

FCC PART 15.247 TEST REPORT

For

SHANGHAI MERIT TECHNOLOGY CORP.

1058 TAOGAN RD., SHESHAN TOWN, SONGJIANG DISTRICT, SHANGHAI, China

FCC ID: XJ6MT-203-1

Report Type: Original Report	Product Type: 3CH 2.4GHZ FHSS RADIO CONTROL SYSTEM
Test Engineer: <u>Chao Gao</u>	<i>Chao Gao</i>
Report Number: <u>RSHF200914001-00A</u>	
Report Date: <u>2020-10-15</u>	
Reviewed By: <u>Oscar Ye EMC Manager</u>	<i>Oscar Ye</i>
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
SPECIAL ACCESSORIES.....	7
EQUIPMENT MODIFICATIONS	7
SUPPORT EQUIPMENT LIST AND DETAILS	7
EXTERNAL I/O CABLE.....	7
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	9
TEST EQUIPMENT LIST	10
FCC§15.247 (i), §1.1310 &§2.1093 – RF EXPOSURE	11
MEASUREMENT RESULT	11
FCC §15.203 – ANTENNA REQUIREMENT	12
APPLICABLE STANDARD	12
ANTENNA INFORMATION	12
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS.....	13
APPLICABLE STANDARD	13
EUT SETUP	13
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	14
TEST PROCEDURE	14
CORRECTED AMPLITUDE & MARGIN CALCULATION	14
TEST RESULTS SUMMARY	14
TEST DATA	15
FCC §15.247(a) (1)-CHANNEL SEPARATION TEST	23
APPLICABLE STANDARD	23
TEST PROCEDURE	23
TEST DATA	23
FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH.....	25
APPLICABLE STANDARD	25
TEST PROCEDURE	25
TEST DATA	25
FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST	28
APPLICABLE STANDARD	28
TEST PROCEDURE	28
TEST DATA	28
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....	30
APPLICABLE STANDARD	30

TEST PROCEDURE	30
TEST DATA	30
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT	33
APPLICABLE STANDARD	33
TEST PROCEDURE	33
TEST DATA	33
FCC §15.247(d) - BAND EDGES TESTING	36
APPLICABLE STANDARD	36
TEST PROCEDURE	36
TEST DATA	36

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	SHANGHAI MERIT TECHNOLOGY CORP.
Tested Model:	MT-203
Product Type:	3CH 2.4GHZ FHSS RADIO CONTROL SYSTEM
Power Supply:	DC 6V from 1.5V*4cell "AA" alkaline battery
RF Function:	SRD
Operating Band/Frequency:	2405-2450 MHz
Total Channel Number:	46
Hopping Channel Number	29
Minimum Hopping Channel Separation:	1 MHz
Modulation Type:	GFSK
Antenna Type:	Dipole antenna
*Maximum Antenna Gain:	2 dBi

Note*: The maximum antenna gain was provided by the applicant.

*All measurement and test data in this report was gathered from production sample serial number: 20200914001. (Assigned by BACL, Kunshan). The EUT was received on 2020-09-14.

Objective

This test report is prepared on behalf of *SHANGHAI MERIT TECHNOLOGY CORP.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliant Testing of Unlicensed Wireless Devices and FCC 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Bay Area Compliant Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01), the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISSED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel list for FHSS (GFSK) Modulation:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	24	2428
2	2406	25	2429
3	2407	26	2430
4	2408	27	2431
5	2409	28	2432
6	2410	29	2433
7	2411	30	2434
8	2412	31	2435
9	2413	32	2436
10	2414	33	2437
11	2415	34	2438
12	2416	35	2439
13	2417	36	2440
14	2418	37	2441
15	2419	38	2442
16	2420	39	2443
17	2421	40	2444
18	2422	41	2445
19	2423	42	2446
20	2424	43	2447
21	2425	44	2448
22	2426	45	2449
23	2427	46	2450

For fixed channel mode: EUT was tested with Channel 1, 24, 46.

For Hopping mode: 29 random frequency hopping channels was test.

EUT Exercise Software

The EUT was tested in the engineering mode; EUT can be setup for fixed channel mode and hopping mode.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

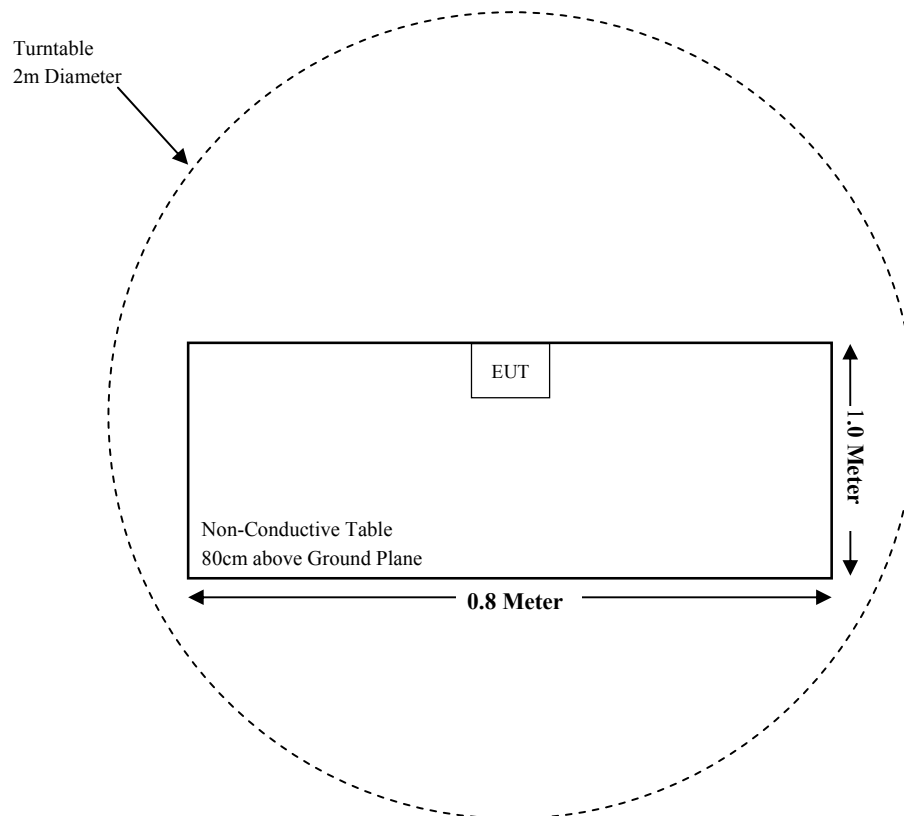
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

