

**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.....: GTSR18080199-BLE****FCC ID.....: 2AQ4K-L8**

Compiled by

(position+printed name+signature)..: File administrators Jimmy Wang

Supervised by

(position+printed name+signature)..: Test Engineer Aaron Tan

Approved by

(position+printed name+signature)..: Manager Jason Hu

Date of issue.....: Sep.12, 2018

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, China

Applicant's name.....: Shandong Praytech Optoelectronic Technology Co.,Ltd.

Address.....: F2,Blue Venture Valley,South of Keji Road,East of Longhai Road,Nanhai New District, Weihai City,Shandong Province, China

Test specificationStandard.....: **FCC Part 15.247**

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

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

Shenzhen Global Test Service Co.,Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen Global Test Service Co.,Ltd. is acknowledged as copyright owner and source of the material. Shenzhen Global Test Service Co.,Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Test item description Smart Cube projector

Trade Mark.....: /

Manufacturer.....: Shandong Praytech Optoelectronic Technology Co.,Ltd.

Model/Type reference.....: L8

Listed Models.....: H5

Modulation Type.....: GFSK

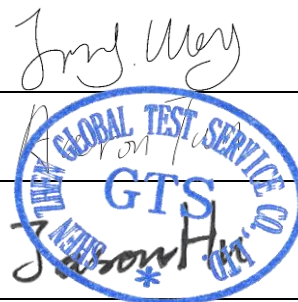
Difference.....: All the same except the model number

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

Hardware Version.....: V4

Software Version.....: V017

Rating.....: DC 3.8V from Battery or DC 5V from adapter

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

TEST REPORT

Test Report No. : GTSR18080199-BLE	Sep. 12, 2018 Date of issue
--	--------------------------------

Equipment under Test : **Smart Cube projector**

Model /Type : **L8**

Listed Models : **H5**

Applicant : **Shandong Praytech Optoelectronic Technology Co.,Ltd.**

Address : F2,Blue Venture Valley,South of Keji Road,East of Longhai Road,Nanhai New District, Weihai City,Shandong Province, China

Manufacturer : **Shandong Praytech Optoelectronic Technology Co.,Ltd.**

Address : F2,Blue Venture Valley,South of Keji Road,East of Longhai Road,Nanhai New District, Weihai City,Shandong Province, China

Test Result:	PASS
---------------------	-------------

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.

Contents

1.	<u>TEST STANDARDS</u>	<u>4</u>
2.	<u>SUMMARY</u>	<u>5</u>
2.1.	General Remarks	5
2.2.	Product Description	5
2.3.	Equipment Under Test	5
2.4.	Short description of the Equipment under Test (EUT)	5
2.5.	EUT operation mode	5
2.6.	Block Diagram of Test Setup	错
	误!未定义书签。	
2.7.	Related Submittal(s) / Grant (s)	错
	误!未定义书签。	
2.8.	EUT configuration	错
	误!未定义书签。	
2.9.	Modifications	错
	误!未定义书签。	
3.	<u>TEST ENVIRONMENT</u>	<u>6</u>
3.1.	Address of the test laboratory	7
3.2.	Test Facility	7
3.3.	Environmental conditions	7
3.4.	Test Description	8
3.5.	Statement of the measurement uncertainty	8
3.6.	Equipments Used during the Test	9
4.	<u>TEST CONDITIONS AND RESULTS.....</u>	<u>10</u>
4.1.	AC Power Conducted Emission	10
4.2.	Radiated Emission.....	15
4.3.	Maximum Peak Output Power.....	20
4.4.	Power Spectral Density	21
4.5.	6dB Bandwidth	24
4.6.	Band Edge Compliance of RF Emission	27
4.7.	Spurious RF Conducted Emission	30
4.8.	Antenna Requirement.....	34
5.	<u>TEST SETUP PHOTOS OF THE EUT</u>	<u>35</u>
6.	<u>EXTERNAL AND INTERNAL PHOTOS OF THE EUT</u>	<u>37</u>

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

[KDB558074 D01 DTS Meas Guidance v05](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Sep. 1, 2018
Testing commenced on	:	Sep. 1, 2018
Testing concluded on	:	Sep. 12, 2018

2.2. Product Description

Product Name:	Smart Cube projector
Trade Mark:	/
Model/Type reference:	L8
Listed Models	H5
Power Supply	DC 3.8V from Battery or DC 5V from adapter
BT	
Modulation Type	GFSK
Operation frequency	2402-2480 MHz
Antenna Type:	Internal Antenna
Antenna Gain:	0.96 dBi

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)	

3.8V from battery

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

This is a **Smart Cube projector**.

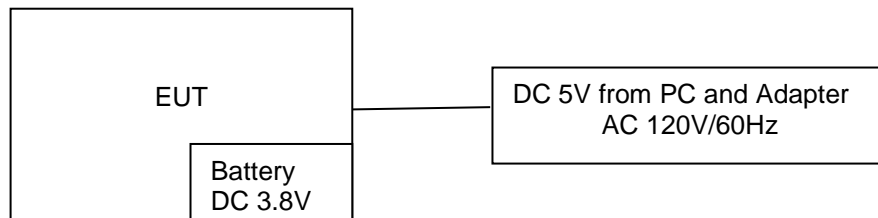
2.5. EUT operation mode

The Applicant provides communication tools software(Realtek MPtool) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 40 channels provided to the EUT. Channel 00/19/39 was selected to test.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446

3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

2.6. Block Diagram of Test Setup



2.7. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
TOSHIBA	Tablet PC	Satellite S40Dt-A	D26T	DOC

2.8. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AQ4K-L8** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.9. 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

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, 2018.

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. Test Description

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	<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
§15.247(e)	Power spectral density	GFSK	<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
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	GFSK	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(b)(1)	Maximum output power	GFSK	<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 checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d)	Band edge compliance conducted	GFSK	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.205	Band edge compliance radiated	GFSK	<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	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d)	TX spurious emissions radiated	GFSK	<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
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK	-/-	GFSK	-/-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-	<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

3.5. 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

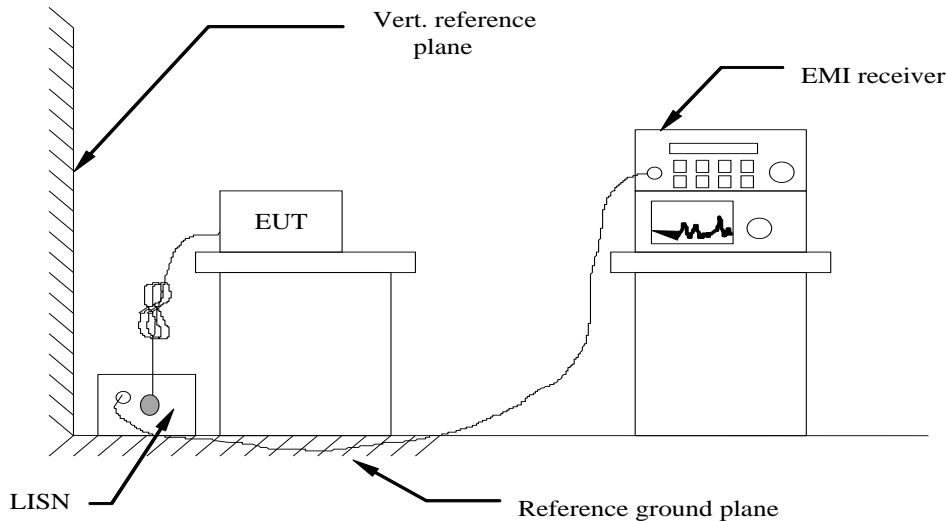
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2017/09/20	2018/09/19
LISN	R&S	ESH2-Z5	893606/008	2017/09/20	2018/09/19
Bilog Antenna	Schwarzbeck	VULB9163	976	2016/09/20	2019/09/19
EMI Test Receiver	R&S	ESCI7	101102	2017/09/20	2018/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2017/09/20	2018/09/19
Spectrum Analyzer	R&S	FSP40	100019	2018/06/05	2019/06/04
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2016/09/20	2019/09/19
Active Loop Antenna	SCHWARZBEC K	FMZB1519	1519-037	2016/09/20	2019/09/19
Broadband Horn Antenna	SCHWARZBEC K	BBHA 9170	971	2016/09/20	2019/09/19
Amplifier	Schwarzbeck	BBV 9743	#202	2017/09/20	2018/09/19
Amplifier	EMCI	EMC051845B	980355	2017/09/20	2018/09/19
Temperature/Humidity Meter	Gangxing	CTH-608	02	2017/09/20	2018/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2017/09/20	2018/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2017/09/20	2018/09/19
RF Cable(below 1GHz)	HUBER+SUHNER	RG214	RE01	2017/09/20	2018/09/19
RF Cable(above 1GHz)	HUBER+SUHNER	RG214	RE02	2017/09/20	2018/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2017/09/20	2018/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2017/09/20	2018/09/19
EMI Test Software	R&S	ES-K1	V1.7.1	2017/09/20	2018/09/19
EMI Test Software	JS Tonscend	JS32-RE	2.0.1.5	2017/09/20	2018/09/19

