ACCREDITED
TESTING LABORATORY
CERTIFICATE # 4821.01

BACL
Bay Area Compliance Labs Corp.

FCC PART 15.247
TEST REPORT

For

Shenzhen VanTop Technology & Innovation Co., Ltd.

502, 5th Flr. BLDG 4, MinQi Technology Park, No. 65 Lishan Road, Taoyuan Street, Nanshan District, Shenzhen, China

FCC ID:2AQ3A-SP500R2420

Report Type:	**Product Type:**
Original Report	REMOTE

Report Number:	RSZ200630002-00A
Report Date:	2020-09-09
Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	REMOTE
Tested Model	SP500
Multiple Model	SP500 Plus, SP500N, SP500 Pro , SP560, SP570, SP580, SP650 Pro, SP680, SP700, SP700 Pro
Model Differences	Refer to the DOS letter
Frequency Range	2404~2480MHz
Maximum conducted Peak output power	-8.13dBm
Modulation Technique	GFSK
Antenna Specification	2dBi
Voltage Range	DC 3.7 V from battery or DC 5.0V from USB Port
Date of Test	2020-07-16 to 2020-09-07
Sample serial number	RSZ200630002-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020-06-30
Sample/EUT Status	Good condition

Objective

This test report is prepared on behalf of Shenzhen VanTop Technology & Innovation Co., Ltd. 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℃
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 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8
2.404GHz	2.411 GHz	2.416 GHz	2.421GHz	2.426 GHz	2.431 GHz	2.436 GHz	2.442 GHz
Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15	Channel 16
2.446 GHz	2.451GHz	2.456GHz	2.461 GHz	2.466 GHz	2.471GHz	2.476 GHz	2.480 GHz

EUT was tested with Channel 1, 8 and 16.

EUT Exercise Software

No exercise software.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

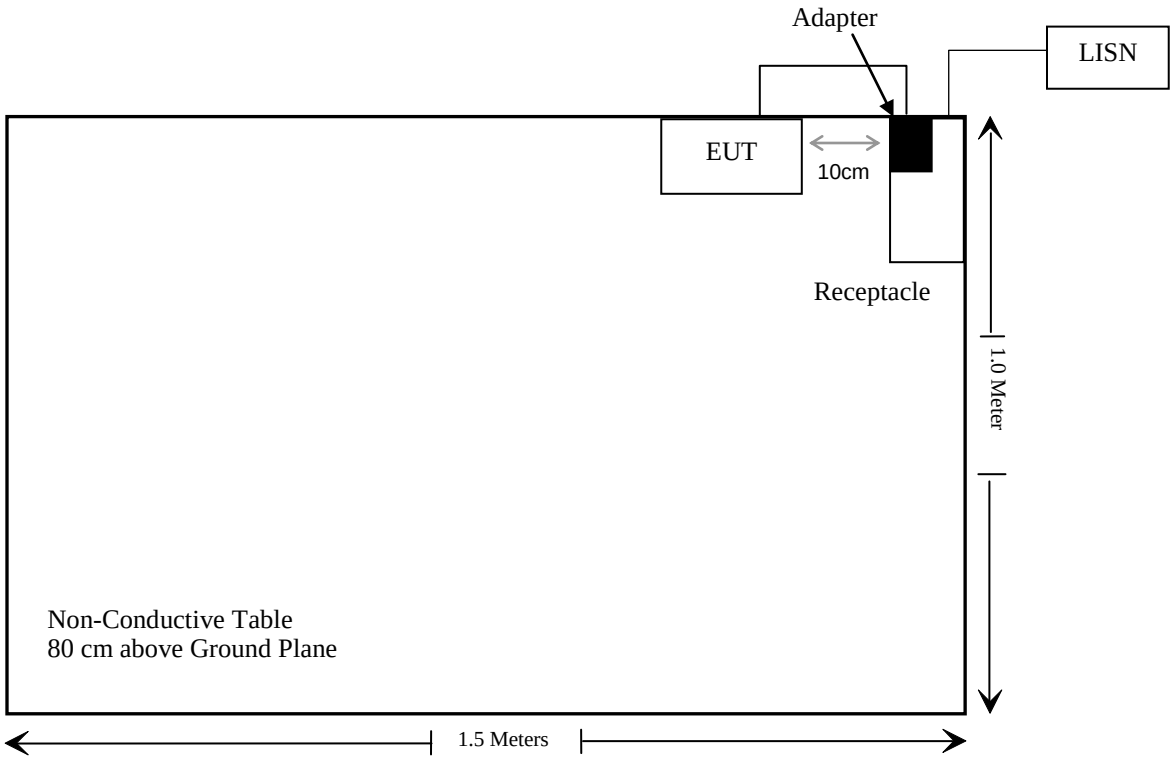
Manufacturer	Description	Model	Serial Number
I Hecho en China	Adapter	US-BB-1001	US-BB-100101
Dongguan Aohai power Technology Co., Ltd.	Adapter	A8A-050200U-US1	A8A-050200U-US101

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	0.50	Adapter	EUT

Block Diagram of Test Setup

For conducted emission:



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	2020/7/8	2021/7/7
Rohde & Schwarz	LISN	ENV216	101613	2020/1/24	2021/1/23
Rohde & Schwarz	Transient Limitor	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	2020/7/8	2021/7/7
Sonoma instrument	Pre-amplifier	310 N	186238	2020/4/20	2021/4/19
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
Unknown	Cable	Chamber Cable 4	EC-007	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Yijia	Temperature & Humidity Meter	TA218B	E0938	2019/10/14	2020/10/13
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/07/21	2021/07/20
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
COM-POWER	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Yijia	Temperature & Humidity Meter	TA218B	E0938	2019/10/14	2020/10/13
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
Unknown	Signal Cable	RG-214	2	2019/11/29	2020/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/4/20	2021/4/19
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/6	2020/12/5

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2020/04/03	2021/04/02
WEINSCHEL	3dB Attenuator	Unknow	F-03-EM121	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:
[(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.

For worst case:

Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2480	-8.0	0.16	5	0.05	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 2.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

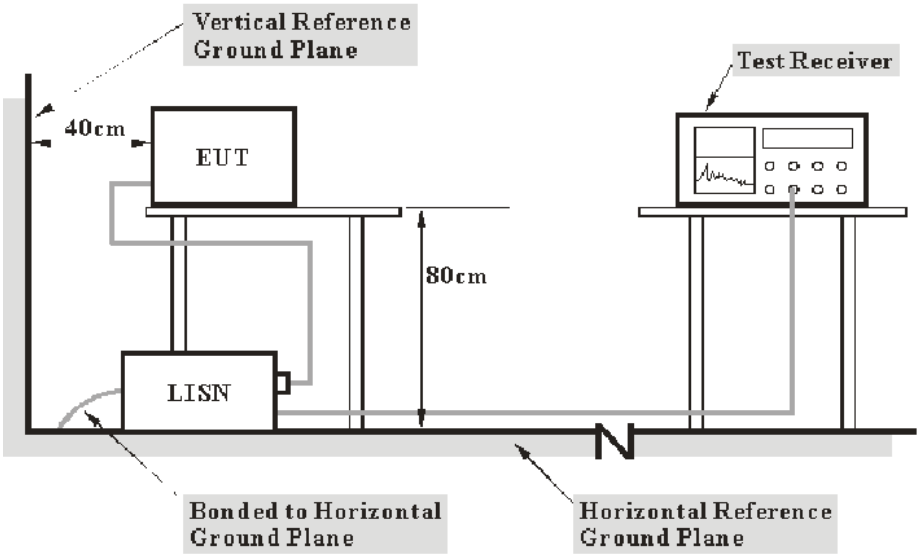
Result: Pass

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:

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 Data

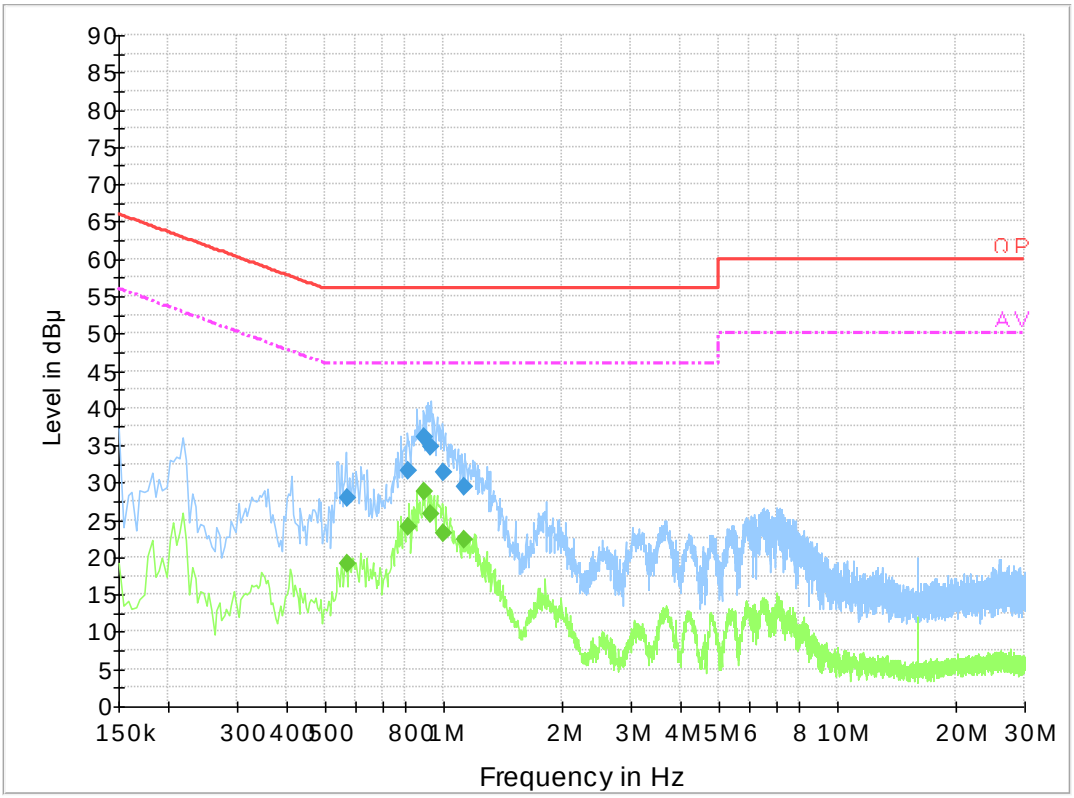
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-07-17.

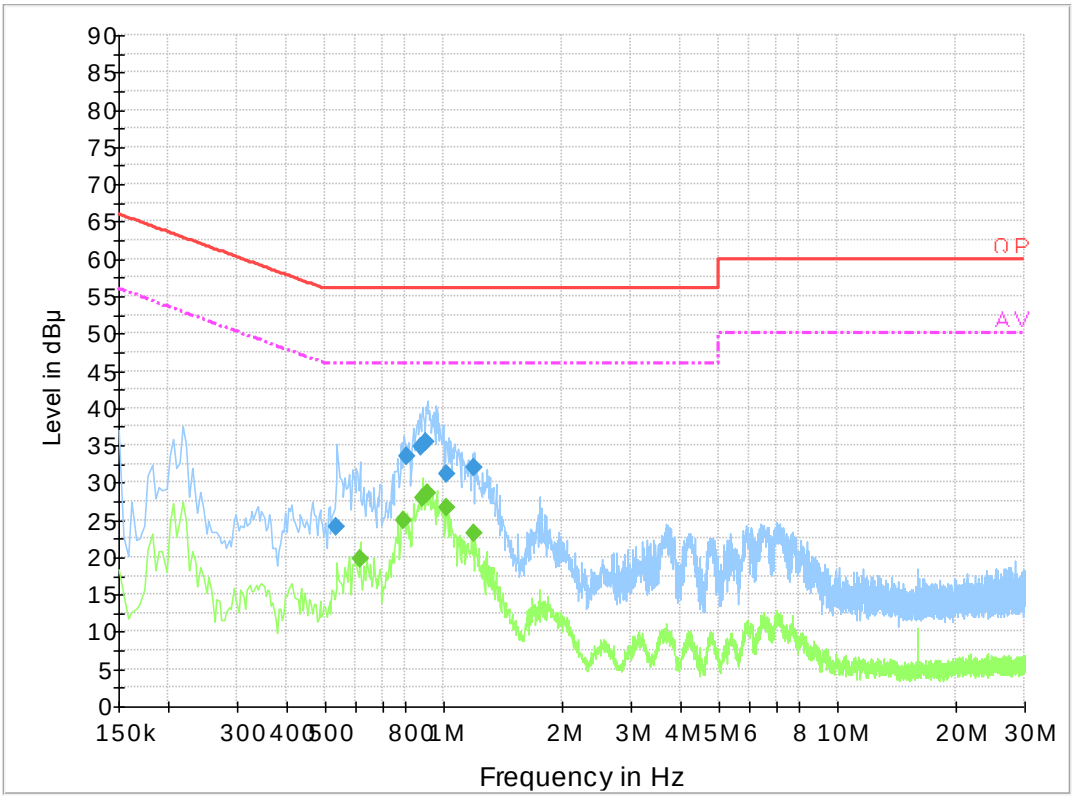
EUT operation mode: Charging& Transmitting *(the worst case is Low channel)*

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.574490	28.0	19.8	56.0	28.0	QP
0.813850	31.5	19.8	56.0	24.5	QP
0.892410	36.1	19.8	56.0	19.9	QP
0.927990	34.9	19.8	56.0	21.1	QP
1.006790	31.3	19.9	56.0	24.7	QP
1.128990	29.4	19.8	56.0	26.6	QP
0.574490	19.0	19.8	46.0	27.0	Ave.
0.813850	24.1	19.8	46.0	21.9	Ave.
0.892410	28.7	19.8	46.0	17.3	Ave.
0.927990	25.7	19.8	46.0	20.3	Ave.
1.006790	23.3	19.9	46.0	22.7	Ave.
1.128990	22.4	19.8	46.0	23.6	Ave.

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.537930	24.1	19.8	56.0	31.9	QP
0.805910	33.4	19.8	56.0	22.6	QP
0.876710	34.8	19.7	56.0	21.2	QP
0.904350	35.4	19.7	56.0	20.6	QP
1.018490	31.1	19.8	56.0	24.9	QP
1.203970	32.0	19.8	56.0	24.0	QP
0.614000	19.8	19.8	46.0	26.2	Ave.
0.794000	24.9	19.8	46.0	21.1	Ave.
0.886000	27.9	19.7	46.0	18.1	Ave.
0.910000	28.5	19.7	46.0	17.5	Ave.
1.022000	26.7	19.8	46.0	19.3	Ave.
1.202000	23.2	19.8	46.0	22.8	Ave.

Note:

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

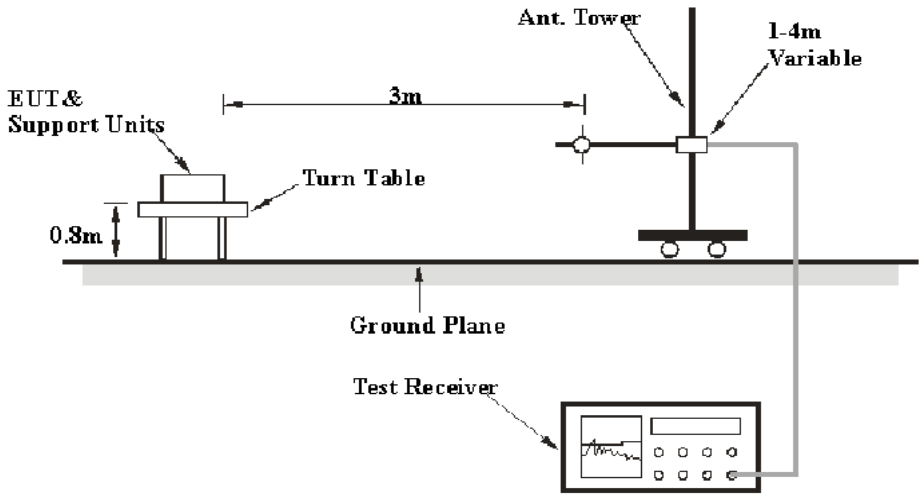
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

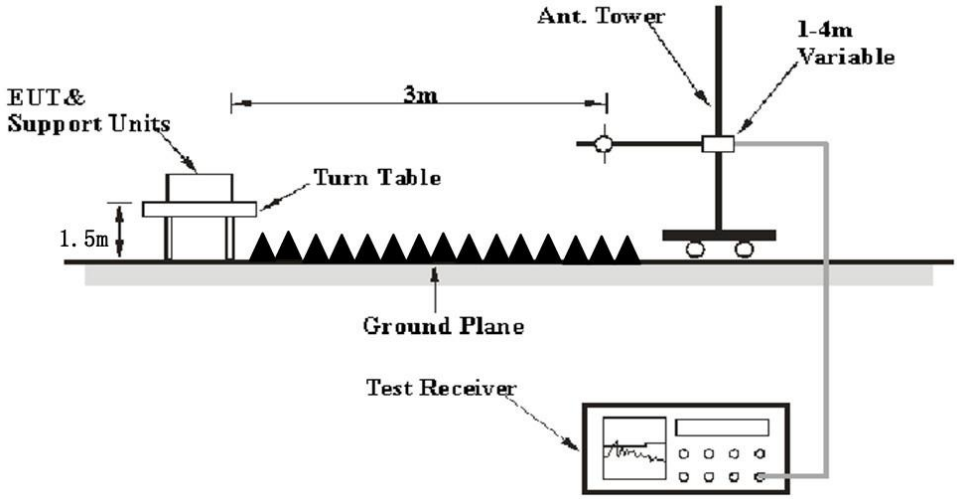
FCC §15.205; §15.209; §15.247(d)

