TEST REPORT

Product Name:	WIFI Module
Trade Mark:	RF-LINK
Model No.:	RL-UM02SPC-8812BU-V1.0
Report Number:	180327015RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C
FCC ID:	QCIIDXMOD1
Test Result:	PASS
Date of Issue:	April 18, 2018

Prepared for:

SMART Technologies Inc.
3636 Research Road NW Calgary, AB T2L 1Y1, Canada

Prepared by:

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Tested by: Henry Lu
Engineer

Reviewed by: Kevin Liang
Team Leader

Approved by: Jim Long
Assistant Manager

Date: April 18, 2018

UnionTrust Laboratories * Certified *

Version

Version No.	Date	Description
V1.0	April 18, 2018	Original
V2.0	April 18, 2018	1. Add 5.9 section on page 45 2. Revised Power limit on page 14 and PSD limit on page 19

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	SMART Technologies Inc.
Address of Applicant:	3636 Research Road NW Calgary, AB T2L 1Y1, Canada
Manufacturer:	SMART Technologies Inc.
Address of Manufacturer:	3636 Research Road NW Calgary, AB T2L 1Y1, Canada

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	WIFI Module		
Model No.:	RL-UM02SPC-8812BU-V1.0		
Add. Model No.:	N/A		
Trade Mark:	RF-LINK		
DUT Stage:	Identical Prototype		
EUT Supports Function:	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
	5 GHz U-NII Bands:	5150 MHz to 5250 MHz	IEEE 802.11a/n/ac
		5250 MHz to 5350 MHz	IEEE 802.11a/n/ac
		5470 MHz to 5600 MHz	IEEE 802.11a/n/ac
		5650 MHz to 5725 MHz	IEEE 802.11a/n/ac
Software Version:	RL-UM02SPC-8812BU-V1.0		
Hardware Version:	rtl88x2bu v5.2.4.5_26498.20180205_COEX20171012-5044		
Sample Received Date:	February 1, 2018		
Sample Tested Date:	February 2, 2018 to March 16, 2018		

1.2.2 Description of Accessories

None.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Range:	2400 MHz to 2483.5 MHz	
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40	
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK)	
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS15 IEEE 802.11n-HT40: Up to MCS15	
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7	
Channel Separation:	5 MHz	
Antenna Type:	Chain 0	Diple Antenna
	Chain 1	Diple Antenna
Antenna Gain:	Chain 0	5.03 dBi
	Chain 1	5.03 dBi

Directional gain:	8.04 dBi	
Maximum Peak Power:	STBC_ Chain 0+1	IEEE 802.11b: 13.82dBm
	CCD_ Chain 0+1	IEEE 802.11g: 21.20 dBm
	MIMO_ Chain 0+1	IEEE 802.11n-HT20: 18.99 dBm IEEE 802.11n-HT40: 20.58 dBm
Normal Test Voltage:	3.3 Vdc	

1.4 OTHER INFORMATION

Operation Frequency Each of Channel							
IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
1	2412 MHz	4	2427 MHz	7	2442 MHz	10	2457 MHz
2	2417 MHz	5	2432 MHz	8	2447 MHz	11	2462 MHz
3	2422 MHz	6	2437 MHz	9	2452 MHz	--	--
IEEE 802.11n-HT40							
--	--	4	2427 MHz	7	2442 MHz	--	--
--	--	5	2432 MHz	8	2447 MHz	--	--
3	2422 MHz	6	2437 MHz	9	2452 MHz	--	--

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	Lenovo	E450	SL10G10780	UnionTrust
--	--	--	--	--

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable * 2	SMA	0.30 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1
The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. 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.

Compliance Certification Services (Shenzhen) Inc.

FCC Registration Number is 441872.
IC Registration Number is 2324I-2.

