



## EMISSIONS TEST REPORT

**Report Number:** 102037004BOX-001c

**Project Number:** G101718120

**Report Issue Date:** 06/16/2015

**Product Designation:** 2048910

**Standards:** CFR47 Part 15 Subpart C 15.247 (2014)  
CFR47 Part 15 Subpart B (2014)  
IC RSS-210 Issue 8 December 2010 Annex 8  
IC RSS-Gen Issue 4 November 2014  
IC ICES-003 Issue 5 August 2012  
IC RSS-102 Issue 4 March 2010 updated December 2010

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

Client:  
Opex Corporation  
305 Commerce Drive  
Moorestown, NJ 08057 U.S.A

Report prepared by

Kouma Sinn / Staff Engineer, EMC

Report reviewed by

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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 3.0. 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 **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

## 2 Test Summary

| Section | Test full name                                                                                                                                                                                                               | Result                      |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 3       | Client Information                                                                                                                                                                                                           | --                          |
| 4       | Description of Equipment Under Test                                                                                                                                                                                          | --                          |
| 5       | System Setup and Method                                                                                                                                                                                                      | --                          |
| 6       | Maximum Peak Output Power, Human RF Exposure, & Duty Cycle<br>CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (b)(3)<br>IC RSS-210 Issue 8 December 2010, A8.4 (4)<br>IC RSS-102 Issue 4 March 2010 updated December 2010 | Pass                        |
| 7       | Transmitter Radiated Spurious Emissions<br>CFR47 FCC Part 15 Subpart C(2014), Section 15.247 (d)<br>IC RSS-210 Issue 8 December 2010, A8.5                                                                                   | Pass                        |
| 8       | 6 dB Bandwidth & 99% Power Bandwidth<br>CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (a)(2)<br>IC RSS-210 Issue 8 December 2010, A8.2 (a)                                                                              | Pass                        |
| 9       | Power Spectral Density<br>CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (e)<br>IC RSS-210 Issue 8 December 2010, A8.2 (b)                                                                                               | Pass                        |
| 10      | Band-edge Compliance<br>CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (d)<br>IC RSS-210 Issue 8 December 2010, A8.5                                                                                                     | Pass                        |
| 11      | Digital Devices Radiated Spurious Emissions<br>CFR47 FCC Part 15:2013 Subpart B Section 15.109<br>IC ICES-003 Issue 5 August 2012                                                                                            | Pass                        |
| --      | Receiver Radiated Spurious Emissions<br>CFR47 FCC Part 15 Subpart B (2014), Section 15.109<br>IC RSS-Gen Issue 4 November 2014, Section 7                                                                                    | Exempt,<br>above 960<br>MHz |
| 12      | AC Mains Conducted Emissions<br>CFR47 FCC Part 15 Subpart B (2014), Section 15.207<br>IC RSS-Gen Issue 4 November 2014, 8.8 (Table 3)                                                                                        | Pass                        |
| 13      | Revision History                                                                                                                                                                                                             | --                          |

### 3 Client Information

This EUT was tested at the request of:

**Company:** Opex Corporation  
305 Commerce Drive  
Moorestown, NJ 08057  
U.S.A

**Contact:** Mr. Michael Powell  
**Telephone:** (856) 727-1100 ext. 2267  
**Email:** mpowell@opex.com

### 4 Description of Equipment Under Test

| Equipment Under Test |                  |              |                   |
|----------------------|------------------|--------------|-------------------|
| Description          | Manufacturer     | Model Number | Serial Number     |
| iBot-New Antennae V2 | Opex Corporation | 2048910      | BOX1503021541-001 |

|                     |                         |
|---------------------|-------------------------|
| Receive Date:       | 07/11/2014 & 03/02/2015 |
| Received Condition: | Good                    |
| Type:               | Production              |

| Description of Equipment Under Test (provided by client)                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Opex iBOT is a small radio controlled robotic vehicle which runs in a track system as part of a larger automated sorting machine. It uses Zigbee, 0-QPSK Modulation operates at frequency range of 2405-2480 MHz with a detachable antenna. |

| Equipment Under Test Power Configuration |               |                 |                  |
|------------------------------------------|---------------|-----------------|------------------|
| Rated Voltage                            | Rated Current | Rated Frequency | Number of Phases |
| 100-240 VAC                              | 1.3 A         | 50/60 Hz        | 1                |

| Operating modes of the EUT: |                                                                                                                                                                                                                                                                                                                         |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                         | Descriptions of EUT Exercising                                                                                                                                                                                                                                                                                          |
| 1                           | The iBOT was connected to a power supply which was powered by 120VAC. Opex Incorporated provided test commands to enable constant transmission at the maximum duty cycle that will be used in normal operation. Tests were performed on the high, middle, and low channels at maximum output power and in receive mode. |

#### Software used by the EUT:

| No. | Descriptions of EUT Exercising |
|-----|--------------------------------|
| 1   | Hyperterminal through RS232    |

## 5 System Setup and Method

| Cables |             |            |           |          |             |
|--------|-------------|------------|-----------|----------|-------------|
| Qty    | Description | Length (m) | Shielding | Ferrites | Termination |
| 1      | AC Mains    | 2          | None      | Yes      | AC Mains    |
|        |             |            |           |          |             |

| Support Equipment |              |                  |               |
|-------------------|--------------|------------------|---------------|
| Description       | Manufacturer | Model Number     | Serial Number |
| Laptop*           | Dell         | P/N: PU982AW#ABA | CNU6101PBW    |
|                   |              |                  |               |

\*Notes: The laptop was used to program the device then disconnected during testing.

### 5.1 Method:

Configuration as required by ANSI C 63.4:2009, FCC Part 15 Subpart C (2014) Section 15.247, RSS-210 Issue 8 December 2010, IC RSS-Gen Issue 4 November 2014 , and ANSI C63.10:2013.

### 5.2 EUT Block Diagram:



## 6 Maximum Peak Output Power, Human RF Exposure, & Duty Cycle

### 6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10:2013, ANSI C63.4:2009, RSS-102, FCC Part 2.1093, KDB558074 V03:2013, and RSS-210 Annex 8.

**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) | Ucisp |
|-------------------------|-----------------|----------------------------|-------|
| Radiated Emissions, 10m | 30-1000 MHz     | 4.6                        | 6.3   |
| Radiated Emissions, 3m  | 30-1000 MHz     | 5.3                        | 6.3   |
| Radiated Emissions, 3m  | 1-6 GHz         | 4.5                        | 5.2   |
| Radiated Emissions, 3m  | 6-15 GHz        | 5.2                        | 5.5   |
| Radiated Emissions, 3m  | 15-18 GHz       | 5.0                        | 5.5   |
| Radiated Emissions, 3m  | 18-40 GHz       | 5.0                        | 5.5   |

### 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 dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- 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 dB $\mu$ V 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

#### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

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    |
|----------|----------------------------------------|-------------------|-------------------|-------------|------------|------------|
| DAV004'  | Weather Station                        | Davis Instruments | 7400              | PE80529A61A | 09/25/2012 | 09/25/2014 |
| CBL030'  | High Frequency Cable 40GHz             | Megaphase         | TM40 K1K1 80      | CBL030      | 04/05/2014 | 04/05/2015 |
| ROS001'  | Spectrum Analyzer 20Hz - 40 GHz        | Rohde & Schwartz  | FSEK-30           | 100225      | 05/19/2014 | 05/19/2015 |
| WEI8'    | Attenuator                             | Weinschel Corp    | 47-10-34          | BD8309      | 03/26/2014 | 03/26/2015 |
| MAN1'    | Digital 4 Line Barometer               | Mannix            | 0ABA116           | MAN1        | 08/13/2012 | 08/13/2014 |
| ETS001'  | 1-18GHz DRG Horn Antenna               | ETS-Lindgren      | 3117              | 00143259    | 01/06/2014 | 01/06/2015 |
| 145-416' | Cables 145-400 145-402 145-404 145-408 | Huber + Suhner    | 3m Track B cables | multiple    | 10/04/2013 | 10/04/2014 |
| 145128'  | EMI Receiver (20 Hz - 40 Ghz)          | Rohde & Schwarz   | ESIB 40           | 839283/001  | 03/17/2014 | 03/17/2015 |

**Software Utilized:**

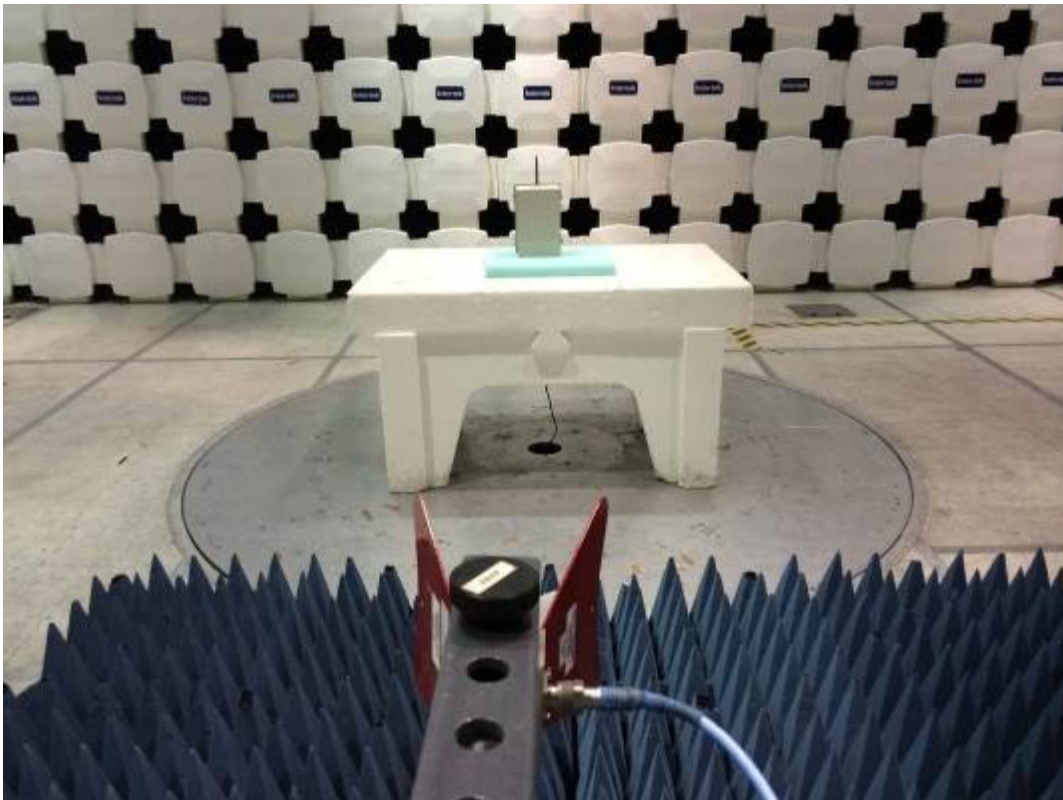
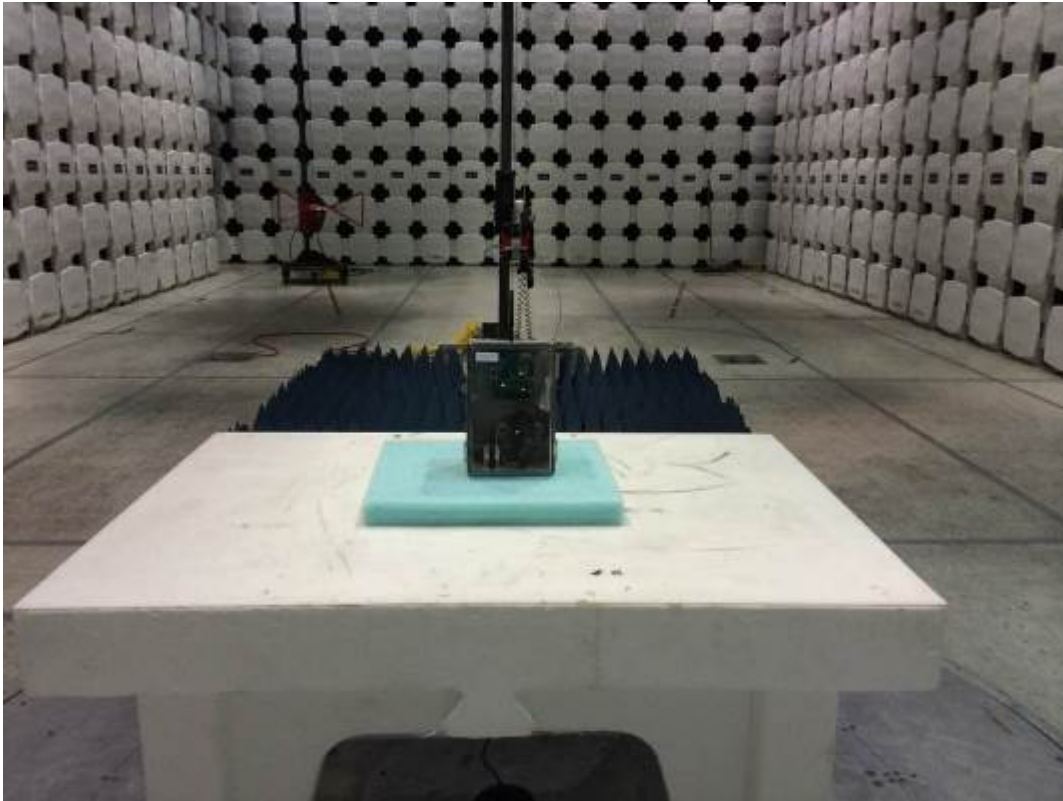
| Name               | Manufacturer | Version            |
|--------------------|--------------|--------------------|
| Excel 2003         | Microsoft    | (11.8231.8221) SP3 |
| EMI Boxborough.xls | Intertek     | 08/27/10           |

**6.3 Results:**

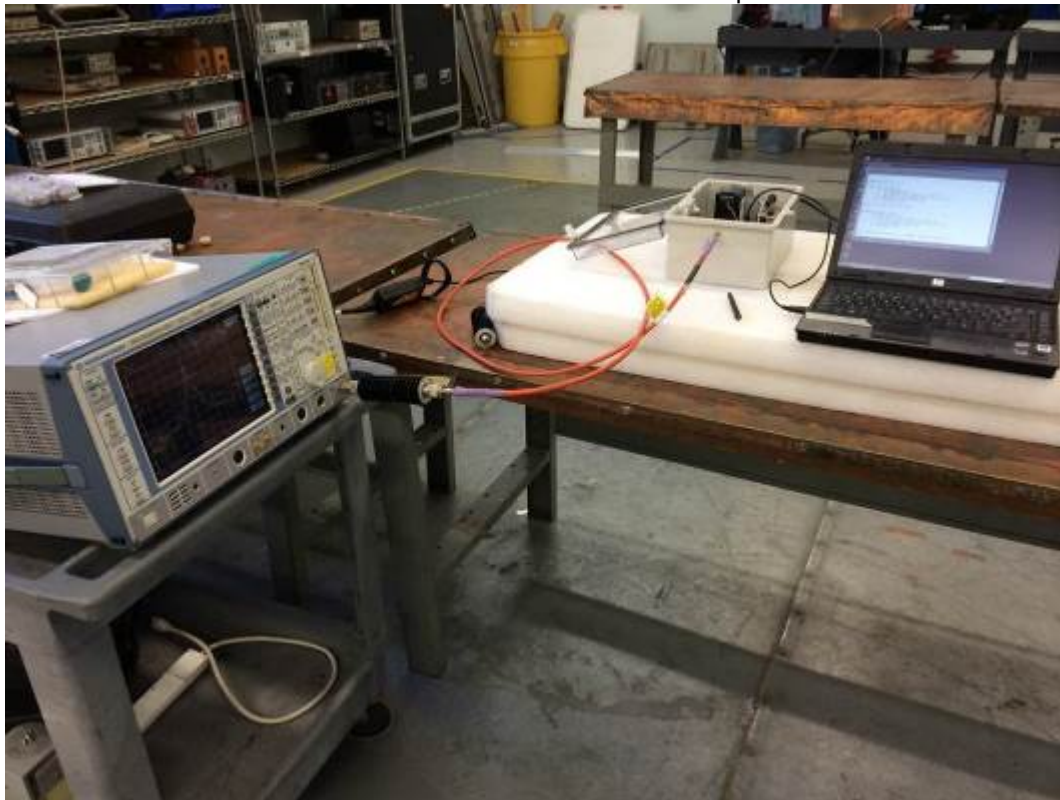
The sample tested was found to comply. The EIRP must not exceed 30 dBm. The Human RF Exposure limit is 1 mW/cm<sup>2</sup>.

#### 6.4 Setup Photographs:

Radiated Emissions Test Setup



Antenna Port Conducted Test Setup



Duty cycle Factor Setup



## 6.5 Test Data:

### Radiated Fundamental Power

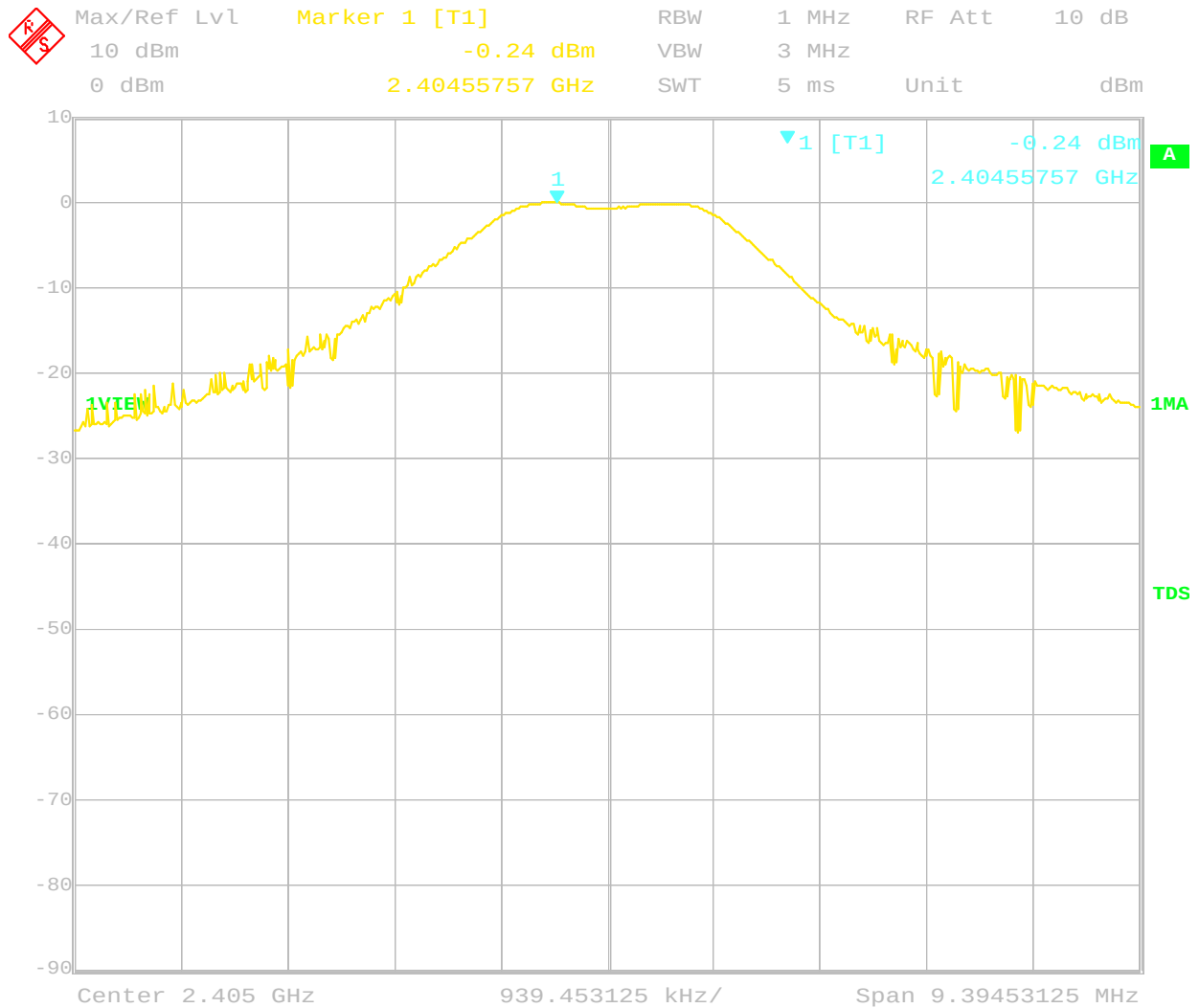
Company: Opex  
 Model #: 2048910  
 Serial #: BOX1503021541-001  
 Engineers: Kouma Sinn  
 Project #: G101718120  
 Standard: FCC Part 15 Subpart C 15.247  
 Receiver: 145-128  
 PreAmp: NONE.  
 Antenna & Cables: LF Bands: N, LF, HF, SHF  
 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt  
 Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.  
 Location: 10m Barometer: MAN1 Filter: NONE  
 Date(s): 07/15/14  
 Temp/Humidity/Pressure: 24C 45% 999mbar  
 Limit Distance (m): 3  
 Test Distance (m): 3  
 PreAmp Used? (Y or N): N Voltage/Frequency: 120VAC/60Hz Frequency Range: Fundamental Frequencies  
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)  
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

| Detector Type                                                                                  | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dBm | Limit dBm | Margin dB | Bandwidth |
|------------------------------------------------------------------------------------------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|---------|-----------|-----------|-----------|
| Tx: CH 2405 MHz - Fundamental Output Power = Peak Reading - 95.22. At 3 meters with no pre-amp |                 |               |                |                        |               |                   |                    |         |           |           |           |
| PK                                                                                             | V               | 2405.000      | 61.42          | 32.11                  | 5.92          | 0.00              | 0.00               | 4.23    | 30.00     | -25.77    | 1/3MHz    |
| PK                                                                                             | H               | 2405.000      | 56.35          | 32.11                  | 5.92          | 0.00              | 0.00               | -0.84   | 30.00     | -30.84    | 1/3MHz    |
| PK                                                                                             | V               | 2405.000      | 61.31          | 32.11                  | 5.92          | 0.00              | 0.00               | 4.12    | 30.00     | -25.88    | 5/10MHz   |
| PK                                                                                             | H               | 2405.000      | 56.42          | 32.11                  | 5.92          | 0.00              | 0.00               | -0.77   | 30.00     | -30.77    | 5/10MHz   |
| Tx: CH 2440 MHz - Fundamental Output Power = Peak Reading - 95.22. At 3 meters with no pre-amp |                 |               |                |                        |               |                   |                    |         |           |           |           |
| PK                                                                                             | V               | 2440.000      | 60.84          | 32.20                  | 5.98          | 0.00              | 0.00               | 3.80    | 30.00     | -26.20    | 1/3MHz    |
| PK                                                                                             | H               | 2440.000      | 52.12          | 32.20                  | 5.98          | 0.00              | 0.00               | -4.92   | 30.00     | -34.92    | 1/3MHz    |
| PK                                                                                             | V               | 2440.000      | 60.93          | 32.20                  | 5.98          | 0.00              | 0.00               | 3.89    | 30.00     | -26.11    | 5/10MHz   |
| PK                                                                                             | H               | 2440.000      | 52.45          | 32.20                  | 5.98          | 0.00              | 0.00               | -4.59   | 30.00     | -34.59    | 5/10MHz   |
| Tx: CH 2480 MHz - Fundamental Output Power = Peak Reading - 95.22. At 3 meters with no pre-amp |                 |               |                |                        |               |                   |                    |         |           |           |           |
| PK                                                                                             | V               | 2480.000      | 58.47          | 32.30                  | 6.06          | 0.00              | 0.00               | 1.61    | 30.00     | -28.39    | 1/3MHz    |
| PK                                                                                             | H               | 2480.000      | 51.29          | 32.30                  | 6.06          | 0.00              | 0.00               | -5.57   | 30.00     | -35.57    | 1/3MHz    |
| PK                                                                                             | V               | 2480.000      | 58.54          | 32.30                  | 6.06          | 0.00              | 0.00               | 1.68    | 30.00     | -28.32    | 5/10MHz   |
| PK                                                                                             | H               | 2480.000      | 51.57          | 32.30                  | 6.06          | 0.00              | 0.00               | -5.29   | 30.00     | -35.29    | 5/10MHz   |

FCC IC

Low Channel Antenna Port Conducted Fundamental Power, 102VAC/60Hz

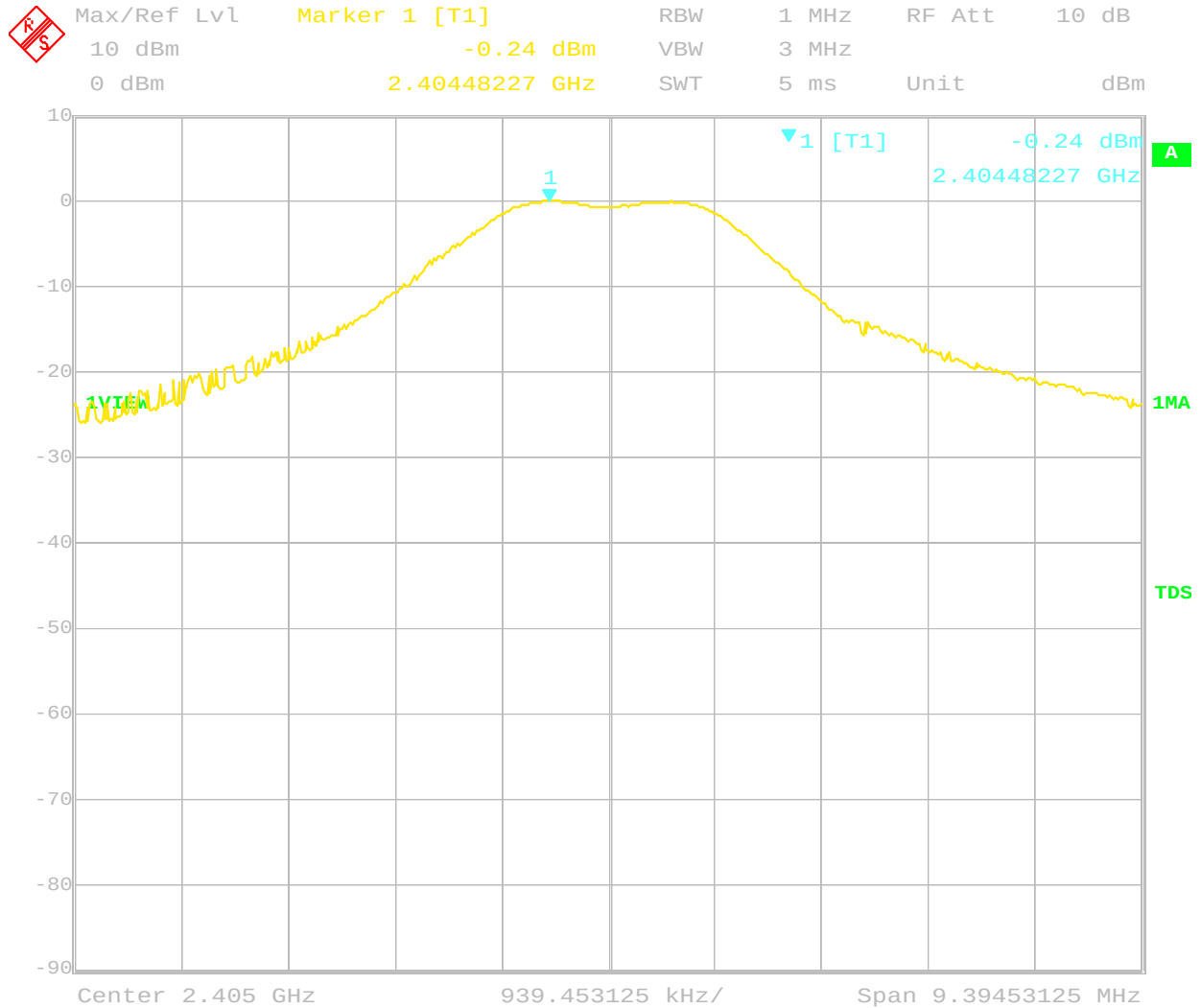
Power, -0.24 dBm



Date: 18.JUL.2014 11:54:21

Low Channel Antenna Port Conducted Fundamental Power, 120VAC/60Hz

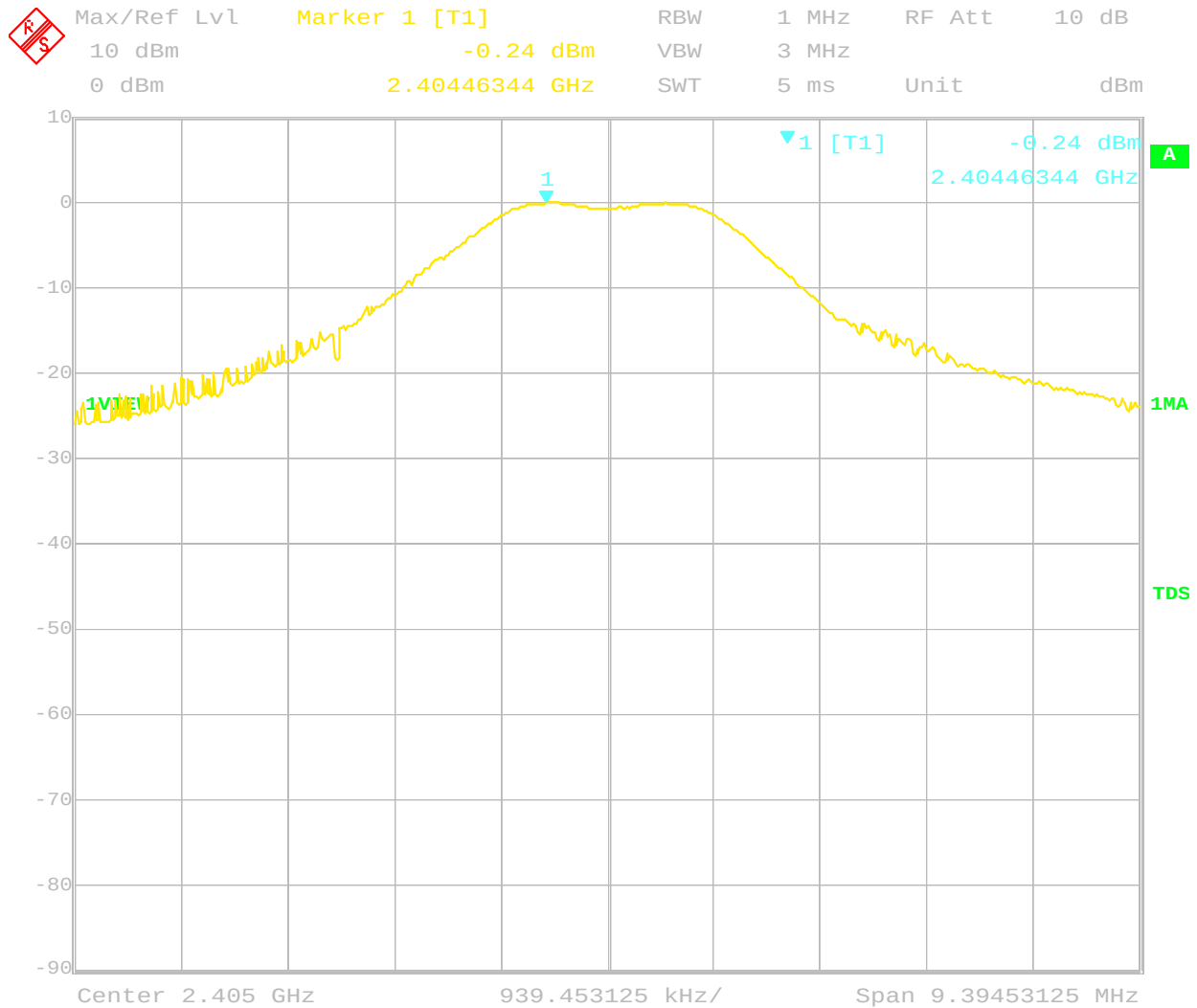
Power, -0.24 dBm



Date: 18.JUL.2014 11:50:21

## Low Channel Antenna Port Conducted Fundamental Power, 138VAC/60Hz

Power, -0.24 dBm

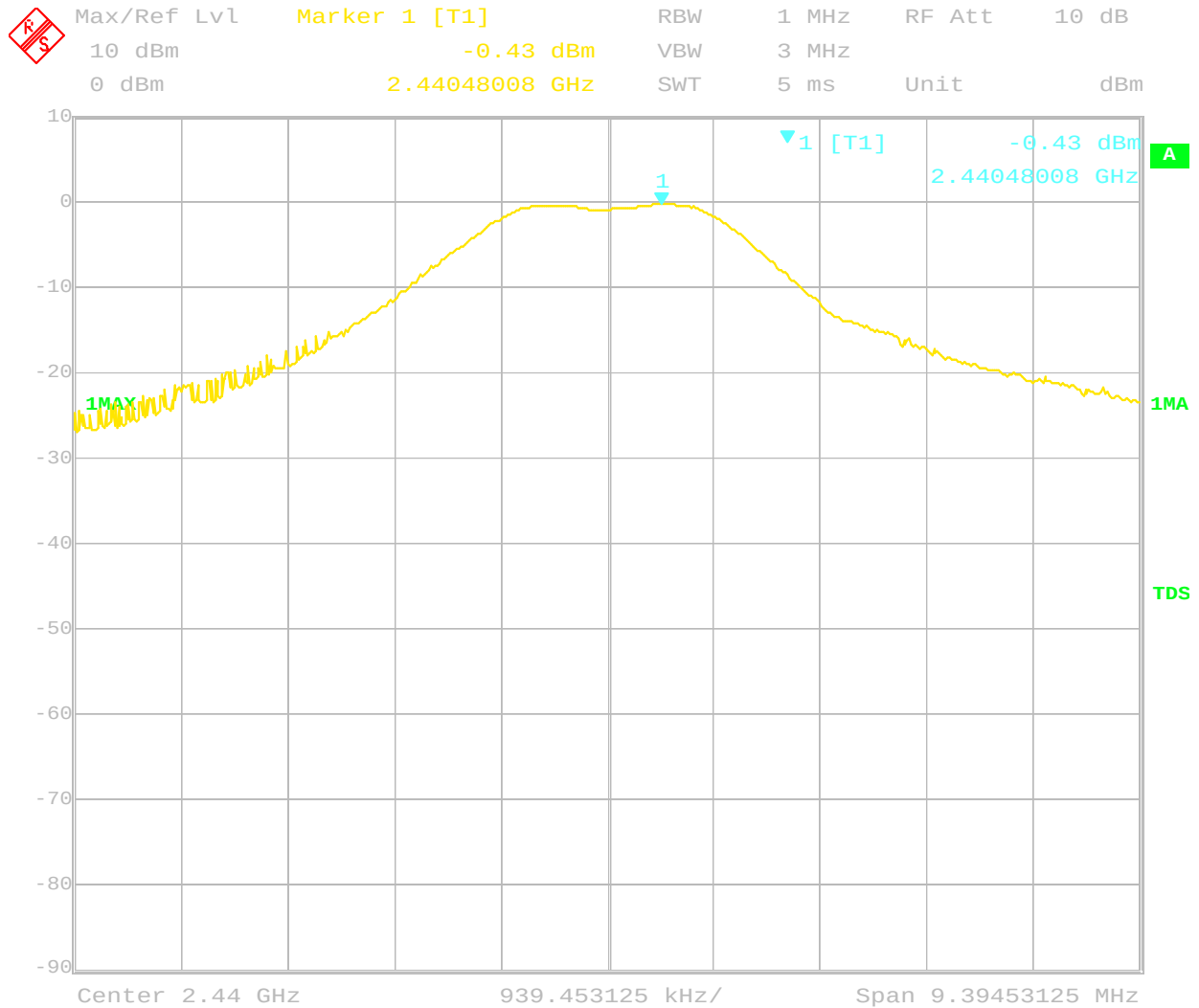


Date: 18.JUL.2014 11:57:59

Notes: There's no fundamental power variation with 85% and 115% of AC mains voltage. The rest of the channels fundamental power was measured at 120VAC/60Hz.

Mid Channel Antenna Port Conducted Fundamental Power, 120VAC/60Hz

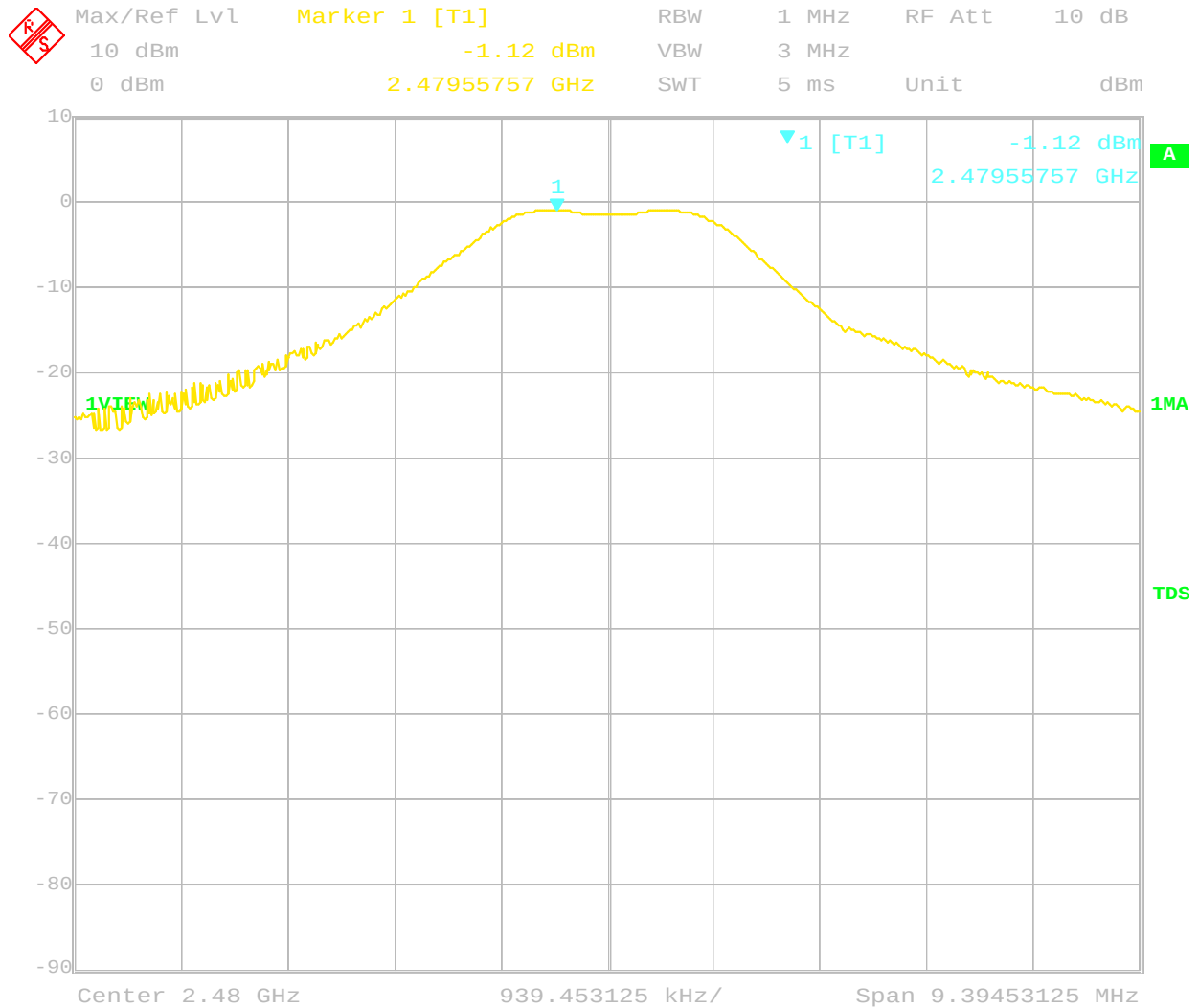
Power, -0.43 dBm



Date: 18.JUL.2014 12:10:15

High Channel Antenna Port Conducted Fundamental Power, 120VAC/60Hz

Power, -1.12 dBm



Date: 18.JUL.2014 12:22:44

Test Personnel: Kouma Sinn *KPS*  
Supervising/Reviewing  
Engineer:  
(Where Applicable) N/A

Test Date: 07/18/2014

Product Standard: FCC Part 15.247,  
RSS-210 Annex 8  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/  
Ambient Signals or  
BB Source: Ambient Signals

Limit Applied: Emissions below the limits  
specified in Section 6.3

Ambient Temperature: 21 °C

Relative Humidity: 64 %

Atmospheric Pressure: 1012mbars

Deviations, Additions, or Exclusions: None

## Human RF Exposure, & Duty Cycle

The EUT was measured in a radiated fashion. The RF output power was measured using a resolution bandwidth which encompassed the entire emission bandwidth. The data obtained was adjusted for equipment losses and converted from a field strength reading to a power reading using the provisions of FCC KDB 558074 and RSS-Gen 4.6. .

