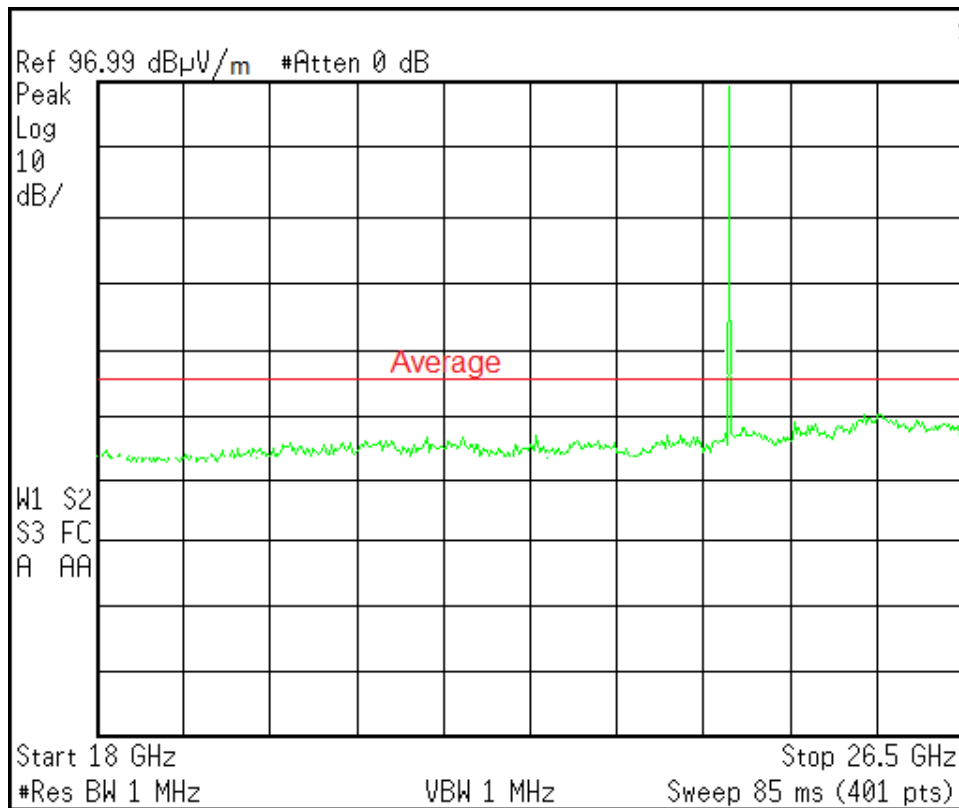


**Figure 5b. Radiated Emissions, 1.2m dish - 18 GHz to 26.5 GHz (Horizontal)**

*Note: The signal exceeding the limit at 24 GHz is the intentional emitter*

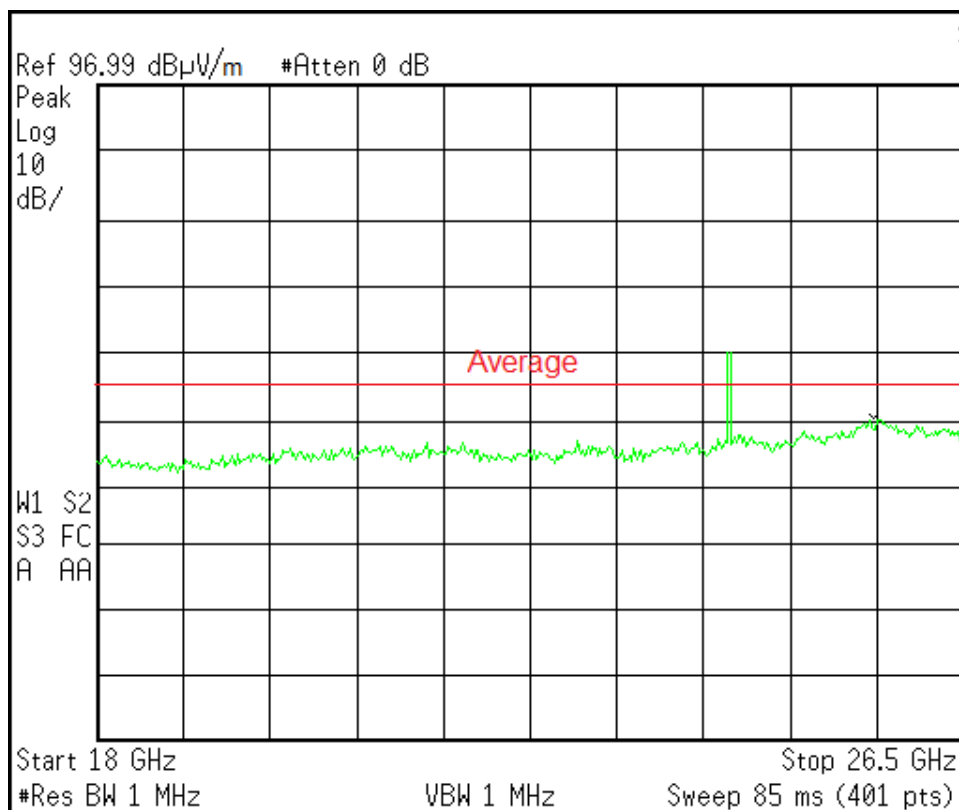
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**Figure 6a. Radiated Emissions, 0.6m dish - 18 GHz to 26.5 GHz (Vertical)**