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.2878 dB
2	Conducted emission 150KHz-30MHz	±3.2878 dB
3	Radiated emission 30MHz-200Hz	±3.8928 dB
4	Radiated emission 200MHz-1GHz	±3.8753 dB
5	Radiated emission 1GHz-8GHz	±5.3112 dB
6	Radiated emission Above 8GHz	±5.3493 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	N/A NOTE 2
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3)	KDB 558074 D01 v04 Section 9.1.3	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)	KDB 558074 D01 v04 Section 8.1	PASS
Occupied Bandwidth	RSS-Gen section 6.6	RSS-Gen section 6.6	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e)	KDB 558074 D01 v04 Section 10.2	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d)	KDB 558074 D01 v04 Section 11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209	KDB 558074 D01 v04 Section 12.1	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209	KDB 558074 D01 v04 Section 12.1	PASS
Note: 1) N/A: In this whole report not application. 2) This EUT is powered by DC form PCB.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List (3M Chamber)						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☑	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 20, 2015	Dec. 19, 2018
☑	Receiver	R&S	ESIB26	100114	Dec. 10, 2017	Dec. 10, 2018
☑	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec.10, 2017	Dec. 10, 2018
☑	Loop Antenna	ETS-LINDGREN	6502	00202525	Dec. 17, 2017	Dec. 17, 2018
☑	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Dec. 17, 2017	Dec. 17, 2018
☑	Preamplifier	HP	8447F	2805A02960	Dec. 10, 2017	Dec. 10, 2018
☑	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	Dec. 17, 2017	Dec. 17, 2018
☑	Horn Antenna	ETS-LINDGREN	3116C	00200180	Jul. 28, 2015	Jul. 27, 2018
☑	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Dec. 17, 2017	Dec. 17, 2018
☑	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☑	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☑	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec. 10, 2017	Dec. 10, 2018
☑	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Dec. 10, 2017	Dec. 10, 2018
☑	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Dec. 10, 2017	Dec. 10, 2018

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	3.3	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 MHz	Channel 3	Channel 6	Channel 9
		2422 MHz	2437 MHz	2452 MHz

4.3 EUT TEST STATUS

Mode	Tx/Rx Function	Description
IEEE 802.11b IEEE 802.11g	1Tx/1Rx	1. Keep the EUT in continuously transmitting or receiving with modulation test single.
IEEE 802.11n-HT20 IEEE 802.11n-HT40	2Tx/2Rx	

4.4 PRE-SCAN

4.4.1 Pre-scan under all rates

Mode and Frequency	Maximum Conducted Average Power (dBm)_Chain 0							
	1		2		5.5		11	
IEEE 802.11b 2437 MHz	**8.45**		8.34		8.27		8.11	
IEEE 802.11g 2437 MHz	6	9	12	18	24	36	48	54
	7.92	7.84	7.78	7.56	7.09	6.98	6.89	6.82
IEEE 802.11n-HT20 2437 MHz	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
	6.38	6.11	5.97	5.82	5.78	5.48	5.41	5.36
	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
	5.33	5.44	5.41	5.68	5.43	5.88	5.72	5.49
IEEE 802.11n-HT40 2437 MHz	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
	8.61	8.56	8.46	7.89	7.94	7.90	7.83	7.78
	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
	7.71	6.67	6.42	6.33	6.12	6.10	6.05	6.01

4.4.2 Worst-case data rates

Mode	Worst-case data rates
IEEE 802.11b	1 Mbps
IEEE 802.11g	6 Mbps
IEEE 802.11n-HT20	MCS0
IEEE 802.11n-HT40	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

