FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**MWR1411000404**
FCC ID.....:	**RQQHLT-E425**
Compiled by (position+printed name+signature)..:	File administrators Martin Ao
Supervised by (position+printed name+signature)..:	Test Engineer Martin Ao
Approved by (position+printed name+signature)..:	Manager Dixon Hao
Date of issue.....:	Nov 19, 2014
Representative Laboratory Name.:	**Maxwell International Co., Ltd.**
Address.....:	Room 509,Hongfa Center Building, Baoan District, Shenzhen, Guangdong, China
Testing Laboratory Name.....:	**Shenzhen CTL Testing Technology Co., Ltd.**
Address.....:	Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan,Shenzhen,China
Applicant's name.....:	**HYUNDAI CORPORATION**
Address.....:	140-2, Kye-dong, Chongro-ku, Seoul, South Korea
Test specification.....:	
Standard.....:	**FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**
TRF Originator.....:	Maxwell International Co., Ltd.
Master TRF.....:	Dated 2011-05

Test item description.....:	Mobile Phone
Trade Mark.....:	HYUNDAI
Manufacturer.....:	**WASAM TECHNOLOGY (SHEN ZHEN) CO.,LTD.**
Model/Type reference.....:	E425
Listed Models .....:	E420
Modulation Type.....:	GFSK
Operation Frequency.....:	From 2402MHz to 2480MHz
Rating.....:	DC 3.70V
Hardware version.....:	DR315 V0.1
Software version .....:	S11P_HS_W412_HYUNDAI_B24859_2014-10-22_64P8_32P8_FWVGA_W25[D]_GpsL_DC_FL_GS_LED_170552
Result.....:	**PASS**

TEST REPORT

Test Report No. :	MWR1411000404	Nov 19, 2014 Date of issue

Equipment under Test	:	Mobile Phone
Model /Type	:	E425
Listed Models	:	E420
Applicant	:	**HYUNDAI CORPORATION**
Address	:	140-2, Kye-dong, Chongro-ku, Seoul, South Korea
Manufacturer		**WASAM TECHNOLOGY (SHEN ZHEN) CO.,LTD.**
Address	:	B,F Building, (Hengqiang Industrial Park), Bogang Taifeng Industrial Zone, Shajing Town, Bao'an District, Shenzhen, 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. 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: American National Standard for Testing Unlicensed Wireless Devices

KDB558074 D01 V03: 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	:	Oct 10, 2014
Testing commenced on	:	Oct 11, 2014
Testing concluded on	:	Nov 17, 2014

2.2. Product Description

The **HYUNDAI CORPORATION**'s Model: E425 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Mobile Phone
Model Number	E425
FCC ID	RQQHLT-E425
Modilation Type	GMSK for GSM/GPRS;QPSK for WCDMA
Antenna Type	Internal
GSM/EDGE/GPRS	Supported GPRS
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.40VDC to 4.20VDC (nominal: 3.70VDC)
GSM Operation Frequency Band	GSM 850MHz/ PCS 1900MHz
GSM Release Version	R99
GPRS operation mode	Class B
GPRS Multislot Class	12
EGPRS Multislot Class	Only support downlink mode

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	120V / 60 Hz	○	115V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 3.70V

2.4. Description of the test mode

Test channel:

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	**2402**	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	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

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

2.5.1 General Description

E425 is subscriber equipment in the WCDMA/GSM system. The HSPA/UMTS frequency band is Band II, Band V; The GSM/GPRS/EDGE (EDGE downlink only) frequency and includes GSM850 and GSM900 and DCS1800 and PCS1900, but only Band II and Band V and GSM850 and PCS1900 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, HSPA/UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS, and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and SIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

2.5.2 Customized Configurations

#EUT Conf.	Signal Description	Operating Frequency
TM1_ Ch00	GFSK modulation	Ch No. 00/2402MHz
TM1_ Ch19	GFSK modulation	Ch No. 19/ 2440MHz
TM1_ Ch39	GFSK modulation	Ch No. 39/ 2480MHz

2.5.3 Test Environments

NOTE: The values used in the test report maybe stringent than the declared.

Environment Parameter	Selected Values During Tests		
NTNV	Temperature	Voltage	Relative Humidity
	Ambient	3.7VDC	Ambient

2.6. EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides command

to control the EUT for staying in continous transmitting (Duty Cycle >98%) and receiving mode for testing.

2.7. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
○	Multimeter	Manufacturer :	/
		Model No. :	/

2.8. Internal Identification of AE used during the test

AE ID*	Description
AE1	Charger and USB cable

AE1

Model：E425
INPUT: 100-300V 50/60HZ 0.15A
OUTPUT: DC 5.0V,500mAh

*AE ID: is used to identify the test sample in the lab internally.

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

This submittal(s) (test report) is intended for **FCC ID: RQQHLT-E425** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.10. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen,China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Test Facility

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

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. 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. Registration 970318, Dec 19, 2013

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 Item	FCC Part No.	Requirements	Verdict
DTS (6 dB) Bandwidth	15.247(a)(2)	≥ 500 kHz.	PASS
Maximum Peak Conducted Output Power	15.247(b)(3)	For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak; Otherwise :< 30dBm, peak.	PASS
Maximum Power Spectral Density Level	15.247(e)	For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak. Otherwise :< 8dBm/3 kHz, peak.	PASS
Band Edges Compliance	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Non-Restricted Frequency Bands	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Conducted)	15.247(d) 15.209	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Radiated)	15.247(d) 15.209	FCC Part 15.209 field strength limit;	PASS
AC Power Line Conducted Emissions	15.207	FCC Part 15.207 conducted limit;	PASS

Remark: The measurement uncertainty is not included in the test result.

3.5. Test Conditions

Test Case	Test Conditions	
	Configuration	Description
DTS (6 dB) Bandwidth	Measurement Method	FCC KDB 558074 §7.1.1Option2.
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00

		TM1_ Ch19 TM1_ Ch39
Maximum Peak Conducted Output Power	Measurement Method	FCC KDB 558074§7.2.1.1
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Maximum Power Spectral Density Level	Measurement Method	FCC KDB 558074 §7.3.1Option 1 (peak PSD).
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Non-Restricted Frequency Bands	Measurement Method	FCC KDB 558074§7.4.1, use Peak PSD.
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Restricted Frequency Bands (Conducted)	Measurement Method	FCC KDB 558074§7.4.2, Conducted (antenna-port).
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§7.4.2,Radiated(cabinet/case emissions with Impedance matching for antenna-port).
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39

Test Case	Test Conditions	
	Configuration	Description
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch19 (Worst Conf.).

