

**Test Report No. 7191120725-EEC15/01**  
dated 11 Dec 2015



PSB Singapore

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**TEST REPORT COVER PAGE**

| Product Information              |                      |                              |          |
|----------------------------------|----------------------|------------------------------|----------|
| Product Name / Description:      | MOBILE TWO-WAY RADIO | Applicant Company Number:    | 109U     |
| Model Number(s):                 | AAM28TRN9RA1AN       | UPN Number:                  | 92FT7076 |
| All Used IC Test Site(s) Reg. #: | 2932I-1              | SAR Test Lab Company Number: | --       |

| Emissions Information                         |                   |        |        |        |        |        |        |        |
|-----------------------------------------------|-------------------|--------|--------|--------|--------|--------|--------|--------|
|                                               | Band 1            | Band 2 | Band 3 | Band 4 | Band 5 | Band 6 | Band 7 | Band 8 |
| RSS # & Issue #                               | RSS-247 & Issue 1 |        |        |        |        |        |        |        |
| Frequency Min (MHz)                           | 2402              |        |        |        |        |        |        |        |
| Frequency Max (MHz)                           | 2480              |        |        |        |        |        |        |        |
| RF Power Min (W)                              | --                |        |        |        |        |        |        |        |
| Conducted / EIRP / ERP                        |                   |        |        |        |        |        |        |        |
| RF Power Max (W)                              | 0.0026            |        |        |        |        |        |        |        |
| Conducted                                     |                   |        |        |        |        |        |        |        |
| Field Strength Units @ distance               | 103.4 dBµV/m @ 3m |        |        |        |        |        |        |        |
| Measured BW (kHz) (99%, 26dB, 6dB, etc.)      | 1044 (99%)        |        |        |        |        |        |        |        |
| Calculated BW (kHz)                           | 1200              |        |        |        |        |        |        |        |
| As per TRC-43                                 |                   |        |        |        |        |        |        |        |
| Emission Classification (FID, GID, DID, etc.) | 1M20G1 D          |        |        |        |        |        |        |        |
| Transmitter Spurious Units @ distance         | 51.2 dBµV/m @ 3m  |        |        |        |        |        |        |        |
|                                               | B                 | B      | B      | B      | B      | B      | B      | B      |
| RSS # & Issue #                               |                   |        |        |        |        |        |        |        |
| Frequency Min (MHz)                           |                   |        |        |        |        |        |        |        |
| Frequency Max (MHz)                           |                   |        |        |        |        |        |        |        |
| RF Power Min (W)                              |                   |        |        |        |        |        |        |        |
| Conducted / EIRP / ERP                        |                   |        |        |        |        |        |        |        |
| RF Power Max (W)                              |                   |        |        |        |        |        |        |        |
| Conducted / EIRP / ERP                        |                   |        |        |        |        |        |        |        |
| Field Strength Units @ distance               |                   |        |        |        |        |        |        |        |
| Measured BW (kHz) (99%, 26dB, 6dB, etc.)      |                   |        |        |        |        |        |        |        |
| Calculated BW (kHz)                           |                   |        |        |        |        |        |        |        |
| As per TRC-43                                 |                   |        |        |        |        |        |        |        |
| Emission Classification (FID, GID, DID, etc.) |                   |        |        |        |        |        |        |        |
| Transmitter Spurious Units @ distance         |                   |        |        |        |        |        |        |        |

**Agreement Signature**

ATTESTATION: The test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all the applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

|                              |               |                          |                          |
|------------------------------|---------------|--------------------------|--------------------------|
| Applicant / Agent Name:      | Lim Cher Hwee | Applicant / Agent Title: | Assistant Vice President |
| Applicant / Agent Signature: |               | Signature Date:          | 11 Dec 2015              |

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH  
47 CFR FCC Parts 15B & C  
RSS-GEN Issue 4: 2014  
RSS-247 Issue 1: 2015  
OF A  
**MOBILE TWO-WAY RADIO (BLUETOOTH LOW ENERGY)**  
[ Model : AAM28TRN9RA1AN ]  
[ FCC ID : AZ492FT7076 & IC : 109U-92FT7076 ]

**TEST FACILITY** TÜV SÜD PSB Pte Ltd  
Electrical & Electronics Centre (EEC), Product Services,  
No. 1 Science Park Drive, Singapore 118221 Or

**FCC REG. NO.** 99142 (3m and 10m Semi-Anechoic Chamber, Science Park)

**IND. CANADA REG. NO.** 2932I-1 (3m and 10m Semi-Anechoic Chamber, Science Park)

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**QUOTATION NUMBER** 2191024734

**JOB NUMBER** 7191120725

**TEST PERIOD** 02 Sep 2015 – 28 Sep 2015

**PREPARED BY**

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## TEST SUMMARY

The product was tested in accordance with the customer's specifications.

### Test Results Summary

| Test Standard                                                          | Description                                                                    | Pass / Fail |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------|
| 47 CFR FCC Part 15 and RSS-GEN Issue 4: 2014 and RSS-247 Issue 1: 2015 |                                                                                |             |
| 15.207<br>RSS-GEN 8.8                                                  | Conducted Emissions                                                            | Pass        |
| 15.205, 15.209<br>RSS-GEN 8.9, 8.10                                    | Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement) | Pass        |
| 15.247(a)(2)<br>RSS-247 5.2(1)                                         | Spectrum Bandwidth (6dB and 99% Bandwidth Measurement)                         | Pass        |
| 15.247(b)(3)<br>RSS-247 5.4(4)                                         | Maximum Peak Power                                                             | Pass        |
| 15.247(d)<br>RSS-247 5.5                                               | RF Conducted Spurious Emissions (Non-Restricted Bands)                         | Pass        |
| 15.247(d)<br>RSS-247 5.5                                               | RF Conducted Spurious Emissions (Restricted Bands)                             | Pass        |
| 15.247(d)<br>RSS-247 5.5                                               | Band Edge Compliance (Conducted)                                               | Pass        |
| 15.247(d)<br>RSS-247 5.5                                               | Band Edge Compliance (Radiated)                                                | Pass        |
| 15.247(e)<br>RSS-247 5.2(2)                                            | Peak Power Spectral Density                                                    | Pass        |
| 1.1310<br>RSS-102 4.0,<br>RSS-GEN 3.2                                  | Maximum Permissible Exposure                                                   | Pass        |

## TEST SUMMARY

### Notes

1. Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

| <u>Transmit Channel</u>     | <u>Frequency (MHz)</u> |
|-----------------------------|------------------------|
| Channel 0 (Lower Channel)   | 2402                   |
| Channel 19 (Middle Channel) | 2440                   |
| Channel 39 (Upper Channel)  | 2480                   |

2. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.
3. All test measurement procedures are according to ANSI C63.4: 2014, ANSI C63.10: 2013 and KDB 558074 D01 DTS Measurement Guidance V03R03.
4. RSS-102 is RSS-102 Issue 4: 2015.
5. The unit was also investigated for inter-modulation products between the co-located Bluetooth and the land mobile radios. All inter-modulation products between the co-located radios were found to be compliant to the FCC limits of 15.209 and Industry Canada RSS-GEN.
6. The EUT uses a 4dBi internal PIFA which connects to the RF port via a spring contact. The EUT meets the requirement of FCC 15.203.
7. The maximum measured RF power of the Equipment Under Test is 4.15dBm.
8. All tests except Maximum Peak Power and Band Edge Compliance (Radiated) were tested at the maximum power of the RF module which is higher than the supported maximum EUT RF power. The Maximum Peak Power and Band Edge Compliance (Radiated) tests were tested at the maximum RF power of the EUT.

### Modifications

No modifications were made.

## PRODUCT DESCRIPTION

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description                        | : The Equipment Under Test (EUT) is a <b>Mobile Two-Way Radio</b> .                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Manufacturer                       | : Motorola Solutions Malaysia Sdn Bhd<br>Plot 2, Technoplex Industrial Park Mukim 12 Swd,<br>Medan Bayan Lepas, Bayan Lepas Industrial Park, 11900 Bayan Lepas,<br>Pulau Penang,<br>Malaysia                                                                                                                                                                                                                                                                                             |
| Model Number                       | : AAM28TRN9RA1AN                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| FCC ID                             | : AZ492FT7076                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| IC                                 | : 109U-92FT7076                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Serial Number                      | : 511TRMA905                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Microprocessor                     | : Ti OMAPL138BZWT3R                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Operating / Transmitting Frequency | : <u>Bluetooth / Bluetooth LE</u><br>2.402GHz (lower channel) to 2.480GHz (upper channel)<br>79 channels (Bluetooth), 40 channels (Bluetooth LE)<br><br><u>WiFi</u><br>2.412GHz (lower channel) to 2.462GHz (upper channel)<br>11 channels<br><br><u>Land Mobile</u><br>450MHz to 527MHz / Channel Spacing 12.5kHz/25kHz                                                                                                                                                                 |
| Clock / Oscillator Frequency       | : Reference Clock: 19.2MHz , LO: 376.65MHz - 453.65MHz                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Modulation                         | : <u>Bluetooth</u><br>Gaussian Frequency Shift Keying (GFSK)<br>( $\pi/4$ ) DQPSK<br>8DPSK<br><br><u>WiFi</u><br>Differential Binary Phase Shift Keying (DBPSK)<br>Differential Quadrature Phase Shift Keying (DQPSK)<br>Complementary Code Keying (CCK )<br>Binary Phase Shift Keying (BPSK)<br>Quadrature Phase Shift Keying (QPSK)<br>16-Quadrature Amplitude Modulation (16QAM)<br>64-Quadrature Amplitude Modulation (64QAM)<br><br><u>Land Mobile</u><br>Frequency Modulation (FM) |
| Antenna Gain                       | : 4.0 dBi (PIFA Antenna)                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



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**PRODUCT DESCRIPTION**

(Continued)

|                   |                                                          |
|-------------------|----------------------------------------------------------|
| Port / Connectors | : Refer to manufacturer's user manual / operating manual |
| Rated Input Power | : 120V 60Hz                                              |
| Accessories       | : Refer to manufacturer's user manual / operating manual |



**SUPPORTING EQUIPMENT DESCRIPTION**

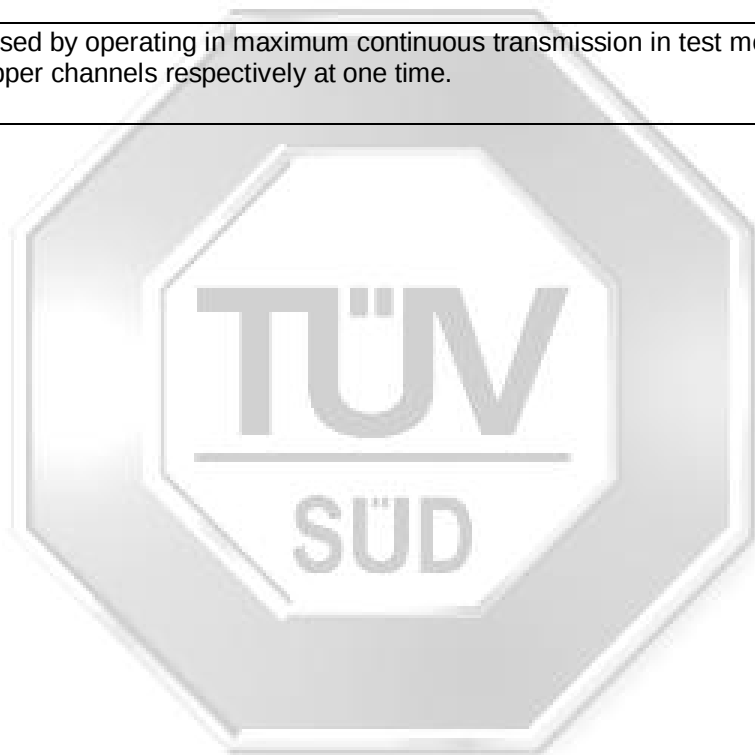
| Equipment Description<br>(Including Brand Name) | Model, Serial & FCC ID Number                     | Cable Description<br>(List Length, Type & Purpose) |
|-------------------------------------------------|---------------------------------------------------|----------------------------------------------------|
| Fujitsu Laptop                                  | M/N: S6310<br>S/N: R7100269<br>FCC ID: DoC        | Nil                                                |
| Fujitsu AC Adapter                              | M/N: CP293662-01<br>S/N: O6X00399B<br>FCC ID: DoC | 1.80m unshielded power cable                       |
| Microsoft Wheel Mouse                           | M/N: X08-71118<br>S/N: Nil<br>FCC ID: DoC         | Nil                                                |
| Alfatronix Limited Desktop Power Supply         | M/N: AD MT 3100/DM<br>S/N: Nil<br>FCC ID: DoC     | Nil                                                |
| Motorola IMPRES Keypad Microphone.              | M/N: RMN5127C<br>S/N: Nil<br>FCC ID: DoC          | Nil                                                |

**EUT OPERATING CONDITIONS**

**CFR FCC Part 15 and RSS-GEN Issue 4 and RSS-247 Issue 1**

1. Conducted Emissions
2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)
3. Spectrum Bandwidth (6dB Bandwidth Measurement)
4. Maximum Peak Power
5. RF Conducted Spurious Emissions (Non-Restricted Bands)
6. RF Conducted Spurious Emissions (Restricted Bands)
7. Band Edge Compliance (Conducted)
8. Band Edge Compliance (Radiated)
9. Peak Power Spectral Density
10. Maximum Permissible Exposure

The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at lower, middle and upper channels respectively at one time.



## CONDUCTED EMISSION TEST

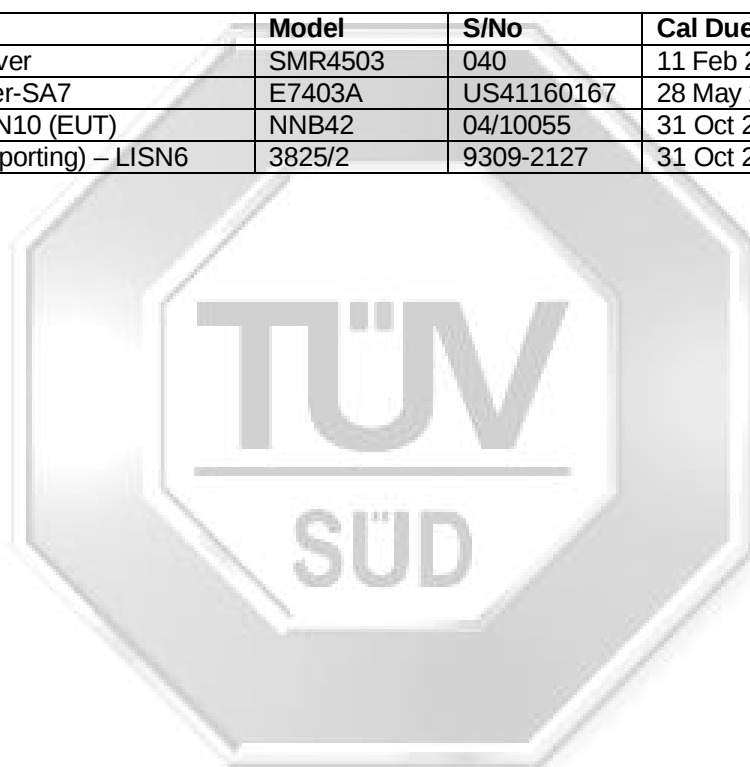
### 47 CFR FCC Part 15.207 and RSS-GEN 8.8 Conducted Emission Limits

| Frequency Range<br>(MHz) | Limit Values (dB $\mu$ V) |              |
|--------------------------|---------------------------|--------------|
|                          | Quasi-peak (Q-P)          | Average (AV) |
| 0.15 - 0.5               | 66 – 56 *                 | 56 – 46 *    |
| 0.5 - 5.0                | 56                        | 46           |
| 5.0 - 30.0               | 60                        | 50           |

\* Decreasing linearly with the logarithm of the frequency

### 47 CFR FCC Part 15.207 and RSS-GEN 8.8 Conducted Emission Test Instrumentation

| Instrument                         | Model   | S/No       | Cal Due Date | Cal Interval |
|------------------------------------|---------|------------|--------------|--------------|
| Schaffner EMI Receiver             | SMR4503 | 040        | 11 Feb 2016  | 1 year       |
| Agilent EMC Analyzer-SA7           | E7403A  | US41160167 | 28 May 2016  | 1 year       |
| Schaffner LISN –LISN10 (EUT)       | NNB42   | 04/10055   | 31 Oct 2015  | 1 year       |
| EMCO LISN (for supporting) – LISN6 | 3825/2  | 9309-2127  | 31 Oct 2015  | 1 year       |





**CONDUCTED EMISSION TEST**

**47 CFR FCC Part 15.207 and RSS-GEN 8.8 Conducted Emission Test Setup**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50 $\Omega$ /50 $\mu$ H EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

**47 CFR FCC Part 15.207 and RSS-GEN 8.8 Conducted Emission Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

**Sample Calculation Example**

At 20 MHz

Q-P limit = 60.0 dB $\mu$ V

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dB $\mu$ V  
(Calibrated for system losses)

Therefore, Q-P margin = 60.0 - 40.0 = 20.0 i.e. 20.0 dB below Q-P limit



CONDUCTED EMISSION TEST

47 CFR FCC Part 15.207 and RSS-GEN 8.8 Conducted Emission Results

|                  |           |                      |             |
|------------------|-----------|----------------------|-------------|
| Test Input Power | 120V 60Hz | Temperature          | 22°C        |
| Line Under Test  | AC Mains  | Relative Humidity    | 55%         |
|                  |           | Atmospheric Pressure | 1030mbar    |
|                  |           | Tested By            | Li Chaoming |

| Frequency (MHz) | Peak Value (dBμV) | Q-P Limit (dBμV) | Q-P Margin (dB) | AV Value (dBμV) | AV Limit (dBμV) | AV Margin (dB) | Line    | Channel |
|-----------------|-------------------|------------------|-----------------|-----------------|-----------------|----------------|---------|---------|
| 0.5174          | 33.7              | 56.0             | 22.3            | *See Note 3     | 46.0            | 12.3           | Live    | 39      |
| 0.5909          | 33.5              | 56.0             | 22.5            | *See Note 3     | 46.0            | 12.5           | Neutral | 39      |
| 0.8970          | 35.0              | 56.0             | 21.0            | *See Note 3     | 46.0            | 11.0           | Neutral | 39      |
| 2.0604          | 35.0              | 56.0             | 21.0            | *See Note 3     | 46.0            | 11.0           | Neutral | 39      |
| 3.7014          | 33.6              | 56.0             | 22.4            | *See Note 3     | 46.0            | 12.5           | Live    | 39      |
| 3.9708          | 32.7              | 56.0             | 23.3            | *See Note 3     | 46.0            | 13.3           | Live    | 39      |

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
3. As the measured peak shows compliance to the Q-P & Average limits, as such no Q-P & Average measurements was carried out. The EUT is deemed to meet both requirements.
4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:  
9kHz - 30MHz  
RBW: 9kHz VBW: 30kHz
5. Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz is ±2.2dB.

