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CERTIFICATE # 4821.01

BACL
Bay Area Compliance Labs Corp.

FCC PART 15.247
TEST REPORT

For

VTech Telecommunications Ltd

23/F Tai Ping Ind Center Block 1 57 Ting Kok Rd Tai Po NT, Hong Kong

FCC ID: EW780-1385-00

Report Type:	**Product Type:**
Original Report	Video Baby Monitor

Report Number: RSZ200622003-00A

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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

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product		Video Baby Monitor
Tested Model		VM320 BU
Multiple Models		VM320-2 BU, VM320-ab BU, VM2251 BU, VM2251-2 BU, VM2x51-ab BU, VM3252 BU, VM3252-2 BU, VM3X52-ab BU (x=any alphanumeric character is presenting different type packaging; a=any alphanumeric character or blank is presenting number of baby unit; b = any alphanumeric character or blank is presenting color of enclosure.)
Model Differences		Refer to the DOS letter
Frequency Range		2405~2475MHz
Maximum conducted Peak output power		17.56dBm
Modulation Technique		GFSK
Antenna Specification		0dBi
Voltage Range		DC 6.0V from adapter
Date of Test		2020-06-23 to 2020-08-26
Sample serial number		RSZ200622003-RF-S1 for VM3252 BU RSZ200622003-RF-S2 for VM320 BU (Assigned by BACL, Shenzhen)
Received date		2020-06-22
Sample/EUT Status		Good condition
Model: VM320 BU	Adapter 1 information	Model: VT05EUS06040 Input: AC 100-240V, 50/60Hz 0.15A Output: DC 6.0 V, 0.4A, 2.4W
	Adapter 2 information	Model: S003GU0600040 Input: AC 100-240V, 50/60Hz 150mA Output: DC 6.0 V, 400mA
Model: VM3252 BU	Adapter 3 information	Model: VT05EUS06050 Input: AC 100-240V, 50/60Hz, 150mA Output: DC 6.0V, 500mA
	Adapter 4 information	Model: S003GU0600050 Input: AC 100-240V, 50/60Hz, 150mA Output: DC 6.0V, 500mA

Objective

This test report is prepared on behalf of VTech Telecommunications 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.

Related Submittal(s)/Grant(s)

Part of system submission with FCC ID: EW780-1385-01

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.

32 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	17	2441
2	2407	18	2443
3	2409	19	2445
4	2411	20	2447
5	2413	21	2451
6	2415	22	2453
7	2419	23	2455
8	2421	24	2457
9	2423	25	2459
10	2425	26	2461
11	2427	27	2463
12	2429	28	2467
13	2431	29	2469
14	2435	30	2471
15	2437	31	2473
16	2439	32	2475

EUT was tested with Channel 1, 16 and 32.

The frequency range of the system is operating from 2405MHz to 2475MHz. There are totally 32 non-overlapping channels with 2MHz channel separation. There are 16 active channels out of the 32 channels. The 16 active channels are selected in pseudo random manner by default. The remaining 16 channels are spare channels which will be exchanged with active channels one at a time when any one of the active channels jamming with noise. Once an active channel has noise jamming during frequency hopping, it will be marked as dirty channel and exchanged with a spare channel 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 of spare channels and can be used in active channels again after all the other spare channels have been used.

EUT Exercise Software

“MBP483 Test mode.cts” software was made to the EUT tested.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

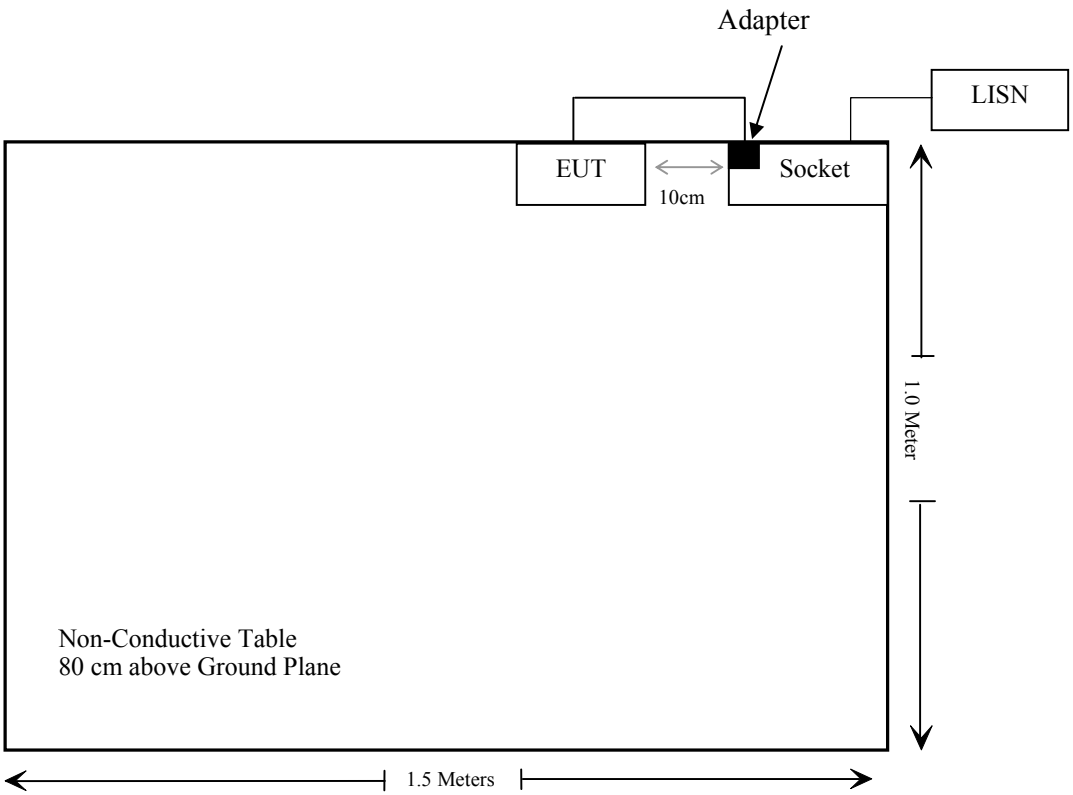
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Un-detachable DC cable	2.0	EUT	Adapter
Unshielded Un-detachable AC cable	1.2	Socket	AC Mains

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	Maximum Permissible Exposure(MPE)	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	2020/7/7	2021/7/6
Rohde & Schwarz	LISN	ENV216	101613	2020/1/22	2021/1/21
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2019/11/29	2020/11/28
Unknow	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	2020/7/7	2021/7/6
Sonoma instrument	Pre-amplifier	310 N	186238	2020/4/20	2021/4/20
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	2019/7/22	2020/7/21
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
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
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/4/20	2021/4/20
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	2020/3/2	2021/3/1
WEINSCHEL	10dB Attenuator	5324	AU3842	2019/11/29	2020/11/28
Unknown	RF Cable	Unknown	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) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Tune Up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
2405-2475	0	1	18.0	63.10	20	0.013	1.0

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Pass

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 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

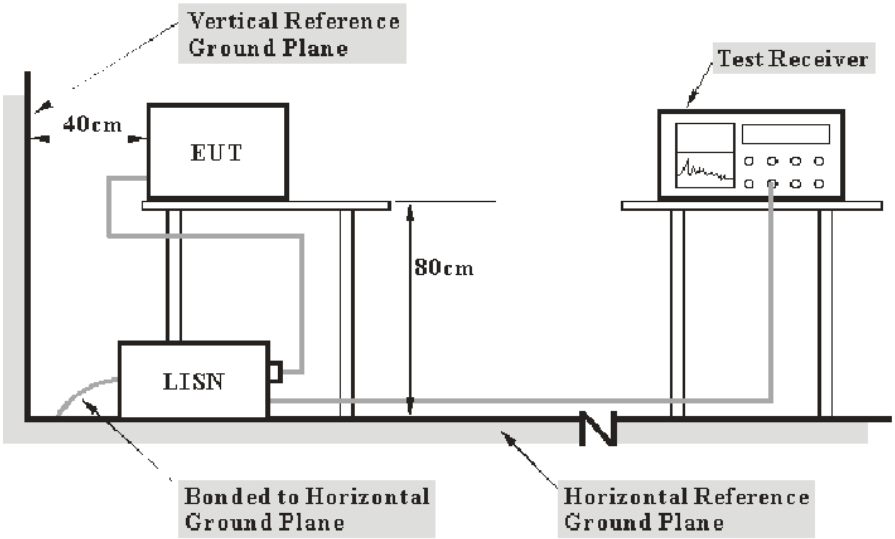
Result: Pass

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

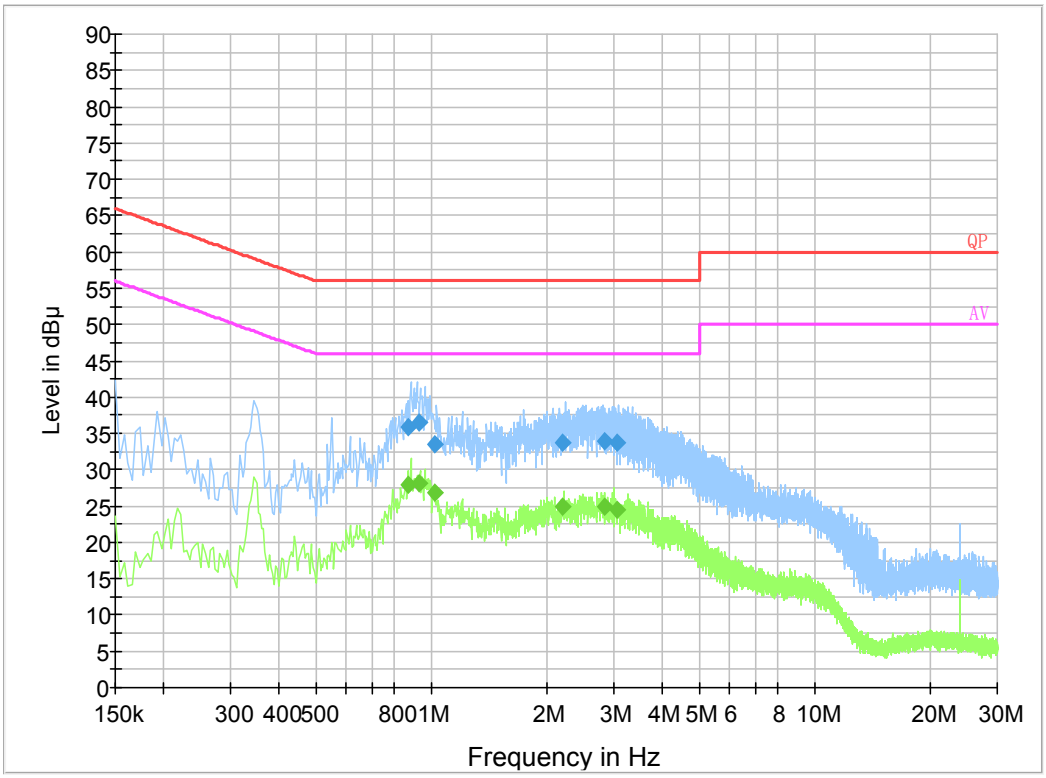
Temperature:	25 ℃
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-07-17 and 2020-08-10.

EUT operation mode: Transmitting

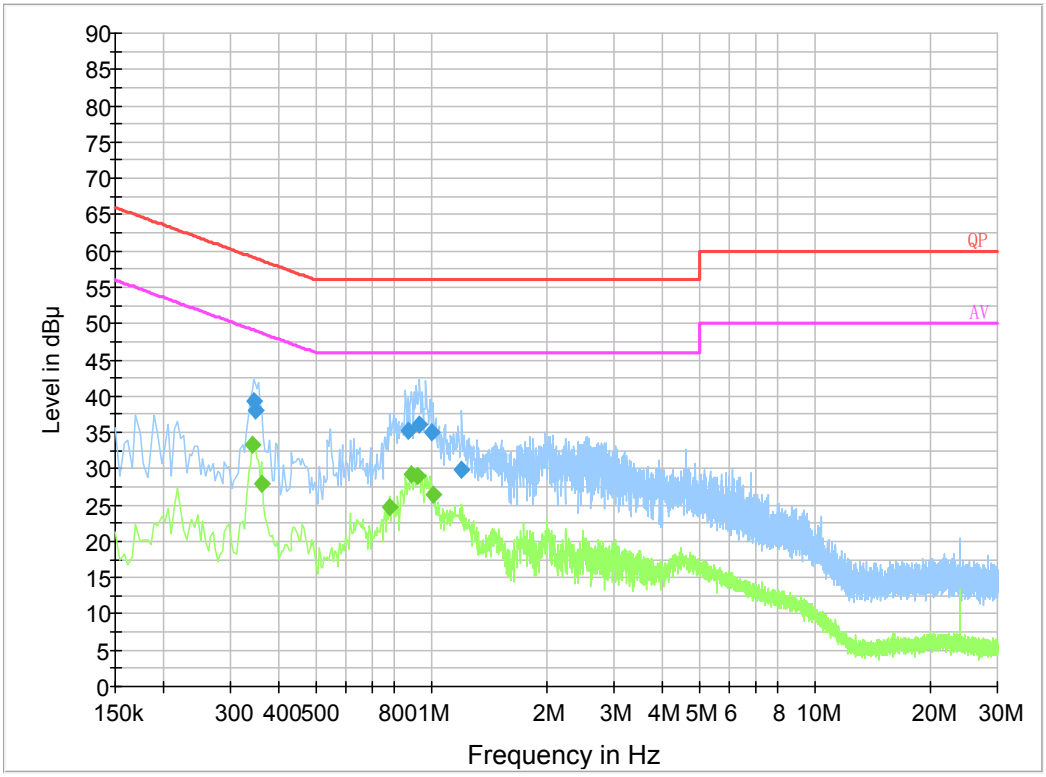
Adapter 1 (VT05EUS06040):

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.872710	36.0	19.8	56.0	20.0	QP
0.931770	36.5	19.8	56.0	19.5	QP
1.018490	33.6	19.9	56.0	22.4	QP
2.212370	33.8	19.9	56.0	22.2	QP
2.823970	33.9	19.9	56.0	22.1	QP
3.067770	33.6	19.9	56.0	22.4	QP
0.872710	28.0	19.8	46.0	18.0	Ave.
0.931770	28.2	19.8	46.0	17.8	Ave.
1.018490	26.8	19.9	46.0	19.2	Ave.
2.212370	24.8	19.9	46.0	21.2	Ave.
2.823970	24.9	19.9	46.0	21.1	Ave.
3.067770	24.6	19.9	46.0	21.4	Ave.

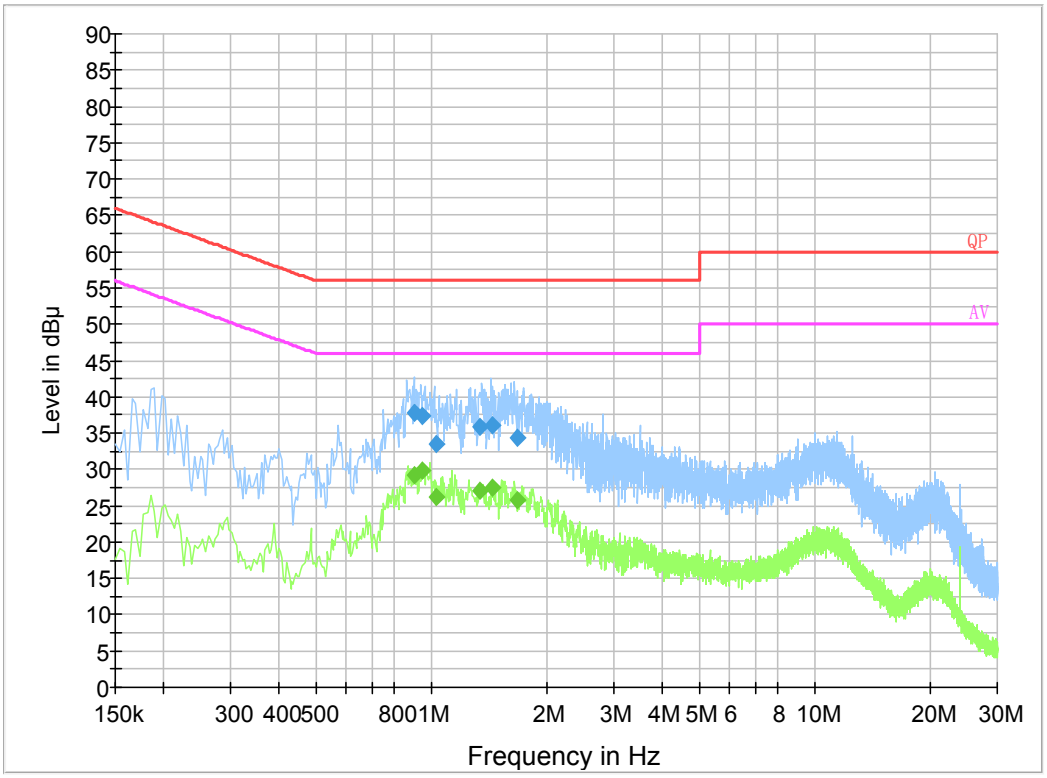
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.344810	39.4	19.8	59.1	19.7	QP
0.348690	38.1	19.9	59.0	20.9	QP
0.870870	35.2	19.7	56.0	20.8	QP
0.927990	36.1	19.8	56.0	19.9	QP
0.998790	35.0	19.8	56.0	21.0	QP
1.203970	29.9	19.8	56.0	26.1	QP
0.342000	33.4	19.8	49.2	15.8	Ave.
0.362000	27.9	19.9	48.7	20.8	Ave.
0.782000	24.7	19.8	46.0	21.3	Ave.
0.886000	29.3	19.7	46.0	16.7	Ave.
0.922000	29.0	19.8	46.0	17.0	Ave.
1.014000	26.4	19.8	46.0	19.6	Ave.

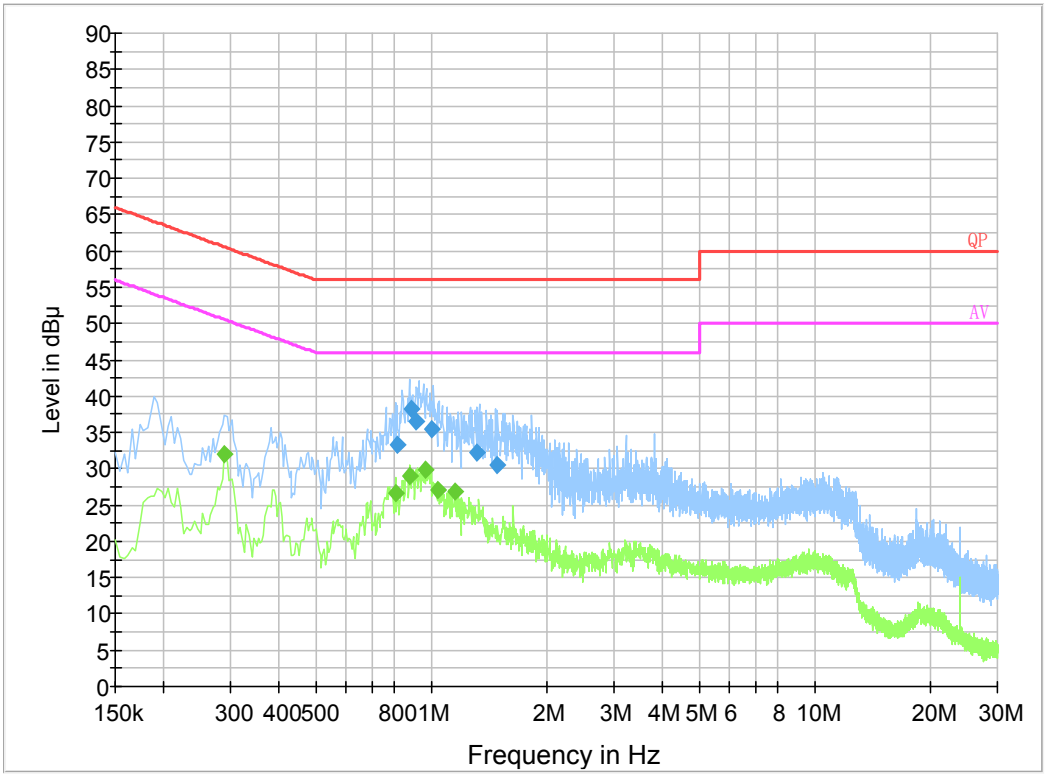
Adapter 2 (S003GU0600040):

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.908470	37.7	19.8	56.0	18.3	QP
0.947870	37.4	19.8	56.0	18.6	QP
1.033270	33.5	19.9	56.0	22.5	QP
1.337630	35.8	19.8	56.0	20.2	QP
1.444550	36.1	19.8	56.0	19.9	QP
1.677190	34.4	19.9	56.0	21.6	QP
0.908470	29.2	19.8	46.0	16.8	Ave.
0.947870	29.9	19.8	46.0	16.1	Ave.
1.033270	26.3	19.9	46.0	19.7	Ave.
1.337630	27.2	19.8	46.0	18.8	Ave.
1.444550	27.4	19.8	46.0	18.6	Ave.
1.677190	25.7	19.9	46.0	20.3	Ave.

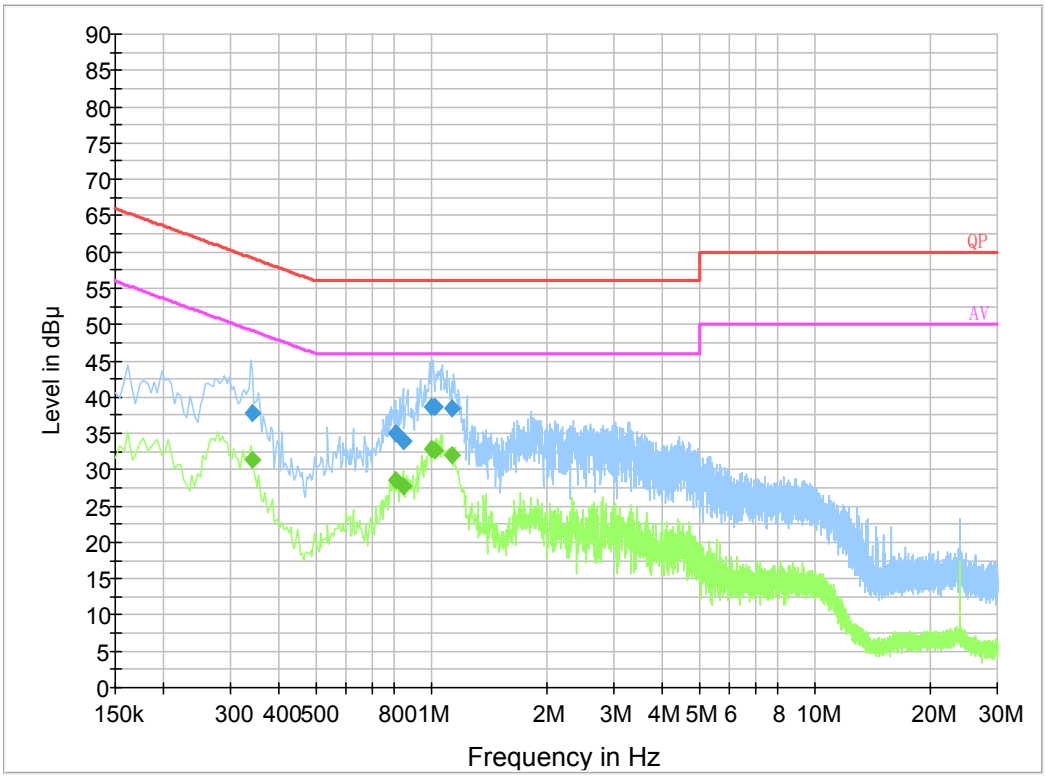
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.817910	33.3	19.8	56.0	22.7	QP
0.884830	38.3	19.7	56.0	17.7	QP
0.916050	36.6	19.7	56.0	19.4	QP
0.998790	35.5	19.8	56.0	20.5	QP
1.321930	32.2	19.8	56.0	23.8	QP
1.487950	30.4	19.8	56.0	25.6	QP
0.290000	31.9	19.7	50.5	18.6	Ave.
0.806000	26.6	19.8	46.0	19.4	Ave.
0.882000	29.1	19.7	46.0	16.9	Ave.
0.970000	29.9	19.8	46.0	16.1	Ave.
1.046000	27.0	19.8	46.0	19.0	Ave.
1.154000	26.8	19.8	46.0	19.2	Ave.