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

3.6. 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 CTL Testing Technology 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 CTL Testing Technology Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Frequency stability	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	1.60 dB	(1)
Radiated spurious emission 9KHz-12.75 GHz	2.20 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)

Radiated Emission 9KHz-30MHz	2.88 dB	(1)
Radiated Emission 30~1000MHz	4.24 dB	(1)
Radiated Emissio 1~18GHz	5.16 dB	(1)
Radiated Emissio 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	---------	(1)
Emission Mask	---------	(1)
Modulation Characteristic	---------	(1)
Transmitter Frequency Behavior	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

3.7. Equipments Used during the Test

AC Power Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ENV216	101316	2014/07/02
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	103710	2014/07/02
3	Pulse Limiter	Com-Power	LIT-153	53226	2014/07/01
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
5	RF Cable4	/	Cable000001	/	2014/07/06

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2014/07/12
2	EMI TEST Receivcer	Rohde&Schwarz	ESCI3	103710	2014/07/02
3	EMI TEST Software	Audix	E3	N/A	N/A
4	EMI TEST Software	Rohde&Schwarz	ESK1	N/A	N/A
5	HORN ANTENNA	Sunol Sciences Corp.	DRH-118	A062013	2014/07/12
6	Amplifer	HP	8447D	3113A07663	2014/10/26
7	Preamplifier	HP	8349B	3155A00882	2014/07/03
8	Amplifer	Compliance Direction systems	PAP1-4060	129	2014/07/03
9	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2014/06/29
10	TURNTABLE	MATURO	TT2.0	----	N/A
11	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
12	Horn Antenna	SCHWARZBECK	BBHA9170	25849	2014/06/21
13	Spectrum Analyzer	Rohde&Schwarz	FSU26	201148	2014/07/02
14	RF Cable 5	/	Cable000005	/	2014/07/06
15	RF Cable 6	/	Cable000006	/	2014/07/06

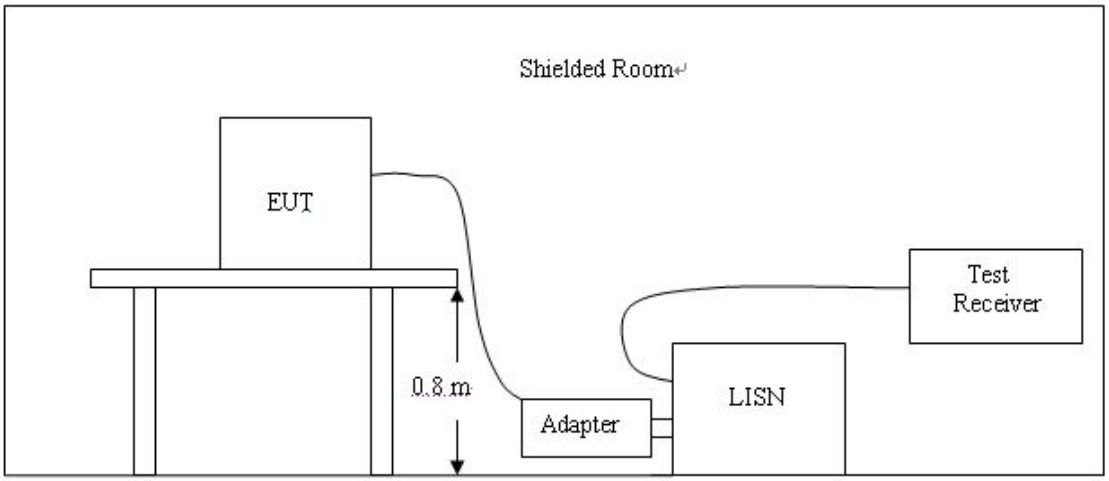
Maximum Peak Output Power / Power Spectral Density / 6dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Spectrum Analyzer	Rohde&Schwarz	FSU26	201148	2014/07/02
2	Power Sensor	Rohde&Schwarz	NRR-Z81	256697	2014/07/02
3	MXA Signal Analyzer	Agilent	N9020A	MY53420615	2014/05/12
4	RF Cable1	/	Cable000001	/	2014/07/06

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 C63.10-2009.
2. Support equipment, if needed, was placed as per ANSI C63.10-2009
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
4. The EUT received DC5V power from the adapter, 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:

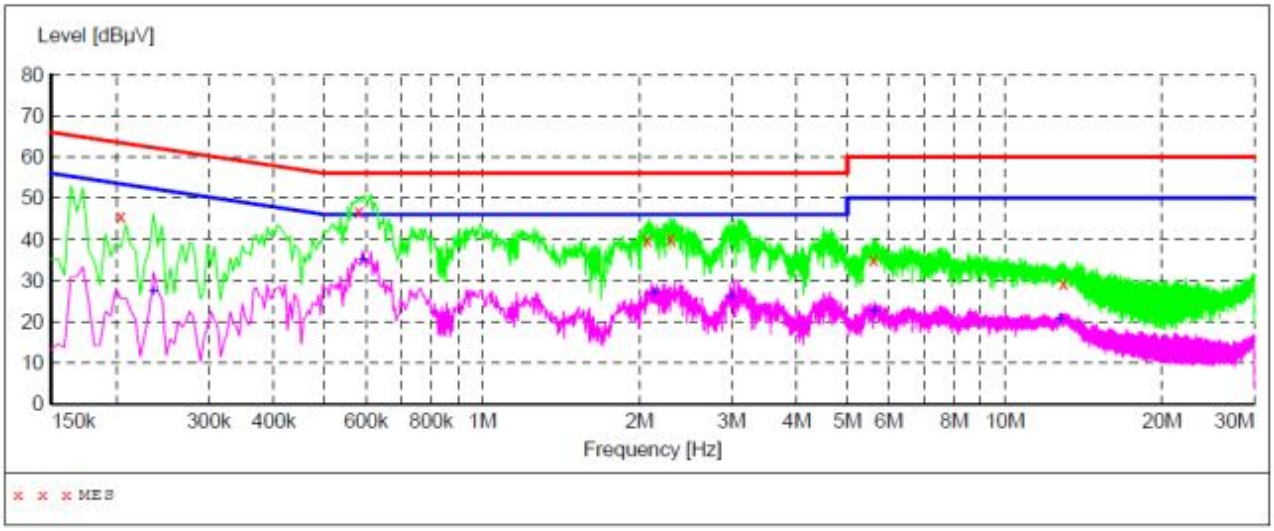
Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

The AC Power Conducted Emission measurement is performed at both TX and RX (Idle) mode, recorded worst case at TX mode..

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



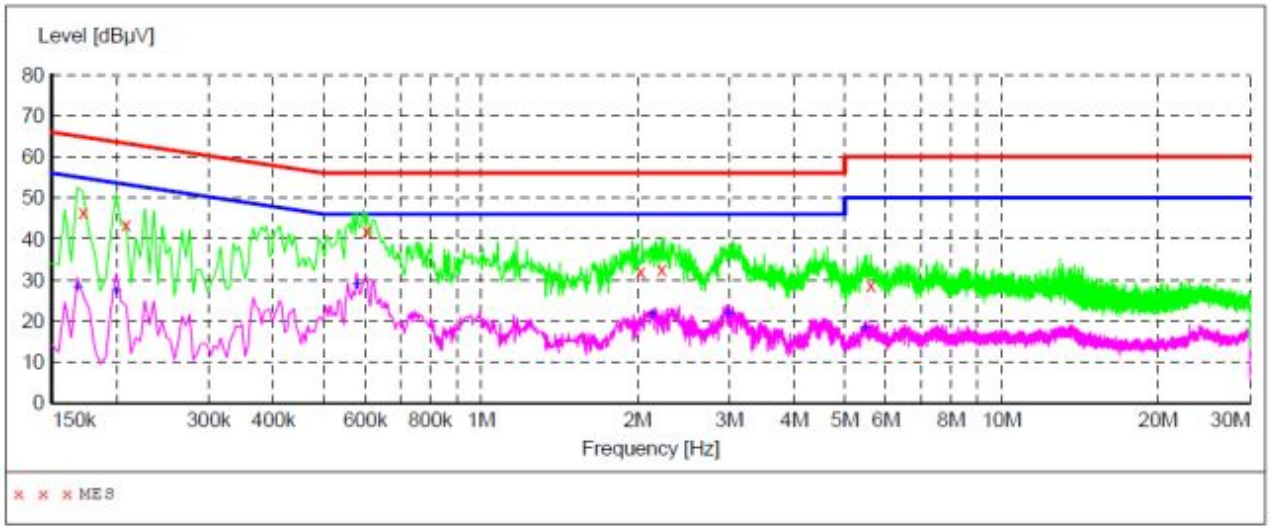
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.204000	45.60	10.4	63.4	17.8	QP	L1	GND
0.582000	46.80	10.3	56.0	9.2	QP	L1	GND
2.071500	39.70	10.3	56.0	16.3	QP	L1	GND
2.296500	40.10	10.3	56.0	15.9	QP	L1	GND
5.617500	35.10	10.3	60.0	24.9	QP	L1	GND
12.961500	29.30	10.7	60.0	30.7	QP	L1	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.235500	27.30	10.5	52.3	25.0	AV	L1	GND
0.591000	35.00	10.3	46.0	11.0	AV	L1	GND
2.130000	26.90	10.3	46.0	19.1	AV	L1	GND
2.994000	25.90	10.3	46.0	20.1	AV	L1	GND
5.626500	22.50	10.3	50.0	27.5	AV	L1	GND
12.777000	20.70	10.7	50.0	29.3	AV	L1	GND