**RADIATED EMISSION TEST**

**47 CFR FCC Part 15.205 and RSS-GEN 8.10 Restricted Bands**

| MHz      |   |          | MHz       |   |           | MHz    |   |        | GHz        |   |       |
|----------|---|----------|-----------|---|-----------|--------|---|--------|------------|---|-------|
| 0.090    | - | 0.110    | 16.42     | - | 16.423    | 399.9  | - | 410    | 4.5        | - | 5.15  |
| 0.495    | - | 0.505    | 16.69475  | - | 16.69525  | 608    | - | 614    | 5.35       | - | 5.46  |
| 2.1735   | - | 2.1905   | 16.80425  | - | 16.80475  | 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 | - | 156.52525 | 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  | - | 167.17    | 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   | Above 38.6 |   |       |
| 13.36    | - | 13.41    |           |   |           |        |   |        |            |   |       |

**47 CFR FCC Part 15.209 and RSS-GEN 8.9 Radiated Emission Limits**

| Frequency Range (MHz) | Quasi-Peak Limit Values (dBµV/m) |
|-----------------------|----------------------------------|
| 0.009 - 0.490         | 20 log [2400 / F (kHz)] @ 300m   |
| 0.490 - 1.705         | 20 log [24000 / F (kHz)] @ 30m   |
| 1.705 - 30.0          | 30.0 @ 30m                       |
| 30 - 88               | 40.0 @ 3m                        |
| 88 - 216              | 43.5 @ 3m                        |
| 216 - 960             | 46.0 @ 3m                        |
| Above 960             | 54.0* @ 3m                       |

\* For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

**47 CFR FCC Part 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Test Instrumentation**

| Instrument                                      | Model    | S/No       | Cal Due Date | Cal Interval |
|-------------------------------------------------|----------|------------|--------------|--------------|
| R&S Test Receiver – ESI1                        | ESI40    | 100010     | 14 Jul 2016  | 1 year       |
| Schaffner Bilog Antenna –(30MHz-2GHz) BL3 (Ref) | CBL6112D | 2549       | 29 Jan 2016  | 1 year       |
| ETS Horn Antenna(18GHz-40GHz)(Ref)              | 3116     | 0004-2474  | 02 Oct 2015  | 1 year       |
| EMCO Horn Antenna(1GHz-18GHz)                   | 3115     | 0003-6088  | 20 Apr 2016  | 1 year       |
| R&S Preamplifier (1GHz -18GHz)                  | SCU18    | 102191     | 13 Mar 2016  | 1 year       |
| Agilent Preamplifier(1GHz-26.5GHz) (PA18)       | 8449D    | 3008A02305 | 06 Oct 2015  | 1 year       |
| Com-Power Preamplifier (1MHz-1GHz)              | PAM-103  | 441096     | 13 Oct 2015  | 1 year       |
| Micro-Tronics Bandstop Filter (2.4-2.5 GHz)     | BRM50701 | 017        | 13 Aug 2016  | 1 year       |



**RADIATED EMISSION TEST**

**47 CFR FCC Part 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Test Setup**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

**47 CFR FCC Part 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in the range of 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10<sup>th</sup> harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

**Sample Calculation Example**

|                                                                                                                                    |                               |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| At 300 MHz                                                                                                                         | Q-P limit = 46.0 dB $\mu$ V/m |
| Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB                                                                      |                               |
| Q-P reading obtained directly from EMI Receiver = 40.0 dB $\mu$ V/m<br>(Calibrated level including antenna factors & cable losses) |                               |
| Therefore, Q-P margin = 46.0 - 40.0 = 6.0                                                                                          | i.e. 6.0 dB below Q-P limit   |

**RADIATED EMISSION TEST**

**47 CFR FCC Part 15.205, 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Results**

|                  |                     |                      |                            |
|------------------|---------------------|----------------------|----------------------------|
| Test Input Power | 120V 60Hz           | Temperature          | 22°C                       |
| Test Distance    | 3m (≥30MHz – 25GHz) | Relative Humidity    | 55%                        |
|                  |                     | Atmospheric Pressure | 1030mbar                   |
|                  |                     | Tested By            | Lim Kay Tak<br>Li Chaoming |

Spurious Emissions ranging from 30MHz – 1GHz

| Frequency (MHz) | Q-P Value (dBμV/m) | Q-P Limit (dBμV/m) | Q-P Margin (dB) | Height (cm) | Azimuth (Degrees) | Pol (H/V) | Channel |
|-----------------|--------------------|--------------------|-----------------|-------------|-------------------|-----------|---------|
| 31.3260         | 9.2                | 40.0               | 30.8            | 282         | 258               | V         | 39      |
| 47.7650         | 0.5                | 40.0               | 39.5            | 100         | 291               | V         | 39      |
| 319.9950        | 14.9               | 46.0               | 31.1            | 98          | 240               | H         | 39      |
| 326.2110        | 11.8               | 46.0               | 34.2            | 97          | 257               | H         | 39      |
| 396.9500        | 21.3               | 46.0               | 24.7            | 105         | 301               | H         | 39      |
| 449.5580        | 11.8               | 46.0               | 34.2            | 99          | 161               | V         | 39      |

Spurious Emissions above 1GHz - 25GHz

| Frequency (GHz) | Peak Value (dBμV/m) | Peak Limit (dBμV/m) | Peak Margin (dB) | AV Value (dBμV/m) | AV Limit (dBμV/m) | AV Margin (dB) | Height (cm) | Azimuth (Degrees) | Pol (H/V) | Ch |
|-----------------|---------------------|---------------------|------------------|-------------------|-------------------|----------------|-------------|-------------------|-----------|----|
| 1.8602          | 47.2                | 74.0                | 26.8             | 30.7              | 54.0              | 23.3           | 200         | 348               | V         | 0  |
| 1.9918          | 44.5                | 74.0                | 29.5             | 29.0              | 54.0              | 25.0           | 200         | 185               | V         | 0  |
| 3.6009          | 43.6                | 74.0                | 30.4             | 41.6              | 54.0              | 12.4           | 300         | 22                | V         | 0  |
| 4.8052          | 44.3                | 74.0                | 29.7             | 39.2              | 54.0              | 14.8           | 100         | 222               | H         | 0  |
| 9.5947          | 50.1                | 74.0                | 23.9             | 41.2              | 54.0              | 12.8           | 400         | 161               | V         | 0  |
| 14.4281         | 49.8                | 74.0                | 24.2             | 41.3              | 54.0              | 12.7           | 100         | 341               | V         | 0  |

Spurious Emissions above 1GHz - 25GHz

| Frequency (GHz) | Peak Value (dBμV/m) | Peak Limit (dBμV/m) | Peak Margin (dB) | AV Value (dBμV/m) | AV Limit (dBμV/m) | AV Margin (dB) | Height (cm) | Azimuth (Degrees) | Pol (H/V) | Ch |
|-----------------|---------------------|---------------------|------------------|-------------------|-------------------|----------------|-------------|-------------------|-----------|----|
| 3.6009          | 44.5                | 74.0                | 29.5             | 41.9              | 54.0              | 12.1           | 300         | 47                | V         | 19 |
| 4.8862          | 44.4                | 74.0                | 29.6             | 37.1              | 54.0              | 16.9           | 400         | 341               | V         | 19 |
| 6.0243          | 43.6                | 74.0                | 30.4             | 31.0              | 54.0              | 23.0           | 400         | 149               | H         | 19 |
| 9.7647          | 43.7                | 74.0                | 30.3             | 35.8              | 54.0              | 18.2           | 200         | 175               | V         | 19 |
| 14.6467         | 51.2                | 74.0                | 22.8             | 41.5              | 54.0              | 12.5           | 100         | 254               | V         | 19 |
| 16.6384         | 51.2                | 74.0                | 22.8             | 39.0              | 54.0              | 15.0           | 100         | 341               | V         | 19 |

Spurious Emissions above 1GHz - 25GHz

| Frequency (GHz) | Peak Value (dBμV/m) | Peak Limit (dBμV/m) | Peak Margin (dB) | AV Value (dBμV/m) | AV Limit (dBμV/m) | AV Margin (dB) | Height (cm) | Azimuth (Degrees) | Pol (H/V) | Ch |
|-----------------|---------------------|---------------------|------------------|-------------------|-------------------|----------------|-------------|-------------------|-----------|----|
| 1.6072          | 44.0                | 74.0                | 30.0             | 27.4              | 54.0              | 26.6           | 300         | 86                | V         | 39 |
| 1.9918          | 45.1                | 74.0                | 28.9             | 29.0              | 54.0              | 25.0           | 400         | 50                | H         | 39 |
| 2.0829          | 41.2                | 74.0                | 32.8             | 27.5              | 54.0              | 26.5           | 100         | 337               | V         | 39 |
| 3.6009          | 43.6                | 74.0                | 30.4             | 41.4              | 54.0              | 12.6           | 300         | 22                | V         | 39 |
| 4.9671          | 45.3                | 74.0                | 28.7             | 41.7              | 54.0              | 12.3           | 400         | 250               | H         | 39 |
| 14.6710         | 42.3                | 74.0                | 31.7             | 39.1              | 54.0              | 14.9           | 100         | 235               | V         | 39 |

## RADIATED EMISSION TEST

### Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
3. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:  
30MHz - 1GHz  
RBW: 100kHz                      VBW: 1MHz  
>1GHz  
RBW: 1MHz                      VBW: 3MHz
5. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
6. The upper frequency of radiated emission investigations was according to requirements stated in RSS-GEN 6.13.
7. The channel in the table refers to the transmit channel of the EUT.
8. Radiated Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is  $\pm 4.0\text{dB}$ .

**SPECTRUM BANDWIDTH (6dB and 99% BANDWIDTH MEASUREMENT) TEST**

**47 CFR FCC Part 15.247(a)(2) and RSS-247 5.2(1) Spectrum Bandwidth (6dB and 99% Bandwidth Measurement) Limits**

The EUT shows compliance to the requirements of this section, which states that the minimum bandwidth of the EUT employing digital modulation techniques shall be at least 500kHz.

**47 CFR FCC Part 15.247(a)(2) and RSS-247 5.2(1) Spectrum Bandwidth (6dB and 99% Bandwidth Measurement) Test Instrumentation**

| Instrument                | Model  | S/No       | Cal Due Date | Cal Interval |
|---------------------------|--------|------------|--------------|--------------|
| Agilent Spectrum Analyzer | E4404B | US39440632 | 02 Apr 2016  | 1 year       |

**47 CFR FCC Part 15.247(a)(2) and RSS-247 5.2(1) Spectrum Bandwidth (6dB and 99% Bandwidth Measurement) Test Setup**

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to the following:  
RBW = 100kHz  
VBW = 3 times RBW
5. All other supporting equipment were powered separately from another filtered mains.

**47 CFR FCC Part 15.247(a)(2) and RSS-247 5.2(1) Spectrum Bandwidth (6dB and 99% Bandwidth Measurement) Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at lower channel.
2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 6dB and 99% bandwidth of the transmitting frequency.
3. The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.
4. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. For 6dB bandwidth measurement, the frequencies below the 6dB peak frequency at lower ( $f_L$ ) and upper ( $f_H$ ) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser. For 99% bandwidth measurement, the spectrum analyser power measurement was activated with bandwidth measurement as 99%.
5. For 6dB bandwidth measurement, the 6dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies,  $|f_H - f_L|$ . For 99% bandwidth measurement, the measured 99% bandwidth shown on the spectrum analyser was recorded.
6. The steps 2 to 5 were repeated with the transmitting frequency was set to middle and upper channel respectively.

**SPECTRUM BANDWIDTH (6dB and 99% BANDWIDTH MEASUREMENT) TEST**

**47 CFR FCC Part 15.247(a)(2) and RSS-247 5.2(1) Spectrum Bandwidth (6dB and 99% Bandwidth Measurement) Results**

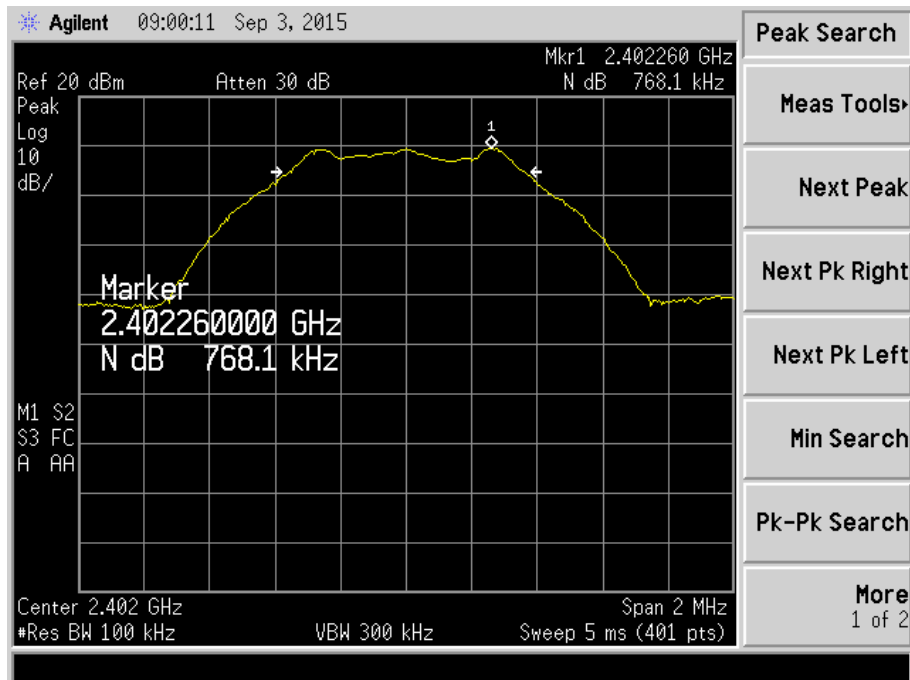
|                  |                        |                      |              |
|------------------|------------------------|----------------------|--------------|
| Test Input Power | 120V 60Hz              | Temperature          | 24°C         |
| Attached Plots   | 1 – 3 (20dB Bandwidth) | Relative Humidity    | 56%          |
|                  | 4 – 6 (99% Bandwidth)  | Atmospheric Pressure | 1030mbar     |
|                  |                        | Tested By            | Liau Lee Yin |

| Channel | Channel Frequency (GHz) | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-------------------------|---------------------|---------------------|
| 0       | 2.402                   | 0.768               | 1.041               |
| 19      | 2.440                   | 0.758               | 1.044               |
| 39      | 2.480                   | 0.778               | 1.031               |

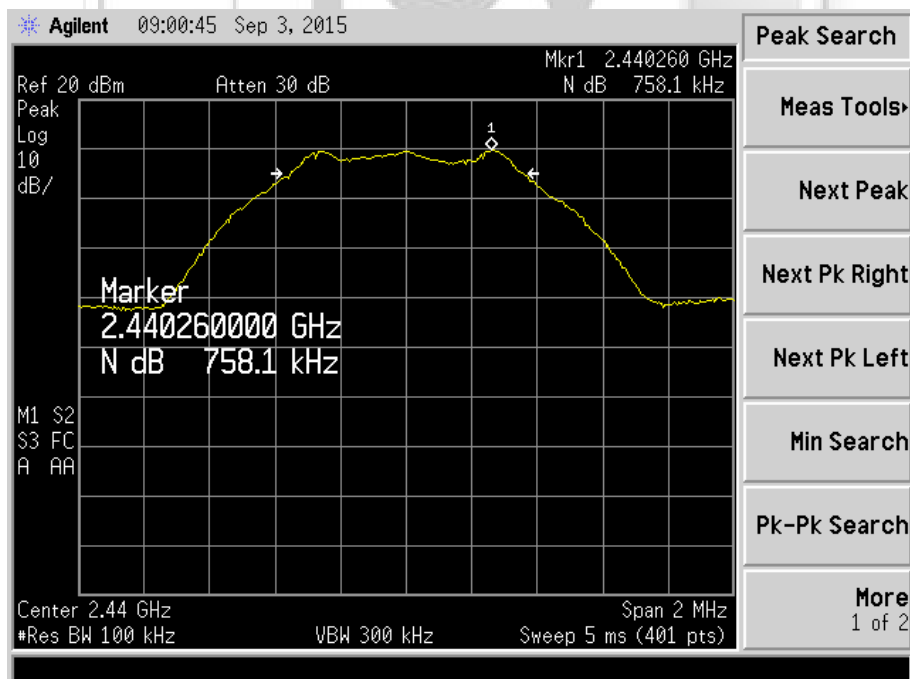


**SPECTRUM BANDWIDTH (6dB and 99% BANDWIDTH MEASUREMENT) TEST**

**Spectrum Bandwidth (6dB Bandwidth Measurement) Plots**



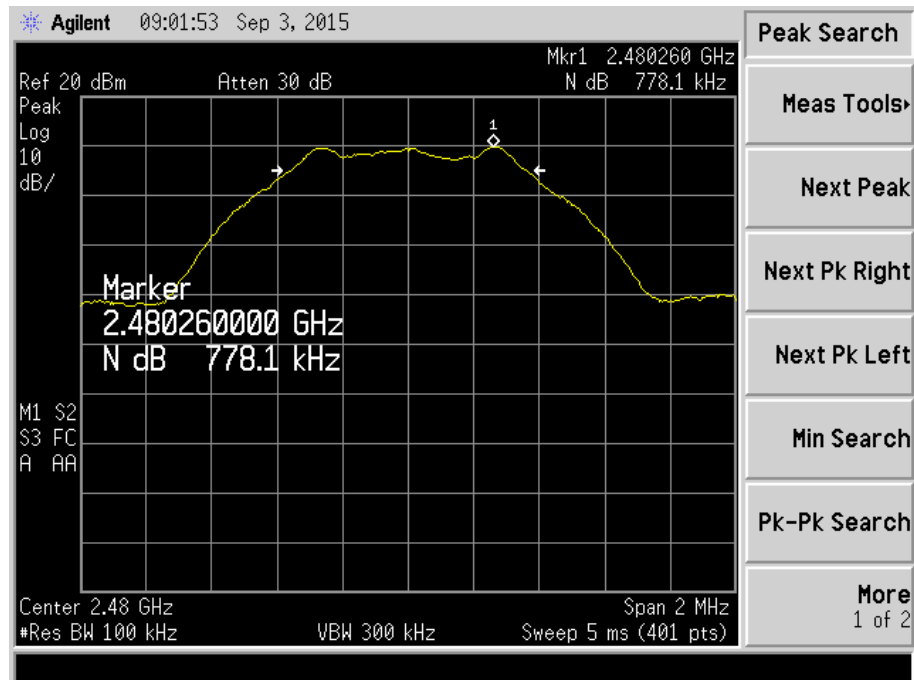
**Plot 1 - Channel 0**



**Plot 2 - Channel 19**

**SPECTRUM BANDWIDTH (6dB and 99% BANDWIDTH MEASUREMENT) TEST**

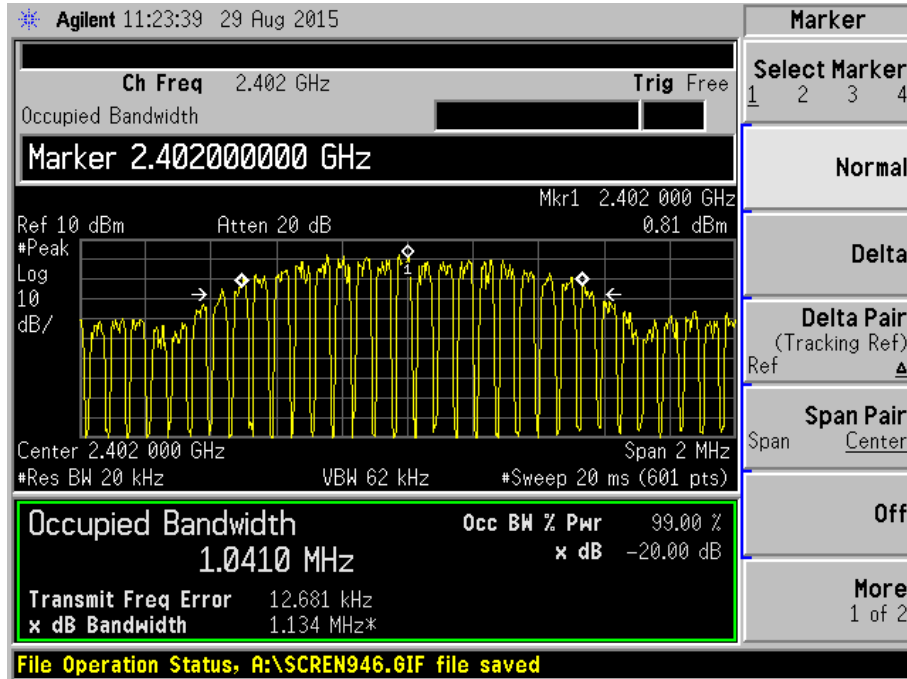
**Spectrum Bandwidth (6dB Bandwidth Measurement) Plots**



