FCC Part 15C
Measurement and Test Report

For

Hangzhou BroadLink Technology Co., Ltd.

Unit C,Building 1,No.57 Jiang'er Road, Changhe Street,Binjiang District,

Hangzhou, Zhejiang, China

FCC ID: 2ATEV-SP4M-US

FCC Rule(s):	FCC Part 15.247
Product Description:	Smart Plug
Tested Model:	SP4M-US
Report No.:	WTX20X04018146W
Sample Receipt Date:	Apr.13, 2020
Tested Date:	Apr.13, 2020 to Apr.28, 2020
Issued Date:	Apr.28, 2020
Tested By:	Mike Shi/ Engineer
Reviewed By:	Lion Cai / RF Manager
Approved & Authorized By:	Silin Chen / Manager

Prepared By:

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Version No.	Date of issue	Description
Rev.00	Apr.28, 2020	Original
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Hangzhou BroadLink Technology Co., Ltd.
Address of applicant:	Unit C,Building 1,No.57 Jiang'er Road, Changhe Street,Binjiang District, Hangzhou, Zhejiang, China
Manufacturer:	Hangzhou BroadLink Technology Co., Ltd.
Address of manufacturer:	Unit C,Building 1,No.57 Jiang'er Road, Changhe Street,Binjiang District, Hangzhou, Zhejiang, China

General Description of EUT	
Product Name:	Smart Plug
Trade Name:	BroadLink
Model No.:	SP4M-US
Adding Model(s):	SP4F-US,SP4M-US-FFS,SP4D-US,SP4D-US-FFS
Rated Voltage:	AC120V 60Hz
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 SP4M-US, 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 for 802.11b/g/n-HT20 2422-2452MHz for 802.11n-HT40
RF Output Power:	13.19dBm (Conducted)
Type of Modulation:	DBPSK,BPSK,DQPSK,QPSK,16QAM,64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11 for 802.11b/g/n-HT20 7 for 802.11n-HT40
Channel Separation:	5MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	0dBi

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 v05r02: 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 v05r02.
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

Address of the test laboratory
Laboratory: Waltek Testing Group (Shenzhen) Co., Ltd.
Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C. (518101）

FCC – Registration No.: 125990
Waltek Testing Group (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A
The 3m Semi-anechoic chamber of Waltek Testing Group (Shenzhen) 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

Use “SecureCRT.exe” and follow the instructions given by the manufacturer, you can start to test. During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. Test use the customer default power level, 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
TM4	802.11n-HT40	Low:2422MHz, Middle:2437MHz,High:2452MHz

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	2019-04-30	2020-04-29
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2019-04-30	2020-04-29
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2019-04-30	2020-04-29
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2019-04-30	2020-04-29
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2019-04-30	2020-04-29
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
SEMT-1042	Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2019-05-05	2021-05-04
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2019-04-30	2020-04-29
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2019-04-30	2020-04-29
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2019-04-30	2020-04-29
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2019-04-30	2020-04-29
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2019-04-30	2020-04-29
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2019-04-30	2020-04-29
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2019-05-05	2021-05-04
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2019-04-30	2020-04-29
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2019-04-30	2020-04-29
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2019-04-30	2020-04-29
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2020-03-17	2021-03-16
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2020-03-17	2021-03-16
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2020-03-17	2021-03-16
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2020-03-17	2021-03-16
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2020-03-17	2021-03-16
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2020-03-17	2021-03-16

Software List			
Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§2.1091	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 §2.1091, the mobile 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 a PCB 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

