

**ELECTROMAGNETIC COMPATIBILITY  
TEST REPORT  
TO  
FCC 47 CFR Part 15 SUBPART C SECTION 15.247  
&  
INDUSTRY CANADA RSS-210**

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**Testing laboratory:** Quality Auditing Institute

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**Accreditations (ISO 17025):**



**Standard Council of Canada: Accredited Laboratory No. 743  
International Accreditation Service Inc.: Accredited Laboratory: No. TL-239**

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**Test Standard:** RSS-Gen, Issue 3; RSS-210, Issue 8; FCC Part 15.247

**Test Item Description:** Motion Tracking sensor to analyze human movement.



**Trade Mark:**  
**Manufacturer:** Kineteks Corporation  
**Model Number:** BT Smart Sensor  
**IC Certificate number:** 9751A-TSEN002  
**FCC Registration:** ZP2-TSEN002



**BT Smart Sensor**

## Revision History

| Date         | Report Number | Rev # | Details                                                                      | Authors Initials |
|--------------|---------------|-------|------------------------------------------------------------------------------|------------------|
| Apr 16, 2014 | E10633-1402   | 0.0   | Draft Test Report                                                            | AJ               |
| Apr 23, 2014 | E10633-1402   | 1.0   | Final Test Report- with some minor corrections                               | AJ               |
| Apr 29, 2014 | E10633-1402   | 2.0   | Final Test Report- added plots at page 44 and 45 in response to TCB findings | AJ               |
|              |               |       |                                                                              |                  |
|              |               |       |                                                                              |                  |
|              |               |       |                                                                              |                  |

*All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.*

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## Section I. GENERAL TEST INFORMATION

### EMC TEST SUMMARY

The following tests demonstrate testimony for the FCC & IC Marks for Transceivers / electromagnetic compatibility testing for this EUT.

| Test / Requirement Description             | Applicable FCC Rule Parts                                       | Applicable Industry Canada Rule Parts        | Results  |
|--------------------------------------------|-----------------------------------------------------------------|----------------------------------------------|----------|
| Antenna requirement                        | FCC 47 CFR Part 15.203                                          | RSS-Gen (7.1.2)                              | Complies |
| RF Peak Power Output                       | FCC Part 15.247 (b)(3)                                          | RSS 210 Issue 8 A8.4(4)                      | Complies |
| Occupied Bandwidth 6dB Bandwidth           | FCC Part 15.247 (b)(3)                                          | RSS 210 Issue 8 A8.2(a)                      | Complies |
| Power Spectral Density                     | FCC Part 15.247 (e)                                             | RSS 210 Issue 8 A8.2(b)                      | Complies |
| Out-of-band Emissions (Band edge)          | FCC Part 15.247 (d)<br>RSS 210 Issue 8 A8.2(a)                  | RSS 210 Issue 8 A8.5                         | Complies |
| Conducted Spurious Emissions               | FCC Part 15.247 (d)                                             | RSS 210 Issue 8 A8.5                         | Complies |
| Radiated Spurious Emissions- Transmit Mode | FCC Part 15.247 (d),<br>FCC Part 15.209 (a),<br>FCC Part 15.205 | RSS 210 Issue 8 A2.5,A8.5,<br>RSS-Gen Issue3 | Complies |
| Radiated Spurious Emissions - Receive Mode | FCC Part 15.247 (d),<br>FCC Part 15.209 (a),<br>FCC Part 15.205 | RSS-210, ICES-003 Issue 5                    | Complies |

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC 15.247 & Industry Canada RSS-210. The manufacturer is responsible for the tested product configuration, continued product compliance with these standards listed, and for the appropriate auditing of subsequent products as required. BT Smart Sensor (EUT) has Bluetooth low energy transmitter. Bluetooth LE devices do not fulfill the requirements of FHSS and Bluetooth LE devices are classified as system using digital modulation techniques. Hence EUT was tested to comply for FCC 15.247 and RSS-210 as systems using digital modulation techniques operating in 2400 - 2483.5MHz band.

**X**

Tested By  
Aman Jathaul, EMC Project Manager

**X**

Reviewed By  
David Johanson RF/EMC Test Engineer

## PRODUCT DESCRIPTION

Applicant: Kineteks Corporation  
 #126 – 1020 Mainland Street Vancouver, BC, Canada V6B 2T4  
 Equipment Under Test: Motion tracking sensor to analyze human movement.  
 Trade Name: BT Smart Sensor  
 Model: BT Smart Sensor  
 Date of Test: March 24 –April 2 2014

## EUT DESCRIPTION

|                         |                                                                                                                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT                     | BT Smart Sensor                                                                                                                                                                                                                           |
| Functional Description  | A health awareness solution that discretely tracks your activity --- the distance you walk or run, the calories you burn, the amount of time that you are active --- all for the purpose of helping you to develop a healthier lifestyle. |
| Operational Description | BT Smart Sensor tracks motion for the purpose of assisting people to live more active and healthier lives. Bluetooth Low energy module communicates with iPad using application to track, transfer and analyze the stored data.           |
| FRN                     | 0020989547                                                                                                                                                                                                                                |
| FCC ID                  | ZP2-TSEN002                                                                                                                                                                                                                               |
| IC                      | 9751A-TSEN002                                                                                                                                                                                                                             |
| Manufacturer            | Kineteks Corporation                                                                                                                                                                                                                      |
| Model/Type              | BT Smart Sensor                                                                                                                                                                                                                           |
| Serial No.              | #1                                                                                                                                                                                                                                        |
| Transmitter Type        | Bluetooth Low Energy                                                                                                                                                                                                                      |
| Frequency Range         | 2402-2480MHz                                                                                                                                                                                                                              |
| Transmit Power          | 0.00089W                                                                                                                                                                                                                                  |
| Modulation              | GFSK                                                                                                                                                                                                                                      |
| Number of Channels      | 40                                                                                                                                                                                                                                        |
| Antenna                 | Integrated, maximum gain is 0.8 dBi                                                                                                                                                                                                       |
| Ratings                 | 3Vdc (coin cell battery)                                                                                                                                                                                                                  |
| Software and Firmware   | Version 19473                                                                                                                                                                                                                             |
| Received Date           | March-24-2014                                                                                                                                                                                                                             |
| Received By             | Aman                                                                                                                                                                                                                                      |
| Sample Log              | QAI Product Control Log (QM 1305 - Sample Inventory)                                                                                                                                                                                      |

## ANTENNA DESCRIPTION

|                 |                 |
|-----------------|-----------------|
| Polarization    | Linear          |
| Compact Size    | 5.4mm x 14.4    |
| RoHS            | Compatible      |
| Frequency Range | 2400 – 2480 MHz |
| Linear Max Gain | 0.8 dBi         |
| Impedance       | 50 $\Omega$     |

## FACILITIES AND ACCREDITATION

|                                                                                                                   |                                                            |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| <b>Main Laboratory Headquarters:</b>                                                                              | Quality Auditing Institute                                 |
| Headquarters Location/Address:                                                                                    | 16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada |
| <b>Associated Laboratory:</b>                                                                                     | Quality Auditing Institute (Remote Location)               |
| EMC Laboratory Address:                                                                                           | 19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada        |
| FCC Test Site Registration Number:<br>(3 m /10 m Open Area Test Site [OATS] and 3 m Semi-Anechoic Chamber [SAC]): | 226383                                                     |
| Industry Canada Test Site Registration Number (3m SAC):                                                           | 9543B-1                                                    |
| Standard Council of Canada:                                                                                       | ISO/IEC 17025:2005 Accredited Laboratory No. 743           |
| International Accreditation Service Inc.:                                                                         | ISO/IEC 17025:2005 Accredited Laboratory: No. TL-239       |
| Tested by:                                                                                                        | Aman Jathaul                                               |
| Reviewed by:                                                                                                      | David Johanson                                             |

## ENVIROMENTAL CONDITIONS: INDOORS

Temperature: 22-28°C R.H.: 39.7 - 54.4%

## TESTING METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4, ANSI C63.10, FCC CFR 47 Part 2, FCC CFR 47 Part 15, and RSS-Gen, Issue 3 and RSS-210, Issue 8. The FCC testing was also done using the FCC KDB 558074 D01 DTS Measurement Guidance v03r01 for the BLE transmitters

## EUT TESTING CONFIGURATION

EUT was powered using the +3Vdc power supply and tests were performed at low , middle and high channel for the purpose of compliance. The transmitter was set for continuous operation at fundamental frequencies in modulated modes of operation.

BT Smart Sensor (EUT) has Bluetooth low energy transmitter. As per FCC Bluetooth LE devices do not fulfill the requirements of FHSS and Bluetooth LE devices are classified as system using digital modulation techniques. Hence EUT was tested to comply for FCC 15.247 and RSS-210 as systems using digital modulation techniques operating in 2400 - 2483.5MHz band.

## WORST TEST CASE

Worst-case orientation was determined by rotating the EUT on three axis, during the pre-compliance test and final radiated emissions tests were performed in that orientation. The highest measured output power was at 2402MHz.

## **GENERAL TEST PROCEDURES**

### **RF Conducted Emissions**

The EUT is placed on a test bench connected directly to an EMI Receiver and Spectrum Analyzer. Conducted emissions are measured in the frequency range 9kHz to 25GHz using CISPR Peak, Quasi-Peak and Average detectors. EUT was set up to transmit modulated signal at particular channel at full power.

### **AC Mains Conducted Emissions**

This test was not applicable to this device. EUT operates only with 3Vdc Coin cell battery.

### **Radiated Emissions**

The EUT is placed on the turntable 0.8m above a ground plane 3m away from a receiving antenna. Height of receiving antenna varied from 1m to 4m, its polarity changes from vertical to horizontal. Turntable rotates 360 degrees. Motion of turntable and receiving antenna allows determining position of maximum emission level. Quasi-peak detector applies for measurements of emissions with frequency range of 30 to 1000MHz. and average/peak detector otherwise.

## MEASUREMENT UNCERTAINTY

|                                    |                          |
|------------------------------------|--------------------------|
| Radio Frequency .....              | $\pm 1,5 \times 10^{-5}$ |
| Total RF power, conducted.....     | $\pm 1$ dB               |
| RF power density, conducted.....   | $\pm 2.75$ dB            |
| Spurious emissions, conducted..... | $\pm 3$ dB               |
| All emissions, radiated.....       | $\pm 3.5$ dB             |
| Temperature.....                   | $\pm 1^{\circ}\text{C}$  |
| Humidity.....                      | $\pm 5$ %                |
| DC and low frequency voltages..... | $\pm 3$ %                |

## Test Equipment List

### Semi-Anechoic Chamber Equipment List

| Manufacturer    | Model     | Description                                           | Serial No. | Last Cal        | Cal Due Date       |
|-----------------|-----------|-------------------------------------------------------|------------|-----------------|--------------------|
| ETS Lindgren    | 2165      | Turntable                                             | 00043677   | N/A             | N/A                |
| ETS Lindgren    | 2125      | Mast                                                  | 00077487   | N/A             | N/A                |
| Sunol Sciences  | JB3       | Biconilog Antenna<br>30MHz-3GHz<br>(Prescan use only) | A120106    | 28-Oct-2013     | 28-Oct-2015        |
| Rohde & Schwarz | ESU40     | EMI Receiver                                          | 100011     | 26-June-2012    | 26-Jun-2015        |
| COM-POWER       | AHA-118   | Dual Ridge Horn<br>Antenna                            | 711040     | 11-Mar-2011     | 11-Apr-2014        |
| ETS Lindgren    | S201      | 5 meter Semi-Anechoic<br>Chamber                      | 1030       | Conditional Use | Conditional<br>Use |
| AH Systems      | PAM118    | Amplifier<br>10KHz-18GHz                              | 189        | Conditional Use | Conditional<br>Use |
| AH Systems      | PAM-1840H | Amplifier<br>18-40GHz                                 | 152        | 14-Jun-2013     | 14-Jun-2016        |

### Measurement Software List

| Manufacturer    | Model  | Version | Description                         |
|-----------------|--------|---------|-------------------------------------|
| Rhode & Schwarz | EMC 32 | 6.20.0  | Emissions Pre-scan Test<br>Software |

## Section II: Requirements as FCC and Industry Canada

### Test Summary:

|               | Test                                       | Standard                                                                                   | Description                                                                                                                                                                                | Result   |
|---------------|--------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Part 1</b> | Antenna requirement                        | FCC 47 CFR Part 15.203<br>RSS-Gen (7.1.2)                                                  | Soldered, non-replaceable antenna                                                                                                                                                          | Complies |
| <b>Part 2</b> | RF Peak Power Output                       | FCC Part 15.247 (b)(3)<br>RSS 210 Issue 8 A8.4(4)                                          | Maximum peak conducted output power shall not exceed 1 W. Except as provided in Section RSS 210 A8.4 (5), the e.i.r.p. shall not exceed 4 W.                                               | Complies |
| <b>Part 3</b> | Occupied Bandwidth 6dB Bandwidth           | FCC Part 15.247 (a)(2)<br>RSS 210 Issue 8 A8.2(a)                                          | The minimum -6 dB bandwidth shall be at least 500 kHz.                                                                                                                                     | Complies |
| <b>Part 4</b> | Power Spectral Density                     | FCC Part 15.247 (e)<br>RSS 210 Issue 8 A8.2(b)                                             | The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission | Complies |
| <b>Part 5</b> | Out-of-band Emissions (Bandedge)           | FCC Part 15.247 (d)<br>RSS 210 Issue 8 A8.5                                                | In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.                            | Complies |
| <b>Part 6</b> | Conducted Spurious Emissions               | FCC Part 15.247 (d)<br>RSS 210 Issue 8 A8.5                                                | In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.                            | Complies |
| <b>Part 7</b> | Radiated Spurious Emissions-Transmit Mode  | FCC Part 15.247 (d)<br>FCC Part 15.209 (a)<br>RSS 210 Issue 8 A2.5,A8.5<br>RSS Gen Issue 3 | Radiated emissions requirements as stated in the Standards.                                                                                                                                | Complies |
| <b>Part 8</b> | Radiated Spurious Emissions – Receive Mode | FCC Part 15.247 (d)<br>FCC Part 15.209 (a)<br>ICES-003 Issue 5                             | Radiated emissions requirements as stated in the Standards                                                                                                                                 | Complies |
| <b>Part 9</b> | Duty Cycle Correction                      | FCC Part 15.35(C) RSS-GEN,RSS-210                                                          | Measurement and Calculation for duty cycle correction as stated in the standards.                                                                                                          | Complies |

## **Part 1 - Antenna Requirements**

DATE: March 24 2014

TEST STANDARD: FCC 47 CFR Part 15.203 and IC RSS-Gen Section 7.1.2

APPLICABLE REGULATIONS: - "An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited."... "the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded."

RESULT: This unit meets antenna requirement. Bluetooth antenna was soldered to the circuit board and was not accessible to the end-user.

## Part 2 - RF Peak Power Output

DATE: Mar-24-2014

TEST STANDARD: FCC Part 15.247 (b)(3) RSS 210 Issue 8 A8.4(4)

TEST REQUIREMENT: For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in RSS 210 Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyser.

MEASUREMENT METHOD: As called by the standards above.

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

### Conducted Output Power Measurements

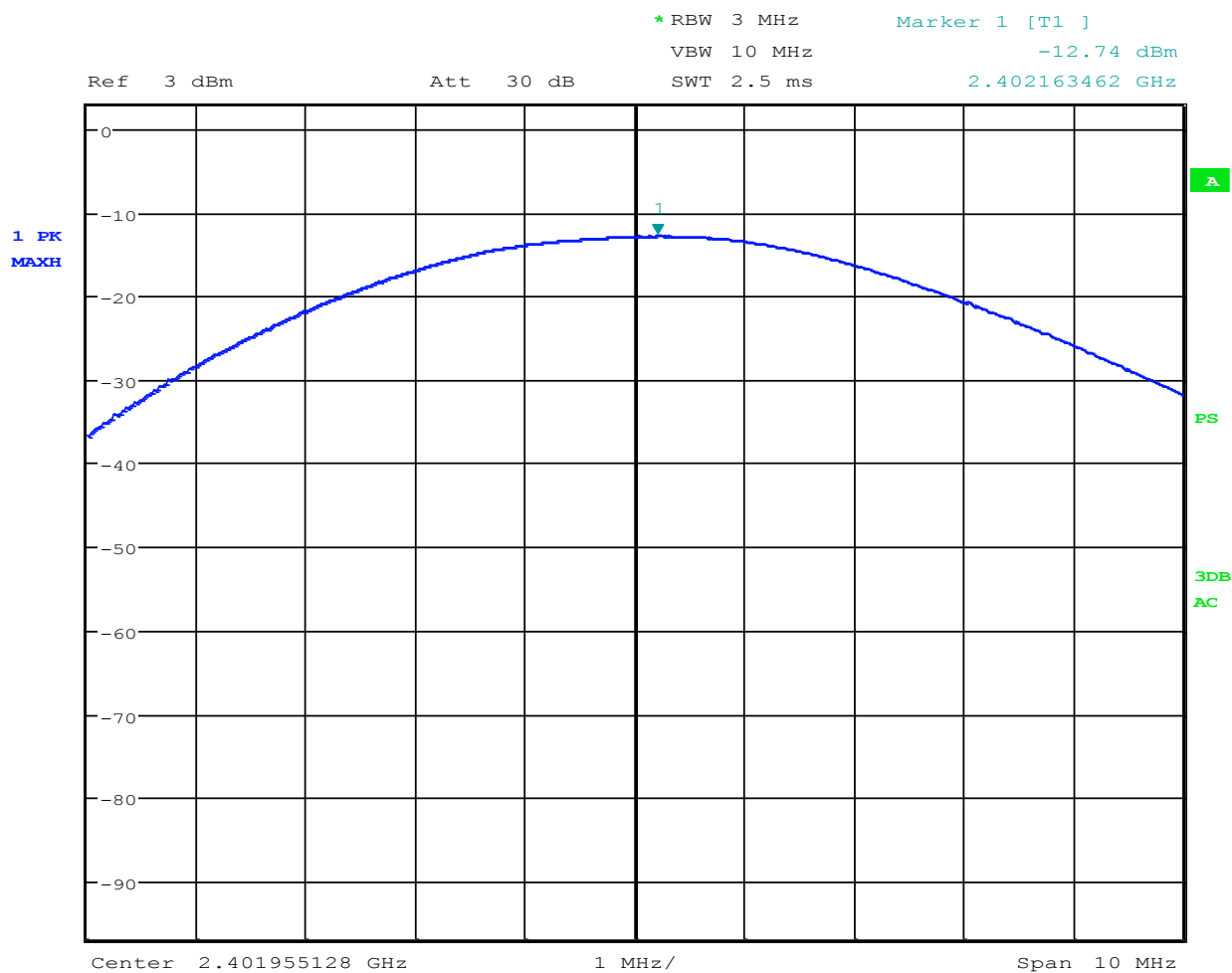
| Channel | Frequency (GHz) | Peak Power (dBm) | CF (dB) | Corrected Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|---------|-----------------------|-------------|
| Low     | 2.402           | -12.74           | 12.23   | -0.51                 | 30          |
| Mid     | 2.440           | -14.21           | 12.65   | -1.56                 | 30          |
| High    | 2.480           | -15.44           | 12.83   | -2.61                 | 30          |

### EIRP Measurements

| Channel | Frequency (GHz) | Corrected Peak at 3m (dBuV/m) | 3m EIRP (dBm) |
|---------|-----------------|-------------------------------|---------------|
| Low     | 2.402           | 95.8                          | 0.64          |
| Mid     | 2.44            | 95.51                         | 0.35          |
| High    | 2.48            | 94.7                          | -0.45         |

RESULTS: Pass: Complies.