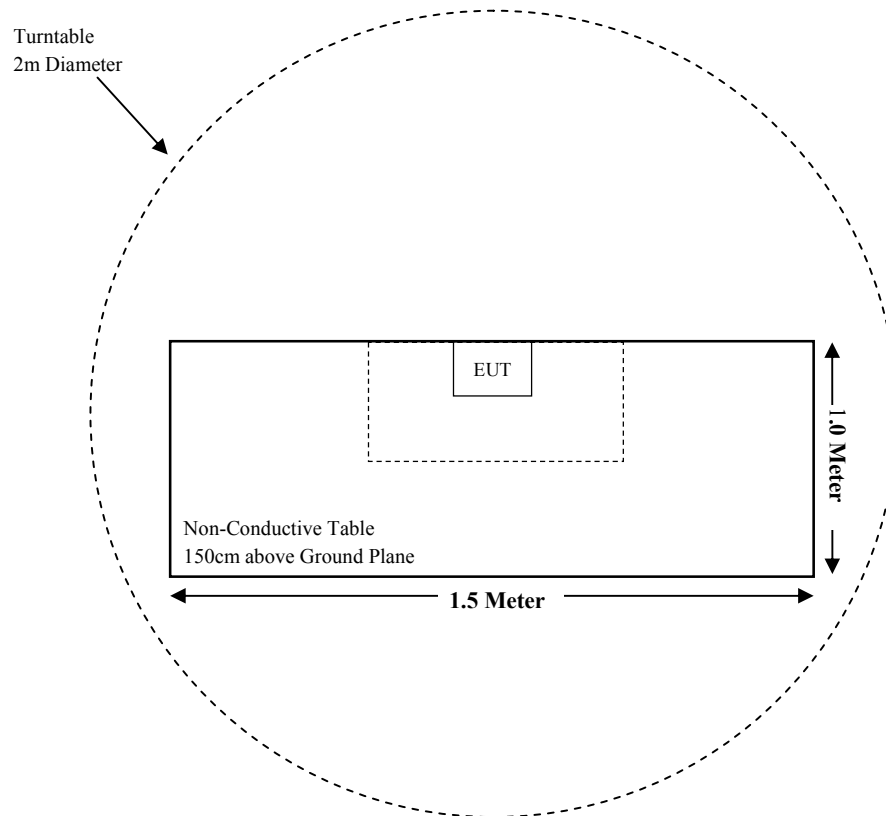
Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i)§1.1310 & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Not Applicable (See Note)
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliant
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

Note: The EUT is powered by batteries.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test (Chamber 1#)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2019-12-14	2020-12-13
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2017-12-26	2020-12-25
Sonoma Instrument	Pre-amplifier	310N	171205	2020-08-14	2021-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2020-08-15	2021-08-14
Radiated Emission Test (Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2020-04-01	2021-03-31
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2020-07-15	2023-07-14
ETS-LINDGREN	Horn Antenna	3116	84159	2019-12-12	2022-12-11
A.H.Systems,inc	Amplifier	PAM-0118P	512	2020-02-20	2021-02-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2020-03-22	2021-03-21
MICRO-TRONICS	Band Reject Filter	BRM50702	G024	2020-08-05	2021-08-04
Narda	Attenuator/10dB	10dB	/	2020-08-15	2021-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2020-08-15	2021-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2019-12-14	2020-12-13
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2020-07-23	2021-07-22
Narda	Attenuator	10dB	010	2020-08-15	2021-08-14
SHANGHAI MERIT TECHNOLOGY CORP.	RF Cable	MERIT C01	C01	Each Time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1310 &§2.1093 – RF EXPOSURE

Applicable Standard

According to §2.1093 and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Measurement Result

Frequency Range (MHz)	Max Tune-up Conducted Power		Calculated Distance (mm)	Calculated Value	Threshold (10-g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2405-2450	18.60	72.44	20	5.67	7.5	Yes

Note:

1. This is a handheld device



Result: No SAR test is required.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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. 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.

Antenna Information

The EUT has a dipole antenna, which the antenna gain is 2.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

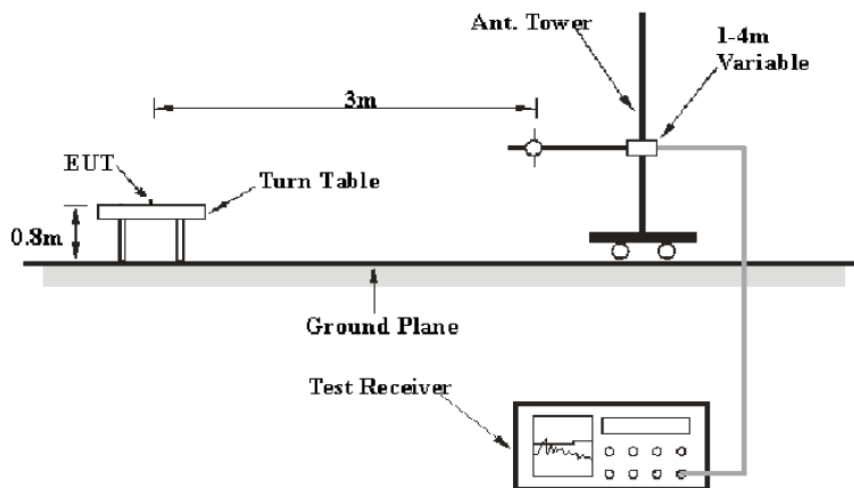
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

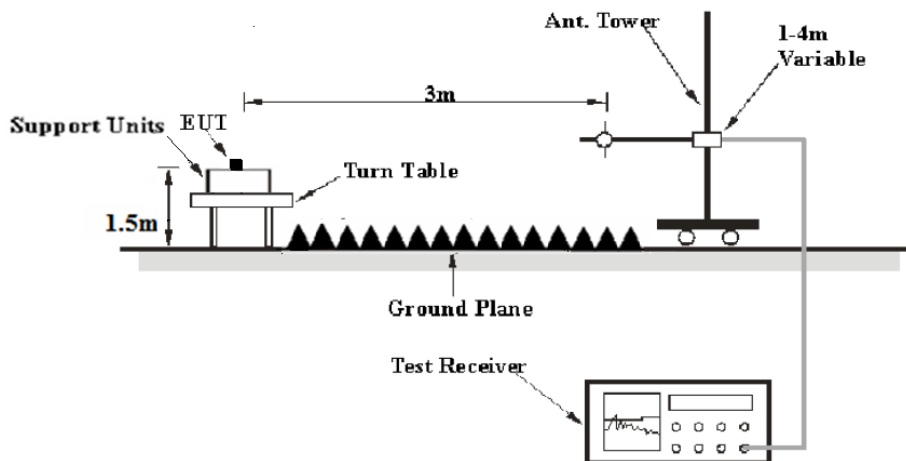
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz - 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data**Environmental Conditions**

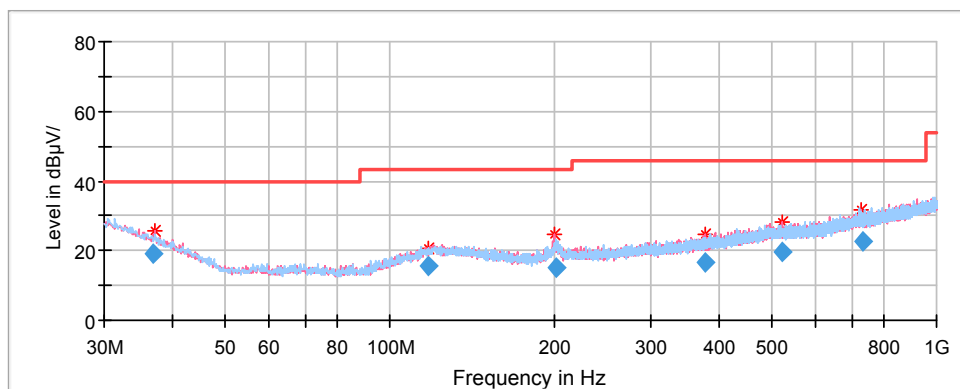
Temperature:	23.5 °C~25°C
Relative Humidity:	50%~51%
ATM Pressure:	101.1 kPa~101.5kPa

The testing was performed by Chao Gao from 2020-09-27 to 2020-10-10.