*Note: The signal exceeding the limit at 24 GHz is the intentional emitter*



**Figure 6b. Radiated Emissions, 0.6m dish - 18 GHz to 26.5 GHz (Horizontal)**

*Note: The signal exceeding the limit at 24 GHz is the intentional emitter*

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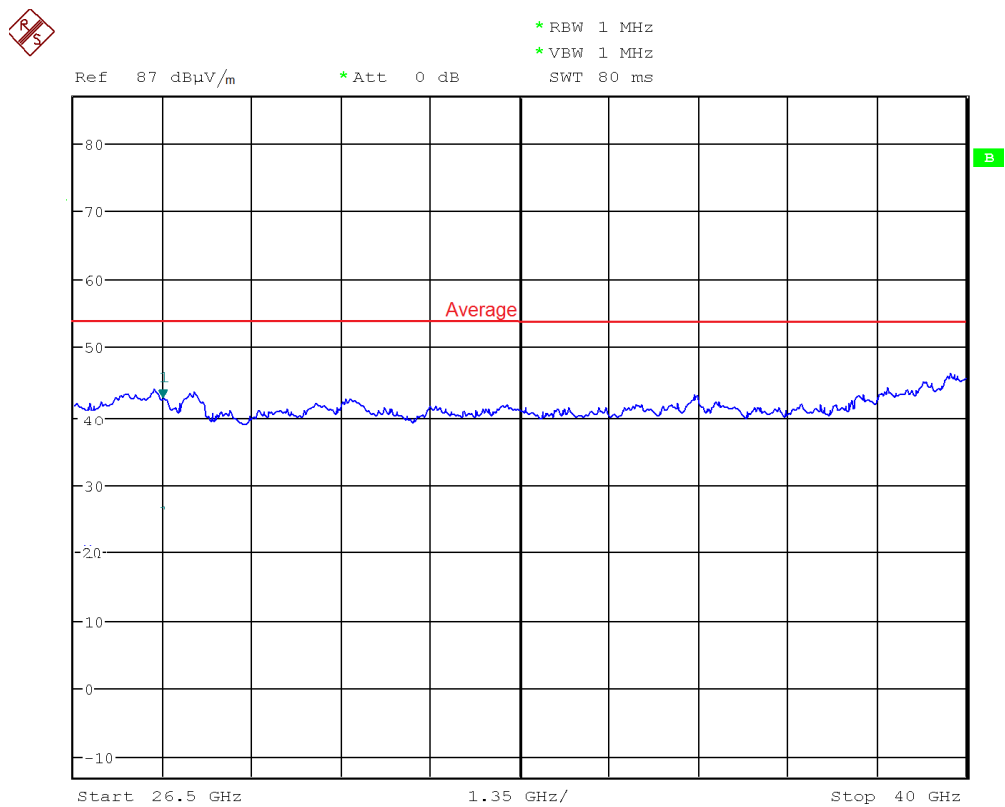


Figure 7a. Radiated Emissions, 1.2m dish - 26.5 GHz to 40 GHz (Vertical)

