EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 102497759BOX-001a
Project Number: G102497759

Report Issue Date: 05/03/2016

Model(s) Tested: AXWK
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: FCC CFR 47 Part 15.231 (2016)
FCC CFR 47 Part 15 Subpart B (2016)
RSS-210 Issue 8 December 2010, Annex 1
ICES-003 Issue 6 January 2016

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Ghost Controls
1572 Capital Circle Northwest
Tallahassee, FL 32303
USA

Report prepared by

Kouma Sinn / Staff Engineer, EMC

Report reviewed by

Michael F. Murphy / Sr. Staff Engineer

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested was found to Comply with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Fundamental Field Strength (CFR47 Part 15 Subpart C Section 15.231(b) IC RSS-210 Annex 1.1.2 and Table A)	Pass
7	Occupied Bandwidth (CFR47 Part 15 Subpart C Sections 15.215, 15.231(c) IC RSS-Gen Section 6.6, IC RSS-210 Annex1.1.3)	Pass
8	Radiated Spurious Emissions (CFR47 Part 15 Subpart C Sections 15.205, 15.209, and 15.231(b)(1-3), IC RSS-Gen Section 8.9 Table 4, IC RSS-210 Annex 1.1.2 and Table A)	Pass
9	Duty Cycle (CFR47 Part 15 Section 15.35 and Subpart C Section 15.231(b)(2) IC RSS-Gen Section 6.10)	Pass
10	5 Second Shut Off Time (CFR47 Part 15 Subpart C Section 15.231(a)(1) IC RSS-210 Section A1.1.1(a))	Pass
--	AC Line-Conducted Emissions (CFR47 FCC Part 15 Subpart C 15.207; IC RSS-Gen Section 7.2.4)	N/A – Battery
11	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: Ghost Controls
1572 Capital Circle Northwest
Tallahassee, FL 32303
USA

Contact: Mickey Nguyen
Telephone: (850) 635-0191
Fax: None
Email: mnguyen@ghostcontrols.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Ghost Controls
1572 Capital Circle Northwest
Tallahassee, FL 32303
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Keypad	Ghost Controls	AXWK	BOX1603230903-001 (Intertek Assigned)

Receive Date:	03/23/2016
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The AXWK radio frequency (RF) design the same in both hardware and modulation scheme as that of the GCTx1-5 transmitter. When the user enter a valid PIN and press the SEND button, the AXWK keypad will transmit an RF signal identical to that of the transmitter on the same 433.92 MHz frequency.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
3V (two C batteries)	N/A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed to transmit continuously when the pressing the ‘Program’ and the ‘Send’ button.
2	Normal transmitting when pressing any ‘Keypad’ and ‘Send’ button.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	433.92 MHz
Modulation Type(s)	On-Off-Key (OOK)
Maximum Output Power	0.0605 mW
Test Channels	1
Occupied Bandwidth	25.175 kHz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	N/A
Equipment Type	Standalone
ETSI LBT/Adaptivity	N/A
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	N/A
Antenna Type and Gain	Integral antenna (0 dBi gain)

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

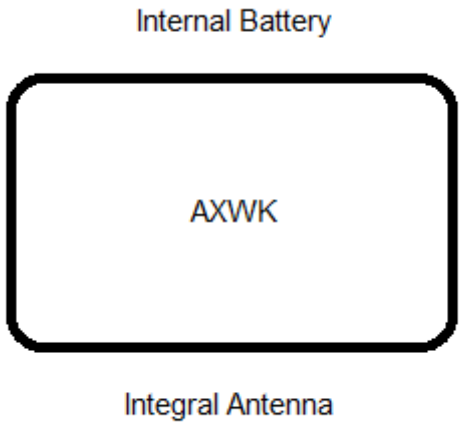
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
	None				

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None			

5.1 Method:

Configuration as required by FCC CFR 47 Part 15.231 (2016), FCC CFR 47 Part 15 Subpart B (2016) RSS-210 Issue 8 December 2010, Annex 1, ICES-003 Issue 6 January 2016, ANSI C63.4:2014 and ANSI C63.10:2013.

5.2 EUT Block Diagram:



6 Fundamental Field Strength

6.1 Method

Tests are performed in accordance with FCC 47CFR Part 15 Subpart C Section 15.231 and RSS 210.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when C5 Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. “AF” is the Antenna Factor; “PA+CL” are Preamp and Cable Loss. These are already accounted for in the “Level” column.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	09/28/2015	09/28/2016
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/14/2015	03/14/2016
145013'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2944A07027	10/12/2015	10/12/2016
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	09/01/2015	09/01/2016
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	11/10/2015	11/10/2016

Software Utilized:

Name	Manufacturer	Version
Compliance 5	Teseq	3.26.46.46

6.3 Results:

The sample tested was found to Comply. The Fundamental field strength must meet the following limits:

Fundamental Frequency (MHz), excluding restricted band frequencies of RSS-Gen	Field Strength of the Fundamental (Note 1) (microvolts/m at 3 metres)	Field Strength of Unwanted Emissions (Note 1) (microvolts/m at 3 metres)
40.66-40.70	See Section A2.7	
70-130	1,250	125
130-174	1,250 to 3,750*	125 to 375
174-260 (Note 2)	3,750	375
260-470 (Note 2)	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

Note 1: Limits on the field strength of emissions, as shown in this table, are based on the average value of the measured emissions. As an alternative, compliance with the limits in this table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

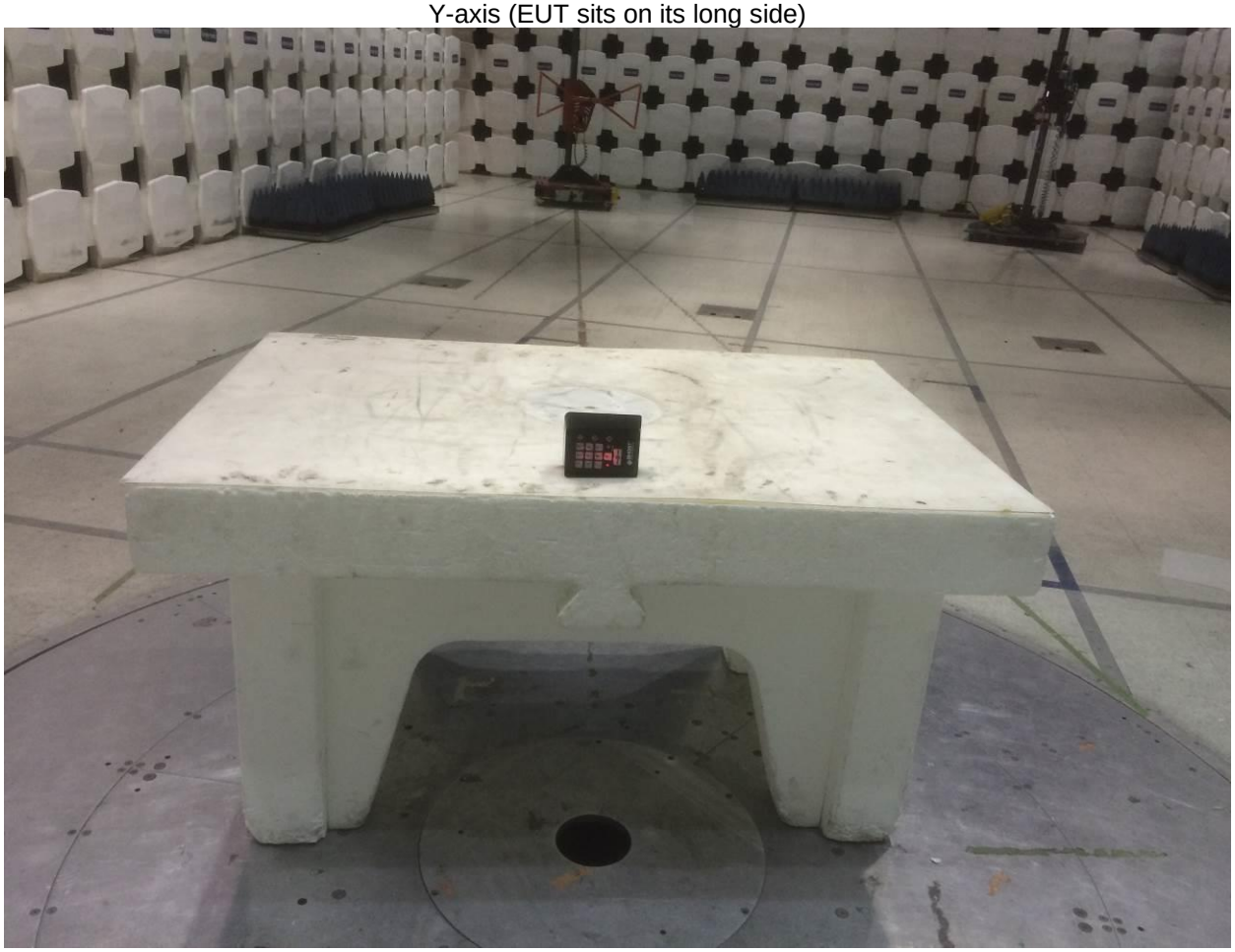
* Linear interpolation with frequency F in MHz:
For 130-174 MHz: FS (microvolts/m) = (56.82 x F)-6136
For 260-470 MHz: FS (microvolts/m) = (41.67 x F)-7083

For a fundamental frequency of 433.92 MHz, this corresponds to a limit of 100.8 dBuV/m peak and 80.8 dBuV/m average at a 3 meter test distance or 90.3 dBuV/m peak and 70.3 dBuV/m average at a 10 meter test distance.

6.4 Setup Photographs:

X-axis (EUT sits straight up)

Y-axis (EUT sits on its long side)



Z-axis (EUT sits on its back)

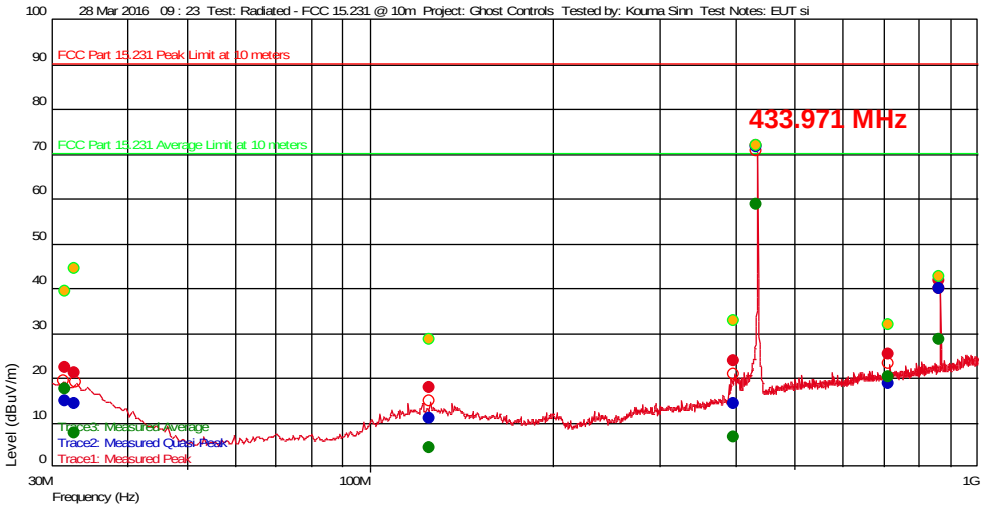
6.5 Plots/Data:

X-axis (EUT sits straight up), Fundamental Field Strength

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Ghost Controls	
Test Notes:	EUT sits straight up	
Temperature:	19C	
Humidity:	30%, 1001mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 09 : 23	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
433.970941513 M	71.79	16.600	-24.353	90.30	-18.51	--	0	2.40	120 k	

Trace3: Measured Average

Frequency(Hz)	Level* dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
433.970941513 M	59.75	16.600	-24.353	70.3	-10.55	--	0	2.40	120 k	

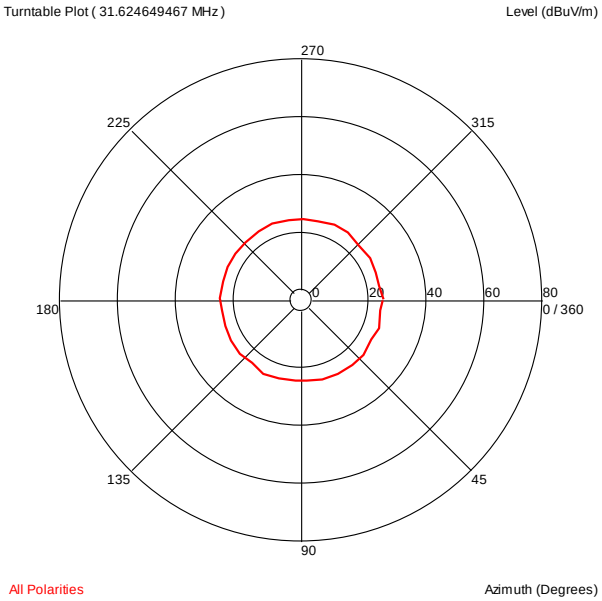
Note # 1: *Measured Average = Measured Peak – Average Factor of 12.04 dB.

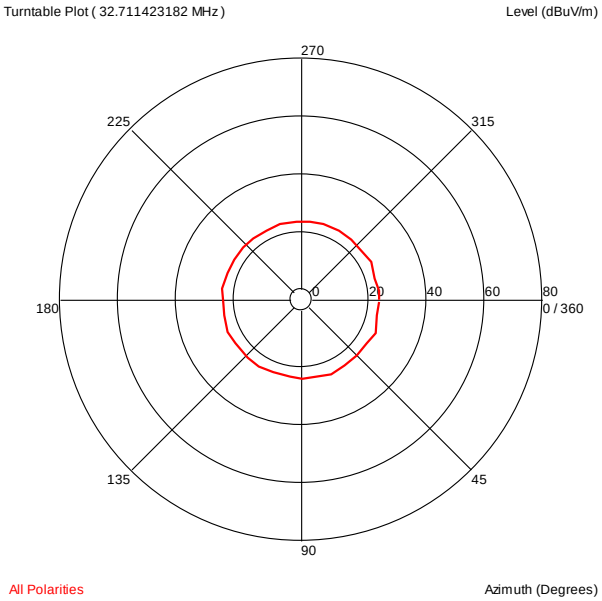
Note # 2: EIRP was obtained by applying the path loss correction for a 3m test distance, E(dBuV/m) at 3 meter - 95.22 = dBm EIRP.

The net reading at 10 meters above is 71.79 dBuV/m. The reading at 3 meters would be [71.79 dBuV/m + Distance Factor at 3 meters] or [71.79 dBuV/m + 10.5 dB] or 82.29 dBuV/m.

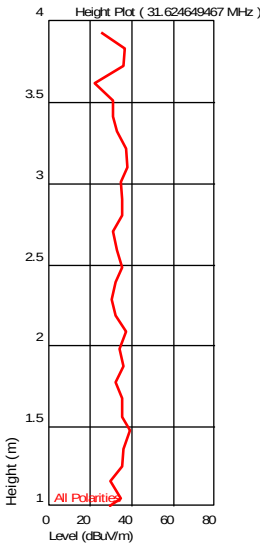
The EIRP at 3 meters is 82.29 – 95.22 = -12.93 dBm or 0.0509 mW.

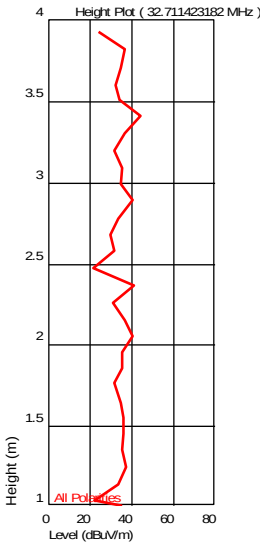
Azimuth Plots

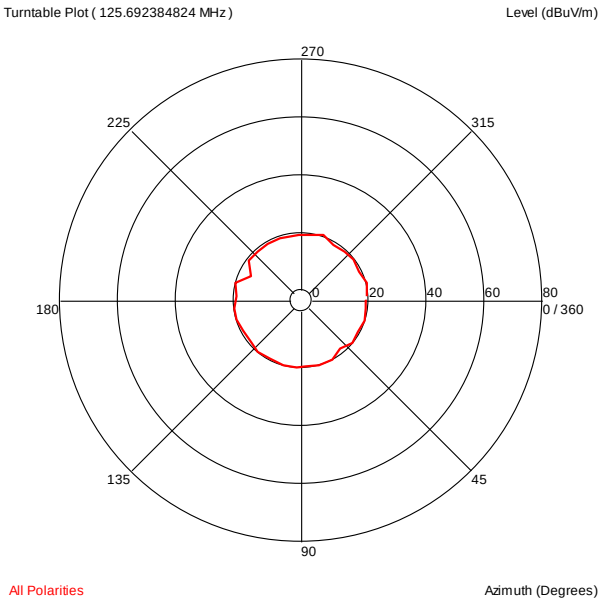


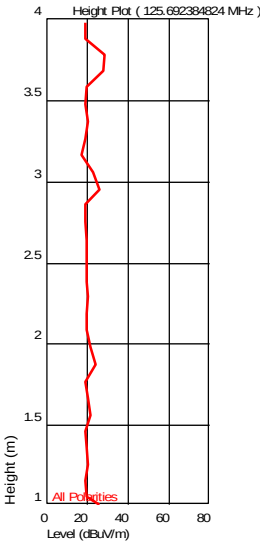


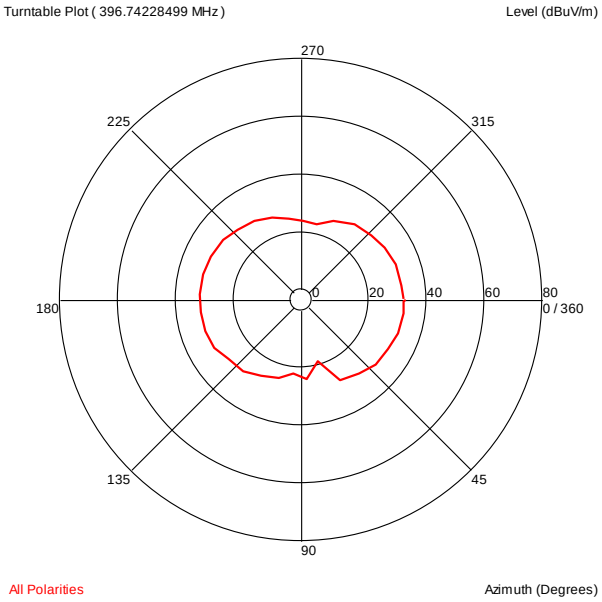
Turntable Plots

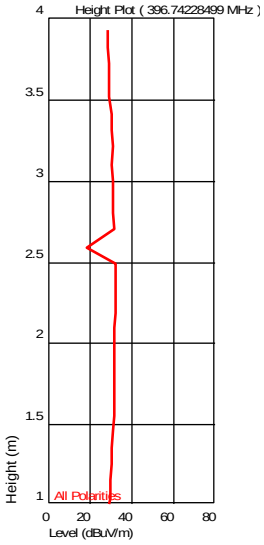


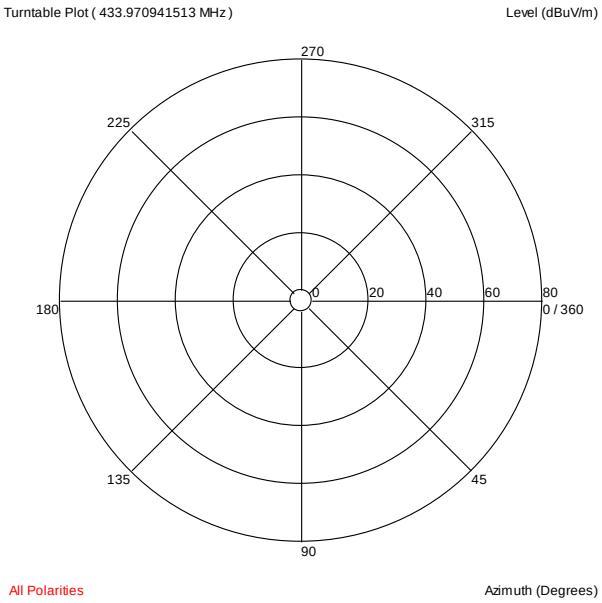


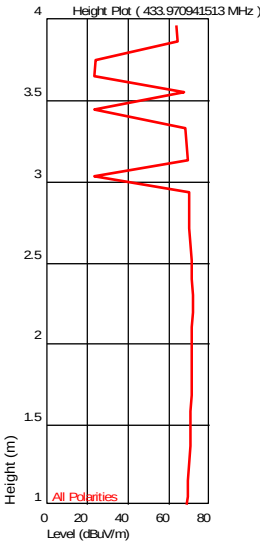

Turntable Plot (125.692384824 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