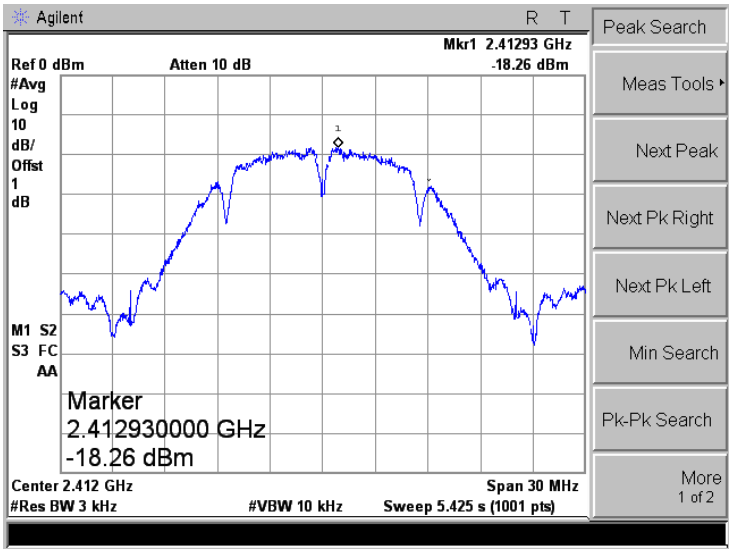
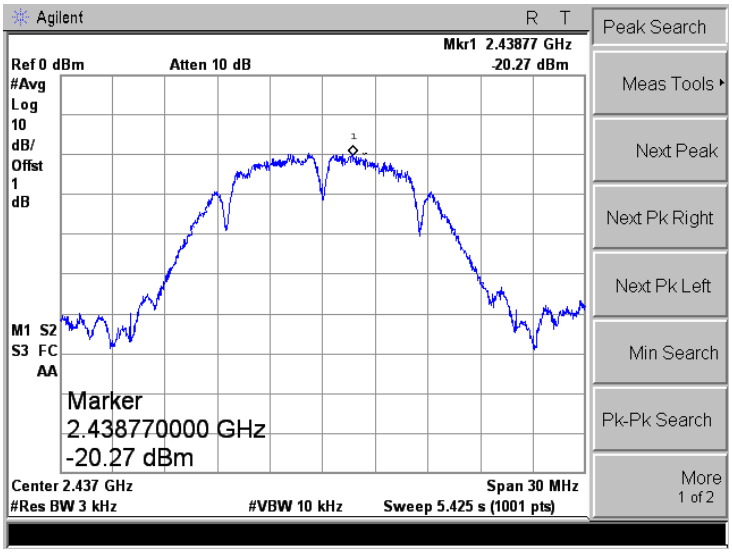
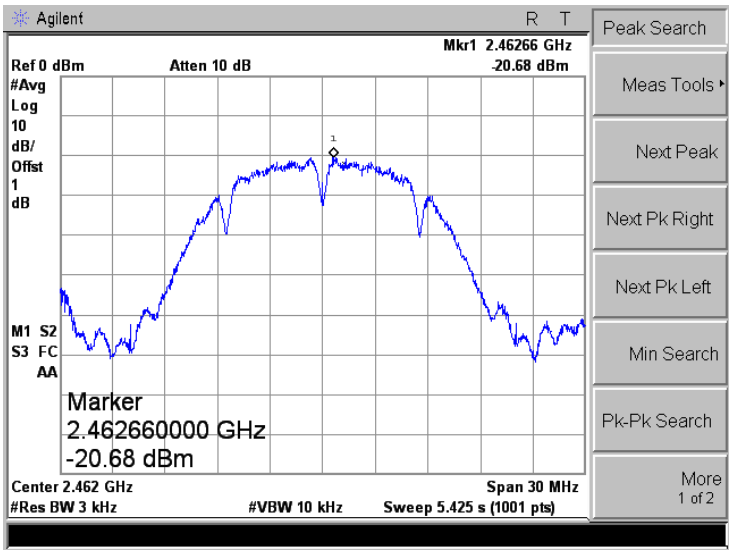
According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.10.3, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

