FCC Radio Test Report

FCC ID: 2AYRI-CS55943T

Original Grant

Report No.	:	TB-FCC178049
Applicant	:	Zhuhai Canshuo Technology Co. LTD
Equipment Under Test (EUT)		
EUT Name	:	Baby Monitor
Model No.	:	CS55943T
Series Model No.	:	CS55943TT/R
Brand Name	:	CANSHUO
Sample ID	:	20201217-10-1#
Receipt Date	:	2020-12-24
Test Date	:	2020-12-25 to 2021-01-21
Issue Date	:	2021-01-21
Standards	:	FCC Part 15, Subpart C 15.247
Test Method	:	ANSI C63.10: 2013
Conclusions	:	**PASS**

In the configuration tested, the EUT complied with the standards specified above,

The EUT technically complies with the FCC requirements

Test/Witness Engineer	:	Rebeca
Engineer Supervisor	:	Ivan Su
Engineer Manager	:	Ray Lai

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, China
Tel: +86 75526509301 Fax: +86 75526509195

Contents

//
CONTENTS....2
1. GENERAL INFORMATION ABOUT EUT....5
1.1 Client Information....5
1.2 General Description of EUT (Equipment Under Test)....5
1.3 Block Diagram Showing the Configuration of System Tested....6
1.4 Description of Support Units....6
1.5 Description of Test Mode....7
1.6 Description of Test Software Setting....8
1.7 Measurement Uncertainty....8
1.8 Test Facility....9
2. TEST SUMMARY....10
3. TEST SOFTWARE....10
4. TEST EQUIPMENT....11
5. CONDUCTED EMISSION TEST....12
5.1 Test Standard and Limit....12
5.2 Test Setup....12
5.3 Test Procedure....13
5.4 Deviation From Test Standard....13
5.5 EUT Operating Mode....13
5.6 Test Data....13
6. RADIATED EMISSION TEST....14
6.1 Test Standard and Limit....14
6.2 Test Setup....15
6.3 Test Procedure....16
6.4 Deviation From Test Standard....17
6.5 EUT Operating Condition....17
6.6 Test Data....17
7. RESTRICTED BANDS AND BAND-EDGE TEST....18
7.1 Test Standard and Limit....18
7.2 Test Setup....18
7.3 Test Procedure....19
7.4 Deviation From Test Standard....19
7.5 EUT Operating Condition....19
7.6 Test Data....19
8. NUMBER OF HOPPING CHANNEL....20
8.1 Test Standard and Limit....20
8.2 Test Setup....20
8.3 Test Procedure....20

8.4 Deviation From Test Standard 20
8.5 EUT Operating Condition 20
8.6 Test Data 20
9. AVERAGE TIME OF OCCUPANCY 21
9.1 Test Standard and Limit 21
9.2 Test Setup 21
9.3 Test Procedure 21
9.4 EUT Operating Condition 21
9.4 Deviation From Test Standard 21
9.5 Test Data 21
10. CHANNEL SEPARATION AND BANDWIDTH TEST 22
10.1 Test Standard and Limit 22
10.2 Test Setup 22
10.3 Test Procedure 22
10.4 Deviation From Test Standard 22
10.5 EUT Operating Condition 22
10.6 Test Data 22
11. PEAK OUTPUT POWER TEST 23
11.1 Test Standard and Limit 23
11.2 Test Setup 23
11.3 Test Procedure 23
11.4 Deviation From Test Standard 23
11.5 EUT Operating Condition 23
11.6 Test Data 23
12. ANTENNA REQUIREMENT 24
12.1 Standard Requirement 24
12.2 Deviation From Test Standard 24
12.3 Antenna Connected Construction 24
12.4 Result 24
ATTACHMENT A-- CONDUCTED EMISSION TEST DATA 25
ATTACHMENT B-- RADIATED EMISSION TEST DATA 27
ATTACHMENT C-- RESTRICTED BANDS REQUIREMENT TEST DATA 32
ATTACHMENT D-- NUMBER OF HOPPING CHANNEL TEST DATA 38
ATTACHMENT E-- AVERAGE TIME OF OCCUPANCY TEST DATA 39
ATTACHMENT F-- CHANNEL SEPARATION AND BANDWIDTH TEST DATA 41
ATTACHMENT G-- PEAK OUTPUT POWER TEST DATA 45

Revision History

Report No.	Version	Description	Issued Date
TB-FCC178049	Rev.01	Initial issue of report	2021-01-21

1. General Information about EUT

1.1 Client Information

Applicant	:	Zhuhai Canshuo Technology Co. LTD
Address	:	Room 1006, Building 2, Tianlang Haifeng, Nanping Town, Xiangzhou District, Zhuhai city, Guangdong Province, China
Manufacturer	:	Zhongshan Jesmay Electronics Co., Ltd.
Address	:	No.1 Industry District, Tan Zhou Town, Zhong Shan City, Guangdong, China

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	Baby Monitor	
Models No.	:	CS55943T, CS55943TT/R	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is Model name.	
Product Description	:	Operation Frequency:	2406MHz~2475MHz
		Number of Channel:	24 Channels See Note 2
		Max Peak Output Power:	18.543dBm
		Antenna Gain:	3dBi Dipole Antenna
		Modulation Type:	GFSK (4Mbps)
Power Rating	:	Adapter(ZD5C050100USW) Input: 100-240V~, 50/60Hz, 0.2A MAX Output: DC 5V 1000mA	
Software Version	:	VC 0902	
Hardware Version	:	I	
Remark	:	The adapter and antenna gain provided by the applicant, the verified for the RF conduction test provided by TOBY test lab.	

Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

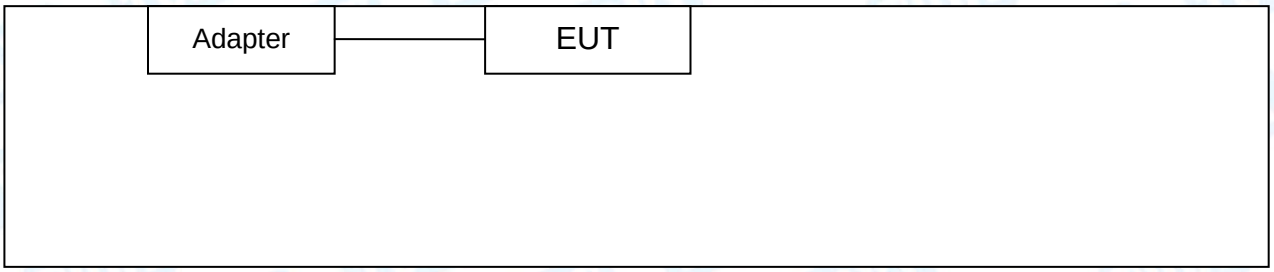
(2) Channel List:

Channel List					
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
01	2406	09	2430	17	2454
02	2409	10	2433	18	2457
03	2412	11	2436	19	2460
04	2415	12	2439	20	2463
05	2418	13	2442	21	2466
06	2421	14	2445	22	2469
07	2424	15	2448	23	2472
08	2427	16	2451	24	2475
Note: Test frequencies are lowest channel: 2406 MHz, middle channel: 2442 MHz and highest channel: 2475 MHz.					

(3) The Antenna information about the equipment is provided by the applicant.

1.3 Block Diagram Showing the Configuration of System Tested

Adapter & TX Mode



1.4 Description of Support Units

The EUT has been tested as an independent unit.

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Conducted Test	
Final Test Mode	**Description**
Mode 1	Adapter+ TX Mode

For Radiated Test	
Final Test Mode	**Description**
Mode 1	TX GFSK Mode
Mode 2	TX Mode(GFSK) Channel 01/13/24

Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate. We have pretested all the test modes above.
According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:
TX Mode: GFSK (4Mbps)

(2) The EUT is considered a Mobile unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on X-plane as the normal use. Therefore only the test data of this X-plane was used for radiated emission measurement test.

1.6 Description of Test Software Setting

During testing channel power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Bluetooth mode.

Test Software Version	Control by pressing the button		
Frequency	2406 MHz	2442 MHz	2475 MHz
GFSK	DEF	DEF	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %.

Test Item	**Parameters**	**Expanded Uncertainty (U_{Lab})**
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	±3.50 dB ±3.10 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.50 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025：2017 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01. FCC Accredited Test Site Number: 854351. Designation Number: CN1223.

IC Registration No.: (11950A)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A.

2. Test Summary

FCC Part 15 Subpart C(15.247)/ RSS 247 Issue 2					
Standard Section		Test Item	Test Sample(s)	Judgment	Remark
FCC	IC				
15.203		Antenna Requirement	20201217-10-1#	PASS	N/A
15.207	RSS-GEN 7.2.2	Conducted Emission	20201217-10-1#	PASS	N/A
15.205	RSS-Gen 7.2.3	Restricted Bands	20201217-10-1#	PASS	N/A
15.247(a)(1)	RSS 247 5.1 (2)	Hopping Channel Separation	20201217-10-1#	PASS	N/A
15.247(a)(1)	RSS 247 5.1 (4)	Dwell Time	20201217-10-1#	PASS	N/A
15.247(b)(1)	RSS 247 5.4 (2)	Peak Output Power	20201217-10-1#	PASS	N/A
15.247(b)(1)	RSS 247 5.1 (4)	Number of Hopping Frequency	20201217-10-1#	PASS	N/A
15.247(d)	RSS 247 5.5	Band Edge	20201217-10-1#	PASS	N/A
15.247(c)& 15.209	RSS 247 5.5	Radiated Spurious Emission	20201217-10-1#	PASS	N/A
15.247(a)	RSS 247 5.1 (1)	99% Occupied Bandwidth & 20dB Bandwidth	20201217-10-1#	PASS	N/A
Note: N/A is an abbreviation for Not Applicable.					