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



MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.172500	46.60	10.3	64.8	18.2	QP	N	GND
0.208500	43.40	10.4	63.3	19.9	QP	N	GND
0.604500	42.00	10.3	56.0	14.0	QP	N	GND
2.031000	31.90	10.3	56.0	24.1	QP	N	GND
2.229000	32.50	10.3	56.0	23.5	QP	N	GND
5.613000	28.60	10.3	60.0	31.4	QP	N	GND

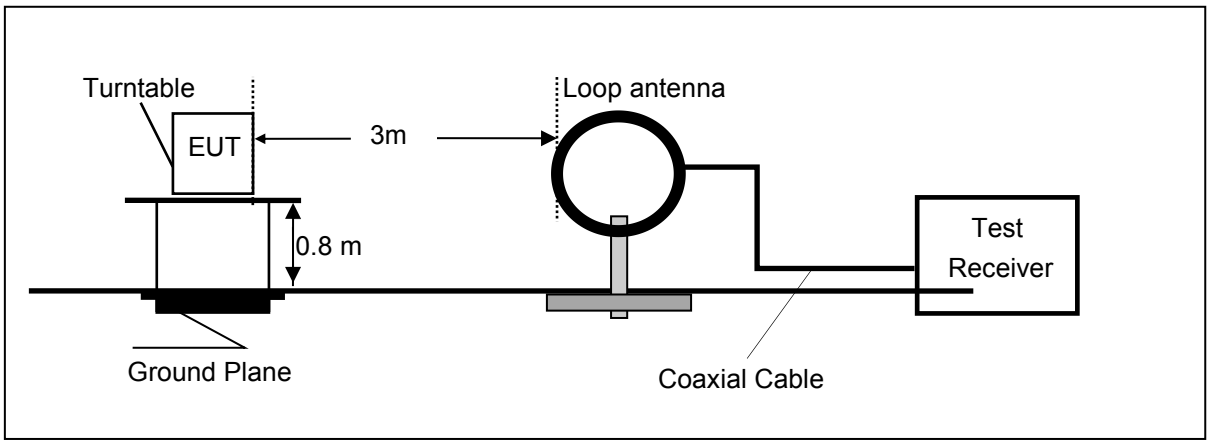
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.168000	28.00	10.3	55.1	27.1	AV	N	GND
0.199500	27.10	10.4	53.6	26.5	AV	N	GND
0.577500	28.60	10.3	46.0	17.4	AV	N	GND
2.130000	21.50	10.3	46.0	24.5	AV	N	GND
2.989500	21.90	10.3	46.0	24.1	AV	N	GND
5.455500	18.20	10.3	50.0	31.8	AV	N	GND

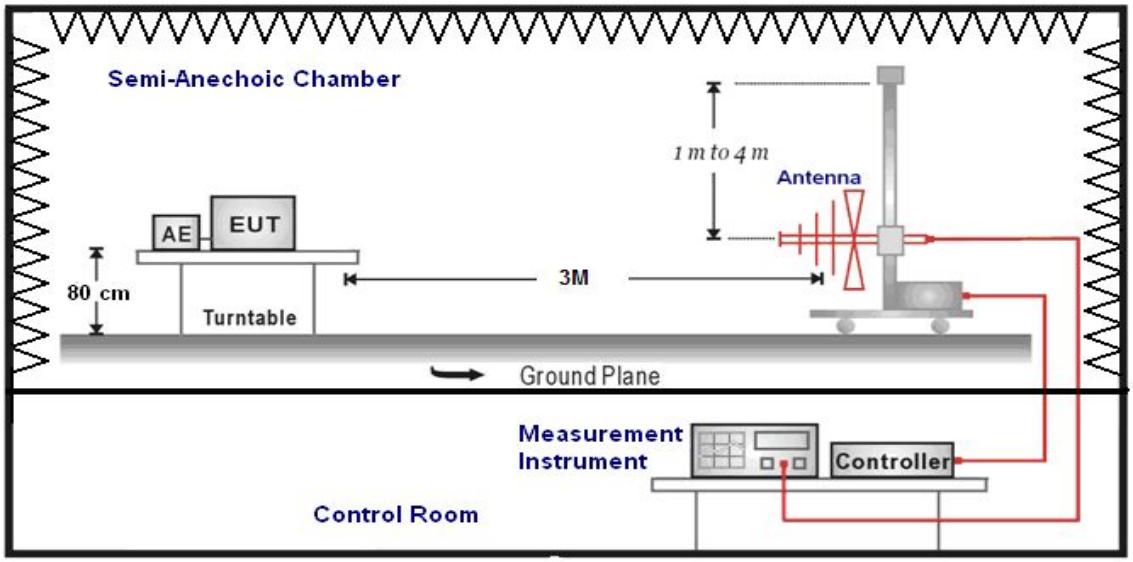
4.2. Radiated Emission

TEST CONFIGURATION

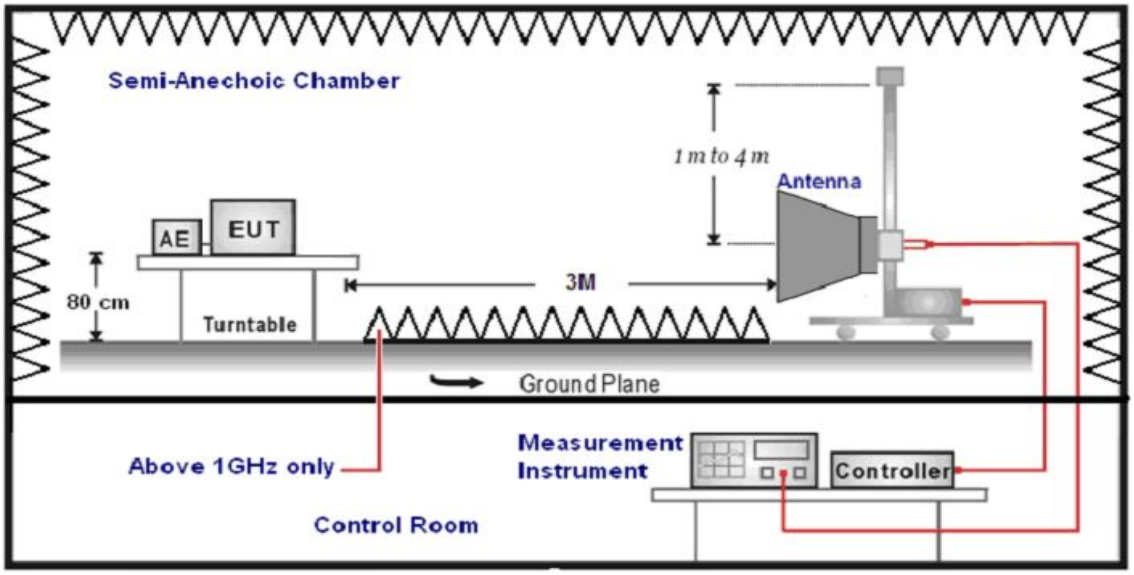
Frequency range 9KHz – 30MHz



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.
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 EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2462MHz.so radiated emission test frequency band from 9KHz to 25GHz.

