# FCC PART 15C TEST REPORT

*Issued to*

**SZ DJI TECHNOLOGY CO.,LTD**

*For*

**2.4G Bluetooth Datalink**

| | |
|---|---|
| Model Name: | LK24-BT |
| Trade Name: | DJI |
| Brand Name: | DJI |
| FCC ID: | SS3-201309001 |
| Standard: | 47 CFR Part 15 Subpart C |
| Test date: | 2013-9-16 to 2013-10-27 |
| Issue date: | 2013-10-30 |

*By*

**Shenzhen MORLAB Communication Technology Co., Ltd.**

| | | |
|---|---|---|
| *Tested by* Nie Quan | *Approved by* Zeng Dexin | *Review by* Peng Huarui |
| *Nie Quan* | *Zeng Dexin* | *Peng Huarui* |
| *(Test Engineer)* | *(Chief Engineer)* | *(Project Manager)* |
| *Date* 2013.10.30 | *Date* 2013.10.30 | *Date* 2013.10.30 |

# DIRECTORY



| Change History | | |
|---|---|---|
| Issue | Date | Reason for change |
| 1.0 | October 30, 2013 | First edition |
| | | |
| | | |

# 1. General Information

## 1.1. EUT Description

| | |
|---|---|
| EUT Type ..... : | 2.4G Bluetooth Datalink |
| Serial No..... : | (n.a, marked #1 by test site) |
| Hardware Version ..... : | V1 |
| Software Version ..... : | 1.0 |
| Applicant ..... : | SZ DJI TECHNOLOGY CO.,LTD<br>Room 613、614, 6/F, HKUST SZ IER Bldg, No.9 Yuexing 1st Rd Hi-Tech Park(South), Nanshan District, Shenzhen, Guangdong, China |
| Manufacturer ..... : | SZ DJI TECHNOLOGY CO.,LTD<br>6F, HKUST SZ IER Bldg. No.9 Yuexing 1st Rd. Hi-Tech Park(South), Nanshan Dist. Shenzhen, Guangdong, China |
| Frequency Range..... : | The frequency range used is 2405.376MHz – 2477.056MHz (36channels, at intervals of 2.048MHz);<br>The frequency block is 2400MHz to 2483.5MHz. |
| Modulation Type ..... : | FHSS |
| Antenna Type..... : | SMA Antenna |
| Antenna Gain..... : | 1.8dBi |

Note 1: The EUT is 2.4G Bluetooth Datalink, it operating at 2.4GHz ISM band, the frequencies allocated is F (MHz) =2405.376+2.048*(n-1) (1<=n<=36). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1 (2405.376MHz), 18 (2440.192MHz) and 36 (2477.056MHz).

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

## 1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

| No. | Identity | Document Title |
|---|---|---|
| 1 | 47 CFR Part 15 (10-1-12 Edition) | Radio Frequency Devices |

Test detailed items/section required by FCC rules and results are as below:

| No. | Section in CFR 47 | Description | Result |
|---|---|---|---|
| 1 | 15.203 | Antenna Requirement | PASS |
| 2 | 15.247(a) | Number of Hopping Frequency | PASS |
| 3 | 15.247(b) | Peak Output Power | PASS |
| 4 | 15.247(a) | 20dB Bandwidth | PASS |
| 5 | 15.247(a) | Carrier Frequency Separation | PASS |
| 6 | 15.247(a) | Time of Occupancy (Dwell time) | PASS |
| 7 | 15.247(d) | Conducted Spurious Emission | PASS |
| 8 | 15.247(d) | Restricted Frequency Bands | PASS |
| 9 | 15.207 | Conducted Emission | PASS |
| 10 | 15.209<br>15.247(d) | Radiated Emission | PASS |
| 11 | 15.247(i),<br>1.1307&2.1093 | RF exposure evaluation | PASS |

NOTE:

The tests were performed according to the method of measurements prescribed in DA-00-705.

## 1.3. Facilities and Accreditations

### 1.3.1. Facilities

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.1, Building A, FeiYang Science Park,Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10 2009, ANSI C63.4 2009 and CISPR Publication 22; the FCC registration number is 695796.

### 1.3.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

| | |
|---|---|
| Temperature (°C): | 15 - 35 |
| Relative Humidity (%): | 30 -60 |
| Atmospheric Pressure (kPa): | 86-106 |

# 2. 47 CFR Part 15C Requirements

## 2.1. Antenna requirement

### 2.1.1. Applicable Standard

According to FCC 15.203, 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.

### 2.1.2. **Result:** Compliant

The maximum gain of antenna was defined by manufacturer. The max gain is 1.8dBi.
The antenna type is SMA Antenna. For more info, please refer to the user manual.

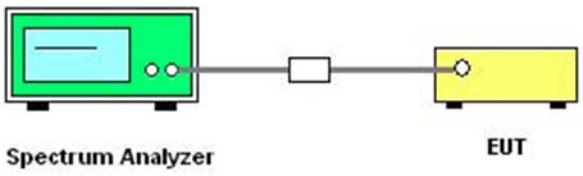
## 2.2. Number of Hopping Frequency

### 2.2.1. Requirement

According to FCC §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

### 2.2.2. Test Description

**A. Test Setup:**




The RF Module of the EUT is coupled to the Spectrum Analyzer (SA) Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| System Simulator | Anritsu | MT8852B | 6K00006210 | 2013.05.12 | 2014.05.11 |
| Spectrum Analyzer | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Power Splitter | Weinschel | 1506A | NW521 | 2013.05.12 | 2014.05.11 |
| Attenuator 1 | Resnet | 10dB | (n.a.) | 2013.05.12 | 2014.05.11 |
| Attenuator 2 | Resnet | 3dB | (n.a.) | 2013.05.12 | 2014.05.11 |

### 2.2.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

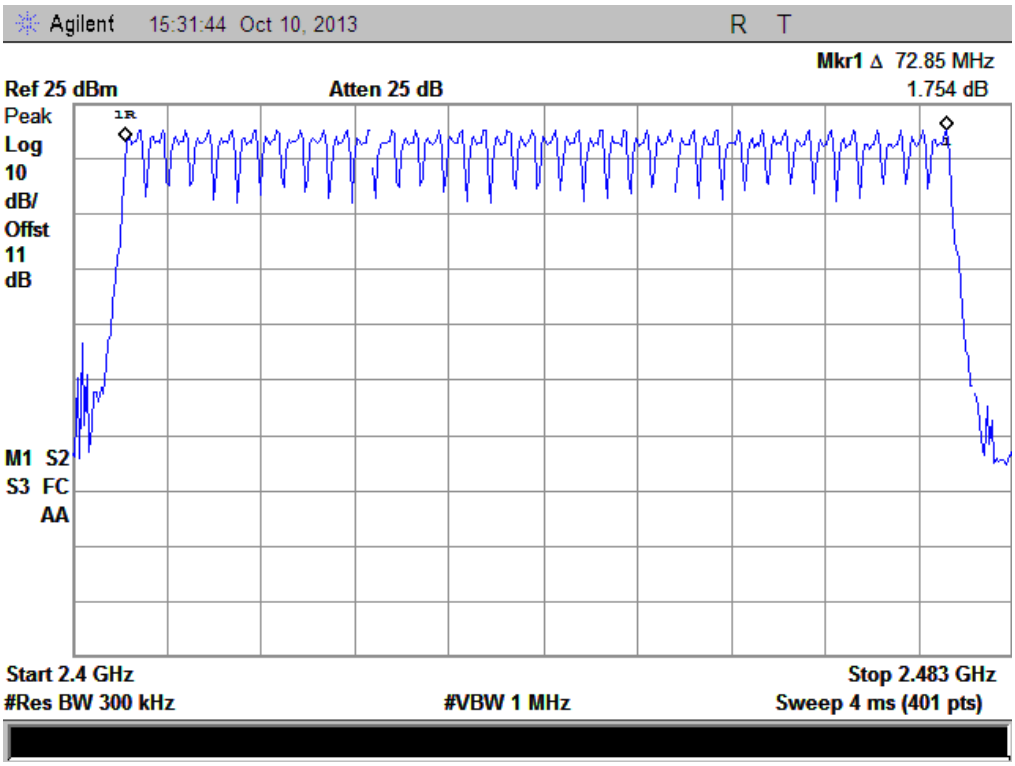
### 2.2.4. Test Result

The EUT operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

Test Verdict:

| Frequency Block (MHz) | Measured Channel Numbers | Min. Limit | Refer to Plot | Verdict |
|---|---|---|---|---|
| 2400 - 2483.5 | 36 | 15 | Plot A | PASS |

**Test Plots:**




(Plot A)

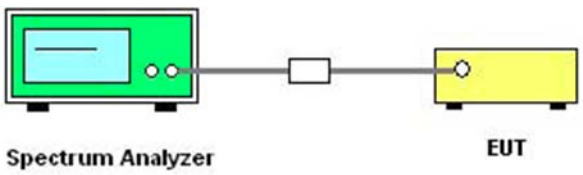
## 2.3. Peak Output Power

### 2.3.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

### 2.3.2. Test Description

**A. Test Setup:**




The RF Module of the EUT is coupled to the Spectrum Analyzer (SA) Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Power meter | Agilent | E4418B | GB44318055 | 2013.05.12 | 2014.05.11 |
| Power Sensor | Agilent | 8482A | MY41091706 | 2013.05.12 | 2014.05.11 |
| Attenuator 1 | Resnet | 10dB | (n.a.) | 2013.05.12 | 2014.05.11 |
| Attenuator 2 | Resnet | 3dB | (n.a.) | 2013.05.12 | 2014.05.11 |

### 2.3.3. Test Result

The EUT operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.The lowest, middle and highest channel were tested by Power meter.

Test Verdict:

| Channel | Frequency (MHz) | Measured Output Peak Power | | Limit | | Verdict |
|---|---|---|---|---|---|---|
| | | dBm | W | dBm | W | |
| 0 | 2405.376 | 20.16 | 0.103753 | 20.97 | 0.125 | PASS |
| 18 | 2440.192 | 20.17 | 0.103992 | | | PASS |
| 36 | 2477.056 | 20.42 | 0.110154 | | | PASS |

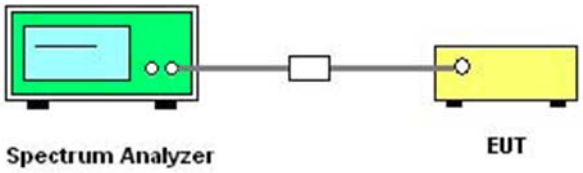
## 2.4. 20dB Bandwidth

### 2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

### 2.4.2. Test Description

**A. Test Setup:**




The RF Module of the EUT is coupled to the Spectrum Analyzer (SA) Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Power Splitter | Weinschel | 1506A | NW521 | 2013.05.12 | 2014.05.11 |
| Attenuator 1 | Resnet | 10dB | (n.a.) | 2013.05.12 | 2014.05.11 |
| Attenuator 2 | Resnet | 3dB | (n.a.) | 2013.05.12 | 2014.05.11 |

### 2.4.1. Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥ 1% of the 20 dB bandwidth

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

### 2.4.2. Test Result

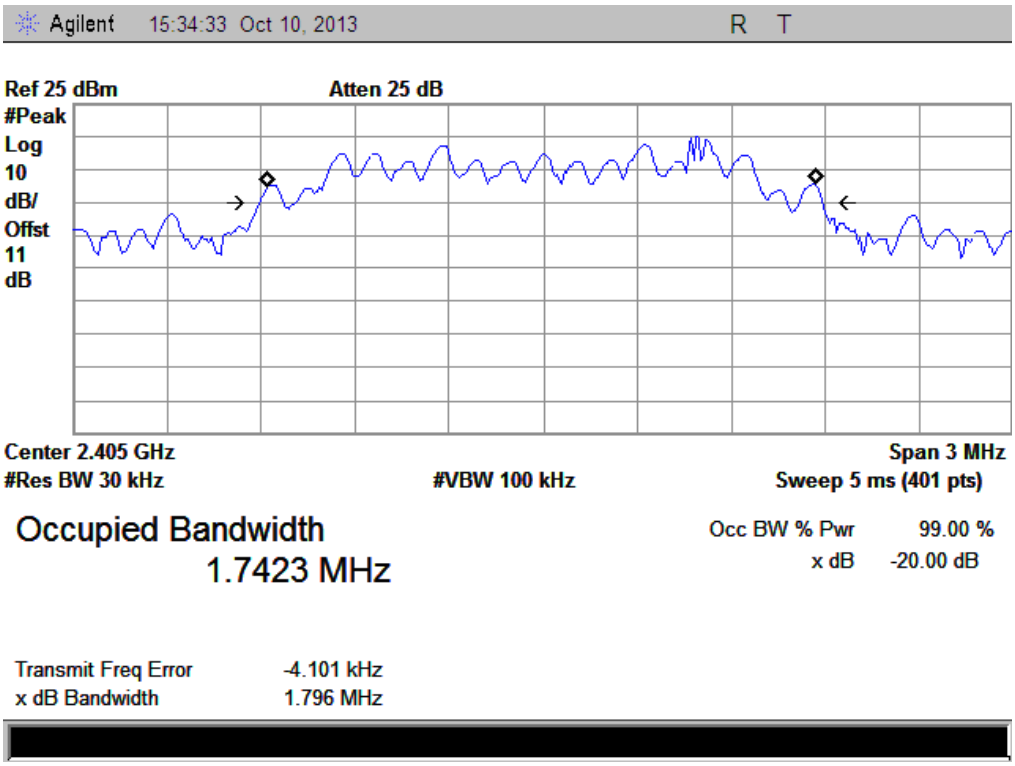
The EUT operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