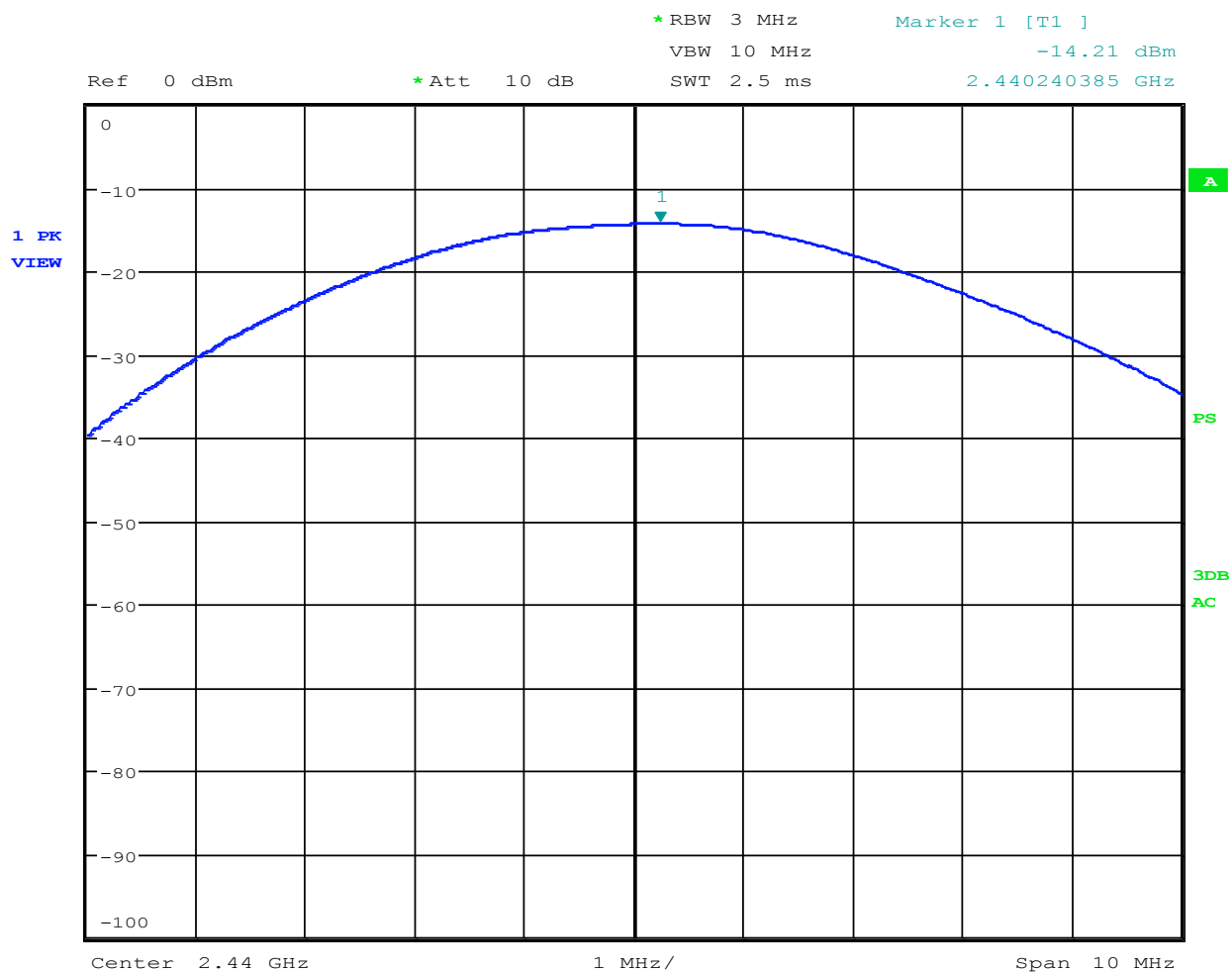
## TEST PLOTS - RF PEAK POWER



TTTTTT

Date: 24.MAR.2014 18:45:22

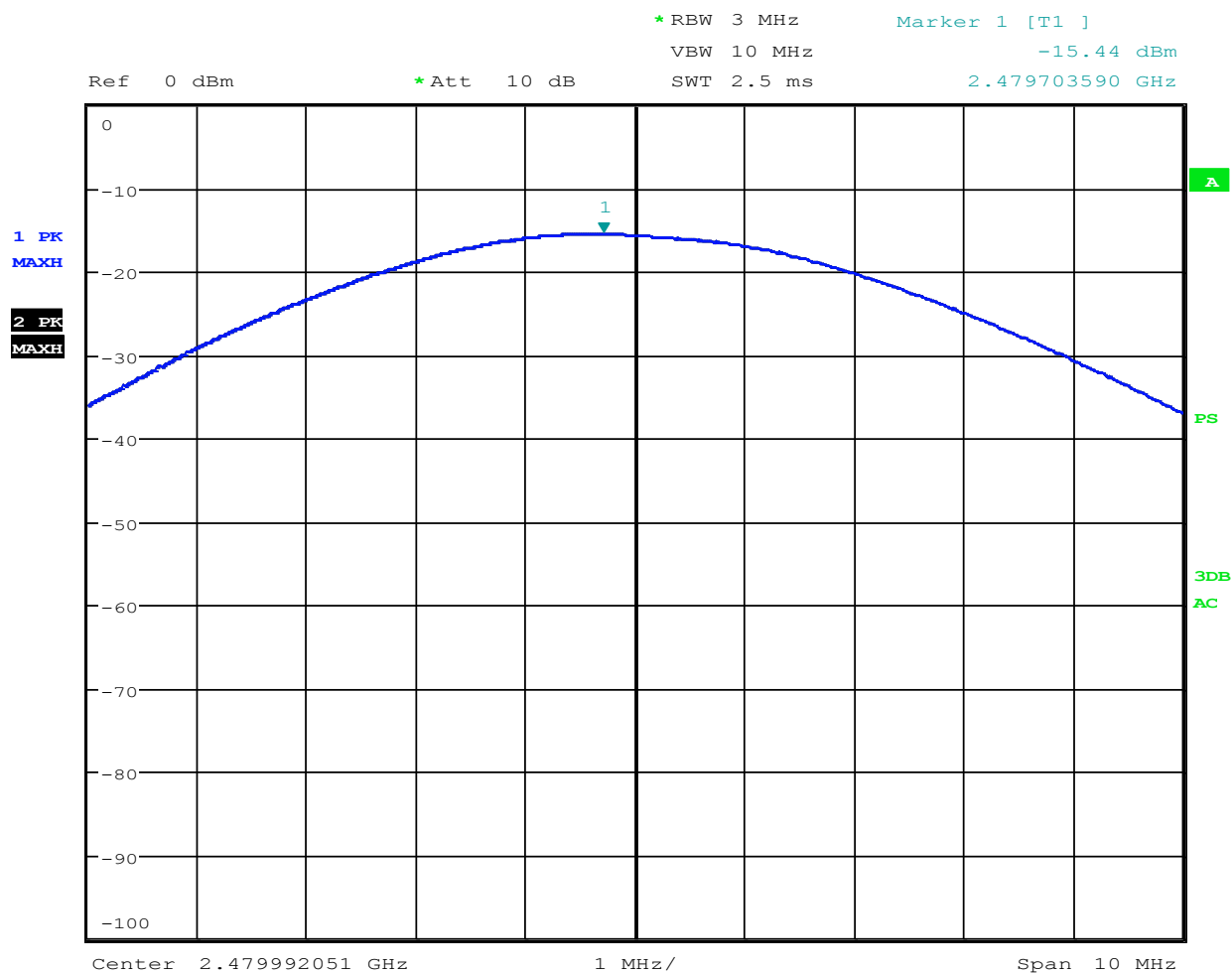
### **PLOT 1 - PEAK OUTPUT POWER, LOW CHANNEL**



TTTTTT

Date: 24.MAR.2014 19:43:18

## PLOT 2 - PEAK POWER, MID CHANNEL



TTTTTT

Date: 24.MAR.2014 20:28:25

### PLOT 3 - PEAK POWER, HIGH CHANNEL

### Part 3 - Occupied Bandwidth 6dB Bandwidth

DATE: March 24 2014

TEST STANDARD: FCC Part 15.247 (a) (2) and RSS 210 Issue 8 A8.2

TEST REQUIREMENT: The minimum -6 dB bandwidth shall be at least 500 kHz.

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

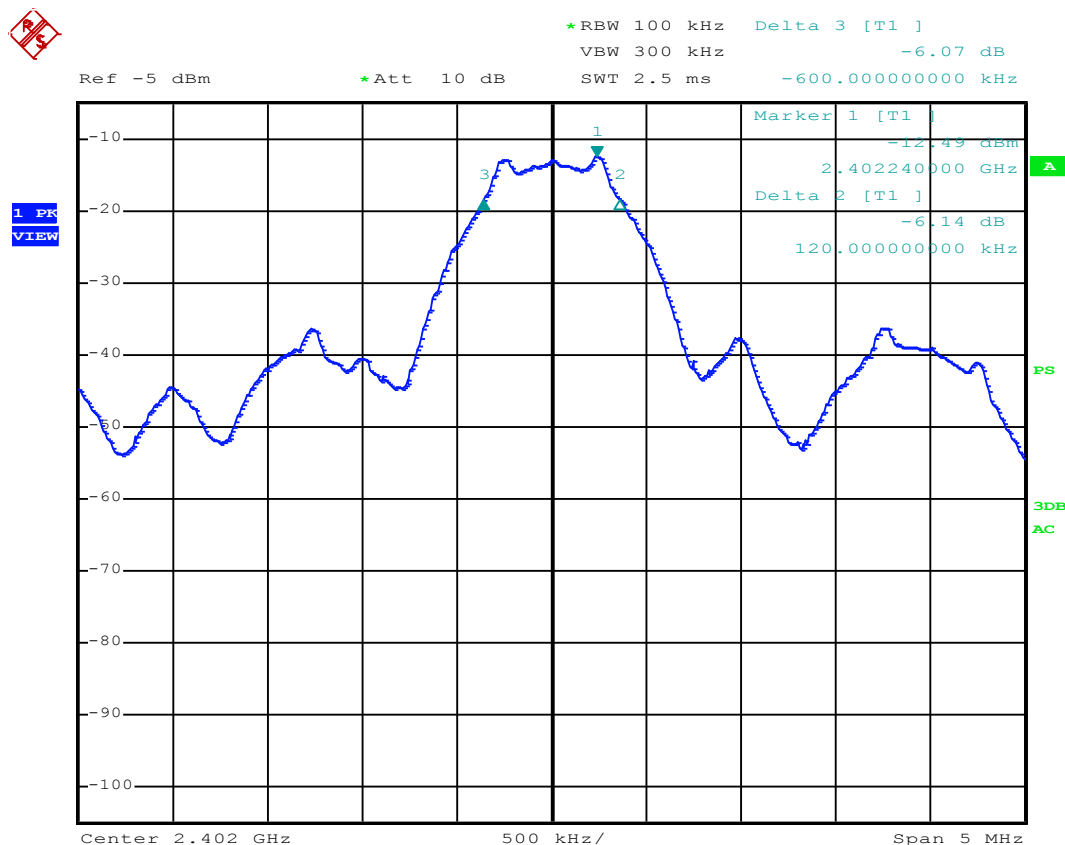
DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

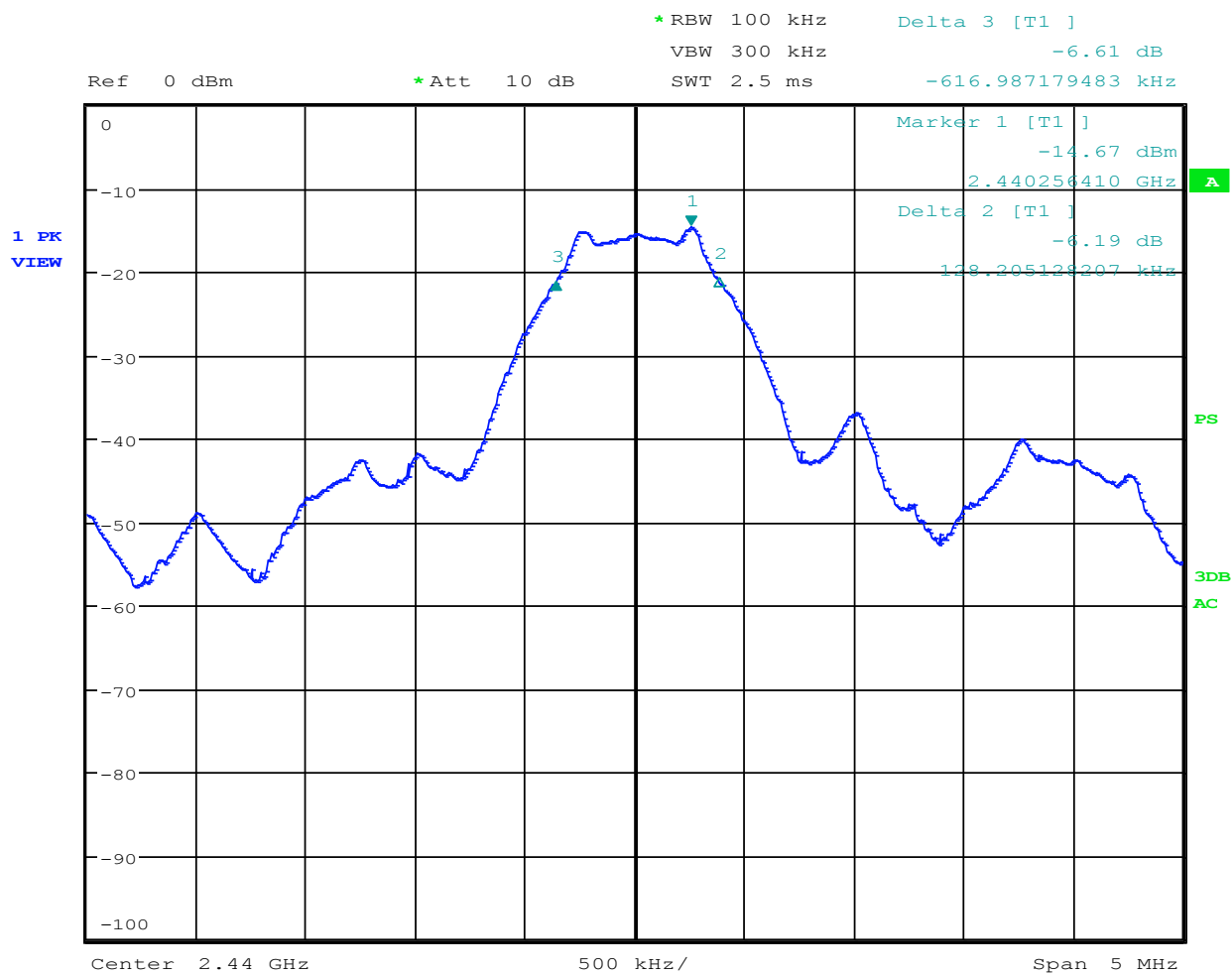
| Channel | Frequency<br>(GHz) | 6dB Bandwidth<br>(kHz) |
|---------|--------------------|------------------------|
| Low     | 2.402              | 720                    |
| Mid     | 2.440              | 745.18                 |
| High    | 2.480              | 743.99                 |

RESULTS: Pass: Complies.