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	

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 the100kHz bandwidth within the band that contains the highest level of desired power.

The frequency spectrum above 1 GHz for Transmitter was investigated. All emission not reported are much lower than the prescribed limits. Set the RBW=1MHz,VBW=3MHz for Peak Detector while the RBW=1MHz,VBW=10Hz for Average Detector,Readings are both peak and average values.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	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. The radiated measurement are performed the each channel (low/mid/high), the datum recorded below (the middle channel) is the worst case for all test channels.
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. We tested both battery powered and powered by adapter charging mode at three orientations, recorded worst case at powered by adapter charging mode.
5. “---” means not recorded as emission levels lower than limit.

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
12.00	44.98	69.54	24.56	QP	PASS
24.00	42.86	69.54	26.68	QP	PASS

For 30MHz to 1000MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization
34.87	48.85	15.82	0.61	32.06	33.22	40.00	6.78	Vertical
113.39	47.30	14.15	1.31	31.83	30.93	43.50	12.57	Vertical
232.56	43.50	14.88	2.04	32.16	28.26	46.00	17.74	Vertical
745.17	38.23	22.34	4.24	31.25	33.56	46.00	12.44	Vertical
35.37	47.66	15.80	0.60	32.06	32.00	40.00	8.00	Horizontal
97.42	46.85	16.02	1.16	31.75	32.28	43.50	11.22	Horizontal
147.41	52.02	11.27	1.55	31.97	32.87	43.50	10.63	Horizontal
238.19	40.95	15.06	2.06	32.16	25.91	46.00	20.09	Horizontal

For 1GHz to 25GHz

Low Channel @ Channel 00 @ 2402 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4804.00	55.26	PK	74.00	18.74	1.00	104	53.18	31.58	7.00	36.5	2.08
2	4804.00	40.11	AV	54.00	13.89	1.00	104	38.03	31.58	7.00	36.5	2.08
3	7206.00	57.6	PK	74.00	16.4	1.00	246	46.94	37.06	8.90	35.3	10.66
4	7206.00	39.68	AV	54.00	14.32	1.00	246	29.02	37.06	8.90	35.3	10.66

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4804.00	52.59	PK	74.00	21.41	1.00	150	50.51	31.58	7.00	36.5	2.08
2	4804.00	38.12	AV	54.00	15.88	1.00	150	36.04	31.58	7.00	36.5	2.08
3	7206.00	55.46	PK	74.00	18.54	1.00	147	44.8	37.06	8.90	35.3	10.66
4	7206.00	37.64	AV	54.00	16.36	1.00	147	26.98	37.06	8.90	35.3	10.66

Middle Channel @ Channel 19 @ 2440 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4880.00	54.59	PK	74.00	19.41	1.00	322	52.45	31.04	7.60	36.5	2.14
2	4880.00	40.7	AV	54.00	13.3	1.00	322	38.56	31.04	7.60	36.5	2.14
3	7320.00	56.56	PK	74.00	17.44	1.00	85	45.42	37.84	8.60	35.3	11.14
4	7320.00	39.25	AV	54.00	14.75	1.00	85	28.11	37.84	8.60	35.3	11.14

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4880.00	53.09	PK	74.00	20.91	1.00	177	50.95	31.04	7.60	36.5	2.14
2	4880.00	39.02	AV	54.00	14.98	1.00	177	36.88	31.04	7.60	36.5	2.14
3	7320.00	54.85	PK	74.00	19.15	1.00	346	43.71	37.84	8.60	35.3	11.14
4	7320.00	37.72	AV	54.00	16.28	1.00	346	26.58	37.84	8.60	35.3	11.14

High Channel @ Channel 39 @ 2480 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4960.00	55.24	PK	74.00	18.76	1.00	252	52.81	31.63	7.00	36.2	2.43
2	4960.00	40.16	AV	54.00	13.84	1.00	252	37.73	31.63	7.00	36.2	2.43
3	7340.00	57.79	PK	74.00	16.21	1.00	194	46.19	38.40	8.50	35.3	11.60
4	7340.00	39.58	AV	54.00	14.42	1.00	194	27.98	38.40	8.50	35.3	11.60

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4960.00	53.67	PK	74.00	20.33	1.00	24	51.24	31.63	7.00	-36.2	2.43
2	4960.00	37.93	AV	54.00	16.07	1.00	24	35.5	31.63	7.00	-36.2	2.43
3	7340.00	56.36	PK	74.00	17.64	1.00	166	44.76	38.40	8.50	-35.3	11.60
4	7340.00	37.89	AV	54.00	16.11	1.00	166	26.29	38.40	8.50	-35.3	11.60

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 Factor
3. The other emission levels were very low against the limit.
4. Margin value = Limit value- Emission level.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

4.3. Maximum Peak Output Power

TEST CONFIGURATION

TEST PROCEDURE

According to KDB558074 D01 DTS Mea Guidance v03r02 9.1.2 PKPM1 Peak power meter method “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

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	-5.298	30	PASS
19	2440	-4.935	30	PASS
39	2480	-5.026	30	PASS

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

4.4. Power Spectral Density

TEST CONFIGURATION

TEST PROCEDURE

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
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 amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/50kHz)	Refer to Plot	Limits (dBm/3KHz)	Verdict
00	2402	-9.749	Plot 4.4.1 A	8	PASS
19	2440	-9.367	Plot 4.4.1 B	8	PASS
39	2480	-9.341	Plot 4.4.1 C	8	PASS

Note 1.The test results including the cable lose.

B. Test Plots

(Plot 4.4.1 A: Channel 00: 2402 MHz @ GFSK)

(Plot 4.4.1 B: Channel 19: 2440 MHz @ GFSK)

(Plot 4.4.1 C: Channel 39: 2480 MHz @ GFSK)

4.5. 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 PROCEDURE

According to KDB 558074 D01 V03 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for average detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
    E = EIRP – 20log D + 104.8

where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test dures until all measured frequencies were complete.