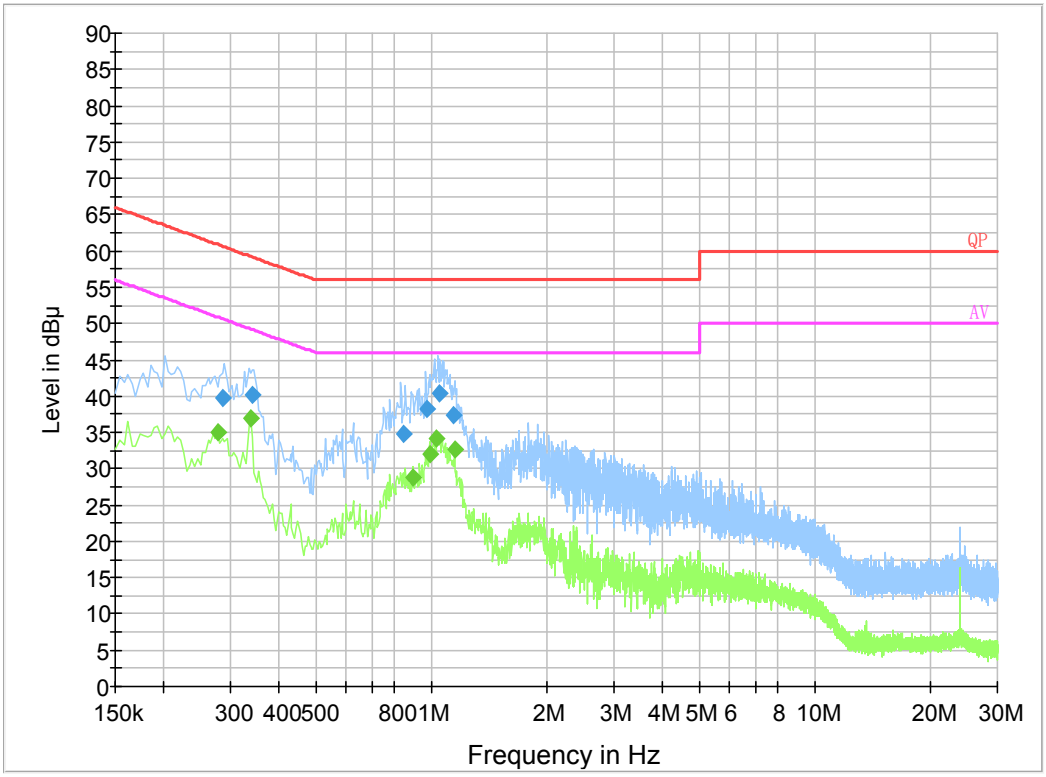
Adapter 3 (VT05EUS06050):

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.340930	37.7	19.9	59.2	21.5	QP
0.809910	35.0	19.8	56.0	21.0	QP
0.849310	33.9	19.8	56.0	22.1	QP
0.999150	38.6	19.9	56.0	17.4	QP
1.026790	38.6	19.9	56.0	17.4	QP
1.128810	38.4	19.8	56.0	17.6	QP
0.340930	31.4	19.9	49.2	17.8	Ave.
0.809910	28.5	19.8	46.0	17.5	Ave.
0.849310	27.6	19.8	46.0	18.4	Ave.
0.999150	32.8	19.9	46.0	13.2	Ave.
1.026790	32.6	19.9	46.0	13.4	Ave.
1.128810	32.1	19.8	46.0	13.9	Ave.

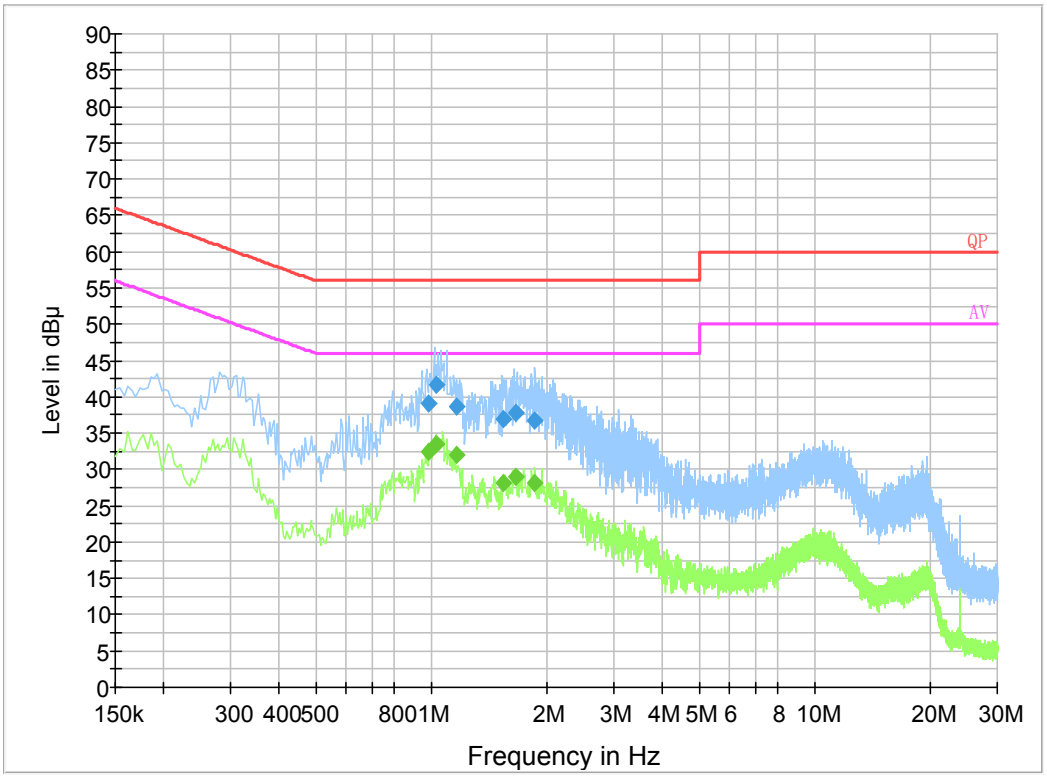
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.285500	39.7	19.7	60.7	20.9	QP
0.340810	40.1	19.8	59.2	19.1	QP
0.846510	34.9	19.8	56.0	21.1	QP
0.971450	38.2	19.8	56.0	17.8	QP
1.054370	40.4	19.8	56.0	15.6	QP
1.140750	37.4	19.8	56.0	18.6	QP
0.278000	34.9	19.7	50.9	15.9	Ave.
0.338000	37.0	19.8	49.3	12.2	Ave.
0.894000	28.7	19.7	46.0	17.3	Ave.
0.990000	32.0	19.8	46.0	14.0	Ave.
1.034000	34.1	19.8	46.0	11.9	Ave.
1.150000	32.6	19.8	46.0	13.4	Ave.

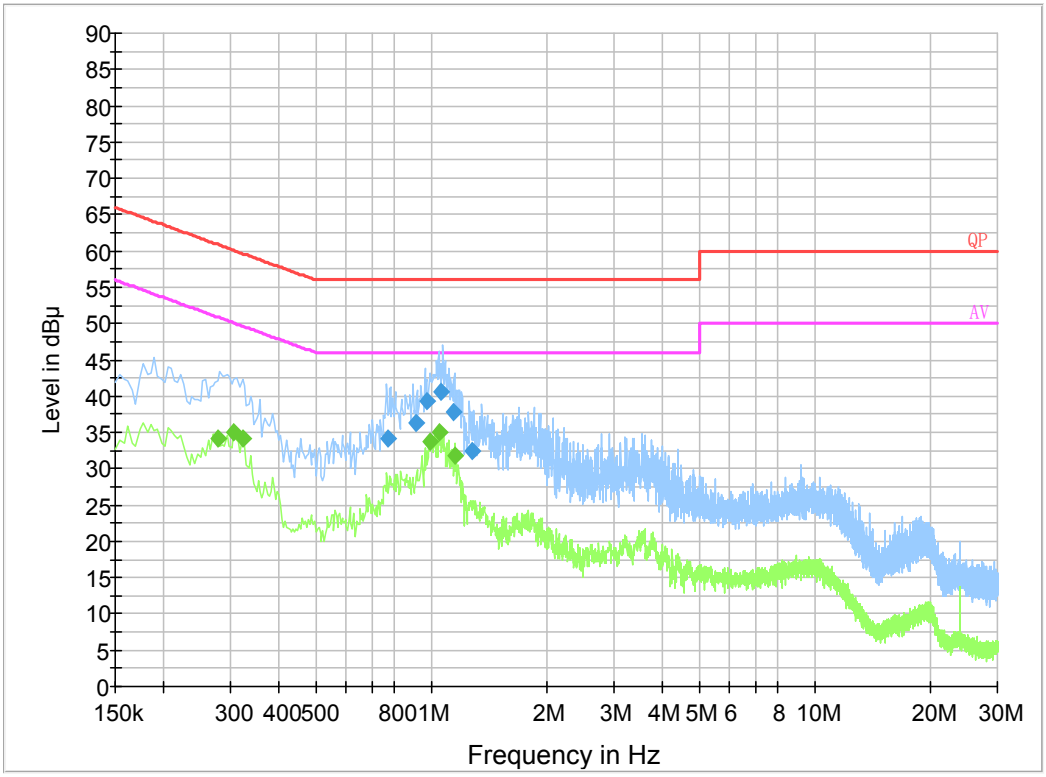
Adapter 4 (S003GU0600050):

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.987390	39.2	19.9	56.0	16.8	QP
1.033270	41.6	19.9	56.0	14.4	QP
1.163190	38.7	19.8	56.0	17.3	QP
1.546990	36.9	19.8	56.0	19.1	QP
1.657310	37.8	19.9	56.0	18.2	QP
1.862010	36.8	19.9	56.0	19.2	QP
0.987390	32.5	19.9	46.0	13.5	Ave.
1.033270	33.5	19.9	46.0	12.5	Ave.
1.163190	32.0	19.8	46.0	14.0	Ave.
1.546990	28.2	19.8	46.0	17.8	Ave.
1.657310	29.1	19.9	46.0	16.9	Ave.
1.862010	28.1	19.9	46.0	17.9	Ave.

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.770510	34.2	19.8	56.0	21.8	QP
0.911470	36.2	19.7	56.0	19.8	QP
0.971570	39.3	19.8	56.0	16.7	QP
1.057890	40.7	19.8	56.0	15.3	QP
1.148750	37.8	19.8	56.0	18.2	QP
1.276870	32.4	19.8	56.0	23.6	QP
0.278000	34.2	19.7	50.9	16.7	Ave.
0.306000	35.1	19.7	50.1	15.0	Ave.
0.322000	34.1	19.8	49.7	15.5	Ave.
0.998000	33.8	19.8	46.0	12.2	Ave.
1.050000	35.0	19.8	46.0	11.0	Ave.
1.150000	31.7	19.8	46.0	14.3	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

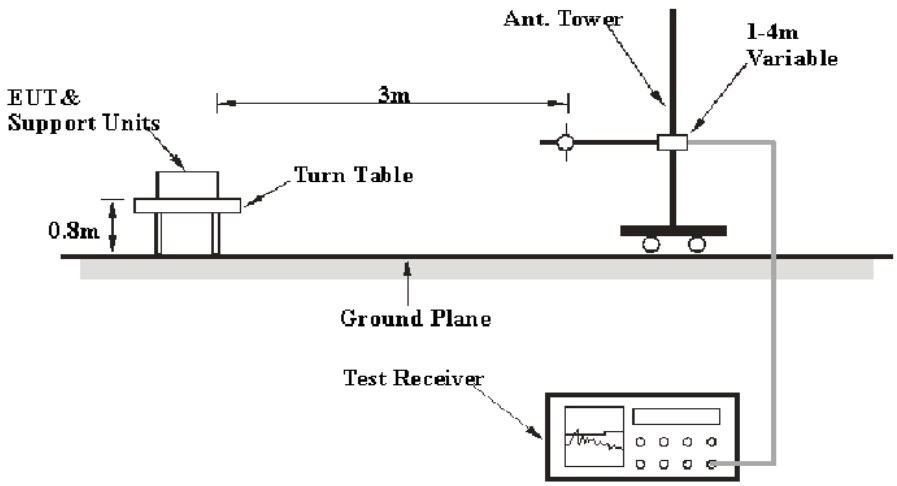
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

