FCC Test Report

Report No: FCS202406284W02

Issued for

Applicant:	Renqiu xinmaizhong auto parts co.ltd
Address:	No.3, Jingnan Innovation Industrial Park, North Linxing Road, Renqiu Economic Development Zone, Cangzhou City, Hebei Province
Product Name:	Bluetooth Smart Switch
Brand Name:	N/A
Model Name:	XMZ-HTB1 pro
Series Model:	XMZ-TB10 pro, XMZ-TB20 pro, XMZ-TB30 pro, XMZ-TB40 pro
FCC ID:	2BAZM-XMZHTB1

Issued By: Flux Compliance Service Laboratory
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TEST RESULT CERTIFICATION

Applicant's Name..... :	Renqiu xinmaizhong auto parts co.ltd
Address..... :	No.3, Jingnan Innovation Industrial Park, North Linxing Road, Renqiu Economic Development Zone, Cangzhou City, Hebei Province
Manufacture's Name..... :	Renqiu xinmaizhong auto parts co.ltd
Address..... :	No.3, Jingnan Innovation Industrial Park, North Linxing Road, Renqiu Economic Development Zone, Cangzhou City, Hebei Province

Product Description

Product Name..... :	Bluetooth Smart Switch
Brand Name.....:	N/A
Model Name..... :	XMZ-HTB1 pro
Series Model.....:	XMZ-TB10 pro, XMZ-TB20 pro, XMZ-TB30 pro, XMZ-TB40 pro
Test Standards..... :	FCC Rules and Regulations Part 15 Subpart C, Section 247
Test Procedure..... :	ANSI C63.10:2013

This device described above has been tested by Flux Compliance Service Laboratory, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test..... :

Date (s) of performance of tests. :	Jun 28, 2024 ~ Jul 03, 2024
Date of Issue.....:	Jul 03, 2024
Test Result.....:	Pass

Tested by : Scott Shen

(Scott Shen)

Reviewed by : Duke Qian

(Duke Qian)

Approved by : Jack Wang

(Jack Wang)

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Revision History

Rev.	Issue Date	Effect Page	Contents
00	Jul 03, 2024	N/A	N/A

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02

FCC Part 15.247,Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.247(a)(1)	Hopping Channel Separation	PASS	--
15.247 (b)(1)	Output Power	PASS	--
15.209	Radiated Spurious Emission	PASS	--
15.247(d)	Conducted Spurious & Band Edge Emission	PASS	--
15.247(a)(1)(i)	Number of Hopping Frequency	PASS	--
15.247(a)(1)(i)	Dwell Time	PASS	--
15.247(a)(1)	20dB Bandwidth 99% Bandwidth	PASS	--
15.205	Restricted bands of operation	PASS	--
Part 15.247(d)/part 15.209(a)	Band Edge Emission	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) All tests are according to ANSI C63.10-2013

1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
Laboray Accreditations	
FCC Test Firm Registration Number: 514908 CNAS Number： L15566 Designation number：CN0127 A2LA accreditation number：5545.01 ISED Number：25801	

1.2 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** %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.71dB
2	Unwanted Emissions, conducted	±2.988 dB
3	Conducted Emission (9KHz-150KHz)	±4.13 dB
4	All emissions radiated (9KHz -30MHz)	±3.1 dB
5	Conducted Emission (150KHz-30MHz)	±4.74 dB
6	All emissions,radiated(<1G) 30MHz-1000MHz	±5.2 dB
7	All emissions,radiated 1GHz -18GHz	±4.66 dB
8	All emissions,radiated 18GHz -40GHz	±4.31 dB
9	Occupied bandwidth and PSD	±0.3 dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Bluetooth Smart Switch
Trade Name	N/A
Model Name	XMZ-HTB1 pro
Series Model	XMZ-TB10 pro, XMZ-TB20 pro, XMZ-TB30 pro, XMZ-TB40 pro
Model Difference	The above product with same circuit, PCB layout, electrical parts, materials and wiring structures, Appearance shape, the materials of decorative accessories is same, the only difference is the model name and colour.
Channel List	Please refer to the Note 2.
Operation frequency	2402MHz-2480MHz
Modulation:	GFSK
Channel number	79 CH
Transmitter rate:	1MHz
Power Supply	DC 12V
Battery	N/A
Report number	FCS202406284W02
Hardware version number	V1.0
Software version number	V1.0
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

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

2.

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	PCB antenna	N/A	-0.58	Antenna

2.2 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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.

Block diagram of EUT configuration for test

Test software:

FCC Assist 1.0.4

The test softeware was used to control EUT work in continuous TX mode, and select test channel, Wireless mode as below table

No.	Test model descrption
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Hopping GFSK

Note:

1. All the test modes can be supply by DC power supply, only the result of the worst case recorded in the report. GFSK mode is worst mode.
2. For radiated emission, 3 axis were chosen for testing for each applicable mode.
3. The EUT used DC power supply when tested.
4. During the test, The test voltage was tuned from 85% to 115% of the Nominal rate supply votage, and found that the worst case was the nominal rated supply condition, So the report just shows that condition's data.
5. The chip only supports the BR function, and the EDR function has been blocked through software.

2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
1	DC power supply	FLIKE	PS-1350D	Tr10308802	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note	Note

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.4 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2023.08.29	2024.08.28
Signal Analyzer	R&S	FSV40-N	FCS-E012	2023.08.29	2024.08.28
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2023.08.29	2024.08.28
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2023.08.29	2024.08.28
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2023.08.29	2024.08.28
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2023.08.29	2024.08.28
Pre-Amplifier(0.1M-3G Hz)	EMCI	EM330N	FCS-E004	2023.08.29	2024.08.28
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2023.08.29	2024.08.28
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2023.08.29	2024.08.28
Temperature & Humidity	HTC-1	victor	FCS-E005	2023.08.29	2024.08.28
Testing Software	EZ-EMC(Ver.STSLAB 03A1 RE)				

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2023.08.29	2024.08.28
LISN	R&S	ENV216	FCS-E007	2023.08.29	2024.08.28
LISN	ETS	3810/2NM	FCS-E009	2023.08.29	2024.08.28
Temperature & Humidity	HTC-1	victor	FCS-E008	2023.08.29	2024.08.28
Testing Software	EZ-EMC(Ver.EMC-CON 3A1.1)				

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
MXA SIGNAL Analyzer	Keysight	N9020A	FCS-E015	2023.08.29	2024.08.28
Spectrum Analyzer	Agilent	E4447A	MY50180039	2023.08.29	2024.08.28
Spectrum Analyzer	R&S	FSV-40	101499	2023.08.29	2024.08.28
Power Sensor	Agilent	UX2021XA	FCS-E021	2023.08.29	2024.08.28
Testing Software	EZ-EMC(Ver.STSLAB 03A1 RE)				

3. 20 DB BANDWIDTH

3.1 Limit

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
15.247a(1)	20dB bandwidth	N/A	2400-2483.5

3.2 Test Procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Set the spectrum analyzer as follows

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 20 dB Bandwidth :30KHz For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 20dB Bandwidth : ≥3 × RBW For 99% Bandwidth : approximately 3×RBW
Trace	Max hold
Sweep	Auto

