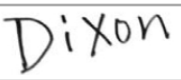
FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**MWR150600504**	
FCC ID.....:	**2AFAP0AX1**	
Compiled by (position+printed name+signature)..:	File administrators Martin Ao	
Supervised by (position+printed name+signature)..:	Test Engineer Yuchao Wang	
Approved by (position+printed name+signature)..:	Manager Dixon Hao	
Date of issue.....:	July 07, 2015	
Representative Laboratory Name .:	**Maxwell International Co., Ltd.**	
Address .....:	Room 509,Hongfacenter 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.....:	**ALPHA EXPORT AND IMPORT CO.,LIMITED**	
Address .....:	Room 4d, Huashang Block, NO.3, Biezhan Road, Shenzhen , China	
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.	

Test item description .....:	Mobile Phone
Trade Mark .....:	ALPHARD
Manufacturer.....:	**ALPHA EXPORT AND IMPORT CO.,LIMITED**
Model/Type reference.....:	AX1
Listed Models .....:	AX2, AX3, AX4, AX5, AX6, AX7, AX8, AX9, AX10
Modulation Type .....:	GFSK
Operation Frequency.....:	From 2402MHz to 2480MHz
Rating .....:	DC 3.70V
Hardware version .....:	S9_V2.3
Software version .....:	S9_72KK_KK_3G_EMMC_32_4_XX_ZXMD_20150604-114737
Result.....:	**PASS**

T E S T R E P O R T

Test Report No. :	MWR150600504	July 07, 2015 Date of issue

Equipment under Test	:	Mobile Phone
Model /Type	:	AX1
Listed Models	:	AX2, AX3, AX4, AX5, AX6, AX7, AX8, AX9, AX10
Applicant	:	**ALPHA EXPORT AND IMPORT CO.,LIMITED**
Address	:	Room 4d, Huashang Block, NO.3, Biezhan Road, Shenzhen , China
Manufacturer	:	**ALPHA EXPORT AND IMPORT CO.,LIMITED**
Address	:	Room 4d, Huashang Block, NO.3, Biezhan Road, 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 C63.10:2009: American National Standard for Testing Unlicensed Wireless Devices

558074 D01 DTS Mesa Guidance v03r03: 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	:	Jun 18, 2015
Testing commenced on	:	Jun 20,2015
Testing concluded on	:	July 07 ,2015

2.2. Product Description

The **ALPHA EXPORT AND IMPORT CO.,LIMITED's** Model: AX1 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	AX1
Serial Number	AX8745B485
Modilation Type	GMSK for GSM/GPRS, 8-PSK for EDGE QPSK for UMTS
Antenna Type	Internal
UMTS Operation Frequency Band	Device supported UMTS Band I/UMTS Band V
WLAN FCC Operation frequency	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz IEEE 802.11n HT40:2422-2452MHz
BT FCC Operation frequency	2402MHz-2480MHz
HSDPA Release Version:	Release 7, CAT14
HSUPA Release Version:	Release 6, CAT6
DC-HSUPA Release Version	Not Supported
WCDMA Release Version	R99
WLAN FCC Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
BT Modulation Type	GFSK (BT 4.0)/GFSK,8DPSK,π/4DQPSK(BT 3.0+EDR)
Hardware version	S9_V2.3
Software version	S9_72KK_KK_3G_EMMC_32_4_XX_ZXMD_20150604-114737
GPS function	Supported
WLAN	Supported 802.11b/802.11g/802.11n
Bluetooth	Supported BT 4.0/BT 3.0+EDR
GSM/EDGE/GPRS	Supported GSM/GPRS/EDGE
GSM/EDGE/GPRS Power Class	GSM850:Power Class 4/PCS1900:Power Class 1
GSM/EDGE/GPRS Operation Frequency	GSM850 :824.2MHz-848.8MHz PCS1900:1850.2MHz-1909.8MHz
GSM/EDGE/GPRS Operation Frequency Band	GSM850/PCS1900/GPRS850/ GPRS1900/EDGE850/EDGE1900
GSM Release Version	R99
GPRS/EDGE Multislot Class	GPRS/EDGE: Multi-slot Class 12
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.00VDC to 4.35VDC (nominal: 3.70VDC)
GPRS operation mode	Class B

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

The application provider specific test software to control sample in continuous TX and RX (Duty Cycle >98%)

For testing meet KDB558074 test requirement.

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 40 channels of EUT, and the test carried out at the lowest channel, middle channel and highest 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

AX1 is subscriber equipment in the UMTS/GSM system. Support HSPA/UMTS frequency band I and band V, only UMTS band V used in USA; The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. 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.

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	3.70VDC	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 continuous 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: ETA-U90JWE
INPUT:100-240V 50/60Hz 0.35A
OUTPUT: DC 5.0V,2 A

*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: 2AFAP0AX1** filing to comply with FCC Part 15.247 Rules

2.10. Modifications

No modifications were implemented to meet testing criteria.

2.11. Note

1. The EUT is a Mobile Phone with UMTS/GSM/GPRS/EDGE, WiFi and Bluetooth function, The functions of the EUT listed as below:

	Test Standards	Reference Report
GSM/GPRS/EDGE	FCC Part 22/FCC Part 24	MWR150600501
WCDMA	FCC Part 22	MWR150600502
Bluetooth	FCC Part 15 C 15.247	MWR150600503
BLE	FCC Part 15 C 15.247	MWR150600504
WiFi	FCC Part 15 C 15.247	MWR150600505
USB Port	FCC Part 15 B	MWR150600506
SAR	FCC Part 2 §2.1093	MWR150600507

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. Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(e)	Power spectral density	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(a)(1)	Spectrum bandwidth – 6 dB bandwidth	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(b)(1)	Maximum output power	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	Band edge compliance conducted	GFSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.205	Band edge compliance radiated	GFSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions conducted	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions radiated	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies
§15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

3.6. Test Conditions

Test Case	Test Conditions	
	Configuration	Description
DTS (6 dB) Bandwidth	Measurement Method	FCC KDB 558074 §8.2 Option 2
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Maximum Peak Conducted Output Power	Measurement Method	FCC KDB 558074§9.1.2
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Maximum Power Spectral Density Level	Measurement Method	FCC KDB 558074 §10.2 (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§11.0
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§12.2, Conducted

Frequency Bands (Conducted)		(antenna-port).
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch00 TM1_ Ch19 TM1_ Ch39
Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§12.1,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.

