



FCC Test Report

Equipment : R610 Access Point
Brand Name : Ruckus
Model No. : R610
FCC ID : S9GR610
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
Function : ☒ Point-to-multipoint; ☐ Point-to-point
Applicant : Ruckus Wireless, Inc.
350 West Java Drive Sunnyvale, California 94089
U.S.A
Manufacturer : Ruckus Wireless, Inc.
350 West Java Drive Sunnyvale, California 94089
U.S.A

The product sample received on Jul. 25, 2016 and completely tested on Jan. 09, 2018. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.


Cliff Chang
SPORTON INTERNATIONAL INC.



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APPENDIX A. TEST RESULTS OF EMISSIONS IN RESTRICTED FREQUENCY BANDS

APPENDIX B. TEST PHOTOS



Summary of Test Result

Conformance Test Specifications				
Report Clause	Ref. Std. Clause	Description	Limit	Result
1.1.2	15.203	Antenna Requirement	FCC 15.203	Complied
3.1	15.247(d)	Emissions in Restricted Frequency Bands	Restricted Bands: FCC 15.209	Complied



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FCC ID: S9GR610

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
2400-2483.5	b, g, n (HT20), ac (VHT20)	2412-2462	1-11 [11]
2400-2483.5	n (HT40), ac (VHT40)	2422-2452	3-9 [7]

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	11b	20	3
2.4-2.4835GHz	11g	20	3
2.4-2.4835GHz	HT20	20	3
2.4-2.4835GHz	HT20,BF	20	3
2.4-2.4835GHz	VHT20	20	3
2.4-2.4835GHz	VHT20,BF	20	3
2.4-2.4835GHz	HT40	40	3
2.4-2.4835GHz	HT40,BF	40	3
2.4-2.4835GHz	VHT40	20	3
2.4-2.4835GHz	VHT40,BF	20	3

Note:

- 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- VHT20, VHT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM, modulation.
- BWch is the nominal channel bandwidth.
- Nss-Min is the minimum number of spatial streams.
- Nant is the number of outputs. e.g., 2(2,3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	
					2.4GHz	5GHz
1	Ruckus	R610	PIFA Antenna	I-PEX	1	3
2	Ruckus	R610	PIFA Antenna	I-PEX	1	3
3	Ruckus	R610	PIFA Antenna	I-PEX	1	3

Note: 1. The EUT has three antennas.

2. The EUT is with 3 antennas. Two of the antennas' polarity is vertical and the other antenna's polarity is Horizontal which is 3T2S, the array gain is 1.76dBi.

The 80+80MHz mode which is 2T2S(Chain 1 + Chain 3), the array gain is 0 dBi.

The non-beamforming 80+80MHz mode=beamforming 80+80MHz mode.

<For 2.4GHz Band>

For IEEE 802.11b/g/n/ac mode <3TX/3RX>:

Chain 1, Chain 2 and Chain 3 will transmit/receive the same signal simultaneously.

Chain 1, Chain 2 and Chain 3 can be used as transmitting/receiving antennas.

<For 5GHz Band>

For IEEE 802.11a/n/ac mode <3TX/3RX>:

Chain 1, Chain 2 and Chain 3 will transmit/receive the same signal simultaneously.

Chain 1, Chain 2 and Chain 3 can be used as transmitting/receiving antennas.

For IEEE 802.11ac 80+80MHz <2TX/2RX>:

Chain 1 and Chain 3 will transmit/receive the same signal simultaneously.

Chain 1 and Chain 3 can be used as transmitting/receiving antennas.



1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
802.11g	0.969	0.137	2.033m	1k
802.11ac VHT40	0.971	0.128	2.42m	1k
802.11ac VHT40,BF	0.925	0.338	845u	3k

1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter or PoE			
Beamforming Function	☒	With beamforming for 802.11n/ac in 2.4GHz/5GHz	☐	Without beamforming
Test Software Version	QCA Radio Control Toolkit			

1.1.5 Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR672501AA

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Adding diplexer second source (Brand: ACX, Model: DP2012-A2455NXA0).	Emissions in Restricted Frequency Bands After evaluating, the worst case is found at 802.11g 2437MHz, and retest this channel only.

Note: The above test items will be based on original output power to re-test.

1.1.6 Table for Diplexer

Source	Brand Name	Part Number	Location
Diplexer main source	ACX	DP2012-A2455NTT	FT7,FT8,FT9
Diplexer second source	ACX	DP2012-A2455NXA0	FT7,FT8,FT9

1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ◆ 47 CFR FCC Part 15
- ◆ ANSI C63.10-2013
- ◆ FCC KDB 558074 D01 v04
- ◆ FCC KDB 662911 D01 v02r01

1.3 Testing Location Information

Testing Location				
☐	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.	TEL : 886-3-327-3456	FAX : 886-3-318-0055
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.	TEL : 886-3-656-9065	FAX : 886-3-656-9085

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
Radiated	03CH01-CB	Brian Sun	22°C / 54%	Jan. 03, 2018 ~ Jan. 09, 2018

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
802.11g_Nss1,(6Mbps)_3TX	-
2437MHz	23

2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode > 1GHz	CTX
1	EUT in Y axis
2	EUT in Z axis
Mode 2 has been evaluated to be the worst case after evaluating. Consequently, measurement will follow this same test mode.	

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

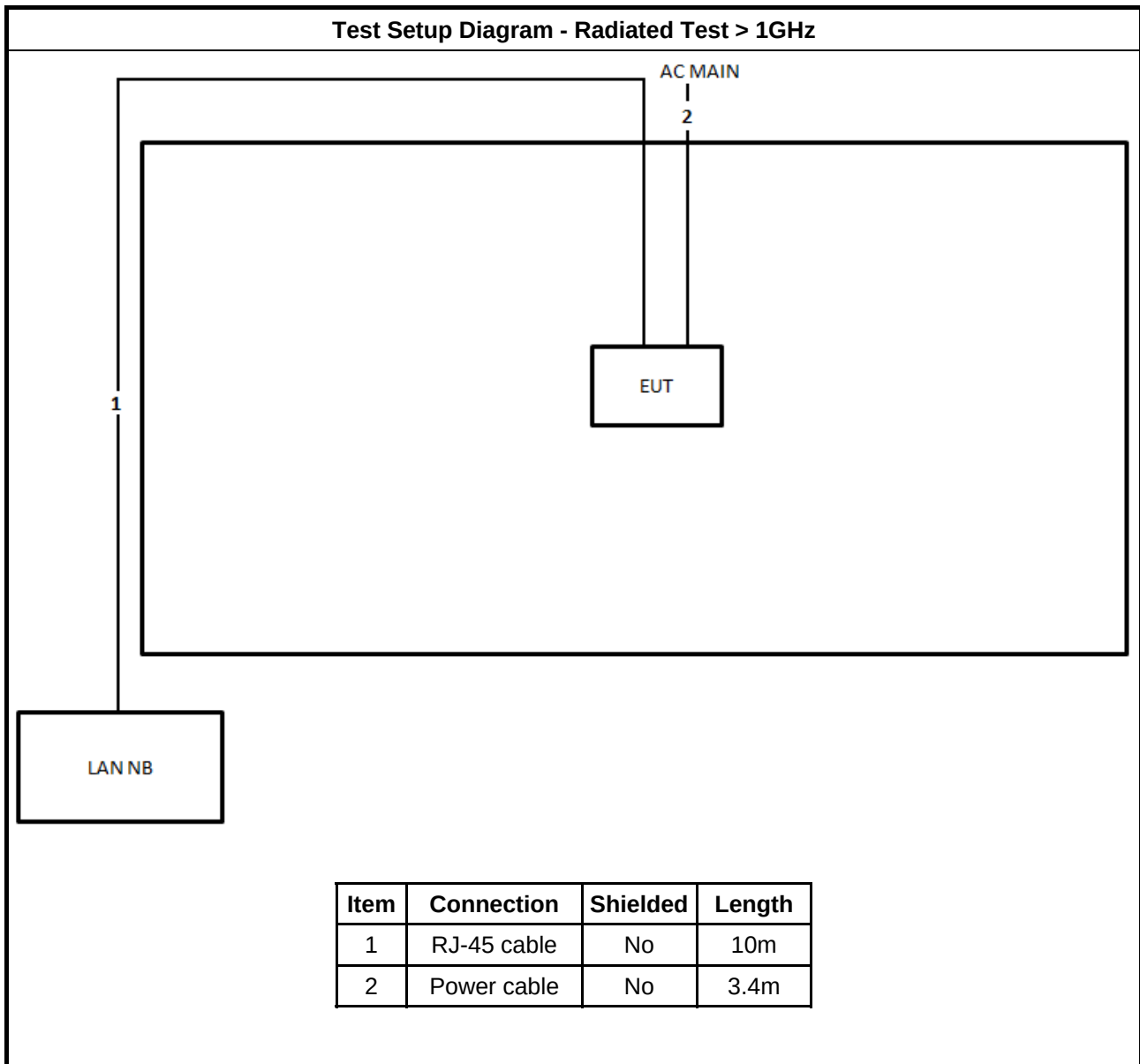
2.4 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter	Ruckus	WGF-1200200T3	Input: 100-240V~, 50/60Hz, 0.6A Output: 12.0V, 2.0A
PoE	Ruckus	740-64214-001	Input: 100-240V~50/60Hz 0.75A MAX Output: 48V, 0.5A
Other			
Wall-mounted rack*1			

2.5 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	NB	DELL	E4300	DoC

2.6 Test Setup Diagram



3 Transmitter Test Result

3.1 Emissions in Restricted Frequency Bands

3.1.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

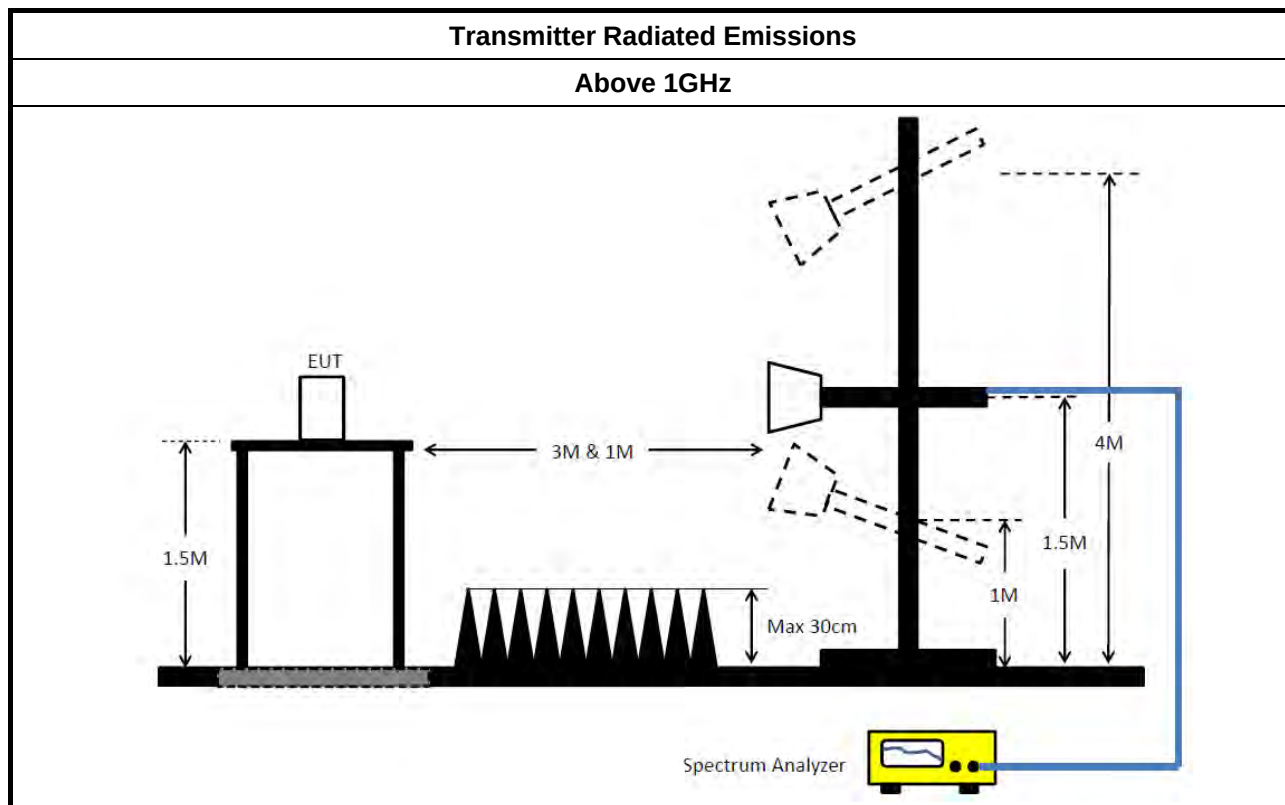
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method	
The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
Refer as ANSI C63.10, clause 6.9.2.2 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
For the transmitter unwanted emissions shall be measured using following options below:	
	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
	☐ Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$)
	☐ Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
	☒ Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq 1/T$).
	☐ Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time.
	☐ Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
	☒ Refer as FCC KDB 558074, clause 12.2.4 measurement procedure peak limit.
For the transmitter band-edge emissions shall be measured using following options below:	
	Refer as FCC KDB 558074 clause 13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	Refer as FCC KDB 558074, clause 13.2 (ANSI C63.10, clause 6.9.3) for marker-delta method for band-edge measurements.
	Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
For conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 12.2.2.	
	For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add $10 \log(N)$ dB
	For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

3.1.4 Test Setup



3.1.5 Test Result of Transmitter Radiated Unwanted Emissions

Refer as Appendix A

4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 20, 2017	Nov. 19, 2018	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 05, 2017	Jul. 04, 2018	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 16, 2017	Jan. 15, 2018	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 10, 2017	Jul. 09, 2018	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 23, 2017	Nov. 22, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)

Note: Calibration Interval of instruments listed above is one year.



RSE TX above 1GHz Result

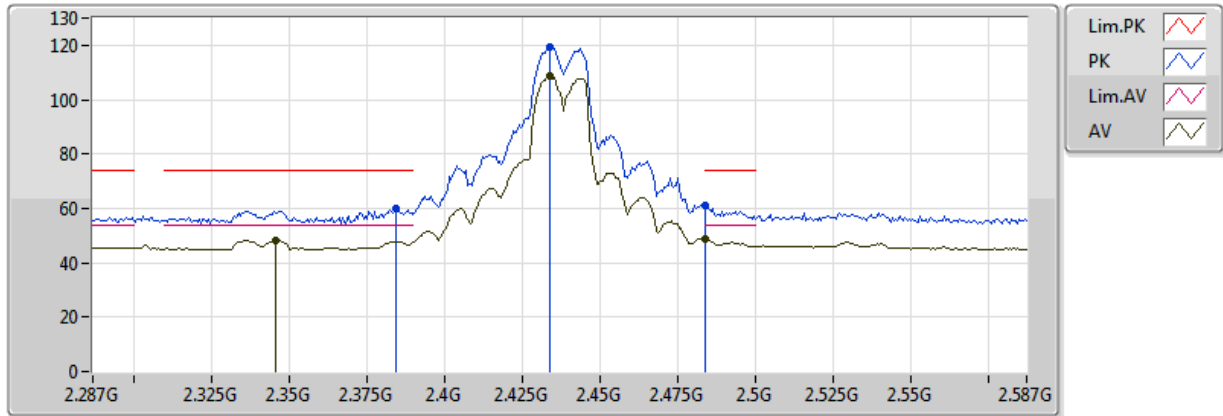
Appendix A

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
802.11g_Nss1,(6Mbps)_3TX	Pass	AV	2.4838G	48.79	54.00	-5.21	32.42	3	Vertical	187	2.58	-

802.11g_Nss1,(6Mbps)_3TX

2437MHz_TX

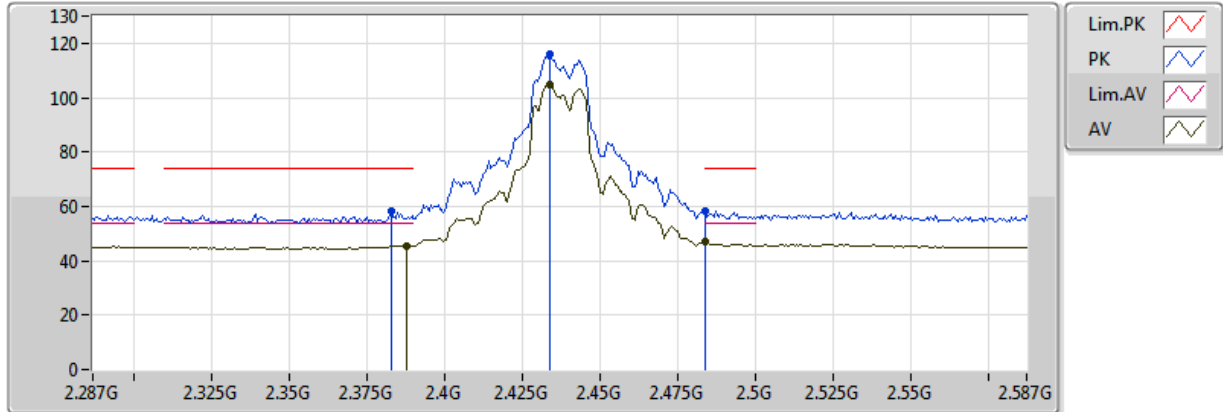


20180102
EUT_Z_3TX
Setting 23
06-Z-1
FSP

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)					
AV	2.3458G	48.15	54.00	-5.85	31.98	3	Vertical	187	2.58					
AV	2.434G	108.98	Inf	-Inf	32.26	3	Vertical	187	2.58					
AV	2.4838G	48.79	54.00	-5.21	32.42	3	Vertical	187	2.58					
PK	2.3842G	59.68	74.00	-14.32	32.10	3	Vertical	187	2.58					
PK	2.434G	119.49	Inf	-Inf	32.26	3	Vertical	187	2.58					
PK	2.4838G	61.34	74.00	-12.66	32.42	3	Vertical	187	2.58					

802.11g_Nss1,(6Mbps)_3TX

2437MHz_TX

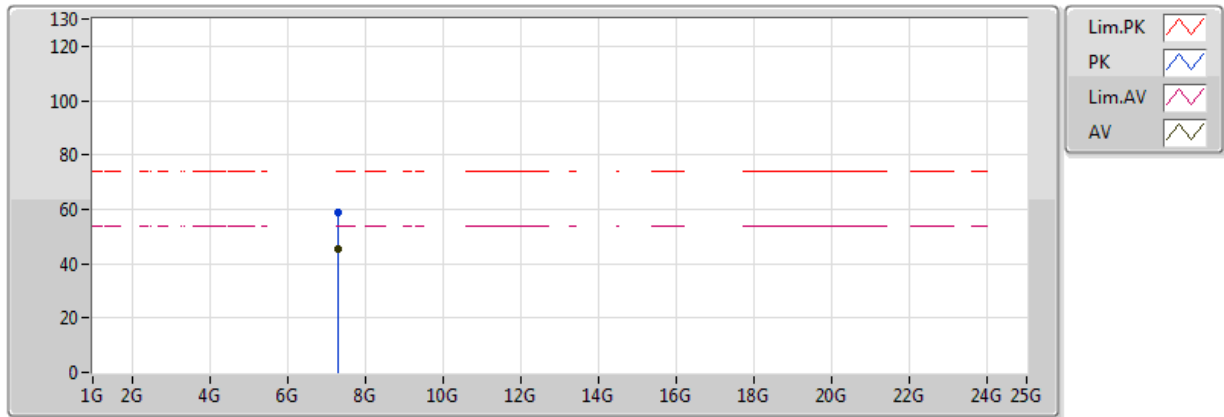


20180102
EUT_Z_3TX
Setting 23
06-Z-1
FSP

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)					
AV	2.3878G	45.53	54.00	-8.47	32.11	3	Horizontal	288	1.25					
AV	2.434G	104.84	Inf	-Inf	32.26	3	Horizontal	288	1.25					
AV	2.483502G	46.99	54.00	-7.01	32.42	3	Horizontal	288	1.25					
PK	2.383G	58.02	74.00	-15.98	32.10	3	Horizontal	288	1.25					
PK	2.434G	115.76	Inf	-Inf	32.26	3	Horizontal	288	1.25					
PK	2.483502G	58.44	74.00	-15.56	32.42	3	Horizontal	288	1.25					

802.11g_Nss1,(6Mbps)_3TX

2437MHz_TX

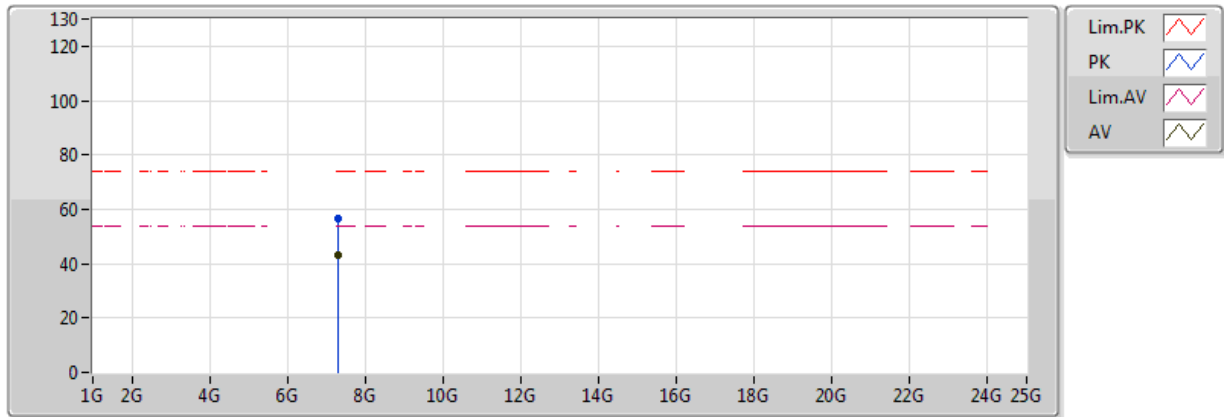


20180102
EUT_Z_3TX
Setting 23
06-Z-1
FSP

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)					
AV	7.30868G	45.62	54.00	-8.38	11.92	3	Vertical	344	1.01					
PK	7.30884G	58.96	74.00	-15.04	11.92	3	Vertical	344	1.01					

802.11g_Nss1,(6Mbps)_3TX

2437MHz_TX



20180102
EUT_Z_3TX
Setting 23
06-Z-1
FSP

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)					
AV	7.3086G	43.39	54.00	-10.61	11.92	3	Horizontal	318	1.02					
PK	7.31756G	56.46	74.00	-17.54	11.93	3	Horizontal	318	1.02					