



TEST REPORT

Report Reference No. : **TRE1709024301** **R/C.....:** 74361
FCC ID : **2AMIL-PM3**
Applicant's name : **Foneric Electronics Co.,Ltd**
Address : **201,Floor 2,No.2 Building,Foxda Industrial Zone, Northern Lanzhu Road,Pingshan,Shenzhen,518038,China**
Manufacturer : **Foneric Electronics Co.,Ltd**
Address : **201,Floor 2,No.2 Building,Foxda Industrial Zone, Northern Lanzhu Road,Pingshan,Shenzhen,518038,China**
Test item description : **VOCOlinc PM3 Smart Outlet**
Trade Mark : **VOCOlinc**
Model/Type reference : **PM3**
Listed Model(s) : **-**
Standard : **FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of receipt of test sample : **Sept. 29, 2017**
Date of testing : **Sept. 29, 2017 - Oct. 30, 2017**
Date of issue : **Oct. 30, 2017**
Result : **PASS**

Compiled by
(position+printedname+signature)....: File administrators Becky Liang

Supervised by
(position+printedname+signature)....: Project Engineer Jeff Sun

Approved by
(position+printedname+signature)....: RF Manager Hans Hu

Testing Laboratory Name : **Shenzhen Huatongwei International Inspection Co., Ltd.**

Address : **1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China**

Shenzhen Huatongwei International Inspection Co., Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen Huatongwei International Inspection Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen Huatongwei International Inspection Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

The test report merely correspond to the test sample.

Contents

<u>1.</u>	<u>TEST STANDARDS AND REPORT VERSION</u>	<u>3</u>
1.1.	Test Standards	3
1.2.	Report version	3
<u>2.</u>	<u>TEST DESCRIPTION</u>	<u>4</u>
<u>3.</u>	<u>SUMMARY</u>	<u>5</u>
3.1.	Client Information	5
3.2.	Product Description	5
3.3.	Operation state	6
3.4.	EUT configuration	6
3.5.	Modifications	6
<u>4.</u>	<u>TEST ENVIRONMENT</u>	<u>7</u>
4.1.	Address of the test laboratory	7
4.2.	Test Facility	7
4.3.	Environmental conditions	8
4.4.	Statement of the measurement uncertainty	8
4.5.	Equipments Used during the Test	9
<u>5.</u>	<u>TEST CONDITIONS AND RESULTS</u>	<u>10</u>
5.1.	Antenna requirement	10
5.2.	Conducted Emissions (AC Main)	11
5.3.	Conducted Peak Output Power	14
5.4.	Power Spectral Density	15
5.5.	6dB bandwidth	19
5.6.	Restricted band	23
5.7.	Band edge and Spurious Emissions (conducted)	26
5.8.	Spurious Emissions (radiated)	39
<u>6.</u>	<u>TEST SETUP PHOTOS</u>	<u>45</u>
<u>7.</u>	<u>EXTERANAL AND INTERNAL PHOTOS</u>	<u>46</u>

1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

[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.

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

[KDB 558074 D01 DTS Meas Guidance v04](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

1.2. Report version

Version No.	Date of issue	Description
00	Oct. 30, 2017	Original

2. TEST DESCRIPTION

Test Item	FCC Rule	Result	Test Engineer
Antenna requirement	15.203/15.247(c)	Pass	Jeff Sun
Line Conducted Emissions (AC Main)	15.207	Pass	Michael Jie
Conducted Peak Output Power	15.247(b)(3)	Pass	Baozhu Hu
Power Spectral Density	15.247(e)	Pass	Baozhu Hu
6dB Bandwidth	15.247(a)(2)	Pass	Baozhu Hu
Restricted band	15.247(d)/15.205	Pass	Hongquan Li
Spurious Emissions	15.247(d)/15.209	Pass	Hongquan Li

Note: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	Foneric Electronics Co.,Ltd
Address:	201,Floor 2,No.2 Building,Foxda Industrial Zone, Northern Lanzhu Road,Pingshan,Shenzhen,518038,China
Manufacturer:	Foneric Electronics Co.,Ltd
Address:	201,Floor 2,No.2 Building,Foxda Industrial Zone, Northern Lanzhu Road,Pingshan,Shenzhen,518038,China

3.2. Product Description

Name of EUT:	VOCOlinc PM3 Smart Outlet
Trade Mark:	VOCOlinc
Model No.:	PM3
Listed Model(s):	-
Power supply:	AC 120V/60Hz
Adapter information:	-
WIFI	
Supported type:	802.11b/802.11g/802.11n(HT20)
Modulation:	DSSS for 802.11b OFDM for 802.11g/802.11n(HT20)
Operation frequency:	2412MHz~2462MHz
Channel number:	11
Channel separation:	5MHz
Antenna type:	Integral Antenna
Antenna gain:	2.30 dBi

3.3. Operation state

➤ Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

802.11b/g/n(HT20)	
Channel	Frequency (MHz)
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

➤ Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).
For AC power line conducted emissions:
The EUT was set to connect with the WLAN AP under large package sizes transmission.
For RF test axis
EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data Recorded in the report.

3.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

○	/	Manufacturer:	/
		Model No.:	/
○	/	Manufacturer:	/
		Model No.:	/

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

IC-Registration No.: 5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.39 dB	(1)
Radiated Emissions 30~1000MHz	4.24 dB	(1)
Radiated Emissions 1~18GHz	5.16 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.5. Equipments Used during the Test

Conducted Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	2016/11/13
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	100038	2016/11/13
3	Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	2016/11/13
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	-	-

Radiated Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI test receiver	Rohde&Schwarz	ESI 26	100009	2016/11/13
2	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2016/11/13
3	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2016/11/13
4	Horn antenna	ShwarzBeck	9120D	1011	2016/11/13
5	Horn Antenna	SCHWARZBECK	BBHA9170	25841	2016/11/13
6	Amplifier	Sonoma	310N	E009-13	2016/11/13
7	JS Amplifier	Rohde&Schwarz	JS4-00101800-28-5A	F201504	2016/11/13
8	Amplifier	Compliance Direction systems	PAP1-4060	120	2016/11/13
9	High pass filter	Compliance Direction systems	BSU-6	34202	2016/11/13
10	EMI test Software	Rohde&Schwarz	ESK1	-	-
11	EMI test Software	Audix	E3	-	-
12	TURNTABLE	MATURO	TT2.0	-	-
13	ANTENNA MAST	MATURO	TAM-4.0-P	-	-

RF Conducted methods					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Spectrum Analyzer	Rohde&Schwarz	FSP	1164.4391.40	2016/11/13
2	MXA Signal Analyzer	Agilent Technologies	N9020A	MY5050187	2016/11/13
3	Power Meter	Anritsu	ML2480B	100798	2016/11/13
4	Power Sensor	Anritsu	MA2411B	100258	2016/11/13

The Cal.Interval was one year.