EUT operation mode: Transmitting

Spurious Emission Test:**30MHz-1GHz:**

Pre-Scan with low, middle and high channels in the X,Y and Z axes of orientation, the worst case **low channel in X-axis of orientation** was recorded



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
36.918250	18.91	100.0	V	277.0	-8.9	40.00	21.09
117.735900	15.39	200.0	V	118.0	-12.0	43.50	28.11
201.606750	14.86	100.0	V	0.0	-12.8	43.50	28.64
377.043200	16.40	100.0	V	115.0	-9.2	46.00	29.60
522.382700	19.57	100.0	V	189.0	-6.0	46.00	26.43
730.964900	22.84	100.0	V	163.0	-2.5	46.00	23.16

1GHz-18GHz

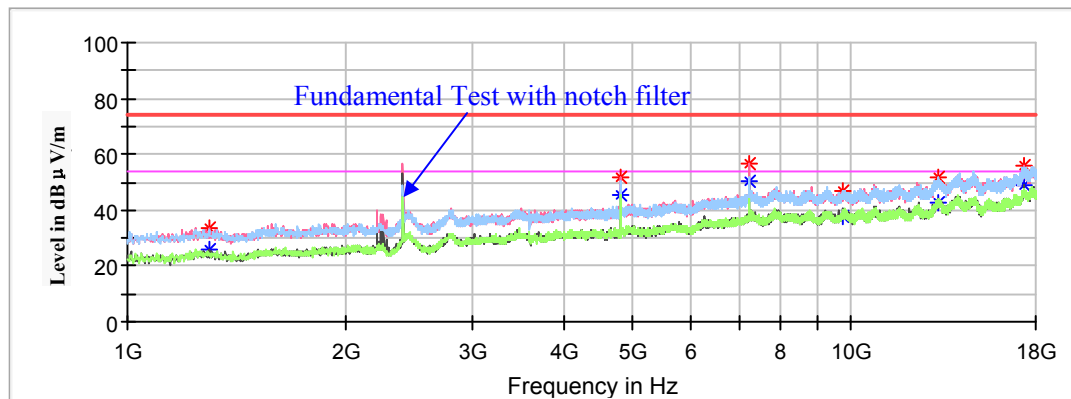
(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded.)

Note:

1. This test was performed with the 2.4 - 2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
 Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV/m)

Low Channel: 2405MHz

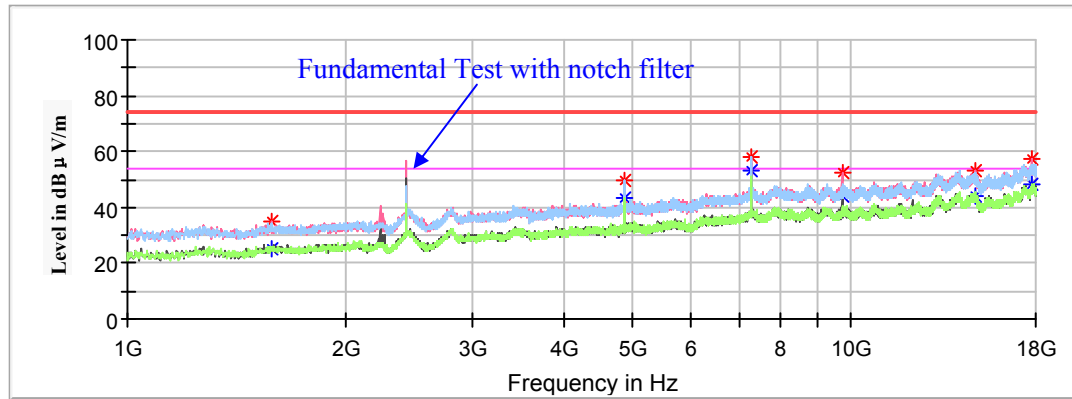
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
1294.10	33.78	---	150.0	V	295.0	-17.5	74.00	40.22
1294.10	---	25.73	150.0	V	295.0	-17.5	54.00	28.27
4810.00	---	45.38	150.0	H	129.0	-5.6	54.00	8.62
4810.00	51.56	---	150.0	H	129.0	-5.6	74.00	22.44
7215.00	56.62	---	200.0	V	231.0	0.4	74.00	17.38
7215.00	---	50.38	200.0	V	231.0	0.4	54.00	3.62
9744.80	---	38.06	200.0	H	263.0	2.0	54.00	15.94
9744.80	46.87	---	200.0	H	263.0	2.0	74.00	27.13
13197.50	---	42.96	150.0	H	350.0	5.4	54.00	11.04
13197.50	51.71	---	150.0	H	350.0	5.4	74.00	22.29
17335.30	56.13	---	200.0	V	181.0	8.3	74.00	17.87
17335.30	---	48.84	200.0	V	181.0	8.3	54.00	5.16

Middle Channel: 2428MHz

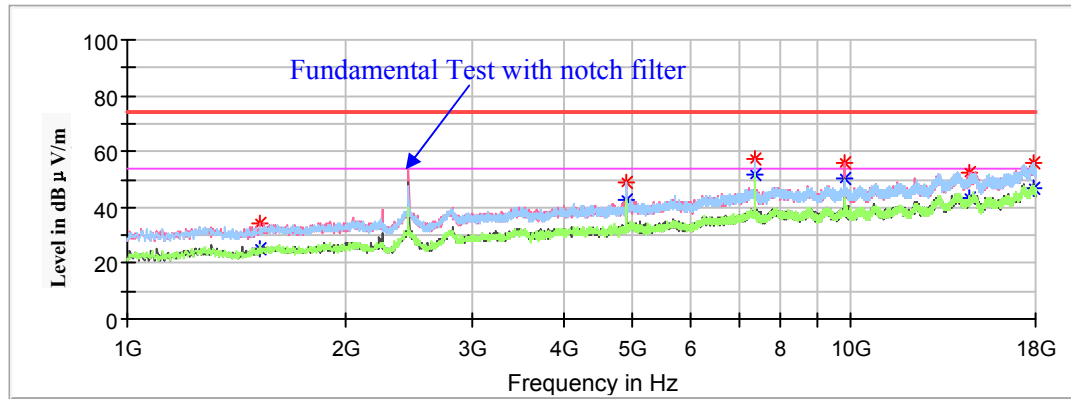
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
1581.40	---	24.99	200.0	V	283.0	-16.1	54.00	29.01
1581.40	34.62	---	200.0	V	283.0	-16.1	74.00	39.38
4856.00	---	43.48	150.0	H	59.0	-5.5	54.00	10.52
4856.00	49.53	---	150.0	H	59.0	-5.5	74.00	24.47
7284.00	58.28	---	200.0	V	109.0	0.6	74.00	15.72
7284.00	---	53.03	200.0	V	109.0	0.6	54.00	0.97
9710.80	---	44.39	150.0	V	195.0	2.0	54.00	9.61
9710.80	52.30	---	150.0	V	195.0	2.0	74.00	21.70
14841.40	---	43.96	200.0	H	350.0	5.6	54.00	10.04
14841.40	53.12	---	200.0	H	350.0	5.6	74.00	20.88
17830.00	---	48.40	150.0	H	20.0	8.8	54.00	5.60
17830.00	57.27	---	150.0	H	20.0	8.8	74.00	16.73