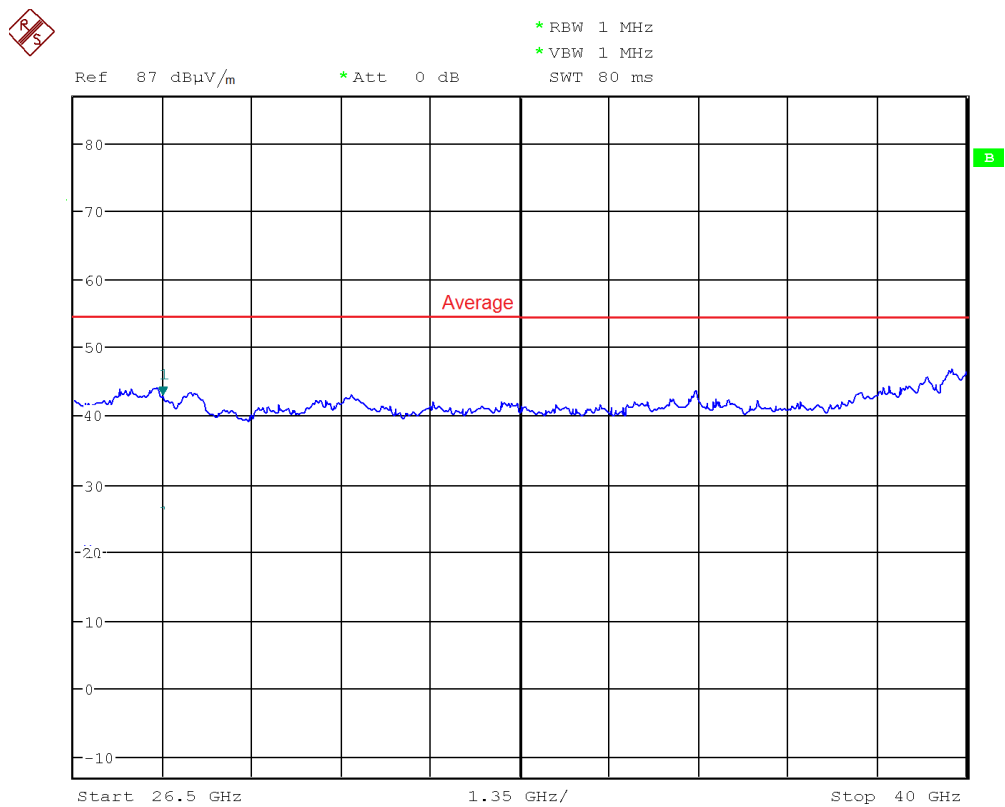


Figure 7b. Radiated Emissions, 1.2m dish - 26.5 GHz to 40 GHz (Horizontal)

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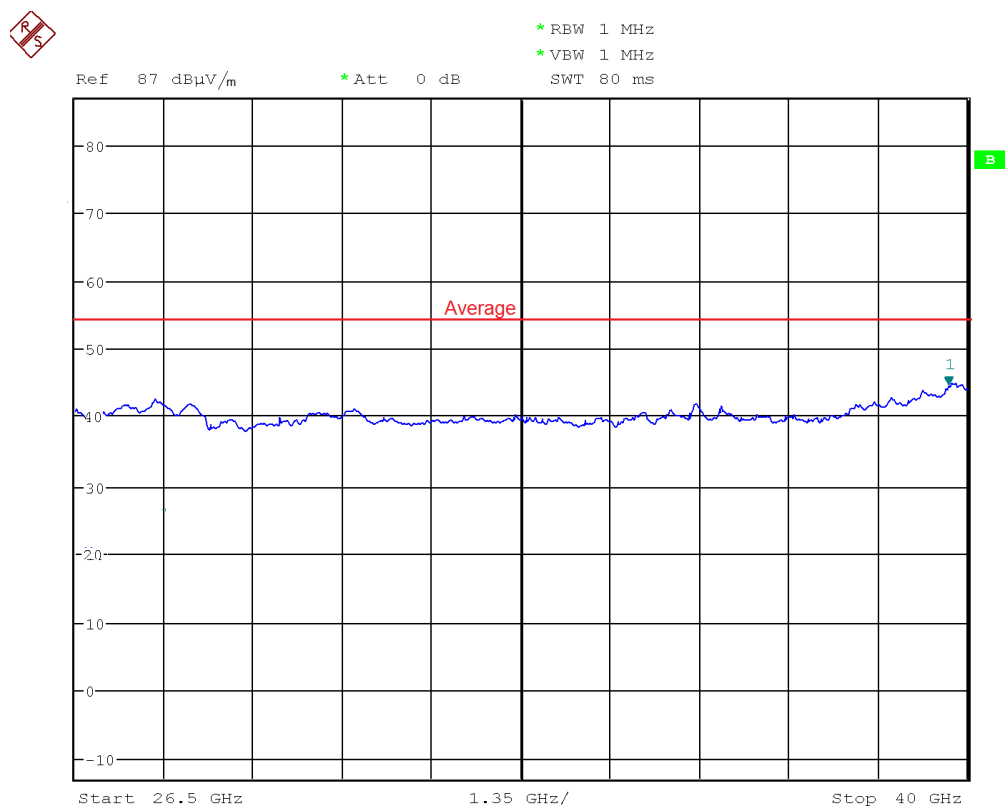


