TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.247

TEST REPORT

For

Shanghai HowayGIS Co., Ltd

RM230, Fawkes Building, No. 1985, Road Chunshen, Shanghai, China

FCC ID: 2AAZD-TGU1-S3

Report Type:	**Product Type:**
Original Report	High Precision Mobile GNSS Receiver

Test Engineer:	Hope Zhang
Report Number:	RKSA171222002-00B
Report Date:	2018-10-17
Reviewed By:	Oscar Ye RF Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Shanghai HowayGIS Co., Ltd
Tested Model	TG-U2
Series Model	TG-U1, TG-U3, X1
Product Type	High Precision Mobile GNSS Receiver
Dimension	210 mm(L)×60 mm(W)×110 mm(H)
Power Supply	DC 7.2V from battery and DC 12V charging by adapter

Adapter Information:
Model: A122-1201000ID
Input: AC100-240 V 50/60Hz 0.4A
Output:12V, 1000mA

Note: The differences between the tested model and series models were explained in the declaration letter.

**All measurement and test data in this report was gathered from production sample serial number: 20171222002. (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-12-22)*

Objective

This report is prepared on behalf of *Shanghai HowayGIS 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, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS and Part 15B JBP submittals with FCC ID: 2AAZD-TGU1-S3.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC 558074 D01 15.247 Meas Guidance v05.

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

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19 dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel List for BLE mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
18	2438	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

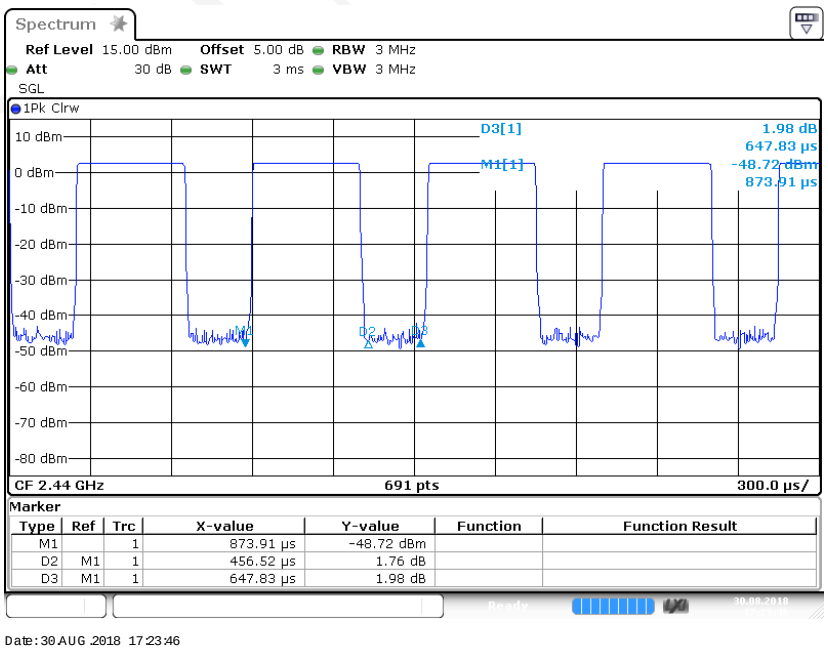
EUT Exercise Software

RF test tool: Blue Test 3

Power Level: 50

Duty Cycle:

Middle Channel



Mode	Duty Cycle (%)	T(us)	1/T(kHz)	10log(1/x)
BLE	70.52	457	2.19	1.52

Note: "x" means the Duty Cycle.

Support Equipment List and Details

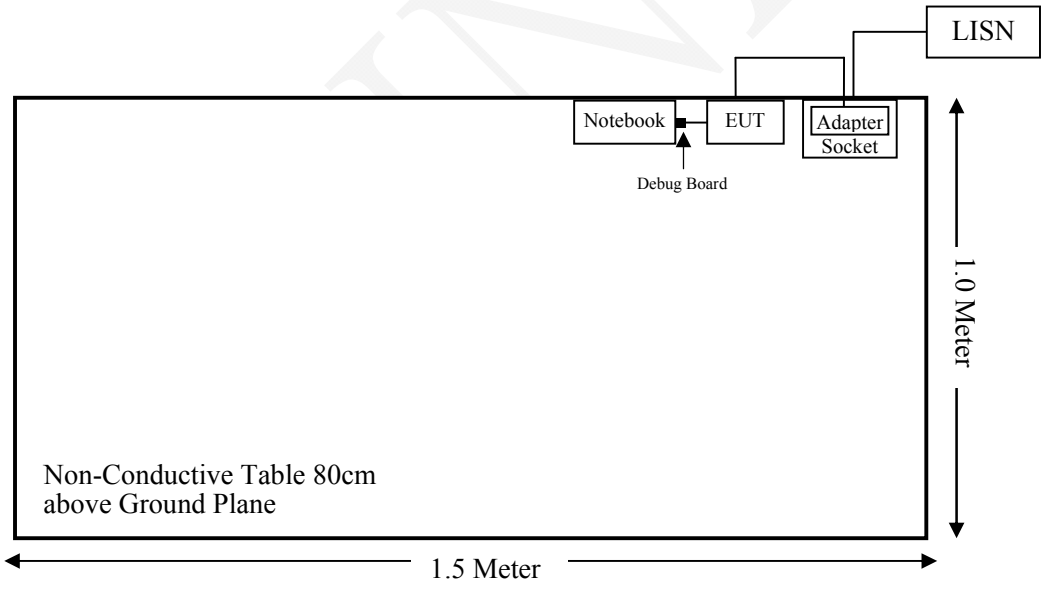
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152
Shanghai HowayGIS	Debug Board	/	/

External I/O Cable

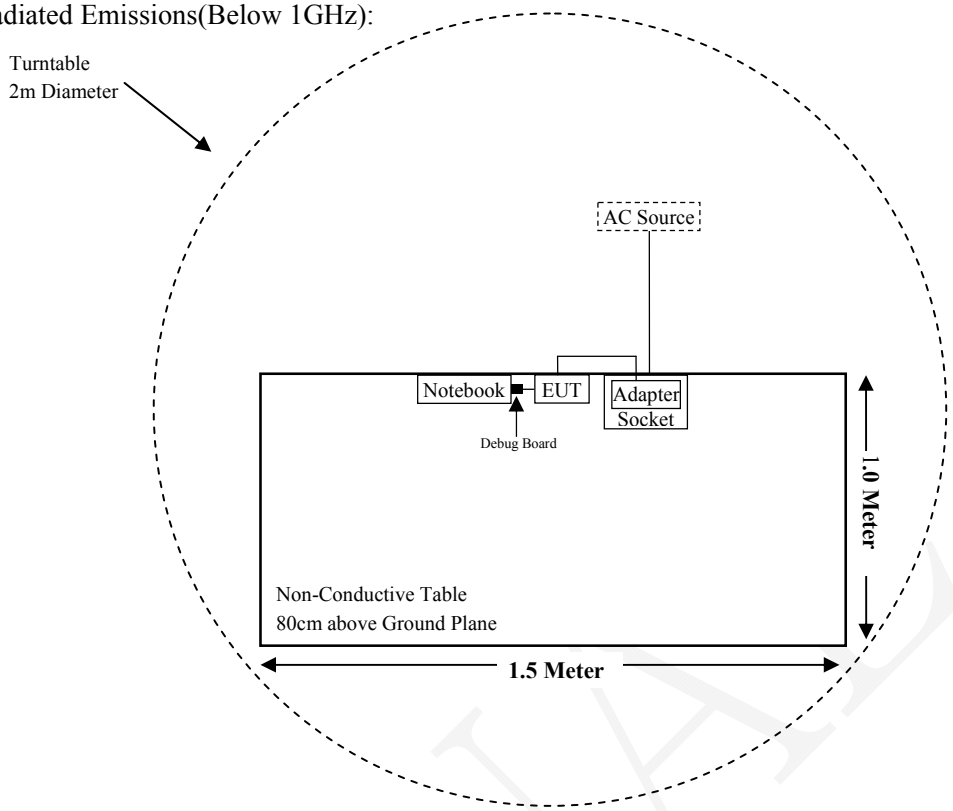
Cable Description	Length (m)	From Port	To
Data Cable	0.2	Debug Board	EUT
Power Cable	1.5	EUT	Adapter

Block Diagram of Test Setup

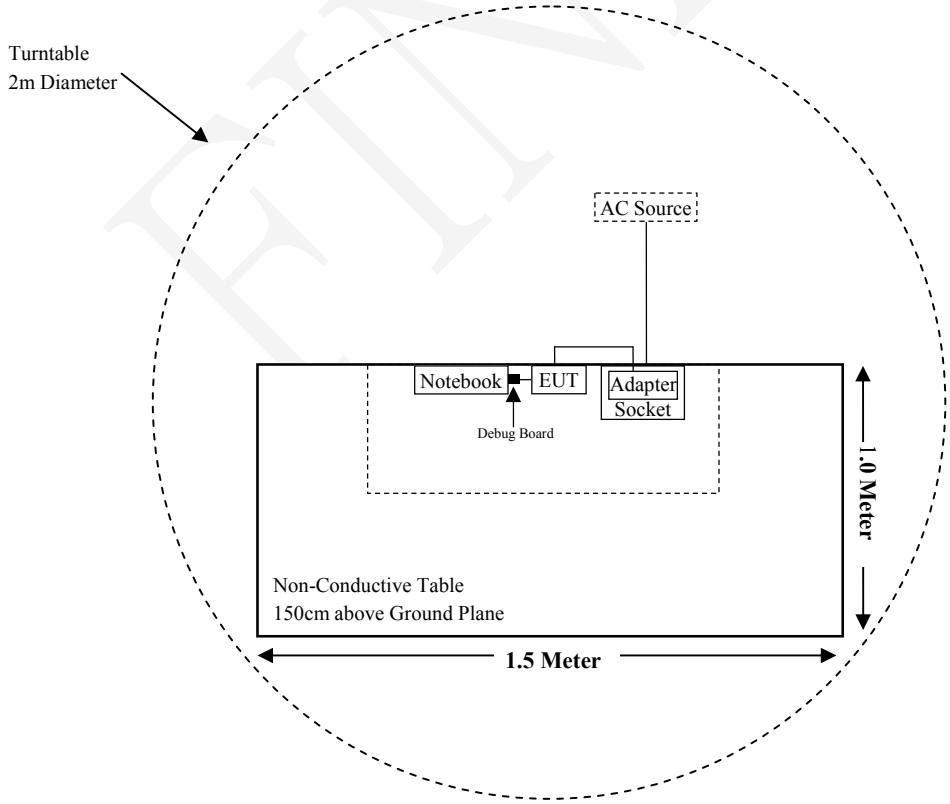
For Conducted Emissions:



For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1093	RF EXPOSURE	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sonoma Instrunent	Pre-amplifier	310N	171205	2018-08-15	2019-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
Radiated Emission Test（Chamber 2#）					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2018-08-27	2019-08-26
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Mini-Circuits	Amplifier	ZVA-183W-S+	220701818	2018-05-20	2019-05-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2018-03-22	2019-03-21
MICRO-TRONICS	Band notch Filter	BRM50702	G024	2018-08-05	2019-08-04
Narda	Attenuator/10dB	10dB	010	2018-08-15	2019-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2018-08-15	2019-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2018-07-23	2019-07-22
Narda	Attenuator/10dB	10dB	010	2018-08-15	2019-08-14
Shanghai HowayGIS	RF Cable	HowayGISC01	C01	Each Time	/
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2017-11-12	2018-11-11
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2017-11-12	2018-11-11
BACL	Auto test Software	BACL-EMC	CE001	/	/
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2018-08-15	2019-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (I) & §1.1310 & §2.1093 - RF EXPOSURE

Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

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

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

Mode	Frequency Range (MHz)	Target Output Power		Minimum test separation distance required for the exposure conditions (mm)
		(dBm)	(mW)	
BT3.0	2402-2480	4.50	2.82	5.00
BLE	2402-2480	4.60	2.88	5.00

Note: The target output power was declared by the manufacturer.

Result:

BT3.0: [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)]= 2.82/5*√2.48=0.9 <3.0

BLE: [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)]= 2.88/5*√2.48=0.9 <3.0

So the stand-alone SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

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

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has an internal ceramic antenna for Bluetooth and the antenna gain is 1dBi, which was permanently attached; fulfill the requirement of this section. Please refer to the EUT photos.

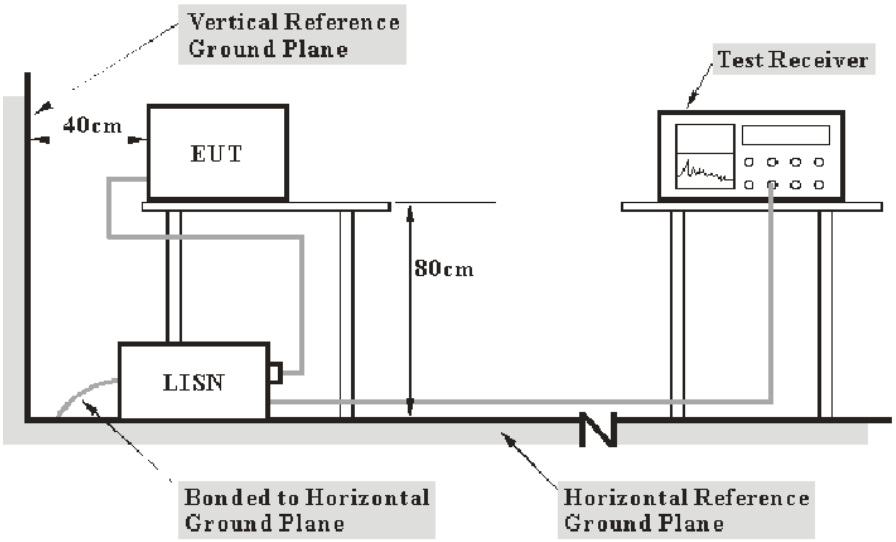
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

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

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:

Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

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 (dB) = Limit (dBμV) - Corrected Amplitude (dBμV)

Test Results Summary

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

Test Data

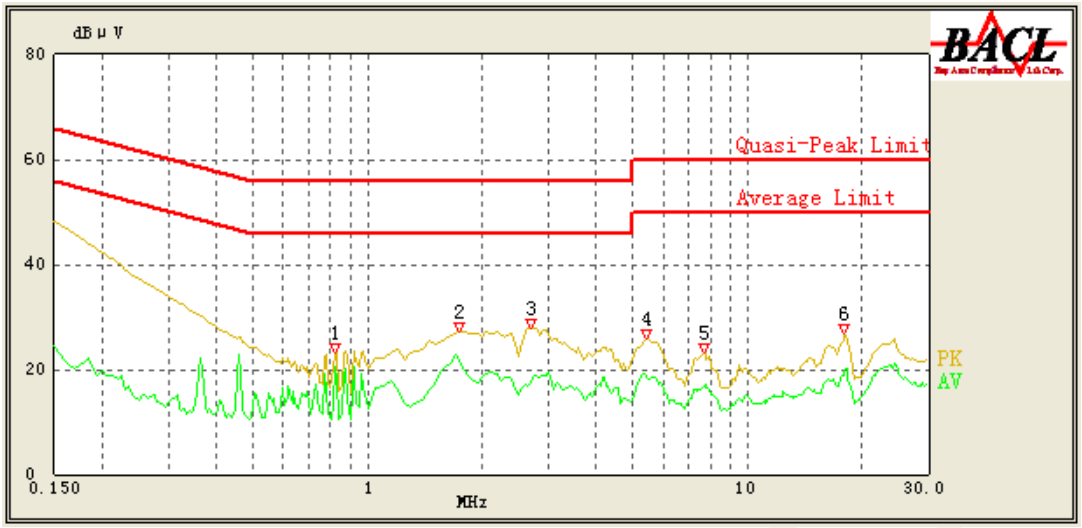
Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Hope Zhang on 2018-09-01.

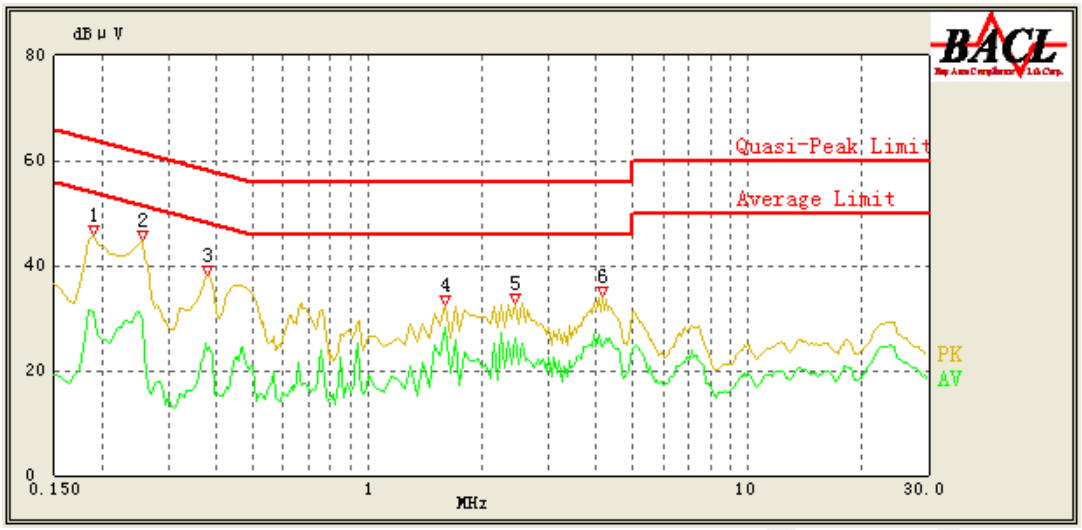
EUT operation mode: Transmitting in high channel. (Worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.825	23.09	QP	9.000	L1	15.92	56.00	32.91	Compliance
0.825	20.56	AV	9.000	L1	15.92	46.00	25.44	Compliance
1.750	27.15	QP	9.000	L1	15.86	56.00	28.85	Compliance
1.750	21.84	AV	9.000	L1	15.86	46.00	24.16	Compliance
2.700	27.93	QP	9.000	L1	15.85	56.00	28.07	Compliance
2.700	17.39	AV	9.000	L1	15.85	46.00	28.61	Compliance
5.400	25.95	QP	9.000	L1	15.88	60.00	34.05	Compliance
5.400	18.67	AV	9.000	L1	15.88	50.00	31.33	Compliance
7.650	23.06	QP	9.000	L1	16.00	60.00	36.94	Compliance
7.650	16.93	AV	9.000	L1	16.00	50.00	33.07	Compliance
17.950	26.72	QP	9.000	L1	16.35	60.00	33.28	Compliance
18.000	19.76	AV	9.000	L1	16.35	50.00	30.24	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.190	45.80	QP	9.000	N	16.05	64.04	18.24	Compliance
0.190	31.16	AV	9.000	N	16.05	54.04	22.88	Compliance
0.255	44.75	QP	9.000	N	16.06	61.59	16.84	Compliance
0.255	29.38	AV	9.000	N	16.06	51.59	22.21	Compliance
0.380	38.20	QP	9.000	N	16.09	58.28	20.08	Compliance
0.380	23.86	AV	9.000	N	16.09	48.28	24.42	Compliance
1.600	32.64	QP	9.000	N	15.92	56.00	23.36	Compliance
1.600	28.18	AV	9.000	N	15.92	46.00	17.82	Compliance
2.450	32.88	QP	9.000	N	15.90	56.00	23.12	Compliance
2.450	26.12	AV	9.000	N	15.90	46.00	19.88	Compliance
4.150	34.15	QP	9.000	N	15.88	56.00	21.85	Compliance
4.150	24.45	AV	9.000	N	15.88	46.00	21.55	Compliance

Note:
1) Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Margin (dB) = Limit (dBµV) - Corrected Amplitude (dBµV)

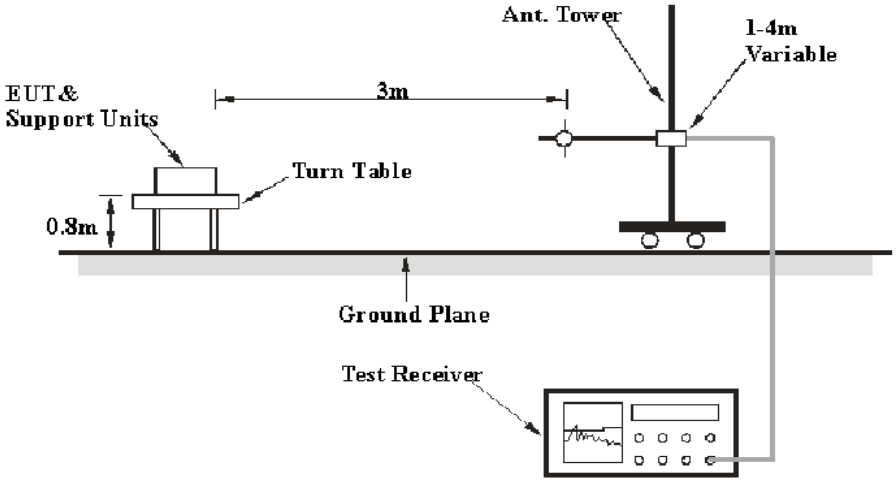
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

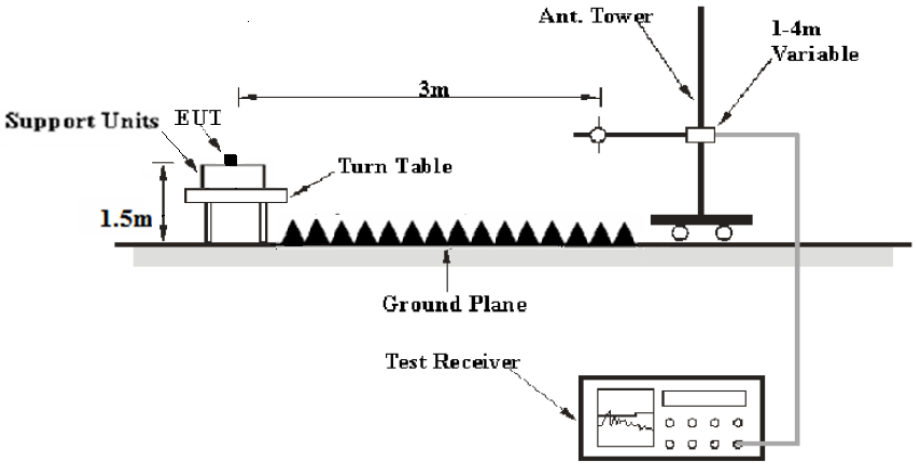
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz - 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (dBμV /m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

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 (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

Temperature:	23.3-23.4 ℃
Relative Humidity:	49-50 %
ATM Pressure:	101.1-101.2 kPa

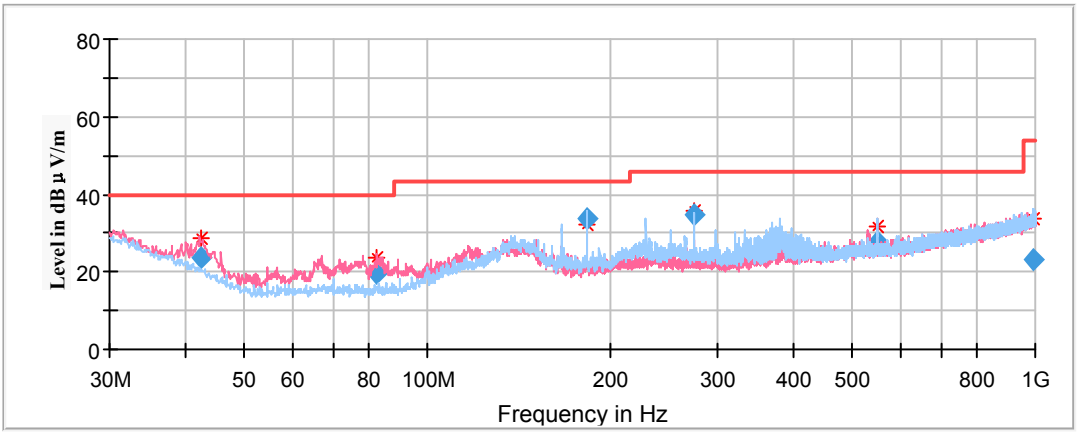
Radiated emission test was performed by Hope Zhang on 2018-09-14 & 2018-10-17;
RF conducted test was performed by Hope Zhang on 2018-08-30.