§1.1310 The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices shall be evaluated according to the provisions of §2.1093 of this chapter.

Part §1.1310 Limits for Maximum Permissible Exposure (MPE)

| Frequency range (MHz)                                          | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposure</b>         |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *100                                | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *900/f <sup>2</sup>                 | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1,500                                                      |                               |                               | f/300                               | 6                        |
| 1,500-100,000                                                  |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                       | 614                           | 1.63                          | *100                                | 30                       |
| 1.34-30                                                        | 824/f                         | 2.19/f                        | *180/f <sup>2</sup>                 | 30                       |
| 30-300                                                         | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1,500                                                      |                               |                               | f/1500                              | 30                       |
| 1,500-100,000                                                  |                               |                               | 1.0                                 | 30                       |

f = frequency in MHz \* = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

**RSS-102 Issue 5 Exposure Limits:****Table 4: RF Field Strength Limits for Devices Used by the General Public  
(Uncontrolled Environment)**

| Frequency Range (MHz)                                                                                                   | Electric Field (V/m rms)         | Magnetic Field (A/m rms)                        | Power Density (W/m <sup>2</sup> )  | Reference Period (minutes)      |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------|------------------------------------|---------------------------------|
| 0.003-10 <sup>21</sup>                                                                                                  | 83                               | 90                                              | -                                  | Instantaneous*                  |
| 0.1-10                                                                                                                  | -                                | 0.73/ <i>f</i>                                  | -                                  | 6**                             |
| 1.1-10                                                                                                                  | 87/ <i>f</i> <sup>0.5</sup>      | -                                               | -                                  | 6**                             |
| 10-20                                                                                                                   | 27.46                            | 0.0728                                          | 2                                  | 6                               |
| 20-48                                                                                                                   | 58.07/ <i>f</i> <sup>0.25</sup>  | 0.1540/ <i>f</i> <sup>0.25</sup>                | 8.944/ <i>f</i> <sup>0.5</sup>     | 6                               |
| 48-300                                                                                                                  | 22.06                            | 0.05852                                         | 1.291                              | 6                               |
| 300-6000                                                                                                                | 3.142 <i>f</i> <sup>0.3417</sup> | 0.008335 <i>f</i> <sup>0.3417</sup>             | 0.02619 <i>f</i> <sup>0.6834</sup> | 6                               |
| 6000-15000                                                                                                              | 61.4                             | 0.163                                           | 10                                 | 6                               |
| 15000-150000                                                                                                            | 61.4                             | 0.163                                           | 10                                 | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000                                                                                                           | 0.158 <i>f</i> <sup>0.5</sup>    | 4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup> | 6.67 x 10 <sup>-5</sup> <i>f</i>   | 616000/ <i>f</i> <sup>1.2</sup> |
| Note: <i>f</i> is frequency in MHz.<br>*Based on nerve stimulation (NS).<br>** Based on specific absorption rate (SAR). |                                  |                                                 |                                    |                                 |

**1.1 Test Procedure**

An MPE evaluation was performed in order to show that the device was compliant with §2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20 cm.

For each transmitter the maximum power RF exposure at a 20 cm distance using the formula:

$$\text{Conducted Power}_{\text{mW}} = 10^{\text{Conducted Power (dBm)}/10}$$

$$\text{Power Density} = [\text{Conducted Power}_{\text{mW}} \times \text{Ant. Gain}] / [4\pi \times (20_{\text{cm}})^2]$$

**1.2 Results:**

$$\text{Maximum Conducted Output Power} = 10^{(-0.24/10)} \text{ or } 0.95 \text{ mW}$$

$$\text{Maximum Antenna Gain} = 2.14 \text{ dBi}$$

$$\text{Power Density} = (-0.24 \text{ dBm} + 2.14 \text{ dBi}) / 5025.6 \text{ or } 0.00038 \text{ mW/cm}^2$$

$$\text{Limit at 2.4 GHz} = 1 \text{ mW/cm}^2$$

$$\text{RSS-102 Issue 5 Exposure Limit at 2.4 GHz} = 5.35 \text{ W/m}^2$$

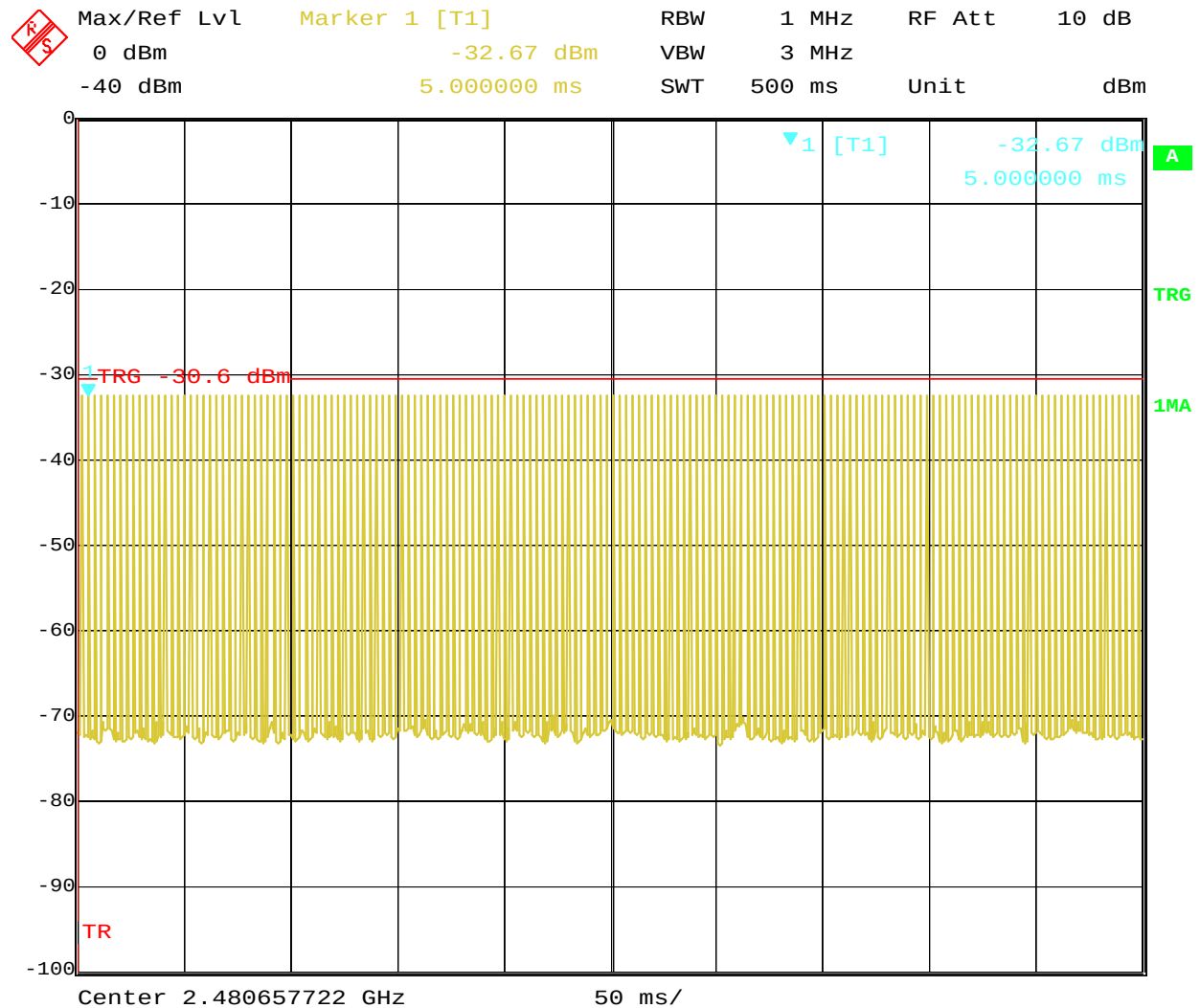
$$\text{Power Density} = 0.0038 \text{ W/m}^2$$

The calculated maximum power density at 20 cm distance is less than the limit for general population / uncontrolled exposure.

# Duty Cycle:

The worst-case duty cycle for typical EUT operation is shown below. The pulse train repeats over a larger than 100ms period.

Pulse train repeats longer than 100 ms

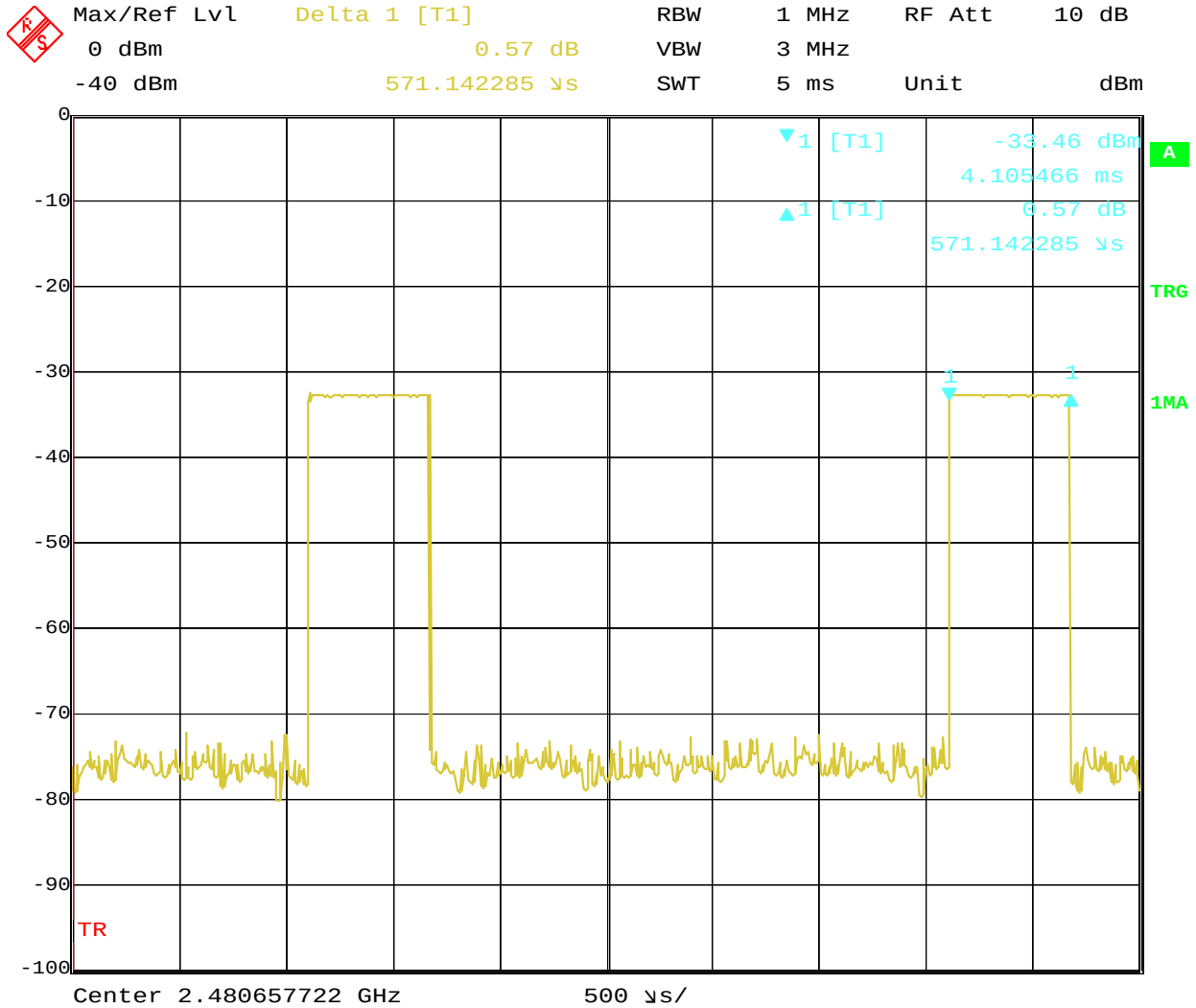


Date:      2.JAN.1997      22:53:28

|                                                                                   |             |               |     |        |        |       |
|-----------------------------------------------------------------------------------|-------------|---------------|-----|--------|--------|-------|
|  | Max/Ref Lvl | Marker 1 [T1] | RBW | 1 MHz  | RF Att | 10 dB |
|                                                                                   | 0 dBm       | -32.87 dBm    | VBW | 3 MHz  |        |       |
|                                                                                   | -40 dBm     | 5.000000 ms   | SWT | 100 ms | Unit   | dBm   |



Pulse Width



Date: 2.JAN.1997 23:01:01

Total on time = 18.8477 ms  
 Duty Cycle = 18.8477/100 or 0.188477  
 Average Factor =  $20 \cdot \log(0.188477)$  or 14.5 dB

Test Personnel: Kouma Sinn *KPS*  
 Supervising/Reviewing Engineer:  
 (Where Applicable) N/A

Test Date: 5/13/2015

Product Standard: FCC Part 15.247,  
 RSS-210 Annex 8  
 Input Voltage: 120VAC/60Hz  
 Pretest Verification w/  
 Ambient Signals or  
 BB Source: N/A

Limit Applied: Emissions below the limits  
 specified in Section 6.3  
 Ambient Temperature: 23 °C  
 Relative Humidity: 26 %  
 Atmospheric Pressure: 1008 mbars

Deviations, Additions, or Exclusions: None

## 7 Transmitter Radiated Spurious Emissions

### 7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.4:2009, and RSS-210 Annex 8.

**TEST SITE:** EMC Lab & 10m ALSE

**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.

**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) | Ucisp |
|-------------------------|-----------------|----------------------------|-------|
| Radiated Emissions, 10m | 30-1000 MHz     | 4.6                        | 6.3   |
| Radiated Emissions, 3m  | 30-1000 MHz     | 5.3                        | 6.3   |
| Radiated Emissions, 3m  | 1-6 GHz         | 4.5                        | 5.2   |
| Radiated Emissions, 3m  | 6-15 GHz        | 5.2                        | 5.5   |
| Radiated Emissions, 3m  | 15-18 GHz       | 5.0                        | 5.5   |
| Radiated Emissions, 3m  | 18-40 GHz       | 5.0                        | 5.5   |

### 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 dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- 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 dB $\mu$ V 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

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.

**7.2 Test Equipment Used:**

| Asset               | Description                                    | Manufacturer    | Model              | Serial     | Cal Date   | Cal Due    |
|---------------------|------------------------------------------------|-----------------|--------------------|------------|------------|------------|
| MAN1'               | Digital 4 Line Barometer                       | Mannix          | 0ABA116            | MAN1       | 08/13/2012 | 08/13/2014 |
| 145-410'            | Cables 145-400 145-403 145-405 145-406 145-407 | Huber + Suhner  | 10m Track A Cables | multiple   | 10/04/2013 | 10/04/2014 |
| 145128'             | EMI Receiver (20 Hz - 40 GHz)                  | Rohde & Schwarz | ESIB 40            | 839283/001 | 03/17/2014 | 03/17/2015 |
| 145106'             | Bilog Antenna (30MHz - 5GHz)                   | Sunol Sciences  | JB5                | A111003    | 10/01/2013 | 10/01/2014 |
| 145003'             | Preamplifier (150 KHz to 1.3 GHz)              | Hewlett Packard | 8447D              | 2443A04077 | 10/07/2013 | 10/07/2014 |
| ETS001'             | 1-18GHz DRG Horn Antenna                       | ETS-Lindgren    | 3117               | 00143259   | 01/14/2015 | 01/14/2016 |
| EMC04'              | ANTENNA, RIDGED GUIDE, 18-40 GHZ               | EMCO            | 3116               | 2090       | 04/07/2015 | 04/07/2016 |
| PRE8'               | PREAMPLIFIER 1- 40 GHZ                         | MITEQ           | NSP4000-NF         | 507145     | 04/15/2014 | 04/15/2015 |
| 145014'             | Preamplifier (1 GHz to 26.5 GHz)               | Hewlett Packard | 8449B              | 3008A00232 | 05/05/2014 | 05/05/2015 |
| CBLHF2012<br>-2M-1' | 2m 9kHz-40GHz Coaxial Cable - SET1             | Huber & Suhner  | SF102              | 252675001  | 02/05/2015 | 02/05/2016 |
| CBLHF2012<br>-5M-1' | 5m 9kHz-40GHz Coaxial Cable - SET 1            | Huber & Suhner  | SF102              | 252676001  | 02/05/2015 | 02/05/2016 |
| REA003'             | 1GHz High Pass Filter                          | Reactel, Inc    | 7HS-1G/10G-S11     | 06-1       | 12/30/2013 | 12/30/2015 |

**Software Utilized:**

| Name               | Manufacturer | Version    |
|--------------------|--------------|------------|
| C5 Emissions       | TESEQ        | 5.26.46.46 |
| EMI Boxborough.xls | Intertek     | 08/27/2010 |

**Equipment used for Antenna Port Conducted Measurements**

| Asset   | Description                     | Manufacturer      | Model           | Serial      | Cal Date   | Cal Due    |
|---------|---------------------------------|-------------------|-----------------|-------------|------------|------------|
| DAV004' | Weather Station                 | Davis Instruments | 7400            | PE80529A61A | 09/25/2012 | 09/25/2014 |
| REA006' | 18GHz High Pass Filter          | Reactel, Inc      | 7HS-18G/40G K11 | (06)1       | 08/08/2012 | 08/08/2014 |
| CBL030' | High Frequency Cable 40GHz      | Megaphase         | TM40 K1K1 80    | CBL030      | 04/05/2014 | 04/05/2015 |
| ROS001' | Spectrum Analyzer 20Hz - 40 GHz | Rohde & Schwartz  | FSEK-30         | 100225      | 05/19/2014 | 05/19/2015 |
| WEI8'   | Attenuator                      | Weinschel Corp    | 47-10-34        | BD8309      | 03/26/2014 | 03/26/2015 |

**Software Utilized:**

| Name | Manufacturer | Version |
|------|--------------|---------|
| None |              |         |

**7.3 Results:**

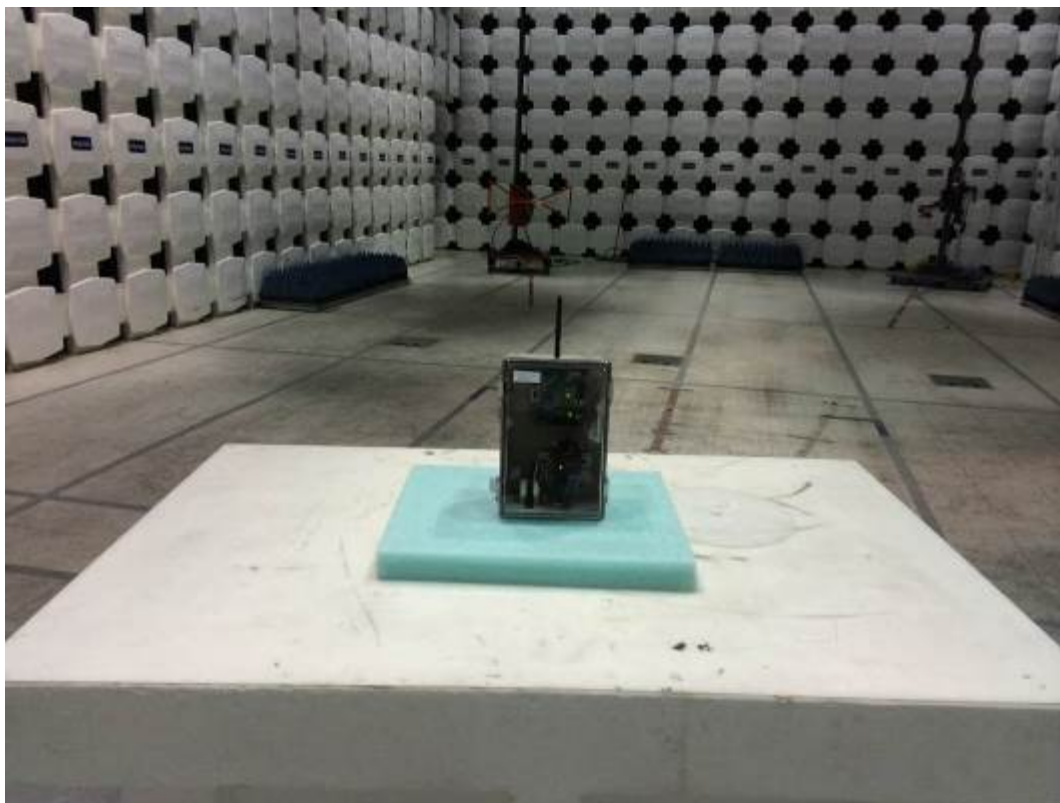
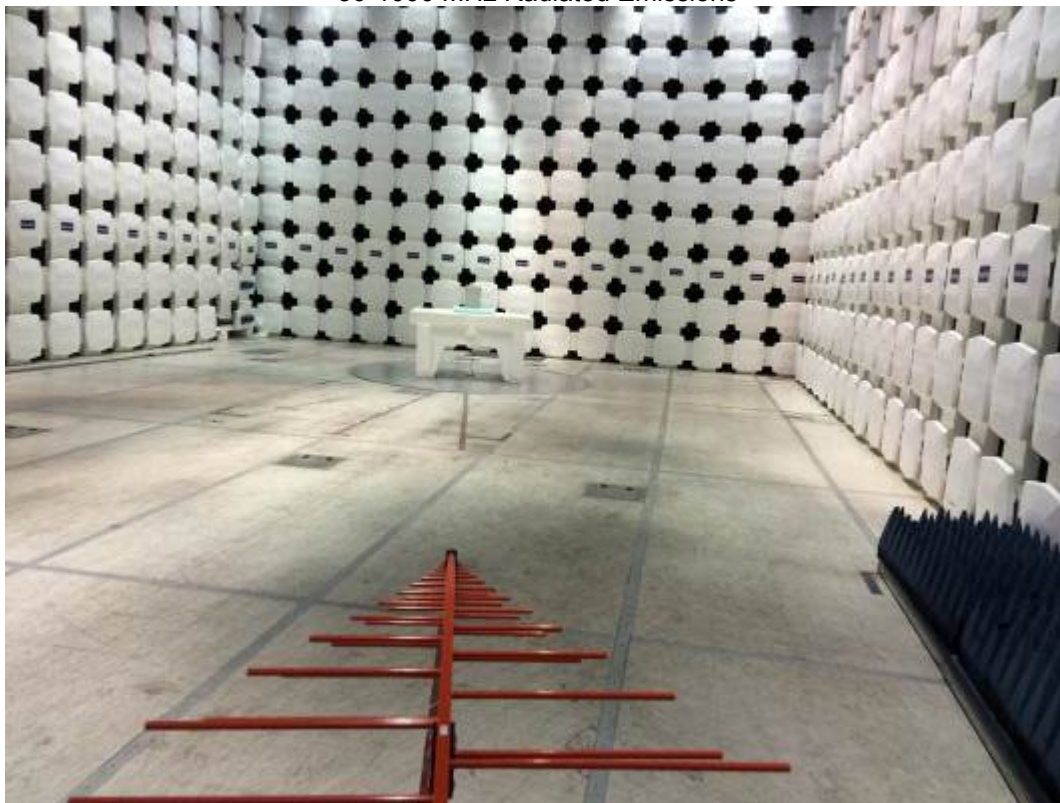
The sample tested was found to Comply.

**FCC Part 15.247(d) & RSS-210 A8.5 – Non Restricted Band Radiated Spurious/Harmonics Limits**

In any 100 kHz bandwidth outside the frequency band, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) and RSS-Gen Section 7.2.5 Table 5 is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a) and RSS-Gen Section 7.2.2 Table 3, must also comply with the radiated emission limits specified in 15.209(a) and IC RSS-Gen Section 7.2.5 Table 5).

**FCC Part 15.209(a) & RSS-210 A8.5 & RSS-Gen Section 7.2.5 Table 5 – Restricted Band Radiated Spurious/Harmonics Limits**

| Frequency | Field Strength |        | Test Distance |
|-----------|----------------|--------|---------------|
| (MHz)     | µV/m           | dBµV/m | (meters)      |
| 30–88     | 100            | 40.00  | 3             |
| 88–216    | 150            | 43.52  | 3             |
| 216–960   | 200            | 46.02  | 3             |
| Above 960 | 500            | 53.98  | 3             |

**7.4 Setup Photographs:****30-1000 MHz Radiated Emissions**

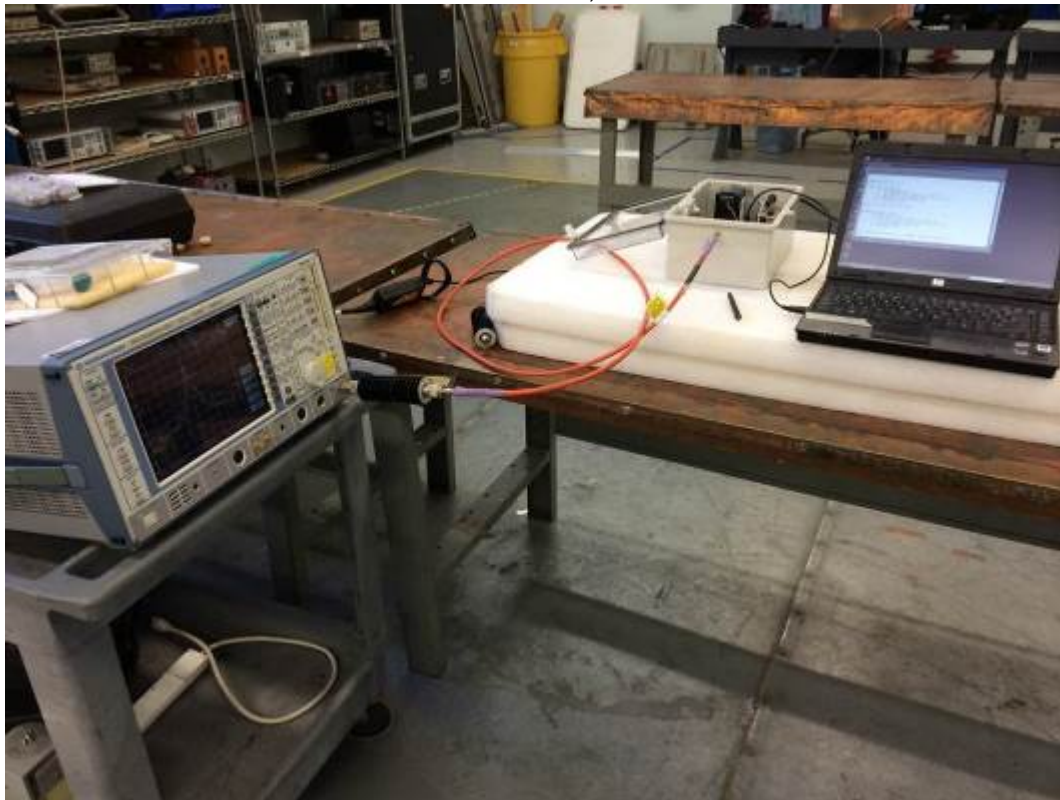
1-18 GHz



18-25 GHz



Antenna Port Conducted, 30MHz-18GHz



Antenna Port Conducted, 18-25 GHz



## 7.5 Plots/Data:

### Low Channel Radiated Emissions

Transmit on 2405 MHz, 50 Ohm Terminator, (30-1000 MHz)

#### Test Information

##### Test Details

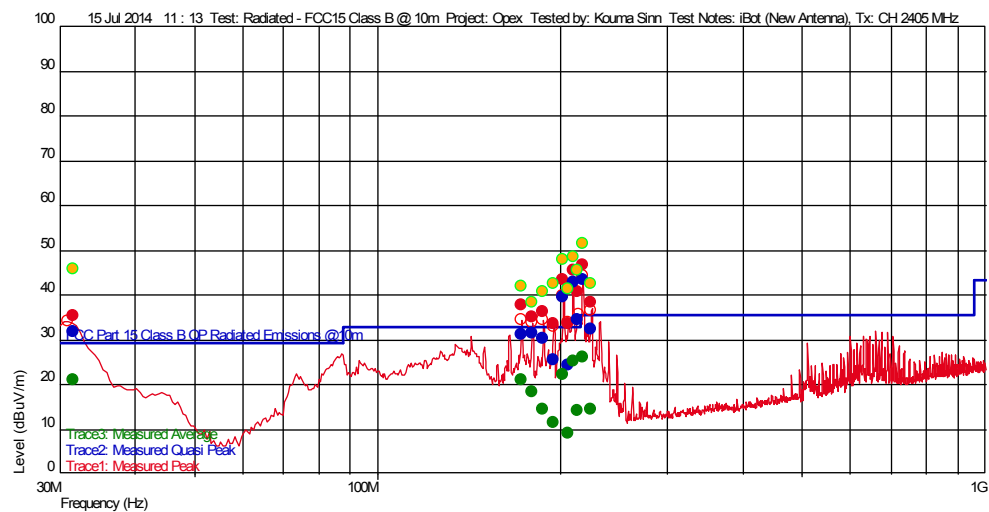
Test: Radiated - FCC15 Class B @ 10m  
Project: Opex  
Test Notes: iBot (New Antenna), Tx: CH 2405 MHz  
Temperature: 22C  
Humidity: 44%, 1000mbar  
Tested by: Kouma Sinn  
Test Started: 15 Jul 2014 11:13

##### User Entry

Radiated - FCC15 Class B @ 10m  
Opex  
iBot (New Antenna), Tx: CH 2405 MHz  
22C  
44%, 1000mbar  
Kouma Sinn  
15 Jul 2014 11:13

##### Additional Information

#### 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

Notes: Disregard the limit line on the plot, see the following page for final test results.

Emissions Test Data

Notes: Non-restricted band emissions limit is 20 dB below the fundamental signal using 100kHz Resolution Bandwidth

Fundamental Peak = 94.63 dBuV/m,

Limit = 94.63-20 or 74.63 dBuV/m (20 dB below the fundamental signal)

## 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    |
|-----------------|----------------|--------|---------|----------------|----------------|-----------------------|--------------------|----------------|---------|------------|
| 194.835070162 M | 33.44          | 12.084 | -24.030 | 74.63          | -41.19         |                       | 208                | 1.56           | 120 k   |            |
| 206.241683679 M | 33.73          | 10.850 | -23.870 | 74.63          | -40.9          |                       | 191                | 1.04           | 120 k   |            |
| 179.970541421 M | 34.96          | 11.400 | -24.435 | 74.63          | -39.67         |                       | 146                | 1.25           | 120 k   |            |
| 224.748897297 M | 38.41          | 11.095 | -23.811 | 74.63          | -36.22         |                       | 192                | 1.05           | 120 k   |            |
| 187.573547275 M | 36.29          | 11.357 | -24.228 | 74.63          | -38.34         |                       | 195                | 1.16           | 120 k   |            |
| 172.432465427 M | 37.88          | 11.757 | -24.640 | --             | --             |                       | 161                | 1.26           | 120 k   | Rest. Band |
| 31.691783679 M  | 35.25          | 20.116 | -26.235 | 74.63          | -39.38         |                       | 168                | 1.05           | 120 k   |            |
| 213.879559385 M | 40.73          | 10.778 | -23.846 | 74.63          | -33.9          |                       | 194                | 1.04           | 120 k   |            |
| 202.527254429 M | 43.46          | 11.790 | -23.882 | 74.63          | -31.17         |                       | 192                | 1.05           | 120 k   |            |
| 217.513025711 M | 46.65          | 10.901 | -23.834 | 74.63          | -27.98         |                       | 173                | 1.04           | 120 k   |            |
| 209.997995754 M | 45.53          | 10.700 | -23.858 | 74.63          | -29.1          |                       | 164                | 1.04           | 120 k   |            |

Notes: Restricted band emissions limit is per FCC Part 15.209.

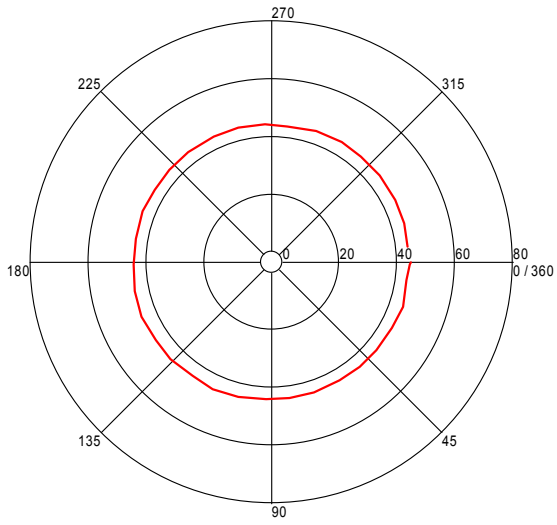
## Trace2: Measured Quasi Peak

| 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    |
|-----------------|----------------|--------|---------|----------------|----------------|-----------------------|--------------------|----------------|---------|------------|
| 206.241683679 M | 24.42          | 10.850 | -23.870 | --             | --             |                       | 191                | 1.04           | 120 k   |            |
| 194.835070162 M | 25.51          | 12.084 | -24.030 | --             | --             |                       | 208                | 1.56           | 120 k   |            |
| 224.748897297 M | 32.43          | 11.095 | -23.811 | --             | --             |                       | 192                | 1.05           | 120 k   |            |
| 187.573547275 M | 30.15          | 11.357 | -24.228 | --             | --             |                       | 195                | 1.16           | 120 k   |            |
| 172.432465427 M | 31.25          | 11.757 | -24.640 | 33.040         | -1.79          |                       | 161                | 1.26           | 120 k   |            |
| 179.970541421 M | 31.46          | 11.400 | -24.435 | --             | --             |                       | 146                | 1.25           | 120 k   | Rest. Band |
| 213.879559385 M | 34.47          | 10.778 | -23.846 | --             | --             |                       | 194                | 1.04           | 120 k   |            |
| 31.691783679 M  | 31.81          | 20.116 | -26.235 | --             | --             |                       | 168                | 1.05           | 120 k   |            |
| 202.527254429 M | 39.60          | 11.790 | -23.882 | --             | --             |                       | 192                | 1.05           | 120 k   |            |
| 217.513025711 M | 43.44          | 10.901 | -23.834 | --             | --             |                       | 173                | 1.04           | 120 k   |            |
| 209.997995754 M | 42.93          | 10.700 | -23.858 | --             | --             |                       | 164                | 1.04           | 120 k   |            |

## Azimuth Plots

Turntable Plot ( 31.691783679 MHz )

Level (dBuV/m)

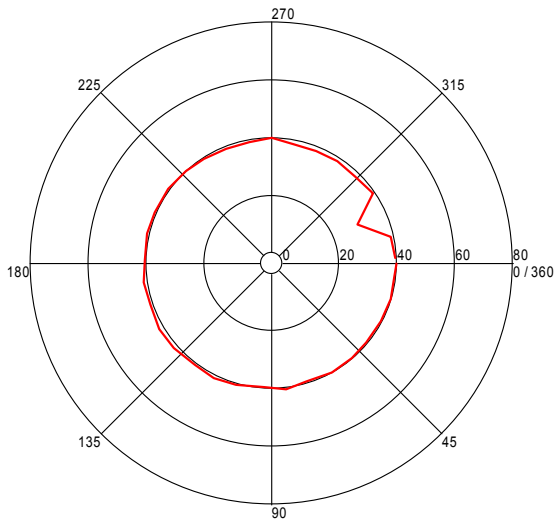


All Polarities

Azimuth (Degrees)

Turntable Plot ( 172.432465427 MHz )

Level (dBuV/m)

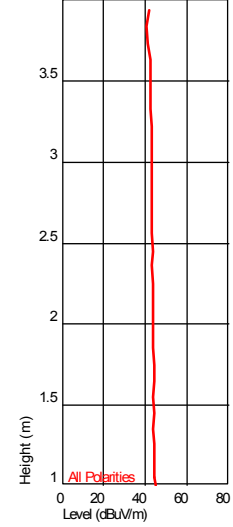


All Polarities

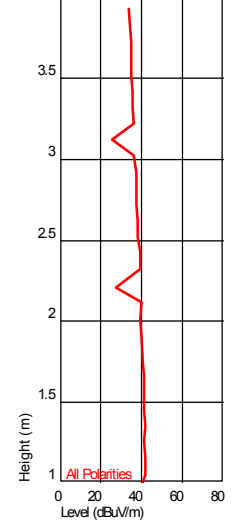
Azimuth (Degrees)

## Turntable Plots

Height Plot ( 31.691783679 MHz )

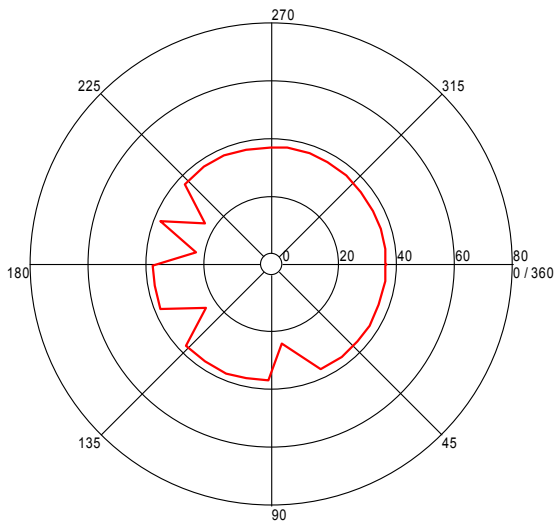


Height Plot ( 172.432465427 MHz )



Turntable Plot ( 179.970541421 MHz )

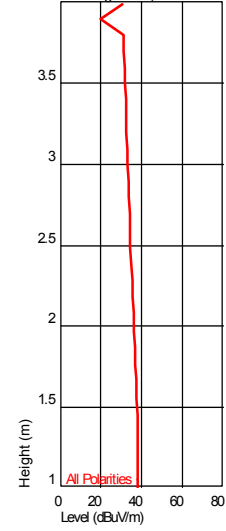
Level (dBuV/m)



All Polarities

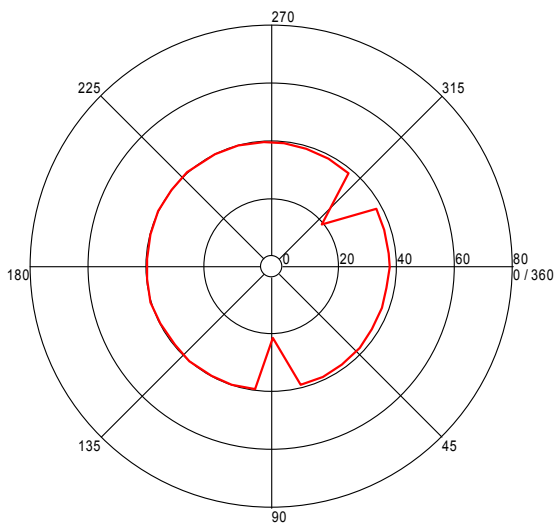
Azimuth (Degrees)