High Channel: 2450MHz

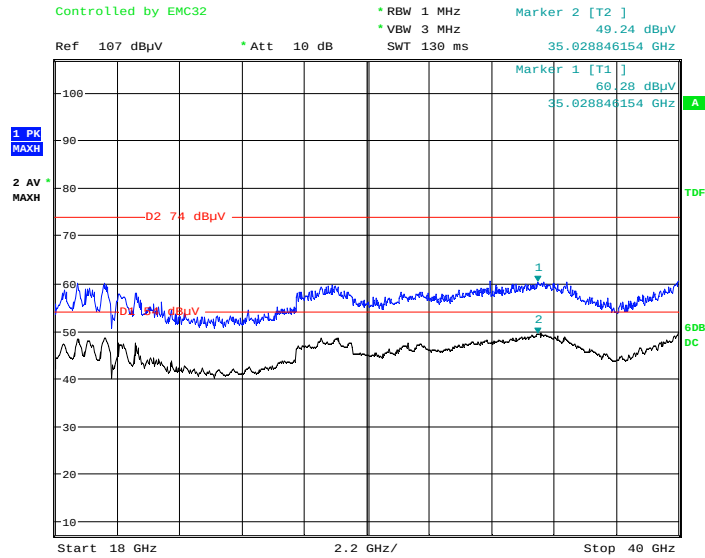
Full Spectrum



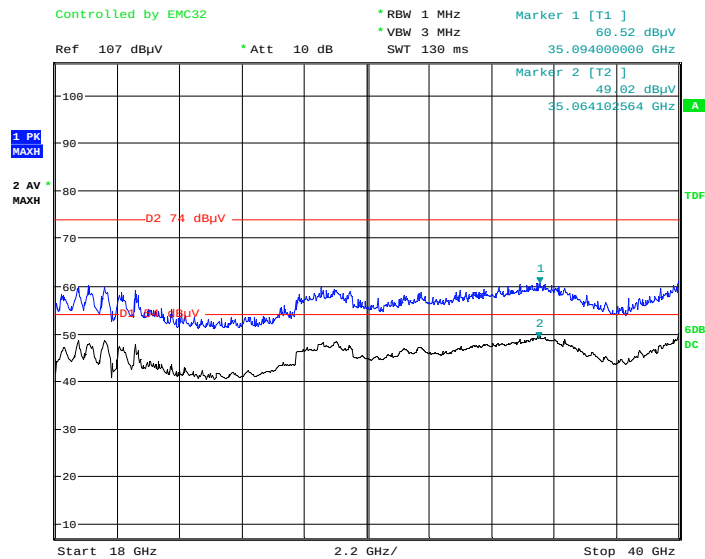
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
1527.00	---	25.13	200.0	V	68.0	-16.3	54.00	28.87
1527.00	34.42	---	200.0	V	68.0	-16.3	74.00	39.58
4910.00	---	42.78	150.0	H	330.0	-5.4	54.00	11.22
4910.00	48.91	---	150.0	H	330.0	-5.4	74.00	25.09
7350.00	---	52.00	200.0	H	104.0	0.7	54.00	2.00
7350.00	57.27	---	200.0	H	104.0	0.7	74.00	16.73
9799.20	---	50.60	200.0	V	341.0	2.0	54.00	3.40
9799.20	55.60	---	200.0	V	341.0	2.0	74.00	18.40
14600.00	---	43.68	150.0	V	156.0	6.2	54.00	10.32
14600.00	52.63	---	150.0	V	156.0	6.2	74.00	21.37
17850.40	---	47.12	200.0	H	220.0	8.8	54.00	6.88
17850.40	55.71	---	200.0	H	220.0	8.8	74.00	18.29

18GHz-25GHz:

Pre-Scan with low, middle and high channels in the X,Y and Z axes of orientation, the worst case **low channel in X-axis of orientation** was recorded

Horizontal

Date: 27.SEP.2020 19:43:30

Vertical

Date: 27.SEP.2020 19:40:07

Fundamental Test & Restricted Bands Emissions:

*Pre-Scan in the X,Y and Z axes of orientation, the worst case **in X-axis of orientation** was recorded*

Note:

1. Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

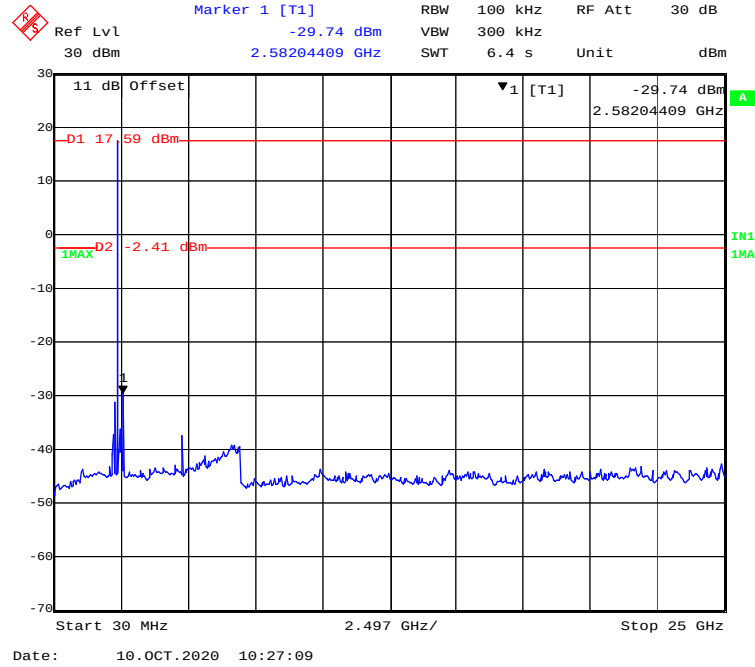
Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

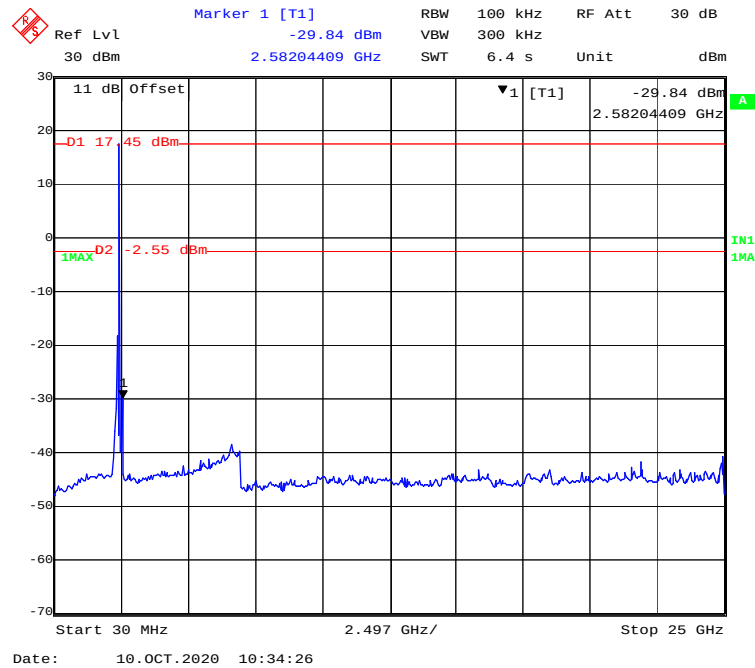
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel								
2390.00	62.57	---	200	H	281	-2.9	74.00	11.43
2390.00	---	50.99	200	H	281	-2.9	54.00	3.01
2390.00	66.00	---	200	V	4	-2.9	74.00	8.00
2390.00	---	53.85	200	V	4	-2.9	54.00	0.15
High Channel								
2483.50	60.87	---	150	H	189	-2.5	74.00	13.13
2483.50	---	49.72	150	H	189	-2.5	54.00	4.28
2483.50	63.45	---	150	V	116	-2.5	74.00	10.55
2483.50	---	50.33	150	V	116	-2.5	54.00	3.67