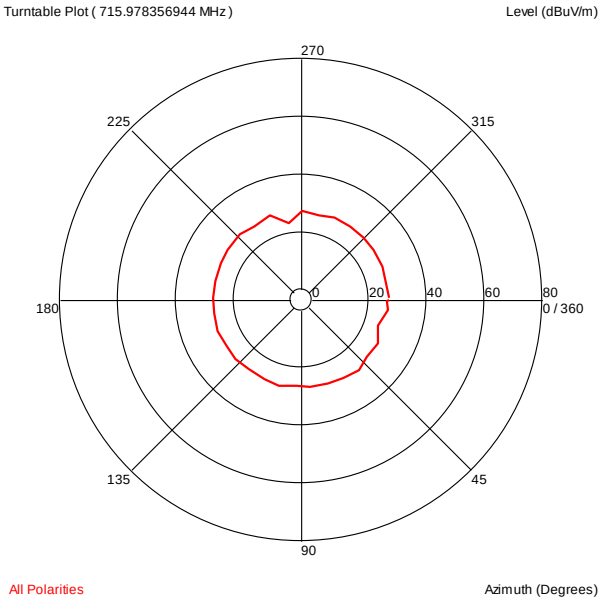

Height Plot (125.692384824 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

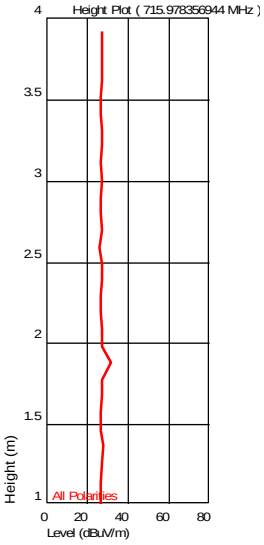

Turntable Plot (396.74228499 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

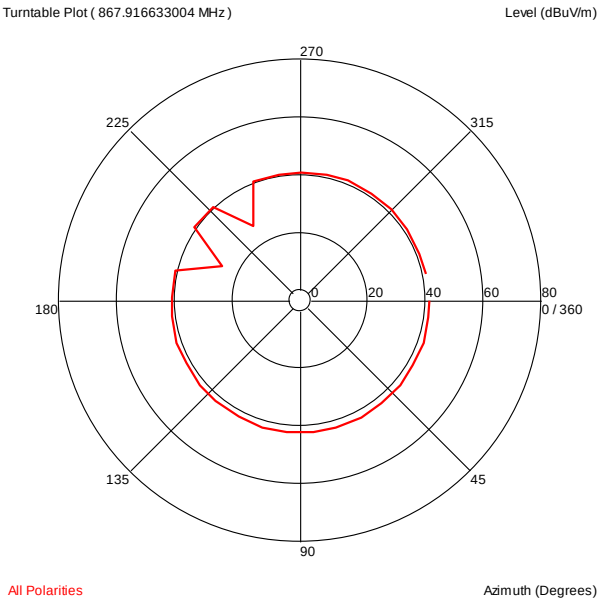

Height Plot (396.74228499 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

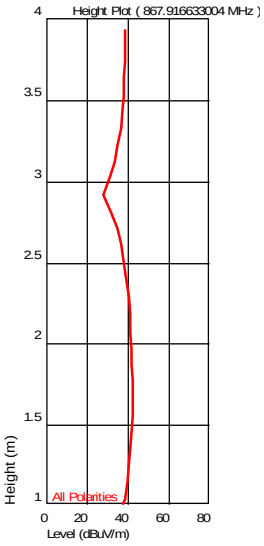

Turntable Plot (433.970941513 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (433.970941513 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (715.978356944 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (715.978356944 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (867.916633004 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

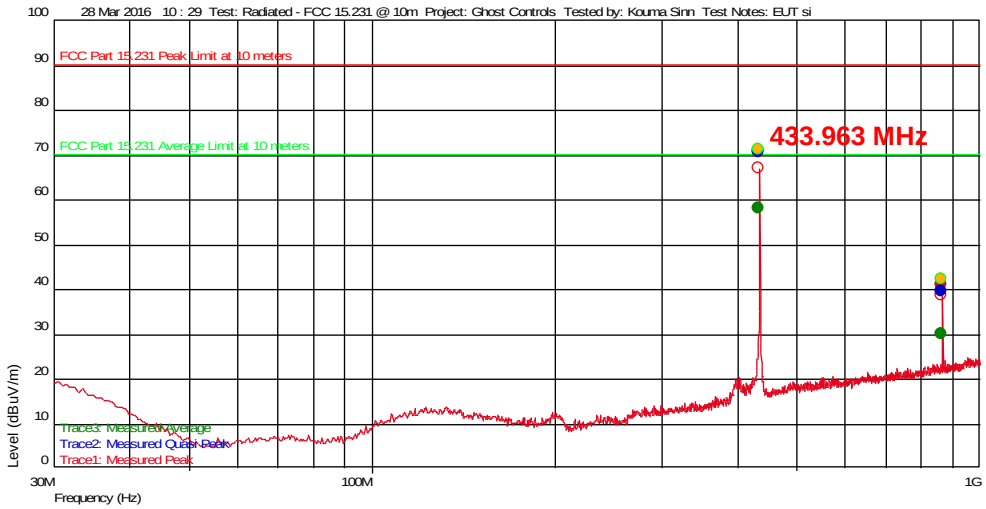

Height Plot (867.916633004 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Y-axis (EUT sits on its long side), Fundamental Field Strength

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Ghost Controls	
Test Notes:	EUT sits its long side	
Temperature:	19C	
Humidity:	30%, 1001mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 10 : 29	

Prescan Emission Graph



Measured Peak Value
Measured Quasi Peak Value
Measured Average Value
Maximum Value of Mast and Turntable
Swept Peak Data
Swept Quasi Peak Data
Swept Average Data

Emissions Test Data

Trace1: Measured Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
433.962925481 M	70.97	16.600	-24.353	90.3	-19.51	|	62	1.05	120 k	

Trace3: Measured Average

Frequency(Hz)	Level* (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
433.962925481 M	58.93	16.600	-24.353	70.3	-11.37	|	62	1.05	120 k	

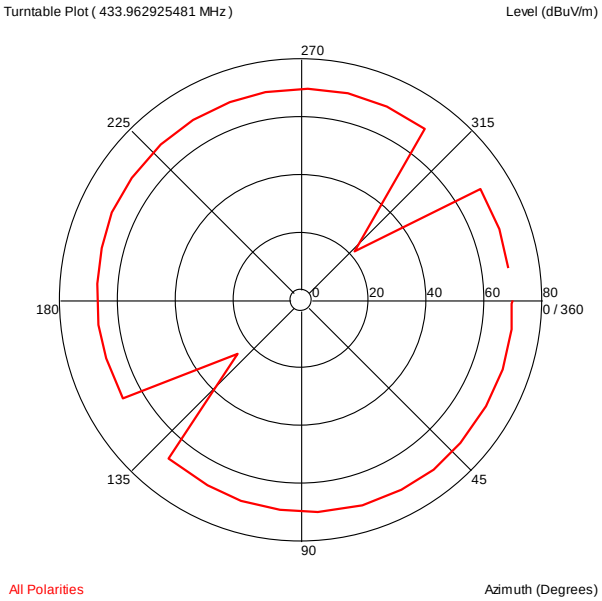
Note # 1: *Measured Average = Measured Peak – Average Factor of 12.04 dB.

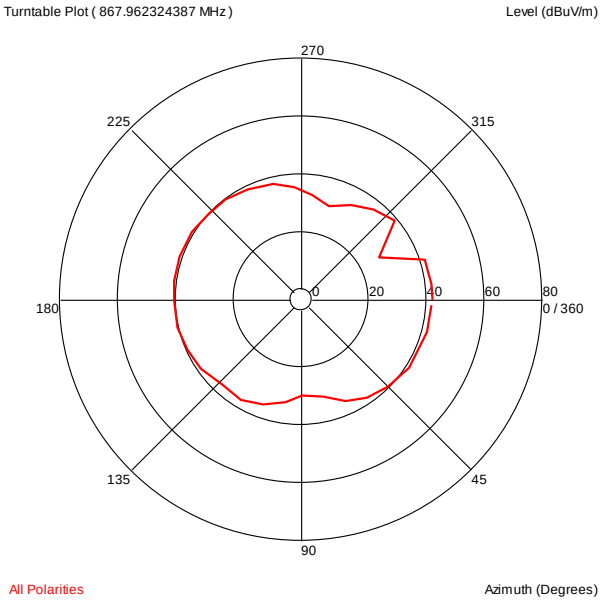
Note # 2: EIRP was obtained by applying the path loss correction for a 3m test distance, E(dBuV/m) at 3 meter - 95.22 = dBm EIRP.

The net reading at 10 meters above is 70.97 dBuV/m. The reading at 3 meters would be, [70.97 dBuV/m + Distance Factor at 3 meters], or [70.97 dBuV/m + 10.5 dB] or 81.47 dBuV/m.

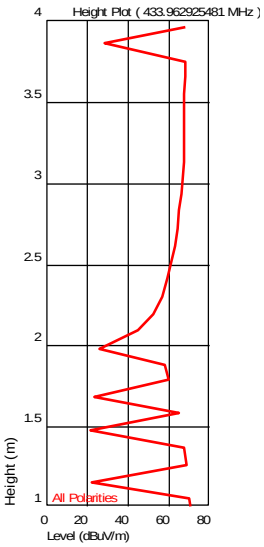
The EIRP at 3 meters is [81.47–95.22 = -13.75 dBm] or 0.0422 mW.

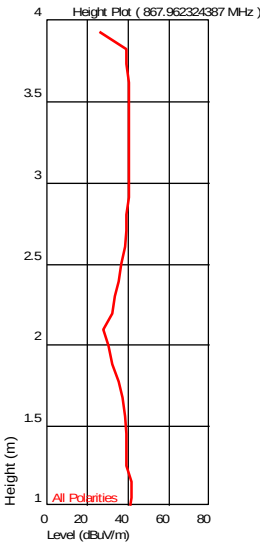
Azimuth Plots





Turntable Plots



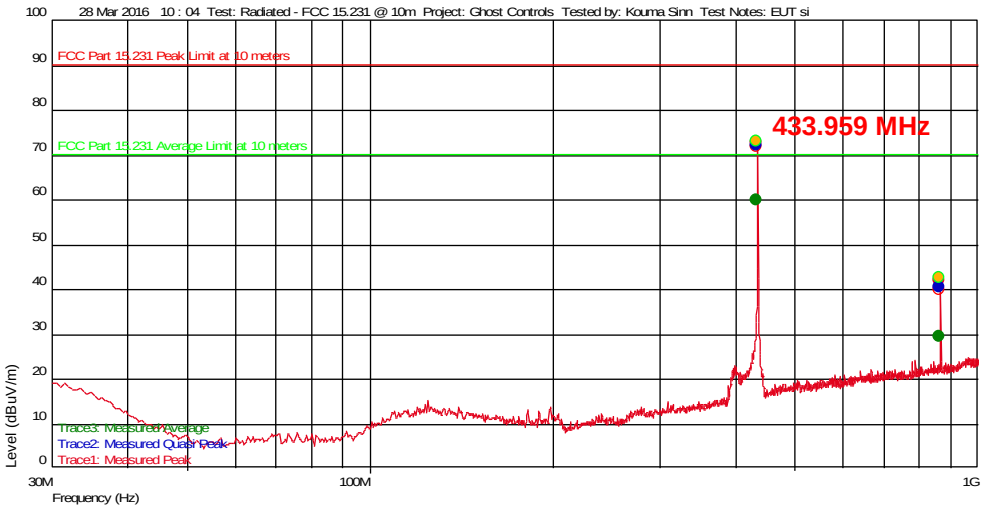


Z-axis (EUT sits on its back), Fundamental Field Strength

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Ghost Controls	
Test Notes:	EUT sits its back	
Temperature:	19C	
Humidity:	30%, 1001mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 10 : 04	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
433.958917465 M	72.54	16.600	-24.353	90.3	-17.76	--	218	2.29	120 k	

Trace3: Measured Average = Measured Peak - Average Factor

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
433.958917465 M	60.50	16.600	-24.353	70.3	-9.80	--	218	2.29	120 k	

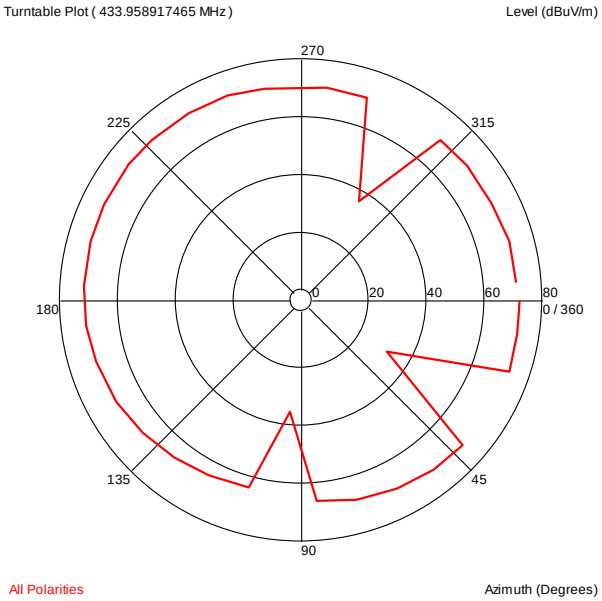
Note # 1: *Measured Average = Measured Peak – Average Factor of 12.04 dB.

Note # 2: EIRP was obtained by applying the path loss correction for a 3m test distance, E(dBuV/m) at 3 meter - 95.22 = dBm EIRP.

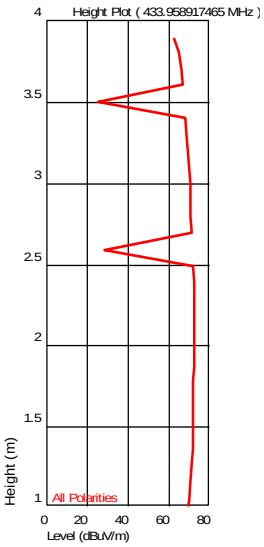
The net reading at 10 meters above is 72.54 dBuV/m. The reading at 3 meters would be, [72.54 dBuV/m + Distance Factor at 3 meters], or [72.54 dBuV/m + 10.5 dB] or 83.04 dBuV/m.

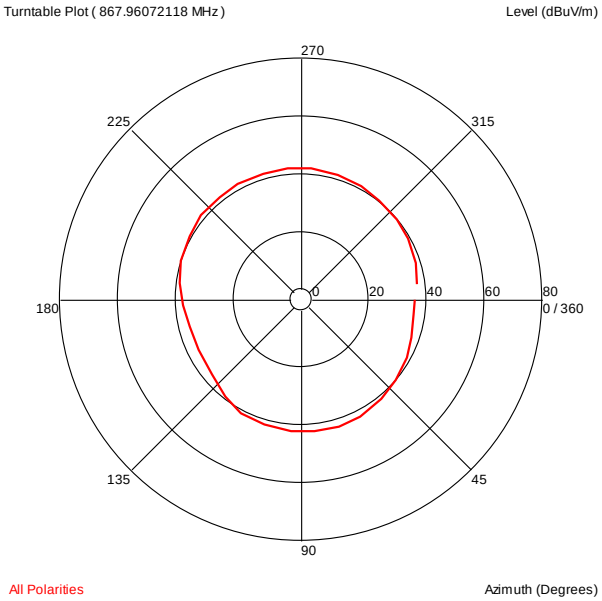
The EIRP at 3 meters is [83.04–95.22 = -12.18 dBm] or 0.0605 mW.

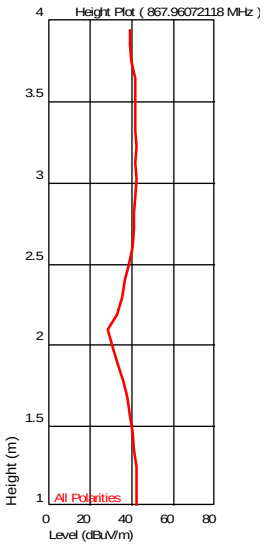
Azimuth Plots



Turntable Plots







Test Personnel:	Kouma Sinn KPS	Test Date:	03/28/2016
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.231 and RSS-210	Limit Applied:	Below specified limits
Input Voltage:	Fresh batteries	Ambient Temperature:	19 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**Yes**	Relative Humidity:	30 %
		Atmospheric Pressure:	1001 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 Method

Tests are performed in accordance with FCC 47CFR Part 15 Subpart C Section 15.231 and RSS 210.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	10/23/2015	10/23/2016
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	06/04/2015	06/04/2016
CBLHF2012-2M-2'	2m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252675002	02/09/2016	02/09/2017
None'	Near Field Probe	ETS	7405-901	None	N/A	N/A

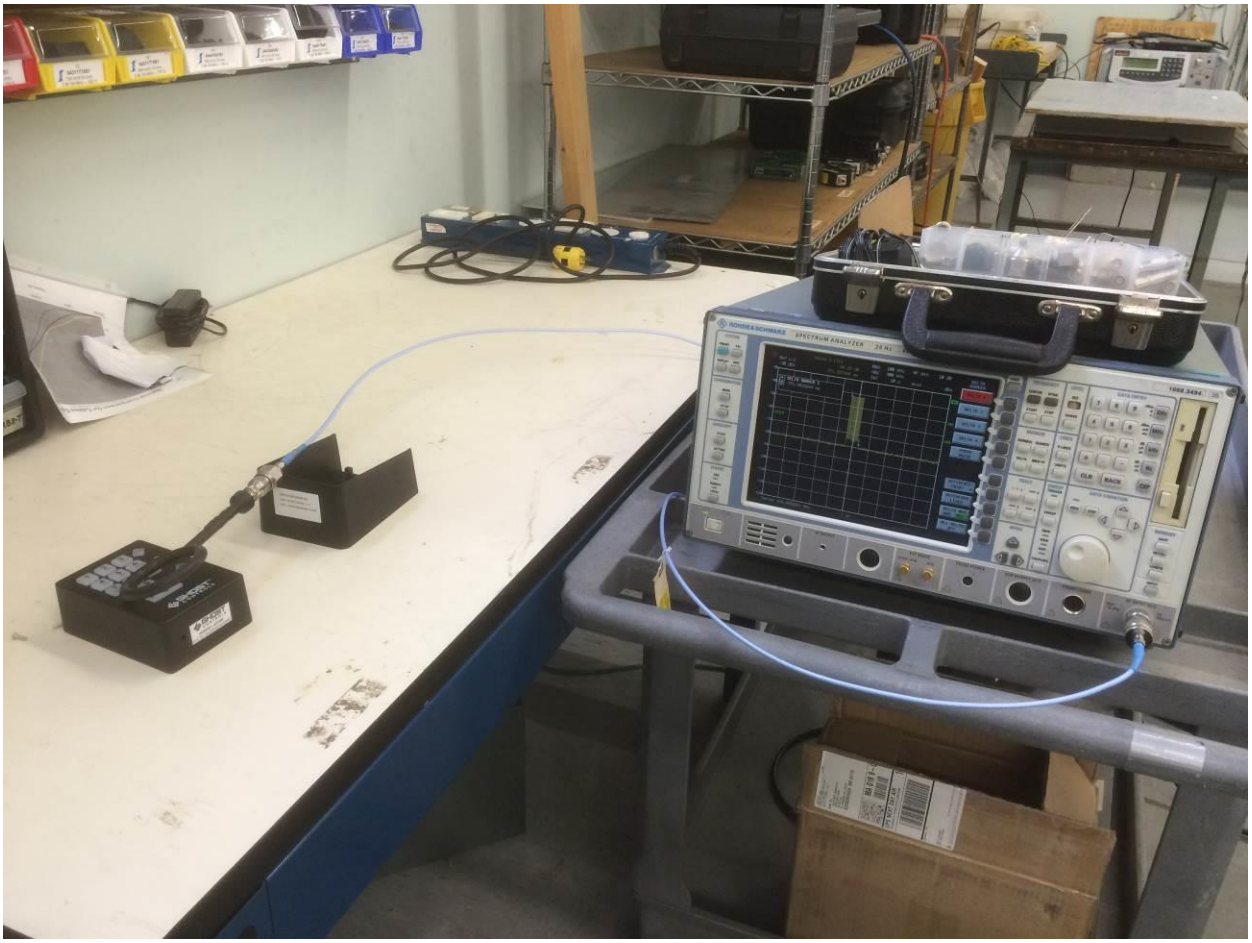
Software Utilized:

Name	Manufacturer	Version
None		

7.3 Results:

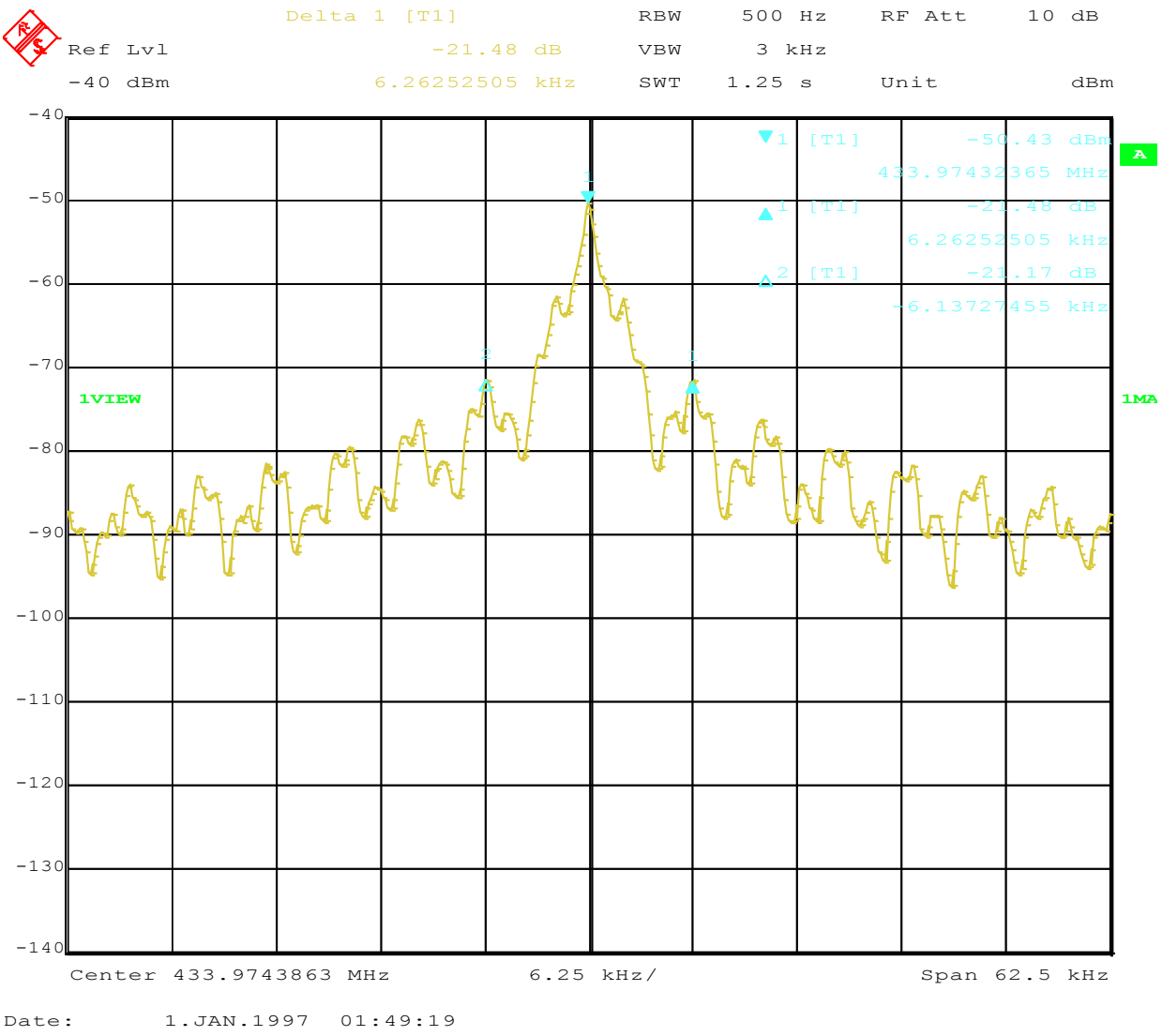
The sample tested was found to Comply. The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier. Therefore the bandwidth must not exceed 1084.8 kHz.

7.4 Setup Photograph:

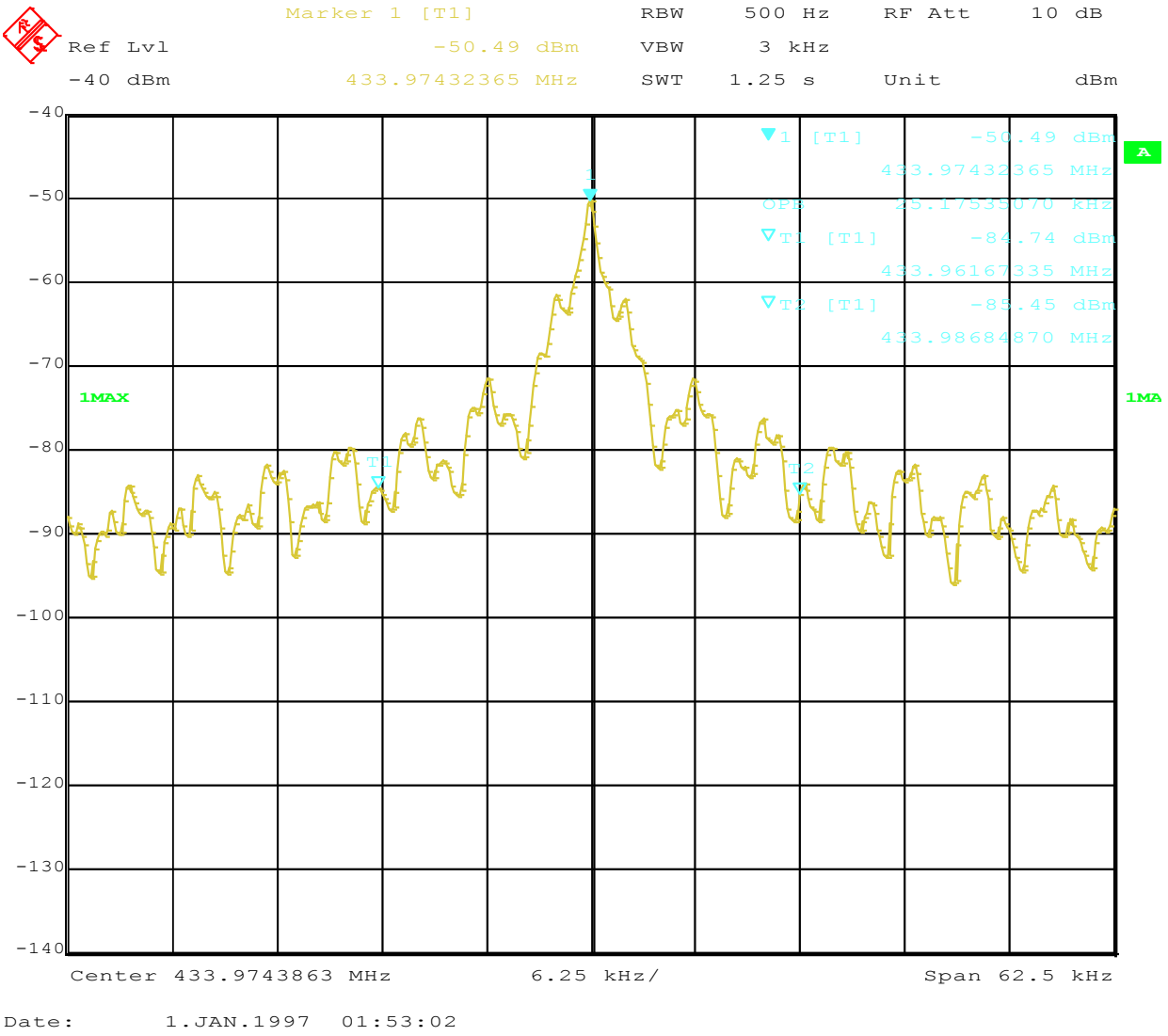


7.5 Plots/Data:

20 dB Bandwidth, 12.400 kHz



Occupied Bandwidth, 25.175 kHz



Test Personnel:	Kouma Sinn KPS	Test Date:	03/29/2016
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.231 and RSS-210	Limit Applied:	Below specified limits
Input Voltage:	Fresh batteries	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**N/A**	Relative Humidity:	22 %
		Atmospheric Pressure:	998 mbars

Deviations, Additions, or Exclusions: None

8 Radiated and Spurious Emissions

8.1 Method

Tests are performed in accordance with FCC 47CFR Part 15 Subpart C Section 15.231 and RSS 210.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when C5 Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. “AF” is the Antenna Factor; “PA+CL” are Preamp and Cable Loss. These are already accounted for in the “Level” column.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	09/28/2015	09/28/2016
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/10/2016	03/10/2017
145013'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2944A07027	10/12/2015	10/12/2016
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	09/01/2015	09/01/2016
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	11/10/2015	11/10/2016
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/08/2015	10/08/2016
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	05/13/2015	05/13/2016
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	04/10/2015	04/10/2016

Software Utilized:

Name	Manufacturer	Version
Compliance 5	Teseq	3.26.46.46

8.3 Results:

The sample tested was found to Comply. The Fundamental field strength must meet the following limits:

Fundamental Frequency (MHz), excluding restricted band frequencies of RSS-Gen	Field Strength of the Fundamental (Note 1) (microvolts/m at 3 metres)	Field Strength of Unwanted Emissions (Note 1) (microvolts/m at 3 metres)
40.66-40.70	See Section A2.7	
70-130	1,250	125
130-174	1,250 to 3,750*	125 to 375
174-260 (Note 2)	3,750	375
260-470 (Note 2)	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

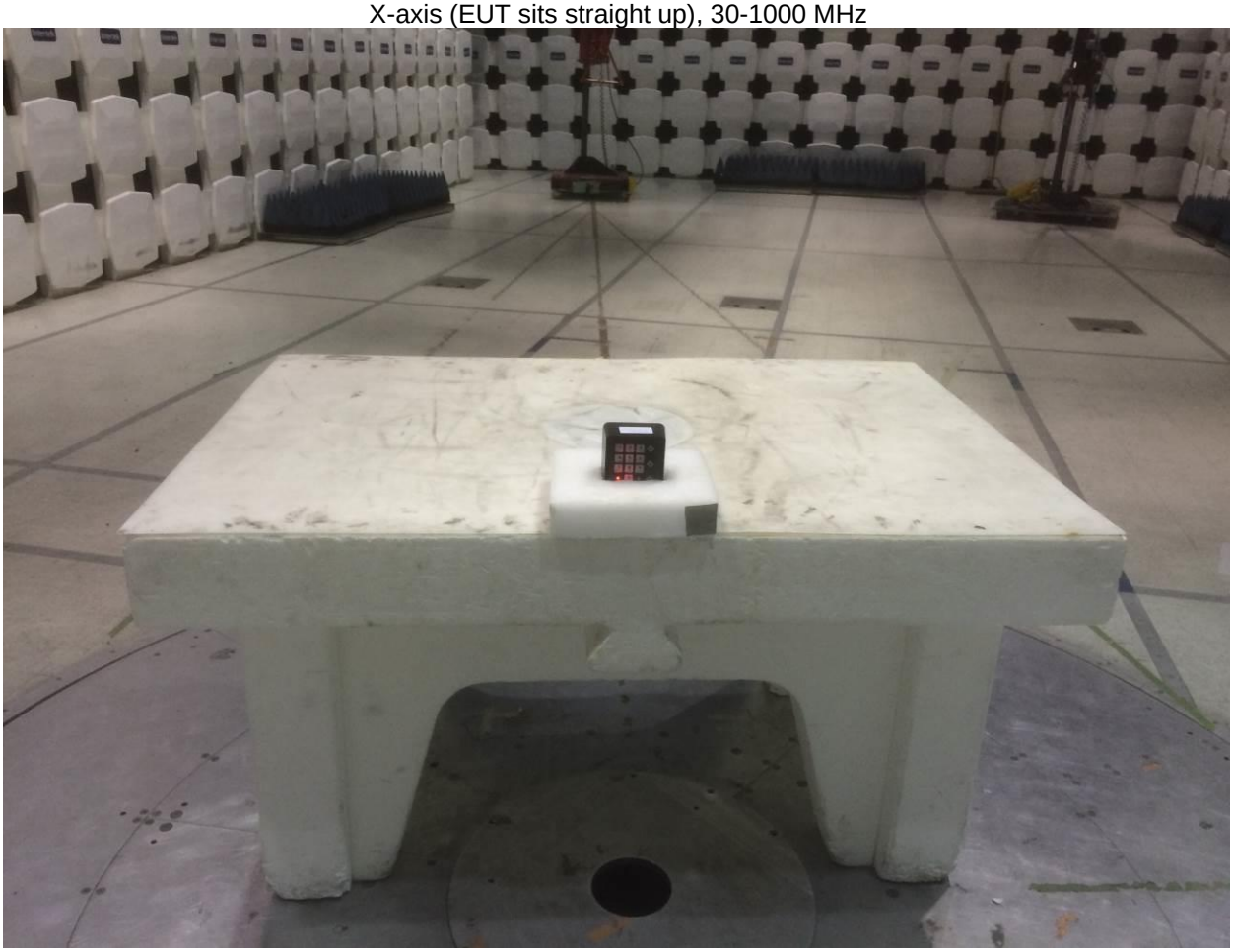
Note 1: Limits on the field strength of emissions, as shown in this table, are based on the average value of the measured emissions. As an alternative, compliance with the limits in this table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

* Linear interpolation with frequency F in MHz:
For 130-174 MHz: FS (microvolts/m) = (56.82 x F)-6136
For 260-470 MHz: FS (microvolts/m) = (41.67 x F)-7083

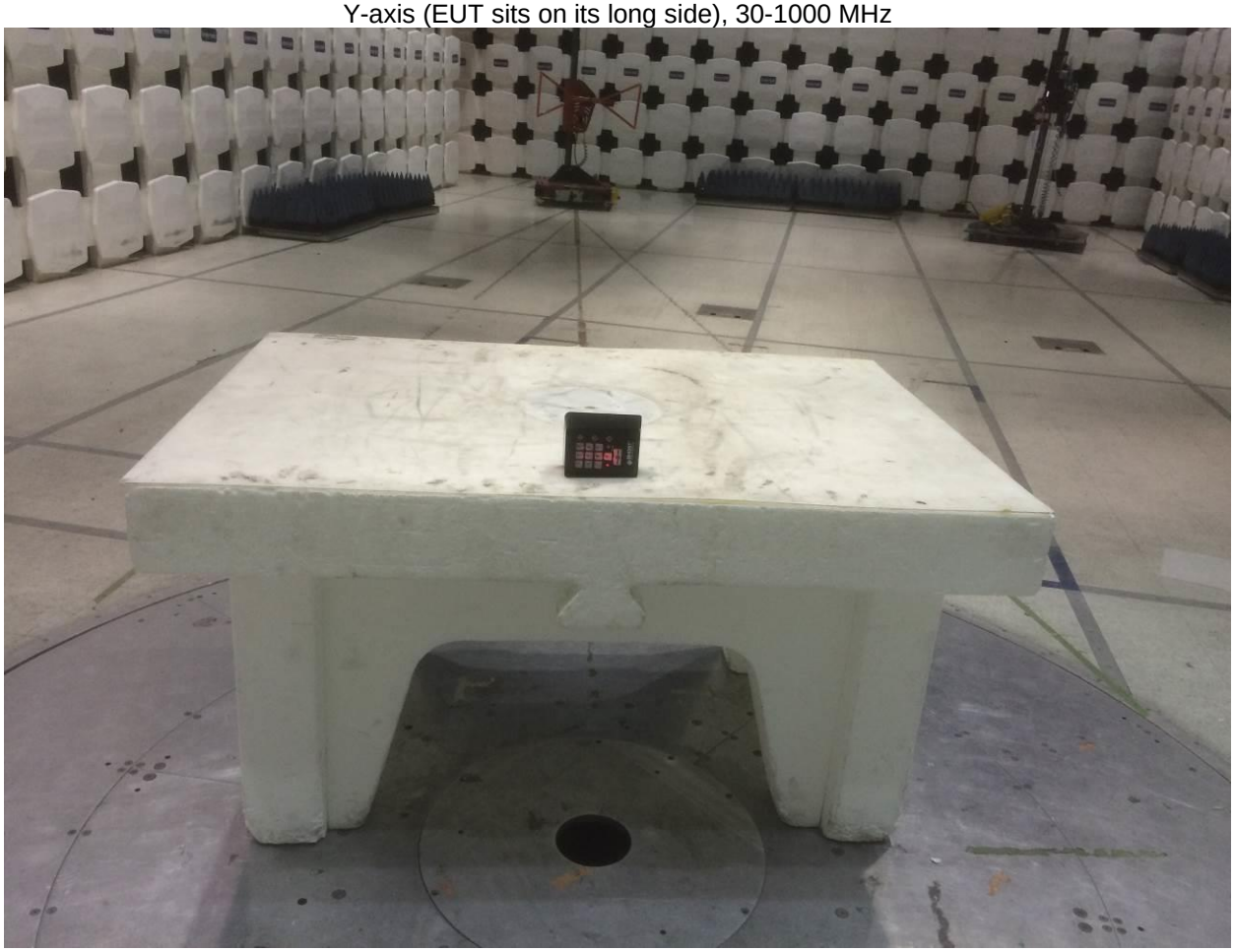
For a fundamental frequency of 433.92 MHz, this corresponds to a limit of 80.80 dBuV/m peak and 60.80 dBuV/m average at a 3 meter test distance or 70.30 dBuV/m peak and 50.30 dBuV/m average at a 10 meter test distance.

8.4 Setup Photographs:

X-axis (EUT sits straight up), 30-1000 MHz

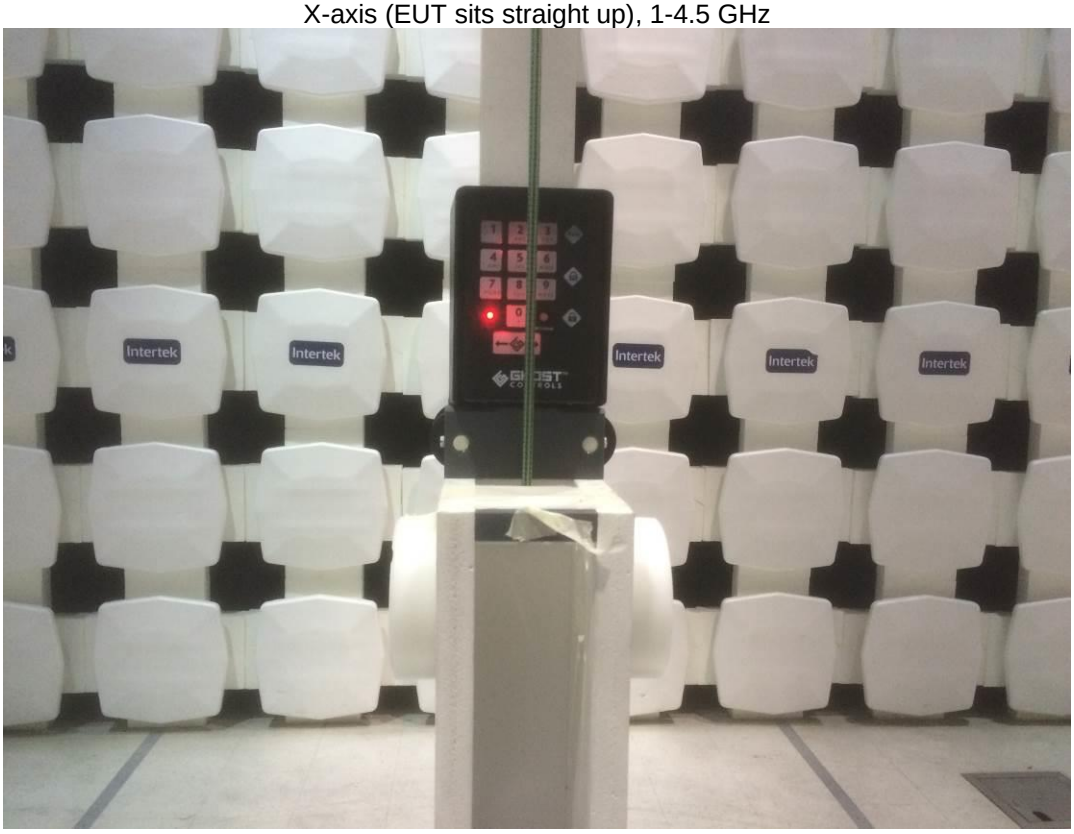


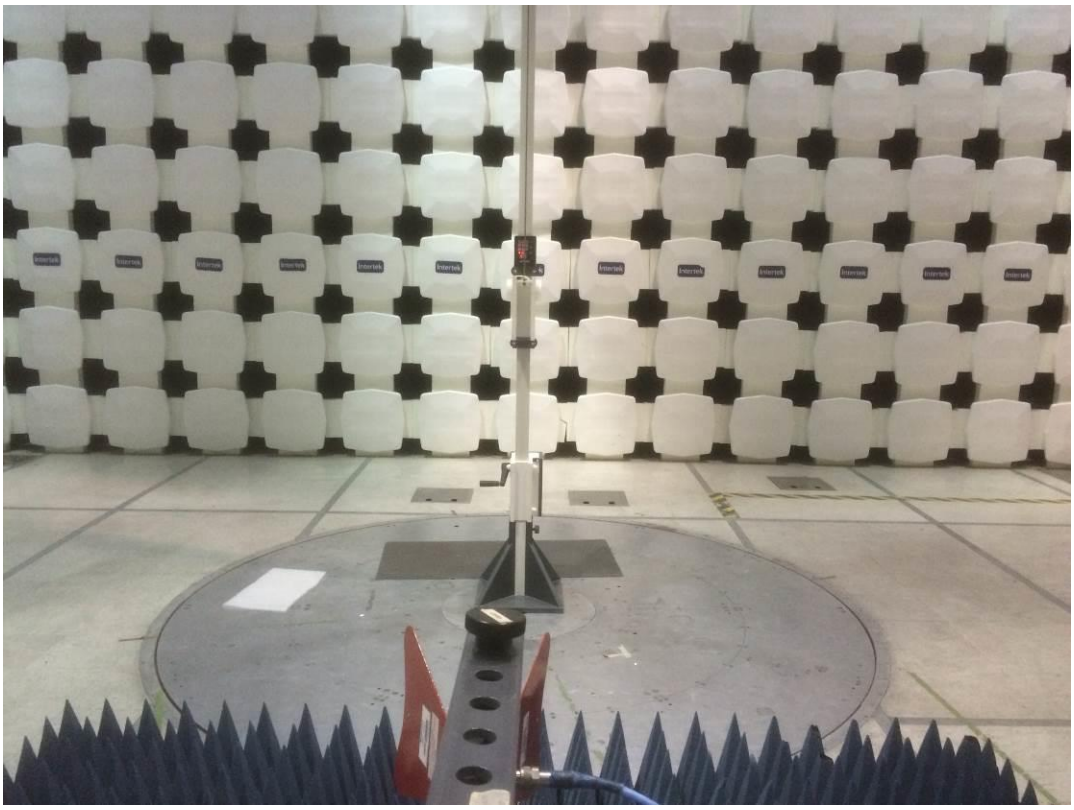
Y-axis (EUT sits on its long side), 30-1000 MHz