3.7. Equipments Used during the Test

AC Power Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	LISN	R&S	ENV216	3560.6550.12	2015/06/02
2	LISN	R&S	ESH2-Z5	860014/010	2015/06/02
3	EMI Test Receiver	R&S	ESCI	103710	2015/06/02
4	Transient Limiter	SCHWARZCECK	VTSD 9561F	9666	2015/06/02
5	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
6	Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2015/05/20

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2015/06/02
2	EMI TEST Receivcer	R&S	ESCI	103710	2015/06/02
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	2015/05/19
6	Loop Antenna	Daze	ZN30900A	N/A	2015/05/19
7	Horn Antenna	ShwarzBeck	BBHA9170	25841	2015/05/19
8	Amplifer	HP	8349B	3008A02306	2015/05/19
9	Preamplifier	HP	8447D	2944A10176	2015/05/19
10	Spectrum Analyzer	Agilent	E4407B	MY41440676	2015/05/21
11	Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	2015/05/21
15	Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2015/05/21

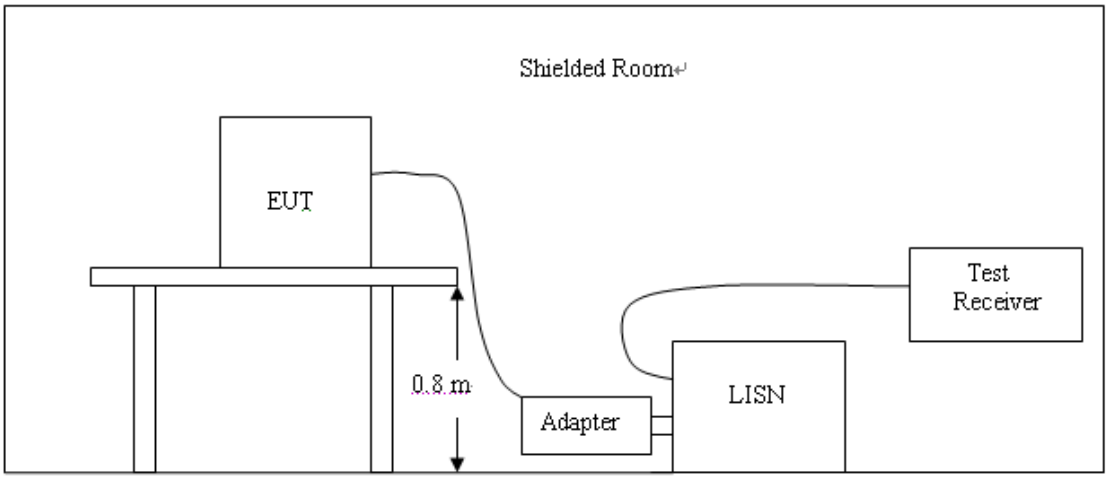
Maximum Peak Output Power / 20dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Power meter	Rohde & Schwarz	NRVD	260540	2015/07/02
2	Power Sensor	Rohde&Schwarz	NRR-Z81	256697	2015/07/02
3	Coaxial Cables	WK CE Cable	N/A	N/A	2014/10/19
4	The temporary antenna connector	MMCX - SMA	1547	23657478	2014/10/19
5	Cable	MURATA	MM8430-2610	11548	2014/10/19

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 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

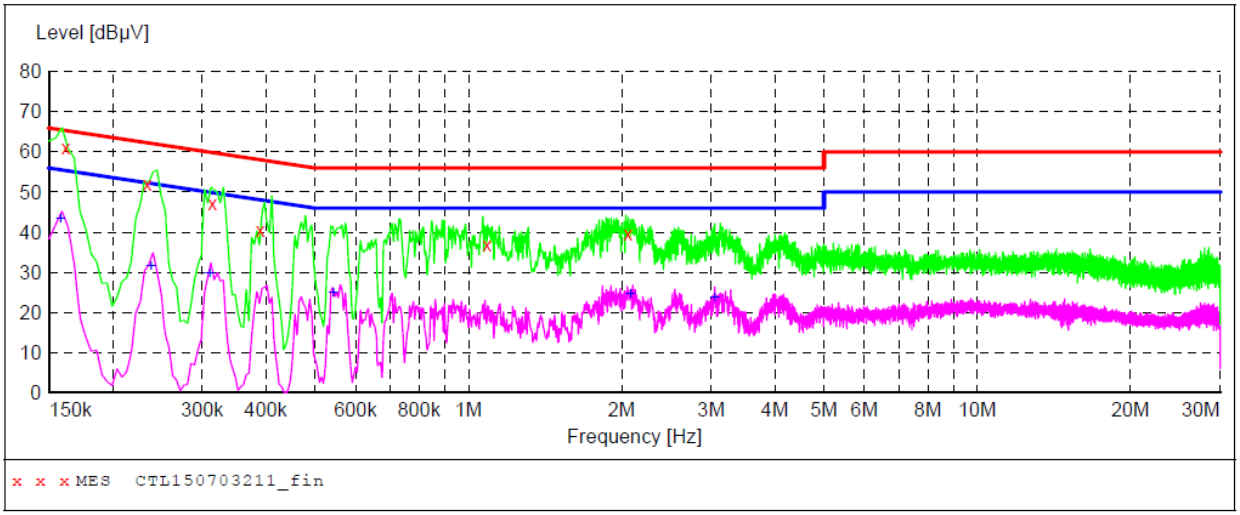
* Decreasing linearly with the logarithm of the frequency

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: "CTL150703211_fin"

7/3/2015 7:30PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.162000	61.00	9.9	65	4.4	QP	N	GND
0.234000	52.00	9.9	62	10.3	QP	N	GND
0.314000	47.10	9.9	60	12.8	QP	N	GND
0.390000	40.50	9.9	58	17.6	QP	N	GND
1.088000	36.90	10.2	56	19.1	QP	N	GND
2.060000	39.60	10.4	56	16.4	QP	N	GND

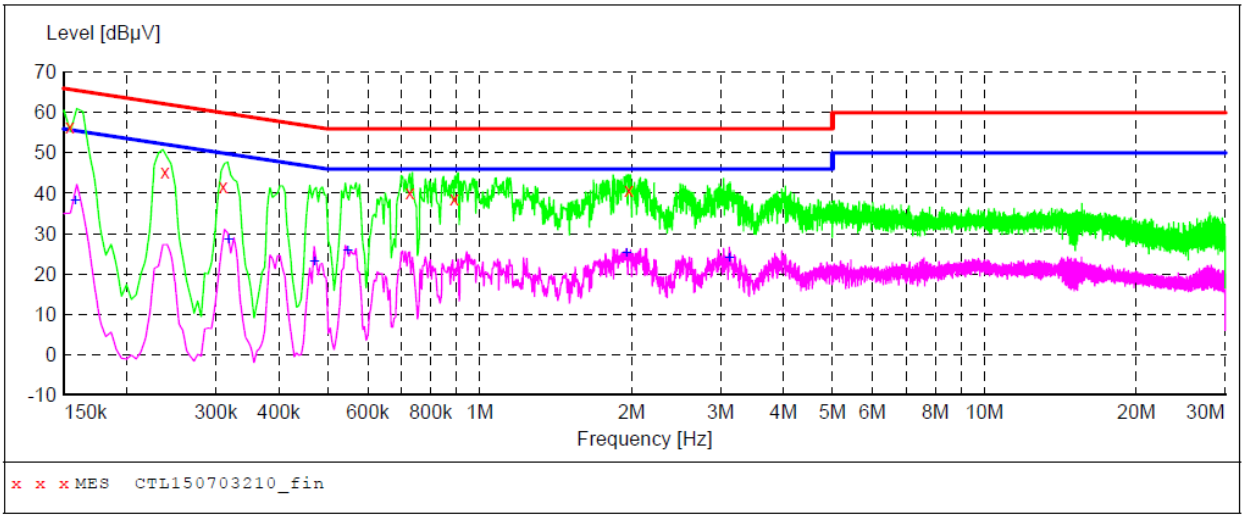
MEASUREMENT RESULT: "CTL150703211_fin2"