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

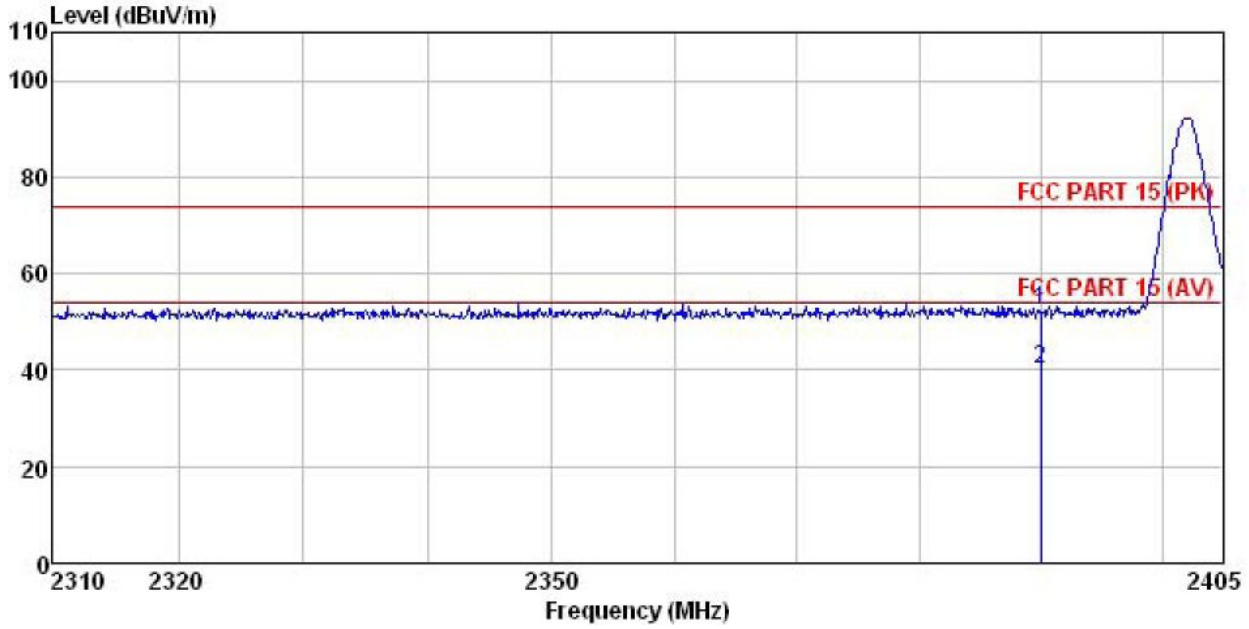
with the radiated emission limits specified in § 15.209(a)

TEST RESULTS

4.5.1 For Radiated Bandedge Measurement

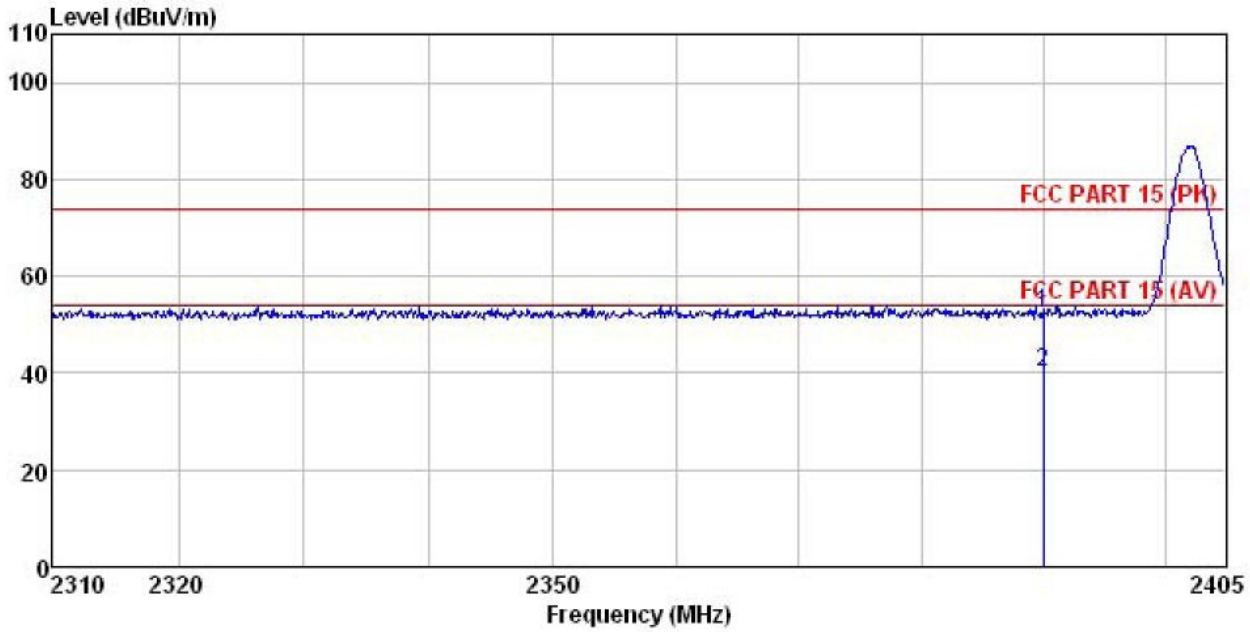
Low Channel

HORIZONTAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2390.000	19.07	27.58	5.67	0.00	52.32	74.00	-21.68	Peak
2	2390.000	6.92	27.58	5.67	0.00	40.17	54.00	-13.83	Average

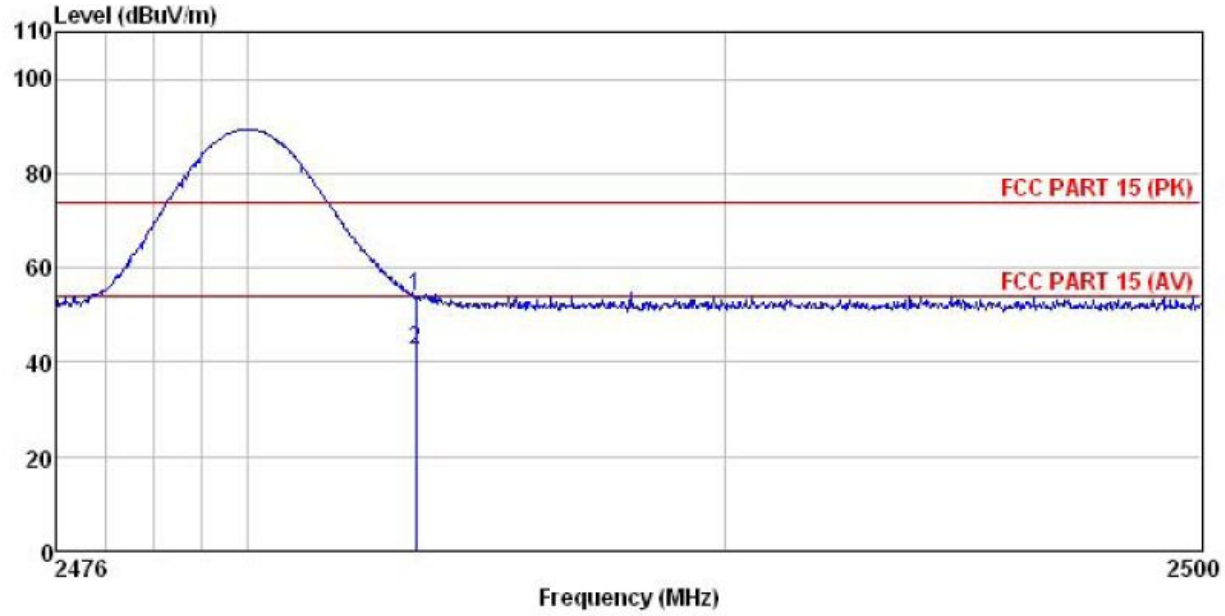
VERTICAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2390.000	19.07	27.58	5.67	0.00	52.32	74.00	-21.68	Peak
2	2390.000	6.92	27.58	5.67	0.00	40.17	54.00	-13.83	Average