**A. Test Verdict:**

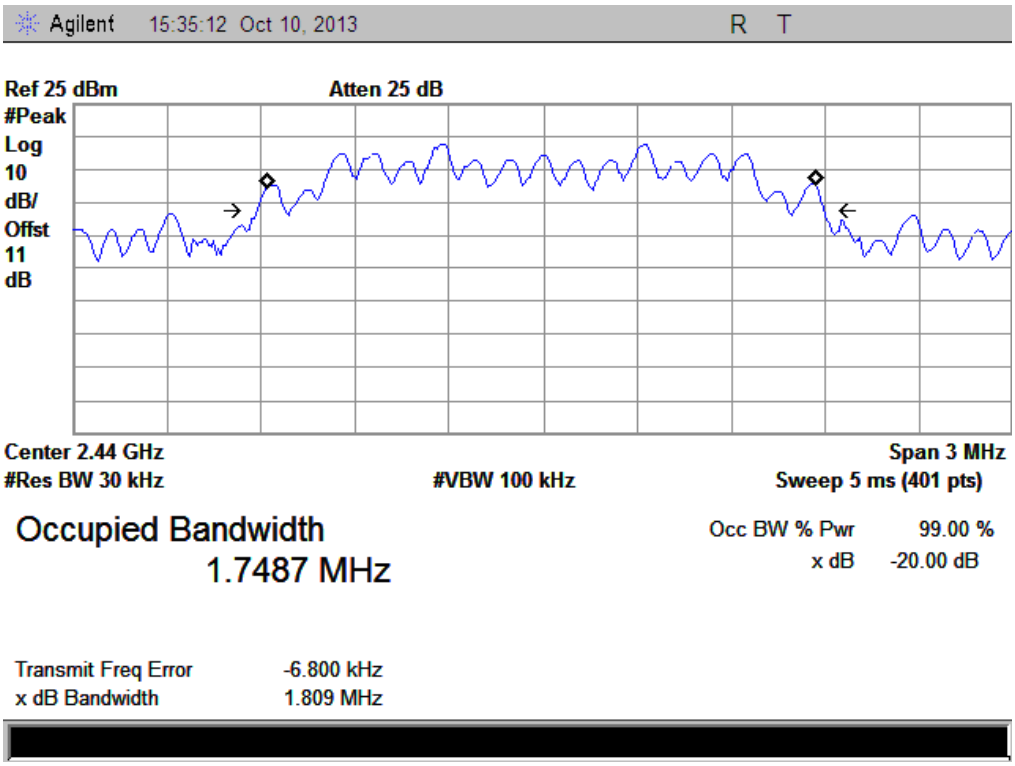
The maximum 20dB bandwidth measured is 1.809MHz according to the table below.

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | Refer to Plot |
|---|---|---|---|
| 1 | 2405.376 | 1.796 | Plot A |
| 18 | 2440.192 | 1.809 | Plot B |
| 36 | 2477.056 | 1.787 | Plot C |

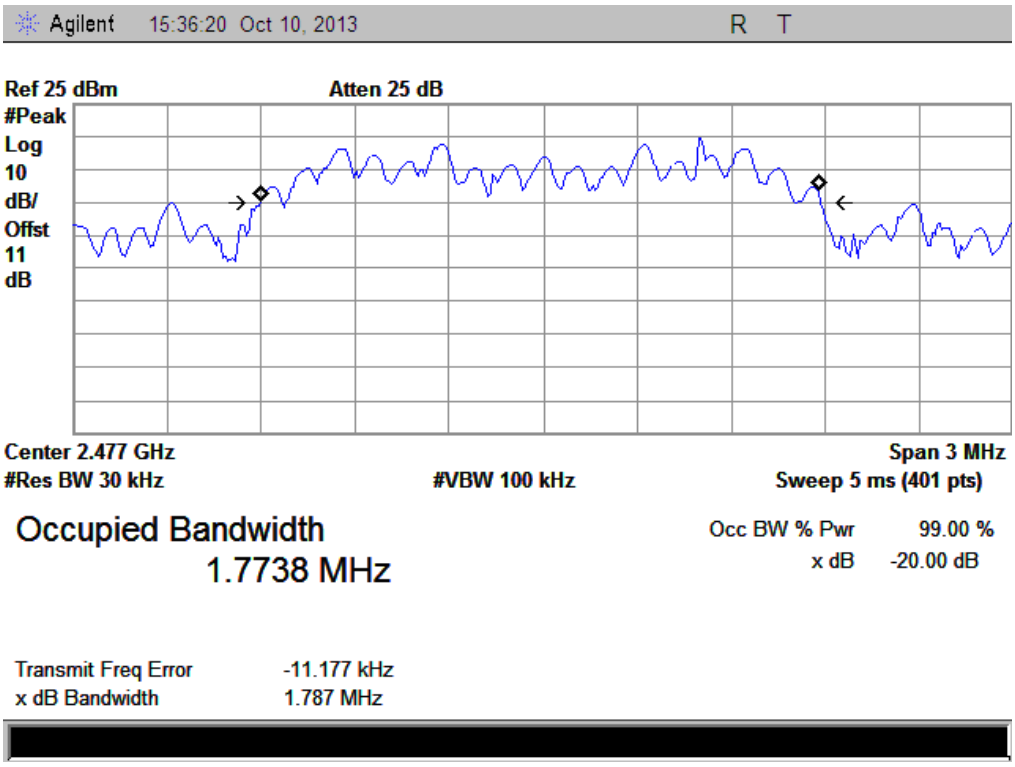
**Test Plots:**




(Plot A)


Agilent 15:35:12 Oct 10, 2013
R T
Ref 25 dBm
Atten 25 dB
#Peak
Log
10
dB/
Offst
11
dB
Center 2.44 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 5 ms (401 pts)
Occupied Bandwidth
1.7487 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -6.800 kHz
x dB Bandwidth 1.809 MHz

(Plot B)


Agilent 15:36:20 Oct 10, 2013
R T
Ref 25 dBm
Atten 25 dB
#Peak
Log
10
dB/
Offst
11
dB
Center 2.477 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 5 ms (401 pts)
Occupied Bandwidth
1.7738 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -11.177 kHz
x dB Bandwidth 1.787 MHz

(Plot C)

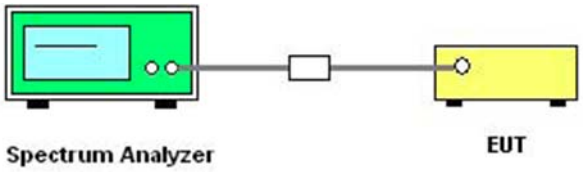
## 2.5. Carried Frequency Separation

### 2.5.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 2.5.2. Test Description

**A. Test Setup:**




The RF Module of the EUT is coupled to the Spectrum Analyzer (SA) Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| System Simulator | Anritsu | MT8852B | 6K00006210 | 2013.05.12 | 2014.05.11 |
| Spectrum Analyzer | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Power Splitter | Weinschel | 1506A | NW521 | 2013.05.12 | 2014.05.11 |
| Attenuator 1 | Resnet | 10dB | (n.a.) | 2013.05.12 | 2014.05.11 |
| Attenuator 2 | Resnet | 3dB | (n.a.) | 2013.05.12 | 2014.05.11 |

### 2.5.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

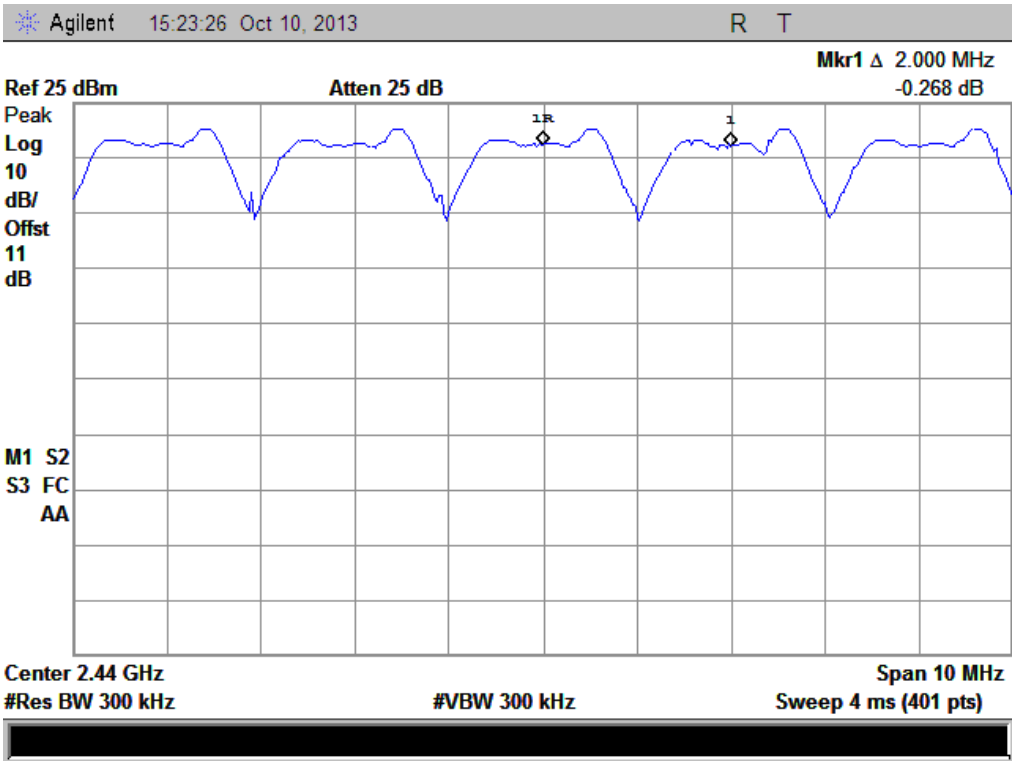
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

## 2.5.4. Test Result

The EUT operates at hopping-on test mode.

For any adjacent channels (e.g. the channel 18 and 19 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.809MHz refer to section 2.4.1), whichever is greater. So, the verdict is PASSING




(Plot A)

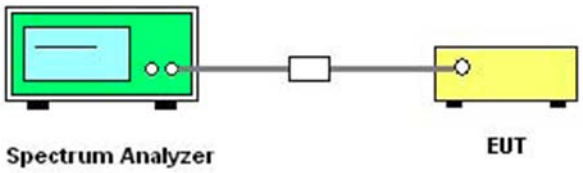
## 2.6. Time of Occupancy (Dwell time)

### 2.6.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 2.6.2. Test Description

**A. Test Setup:**




The RF Module of the EUT is coupled to the Spectrum Analyzer (SA) Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| System Simulator | Anritsu | MT8852B | 6K00006210 | 2013.05.12 | 2014.05.11 |
| Spectrum Analyzer | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Power Splitter | Weinschel | 1506A | NW521 | 2013.05.12 | 2014.05.11 |
| Attenuator 1 | Resnet | 10dB | (n.a.) | 2013.05.12 | 2014.05.11 |
| Attenuator 2 | Resnet | 3dB | (n.a.) | 2013.05.12 | 2014.05.11 |

### 2.6.3. Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

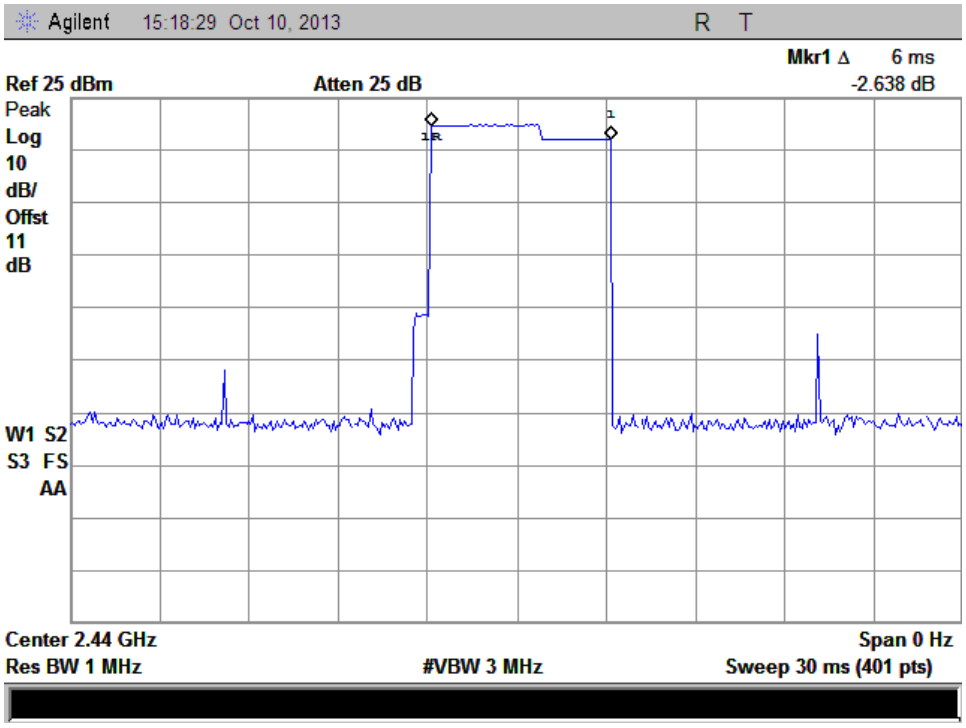
The average time of occupancy in the specified 14.4 second period (36 channel * 0.4 s) is equal to 10 * (# of pulses in 1.44 s) * pulse width.