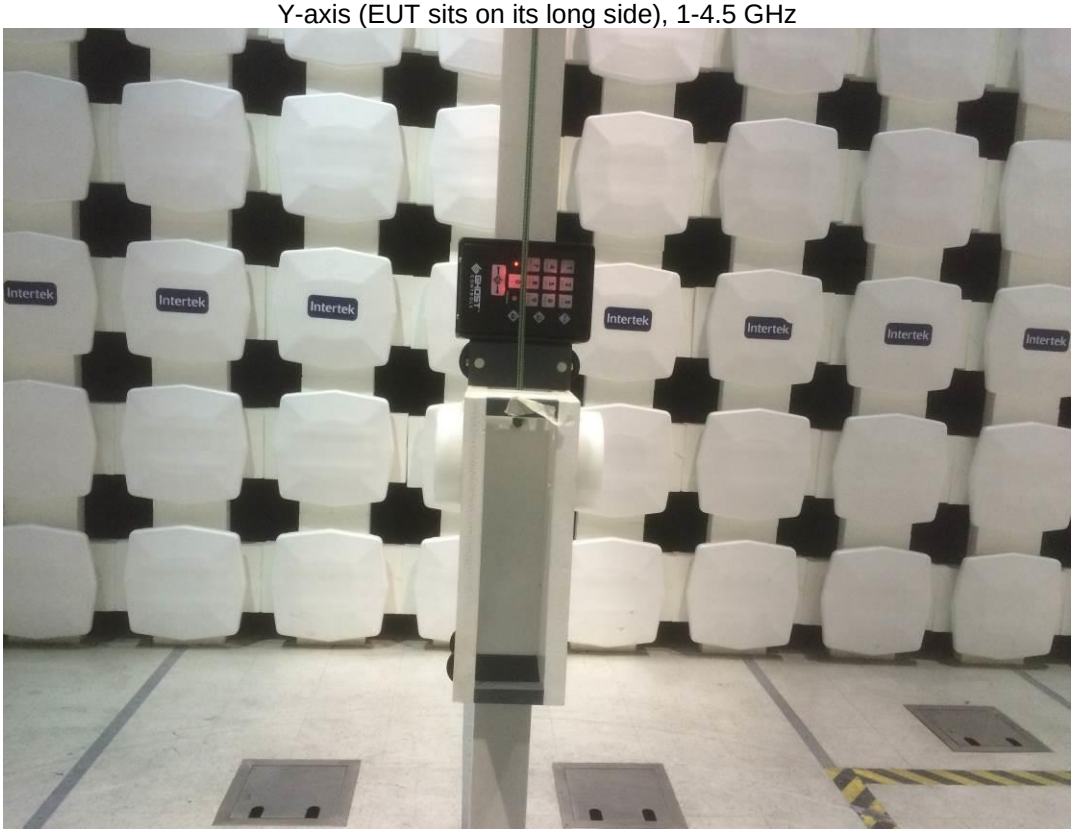
Z-axis (EUT sits on its back), 30-1000 MHz

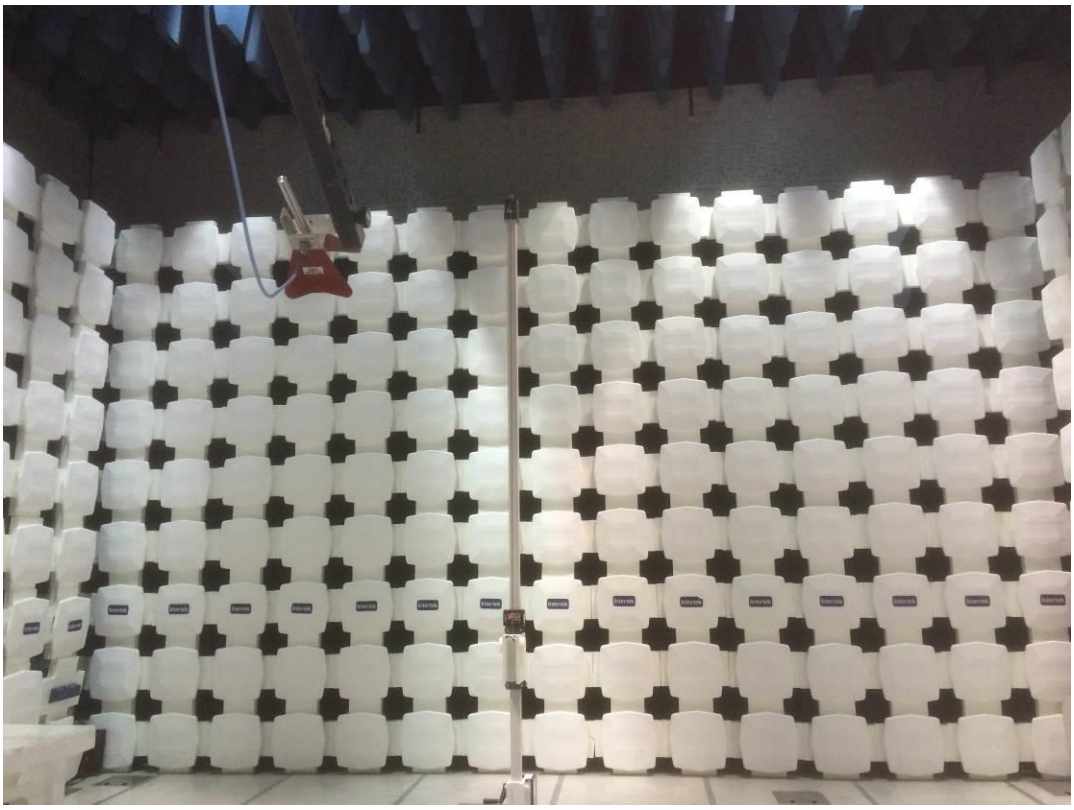
X-axis (EUT sits straight up), 1-4.5 GHz



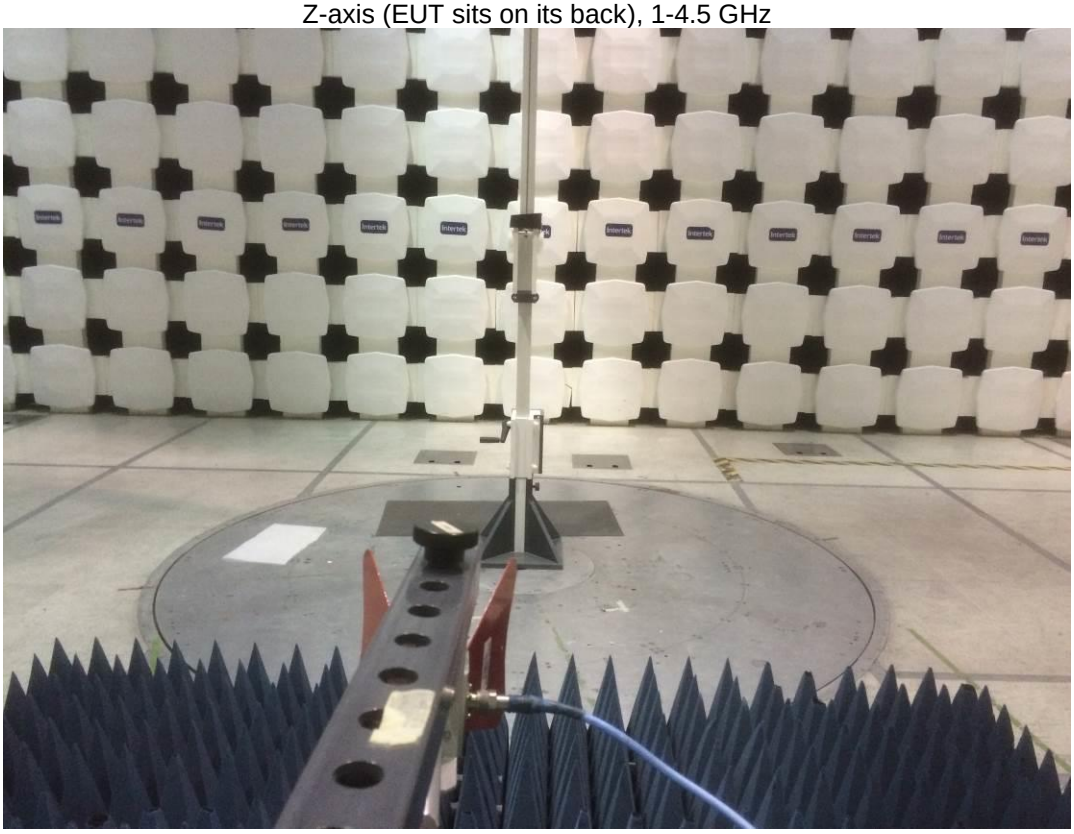


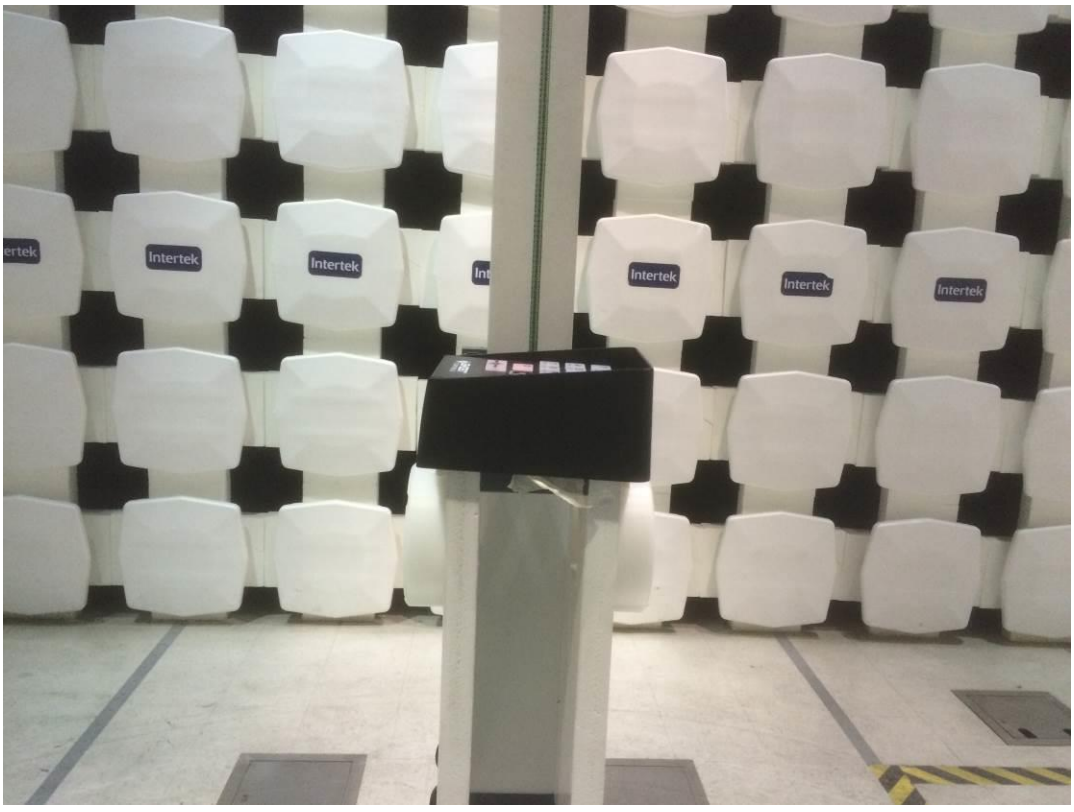
Y-axis (EUT sits on its long side), 1-4.5 GHz





Z-axis (EUT sits on its back), 1-4.5 GHz





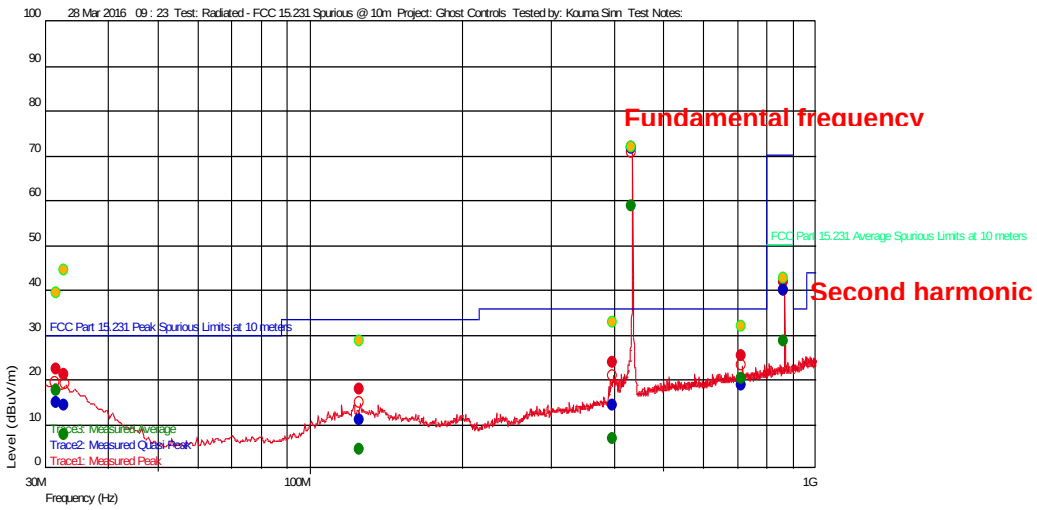
8.5 Plots/Data:

X-axis (EUT sits straight up), 30-1000 MHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Ghost Controls	
Test Notes:	EUT sits straight up	
Temperature:	19C	
Humidity:	30%, 1001mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 09 : 23	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
867.916633004 M	41.55	21.900	-23.212	70.30	-28.75	|	74	1.77	120 k	

Trace2: Measured Quasi Peak

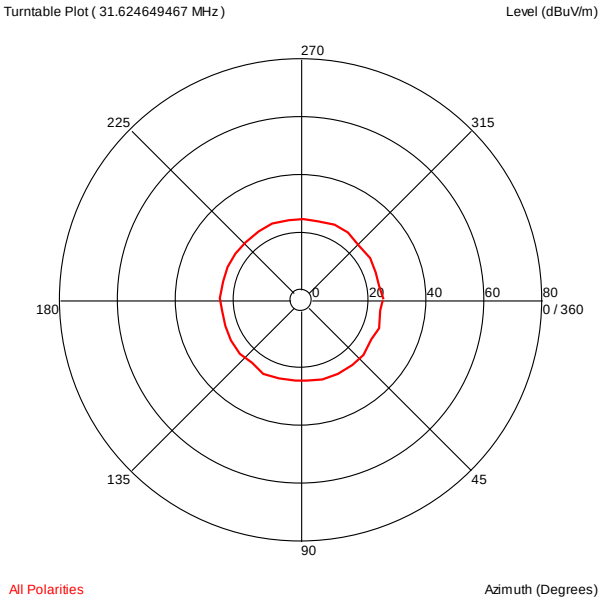
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
125.692384824 M	10.80	14.200	-26.220	33.520	-22.72	|	300	3.88	120 k	Noise floor
396.74228499 M	14.30	15.570	-24.398	36.020	-21.72	--	1	2.59	120 k	Noise floor
715.978356944 M	18.63	20.520	-23.829	36.020	-17.39	--	61	1.98	120 k	Noise floor
32.711423182 M	14.12	19.631	-28.004	30.000	-15.88	--	12	3.51	120 k	Noise floor
31.624649467 M	14.89	20.425	-28.027	30.000	-15.11	--	128	1.56	120 k	Noise floor

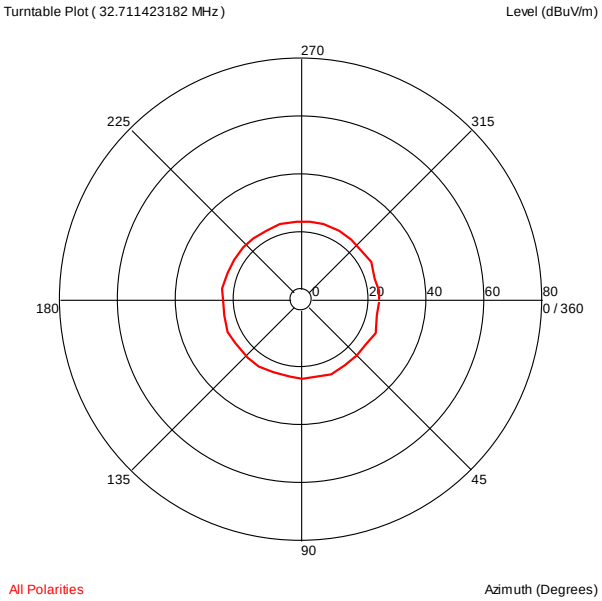
Trace3: Measured Average = Measured Peak – Average factor of 12.04 dB

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
867.916633004 M	29.87	21.900	-23.212	50.30	-20.79	|	74	1.77	120 k	

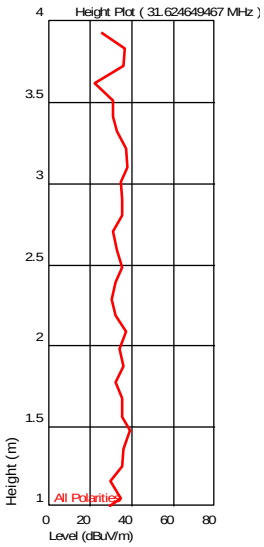
Notes: Used FCC 15.209 limits for all spurious emissions except second harmonic. The limit for the second harmonic (867.917 MHz) is 20 dB from the carrier limit. Only second harmonic emission was detected, the rest of the spurious emissions are noise floor signals.