5. TEST CONDITIONS AND RESULTS

5.1. Antenna requirement

REQUIREMENT:

FCC CFR Title 47 Part 15 Subpart C 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

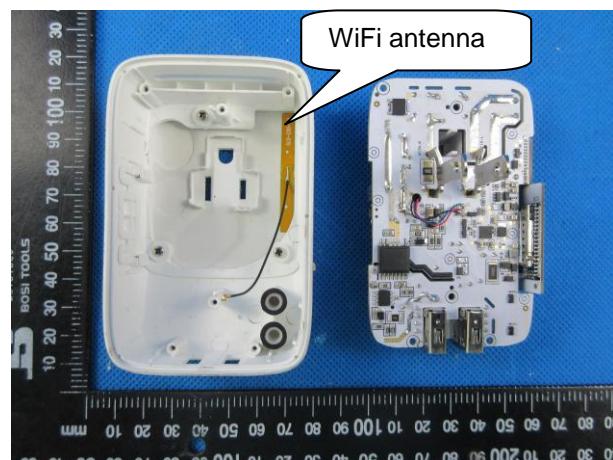
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

TEST RESULTS

Passed Not Applicable

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



5.2. Conducted Emissions (AC Main)

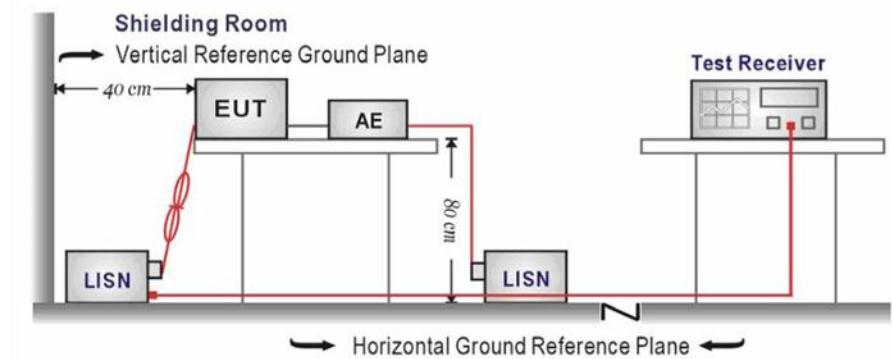
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207:

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

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST MODE:

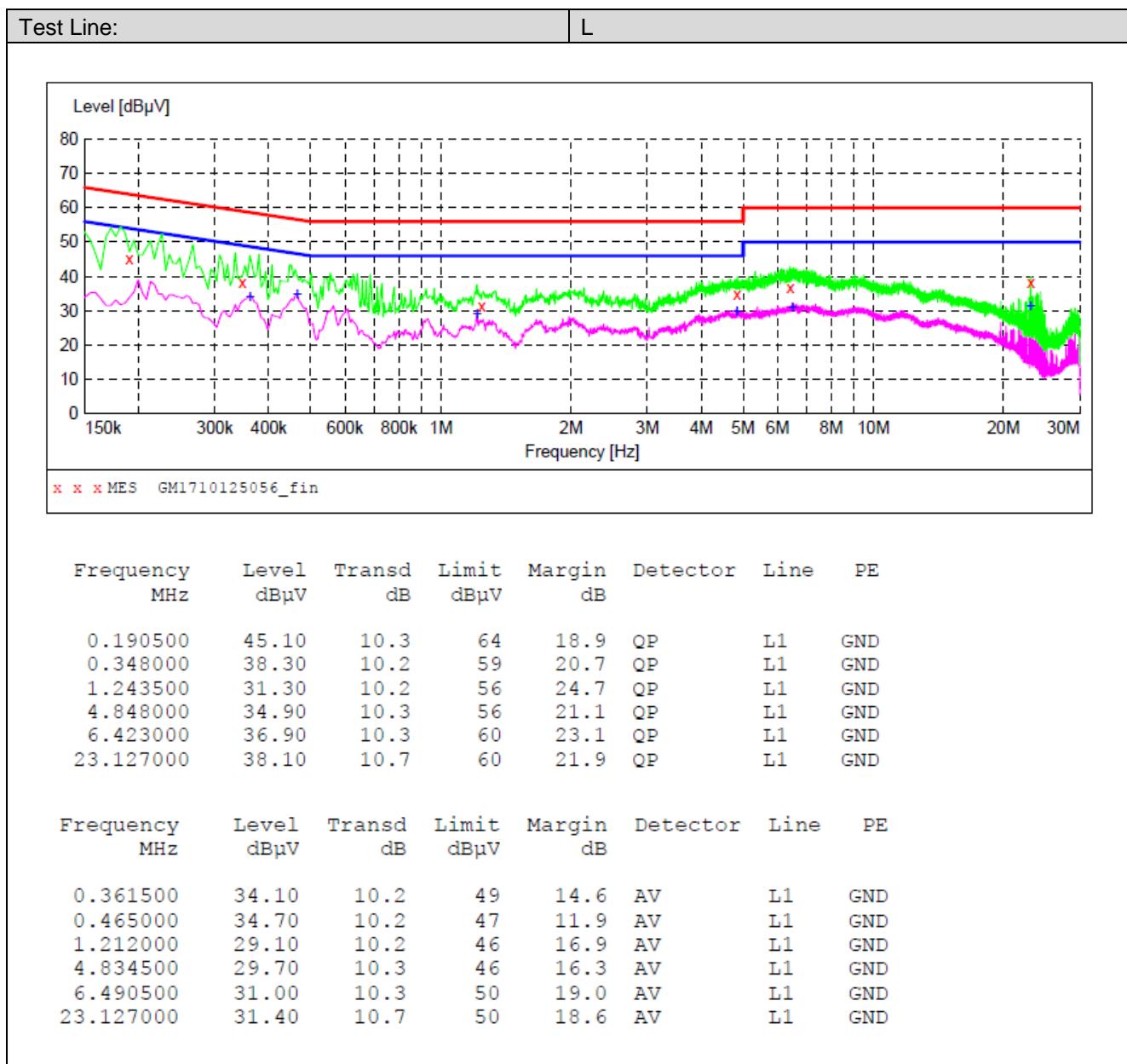
Please refer to the clause 3.3

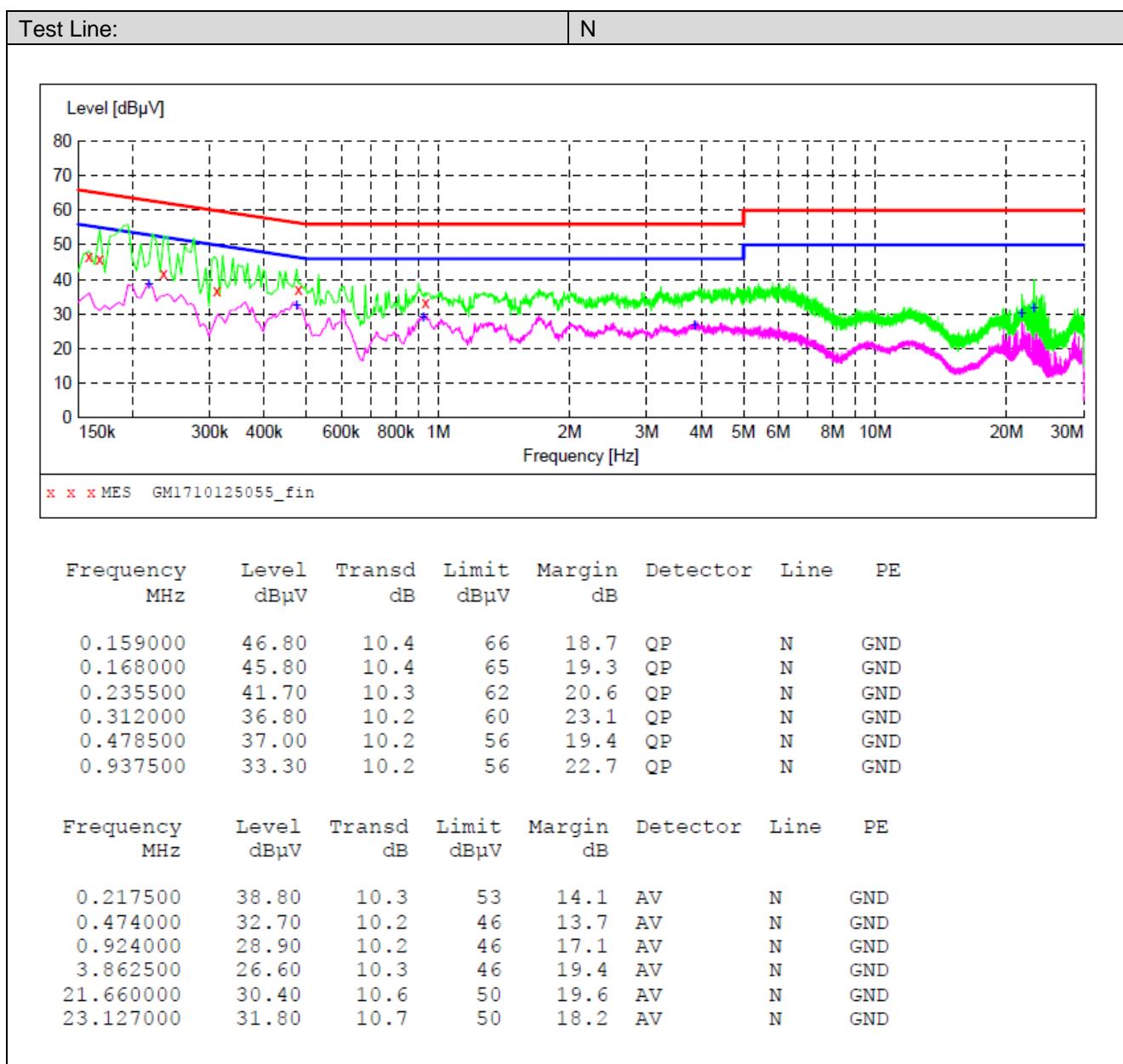
TEST RESULTS

Passed Not Applicable

Note:

- 1) Transd=Cable loss+ Pulse Limiter Factor + Artificial Mains Factor
- 2) Margin= Limit -Level



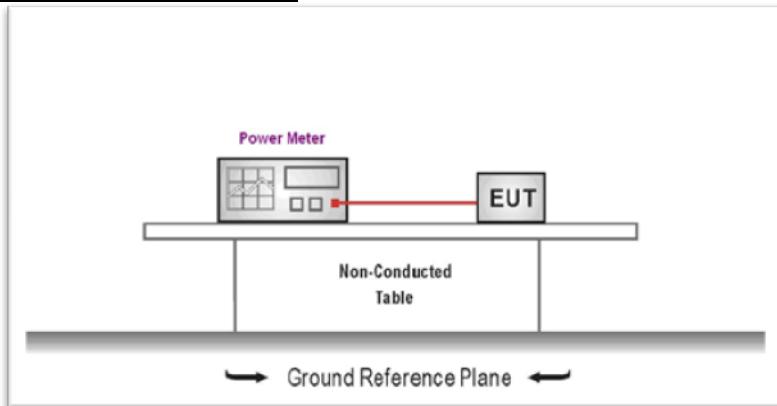


5.3. Conducted Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3): **30dBm**:

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10: 2013 and KDB 558074 D01 for compliance to FCC 47 CFR 15.247 requirements.
2. The maximum peak conducted output power may be measured using a broadband peak RF power meter.
3. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector
4. Record the measurement data.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed Not Applicable

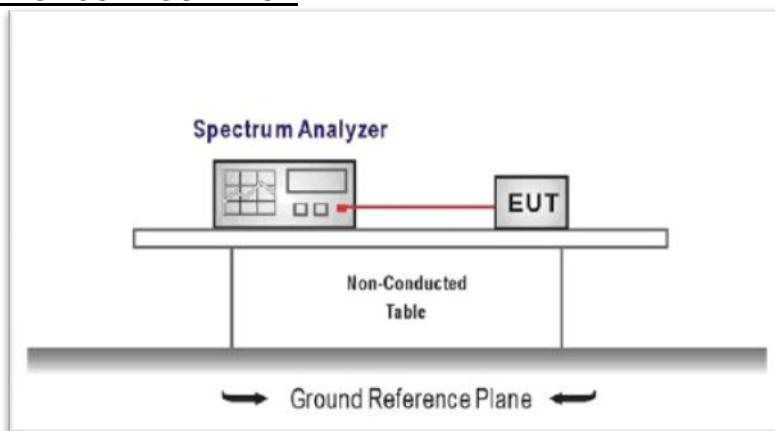
Type	Channel	Output power (dBm)	Limit (dBm)	Result
802.11b	01	12.49	≤30.00	Pass
	06	12.27		
	11	12.53		
802.11g	01	11.49	≤30.00	Pass
	06	12.02		
	11	11.30		
802.11n(HT20)	01	10.18	≤30.00	Pass
	06	10.64		
	11	10.13		