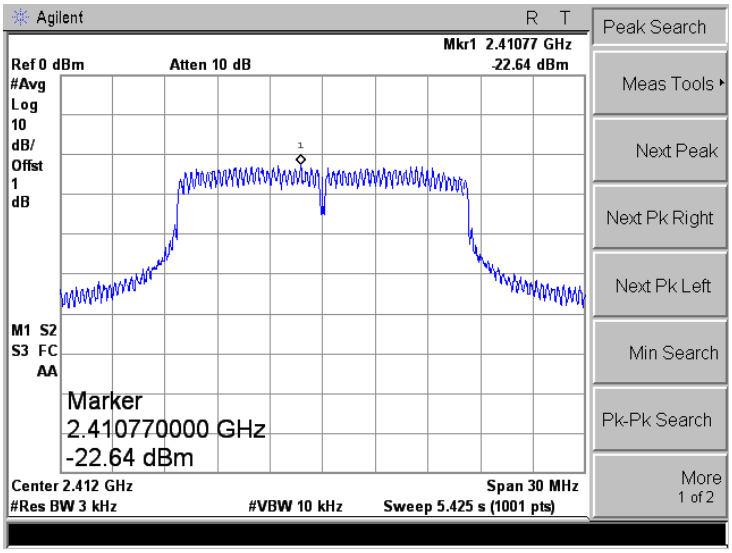
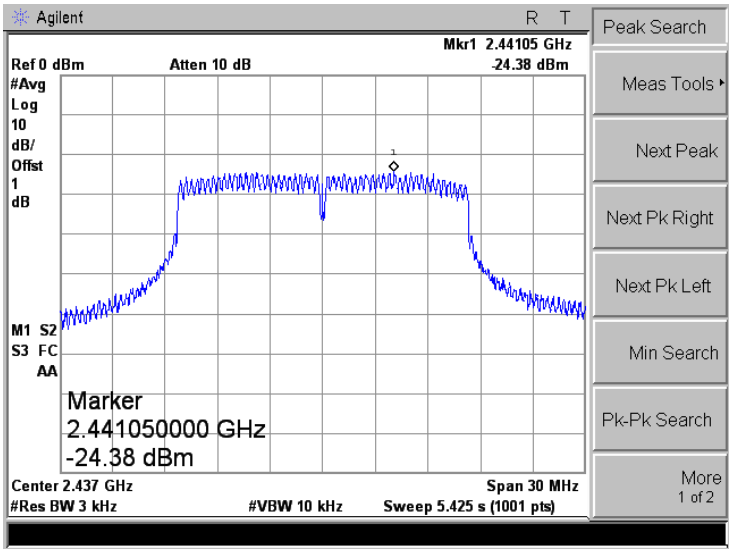
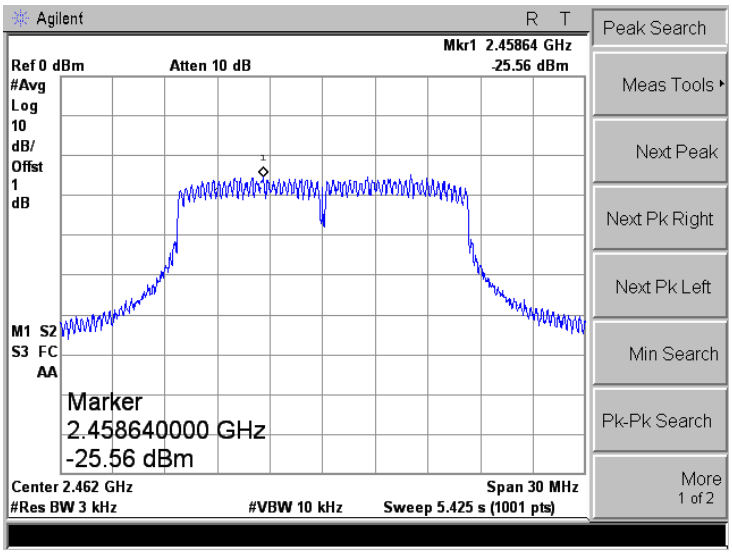
a) Set instrument center frequency to DTS channel center frequency.
b) Set span to at least 1.5 times the OBW.
c) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz. .
d) Set VBW ≥3 x RBW.
e) Detector = power averaging (RMS) or sample detector (when RMS not available).
f) Ensure that the number of measurement points 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).