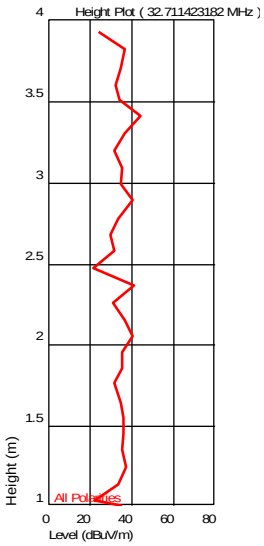
Azimuth Plots

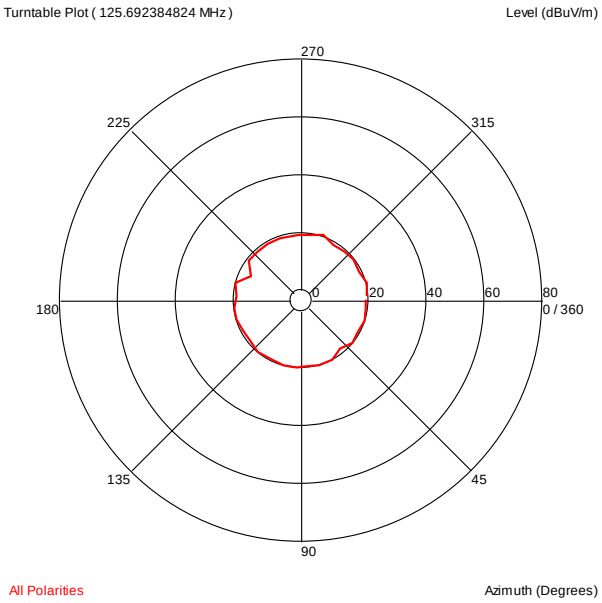


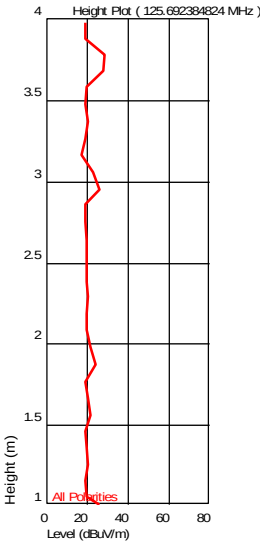


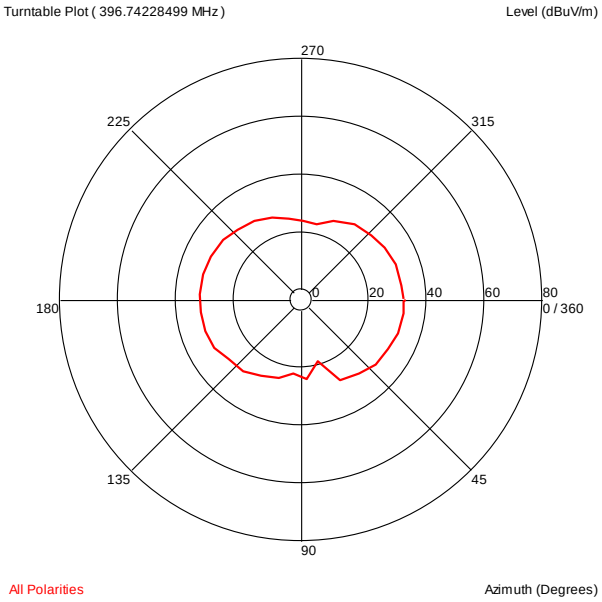
Turntable Plots

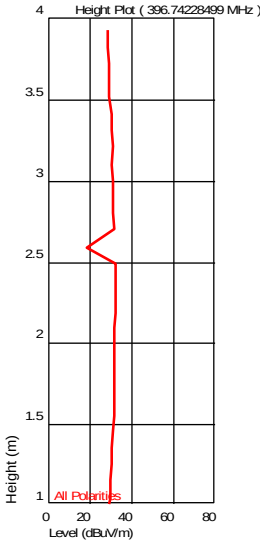


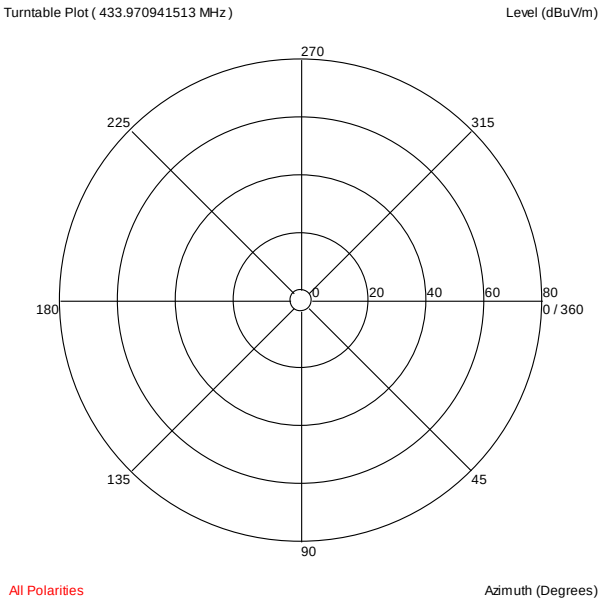


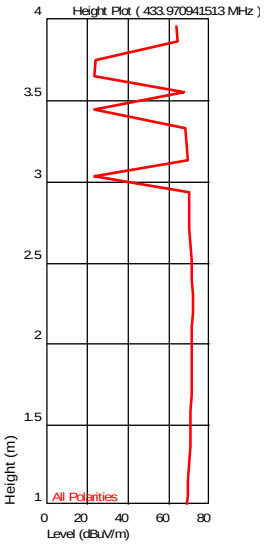

Turntable Plot (125.692384824 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

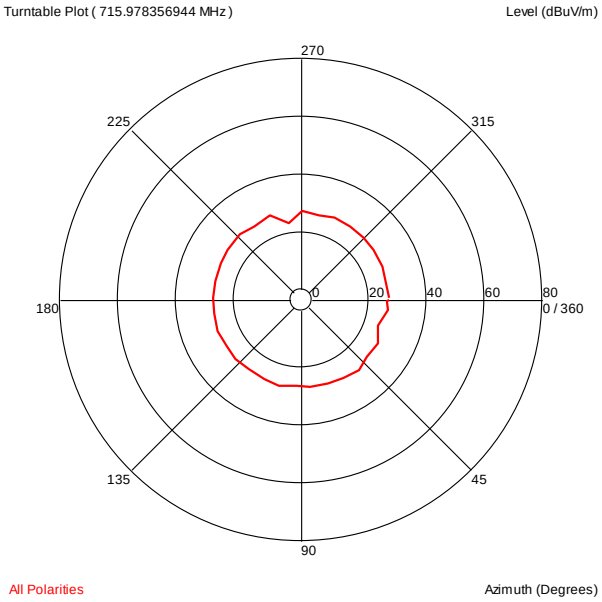

Height Plot (125.692384824 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

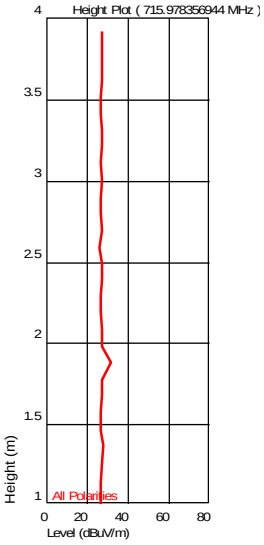

Turntable Plot (396.74228499 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

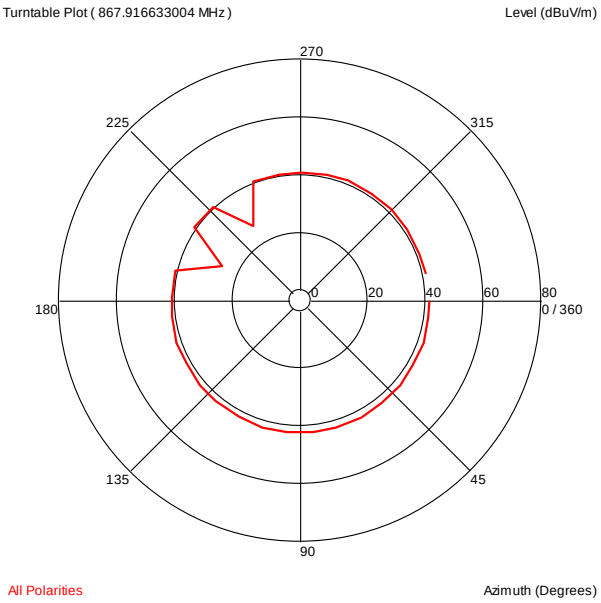

Height Plot (396.74228499 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

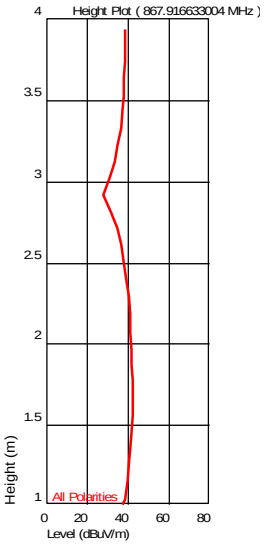

Turntable Plot (433.970941513 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (433.970941513 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (715.978356944 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (715.978356944 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (867.916633004 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

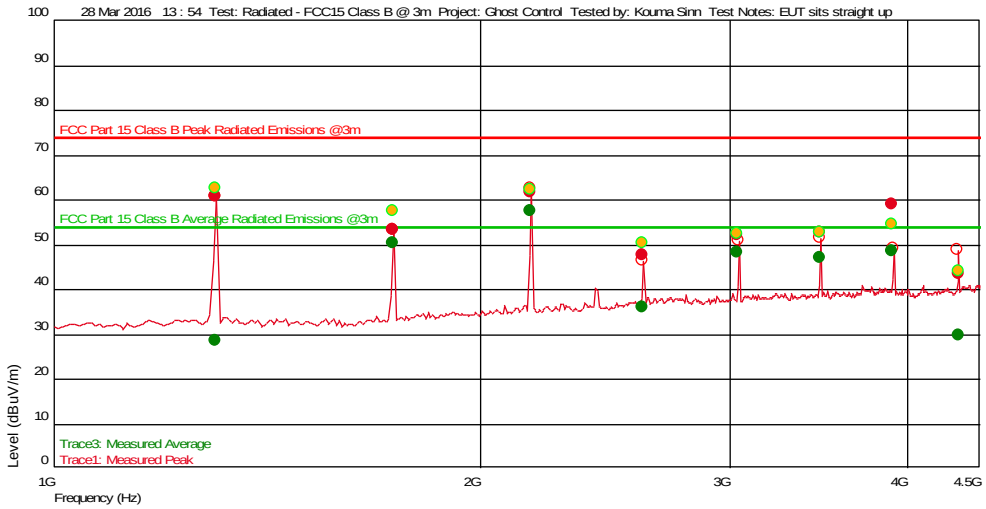

Height Plot (867.916633004 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

X-axis (EUT sits straight up), 1-4.5 GHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 3m	
Project:	Ghost Control	
Test Notes:	EUT sits straight up	
Temperature:	20C	
Humidity:	33%, 992mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 13 : 54	

Prescan Emission Graph



Measured Peak Value
Measured Quasi Peak Value
Measured Average Value
Maximum Value of Mast and Turntable

Swept Peak Data
Swept Quasi Peak Data
Swept Average Data

Emissions Test Data

Trace1: Measured Peak

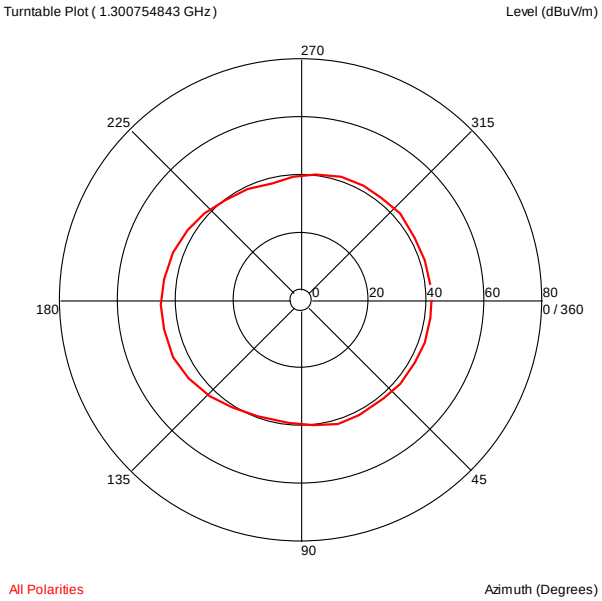
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
4.348056112 G	43.43	33.636	-30.572	74.000	-30.57	|	1	3.48	1 M	Restricted
2.603794255 G	47.68	32.305	-33.823	74.000	-26.32	--	72	1.10	1 M	
3.037748831 G	52.16	32.835	-33.014	74.000	-21.84	--	342	1.48	1 M	
3.471830328 G	52.70	33.044	-32.137	74.000	-21.30	|	360	1.58	1 M	
1.735871744 G	53.20	29.427	-35.014	74.000	-20.80	|	209	1.34	1 M	
3.905738143 G	58.89	33.567	-31.260	74.000	-15.11	--	52	2.67	1 M	Restricted
1.300754843 G	60.88	29.059	-35.136	74.000	-13.12	|	189	1.59	1 M	Restricted
2.169806279 G	61.54	31.424	-34.626	74.000	-12.46	--	275	1.47	1 M	

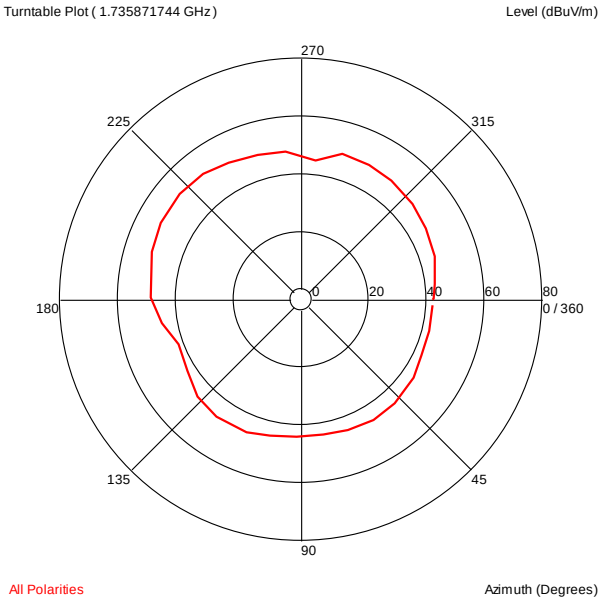
Trace3: Measured Average

Frequency(Hz)	Level* (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
4.348056112 G	31.39	33.636	-30.572	54.000	-22.61	|	1	3.48	1 M	Restricted
2.603794255 G	35.64	32.305	-33.823	54.000	-18.36	--	72	1.10	1 M	
3.037748831 G	40.12	32.835	-33.014	54.000	-13.88	--	342	1.48	1 M	
3.471830328 G	40.66	33.044	-32.137	54.000	-13.34	|	360	1.58	1 M	
1.735871744 G	41.16	29.427	-35.014	54.000	-12.84	|	209	1.34	1 M	
3.905738143 G	46.85	33.567	-31.26	54.000	-7.15	--	52	2.67	1 M	Restricted
1.300754843 G	48.84	29.059	-35.136	54.000	-5.16	|	189	1.59	1 M	Restricted
2.169806279 G	49.5	31.424	-34.626	54.000	-4.5	--	275	1.47	1 M	

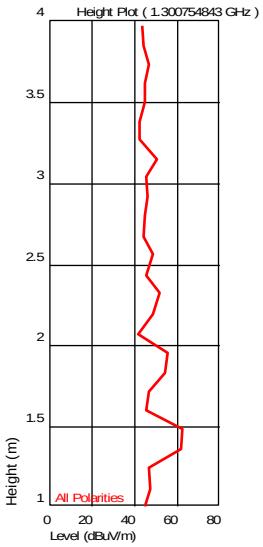
Notes: *Measured Average = Measured Peak – Average factor of 12.04 dB. Disregard the CISPR average on the plot.

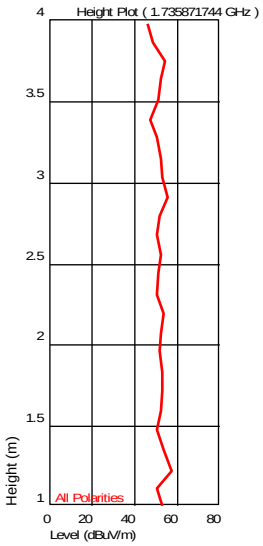
Azimuth Plots

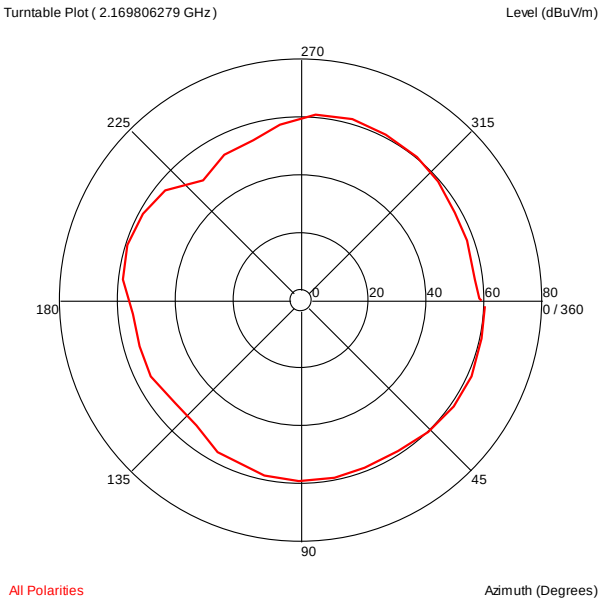


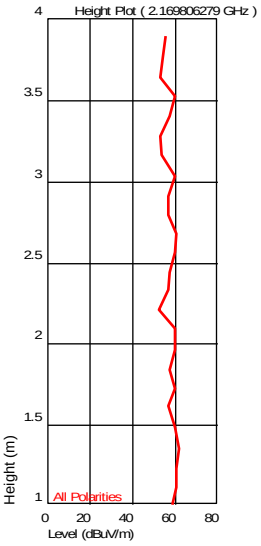


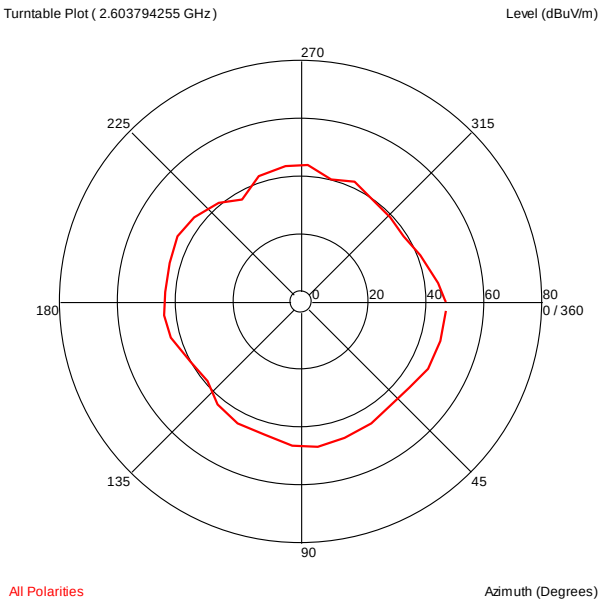
Turntable Plots

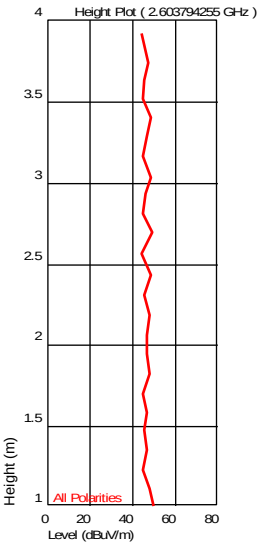


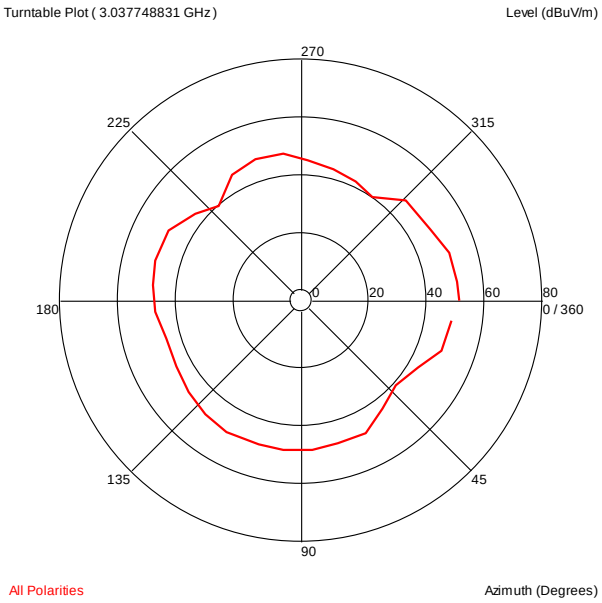


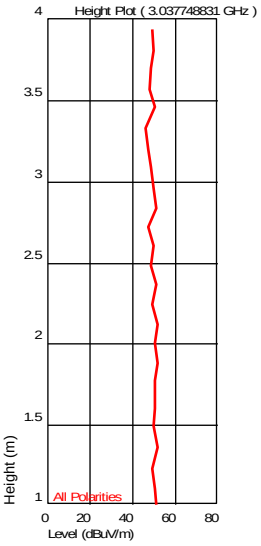

Turntable Plot (2.169806279 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