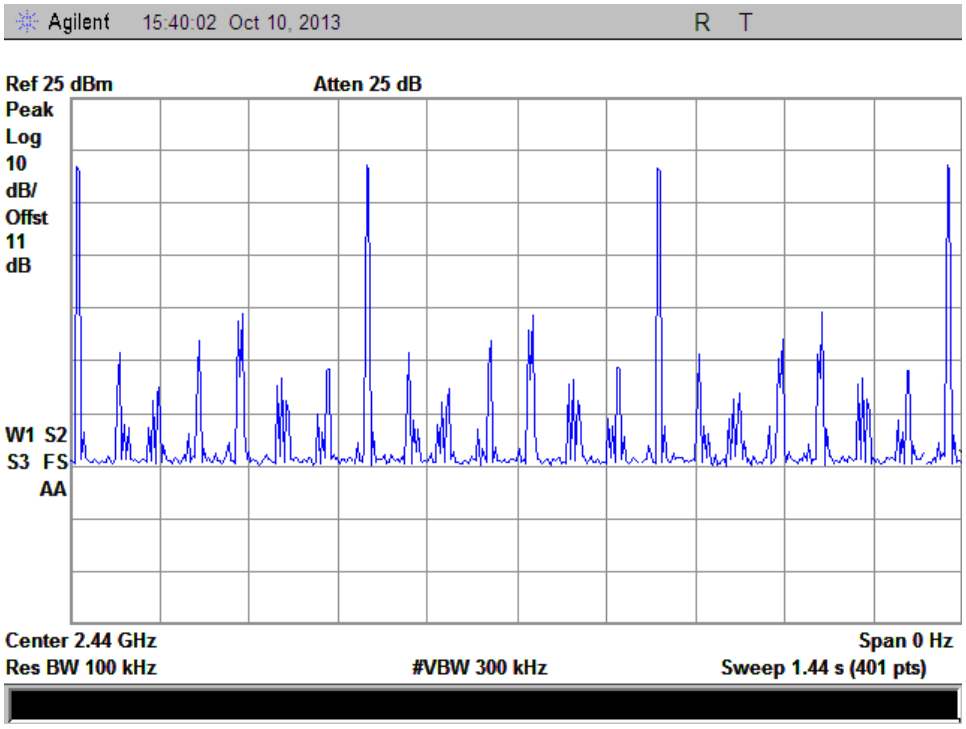
### 2.6.4. Test Result

**A. Test Verdict:**

| Pulse Width (msec) | Number of pulse in 3.16 seconds | Refer to Plot | Average Time of Occupancy (sec) | Limit (sec) | Verdict |
|---|---|---|---|---|---|
| 6 | 4 | Plot A | 0.24 | 0.4 | PASS |

**Test Plots:**




(Plot A)

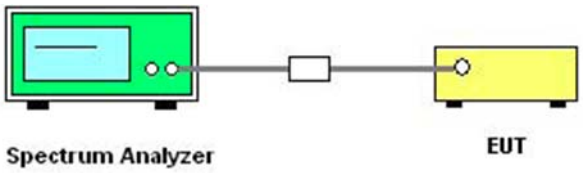
## 2.7. Conducted Spurious Emissions

### 2.7.1. Requirement

According to FCC §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 2.7.2. Test Description

**A. Test Setup:**




The RF Module of the EUT is coupled to the Spectrum Analyzer (SA) Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| System Simulator | Anritsu | MT8852B | 6K00006210 | 2013.05.12 | 2014.05.11 |
| Spectrum Analyzer | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Power Splitter | Weinschel | 1506A | NW521 | 2013.05.12 | 2014.05.11 |
| Attenuator 1 | Resnet | 10dB | (n.a.) | 2013.05.12 | 2014.05.11 |
| Attenuator 2 | Resnet | 3dB | (n.a.) | 2013.05.12 | 2014.05.11 |

### 2.7.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

### 2.7.4. Test Result

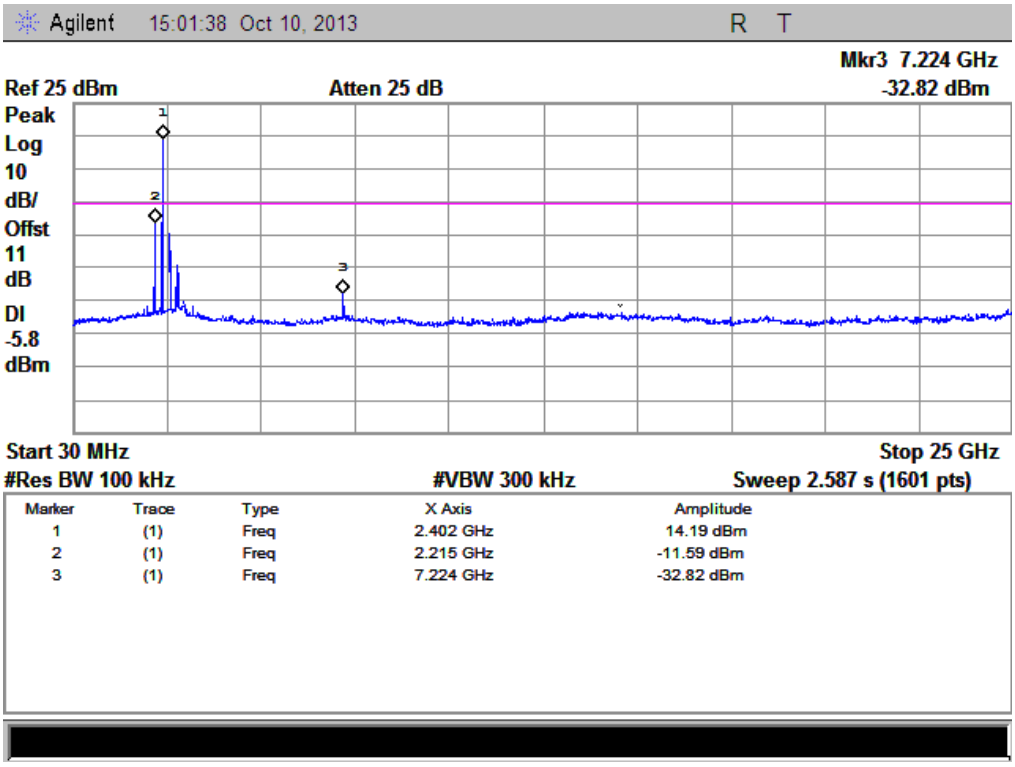
The EUT operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

**A. Test Verdict:**

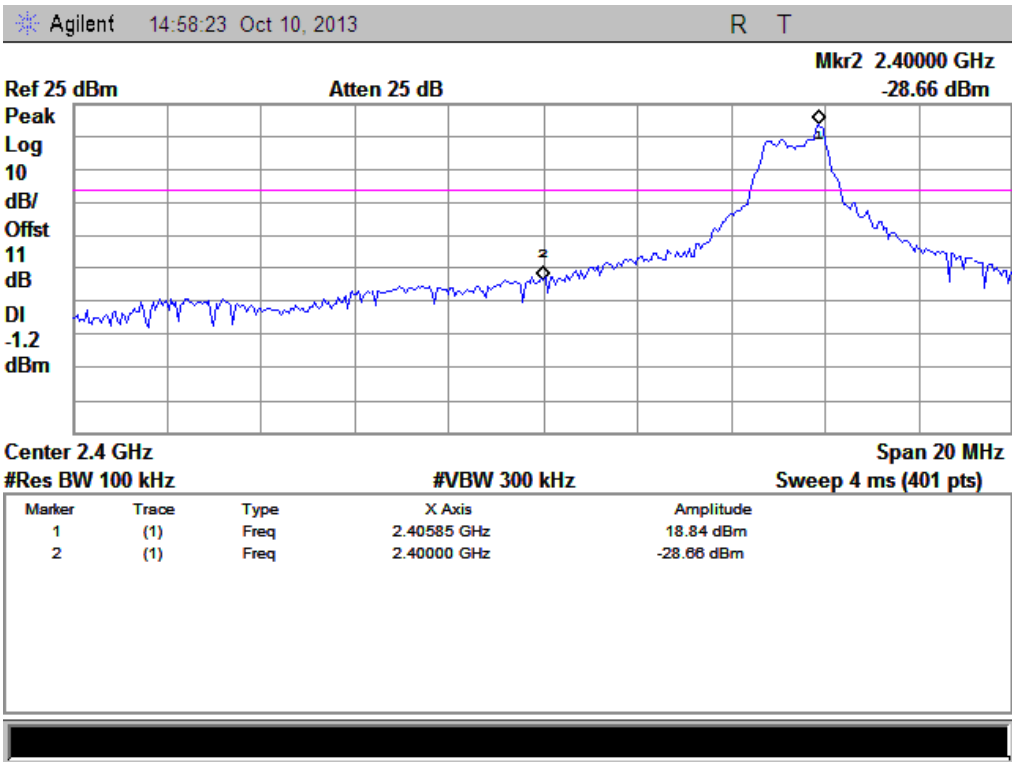
| Channel | Frequency (MHz) | Measured Max. Out of Band Emission(dBm) | Refer to Plot | Limit (dBm) | | Verdict |
|---|---|---|---|---|---|---|
| | | | | Carrier Level | Calculated -20dBc Limit | |
| 1 | 2405.376 | -11.59 | Plot A.1 | 14.19 | -5.8 | PASS |
| 18 | 2440.192 | -35.71 | Plot B.1 | 14.20 | -5.8 | PASS |
| 36 | 2477.056 | -33.83 | Plot C.1 | 14.35 | -5.6 | PASS |

**B. Test Plots:**

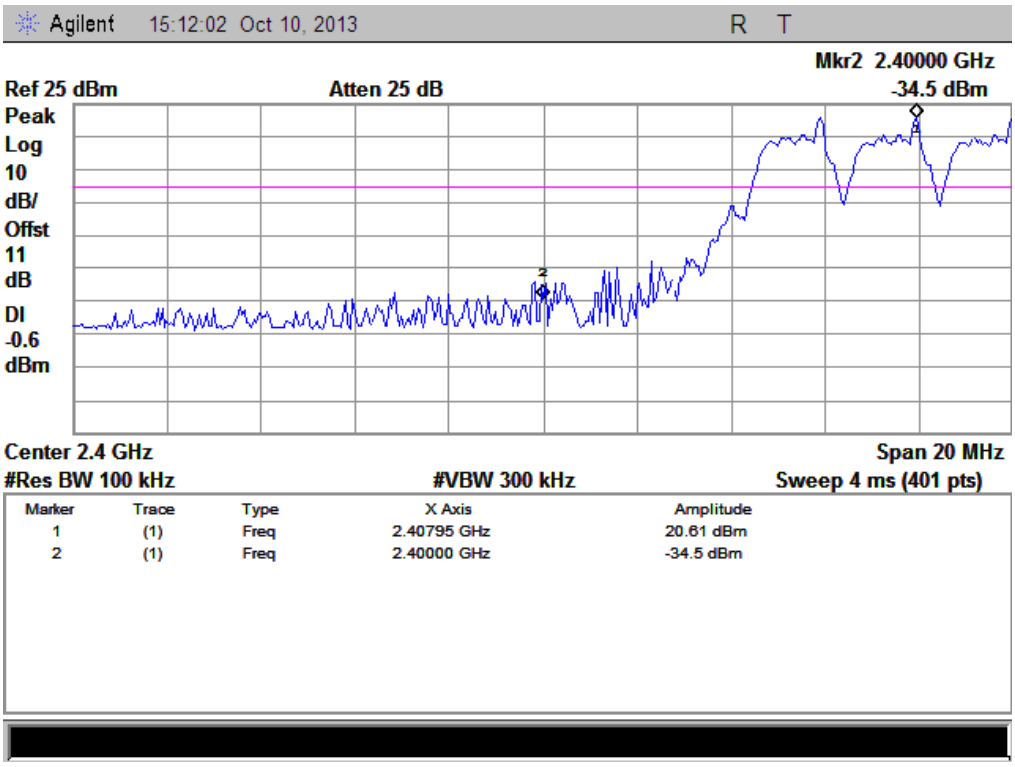
Note: the power of the Module transmitting frequency should be ignored.



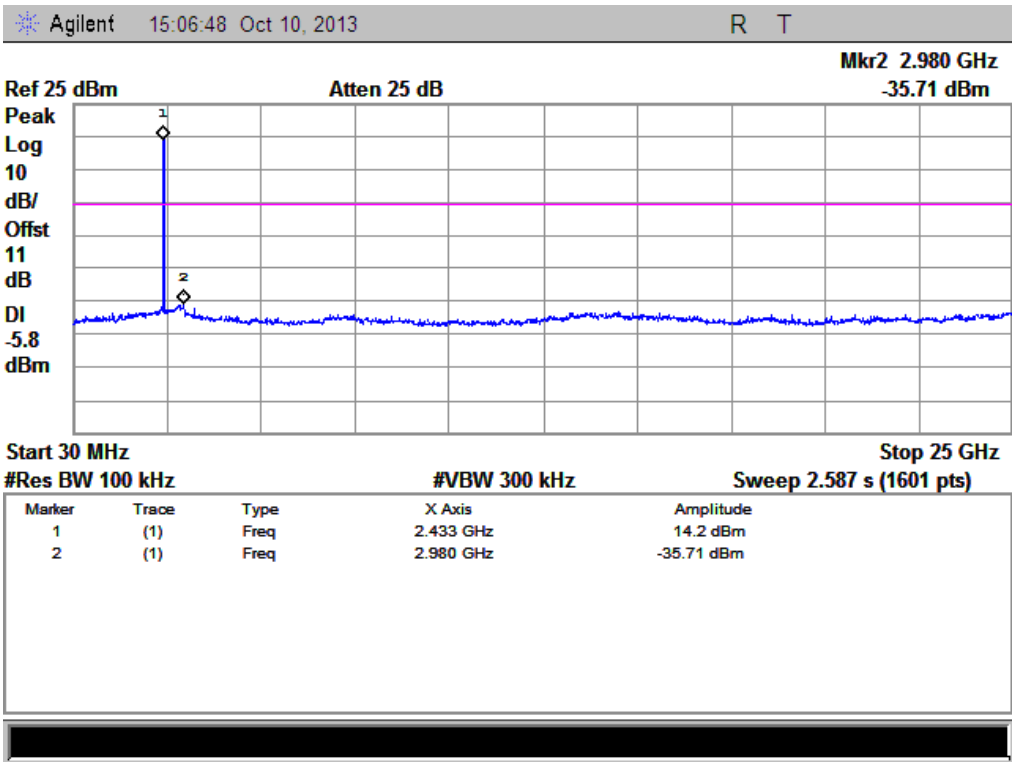

(Plot A.1: Channel = 1, 30MHz to 25GHz)



