



FCC TEST REPORT

FCC PART 15 SUBPART C 15.247 & RSS 247

Test report
On Behalf of
Control Technology China Co., LTD
For
Diagnose charge battery station
Model No.: DCBS

FCC ID: 2AK5Y-DCBS
IC ID: 25313-DCBS

Prepared for : **Control Technology China Co., LTD**
 No.98 Jianpeng Road, Jiuting Town, Shanghai, China

Prepared By : **Shenzhen HUAK Testing Technology Co., Ltd.**
 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street,
 Bao'an District, Shenzhen City, China

Date of Test: **July 10, 2019 ~ Aug. 02, 2019**
Date of Report: **Aug. 02, 2019**
Report Number: **HK1907221811-1E**



TEST RESULT CERTIFICATION

Applicant's name.....: Control Technology China Co., LTD

Address: No.98 Jianpeng Road, Jiuting Town, Shanghai, China

Manufacture's Name.....: Control Technology China Co., LTD

Address: No.98 Jianpeng Road, Jiuting Town, Shanghai, China

Product description

Trade Mark: E-XTEQ

Product name.....: Diagnose charge battery station

Model and/or type reference : DCBS

Standards.....: FCC Rules and Regulations Part 15 Subpart C Section 15.247
ANSI C63.10: 2013; RSS 247 Issue 2, February 2017

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Date of Test.....:

Date (s) of performance of tests: July 10, 2019 ~ Aug. 02, 2019

Date of Issue.....: Aug. 02, 2019

Test Result.....: **Pass**

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



TABLE OF CONTENTS

1. Test Result Summary	4
1.1. TEST PROCEDURES AND RESULTS.....	5
1.2. TEST FACILITY	5
1.3. MEASUREMENT UNCERTAINTY	6
2. EUT Description	7
2.1. GENERAL DESCRIPTION OF EUT	7
2.2. CARRIER FREQUENCY OF CHANNELS	8
2.3. OPERATION OF EUT DURING TESTING	8
2.4. DESCRIPTION OF TEST SETUP	9
3. General Information	10
3.1. TEST ENVIRONMENT AND MODE	10
3.2. DESCRIPTION OF SUPPORT UNITS	11
4. Test Results and Measurement Data	12
4.1. CONDUCTED EMISSION	12
4.2. MAXIMUM CONDUCTED OUTPUT POWER	16
4.3. EMISSION BANDWIDTH.....	18
4.4. POWER SPECTRAL DENSITY	22
4.5. CONDUCTED BAND EDGE AND SPURIOUS EMISSION MEASUREMENT	26
4.6. RADIATED SPURIOUS EMISSION MEASUREMENT	30
4.7. PHOTOGRAPH OF TEST.....	47



1. Test Result Summary

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[RSS-247-Issue 2](#): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

[RSS-Gen Issue 5](#): — General Requirements for Compliance of Radio Apparatus

[ANSI C63.10:2013](#) : American National Standard for Testing Unlicensed Wireless Devices

[ANSI C63.4: 2014](#): —American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz

[KDB558074 D01 V05](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247



1.1. TEST PROCEDURES AND RESULTS

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247 (c) RSS-Gen	PASS
AC Power Line Conducted Emission	FCC Part 15.207 RSS-Gen 8.8	PASS
Conducted Peak Output Power	FCC Part 15.247(b) RSS 247 5.4 (d)	PASS
6dB Emission Bandwidth	FCC Part 15.247(a)(2) RSS 247 5.2(a) RSS GEN	PASS
Power Spectral Density	FCC Part 15.247(e) RSS 247 5.2(b)	PASS
Band Edge	1§5.247(d) §2.1051, §2.1057 RSS-Gen 8.10	PASS
Spurious Emission	§15.205/§15.209 §2.1053, §2.1057 RSS-Gen 8.9	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

1.2. TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China



1.3. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^{\circ}\text{C}$
7	Humidity	$\pm 1.0\%$



2. EUT Description

2.1. GENERAL DESCRIPTION OF EUT

Equipment	Diagnose charge battery station
Model Name	DCBS
Serial No.	N/A
Model Difference	N/A
Trade Mark	E-XTEQ
FCC ID	2AK5Y-DCBS
IC ID	25313-DCBS
Antenna Type	Internal Antenna
Antenna Gain	2dBi
Operation frequency	802.11b/g:2412~2462 MHz
Number of Channels	802.11b/g: 11CH
Modulation Type	CCK/OFDM/DBPSK/DAPSK
Power Source	DC24V From 100-240VAC Aadapter
Power Rating	DC24V From 100-240VAC Aadapter



2.2. Carrier Frequency of Channels

Channel List for 802.11b/802.11g							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

2.3. Operation of EUT during testing

Operating Mode

The mode is used: **Transmitting mode for 802.11b/802.11g**

Low Channel: 2412MHz

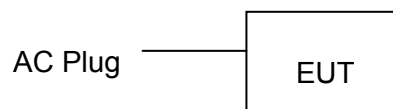
Middle Channel: 2437MHz

High Channel: 2462MHz

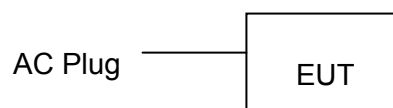


2.4. DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing:



Operation of EUT during Radiation testing and Above1GHz Radiation testing:





3. General Information

3.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 98.46%)
<p>The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state.</p>	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps

Final Test Mode:

Operation mode:	Keep the EUT in continuous transmitting with modulation
<p>1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.</p> <p>2. According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup” 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20), 13.5Mbps for 802.11(H40). Duty cycle setting during the transmission is 98.5% with maximum power setting for all modulations.</p>	



3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

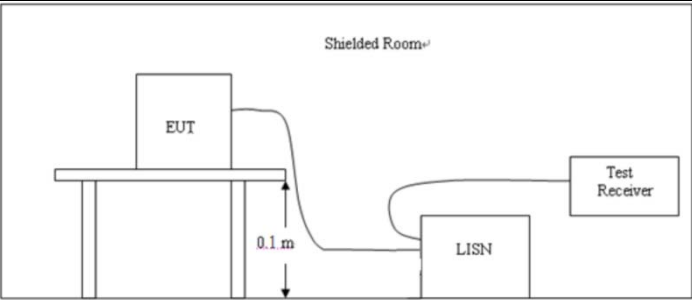
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.



4. Test Results and Measurement Data

4.1. Conducted Emission

Test Specification

Test Requirement:	FCC Part15 C Section 15.207 RSS Gen 8.8		
Test Method:	ANSI C63.10:2013		
Frequency Range:	150 kHz to 30 MHz		
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto		
Limits:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
Test Setup:			
Test Mode:	Charging + transmitting with modulation		
Test Procedure:	<ol style="list-style-type: none">1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.		
Test Result:	PASS		

**Test Instruments**

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Receiver	R&S	ESCI 7	HKE-010	Dec. 26, 2019
LISN	R&S	ENV216	HKE-002	Dec. 26, 2019
Conducted test software	Tonscend	TS+ Rev 2.5.0.0	HKE-081	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

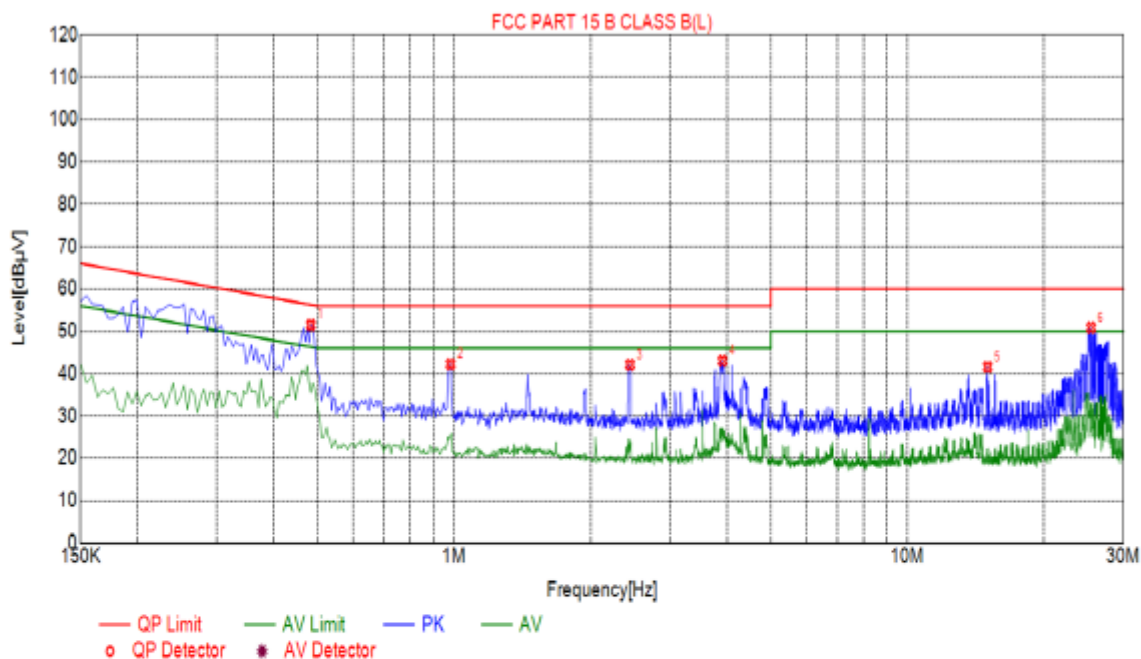


Test data

Remark: We tested three Channels in AC 120V/60Hz and AC 240V/60Hz, the worst case was recorded.

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)

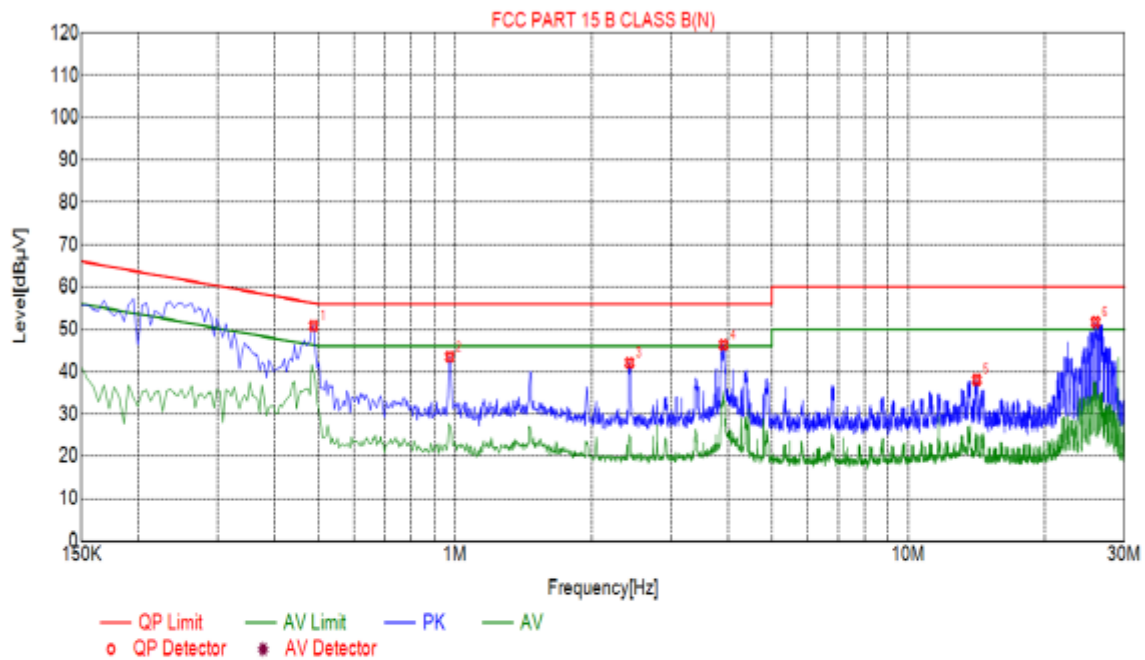


Suspected List						
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Detector
1	0.4830	51.50	10.04	56.30	4.80	PK
2	0.9825	42.27	10.06	56.00	13.73	PK
3	2.4450	42.14	10.19	56.00	13.86	PK
4	3.9120	43.03	10.25	56.00	12.97	PK
5	15.0450	41.60	9.96	60.00	18.40	PK
6	25.4490	50.88	10.25	60.00	9.12	PK

Remark: Transd = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

**Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)**

Suspected List						
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Detector
1	0.4875	50.84	10.04	56.24	5.40	PK
2	0.9735	43.52	10.06	56.00	12.48	PK
3	2.4270	42.13	10.18	56.00	13.87	PK
4	3.9120	46.38	10.25	56.00	9.62	PK
5	14.1630	38.07	9.95	60.00	21.93	PK
6	25.8945	51.69	10.26	60.00	8.31	PK

Remark: $\text{Transd} = \text{Cable lose} + \text{Antenna factor} - \text{Pre-amplifier}$; $\text{Margin} = \text{Limit} - \text{Level}$

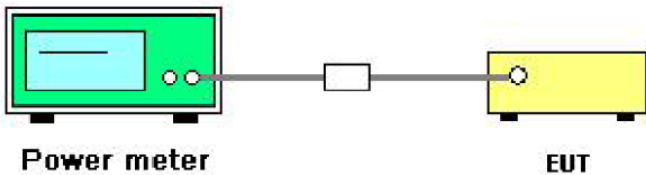
Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. $\text{Final Level} = \text{Receiver Read level} + \text{LISN Factor} + \text{Cable Loss}$.
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.



4.2. Maximum Conducted Output Power

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3) RSS 247 5.4 (d)
Test Method:	KDB 558074
Limit:	30dBm
Test Setup:	 <p style="text-align: center;">Power meter EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v05. 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Measure the Peak output power and record the results in the test report.
Test Result:	PASS

Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power meter	Agilent	E4417B	HKE-107	Dec. 26, 2019
Power Sensor	Agilent	E9327A	HKE-113	Dec. 26, 2019
RF cable	Times	1-40G	HKE-034	Dec. 26, 2019
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 26, 2019

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI)

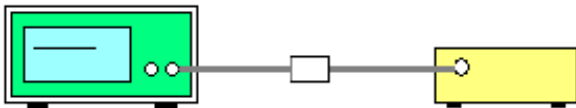
**Test Data**

TX 802.11b Mode			
Test Channe	Frequency	MaximumPeak Conducted Output Power	LIMIT
	(MHz)	(dBm)	dBm
CH01	2412	15.36	30
CH06	2437	15.24	30
CH11	2462	15.42	30
TX 802.11g Mode			
CH01	2412	14.80	30
CH06	2437	14.91	30
CH11	2462	14.95	30



4.3. Emission Bandwidth

Test Specification

Test Requirement:	FCC Part 15.247(a)(2)/RSS 247 5.2(a) RSS GEN
Test Method:	KDB 558074
Limit:	>500kHz
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none">1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v05.2. Set to the maximum power setting and enable the EUT transmit continuously.3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.4. Measure and record the results in the test report.
Test Result:	PASS

Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 26, 2019
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Dec. 26, 2019
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 26, 2019

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**Test data**

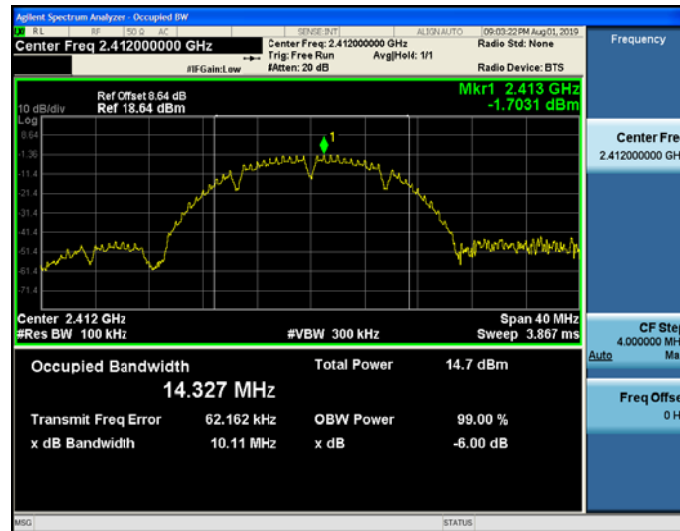
Test channel	6dB Emission Bandwidth (MHz)	
	802.11b	802.11g
Lowest	10.11	16.38
Middle	10.10	16.46
Highest	10.07	16.39
Limit:	>500k	
Test Result:	PASS	

Test plots as follows:

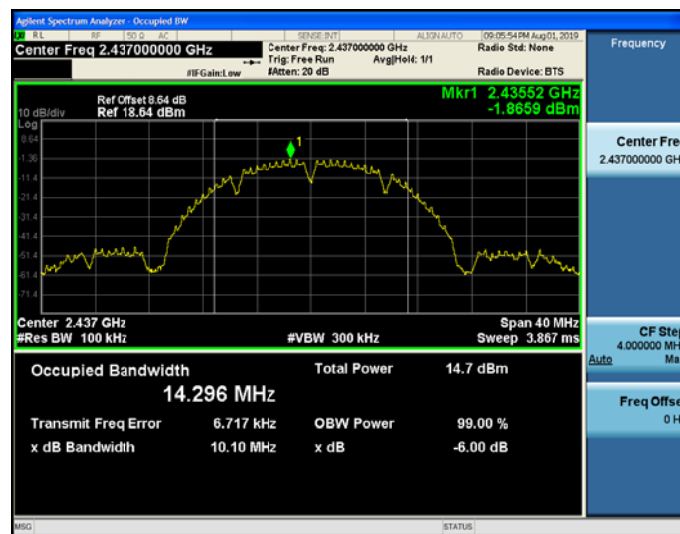


802.11b Modulation

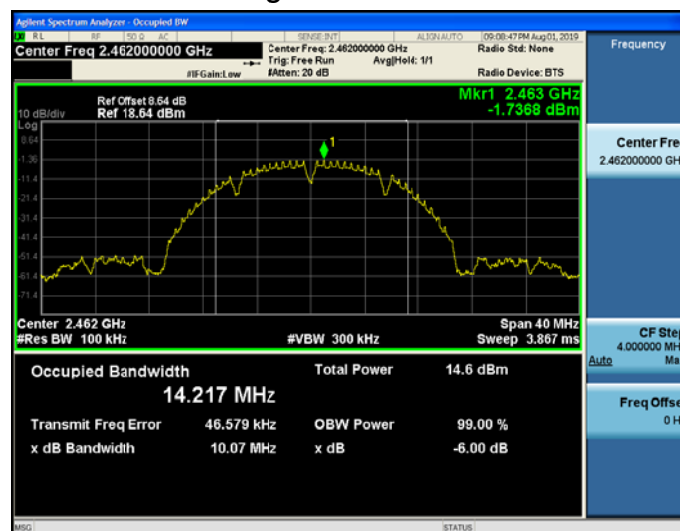
Lowest channel



Middle channel



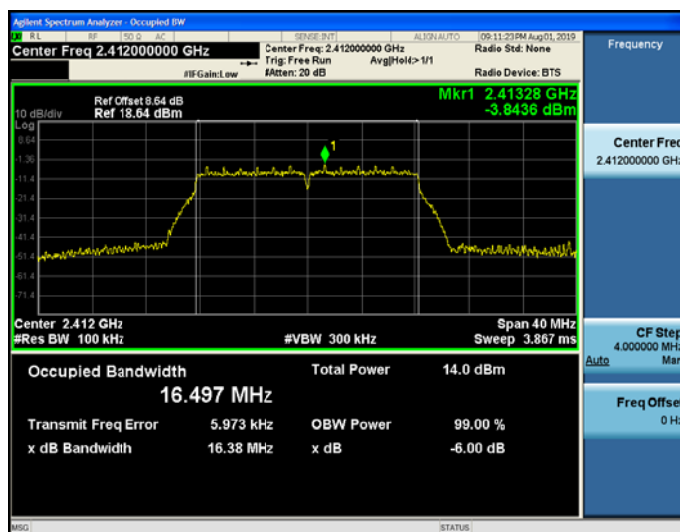
Highest channel



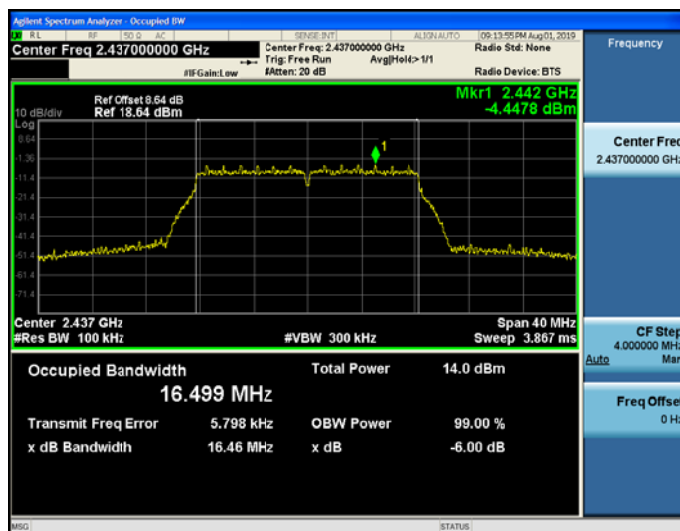


802.11g Modulation

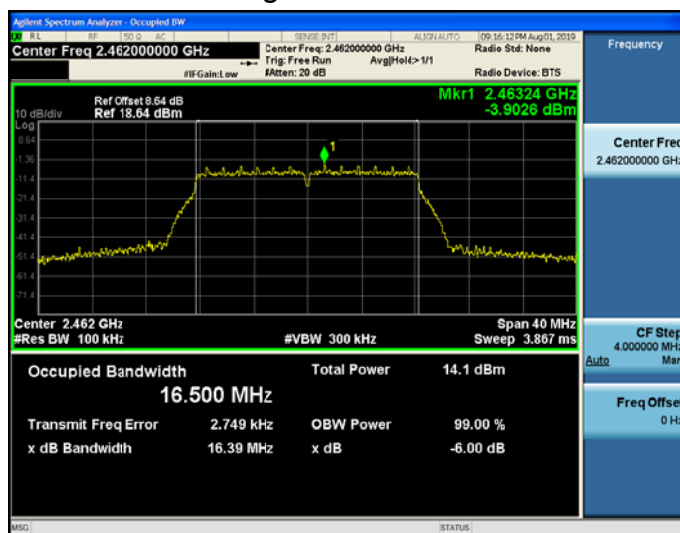
Lowest channel



Middle channel



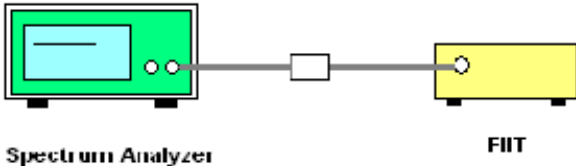
Highest channel





4.4. Power Spectral Density

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e) RSS 247 5.2(b)
Test Method:	KDB 558074
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	 <p style="text-align: center;">Spectrum Analyzer FIIT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows Measurement procedure 10.2 method PKPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v05. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$. Video bandwidth VBW $\geq 3 \times \text{RBW}$. Set the span to at least 1.5 times the OBW. 5. Detector = Peak, Sweep time = auto couple. 6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 6. Measure and record the results in the test report.
Test Result:	PASS

Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 26, 2019
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Dec. 26, 2019
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 26, 2019

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**Test data**

EUT Set Mode	Channel	Result(dBm/30kHz)	Result(dBm/3kHz)
802.11b	Lowest	-2.63	-12.63
	Middle	-5.72	-15.72
	Highest	-3.31	-13.31
802.11g	Lowest	-9.2	-19.2
	Middle	-8.94	-18.94
	Highest	-8.52	-18.52
PSD test result(dBm/3kHz)= PSD test result(dBm/30kHz)-10			
Limit: 8dBm/3kHz			
TestResult:	PASS		

Test plots as follows:



802.11b Modulation

Lowest channel



Middle channel



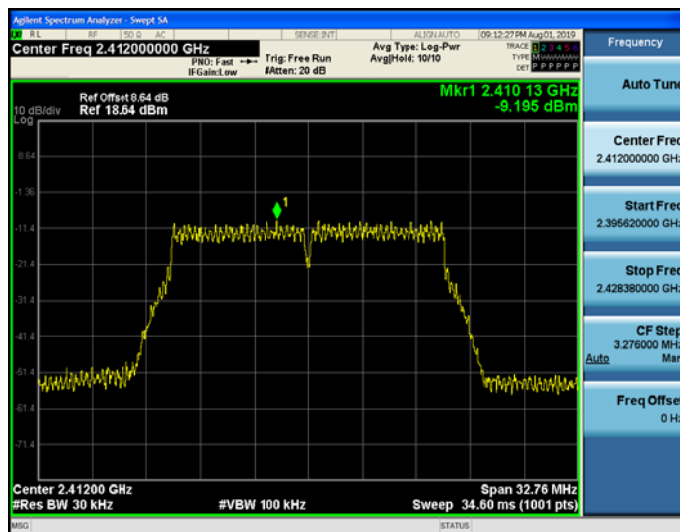
Highest channel



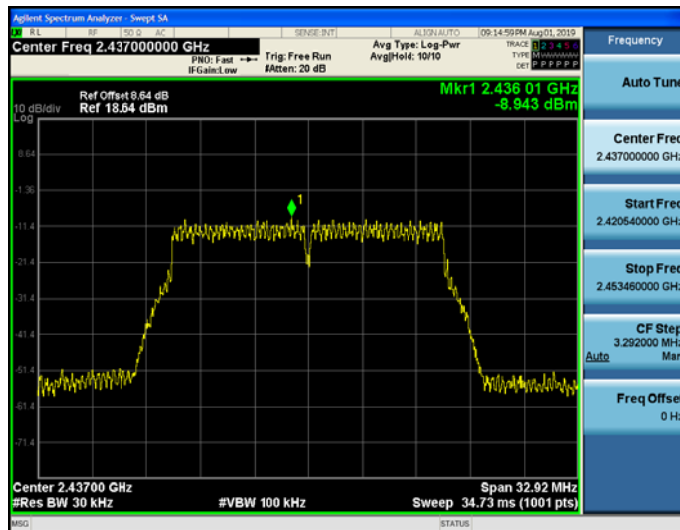


802.11g Modulation

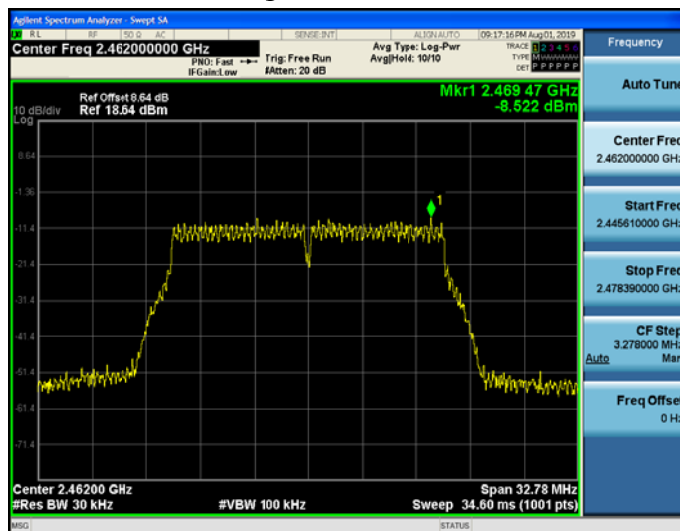
Lowest channel



Middle channel




Highest channel





4.5. Conducted Band Edge and Spurious Emission Measurement

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d) RSS-Gen 8.10
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test Setup:	 <p>The diagram illustrates the test setup. On the left is a green box labeled 'Spectrum Analyzer'. A cable connects it to a small white box labeled 'Attenuator'. Another cable connects the attenuator to a yellow box labeled 'EUT' (Equipment Under Test).</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none">1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.3. Set to the maximum power setting and enable the EUT transmit continuously.4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).5. Measure and record the results in the test report.6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

**Test Instruments**

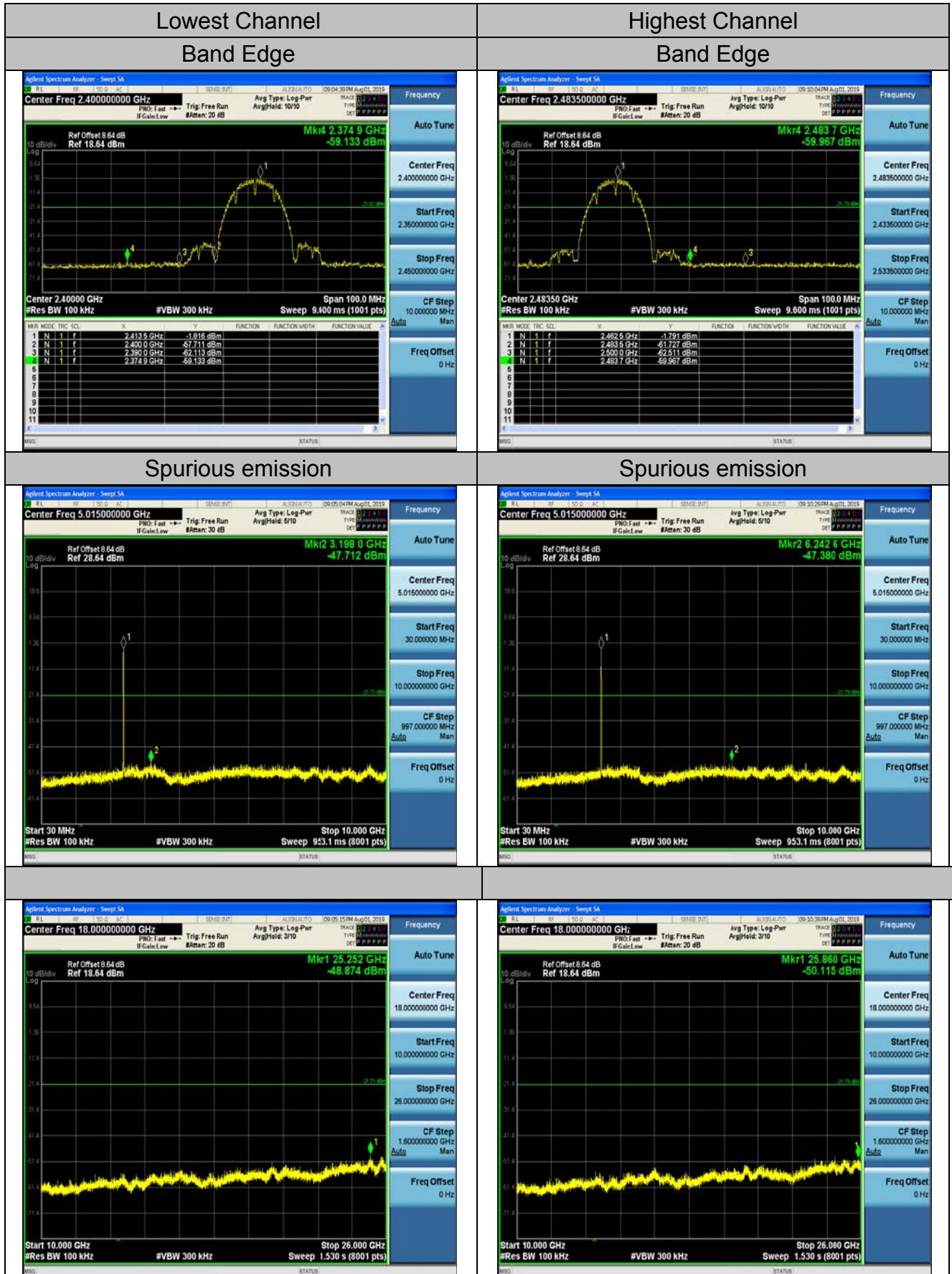
RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 26, 2019
Signal generator	Agilent	N5183A	HKE-071	Dec. 26, 2019
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Dec. 26, 2019
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 26, 2019