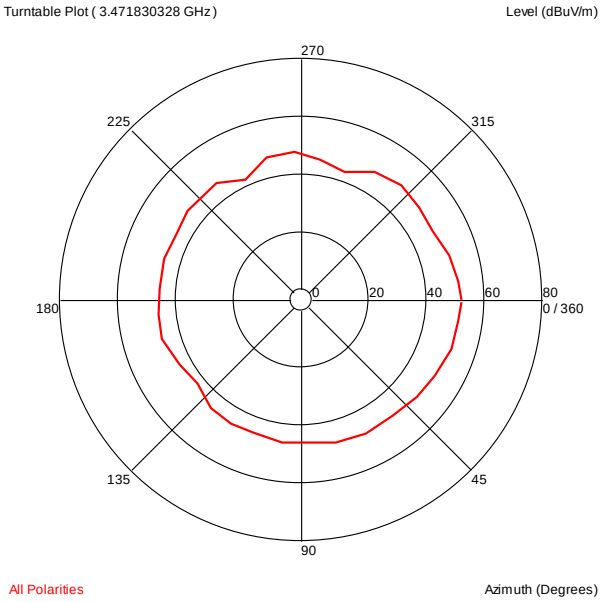

Height Plot (2.169806279 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

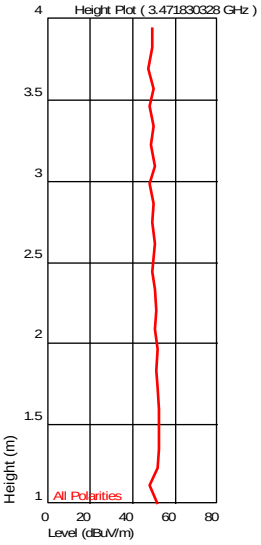

Turntable Plot (2.603794255 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

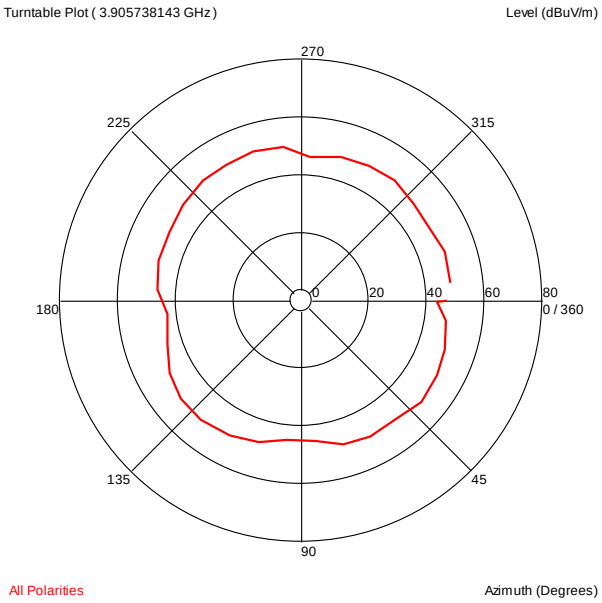

Height Plot (2.603794255 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

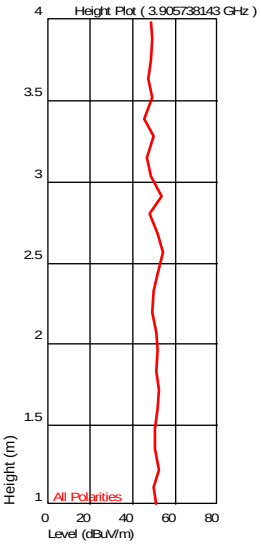

Turntable Plot (3.037748831 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

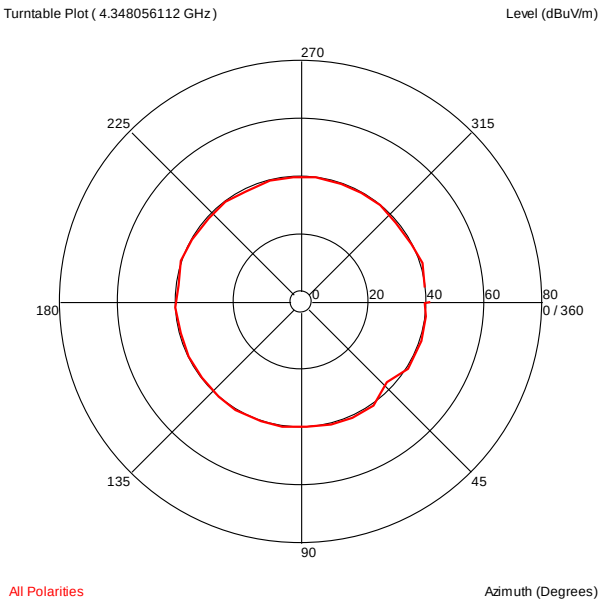

Height Plot (3.037748831 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

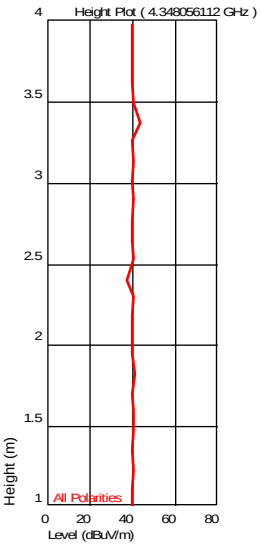

Turntable Plot (3.471830328 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (3.471830328 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (3.905738143 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (3.905738143 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (4.348056112 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

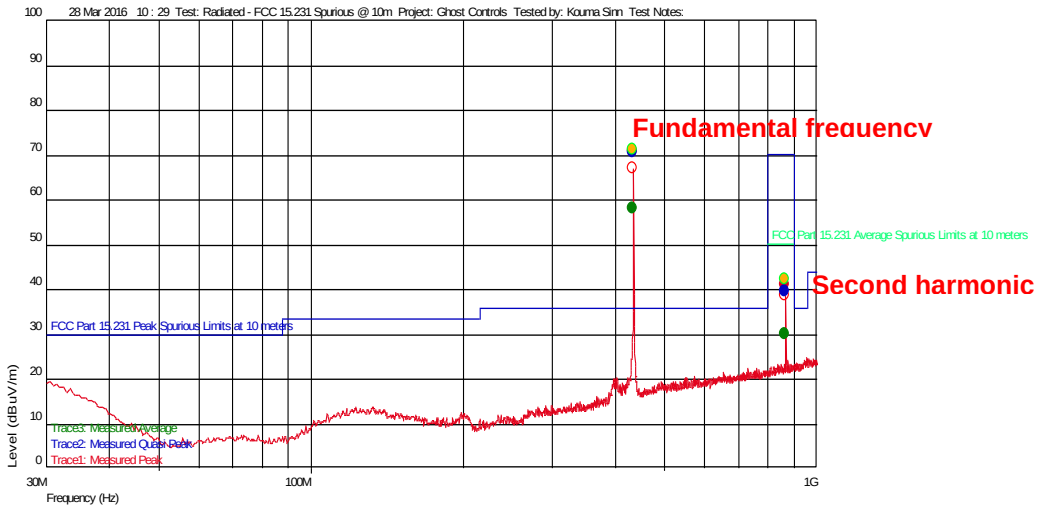

Height Plot (4.348056112 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Y-axis (EUT sits its long side), 30-1000 MHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Ghost Controls	
Test Notes:	EUT sits its long side	
Temperature:	19C	
Humidity:	30%, 1001mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 10 : 29	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

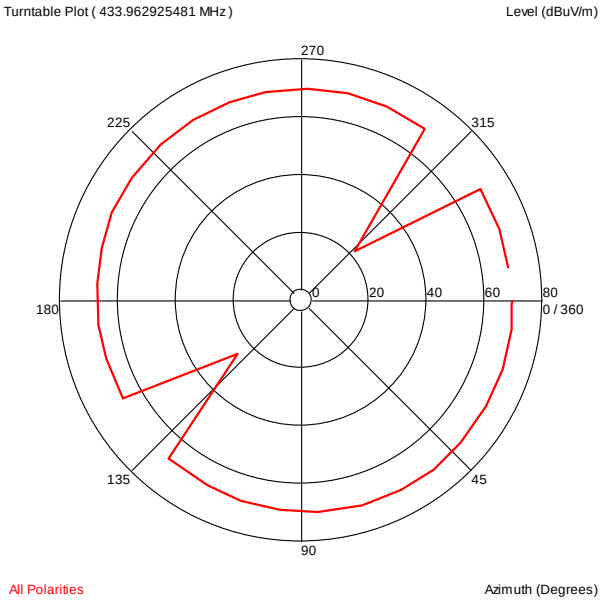
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
867.962324387 M	41.09	21.900	-23.212	70.3	-29.21	--	342	1.15	120 k	

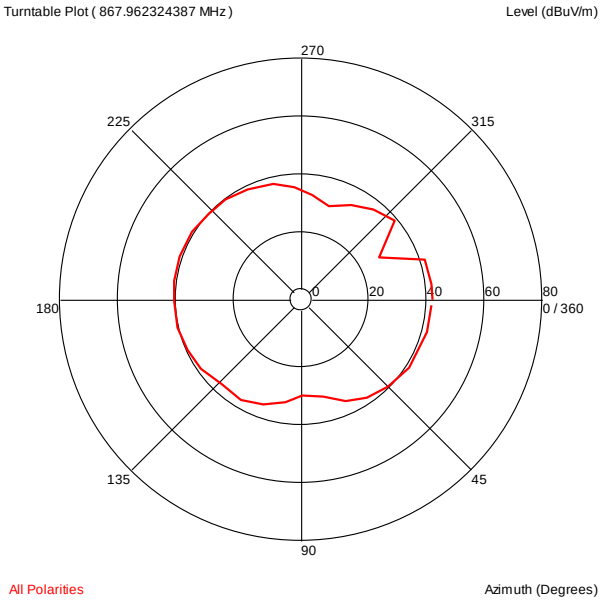
Trace3: Measured Average

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
867.962324387 M	29.05	21.900	-23.212	50.3	-21.25	--	342	1.15	120 k	

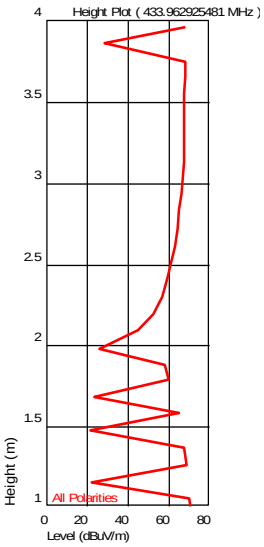
Notes: Only second harmonic emission was detected. The measured average = measured peak – average factor of 12.04 dB.

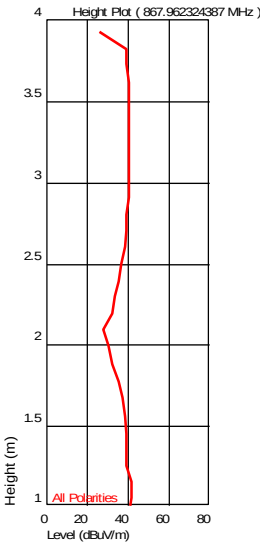
Azimuth Plots





Turntable Plots



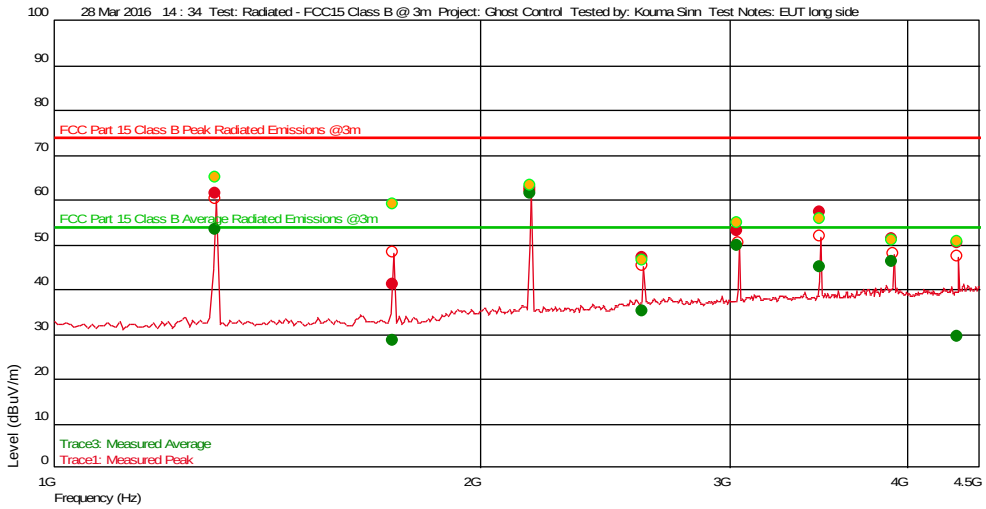


Y-axis (EUT sits on long side), 1-4.5 GHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 3m	
Project:	Ghost Control	
Test Notes:	EUT long side	
Temperature:	20C	
Humidity:	33%, 992mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 14 : 34	

Prescan Emission Graph



Measured Peak Value
Measured Quasi Peak Value
Measured Average Value
Maximum Value of Mast and Turntable
Swept Peak Data
Swept Quasi Peak Data
Swept Average Data

Emissions Test Data

Trace1: Measured Peak

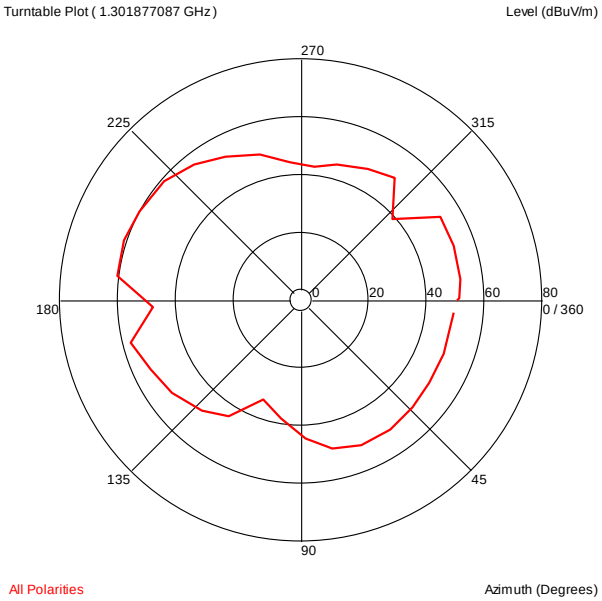
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
1.736900468 G	41.07	29.438	-35.014	74.000	-32.93	--	187	1.09	1 M	
2.603941216 G	47.14	32.305	-33.823	74.000	-26.86	|	229	1.45	1 M	
4.344362058 G	50.36	33.632	-30.578	74.000	-23.64	--	85	1.09	1 M	Restricted
3.905831663 G	51.23	33.566	-31.260	74.000	-22.77	--	0	1.33	1 M	Restricted
3.037762191 G	53.00	32.835	-33.014	74.000	-21.00	--	321	3.74	1 M	
3.471816967 G	57.11	33.044	-32.137	74.000	-16.89	--	360	3.66	1 M	
1.301877087 G	61.25	29.052	-35.135	74.000	-12.75	--	188	1.58	1 M	Restricted
2.169819639 G	62.59	31.424	-34.626	74.000	-11.41	|	8	2.89	1 M	

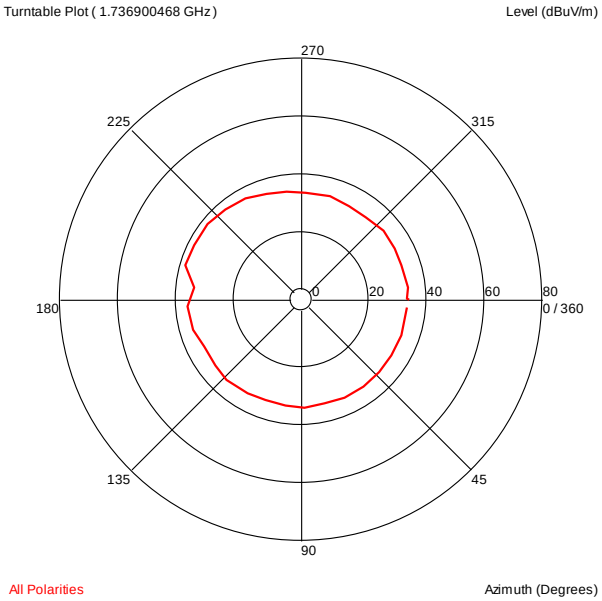
Trace3: Measured Average

Frequency(Hz)	Level* (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
1.736900468 G	29.03	29.438	-35.014	54.0000	-24.97	--	187	1.09	1 M	
2.603941216 G	35.1	32.305	-33.823	54.0000	-18.9	|	229	1.45	1 M	
4.344362058 G	38.32	33.632	-30.578	54.0000	-15.68	--	85	1.09	1 M	Restricted
3.905831663 G	39.19	33.566	-31.26	54.0000	-14.81	--	0	1.33	1 M	Restricted
3.037762191 G	40.96	32.835	-33.014	54.0000	-13.04	--	321	3.74	1 M	
3.471816967 G	45.07	33.044	-32.137	54.0000	-8.93	--	360	3.66	1 M	
1.301877087 G	49.21	29.052	-35.135	54.0000	-4.79	--	188	1.58	1 M	Restricted
2.169819639 G	50.55	31.424	-34.626	54.0000	-3.45	|	8	2.89	1 M	

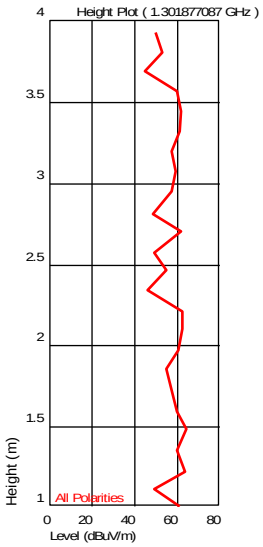
Notes: *Measured Average = Measured Peak – Average factor of 12.04 dB. Disregard CISPR average on the plot.

