FCC Part 15C
Measurement and Test Report

For

ooma, Inc.

1840 Embarcadero Road, Palo Alto, California, United States

FCC ID: XFT-BFLY2

FCC Rule(s):	FCC Part 15.247
Product Description:	Indoor/Outdoor Smart Security Camera
Tested Model:	BTFU2100
Report No.:	STRD1810021I
Sample Receipt Date:	2018-11-16
Tested Date:	2018-11-16 to 2019-01-04
Issued Date:	2019-01-04
Tested By:	Long Tang / Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	ooma, Inc.
Address of applicant:	1840 Embarcadero Road, Palo Alto, California, United States
Manufacturer:	Kenxen Digitech Limited
Address of manufacturer:	Room 1605, APEC Plaza, 49 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong

General Description of EUT	
Product Name:	Indoor/Outdoor Smart Security Camera
Trade Name:	Ooma Butterfleye
Model No.:	BTFU2100
Adding Model(s):	BTFU2300, BTFU2500
Rated Voltage:	Battery:DC3.8V
Power Adapter:	MODEL: CC10-050200U INPUT: 100-240V, 50/60Hz, 0.35A OUTPUT: 5V, 2A
Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model BTFU2100, but the circuit and the electronic construction do not change, declared by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz
RF Output Power:	5.54dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 72.2Mbps
Quantity of Channels:	11
Channel Separation:	5MHz
Type of Antenna:	Integral Antenna
Antenna Gain:	3dBi

1.2 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.
558074 D01 15.247 Meas Guidance v05: Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The Fcc Rules
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05
The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Test Facility

FCC – Registration No.: 125990
Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A
The 3m Semi-anechoic chamber of Shenzhen SEM Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	Low:2412MHz, Middle:2437MHz,High:2462MHz
TM2	802.11g	Low:2412MHz, Middle:2437MHz,High:2462MHz
TM3	802.11n-HT20	Low:2412MHz, Middle:2437MHz,High:2462MHz
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

Test Conditions	
Temperature:	22~25 °C
Relative humidity	50~56 %.
ATM Pressure:	1019 mbar

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Accessories Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	9-150kHz ±3.74dB
		0.15-30MHz ±3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ±4.52dB
		0.2-1GHz ±5.56dB
		1-6GHz ±3.84dB
		6-18GHz ±3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2018-05-22	2019-05-21
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2018-05-22	2019-05-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2018-05-22	2019-05-21
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2018-05-22	2019-05-21
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2018-05-22	2019-05-21
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2020-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2018-05-22	2019-05-21
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2018-05-22	2019-05-21
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2018-05-22	2019-05-21
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2018-05-22	2019-05-21
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2018-05-22	2019-05-21
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2018-05-22	2019-05-21
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2018-05-22	2019-05-21
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2018-05-22	2019-05-21
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2018-05-22	2019-05-21
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2018-03-19	2019-03-18
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2018-03-19	2019-03-18
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2018-03-19	2019-03-18
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2018-03-19	2019-03-18
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§2.1093	RF Exposure	Compliant
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.247(e)	Power Spectral Density	Compliant
§ 15.247(a)(2)	DTS Bandwidth	Compliant
§ 15.247(b)(3)	RF Output Power	Compliant
§ 15.209(a)	Radiated Emission	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 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 shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has an integral antenna, fulfill the requirement of this section.

5. Power Spectral Density

5.1 Standard Applicable

According to 15.247(a)(1)(iii), 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.

5.2 Test Procedure

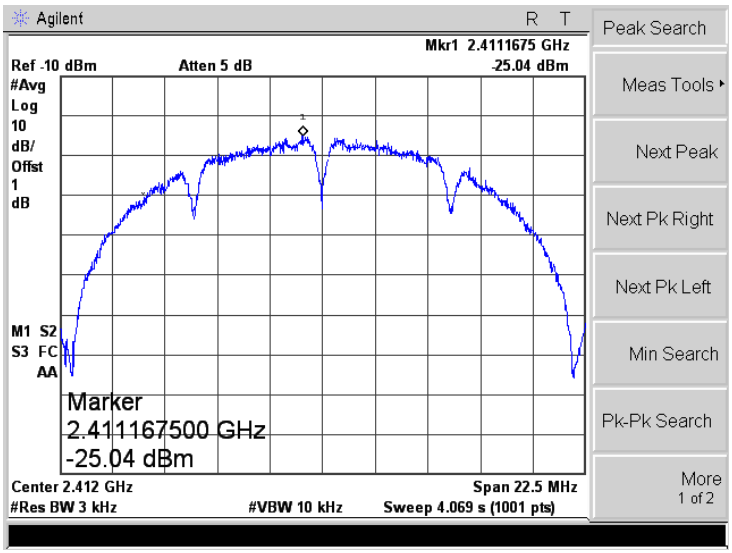
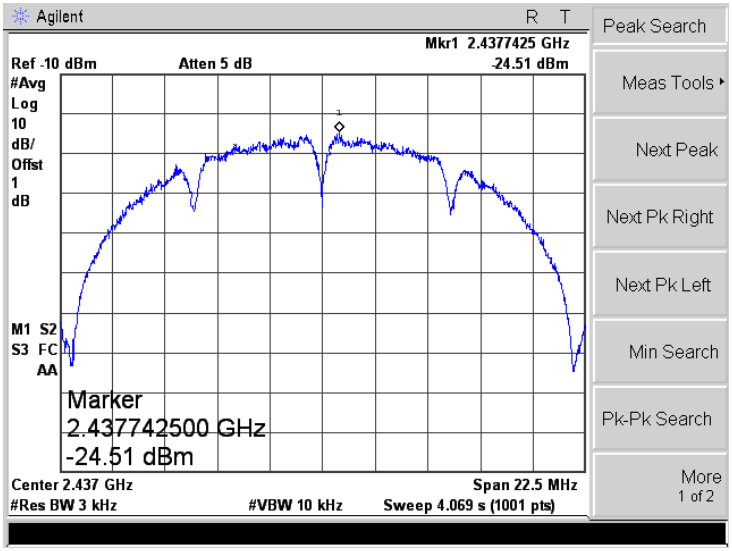
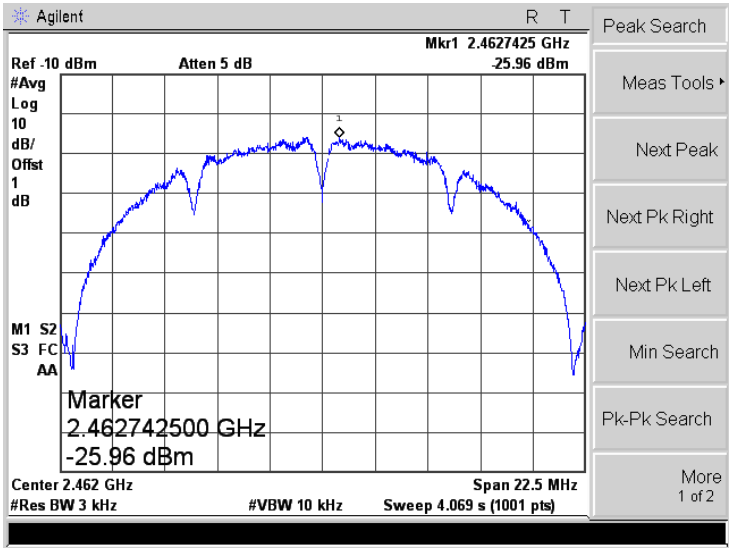
According to the KDB 558074 D01 v05 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.10.3, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

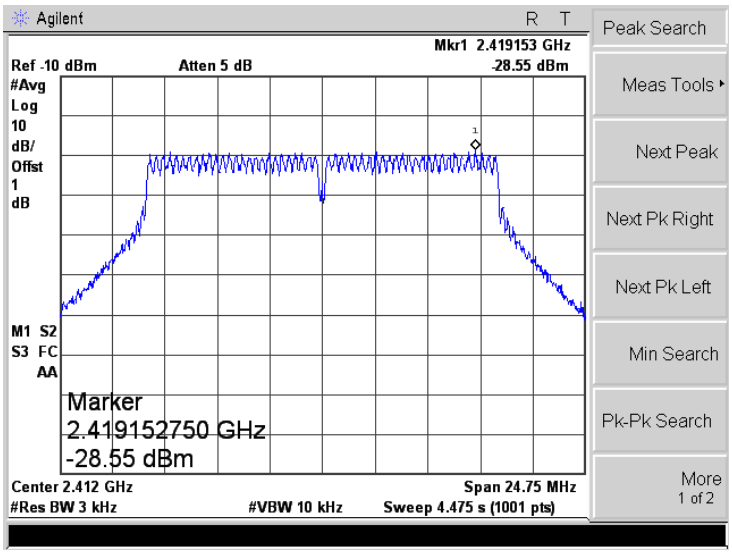
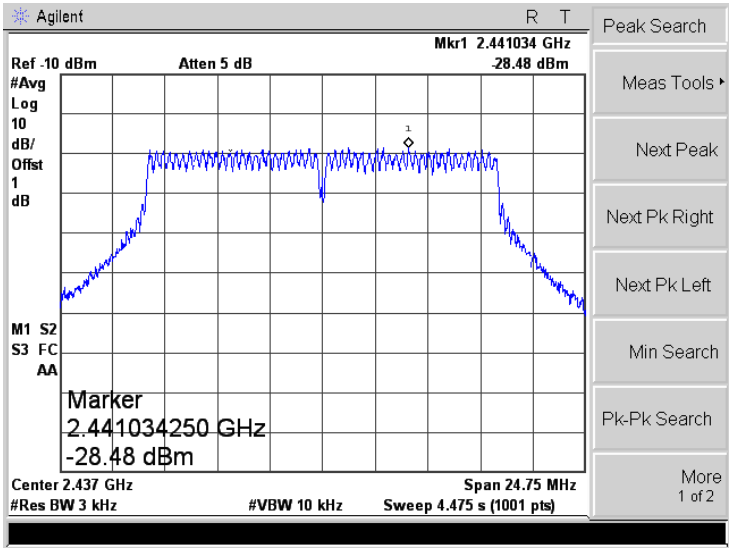
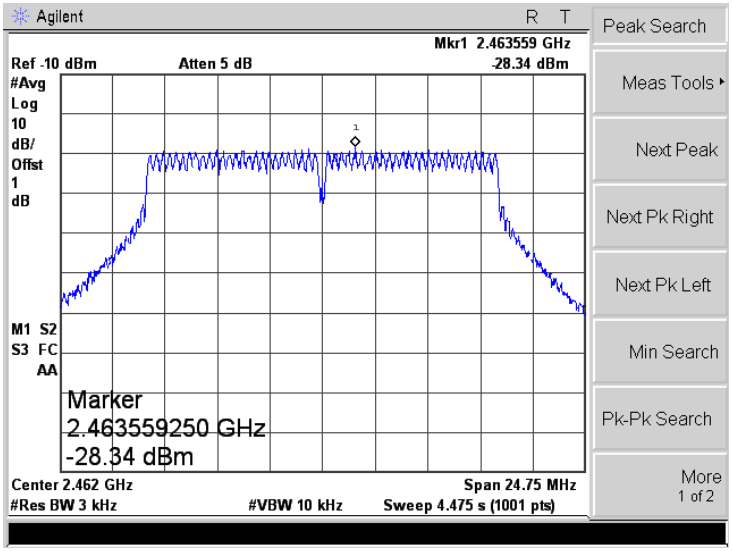
a) Set instrument center frequency to DTS channel center frequency.
b) Set span to at least 1.5 times the OBW.
c) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz. .
d) Set VBW ≥3 x RBW.
e) Detector = power averaging (RMS) or sample detector (when RMS not available).
f) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
g) Sweep time = auto couple.
h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
i) Use the peak marker function to determine the maximum amplitude level.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

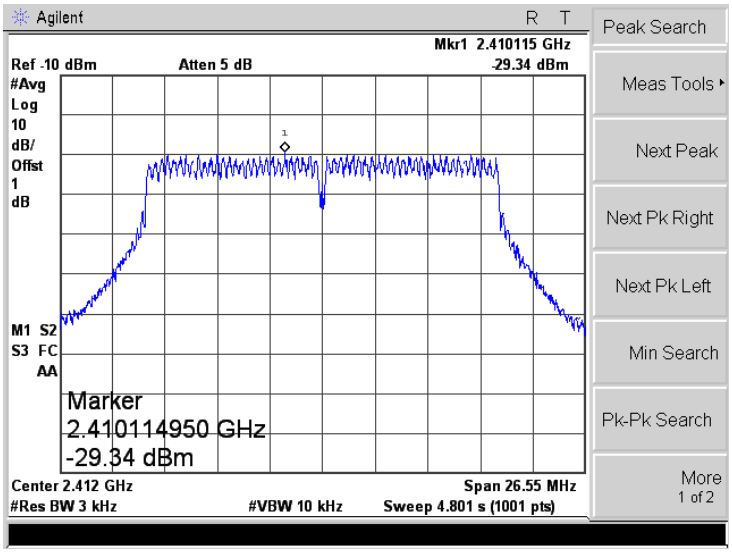
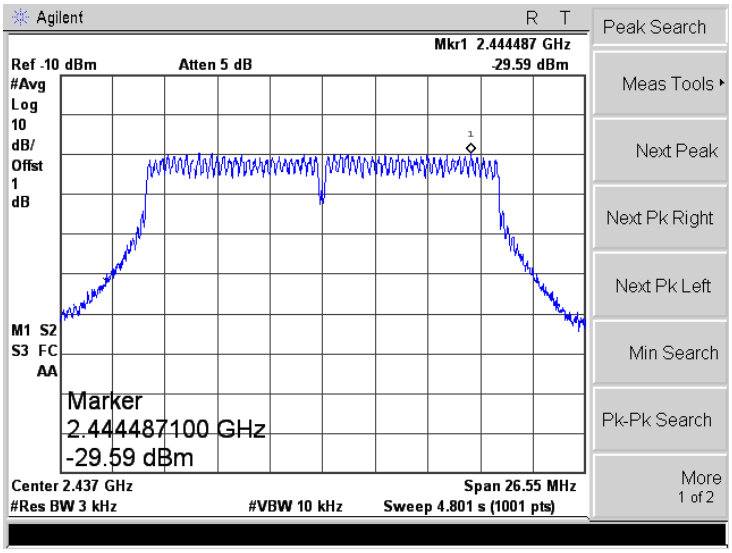
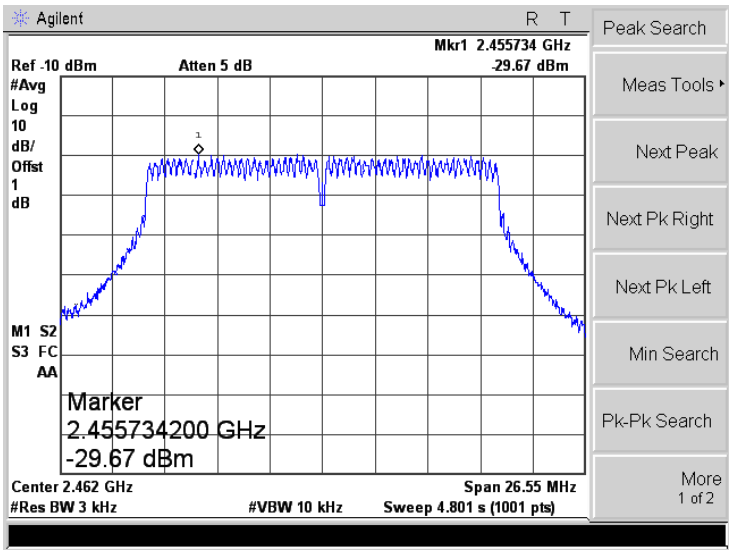
5.3 Summary of Test Results/Plots

Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b_11Mbps	2412	-25.04	8
	2437	-24.51	8
	2462	-25.96	8
802.11g_54Mbps	2412	-28.55	8
	2437	-28.48	8
	2462	-28.34	8
802.11n-HT20_MCS7	2412	-29.34	8
	2437	-29.59	8
	2462	-29.67	8

Please refer to the following test plots:

802.11b-Low	
802.11b-Middle	
802.11b-High	

802.11g-Low	
802.11g-Middle	
802.11g-High	

802.11n-HT20-Low	
802.11n-HT20-Middle	
802.11n-HT20-High	

6. DTS Bandwidth

6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.2 Test Procedure

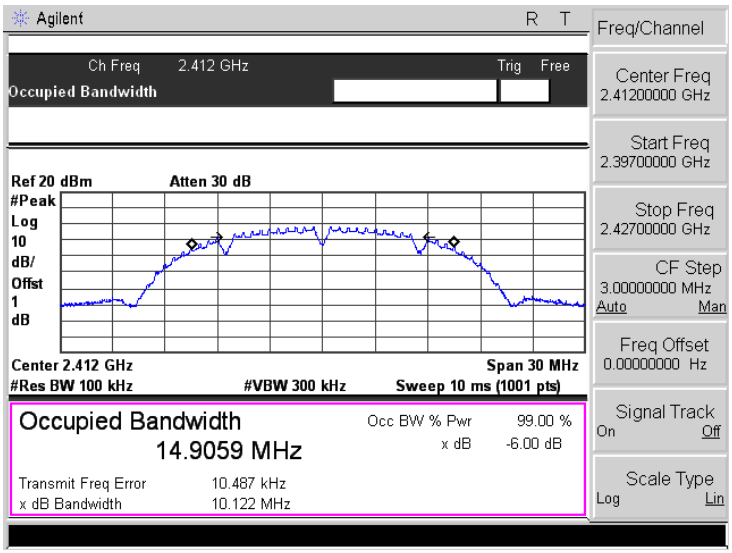
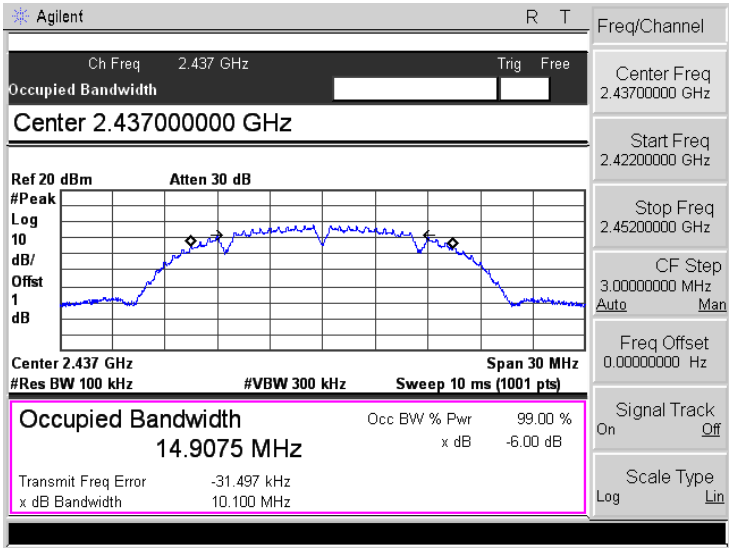
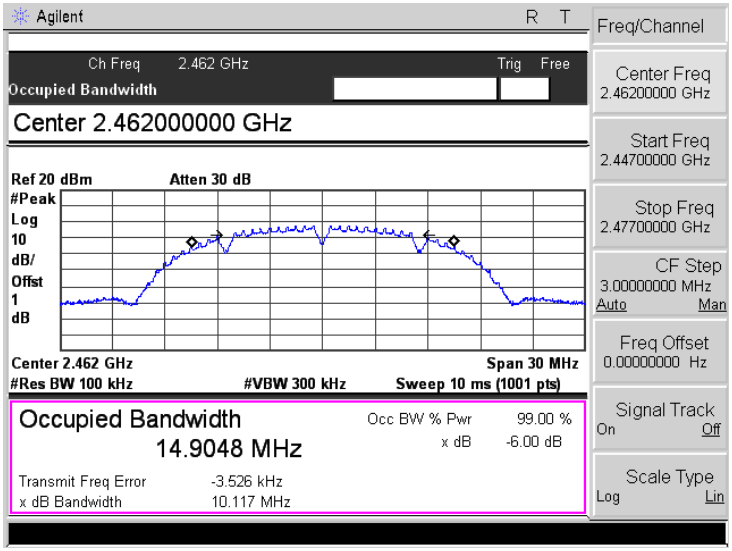
According to the KDB 558074 D01 v05 Subclause 8.2 and ANSI C63.10-2013 Subclause 11.8.1, the test method of DTS Bandwidth as below:

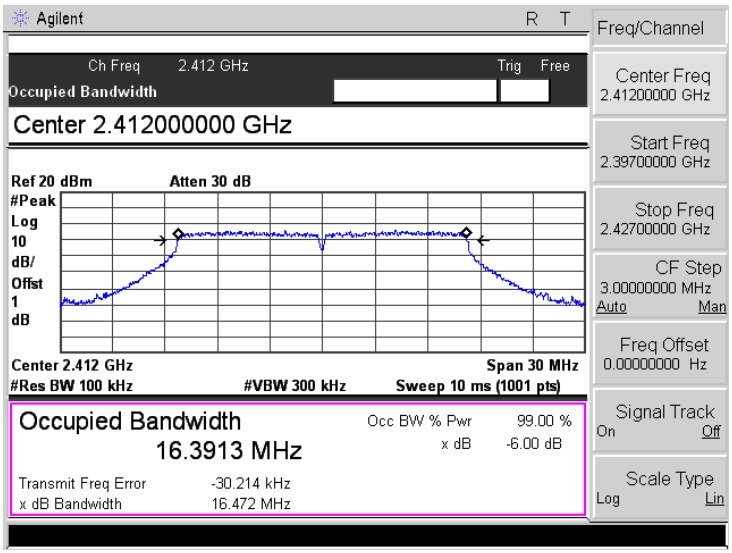
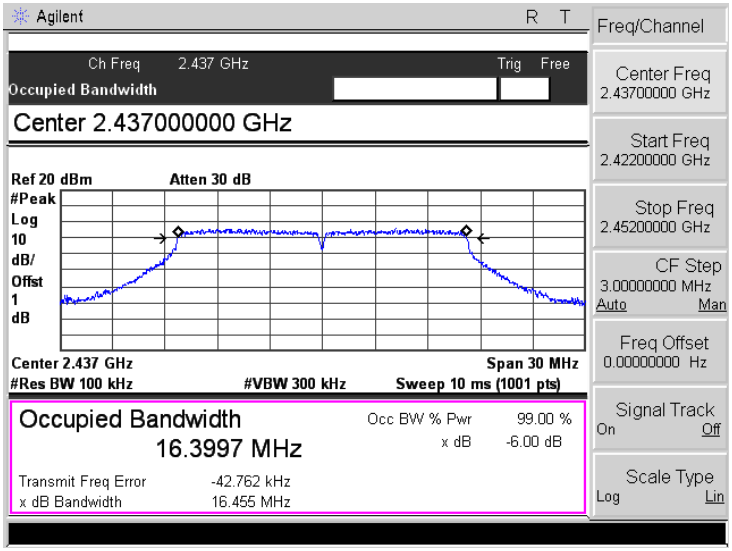
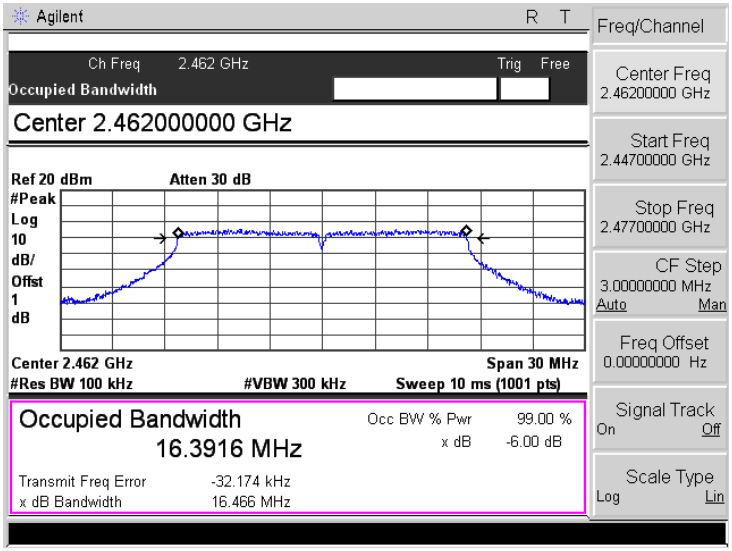
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

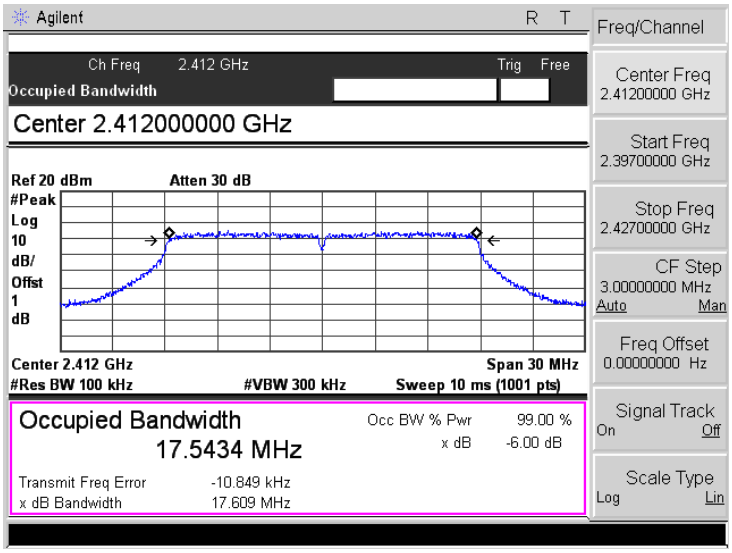
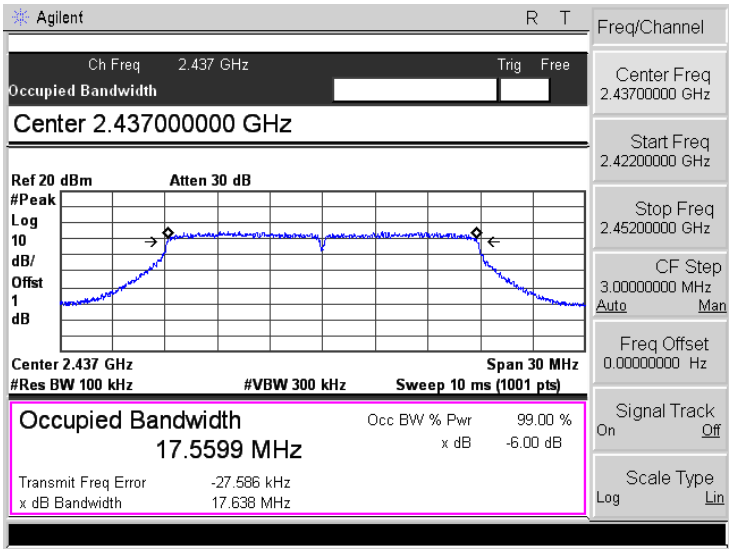
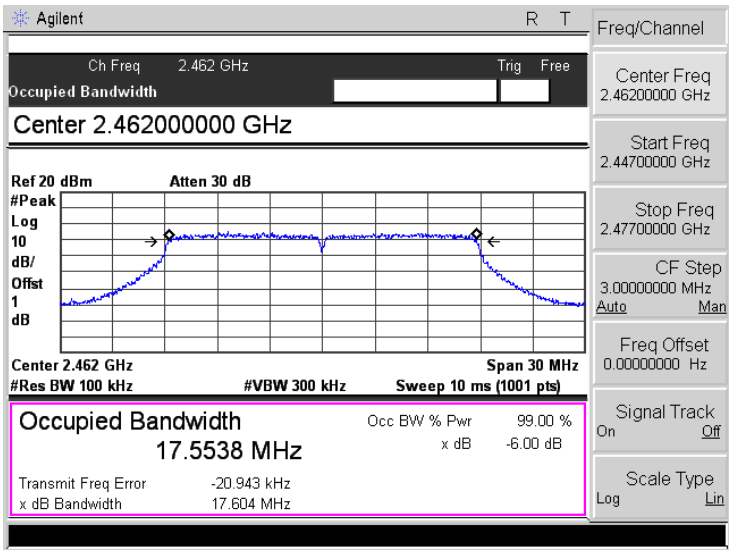
6.3 Summary of Test Results/Plots

Test Mode	Test Channel MHz	6 dB Bandwidth MHz	Limit kHz
802.11b_11Mbps	2412	10.122	≥500
	2437	10.100	≥500
	2462	10.117	≥500
802.11g_54Mbps	2412	16.472	≥500
	2437	16.455	≥500
	2462	16.466	≥500
802.11n-HT20_MCS7	2412	17.609	≥500
	2437	17.638	≥500
	2462	17.604	≥500

Please refer to the following test plots:

802.11b-Low	
802.11b-Middle	
802.11b-High	

802.11g-Low	
802.11g-Middle	
802.11g-High	

802.11n-HT20-Low	
802.11n-HT20-Middle	
802.11n-HT20-High	

7. RF Output Power

7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

7.2 Test Procedure

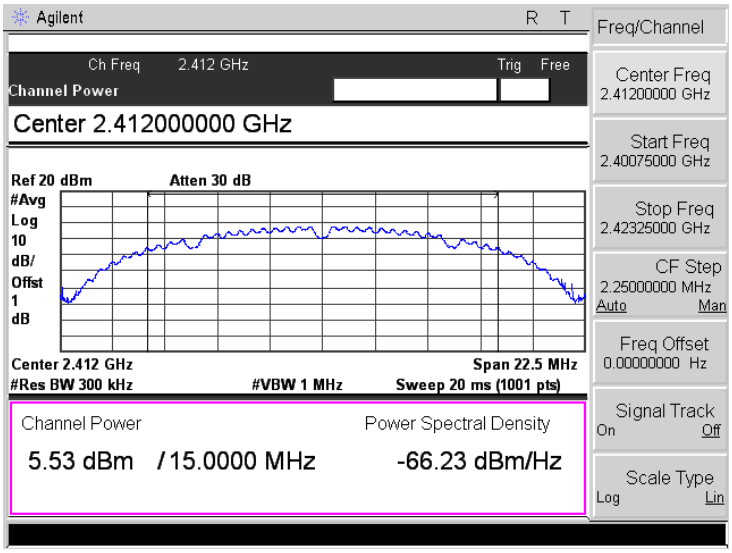
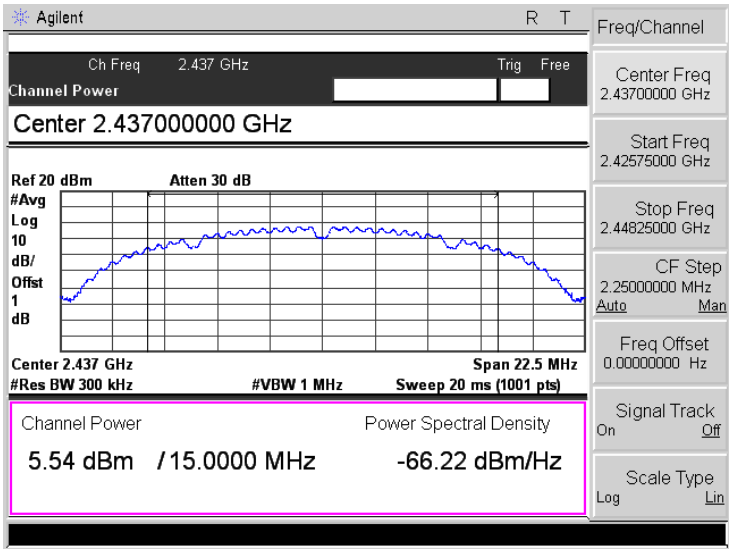
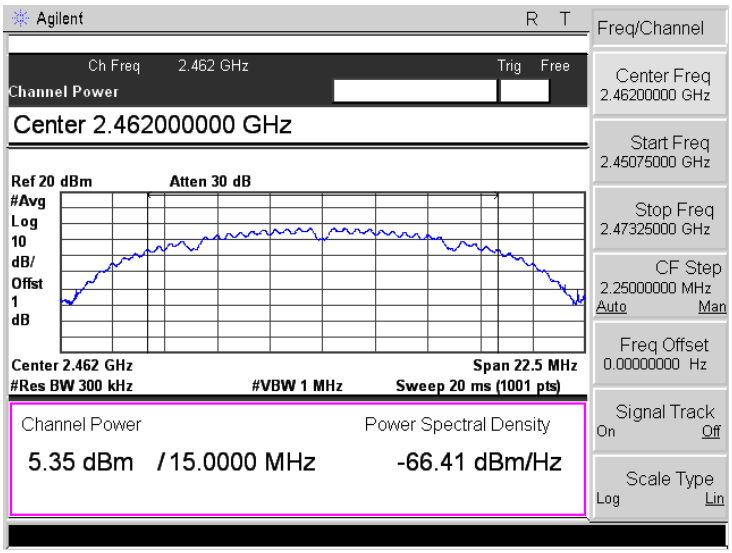
According to the KDB-558074 D01 v05 Subclause 8.3.2.2 and ANSI C63.10-2013 Subclause 11.9.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

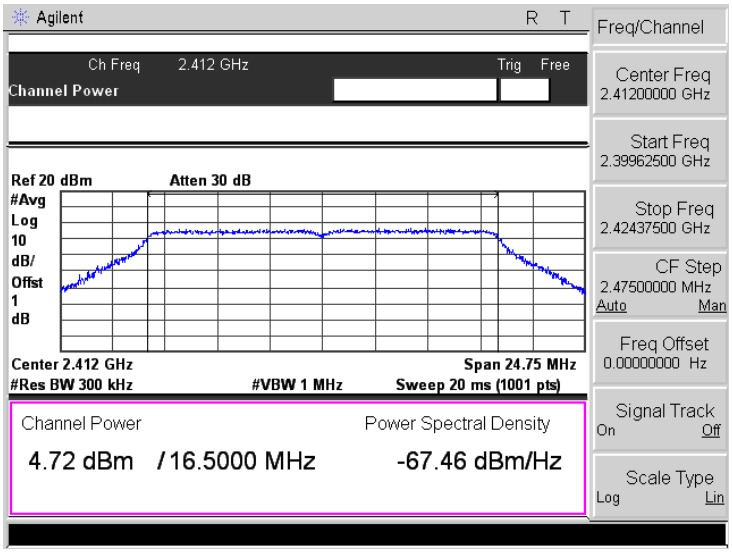
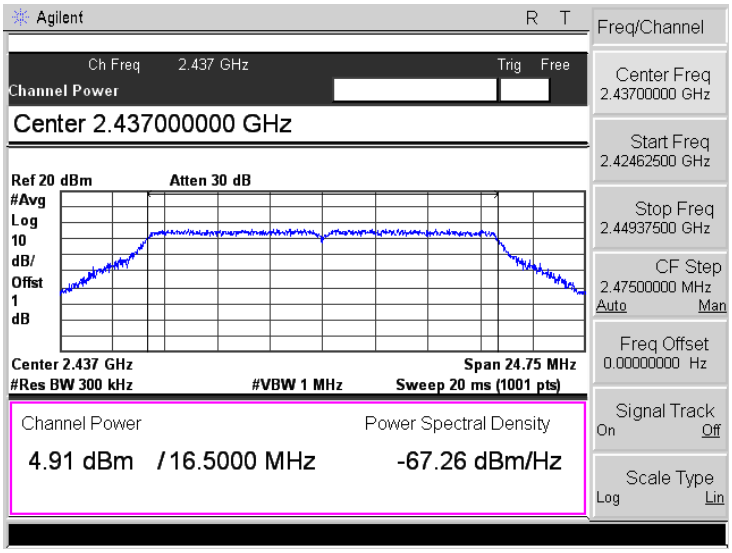
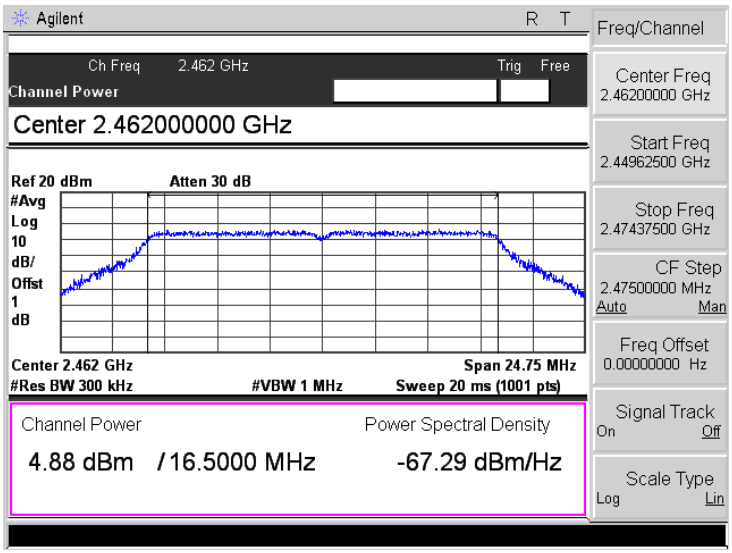
a) Set span to at least 1.5 times the OBW.
b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
c) Set VBW ≥ 3 x RBW.
d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
e) Sweep time = auto.
f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".
h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