7/3/2015 7:30PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	43.60	9.9	56	12.0	AV	N	GND
0.238000	31.70	9.9	52	20.5	AV	N	GND
0.310000	30.00	9.9	50	20.0	AV	N	GND
0.542000	25.10	9.9	46	20.9	AV	N	GND
2.084000	24.80	10.4	46	21.2	AV	N	GND
3.050000	23.90	10.5	46	22.1	AV	N	GND

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL150703210_fin"

7/3/2015 7:25PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154000	56.60	9.9	66	9.2	QP	L1	GND
0.238000	45.40	9.9	62	16.8	QP	L1	GND
0.310000	41.80	9.9	60	18.2	QP	L1	GND
0.728000	40.20	10.0	56	15.8	QP	L1	GND
0.890000	38.70	10.1	56	17.3	QP	L1	GND
1.976000	40.80	10.4	56	15.2	QP	L1	GND

MEASUREMENT RESULT: "CTL150703210_fin2"

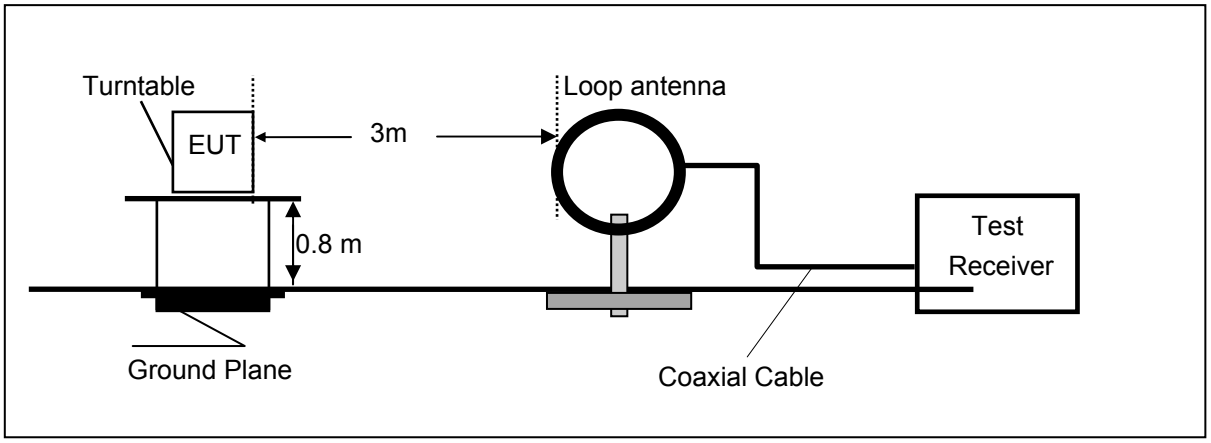
7/3/2015 7:25PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	38.40	9.9	56	17.2	AV	L1	GND
0.318000	28.80	9.9	50	21.0	AV	L1	GND
0.470000	23.10	9.9	47	23.4	AV	L1	GND
0.548000	26.10	9.9	46	19.9	AV	L1	GND
1.952000	25.20	10.4	46	20.8	AV	L1	GND
3.122000	24.10	10.5	46	21.9	AV	L1	GND

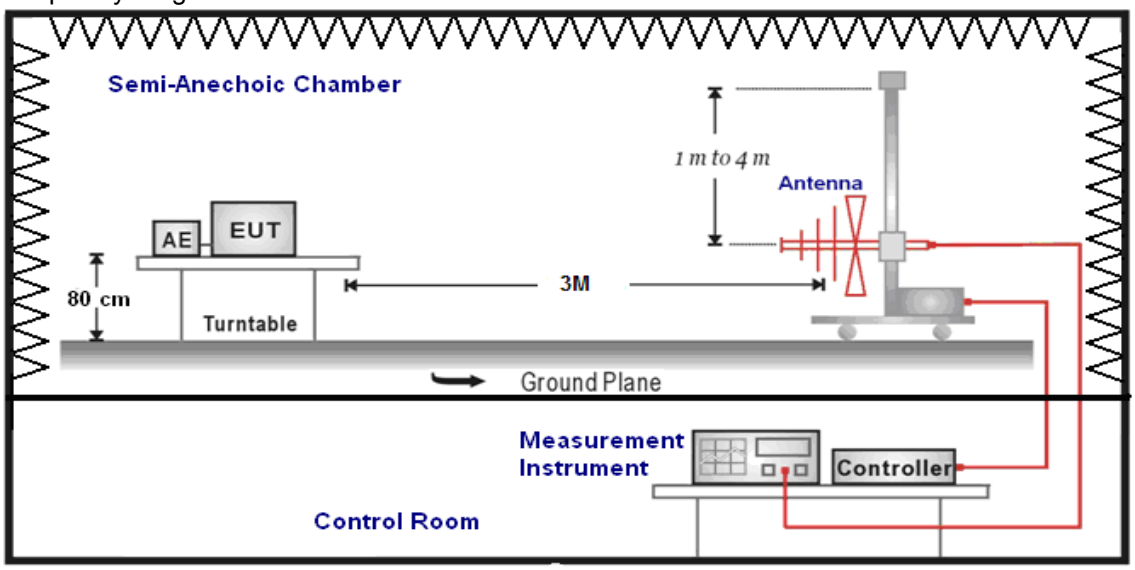
4.2. Radiated Emission

TEST CONFIGURATION

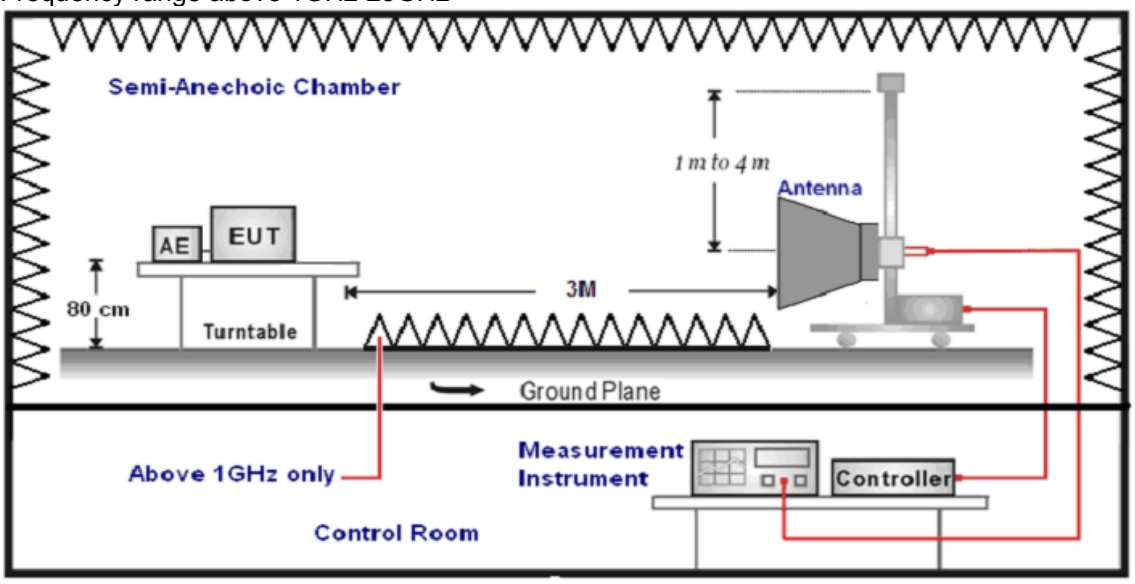
Frequency range 9 KHz – 30MHz



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.
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. For the radiated emission test above 1GHz:
   Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measurements have been completed.
6. The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz..
7. 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 Anternna	3

8. 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	Peak
	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	

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.

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)).

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

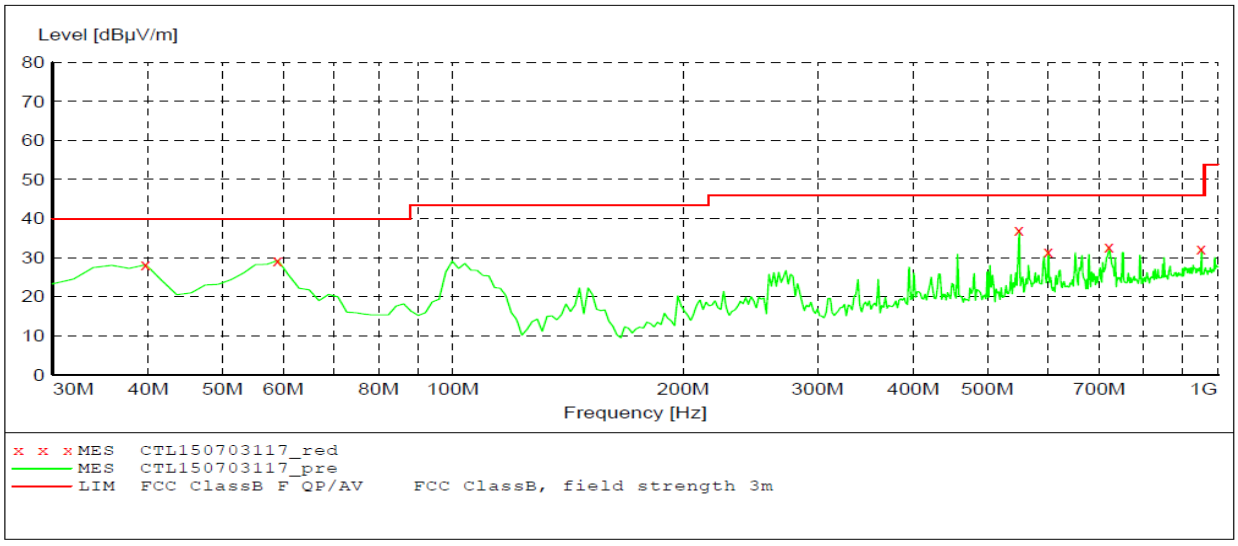
Remark:
1. The radiated measurement are performed the each channel (low/mid/high), the datum recorded below (the middle channel) is the worst case for all test channels.
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. We 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.
6. Margin= Limit - Level

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
13.54	43.59	69.54	25.95	QP	PASS
22.41	44.18	69.54	25.36	QP	PASS

For 30MHz to 1000MHz

Polarization	*Vertical*

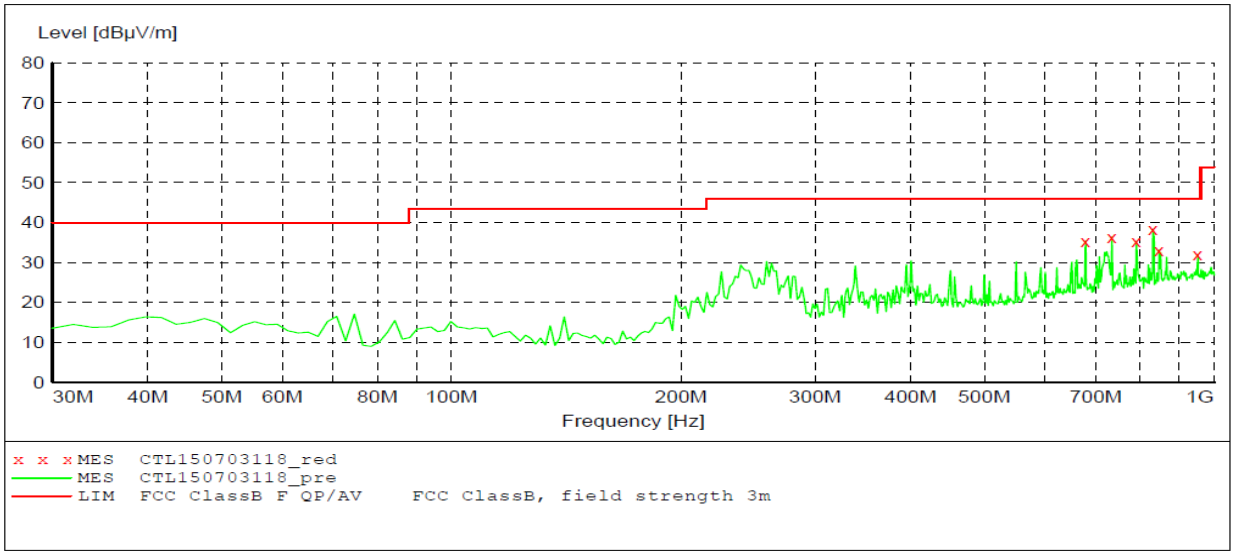


MEASUREMENT RESULT: "CTL150703117_red"

7/3/2015 3:10PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
39.700000	28.20	-16.1	40.0	11.8	---	100.0	0.00	VERTICAL
59.100000	29.30	-16.8	40.0	10.7	---	100.0	245.00	VERTICAL
549.920000	37.00	-9.5	46.0	9.0	---	100.0	57.00	VERTICAL
600.360000	31.60	-7.9	46.0	14.4	---	100.0	149.00	VERTICAL
720.640000	32.60	-6.8	46.0	13.4	---	100.0	102.00	VERTICAL
951.500000	32.20	-4.2	46.0	13.8	---	100.0	0.00	VERTICAL

Polarization	Horizontal



MEASUREMENT RESULT: "CTL150703118_red"

7/3/2015 3:14PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
677.960000	35.40	-7.4	46.0	10.6	---	100.0	145.00	HORIZONTAL
734.220000	36.40	-6.3	46.0	9.6	---	300.0	161.00	HORIZONTAL
790.480000	35.30	-5.8	46.0	10.7	---	100.0	158.00	HORIZONTAL
831.220000	38.30	-5.4	46.0	7.7	---	100.0	70.00	HORIZONTAL
846.740000	33.10	-5.1	46.0	12.9	---	100.0	166.00	HORIZONTAL
951.500000	32.00	-4.2	46.0	14.0	---	100.0	328.00	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)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2402.00	88.78	PK	--	25.22	55.38	28.78	4.61	0.00	33.40
2	2402.00	77.87	AV	--	16.13	44.47	28.78	4.61	0.00	33.40
3	2390.00	36.25	PK	74.00	37.75	2.93	28.72	4.60	0.00	33.32
4	2390.00	--	AV	54.00	--	--	--	--	--	--
5	2400.00	39.52	PK	74.00	34.48	6.13	28.78	4.61	0.00	33.39
6	2400.00	--	AV	54.00	--	--	--	--	--	--
7	4804.00	48.26	PK	74.00	25.74	43.75	33.49	6.91	35.89	4.51
8	4804.00	--	AV	54.00	--	--	--	--	--	--
9	7206.00	43.25	PK	74.00	30.75	32.14	36.95	9.18	35.03	11.11
10	7206.00	--	AV	54.00	--	--	--	--	--	--

ANTENNA POLARITY & TEST DISTANCE: VERTICAI AT 3 M										
No.	Frequency (MHz)	Emssion 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)
1	2402.00	89.26	PK	--	24.74	55.86	28.78	4.61	0.00	33.40
2	2402.00	80.14	AV	--	13.86	46.74	28.78	4.61	0.00	33.40
3	2390.00	35.64	PK	74.00	38.36	2.32	28.72	4.60	0.00	33.32
4	2390.00	--	AV	54.00	--	--	--	--	--	--
5	2400.00	40.26	PK	74.00	33.74	6.87	28.78	4.61	0.00	33.39
6	2400.00	--	AV	54.00	--	--	--	--	--	--
7	4804.00	47.26	PK	74.00	26.74	42.75	33.49	6.91	35.89	4.51
8	4804.00	--	AV	54.00	--	--	--	--	--	--
9	7206.00	42.74	PK	74.00	31.26	31.63	36.95	9.18	35.03	11.11
10	7206.00	--	AV	54.00	--	--	--	--	--	--

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.

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)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2440.00	88.74	PK	--	--	55.23	28.85	4.65	0.00	33.51
2	2440.00	79.87	AV	--	--	46.36	28.85	4.65	0.00	33.51
3	4880.00	45.42	PK	74.00	28.58	39.17	33.60	6.95	34.30	6.25
4	4880.00	--	AV	54.00	--	--	--	--	--	--
5	7320.00	43.60	PK	74.00	30.4	29.82	37.46	9.23	32.91	13.78
6	7320.00	--	AV	54.00	--	--	--	--	--	--

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
No.	Frequency (MHz)	Emssion 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)
1	2440.00	89.63	PK	--	--	56.12	28.85	4.65	0.00	33.51
2	2440.00	80.26	AV	--	--	46.75	28.85	4.65	0.00	33.51
3	4880.00	45.45	PK	74.00	28.55	39.20	33.60	6.95	34.30	6.25
4	4880.00	--	AV	54.00	--	--	--	--	--	--
5	7320.00	42.36	PK	74.00	31.64	28.58	37.46	9.23	32.91	13.78
6	7320.00	--	AV	54.00	--	--	--	--	--	--

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.

High Channel @ Channel 39 @ 2480 MHz

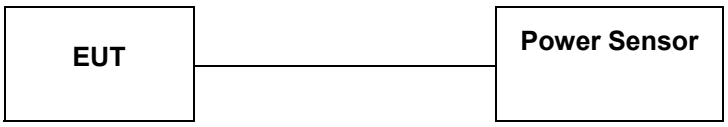
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2480.00	88.84	PK	--	--	55.22	28.92	4.70	0.00	33.62
2	2480.00	77.78	AV	--	--	44.16	28.92	4.70	0.00	33.62
3	2483.50	37.26	PK	74.00	36.74	3.63	28.93	4.70	0.00	33.63
4	2483.50	--	AV	54.00	--	--	--	--	--	--
5	2500.00	42.50	PK	74.00	31.5	8.82	28.96	4.72	0.00	33.68
6	2500.00	--	AV	54.00	--	--	--	--	--	--
7	4960.00	48.32	PK	74.00	25.68	43.57	33.49	6.91	35.65	4.75
8	4960.00	--	AV	54.00	--	--	--	--	--	--
9	7440.00	42.41	PK	74.00	31.59	31.30	36.95	9.18	35.03	11.11
10	7440.00	--	AV	54.00	--	--	--	--	--	--

ANTENNA POLARITY & TEST DISTANCE: VERTICAl AT 3 M										
No.	Frequency (MHz)	Emssion 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)
1	2480.00	89.99	PK	--	--	56.37	28.92	4.70	0.00	33.62
2	2480.00	80.85	AV	--	--	47.23	28.92	4.70	0.00	33.62
3	2483.50	36.65	PK	74.00	37.35	3.02	28.93	4.70	0.00	33.63
4	2483.50	--	AV	54.00	--	--	--	--	--	--
5	2500.00	40.24	PK	74.00	33.76	6.56	28.96	4.72	0.00	33.68
6	2500.00	--	AV	54.00	--	--	--	--	--	--
7	4960.00	47.30	PK	74.00	26.7	42.38	33.84	7.00	35.92	4.92
8	4960.00	--	AV	54.00	--	--	--	--	--	--
9	7440.00	42.44	PK	74.00	31.56	30.49	37.64	9.28	34.97	11.95
10	7440.00	--	AV	54.00	--	--	--	--	--	--

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 558074 D01 DTS Meas Guidance v03r03 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

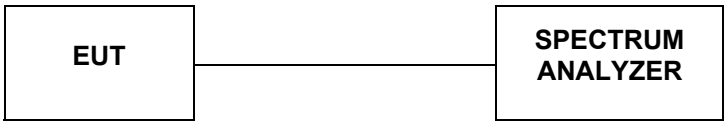
A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	-3.34	30	PASS
19	2440	-3.25	30	PASS
39	2480	-3.46	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

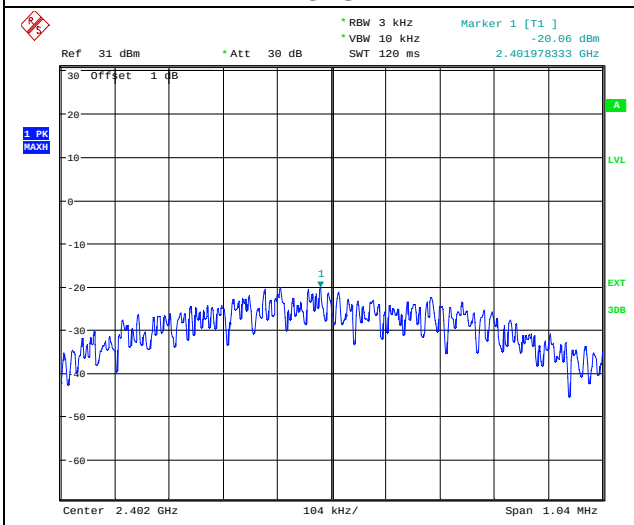
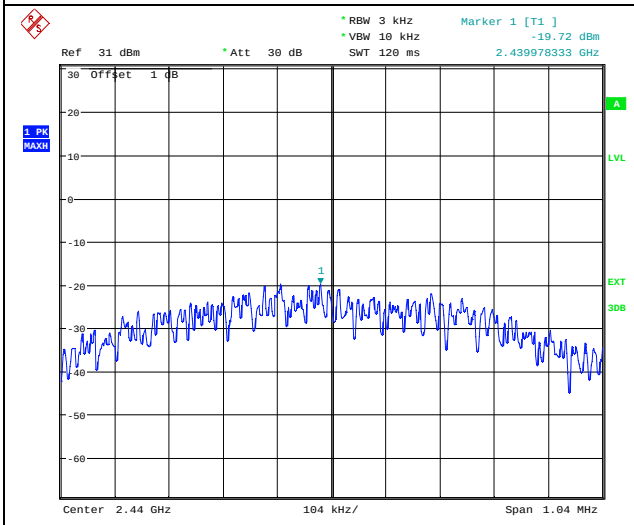
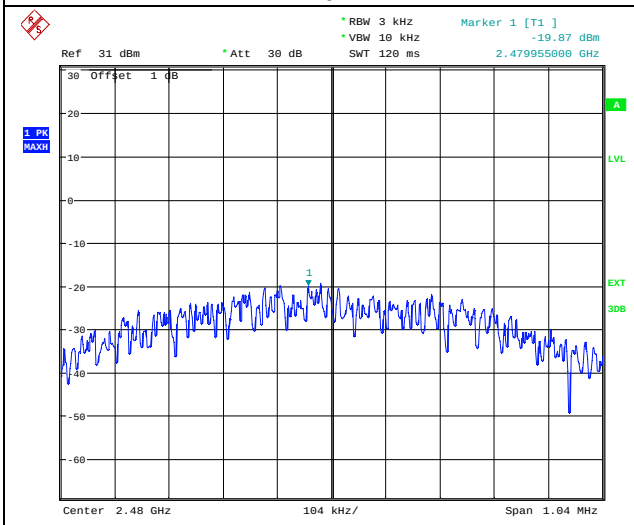
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST RESULTS

A. Test Verdict

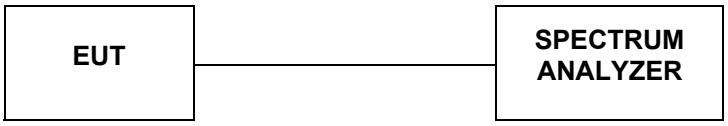
Channel	Frequency (MHz)	Report PSD (dBm/3kHz)	Limits (dBm/3KHz)	Verdict
00	2402	-20.06	8	PASS
19	2440	-19.72	8	PASS
39	2480	-19.87	8	PASS

Remark:
1.The test results including the cable lose.
2. Test plots for next page.

Power Spectral Density	
GFSK	
	
2402 MHz	2402 MHz
	
2440 MHz	2440 MHz
	
2480 MHz	2480 MHz

4.5. 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 9KHz 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.

Conducted Spurious Emission				
Channel	**Frequency (MHz)**	**Frequency Range**	**Limit (dBc)**	**Verdict**
00	2402	30MHz-3GHz	-20	PASS
		3GHz-15GHz	-20	PASS
		15GHz-25GHz	-20	PASS
19	2440	30MHz-3GHz	-20	PASS
		3GHz-15GHz	-20	PASS
		15GHz-25GHz	-20	PASS
39	2480	30MHz-3GHz	-20	PASS
		3GHz-15GHz	-20	PASS
		15GHz-25GHz	-20	PASS

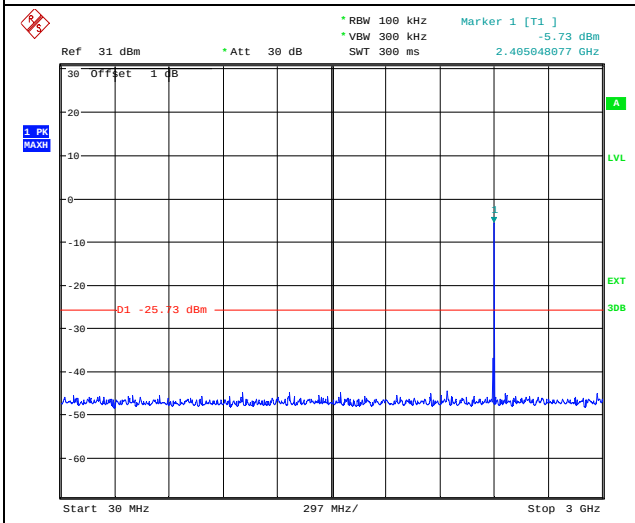
Conducted Bandedge		
	Limit (dBc)	**Verdict**
Lower Bandedge	-20	PASS
Upper Bandedge	-20	PASS

Remark:
1. We tested conducted spurious from 9KHz to 10th harmonic of the carrier frequency, and only recorded from 30MHz to 10th harmonic of the carrier frequency.
2. The test results including the cable lose.
3. Test plots for next page.

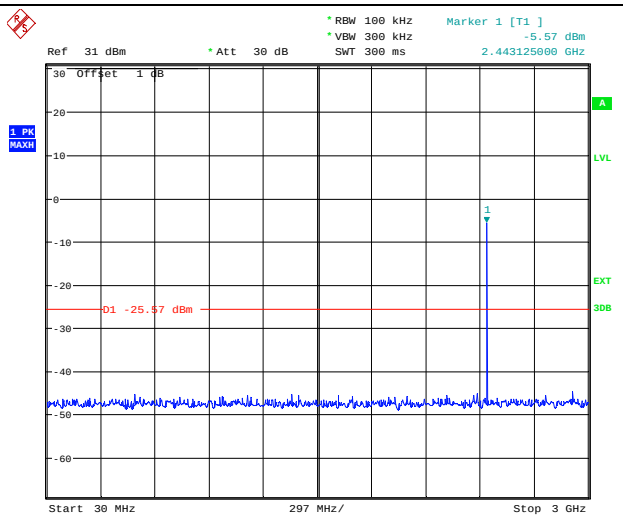
Conducted Spurious Emission

GFSK

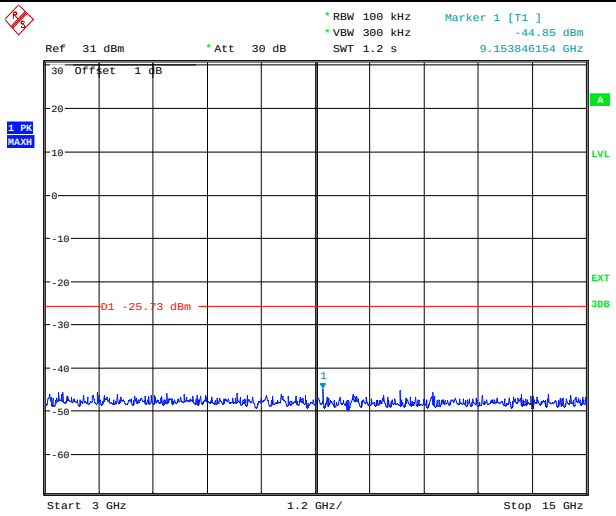
Lower Channel



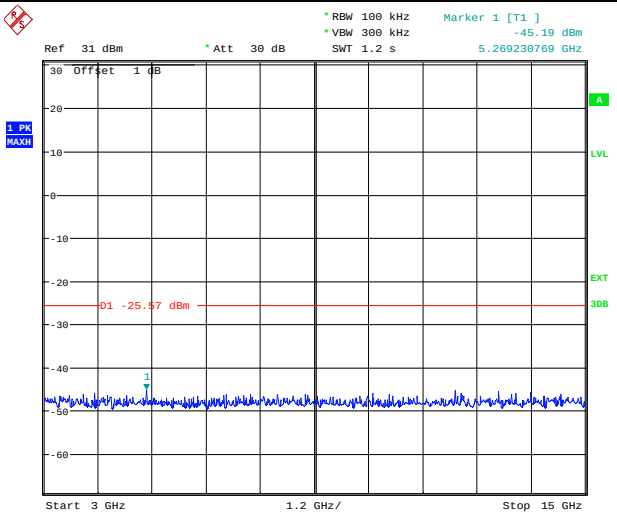
Middle Channel



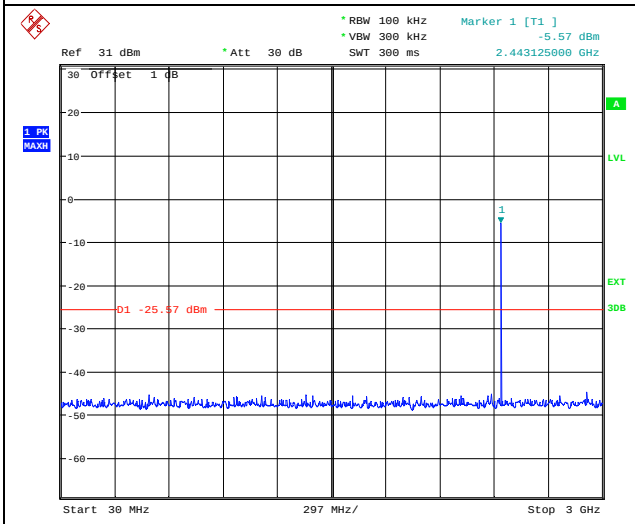
30MHz-3GHz



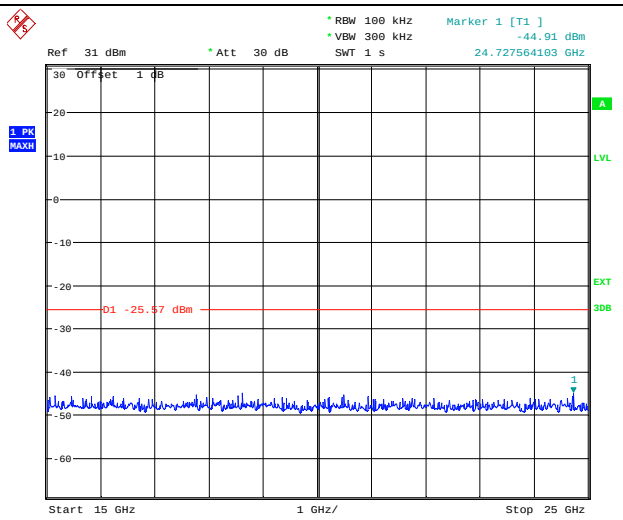
30MHz-3GHz



3GHz-15GHz

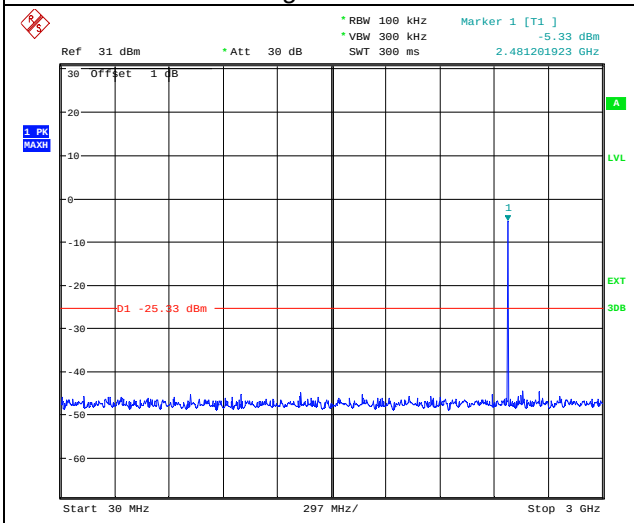
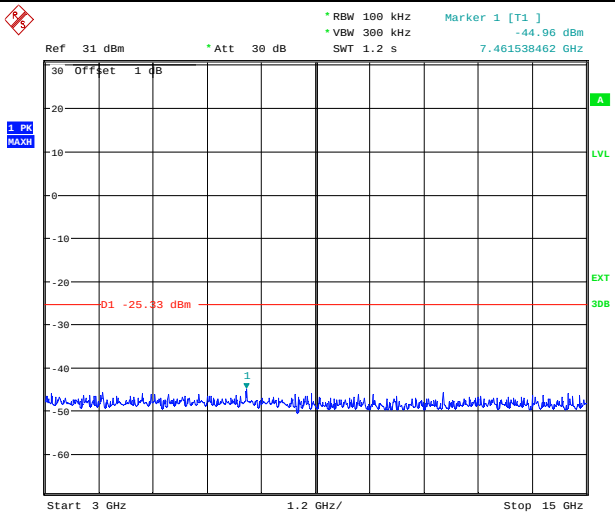
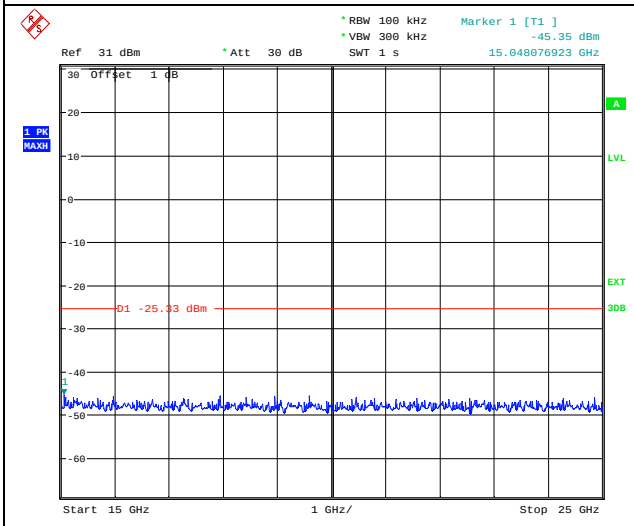


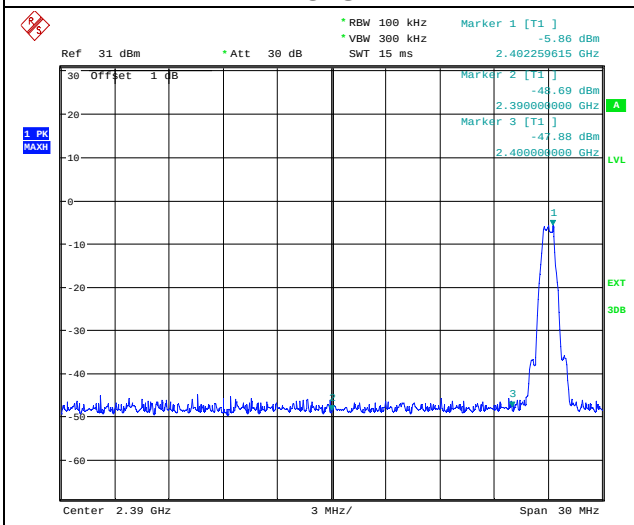
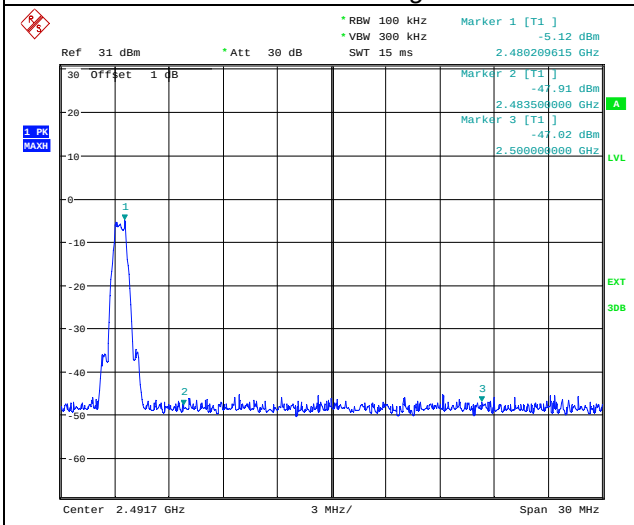
3GHz-15GHz



15GHz-25GHz

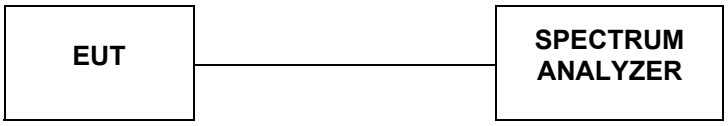
15GHz-25GHz

Conducted Spurious Emission	
GFSK	
High Channel	
	
30MHz-3GHz	30MHz-3GHz
	
3GHz-15GHz	3GHz-15GHz
	
15GHz-25GHz	15GHz-25GHz

Conducted Bandedge	
GFSK	
	
Lower Bandedge	Lower Bandedge
	
Upper Bandedge	Upper Bandedge

4.6. 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.

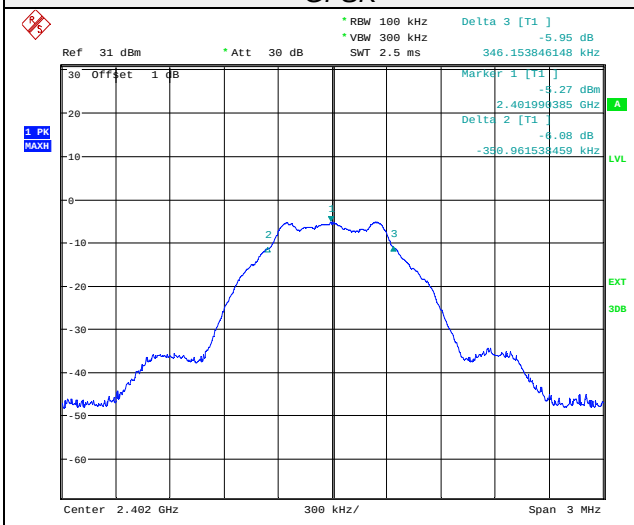
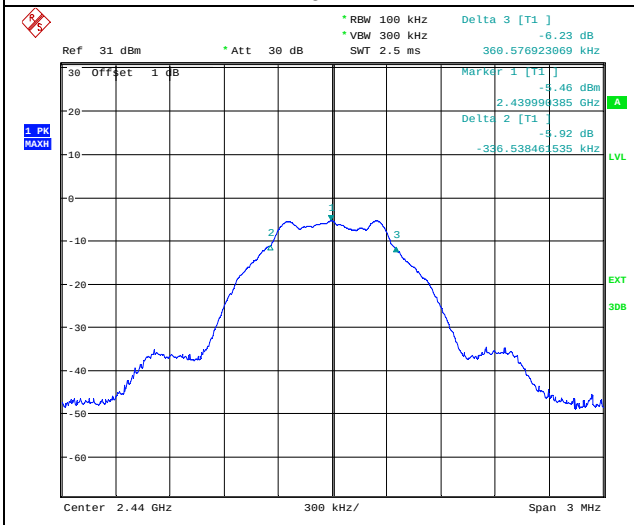
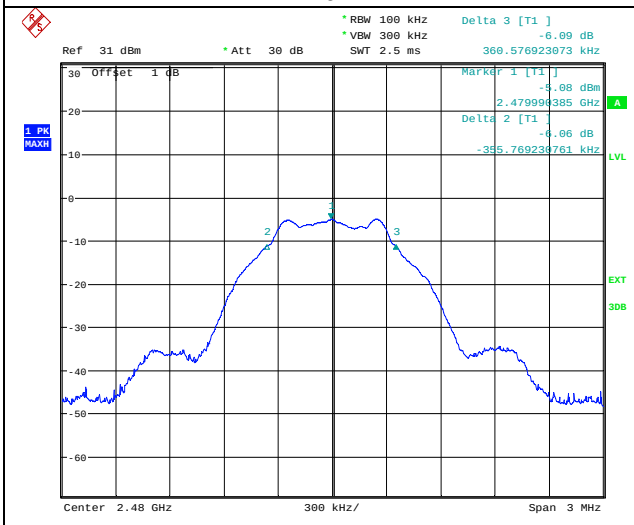
LIMIT

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

TEST RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits (kHz)	Verdict
00	2402	0.697	≥500	PASS
19	2440	0.697	≥500	PASS
39	2480	0.716	≥500	PASS

Remark:
1. The test results including the cable lose.
2. Test plots for next page.

6dB Bandwidth	
GFSK	
	
2402 MHz	2402 MHz
	
2440 MHz	2440 MHz
	
2480 MHz	2480 MHz

4.7. 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 maximum gain of Bluetooth antenna was -0.47dBi and it is a FPC ANT.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

FCC	IC
Antenna Gain	
6 dBi	

Results

T_{nom}	V_{nom}	Lowest Channel 2402 MHz	Middle Channel 2440 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		-3.29	-3.22	-3.53
Radiated power [dBm] Measured with GFSK modulation		-3.98	-3.74	-4.33
Gain [dBi] Calculated		-0.69	-0.52	-0.80
Measurement uncertainty		± 0.6 dB (cond.) / ± 2.56 dB (rad.)		

5. Test Setup Photos of the EUT

Please refer to separated files for Test Setup Photos of the EUT.

6. External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

7. Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

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