Height Plot ( 179.970541421 MHz )



Turntable Plot ( 187.573547275 MHz )

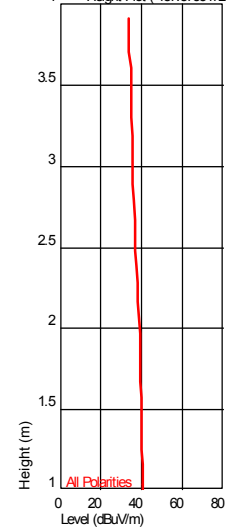
Level (dBuV/m)



All Polarities

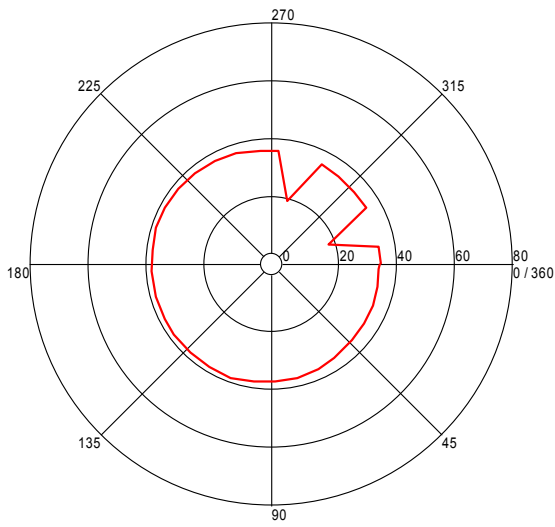
Azimuth (Degrees)

Height Plot ( 187.573547275 MHz )



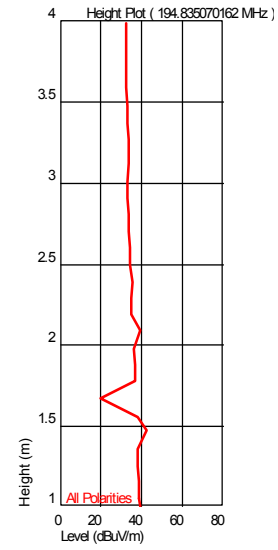
Turntable Plot ( 194.835070162 MHz )

Level (dBuV/m)



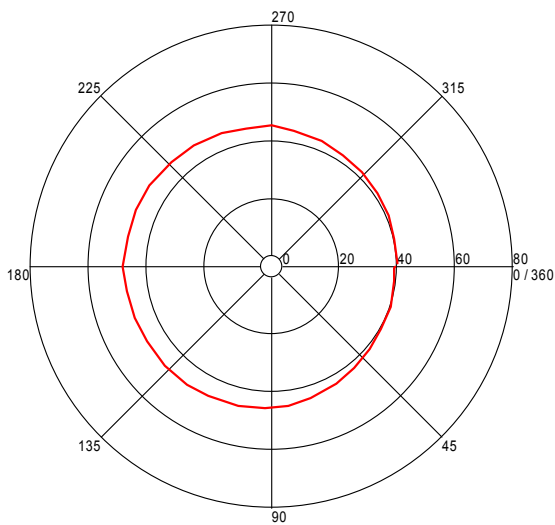
All Polarities

Azimuth (Degrees)



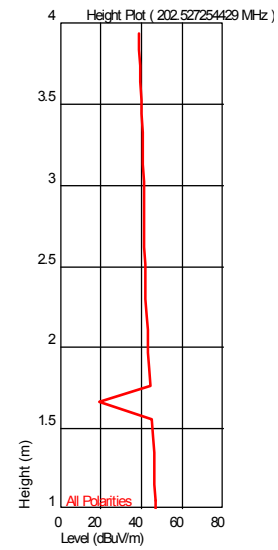
Turntable Plot ( 202.527254429 MHz )

Level (dBuV/m)



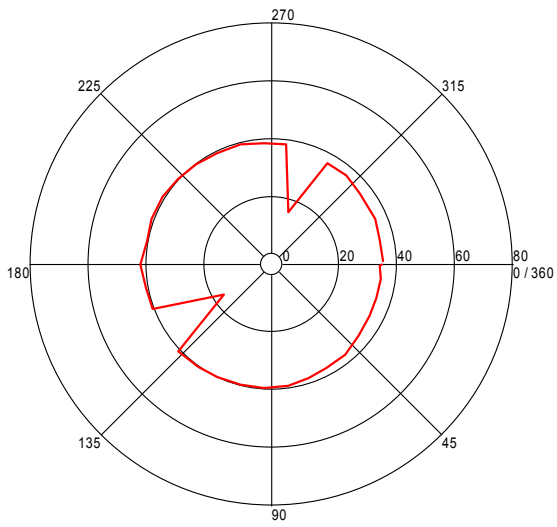
All Polarities

Azimuth (Degrees)



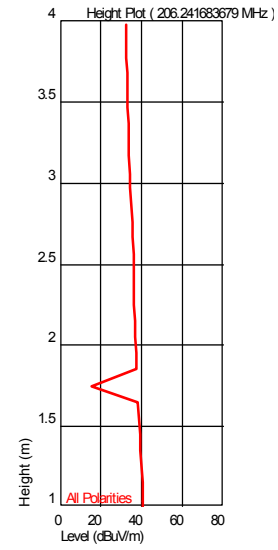
Turntable Plot ( 206.241683679 MHz )

Level (dBuV/m)



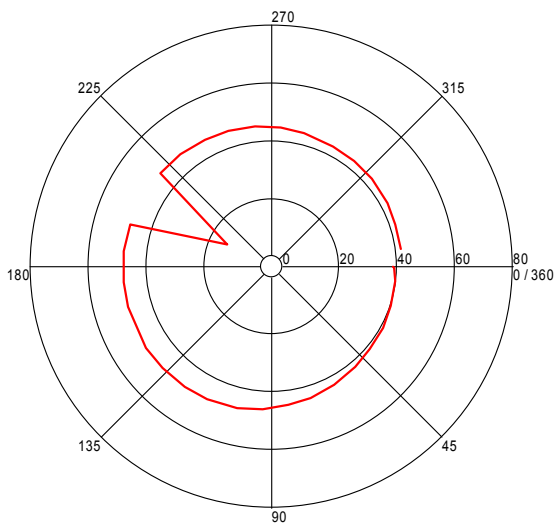
All Polarities

Azimuth (Degrees)



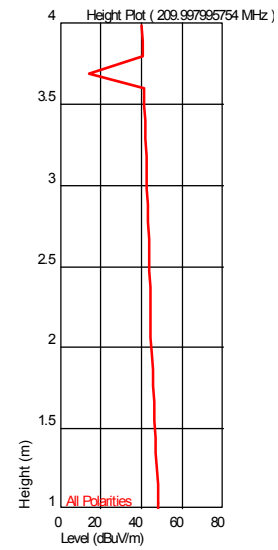
Turntable Plot ( 209.997995754 MHz )

Level (dBuV/m)



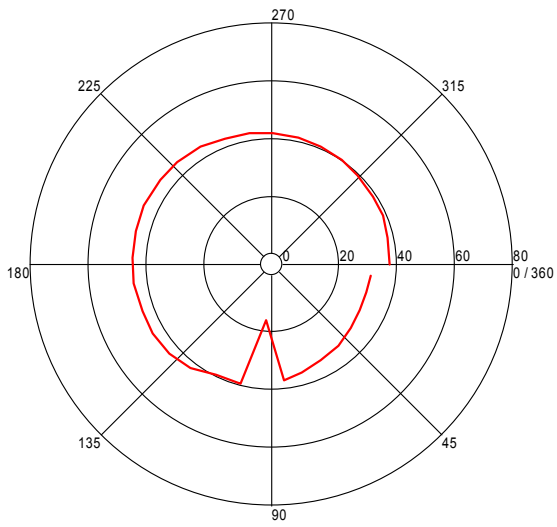
All Polarities

Azimuth (Degrees)



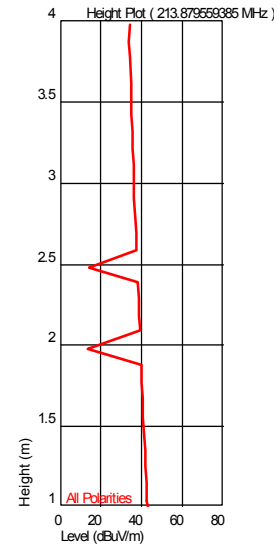
Turntable Plot ( 213.879559385 MHz )

Level (dBuV/m)



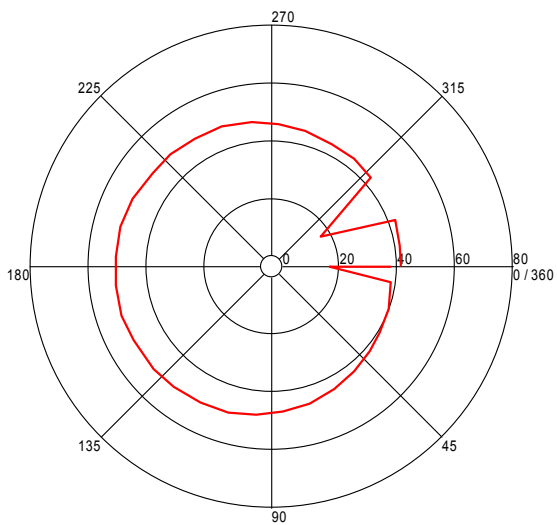
All Polarities

Azimuth (Degrees)



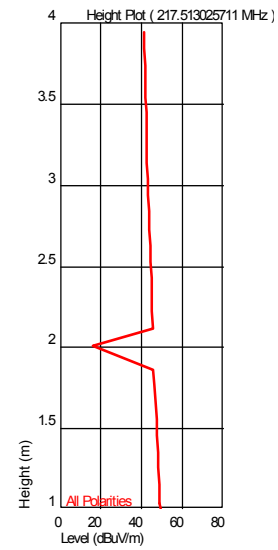
Turntable Plot ( 217.513025711 MHz )

Level (dBuV/m)



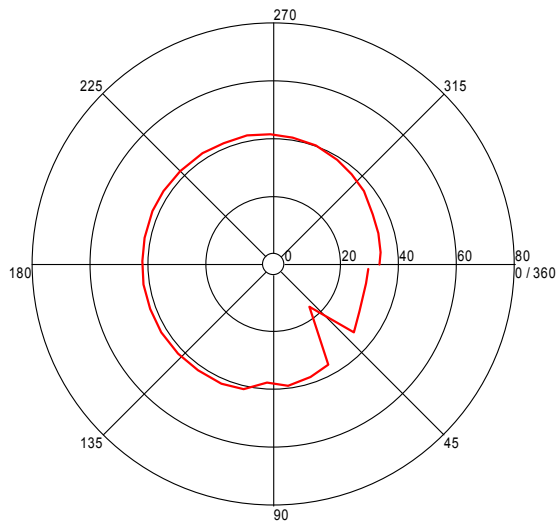
All Polarities

Azimuth (Degrees)



Turntable Plot ( 224.748897297 MHz )

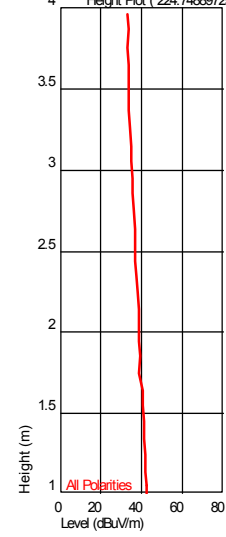
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot ( 224.748897297 MHz )



Height (m)

Level (dBuV/m)

**Low Radiated Emissions**

**Transmit on 2405 MHz, 50 Ohm Terminator, (1-25 GHz)**

Company: Opex  
 Model #: 2048910  
 Serial #: BOX1503021541-001  
 Engineers: Kouma Sinn  
 Project #: G101718120  
 Standard: FCC Part 15 Subpart C, 15.247/RSS-210  
 Receiver: 145-128  
 PreAmp: PRE145014 04-29-2015.txt  
 Antenna & Cables: LF  
 Antenna: ETS001 01-06-15.txt  
 Cable(s): 145-416 3mTrkB 10-03-2014.txt  
 Bands: N, LF, HF, SHF  
 ETS001 01-06-15.txt  
 NONE.  
 Location: 10m  
 Barometer: MAN1  
 Filter: NONE  
 Date(s): 07/15/14  
 Temp/Humidity/Pressure: 24C 45% 999mbar  
 Limit Distance (m): 3  
 Test Distance (m): 3  
 PreAmp Used? (Y or N): Y  
 Voltage/Frequency: 120VAC/60Hz  
 Frequency Range: 1-25 GHz  
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)  
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

| Detector Type                                                                                    | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB | Bandwidth   | FCC | IC |
|--------------------------------------------------------------------------------------------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|--------------|----------------|-----------|-------------|-----|----|
| Hand scans were done from 18-25 GHz. No emissions were detected above the measuring noise floor. |                 |               |                |                        |               |                   |                    |              |                |           |             |     |    |
| Tx: CH 2405 MHz (The EUT sits on its side), worst-case.                                          |                 |               |                |                        |               |                   |                    |              |                |           |             |     |    |
| PK                                                                                               | H               | 1008.000      | 42.00          | 27.24                  | 3.75          | 30.80             | 0.00               | 42.19        | 74.00          | -31.81    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 1008.000      | 28.60          | 27.24                  | 3.75          | 30.80             | 0.00               | 28.79        | 54.00          | -25.21    | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 4810.000      | 34.80          | 34.20                  | 8.65          | 31.71             | 0.00               | 45.94        | 74.00          | -28.06    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 4810.000      | 24.40          | 34.20                  | 8.65          | 31.71             | 0.00               | 35.54        | 54.00          | -18.46    | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 7215.000      | 25.88          | 35.76                  | 11.02         | 32.18             | 0.00               | 40.49        | 54.00          | -13.51    | 100/300 kHz |     |    |
| PK                                                                                               | H               | 9620.000      | 25.60          | 36.84                  | 12.78         | 32.03             | 0.00               | 43.19        | 74.00          | -30.81    | 100/300 kHz |     |    |
| PK                                                                                               | H               | 12025.000     | 32.96          | 38.82                  | 14.93         | 31.46             | 0.00               | 55.25        | 74.00          | -18.75    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 12025.000     | 22.47          | 38.82                  | 14.93         | 31.46             | 0.00               | 44.76        | 54.00          | -9.24     | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 14430.000     | 22.80          | 39.49                  | 15.12         | 29.48             | 9.54               | 38.39        | 54.00          | -15.61    | 100/300 kHz | 1m  |    |
| PK                                                                                               | H               | 16835.000     | 24.40          | 42.01                  | 18.22         | 30.49             | 9.54               | 44.60        | 54.00          | -9.40     | 100/300 kHz | 1m  |    |

## Mid Channel Radiated Emissions

Transmit on 2440 MHz, 50 Ohm Terminator, (30-1000 MHz)

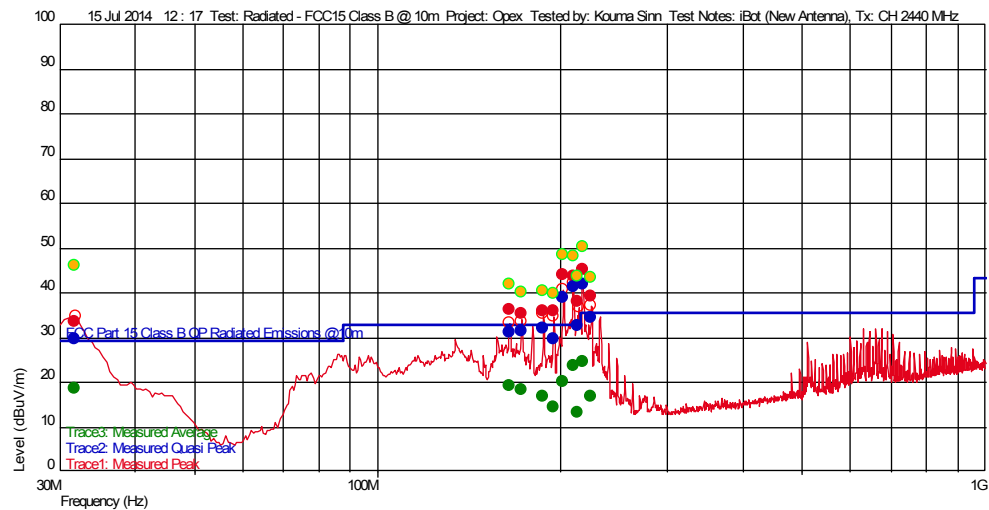
## Test Information

Test Details  
Test:  
Project:  
Test Notes:  
Temperature:  
Humidity:  
Tested by:  
Test Started:

User Entry  
Radiated - FCC15 Class B @ 10m  
Opex  
iBot (New Antenna), Tx: CH 2440 MHz  
22C  
44%, 1000mbar  
Kouma Sinn  
15 Jul 2014 12 : 17

Additional Information

## 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

Notes: Disregard the limit line on the plot, see the following page for final test results.

Emissions Test Data

Notes: Non-restricted band emissions limit is 20dB below the fundamental signal using 100kHz Resolution Bandwidth

Fundamental Peak Reading = 103.82 dBuV/m,  
Limit = 103.82-20 or 83.82 dBuV/m (20 dB below the fundamental signal)

## 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    |
|-----------------|----------------|--------|---------|----------------|----------------|-----------------------|--------------------|----------------|---------|------------|
| 172.514028497 M | 35.27          | 11.749 | -24.638 | --             | --             |                       | 158                | 1.34           | 120 k   | Rest. Band |
| 187.478156493 M | 35.83          | 11.348 | -24.231 | 83.82          | -47.99         |                       | 222                | 1.25           | 120 k   |            |
| 194.909018114 M | 35.94          | 12.091 | -24.028 | 83.82          | -47.88         |                       | 194                | 1.14           | 120 k   |            |
| 164.95270501 M  | 36.23          | 12.195 | -24.843 | --             | --             |                       | 180                | 1.45           | 120 k   | Rest. Band |
| 224.720841184 M | 39.40          | 11.094 | -23.811 | 83.82          | -44.42         |                       | 183                | 1.05           | 120 k   |            |
| 31.811623471 M  | 33.50          | 20.032 | -26.234 | 83.82          | -50.32         |                       | 127                | 3.44           | 120 k   |            |
| 213.915631529 M | 37.95          | 10.778 | -23.845 | 83.82          | -45.87         |                       | 165                | 1.04           | 120 k   |            |
| 217.481562729 M | 45.18          | 10.899 | -23.834 | 83.82          | -38.64         |                       | 166                | 1.04           | 120 k   |            |
| 209.990981782 M | 43.70          | 10.700 | -23.858 | 83.82          | -40.12         |                       | 169                | 1.04           | 120 k   |            |
| 202.438276473 M | 44.17          | 11.822 | -23.882 | 83.82          | -39.65         |                       | 191                | 1.05           | 120 k   |            |

Notes: Restricted band emissions limit is per FCC Part 15.209.

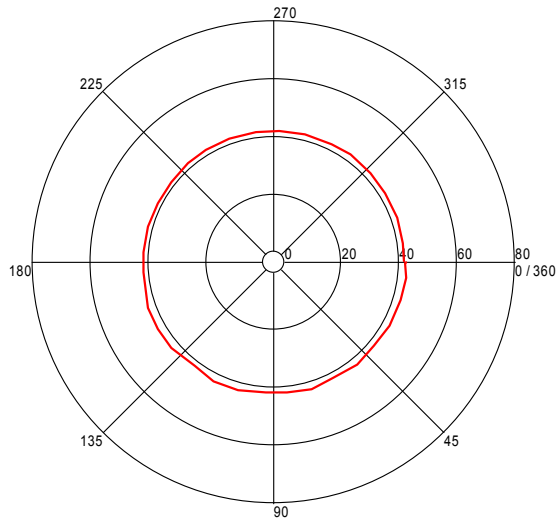
## Trace2: Measured Quasi Peak

| 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    |
|-----------------|----------------|--------|---------|----------------|----------------|-----------------------|--------------------|----------------|---------|------------|
| 194.909018114 M | 29.62          | 12.091 | -24.028 | --             | --             |                       | 194                | 1.14           | 120 k   |            |
| 164.95270501 M  | 31.15          | 12.195 | -24.843 | 33.040         | -1.89          |                       | 180                | 1.45           | 120 k   | Rest. Band |
| 172.514028497 M | 31.35          | 11.749 | -24.638 | 33.040         | -1.69          |                       | 158                | 1.34           | 120 k   | Rest. Band |
| 187.478156493 M | 32.09          | 11.348 | -24.231 | --             | --             |                       | 222                | 1.25           | 120 k   |            |
| 224.720841184 M | 34.60          | 11.094 | -23.811 | --             | --             |                       | 183                | 1.05           | 120 k   |            |
| 213.915631529 M | 32.70          | 10.778 | -23.845 | --             | --             |                       | 165                | 1.04           | 120 k   |            |
| 31.811623471 M  | 29.83          | 20.032 | -26.234 | --             | --             |                       | 127                | 3.44           | 120 k   |            |
| 202.438276473 M | 38.87          | 11.822 | -23.882 | --             | --             |                       | 191                | 1.05           | 120 k   |            |
| 217.481562729 M | 41.89          | 10.899 | -23.834 | --             | --             |                       | 166                | 1.04           | 120 k   |            |
| 209.990981782 M | 41.29          | 10.700 | -23.858 | --             | --             |                       | 169                | 1.04           | 120 k   |            |

## Azimuth Plots

Turntable Plot ( 31.811623471 MHz )

Level (dBuV/m)

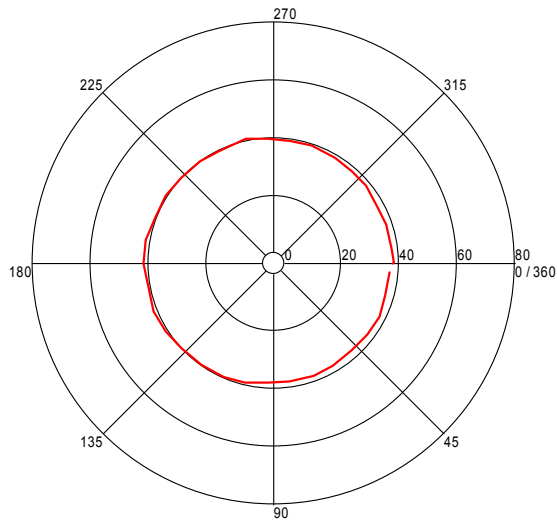


All Polarities

Azimuth (Degrees)

Turntable Plot ( 164.95270501 MHz )

Level (dBuV/m)

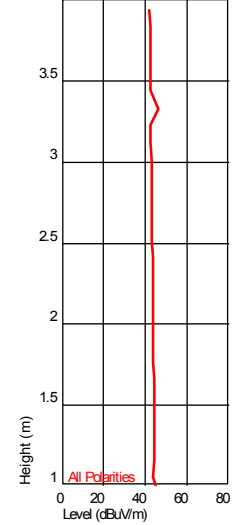


All Polarities

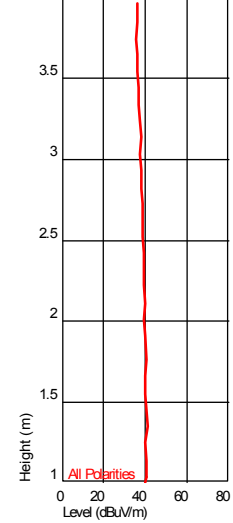
Azimuth (Degrees)

## Turntable Plots

Height Plot ( 31.811623471 MHz )

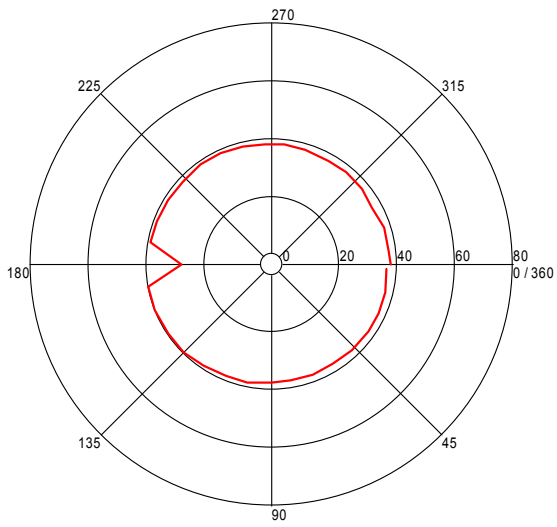


Height Plot ( 164.95270501 MHz )



Turntable Plot ( 172.514028497 MHz )

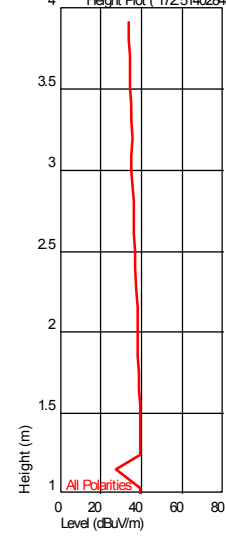
Level (dBuV/m)



All Polarities

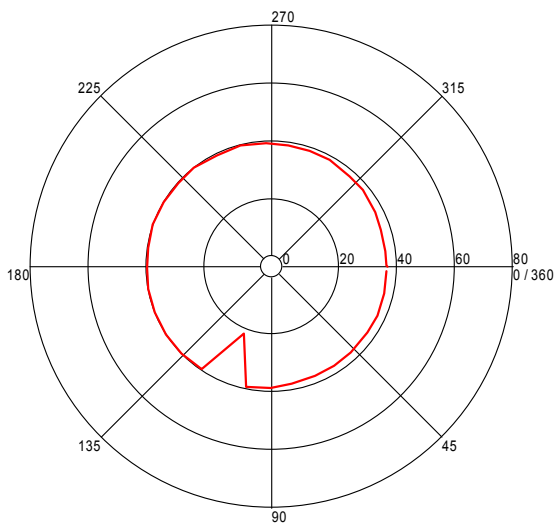
Azimuth (Degrees)

Height Plot ( 172.514028497 MHz )



Turntable Plot ( 187.478156493 MHz )

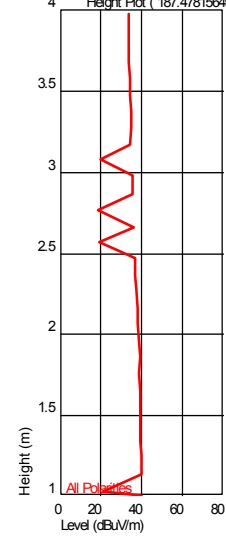
Level (dBuV/m)



All Polarities

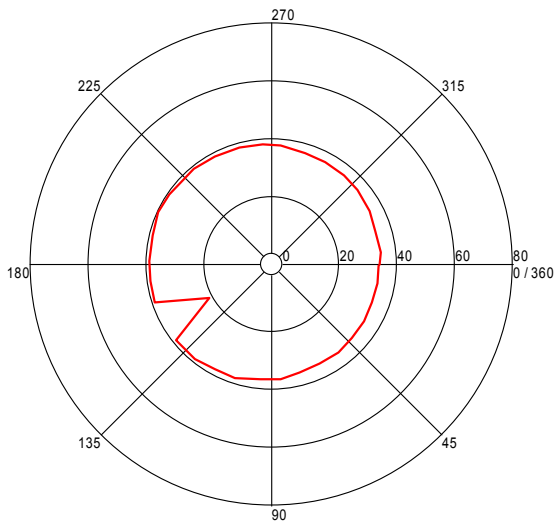
Azimuth (Degrees)

Height Plot ( 187.478156493 MHz )



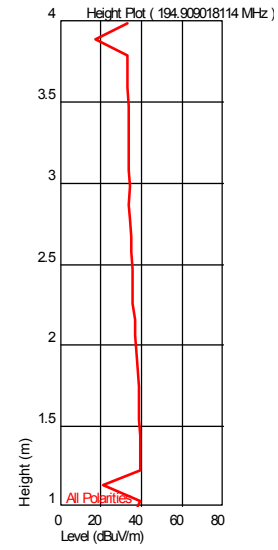
Turntable Plot ( 194.909018114 MHz )

Level (dBuV/m)



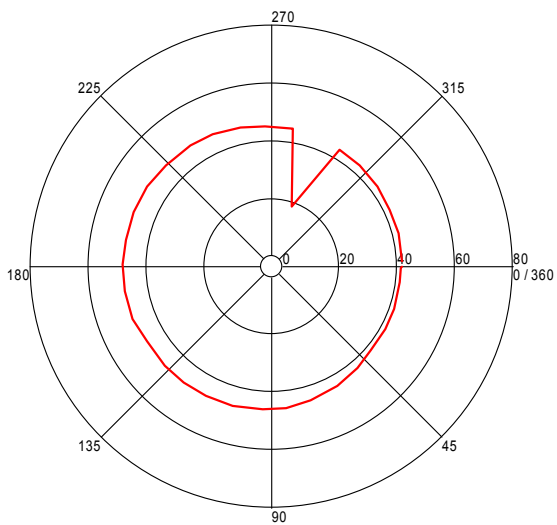
All Polarities

Azimuth (Degrees)



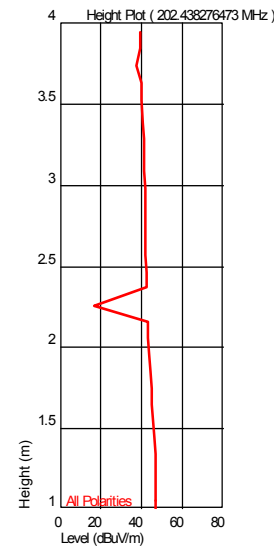
Turntable Plot ( 202.438276473 MHz )

Level (dBuV/m)



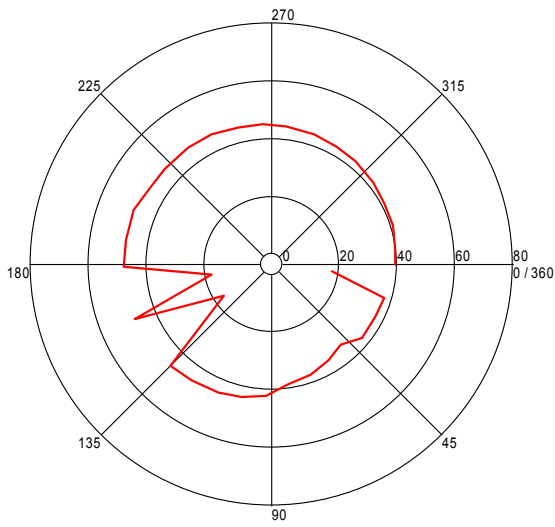
All Polarities

Azimuth (Degrees)



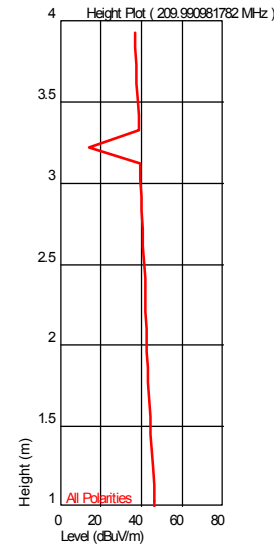
Turntable Plot ( 209.990981782 MHz )

Level (dBuV/m)



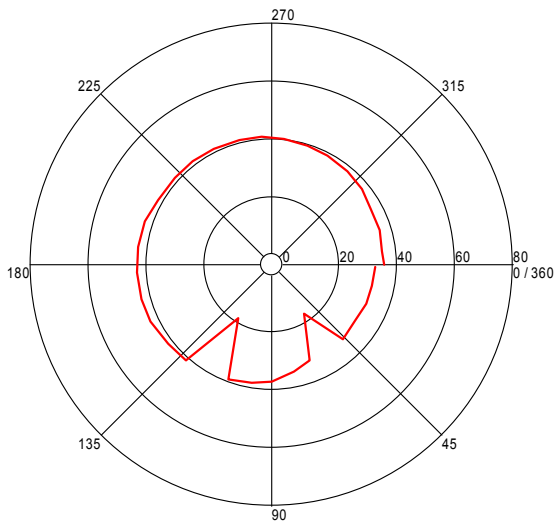
All Polarities

Azimuth (Degrees)



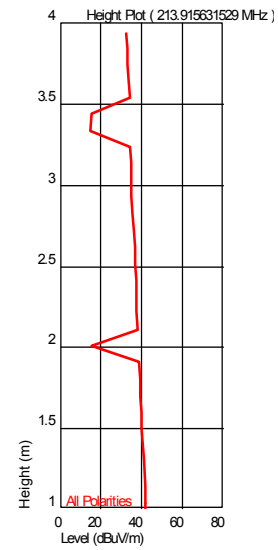
Turntable Plot ( 213.915631529 MHz )

Level (dBuV/m)



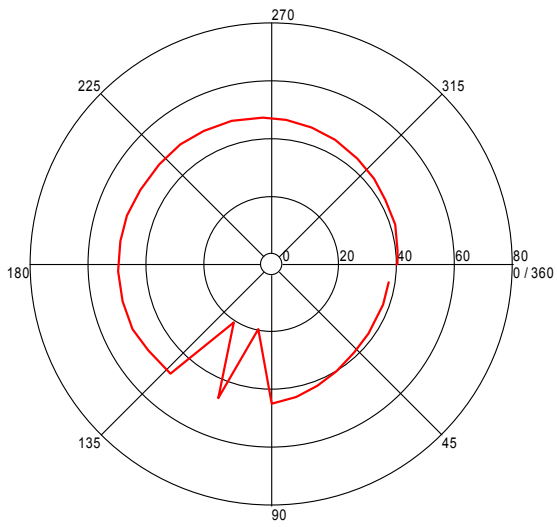
All Polarities

Azimuth (Degrees)



Turntable Plot ( 217.481562729 MHz )

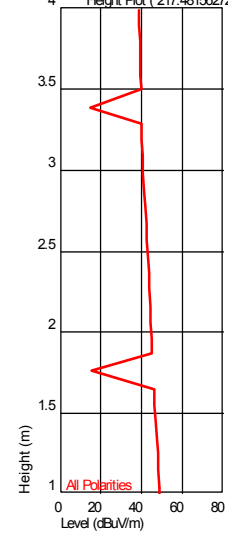
Level (dBuV/m)



All Polarities

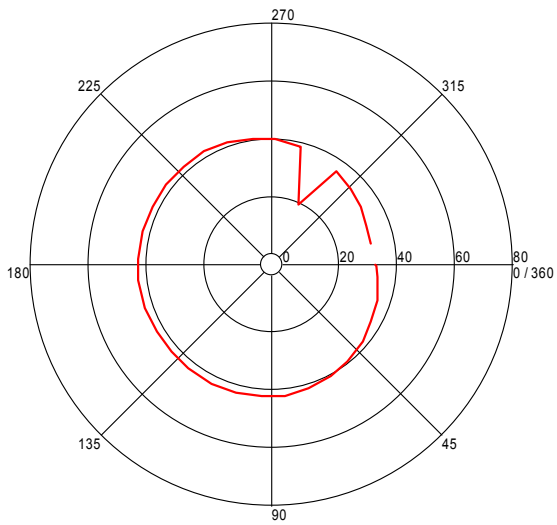
Azimuth (Degrees)

Height Plot ( 217.481562729 MHz )



Turntable Plot ( 224.720841184 MHz )

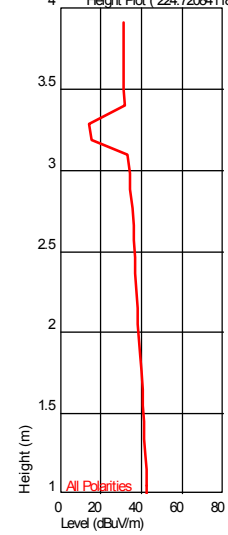
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot ( 224.720841184 MHz )



**Mid Channel Radiated Emissions**

**Transmit on 2440 MHz, 50 Ohm Terminator, (1-25 GHz)  
Radiated Emissions**

Company: Opex  
 Model #: 2048910  
 Serial #: BOX1503021541-001  
 Engineers: Kouma Sinn  
 Project #: G101718120  
 Standard: FCC Part 15 Subpart C, 15.247/RSS-210  
 Receiver: 145-128  
 PreAmp: PRE145014 04-29-2015.txt  
 PreAmp Used? (Y or N): Y  
 Antenna & Cables: LF Bands: N, LF, HF, SHF  
 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt  
 Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.  
 Location: 10m  
 Barometer: MAN1  
 Filter: NONE  
 Date(s): 07/15/14  
 Temp/Humidity/Pressure: 24C 45% 999mbar  
 Limit Distance (m): 3  
 Test Distance (m): 3  
 Voltage/Frequency: 120VAC/60Hz  
 Frequency Range: 1-25 GHz  
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)  
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

| Detector Type                                                                                    | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB | Bandwidth   | FCC | IC |
|--------------------------------------------------------------------------------------------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|--------------|----------------|-----------|-------------|-----|----|
| Hand scans were done from 18-25 GHz. No emissions were detected above the measuring noise floor. |                 |               |                |                        |               |                   |                    |              |                |           |             |     |    |
| Tx: CH 2405 MHz (The EUT sits on its side), worst-case.                                          |                 |               |                |                        |               |                   |                    |              |                |           |             |     |    |
| PK                                                                                               | H               | 1008.000      | 39.90          | 27.24                  | 3.75          | 30.80             | 0.00               | 40.09        | 74.00          | -33.91    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 1008.000      | 28.40          | 27.24                  | 3.75          | 30.80             | 0.00               | 28.59        | 54.00          | -25.41    | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 4880.000      | 36.15          | 34.25                  | 8.75          | 31.70             | 0.00               | 47.45        | 74.00          | -26.55    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 4880.000      | 24.60          | 34.25                  | 8.75          | 31.70             | 0.00               | 35.90        | 54.00          | -18.10    | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 7320.000      | 34.18          | 35.75                  | 11.10         | 32.21             | 0.00               | 48.82        | 74.00          | -25.18    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 7320.000      | 24.26          | 35.75                  | 11.10         | 32.21             | 0.00               | 38.90        | 54.00          | -15.10    | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 9760.000      | 24.70          | 36.96                  | 13.11         | 32.27             | 0.00               | 42.51        | 54.00          | -11.49    | 100/300 kHz |     |    |
| PK                                                                                               | H               | 12200.000     | 33.67          | 39.03                  | 14.80         | 31.17             | 0.00               | 56.33        | 74.00          | -17.67    | 1/3MHz      | RB  | RB |
| AVG                                                                                              | H               | 12200.000     | 22.20          | 39.03                  | 14.80         | 31.17             | 0.00               | 44.86        | 54.00          | -9.14     | 1/3MHz      | RB  | RB |
| PK                                                                                               | H               | 14640.000     | 22.30          | 39.62                  | 15.25         | 29.93             | 9.54               | 37.69        | 54.00          | -16.31    | 100/300 kHz | 1m  |    |
| PK                                                                                               | H               | 17080.000     | 22.50          | 42.09                  | 19.00         | 30.30             | 9.54               | 43.75        | 54.00          | -10.25    | 100/300 kHz | 1m  |    |

## High Channel Radiated Emissions

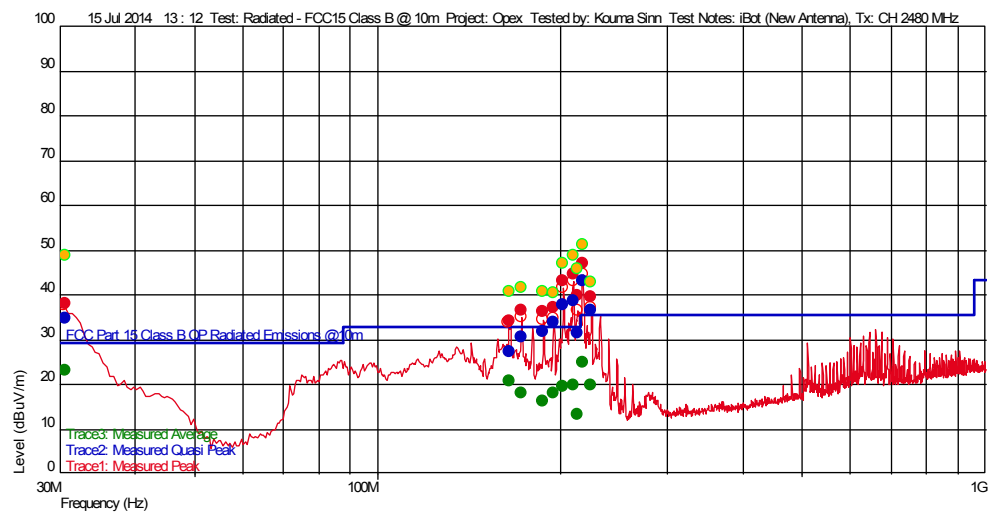
Transmit on 2480 MHz, 50 Ohm Terminator,

30-1000 MHz

## Test Information

|               |                                     |                        |
|---------------|-------------------------------------|------------------------|
| Test Details  | User Entry                          | Additional Information |
| Test:         | Radiated - FCC15 Class B @ 10m      |                        |
| Project:      | Opex                                |                        |
| Test Notes:   | iBot (New Antenna), Tx: CH 2480 MHz |                        |
| Temperature:  | 22C                                 |                        |
| Humidity:     | 44%, 1000mbar                       |                        |
| Tested by:    | Kouma Sinn                          |                        |
| Test Started: | 15 Jul 2014 13 : 12                 |                        |

## Prescan Emission Graph



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

Notes: Disregard the limit line on the plot, see the following page for final test results.

