

# FCC PART 15.247 TEST REPORT

For

## SHANGHAI MERIT TECHNOLOGY CORP.

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

**FCC ID: XJ6-MT-305**

<b>Report Type:</b> Original Report	<b>Product Type:</b> 3CH 2.4GHZ FHSS RADIO CONTROL SYSTEM
<b>Test Engineer:</b> Chris Wang	<i>Chris Wang</i>
<b>Report Number:</b> RKS170516002-00B	
<b>Report Date:</b> 2017-06-30	
<b>Reviewed By:</b> Oscar Ye RF Leader	<i>Oscar Ye</i>
<b>Prepared By:</b>	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 <a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a>

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>4</b>
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
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION .....	6
EUT EXERCISE SOFTWARE .....	6
SPECIAL ACCESSORIES.....	6
EQUIPMENT MODIFICATIONS .....	6
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
EXTERNAL I/O CABLE.....	6
BLOCK DIAGRAM OF TEST SETUP .....	7
<b>SUMMARY OF TEST RESULTS .....</b>	<b>8</b>
<b>TEST EQUIPMENT LIST .....</b>	<b>9</b>
<b>FCC§15.247 (i), §1.1310 &amp;§2.1093 –RF EXPOSURE .....</b>	<b>10</b>
APPLICABLE STANDARD .....	10
MEASUREMENT RESULT .....	10
<b>FCC §15.203 – ANTENNA REQUIREMENT .....</b>	<b>11</b>
APPLICABLE STANDARD .....	11
ANTENNA INFORMATION .....	11
<b>FCC §15.205, §15.209 &amp; §15.247(d) – RADIATED EMISSIONS.....</b>	<b>12</b>
APPLICABLE STANDARD .....	12
MEASUREMENT UNCERTAINTY .....	12
EUT SETUP .....	12
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	13
TEST PROCEDURE .....	13
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	14
TEST RESULTS SUMMARY .....	14
TEST DATA .....	14
<b>FCC §15.247(a) (1)-CHANNEL SEPARATION TEST .....</b>	<b>17</b>
APPLICABLE STANDARD .....	17
TEST PROCEDURE .....	17
TEST DATA .....	17
<b>FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH.....</b>	<b>20</b>
APPLICABLE STANDARD .....	20
TEST PROCEDURE .....	20
TEST DATA .....	20
<b>FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST .....</b>	<b>23</b>
APPLICABLE STANDARD .....	23
TEST PROCEDURE .....	23

TEST DATA .....	23
<b>FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....</b>	<b>25</b>
APPLICABLE STANDARD .....	25
TEST PROCEDURE .....	25
TEST DATA .....	25
<b>FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT .....</b>	<b>28</b>
APPLICABLE STANDARD .....	28
TEST PROCEDURE .....	28
TEST DATA .....	28
<b>FCC §15.247(d) - BAND EDGES TESTING .....</b>	<b>31</b>
APPLICABLE STANDARD .....	31
TEST PROCEDURE .....	31
TEST DATA .....	31

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Applicant	SHANGHAI MERIT TECHNOLOGY CORP.
Tested Model	MT-305
Product Type	3CH 2.4GHZ FHSS RADIO CONTROL SYSTEM
Dimension	210mm(L)×141 mm(W)×70 mm(H)
Power Supply	DC 6V supplied from 1.5V*4cell “AA” alkaline battery

*\*All measurement and test data in this report was gathered from production sample serial number: 20170504006/7 (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-05-04)*

### 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, 15.207, 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 Compliance Testing of Unlicensed Wireless Devices and DA 00-705 March 30, 2000.

All emissions measurement was performed and Bay Area Compliance 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
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
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.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

For GFSK Modulation, 46 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	25	2429
2	2406	...	
...		...	
...		45	2449
24	2428	46	2450

EUT was tested with Channel 1, 24 and 46.

### EUT Exercise Software

The EUT is 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

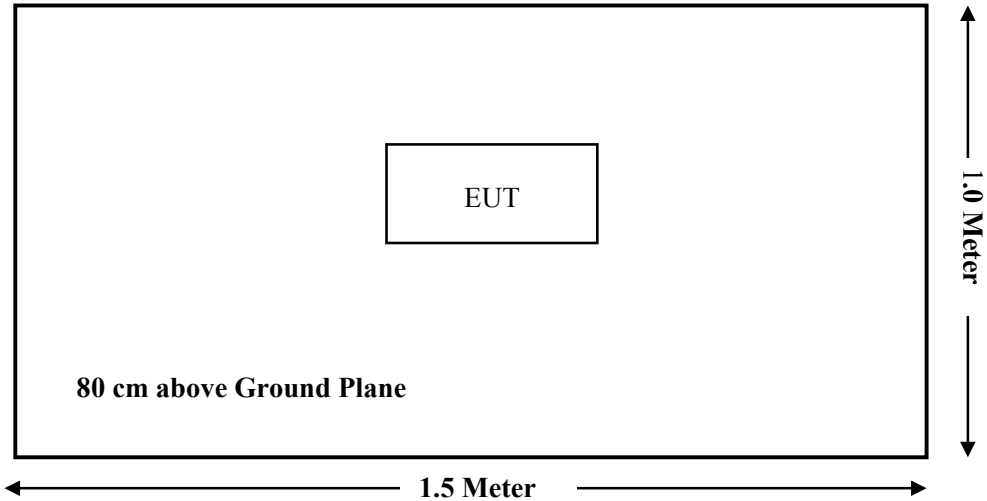
Manufacturer	Description	Model	Serial Number
/	/	/	/

### External I/O Cable

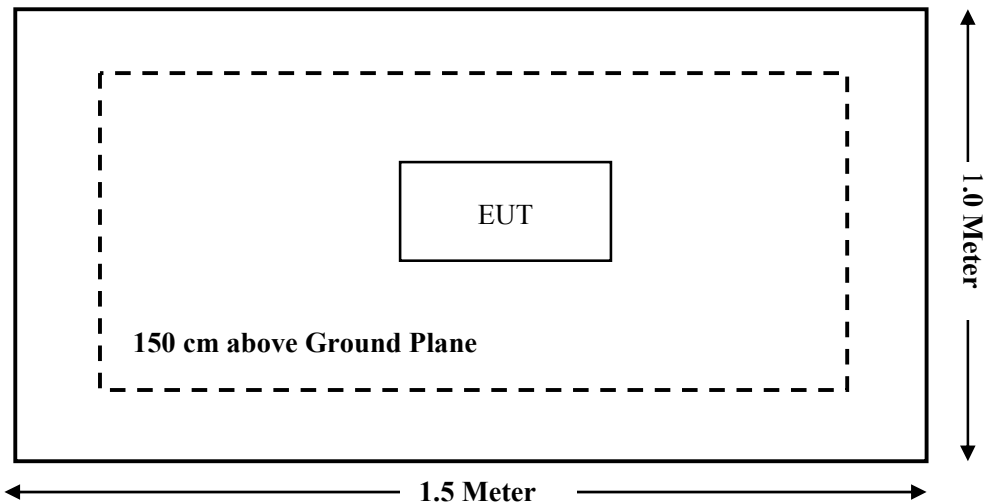
Cable Description	Shielding Type	Length (m)	From Port	To
/	/	/	/	/

### 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)§1.1307(b)(1) & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band edges	Compliance

Note: The EUT is powered by battery only.



**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Sonoma Instrument	Pre-amplifier	330N	160904	2016-10-21	2017-10-20
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
R&S	Auto test Software	EMC32	100361	/	/
Haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-11
<b>RF Conducted Test</b>					
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2016-07-04	2017-07-03
MERIT	RF Cable	N/A	N/A	2017-05-22	2018-05-21

**\* 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  $\leq 50$  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  $\leq 7.5$  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	Conducted Peak power	Conducted Peak power	Duty cycle	Source-based time-averaged maximum conducted output power	Minimum test separation distance required for the exposure conditions
(MHz)	(dBm)	(mW)	(%)	(mW)	(mm)
2405-2450	18.00	63.10	0.32	0.20	5.00

#### **Note:**

1. Turn up power  $17 \pm 1$  dBm, which is declared by the manufacturer.
2. Calculation formula: Source-based time-averaged maximum conducted output power (mW) = Conducted peak power (mW) \* Duty factor
3. For Duty cycle calculation:  $T_{\text{on}} = 1.5\text{ms} \times 3 = 4.5\text{ms}$ ,  $T_{\text{p}} = 1.42\text{s}$  Duty cycle =  $4.5\text{ms} / 1.42\text{s} = 0.32\%$  (refer to the plots on P26~P27).
4. This is a handheld device.

**Result:**  $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})]$

- $[\sqrt{f(\text{GHz})}] = 0.20 / 5 \times \sqrt{2.45} = \mathbf{0.063} < \mathbf{7.5}$ . So no SAR test is needed.

**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 arrangement, which the antenna gain is 2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

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

### **Applicable Standard**

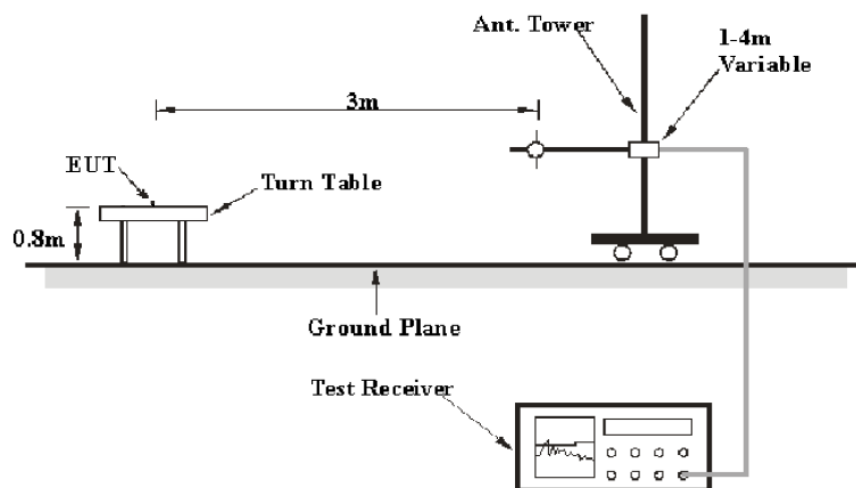
FCC §15.205; §15.209; §15.247(d)

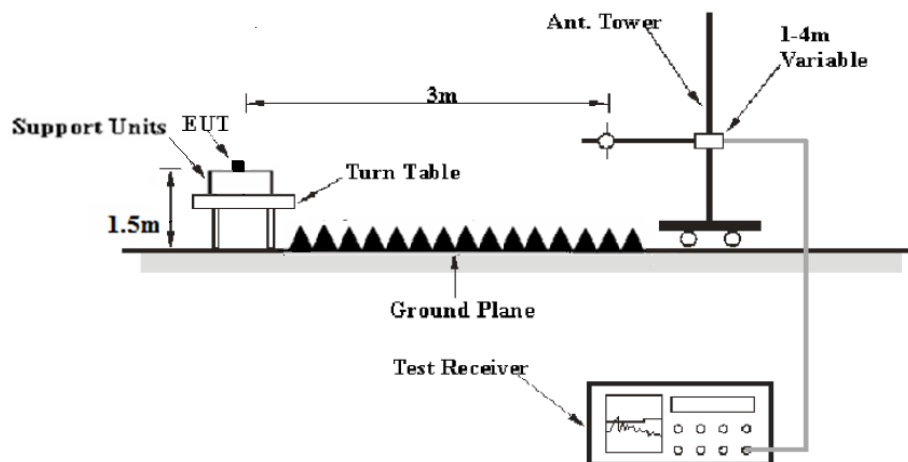
### **Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

### **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 & Spectrum Analyzer Setup were 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

Frequency Range	RBW	Video B/W	Duty cycle	Detector
1GHz – 25GHz	1MHz	3 MHz	Any	PK
	1MHz	10 Hz	>98%	Ave.
	1MHz	1/T	<98%	

**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:	24.1 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

*The testing was performed by Chris Wang on 2017-05-24.*

*EUT operation mode: Transmitting(Scan with X-Axis, Y-Axis and Z-Axis position, the worst case was recorded)*

**30MH -25 GHz:**

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Low Channel (2405 MHz)									
497.90	20.66	QP	317	163	V	5.7	26.36	46	19.64
2405.00	118.59	PK	27	119	V	-6.19	112.40	/	/
2405.00	100.11	Ave	27	119	V	-6.19	93.92	/	/
2405.00	112.42	PK	18	135	H	-6.19	106.23	/	/
2405.00	92.83	Ave	18	135	H	-6.19	86.64	/	/
2390.00	50.53	PK	241	249	V	-6.22	44.31	74.00	29.69
2390.00	36.69	Ave	241	249	V	-6.22	30.47	54.00	23.53
2400.00	70.56	PK	348	181	V	-6.19	64.37	74.00	9.63
2400.00	52.87	Ave	348	181	V	-6.19	46.68	54.00	7.32
1140.28	46.13	PK	123	162	V	-11.61	34.52	74.00	39.48
1140.28	32.42	Ave	123	162	V	-11.61	20.81	54.00	33.19
4810.00	60.18	PK	7	217	H	1.61	61.79	74.00	12.21
4810.00	45.39	Ave	7	217	H	1.61	47.00	54.00	7.00
7215.00	51.77	PK	207	123	V	7.55	59.32	74.00	14.68
7215.00	36.59	Ave	207	123	V	7.55	44.14	54.00	9.86
Middle Channel (2428 MHz)									
497.90	21.25	QP	119	132	V	5.7	26.95	46	19.05
2428.00	118.36	PK	154	249	V	-6.10	112.26	/	/
2428.00	99.94	Ave	154	249	V	-6.10	93.84	/	/
2428.00	112.18	PK	171	187	H	-6.10	106.08	/	/
2428.00	92.44	Ave	171	187	H	-6.10	86.34	/	/
1140.28	45.25	PK	220	112	V	-11.61	33.64	74.00	40.36
1140.28	32.42	Ave	220	112	V	-11.61	20.81	54.00	33.19
4773.55	42.61	PK	137	237	V	1.54	44.15	74.00	29.85
4773.55	30.02	Ave	137	237	V	1.54	31.56	54.00	22.44
4856.00	60.03	PK	301	139	H	1.79	61.82	74.00	12.18
4856.00	45.37	Ave	301	139	V	1.79	47.16	54.00	6.84
6961.92	42.76	PK	83	243	H	7.23	49.99	74.00	24.01
6961.92	29.39	Ave	83	243	H	7.23	36.62	54.00	17.38
7284.00	51.68	PK	118	186	V	7.67	59.35	74.00	14.65
7284.00	36.06	Ave	118	186	V	7.67	43.73	54.00	10.27

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
High Channel (2450 MHz)									
497.90	20.92	QP	346	127	V	5.7	26.62	46	19.38
2450.00	117.91	PK	72	140	V	-6.01	111.90	/	/
2450.00	99.42	Ave	72	140	V	-6.01	93.41	/	/
2450.00	111.88	PK	236	121	H	-6.01	105.87	/	/
2450.00	92.03	Ave	236	121	H	-6.01	86.02	/	/
2483.50	60.57	PK	229	210	V	-6.01	54.56	74.00	19.44
2483.50	45.19	Ave	229	210	V	-6.01	39.18	54.00	14.82
1126.25	44.67	PK	185	224	V	-11.70	32.97	74.00	41.03
1126.25	31.94	Ave	185	224	V	-11.70	20.24	54.00	33.76
4900.00	59.47	PK	301	121	H	1.97	61.44	74.00	12.56
4900.00	44.85	Ave	301	121	H	1.97	46.82	54.00	7.18
6667.33	43.19	PK	109	153	V	6.39	49.58	74.00	24.42
6667.33	30.23	Ave	109	153	V	6.39	36.62	54.00	17.38
7350.00	51.57	PK	179	177	V	7.79	59.36	74.00	14.64
7350.00	35.92	Ave	179	177	V	7.79	43.71	54.00	10.29

Note: The fundamental test is without Amplifier



**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**

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Chris Wang on 2017-05-24.*

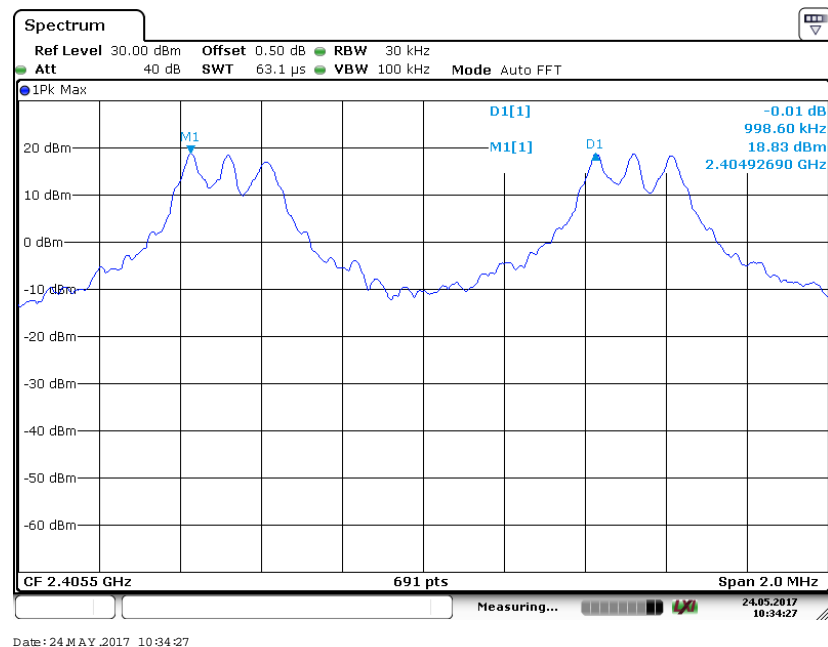
*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to following tables and plots*

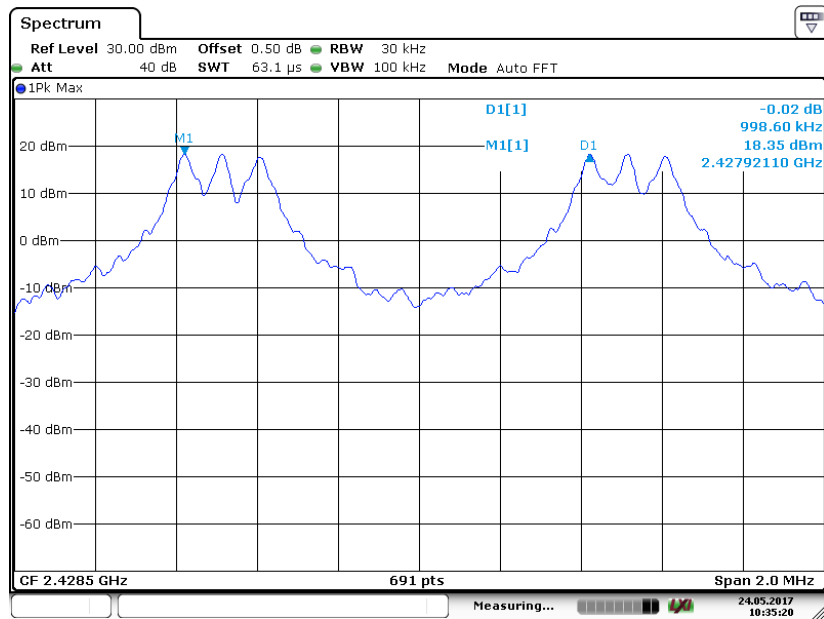
Modulation	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
GFSK	Low	2405	0.9986	0.2624	Pass
	Adjacent	2406			
	Middle	2428	0.9986	0.2624	Pass
	Adjacent	2429			
	Adjacent	2449	1.0014	0.2624	Pass
	High	2450			

The limit = 20dB Bandwidth\*2/3

### Low Channel

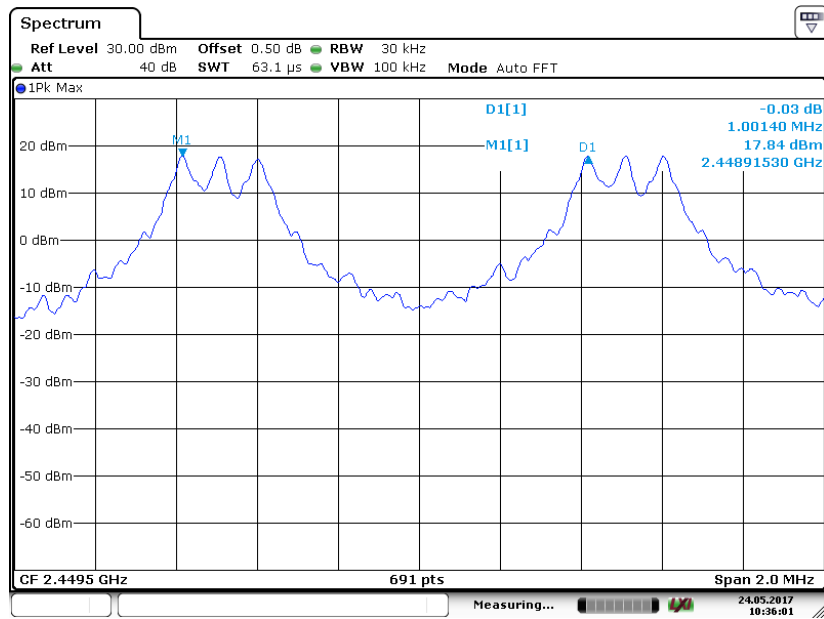


### Middle Channel



Date: 24 MAY 2017 10:35:20

### High Channel



Date: 24 MAY 2017 10:36:02

**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**

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	51%
<b>ATM Pressure:</b>	101.3 kPa

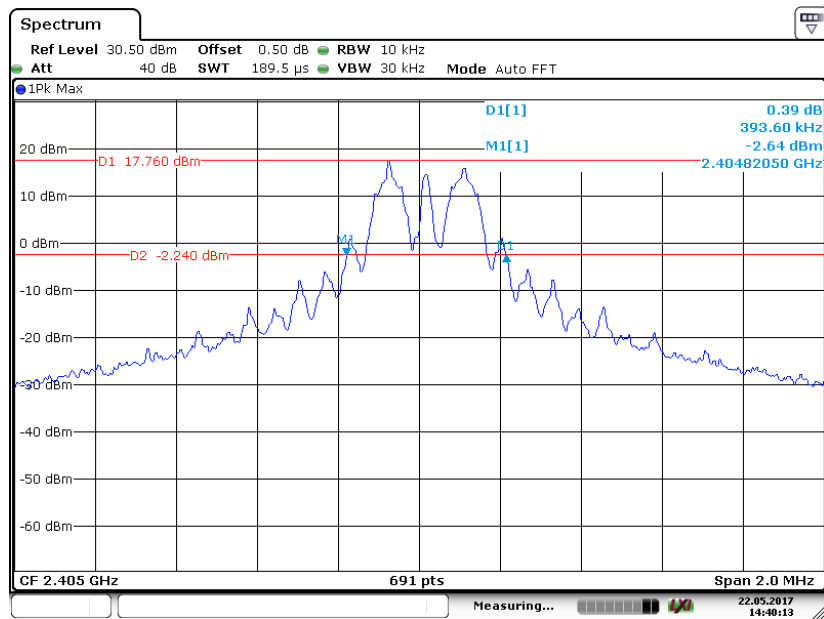
*The testing was performed by Chris Wang on 2017-05-22.*

*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to following tables and plots*

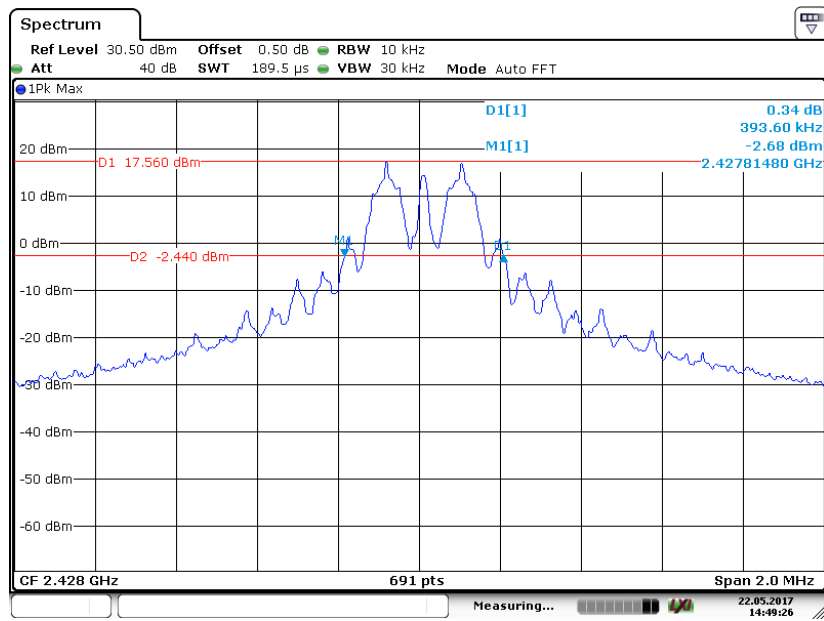
Modulation	Channel	Frequency (MHz)	20 dB Emission Bandwidth (kHz)	Limit (kHz)
GFSK	Low	2405	393.6	≤500
	Middle	2428	393.6	≤500
	High	2450	393.6	≤500

## Low Channel

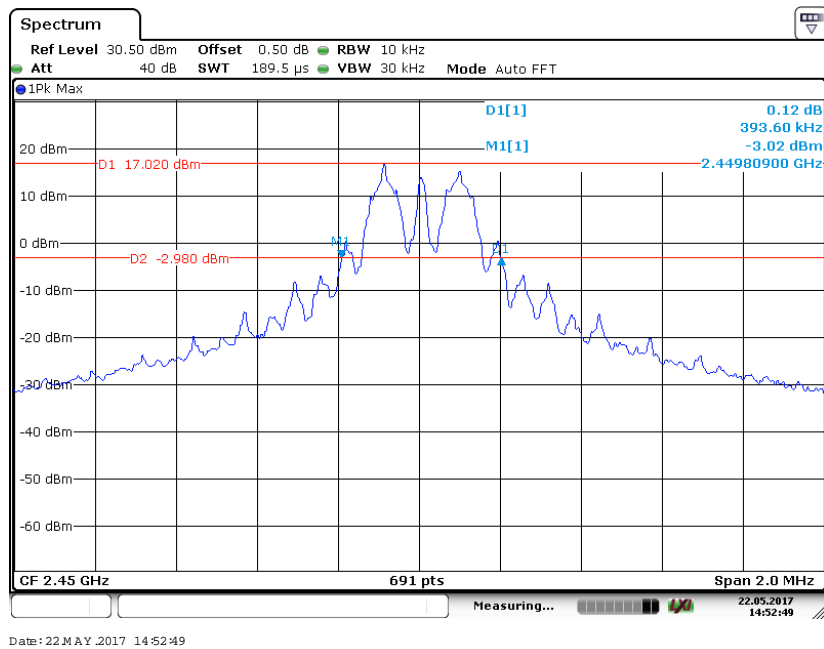


Date: 22 MAY 2017 14:40:14

### 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**

<b>Temperature:</b>	24.2 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

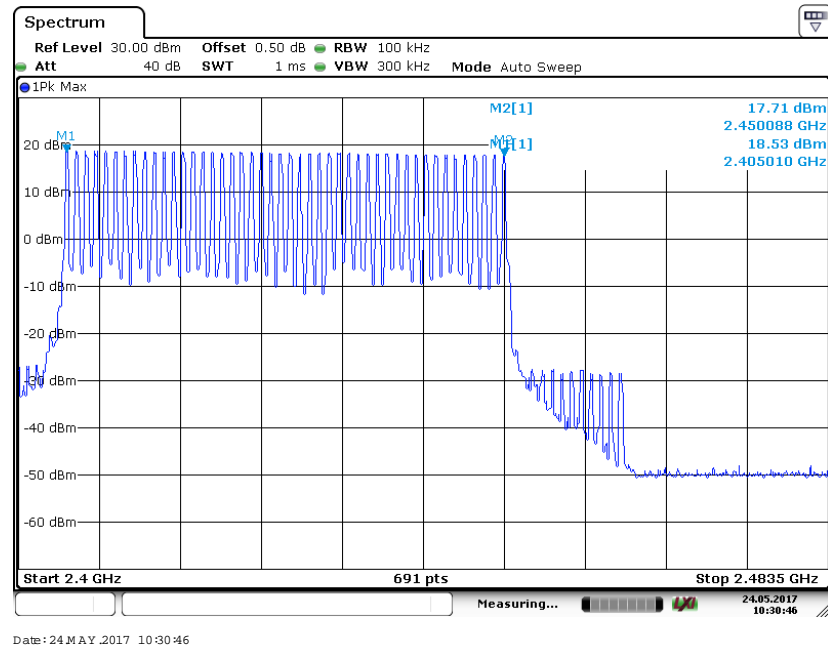
*The testing was performed by Chris Wang on 2017-05-24.*

*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to following tables and plots*

Modulation	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
GFSK	2405-2450	46	$\geq 15$

### 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

<b>Temperature:</b>	24.2 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

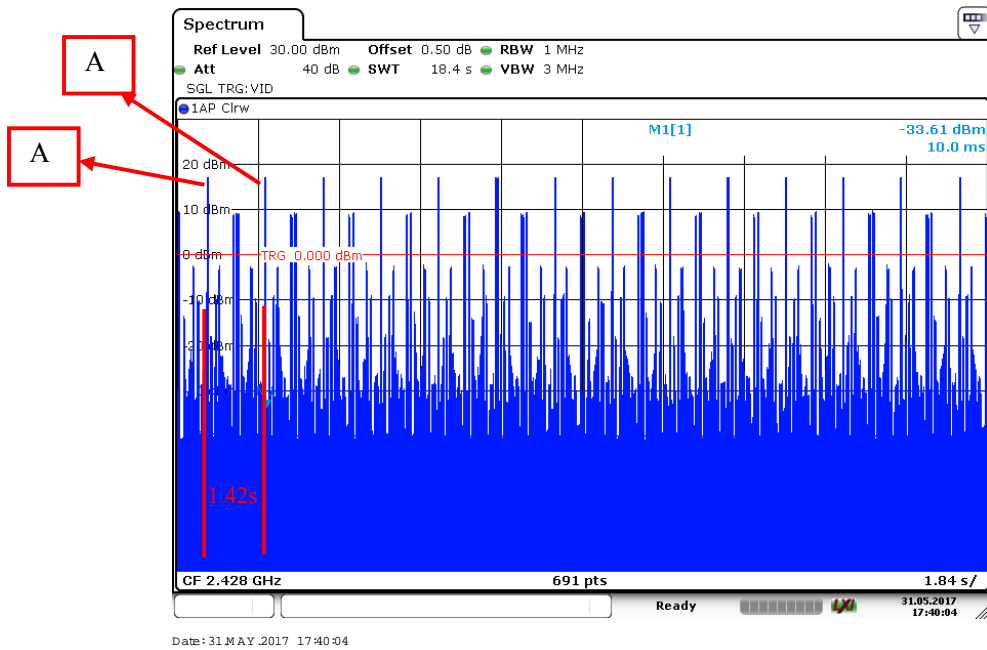
*The testing was performed by Chris Wang on 2017-05-24.*

*EUT operation mode: Transmitting*

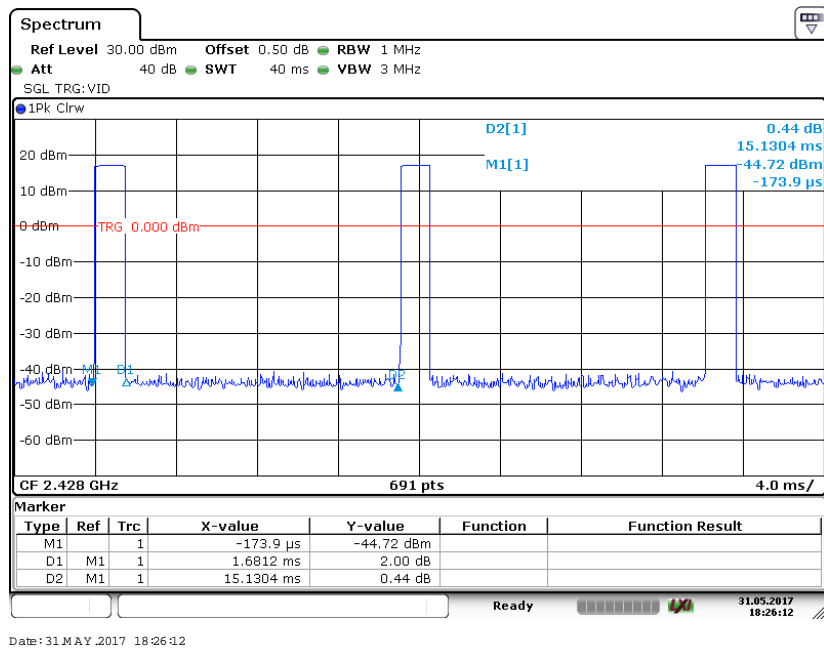
*Test Result: Compliance. Please refer to following tables and plots*

Modulation	Channel Frequency (MHz)	Pulse Width	Pulse Number	Dwell Time	Limit	Result
		(ms)		(S)	(S)	
GFSK	2428	1.50	14*3	0.063	≤0.4	Pass
	Note:Dwell time = Pulse time*N					

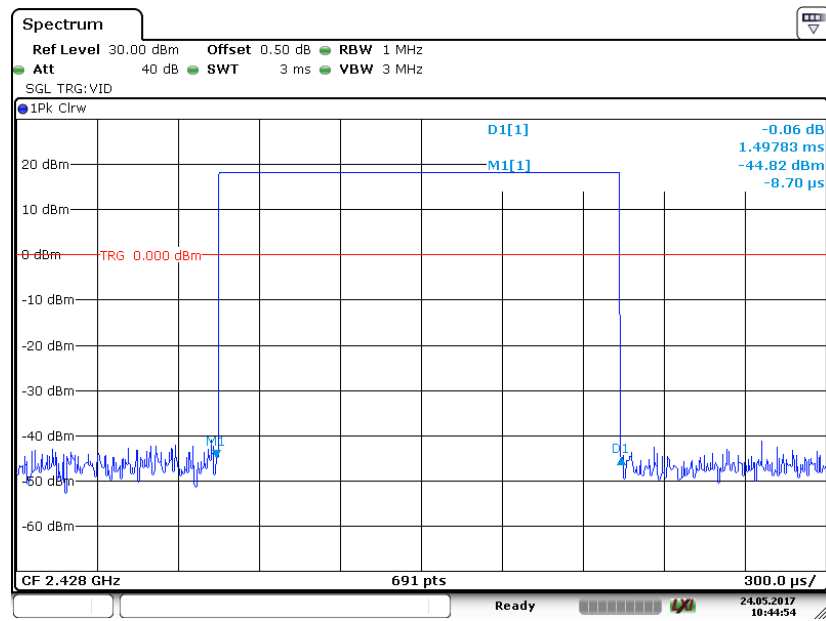
### Number of pusles



### Zoom in A



# Single Pusle



Date: 24 MAY 2017 10:44:54

## **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**

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	51%
<b>ATM Pressure:</b>	101.3 kPa

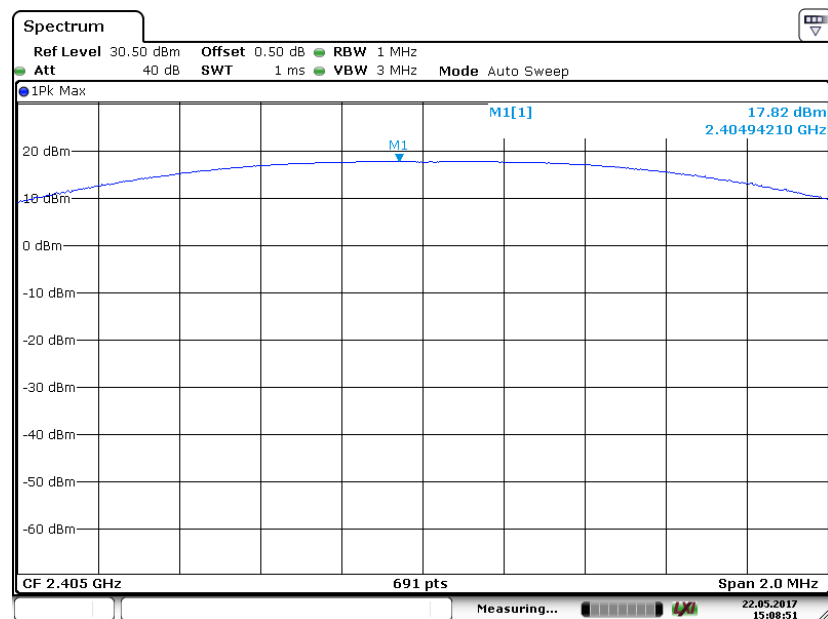
*The testing was performed by Chris Wang on 2017-05-22.*

*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to following tables and plots*

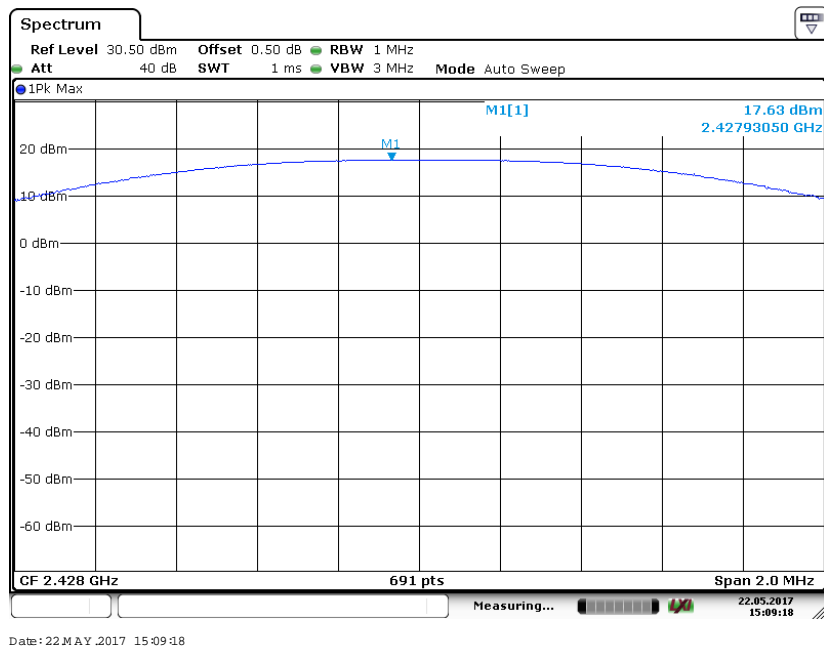
Modulation	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
GFSK	Low	2405	17.82	60.53	125
	Middle	2428	17.63	57.94	125
	High	2450	17.09	51.17	125

## Low Channel

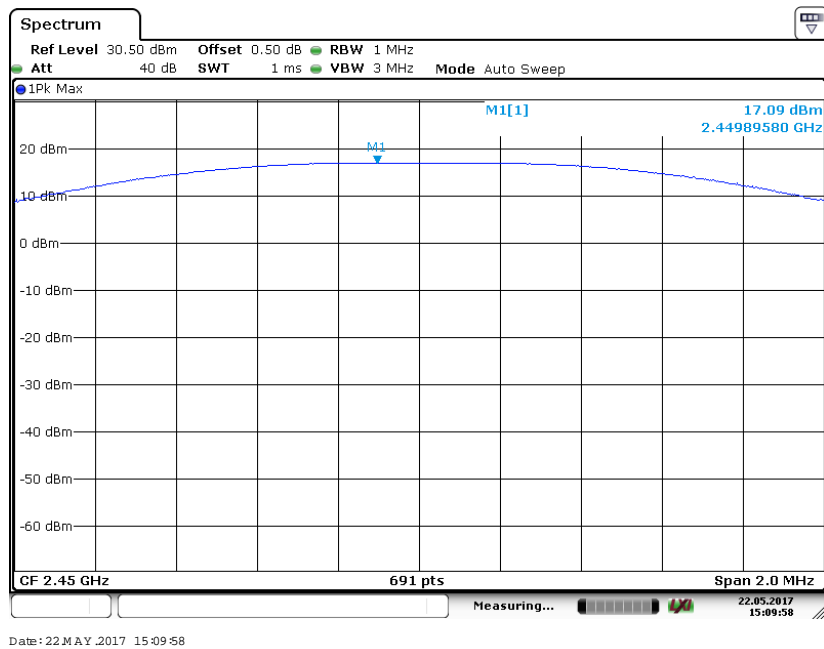


Date: 22 MAY 2017 15:08:51

### 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**

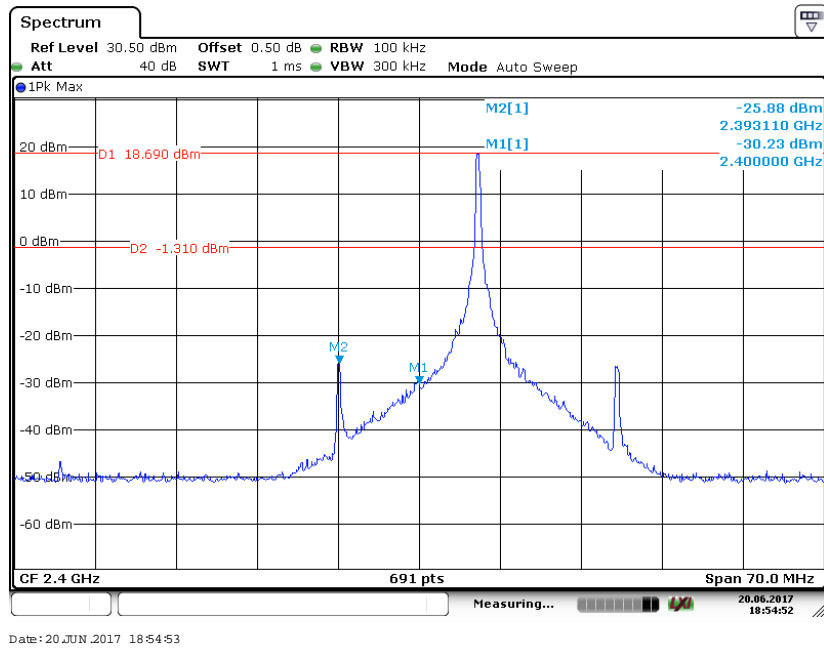
<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	51%
<b>ATM Pressure:</b>	101.3 kPa

*The testing was performed by Chris Wang on 2017-06-20.*

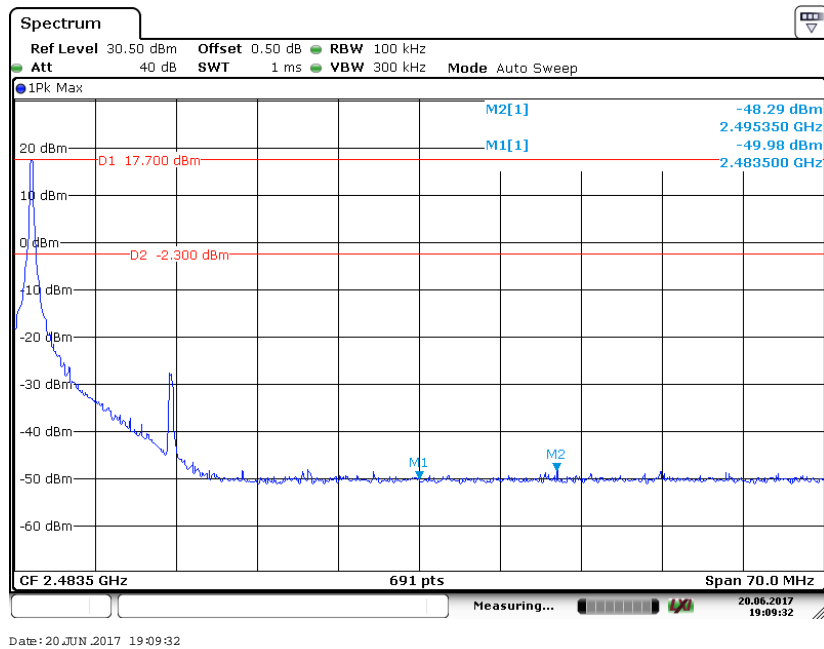
*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to following plots.*

### Band Edge-Left Side



### Band Edge-Right Side



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