Figure 8a. Radiated Emissions, 0.6m dish - 26.5 GHz to 40 GHz (Vertical)

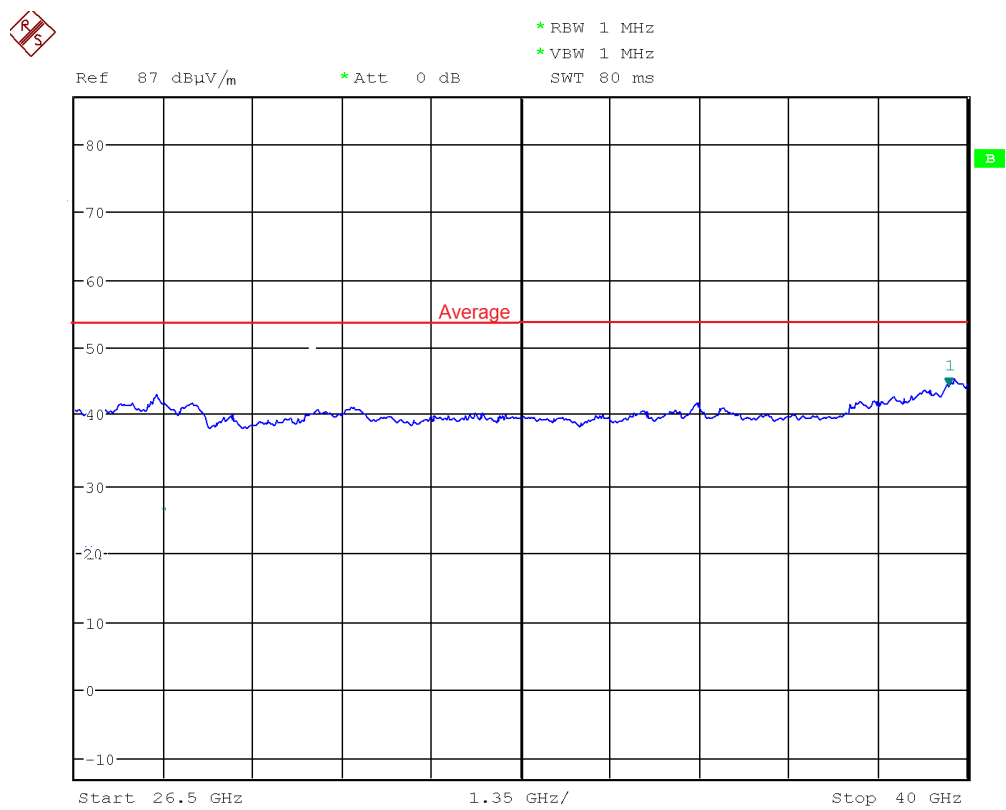


Figure 8b. Radiated Emissions, 0.6m dish - 26.5 GHz to 40 GHz (Horizontal)

		<b>Temp: 55 Degrees C</b>		<b>Temp: 22 Degrees C</b>		<b>Temp: 30 Degrees C</b>	
		Variation in Hz, Narrow	Variation in Hz, Wide	Variation in Hz, Narrow	Variation in Hz, Wide	Variation in Hz, Narrow	Variation in Hz, Wide
<b>Low Band Nominal Frequency</b>							
Channel	MHz						
0	24048.5	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz
1	24052.5						
2	24057.5						
3	24062.5						
4	24067.5	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz
5	24072.5						
6	24077.5						
7	24082.5						
8	24087.5	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz
<b>High band nominal Frequency</b>							
Channel	MHz						
0	24206	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz
1	24210						
2	24215						
3	24220						
4	24225	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz
5	24230						
6	24235						
7	24240						
8	24245	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz	<100 Hz