3. Test Software

Test Item	Test Software	Manufacturer	Version No.
Conducted Emission	EZ-EMC	EZ	CDI-03A2
Radiation Emission	EZ-EMC	EZ	FA-03A2RE
RF Conducted Measurement	MTS-8310	MWRFtest	V2.0.0.0

4. Test Equipment

Conducted Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 06, 2020	Jul. 05, 2021
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 06, 2020	Jul. 05, 2021
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 06, 2020	Jul. 05, 2021
LISN	Rohde & Schwarz	ENV216	101131	Jul. 06, 2020	Jul. 05, 2021
Radiation Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 06, 2020	Jul. 05, 2021
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 06, 2020	Jul. 05, 2021
Spectrum Analyzer	Rohde & Schwarz	FSVR	102197	Jul. 06, 2020	Jul. 05, 2021
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	BBHA 9170	BBHA9170582	Mar.01, 2020	Feb. 28, 2022
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jul. 07, 2020	Jul. 06, 2021
Pre-amplifier	Sonoma	310N	185903	Mar.01, 2020	Feb. 28, 2021
Pre-amplifier	HP	8449B	3008A00849	Mar.01, 2020	Feb. 28, 2021
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.01, 2020	Feb. 28, 2021
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 06, 2020	Jul. 05, 2021
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 06, 2020	Jul. 05, 2021
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Sep. 11, 2020	Sep. 10, 2021
Vector Signal Generator	Agilent	N5182A	MY50141294	Sep. 11, 2020	Sep. 10, 2021
Analog Signal Generator	Agilent	N5181A	MY50141953	Sep. 11, 2020	Sep. 10, 2021
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Sep. 11, 2020	Sep. 10, 2021
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Sep. 11, 2020	Sep. 10, 2021

5. Conducted Emission Test

5.1 Test Standard and Limit

5.1.1Test Standard

FCC Part 15.207/RSS-GEN 8.8

5.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

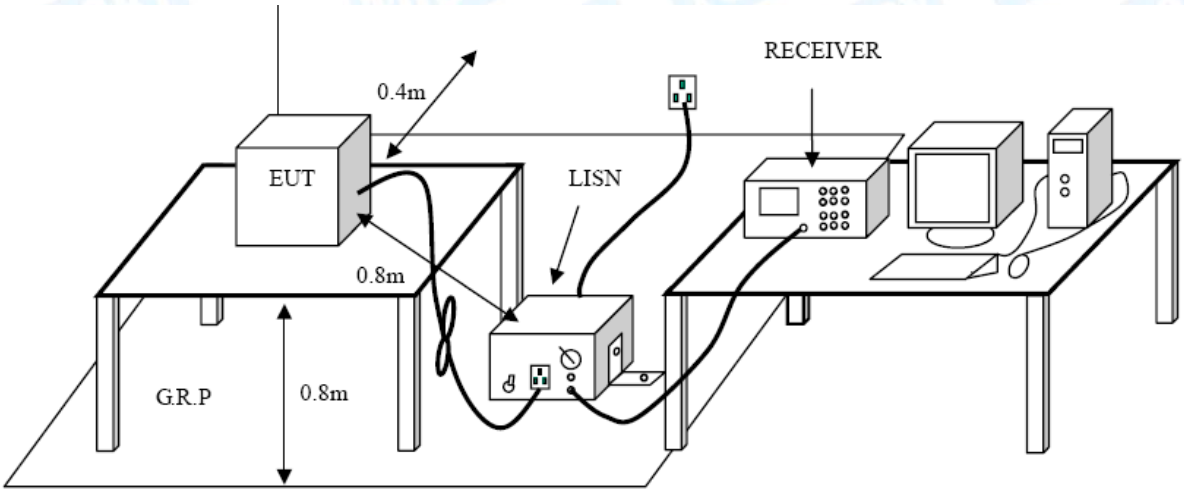
Notes:

(1) *Decreasing linearly with logarithm of the frequency.

(2) The lower limit shall apply at the transition frequencies.

(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.2 Test Setup



5.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

5.4 Deviation From Test Standard

No deviation

5.5 EUT Operating Mode

Please refer to the description of test mode.

5.6 Test Data

Please refer to the Attachment A.

6. Radiated Emission Test

6.1 Test Standard and Limit

6.1.1 Test Standard

FCC Part 15.209/RSS-GEN 8.9

6.1.2 Test Limit

Radiated Emission Limit (9 kHz~1000MHz)

Frequency (MHz	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Radiated Emission Limit (Above 1000MHz)

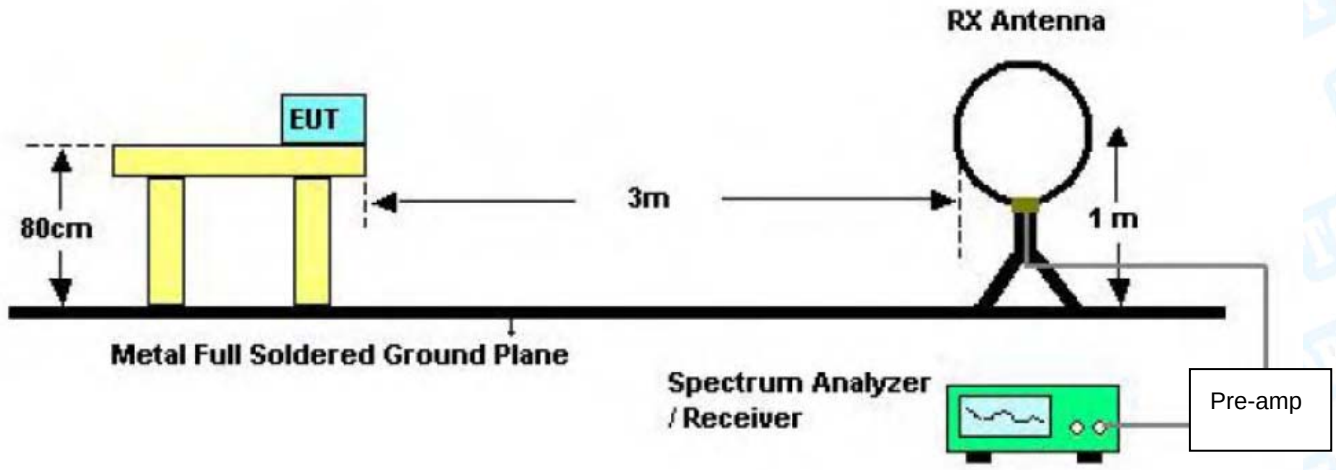
Frequency (MHz)	Distance Meters(at 3m)	
	Peak	Average
Above 1000	74	54

Note:

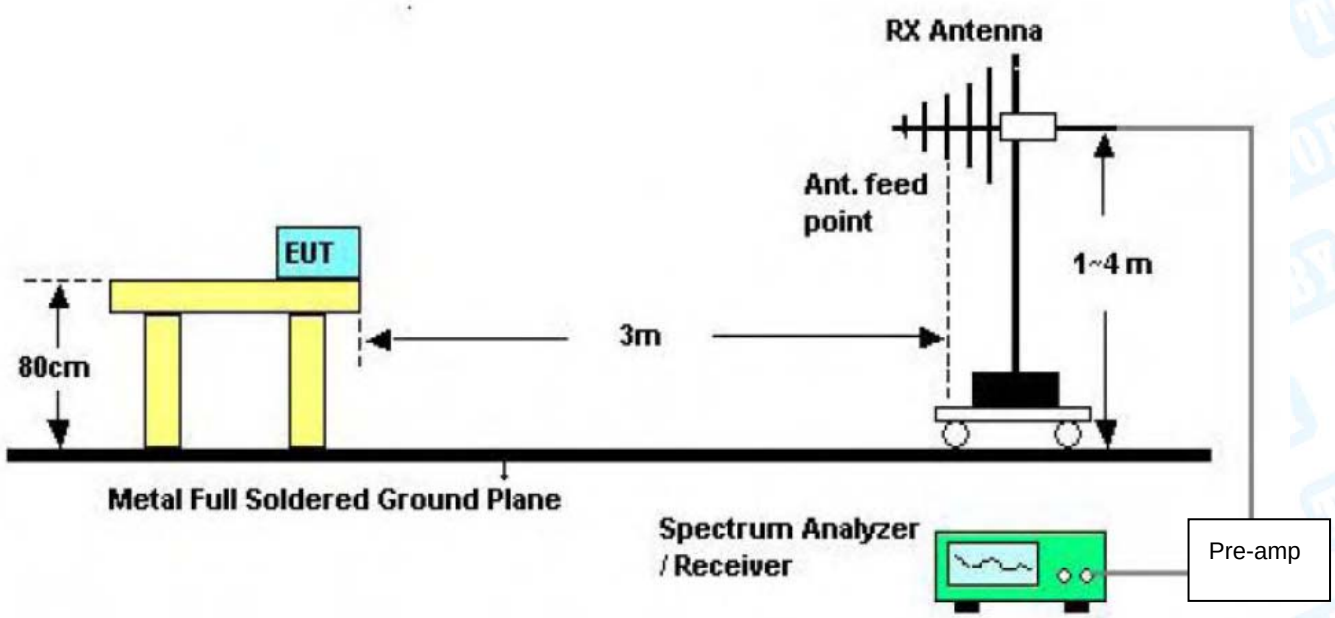
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

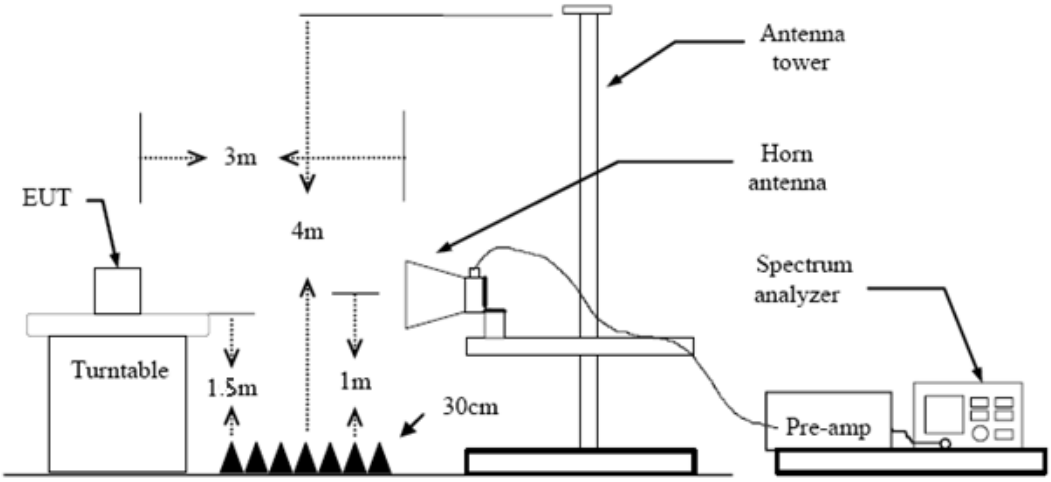
6.2 Test Setup



Below 30MHz Test Setup



Below 1000MHz Test Setup



Above 1GHz Test Setup

6.3 Test Procedure

(1) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency Below 1GHz. The EUT was placed on a rotating 0.8m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

6.4 Deviation From Test Standard

No deviation

6.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

6.6 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

Please refer to the Attachment B.

7. Restricted Bands and Band-edge test

7.1 Test Standard and Limit

7.1.1 Test Standard

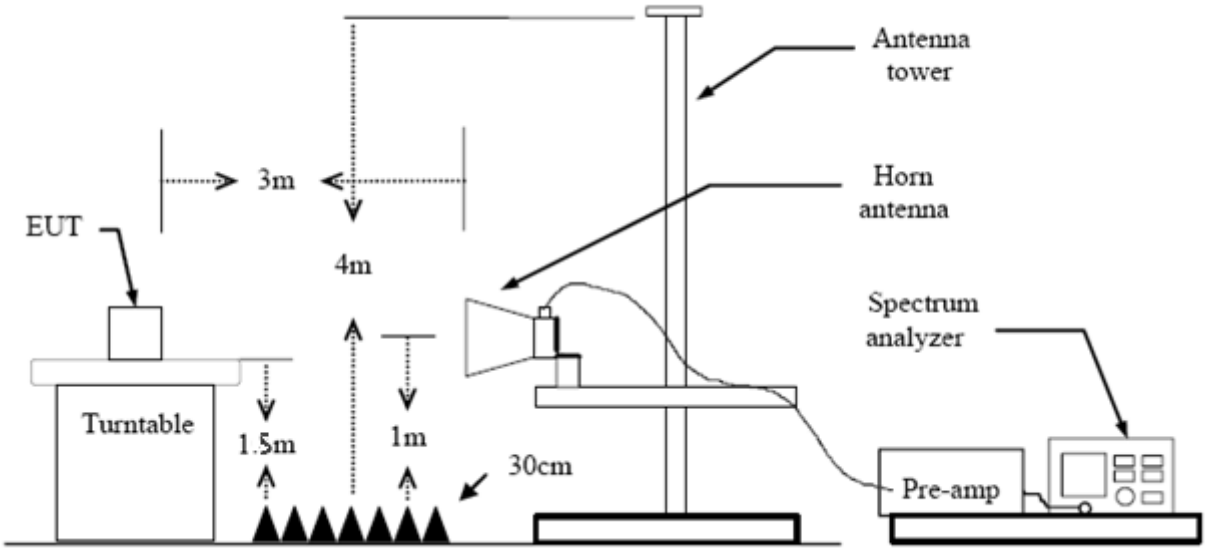
FCC Part 15.209&15.205

RSS-GEN 8.9&8.10

7.1.2 Test Limit

Restricted Frequency Band (MHz)	Distance Meters(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

7.2 Test Setup



7.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.
(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with AVG Detector for Average Values.
(8) For the actual test configuration, please see the test setup photo.