Note: 1. 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 DC5V power, the adapter received AC120V/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

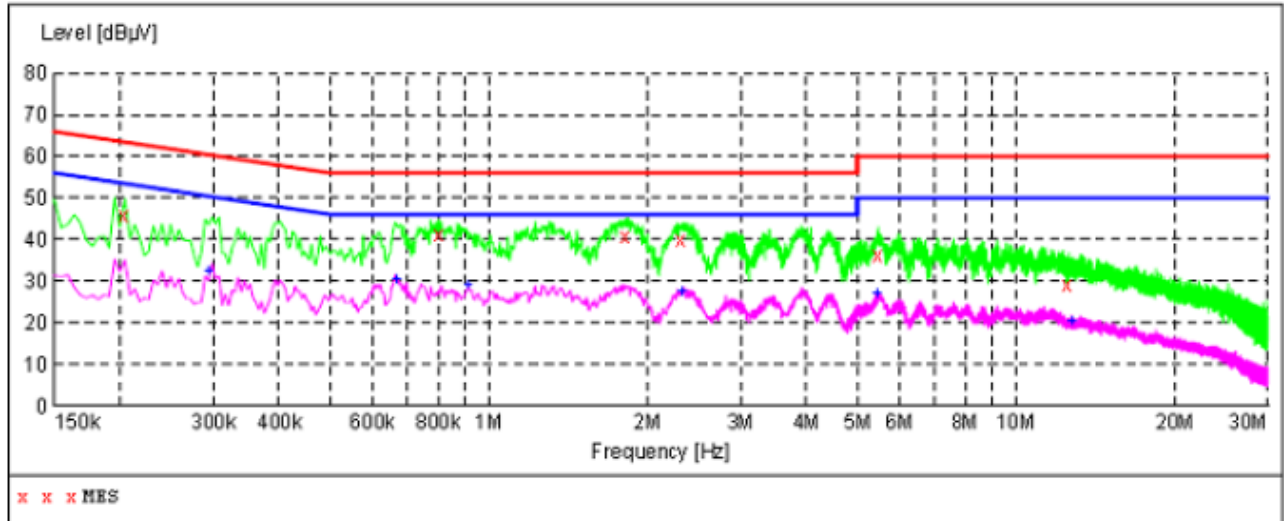
Remark: We measured Conducted Emission at all mode in AC 120V/60Hz and AC 240V/50Hz, Pre-test AC conducted emission at power from AC mains mode and at charge from PC mode, recorded worst case..

Power supply:

AC 120V/60Hz(adapter)

Polarization

L

**MEASUREMENT RESULT:**

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.204000	45.70	10.0	63	17.7	QP	L1	GND
0.802500	41.10	9.7	56	14.9	QP	L1	GND
1.810500	40.90	9.5	56	15.1	QP	L1	GND
2.319000	39.90	9.5	56	16.1	QP	L1	GND
5.469000	36.30	9.3	60	23.7	QP	L1	GND
12.565500	29.10	8.5	60	30.9	QP	L1	GND

MEASUREMENT RESULT:

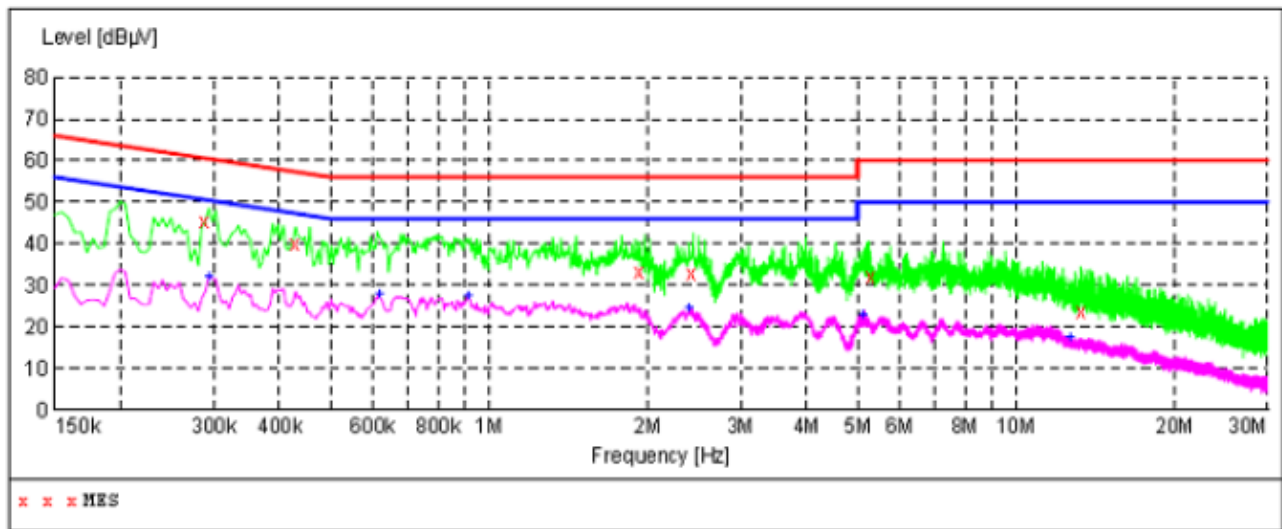
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.294000	32.40	9.9	50	18.0	AV	L1	GND
0.667500	30.40	9.7	46	15.6	AV	L1	GND
0.910500	29.10	9.6	46	16.9	AV	L1	GND
2.332500	27.60	9.5	46	18.4	AV	L1	GND
5.464500	26.90	9.3	50	23.1	AV	L1	GND
12.777000	20.10	8.5	50	29.9	AV	L1	GND

Power supply:

AC 120V/60Hz(adapter)

Polarization

N

**MEASUREMENT RESULT:**

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.289500	45.30	9.9	61	15.2	QP	N	GND
0.429000	40.10	9.8	57	17.2	QP	N	GND
1.932000	33.30	9.5	56	22.7	QP	N	GND
2.418000	33.00	9.5	56	23.0	QP	N	GND
5.293500	32.20	9.3	60	27.8	QP	N	GND
13.272000	23.60	8.4	60	36.4	QP	N	GND

MEASUREMENT RESULT:

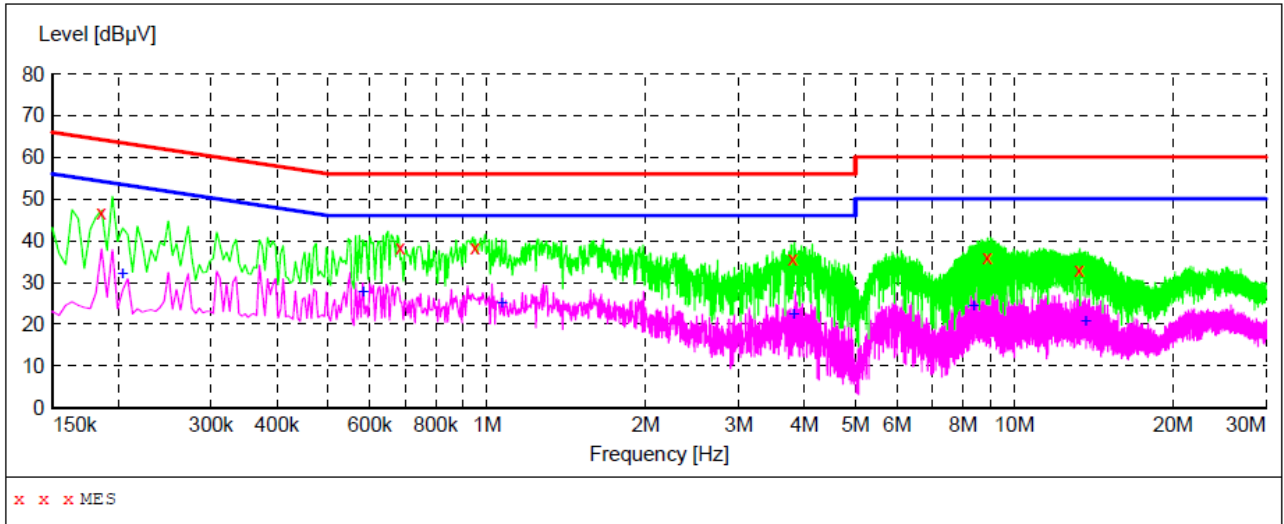
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.294000	32.10	9.9	50	18.3	AV	N	GND
0.618000	27.80	9.7	46	18.2	AV	N	GND
0.910500	27.60	9.6	46	18.4	AV	N	GND
2.395500	24.40	9.5	46	21.6	AV	N	GND
5.140500	22.80	9.3	50	27.2	AV	N	GND
12.642000	17.50	8.5	50	32.5	AV	N	GND