## TEST PLOTS – 6dB OCCUPIED BANDWIDTH



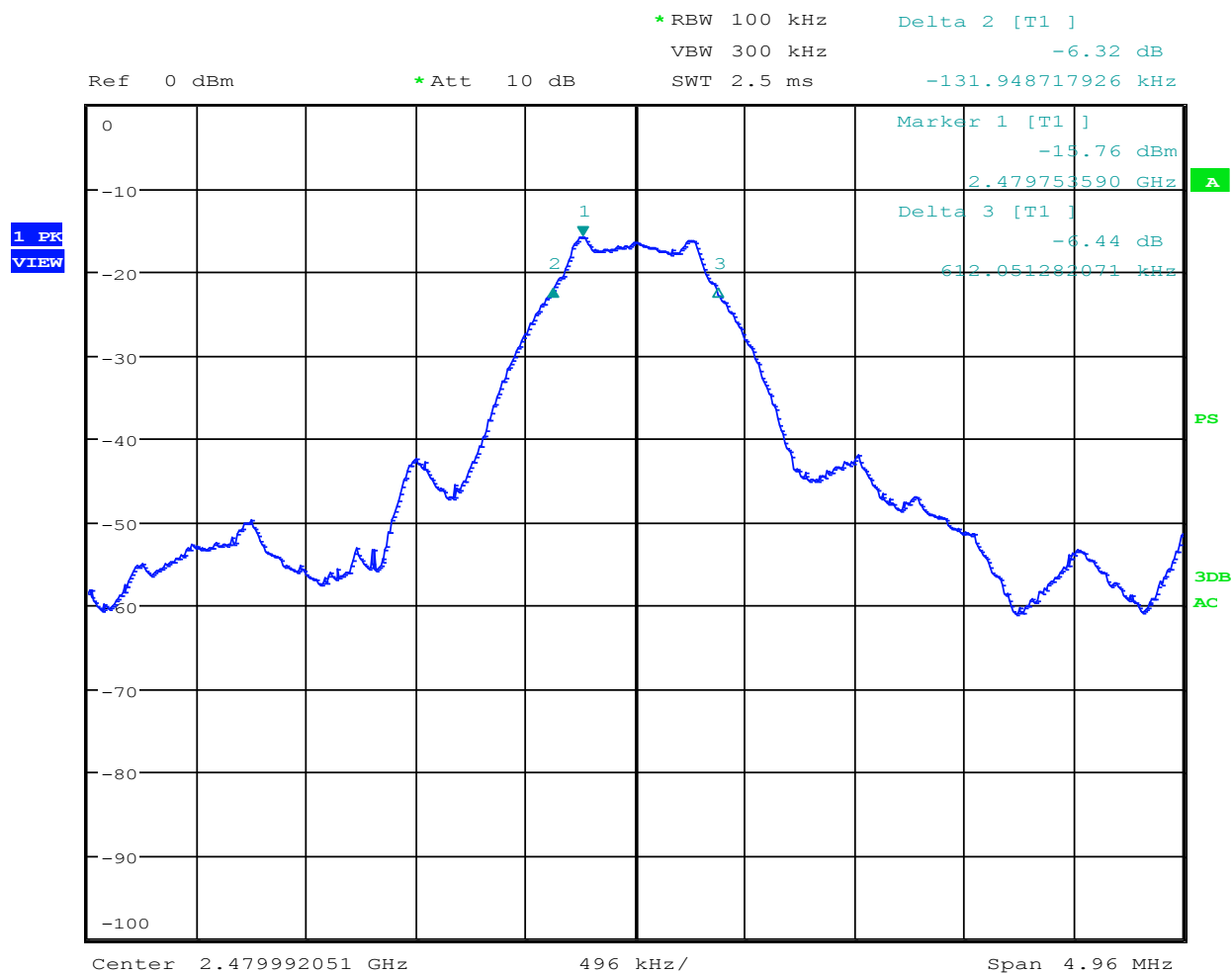
**PLOT 4 - LOW CHANNEL – 6dB OCCUPIED BANDWIDTH**



TTTTTT

Date: 24.MAR.2014 19:56:35

### PLOT 5 – MID CHANNEL – 6dB OCCUPIED BANDWIDTH



TTTTTT

Date: 24.MAR.2014 20:26:02

### PLOT 6 - HIGH CHANNEL – 6dB OCCUPIED BANDWIDTH

## Part 4 - Power Spectral Density

DATE: March 24 2014

TEST STANDARD: FCC Part 15.247 (e) and RSS 210 Issue 8 A 8.2(b)

TEST REQUIREMENT: The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. The power spectral density was determined using the same method as is used to determine the conducted output power).

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

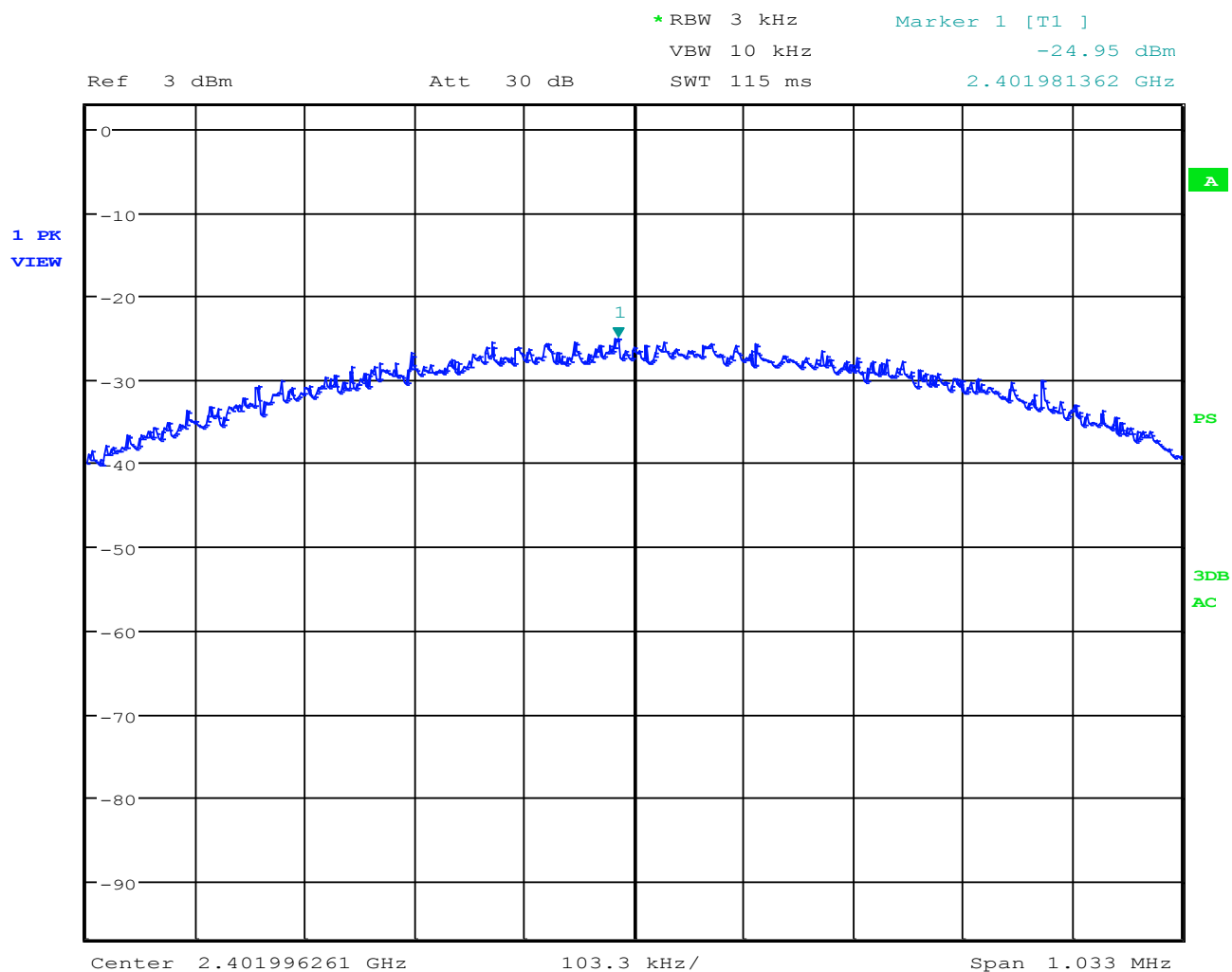
DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

| Channel | Frequency | Un-Corrected PSD | Correction Factor | Corrected PSD | Limit | Margin | Results   |
|---------|-----------|------------------|-------------------|---------------|-------|--------|-----------|
|         | (GHz)     | (dBm)            | (dB)              | (dBm)         | (dBm) | (dB)   | Pass/Fail |
| Low     | 2.402     | -24.95           | 12.23             | -12.72        | 8     | 20.72  | Pass      |
| Mid     | 2.44      | -25.82           | 12.65             | -13.17        | 8     | 21.17  | Pass      |
| High    | 2.48      | -27.65           | 12.83             | -14.82        | 8     | 22.82  | Pass      |

RESULTS: PASS: Complies.

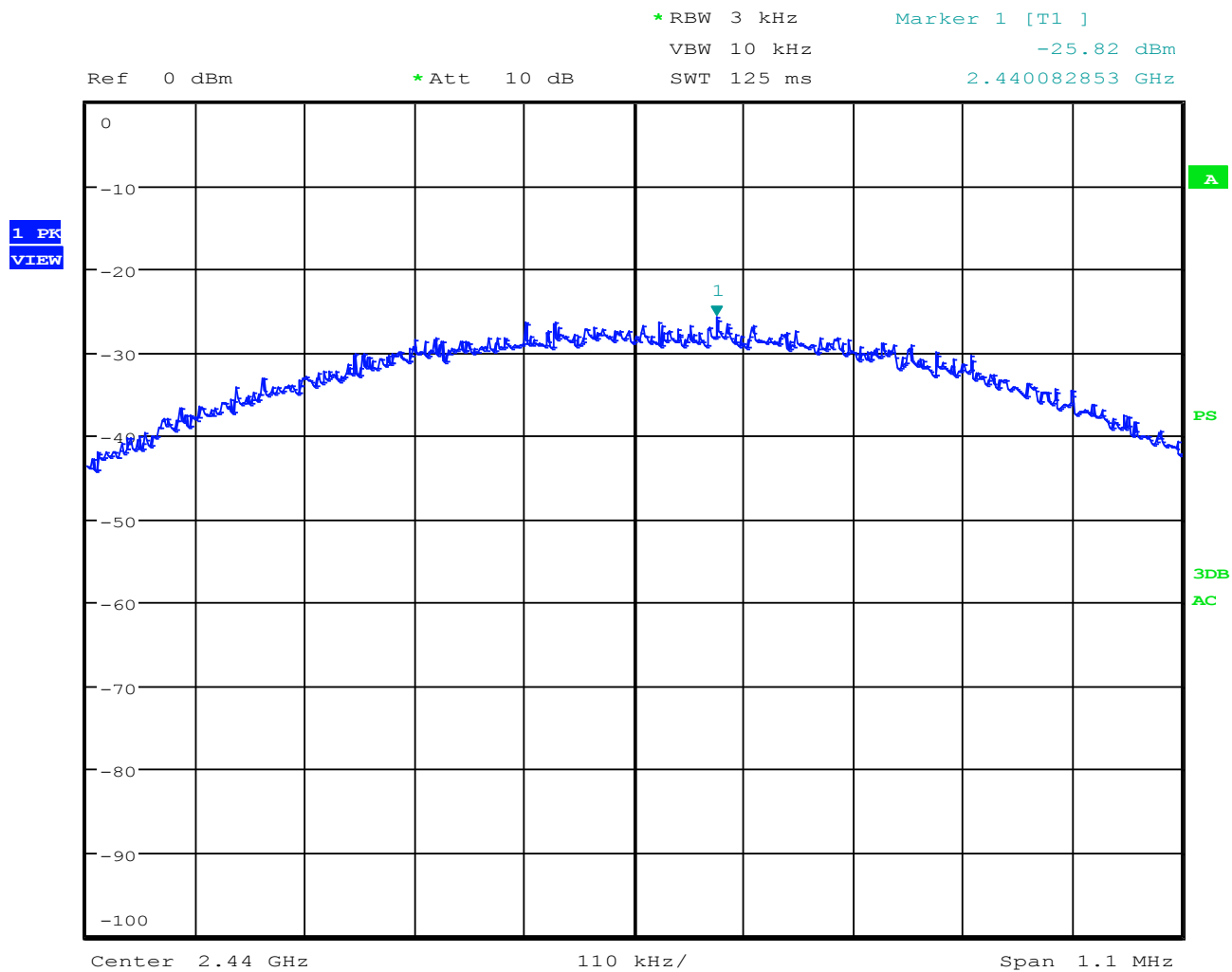
## TEST PLOTS - POWER SPECTRAL DENSITY



TTTTTT

Date: 24.MAR.2014 18:50:21

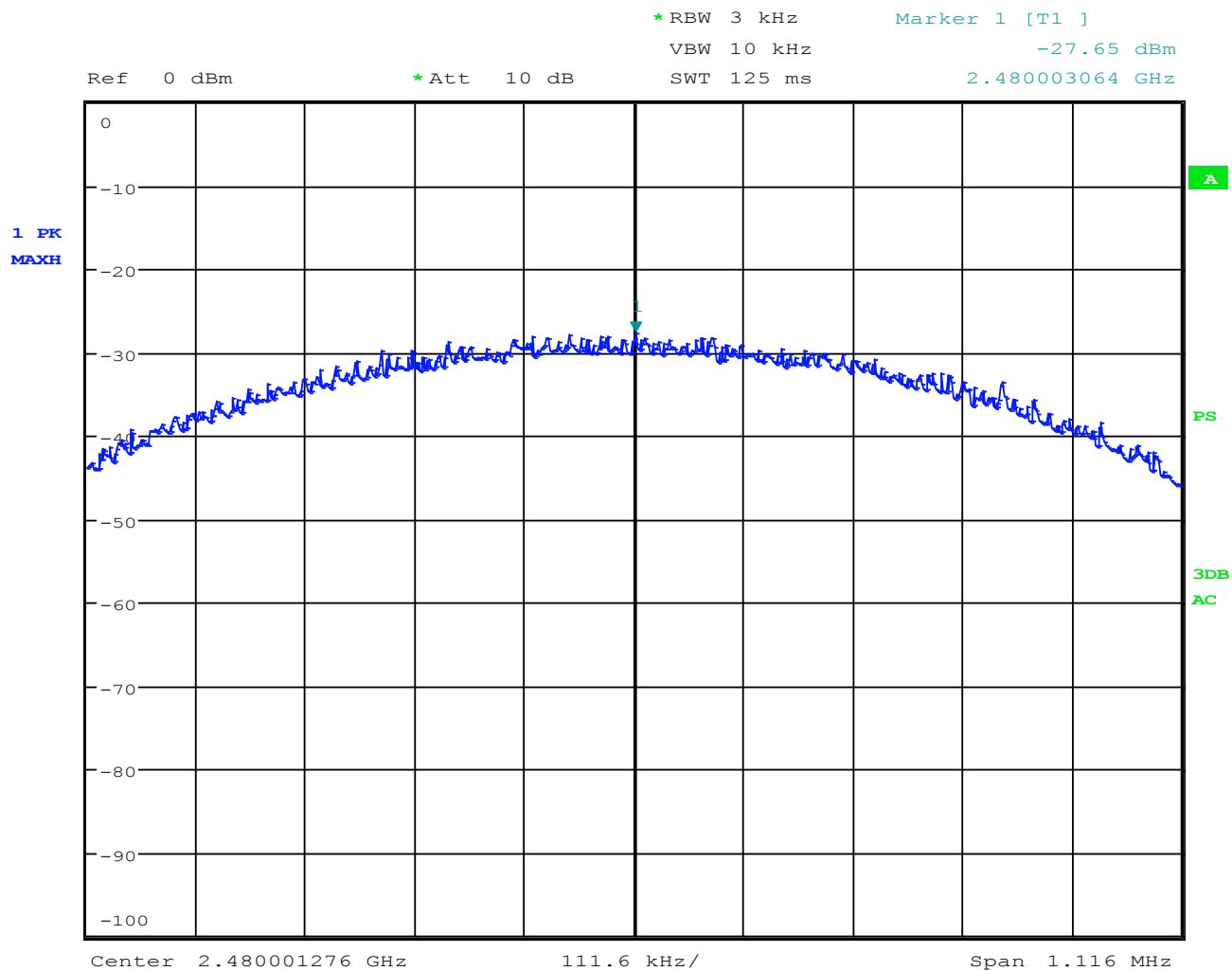
### **PLOT 7 – LOW CHANNEL - POWER SPECTRAL DENSITY**