7.4 Deviation From Test Standard

No deviation

7.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

7.6 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

All restriction bands have been tested, only the worst case is reported.

Please refer to the Attachment C.

8. Number of Hopping Channel

8.1 Test Standard and Limit

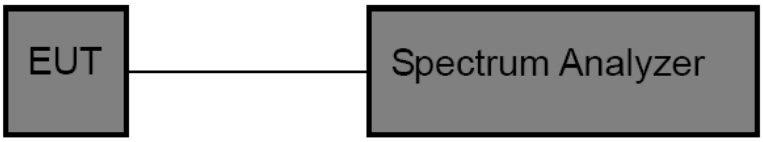
8.1.1 Test Standard

FCC Part 15.247 (a)(1) / RSS 247 5.1(4)

8.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

8.2 Test Setup



8.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting: RBW=100 KHz, VBW=100 KHz, Sweep time= Auto.

8.4 Deviation From Test Standard

No deviation

8.5 EUT Operating Condition

The EUT was set to the Hopping Mode by the Customer.

8.6 Test Data

Please refer to the Attachment D.

9. Average Time of Occupancy

9.1 Test Standard and Limit

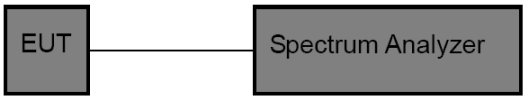
9.1.1 Test Standard

FCC Part 15.247 (a)(1) / RSS 247 5.1(d)

9.1.2 Test Limit

Test Item	Limit
Average Time of Occupancy	0.4 sec

9.2 Test Setup



9.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting: RBW=100KHz, VBW=300KHz.
(3) Use video trigger with the trigger level set to enable triggering only on full pulses.
(4) Sweep Time is more than once pulse time.
(5) Set the center frequency on any frequency would be measure and set the frequency span to zero.
(6) Measure the maximum time duration of one single pulse.
(7) Set the EUT for packet transmitting.
(8) Measure the maximum time duration of one single pulse.

9.4 EUT Operating Condition

The average time of occupancy on any channel within the Period can be calculated with formulas:
The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 20 [ch] = 8.0 [s*ch];
The burst width, which is directly measured, refers to the duration on one channel hop.
The maximum number of hopping channels in 8.0s =3*(8.0/0.24) =100
The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

The EUT was set to the Hopping Mode by the Customer.

9.4 Deviation From Test Standard

No deviation

9.5 Test Data

Please refer to the Attachment E.

10. Channel Separation and Bandwidth Test

10.1 Test Standard and Limit

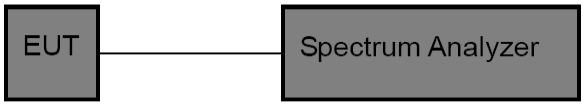
10.1.1 Test Standard

FCC Part 15.247/RSS 247 5.1(b)

10.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

10.2 Test Setup



10.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:
Channel Separation: RBW=100 kHz, VBW=100 kHz.
Bandwidth: RBW=30 kHz, VBW=100 kHz.

(3) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.

(4) Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:30 kHz, and Video Bandwidth:100 kHz. Sweep Time set auto.

10.4 Deviation From Test Standard

No deviation

10.5 EUT Operating Condition

The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Bandwidth Test.

10.6 Test Data

Please refer to the Attachment F.

11. Peak Output Power Test

11.1 Test Standard and Limit

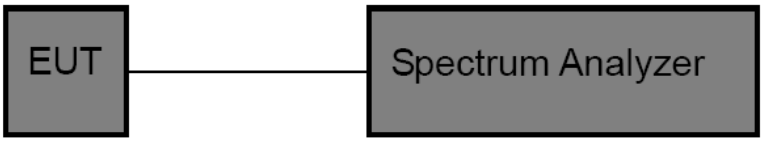
11.1.1 Test Standard

FCC Part 15.247 (b) (1)/RSS 247 5.4(b)

11.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125 mW(21dBm)	2400~2483.5

11.2 Test Setup



11.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:

Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.

RBW=3 MHz, VBW=3 MHz for bandwidth more than 1MHz.

11.4 Deviation From Test Standard

No deviation

11.5 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

11.6 Test Data

Please refer to the Attachment G.

12. Antenna Requirement

12.1 Standard Requirement

12.1.1 Standard

FCC Part 15.203

12.1.2 Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

12.2 Deviation From Test Standard

No deviation

12.3 Antenna Connected Construction

The gains of the antenna used for transmitting is 3dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

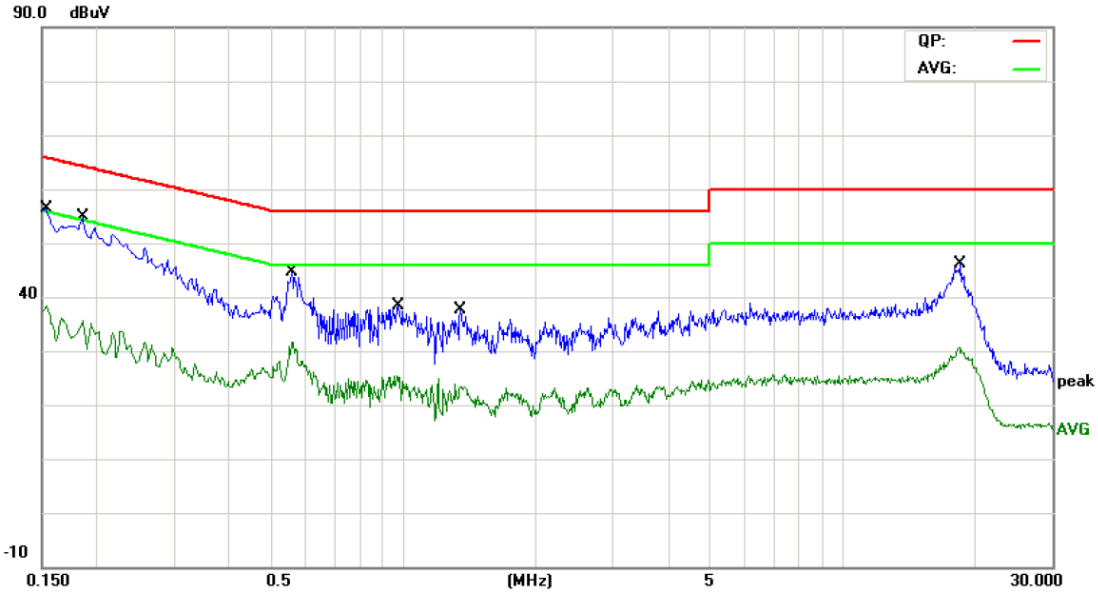
12.4 Result

The EUT antenna is a Dipole Antenna. It complies with the standard requirement.

Antenna Type
☒Permanent attached antenna
☐Unique connector antenna
☐Professional installation antenna

Attachment A-- Conducted Emission Test Data

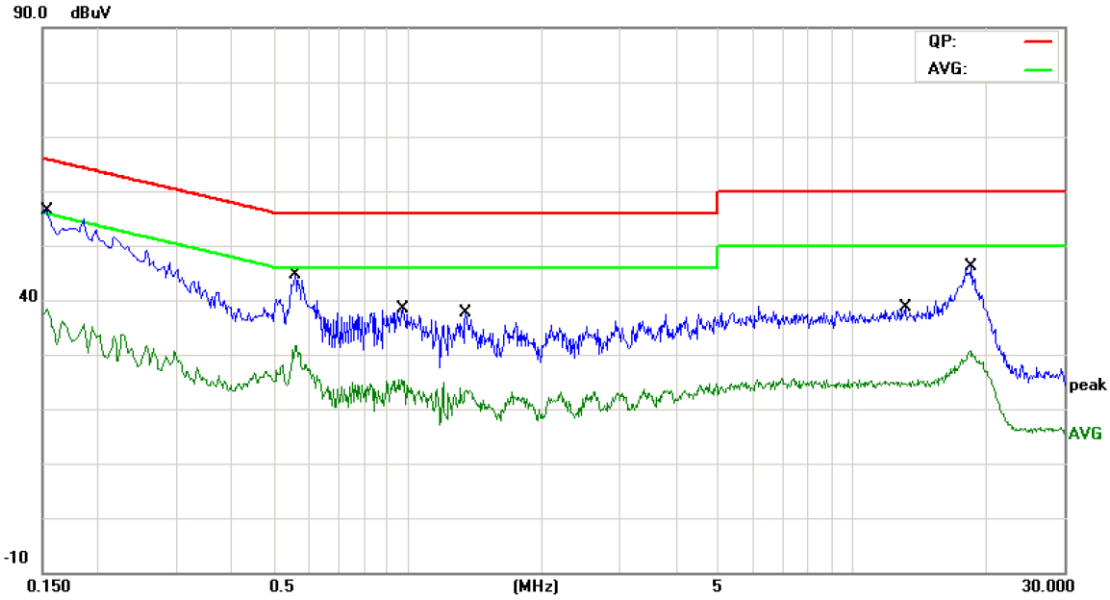
Temperature:	23.8℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Terminal:	Line		
Test Mode:	TX GFSK Mode 2408MHz		
Remark:	All channels have been tested and Shows only the worst channels.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1539	41.15	9.70	50.85	65.78	-14.93	QP
2		0.1539	24.00	9.70	33.70	55.78	-22.08	AVG
3		0.1860	38.67	9.70	48.37	64.21	-15.84	QP
4		0.1860	22.09	9.70	31.79	54.21	-22.42	AVG
5		0.5580	30.56	9.70	40.26	56.00	-15.74	QP
6		0.5580	20.24	9.70	29.94	46.00	-16.06	AVG
7		0.9700	23.92	9.79	33.71	56.00	-22.29	QP
8		0.9700	14.70	9.79	24.49	46.00	-21.51	AVG
9		1.3460	21.68	9.77	31.45	56.00	-24.55	QP
10		1.3460	12.88	9.77	22.65	46.00	-23.35	AVG
11		18.6180	27.59	10.00	37.59	60.00	-22.41	QP
12		18.6180	17.98	10.00	27.98	50.00	-22.02	AVG

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)