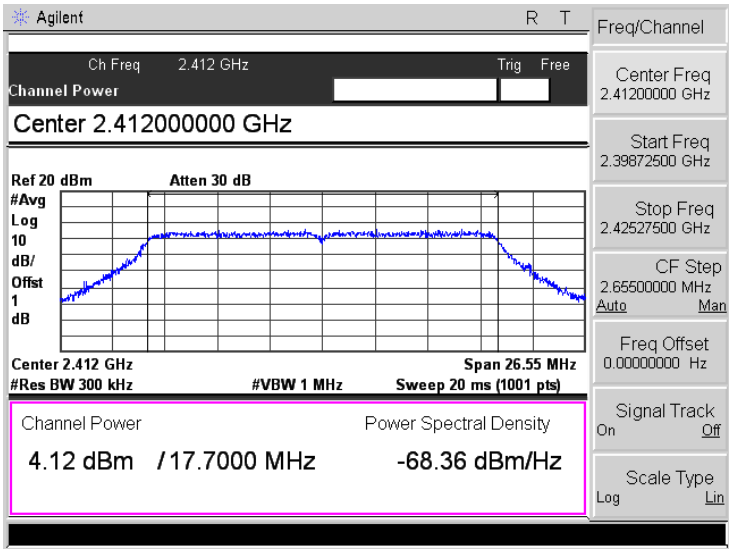
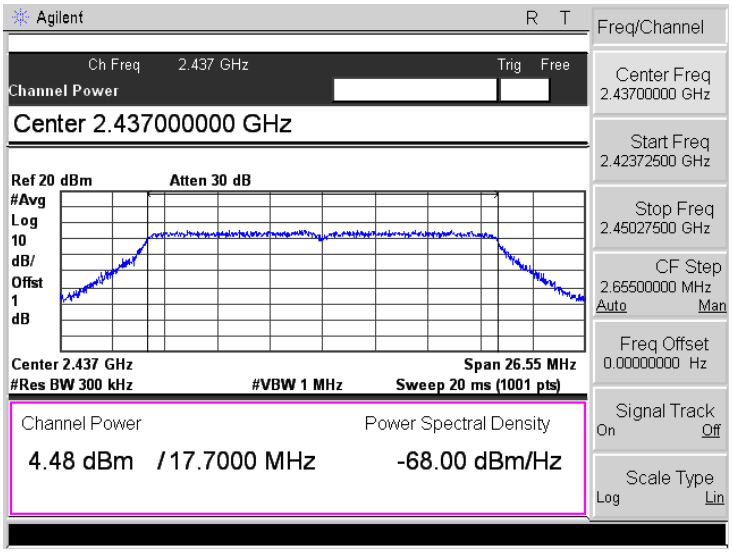
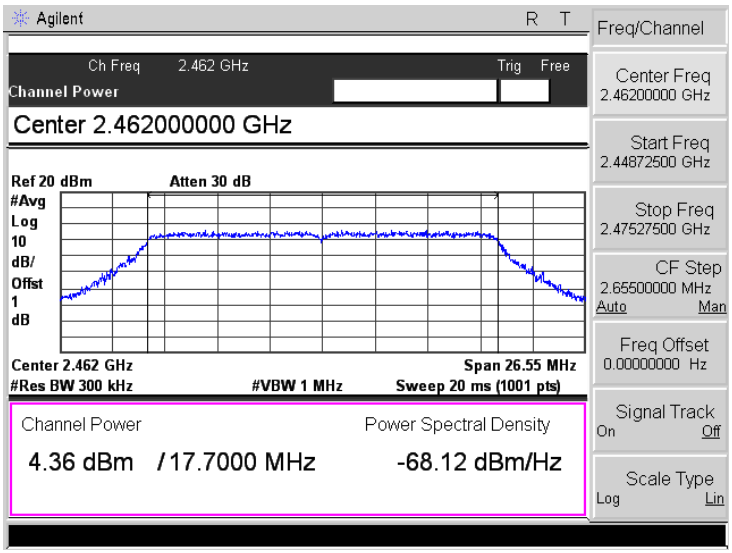
7.3 Summary of Test Results/Plots

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	5.53	3.57	1000
	2437	5.54	3.58	1000
	2462	5.35	3.43	1000
802.11g_54Mbps	2412	4.72	2.96	1000
	2437	4.91	3.10	1000
	2462	4.88	3.08	1000
802.11n HT20_MCS7	2412	4.12	2.58	1000
	2437	4.48	2.81	1000
	2462	4.36	2.73	1000

Please refer to the following test plots:

802.11b-Low 11Mbps	
802.11b-Middle 11Mbps	
802.11b-High 11Mbps	

802.11g-Low 54Mbps	
802.11g-Middle 54Mbps	
802.11g-High 54Mbps	

802.11n-HT20-Low MCS7	
802.11n-HT20-Middle MCS7	
802.11n-HT20-High MCS7	

8. Field Strength of Spurious Emissions

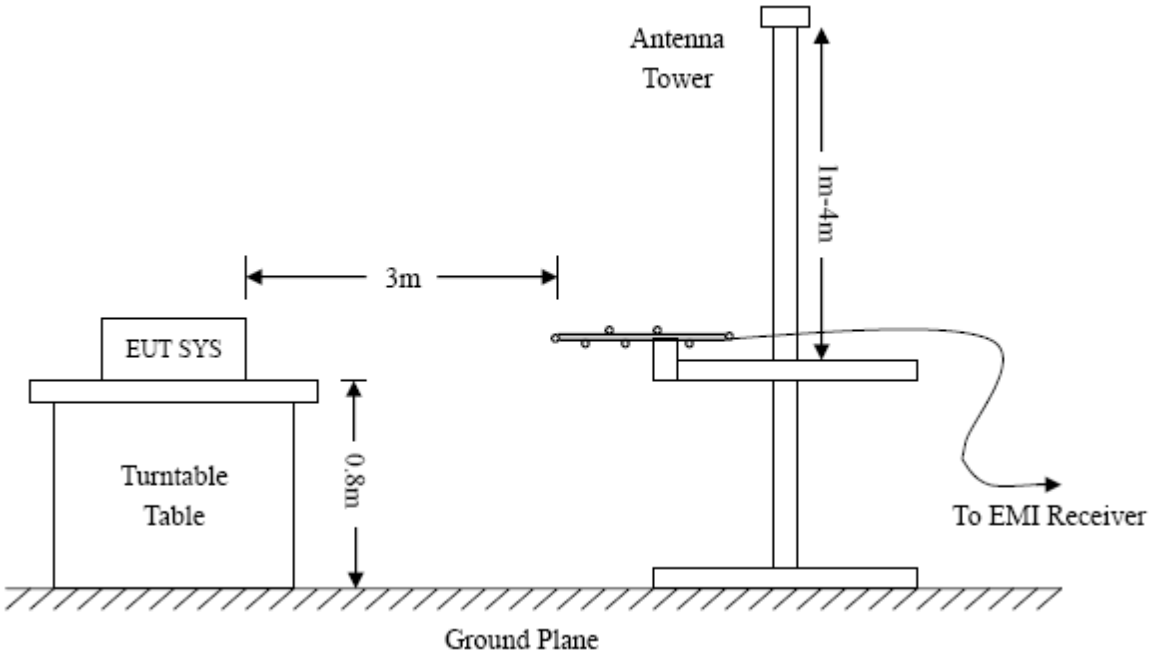
8.1 Standard Applicable

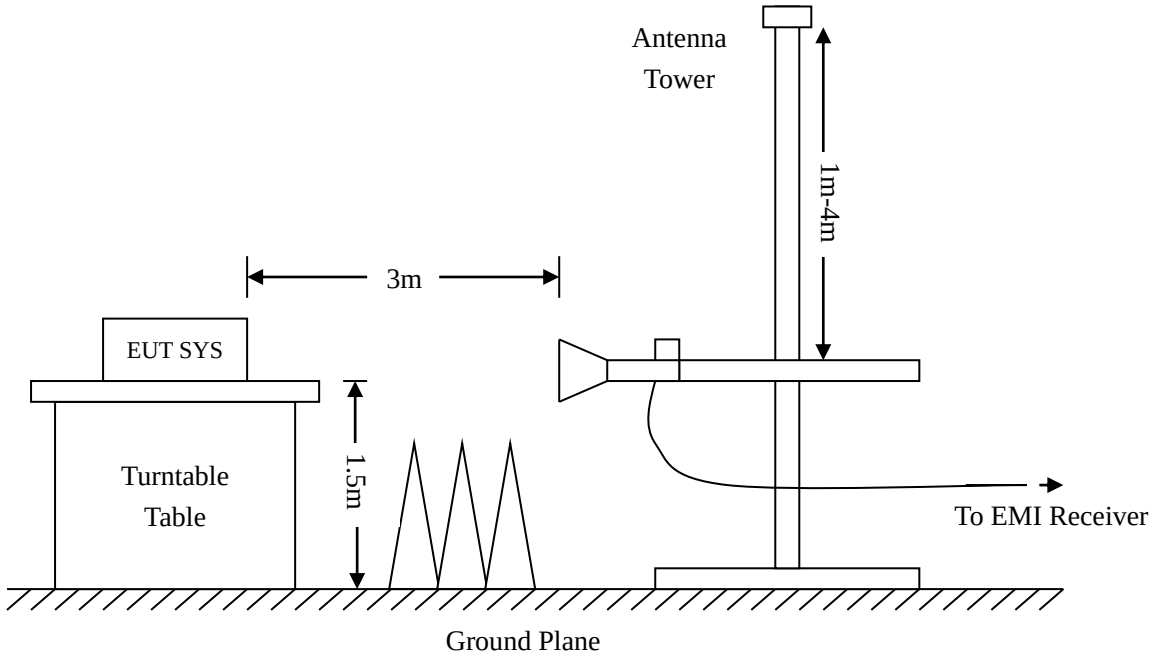
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

8.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=360KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

8.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

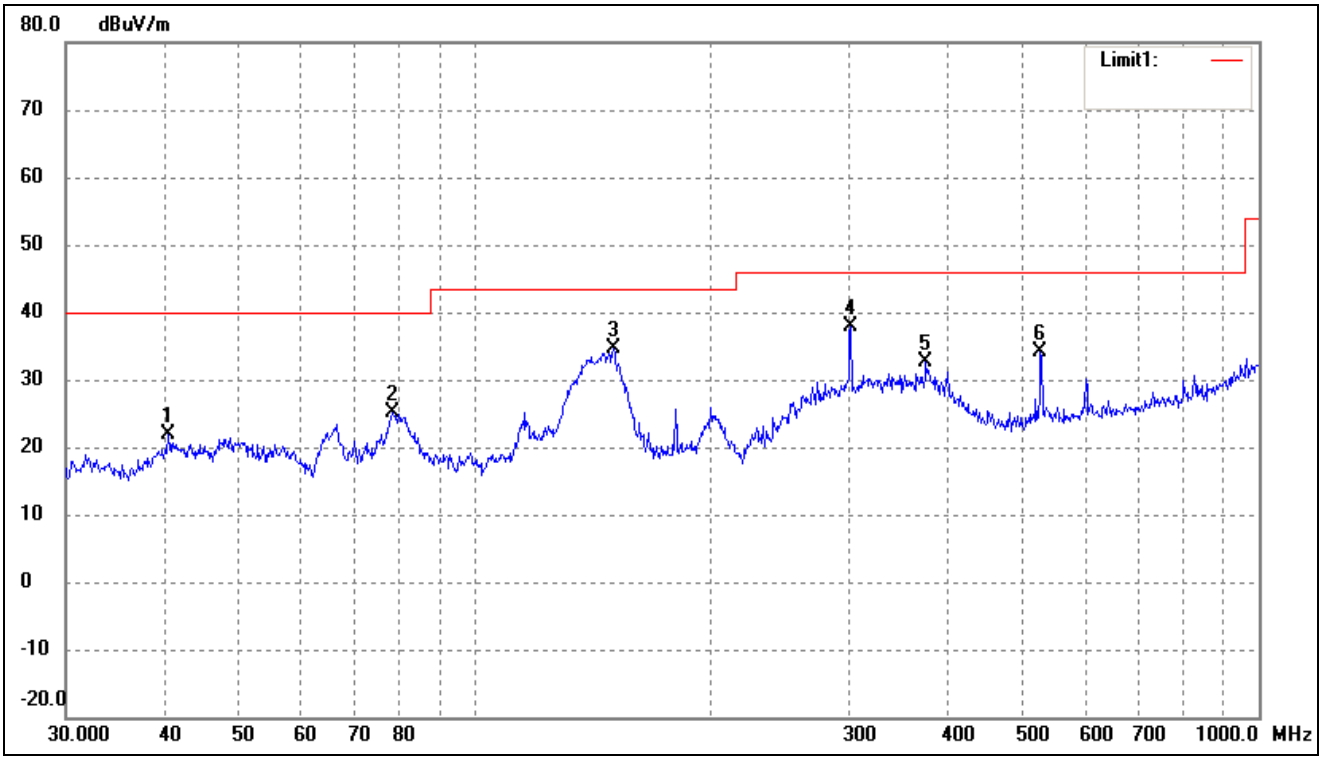
Margin = Corr. Ampl. – FCC Part 15 Limit

8.4 Summary of Test Results/Plots

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.
All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.