Emissions Test Data

Notes: Non-restricted band emissions limit is 20dB below fundamental signals using 100kHz Resolution Bandwidth

Fundamental Peak Reading = 92.59 dBuV/m,

Limit = 92.59-20 or 72.59 dBuV/m (20 dB below the fundamental signal)

## 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    |
|-----------------|----------------|--------|---------|----------------|-----------------|-----------------------|--------------------|----------------|---------|------------|
| 164.857915375 M | 34.15          | 12.186 | -24.846 | --             | --              |                       | 212                | 1.87           | 120 k   | Rest. Band |
| 187.458918016 M | 36.34          | 11.346 | -24.231 | 72.59          | -36.25          |                       | 200                | 1.15           | 120 k   |            |
| 172.442685812 M | 36.64          | 11.756 | -24.640 | --             | --              |                       | 160                | 1.56           | 120 k   | Rest. Band |
| 224.671141786 M | 39.55          | 11.093 | -23.811 | 72.59          | -33.04          |                       | 218                | 1.05           | 120 k   |            |
| 195.028456992 M | 37.20          | 12.106 | -24.025 | 72.59          | -35.39          |                       | 202                | 1.03           | 120 k   |            |
| 213.832665485 M | 39.82          | 10.777 | -23.846 | 72.59          | -32.77          |                       | 169                | 1.04           | 120 k   |            |
| 30.646292641 M  | 38.03          | 20.848 | -26.244 | 72.59          | -34.56          |                       | 141                | 1.05           | 120 k   |            |
| 202.56252497 M  | 43.12          | 11.777 | -23.882 | 72.59          | -29.47          |                       | 203                | 1.04           | 120 k   |            |
| 217.460921503 M | 47.07          | 10.898 | -23.834 | 72.59          | -25.52          |                       | 177                | 1.04           | 120 k   |            |
| 209.910019858 M | 44.75          | 10.704 | -23.858 | 72.59          | -27.84          |                       | 222                | 1.05           | 120 k   |            |

Notes: Restricted band emissions limit is per FCC Part 15.209.

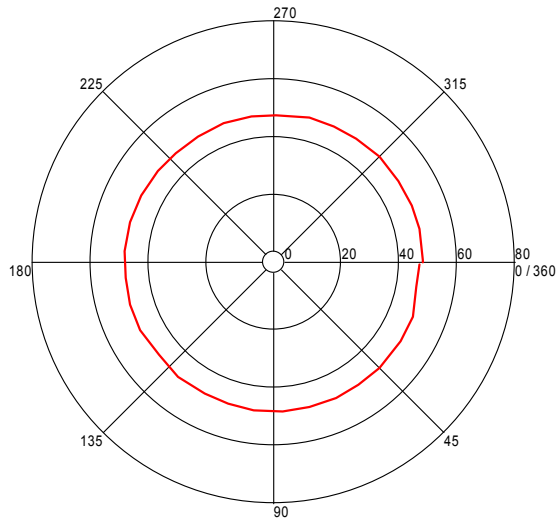
## Trace2: Measured Quasi Peak

| 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    |
|-----------------|----------------|--------|---------|----------------|-----------------|-----------------------|--------------------|----------------|---------|------------|
| 164.857915375 M | 27.18          | 12.186 | -24.846 | 33.040         | -5.86           |                       | 212                | 1.87           | 120 k   | Rest. Band |
| 172.442685812 M | 30.64          | 11.756 | -24.640 | 33.040         | -2.40           |                       | 160                | 1.56           | 120 k   | Rest. Band |
| 213.832665485 M | 31.44          | 10.777 | -23.846 | --             | --              |                       | 169                | 1.04           | 120 k   |            |
| 187.458918016 M | 31.65          | 11.346 | -24.231 | --             | --              |                       | 200                | 1.15           | 120 k   |            |
| 195.028456992 M | 34.00          | 12.106 | -24.025 | --             | --              |                       | 202                | 1.03           | 120 k   |            |
| 224.671141786 M | 36.59          | 11.093 | -23.811 | --             | --              |                       | 218                | 1.05           | 120 k   |            |
| 202.56252497 M  | 37.65          | 11.777 | -23.882 | --             | --              |                       | 203                | 1.04           | 120 k   |            |
| 30.646292641 M  | 34.80          | 20.848 | -26.244 | --             | --              |                       | 141                | 1.05           | 120 k   |            |
| 209.910019858 M | 38.59          | 10.704 | -23.858 | --             | --              |                       | 222                | 1.05           | 120 k   |            |
| 217.460921503 M | 43.02          | 10.898 | -23.834 | --             | --              |                       | 177                | 1.04           | 120 k   |            |

## Azimuth Plots

Turntable Plot ( 30.646292641 MHz )

Level (dBuV/m)

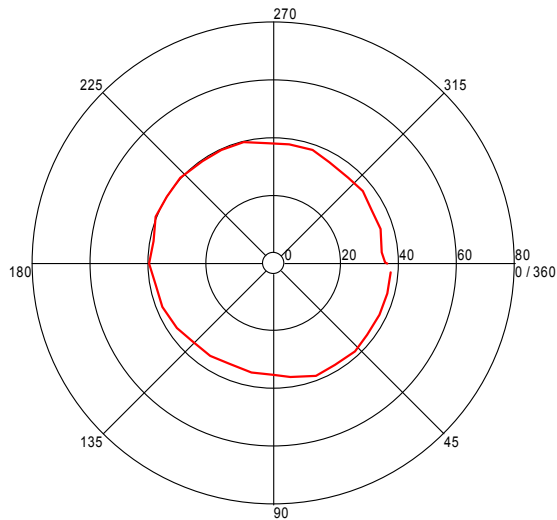


All Polarities

Azimuth (Degrees)

Turntable Plot ( 164.857915375 MHz )

Level (dBuV/m)

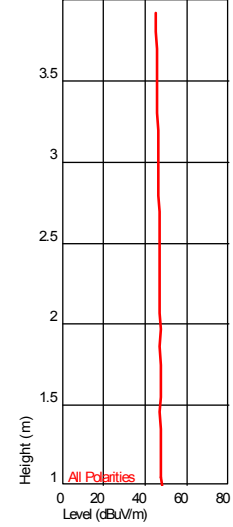


All Polarities

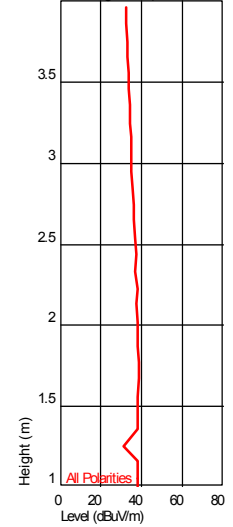
Azimuth (Degrees)

## Turntable Plots

Height Plot ( 30.646292641 MHz )

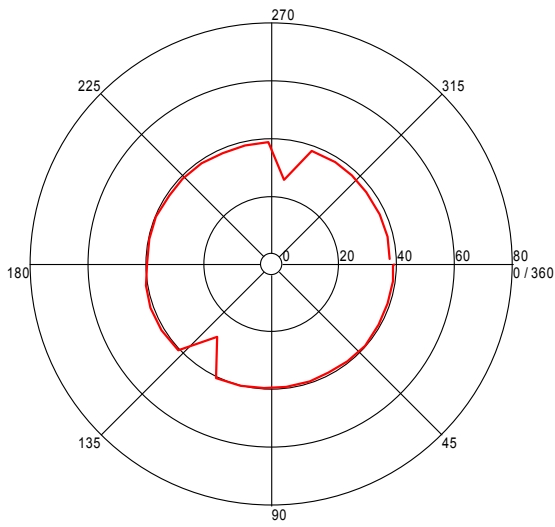


Height Plot ( 164.857915375 MHz )



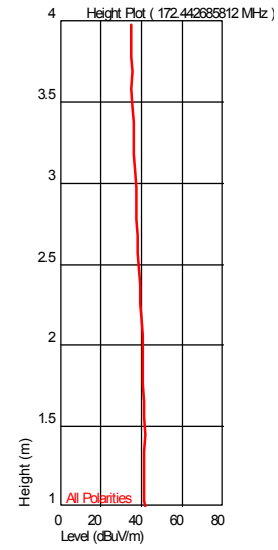
Turntable Plot ( 172.442685812 MHz )

Level (dBuV/m)



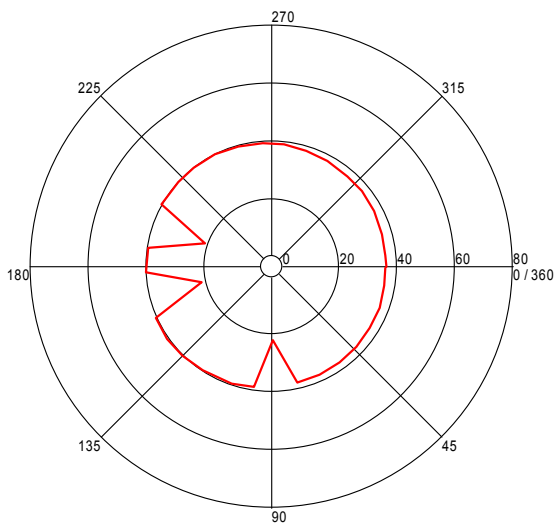
All Polarities

Azimuth (Degrees)



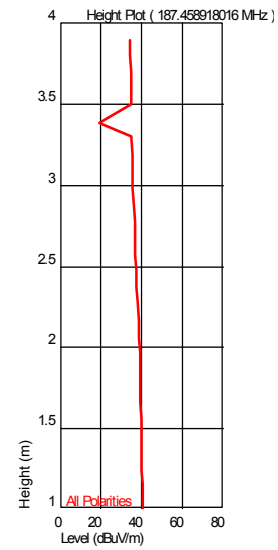
Turntable Plot ( 187.458918016 MHz )

Level (dBuV/m)



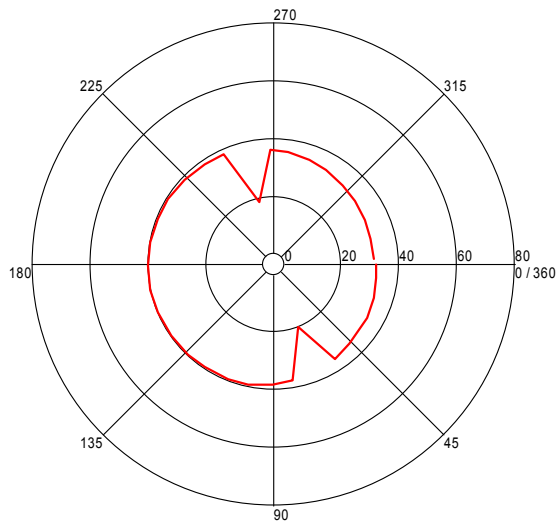
All Polarities

Azimuth (Degrees)



Turntable Plot ( 195.028456992 MHz )

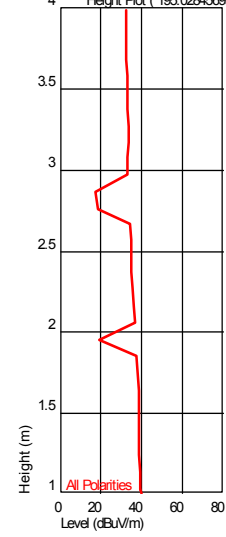
Level (dBuV/m)



All Polarities

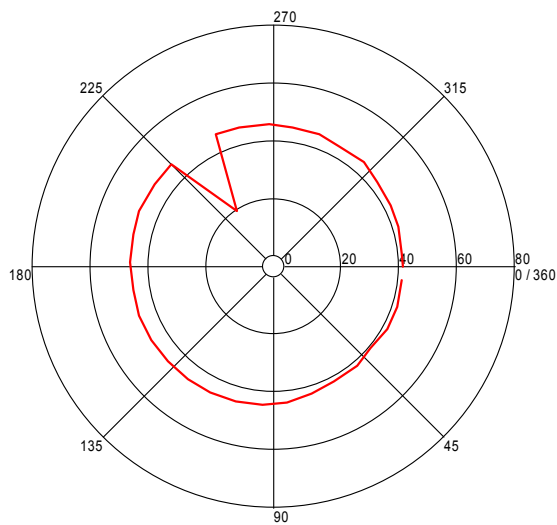
Azimuth (Degrees)

Height Plot ( 195.028456992 MHz )



Turntable Plot ( 202.56252497 MHz )

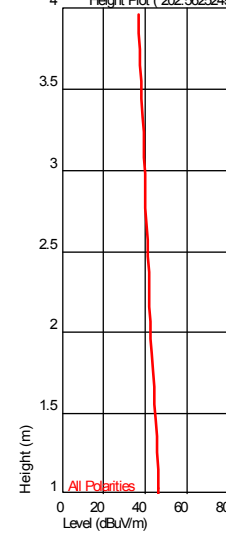
Level (dBuV/m)



All Polarities

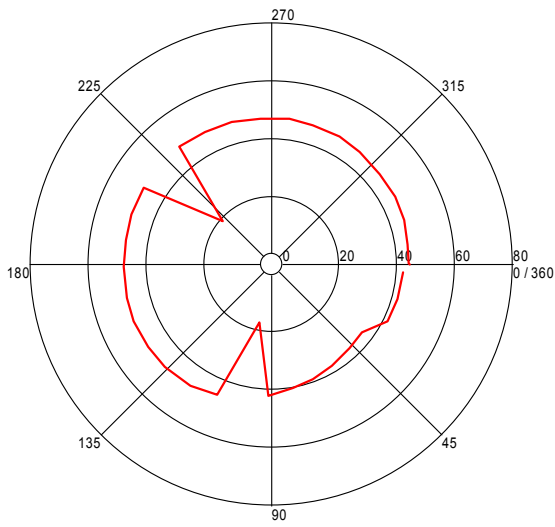
Azimuth (Degrees)

Height Plot ( 202.56252497 MHz )



Turntable Plot ( 209.910019858 MHz )

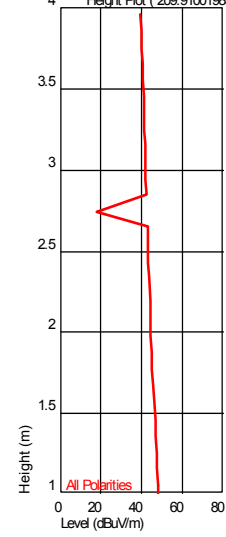
Level (dBuV/m)



All Polarities

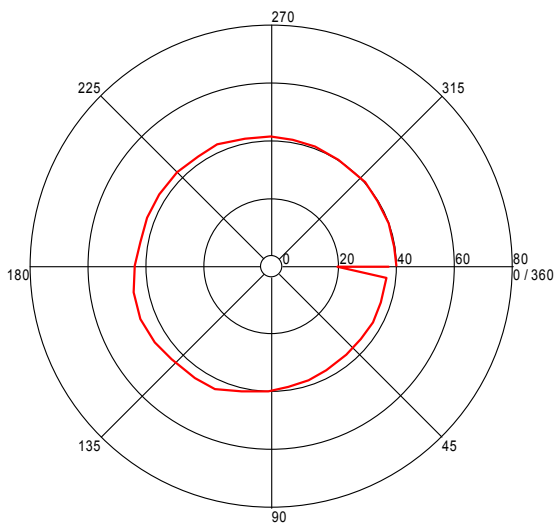
Azimuth (Degrees)

Height Plot ( 209.910019858 MHz )



Turntable Plot ( 213.832665485 MHz )

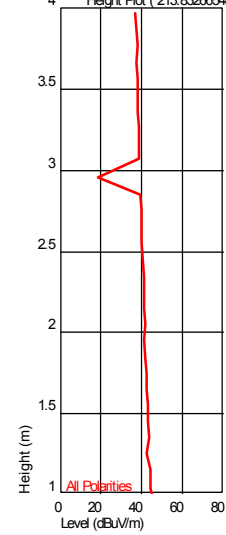
Level (dBuV/m)



All Polarities

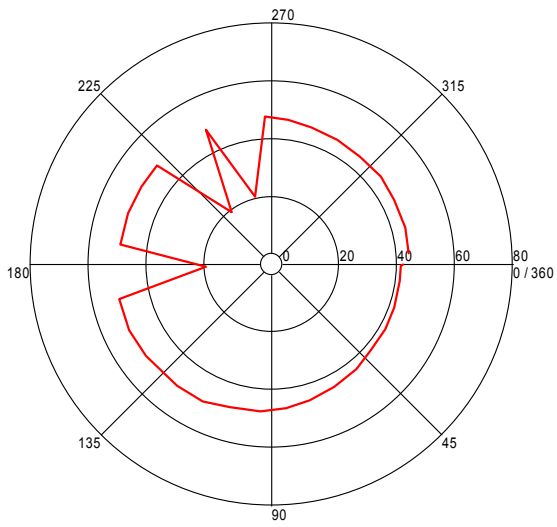
Azimuth (Degrees)

Height Plot ( 213.832665485 MHz )



Turntable Plot ( 217.460921503 MHz )

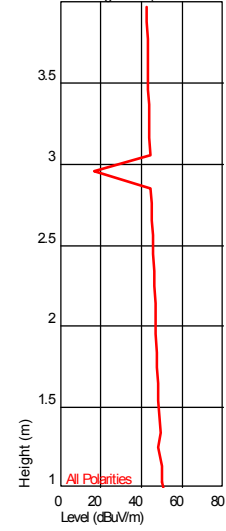
Level (dBuV/m)



All Polarities

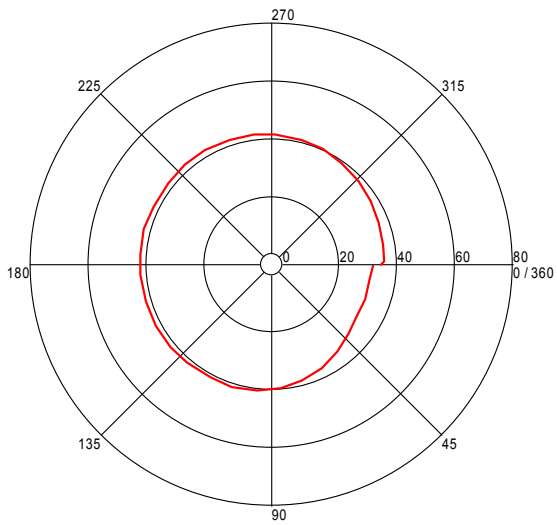
Azimuth (Degrees)

Height Plot ( 217.460921503 MHz )



Turntable Plot ( 224.671141786 MHz )

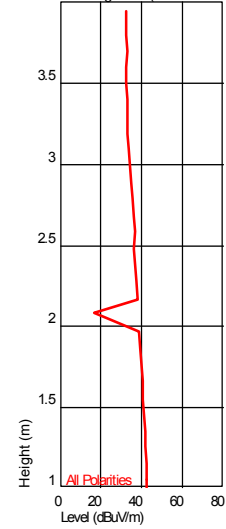
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot ( 224.671141786 MHz )



### High Channel Radiated Emissions

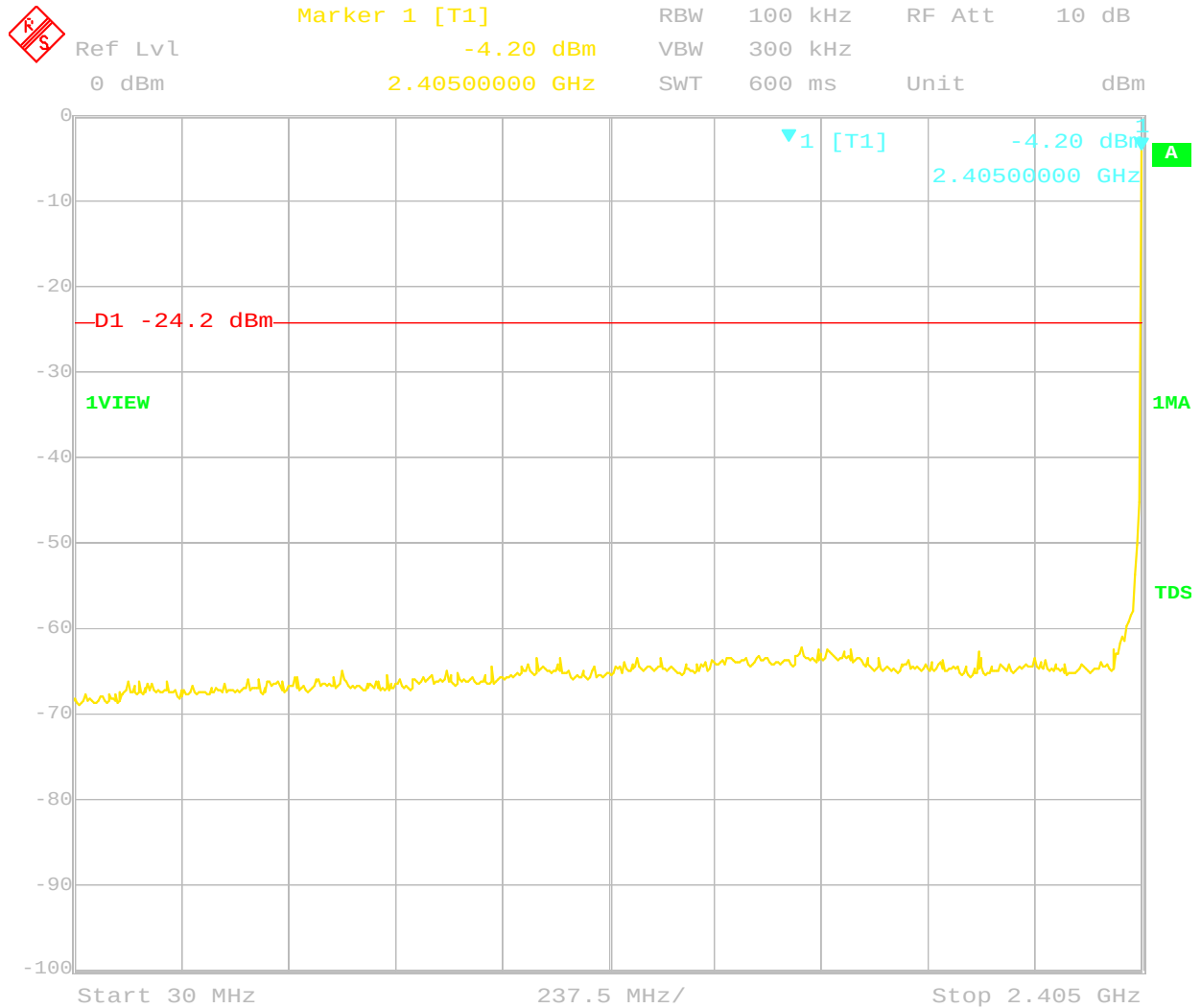
Transmit on 2480MHz, 50 Ohm Terminator, 1-25 GHz  
Radiated Emissions

|                                                                                                                     |                                         |                           |
|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------------------|
| Company: Opex                                                                                                       | Antenna & Cables: LF                    | Bands: N, LF, HF, SHF     |
| Model #: 2048910                                                                                                    | Antenna: ETS001 01-06-15.txt            | ETS001 01-06-15.txt       |
| Serial #: BOX1503021541-001                                                                                         | Cable(s): 145-416 3mTrkB 10-03-2014.txt | NONE.                     |
| Engineers: Kouma Sinn                                                                                               | Location: 10m                           | Barometer: MAN1           |
| Project #: G101718120                                                                                               | Date(s): 07/15/14                       | Filter: NONE              |
| Standard: FCC Part 15 Subpart C, 15.247/RSS-210                                                                     | Temp/Humidity/Pressure: 24C             | 45% 999mbar               |
| Receiver: 145-128                                                                                                   | Limit Distance (m): 3                   |                           |
| PreAmp: PRE145014 04-29-2015.txt                                                                                    | Test Distance (m): 3                    |                           |
| PreAmp Used? (Y or N): Y                                                                                            | Voltage/Frequency: 120VAC/60Hz          | Frequency Range: 1-25 GHz |
| Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)       |                                         |                           |
| Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW |                                         |                           |

| Detector Type                                                                                    | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB | Bandwidth   | FCC |
|--------------------------------------------------------------------------------------------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|--------------|----------------|-----------|-------------|-----|
| Hand scans were done from 18-25 GHz. No emissions were detected above the measuring noise floor. |                 |               |                |                        |               |                   |                    |              |                |           |             |     |
| Tx: CH 2480 MHz (The EUT sits on its side), worst-case.                                          |                 |               |                |                        |               |                   |                    |              |                |           |             |     |
| PK                                                                                               | H               | 1008.000      | 38.90          | 27.24                  | 3.75          | 30.80             | 0.00               | 39.09        | 74.00          | -34.91    | 1/3MHz      | RB  |
| AVG                                                                                              | H               | 1008.000      | 26.70          | 27.24                  | 3.75          | 30.80             | 0.00               | 26.89        | 54.00          | -27.11    | 1/3MHz      | RB  |
| PK                                                                                               | H               | 4960.000      | 34.67          | 34.28                  | 8.86          | 31.65             | 0.00               | 46.15        | 74.00          | -27.85    | 1/3MHz      | RB  |
| AVG                                                                                              | H               | 4960.000      | 23.92          | 34.28                  | 8.86          | 31.65             | 0.00               | 35.40        | 54.00          | -18.60    | 1/3MHz      | RB  |
| PK                                                                                               | H               | 7440.000      | 36.00          | 35.78                  | 11.19         | 32.22             | 0.00               | 50.74        | 74.00          | -23.26    | 1/3MHz      | RB  |
| AVG                                                                                              | H               | 7440.000      | 23.84          | 35.78                  | 11.19         | 32.22             | 0.00               | 38.58        | 54.00          | -15.42    | 1/3MHz      | RB  |
| PK                                                                                               | H               | 9920.000      | 23.16          | 37.11                  | 13.49         | 32.46             | 0.00               | 41.30        | 54.00          | -12.70    | 100/300 kHz | RB  |
| PK                                                                                               | H               | 12400.000     | 34.05          | 39.22                  | 14.65         | 30.85             | 0.00               | 57.07        | 74.00          | -16.93    | 1/3MHz      | RB  |
| AVG                                                                                              | H               | 12400.000     | 22.64          | 39.22                  | 14.65         | 30.85             | 0.00               | 45.66        | 54.00          | -8.34     | 1/3MHz      | RB  |
| PK                                                                                               | H               | 14880.000     | 23.05          | 39.81                  | 15.67         | 29.90             | 9.54               | 39.08        | 54.00          | -14.92    | 100/300 kHz | 1m  |
| PK                                                                                               | H               | 17360.000     | 25.30          | 42.07                  | 20.94         | 30.40             | 9.54               | 48.37        | 54.00          | -5.63     | 100/300 kHz | 1m  |

Low Channel Antenna Port Conducted Emissions (30-2405 MHz)

No emissions were detected

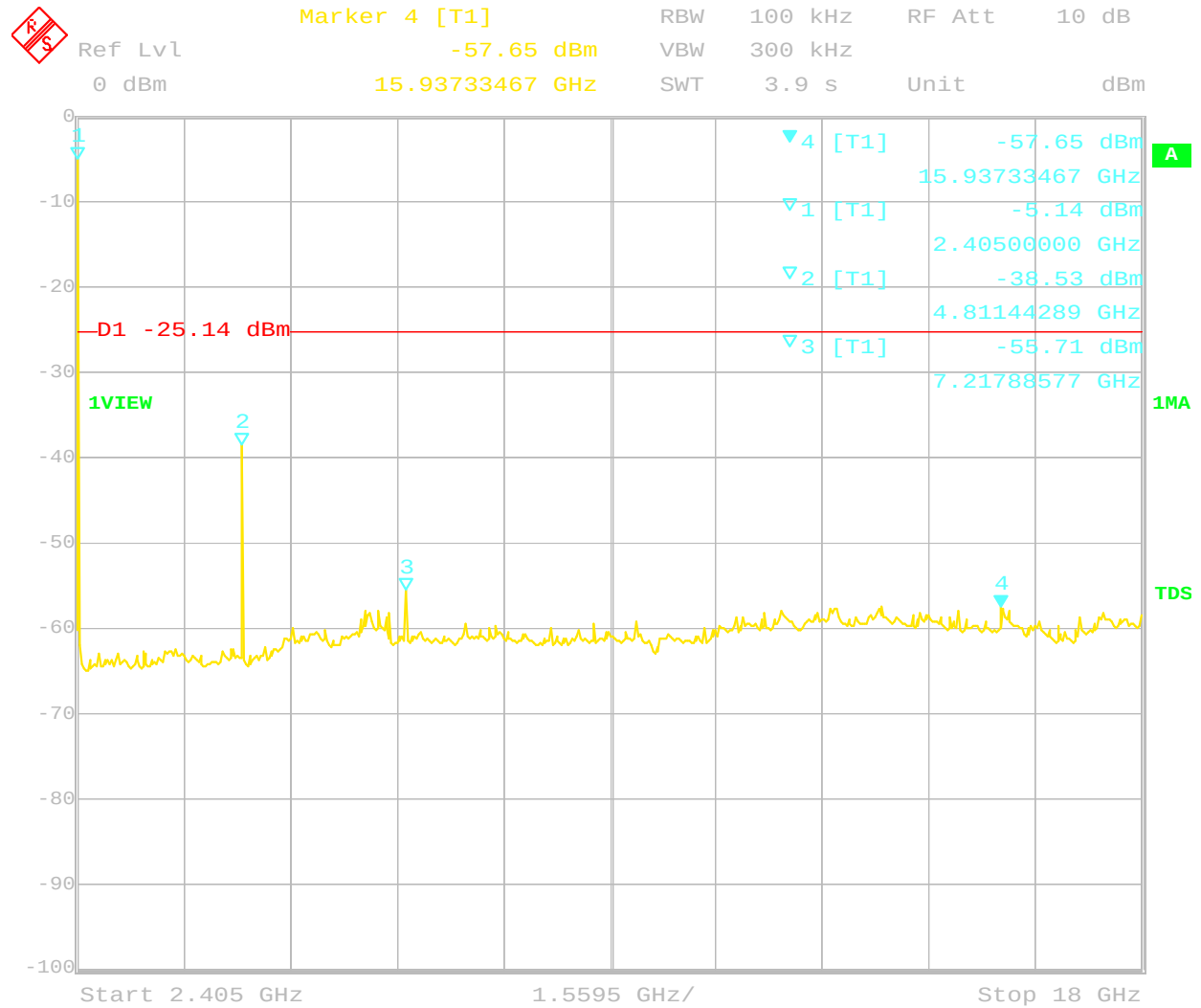


Date: 18.JUL.2014 10:50:46

**Low Channel Antenna Port Conducted Emissions (2.405-18 GHz), 100 kHz ResBW**

Emissions were detected as shown in plot below

Limit line = 20 dB below Fund.

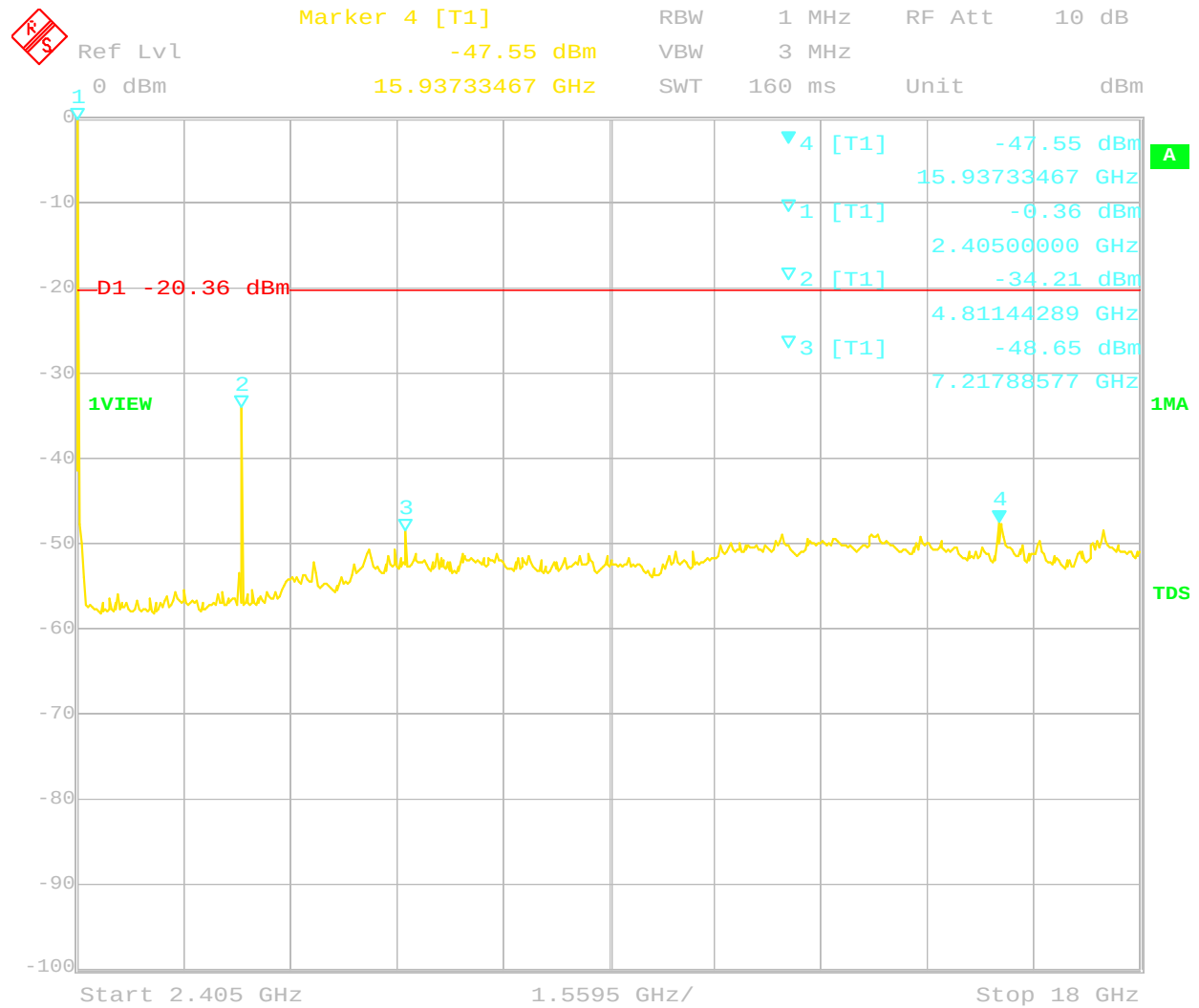


Date: 18.JUL.2014 11:30:37

**Low Channel Antenna Port Conducted Emissions (2.405-18 GHz), 1MHz ResBW**

Emissions were detected as shown in plot below

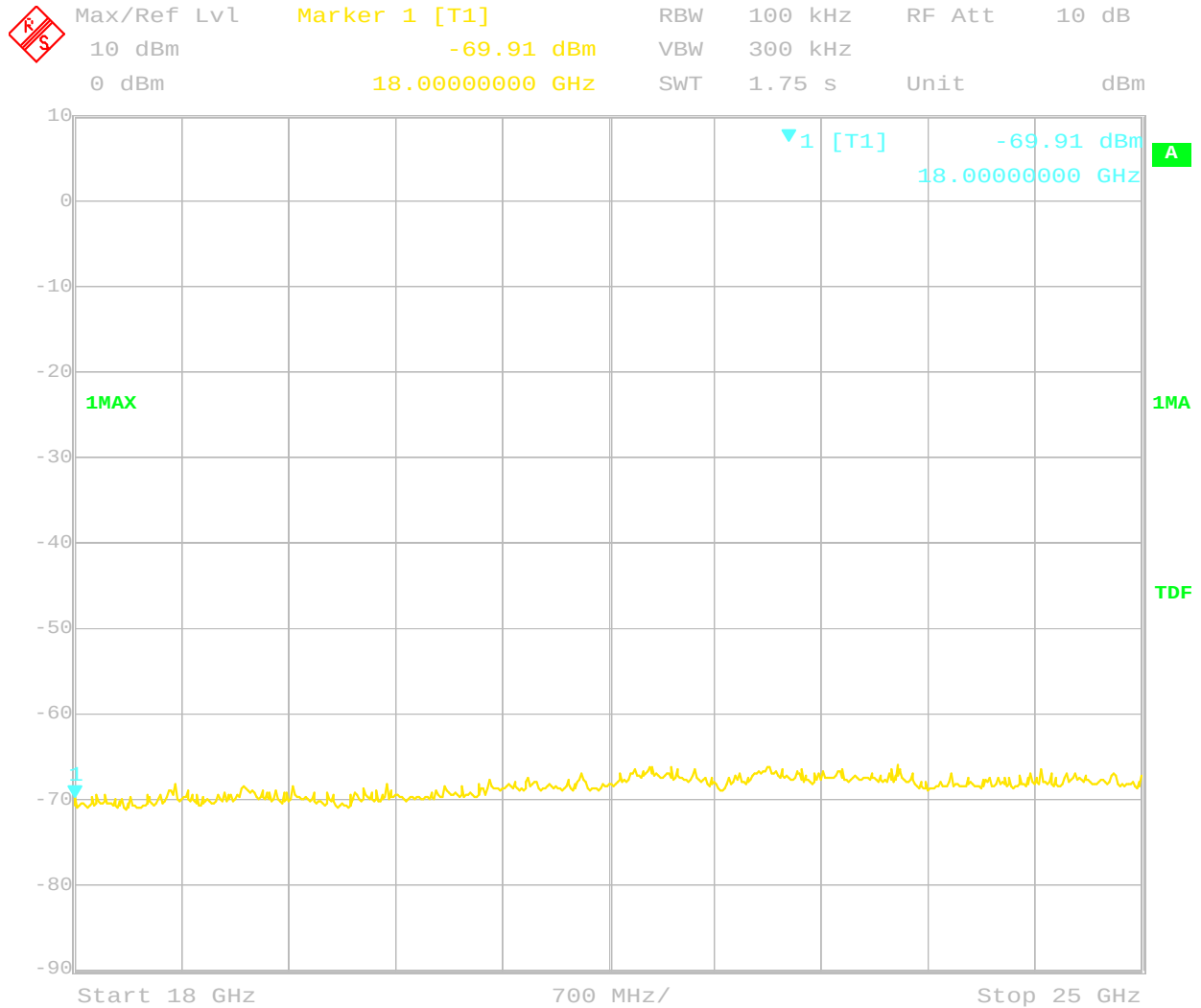
Limit line = 20 dB below Fund.



