



**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

## FCC PART 15 SUBPART C TEST REPORT

### FCC PART 15.247

**Report Reference No.....** : GTS20191118015-1-1

**FCC ID.....** : 2AC5R-SC-2327BT

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Date of issue.....: Nov. 13, 2019

**Representative Laboratory Name ..:** Shenzhen Global Test Service Co., Ltd.

Address.....: No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

**Applicant's name .....** : SUPERSONIC INC

Address .....: 6555 BANDINI BOULEVARD COMMERCE CA 90040-3119 USA  
Los Angeles California United States

**Test specification .....**:

Standard .....: FCC Part 15.247

TRF Originator.....: Shenzhen Global Test Service Co.,Ltd.

Master TRF.....: Dated 2014-12

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**Test item description .....**: BLUETOOTH SPEAKER

Trade Mark .....: N/A

Manufacturer .....: SUPERSONIC INC

Model/Type reference.....: SC-2327BT

Listed Models .....: N/A

Modulation Type .....: GFSK,  $\Pi/4$ DQPSK, 8DPSK

Operation Frequency.....: From 2402MHz to 2480MHz

Rating .....: DC 3.7V from battery

Result.....: **PASS**

## TEST REPORT

Test Report No. :	GTS20191118015-1-1	Nov. 13, 2019
		Date of issue

Equipment under Test : BLUETOOTH SPEAKER

Model /Type : SC-2327BT

Listed Models : N/A

**Applicant** : **SUPERSONIC INC**

Address : 6555 BANDINI BOULEVARD COMMERCE CA 90040-3119 USA Los Angeles California United States

**Manufacturer** : **SUPERSONIC INC**

Address : 6555 BANDINI BOULEVARD COMMERCE CA 90040-3119 USA Los Angeles California United States

<b>Test Result:</b>	<b>PASS</b>
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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## **1 TEST STANDARDS**

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

## 2 SUMMARY

### 2.1 General Remarks

Date of receipt of test sample	:	Nov. 05, 2019
Testing commenced on	:	Nov. 06, 2019
Testing concluded on	:	Nov. 11, 2019

### 2.2 Product Description

Product Name:	BLUETOOTH SPEAKER
Model/Type reference:	SC-2327BT
Power supply:	DC 3.7V from battery
Adapter(Auxiliary test Provided by the laborator)	Mode:EP-TA20CBC Input:AC100-240V-50/60Hz, 0.5A Output:DC 5V,2A
<b>Bluetooth :</b>	
Supported Type:	Bluetooth BR/EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PCB antenna
Antenna gain:	1.0dBi

### 2.3 Equipment Under Test

#### Power supply system utilised

Power supply voltage	:	<input type="radio"/>	230V / 50 Hz	<input type="radio"/>	120V / 60Hz
		<input type="radio"/>	12 V DC	<input type="radio"/>	24 V DC
		<input checked="" type="radio"/>	Other (specified in blank below)		

DC 3.70V

### 2.4 Short description of the Equipment under Test (EUT)

This is a BLUETOOTH SPEAKER.

For more details, refer to the user's manual of the EUT.

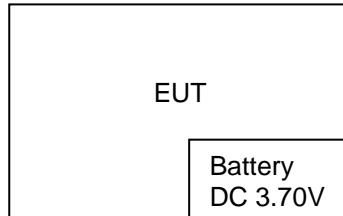
## 2.5 EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT and Channel 00/39/78 were selected to test.

### Operation Frequency:

Channel	Frequency (MHz)
00	2402
01	2403
:	:
38	2440
39	2441
40	2442
:	:
77	2479
78	2480

## 2.6 Block Diagram of Test Setup



## 2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for the device filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.8 Modifications

No modifications were implemented to meet testing criteria.

### **3 TEST ENVIRONMENT**

#### **3.1 Address of the test laboratory**

##### **Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

#### **3.2 Test Facility**

The test facility is recognized, certified, or accredited by the following organizations:

##### **FCC-Registration No.: 165725**

Shenzhen Global Test Service Co.,Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

##### **A2LA-Lab Cert. No.: 4758.01**

Shenzhen Global Test Service Co.,Ltd. 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.

##### **CNAS-Lab Code: L8169**

Shenzhen Global Test Service Co.,Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. Date of Registration: Dec. 11, 2015. Valid time is until Dec. 10, 2024.

#### **3.3 Environmental conditions**

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

### 3.4 Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(a)(1)	Carrier Frequency separation	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Middle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1)	Number of Hopping channels	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Full	GFSK 8DPSK	<input checked="" type="checkbox"/> Full	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Middle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1)	Spectrum bandwidth of a FHSS system 20dB bandwidth	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(b)(1)	Maximum output power	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d)	Band edge compliance conducted	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.205	Band edge compliance radiated	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	GFSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d)	TX spurious emissions conducted	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d)	TX spurious emissions radiated	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.209(a)	TX spurious Emissions radiated Below 1GHz	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK	<input checked="" type="checkbox"/> Middle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.107(a) §15.207	Conducted Emissions 9KHz-30 MHz	GFSK Π/4DQPSK 8DPSK	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	GFSK	<input checked="" type="checkbox"/> Middle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. We tested all test mode and recorded worst case in report

### 3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

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

### 3.6 Equipments Used during the Test

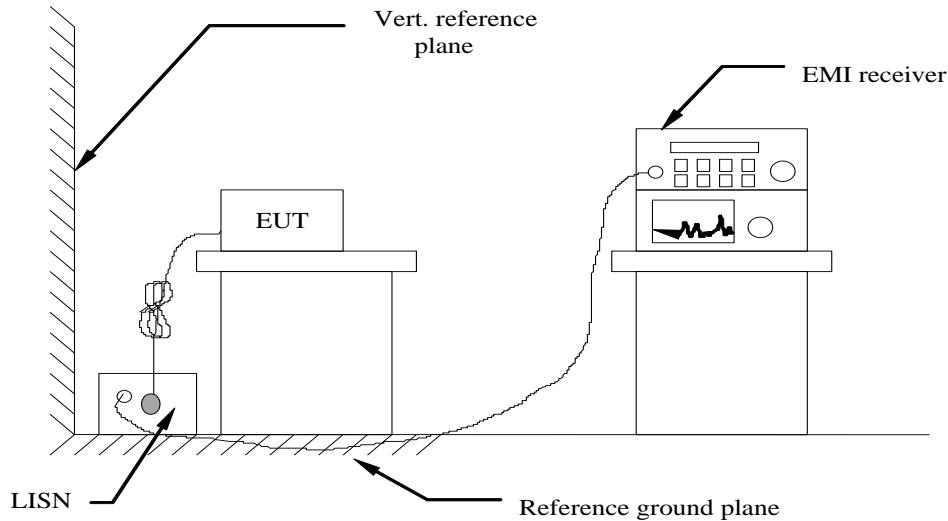
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2019/09/20	2020/09/19
LISN	R&S	ESH2-Z5	893606/008	2019/09/20	2020/09/19
Bilog Antenna	Schwarzbeck	VULB9163	976	2019/09/20	2020/09/19
EMI Test Receiver	R&S	ESCI7	101102	2019/09/20	2020/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2019/09/20	2020/09/19
Spectrum Analyzer	R&S	FSP40	100019	2019/09/20	2020/09/19
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2019/09/20	2020/09/19
Active Loop Antenna	SCHWARZBEC K	FMZB1519	1519-037	2019/09/20	2020/09/19
Broadband Horn Antenna	SCHWARZBEC K	BBHA 9170	971	2019/09/20	2020/09/19
Amplifier	Schwarzbeck	BBV 9743	#202	2019/09/20	2020/09/19
Amplifier	EMCI	EMC051845B	980355	2019/09/20	2020/09/19
Temperature/Humidity Meter	Gangxing	CTH-608	02	2019/09/20	2020/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2019/09/20	2020/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2019/09/20	2020/09/19
RF Cable(below 1GHz)	HUBER+SUHNE R	RG214	RE01	2019/09/20	2020/09/19
RF Cable(above 1GHz)	HUBER+SUHNE R	RG214	RE02	2019/09/20	2020/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2019/09/20	2020/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2019/09/20	2020/09/19
EMI Test Software	R&S	ES-K1	V1.7.1	2019/09/20	2020/09/19
EMI Test Software	JS Tonscend	JS32-RE	2.0.1.5	2019/09/20	2020/09/19

Note: The Cal.Interval was one year.

## 4 TEST CONDITIONS AND RESULTS

### 4.1 AC Power Conducted Emission

#### TEST CONFIGURATION



#### TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC 12V power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

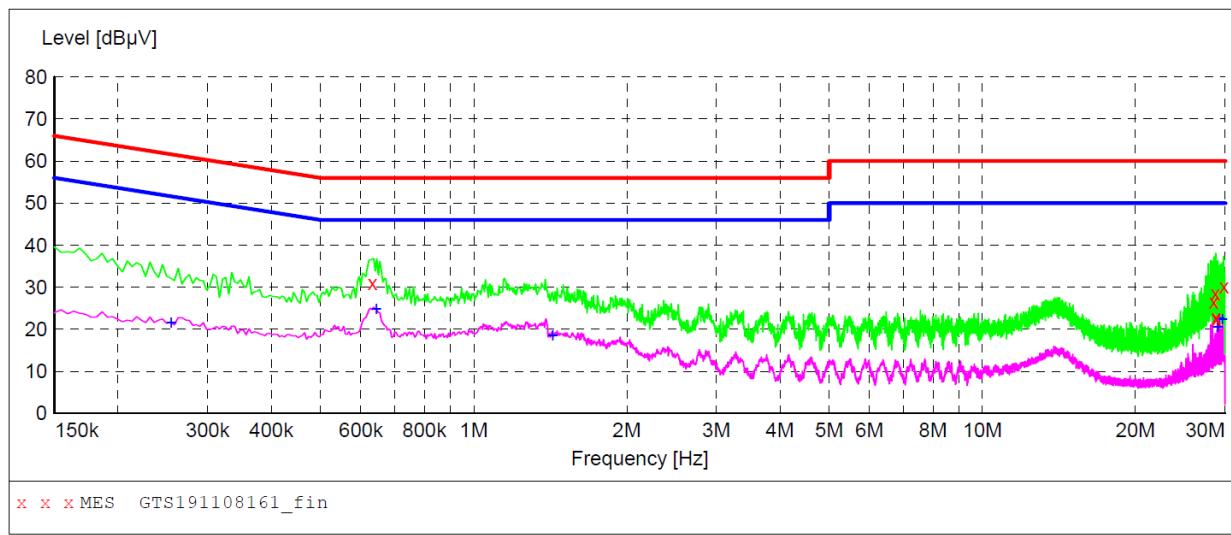
**TEST RESULTS**

Remark:

1. All modes of GFSK, Pi/4 DQPSK, and 8DPSK were test at Low, Middle, and High channel; only the worst result of GFSK Middle Channel was reported as below:
2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:

Power supply:	DC 5V from Adapter AC 120V/60Hz	Polarization	L
---------------	------------------------------------	--------------	---

**SCAN TABLE: "Voltage (9K-30M) FIN"**  
Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "GTS191108161\_fin"**

11/08/2019 11:31

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.632000	30.90	10.2	56	25.1	QP	L1	GND
28.520000	26.40	11.2	60	33.6	QP	L1	GND
28.700000	28.50	11.2	60	31.5	QP	L1	GND
28.766000	22.80	11.2	60	37.2	QP	L1	GND
28.826000	22.50	11.2	60	37.5	QP	L1	GND
29.840000	30.20	11.3	60	29.8	QP	L1	GND

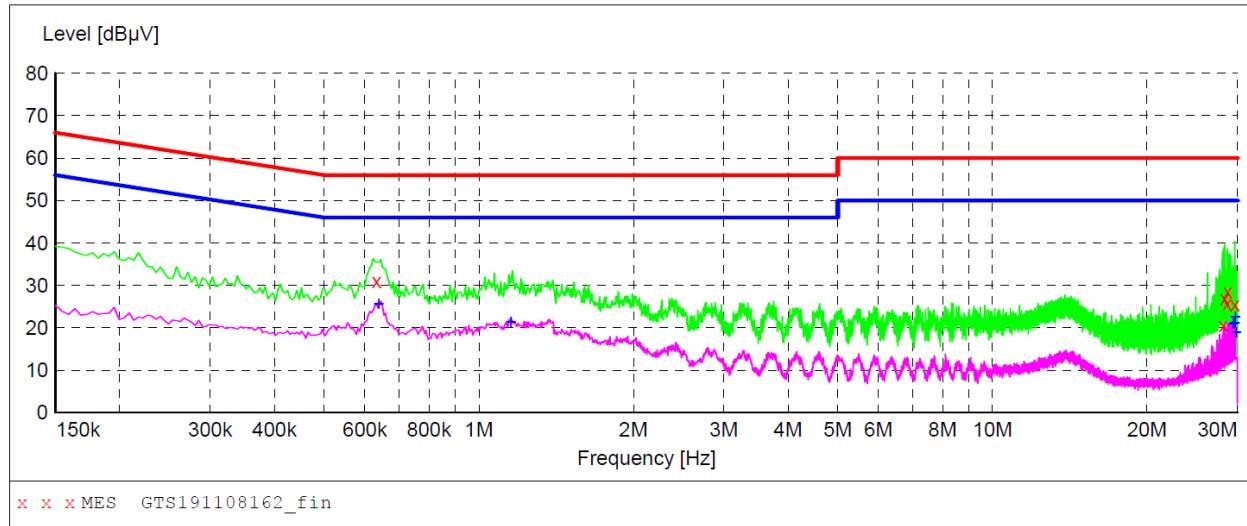
**MEASUREMENT RESULT: "GTS191108161\_fin2"**

11/08/2019 11:31

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.254000	21.60	10.2	52	30.0	AV	L1	GND
0.644000	24.80	10.2	46	21.2	AV	L1	GND
1.430000	18.50	10.3	46	27.5	AV	L1	GND
29.000000	20.70	11.2	50	29.3	AV	L1	GND
29.240000	22.60	11.2	50	27.4	AV	L1	GND
29.660000	22.40	11.3	50	27.6	AV	L1	GND

Power supply:	DC 5V from Adapter AC 120V/60Hz	Polarization	N
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**SCAN TABLE: "Voltage (9K-30M) FIN"**  
Short Description: 150K-30M Voltage



**MEASUREMENT RESULT: "GTS191108162\_fin"**

11/08/2019 11:34

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.632000	30.90	10.2	56	25.1	QP	N	GND
28.166000	20.50	11.2	60	39.5	QP	N	GND
28.340000	26.90	11.2	60	33.1	QP	N	GND
28.640000	25.60	11.2	60	34.4	QP	N	GND
28.700000	28.50	11.2	60	31.5	QP	N	GND
29.654000	25.50	11.3	60	34.5	QP	N	GND

**MEASUREMENT RESULT: "GTS191108162\_fin2"**

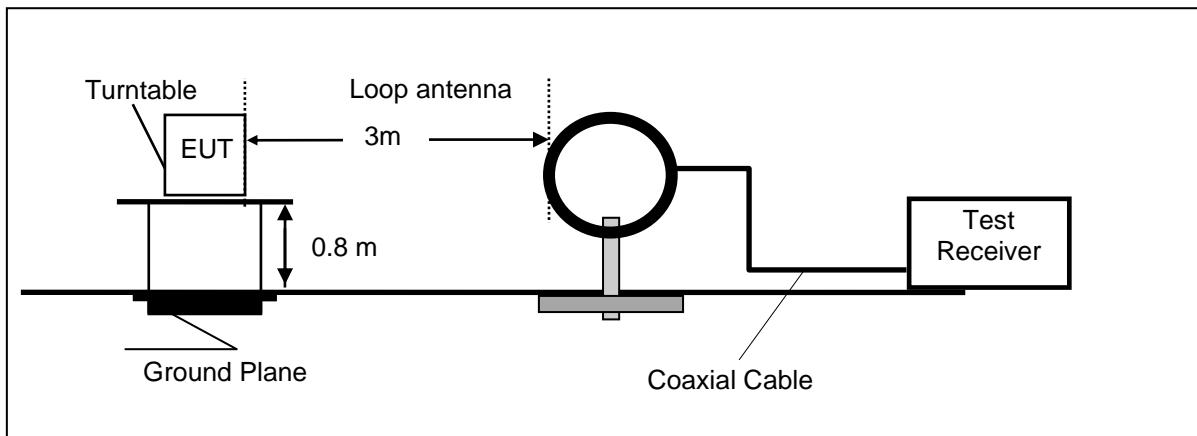
11/08/2019 11:34

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.638000	25.60	10.2	46	20.4	AV	N	GND
1.154000	21.50	10.3	46	24.5	AV	N	GND
29.420000	21.00	11.3	50	29.0	AV	N	GND
29.660000	21.10	11.3	50	28.9	AV	N	GND
29.720000	22.60	11.3	50	27.4	AV	N	GND
29.840000	19.00	11.3	50	31.0	AV	N	GND

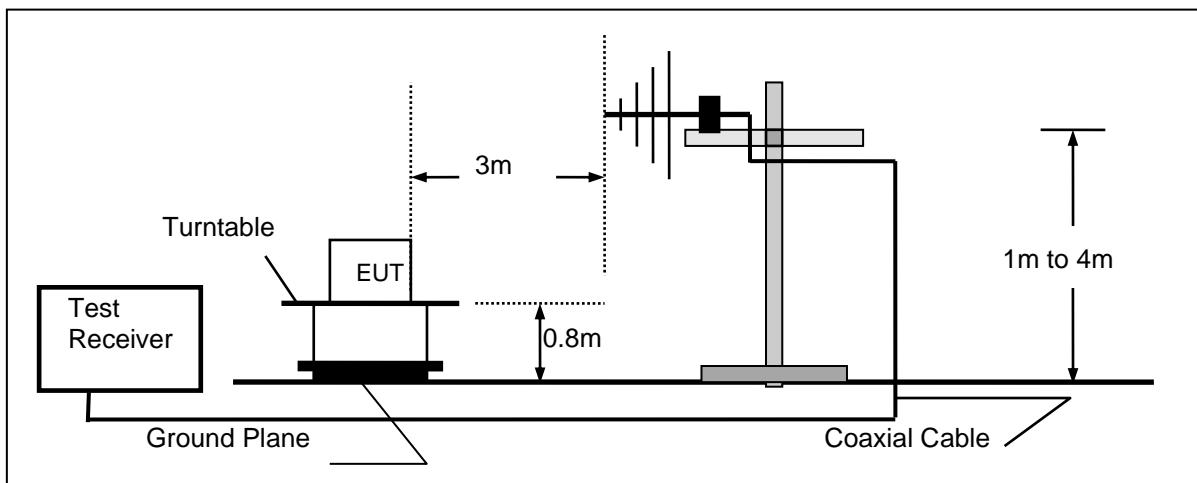
## 4.2 Radiated Emission

### TEST CONFIGURATION

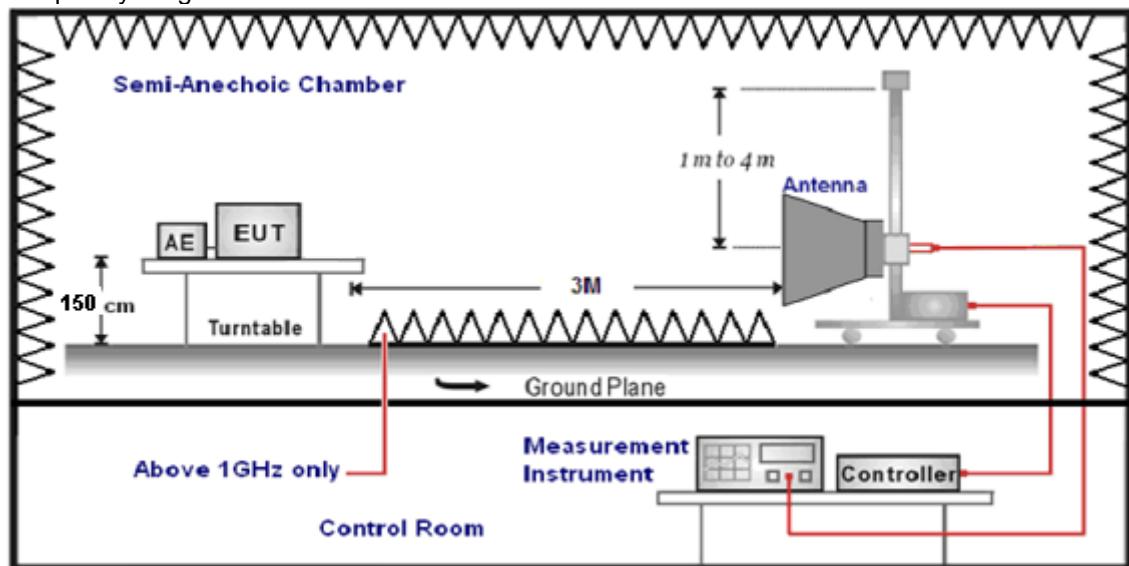
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



**TEST PROCEDURE**

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz; the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz, Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz, Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz, Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

**Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

$$Transd = AF + CL - AG$$

**RADIATION LIMIT**

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

**TEST RESULTS**

Remark:

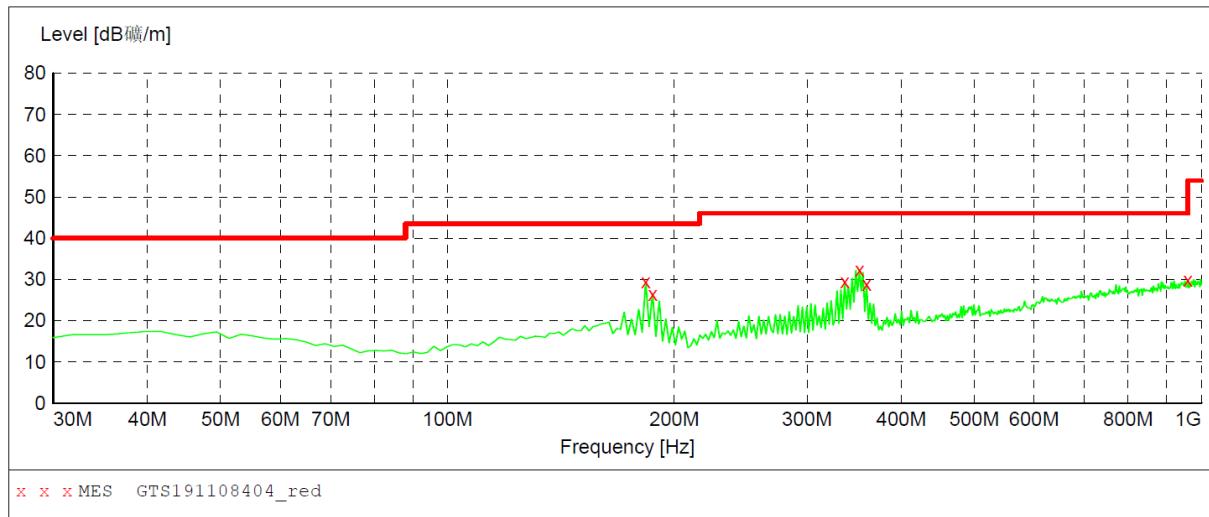
1. We measured Radiated Emission at GFSK,  $\pi/4$  DQPSK and 8DPSK mode from 9 KHz to 25GHz and recorded worst case at GFSK DH5 mode.
2. For below 1GHz testing recorded worst at GFSK DH5 middle channel.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

**For 30MHz-1GHz**

Horizontal

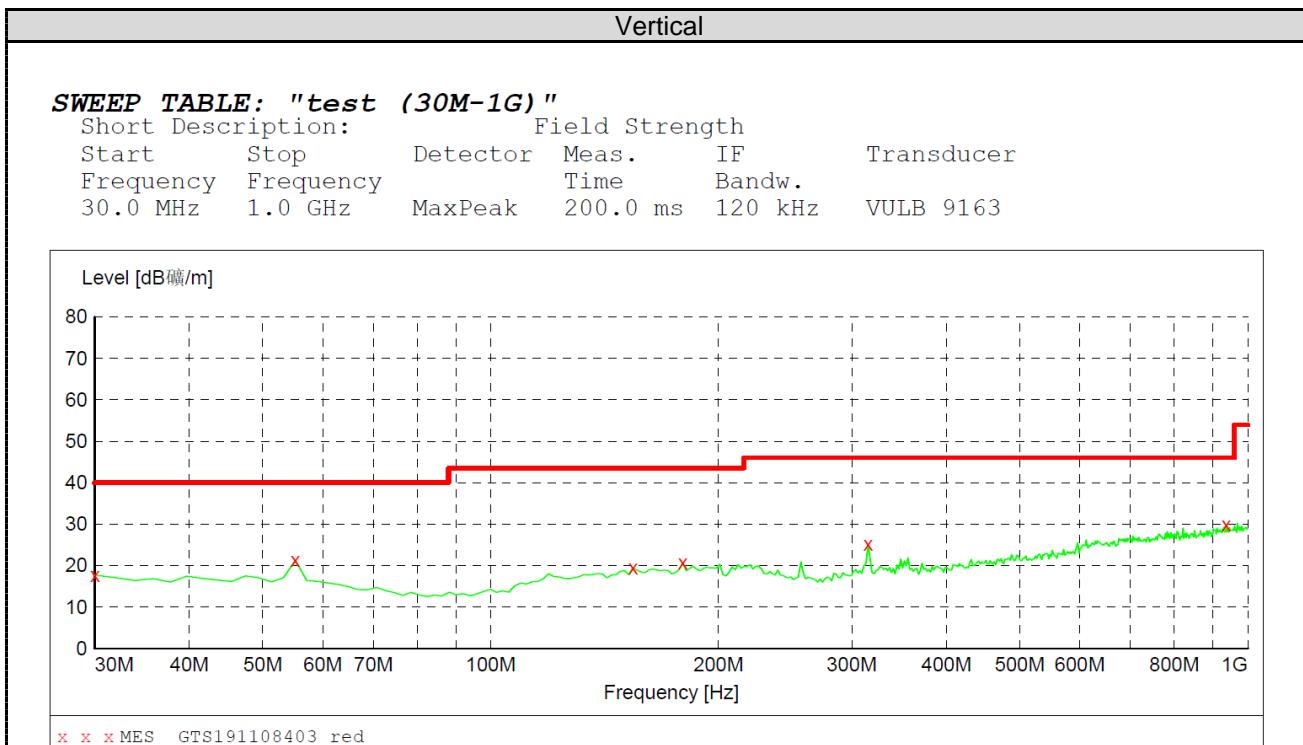
***SWEEP TABLE: "test (30M-1G)"***

Short Description:		Field Strength		
Start Frequency	Stop Frequency	Detector	Meas.	IF
30.0 MHz	1.0 GHz	MaxPeak	200.0 ms	120 kHz
				Transducer
				VULB 9163

**MEASUREMENT RESULT: "GTS191108404\_red"**

2019-11-8 8:41

Frequency MHz	Level dB <sub>μ</sub> /m	Transd dB	Limit dB <sub>μ</sub> /m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
183.260000	29.50	12.5	43.5	14.0	---	0.0	0.00	HORIZONTAL
187.140000	26.50	12.0	43.5	17.0	---	0.0	0.00	HORIZONTAL
336.520000	29.50	15.5	46.0	16.5	---	0.0	0.00	HORIZONTAL
352.040000	32.40	15.8	46.0	13.6	---	0.0	0.00	HORIZONTAL
359.800000	28.90	16.0	46.0	17.1	---	0.0	0.00	HORIZONTAL
959.260000	29.90	25.9	46.0	16.1	---	0.0	0.00	HORIZONTAL



***MEASUREMENT RESULT: "GTS191108403\_red"***

2019-11-8 8:39

Frequency MHz	Level dB <sub>礦</sub> /m	Transd dB	Limit dB <sub>礦</sub> /m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	17.70	13.4	40.0	22.3	---	0.0	0.00	VERTICAL
55.220000	21.30	13.4	40.0	18.7	---	0.0	0.00	VERTICAL
154.160000	19.50	15.2	43.5	24.0	---	0.0	0.00	VERTICAL
179.380000	20.70	12.9	43.5	22.8	---	0.0	0.00	VERTICAL
315.180000	25.20	14.9	46.0	20.8	---	0.0	0.00	VERTICAL
935.980000	29.80	25.7	46.0	16.2	---	0.0	0.00	VERTICAL

## For 1GHz to 25GHz

Note: GFSK, Pi/4 DQPSK and 8DPSK all have been tested, only worse case GFSK is reported.

## GFSK (above 1GHz)

Frequency(MHz):		2402		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	59.25	PK	74	14.75	57.35	31.42	6.98	36.5
4804.00	50.41	AV	54	3.59	48.51	31.42	6.98	36.5
7206.00	46.25	PK	74	27.75	35.65	37.03	8.87	35.3
7206.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2402		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	60.39	PK	74	13.61	58.49	31.42	6.98	36.5
4804.00	51.05	AV	54	2.95	49.15	31.42	6.98	36.5
7206.00	47.25	PK	74	26.75	36.65	37.03	8.87	35.3
7206.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2441		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	58.14	PK	74	15.86	56.08	30.98	7.58	36.5
4882.00	49.69	AV	54	4.31	47.63	30.98	7.58	36.5
7323.00	45.22	PK	74	28.78	34.30	37.66	8.56	35.3
7323.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2441		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	59.63	PK	74	14.37	57.57	30.98	7.58	36.5
4882.00	50.12	AV	54	3.88	48.06	30.98	7.58	36.5
7323.00	47.58	PK	74	26.42	36.66	37.66	8.56	35.3
7323.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	59.36	PK	74	14.64	56.29	31.47	7.80	36.2
4960.00	51.02	AV	54	2.98	47.95	31.47	7.80	36.2
7440.00	46.36	PK	74	27.64	34.62	38.32	8.72	35.3
7440.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	60.57	PK	74	13.43	57.50	31.47	7.80	36.2
4960.00	51.98	AV	54	2.02	48.91	31.47	7.80	36.2
7440.00	48.59	PK	74	25.41	36.85	38.32	8.72	35.3
7440.00	--	AV	54	--	--	--	--	--

## REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier

3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

**Results of Band Edges Test (Radiated)**

Note: GFSK, Pi/4 DQPSK and 8DPSK all have been tested, only worse case GFSK is reported.

**GFSK**

Frequency(MHz):		2402		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	48.23	PK	74	25.77	53.64	27.49	3.32	36.22
2390.00	--	AV	54	--	--	--	--	--
Frequency(MHz):		2402		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	50.85	PK	74	23.15	56.26	27.49	3.32	36.22
2390.00	--	AV	54	--	--	--	--	--
Frequency(MHz):		2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	47.36	PK	74	26.64	52.87	27.45	3.38	36.34
2483.50	--	AV	54	--	--	--	--	--
Frequency(MHz):		2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	48.84	PK	74	25.16	54.35	27.45	3.38	36.34
2483.50	--	AV	54	--	--	--	--	--

## REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier
3. Margin value = Limit value - Emission level.
4. -- Mean the PK detector measured value is below average limit.

### 4.3 Maximum Peak Output Power

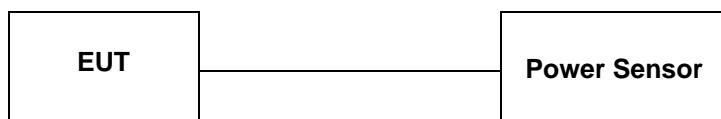
#### Limit

The Maximum Peak Output Power Measurement is 125mW (20.97).

#### Test Procedure

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

#### Test Configuration



#### Test Results

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	2.857	20.97	Pass
	39	2.950		
	78	3.011		
$\pi/4$ DQPSK	00	4.523	20.97	Pass
	39	4.512		
	78	4.221		
8DPSK	00	4.510	20.97	Pass
	39	4.540		
	78	4.583		

Note: 1.The test results including the cable loss.

#### 4.4 20dB Bandwidth

##### Limit

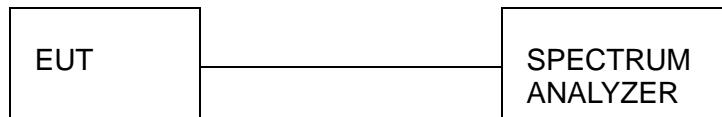
For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

##### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

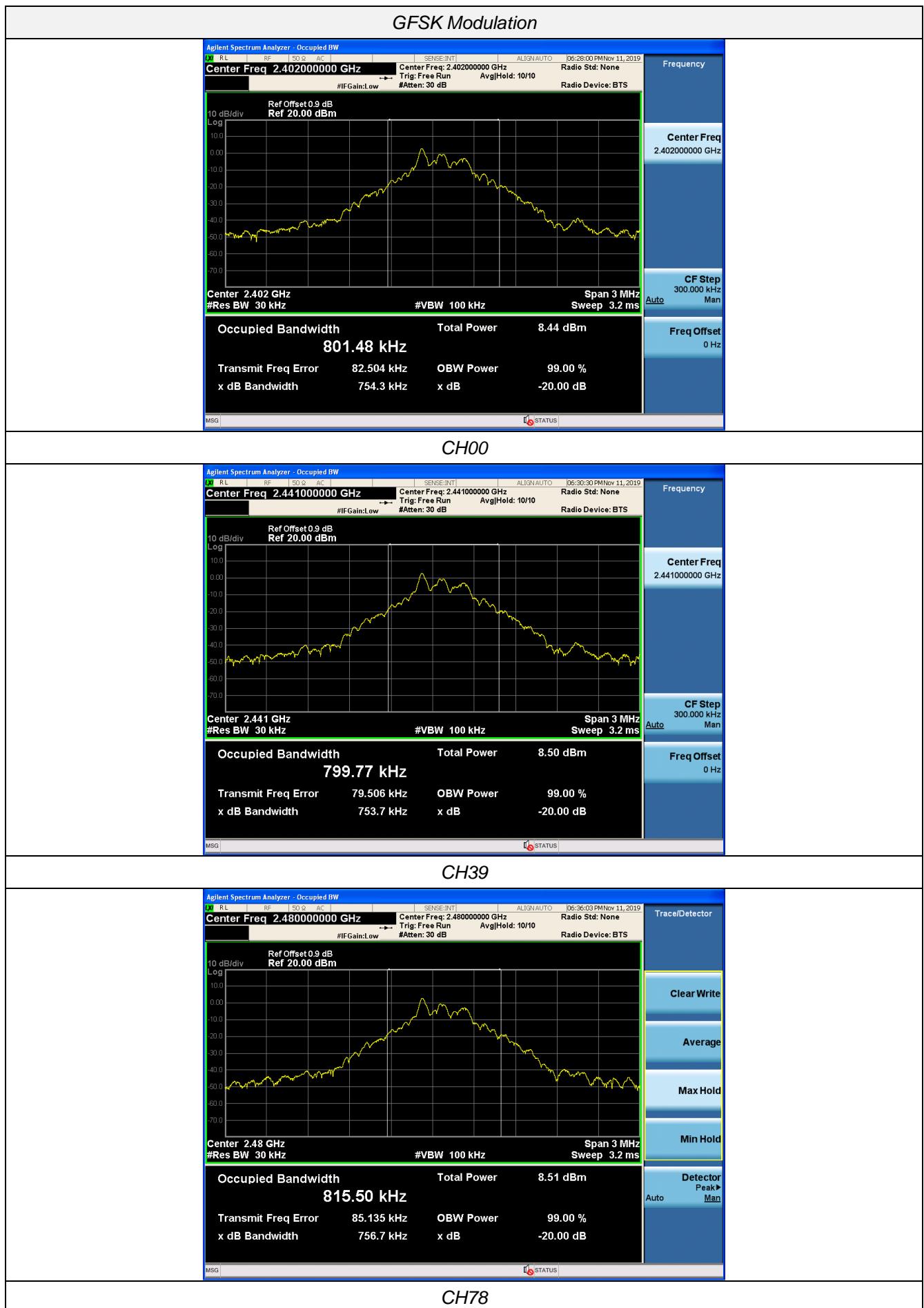
##### Test Configuration

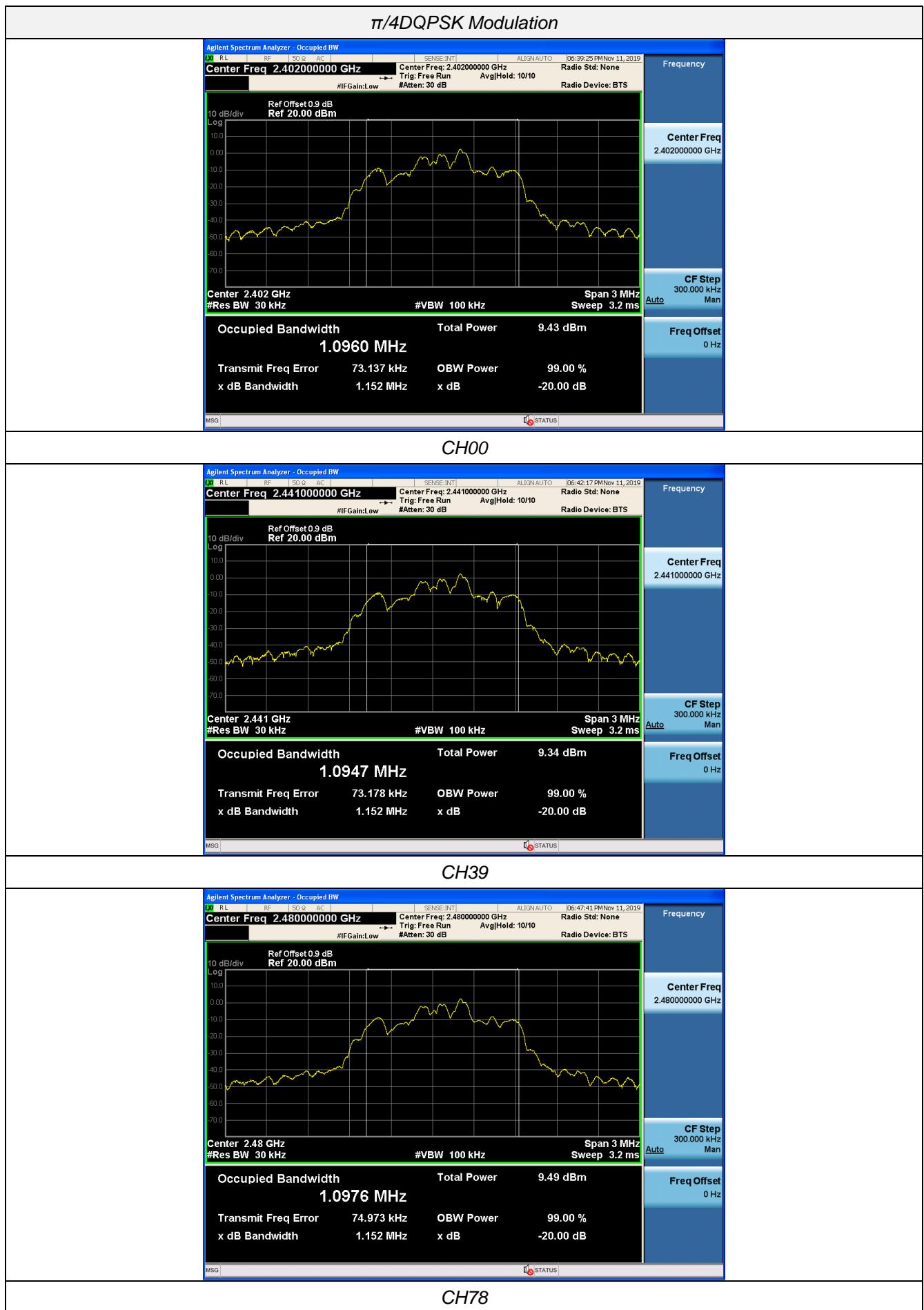


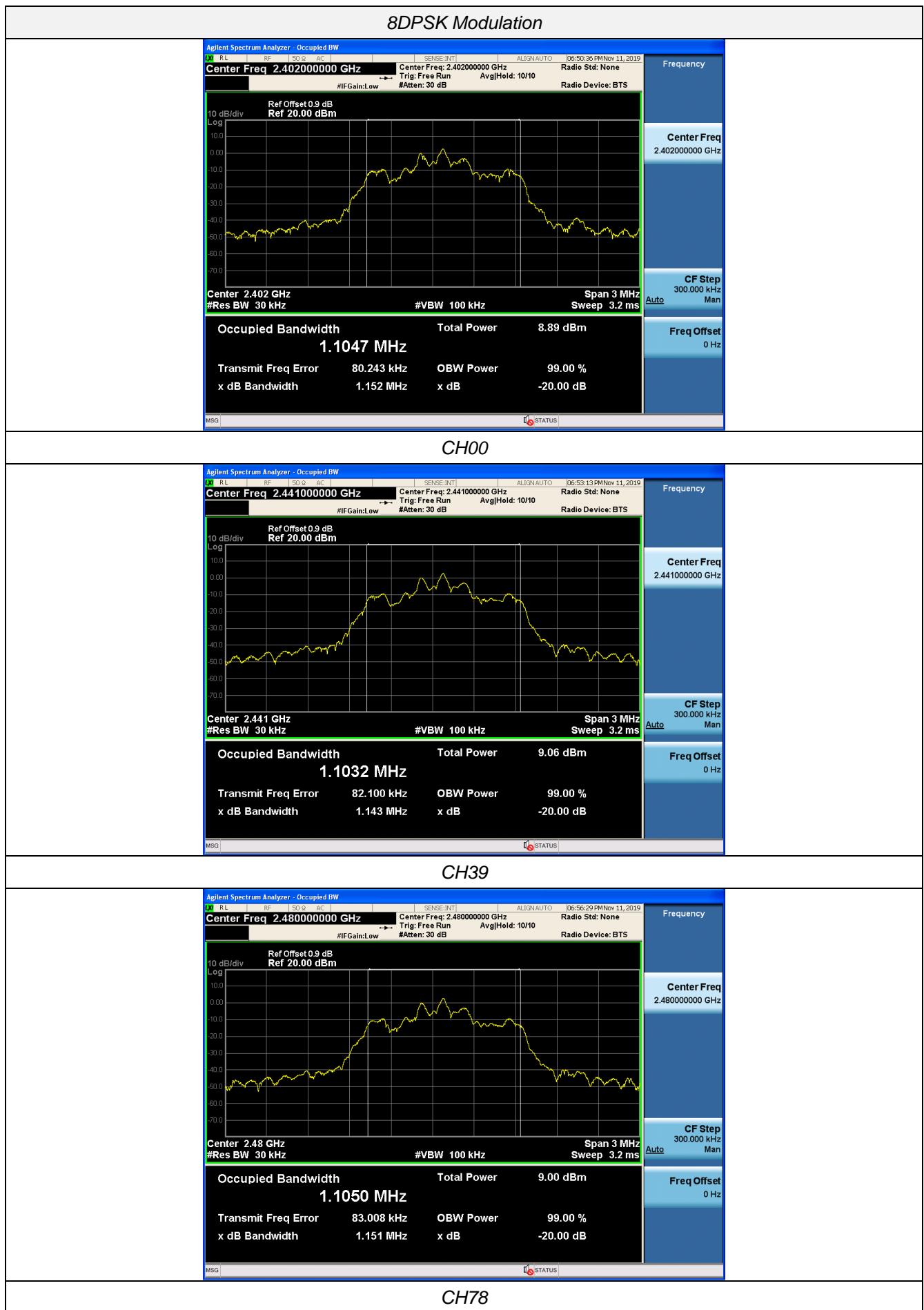
##### Test Results

Modulation	Channel	20dB bandwidth (MHz)	99% OBW (MHz)	Result
GFSK	CH00	0.7543	0.80148	Pass
	CH39	0.7537	0.79977	
	CH78	0.7567	0.81550	
$\pi/4$ DQPSK	CH00	1.152	1.0960	Pass
	CH39	1.152	1.0947	
	CH78	1.152	1.0976	
8DPSK	CH00	1.152	1.1047	Pass
	CH39	1.143	1.1032	
	CH78	1.151	1.1050	

Test plot as follows:







## 4.5 Frequency Separation

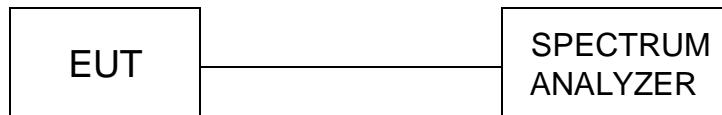
### LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the  $2/3*20$ dB bandwidth of the hopping channel, whichever is greater.

### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW.

### TEST CONFIGURATION



### TEST RESULTS

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH39	0.999	25KHz or $2/3*20$ dB bandwidth	Pass
	CH40			
$\pi/4$ DQPSK	CH39	0.999	25KHz or $2/3*20$ dB bandwidth	Pass
	CH40			
8DPSK	CH39	1.001	25KHz or $2/3*20$ dB bandwidth	Pass
	CH40			

Note:

We have tested all mode at high, middle and low channel, and recorded worst case at middle

Test plot as follows:



## 4.6 Number of hopping frequency

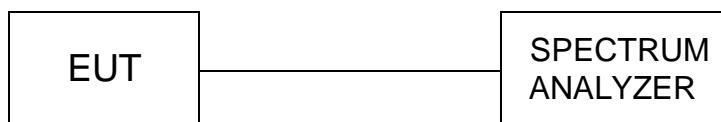
### Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

### Test Configuration



### Test Results

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
π/4DQPSK	79		
8DPSK	79		

### Test plot as follows:



## 4.7 Time of Occupancy (Dwell Time)

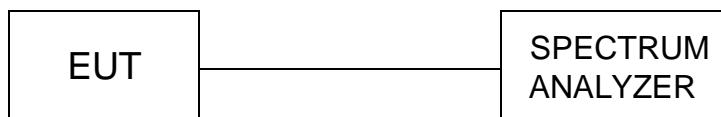
### Limit

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.

### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

### Test Configuration



### Test Results

Modulation	Packet	Pulse time (ms)	Dwell time (s)	Limit (s)	Result
GFSK	DH1	0.422	0.135	0.40	Pass
	DH3	1.681	0.269		
	DH5	2.930	0.313		
$\pi/4$ DQPSK	2-DH1	0.422	0.135	0.40	Pass
	2-DH3	1.682	0.269		
	2-DH5	2.930	0.313		
8DPSK	3-DH1	0.422	0.135	0.40	Pass
	3-DH3	1.681	0.269		
	3-DH5	2.928	0.312		

Note:

1. We have tested all mode at high,middle and low channel, and recorded worst case at middle channel.
2. Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  2  $\div$  79)  $\times$  31.6 Second for DH1, 2-DH1, 3-DH1  
Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  4  $\div$  79)  $\times$  31.6 Second for DH3, 2-DH3, 3-DH3  
Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  6  $\div$  79)  $\times$  31.6 Second for DH5, 2-DH5, 3-DH5

### Test plot as follows:



