FCC PART 15.247

TEST REPORT

For

Dongguan Mosaic Electronics Fty

Xingye 3 Road, Xiabian Changan, Dongguan, Guangdon, China.

FCC ID: N4XKF23S

Report Type:	Product Type:
Original Report	Remote control for help alarm HA28S

Report Number:	RSZ170214006-00B
Report Date:	2018-02- 01
Reviewed By:	Oscar Ye Engineer
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Dongguan Mosaic Electronics Fty's* product, model number: KF23S *(FCC ID: N4XKF23S)* in this report is a *Remote control for help alarm HA28S* which was measured approximately: 6.0 cm (L) * 3.8 cm (W) * 1.2 cm (H), rated with input voltage: DC 3.7 V battery.

** All measurement and test data in this report was gathered from production sample serial number: 1700150 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-02-14.*

Objective

This report is prepared on behalf of *Dongguan Mosaic Electronics Fty* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Submitted with DSS Help alarm unit submission with FCC ID: N4XHA28S.

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.

All emissions measurement was performed at 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		±3.26 dB
RF conducted test with spectrum		±0.9dB
RF Output Power with Power meter		±0.5dB
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1G	±4.92dB
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.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 815570, the FCC Designation No. : CN1185.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062E.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode by manufactor, pressed the blue button then the frequency will be changed. The frequencies 2405.888MHz, 2442.752MHz and 2475.52MHz were chosen for testing.

Frequency point	frequency	Frequency point	frequency
1	2405.888 MHz （**low**）	19	2442.752 MHz(**middle**)
2	2407.936 MHz	20	2444.8 MHz
3	2409.984 MHz	21	2446.848 MHz
4	2412.032 MHz	22	2448.896 MHz
5	2414.08 MHz	23	2450.944MHz
6	2416.128 MHz	24	2452.992 MHz
7	2418.176 MHz	25	2455.04 MHz
8	2420.224 MHz	26	2457.088 MHz
9	2422.272 MHz	27	2459.136 MHz
10	2424.32 MHz	28	2461.184 MHz
11	2426.368 MHz	29	2463.232 MHz
12	2428.416 MHz	30	2465.28 MHz
13	2430.464 MHz	31	2467.328 MHz
14	2432.512 MHz	32	2469.376 MHz
15	2434.56 MHz	33	2471.424 MHz
16	2436.608 MHz	34	2473.472 MHz
17	2438.656 MHz	35	2475.52 MHz (**high**)
18	2440.704 MHz		

EUT Exercise Software

No Exercise software was used

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

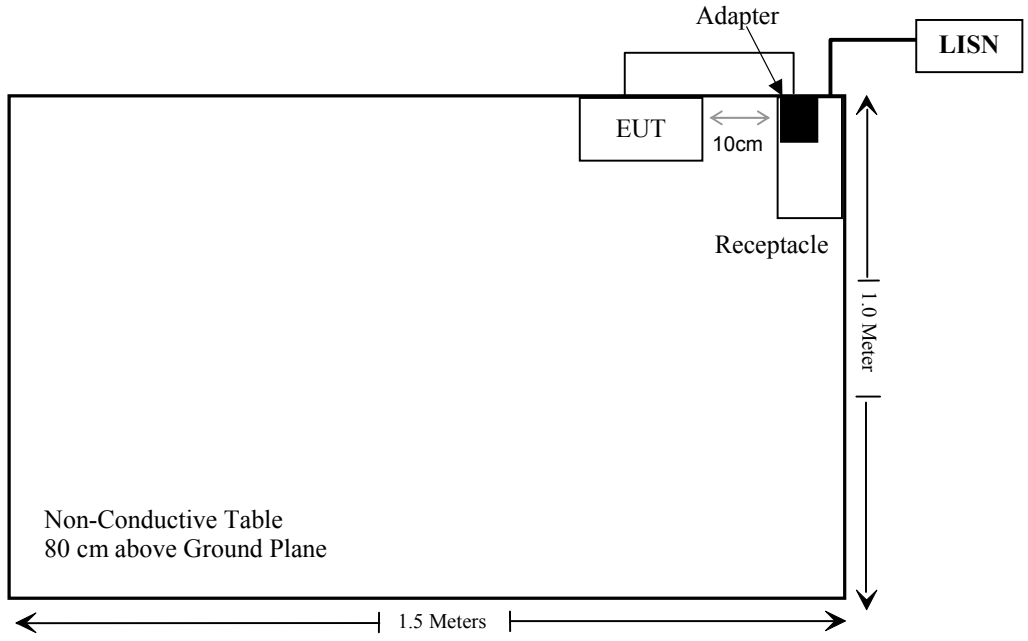
Manufacture	Description	Model	Serial Number
BLU	adapter	TPA-46B050070UU	N/A

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§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

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2016-11-25	2017-11-25
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-10
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2016-06-19	2017-06-18
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2016-09-08	2017-09-08
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	NCR	NCR
Radiation test					
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-25
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-12

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted test					
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2016-12-09	2017-12-08
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2017-12-08	2018-12-08
BACL	RF cable	KS-LAB-012	KS-LAB-012	2016-12-15	2017-12-15
BACL	RF cable	KS-LAB-012	KS-LAB-012	2017-12-15	2018-12-15
WEINSCHEL	10dB Attenuator	5328	N/A	2016-06-18	2017-06-18
WEINSCHEL	10dB Attenuator	5328	N/A	2017-06-18	2018-06-18
Agilent	Power Meter	N1912A	MY5000492	2016-11-17	2017-11-16
Agilent	Power Sensor	N1921A	MY54210024	2016-11-17	2017-11-16
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3006K06-206515-mw	2017-08-19	2018-08-19

*** 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), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §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 KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Measurement Result

For worst case:

Mode	Frequency (MHz)	Max Tune-up Conducted Power (dBm)	Max Tune-up Conducted Power (mW)	Calculated Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
GFSK	2475.52	6	3.98	5	1.3	3.0	Yes

Result: No SAR test is required

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the 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 6 dBi.

Antenna Connector Construction

The EUT has an internal antenna arrangement, which was permanently attached and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

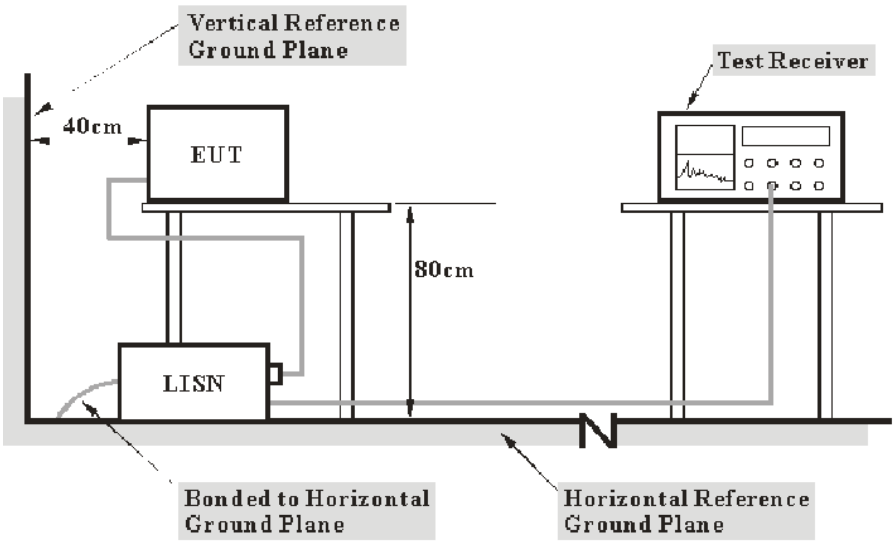
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

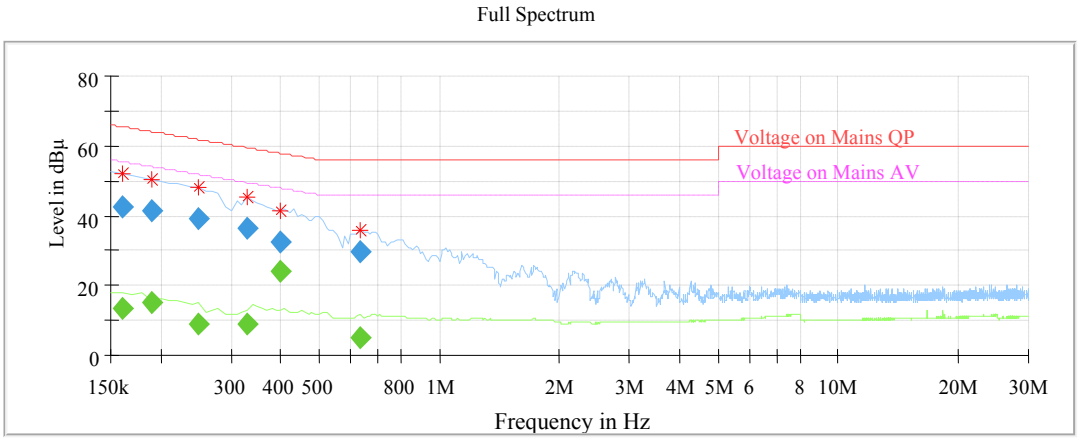
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2017-03-02.

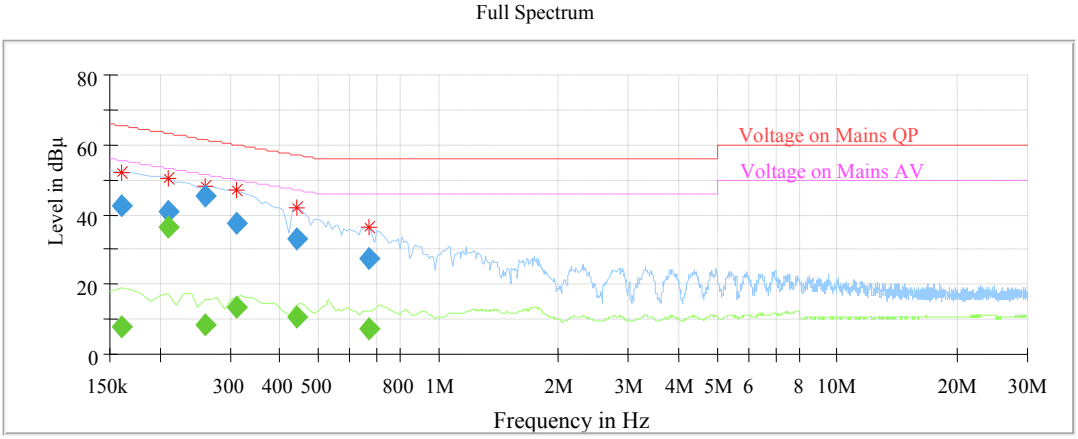
EUT operation mode: Transmitting

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.160000	---	13.54	9.000	L1	10.1	41.92	55.46	Compliance
0.160000	42.79	---	9.000	L1	10.1	22.67	65.46	Compliance
0.190000	---	14.83	9.000	L1	10.0	39.21	54.04	Compliance
0.190000	41.27	---	9.000	L1	10.0	22.77	64.04	Compliance
0.250000	---	8.79	9.000	L1	10.0	42.97	51.76	Compliance
0.250000	38.94	---	9.000	L1	10.0	22.82	61.76	Compliance
0.330000	---	9.07	9.000	L1	10.0	40.38	49.45	Compliance
0.330000	36.61	---	9.000	L1	10.0	22.84	59.45	Compliance
0.400000	---	24.32	9.000	L1	10.1	23.53	47.85	Compliance
0.400000	32.55	---	9.000	L1	10.1	25.30	57.85	Compliance
0.630000	---	5.07	9.000	L1	10.0	40.93	46.00	Compliance
0.630000	29.82	---	9.000	L1	10.0	26.18	56.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.160000	---	7.95	9.000	N	10.1	47.51	55.46	Compliance
0.160000	42.36	---	9.000	N	10.1	23.10	65.46	Compliance
0.210000	---	36.14	9.000	N	10.4	17.07	53.21	Compliance
0.210000	40.79	---	9.000	N	10.4	22.42	63.21	Compliance
0.260000	---	8.30	9.000	N	10.3	43.13	51.43	Compliance
0.260000	45.52	---	9.000	N	10.3	15.91	61.43	Compliance
0.310000	---	13.66	9.000	N	10.3	36.31	49.97	Compliance
0.310000	37.49	---	9.000	N	10.3	22.48	59.97	Compliance
0.440000	---	10.75	9.000	N	10.2	36.31	47.06	Compliance
0.440000	33.12	---	9.000	N	10.2	23.94	57.06	Compliance
0.670000	---	7.48	9.000	N	10.0	38.52	46.00	Compliance
0.670000	27.44	---	9.000	N	10.0	28.56	56.00	Compliance

Note:

1) Corrected Amplitude = Reading + Correction Factor
2) Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation
3) Margin = Limit – Corrected Amplitude

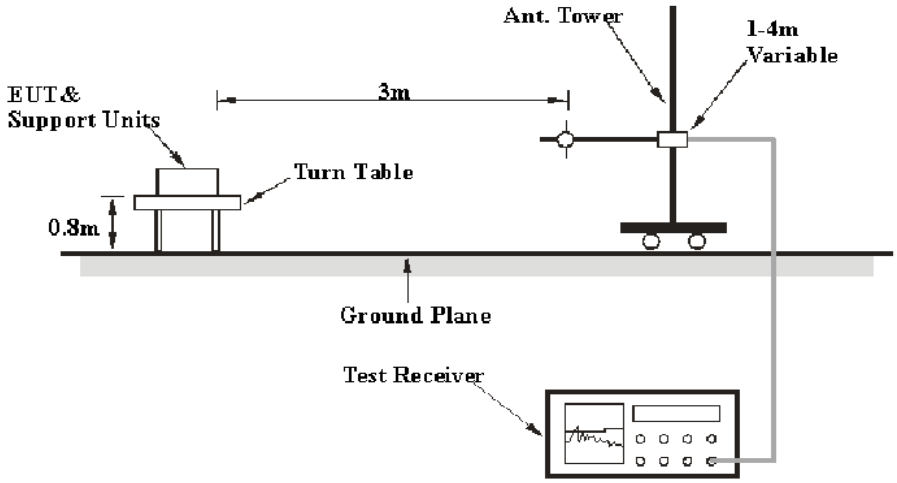
FCC §15.205, §15.209 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

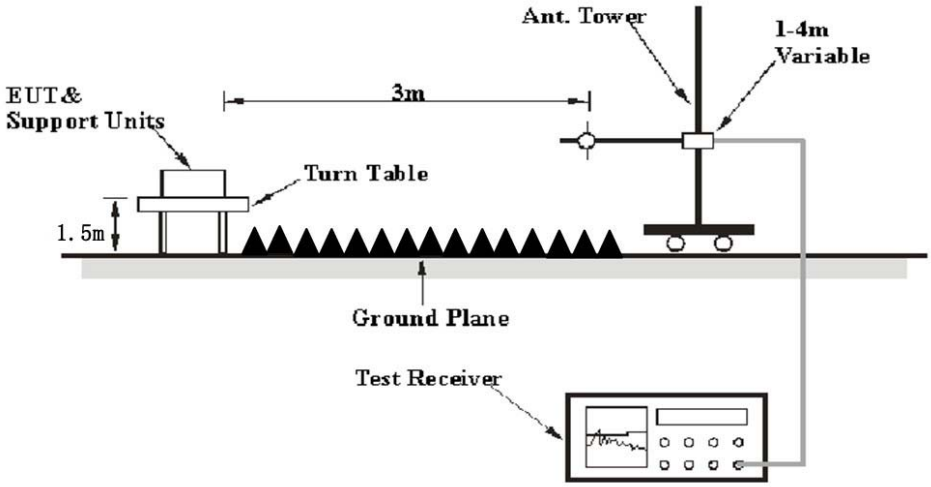
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, 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	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Average

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, 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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – 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.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

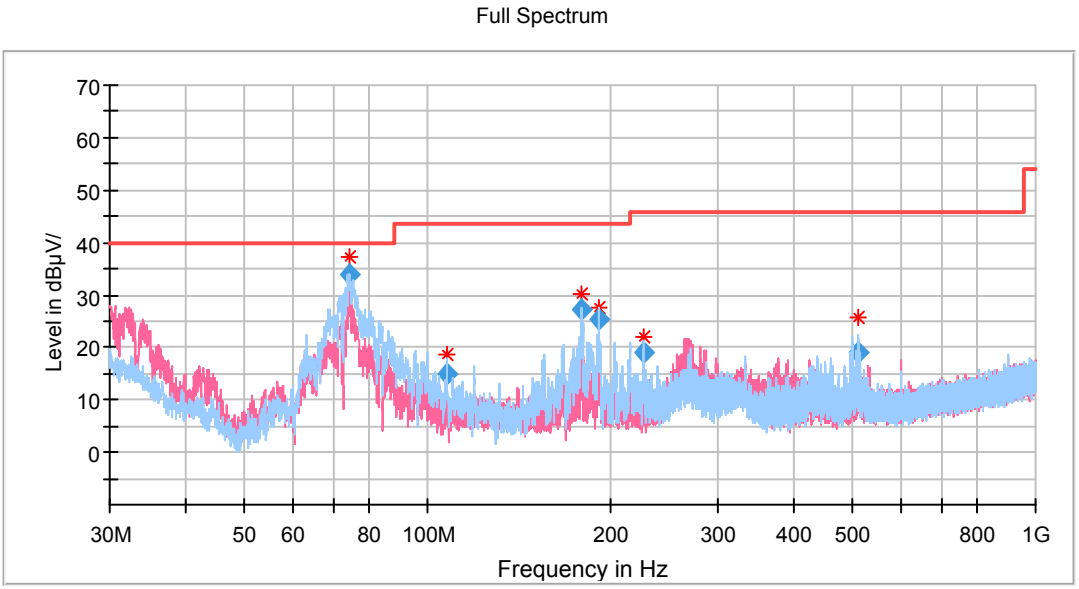
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2017-03-02..

EUT operation mode: Transmitting

30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
74.312034	33.73	200.0	H	152.0	-23.1	40.00	6.27
107.235066	15.11	200.0	H	152.0	-19.8	43.50	28.39
179.103933	27.25	200.0	H	128.0	-20.4	43.50	16.25
190.997866	25.52	100.0	H	7.0	-19.8	43.50	17.98
226.897934	18.88	100.0	H	133.0	-19.5	46.00	27.12
510.501167	19.08	200.0	H	57.0	-13.6	46.00	26.92

1 GHz - 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 (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2405.888 MHz)									
2405.888	113	PK	265	1.0	H	-6.19	106.81	/	/
2405.888	106.72	Ave.	265	1.0	H	-6.19	100.53	/	/
2405.888	105.61	PK	207	1.7	V	-6.19	99.42	/	/
2405.888	100.97	Ave.	66	1.3	V	-6.19	94.78	/	/
2372.82	68.63	PK	284	2.1	H	-6.19	62.44	74	11.56
2372.82	56.99	Ave.	284	2.1	H	-6.19	50.80	54	3.20
2490.97	68.69	PK	244	2.2	H	-5.97	62.72	74	11.28
2490.97	54.24	Ave.	244	2.2	H	-5.97	48.27	54	5.73
4811.776	59.24	PK	141	1.0	H	1.6	60.84	74	13.16
4811.776	49.53	Ave.	141	1.0	H	1.6	51.13	54	2.87
7217.664	50.64	PK	133	1.5	H	7.54	58.18	74	15.82
7217.664	32	Ave.	133	1.5	H	7.54	39.54	54	14.46
Middle Channel(2442.752 MHz)									
2442.752	109.69	PK	122	1.7	H	-6.19	103.50	/	/
2442.752	103.22	Ave.	122	1.7	H	-6.19	97.03	/	/
2442.752	105.58	PK	348	1.7	V	-6.19	99.39	/	/
2442.752	99.54	Ave.	348	1.7	V	-6.19	93.35	/	/
2388.77	68.12	PK	193	1.1	H	-6.19	61.93	74	12.07
2388.77	54.29	Ave.	193	1.1	H	-6.19	48.10	54	5.90
2492.42	68.67	PK	237	2.1	H	-5.97	62.70	74	11.30
2492.42	55.38	Ave.	237	2.1	H	-5.97	49.41	54	4.59
4885.504	55.8	PK	104	1.9	H	1.83	57.63	74	16.37
4885.504	48.01	Ave.	104	1.9	H	1.83	49.84	54	4.16
7328.256	47.21	PK	303	2.0	H	7.54	54.75	74	19.25
7328.256	31.9	Ave.	303	2.0	H	7.54	39.44	54	14.56

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 (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2475.52 MHz)									
2475.52	107.7	PK	312	1.1	H	-5.97	101.73	/	/
2475.52	101.22	Ave.	312	1.1	H	-5.97	95.25	/	/
2475.52	103.78	PK	201	1.5	V	-5.97	97.81	/	/
2475.52	97.87	Ave.	201	1.5	V	-5.97	91.90	/	/
2377.26	68.81	PK	195	1.1	H	-6.19	62.62	74	11.38
2377.26	56.32	Ave.	195	1.1	H	-6.19	50.13	54	3.87
2489.88	67.88	PK	186	2.5	H	-5.97	61.91	74	12.09
2489.88	54.25	Ave.	186	2.5	H	-5.97	48.28	54	5.72
4951.04	58.37	PK	176	1.3	H	2.06	60.43	74	13.57
4951.04	50.87	Ave.	176	1.3	H	2.06	52.93	54	1.07
7426.56	48.1	PK	238	2.2	H	7.54	55.64	74	18.36
7426.56	31.13	Ave.	238	2.2	H	7.54	38.67	54	15.33

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.

FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hoping 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:	24 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

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

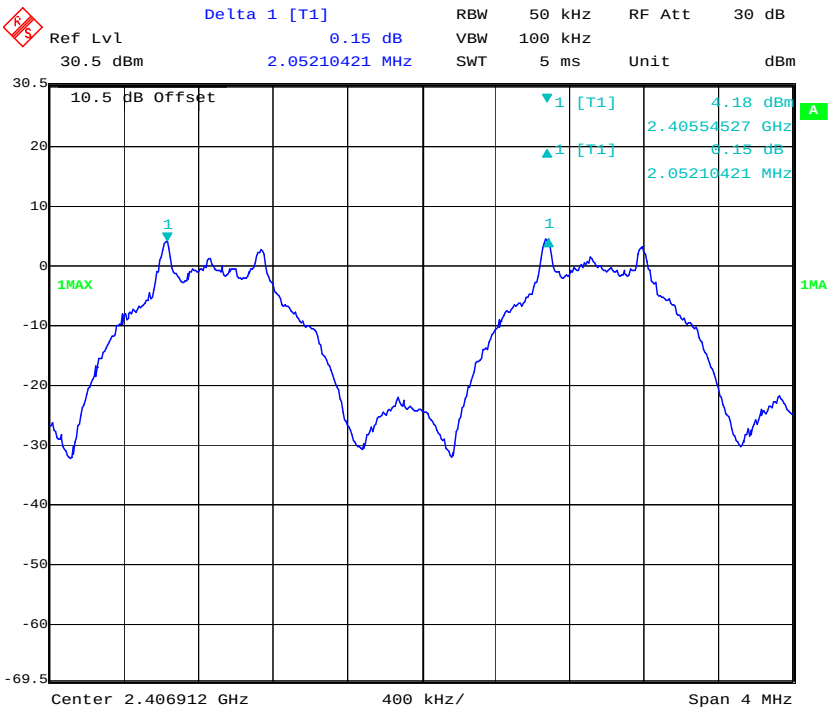
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots

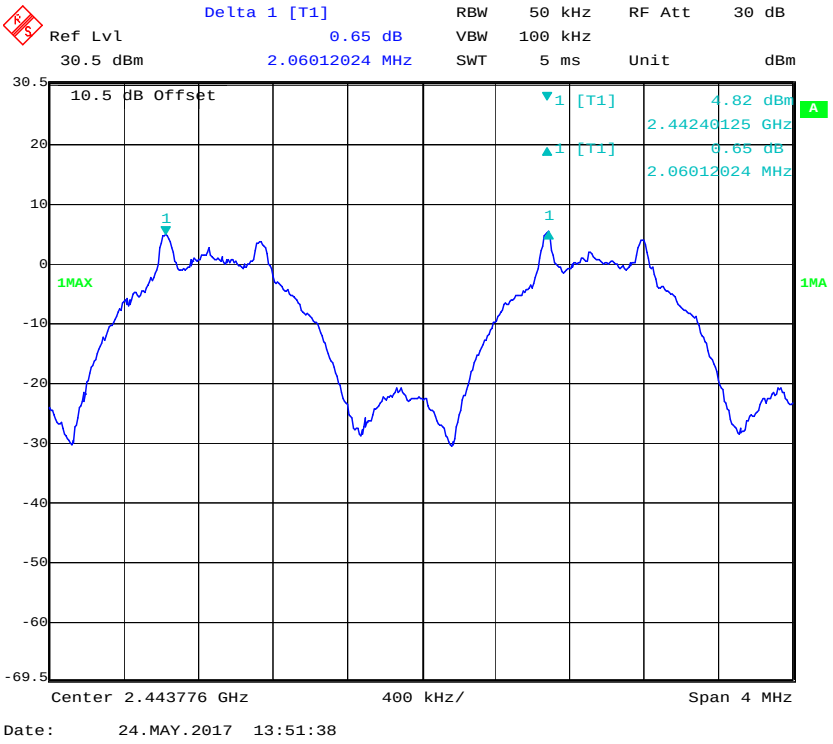
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	≥Limit (MHz)	Result
GFSK	Low	2405.888	2.052	0.855	Pass
	Adjacent	2407.936			
	Middle	2442.752	2.060	0.857	Pass
	Adjacent	2444.8			
	High	2475.52	2.060	0.859	Pass
	Adjacent	2473.472			

Note: Limit = 20 dB bandwidth *2/3

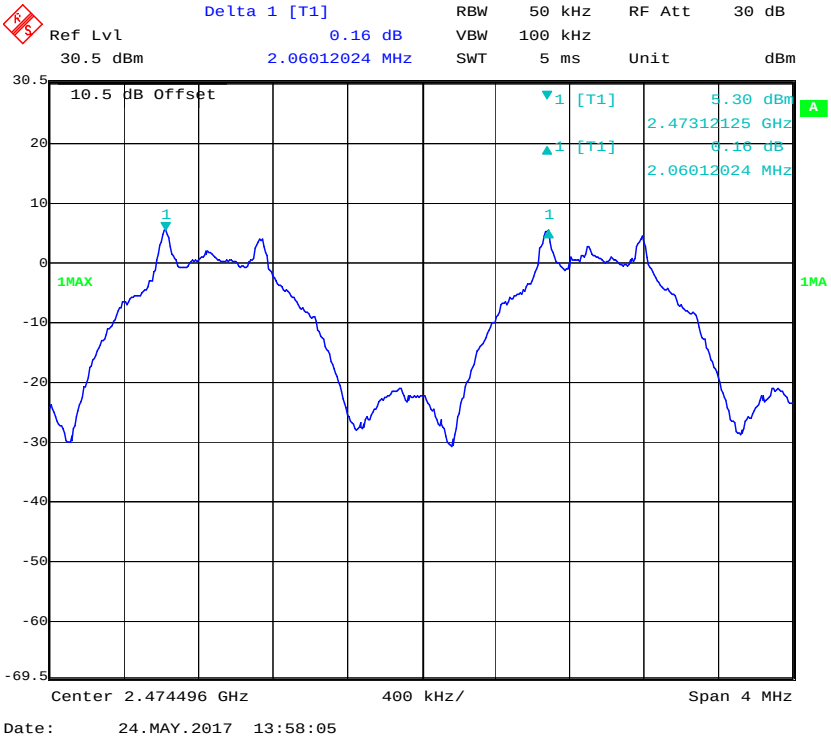
Low Channel



Middle Channel



High Channel



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 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

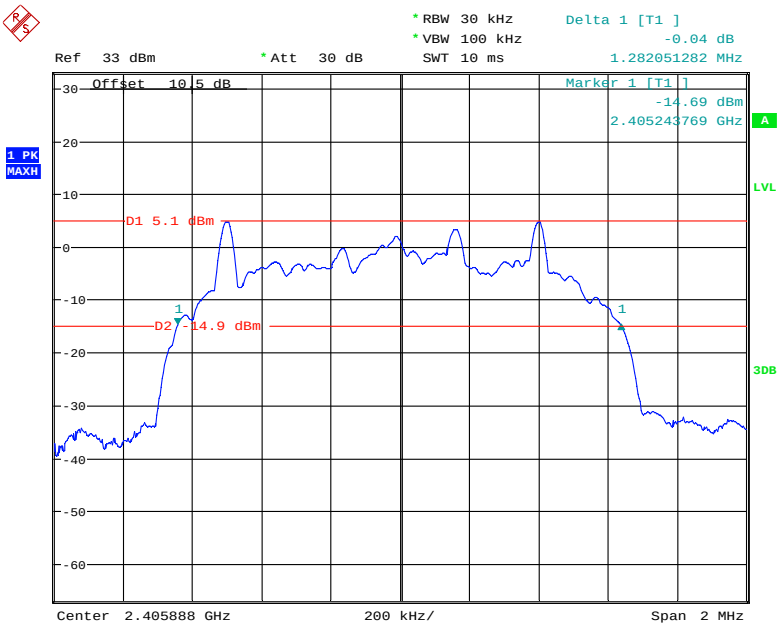
The testing was performed by Chris Wang on 2018-01-25.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

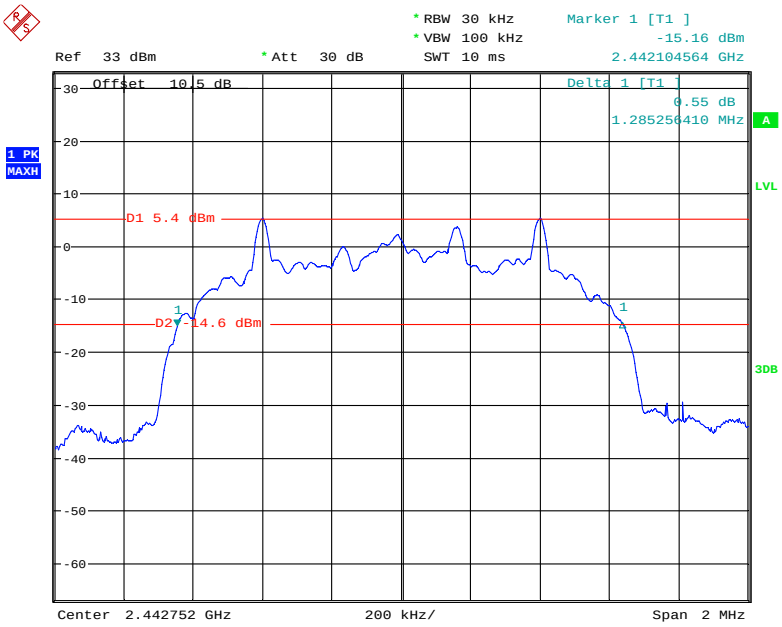
Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)	Limit (kHz)
Low	2405.888	1.282	≥500
Middle	2442.752	1.285	≥500
High	2475.52	1.288	≥500

Low Channel



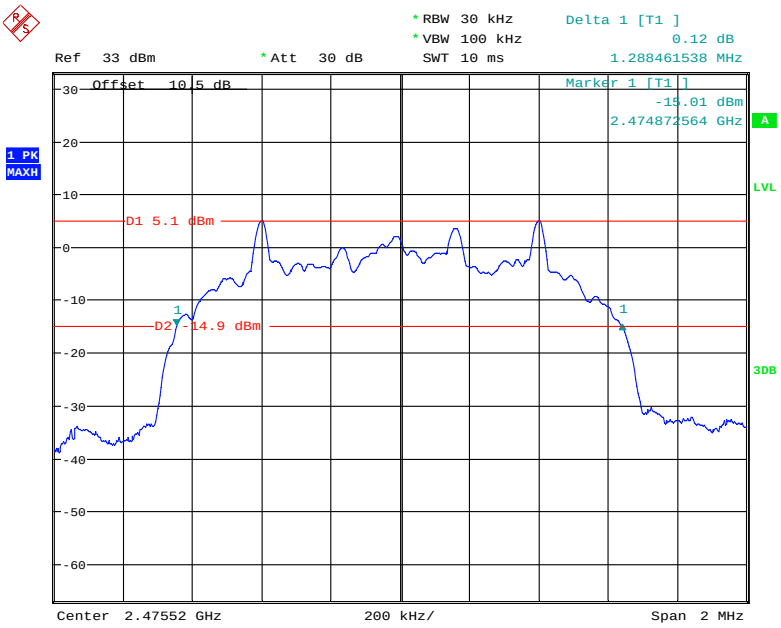
Date: 25.JAN.2018 19:32:24

Middle Channel



Date: 25.JAN.2018 19:28:35

High Channel



Date: 25.JAN.2018 19:35:59

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 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

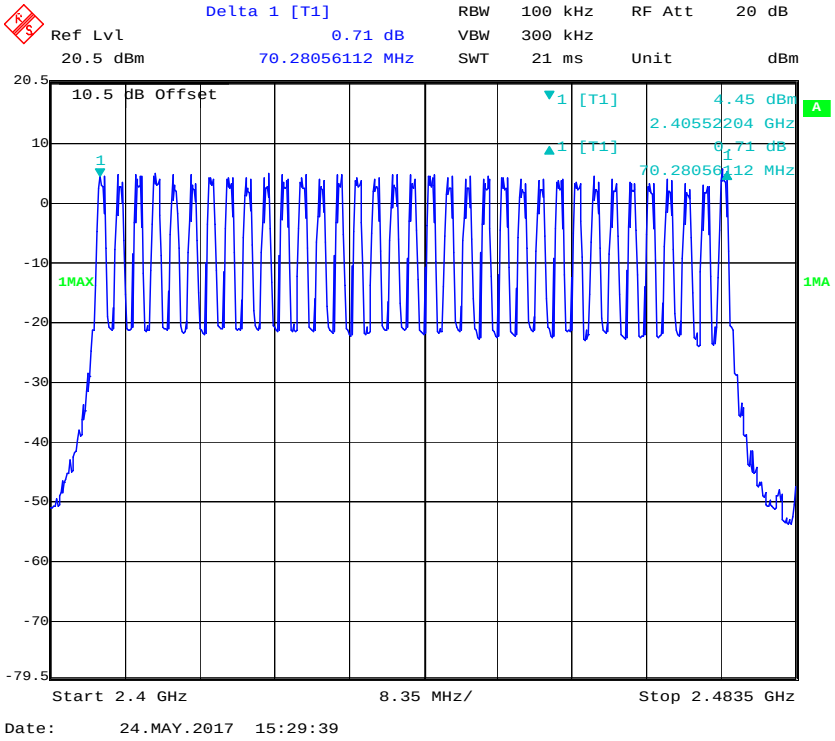
The testing was performed by Chris Wang on 2017-05-24.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
GFSK	2400-2483.5	35	≥15

BDR (GFSK): 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 shall have its hopping function enabled. Use the following spectrum analyzer settings:
a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / spectrum analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

Test Data

Environmental Conditions

Temperature:	24~25 ℃
Relative Humidity:	47~52 %
ATM Pressure:	100.0~101.0 kPa

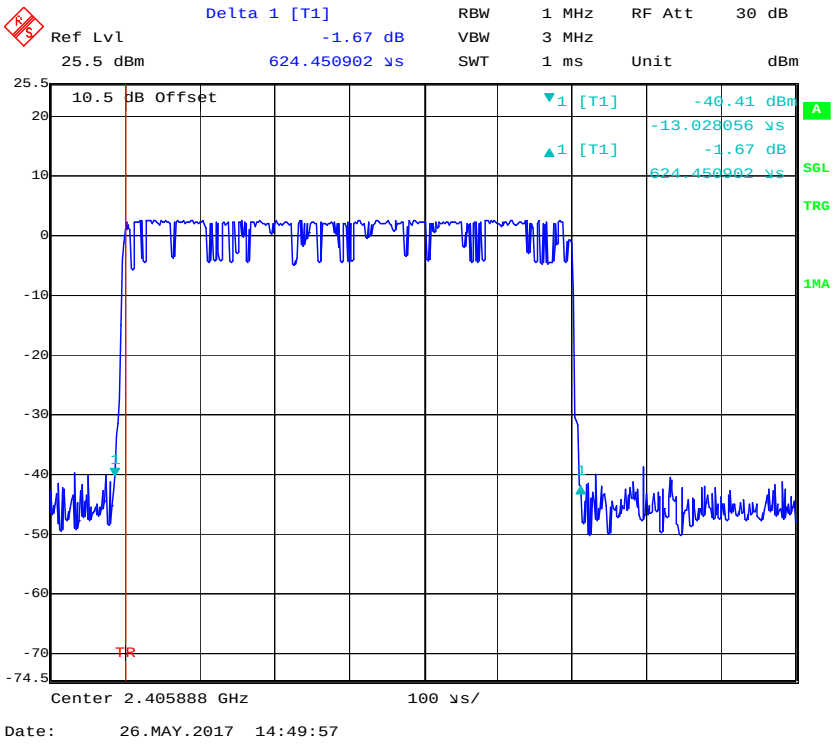
The testing was performed by Chris Wang on 2017-05-26 and 2017-06-12.

EUT operation mode: Transmitting

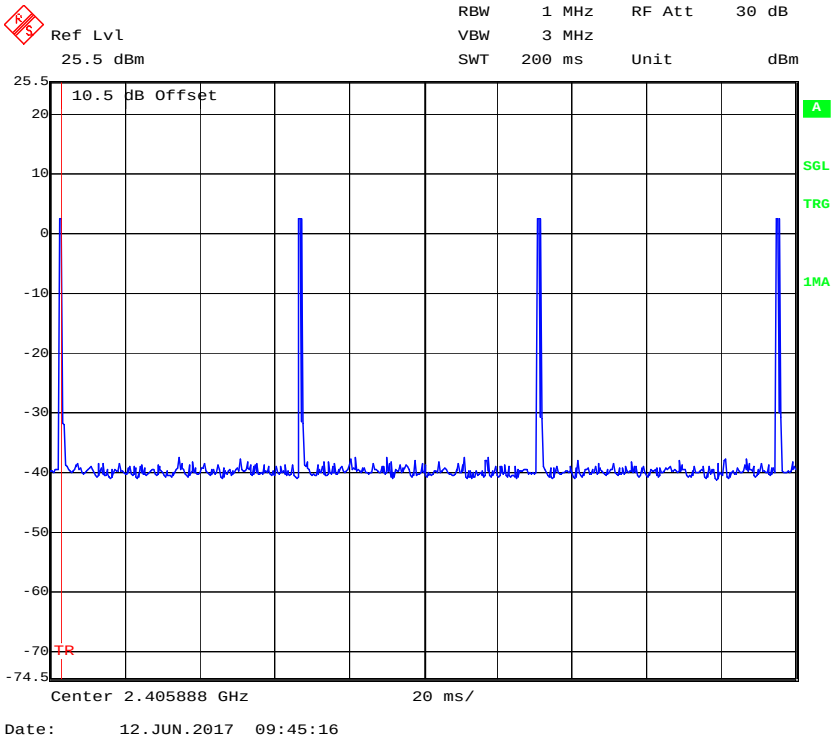
Test Result: Compliance. Please refer to following table and plots.

Mode	Number of hops in the period	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
GFSK	280	0.624	0.175	0.4	Pass
	Note: (Number of hops in the period) = (number of hops on spectrum analyzer) × (period specified in the requirements / spectrum analyzer sweep time)= 4×(0.4*35/0.2)=280 Dwell time = Pulse time*(Number of hops in the period) s				

Pulse time



Number of hops in the period



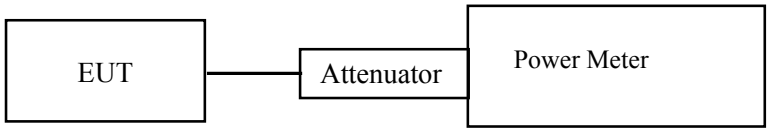
FCC §15.247(b) (1) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §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. 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 it 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 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

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

Test Result: Compliance. Please refer to following table and plots.

EUT operation mode: Transmitting

Channel	Frequency (MHz)	Reading Power (dBm)	Peak Output Power (mW)	Limit (mW)
Low	2405.888	4.66	2.92	125
Middle	2442.752	4.73	2.97	125
High	2475.52	5.61	3.64	125

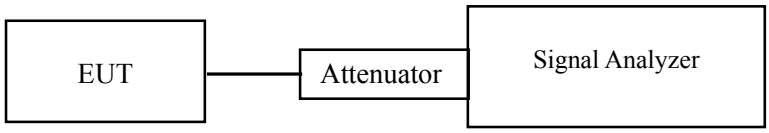
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 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

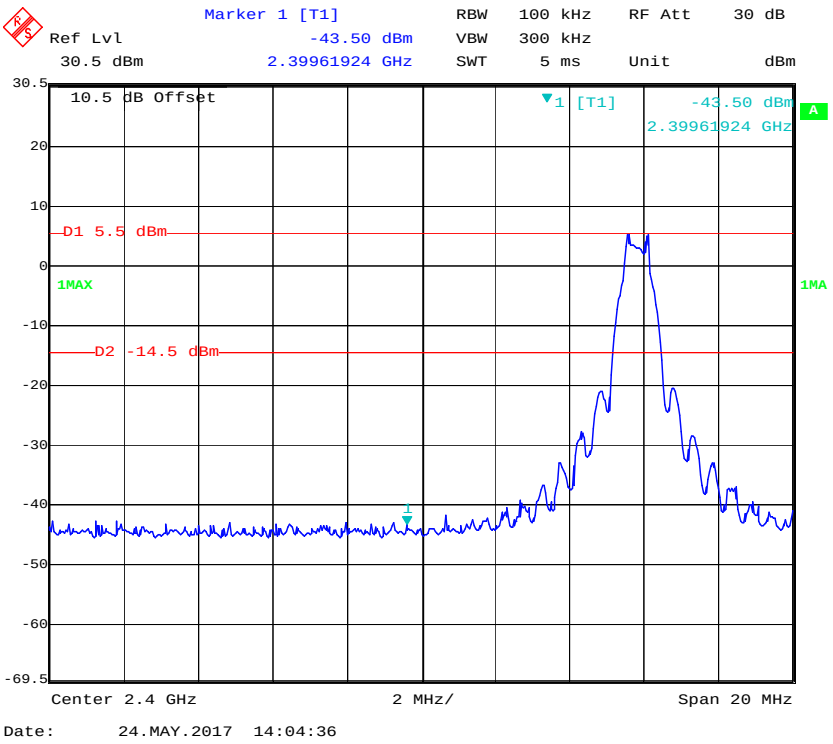
Temperature:	24~25 ℃
Relative Humidity:	49~54 %
ATM Pressure:	100.9~101.0 kPa

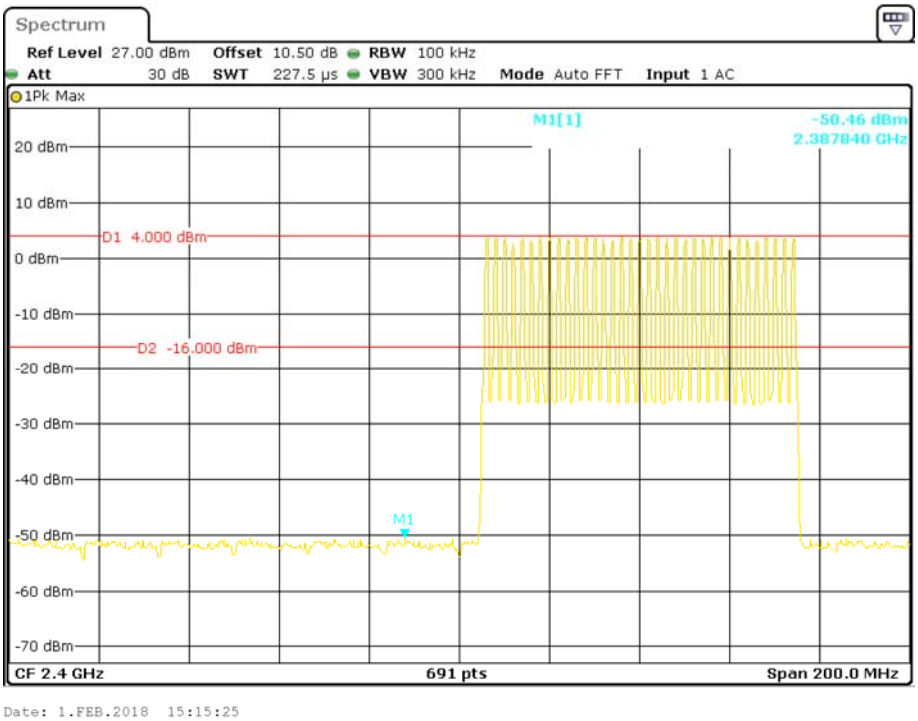
The testing was performed by Chris Wang from 2017-05-24 to 2018-02-01.

Test Result: Compliance. Please refer to following table and plots.

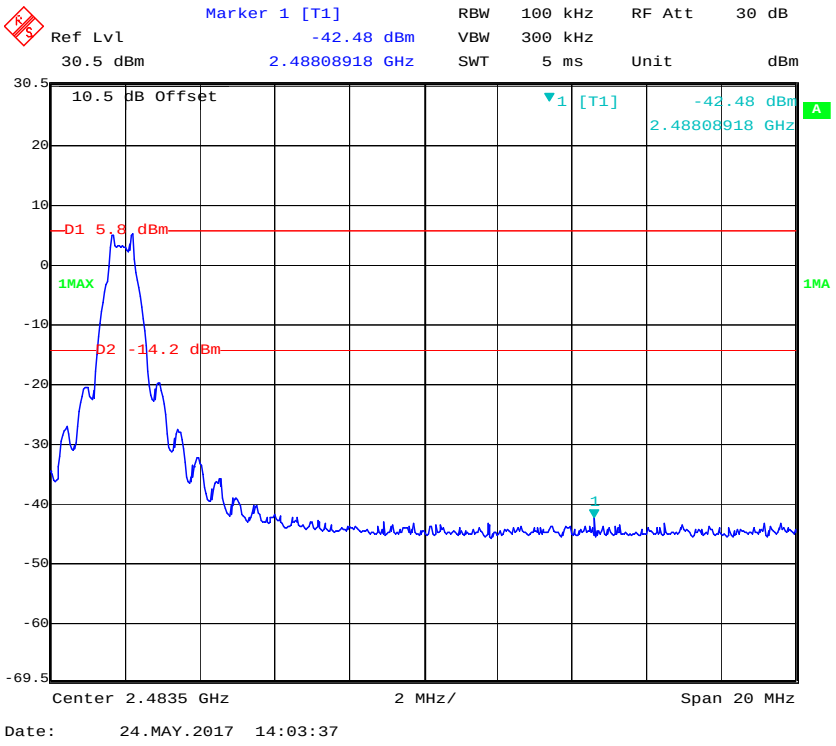
EUT operation mode: Transmitting

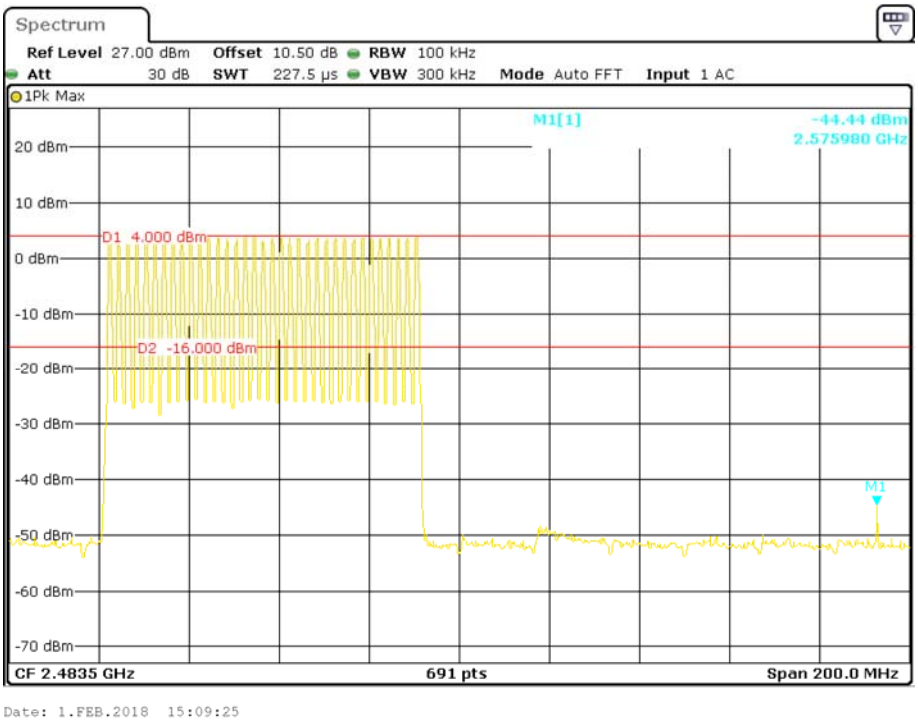
Band Edge, Left Side





Band Edge, Right Side





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