Power supply:

AC 240V/50Hz(adapter)

Polarization

L

**MEASUREMENT RESULT:**

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.186000	46.70	10.0	64	17.5	QP	L1	GND
0.685500	38.50	9.7	56	17.5	QP	L1	GND
0.951000	38.50	9.6	56	17.5	QP	L1	GND
3.799500	35.60	9.4	56	20.4	QP	L1	GND
8.880000	36.10	9.0	60	23.9	QP	L1	GND
13.272000	32.90	8.4	60	27.1	QP	L1	GND

MEASUREMENT RESULT:

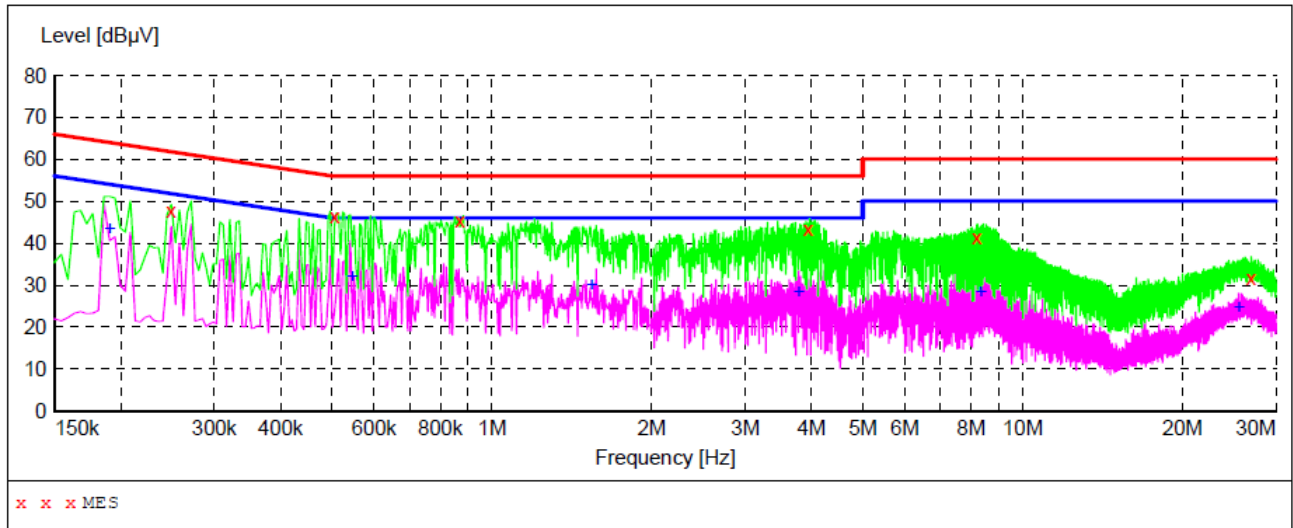
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.204000	32.00	10.0	53	21.4	AV	L1	GND
0.582000	27.60	9.7	46	18.4	AV	L1	GND
1.068000	25.00	9.6	46	21.0	AV	L1	GND
3.808500	22.40	9.4	46	23.6	AV	L1	GND
8.371500	24.40	9.0	50	25.6	AV	L1	GND
13.645500	20.70	8.4	50	29.3	AV	L1	GND

Power supply:

AC 240V/50Hz(adapter)

Polarization

N

**MEASUREMENT RESULT:**

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.249000	47.90	10.0	62	13.9	QP	N	GND
0.505500	46.50	9.8	56	9.5	QP	N	GND
0.870000	45.50	9.6	56	10.5	QP	N	GND
3.939000	43.40	9.4	56	12.6	QP	N	GND
8.196000	41.50	9.0	60	18.5	QP	N	GND
26.920500	31.70	8.9	60	28.3	QP	N	GND

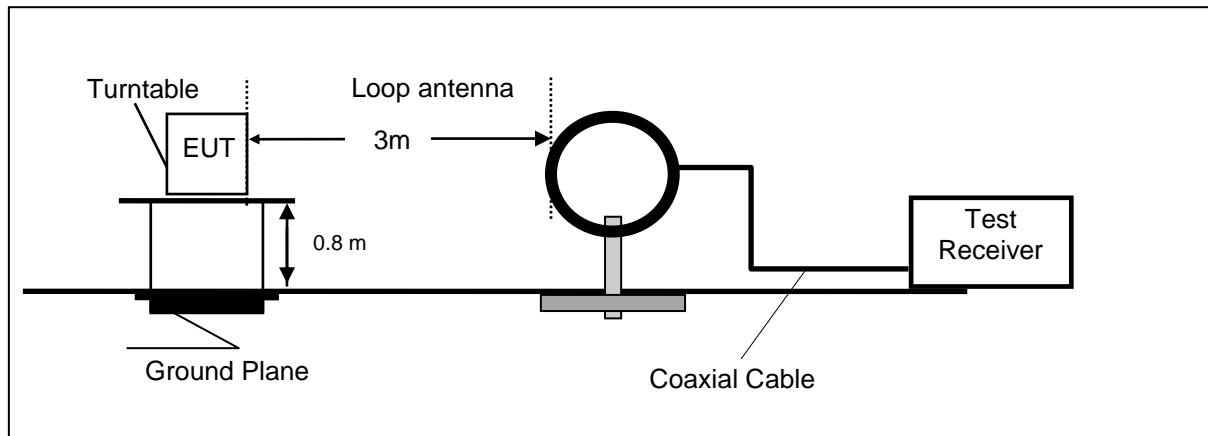
MEASUREMENT RESULT:

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.190500	43.30	10.0	54	10.7	AV	N	GND
0.546000	31.90	9.8	46	14.1	AV	N	GND
1.540500	29.90	9.5	46	16.1	AV	N	GND
3.786000	28.30	9.4	46	17.7	AV	N	GND
8.340000	28.40	9.0	50	21.6	AV	N	GND
25.534500	24.70	9.0	50	25.3	AV	N	GND