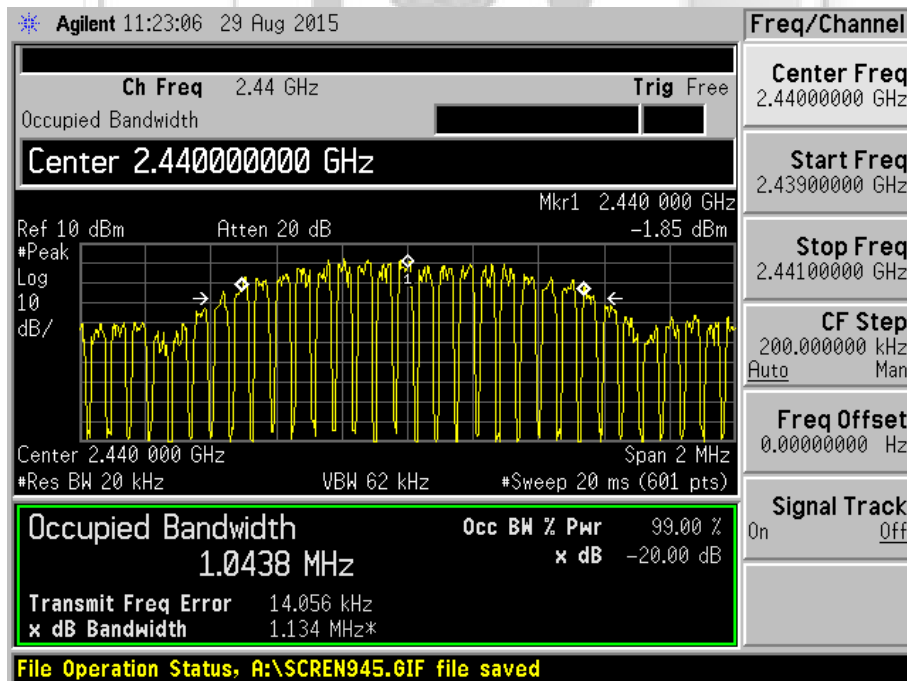
Plot 3 - Channel 39

**SPECTRUM BANDWIDTH (6dB and 99% BANDWIDTH MEASUREMENT) TEST**

**Spectrum Bandwidth (99% Bandwidth Measurement) Plots**



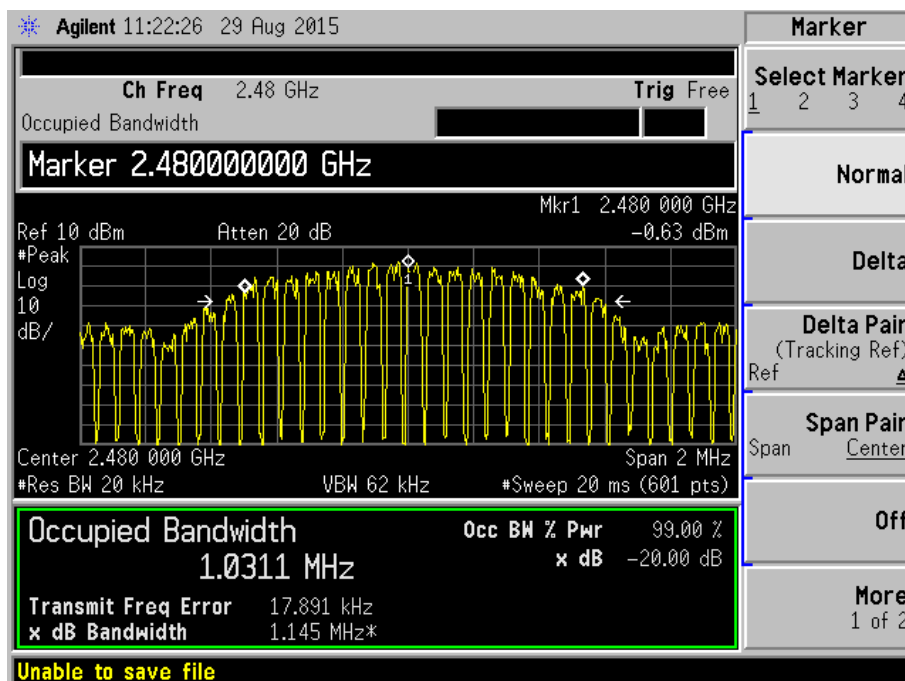
Plot 4 - Channel 0



Plot 5 - Channel 19

**SPECTRUM BANDWIDTH (6dB and 99% BANDWIDTH MEASUREMENT) TEST**

**Spectrum Bandwidth (99% Bandwidth Measurement) Plots**



Plot 6 - Channel 39



**MAXIMUM PEAK POWER TEST**

**47 CFR FCC Part 15.247(b)(3) and RSS-247 5.4(4) Maximum Peak Power Limits**

The EUT shows compliance to the requirements of this section, which states the maximum peak power of the EUT employing digital modulation shall not exceed 1W (30dBm).

**47 CFR FCC Part 15.247(b)(3) and RSS-247 5.4(4) Maximum Peak Power Test Instrumentation**

| Instrument                            | Model     | S/No  | Cal Due Date | Cal Interval |
|---------------------------------------|-----------|-------|--------------|--------------|
| Boonton Electronics RF Power Meter    | 4532      | 72901 | 27 Aug 2016  | 1 year       |
| Boonton Electronics Peak Power Sensor | 56218-S/1 | 1417  | 27 Aug 2016  | 1 year       |

**47 CFR FCC Part 15.247(b)(3) and RSS-247 5.4(4) Maximum Peak Power Test Setup**

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the power meter.
4. All other supporting equipment were powered separately from another filtered mains.

**47 CFR FCC Part 15.247(b)(3) and RSS-247 5.4(4) Maximum Peak Power Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at lower channel.
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. The step 2 was repeated with the transmitting frequency was set to middle and upper channel respectively.

**MAXIMUM PEAK POWER TEST**

**47 CFR FCC Part 15.247(b)(3) and RSS-247 5.4(4) Maximum Peak Power Results**

|                  |           |                      |              |
|------------------|-----------|----------------------|--------------|
| Test Input Power | 120V 60Hz | Temperature          | 24°C         |
| Antenna Gain     | 4.0 dBi   | Relative Humidity    | 56%          |
|                  |           | Atmospheric Pressure | 1030mbar     |
|                  |           | Tested By            | Liau Lee Yin |

| Channel | Channel Frequency (GHz) | Maximum Peak Power (W) | Limit (W) |
|---------|-------------------------|------------------------|-----------|
| 0       | 2.402                   | 0.0025                 | 1.0       |
| 19      | 2.440                   | 0.0024                 | 1.0       |
| 39      | 2.480                   | 0.0026                 | 1.0       |

Notes

1. Nil.





**RF CONDUCTED SPURIOUS EMISSIONS (NON-RESTRICTED BANDS) TEST**

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Non-Restricted Bands) Limits**

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Non-Restricted Bands) Test Instrumentation**

| Instrument                | Model  | S/No       | Cal Due Date | Cal Interval |
|---------------------------|--------|------------|--------------|--------------|
| Agilent Spectrum Analyzer | E4440A | MY45304764 | 12 Dec 2015  | 1 year       |

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Non-Restricted Bands) Test Setup**

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Non-Restricted Bands) Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, with the transmitting frequency was set to lower channel.
2. The start and stop frequencies of the spectrum analyser were set to 30MHz and 10GHz.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with frequency span was set from 10GHz to 25GHz.
5. The steps 2 to 4 were repeated with the transmitting frequency was set to middle and upper channel respectively.

**RF CONDUCTED SPURIOUS EMISSIONS (NON-RESTRICTED BANDS) TEST**

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Non-Restricted Bands) Results**

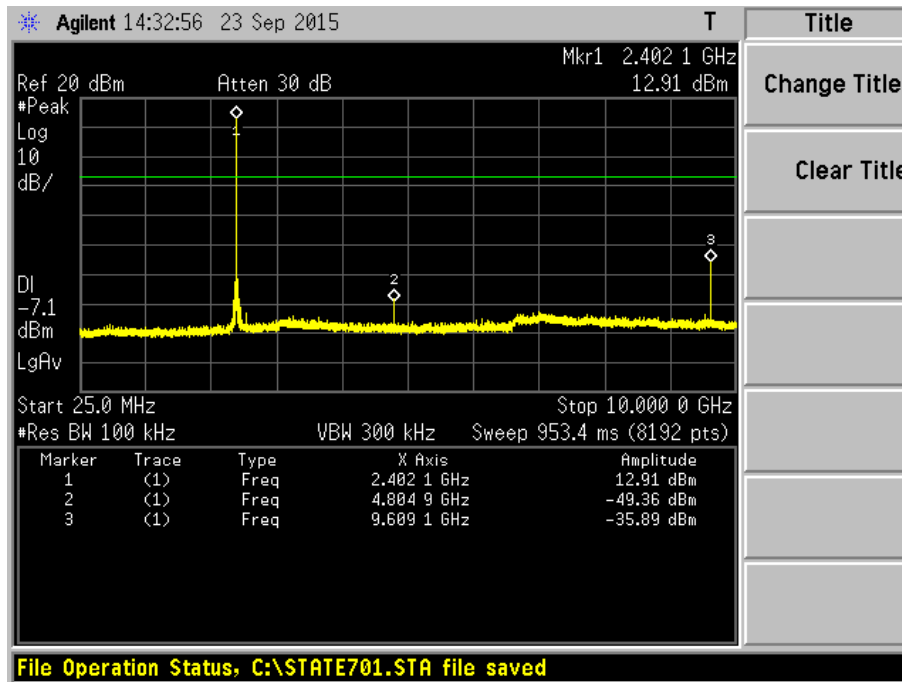
|                  |           |                      |              |
|------------------|-----------|----------------------|--------------|
| Test Input Power | 120V 60Hz | Temperature          | 24°C         |
| Attached Plots   | 7 – 12    | Relative Humidity    | 56%          |
|                  |           | Atmospheric Pressure | 1030mbar     |
|                  |           | Tested By            | Liau Lee Yin |

All spurious signals found were below the specified limit. Please refer to the attached plots.

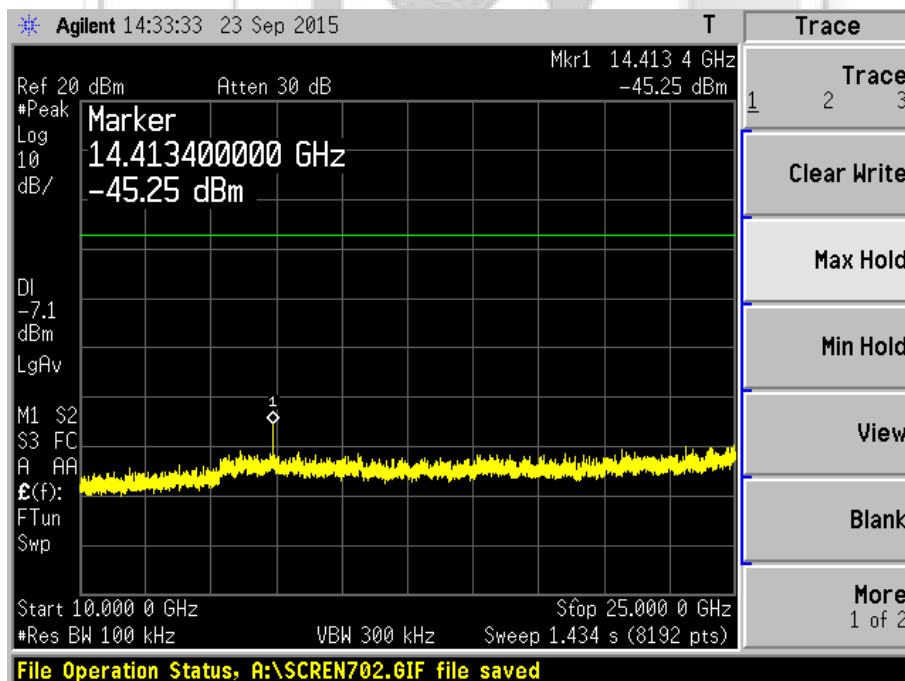


RF CONDUCTED SPURIOUS EMISSIONS (NON-RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Non-Restricted Bands) Plots