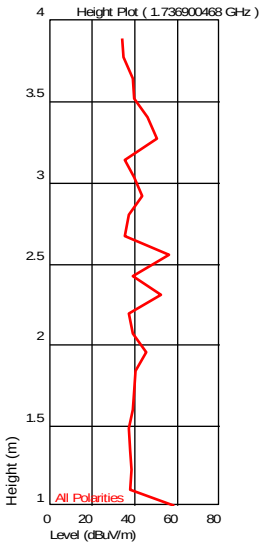
Azimuth Plots

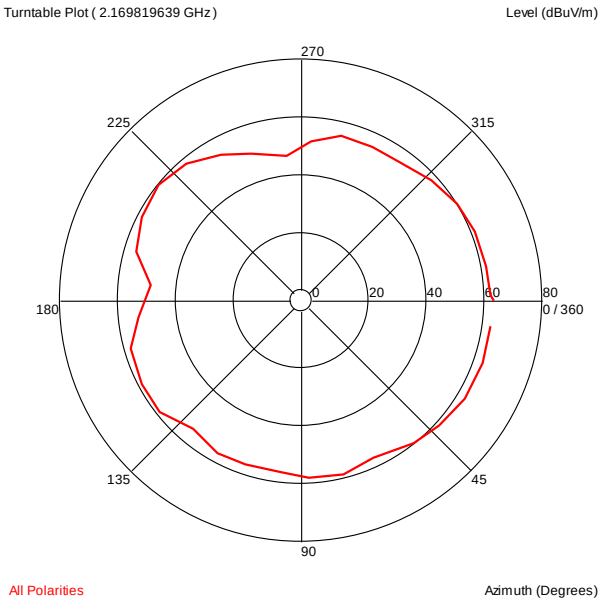


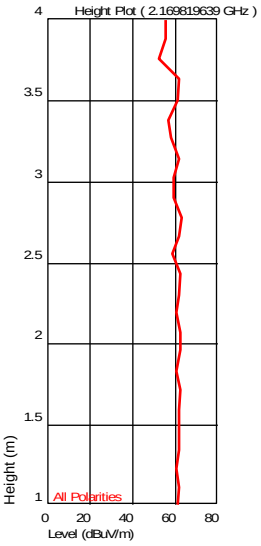


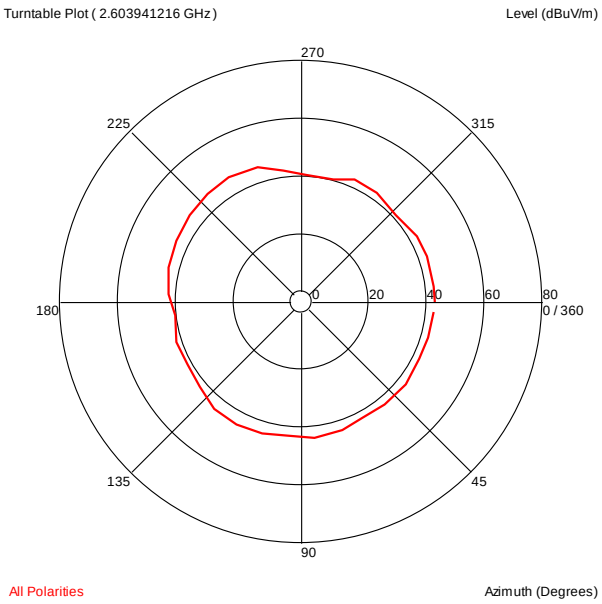
Turntable Plots

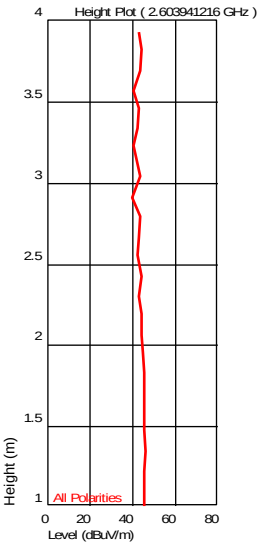




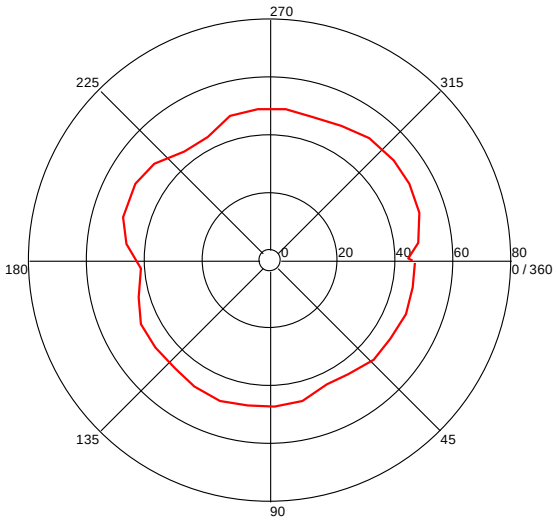

Turntable Plot (2.169819639 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (2.169819639 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

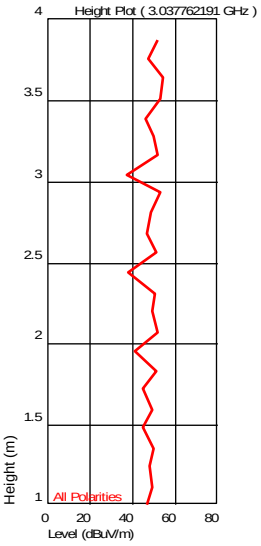

Turntable Plot (2.603941216 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (2.603941216 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

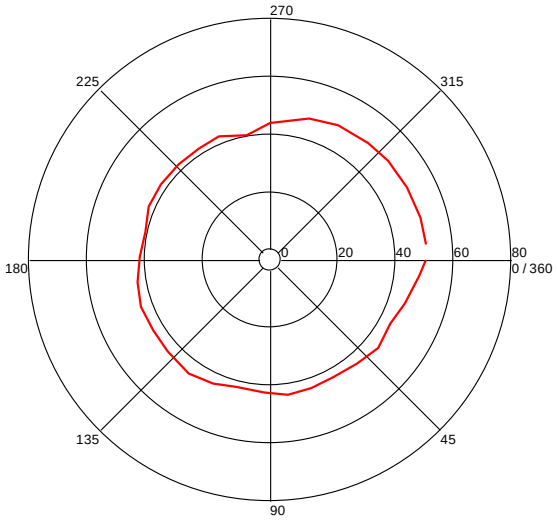
Turntable Plot (3.037762191 GHz) Level (dBuV/m)



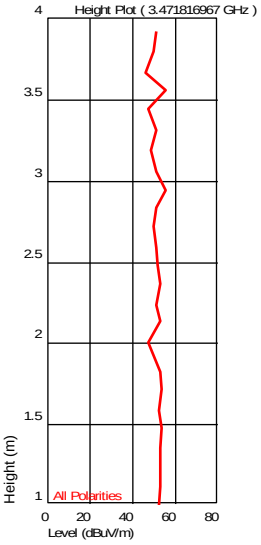
All Polarities Azimuth (Degrees)

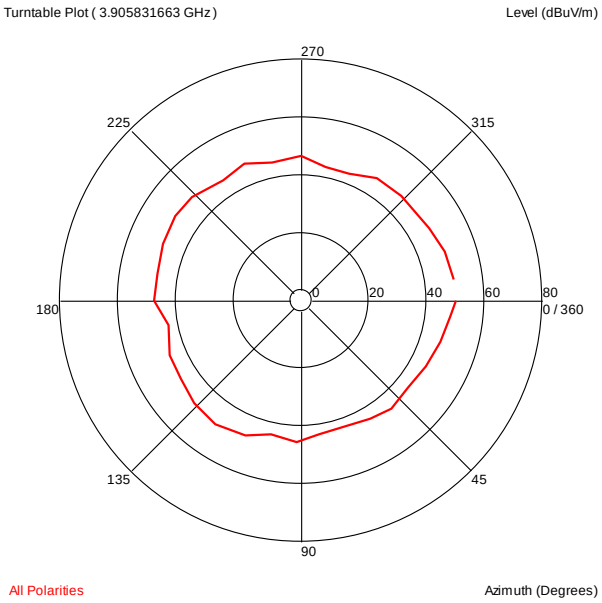


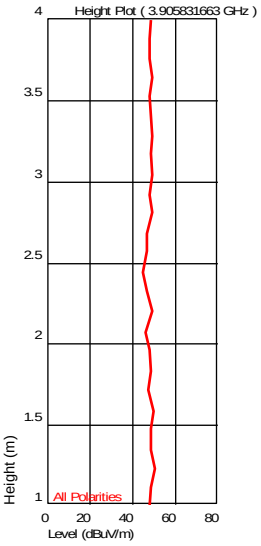
Turntable Plot (3.471816967 GHz) Level (dBuV/m)

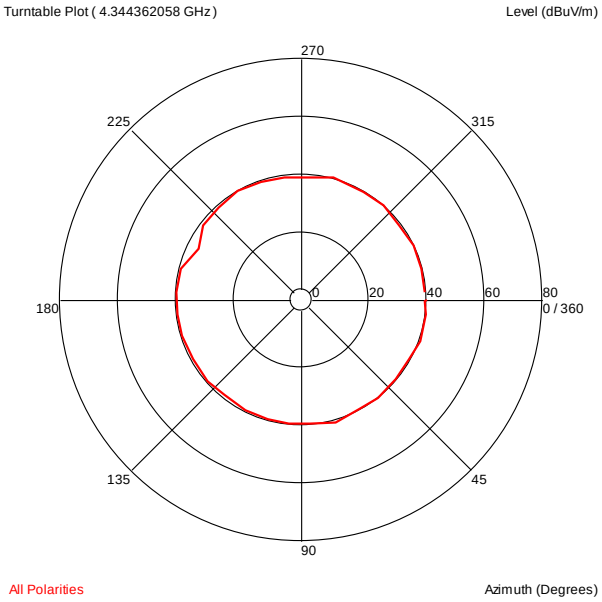


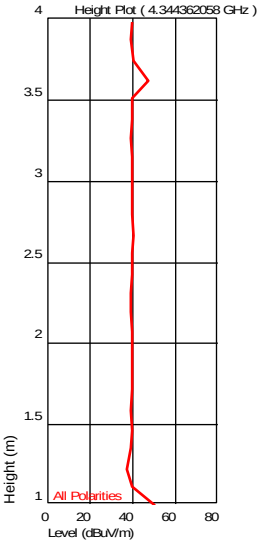
All Polarities Azimuth (Degrees)




Turntable Plot (3.905831663 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (3.905831663 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (4.344362058 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

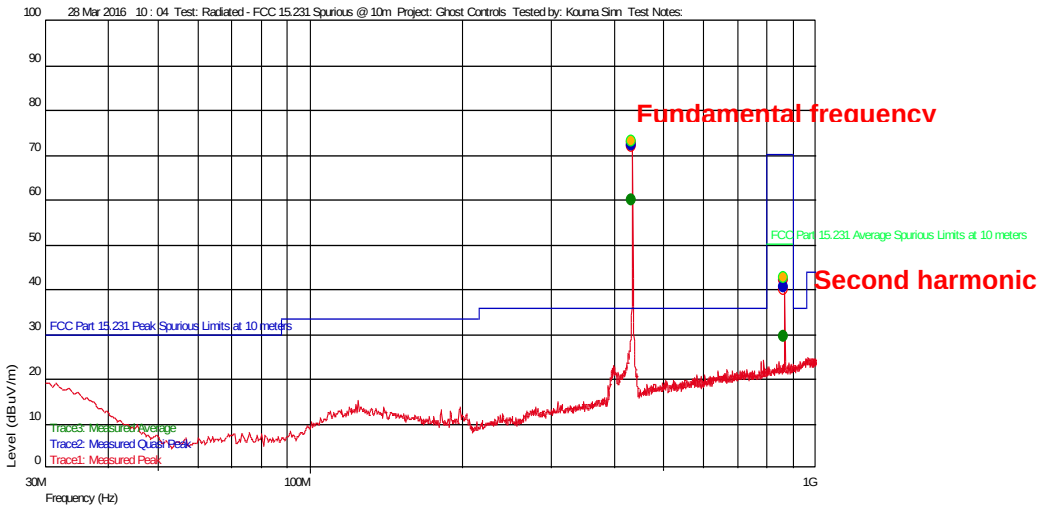

Height Plot (4.344362058 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Z-axis (EUT sits its back), 30-1000 MHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Ghost Controls	
Test Notes:	EUT sits its back	
Temperature:	19C	
Humidity:	30%, 1001mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 10 : 04	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

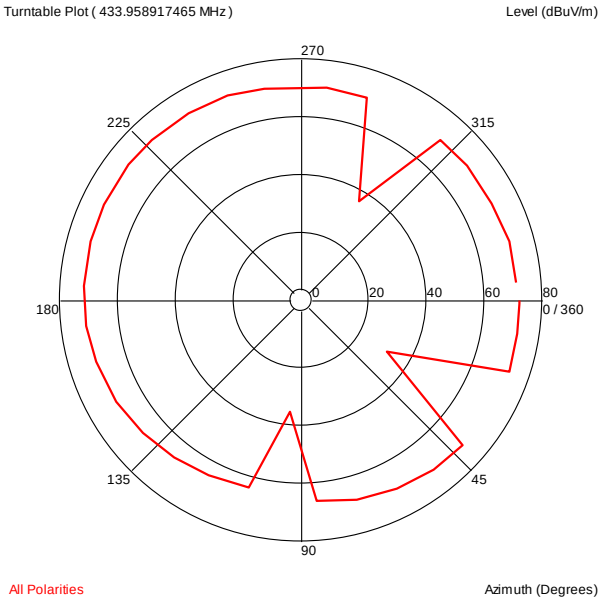
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
867.96072118 M	41.90	21.900	-23.212	70.30	-28.4	--	95	1.15	120 k	

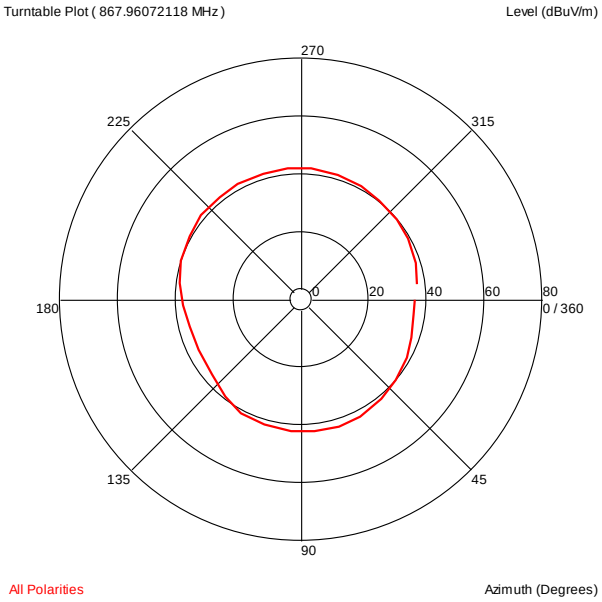
Trace3: Measured Average

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
867.96072118 M	29.86	21.900	-23.212	50.3	-20.44	--	95	1.15	120 k	

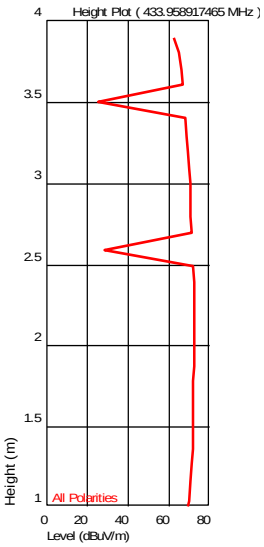
Notes: Only second harmonic emission was detected. The measured average = measured peak – average factor of 12.04 dB.

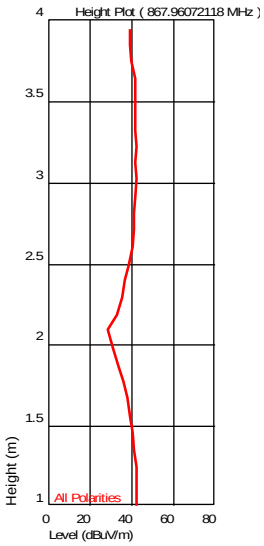
Azimuth Plots





Turntable Plots



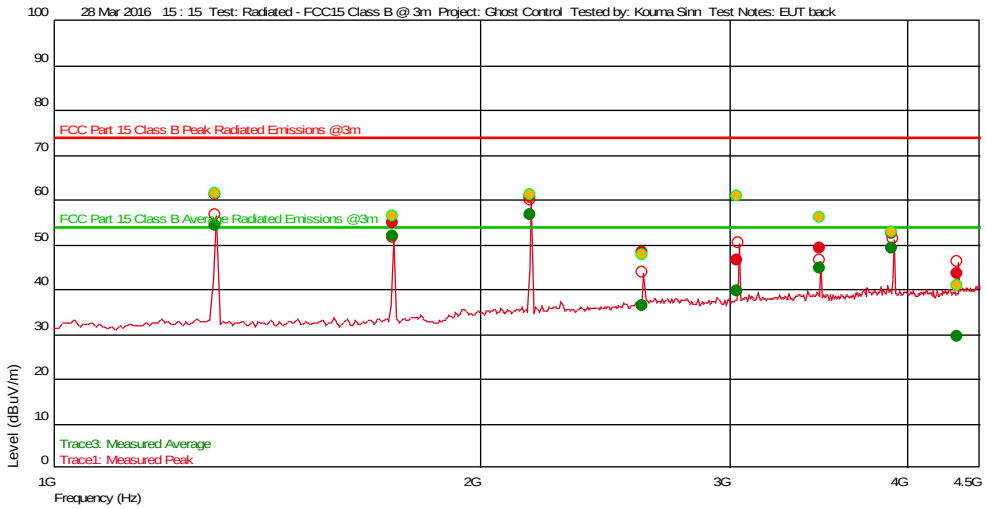


Z-axis (EUT sits on its back), 1-4.5 GHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 3m	
Project:	Ghost Control	
Test Notes:	EUT back	
Temperature:	20C	
Humidity:	33%, 992mbar	
Tested by:	Kouma Sinn	
Test Started:	28 Mar 2016 15 : 15	

Prescan Emission Graph



Measured Peak Value
Measured Quasi Peak Value
Measured Average Value
Maximum Value of Mast and Turntable
Swept Peak Data
Swept Quasi Peak Data
Swept Average Data

Emissions Test Data

Trace1: Measured Peak

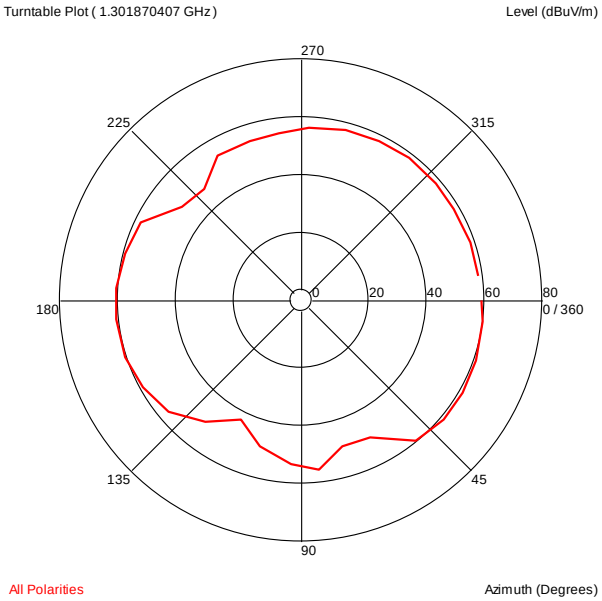
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
4.345470942 G	43.29	33.633	-30.576	74.000	-30.71	--	238	2.48	1 M	Restricted
3.037735471 G	46.32	32.835	-33.014	74.000	-27.68	--	360	2.66	1 M	
2.603861056 G	48.24	32.305	-33.823	74.000	-25.76	|	331	3.39	1 M	
3.471750167 G	49.16	33.044	-32.137	74.000	-24.84	--	66	1.08	1 M	
3.905778223 G	52.49	33.567	-31.260	74.000	-21.51	|	118	1.44	1 M	Restricted
1.735898464 G	54.67	29.427	-35.014	74.000	-19.33	--	188	2.79	1 M	
2.169839679 G	60.50	31.424	-34.626	74.000	-13.5	|	353	2.19	1 M	
1.301870407 G	61.13	29.052	-35.135	74.000	-12.87	--	40	3.09	1 M	Restricted

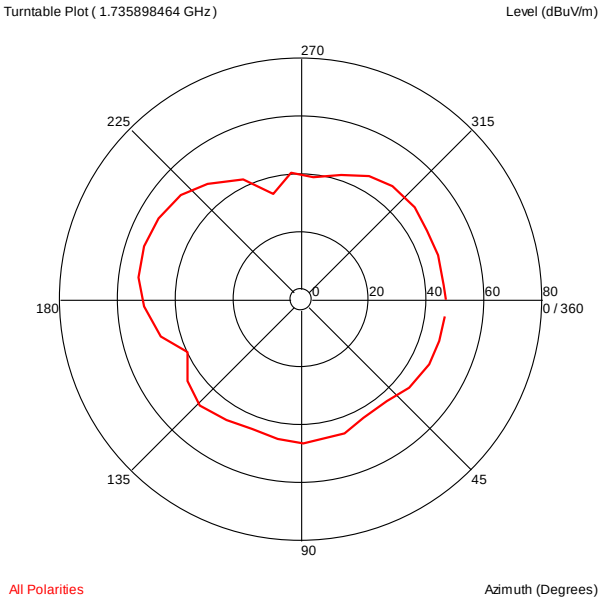
Trace3: Measured Average

Frequency(Hz)	Level* (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
4.345470942 G	31.25	33.633	-30.576	54.0000	-22.75	--	238	2.48	1 M	Restricted
3.037735471 G	34.28	32.835	-33.014	54.0000	-19.72	--	360	2.66	1 M	
2.603861056 G	36.2	32.305	-33.823	54.0000	-17.8	|	331	3.39	1 M	
3.471750167 G	37.12	33.044	-32.137	54.0000	-16.88	--	66	1.08	1 M	
3.905778223 G	40.45	33.567	-31.26	54.0000	-13.55	|	118	1.44	1 M	Restricted
1.735898464 G	42.63	29.427	-35.014	54.0000	-11.37	--	188	2.79	1 M	
2.169839679 G	48.46	31.424	-34.626	54.0000	-5.54	|	353	2.19	1 M	
1.301870407 G	49.09	29.052	-35.135	54.0000	-4.91	--	40	3.09	1 M	Restricted

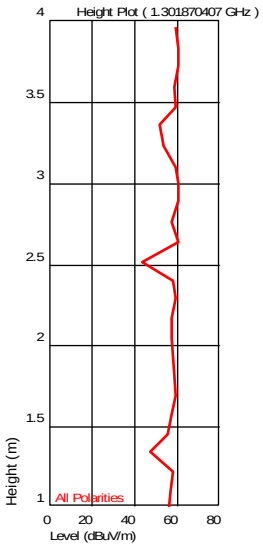
Notes: *Measured Average = Measured Peak – Average factor of 12.04 dB. Disregard CISPR average on the plot.

