



## FCC Test Report

**Report No.:** ACON-ESH-P19112701B-2

**FCC ID:** 2AVHC-OEM-05146

**Product:** Bluetooth Audio Amplifier Board

**Model:** OEM-05146

**Received Date:** Nov.27, 2019

**Test Date:** Dec.02 to Dec.15, 2019

**Issued Date:** Dec.28, 2019

**Applicant:** Sure Electronics Co.,Ltd.

**Address:** 3F,Building F6,No.9,Weidi Road,Qixia Dist.,Nanjing,China

**Manufacturer:** Sure Electronics Co.,Ltd.

**Address:** 3F,Building F6,No.9,Weidi Road,Qixia Dist.,Nanjing,China

**Issued By:** BUREAU VERITAS ADT (Shanghai) Corporation

**Address:** No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.



## Table of Contents

Release Control Record.....	5
1 Certificate of Conformity .....	6
2 Summary of Test Results .....	7
2.1 Test Instruments.....	8
2.2 Measurement Uncertainty .....	9
2.3 Modification Record .....	9
3 General Information.....	10
3.1 General Description of EUT.....	10
3.2 Description of Test Modes .....	11
3.2.1 Test Mode Applicability: .....	11
3.2.2 Test Condition: .....	13
3.3 Description of Support Units.....	14
3.4 General Description of Applied Standards .....	14
4 Test Procedure and Results .....	15
4.1 Conducted Emission Measurement.....	15
4.1.1 Limit.....	15
4.1.2 Test Setup.....	15
4.1.3 Test Procedures .....	15
4.1.4 Deviation of Test Standard.....	16
4.1.5 Test Results .....	17
4.2 Number of Hopping Frequency Used .....	19
4.2.1 Limit.....	19
4.2.2 Test Setup.....	19
4.2.3 Test Procedures .....	19
4.2.4 Deviation of Test Standard.....	19
4.2.5 Test Results .....	20
4.3 Dwell Time on Each Channel .....	22
4.3.1 Limit.....	22
4.3.2 Test Setup.....	22
4.3.3 Test Procedures .....	22
4.3.4 Deviation of Test Standard.....	22
4.3.5 Test Results .....	23



4.4	Channel Bandwidth .....	33
4.4.1	Limit.....	33
4.4.2	Test Setup.....	33
4.4.3	Test Procedures .....	33
4.4.4	Deviation of Test Standard.....	33
4.4.5	EUT Operating Condition .....	33
4.4.6	Test Results .....	34
4.5	Hopping Channel Separation .....	39
4.5.1	Limit.....	39
4.5.2	Test Setup.....	39
4.5.3	Test Procedures .....	39
4.5.4	Deviation of Test Standard.....	40
4.5.5	Test Results .....	40
4.6	Maximum Output Power.....	43
4.6.1	Limit.....	43
4.6.2	Test Setup.....	43
4.6.3	Test Procedures .....	43
4.6.4	Deviation of Test Standard.....	43
4.6.5	EUT Operating Condition .....	43
4.6.6	Test Results .....	44
4.7	Conducted Out of Band Emission Measurement .....	46
4.7.1	Limit.....	46
4.7.2	Test Procedures .....	46
4.7.3	Deviation of Test Standard.....	46
4.7.4	Test Result .....	46
4.8	Out of Band Emission .....	53
4.9	Radiated Emission Measurement.....	68
4.9.1	Limits .....	68
4.9.2	Test Procedures .....	68
4.9.3	Deviation from Test Standard.....	70
4.9.4	Test Setup.....	70
4.9.5	EUT Operating Conditions.....	71
4.9.6	Test Results .....	71



4.10	Radiated Restricted Band Edge Measurement .....	77
4.10.1	Test Limit.....	77
4.10.2	Test Procedure Reference.....	78
4.10.3	Test Procedures .....	78
4.10.4	Test Setup.....	79
4.10.5	Test Results .....	80
5	Pictures of Test Arrangements .....	104



### Release Control Record

Issue No.	Description	Date Issued
ACON-ESH-P19112701B-2	Original release	Dec.28, 2019

## 1 Certificate of Conformity

**Product:** Bluetooth Audio Amplifier Board

**Brand:** --

**Model:** OEM-05146

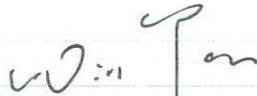
**Applicant:** Sure Electronics Co.,Ltd.

**Test Date:** Dec.02 to Dec.10, 2019

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2013

The above equipment has been tested by **BUREAU VERITAS ADT (Shanghai) Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :



, Date:

Dec.28, 2019

Will YAN

Project Engineer

Approved by :



, Date:

Dec.28, 2019

Daniel SUN

RF Supervisor

## 2 Summary of Test Results

The EUT has been tested according to the following specifications:

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note: The data shown in the report is the worst case data when the EUT is powered by AC120V, 60Hz(Via Adaptor)



## 2.1 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Hybrid antenna(25MHz-1.5GHz)	Schwarzbeck	VULB9168	E1A1012	Aug.26,19	Aug.25,20
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	Aug.26,19	Aug.25,20
Pre-Amplifier(100kHz-1.3GHz)	Agilent	8447D	E1A2001	Oct.18, 19	Oct.17, 20
Pre-Amplifier(1GHz-26.5GHz)	Agilent	8449B	E1A2002	Mar. 25, 19	Mar. 25, 20
EMI test receiver	R&S	ESR7	E1R1005	Dec.04, 19	Dec.03, 20
Spectrum Analyzer	Keysight	N9030B	E1S1003	Jul.23,19	Jul.22, 20
EMI test receiver	R&S	ESCS30	E1R1001	Mar.26, 19	Mar.25, 20
LISN	R&S	ENV216	E1L1011	Jul.18, 19	Jul.17, 20
Humidity&Temp Tester	Baolima	WS508	E1H1011	Apr. 04, 19	Apr. 03, 20
Test Software	ADT	ADT_COND_V 7.3.1	N/A	N/A	N/A
Test Software	Toscend	JS32-RE	N/A	N/A	N/A
Test Software	Toscend	JS1120	N/A	N/A	N/A

## 2.2 Measurement Uncertainty

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

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

Measurement	Frequency	Expanded Uncertainty ( $k=2$ ) ( $\pm$ )
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

## 2.3 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Bluetooth Audio Amplifier Board
Brand	--
Test Model	OEM-05146
Model Difference	--
Power Rating	12~24Vdc,0~2A
Modulation Type	GFSK, $\pi/4$ -DQPSK,8DPSK
Modulation Technology	BT-EDR, FHSS
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	0.69dBm
Antenna Type	PCB antenna
Antenna Connector	--
Antenna Gain	4dBi

Note: For more details, please refer to the User's manual of the EUT.

### 3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

Channel	Freq. (MHz)						
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	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		

#### 3.2.1 Test Mode Applicability:

EUT Configure Mode	Applicable to				Description
	RE ≥ 1G	RE < 1G	PLC	APCM	
-	√	√	-	√	-

Where **RE≥1G**: Radiated Emission above 1GHz

**RE≤1G**: Radiated Emission below 1GHz

**PLC**: Power Line Conducted Emission

**APCM**: Antenna Port Conducted Measurement

**Radiated Emission Test (Above 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	$\pi/4$ -DQPSK	2DH5

**Radiated Emission Test (Below 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	$\pi/4$ -DQPSK	2DH5

**Power Line Conducted Emission Test:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	$\pi/4$ -DQPSK	2DH5

**Antenna Port Conducted Measurement**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	$\pi/4$ -DQPSK	2DH5

### 3.2.2 Test Condition:

Applicable to	Normal Environmental Conditions	Normal Input Power
<b>RE <math>\geq</math> 1G</b>	23deg. C, 58%RH	AC120V 60Hz
<b>RE &lt; 1G</b>	23deg. C, 58%RH	AC120V 60Hz
<b>PLC</b>	22deg. C, 54%RH	AC120V 60Hz
<b>APCM</b>	25deg. C, 60%RH	AC120V 60Hz



### **3.3 Description of Support Units**

The EUT has been tested as an independent unit together with other necessary accessories or support units.

### **3.4 General Description of Applied Standards**

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

**FCC Part 15, Subpart C (15.247)**

**FCC DA 00705**

**ANSI C63.10:2013**

All relaxed test items have been performed and recorded as per the above standard.

## 4 Test Procedure and Results

### 4.1 Conducted Emission Measurement

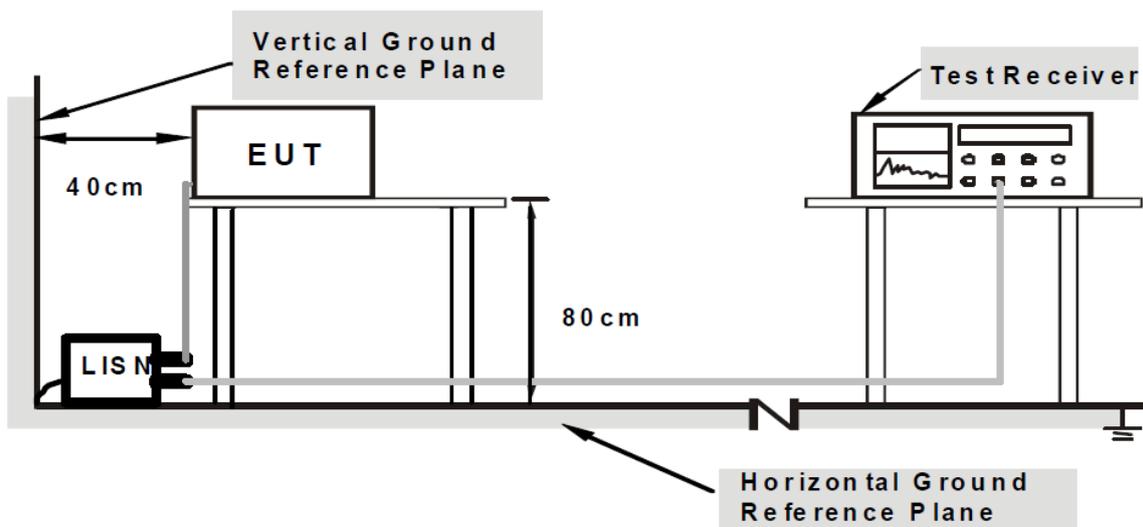
#### 4.1.1 Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

#### 4.1.2 Test Setup



#### 4.1.3 Test Procedures

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.1.4 Deviation of Test Standard

No deviation.

#### 4.1.5 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	----------	-------------------	-----------------------------------

Location: Conduction 1

Date: 12/5/2019

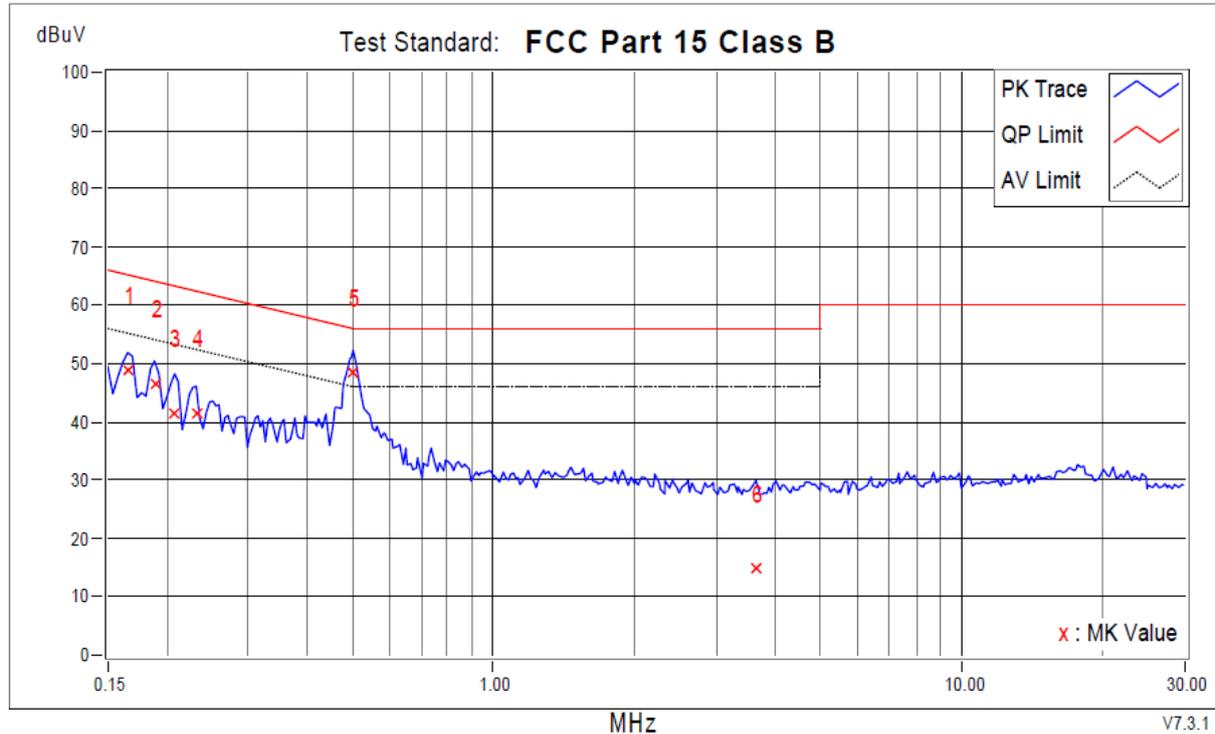
Time: 2:20:49 PM

Phase L1

Temperatur (C): 19

Humidity (%): 53

Approved by:



No.	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
	MHz		QP	AV	QP	AV	QP	AV	QP	AV	
1	0.16564	9.85	38.87	27.40	48.72	37.25	65.18	55.18	-16.46	-17.93	
2	0.18910	9.86	36.64	26.76	46.50	36.62	64.08	54.08	-17.58	-17.46	
3	0.20865	9.85	31.45	20.06	41.30	29.91	63.26	53.26	-21.96	-23.35	
4	0.23211	9.81	31.64	20.56	41.45	30.37	62.37	52.37	-20.93	-22.01	
+5	0.50190	9.72	38.86	30.65	48.58	40.37	56.00	46.00	-7.42	-5.63	
6	3.63925	9.92	4.97	-4.25	14.89	5.67	56.00	46.00	-41.11	-40.33	

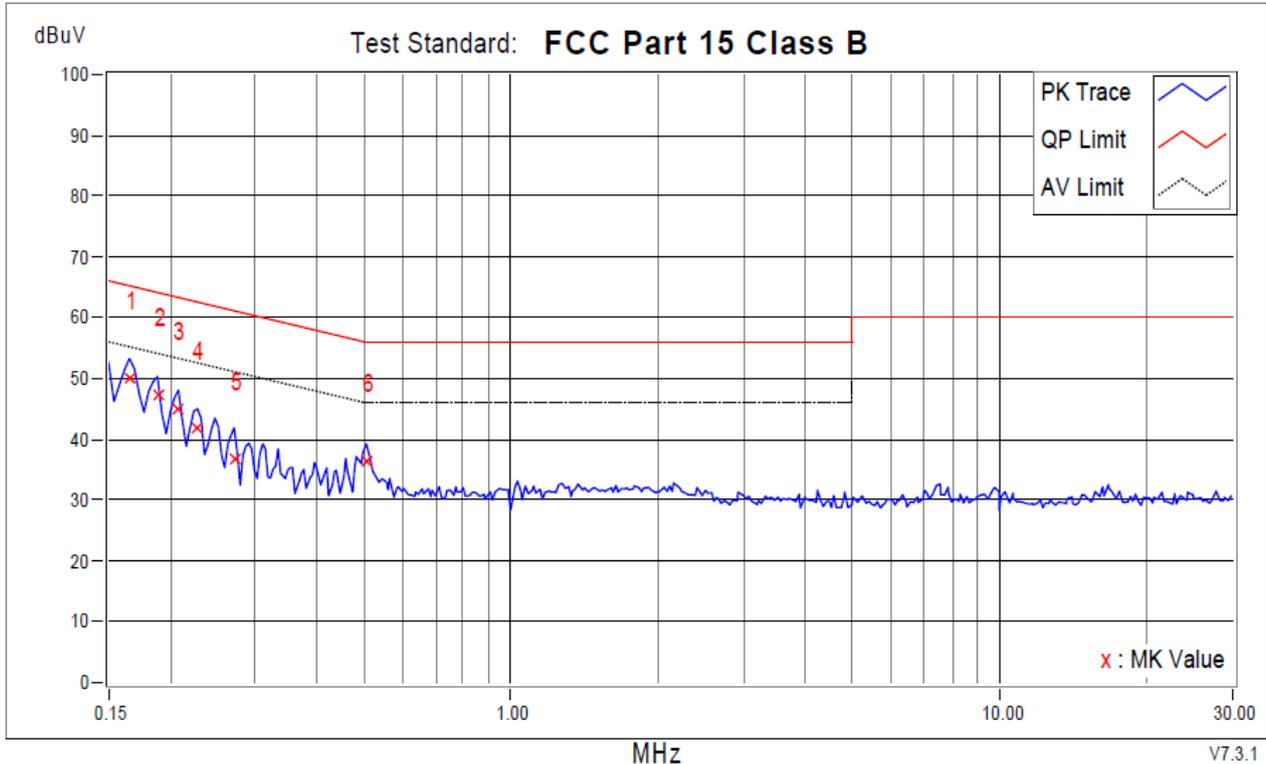
#### REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

Location: Conduction 1      Date: 12/5/2019      Time: 2:22:54 PM      Phase N  
 Temperatur (C): 19      Humidity (%): 53      Approved by:



No.	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
	MHz		QP	AV	QP	AV	QP	AV	QP	AV	
+1	0.16564	9.83	40.10	28.41	49.93	38.24	65.18	55.18	-15.24	-16.93	
2	0.18910	9.81	37.35	27.45	47.16	37.26	64.08	54.08	-16.92	-16.82	
3	0.20865	9.81	35.14	25.27	44.95	35.08	63.26	53.26	-18.31	-18.18	
4	0.22820	9.82	31.95	24.05	41.77	33.87	62.51	52.51	-20.75	-18.65	
5	0.27121	9.85	26.97	13.41	36.82	23.26	61.08	51.08	-24.26	-27.82	
6	0.50581	9.84	26.39	20.01	36.23	29.85	56.00	46.00	-19.77	-16.15	

**REMARKS:**

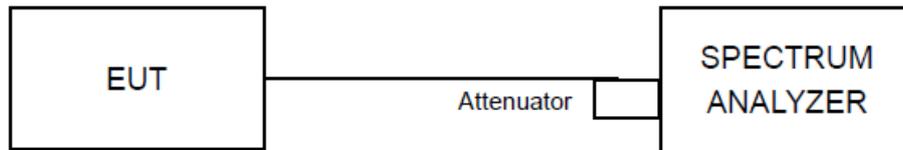
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

## 4.2 Number of Hopping Frequency Used

### 4.2.1 Limit

At least 15 channels frequencies, and should be equally spaced.

### 4.2.2 Test Setup



### 4.2.3 Test Procedures

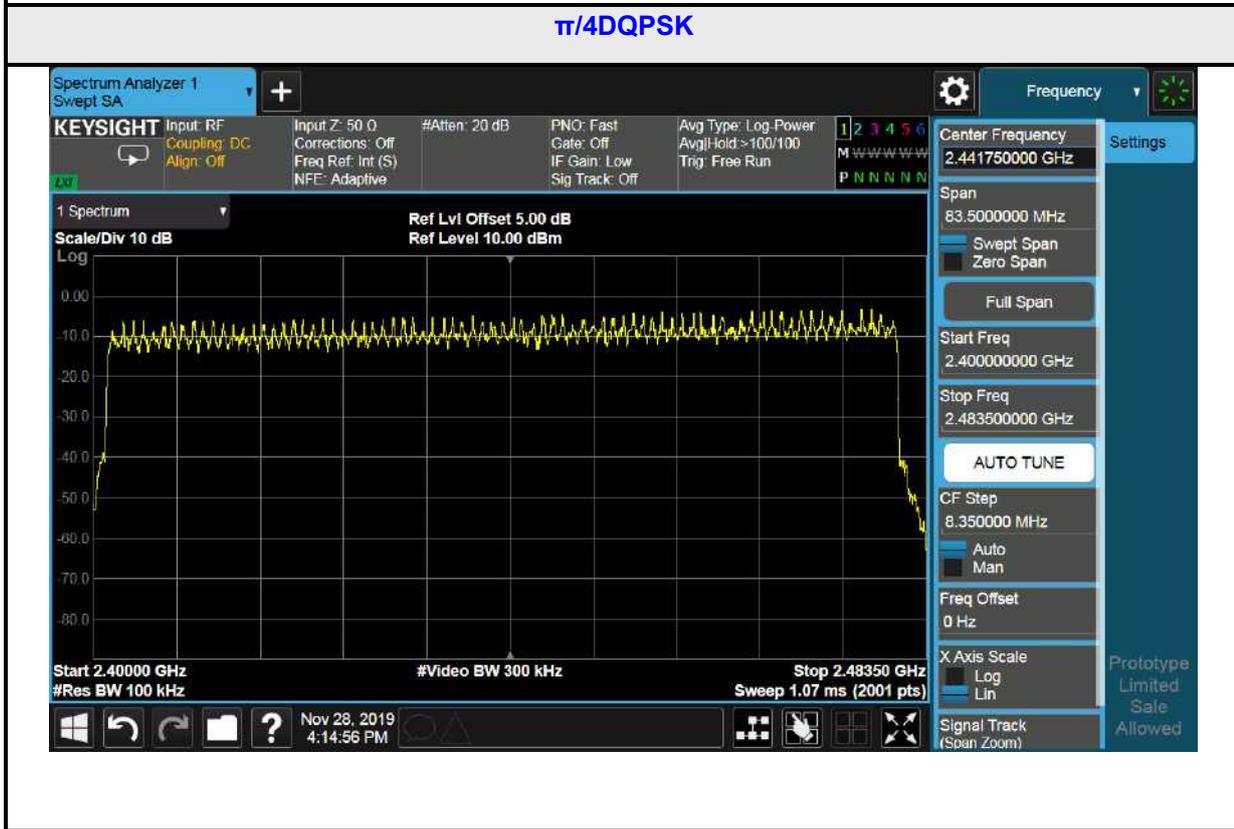
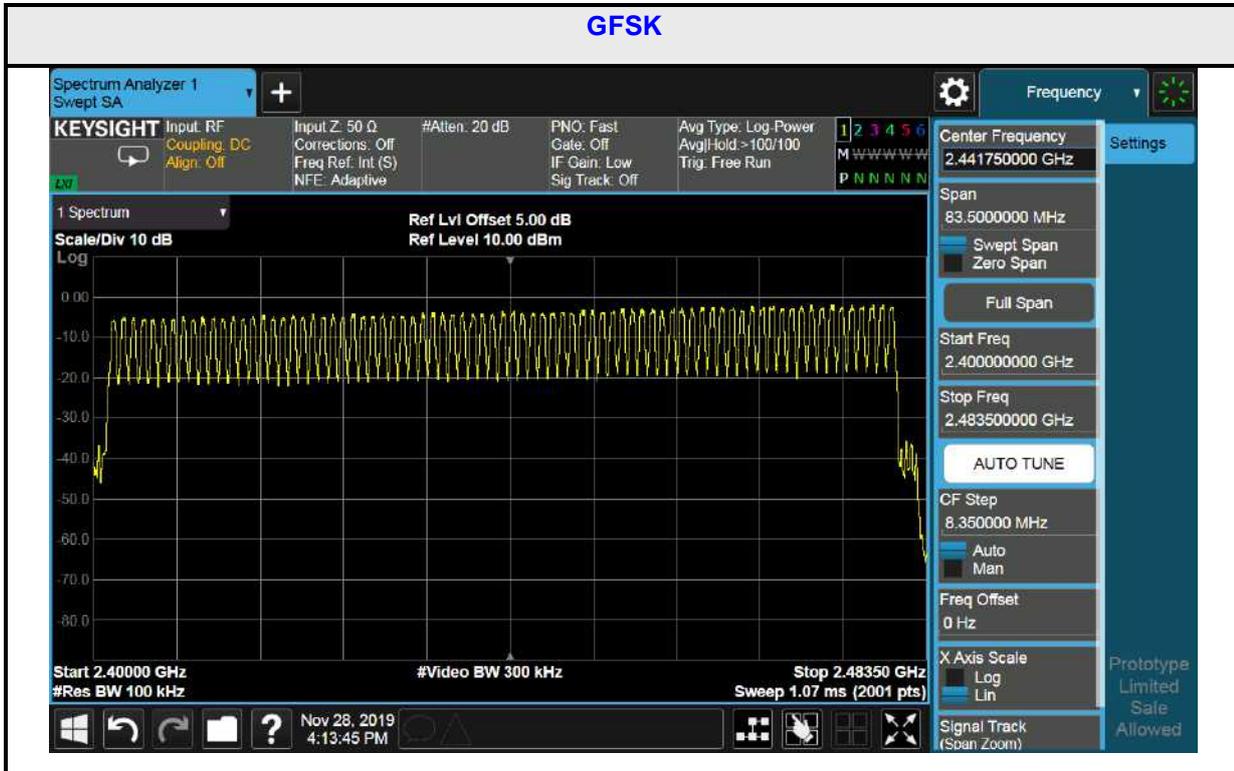
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

### 4.2.4 Deviation of Test Standard

No deviation.

### 4.2.5 Test Results

There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



### 8DPSK

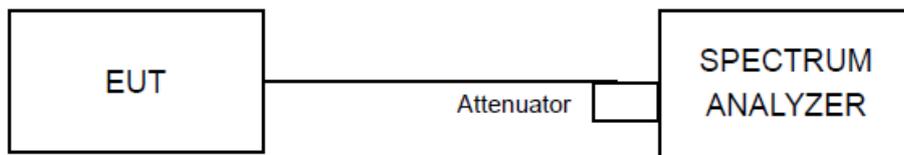


### 4.3 Dwell Time on Each Channel

#### 4.3.1 Limit

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.

#### 4.3.2 Test Setup



#### 4.3.3 Test Procedures

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

#### 4.3.4 Deviation of Test Standard

No deviation.

#### 4.3.5 Test Results

##### GFSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (sec)	Limit (sec)
DH1	322	0.40	0.129	0.4
DH3	158	1.65	0.261	0.4
DH5	108	2.90	0.313	0.4

##### $\pi/4$ DQPSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (sec)	Limit (sec)
DH1	322	0.41	0.132	0.4
DH3	165	1.68	0.276	0.4
DH5	158	1.65	0.313	0.4

##### 8DPSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (sec)	Limit (sec)
DH1	316	0.41	0.132	0.4
DH3	158	1.68	0.265	0.4
DH5	108	2.90	0.313	0.4

**NOTE:** Test plots of the transmitting time slot are shown on next page.

GFSK

DH1



DH3



DH5



$\pi/4$ DQPSK

2DH1



### 2DH3

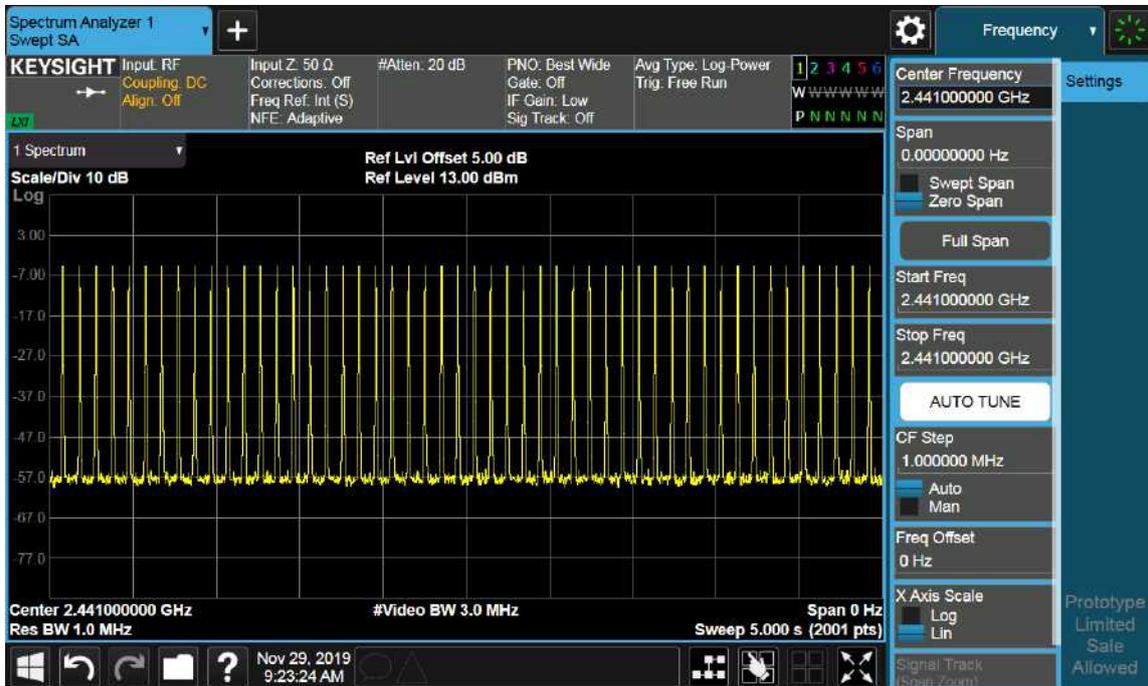
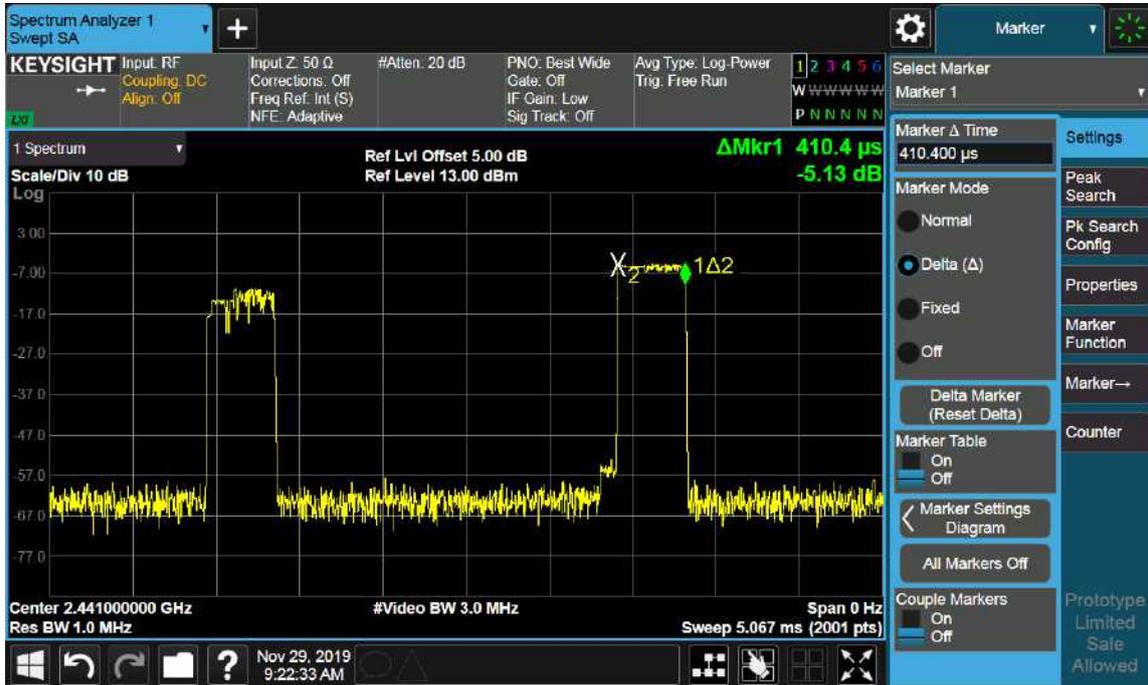


## 2DH5



8DPSK

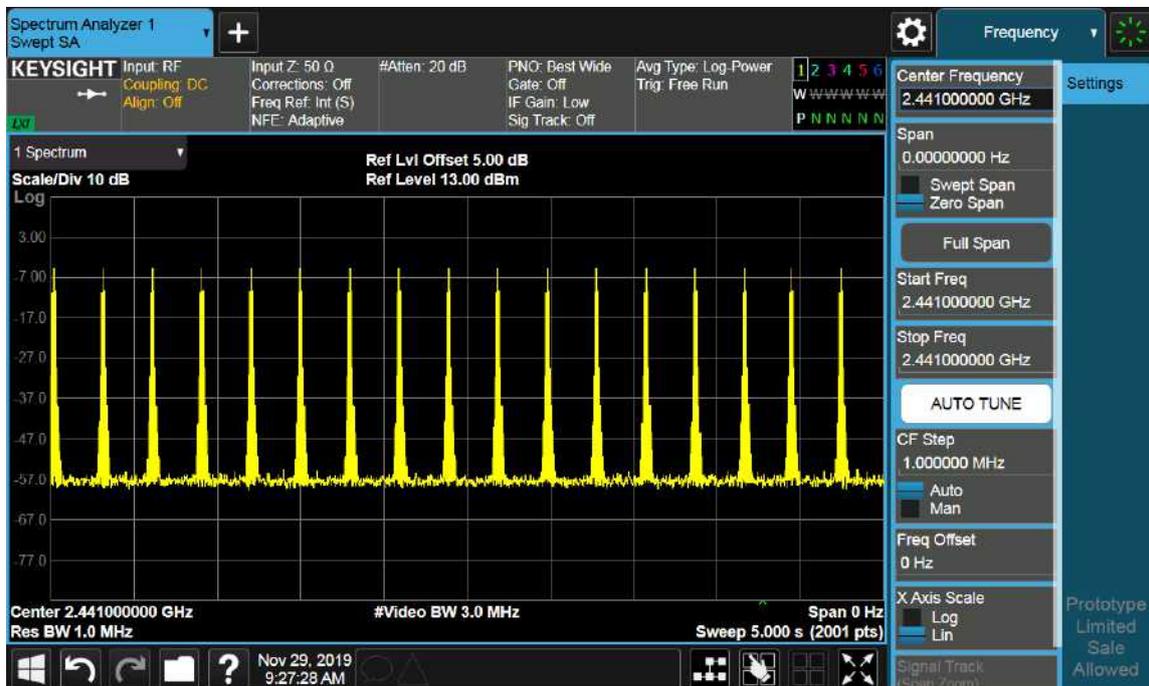
3DH1



### 3DH3



### 3DH5

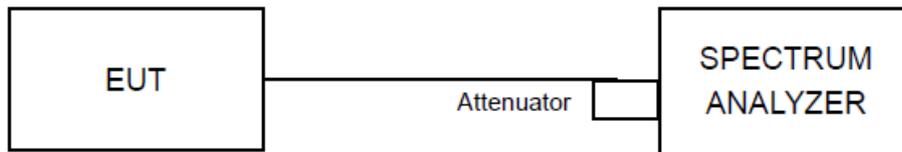


## 4.4 Channel Bandwidth

### 4.4.1 Limit

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

### 4.4.2 Test Setup



### 4.4.3 Test Procedures

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

### 4.4.4 Deviation of Test Standard

No deviation.

### 4.4.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

#### 4.4.6 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)		
		GFSK	$\pi/4$ DQPSK	8DPSK
0	2402	0.9313	1.259	1.276
39	2441	0.9309	1.245	1.259
78	2480	0.9290	1.245	1.258

#### Spectrum Plot

#### GFSK,2402MHz



## GFSK,2441MHz



## GFSK,2480MHz



### $\pi/4$ DQPSK,2402MHz



### $\pi/4$ DQPSK,2441MHz



## π/4DQPSK,2480MHz



### 8DPSK,2402MHz



### 8DPSK,2441MHz



## 8DPSK,2480MHz

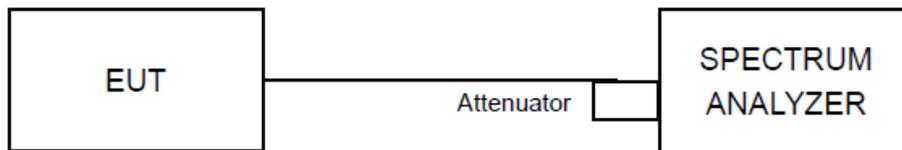


### 4.5 Hopping Channel Separation

#### 4.5.1 Limit

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater)

#### 4.5.2 Test Setup



#### 4.5.3 Test Procedures

Measurement Procedure REF

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal

from an external generator.

- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- c. By using the MaxHold function record the separation of two adjacent channels.
- d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

#### 4.5.4 Deviation of Test Standard

No deviation.

#### 4.5.5 Test Results

Test Mode	Channel	Result	Limit	Pass / Fail
GFSK	HOP	0.9945	0.9313	PASS
$\pi/4$ DQPSK	HOP	1.0080	0.8393	PASS
8DPSK	HOP	1.0035	0.8507	PASS

### Spectrum Plot

### GFSK



### $\pi/4$ DQPSK



### 8DPSK

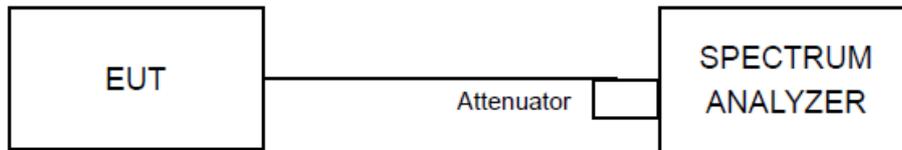


## 4.6 Maximum Output Power

### 4.6.1 Limit

The Maximum Output Power Measurement is 125mW(21dBm).

### 4.6.2 Test Setup



### 4.6.3 Test Procedures

- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
  - 2) RBW > 20 dB bandwidth of the emission being measured.
  - 3) VBW  $\geq$  RBW.
  - 4) Sweep: Auto.
  - 5) Detector function: Peak.
  - 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
- e) A plot of the test results and setup description shall be included in the test report.

### 4.6.4 Deviation of Test Standard

No deviation.

### 4.6.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

#### 4.6.6 Test Results

Test Mode	Channel	Result (dBm)	Limit (dBm)	Pass / Fail
GFSK	0	-11.65	30	PASS
GFSK	39	-10.46	30	PASS
GFSK	78	-8.78	30	PASS
$\pi/4$ DQPSK	0	-2.12	21	PASS
$\pi/4$ DQPSK	39	-0.82	21	PASS
$\pi/4$ DQPSK	78	0.24	21	PASS
8DPSK	0	-2.16	21	PASS
8DPSK	39	-0.89	21	PASS
8DPSK	78	0.69	21	PASS

#### Spectrum Plot of Worst Value

#### GFSK / CH 78



π/4DQPSK / CH 78



8DPSK / CH 78



## 4.7 Conducted Out of Band Emission Measurement

### 4.7.1 Limit

Below -20dB of the highest emission level of operating band (in 100kHz RBW).

### 4.7.2 Test Procedures

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### 4.7.3 Deviation of Test Standard

No deviation.

### 4.7.4 Test Result

TestMode	ChName	Channel	Max. Level	Result	Limit	Verdict
DH5	Low	2402	-12.33	-53.68	-32.33	PASS
DH5	High	2480	-8.85	-55.36	-28.85	PASS
DH5	Low	HOP	-2.54	-41.57	-22.54	PASS
DH5	High	HOP	-2.19	-61.73	-22.19	PASS
2DH5	Low	2402	-2.78	-44.20	-22.78	PASS
2DH5	High	2480	-1.35	-59.21	-21.35	PASS
2DH5	Low	HOP	-6.43	-45.66	-26.43	PASS
2DH5	High	HOP	-3.72	-60.11	-3.72	PASS
3DH5	Low	2402	-3.12	-41.09	-23.12	PASS
3DH5	High	2480	-1.80	-58.76	-21.80	PASS
3DH5	Low	HOP	-6.29	-44.48	-26.29	PASS
3DH5	High	HOP	-1.35	-60.56	-21.35	PASS

GFSK

Hopping disabled\_ Low Channel



Hopping disabled\_ High Channel



### Hopping enabled\_ Low Channel



### Hopping enabled\_ High Channel



π/4DQPSK

Hopping disabled\_ Low Channel



Hopping disabled\_ High Channel



### Hopping enabled\_ Low Channel



### Hopping enabled\_ High Channel



8DPSK

Hopping disabled\_ Low Channel



Hopping disabled\_ High Channel



### Hopping enabled\_ Low Channel



### Hopping enabled\_ High Channel



#### 4.8 Out of Band Emission

TestMode	Channel	FreqRange	RefLevel	Result	Limit	Verdict
DH5	2402	30~1000	-12.33	-52.50	-32.33	PASS
DH5	2402	1000~26500	-12.33	-46.14	-32.33	PASS
DH5	2441	30~1000	-10.92	-49.58	-30.92	PASS
DH5	2441	1000~26500	-10.92	-51.18	-30.92	PASS
DH5	2480	30~1000	-8.85	-52.17	-28.85	PASS
DH5	2480	1000~26500	-8.85	-51.30	-28.85	PASS
2DH5	2402	30~1000	-2.78	-49.00	-22.78	PASS
2DH5	2402	1000~26500	-2.78	-52.73	-22.78	PASS
2DH5	2441	30~1000	-1.80	-48.79	-21.80	PASS
2DH5	2441	1000~26500	-1.80	-53.05	-21.80	PASS
2DH5	2480	30~1000	-1.35	-46.80	-21.35	PASS
2DH5	2480	1000~26500	-1.35	-40.70	-21.35	PASS
3DH5	2402	30~1000	-3.12	-53.88	-23.12	PASS
3DH5	2402	1000~26500	-3.12	-50.28	-23.12	PASS
3DH5	2441	30~1000	-2.43	-39.33	-22.43	PASS
3DH5	2441	1000~26500	-2.43	-45.26	-22.43	PASS
3DH5	2480	30~1000	-1.80	-34.17	-21.80	PASS
3DH5	2480	1000~26500	-1.80	-58.74	-21.80	PASS

GFSK

2402MHz



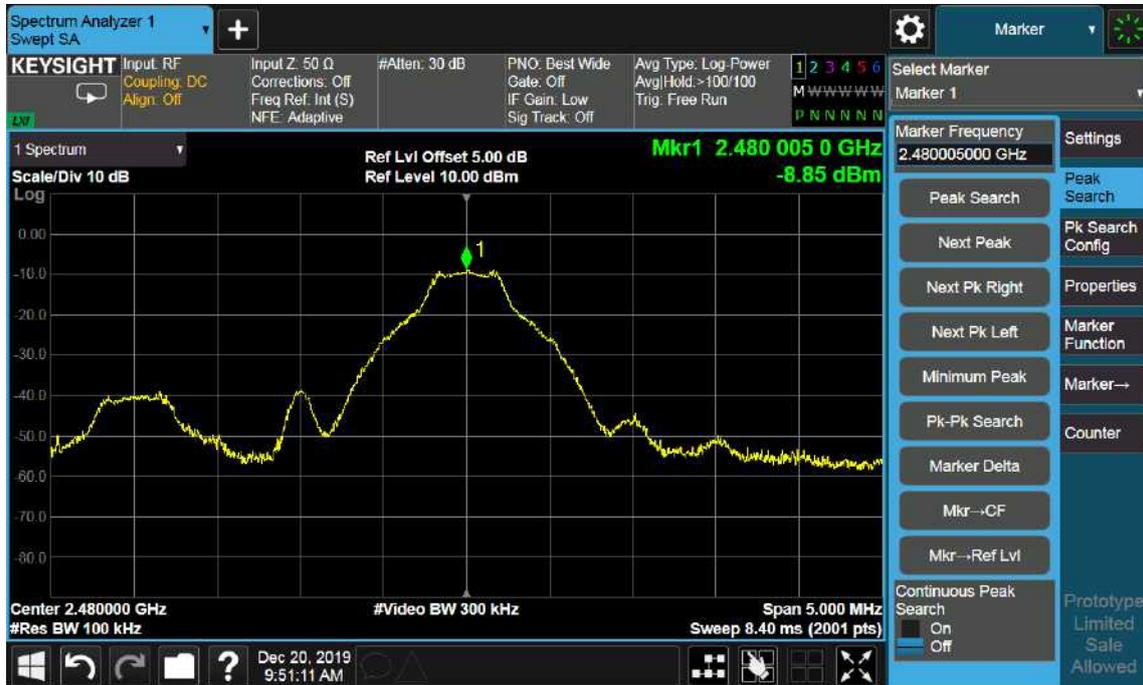


2441MHz





## 2480MHz





$\pi/4$ DQPSK

2402MHz





2441MHz





2480MHz

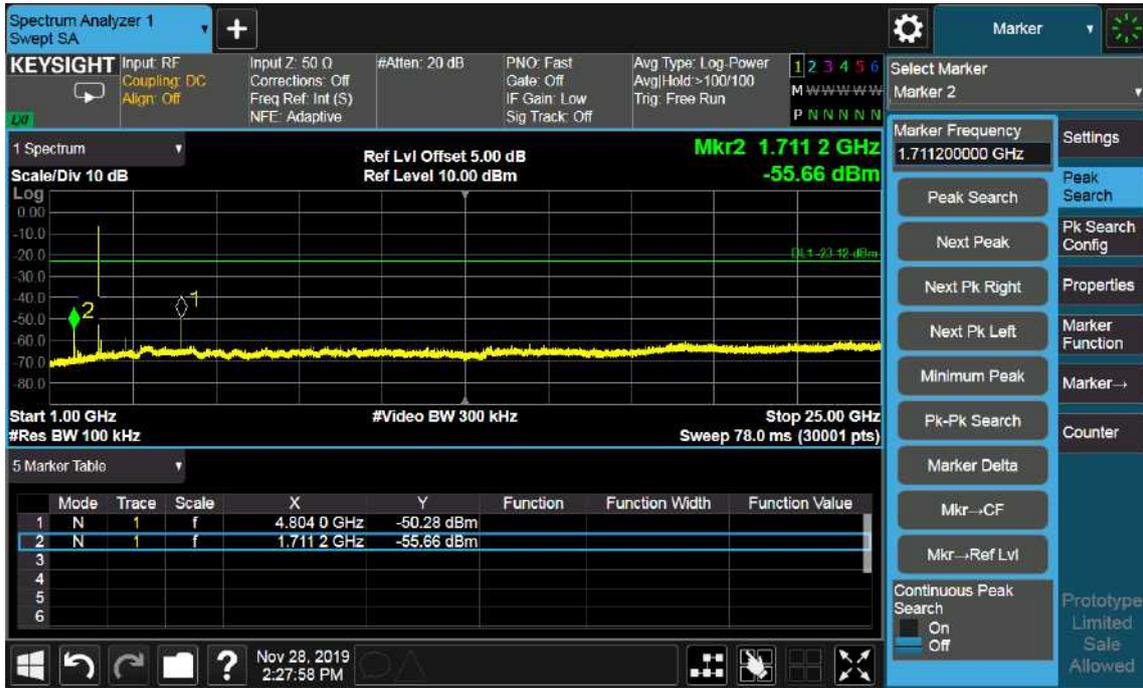




8DPSK

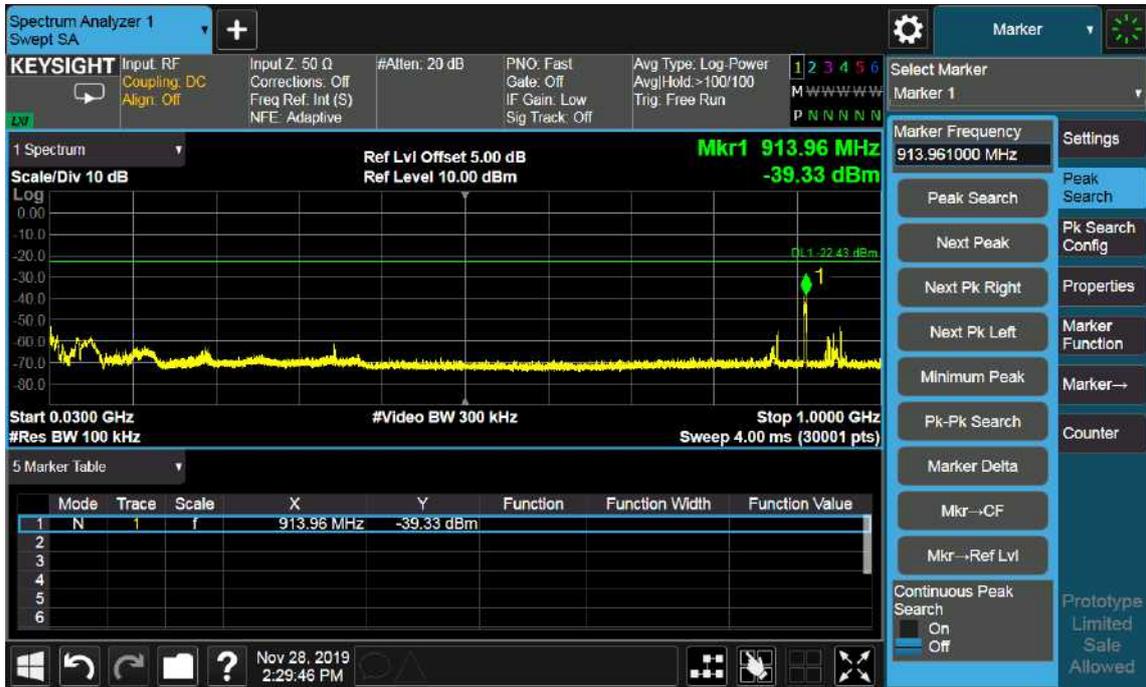
2402MHz





2441MHz





2480MHz





## 4.9 Radiated Emission Measurement

### 4.9.1 Limits

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (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
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

### 4.9.2 Test Procedures

#### For Radiated emission below 30MHz

- a. The EUT was placed on a 80cm height table above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotate table was turned from 0 degree to 360 degree to find the maximum reading.

- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**Note:**

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

**For Radiated emission above 30MHz**

- a. The EUT was placed on a 80cm height(above 1GHz is 1.5m height) table above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

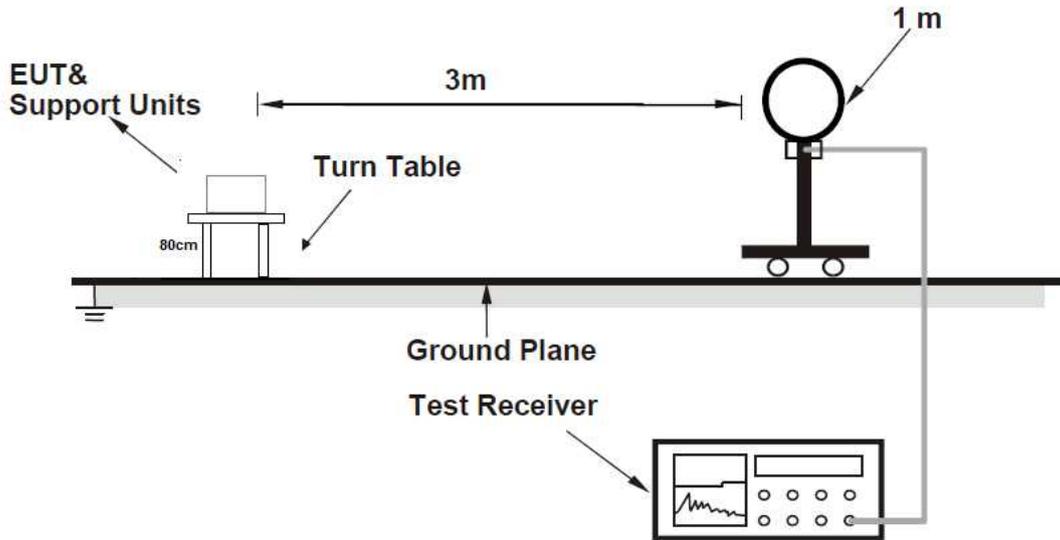
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for RMS Average (Duty cycle < 98 %) for Peak detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle  $\geq$  98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.9.3 Deviation from Test Standard

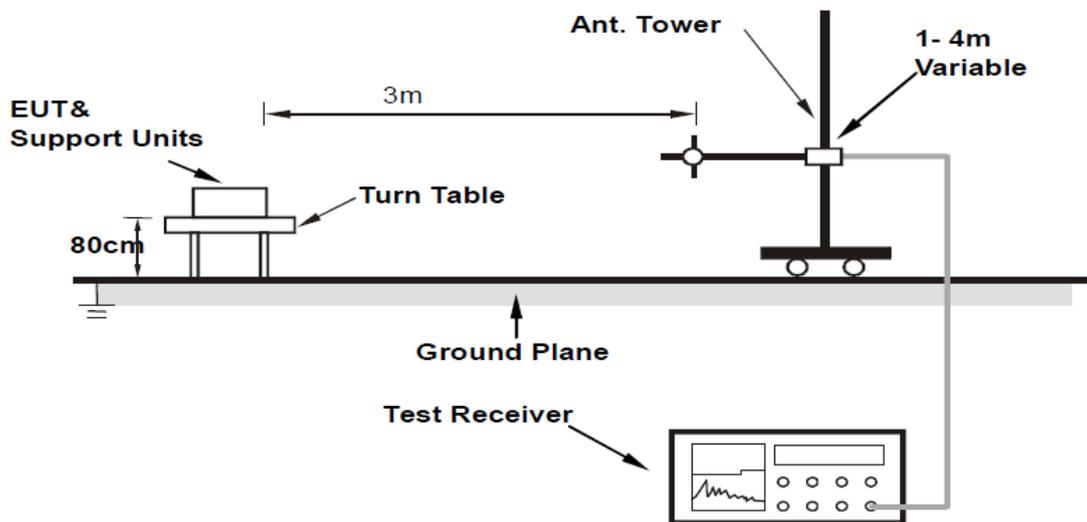
No deviation.

#### 4.9.4 Test Setup

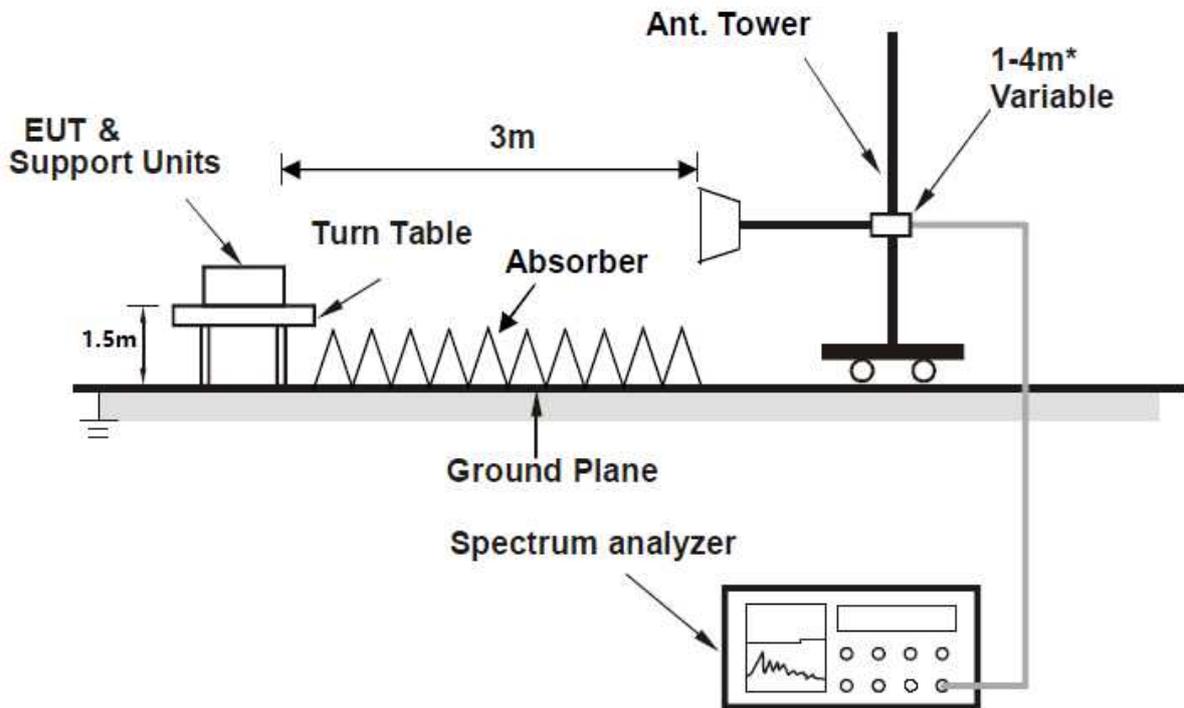
For Radiated emission between 30MHz~1000MHz



For Radiated emission between 30MHz~1000MHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.9.5 EUT Operating Conditions

- Placed the EUT on a testing table.
- Use the software to control the EUT under transmission condition continuously at specific channel frequency.

#### 4.9.6 Test Results

##### Radiated Emissions Range 9kHz~30MHz

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

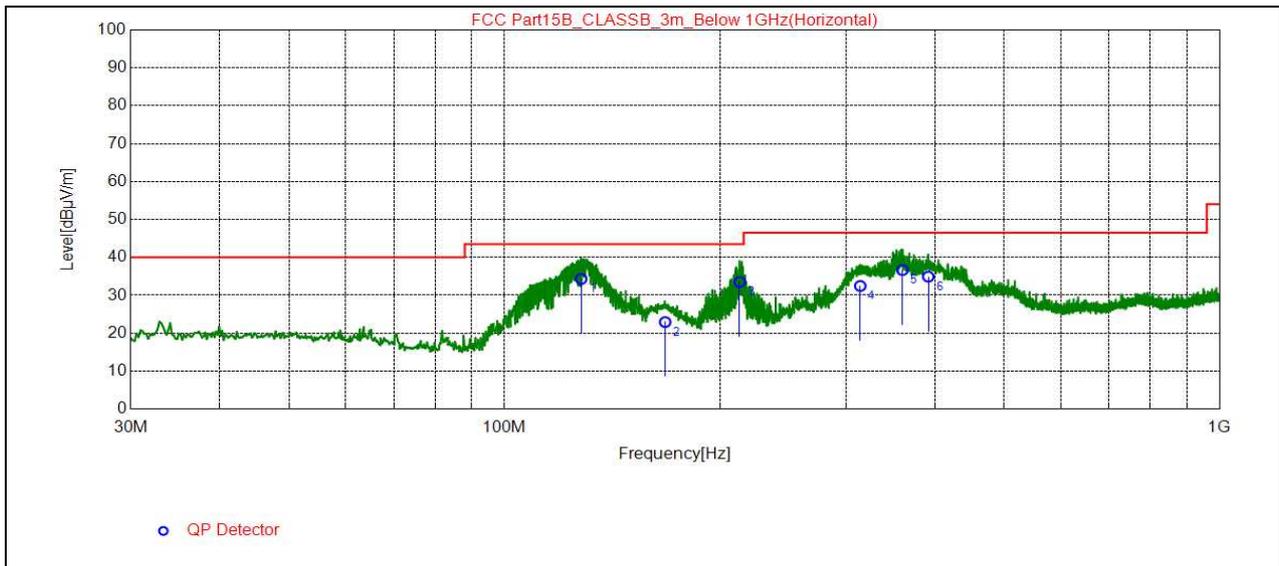
### Radiated Emissions Range 30MHz~1GHz

<b>Channel</b>	TX Channel 0	<b>Detector Function</b>	Quasi-Peak (QP)		
<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Antenna Polarity</b>	Horizontal		
<b>Spurious Emission Level</b>					
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)
1	127.9700	34.30	43.50	-9.20	-10.94
2	167.7400	22.93	43.50	-20.57	-9.27
3	213.3300	33.52	43.50	-9.98	-11.77
4	314.4040	32.46	46.50	-14.04	-8.80
5	360.1880	36.65	46.50	-9.85	-8.49
6	391.4220	34.91	46.50	-11.59	-7.83

**REMARKS:**

1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

**Test Plot:**

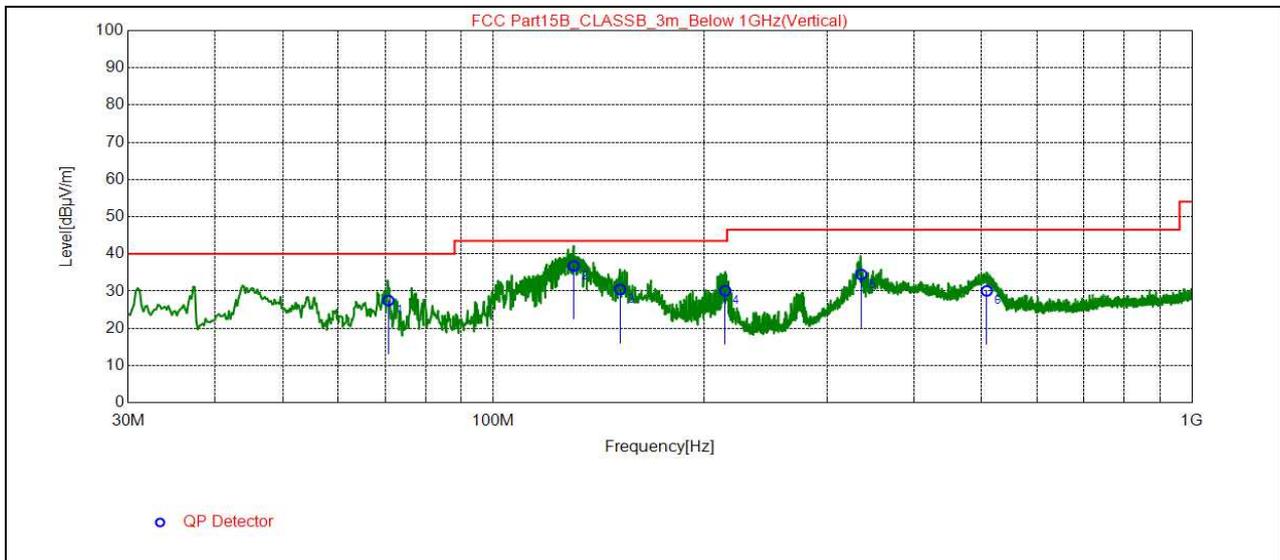


Channel	TX Channel 0	Detector Function	Quasi-Peak (QP)		
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical		
Spurious Emission Level					
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)
1	70.7400	27.47	40.00	-12.53	-12.23
2	130.2980	36.76	43.50	-6.74	-10.73
3	151.8320	30.45	43.50	-13.05	-9.23
4	214.6880	30.11	43.50	-13.39	-11.70
5	336.1320	34.49	46.50	-12.01	-8.90
6	508.4040	30.06	46.50	-16.44	-5.66

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

**Test Plot:**



### Radiated Emission Range 1GHz~10th Harmonic

#### GFSK

<b>Channel</b>		TX Channel 0		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4803.75	52.50	74.00	-21.50	9.42	H	PK
2	4804.60	51.01	54.00	-2.99	9.42	H	AV
3	4803.75	53.01	74.00	-20.99	9.42	V	PK
4	4804.60	52.28	54.00	-1.72	9.42	V	AV

<b>Channel</b>		TX Channel 39		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4881.95	51.71	74.00	-22.29	9.32	H	PK
2	4882.80	50.75	54.00	-3.25	9.32	H	AV
3	4881.95	53.04	74.00	-20.96	9.32	V	PK
4	4882.80	51.81	54.00	-2.19	9.32	V	AV

<b>Channel</b>		TX Channel 78		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4959.30	50.02	74.00	-23.98	9.23	H	PK
2	4961.00	48.26	54.00	-5.74	9.22	H	AV
3	4960.15	51.71	74.00	-22.29	9.23	V	PK
4	4961.00	50.41	54.00	-3.59	9.22	V	AV

#### REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

**π/4DQPSK**

<b>Channel</b>		TX Channel 0		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4804.60	52.79	74.00	-21.21	9.42	H	PK
2	4804.60	48.39	54.00	-5.61	9.42	H	AV
3	4804.60	52.12	74.00	-21.88	9.42	V	PK
4	4804.60	47.97	54.00	-6.03	9.42	V	AV

<b>Channel</b>		TX Channel 39		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4881.95	51.31	74.00	-22.69	9.32	H	PK
2	4882.80	47.71	54.00	-6.29	9.32	H	AV
3	4881.95	51.65	74.00	-22.35	9.32	V	PK
4	4882.80	50.03	54.00	-3.97	9.32	V	AV

<b>Channel</b>		TX Channel 78		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4960.15	48.22	74.00	-25.78	9.23	H	PK
2	4961.00	44.09	54.00	-9.91	9.22	H	AV
3	4960.15	49.08	74.00	-24.92	9.23	V	PK
4	4961.00	45.94	54.00	-8.06	9.22	V	AV

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

### 8DPSK

<b>Channel</b>		TX Channel 0		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4803.75	50.38	74.00	-23.62	9.42	H	PK
2	4804.60	47.38	54.00	-6.62	9.42	H	AV
3	4804.60	51.54	74.00	-22.46	9.42	V	PK
4	4804.60	47.48	54.00	-6.52	9.42	V	AV

<b>Channel</b>		TX Channel 39		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4881.95	50.14	74.00	-23.86	9.32	H	PK
2	4882.80	47.52	54.00	-6.48	9.32	H	AV
3	4881.95	51.63	74.00	-22.37	9.32	V	PK
4	4882.80	47.95	54.00	-6.05	9.32	V	AV

<b>Channel</b>		TX Channel 78		<b>Detector Function</b>		Peak (PK)	
<b>Frequency Range</b>		1GHz ~ 25GHz				Average (AV)	
<b>Spurious Emission Level</b>							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4959.30	47.91	74.00	-26.09	9.23	H	PK
2	4961.00	43.08	54.00	-10.92	9.22	H	AV
3	4959.30	49.25	74.00	-24.75	9.23	V	PK
4	4960.15	45.68	54.00	-8.32	9.22	V	AV

#### REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



#### 4.10 Radiated Restricted Band Edge Measurement

##### 4.10.1 Test Limit

##### For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
1 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 - 156.525	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	(2)
13.36 - 13.41	--	--	--



All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

<b>FCC Part 15 Subpart C Paragraph 15.209</b>		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

#### **4.10.2 Test Procedure Reference**

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

#### **4.10.3 Test Procedures**

##### **Peak Field Strength Measurements**

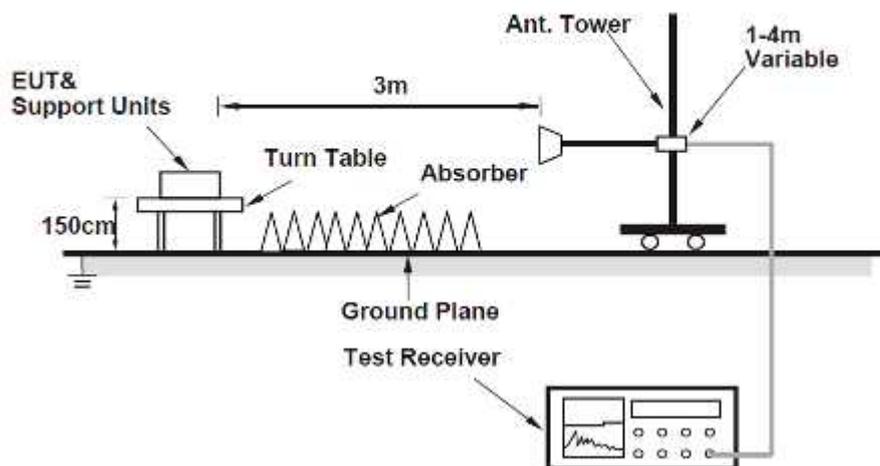
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

### Average Measurements above 1GHz (Method VB)

8. 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
9. 2. RBW = 1MHz
10. 3. VBW; If the EUT is configured to transmit with duty cycle  $\geq 98\%$ , set VBW = 10 Hz.
11. If the EUT duty cycle is  $< 98\%$ , set VBW  $\geq 1/T$ . T is the minimum transmission duration.
12. 4. Detector = Peak
13. 5. Sweep time = auto
14. 6. Trace mode = max hold
15. 7. Trace was allowed to stabilize

#### 4.10.4 Test Setup

For Radiated emission above 1GHz

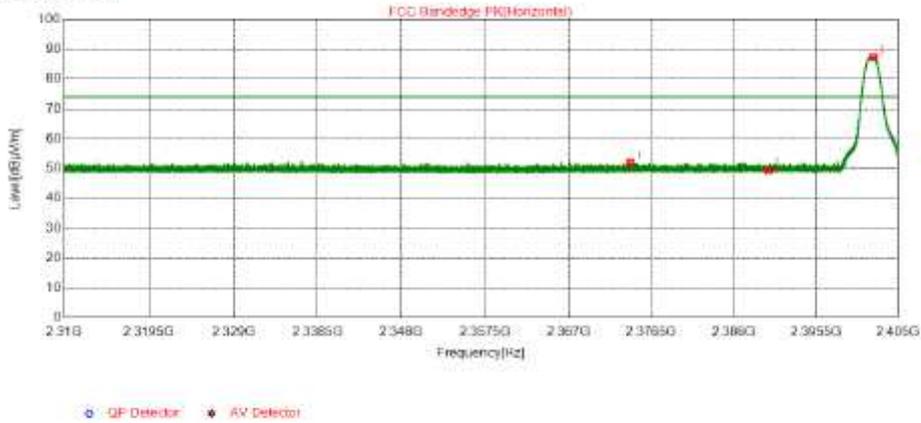


#### 4.10.5 Test Results

##### Test Plot

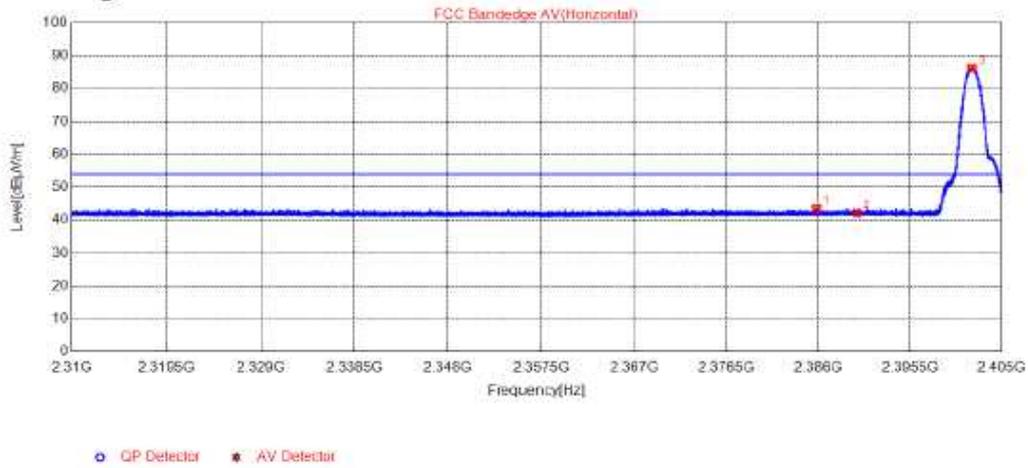
DH5 2402MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2374.1108	47.04	51.93	74.00	22.07	155	326	Horizontal	PK
2	2390.0043	44.49	49.41	74.00	24.59	175	159	Horizontal	PK
3	2402.1500	82.32	87.27	74.00	-13.27	155	61	Horizontal	PK

### Test Graph

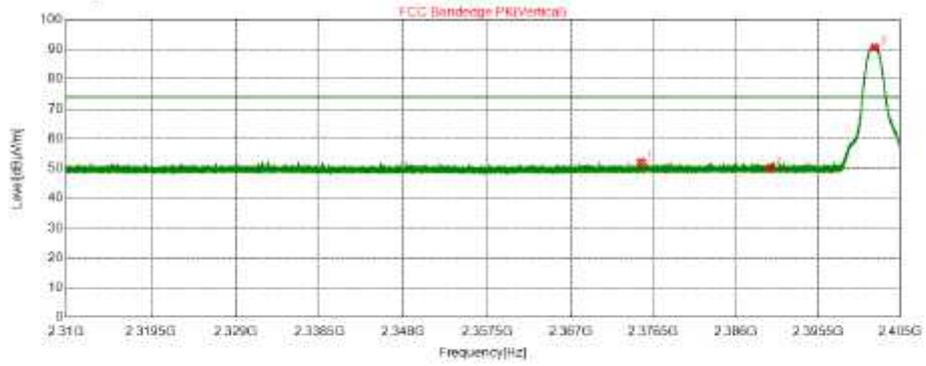


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2385.8243	38.54	43.45	54.00	10.55	155	307	Horizontal	AV
2	2390.0043	37.22	42.14	54.00	11.86	175	128	Horizontal	AV
3	2401.9268	81.23	86.18	54.00	-32.18	155	77	Horizontal	AV

Test Plot

DH5 2402MHz/ Vertical

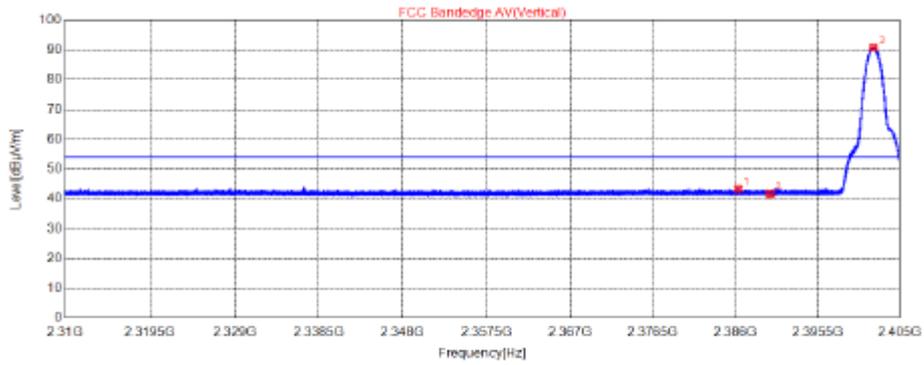
Test Graph



GP Detector AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2375.1415	47.14	52.02	74.00	21.97	155	43	Vertical	PK
2	2390.0043	45.19	50.11	74.00	23.89	175	210	Vertical	PK
3	2402.0883	85.70	90.65	74.00	-16.65	175	143	Vertical	PK

### Test Graph



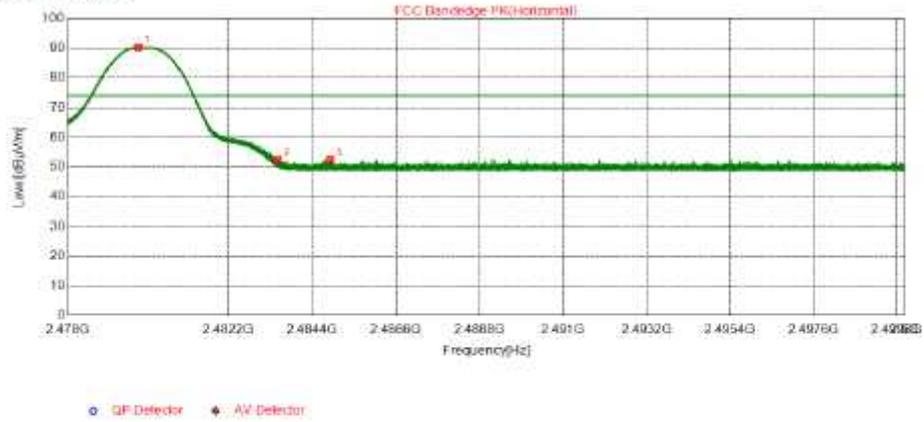
○ QP Detector    ● AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2386.3135	38.42	43.34	54.00	10.66	155	180	Vertical	AV
2	2390.0043	36.74	41.66	54.00	12.34	155	126	Vertical	AV
3	2401.9458	85.87	90.82	54.00	-36.82	175	162	Vertical	AV

Test Plot

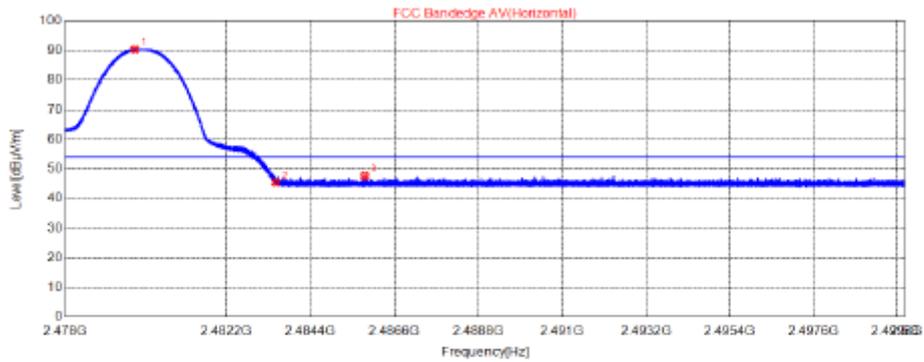
DH5 2480MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8458	85.17	90.28	74.00	-16.25	175	310	Horizontal	PK
2	2483.5000	47.29	52.38	74.00	21.62	175	343	Horizontal	PK
3	2484.8761	47.30	52.39	74.00	21.61	175	9	Horizontal	PK

### Test Graph



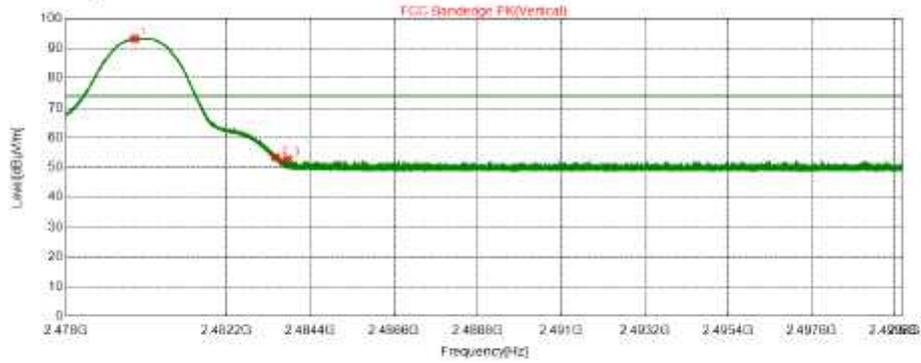
● QP Detector ● AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8194	85.29	90.37	54.00	-36.37	175	331	Horizontal	AV
2	2483.5000	40.36	45.45	54.00	8.55	175	331	Horizontal	AV
3	2485.8265	42.52	47.62	54.00	6.38	175	108	Horizontal	AV

Test Plot

DH5 2480MHz/ Vertical

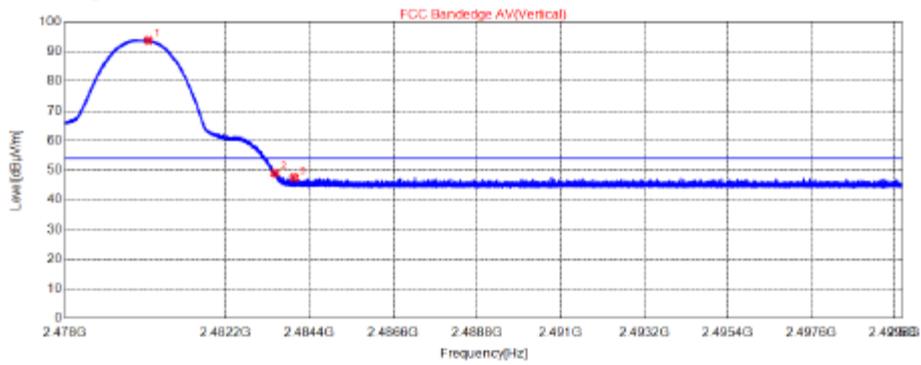
Test Graph



□ GP Detector ● AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8128	88.20	88.28	74.00	-19.28	175	210	Vertical	PK
2	2483.5000	48.33	53.42	74.00	20.58	165	150	Vertical	PK
3	2483.8201	47.70	52.79	74.00	21.21	175	126	Vertical	PK

### Test Graph



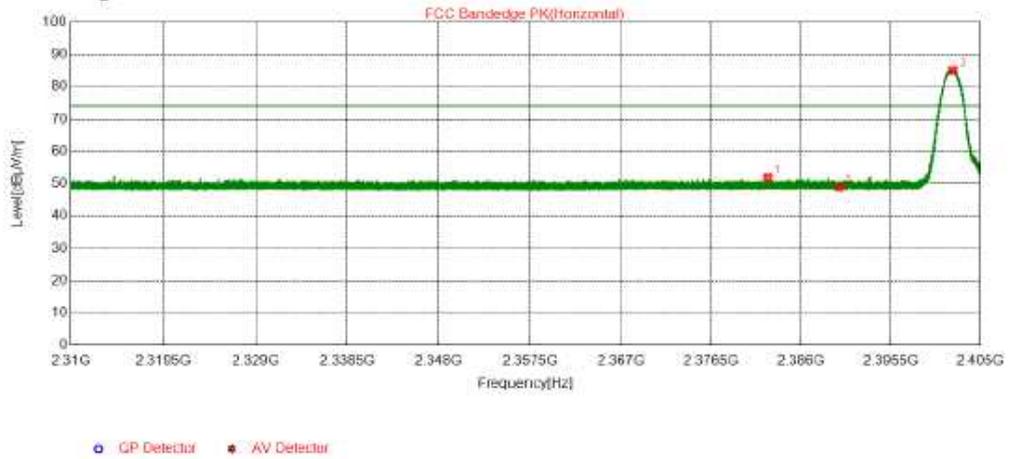
○ QP Detector    ✱ AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.1835	88.69	93.78	54.00	-39.78	175	224	Vertical	AV
2	2483.5000	43.89	48.98	54.00	5.02	175	206	Vertical	AV
3	2484.0038	42.42	47.51	54.00	6.49	165	154	Vertical	AV

Test Plot

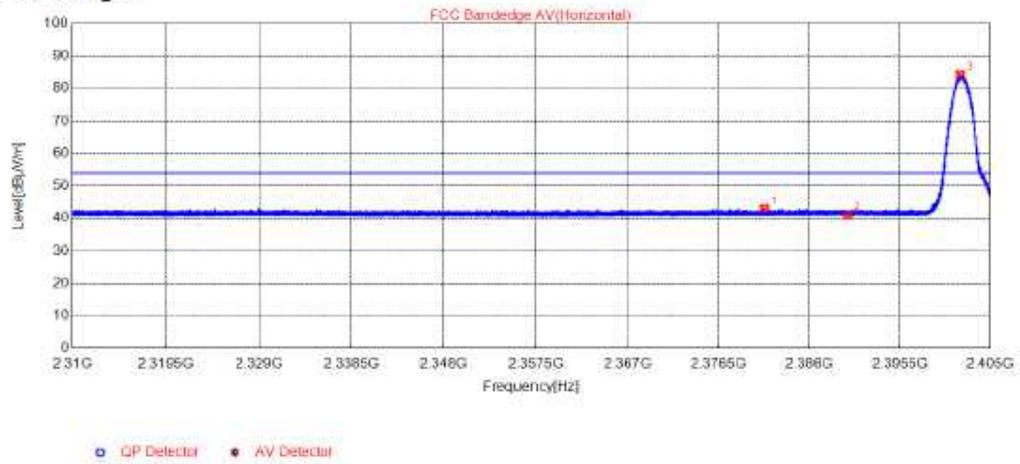
2DH5 2402MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2382.4708	46.91	51.82	74.00	22.18	165	67	Horizontal	PK
2	2390.0043	43.86	48.78	74.00	25.22	175	226	Horizontal	PK
3	2402.0978	80.18	85.13	74.00	-11.13	155	59	Horizontal	PK

### Test Graph

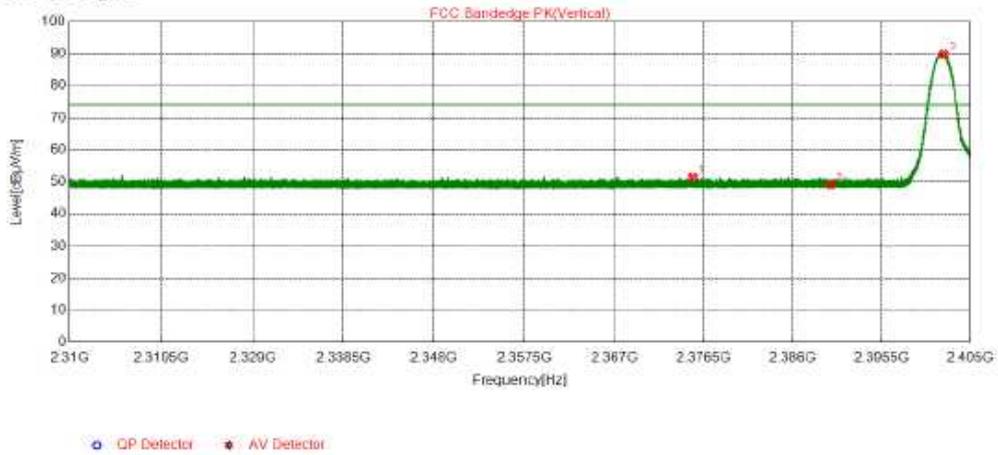


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2381.3023	38.07	42.97	54.00	11.03	178	232	Horizontal	AV
2	2390.0090	36.14	41.06	54.00	12.94	185	134	Horizontal	AV
3	2401.8650	79.29	84.24	54.00	-30.24	158	72	Horizontal	AV

Test Plot

2DH5 2402MHz/ Vertical

Test Graph

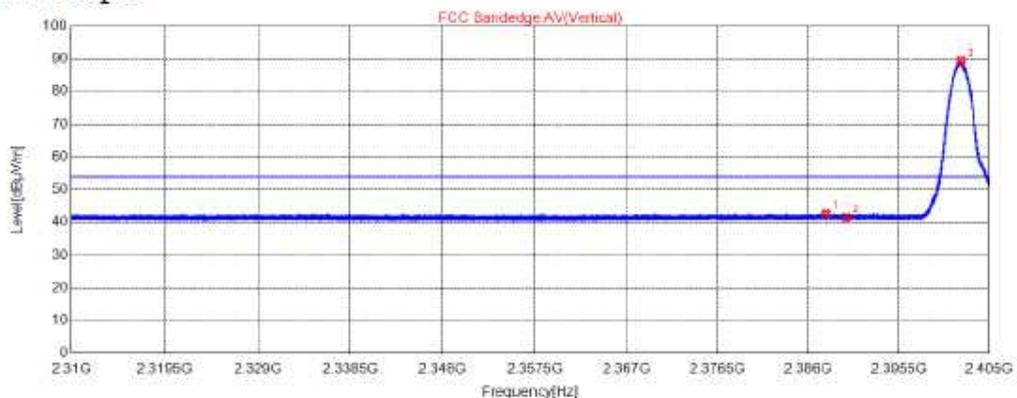


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2375.3268	46.47	51.36	74.00	22.64	175	293	Vertical	PK
2	2390.0043	44.12	49.04	74.00	24.96	175	193	Vertical	PK
3	2402.1643	84.83	89.78	74.00	-15.78	175	143	Vertical	PK



BUREAU  
VERITAS

### Test Graph



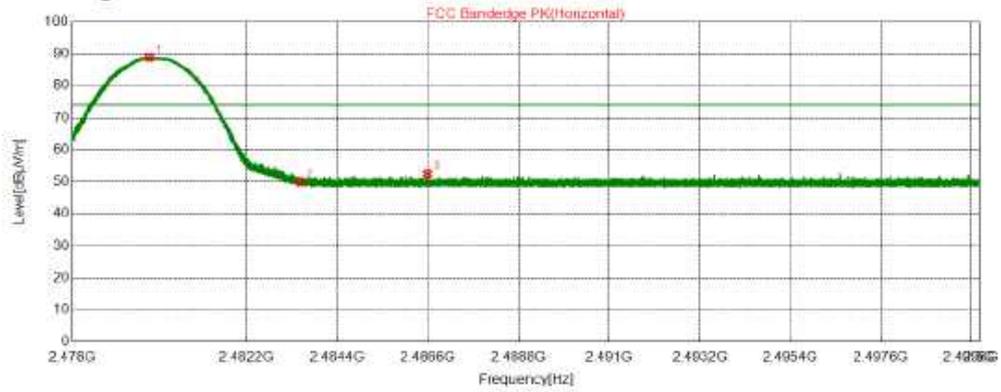
○ GP Detector    ● AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2387.8430	37.70	42.62	54.00	11.38	165	306	Vertical	AV
2	2390.0043	36.62	41.54	54.00	12.46	165	244	Vertical	AV
3	2402.0503	84.36	89.31	54.00	-35.31	175	161	Vertical	AV

Test Plot

2DH5 2480MHz/ Horizontal

Test Graph



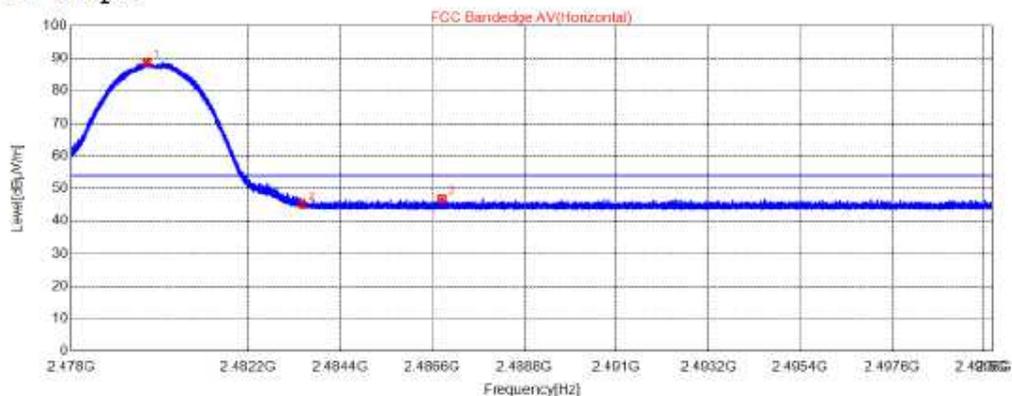
Q Detector AV Detector

NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8634	83.83	88.91	74.00	-14.91	175	310	Horizontal	PK
2	2483.5000	44.90	49.99	74.00	24.01	175	227	Horizontal	PK
3	2486.5899	47.43	52.53	74.00	21.47	165	34	Horizontal	PK



BUREAU  
VERITAS

Test Graph



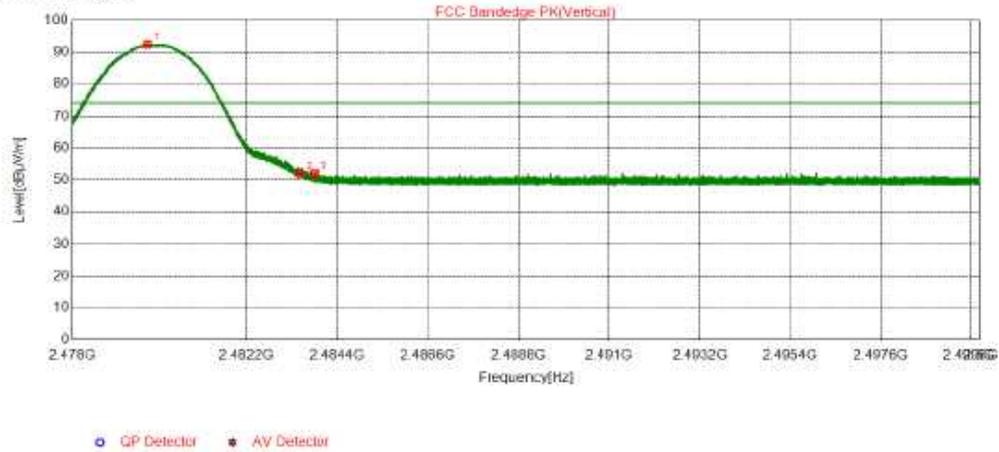
○ QP Detector ● AV Detector

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8040	83.64	88.72	54.00	-34.72	175	329	Horizontal	AV
2	2483.5000	40.02	45.11	54.00	8.89	165	351	Horizontal	AV
3	2486.8341	41.80	46.90	54.00	7.10	175	99	Horizontal	AV

Test Plot

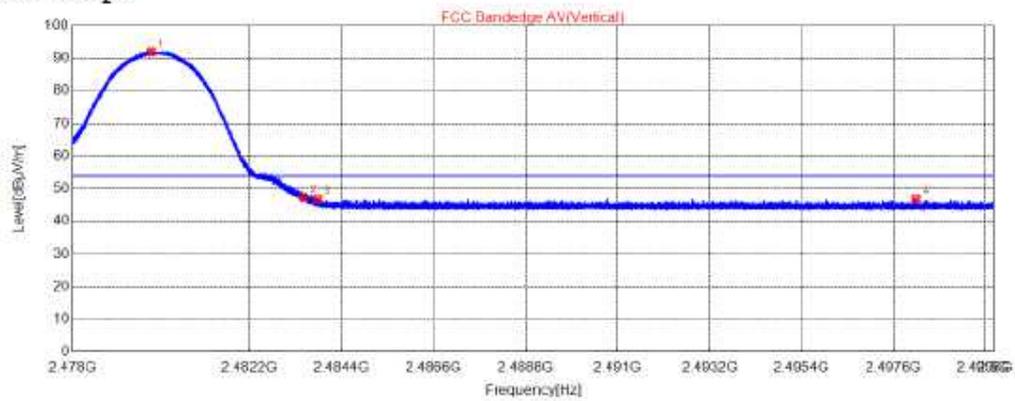
2DH5 2480MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8161	87.31	92.39	74.00	-16.39	165	117	Vertical	PK
2	2483.5000	46.80	51.89	74.00	22.11	155	227	Vertical	PK
3	2483.8531	46.90	51.99	74.00	22.01	165	17	Vertical	PK

### Test Graph



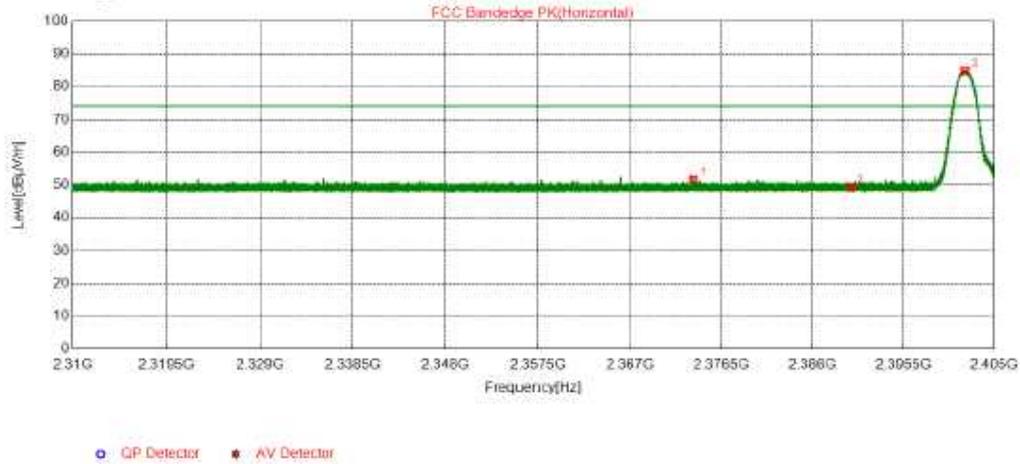
○ QP Detector    ■ AV Detector

NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8722	86.90	91.98	54.00	-37.98	175	231	Vertical	AV
2	2483.5000	42.24	47.33	54.00	6.67	165	324	Vertical	AV
3	2483.8234	41.73	46.82	54.00	7.18	175	312	Vertical	AV
4	2498.1432	41.71	46.83	54.00	7.17	165	315	Vertical	AV

### Test Plot

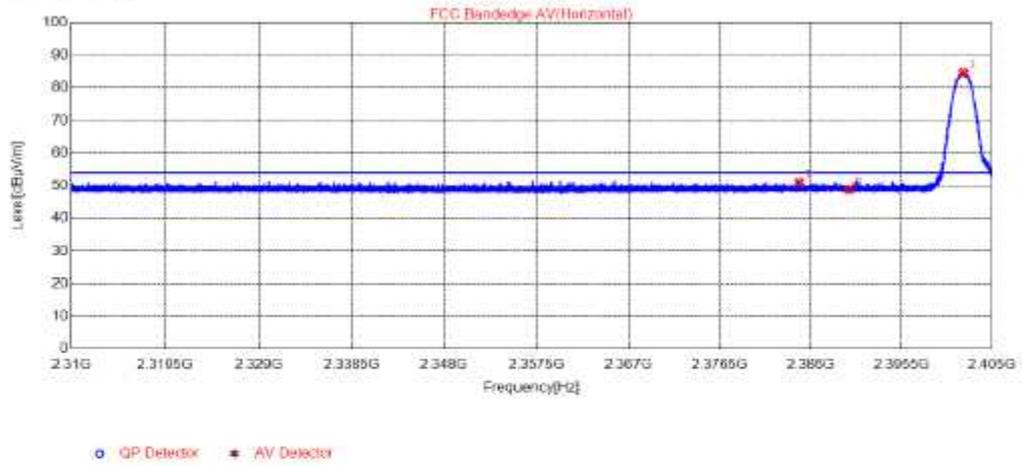
3DH5 2402MHz/ Horizontal

#### Test Graph



NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2373.5740	46.71	51.60	74.00	22.40	175	127	Horizontal	PK
2	2390.0043	44.24	49.16	74.00	24.84	165	183	Horizontal	PK
3	2401.9600	79.88	84.83	74.00	-10.83	155	57	Horizontal	PK

### Test Graph

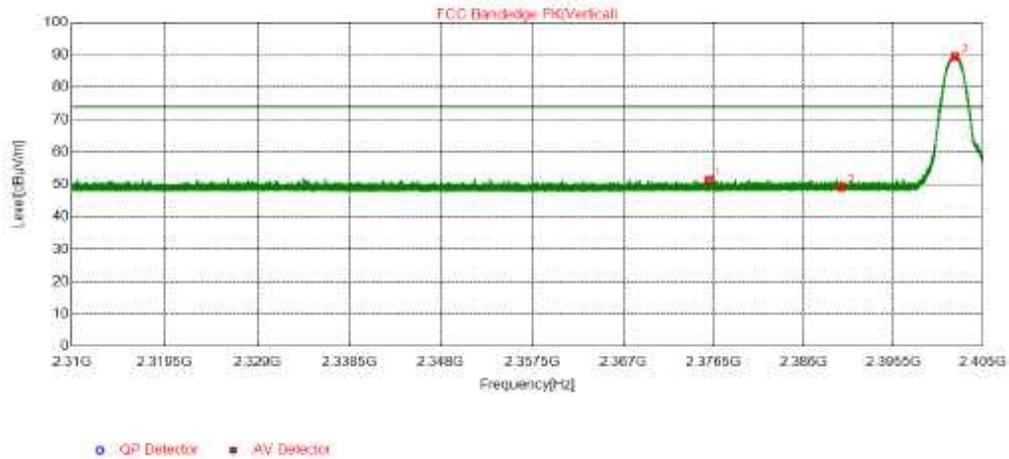


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2384.7603	46.13	51.04	54.00	2.96	155	108	Horizontal	AV
2	2390.0090	43.84	48.76	54.00	5.24	175	143	Horizontal	AV
3	2401.9838	79.64	84.59	54.00	-30.59	155	81	Horizontal	AV

### Test Plot

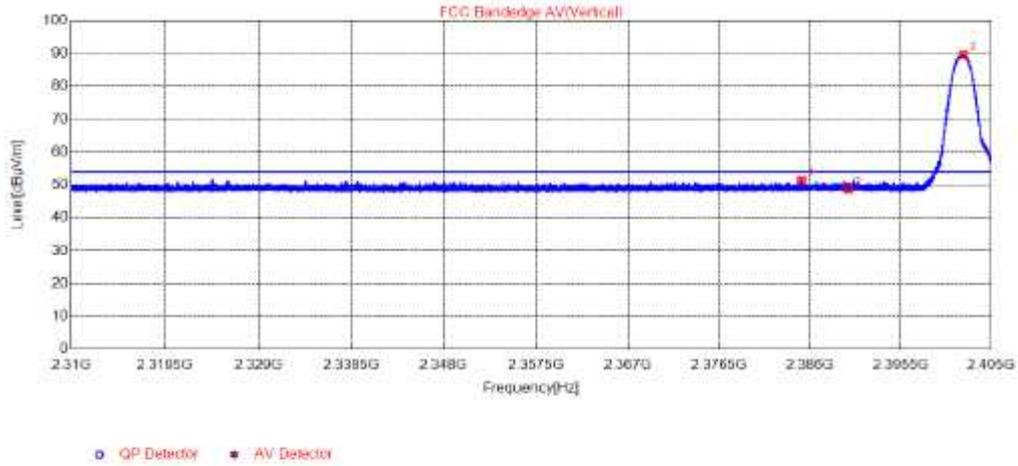
3DH5 2402MHz/ Vertical

#### Test Graph



NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2375.9965	46.48	51.37	74.00	22.63	165	310	Vertical	PK
2	2390.0090	44.22	49.14	74.00	24.86	155	218	Vertical	PK
3	2402.0123	84.61	89.56	74.00	-15.56	175	166	Vertical	PK

### Test Graph

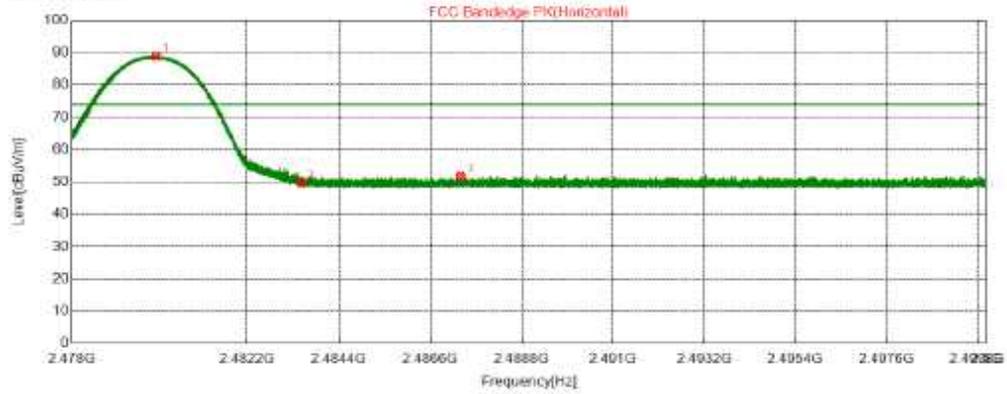


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2385.1403	46.42	51.33	54.00	2.67	165	198	Vertical	AV
2	2390.0043	43.78	48.70	54.00	5.30	155	145	Vertical	AV
3	2402.0503	84.66	89.61	54.00	-35.61	175	145	Vertical	AV

### Test Plot

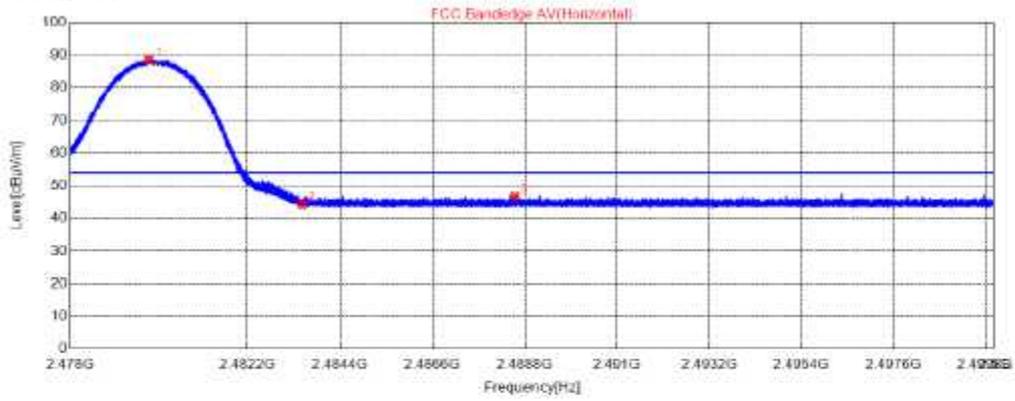
3DH5 2480MHz/ Horizontal

#### Test Graph



NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.0086	83.88	88.96	74.00	-14.96	175	310	Horizontal	PK
2	2483.5000	44.64	49.73	74.00	24.27	155	145	Horizontal	PK
3	2487.3346	46.59	51.69	74.00	22.31	175	227	Horizontal	PK

### Test Graph



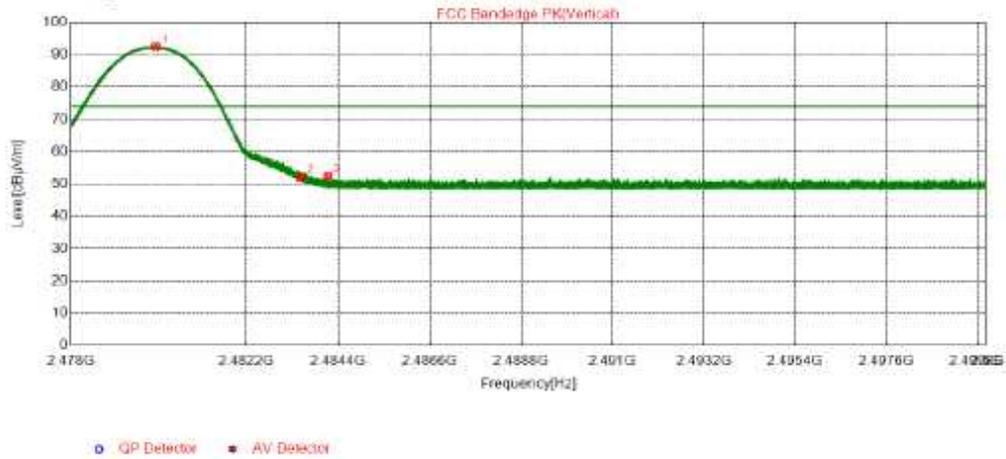
○ QP Detector    ● AV Detector

NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8645	83.53	88.61	54.00	-34.61	175	329	Horizontal	AV
2	2483.5000	39.23	44.32	54.00	9.68	175	285	Horizontal	AV
3	2488.5600	41.63	46.73	54.00	7.27	155	133	Horizontal	AV

Test Plot

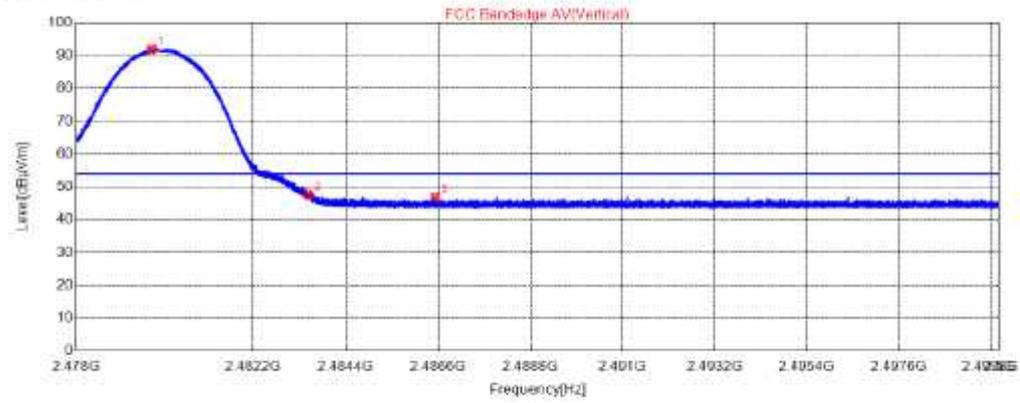
3DH5 2480MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.0218	87.45	92.53	74.00	-18.53	175	211	Vertical	PK
2	2483.5000	46.96	52.05	74.00	21.95	165	116	Vertical	PK
3	2484.1556	47.26	52.35	74.00	21.65	175	46	Vertical	PK

### Test Graph



□ QP Detector    ■ AV Detector

NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.7853	86.85	91.93	54.00	-37.93	175	230	Vertical	AV
2	2483.5000	42.49	47.58	54.00	6.42	165	351	Vertical	AV
3	2486.5316	41.81	46.91	54.00	7.09	175	124	Vertical	AV

## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

--- END ---