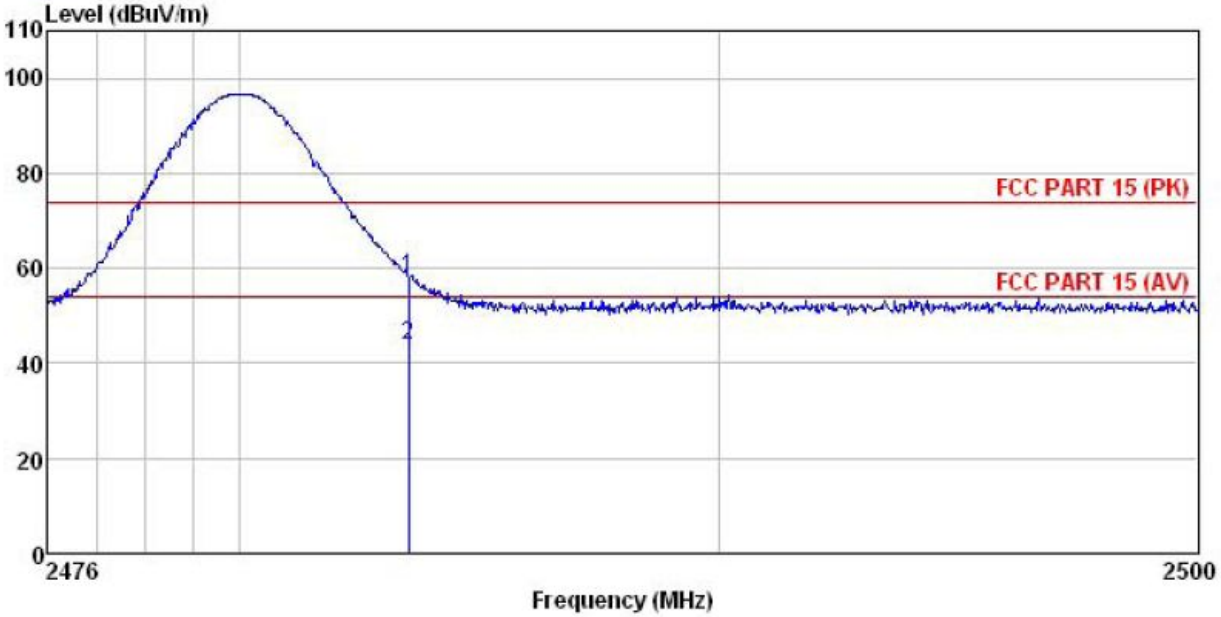
High Channel

HORIZONTAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.500	20.90	27.52	5.70	0.00	54.12	74.00	-19.88	Peak
2	2483.500	9.42	27.52	5.70	0.00	42.64	54.00	-11.36	Average

VERTICAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.511	24.85	27.52	5.70	0.00	58.07	74.00	-15.93	Peak
2	2483.511	10.71	27.52	5.70	0.00	43.93	54.00	-10.07	Average

4.5.2 For Conducted Bandedge Measurement

A. Test Plots

(Plot 4.5.2.1 A: Channel 00: 2402MHz @ GFSK)

(Plot 4.5.2.1 B: Channel 39: 2402MHz @ GFSK)

4.6. 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 C63.10-2009 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=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 26.5GHz.

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

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

TEST RESULTS

Remark: The measurement frequency range is from 9 KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

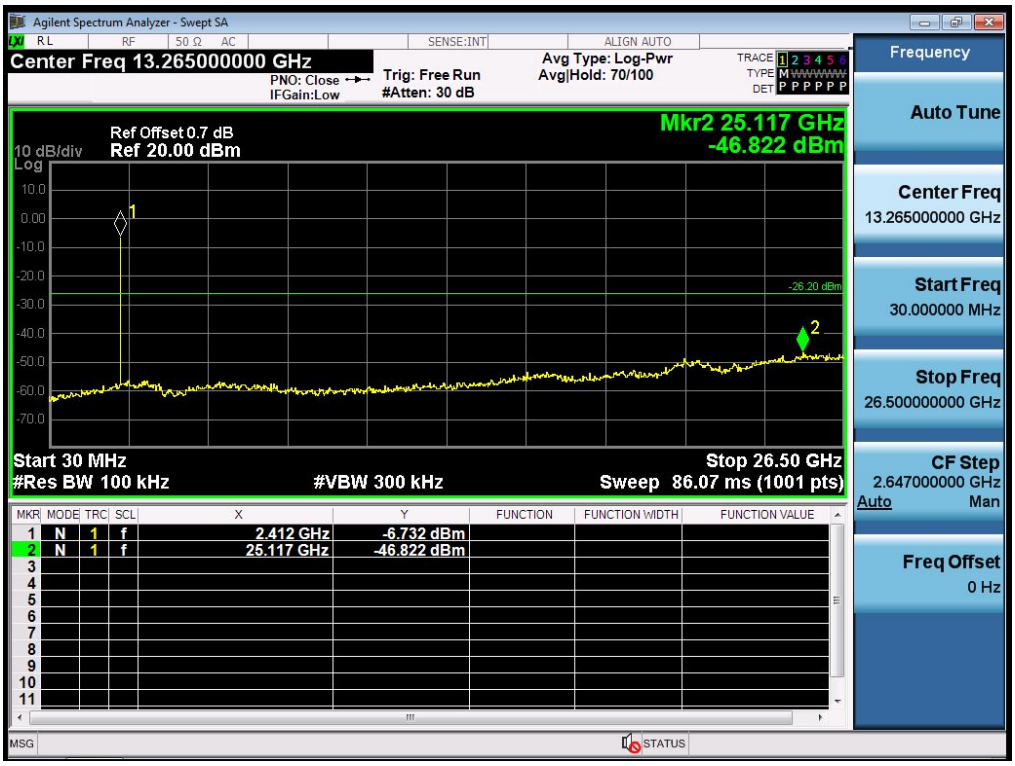
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	2.402 GHz	Plot 4.6.1 A1	---	PASS
		30MH-26 GHz	Plot 4.6.1 A2	-20	PASS
19	2440	2.440 GHz	Plot 4.6.1 B1	---	PASS
		30MH-26 GHz	Plot 4.6.1 B2	-20	PASS
39	2480	2.480 GHz	Plot 4.6.1 C1	---	PASS
		30MH-26 GHz	Plot 4.6.1 C2	-20	PASS

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

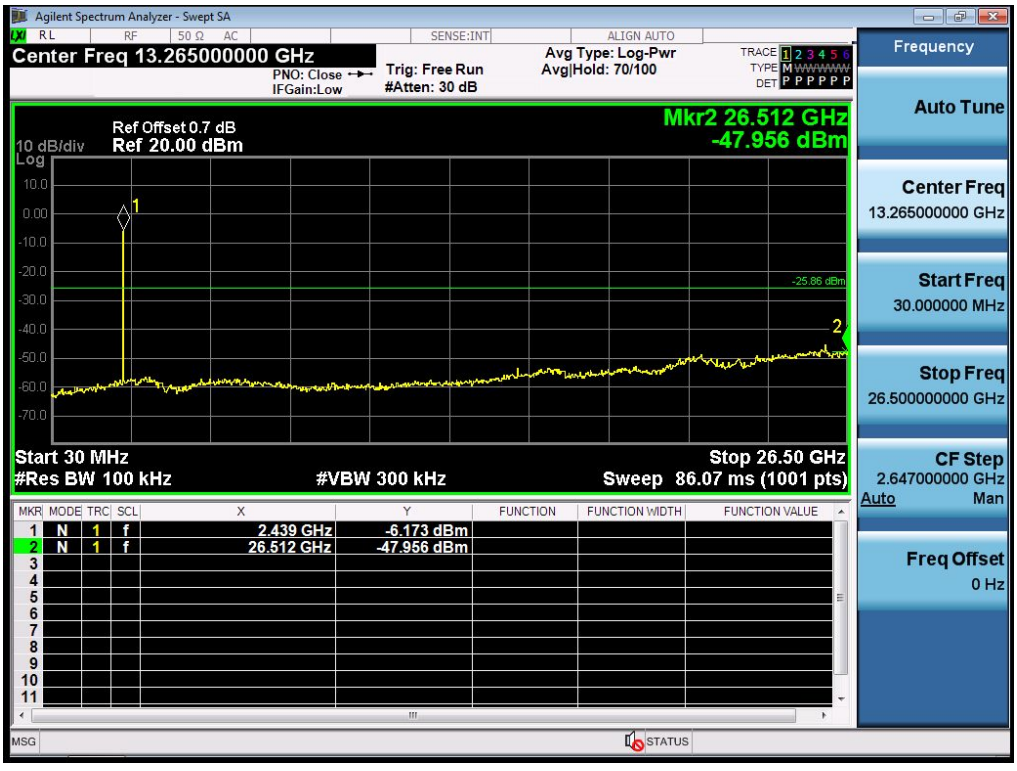
B. Test Plots

(Plot 4.6.1 A1: Channel 00: 2402MHz @ GFSK)



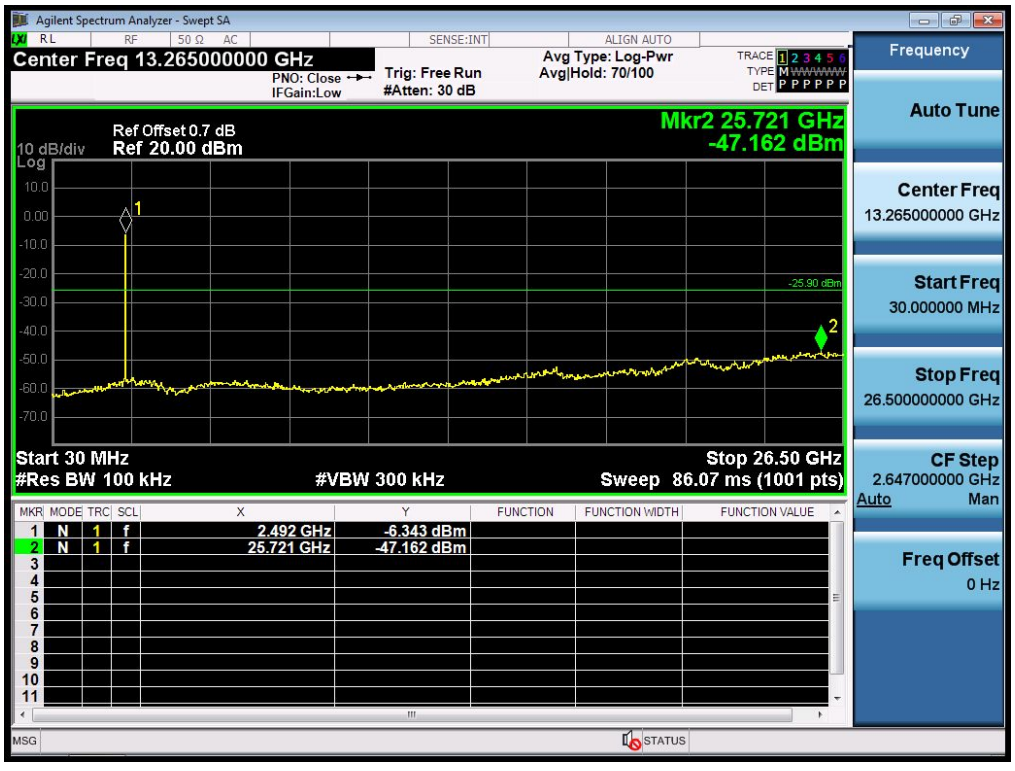
(Plot 4.6.1 A2: Channel 00: 2402MHz @ GFSK)

(Plot 4.6.1 B1: Channel 19: 2440MHz @ GFSK)



(Plot 4.6.1 B2: Channel 19: 2440MHz @ GFSK)

(Plot 4.6.1 C1: Channel 39: 2480MHz @ GFSK)



(Plot 4.6.1 C2: Channel 39: 2480MHz @ GFSK)
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4.7. 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 with100 KHz RBW and 300KHz VBW.
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.

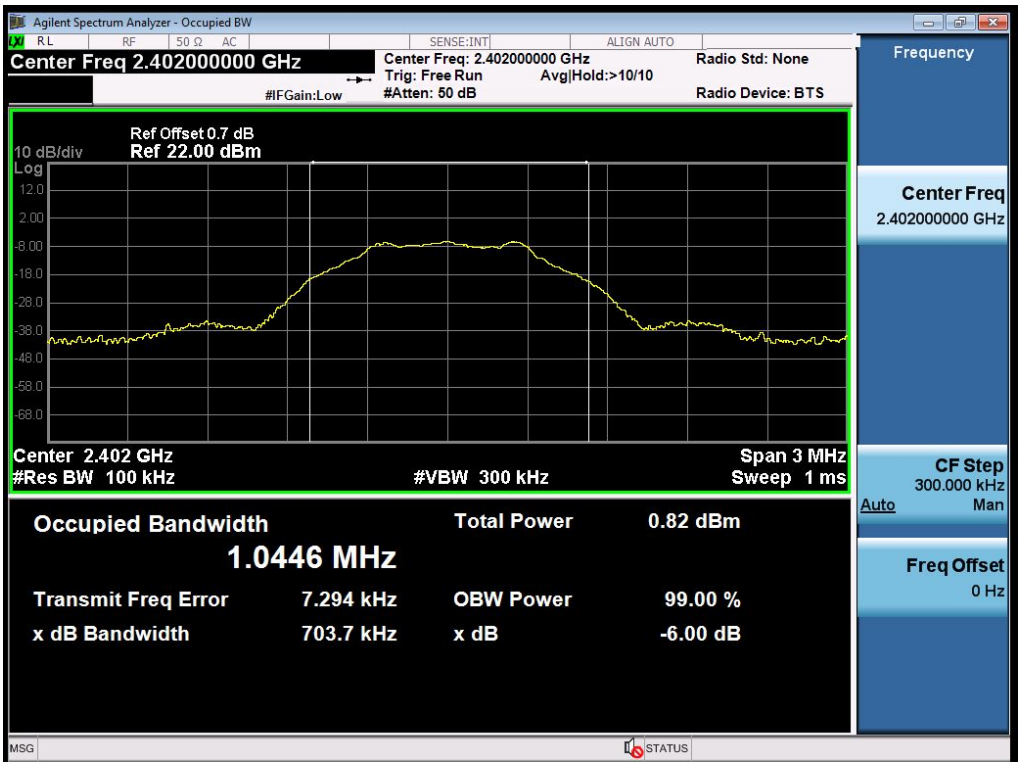
TEST RESULTS

A. Test Verdict

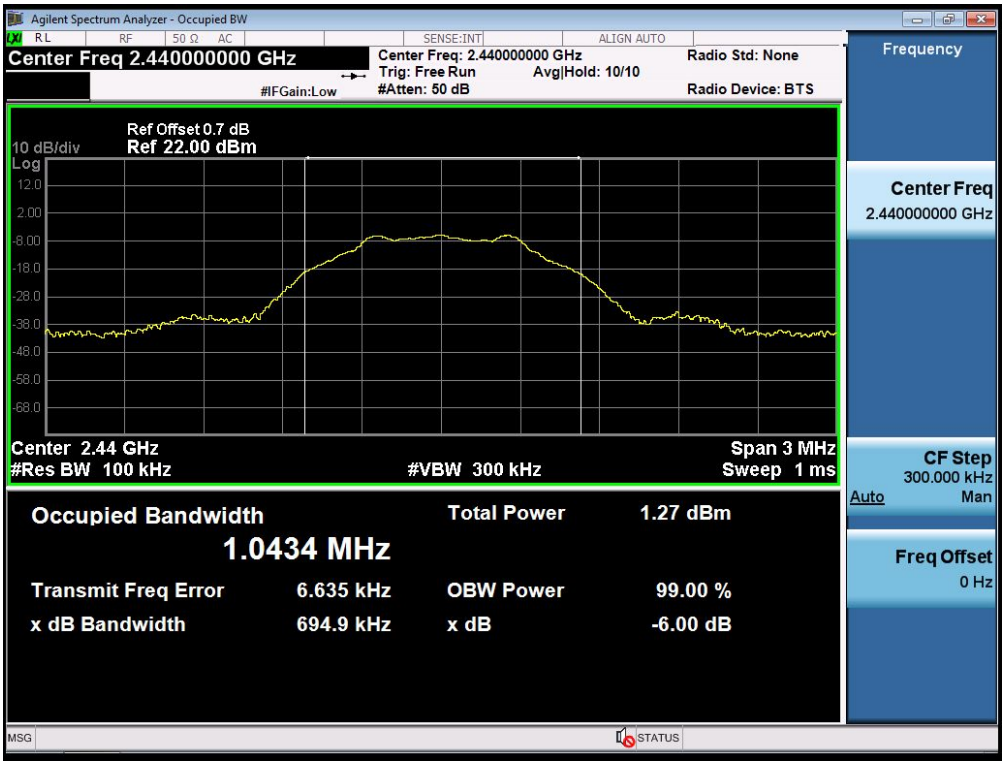
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
00	2402	0.7037	Plot 4.7.1 A	≥500	PASS
19	2440	0.6949	Plot 4.7.1 B	≥500	PASS
39	2480	0.6819	Plot 4.7.1 C	≥500	PASS

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

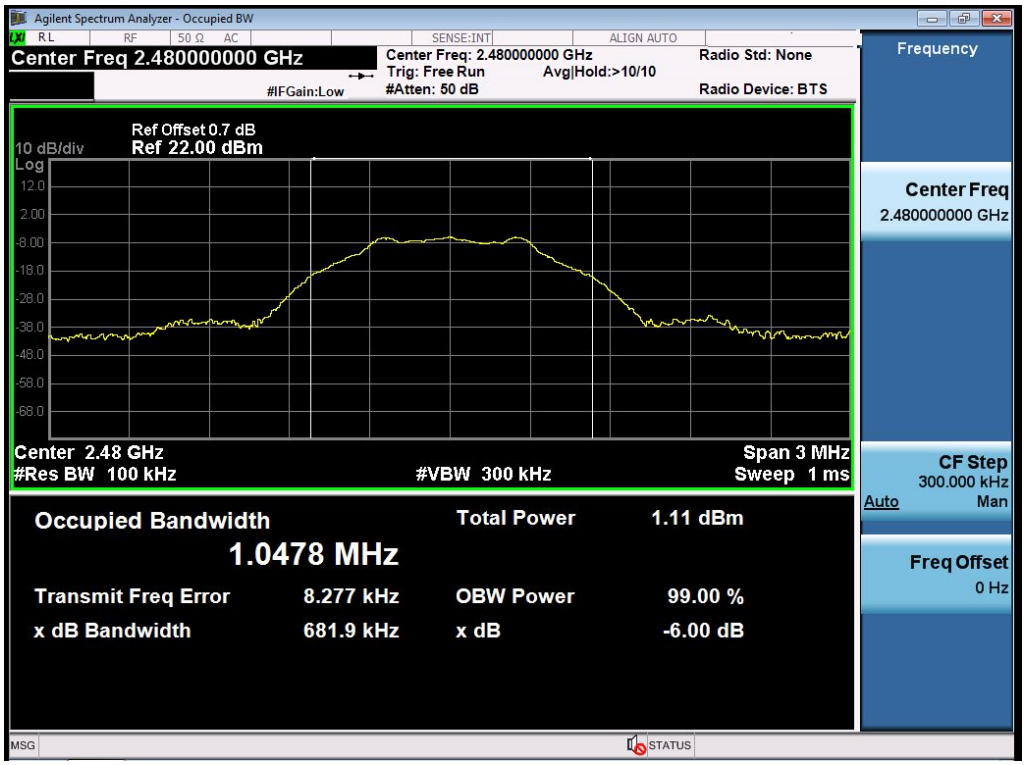
B. Test Plots



(Plot 4.7.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 4.7.1 B: Channel 19: 2440MHz @ GFSK)



(Plot 4.7.1 C: Channel 39: 2480MHz @ GFSK)

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.

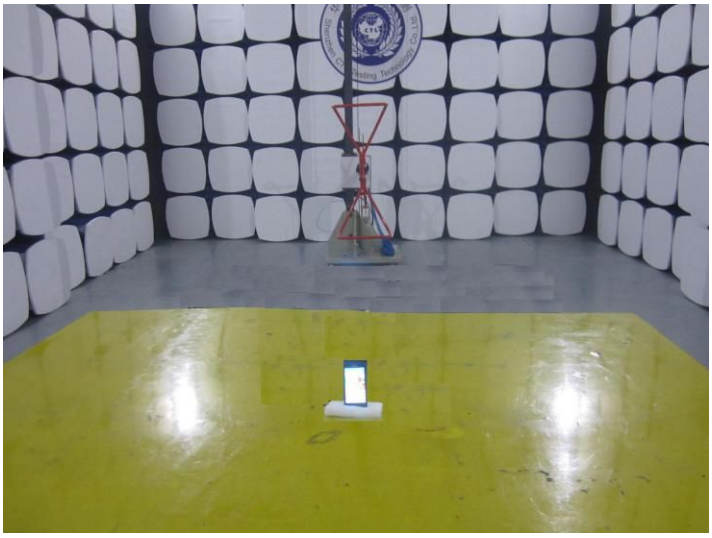
Refer to statement below for compliance

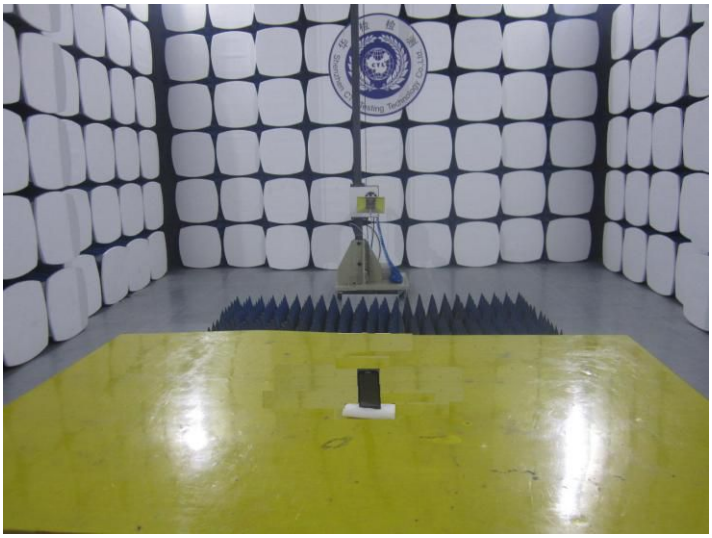
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The WLAN and Bluetooth sharing same antenna and the maximum antenna gain of WLAN uesed was 0.00 dBi.

5. Test Setup Photos of the EUT





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