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



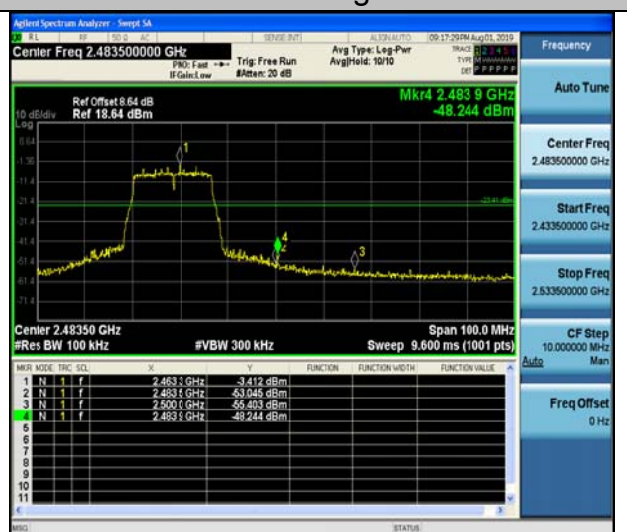
Test Data

802.11b Modulation

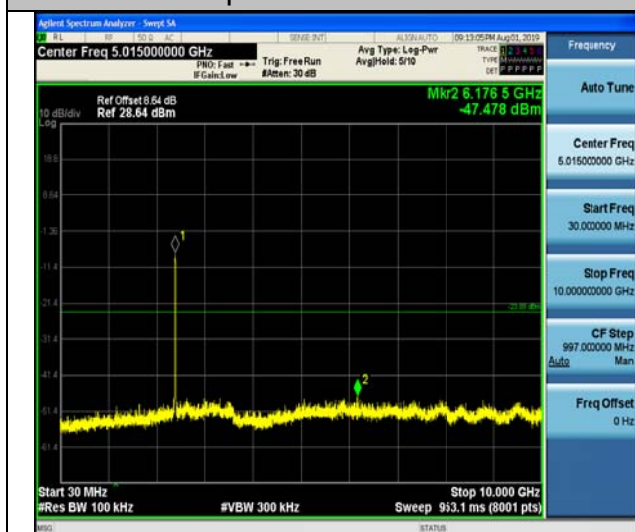




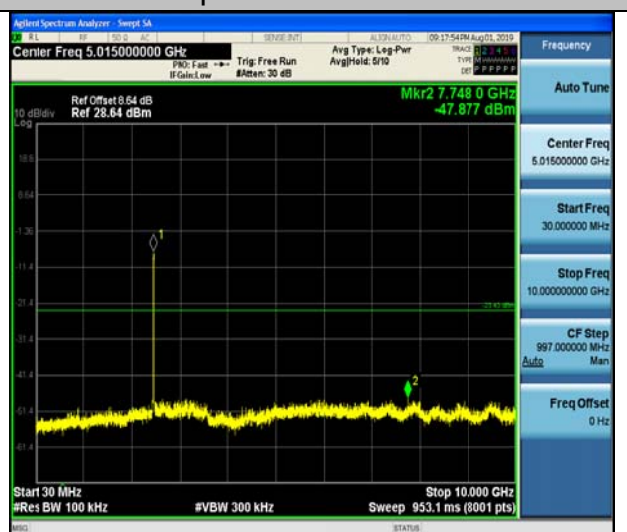
802.11g Modulation

Lowest Channel
Band EdgeHighest Channel
Band Edge

Spurious emission



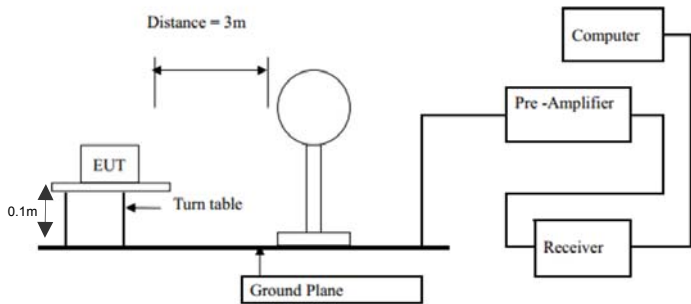
Spurious emission

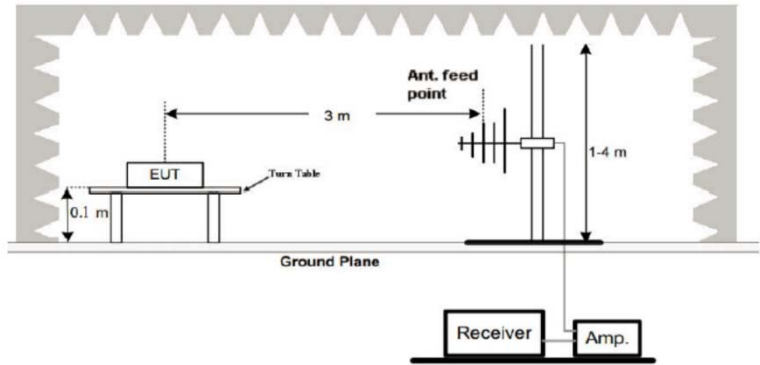




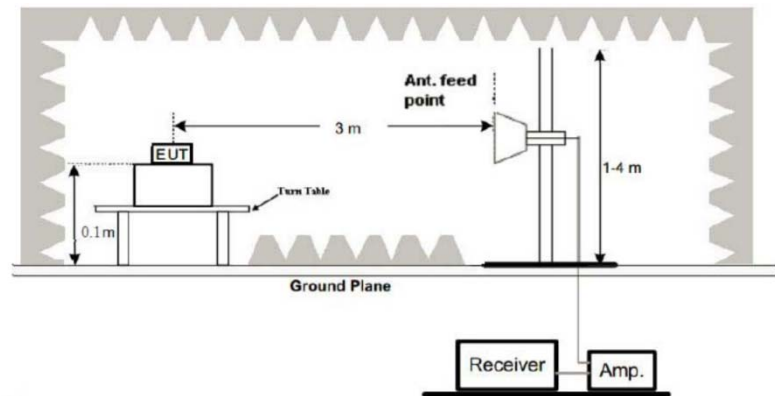
4.6. Radiated Spurious Emission Measurement

Test Specification

Test Requirement:	FCC Part15 C Section 15.205/ 15.209 RSS-Gen 8.9					
Test Method:	ANSI C63.10: 2013					
Frequency Range:	9 kHz to 25 GHz					
Measurement Distance:	3 m					
Antenna Polarization:	Horizontal & Vertical					
Operation mode:	Transmitting mode with modulation					
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark	
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value	
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value	
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value	
	Above 1GHz	Peak	1MHz	3MHz	Peak Value	
		Peak	1MHz	10Hz	Average Value	
Limit:	Frequency		Field Strength (microvolts/meter)		Measurement Distance (meters)	
	0.009-0.490		2400/F(KHz)		300	
	0.490-1.705		24000/F(KHz)		30	
	1.705-30		30		30	
	30-88		100		3	
	88-216		150		3	
	216-960		200		3	
	Above 960		500		3	
	Frequency		Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector	
	Above 1GHz		500	3	Average	
			5000	3	Peak	
	Test setup:	For radiated emissions below 30MHz				
						
		30MHz to 1GHz				



Above 1GHz



Test Procedure:

- For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
- For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.



	<p>3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</p> <p>4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.</p> <p>5. Use the following spectrum analyzer settings:</p> <p>(1) Span shall wide enough to fully capture the emission being measured;</p> <p>(2) Set RBW=100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;</p> <p>(3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.</p> <p>For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.</p>
Test results:	PASS

**Test Instruments**

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Receiver	R&S	ESCI-7	HKE-010	Dec. 26, 2019
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 26, 2019
Preamplifier	EMCI	EMC051845 SE	HKE-015	Dec. 26, 2019
Preamplifier	Agilent	83051A	HKE-016	Dec. 26, 2019
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 26, 2019
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Dec. 26, 2019
Horn antenna	Schwarzbeck	9120D	HKE-013	Dec. 26, 2019
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Dec. 26, 2019
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A
RF cable	Times	1-40G	HKE-034	Dec. 26, 2019

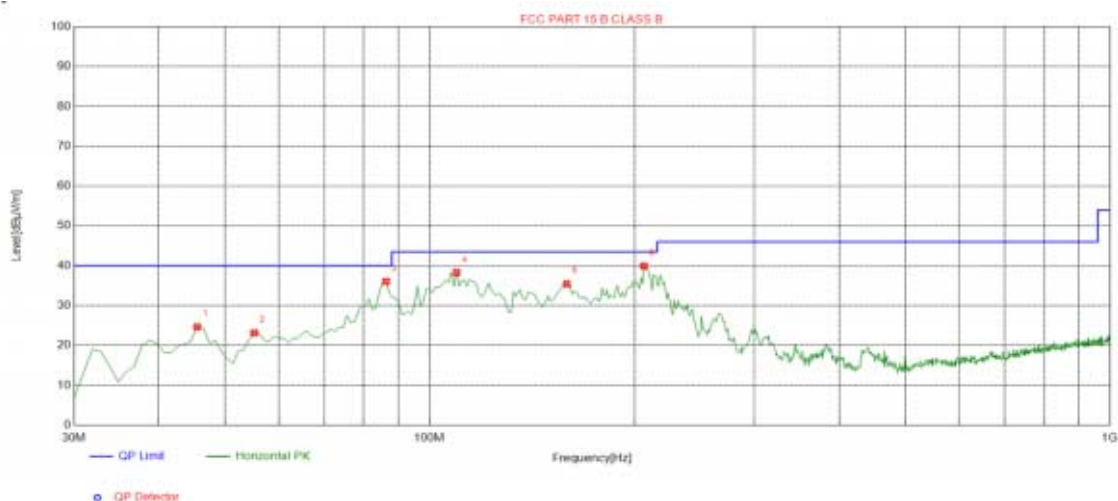
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



Test Data

Please refer to following diagram for individual
Below 1GHz

Horizontal

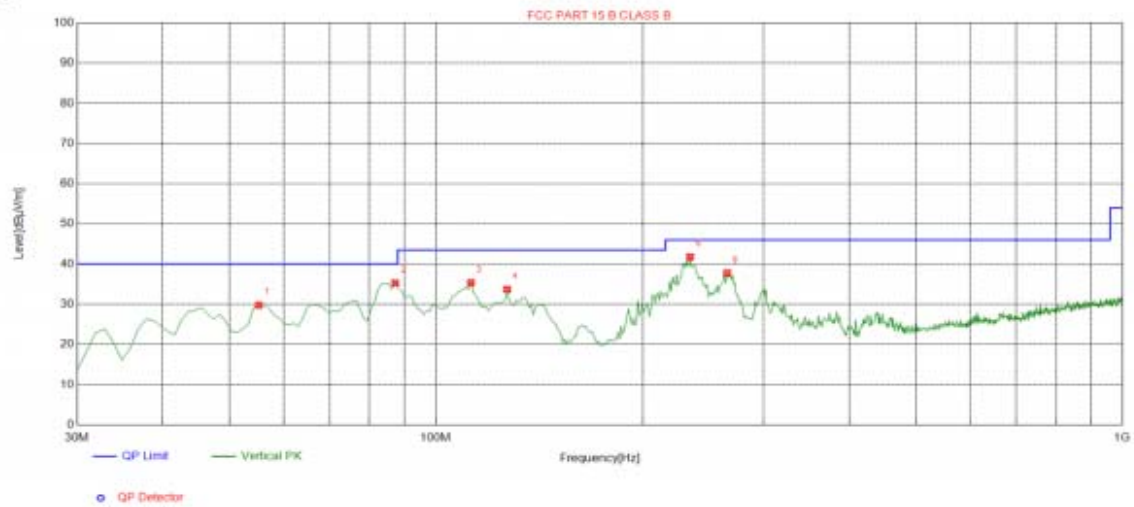


Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	45.5200	24.63	-13.65	40.00	15.37	100	139	Horizontal
2	55.2200	23.14	-14.44	40.00	16.86	100	101	Horizontal
3	86.2600	36.06	-17.97	40.00	3.94	100	76	Horizontal
4	109.540	38.31	-15.43	43.50	5.19	100	212	Horizontal
5	159.010	35.44	-18.29	43.50	8.06	100	89	Horizontal
6	206.540	39.95	-14.89	43.50	3.55	100	51	Horizontal

Remark: Transd = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level



Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	55.2200	29.75	-14.44	40.00	10.25	100	84	Vertical
2	87.2300	35.31	-17.73	40.00	4.69	100	1	Vertical
3	112.450	35.35	-15.84	43.50	8.15	100	21	Vertical
4	127.000	33.71	-18.13	43.50	9.79	100	145	Vertical
5	234.670	41.80	-14.10	46.00	4.20	100	351	Vertical
6	265.710	37.79	-13.60	46.00	8.21	100	351	Vertical

Remark: Transd = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

**Above 1GHz****RADIATED EMISSION TEST**

LOW CH1 (802.11b Mode)/2412

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	65.22	-3.64	61.58	74	-12.42	peak
4824	50.72	-3.64	47.08	54	-6.92	AVG
7236	56.61	-0.95	55.66	74	-18.34	peak
7236	44.25	-0.95	43.3	54	-10.7	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	65.73	-3.64	62.09	74	-11.91	peak
4824	49.61	-3.64	45.97	54	-8.03	AVG
7236	57.42	-0.95	56.47	74	-17.53	peak
7236	44.42	-0.95	43.47	54	-10.53	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



MID CH6 (802.11b Mode)/2437

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4874	62.20	-3.51	58.69	74	-15.31	peak
4874	48.83	-3.51	45.32	54	-8.68	AVG
7311	58.53	-0.82	57.71	74	-16.29	peak
7311	44.62	-0.82	43.8	54	-10.2	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4874	64.83	-3.51	61.32	74	-12.68	peak
4874	47.09	-3.51	43.58	54	-10.42	AVG
7311	59.51	-0.82	58.69	74	-15.31	peak
7311	42.99	-0.82	42.17	54	-11.83	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



HIGH CH11 (802.11b Mode)/2462

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4924	64.2	-3.43	60.77	74	-13.23	peak
4924	46.95	-3.43	43.52	54	-10.48	AVG
7386	59.52	-0.75	58.77	74	-15.23	peak
7386	43.27	-0.75	42.52	54	-11.48	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4924	63.51	-3.43	60.08	74	-13.92	peak
4924	48.57	-3.43	45.14	54	-8.86	AVG
7386	55.04	-0.75	54.29	74	-19.71	peak
7386	42.13	-0.75	41.38	54	-12.62	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark:

(1) Measuring frequencies from 1 GHz to the 25 GHz.

(2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.

(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.

(4) Data of measurement within this frequency range shown "----" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.



LOW CH1 (802.11g Mode)/2412

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	63.31	-3.64	59.67	74	-14.33	peak
4824	49.59	-3.64	45.95	54	-8.05	AVG
7236	58.95	-0.95	58	74	-16	peak
7236	45.62	-0.95	44.67	54	-9.33	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	62.33	-3.64	58.69	74	-15.31	peak
4824	47.81	-3.64	44.17	54	-9.83	AVG
7236	59.13	-0.95	58.18	74	-15.82	peak
7236	43.25	-0.95	42.3	54	-11.7	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



MID CH6 (802.11g Mode)/2437

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB μ V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	
4874	62.44	-3.51	58.93	74	-15.07	peak
4874	46.72	-3.51	43.21	54	-10.79	AVG
7311	58.49	-0.82	57.67	74	-16.33	peak
7311	43.31	-0.82	42.49	54	-11.51	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB μ V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	
4874	64.28	-3.51	60.77	74	-13.23	peak
4874	47.13	-3.51	43.62	54	-10.38	AVG
7311	56.33	-0.82	55.51	74	-18.49	peak
7311	43.54	-0.82	42.72	54	-11.28	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



HIGH CH11 (802.11g Mode)/2462

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4924	63.30	-3.43	59.87	74	-14.13	peak
4924	48.25	-3.43	44.82	54	-9.18	AVG
7386	57.55	-0.75	56.8	74	-17.2	peak
7386	42.90	-0.75	42.15	54	-11.85	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4924	61.20	-3.43	57.77	74	-16.23	peak
4924	48.92	-3.43	45.49	54	-8.51	AVG
7386	56.23	-0.75	55.48	74	-18.52	peak
7386	41.54	-0.75	40.79	54	-13.21	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark:

(1) Measuring frequencies from 1 GHz to the 25 GHz.

(2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.

(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.

(4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

**Test Result of Radiated Spurious at Band edges**

Operation Mode:
802.11b Mode TX CH Low (2412MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	58.21	-5.81	52.4	74	-21.6	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	62.06	-5.84	56.22	74	-17.78	peak
2390.00	47.14	-5.84	41.3	54	-12.7	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	58.78	-5.81	52.97	74	-21.03	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	63.39	-5.84	57.55	74	-16.45	peak
2390.00	47.70	-5.84	41.86	54	-12.14	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	57.62	-5.81	51.81	74	-22.19	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	54.3	-6.06	48.24	74	-25.76	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	57.79	-5.81	51.98	74	-22.02	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	53.48	-6.06	47.42	74	-26.58	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						



Operation Mode: 802.11g Mode TX CH Low (2412MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	56.6	-5.81	50.79	74	-23.21	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	62.29	-5.84	56.45	74	-17.55	peak
2390.00	46.82	-5.84	40.98	54	-13.02	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	55.89	-5.81	50.08	74	-23.92	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	61.98	-5.84	56.14	74	-17.86	peak
2390.00	44.46	-5.84	38.62	54	-15.38	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	56.1	-5.65	50.45	74	-23.55	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	54.98	-5.65	49.33	74	-24.67	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	56.62	-5.65	50.97	74	-23.03	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.48	-5.65	49.83	74	-24.17	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						



ANTENNA REQUIREMENT

Standard Applicable

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247, if 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 6dBi.

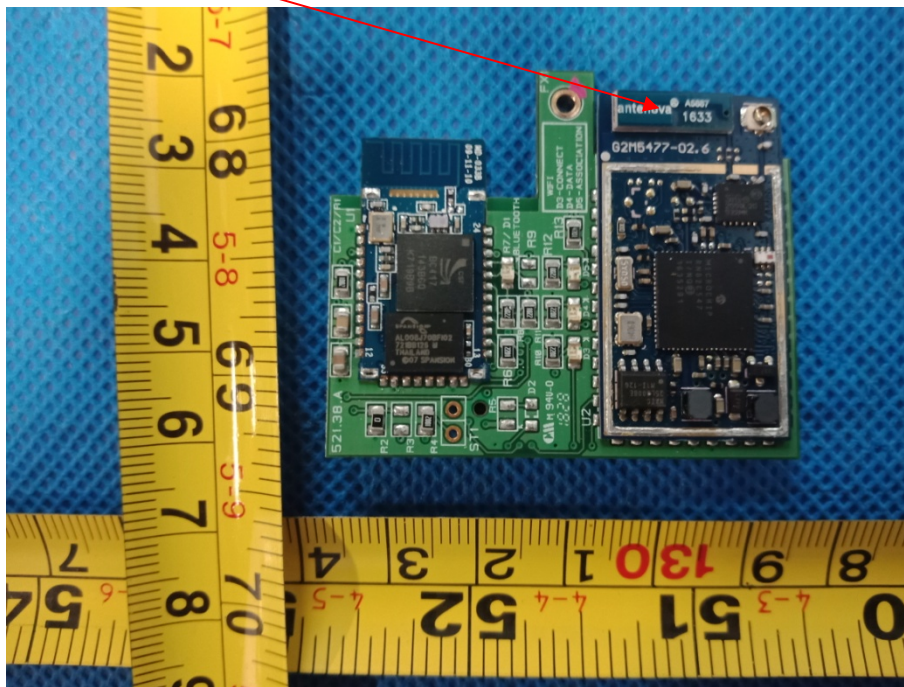
Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The antenna used in this product is a Internal Antenna, The directional gains of antenna used for transmitting is 2dBi.

WIFI ANTENNA



4.7. PHOTOGRAPH OF TEST

Radiated Emission





Conducted Emission





4.8. PHOTOS OF THE EUT

Reference to the reporter : ANNEX A of external photos and ANNEX B of internal photos