Date: 18.JUL.2014 11:38:19

Low Channel Antenna Port Conducted Emissions (18-25 GHz), 100kHz ResBW

No emissions were detected

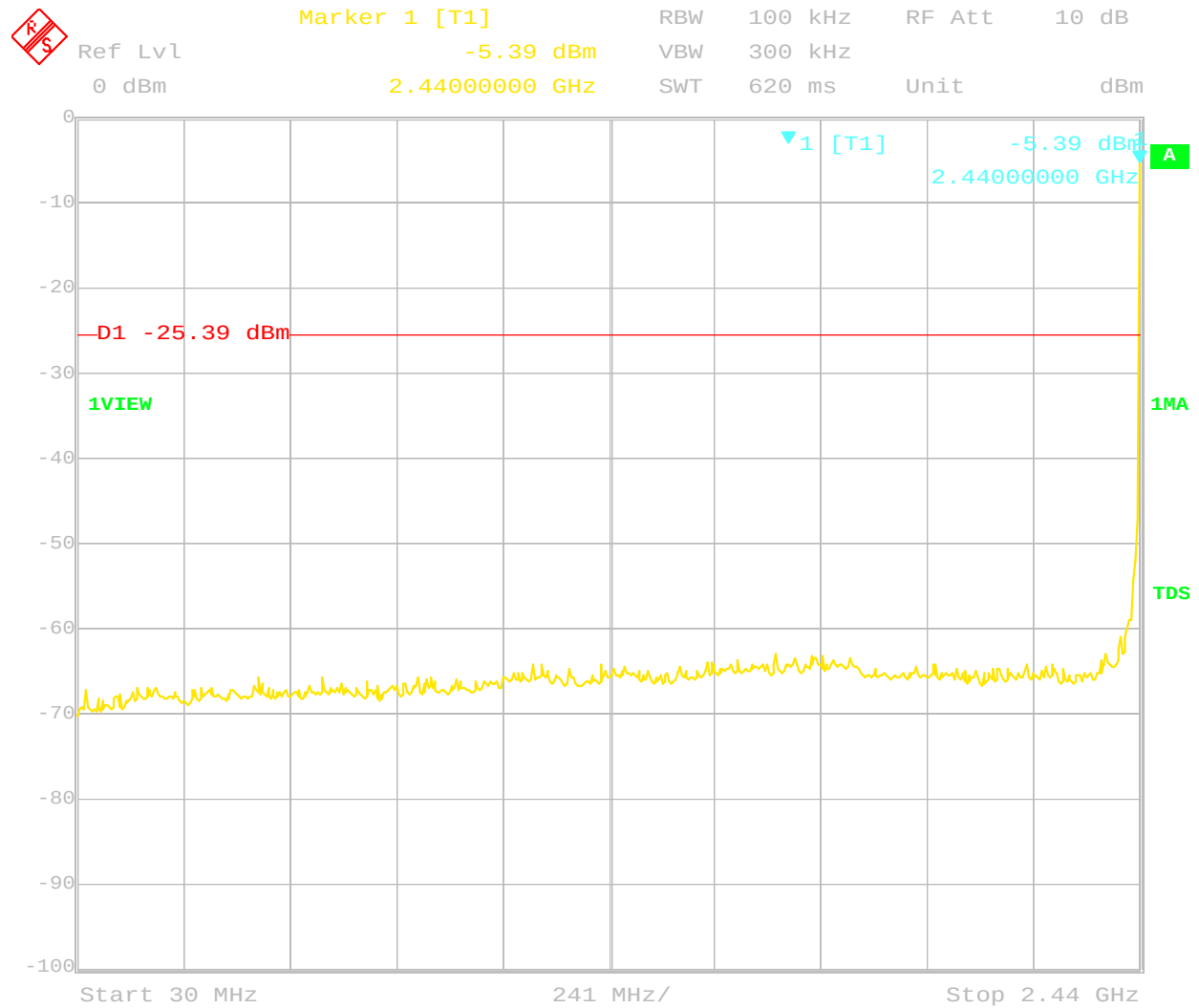


Date: 18.JUL.2014 14:45:57

Mid Antenna Port Conducted Emissions (30-2440 MHz)

No emissions were detected

Limit line = 20 dB below Fund.

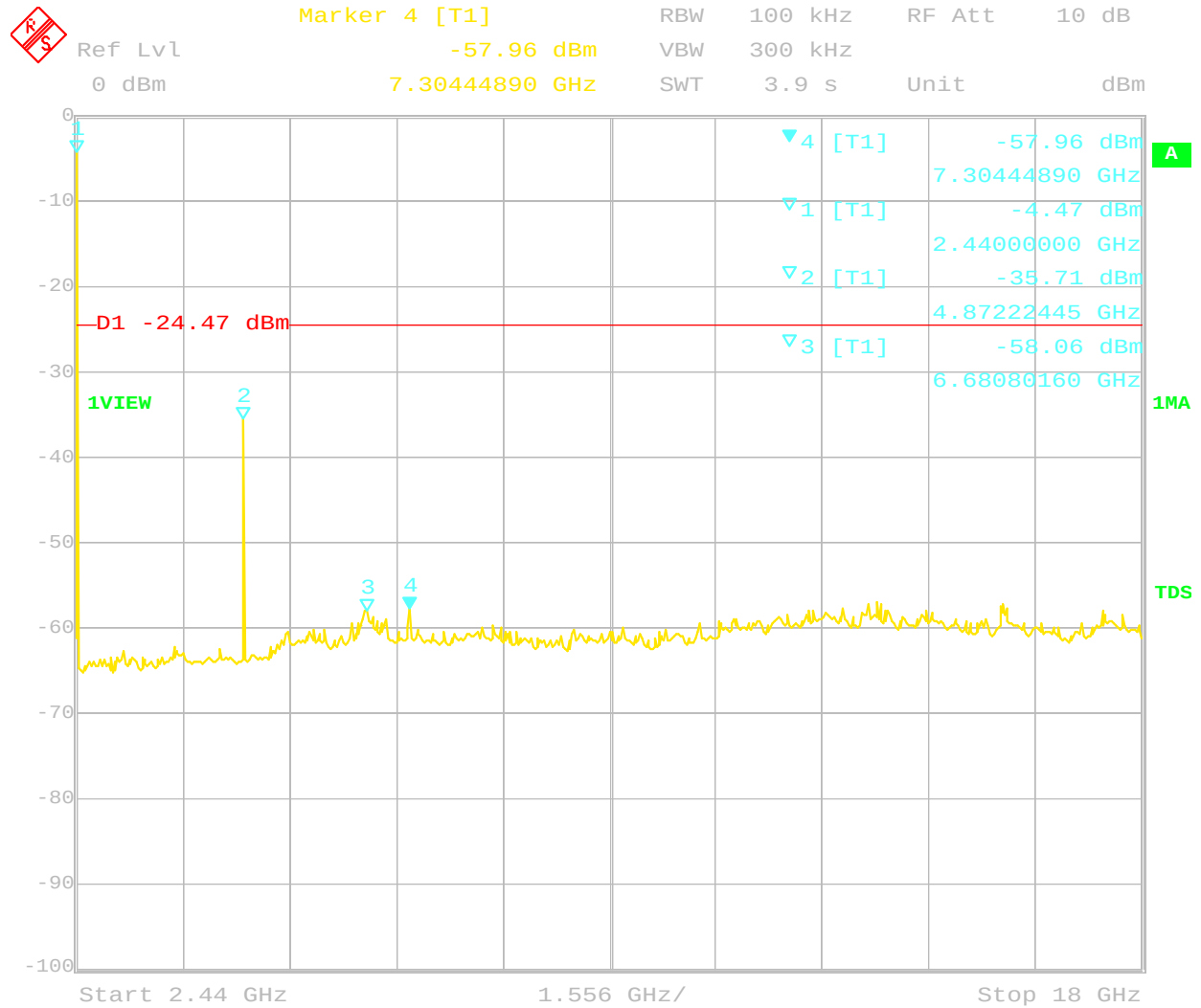


Date: 18.JUL.2014 10:59:12

Mid Channel Antenna Port Conducted Emissions (2.440-18 GHz), 100kHz ResBW

Emissions were detected as shown in plot below

Limit line = 20 dB below Fund.

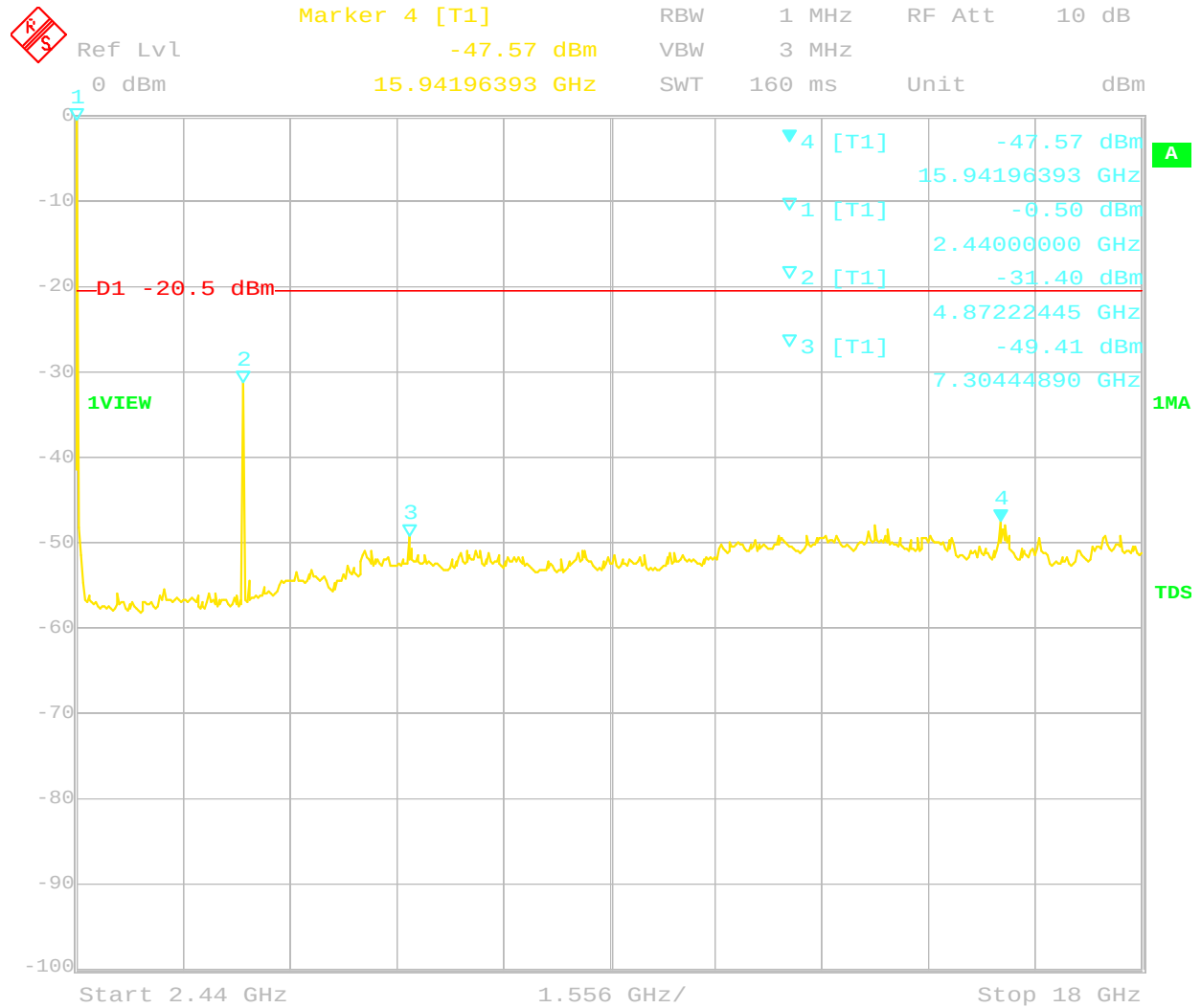


Date: 18.JUL.2014 11:27:29

**Mid Channel Antenna Port Conducted Emissions (2.440-18 GHz), 1MHz ResBW**

Emissions were detected as shown in plot below

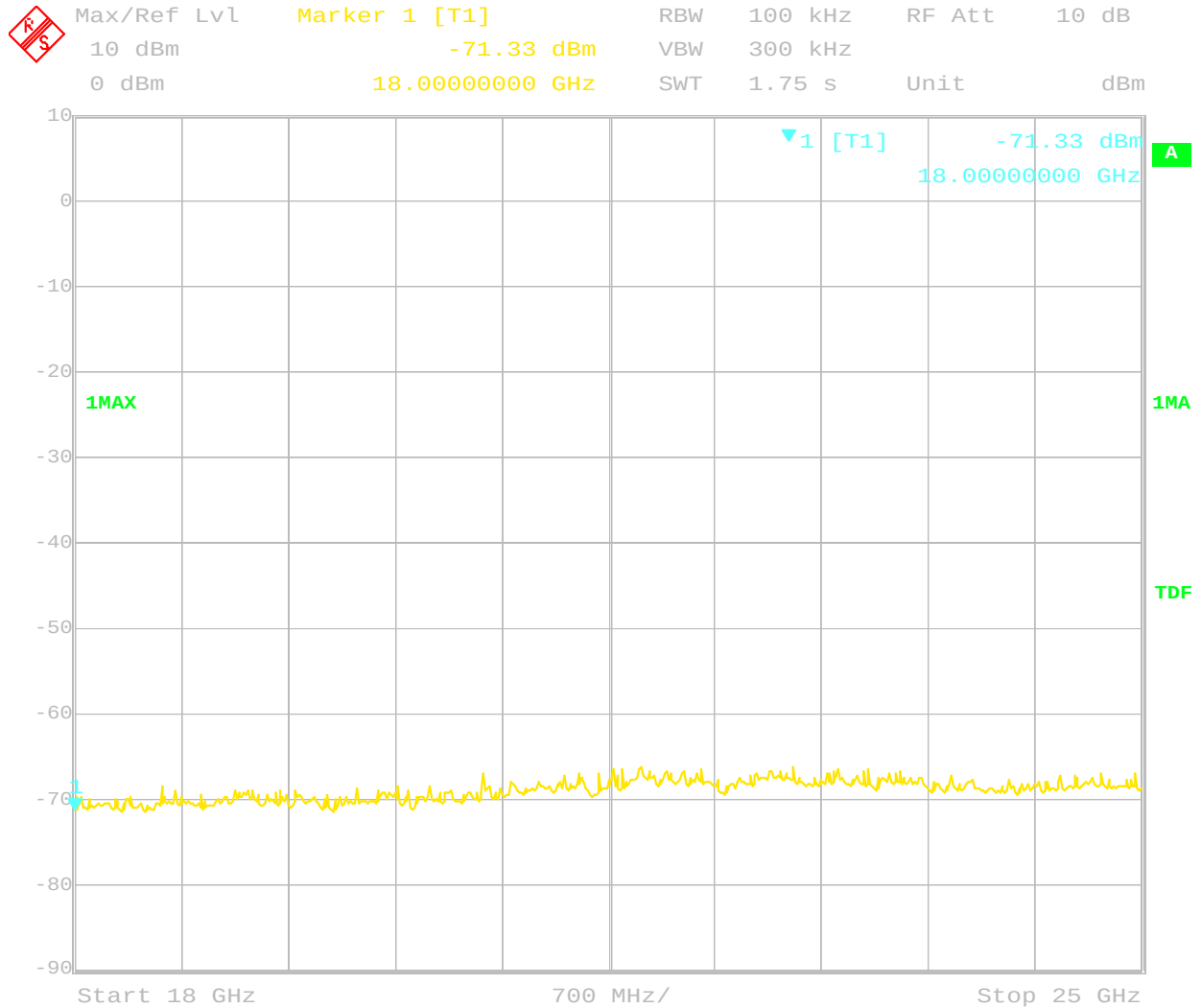
Limit line = 20 dB below Fund.



Date: 18.JUL.2014 11:23:53

Mid Channel Antenna Port Conducted Emissions (18-25 GHz), 100kHz ResBW

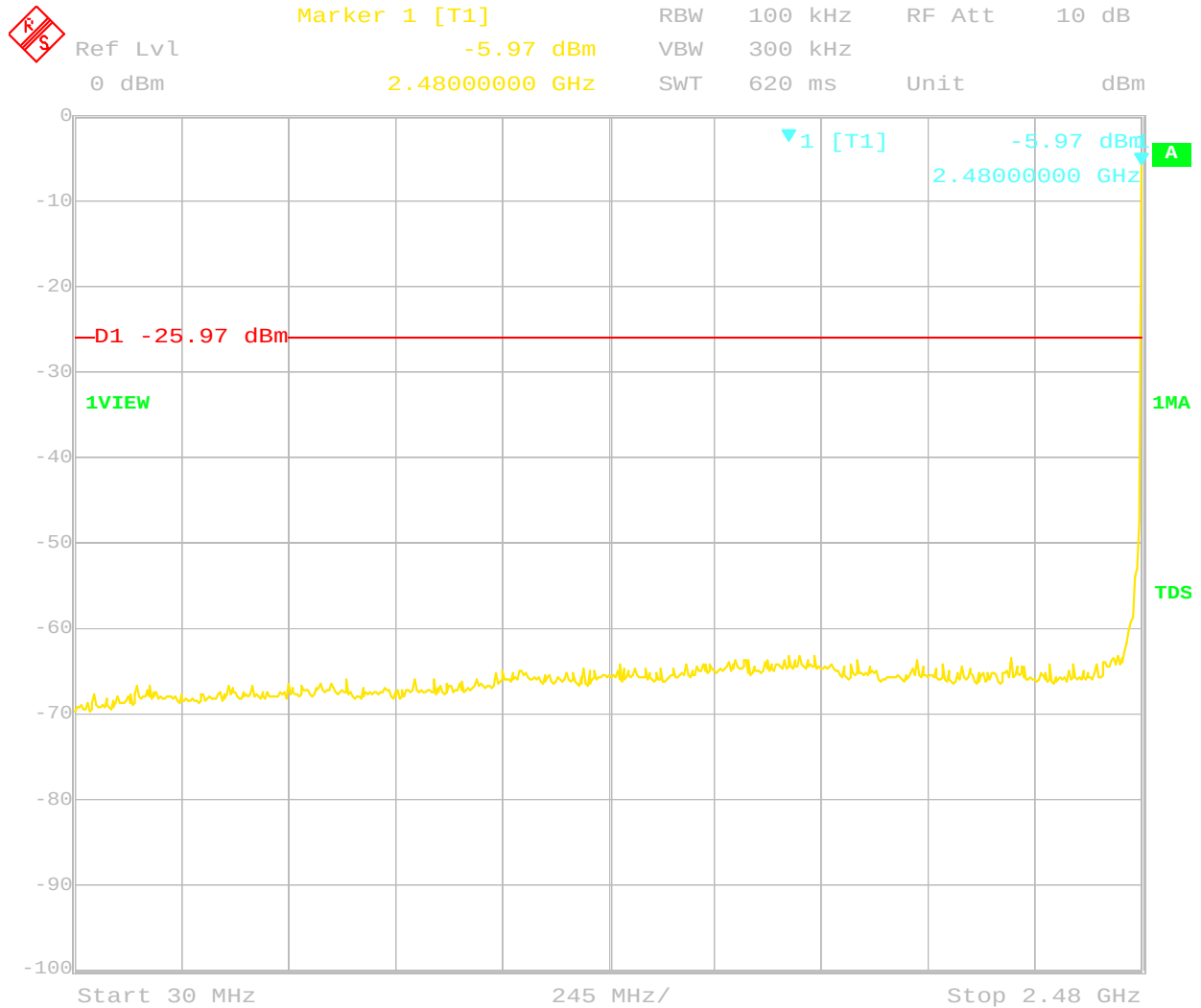
No emissions were detected



Date: 18.JUL.2014 14:50:28

High Channel Antenna Port Conducted Emissions (30-2480 MHz)

No emissions were detected

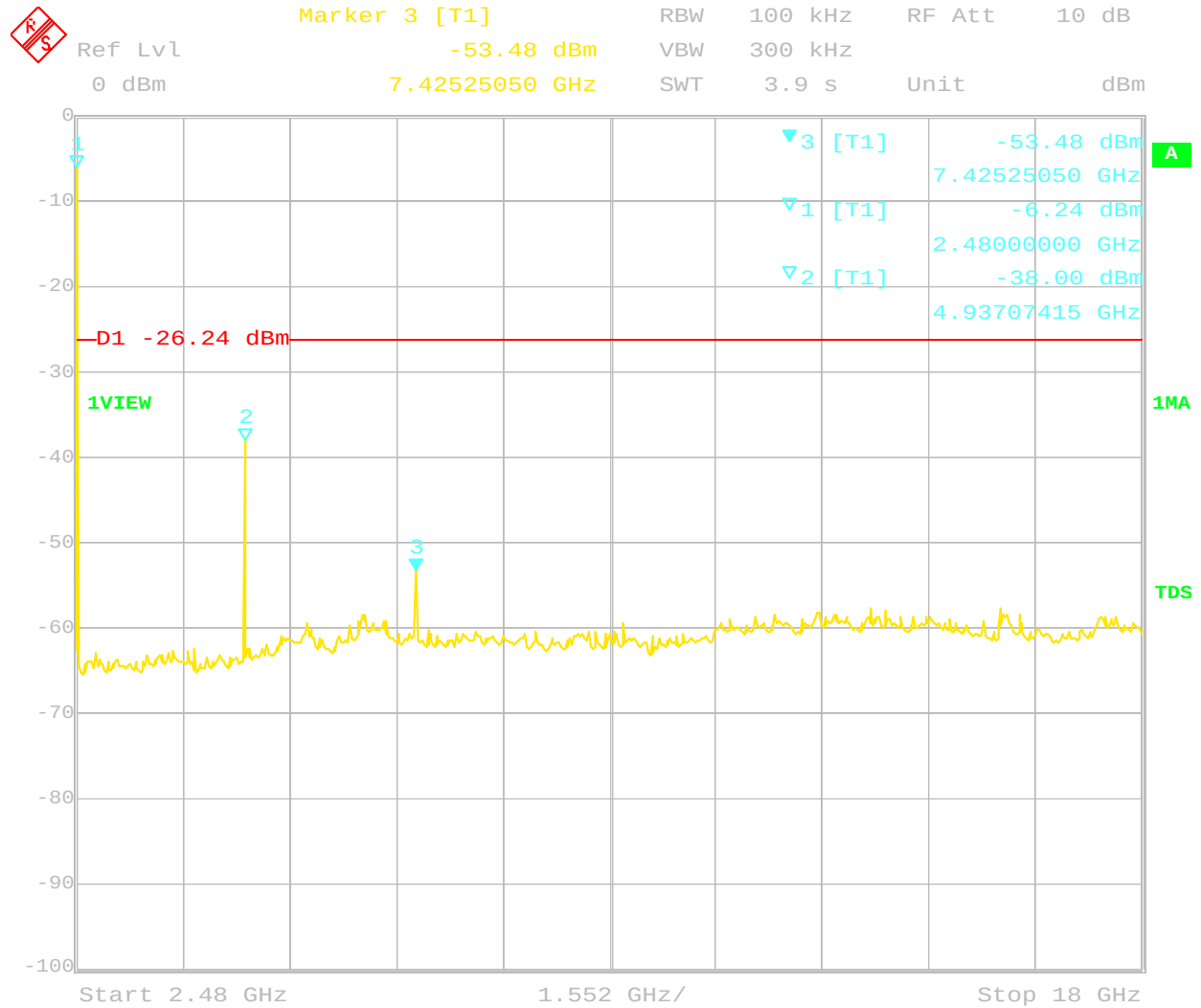


Date: 18.JUL.2014 11:03:13

High Channel Antenna Port Conducted Emissions (2.480-18 GHz), 100kHz ResBW

Emissions were detected as shown in plot below

Limit line = 20 dB below Fund.

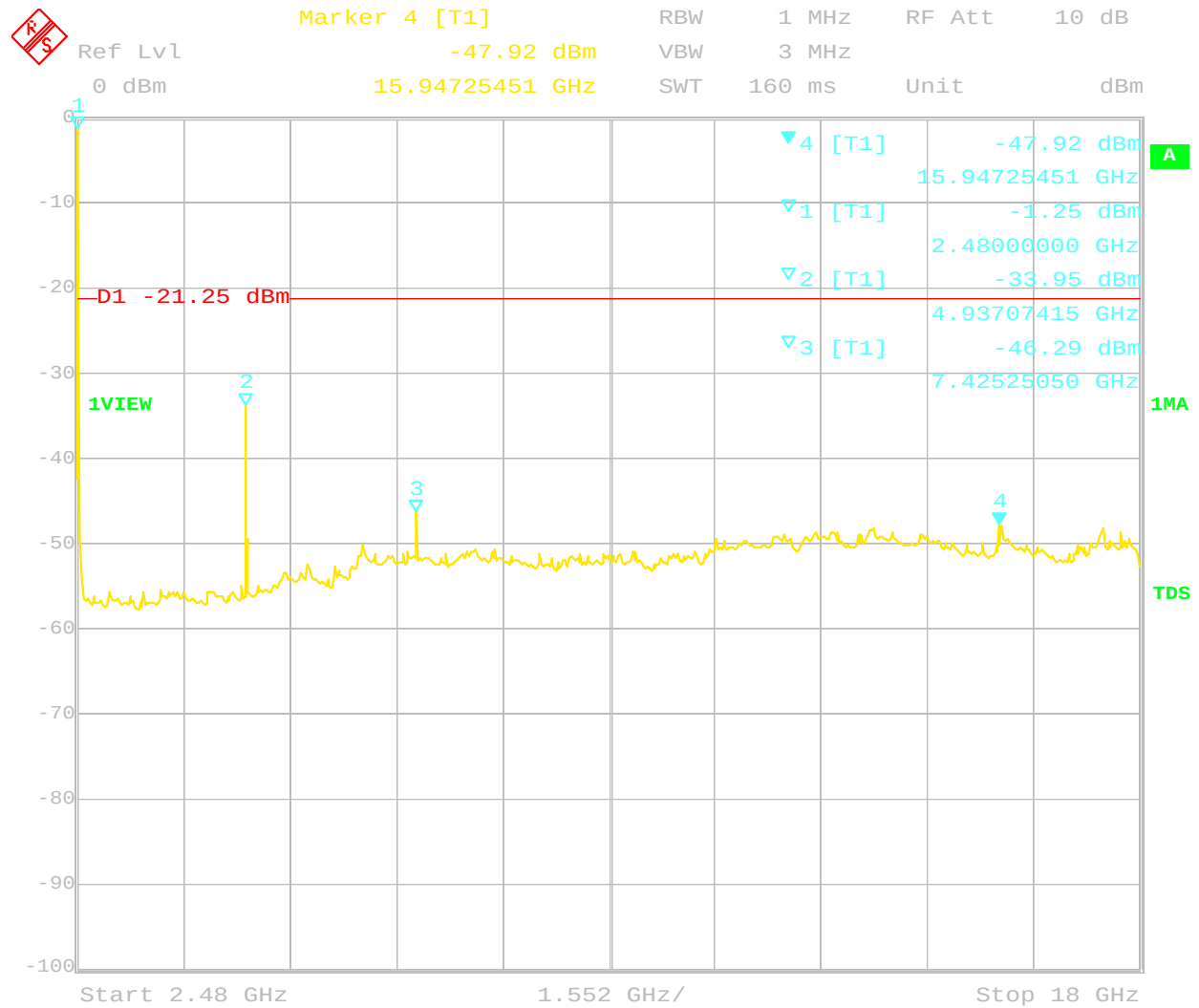


Date: 18.JUL.2014 11:13:25

### High Channel Antenna Port Conducted Emissions (2.480-18 GHz), 1MHz ResBW

Emissions were detected as shown in plot below

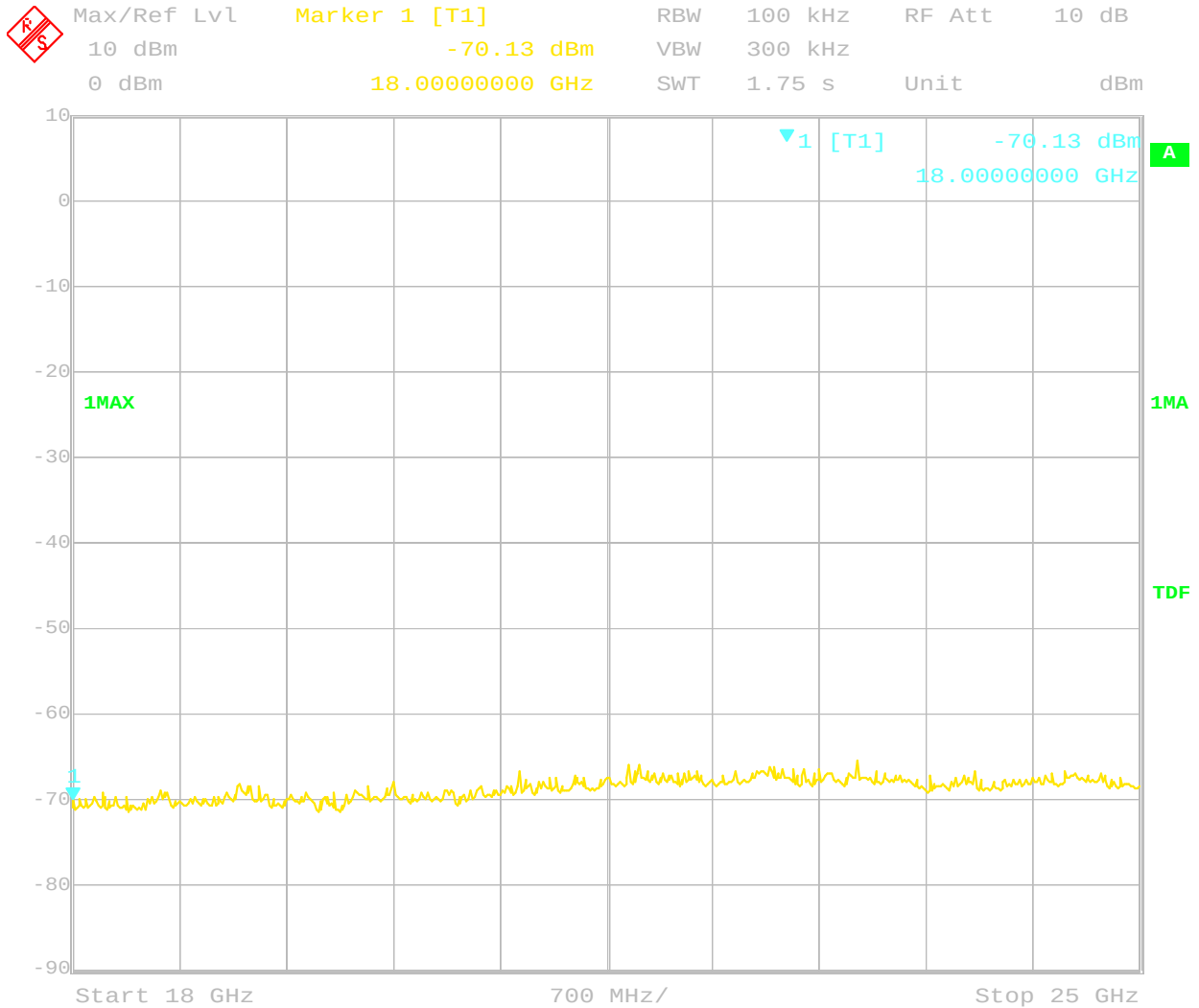
Limit line = 20 dB below Fund.



Date: 18.JUL.2014 11:19:23

High Channel Antenna Port Conducted Emissions (18-25 GHz)

No emissions were detected



Date: 18.JUL.2014 14:52:11

Test Personnel: Kouma Sinn *KPS*  
 Supervising/Reviewing Engineer: Vathana Ven *VSV*  
 (Where Applicable) N/A

Test Date: 07/15/2014, 7/18/2014

Product Standard: FCC Part 15.247, RSS-210 Annex 8  
 Input Voltage: 120VAC/60Hz  
 Pretest Verification w/ Ambient Signals or BB Source: Ambient Signals

Limit Applied: Emissions below the limits specified in Section 7.3  
 Ambient Temperature: 22, 24, 21 °C  
 Relative Humidity: 44, 45, 64 %  
 Atmospheric Pressure: 1000, 999, 1012 mbars

Deviations, Additions, or Exclusions: None

## 8 6 dB Bandwidth & 99% Power Bandwidth

### 8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10:2009, and RSS-210 Annex 8.

**TEST SITE:** EMC Lab

**The EMC Lab** has two Semi-anechoic Chambers 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.

### 8.2 Test Equipment Used:

| Asset   | Description                     | Manufacturer      | Model           | Serial      | Cal Date   | Cal Due    |
|---------|---------------------------------|-------------------|-----------------|-------------|------------|------------|
| DAV004' | Weather Station                 | Davis Instruments | 7400            | PE80529A61A | 09/25/2012 | 09/25/2014 |
| REA006' | 18GHz High Pass Filter          | Reactel, Inc      | 7HS-18G/40G K11 | (06)1       | 08/08/2012 | 08/08/2014 |
| CBL030' | High Frequency Cable 40GHz      | Megaphase         | TM40 K1K1 80    | CBL030      | 04/05/2014 | 04/05/2015 |
| ROS001' | Spectrum Analyzer 20Hz - 40 GHz | Rohde & Schwartz  | FSEK-30         | 100225      | 05/19/2014 | 05/19/2015 |
| WEI8'   | Attenuator                      | Weinschel Corp    | 47-10-34        | BD8309      | 03/26/2014 | 03/26/2015 |

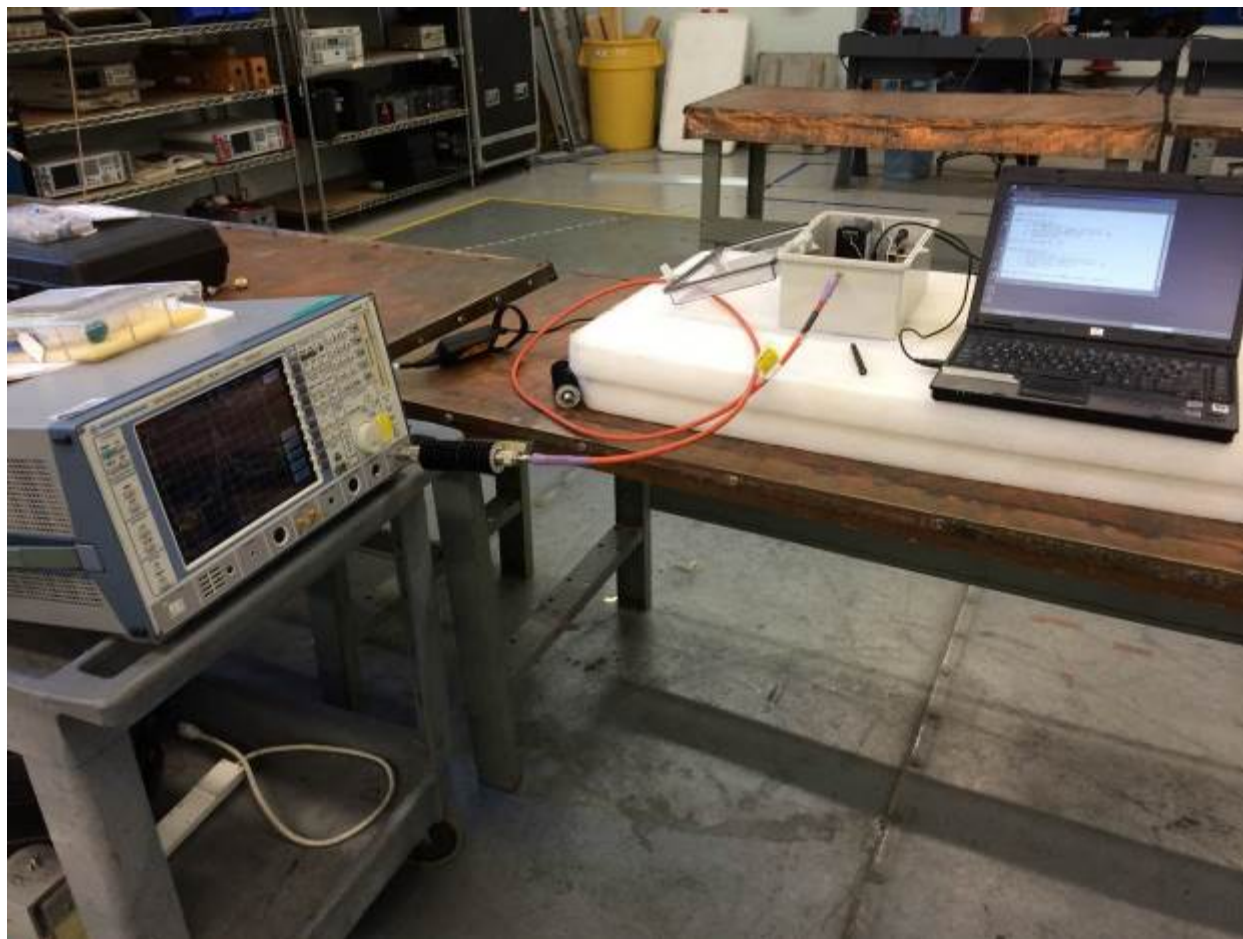
#### Software Utilized:

| Name | Manufacturer | Version |
|------|--------------|---------|
| None |              |         |

### 8.3 Results:

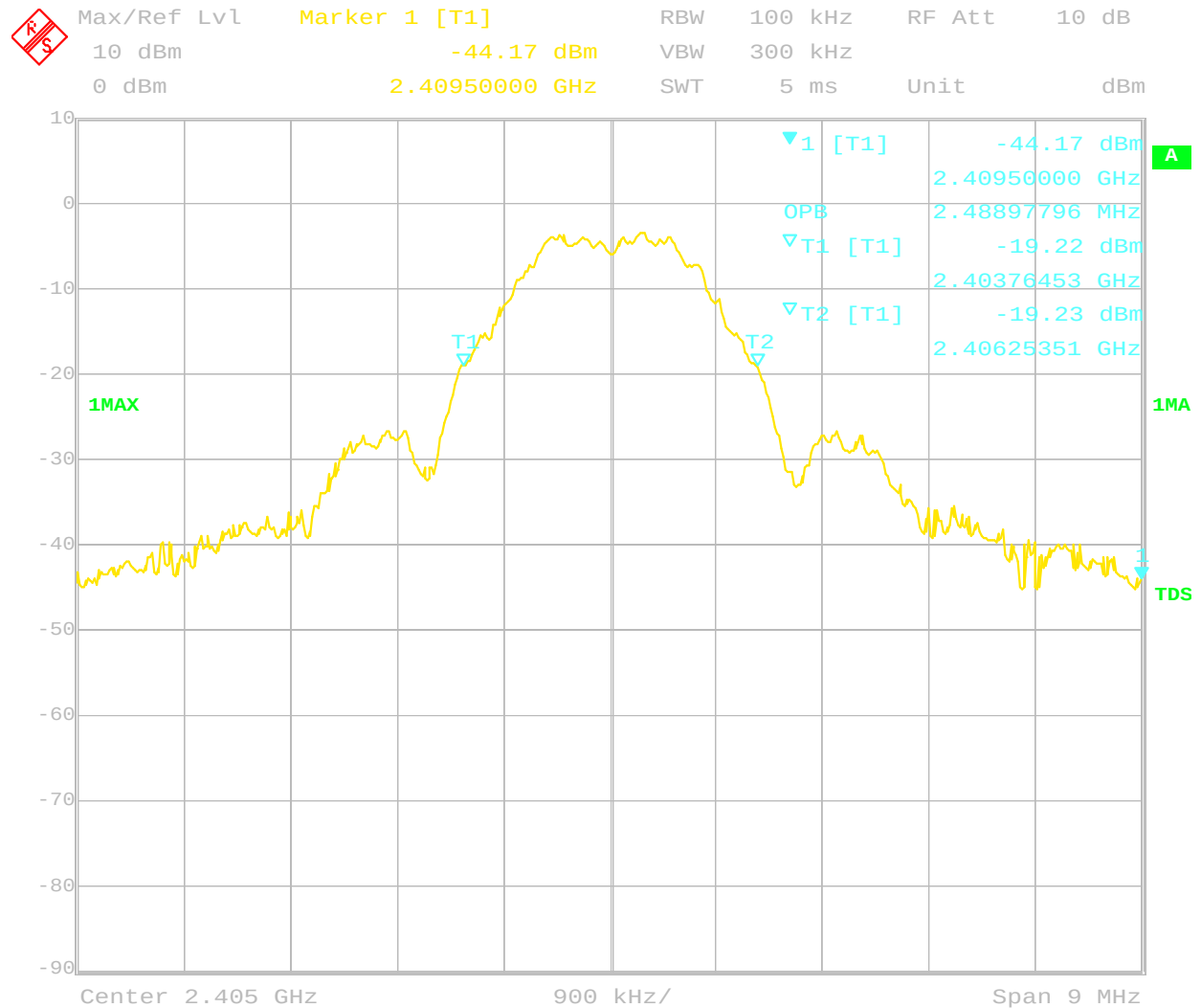
The sample tested was found to Comply. The 99% power bandwidth, or 6 dB bandwidth, must not be less than 500 kHz.

