



## CFR 47 FCC PART 15 SUBPART C

### CERTIFICATION TEST REPORT

*For*

**ZigBee Smart Plug**

**MODEL NUMBER: HPPA11SZ**

**FCC ID: 2AB2QHPPA11SZ**

**REPORT NUMBER: 4789546348-2**

**ISSUE DATE: July 15, 2020**

*Prepared for*

**LEEDARSON LIGHTING CO.,Ltd.  
XINGDA RD, XINGTAI INDUSTRIAL ZONE, CHANGTAI COUNTY, ZHANGZHOU,  
FUJIAN, 363900, CHINA**

*Prepared by*

**UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch  
Building 10, Innovation Technology Park, No. 1, Li Bin Road,  
Song Shan Lake Hi-Tech Development Zone, Dongguan, People's Republic of China  
Tel: +86 769-22038881  
Fax: +86 769 33244054  
Website: [www.ul.com](http://www.ul.com)**

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	07/15/2020	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6dB Bandwidth and 99% Occupied Bandwidth	FCC Part 15.247 (a) (2)	Pass
2	Peak Conducted Output Power	FCC Part 15.247 (b) (3)	Pass
3	Power Spectral Density	FCC Part 15.247 (e)	Pass
4	Conducted Bandedge and Spurious Emission	FCC Part 15.247 (d)	Pass
5	Radiated Bandedge and Spurious Emission	FCC Part 15.247 (d) FCC Part 15.209 FCC Part 15.205	Pass
6	Conducted Emission Test For AC Power Port	FCC Part 15.207	Pass
7	Antenna Requirement	FCC Part 15.203	Pass

---

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>6</b>
<b>2. TEST METHODOLOGY .....</b>	<b>7</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>7</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>8</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION .....</i>	<i>8</i>
4.2. <i>MEASUREMENT UNCERTAINTY .....</i>	<i>8</i>
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>9</b>
5.1. <i>DESCRIPTION OF EUT .....</i>	<i>9</i>
5.2. <i>MAXIMUM OUTPUT POWER .....</i>	<i>9</i>
5.3. <i>CHANNEL LIST .....</i>	<i>9</i>
5.4. <i>TEST CHANNEL CONFIGURATION .....</i>	<i>10</i>
5.5. <i>THE WORSE CASE POWER SETTING PARAMETER .....</i>	<i>10</i>
5.6. <i>DESCRIPTION OF AVAILABLE ANTENNAS .....</i>	<i>10</i>
5.7. <i>TEST ENVIRONMENT .....</i>	<i>10</i>
5.8. <i>DESCRIPTION OF TEST SETUP .....</i>	<i>11</i>
5.9. <i>MEASURING INSTRUMENT AND SOFTWARE USED .....</i>	<i>12</i>
<b>6. ANTENNA PORT TEST RESULTS .....</b>	<b>14</b>
6.1. <i>ON TIME AND DUTY CYCLE .....</i>	<i>14</i>
6.2. <i>6 dB DTS BANDWIDTH AND 99% BANDWIDTH .....</i>	<i>15</i>
6.3. <i>PEAK CONDUCTED OUTPUT POWER .....</i>	<i>17</i>
6.4. <i>POWER SPECTRAL DENSITY .....</i>	<i>18</i>
6.5. <i>CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS .....</i>	<i>20</i>
<b>7. RADIATED TEST RESULTS .....</b>	<b>22</b>
7.1. <i>RESTRICTED BANDEDGE .....</i>	<i>28</i>
7.2. <i>SPURIOUS EMISSIONS (1~3GHz) .....</i>	<i>38</i>
7.3. <i>SPURIOUS EMISSIONS (3~18GHz) .....</i>	<i>46</i>
7.4. <i>SPURIOUS EMISSIONS 18G ~ 26GHz .....</i>	<i>54</i>
7.5. <i>SPURIOUS EMISSIONS 30M ~ 1 GHz .....</i>	<i>56</i>
7.6. <i>SPURIOUS EMISSIONS BELOW 30M .....</i>	<i>58</i>
<b>8. AC POWER LINE CONDUCTED EMISSIONS .....</b>	<b>61</b>
<b>9. ANTENNA REQUIREMENTS .....</b>	<b>64</b>

---

<b>10. Appendix.....</b>	<b>65</b>
10.1. <i>Appendix A: DTS Bandwidth</i> .....	65
10.1.1. Test Result.....	65
10.1.2. Test Graphs .....	66
10.2. <i>Appendix B: Occupied Channel Bandwidth</i> .....	68
10.2.1. Test Result.....	68
10.2.2. Test Graphs .....	69
10.3. <i>Appendix C: Maximum conducted output power</i> .....	71
10.3.1. Test Result.....	71
10.4. <i>Appendix D: Maximum power spectral density</i> .....	72
10.4.1. Test Result.....	72
10.4.2. Test Graphs .....	73
10.5. <i>Appendix E: Band edge measurements</i> .....	75
10.5.1. Test Result.....	75
10.5.2. Test Graphs .....	76
10.6. <i>Appendix F: Conducted Spurious Emission</i> .....	78
10.6.1. Test Result.....	78
10.6.2. Test Graphs .....	79
10.7. <i>Appendix G: Duty Cycle</i> .....	85
10.7.1. Test Result.....	85
10.7.2. Test Graphs .....	86

## 1. ATTESTATION OF TEST RESULTS

### Applicant Information

Company Name: LEEDARSON LIGHTING CO.,Ltd.  
Address: XINGDA RD, XINGTAI INDUSTRIAL ZONE, CHANGTAI COUNTY, ZHANGZHOU, FUJIAN, 363900, CHINA

### Manufacturer Information

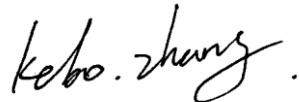
Company Name: LEEDARSON LIGHTING CO.,Ltd.  
Address: XINGDA RD, XINGTAI INDUSTRIAL ZONE, CHANGTAI COUNTY, ZHANGZHOU, FUJIAN, 363900, CHINA

### EUT Information

EUT Name: ZigBee Smart Plug  
Model: HPPA11SZ  
Brand Name: LEEDARSON  
Sample Received Date: July 6, 2020  
Date of Tested: July 6~14, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 FCC PART 15 SUBPART C	PASS

Tested By:



Kebo Zhang  
Project Engineer

Checked By:



Shawn Wen  
Laboratory Leader

Approved By:



Stephen Guo  
Laboratory Manager

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB 558074 D01 DTS Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, CFR 47 FCC Part 2, CFR 47 FCC Part 15, ANSI C63.10-2013.

## 3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p><b>A2LA (Certificate No.: 4102.01)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.</p> <p><b>FCC (FCC Designation No.: CN1187)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules</p> <p><b>ISED(Company No.: 21320)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320.</p> <p><b>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793.</p> <p>Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011</p>
---------------------------	--

Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OFS.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.62dB
Radiation Emission test(include Fundamental emission) (9kHz-30MHz)	2.2dB
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.00dB
Radiation Emission test (1GHz to 26GHz)( include Fundamental emission)	5.78dB (1GHz-18GHz) 5.23dB (18GHz-26GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

EUT Name	ZigBee Smart Plug		
Model	HPPA11SZ		
Product Description	Operation Frequency		2405 MHz ~ 2480 MHz
	Modulation Type		Data Rate
O-QPSK		250kbps	
Power supply	AC 120V,60Hz		

### 5.2. MAXIMUM OUTPUT POWER

Mode	Frequency (MHz)	Channel Number	Max Output PEAK Power (dBm)
ZigBee	2405-2480	11-26 [16]	11

### 5.3. CHANNEL LIST

Channel	Frequency (MHz)						
11	2405	15	2425	19	2445	23	2465
12	2410	16	2430	20	2450	24	2470
13	2415	17	2435	21	2455	25	2475
14	2420	18	2440	22	2460	26	2480

## 5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
ZigBee	Low, Middle, High, CH26	2405MHz, 2445MHz, 2475MHz, 2480MHz

## 5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band					
Test Software		UartAssis			
Modulation Type	Transmit Antenna Number	Test Channel			
		CH 11	CH 19	CH 25	CH 26
O-QPSK	1	10	10	10	10

## 5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2405-2480	PCB Antenna	-4.1

Test Mode	Transmit and Receive Mode	Description
ZigBee	<input checked="" type="checkbox"/> 1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

## 5.7. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	40 ~ 60%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	22 ~ 28°C
Voltage :	VL	N/A
	VN	AC 120V, 60Hz
	VH	N/A

Note: VL= Lower Extreme Test Voltage

VN= Normal Voltage

VH= Upper Extreme Test Voltage

TN= Normal Temperature

## 5.8. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	Laptop	ThinkPad	T460S	SL10K24796 JS
2	USB TO RS232	/	/	/

### I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	/	/	1	N/A

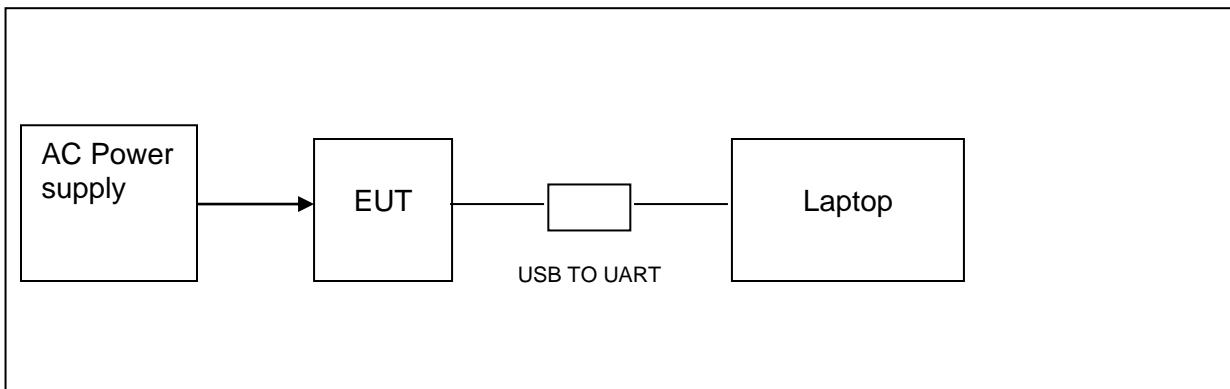
### ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
/	/	/	/	/

### TEST SETUP

The EUT can work in an engineer mode with a software through a PC.

### SETUP DIAGRAM FOR TEST



## 5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions										
Instrument										
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.				
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESR3	101961	Dec.05,2019	Dec.05,2020				
<input checked="" type="checkbox"/>	Two-Line V-Network	R&S	ENV216	101983	Dec.05,2019	Dec.05,2020				
Software										
Used	Description		Manufacturer	Name	Version					
<input checked="" type="checkbox"/>	Test Software for Conducted disturbance		Farad	EZ-EMC	Ver. UL-3A1					
Radiated Emissions										
Instrument										
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.				
<input checked="" type="checkbox"/>	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec.06,2019	Dec.06,2020				
<input checked="" type="checkbox"/>	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Sep.17, 2018	Sep.17, 2021				
<input checked="" type="checkbox"/>	Preamplifier	HP	8447D	2944A09099	Dec.05,2019	Dec.05,2020				
<input checked="" type="checkbox"/>	EMI Measurement Receiver	R&S	ESR26	101377	Dec.05,2019	Dec.05,2020				
<input checked="" type="checkbox"/>	Horn Antenna	TDK	HRN-0118	130939	Sep.17, 2018	Sep.17, 2021				
<input checked="" type="checkbox"/>	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Aug.11, 2018	Aug.11, 2021				
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec.05,2019	Dec.05,2020				
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.05,2019	Dec.05,2020				
<input checked="" type="checkbox"/>	Loop antenna	Schwarzbeck	1519B	00008	Jan.07, 2019	Jan.07, 2022				
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-001-3000	TRS-302-00050	Dec.5, 2019	Dec.5, 2020				
<input checked="" type="checkbox"/>	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Dec.05,2019	Dec.05,2020				
<input checked="" type="checkbox"/>	High Pass Filter	Wi	WPKX10-2700-3000-18000-40SS	23	Dec.05,2019	Dec.05,2020				
Software										
Used	Description		Manufacturer	Name	Version					
<input checked="" type="checkbox"/>	Test Software for Radiated disturbance		Farad	EZ-EMC	Ver. UL-3A1					

Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.10,2018	Dec.10,2019
<input checked="" type="checkbox"/>	Power Meter	Keysight	N9031A	MY55416024	Dec.10,2018	Dec.10,2019
<input checked="" type="checkbox"/>	Power Sensor	Keysight	N9323A	MY55440013	Dec.10,2018	Dec.10,2019

## 6. ANTENNA PORT TEST RESULTS

### 6.1. ON TIME AND DUTY CYCLE

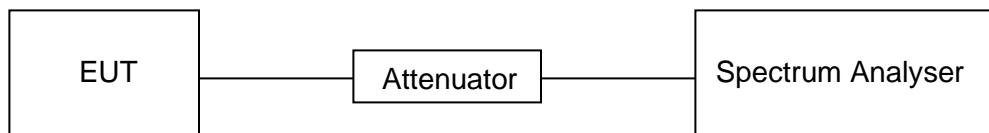
#### LIMITS

None; for reporting purposes only

#### PROCEDURE

Refer to ANSI C63.10-2013 clause 11.6 Zero – Span Spectrum Analyzer method.

#### TEST SETUP



#### TEST ENVIRONMENT

Temperature	26.7°C	Relative Humidity	58.1%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz

#### RESULTS

Please refer to appendix G.

## 6.2. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

### LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(a)(2)	6 dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5
ANSI C63.10 clause 6.93	99% Occupied Bandwidth	For reporting purposes only.	2400-2483.5

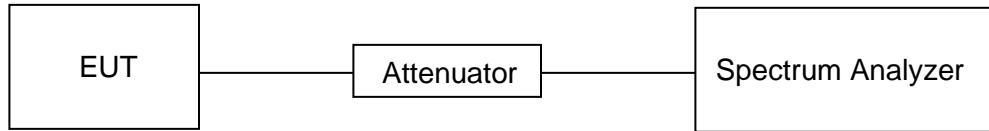
### TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.8 for DTS bandwidth and clause 6.9 for Occupied Bandwidth.

Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	Between 1.5 times and 5.0 times the OBW
Detector	Peak
RBW	For 6 dB Bandwidth: 100kHz For 99% Occupied Bandwidth: 1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth: $\geq 3 \times \text{RBW}$ For 99% Occupied Bandwidth: $\geq 3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto couple

- Use the 99% power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.
- Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUPTEST ENVIRONMENT

Temperature	26.7°C	Relative Humidity	58.1%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz

RESULTS

Please refer to appendix A & B.

### 6.3. PEAK CONDUCTED OUTPUT POWER

#### LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5

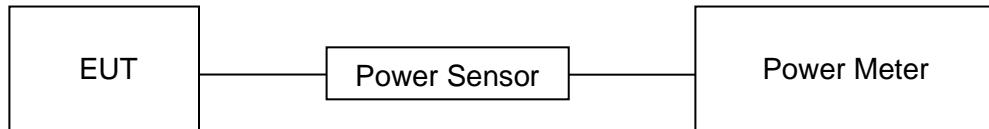
#### TEST PROCEDURE

Place the EUT on the table and set it in the transmitting mode.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.

Measure peak power each channel.

#### TEST SETUP



#### TEST ENVIRONMENT

Temperature	26.7°C	Relative Humidity	58.1%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz

#### RESULTS

Please refer to appendix C.

## 6.4. POWER SPECTRAL DENSITY

### LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC §15.247 (e)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

### TEST PROCEDURE

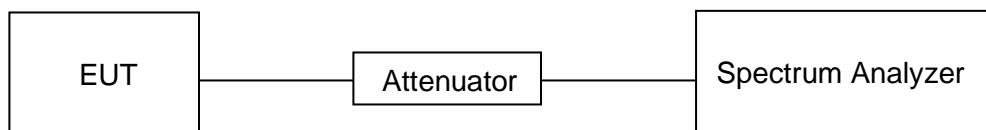
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	$1.5 \times \text{DTS bandwidth}$
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### TEST SETUP





Temperature	26.7°C	Relative Humidity	58.1%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz

## RESULTS

Please refer to appendix D.

## 6.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

### LIMITS

CFR 47 FCC Part15 (15.247) Subpart C		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d)	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

### TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

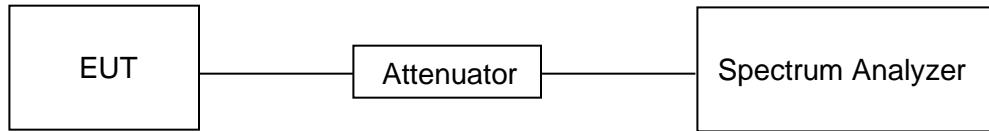
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times$ RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determin the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times$ RBW
measurement points	$\geq$ span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

### TEST SETUP





**TEST ENVIRONMENT**

Temperature	26.7°C	Relative Humidity	58.1%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz

**RESULTS**

Please refer to appendix E & F.

## 7. RADIATED TEST RESULTS

### LIMITS

Please refer to CFR 47 FCC §15.205 and §15.209.

Radiation Disturbance Test Limit for FCC (Class B) (9kHz-1GHz)

Emissions radiated outside of the specified frequency bands above 30MHz		
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
Quasi-Peak		
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54
Above 1000	500	Peak
		Average 74
54		

FCC Emissions radiated outside of the specified frequency bands below 30MHz		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30



FCC Restricted bands of operation refer to FCC §15.205 (a):

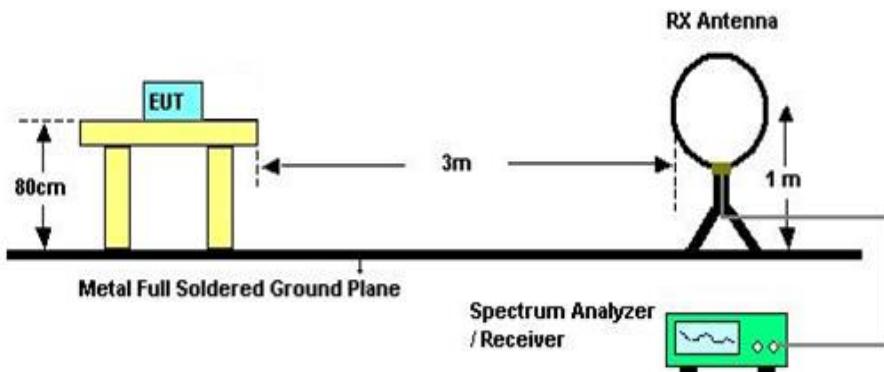
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
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	( <sup>2</sup> )
13.36-13.41			

Note: <sup>1</sup>Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup>Above 38.6c

**TEST SETUP AND PROCEDURE**

Below 30MHz

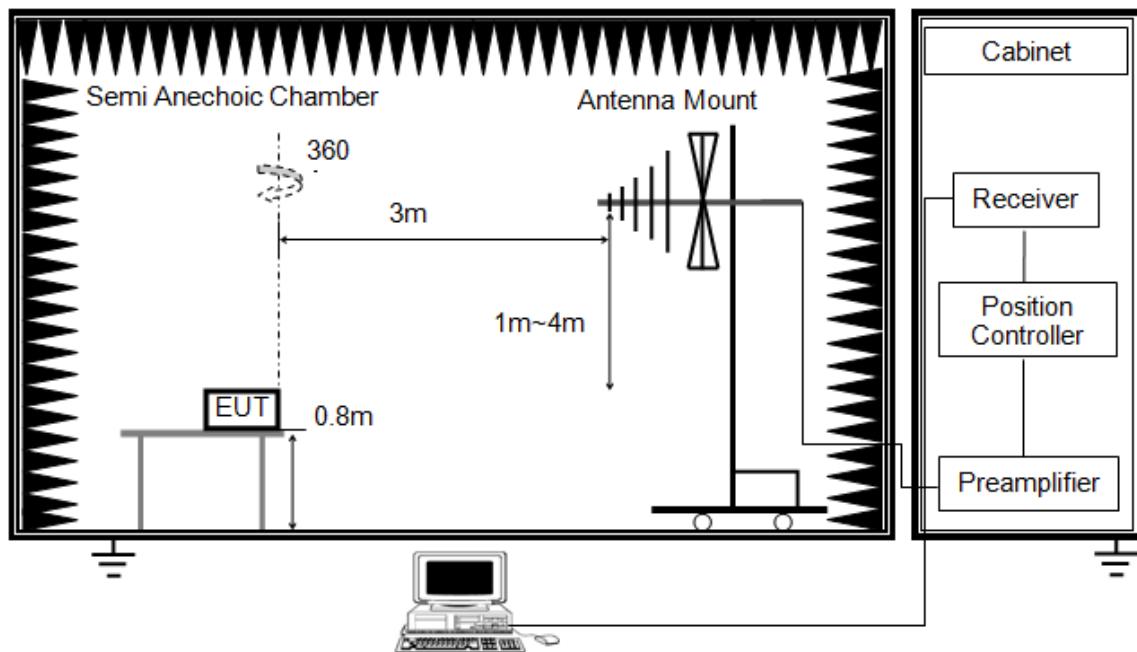


The setting of the spectrum analyser

RBW	200Hz (From 9kHz to 0.15MHz)/ 9kHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9kHz (From 0.15MHz to 30MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.
7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Below 1G and above 30MHz

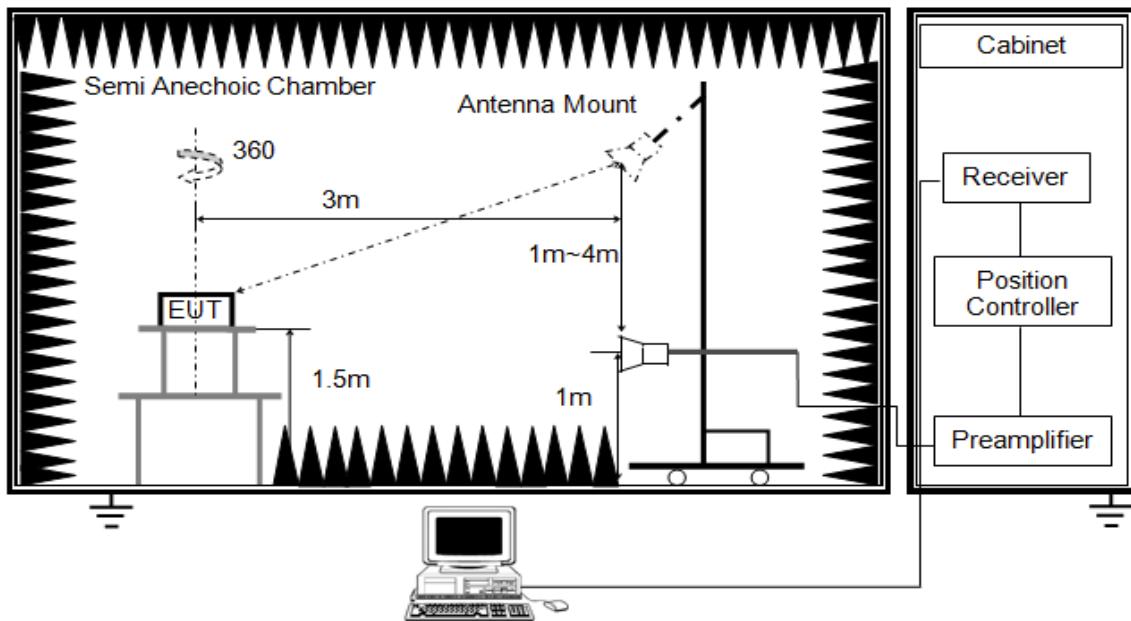


The setting of the spectrum analyser

RBW	120K
VBW	300K
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1G

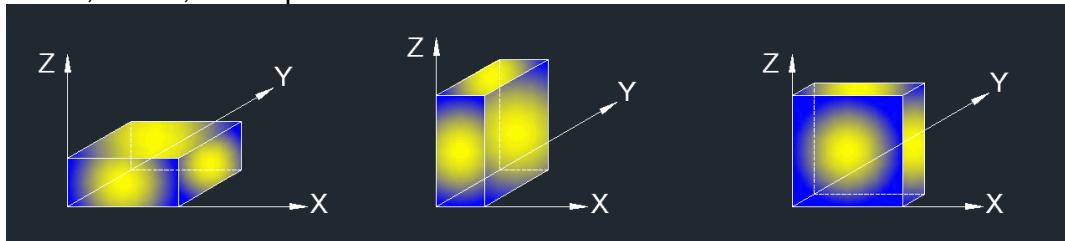


The setting of the spectrum analyser

RBW	1M
VBW	PEAK: 3M AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (1.5 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5m above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement above 1GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle and Correction Factor please refer to clause 7.1.ON TIME AND DUTY CYCLE.