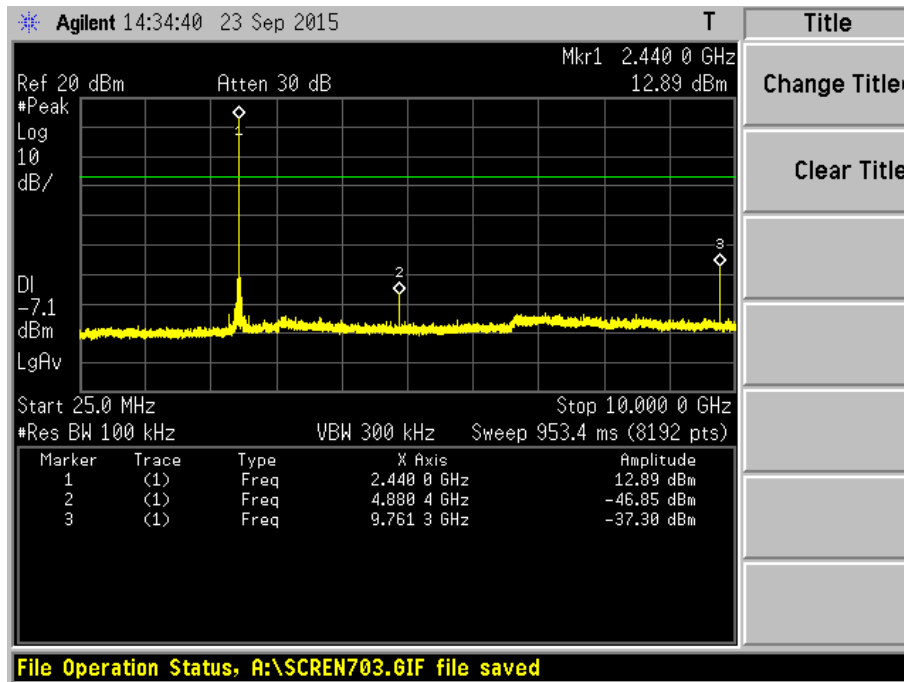
Plot 7 – Channel 0



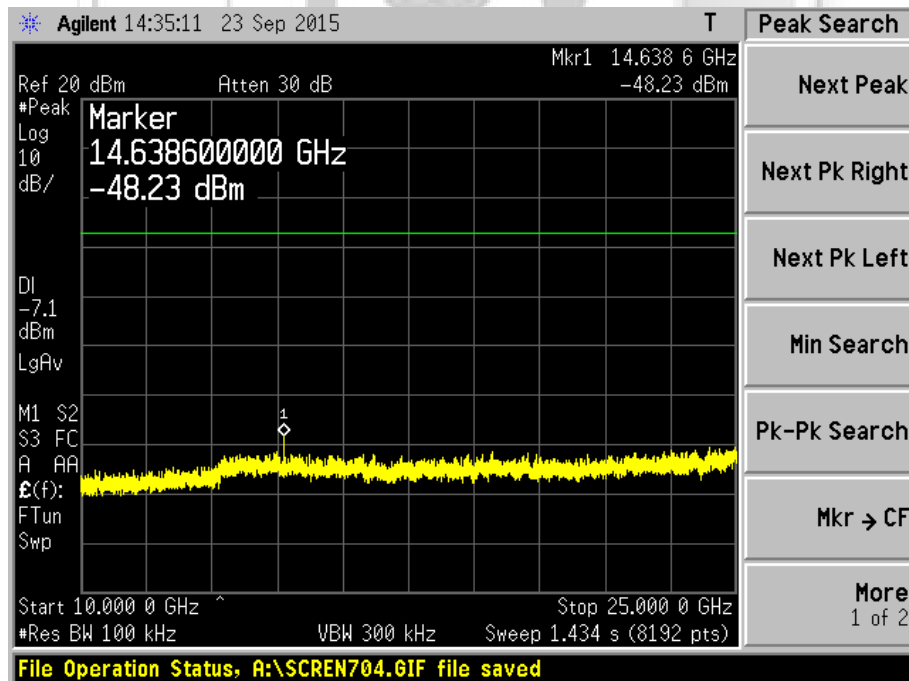
Plot 8 – Channel 0

## RF CONDUCTED SPURIOUS EMISSIONS (NON-RESTRICTED BANDS) TEST

### RF Conducted Spurious Emissions (Non-Restricted Bands) Plots



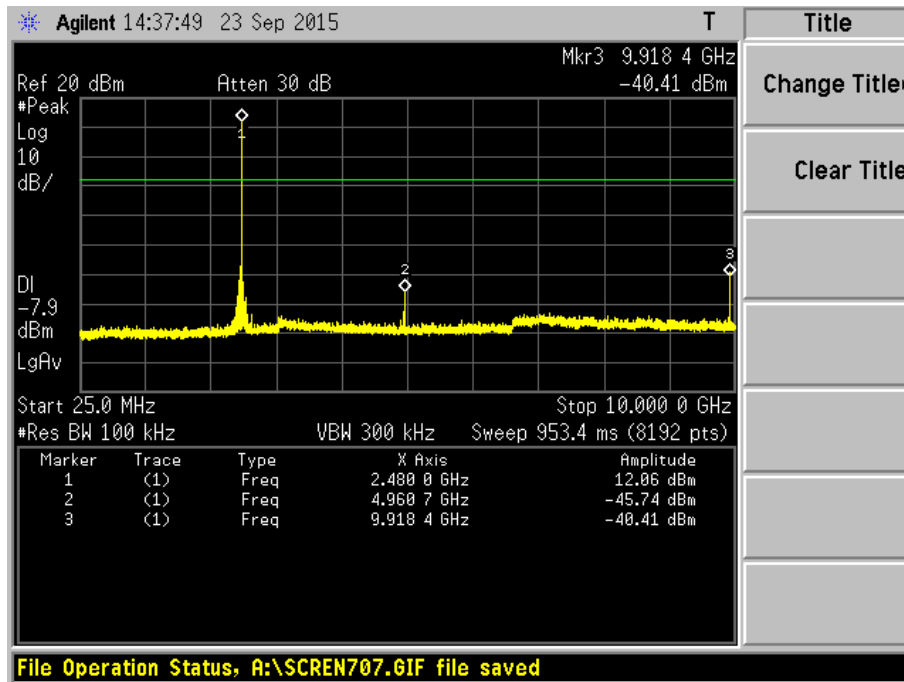
Plot 9 – Channel 19



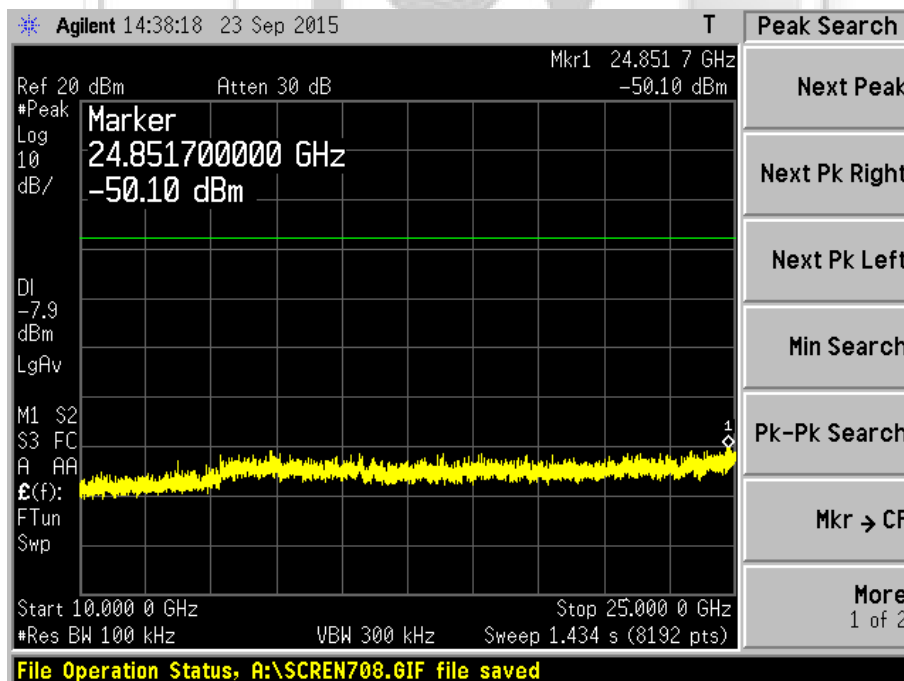
Plot 10 – Channel 19

## RF CONDUCTED SPURIOUS EMISSIONS (NON-RESTRICTED BANDS) TEST

### RF Conducted Spurious Emissions (Non-Restricted Bands) Plots



Plot 11 – Channel 39



Plot 12 – Channel 39

**RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST**

**47 CFR FCC Part 15.205 and RSS-GEN 8.10 Restricted Bands**

| MHz                 | MHz                   | MHz             | GHz           |
|---------------------|-----------------------|-----------------|---------------|
| 0.090 - 0.110       | 16.42 - 16.423        | 399.9 - 410     | 4.5 - 5.15    |
| 0.495 - 0.505       | 16.69475 - 16.69525   | 608 - 614       | 5.35 - 5.46   |
| 2.1735 - 2.1905     | 16.80425 - 16.80475   | 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 - 156.52525 | 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 - 167.17     | 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     | Above 38.6    |
| 13.36 - 13.41       |                       |                 |               |

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Restricted Bands) Limits**

The EUT shows compliance to the requirements of this section, which states that emissions which fall in the restricted bands must comply with the radiated emission limits specified in the table below:

| Frequency Range (MHz)                                                    | EIRP (dBm)         | Radiated Emissions (dBμV/m) |
|--------------------------------------------------------------------------|--------------------|-----------------------------|
| 0.009 – 0.490                                                            | -6.7 – (-41.4) **  | 67.6 – 20logF* @ 300m **    |
| 0.490 – 1.705                                                            | -41.4 – (-52.3) ** | 87.6 – 20logF* @ 30m **     |
| 1.705 – 30                                                               | -45.7              | 29.5 @ 30m                  |
| 30 - 88                                                                  | -55.2              | 40.0 @ 3m                   |
| 88 - 216                                                                 | -51.7              | 43.5 @ 3m                   |
| 216 - 960                                                                | -49.2              | 46.0 @ 3m                   |
| >960                                                                     | -41.2 ***          | 54.0 @ 3m ***               |
| * F is frequency in kHz.                                                 |                    |                             |
| ** Decreasing linearly with the logarithm of the frequency.              |                    |                             |
| *** Above 1GHz, a peak limit of 20dB above the average limit does apply. |                    |                             |

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Restricted Bands) Test Instrumentation**

| Instrument                    | Model    | S/No       | Cal Due Date | Cal Interval |
|-------------------------------|----------|------------|--------------|--------------|
| Agilent Spectrum Analyzer     | E4440A   | MY45304764 | 12 Dec 2015  | 1 year       |
| Micro-Tronics Bandstop Filter | BRM50701 | 017        | 13 Aug 2016  | 1 year       |

**RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST**

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Restricted Bands)  
Test Setup**

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) of the spectrum analyser was set to the following settings. The video bandwidth (VBW) was set to at least three times of the RBW.

| Frequency (MHz) | RBW (kHz) |
|-----------------|-----------|
| 0.009 – 0.150   | 0.2       |
| 0.150 – 30.0    | 9.0       |
| 30.0 - 1000     | 100.0     |
| > 1000          | 1000.0    |

5. The detector of the spectrum analyser was set to peak detection mode.
6. All other supporting equipment were powered separately from another filtered mains.

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Restricted Bands)  
Test Method**

1. Measurement in the range 9kHz – 1000MHz
  - 1.1 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, with the transmitting frequency was set to lower channel.
  - 1.2 The start and stop frequencies of the spectrum analyser were set according to the supported RBW.
  - 1.3 The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
  - 1.4 No further measurement was required if all the captured emissions complied to the limits. Else, the spectrum analyser was set to zoom to the captured emission with the detector of the spectrum analyser was set to quasi-peak. The emission level of the captured frequency was measured.
  - 1.5 The step 1.4 was repeated until all the captured emissions which exceeding the limits were measured.
  - 1.6 The steps 1.2 to 1.5 were repeated with the transmitting frequency was set to middle and upper channel respectively.
2. Measurement above 1000MHz
  - 2.1 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, with the transmitting frequency was set to lower channel.
  - 2.2 The start and stop frequencies of the spectrum analyser were set according to the supported frequency band of the set RBW with the number of points in a sweep was set to equal or greater than 2 times of the ratio of span over RBW.
  - 2.3 The detector of the spectrum analyser was set to power average (RMS) mode with the sweep time was set to equal or greater than 10 times of the product of number of measurement points in a sweep and transmission symbol time.
  - 2.4 The spectrum analyser was then allowed to capture any spurious emissions within a single sweep. The peak marker function of the spectrum analyser was used to locate the highest power level.
  - 2.5 The steps 2.2 to 2.4 were repeated until all the required frequency bands were measured.
  - 2.6 The steps 2.2 to 2.5 were repeated with the transmitting frequency was set to middle and upper channel respectively.
  - 2.7 The measurements were repeated with the detector of the spectrum analyser was set to peak detecting mode. The sweep time was set to auto coupler.

**RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST**

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions (Restricted Bands)  
Results**

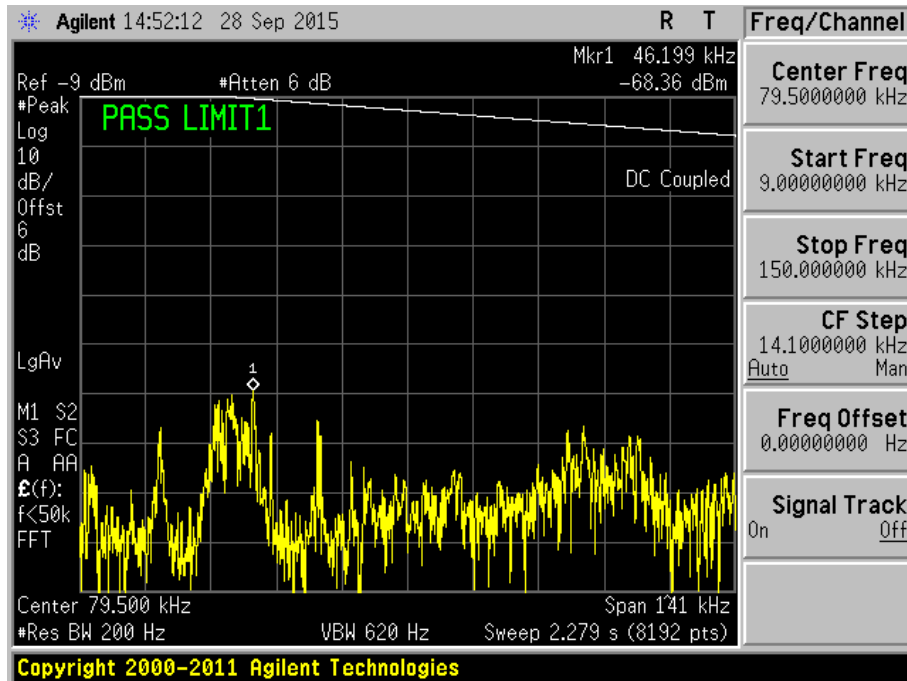
|                  |           |                      |              |
|------------------|-----------|----------------------|--------------|
| Test Input Power | 120V 60Hz | Temperature          | 24°C         |
| Attached Plots   | 13 – 30   | Relative Humidity    | 60%          |
|                  |           | Atmospheric Pressure | 1030mbar     |
|                  |           | Tested By            | Liau Lee Yin |

All spurious signals found were below the specified limit. Please refer to the attached plots.

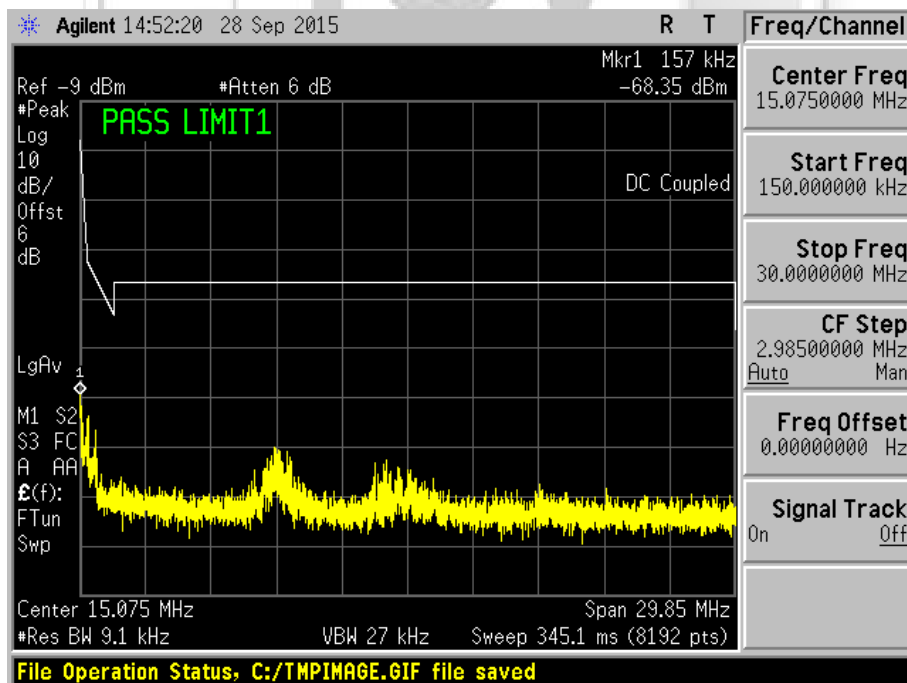


RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



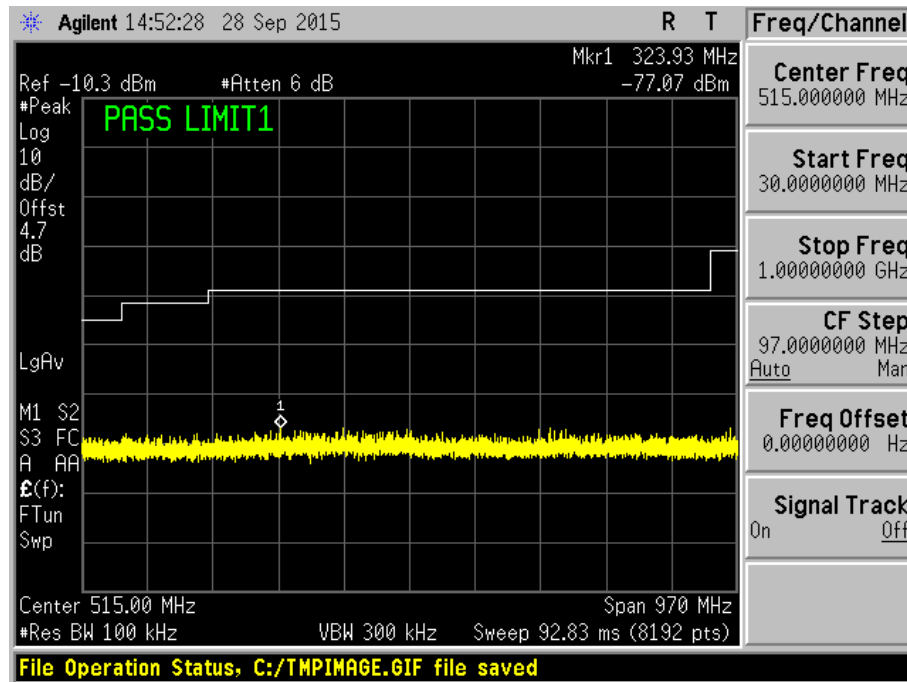
Plot 13 - Channel 0 (lower ch)



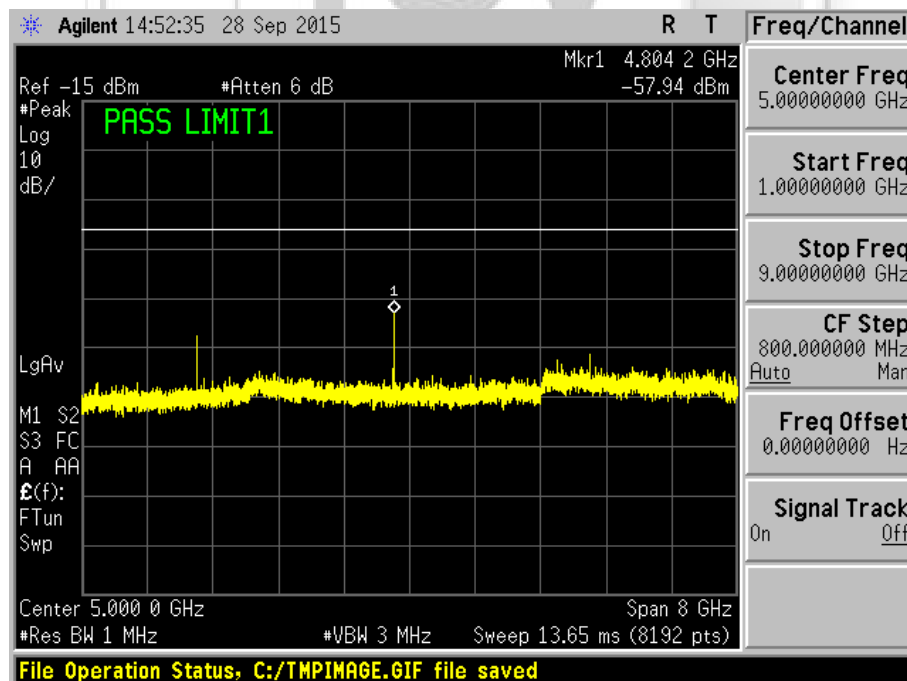
Plot 14 - Channel 0 (lower ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