Plots were taken using a RBW of 100 kHz per KDB 558074v03 04/09/2013 and IC RSS-Gen Section 4.6.2.

**8.4 Setup Photograph:**

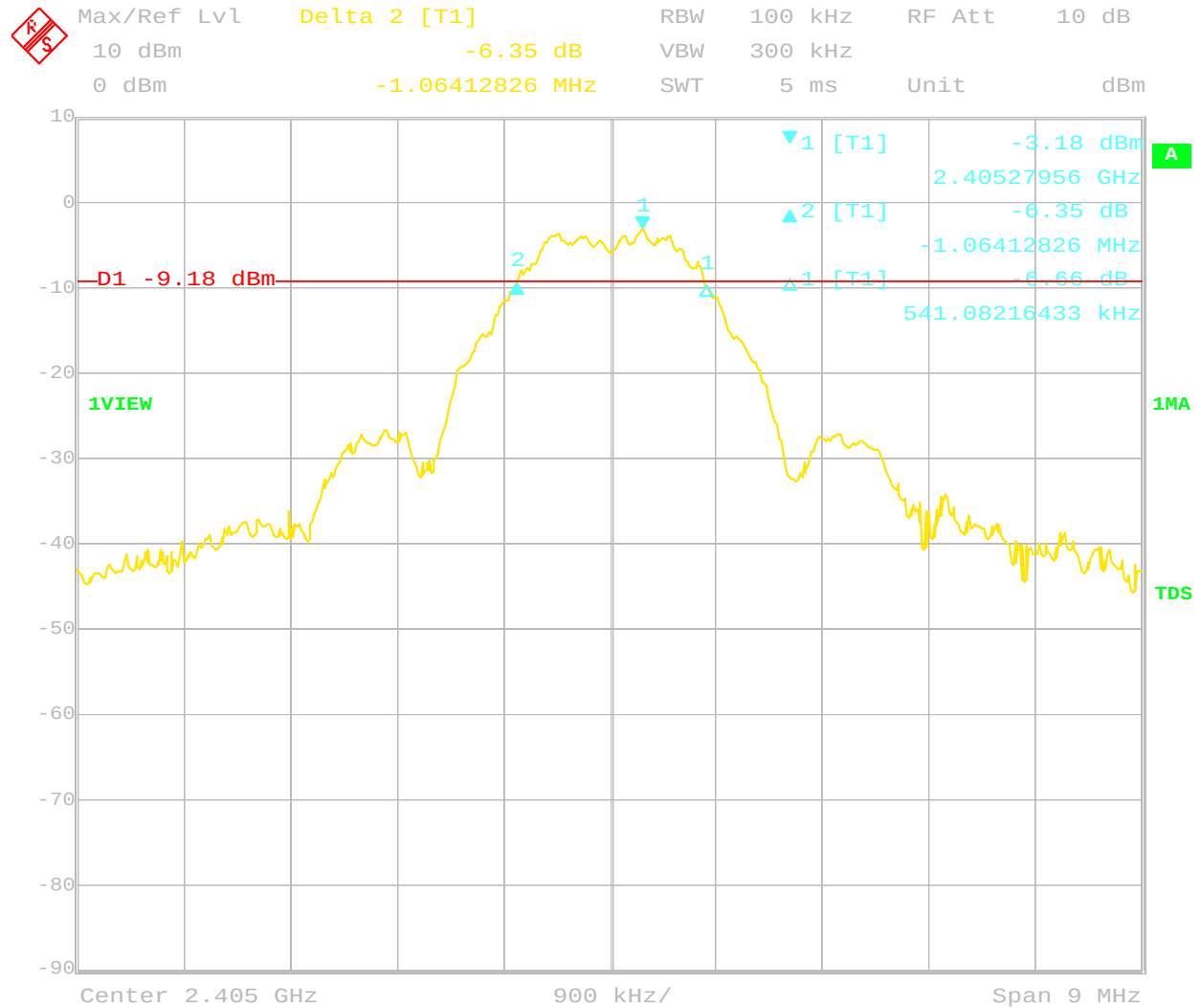
## 8.5 Plots/Data:

Low Channel, 99% Power BW = 2.489 MHz



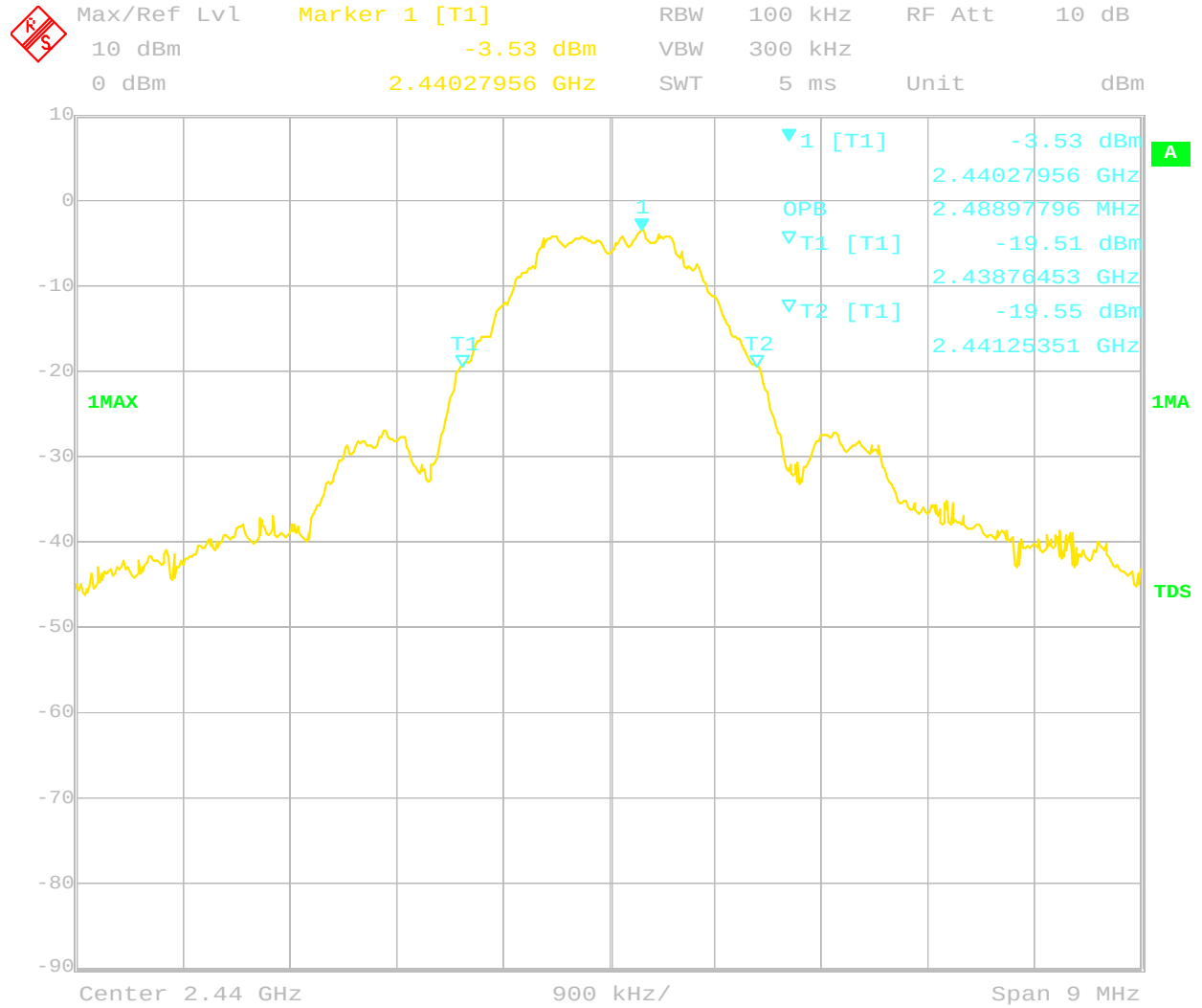
Date: 18.JUL.2014 13:00:26

Low Channel, 6dB BW = 1.605 MHz



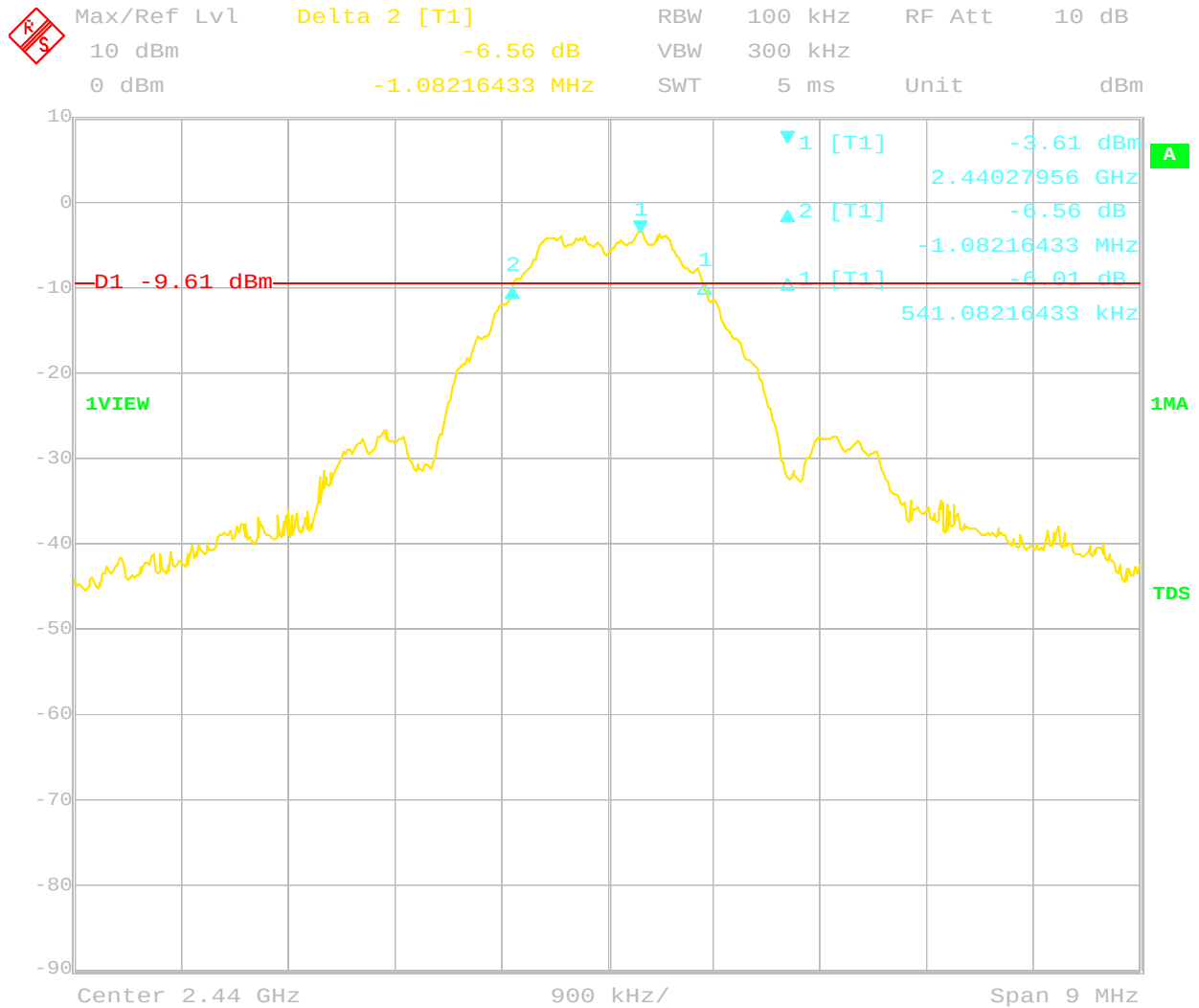
Date: 18.JUL.2014 13:04:46

Mid Channel, 99% Power BW = 2.489 MHz



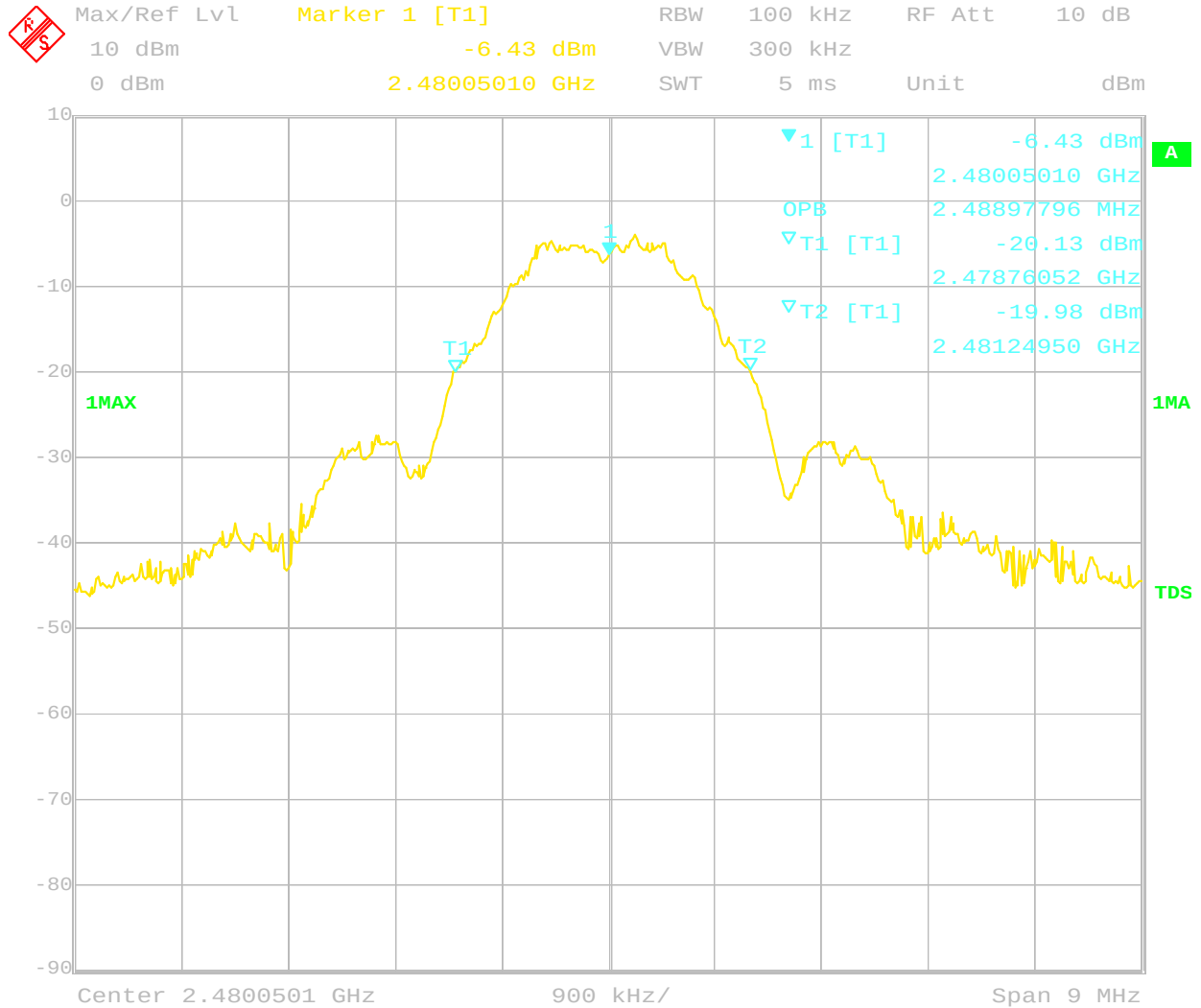
Date: 18.JUL.2014 12:57:15

Mid Channel, 6dB BW = 1.623 MHz



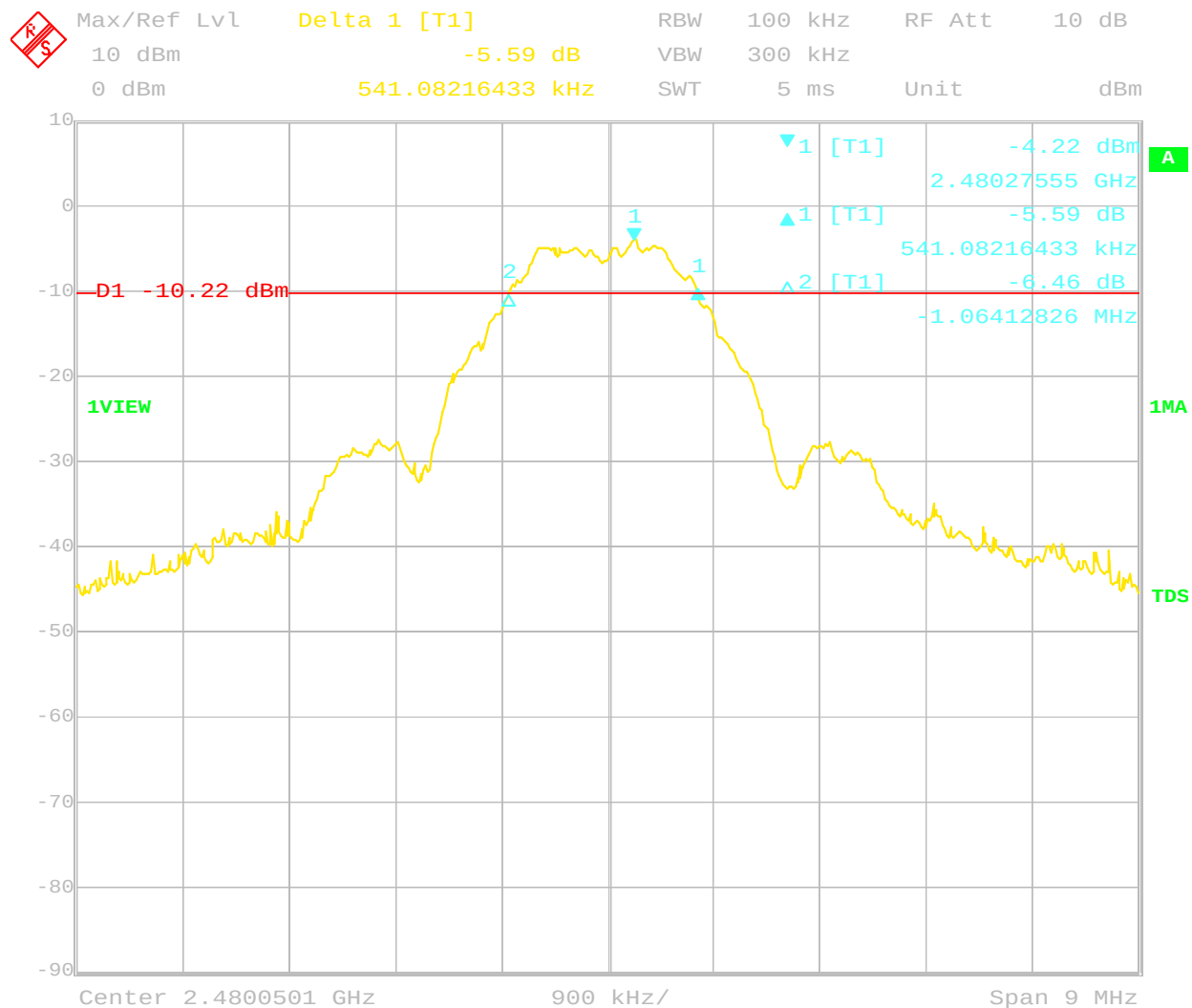
Date: 18.JUL.2014 12:54:21

High Channel, 99% Power BW = 2.489 MHz



Date: 18.JUL.2014 12:48:31

High Channel, 6dB BW = 1.605 MHz



Date: 18. JUL. 2014 12:51:23

Test Personnel: Kouma Sinn *KPS*  
Supervising/Reviewing Engineer:  
(Where Applicable) N/A  
Product Standard: FCC Part 15.247,  
RSS-210 Annex 8  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/  
Ambient Signals or  
BB Source: Ambient Signals

Test Date: 7/18/2014

Limit Applied: Emissions below the limits  
specified in Section 8.3  
Ambient Temperature: 21 °C  
Relative Humidity: 64 %  
Atmospheric Pressure: 1012 mbars

Deviations, Additions, or Exclusions: None

## 9 Power Spectral Density

### 9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10:2009, and RSS-210 Annex 8.

**TEST SITE:** EMC Lab & 10m ALSE

**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.

**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) | Ucisp |
|-------------------------|-----------------|----------------------------|-------|
| Radiated Emissions, 10m | 30-1000 MHz     | 4.6                        | 6.3   |
| Radiated Emissions, 3m  | 30-1000 MHz     | 5.3                        | 6.3   |
| Radiated Emissions, 3m  | 1-6 GHz         | 4.5                        | 5.2   |
| Radiated Emissions, 3m  | 6-15 GHz        | 5.2                        | 5.5   |
| Radiated Emissions, 3m  | 15-18 GHz       | 5.0                        | 5.5   |
| Radiated Emissions, 3m  | 18-40 GHz       | 5.0                        | 5.5   |

### 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 dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- 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 dB $\mu$ V 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

#### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

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.

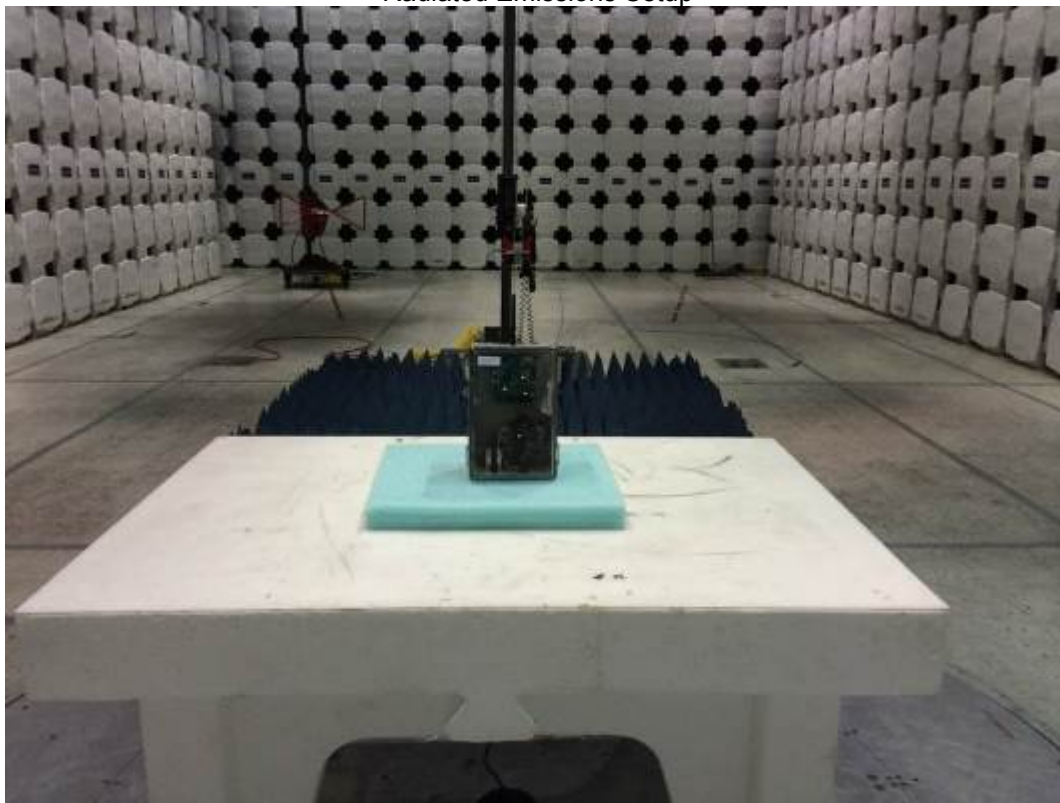
| Asset   | Description                            | Manufacturer      | Model             | Serial      | Cal Date   | Cal Due    |
|---------|----------------------------------------|-------------------|-------------------|-------------|------------|------------|
| DAV004  | Weather Station                        | Davis Instruments | 7400              | PE80529A61A | 09/25/2012 | 09/25/2014 |
| REA006  | 18GHz High Pass Filter                 | Reactel, Inc      | 7HS-18G/40G K11   | (06)1       | 08/08/2012 | 08/08/2014 |
| CBL030  | High Frequency Cable 40GHz             | Megaphase         | TM40 K1K1 80      | CBL030      | 04/05/2014 | 04/05/2015 |
| ROS001  | Spectrum Analyzer 20Hz - 40 GHz        | Rohde & Schwartz  | FSEK-30           | 100225      | 05/19/2014 | 05/19/2014 |
| WEI8    | Attenuator                             | Weinschel Corp    | 47-10-34          | BD8309      | 03/26/2014 | 03/26/2015 |
| MAN1    | Digital 4 Line Barometer               | Mannix            | OABA116           | MAN1        | 08/13/2012 | 08/13/2014 |
| ETS001  | 1-18GHz DRG Horn Antenna               | ETS-Lindgren      | 3117              | 00143259    | 01/06/2014 | 01/06/2015 |
| 145-416 | Cables 145-400 145-402 145-404 145-408 | Huber & Suhner    | 3m Track B cables | multiple    | 10/04/2013 | 10/04/2014 |
| 145128  | EMI Receiver (20 Hz - 40 Ghz)          | Rohde & Schwarz   | ESIB 40           | 839283/001  | 03/17/2014 | 03/17/2015 |

| Name | Manufacturer | Version |
|------|--------------|---------|
| None |              |         |

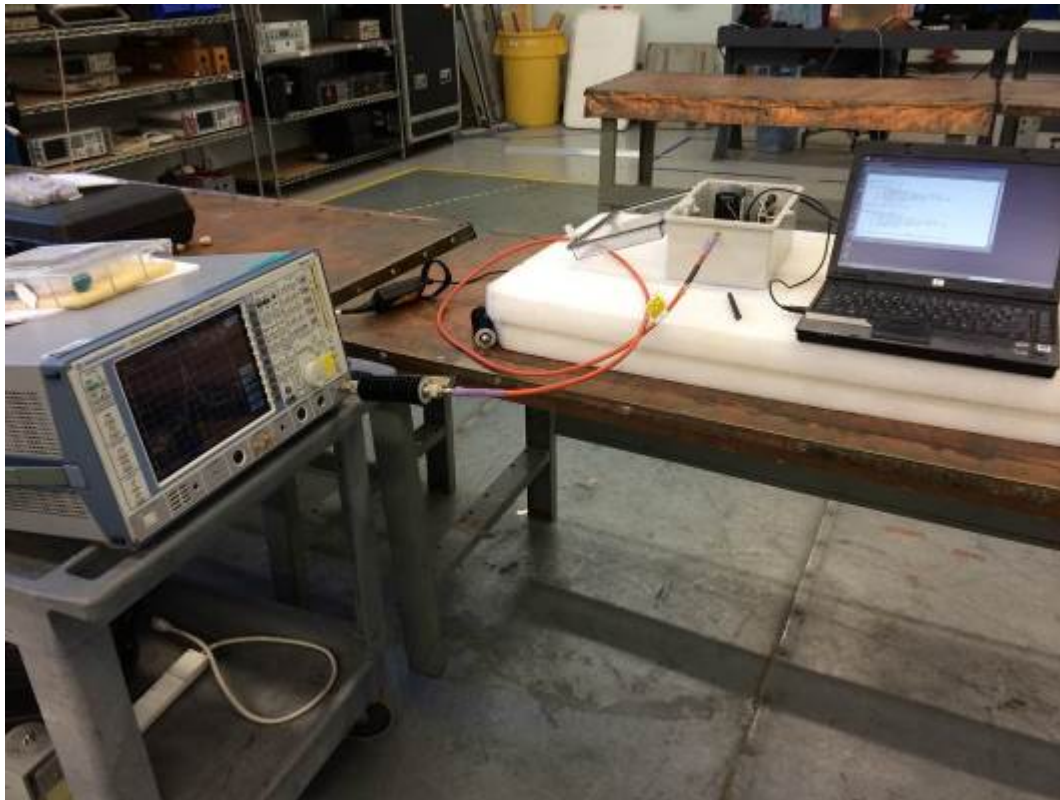
**9.3** The sample tested was found to Comply. The peak power spectral density must not exceed 8 dBm in any 3 kHz bandwidth using the methods of ANSI C63.10:2009.

#### 9.4 Setup Photographs:

Radiated Emissions Setup



Antenna Port Conducted Emissions



## 9.5 Test Data:

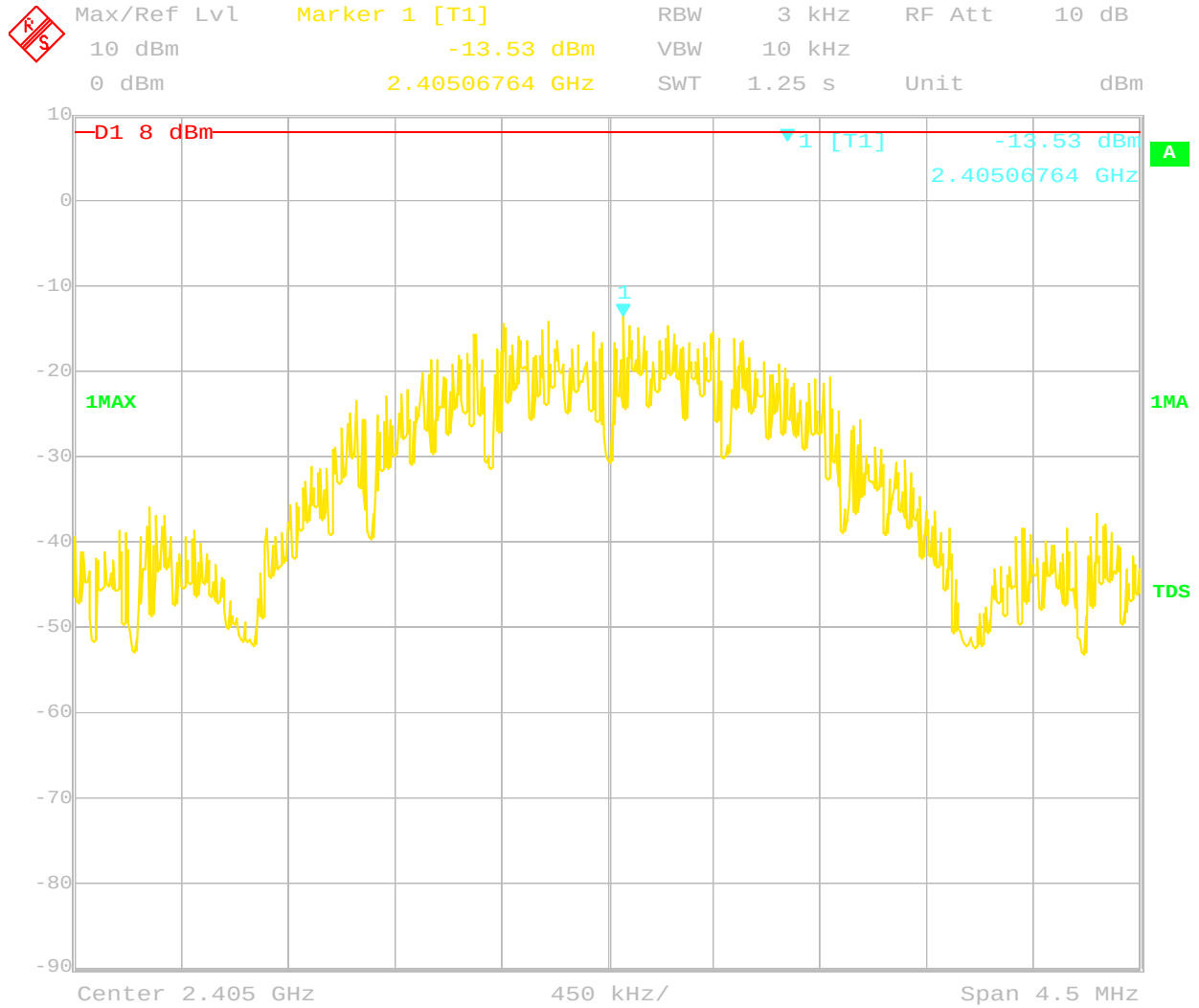
### Low, Mid, and High Channel Radiated Spectral Density

Company: Opex  
 Model #: 2048910  
 Serial #: BOX1503021541-001  
 Engineers: Kouma Sinn  
 Project #: G101718120  
 Standard: FCC Part 15 Subpart C 15.247  
 Receiver: 145-128  
 PreAmp: NONE.  
 PreAmp Used? (Y or N): N  
 Antenna & Cables: LF Bands: N, LF, HF, SHF  
 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt  
 Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.  
 Location: 10m  
 Barometer: MAN1  
 Filter: NONE  
 Date(s): 07/15/14  
 Temp/Humidity/Pressure: 24C 45% 999mbar  
 Limit Distance (m): 3  
 Test Distance (m): 3  
 Voltage/Frequency: 120VAC/60Hz  
 Frequency Range: Fundamental Frequencies  
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)  
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

| Detector Type                                                        | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dBm | Limit dBm | Margin dB | Bandwidth |
|----------------------------------------------------------------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|---------|-----------|-----------|-----------|
| Spectral Density = Peak Reading - 95.22. At 3 meters with no pre-amp |                 |               |                |                        |               |                   |                    |         |           |           |           |
| PK                                                                   | V               | 2405.000      | 46.29          | 32.11                  | 5.92          | 0.00              | 0.00               | -10.90  | 8.00      | -18.90    | 3/30kHz   |
| PK                                                                   | H               | 2405.000      | 41.13          | 32.11                  | 5.92          | 0.00              | 0.00               | -16.06  | 8.00      | -24.06    | 3/30kHz   |
| Spectral Density = Peak Reading - 95.22. At 3 meters with no pre-amp |                 |               |                |                        |               |                   |                    |         |           |           |           |
| PK                                                                   | V               | 2440.000      | 45.70          | 32.20                  | 5.98          | 0.00              | 0.00               | -11.34  | 8.00      | -19.34    | 3/30kHz   |
| PK                                                                   | H               | 2440.000      | 36.40          | 32.20                  | 5.98          | 0.00              | 0.00               | -20.64  | 8.00      | -28.64    | 3/30kHz   |
| Spectral Density = Peak Reading - 95.22. At 3 meters with no pre-amp |                 |               |                |                        |               |                   |                    |         |           |           |           |
| PK                                                                   | V               | 2480.000      | 43.12          | 32.30                  | 6.06          | 0.00              | 0.00               | -13.74  | 8.00      | -21.74    | 3/30kHz   |
| PK                                                                   | H               | 2480.000      | 35.77          | 32.30                  | 6.06          | 0.00              | 0.00               | -21.09  | 8.00      | -29.09    | 3/30kHz   |