X axis, Y axis, Z axis positions:



Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

#### TEST ENVIRONMENT

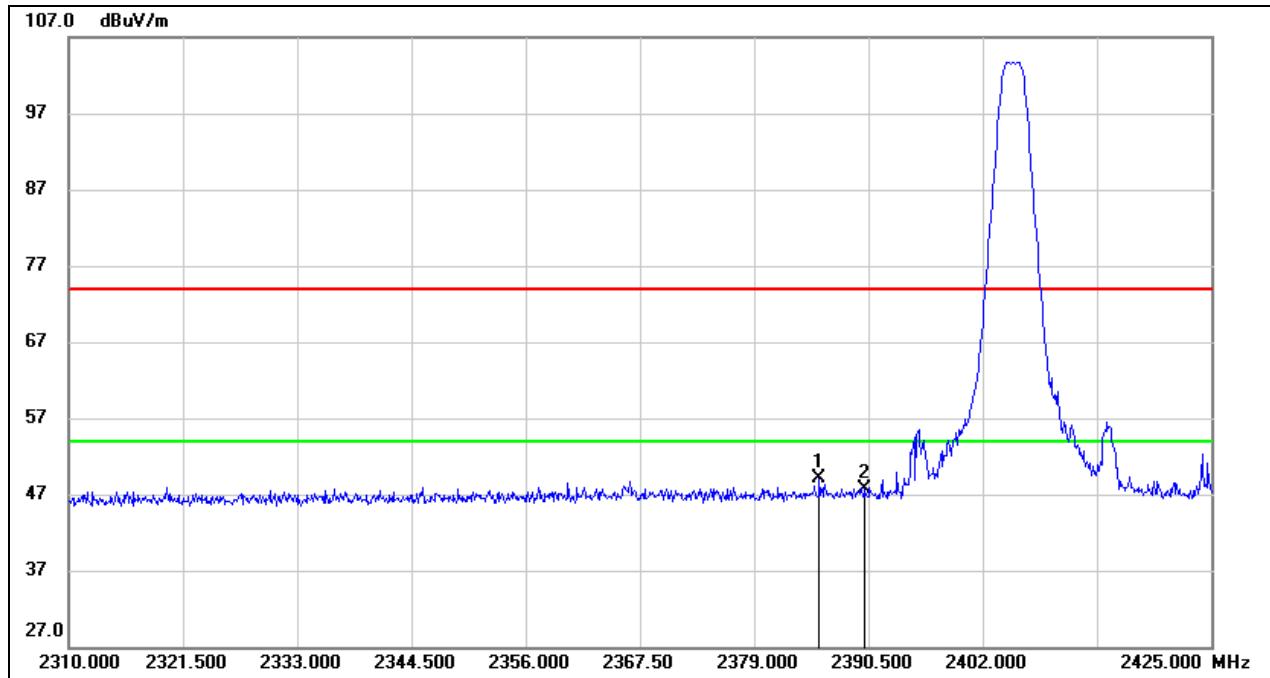
Temperature	23.6°C	Relative Humidity	57%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz

#### RESULTS

## 7.1. RESTRICTED BANDEDGE

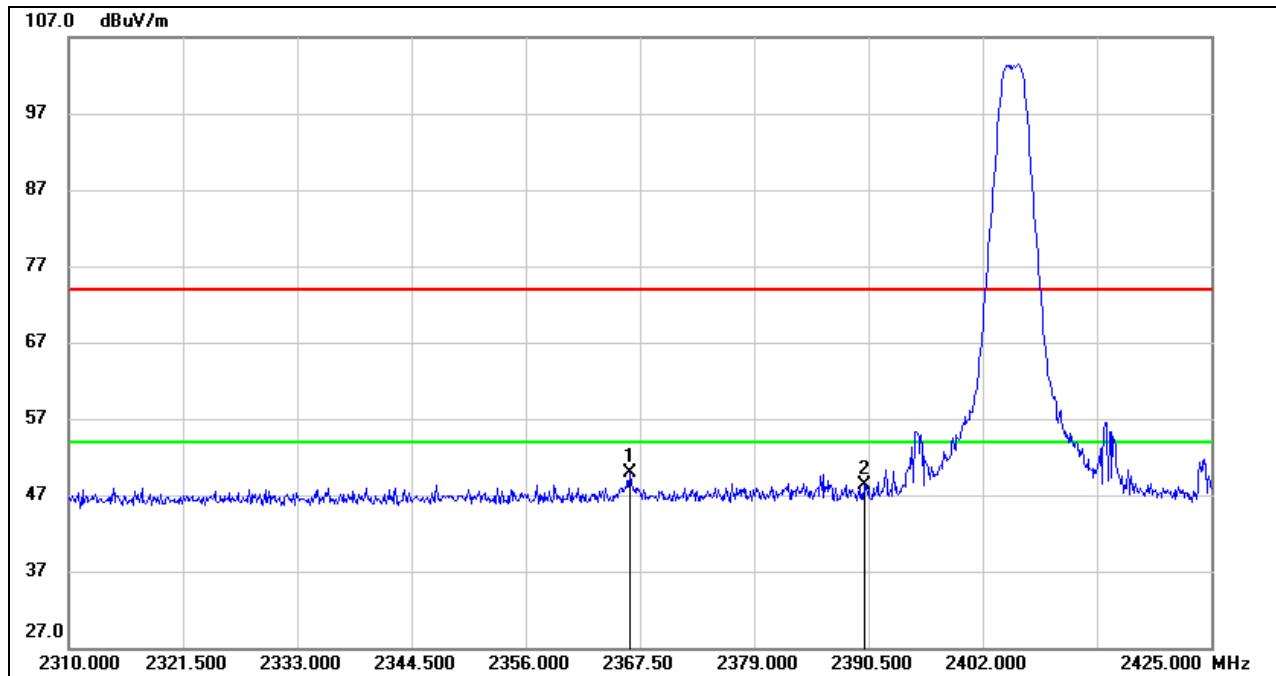
### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

#### PEAK



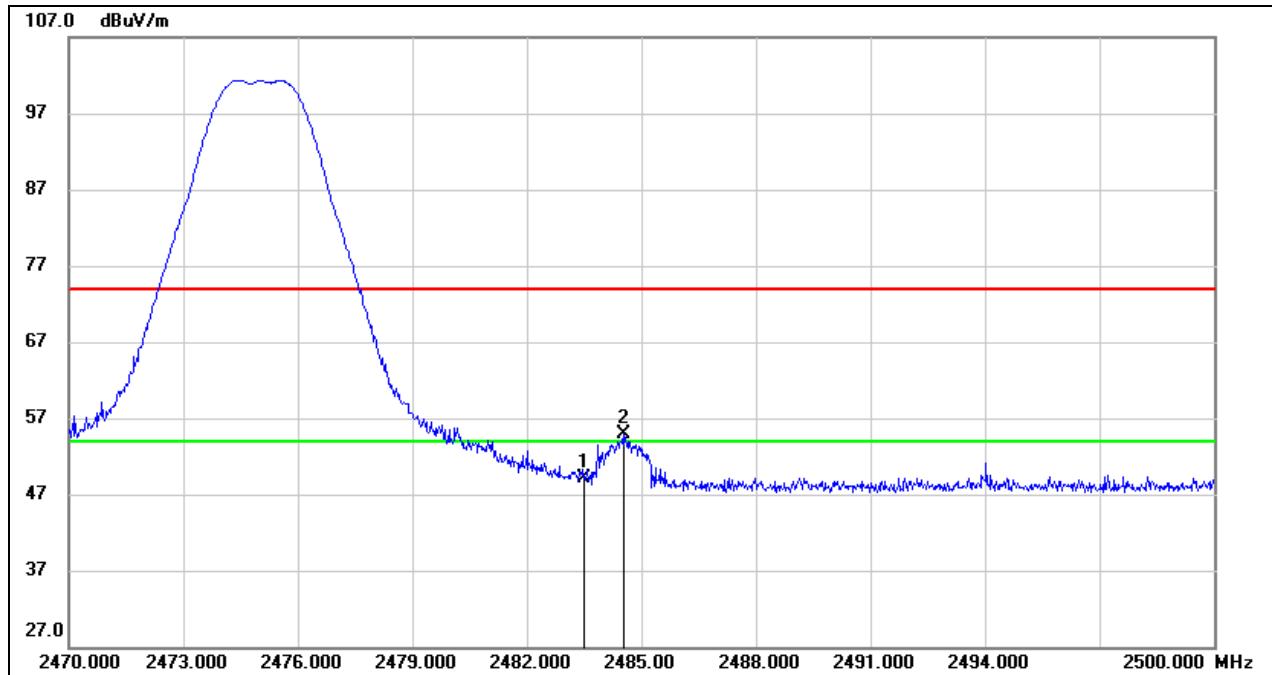
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2385.555	16.25	32.93	49.18	74.00	-24.82	peak
2	2390.000	14.76	32.94	47.70	74.00	-26.30	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)PEAK

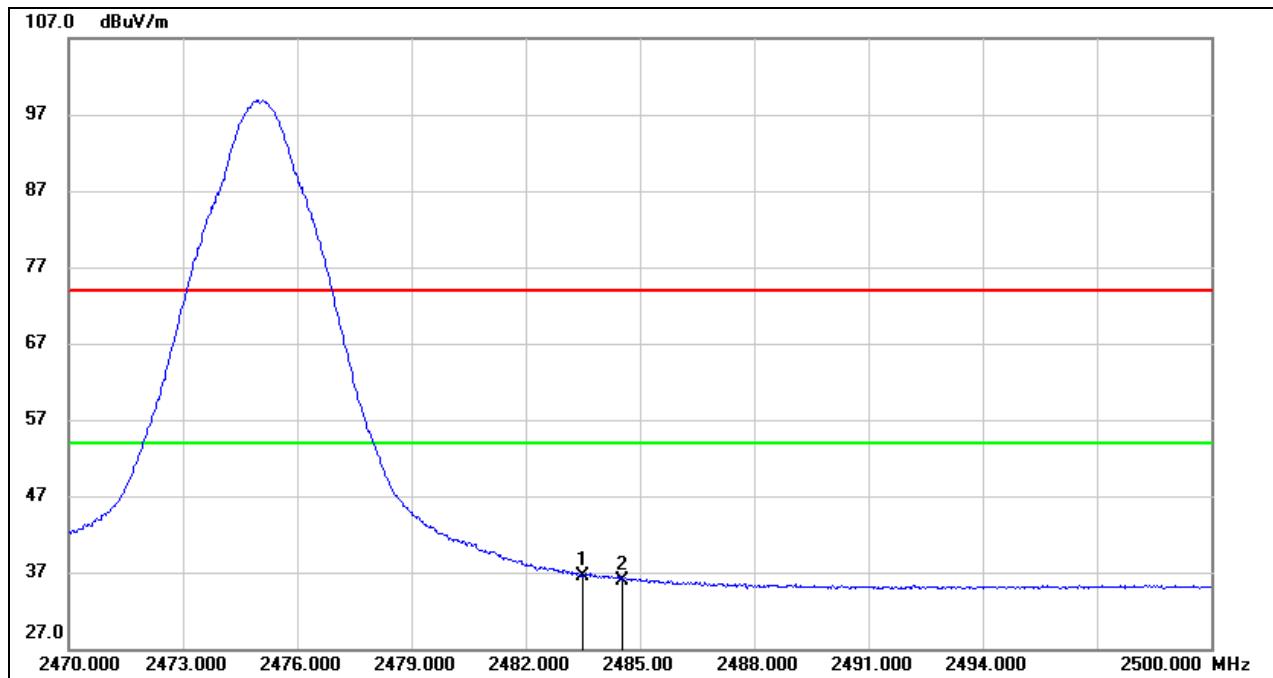
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2366.465	16.97	32.87	49.84	74.00	-24.16	peak
2	2390.000	15.43	32.94	48.37	74.00	-25.63	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE ( HIGH CHANNEL, HORIZONTAL)PEAK

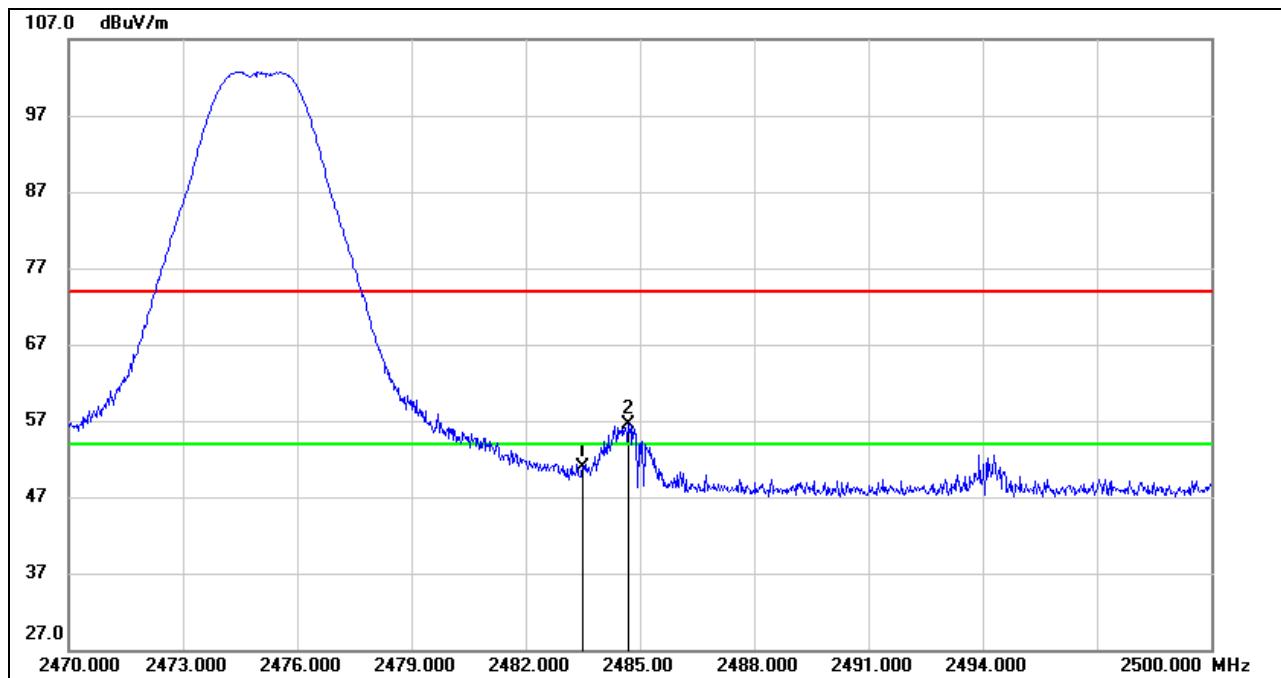
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	15.52	33.58	49.10	74.00	-24.90	peak
2	2484.520	21.29	33.59	54.88	74.00	-19.12	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

AVG

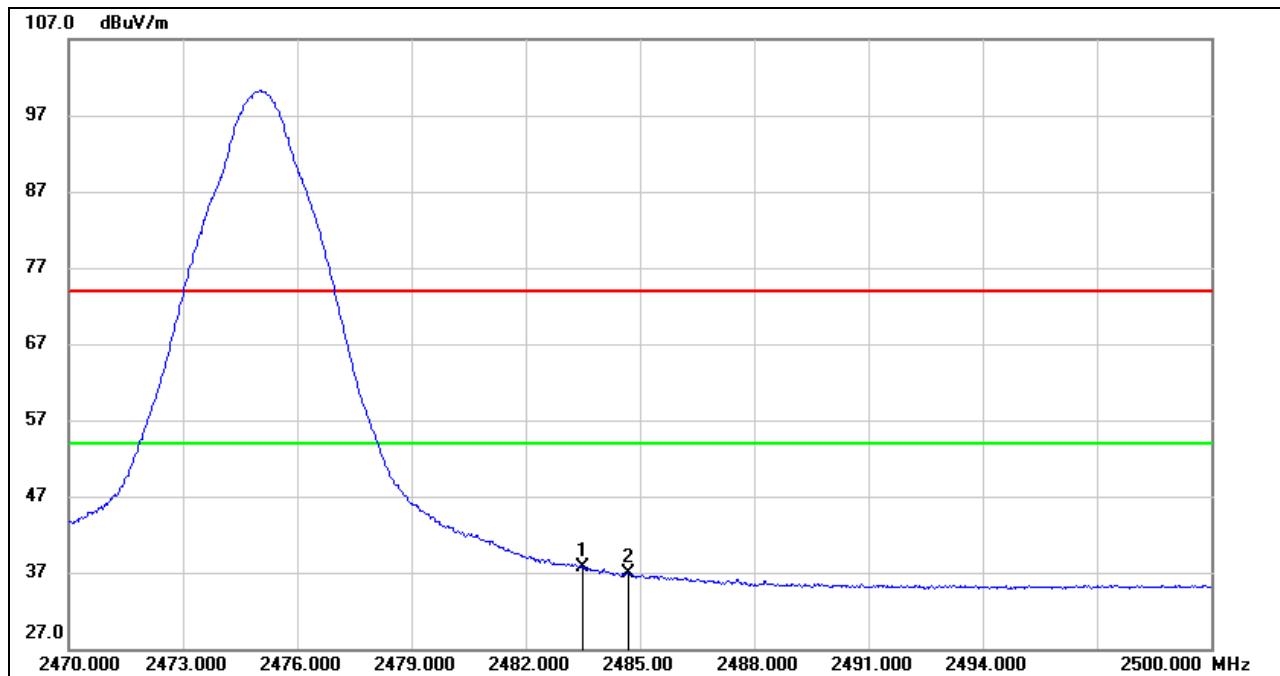
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	2.84	33.58	36.42	54.00	-17.58	AVG
2	2484.520	2.36	33.59	35.95	54.00	-18.05	AVG

Note: 1. Measurement = Reading Level + Correct Factor.  
2. AVG: VBW=1/Ton where: ton is transmit duration.  
3. For duty cycle, please refer to clause 7.1.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)PEAK

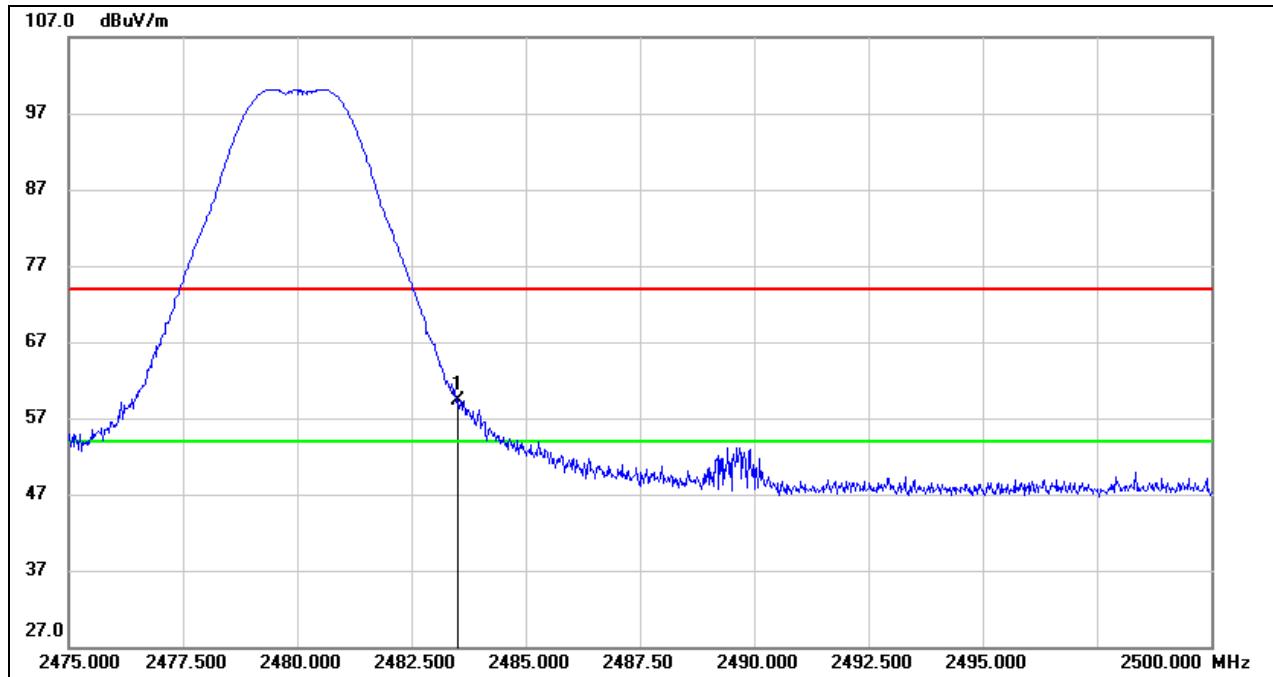
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	17.41	33.58	50.99	74.00	-23.01	peak
2	2484.700	22.97	33.59	56.56	74.00	-17.44	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

AVG

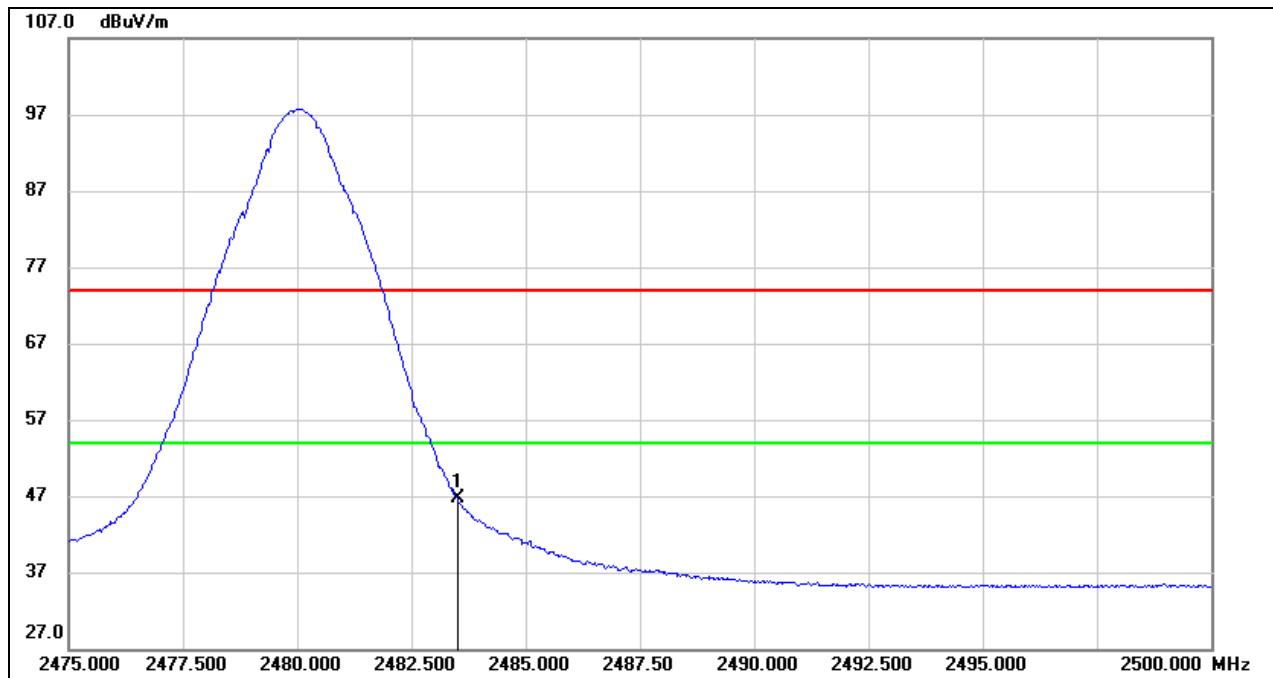
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	4.08	33.58	37.66	54.00	-16.34	AVG
2	2484.700	3.28	33.59	36.87	54.00	-17.13	AVG