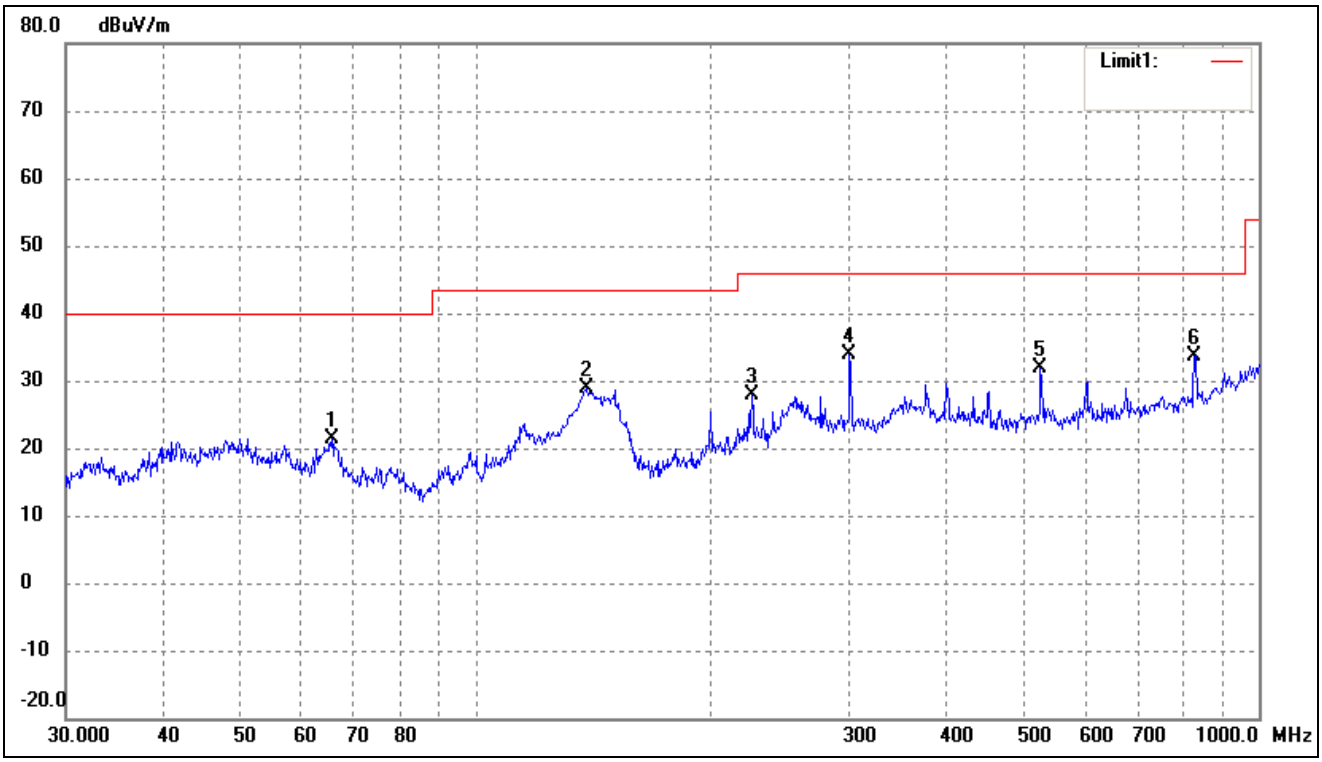
➢ Spurious Emissions Below 1GHz

802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal



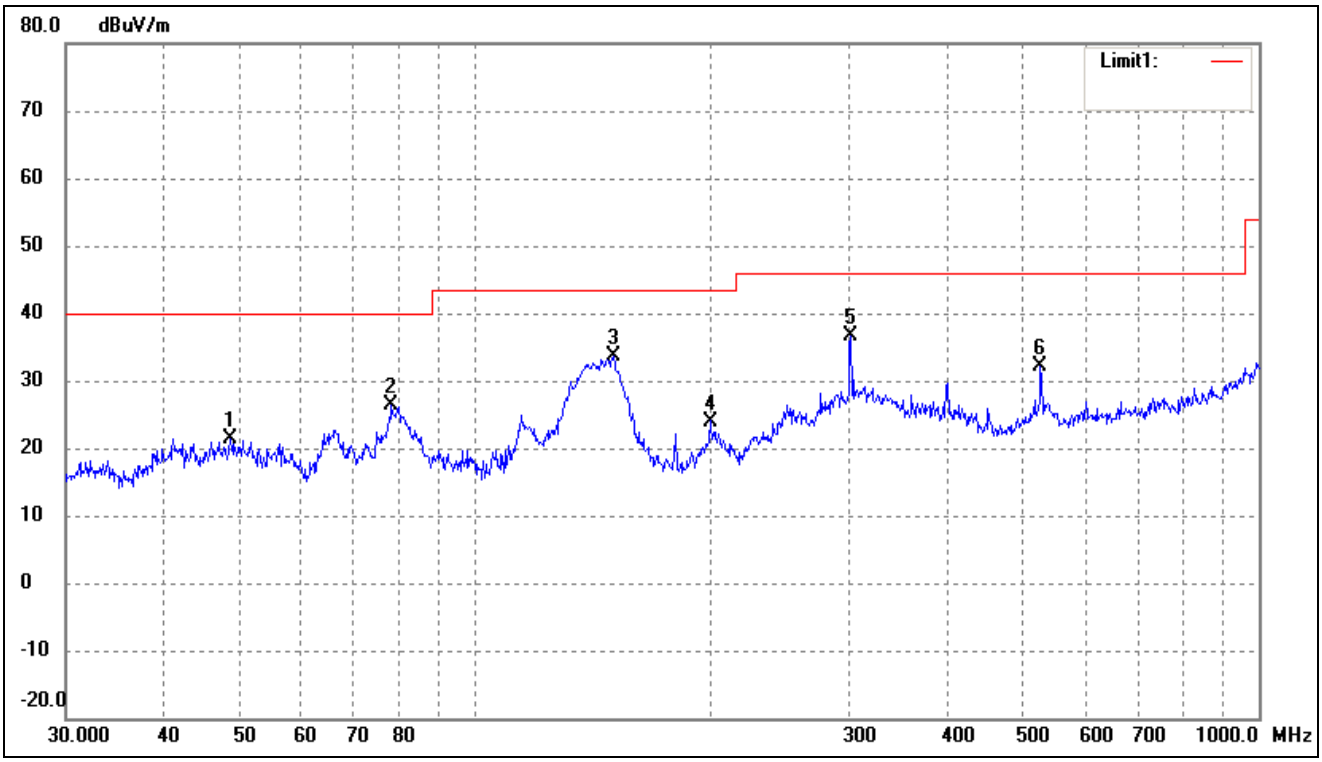
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	40.5591	35.68	-13.81	21.87	40.00	-18.13	300	100	peak
2	78.4133	43.80	-18.75	25.05	40.00	-14.95	91	100	peak
3	150.0108	51.50	-16.76	34.74	43.50	-8.76	295	100	peak
4	301.4224	45.39	-7.40	37.99	46.00	-8.01	104	100	peak
5	375.9385	39.48	-6.76	32.72	46.00	-13.28	338	100	peak
6	526.3967	39.68	-5.62	34.06	46.00	-11.94	226	100	peak

802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical



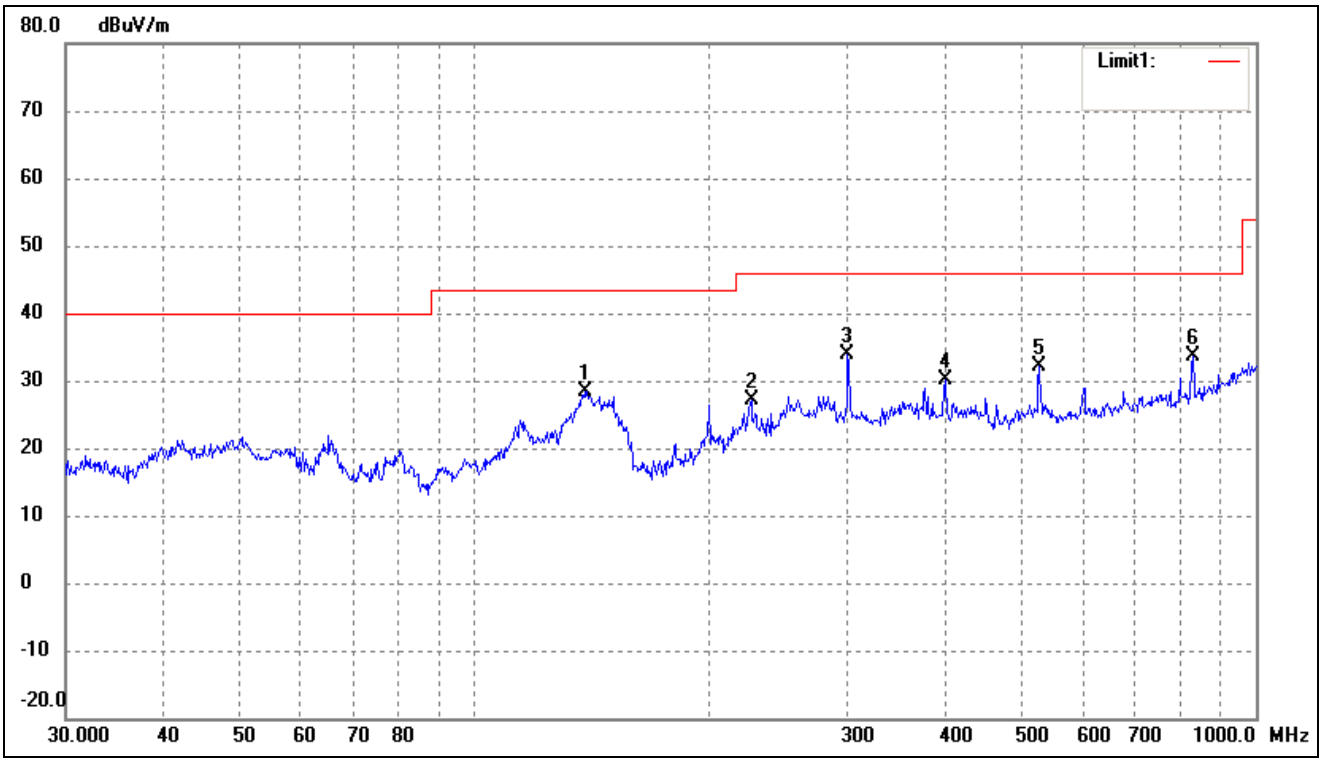
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	65.5727	36.77	-15.45	21.32	40.00	-18.68	245	100	peak
2	138.8735	45.81	-16.99	28.82	43.50	-14.68	96	100	peak
3	225.3080	38.97	-11.16	27.81	46.00	-18.19	144	100	peak
4	300.3672	41.35	-7.44	33.91	46.00	-12.09	97	100	peak
5	526.3967	37.40	-5.62	31.78	46.00	-14.22	295	100	peak
6	827.4934	34.43	-0.76	33.67	46.00	-12.33	310	100	peak

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Horizontal



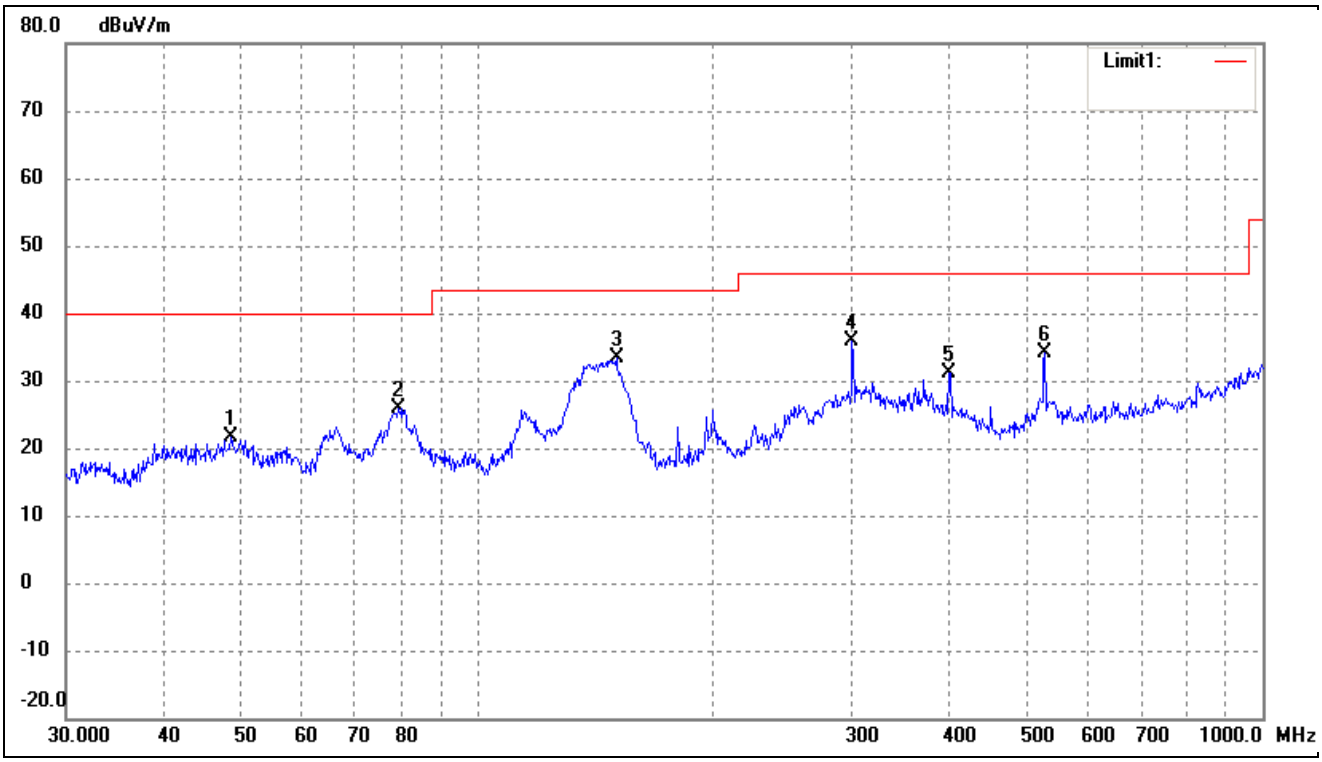
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	48.6719	34.13	-12.82	21.31	40.00	-18.69	191	100	peak
2	78.1389	45.09	-18.75	26.34	40.00	-13.66	221	100	peak
3	150.0108	50.27	-16.76	33.51	43.50	-9.99	76	100	peak
4	199.2855	36.19	-12.19	24.00	43.50	-19.50	216	100	peak
5	301.4224	43.94	-7.40	36.54	46.00	-9.46	186	100	peak
6	526.3967	37.83	-5.62	32.21	46.00	-13.79	346	100	peak

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Vertical



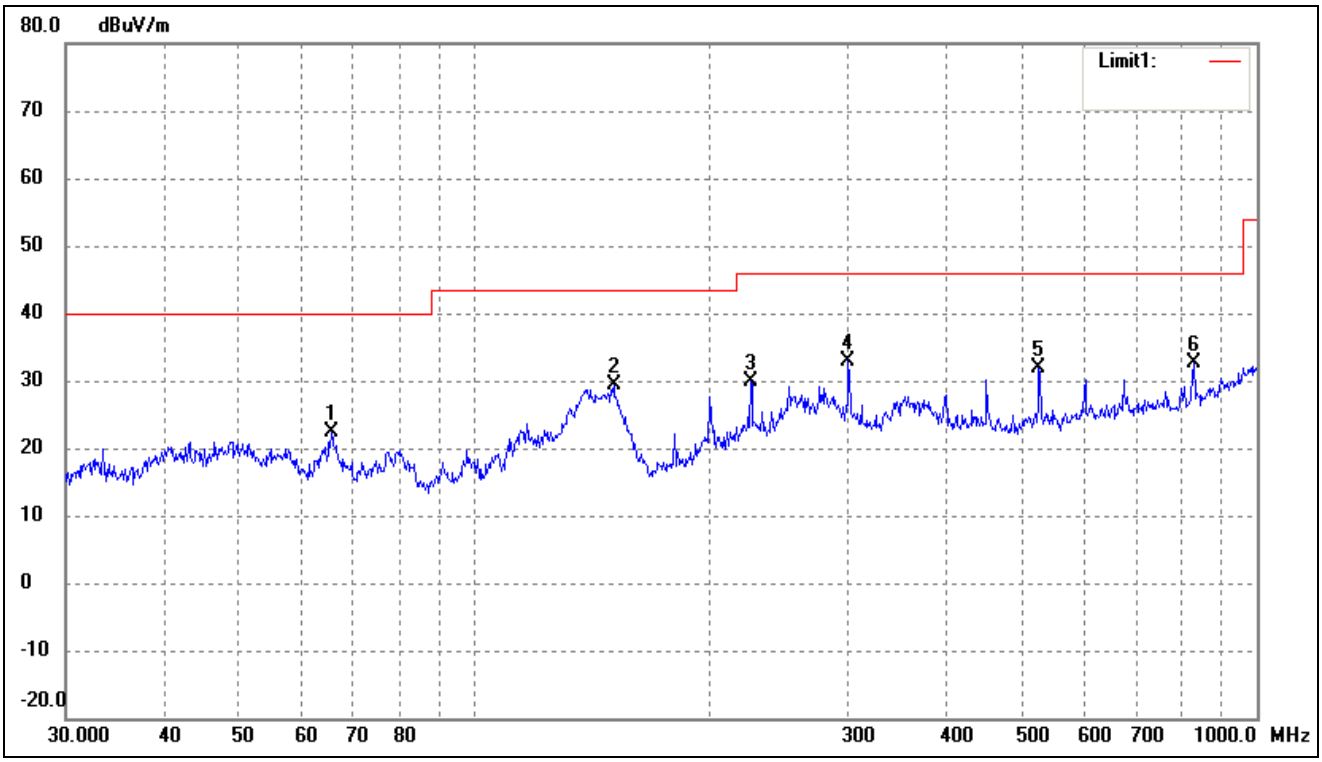
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	138.3873	45.39	-17.00	28.39	43.50	-15.11	222	100	peak
2	226.0994	38.14	-11.09	27.05	46.00	-18.95	256	100	peak
3	300.3672	41.35	-7.44	33.91	46.00	-12.09	61	100	peak
4	400.4319	36.58	-6.45	30.13	46.00	-15.87	271	100	peak
5	528.2458	37.78	-5.56	32.22	46.00	-13.78	98	100	peak
6	830.4002	34.23	-0.70	33.53	46.00	-12.47	147	100	peak

802.11b_11Mbps			
Test Channel	High	Polarity:	Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	48.6719	34.48	-12.82	21.66	40.00	-18.34	165	100	peak
2	79.5209	44.73	-18.78	25.95	40.00	-14.05	127	100	peak
3	150.5378	50.11	-16.73	33.38	43.50	-10.12	93	100	peak
4	300.3672	43.28	-7.44	35.84	46.00	-10.16	93	100	peak
5	399.0302	37.66	-6.48	31.18	46.00	-14.82	324	100	peak
6	528.2458	39.67	-5.56	34.11	46.00	-11.89	299	100	peak

802.11b_11Mbps			
Test Channel	High	Polarity:	Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	65.5727	37.74	-15.45	22.29	40.00	-17.71	93	100	peak
2	150.5378	46.04	-16.73	29.31	43.50	-14.19	142	100	peak
3	225.3080	41.01	-11.16	29.85	46.00	-16.15	90	100	peak
4	300.3672	40.22	-7.44	32.78	46.00	-13.22	118	100	peak
5	526.3967	37.38	-5.62	31.76	46.00	-14.24	304	100	peak
6	830.4002	33.31	-0.70	32.61	46.00	-13.39	310	100	peak

- Spurious Emissions Below 1GHz
- *Test Mode: 802.11b_11Mbps (worst case)*

Frequency (MHz)	Reading (dBuV/m)	Correct dB	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar H/V	Detector
Low Channel-2412MHz							
4824.000	58.45	-3.59	54.86	74	-19.14	H	PK
4824.000	38.7	-3.59	35.11	54	-18.89	H	AV
7236.000	60.55	-0.52	60.03	74	-13.97	H	PK
7236.000	41.47	-0.52	40.95	54	-13.05	H	AV
4824.000	60.28	-3.59	56.69	74	-17.31	V	PK
4824.000	40.23	-3.59	36.64	54	-17.36	V	AV
7236.000	59.22	-0.52	58.7	74	-15.3	V	PK
7236.000	41.09	-0.52	40.57	54	-13.43	V	AV
Middle Channel-2437MHz							
4874.000	60.81	-3.49	57.32	74	-16.68	H	PK
4874.000	39.15	-3.49	35.66	54	-18.34	H	AV
7311.000	58.87	-0.47	58.4	74	-15.6	H	PK
7311.000	41.1	-0.47	40.63	54	-13.37	H	AV
4874.000	58.23	-3.49	54.74	74	-19.26	V	PK
4874.000	40.54	-3.49	37.05	54	-16.95	V	AV
7311.000	58.21	-0.47	57.74	74	-16.26	V	PK
7311.000	41.13	-0.47	40.66	54	-13.34	V	AV
High Channel-2462MHz							
4924.000	61.4	-3.41	57.99	74	-16.01	H	PK
4924.000	39.12	-3.41	35.71	54	-18.29	H	AV
7386.000	59.27	-0.42	58.85	74	-15.15	H	PK
7386.000	41.15	-0.42	40.73	54	-13.27	H	AV
4924.000	61.2	-3.41	57.79	74	-16.21	V	PK
4924.000	39.8	-3.41	36.39	54	-17.61	V	AV
7386.000	61.16	-0.42	60.74	74	-13.26	V	PK
7386.000	41.53	-0.42	41.11	54	-12.89	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