Figure 9a. Frequency stability tests (bottom, middle and top of band) of the transmitter with temperature variation

		<b>DC Supply: 40.8V (85 %)</b>		<b>DC Supply: 48V (Nominal)</b>		<b>DC Supply: 55.2V (115 %)</b>	
		Narrow (dBm)	Wide (dBm)	Narrow (dBm)	Wide (dBm)	Narrow (dBm)	Wide (dBm)
<b>LOW BAND</b>							
Channel	MHz						
0	24048.5	-36	-10.7	-38.8	-10.9	-36	-10.9
1	24052.5						
2	24057.5						
3	24062.5						
4	24067.5	-35.9	-10.5	-36.9	-11.7	-36.06	-10.7
5	24072.5						
6	24077.5						
7	24082.5						
8	24087.5	-37.5	-11.1	-38	-12	-38.1	-11.3
<b>High BAND</b>							
Channel	MHz						
0	24206	-38.2	-11.82	-40.1	-12.8	-38.5	-12.8
1	24210						
2	24215						
3	24220						
4	24225	-38.7	-12	-40.4	-13.1	-38.9	-13
5	24230						
6	24235						
7	24240						
8	24245	-38.6	-12.2	-40.5	-13.3	-38.9	-13

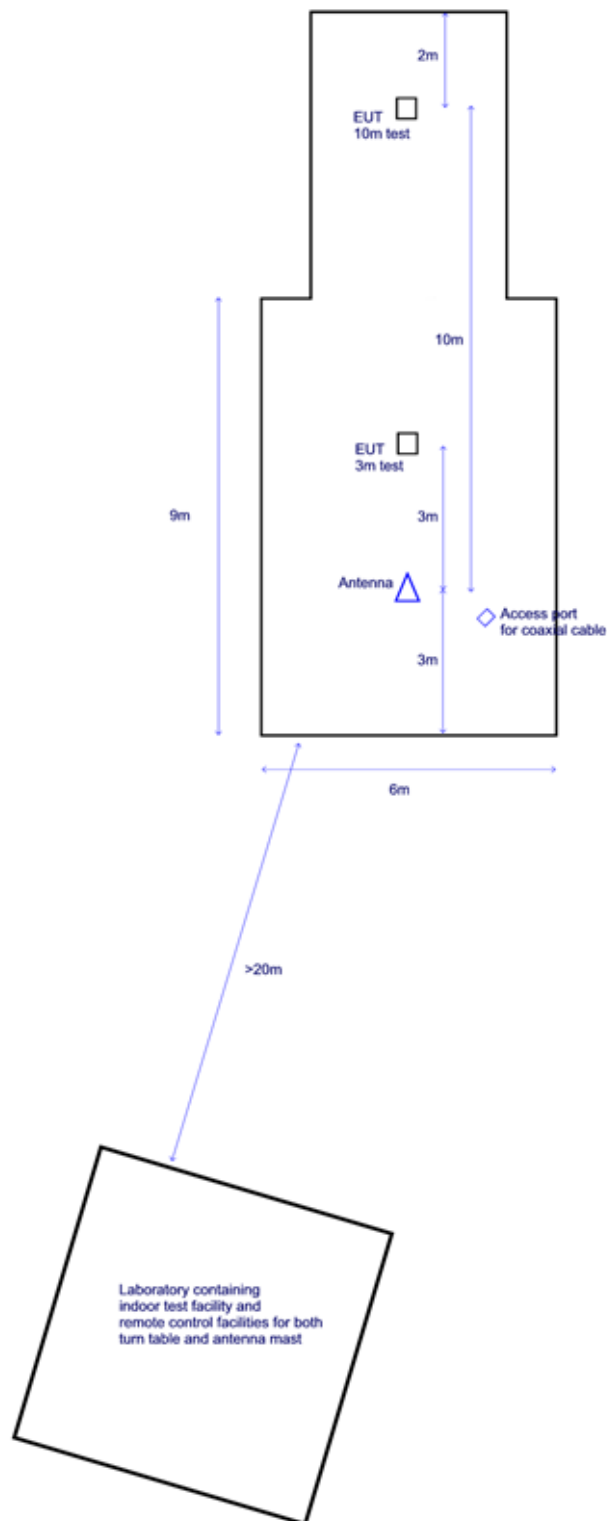
Figure 9b. Output power tests (bottom, middle and top of band) of the transmitter with the DC supply voltage varied between 85% and 115% of nominal value

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## 9. Test Facility

### EMC Services Hampton Test Facility



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## 10. Photographs

The unit tested is depicted in the photographs below.