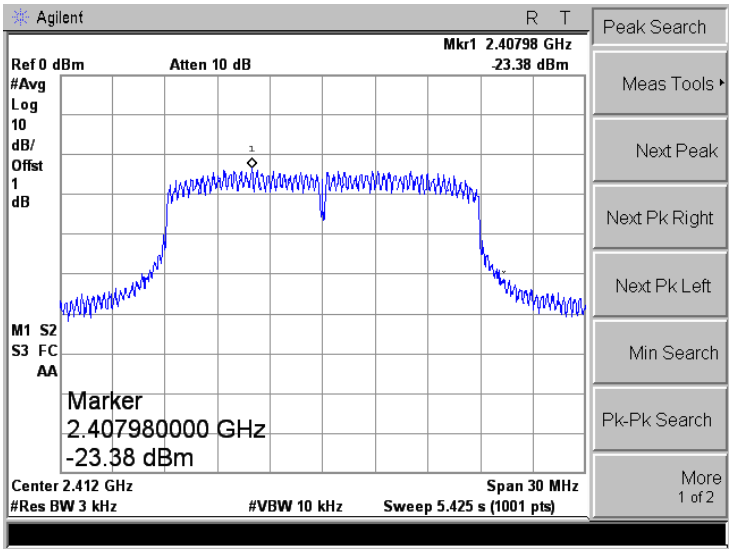
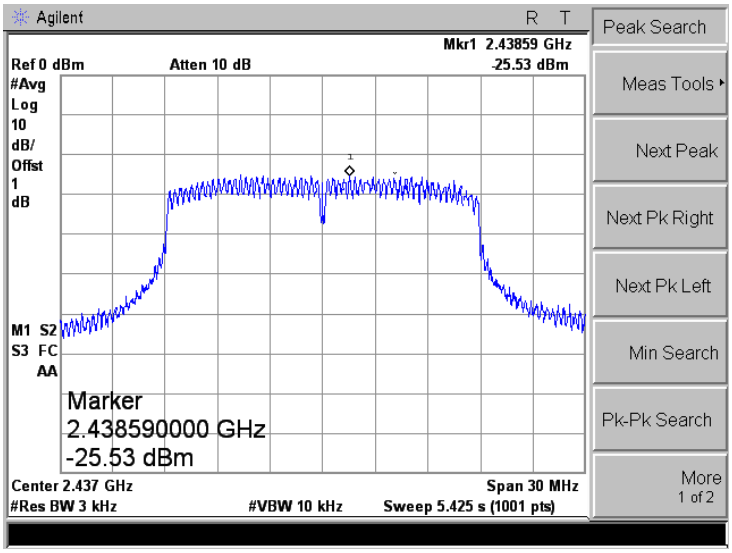
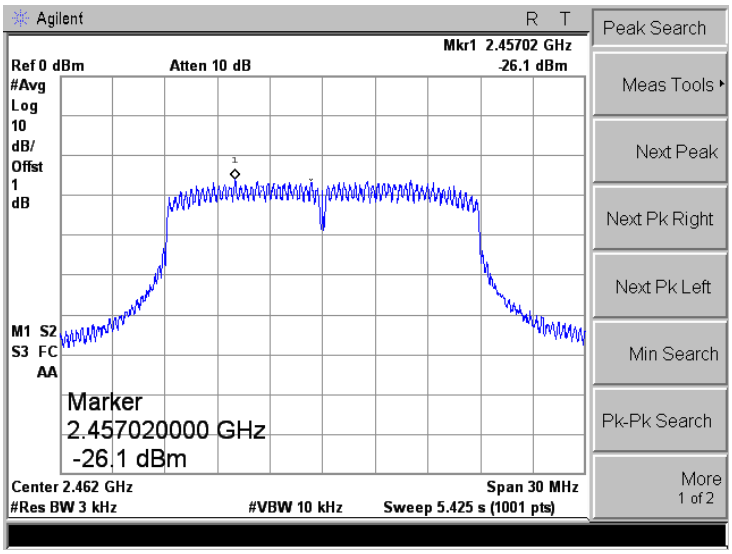
5.3 Summary of Test Results/Plots

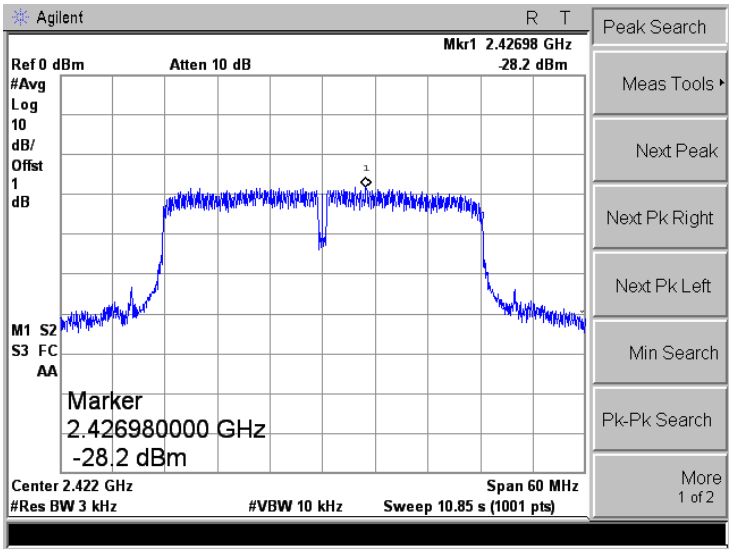
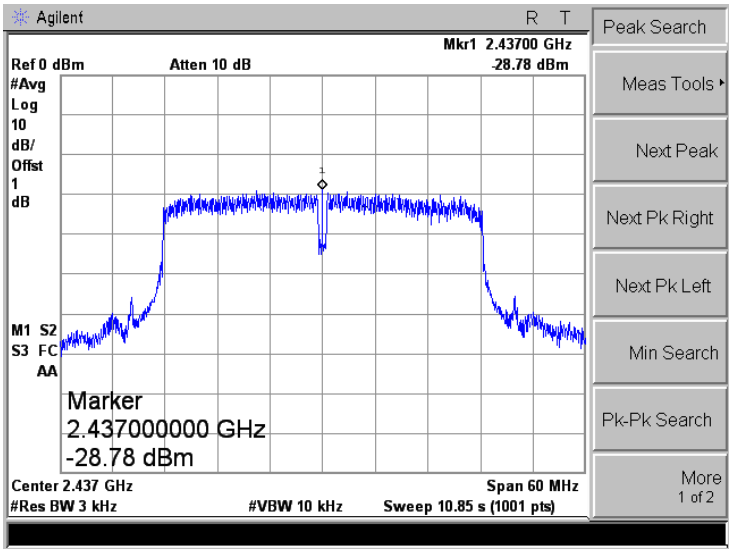
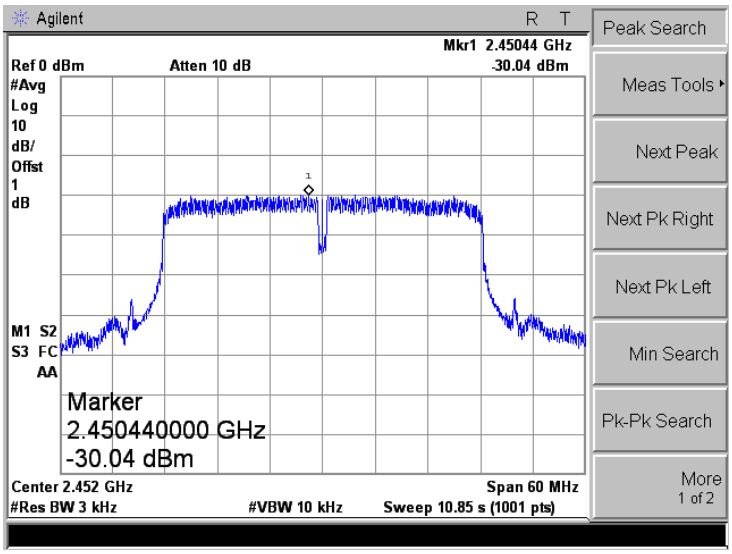
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b_11Mbps	2412	-18.26	8
	2437	-20.27	8
	2462	-20.68	8
802.11g_54Mbps	2412	-22.64	8
	2437	-24.38	8
	2462	-25.56	8
802.11n-HT20_MCS7	2412	-23.38	8
	2437	-25.53	8
	2462	-26.10	8
802.11n-HT40_MCS7	2422	-28.20	8
	2437	-28.78	8
	2452	-30.04	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	

802.11n-HT40-Low	
802.11n-HT40-Middle	
802.11n-HT40-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