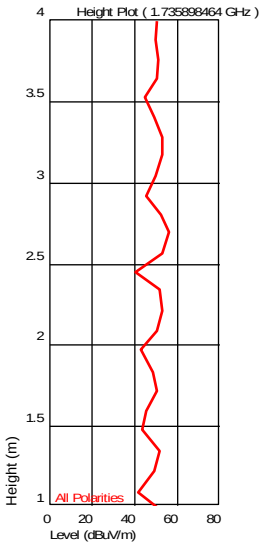
Azimuth Plots

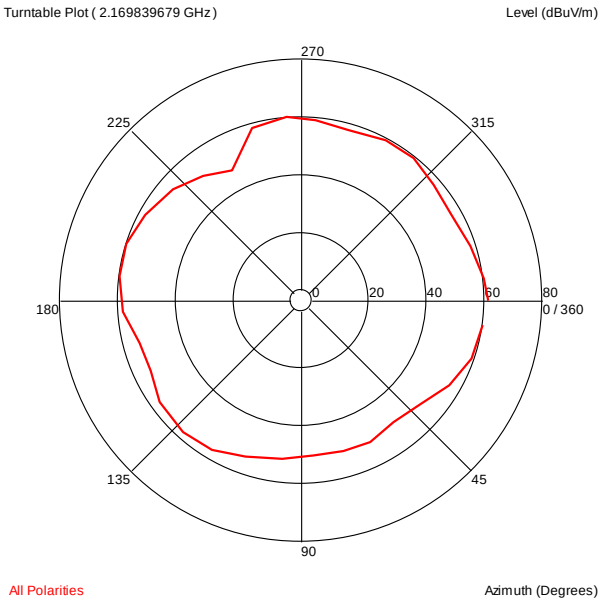


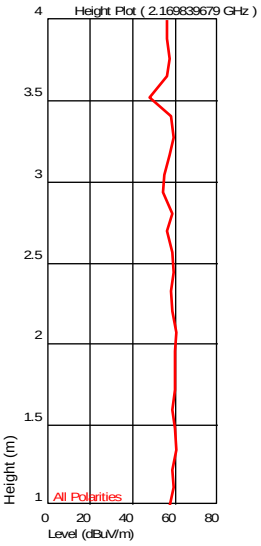


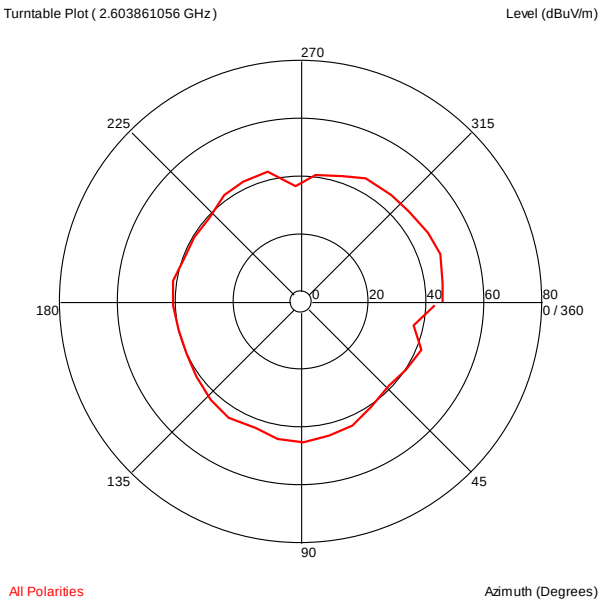
Turntable Plots

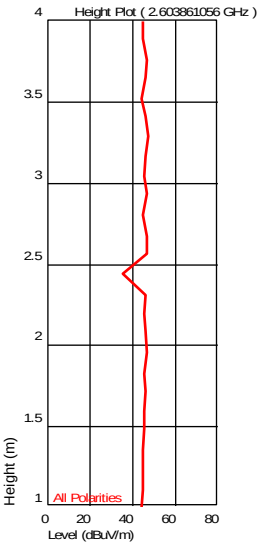


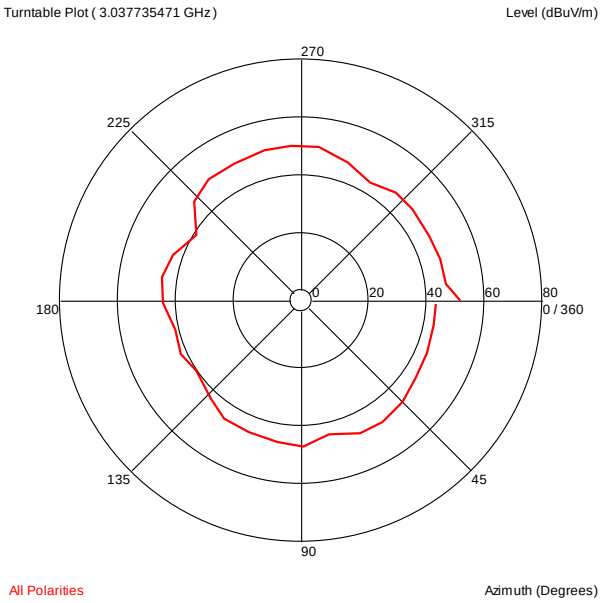


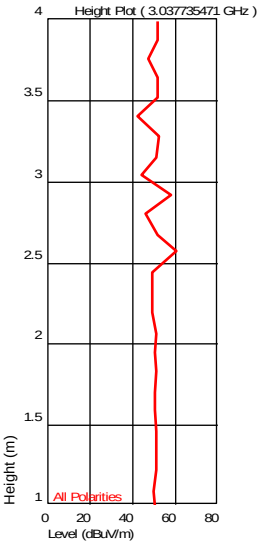

Turntable Plot (2.169839679 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

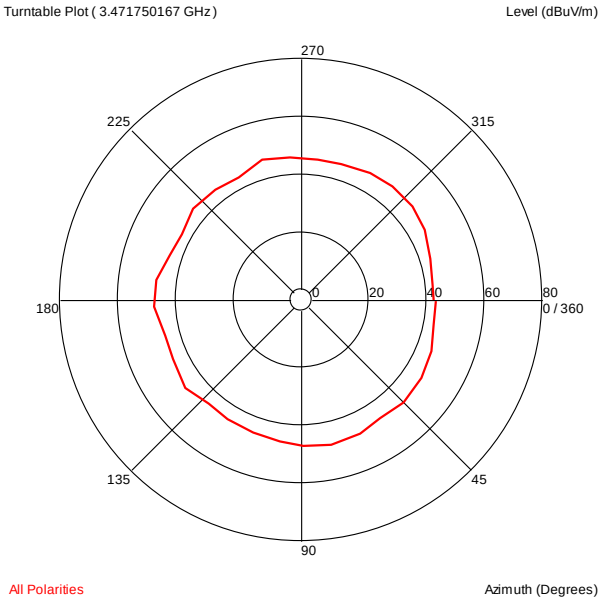

Height Plot (2.169839679 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

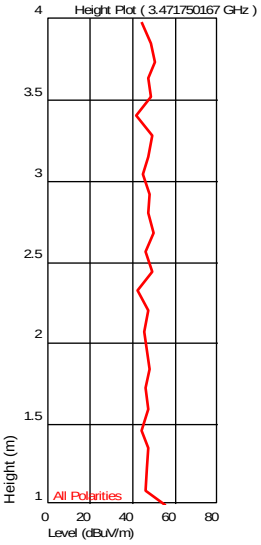

Turntable Plot (2.603861056 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

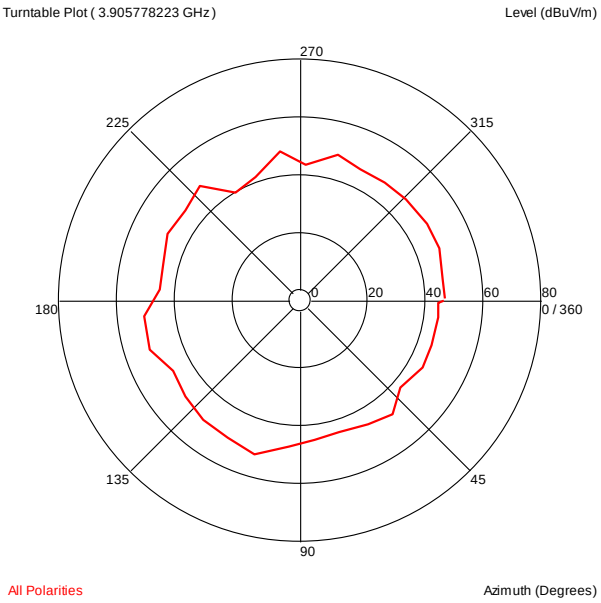

Height Plot (2.603861056 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

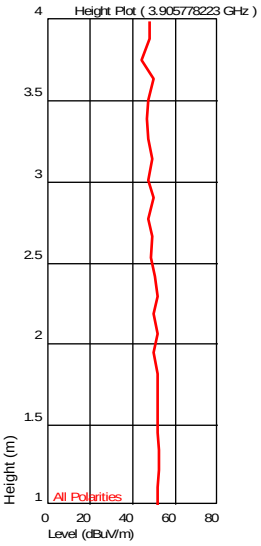

Turntable Plot (3.037735471 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

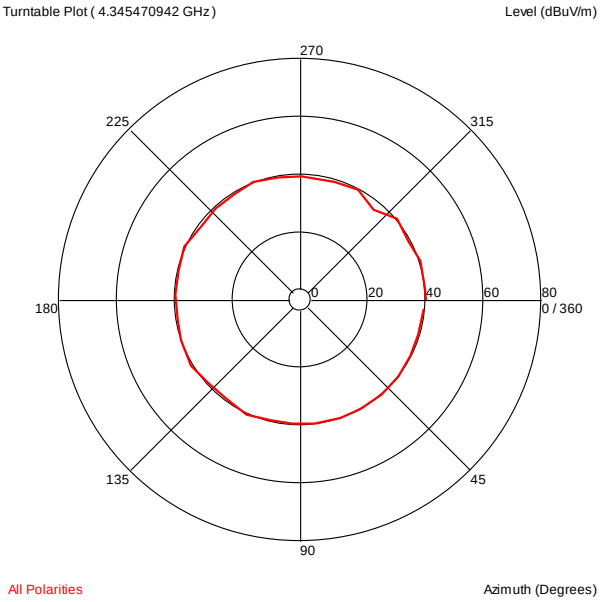

Height Plot (3.037735471 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

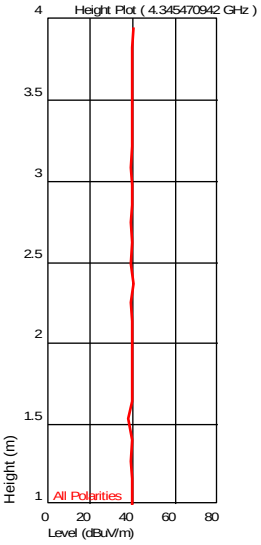

Turntable Plot (3.471750167 GHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (3.471750167 GHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)









Test Personnel:	Kouma Sinn KPS	Test Date:	03/29/2016
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.231 and RSS-210	Limit Applied:	Below specified limits
Input Voltage:	Fresh batteries	Ambient Temperature:	19 ºC
Pretest Verification w/ Ambient Signals or BB Source:	30-1000 MHz (BB Source) 1-4.5 GHz (Ambient Signals)	Relative Humidity:	30 %
		Atmospheric Pressure:	1001 mbars

Deviations, Additions, or Exclusions: None

9 Duty Cycle

9.1 Method

The duty cycle factor was provided by the client.

9.2 Test Data:

Worst case scenario for transmission:
Packet/Word contains 20 '1-bit' and 22 '0-bit'

ON-TIME:
- 1-bit ó 20 x .75 msec = 15 msec
- 0-bit ó 22 x .25 msec = 5.5 msec
- Total Packet/Word ON-TIME = 20.5 msec

OFF-TIME:
- 1-bit ó 20 x .25 msec = 5 msec
- 0-bit ó 22 x .75 msec = 16.5 msec
- Total Packet/Word OFF-TIME = 21.5 msec

Inter-packet OFF-TIME = 40.0 msec

TOTAL ON-TIME = 20.5 msec
TOTAL OFF_TIME = 21.5 + 40.0 msec = 61.5 msec
TOTAL PERIOD = 82 msec

Average Power Factor:
20 Log (20.5/ 82) = -12.04dB

Burst is 21.353 ms

ON time of short pulses = 15 * 52.7864 uS or 791.796 uS
ON time of long pulses = 27 * 761.5230 uS or 20,561.121 uS

10 5 Second Shut off

10.1 Method

Tests are performed in accordance with FCC 47CFR Part 15 Subpart C Section 15.231 and RSS 210.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	10/23/2015	10/23/2016
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	06/04/2015	06/04/2016
CBLHF2012-2M-2'	2m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252675002	02/09/2016	02/09/2017
None'	Near Field Probe	ETS	7405-901	None	N/A	N/A

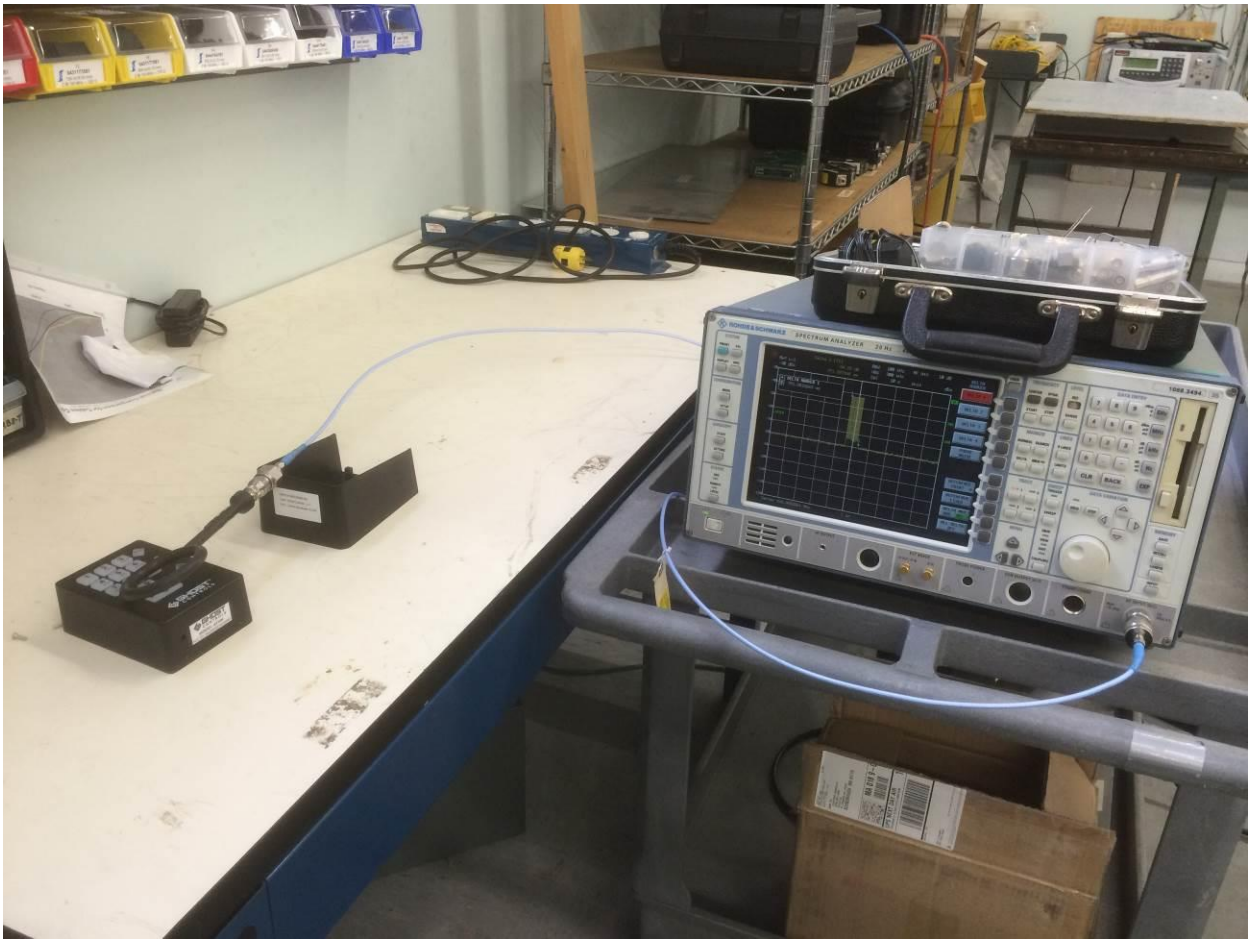
Software Utilized:

Name	Manufacturer	Version
None		

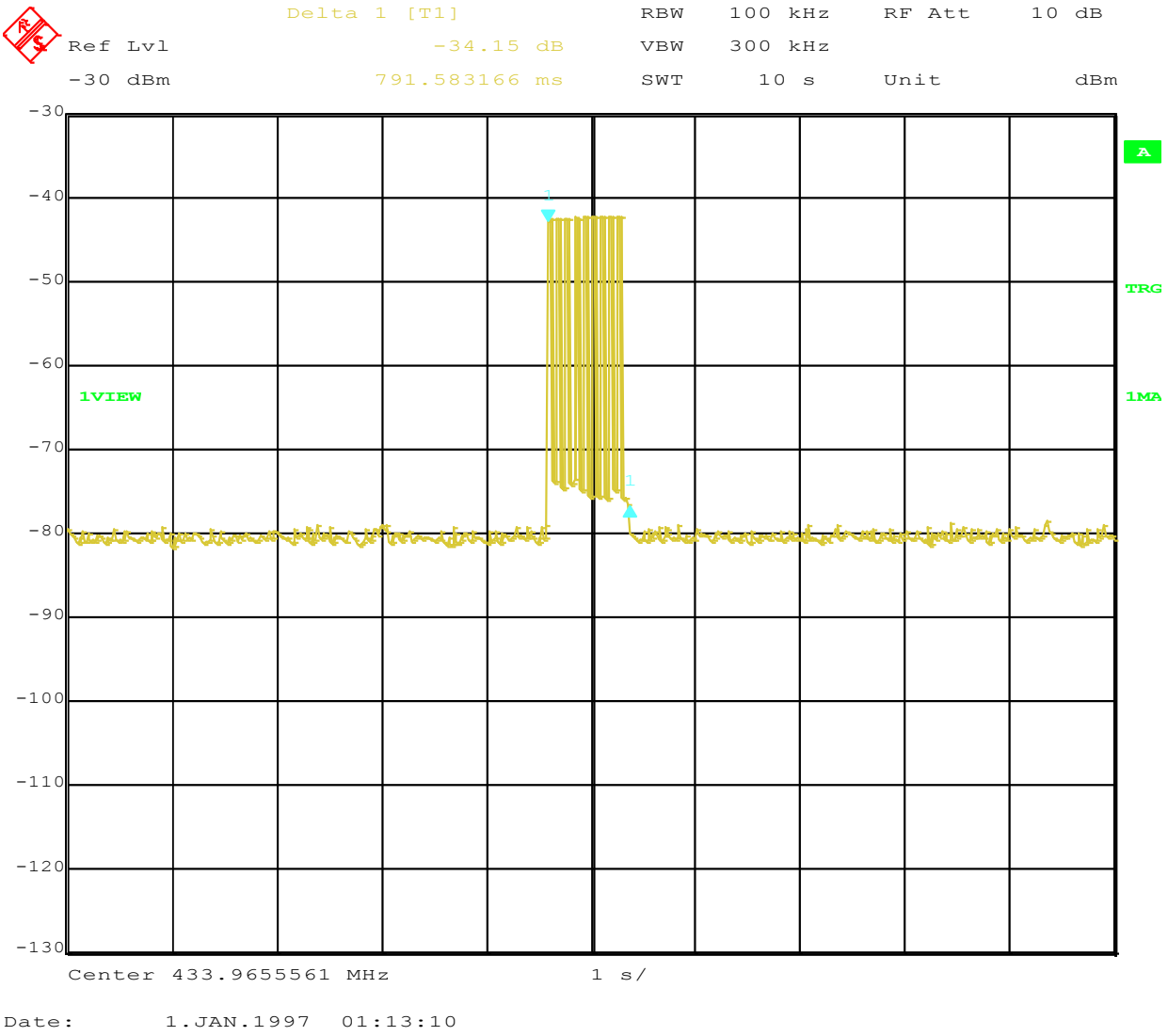
10.3 Results:

The sample tested was found to Comply. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

10.4 Setup Photograph:



10.5 Plots/Data:



Total on time when the button is pressed and released is 791.583 ms

Test Personnel:	Kouma Sinn KPS	Test Date:	03/29/2016
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.231 and RSS-210	Limit Applied:	Below specified limits
Input Voltage:	Fresh batteries	Ambient Temperature:	20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**Yes**	Relative Humidity:	9 %
		Atmospheric Pressure:	999 mbars

Deviations, Additions, or Exclusions: None

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	03/29/2016	102497759BOX-001	KPS	MFM	Original Issue
1	05/03/2016	102497759BOX-001a	KPS	MFM	Included antenna gain on page 5. Revised duty cycle factor. And revised test data with new duty cycle factor