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator

(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

(3) Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

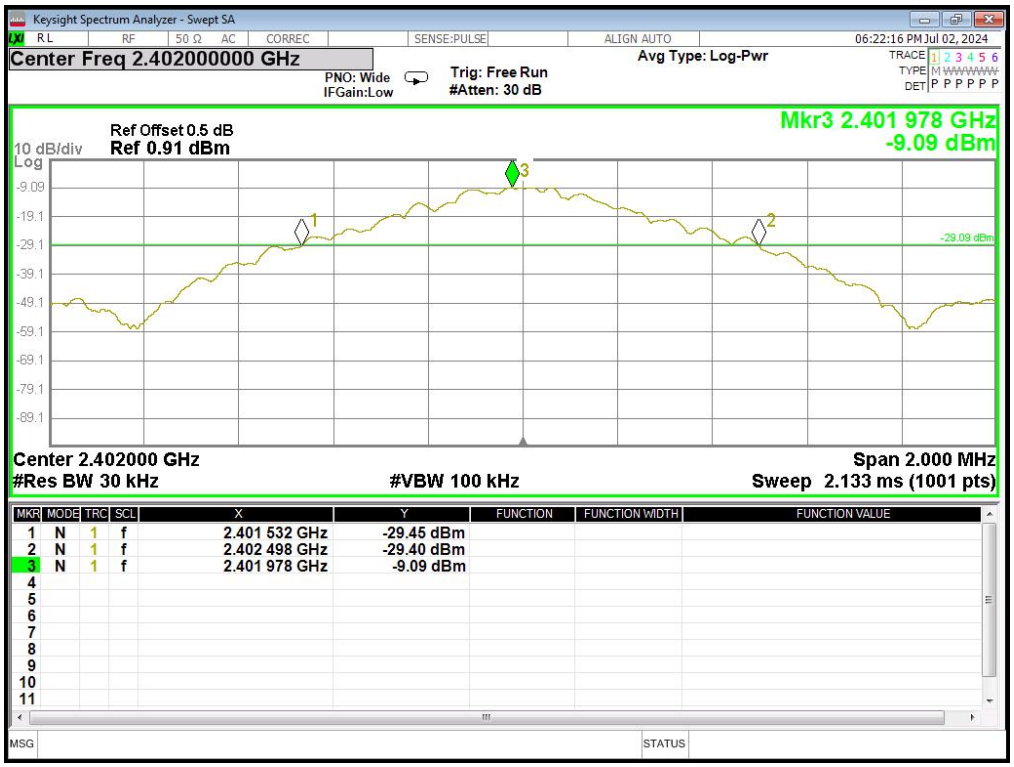
3.3 Test setup

3.4 Test results

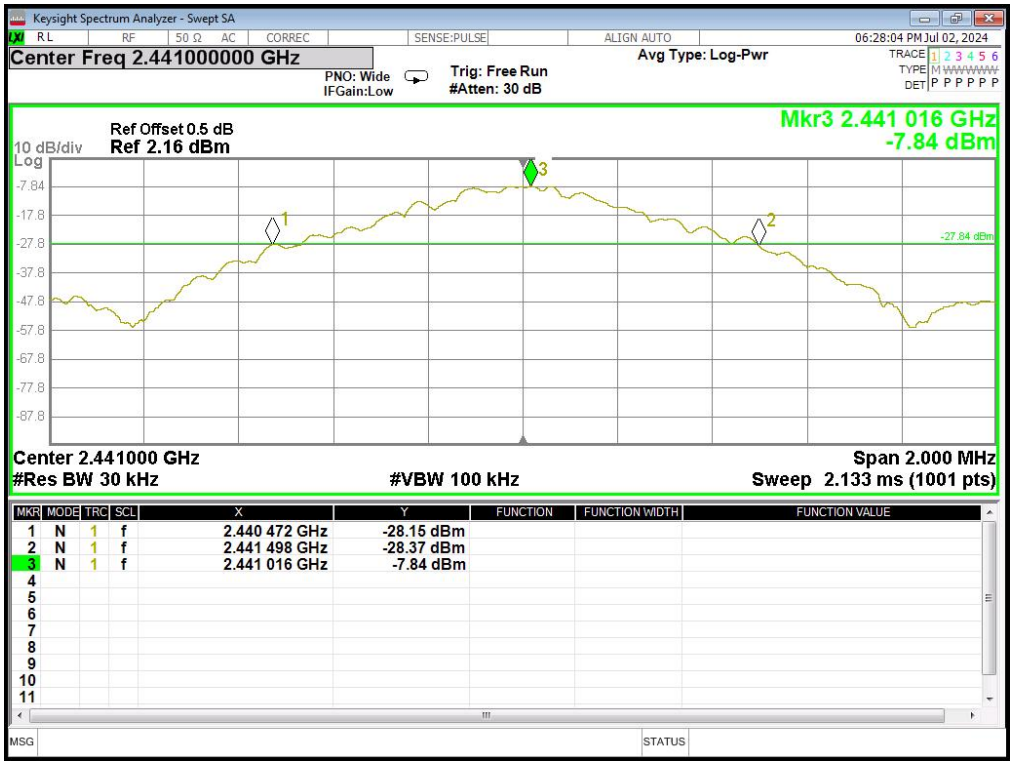
TestMode	Channel (MHz)	99%OBW(MHz)	20dB Bandwidth (MHz)	Verdict
Lowest	2402MHz	0.892	0.966	Pass
Middle	2441MHz	0.886	1.026	Pass
Highest	2480MHz	0.888	0.966	Pass