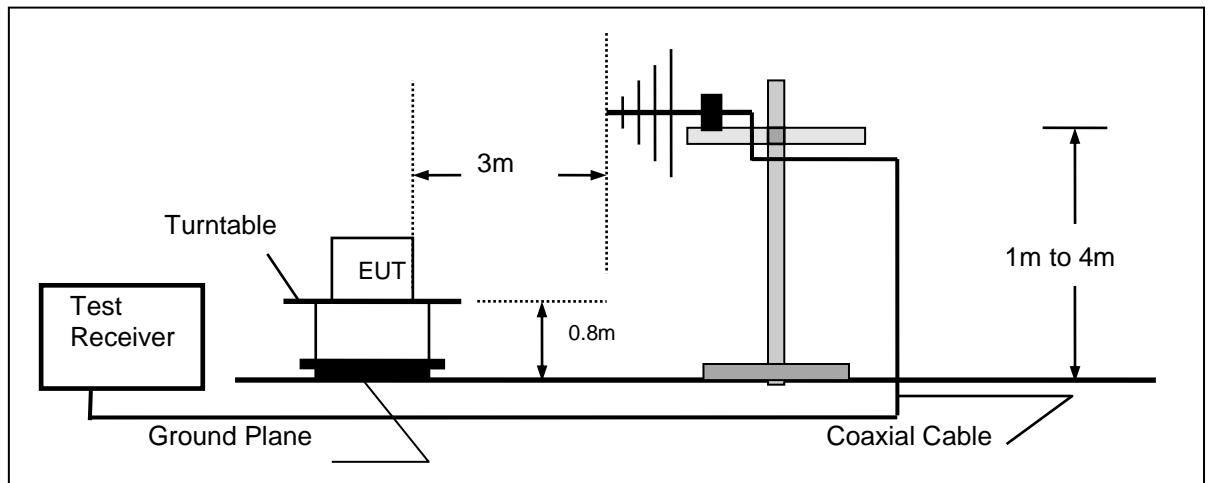
4.2. Radiated Emission

TEST CONFIGURATION

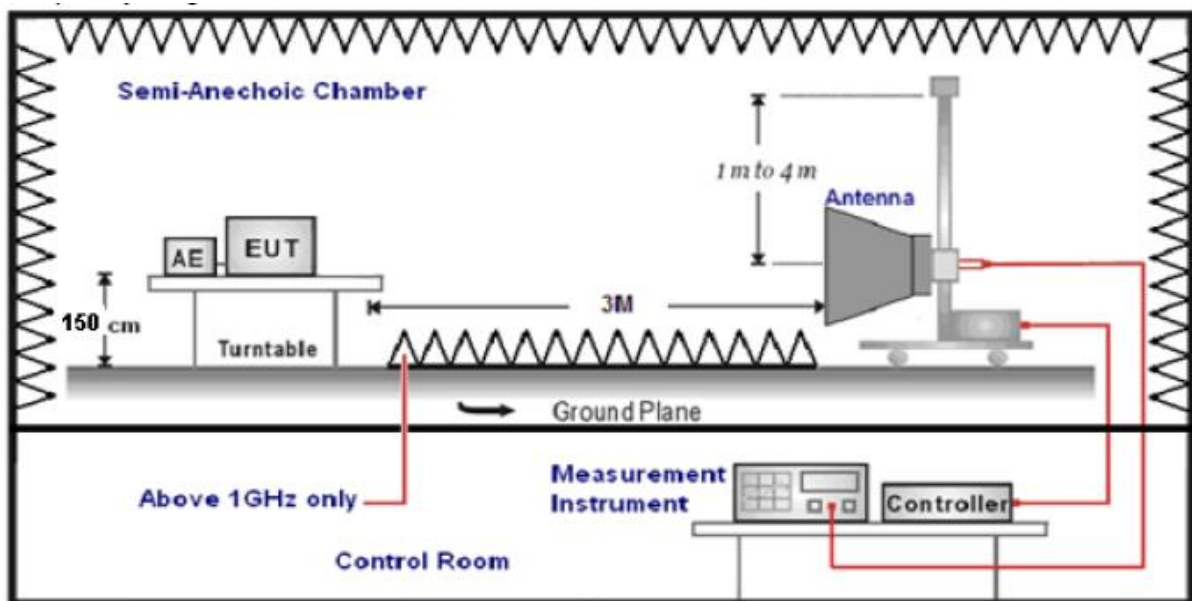
Frequency range 9 KHz – 30MHz



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°C to 360°C 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. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so 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	

$$\text{Transd}=AF +CL-AG$$

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 (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30)+40\log(30/3)$	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

For 9KHz to 30MHz

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

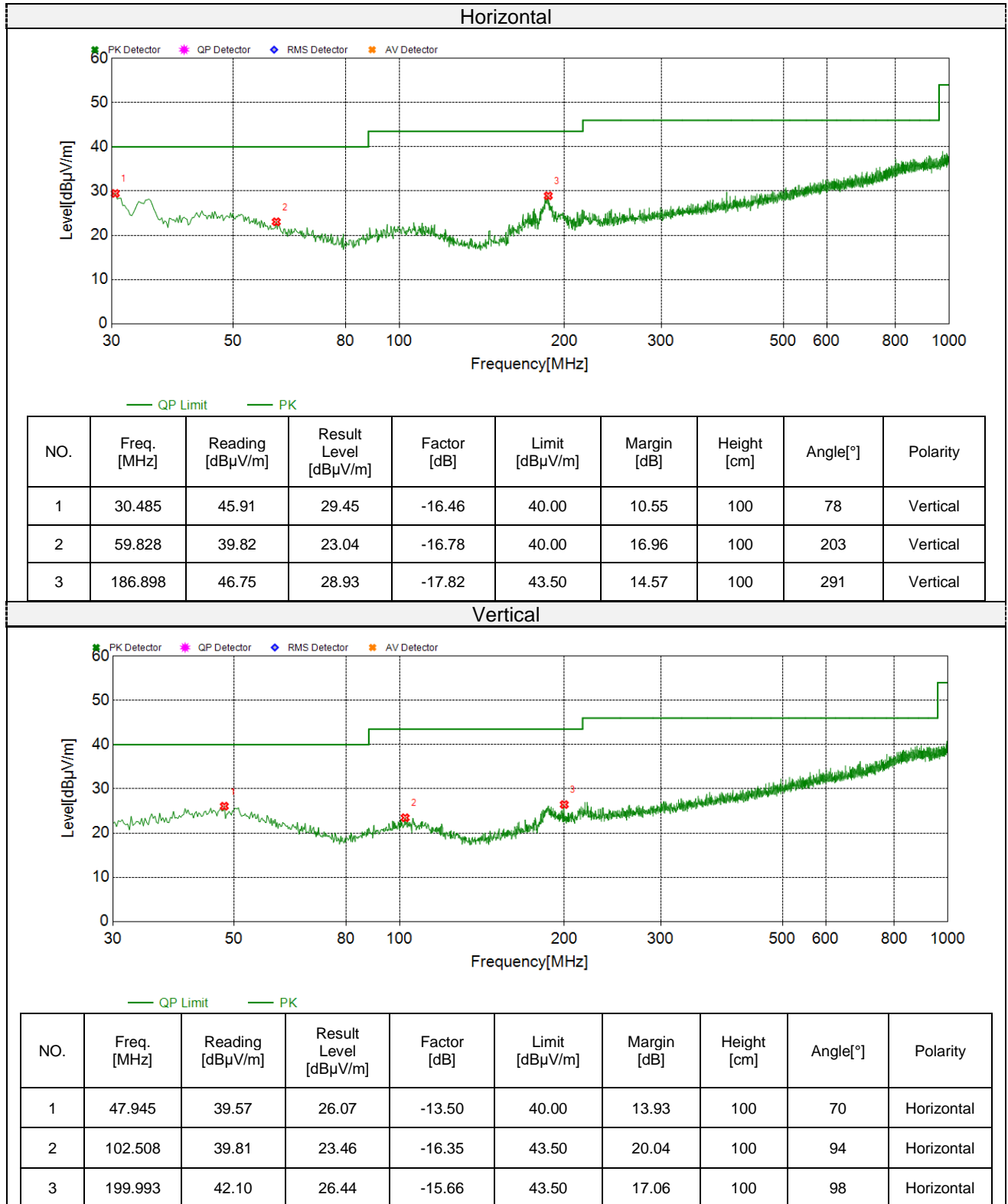
Note:

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

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

For 30MHz to 1000MHz

**Note:**

1. Pre-scan all modes and recorded the worst case results in this report (BT LE (Middle Channel))@Chain1
2. Emission level (dBμV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor
3. Margin value = Emission level-Limits

For 1GHz to 25GHz

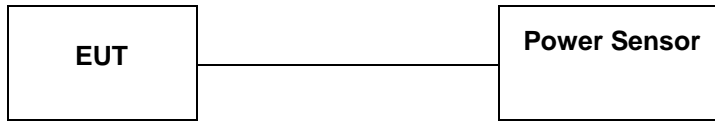
Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	antenna Factor (dB)	cable loss (dB)	preamp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
2402									
Vertical	4804	41.28	30.26	6.98	26.63	51.89	74	-22.96	Pk
Horizontal	4804	42.13	30.26	6.98	26.63	52.74	74	-22.16	PK
Vertical	7206	36.07	36.55	8.87	27.02	54.47	74	-20.48	Pk
Horizontal	7206	35.14	36.55	8.87	27.02	53.54	74	-21.38	PK
2440									
Vertical	4880	39.98	30.34	7.58	26.67	51.23	74	-23.52	Pk
Horizontal	4880	40.59	30.34	7.58	26.67	51.84	74	-23.29	PK
Vertical	7320	34.26	36.69	8.56	27.18	52.33	74	-20.65	Pk
Horizontal	7320	33.37	36.69	8.56	27.18	51.44	74	-22.56	PK
2480									
Vertical	4960	39.47	30.58	7.81	26.73	51.13	74	-24.11	Pk
Horizontal	4960	40.51	30.58	7.81	26.73	52.17	74	-22.88	PK
Vertical	7440	33.82	37.31	8.72	27.23	52.62	74	-20.92	Pk
Horizontal	7440	34.56	37.31	8.72	27.23	53.36	74	-21.55	PK

REMARKS:

4. Emission level (dBuV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor
5. Margin value = Emission level-Limits
6. -- Mean the PK detector measured value is below average limit.
7. The other emission levels were very low against the limit.
8. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB558074 D01 DTS Measurement Guidance Section 9.1 Maximum peak conducted output power, 9.1.2.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

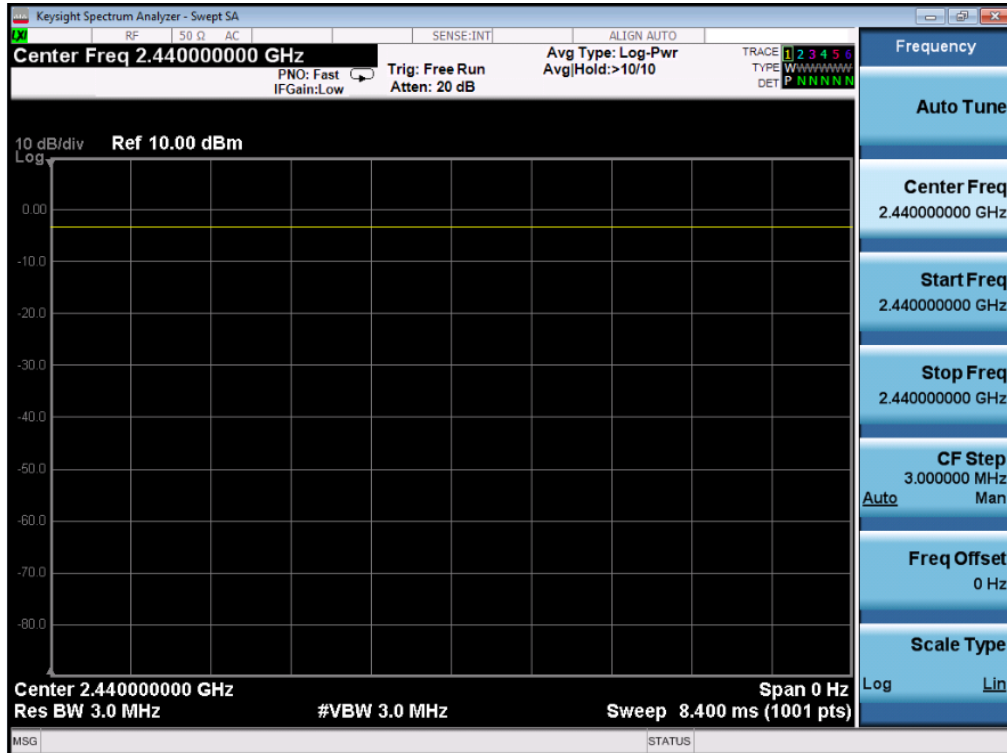
LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

TEST RESULTS

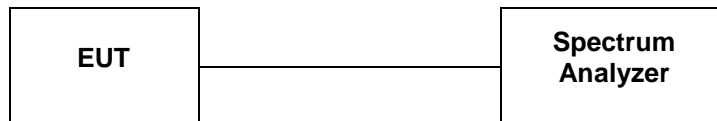
Type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	0	-3.57	-5.12	30	Pass
	19	-2.69	-4.57		
	39	-3.96	-5.28		

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



4.4. Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 3 kHz.
3. Set the VBW = 10 KHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8 dBm.

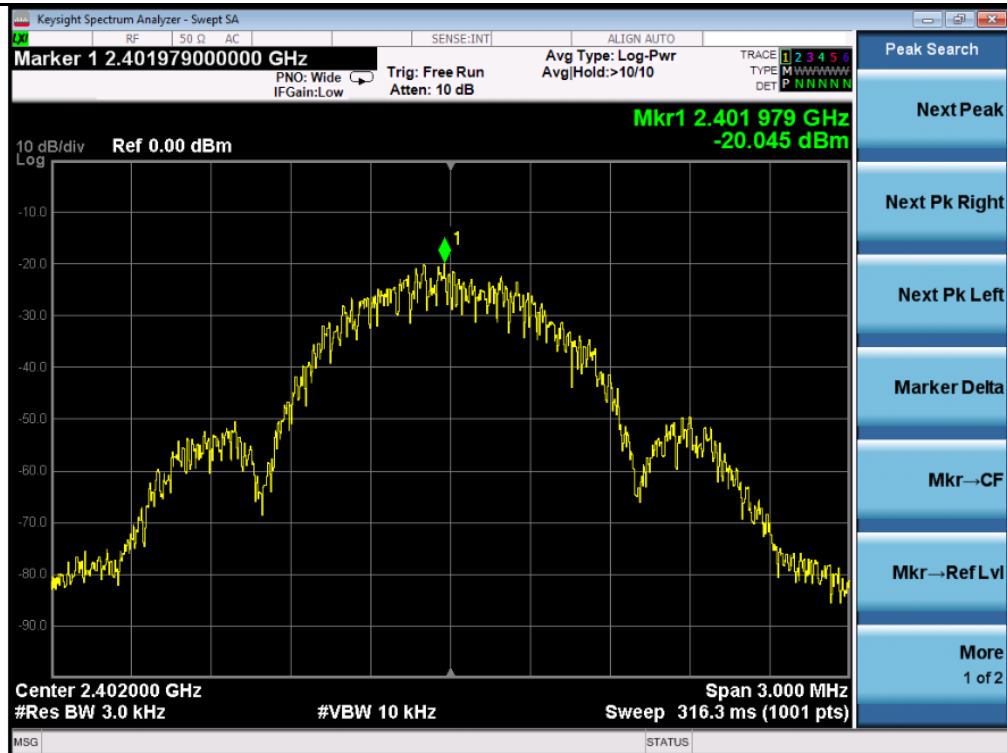
LIMIT

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

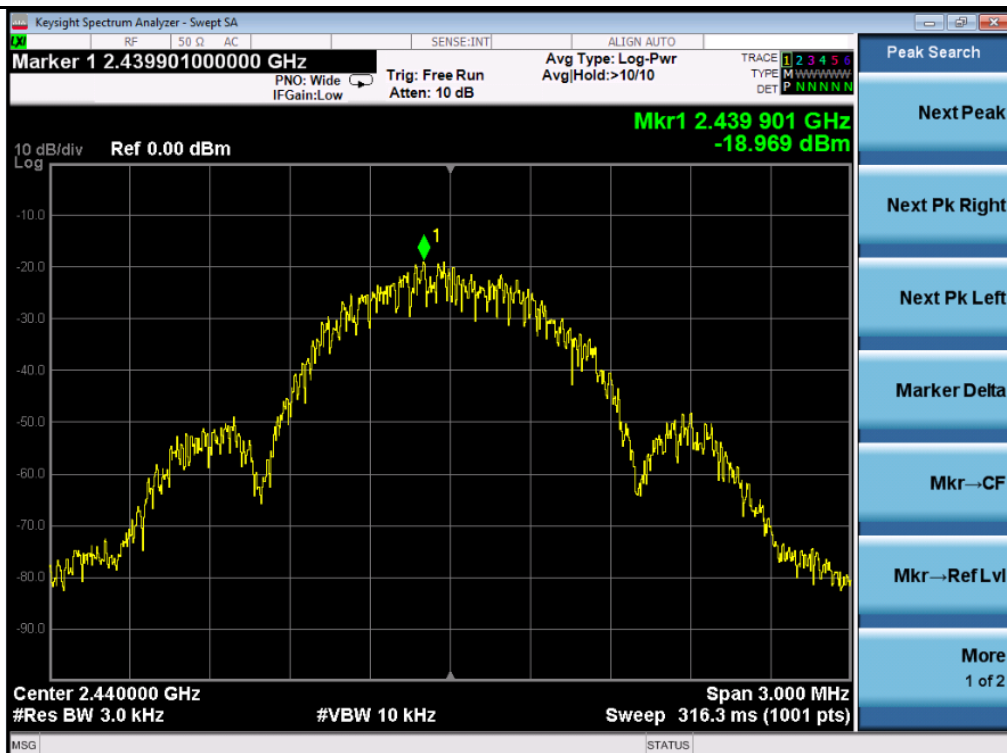
TEST RESULTS

Type	Channel	Power Spectral Density	Limit (dBm/3KHz)	Result
GFSK	0	-20.045	8.00	Pass
	19	-18.969		
	39	-21.336		

CH00

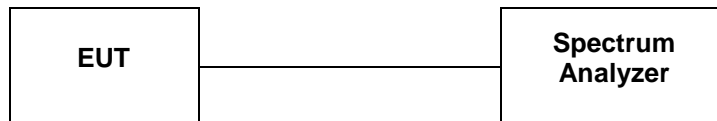


CH19



4.5. 6dB Bandwidth

TEST CONFIGURATION



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 RBW=100 KHz and VBW=300KHz. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