Photo 1 - EUT (1.2m dish) at the open area test site (OATS)



Photo 2 - Front internal view of 1.2m dish

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Photo 3 - EUT (1.2m dish) side view



Photo 4 - EUT (1.2m dish) rear view

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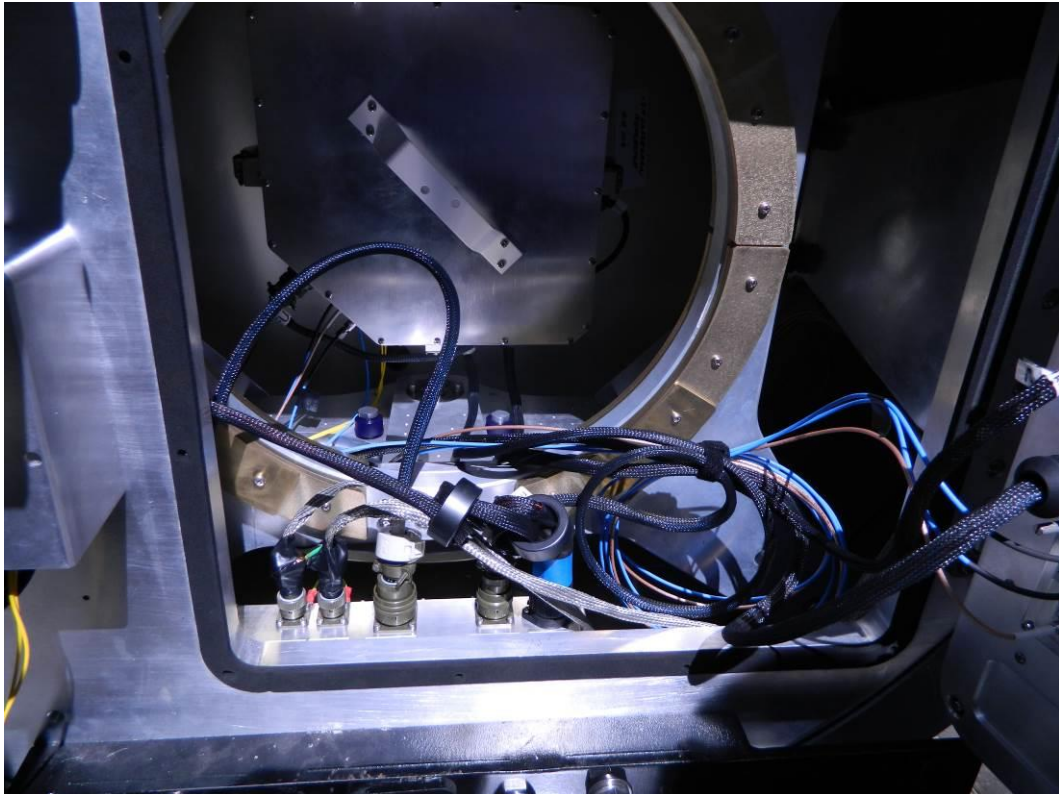


