



# FCC PART 15.247 TEST REPORT

For

## **MOIMSTONE CO., LTD**

16, sapyeong-daero, Seocho-gu, Seoul, South Korea

### **FCC ID: 2AAKFAIPHONE**

Report Type: **Product Type:** AI Phone Original Report **Report Number:** RSZ180723002-00C **Report Date:** 2018-08-17 Rocky Kang Rocky Kang Reviewed By: RF Engineer **Prepared By:** Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

**Note**: This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA\* or any agency of the Federal Government. \* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "\*".

## **TABLE OF CONTENTS**

GENERAL INFORMATION	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	
OBJECTIVE	
RELATED SUBMITTAL(S)/GRANT(S) TEST METHODOLOGY	
MEASUREMENT UNCERTAINTY	
SYSTEM TEST CONFIGURATION	
DESCRIPTION OF TEST CONFIGURATION	
EQUIPMENT MODIFICATIONS	
EÙT Exercise Software	
DUTY CYCLE	
EXTERNAL I/O CABLE	
BLOCK DIAGRAM OF TEST SETUP	
SUMMARY OF TEST RESULTS	12
TEST EQUIPMENT LIST	13
FCC §15.247 (i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)	15
APPLICABLE STANDARD	
Result	15
FCC §15.203 - ANTENNA REQUIREMENT	17
APPLICABLE STANDARD	
ANTENNA CONNECTOR CONSTRUCTION	17
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	18
APPLICABLE STANDARD	
EUT SETUP	
EMI TEST RECEIVER SETUP	
TEST PROCEDURE	
CORRECTED FACTOR & MARGIN CALCULATION	
TEST DATA	
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS	
APPLICABLE STANDARD	
EUT SETUP	
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	
TEST PROCEDURE	
CORRECTED AMPLITUDE & MARGIN CALCULATION	
TEST RESULTS SUMMARY	
TEST DATA	
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH	
APPLICABLE STANDARD	
TEST PROCEDURE	
Test Data	
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER	
APPLICABLE STANDARD	48

TEST PROCEDURE	48
Test Data	48
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE	50
APPLICABLE STANDARD	50
TEST PROCEDURE	50
Test Data	50
FCC §15.247(e) - POWER SPECTRAL DENSITY	56
APPLICABLE STANDARD	56
TEST PROCEDURE	56
TEST DATA	56

### **GENERAL INFORMATION**

#### **Product Description for Equipment under Test (EUT)**

The *MOIMSTONE CO.*, *LTD*'s product, model number: *AI-PHONE* (*FCC ID*: 2AAKFAIPHONE) or the "EUT" in this report was an *AI Phone*, which was measured approximately: 224 mm (L) \* 170 mm (W) \* 144 mm (H), rated with input voltage: DC 5 V from adapter.

Report No.: RSZ180723002-00C

Adapter Information: Model: KT241050300US

Input:  $100-240V \sim 50/60Hz$ , 0.8A

Output: 5V, 3A

\*All measurement and test data in this report was gathered from production sample serial number: 180723002 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-07-23.

#### **Objective**

This report is prepared on behalf of *MOIMSTONE CO.*, *LTD* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's 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 15B JBP, Part 15.247 DSS and Part 15.407 NII submissions with FCC ID: 2AAKFAIPHONE.

#### **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 KDB 558074 D01 DTS Meas Guidance v04.

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.

FCC Part 15.247 Page 4 of 65

### **Measurement Uncertainty**

Para	meter	Uncertainty	
Occupied Cha	nnel Bandwidth	±5%	
RF Output Power	r with Power meter	±0.5dB	
RF conducted test with spectrum		±1.5dB	
AC Power Lines Conducted Emissions		±1.95dB	
Emissions,	Below 1GHz	±4.75dB	
Radiated	Above 1GHz	±4.88dB	
Temperature		±3℃	
Humidity		±6%	
Supply	voltages	±0.4%	

Report No.: RSZ180723002-00C

### **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.

FCC Part 15.247 Page 5 of 65

### **SYSTEM TEST CONFIGURATION**

### **Description of Test Configuration**

For 802.11b, 802.11g and 802.11n-HT20 mode, 11 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	/	/
6	2437	/	/
7	2442	/	/

Report No.: RSZ180723002-00C

For 802.11b, 802.11g, 802.11n-HT20 mode, EUT was tested with Channel 1, 6 and 11.

For 802.11n-HT40 mode, 7 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2422	6	2447
2	2427	7	2452
3	2432	/	/
4	2437	/	/
5	2442	/	/

EUT was tested with Channel 1, 4 and 7.

FCC Part 15.247 Page 6 of 65

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

Report No.: RSZ180723002-00C

EUT was tested with Channel 0, 19 and 39.

### **Equipment Modifications**

No modification was made to the EUT tested.

### **EUT Exercise Software**

CMD command was used for BLE & Wi-Fi testing.

The device was tested with the worst case was performed as below:

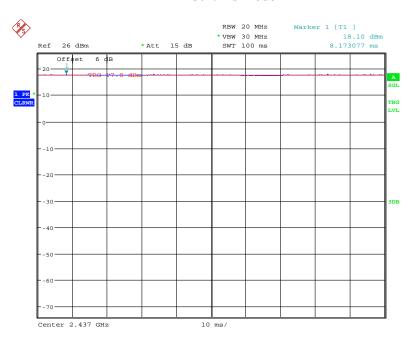
Mode	Data wata	Power level		
Mode	Data rate	Low channel	Middle channel	High channel
802.11b	1 Mbps	12	12	12
802.11g	6 Mbps	9	9	9
802.11n-HT20	MCS0	9	9	9
802.11n-HT40	MCS0	9	9	9
BLE	/	Default	Default	Default

Pre-scan with all the data rates, the above data rate is the worst case for Wi-Fi test.

FCC Part 15.247 Page 7 of 65

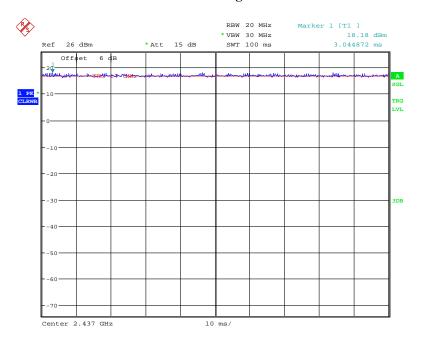
## **Duty cycle**

#### 802.11b mode



Date: 3.AUG.2018 10:07:27

## 802.11g mode

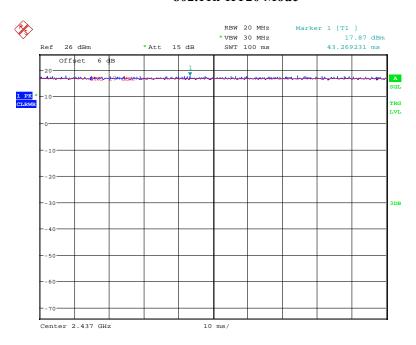


Date: 3.AUG.2018 10:08:15

FCC Part 15.247 Page 8 of 65

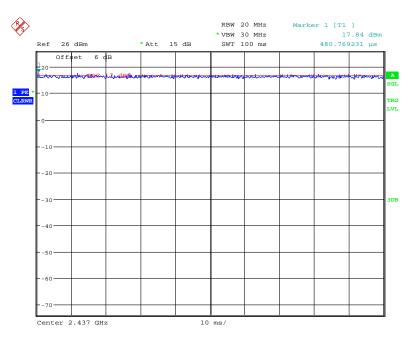
### Report No.: RSZ180723002-00C

### 802.11n-HT20 Mode



Date: 3.AUG.2018 10:08:37

#### 802.11n-HT40 Mode

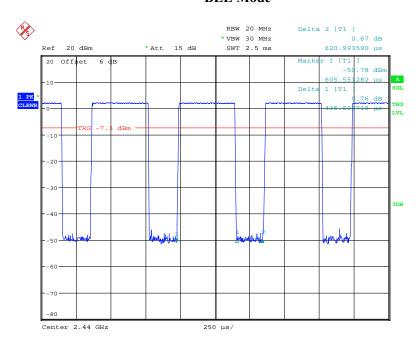


Date: 3.AUG.2018 10:09:00

FCC Part 15.247 Page 9 of 65

### **BLE Mode**

Report No.: RSZ180723002-00C



Date: 10.AUG.2018 14:32:44

Mode	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/ Duty Cycle)
802.11b	100	-	-	10Hz	-
802.11g	100	-	-	10Hz	-
802.11n-HT20	100	-	-	10Hz	-
802.11n-HT40	100	-	-	10Hz	-
BLE	70	437	2.29	3kHz	1.55

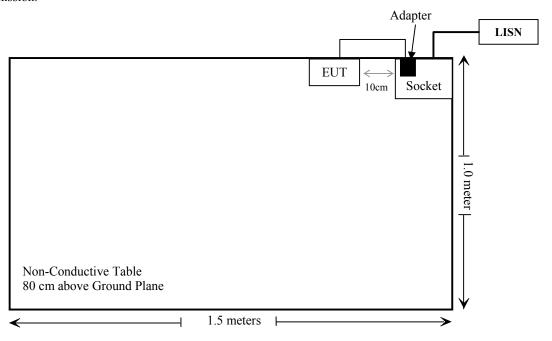
### **External I/O Cable**

Cable Description	Length (m)	From Port	То
Un-shielding Un-detachable DC Cable	1.5	EUT	Adapter

FCC Part 15.247 Page 10 of 65

## **Block Diagram of Test Setup**

For conducted emission:



FCC Part 15.247 Page 11 of 65

## 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)	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

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 12 of 65

## TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date		
	Conducted Emissions Test						
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2018-07-11	2019-07-11		
Rohde & Schwarz	LISN	ENV216	3560.6650.12- 101613-Yb	2017-12-21	2018-12-21		
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2018-05-21	2018-11-19		
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR		
N/A	Conducted Emission Cable	N/A	UF A210B-1- 0720-504504	2018-05-12	2018-11-12		
	Radia	ated Emission T	`est				
A.H.System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17		
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-06-23	2019-06-23		
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-05-21	2019-05-21		
НР	Amplifier	HP8447E	1937A01046	2018-05-21	2018-11-19		
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21		
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11		
UTiFLEX MICRO-C0AX	RF Cable	UFA147A- 2362-100100	MFR64639 231029-003	2018-04-01	2018-10-01		
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-19		
Ducommun technologies	RF Cable	RG-214	1	2018-05-21	2018-11-19		
Ducommun technologies	RF Cable	RG-214	2	2018-05-22	2018-11-22		
Ducommun Technologies	Horn Antenna	ARH-4223- 02	1007726-04	2017-12-06	2020-12-05		
Ducommun Technologies	Pre-amplifier	ALN- 22093530-01	991373-01	2018-08-03	2019-08-03		
Sinoscite	Notch Filter	BSF2402- 2480MN- 0898-001	N/A	2018-05-21	2019-05-21		
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR		

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 13 of 65

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 14 of 65

<sup>\*</sup> 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

Report No.: RSZ180723002-00C

Limits for General Population/Uncontrolled Exposure					
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	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	Ante	Antenna Gain		Turn up conducted power		Power Density	MPE Limit (mW/cm²)
(MHz)	(dBi)	(numeric)	(dBm)	(mW)	(cm)		
2402-2480	0.46	1.11	2.5	1.78	20	0.0004	1
2412-2462	0.46	1.11	19	79.43	20	0.0175	1

FCC Part 15.247 Page 15 of 65 Simultaneous transmitting consideration: (referring to the DSS report, the highest MPE for Bluetooth is  $0.002 \text{mW/cm}^2$ )

Report No.: RSZ180723002-00C

The ratio=MPE/limit<sub>DSS</sub>+MPE/limit<sub>DTS</sub>=0.002+0.0175=0.0195<1.0, simultaneous exposure is not required.

Note: 2.4GHz and 5GHz WiFi can't transmit simultaneously for this device.

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

**Result: Compliance** 

FCC Part 15.247 Page 16 of 65

### 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:

Report No.: RSZ180723002-00C

- 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 antenna arrangement, which was permanently attached and the antenna gain is 0.46 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

FCC Part 15.247 Page 17 of 65

### FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

#### **Applicable Standard**

FCC§15.207

#### **EUT Setup**



Report No.: RSZ180723002-00C

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.

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.

FCC Part 15.247 Page 18 of 65

#### **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:

Report No.: RSZ180723002-00C

Margin = Limit – Corrected Amplitude

### **Test Results Summary**

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_{\rm m} + U_{(L{\rm m})} \leq L_{\rm lim} + U_{\rm cispr}$$

In BACL,  $U_{(Lm)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

#### **Test Data**

#### **Environmental Conditions**

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

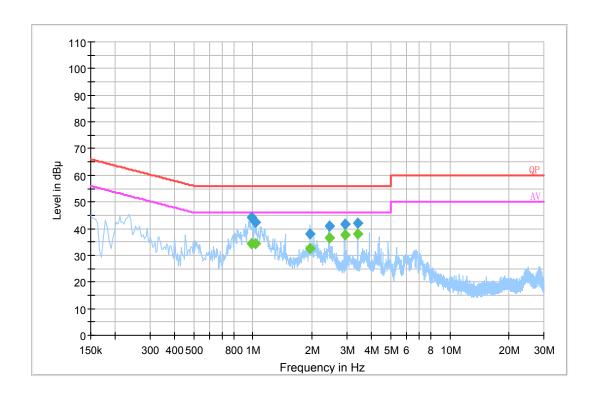
The testing was performed by Kiki Kong on 2018-08-11.

EUT operation mode: Transmitting

FCC Part 15.247 Page 19 of 65

**BLE Mode:** 

### AC 120V/60 Hz, Line

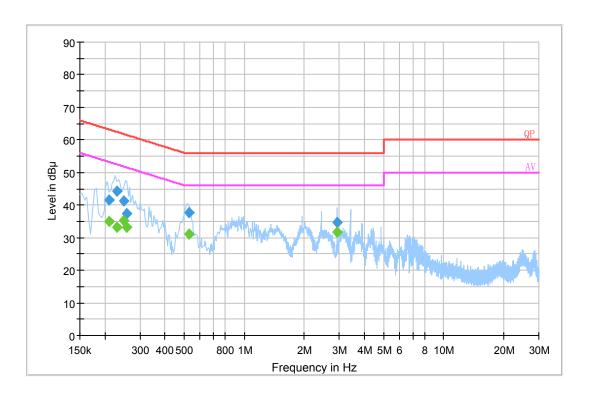


Report No.: RSZ180723002-00C

Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.983030	44.2	20.0	56.0	11.8	QP
1.030670	42.5	20.0	56.0	13.5	QP
1.944810	38.1	20.0	56.0	17.9	QP
2.433490	41.0	20.0	56.0	15.0	QP
2.922170	41.8	20.0	56.0	14.2	QP
3.406910	42.2	20.0	56.0	13.8	QP
0.983030	34.3	20.0	46.0	11.7	Ave.
1.030670	34.4	20.0	46.0	11.6	Ave.
1.944810	32.6	20.0	46.0	13.4	Ave.
2.433490	36.5	20.0	46.0	9.5	Ave.
2.922170	37.7	20.0	46.0	8.3	Ave.
3.406910	38.2	20.0	46.0	7.8	Ave.

FCC Part 15.247 Page 20 of 65

### AC 120V/60 Hz, Neutral



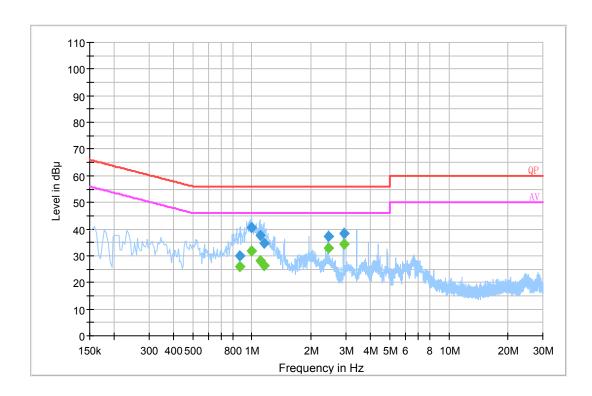
Report No.: RSZ180723002-00C

Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.209500	41.6	20.1	63.2	21.6	QP
0.229500	44.3	20.1	62.5	18.2	QP
0.249500	41.3	20.1	61.8	20.5	QP
0.257500	37.3	20.1	61.5	24.2	QP
0.526170	37.5	20.1	56.0	18.5	QP
2.918170	34.7	20.0	56.0	21.3	QP
0.209500	34.9	20.1	53.2	18.3	Ave.
0.229500	33.0	20.1	52.5	19.5	Ave.
0.249500	35.2	20.1	51.8	16.6	Ave.
0.257500	33.1	20.1	51.5	18.4	Ave.
0.526170	31.1	20.1	46.0	14.9	Ave.
2.918170	31.6	20.0	46.0	14.4	Ave.

FCC Part 15.247 Page 21 of 65

### Wi-Fi Mode:

### AC 120 V/60 Hz, Line:

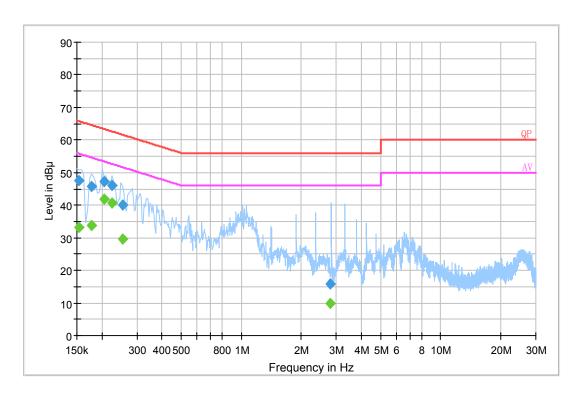


Report No.: RSZ180723002-00C

Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.868890	30.0	20.0	56.0	26.0	QP
0.999090	40.7	20.0	56.0	15.3	QP
1.101530	37.5	20.0	56.0	18.5	QP
1.152690	34.9	20.0	56.0	21.1	QP
2.437490	37.3	20.0	56.0	18.7	QP
2.922170	38.5	20.0	56.0	17.5	QP
0.868890	26.0	20.0	46.0	20.0	Ave.
0.999090	31.8	20.0	46.0	14.2	Ave.
1.101530	28.1	20.0	46.0	17.9	Ave.
1.152690	26.3	20.0	46.0	19.7	Ave.
2.437490	32.8	20.0	46.0	13.2	Ave.
2.922170	34.5	20.0	46.0	11.5	Ave.

FCC Part 15.247 Page 22 of 65

### **AC 120V/60 Hz, Neutral:**



Report No.: RSZ180723002-00C

Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.153500	47.5	20.1	65.8	18.3	QP
0.177500	45.6	20.1	64.6	19.0	QP
0.205500	47.1	20.1	63.4	16.3	QP
0.225500	46.0	20.1	62.6	16.6	QP
0.253500	40.0	20.1	61.6	21.6	QP
2.803490	15.8	20.0	56.0	40.2	QP
0.153500	33.2	20.1	55.8	22.6	Ave.
0.177500	33.9	20.1	54.6	20.7	Ave.
0.205500	41.9	20.1	53.4	11.5	Ave.
0.225500	40.7	20.1	52.6	11.9	Ave.
0.253500	29.6	20.1	51.6	22.0	Ave.
2.803490	10.0	20.0	46.0	36.0	Ave.

- 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 Part 15.247 Page 23 of 65

## 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:**



Report No.: RSZ180723002-00C

#### 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.

FCC Part 15.247 Page 24 of 65

### **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:

Report No.: RSZ180723002-00C

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
	1MHz	3 MHz	/	PK
Above 1 GHz	1MHz	10 Hz Note 1	/	Average
	1MHz	>1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98% Note 2: when duty cycle is less than 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 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 Results Summary**

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_{\rm m} + U_{(L{\rm m})} \leq L_{\rm lim} + U_{\rm cispr}$$

In BACL,  $U_{(Lm)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

FCC Part 15.247 Page 25 of 65

## **Test Data**

### **Environmental Conditions**

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

Report No.: RSZ180723002-00C

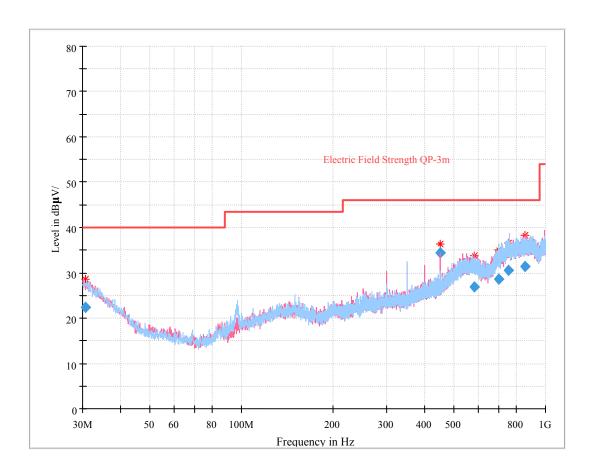
The testing was performed by Kiki Kong on 2018-08-08.

EUT operation mode: Transmitting

FCC Part 15.247 Page 26 of 65

### **BLE Mode:**

### 30 MHz~1 GHz:



Report No.: RSZ180723002-00C

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.609291	22.45	198.0	V	167.0	0.3	40.00	17.55
450.012500	34.35	109.0	V	281.0	0.2	46.00	11.65
584.773125	26.92	297.0	V	161.0	4.9	46.00	19.08
699.648500	28.50	302.0	Н	218.0	7.0	46.00	17.50
758.130375	30.54	263.0	Н	328.0	8.7	46.00	15.46
858.175875	31.41	165.0	V	54.0	9.7	46.00	14.59

FCC Part 15.247 Page 27 of 65

### 1 GHz-25 GHz (BLE):

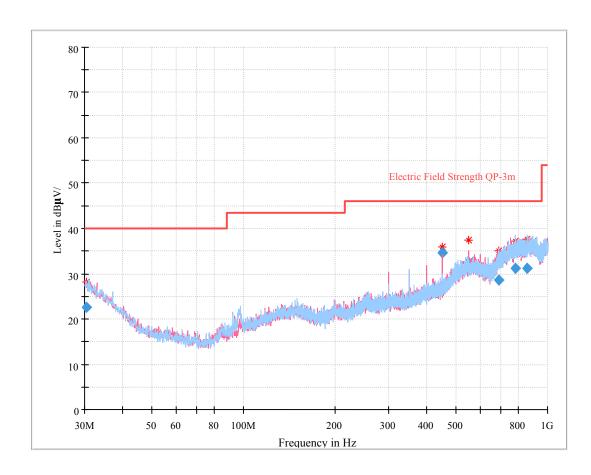
<b>T</b>	Re	eceiver	T4.1.1.	Rx Ar	itenna	Corrected	Corrected	T **4	M		
Frequency (MHz)	Reading (dBµV)	PK/QP/Ave.	Turntable Degree	Height (m)	Polar (H/V)	Factor (dB/m)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)		
Low Channel (2402 MHz)											
2402.00	62.11	PK	111	2.3	Н	33.92	96.03	/	/		
2402.00	60.46	Ave.	111	2.3	Н	33.92	94.38	/	/		
2402.00	60.33	PK	8	1.4	V	33.92	94.25	/	/		
2402.00	58.02	Ave.	8	1.4	V	33.92	91.94	/	/		
2352.32	27.91	PK	285	1.1	Н	33.92	61.83	74	12.17		
2352.32	13.66	Ave.	285	1.1	Н	33.92	47.58	54	6.42		
2486.23	27.44	PK	102	2.2	Н	34.08	61.52	74	12.48		
2486.23	13.45	Ave.	102	2.2	Н	34.08	47.53	54	6.47		
4804.00	45.47	PK	142	2.0	Н	5.84	51.31	74	22.69		
4804.00	34.02	Ave.	142	2.0	Н	5.84	39.86	54	14.14		
			Middle C	hannel	(2440 N	(IHz)					
2440.00	62.41	PK	225	1.7	Н	33.92	96.33	/	/		
2440.00	60.71	Ave.	225	1.7	Н	33.92	94.63	/	/		
2440.00	59.71	PK	29	1.5	V	33.92	93.63	/	/		
2440.00	56.47	Ave.	29	1.5	V	33.92	90.39	/	/		
4880.00	44.73	PK	313	2.5	Н	6.21	50.94	74	23.06		
4880.00	31.77	Ave.	313	2.5	Н	6.21	37.98	54	16.02		
			High Ch	annel (	2480 M	Hz)					
2480.00	63.22	PK	274	1.7	Н	33.92	97.14	/	/		
2480.00	61.11	Ave.	274	1.7	Н	33.92	95.03	/	/		
2480.00	61.70	PK	335	1.1	V	33.92	95.62	/	/		
2480.00	59.63	Ave.	335	1.1	V	33.92	93.55	/	/		
2387.65	27.63	PK	284	2.0	Н	33.92	61.55	74	12.45		
2387.65	13.57	Ave.	284	2.0	Н	33.92	47.49	54	6.51		
2486.23	28.35	PK	265	1.3	Н	34.08	62.43	74	11.57		
2486.23	16.85	Ave.	265	1.3	Н	34.08	50.93	54	3.07		
4960.00	42.28	PK	69	2.4	Н	7.82	50.10	74	23.9		
4960.00	30.29	Ave.	69	2.4	Н	7.82	38.11	54	15.89		

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 28 of 65

### Wi-Fi 802.11b Mode low channel:

### 30 MHz~1 GHz:



Report No.: RSZ180723002-00C

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.446500	22.53	277.0	Н	0.0	0.4	40.00	17.47
449.995250	34.63	100.0	V	304.0	0.2	46.00	11.37
549.987125	32.53	107.0	V	237.0	5.3	46.00	13.47
691.443750	28.66	257.0	Н	207.0	6.4	46.00	17.34
783.692500	31.11	229.0	Н	338.0	9.0	46.00	14.89
855.807250	31.19	332.0	Н	117.0	9.6	46.00	14.81

FCC Part 15.247 Page 29 of 65

## 1 GHz-25 GHz (WIFI):

### 802.11b Mode:

Frequency	Re	eceiver	Turntable	Rx An	tenna	Corrected	Corrected	Limit	Margin	
(MHz)	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H/V)	Factor (dB/m)	Amplitude (dBµV/m)	(dBµV/m)	(dB)	
Low Channel (2412 MHz)										
2412.00	71.77	PK	49	1.2	Н	33.92	105.69	/	/	
2412.00	66.61	Ave.	49	1.2	Н	33.92	100.53	/	/	
2412.00	71.75	PK	342	2.2	V	33.92	105.67	/	/	
2412.00	66.59	Ave.	342	2.2	V	33.92	100.51	/	/	
2359.64	28.18	PK	57	1.8	Н	33.92	62.10	74	11.90	
2359.64	13.36	Ave.	57	1.8	Н	33.92	47.28	54	6.72	
2489.43	27.15	PK	337	1.9	Н	34.08	61.23	74	12.77	
2489.43	13.24	Ave.	337	1.9	Н	34.08	47.32	54	6.68	
4824.00	43.37	PK	131	1.3	Н	5.84	49.21	74	24.79	
4824.00	29.04	Ave.	131	1.3	Н	5.84	34.88	54	19.12	
			Middle C	hannel	(2437 N	/IHz)				
2437.00	71.52	PK	175	1.6	Н	33.92	105.44	/	/	
2437.00	66.43	Ave.	175	1.6	Н	33.92	100.35	/	/	
2437.00	69.74	PK	143	1.8	V	33.92	103.66	/	/	
2437.00	64.51	Ave.	143	1.8	V	33.92	98.43	/	/	
4874.00	42.61	PK	161	1.9	Н	6.21	48.82	74	25.18	
4874.00	28.17	Ave.	161	1.9	Н	6.21	34.38	54	19.62	
			High Ch	annel (	2462 M	Hz)				
2462.00	71.66	PK	245	1.8	Н	34.08	105.74	/	/	
2462.00	66.94	Ave.	245	1.8	Н	34.08	101.02	/	/	
2462.00	69.05	PK	302	1.0	V	34.08	103.13	/	/	
2462.00	64.21	Ave.	302	1.0	V	34.08	98.29	/	/	
2387.00	27.61	PK	11	1.8	Н	33.92	61.53	74	12.47	
2387.00	13.25	Ave.	11	1.8	Н	33.92	47.17	54	6.83	
2483.50	27.54	PK	18	1.8	Н	34.08	61.62	74	12.38	
2483.50	13.31	Ave.	18	1.8	Н	34.08	47.39	54	6.61	
4924.00	42.44	PK	22	1.2	Н	6.21	48.65	74	25.35	
4924.00	28.96	Ave.	22	1.2	Н	6.21	35.17	54	18.83	

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 30 of 65

## 802.11g Mode:

	Receiver			Rx Antenna		Corrected	Corrected	T • • •	3.6	
Frequency (MHz)	Reading (dBµV)	PK/QP/Ave.	Turntable Degree	Height (m)		Factor (dB/m)	Amplitude (dBμV/m)	Limit (dBµV/m)	Margin (dB)	
Low Channel (2412 MHz)										
2412.00	70.71	PK	244	1.0	Н	33.92	104.63	/	/	
2412.00	58.06	Ave.	244	1.0	Н	33.92	91.98	/	/	
2412.00	66.08	PK	308	1.3	V	33.92	100.00	/	/	
2412.00	53.71	Ave.	308	1.3	V	33.92	87.63	/	/	
2390.00	27.65	PK	321	1.8	Н	33.92	61.57	74	12.43	
2390.00	13.95	Ave.	321	1.8	Н	33.92	47.87	54	6.13	
2483.50	26.54	PK	91	2.1	Н	34.08	60.62	74	13.38	
2483.50	13.24	Ave.	91	2.1	Н	34.08	47.32	54	6.68	
4824.00	42.32	PK	205	2.0	Н	5.84	48.16	74	25.84	
4824.00	28.51	Ave.	205	2.0	Н	5.84	34.35	54	19.65	
	Т	T	Middle C	hannel	`	<del></del>				
2437.00	69.74	PK	26	1.4	Н	33.92	103.66	/	/	
2437.00	57.13	Ave.	26	1.4	Н	33.92	91.05	/	/	
2437.00	66.41	PK	211	1.2	V	33.92	100.33	/	/	
2437.00	54.21	Ave.	211	1.2	V	33.92	88.13	/	/	
4874.00	42.56	PK	32	2.0	Н	6.21	48.77	74	25.23	
4874.00	28.49	Ave.	32	2.0	Н	6.21	34.70	54	19.30	
			High Ch	annel (	2462 M	Hz)		'		
2462.00	69.92	PK	265	1.1	Н	34.08	104.00	/	/	
2462.00	57.46	Ave.	265	1.1	Н	34.08	91.54	/	/	
2462.00	66.83	PK	84	1.5	V	34.08	100.91	/	/	
2462.00	54.26	Ave.	84	1.5	V	34.08	88.34	/	/	
2387.54	27.02	PK	168	2.5	Н	33.92	60.94	74	13.06	
2387.54	13.19	Ave.	168	2.5	Н	33.92	47.11	54	6.89	
2483.50	27.15	PK	150	2.0	Н	34.08	61.23	74	12.77	
2483.50	13.26	Ave.	150	2.0	Н	34.08	47.34	54	6.66	
4924.00	42.79	PK	266	1.3	Н	6.21	49.00	74	25.00	
4924.00	28.31	Ave.	266	1.3	Н	6.21	34.52	54	19.48	

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 31 of 65

### 802.11n-HT20 Mode:

Frequency (MHz)	Receiver		T4.11.	Rx Antenna		Corrected	Corrected	T • • •	M
	Reading (dBµV)	PK/QP/Ave.	Turntable Degree	Height (m)	Polar (H/V)	Factor (dB/m)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
			Low Ch	annel (2	2412 M	Hz)			
2412.00	69.95	PK	326	1.3	Н	33.92	103.87	/	/
2412.00	57.38	Ave.	326	1.3	Н	33.92	91.30	/	/
2412.00	66.45	PK	271	1.9	V	33.92	100.37	/	/
2412.00	54.16	Ave.	271	1.9	V	33.92	88.08	/	/
2389.96	27.21	PK	110	1.4	Н	33.92	61.13	74	12.87
2389.96	13.15	Ave.	110	1.4	Н	33.92	47.07	54	6.93
2489.40	26.14	PK	160	1.0	Н	34.08	60.22	74	13.78
2489.40	13.25	Ave.	160	1.0	Н	34.08	47.33	54	6.67
4824.00	42.54	PK	275	1.7	Н	5.84	48.38	74	25.62
4824.00	28.39	Ave.	275	1.7	Н	5.84	34.23	54	19.77
	1		Middle C	Channel	(2437N	(IHz)	T		
2437.00	69.75	PK	29	2.2	Н	33.92	103.67	/	/
2437.00	57.27	Ave.	29	2.2	Н	33.92	91.19	/	/
2437.00	65.49	PK	46	1.2	V	33.92	99.41	/	/
2437.00	53.28	Ave.	46	1.2	V	33.92	87.20	/	/
4874.00	42.89	PK	208	1.8	Н	6.21	49.10	74	24.90
4874.00	28.61	Ave.	208	1.8	Н	6.21	34.82	54	19.18
			High Ch	annel (2	2462 M	Hz)			
2462.00	69.93	PK	216	2.1	Н	34.08	104.01	/	/
2462.00	57.64	Ave.	216	2.1	Н	34.08	91.72	/	/
2462.00	65.77	PK	128	2.3	V	34.08	99.85	/	/
2462.00	53.36	Ave.	128	2.3	V	34.08	87.44	/	/
2312.00	27.80	PK	261	2.1	Н	33.83	61.63	74	12.37
2312.00	13.24	Ave.	261	2.1	Н	33.83	47.07	54	6.93
2487.00	27.12	PK	93	2.2	Н	34.08	61.20	74	12.80
2487.00	13.32	Ave.	93	2.2	Н	34.08	47.40	54	6.60
4924.00	42.87	PK	104	2.0	Н	6.21	49.08	74	24.92
4924.00	28.39	Ave.	104	2.0	Н	6.21	34.60	54	19.40

Report No.: RSZ180723002-00C

FCC Part 15.247 Page 32 of 65

### 802.11n-HT40 Mode:

Funguenes	Receiver		Turntable	Rx Antenna		Corrected	Corrected	T	3.7
Frequency (MHz)	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H/V)	Factor (dB/m)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
			Low Ch	annel (2	2422 M	Hz)			
2422.00	67.76	PK	11	1.4	Н	33.92	101.68	/	/
2422.00	55.12	Ave.	11	1.4	Н	33.92	89.04	/	/
2422.00	62.15	PK	358	2.1	V	33.92	96.07	/	/
2422.00	49.67	Ave.	358	2.1	V	33.92	83.59	/	/
2388.57	36.49	PK	98	1.9	Н	33.92	70.41	74	3.59
2388.57	15.82	Ave.	98	1.9	Н	33.92	49.74	54	4.26
2489.70	27.25	PK	237	1.4	Н	34.08	61.33	74	12.67
2489.70	13.34	Ave.	237	1.4	Н	34.08	47.42	54	6.58
4844.00	42.25	PK	340	1.2	Н	5.84	48.09	74	25.91
4844.00	28.71	Ave.	340	1.2	Н	5.84	34.55	54	19.45
		<b>.</b>	Middle C	hannel	(2437 N	(IHz)			
2437.00	67.13	PK	217	2.0	Н	33.92	101.05	/	/
2437.00	54.68	Ave.	217	2.0	Н	33.92	88.60	/	/
2437.00	62.94	PK	337	1.7	V	33.92	96.86	/	/
2437.00	50.25	Ave.	337	1.7	V	33.92	84.17	/	/
4874.00	43.87	PK	25	1.4	Н	6.21	50.08	74	23.92
4874.00	28.96	Ave.	25	1.4	Н	6.21	35.17	54	18.83
		•	High Ch	annel (	2452 M	Hz)			
2452.00	66.93	PK	266	2.4	Н	34.08	101.01	/	/
2452.00	54.57	Ave.	266	2.4	Н	34.08	88.65	/	/
2452.00	63.28.	PK	273	2.3	V	34.08	97.36	/	/
2452.00	50.61	Ave.	273	2.3	V	34.08	84.69	/	/
2390.00	27.24	PK	38	1.7	Н	33.92	61.16	74	12.84
2390.00	13.15	Ave.	38	1.7	Н	33.92	47.07	54	6.93
2486.40	31.25	PK	47	1.4	Н	34.08	65.33	74	8.67
2486.40	14.11	Ave.	47	1.4	Н	34.08	48.19	54	5.81
4904.00	42.85	PK	243	1.1	Н	6.21	49.06	74	24.94
4904.00	28.96	Ave.	243	1.1	Н	6.21	35.17	54	18.83

Report No.: RSZ180723002-00C

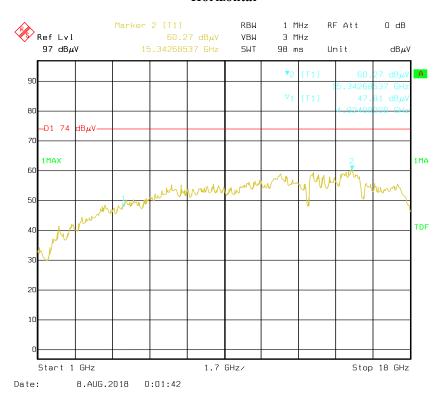
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor Corrected Amplitude = Corrected Factor + Reading

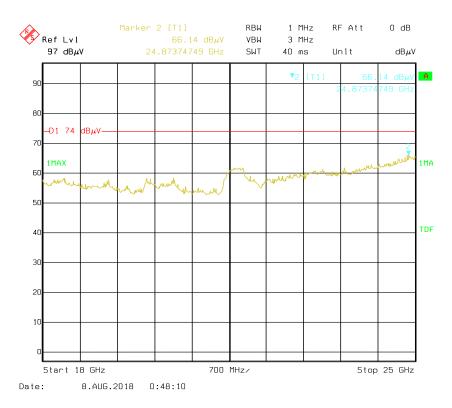
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.

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

FCC Part 15.247 Page 33 of 65

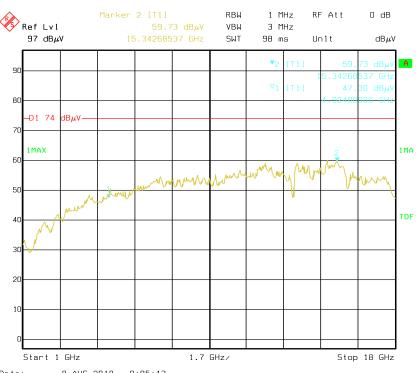
# Pre-scan with 802.11b Mode, High channel Horizontal



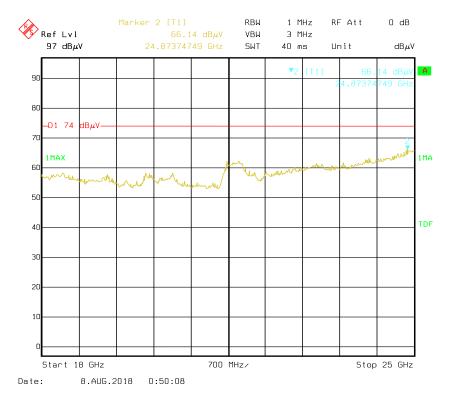


FCC Part 15.247 Page 34 of 65

#### Vertical



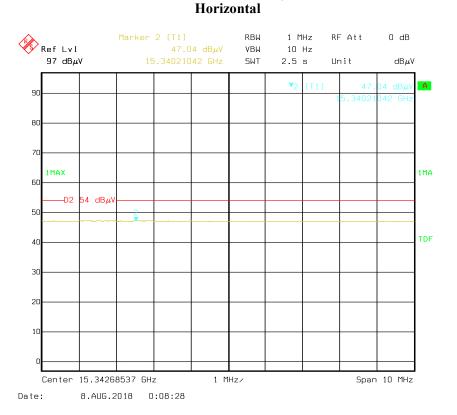


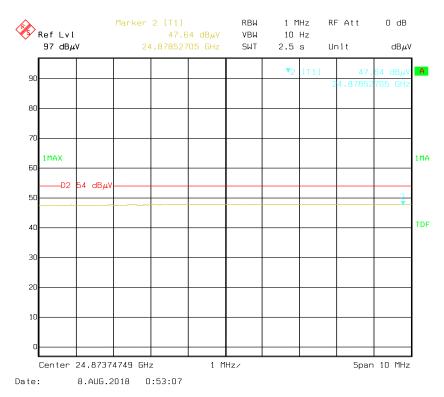


FCC Part 15.247 Page 35 of 65

## Pre-scan for Average

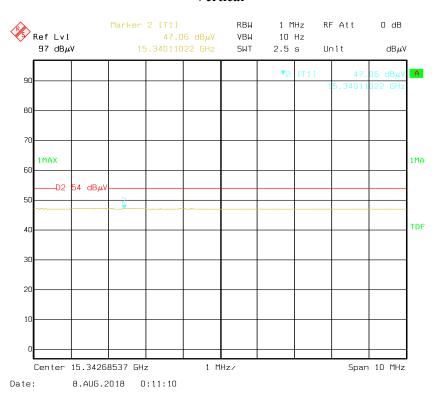
Report No.: RSZ180723002-00C

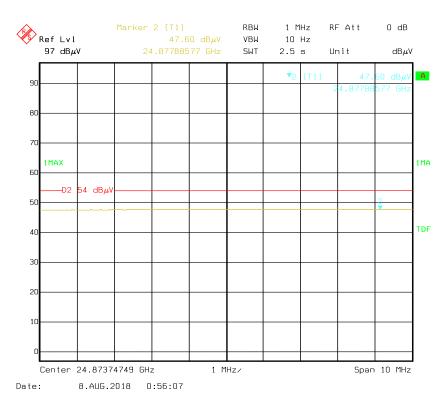




FCC Part 15.247 Page 36 of 65

#### Vertical





FCC Part 15.247 Page 37 of 65

# FCC $\S15.247(a)$ (2) – 6 dB EMISSION BANDWIDTH

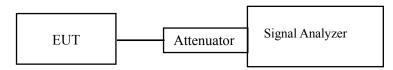
### **Applicable Standard**

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.

Report No.: RSZ180723002-00C

#### **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 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.



#### **Test Data**

#### **Environmental Conditions**

Temperature:	24~25 ℃	
Relative Humidity:	51~52 %	
ATM Pressure:	100.6~101.0 kPa	

The testing was performed by Kiki Kong from 2018-08-03 to 2018-08-10.

Test Result: Pass.

Please refer to the following tables and plots.

FCC Part 15.247 Page 38 of 65

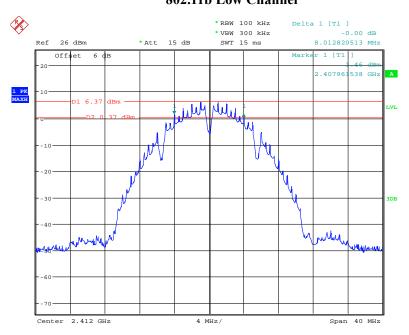
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)		
	802	2.11b mode			
Low	2412	8.013	≥500		
Middle	2437	8.013	≥500		
High	2462	8.013	≥500		
		802.11g			
Low	2412	15.321	≥500		
Middle	2437	15.128	≥500		
High	2462	15.385	≥500		
	802.11	n-HT20 mode			
Low	2412	15.128	≥500		
Middle	2437	15.449	≥500		
High	2462	15.449	≥500		
	802.11n-HT40 mode				
Low	2422	35.000	≥500		
Middle	2437	35.000	≥500		
High	2452	35.128	≥500		

Channel	Frequency (MHz)	6 dB Emission Bandwidth(MHz)	Limit (kHz)	
	BLE mode			
Low	2402	0.663	≥500	
Middle	2440	0.673	≥500	
High	2480	0.696	≥500	

FCC Part 15.247 Page 39 of 65

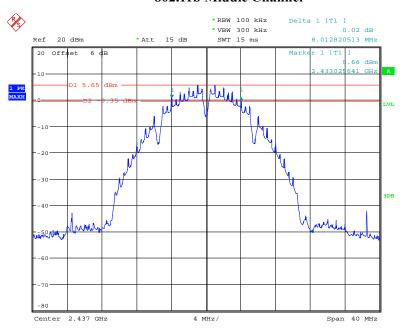
# 802.11b Low Channel

Report No.: RSZ180723002-00C



Date: 3.AUG.2018 09:28:16

### 802.11b Middle Channel



Date: 10.AUG.2018 14:37:56

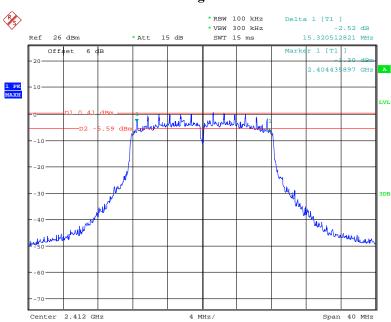
FCC Part 15.247 Page 40 of 65

# 802.11b High Channel



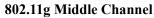
Date: 3.AUG.2018 09:34:50

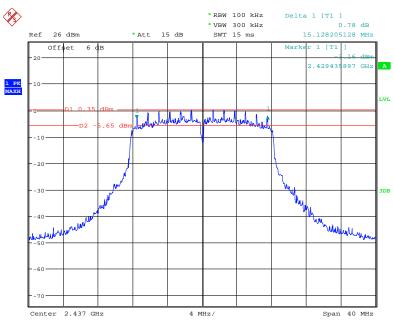
# 802.11g Low Channel



Date: 3.AUG.2018 09:41:34

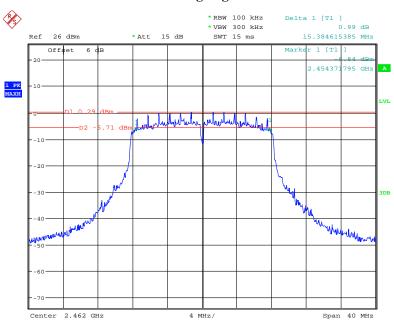
FCC Part 15.247 Page 41 of 65





Date: 3.AUG.2018 09:39:59

# 802.11g High Channel

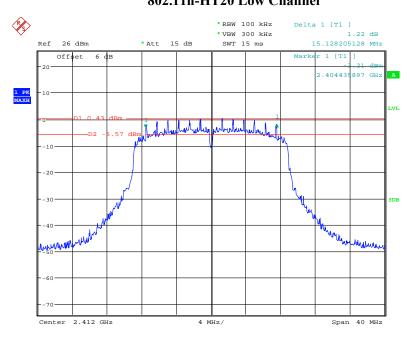


Date: 3.AUG.2018 09:43:21

FCC Part 15.247 Page 42 of 65

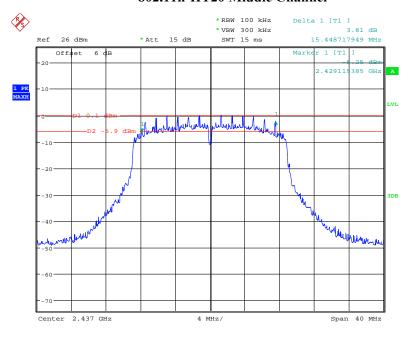
# 802.11n-HT20 Low Channel

Report No.: RSZ180723002-00C



Date: 3.AUG.2018 09:45:17

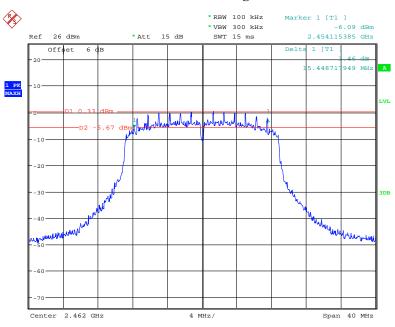
### 802.11n-HT20 Middle Channel



Date: 3.AUG.2018 09:46:40

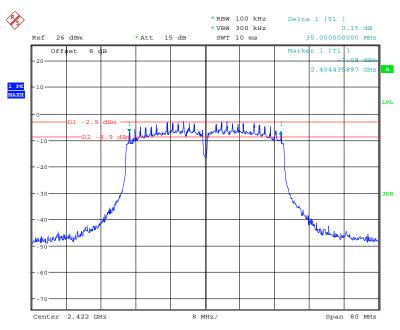
FCC Part 15.247 Page 43 of 65

# 802.11n-HT20 High Channel



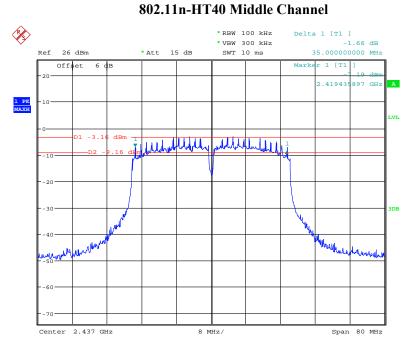
Date: 3.AUG.2018 09:48:15

#### 802.11n-HT40 Low Channel



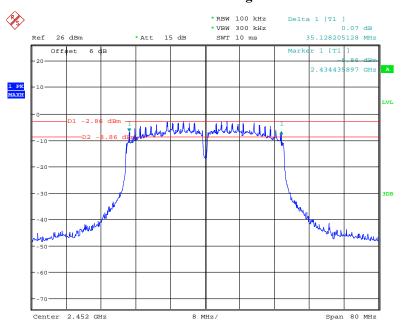
Date: 3.AUG.2018 09:50:27

FCC Part 15.247 Page 44 of 65



Date: 3.AUG.2018 09:51:45

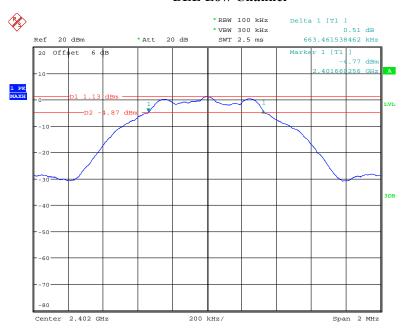
# 802.11n-HT40 High Channel



Date: 3.AUG.2018 09:54:44

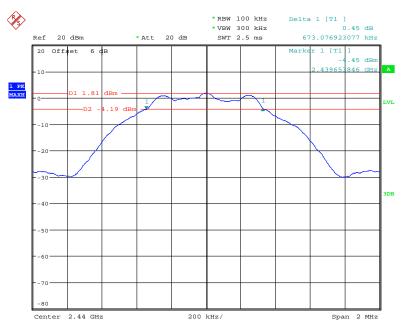
FCC Part 15.247 Page 45 of 65

#### **BLE Low Channel**



Date: 5.AUG.2018 21:44:00

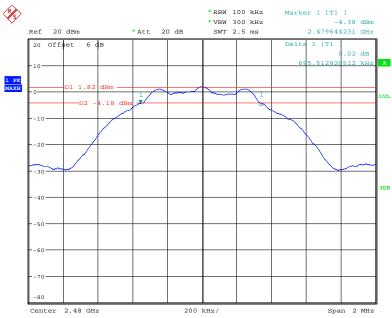
#### **BLE Middle Channel**



Date: 5.AUG.2018 21:45:58

FCC Part 15.247 Page 46 of 65





Date: 5.AUG.2018 21:47:50

FCC Part 15.247 Page 47 of 65

# 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.

Report No.: RSZ180723002-00C

#### **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:	25 ℃	
Relative Humidity:	50 %	
ATM Pressure:	100.0 kPa	

The testing was performed by Kiki Kong on 2018-08-05.

EUT operation mode: Transmitting

FCC Part 15.247 Page 48 of 65

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	
		802.11b		
Low	2412	17.33	30	
Middle	2437	17.10	30	
High	2462	17.19	30	
		802.11g		
Low	2412	18.15	30	
Middle	2437	18.03	30	
High	2462	18.30	30	
	802	2.11n HT20		
Low	2412	18.36	30	
Middle	2437	18.00	30	
High	2462	18.09	30	
802.11n HT40				
Low	2422	18.52	30	
Middle	2437	17.89	30	
High	2452	18.33	30	

**BLE** mode

Channel	Frequency (MHz)	Max Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	1.40	30	Pass
Middle	2440	2.09	30	Pass
High	2480	2.16	30	Pass

FCC Part 15.247 Page 49 of 65

# FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

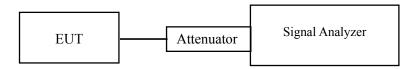
Report No.: RSZ180723002-00C

#### **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:	24~25 ℃	
Relative Humidity:	51~52 %	
ATM Pressure:	100.5~101.0 kPa	

The testing was performed by Kiki Kong from 2018-08-03 to 2018-08-10.

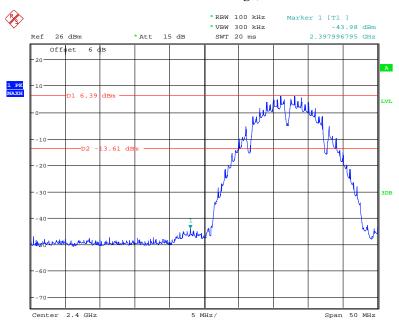
EUT operation mode: Transmitting

Test Result: Compliance

Please refer to the following plots.

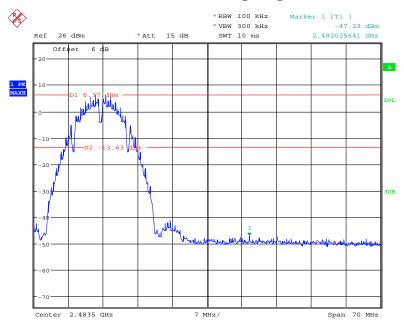
FCC Part 15.247 Page 50 of 65

802.11b: Band Edge, Left Side



Date: 3.AUG.2018 09:57:36

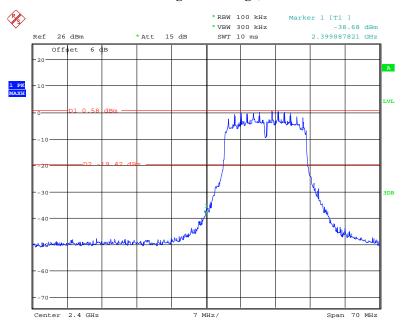
802.11b: Band Edge, Right Side



Date: 3.AUG.2018 09:59:16

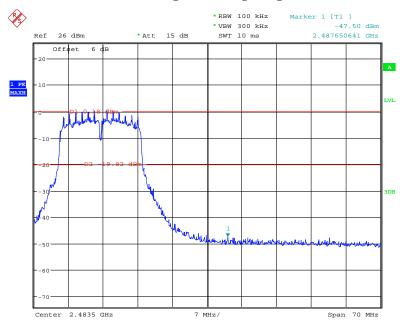
FCC Part 15.247 Page 51 of 65

# 802.11g: Band Edge, Left Side



Date: 3.AUG.2018 10:01:11

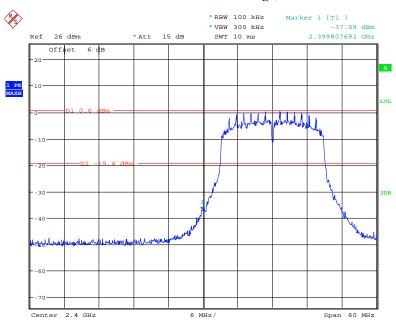
## 802.11g: Band Edge, Right Side



Date: 3.AUG.2018 10:00:13

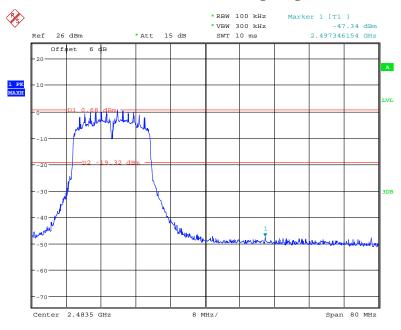
FCC Part 15.247 Page 52 of 65

# 802.11n-HT20: Band Edge, Left Side



Date: 3.AUG.2018 10:02:24

## 802.11n-HT20: Band Edge, Right Side

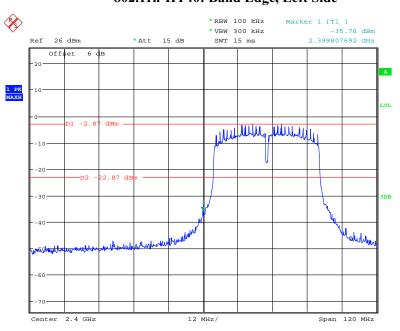


Date: 3.AUG.2018 10:03:57

FCC Part 15.247 Page 53 of 65

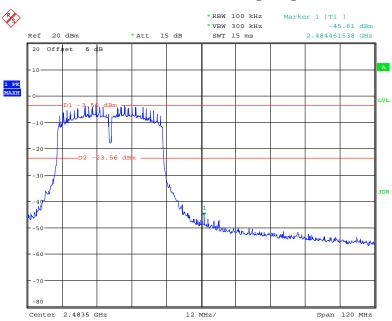
# 802.11n-HT40: Band Edge, Left Side

Report No.: RSZ180723002-00C



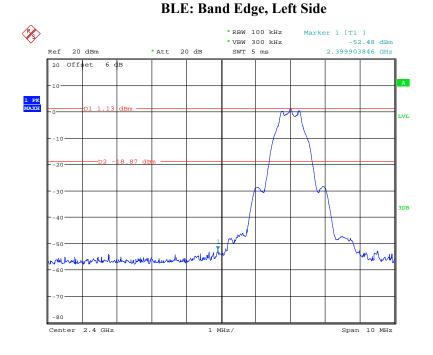
Date: 3.AUG.2018 10:05:48

## 802.11n-HT40: Band Edge, Right Side



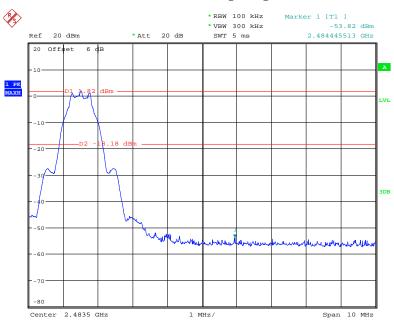
Date: 10.AUG.2018 14:35:48

FCC Part 15.247 Page 54 of 65



Date: 5.AUG.2018 22:04:48

## BLE: Band Edge, Right Side



Date: 5.AUG.2018 22:03:17

FCC Part 15.247 Page 55 of 65

# 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.

Report No.: RSZ180723002-00C

#### **Test Procedure**

- 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:  $3kHz \le RBW \le 100 \text{ kHz}$ .
- 3. Set the VBW  $> 3 \times RBW$ .
- 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:	25 ℃	
Relative Humidity:	52 %	
ATM Pressure:	101.0 kPa	

The testing was performed by Kiki Kong on 2018-08-03 and 2018-08-05.

EUT operation mode: Transmitting

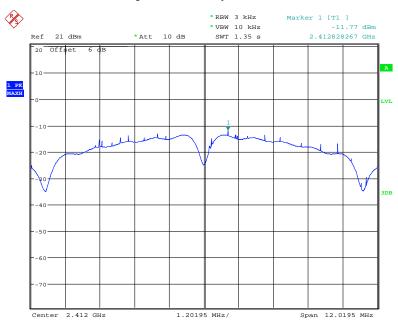
**Test Result:** Pass

FCC Part 15.247 Page 56 of 65

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)		
	802.11b	mode			
Low	2412	-11.77	≤8		
Middle	2437	-10.78	≤8		
High	2462	-9.53	≤8		
	802.11g	mode			
Low	2412	-15.41	≤8		
Middle	2437	-16.39	≤8		
High	2462	-15.64	≤8		
	802.11n-H7	Γ20 mode			
Low	2412	-17.23	≤8		
Middle	2437	-16.23	≤8		
High	2462	-15.31	≤8		
	802.11n-HT40 mode				
Low	2422	-19.40	≤8		
Middle	2437	-19.73	≤8		
High	2452	-19.36	≤8		
BLE mode					
Low	2402	-13.36	≤8		
Middle	2440	-12.62	≤8		
High	2480	-12.67	≤8		

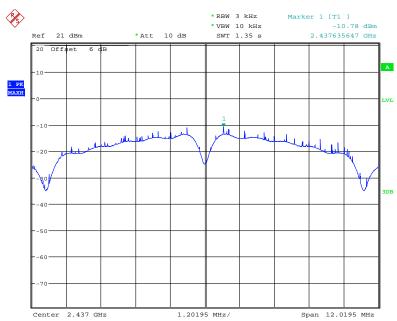
FCC Part 15.247 Page 57 of 65

# Power Spectral Density, 802.11b Low Channel



Date: 3.AUG.2018 10:13:27

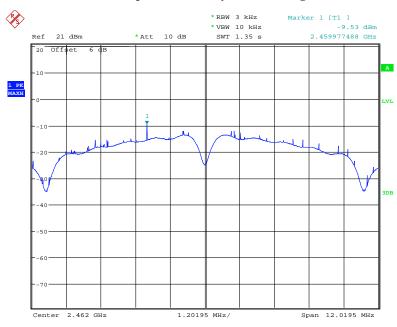
# Power Spectral Density, 802.11b Middle Channel



Date: 3.AUG.2018 10:14:12

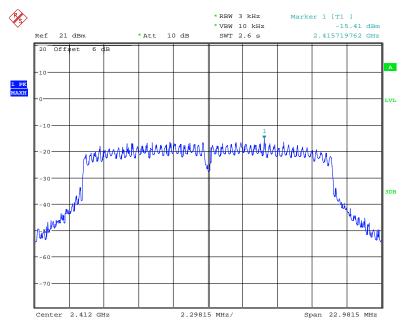
FCC Part 15.247 Page 58 of 65

# Power Spectral Density, 802.11b High Channel



Date: 3.AUG.2018 10:14:39

# Power Spectral Density, 802.11g Low Channel

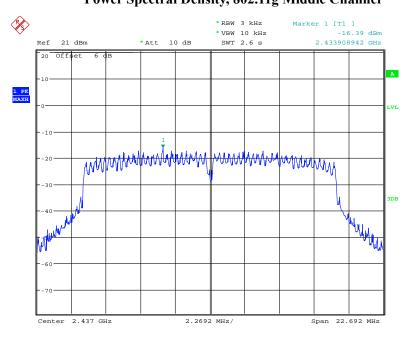


Date: 3.AUG.2018 10:16:28

FCC Part 15.247 Page 59 of 65

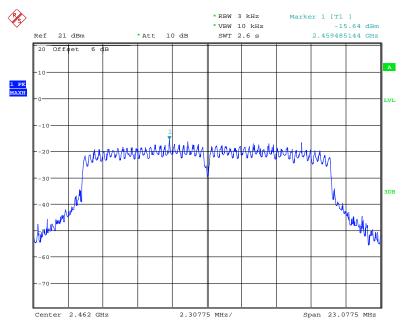
# Power Spectral Density, 802.11g Middle Channel

Report No.: RSZ180723002-00C



Date: 3.AUG.2018 10:17:37

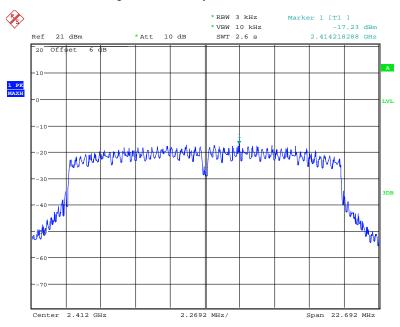
# Power Spectral Density, 802.11g High Channel



Date: 3.AUG.2018 10:20:18

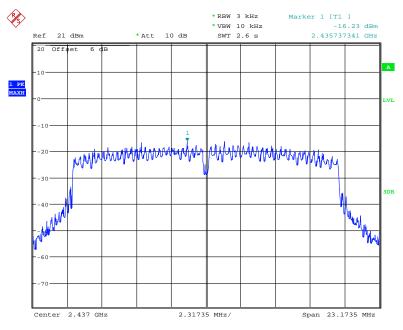
FCC Part 15.247 Page 60 of 65

# Power Spectral Density, 802.11n-HT20 Low Channel



Date: 3.AUG.2018 10:21:40

# Power Spectral Density, 802.11n-HT20 Middle Channel

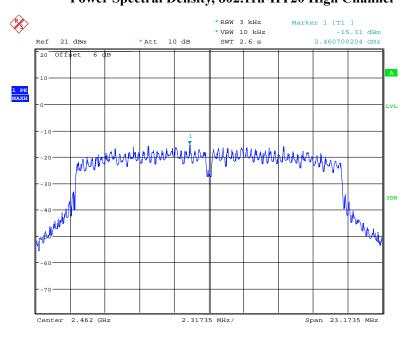


Date: 3.AUG.2018 10:22:38

FCC Part 15.247 Page 61 of 65

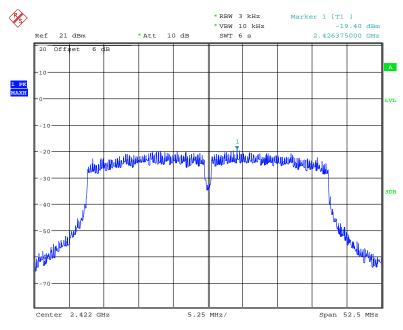
# Power Spectral Density, 802.11n-HT20 High Channel

Report No.: RSZ180723002-00C



Date: 3.AUG.2018 10:24:18

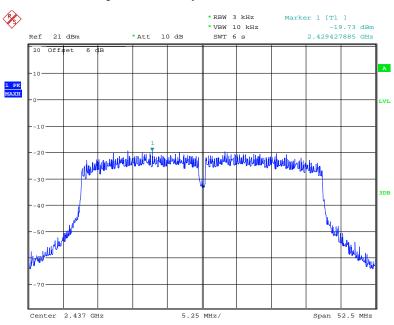
# Power Spectral Density, 802.11n-HT40 Low Channel



Date: 3.AUG.2018 10:25:29

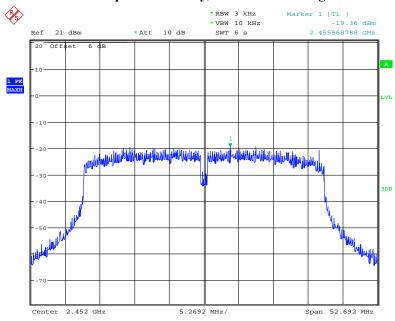
FCC Part 15.247 Page 62 of 65

# Power Spectral Density, 802.11n-HT40 Middle Channel



Date: 3.AUG.2018 10:26:16

## Power Spectral Density, 802.11n-HT40 High Channel

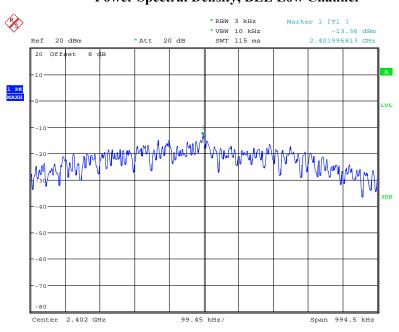


Date: 3.AUG.2018 10:27:14

FCC Part 15.247 Page 63 of 65

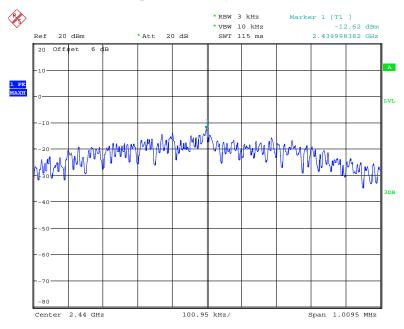
# **Power Spectral Density, BLE Low Channel**

Report No.: RSZ180723002-00C



Date: 5.AUG.2018 21:49:47

## Power Spectral Density, BLE Middle Channel

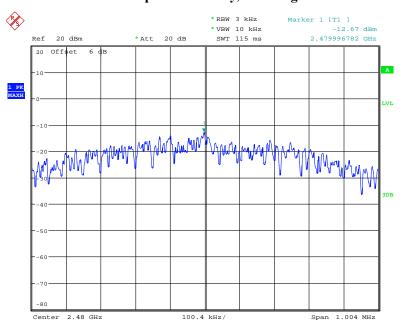


Date: 5.AUG.2018 21:50:46

FCC Part 15.247 Page 64 of 65

# Power Spectral Density, BLE High Channel

Report No.: RSZ180723002-00C



Date: 5.AUG.2018 21:51:58

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

FCC Part 15.247 Page 65 of 65