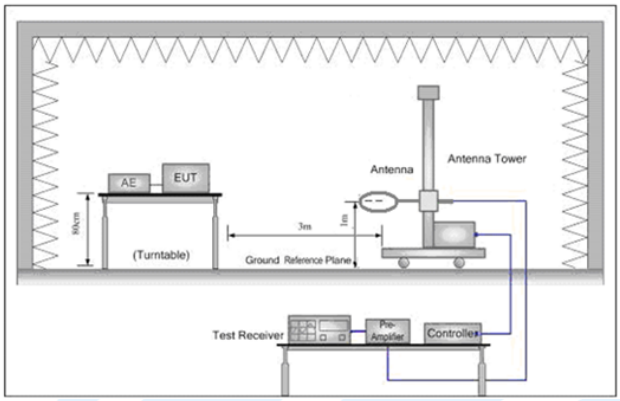


Figure 1. Below 30MHz

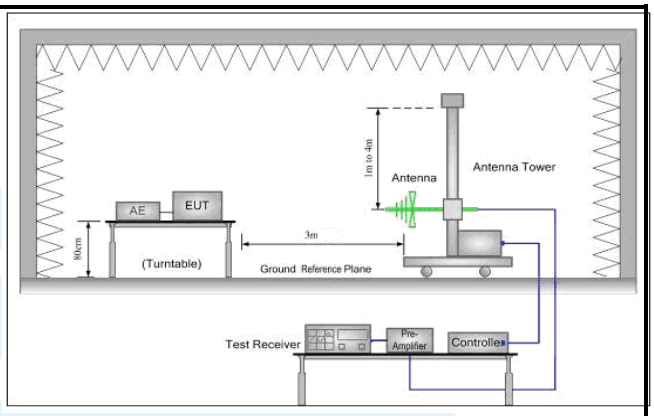


Figure 2. 30MHz to 1GHz

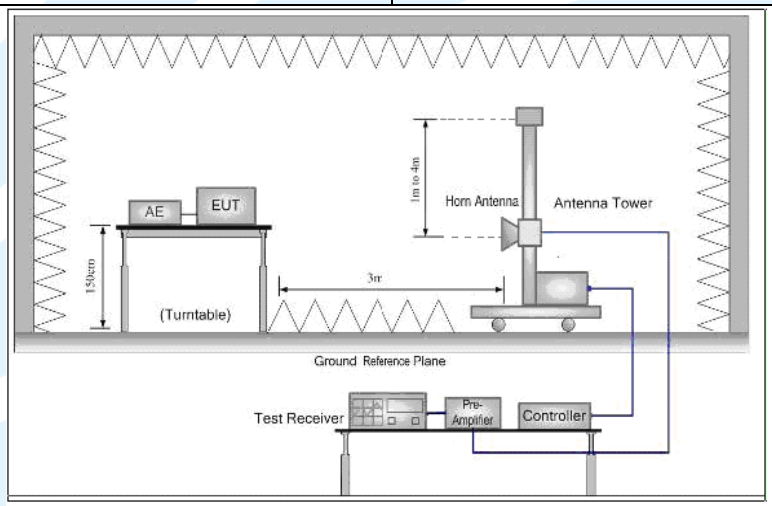
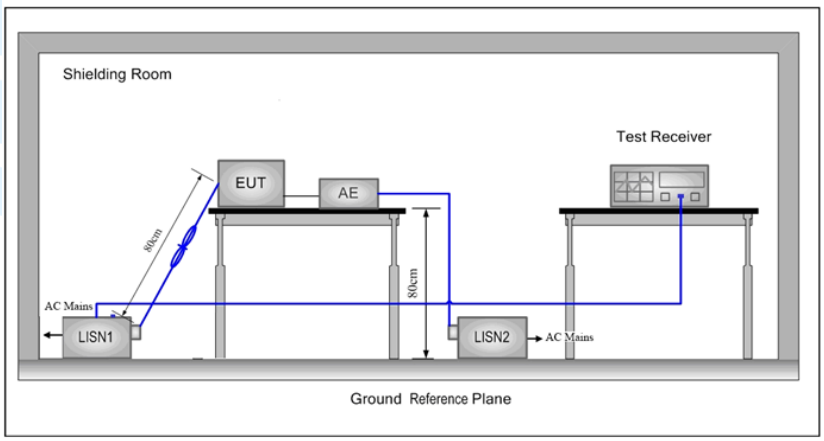


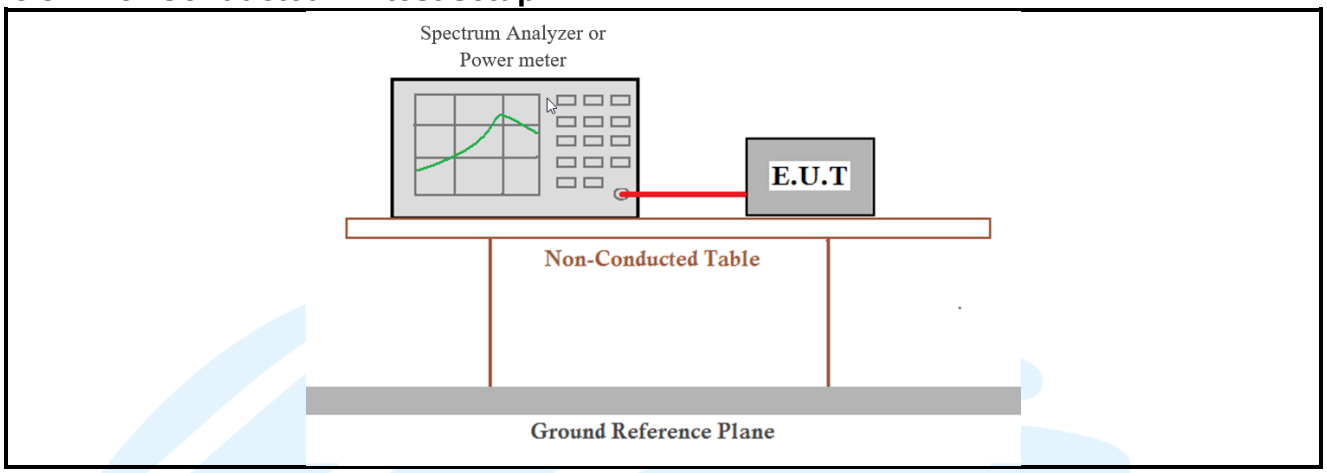
Figure 3. Above 1GHz

4.5.2 For Conducted Emissions test setup

Figure 3. Conducted Emissions setup



4.5.3 For Conducted RF test setup



4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.3Vdc. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