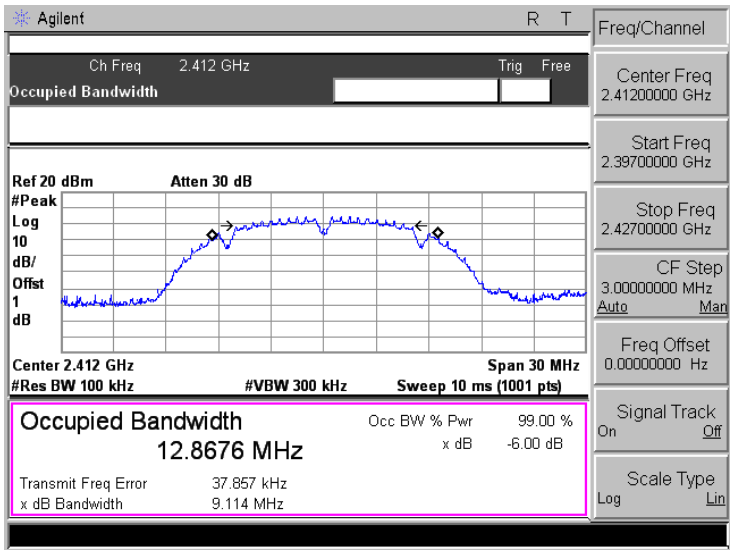
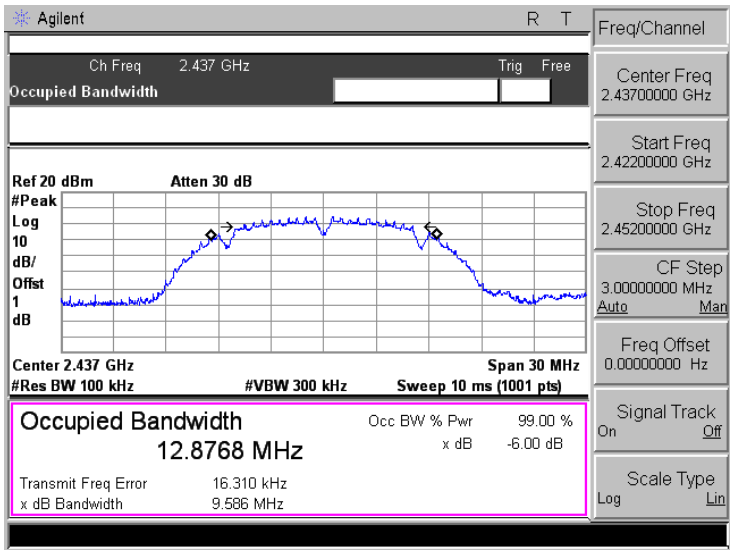
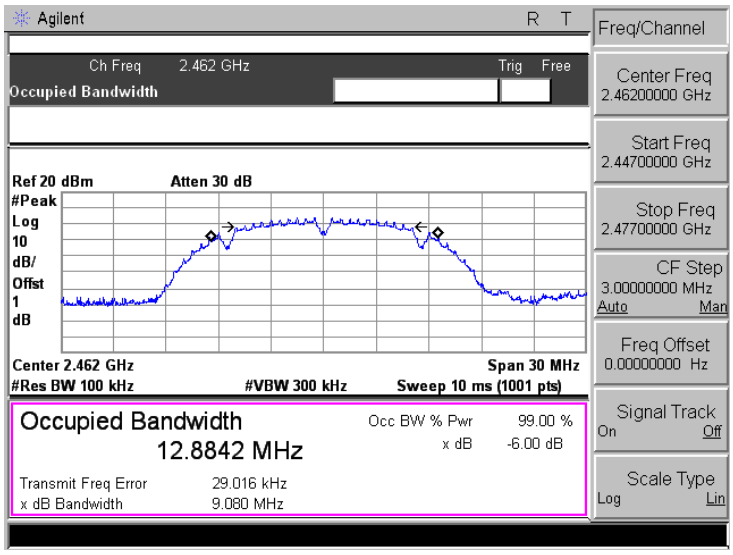
According to the KDB 558074 D01 v05r02 Subclause 8.2 and ANSI C63.10-2013 Subclause 11.8.1, the test method of DTS Bandwidth as below:

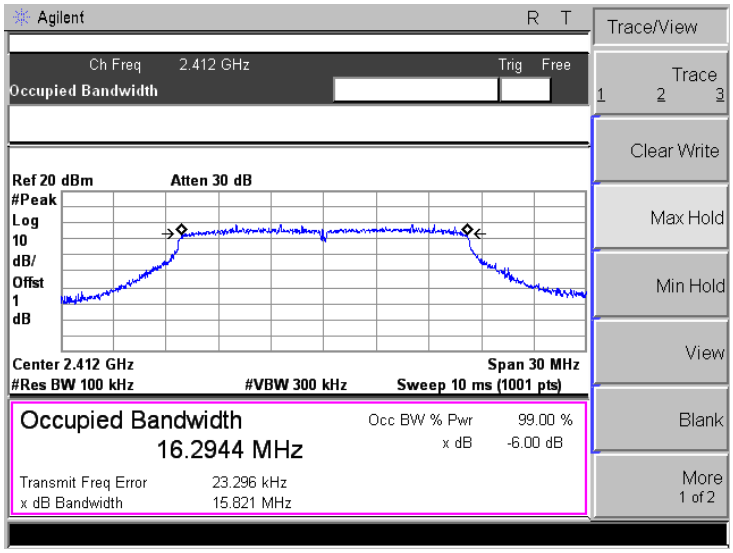
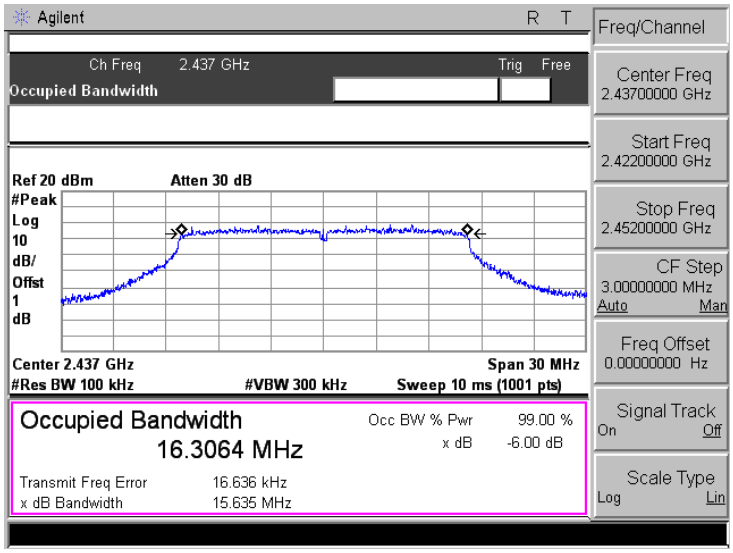
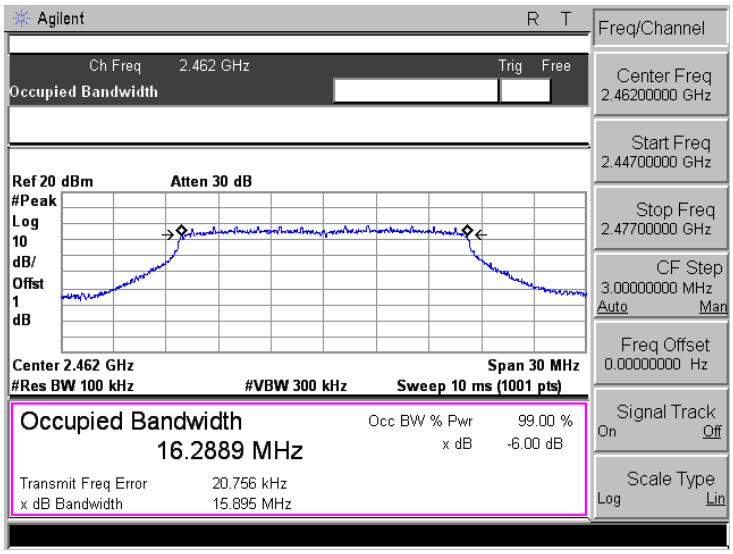
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points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