LIMIT

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

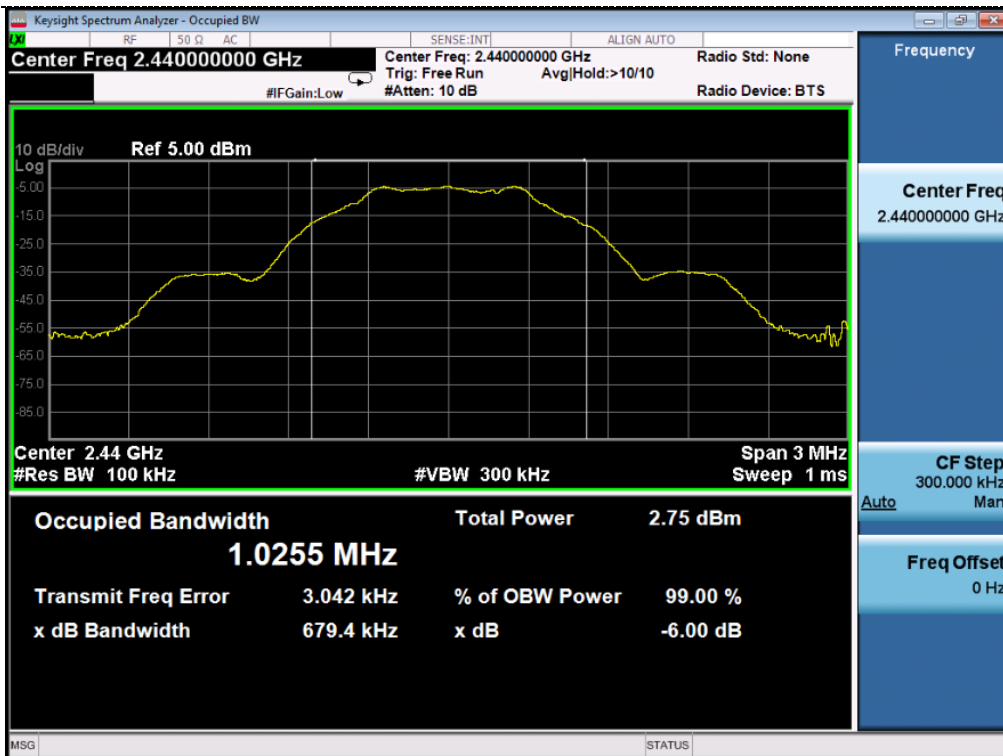
TEST RESULTS

Type	Channel	6dB Bandwidth (KHz)	Limit (KHz)	Result
GFSK	0	683.9	≥ 500	Pass
	19	679.4		
	39	681.1		

CH00



CH19



CH39

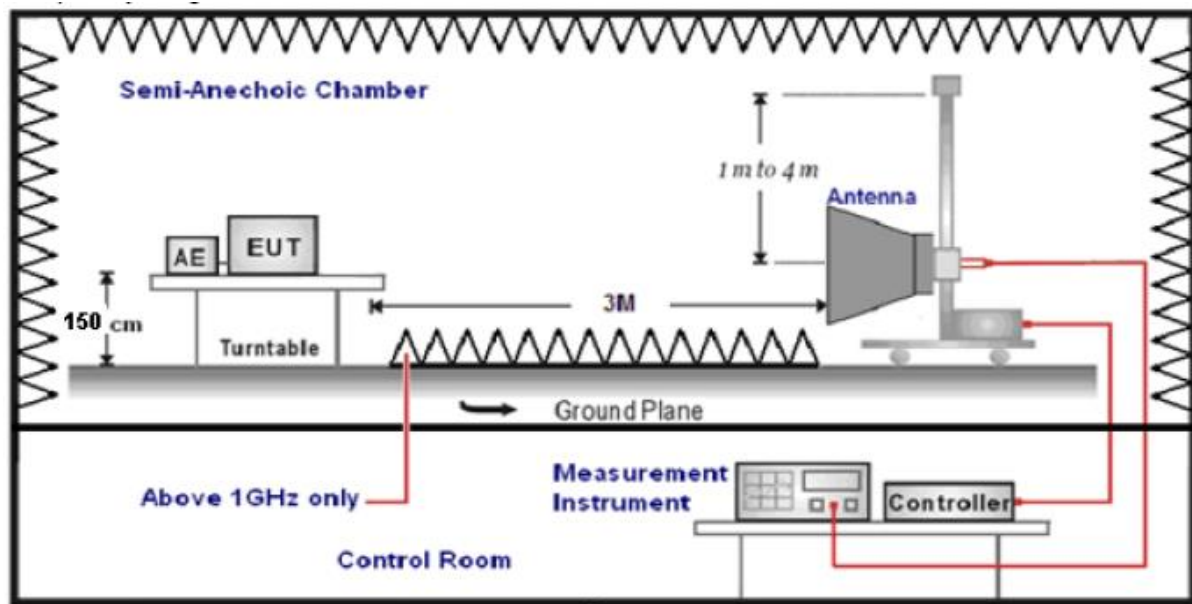


4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above ground plane.
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. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

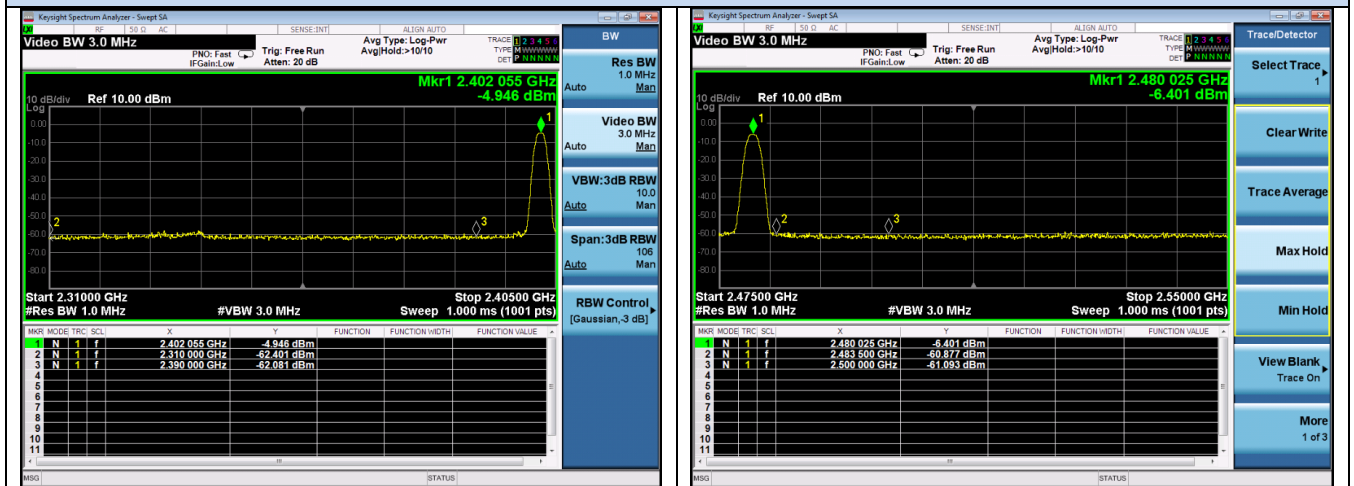
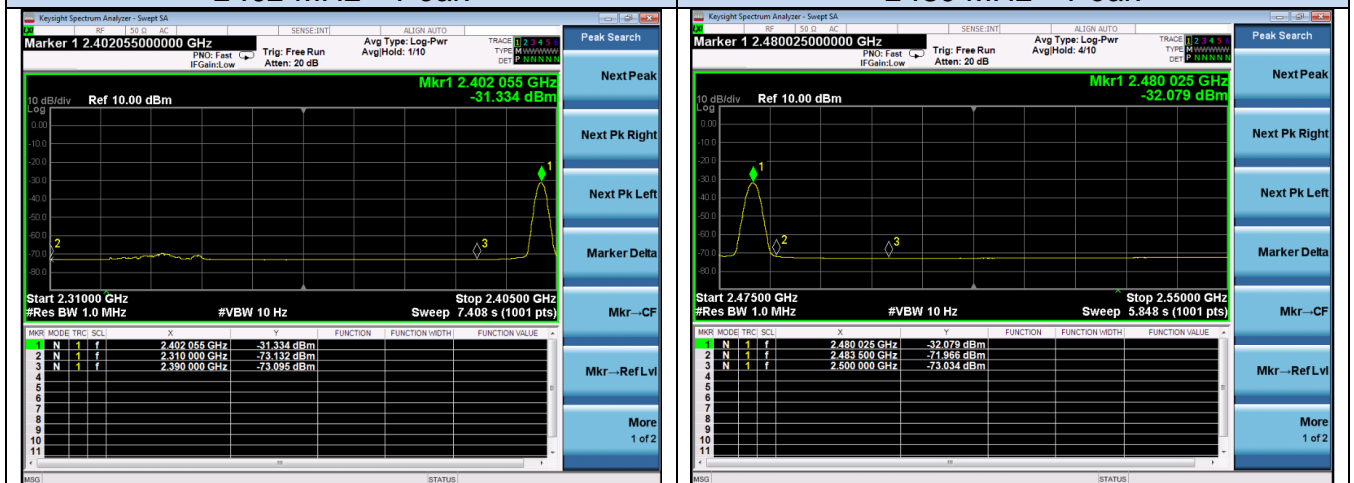
LIMIT

Below -20dB of the highest emission level in operating band.