5.4. Power Spectral Density

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e): 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.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input,
2. Configure the spectrum analyzer as shown below:
Center frequency=DTS channel center frequency
Span =1.5 times the DTS bandwidth
 $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$, $VBW \geq 3 \times RBW$
Sweep time = auto couple
Detector = peak
Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Use the peak marker function to determine the maximum amplitude level within the RBW.
5. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST MODE:

Please refer to the clause 3.3

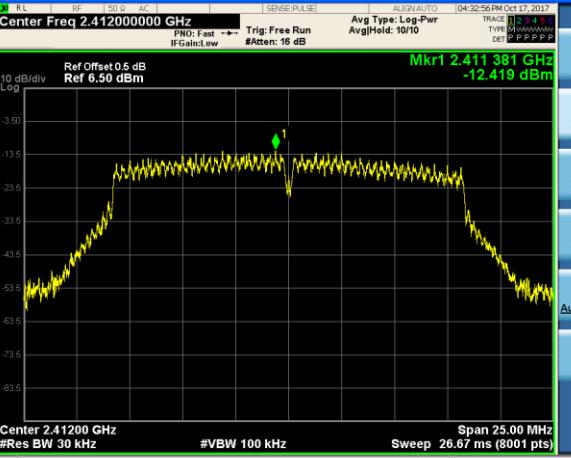
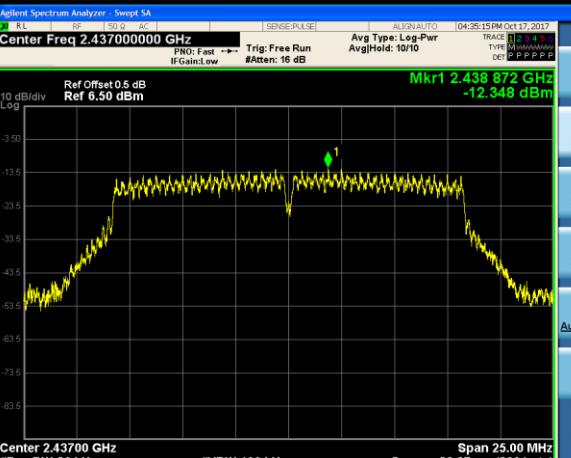
TEST RESULTS

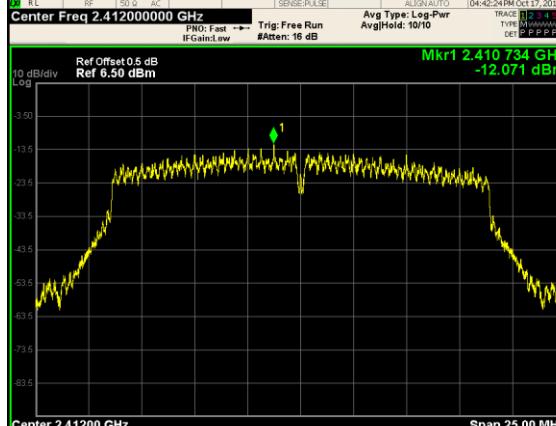
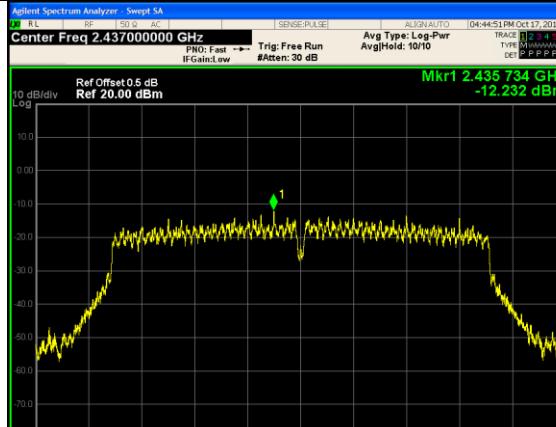
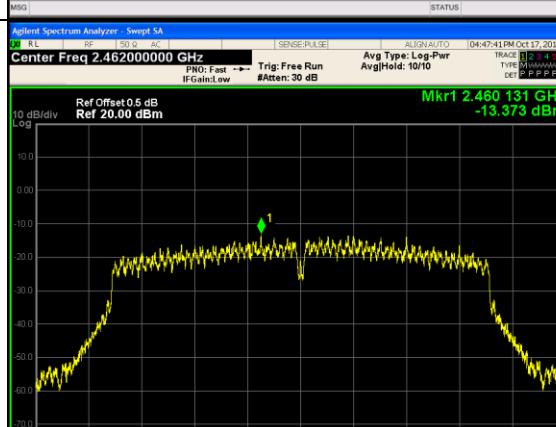
Passed Not Applicable

Type	Channel	Power Spectral Density (dBm/RBW)	Limit (dBm/RBW)	Result
802.11b	01	-0.905	≤ 8.00	Pass
	06	-1.370		
	11	-0.868		
802.11g	01	-12.419	≤ 8.00	Pass
	06	-12.348		
	11	-12.061		
802.11n(HT20)	01	-12.071	≤ 8.00	Pass
	06	-12.232		
	11	-13.373		

Test plot as follows:

Type:	802.11 b
CH01	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.412000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.411 251.9 GHz -0.905 dBm</p> <p>Center 2.412000 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 16.00 ms (8001 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.412000000 GHz</p> <p>Start Freq 2.404500000 GHz</p> <p>Stop Freq 2.419500000 GHz</p> <p>CF Step 1.500000 MHz Man</p> <p>Freq Offset 0 Hz</p>
CH06	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.437 751.9 GHz -1.370 dBm</p> <p>Center 2.437000 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 16.00 ms (8001 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.437000000 GHz</p> <p>Start Freq 2.429500000 GHz</p> <p>Stop Freq 2.444500000 GHz</p> <p>CF Step 1.500000 MHz Man</p> <p>Freq Offset 0 Hz</p>
CH11	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.462000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.462 751.9 GHz -0.868 dBm</p> <p>Center 2.462000 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 16.00 ms (8001 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.462000000 GHz</p> <p>Start Freq 2.454500000 GHz</p> <p>Stop Freq 2.469500000 GHz</p> <p>CF Step 1.500000 MHz Man</p> <p>Freq Offset 0 Hz</p>

Type:	802.11 g
CH01	 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.41200000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>Span 25.00 MHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Sweep 26.67 ms (8001 pts)</p> <p>Mkr1 2.411 381 GHz -12.419 dBm</p> <p>MSG STATUS</p>
CH06	 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.43700000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>Span 25.00 MHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Sweep 26.67 ms (8001 pts)</p> <p>Mkr1 2.438 872 GHz -12.348 dBm</p> <p>MSG STATUS</p>
CH11	 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.46200000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>Span 25.00 MHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Sweep 26.67 ms (8001 pts)</p> <p>Mkr1 2.463 875 GHz -12.061 dBm</p> <p>MSG STATUS</p>

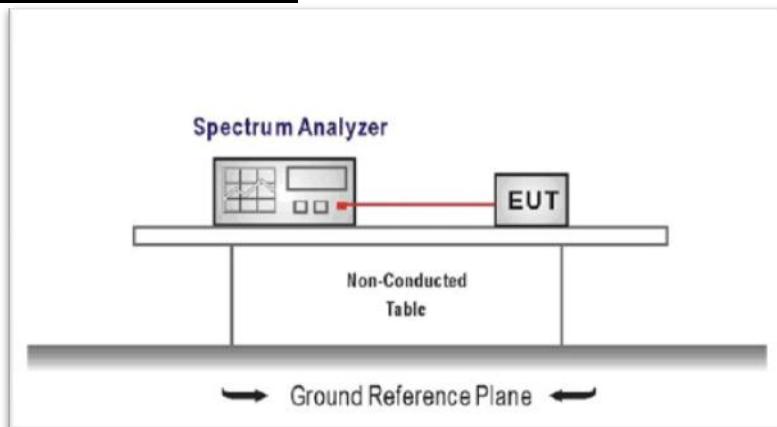
Type:		802.11n(HT20)
CH01		<p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.412000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 6.50 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.410 734 GHz -12.071 dBm</p> <p>Center 2.41200 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 25.00 MHz Span 26.67 ms (8001 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.412000000 GHz</p> <p>Start Freq 2.399500000 GHz</p> <p>Stop Freq 2.424500000 GHz</p> <p>CF Step 2.500000 MHz Auto</p> <p>Freq Offset 0 Hz</p> 
CH06		<p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 20.00 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.435 734 GHz -12.232 dBm</p> <p>Center 2.43700 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 25.00 MHz Span 26.67 ms (8001 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.437000000 GHz</p> <p>Start Freq 2.424500000 GHz</p> <p>Stop Freq 2.449500000 GHz</p> <p>CF Step 2.500000 MHz Auto</p> <p>Freq Offset 0 Hz</p> 
CH11		<p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.462000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 20.00 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.460 131 GHz -13.373 dBm</p> <p>Center 2.46200 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 25.00 MHz Span 26.67 ms (8001 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.462000000 GHz</p> <p>Start Freq 2.449500000 GHz</p> <p>Stop Freq 2.474500000 GHz</p> <p>CF Step 2.500000 MHz Auto</p> <p>Freq Offset 0 Hz</p> 

5.5. 6dB bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
 - Center Frequency = DTS channel center frequency
 - Span=2 x DTS bandwidth
 - RBW = 100 kHz, VBW $\geq 3 \times$ RBW
 - Sweep time= auto couple
 - Detector = Peak
 - Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission, and record the pertinent measurements.

TEST MODE:

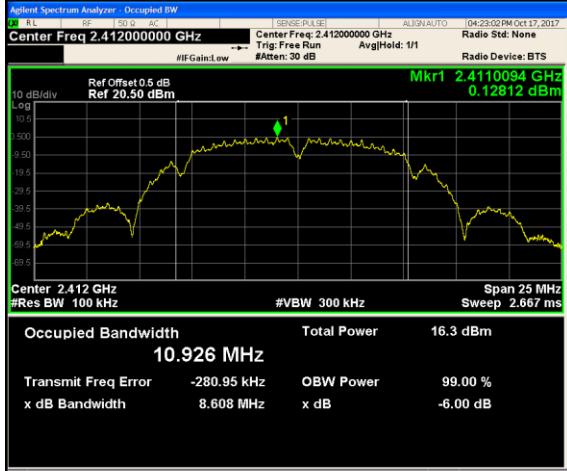
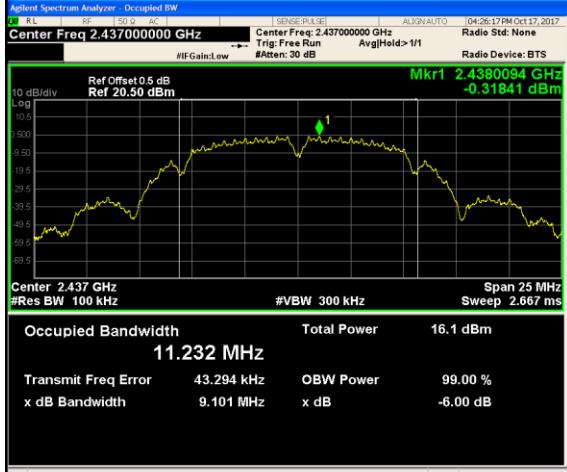
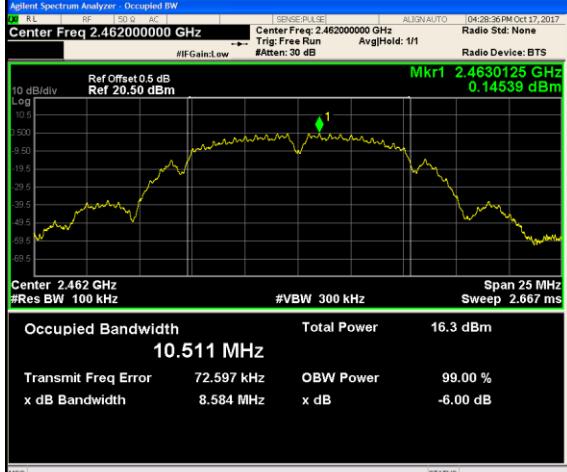
Please refer to the clause 3.3