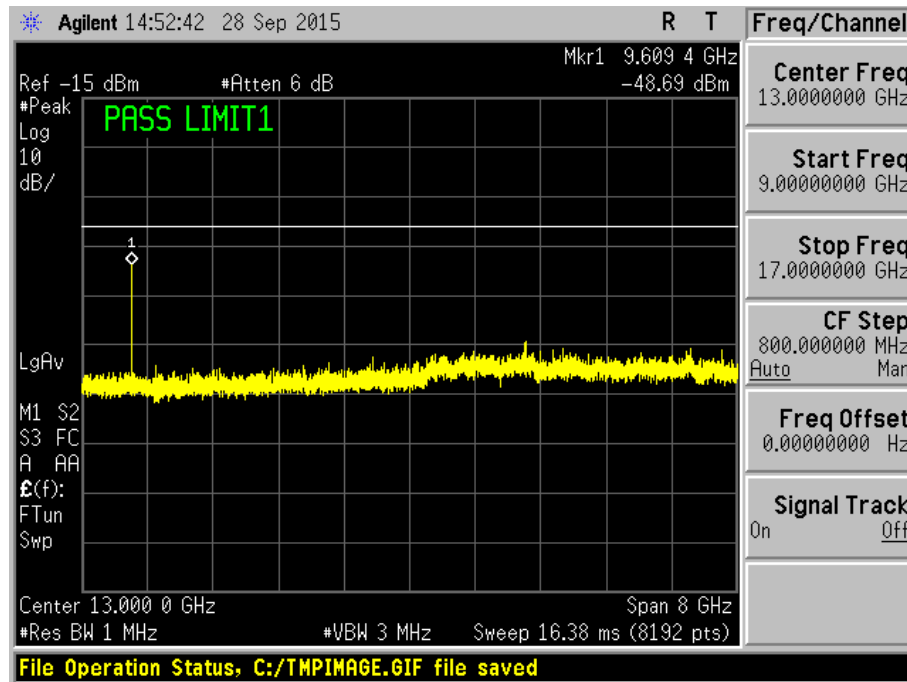
Plot 15 - Channel 0 (lower ch)



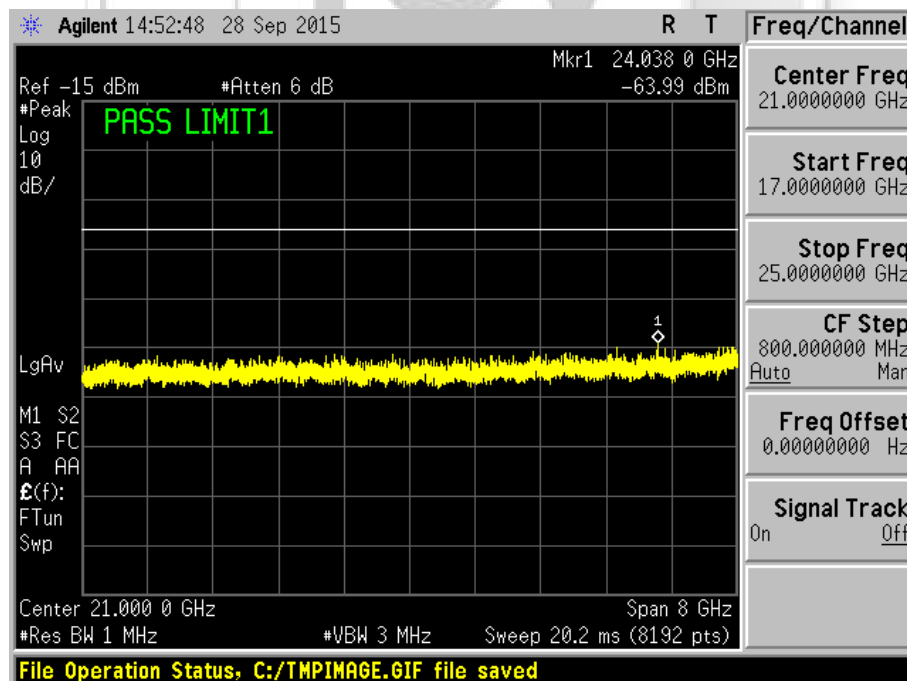
Plot 16 - Channel 0 (lower ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



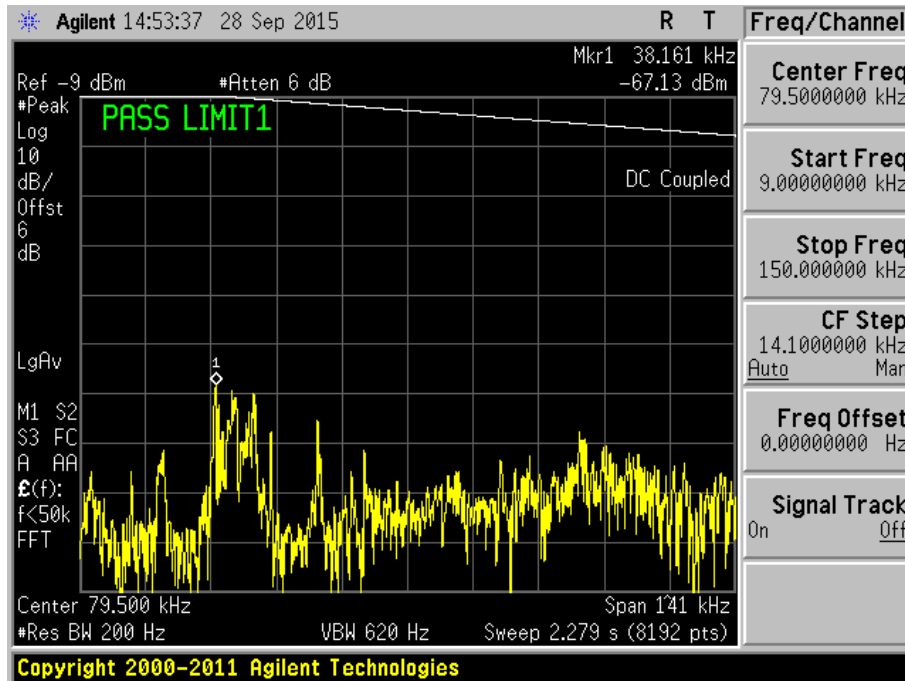
Plot 17 - Channel 0 (lower ch)



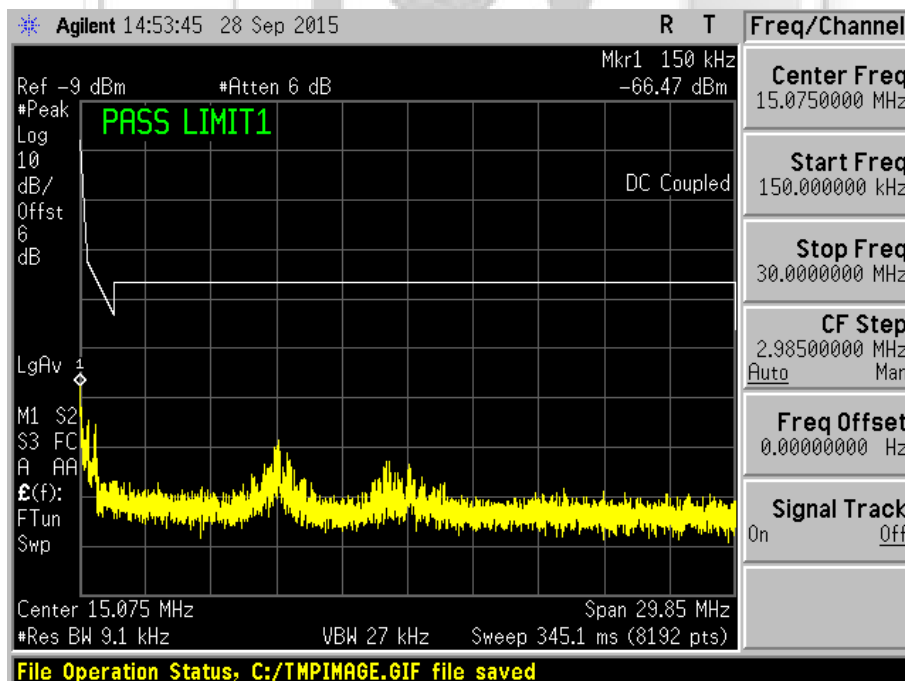
Plot 18 - Channel 0 (lower ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



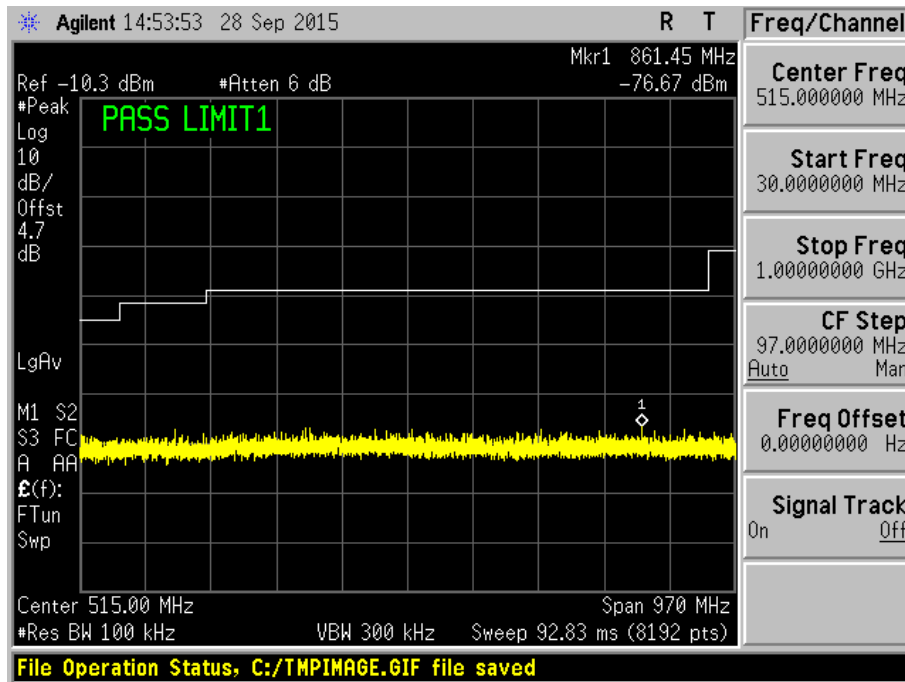
Plot 19 – Channel 19 (middle ch)



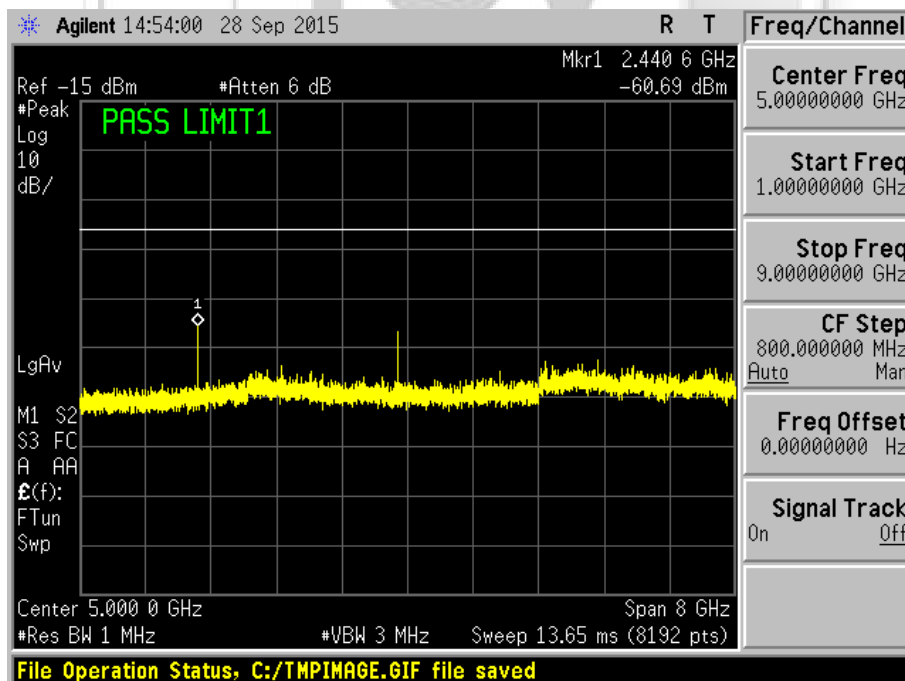
Plot 20 – Channel 19 (middle ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



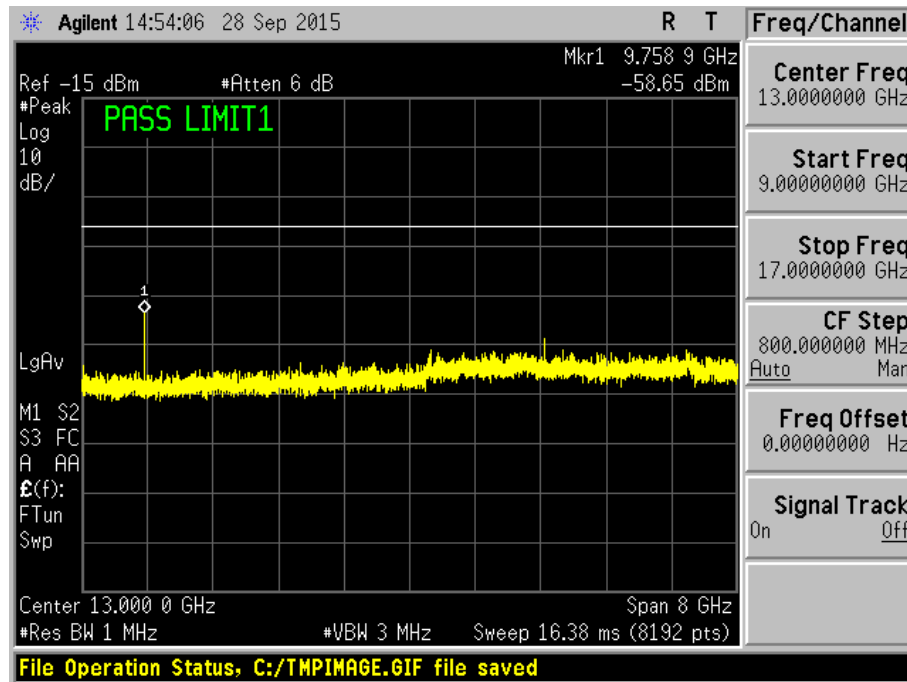
Plot 21 – Channel 19 (middle ch)



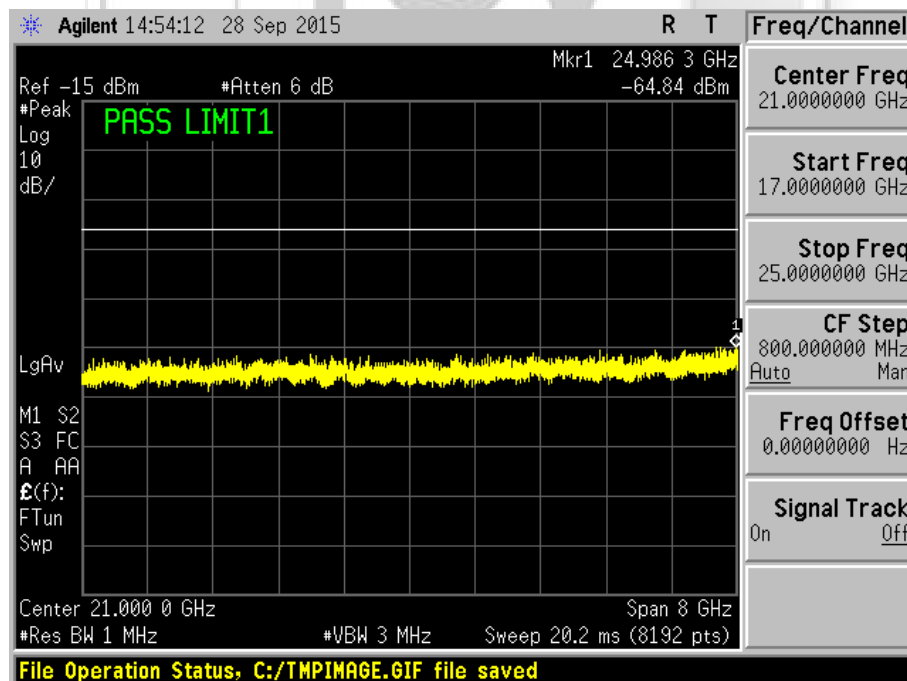
Plot 22 – Channel 19 (middle ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



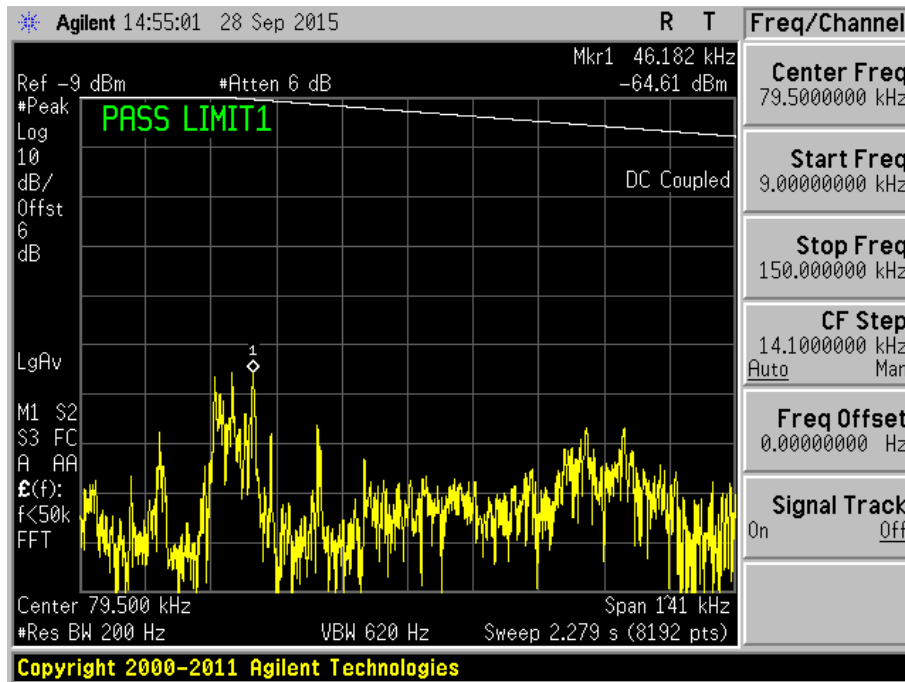
Plot 23 - Channel 19 (middle ch)



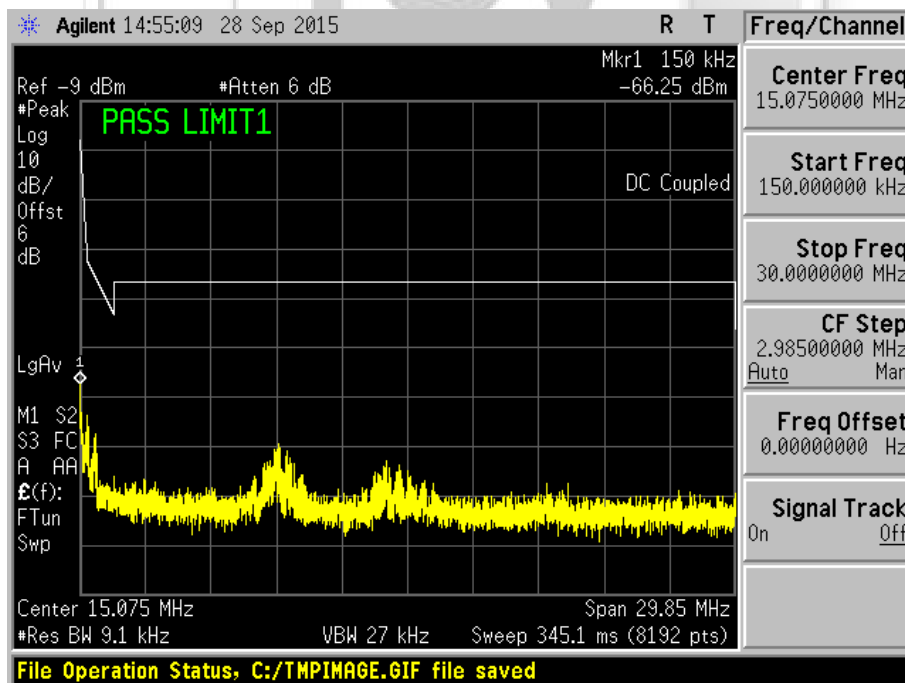
Plot 24 - Channel 19 (middle ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



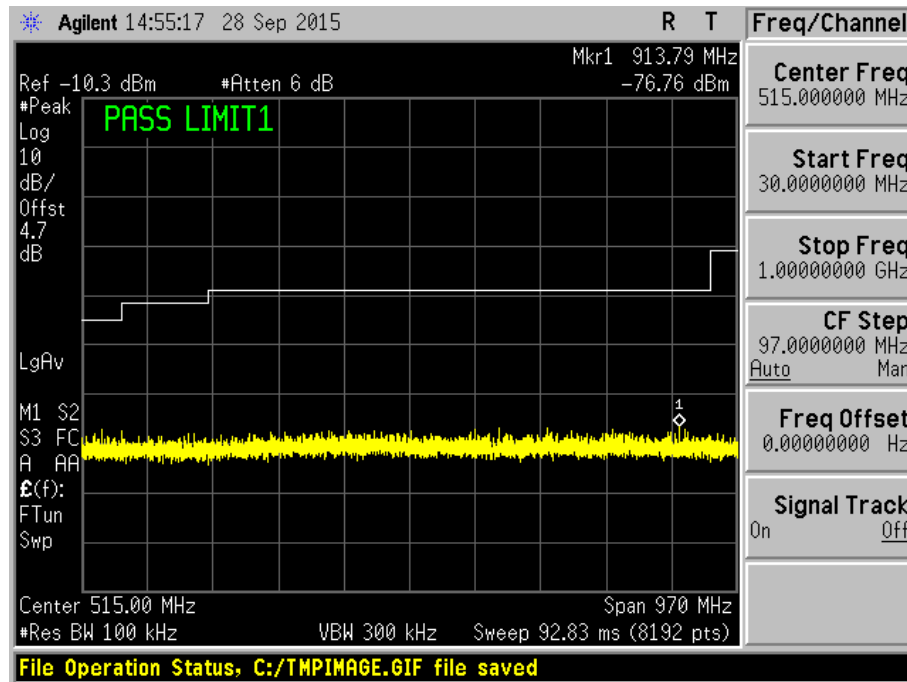
Plot 25 – Channel 39 (upper ch)



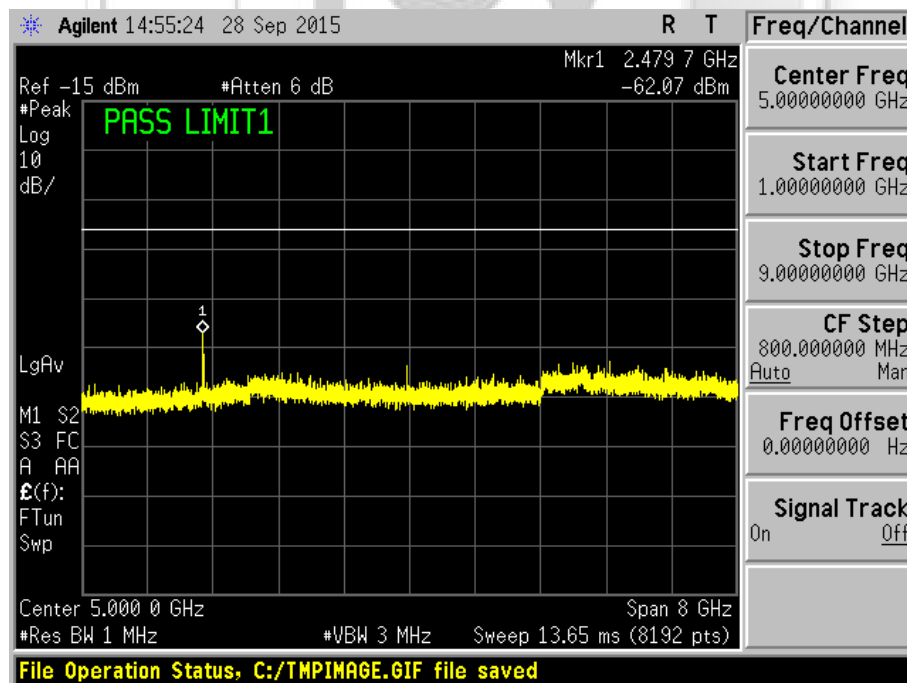
Plot 26 – Channel 39 (upper ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



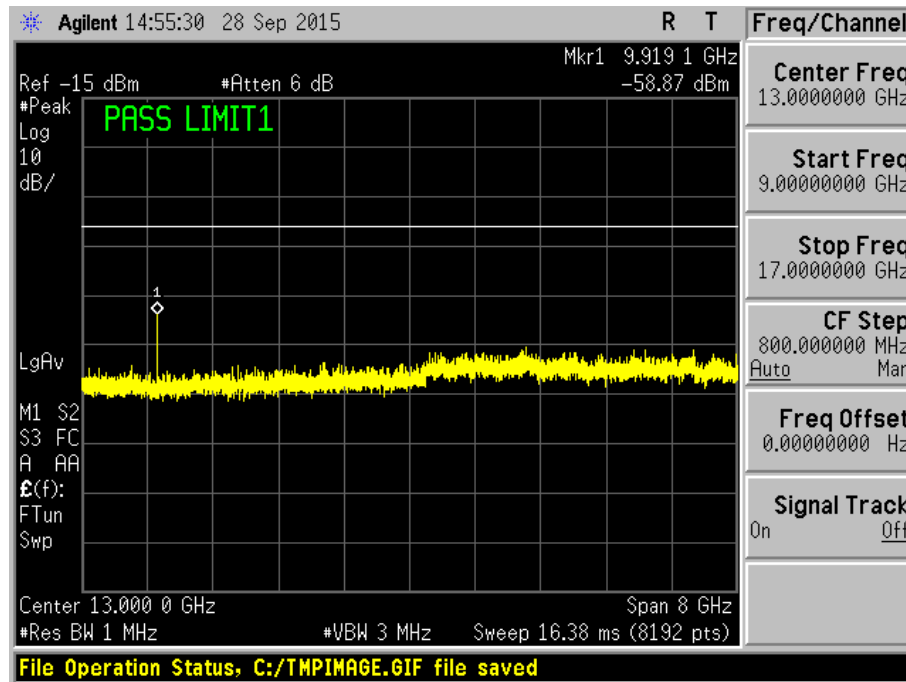
Plot 27 - Channel 39 (upper ch)



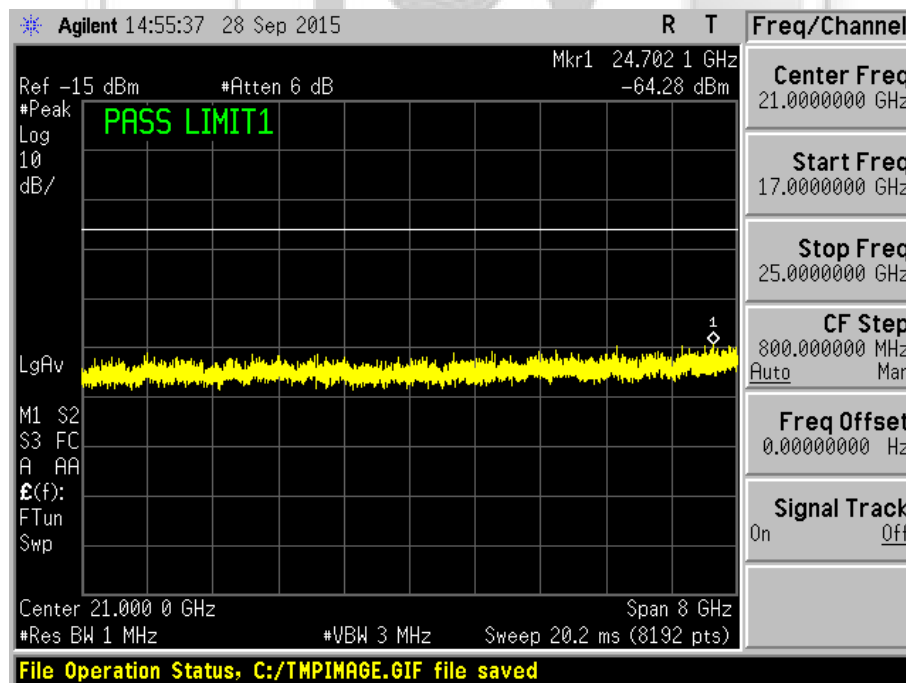
Plot 28 - Channel 39 (upper ch)

RF CONDUCTED SPURIOUS EMISSIONS (RESTRICTED BANDS) TEST

RF Conducted Spurious Emissions (Restricted) Plots



Plot 29 - Channel 39 (upper ch)



Plot 30 Channel 39 (upper ch)

## BAND EDGE COMPLIANCE (CONDUCTED) TEST

### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Test Instrumentation

| Instrument                | Model  | S/No       | Cal Due Date | Cal Interval |
|---------------------------|--------|------------|--------------|--------------|
| Agilent Spectrum Analyzer | E4404B | US39440632 | 02 Apr 2016  | 1 year       |

### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

**BAND EDGE COMPLIANCE (CONDUCTED) TEST**

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Results**

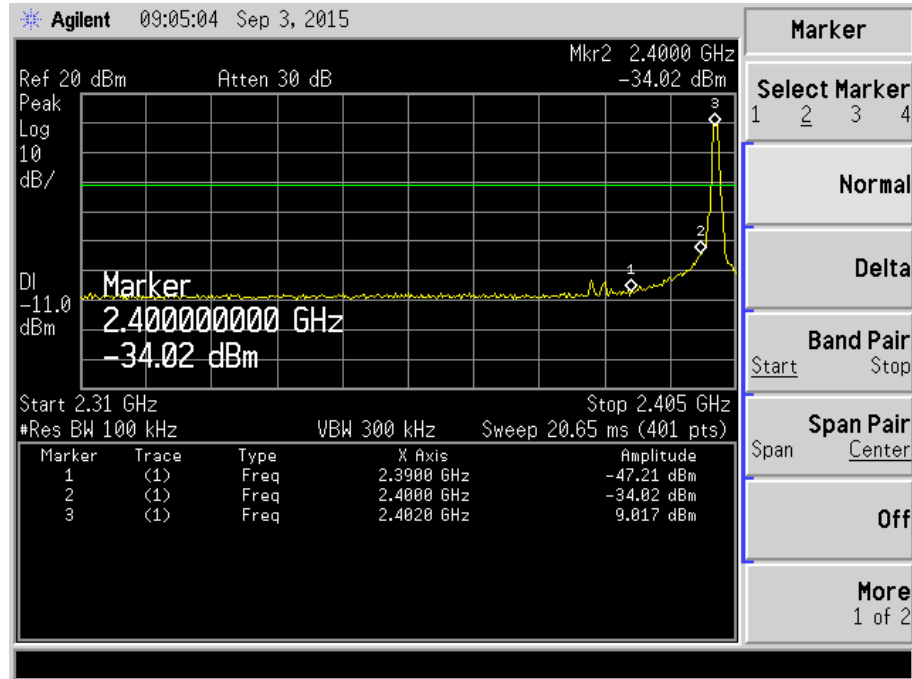
|                  |           |                      |              |
|------------------|-----------|----------------------|--------------|
| Test Input Power | 120V 60Hz | Temperature          | 24°C         |
| Attached Plots   | 31 – 32   | Relative Humidity    | 56%          |
|                  |           | Atmospheric Pressure | 1030mbar     |
|                  |           | Tested By            | Liau Lee Yin |

No significant signal was found and they were below the specified limit.

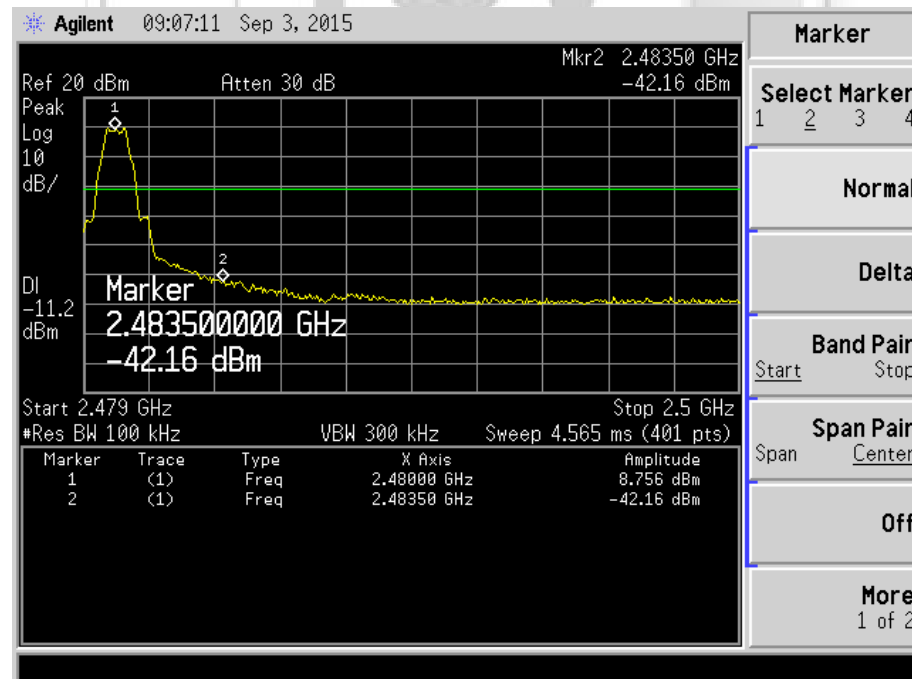


**BAND EDGE COMPLIANCE (CONDUCTED) TEST**

**Band Edge Compliance (Conducted) Plots**



**Plot 31 – Lower Band Edge at 2.4000GHz**



**Plot 32 – Upper Band Edge at 2.4835GHz**

## **BAND EDGE COMPLIANCE (RADIATED) TEST**

### **47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Limits**

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands shall comply to the radiated emission limits specified in 15.209.

### **47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Test Instrumentation**

| Instrument                     | Model | S/No      | Cal Due Date | Cal Interval |
|--------------------------------|-------|-----------|--------------|--------------|
| R&S Test Receiver – ESI1       | ESI40 | 100010    | 14 Jul 2016  | 1 year       |
| EMCO Horn Antenna(1GHz-18GHz)  | 3115  | 0003-6088 | 20 Apr 2016  | 1 year       |
| R&S Preamplifier (1GHz -18GHz) | SCU18 | 102191    | 13 Mar 2016  | 1 year       |

### **47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Test Setup**

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz to show compliance of spurious at band edges are at least 20dB below the carriers. For restricted band spurious at band edges, peak and average measurement plots were taken using the following setting:
  - a. Peak Plot:  
RBW = 1MHz, VBW = 3MHz
  - b. Average Plot  
RBW = 1MHz, VBW = 30Hz
4. All other supporting equipment were powered separately from another filtered mains.

### **47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with specified modulation and data rate.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected. For the average measurement, it was done via a video average mode with a reduced VBW.
4. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 2 to 4 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

**BAND EDGE COMPLIANCE (RADIATED) TEST**

**47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Results**

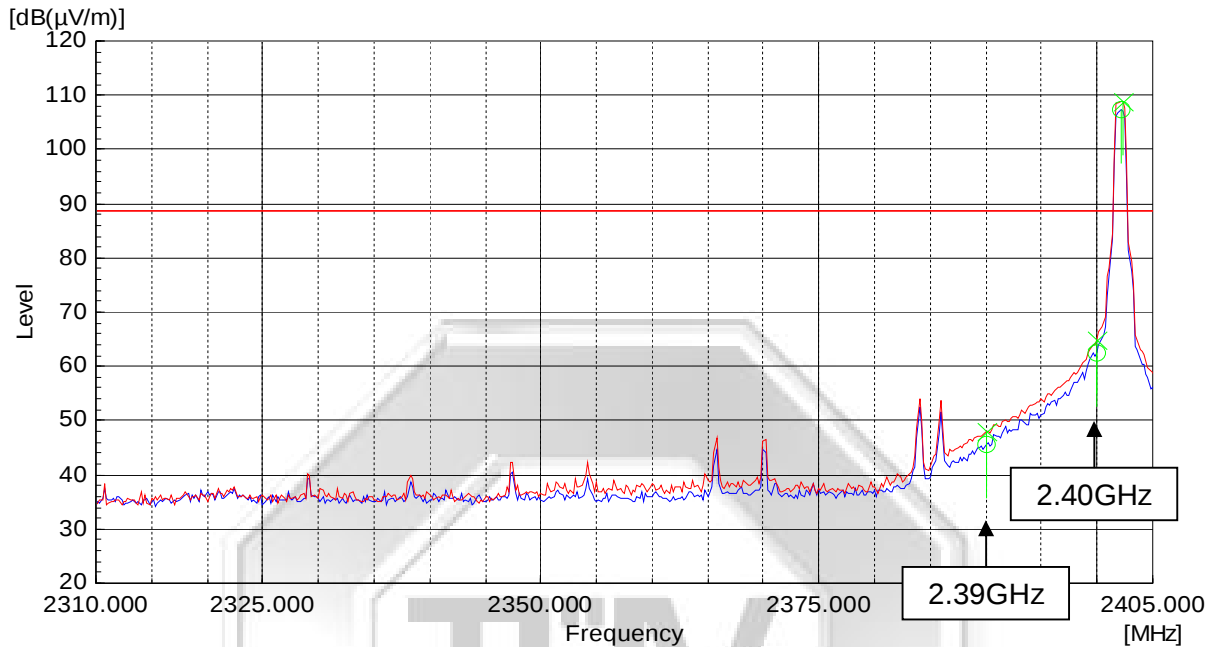
|                  |           |                      |           |
|------------------|-----------|----------------------|-----------|
| Test Input Power | 120V 60Hz | Temperature          | 24°C      |
| Attached Plots   | 33 – 38   | Relative Humidity    | 60%       |
|                  |           | Atmospheric Pressure | 1030mbar  |
|                  |           | Tested By            | Dylan Lin |

No significant signal was found and they were below the specified limit.

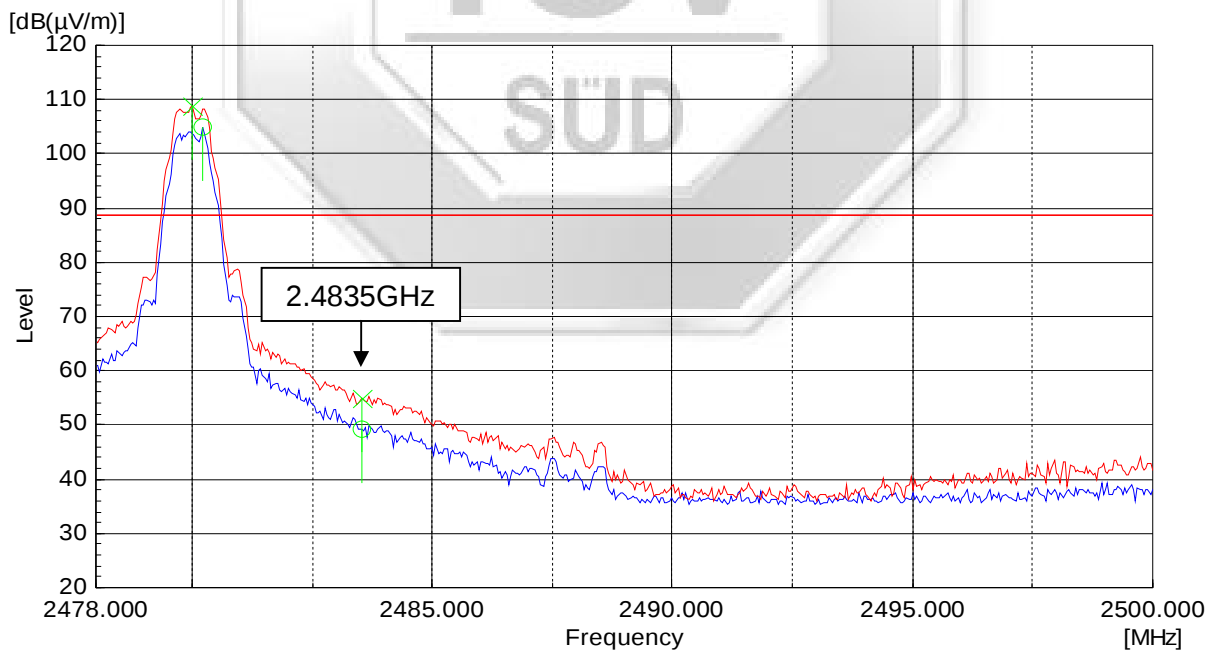


**BAND EDGE COMPLIANCE (RADIATED) TEST**

**Band Edge Compliance (Radiated) Plots (20dB Delta from Carrier at Band Edge)**



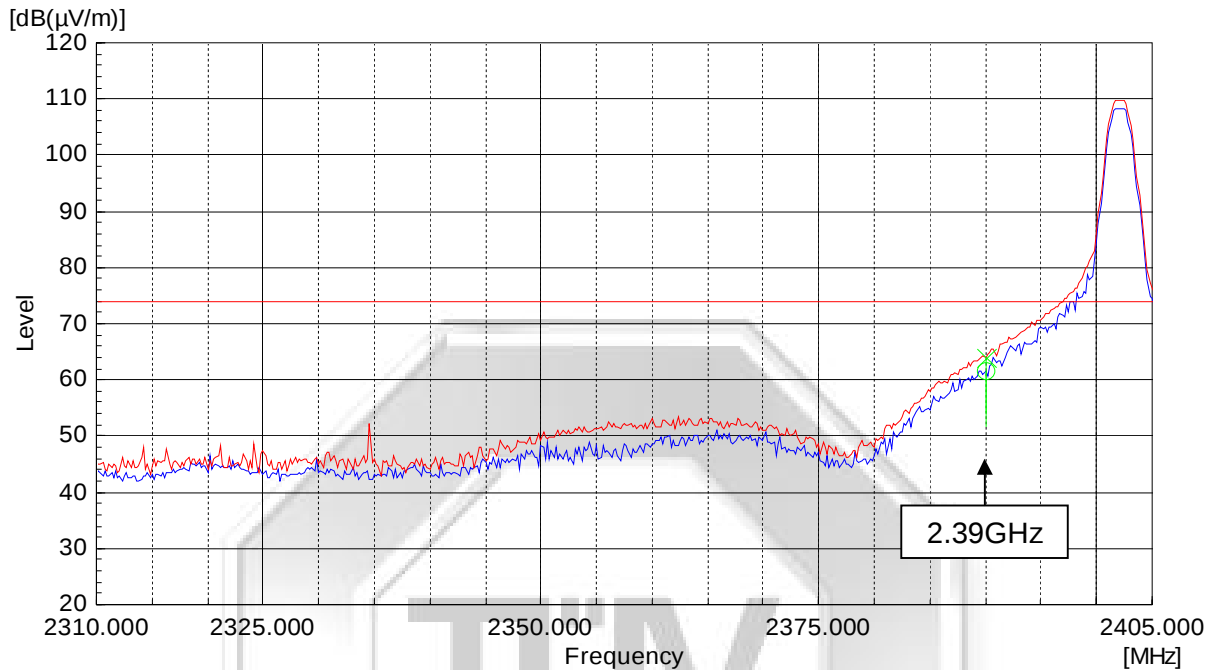
**Plot 33 – Lower Band Edge at 2.4000GHz**



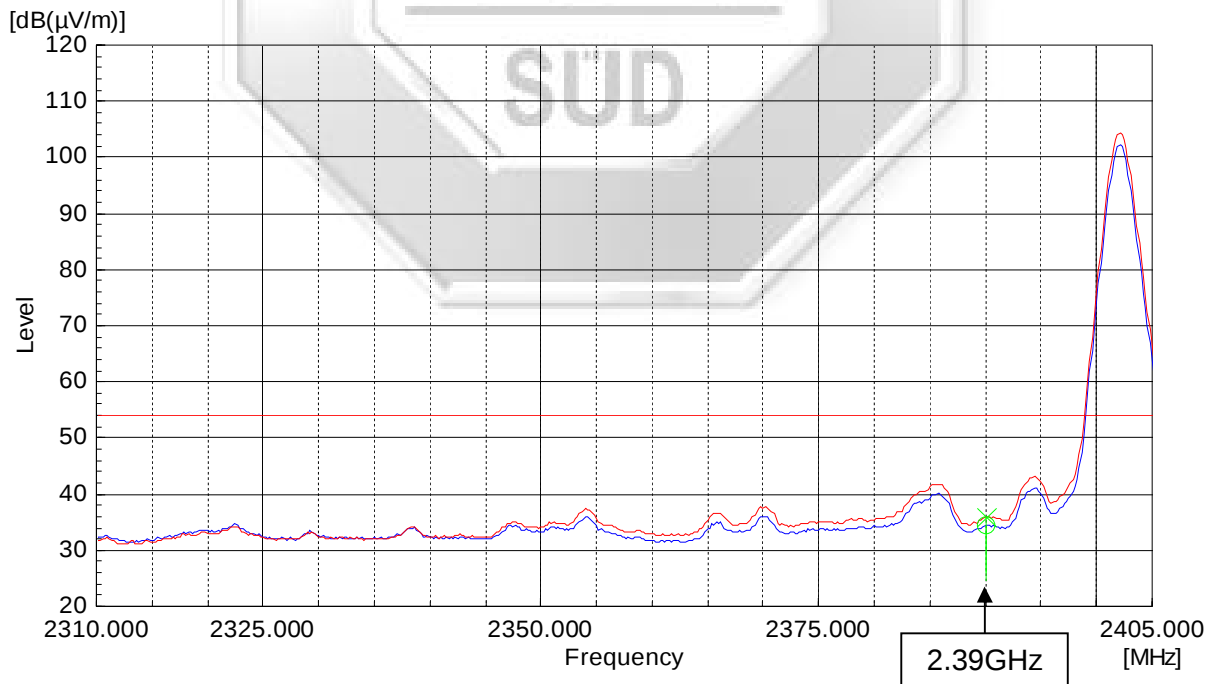
**Plot 34 – Upper Band Edge at 2.4835GHz**

**BAND EDGE COMPLIANCE (RADIATED) TEST**

**Band Edge Compliance (Radiated) Plots (Restricted Band)**



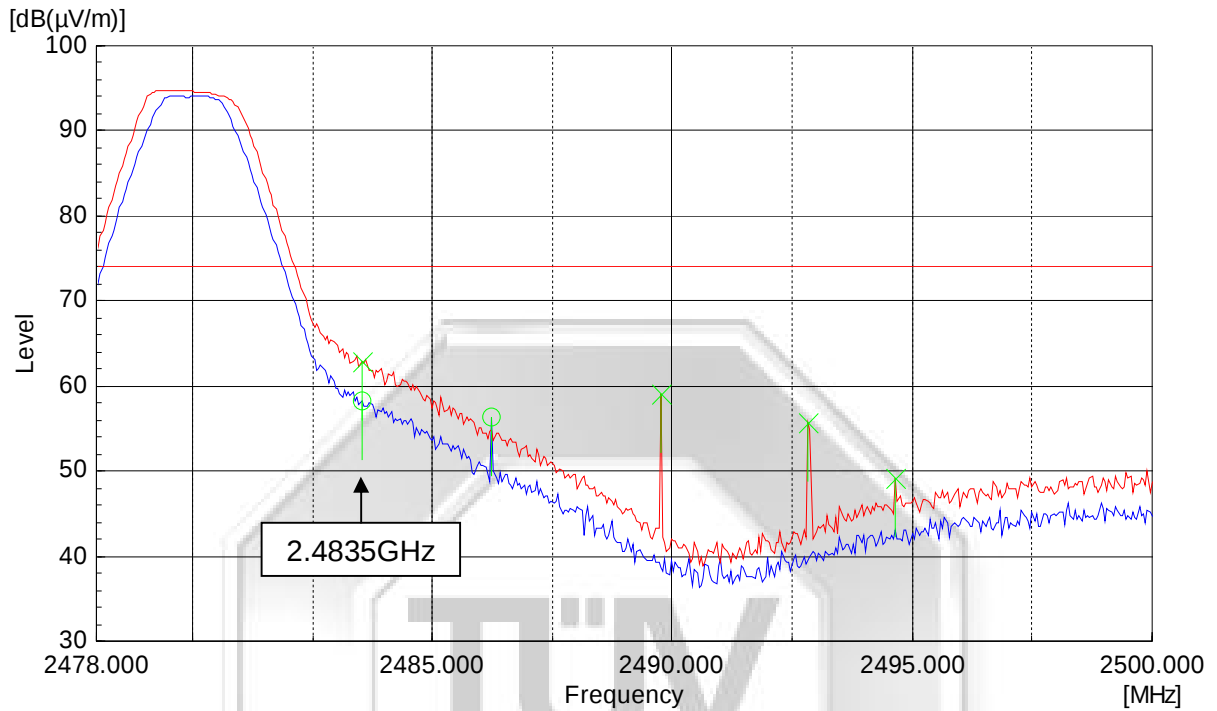
**Plot 35 – Peak Plot at Lower Band Edge at 2.4000GHz**



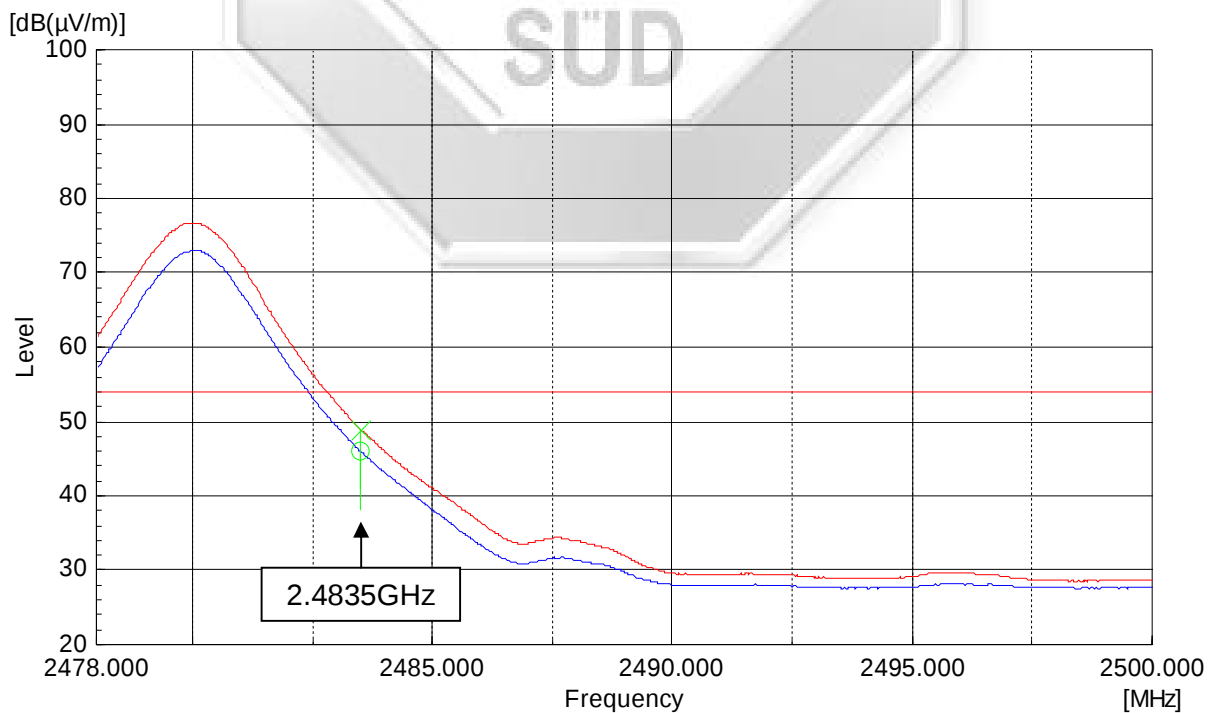
**Plot 36 – Average Plot at Lower Band Edge at 2.4000GHz**

**BAND EDGE COMPLIANCE (RADIATED) TEST**

**Band Edge Compliance (Radiated) Plots (Restricted Band)**



**Plot 37 – Peak Plot at Upper Band Edge at 2.4835GHz**



**Plot 38 – Average Plot at Upper Band Edge at 2.4835GHz**

## PEAK POWER SPECTRAL DENSITY TEST

### 47 CFR FCC Part 15.247(e) and RSS-247 5.2(2) Peak Power Spectral Density Limits

The EUT shows compliance to the requirements of this section, which states the peak power spectral density conducted from the intentional radiator (EUT) to the antenna shall not be greater than 8dBm (6.3mW) in any 3kHz band during any time interval of continuous transmission.

### 47 CFR FCC Part 15.247(e) and RSS-247 5.2(2) Peak Power Spectral Density Test Instrumentation

| Instrument                | Model  | S/No       | Cal Due Date | Cal Interval |
|---------------------------|--------|------------|--------------|--------------|
| Agilent Spectrum Analyzer | E4404B | US39440632 | 02 Apr 2016  | 1 year       |

### 47 CFR FCC Part 15.247(e) and RSS-247 5.2(2) Peak Power Spectral Density Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum via a low-loss coaxial cable.
4. The resolution bandwidth (RBW), video bandwidth (VBW) and span of the spectrum analyser were set to the following:  
RBW = 3kHz  
VBW = 9kHz  
Span = 1.5 times the channel bandwidth  
Sweep time = auto couple
5. All other supporting equipment were powered separately from another filtered mains.

### 47 CFR FCC Part 15.247(e) and RSS-247 5.2(2) Peak Power Spectral Density Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at lower channel.
2. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser.
3. The peak power density of the transmitting frequency was plotted and recorded.
4. The steps 2 to 3 were repeated with the transmitting frequency was set to middle and upper channel respectively.

**PEAK POWER SPECTRAL DENSITY TEST**

**47 CFR FCC Part 15.247(e) and RSS-247 5.2(2) Peak Power Spectral Density Results**

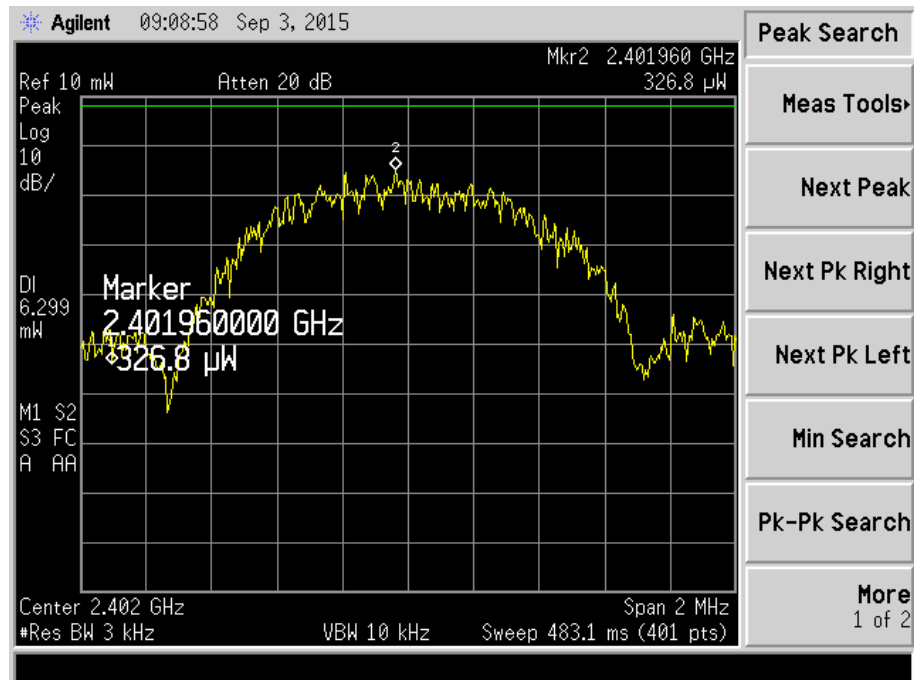
|                  |           |                      |              |
|------------------|-----------|----------------------|--------------|
| Test Input Power | 120V 60Hz | Temperature          | 24°C         |
| Attached Plots   | 39 – 41   | Relative Humidity    | 56%          |
|                  |           | Atmospheric Pressure | 1030mbar     |
|                  |           | Tested By            | Liau Lee Yin |

| Channel | Channel Frequency (GHz) | Peak Power Spectral Density (mW) | Limit (mW) |
|---------|-------------------------|----------------------------------|------------|
| 0       | 2.402                   | 0.327                            | 6.3        |
| 19      | 2.440                   | 0.340                            | 6.3        |
| 39      | 2.480                   | 0.346                            | 6.3        |

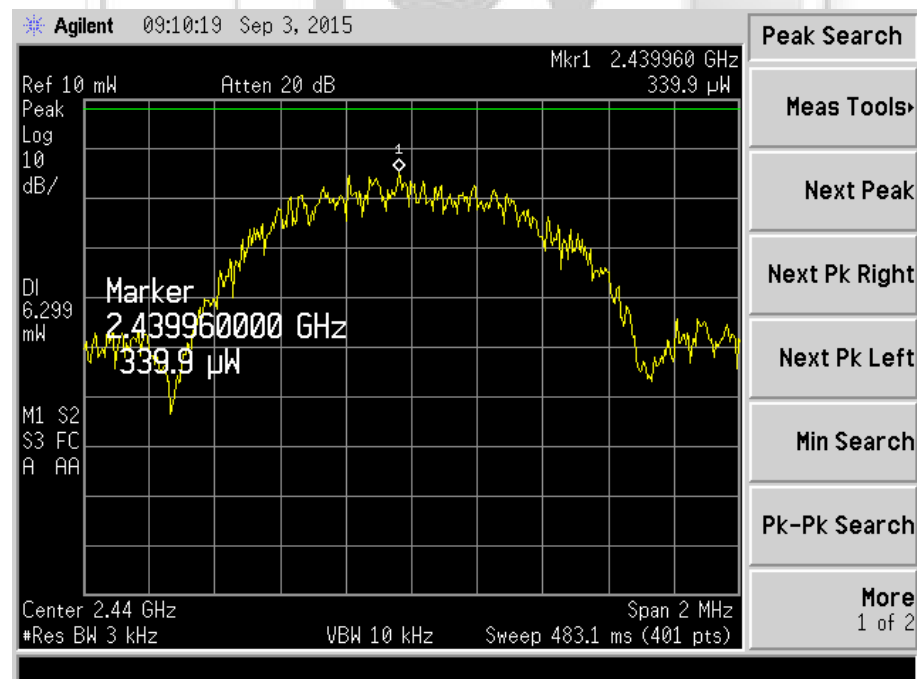


PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots



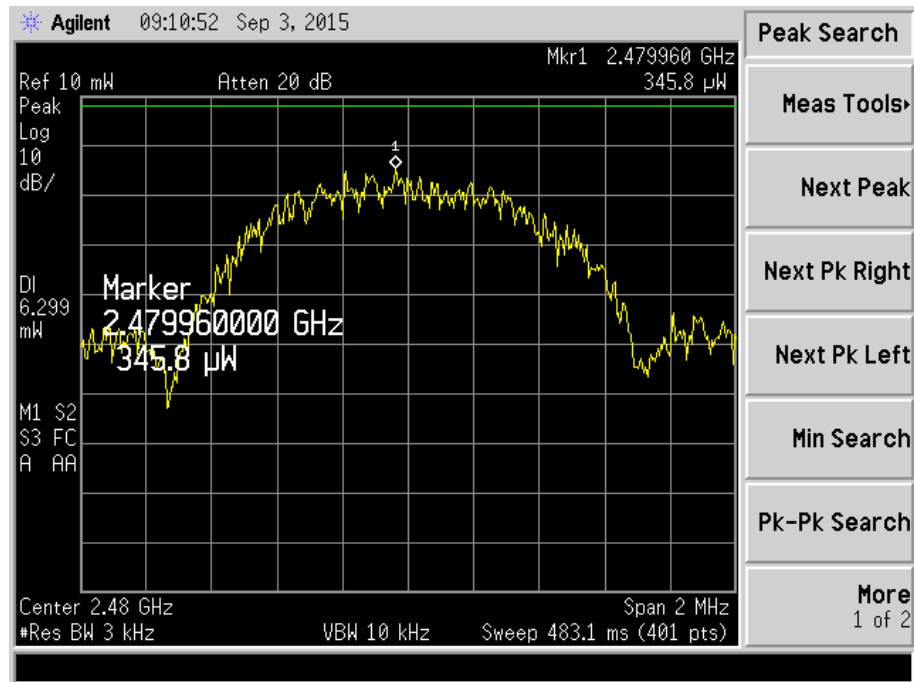
Plot 39 – Channel 0



Plot 40 – Channel 19

PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots



Plot 41 – Channel 39

## MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

### 47 CFR FCC Part 1.1310, RSS-102 4.0 and RSS-GEN 3.2 Maximum Permissible Exposure (MPE) Limits

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Average Time (min) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------|
| 0.3 - 1.34            | 614                           | 1.63                          | 100 <sup>Note 2</sup>               | 30                 |
| 1.34 - 30             | 824 / f                       | 2.19 / f                      | 180 / f <sup>2</sup> Note 2         | 30                 |
| 30 - 300              | 27.5                          | 0.073                         | 0.2                                 | 30                 |
| 300 - 1500            | -                             | -                             | f / 1500                            | 30                 |
| 1500 - 100000         | -                             | -                             | 1.0                                 | 30                 |

#### Notes

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

### 47 CFR FCC Part 1.1310, RSS-102 4.0 and RSS-GEN 3.2 Maximum Permissible Exposure Computation

The power density at 20cm distance was computed from the following formula:

$$\begin{aligned}
 S &= (30GP) / (377d^2) \\
 \text{where } S &= \text{Power density in W/m}^2 \\
 P &= 0.0026W \\
 d &= \text{Test distance at 0.2m} \\
 G &= \text{Numerical isotropic gain, 2.51 (4.0dBi)}
 \end{aligned}$$

Substituting the relevant parameters into the formula:

$$\begin{aligned}
 S &= [(30GP) / 377d^2] \\
 &= 0.0130 \text{ W/m}^2 \\
 &= 0.0013 \text{ mW/cm}^2
 \end{aligned}$$

∴ The power density of the EUT at 20cm distance is 0.0013mW/cm<sup>2</sup> based on the above computation and found to be lower than the power density limit of 1.0mW/cm<sup>2</sup>.



Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
2. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.
3. Nothing in this report shall be interpreted to mean that TÜV SÜD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on that sample.
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5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

July 2011



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**ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS**

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**ANNEX A**  
**TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS**

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

TEST SETUP



Conducted Emissions Test Setup (Front View)



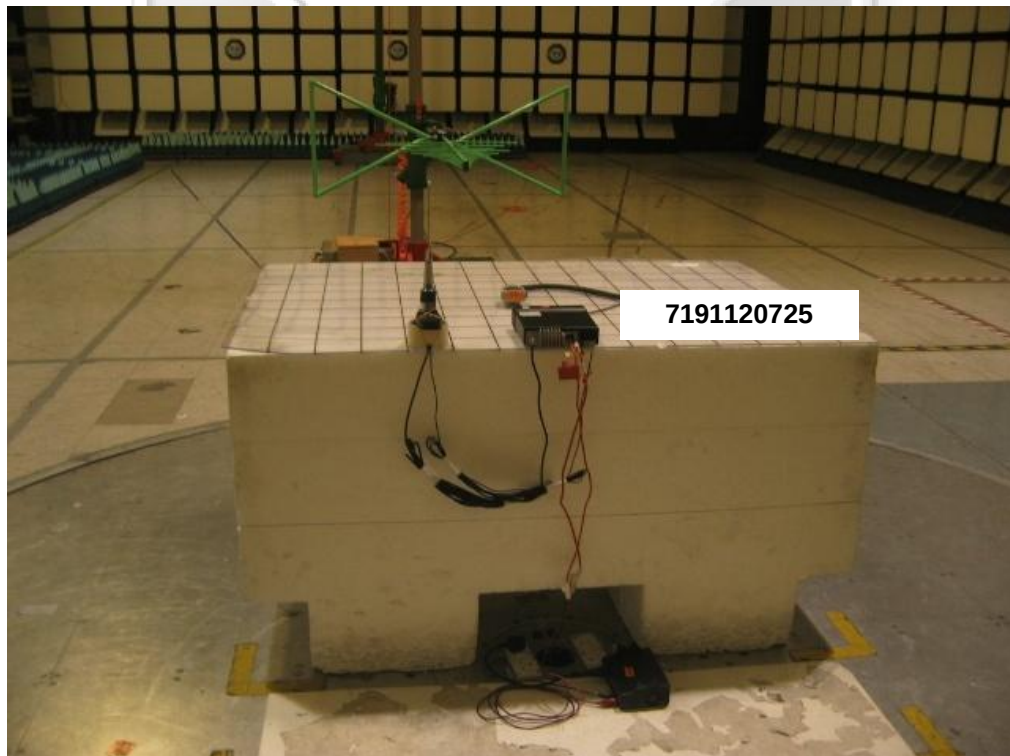
Conducted Emissions Test Setup (Rear View)

**ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS**

**TEST SETUP (30MHz to 1GHz)**



**Radiated Emissions Test Setup (Front View)**



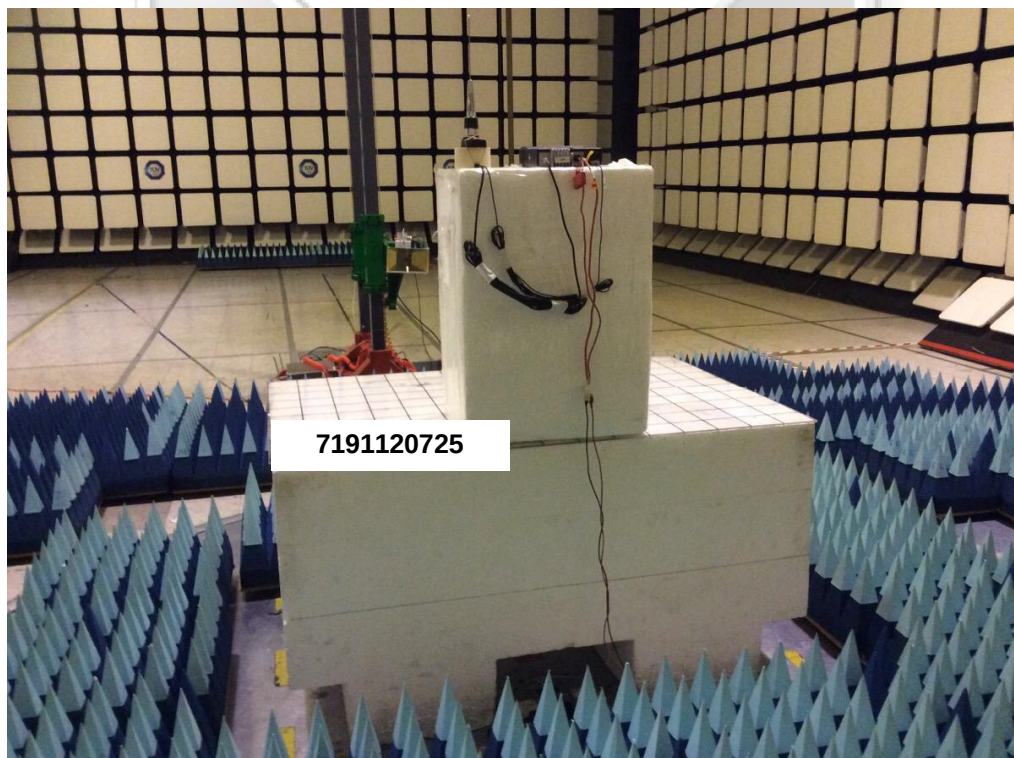
**Radiated Emissions Test Setup (Rear View)**

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

TEST SETUP (Above 1GHz)



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

TEST SETUP



Spectrum Bandwidth (6dB Bandwidth Measurement) Test Setup



Maximum Peak Power Test Setup

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

TEST SETUP



RF Conducted Spurious Emissions (Non-Restricted Bands) Test Setup



RF Conducted Spurious Emissions (Restricted Bands) Test Setup

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

TEST SETUP



Band Edge Compliance (Conducted) Test Setup



Band Edge Compliance (Radiated) Test Setup

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

TEST SETUP



Peak Power Spectral Density Test Setup

ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS



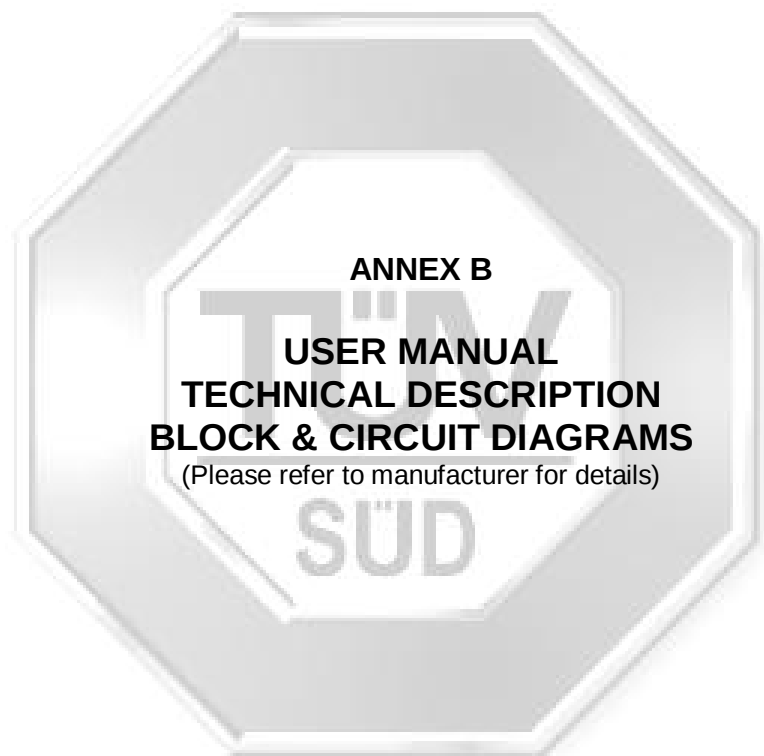
Front View



Rear View

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**ANNEX B USER MANUAL TECHNICAL DESCRIPTION BLOCK & CIRCUIT DIAGRAMS**



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**ANNEX C FCC LABEL, IC LABEL & POSITION**



## ANNEX C FCC LABEL & POSITION

Labelling requirements per Section 2.925 & 15.19 and RSS-GEN 2.1

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.



Sample Label



Physical Location of FCC Label on EUT



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**ANNEX D TEST SITE DESCRIPTION**



## ANNEX D TEST SITE DESCRIPTION

### Radiated Emission Test Site Description

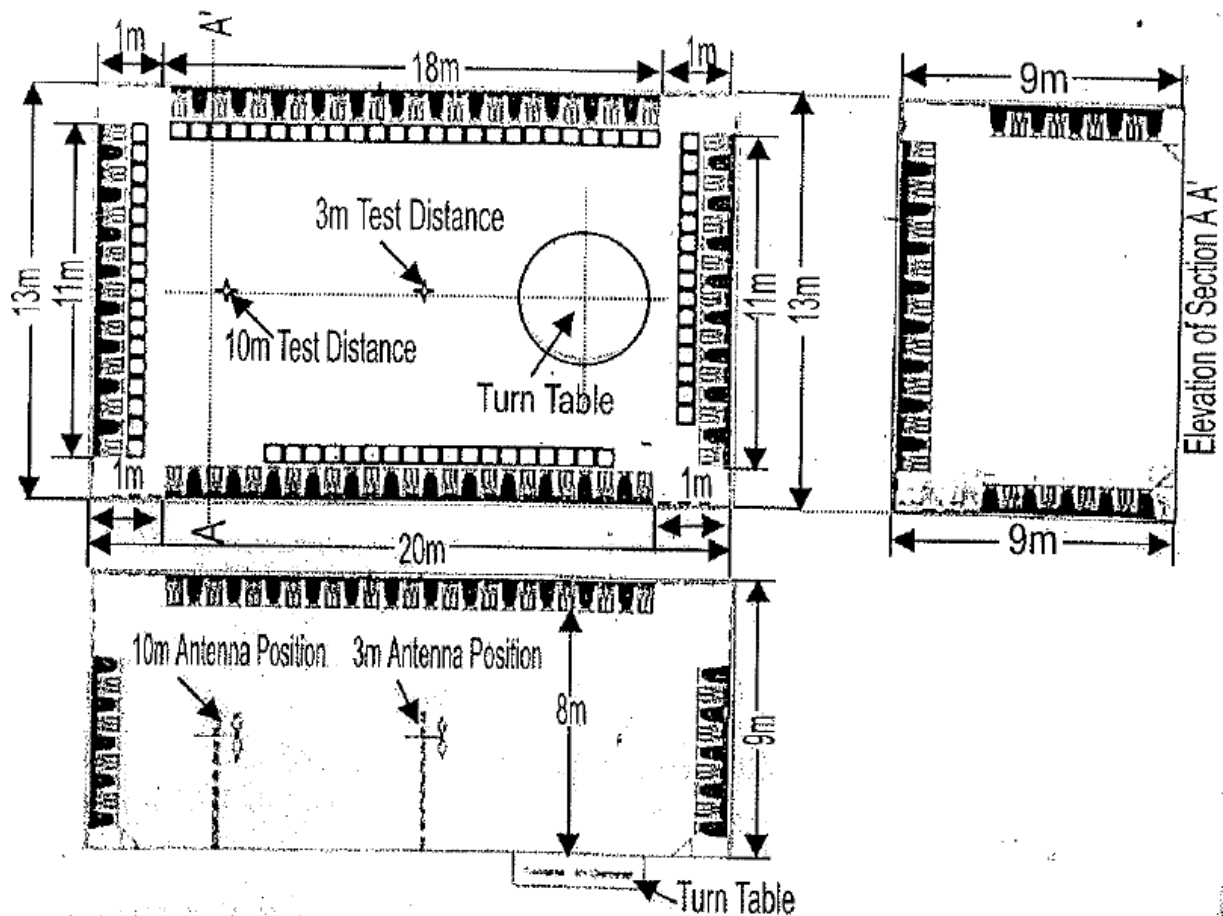
The Radiated Emission test facility consists of a RF-shielded enclosure (Model: 04" x 07") manufactured by Lindgren whose dimensions are shown below. The exterior of the chamber is made of rigid steel panels while the interior is covered with RF absorbing panels on the 4 walls and ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is mounted flushed with the chamber floor and is driven by a pneumatic motor, which is capable of supporting 4,000 kg.

The boresight antenna mast is driven by a pneumatic motor with heights variation from 1m- 4m for both vertical and horizontal polarity and with tilt capability.

Both turntable and antenna mast in the chamber are controlled by system controller stationed outside the chamber.

The physical layout of the chamber is show below:



## ANNEX D TEST SITE DESCRIPTION

### Conducted Emission Test Site Description

The Conducted Emission facility consists of an RF-shielded enclosure measuring 4.3m x 3.7m x 2.45m manufactured by Universal Shielding Corporation. The Conducted Emission data were taken using two LISNs.

The physical layout of the test site is show below:

