

FCC PART 15.247

TEST REPORT

For

OKIN Refined Electric Technology Co., Ltd.

Plant 4, No. 410, Xinyonglian Road, Wangjiangjing, Development Zone, Jiaxing, Zhejiang,
China

FCC ID: PCU-BTCB02

Report Type: Original Report	Product Type: BT Control Box
Test Engineer:	Edison Hu
Report Number:	RSHA170925001-00A
Report Date:	2017-10-20
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

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
SYSTEM TEST CONFIGURATION	6
DESCRIPTION OF TEST CONFIGURATION	6
EQUIPMENT MODIFICATIONS	6
EUT EXERCISE SOFTWARE	6
SUPPORT EQUIPMENT LIST AND DETAILS	7
EXTERNAL I/O CABLE.....	7
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	9
TEST EQUIPMENT LIST	10
FCC§15.247 (i), §1.1310& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	11
APPLICABLE STANDARD	11
FCC §15.203 - ANTENNA REQUIREMENT.....	12
APPLICABLE STANDARD	12
ANTENNA CONNECTOR CONSTRUCTION	12
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	13
APPLICABLE STANDARD	13
EUT SETUP	13
EMI TEST RECEIVER SETUP.....	13
TEST PROCEDURE	13
CORRECTED FACTOR & MARGIN CALCULATION	14
TEST RESULTS SUMMARY	14
TEST DATA	14
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	17
APPLICABLE STANDARD	17
EUT SETUP	17
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	18
TEST PROCEDURE	18
CORRECTED AMPLITUDE & MARGIN CALCULATION	18
TEST RESULTS SUMMARY	18
TEST DATA	19
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH.....	23
APPLICABLE STANDARD	23
TEST PROCEDURE	23
TEST DATA	23
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....	26
APPLICABLE STANDARD	26
TEST PROCEDURE	26
TEST DATA	26

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....	29
APPLICABLE STANDARD	29
TEST PROCEDURE	29
TEST DATA	29
FCC §15.247(e) - POWER SPECTRAL DENSITY	31
APPLICABLE STANDARD	31
TEST PROCEDURE	31
TEST DATA	31

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	OKIN Refined Electric Technology Co., Ltd.
Tested Model	BT-CB.02
Product Type	BT Control Box
Dimension	83.5 mm(L)×60.0 mm(W)×36.5 mm(H)
Power Supply	DC 29V

**All measurement and test data in this report was gathered from production sample serial number: 20170925001.
(Assigned by the BACL. The EUT supplied by the applicant was received on 2017-09-25)*

Objective

This report is prepared on behalf of OKIN Refined Electric Technology 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)

N/A

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 KDB558074 D01 DTS Meas Guidance v04.

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	4.88dB
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.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel list for BLE mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	...	...
...	...	...	...
...	...	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

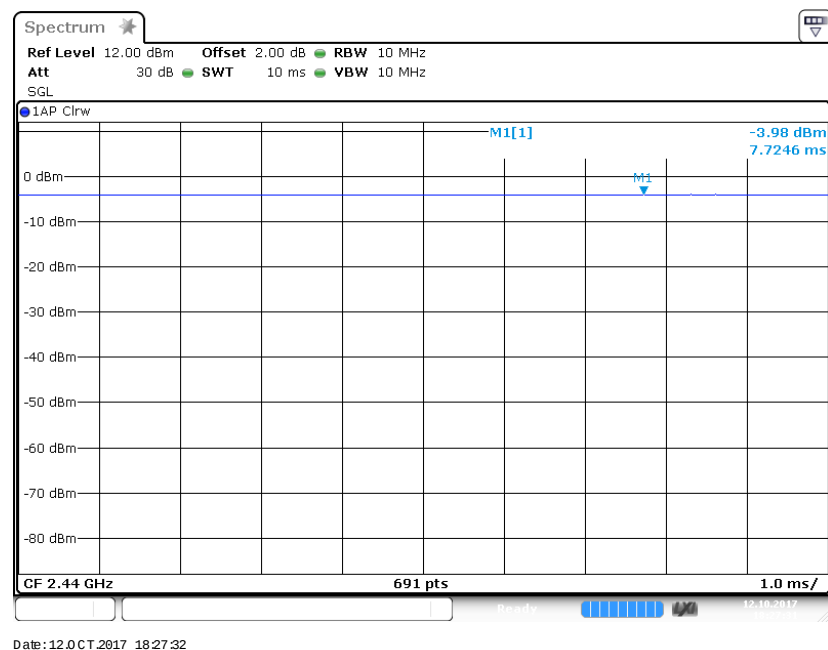
RF test tool: Bluetool

BLE : Power level: 0

The worst case was performed as below:

Duty Cycle:

Middle Channel



Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/x)
100	/	/	10Hz	0.0

Support Equipment List and Details

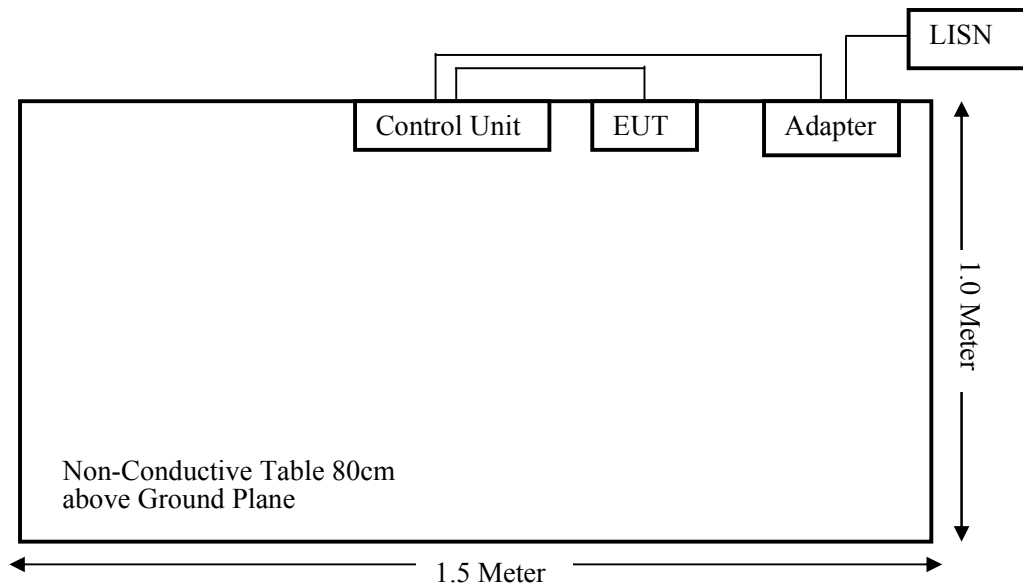
Manufacturer	Description	Model	Serial Number
OKIN	Control Unit	CB1342	CB134201A17802010251
OKIN	Adapter Input:AC100-240V, 50/60Hz, 1.5A Output:DC29V, 1.8A	09-290018	JLDP.10.023.000

External I/O Cable

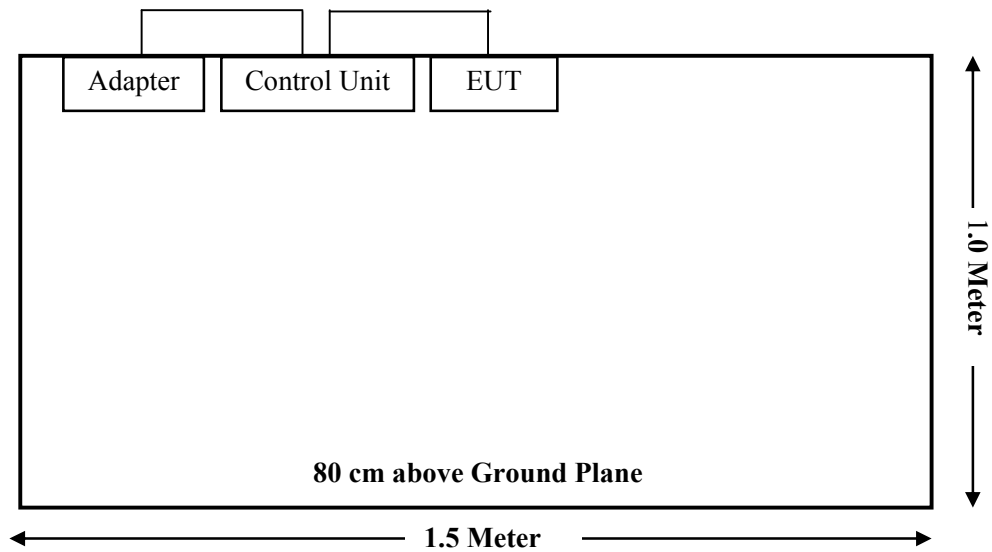
Cable Description	Length (m)	From Port	To
Power Cable	1.2	Control Unit	Adapter
Power Cable	1.2	Adapter	LISN

Block Diagram of Test Setup

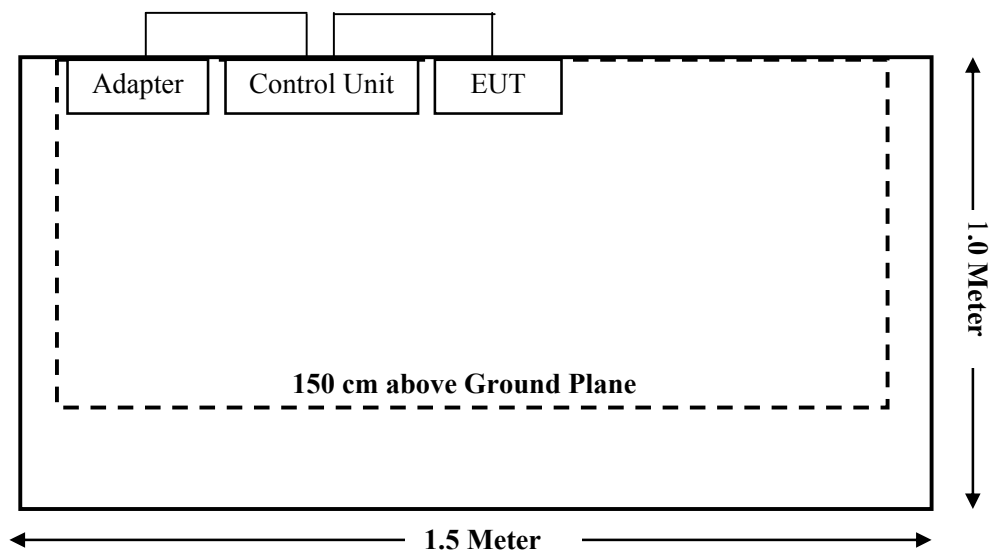
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

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	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A040914-2	2016-01-09	2019-01-08
Sonoma Instrument	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
Radiated Emission Test (Chamber 2#)					
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Heatsink Required	Amplifier	QLW-18405536-J0	15964001009	2016-12-12	2017-12-11
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2017-07-22	2018-07-21
Agilent	Power Meter	N1912A	MY5000492	2016-11-18	2017-11-17
Agilent	Power Sensor	N1921A	MY54210024	2016-11-18	2017-11-17
OKIN	RF Cable	N/A	N/A	2017-10-10	2018-10-09
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2017-10-10	2018-10-09
Rohde & Schwarz	LISN	ENV216	3560655016	2016-11-25	2017-11-24
BACL	BACL-EMC	V1.0	CE001	/	/
Narda	Attenuator/6dB	10690812-2	26850-6	2017-01-10	2018-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2017-08-15	2018-08-14

* **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& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) 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;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = 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);

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Target Output Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402-2480	1.50	1.41	-4.0	0.40	20	0.0001	1

Note: For the above target output power is declared by the manufacturer.

Result: The device meet FCC MPE at 20 cm distance.

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 a PCB antenna arrangement for BLE, which the antenna gain is 1.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(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.

EMI Test Receiver Setup

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

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

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

Test Procedure

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

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

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

Corrected Factor & Margin Calculation

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

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

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

$$\text{Margin} = \text{Limit} - \text{Reading}$$

Test Results Summary

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

Test Data

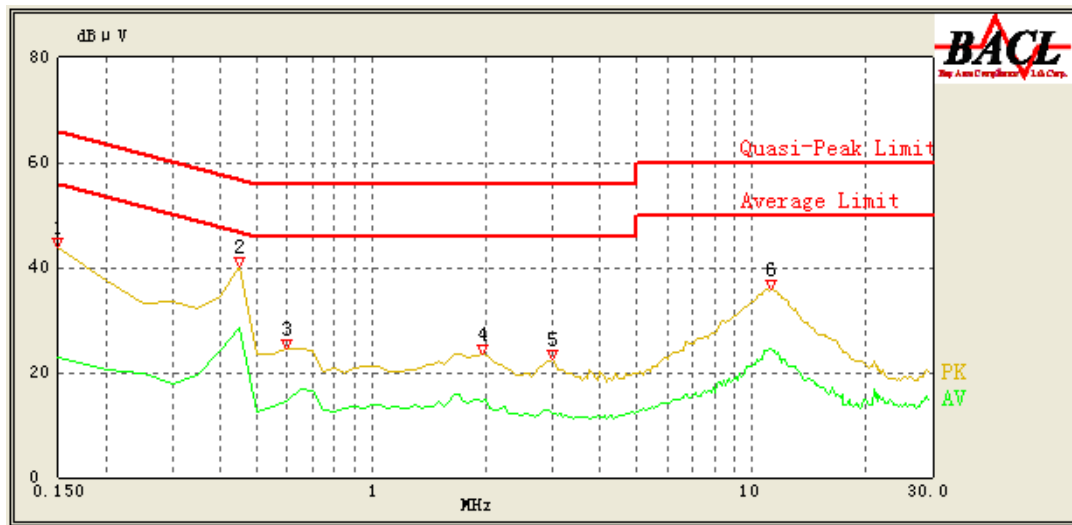
Environmental Conditions

Temperature:	20.2 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

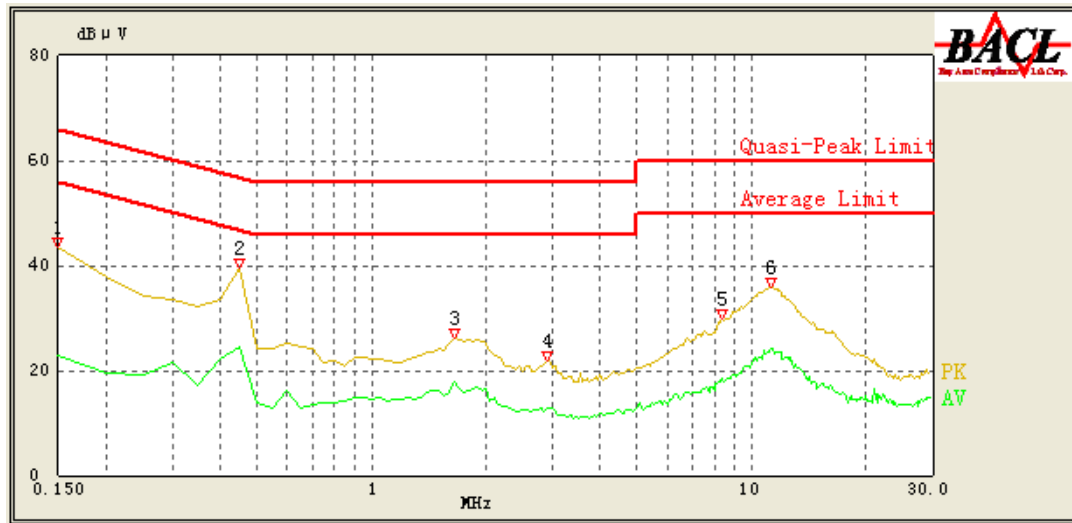
The testing was performed by Edison Hu on 2017-10-11.

EUT operation mode: Transmitting in low channel (Worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Reading (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corr. (dB)	Limit (dBμV)	Margin (dB)	Comment
0.150	43.80	QP	9.000	L1	16.06	66.00	22.20	Compliance
0.150	22.83	AV	9.000	L1	16.06	56.00	33.17	Compliance
0.450	40.33	QP	9.000	L1	16.07	57.43	17.10	Compliance
0.450	28.65	AV	9.000	L1	16.07	47.43	18.78	Compliance
0.600	24.59	QP	9.000	L1	16.01	56.00	31.41	Compliance
0.600	14.59	AV	9.000	L1	16.01	46.00	31.41	Compliance
1.950	23.55	QP	9.000	L1	15.85	56.00	32.45	Compliance
1.950	14.64	AV	9.000	L1	15.85	46.00	31.36	Compliance
3.000	22.41	QP	9.000	L1	15.85	56.00	33.59	Compliance
3.000	12.22	AV	9.000	L1	15.85	46.00	33.78	Compliance
11.200	35.94	QP	9.000	L1	16.10	60.00	24.06	Compliance
11.150	24.65	AV	9.000	L1	16.09	50.00	25.35	Compliance

AC 120V/60 Hz, Neutral

Frequency (MHz)	Reading (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corr. (dB)	Limit (dBμV)	Margin (dB)	Comment
0.150	43.59	QP	9.000	N	16.06	66.00	22.41	Compliance
0.150	22.90	AV	9.000	N	16.06	56.00	33.10	Compliance
0.450	39.62	QP	9.000	N	16.10	57.43	17.81	Compliance
0.450	24.46	AV	9.000	N	16.10	47.43	22.97	Compliance
1.650	26.11	QP	9.000	N	15.92	56.00	29.89	Compliance
1.650	17.69	AV	9.000	N	15.92	46.00	28.31	Compliance
2.900	21.80	QP	9.000	N	15.90	56.00	34.20	Compliance
2.900	12.86	AV	9.000	N	15.90	46.00	33.14	Compliance
8.350	29.69	QP	9.000	N	15.95	60.00	30.31	Compliance
8.400	18.43	AV	9.000	N	15.95	50.00	31.57	Compliance
11.200	35.92	QP	9.000	N	15.99	60.00	24.08	Compliance
11.250	24.09	AV	9.000	N	15.99	50.00	25.91	Compliance

Note:

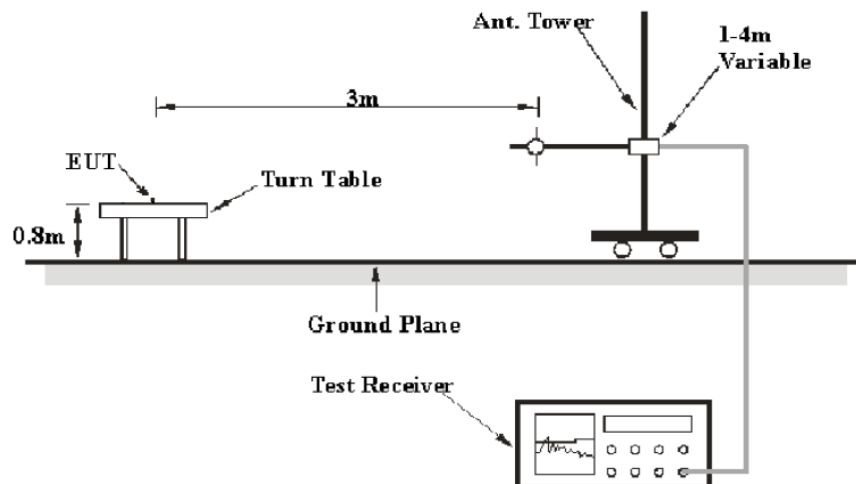
- 1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
- 2) Margin = Limit – Reading

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

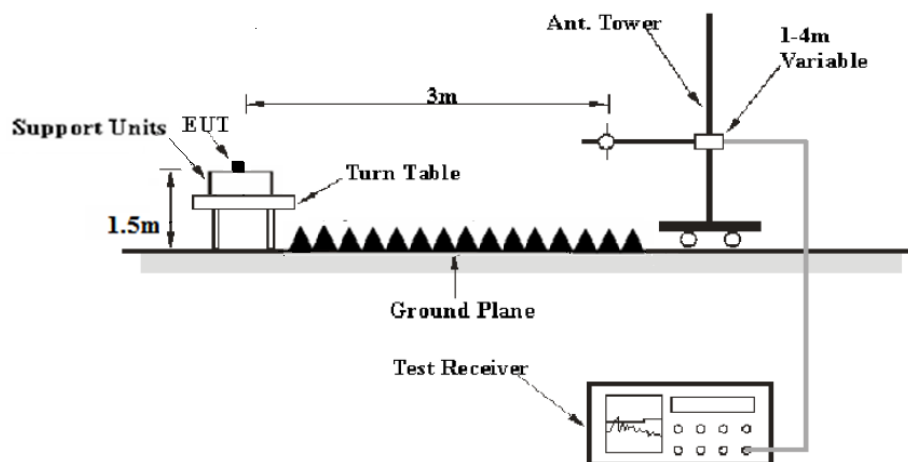
FCC §15.247 (d); §15.209; §15.205;

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 & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Frequency Range	Item	RBW	Video B/W	Duty cycle	Detector
1GHz – 25GHz	PK Value	1MHz	3 MHz	Any	PK
	AV Value	1MHz	10 Hz	>98%	PK
		1MHz	1/T	<98%	

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 detection mode for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

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

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

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

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

Test 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:	24.1 °C
Relative Humidity:	54 %
ATM Pressure:	101.2kPa

The testing was performed by Edison Hu on 2017-10-10 to 2017-10-12.

EUT operation mode: Transmitting (Scan with X-Axis, Y-Axis and Z-Axis position, the worst case was recorded)

30MHz-25GHz

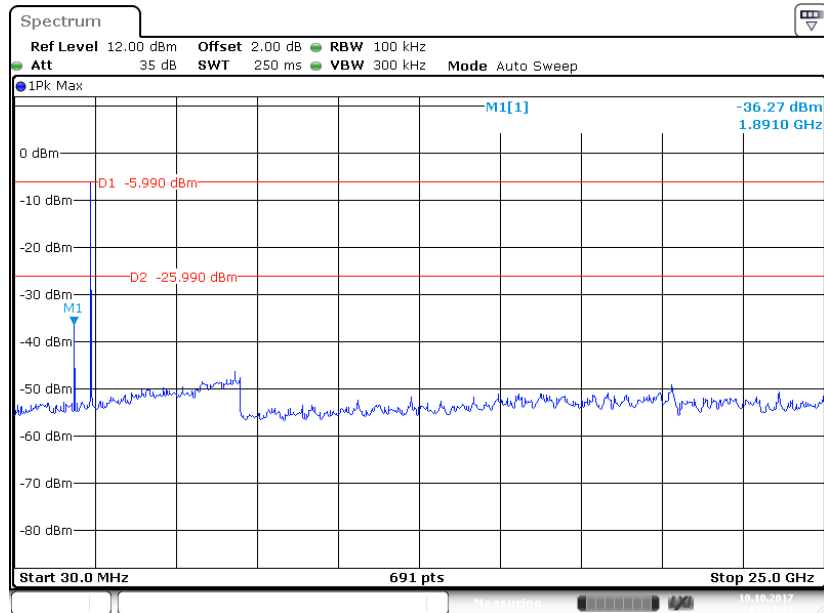
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/ Ave.)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2402 MHz)									
72.00	44.52	QP	282	214	V	-17.15	27.37	40.00	12.63
2402.00	89.79	PK	107	128	V	-4.93	84.86	/	/
2402.00	88.44	Ave	107	128	V	-4.93	83.51	/	/
2402.00	95.37	PK	68	183	H	-4.93	90.44	/	/
2402.00	93.80	Ave	68	183	H	-4.93	88.87	/	/
2390.00	46.54	PK	123	179	H	-4.96	41.58	74.00	32.42
2390.00	32.48	Ave	123	179	H	-4.96	27.52	54.00	26.48
1200.00	52.11	PK	246	161	V	-10.24	41.87	74.00	32.13
1200.00	41.08	Ave	246	161	V	-10.24	30.84	54.00	23.16
1365.00	49.23	PK	233	156	V	-9.04	40.19	74.00	33.81
1365.00	38.62	Ave	233	156	V	-9.04	29.58	54.00	24.42
4804.00	46.51	PK	132	247	H	2.41	48.92	74.00	25.08
4804.00	30.12	Ave	132	247	H	2.41	32.53	54.00	21.47
7206.00	43.31	PK	171	175	H	9.79	53.1	74.00	20.9
7206.00	29.02	Ave	171	175	H	9.79	38.81	54.00	15.19

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/ Ave.)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Middle Channel (2440 MHz)									
72.00	44.14	QP	357	176	V	-17.15	26.99	40.00	13.01
2440.00	86.78	PK	104	213	V	-4.83	81.95	/	/
2440.00	83.37	Ave	104	213	V	-4.83	78.54	/	/
2440.00	96.70	PK	321	119	H	-4.83	91.87	/	/
2440.00	87.96	Ave	321	119	H	-4.83	83.13	/	/
1200.00	43.55	PK	327	130	V	-10.24	33.31	74.00	40.69
1200.00	30.57	Ave	327	130	V	-10.24	20.33	54.00	33.67
3060.00	44.70	PK	176	190	V	-1.91	42.79	74.00	31.21
3060.00	30.65	Ave	176	190	V	-1.91	28.74	54.00	25.26
4880.00	46.88	PK	274	179	H	2.64	49.52	74.00	24.48
4880.00	30.56	Ave	274	179	H	2.64	33.2	54.00	20.80
6470.00	44.75	PK	99	191	V	8.12	52.87	74.00	21.13
6470.00	30.79	Ave	99	191	V	8.12	38.91	54.00	15.09
7320.00	43.49	PK	181	108	H	9.96	53.45	74.00	20.55
7320.00	29.22	Ave	181	108	H	9.96	39.18	54.00	14.82

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/ Ave.)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2480MHz)									
72.00	44.26	QP	228	205	V	-17.15	27.11	40.00	12.89
2480.00	87.95	PK	310	204	V	-4.72	83.23	/	/
2480.00	81.18	Ave	310	204	V	-4.72	76.46	/	/
2480.00	96.94	PK	309	181	H	-4.72	92.22	/	/
2480.00	85.21	Ave	309	181	H	-4.72	80.49	/	/
2483.50	62.09	PK	213	216	H	-4.71	57.38	74.00	16.62
2483.50	43.51	Ave	213	216	H	-4.71	38.8	54.00	15.20
2562.00	53.43	PK	57	171	V	-4.34	49.09	74.00	24.91
2562.00	32.15	Ave	57	171	V	-4.34	27.81	54.00	26.19
4960.00	47.28	PK	2	215	H	2.82	50.1	74.00	23.90
4960.00	30.76	Ave	2	215	H	2.82	33.58	54.00	20.42
6470.00	44.35	PK	65	113	V	8.12	52.47	74.00	21.53
6470.00	30.72	Ave	65	113	V	8.12	38.84	54.00	15.16
7440.00	43.70	PK	84	179	H	10.14	53.84	74.00	20.16
7440.00	29.72	Ave	84	179	H	10.14	39.86	54.00	14.14

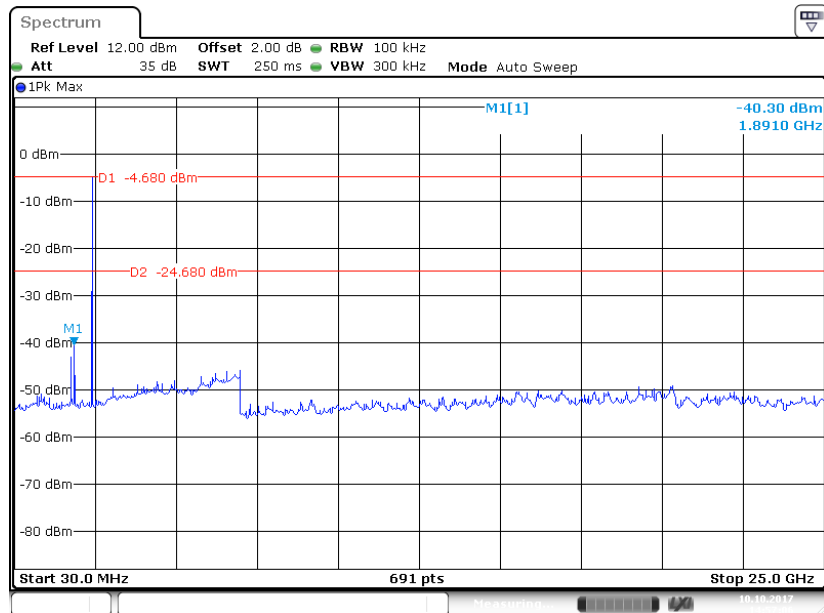
Conducted Spurious Emissions at Antenna Port

Low Channel



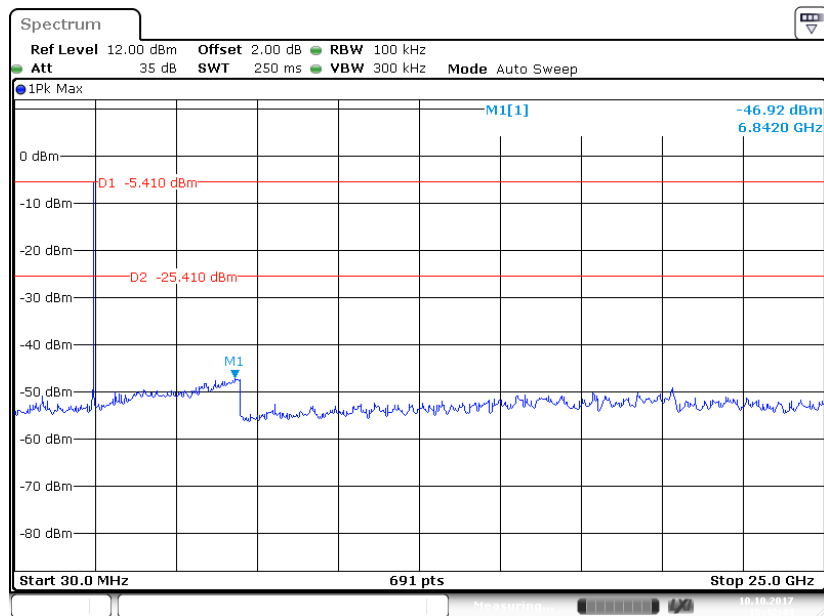
Date: 10 OCT 2017 15:39:11

Middle Channel



Date: 10 OCT 2017 14:57:07

High Channel



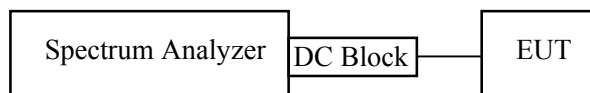
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
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 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

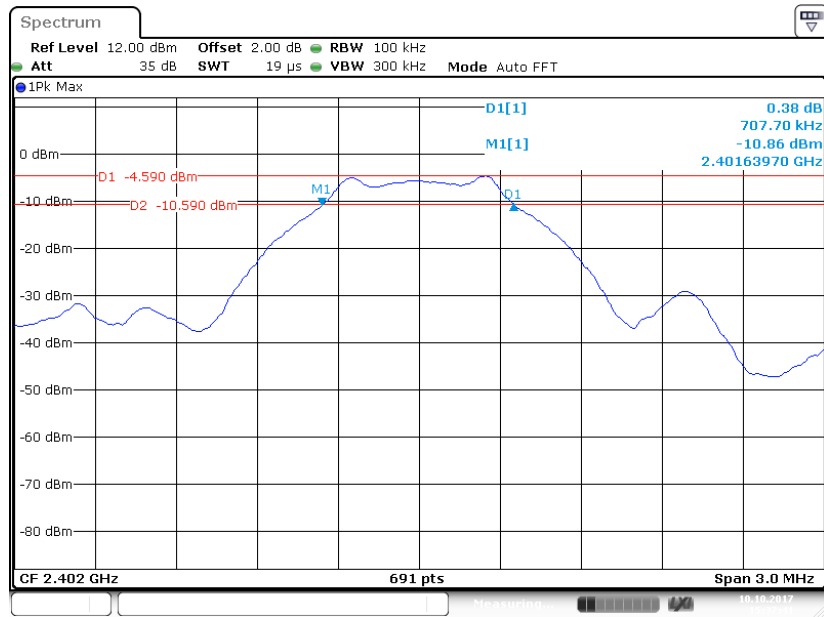
The testing was performed by Edison Hu on 2017-10-10.

Test Result: Pass.

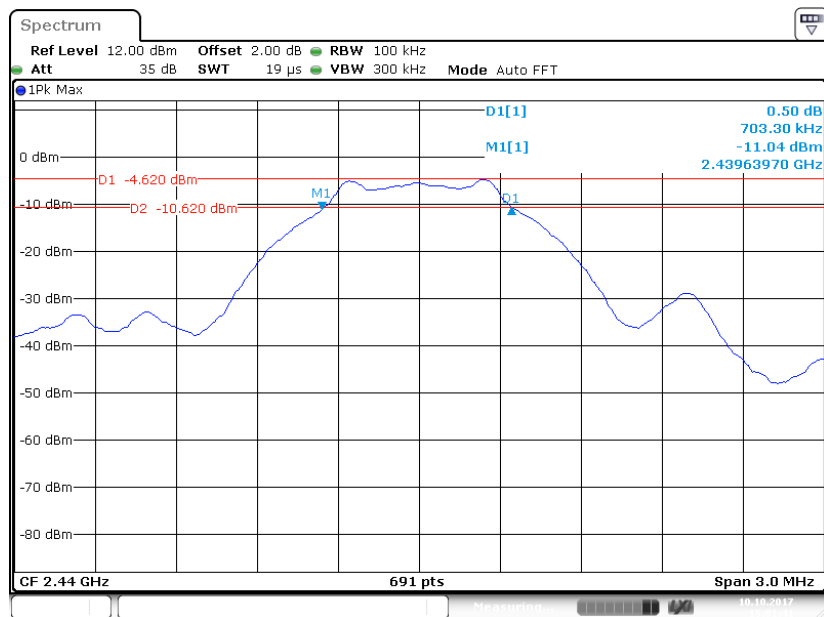
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
Low	2402	0.707	≥ 0.5
Middle	2440	0.703	≥ 0.5
High	2480	0.712	≥ 0.5

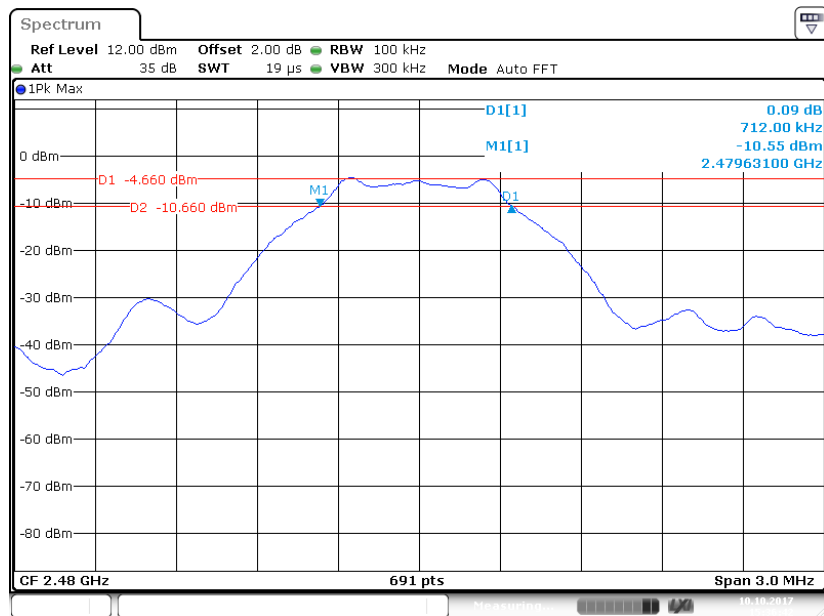
Low Channel



Middle Channel



High Channel



Date: 10 OCT 2017 15:36:42

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

1. Set the RBW $\geq$ DTS bandwidth.
2. Set VBW $\geq$ 3 x RBW.
3. Set span $\geq$ 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

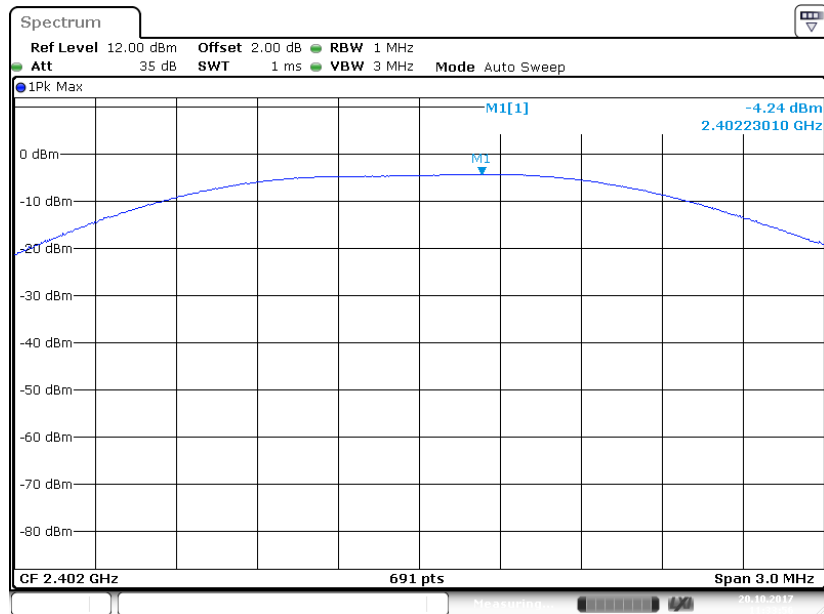
Temperature:	23.8°C
Relative Humidity:	54 %
ATM Pressure:	101.2 kPa

The testing was performed by Edison Hu on 2017-10-20.

EUT operation mode: Transmitting

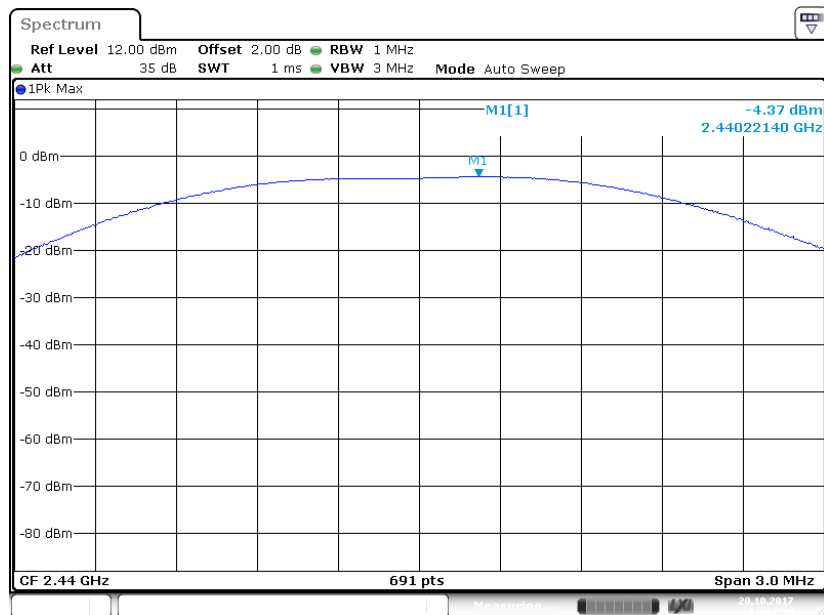
Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	-4.24	30	Pass
Middle	2440	-4.37	30	Pass
High	2480	-4.44	30	Pass

Low Channel



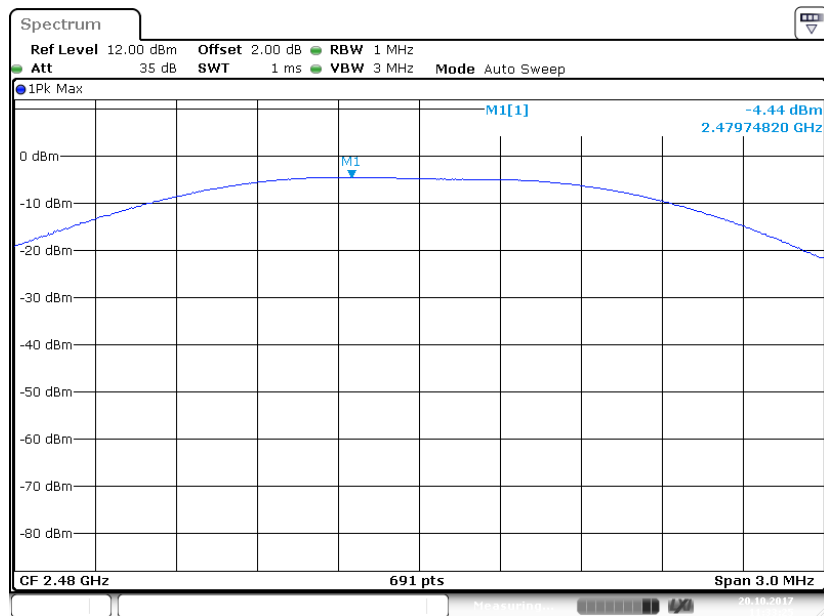
Date: 20.10.2017 11:33:56

Middle Channel



Date: 20.10.2017 11:34:29

High Channel



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

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

Test Procedure

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

Test Data**Environmental Conditions**

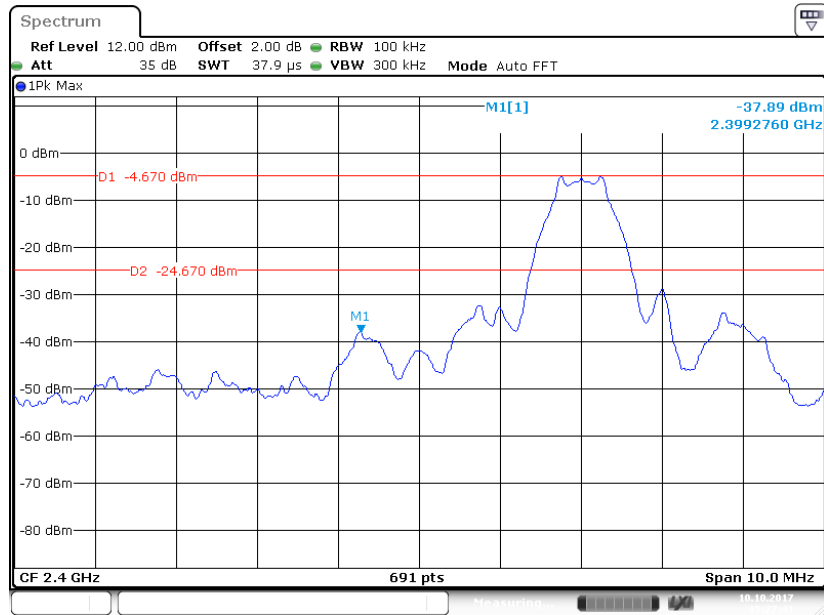
Temperature:	24.3 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Edison Hu on 2017-10-10.

Test Result: *Compliance*

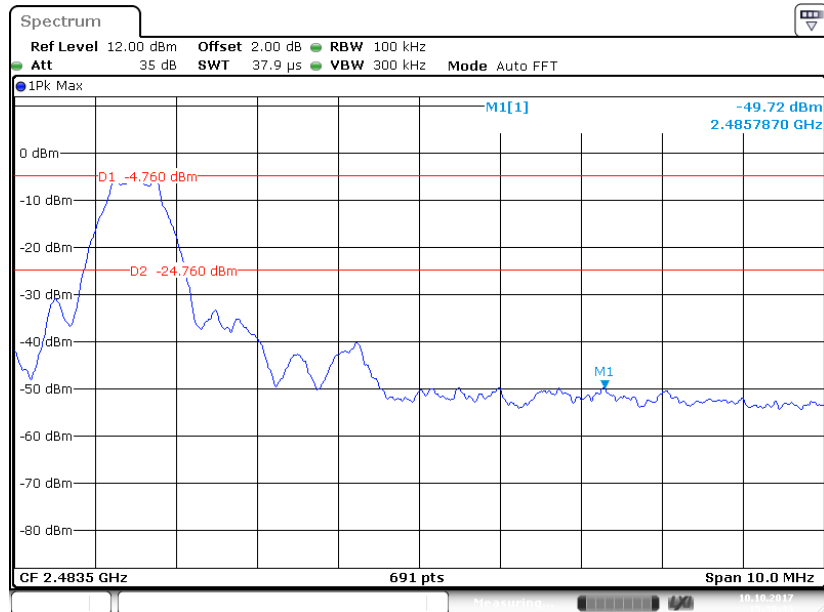
Band Edge

Left Side



Date: 10 OCT 2017 15:27:41

Right Side



Date: 10 OCT 2017 15:30:33

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 KDB558074 D01 DTS Meas Guidance v04.

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
3. Set the VBW $\geq 3 \times \text{RBW}$.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

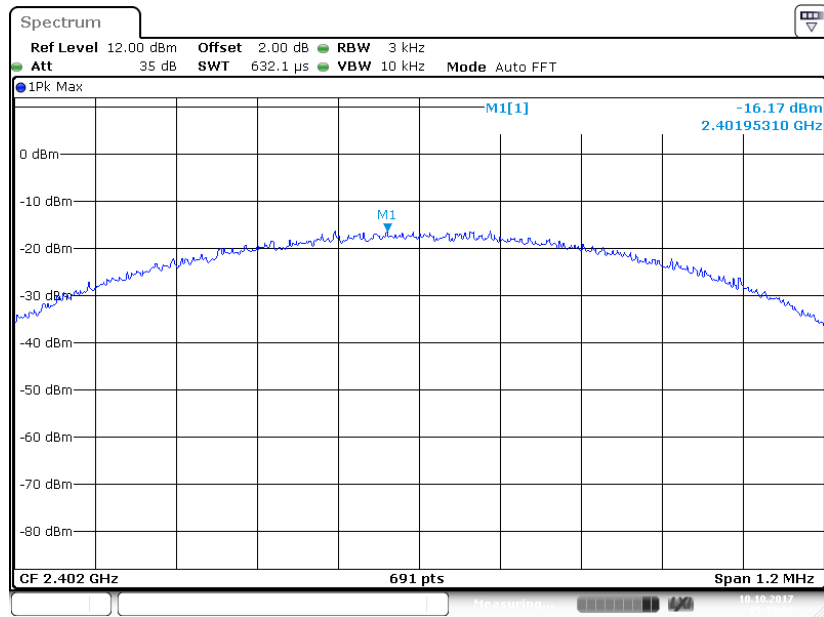
The testing was performed by Edison Hu on 2017-10-10.

EUT operation mode: Transmitting

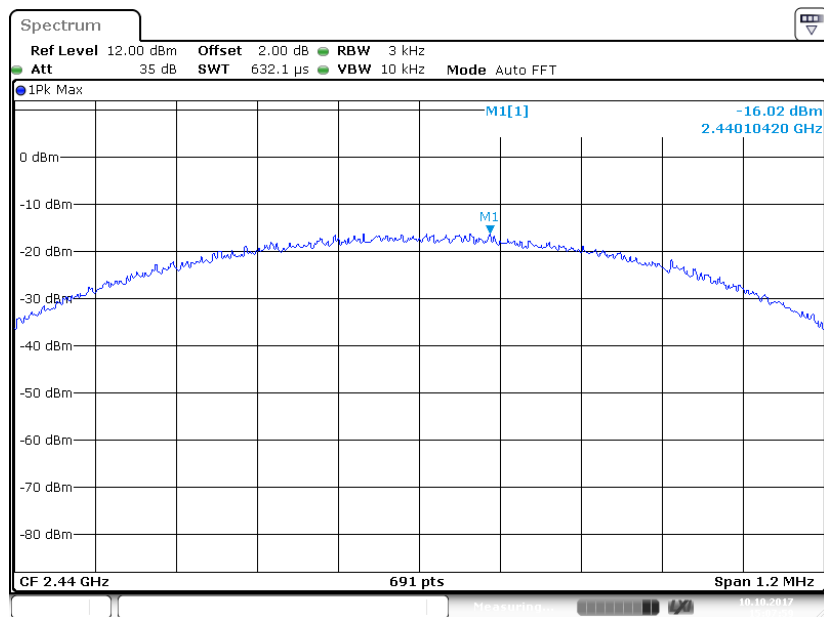
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-16.17	≤ 8
Middle	2440	-16.02	≤ 8
High	2480	-16.35	≤ 8

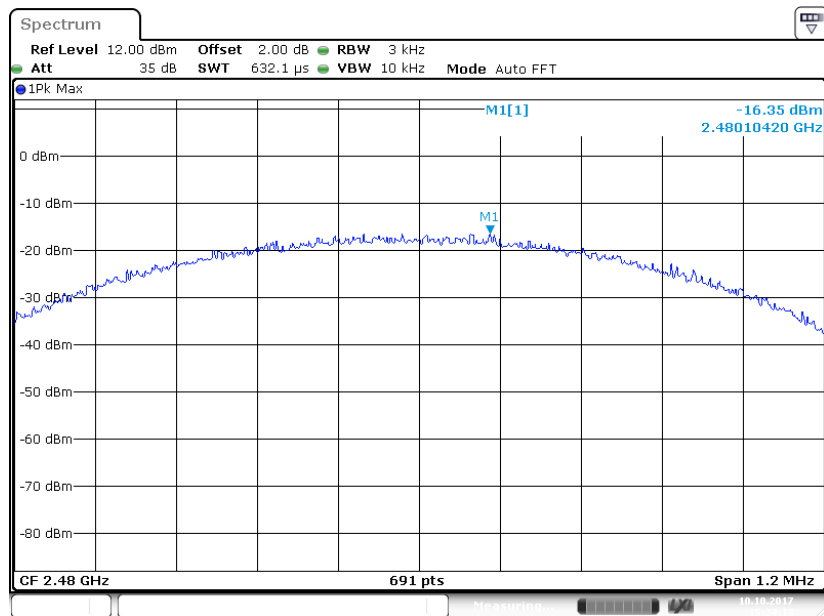
Low Channel



Middle Channel



High Channel



Date: 10 OCT 2017 15:24:13

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