

RF TEST REPORT

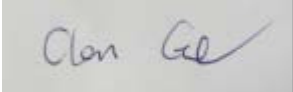


Report No.: FCC IC_RF_SL16032801-RUC-008_DTS

Supersede Report No.: None

Applicant	:	Ruckus Wireless, Inc.
Product Name	:	ZoneFlex T610 Access Point
Model No.	:	T610
Test Standard	:	47 CFR 15.247 RSS-247 Iss 1: May 2015
Test Method	:	ANSI C63.10: 2013 RSS Gen Iss 4: Nov 2014 558074 D01 DTS Meas Guidance v03r04
FCC ID	:	S9GT610
IC ID	:	5912A-T610
Dates of test	:	07/11/2016 – 07/19/2016
Issue Date	:	09/06/2016
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification []		

This Test Report is Issued Under the Authority of:

	
Rachana Khanduri	Chen Ge
Test Engineer	Engineer Reviewer

Issued By:
SIEMIC Laboratories
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Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRR, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC IC_RF_SL16032801-RUC-008_DTS	None	Original	09/06/2016

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Ruckus Wireless, Inc.
Product: ZoneFlex T610 Access Point
Model: T610

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Ruckus Wireless, Inc.
Applicant Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A
Manufacturer Name	:	Ruckus Wireless, Inc.
Manufacturer Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	ZoneFlex T610 Access Point
Model No.	T610
Trade Name	Ruckus
Serial No.	271604004848
Host Model No.	N/A
Input Power	100Vac-240Vac 50-60Hz / 48VDC 1.0A (PoE)
Poe Power Adapter Manu/Model	Ruckus Wireless, Inc. / GRT-480125A(740-64216-001)
AC/DC Power Adapter SN	N/A
PoE Power Adapter SN	20150129
Product Hardware version	705-60425-001
Product Software version	812-72410-002
Radio Hardware version	705-60425-001
Radio Software version	812-72410-002
Test Software version	117-11325-001
Date of EUT received	07/09/2016
Equipment Class/ Category	DTS, UNII
Clock Frequencies	N/A
Port/Connectors	PoE, Ethernet

6.2 Radio Description

Radio Type	802.11b	802.11g	802.11n-20M	802.11n-40M
Operating Frequency	2412-2462MHz	2412-2462MHz	2412-2462MHz	2422-2452MHz
Modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	5MHz	5MHz	5MHz	5MHz
Number of Channels	11	11	11	7
Antenna Type	Internal Omnidirectional Antenna			
Antenna Gain (Peak)	2.4GHz: Horizontal 1dBi, Vertical 2.5dBi 5GHz: Horizontal 2dBi, Vertical 3.5dBi			
Antenna Connector Type	U.FL			
Note	EUT has 4 antennas, 2 antennas are in horizontal polarity, and 2 antennas in vertical polarity. The 802.11b/g/a is in CDD mode with all 4 antenna transmit simultaneously. Since they're in 90 deg phase shift between the horizontal and vertical antennas, for radiated limit, the result from different polarization antenna will not be combined. So only the result for 2 vertical poparity antennas and 2 horizontal poparity antennas will be combined for MIMO mode separately. For cross-polarized antenna, the total gain—including array gain—is computed separately for each of polarizations using the procedures presented in this document. The highest of the total gains shall apply. For this case, the highest of the total gain will be the directional gain of 2 antennas. For conducted limit like power and psd, the result from all 4 chains will be summed. For 802.11b/g/a mode under CDD mode, the array gain for power will be 0 and for PSD will be 10 log (Nant/Nss) dB to be calculated separately for horizontal and vertical polarity. Reference to the following KDB for clarification. 662911 D01 Multiple Transmitter Output v02r01 662911 D02 MIMO with Cross-Polarized Antennas v01			

EUT Power level setting

Mode	Frequency (MHz)	Power setting
802.11-b	2412	22
802.11-b	2437	22
802.11-b	2462	22
802.11-g	2412	22
802.11-g	2437	22
802.11-g	2462	20
802.11-n-20	2412	22
802.11-n-20	2437	22
802.11-n-20	2462	19
802.11-n-40	2422	21
802.11-n-40	2437	22
802.11-n-40	2452	19

Note: All data rate has been verified and worst case was used for all test items.

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	PP01L Latitude E5440	F1WPF12	Dell	-
2	POE Adapter	740-64157-001	133279963	Ruckus	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
RJ45	EUT	RJ45	POE	RJ45	2	Unshielded	-
RJ45	POE	RJ45	Laptop	RJ45	3	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Command Line in windows	Set the EUT to transmit continuously in diferent test mode

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013	☒ Pass
	IC	RSS Gen 8.10	IC	558074 D01 DTS Meas Guidance v03r03	☐ N/A
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☒ Pass
	IC	RSS Gen 8.8	IC	RSS Gen Issue 4: 2014	☐ N/A

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	-	-	-	-	☒ Pass
	IC	RSS Gen 6.6	IC	RSS Gen Issue 4: 2014 -	☐ N/A
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v03r04	☒ Pass
	IC	RSS247 (5.2.1)	IC		☐ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013	☒ Pass
	IC	RSS247 (5.5)	IC	558074 D01 DTS Meas Guidance v03r04	☐ N/A
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v03r04	☒ Pass
	IC	RSS247 (5.4.4)	IC		☐ N/A
Receiver Spurious Emissions	IC	RSS Gen (4.8)	IC	RSS Gen Issue 4: 2014	☐ Pass ☒ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass
	IC	-	IC	-	☒ N/A
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Meas Guidance v03r04	☒ Pass
	IC	RSS247 (5.2.2)	IC		☐ N/A
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass
	IC	RSS Gen(5.5)	IC	RSS Gen Issue 4: 2014	☒ N/A
Remark	- All measurement uncertainties do not take into consideration for all presented test results. - The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.				

9 Measurement Uncertainty

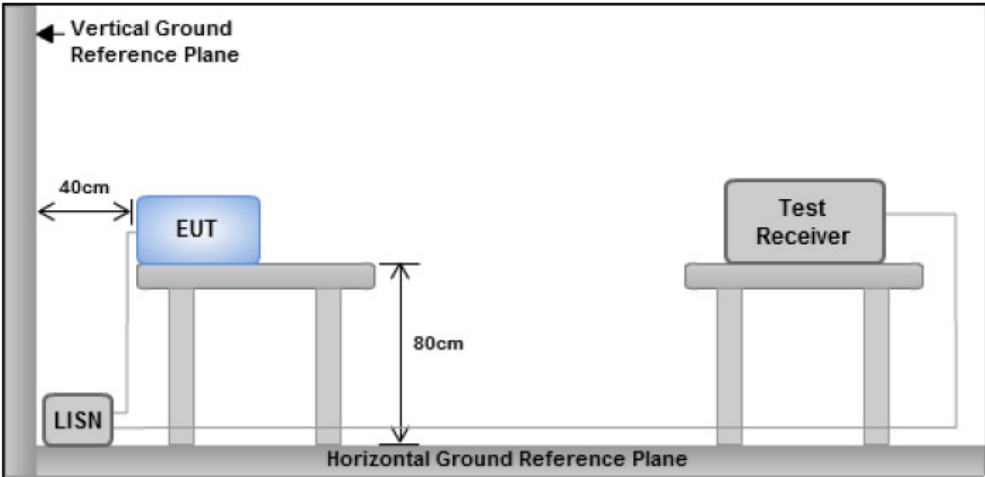
Emissions			
Test Item	Frequency Range	Description	Uncertainty
AC Conducted Emissions	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
Band Edge and Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Band Edge and Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+4.3dB/-4.1dB

10 Measurements, Examination and Derived Results

10.1 Conducted Emissions

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
47CFR§15.207	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒
Test Setup	 Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes		
Procedure	- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.		
Remark	EUT tested with AC 120V 60Hz		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

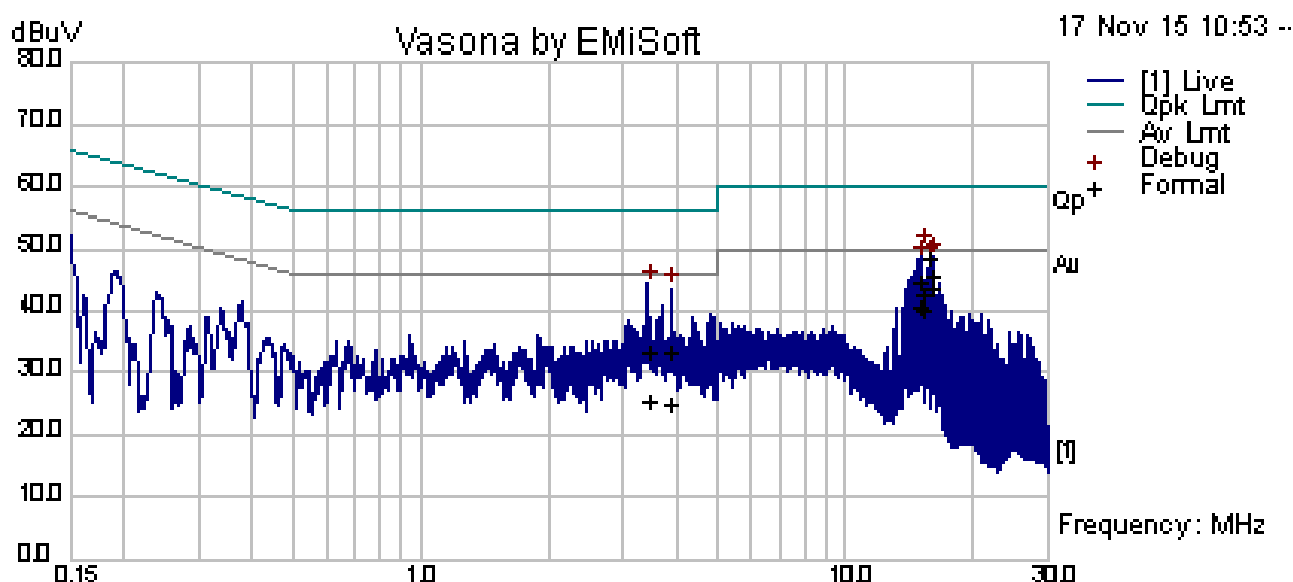
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at **Conducted Emission Test Site**.

Conducted Emission Test Results (Line)

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	22.2	Result:	☒ Pass ☐ Fail
	Humidity (%):	37.1		
	Atmospheric(mbar):	1020.5		
Mains Power:	120Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	2015-11-17			
Remarks:	Line – Tested with AC Line Power Cord			

AC Line – Line Plot @ 120V 60Hz



AC Line - Line Measurements @ 120V 60Hz

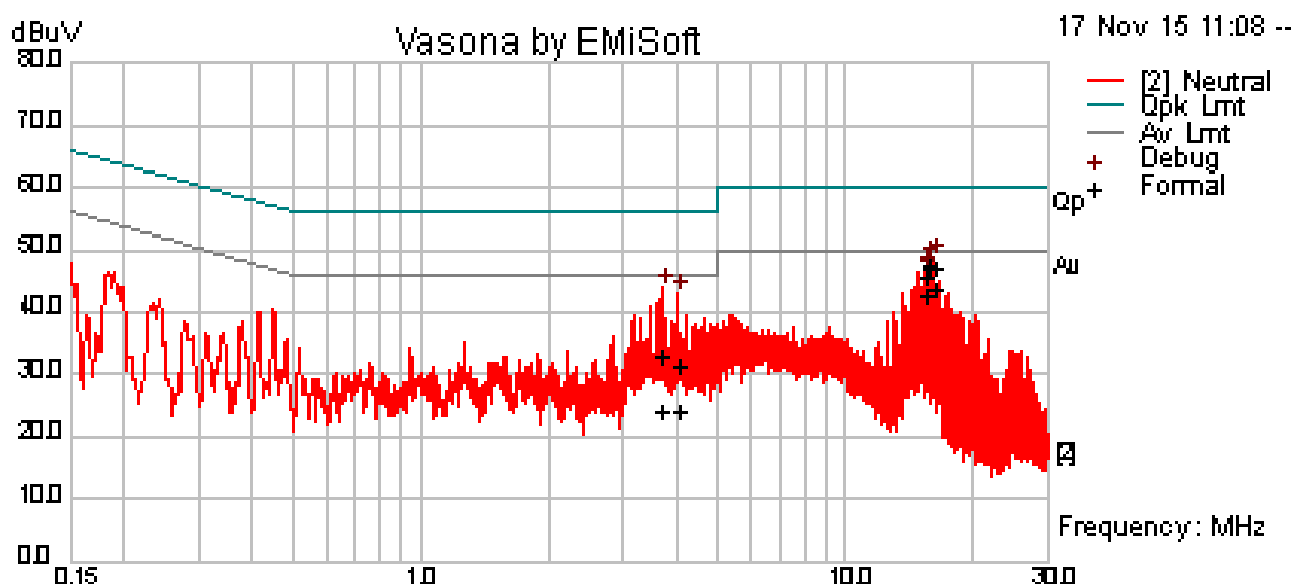
Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)	Pass/Fail
15.16	32.11	10.06	0.60	42.77	Quasi Peak	Line	60.00	-17.23	Pass
16.11	35.03	10.06	0.62	45.71	Quasi Peak	Line	60.00	-14.29	Pass
3.43	22.84	10.03	0.55	33.42	Quasi Peak	Line	56.00	-22.58	Pass
14.85	33.91	10.06	0.60	44.57	Quasi Peak	Line	60.00	-15.43	Pass
15.80	38.06	10.06	0.62	48.73	Quasi Peak	Line	60.00	-11.27	Pass
3.90	22.92	10.03	0.55	33.50	Quasi Peak	Line	56.00	-22.50	Pass
15.16	29.52	10.06	0.60	40.18	Average	Line	50.00	-9.82	Pass
16.11	32.89	10.06	0.62	43.57	Average	Line	50.00	-6.43	Pass
3.43	14.97	10.03	0.55	25.55	Average	Line	46.00	-20.45	Pass
14.85	29.94	10.06	0.60	40.60	Average	Line	50.00	-9.40	Pass
15.80	37.70	10.06	0.62	48.38	Average	Line	50.00	-1.62	Pass*
3.90	14.59	10.03	0.55	25.17	Average	Line	46.00	-20.83	Pass

Pass*: The margin is within the measurement uncertainty.

Conducted Emission Test Results (Neutral)

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	22.2	Result:	☒ Pass ☐ Fail
	Humidity (%):	37.1		
	Atmospheric(mbar):	1020.5		
Mains Power:	120Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	2015-11-17			
Remarks:	Neutral – Tested with AC Line Power Cord			

AC Line – Neutral Plot @ 120V 60Hz



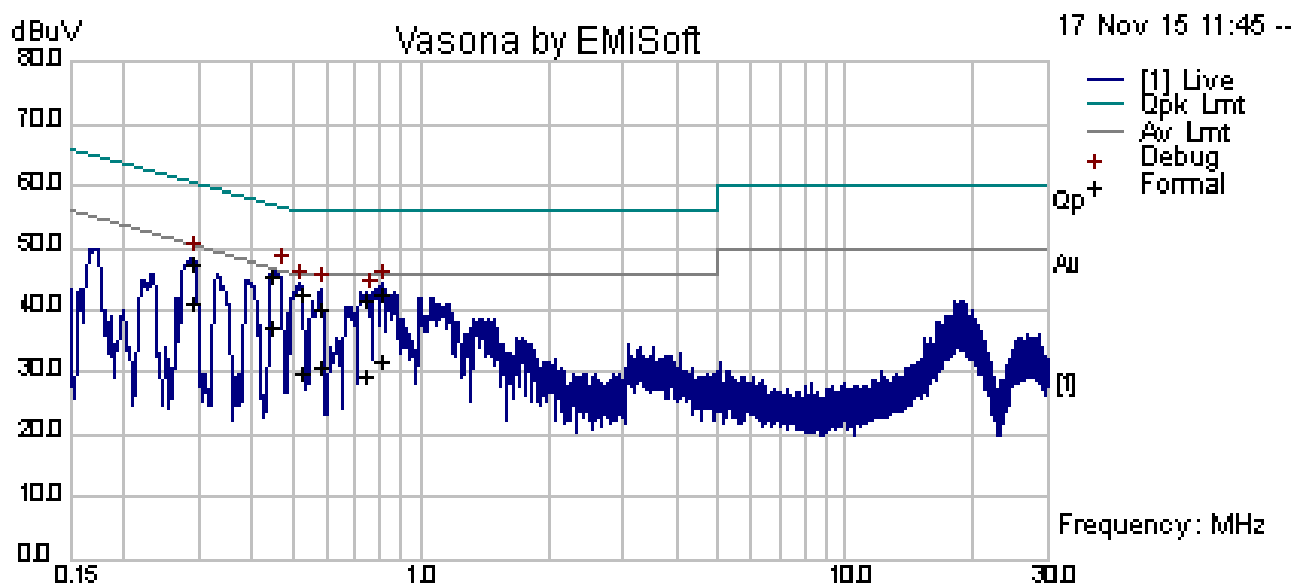
AC Line - Neutral Measurements @ 120V 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
16.14	36.45	10.06	0.62	47.13	Quasi Peak	Neutral	60.00	-12.87	Pass
15.80	36.86	10.06	0.62	47.54	Quasi Peak	Neutral	60.00	-12.46	Pass
3.71	22.51	10.03	0.55	33.09	Quasi Peak	Neutral	56.00	-22.91	Pass
4.06	20.97	10.03	0.55	31.55	Quasi Peak	Neutral	56.00	-24.45	Pass
15.48	35.04	10.06	0.61	45.71	Quasi Peak	Neutral	60.00	-14.29	Pass
15.40	34.96	10.06	0.61	45.63	Quasi Peak	Neutral	60.00	-14.37	Pass
16.14	33.11	10.06	0.62	43.80	Average	Neutral	50.00	-6.20	Pass
15.80	36.53	10.06	0.62	47.20	Average	Neutral	50.00	-2.80	Pass*
3.71	13.40	10.03	0.55	23.98	Average	Neutral	46.00	-22.02	Pass
4.06	13.23	10.03	0.55	23.82	Average	Neutral	46.00	-22.18	Pass
15.48	32.03	10.06	0.61	42.70	Average	Neutral	50.00	-7.30	Pass
15.40	32.06	10.06	0.61	42.73	Average	Neutral	50.00	-7.27	Pass

Pass*: The margin is within the measurement uncertainty.

Conducted Emission Test Results (Line)

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	11/17/2015			
Remarks	Line – Tested with Poe			

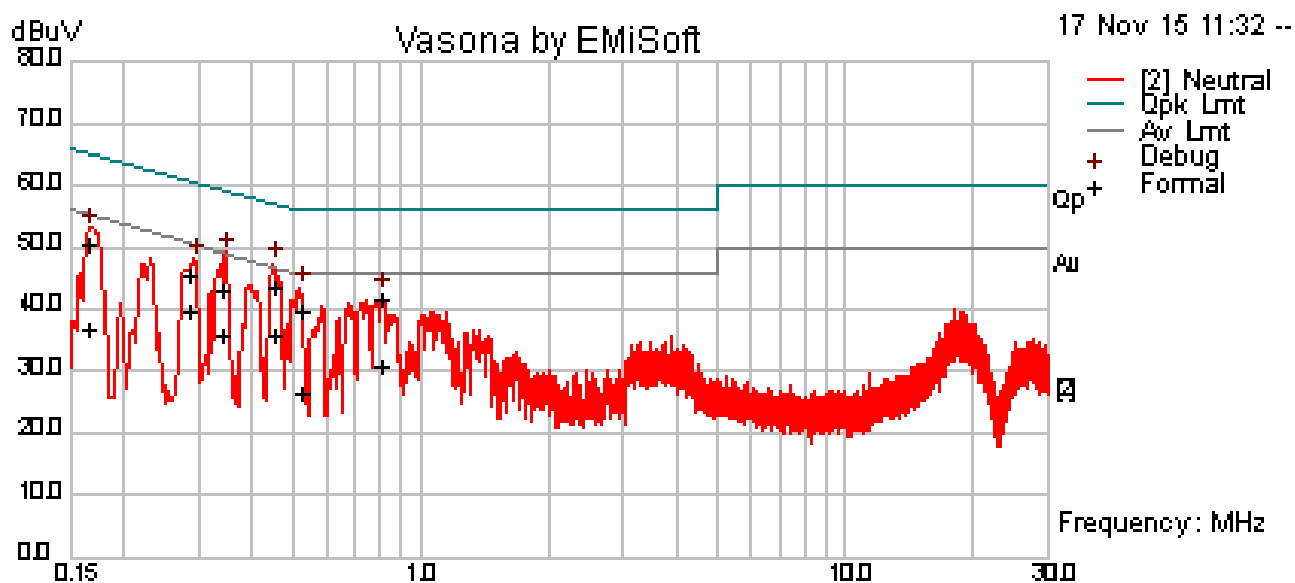


Live Line Measurements at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.45	34.77	10.01	0.71	45.49	Quasi Peak	Line	56.90	-11.41	Pass
0.81	31.99	10.01	0.60	42.60	Quasi Peak	Line	56.00	-13.40	Pass
0.53	32.18	10.01	0.67	42.86	Quasi Peak	Line	56.00	-13.14	Pass
0.29	36.72	10.00	0.94	47.66	Quasi Peak	Line	60.51	-12.85	Pass
0.58	29.70	10.01	0.65	40.35	Quasi Peak	Line	56.00	-15.65	Pass
0.74	30.86	10.01	0.61	41.48	Quasi Peak	Line	56.00	-14.52	Pass
0.45	26.69	10.01	0.71	37.41	Average	Line	46.90	-9.49	Pass
0.81	21.06	10.01	0.60	31.67	Average	Line	46.00	-14.33	Pass
0.53	19.15	10.01	0.67	29.83	Average	Line	46.00	-16.17	Pass
0.29	30.08	10.00	0.94	41.02	Average	Line	50.51	-9.50	Pass
0.58	20.03	10.01	0.65	30.68	Average	Line	46.00	-15.32	Pass
0.74	19.00	10.01	0.61	29.62	Average	Line	46.00	-16.38	Pass

Conducted Emission Test Results (Neutral)

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	11/17/2015			
Remarks	Neutral – Tested with Poe			



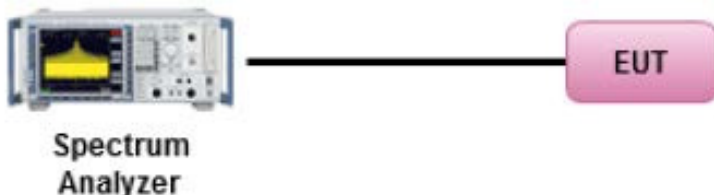
Neutral Line@ 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.45	32.91	10.01	0.71	43.63	Quasi Peak	Neutral	56.84	-13.21	Pass
0.34	32.32	10.01	0.83	43.16	Quasi Peak	Neutral	59.22	-16.06	Pass
0.17	38.90	10.00	1.59	50.50	Quasi Peak	Neutral	65.14	-14.64	Pass
0.28	34.48	10.00	0.95	45.43	Quasi Peak	Neutral	60.68	-15.25	Pass
0.53	29.23	10.01	0.67	39.91	Quasi Peak	Neutral	56.00	-16.09	Pass
0.81	30.99	10.01	0.60	41.60	Quasi Peak	Neutral	56.00	-14.40	Pass
0.45	25.11	10.01	0.71	35.83	Average	Neutral	46.84	-11.01	Pass
0.34	25.19	10.01	0.83	36.03	Average	Neutral	49.22	-13.19	Pass
0.17	25.06	10.00	1.59	36.66	Average	Neutral	55.14	-18.48	Pass
0.28	28.89	10.00	0.95	39.85	Average	Neutral	50.68	-10.84	Pass
0.53	15.95	10.01	0.67	26.63	Average	Neutral	46.00	-19.37	Pass
0.81	20.22	10.01	0.60	30.83	Average	Neutral	46.00	-15.17	Pass

Note: The results above show only the worst case.

10.2 6dB & 99% Bandwidth

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.2.1)	a)(2)	6dB BW≥500KHz;	☒
RSS Gen 4.6.1	The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual. The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth		☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r04, 8.1 DTS bandwidth <u>6dB Emission bandwidth measurement procedure</u> - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ≥ 3 x RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - 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. - Measure the 99% BW.		
Test Date	11/20/2015 – 12/03/2015	Environmental condition	Temperature 23°C Relative Humidity 42% Atmospheric Pressure 1021mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by Gary Chou at RF Test Site.

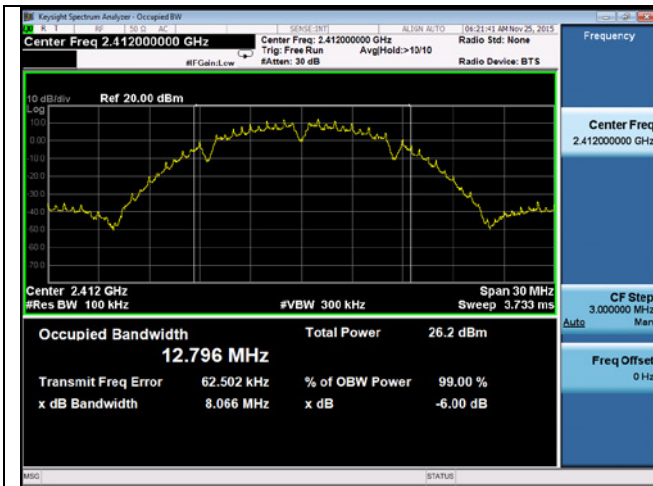
6dB Bandwidth measurement result for 2.4GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	802.11b	2412	Low	8.06	≥0.5	Pass
6dB BW	802.11b	2437	Mid	8.07	≥0.5	Pass
6dB BW	802.11b	2462	High	7.75	≥0.5	Pass
6dB BW	802.11g	2412	Low	15.94	≥0.5	Pass
6dB BW	802.11g	2437	Mid	16.08	≥0.5	Pass
6dB BW	802.11g	2462	High	16.32	≥0.5	Pass
6dB BW	802.11n-20M	2412	Low	16.92	≥0.5	Pass
6dB BW	802.11n-20M	2437	Mid	16.90	≥0.5	Pass
6dB BW	802.11n-20M	2462	High	17.57	≥0.5	Pass
6dB BW	802.11n-40M	2422	Low	34.05	≥0.5	Pass
6dB BW	802.11n-40M	2437	Mid	35.42	≥0.5	Pass
6dB BW	802.11n-40M	2452	High	36.29	≥0.5	Pass

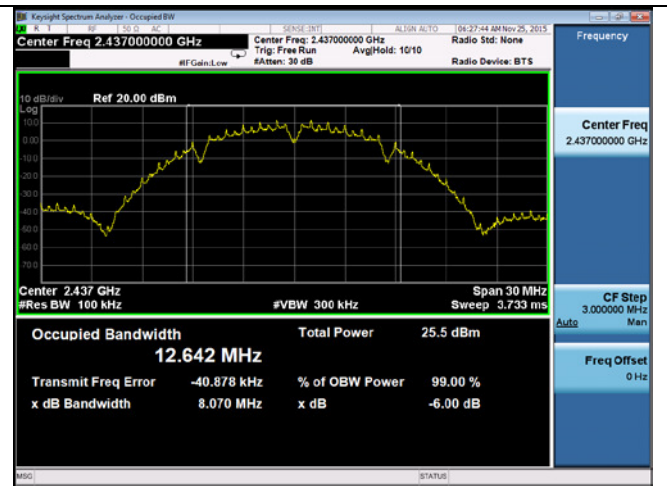
99% OBW measurement result for 2.4GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)
99% OBW	802.11b	2412	Low	12.79
99% OBW	802.11b	2437	Mid	12.64
99% OBW	802.11b	2462	High	12.74
99% OBW	802.11g	2412	Low	16.35
99% OBW	802.11g	2437	Mid	16.37
99% OBW	802.11g	2462	High	16.37
99% OBW	802.11n-20M	2412	Low	17.56
99% OBW	802.11n-20M	2437	Mid	17.55
99% OBW	802.11n-20M	2462	High	17.57
99% OBW	802.11n-40M	2422	Low	35.93
99% OBW	802.11n-40M	2437	Mid	35.88
99% OBW	802.11n-40M	2452	High	36.04

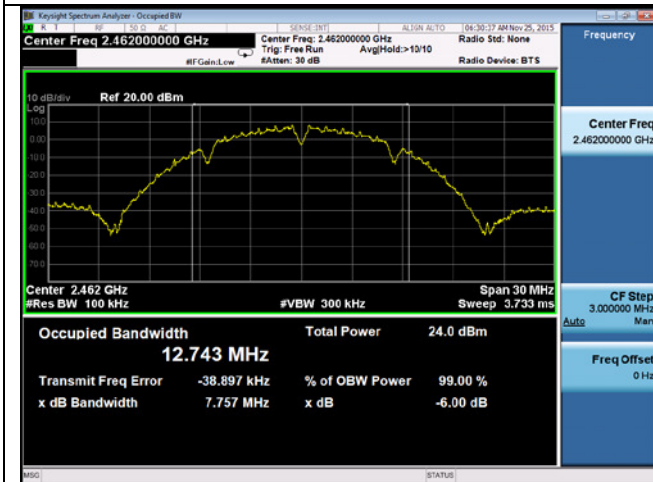
Test Plots



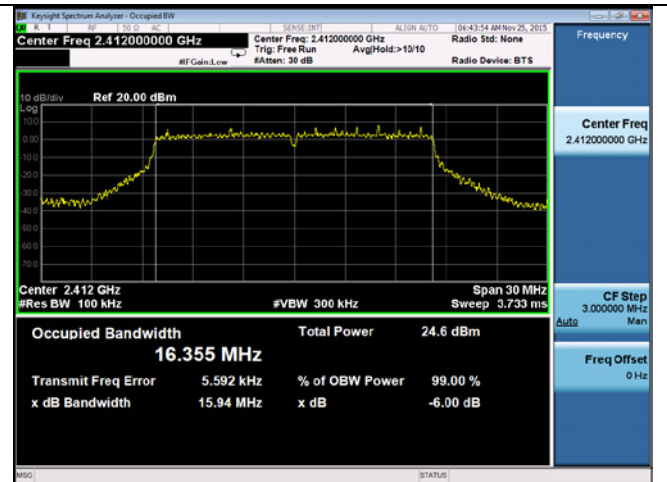
BW -2.4G 802.11b 2412MHz



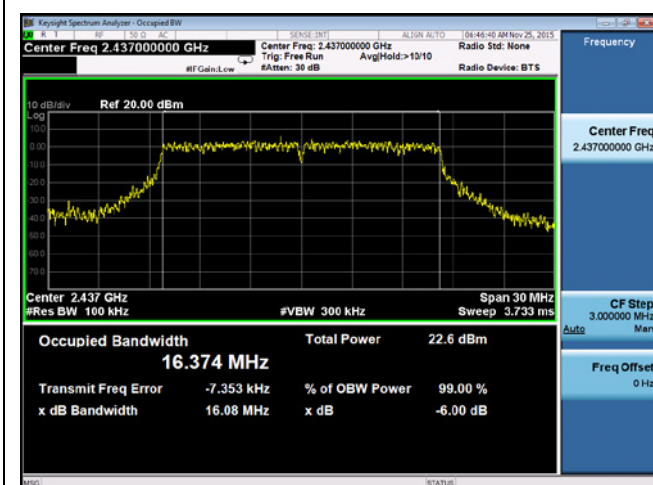
BW -2.4G 802.11b 2437MHz



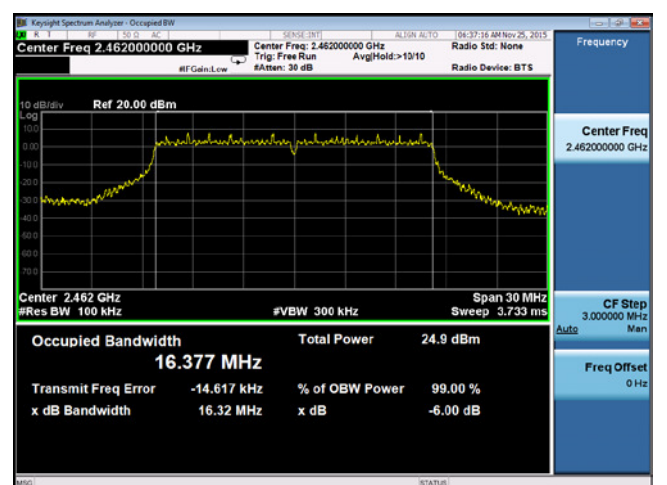
BW -2.4G 802.11b 2462MHz



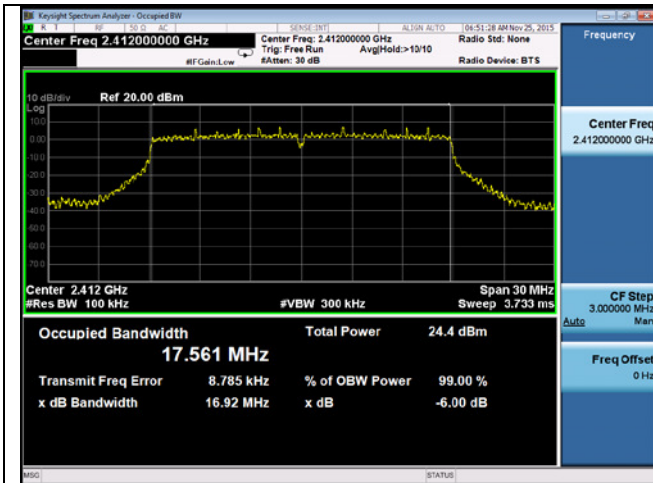
BW -2.4G 802.11g 2412MHz



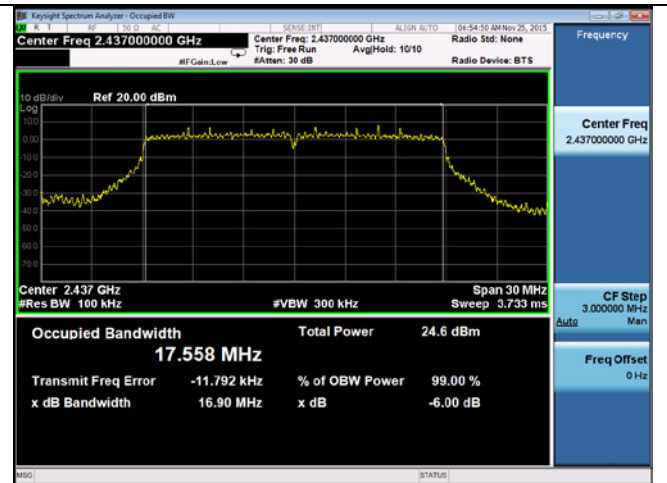
BW -2.4G 802.11g 2437MHz



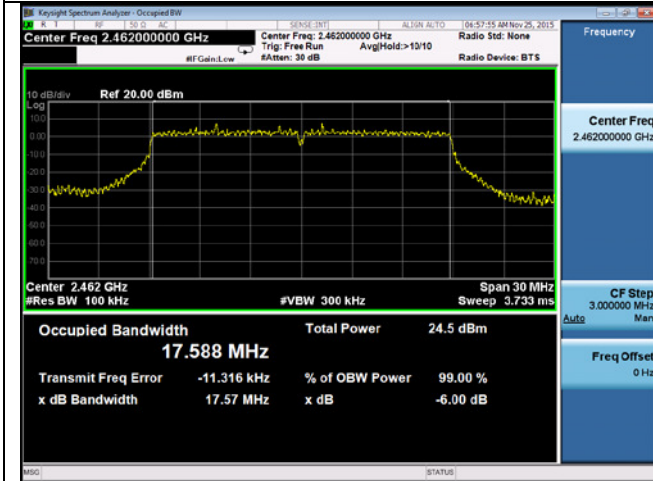
BW -2.4G 802.11g 2462MHz



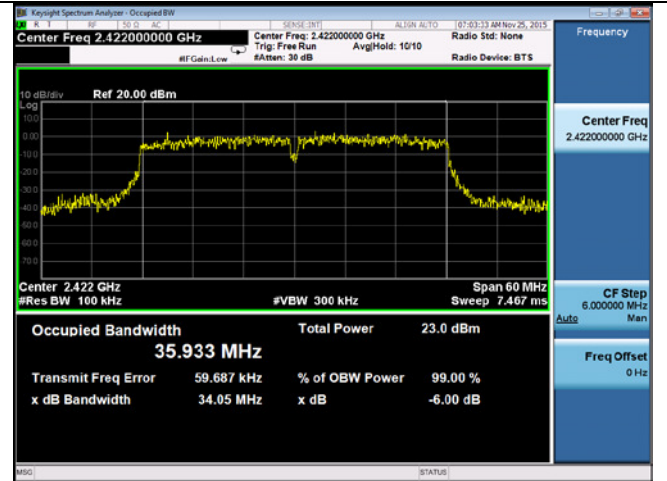
BW -2.4G 802.11n-20M 2412MHz



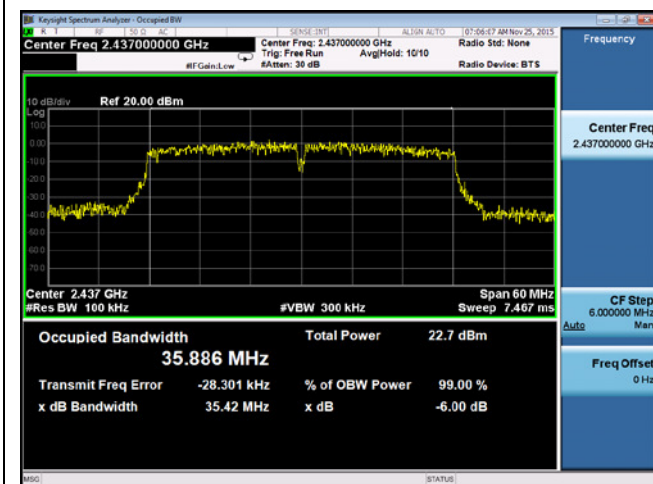
BW -2.4G 802.11n-20M 2437MHz



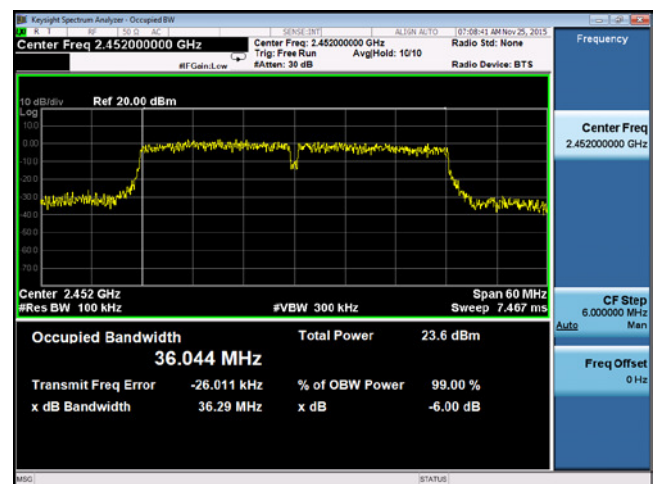
BW -2.4G 802.11n-20M 2462MHz



BW -2.4G 802.11n-40M 2422MHz



BW -2.4G 802.11n-40M 2437MHz



BW -2.4G 802.11n-40M 2452MHz

10.3 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.4)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤ 1 Watt	☐
	b)	FHSS in 5725-5850MHz: ≤ 1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤ 0.125 Watt.	☐
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤ 1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & < 50 channels: ≤ 0.25 Watt	☐
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤ 1 Watt	☒
Test Setup	 Power Meter		
Test Procedure	558074 D01 DTS Meas Guidance v03r04, 9.2.2.2 <u>Measurement using a Power Meter (PM)</u> Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required. - Connect EUT's RF output power to power meter - Set EUT to be continuous transmission mode - Measurement the average output power using power meter and record the result Repeat above steps for different test channel and other modulation type.		
Test Date	07/12/2016	Environmental condition	Temperature 23.7 °C Relative Humidity 44% Atmospheric Pressure 1011.4mbar
Remark	Per KDB 662911 D01 Multiple Transmitter Output v02r01, the direction gain for horizontal polarization and vertical polarization is calculated separately. For 2.4GHz band, peak antenna gain = 2.5 dBi, directional gain = 5.5 dB. Highest of total directional gain is 5.5 dBi. The power limit and PSD limit will be reduced by amount of 0 dB. Offset was added.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

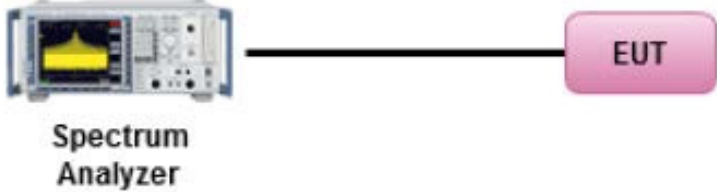
Test was done by **Rachana Khanduri** at **RF Test Site**.

Output Power measurement result

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)					Limit (dBm)	Result
				Chain1	Chain2	Chain3	Chain4	Combined Power		
Output Power	802.11b	2412	Low	19.35	19.50	20.02	20.06	25.76	30	Pass
		2437	Mid	20.06	21.20	20.72	20.55	26.67	30	Pass
		2462	High	19.39	19.50	18.94	19.24	25.29	30	Pass
	802.11g	2412	Low	18.93	19.02	19.04	19.17	25.06	30	Pass
		2437	Mid	19.48	19.73	19.36	19.53	25.55	30	Pass
		2462	High	16.84	16.97	16.61	16.78	22.82	30	Pass
	802.11n-20M	2412	Low	18.80	18.81	19.10	19.03	24.96	30	Pass
		2437	Mid	19.42	19.59	19.43	19.47	25.50	30	Pass
		2462	High	15.46	15.81	15.42	15.65	21.61	30	Pass
	802.11n-40M	2422	Low	19.65	19.65	19.37	19.32	25.52	30	Pass
		2437	Mid	20.32	20.30	20.17	20.37	26.31	30	Pass
		2452	High	16.87	17.18	16.59	16.87	22.90	30	Pass
Note	Directional gain of the EUT is 5.5dBi. No limit adjustment is needed.									

10.4 Band Edge

Requirement(s):

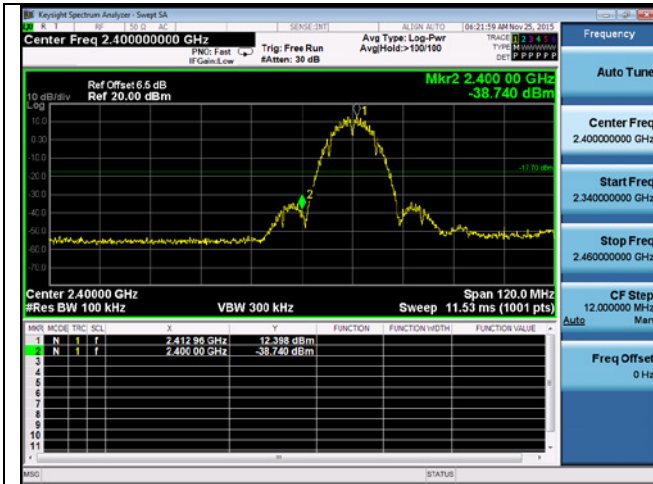
Spec	Item	Requirement	Applicable
§ 15.247 RSS247(5.5)	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209 (a) is not required ☐ 20 dB down ☒ 30 dB down	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r04 <u>Band Edge measurement procedure</u> 1. Set the EUT to maximum power setting and enable the EUT transmit continuously. 2. Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. 3. Change modulation and channel bandwidth then repeat step 1 to 2. 4. Measured and record the results in the test report.		
Test Date	11/20/2015 – 12/03/2015	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	Offset was added.		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes ☒ N/A

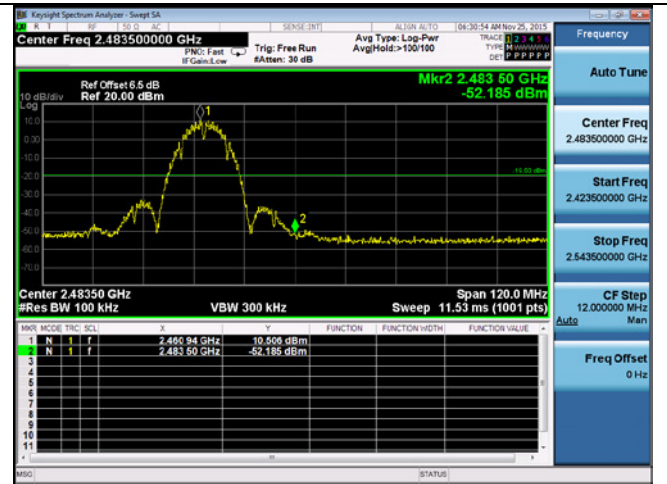
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at RF Test Site.

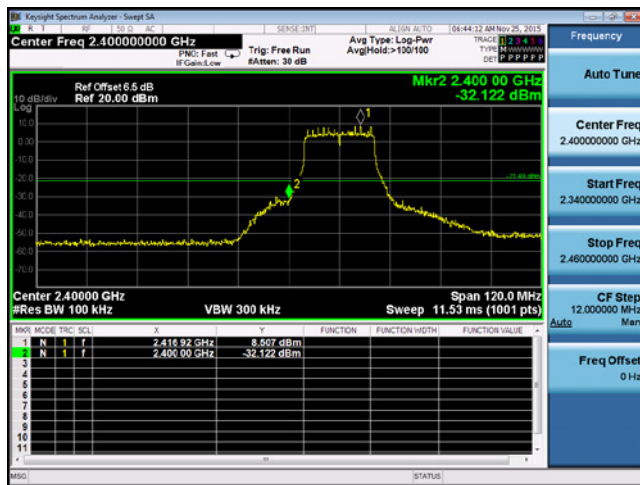
Test Plots (Worst case of 4 chains)



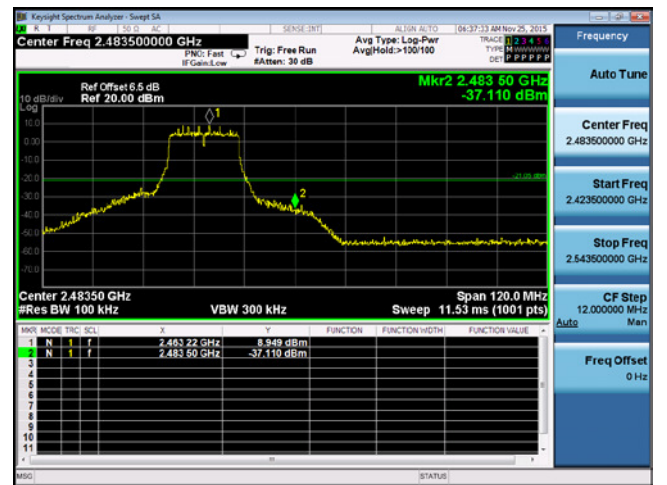
Band Edge-2.4G-802.11b Low



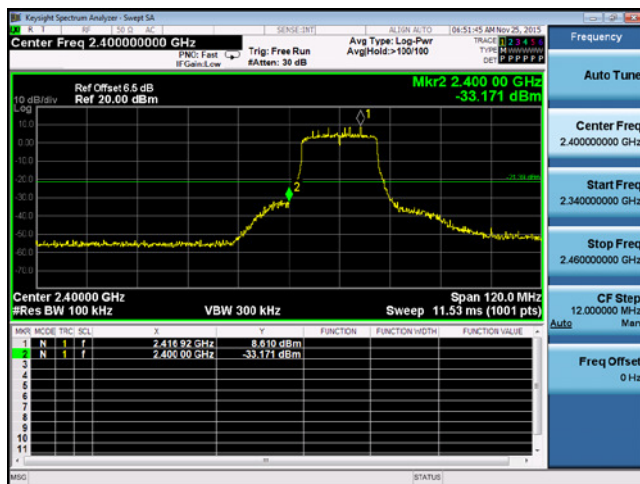
Band Edge-2.4G-802.11b High



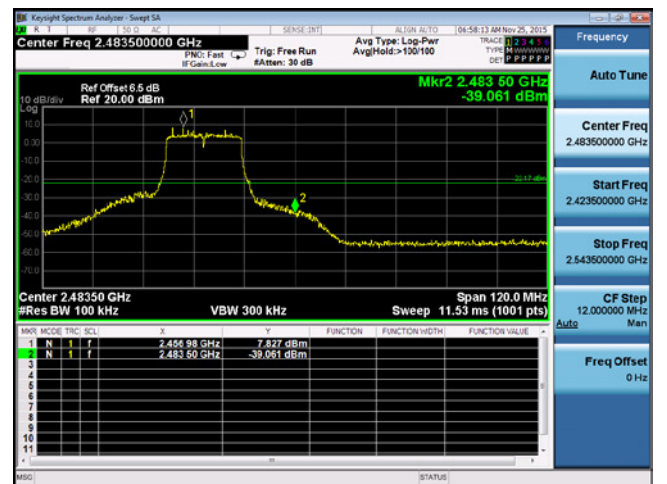
Band Edge-2.4G-802.11g Low



Band Edge-2.4G-802.11g High



Band Edge-2.4G-802.11n20 Low



Band Edge-2.4G-802.11n20 High



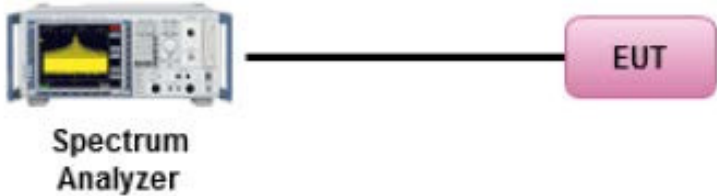
Band Edge-2.4G-802.11n40 Low



Band Edge-2.4G-802.11n40 High

10.5 Power Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e)	e)	DSSS: ≤8dBm/3KHz	☒
RSS247 (5.2.2)	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r04, 10.3 Method AVGPSD-1 <u>Peak spectral density measurement procedure</u> - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. - Set the VBW $\geq 3 \times \text{RBW}$. - Detector = RMS - Sweep time = auto couple. - Trace mode = Trace average over 100 traces - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	07/12/16	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	Per KDB 662911 D01 Multiple Transmitter Output v02r01, the direction gain for horizontal polarization and vertical polarization is calculated separately. For 2.4GHz band, peak antenna gain = 2.5 dBi, directional gain = 5.5 dB. Highest of total directional gain is 5.5 dBi. The power limit and PSD limit will be reduced by amount of 0 dB. Offset was added.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by **Rachana Khanduri** at **RF Test Site**.

PSD measurement results

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/3KHz)					Limit (dBm/3KHz)	Result
				Chain0	Chain1	Chain2	Chain4	Combined		
PSD	802.11b	2412	Low	-6.26	-5.97	-5.22	-6.04	0.17	≤8	Pass
		2437	Mid	-4.82	-3.89	-4.03	-4.02	1.85	≤8	Pass
		2462	High	-6.92	-2.83	-5.43	-4.41	1.38	≤8	Pass
	802.11g	2412	Low	-8.17	-8.09	-7.55	-8.15	-1.96	≤8	Pass
		2437	Mid	-7.38	-7.22	-8.47	-5.39	-0.95	≤8	Pass
		2462	High	-9.96	-8.94	-10.01	-9.26	-3.50	≤8	Pass
	802.11n-20M	2412	Low	-8.27	-7.20	-7.99	-8.42	-1.92	≤8	Pass
		2437	Mid	-8.13	-6.56	-7.68	-7.64	-1.44	≤8	Pass
		2462	High	-11.75	-11.06	-9.87	-11.60	-4.98	≤8	Pass
	802.11n-40M	2422	Low	-9.04	-9.44	-8.53	-9.27	-3.04	≤8	Pass
		2437	Mid	-10.03	-8.79	-8.12	-8.23	-2.71	≤8	Pass
		2452	High	-11.21	-11.92	-12.46	-11.16	-5.63	≤8	Pass

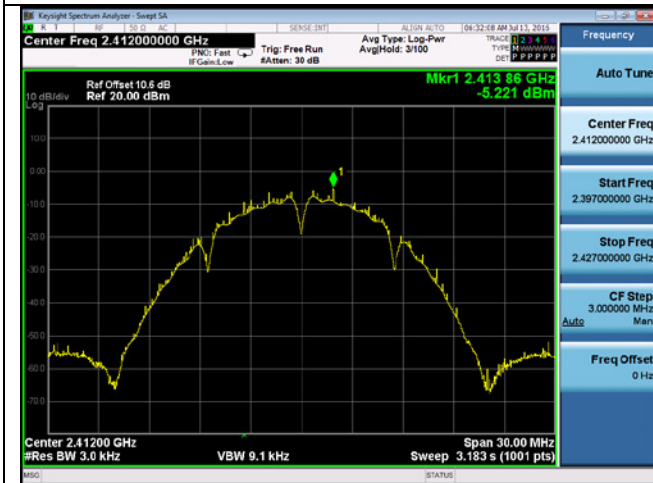
Test Plots



PSD-2.4G-802.11b Low-chain1



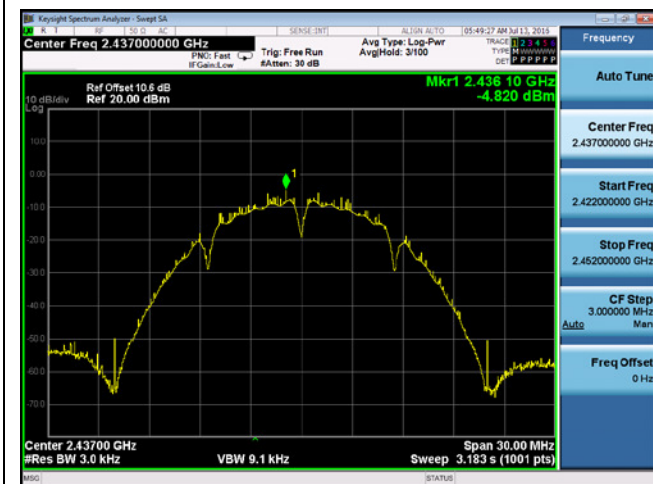
PSD-2.4G-802.11b Low-chain2



PSD-2.4G-802.11b Low-chain3



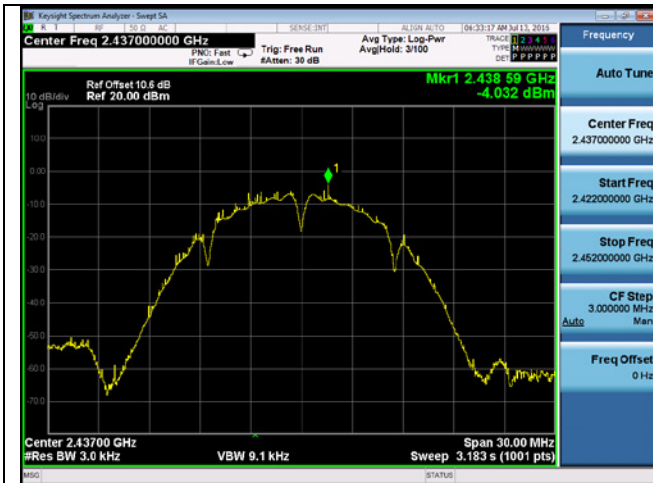
PSD-2.4G-802.11b Low-chain4



PSD-2.4G-802.11b Mid-chain1



PSD-2.4G-802.11b Mid-chain2



PSD-2.4G-802.11b Mid-chain3



PSD-2.4G-802.11b Mid-chain4



PSD-2.4G-802.11b High-chain1



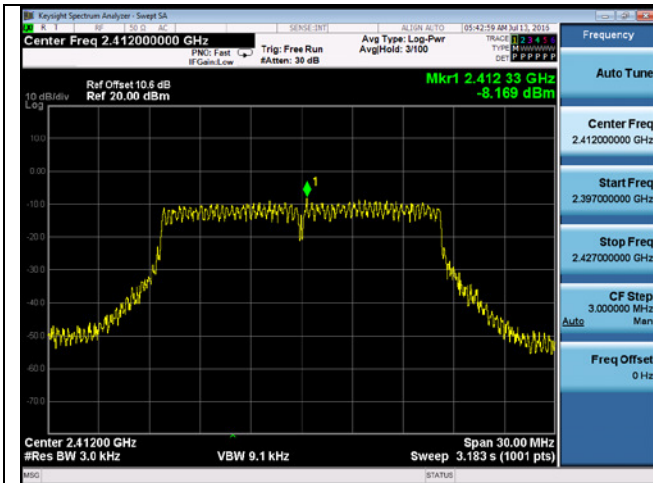
PSD-2.4G-802.11b High-chain2



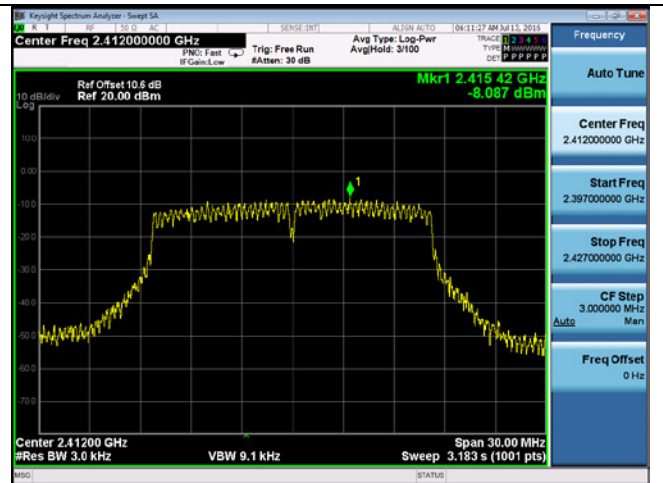
PSD-2.4G-802.11b High-chain3



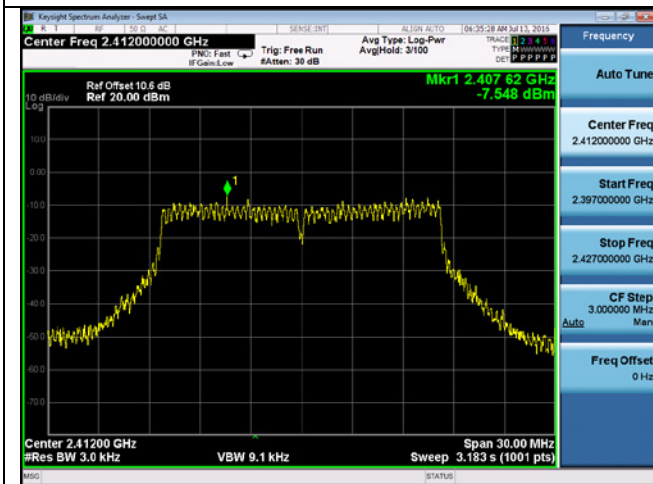
PSD-2.4G-802.11b High-chain4



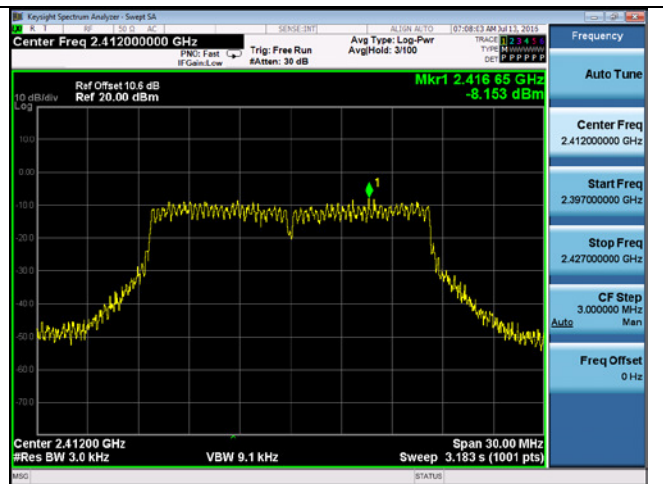
PSD-2.4G-802.11g Low-chain1



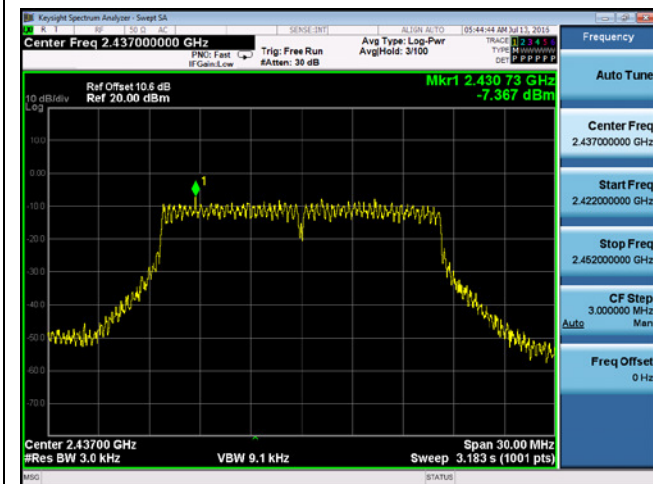
PSD-2.4G-802.11g Low-chain2



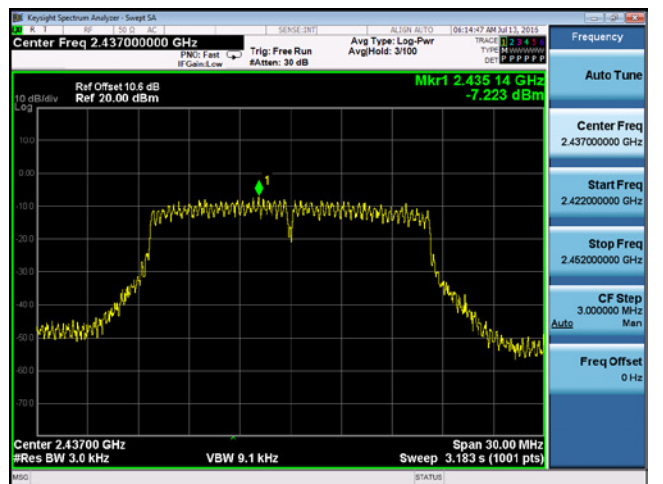
PSD-2.4G-802.11g Low-chain3



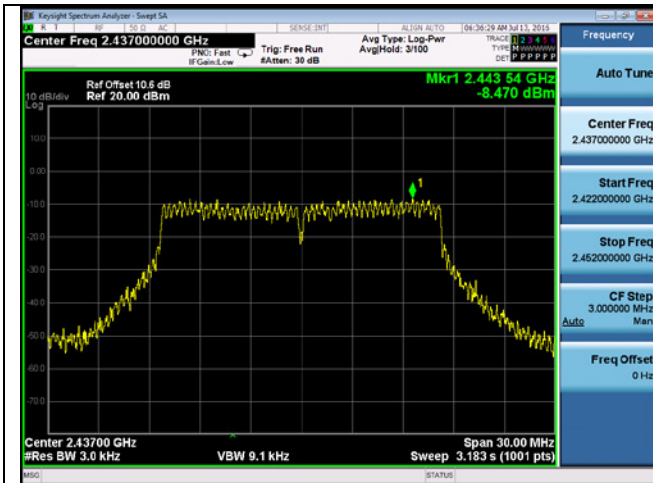
PSD-2.4G-802.11g Low-chain4



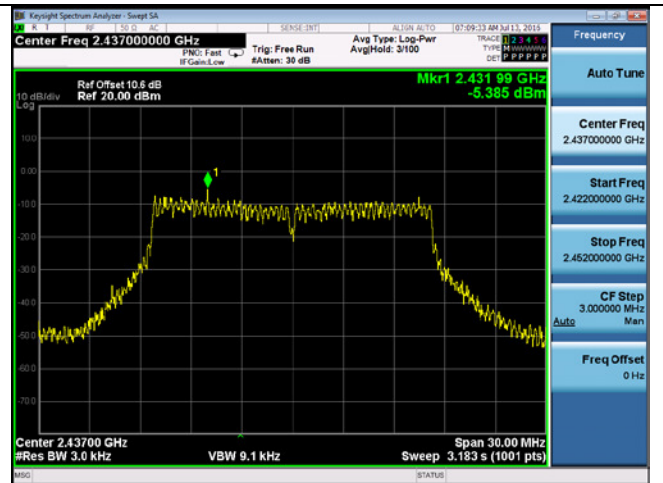
PSD-2.4G-802.11g Mid-chain1



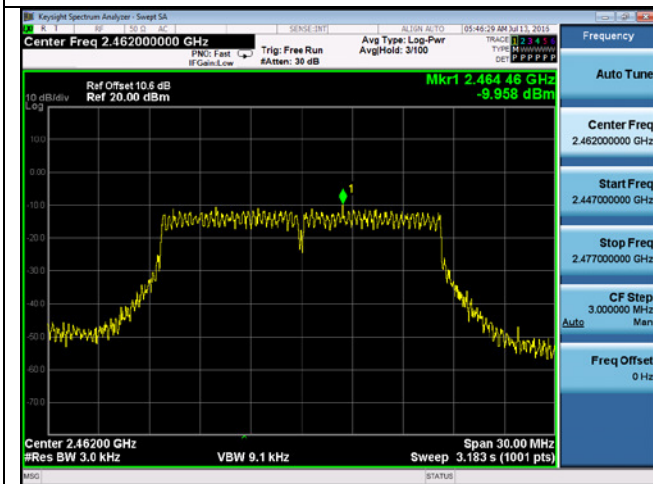
PSD-2.4G-802.11g Mid-chain2



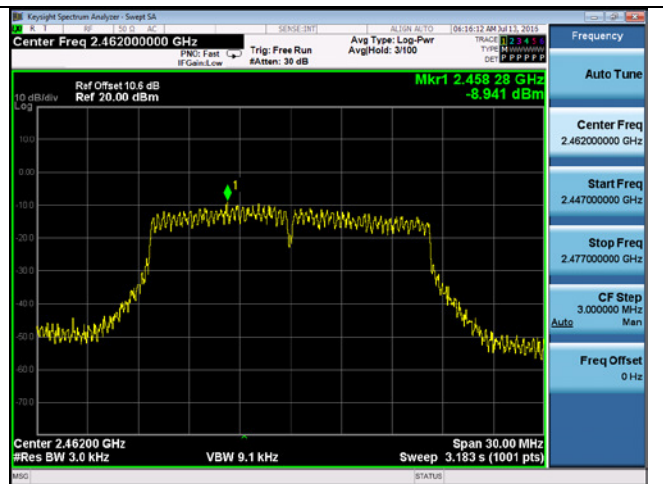
PSD-2.4G-802.11g Mid-chain3



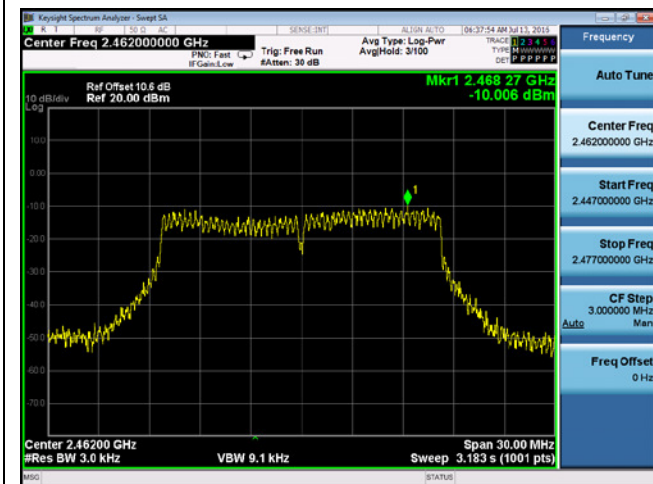
PSD-2.4G-802.11g Mid-chain4



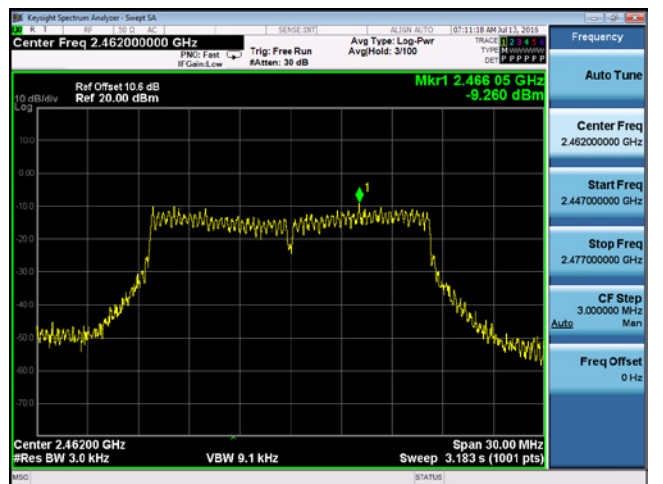
PSD-2.4G-802.11g High-chain1



PSD-2.4G-802.11g High-chain2



PSD-2.4G-802.11g High-chain3



PSD-2.4G-802.11g High-chain4