Photo 5 - EUT internal rear view, 1.2m dish

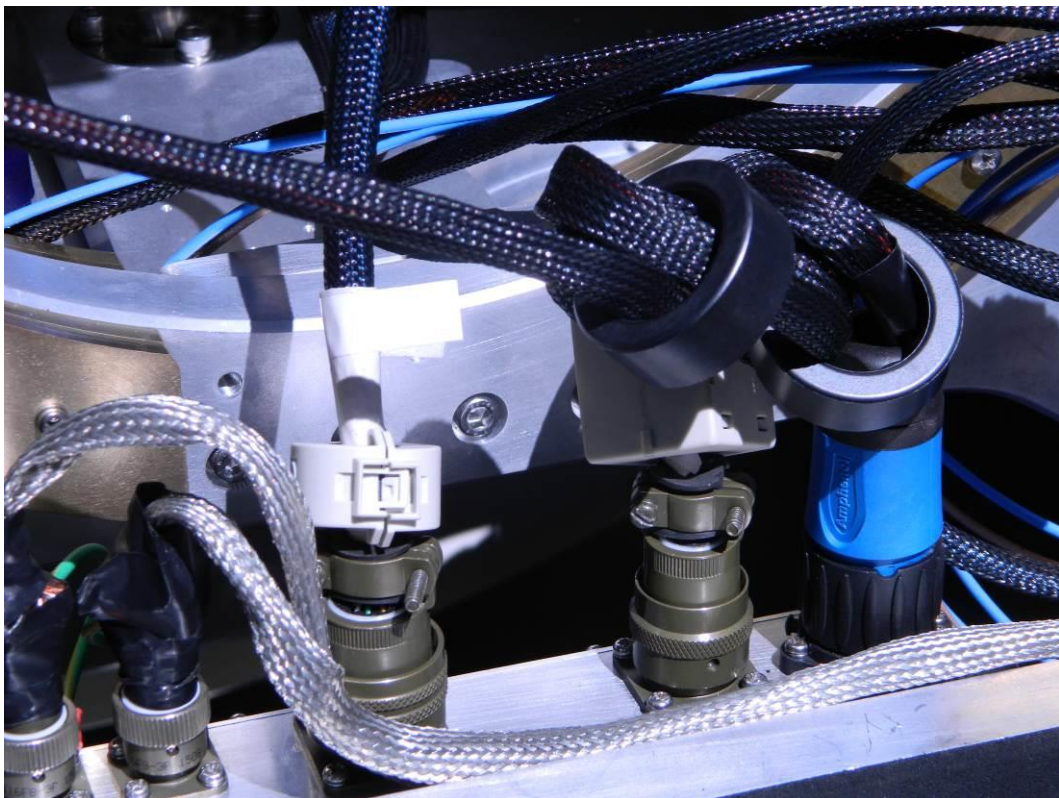


Photo 6 - Close up of ferrites on the cables, 1.2m dish

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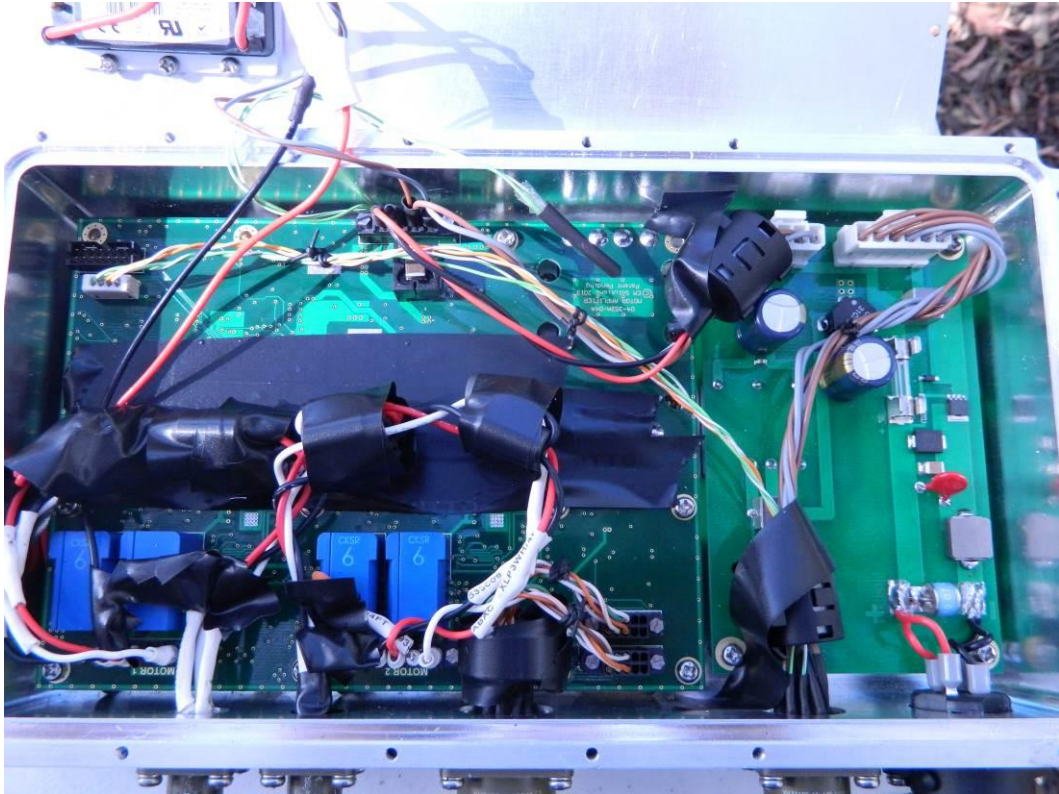