Frequency	Mode	Antenna Port	Worst-case axis positioning
Above 1GHz	1TX	Chain 0	Y axis
	1TX	Chain 1	Y axis
	2TX	Chain 0+1	Y axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

The EUT working with 100% duty cycle of continuous transmit for tested

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
4	KDB 558074 D01 DTS Meas Guidance v04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
5	KDB 662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: 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. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
EUT Antenna:
Both antenna in the interior of the equipment and no consideration of replacement. The transmit signals are correlated with each other and the antenna gain of both chains is completely consistent, the best case directional gain of the antenna is **8.04** dBi (See section 5.3).

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3)

Test Method: KDB 558074 D01 v04, Section 9.1.3

Limit: For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W

Test Procedure:
1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.4.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

The worst case test data:

For maximum peak conducted output power

Mode	Channel/ Frequency (MHz)	Maximum peak conducted power (dBm)				
		Chain 0	Chain 1	Total Power Chain 0+1	Limit (dBm)	Pass / Fail
IEEE 802.11b (STBC)	1(2412)	9.82	10.91	13.41	27.96	Pass
	6(2437)	10.34	11.23	13.82	27.96	Pass
	11(2462)	10.43	10.93	13.70	27.96	Pass
IEEE 802.11g (CCD)	1(2412)	17.68	18.23	20.97	27.96	Pass
	6(2437)	17.21	18.54	20.94	27.96	Pass
	11(2462)	17.68	18.65	21.20	27.96	Pass
IEEE 802.11n-HT20 (MIMO)	1(2412)	15.22	15.46	18.35	27.96	Pass
	6(2437)	15.34	16.03	18.71	27.96	Pass
	11(2462)	16.32	15.61	18.99	27.96	Pass
IEEE 802.11n-HT40 (MIMO)	3(2422)	17.03	17.39	20.22	27.96	Pass
	6(2437)	17.34	17.79	20.58	27.96	Pass
	9(2452)	16.34	17.22	19.81	27.96	Pass

Remark:

1. Total (Chain 0+1) = $10*\log[(10^{\text{Chain 0}/10})+(10^{\text{Chain 1}/10})]$
2. Directional gain and the maximum peak conducted power limit see table below:

Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated chains directional gain (dBi)	Peak Power Limit (dBm)
2400 MHz to 2483.5 MHz	5.03	5.03	8.04	27.96

Basic methodology with N_{ANT} transmit antennas, each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:

If *any* transmit signals are *correlated* with each other,

Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)

Test Method: KDB 558074 D01 v04, Section 8.1

Limit: For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.4.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