Note: 1. Measurement = Reading Level + Correct Factor.  
2. AVG:  $VBW=1/Ton$  where: ton is transmit duration.  
3. For duty cycle, please refer to clause 7.1.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (CHANNEL 26, HORIZONTAL)PEAK

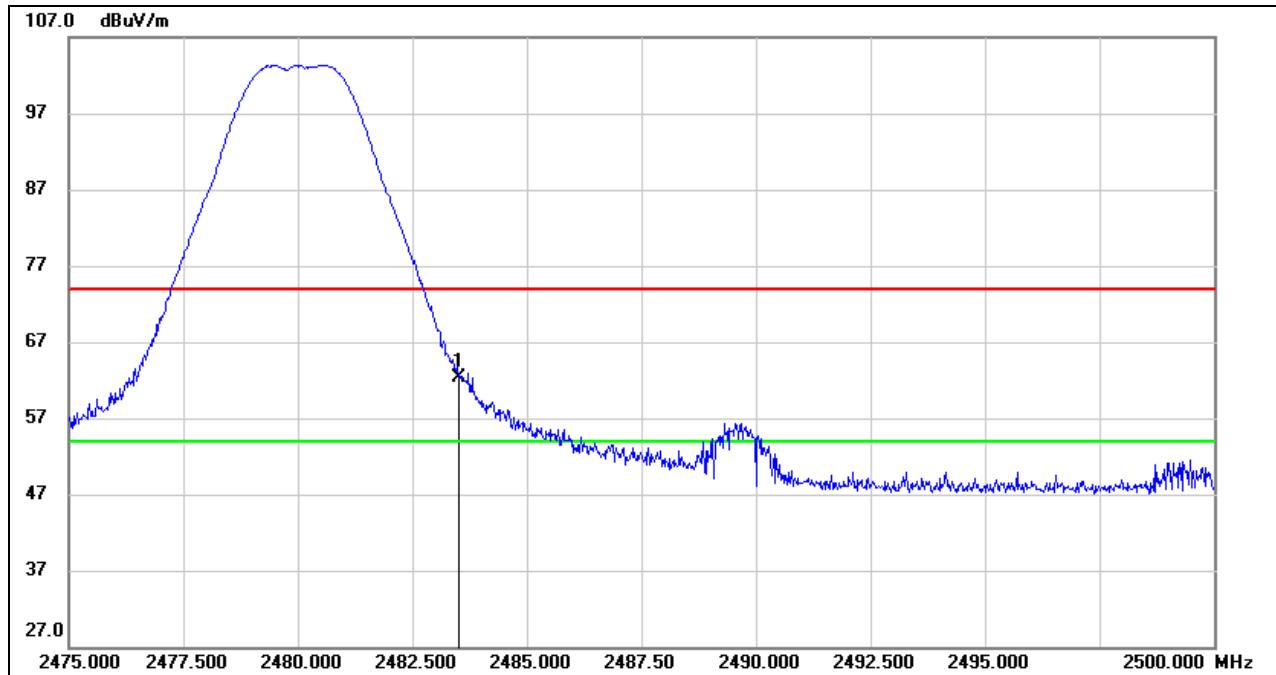
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	25.65	33.58	59.23	74.00	-14.77	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

AVG

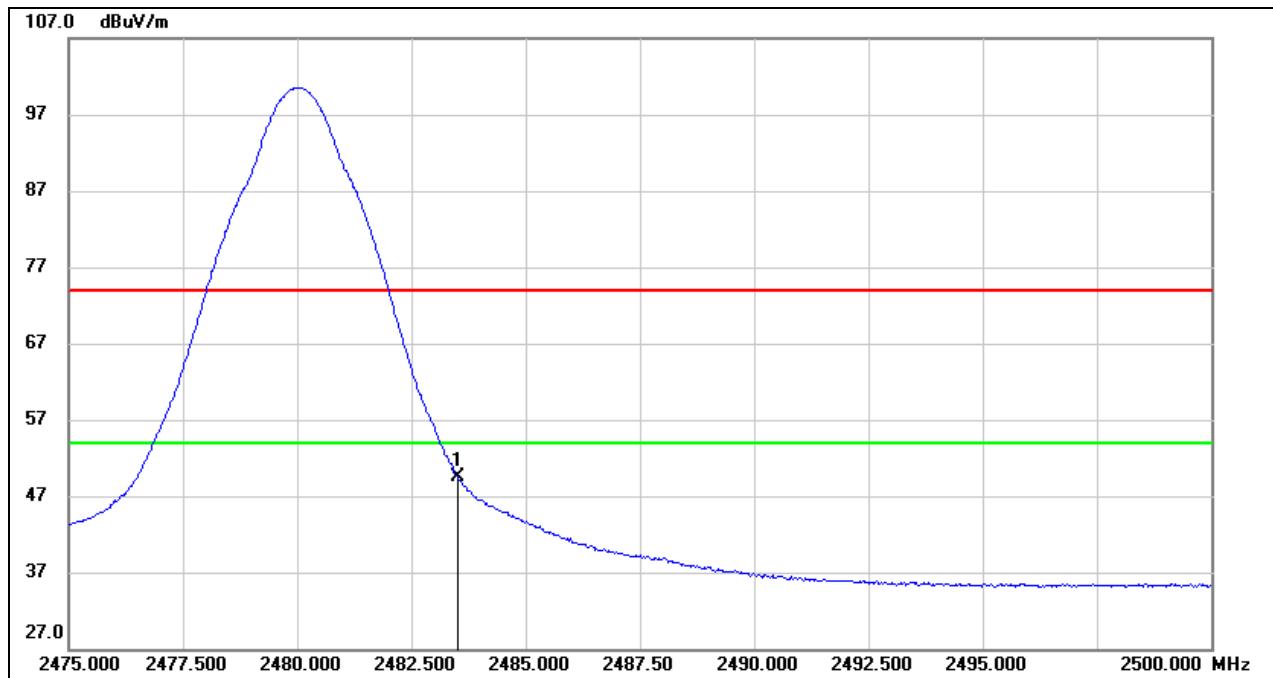
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	13.11	33.58	46.69	54.00	-7.31	AVG

Note: 1. Measurement = Reading Level + Correct Factor.  
2. AVG: VBW=1/Ton where: ton is transmit duration.  
3. For duty cycle, please refer to clause 7.1.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (CHANNEL 26, VERTICAL)PEAK

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	28.80	33.58	62.38	74.00	-11.62	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

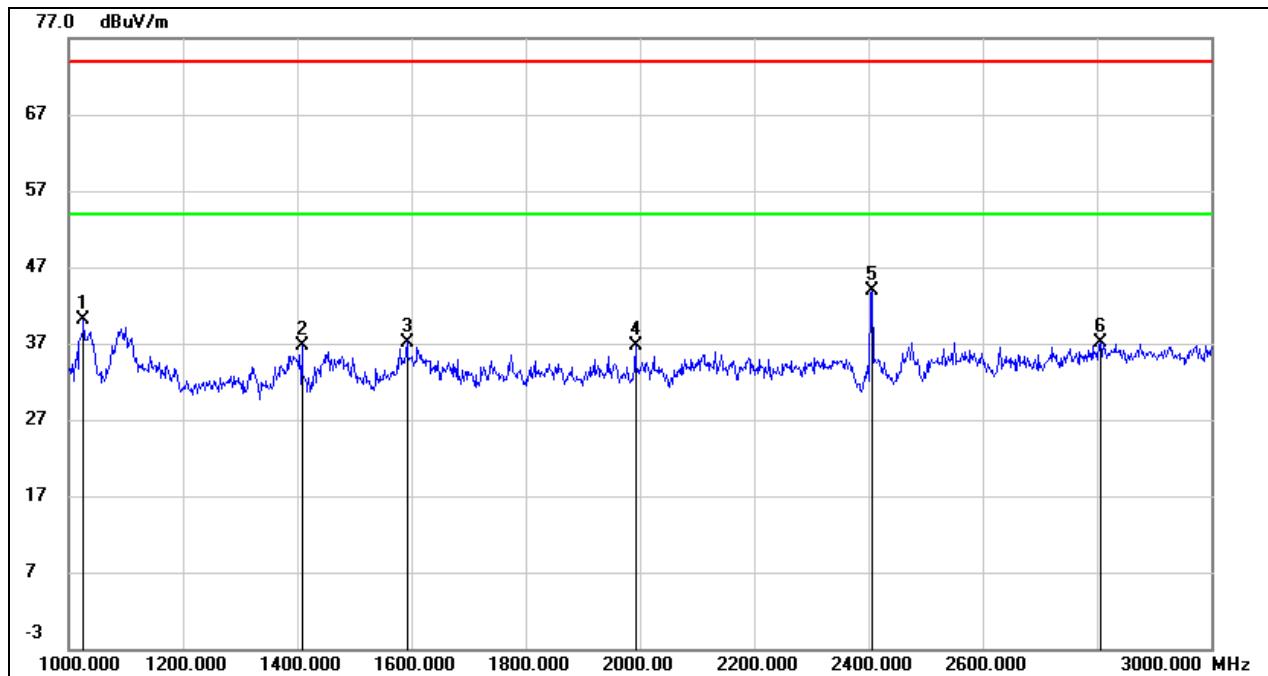
AVG

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	15.99	33.58	49.57	54.00	-4.43	AVG

Note: 1. Measurement = Reading Level + Correct Factor.  
2. AVG: VBW=1/Ton where: ton is transmit duration.  
3. For duty cycle, please refer to clause 7.1.  
4. Only the worst case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

## 7.2. SPURIOUS EMISSIONS (1~3GHz)

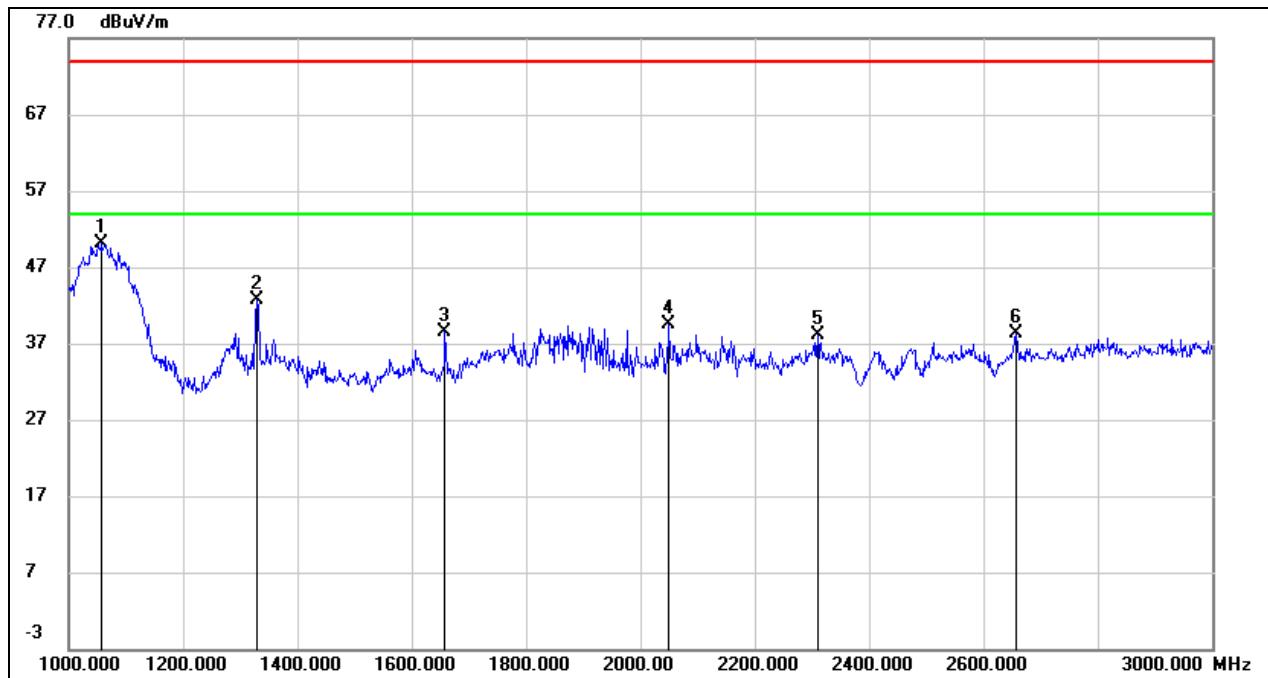
### HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1026.000	53.71	-13.56	40.15	74.00	-33.85	peak
2	1408.000	49.15	-12.37	36.78	74.00	-37.22	peak
3	1592.000	48.67	-11.47	37.20	74.00	-36.80	peak
4	1992.000	46.63	-9.83	36.80	74.00	-37.20	peak
5	2405.000	51.65	-7.81	43.84	/	/	fundamental
6	2806.000	43.05	-6.02	37.03	74.00	-36.97	peak

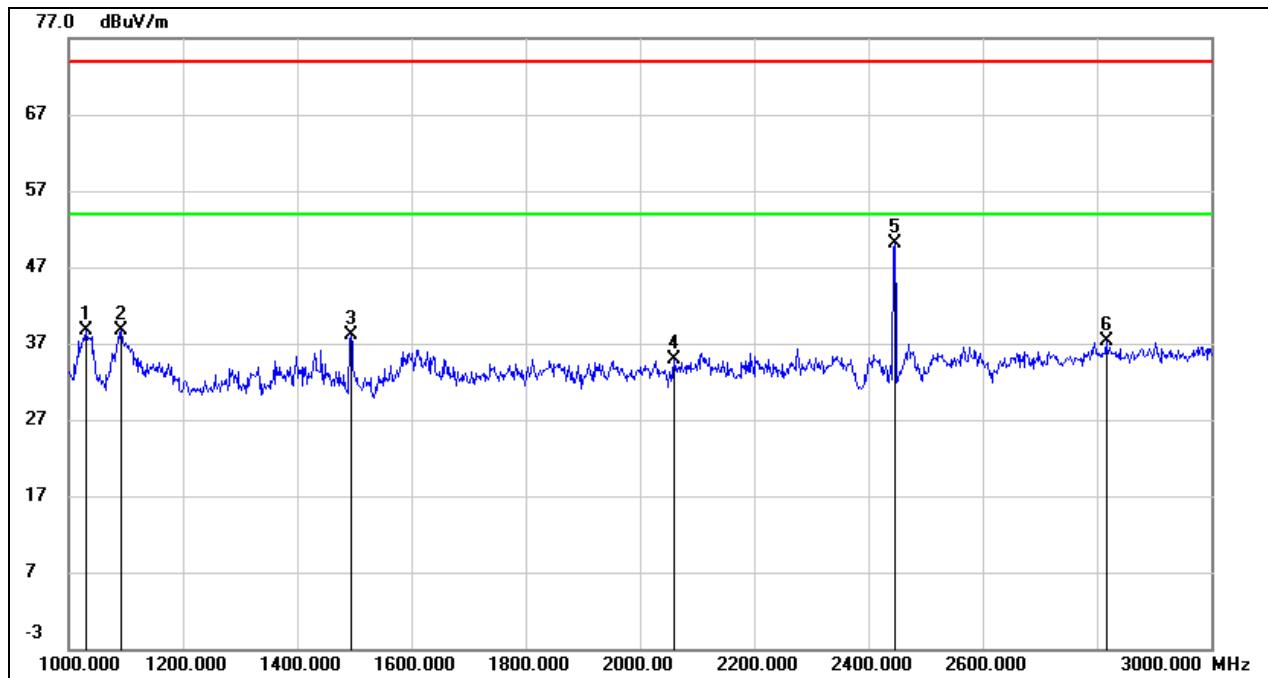
Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)

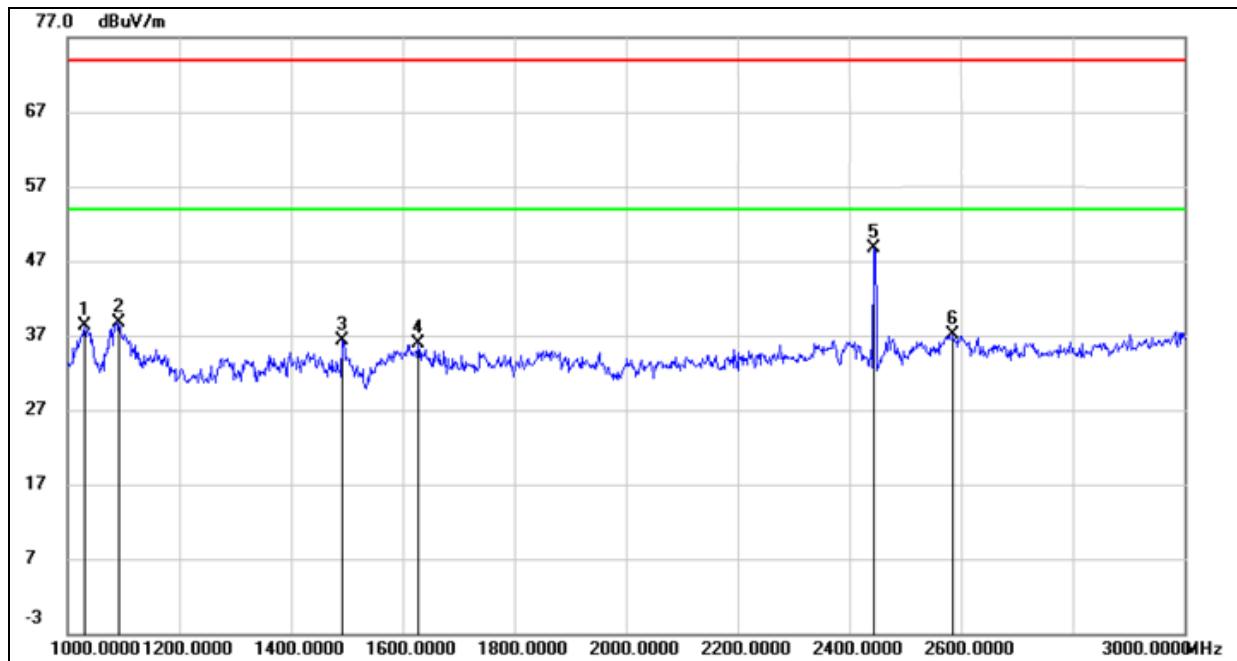
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1058.000	63.68	-13.55	50.13	74.00	-23.87	peak
2	1330.000	55.11	-12.36	42.75	74.00	-31.25	peak
3	1658.000	49.56	-11.11	38.45	74.00	-35.55	peak
4	2050.000	48.91	-9.49	39.42	74.00	-34.58	peak
5	2310.000	46.22	-8.16	38.06	74.00	-35.94	peak
6	2658.000	45.75	-7.37	38.38	74.00	-35.62	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)

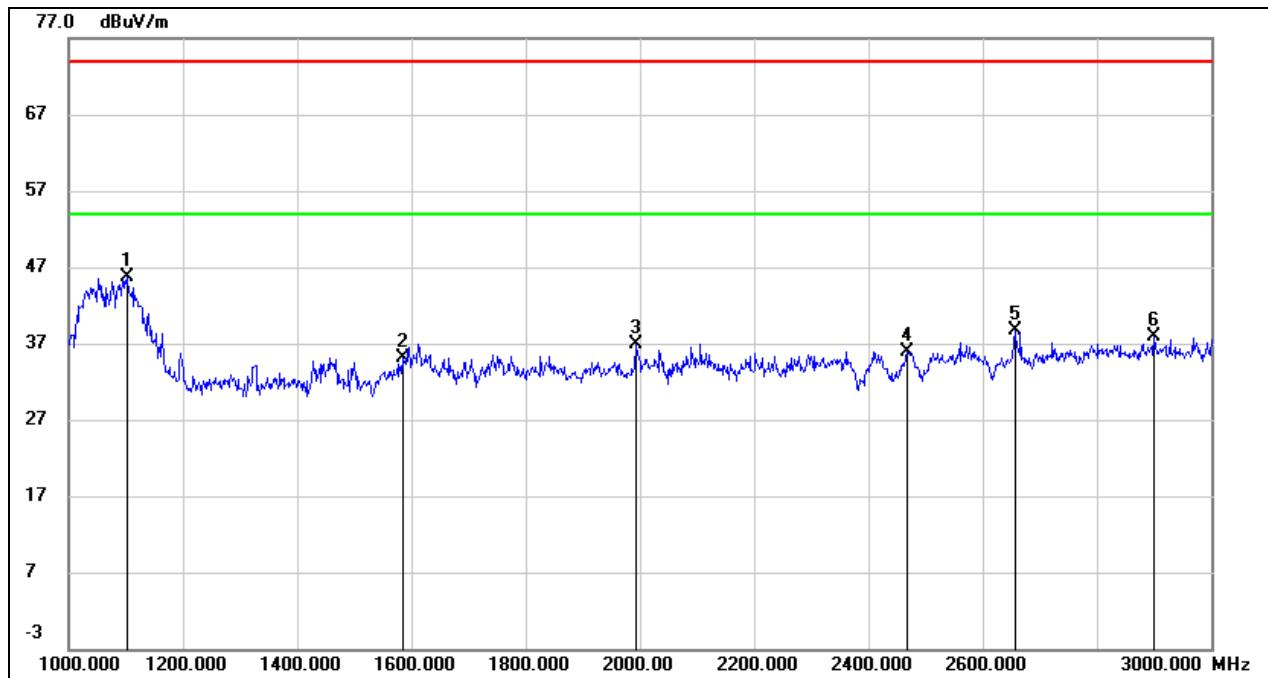
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1030.000	52.33	-13.58	38.75	74.00	-35.25	peak
2	1092.000	52.15	-13.52	38.63	74.00	-35.37	peak
3	1494.000	50.25	-12.22	38.03	74.00	-35.97	peak
4	2060.000	44.30	-9.42	34.88	74.00	-39.12	peak
5	2445.000	57.55	-7.54	50.01	/	/	fundamental
6	2816.000	43.28	-5.97	37.31	74.00	-36.69	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)