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

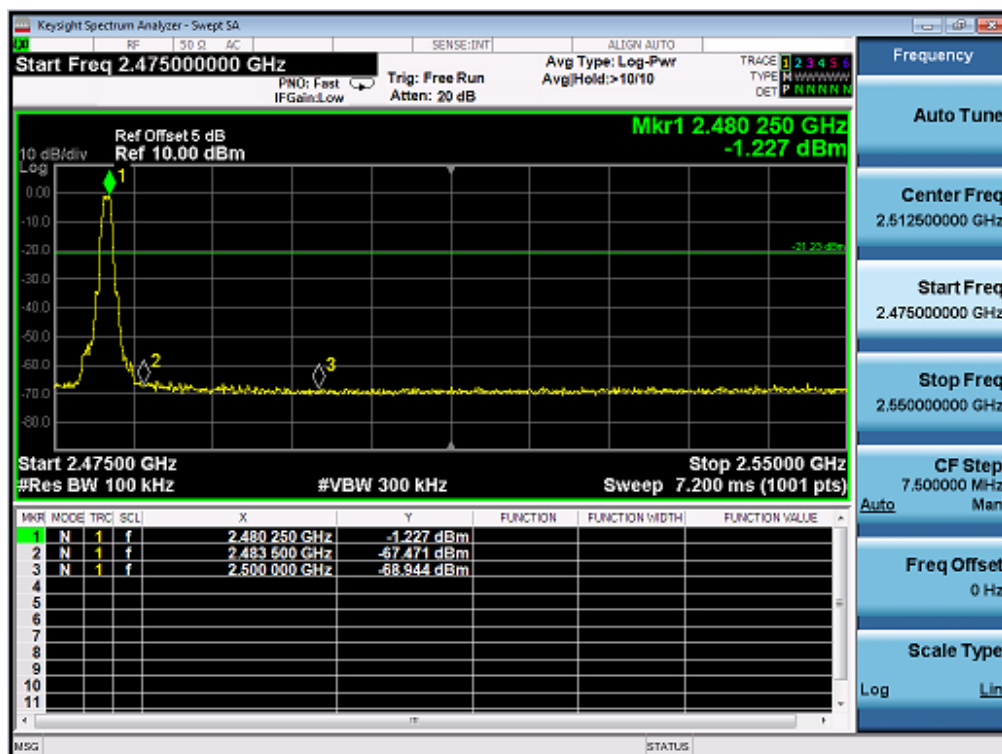
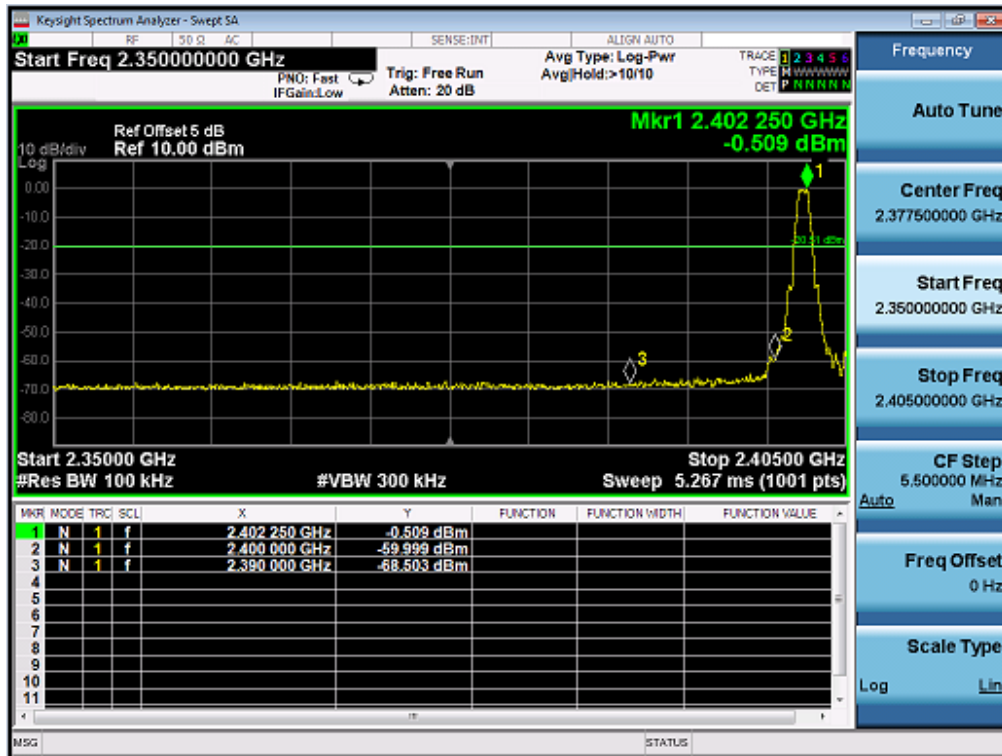
TEST RESULTS**4.6.1 For Radiated Bandedge Measurement**

GFSK								
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Over limit dB	Verdict
2310.000	-62.401	0.96	0	33.789	Peak	74	-40.211	PASS
2310.000	-73.132	0.96	0	23.058	AV	54	-30.942	PASS
2390.000	-62.081	0.96	0	34.109	Peak	74	-39.891	PASS
2390.000	-73.095	0.96	0	23.095	AV	54	-30.905	PASS
2483.500	-60.877	0.96	0	35.313	Peak	74	-38.687	PASS
2483.500	-71.966	0.96	0	24.224	AV	54	-29.776	PASS
2500.000	-61.093	0.96	0	35.097	Peak	74	-38.903	PASS
2500.000	-73.034	0.96	0	23.156	AV	54	-30.844	PASS

Band-edge measurements for radiated emissions**Antenna 1****2402 MHz – Peak****2480 MHz – Peak****2402 MHz – Average****2480 MHz – Average**

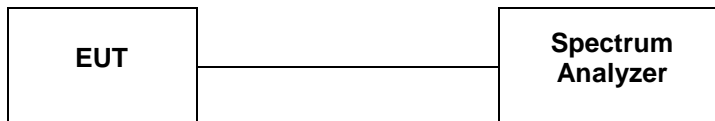
4.6.2 For Conducted Bandedge Measurement

Frequency Band	Delta Peak to band emission(dBc)	>Limit (dBc)	Result
Left-band	59.49	20	Pass
Right-band	66.244	20	Pass



4.7. Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300KHz to measure the peak field strength , and measure frequency range from 9KHz to 25GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

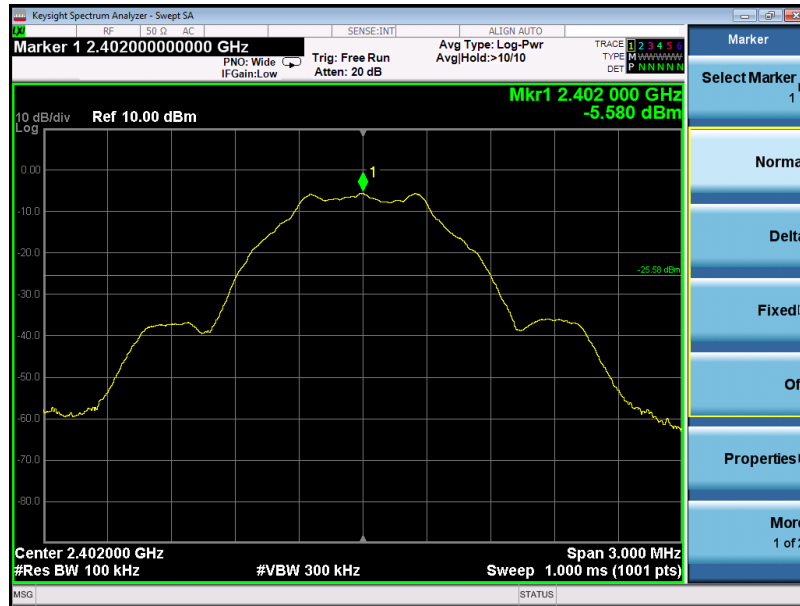
TEST RESULTS

Test Mode:

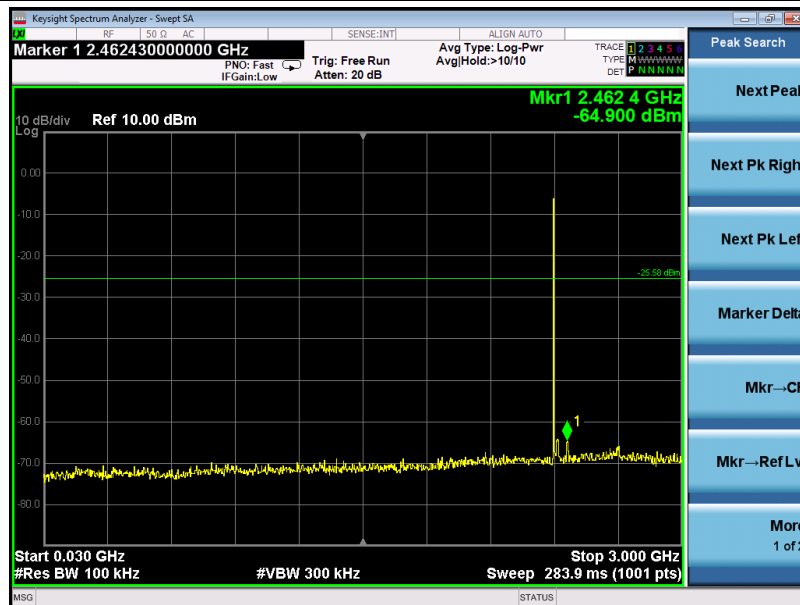
GFSK

Test channel :

00



Channel 0



30MHz~3GHz



3GHz ~25GHz

Test Mode:

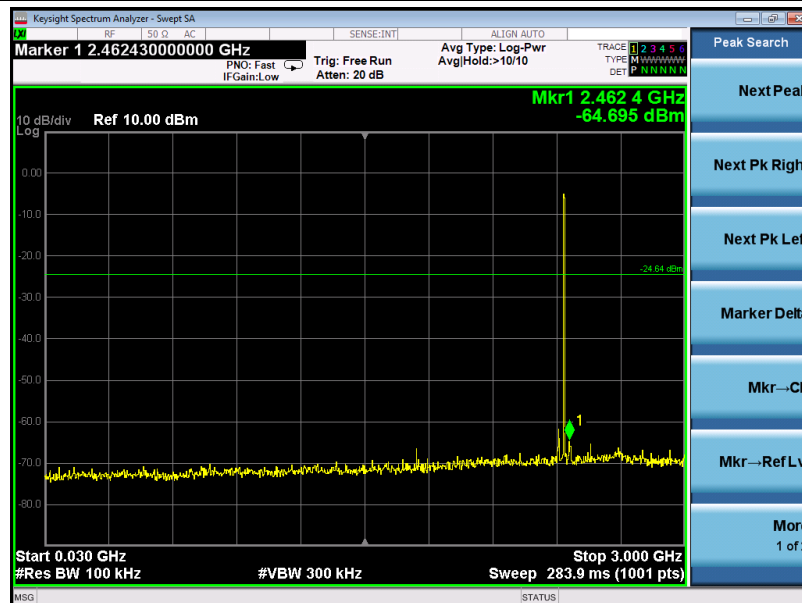
GFSK

Test channel :

19



Channel 19



30MHz~3GHz



3GHz ~25GHz

Test Mode:

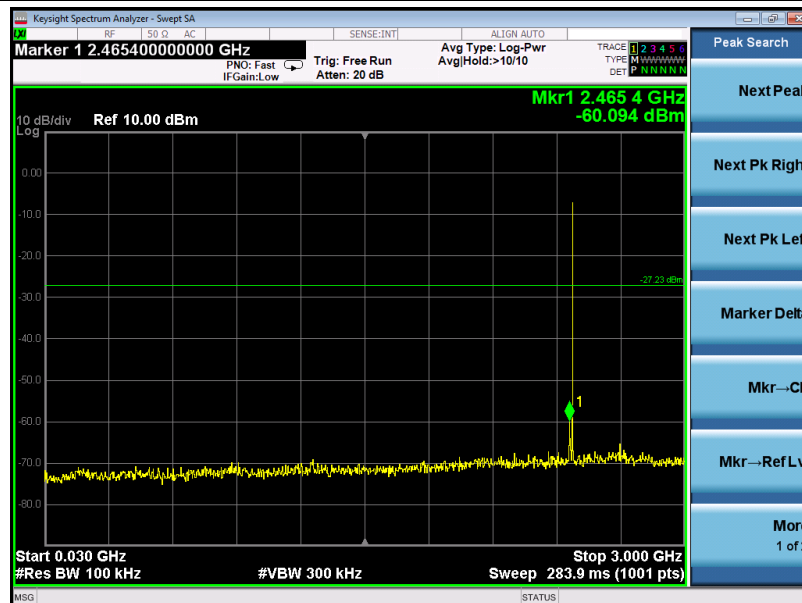
GFSK

Test channel :

39



Channel 39



30MHz~3GHz



3GHz ~25GHz

4.8. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Test Result

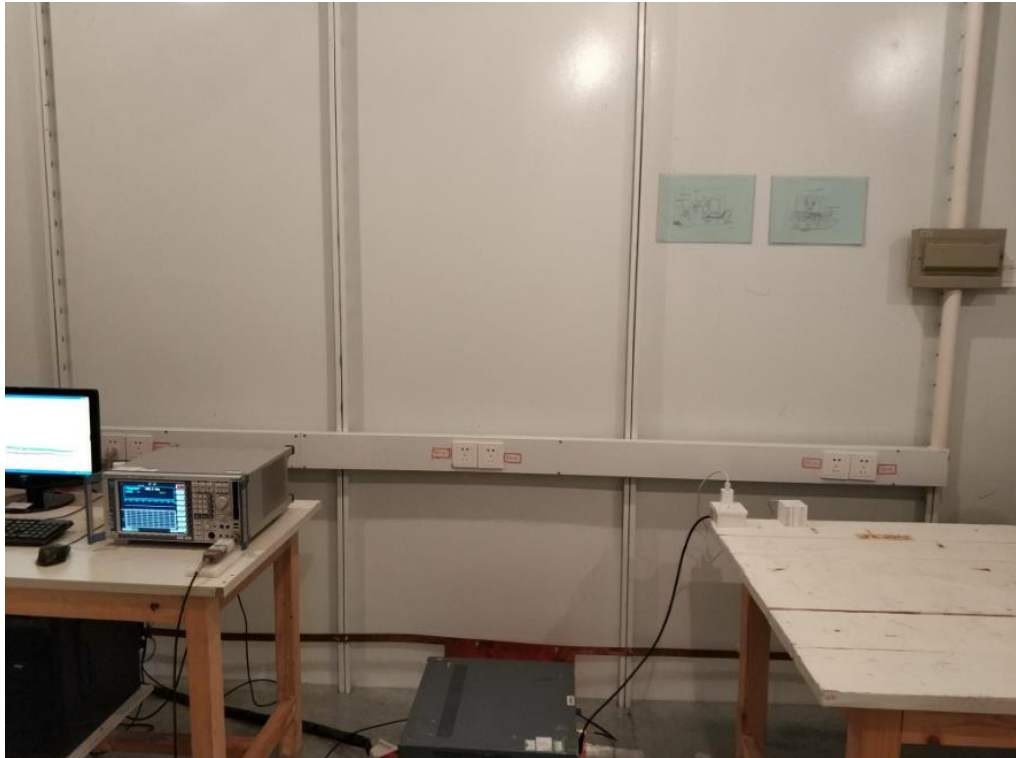
The antenna used for this product is Internal Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0.96dBi.

5. Test Setup Photos of the EUT

Radiated Emission Test



Conducted Emission



6. External and Internal Photos of the EUT

Reference to the test report No. GTSR18080199-WLAN01.

.....End of Report.....