Photo 7 - Internal view of control module, 1.2m dish



Photo 8 - EUT (0.6m dish) at the open area test site (OATS)

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Photo 9 - Close up of EUT (0.6m dish)

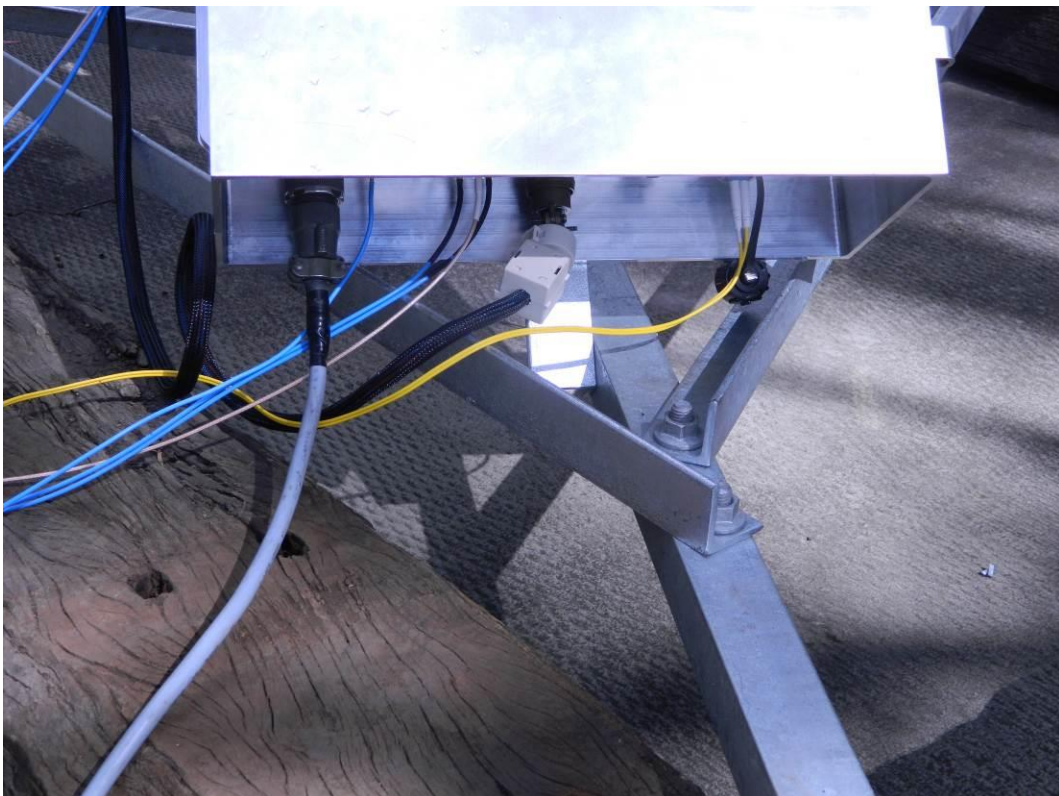


Photo 10 - Close up of cables connected to the electronics enclosure EUT (0.6m dish)

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Photo 11 - Rear view of 0.6m dish

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## 11. Appendices

### 11.1 Labelling Requirements as Specified by the Standard

*FCC Part 15.19 (20<sup>th</sup> Sep 2007) requires the following label to be affixed in a conspicuous location on the device:*

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

If the device is so small as to make placement of this label impractical, the label must be presented in a prominent location in the user documentation, or on the container in which the product is marked.

*Further, Section 15.21 (20<sup>th</sup> Sep 2007) requires the following information to be provided to the user:*

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than on paper, such as on a computer disk or over the internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

### 11.2 Class A Equipment Requirements

*Section 15.105 (20<sup>th</sup> Sep 2007) requires the following information to be provided to the user:*

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their sole expense.

### 11.3 Class B Equipment Requirements

*Section 15.105 (20<sup>th</sup> Sep 2007) requires the following information to be provided to the user:*

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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