



**FCC 47 CFR PART 15 SUBPART C  
ISED RSS-247 ISSUE 2**

**CERTIFICATION TEST REPORT**

*For*

**WIFI+BT module**

**MODEL NUMBER: WCT0LR2201J**

**FCC ID: 2AC23-WCT0LR2201J  
IC: 12290A-WCT0LR2201J**

**REPORT NUMBER: 4788196596.1-2**

**ISSUE DATE: November 24, 2017**

*Prepared for*

**Hui Zhou Gaoshengda Technology Co.,LTD  
HuaXing RD,NO 2,ZhongKai High Technology Development  
Area,Huizhou,Guangdong, China**

*Prepared by*

**UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch  
Room 101, Building 10, Innovation Technology Park,  
Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China  
Tel: +86 769 33817100  
Fax: +86 769 33244054  
Website: www.ul.com**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/24/2017	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	20dB Bandwidth And 99% Bandwidth	FCC 15.247 (a) (1) RSS-247 Clause 5.1 (a)	Complied
2	Peak Conducted Output Power	FCC 15.247 (b) (1) RSS-247 Clause 5.1 (b)	Complied
3	Carrier Hopping Channel Separation	FCC 15.247 (a) (1) RSS-247 Clause 5.1 (b)	Complied
4	Number of Hopping Frequency	15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Complied
5	Time of Occupancy (Dwell Time)	15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Complied
6	Conducted Bandedge	FCC 15.247 (d) RSS-247 Clause 5.5	Complied
7	Radiated Bandedge and Spurious	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	Complied
8	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	Complied
9	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	Complied

## 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. MEASURING INSTRUMENT CALIBRATION .....	8
4.2. MEASUREMENT UNCERTAINTY.....	8
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>9</b>
5.1. DESCRIPTION OF EUT .....	9
5.2. MAXIMUM OUTPUT POWER.....	9
5.3. PACKET TYPE CONFIGURATION .....	9
5.4. CHANNEL LIST.....	10
5.5. TEST CHANNEL CONFIGURATION.....	10
5.6. THE WORSE CASE POWER SETTING PARAMETER.....	10
5.7. DESCRIPTION OF AVAILABLE ANTENNAS .....	11
5.8. WORST-CASE CONFIGURATIONS.....	11
5.9. TEST ENVIRONMENT .....	11
5.10. DESCRIPTION OF TEST SETUP.....	12
5.11. MEASURING INSTRUMENT AND SOFTWARE USED .....	13
<b>6. ANTENNA PORT TEST RESULTS .....</b>	<b>14</b>
6.1. ON TIME AND DUTY CYCLE.....	14
6.2. 20 dB BANDWIDTH AND 99% BANDWIDTH.....	16
6.2.1. GFSK MODE .....	17
6.2.2. 8DPSK MODE .....	19
6.3. PEAK CONDUCTED OUTPUT POWER.....	21
6.3.1. GFSK MODE .....	22
6.3.2. 8DPSK MODE .....	24
6.4. CARRIER HOPPING CHANNEL SEPARATION.....	26
6.4.1. GFSK MODE .....	27
6.4.2. 8DPSK MODE .....	28
6.5. NUMBER OF HOPPING FREQUENCY.....	29
6.5.1. GFSK MODE .....	30
6.5.2. 8DPSK MODE .....	31
6.6. TIME OF OCCUPANCY (DWELL TIME).....	32
6.6.1. GFSK MODE .....	33
6.6.2. 8DPSK MODE .....	35
6.7. CONDUCTED SPURIOUS EMISSION .....	37
6.7.1. GFSK MODE .....	38

6.7.2.	8DPSK MODE .....	42
<b>7.</b>	<b>RADIATED TEST RESULTS.....</b>	<b>46</b>
7.1.	LIMITS AND PROCEDURE .....	46
7.2.	RESTRICTED BANDEDGE .....	51
7.2.1.	GFSK MODE .....	51
7.2.2.	8DPSK MODE .....	55
7.3.	SPURIOUS EMISSIONS (1~18GHz) .....	59
7.3.1.	GFSK MODE .....	59
7.3.2.	8DPSK MODE .....	65
7.4.	SPURIOUS EMISSIONS 18G ~ 26GHz.....	71
7.4.1.	GFSK MODE .....	71
7.5.	SPURIOUS EMISSIONS 30M ~ 1 GHz .....	73
7.5.1.	GFSK MODE .....	73
7.6.	SPURIOUS EMISSIONS BELOW 30M.....	75
7.6.1.	GFSK MODE .....	75
<b>8.</b>	<b>AC POWER LINE CONDUCTED EMISSIONS.....</b>	<b>79</b>
8.1.1.	GFSK MODE .....	80
<b>9.</b>	<b>ANTENNA REQUIREMENTS.....</b>	<b>82</b>

## 1. ATTESTATION OF TESCT RESULTS

### Applicant Information

Company Name: Hui Zhou Gaoshengda Technology Co.,LTD  
Address: HuaXing RD,NO 2,ZhongKai High Technology Development Area,Huizhou,Guangdong, China

### Manufacturer Information

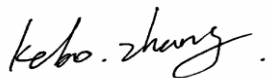
Company Name: Hui Zhou Gaoshengda Technology Co.,LTD  
Address: HuaXing RD,NO 2,ZhongKai High Technology Development Area,Huizhou,Guangdong, China

### EUT Description

Product Name: WIFI+BT module  
Brand Name: GSD  
Model Name: WCT0LR2201J  
Sample ID: 1220986  
Sample Status: Good  
Sample Received date: October 20, 2017  
Date Tested: October 23~November 23, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS
ISED RSS-247 Issue 2	PASS
ISED RSS-GEN Issue 4	PASS

Tested By:



Kebo Zhang  
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 DA 00-705, KDB414788 D01 Radiated Test Site v01, ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 2.

## 3. FACILITIES AND ACCREDITATION

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. The Certificate Registration Number is 4102.01. UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The Designation Number is CN1187. UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.

Note: 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.

## 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 recognized 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
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)( include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
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

Equipment	WIFI+BT module		
Model Name	WCT0LR2201J		
Product Description (Bluetooth)	Operation Frequency	2402 MHz ~ 2480 MHz	
	Modulation Type		Data Rate
	GFSK		1Mbps
	π/4-DQPSK		2Mbps
	8DPSK		3Mbps
Power Supply	AC120V/60Hz		
Bluetooth Version	BT 4.1+EDR		
Hardware Version	V1.0		
Software Version	V1.2		

### 5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency (MHz)	Channel Number	Max Output Power (dBm)	EIRP (dBm)
GFSK	2402-2480	0-78[79]	2.119	5.359
8DPSK	2402-2480	0-78[79]	3.373	6.613

### 5.3. PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting(Packet Length)
GFSK	DH1	27
	DH3	183
	DH5	339
π/4-DQPSK	2-DH1	54
	2-DH3	367
	2-DH5	679
8DPSK	3-DH1	83
	3-DH3	552
	3-DH5	1021

#### 5.4. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

#### 5.5. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel Number	Test Channel
GFSK	CH 00, CH 39, CH 78	Low, Middle, High
8DPSK	CH 00, CH 39, CH 78	Low, Middle, High

#### 5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worst Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		RELBTAPP		
Modulation Type	Transmit Antenna Number	Test Channel		
		CH 00	CH 39	CH 78
GFSK	1	6	6	6
8DPSK	1	6	6	6

## 5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
2	2402-2480	External Antenna	3.24

Note: There are two antenna in the EUT, only antenna 2 support BT mode.

Test Mode	Transmit and Receive Mode	Description
GFSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
8DPSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

## 5.8. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BR	FHSS	GFSK	1Mbit/s
EDR	FHSS	8DPSK	3Mbit/s

Note: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

## 5.9. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23 ~ 28 °C
Voltage :	VL	N/A
	VN	AC 120V 60Hz
	VH	N/A

Note: VL= Lower Extreme Test Voltage  
VN= Nominal Voltage.  
VH= Upper Extreme Test Voltage  
TN= Normal Temperature

## 5.10. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	PC	Dell	Vostro 3902	8KNDDDB2
2	USB TO RS232	N/A	N/A	N/A

### I/O CABLES

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

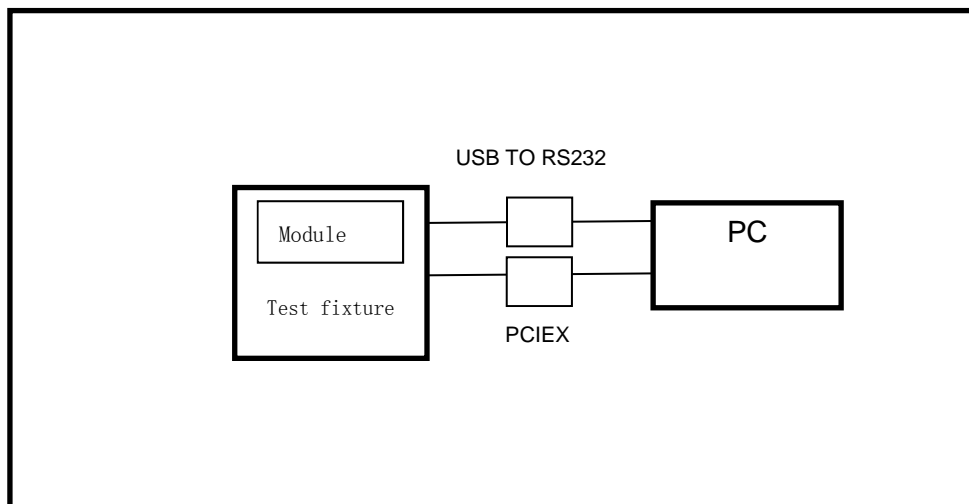
### ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

### TEST SETUP

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

### SETUP DIAGRAM FOR TESTS



## 5.11. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESR3	101961	Dec.20, 2016	Dec.19, 2017
<input checked="" type="checkbox"/>	Two-Line V-Network	R&S	ENV216	101983	Dec.20, 2016	Dec.19, 2017
<input checked="" type="checkbox"/>	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Feb.10, 2017	Feb.10, 2018
Software						
Used	Description		Manufacturer	Name		Version
<input checked="" type="checkbox"/>	Test Software for Conducted disturbance		UL	Antenna port		Ver. 7.2
Radiated Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Feb. 24, 2017	Feb. 24, 2018
<input checked="" type="checkbox"/>	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Jan.09, 2016	Jan.09, 2019
<input checked="" type="checkbox"/>	Preamplifier	HP	8447D	2944A09099	Feb. 13, 2017	Feb. 13, 2018
<input checked="" type="checkbox"/>	EMI Measurement Receiver	R&S	ESR26	101377	Dec. 20, 2016	Dec. 20, 2017
<input checked="" type="checkbox"/>	Horn Antenna	TDK	HRN-0118	130939	Jan. 09, 2016	Jan. 09, 2019
<input checked="" type="checkbox"/>	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Jan.06, 2016	Jan.06, 2019
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Jan. 14, 2017	Jan. 14, 2018
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec. 20, 2016	Dec. 20, 2017
<input checked="" type="checkbox"/>	Loop antenna	Schwarzbeck	1519B	00008	Mar. 26, 2016	Mar. 26, 2019
<input checked="" type="checkbox"/>	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Dec. 20, 2016	Dec. 20, 2017
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. 20, 2016	Dec. 20, 2017
<input checked="" type="checkbox"/>	Power Meter	Keysight	N9031A	MY55416024	Feb. 13, 2017	Feb. 13, 2018
<input checked="" type="checkbox"/>	Power Sensor	Keysight	N9323A	MY55440013	Feb. 13, 2017	Feb. 13, 2018

## 6. ANTENNA PORT TEST RESULTS

### 6.1. ON TIME AND DUTY CYCLE

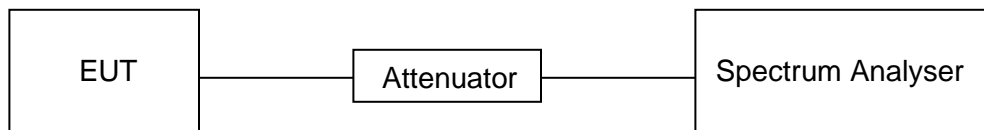
#### LIMITS

None; for reporting purposes only

#### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

#### TEST SETUP



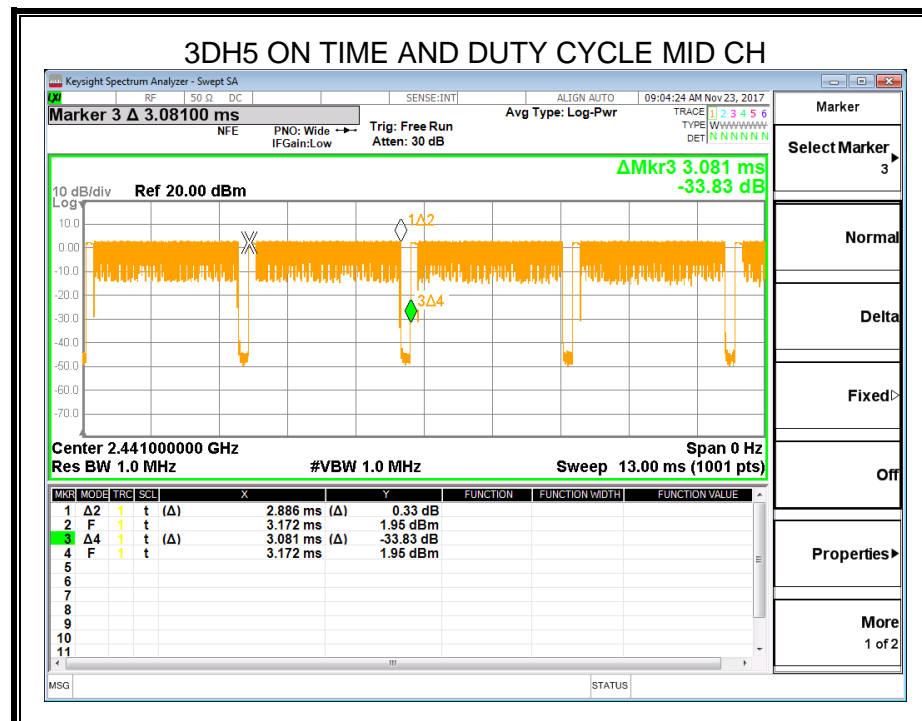
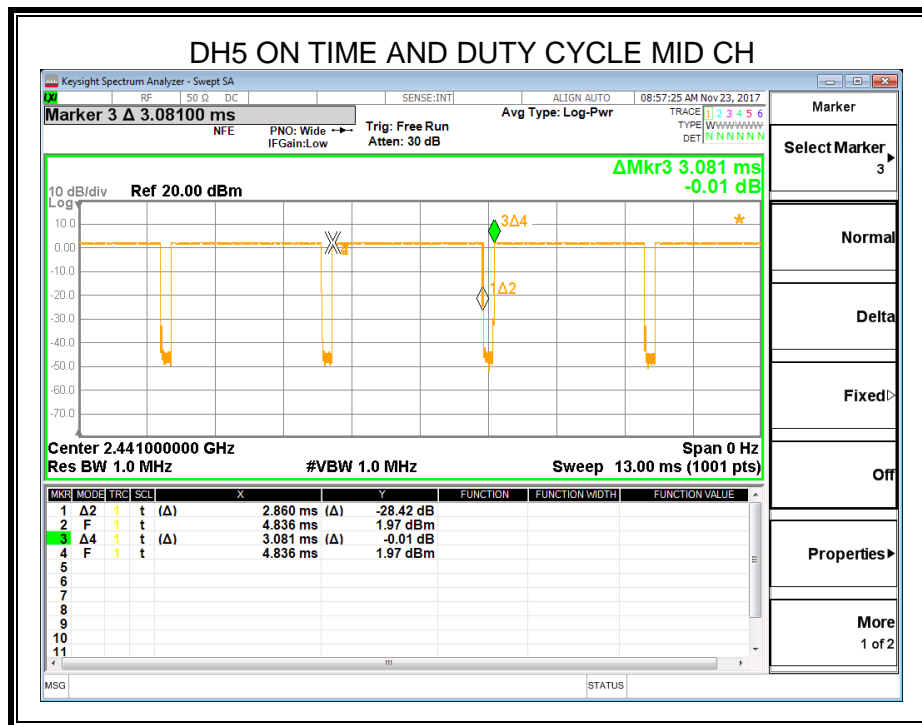
#### RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)
GFSK	2.860	3.081	0.928	93	0.325	0.350
8DPSK	2.886	3.081	0.937	94	0.283	0.347

Note: Duty Cycle Correction Factor= $10\log(1/x)$ .

Where: x is Duty Cycle(Linear)

Where: T is On Time (transmit duration)



## 6.2. 20 dB BANDWIDTH AND 99% BANDWIDTH

### LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (a) (1) RSS-247 Clause 5.1 (a)	20dB Bandwidth	500KHz	2400-2483.5
RSS-Gen Clause 6.6	99% Bandwidth	N/A	2400-2483.5

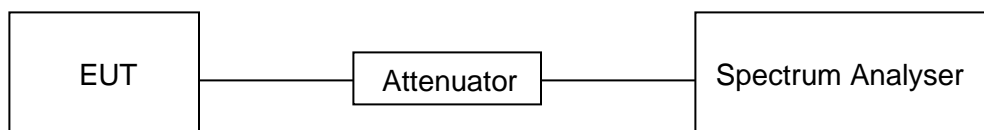
### TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 20dB Bandwidth: 1% of the 20 dB bandwidth For 99% Bandwidth: 1% to 5% of the occupied bandwidth
VBW	For 20dB Bandwidth: $\geq$ RBW For 99% Bandwidth: approximately $3 \times$ RBW
Span	approximately 2 to 3 times the 20 dB bandwidth
Trace	Max hold
Sweep	Auto couple

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 20 dB relative to the maximum level measured in the fundamental emission.

### TEST SETUP



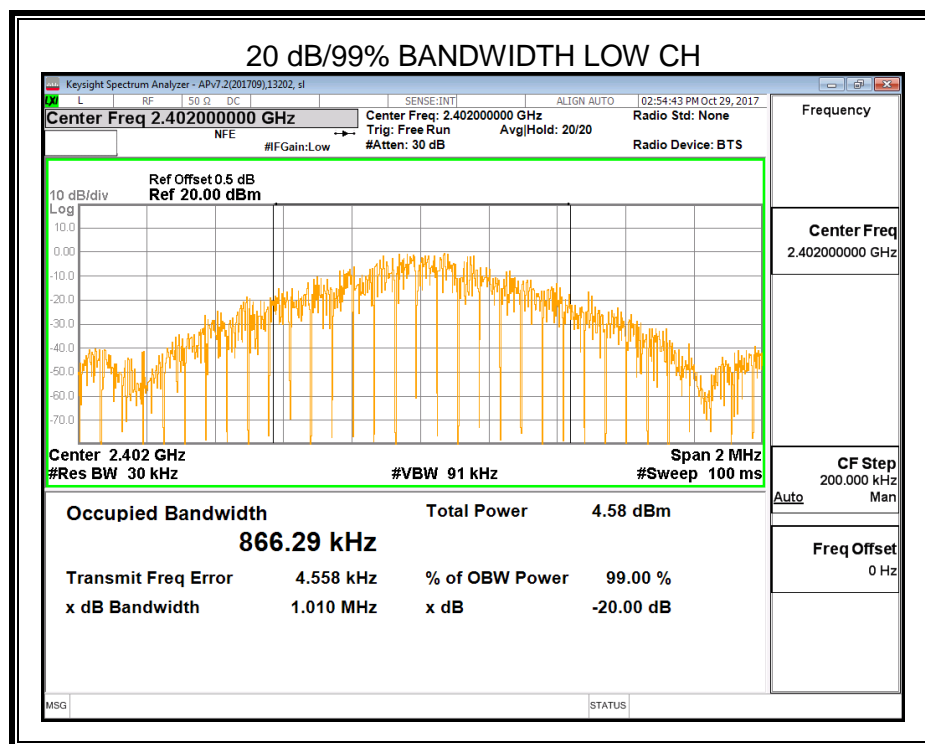


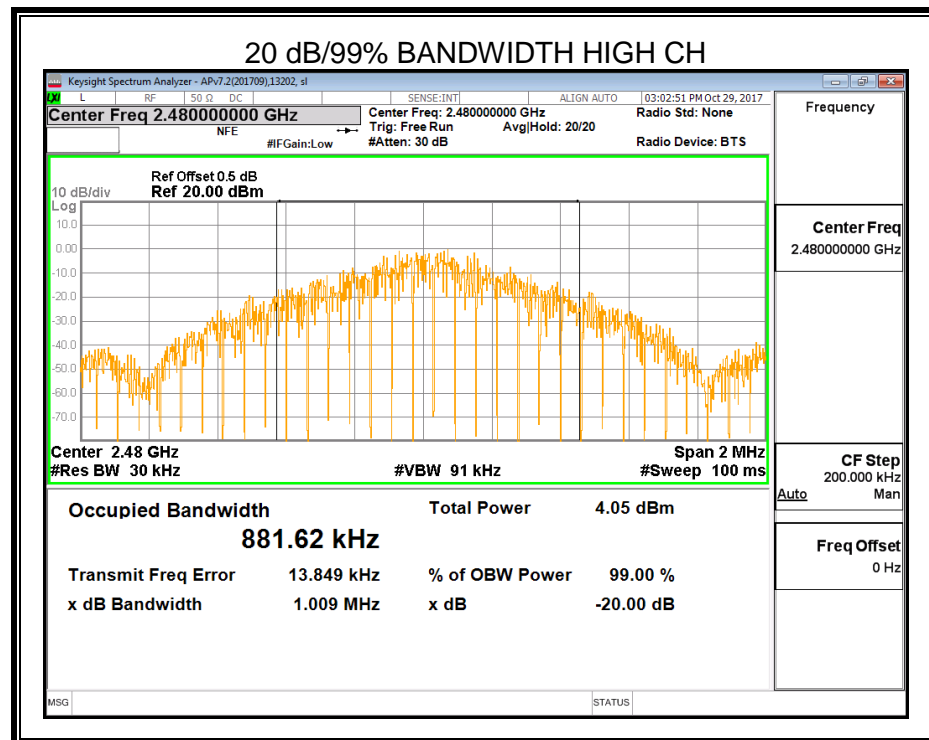
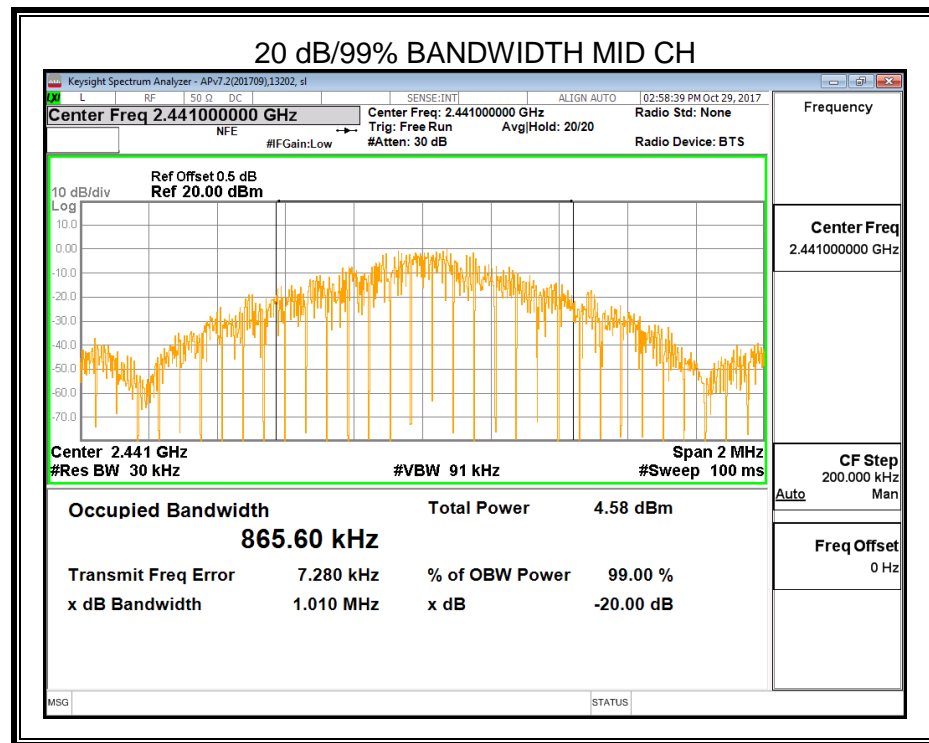
## RESULTS

### 6.2.1. GFSK MODE

Channel	Frequency (MHz)	20dB bandwidth (MHz)	99% bandwidth (MHz)	Result
Low	2402	1.010	0.866	PASS
Middle	2441	1.010	0.866	PASS
High	2480	1.009	0.882	PASS