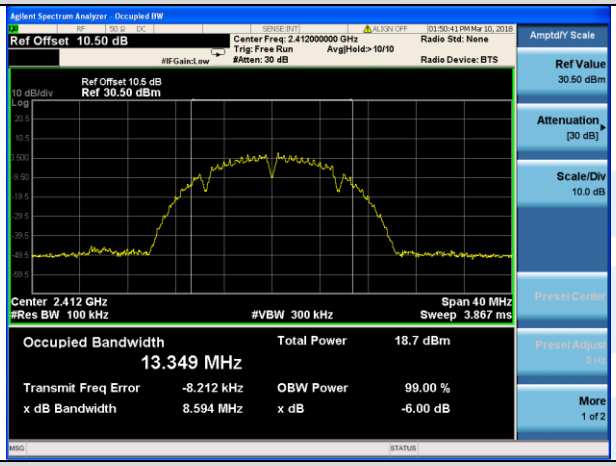
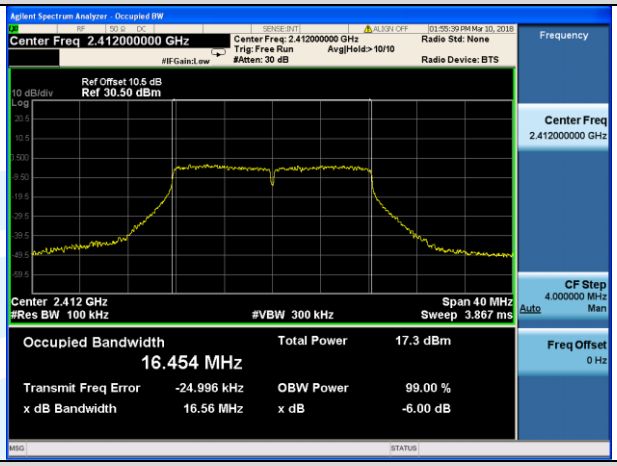
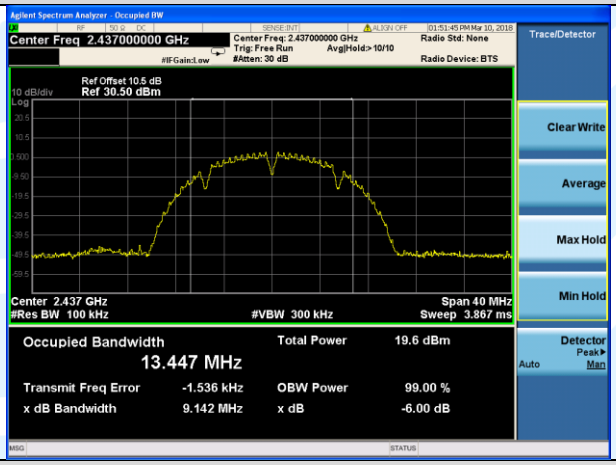
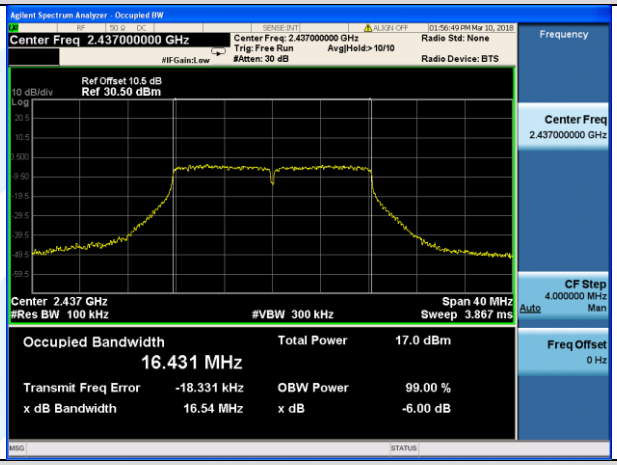
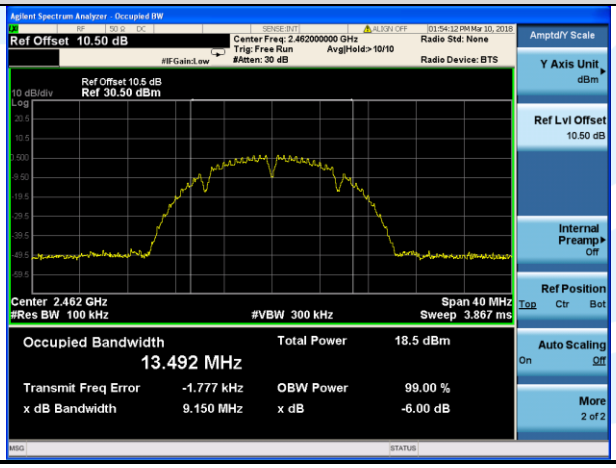
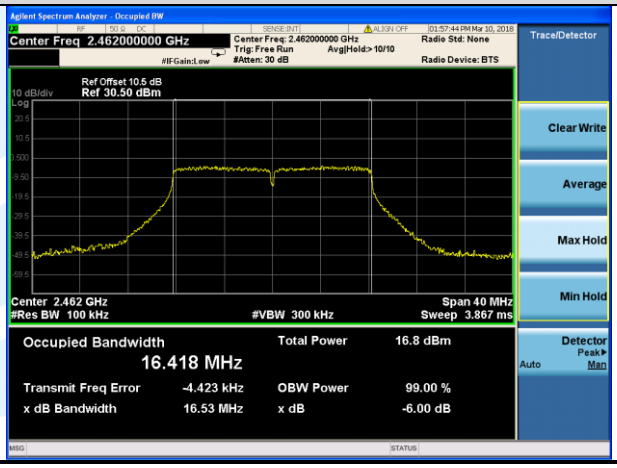
Test Results: Pass

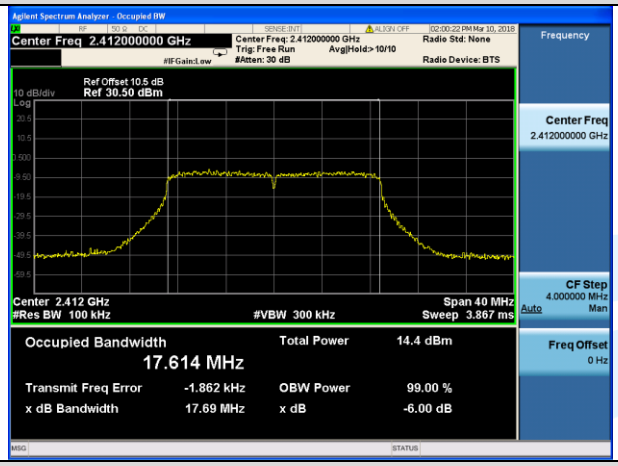
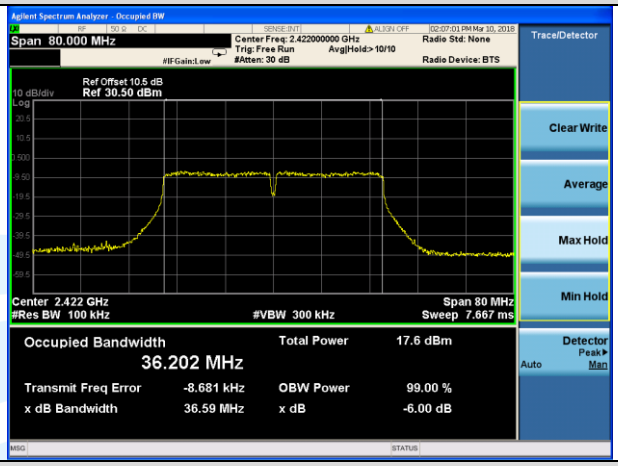
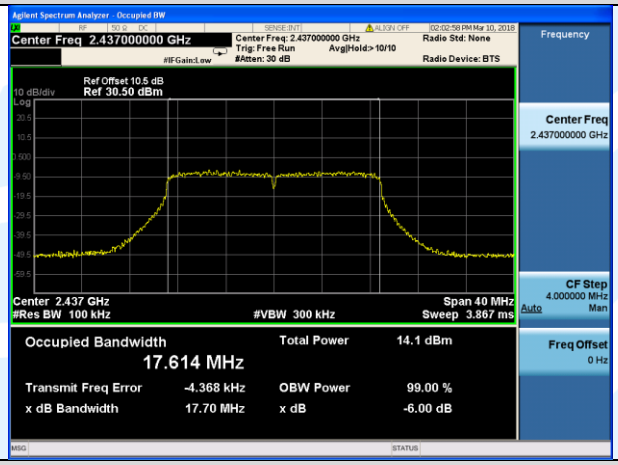
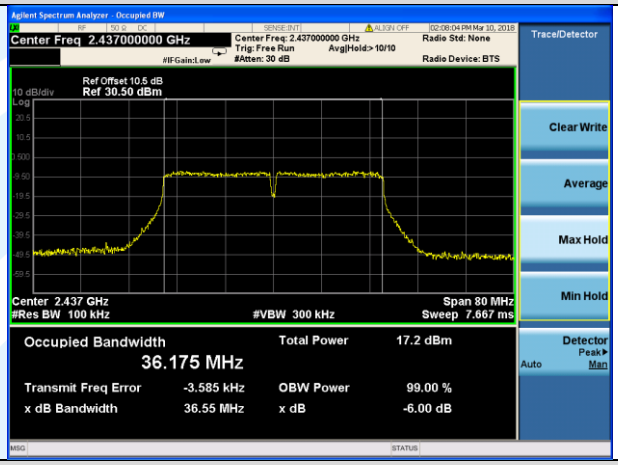
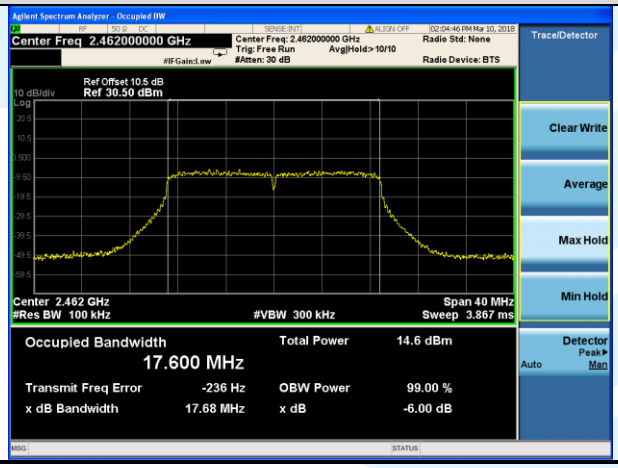
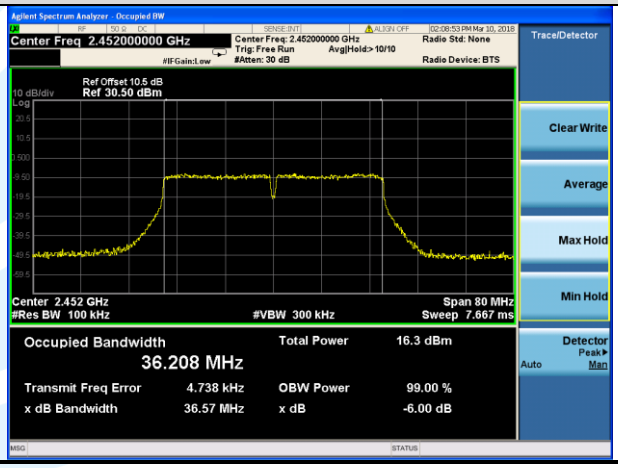
The worst case test data:

Mode	Channel/ Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit	Pass / Fail
IEEE 802.11b STBC_Chain 1	1(2412)	8.594	13.349	> 500 kHz	Pass
	6(2437)	9.142	13.447	> 500 kHz	Pass
	11(2462)	9.150	13.492	> 500 kHz	Pass
IEEE 802.11g CDD_Chain 1	1(2412)	16.560	16.454	> 500 kHz	Pass
	6(2437)	16.540	16.431	> 500 kHz	Pass
	11(2462)	16.530	16.418	> 500 kHz	Pass
IEEE 802.11n-HT20 MIMO_Chain 1	1(2412)	17.690	17.614	> 500 kHz	Pass
	6(2437)	17.700	17.614	> 500 kHz	Pass
	11(2462)	17.680	17.600	> 500 kHz	Pass
IEEE 802.11n-HT40 MIMO_Chain 1	3(2422)	36.590	36.202	> 500 kHz	Pass
	6(2437)	36.550	36.175	> 500 kHz	Pass
	9(2452)	36.570	36.208	> 500 kHz	Pass

The test plot as follows:

The worst case test data:

IEEE 802.11b_Chain 1	IEEE 802.11g_Chain 1
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

IEEE 802.11n-HT20_Chain 1	IEEE 802.11n-HT40_Chain 1
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

5.5 POWER SPECTRAL DENSITY

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (e)

Test Method: KDB 558074 D01 v04, Section 10.2

Limit: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Use the following spectrum analyzer settings:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.4.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

The worst case test data:

Mode	Channel/ Frequency (MHz)	Power spectral density (dBm)				
		Chain 0	Chain 1	Total Power Chain 0+1	Limit @3kHz (dBm)	Pass / Fail
IEEE 802.11b (STBC)	1(2412)	-22.60	-21.52	-19.02	5.96	Pass
	6(2437)	-21.76	-18.25	-16.65	5.96	Pass
	11(2462)	-22.77	-16.94	-15.93	5.96	Pass
IEEE 802.11g (CDD)	1(2412)	-22.67	-18.59	-17.16	5.96	Pass
	6(2437)	-22.88	-18.50	-17.15	5.96	Pass
	11(2462)	-22.63	-17.13	-16.05	5.96	Pass
IEEE 802.11n-HT20 (MIMO)	1(2412)	-23.65	-20.26	-18.62	5.96	Pass
	6(2437)	-24.33	-20.10	-18.71	5.96	Pass
	11(2462)	-23.55	-19.38	-17.97	5.96	Pass
IEEE 802.11n-HT40 (MIMO)	3(2422)	-23.23	-17.96	-16.83	5.96	Pass
	6(2437)	-21.87	-19.04	-17.22	5.96	Pass
	9(2452)	-23.29	-18.72	-17.42	5.96	Pass