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:

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 Data

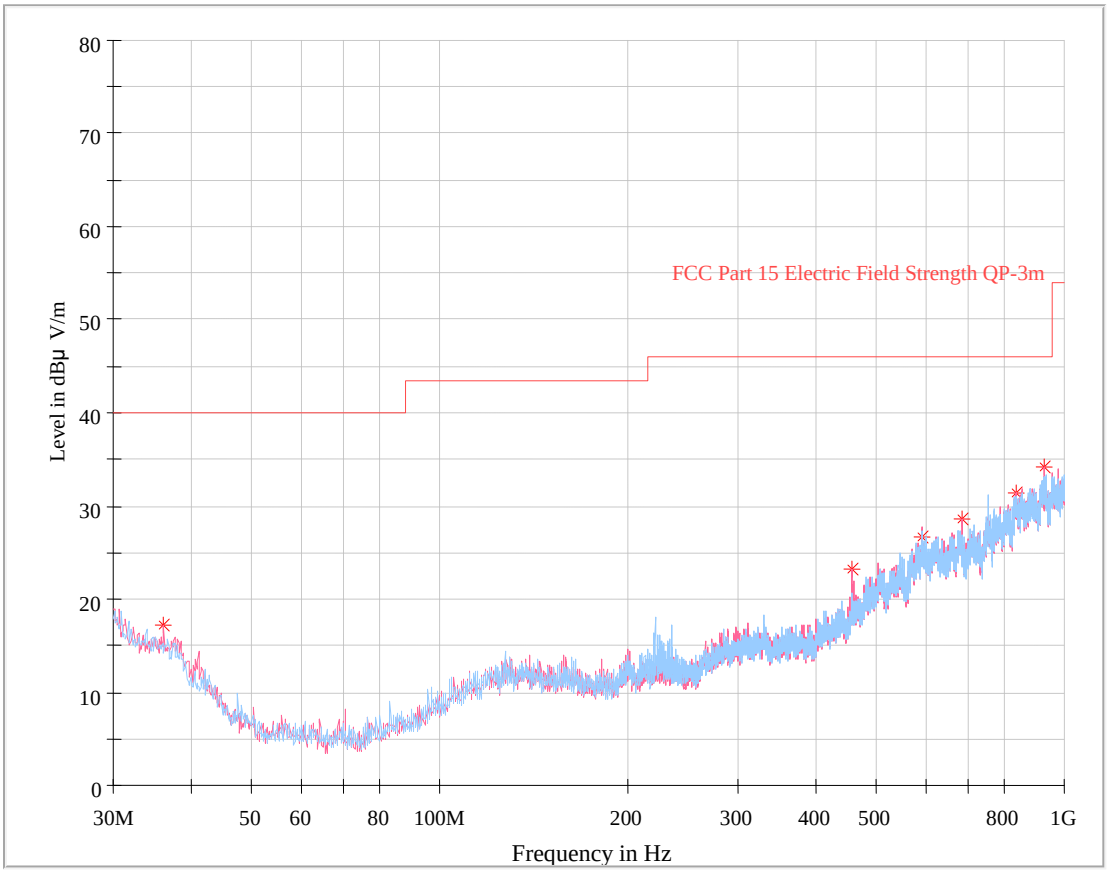
Environmental Conditions

Temperature:	23~30 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Charlie Cha on 2020-07-16 for below 1G and Charlie Cha on 2020-08-21for above 1G.

EUT operation mode: Transmitting

30 MHz~1 GHz: *(the worst case is Low channel)*



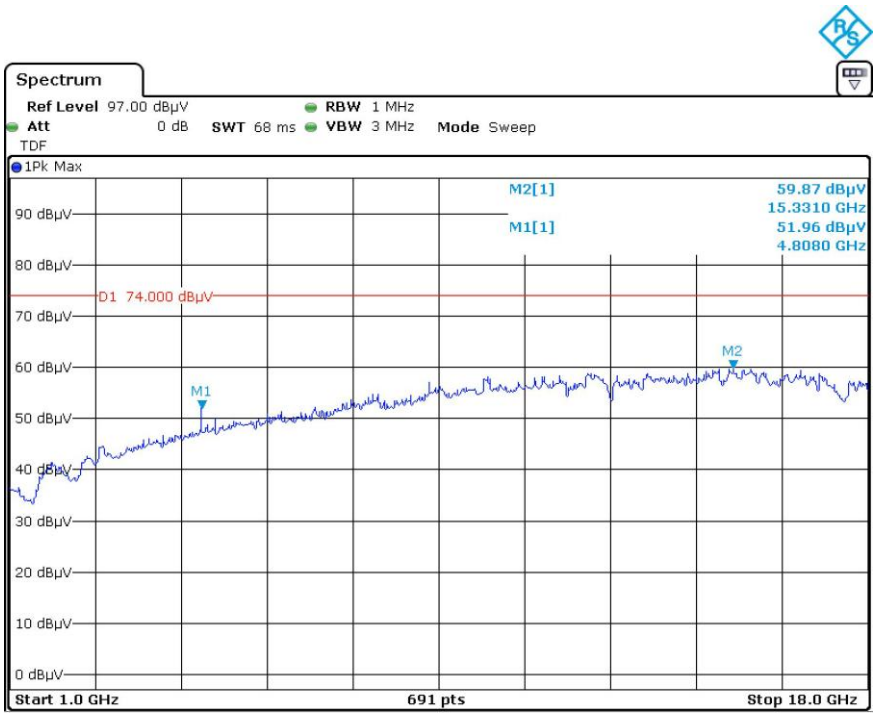
Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
36.183750	17.11	300.0	V	214.0	-11.3	40.00	22.89
458.618750	23.23	100.0	V	0.0	-7.7	46.00	22.77
590.902500	26.70	200.0	V	46.0	-2.0	46.00	19.30
684.750000	28.54	300.0	V	279.0	-1.3	46.00	17.46
838.252500	31.49	300.0	V	159.0	2.8	46.00	14.51
930.645000	34.15	300.0	V	14.0	4.7	46.00	11.85

1 GHz - 25 GHz:

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 (2404 MHz)									
2363.42	27.74	PK	128	2.2	H	31.87	59.61	74	14.39
2363.42	14.09	Ave.	128	2.2	H	31.87	45.96	54	8.04
2486.75	27.62	PK	95	1.4	H	32.13	59.75	74	14.25
2486.75	14.06	Ave.	95	1.4	H	32.13	46.19	54	7.81
4808.00	47.89	PK	321	1.3	H	6.28	54.17	74	19.83
4808.00	40.87	Ave.	321	1.3	H	6.28	47.15	54	6.85
Middle Channel (2442 MHz)									
4884.00	47.15	PK	16	1.6	H	6.76	53.91	74	20.09
4884.00	40.02	Ave.	16	1.6	H	6.76	46.78	54	7.22
High Channel (2480 MHz)									
2336.34	27.74	PK	321	1.7	H	31.64	59.38	74	14.62
2336.34	14.11	Ave.	321	1.7	H	31.64	45.75	54	8.25
2489.67	27.88	PK	301	2.3	H	32.13	60.01	74	13.99
2489.67	14.14	Ave.	301	2.3	H	32.13	46.27	54	7.73
4960.00	46.21	PK	308	1.9	H	6.80	53.01	74	20.99
4960.00	40.17	Ave.	308	1.9	H	6.80	46.97	54	7.03

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.
And for the pre-scan is performed with the 2400-2483.5MHz band filter.

Pre-scan with middle channel Peak
Horizontal



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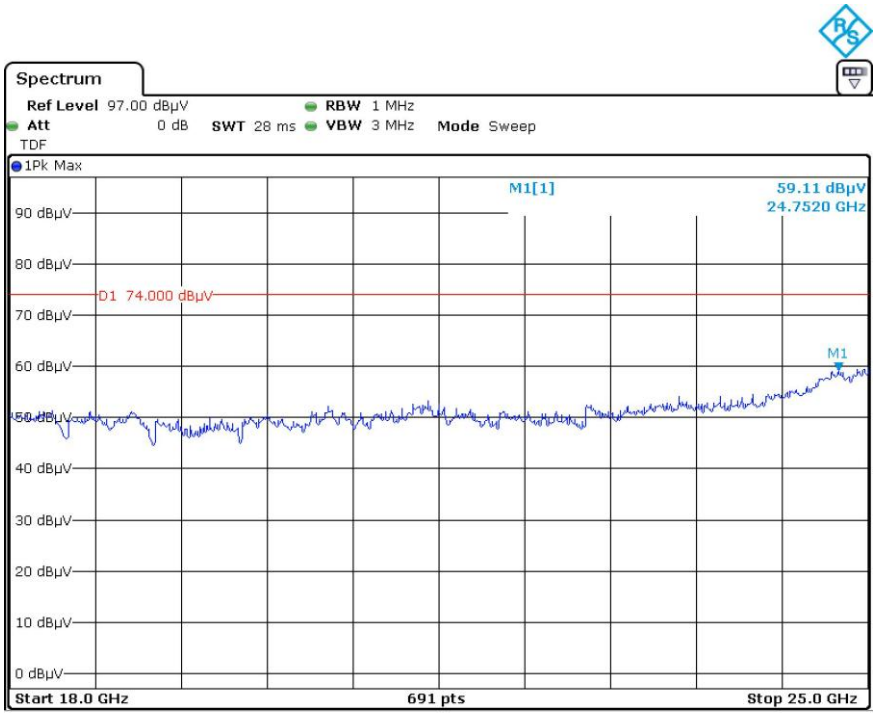

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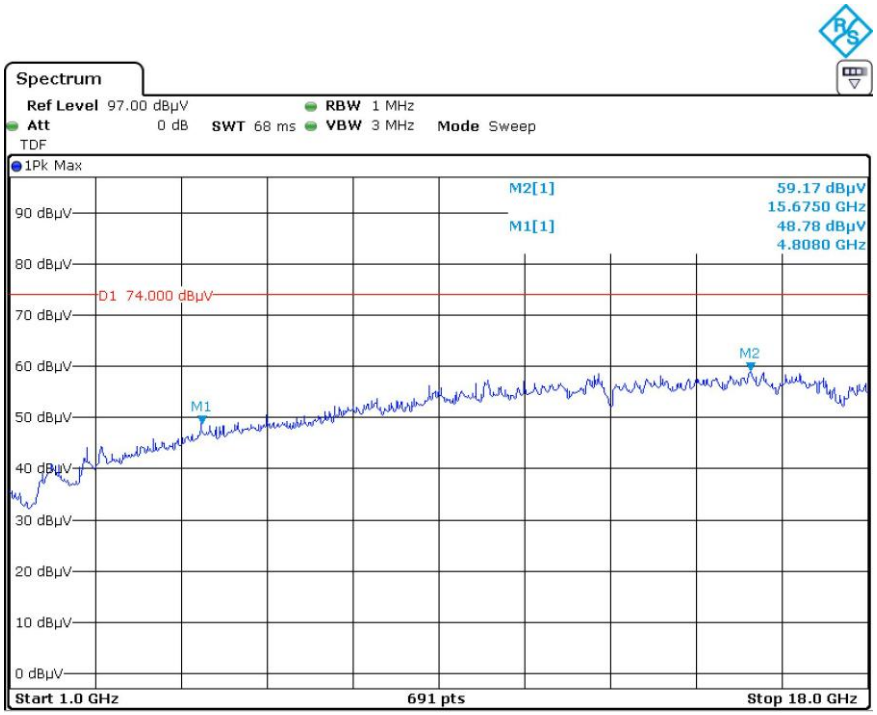
Vertical



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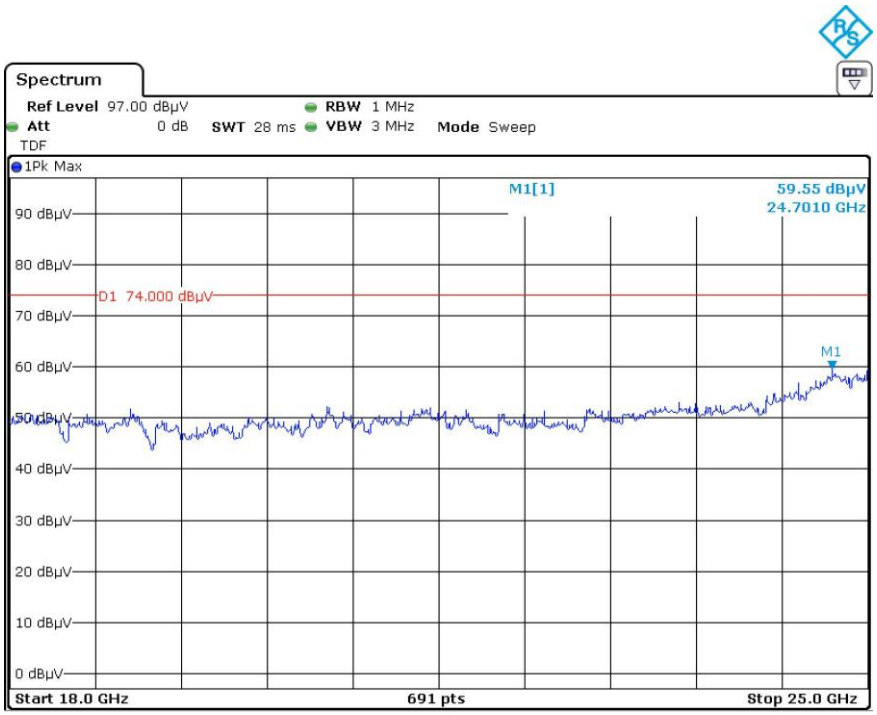

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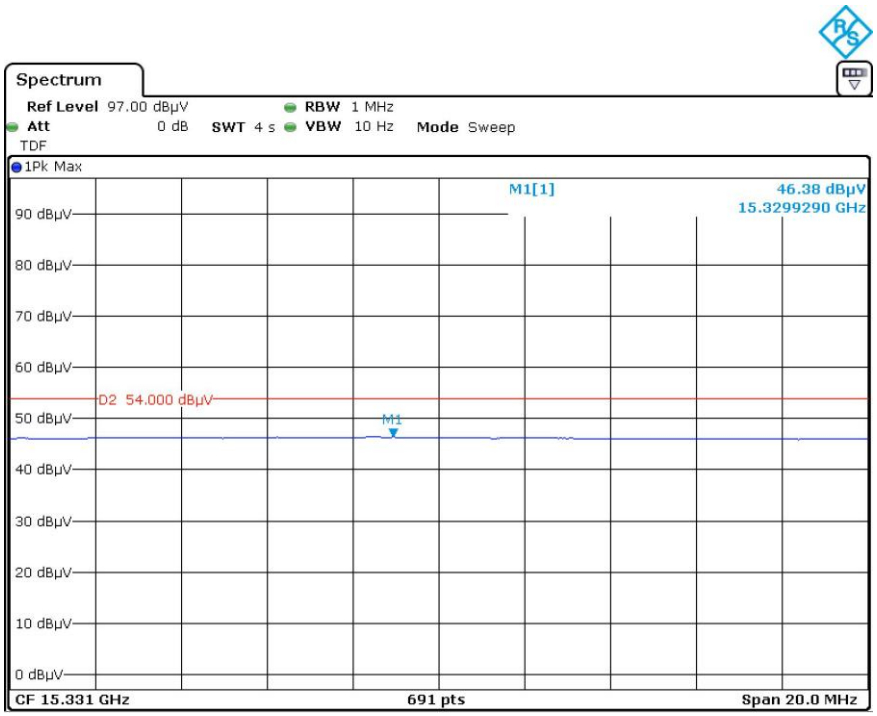
Pre-scan for Average
Horizontal



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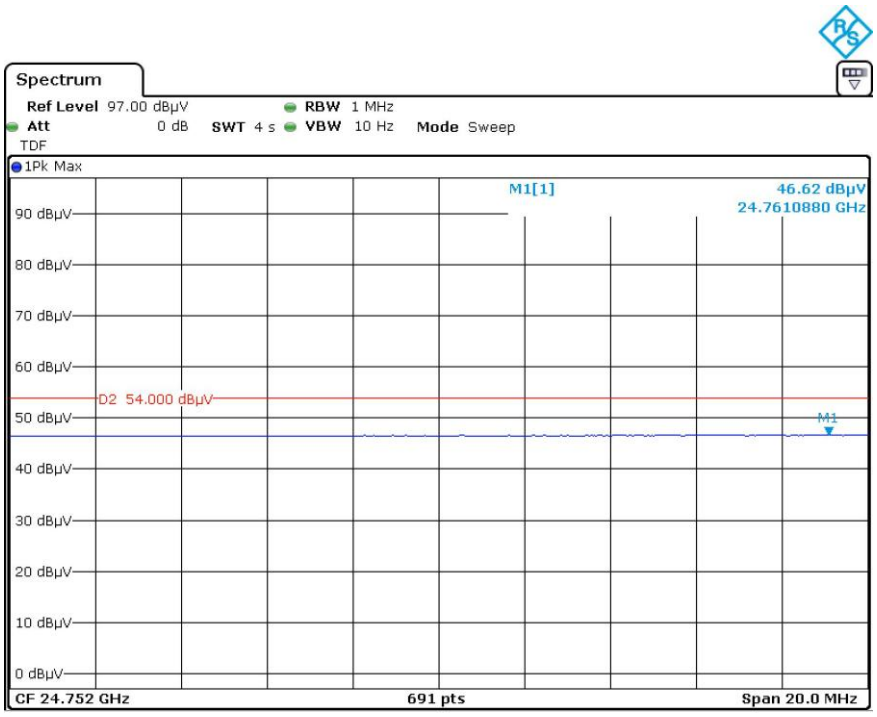

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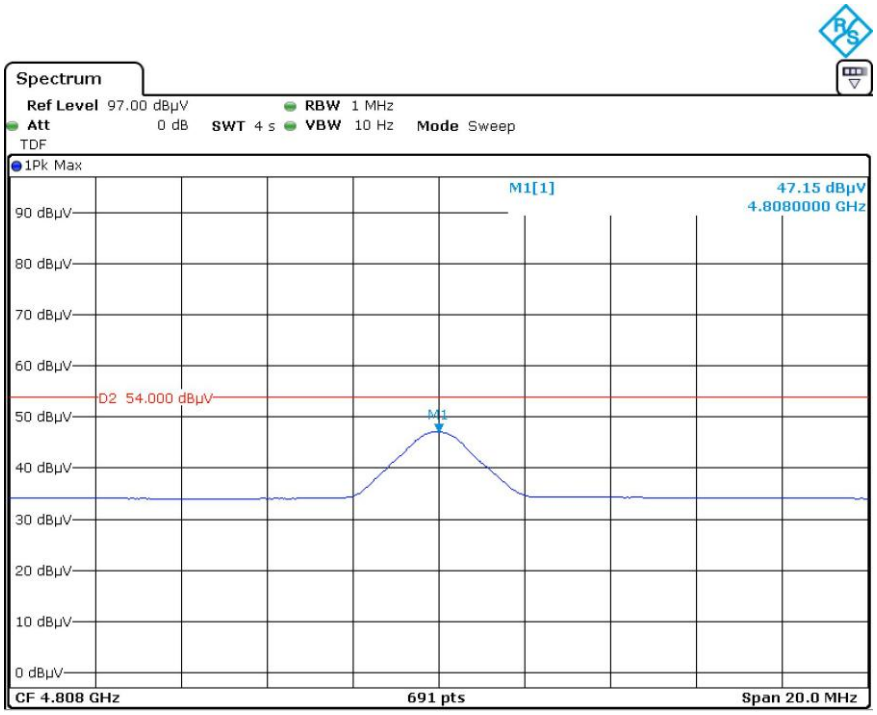
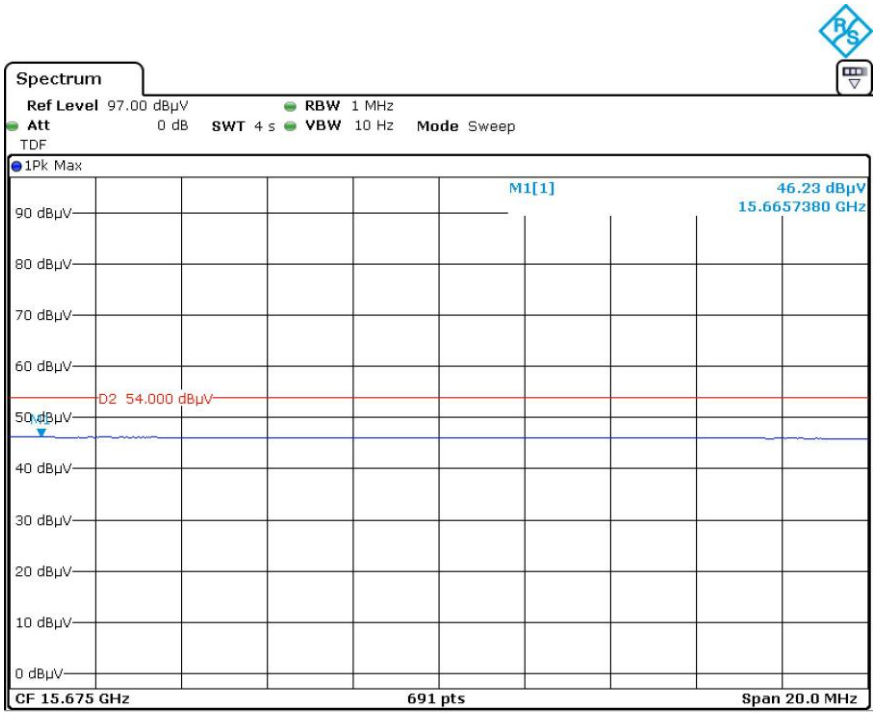
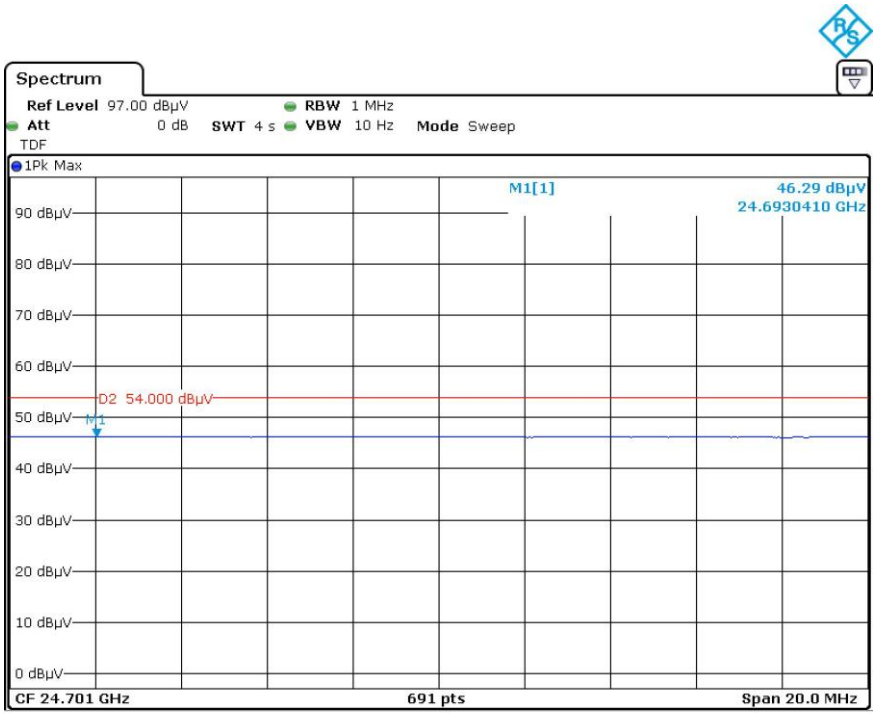
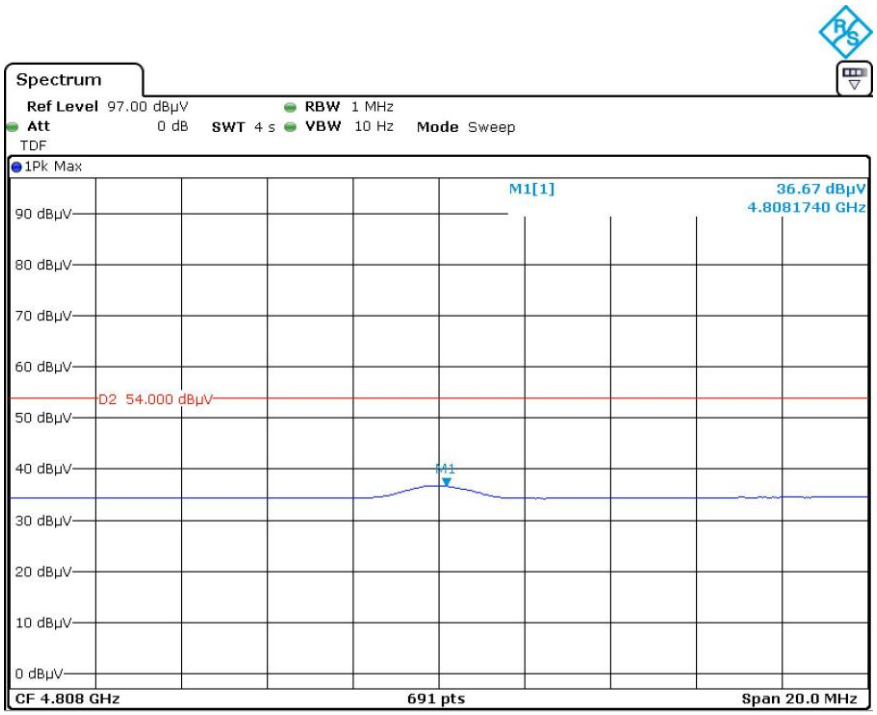

Spectrum
Ref Level 97.00 dBµV
RBW 1 MHz
Att 0 dB SWT 4 s VBW 10 Hz Mode Sweep
TDF
1Pk Max
M1[1]
47.15 dBµV
4.8080000 GHz
90 dBµV
80 dBµV
70 dBµV
60 dBµV
D2 54.000 dBµV
50 dBµV
M1
40 dBµV
30 dBµV
20 dBµV
10 dBµV
0 dBµV
CF 4.808 GHz
691 pts
Span 20.0 MHz
Date: 21.AUG.2020 01:08:59

Vertical


Spectrum
Ref Level 97.00 dBµV
RBW 1 MHz
Att 0 dB SWT 4 s VBW 10 Hz Mode Sweep
TDF
1Pk Max
M1[1]
46.23 dBµV
15.6657380 GHz
90 dBµV
80 dBµV
70 dBµV
60 dBµV
D2 54.000 dBµV
50 dBµV
M1
40 dBµV
30 dBµV
20 dBµV
10 dBµV
0 dBµV
CF 15.675 GHz
691 pts
Span 20.0 MHz
Date: 21.AUG.2020 01:15:39



Date: 21.AUG.2020 02:17:03



Date: 21.AUG.2020 01:21:30

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. 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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Felix Wen on 2020-08-24.

EUT operation mode: Transmitting

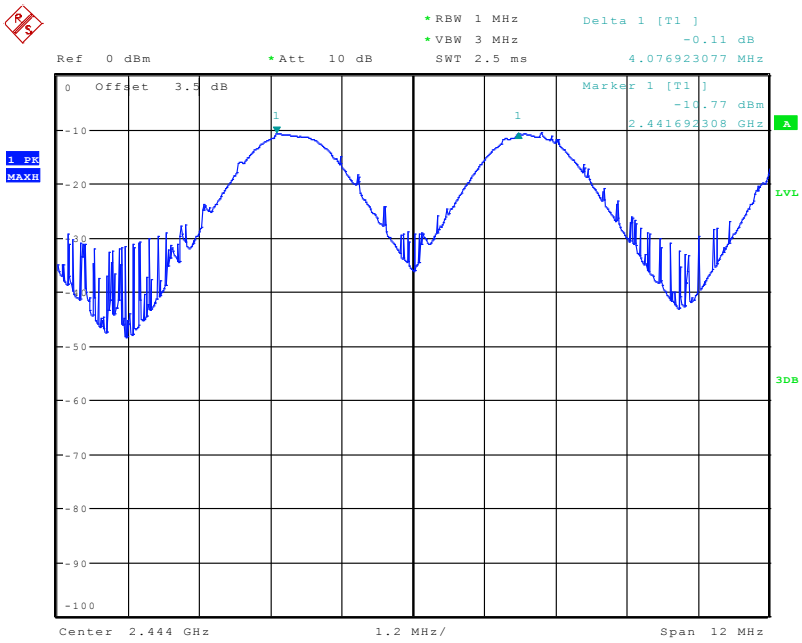
Test Result: Pass

Please refer to following table and plots.

Channel	Channel Sepration(MHZ)	20dBc BW (MHZ)	Two-thrids of the 20 dB bandwidth (MHZ)	Channel Sepration limit	Result
Hop	4.077	1.046	0.697	>Two-thrids of the 20 dB bandwidth	Pass

Please refer to the following plots.

Hop Channel



Date: 24.AUG.2020 09:14:22

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:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Felix Wen on 2020-08-04.

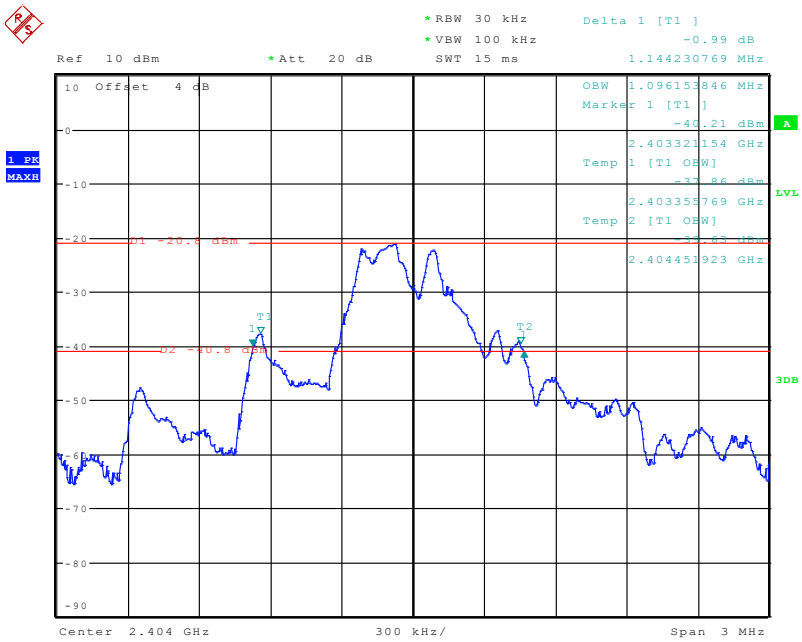
EUT operation mode: Transmitting

Test Result: Pass

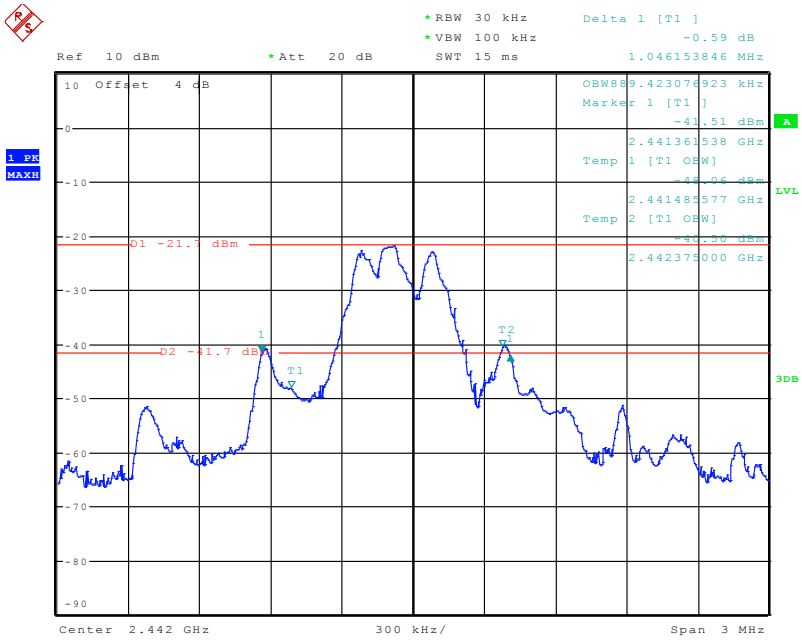
Please refer to following table and plots.

Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
Low	2404	1.144
Middle	2442	1.046
High	2480	1.267

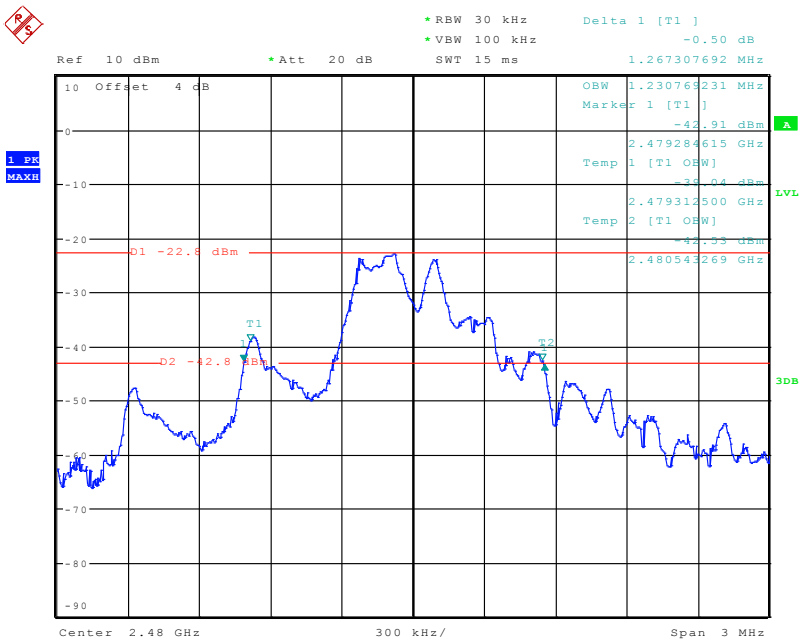
Low Channel



Middle Channel



High Channel



Date: 4.AUG.2020 00:27:21

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:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Felix Wen on 2020-08-24.

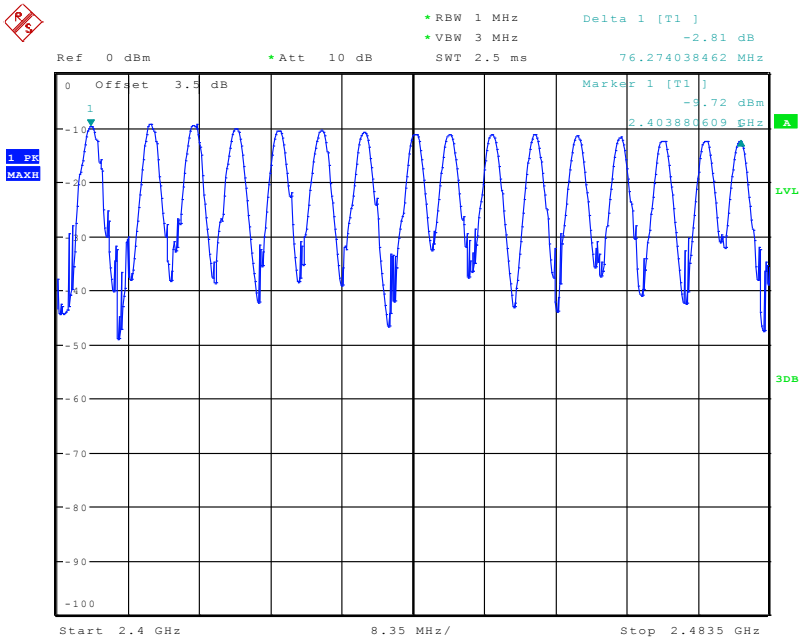
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

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

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW ≥ 3×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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Felix Wen on 2020-09-07.

EUT operation mode: Transmitting

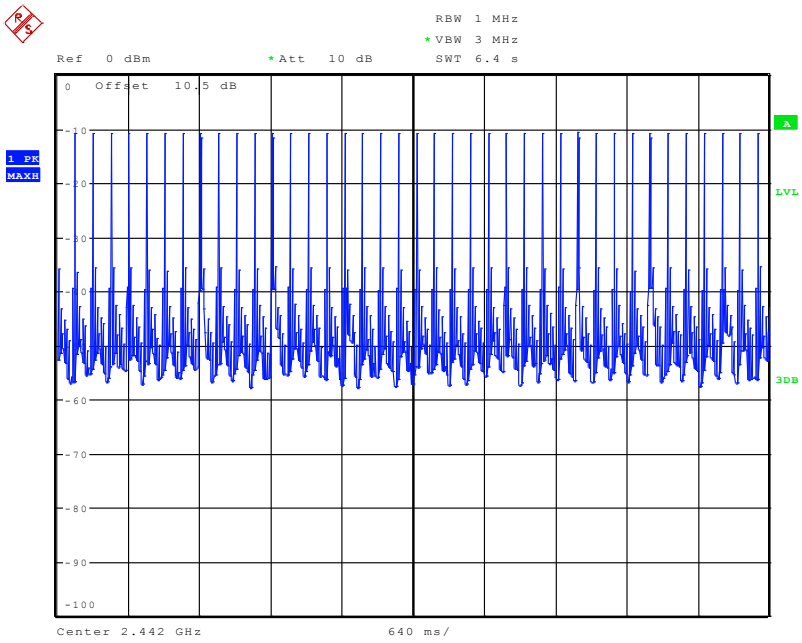
Test Result: Pass

Please refer to following table and plots

Mode	Channel	Pulse Width (ms)	Total Hops	Dwell Time (s)	Limit (s)	Result
Hopping	Middle	1.126	40	0.045	0.4	Pass
	Note: Dwell time = Pulse time* Hops in Observed Period					

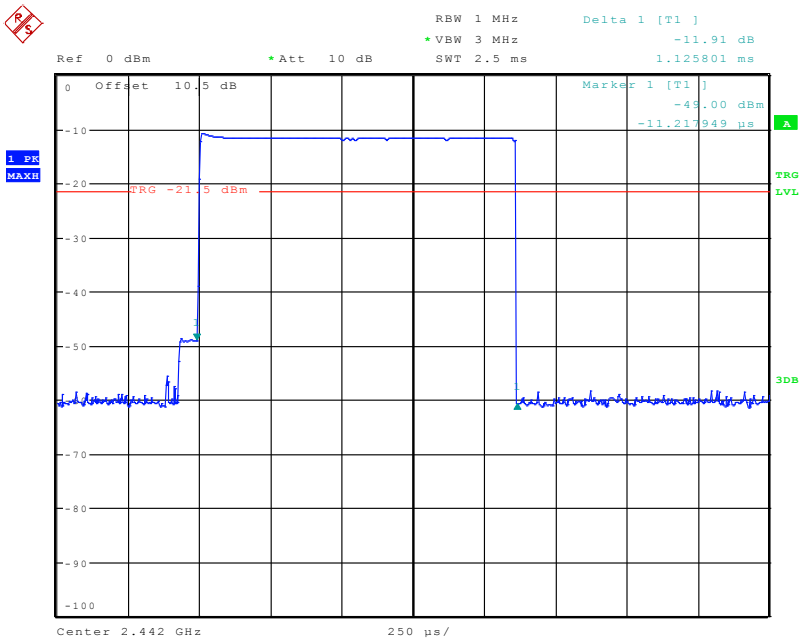
Note 1: A period time=0.4*16=6.4(S), Result=Pulse Time* Total Hops
Note 2: Total Hops = Hopping Number in 6.4s

Hopping number in 6.4S



Date: 7.SEP.2020 19:01:24

Pulse time



Date: 7.SEP.2020 19:03:42

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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Felix Wen on 2020-08-24.

EUT operation mode: Transmitting

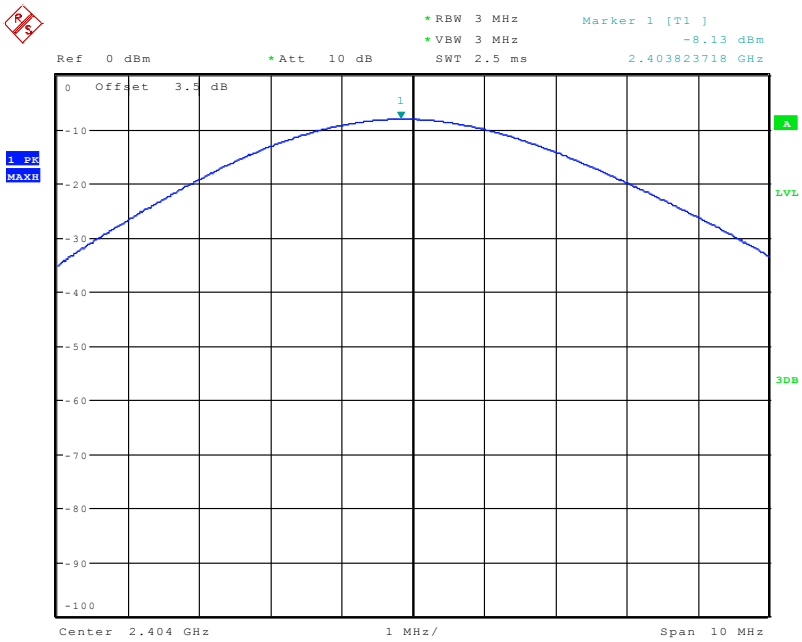
Test Result: Pass

Please refer to following table and plots

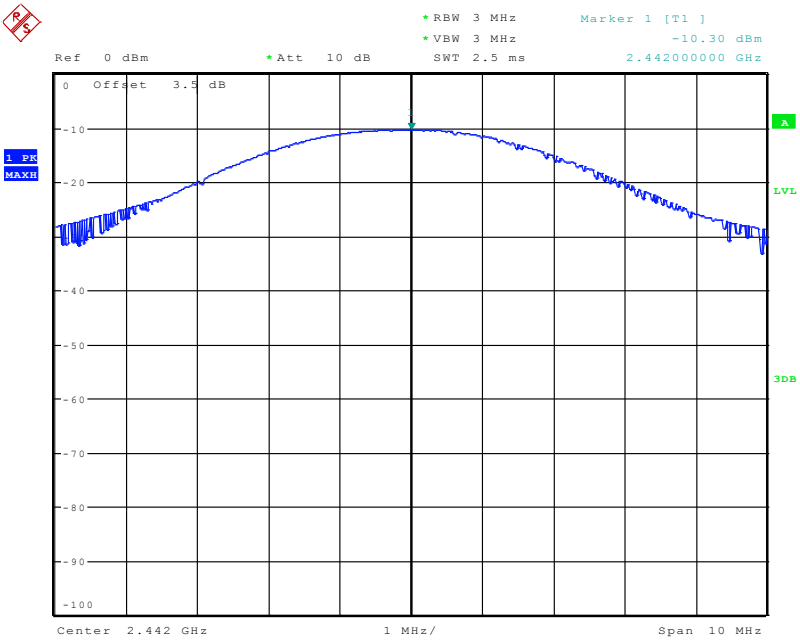
Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	Limit (dBm)
Low	2404	-8.13	20.97
Middle	2442	-10.30	20.97
High	2480	-12.28	20.97

Note: The data above was tested in conducted mode
Limit: 0.125W=20.97dBm.

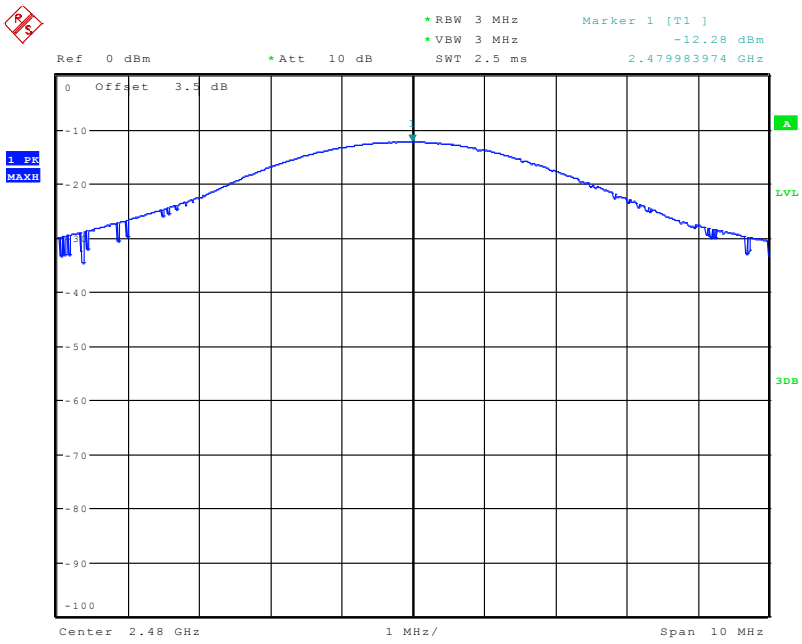
Low Channel



Middle Channel



High Channel



Date: 24.AUG.2020 09:06:23

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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Felix Wen on 2020-08-24.

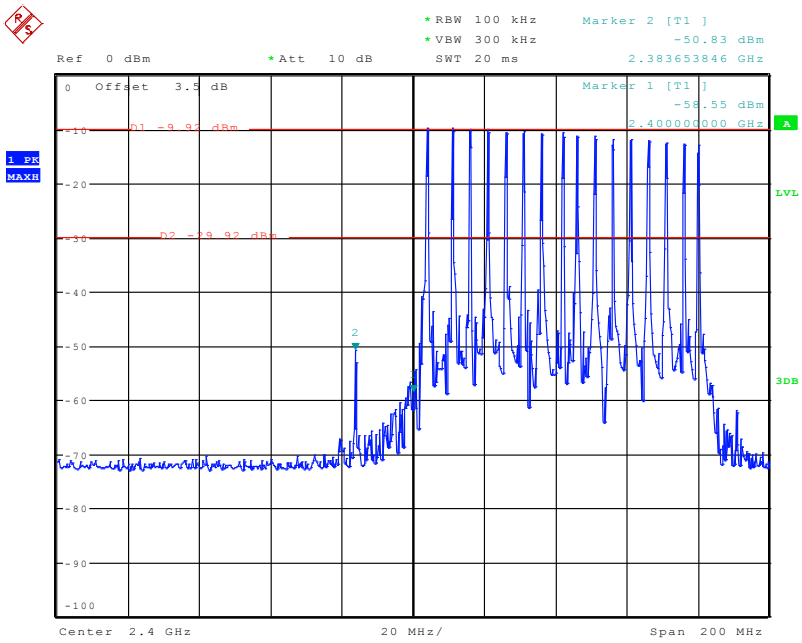
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots

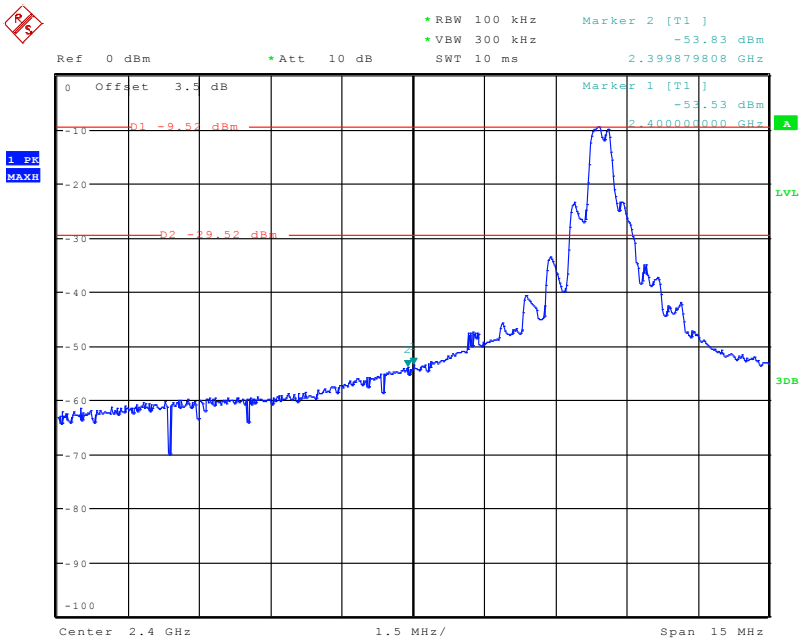
Band Edge-Left Side

Hopping



Date: 24.AUG.2020 09:18:59

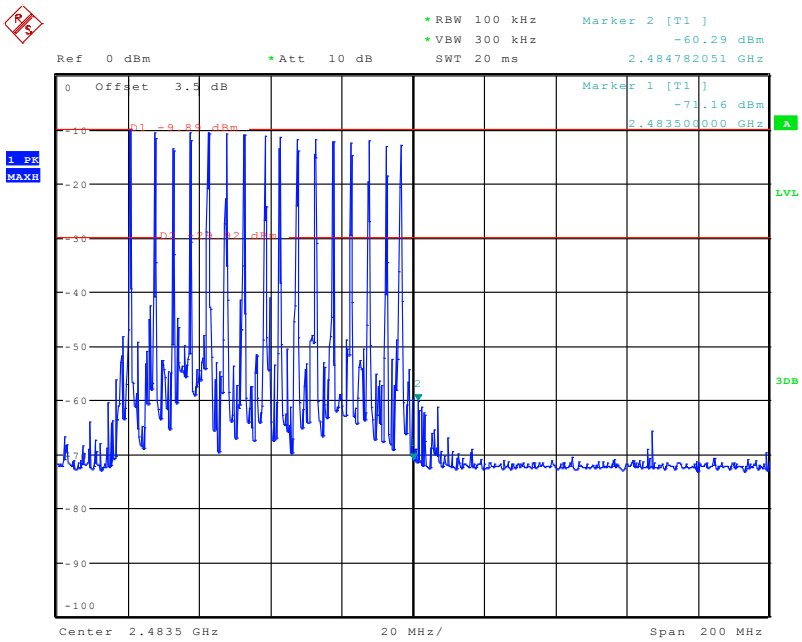
Single



Date: 24.AUG.2020 09:21:39

Band Edge-Right Side

Hopping



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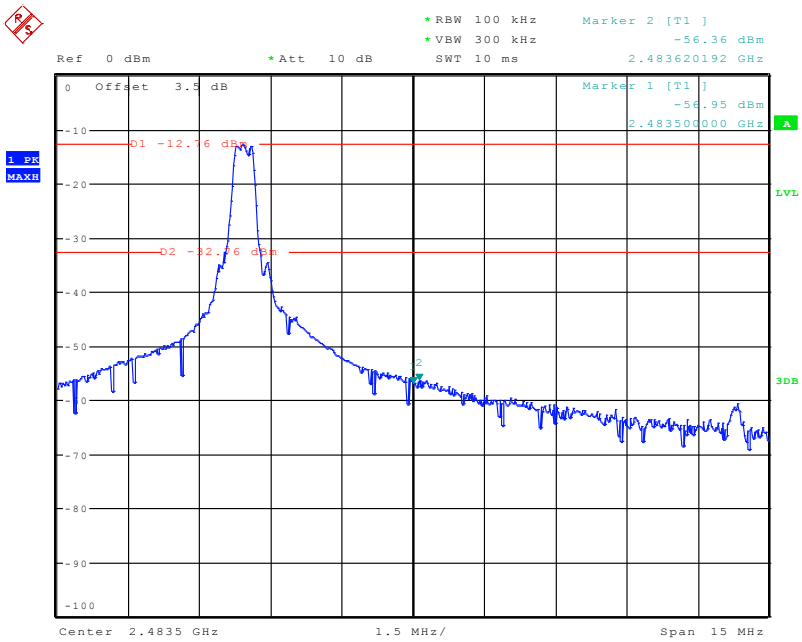
Single



Date: 24.AUG.2020 09:23:52

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