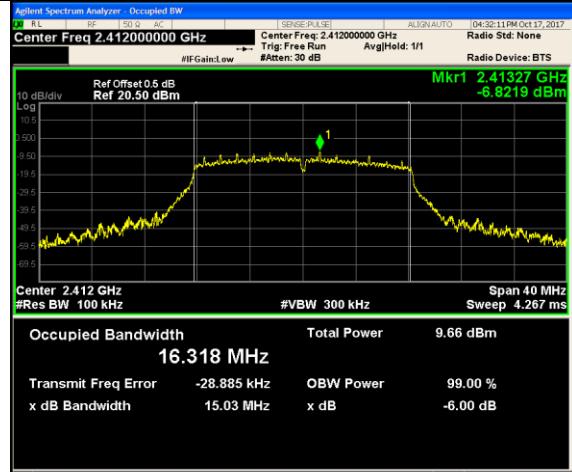
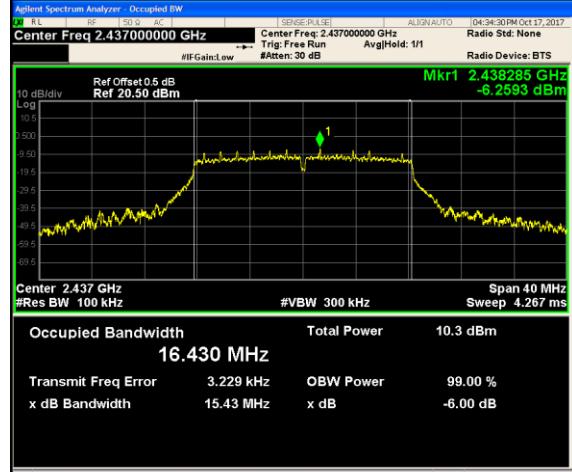
TEST RESULTS

Passed Not Applicable

Type	Channel	6dB Bandwidth (MHz)	Limit (kHz)	Result
802.11b	01	8.608	≥ 500	Pass
	06	9.101		
	11	8.584		
802.11g	01	15.03	≥ 500	Pass
	06	15.43		
	11	15.10		
802.11n(HT20)	01	15.07	≥ 500	Pass
	06	15.11		
	11	15.01		

Test plot as follows:

Type:	802.11 b
CH01	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.412000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 20.50 dBm</p> <p>Span 25 MHz</p> <p>Sweep 2.667 ms</p> <p>Occupied Bandwidth 10.926 MHz</p> <p>Total Power 16.3 dBm</p> <p>Transmit Freq Error -280.95 kHz</p> <p>x dB Bandwidth 8.608 MHz</p> <p>OBW Power 99.00 %</p> <p>x dB -6.00 dB</p>
CH06	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 20.50 dBm</p> <p>Span 25 MHz</p> <p>Sweep 2.667 ms</p> <p>Occupied Bandwidth 11.232 MHz</p> <p>Total Power 16.1 dBm</p> <p>Transmit Freq Error 43.294 kHz</p> <p>x dB Bandwidth 9.101 MHz</p> <p>OBW Power 99.00 %</p> <p>x dB -6.00 dB</p>
CH11	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.462000000 GHz</p> <p>Ref Offset 0.5 dB</p> <p>Ref 20.50 dBm</p> <p>Span 25 MHz</p> <p>Sweep 2.667 ms</p> <p>Occupied Bandwidth 10.511 MHz</p> <p>Total Power 16.3 dBm</p> <p>Transmit Freq Error 72.597 kHz</p> <p>x dB Bandwidth 8.584 MHz</p> <p>OBW Power 99.00 %</p> <p>x dB -6.00 dB</p>

Type:	802.11 g
CH01	 <p>CH01 Spectrum Analysis Data:</p> <p>Center Freq: 2.412000000 GHz</p> <p>Occupied Bandwidth: 16.318 MHz</p> <p>Total Power: 9.66 dBm</p> <p>Transmit Freq Error: -28.885 kHz</p> <p>x dB Bandwidth: 15.03 MHz</p> <p>OBW Power: 99.00 %</p> <p>x dB: -6.00 dB</p>
CH06	 <p>CH06 Spectrum Analysis Data:</p> <p>Center Freq: 2.437000000 GHz</p> <p>Occupied Bandwidth: 16.430 MHz</p> <p>Total Power: 10.3 dBm</p> <p>Transmit Freq Error: 3.229 kHz</p> <p>x dB Bandwidth: 15.43 MHz</p> <p>OBW Power: 99.00 %</p> <p>x dB: -6.00 dB</p>
CH11	 <p>CH11 Spectrum Analysis Data:</p> <p>Center Freq: 2.462000000 GHz</p> <p>Occupied Bandwidth: 16.258 MHz</p> <p>Total Power: 9.55 dBm</p> <p>Transmit Freq Error: 14.298 kHz</p> <p>x dB Bandwidth: 15.10 MHz</p> <p>OBW Power: 99.00 %</p> <p>x dB: -6.00 dB</p>

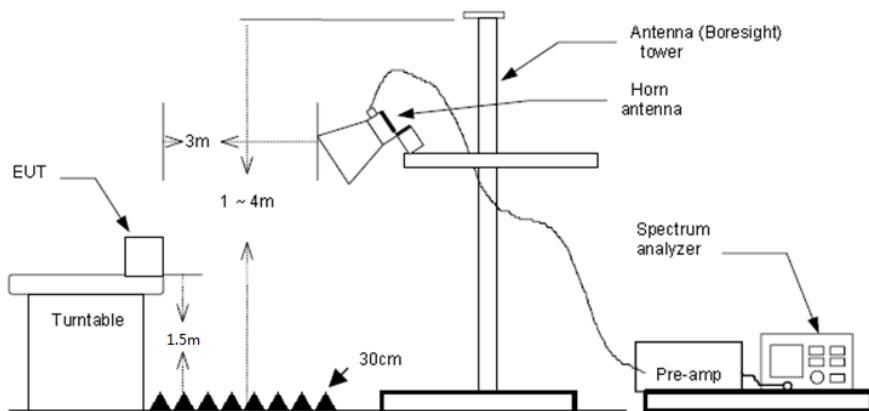
Type:	802.11n(HT20)
CH01	<p>CH01</p> <p>17.384 MHz</p> <p>8.58 dBm</p>
CH06	<p>17.531 MHz</p> <p>9.09 dBm</p>
CH11	<p>17.347 MHz</p> <p>8.46 dBm</p>