TTTTTT

Date: 24.MAR.2014 20:00:56

### PLOT 8 – MID CHANNEL - POWER SPECTRAL DENSITY



TTTTTT

Date: 24.MAR.2014 20:31:33

### PLOT 9 – HIGH CHANNEL - POWER SPECTRAL DENSITY

## Part 5 - Out of Band Emissions (Band Edge)

DATE: March 24 2014

TEST STANDARD: FCC Part 15.247 (d) and RSS 210 Issue 8 A8.5

**TEST REQUIREMENTS:**

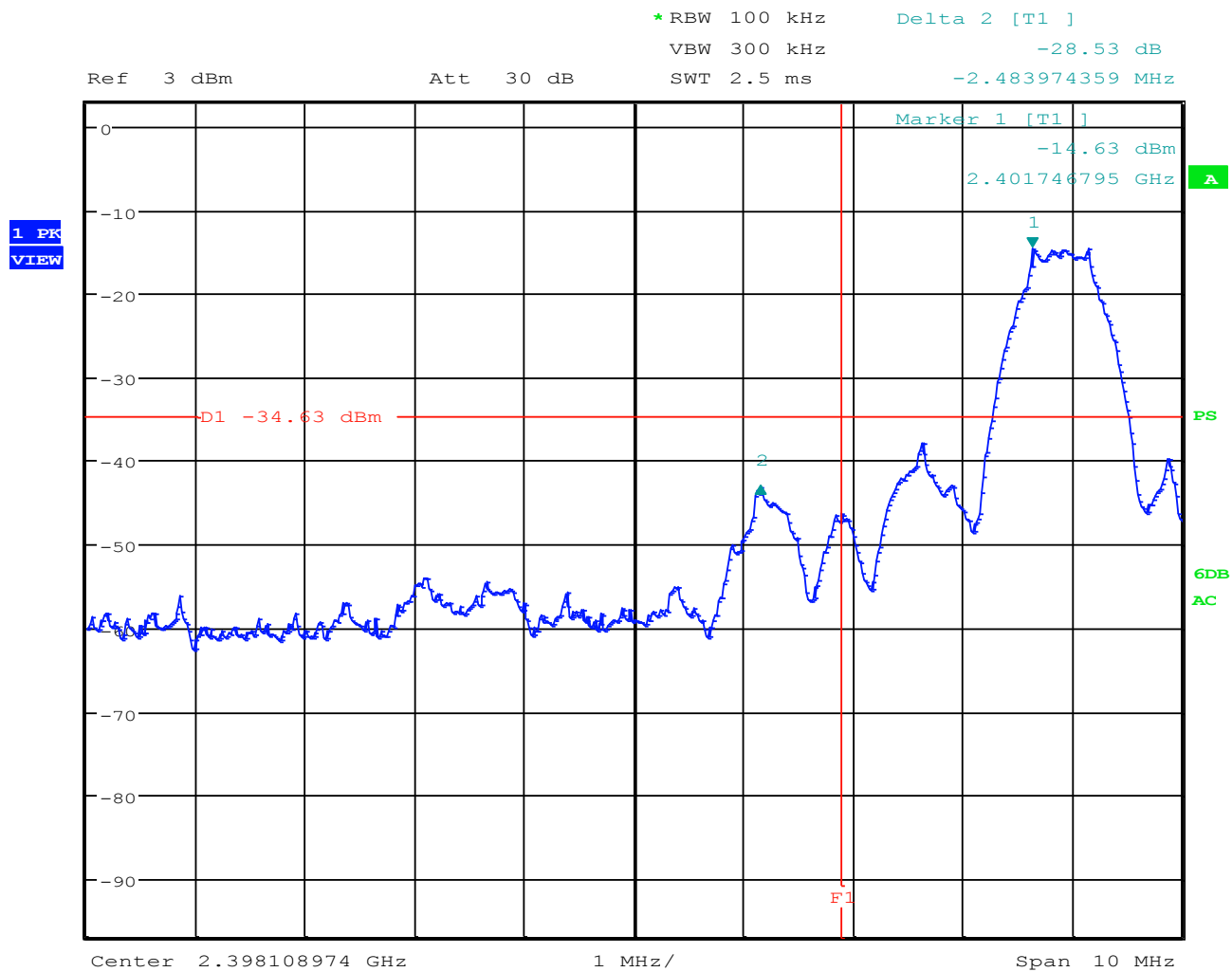
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

MEASUREMENT METHOD: As called by the standards above.

**EMISSIONS DATA:**

| Frequency (MHz) | Out of band Emissions Level (dBc) | Limit  | Results |
|-----------------|-----------------------------------|--------|---------|
| 2399.26         | -28.53                            | >20dBc | Pass    |
| 2483.53         | -38.28                            | >20dBc | Pass    |

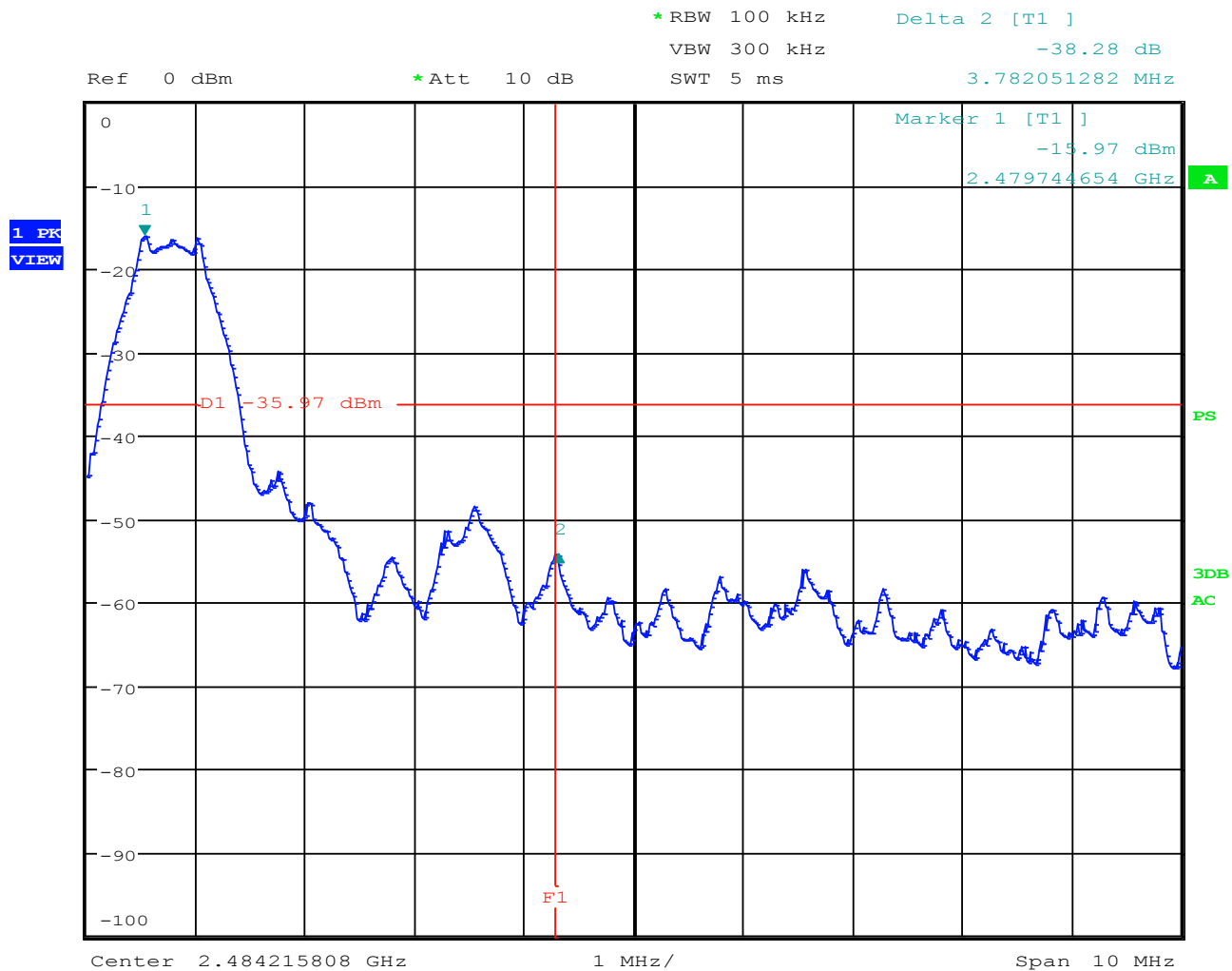
RESULTS: Pass: Complies



TTTTTT

Date: 24.MAR.2014 18:39:01

### PLOT 10: OUT OF BAND EMISSIONS LOW CHANNEL



TTTTTT

Date: 24.MAR.2014 20:43:28

### PLOT 11: OUT OF BAND EMISSIONS HIGH CHANNEL

## Part 6 - Conducted Spurious Emissions

DATE: March 24 2014

TEST STANDARD: FCC Part 15.247 (d), FCC Part 15.209 (a) and RSS 210 Issue 8 A8.5

### TEST REQUIREMENTS:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, provided that the transmitter demonstrates compliance with the peak conducted power limits.

MEASUREMENT METHOD: As called by the standards above. Conducted spurious emissions were measured up to 25GHz

### EMISSIONS DATA:

#### Low Channel Conducted Spurious Emissions

| Frequency (MHz) | Conducted Spurious Level (dBc) | Limit dBc | Results (Pass/Fail) |
|-----------------|--------------------------------|-----------|---------------------|
| 32.02           | -56.45                         | >20       | Pass                |
| 63.98           | -59.05                         | >20       | Pass                |
| 4807.74         | -41.26                         | >20       | Pass                |

#### Middle Channel Conducted Spurious Emissions

| Frequency (MHz) | Conducted Emissions Level (dBc) | Limit dBc | Results (Pass/Fail) |
|-----------------|---------------------------------|-----------|---------------------|
| 32.02           | -53.81                          | >20       | Pass                |
| 63.98           | -55.98                          | >20       | Pass                |
| 4879.8          | -43.4                           | >20       | Pass                |

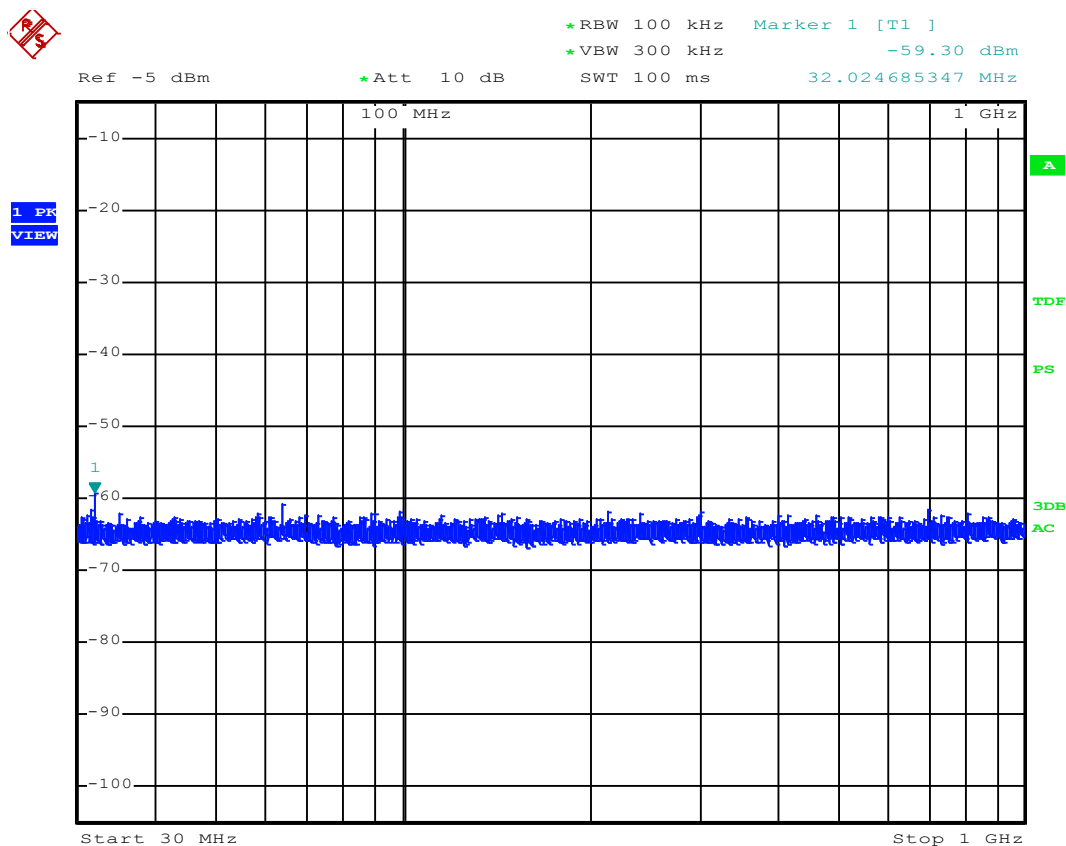
#### High Channel Conducted Spurious Emissions

| Frequency (MHz) | Conducted Spurious Emissions Level (dBc) | Limit dBc | Results (Pass/Fail) |
|-----------------|------------------------------------------|-----------|---------------------|
| 32.01           | -54.83                                   | >20       | Pass                |
| 63.98           | -55.29                                   | >20       | Pass                |
| 4966.34         | -49.59                                   | >20       | Pass                |

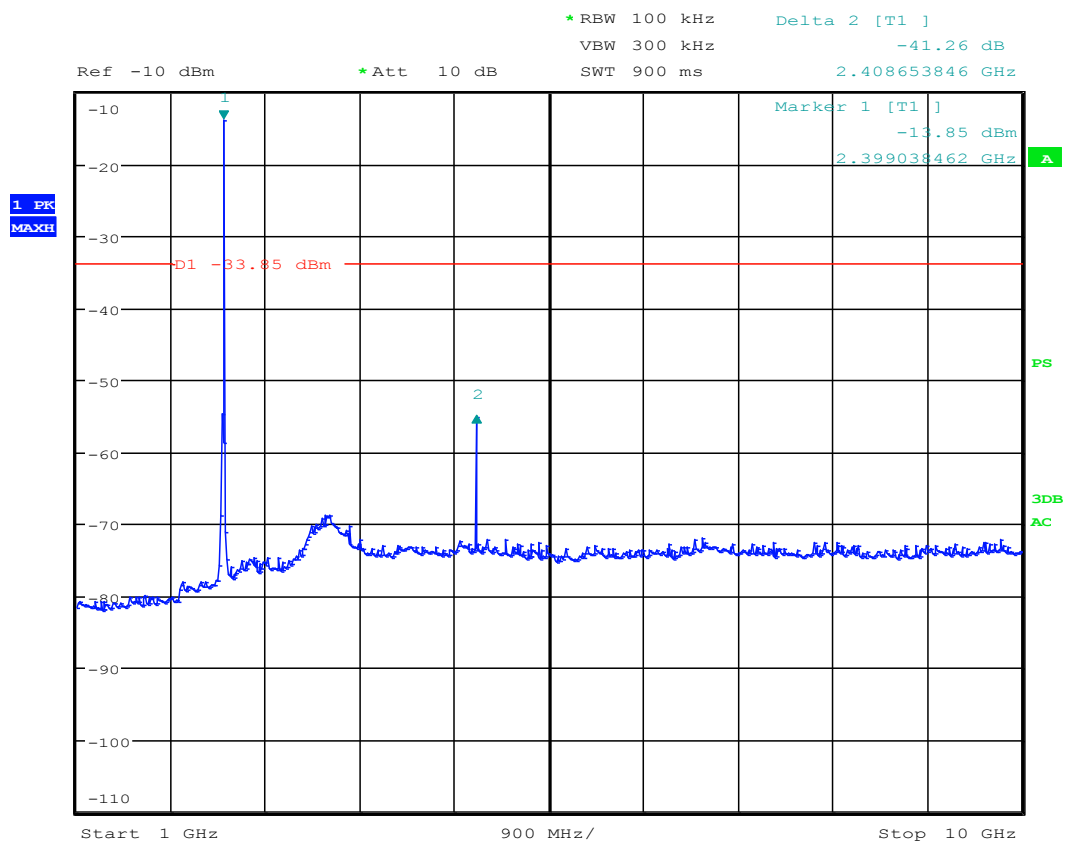
RESULTS: Pass: Complies

## TEST PLOTS – RF CONDUCTED SPURIOUS EMISSIONS

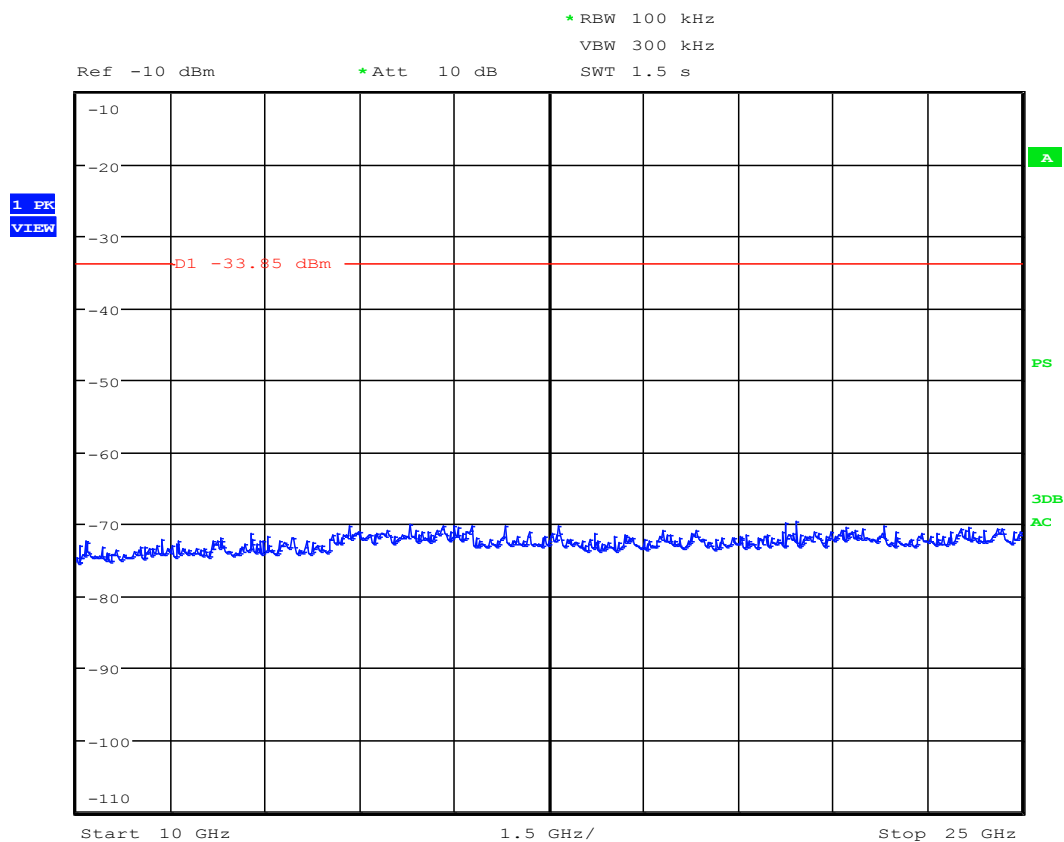
### RF CONDUCTED SPURIOUS EMISSIONS – LOW CHANNEL