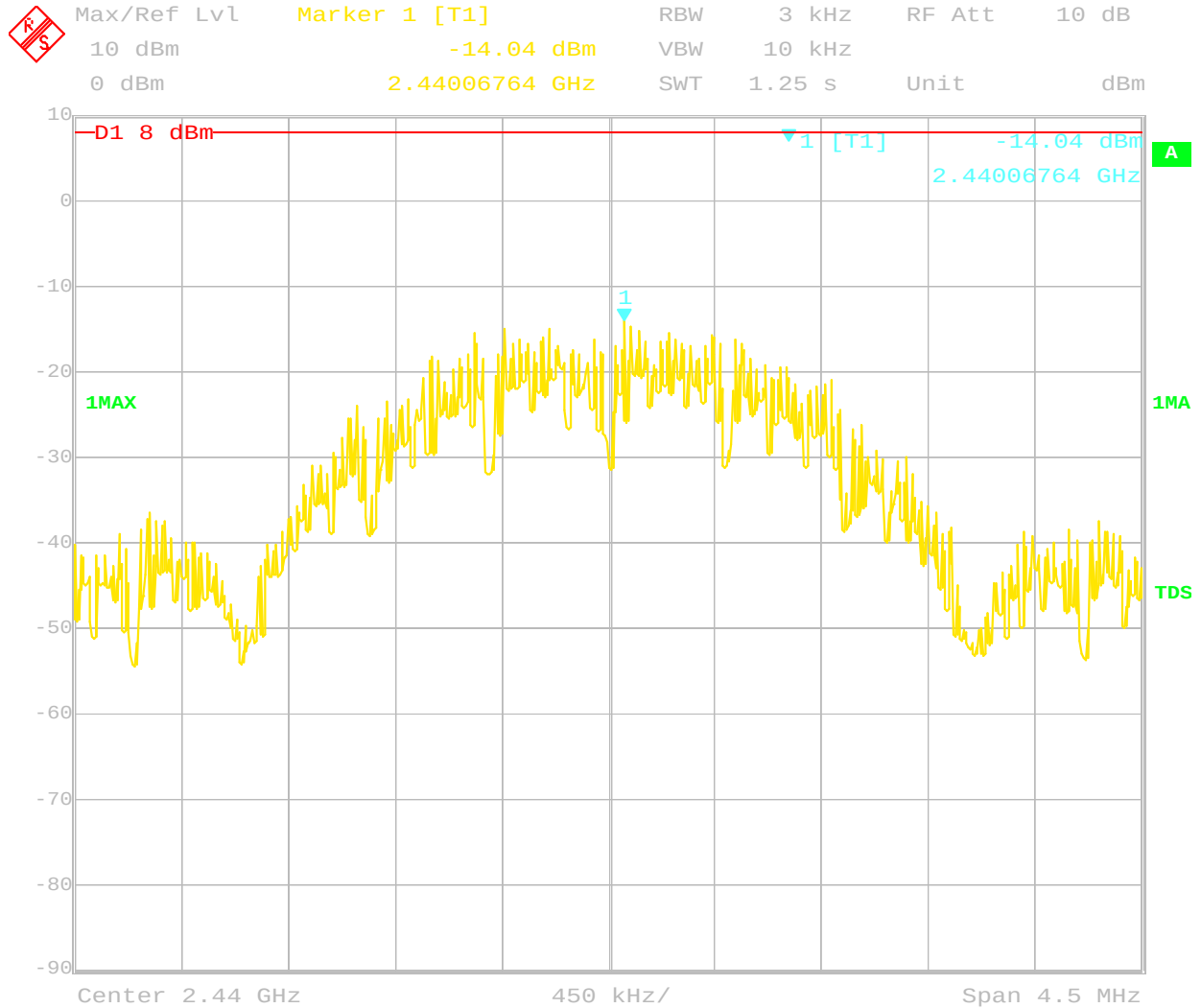
FCC IC

Low Channel Antenna Port Conducted Spectral Density



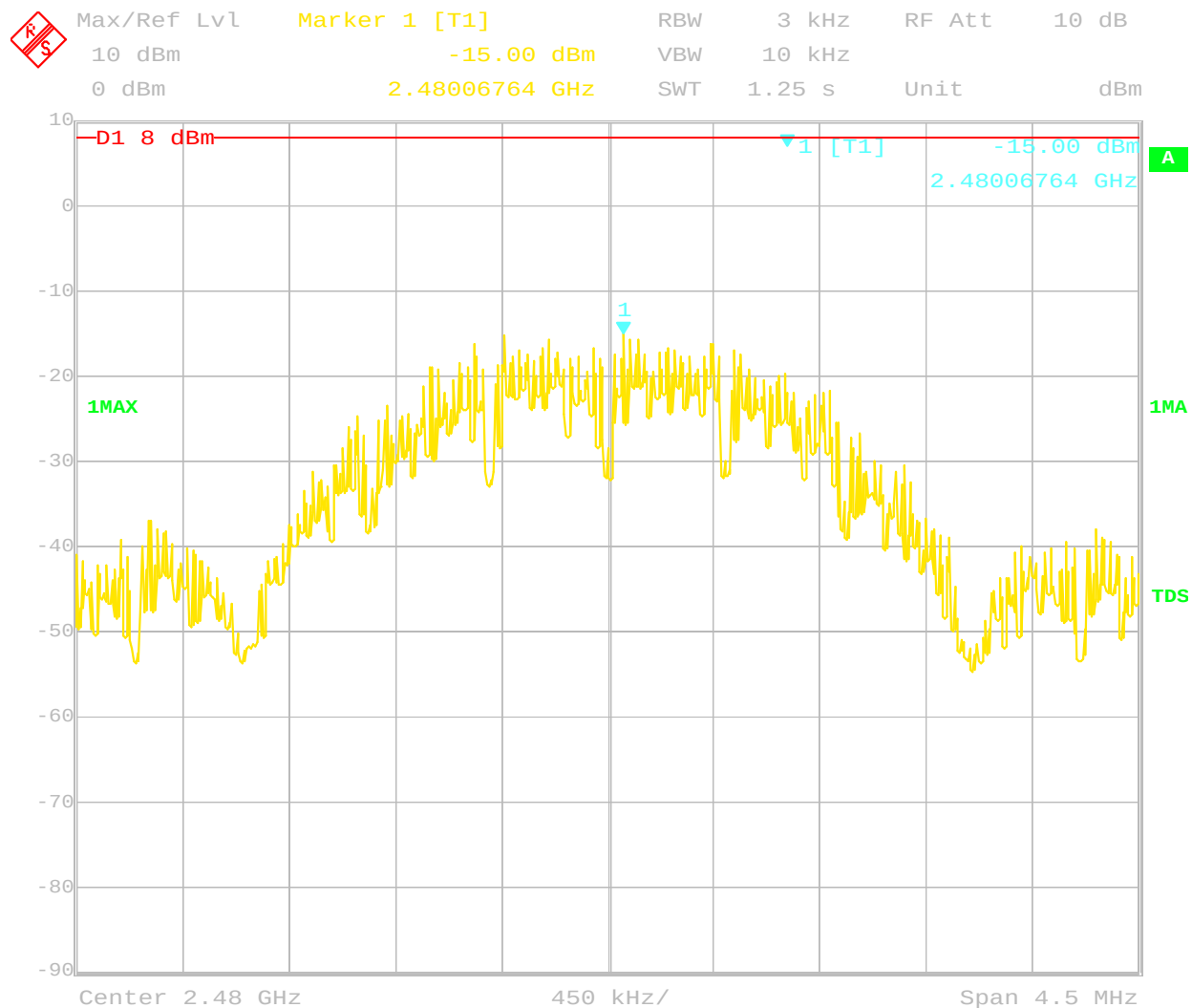
Date: 18.JUL.2014 14:01:03

Mid Channel Antenna Port Conducted Spectral Density



Date: 18.JUL.2014 14:04:35

## High Channel Antenna Port Conducted Spectral Density



Date: 18. JUL. 2014 14:07:18

Test Personnel: Kouma Sinn *KPS*  
Supervising/Reviewing Engineer:  
(Where Applicable) N/A

Test Date: 07/18/2014

Product Standard: FCC Part 15.247,  
RSS-210 Annex 8  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/  
Ambient Signals or  
BB Source: Ambient Signals

Limit Applied: Emissions below the limits  
specified in Section 9.3  
Ambient Temperature: 21 °C  
Relative Humidity: 64 %  
Atmospheric Pressure: 1012 mbars

Deviations, Additions, or Exclusions: None

## 10 Band-edge Compliance

### 10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.4:2009, ANSI C63.10:2013, KDB558074 V03:2013, and RSS-210 Annex 8.

**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) | Ucisp |
|-------------------------|-----------------|----------------------------|-------|
| Radiated Emissions, 10m | 30-1000 MHz     | 4.6                        | 6.3   |
| Radiated Emissions, 3m  | 30-1000 MHz     | 5.3                        | 6.3   |
| Radiated Emissions, 3m  | 1-6 GHz         | 4.5                        | 5.2   |
| Radiated Emissions, 3m  | 6-15 GHz        | 5.2                        | 5.5   |
| Radiated Emissions, 3m  | 15-18 GHz       | 5.0                        | 5.5   |
| Radiated Emissions, 3m  | 18-40 GHz       | 5.0                        | 5.5   |

### 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 dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- 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 dB $\mu$ V 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

#### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

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.

**10.2 Test Equipment Used:**

| Asset    | Description                            | Manufacturer    | Model             | Serial     | Cal Date   | Cal Due    |
|----------|----------------------------------------|-----------------|-------------------|------------|------------|------------|
| ETS001'  | 1-18GHz DRG Horn Antenna               | ETS Lindgren    | 3117              | 00143259   | 01/14/2015 | 01/14/2016 |
| 145014'  | Preamplifier (1 GHz to 26.5 GHz)       | Hewlett Packard | 8449B             | 3008A00232 | 05/05/2014 | 05/05/2015 |
| 145128'  | EMI Receiver (20 Hz - 40 Ghz)          | Rohde & Schwarz | ESIB 40           | 839283/001 | 03/14/2015 | 03/14/2016 |
| 145-416' | Cables 145-400 145-402 145-404 145-408 | Huber + Suhner  | 3m Track B cables | multiple   | 10/04/2014 | 10/04/2015 |

**Software Utilized:**

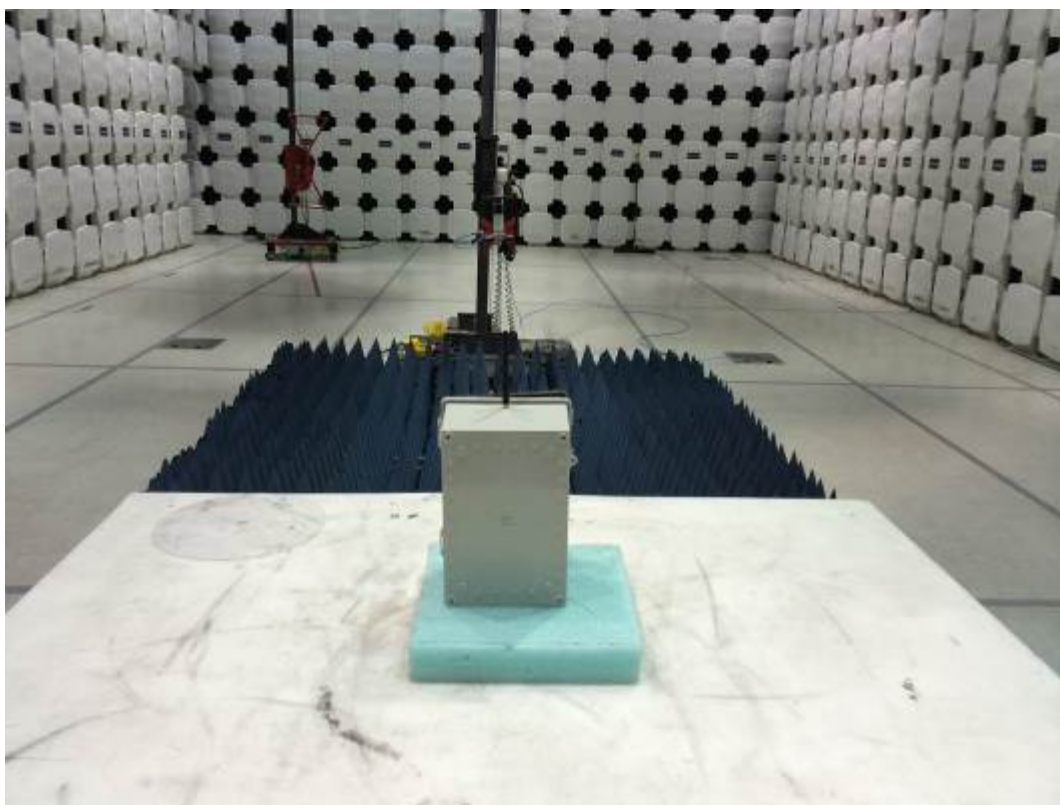
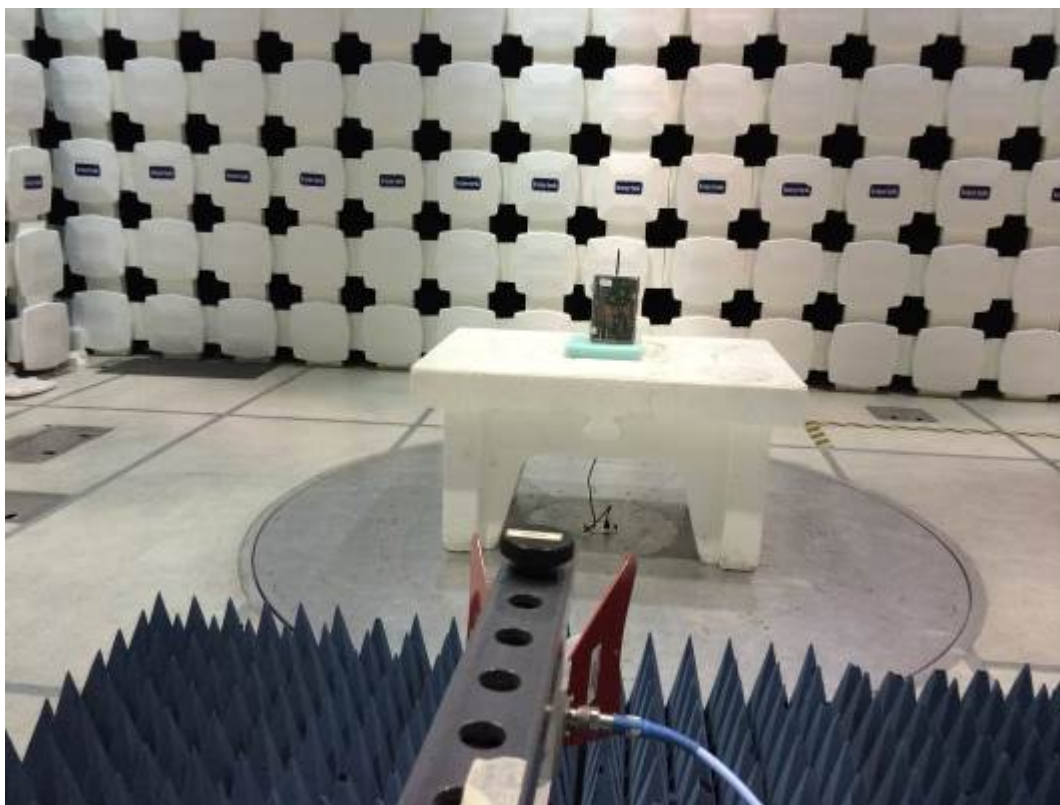
| Name               | Manufacturer | Version            |
|--------------------|--------------|--------------------|
| Excel 2003         | Microsoft    | (11.8231.8221) SP3 |
| EMI Buxborough.xls | Intertek     | 08/27/10           |

**10.3 Results:**

The sample tested was found to Comply.

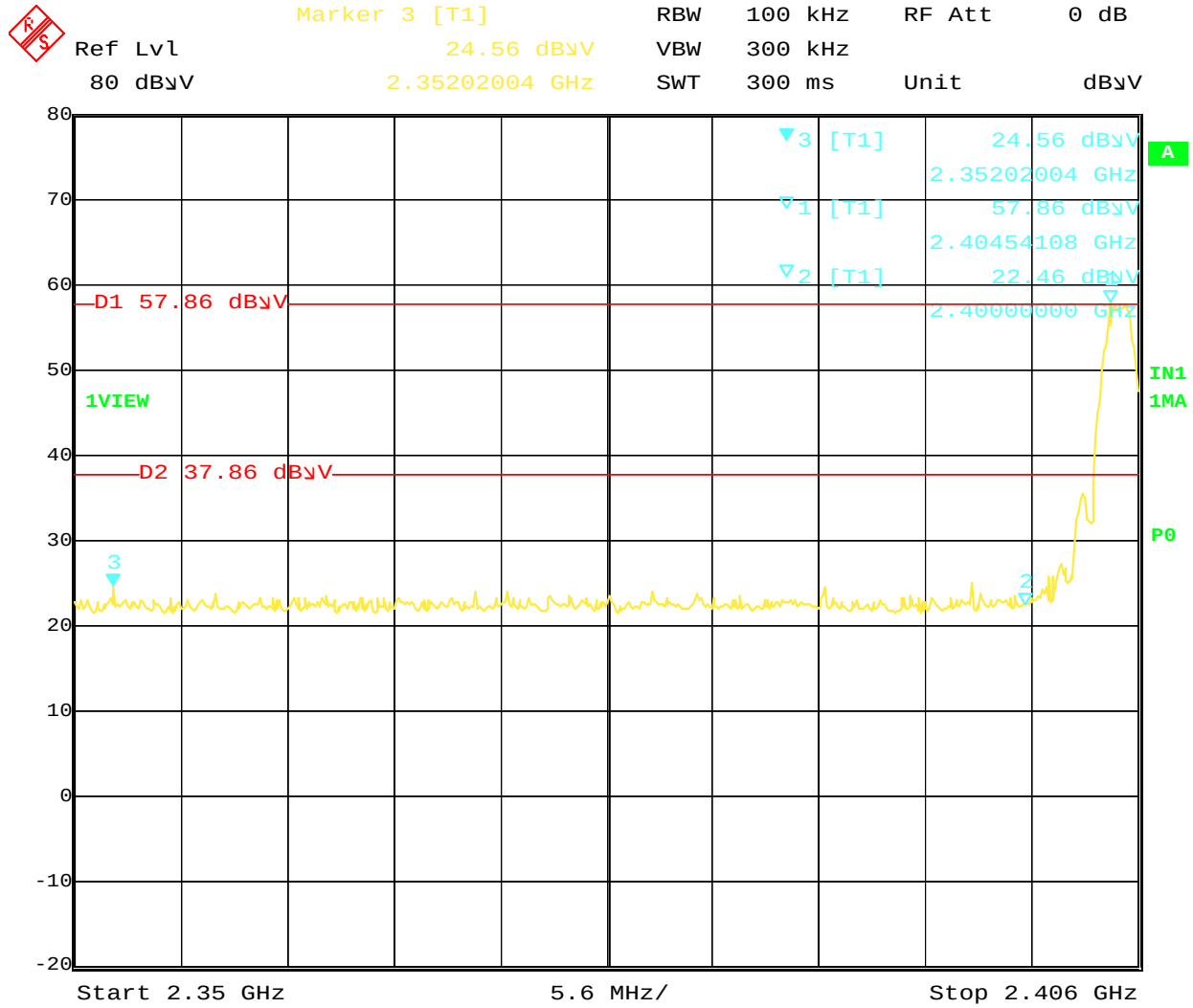
Spurious emissions at the band edges must be at least 20 dB lower than the fundamental field strength when measured with a 100 kHz bandwidth, without the need to be below the general limits of FCC Part 15 Section 15.209 and of RSS-Gen 7.2.5 Table 5. Emissions in restricted bands must meet the general limits of FCC Part 15 Section 15.209 and of RSS-Gen 7.2.5 Table 5.

#### 10.4 Setup Photographs:



# 10.5 Test Data:

## Lower Bandedge Compliant



Date: 25.APR.2015 15:45:29

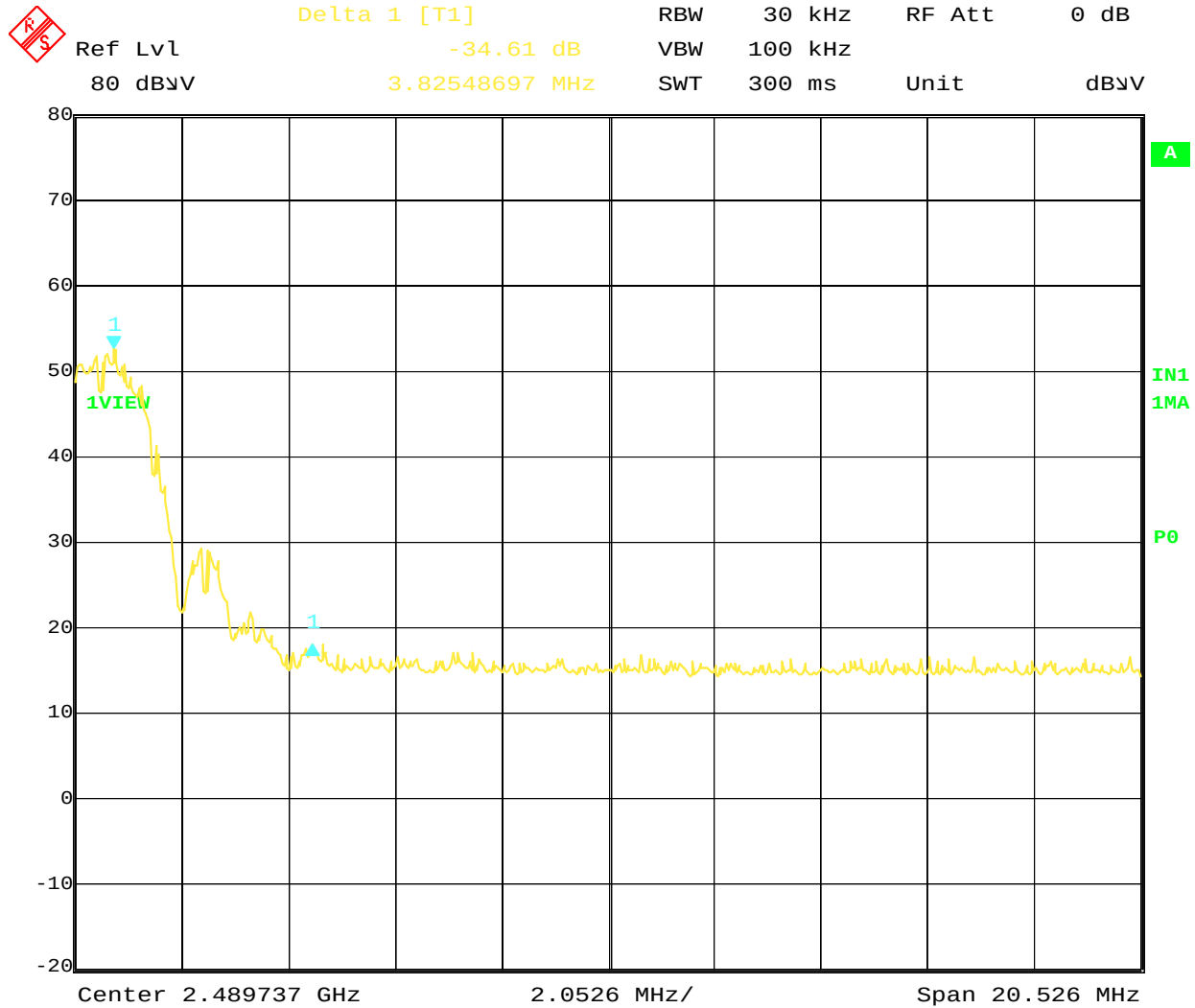
**Upper Bandedge Radiated Emissions**

Company: Opex Corporation      Antenna & Cables: LF      Bands: N, LF, HF, SHF  
 Model #: 2048910      Antenna: ETS001 01-06-15.txt      ETS001 01-06-15.txt  
 Serial #: BOX1503021541-001      Cable(s): 145-416 3m Track B 1-15GHz Cable 10-04-15.txt      NONE.  
 Engineers: Kouma Sinn      Location: 10m Chamber      Barometer: DAV004      Filter: NONE  
 Project #: G102037004      Date(s): 04/25/15  
 Standard: FCC Part 15 Subpart C 15.247      Temp/Humidity/Pressure: 22C      16%      995mbar  
 Receiver: 145128      Limit Distance (m): 3  
 PreAmp: NONE      Test Distance (m): 3  
 PreAmp Used? (Y or N): N      Voltage/Frequency: 120VAC/60Hz      Frequency Range: Band edge  
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)  
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

| Detector Type                                                                                                                          | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB | Bandwidth |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|--------------|----------------|-----------|-----------|
| Upper Band edge - Delta Method Method per ANSI 63.10-2013 Section 6.10.6. Part (a). AVG-AF = PK -9.4 dB                                |                 |               |                |                        |               |                   |                    |              |                |           |           |
| PK                                                                                                                                     | V               | 2483.500      | 39.83          | 32.31                  | 5.99          | 0.00              | 0.00               | 78.12        | --             | --        | 1/3MHz    |
| AVG-AF                                                                                                                                 | V               | 2483.500      | 25.33          | 32.31                  | 5.99          | 0.00              | 0.00               | 63.62        | --             | --        | 1/3MHz    |
| PK                                                                                                                                     | V               | 2484.117      | 37.44          | 32.31                  | 5.99          | 0.00              | 0.00               | 75.74        | --             | --        | 1/3MHz    |
| AVG-AF                                                                                                                                 | V               | 2484.117      | 22.94          | 32.31                  | 5.99          | 0.00              | 0.00               | 61.24        | --             | --        | 1/3MHz    |
| Set the ResBW to 1% the total span to cover the fundamental peak and the emissions in the restricted band of 2483.5-2500 MHz. Part (b) |                 |               |                |                        |               |                   |                    |              |                |           |           |
| PK                                                                                                                                     | V               | 2483.500      | 23.63          | 32.31                  | 5.99          | 0.00              | 0.00               | 61.92        | --             | --        | 30/100kHz |
| PK                                                                                                                                     | V               | 2484.117      | 24.61          | 32.31                  | 5.99          | 0.00              | 0.00               | 62.91        | --             | --        | 30/100kHz |
| PK                                                                                                                                     | V               | 2486.167      | 23.54          | 32.32                  | 5.99          | 0.00              | 0.00               | 61.85        | --             | --        | 30/100kHz |
| PK                                                                                                                                     | V               | 2500.000      | 23.72          | 32.35                  | 6.01          | 0.00              | 0.00               | 62.08        | --             | --        | 30/100kHz |
| The delta from the fundamental peak to the highest peak in the restricted band is -34.64 dB.                                           |                 |               |                |                        |               |                   |                    |              |                |           |           |
| Reading below is: Reading Part a (1MHz ResBW) - Delta (34.64 dB). Part c                                                               |                 |               |                |                        |               |                   |                    |              |                |           |           |
| PK                                                                                                                                     | V               | 2483.500      | 5.19           | 32.31                  | 5.99          | 0.00              | 0.00               | 43.48        | 74.00          | -30.52    | 1/3MHz    |
| AVG-AF                                                                                                                                 | V               | 2483.500      | -9.31          | 32.31                  | 5.99          | 0.00              | 0.00               | 28.99        | 54.00          | -25.01    | 1/3MHz    |
| PK                                                                                                                                     | V               | 2484.117      | 2.80           | 32.32                  | 5.99          | 0.00              | 0.00               | 41.11        | 74.00          | -32.89    | 1/3MHz    |
| AVG-AF                                                                                                                                 | V               | 2484.117      | -11.70         | 32.35                  | 6.01          | 0.00              | 0.00               | 26.66        | 54.00          | -27.34    | 1/3MHz    |

The average factor 14.5 dB was applied to the peak reading to obtain average reading

Delta from fundamental highest peak to highest spurious in the restricted band



Date: 25.APR.2015 14:37:51

Spurious Emissions in the restricted band (2483.5-2500 MHz)



Ref Lvl  
80 dBμV

Marker 2 [T1]

14.63 dBμV

2.50000000 GHz

RBW

30 kHz

RF Att

0 dB

VBW

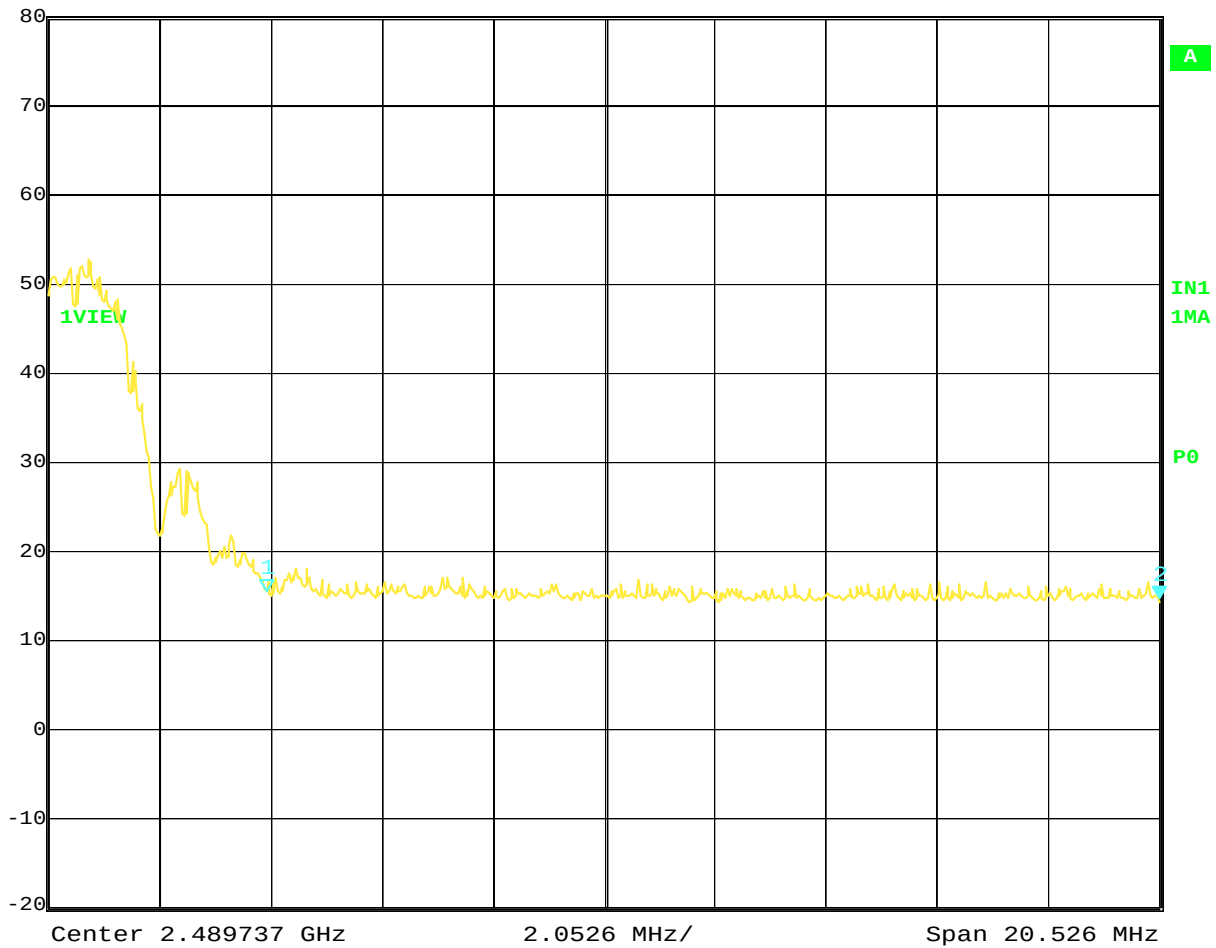
100 kHz

SWT

300 ms

Unit

dBμV

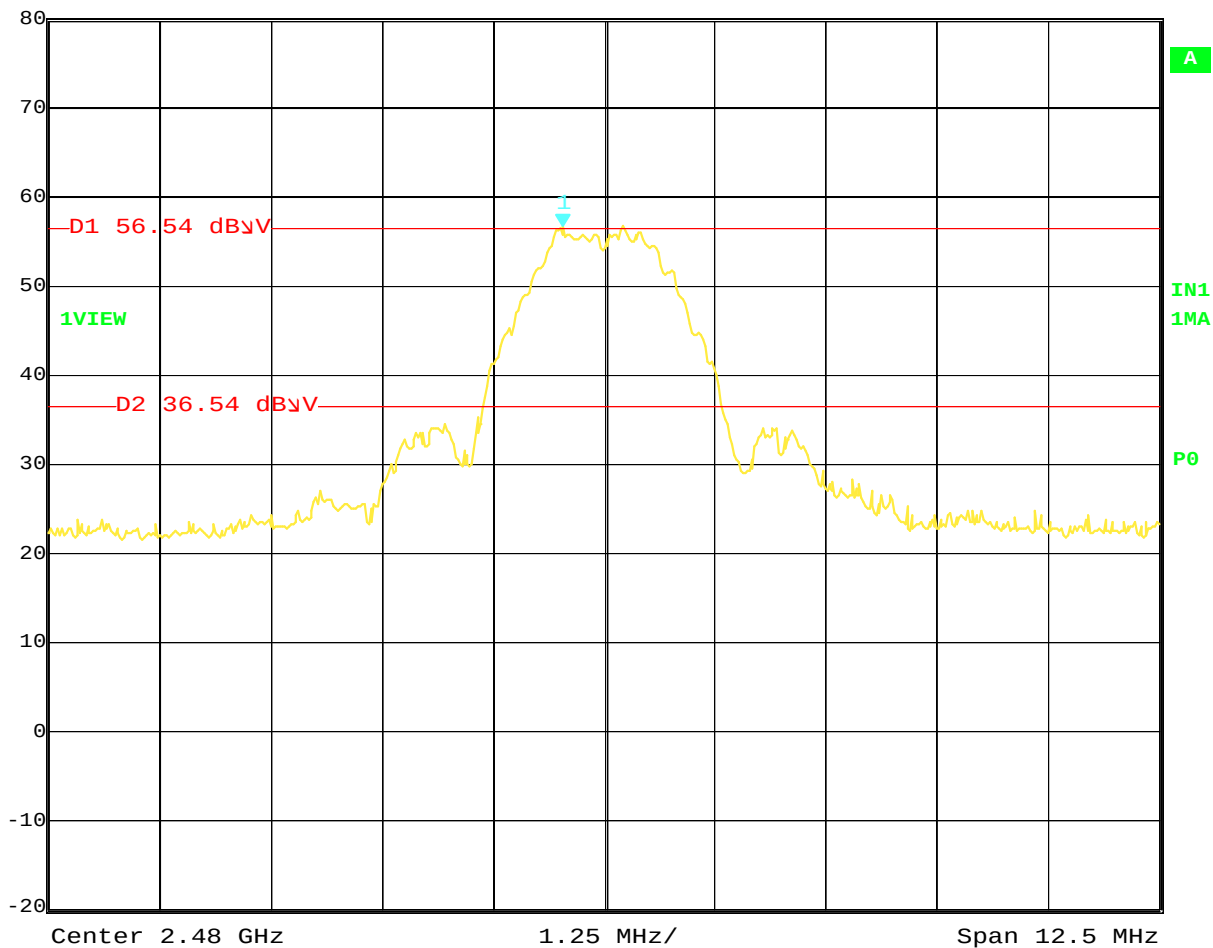


Date: 25.APR.2015 14:35:45

No emissions exceed the 20 dB/below carrier limit



Ref Lvl 80 dBμV  
Marker 1 [T1] 56.54 dBμV  
2.47953657 GHz  
RBW 100 kHz  
VBW 300 kHz  
SWT 300 ms  
RF Att 0 dB  
Unit dBμV



Date: 25.APR.2015 14:19:45

Test Personnel: Kouma Sinn *KPS*  
Supervising/Reviewing Engineer:  
(Where Applicable) N/A

Test Date: 04/26/2015

Product Standard: FCC Part 15.247,  
RSS-210 Annex 8  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/  
Ambient Signals or  
BB Source: Ambient Signals

Limit Applied: Emissions below the limits  
specified in Section 10.3

Ambient Temperature: 22 °C

Relative Humidity: 16 %

Atmospheric Pressure: 995 mbars

## 11 Digital Devices Radiated Spurious Emissions

### 11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, IC ICES-003, and ANSI C63.4:2009.

**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) | Ucisp |
|-------------------------|-----------------|----------------------------|-------|
| Radiated Emissions, 10m | 30-1000 MHz     | 4.6                        | 6.3   |
| Radiated Emissions, 3m  | 30-1000 MHz     | 5.3                        | 6.3   |
| Radiated Emissions, 3m  | 1-6 GHz         | 4.5                        | 5.2   |
| Radiated Emissions, 3m  | 6-15 GHz        | 5.2                        | 5.5   |
| Radiated Emissions, 3m  | 15-18 GHz       | 5.0                        | 5.5   |
| Radiated Emissions, 3m  | 18-40 GHz       | 5.0                        | 5.5   |

### 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 dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- 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 dB $\mu$ V 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

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.

**11.2 Test Equipment Used:**

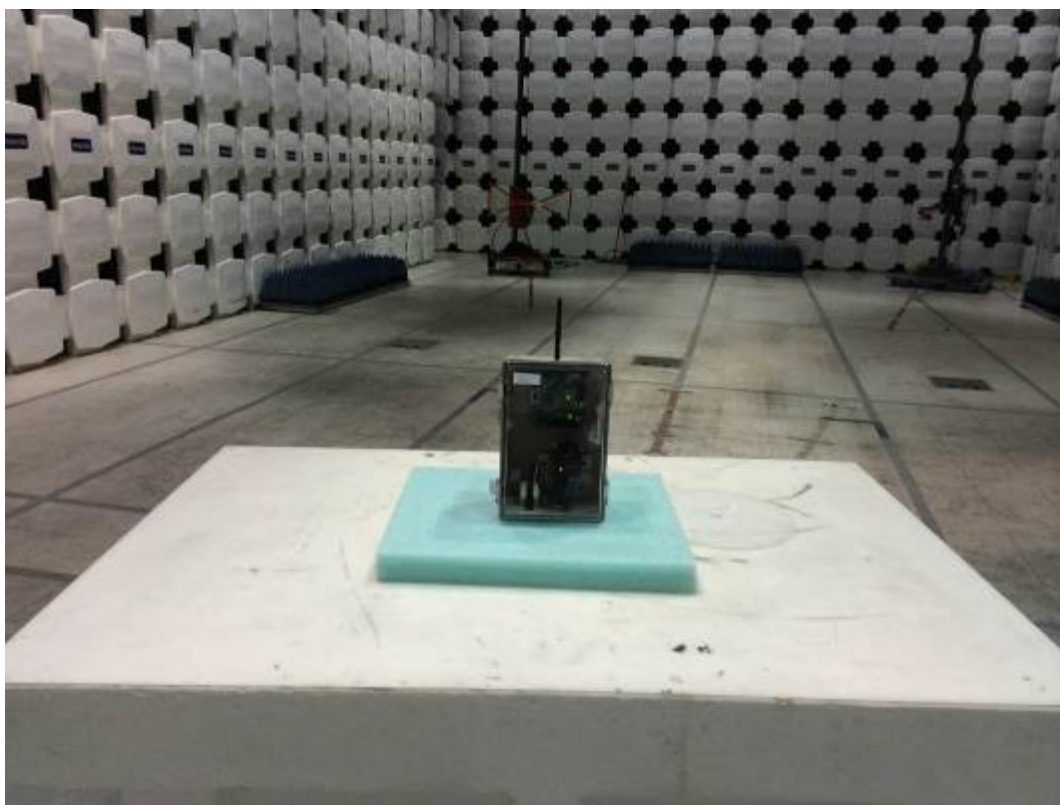
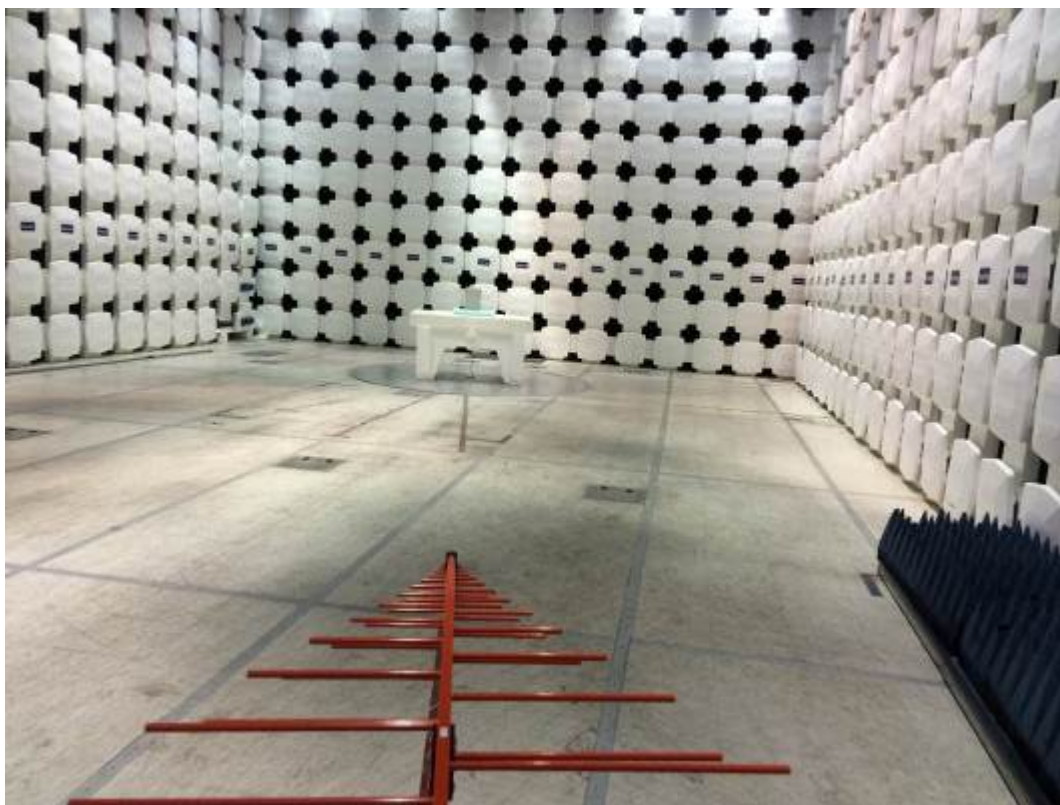
| Asset    | Description                                    | Manufacturer    | Model              | Serial     | Cal Date   | Cal Due    |
|----------|------------------------------------------------|-----------------|--------------------|------------|------------|------------|
| MAN1'    | Digital 4 Line Barometer                       | Mannix          | 0ABA116            | MAN1       | 08/13/2012 | 08/13/2014 |
| 145-410' | Cables 145-400 145-403 145-405 145-406 145-407 | Huber + Suhner  | 10m Track A Cables | multiple   | 10/04/2013 | 10/04/2014 |
| 145128'  | EMI Receiver (20 Hz - 40 Ghz)                  | Rohde & Schwarz | ESIB 40            | 839283/001 | 03/17/2014 | 03/17/2015 |
| 145106'  | Bilog Antenna (30MHz - 5GHz)                   | Sunol Sciences  | JB5                | A111003    | 10/01/2013 | 10/01/2014 |
| 145003'  | Preamplifier (150 KHz to 1.3 GHz)              | Hewlett Packard | 8447D              | 2443A04077 | 10/07/2013 | 10/07/2014 |

**Software Utilized:**

| Name | Manufacturer | Version    |
|------|--------------|------------|
| C5   | Teseq        | 5.26.46.46 |

**11.3 Results:**

The sample tested was found to comply.