5.6. Restricted band

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

- 1) The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
- 2) The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
- 3) The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
- 4) The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
- 5) The receiver set as follow:
RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed Not Applicable

Note:

- 1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor

802.11b					CH01				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	13.38	28.05	6.62	0.00	48.05	74.00	-25.95	Vertical	Peak
2390.01	12.94	27.65	6.75	0.00	47.34	74.00	-26.66	Vertical	Peak
2310.00	13.73	28.05	6.62	0.00	48.40	74.00	-25.60	Horizontal	Peak
2390.01	13.12	27.65	6.75	0.00	47.52	74.00	-26.48	Horizontal	Peak
2310.00	10.89	28.05	6.62	0.00	45.56	54.00	-8.44	Vertical	Average
2390.01	10.43	27.65	6.75	0.00	44.83	54.00	-9.17	Vertical	Average
2310.00	10.89	28.05	6.62	0.00	45.56	54.00	-8.44	Horizontal	Average
2390.01	10.41	27.65	6.75	0.00	44.81	54.00	-9.19	Horizontal	Average

802.11b					CH11				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.49	11.76	27.26	6.83	0.00	45.85	74.00	-28.15	Vertical	Peak
2500.00	12.54	27.20	6.84	0.00	46.58	74.00	-27.42	Vertical	Peak
2483.49	13.10	27.26	6.83	0.00	47.19	74.00	-26.81	Horizontal	Peak
2500.00	13.26	27.20	6.84	0.00	47.30	74.00	-26.70	Horizontal	Peak
2483.49	10.53	27.26	6.83	0.00	44.62	54.00	-9.38	Vertical	Average
2500.00	10.45	27.20	6.84	0.00	44.49	54.00	-9.51	Vertical	Average
2483.49	10.51	27.26	6.83	0.00	44.60	54.00	-9.40	Horizontal	Average
2500.00	10.43	27.20	6.84	0.00	44.47	54.00	-9.53	Horizontal	Average

802.11g					CH01				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	14.03	28.05	6.62	0.00	48.70	74.00	-25.30	Vertical	Peak
2390.01	14.75	27.65	6.75	0.00	49.15	74.00	-24.85	Vertical	Peak
2310.00	15.41	28.05	6.62	0.00	50.08	74.00	-23.92	Horizontal	Peak
2390.01	12.86	27.65	6.75	0.00	47.26	74.00	-26.74	Horizontal	Peak
2310.00	10.90	28.05	6.62	0.00	45.57	54.00	-8.43	Vertical	Average
2390.01	10.41	27.65	6.75	0.00	44.81	54.00	-9.19	Vertical	Average
2310.00	10.92	28.05	6.62	0.00	45.59	54.00	-8.41	Horizontal	Average
2390.01	10.47	27.65	6.75	0.00	44.87	54.00	-9.13	Horizontal	Average

802.11g					CH11				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.49	12.72	27.26	6.83	0.00	46.81	74.00	-27.19	Vertical	Peak
2500.00	13.85	27.20	6.84	0.00	47.89	74.00	-26.11	Vertical	Peak
2483.49	13.75	27.26	6.83	0.00	47.84	74.00	-26.16	Horizontal	Peak
2500.00	12.68	27.20	6.84	0.00	46.72	74.00	-27.28	Horizontal	Peak
2483.49	10.45	27.26	6.83	0.00	44.54	54.00	-9.46	Vertical	Average
2500.00	10.45	27.20	6.84	0.00	44.49	54.00	-9.51	Vertical	Average
2483.49	10.46	27.26	6.83	0.00	44.55	54.00	-9.45	Horizontal	Average
2500.00	10.46	27.20	6.84	0.00	44.50	54.00	-9.50	Horizontal	Average

802.11n(HT20)					CH01				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	12.69	28.05	6.62	0.00	47.36	74.00	-26.64	Vertical	Peak
2390.01	11.74	27.65	6.75	0.00	46.14	74.00	-27.86	Vertical	Peak
2310.00	13.87	28.05	6.62	0.00	48.54	74.00	-25.46	Horizontal	Peak
2390.01	13.22	27.65	6.75	0.00	47.62	74.00	-26.38	Horizontal	Peak
2310.00	10.90	28.05	6.62	0.00	45.57	54.00	-8.43	Vertical	Average
2390.01	10.45	27.65	6.75	0.00	44.85	54.00	-9.15	Vertical	Average
2310.00	10.94	28.05	6.62	0.00	45.61	54.00	-8.39	Horizontal	Average
2390.01	10.45	27.65	6.75	0.00	44.85	54.00	-9.15	Horizontal	Average

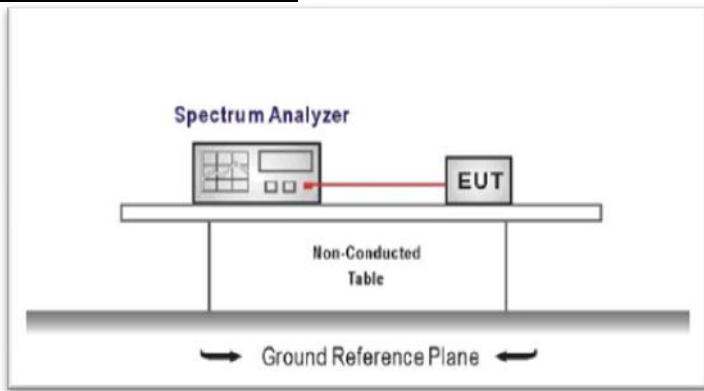
802.11n(HT20)					CH11				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.49	13.57	27.26	6.83	0.00	47.66	74.00	-26.34	Vertical	Peak
2500.00	12.38	27.20	6.84	0.00	46.42	74.00	-27.58	Vertical	Peak
2483.49	13.88	27.26	6.83	0.00	47.97	74.00	-26.03	Horizontal	Peak
2500.00	13.57	27.20	6.84	0.00	47.61	74.00	-26.39	Horizontal	Peak
2483.49	10.43	27.26	6.83	0.00	44.52	54.00	-9.48	Vertical	Average
2500.00	10.41	27.20	6.84	0.00	44.45	54.00	-9.55	Vertical	Average
2483.49	10.45	27.26	6.83	0.00	44.54	54.00	-9.46	Horizontal	Average
2500.00	10.43	27.20	6.84	0.00	44.47	54.00	-9.53	Horizontal	Average

5.7. Band edge and Spurious Emissions (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Establish a reference level by using the following procedure
Center frequency=DTS channel center frequency
The span = 1.5 times the DTS bandwidth.
RBW = 100 kHz, VBW \geq 3 x RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum PSD level

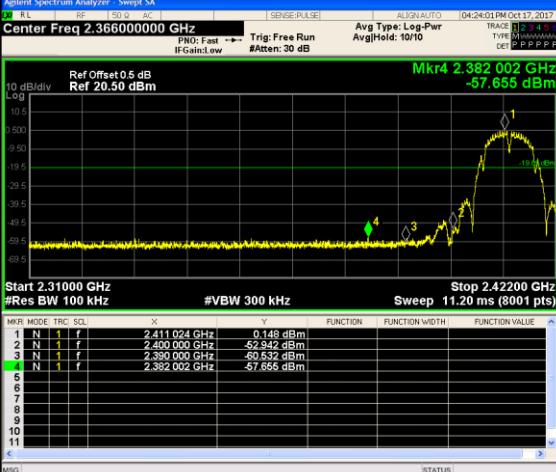
Note: the channel found to contain the maximum PSD level can be used to establish the reference level.
3. Emission level measurement
Set the center frequency and span to encompass frequency range to be measured
RBW = 100 kHz, VBW \geq 3 x RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum amplitude level.
4. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
5. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

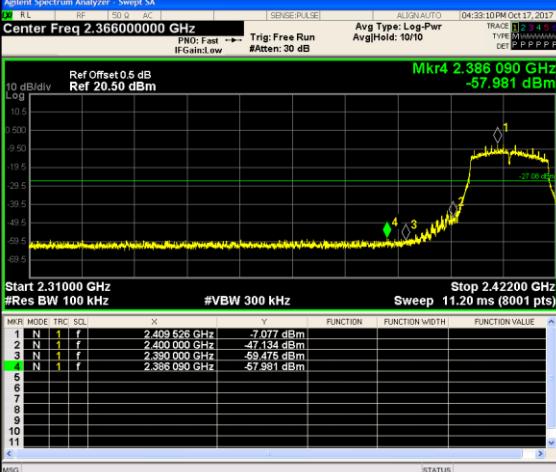
TEST MODE:

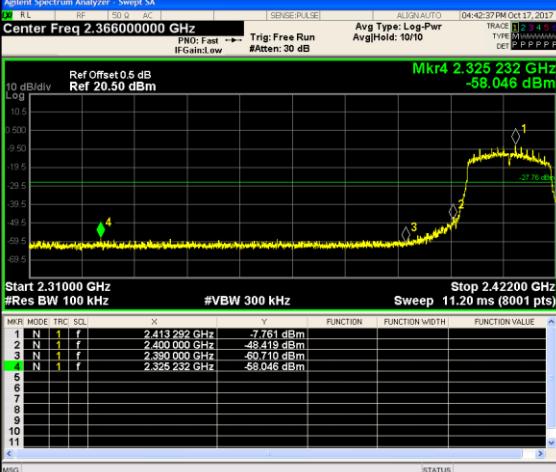
Please refer to the clause 3.3

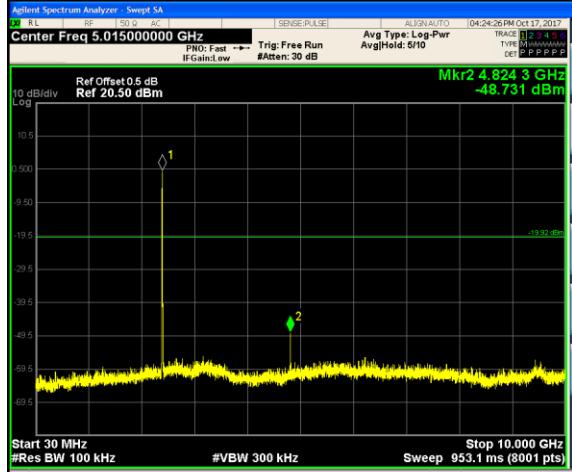
TEST RESULTS

Passed Not Applicable

Test Item:	Bandedge	Type:	802.11 b
CH01			
CH11			

Test Item:	Bandedge	Type:	802.11 g
CH01			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.36600000 GHz</p> <p>Start Freq 2.31000000 GHz</p> <p>Stop Freq 2.42200000 GHz</p> <p>CF Step 11.200000 MHz Man</p> <p>Freq Offset 0 Hz</p>
CH11			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.47600000 GHz</p> <p>Start Freq 2.45200000 GHz</p> <p>Stop Freq 2.50000000 GHz</p> <p>CF Step 4.800000 MHz Man</p> <p>Freq Offset 0 Hz</p>

Test Item:	Bandedge	Type:	802.11 n(HT20)
CH01			
CH11			

Test Item:	SE	Type:	802.11 b
CH01 Reference Level		 A screenshot of an Agilent Spectrum Analyzer showing a reference level sweep. The center frequency is 2.412000000 GHz. The trace shows a noisy baseline with a small peak around 2.412 GHz. The right panel displays various parameters: Frequency (2.412000000 GHz), Auto Tune, Center Freq (2.412000000 GHz), Start Freq (2.392000000 GHz), Stop Freq (2.432000000 GHz), CF Step (4.000000 MHz), Auto, and Freq Offset (0 Hz). MSG STATUS	
CH01 30MHz~10GHz		 A screenshot of an Agilent Spectrum Analyzer showing a sweep from 30 MHz to 10 GHz. The trace shows a sharp peak at 30 MHz (labeled 1) and a broad emission starting around 1 GHz (labeled 2). The right panel displays parameters: Frequency (5.015000000 GHz), Auto Tune, Center Freq (5.015000000 GHz), Start Freq (30.000000 MHz), Stop Freq (10.000000000 GHz), CF Step (997.000000 MHz), Auto, and Freq Offset (0 Hz). MSG STATUS	
CH01 10GHz~26GHz		 A screenshot of an Agilent Spectrum Analyzer showing a sweep from 10 GHz to 26 GHz. The trace shows a broad emission starting around 10 GHz. The right panel displays parameters: Frequency (18.000000000 GHz), Auto Tune, Center Freq (18.000000000 GHz), Start Freq (10.000000000 GHz), Stop Freq (26.000000000 GHz), CF Step (1.600000000 GHz), Auto, and Freq Offset (0 Hz). MSG STATUS	