**PLOT 12: Low Channel - Conducted Spurious Emissions 30MHz-1GHz**

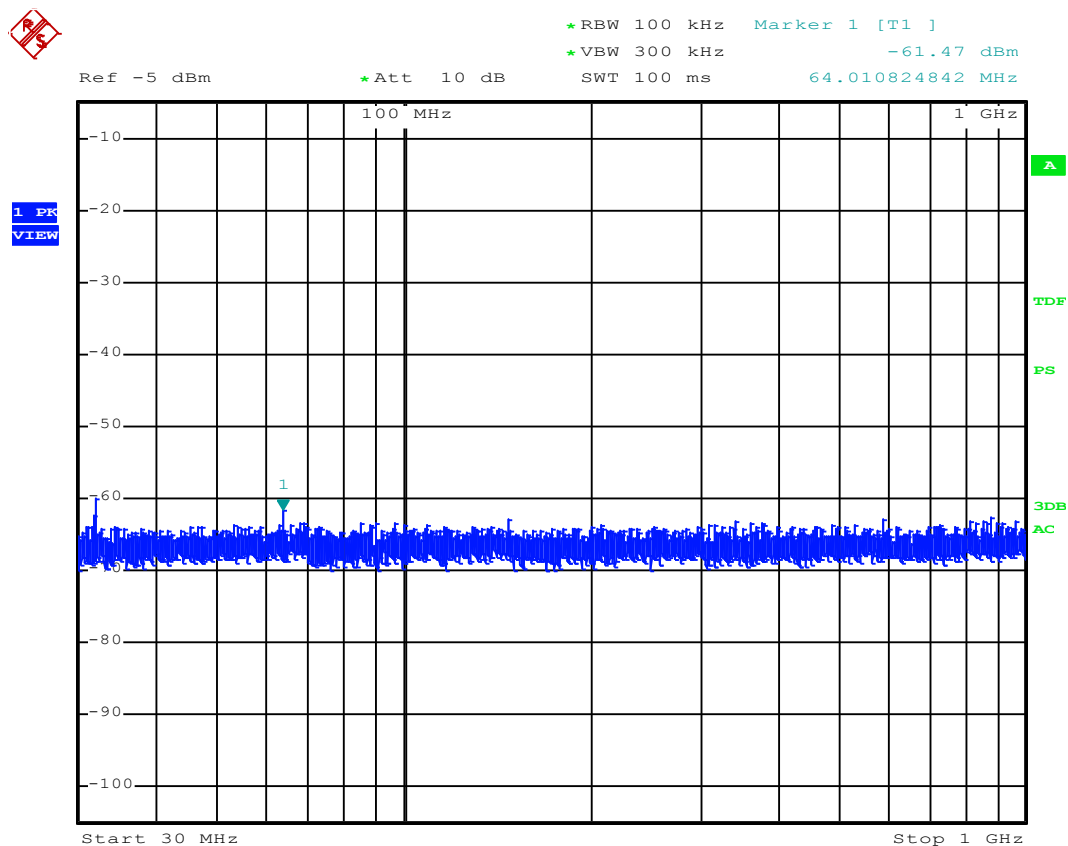


**PLOT 13: Low Channel - Conducted Spurious Emissions 1 - 10GHz**

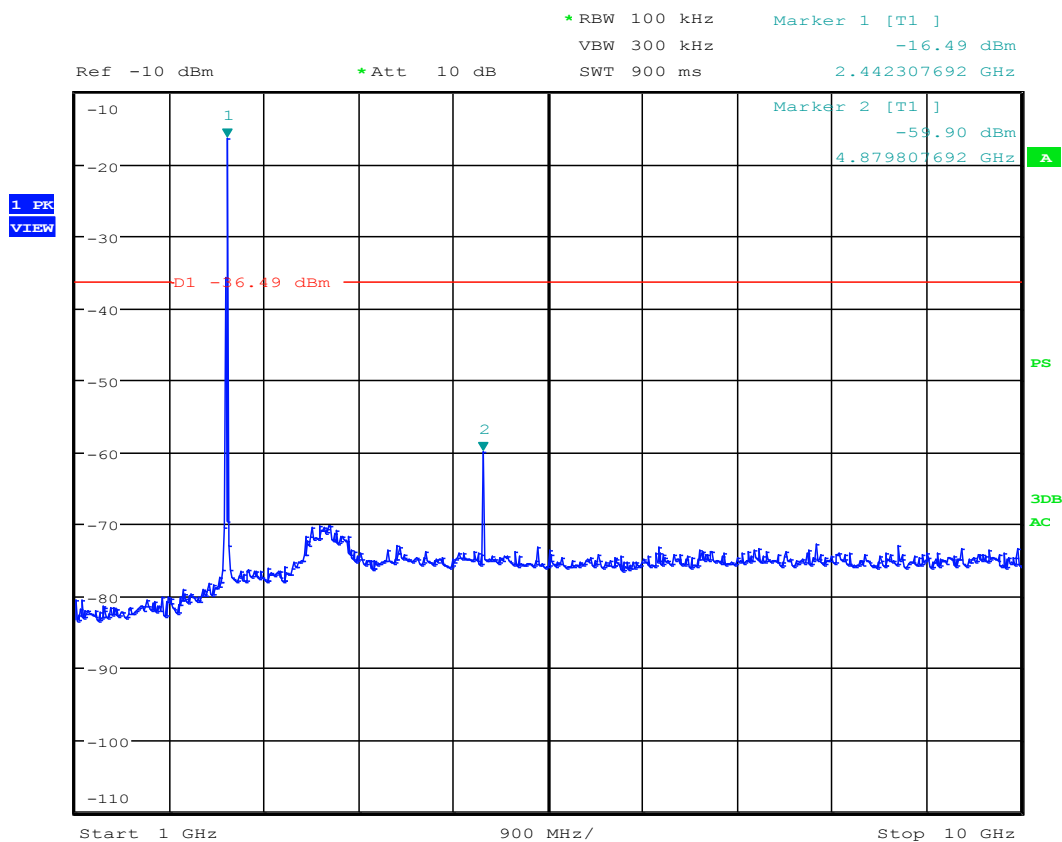


**PLOT 14: Low Channel - Conducted Spurious Emissions 10 - 25GHz**

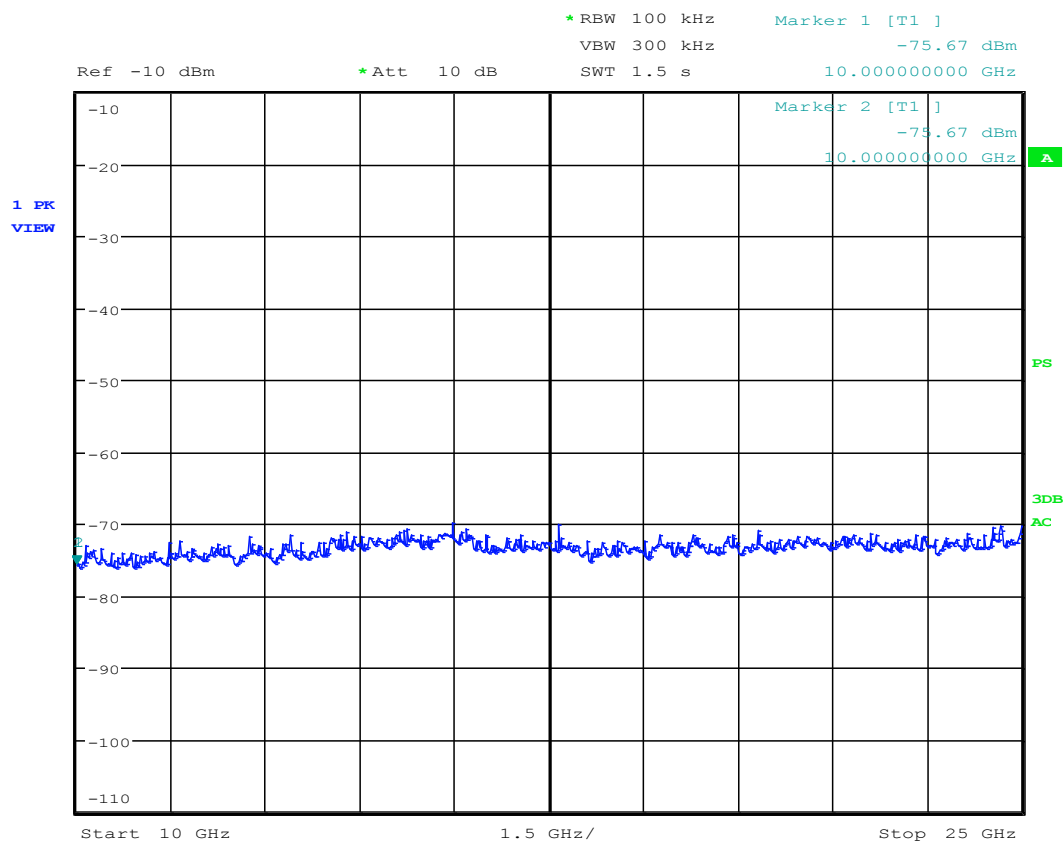
## RF CONDUCTED SPURIOUS EMISSIONS – MIDDLE CHANNEL



**PLOT 15: Middle Channel - Conducted Spurious Emissions 30MHz-1GHz**

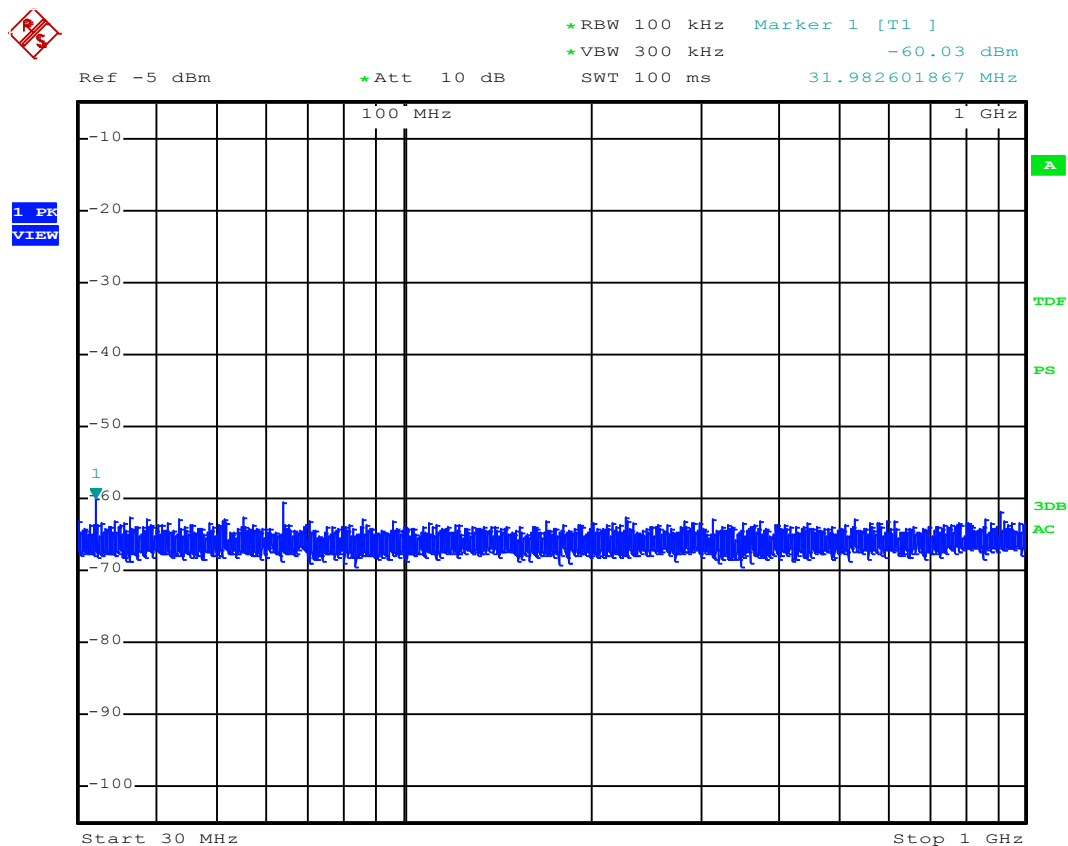


**PLOT 16: Middle Channel - Conducted Spurious Emissions 1 - 10GHz**

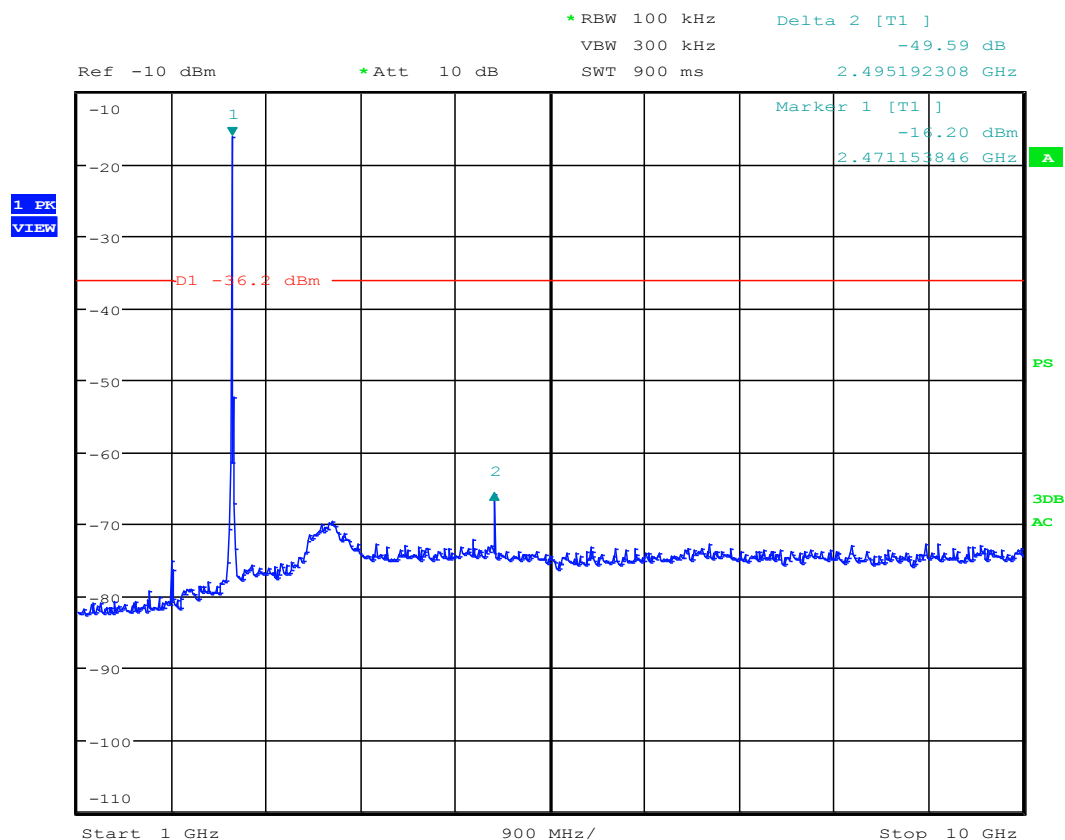


**PLOT 17: Middle Channel - Conducted Spurious Emissions 10 – 25GHz**

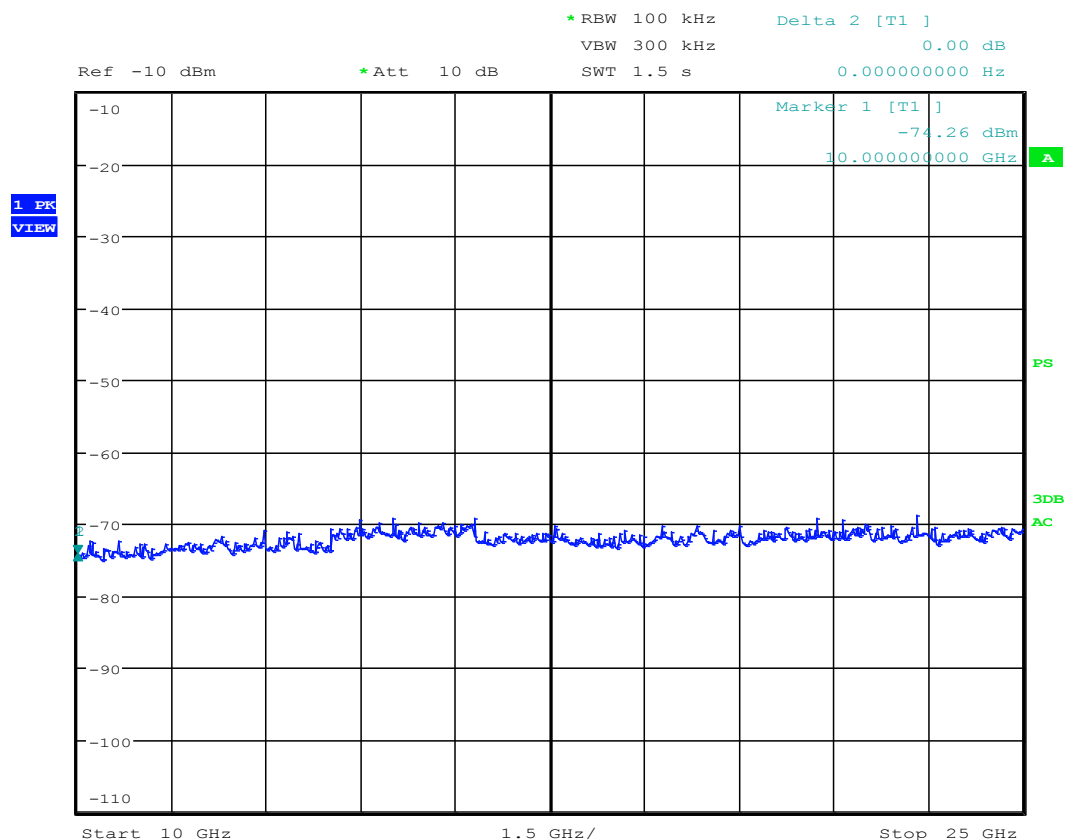
## RF CONDUCTED SPURIOUS EMISSIONS – HIGH CHANNEL



