



FCC PART 15.247 TEST REPORT

For

JEM ACCESSORIES INC.

32 Brunswick Avenue, Edison, New Jersey, United States, 08817

FCC ID: 2AHAS-XCA21013R

Report Type: Original Report	Product Type: Basic Wireless Keyboard USB receiver
Report Number: RSZ200822831-00	
Report Date: 2020-09-21	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Basic Wireless Keyboard USB receiver
Tested Model	XCA2-1013-BLK
Multiple Model	12484, 12485
Model Differences	Refer to the DoS letter
Frequency Range	2402-2480MHz
Maximum conducted Peak output power	1.19dBm
Modulation Technique	GFSK
Antenna Specification	PCB Antenna: 0dBi
Voltage Range	DC 5V from USB Port
Date of Test	2020-09-03 to 2020-09-21
Sample serial number	RSZ200822831-RF-S1 (Assigned by BAACL, Shenzhen)
Received date	2020-08-22
Sample/EUT Status	Good condition

Objective

This test report is 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.

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.

For Radiated Emissions testing, please refer to DA 00-705 Released March 30, 2000, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

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

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1°C
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, 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.: 342867, the FCC Designation No.: CN1221.

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

Channel list

Channel	Frequency	Channel	Frequency
1	2402 MHz	21	2442 MHz
2	2404 MHz	22	2444 MHz
3	2406 MHz	23	2446 MHz
4	2408 MHz	24	2448 MHz
5	2410 MHz	25	2450 MHz
6	2412 MHz	26	2452 MHz
7	2414 MHz	27	2454 MHz
8	2416 MHz	28	2456 MHz
9	2418 MHz	29	2458 MHz
10	2420 MHz	30	2460 MHz
11	2422 MHz	31	2462 MHz
12	2424 MHz	32	2464 MHz
13	2426 MHz	33	2466 MHz
14	2428 MHz	34	2468 MHz
15	2430 MHz	35	2470 MHz
16	2432 MHz	36	2472 MHz
17	2434 MHz	37	2474 MHz
18	2436 MHz	38	2476 MHz
19	2438 MHz	39	2478 MHz
20	2440 MHz	40	2480 MHz

EUT was tested with Channel 1, 20 and 40.

The frequency range of the system is operating from 2402MHz to 2480MHz. There are totally 40 non overlapping channels with 2MHz channel separation. There are 16 active channels out of the 40 channels. The 16 active channels are selected in pseudo random manner by default. The remaining 24 channels are spare channels which will be exchanged with channels one at a time when any one of the active channels jamming with noise. Once an active channels has noise jamming during frequency hopping, it will be marked as dirty channels and exchanged with a spare channels after a dwell time. The spare channel is selected randomly so that at any time the active channels are always equally used in a pseudo random manner. The dirty channel become part as spare channels and can be used in active channels again after all the other spare channels have been used.

EUT Exercise Software

“SE67T_Test_v161.exe” exercise software was used and the power level is 15.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

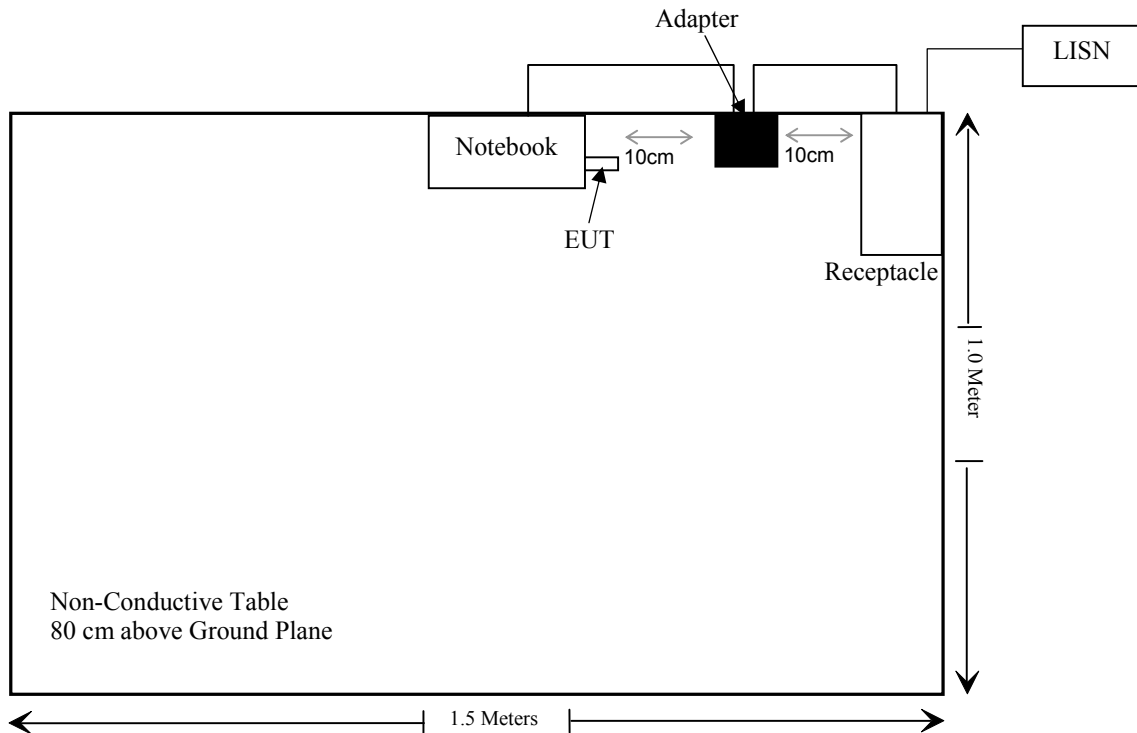
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Dell	Notebook	Latitude E5430	26913588589
Toshiba	Toshiba	Satellite C600	PSCZNP-00G006
Toshiba	AC/DC Adapter	PA3715E-1AC3	T0311043001798DA

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Un-detachable DC Cable	2.0	Laptop	Adapter

Block Diagram of Test Setup



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	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
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2020/08/04	2021/08/03
Rohde & Schwarz	LISN	ENV216	101613	2020/08/04	2021/08/03
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2019/11/29	2020/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2019/11/29	2020/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulated Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknow	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/04/20	2021/04/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-021304	2017/12/6	2020/12/5
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2020/04/03	2021/04/02
WEINSCHTEL	10dB Attenuator	5324	AU3842	2019/11/29	2020/11/28
Unknow	RF Cable	Unknow	2301 276	2019/11/29	2020/11/28

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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:

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

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.

For worst case:

Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2402-2480	1.5	1.41	5	0.4	3.0	Yes

Result: No Standalone 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 Connector Construction

The EUT has one 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: Pass

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

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:

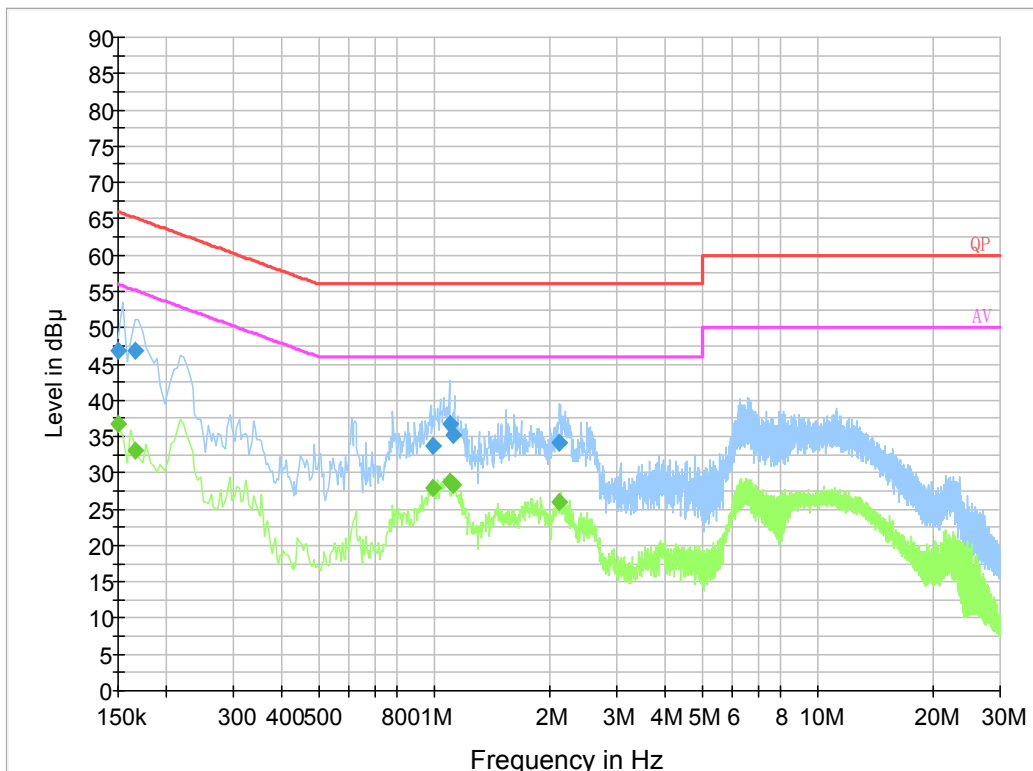
$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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:

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

Test Data

Project No: RSZ200822831-RF
 Company Name: JEM ACCESSORIES INC.
 Model Number: XCA2-1013-BLK EUT Number: RSZ200822831-RF-S1
 Test Standard: FCC 15.247
 Climatic: 25°C 65%RH 101kPa
 Test Date: 2020.09.06 Test Engineer: Haiguo Li
 Power Source: AC 120V 60Hz Port: L
 Test Mode: Transmitting



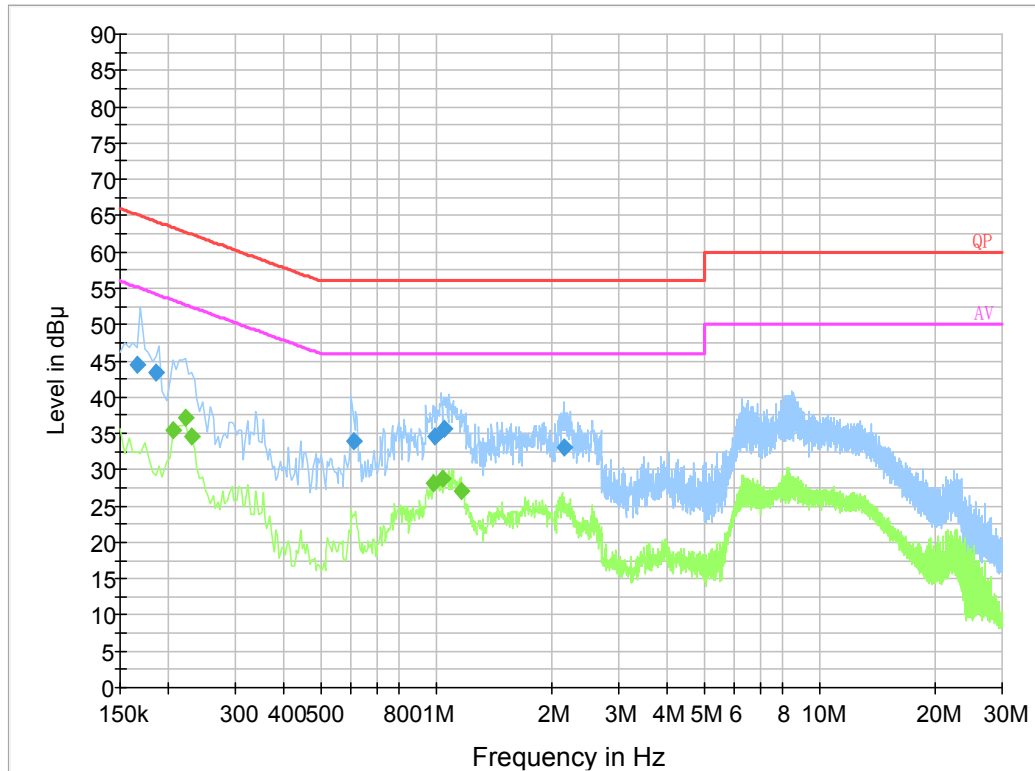
Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.150000	46.8	0.200	L1	19.8	19.2	66.0
0.165500	46.8	9.000	L1	19.9	18.4	65.2
0.991270	33.7	9.000	L1	19.9	22.3	56.0
1.101530	36.7	9.000	L1	19.8	19.3	56.0
1.124990	35.3	9.000	L1	19.8	20.7	56.0
2.122050	34.2	9.000	L1	19.9	21.8	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.150000	36.7	9.000	L1	19.8	19.3	56.0
0.165500	33.0	9.000	L1	19.9	22.2	55.2
0.991270	28.0	9.000	L1	19.9	18.0	46.0
1.101530	28.8	9.000	L1	19.8	17.2	46.0
1.124990	28.3	9.000	L1	19.8	17.7	46.0
2.122050	26.0	9.000	L1	19.9	20.0	46.0

Project No: RSZ200822831-RF
 Company Name: JEM ACCESSORIES INC.
 Model Number: XCA2-1013-BLK EUT Number: RSZ200822831-RF-S1
 Test Standard: FCC 15.247
 Climatic: 25°C 65%RH 101kPa
 Test Date: 2020.09.06 Test Engineer: Haiguo Li
 Power Source: AC 120V 60Hz Port: N
 Test Mode: Transmitting



Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.165500	44.5	9.000	N	19.8	20.7	65.2
0.185500	43.3	9.000	N	19.8	20.9	64.2
0.611030	33.8	9.000	N	19.8	22.2	56.0
0.996730	34.5	9.000	N	19.8	21.5	56.0
1.049510	35.6	9.000	N	19.8	20.4	56.0
2.169630	33.1	9.000	N	19.8	22.9	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.206000	35.5	9.000	N	19.8	17.9	53.4
0.222000	37.1	9.000	N	19.8	15.6	52.7
0.230000	34.5	9.000	N	19.8	17.9	52.4
0.986000	28.2	9.000	N	19.8	17.8	46.0
1.046000	28.8	9.000	N	19.8	17.2	46.0
1.162000	27.1	9.000	N	19.8	18.9	46.0

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, according to the DA 00-705 Released March 30, 2000, 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.

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:

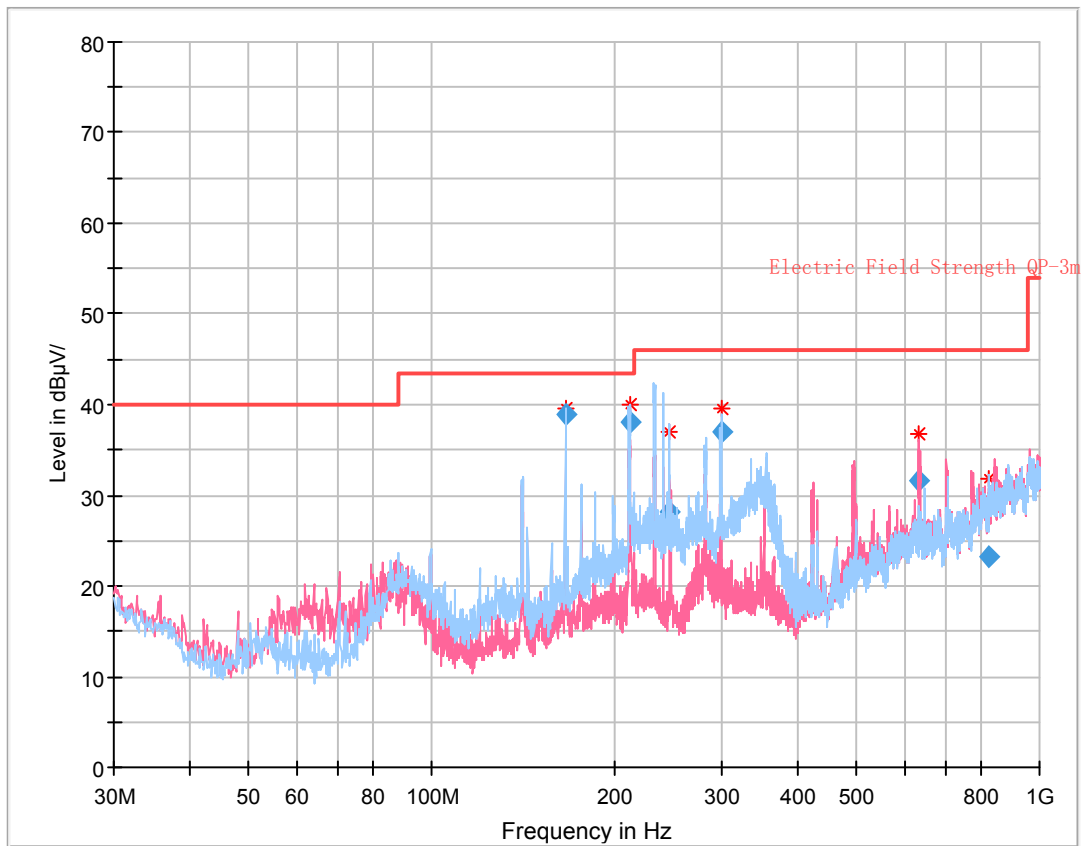
$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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 Data

Project No.: RSZ200822831-RF
 Company: JEM ACCESSORIES INC.
 EUT Description: Basic Wireless Keyboard USB receiver
 EUT Model: XCA2-1013-BLK
 EUT Number: RSZ200822831-RF-S1
 Climatic: 30.2°C 61%RH 101kPa
 Test Engineer: *Huihui Yang* Test Date: 2020.09.06
 Operating Mode: Transmitting (High channel was worst case)
 Voltage/Frequency: DC 5.0V



Final Result

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
166.276625	38.97	43.50	4.53	141.0	H	80.0	-14.7
212.049875	38.04	43.50	5.46	145.0	H	85.0	-13.9
246.581625	28.08	46.00	17.92	121.0	H	281.0	-14.1
299.309125	37.06	46.00	8.94	109.0	H	188.0	-10.7
633.654000	31.52	46.00	14.48	145.0	V	152.0	-1.6
826.237375	23.19	46.00	22.81	382.0	H	0.0	2.5

1 GHz - 25 GHz:

Project No.:	RSZ200822831-RF		
Company:	JEM ACCESSORIES INC.		
EUT model	XCA2-1013-BLK		
EUT Number:	RSZ200822831-RF-S1		
Operating Mode:	Transmitting		
Test Conditions:	Temperature: 32.2°C; Relative Humidity:55 %; ATM Pressure: 100.7kPa		
Test Engineer:	Leven Gan	Test Date:	2020-09-03

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402MHz)									
2389.47	28.48	PK	358	1.9	H	31.87	60.35	74	13.65
2389.47	14.46	Ave.	358	1.9	H	31.87	46.33	54	7.67
2484.91	28.17	PK	321	2.5	H	32.13	60.30	74	13.70
2484.91	14.33	Ave.	321	2.5	H	32.13	46.46	54	7.54
4804.00	51.40	PK	349	1.1	H	6.28	57.68	74	16.32
4804.00	44.70	Ave.	349	1.1	H	6.28	50.98	54	3.02
7206.00	46.81	PK	282	1.3	H	11.93	58.74	74	15.26
7206.00	36.05	Ave.	282	1.3	H	11.93	47.98	54	6.02
Middle Channel (2440MHz)									
4880.00	51.57	PK	154	2.4	H	6.76	58.33	74	15.67
4880.00	44.17	Ave.	154	2.4	H	6.76	50.93	54	3.07
7320.00	44.26	PK	30	2.5	H	11.66	55.92	74	18.08
7320.00	33.75	Ave.	30	2.5	H	11.66	45.41	54	8.59
High Channel (2480 MHz)									
2388.67	28.24	PK	291	2.0	H	31.87	60.11	74	13.89
2388.67	14.37	Ave.	291	2.0	H	31.87	46.24	54	7.76
2484.65	34.71	PK	119	1.1	H	32.13	66.84	74	7.16
2484.65	15.26	Ave.	119	1.1	H	32.13	47.39	54	6.61
4960.00	51.61	PK	338	2.4	H	6.80	58.41	74	15.59
4960.00	43.59	Ave.	338	2.4	H	6.80	50.39	54	3.61
7440.00	43.79	PK	92	1.4	H	12.39	56.18	74	17.82
7440.00	31.19	Ave.	92	1.4	H	12.39	43.58	54	10.42

Note:

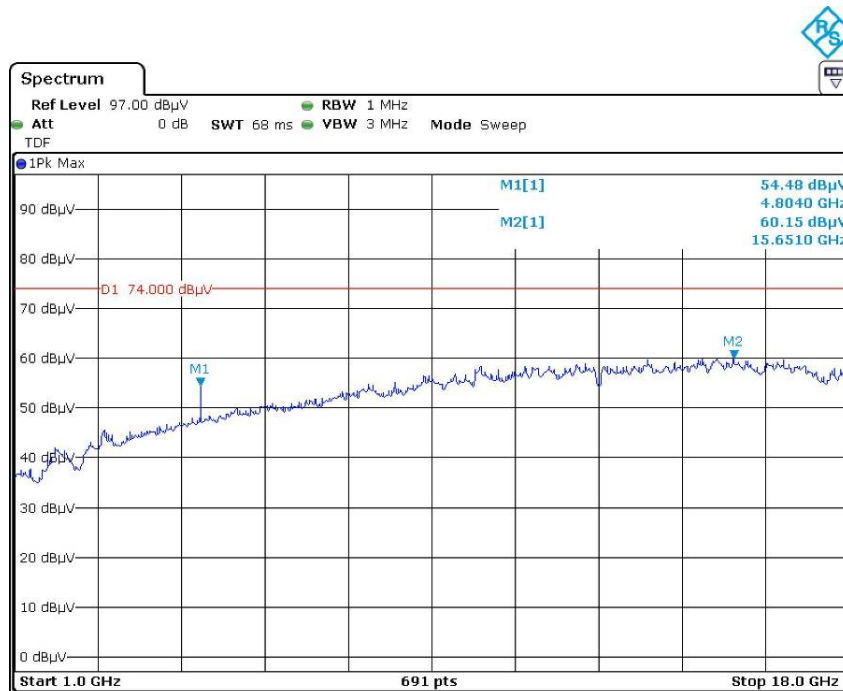
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

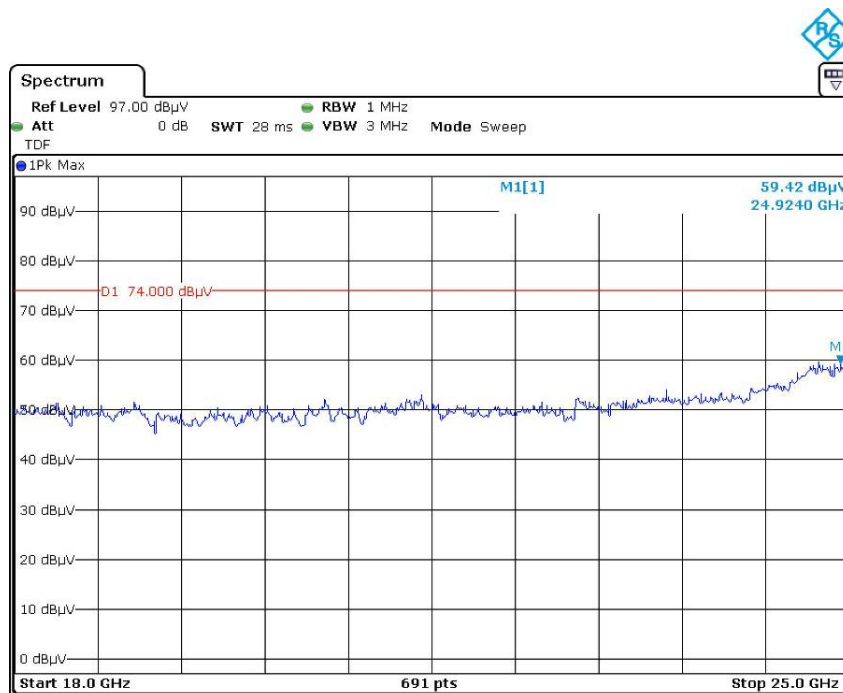
Margin = Limit - Corrected. Amplitude

The other spurious emission which is 20dB to the limit was not recorded.

Pre-scan with Low channel Peak Horizontal

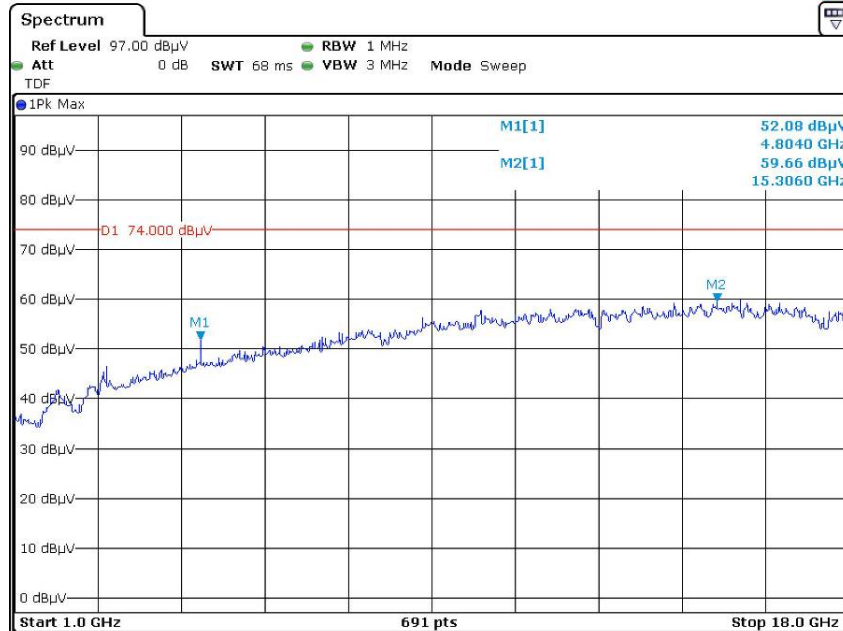


Date: 3.SEP.2020 16:03:03

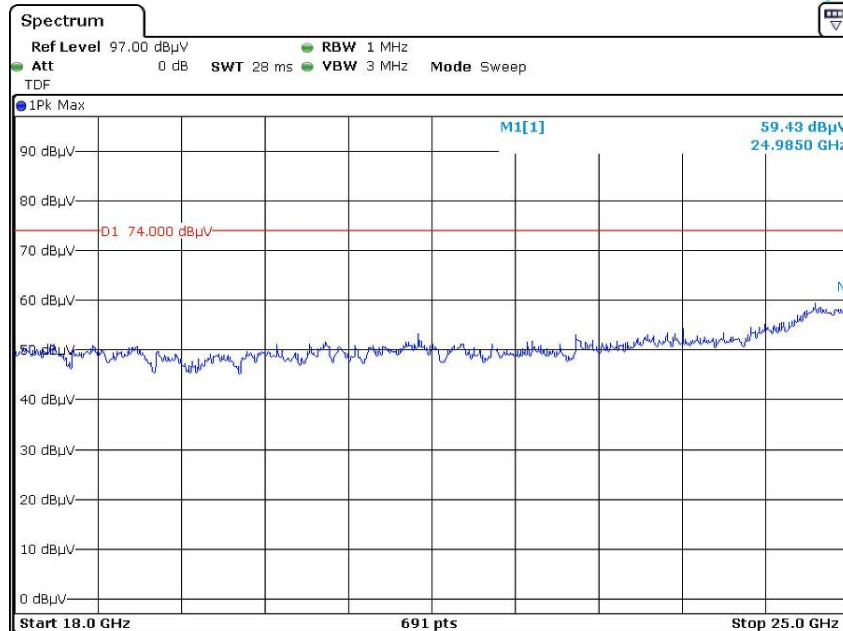


Date: 3.SEP.2020 16:46:29

Vertical

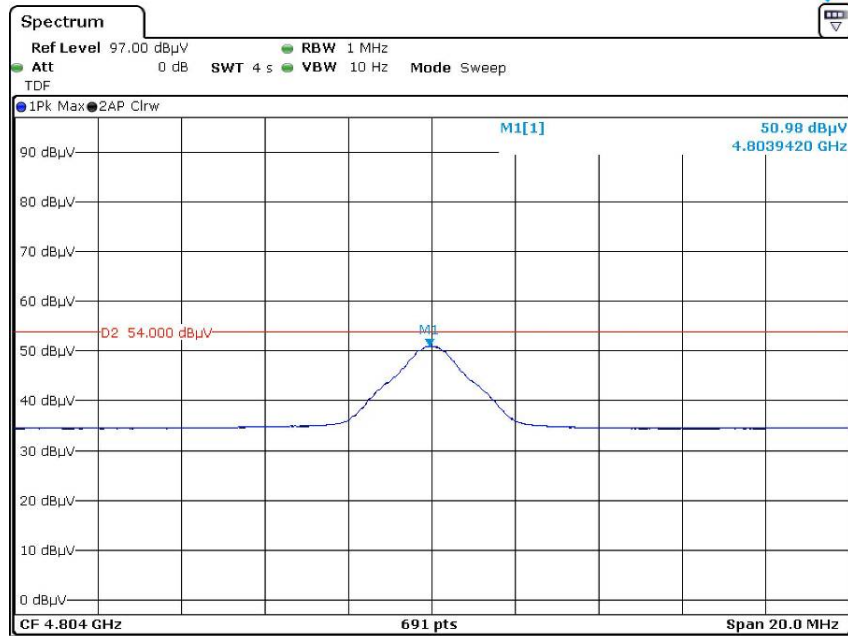


Date: 3.SEP.2020 18:13:15

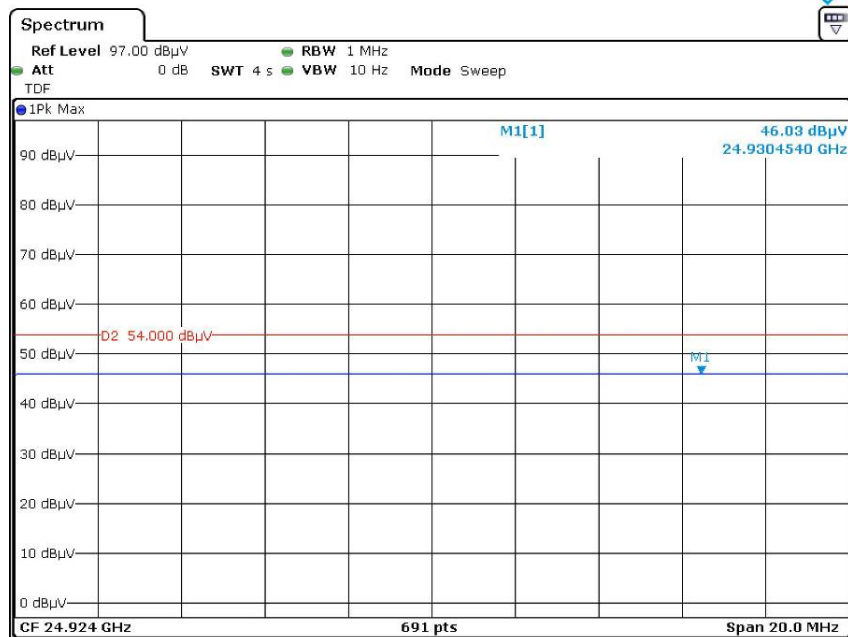


Date: 3.SEP.2020 18:55:25

Average Horizontal

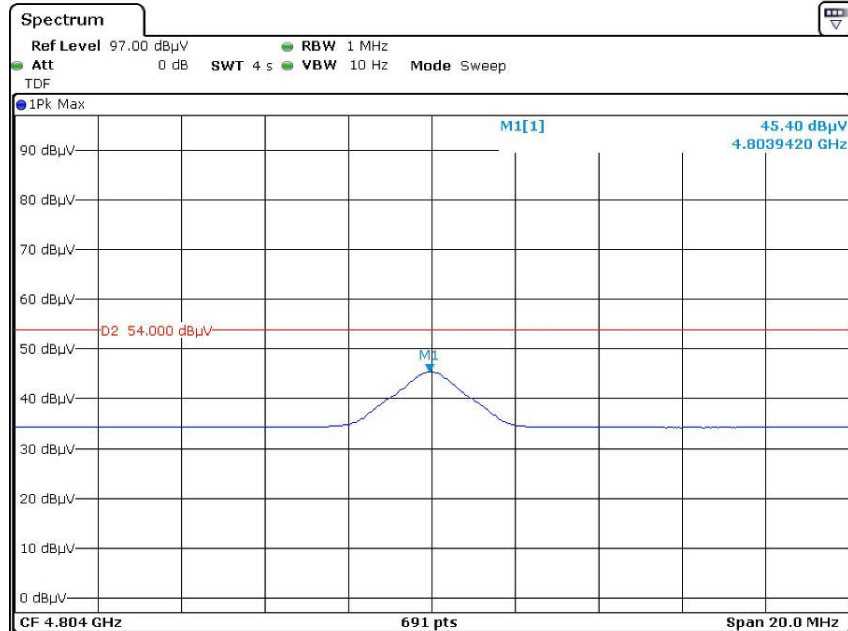


Date: 3.SEP.2020 18:09:07

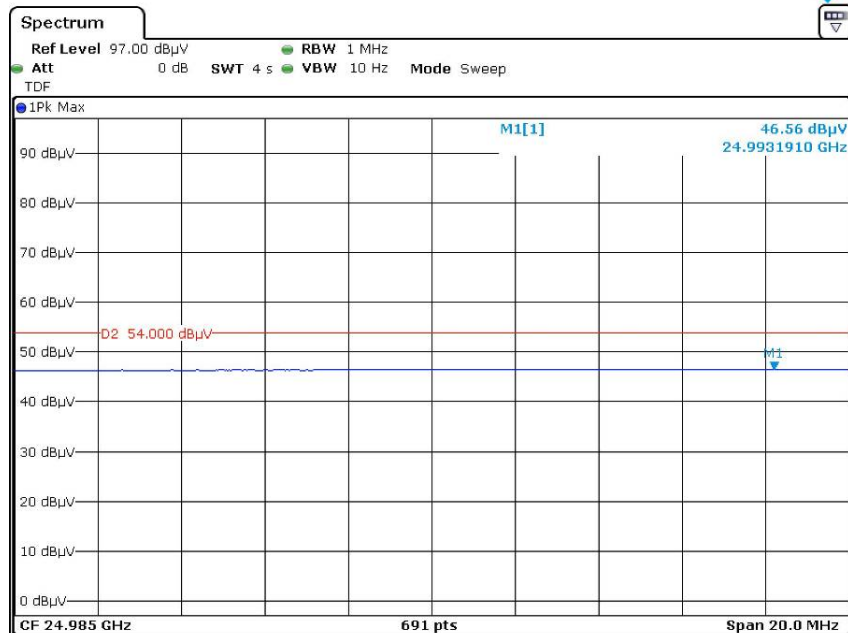


Date: 3.SEP.2020 18:51:59

Vertical



Date: 3.SEP.2020 18:17:44



Date: 3.SEP.2020 18:59:49

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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Blaker Zhang on 2020-09-17.

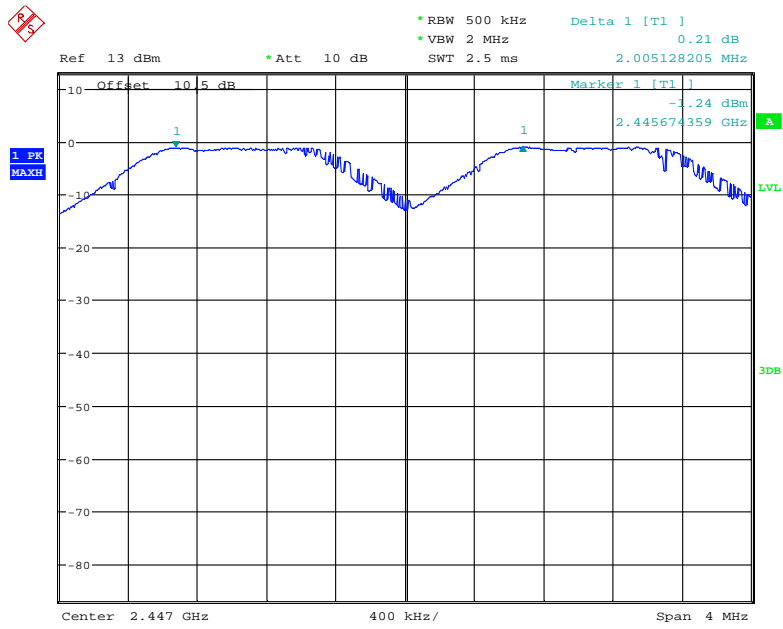
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

Mode	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit (MHz)
Hopping	2.005	2.092	1.395	> two-thirds of the 20 dB bandwidth

Please refer to the following plots.



Date: 17.SEP.2020 00:18:38

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 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Blaker Zhang on 2020-09-08 and 2020-09-10.

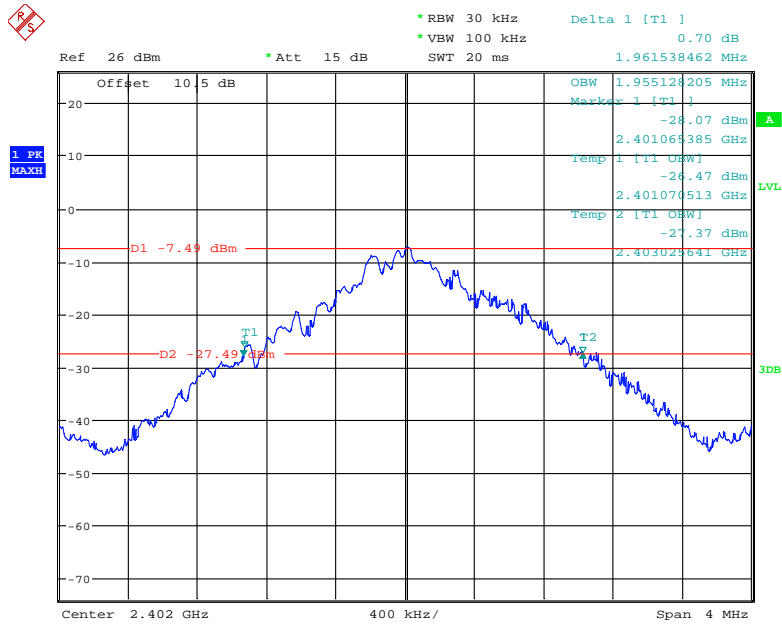
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

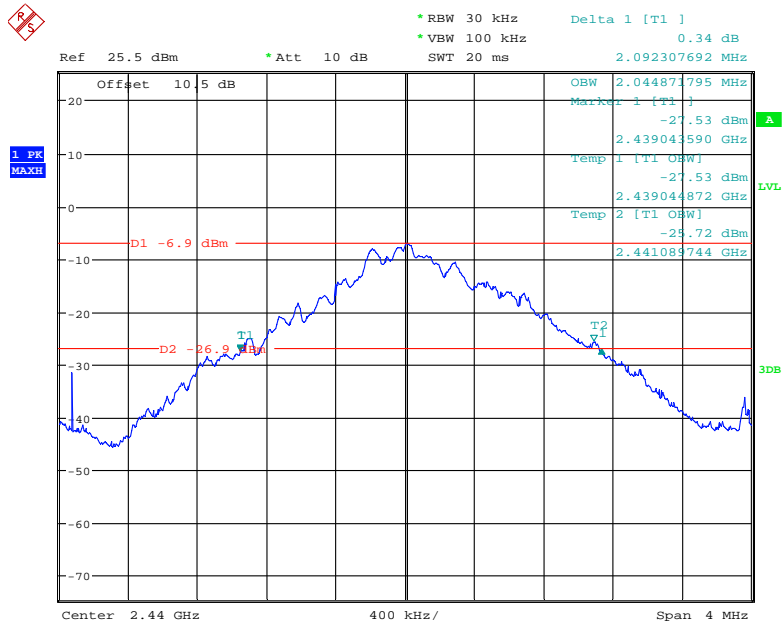
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
FHSS	Low	2402	1.962
	Middle	2440	2.092
	High	2480	2.051

Low Channel



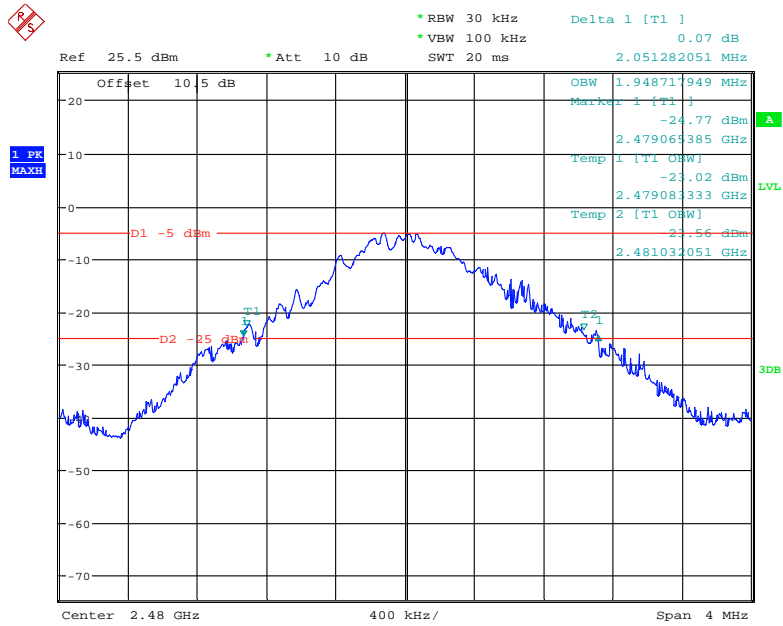
Date: 8.SEP.2020 02:07:02

Middle Channel



Date: 10.SEP.2020 01:38:49

High Channel



Date: 10.SEP.2020 00:02:23

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 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Blaker Zhang on 2020-09-10.

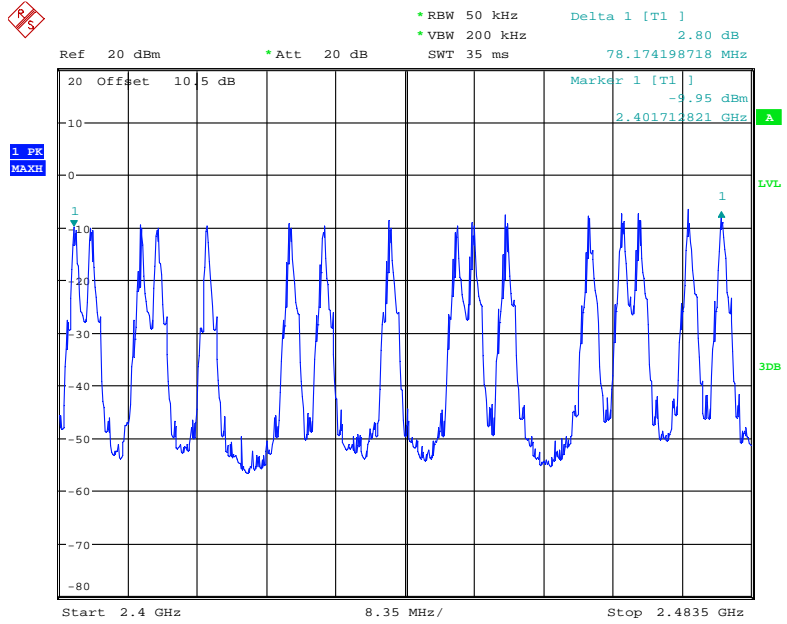
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
FHSS	2400-2483.5	16	≥15

Number of Hopping Channels



Date: 10.SEP.2020 23:46:15

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

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Blaker Zhang on 2020-09-09.

EUT operation mode: Transmitting

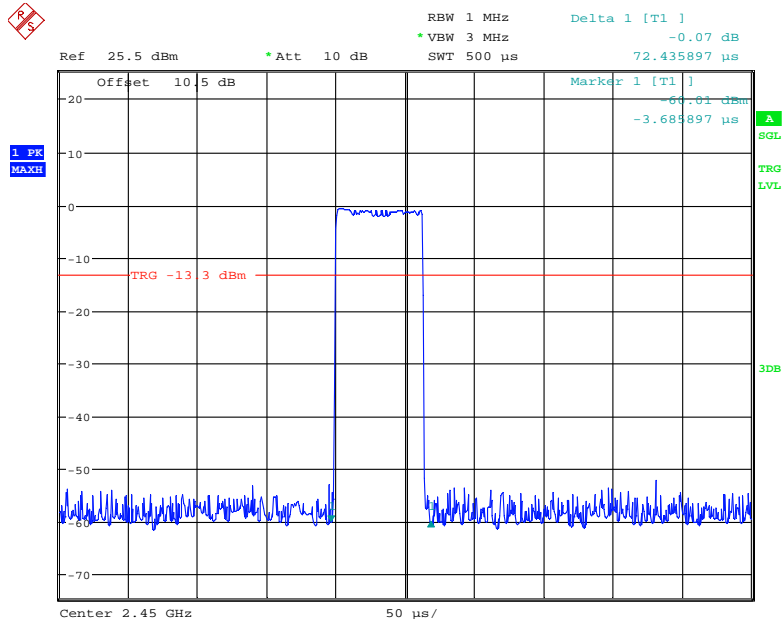
Test Result: Pass

Please refer to following table and plots

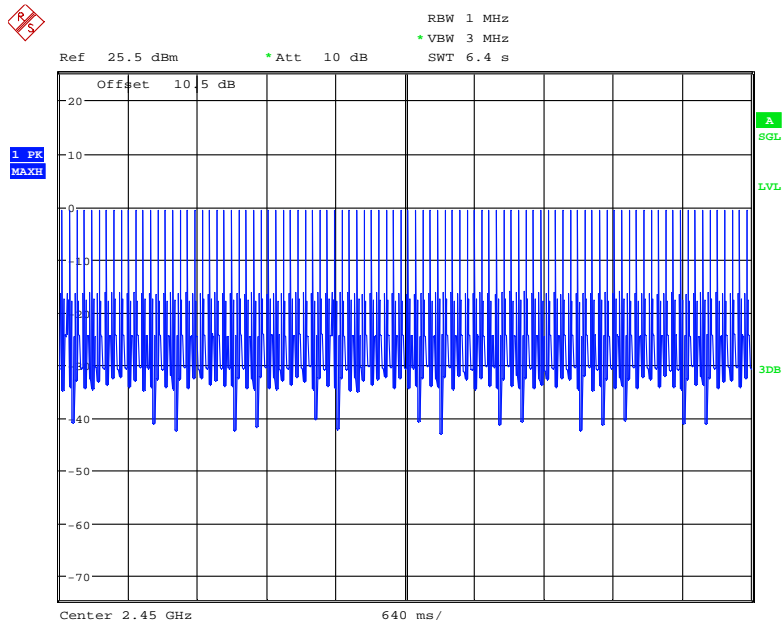
Test Mode	Channel	Pulse Time (ms)	Total Hops	Period Time (s)	Dwell Time (ms)	Limit (ms)	Result
Hopping	Middle	0.07	94	6.4	6.58	400	Pass

Note: A period time=0.4*16=6.4(s), Dwell Time= Pulse Time* Total Hops

Pulse time, Middle Channel



Date: 9.SEP.2020 03:05:10



Date: 9.SEP.2020 03:04:18

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 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Blaker Zhang on 2020-09-09.

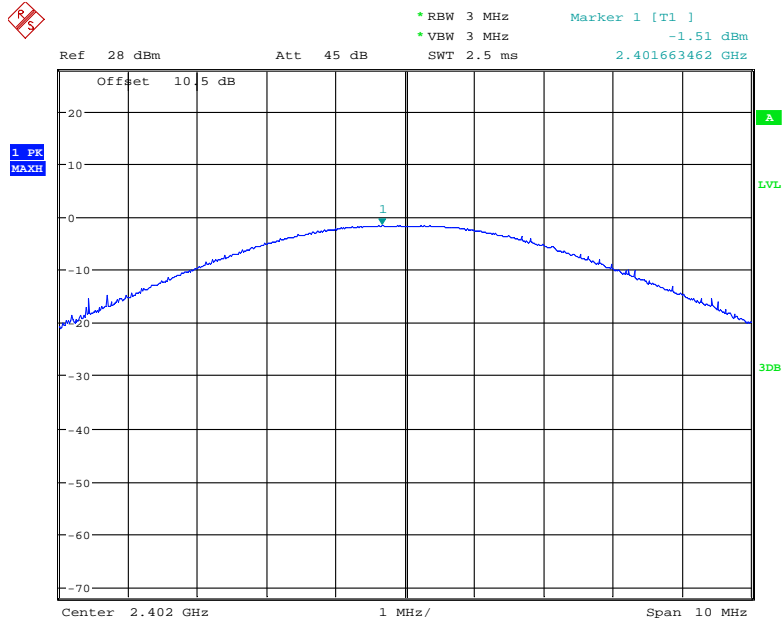
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots

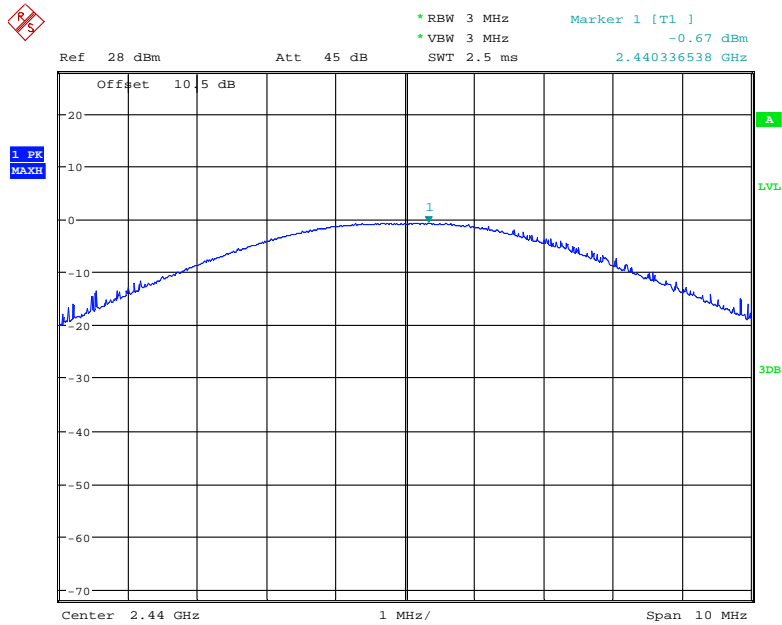
Channel	Frequency (MHz)	Conducted Peak Output Power	Limit (dBm)
		(dBm)	
Low	2402	-1.51	21
Middle	2440	-0.67	21
High	2480	1.19	21

Low Channel



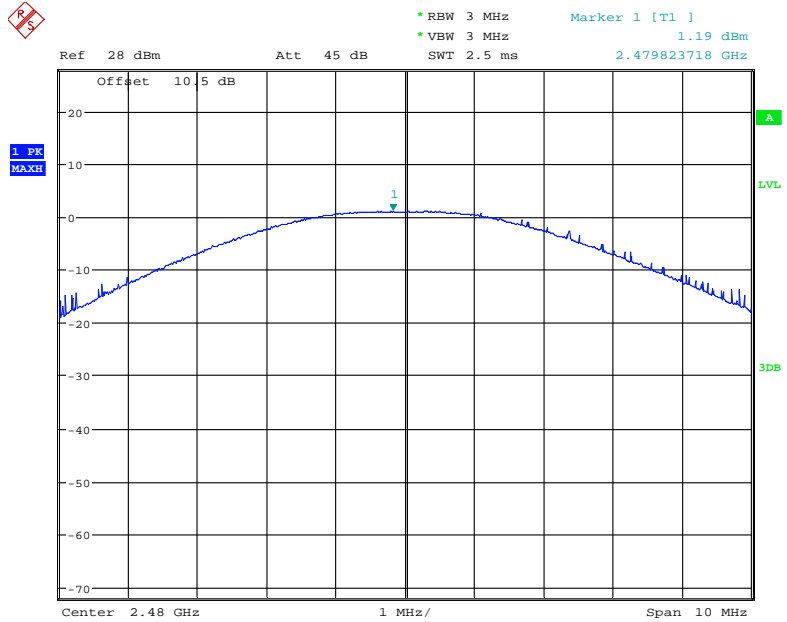
Date: 9.SEP.2020 02:55:53

Middle Channel



Date: 9.SEP.2020 02:55:08

High Channel



Date: 9.SEP.2020 02:56:35

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.
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 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

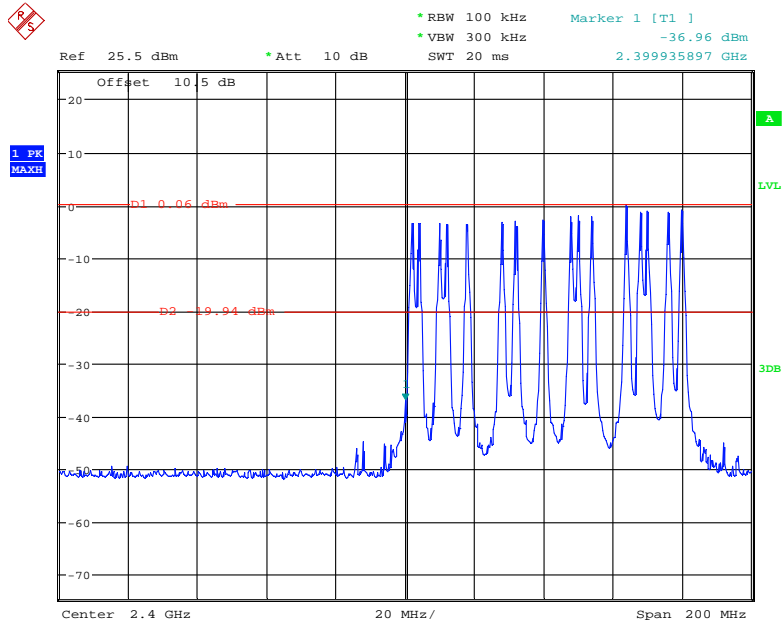
The testing was performed by Blaker Zhang from 2020-09-08 to 2020-09-21.

EUT operation mode: Transmitting

Test Result: Pass

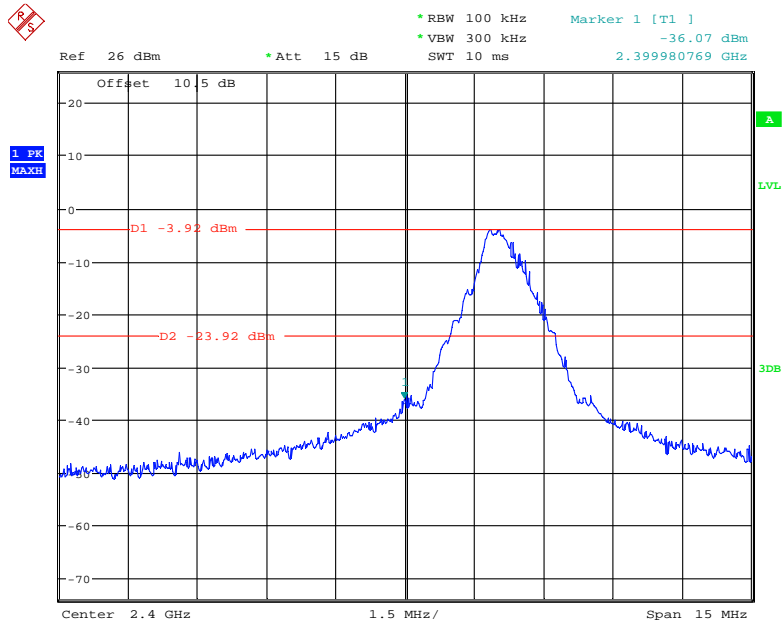
Please refer to following table and plots

Band Edge-Left Side Hopping



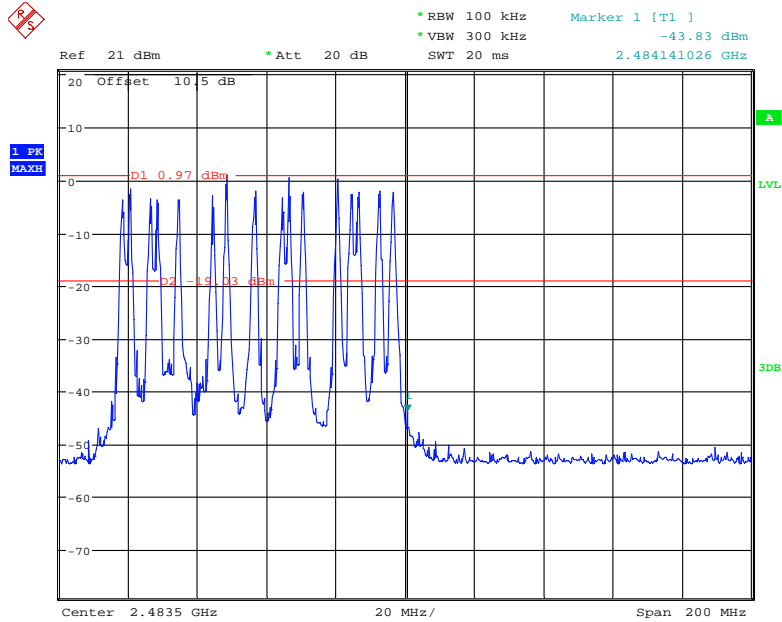
Date: 17.SEP.2020 01:29:35

Single



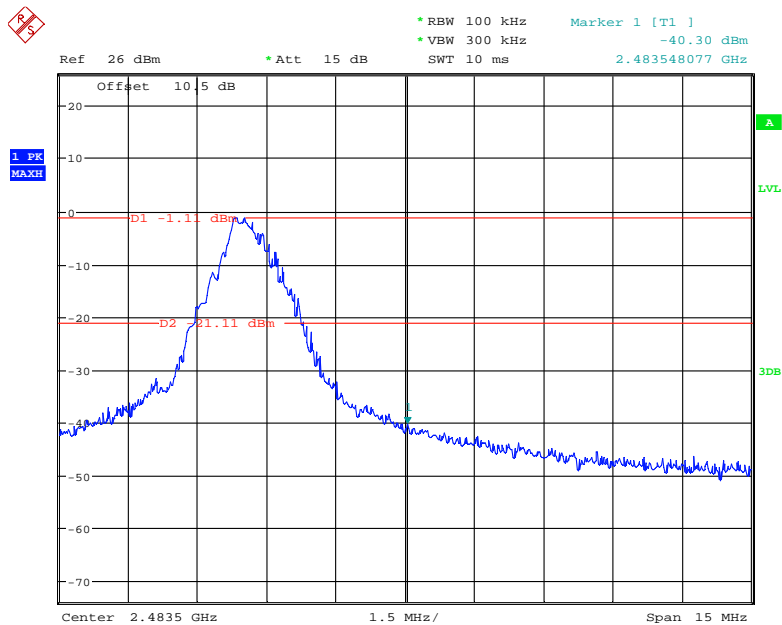
Date: 8.SEP.2020 03:03:58

Band Edge-Right Side Hopping



Date: 21.SEP.2020 19:32:15

Single



Date: 8.SEP.2020 02:58:02

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