Temperature:	23.8℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Terminal:	Neutral		
Test Mode:	TX GFSK Mode 2408MHz		
Remark:	All channels have been tested and Shows only the worst channels.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1539	40.59	9.80	50.39	65.78	-15.39	QP
2		0.1539	23.31	9.80	33.11	55.78	-22.67	AVG
3		0.5580	28.70	9.80	38.50	56.00	-17.50	QP
4	*	0.5580	21.35	9.80	31.15	46.00	-14.85	AVG
5		0.9700	20.74	9.80	30.54	56.00	-25.46	QP
6		0.9700	12.55	9.80	22.35	46.00	-23.65	AVG
7		1.3460	19.30	9.80	29.10	56.00	-26.90	QP
8		1.3460	11.37	9.80	21.17	46.00	-24.83	AVG
9		13.1540	15.02	9.96	24.98	60.00	-35.02	QP
10		13.1540	8.09	9.96	18.05	50.00	-31.95	AVG
11		18.6180	19.46	10.00	29.46	60.00	-30.54	QP
12		18.6180	11.71	10.00	21.71	50.00	-28.29	AVG

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)

Attachment B-- Radiated Emission Test Data

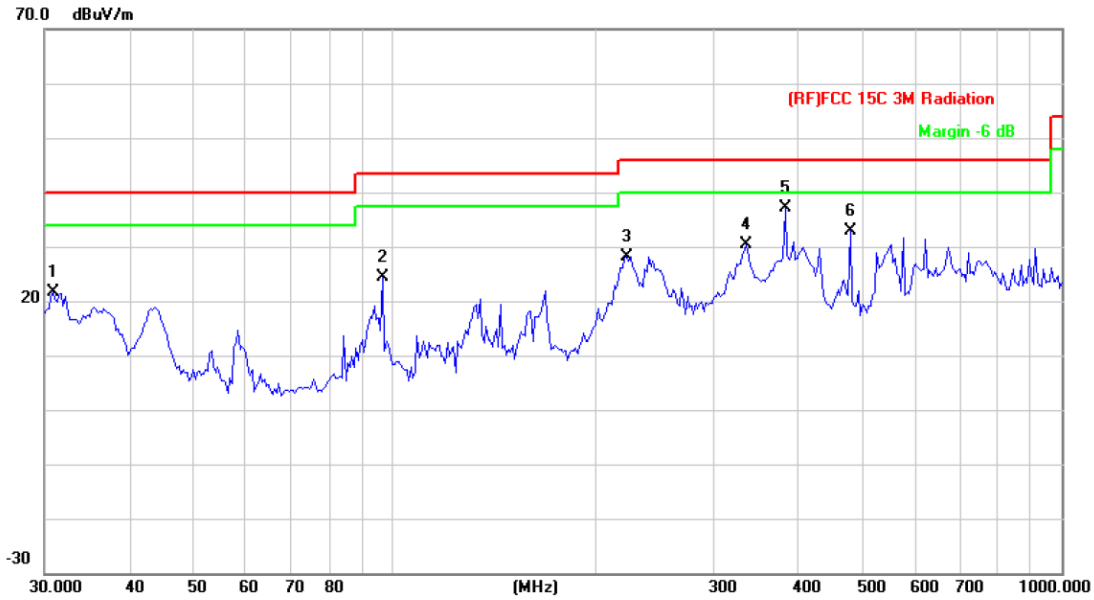
9KHz~30MHz

From 9KHz to 30MHz: Conclusion: PASS

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

30MHz~1GHz

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2406MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		30.8535	35.20	-13.58	21.62	40.00	-18.38	peak
2		96.0986	46.23	-21.91	24.32	43.50	-19.18	peak
3		222.9502	46.86	-18.70	28.16	46.00	-17.84	peak
4		337.2155	45.41	-15.05	30.36	46.00	-15.64	peak
5	*	385.2805	50.03	-12.98	37.05	46.00	-8.95	peak
6		482.2156	43.98	-10.99	32.99	46.00	-13.01	peak

*:Maximum data x:Over limit !:over margin

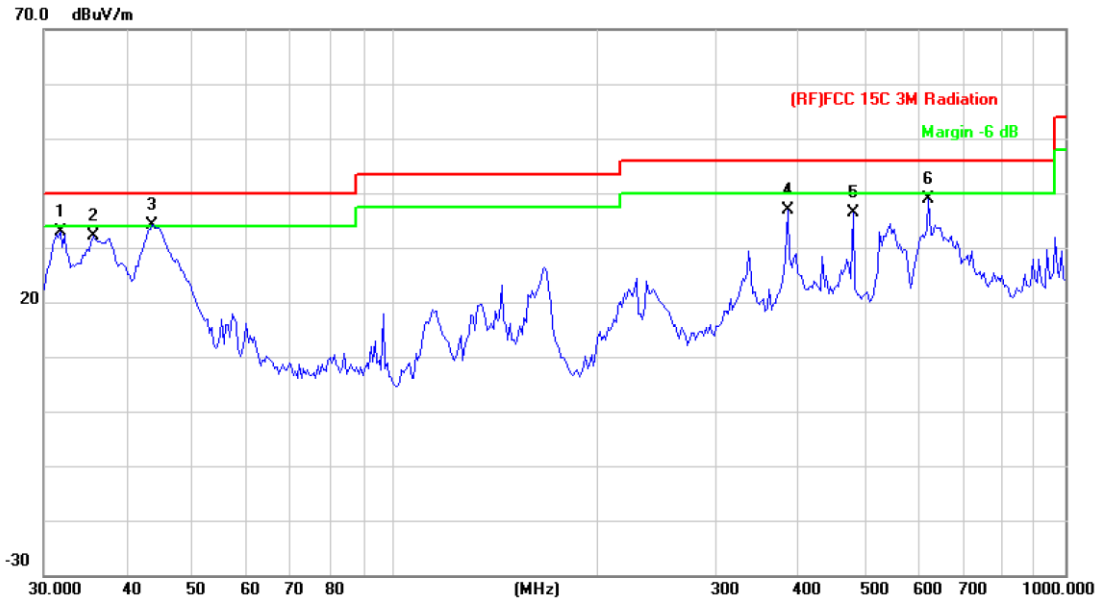
Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2406MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		31.7313	47.07	-14.25	32.82	40.00	-7.18	peak
2		35.4993	49.07	-16.91	32.16	40.00	-7.84	peak
3	*	43.5057	54.80	-20.70	34.10	40.00	-5.90	peak
4		385.2805	49.89	-12.98	36.91	46.00	-9.09	peak
5		482.2156	47.40	-10.99	36.41	46.00	-9.59	peak
6		625.0780	47.00	-8.14	38.86	46.00	-7.14	peak

*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Above 1GHz (Only worse case is reported)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2406MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4811.752	34.63	13.07	47.70	54.00	-6.30	AVG
2		4811.778	48.14	13.07	61.21	74.00	-12.79	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2406MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4811.798	51.03	13.07	64.10	74.00	-9.90	peak
2	*	4811.800	38.43	13.07	51.50	54.00	-2.50	AVG

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2442MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4883.548	48.27	13.59	61.86	74.00	-12.14	peak
2	*	4884.412	35.18	13.61	48.79	54.00	-5.21	AVG

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2442MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4883.548	34.77	13.59	48.36	54.00	-5.64	AVG
2		4886.000	47.53	14.20	61.73	74.00	-12.27	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2475MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4951.772	34.69	13.07	47.76	54.00	-6.24	AVG
2		4952.388	48.33	13.07	61.40	74.00	-12.60	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2475MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		

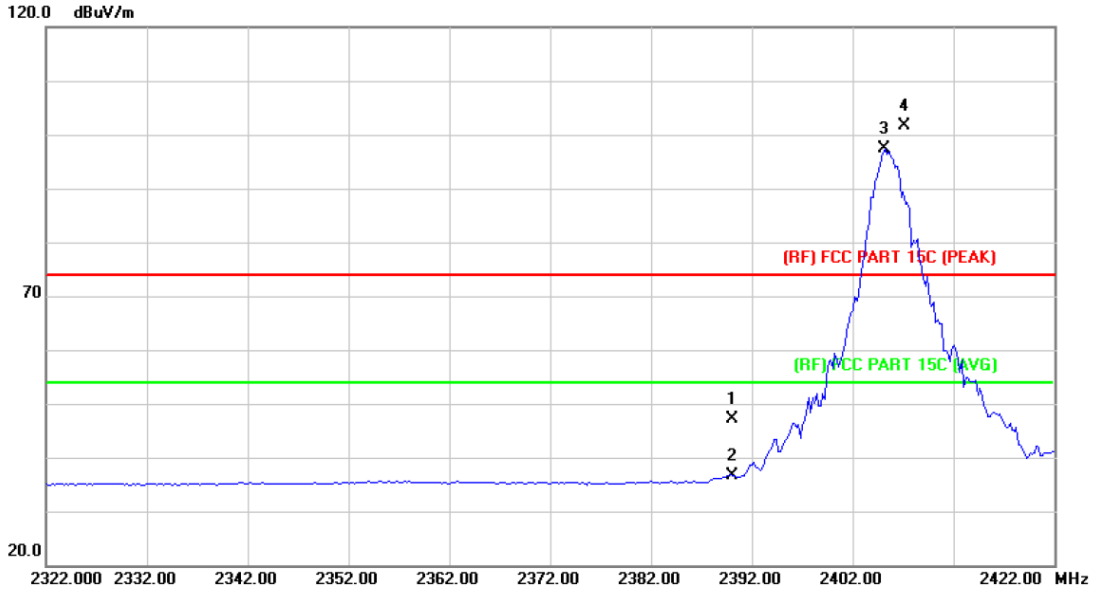
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4951.792	38.13	13.07	51.20	54.00	-2.80	AVG
2		4951.938	56.04	13.07	69.11	74.00	-4.89	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Attachment C-- Restricted Bands Requirement Test Data

(1) Radiation Test

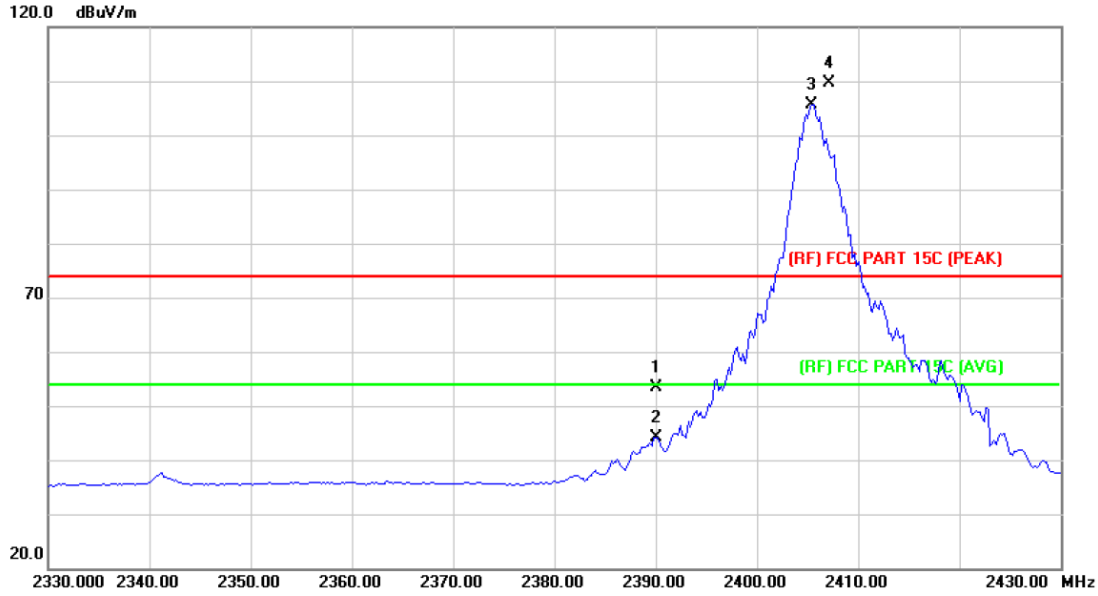
Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2406MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	45.89	1.28	47.17	74.00	-26.83	peak
2		2390.000	35.24	1.28	36.52	54.00	-17.48	AVG
3	*	2405.200	96.07	1.35	97.42	Fundamental Frequency		AVG
4	X	2407.200	100.37	1.36	101.73	Fundamental Frequency		peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

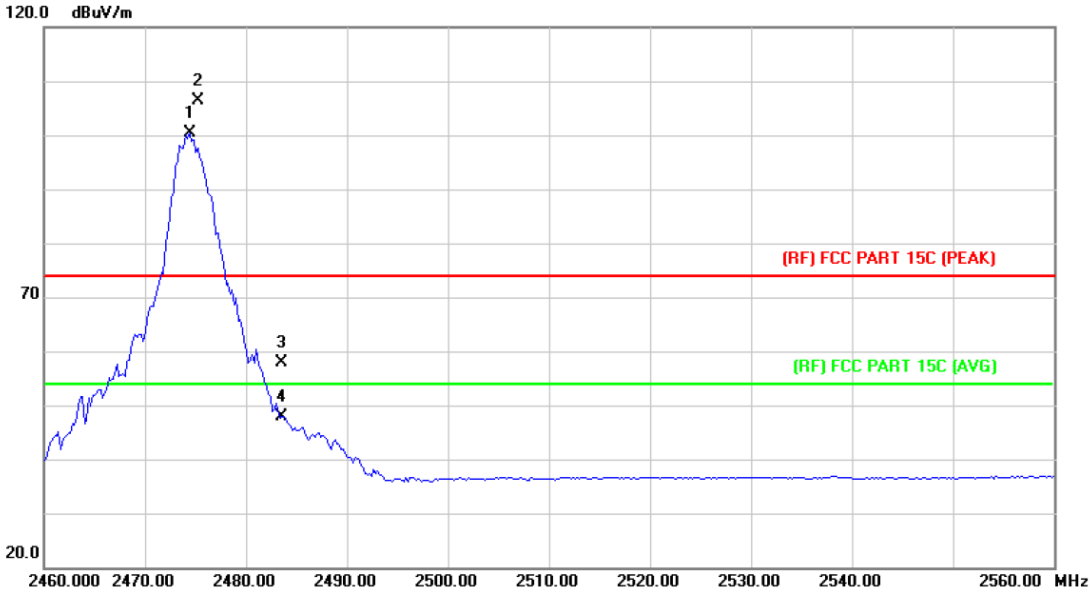
Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2406MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	52.07	1.28	53.35	74.00	-20.65	peak
2		2390.000	42.94	1.28	44.22	54.00	-9.78	AVG
3	*	2405.400	104.35	1.35	105.70	Fundamental Frequency		AVG
4	X	2407.200	108.34	1.36	109.70	Fundamental Frequency		peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

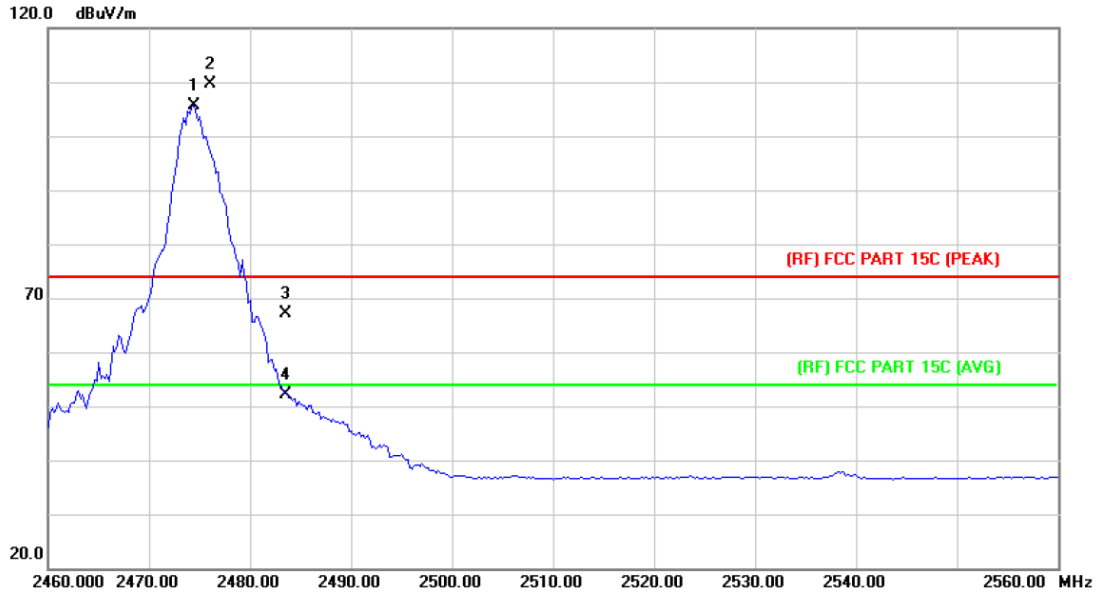
Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2475 MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2474.400	98.50	1.82	100.32	Fundamental Frequency		AVG
2	X	2475.213	104.49	1.83	106.32	Fundamental Frequency		peak
3		2483.500	56.07	1.88	57.95	74.00	-16.05	peak
4		2483.500	46.07	1.88	47.95	54.00	-6.05	AVG

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

Temperature:	23.2℃	**Relative Humidity:**	41%
Test Voltage:	AC 120V/60Hz		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2475 MHz		
Remark:	Only worse case is reported		

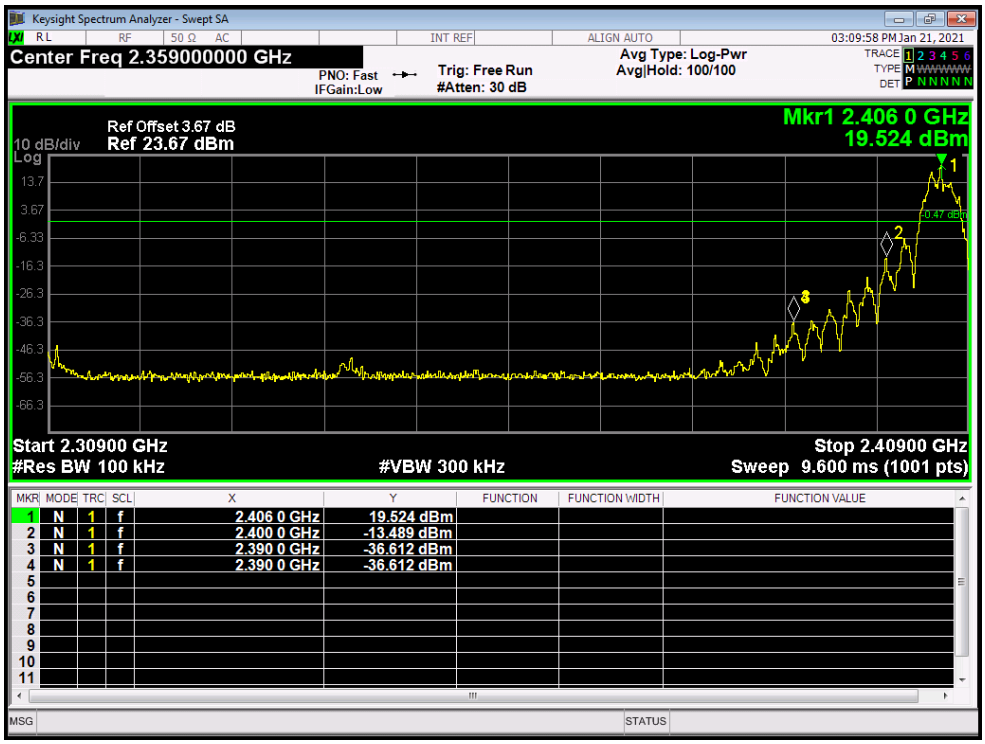


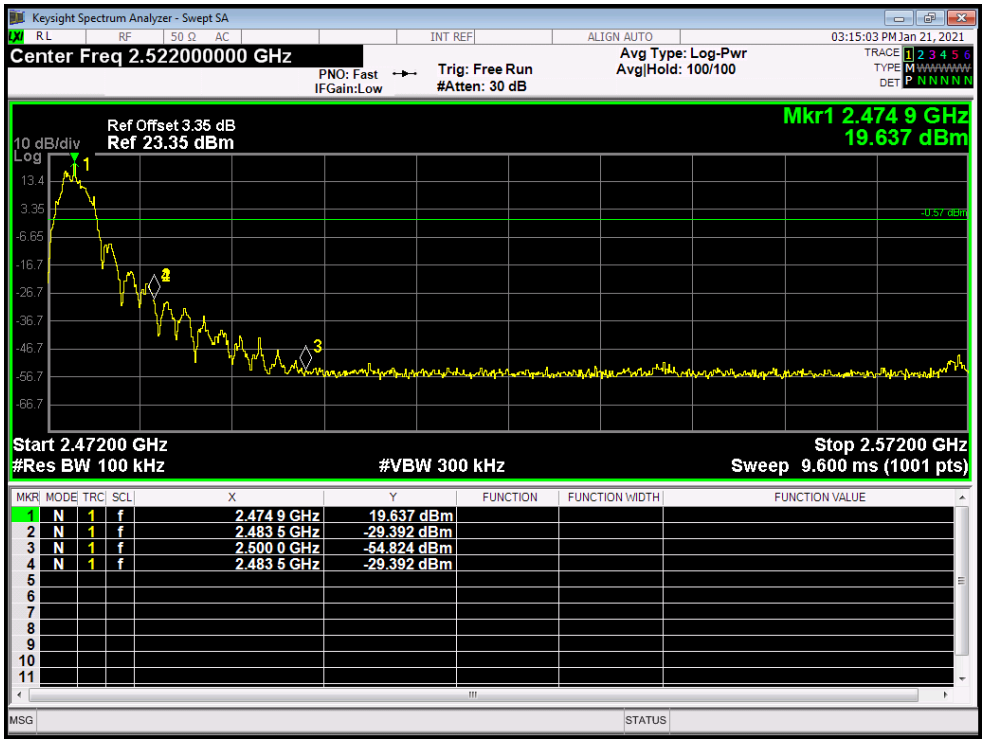
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2474.400	103.77	1.82	105.59	Fundamental Frequency		AVG
2	X	2476.000	107.72	1.83	109.55	Fundamental Frequency		peak
3		2483.500	65.20	1.88	67.08	74.00	-6.92	peak
4		2483.500	50.31	1.88	52.19	54.00	-1.81	AVG

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
3. Margin (dB) = Peak/AVG (dBµV/m)-Limit PK/AVG(dBµV/m)

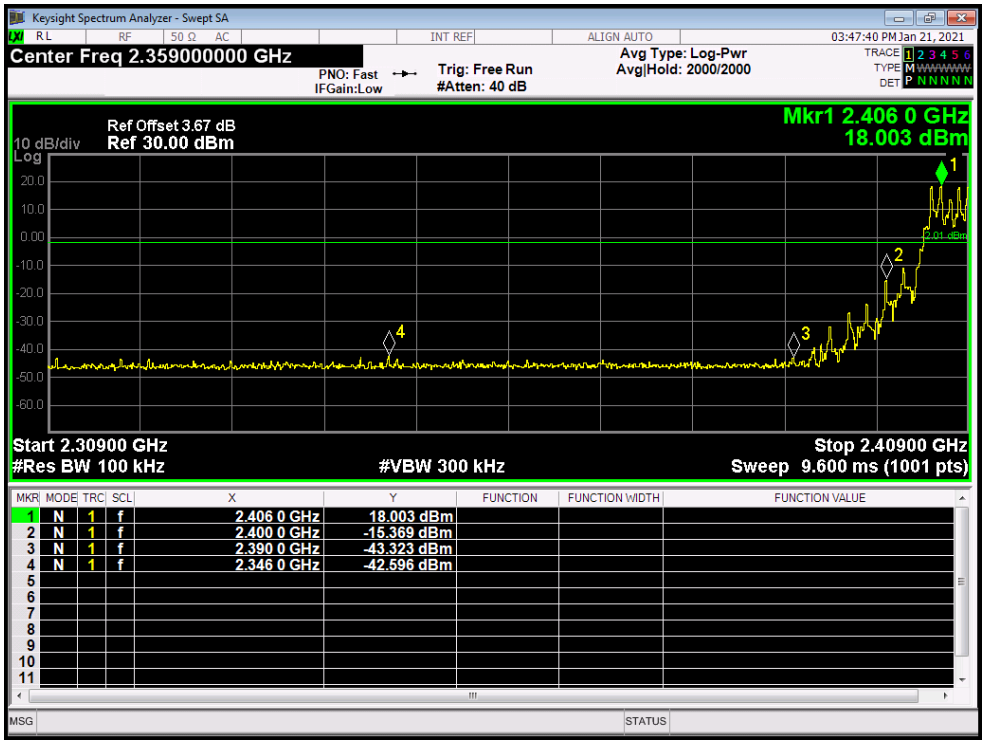
(2) Conducted Band Edge Test

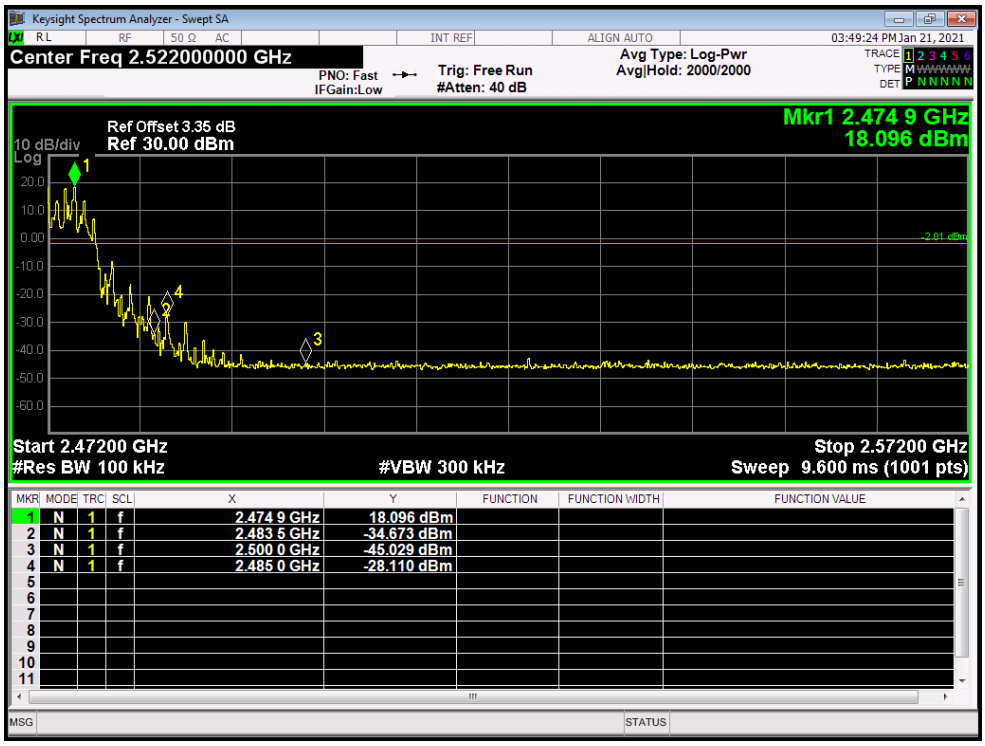
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	TX Mode 2406MHz/2475MHz		
Remark:	Only worse case is reported		





Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	Hopping Mode		
Remark:	Only worse case is reported		



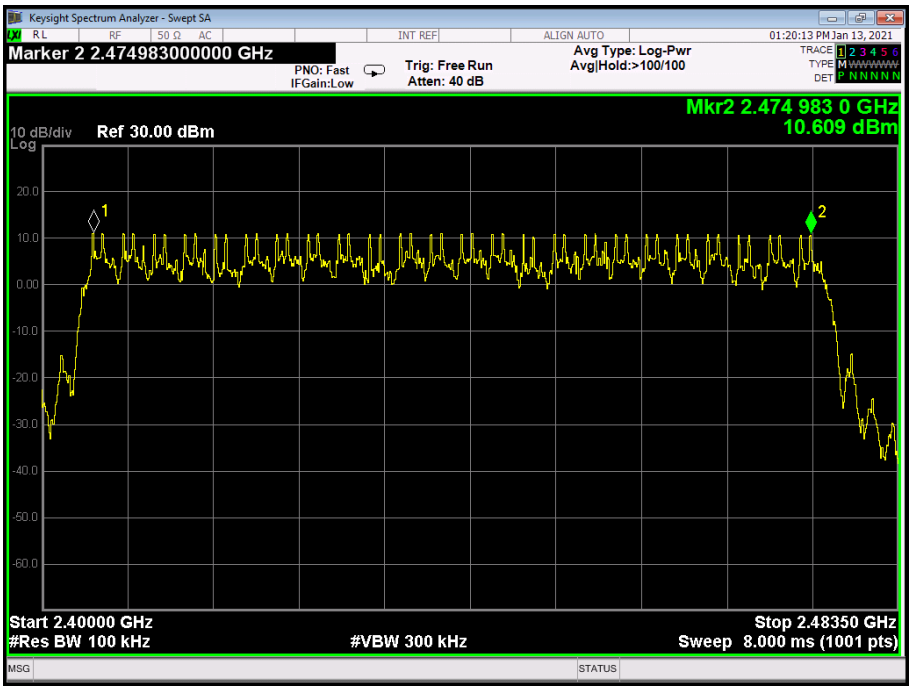


Attachment D-- Number of Hopping Channel Test Data

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	Hopping Mode		

Frequency Range	Test Mode	Quantity of Hopping Channel	Limit
2406MHz~2475MHz	GFSK	16	**>15**

GFSK Mode



Attachment E-- Average Time of Occupancy Test Data

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	Hopping Mode (GFSK)		
Remark:	The number of total hopping frequencies up to 24.		

Test Mode	Channel (MHz)	Reading Time (ms)	Total hops (N)	Test Result (ms)	Limit (ms)	Result
GFSK	2442	0.471	24	51.81	**400**	**PASS**

The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:

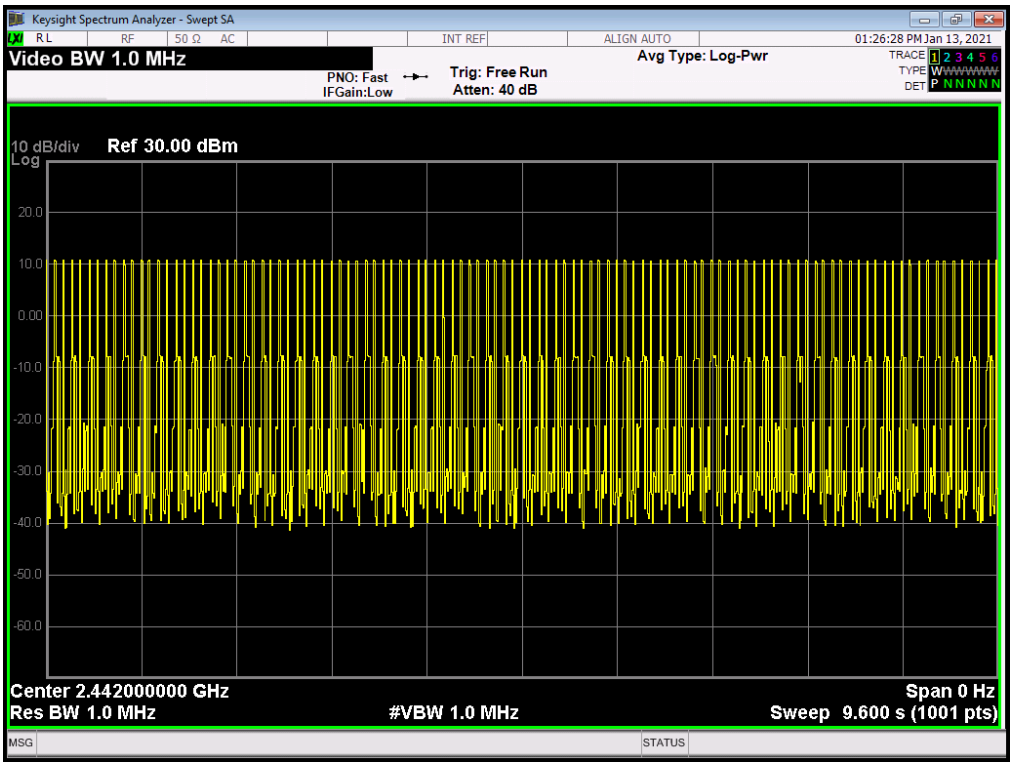
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 24[ch] =9.6[s*ch];

The burst width, which is directly measured, refers to the duration on one channel hop.

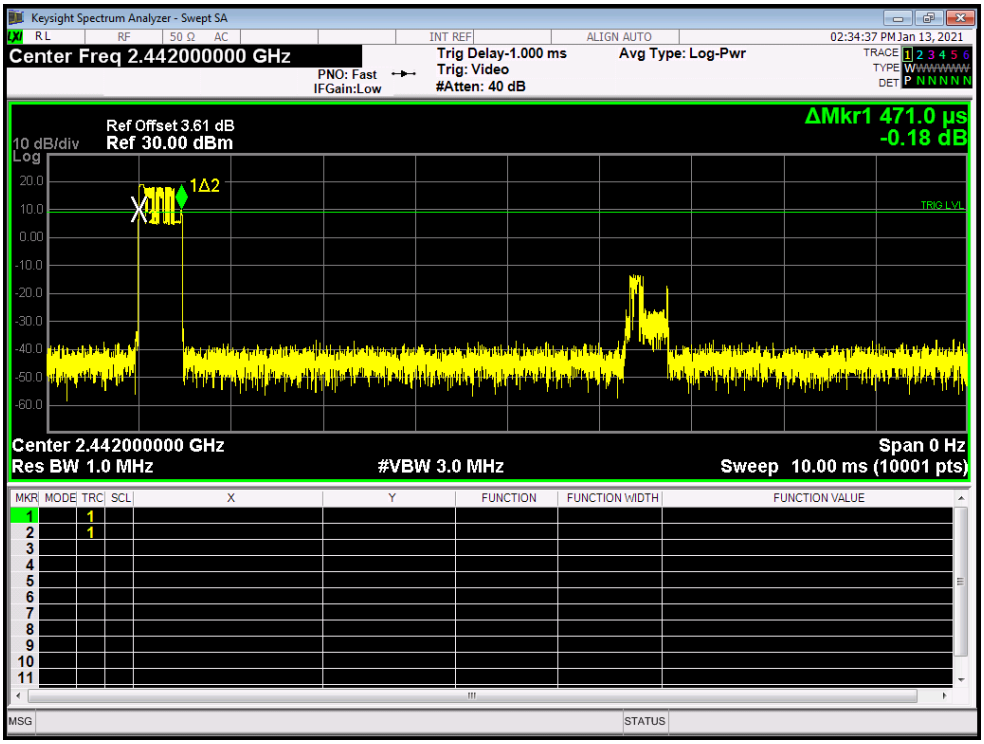
The maximum number of hopping channels in 9.6s is 110.

Reading Time=0.471ms*110=51.81ms

Hopping Channels in 9.6s



GFSK Hopping Mode



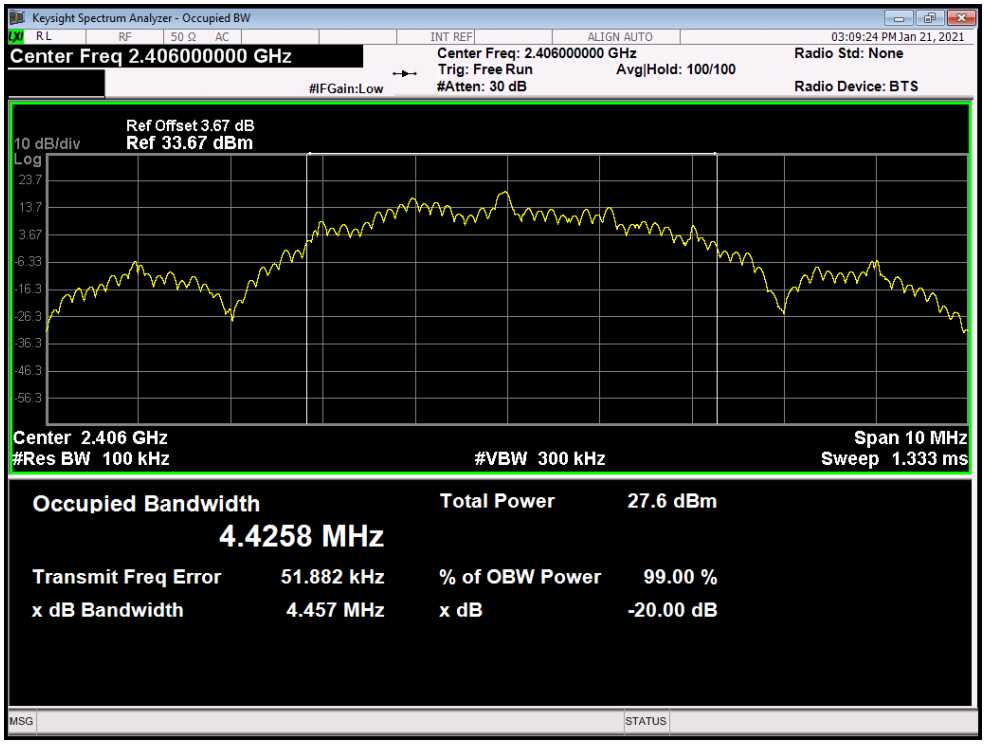
Attachment F-- Channel Separation and Bandwidth Test Data

Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	TX Mode (GFSK)		

Channel frequency (MHz)	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2406	4425.8	4457	2971.33
2442	4336.7	4367	2911.33
2475	4412.9	4345	2896.67

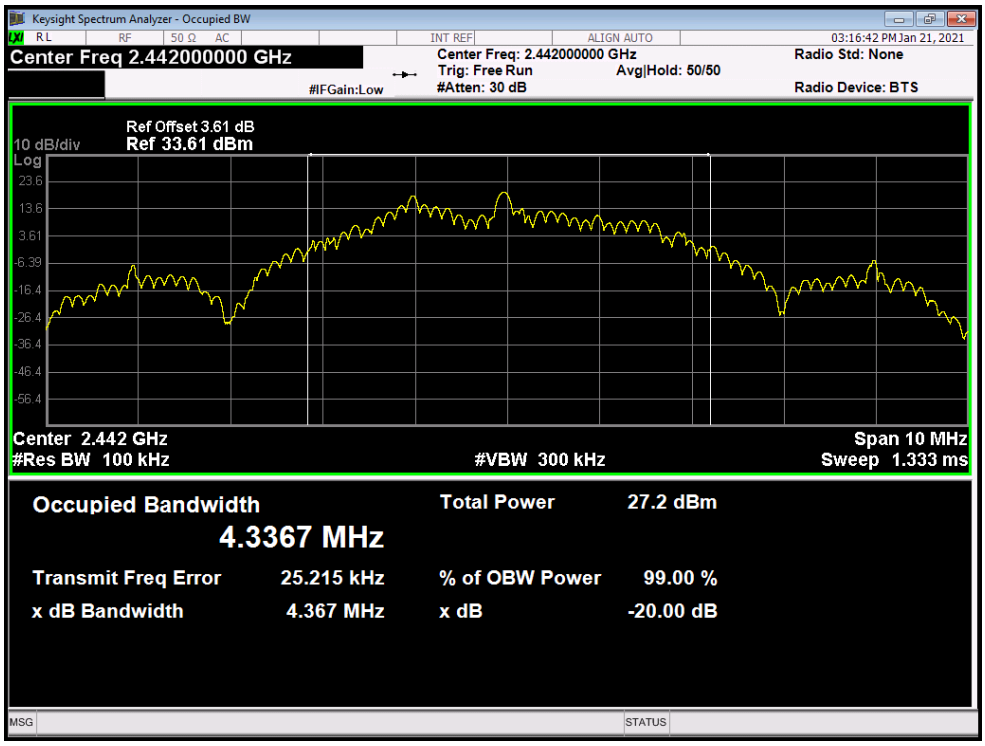
GFSK TX Mode

2406 MHz



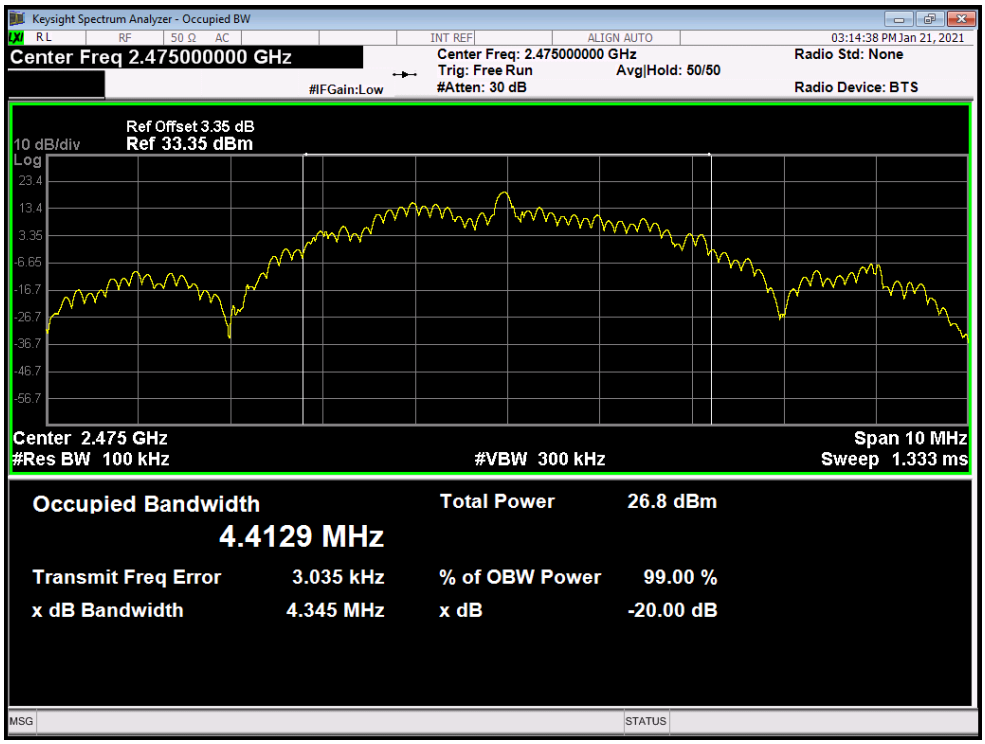
GFSK TX Mode

2442 MHz



GFSK TX Mode

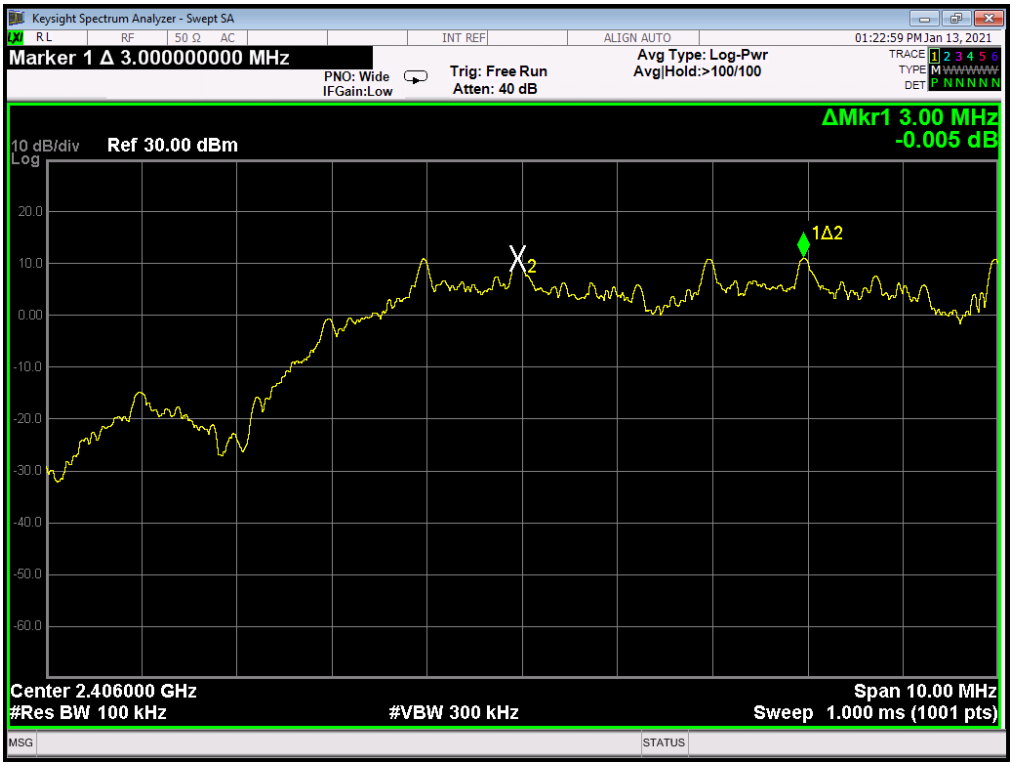
2475 MHz



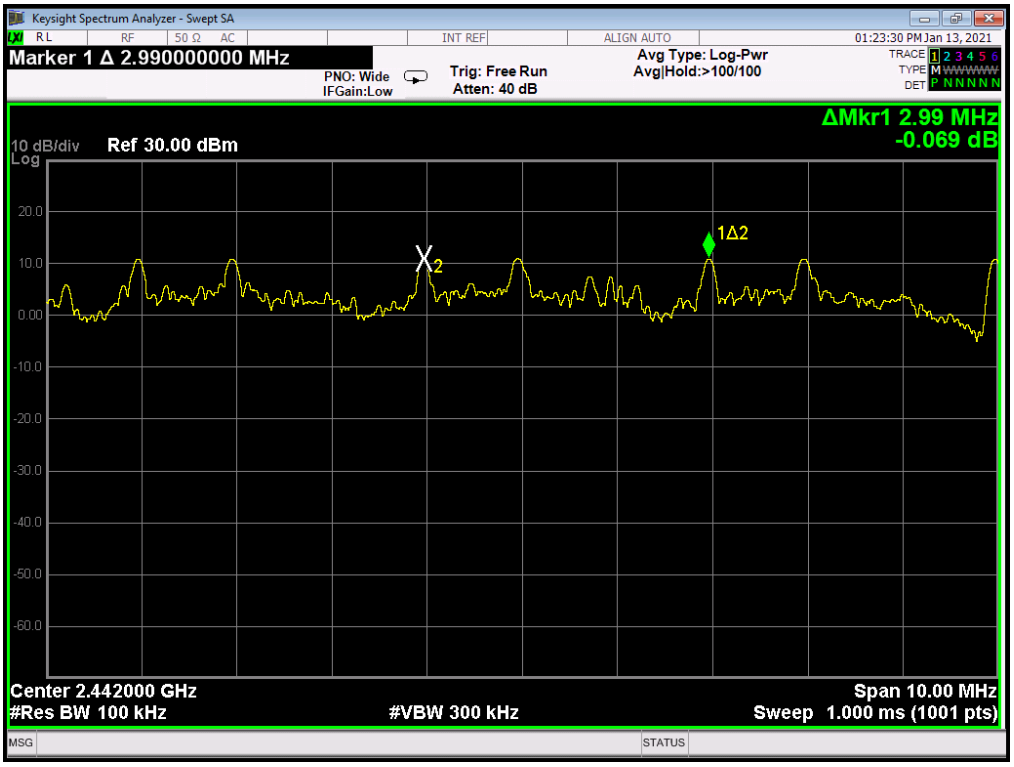
Channel Separation Test data:

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	Hopping Mode (GFSK)		
Remark:	We test all channel and worse case recorded in the report.		

Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
2406	3000	2971.33
2442	2990	2911.33
2475	3000	2896.67
Hopping Mode		
2406 MHz		



2442MHz



2475MHz

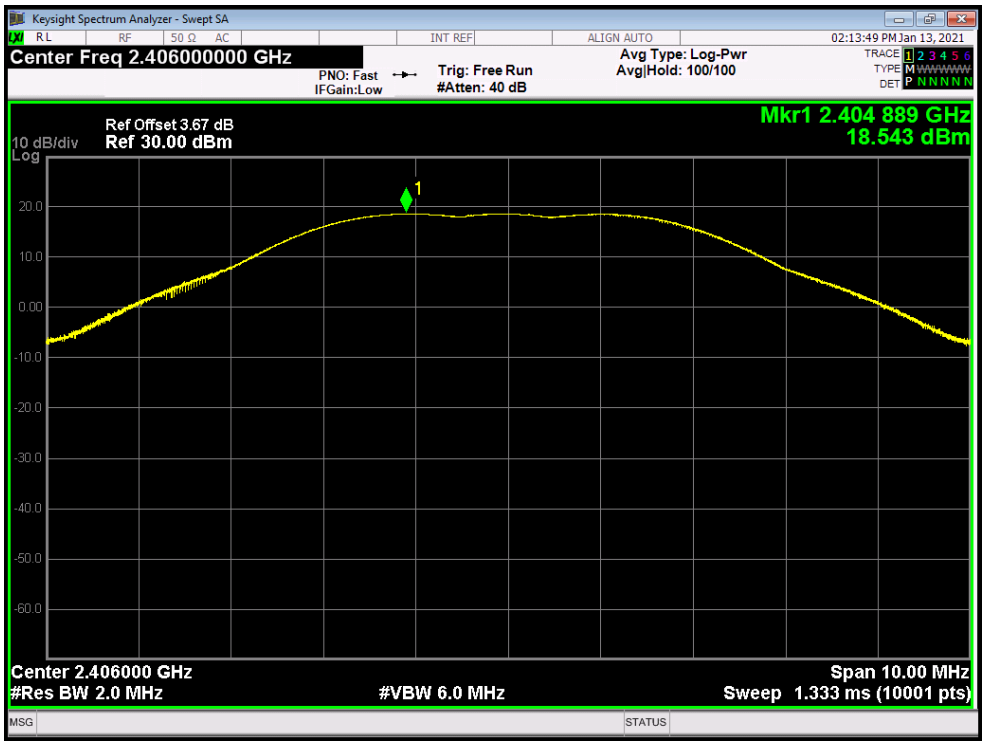
Attachment G-- Peak Output Power Test Data

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60Hz		
Test Mode:	TX Mode (GFSK)		

Channel frequency (MHz)	**Test Result (dBm)**	**Limit (dBm)**
2406	18.543	**30**
2442	18.390	
2475	18.216	

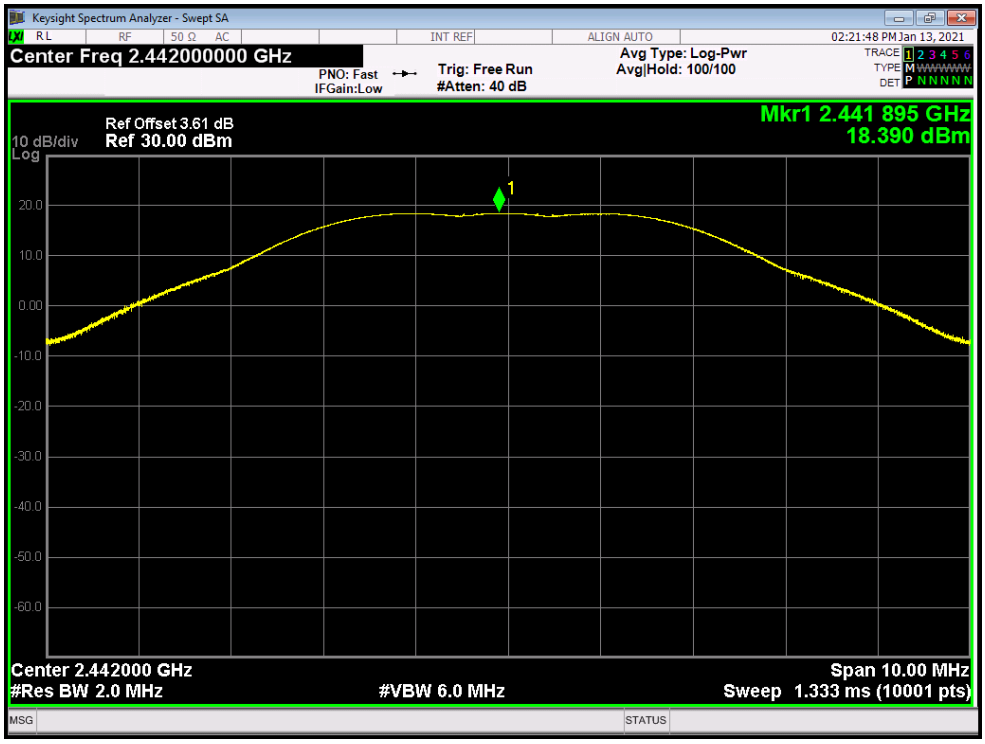
GFSK TX Mode

2406 MHz



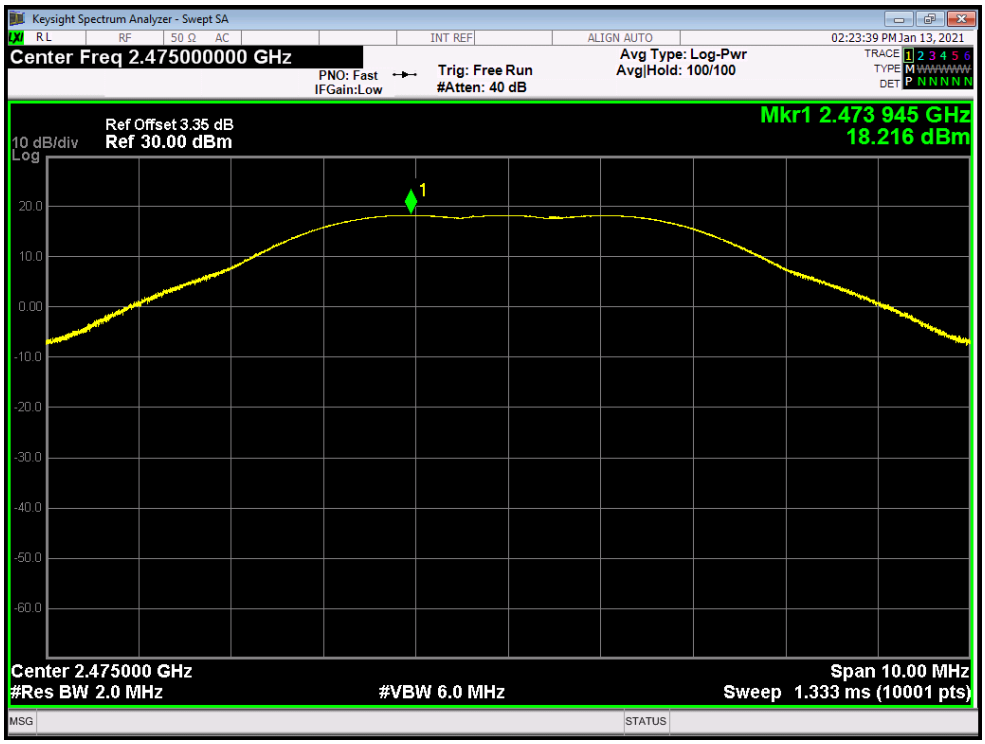
GFSK TX Mode

2442 MHz



GFSK TX Mode

2475MHz



-----END OF REPORT-----