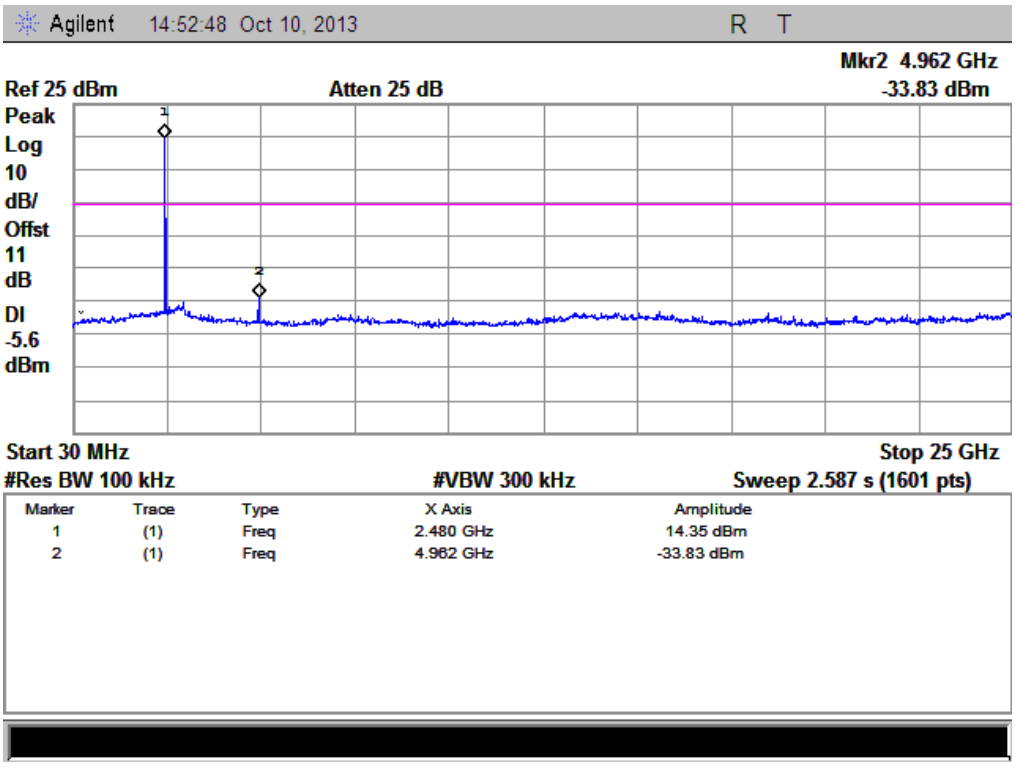

(Channel = 1, Band edge)



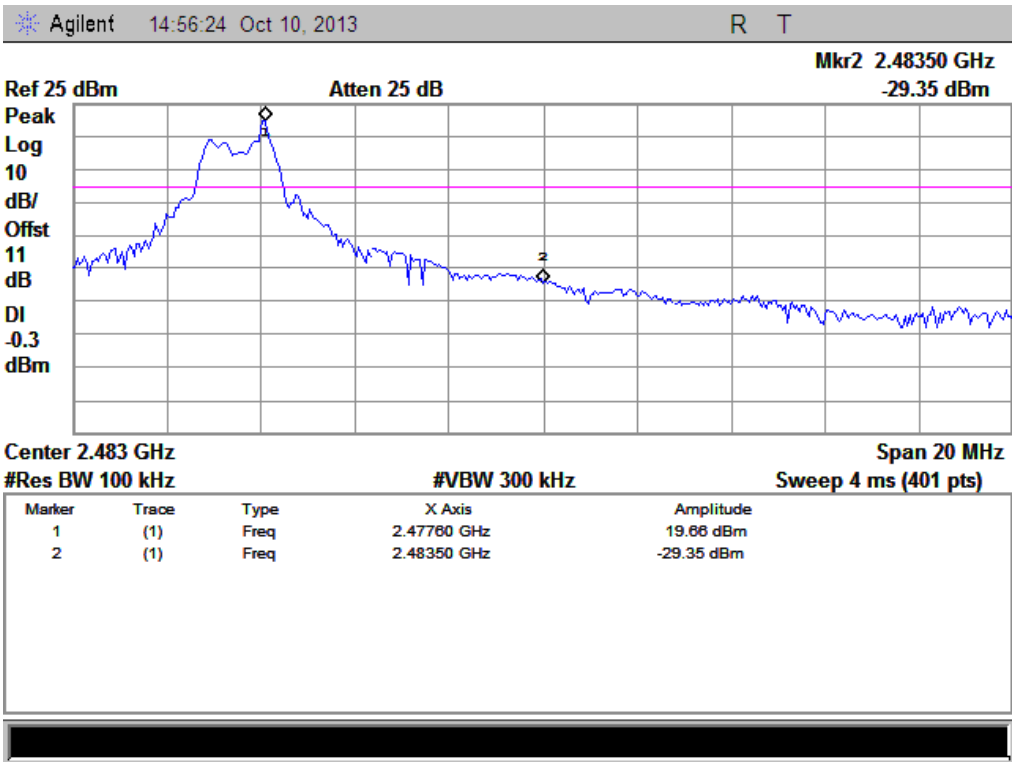

(Channel = 1, Band edge with hopping on)



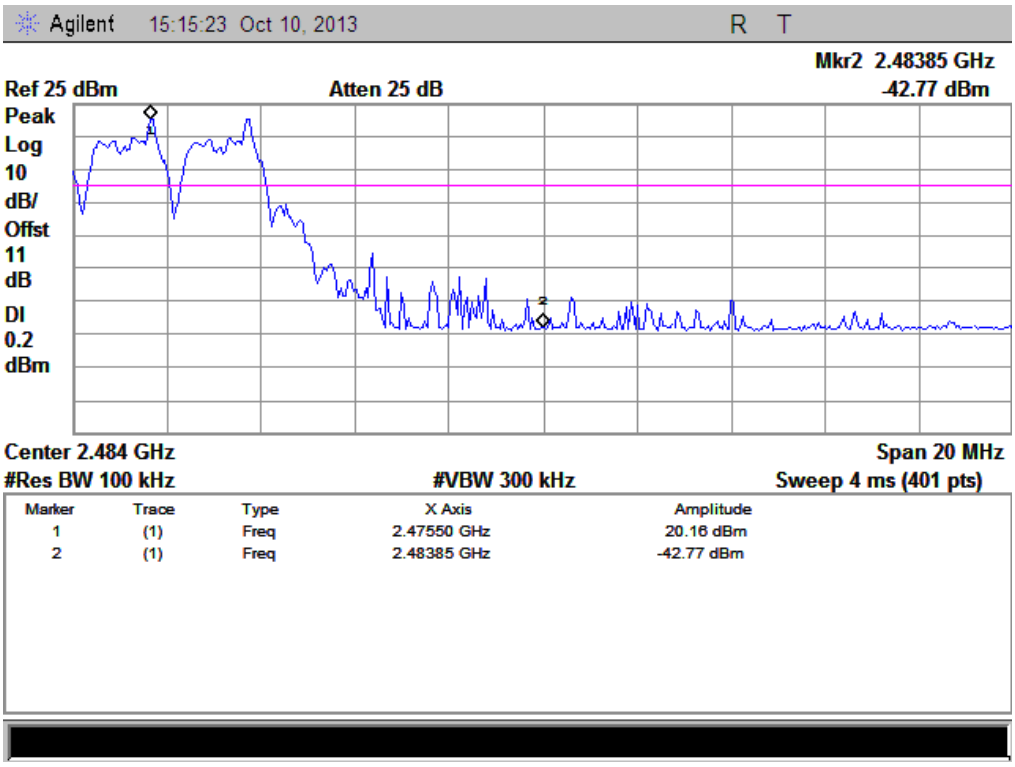

(Plot B.1: Channel = 18, 30MHz to 25GHz)




(Plot C.1: Channel = 36, 30MHz to 25GHz)




(Channel = 36, Band edge)




(Channel = 36, Band edge with hopping on)

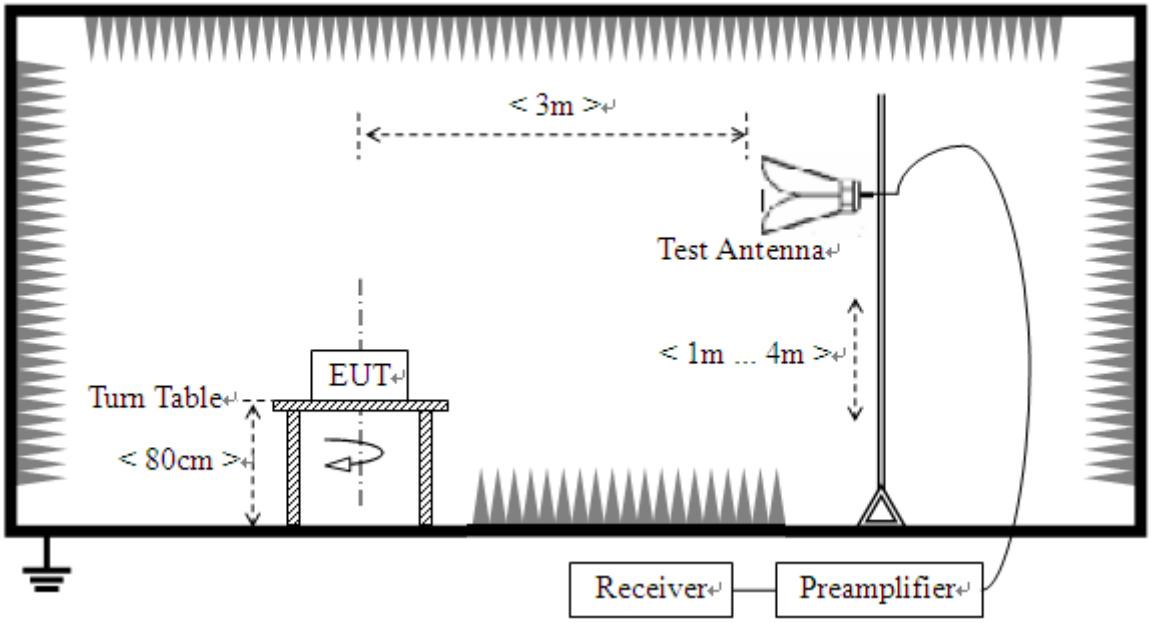
## 2.8. Restricted Frequency Bands

### 2.8.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

### 2.8.2. Test Description

**A. Test Setup:**




The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| System Simulator | R&S | CMU200 | 100448 | 2013.05.12 | 2014.05.11 |
| Receiver | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Full-Anechoic Chamber | Albatross | 9m*6m*6m | (n.a.) | 2013.05.12 | 2014.05.11 |
| Test Antenna - Horn | Schwarzbeck | BBHA | 9120D-963 | 2013.05.12 | 2014.05.11 |

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| | | 9120D | | | |

### 2.8.3. Test Procedure

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1GHz, 100 KHz for f < 1GHz

VBW = 3 MHz for peak and 10Hz for average

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

### 2.8.4. Test Result

The lowest and highest channels are tested to verify Restricted Frequency Bands.

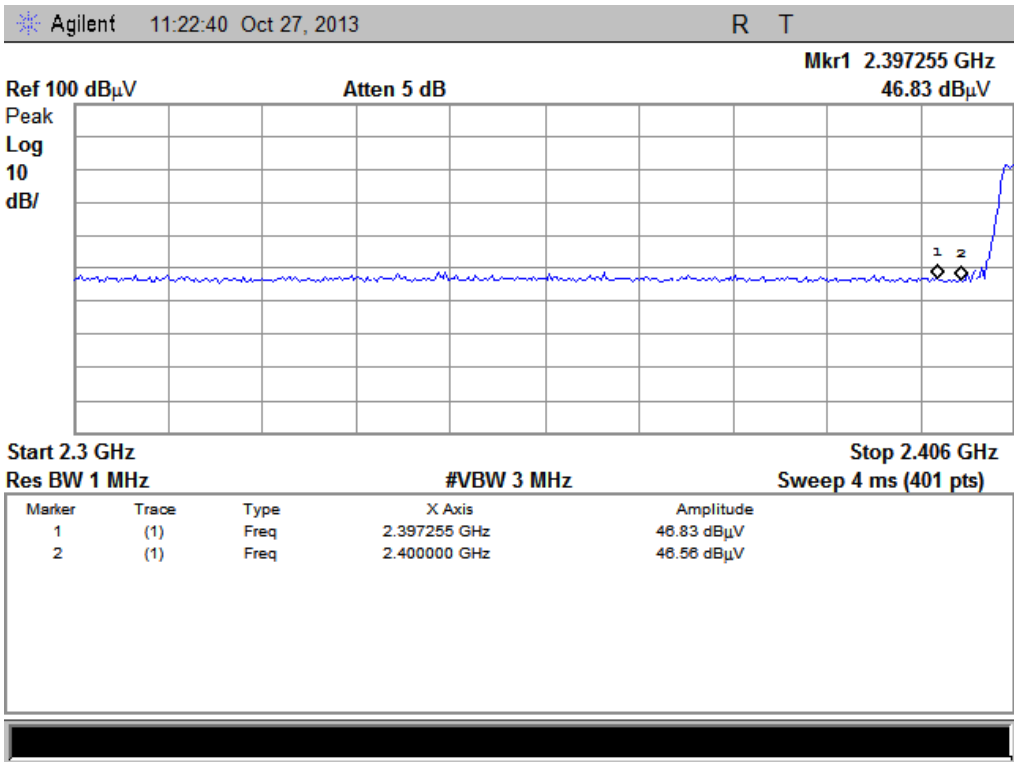
The measurement results are obtained as below:
$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$
$A_T$: Total correction Factor except Antenna
$U_R$: Receiver Reading
$G_{preamp}$: Preamplifier Gain
$A_{Factor}$: Antenna Factor at 3m