3.5 Original Test Data

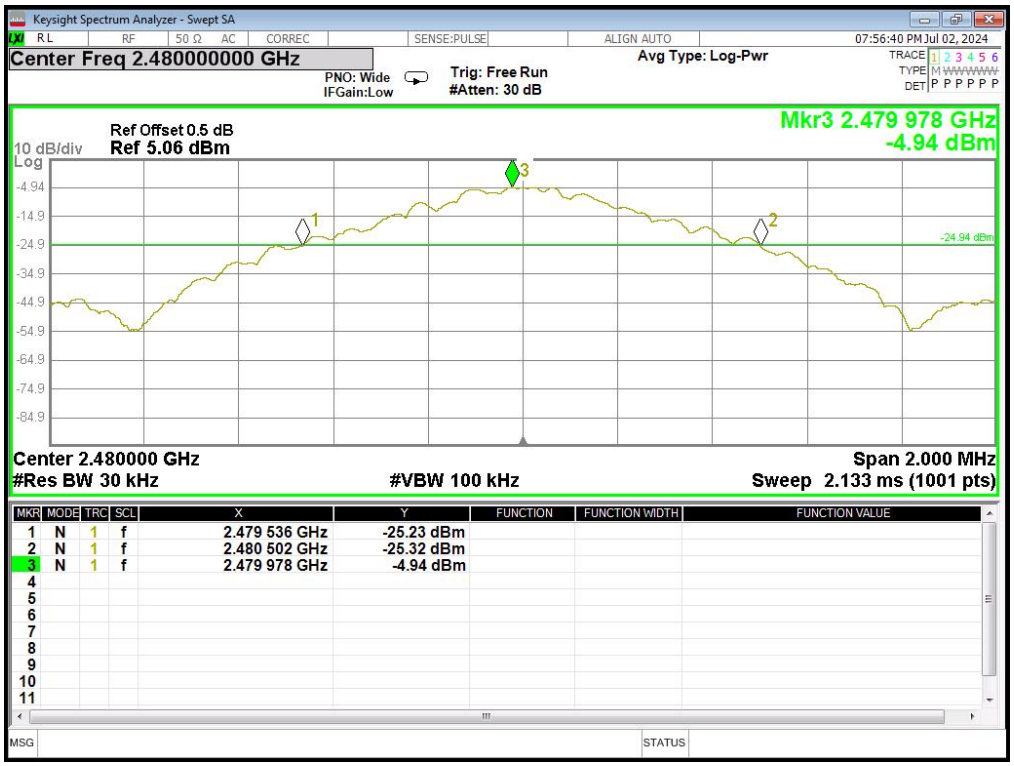
20BW,1DH1,LOWEST



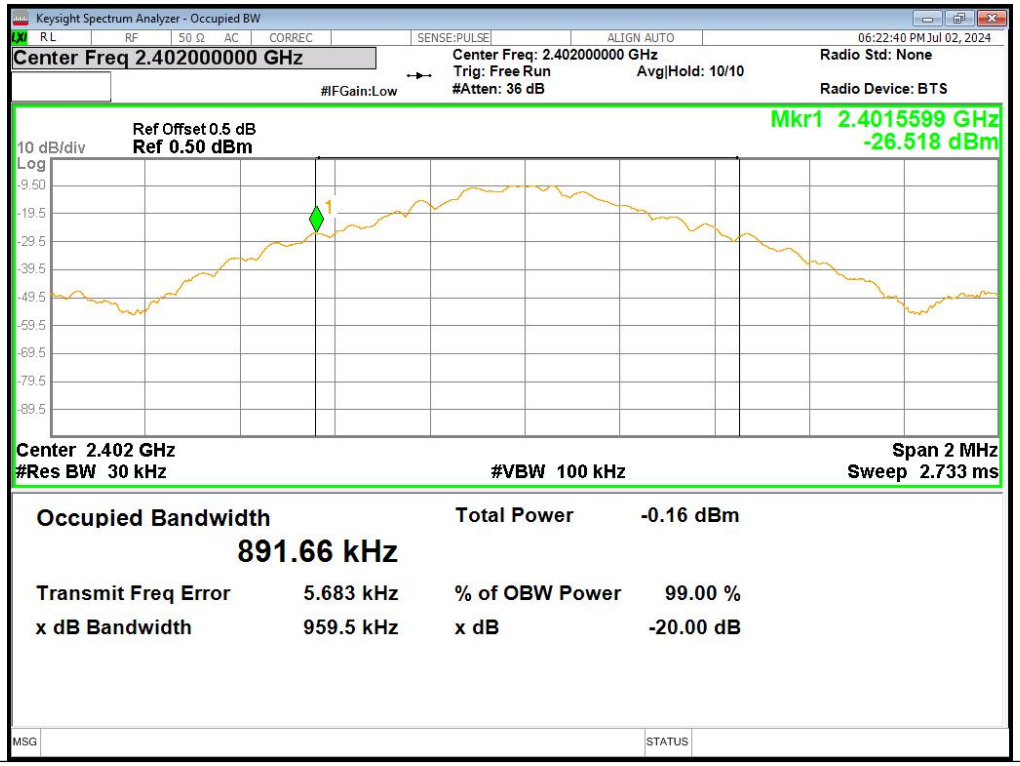
20BW,1DH1,MIDDLE



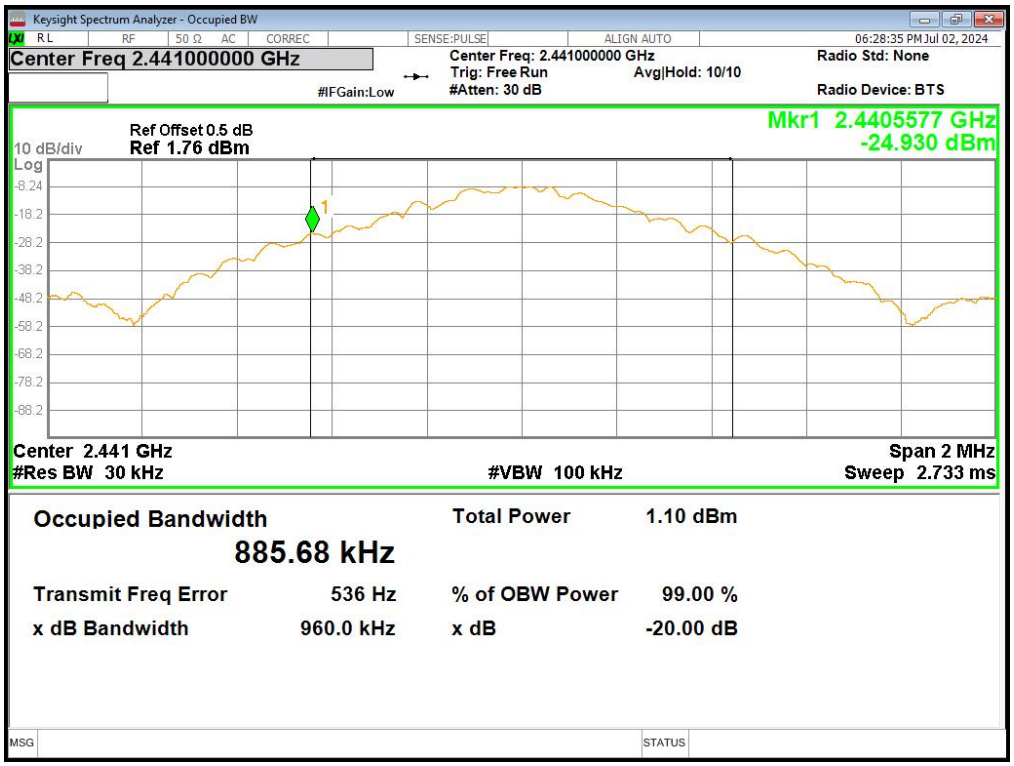
20BW,1DH1,HIGHEST



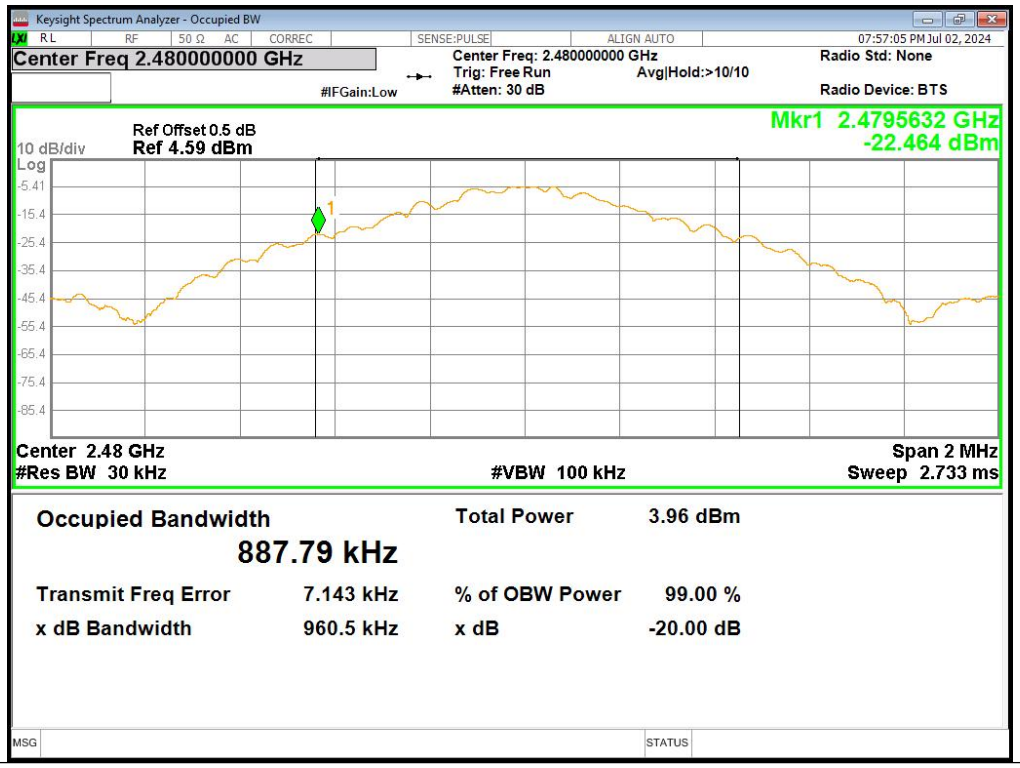
OBW,1DH1,LOWEST



OBW,1DH1,MIDDLE



OBW,1DH1,HIGHEST



4. CONDUCTED OUTPUT POWER

4.1 LIMIT

FCC Part 15 Subpart C			
Section	Test Item	Limit	Frequency Range
15.247(b)(1)	Peak output power	Power <1W(30dBm)	2400-2483.5

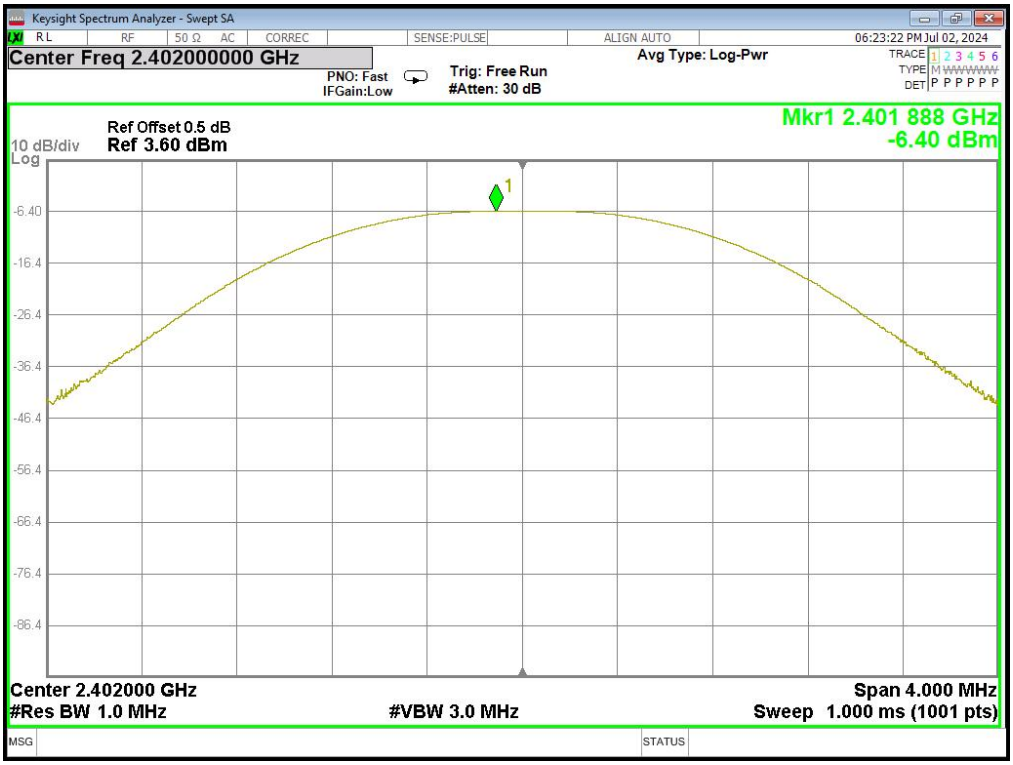
1.Connect each EUT's antenna output to power sensor by RF cable and attenuator
2.Measure the PK output power of each antenna port by power sensor.

4.2 TEST SETUP

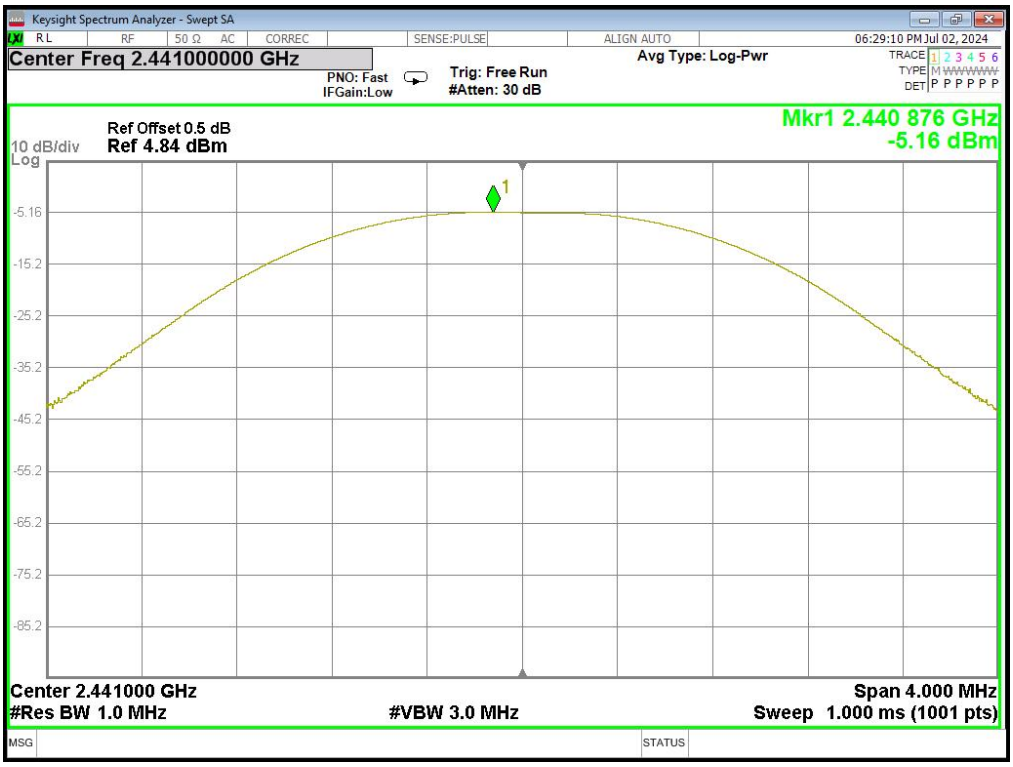
4.3 TEST RESULTS

TestMode	Channel (MHz)	Result（dBm）	Limit（dBm）	Verdict
Lowest	2402MHz	-6.40	30	Pass
Middle	2441MHz	-5.16	30	Pass
Highest	2480MHz	-2.49	30	Pass

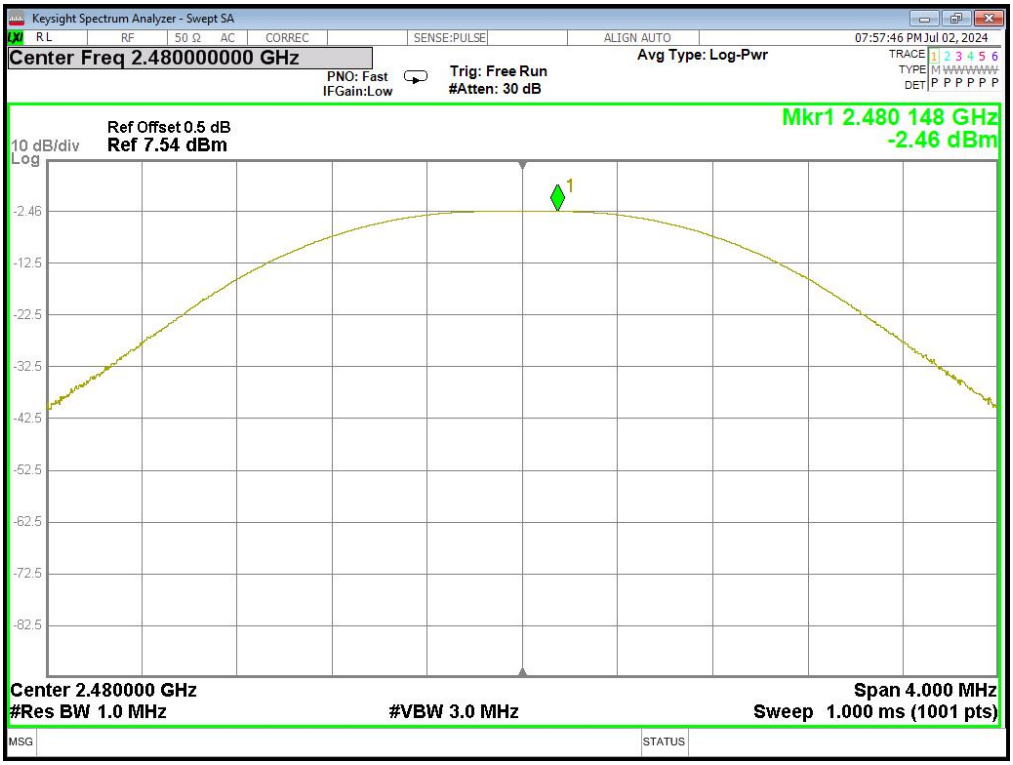
LOW-2402MHZ



MID-2441MHZ



HIG-2480MHz


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
CORREC
SENSE:PULSE
ALIGN AUTO
07:57:46 PM Jul 02, 2024
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M
DET P P P P P P
Ref Offset 0.5 dB
10 dB/div
Ref 7.54 dBm
Log
Mkr1 2.480 148 GHz
-2.46 dBm
-2.46
-12.5
-22.5
-32.5
-42.5
-52.5
-62.5
-72.5
-82.5
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 4.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS

5 NUMBER OF HOPPING CHANNEL

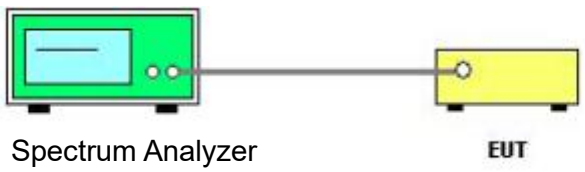
5.1 LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(iii) RSS-247	Number of Hopping Channel	>15	2400-2483.5	PASS

5.2 TEST PROCEDURE

a The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.5 TEST RESULTS

Temperature:	25 °C	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	DC 12V

6. BAND EDGE AND SPURIOUS(CONDUCTED)

6.1 LIMIT

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

6.2 TEST PROCEDURE

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Establish a reference level by using the following procedure:

Center frequency	DTS Channel center frequency
RBW:	100kHz
VBW:	300kHz
Span	1.5times the DTS bandwidth
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

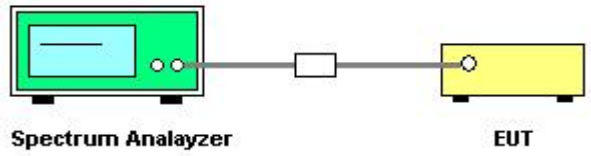
(3) Establish Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.

(4) Set the spectrum analyzer as follows:

RBW:	100kHz
VBW:	300kHz
Span	Encompass frequency range to be measured
Number of measurement points	≥span/RBW
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

(5) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

6.3 TEST SETUP

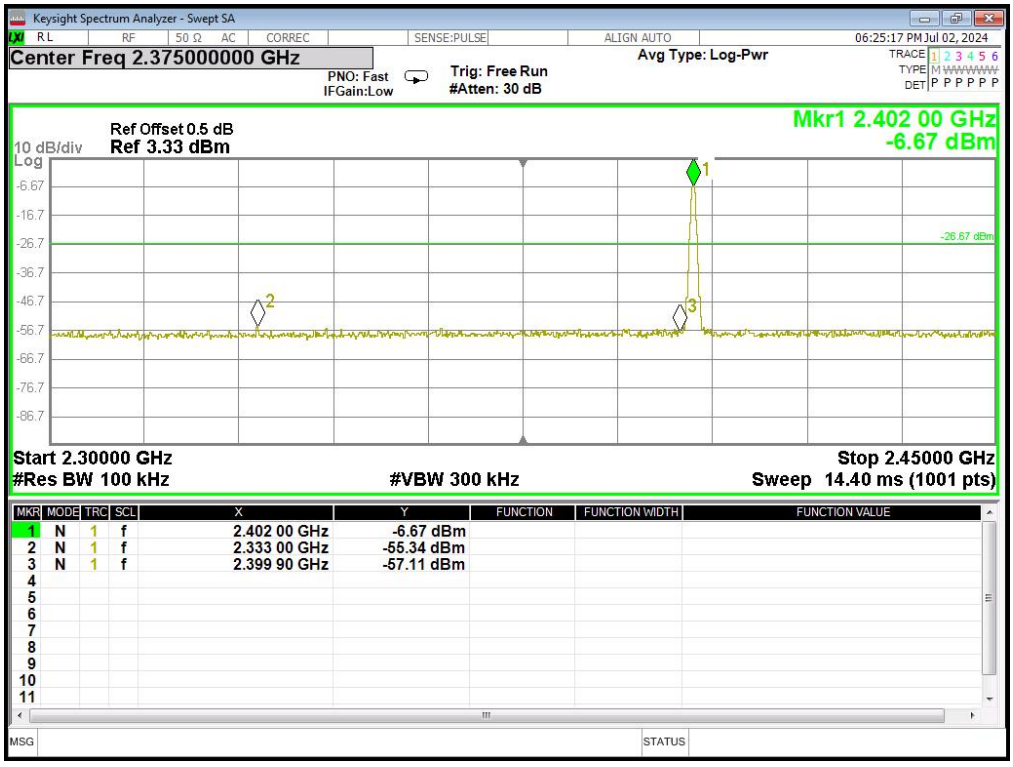


6.4 TEST RESULTS

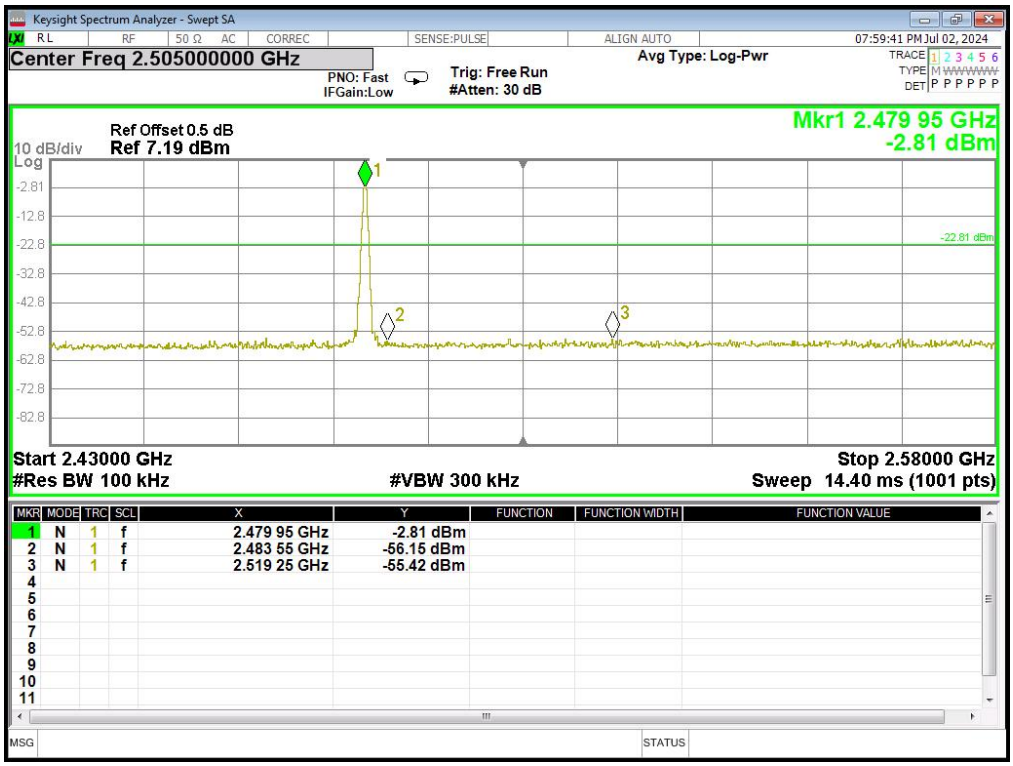
Eut set mode	CH or Frequency	Result
GFSK	CH1	Pass
	CH79	Pass

6.5 Original test data

CH1 2402MHZ



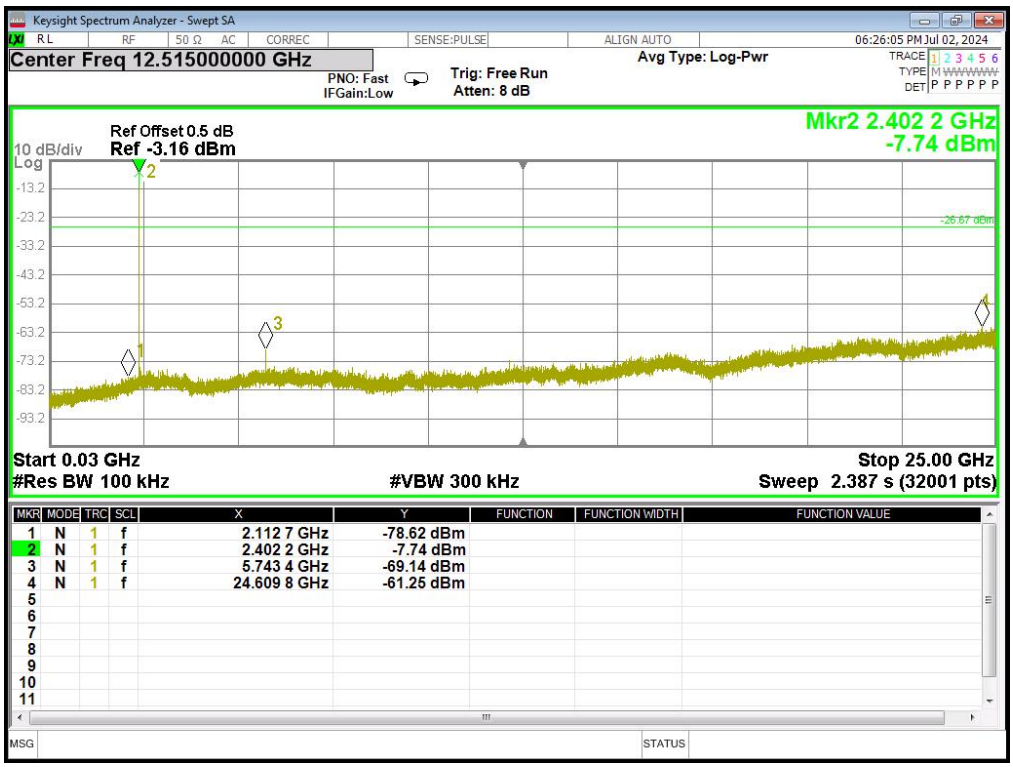
CH79 2480MHZ



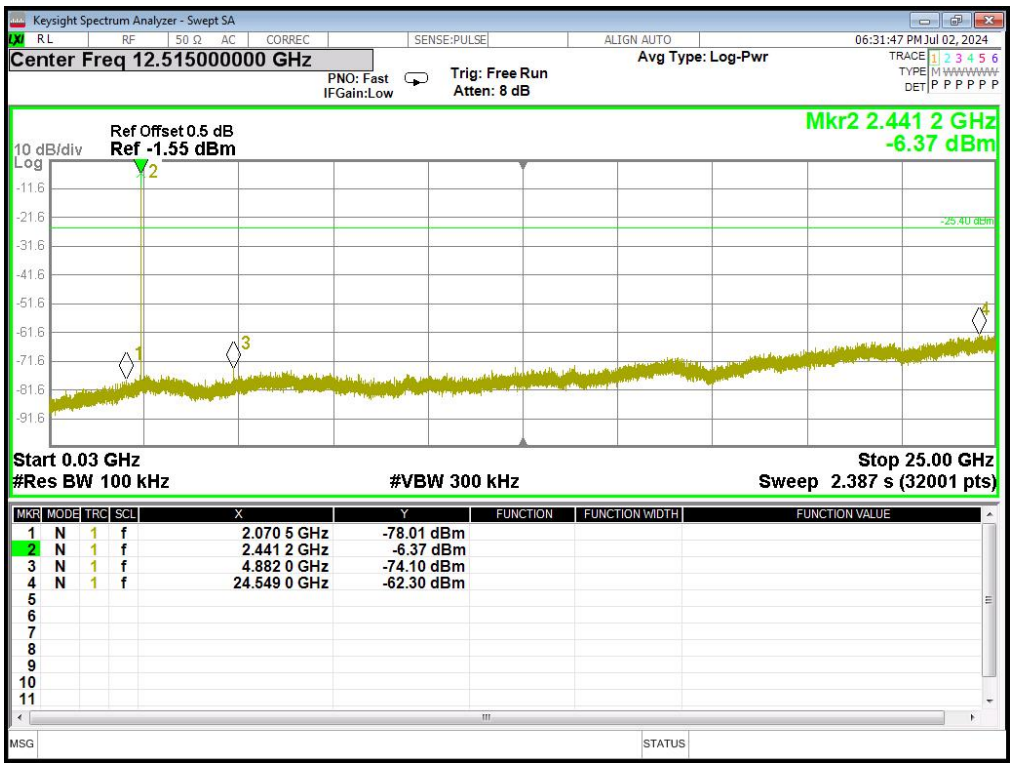
Temperature:	25 °C	Relative Humidity:	60%
Test Mode:	GFSK Mode	Test Voltage:	DC 12V

Spurious emissions

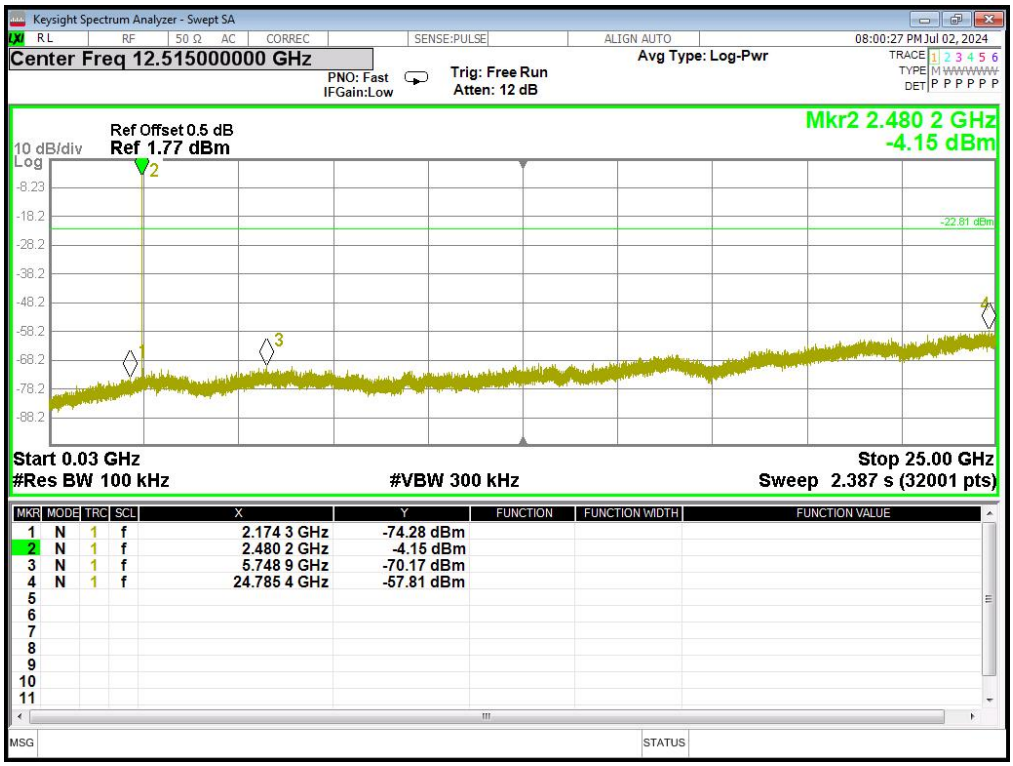
Low Channel 30MHz-26.5GHz



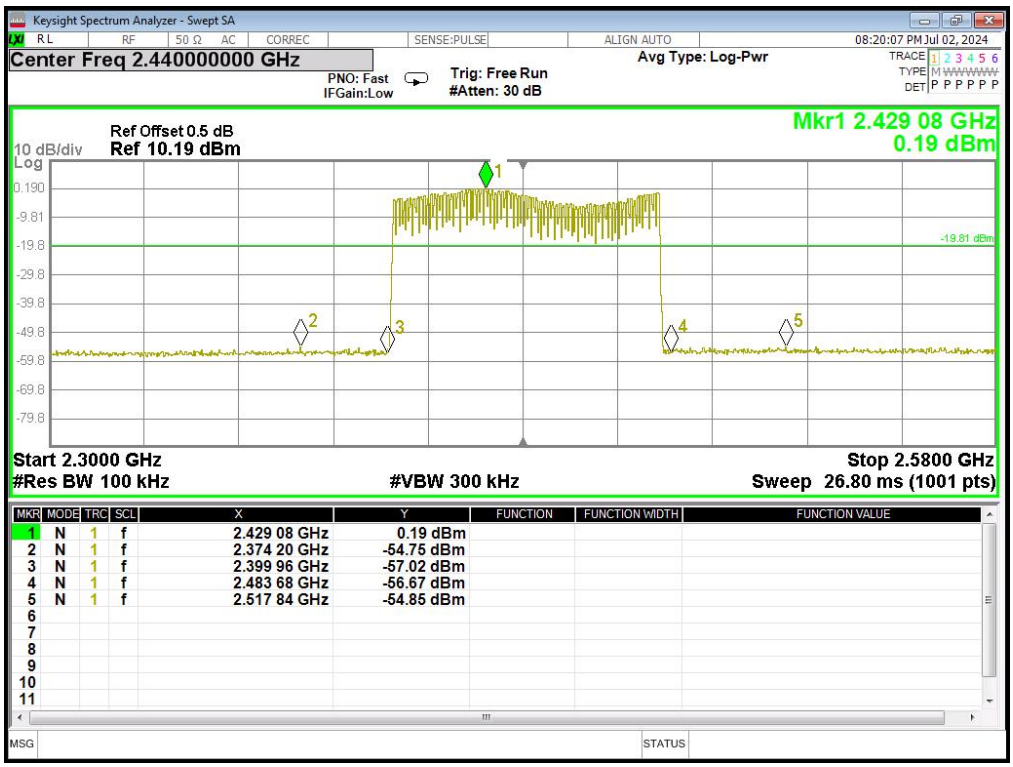
Middle Channel 30MHz-26.5GHz



High Channel 30MHz-26.5GHz



6.6 For Hopping Band edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.429 08 GHz	0.19 dBm			
2	N	1	f	2.374 20 GHz	-54.75 dBm			
3	N	1	f	2.399 96 GHz	-57.02 dBm			
4	N	1	f	2.483 68 GHz	-56.67 dBm			
5	N	1	f	2.517 84 GHz	-54.85 dBm			
6								
7								
8								
9								
10								
11								

7. RADIATED EMISSION MEASUREMENT

7.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/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

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

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

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	PK=1MHz / 1MHz, AV=1 MHz /10 Hz

For Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2300 to 2403 MHz Upper Band Edge: 2479 to 2500 MHz
RB / VB (emission in restricted band)	PK=1MHz / 1MHz, AV=1 MHz / 10 Hz

Receiver Parameter	**Setting**
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

7.2 TEST PROCEDURE

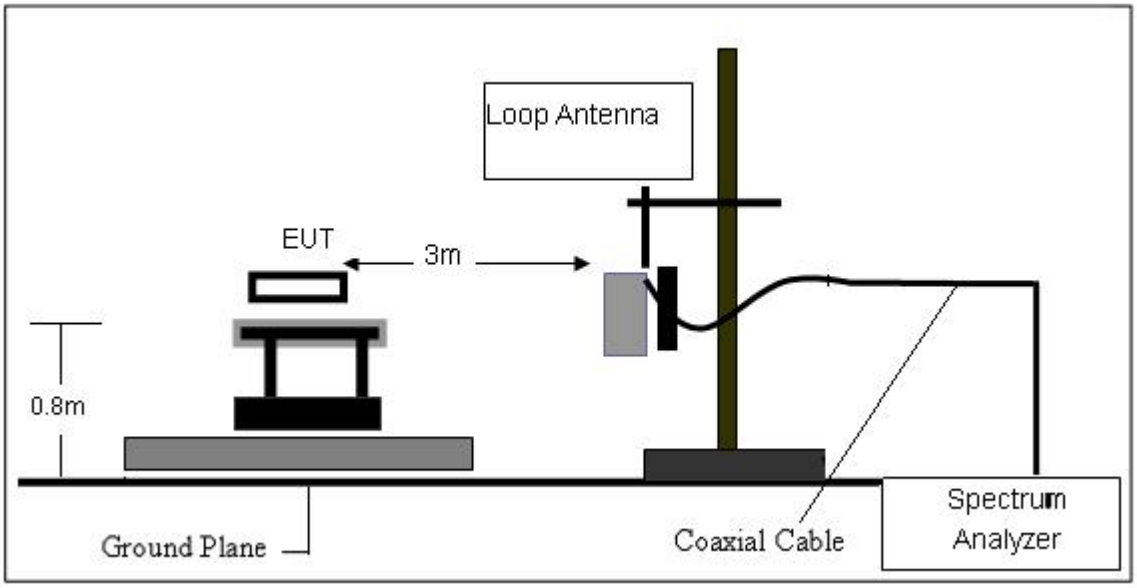
a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz,and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
d. 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 QuasiPeak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

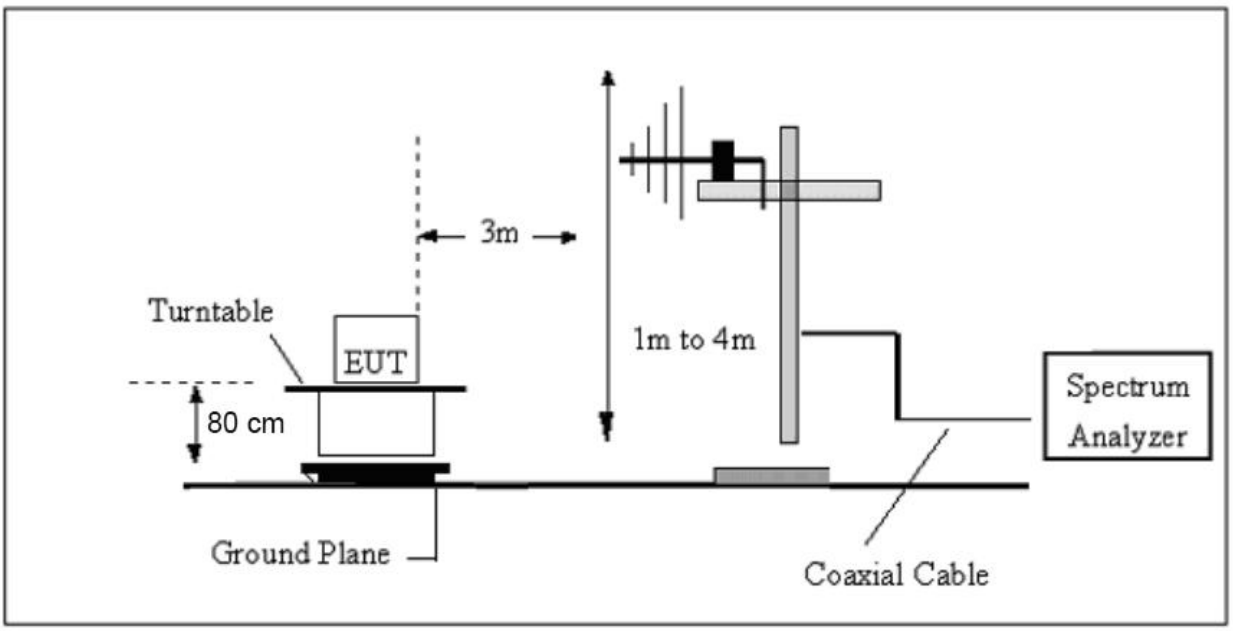
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

7.3 TESTSETUP

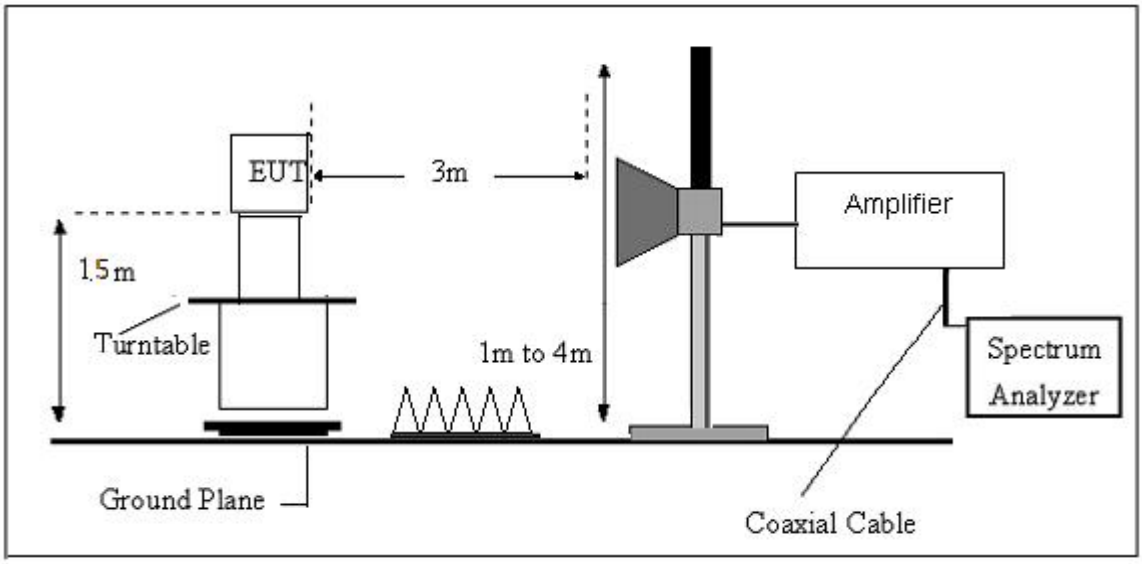
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



7.4. TEST RESULTS

(9KHz-30MHz)

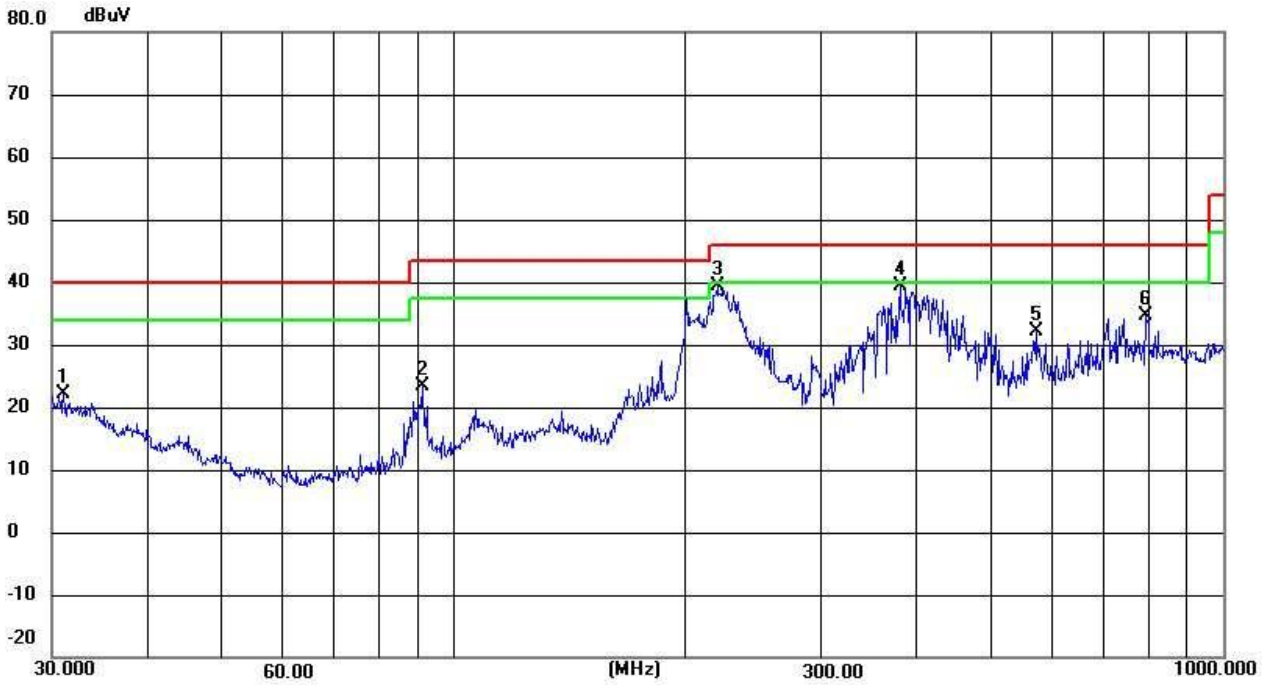
Temperature:	22.7℃	Relative Humidity:	61%
Test Voltage:	DC 12V	Test Mode:	GFSK(worst mode)

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

Note:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits (dBuv) + distance extrapolation factor.

7.5 (30MHZ-1000MHZ)

Temperature:	24.7℃	Relative Humidity:	61%
Test Voltage:	DC 12V	Phase:	Horizontal
Test Mode:	GFSK(worst mode)		



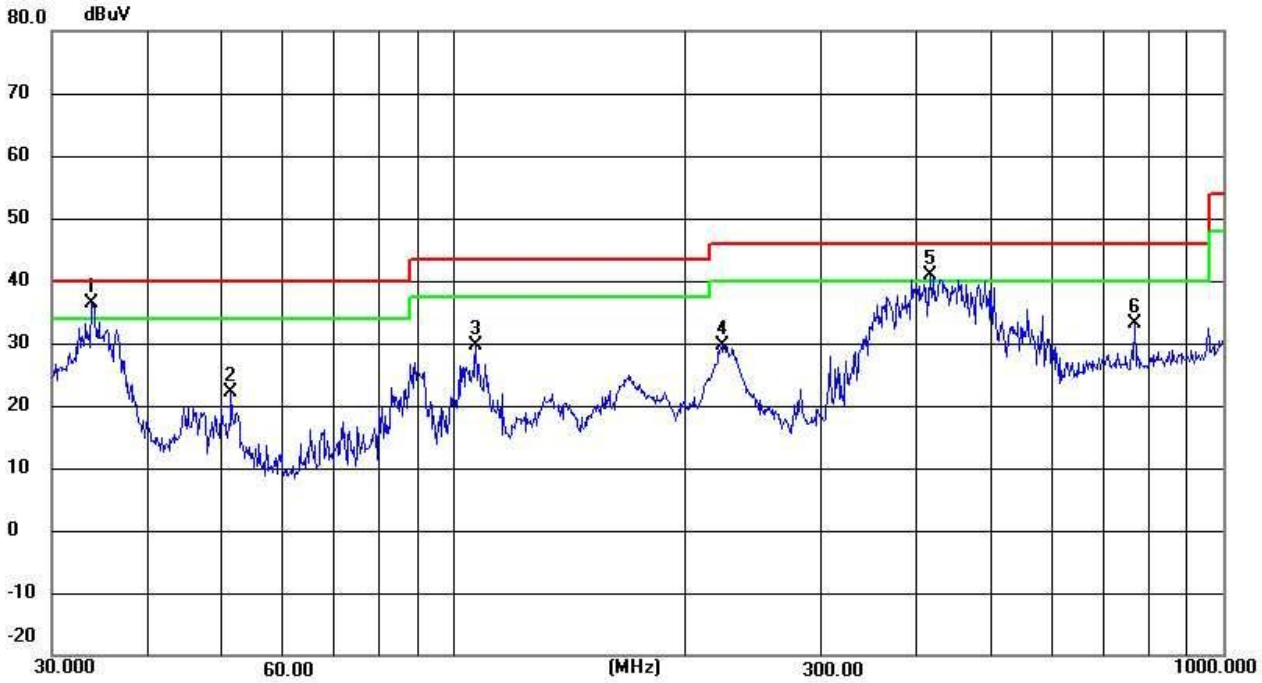
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	31.0706	30.13	-7.90	22.23	40.00	-17.77	QP
2	90.8554	55.49	-32.18	23.31	43.50	-20.19	QP
3	219.8449	71.50	-32.02	39.48	46.00	-6.52	QP
4	379.9141	70.98	-31.66	39.32	46.00	-6.68	QP
5	570.6100	63.23	-31.18	32.05	46.00	-13.95	QP
6	793.3960	65.44	-30.81	34.63	46.00	-11.37	QP

Note: 1. Margin = Result (Result =Reading + Factor)–Limit

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Temperature:	22.7℃	Relative Humidity:	61%
Test Voltage:	DC 12V	Phase:	Vertical
Test Mode:	GFSK(worst mode)		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.7986	46.08	-9.74	36.34	40.00	-3.66	QP
2	51.3005	40.41	-18.28	22.13	40.00	-17.87	QP
3	106.7587	61.90	-32.19	29.71	43.50	-13.79	QP
4	223.7334	61.56	-32.01	29.55	46.00	-16.45	QP
5	416.1791	72.49	-31.55	40.94	46.00	-5.06	QP
6	768.7481	64.02	-30.85	33.17	46.00	-12.83	QP

Note: 1. Margin = Result (Result =Reading + Factor)–Limit

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

7.6 ABOVE 1GHZ

Temperature:	25 °C	Relative Humidity:	60%
Test Mode:	GFSK Mode	Test Voltage:	DC 12V

Low CH (GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	34.96	31.78	8.60	32.09	43.25	74.00	-30.75	Vertical
7206.00	30.28	36.15	11.65	32.00	46.08	74.00	-27.92	Vertical
9608.00	30.09	37.95	14.14	31.62	50.56	74.00	-23.44	Vertical
12010.00	*					74.00		Vertical
14412.00	*					74.00		Vertical
4804.00	38.77	31.78	8.60	32.09	47.06	74.00	-26.94	Horizontal
7206.00	31.83	36.15	11.65	32.00	47.63	74.00	-26.37	Horizontal
9608.00	29.29	37.95	14.14	31.62	49.76	74.00	-24.24	Horizontal
12010.00	*					74.00		Horizontal
14412.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	24.22	31.78	8.60	32.09	32.51	54.00	-21.49	Vertical
7206.00	19.23	36.15	11.65	32.00	35.03	54.00	-18.97	Vertical
9608.00	18.45	37.95	14.14	31.62	38.92	54.00	-15.08	Vertical
12010.00	*					54.00		Vertical
14412.00	*					54.00		Vertical
4804.00	28.19	31.78	8.60	32.09	36.48	54.00	-17.52	Horizontal
7206.00	21.25	36.15	11.65	32.00	37.05	54.00	-16.95	Horizontal
9608.00	17.99	37.95	14.14	31.62	38.46	54.00	-15.54	Horizontal
12010.00	*					54.00		Horizontal
14412.00	*					54.00		Horizontal

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *"*", means this data is the too weak instrument of signal is unable to test.*

Temperature:	25 °C	Relative Humidity:	60%
Test Mode:	GFSK Mode	Test Voltage:	DC 12V

Middle CH (GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4882.00	34.75	31.85	8.67	32.12	43.15	74.00	-30.85	Vertical
7323.00	30.14	36.37	11.72	31.89	46.34	74.00	-27.66	Vertical
9764.00	29.96	38.35	14.25	31.62	50.94	74.00	-23.06	Vertical
12205.00	*					74.00		Vertical
14646.00	*					74.00		Vertical
4882.00	38.52	31.85	8.67	32.12	46.92	74.00	-27.08	Horizontal
7323.00	31.67	36.37	11.72	31.89	47.87	74.00	-26.13	Horizontal
9764.00	29.14	38.35	14.25	31.62	50.12	74.00	-23.88	Horizontal
12205.00	*					74.00		Horizontal
14646.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4882.00	24.05	31.85	8.67	32.12	32.45	54.00	-21.55	Vertical
7323.00	19.11	36.37	11.72	31.89	35.31	54.00	-18.69	Vertical
9764.00	18.35	38.35	14.25	31.62	39.33	54.00	-14.67	Vertical
12205.00	*					54.00		Vertical
14646.00	*					54.00		Vertical
4882.00	27.99	31.85	8.67	32.12	36.39	54.00	-17.61	Horizontal
7323.00	21.12	36.37	11.72	31.89	37.32	54.00	-16.68	Horizontal
9764.00	17.87	38.35	14.25	31.62	38.85	54.00	-15.15	Horizontal
12205.00	*					54.00		Horizontal
14646.00	*					54.00		Horizontal

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *"*", means this data is the too weak instrument of signal is unable to test.*

Temperature:	25 °C	Relative Humidity:	60%
Test Mode:	GFSK Mode	Test Voltage:	DC 12V

High CH(GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	34.60	31.93	8.73	32.16	43.10	74.00	-30.90	Vertical
7440.00	30.04	36.59	11.79	31.78	46.64	74.00	-27.36	Vertical
9920.00	29.87	38.81	14.38	31.88	51.18	74.00	-22.82	Vertical
12400.00	*					74.00		Vertical
14880.00	*					74.00		Vertical
4960.00	38.34	31.93	8.73	32.16	46.84	74.00	-27.16	Horizontal
7440.00	31.55	36.59	11.79	31.78	48.15	74.00	-25.85	Horizontal
9920.00	29.04	38.81	14.38	31.88	50.35	74.00	-23.65	Horizontal
12400.00	*					74.00		Horizontal
14880.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	23.93	31.93	8.73	32.16	32.43	54.00	-21.57	Vertical
7440.00	19.03	36.59	11.79	31.78	35.63	54.00	-18.37	Vertical
9920.00	18.28	38.81	14.38	31.88	39.59	54.00	-14.41	Vertical
12400.00	*					54.00		Vertical
14880.00	*					54.00		Vertical
4960.00	27.86	31.93	8.73	32.16	36.36	54.00	-17.64	Horizontal
7440.00	21.03	36.59	11.79	31.78	37.63	54.00	-16.37	Horizontal
9920.00	17.78	38.81	14.38	31.88	39.09	54.00	-14.91	Horizontal
12400.00	*					54.00		Horizontal
14880.00	*					54.00		Horizontal

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *"*", means this data is the too weak instrument of signal is unable to test.*

7.6 RADIATED BAND EDGE DATA

Remark: All restriction band have been tested, and only the worst case is shown in report

Low CH (GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	35.49	27.59	5.38	30.18	38.28	74.00	-35.72	Horizontal
2390.00	51.22	27.58	5.39	30.18	54.01	74.00	-19.99	Horizontal
2400.00	51.64	27.56	5.40	30.18	54.42	74.00	-19.58	Horizontal
2310.00	35.33	27.59	5.38	30.18	38.12	74.00	-35.88	Vertical
2390.00	52.47	27.58	5.39	30.18	55.26	74.00	-18.74	Vertical
2400.00	51.77	27.56	5.40	30.18	54.55	74.00	-19.45	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	27.71	27.59	5.38	30.18	30.50	54.00	-23.50	Horizontal
2390.00	38.51	27.58	5.39	30.18	41.30	54.00	-12.70	Horizontal
2400.00	37.53	27.56	5.40	30.18	40.31	54.00	-13.69	Horizontal
2310.00	27.13	27.59	5.38	30.18	29.92	54.00	-24.08	Vertical
2390.00	39.45	27.59	5.38	30.18	42.24	54.00	-11.76	Vertical
2400.00	39.06	27.56	5.40	30.18	41.84	54.00	-12.16	Vertical

High CH(GFSK)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	36.71	27.53	5.47	29.93	39.78	74.00	-34.22	Horizontal
2500.00	37.29	27.55	5.49	29.93	40.40	74.00	-33.60	Horizontal
2483.50	36.33	27.53	5.47	29.93	39.40	74.00	-34.60	Vertical
2500.00	37.59	27.55	5.49	29.93	40.70	74.00	-33.30	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	30.45	27.53	5.47	29.93	33.52	54.00	-20.48	Horizontal
2500.00	29.51	27.55	5.49	29.93	32.62	54.00	-21.38	Horizontal
2483.50	31.05	27.53	5.47	29.93	34.12	54.00	-19.88	Vertical
2500.00	28.81	27.55	5.49	29.93	31.92	54.00	-22.08	Vertical

Remark.

1.Final Level =Receiver Read level + Antenna Factor + Cable Loss - Preamplifier Factor

2.The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

8. AVERAGE TIME OF OCCUPANCY

8.1 LIMIT

FCC Parti 5 (15.247), Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
15.247(a)(1)	Average Time of Occupancy	0.4 sec	2400-2483.5

8.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer.

b. Set RBW =1MHz/VBW =1MHz.

c. Use a video trigger with the trigger level set to enable triggering only on full pulses.

d. Sweep Time is more than once pulse time.

e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.

f. Measure the maximum time duration of one single pulse.

g. Set the EUT for DH5, DH3 and DH1 packet transmitting.

h. Measure the maximum time duration of one single pulse.

i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 3.37x31.6 = 106.6.

j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 5.06x31.6 = 160.

k. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 10.12x31.6 = 320.

8.3 TEST SETUP

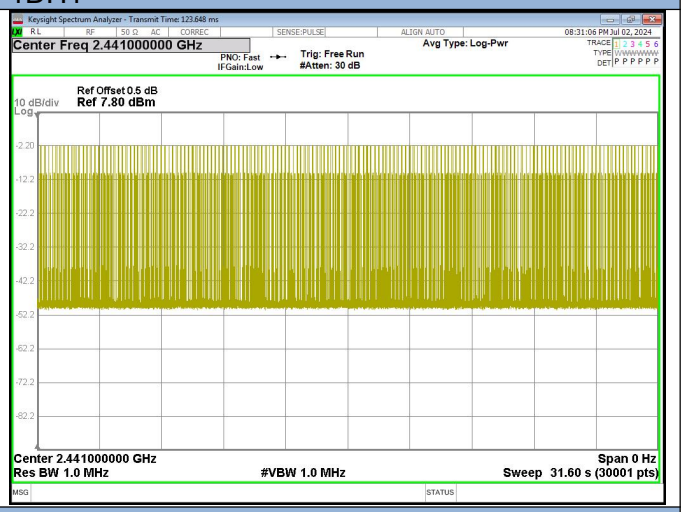
8.4 TEST RESULTS

AVERAGE_TIME_OF_OCCUPANCY							
CONDITION	MODE	FREQUENCY (MHZ)	PULSE TIME (MS)	AVERAGE TIME OF OCCUPANCY (MS)	LIMIT (MS)	BURST NUMBER	RESULTS
NVNT	1DH1	2441	0.386	123.648	400	320	PASS
NVNT	1DH3	2480	1.645	254.975	400	155	PASS
NVNT	1DH5	2441	2.896	312.768	400	108	PASS

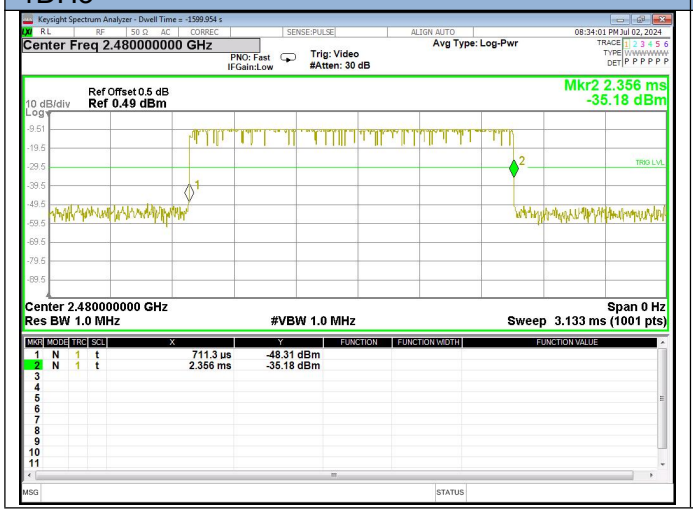
8.5 ORIGINAL TEST DATA

1DH1

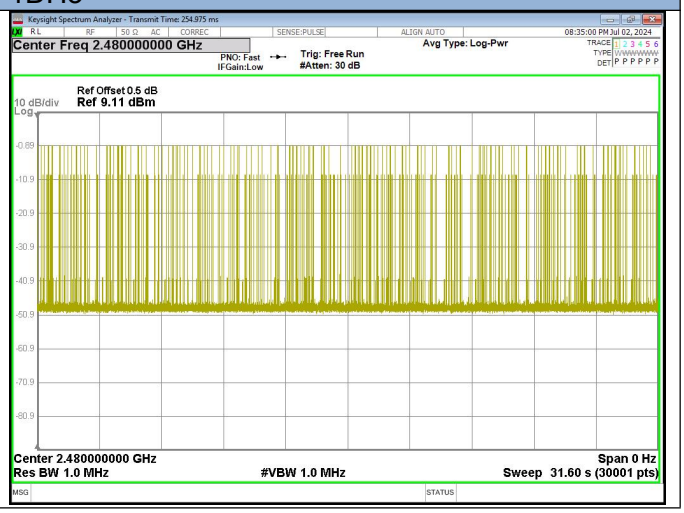
1DH1



1DH3



1DH3



1DH5

Keysight Spectrum Analyzer - Dwell Time = -1066.623 s
08:36:42 PM Jul 02, 2024
Center Freq 2.441000000 GHz
Avg Type: Log-Pwr
PNO: Fast
IFGain:Low
Trig: Video
#Atten: 30 dB
Mkr2 3.484 ms
-39.17 dBm
Ref Offset 0.5 dB
10 dB/div
Ref 7.81 dBm
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 4.000 ms (1001 pts)
1 N 1 t 588.0 us -38.96 dBm
2 N 1 t 3.484 ms -39.17 dBm

1DH5

Keysight Spectrum Analyzer - Transmit Time: 312.768 ms
08:37:42 PM Jul 02, 2024
Center Freq 2.441000000 GHz
Avg Type: Log-Pwr
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Ref Offset 0.5 dB
10 dB/div
Ref 7.81 dBm
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 31.60 s (30001 pts)

9. HOPPING CHANNEL SEPARATION MEASUREMEN

9.1 LIMIT

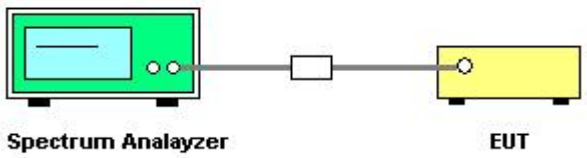
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 20 dB Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) /100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

9.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
b. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
c. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for channel separation measurement

9.3 TEST SETUP



9.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

9.5 TEST RESULTS

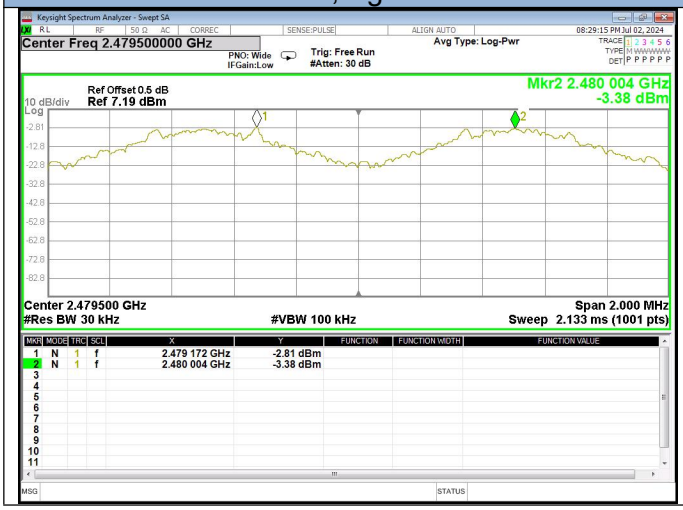
Temperature:	25 °C	Relative Humidity:	60%
Test Mode:	GFSK Mode	Test Voltage:	DC 12V

Modulation	Test Mode	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
GFSK	1DH1	2402	1.096	> 0.64	Pass
	1DH1	2441	0.998	> 0.68	Pass
	1DH1	2480	0.832	> 0.64	Pass

1DH1,Lowest

1DH1,Middle

1DH1,Highest



10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

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 (b), 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.

10.2 RESULT

The antennas used for this product are PCB antenna and no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is -0.58dBi.

※※※※※END OF THE REPORT※※※※※