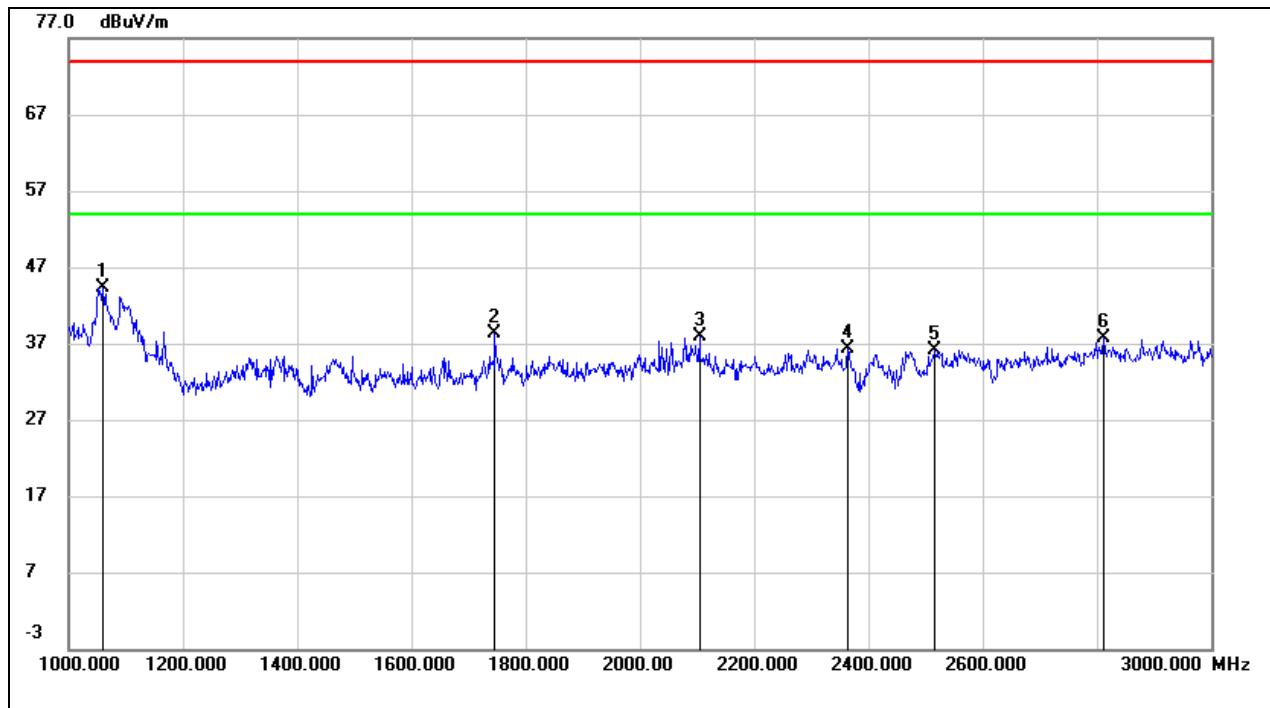
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1030.000	51.83	-13.58	38.25	74.00	-35.75	peak
2	1092.000	52.15	-13.52	38.63	74.00	-35.37	peak
3	1492.000	48.62	-12.22	36.40	74.00	-37.60	peak
4	1628.000	47.13	-11.25	35.88	74.00	-38.12	peak
5	2445.000	56.34	-7.55	48.79	/	/	fundamental
6	2586.000	44.64	-7.63	37.01	74.00	-36.99	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1102.000	59.29	-13.51	45.78	74.00	-28.22	peak
2	1584.000	46.69	-11.53	35.16	74.00	-38.84	peak
3	1992.000	46.72	-9.83	36.89	74.00	-37.11	peak
4	2475.000	43.37	-7.39	35.98	/	/	fundamental
5	2656.000	46.02	-7.38	38.64	74.00	-35.36	peak
6	2900.000	43.49	-5.52	37.97	74.00	-36.03	peak

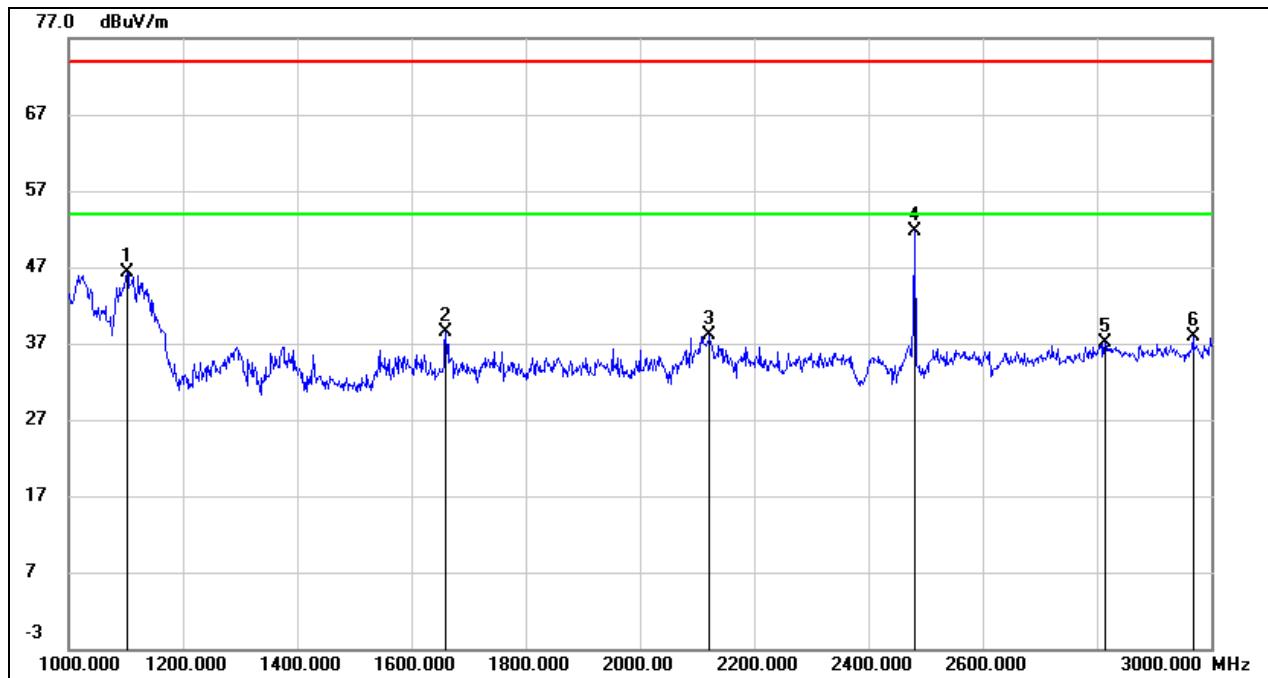
Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1060.000	57.88	-13.54	44.34	74.00	-29.66	peak
2	1746.000	48.70	-10.45	38.25	74.00	-35.75	peak
3	2104.000	47.00	-9.13	37.87	74.00	-36.13	peak
4	2364.000	44.36	-7.98	36.38	74.00	-37.62	peak
5	2516.000	43.30	-7.25	36.05	74.00	-37.95	peak
6	2812.000	43.61	-6.00	37.61	74.00	-36.39	peak

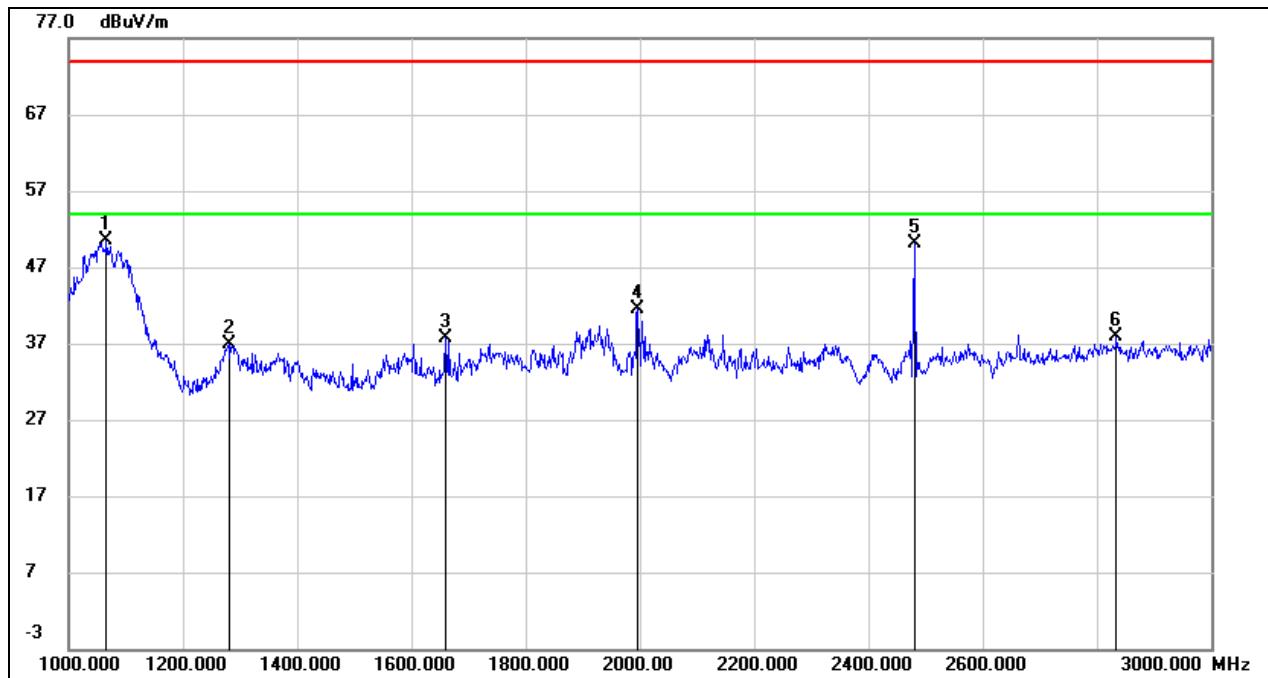
Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (CHANNEL26, HORIZONTAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1102.000	59.78	-13.51	46.27	74.00	-27.73	peak
2	1660.000	49.53	-11.10	38.43	74.00	-35.57	peak
3	2122.000	47.08	-9.05	38.03	74.00	-35.97	peak
4	2480.000	58.93	-7.28	51.65	/	/	fundamental
5	2814.000	43.02	-5.98	37.04	74.00	-36.96	peak
6	2968.000	43.36	-5.38	37.98	74.00	-36.02	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

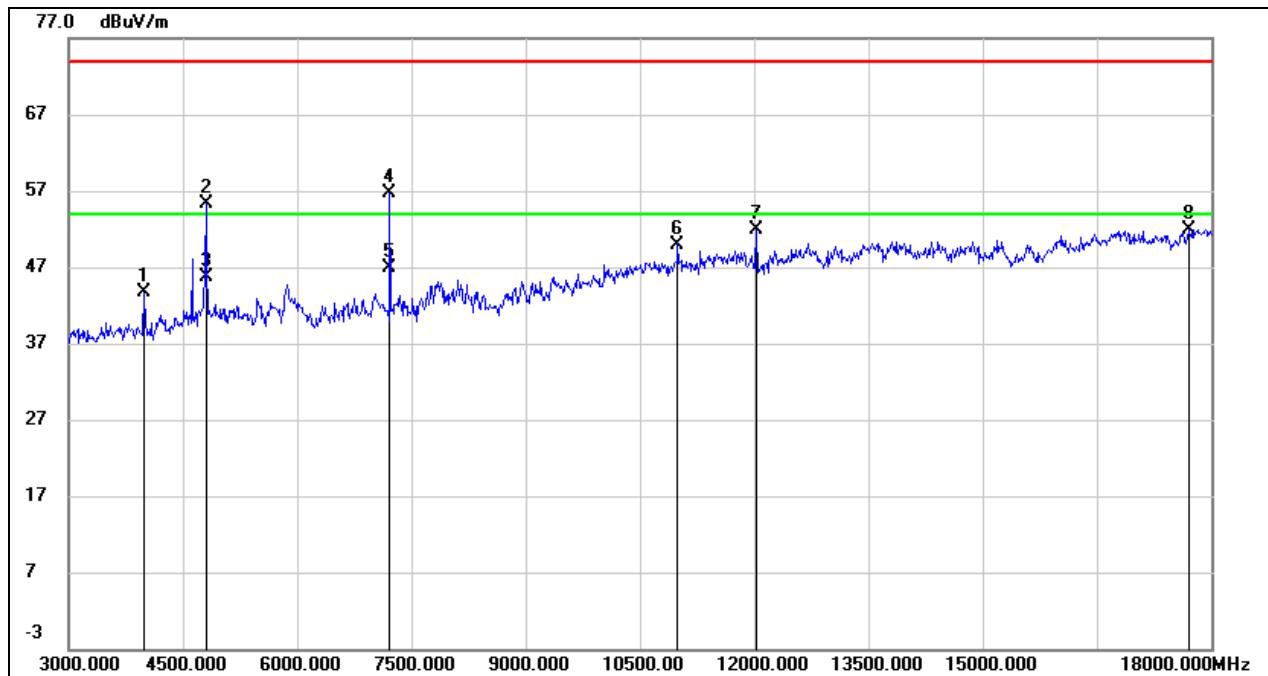
HARMONICS AND SPURIOUS EMISSIONS (CHANNEL26, VERTICAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1066.000	63.98	-13.54	50.44	74.00	-23.56	peak
2	1280.000	49.30	-12.41	36.89	74.00	-37.11	peak
3	1660.000	48.76	-11.10	37.66	74.00	-36.34	peak
4	1996.000	51.35	-9.83	41.52	74.00	-32.48	peak
5	2480.000	57.40	-7.31	50.09	/	/	fundamental
6	2834.000	43.76	-5.88	37.88	74.00	-36.12	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

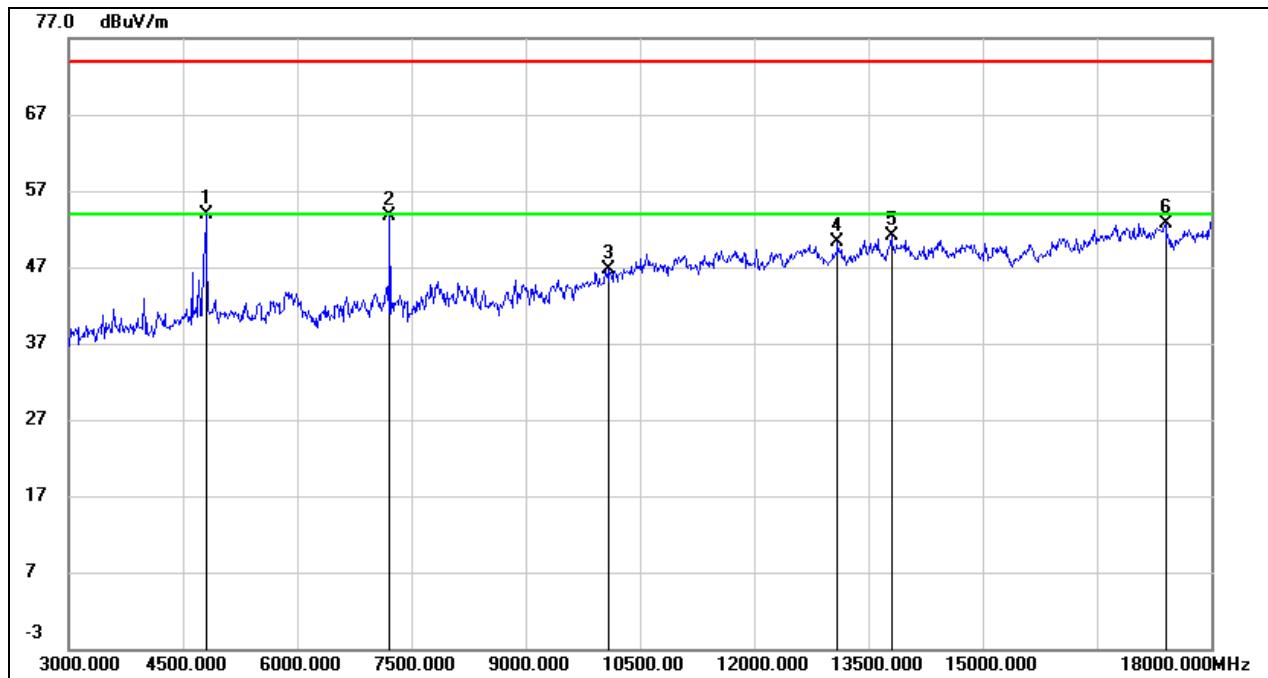
### 7.3. SPURIOUS EMISSIONS (3~18GHz)

#### HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



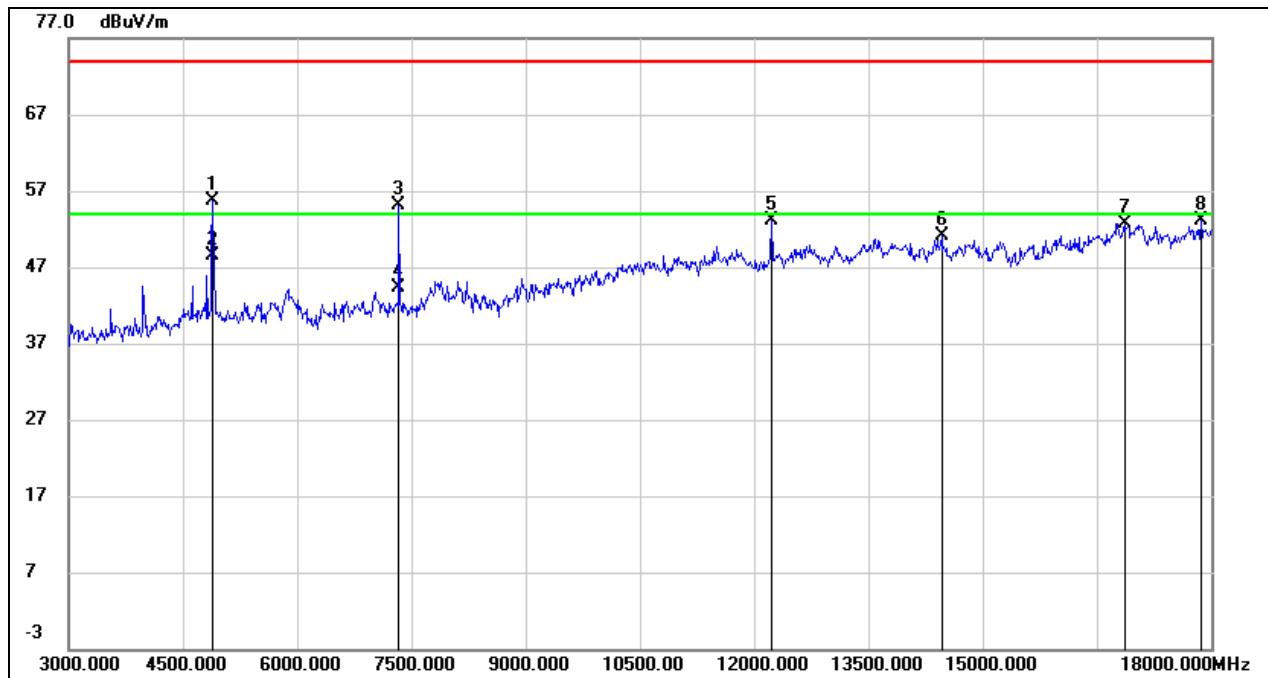
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3990.000	46.56	-2.89	43.67	74.00	-30.33	peak
2	4810.889	54.89	0.50	55.39	74.00	-18.61	peak
3	4810.889	45.28	0.50	45.78	54.00	-8.22	AVG
4	7216.339	50.88	5.85	56.73	74.00	-17.27	peak
5	7216.339	41.08	5.85	46.93	54.00	-7.07	AVG
6	10995.000	37.40	12.60	50.00	74.00	-24.00	peak
7	12030.000	38.28	13.57	51.85	74.00	-22.15	peak
8	17715.000	29.39	22.56	51.95	74.00	-22.05	peak

Note: 1. Peak Result = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. AVG: VBW=1/Ton, where: Ton is the transmitting duration.  
5. For the transmitting duration, please refer to clause 7.1.  
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.  
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

**HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)**

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4800.000	53.51	0.46	53.97	74.00	-20.03	peak
2	7215.000	47.76	5.85	53.61	74.00	-20.39	peak
3	10095.000	36.12	10.55	46.67	74.00	-27.33	peak
4	13095.000	35.05	15.20	50.25	74.00	-23.75	peak
5	13800.000	33.93	17.10	51.03	74.00	-22.97	peak
6	17400.000	31.22	21.41	52.63	74.00	-21.37	peak

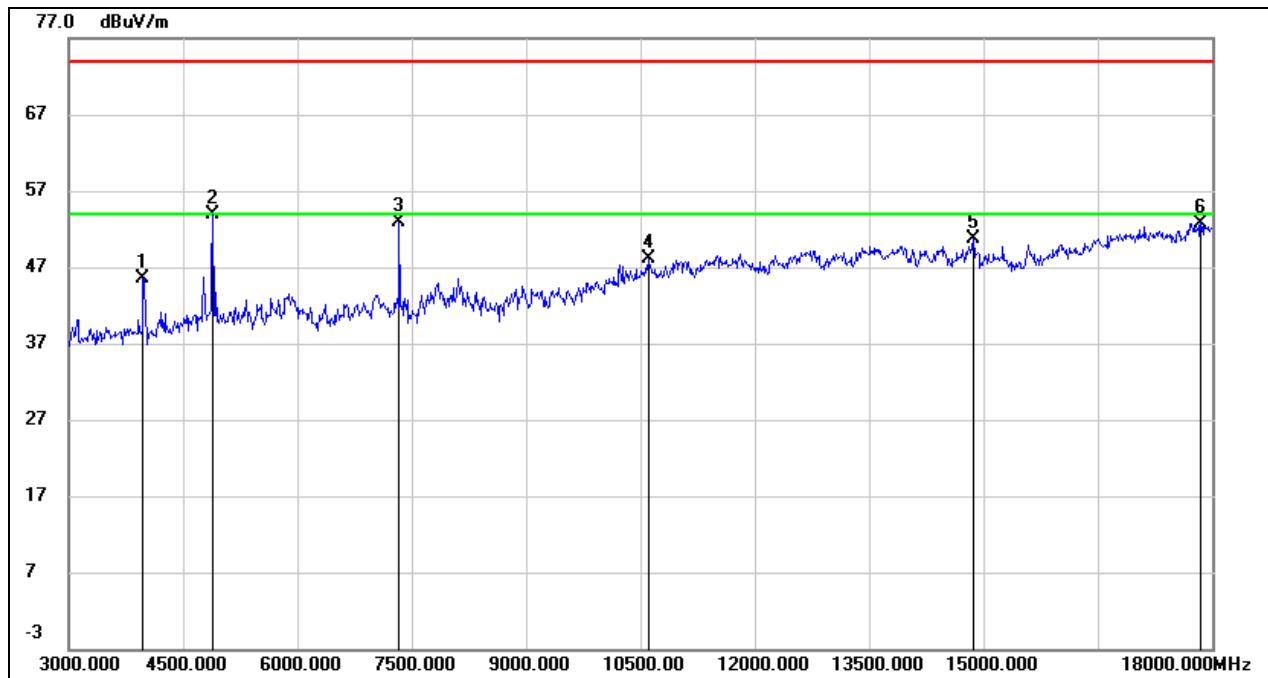
Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. The High Pass filter loss factor already add into the correct factor.  
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4892.717	54.83	0.83	55.66	74.00	-18.34	peak
2	4892.717	47.75	0.83	48.58	54.00	-5.42	AVG
3	7336.259	48.90	6.21	55.11	74.00	-18.89	peak
4	7336.259	38.05	6.21	44.26	54.00	-9.74	AVG
5	12225.000	39.34	13.81	53.15	74.00	-20.85	peak
6	14460.000	34.69	16.36	51.05	74.00	-22.95	peak
7	16860.000	32.83	19.95	52.78	74.00	-21.22	peak
8	17865.000	29.77	23.33	53.10	74.00	-20.90	peak

Note:

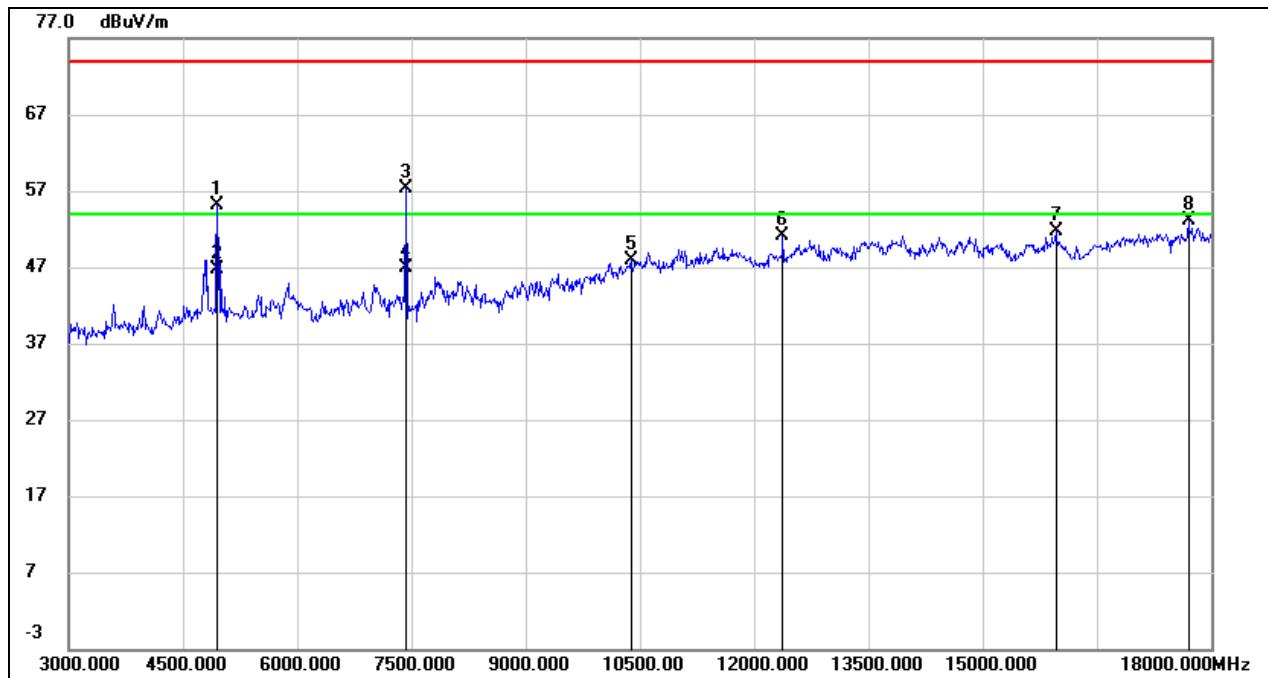
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. AVG:  $VBW=1/T_{on}$ , where:  $T_{on}$  is the transmitting duration.
5. For the transmitting duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3975.000	48.49	-2.90	45.59	74.00	-28.41	peak
2	4890.000	52.99	0.82	53.81	74.00	-20.19	peak
3	7335.000	46.67	6.21	52.88	74.00	-21.12	peak
4	10605.000	36.24	11.93	48.17	74.00	-25.83	peak
5	14865.000	34.74	15.98	50.72	74.00	-23.28	peak
6	17850.000	29.48	23.32	52.80	74.00	-21.20	peak

Note:

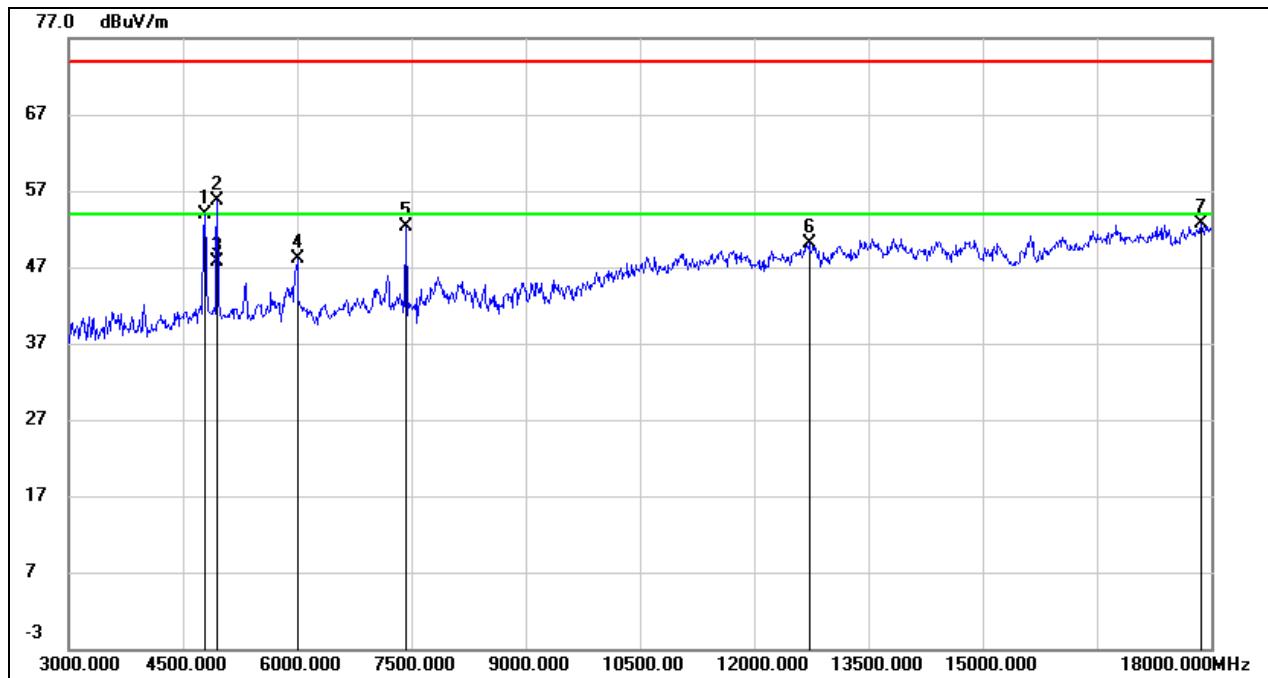
1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. The High Pass filter loss factor already add into the correct factor.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4952.737	53.97	1.14	55.11	74.00	-18.89	peak
2	4952.737	45.64	1.14	46.78	54.00	-7.22	AVG
3	7426.199	50.84	6.38	57.22	74.00	-16.78	peak
4	7426.199	40.53	6.38	46.91	54.00	-7.09	AVG
5	10380.000	37.00	11.00	48.00	74.00	-26.00	peak
6	12375.000	37.08	14.03	51.11	74.00	-22.89	peak
7	15960.000	33.98	17.63	51.61	74.00	-22.39	peak
8	17700.000	30.63	22.43	53.06	74.00	-20.94	peak

Note:

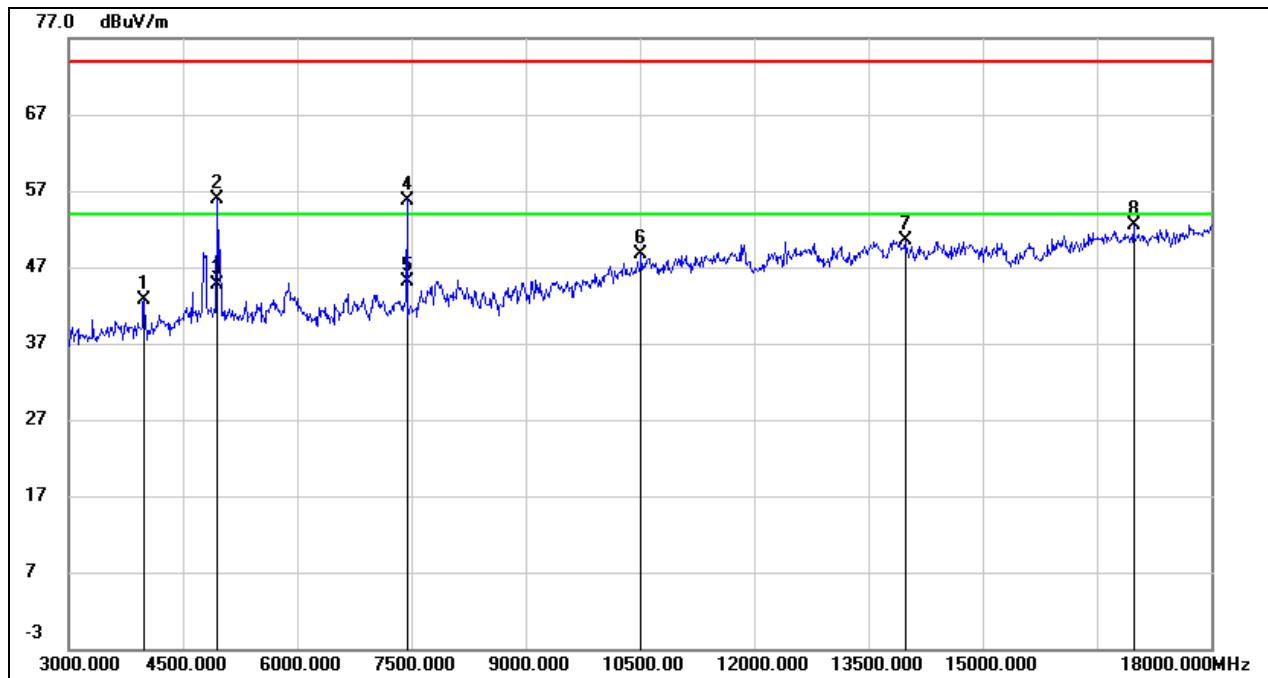
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. AVG:  $VBW=1/T_{on}$ , where:  $T_{on}$  is the transmitting duration.
5. For the transmitting duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4785.000	53.43	0.42	53.85	74.00	-20.15	peak
2	4952.777	54.59	1.14	55.73	74.00	-18.27	peak
3	4952.777	46.66	1.14	47.80	54.00	-6.20	AVG
4	6000.000	44.74	3.29	48.03	74.00	-25.97	peak
5	7425.000	45.91	6.39	52.30	74.00	-21.70	peak
6	12720.000	35.48	14.57	50.05	74.00	-23.95	peak
7	17865.000	29.35	23.33	52.68	74.00	-21.32	peak

Note:

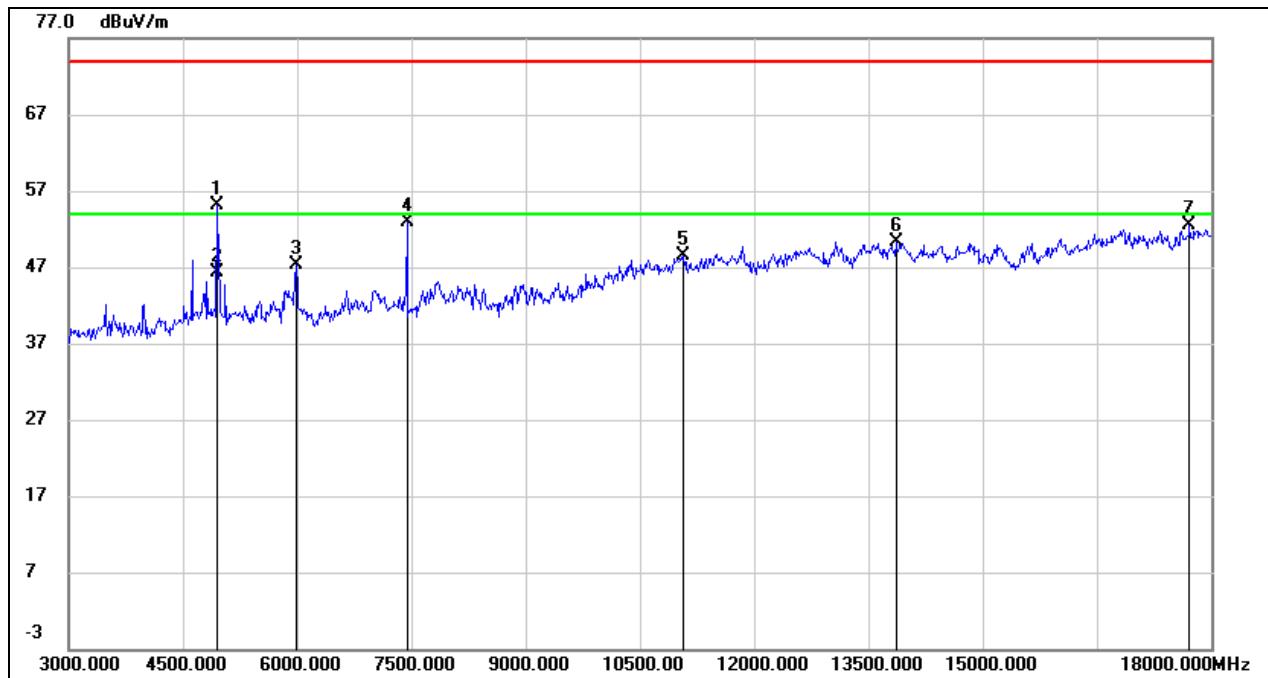
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. AVG:  $VBW=1/T_{on}$ , where:  $T_{on}$  is the transmitting duration.
5. For the transmitting duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (CHANNEL26, HORIZONTAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3990.000	45.53	-2.89	42.64	74.00	-31.36	peak
2	4961.049	54.79	1.18	55.97	74.00	-18.03	peak
3	4961.049	43.55	1.18	44.73	54.00	-9.27	AVG
4	7441.319	49.49	6.31	55.80	74.00	-18.20	peak
5	7441.319	38.72	6.31	45.03	54.00	-8.97	AVG
6	10515.000	37.14	11.47	48.61	74.00	-25.39	peak
7	13980.000	34.46	16.07	50.53	74.00	-23.47	peak
8	16980.000	32.21	20.31	52.52	74.00	-21.48	peak

Note:

1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. AVG:  $VBW=1/T_{on}$ , where:  $T_{on}$  is the transmitting duration.
5. For the transmitting duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (CHANNEL26, VERTICAL)

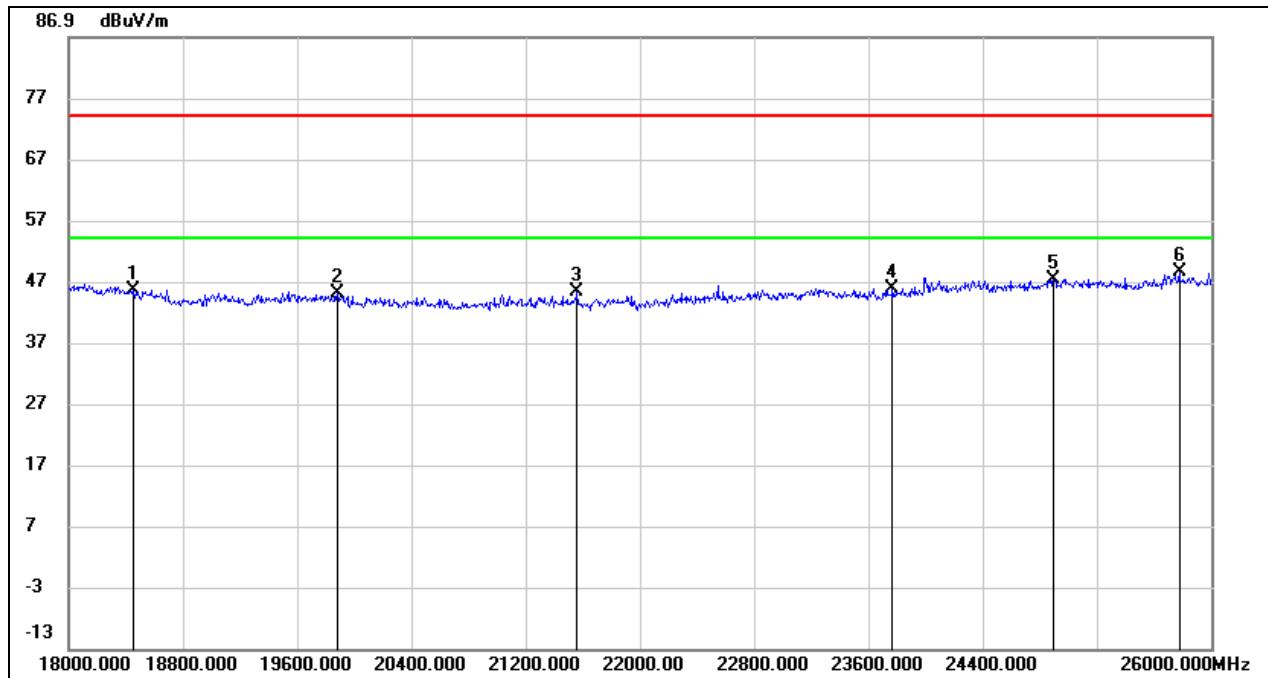
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4962.747	53.99	1.20	55.19	74.00	-18.81	peak
2	4962.747	45.05	1.20	46.25	54.00	-7.75	AVG
3	5985.000	43.74	3.54	47.28	74.00	-26.72	peak
4	7440.000	46.53	6.32	52.85	74.00	-21.15	peak
5	11070.000	35.86	12.58	48.44	74.00	-25.56	peak
6	13860.000	33.68	16.56	50.24	74.00	-23.76	peak
7	17715.000	29.89	22.56	52.45	74.00	-21.55	peak

Note:

1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. AVG:  $VBW=1/Ton$ , where: Ton is the transmitting duration.
5. For the transmitting duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

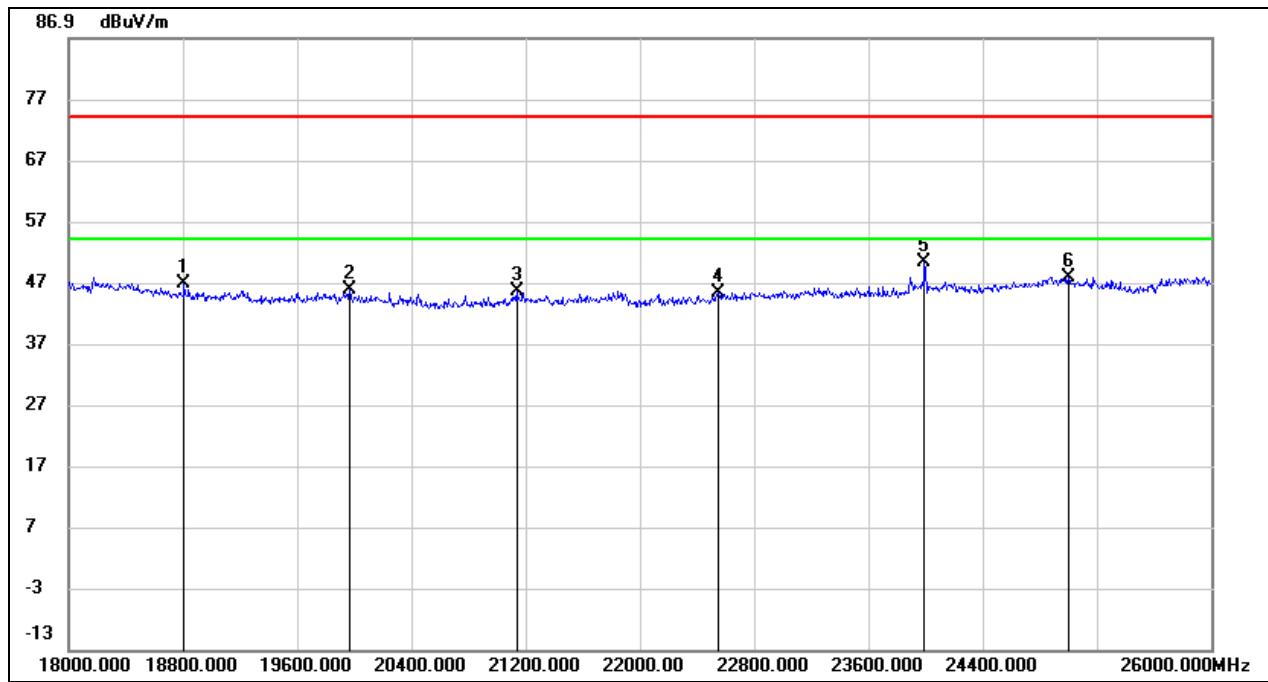
## 7.4. SPURIOUS EMISSIONS 18G ~ 26GHz

### SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18456.000	49.93	-4.38	45.55	74.00	-28.45	peak
2	19880.000	49.35	-4.36	44.99	74.00	-29.01	peak
3	21560.000	51.06	-5.77	45.29	74.00	-28.71	peak
4	23768.000	50.29	-4.59	45.70	74.00	-28.30	peak
5	24896.000	48.77	-1.44	47.33	74.00	-26.67	peak
6	25776.000	49.92	-1.45	48.47	74.00	-25.53	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
 3. Peak: Peak detector.  
 4. Proper operation of the transmitter prior to adding the filter to the measurement chain.

**SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)**

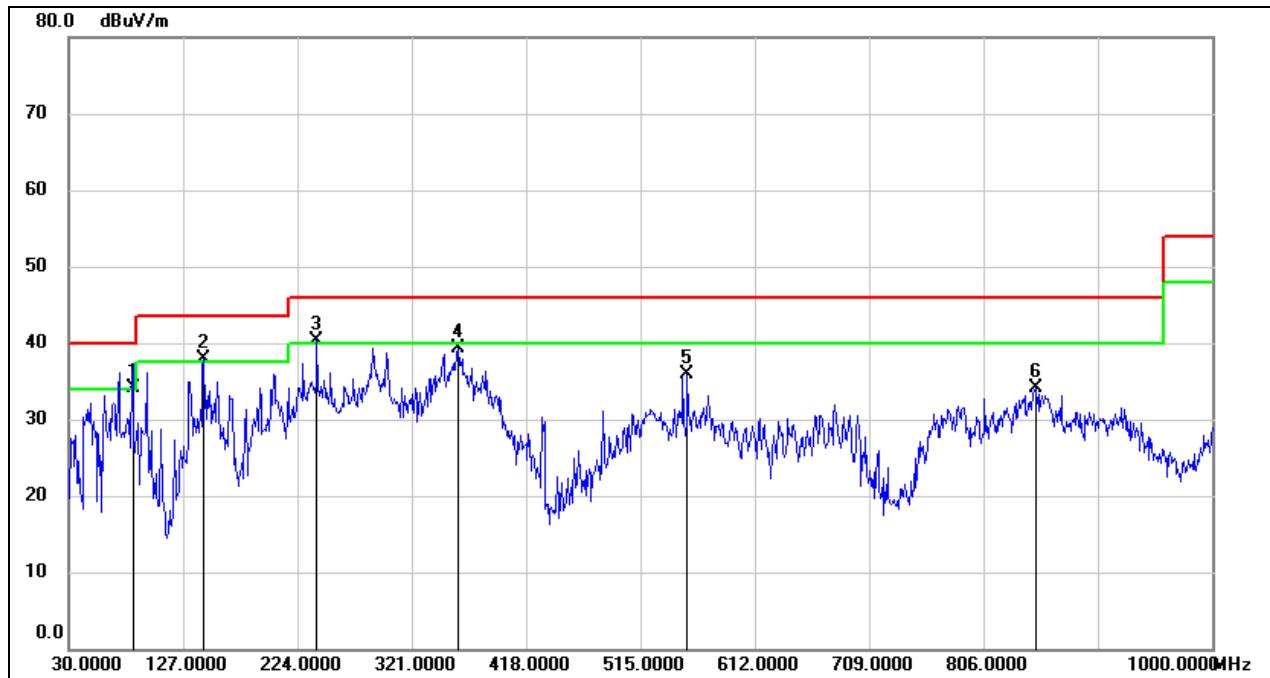
No.	Frequency (MHz)	Reading (dB <sub>UV</sub> )	Correct (dB/m)	Result (dB <sub>UV</sub> /m)	Limit (dB <sub>UV</sub> /m)	Margin (dB)	Remark
1	18808.000	51.55	-4.85	46.70	74.00	-27.30	peak
2	19968.000	50.23	-4.36	45.87	74.00	-28.13	peak
3	21136.000	50.86	-5.41	45.45	74.00	-28.55	peak
4	22552.000	51.17	-5.78	45.39	74.00	-28.61	peak
5	23992.000	54.22	-4.03	50.19	74.00	-23.81	peak
6	25000.000	48.96	-1.08	47.88	74.00	-26.12	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
 3. Peak: Peak detector.  
 4. Proper operation of the transmitter prior to adding the filter to the measurement chain.

Note: All the modes had been tested, but only the worst data were recorded in the report.

## 7.5. SPURIOUS EMISSIONS 30M ~ 1 GHz

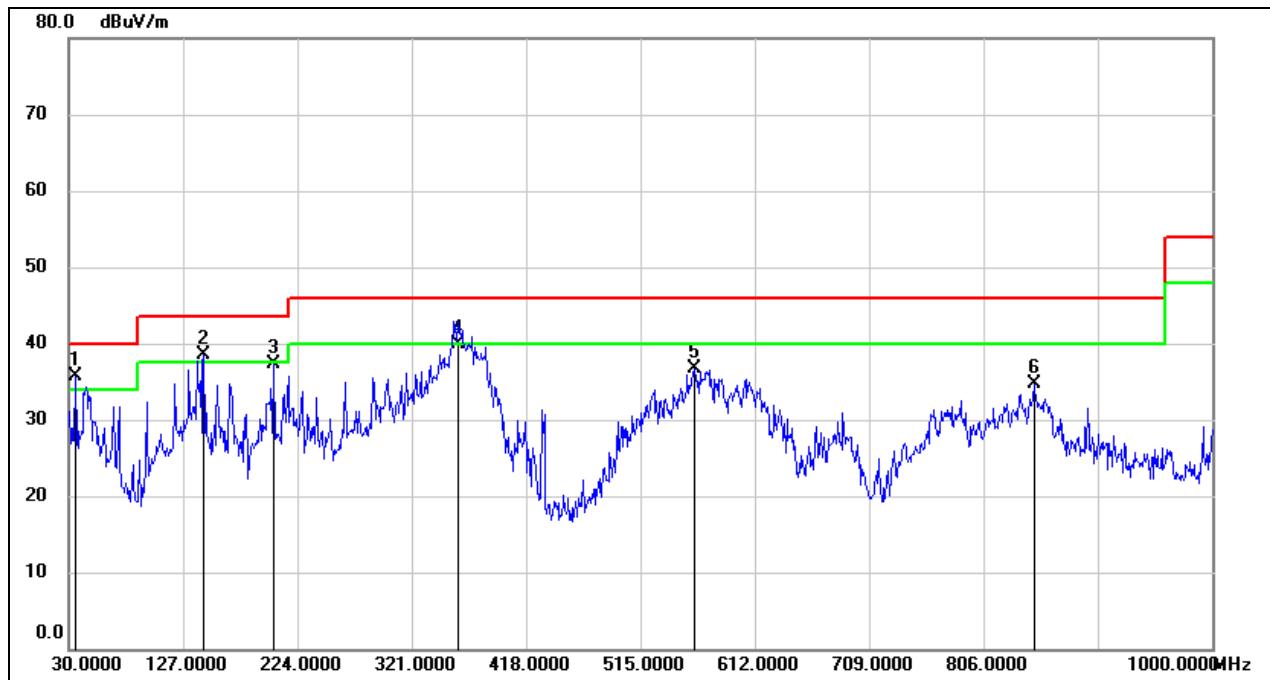
### SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	84.3200	55.92	-21.76	34.16	40.00	-5.84	QP
2	144.4600	56.67	-18.82	37.85	43.50	-5.65	QP
3	240.4900	59.65	-19.41	40.24	46.00	-5.76	QP
4	360.7700	53.56	-14.29	39.27	46.00	-6.73	QP
5	554.7700	46.56	-10.70	35.86	46.00	-10.14	QP
6	850.6200	40.88	-6.76	34.12	46.00	-11.88	QP

Note: 1. Result Level = Read Level + Correct Factor.

2. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	35.8200	55.30	-19.62	35.68	40.00	-4.32	QP
2	144.4600	57.29	-18.82	38.47	43.50	-5.03	QP
3	203.6300	54.06	-16.81	37.25	43.50	-6.25	QP
4	359.8000	54.19	-14.32	39.87	46.00	-6.13	QP
5	560.5900	47.38	-10.63	36.75	46.00	-9.25	QP
6	848.6800	41.43	-6.80	34.63	46.00	-11.37	QP

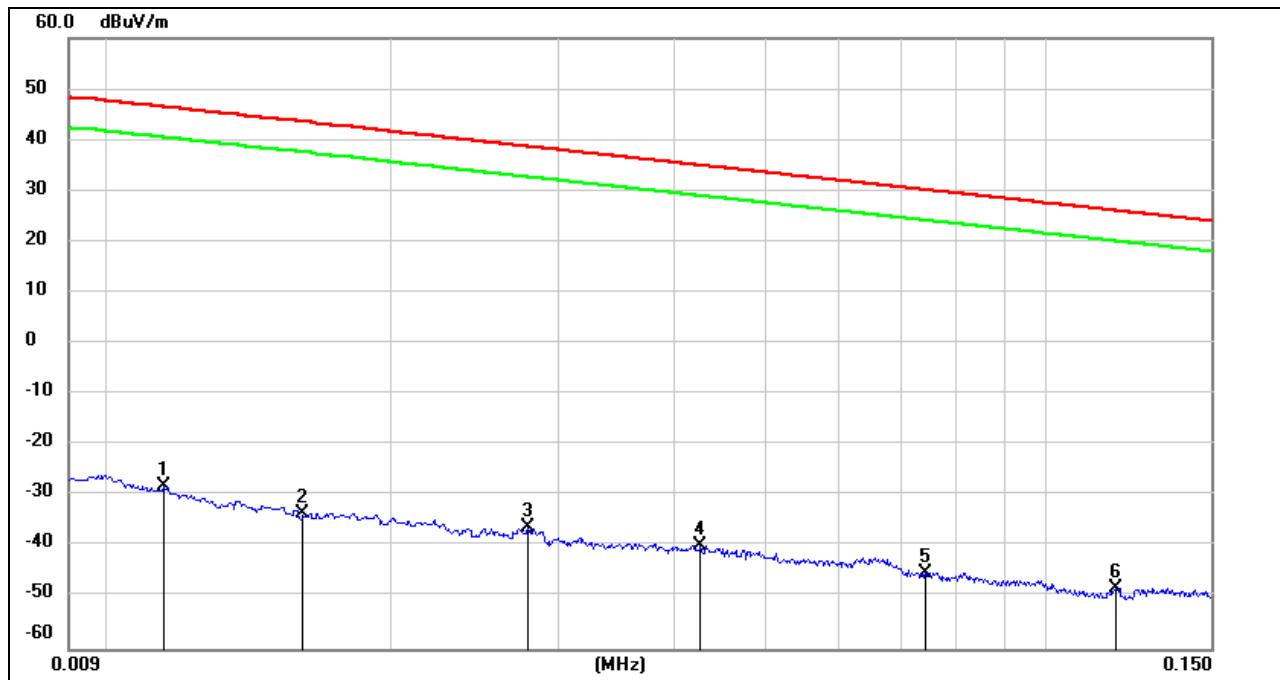
Note: 1. Result Level = Read Level + Correct Factor.  
2. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Note: All the modes had been tested, but only the worst data were recorded in the report.

## 7.6. SPURIOUS EMISSIONS BELOW 30M

### SPURIOUS EMISSIONS (MID CHANNEL, LOOP ANTENNA FACE ON TO THE EUT, WORST-CASE CONFIGURATION)

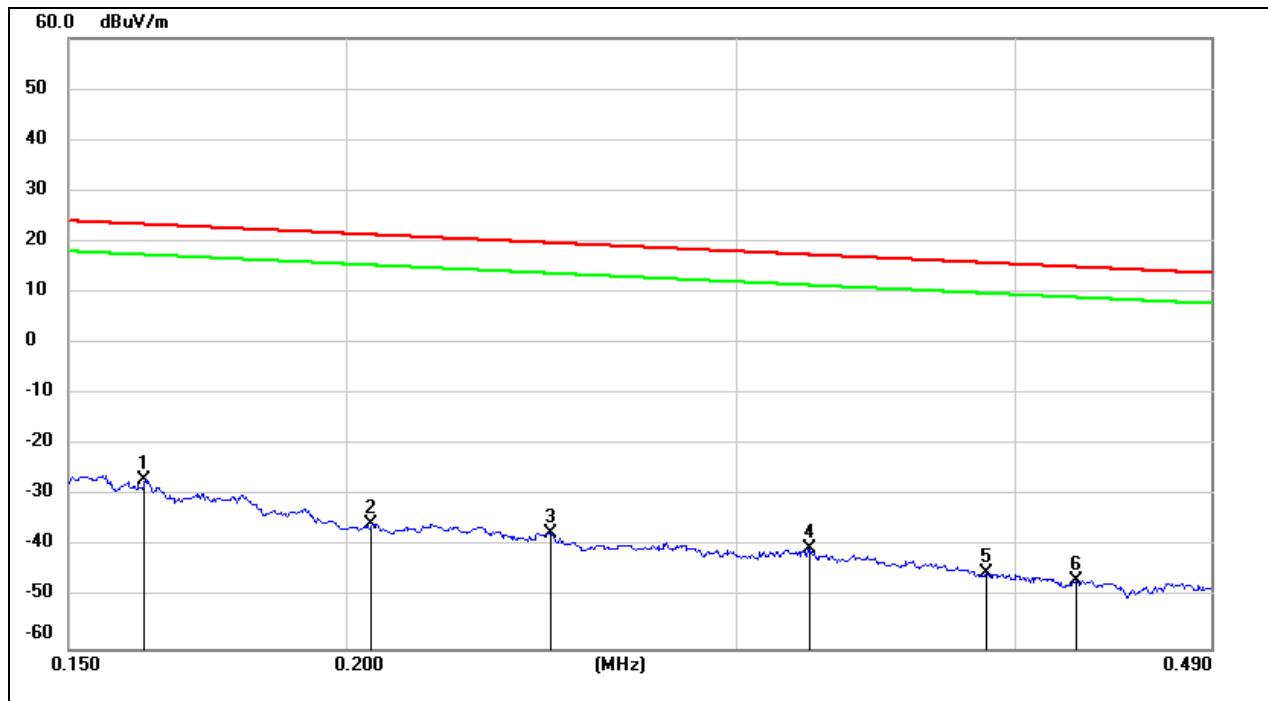
9kHz~ 150kHz



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	FCC Result (dBuV/m)	FCC Limit (dBuV/m)	Margin (dB)	Remark
1	0.0114	73.38	-101.40	-28.02	46.46	-74.48	peak
2	0.0160	67.97	-101.37	-33.40	43.52	-76.92	peak
3	0.0279	65.17	-101.38	-36.21	38.69	-74.90	peak
4	0.0427	61.64	-101.45	-39.81	34.99	-74.80	peak
5	0.0743	56.58	-101.59	-45.01	30.18	-75.19	peak
6	0.1188	53.56	-101.74	-48.18	26.11	-74.29	peak

Note:

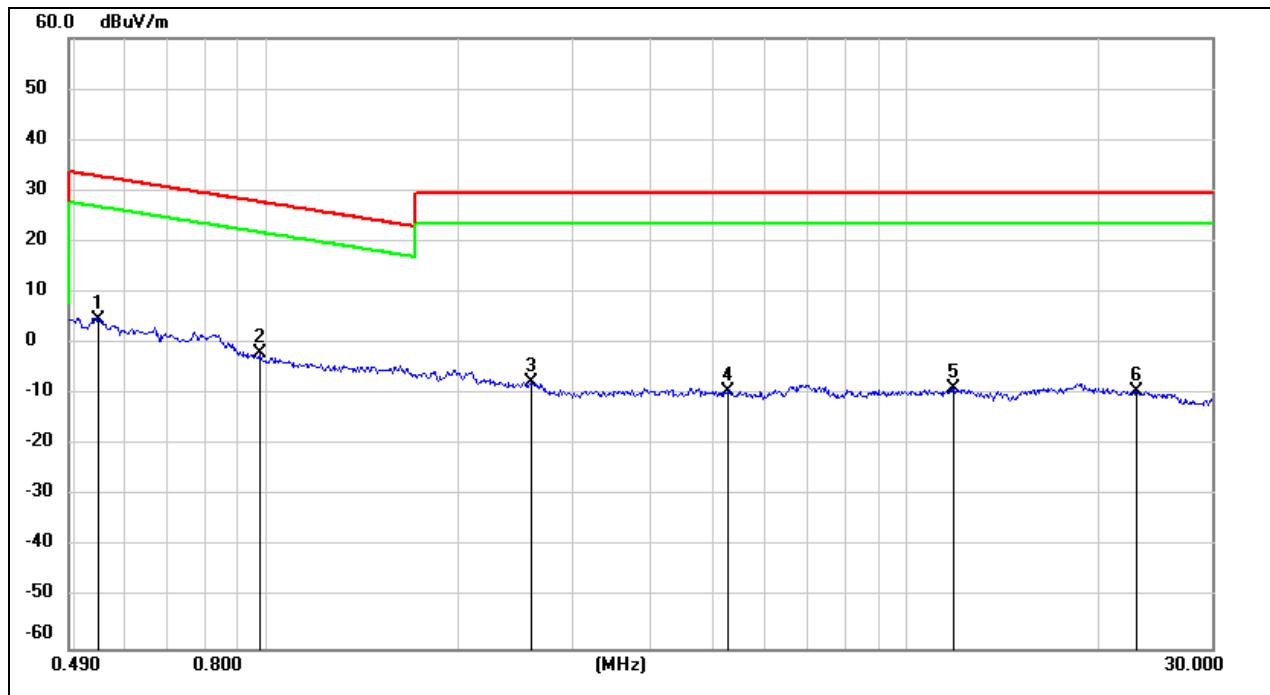
1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations(Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

150kHz ~ 490kHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	FCC Result (dBuV/m)	FCC Limit (dBuV/m)	Margin (dB)	Remark
1	0.1621	74.92	-101.65	-26.73	23.41	-50.14	peak
2	0.2053	66.29	-101.73	-35.44	21.35	-56.79	peak
3	0.2472	64.45	-101.80	-37.35	19.74	-57.09	peak
4	0.3234	61.48	-101.88	-40.40	17.41	-57.81	peak
5	0.3881	56.90	-101.95	-45.05	15.82	-60.87	peak
6	0.4259	55.38	-101.99	-46.61	15.02	-61.63	peak

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations(Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

490kHz ~ 30MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	FCC Result (dBuV/m)	FCC Limit (dBuV/m)	Margin (dB)	Remark
1	0.5453	66.87	-62.08	4.79	32.87	-28.08	peak
2	0.9737	60.21	-62.25	-2.04	27.83	-29.87	peak
3	2.5935	54.11	-61.68	-7.57	29.54	-37.11	peak
4	5.2705	52.04	-61.45	-9.41	29.54	-38.95	peak
5	11.8513	52.06	-60.88	-8.82	29.54	-38.36	peak
6	22.8881	51.11	-60.61	-9.50	29.54	-39.04	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.  
3. All 3 polarizations(Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

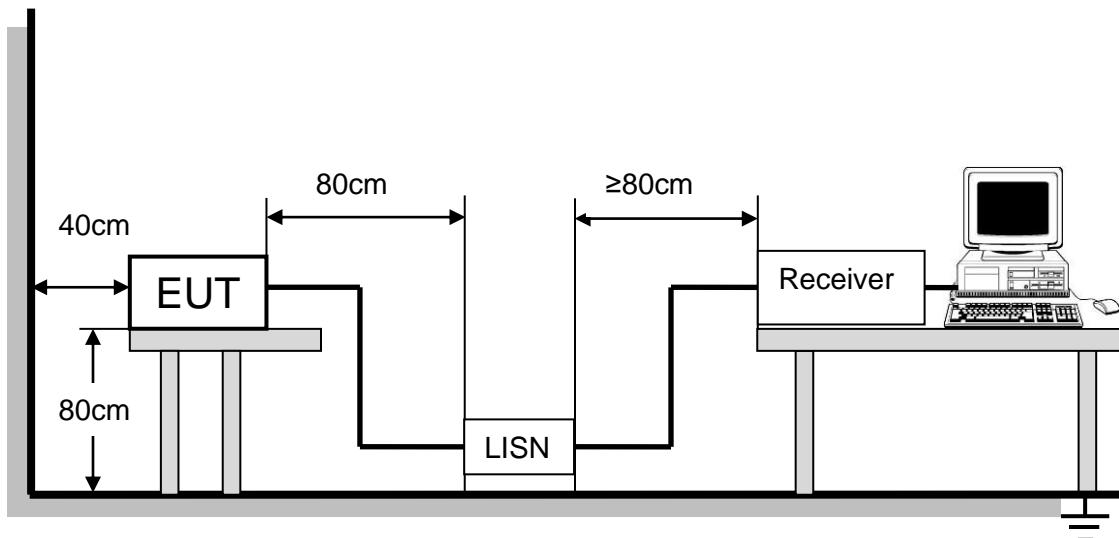
## 8. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

Please refer to CFR 47 FCC §15.207 (a) and ISED RSS-Gen Clause 8.8

FREQUENCY (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

### TEST SETUP AND PROCEDURE

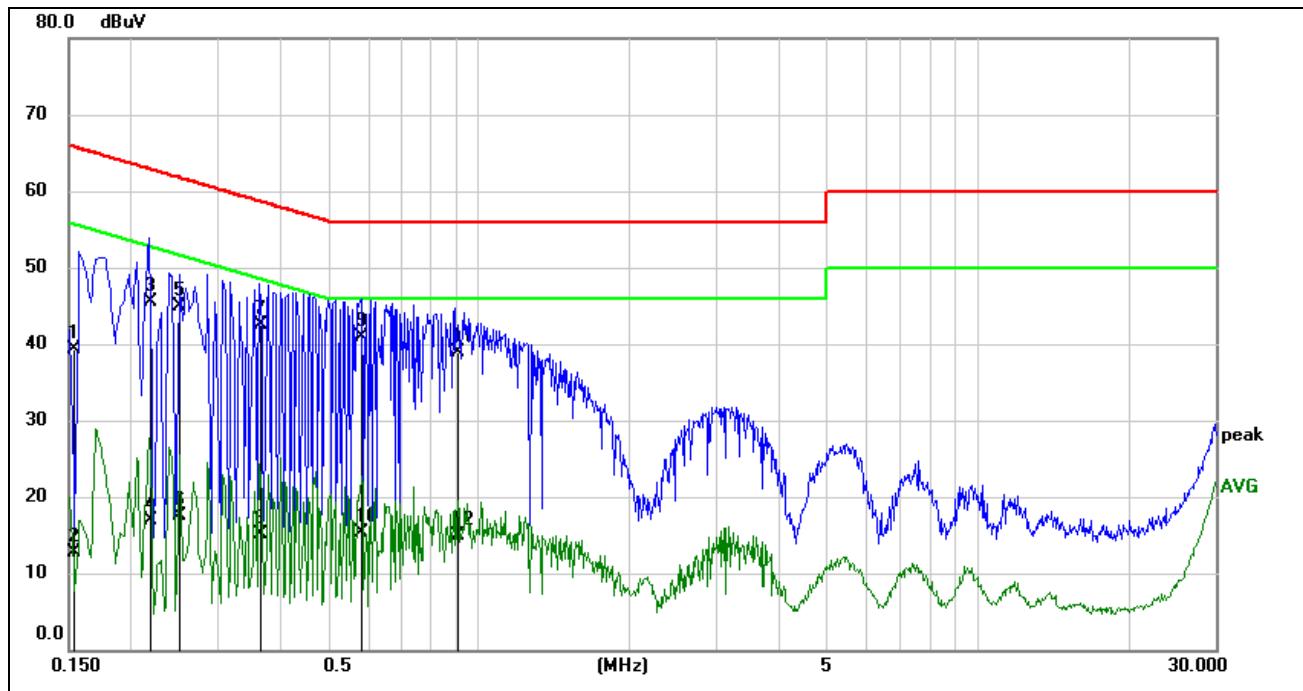


The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10 -2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

## TEST RESULTS

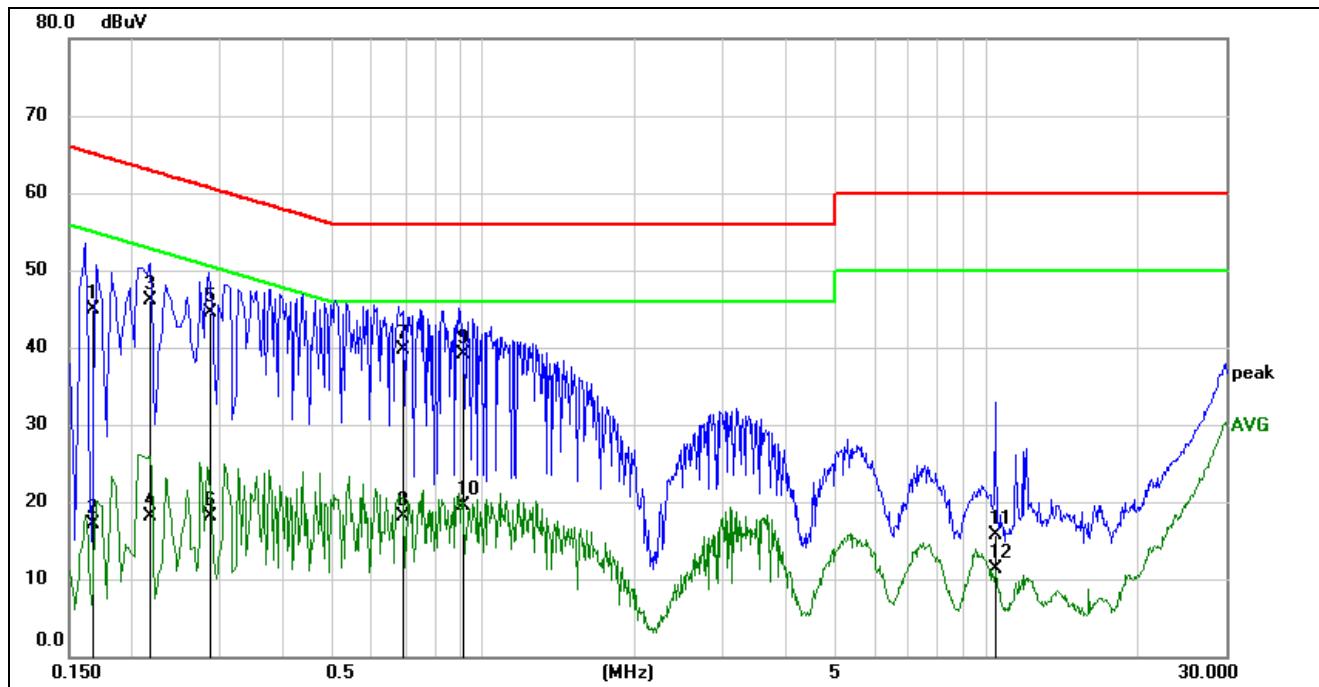
## LINE N RESULTS (LOW CHANNEL, WORST-CASE CONFIGURATION)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1532	29.67	9.60	39.27	65.82	-26.55	QP
2	0.1532	3.13	9.60	12.73	55.82	-43.09	AVG
3	0.2191	35.95	9.60	45.55	62.85	-17.30	QP
4	0.2191	7.30	9.60	16.90	52.85	-35.95	AVG
5	0.2499	35.32	9.60	44.92	61.76	-16.84	QP
6	0.2499	7.90	9.60	17.50	51.76	-34.26	AVG
7	0.3638	32.87	9.60	42.47	58.64	-16.17	QP
8	0.3638	5.46	9.60	15.06	48.64	-33.58	AVG
9	0.5822	31.24	9.60	40.84	56.00	-15.16	QP
10	0.5822	5.80	9.60	15.40	46.00	-30.60	AVG
11	0.9095	29.33	9.60	38.93	56.00	-17.07	QP
12	0.9095	5.29	9.60	14.89	46.00	-31.11	AVG

Note:

1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

LINE L RESULTS (LOW CHANNEL, WORST-CASE CONFIGURATION)

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1663	35.32	9.61	44.93	65.14	-20.21	QP
2	0.1663	7.50	9.61	17.11	55.14	-38.03	AVG
3	0.2183	36.57	9.60	46.17	62.88	-16.71	QP
4	0.2183	8.41	9.60	18.01	52.88	-34.87	AVG
5	0.2866	34.93	9.60	44.53	60.62	-16.09	QP
6	0.2866	8.57	9.60	18.17	50.62	-32.45	AVG
7	0.6917	30.13	9.60	39.73	56.00	-16.27	QP
8	0.6917	8.41	9.60	18.01	46.00	-27.99	AVG
9	0.9087	29.58	9.60	39.18	56.00	-16.82	QP
10	0.9087	9.90	9.60	19.50	46.00	-26.50	AVG
11	10.3872	6.00	9.75	15.75	60.00	-44.25	QP
12	10.3872	1.53	9.75	11.28	50.00	-38.72	AVG

Note: 1. Result = Reading +Correct Factor.  
 2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.  
 3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).  
 4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

Note: All test mode has been tested, only the worst data record in the report.