Conducted Spurious Emissions at Antenna Port:

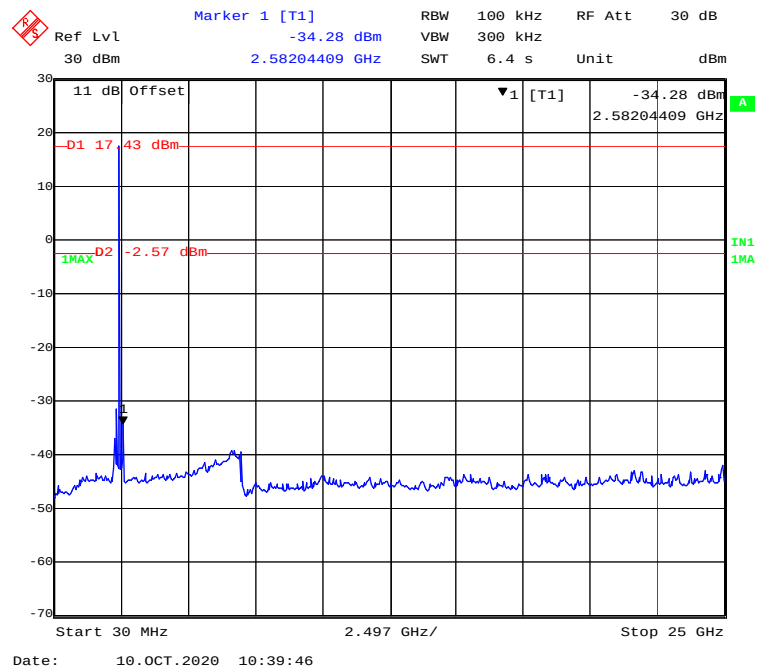
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (1)-CHANNEL SEPARATION TEST**Applicable Standard**

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.

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Data**Environmental Conditions**

Temperature:	23.5 °C
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Chao Gao on 2020-10-10.

EUT operation mode: Hopping

Test Result: Compliant.

Modulation	Channel	Frequency (MHz)	Channel Separation (kHz)	Limit (kHz)	Result
GFSK	Middle	2428	999	260.53	Pass
	Adjacent	2429			

The limit = 20dB Bandwidth*2/3

Middle Channel



Date: 10.OCT.2020 14:46:04

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH**Applicable Standard**

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.

Test Procedure

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.
4. Repeat above procedures until all frequencies measured were complete.

Test Data**Environmental Conditions**

Temperature:	24.2 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

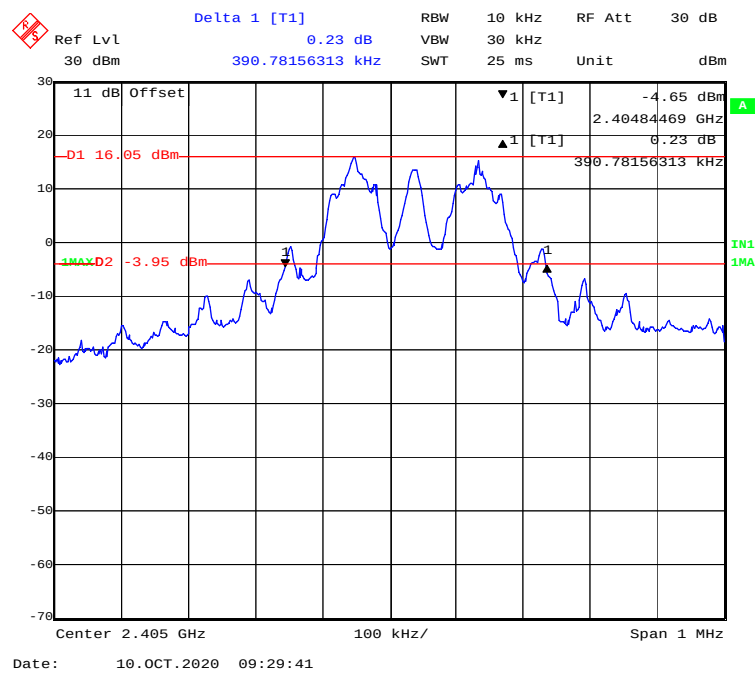
The testing was performed by Chao Gao on 2020-10-10.

EUT operation mode: Transmitting

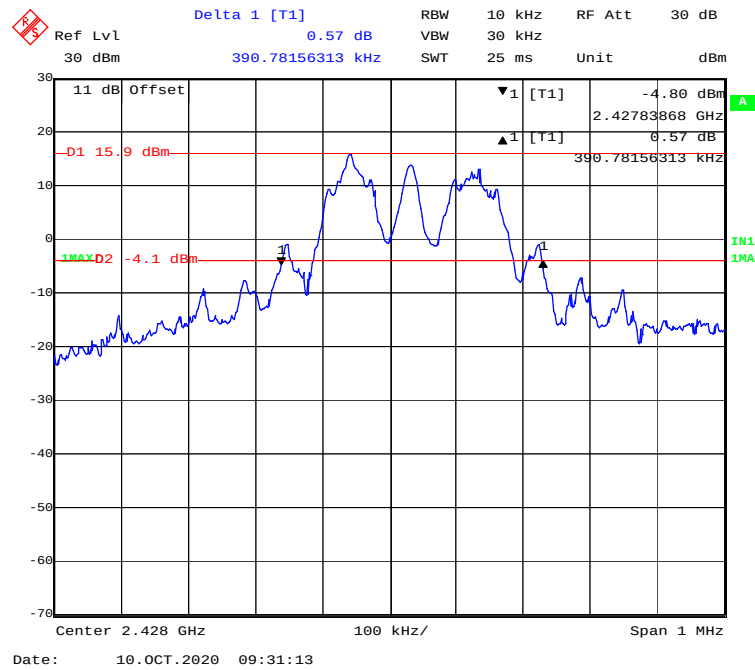
Test Result: Compliant.

Modulation	Channel	Frequency (MHz)	20 dB Emission Bandwidth (kHz)
GFSK	Low	2405	390.8
	Middle	2428	390.8
	High	2450	390.8

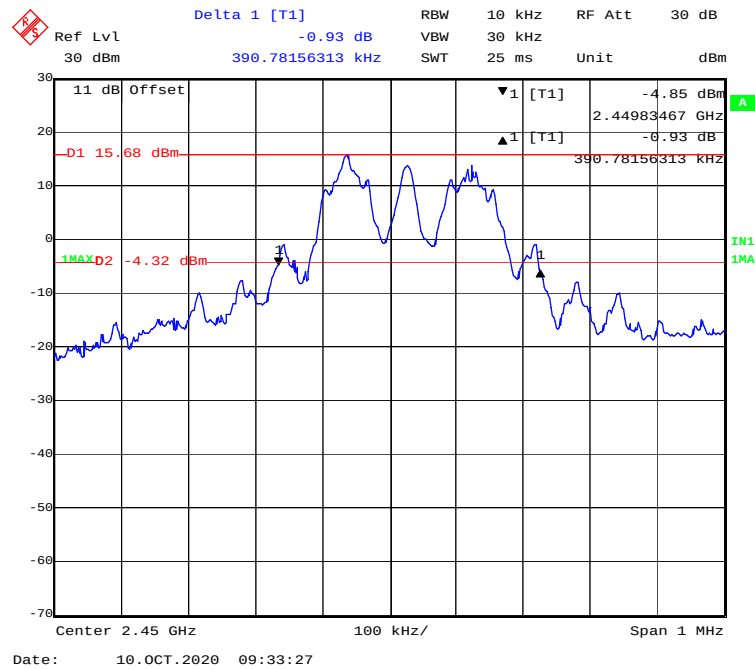
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST**Applicable Standard**

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the max-hold function record the quantity of the channel.

Test Data**Environmental Conditions**

Temperature:	24.2 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

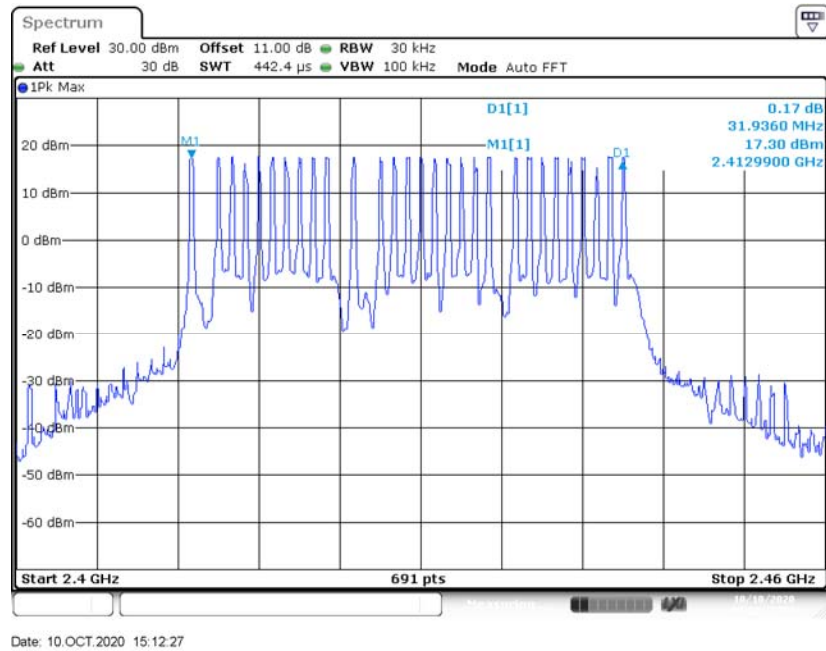
The testing was performed by Chao Gao on 2020-10-10.

EUT operation mode: Hopping

Test Result: Compliant.

Modulation	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
GFSK	2405-2450	29	≥15

Number of Hopping Channels



FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 X channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Test Data

Environmental Conditions

Temperature:	23.5 °C
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

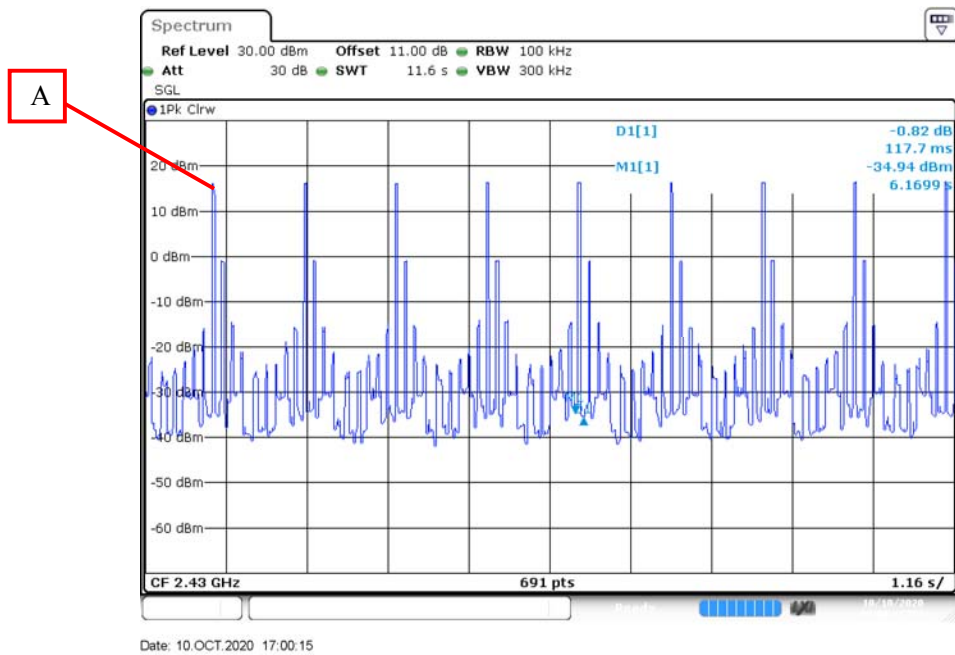
The testing was performed by Chao Gao on 2020-10-10.

EUT operation mode: Hopping

Test Result: Compliant.

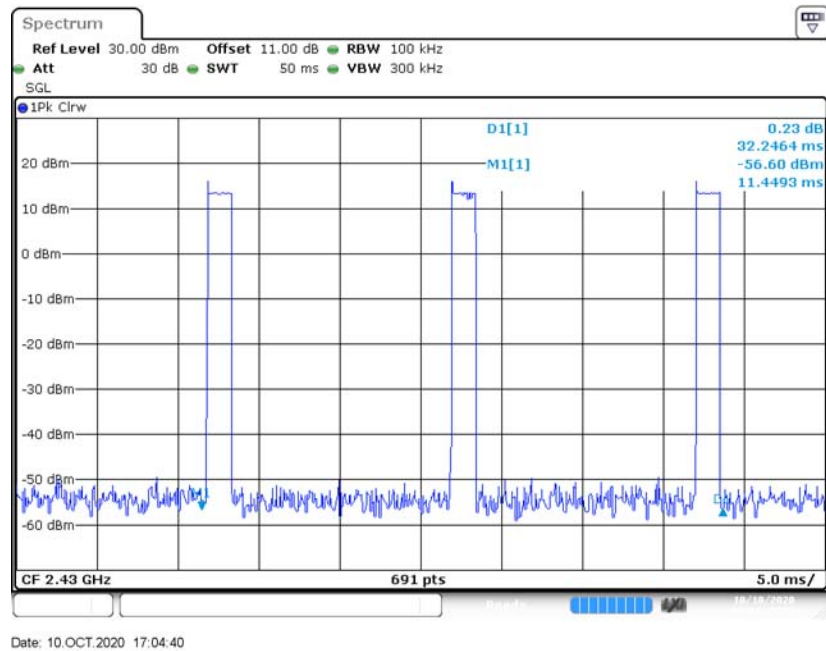
Modulation	Pulse Width	Pulse Number	Dwell Time	Limit	Result
	(ms)		(s)	(s)	
GFSK	1.993	9*3	0.054	≤0.4	Pass
	Note:Dwell time = Pulse time*N Observed time = 0.4s* hopping number= 0.4s*29=11.6s				

Number of Pulses

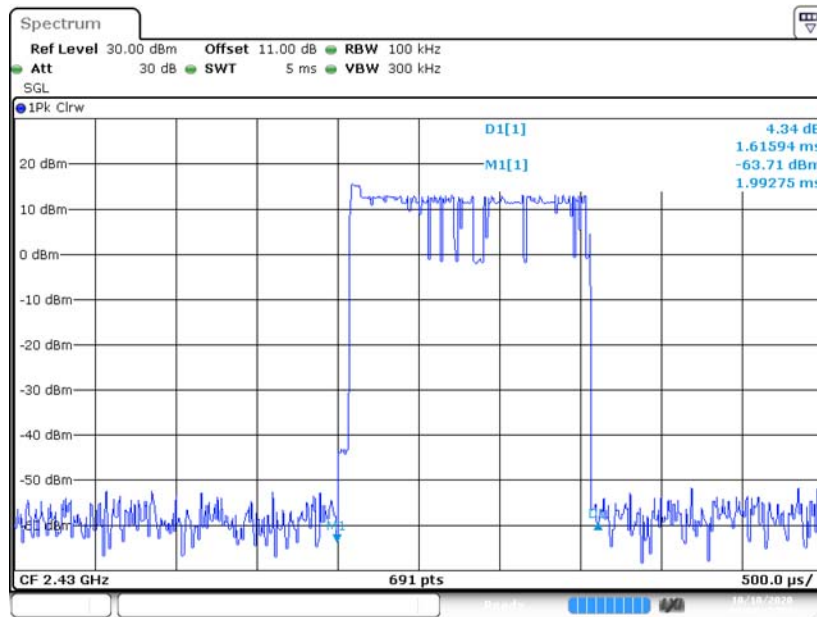


Note: A means one pulse train.

Zoom in A



Single Pulse



FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT**Applicable Standard**

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Data**Environmental Conditions**

Temperature:	24.2 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

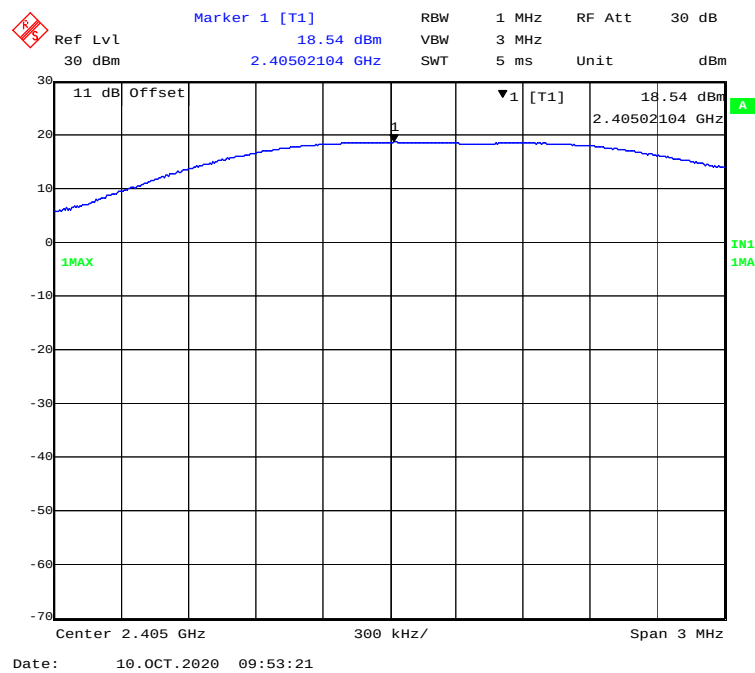
The testing was performed by Chao Gao on 2020-10-10.

EUT operation mode: Transmitting

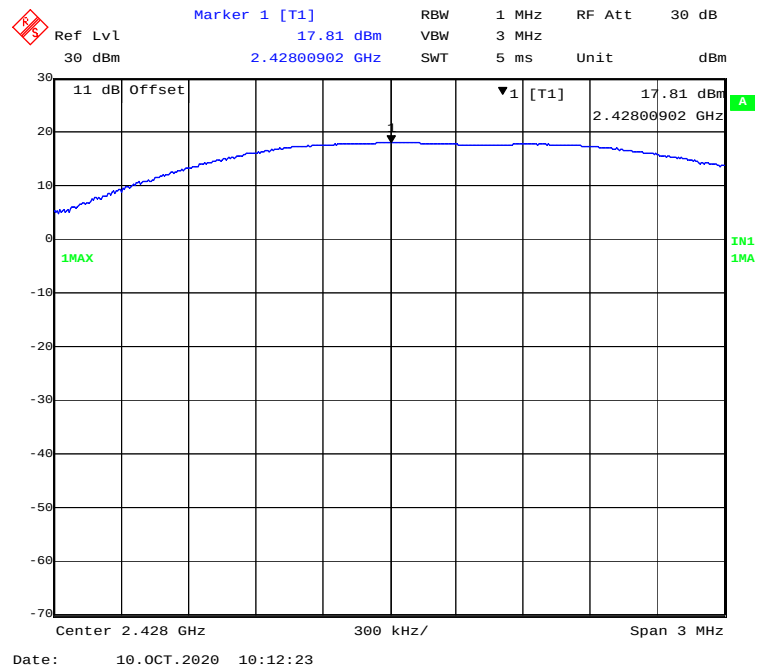
Test Result: Compliant.

Modulation	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
GFSK	Low	2405	18.54	71.45	125
	Middle	2428	17.81	60.39	125
	High	2450	17.62	57.81	125

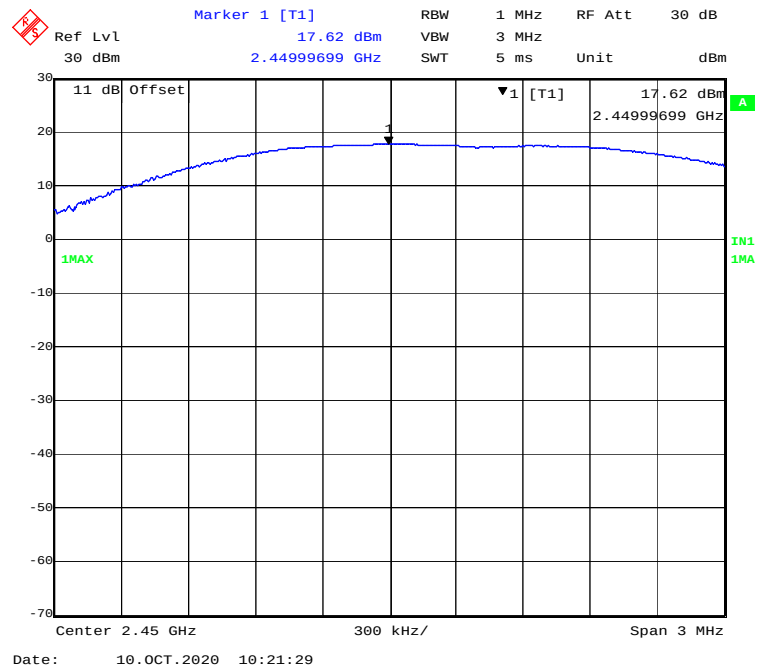
Low Channel



Middle Channel



High Channel



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

Temperature:	24.2 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

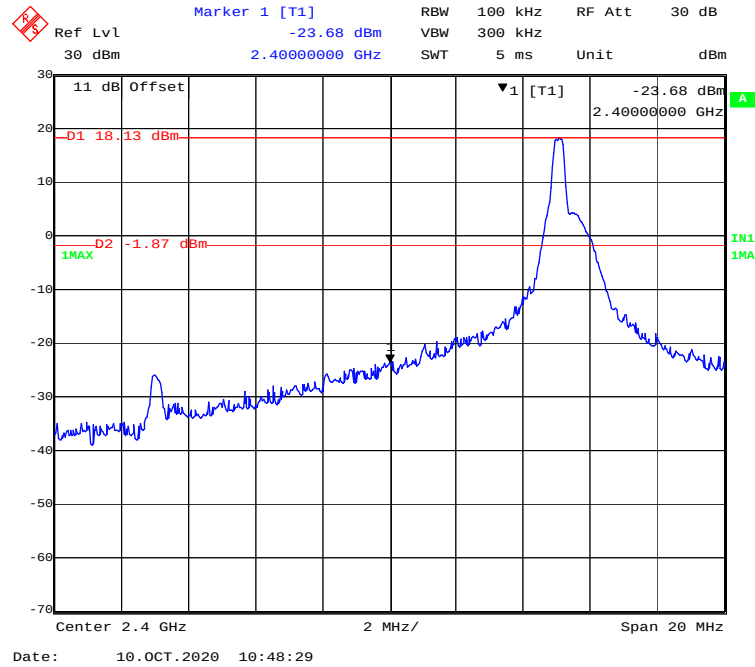
The testing was performed by Chao Gao on 2020-10-10.

EUT operation mode: Transmitting&Hopping

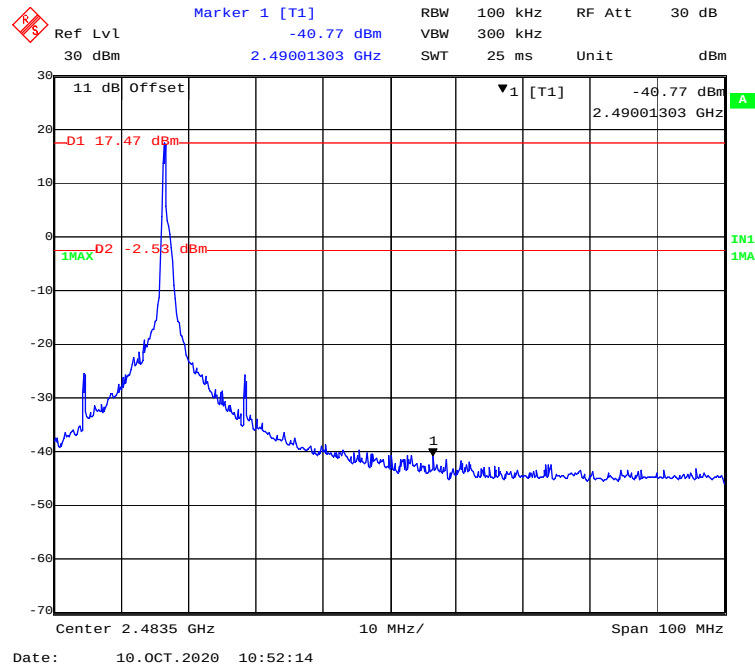
Test Result: Compliant.

Band Edge

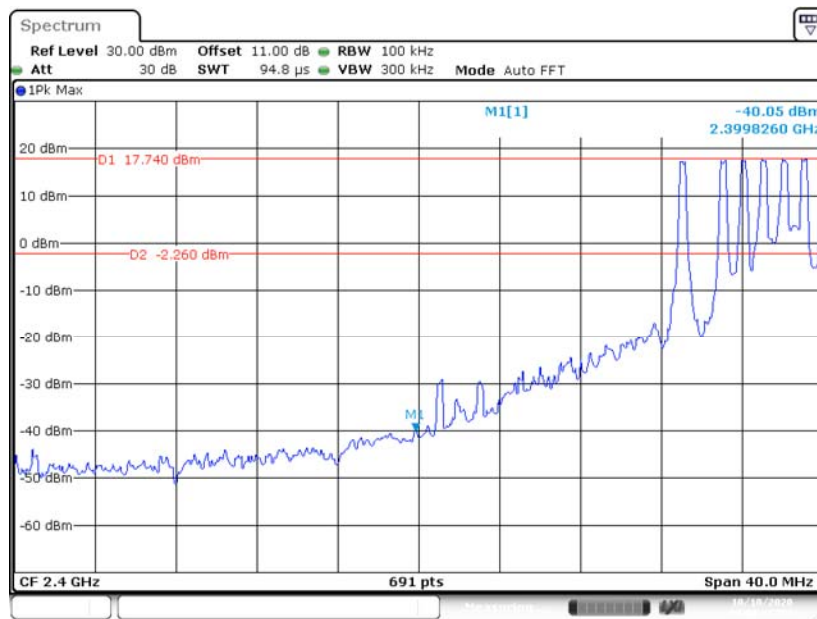
Left Side



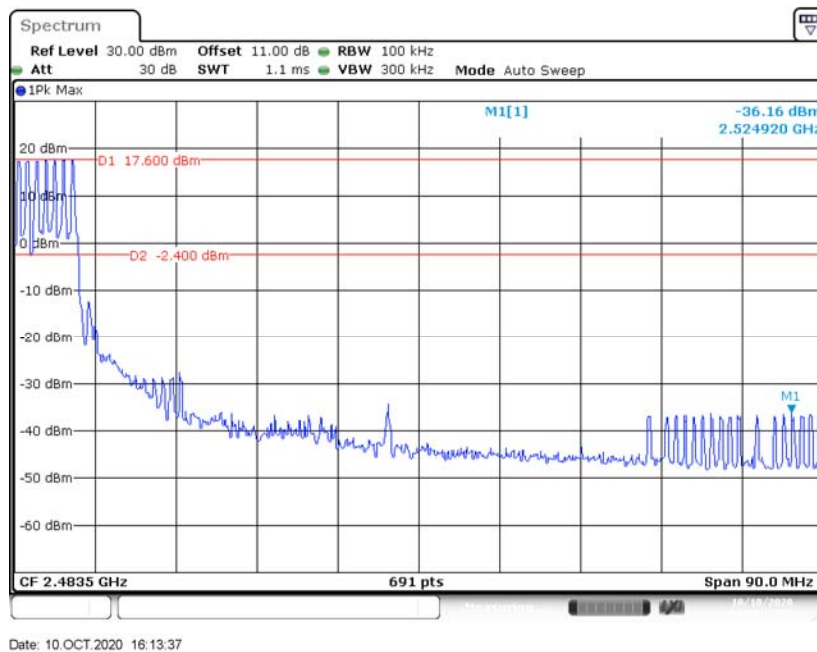
Right Side



Left Side-Hopping



Right Side-Hopping



***** END OF REPORT *****