**PLOT 18: High Channel - Conducted Spurious Emissions 30MHz-1GHz**



**PLOT 19: High Channel - Conducted Spurious Emissions 1 - 10GHz**



**PLOT 20: High Channel - Conducted Spurious Emissions 10 - 25GHz**

## **Part 7 - Radiated Spurious Emissions-Transmit Mode**

DATE: March 28 2014

TEST STANDARD: FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205, IC RSS-210 Annex 2 Section (A2.2)(b), RSS-Gen Section (7.2.5)

TEST VOLTAGE: 3Vdc

TEST CONDITIONS: Indoor

MINIMUM STANDARD: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency ... if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

**Unwanted emissions falling into restricted bands of shall comply with the limits specified below**

| Frequency<br>(MHz) | Field Strength |                            |
|--------------------|----------------|----------------------------|
|                    | uV/m @ 3-m     | Calculated<br>dBµV/m at 3m |
| 30 – 88            | 100            | 40.0                       |
| 88 - 216           | 150            | 43.5                       |
| 216 - 960          | 200            | 46.0                       |
| 960 - 1000         | 500            | 54.0                       |

## **FCC PART 15.205-RESTRICTED BANDS OF OPERATION**

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| <b>MHz</b>        | <b>MHz</b>   | <b>MHz</b>    | <b>GHz</b>  |
|-------------------|--------------|---------------|-------------|
| 0.090-0.110       | 16.42-16.423 | 399.9-410     | 4.5-5.15    |
| 1 0.495-0.505*    | 16.69475-    | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-    | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67   | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25   | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6      | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2    | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94   | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138      | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05 | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-   | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9  | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-    | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2 | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285      | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4    | 3600-4400     | (2)         |
| 13.36-13.41       |              |               |             |

\* - note FCC-specific .

Canada-specific frequency ranges - 3.020-3.026, 5.677–5.683, 121.94-123.0, 149.9-150.05, 162.0125-167.17, 167.72-173.2, 1300-1427, 2483.5-2500, 3500-3600,

(2) Above 38,6 GHz

- (b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

### RESTRICTED FREQUENCY BANDS (RSS-GEN)

| MHz                 | MHz           | GHz         |
|---------------------|---------------|-------------|
| 0.090-0.110         | 240-285       | 9.0-9.2     |
| 2.1735-2.1905       | 322-335.4     | 9.3-9.5     |
| 3.020-3.026         | 399.9-410     | 10.6-12.7   |
| 4.125-4.128         | 608-614       | 13.25-13.4  |
| 4.17725-4.17775     | 960-1427      | 14.47-14.5  |
| 4.20725-4.20775     | 1435-1626.5   | 15.35-16.2  |
| 5.677-5.683         | 1645.5-1646.5 | 17.7-21.4   |
| 6.215-6.218         | 1660-1710     | 22.01-23.12 |
| 6.26775-6.26825     | 1718.8-1722.2 | 23.6-24.0   |
| 6.31175-6.31225     | 2200-2300     | 31.2-31.8   |
| 8.291-8.294         | 2310-2390     | 36.43-36.5  |
| 8.362-8.366         | 2655-2900     | Above 38.6  |
| 8.37625-8.38675     | 3260-3267     |             |
| 8.41425-8.41475     | 3332-3339     |             |
| 12.29-12.293        | 3345.8-3358   |             |
| 12.51975-12.52025   | 3500-4400     |             |
| 12.57675-12.57725   | 4500-5150     |             |
| 13.36-13.41         | 5350-5460     |             |
| 16.42-16.423        | 7250-7750     |             |
| 16.69475-16.69525   | 8025-8500     |             |
| 16.80425-16.80475   |               |             |
| 25.5-25.67          |               |             |
| 37.5-38.25          |               |             |
| 73-74.6             |               |             |
| 74.8-75.2           |               |             |
| 108-138             |               |             |
| 156.52475-156.52525 |               |             |
| 156.7-156.9         |               |             |

**Note:** Certain frequency bands listed in Table 3 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300- series RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

#### TEST SETUP:

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and connected to a 3Vdc battery. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

#### MEASUREMENT METHOD:

Measurements were made using spectrum analyser and receiver, 200Hz RBW average detector for the frequency range 9-150KHz; 9kHz RBW average detector for the Frequency range 150kHz to 30MHz; 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters.

The measurement results are obtained as described below:

$$E [dB\mu V/m] = \text{Un-Corrected Value} + \text{ATOT}$$

Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

#### EMISSIONS DATA:

##### Radiated Spurious Emissions – Low Channel

| Freq      | Un-corr<br>Pk | Un-corr<br>Avg | Height | Pol | Table<br>position | Ant.<br>Factor | Corr.<br>Factors | Corr.<br>Avg | Corr<br>Peak | Margin<br>Avg | Limit<br>Avg | Margin<br>Peak | Limit<br>Peak |
|-----------|---------------|----------------|--------|-----|-------------------|----------------|------------------|--------------|--------------|---------------|--------------|----------------|---------------|
| MHz       | dB $\mu$ V/m  | dB $\mu$ V/m   | cm     |     | deg               | dB             | dB               | dB $\mu$ V/m | dB $\mu$ V/m | dB            | dB $\mu$ V/m | dB             | dB $\mu$ V/m  |
| 4807.8578 | 45.9          | 39.5           | 133    | V   | 212               | 28.5           | -26.4            | 41.6         | 48           | 12.4          | 54           | 26             | 74            |
| 4809.4656 | 49.9          | 44.06          | 158    | H   | 272               | 28.5           | -26.2            | 46.36        | 52.2         | 7.64          | 54           | 21.8           | 74            |
| 7213.212  | 40.3          | 28.7           | 100    | V   | 60                | 33.4           | -26.6            | 35.5         | 47.1         | 18.5          | 54           | 26.9           | 74            |
| 7213.3582 | 43.2          | 31.4           | 156    | H   | 165               | 33.4           | -26.6            | 38.2         | 50           | 15.8          | 54           | 24             | 74            |
| 9608      | 35.3          | 24.1           | 144    | H   | 180               | 37.1           | -20.7            | 40.5         | 51.7         | 13.5          | 54           | 22.3           | 74            |

##### Radiated Spurious Emissions – Middle Channel

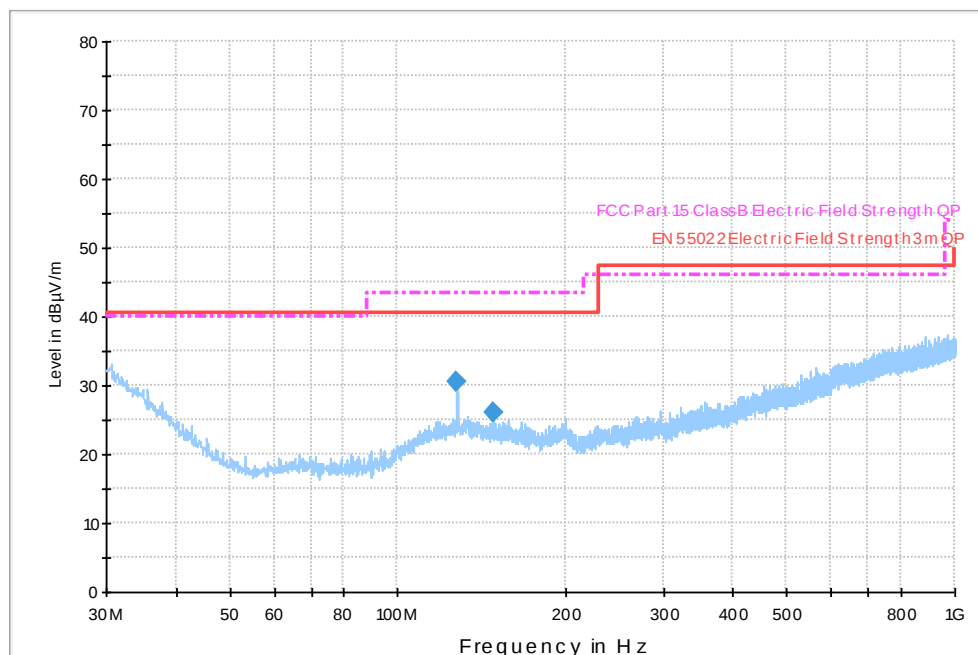
| Freq | Un-corr<br>Pk | Un-corr<br>Avg | Height | Pol | Table<br>position | Ant.<br>Factor | Corr.<br>Factors | Corr.<br>Avg | Corr<br>PK   | Margin<br>Avg | Limit<br>Avg | Margin<br>Peak | Limit<br>Peak |
|------|---------------|----------------|--------|-----|-------------------|----------------|------------------|--------------|--------------|---------------|--------------|----------------|---------------|
| MHz  | dB $\mu$ V/m  | dB $\mu$ V/m   | cm     |     | deg               | dB             | dB               | dB $\mu$ V/m | dB $\mu$ V/m | dB            | dB $\mu$ V/m | dB             | dB $\mu$ V/m  |
| 4880 | 44.62         | 36.51          | 172    | V   | 184               | 28.6           | -27.7            | 37.41        | 45.52        | 16.59         | 54           | 28.48          | 74            |
| 4880 | 48.86         | 41.85          | 152    | H   | 300               | 28.6           | -27.7            | 42.75        | 49.76        | 11.25         | 54           | 24.24          | 74            |
| 7320 | 40.5          | 27.6           | 100    | V   | 30                | 33.5           | -25.68           | 35.42        | 48.32        | 18.58         | 54           | 25.68          | 74            |
| 7320 | 41.8          | 30.1           | 145    | H   | 350               | 33.5           | -25.68           | 37.92        | 49.62        | 16.08         | 54           | 24.38          | 74            |

##### Radiated Spurious Emissions – High Channel

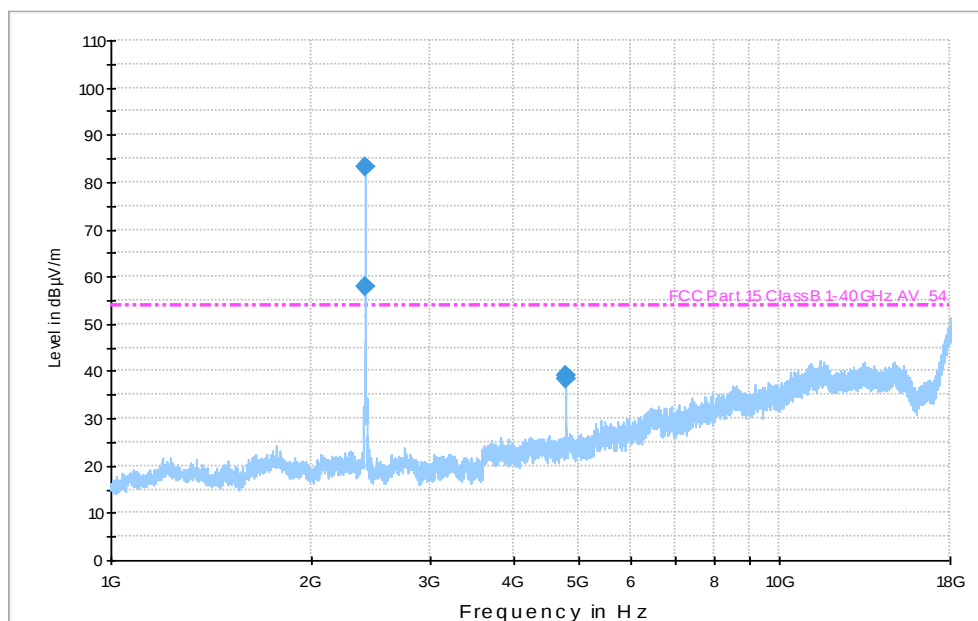
| Freq      | Un-corr<br>Pk | Un-corr<br>Avg | Height | Pol | Table<br>position | Ant.<br>Factors | Corr.<br>Factors | Corr.<br>Avg | Corr<br>PK   | Margin<br>Avg | Limit<br>Avg | Margin<br>Peak | Limit<br>Peak |
|-----------|---------------|----------------|--------|-----|-------------------|-----------------|------------------|--------------|--------------|---------------|--------------|----------------|---------------|
| MHz       | dB $\mu$ V/m  | dB $\mu$ V/m   | cm     |     | deg               | dB              | dB               | dB $\mu$ V/m | dB $\mu$ V/m | dB            | dB $\mu$ V/m | dB             | dB $\mu$ V/m  |
| 4960      | 44            | 34.76          | 184    | V   | 213               | 28.85           | -25.89           | 37.72        | 46.96        | 16.28         | 54           | 27.04          | 74            |
| 4960      | 47.5          | 39.4           | 155    | H   | 293               | 28.85           | -25.89           | 42.36        | 50.46        | 11.64         | 54           | 23.54          | 74            |
| 7438.5632 | 39.8          | 30             | 100    | V   | 360               | 33.5            | -26.38           | 37.12        | 46.92        | 16.88         | 54           | 27.08          | 74            |
| 7438.6957 | 41.78         | 31.29          | 100    | H   | 335               | 33.5            | -26.38           | 38.41        | 48.9         | 15.59         | 54           | 25.1           | 74            |

RESULTS: Pass: Complies

## TEST PLOTS: RADIATED SPURIOUS EMISSIONS TRANSMIT MODE



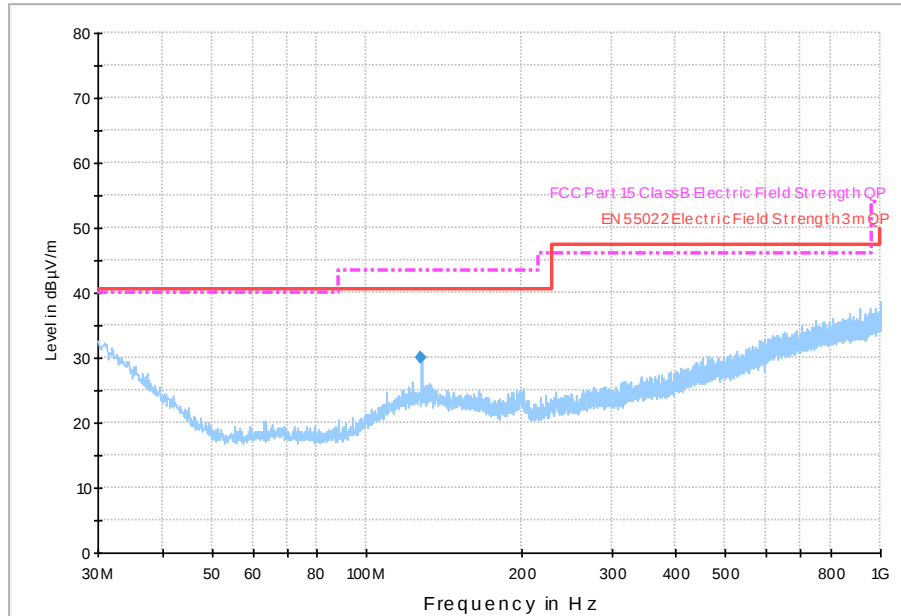
**PLOT 21: Low Channel Radiated Spurious Emissions 30MHz – 1GHz**



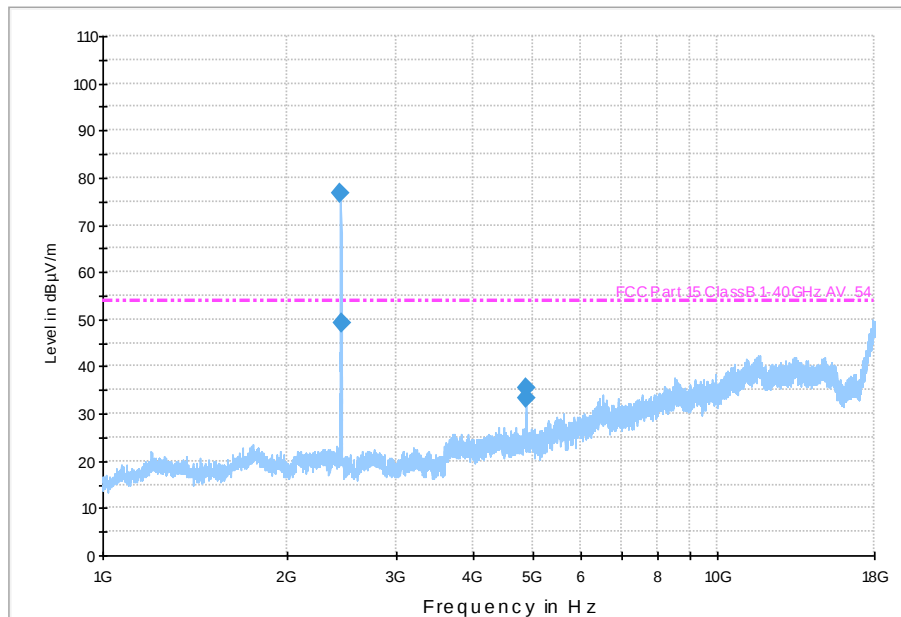
**PLOT 22: Low Channel Radiated Spurious Emissions 1 – 18GHz**

**Note:**

1. Emissions marked in Plot 21 were ambient signals. All other emissions below 1GHz were more than 20dB lower than the limit line.
2. Radiated Emissions test was performed from 9 kHz-25GHz. Except the emissions reported above, all other signals were more than 20dB lower than the limit.