## 9. ANTENNA REQUIREMENTS

### Applicable requirements

Please refer 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.247(b)(4)

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## RESULTS

Complies

## 10. Appendix

### 10.1. Appendix A: DTS Bandwidth

#### 10.1.1. Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIGBEE	Ant1	2405	1.815	2404.105	2405.920	0.5	PASS
		2445	1.630	2444.195	2445.825	0.5	PASS
		2475	1.590	2474.215	2475.805	0.5	PASS
		2480	1.815	2479.110	2480.925	0.5	PASS

## 10.1.2. Test Graphs



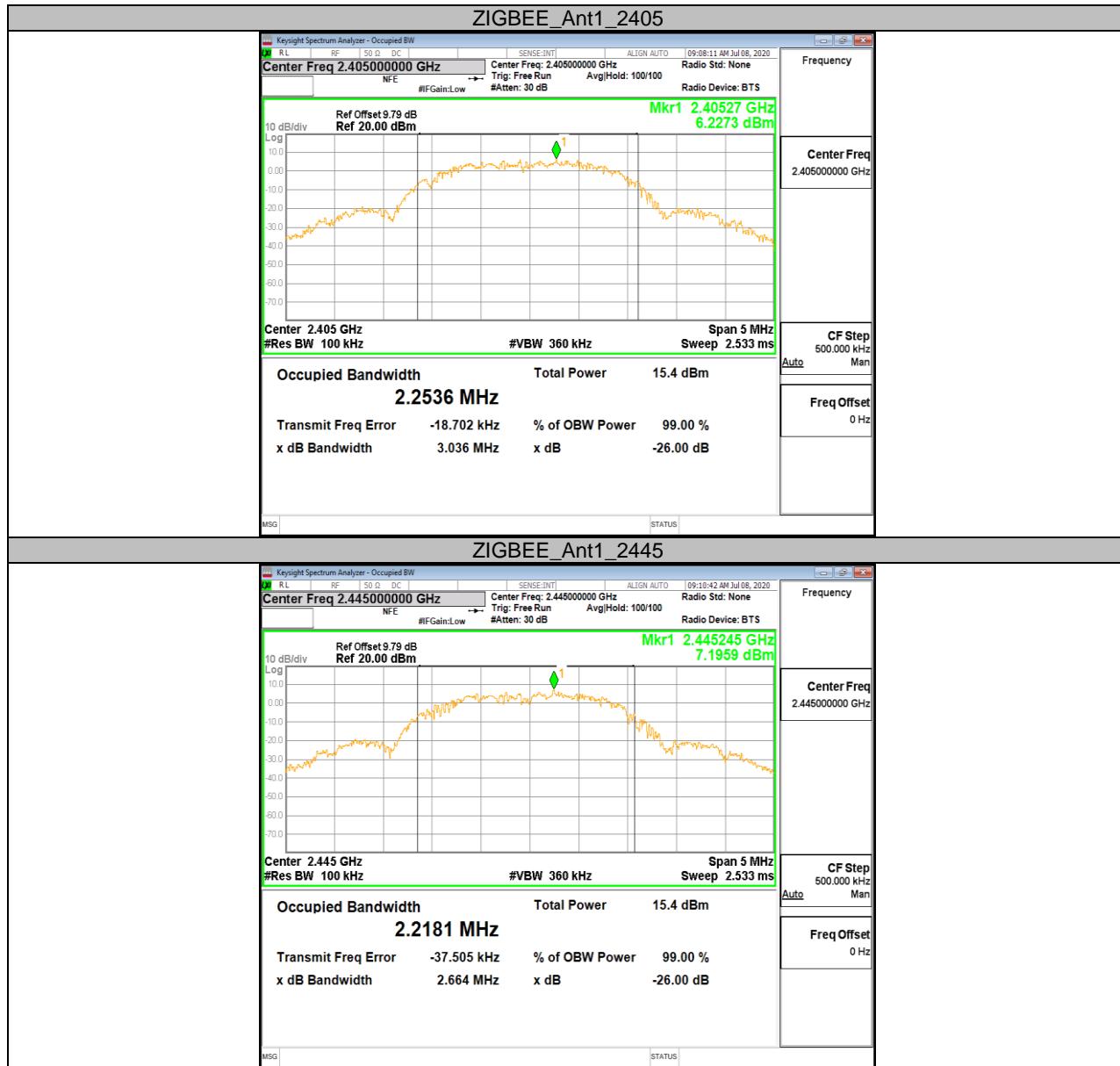


## 10.2. Appendix B: Occupied Channel Bandwidth

### 10.2.1. Test Result

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIGBEE	Ant1	2405	2.2536	2403.855	2406.108	---	PASS
		2445	2.2181	2443.853	2446.072	---	PASS
		2475	2.2427	2473.862	2476.104	---	PASS
		2480	2.2740	2478.850	2481.124	---	PASS

## 10.2.2. Test Graphs





### 10.3. Appendix C: Maximum conducted output peak power

#### 10.3.1. Test Result

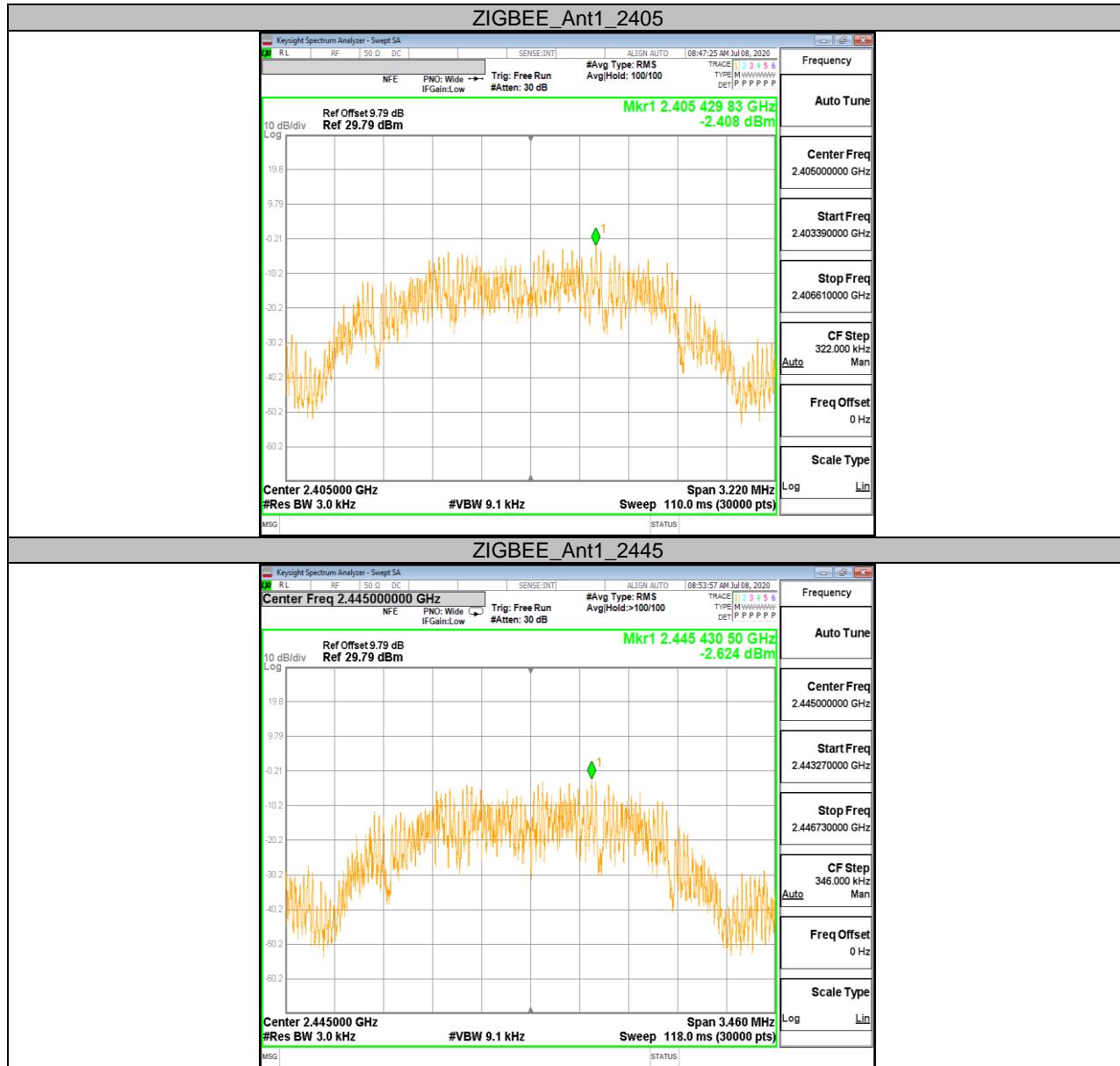
Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
ZIGBEE	Ant1	2405	10.93	<=30	PASS
		2445	11.00	<=30	PASS
		2475	10.89	<=30	PASS
		2480	11.00	<=30	PASS

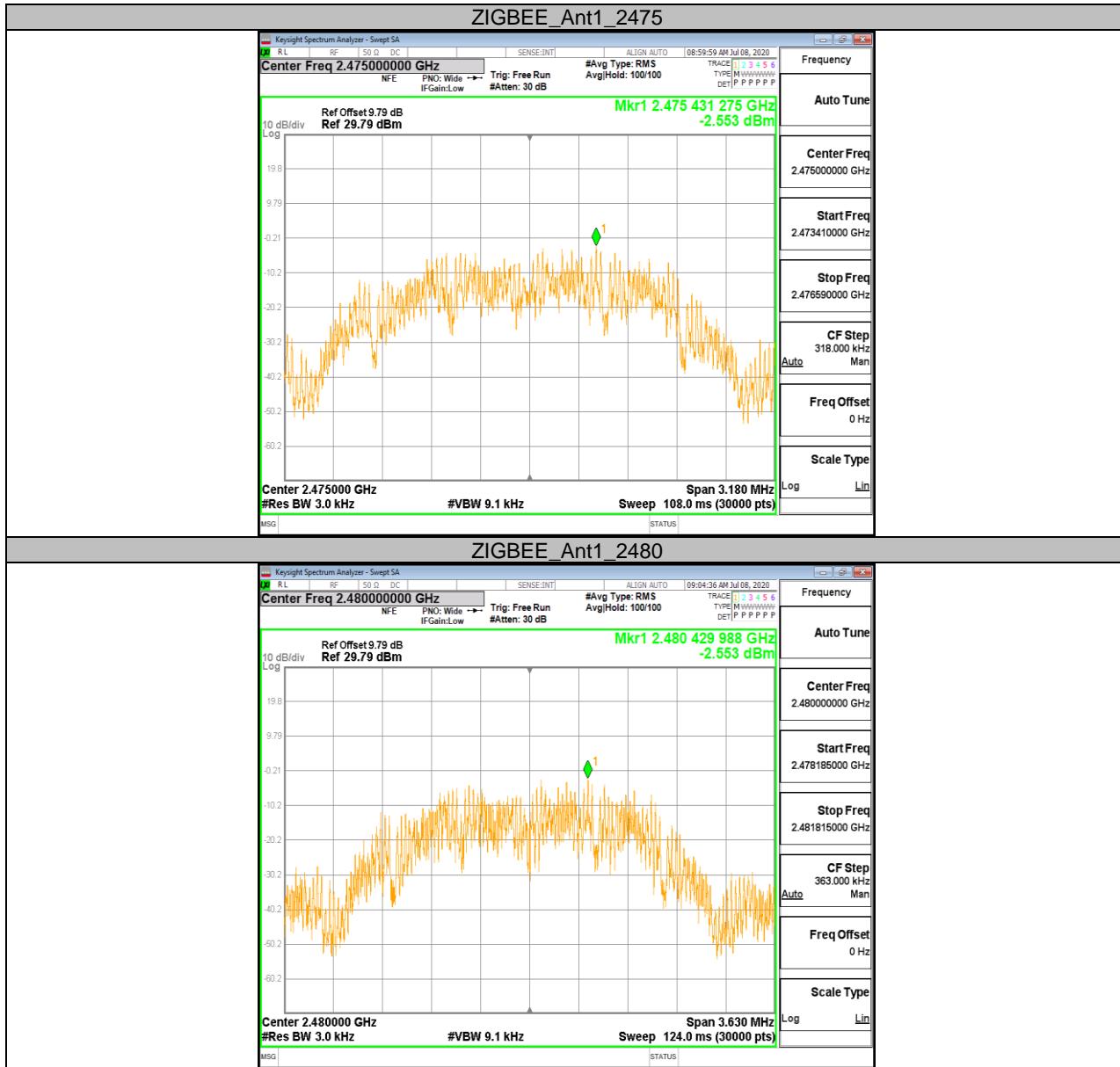
## 10.4. Appendix D: Maximum power spectral density

### 10.4.1. Test Result

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
ZIGBEE	Ant1	2405	-2.41	<=8	PASS
		2445	-2.62	<=8	PASS
		2475	-2.55	<=8	PASS
		2480	-2.55	<=8	PASS

### 10.4.2. Test Graphs



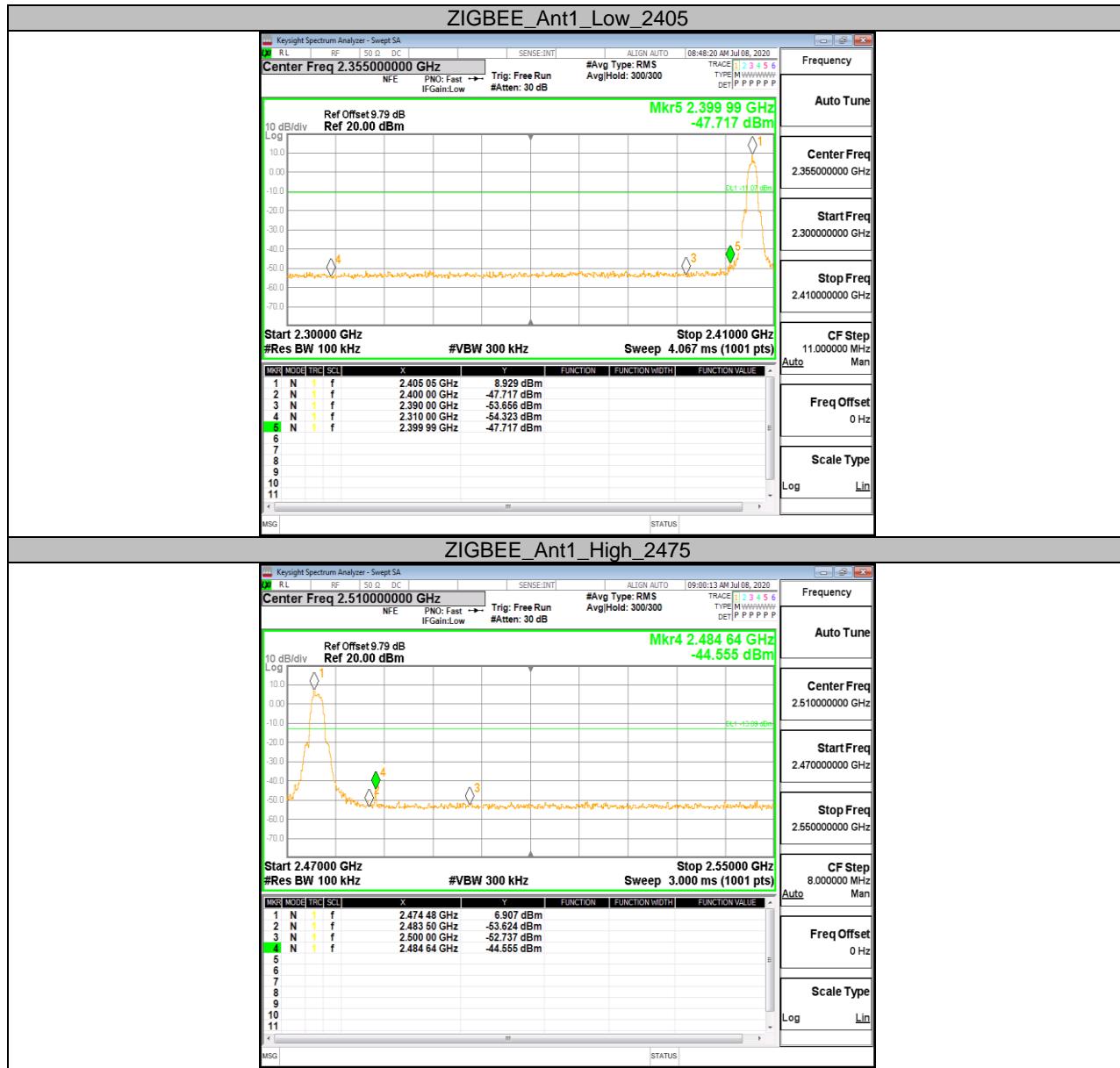


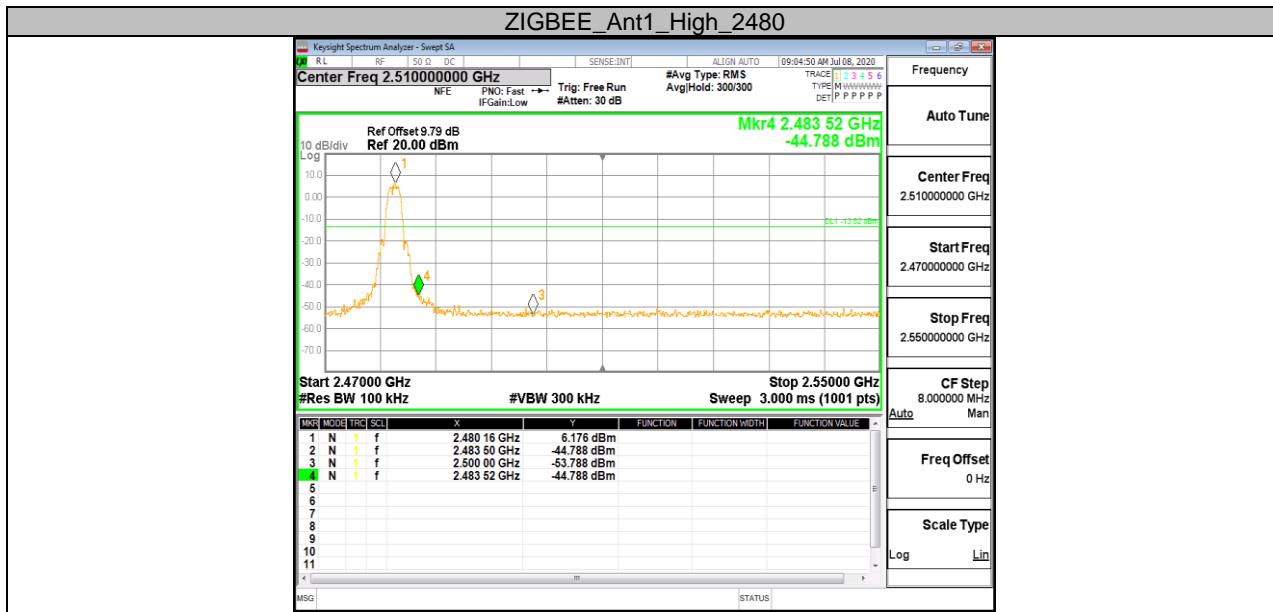
## 10.5. Appendix E: Band edge measurements

### 10.5.1. Test Result

Test Mode	Antenna	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIGBEE	Ant1	2405	8.93	-47.72	<=-11.07	PASS
		2475	6.91	-44.56	<=-13.09	PASS
		2480	6.18	-44.79	<=-13.82	PASS

## 10.5.2. Test Graphs



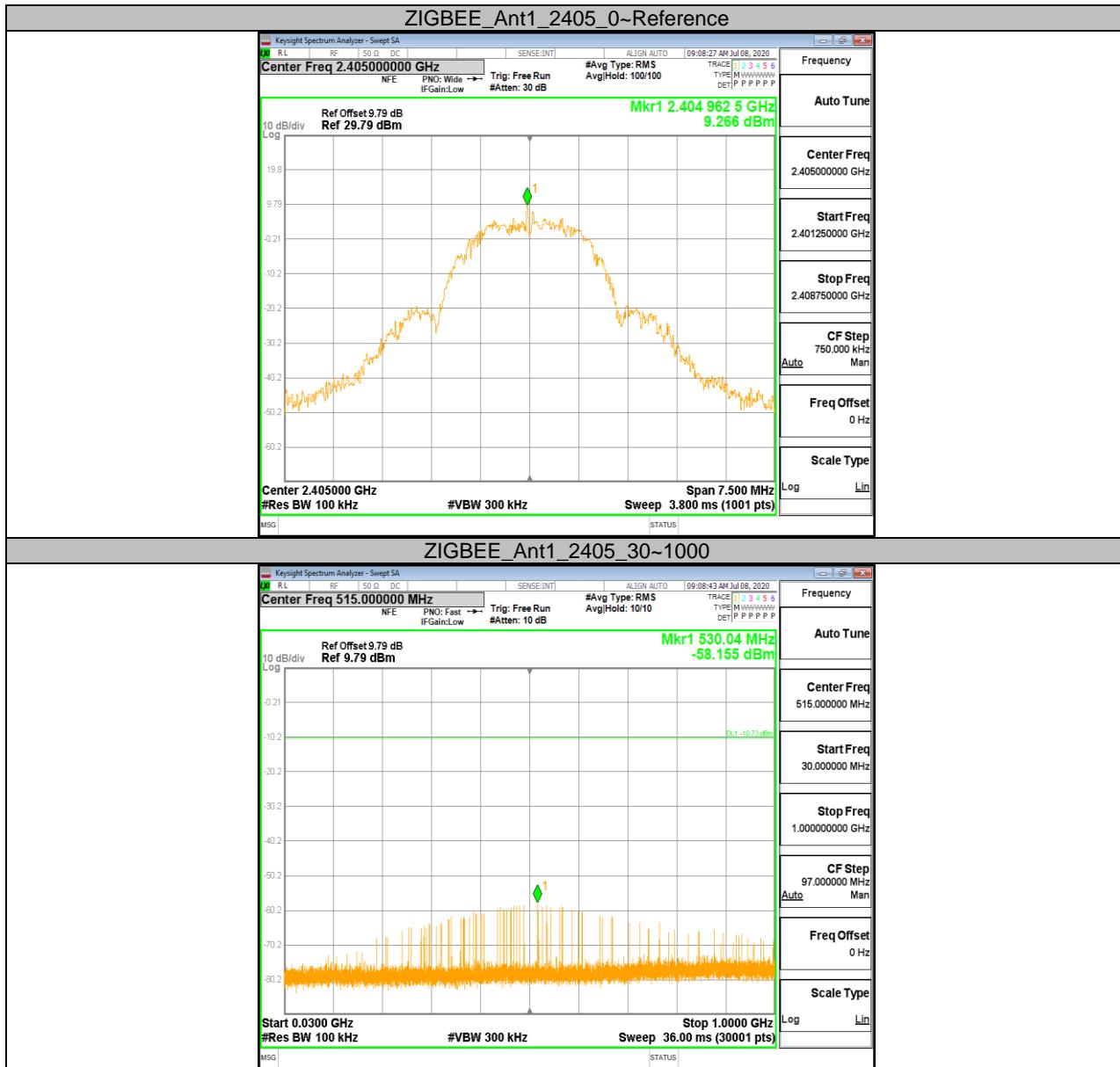


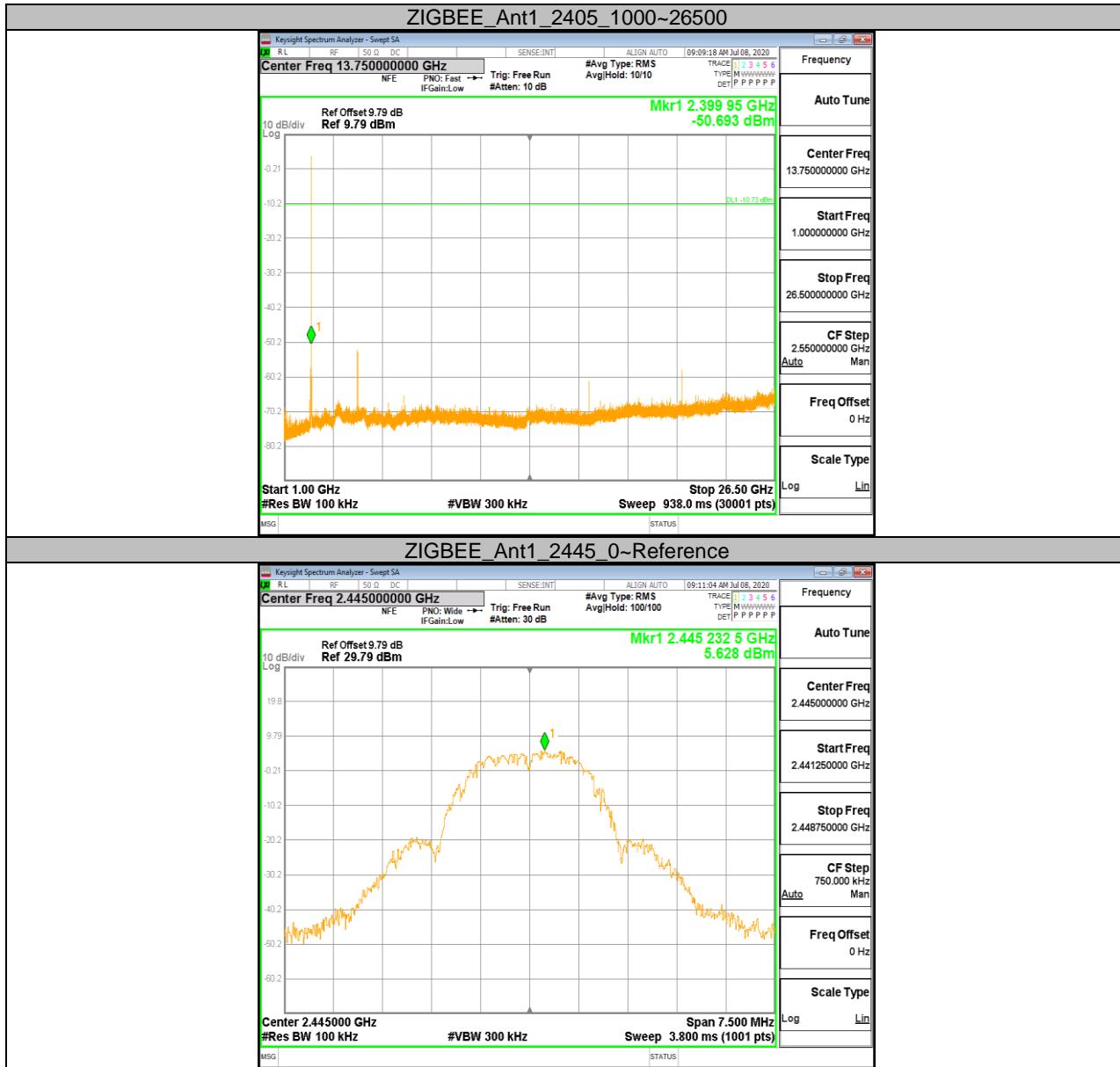
## 10.6. Appendix F: Conducted Spurious Emission

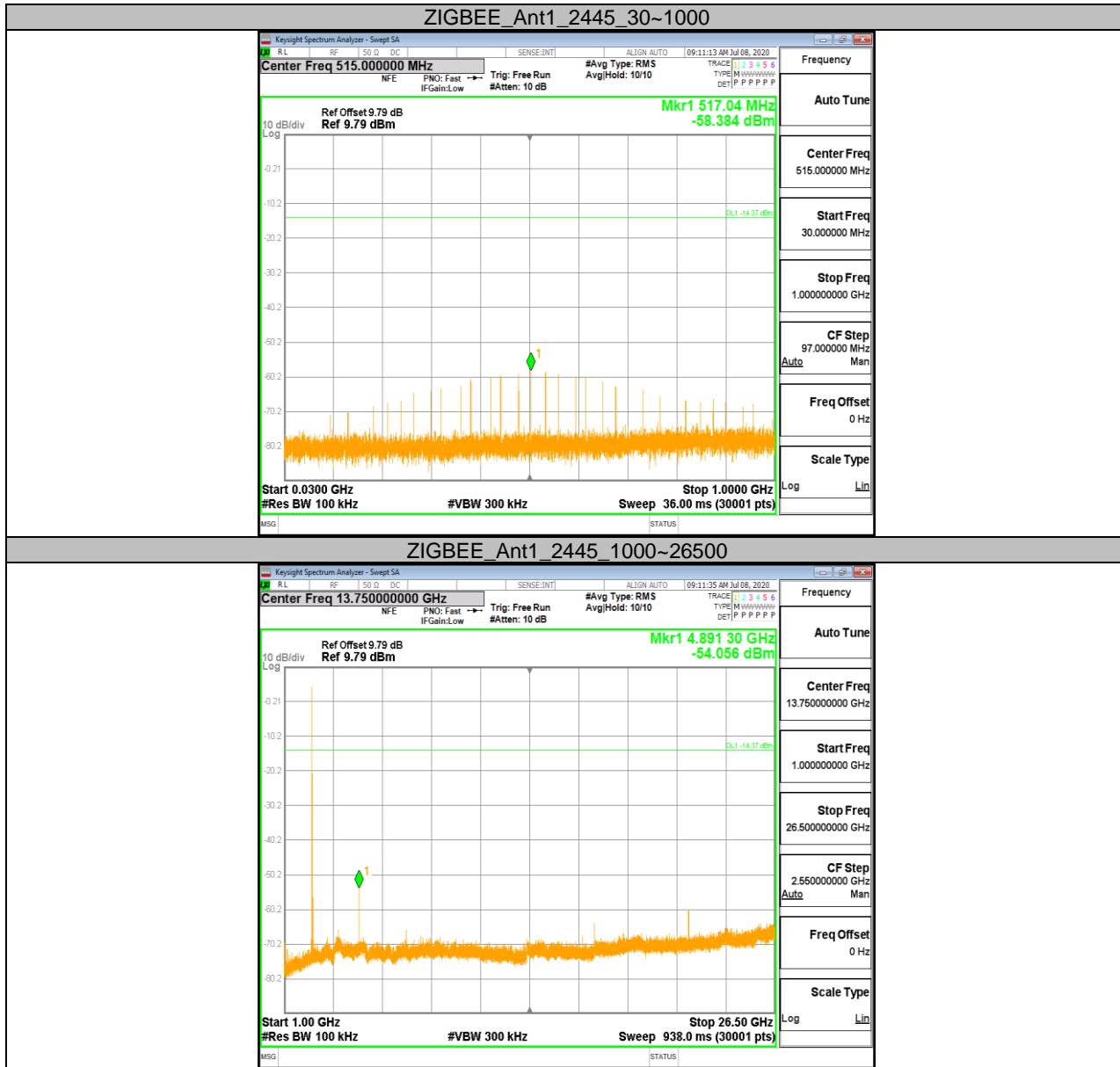
### 10.6.1. Test Result

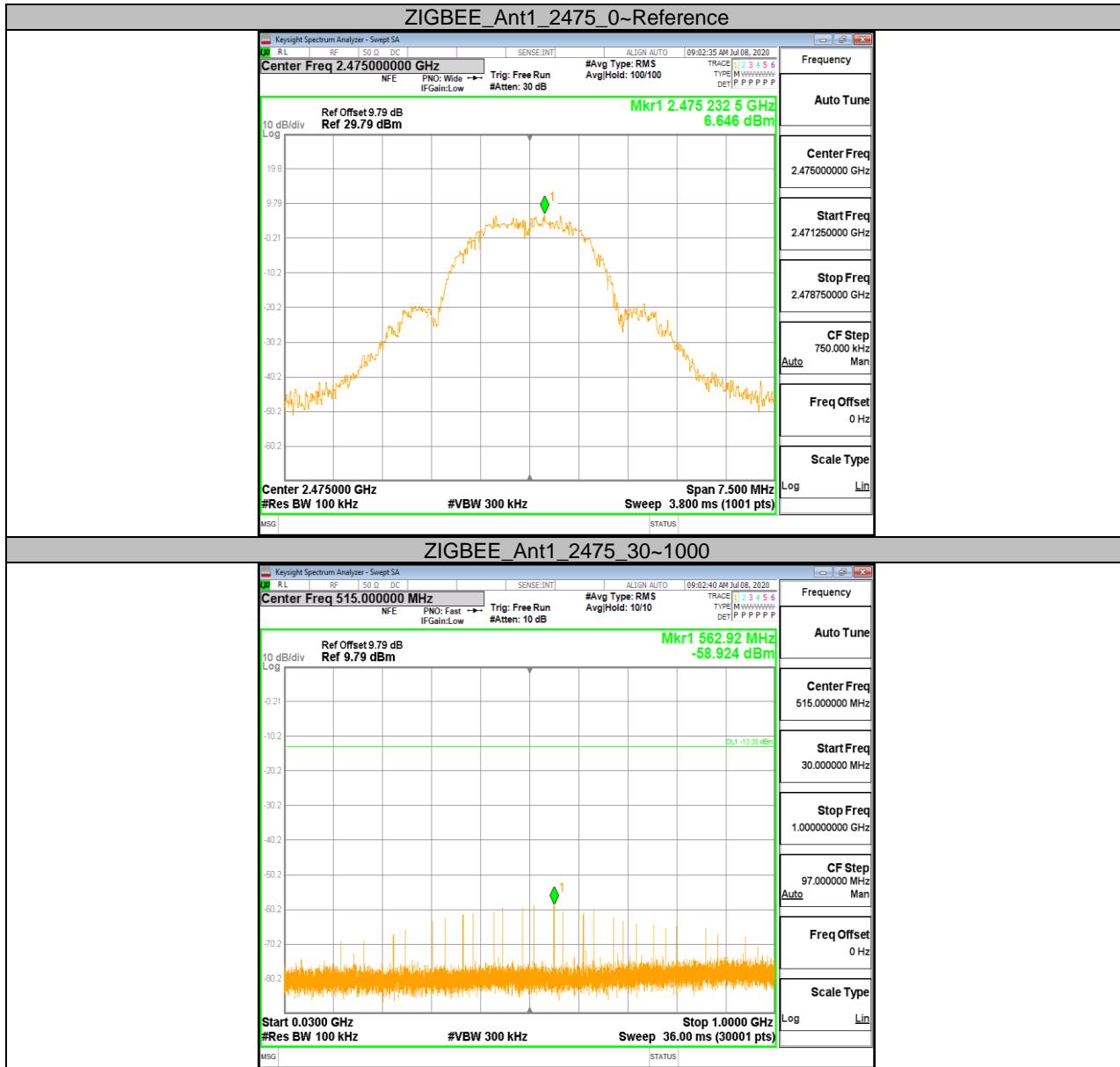
Test Mode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIGBEE	Ant1	2405	Reference	9.27	9.27	---	PASS
			30~1000	---	-58.155	<=-10.734	PASS
			1000~26500	---	-50.693	<=-10.734	PASS
		2445	Reference	5.63	5.63	---	PASS
			30~1000	---	-58.384	<=-14.372	PASS
			1000~26500	---	-54.056	<=-14.372	PASS
		2475	Reference	6.65	6.65	---	PASS
			30~1000	---	-58.924	<=-13.354	PASS
			1000~26500	---	-54.279	<=-13.354	PASS
		2480	Reference	9.33	9.33	---	PASS
			30~1000	---	-58.452	<=-10.667	PASS
			1000~26500	---	-49.848	<=-10.667	PASS

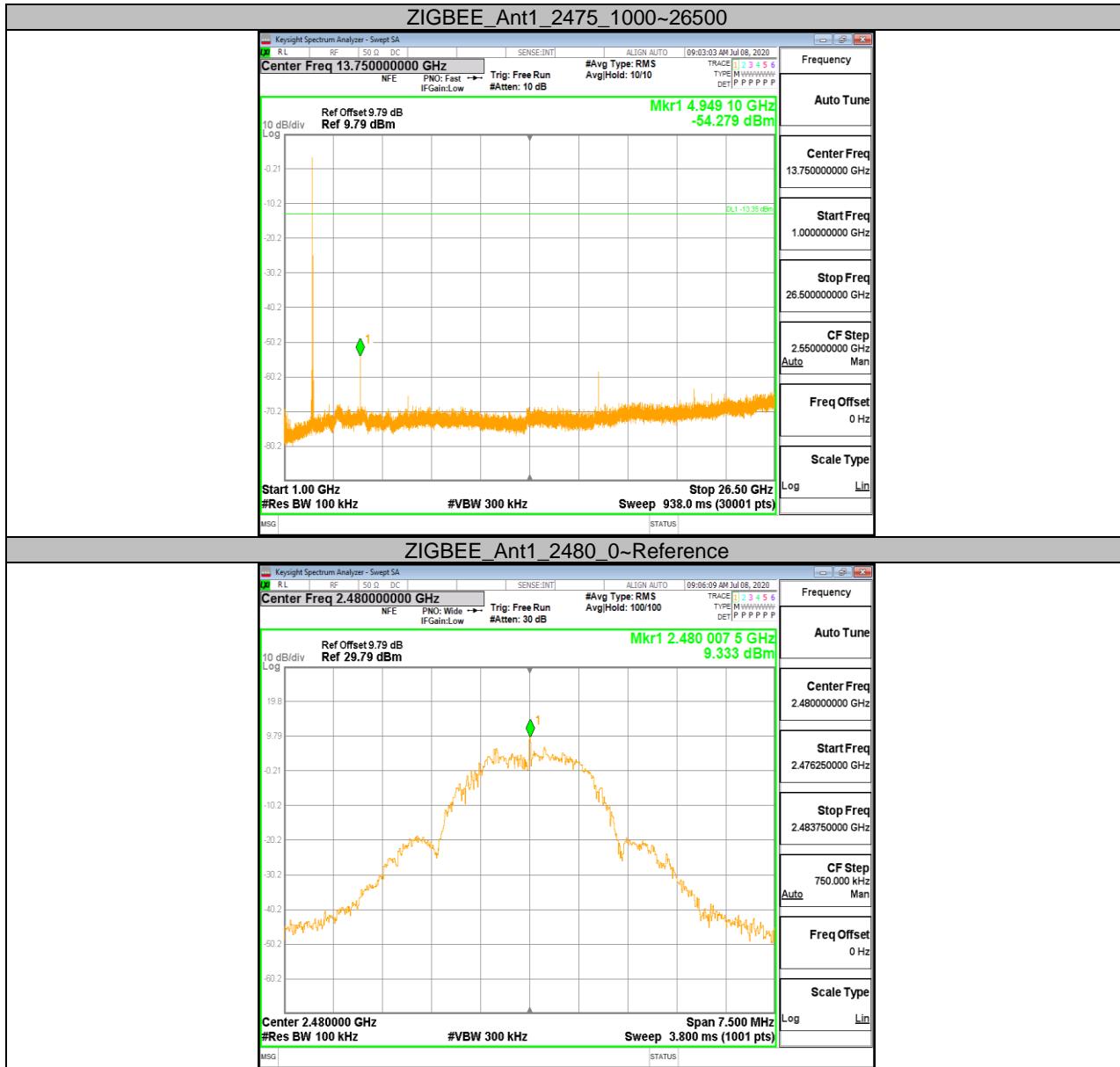
## 10.6.2. Test Graphs

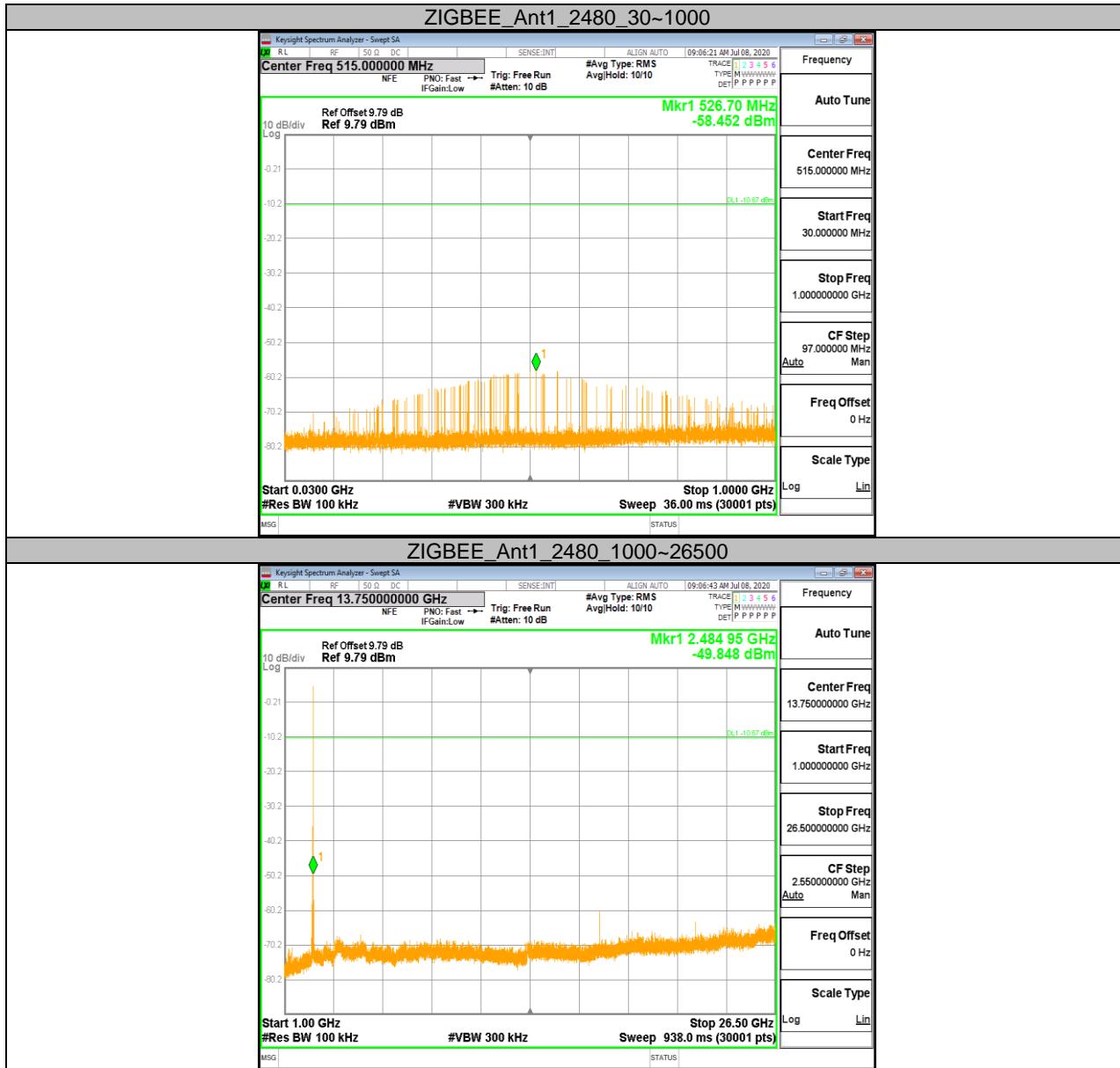












## 10.7. Appendix G: Duty Cycle

### 10.7.1. Test Result

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
ZigBee	2.8	22.9	0.12	12%	9.2	0.36	0.37

Note:

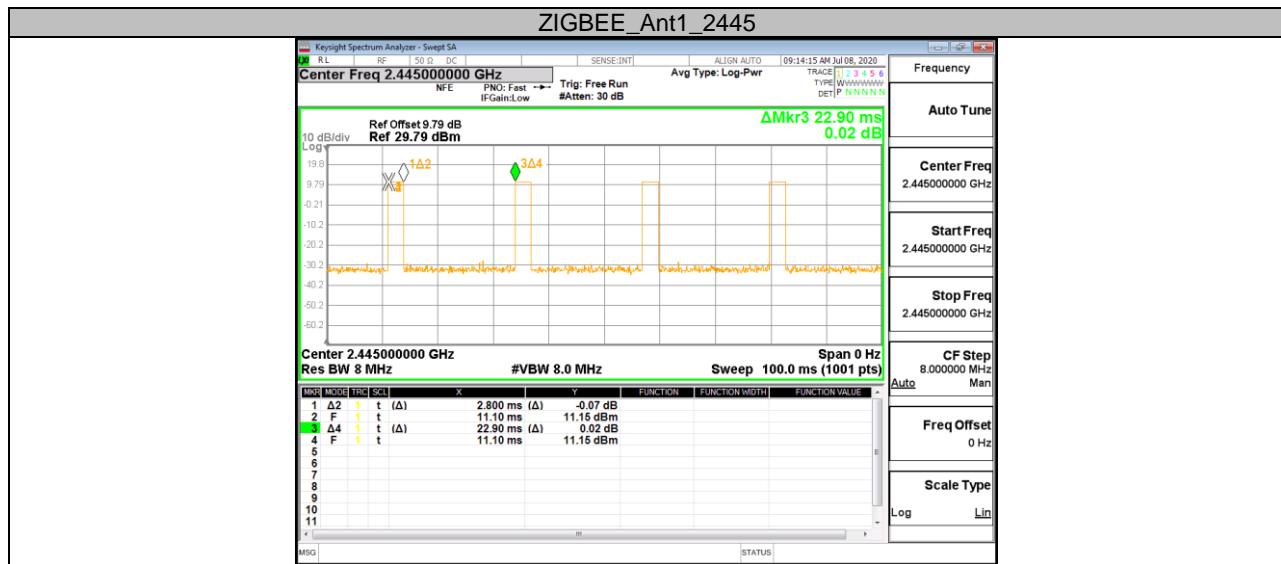
Duty Cycle Correction Factor=10log (1/x).

Where: x is Duty Cycle (Linear)

Where: T is On Time

If that calculated VBW is not available on the analyzer then the next higher value should be used.

## 10.7.2. Test Graphs



**END OF REPORT**