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

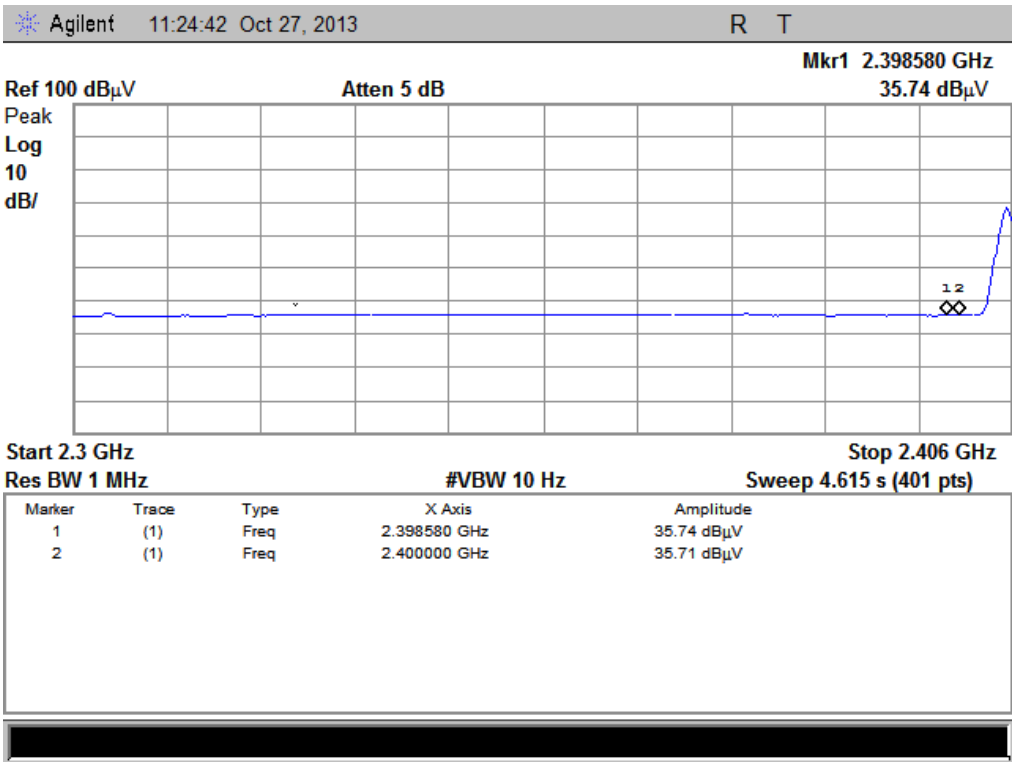
**A. Test Verdict:**

| Channel | Frequency (MHz) | Detector | Receiver Reading UR (dBuV) | AT (dB) | AFactor (dB@3m) | Max. Emission E (dBμV/m) | Limit (dBμV/m) | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | PK/ AV | | | | | | |
| 1 | 2397.26 | PK | 46.83 | -30.93 | 32.56 | 48.46 | 74 | Pass |
| 1 | 2398.58 | AV | 35.74 | -30.93 | 32.56 | 37.37 | 54 | Pass |
| 36 | 2485.91 | PK | 46.54 | -29.05 | 32.50 | 49.99 | 74 | Pass |
| 36 | 2485.91 | AV | 35.69 | -29.05 | 32.50 | 39.14 | 54 | Pass |

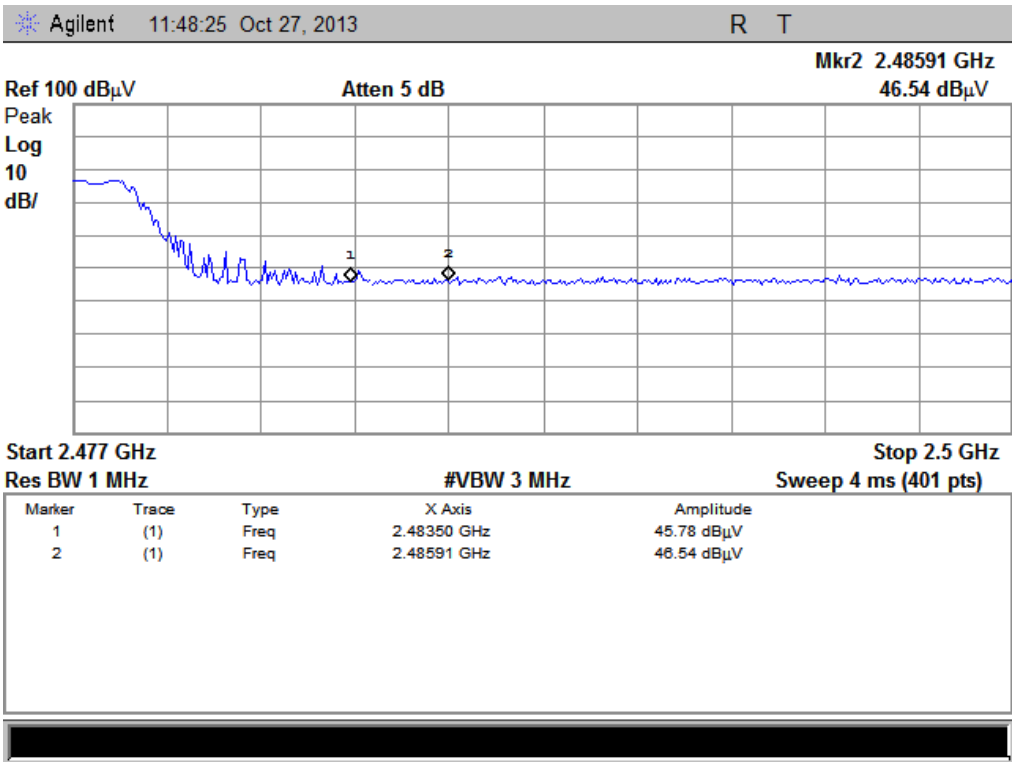
**B. Test Plots:**



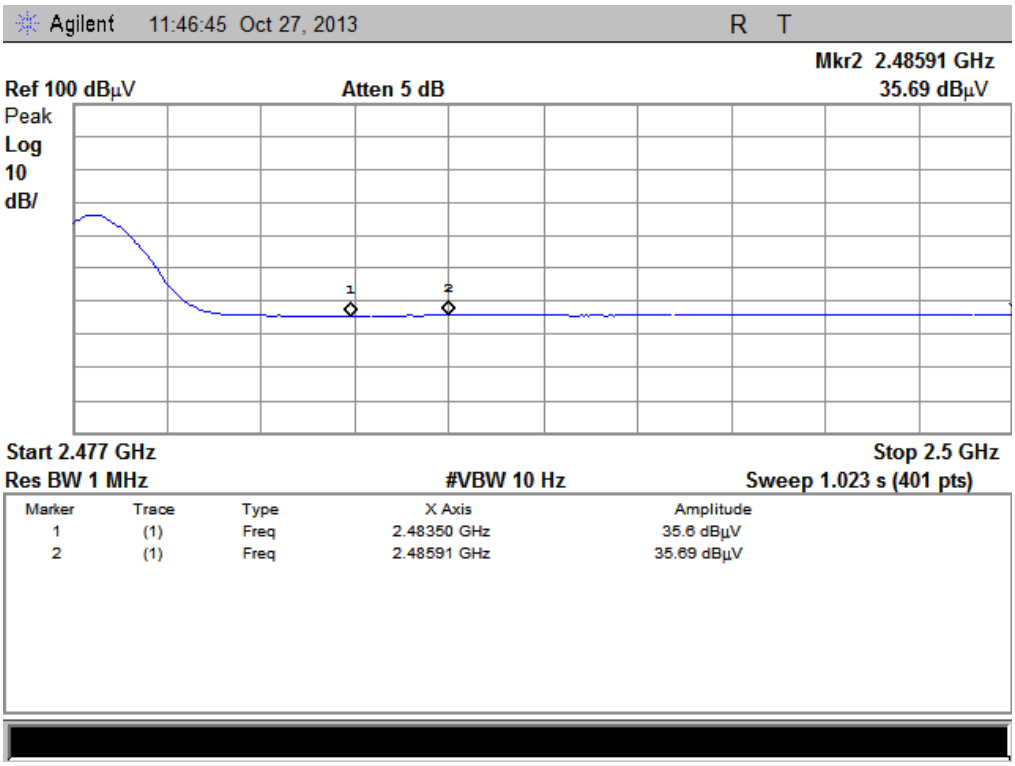

(Plot A1: Channel = 1 PEAK)




(Plot A2: Channel = 1 AVERAGE)




(Plot B1: Channel = 36 PEAK)




(Plot B2: Channel = 36 AVERAGE)

## 2.9. Conducted Emission

### 2.9.1. Requirement

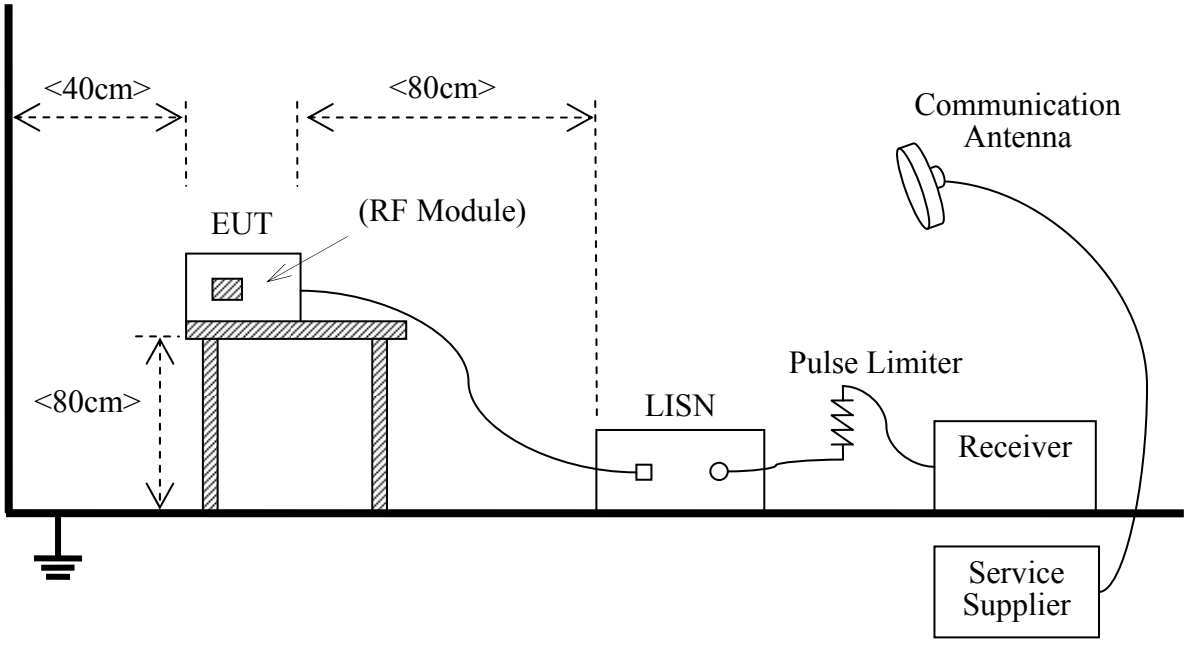
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

| Frequency range (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quai-peak | Average |
| 0.15 - 0.50 | 66 to 56 | 56 to 46 |
| 0.50 - 5 | 56 | 46 |
| 5- 30 | 60 | 50 |

NOTE:
(a) The lower limit shall apply at the band edges.
(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

### 2.9.2. Test Description

**A. Test Setup:**




The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

**Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Receiver | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| LISN | Schwarzbeck | NSLK 8127 | 812744 | 2013.05.12 | 2014.05.11 |
| Service Supplier | R&S | CMU200 | 100448 | 2013.05.12 | 2014.05.11 |
| Pulse Limiter (20dB) | Schwarzbeck | VTSD 9561-D | 9391 | 2013.05.12 | 2014.05.11 |

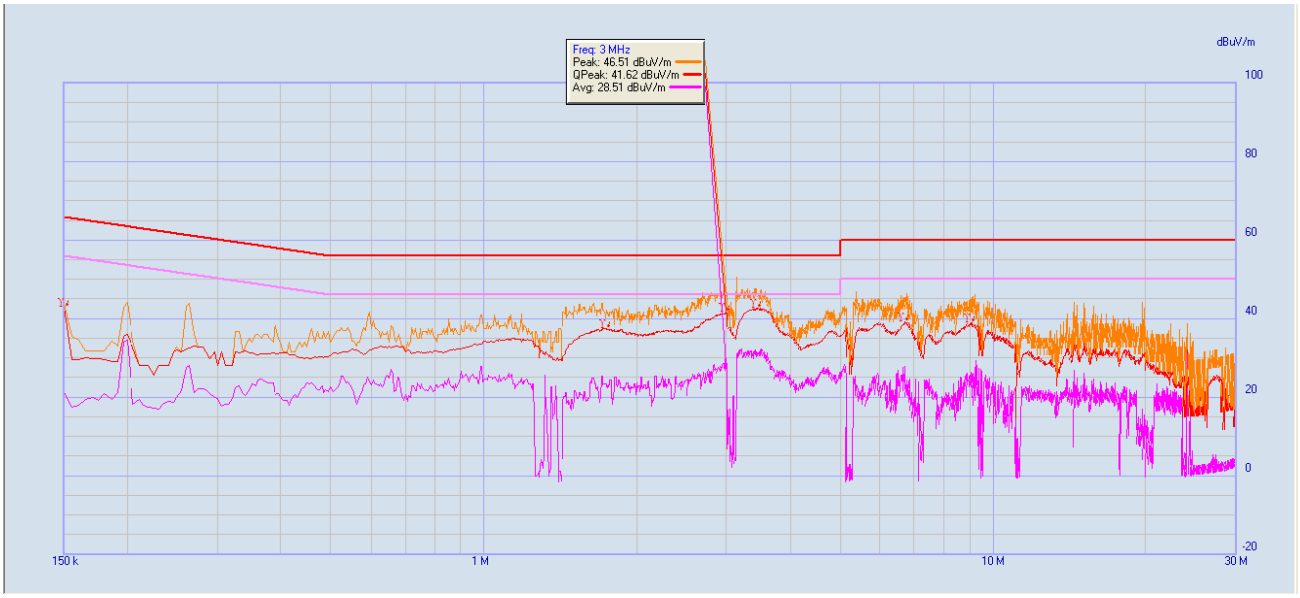
### 2.9.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

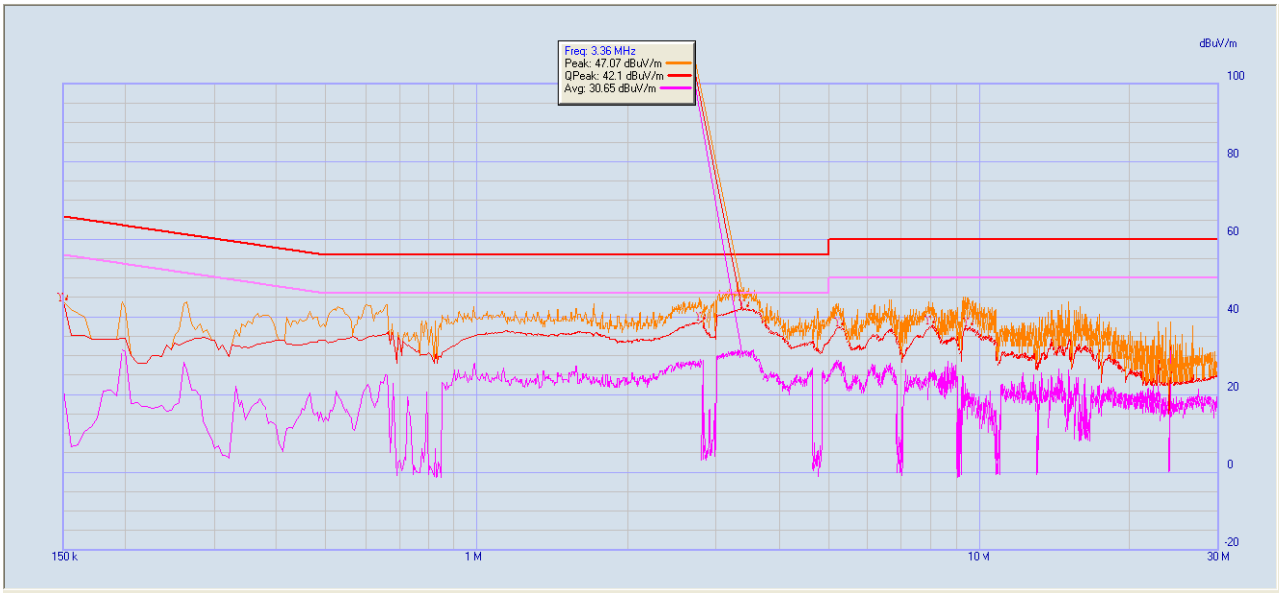
**A. Test setup:**

The EUT configuration of the emission tests is EUT + Link.

**B. Test Plots:**




(Plot A: L Phase)




(Plot B: N Phase)

## 2.10. Radiated Emission

### 2.10.1. Requirement

According to FCC section 15.247(d) and RSS-A8.5, radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (μV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note:

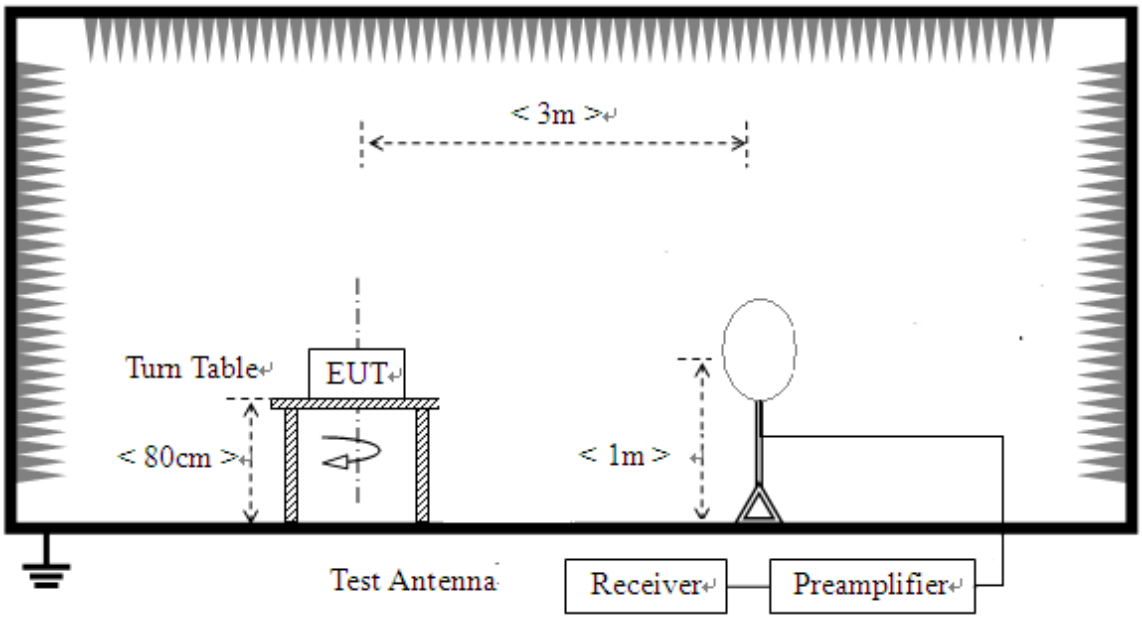
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

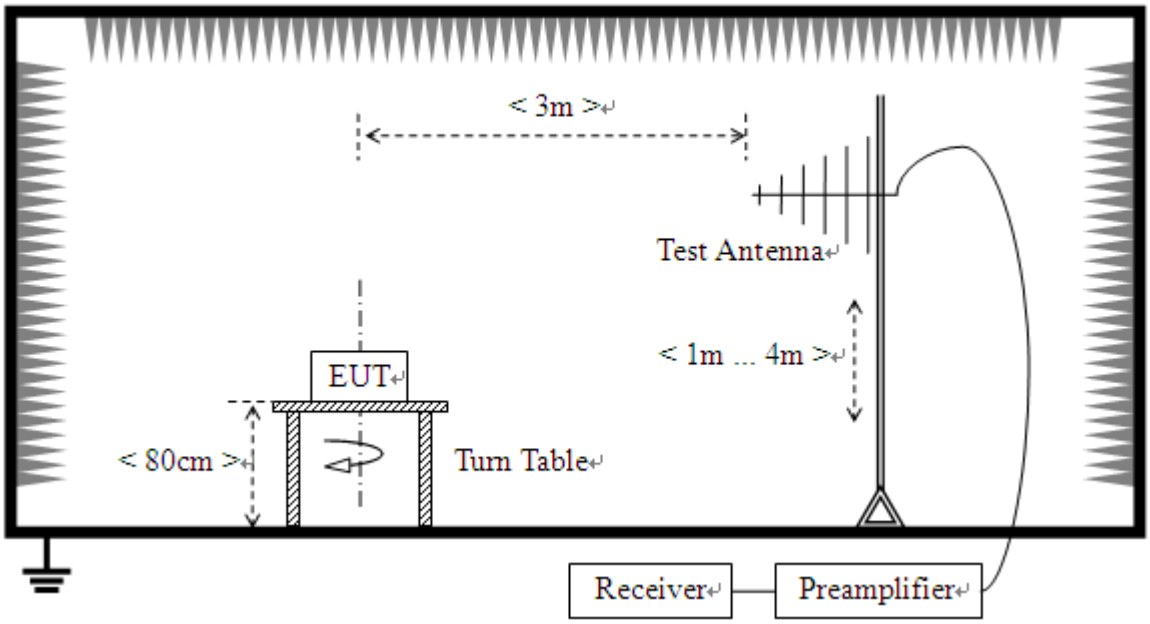
### 2.10.2. Test Description

**A. Test Setup:**

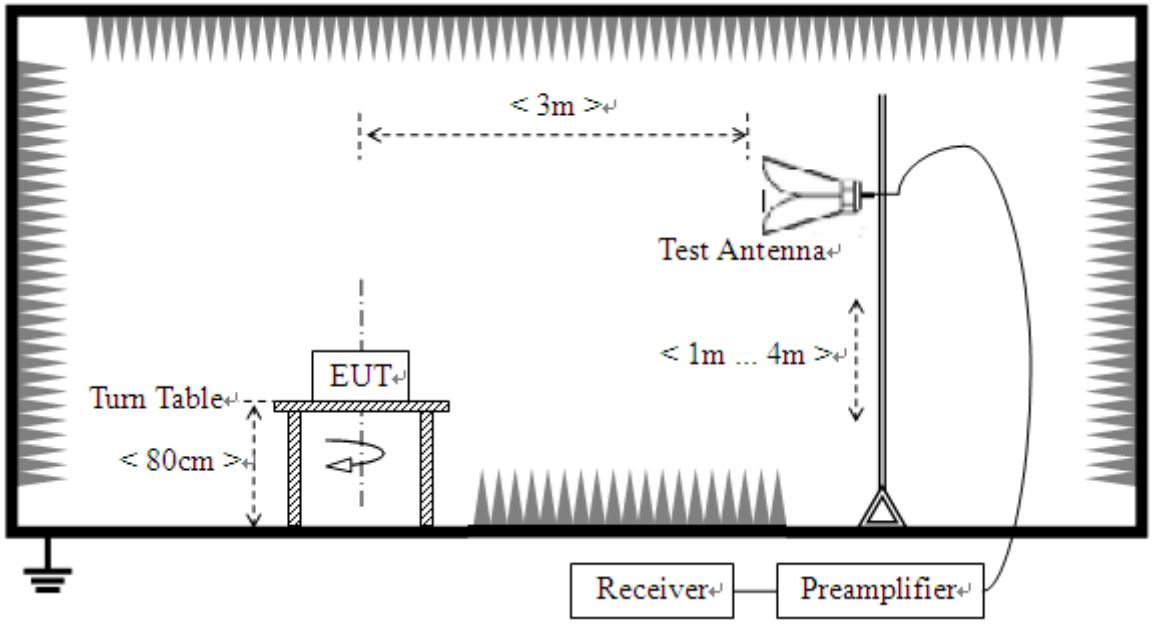
1) For radiated emissions from 9kHz to 30MHz




2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz




The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The RF Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 2GHz) and Horn Test Antenna (above 2GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

**B. Equipments List:**

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| System Simulator | R&S | CMU200 | 100448 | 2013.05.12 | 2014.05.11 |
| Receiver | Agilent | E7405A | US44210471 | 2013.05.12 | 2014.05.11 |
| Full-Anechoic Chamber | Albatross | 9m*6m*6m | (n.a.) | 2013.05.12 | 2014.05.11 |
| Test Antenna - Bi-Log | Schwarzbeck | VULB 9163 | 9163-274 | 2013.05.12 | 2014.05.11 |
| Test Antenna - Horn | Schwarzbeck | BBHA 9120D | 9120D-963 | 2013.05.12 | 2014.05.11 |
| Test Antenna - Horn | R&S | HL050S7 | 71688 | 2013.05.12 | 2014.05.11 |

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Test Antenna - Loop | Schwarzbeck | FMZB 1519 | 1519-022 | 2013.05.12 | 2014.05.11 |

### 2.10.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

### 2.10.4. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

$A_T$: Total correction Factor except Antenna

$U_R$: Receiver Reading

$G_{preamp}$: Preamplifier Gain

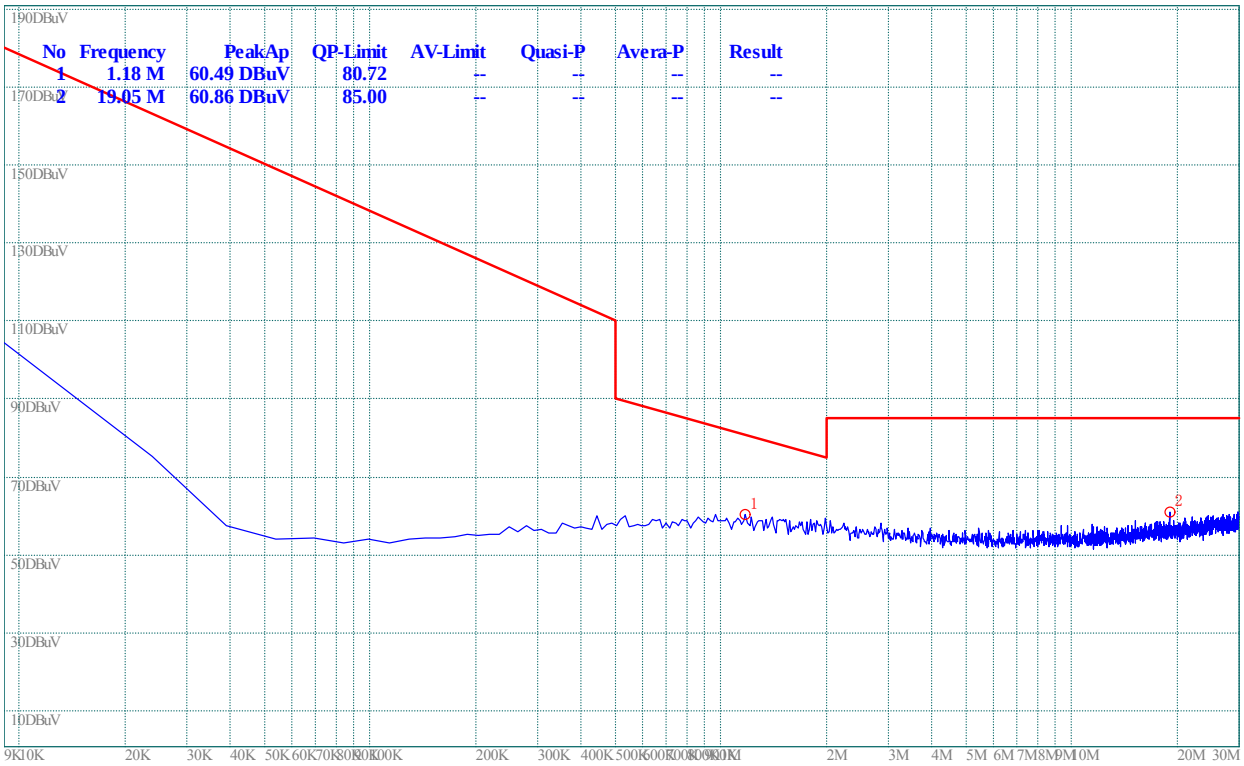
$A_{Factor}$: Antenna Factor at 3m

During the test, the total correction Factor AT and $A_{Factor}$ were built in test software.

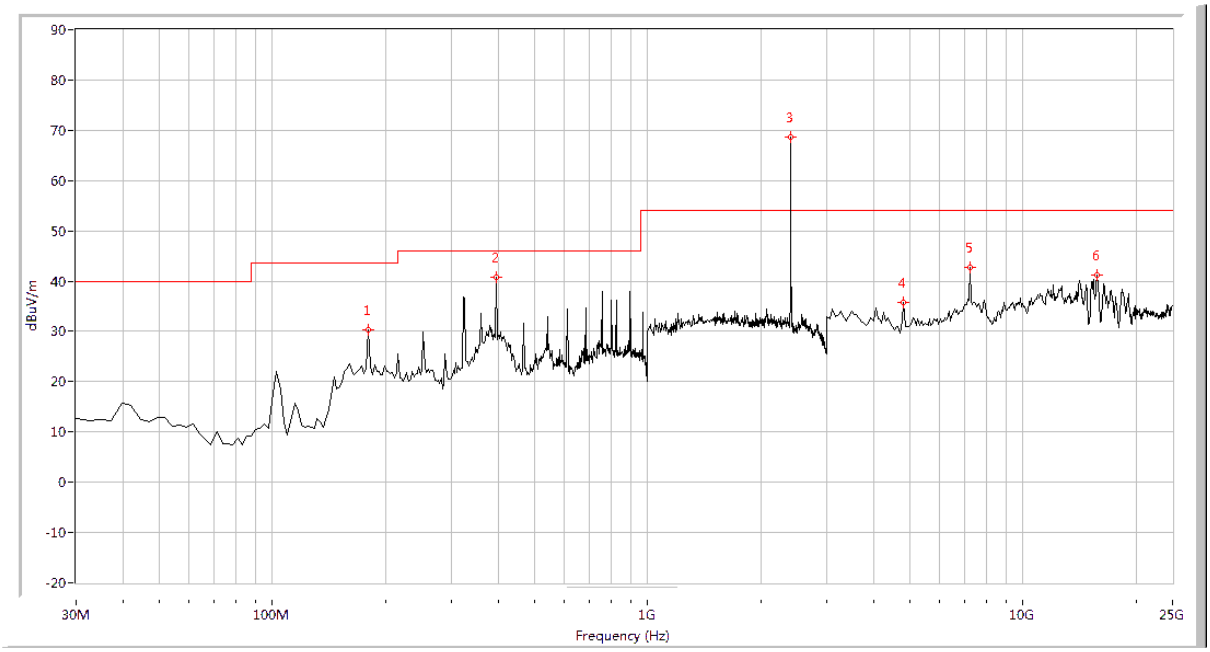
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

**A. Test Plots for the Whole Measurement Frequency Range:**

Plots for Channel = 1

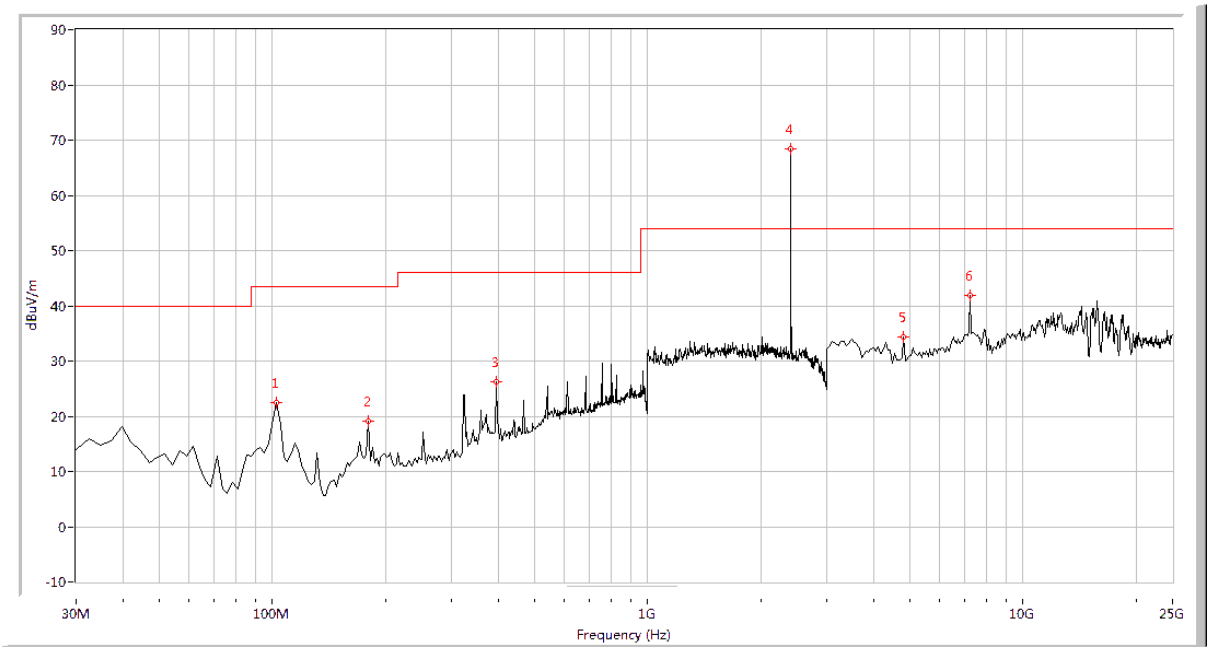



(Plot A.0: 9kHz to 30MHz, channel 1)




| Fre. (MHz) | Pk | QP | AV | Limit-PK | Limit-QP | Limit-AV | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|
| 179.975 | 30.37 | N.A | N.A | N.A | 43.5 | N.A | Horizontal | PASS |
| 395.262 | 40.73 | N.A | N.A | N.A | 46.0 | N.A | Horizontal | PASS |
| 2405.375 | 68.72 | N.A | N.A | N.A | N.A | N.A | Horizontal | N.A |
| 4810.474 | 35.69 | N.A | N.A | 74.0 | N.A | 54.0 | Horizontal | PASS |
| 7224.439 | 42.77 | N.A | N.A | 74.0 | N.A | 54.0 | Horizontal | PASS |
| 15728.180 | 41.20 | N.A | N.A | 74.0 | N.A | 54.0 | Horizontal | PASS |

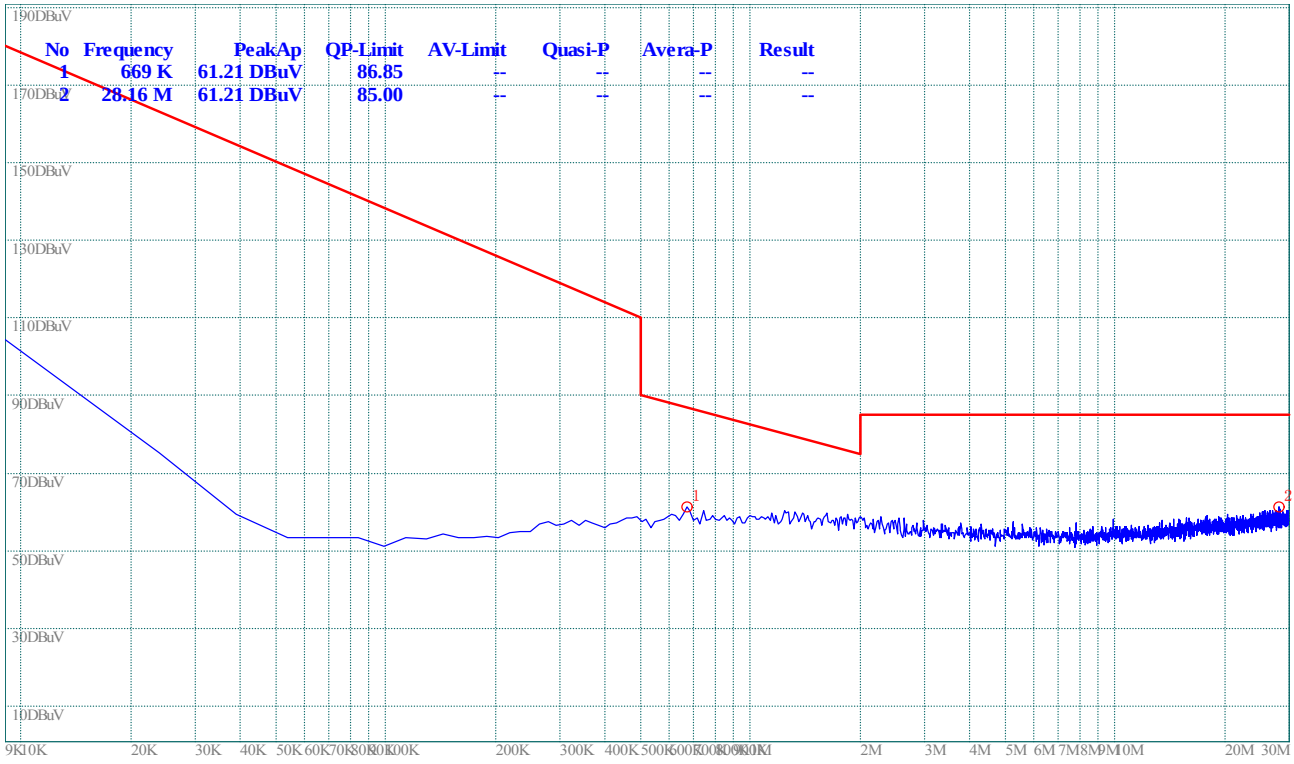
(Plot A.1: 30MHz to 25GHz, Antenna Horizontal, channel 1)



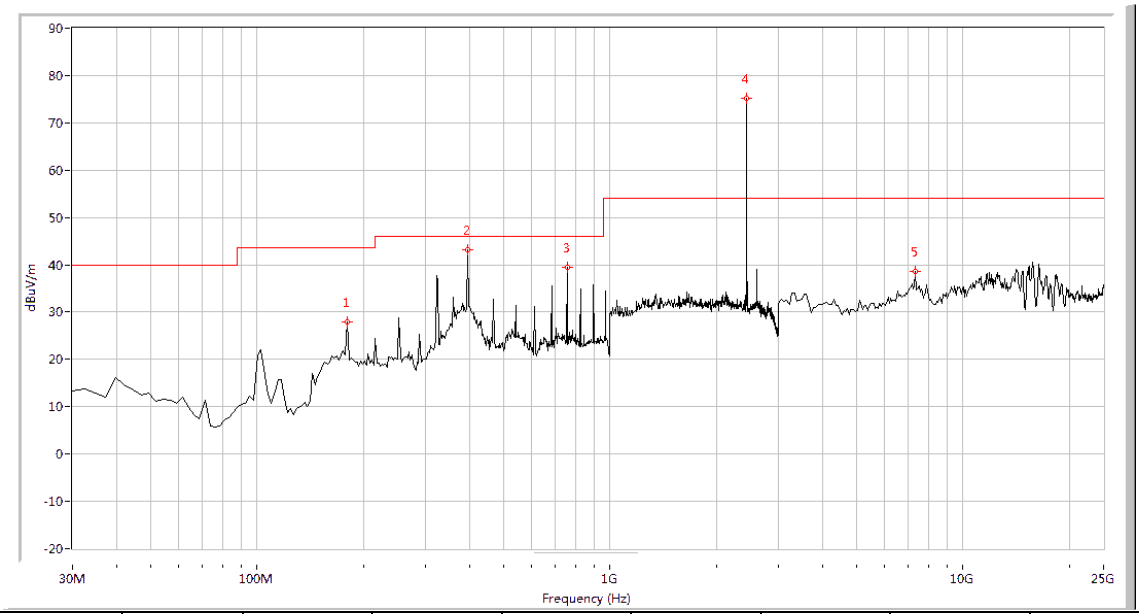

| Fre. (MHz) | Pk | QP | AV | Limit-PK | Limit-QP | Limit-AV | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|
| 102.569 | 36.36 | 29.92 | 29.33 | N.A | 43.5 | N.A | Vertical | PASS |
| 179.975 | 41.00 | 37.47 | 38.82 | N.A | 43.5 | N.A | Vertical | PASS |
| 395.262 | 26.15 | N.A | N.A | N.A | 46.0 | N.A | Vertical | PASS |
| 2405.375 | 68.51 | N.A | N.A | N.A | N.A | N.A | Vertical | N.A |
| 4810.474 | 34.33 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |
| 7224.439 | 41.82 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |

(Plot A.2: 30MHz to 25GHz, Antenna Vertical, channel 1)

Plot for Channel = 18

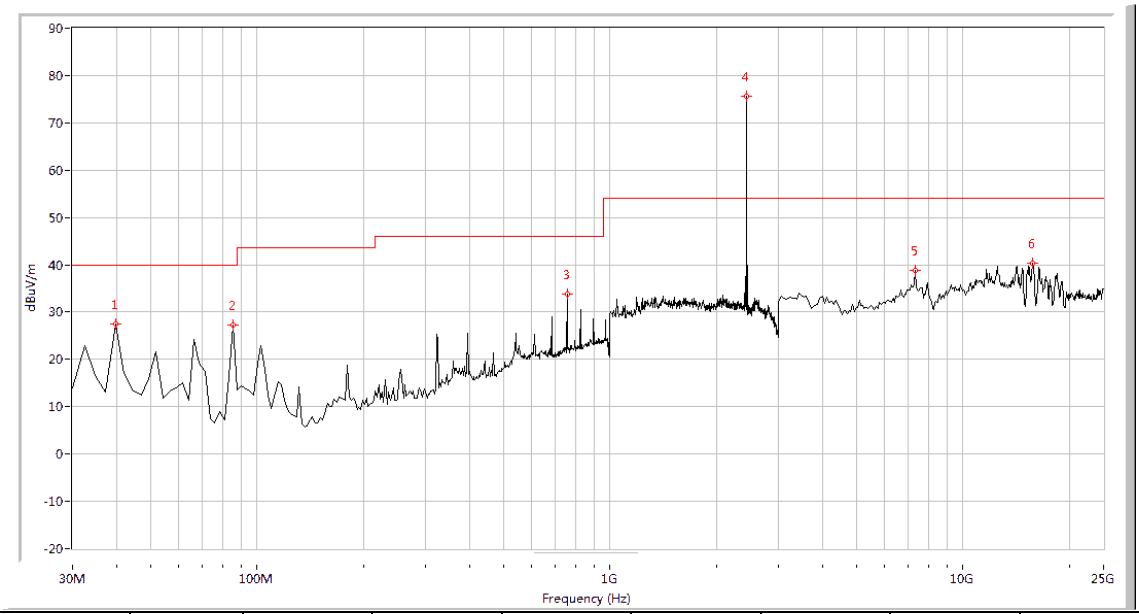



(Plot B.0: 9kHz to 30MHz, channel 18)




| Fre. (MHz) | Pk | QP | AV | Limit-PK | Limit-QP | Limit-AV | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|
| 179.975 | 27.96 | N.A | N.A | N.A | 43.5 | N.A | Horizontal | PASS |
| 395.262 | 43.23 | 41.41 | 42.49 | N.A | 46.0 | N.A | Horizontal | PASS |
| 755.686 | 39.43 | N.A | N.A | N.A | 46.0 | N.A | Horizontal | PASS |
| 2440.192 | 75.16 | N.A | N.A | N.A | N.A | N.A | Horizontal | N.A |
| 7334.165 | 38.50 | N.A | N.A | 74.0 | N.A | 54.0 | Horizontal | PASS |

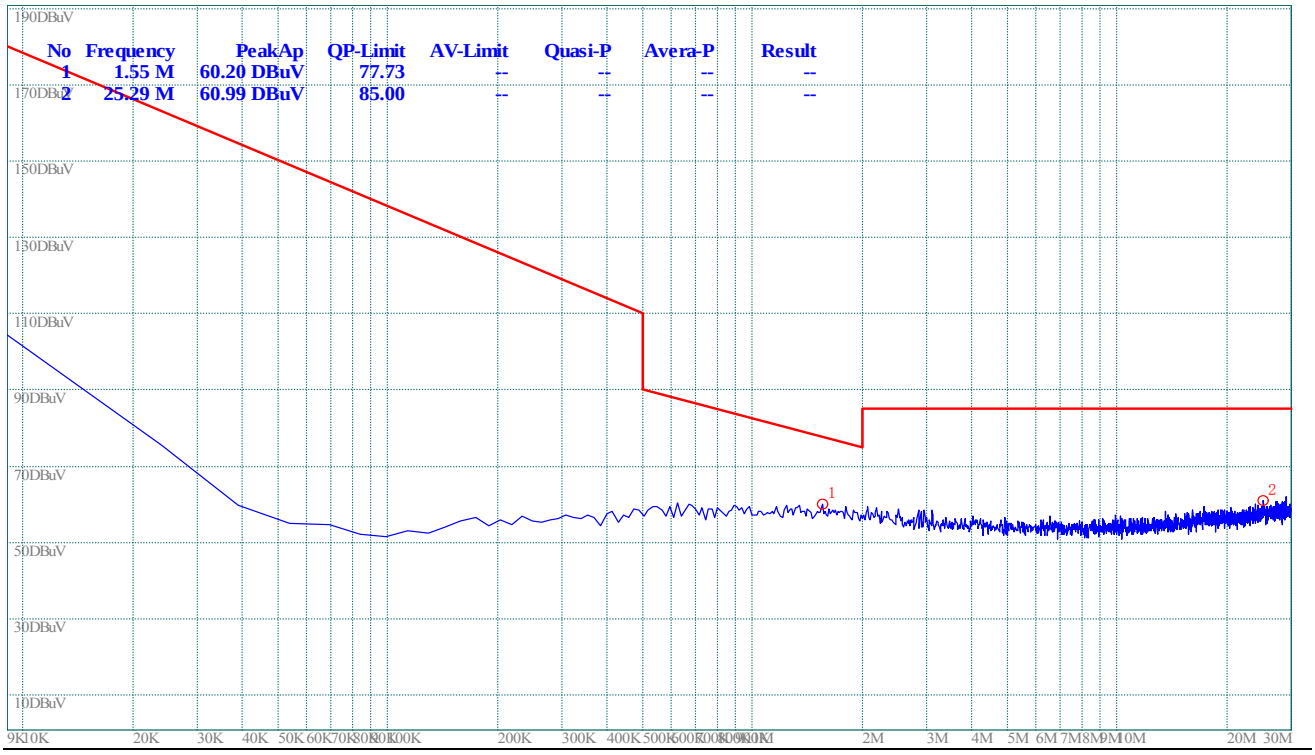
(Plot B.1: 30MHz to 25GHz, Antenna Horizontal, channel 18)



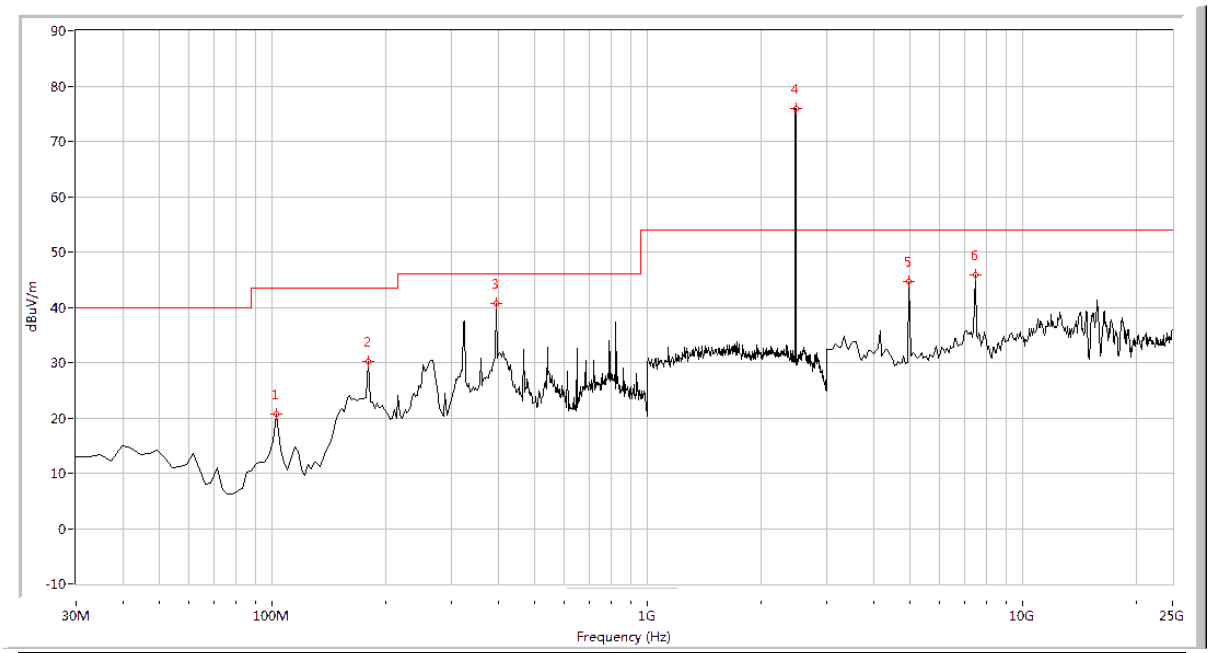

| Fre. (MHz) | Pk | QP | AV | Limit-PK | Limit-QP | Limit-AV | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|
| 39.676 | 27.46 | N.A | N.A | N.A | 40.0 | N.A | Vertical | PASS |
| 85.636 | 27.18 | N.A | N.A | N.A | 40.0 | N.A | Vertical | PASS |
| 755.686 | 33.90 | N.A | N.A | N.A | 46.0 | N.A | Vertical | PASS |
| 2440.192 | 75.56 | N.A | N.A | N.A | N.A | N.A | Vertical | N.A |
| 7334.165 | 38.80 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |
| 15783.042 | 40.41 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |

(Plot B.2: 30MHz to 25GHz, Antenna Vertical, channel 18)

Plot for Channel = 36

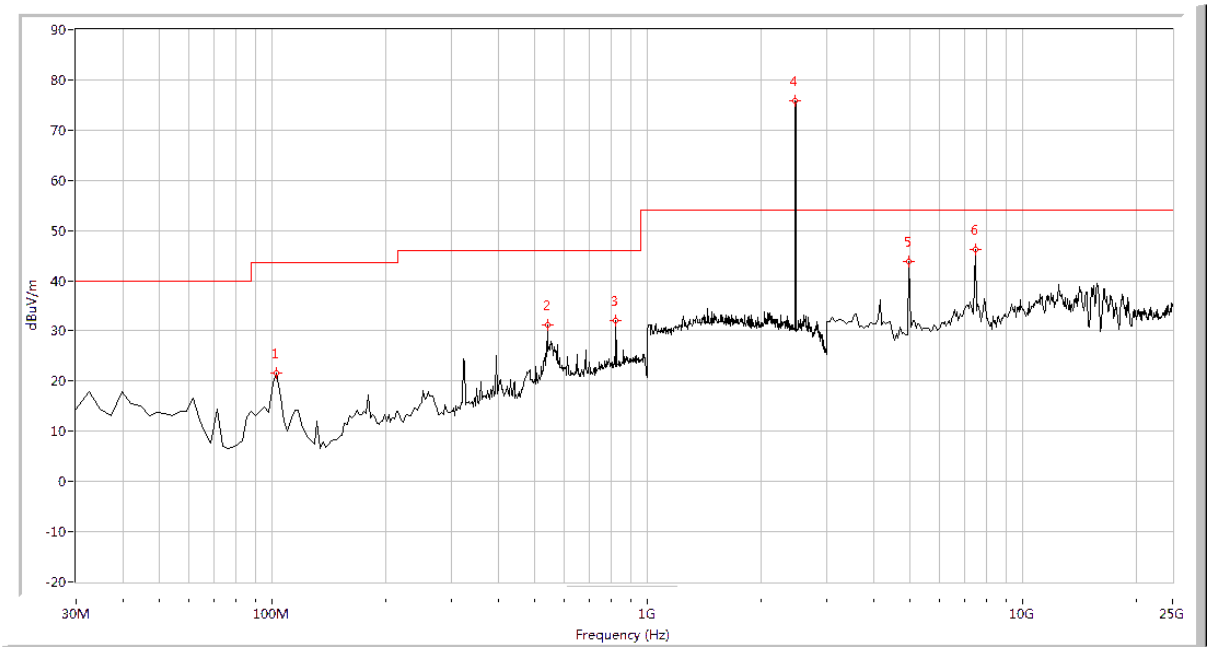



(Plot C.0: 9kHz to 30MHz, channel 36)




| Fre. (MHz) | Pk | QP | AV | Limit-PK | Limit-QP | Limit-AV | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|
| 102.569 | 36.36 | 29.92 | 29.33 | N.A | 43.5 | N.A | Vertical | PASS |
| 179.975 | 41.00 | 37.47 | 38.82 | N.A | 43.5 | N.A | Vertical | PASS |
| 395.262 | 40.67 | N.A | N.A | N.A | 46.0 | N.A | Vertical | PASS |
| 2477.056 | 76.02 | N.A | N.A | N.A | N.A | N.A | Vertical | N.A |
| 4975.062 | 44.59 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |
| 7443.890 | 45.86 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |

(Plot C.1: 30MHz to 25GHz, Antenna Horizontal, channel 36)




| Fre. (MHz) | Pk | QP | AV | Limit-PK | Limit-QP | Limit-AV | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|
| 102.569 | 21.51 | N.A | N.A | N.A | 43.5 | N.A | Vertical | PASS |
| 540.399 | 31.11 | N.A | N.A | N.A | 46.0 | N.A | Vertical | PASS |
| 823.416 | 32.10 | N.A | N.A | N.A | 46.0 | N.A | Vertical | PASS |
| 2477.056 | 75.74 | N.A | N.A | N.A | N.A | N.A | Vertical | N.A |
| 4975.062 | 43.79 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |
| 7443.890 | 46.22 | N.A | N.A | 74.0 | N.A | 54.0 | Vertical | PASS |

(Plot C.2: 30MHz to 25GHz, Antenna Vertical, channel 36)

## 2.11. RF exposure evaluation

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

### 2.11.1. Limits for Maximum Permissible Exposure

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner the ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.

According to FCC Part 1.1310 RF exposure is calculated.

| **Limits for General Population/ Uncontrolled Exposure** | | | |
|---|---|---|---|
| Frequency Range (MHz) | Electric Field Strength(E)(V/m) | Magnetic Field Strength (H)(A/m) | Power Density (S)(mW/cm2) |
| 0.3-1.34 | 614 | 1.63 | (100)* |
| 1.34-30 | 824/f | 2.19/f | (180/f2)* |
| 30-300 | 27.5 | 0.073 | 0.2 |
| 300-1500 | | | f/1500 |
| 1500-100,000 | | | 1.0 |

### 2.11.2. Test result

| | |
|---|---|
| Maximum peak output power at antenna input terminal(dBm): | 20.42 |
| Maximum peak output power at antenna input terminal(mW): | 110.1539 |
| Source-based time-averaged output power: | -- |
| Prediction distance(cm): | 20 |
| Predication frequency(MHz): | 2477.056 |
| Antenna Gain (typical) (dBi): | 1.8 |
| Power density at predication frequency at 20 cm($mW/cm^2$): | 0.033169 |
| MPE limit for RF exposure at prediction frequency($mW/cm^2$): | 1.0 |

### 2.11.3. Conclusion

Since the test result is passed, the SAR measurement is not required.

** END OF REPORT **