**11.4 Setup Photographs:**

Ferrite on power cable



## 11.5 Plots/Data:

Initial Scan: Receive Mode on Mid channel

### Test Information

#### Test Details

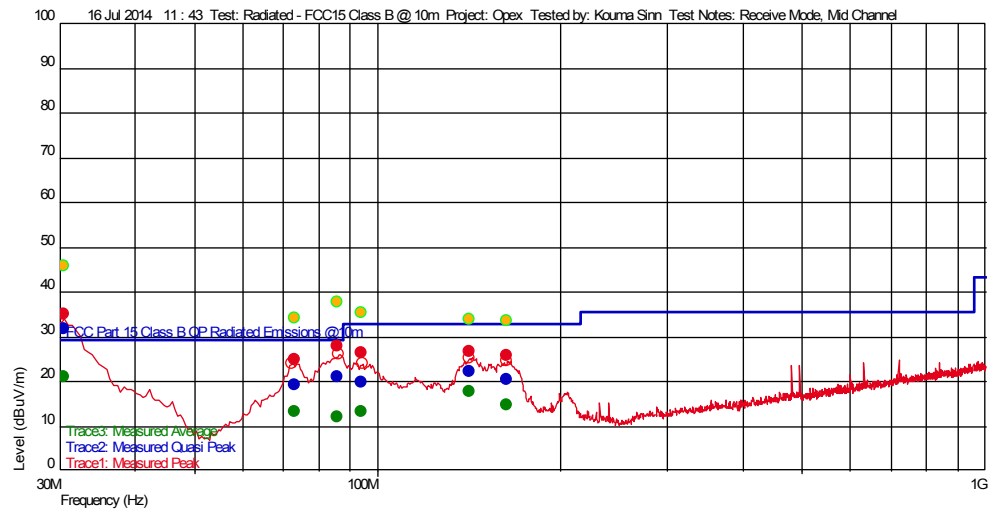
Test:  
Project:  
Test Notes:  
Temperature:  
Humidity:  
Tested by:  
Test Started:

#### User Entry

Radiated - FCC15 Class B @ 10m  
Opex  
Receive Mode, Mid Channel  
21C  
46%, 1000mbar  
Kouma Sinn  
16 Jul 2014 11:43

#### Additional Information

### 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

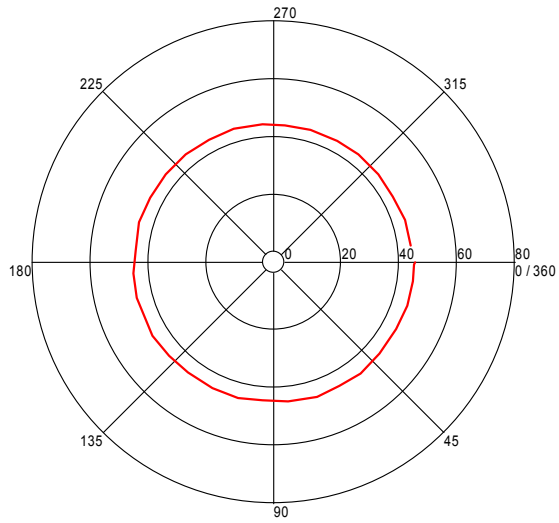
#### Trace2: Measured Quasi Peak

| 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 |
|-----------------|----------------|--------|---------|---------------|----------------|----------------------|--------------------|----------------|---------|---------|
| 94.069138739 M  | 19.79          | 8.721  | -25.518 | 33.040        | -13.25         |                      | 0                  | 1.78           | 120 k   |         |
| 163.07474993 M  | 20.33          | 12.193 | -24.894 | 33.040        | -12.71         |                      | 210                | 1.26           | 120 k   |         |
| 142.123847601 M | 22.36          | 13.388 | -25.286 | 33.040        | -10.68         |                      | 40                 | 1.04           | 120 k   |         |
| 73.023446776 M  | 19.23          | 7.998  | -25.808 | 29.540        | -10.31         |                      | 106                | 1.34           | 120 k   |         |
| 86.118636784 M  | 21.09          | 7.400  | -25.626 | 29.540        | -8.45          |                      | 360                | 1.95           | 120 k   |         |
| 30.569138277 M  | 31.78          | 20.902 | -26.245 | 29.540        | 2.24           |                      | 165                | 1.05           | 120 k   |         |

## Azimuth Plots

Turntable Plot ( 30.569138277 MHz )

Level (dBuV/m)

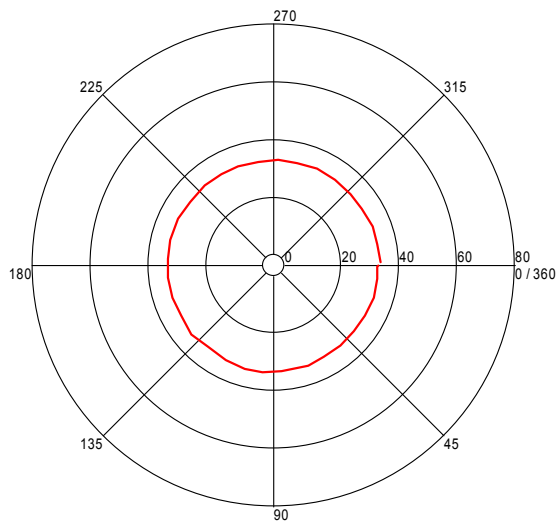


All Polarities

Azimuth (Degrees)

Turntable Plot ( 73.023446776 MHz )

Level (dBuV/m)

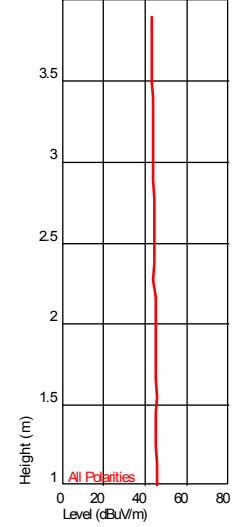


All Polarities

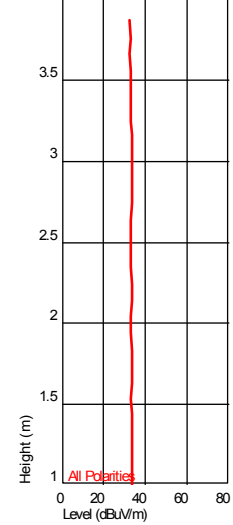
Azimuth (Degrees)

## Turntable Plots

Height Plot ( 30.569138277 MHz )

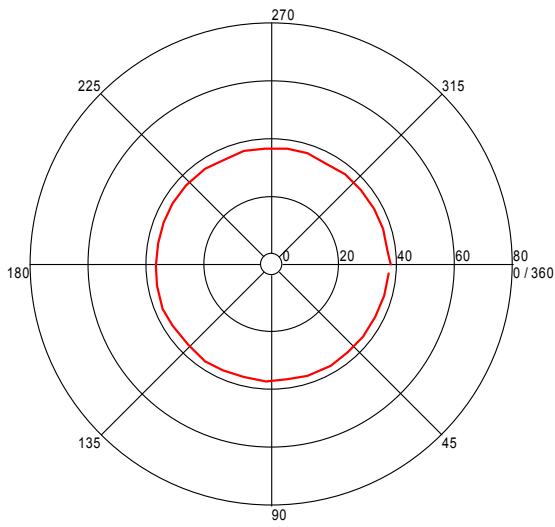


Height Plot ( 73.023446776 MHz )



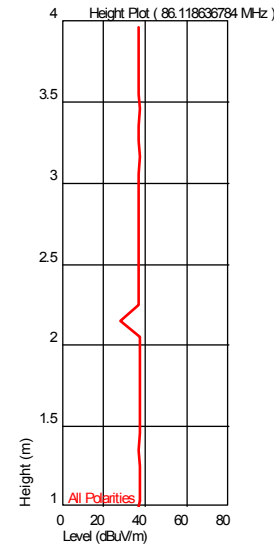
Turntable Plot ( 86.118636784 MHz )

Level (dBuV/m)



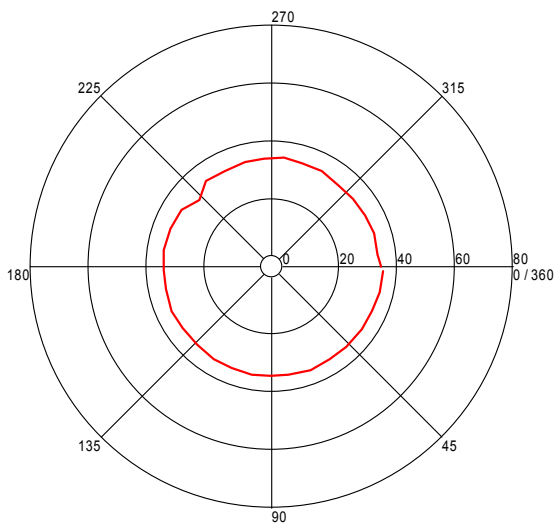
All Polarities

Azimuth (Degrees)



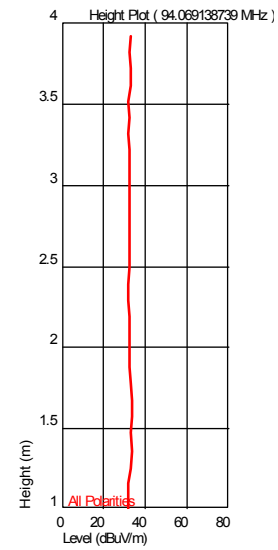
Turntable Plot ( 94.069138739 MHz )

Level (dBuV/m)



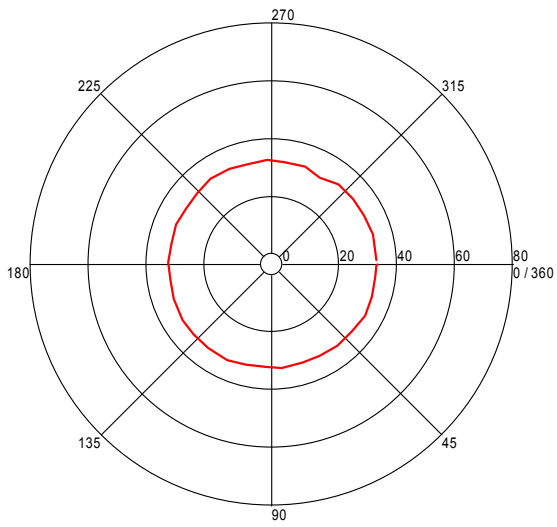
All Polarities

Azimuth (Degrees)



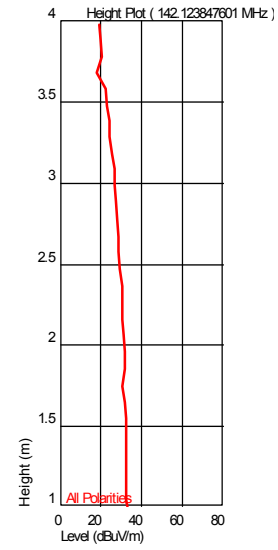
Turntable Plot ( 142.123847601 MHz )

Level (dBuV/m)



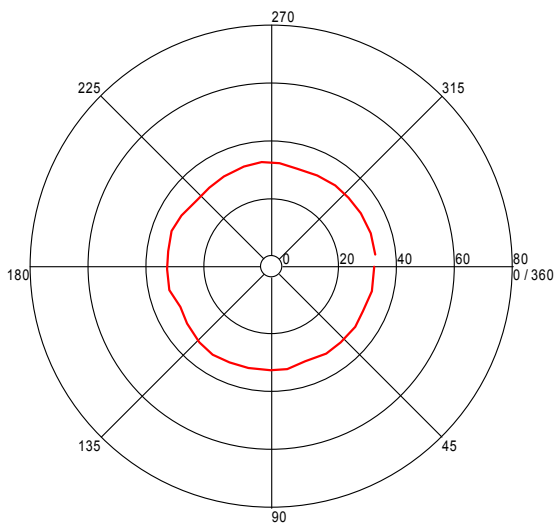
All Polarities

Azimuth (Degrees)



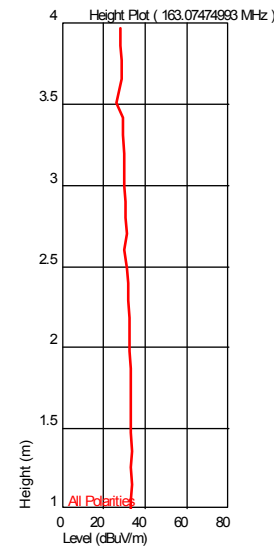
Turntable Plot ( 163.07474993 MHz )

Level (dBuV/m)



All Polarities

Azimuth (Degrees)



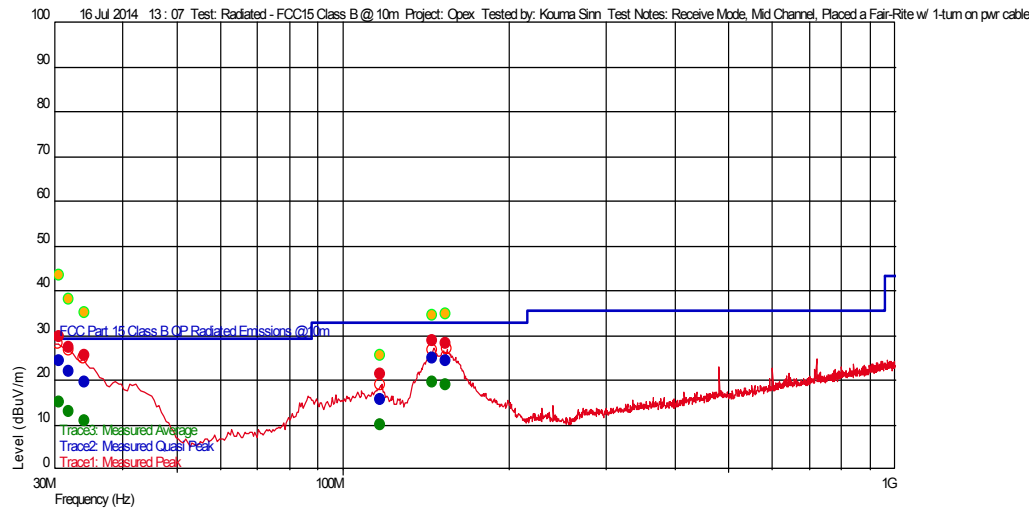
Final Scan: Receive Mode, Mid Channel, with a ferrite sleeve (Manufacturer: Fair-Rite, Part # 0446164151) w/ 1-turn on AC mains power cable as shown in photo

### Test Information

Test Details  
 Test: User Entry  
 Project: Radiated - FCC15 Class B @ 10m  
 Test Notes: Opex  
 Temperature: Receive Mode, Mid Channel, Placed a Fair-Rite w/ 1-turn on pwr  
 Humidity: 21C  
 Tested by: 46%, 1000mbar  
 Test Started: Kouma Sinn  
 16 Jul 2014 13 : 07

Additional Information

### 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

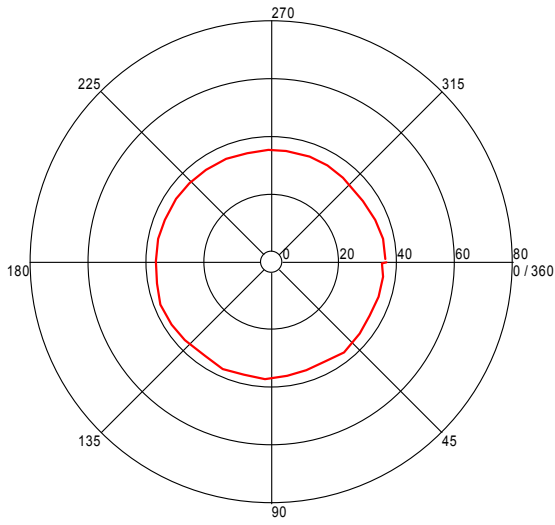
#### Trace2: Measured Quasi Peak

| 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 |
|-----------------|----------------|--------|---------|---------------|----------------|----------------------|--------------------|----------------|---------|---------|
| 116.815030104 M | 15.65          | 13.700 | -25.403 | 33.040        | -17.39         |                      | 132                | 1.77           | 120 k   |         |
| 34.198798044 M  | 19.69          | 18.361 | -26.212 | 29.540        | -9.85          |                      | 118                | 1.25           | 120 k   |         |
| 153.849298962 M | 24.29          | 12.600 | -25.145 | 33.040        | -8.75          |                      | 189                | 1.05           | 120 k   |         |
| 145.569940234 M | 24.94          | 13.086 | -25.270 | 33.040        | -8.10          |                      | 157                | 1.13           | 120 k   |         |
| 31.922244713 M  | 21.91          | 19.954 | -26.233 | 29.540        | -7.63          |                      | 177                | 3.21           | 120 k   |         |
| 30.650300657 M  | 24.43          | 20.845 | -26.244 | 29.540        | -5.11          |                      | 169                | 2.59           | 120 k   |         |

## Azimuth Plots

Turntable Plot ( 30.650300657 MHz )

Level (dBuV/m)

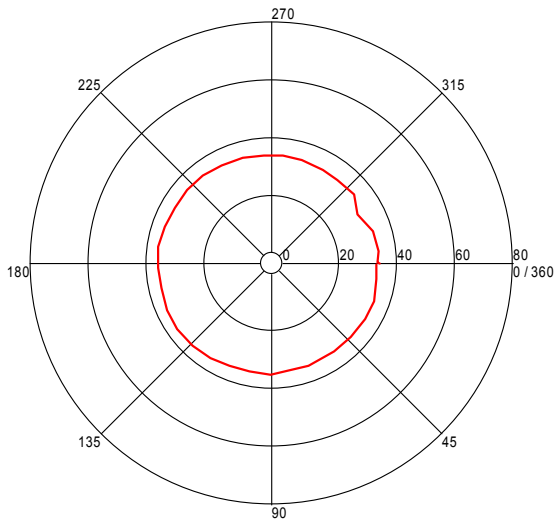


All Polarities

Azimuth (Degrees)

Turntable Plot ( 31.922244713 MHz )

Level (dBuV/m)

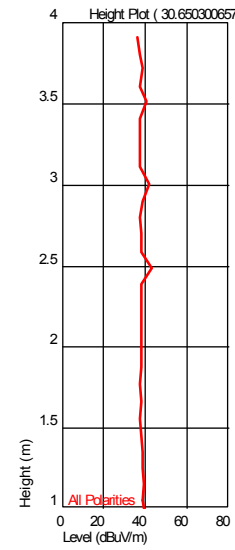


All Polarities

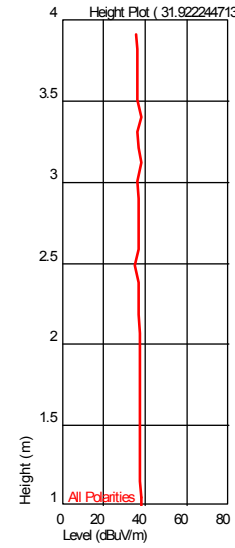
Azimuth (Degrees)

## Turntable Plots

Height Plot ( 30.650300657 MHz )

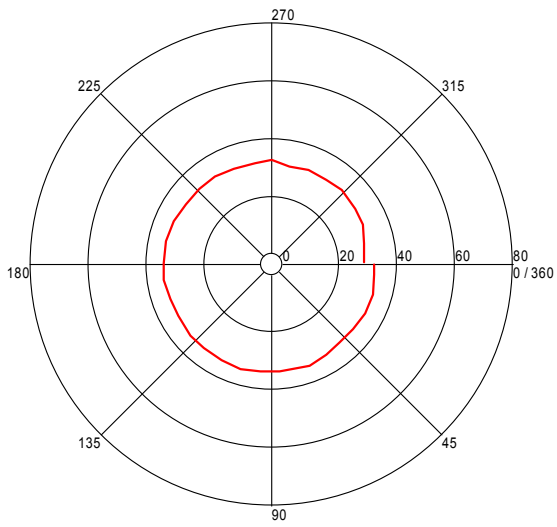


Height Plot ( 31.922244713 MHz )



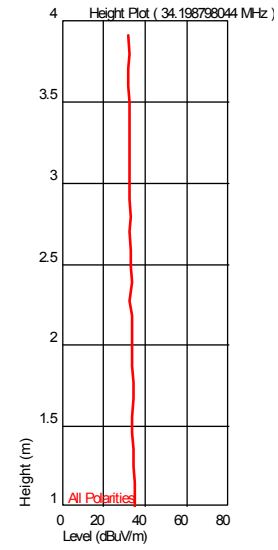
Turntable Plot ( 34.198798044 MHz )

Level (dBuV/m)



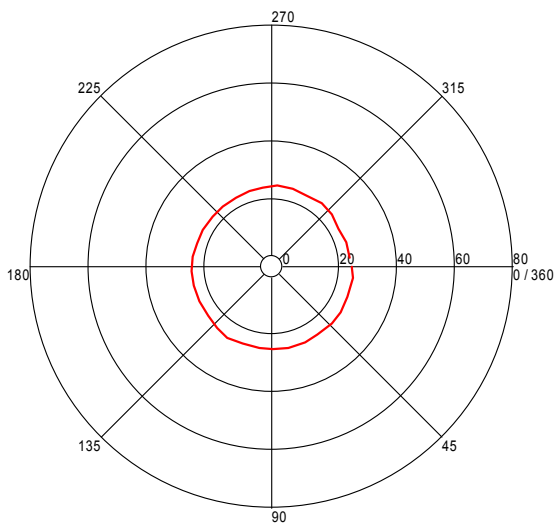
All Polarities

Azimuth (Degrees)



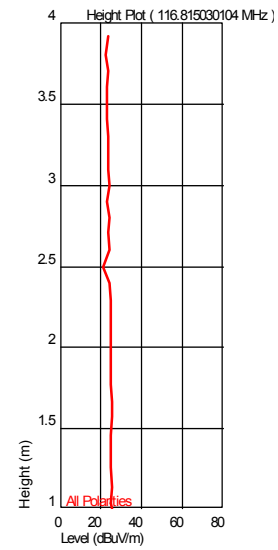
Turntable Plot ( 116.815030104 MHz )

Level (dBuV/m)



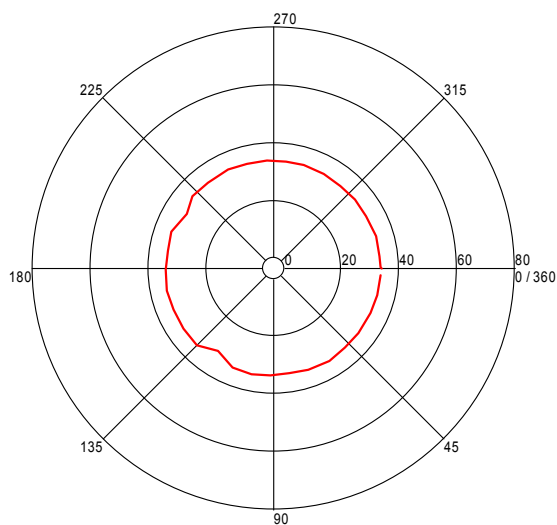
All Polarities

Azimuth (Degrees)



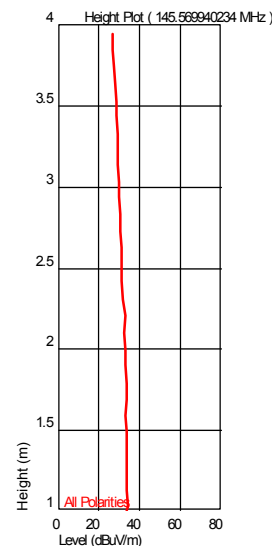
Turntable Plot ( 145.569940234 MHz )

Level (dBuV/m)



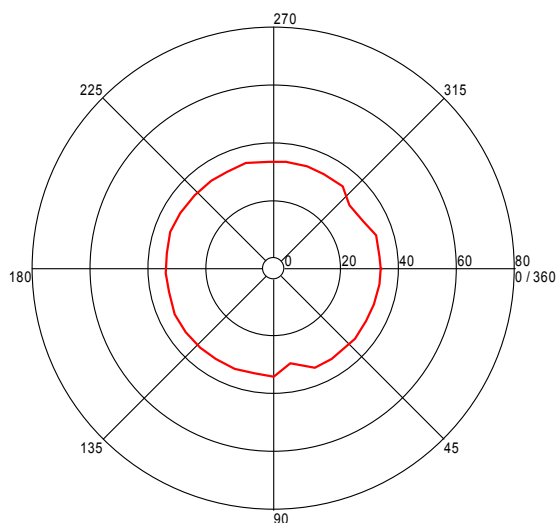
All Polarities

Azimuth (Degrees)



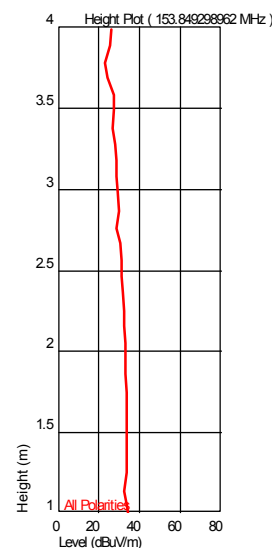
Turntable Plot ( 153.849298962 MHz )

Level (dBuV/m)



All Polarities

Azimuth (Degrees)



Test Personnel: Kouma Sinn *KPS*  
Supervising/Reviewing Engineer: N/A  
(Where Applicable)  
Product Standard: FCC Part 15.247, RSS-210 Annex 8  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/ Ambient Signals or BB Source: BB Source

Test Date: 07/16/2014Limit Applied: Emissions below the limits specified in Section 11.3Ambient Temperature: 21 °CRelative Humidity: 46 %Atmospheric Pressure: 1000 mbars

Deviations, Additions, or Exclusions: None

## 12 AC Mains Conducted Emissions

### 12.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, IC ICES-003, and ANSI C63.4:2009.

**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.

#### Measurement Uncertainty

| Measurement                 | Frequency Range  | Expanded Uncertainty (k=2) | Ucispr |
|-----------------------------|------------------|----------------------------|--------|
| AC Line Conducted Emissions | 150 kHz - 30 MHz | 2.8                        | 3.4    |
| Telco Port Emissions        | 150 kHz - 30 MHz | 3.2                        | 5      |

#### Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB $\mu$ V

RF = Reading from receiver in dB $\mu$ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB $\mu$ V

#### Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

Alternately, when C5 Software is used, the "Level" includes all losses and gains and is compared directly in the "Margin" column to the "Limit". "TF" is the Transducer Factor; in this case LISN or ISN loss.

**12.2 Test Equipment Used:**

| Asset         | Description                    | Manufacturer      | Model             | Serial       | Cal Date   | Cal Due    |
|---------------|--------------------------------|-------------------|-------------------|--------------|------------|------------|
| ROS002'       | 9kHz to 3GHz EMI Test Receiver | Rohde & Schwartz  | ESCI 1166.5950K03 | 100067       | 06/18/2013 | 07/18/2014 |
| CBLBNC2012-1' | 50 Ohm Coaxial Cable           | Pomona            | RG58C/U           | CBLBNC2012-1 | 10/28/2013 | 10/28/2013 |
| DS26A'        | Attenuator, 20dB               | Mini Circuits     | 20dB, 50 ohm      | DS26A        | 10/04/2013 | 10/04/2014 |
| LISN30'       | CISPR 16 LISN                  | Com-Power         | LI-215A           | 191961       | 02/26/2014 | 02/26/2015 |
| DAV004'       | Weather Station                | Davis Instruments | 7400              | PE80529A61A  | 09/25/2012 | 09/25/2014 |

**Software Utilized:**

| Name         | Manufacturer | Version    |
|--------------|--------------|------------|
| C5 Emissions | TESEQ        | 5.26.46.46 |

**12.3 Results:**

The sample tested was found to Comply.

**12.4 Setup Photograph:**

## 12.5 Plots/Data:

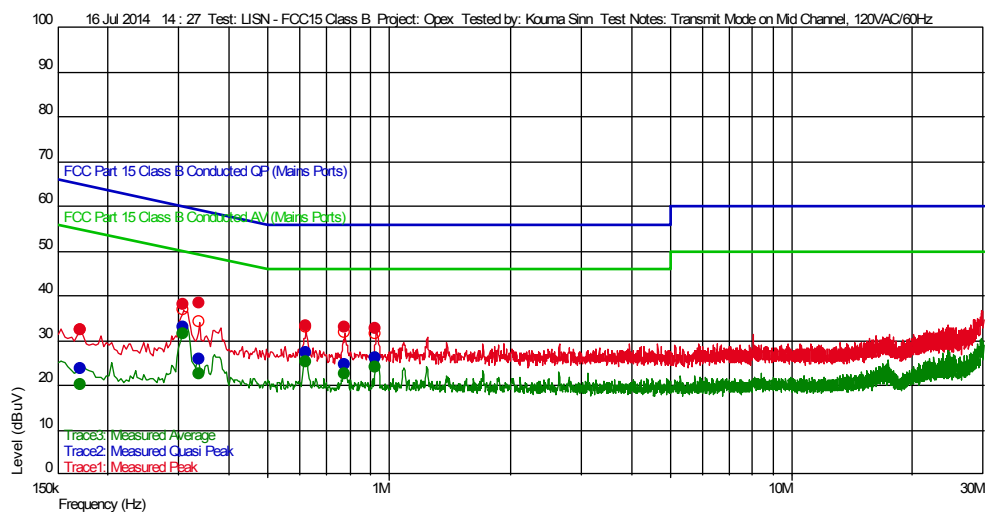
## Transmit Mode on Mid Channel, 120VAC/60Hz

## Test Information

Test Details  
Test: LISN - FCC15 Class B  
Project: Opex  
Test Notes: Transmit Mode on Mid Channel, 120VAC/60Hz  
Temperature: 20C  
Humidity: 67%, 998mbar  
Tested by: Kouma Sinn  
Test Started: 16 Jul 2014 14 : 27

Additional Information

## 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

## Trace2: Measured Quasi Peak

| Frequency(Hz) | Level(dBuV) | TF    | PA+CL  | Limit(dBuV) | Margin(dBuV) | RBW(Hz) | Comment | LINE |
|---------------|-------------|-------|--------|-------------|--------------|---------|---------|------|
| 171.0 k       | 23.75       | 0.056 | 20.767 | 64.912      | -41.16       | 9 k     |         | L1   |
| 339.0 k       | 25.96       | 0.029 | 20.783 | 59.228      | -33.27       | 9 k     |         | N    |
| 777.0 k       | 24.70       | 0.030 | 20.797 | 56.000      | -31.30       | 9 k     |         | L1   |
| 927.0 k       | 26.10       | 0.030 | 20.807 | 56.000      | -29.90       | 9 k     |         | N    |
| 621.0 k       | 27.25       | 0.029 | 20.794 | 56.000      | -28.75       | 9 k     |         | N    |
| 309.0 k       | 32.87       | 0.048 | 20.780 | 59.997      | -27.13       | 9 k     |         | L1   |

## Trace3: Measured Average

| Frequency(Hz) | Level(dBuV) | TF    | PA+CL  | Limit(dBuV) | Margin(dBuV) | RBW(Hz) | Comment | LINE |
|---------------|-------------|-------|--------|-------------|--------------|---------|---------|------|
| 171.0 k       | 20.28       | 0.056 | 20.767 | 54.912      | -34.64       | 9 k     |         | L1   |
| 339.0 k       | 22.45       | 0.029 | 20.783 | 49.228      | -26.78       | 9 k     |         | N    |
| 777.0 k       | 22.55       | 0.030 | 20.797 | 46.000      | -23.45       | 9 k     |         | L1   |
| 927.0 k       | 24.14       | 0.030 | 20.807 | 46.000      | -21.86       | 9 k     |         | N    |
| 621.0 k       | 25.35       | 0.029 | 20.794 | 46.000      | -20.65       | 9 k     |         | N    |
| 309.0 k       | 31.48       | 0.048 | 20.780 | 49.997      | -18.51       | 9 k     |         | L1   |

## Receive Mode on Mid Channel, 120VAC/60Hz

## Test Information

## Test Details

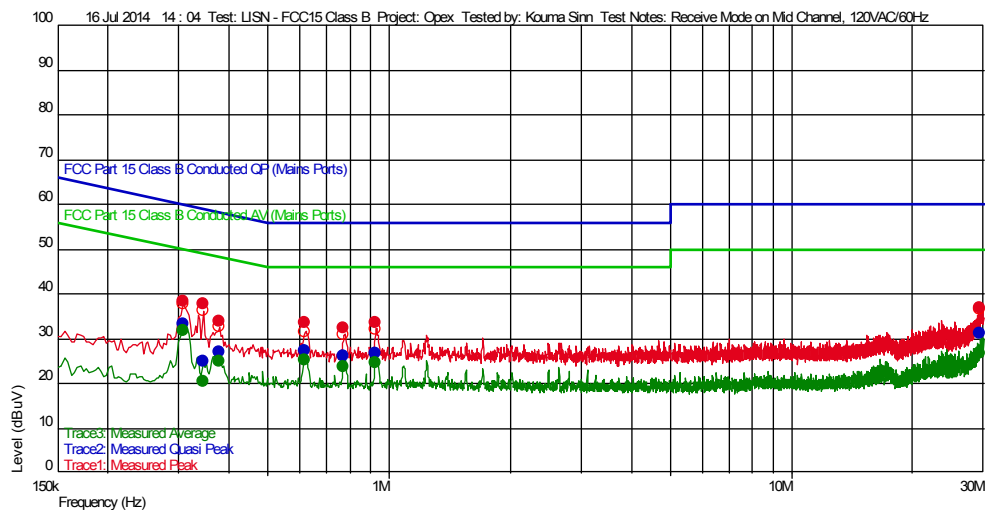
Test: LISN - FCC15 Class B  
Project: Opex  
Test Notes: Receive Mode on Mid Channel, 120VAC/60Hz  
Temperature: 20C  
Humidity: 67%, 998mbar  
Tested by: Kouma Sinn  
Test Started: 16 Jul 2014 14 : 04

## User Entry

LISN - FCC15 Class B  
Opex  
Receive Mode on Mid Channel, 120VAC/60Hz  
20C  
67%, 998mbar  
Kouma Sinn  
16 Jul 2014 14 : 04

## Additional Information

## 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

## Trace2: Measured Quasi Peak

| Frequency(Hz) | Level(dBuV) | TF    | PA+CL  | Limit(dBuV) | Margin(dBuV) | RBW(Hz) | Comment | LINE |
|---------------|-------------|-------|--------|-------------|--------------|---------|---------|------|
| 345.0 k       | 25.01       | 0.024 | 20.783 | 59.082      | -34.08       | 9 k     |         | N    |
| 378.0 k       | 27.11       | 0.030 | 20.786 | 58.323      | -31.22       | 9 k     |         | N    |
| 774.0 k       | 26.05       | 0.030 | 20.797 | 56.000      | -29.95       | 9 k     |         | N    |
| 927.0 k       | 26.61       | 0.030 | 20.807 | 56.000      | -29.39       | 9 k     |         | N    |
| 29.5212 M     | 31.16       | 0.098 | 21.050 | 60.000      | -28.84       | 9 k     |         | L1   |
| 618.0 k       | 27.18       | 0.030 | 20.794 | 56.000      | -28.82       | 9 k     |         | N    |
| 309.0 k       | 33.26       | 0.048 | 20.780 | 59.997      | -26.73       | 9 k     |         | N    |

## Trace3: Measured Average

| Frequency(Hz) | Level(dBuV) | TF    | PA+CL  | Limit(dBuV) | Margin(dBuV) | RBW(Hz) | Comment | LINE |
|---------------|-------------|-------|--------|-------------|--------------|---------|---------|------|
| 345.0 k       | 20.35       | 0.024 | 20.783 | 49.082      | -28.73       | 9 k     |         | N    |
| 378.0 k       | 24.79       | 0.030 | 20.786 | 48.323      | -23.53       | 9 k     |         | N    |
| 29.5212 M     | 26.82       | 0.098 | 21.050 | 50.000      | -23.18       | 9 k     |         | L1   |
| 774.0 k       | 23.84       | 0.030 | 20.797 | 46.000      | -22.16       | 9 k     |         | N    |
| 927.0 k       | 24.67       | 0.030 | 20.807 | 46.000      | -21.33       | 9 k     |         | N    |
| 618.0 k       | 25.25       | 0.030 | 20.794 | 46.000      | -20.75       | 9 k     |         | N    |
| 309.0 k       | 31.93       | 0.048 | 20.780 | 49.997      | -18.06       | 9 k     |         | N    |

Test Personnel: Kouma Sinn *KPS*  
Supervising/Reviewing  
Engineer:  
(Where Applicable) N/A  
Product Standard: FCC Part 15.247,  
RSS-210 Annex 8  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/  
Ambient Signals or  
BB Source: Ambient Signals

Test Date: 07/16/2014  
  
Limit Applied: Class B  
Ambient Temperature: 20 °C  
Relative Humidity: 67 %  
Atmospheric Pressure: 998 mbars

Deviations, Additions, or Exclusions: None

**13 Revision History**

| Revision Level | Date       | Report Number     | Prepared By    | Reviewed By    | Notes                           |
|----------------|------------|-------------------|----------------|----------------|---------------------------------|
| 0              | 05/14/2015 | 102037004BOX-001  | KPS <i>KPS</i> | MFM <i>MFM</i> | Original Issue                  |
| 1              | 05/19/2015 | 102037004BOX-001b | KPS <i>KPS</i> | MFM <i>MFM</i> | Model # correction              |
| 2              | 06/16/2015 | 102037004BOX-001c | KPS <i>KPS</i> |                | Revised RF exposure calculation |
|                |            |                   |                |                |                                 |
|                |            |                   |                |                |                                 |
|                |            |                   |                |                |                                 |