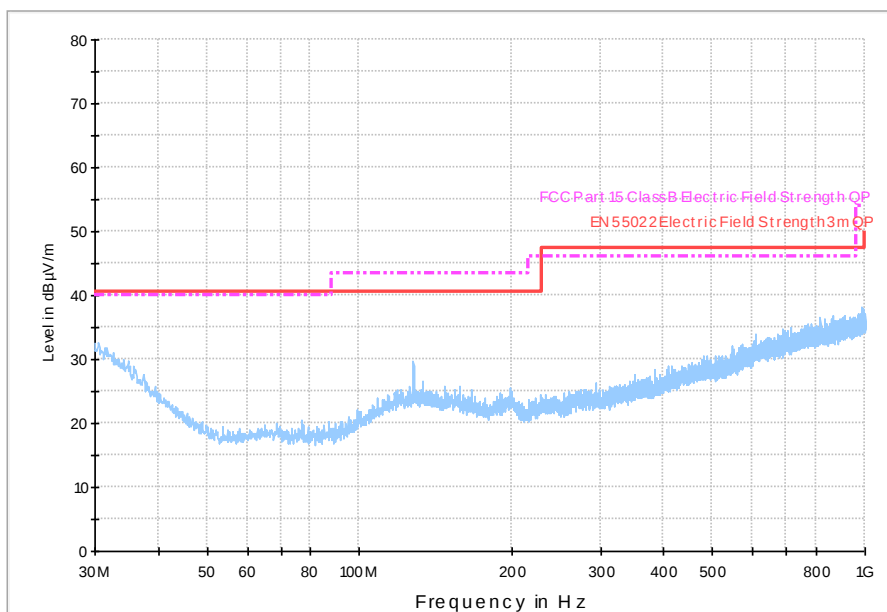
**PLOT 23: Middle Channel - Radiated Spurious Emissions 30MHz – 1GHz**



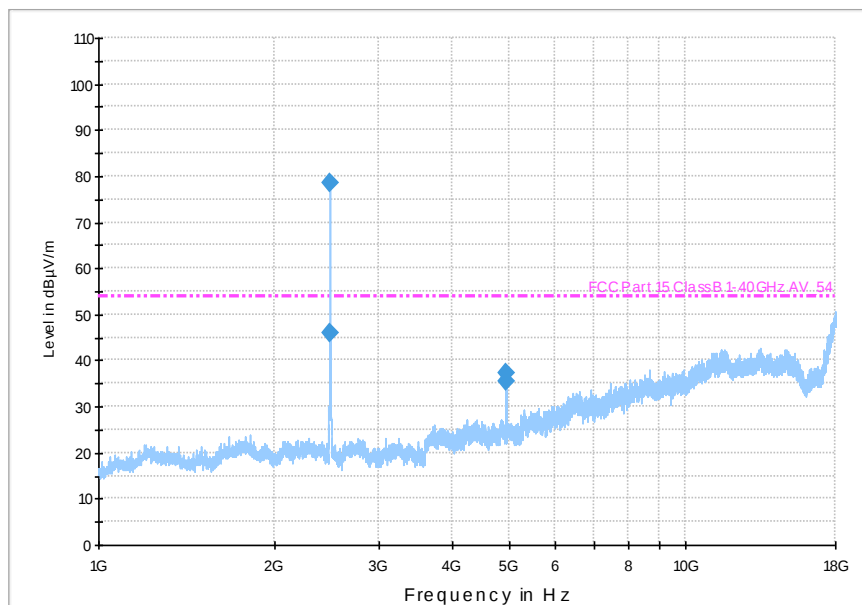
**PLOT 24: Middle Channel - Radiated Spurious Emissions 1-18GHz**

**Note:**

1. Emissions marked in Plot 23 were ambient signals. All other emissions below 1GHz were more than 20dB lower than the limit line.
2. Radiated Emissions test was performed from 9 kHz-25GHz. Except the emissions reported above, all other signals were more than 20dB lower than the limit.



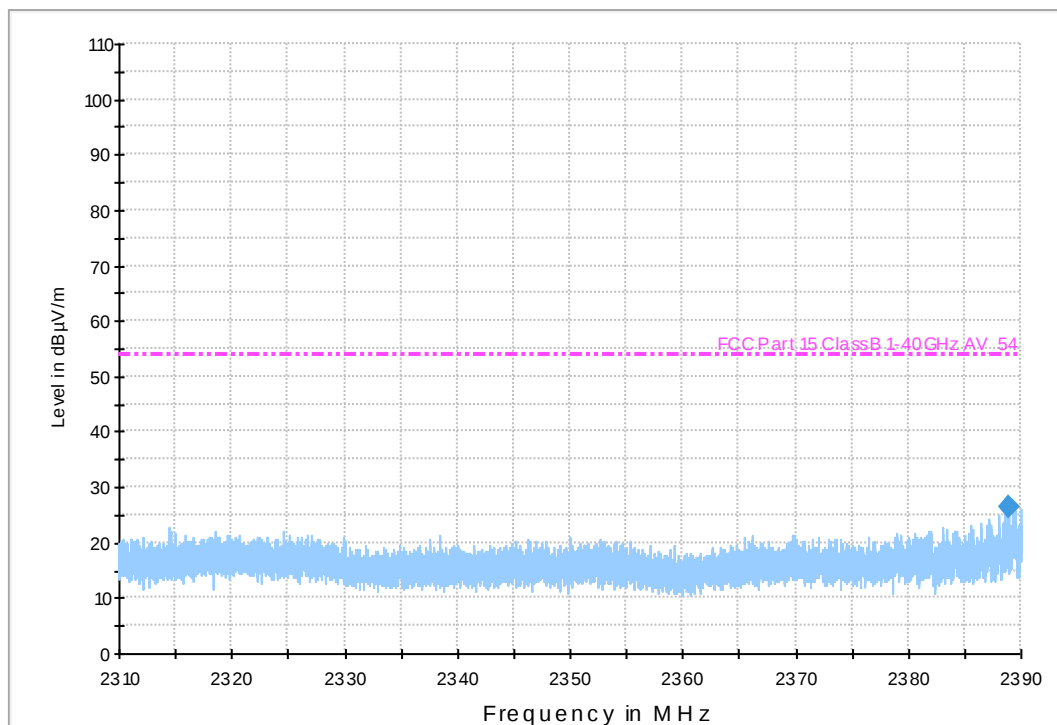
**PLOT 25: High Channel - Radiated Spurious Emissions 30MHz – 1000GHz**



**PLOT 26: High Channel - Radiated Spurious Emissions 1 – 18GHz**

**Note:**

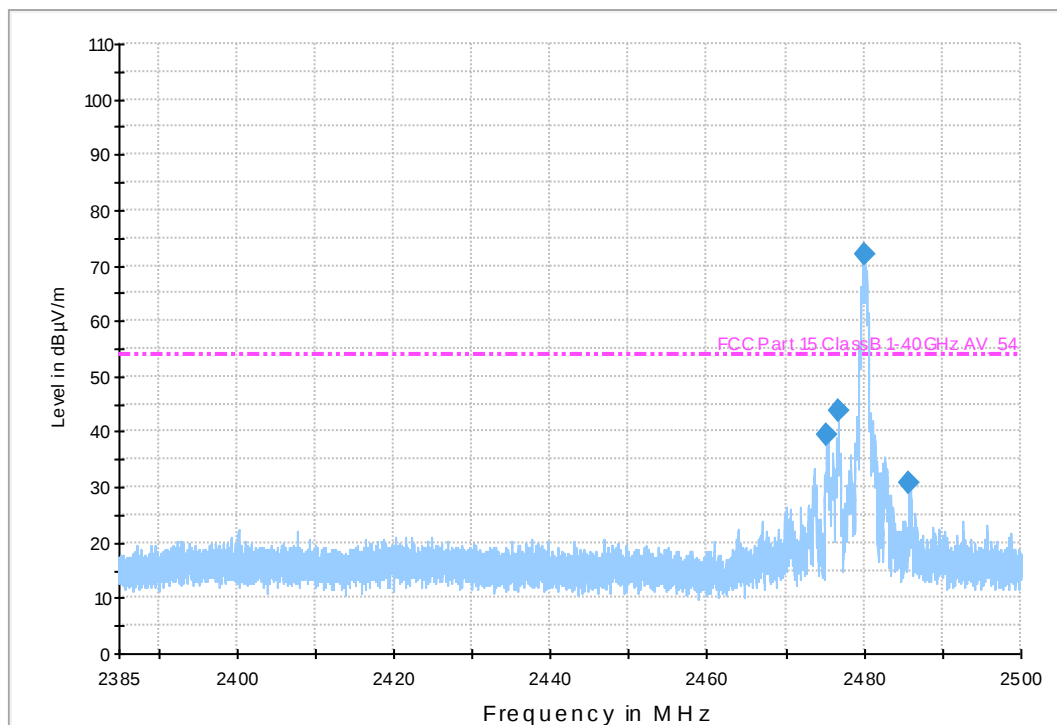
1. Emissions marked in Plot 25 were ambient signals. All other emissions below 1GHz were more than 20dB lower than the limit line.
2. Radiated Emissions test was performed from 9 kHz-25GHz. Except the emissions reported above, all other signals were more than 20dB lower than the limit.



**PLOT 27: Radiated Spurious Emissions 2.31 - 2.39 GHz**

### Radiated Spurious Emissions

| Freq    | Un-corr<br>Pk | Un-corr<br>Avg | Height | Pol | Table<br>position | Corr.<br>Factors | Corr.<br>Avg | Corr<br>PK | Margin<br>Avg | Limit<br>Avg | Margin<br>Peak | Limit<br>Peak |
|---------|---------------|----------------|--------|-----|-------------------|------------------|--------------|------------|---------------|--------------|----------------|---------------|
| MHz     | dBμV/m        | dBμV/m         | cm     |     | deg               | dB               | dBμV/m       | dBμV/m     | dB            | dBμV/m       | dB             | dBμV/m        |
| 2389.01 | 36.58         | 28.26          | 145    | H   | 178               | -9.6             | 18.66        | 26.98      | 35.34         | 54           | 47.02          | 74            |



**PLOT 28: Radiated Spurious Emissions 2.385 - 2.5 GHz**

### Radiated Spurious Emissions

| Freq       | Un-corr | Un-corr | Height | Pol | Table position | Corr. Factors | Corr. Avg | Corr   | Margin | Limit  | Margin | Limit  |
|------------|---------|---------|--------|-----|----------------|---------------|-----------|--------|--------|--------|--------|--------|
|            | Pk      | Avg     |        |     |                |               |           | PK     | Avg    | Avg    | Peak   | Peak   |
| MHz        | dBμV/m  | dBμV/m  | cm     |     | deg            | dB            | dBμV/m    | dBμV/m | dB     | dBμV/m | dB     | dBμV/m |
| 2475.206   | 47.6    | 41.4    | 127    | H   | 279            | -10.1         | 31.3      | 37.5   | 22.7   | 54     | 36.5   | 74     |
| 2485.786   | 44.5    | 38.3    | 115    | H   | 210            | -10.1         | 28.2      | 34.4   | 25.8   | 54     | 39.6   | 74     |
| 2476.71633 | 40.4    | 31.84   | 100    | H   | 289            | -10.1         | 21.7      | 30.3   | 32.3   | 54     | 43.7   | 74     |

Note: Emissions over the limit line in the above plot was the fundamental transmitting frequency.

## **Part 8 - Radiated Spurious Emissions-Receive Mode**

DATE: March 28 2014

TEST STANDARD: FCC Part 15.247 (d), FCC Part 15.209 (a) and ICES-003 Issue 5

TEST VOLTAGE: 3Vdc

TEST CONDITIONS: Indoor

MINIMUM STANDARD: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency ... if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Unwanted emissions falling into restricted bands of shall comply with the limits specified below

| Frequency<br>(MHz) | Field Strength |                            |
|--------------------|----------------|----------------------------|
|                    | uV/m @ 3-m     | Calculated<br>dBµV/m at 3m |
| 30 – 88            | 100            | 40.0                       |
| 88 - 216           | 150            | 43.5                       |
| 216 - 960          | 200            | 46.0                       |
| 960 - 1000         | 500            | 54.0                       |

TEST SETUP: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and connected to a 3Vdc battery. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

MEASUREMENT METHOD: Measurements were made using spectrum analyser and receiver, 200Hz RBW average detector for the frequency range 9-150KHz; 9kHz RBW average detector for the Frequency range 150kHz to 30MHz; 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters.

The measurement results are obtained as described below:

**$E [dB\mu V/m] = \text{Un-Corrected Value} + ATOT$**

Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain ( $ATOT = LCABLES + AF - AMP$ ).

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA:

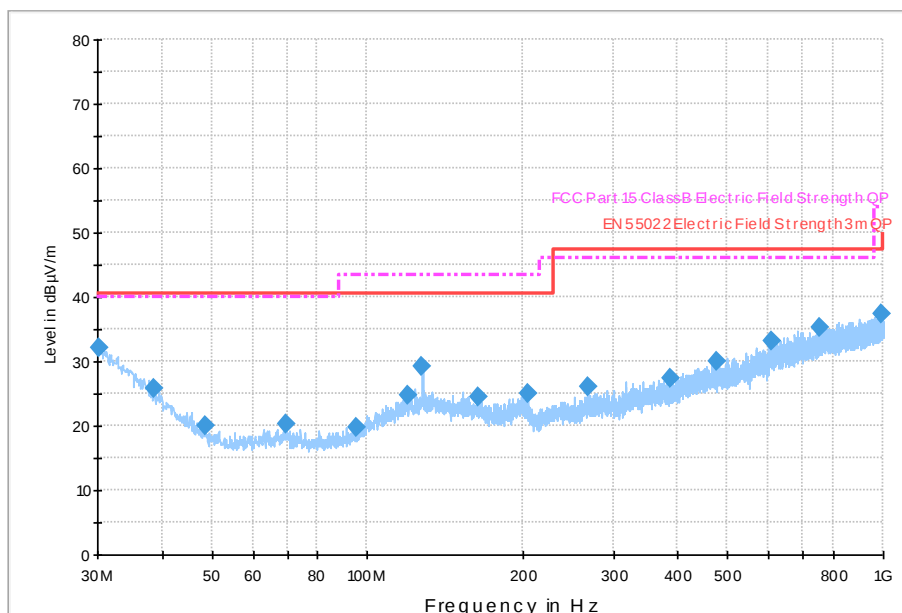
Radiated Emissions Receive Mode for Low, Middle and High Channel

| Frequency | Uncorr-Avg | Bandwidth | Antenna height | Polarity | Turntable position | Antenna Factors | Correction Factors | Corr. Avg | Margin | Limit    |
|-----------|------------|-----------|----------------|----------|--------------------|-----------------|--------------------|-----------|--------|----------|
| (MHz)     | (dBμV/m)   | (kHz)     | (cm)           |          | (deg)              | (dB)            | (dB)               | (dBμV/m)  | (dB)   | (dBμV/m) |
| 4805.4656 | 40.6       | 1000      | 100            | H        | 89                 | 28.5            | -26.2              | 42.9      | 11.1   | 54       |
| 4881.1    | 39.23      | 1000      | 100            | H        | 109                | 28.6            | -27.7              | 40.13     | 13.87  | 54       |
| 4960      | 39.08      | 1000      | 155            | H        | 293                | 28.85           | -25.89             | 42.04     | 11.96  | 54       |

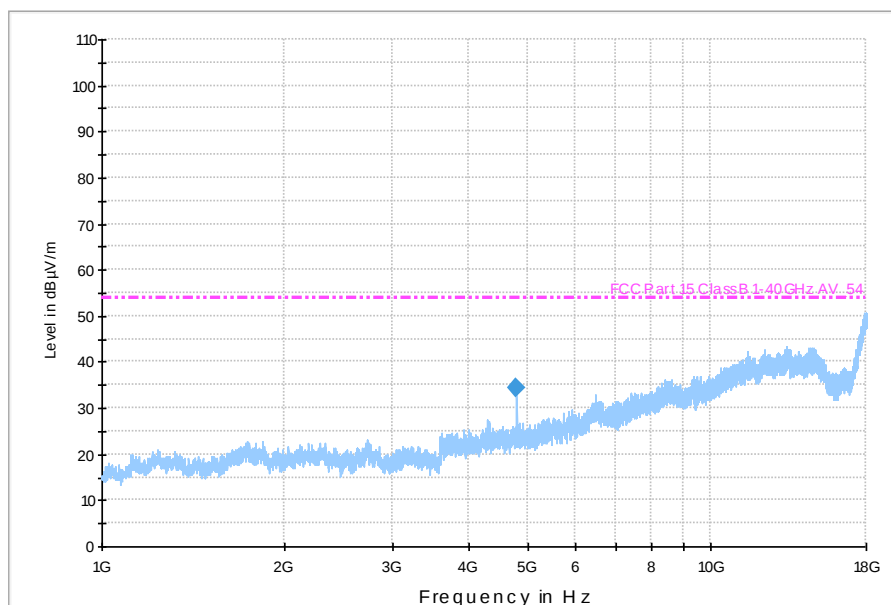
Note: All other emissions from 9KHz – 25GHz were more than 20dB lower than the limit line.