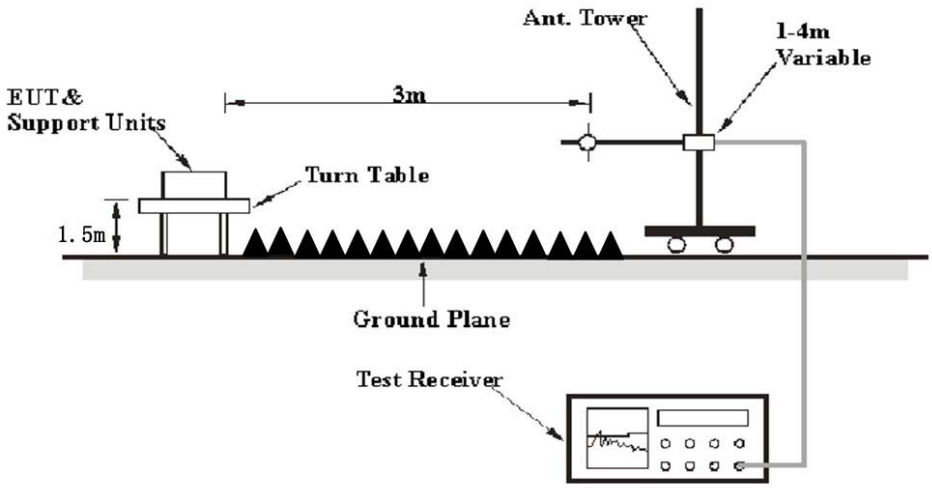
FCC §15.205; §15.209; §15.247(d)

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

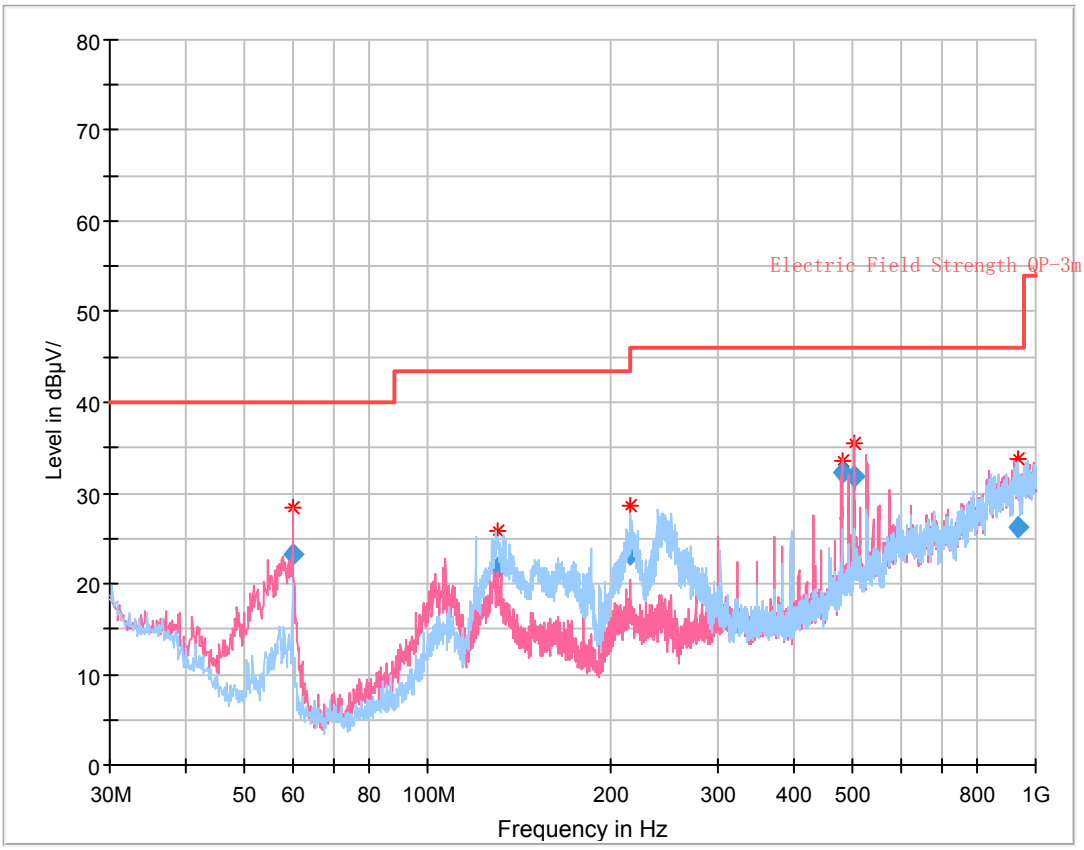
Temperature:	24~28 ℃
Relative Humidity:	56~58 %
ATM Pressure:	101.0 kPa

The testing was performed by Hams He and Charlie Cha on 2020-07-14 and 2020-08-12 for below 1GHz and by Leo Huang on 2020-07-20 for above 1GHz.

EUT operation mode: Transmitting

Adapter 1 (VT05EUS06040):

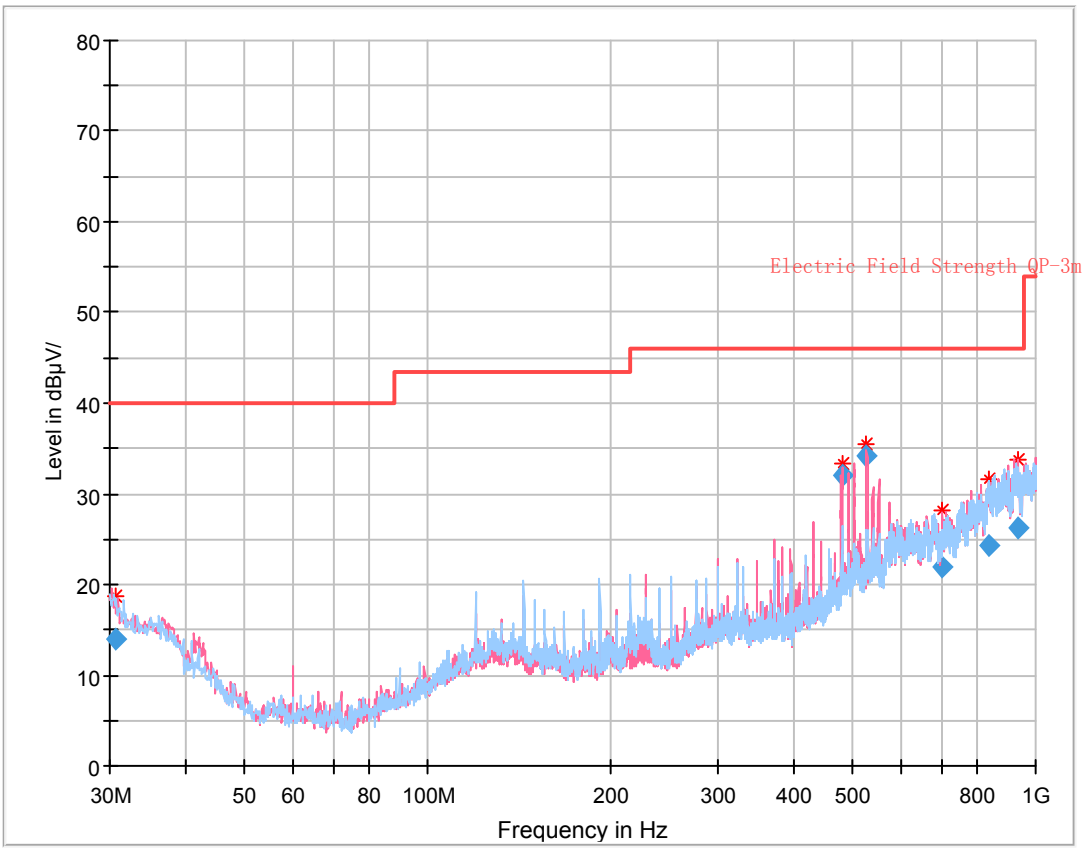
30 MHz~1 GHz: *(the worst case at Low channel)*



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
60.053625	23.29	115.0	V	210.0	-20.2	40.00	16.71
130.081875	21.62	196.0	H	261.0	-13.6	43.50	21.88
214.691000	23.12	130.0	H	253.0	-13.9	43.50	20.38
480.049125	32.25	107.0	V	52.0	-6.4	46.00	13.75
504.136000	31.79	111.0	V	51.0	-5.1	46.00	14.21
932.397875	26.20	130.0	V	281.0	4.8	46.00	19.80

Adapter 2 (S003GU0600040):

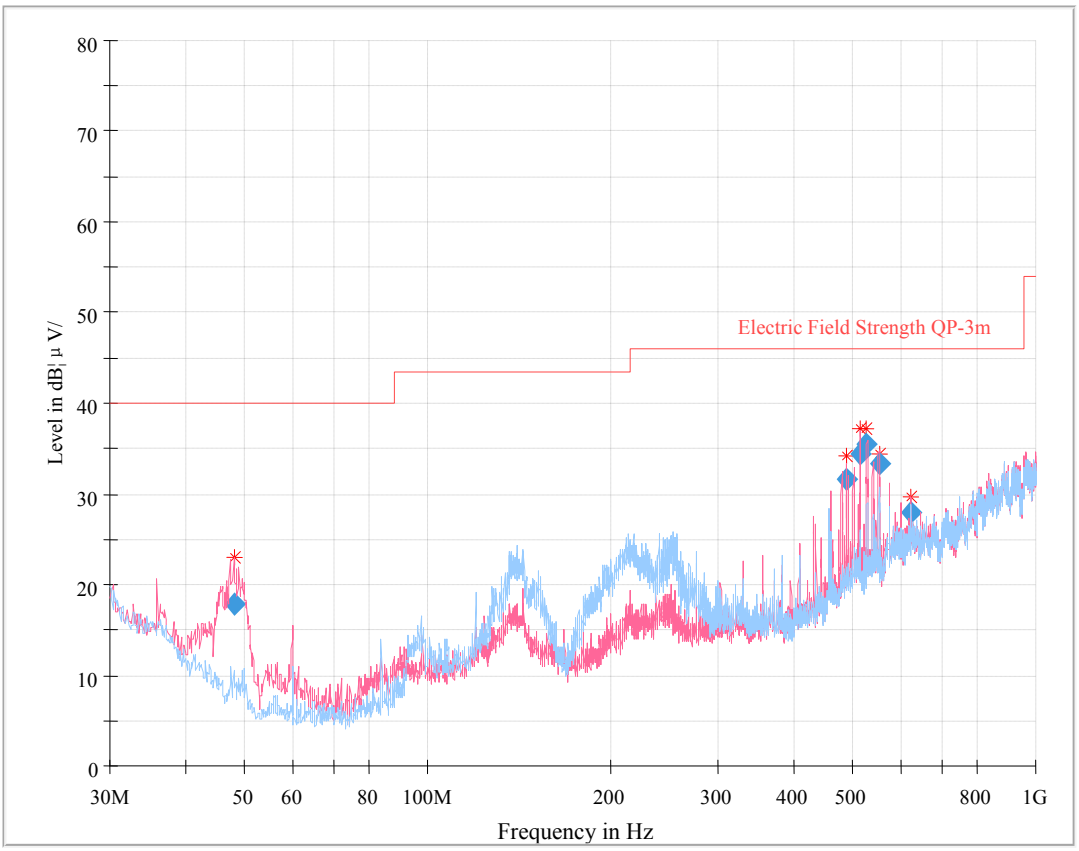
30 MHz~1 GHz: *(the worst case at Low channel)*



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.562351	14.00	321.0	V	191.0	-8.0	40.00	26.00
480.009250	31.95	103.0	V	123.0	-6.4	46.00	14.05
527.975500	34.27	110.0	V	230.0	-4.6	46.00	11.73
703.654750	21.95	228.0	V	257.0	-1.1	46.00	24.05
838.060250	24.26	307.0	V	43.0	2.8	46.00	21.74
933.313250	26.27	209.0	V	0.0	4.8	46.00	19.73

Adapter 3 (VT05EUS06050):

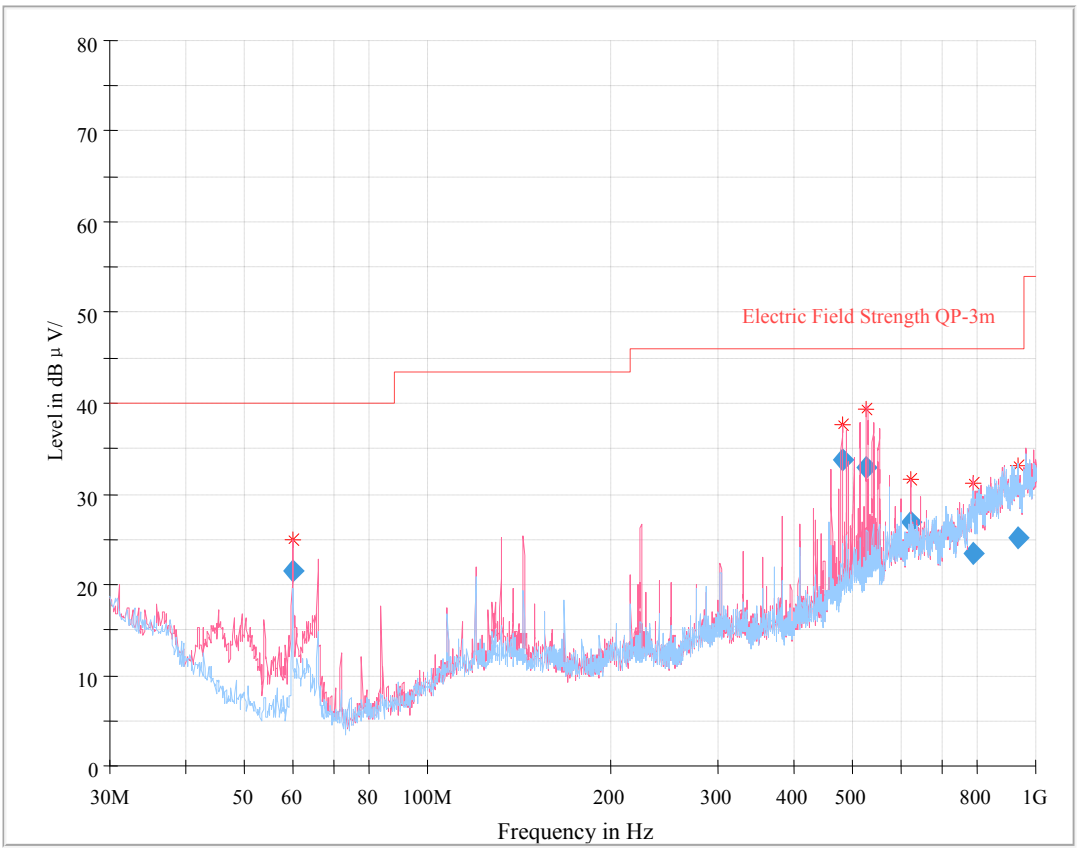
30 MHz~1 GHz: *(the worst case at Low channel)*



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
47.942625	17.94	109.0	V	285.0	-18.7	40.00	22.06
488.429375	31.66	114.0	V	92.0	-5.9	46.00	14.34
514.772375	34.51	110.0	V	201.0	-4.9	46.00	11.49
528.025000	35.53	102.0	V	279.0	-4.6	46.00	10.47
552.085000	33.44	103.0	V	81.0	-4.0	46.00	12.56
623.962125	27.96	104.0	V	0.0	-1.6	46.00	18.04

Adapter 4 (S003GU0600050):

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



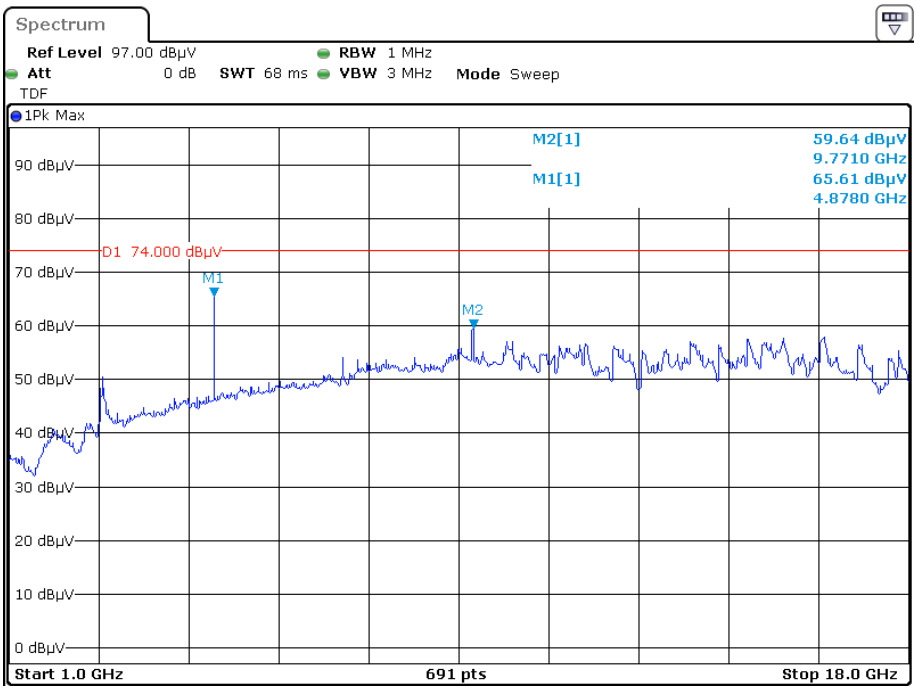
Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
59.987875	21.59	103.0	V	291.0	-20.1	40.00	18.41
480.010500	33.74	103.0	V	153.0	-6.4	46.00	12.26
528.045375	32.85	110.0	V	82.0	-4.6	46.00	13.15
624.076625	26.85	104.0	V	142.0	-1.6	46.00	19.15
789.444125	23.35	368.0	V	301.0	1.4	46.00	22.65
933.447125	25.26	169.0	H	353.0	4.8	46.00	20.74

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 (2405 MHz)									
2388.47	28.22	PK	10	1.7	H	31.87	60.09	74	13.91
2388.47	14.29	Ave.	10	1.7	H	31.87	46.16	54	7.84
2484.36	28.17	PK	117	1.6	H	32.13	60.30	74	13.70
2484.36	14.25	Ave.	117	1.6	H	32.13	46.38	54	7.62
4810.00	59.80	PK	285	2.1	H	6.28	66.08	74	7.92
4810.00	41.76	Ave.	285	2.1	H	6.28	48.04	54	5.96
7215.00	50.80	PK	88	2.0	H	11.93	62.73	74	11.27
7215.00	30.55	Ave.	88	2.0	H	11.93	42.48	54	11.52
9620.00	47.95	PK	3	1.0	H	14.29	62.24	74	11.76
9620.00	32.79	Ave.	3	1.0	H	14.29	47.08	54	6.92
Middle Channel (2439 MHz)									
4878.00	59.76	PK	323	1.8	H	6.76	66.52	74	7.48
4878.00	43.20	Ave.	323	1.8	H	6.76	47.58	54	6.42
7317.00	47.62	PK	203	1.1	H	11.56	59.18	74	14.82
7317.00	29.91	Ave.	203	1.1	H	11.56	41.47	54	12.53
9756.00	47.99	PK	286	2.2	H	15.42	63.41	74	10.59
9756.00	32.94	Ave.	286	2.2	H	15.42	48.36	54	5.64
High Channel (2475 MHz)									
2389.63	28.10	PK	82	2.5	H	31.87	59.97	74	14.03
2389.63	14.33	Ave.	82	2.5	H	31.87	46.20	54	7.80
2484.36	29.14	PK	167	1.4	H	32.13	61.27	74	12.73
2484.36	16.23	Ave.	167	1.4	H	32.13	48.36	54	5.64
4950.00	61.06	PK	254	2.0	H	6.80	67.86	74	6.14
4950.00	42.32	Ave.	254	2.0	H	6.80	49.12	54	4.88
7425.00	45.32	PK	81	1.8	H	12.39	57.71	74	16.29
7425.00	28.82	Ave.	81	1.8	H	12.39	41.21	54	12.79
9900.00	48.36	PK	255	1.4	H	16.29	64.65	74	9.35
9900.00	33.15	Ave.	255	1.4	H	16.29	49.44	54	4.56

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 middle channel Peak
Horizontal



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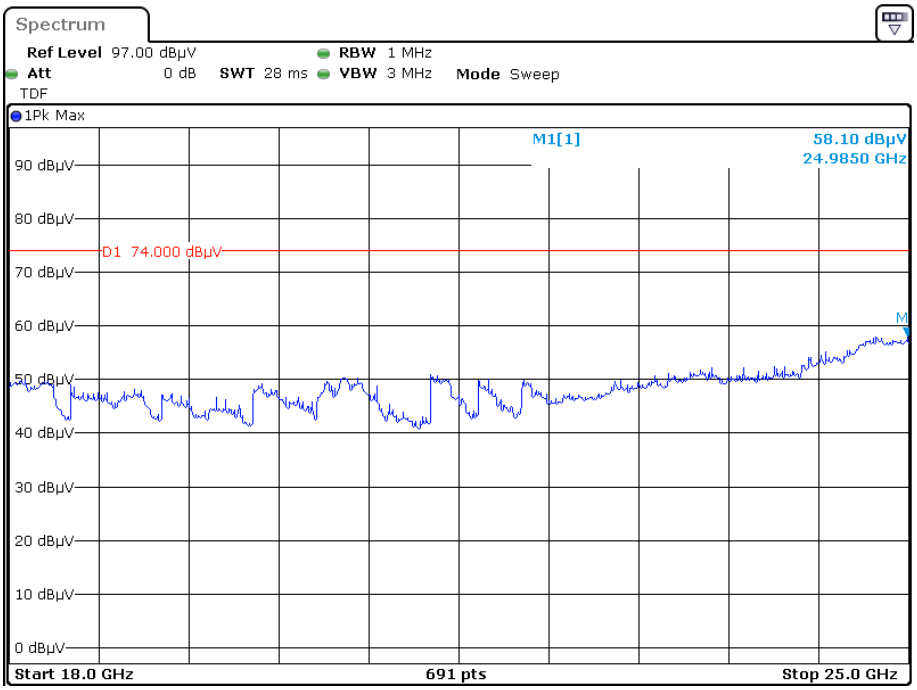

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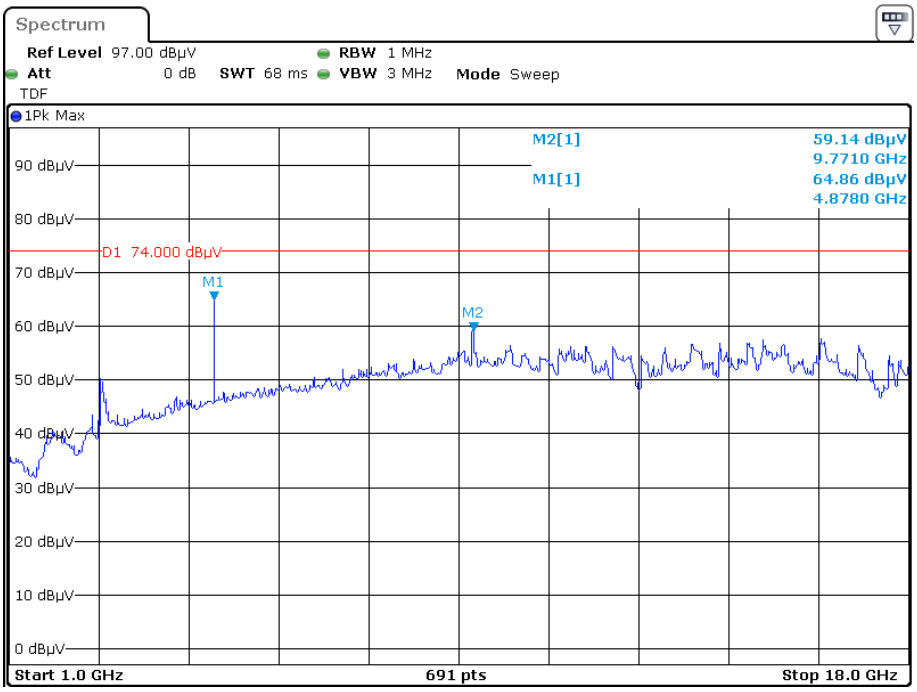
Vertical



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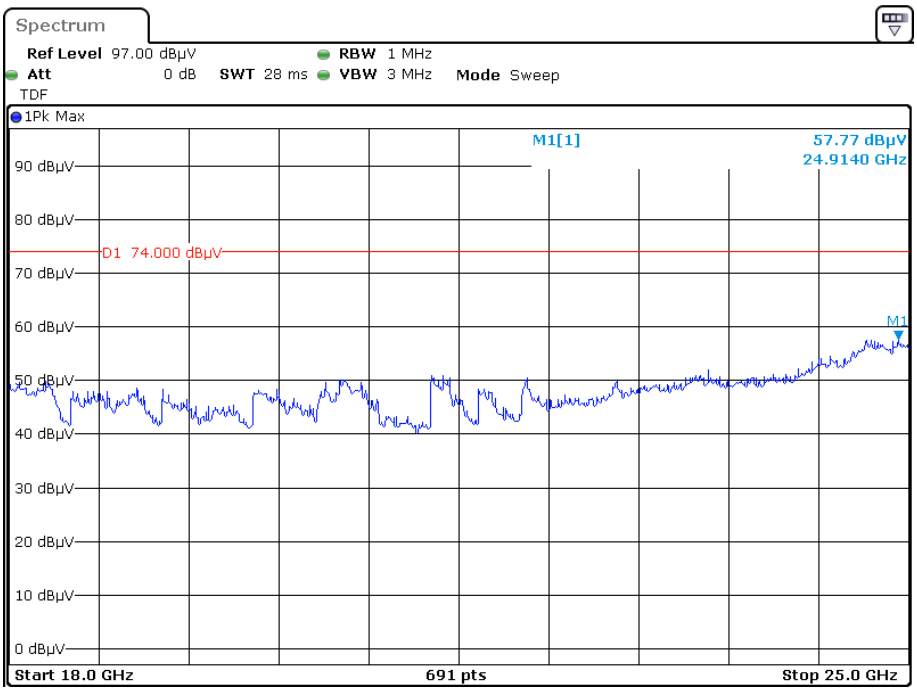
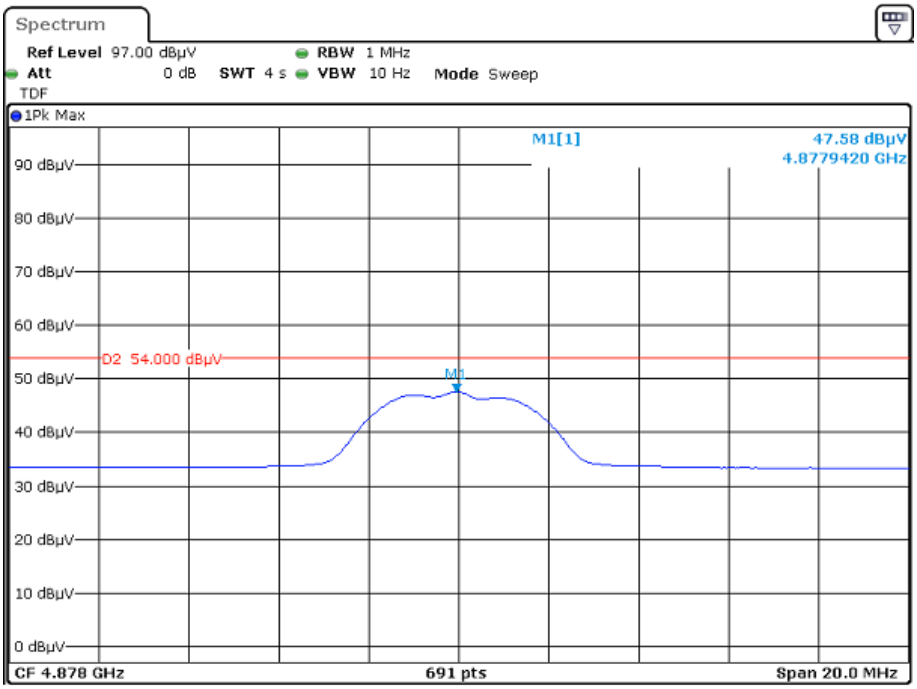


Date: 20.JUL.2020 04:30:26

Pre-scan for Average
Horizontal



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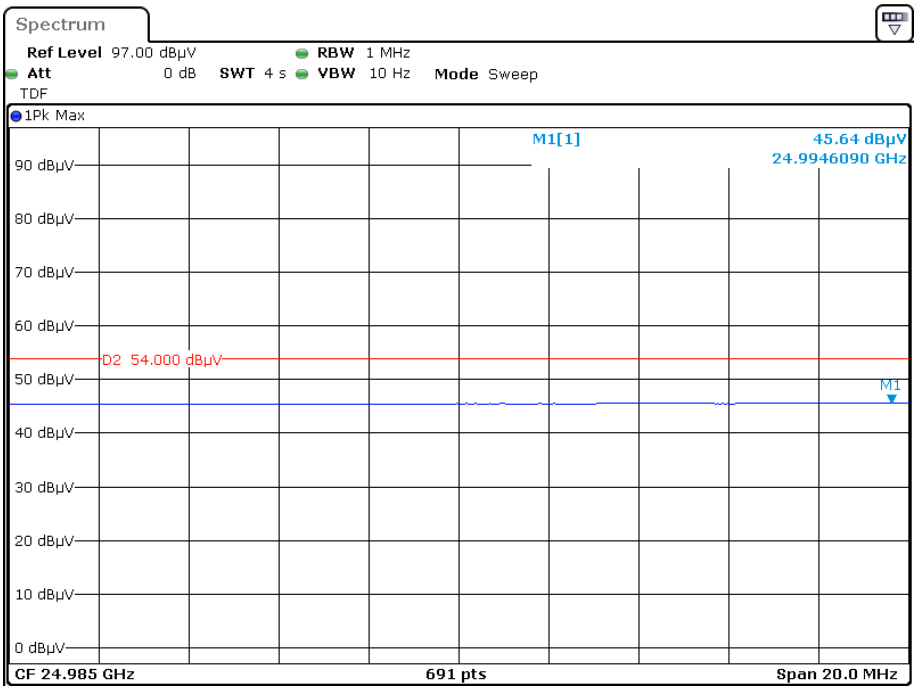
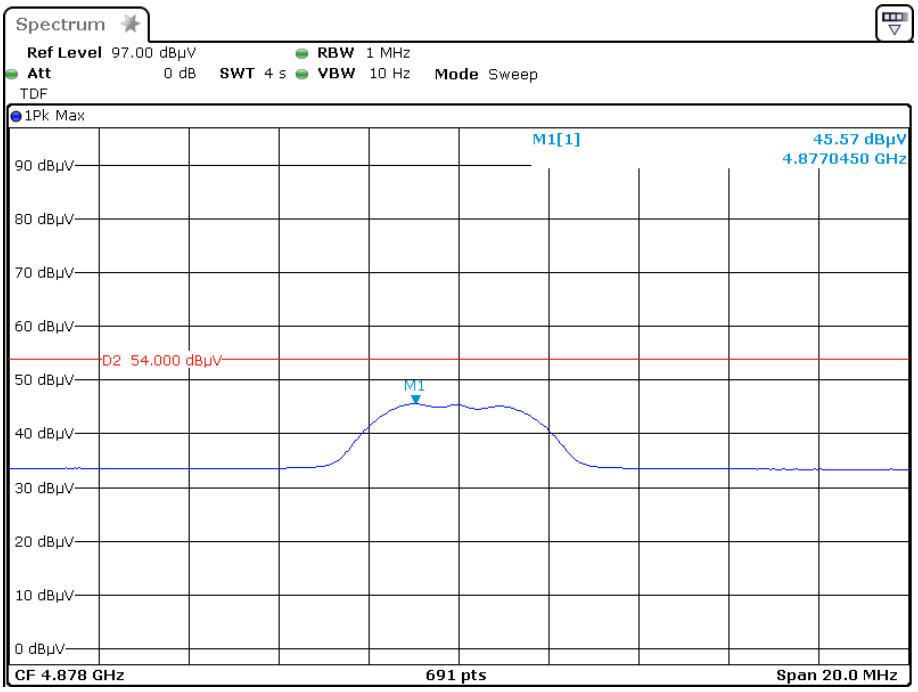


Date: 20.JUL.2020 04:40:01

Vertical



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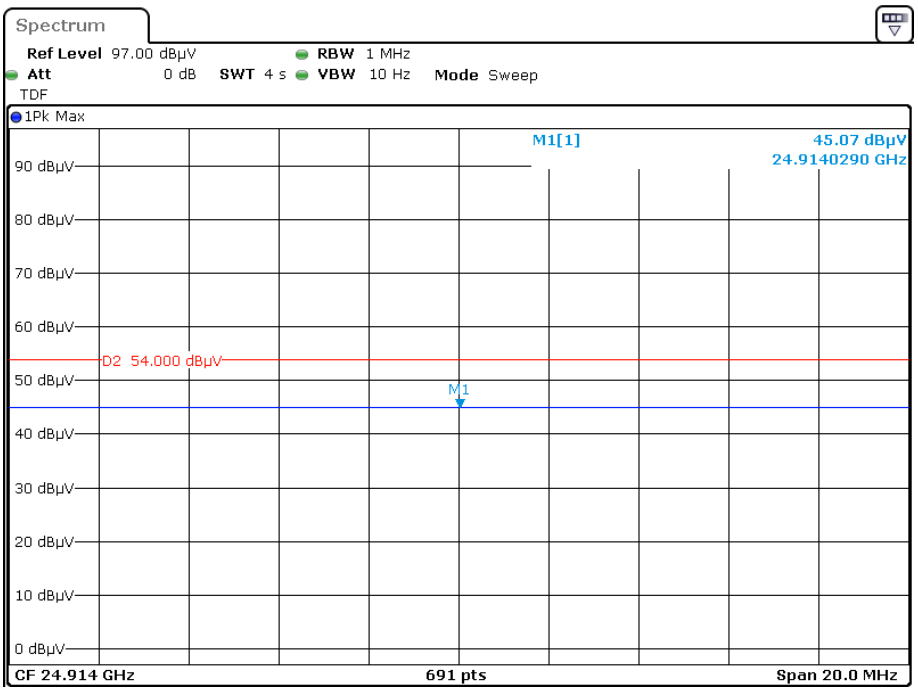


Date: 20.JUL.2020 04:33:25

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, max hold the channel.
2. Set the adjacent channel of the EUT and max hold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Chen on 2020-06-23.

EUT operation mode: Transmitting

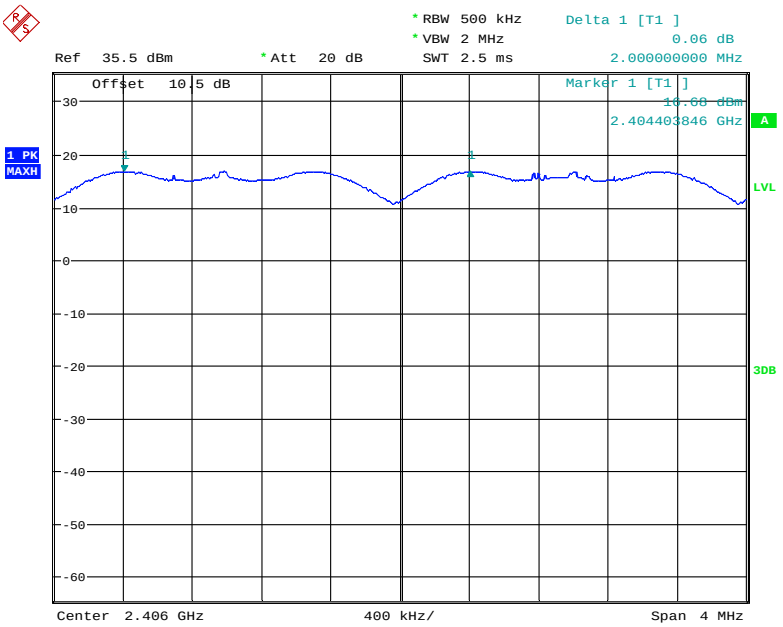
Test Result: Pass

Please refer to following table and plots.

Test Channel	Reading (MHz)	Limit (MHz)	Result
L	2.000	>=1.693	Pass
M	2.000	>=1.593	Pass
H	2.000	>=1.593	Pass

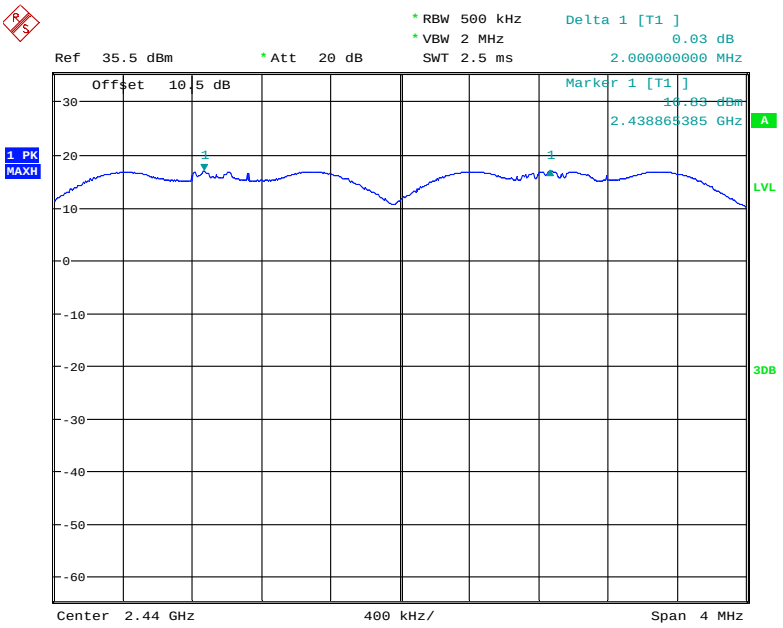
Note: Limit = (2/3) * 20dB bandwidth.

Low Channel



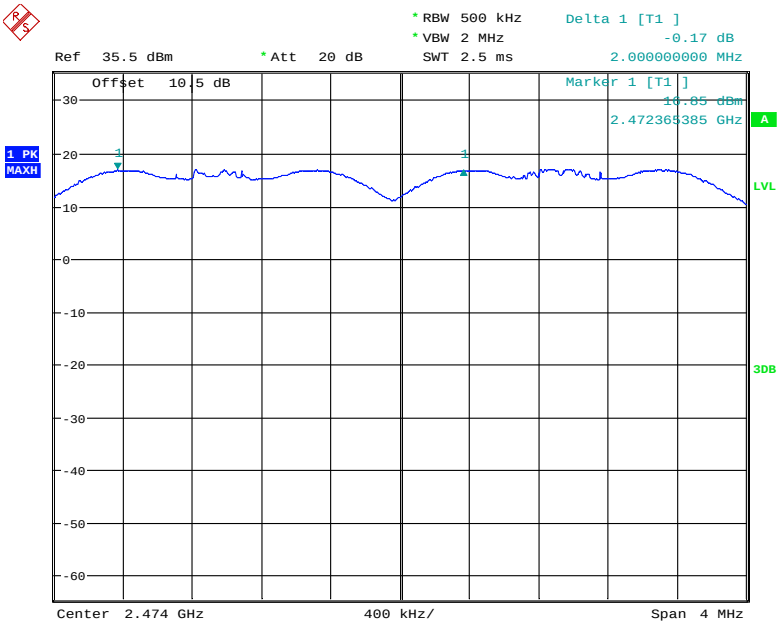
Date: 23.JUN.2020 19:31:32

Middle Channel



Date: 23.JUN.2020 19:38:50

High Channel



Date: 23.JUN.2020 19:46:57

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:	23 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Chen on 2020-06-23.

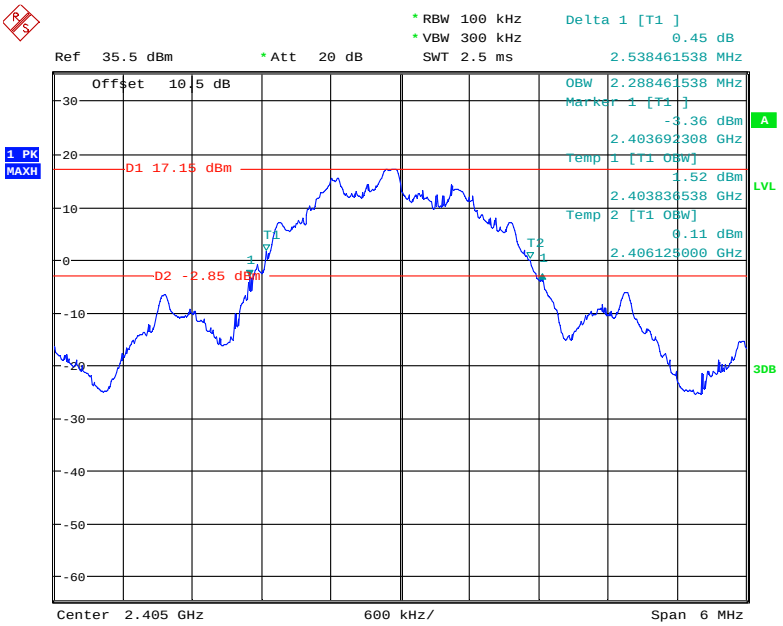
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

Test Channel	20dB Bandwidth (MHz)	OBW (MHz)	Result
L	2.54	2.29	Pass
M	2.39	2.26	Pass
H	2.39	2.26	Pass

Low Channel



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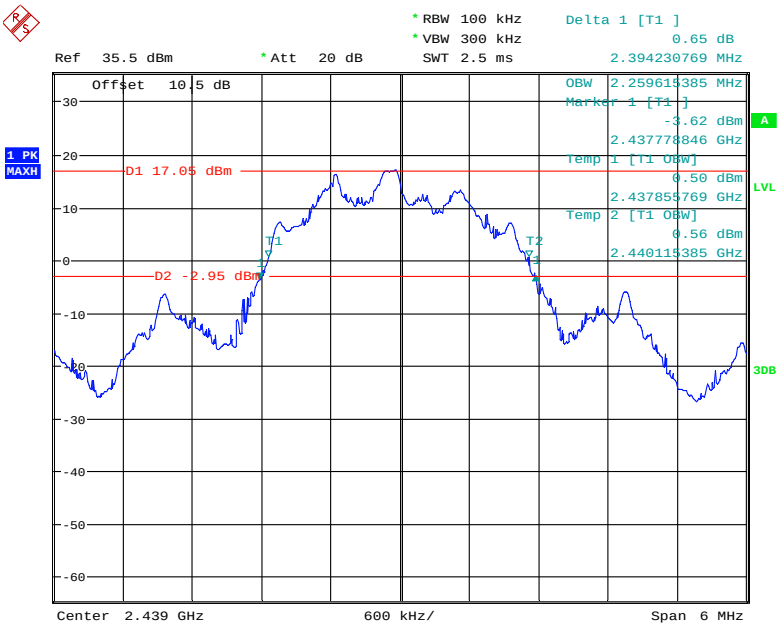
Middle Channel



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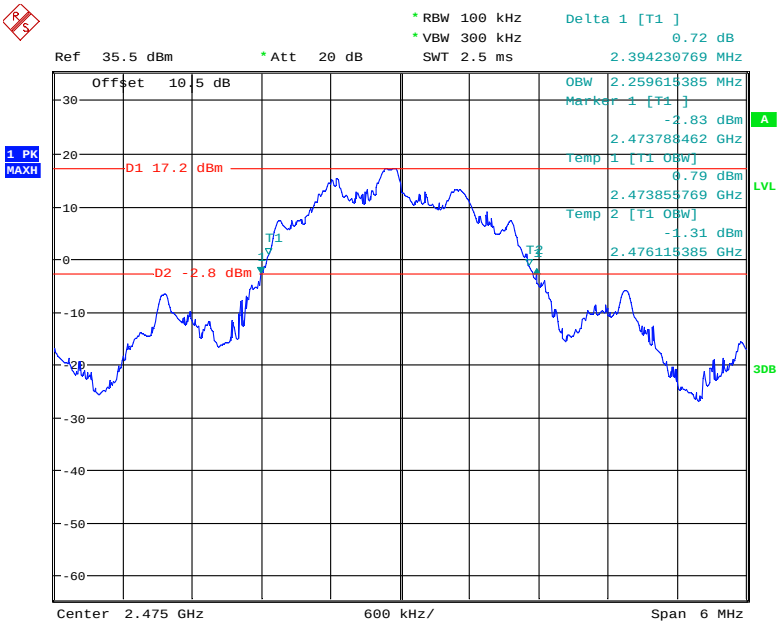
High Channel



Date: 23.JUN.2020 20:18:07

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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Chen on 2020-08-26.

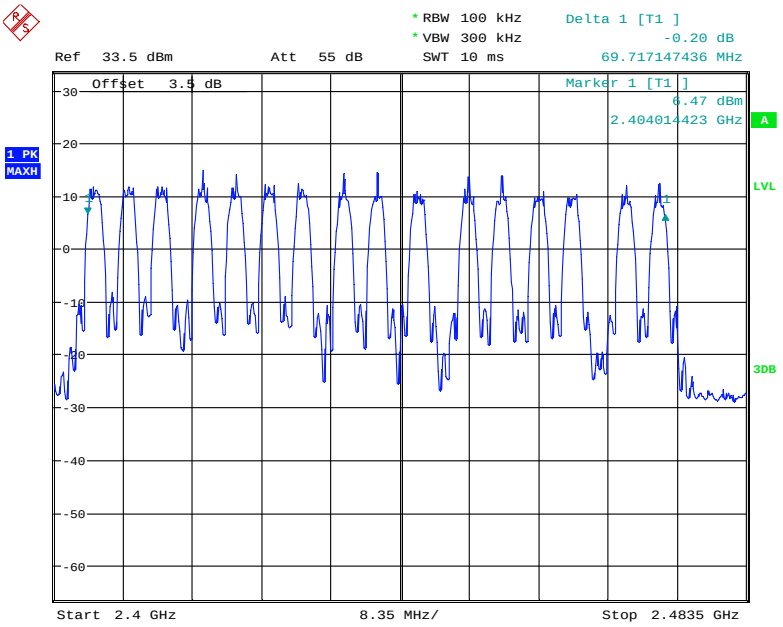
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

Test Mode	Hopping Number	Limit	Result
Hopping	16	>=15	Pass

Number of Hopping Channels



Date: 26.AUG.2020 09:25:45

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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Chen on 2020-06-24 and 2020-06-30.

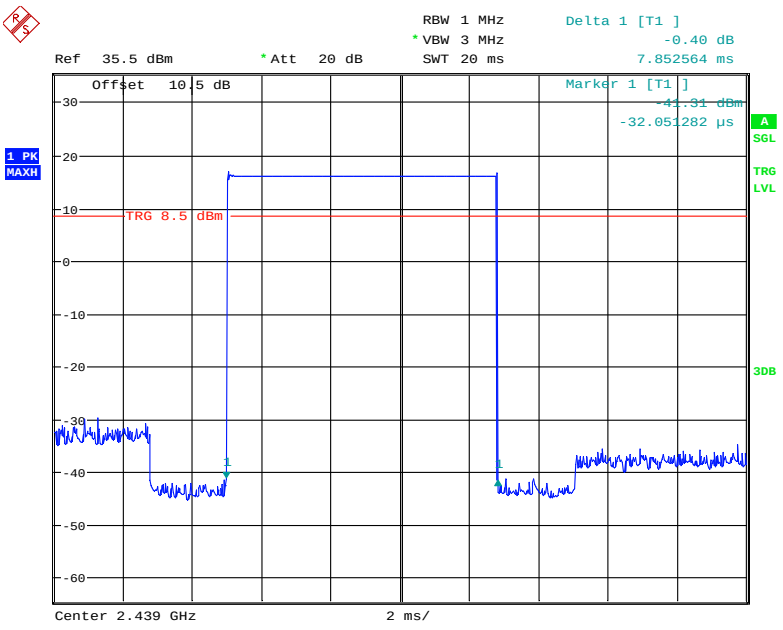
EUT operation mode: Transmitting

Test Result: Pass

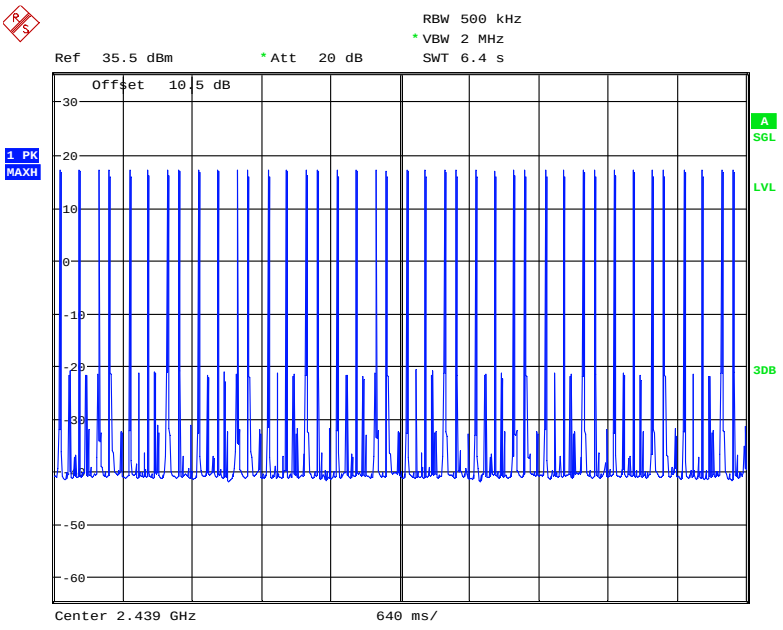
Please refer to following table and plots

Channel	Burst Width (ms)	Total Hopping Number in 6.4s	Total Dwell Time (s)	Limit (s)	Result
Hop	7.85	40	0.314	<=0.4	Pass

Note: 1. Total Dwell Time= Burst Width* Total Hopping Number
2. There are total 32 channels but only 16 channels were active at any time. So the test period is 0.4*16s=6.4s.



Date: 24.JUN.2020 17:34:01



Date: 30.JUN.2020 18:00:21

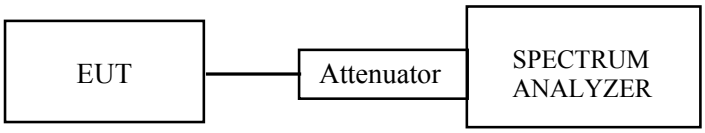
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

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 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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Chen on 2020-06-23.

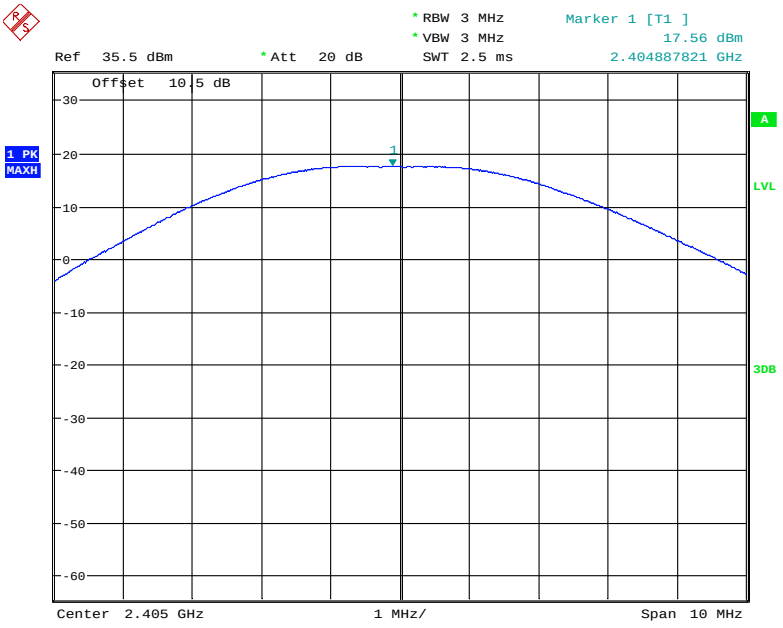
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table.

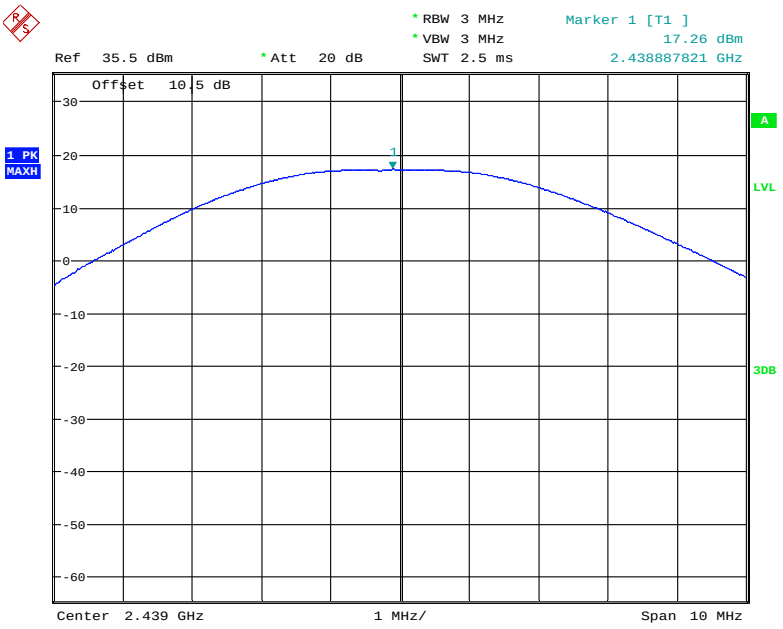
Test Channel	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
L	17.56	<=20.97	Pass
M	17.26	<=20.97	Pass
H	17.23	<=20.97	Pass

Low Channel



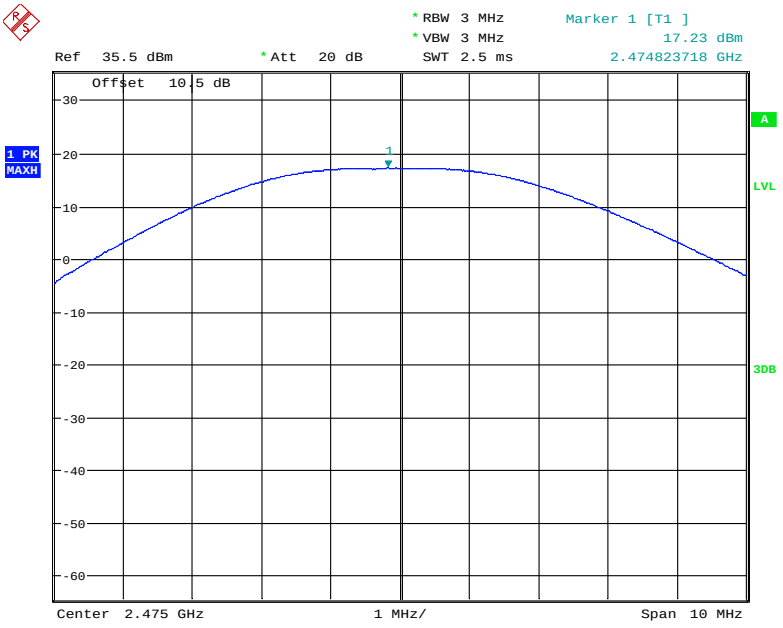
Date: 23.JUN.2020 20:15:23

Middle Channel



Date: 23.JUN.2020 20:15:47

High Channel



Date: 23.JUN.2020 20:15:59

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Chen on 2020-06-23.

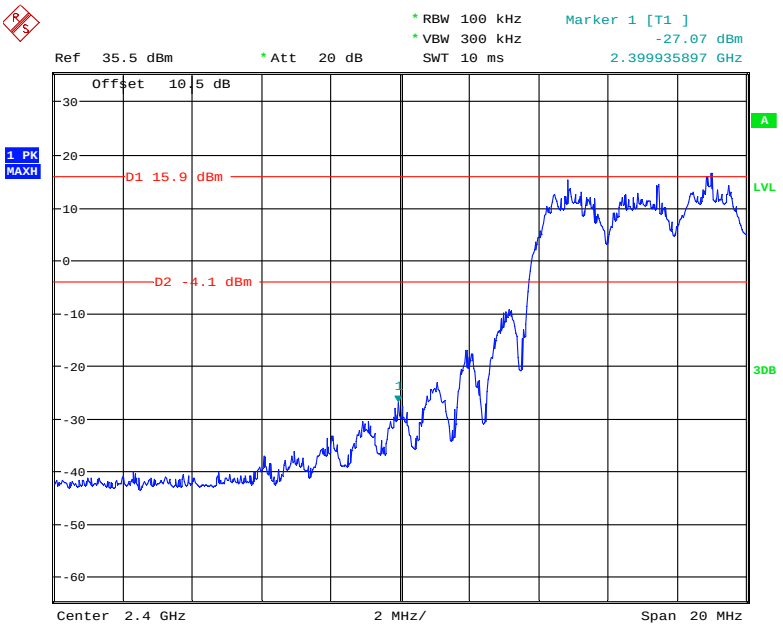
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following plots.

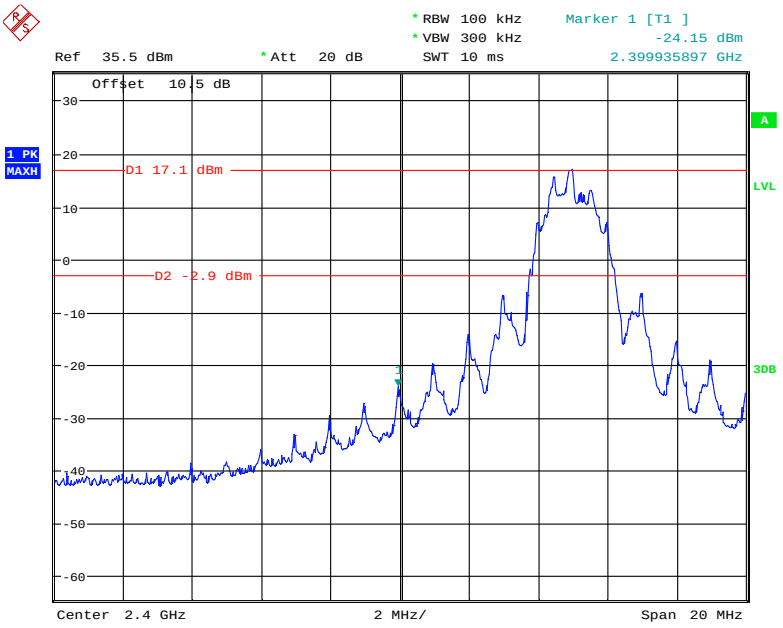
Band Edge-Left Side

Hopping



Date: 23.JUN.2020 19:28:47

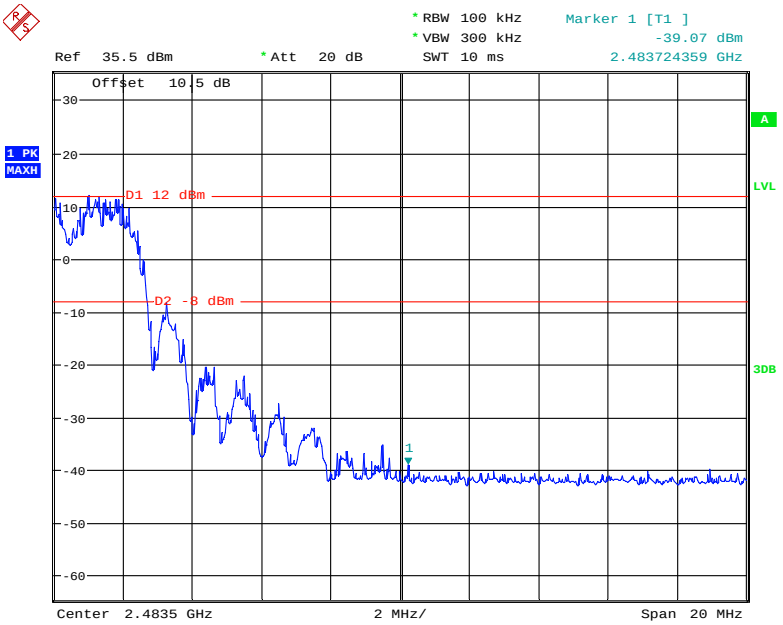
Single



Date: 23.JUN.2020 20:23:51

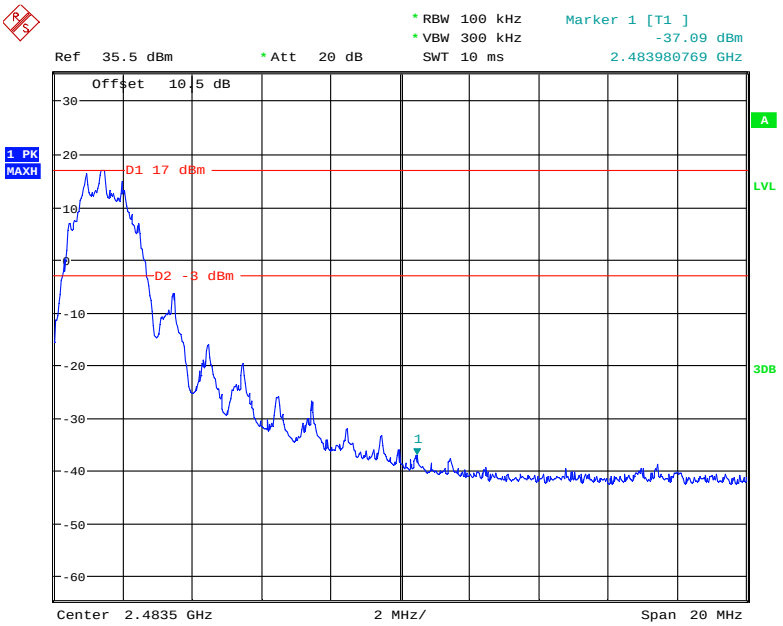
Band Edge-Right Side

Hopping



Date: 23.JUN.2020 19:27:43

Single



Date: 23.JUN.2020 20:27:07

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