9. Out of Band Emissions

9.1 Standard Applicable

According to §15.247 (d) 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 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

9.2 Test Procedure

According to the KDB 558074D01 v05 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.11, the Emissions in nonrestricted frequency bands test method as follows:

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

According to the KDB 558074 D01 v05 Subclause 8.5 and ANSI C63.10-2013 Subclause 11.12, the Emissions in restricted frequency bands test method as follows:

A. Radiated emission measurements:
Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)
RBW = 1MHz, VBW = 1MHz for peak value measured
RBW = 1MHz, VBW = 10Hz for average value measured
Sweep = auto; Detector function = peak/average; Trace = max hold
All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

B. Antenna-port conducted measurements

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 9/

b) VBW ≥ [3 × RBW].

c) Detector = peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

Table 9—RBW as a function of frequency

Frequency	RBW
9 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1000 MHz	100 kHz to 120 kHz
>1000 MHz	1 MHz

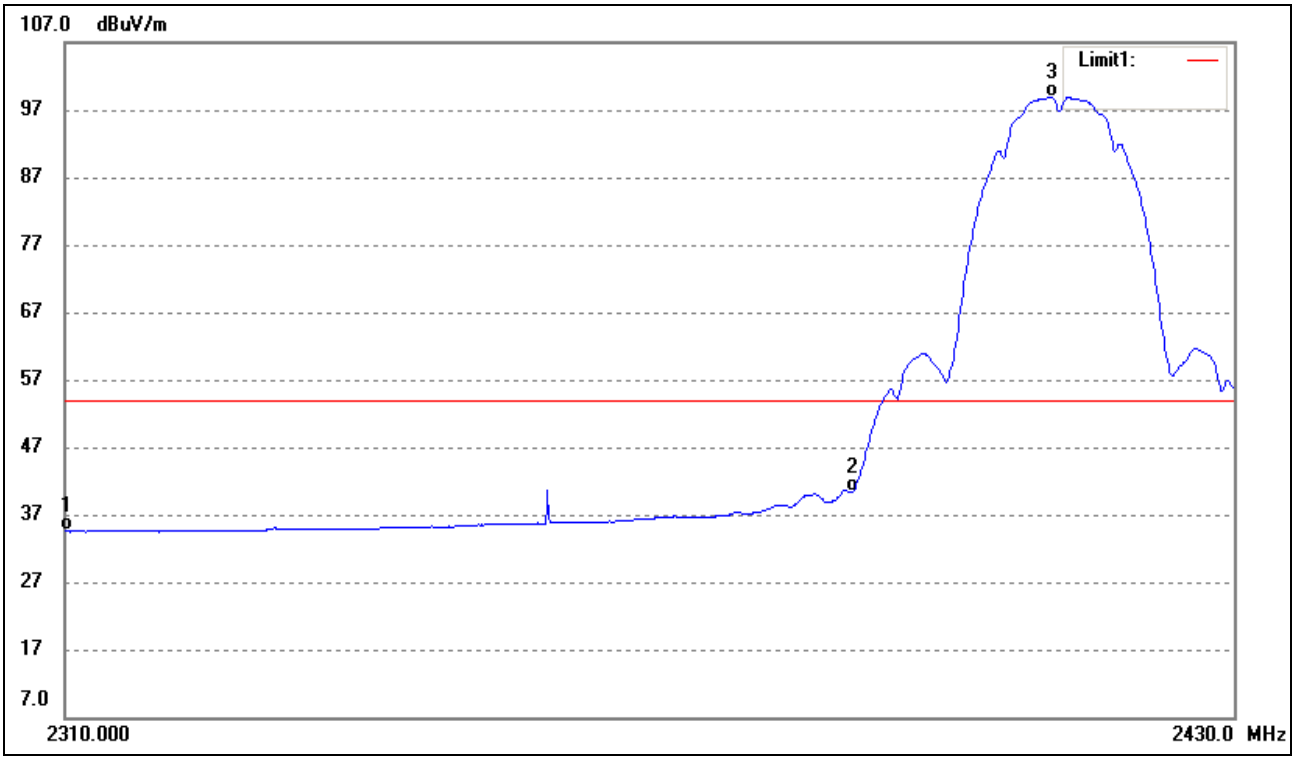
If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

9.3 Summary of Test Results/Plots

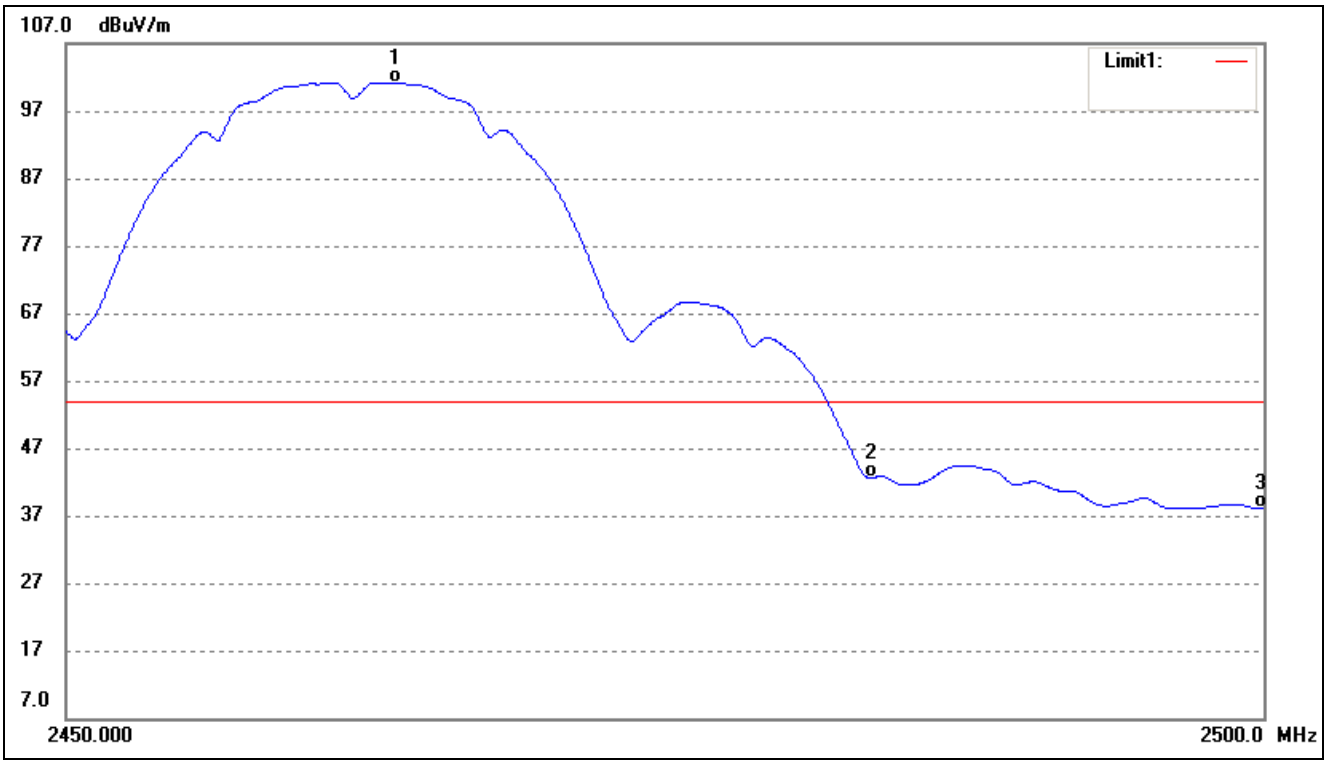
➢ Radiated test

802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical(worst case)



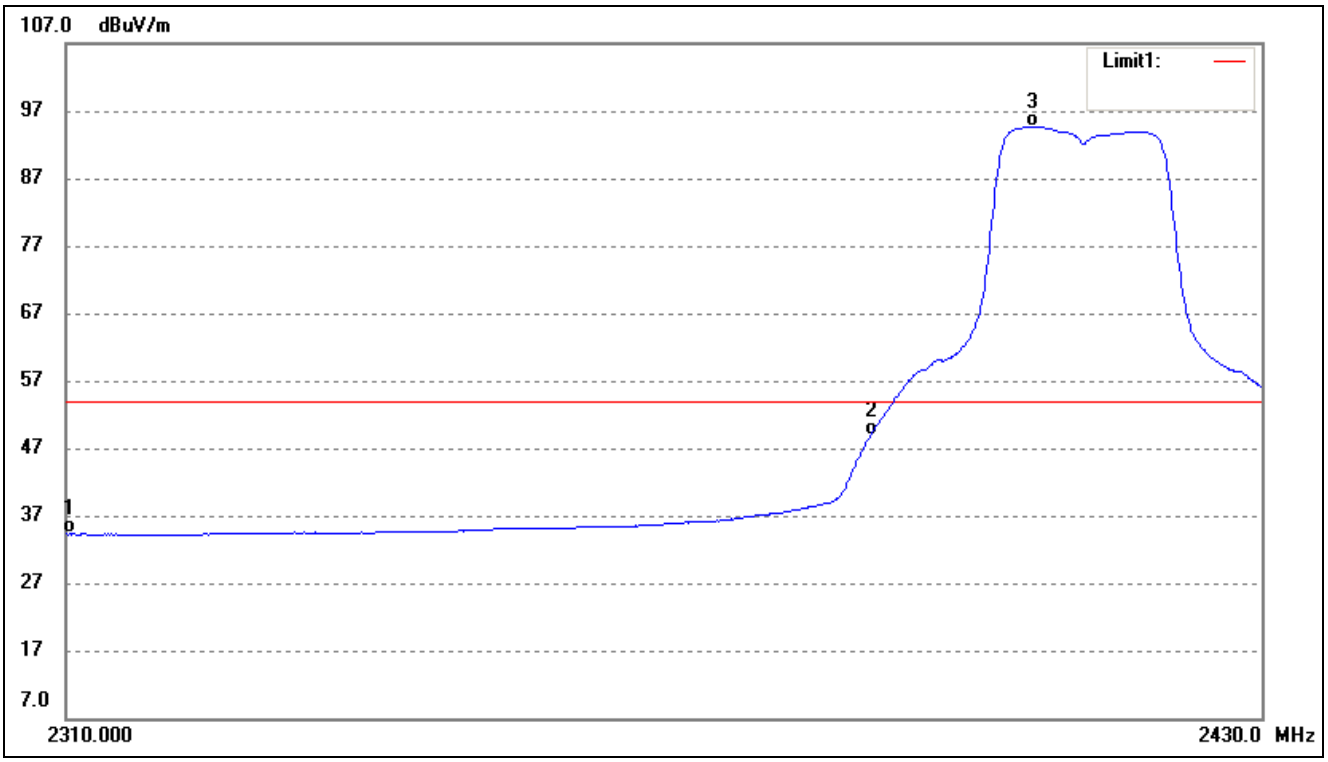
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	42.32	-7.78	34.54	54.00	-19.46	Average Detector
	2310.000	63.20	-7.78	55.42	74.00	-18.58	Peak Detector
2	2390.000	65.46	-7.32	58.14	74.00	-15.86	Peak Detector
	2390.000	47.65	-7.32	40.33	54.00	-13.67	Average Detector

802.11b_11Mbps			
Test Channel	High	Polarity:	Vertical(worst case)



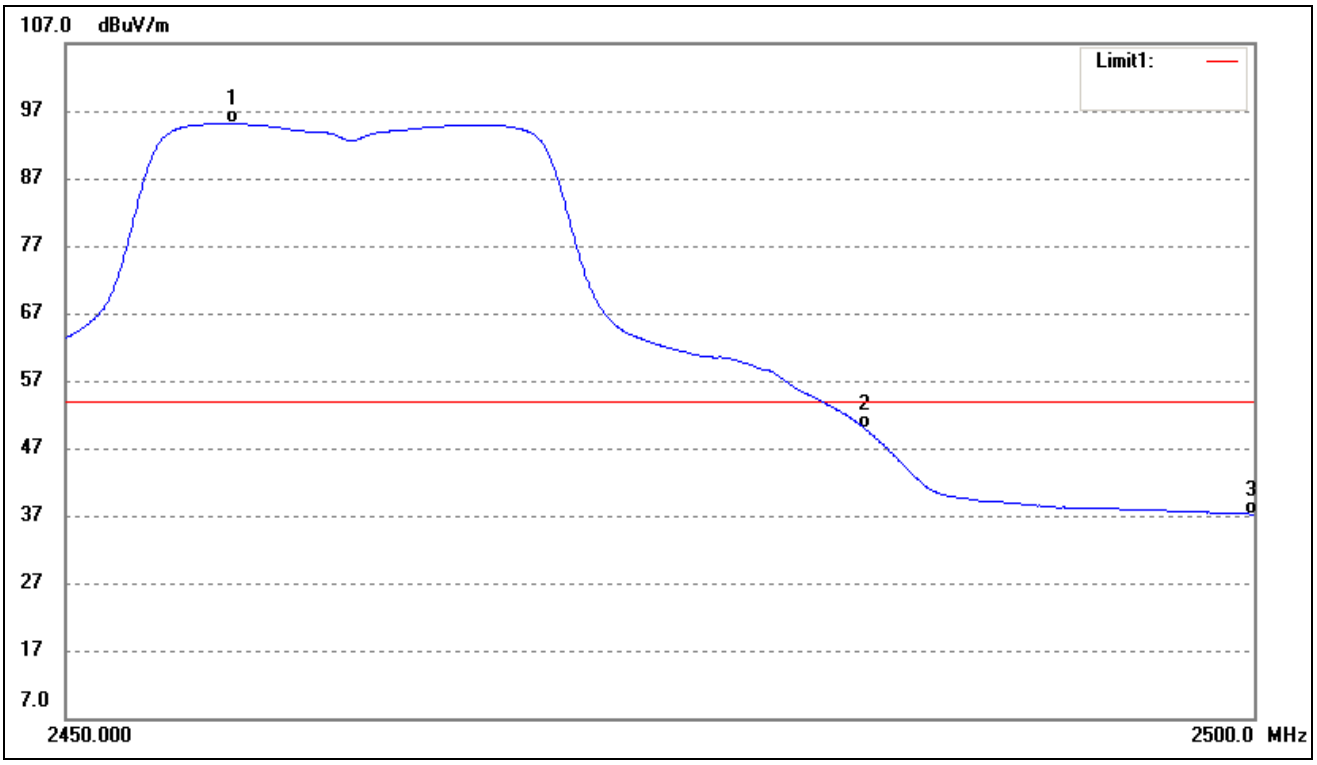
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2463.649	108.13	-6.89	101.24	/	/	Average Detector
	2461.908	114.97	-6.89	108.08	/	/	Peak Detector
2	2483.500	49.37	-6.77	42.60	54.00	-11.40	Average Detector
	2483.500	60.80	-6.77	54.03	74.00	-19.97	Peak Detector
3	2500.000	44.69	-6.67	38.02	54.00	-15.98	Peak Detector
	2500.000	56.74	-6.67	50.07	74.00	-23.93	Average Detector

802.11g_54Mbps			
Test Channel	Low	Polarity:	Vertical(worst case)



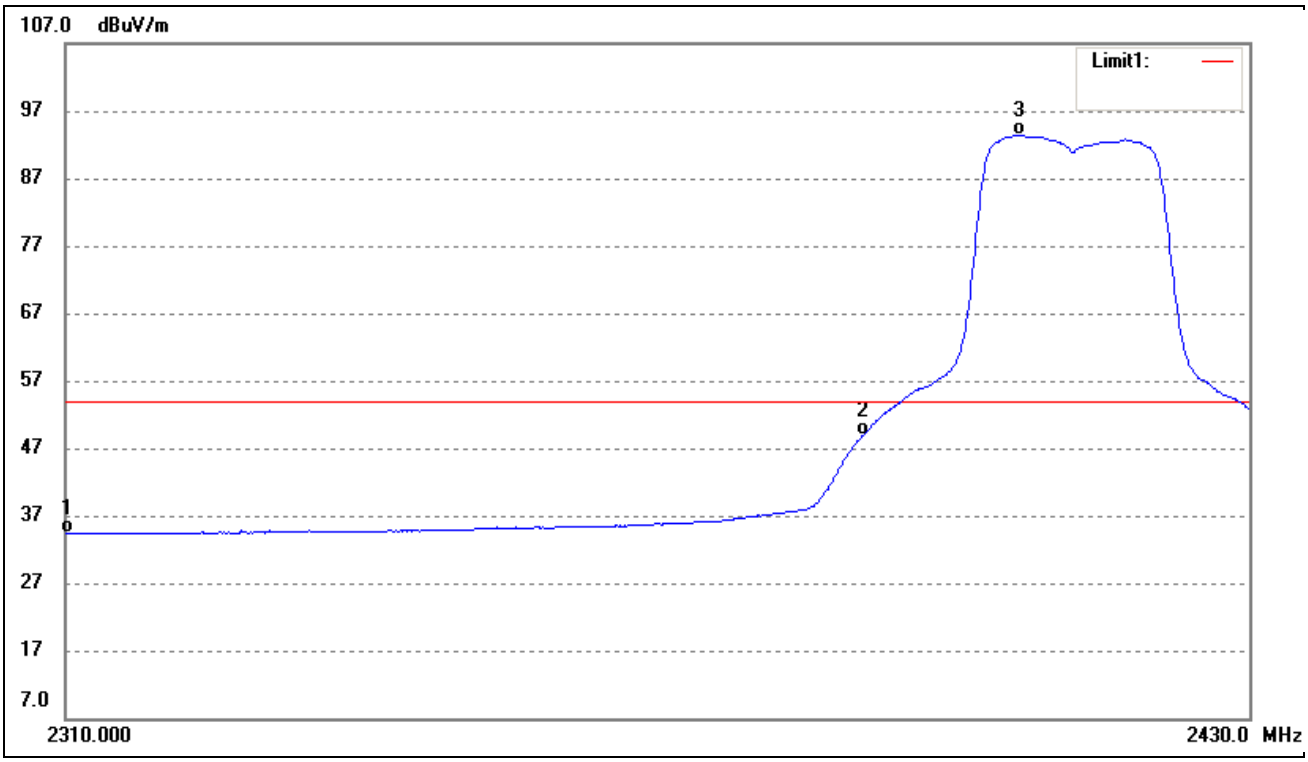
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	42.04	-7.78	34.26	54.00	-19.74	Average Detector
	2310.000	52.96	-7.78	45.18	74.00	-28.82	Peak Detector
2	2390.000	71.74	-7.32	64.42	74.00	-9.58	Peak Detector
	2390.000	56.29	-7.32	48.97	54.00	-5.03	Average Detector

802.11g_54Mbps			
Test Channel	High	Polarity:	Vertical(worst case)



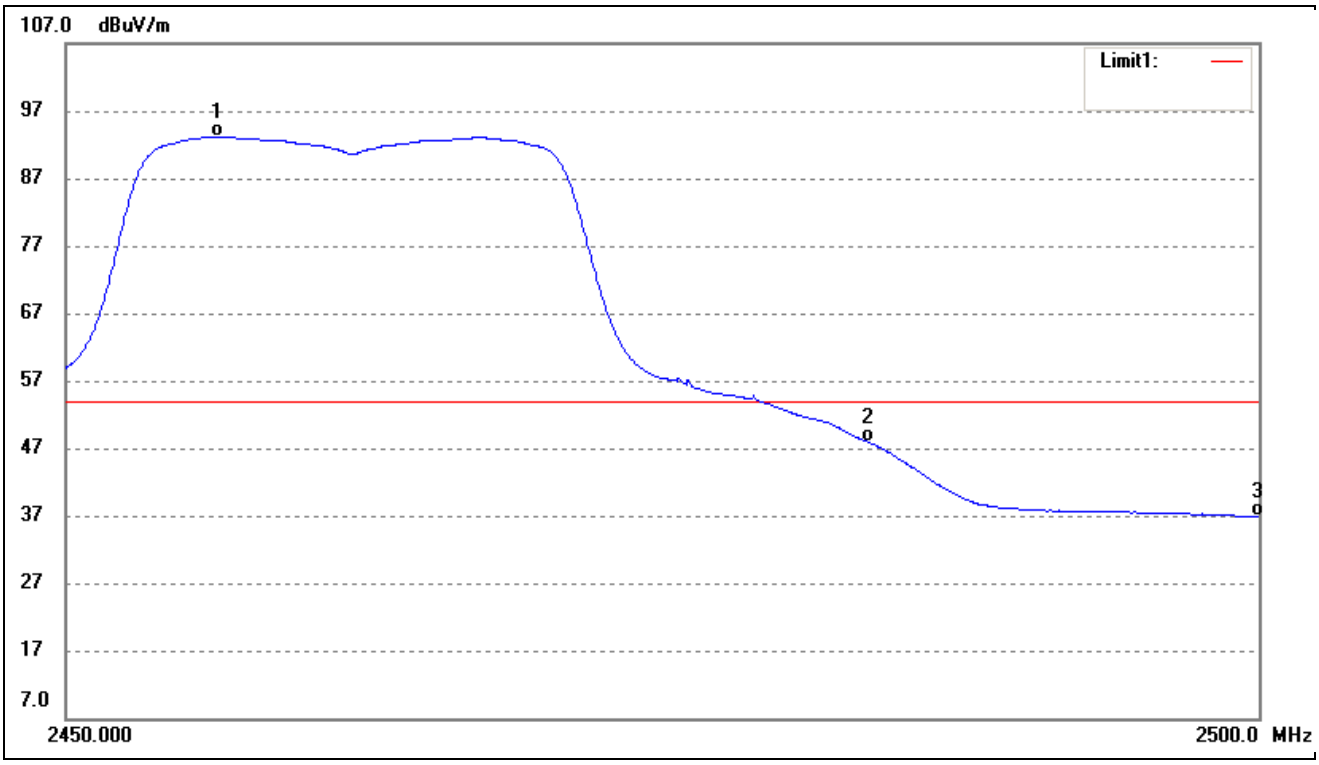
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2456.890	102.04	-6.92	95.12	/	/	Average Detector
	2455.748	111.67	-6.92	104.75	/	/	Peak Detector
2	2483.500	56.59	-6.77	49.82	54.00	-4.18	Average Detector
	2483.500	72.78	-6.77	66.01	74.00	-7.99	Peak Detector
3	2500.000	43.89	-6.67	37.22	54.00	-16.78	Average Detector
	2500.000	55.44	-6.67	48.77	74.00	-25.23	Peak Detector

802.11n-HT20_MCS7			
Test Channel	Low	Polarity:	Vertical(worst case)



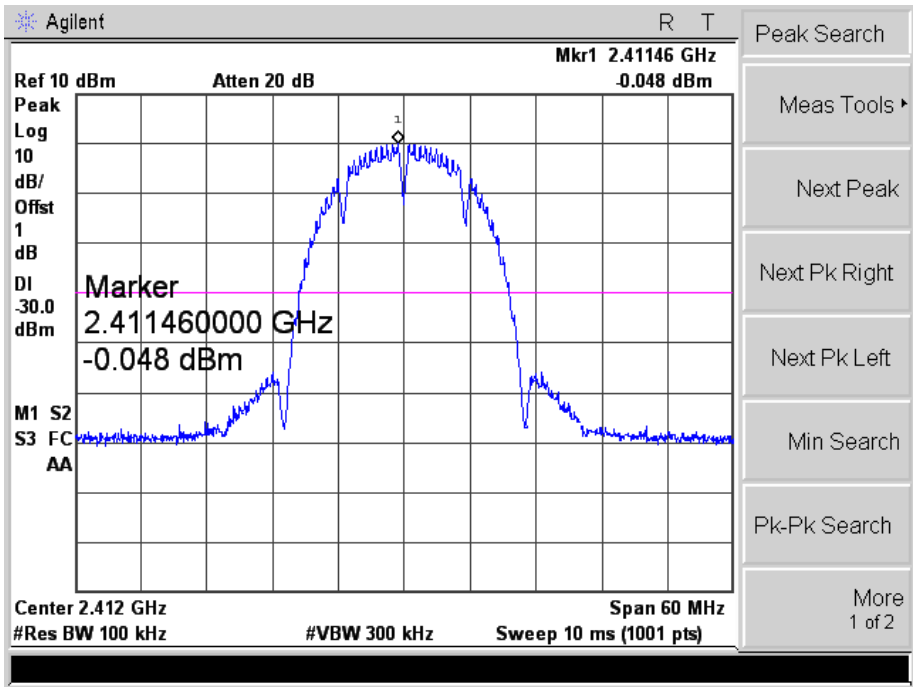
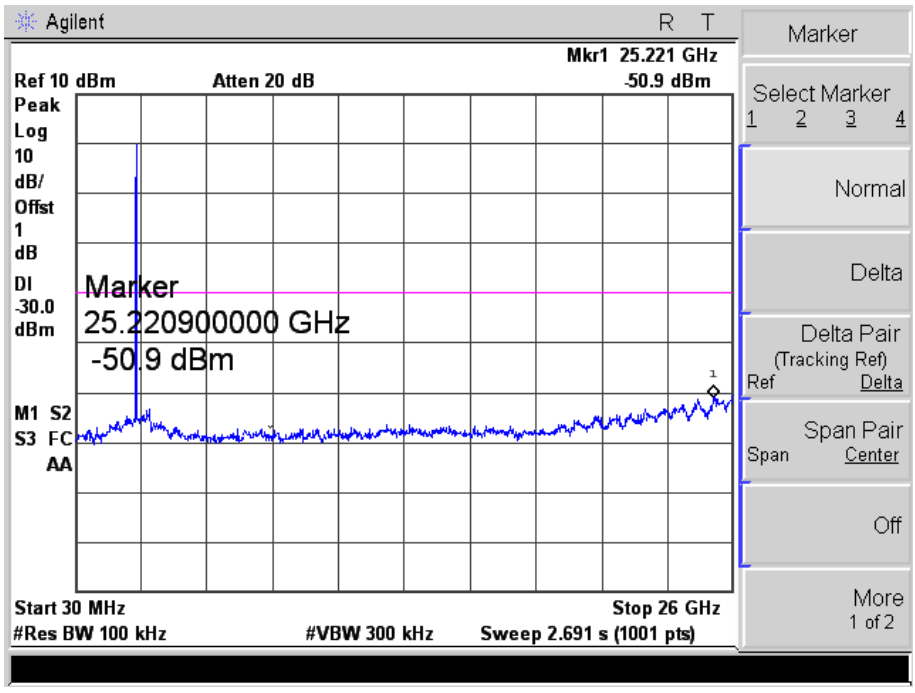
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	42.20	-7.78	34.42	54.00	-19.58	Average Detector
	2310.000	54.79	-7.78	47.01	74.00	-26.99	Peak Detector
2	2390.000	76.60	-7.32	69.28	74.00	-4.72	Peak Detector
	2390.000	56.08	-7.32	48.76	54.00	-5.24	Average Detector

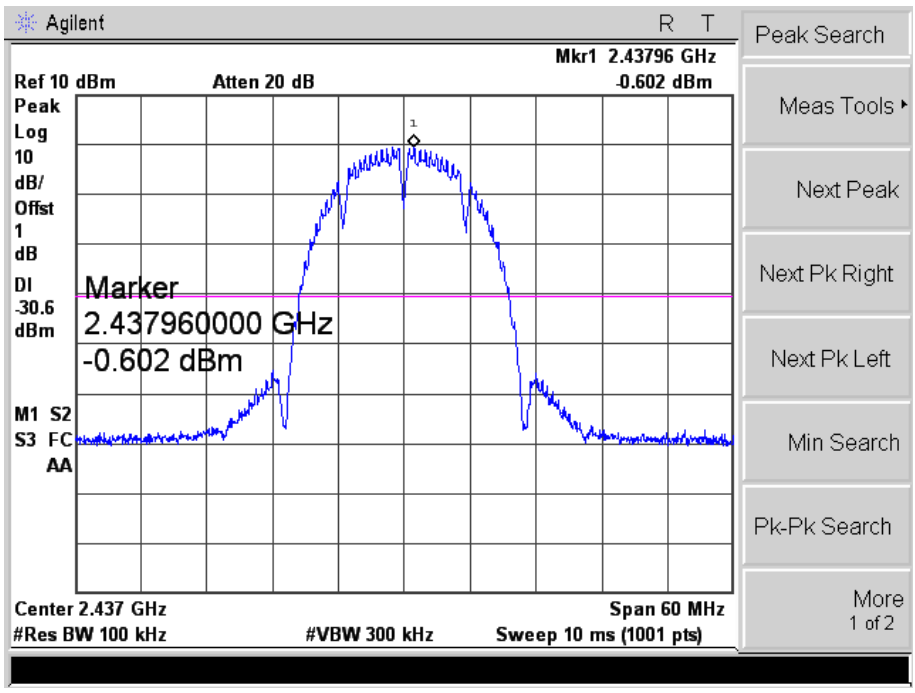
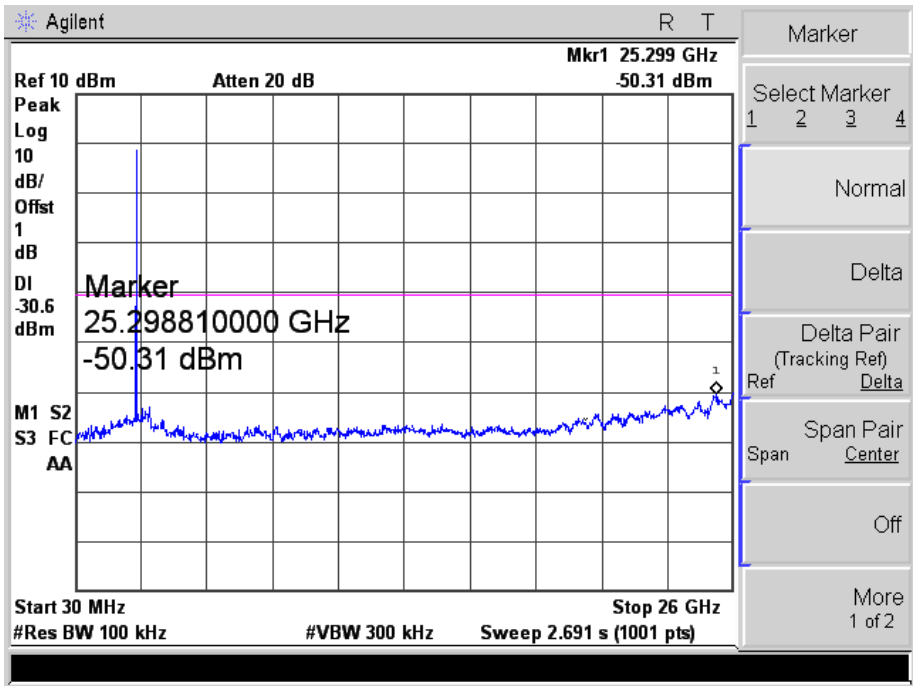
802.11n-HT20_MCS7			
Test Channel	High	Polarity:	Vertical(worst case)

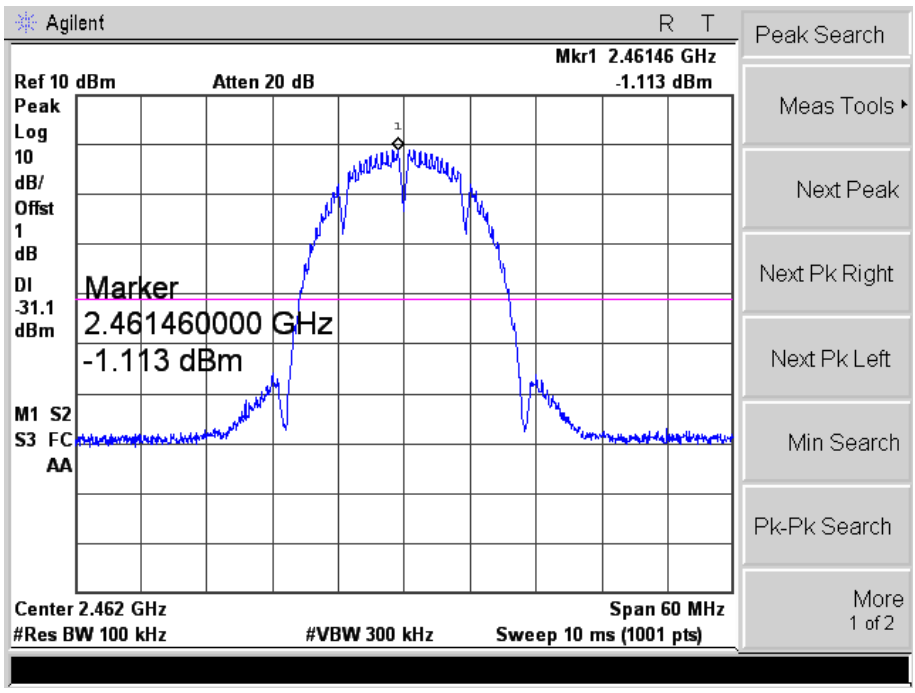
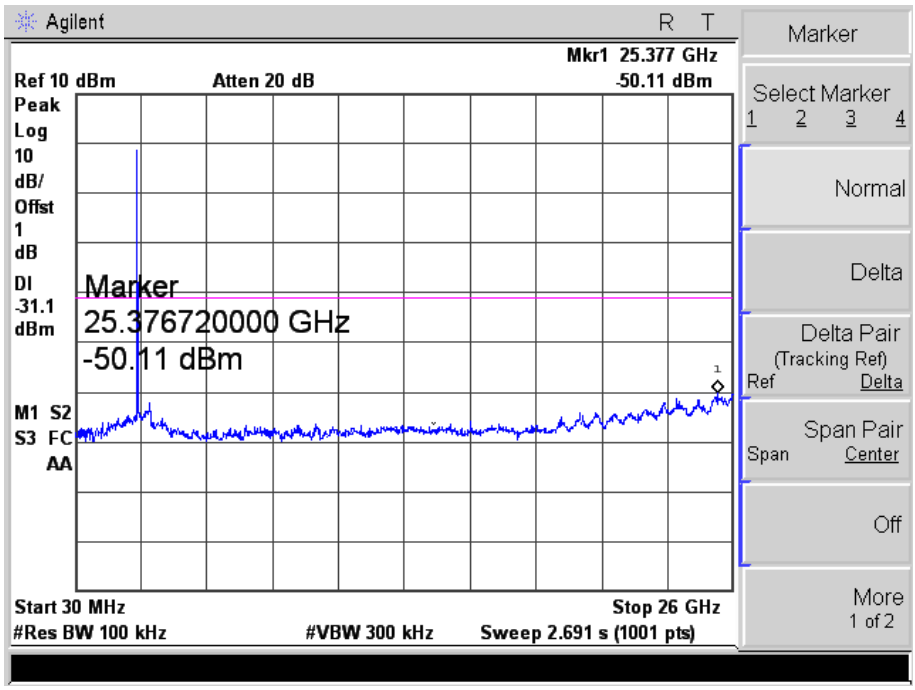


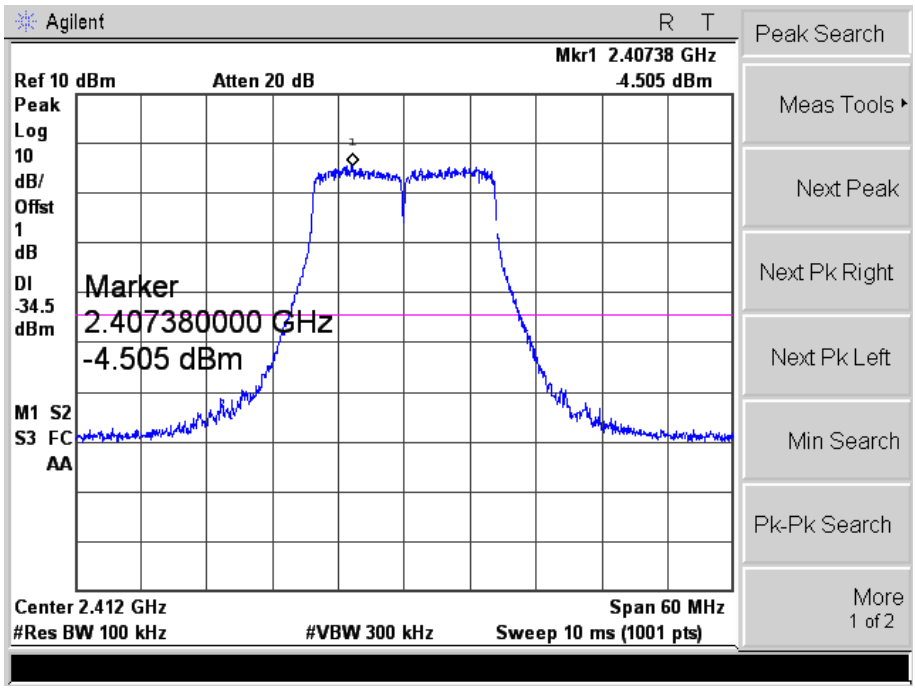
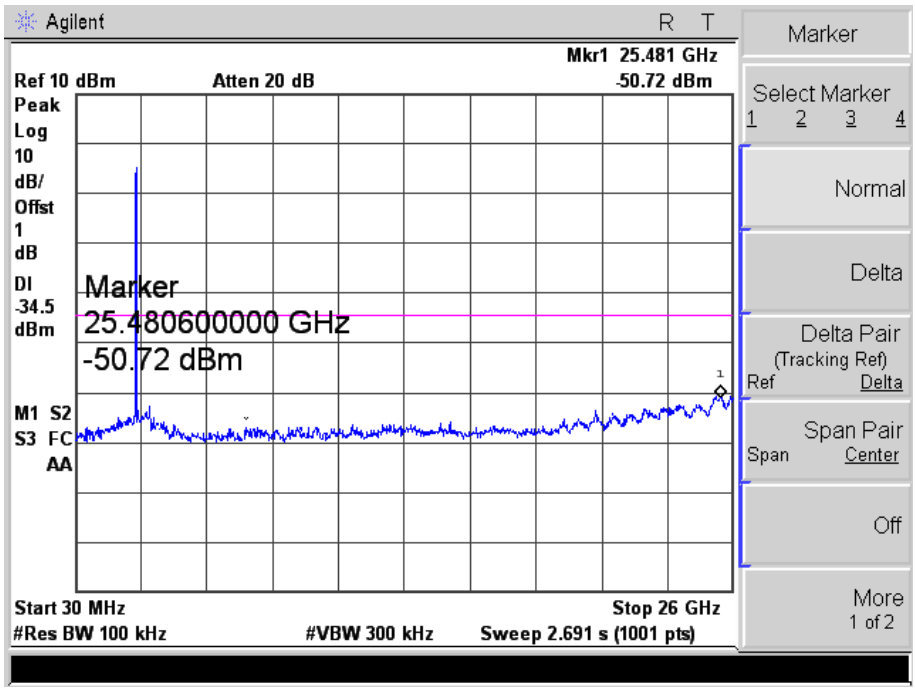
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2456.294	100.15	-6.92	93.23	/	/	Average Detector
	2456.642	109.89	-6.92	102.97	/	/	Peak Detector
2	2483.500	54.64	-6.77	47.87	54.00	-6.13	Average Detector
	2483.500	72.42	-6.77	65.65	74.00	-8.35	Peak Detector
3	2500.000	43.64	-6.67	36.97	54.00	-17.03	Average Detector
	2500.000	54.82	-6.67	48.15	74.00	-25.85	Peak Detector

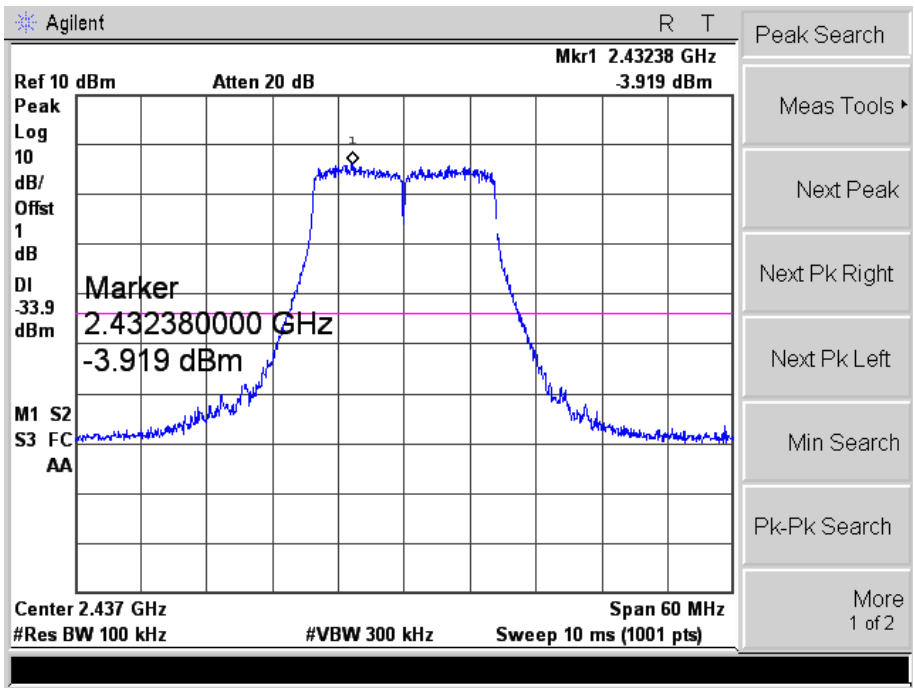
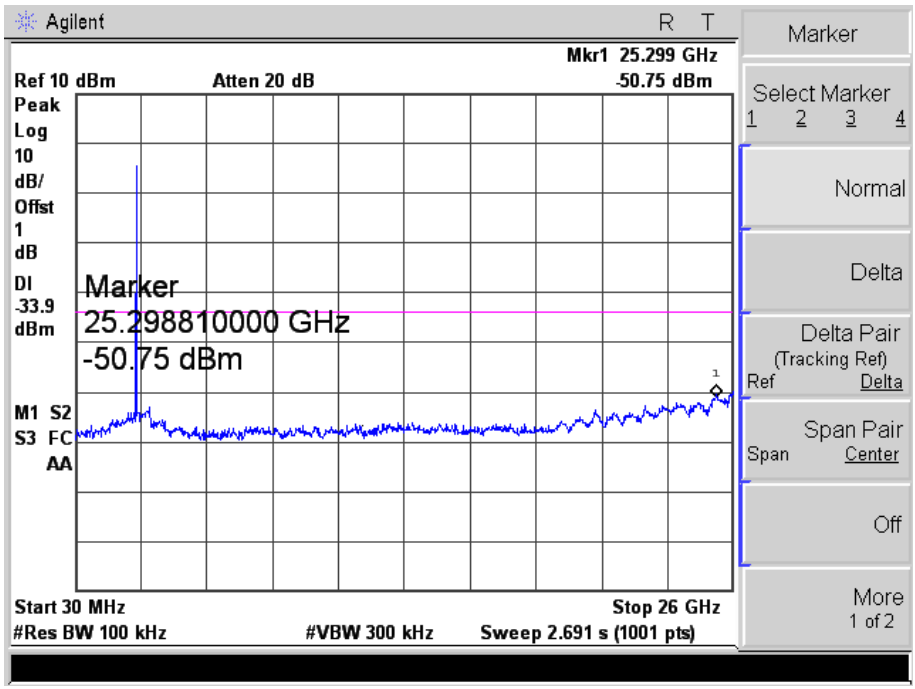
➢ Conducted test

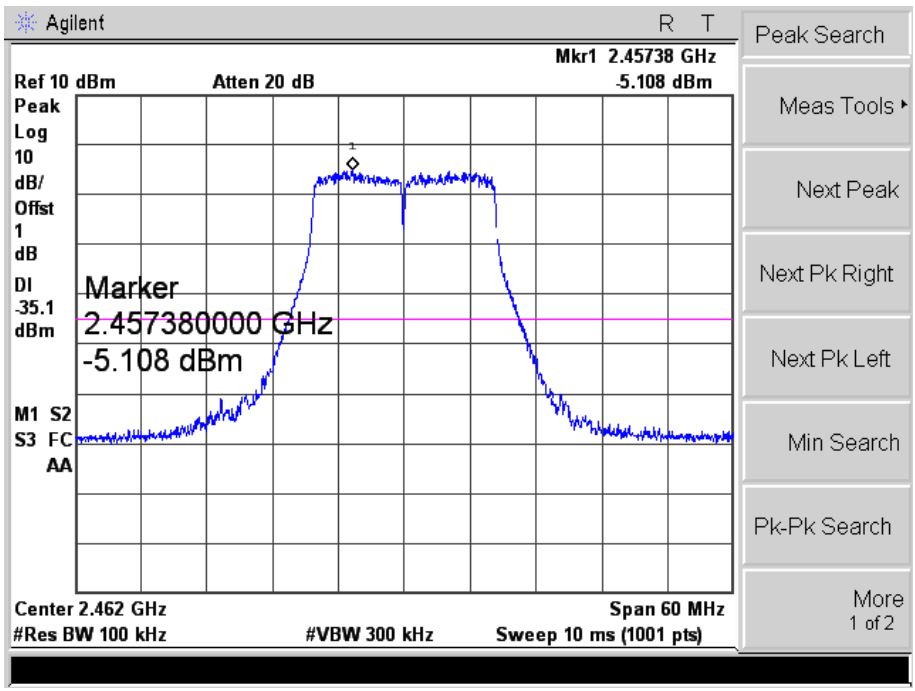
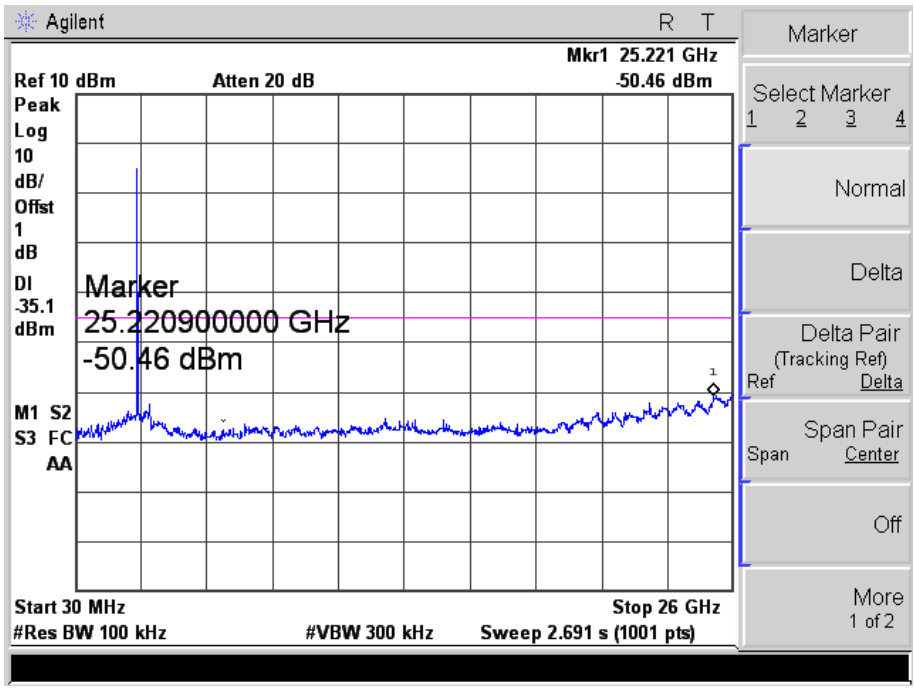
802.11b_11Mbps	
Low	 

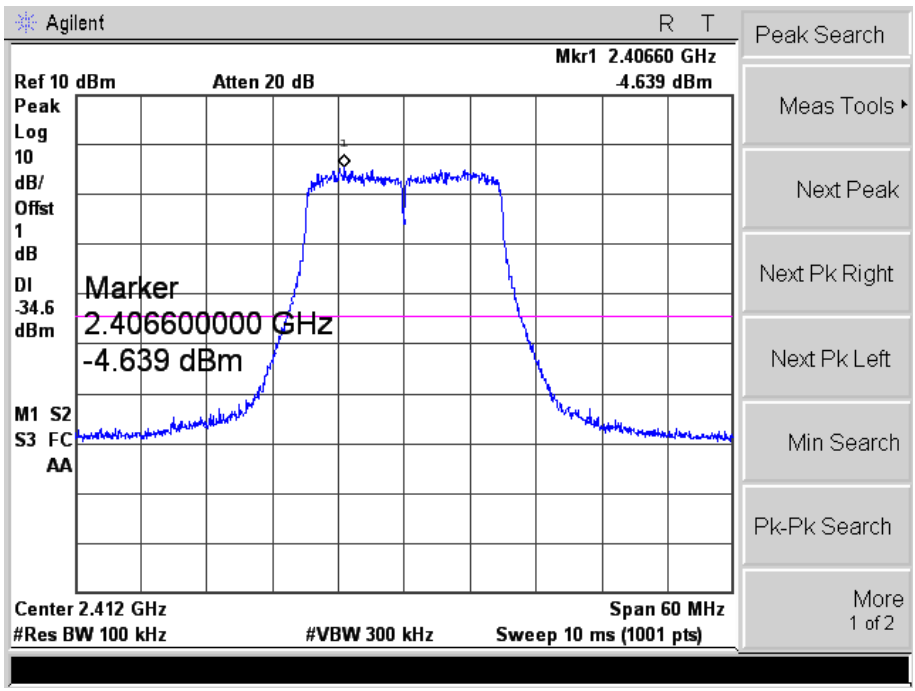
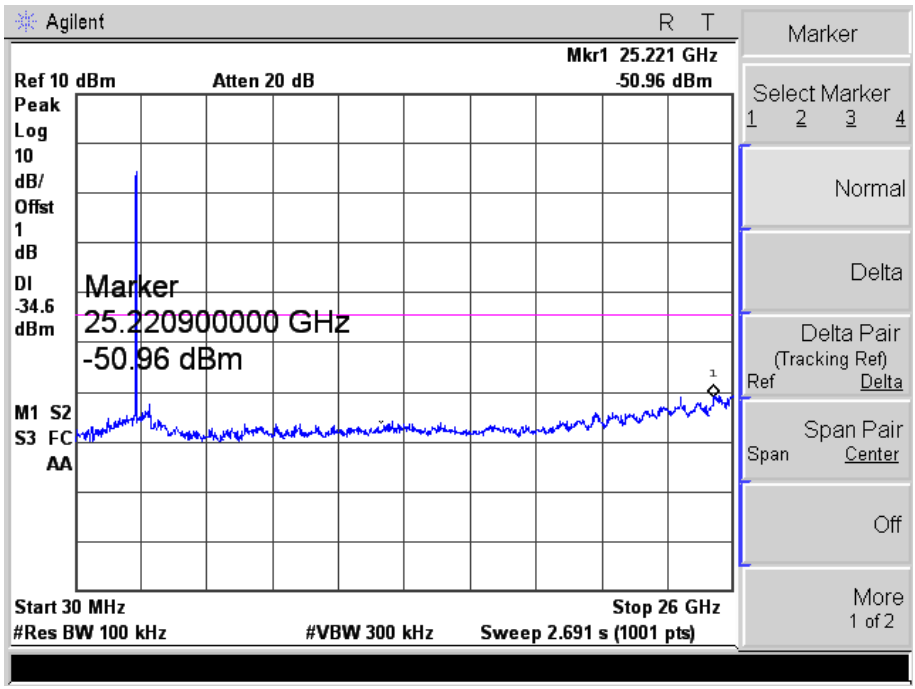
802.11b_11Mbps	
Middle	 

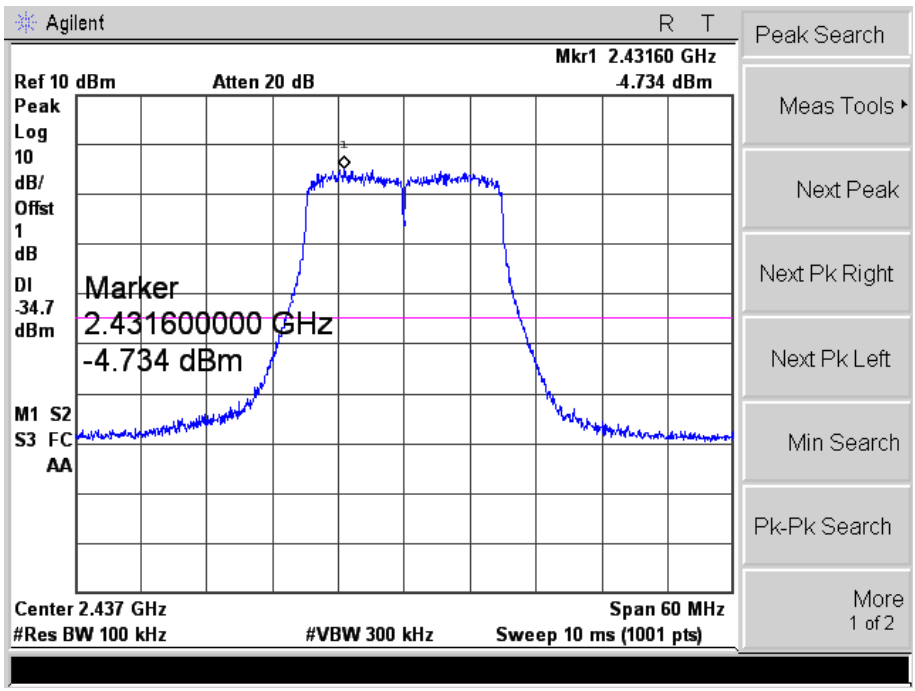
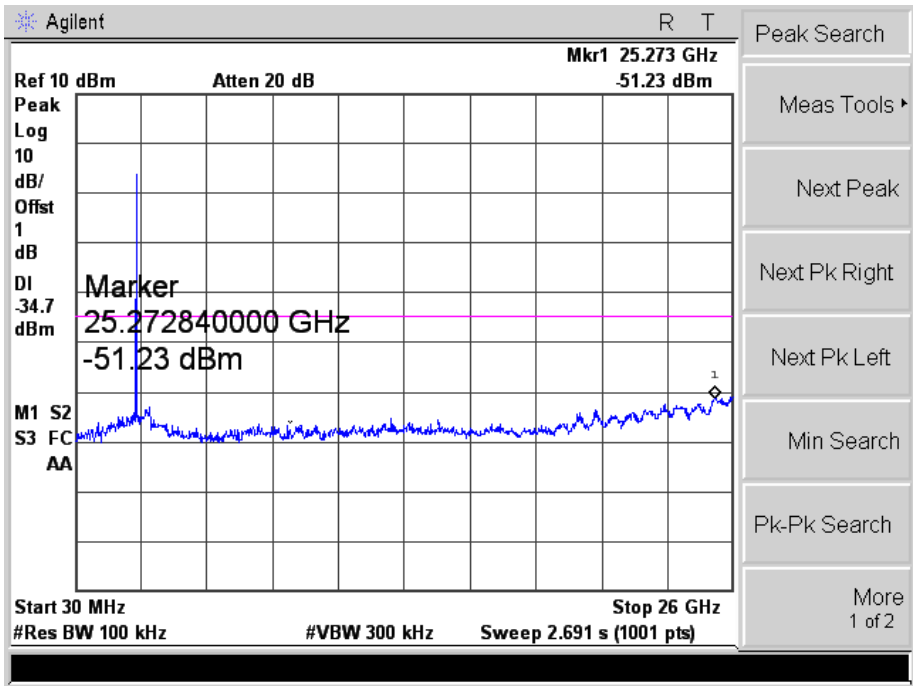
802.11b_11Mbps	
High	 

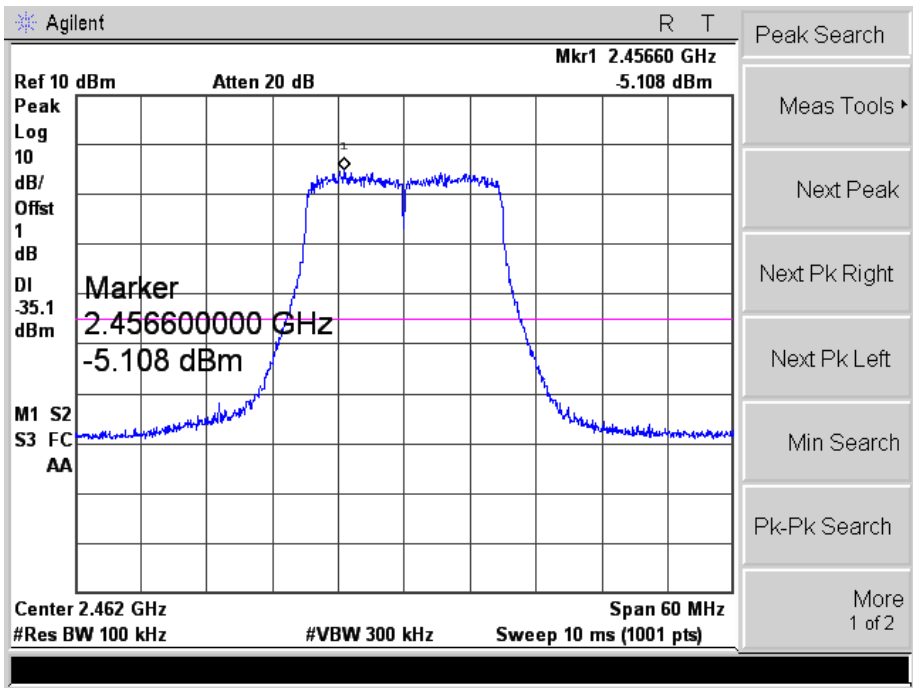
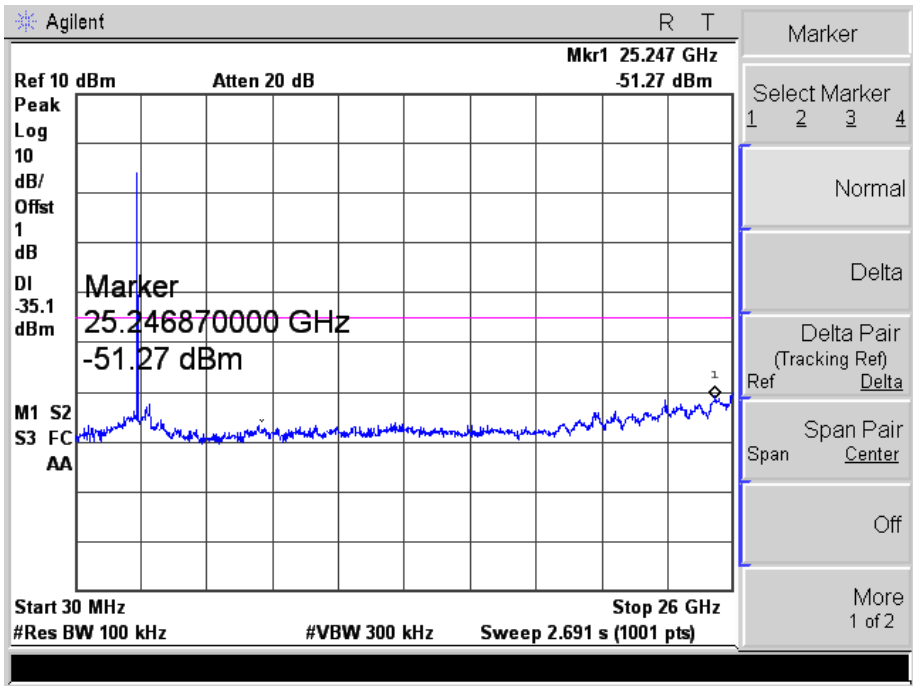
802.11g_54Mbps	
Low	 

802.11g_54Mbps	
Middle	 

802.11g_54Mbps	
High	
	

802.11n-HT20_MCS7	
Low	 

802.11n-HT20_MCS7	
Middle	 

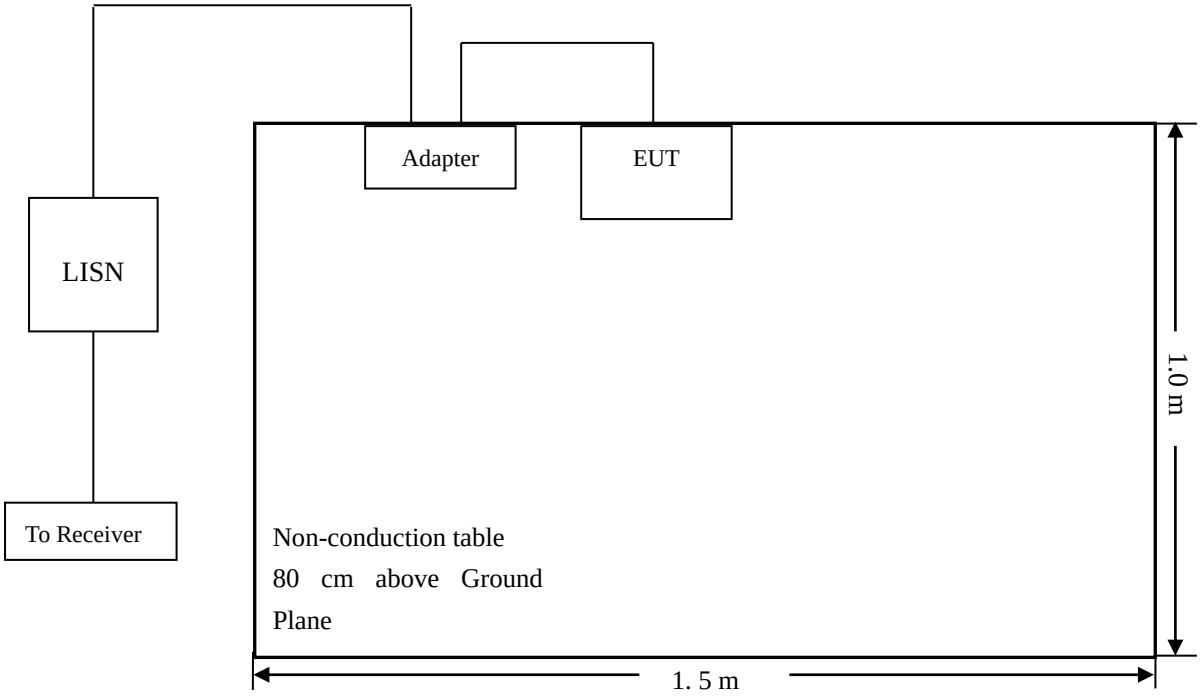
802.11n-HT20_MCS7	
High	 

10. Conducted Emissions

10.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

10.2 Basic Test Setup Block Diagram



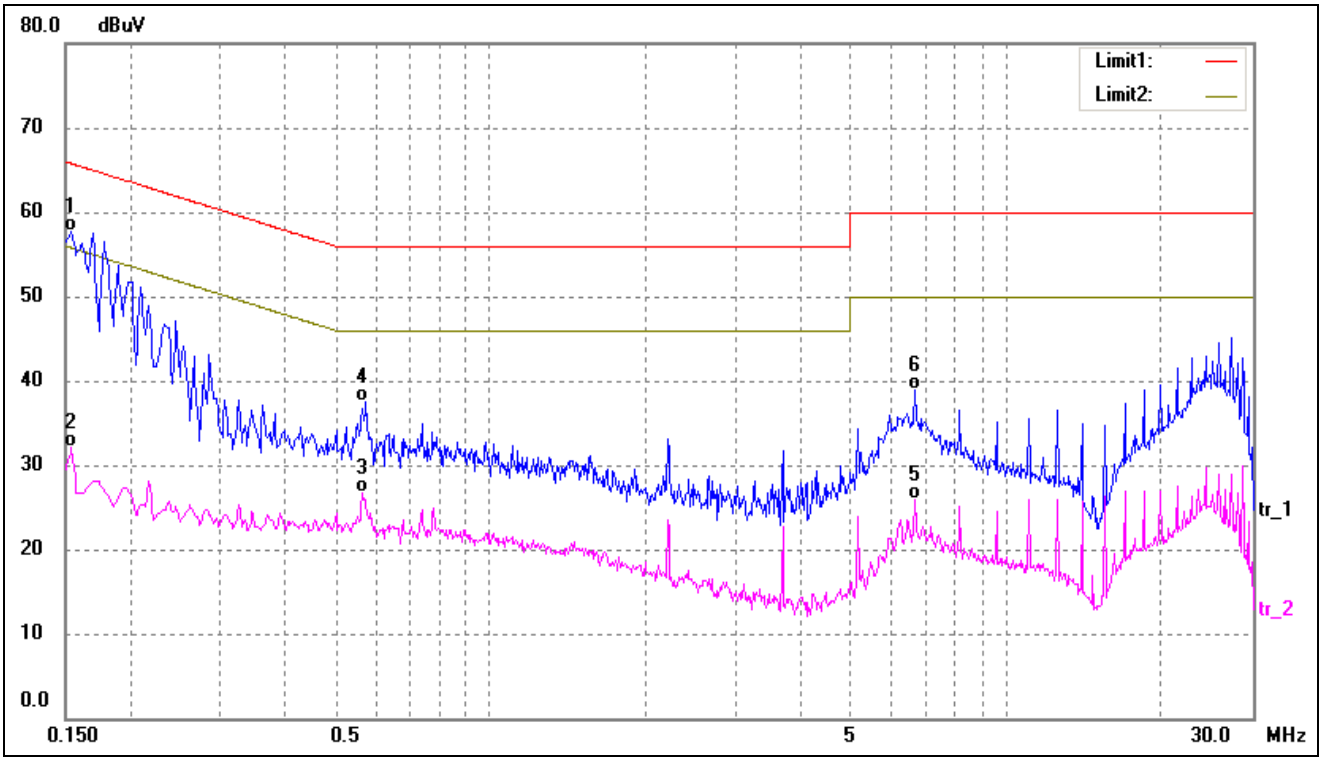
10.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

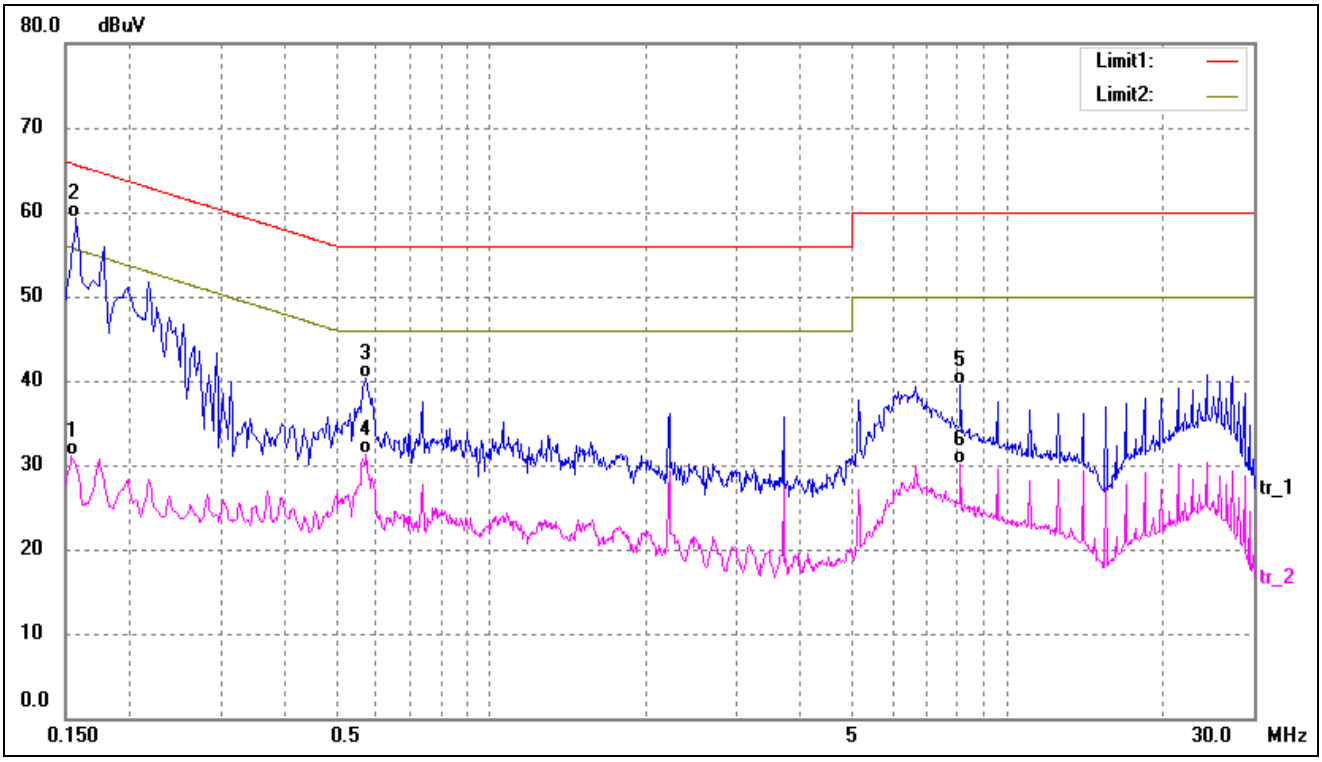
10.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.1539	57.64	0.00	57.64	65.78	-8.14	QP
2	0.1539	32.02	0.00	32.02	55.78	-23.76	AVG
3	0.5660	26.74	0.00	26.74	46.00	-19.26	AVG
4	0.5740	37.52	0.00	37.52	56.00	-18.48	QP
5	6.6339	25.89	0.00	25.89	50.00	-24.11	AVG
6	6.6340	38.87	0.00	38.87	60.00	-21.13	QP

Test Mode	Communication	AC120V 60Hz	Polarity:	Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1539	20.92	10.10	31.02	55.78	-24.76	AVG
2*	0.1580	49.21	10.10	59.31	65.56	-6.25	QP
3	0.5740	29.94	10.33	40.27	56.00	-15.73	QP
4	0.5740	20.89	10.33	31.22	46.00	-14.78	AVG
5	8.1140	28.65	10.89	39.54	60.00	-20.46	QP
6	8.1140	19.13	10.89	30.02	50.00	-19.98	AVG

******* END OF REPORT *******