EUT operation mode: Transmitting

Spurious Emission Test:

30MHz-1GHz

*(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **high channel of operation in Y-axis of orientation** was recorded)*



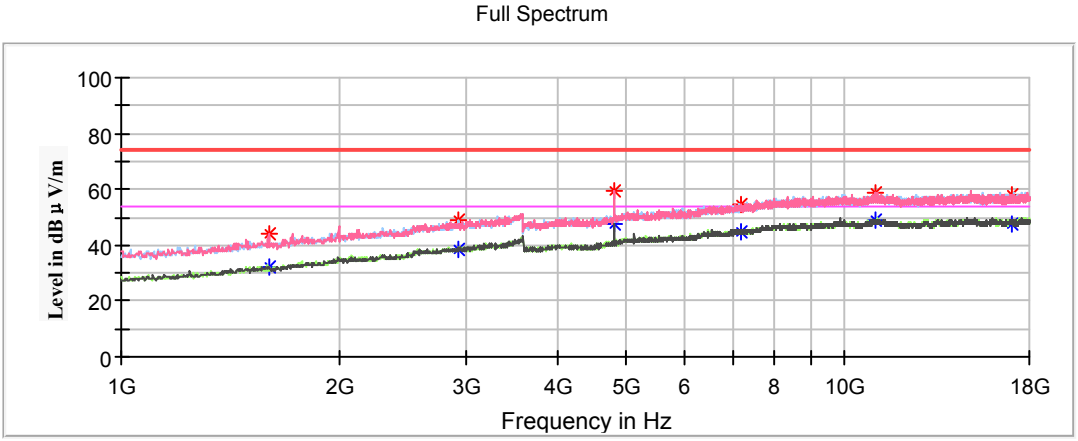
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dBµV/m)	Height (cm)	Polar (H/V)				
42.451750	28.68	100.0	V	93.0	-12.2	40.00	11.32
82.618350	23.71	100.0	V	202.0	-17.7	40.00	16.29
183.229700	32.15	200.0	H	144.0	-13.4	43.50	11.35
274.933900	35.72	100.0	H	0.0	-11.3	46.00	10.28
550.054850	31.79	100.0	H	298.0	-5.6	46.00	14.21
990.723150	33.94	100.0	H	1.0	2.1	53.90	19.96

1GHz-18GHz

*(Pre-scan in the X, Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)*

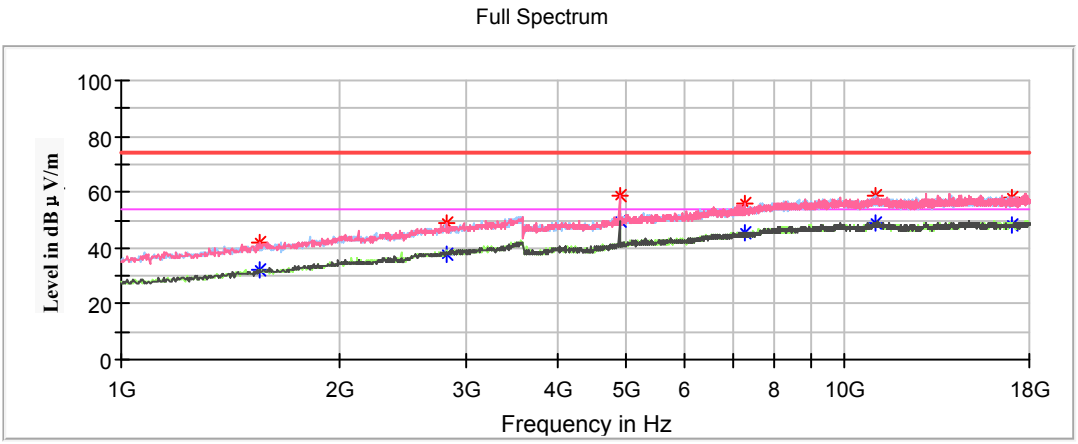
Note:
1. This test was performed with the 2.4 - 2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
   Corrected Amplitude (dBµV/m) = Corrected Factor (dB/m) + Reading (dBµV)
   Margin (dB) = Limit (dBµV/m) - Corrected Amplitude (dBµV /m)

Low Channel: 2402MHz



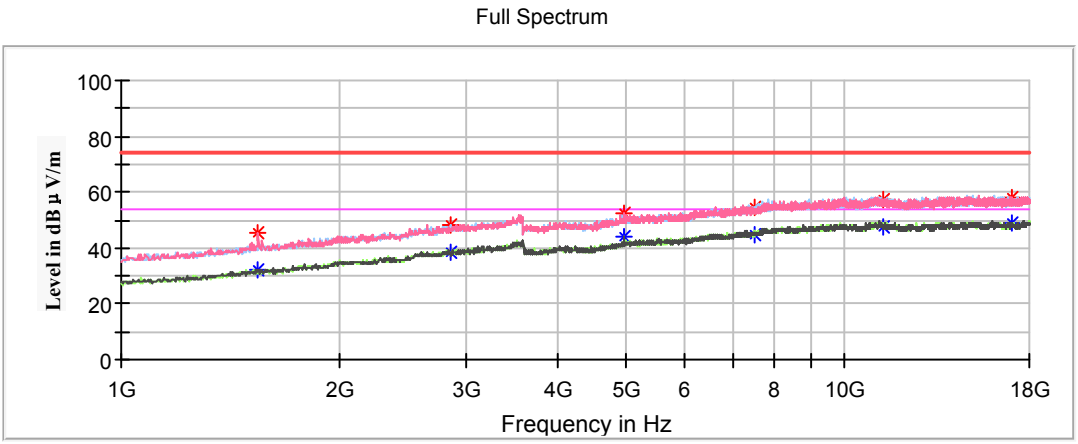
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1598.400000	43.99	---	100.0	V	99.0	-0.6	74.00	30.01
1598.400000	---	31.84	100.0	V	99.0	-0.6	54.00	22.16
2931.200000	48.78	---	150.0	H	146.0	5.6	74.00	25.22
2931.200000	---	38.41	150.0	H	146.0	5.6	54.00	15.59
4804.000000	59.17	---	250.0	V	99.0	10.7	74.00	14.83
4804.000000	---	47.62	250.0	V	99.0	10.7	54.00	6.38
7206.000000	---	45.03	150.0	V	257.0	15.2	54.00	8.97
7206.000000	54.70	---	150.0	V	257.0	15.2	74.00	19.30
11019.800000	---	48.81	200.0	V	358.0	19.0	54.00	5.19
11019.800000	58.93	---	200.0	V	358.0	19.0	74.00	15.07
17058.200000	---	47.76	100.0	V	12.0	18.1	54.00	6.24
17058.200000	58.10	---	100.0	V	12.0	18.1	74.00	15.90

Middle Channel: 2440MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1554.200000	42.15	---	250.0	V	185.0	-0.9	74.00	31.85
1554.200000	---	32.01	250.0	V	185.0	-0.9	54.00	21.99
2819.000000	48.61	---	100.0	V	209.0	5.0	74.00	25.39
2819.000000	---	38.11	100.0	V	209.0	5.0	54.00	15.89
4880.000000	58.42	---	100.0	V	209.0	11.1	74.00	15.58
4880.000000	---	49.83	100.0	V	209.0	11.1	54.00	4.17
7320.000000	---	45.23	250.0	V	276.0	15.4	54.00	8.77
7320.000000	55.73	---	250.0	V	276.0	15.4	74.00	18.27
11016.400000	---	48.83	100.0	H	75.0	19.0	54.00	5.17
11016.400000	58.39	---	100.0	H	75.0	19.0	74.00	15.61
16973.200000	---	48.16	200.0	H	207.0	18.1	54.00	5.84
16973.200000	58.07	---	200.0	H	207.0	18.1	74.00	15.93

High Channel: 2480MHz

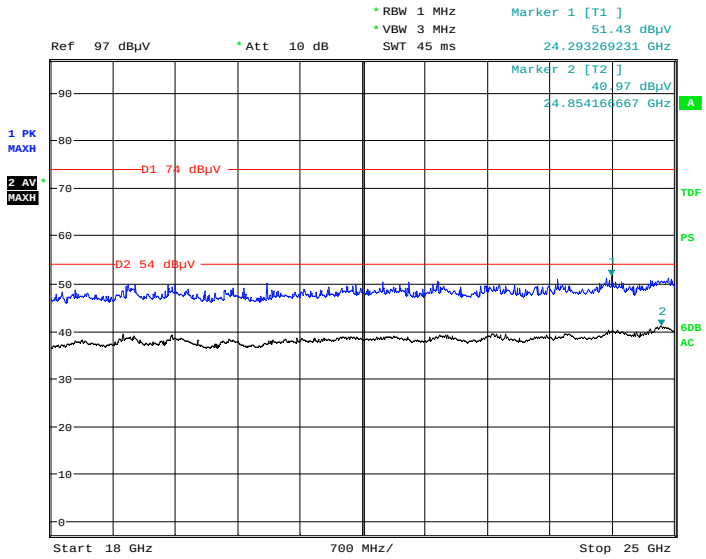


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1547.400000	---	32.20	250.0	V	108.0	-0.9	54.00	21.80
1547.400000	45.66	---	250.0	V	108.0	-0.9	74.00	28.34
2856.400000	---	38.32	100.0	H	79.0	5.2	54.00	15.68
2856.400000	48.49	---	100.0	H	79.0	5.2	74.00	25.51
4960.000000	---	44.37	200.0	V	41.0	11.5	54.00	9.63
4960.000000	52.69	---	200.0	V	41.0	11.5	74.00	21.31
7440.000000	---	44.64	200.0	V	219.0	15.6	54.00	9.36
7440.000000	54.72	---	200.0	V	219.0	15.6	74.00	19.28
11281.600000	---	47.70	100.0	V	269.0	18.7	54.00	6.30
11281.600000	57.66	---	100.0	V	269.0	18.7	74.00	16.34
17065.000000	---	48.71	200.0	V	93.0	18.1	54.00	5.29
17065.000000	57.79	---	200.0	V	93.0	18.1	74.00	16.21

18GHz - 25GHz

*(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **high channel of operation in Y-axis of orientation** was recorded)*

Horizontal



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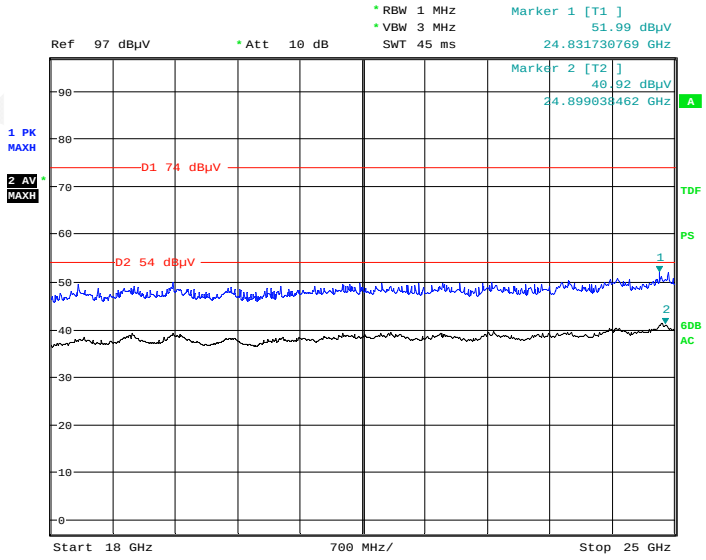
Vertical



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Fundamental Test & Restricted Bands Emissions Test:

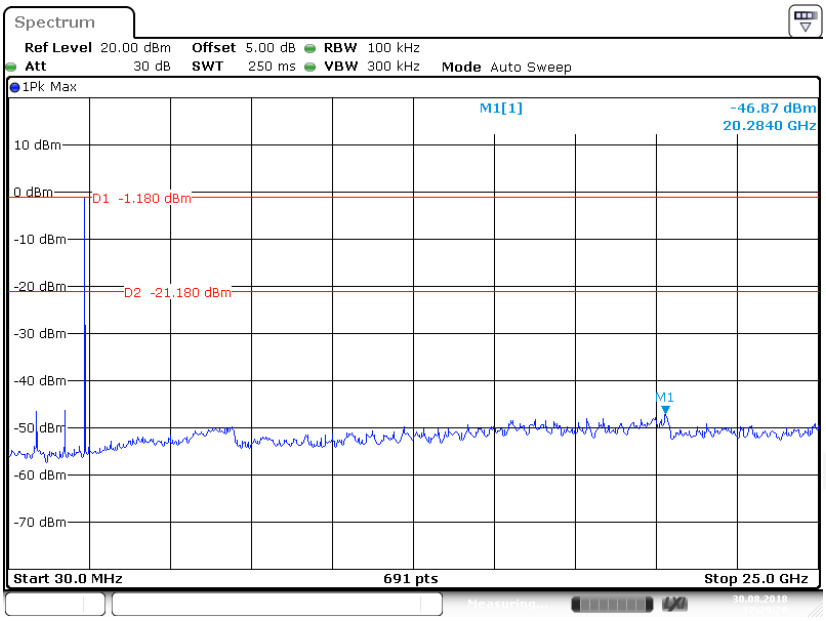
*(Pre-scan in the X, Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)*

Note:
1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
   Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2402MHz								
2402.000000	94.51	---	150.0	V	122.0	2.9	/	/
2402.000000	---	92.25	150.0	V	122.0	2.9	/	/
2402.000000	92.39	---	250.0	H	22.0	2.9	/	/
2402.000000	---	90.11	250.0	H	22.0	2.9	/	/
2390.000000	49.74	---	250.0	V	67.0	2.8	74.00	24.26
2390.000000	---	40.29	250.0	V	67.0	2.8	54.00	13.71
Middle Channel: 2440MHz								
2440.000000	98.14	---	250.0	V	113.0	3.0	/	/
2440.000000	---	95.81	250.0	V	113.0	3.0	/	/
2440.000000	96.06	---	150.0	H	210.0	3.0	/	/
2440.000000	---	93.78	150.0	H	210.0	3.0	/	/
High Channel: 2480MHz								
2480.000000	98.02	---	200.0	V	2.0	3.0	/	/
2480.000000	---	95.67	200.0	V	2.0	3.0	/	/
2480.000000	95.96	---	200.0	H	301.0	3.0	/	/
2480.000000	---	93.73	200.0	H	301.0	3.0	/	/
2483.500000	50.68	---	200.0	V	297.0	3.0	74.00	23.32
2483.500000	---	39.96	200.0	V	297.0	3.0	54.00	14.04

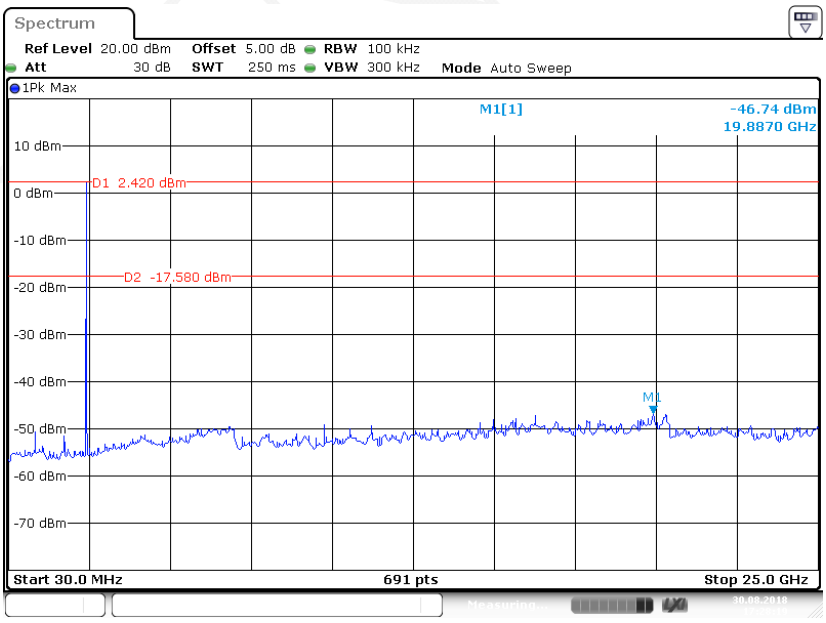
Conducted Spurious Emissions at Antenna Port:

Low Channel



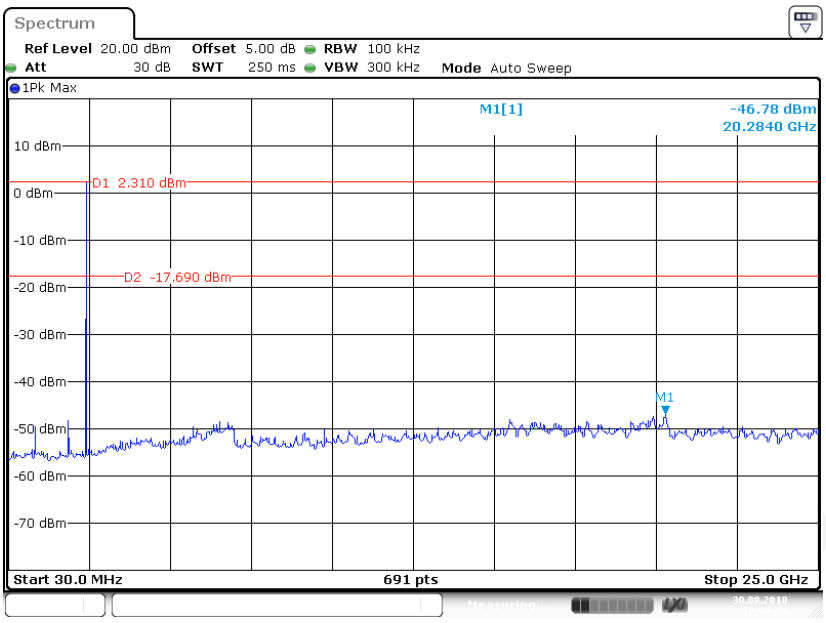
Date: 30.AUG.2018 17:29:29

Middle Channel



Date: 30.AUG.2018 17:28:19

High Channel



Date: 30.AUG.2018 17:30:38

FCC §15.247(a) (2) - 6 dB EMISSION BANDWIDTH

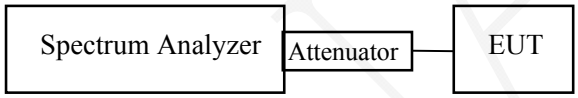
Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3xRBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data

Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

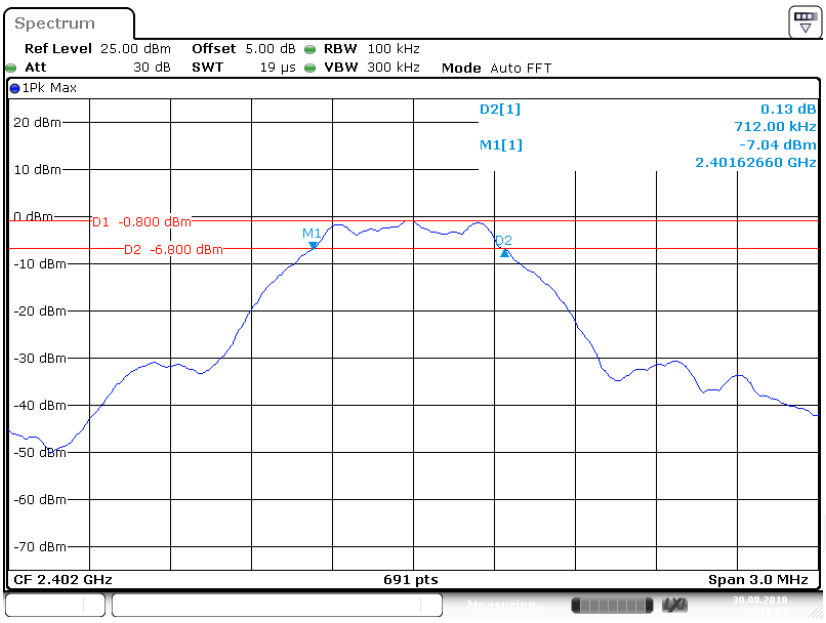
The testing was performed by Hope Zhang on 2018-08-30.

Test Result: Pass.

EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
Low	2402	0.712	≥ 0.5
Middle	2440	0.716	≥ 0.5
High	2480	0.725	≥ 0.5

Low Channel



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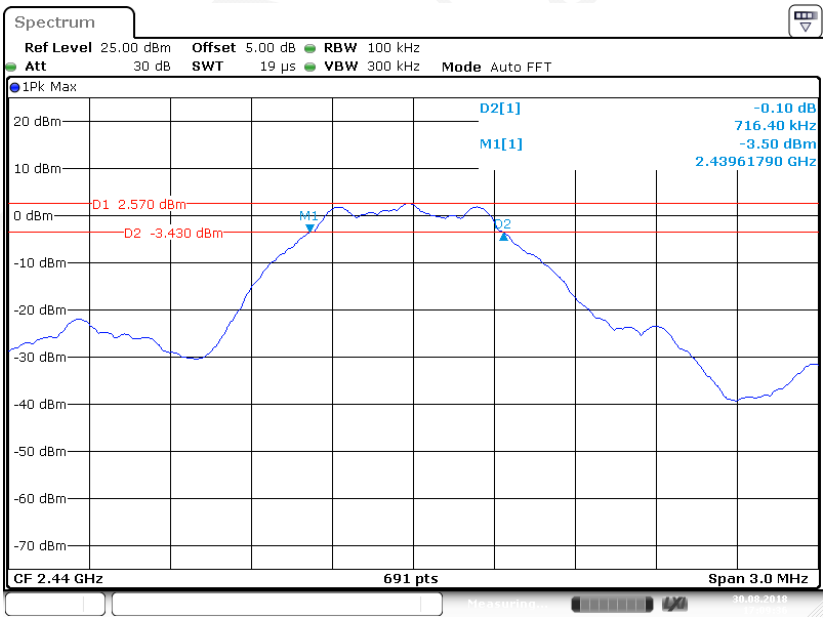
Middle Channel



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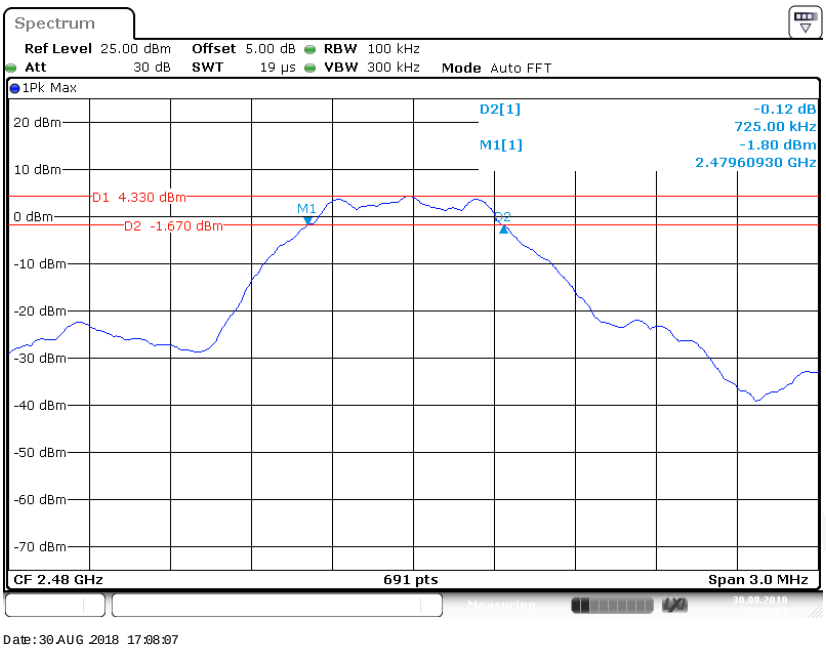
High Channel



FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

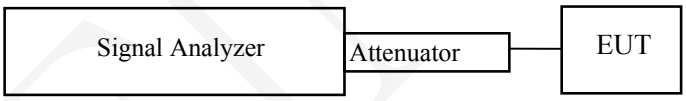
Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.9.1.1

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 x RBW.
3. Set span ≥ 3 x RBW
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.



Test Data

Environmental Conditions

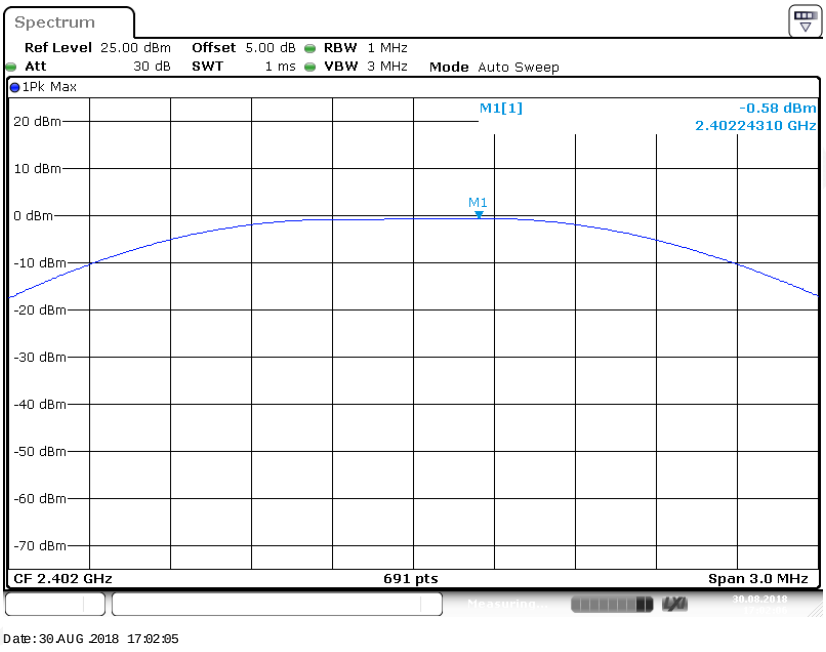
Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Hope Zhang on 2018-08-30.

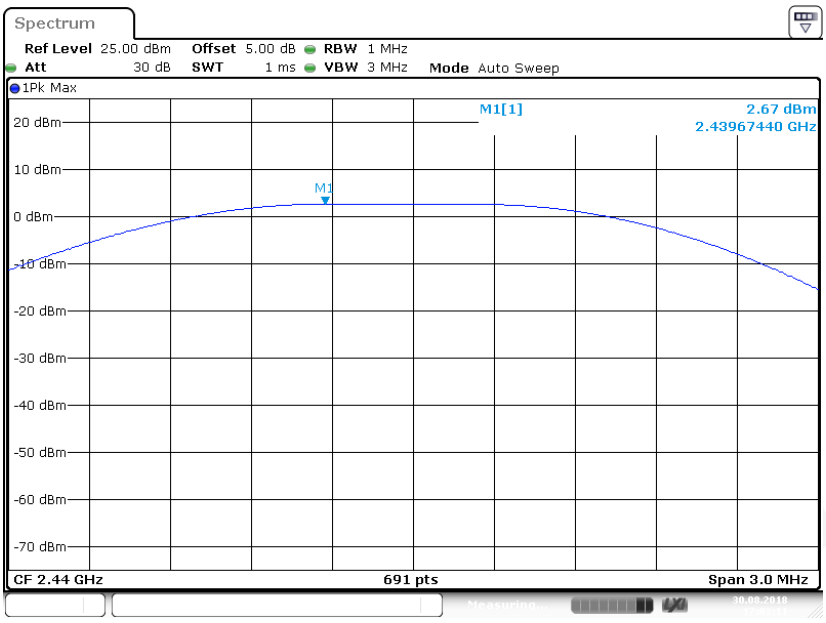
EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	-0.58	≤ 30	Pass
Middle	2440	2.67	≤ 30	Pass
High	2480	4.51	≤ 30	Pass

Low Channel



Middle Channel



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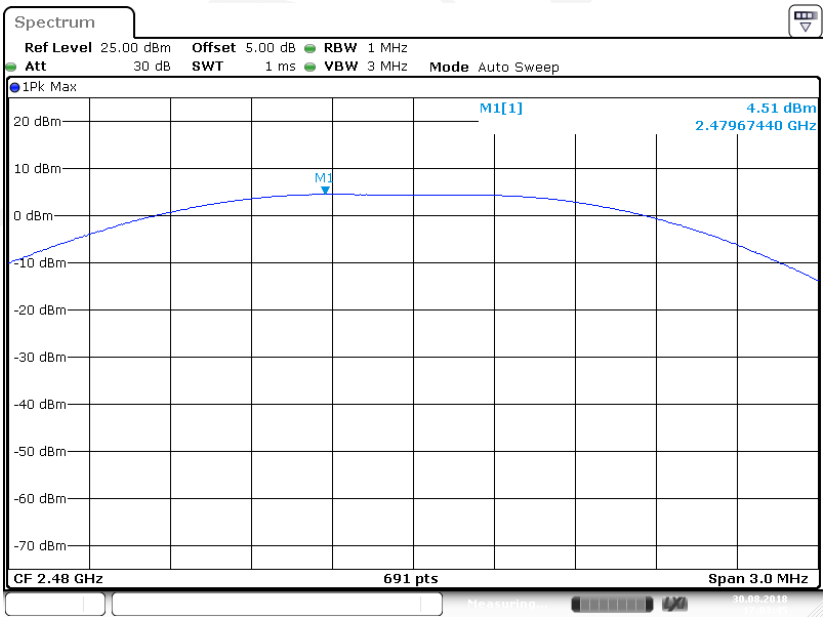
High Channel



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FCC §15.247(d) - BAND EDGE

Applicable Standard

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

Test Procedure

According to ANSI C63.10-2013 clause 6.10

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

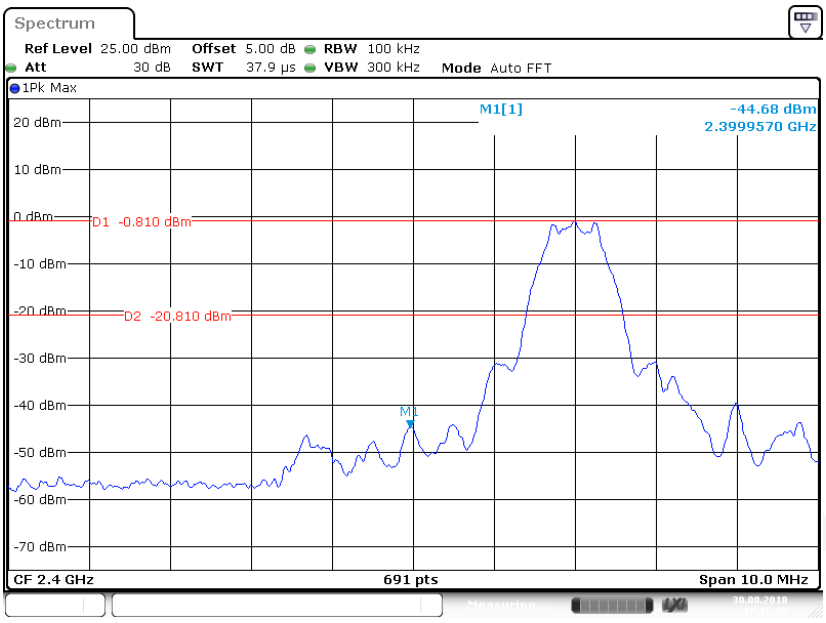
Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Hope Zhang on 2018-08-30.

EUT operation mode: Transmitting

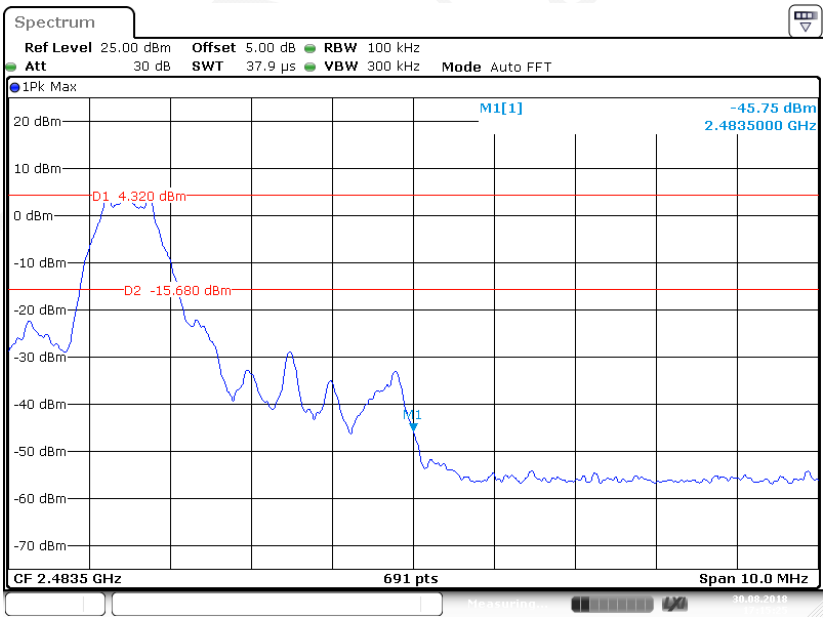
Test Result: *Compliance*

Left Side



Date: 30.AUG.2018 17:16:55

Right Side



Date: 30.AUG.2018 17:15:25

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.10.2

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3xRBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

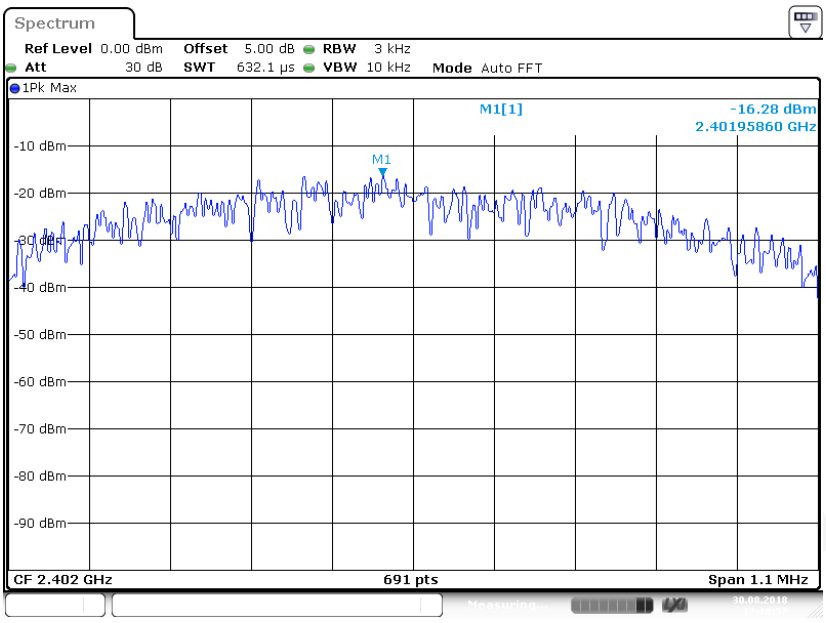
The testing was performed by Hope Zhang on 2018-08-30.

EUT operation mode: Transmitting

Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-16.28	≤ 8
Middle	2440	-12.93	≤ 8
High	2480	-11.33	≤ 8

Low Channel



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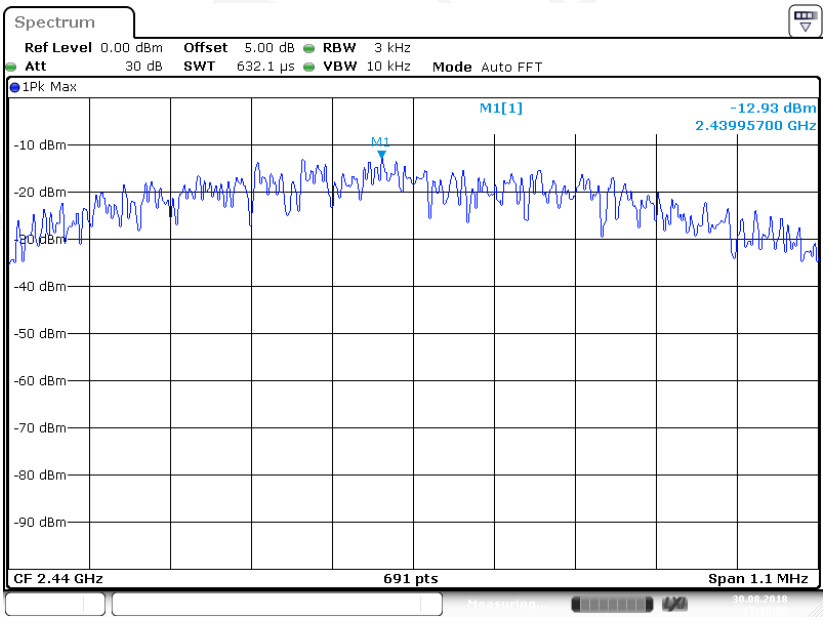
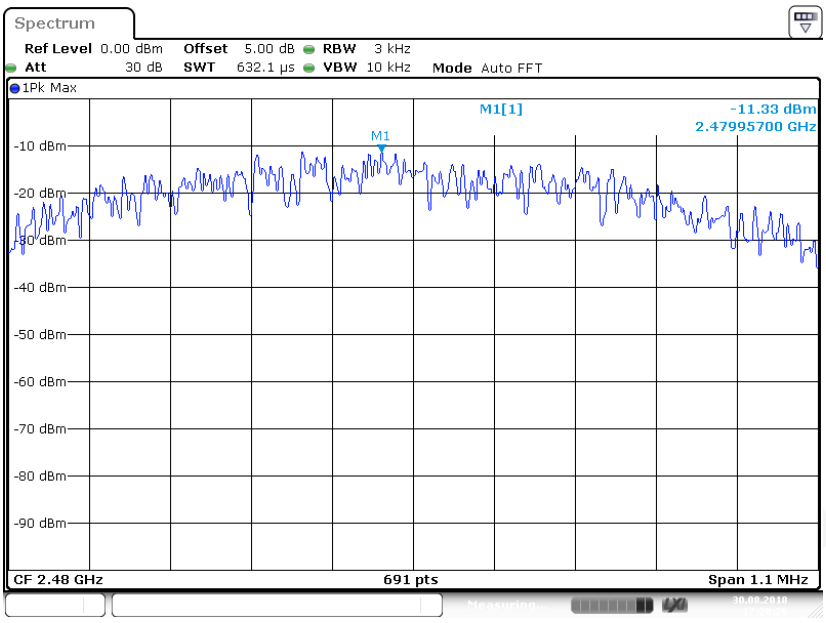
Middle Channel



Date: 30.AUG.2018 17:19:58

High Channel



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