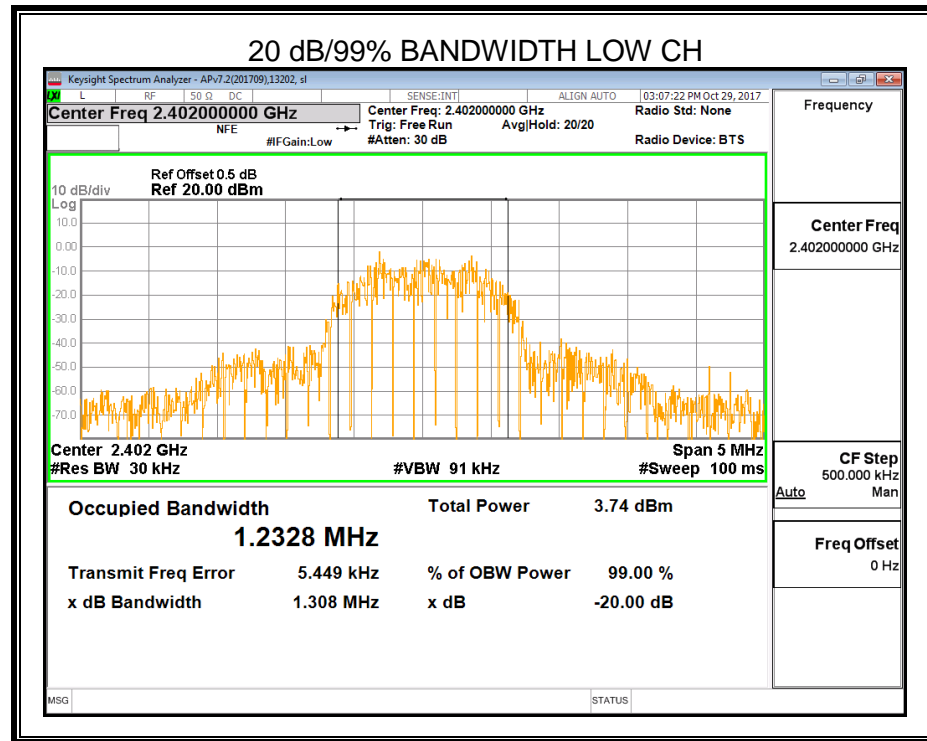
### Test Graph

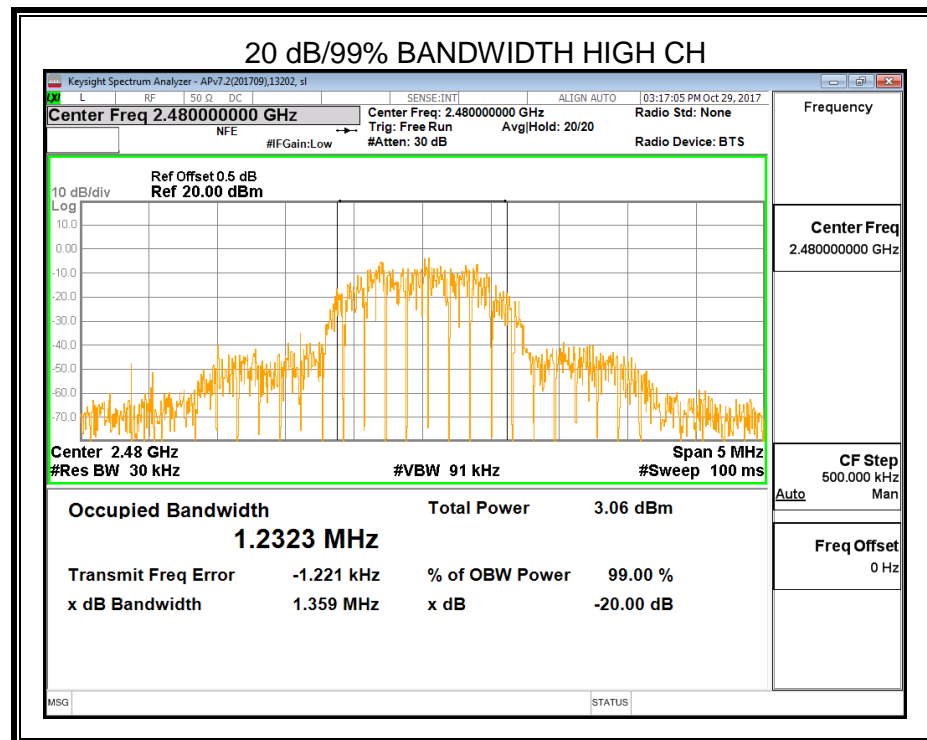
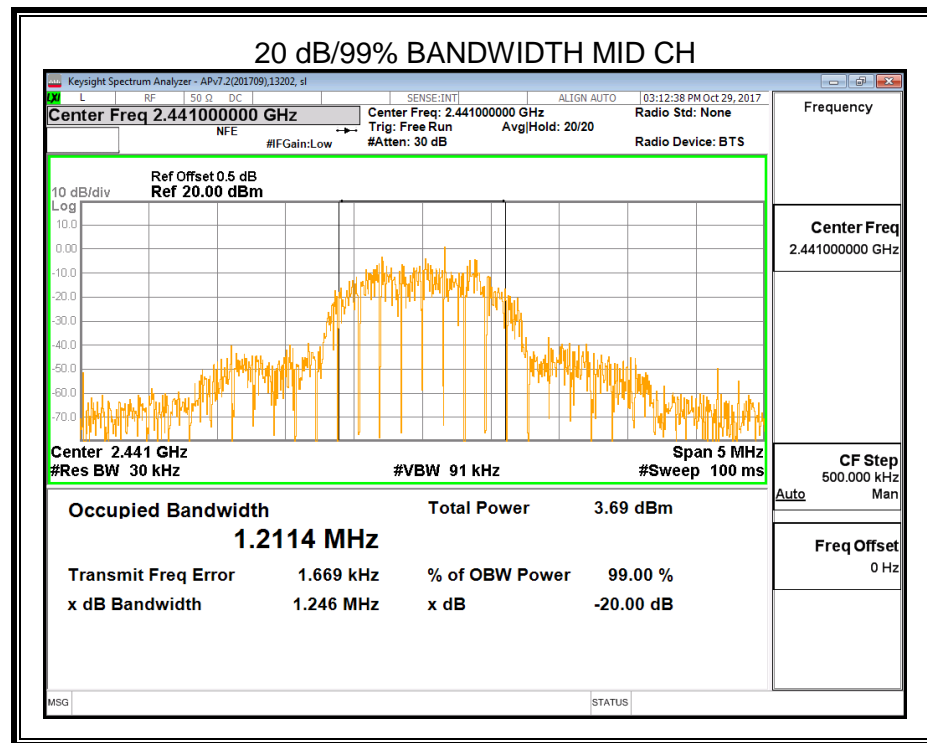




## 6.2.2. 8DPSK MODE

Channel	Frequency (MHz)	20dB bandwidth (MHz)	99% bandwidth (MHz)	Result
Low	2402	1.308	1.2328	Pass
Middle	2441	1.246	1.2114	Pass
High	2480	1.359	1.2323	Pass





### 6.3. PEAK CONDUCTED OUTPUT POWER

#### LIMITS

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (b) (1) RSS-247 Clause 5.4 (b)	Peak Conducted Output Power	1 watt or 30dBm	2400-2483.5

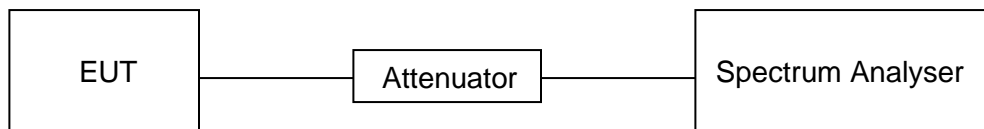
#### TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	≥ 20 dB bandwidth
VBW	≥RBW
Span	Approximately five times the 20 dB bandwidth
Trace	Max hold
Sweep time	Auto couple

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

#### TEST SETUP

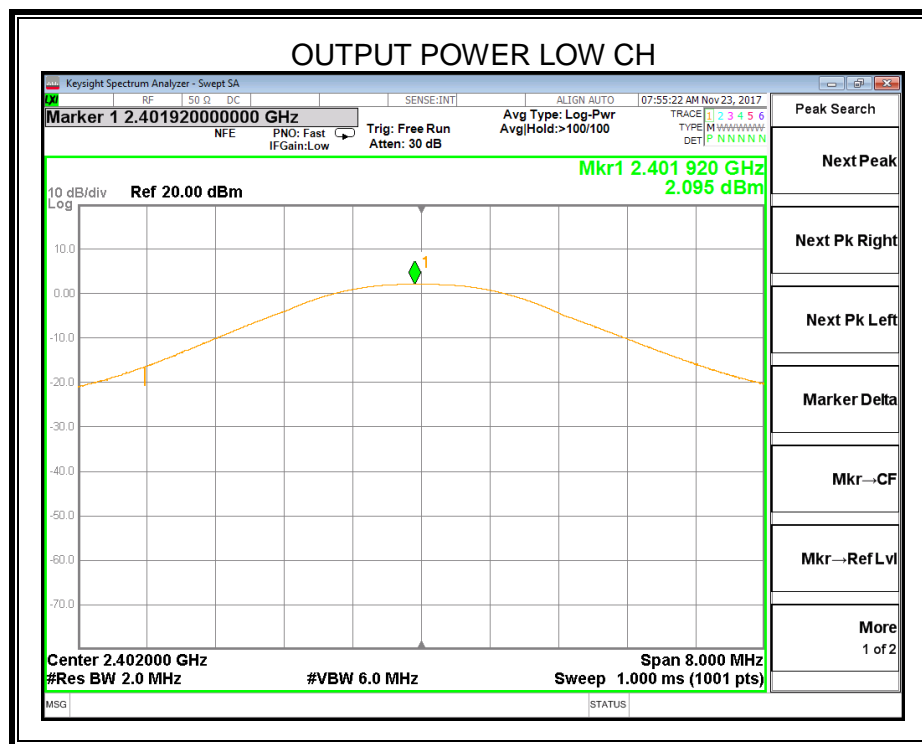


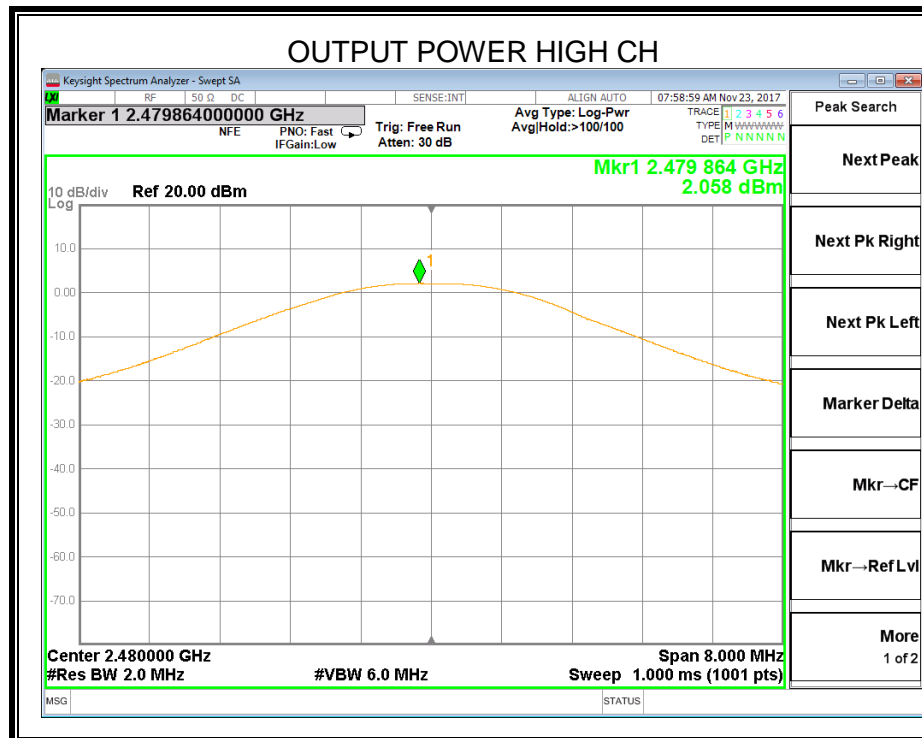
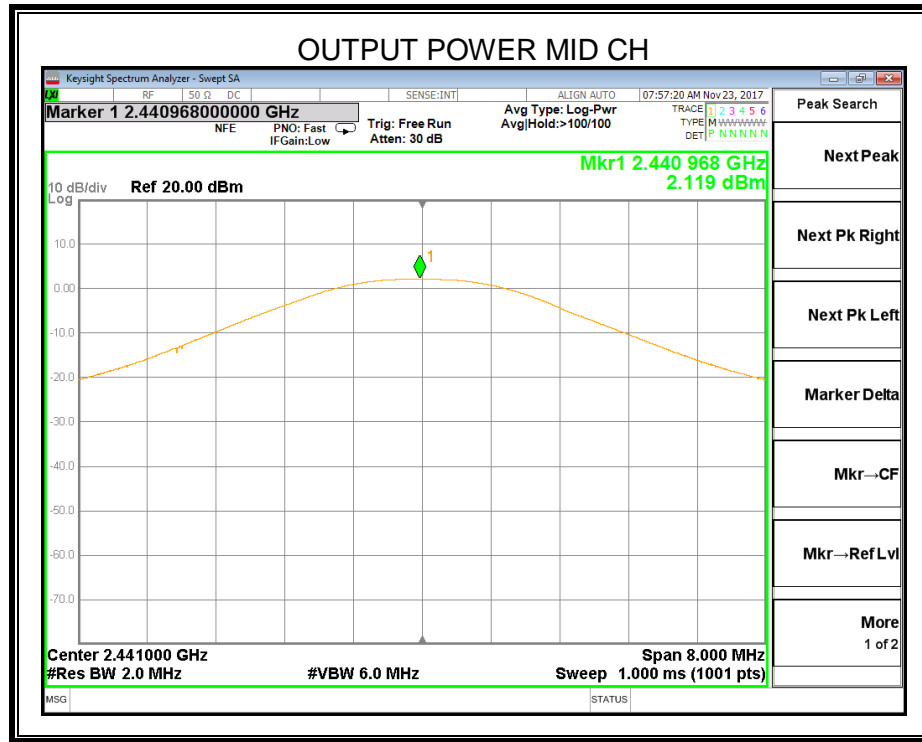
## RESULTS

### 6.3.1. GFSK MODE

Channel	Frequency	Maximum Conducted Output Power(PK)	EIRP	Result
	(MHz)	(dBm)	(dBm)	
Low	2402	2.095	5.335	Pass
Middle	2441	2.119	5.359	Pass
High	2480	2.058	5.298	Pass

Note: EIRP= Maximum Conducted Output Power + Antenna Gain

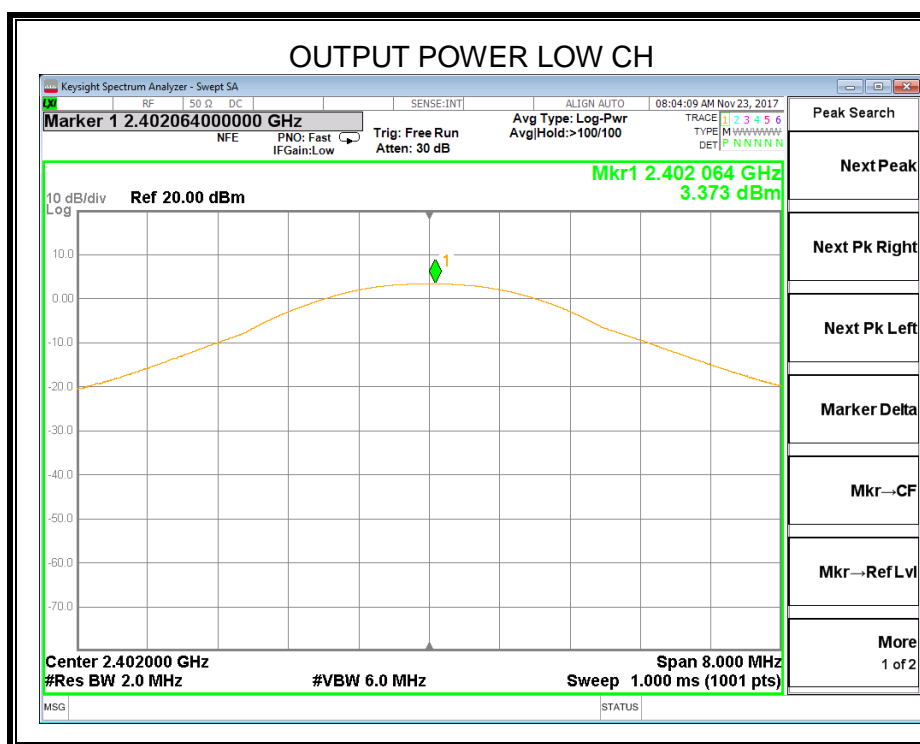




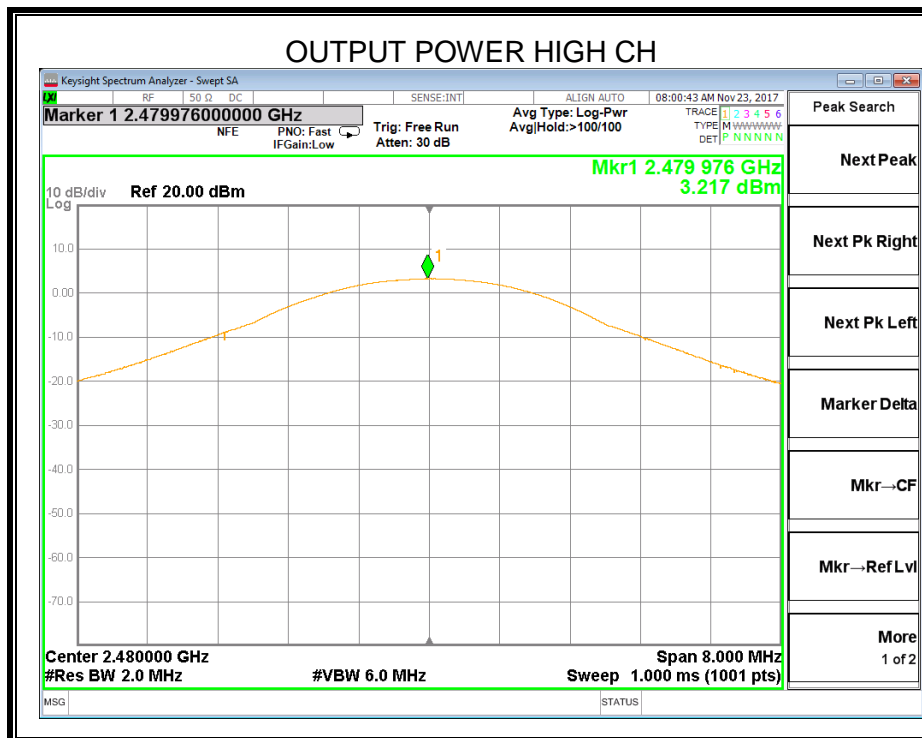
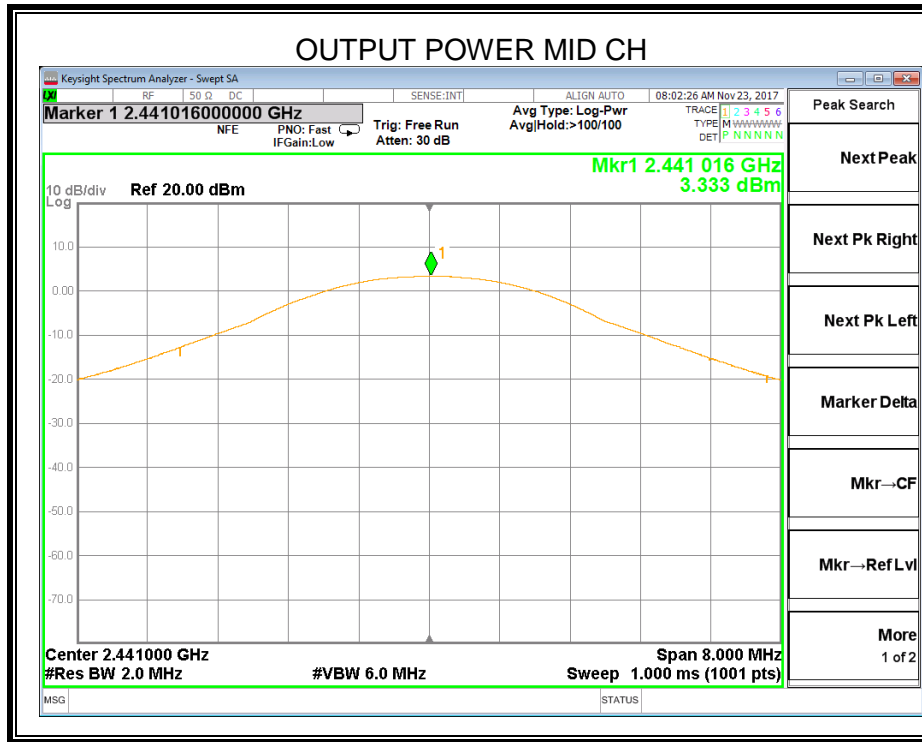
### 6.3.2. 8DPSK MODE

Channel	Frequency	Maximum Conducted Output Power(PK)	EIRP	Result
	(MHz)	(dBm)	(dBm)	
Low	2402	3.373	6.613	Pass
Middle	2441	3.333	6.573	Pass
High	2480	3.217	6.457	Pass

Note: EIRP= Maximum Conducted Output Power + Antenna Gain







## 6.4. CARRIER HOPPING CHANNEL SEPARATION

### LIMITS

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (a) (1) RSS-247 Clause 5.1 (b)	Carrier Hopping Channel Separation	25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.	2400-2483.5

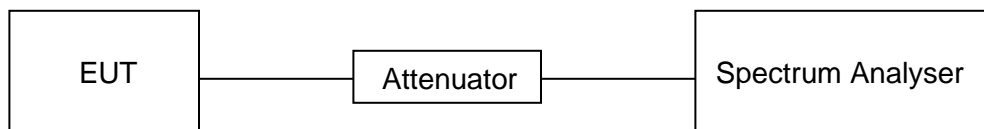
### TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Span	wide enough to capture the peaks of two adjacent channels
Detector	Peak
RBW	$\geq 1\%$ of the span
VBW	$\geq$ RBW
Trace	Max hold
Sweep time	Auto couple

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

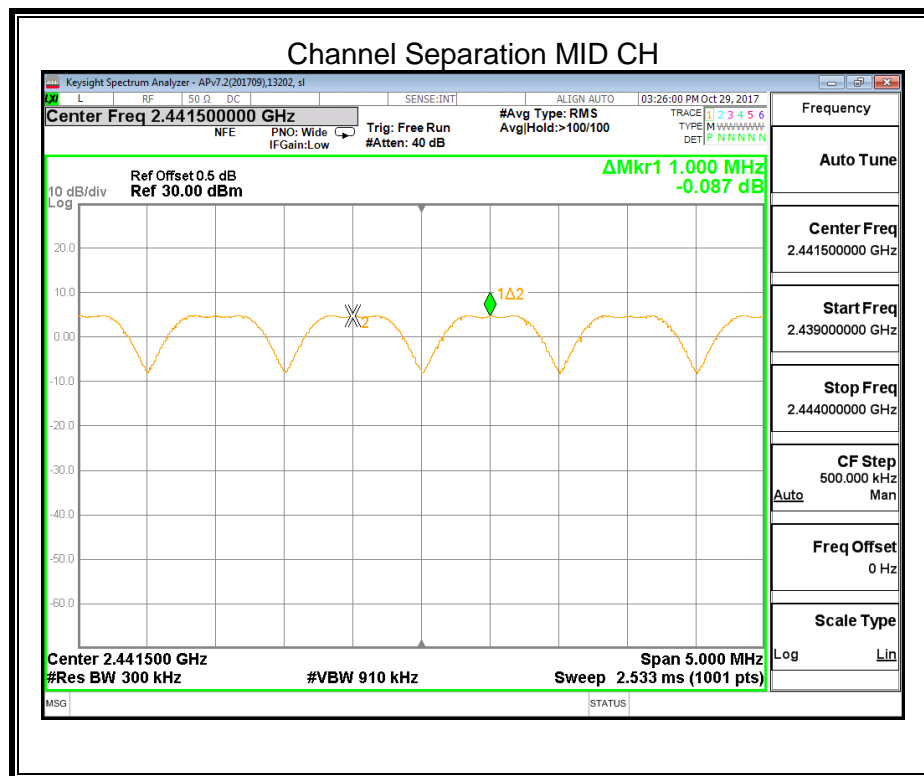
### TEST SETUP



## RESULTS

### 6.4.1. GFSK MODE

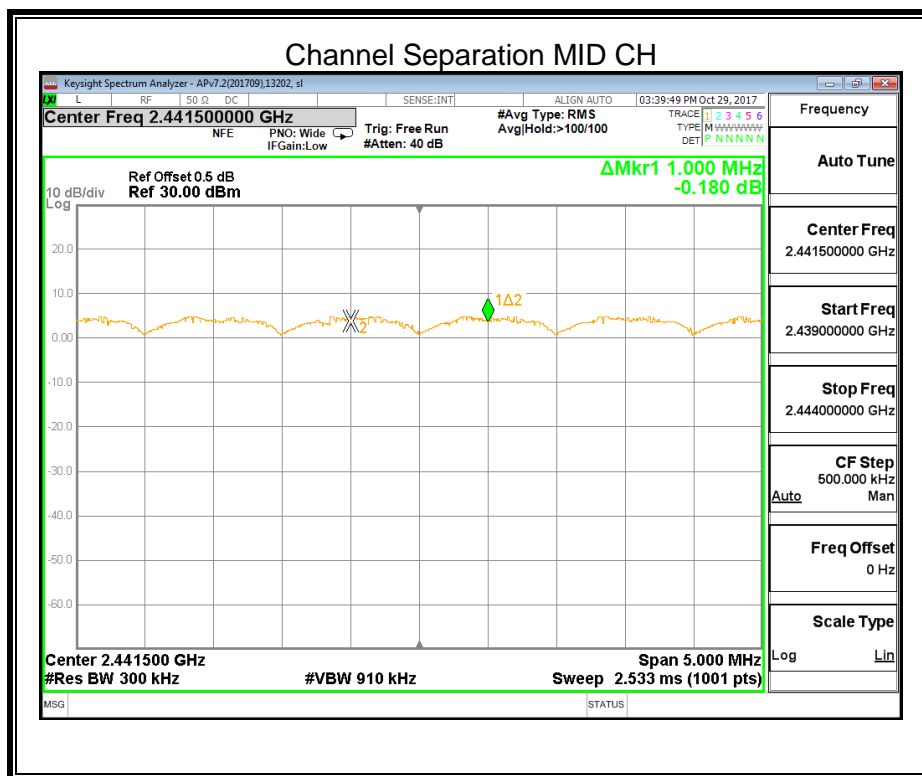
Channel	Carrier Hopping Channel Separation (MHz)	Limit (MHz)	Result
Middle	1.0	≥ two-thirds of the 20 dB Bandwidth Of The Hopping Channel	PASS



Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 6.2.1.

### 6.4.2. 8DPSK MODE

Channel	Carrier Hopping Channel Separation (MHz)	Limit (MHz)	Result
Middle	1.0	$\geq$ two-thirds of the 20 dB Bandwidth Of The Hopping Channel	PASS



Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 6.2.1.

## 6.5. NUMBER OF HOPPING FREQUENCY

### LIMITS

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2		
Section	Test Item	Limit
15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Number of Hopping Frequency	at least 15 hopping channels

### TEST PROCEDURE

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

Detector	Peak
RBW	1% of the span
VBW	≥RBW
Span	The frequency band of operation
Trace	Max hold
Sweep time	Auto couple

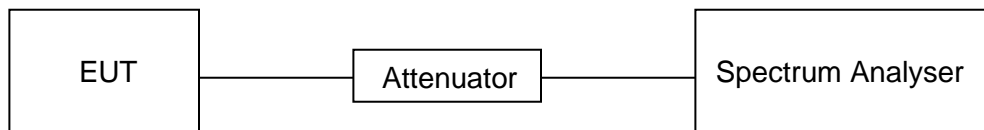
Set EUT to transmit maximum output power and switch on frequency hopping function. then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.

Count the quantity of peaks to get the number of hopping channels.

Normal Mode: 79 Channels observed.

AFH Mode: 20 Channels declared.

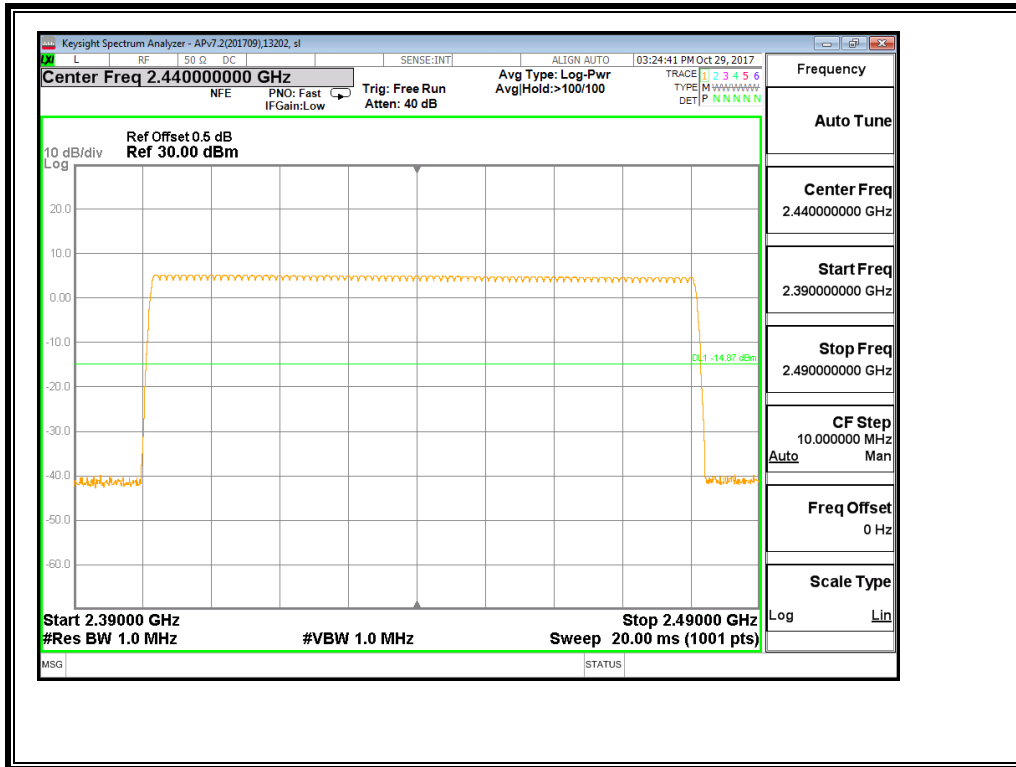
### TEST SETUP



### RESULTS

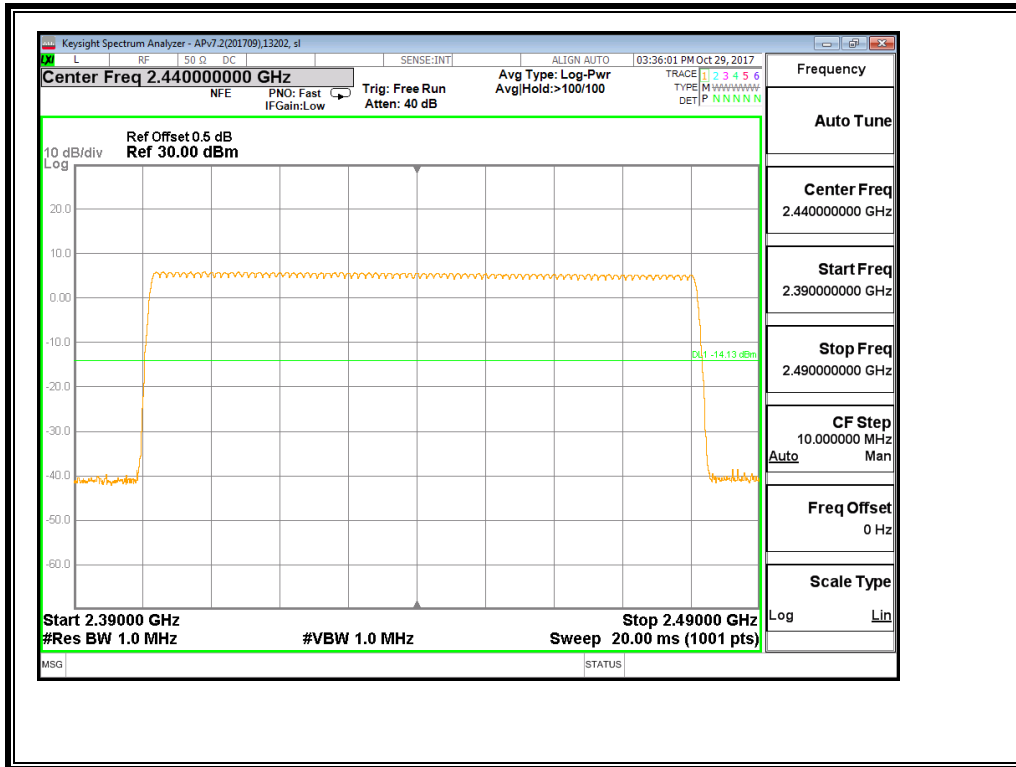
### 6.5.1. GFSK MODE

Hopping numbers	Limit	Results
79	>15	Pass



## 6.5.2. 8DPSK MODE

Hopping numbers	Limit	Results
79	>15	Pass



## 6.6. TIME OF OCCUPANCY (DWELL TIME)

### LIMITS

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2		
Section	Test Item	Limit
15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Time of Occupancy (Dwell Time)	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.

### TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	1 MHz
VBW	≥RBW
Span	zero span
Trace	Max hold
Sweep time	As necessary to capture the entire dwell time per hopping channel

- The transmitter output (antenna port) was connected to the spectrum analyzer
- Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
- Use a video trigger with the trigger level set to enable triggering only on full pulses.
- Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- Measure the maximum time duration of one single pulse.
- Set the EUT for DH5, DH3 and DH1 packet transmitting.
- Measure the maximum time duration of one single pulse.  
 $A \text{ Period Time} = (\text{channel number}) * 0.4$

For Normal Mode (79 Channel):

DH1 Time Slot: Reading \* (1600/2)\*31.6/(channel number)

DH3 Time Slot: Reading \* (1600/4)\*31.6/(channel number)

DH5 Time Slot: Reading \* (1600/6)\*31.6/(channel number)

For AFH Mode (20 Channel):

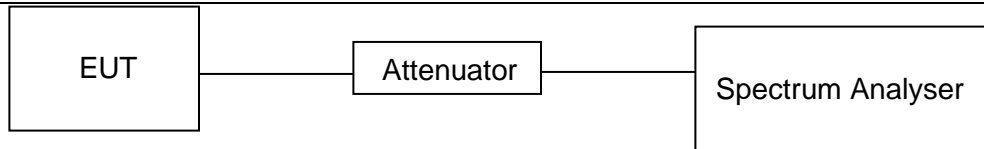
DH1 Time Slot: Reading \* (1600/2)\*8/(channel number)

DH3 Time Slot: Reading \* (1600/4)\*8/(channel number)

DH5 Time Slot: Reading \* (1600/6)\*8/(channel number)

### TEST SETUP



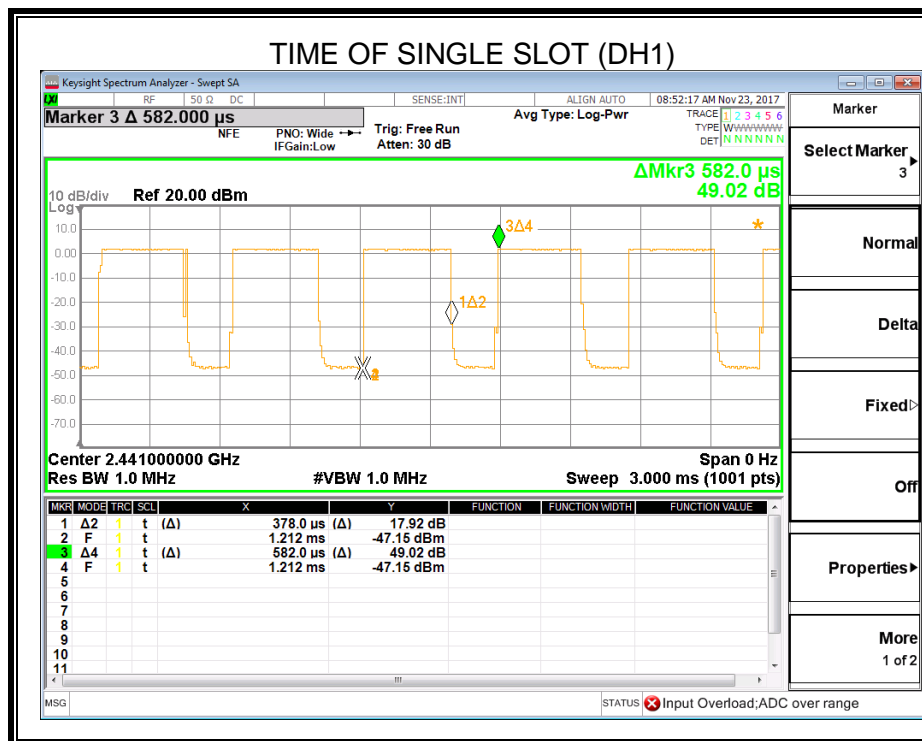


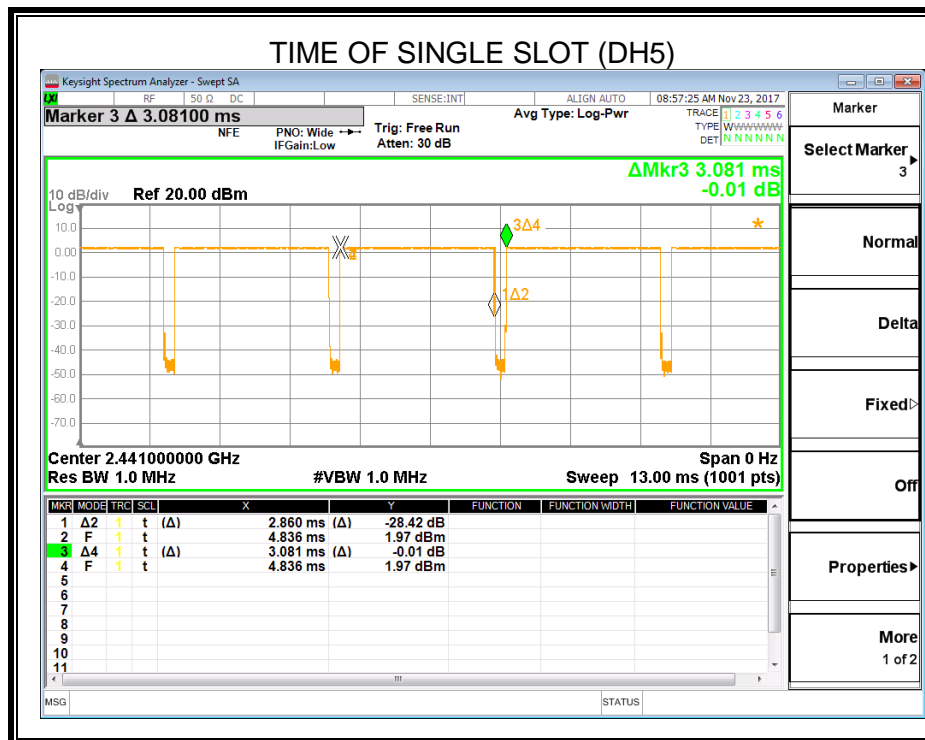
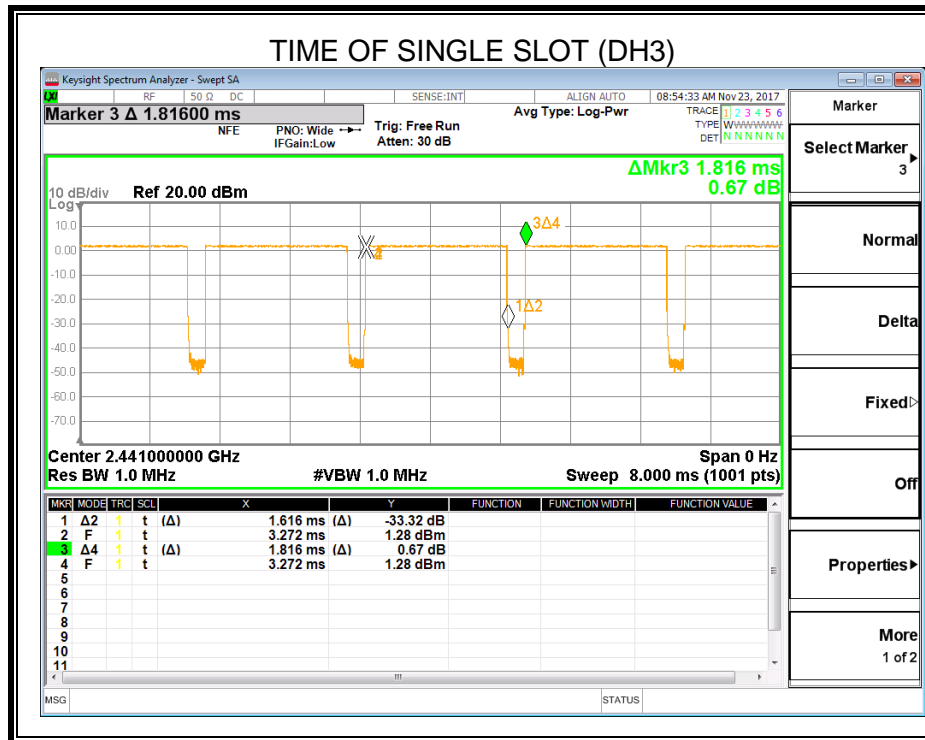
## RESULTS

### 6.6.1. GFSK MODE

Normal Mode					
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [ms]	Duty Cycle [%]	Results
DH1	MCH	0.378	0.121	0.65	PASS
DH3	MCH	1.616	0.259	0.89	PASS
DH5	MCH	2.860	0.305	0.93	PASS
AFH Mode					
DH1	MCH	0.378	0.121	0.65	PASS
DH3	MCH	1.616	0.259	0.89	PASS
DH5	MCH	2.860	0.305	0.93	PASS

## Test Graph

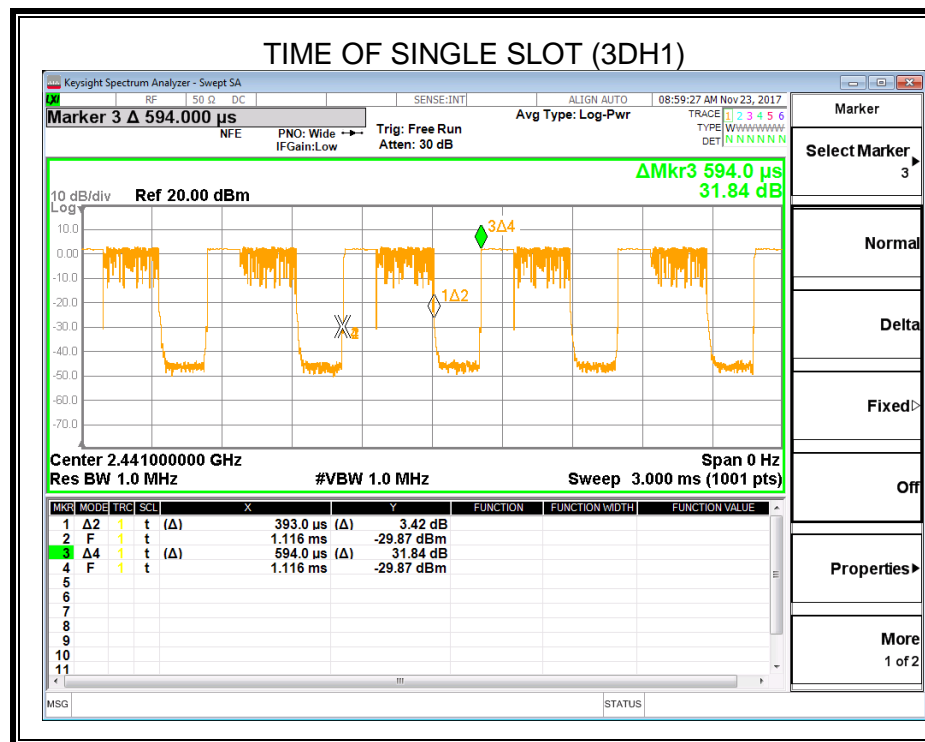


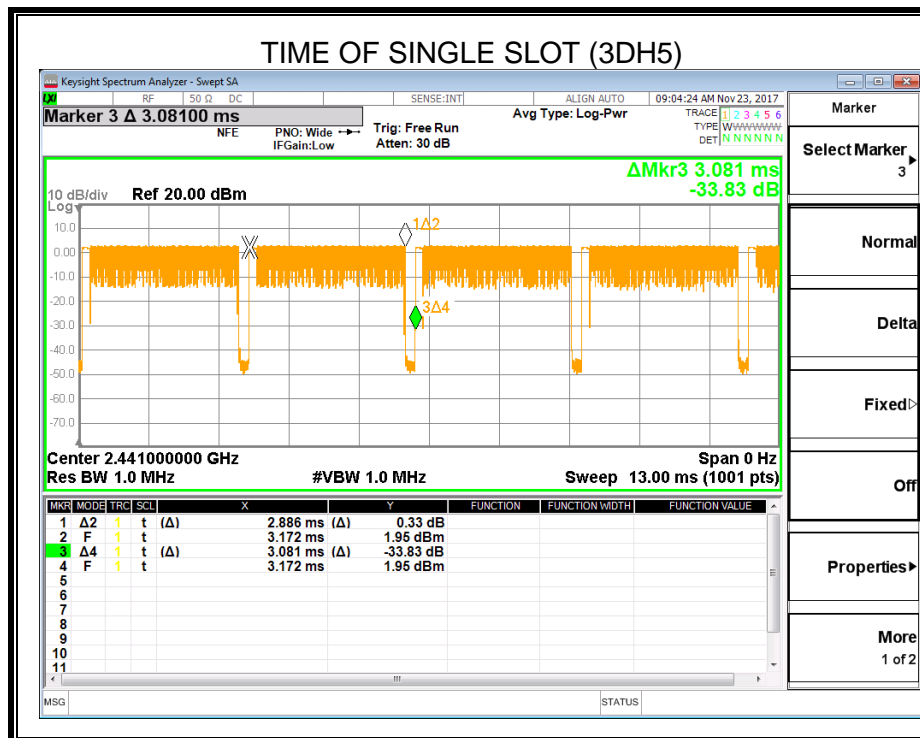
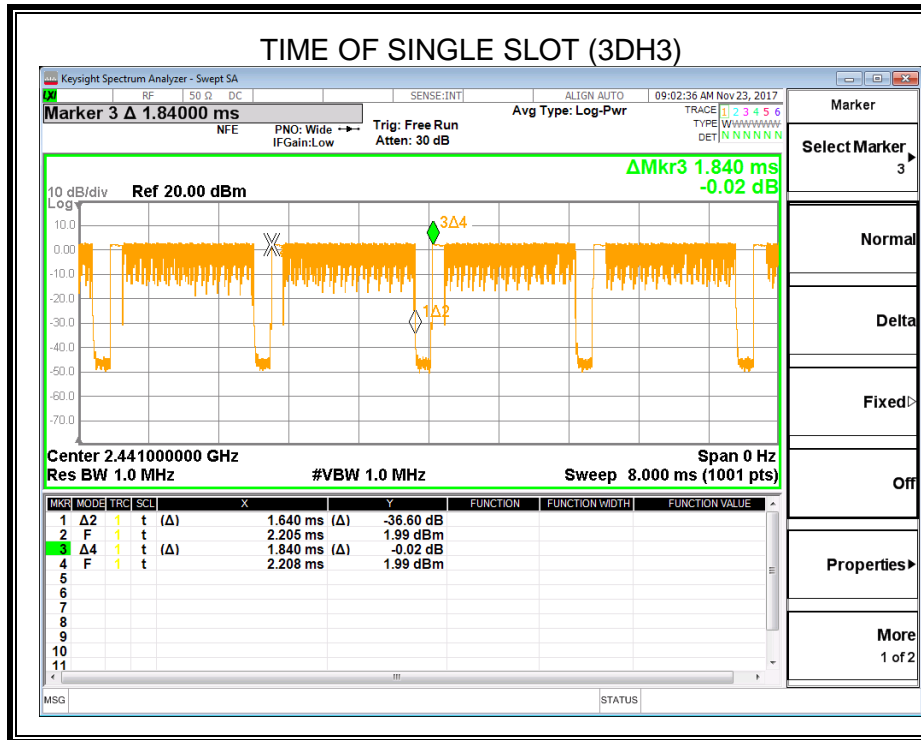


## 6.6.2. 8DPSK MODE

Normal Mode					
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [ms]	Duty Cycle [%]	Results
3DH1	MCH	0.393	0.126	0.66	PASS
3DH3	MCH	1.640	0.262	0.89	PASS
3DH5	MCH	2.886	0.308	0.94	PASS
AFH Mode					
3DH1	MCH	0.393	0.126	0.66	PASS
3DH3	MCH	1.640	0.262	0.89	PASS
3DH5	MCH	2.886	0.308	0.94	PASS

## Test Graph





## 6.7. CONDUCTED SPURIOUS EMISSION

### LIMITS

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2		
Section	Test Item	Limit
FCC §15.247 (d) RSS-247 5.5	Conducted Spurious Emission	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

For Bandedge use the following settings:

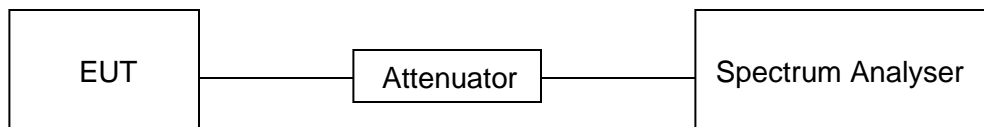
Detector	Peak
RBW	RBW $\geq$ 1% of the span
VBW	$\geq$ RBW
Span	wide enough to fully capture the emission being measured
Trace	Max hold
Sweep time	Auto couple.

For Spurious Emission use the following settings:

Detector	Peak
RBW	100K
VBW	$\geq$ RBW
Span	wide enough to fully capture the emission being measured
Trace	Max hold
Sweep time	Auto couple.

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

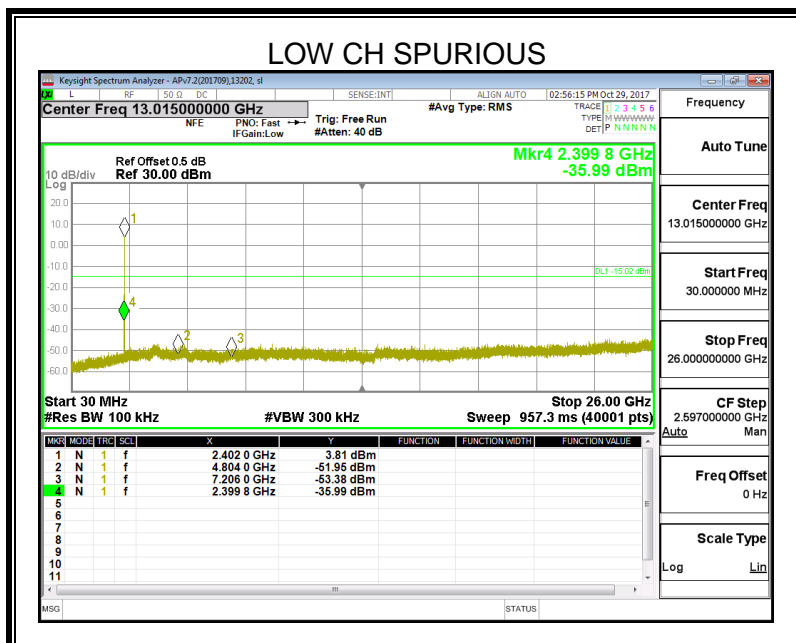
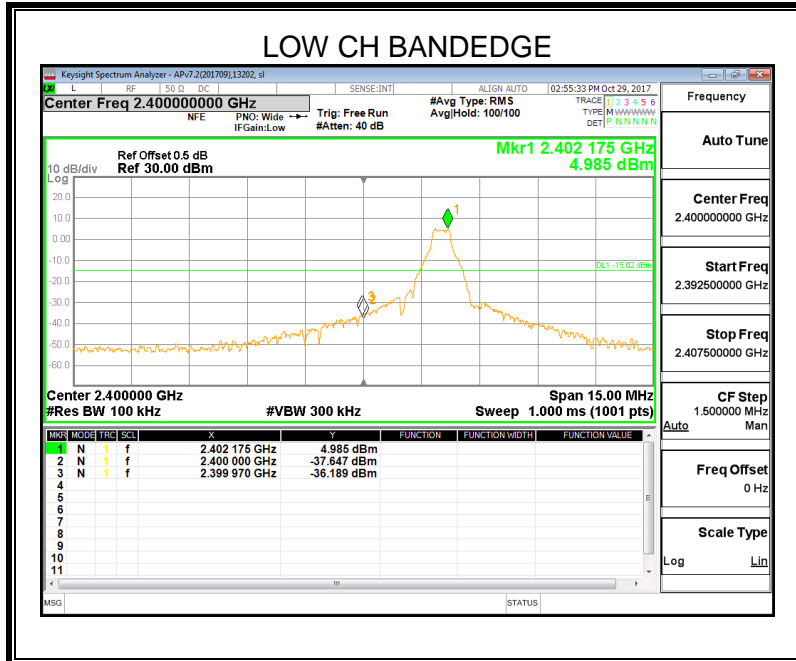
### TEST SETUP



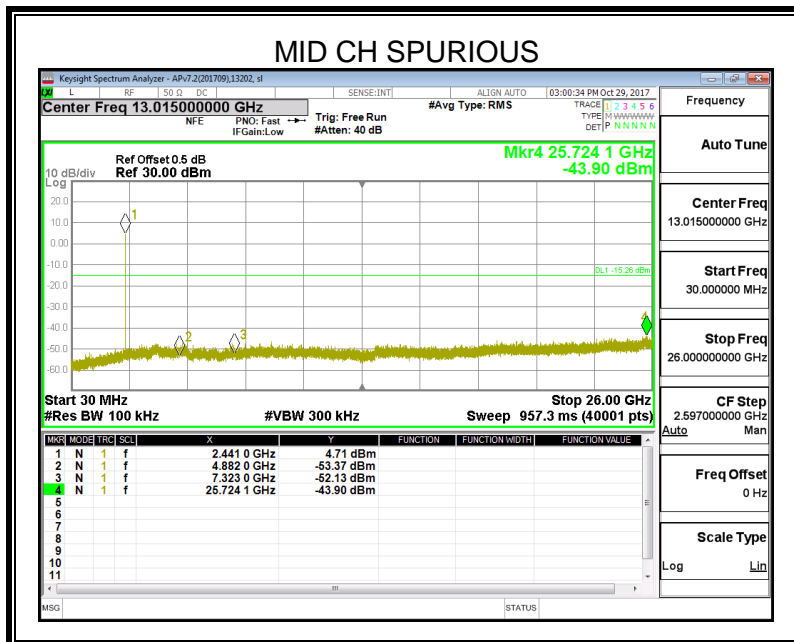
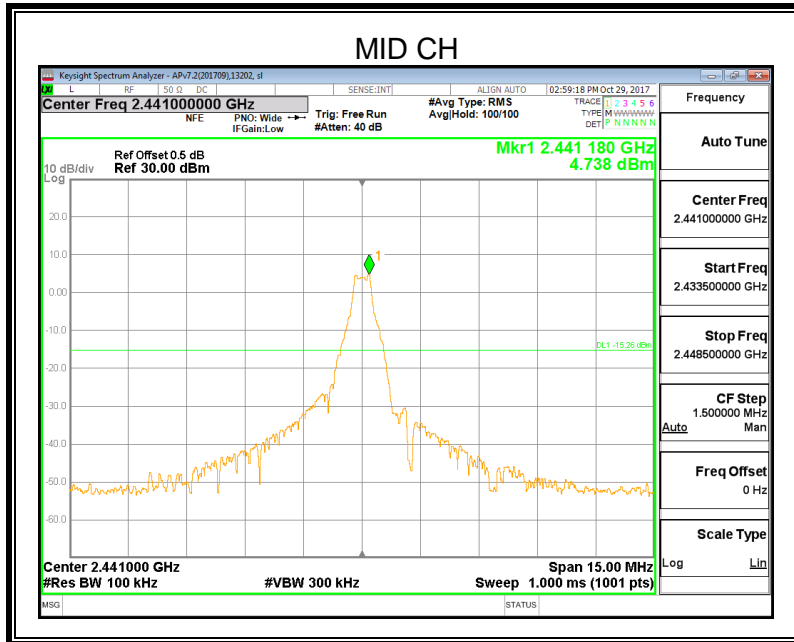
## RESULTS

### 6.7.1. GFSK MODE

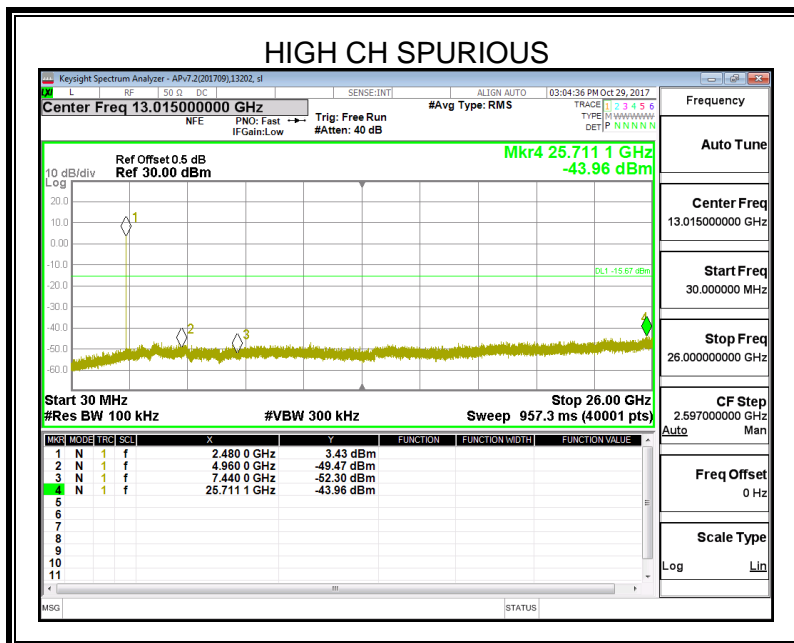
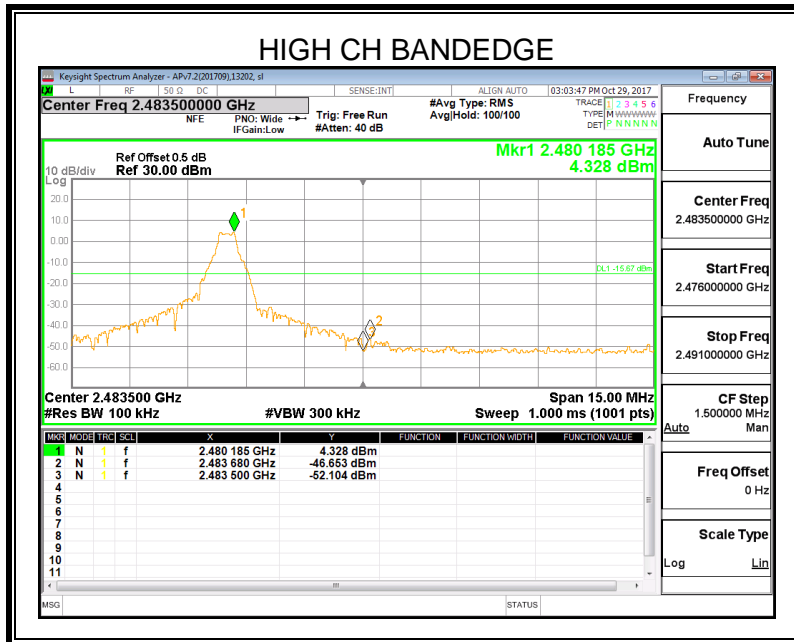
#### SPURIOUS EMISSIONS, LOW CHANNEL



**SPURIOUS EMISSIONS, MID CHANNEL**

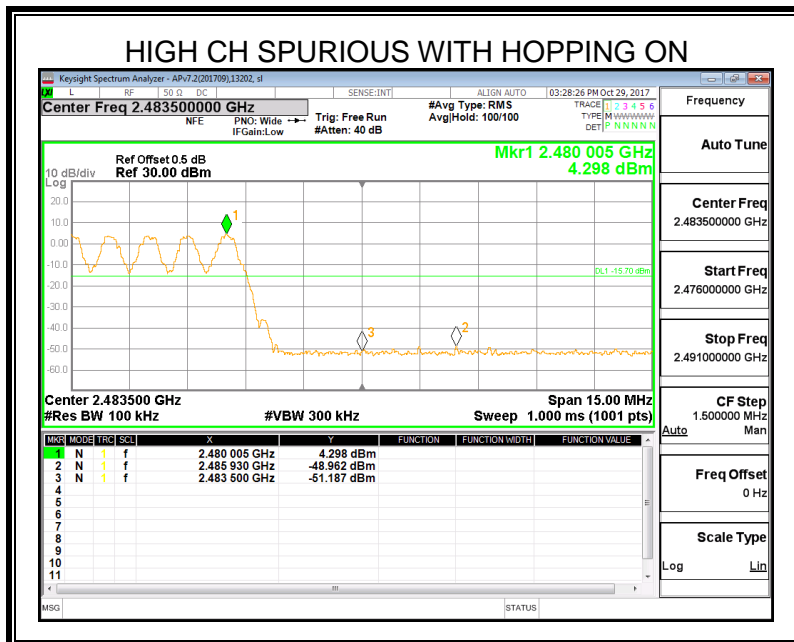
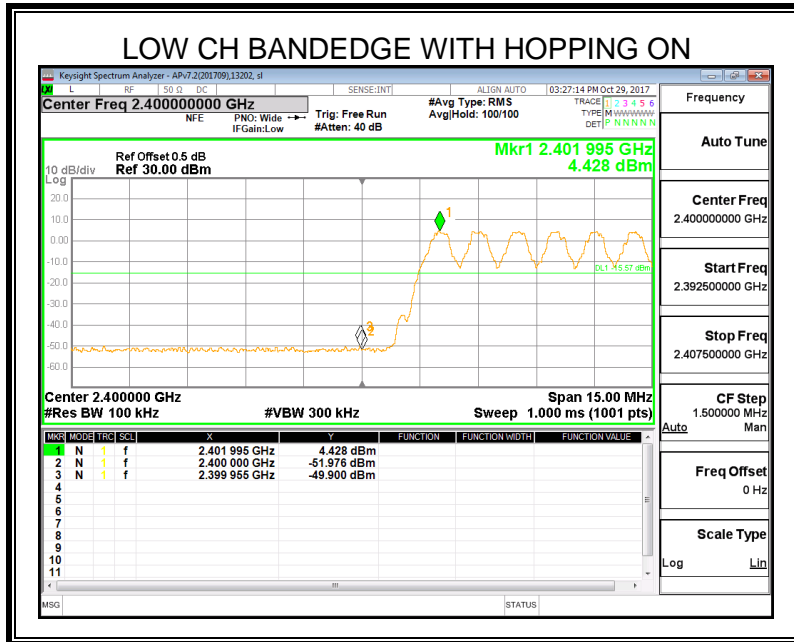


**SPURIOUS EMISSIONS, HIGH CHANNEL**



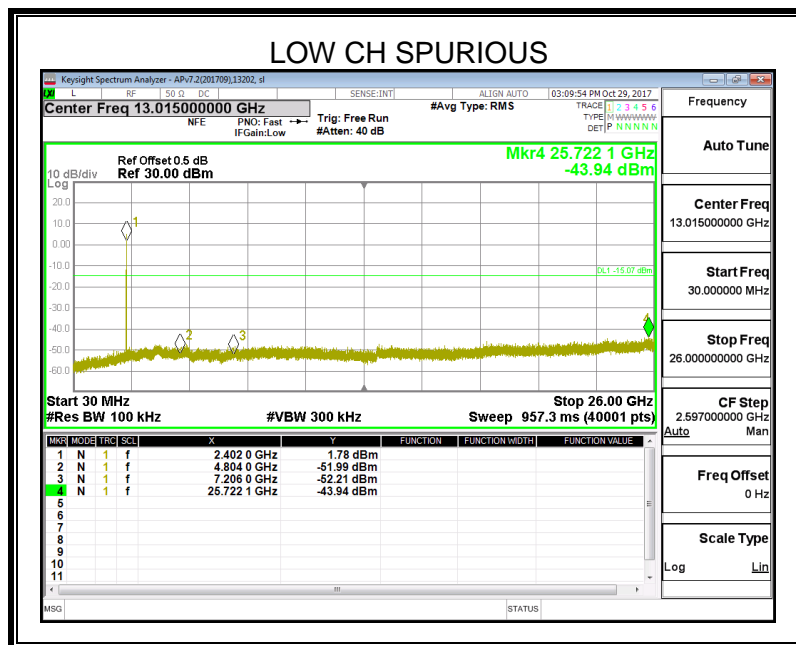
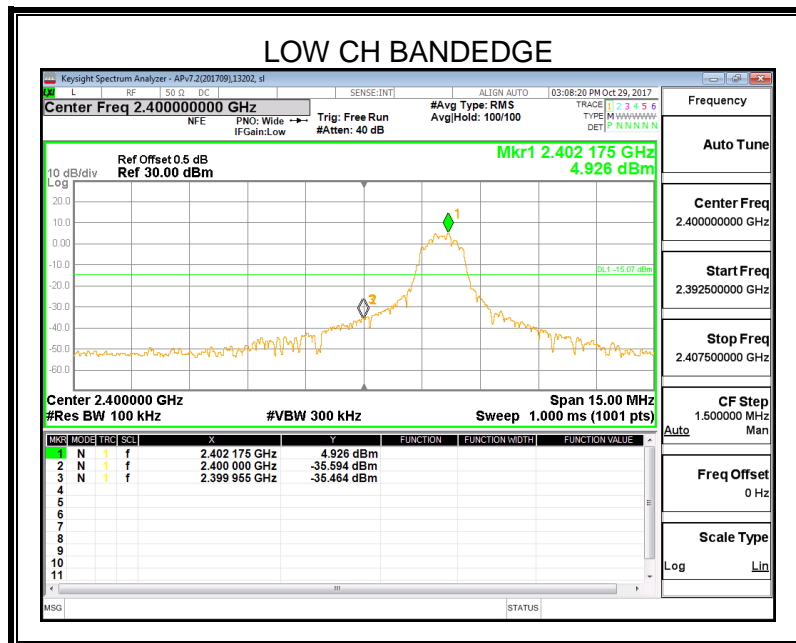


**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

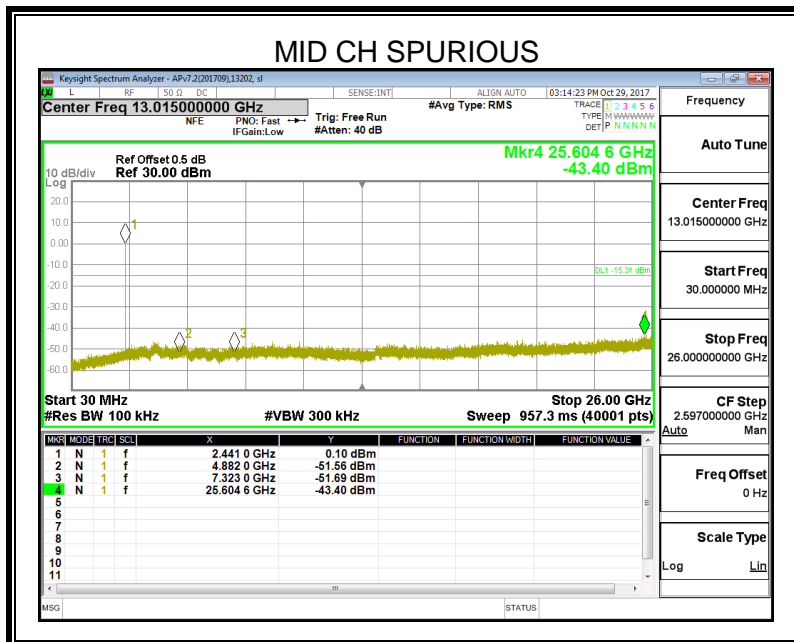
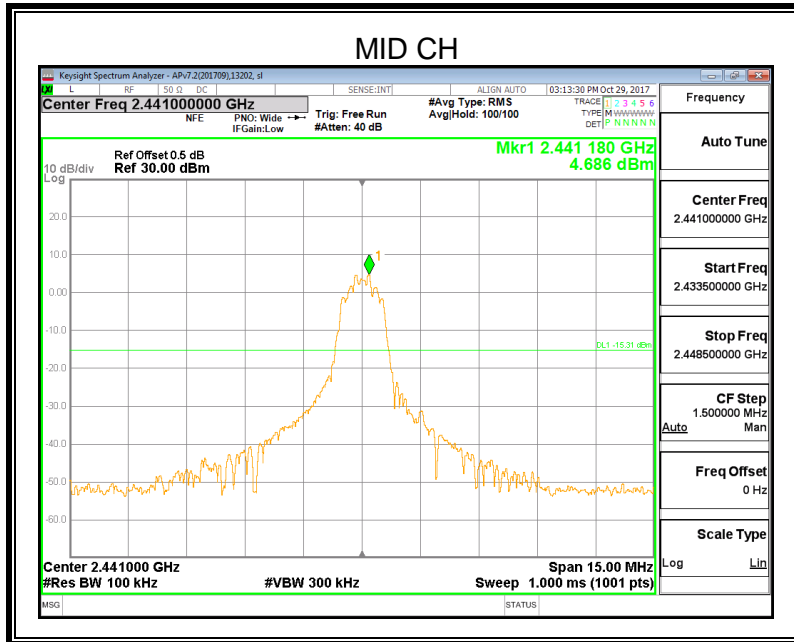


## 6.7.2. 8DPSK MODE

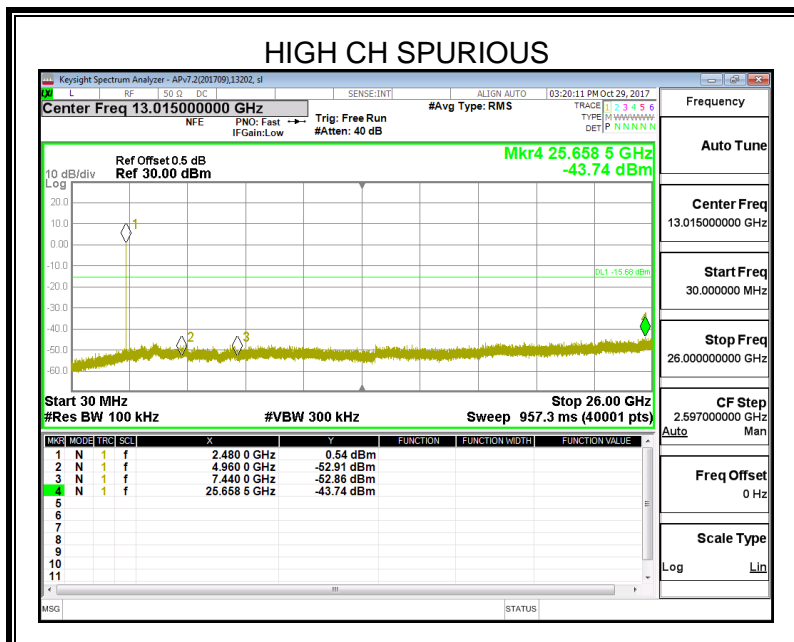
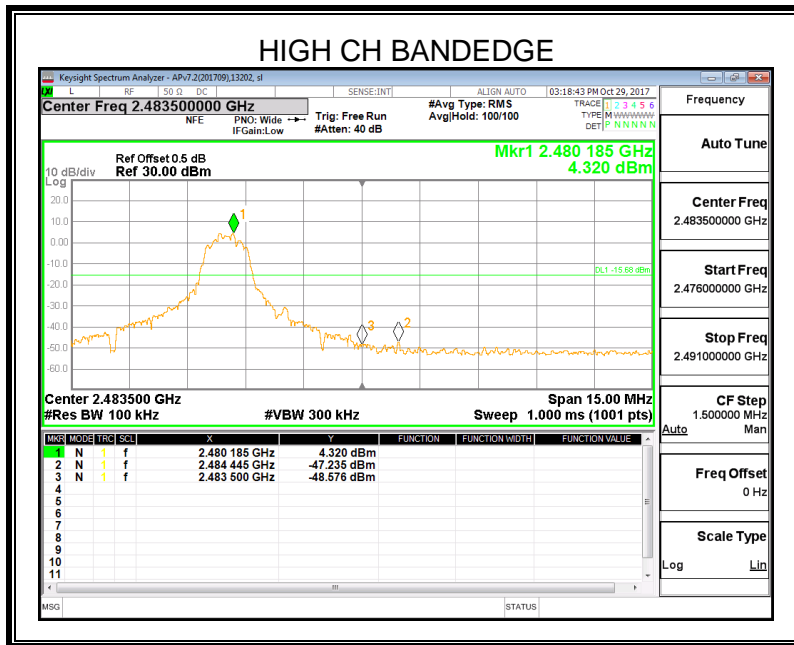
### SPURIOUS EMISSIONS, LOW CHANNEL



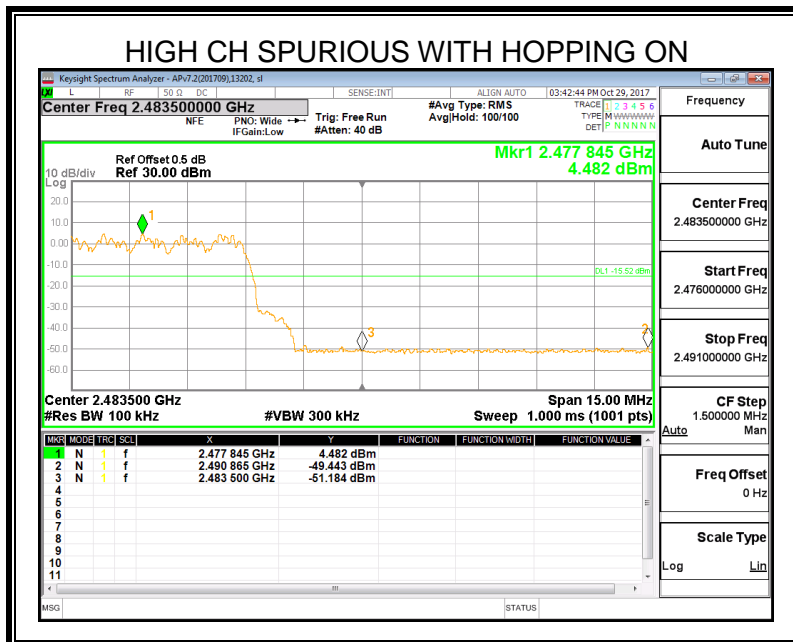
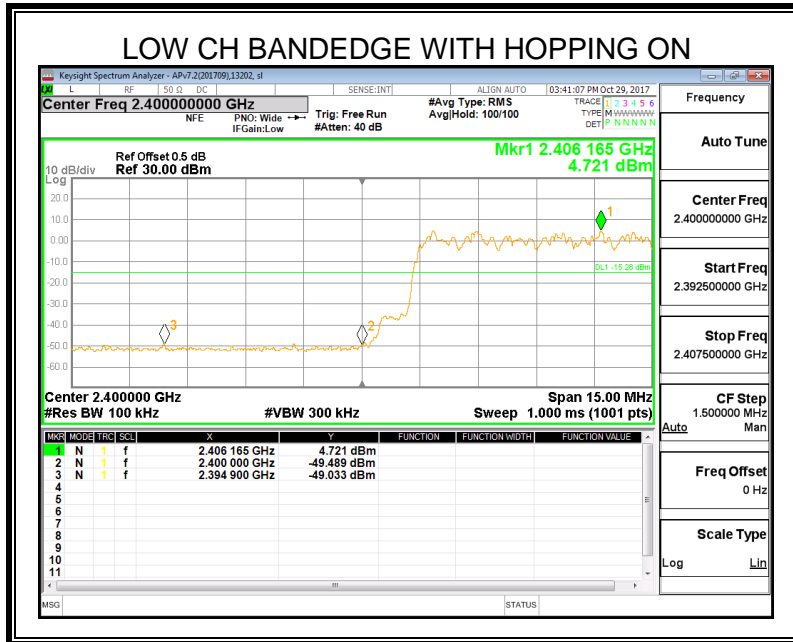
**SPURIOUS EMISSIONS, MID CHANNEL**



**SPURIOUS EMISSIONS, HIGH CHANNEL**



**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 7. RADIATED TEST RESULTS

### 7.1. LIMITS AND PROCEDURE

#### LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to SS-GEN Clause 8.9 and Clause 8.10

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

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
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

Radiation Disturbance Test Limit for FCC (Above 1G)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

Restricted bands of operation

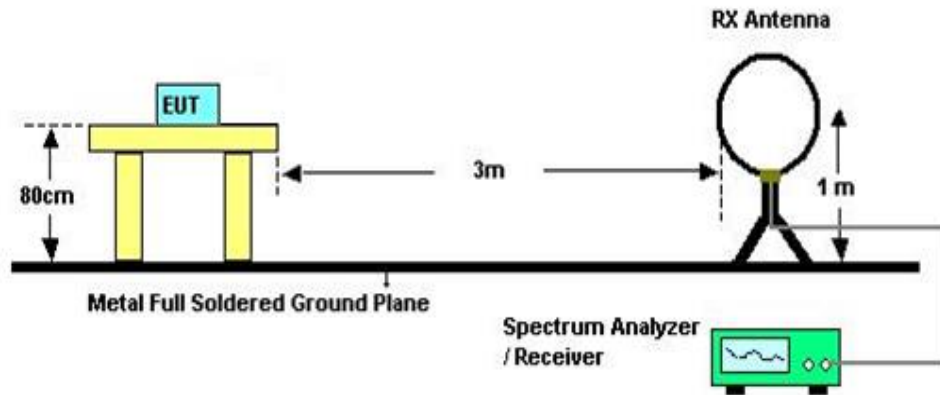
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5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

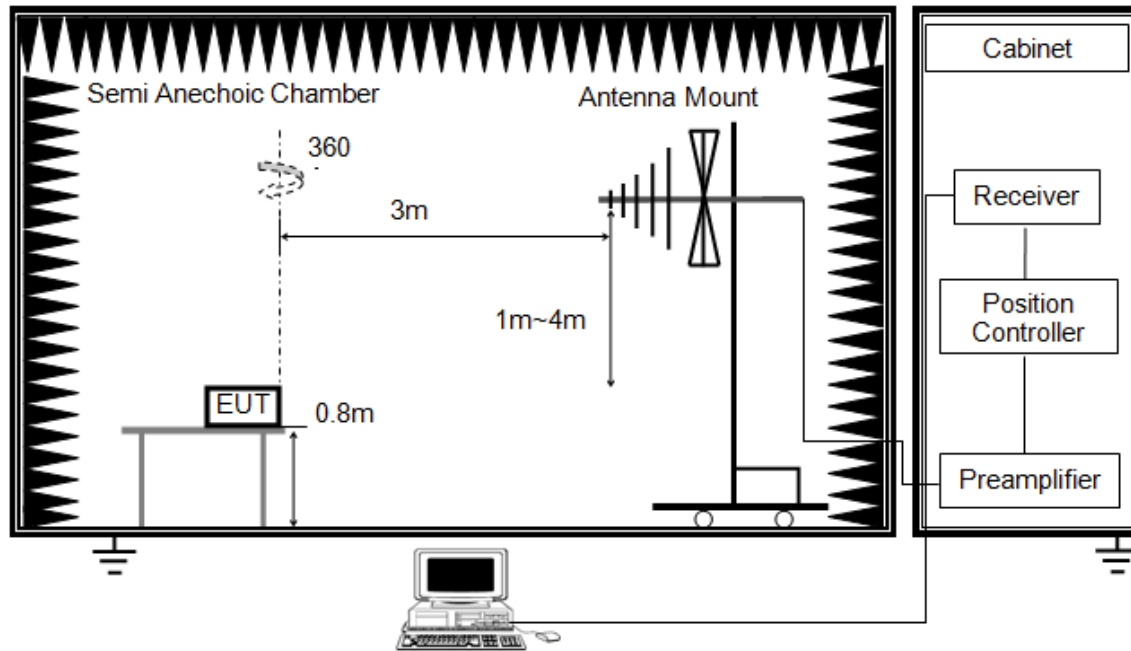


The setting of the spectrum analyser

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 meter 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 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.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)



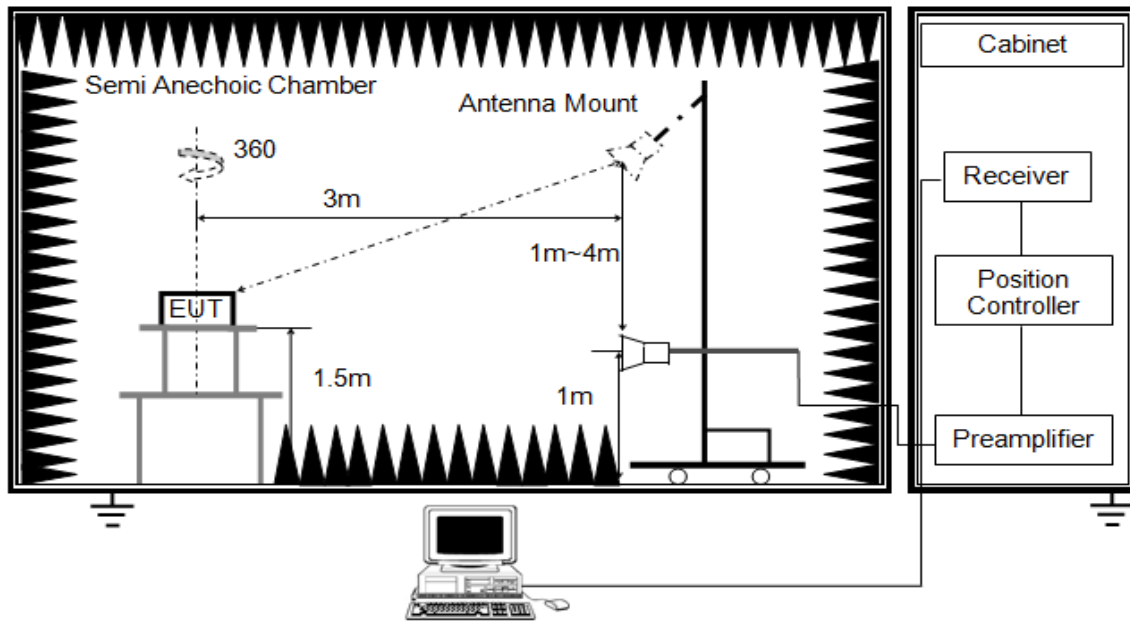


The setting of the spectrum analyser

RBW	120K
VBW	300K
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 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.
6. For the actual test configuration, please refer to the related item in this test report.

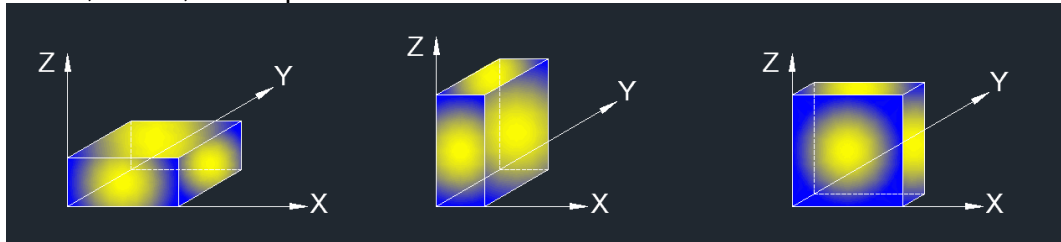
Above 1G



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 (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 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 the Duty Cycle please refer to clause 6.1.ON TIME AND DUTY CYCLE.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

X axis, Y axis, Z axis positions:

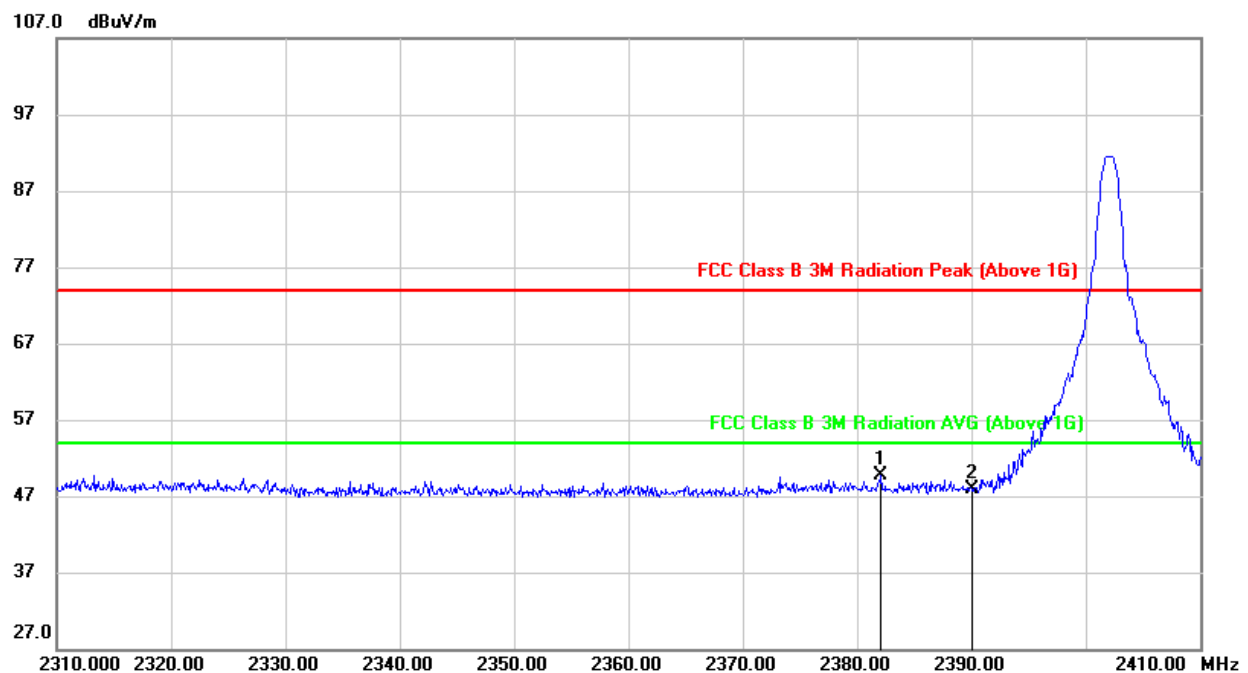


Note: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

## 7.2. RESTRICTED BANDEDGE

### 7.2.1. GFSK MODE

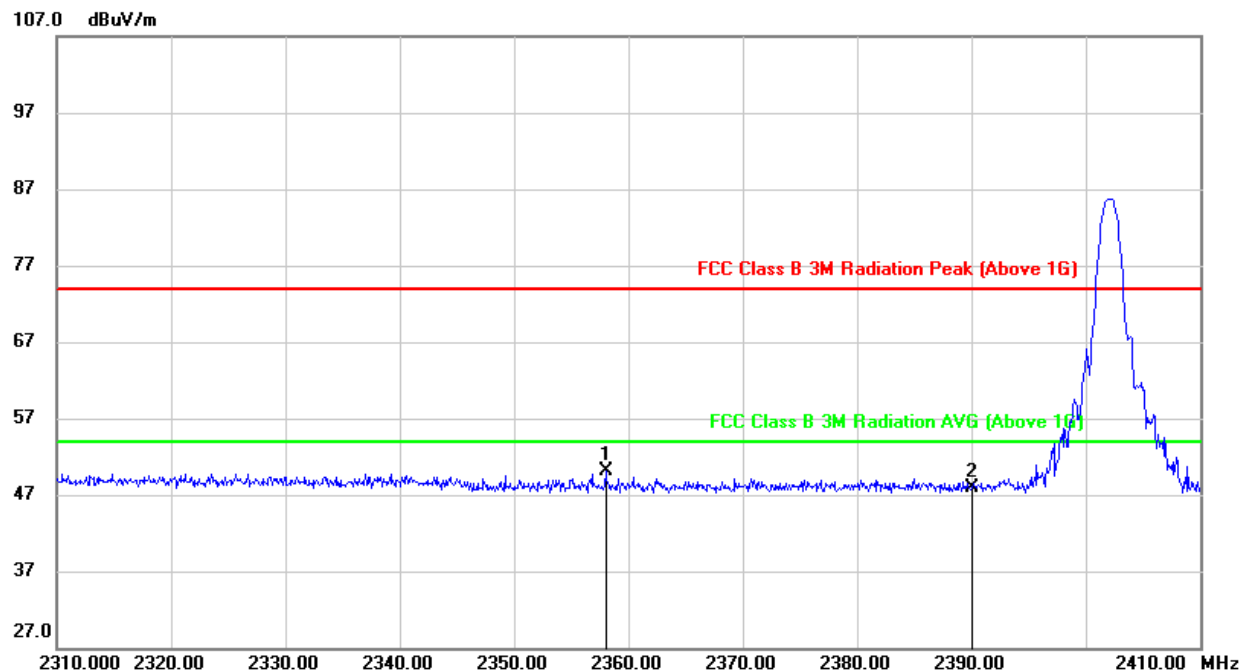
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2382.100	16.45	33.20	49.65	74.00	-24.35	peak
2	2390.000	14.68	33.14	47.82	74.00	-26.18	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

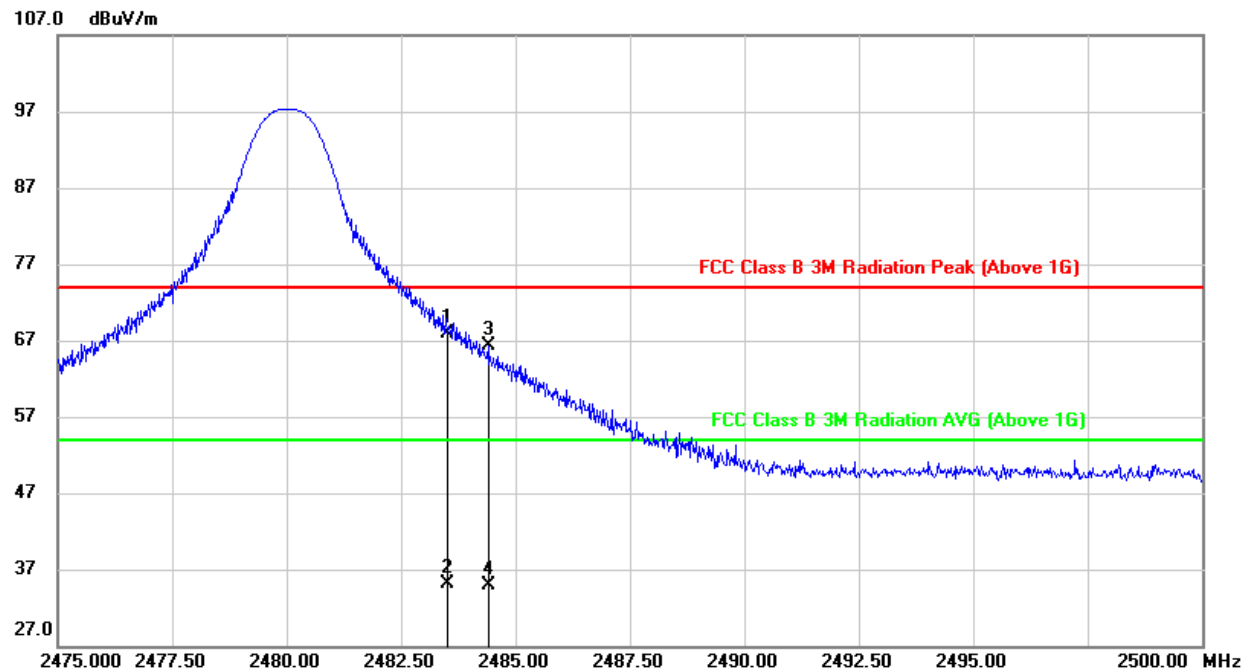
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2358.000	16.67	33.48	50.15	74.00	-23.85	peak
2	2390.000	14.73	33.24	47.97	74.00	-26.03	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. AVG: VBW=1/Ton where: ton is transmit duration.  
 5. For transmit duration, please refer to clause 6.1.

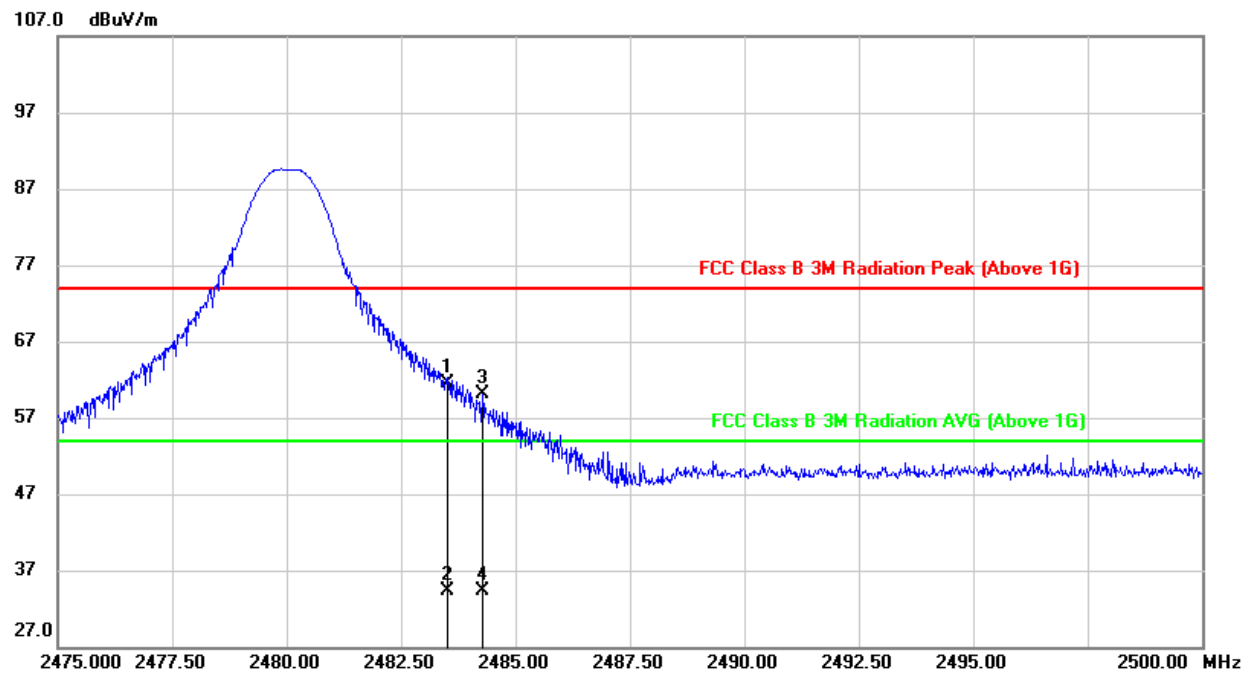
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	35.18	32.78	67.96	74.00	-6.04	peak
2	2483.500	2.23	32.78	35.01	54.00	-18.99	AVG
3	2484.400	33.53	32.78	66.31	74.00	-7.69	peak
4	2484.400	2.06	32.78	34.84	54.00	-19.16	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.  
 5. For transmit duration, please refer to clause 6.1.

**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

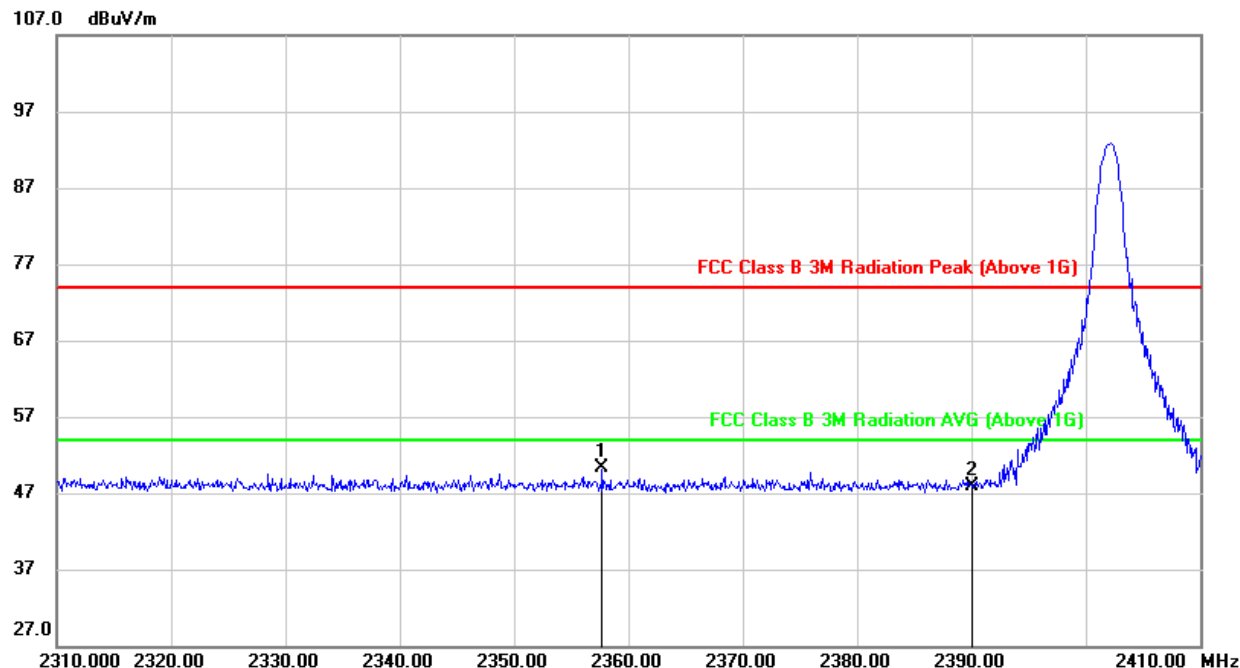


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	28.63	32.88	61.51	74.00	-12.49	peak
2	2483.500	1.48	32.88	34.36	54.00	-19.64	AVG
3	2484.275	27.28	32.88	60.16	74.00	-13.84	peak
4	2484.275	1.50	32.88	34.38	54.00	-19.62	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.  
 5. For transmit duration, please refer to clause 6.1.

## 7.2.2. 8DPSK MODE

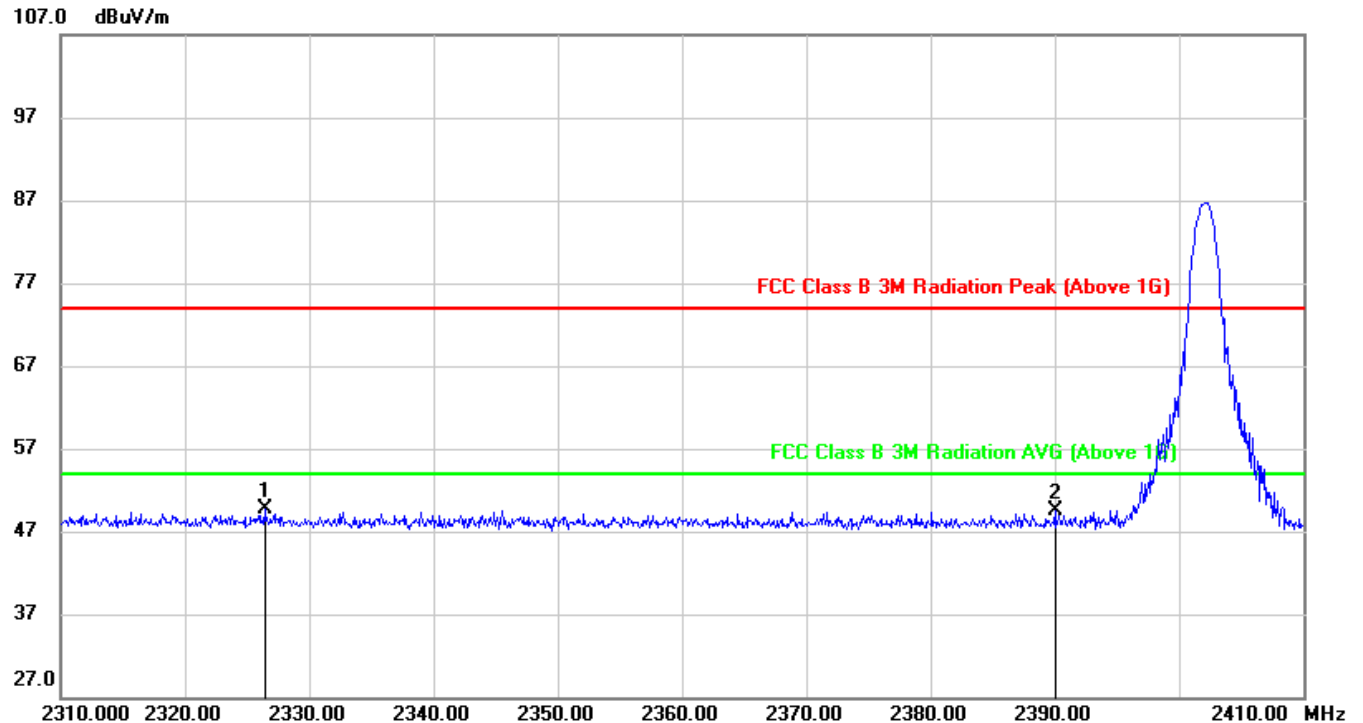
### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2357.700	16.82	33.38	50.20	74.00	-23.80	peak
2	2390.000	14.81	33.14	47.95	74.00	-26.05	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. AVG: VBW=1/Ton where: ton is transmit duration.  
 5. For transmit duration, please refer to clause 6.1.

**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

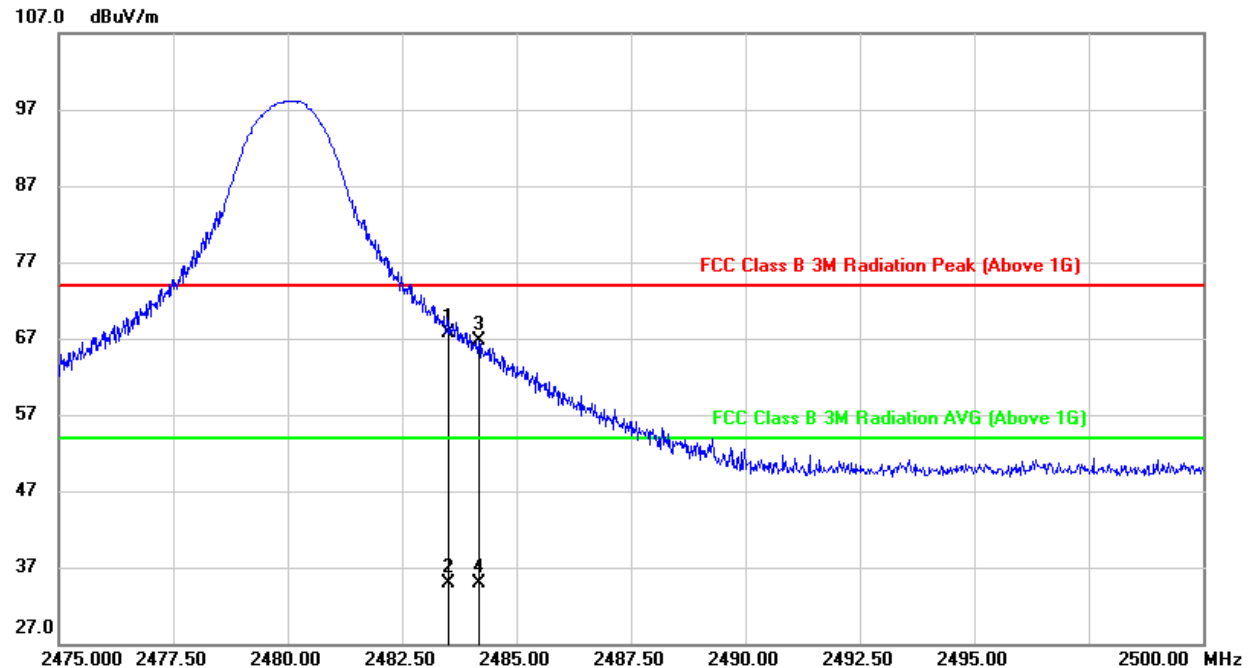


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2326.400	15.98	33.75	49.73	74.00	-24.27	peak
2	2390.000	16.19	33.24	49.43	74.00	-24.57	peak

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. AVG: VBW=1/Ton where: ton is transmit duration.  
 5. For transmit duration, please refer to clause 6.1.



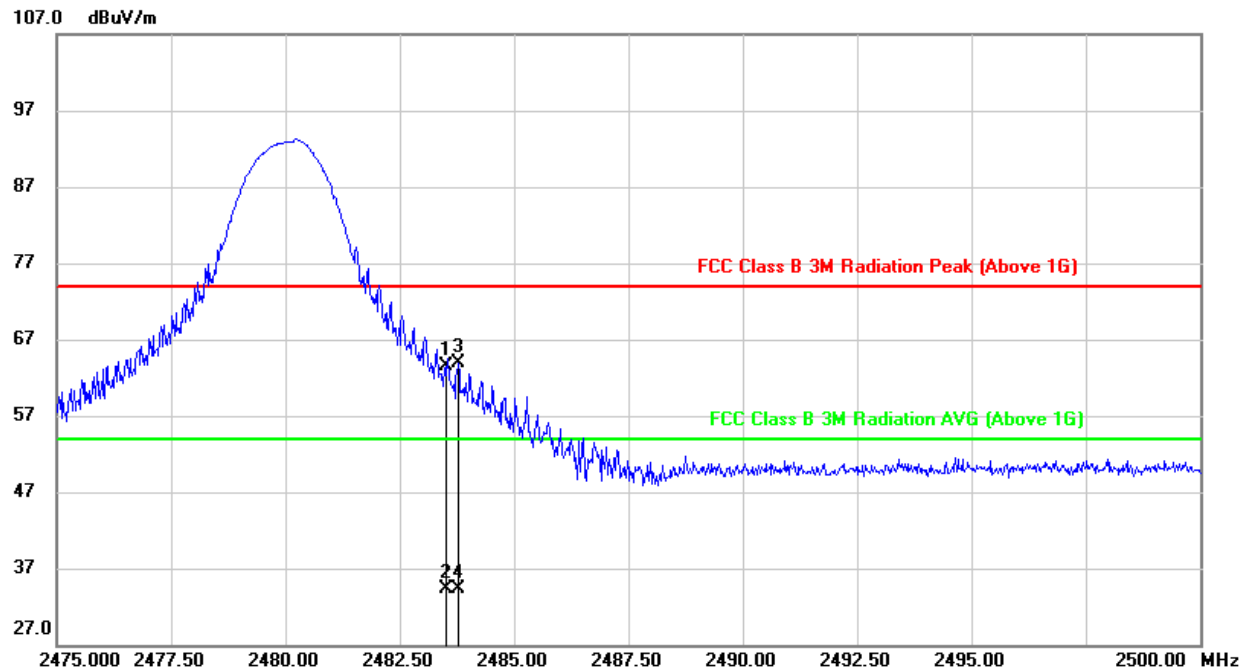
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	35.01	32.78	67.79	74.00	-6.21	peak
2	2483.500	2.15	32.78	34.93	54.00	-19.07	AVG
3	2484.175	33.92	32.78	66.70	74.00	-7.30	peak
4	2484.175	2.04	32.78	34.82	54.00	-19.18	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



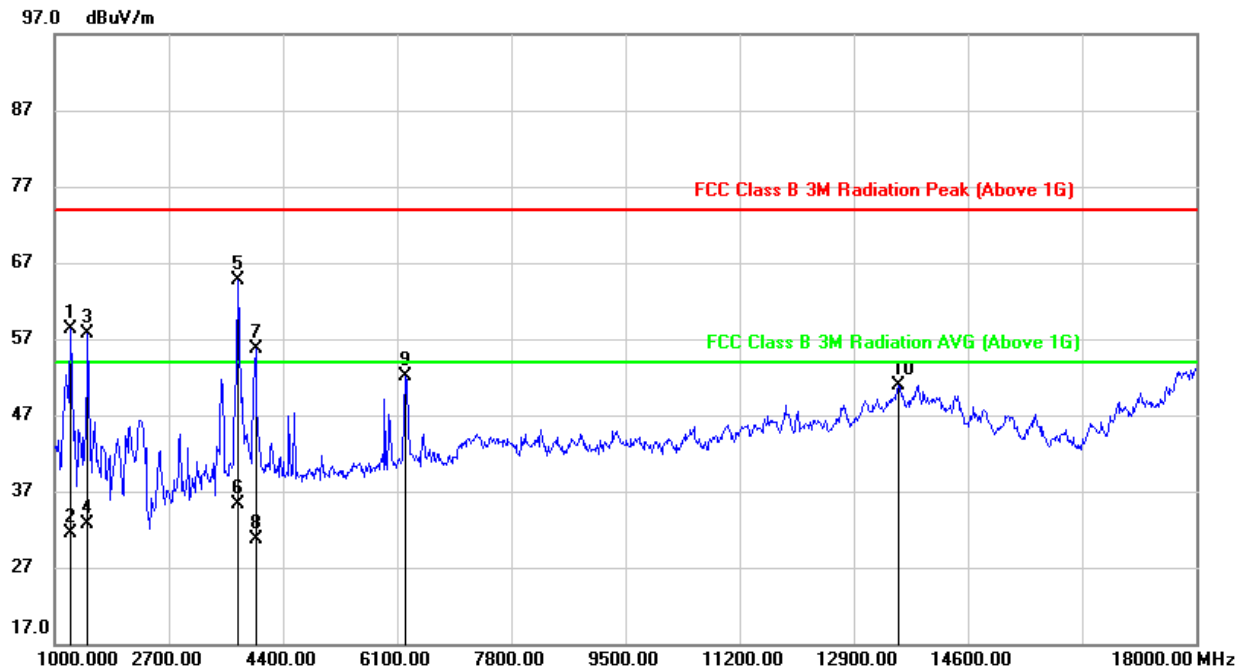
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	30.60	32.88	63.48	74.00	-10.52	peak
2	2483.500	1.48	32.88	34.36	54.00	-19.64	AVG
3	2483.775	31.01	32.88	63.89	74.00	-10.11	peak
4	2483.775	1.48	32.88	34.36	54.00	-19.64	AVG

- 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. AVG: VBW=1/Ton where: ton is transmit duration.
  5. For transmit duration, please refer to clause 6.1.

## 7.3. SPURIOUS EMISSIONS (1~18GHz)

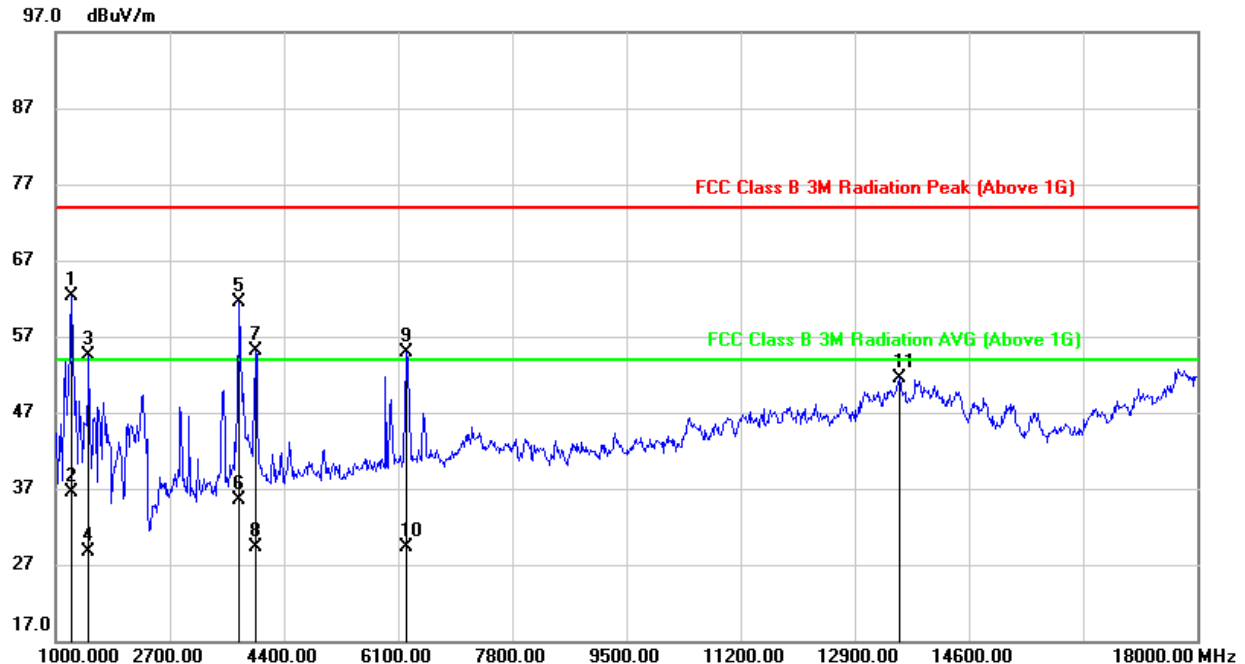
### 7.3.1. GFSK MODE

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



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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

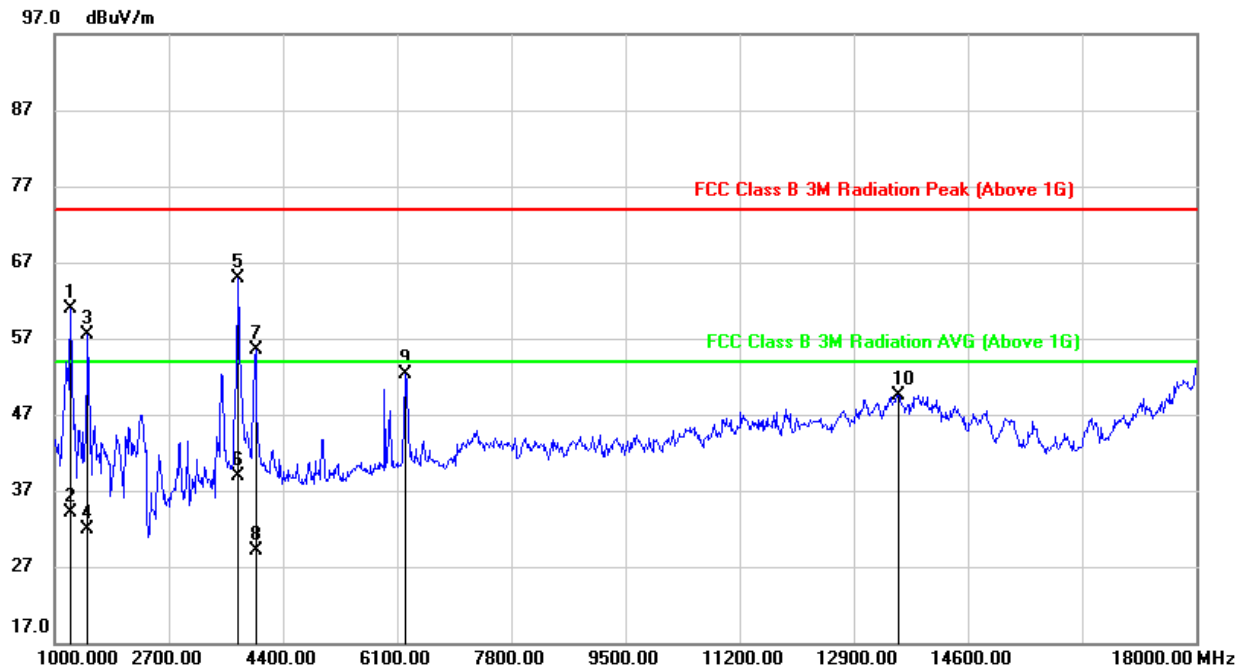
**HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	75.45	-13.22	62.23	74.00	-11.77	peak
2	1238.000	49.68	-13.22	36.46	54.00	-17.54	AVG
3	1493.000	67.34	-12.77	54.57	74.00	-19.43	peak
4	1493.000	41.52	-12.77	28.75	54.00	-25.25	AVG
5	3737.000	66.28	-4.81	61.47	74.00	-12.53	peak
6	3737.000	40.28	-4.81	35.47	54.00	-18.53	AVG
7	3975.000	59.59	-4.42	55.17	74.00	-18.83	peak
8	3975.000	33.64	-4.42	29.22	54.00	-24.78	AVG
9	6219.000	52.13	2.83	54.96	74.00	-19.04	peak
10	6219.000	26.44	2.83	29.27	54.00	-24.73	AVG
11	13563.000	32.31	19.25	51.56	74.00	-22.44	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

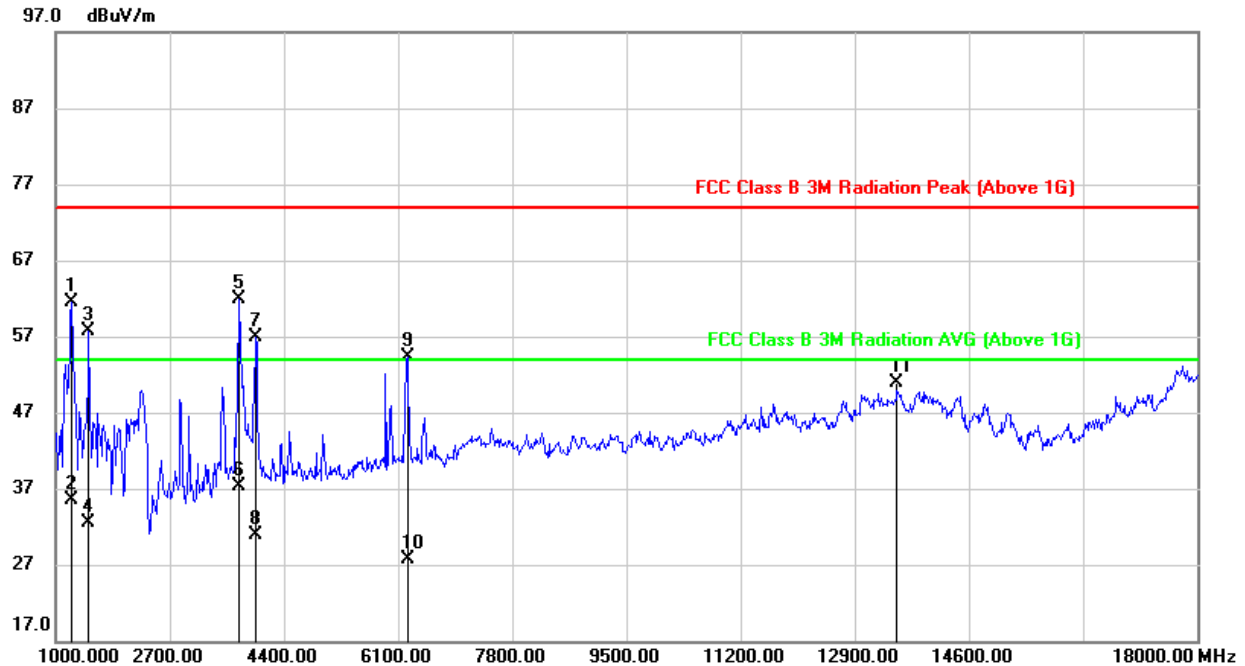
### HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	74.11	-13.27	60.84	74.00	-13.16	peak
2	1238.000	47.33	-13.27	34.06	54.00	-19.94	AVG
3	1493.000	70.26	-12.68	57.58	74.00	-16.42	peak
4	1493.000	44.56	-12.68	31.88	54.00	-22.12	AVG
5	3737.000	69.81	-4.83	64.98	74.00	-9.02	peak
6	3737.000	43.69	-4.83	38.86	54.00	-15.14	AVG
7	3992.000	59.93	-4.42	55.51	74.00	-18.49	peak
8	3992.000	33.61	-4.42	29.19	54.00	-24.81	AVG
9	6219.000	49.44	2.79	52.23	74.00	-21.77	peak
10	13563.000	30.68	18.86	49.54	74.00	-24.46	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

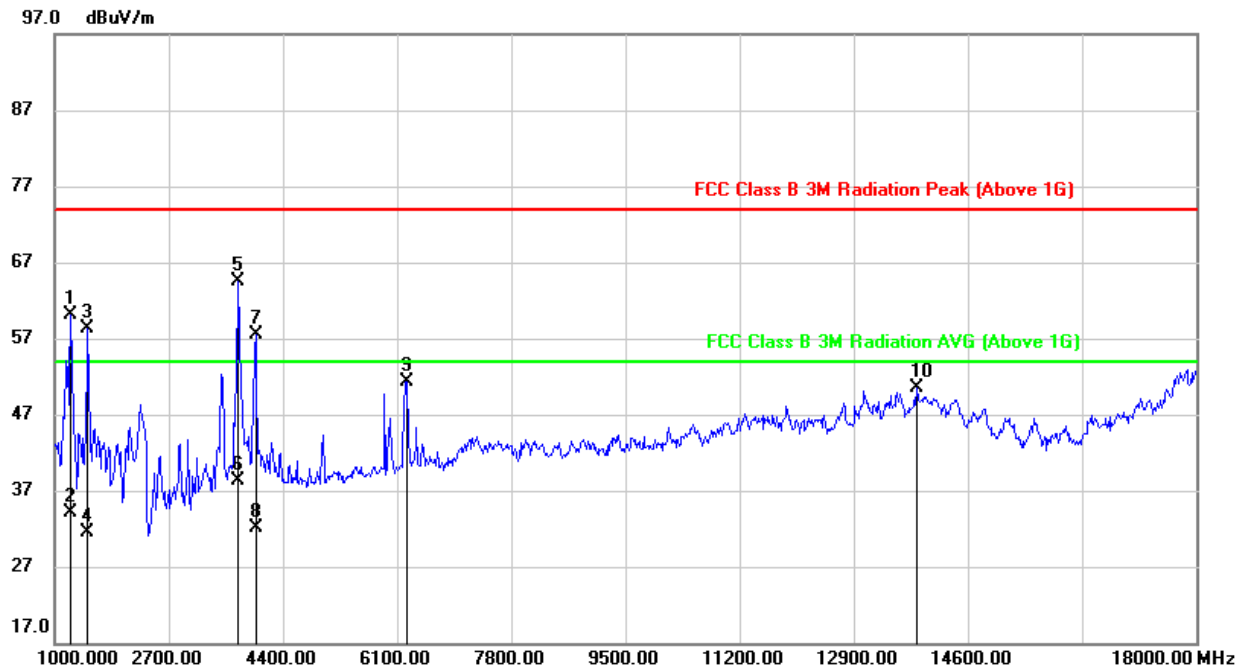
# HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	74.63	-13.22	61.41	74.00	-12.59	peak
2	1238.000	48.69	-13.22	35.47	54.00	-18.53	AVG
3	1493.000	70.57	-12.77	57.80	74.00	-16.20	peak
4	1493.000	45.23	-12.77	32.46	54.00	-21.54	AVG
5	3737.000	66.67	-4.81	61.86	74.00	-12.14	peak
6	3737.000	42.11	-4.81	37.30	54.00	-16.70	AVG
7	3975.000	61.41	-4.42	56.99	74.00	-17.01	peak
8	3975.000	35.26	-4.42	30.84	54.00	-23.16	AVG
9	6236.000	51.41	2.89	54.30	74.00	-19.70	peak
10	6236.000	24.88	2.89	27.77	54.00	-26.23	AVG
11	13529.000	31.67	19.26	50.93	74.00	-23.07	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

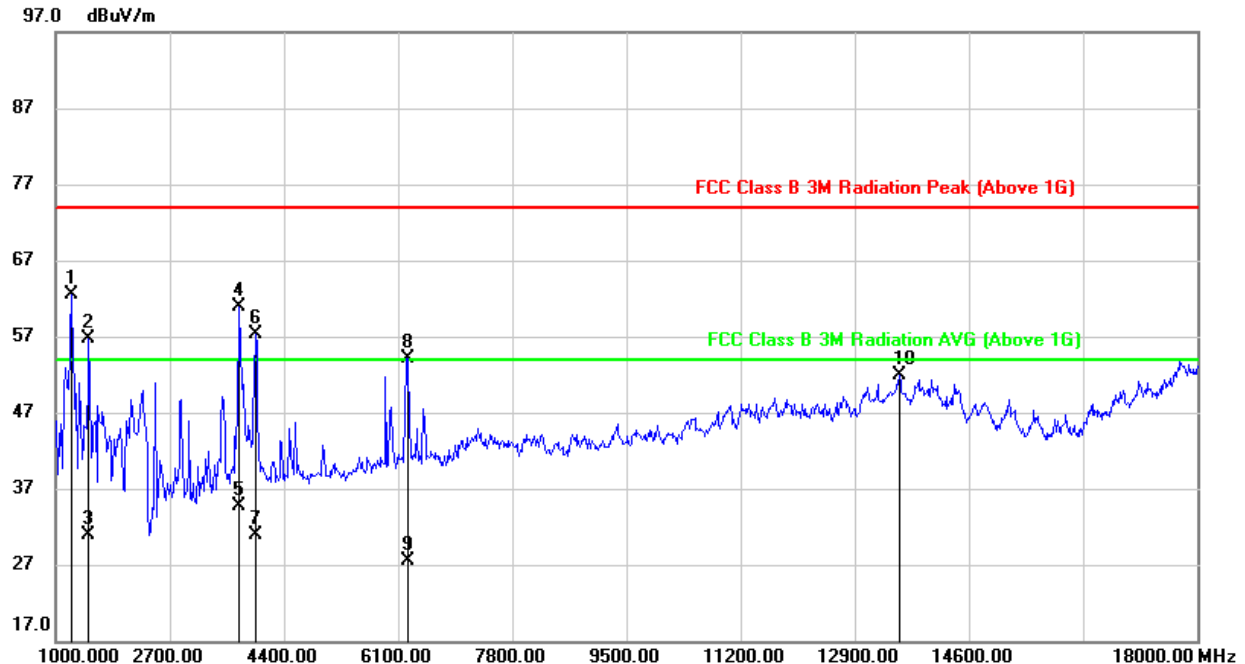
### HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	73.34	-13.27	60.07	74.00	-13.93	peak
2	1238.000	47.31	-13.27	34.04	54.00	-19.96	AVG
3	1493.000	71.00	-12.68	58.32	74.00	-15.68	peak
4	1493.000	44.11	-12.68	31.43	54.00	-22.57	AVG
5	3737.000	69.26	-4.83	64.43	74.00	-9.57	peak
6	3737.000	43.22	-4.83	38.39	54.00	-15.61	AVG
7	3992.000	61.93	-4.42	57.51	74.00	-16.49	peak
8	3992.000	36.51	-4.42	32.09	54.00	-21.91	AVG
9	6236.000	48.56	2.82	51.38	74.00	-22.62	peak
10	13835.000	31.55	19.01	50.56	74.00	-23.44	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

# HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



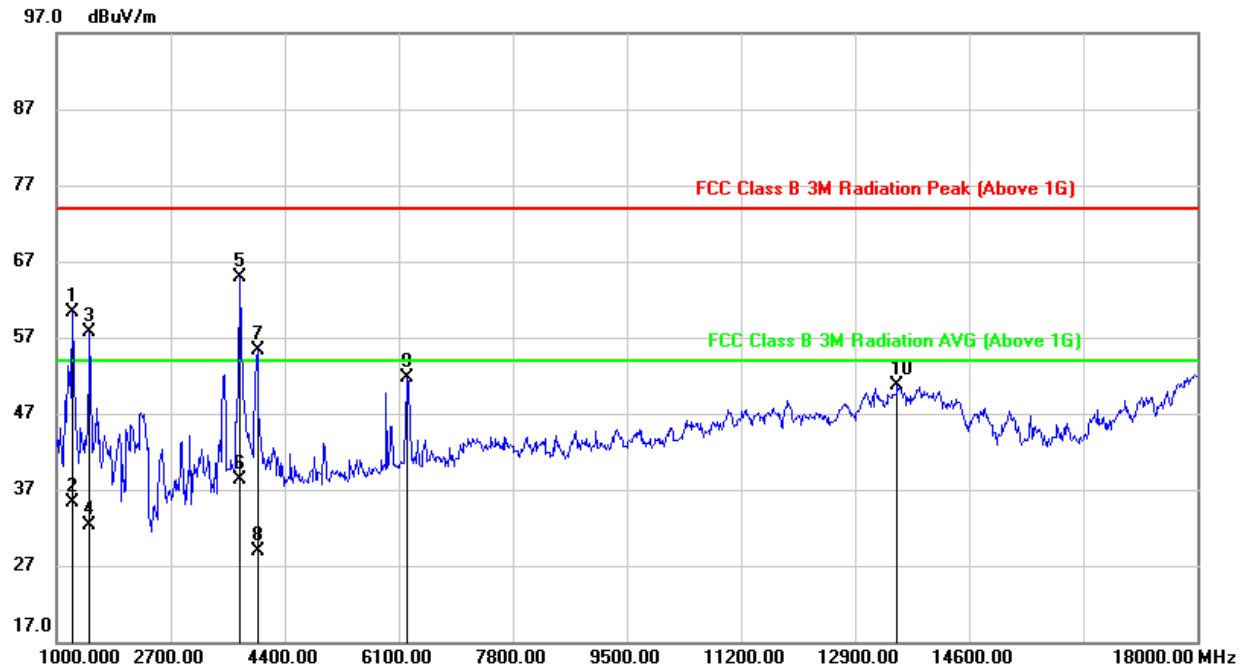
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	75.78	-13.22	62.56	74.00	-11.44	peak
2	1493.000	69.54	-12.77	56.77	74.00	-17.23	peak
3	1493.000	43.58	-12.77	30.81	54.00	-23.19	AVG
4	3737.000	65.64	-4.81	60.83	74.00	-13.17	peak
5	3737.000	39.42	-4.81	34.61	54.00	-19.39	AVG
6	3975.000	61.74	-4.42	57.32	74.00	-16.68	peak
7	3975.000	35.36	-4.42	30.94	54.00	-23.06	AVG
8	6236.000	51.24	2.89	54.13	74.00	-19.87	peak
9	6236.000	24.68	2.89	27.57	54.00	-26.43	AVG
10	13563.000	32.66	19.25	51.91	74.00	-22.09	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.



### 7.3.2. 8DPSK MODE

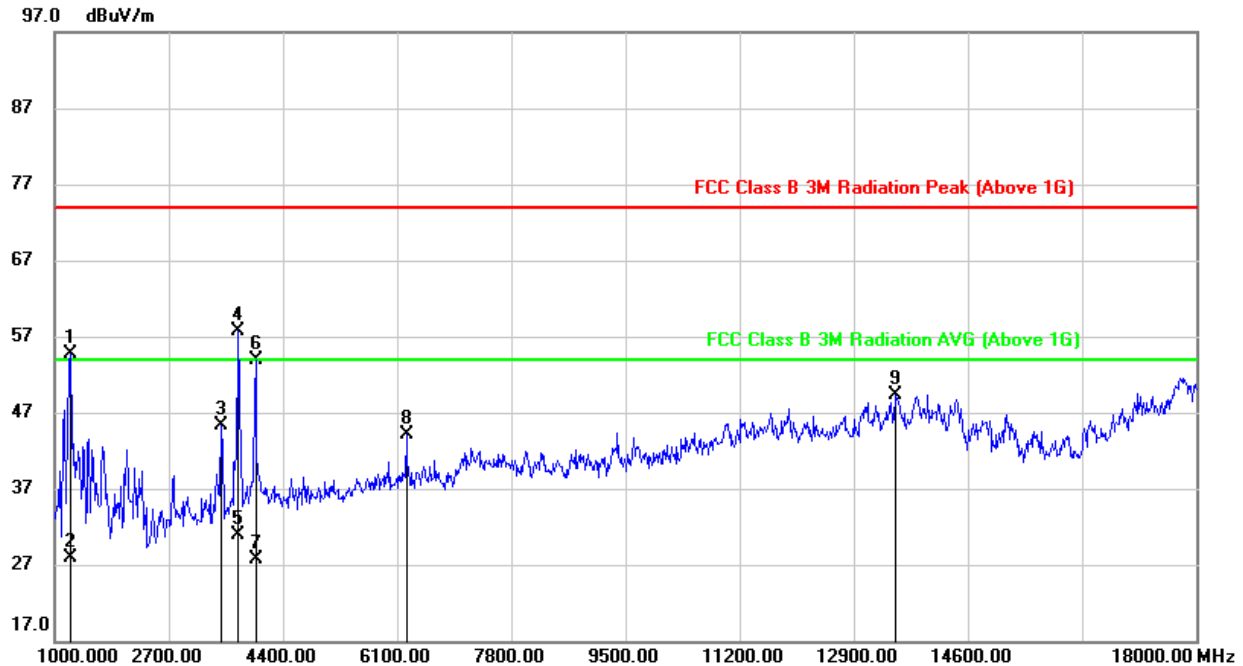
#### HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	73.48	-13.27	60.21	74.00	-13.79	peak
2	1238.000	48.61	-13.27	35.34	54.00	-18.66	AVG
3	1493.000	70.30	-12.68	57.62	74.00	-16.38	peak
4	1493.000	45.02	-12.68	32.34	54.00	-21.66	AVG
5	3720.000	69.77	-4.89	64.88	74.00	-9.12	peak
6	3720.000	43.16	-4.89	38.27	54.00	-15.73	AVG
7	3992.000	59.64	-4.42	55.22	74.00	-18.78	peak
8	3992.000	33.26	-4.42	28.84	54.00	-25.16	AVG
9	6219.000	48.86	2.79	51.65	74.00	-22.35	peak
10	13529.000	32.02	18.71	50.73	74.00	-23.27	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. AVG: VBW=1/Ton where: ton is transmit duration.  
 5. For transmit duration, please refer to clause 6.1.

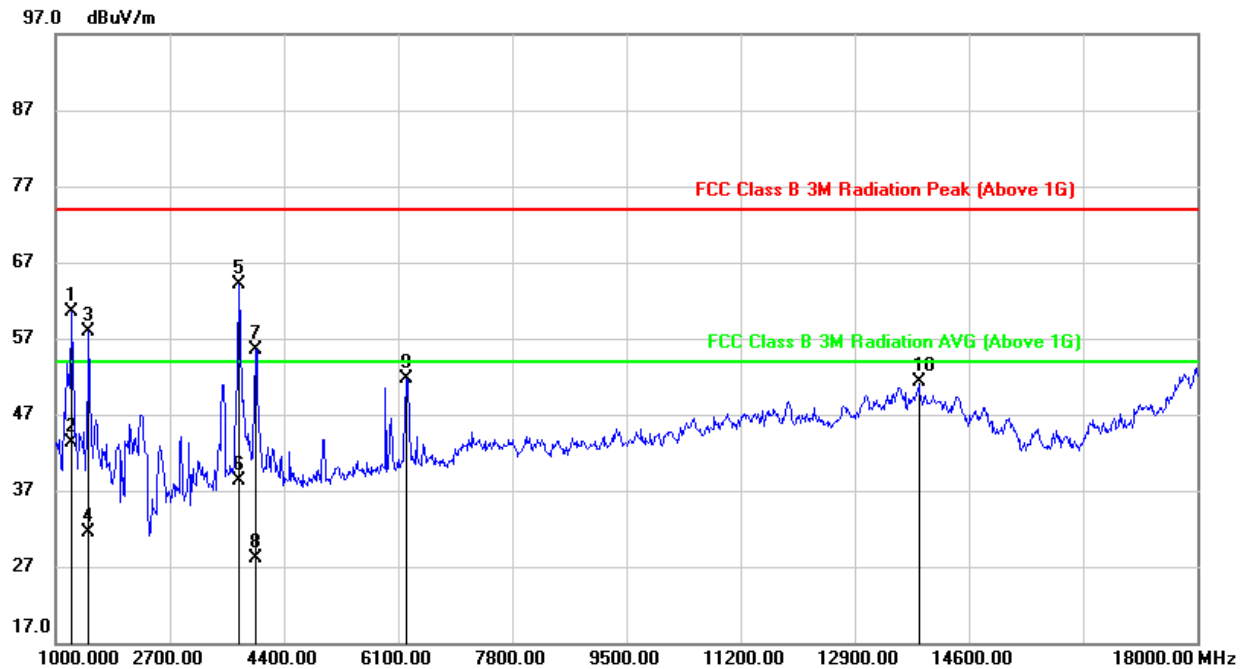
### HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	67.85	-13.22	54.63	74.00	-19.37	peak
2	1238.000	41.09	-13.22	27.87	54.00	-26.13	AVG
3	3482.000	51.24	-5.96	45.28	74.00	-28.72	peak
4	3737.000	62.61	-4.81	57.80	74.00	-16.20	peak
5	3737.000	35.62	-4.81	30.81	54.00	-23.19	AVG
6	3992.000	58.31	-4.42	53.89	74.00	-20.11	peak
7	3992.000	32.03	-4.42	27.61	54.00	-26.39	AVG
8	6236.000	41.15	2.89	44.04	74.00	-29.96	peak
9	13512.000	30.17	19.16	49.33	74.00	-24.67	peak

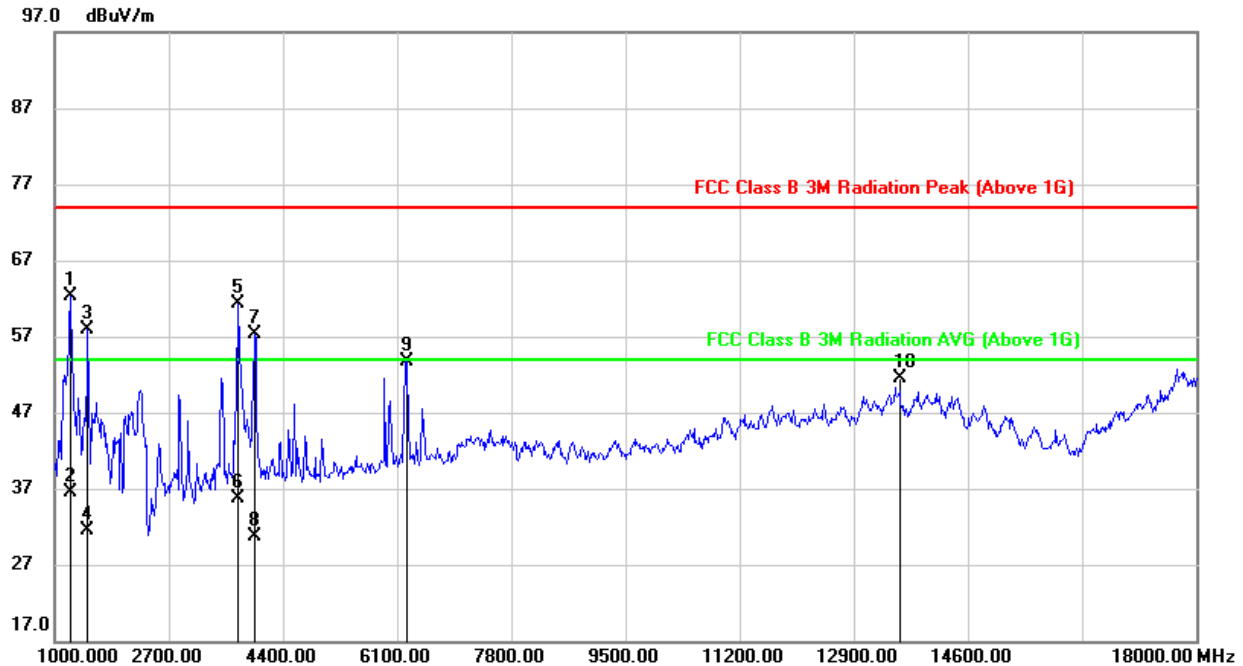
Note: 1. Measurement = Reading Level + Correct Factor.  
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
3. Peak: Peak detector.  
4. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

# HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

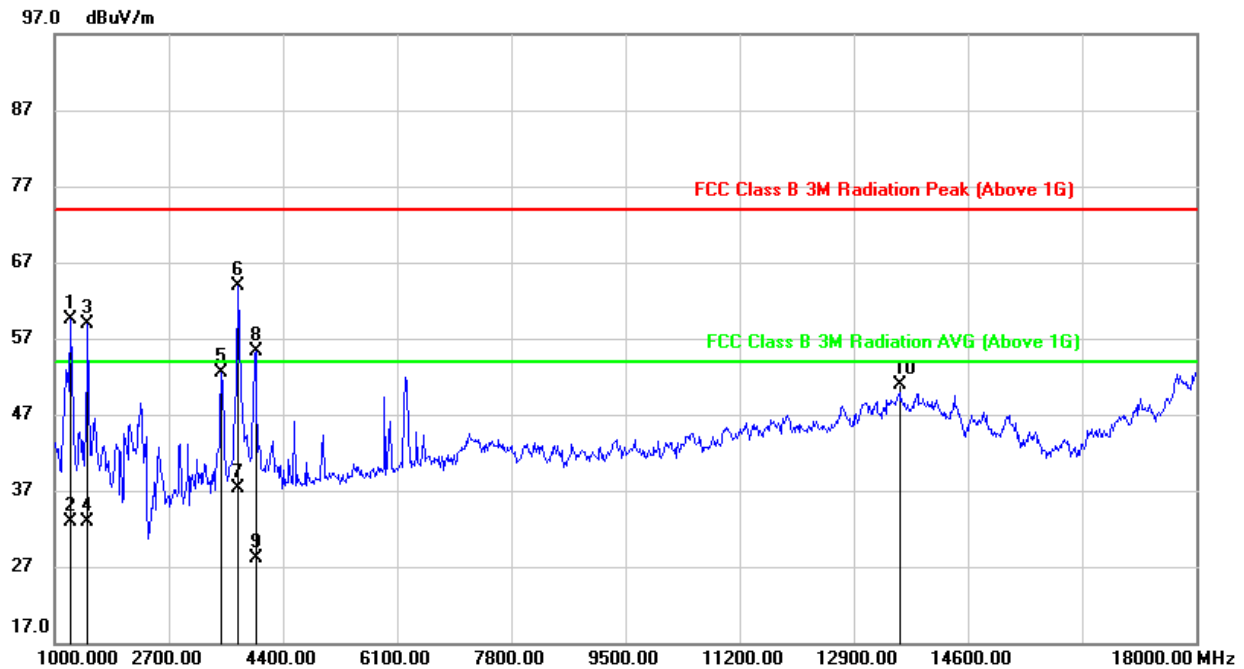
### HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	75.43	-13.22	62.21	74.00	-11.79	peak
2	1238.000	49.81	-13.22	36.59	54.00	-17.41	AVG
3	1493.000	70.68	-12.77	57.91	74.00	-16.09	peak
4	1493.000	44.19	-12.77	31.42	54.00	-22.58	AVG
5	3737.000	66.13	-4.81	61.32	74.00	-12.68	peak
6	3737.000	40.57	-4.81	35.76	54.00	-18.24	AVG
7	3975.000	61.63	-4.42	57.21	74.00	-16.79	peak
8	3975.000	35.22	-4.42	30.80	54.00	-23.20	AVG
9	6236.000	50.90	2.89	53.79	74.00	-20.21	peak
10	13580.000	32.39	19.06	51.45	74.00	-22.55	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

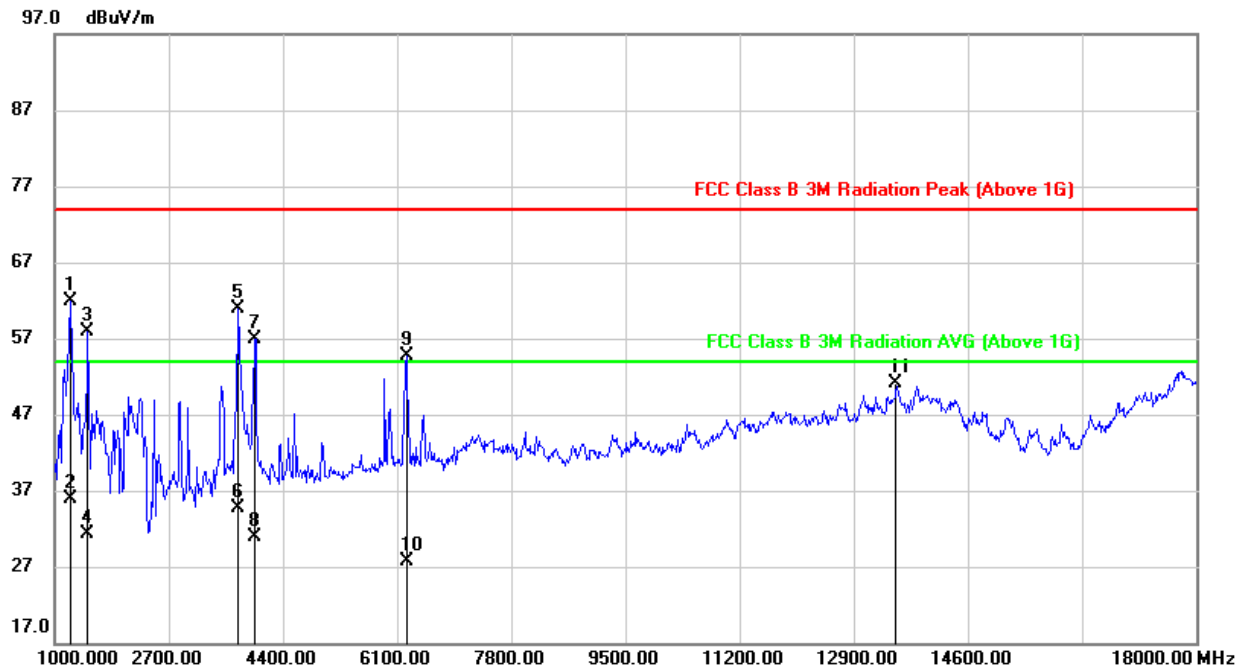
# HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	72.85	-13.27	59.58	74.00	-14.42	peak
2	1238.000	46.12	-13.27	32.85	54.00	-21.15	AVG
3	1493.000	71.61	-12.68	58.93	74.00	-15.07	peak
4	1493.000	45.61	-12.68	32.93	54.00	-21.07	AVG
5	3482.000	58.44	-6.02	52.42	74.00	-21.58	peak
6	3737.000	68.65	-4.83	63.82	74.00	-10.18	peak
7	3737.000	42.15	-4.83	37.32	54.00	-16.68	AVG
8	3992.000	59.80	-4.42	55.38	74.00	-18.62	peak
9	3992.000	32.46	-4.42	28.04	54.00	-25.96	AVG
10	13580.000	32.00	18.94	50.94	74.00	-23.06	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

### HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



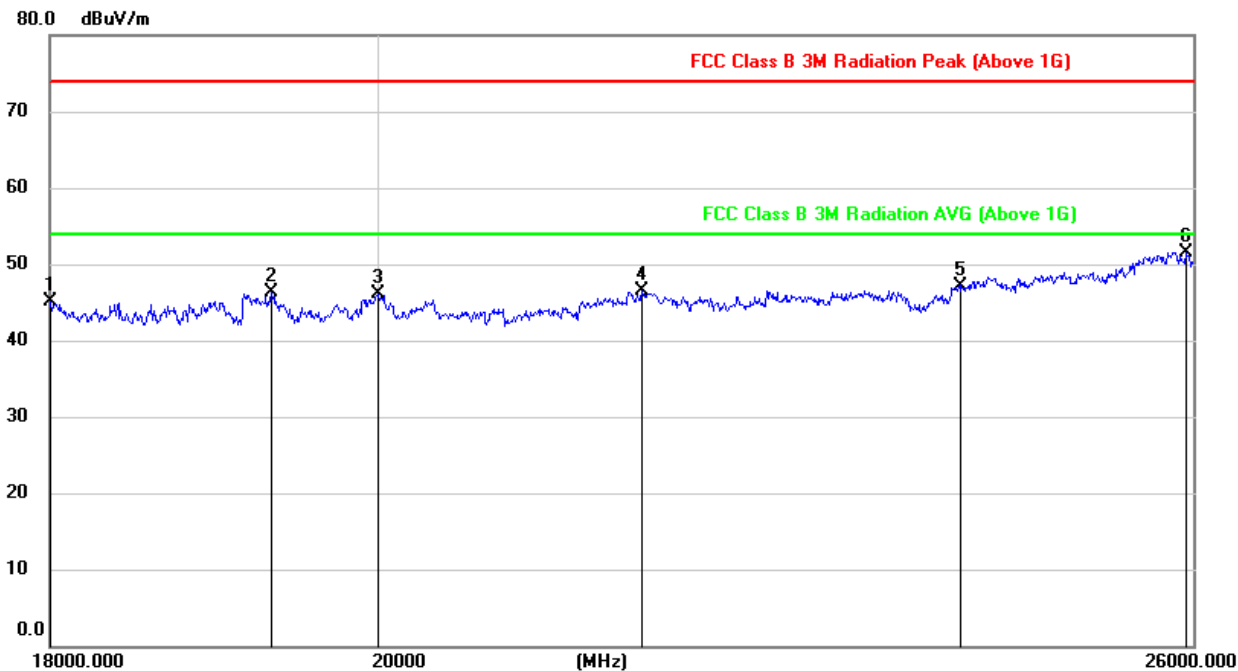
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1238.000	75.08	-13.22	61.86	74.00	-12.14	peak
2	1238.000	49.21	-13.22	35.99	54.00	-18.01	AVG
3	1493.000	70.65	-12.77	57.88	74.00	-16.12	peak
4	1493.000	44.15	-12.77	31.38	54.00	-22.62	AVG
5	3737.000	65.78	-4.81	60.97	74.00	-13.03	peak
6	3737.000	39.45	-4.81	34.64	54.00	-19.36	AVG
7	3975.000	61.41	-4.42	56.99	74.00	-17.01	peak
8	3975.000	35.23	-4.42	30.81	54.00	-23.19	AVG
9	6236.000	51.76	2.89	54.65	74.00	-19.35	peak
10	6236.000	24.86	2.89	27.75	54.00	-26.25	AVG
11	13529.000	31.87	19.26	51.13	74.00	-22.87	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. AVG: VBW=1/Ton where: ton is transmit duration.  
5. For transmit duration, please refer to clause 6.1.

## 7.4. SPURIOUS EMISSIONS 18G ~ 26GHz

### 7.4.1. GFSK MODE

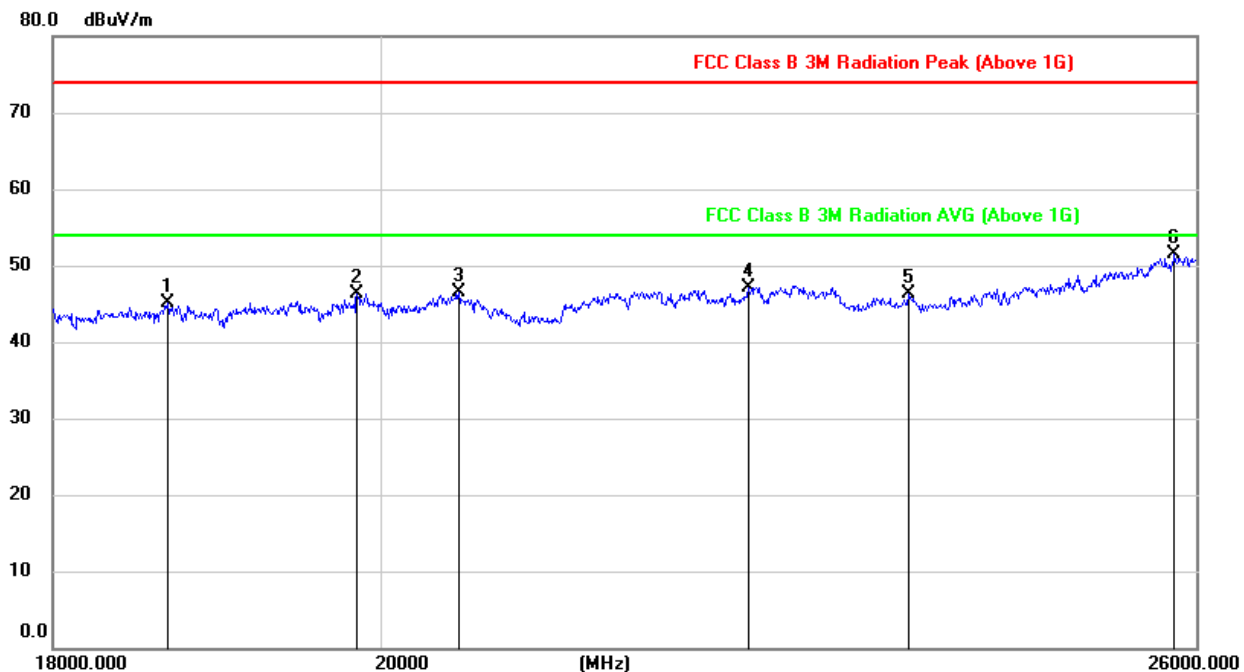
#### SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18006.620	50.53	-5.39	45.14	74.00	-28.86	peak
2	19331.007	51.83	-5.58	46.25	74.00	-27.75	peak
3	20003.530	51.58	-5.45	46.13	74.00	-27.87	peak
4	21776.975	50.84	-4.35	46.49	74.00	-27.51	peak
5	24120.948	49.99	-2.79	47.20	74.00	-26.80	peak
6	25942.698	52.50	-0.96	51.54	74.00	-22.46	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. All the modes had been tested, but only the worst data were recorded in the report.

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



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18681.093	50.50	-5.38	45.12	74.00	-28.88	peak
2	19849.654	51.59	-5.33	46.26	74.00	-27.74	peak
3	20510.030	51.86	-5.35	46.51	74.00	-27.49	peak
4	22518.026	51.05	-3.87	47.18	74.00	-26.82	peak
5	23698.930	49.54	-3.18	46.36	74.00	-27.64	peak
6	25818.977	52.23	-0.74	51.49	74.00	-22.51	peak

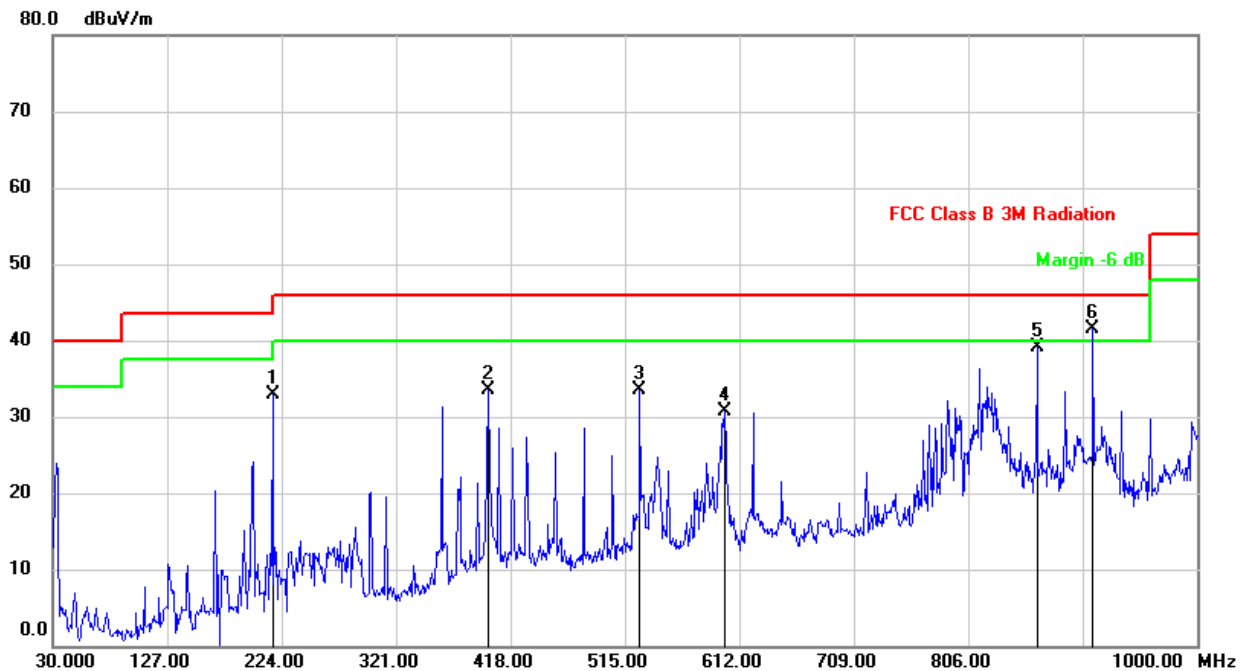
- Note: 1. Peak Result = Reading Level + Correct Factor.  
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
 3. All the modes had been tested, but only the worst data were recorded in the report.



## 7.5. SPURIOUS EMISSIONS 30M ~ 1 GHz

### 7.5.1. GFSK MODE

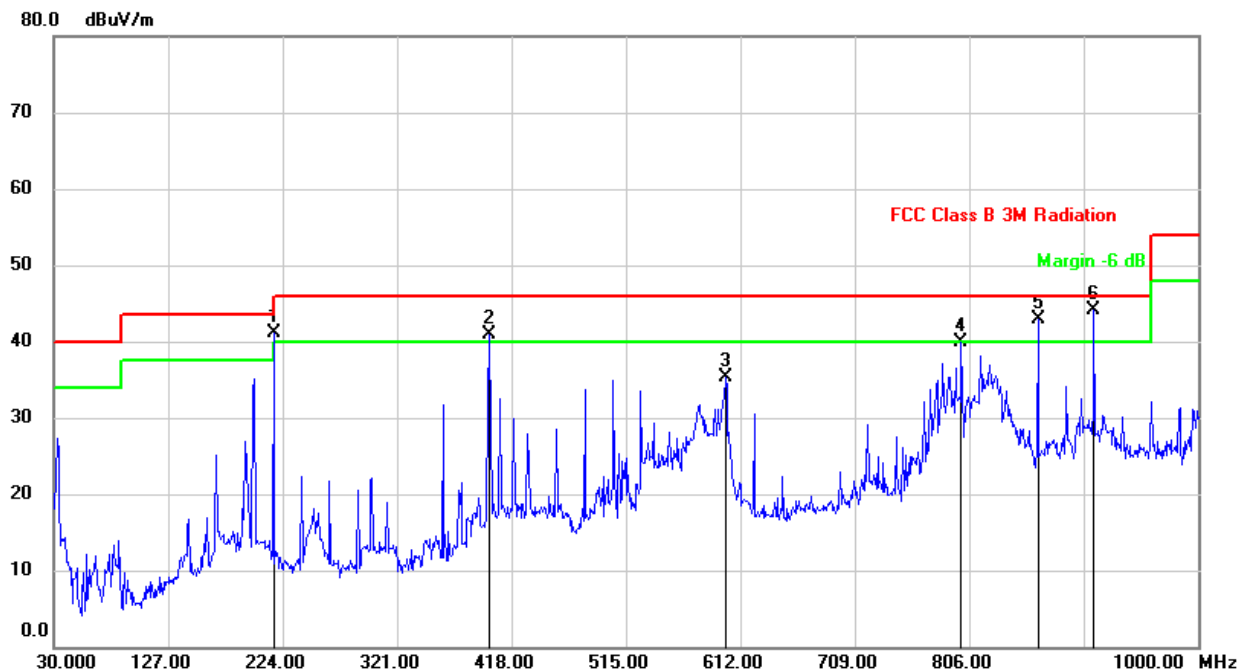
#### SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	216.2400	61.30	-28.45	32.85	46.00	-13.15	QP
2	398.6000	58.69	-25.15	33.54	46.00	-12.46	QP
3	527.6100	55.06	-21.55	33.51	46.00	-12.49	QP
4	599.3900	50.45	-19.84	30.61	46.00	-15.39	QP
5	864.2000	56.28	-17.13	39.15	46.00	-6.85	QP
6	911.7300	57.64	-16.20	41.44	46.00	-4.56	QP

- Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.  
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.  
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

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



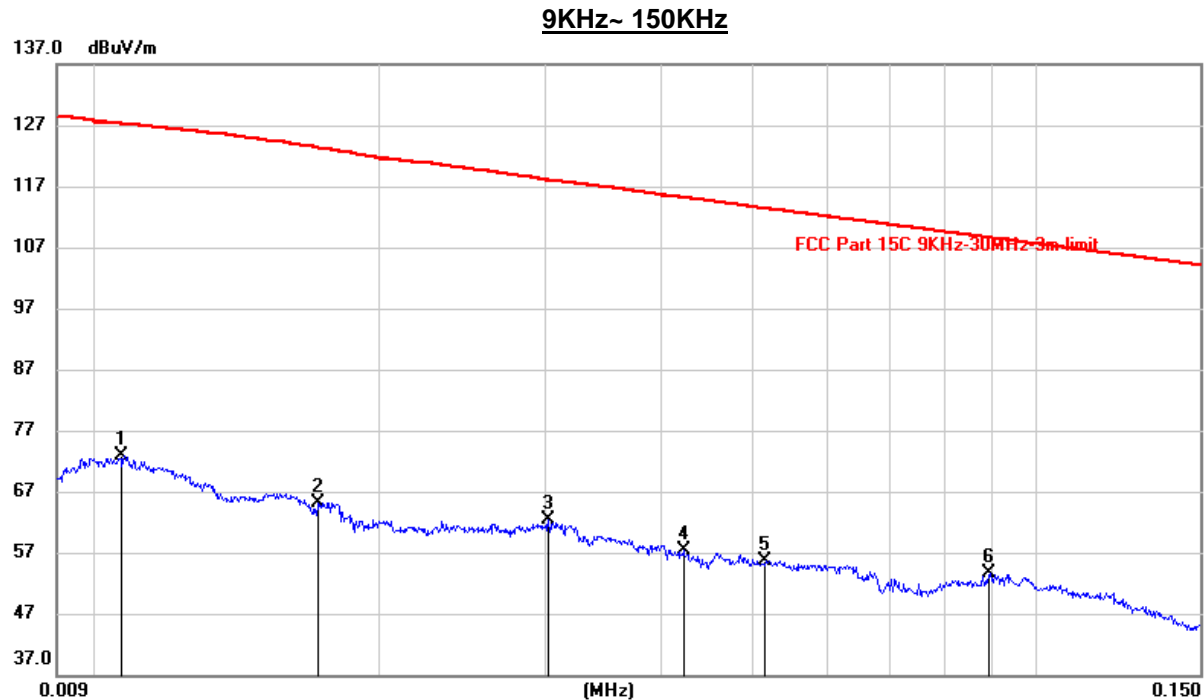
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	216.2400	69.60	-28.45	41.15	46.00	-4.85	QP
2	399.5700	66.10	-25.15	40.95	46.00	-5.05	QP
3	599.3900	55.19	-19.84	35.35	46.00	-10.65	QP
4	799.2100	59.51	-19.60	39.91	46.00	-6.09	QP
5	864.2000	59.97	-17.13	42.84	46.00	-3.16	QP
6	911.7300	60.26	-16.20	44.06	46.00	-1.94	QP

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.  
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.  
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto

## 7.6. SPURIOUS EMISSIONS BELOW 30M

### 7.6.1. GFSK MODE

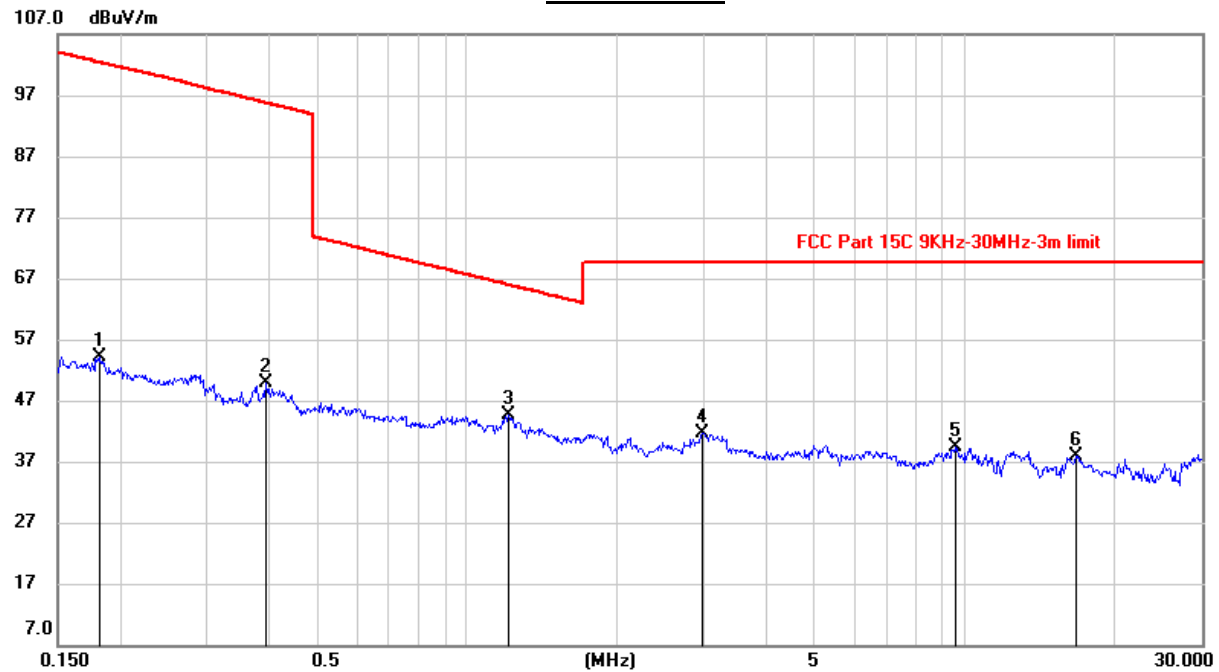
#### SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0106	52.54	20.22	72.76	127.24	-54.48	peak
2	0.0171	44.96	20.28	65.24	123.33	-58.09	peak
3	0.0302	41.96	20.31	62.27	118.01	-55.74	peak
4	0.0420	37.09	20.31	57.40	115.17	-57.77	peak
5	0.0514	35.43	20.31	55.74	113.40	-57.66	peak
6	0.0892	33.45	20.25	53.70	108.60	-54.90	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
 2. All the modes had been tested, but only the worst data were recorded in the report.  
 3. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

**150KHz ~ 30M**

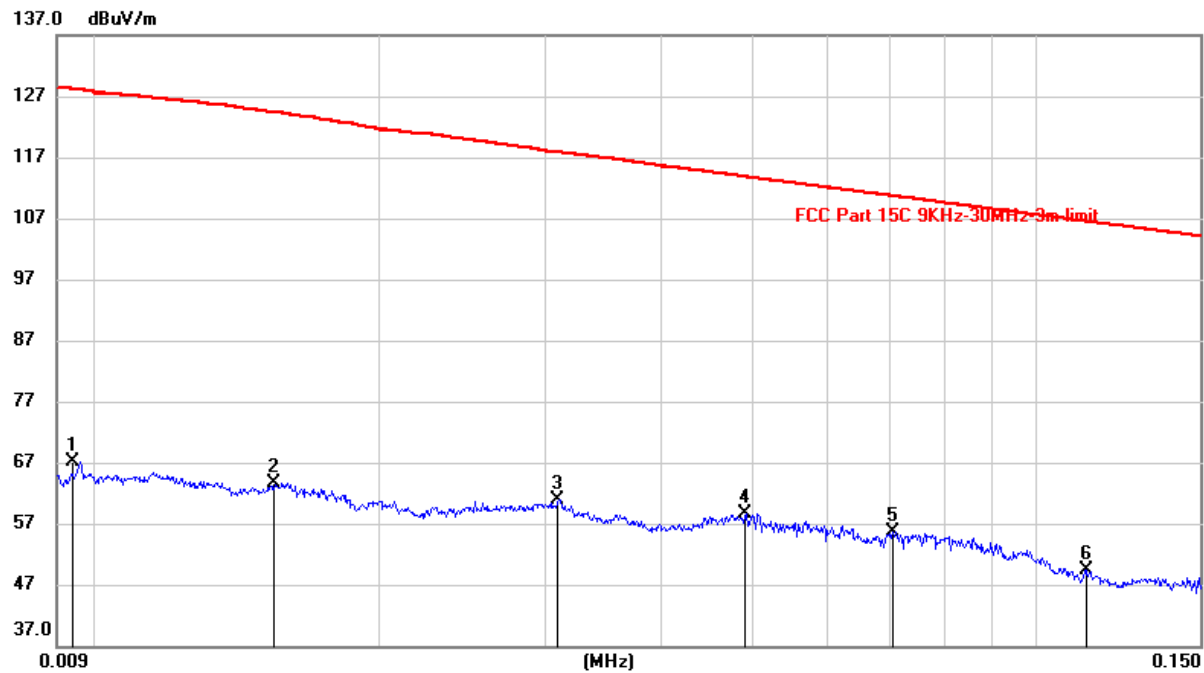


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1833	33.83	20.39	54.22	102.34	-48.12	peak
2	0.3933	29.49	20.27	49.76	95.73	-45.97	peak
3	1.2157	24.20	20.44	44.64	65.91	-21.27	peak
4	2.9618	20.77	20.89	41.66	69.54	-27.88	peak
5	9.5518	18.31	21.04	39.35	69.54	-30.19	peak
6	16.7497	16.86	20.97	37.83	69.54	-31.71	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
2. All the modes had been tested, but only the worst data were recorded in the report.  
3. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

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

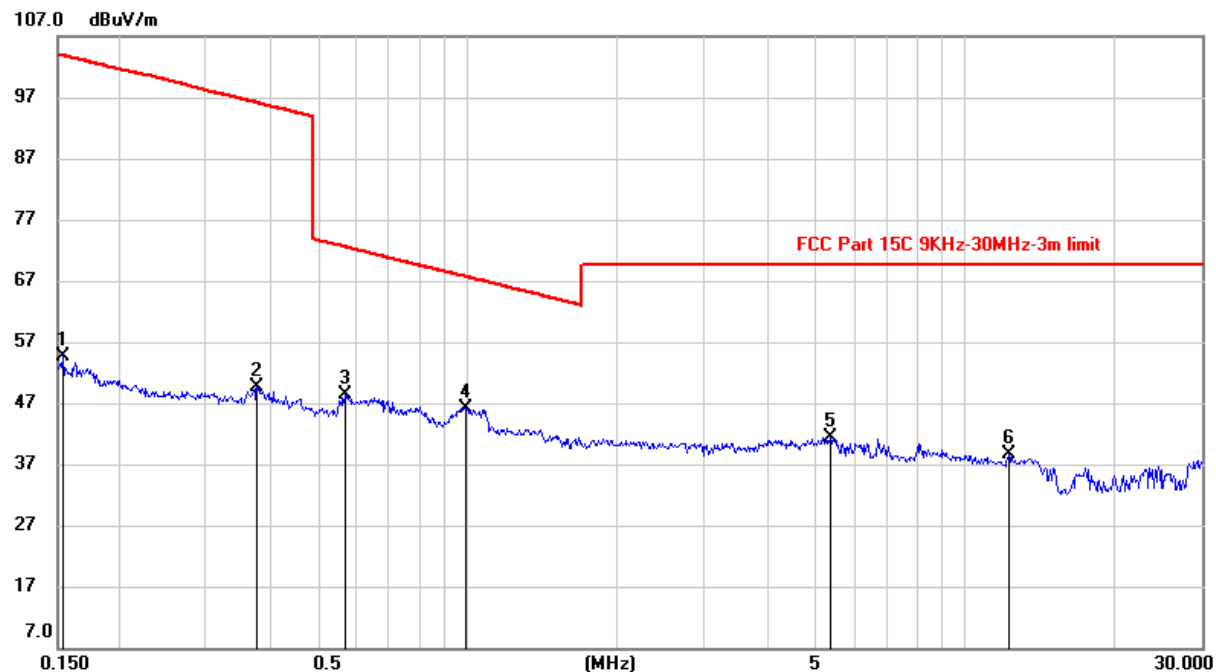
**9KHz~ 150KHz**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0094	46.90	20.26	67.16	128.06	-60.90	peak
2	0.0154	43.37	20.26	63.63	124.35	-60.72	peak
3	0.0309	40.61	20.31	60.92	117.84	-56.92	peak
4	0.0490	38.28	20.31	58.59	113.81	-55.22	peak
5	0.0704	35.36	20.31	55.67	110.65	-54.98	peak
6	0.1131	29.12	20.27	49.39	106.54	-57.15	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
 2. All the modes had been tested, but only the worst data were recorded in the report.  
 3. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

**150KHz ~ 30M**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1539	34.32	20.42	54.74	103.86	-49.12	peak
2	0.3769	29.35	20.28	49.63	96.14	-46.51	peak
3	0.5670	28.05	20.27	48.32	72.57	-24.25	peak
4	0.9889	25.85	20.37	46.22	67.70	-21.48	peak
5	5.3900	20.56	20.84	41.40	69.54	-28.14	peak
6	12.2530	17.71	21.00	38.71	69.54	-30.83	peak

Note: 1. Measurement = Reading Level + Correct Factor.  
 2. All the modes had been tested, but only the worst data were recorded in the report.  
 3. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

## 8. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

Please refer to FCC §15.207 (a) and RSS-Gen Clause 8.8.

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

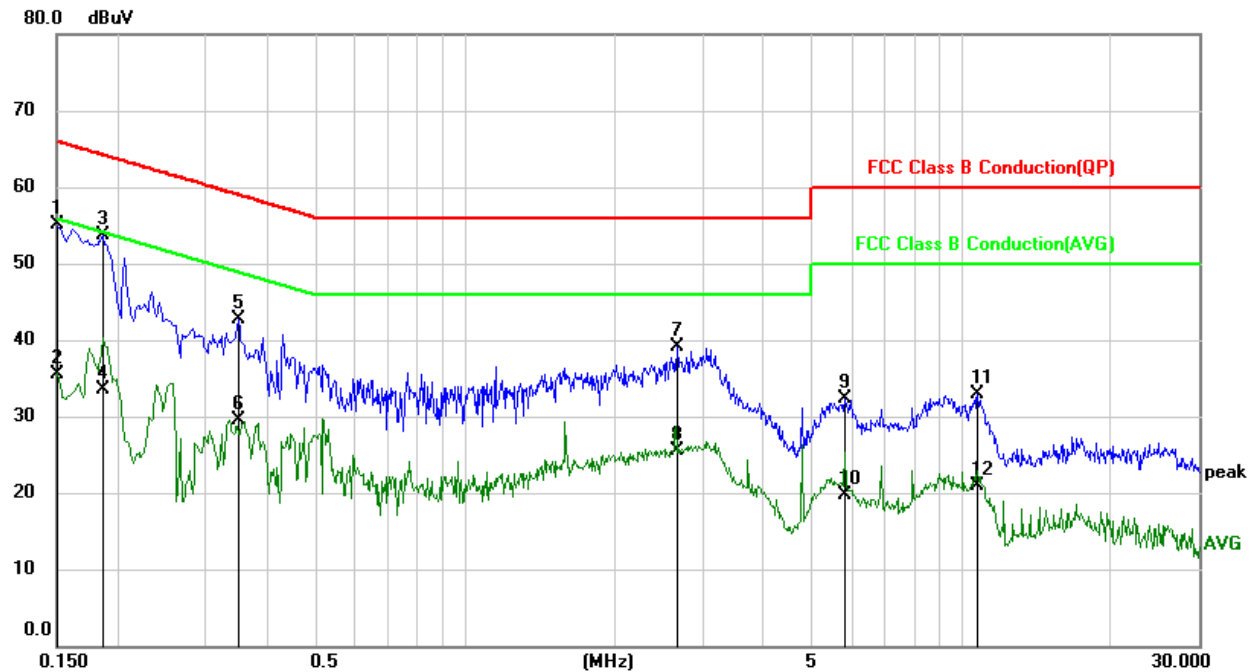
### TEST SETUP AND PROCEDURE

The EUT is put on a table of non-conducting material that is 12mm 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.

### 8.1.1. GFSK MODE

#### TEST RESULTS (MID CHANNEL, WORST-CASE CONFIGURATION)

##### LINE N RESULTS

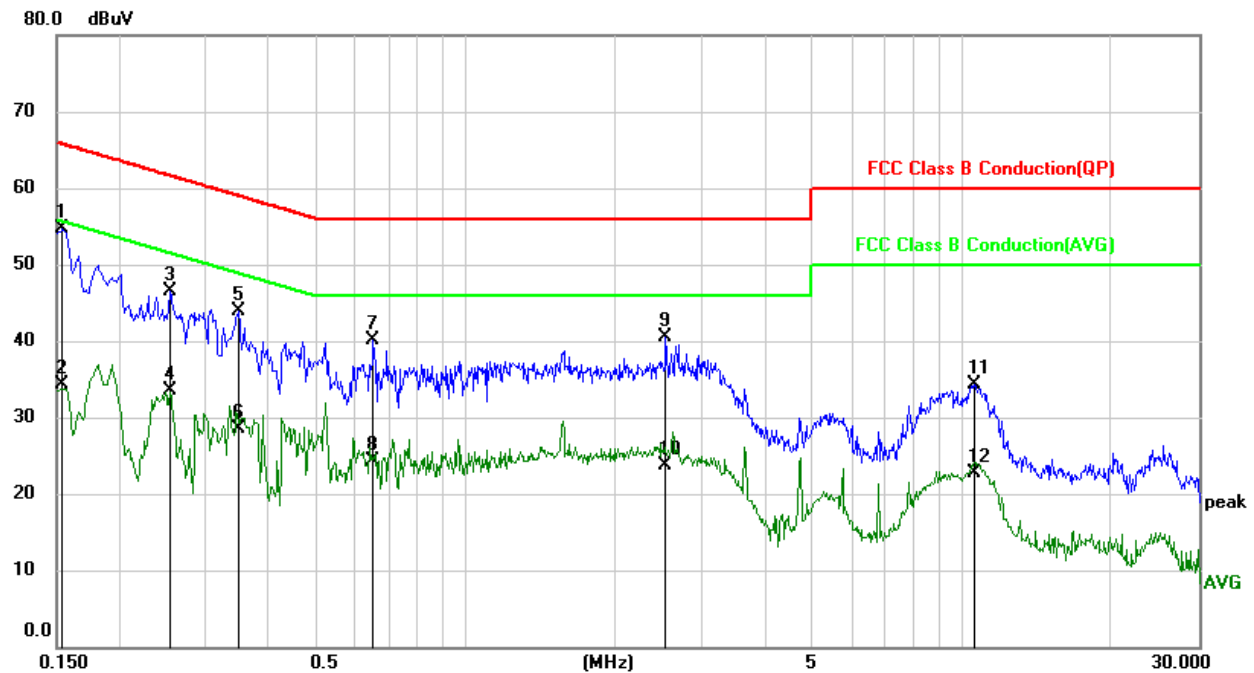


No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	45.45	9.65	55.10	66.00	-10.90	QP
2	0.1500	25.80	9.65	35.45	56.00	-20.55	AVG
3	0.1859	44.03	9.64	53.67	64.22	-10.55	QP
4	0.1860	23.81	9.64	33.45	54.21	-20.76	AVG
5	0.3500	33.04	9.65	42.69	58.96	-16.27	QP
6	0.3500	19.92	9.65	29.57	48.96	-19.39	AVG
7	2.6659	29.37	9.69	39.06	56.00	-16.94	QP
8	2.6660	15.88	9.69	25.57	46.00	-20.43	AVG
9	5.8219	22.58	9.73	32.31	60.00	-27.69	QP
10	5.8219	9.93	9.73	19.66	50.00	-30.34	AVG
11	10.7500	23.14	9.80	32.94	60.00	-27.06	QP
12	10.7500	11.09	9.80	20.89	50.00	-29.11	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**



No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1539	44.95	9.66	54.61	65.79	-11.18	QP
2	0.1539	24.59	9.66	34.25	55.79	-21.54	AVG
3	0.2540	36.77	9.65	46.42	61.63	-15.21	QP
4	0.2540	23.93	9.65	33.58	51.63	-18.05	AVG
5	0.3500	34.21	9.64	43.85	58.96	-15.11	QP
6	0.3500	18.92	9.64	28.56	48.96	-20.40	AVG
7	0.6540	30.40	9.66	40.06	56.00	-15.94	QP
8	0.6540	14.59	9.66	24.25	46.00	-21.75	AVG
9	2.5379	30.72	9.69	40.41	56.00	-15.59	QP
10	2.5380	13.98	9.69	23.67	46.00	-22.33	AVG
11	10.6059	24.48	9.79	34.27	60.00	-25.73	QP
12	10.6059	12.99	9.79	22.78	50.00	-27.22	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 the modulation and channels had been tested, but only the worst data recorded 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.

### **ANTENNA CONNECTOR**

EUT has an external antenna with antenna connector, it will be installed in a specific environment and users cannot change the antenna.

### **ANTENNA GAIN**

The antenna gain of EUT is less than 6 dBi.

**END OF REPORT**