Remark:
1. Power with Duty Factor = Measured Power + Duty Cycle Factor
2. Total (Chain 0+1) = $10*\log[(10^{\text{Chain 0/10}})+(10^{\text{Chain 1/10}})]$
3. Directional gain and the maximum conducted power spectral density limit see table below:

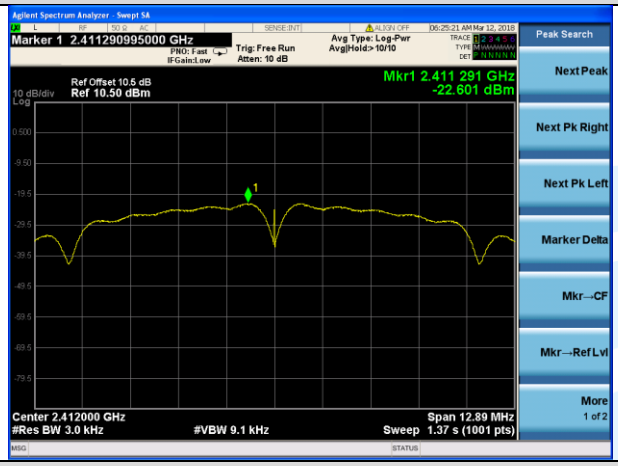
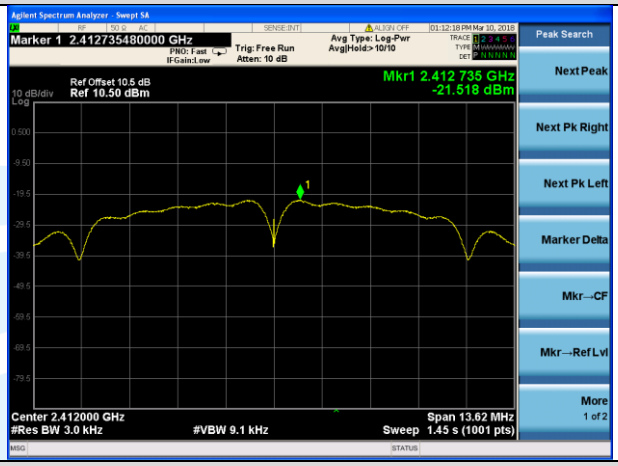
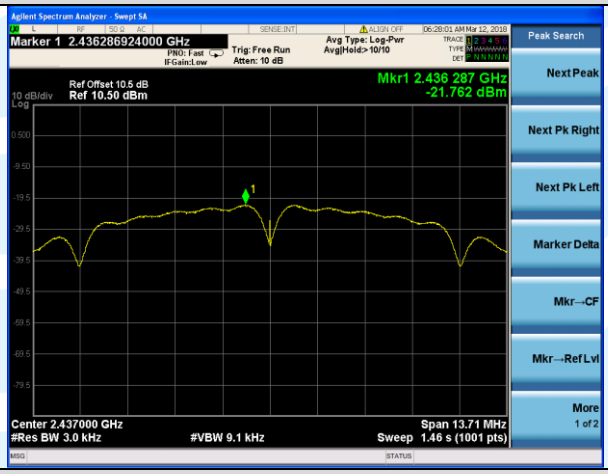
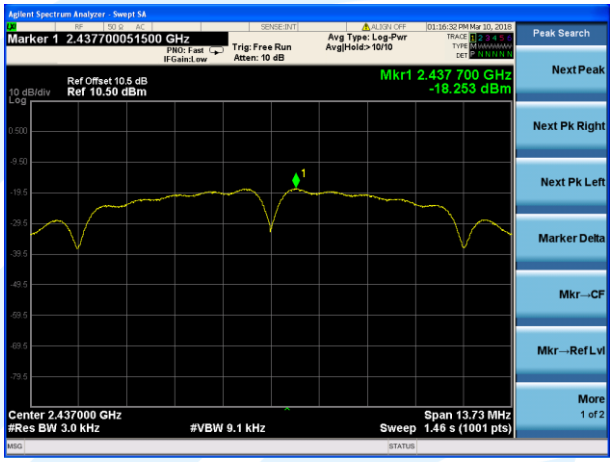
Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated chains directional gain (dBi)	Peak Power Limit (dBm)
2400 MHz to 2483.5 MHz	5.03	5.03	8.04	5.96

Basic methodology with N_{ANT} transmit antennas, each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:

If *any* transmit signals are *correlated* with each other,

Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi

The test plot as follows:

IEEE 802.11b_Chain 0	IEEE 802.11b_Chain 1
Lowest Channel	
	
Middle Channel	
	
Highest Channel