RESULTS: Pass: Complies.

### TEST PLOTS – RADIATED EMISSIONS RECEIVE MODE



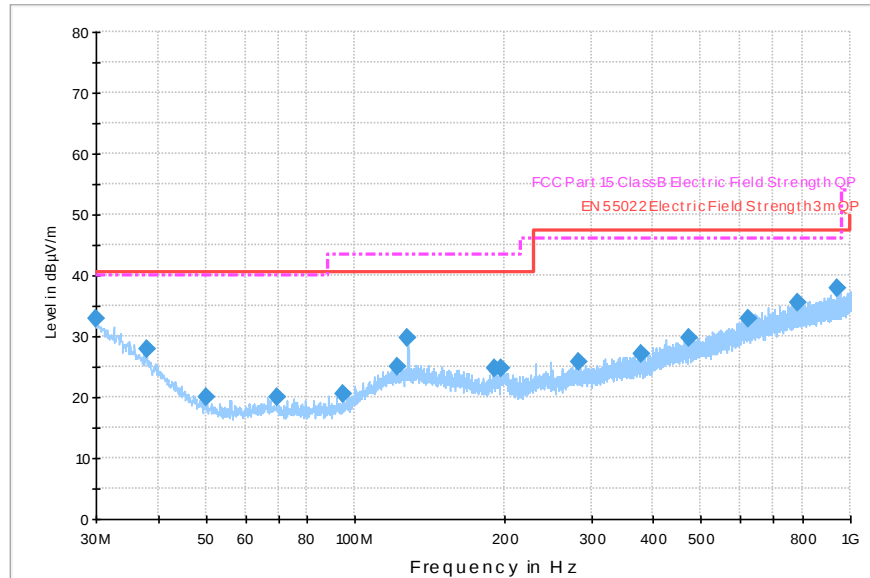
**PLOT 29: Low Channel - Radiated Spurious Emissions (Receive Mode) - 30MHz – 1GHz**



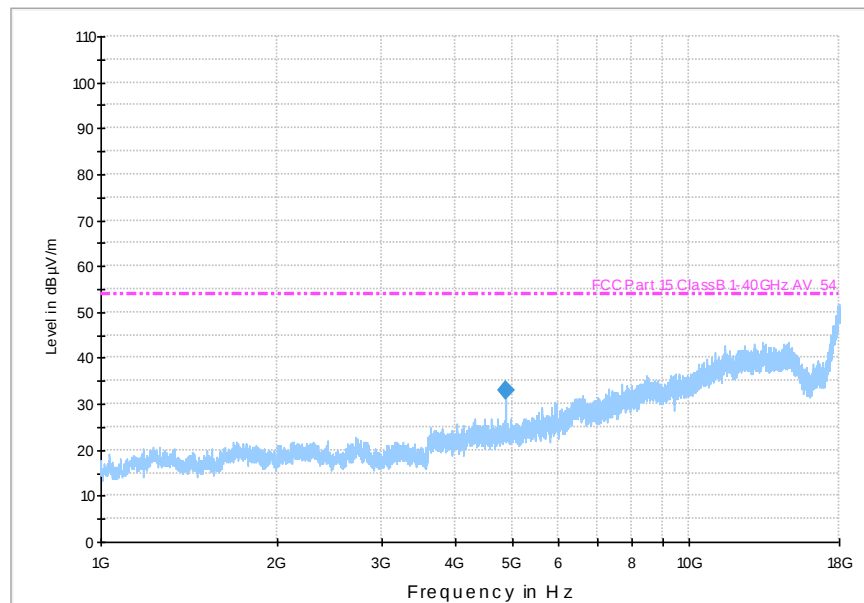
**PLOT 30: Low Channel - Radiated Spurious Emissions (Receive Mode) – 1 - 18GHz**

Note:

1. Emissions marked in Plot 27 were ambient signals. All other emissions below 1GHz were more than 20dB lower than the limit line.
2. Radiated Emissions test was performed from 9 kHz-25GHz. Except the emissions reported above, all other signals were more than 20dB lower than the limit.



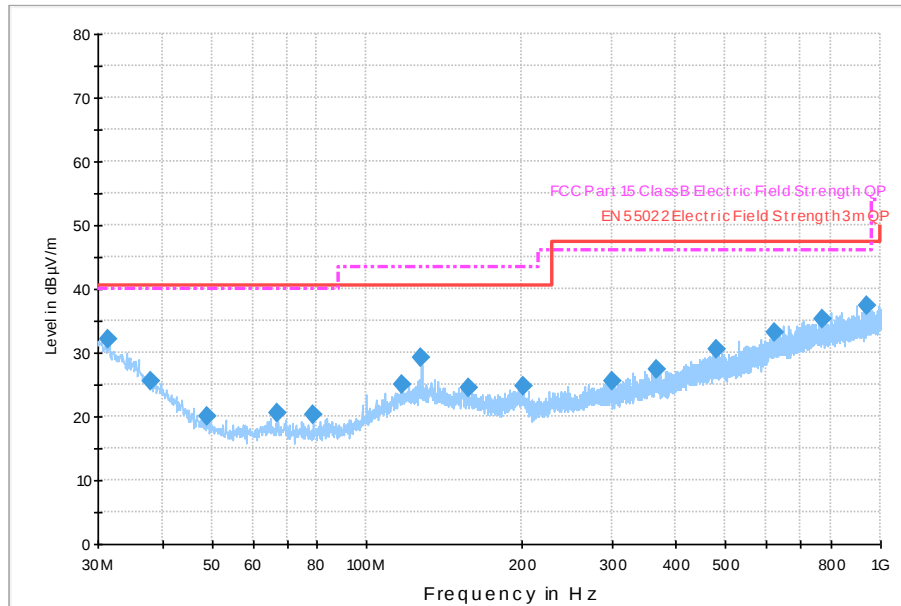
**PLOT 31: Middle Channel - Radiated Spurious Emissions (Receive Mode) - 30MHz – 1GHz**



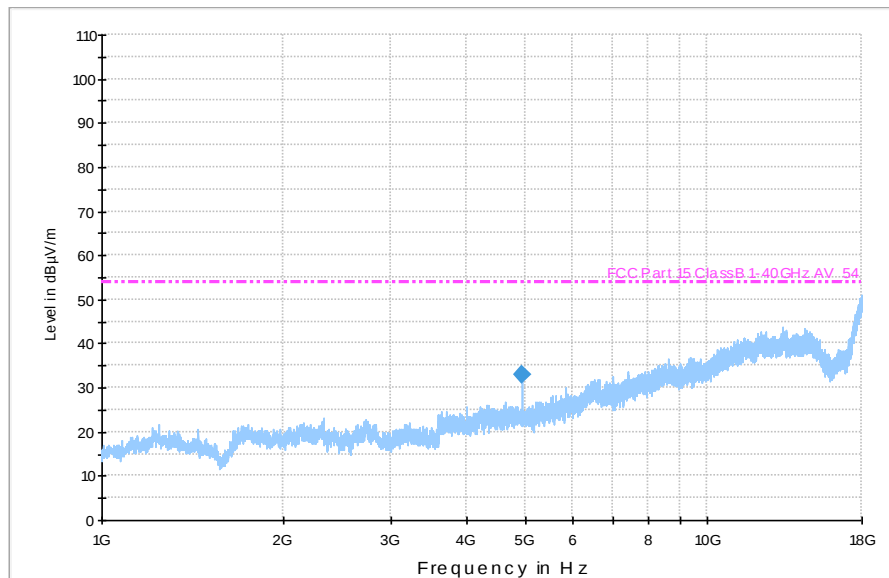
**PLOT 32: Middle Channel - Radiated Spurious Emissions (Receive Mode) – 1-18GHz**

**Note:**

1. Emissions marked in Plot 29 were ambient signals. All other emissions below 1GHz were more than 20dB lower than the limit line.
2. Radiated Emissions test was performed from 9 kHz-25GHz. Except the emissions reported above, all other signals were more than 20dB lower than the limit.



**PLOT 33: High Channel - Radiated Spurious Emissions (Receive Mode) - 30MHz – 1GHz**



**PLOT 34: High Channel - Radiated Spurious Emissions (Receive Mode) – 1 – 18GHz**

**Note:**

1. Emissions marked in Plot 31 were ambient signals. All other emissions below 1GHz were more than 20dB lower than the limit line.
2. Radiated Emissions test was performed from 9 kHz-25GHz. Except the emissions reported above, all other signals were more than 20dB lower than the limit.

## Part 9 - DUTY CYCLE CORRECTION FACTOR FOR RADIATED EMISSIONS

DATE: March 28 2014

TEST STANDARD: FCC Part 15.35 (d), FCC Part 15.209 (a) and ICES-003 Issue 5

TEST VOLTAGE: 3Vdc

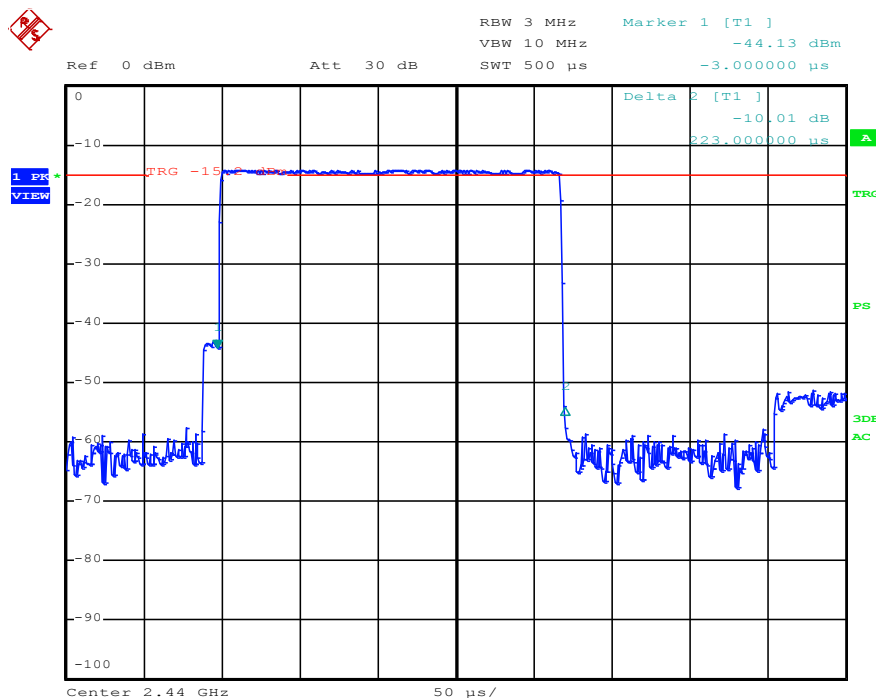
TEST CONDITIONS: Indoor

MEASUREMENT METHOD: The FCC regulations provide an allowance for correcting pulsed transmissions when the limits are expressed in terms of an average, and the average measurement may be derived from the peak pulse amplitude corrected for the duty cycle.

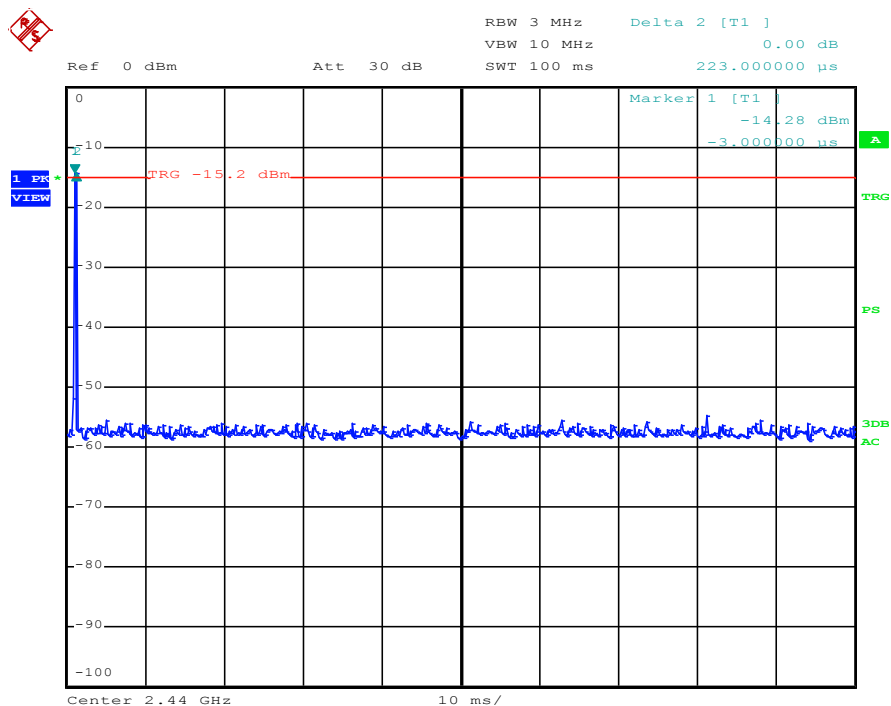
As detailed in 47 CFR Part 15.35(c), the correction factor of a transmission is a 100 ms capture of a characteristic pulse train of "on time". In the event that the pulse train is greater than 100 ms, the 100 ms pulse train captured must include a representation of worst-case "on time" pulses.

TEST SETUP: EUT was set up to operate in its normal mode of operation and communicating with iPad.

MEASUREMENT DATA:



**Plot 35: DWELL TIME: 223μsec**



**PLOT 36: DWELL TIME OVER 100msec**

**RESULTS:** Duty cycle correction factor =  $20 * \log (\text{Dwell Time}/100) = -53.03 \text{ dB}$

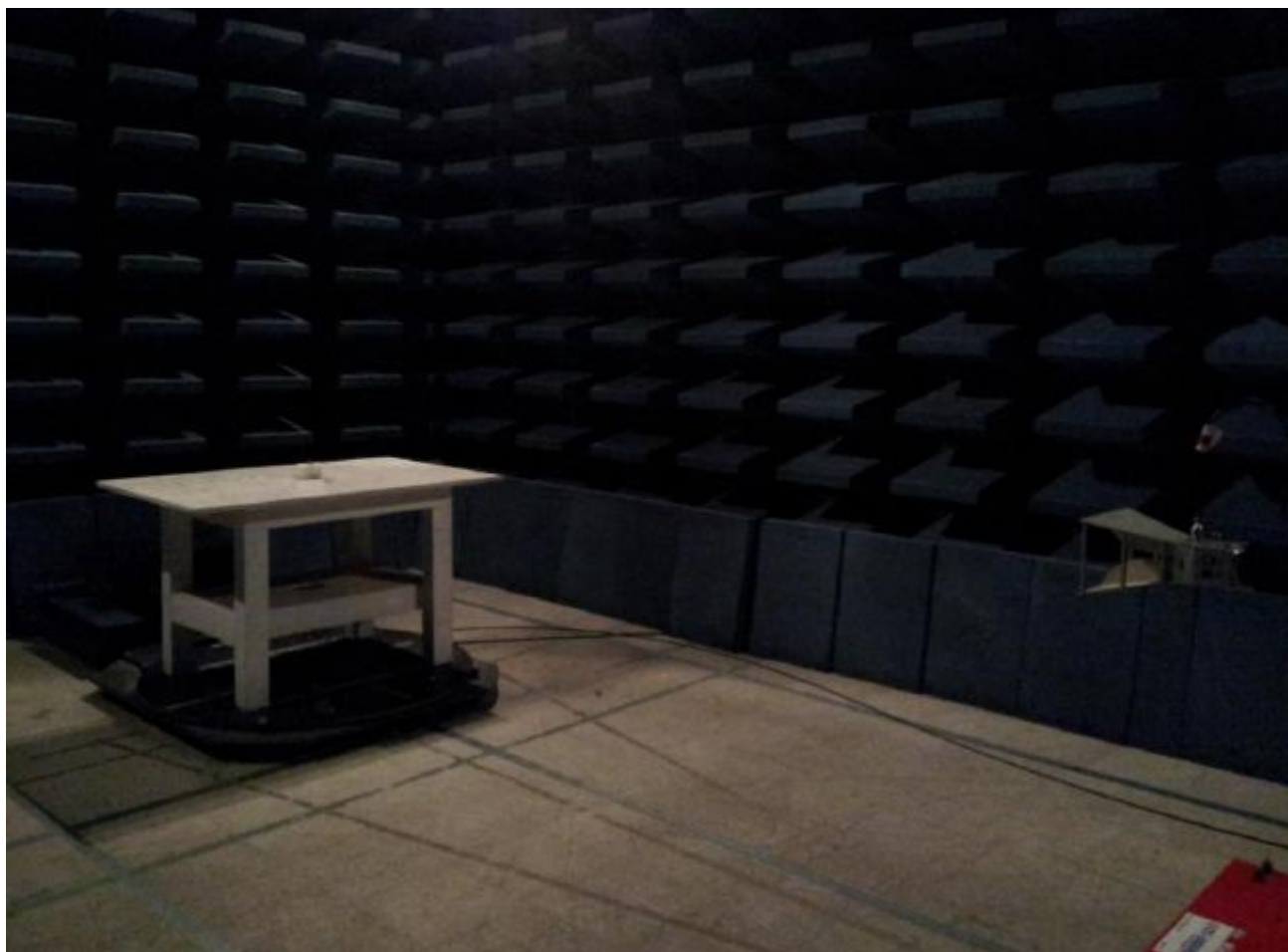
## Appendix A: EUT photos during the testing



Radiated Emissions Setup in Semi-Anechoic Chamber



Radiated Emissions Test-Setup 30MHz-1GHz



Radiated Emissions Test-Setup above 1GHz