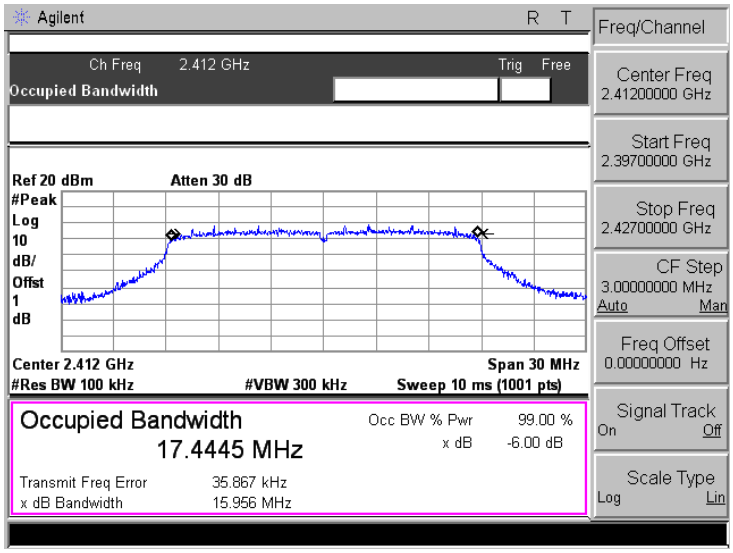
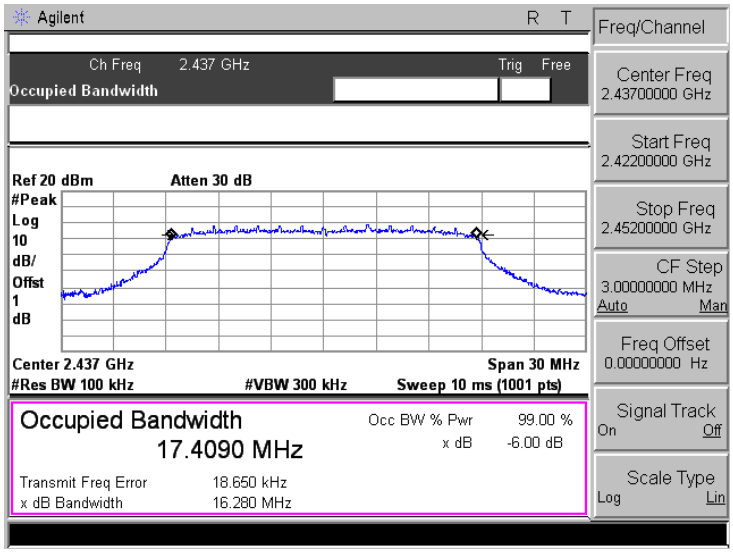
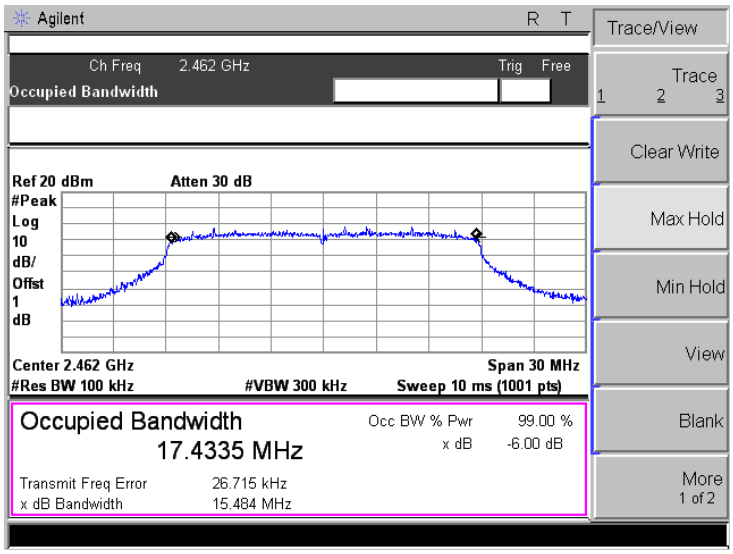
6.3 Summary of Test Results/Plots

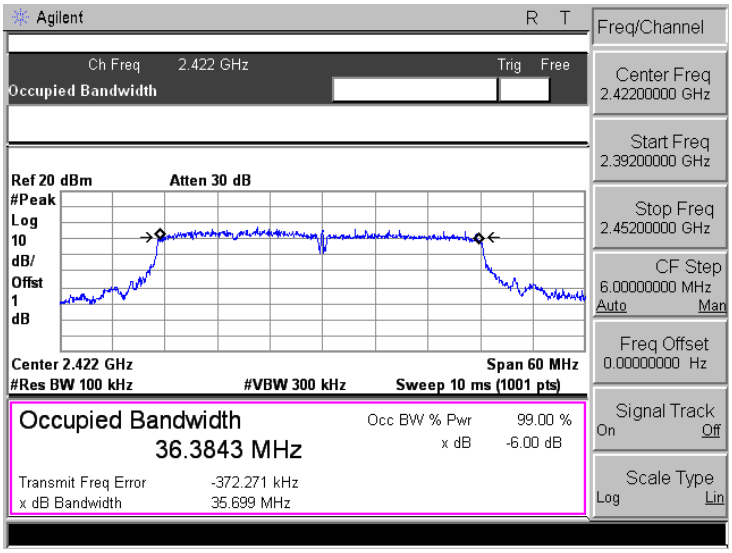
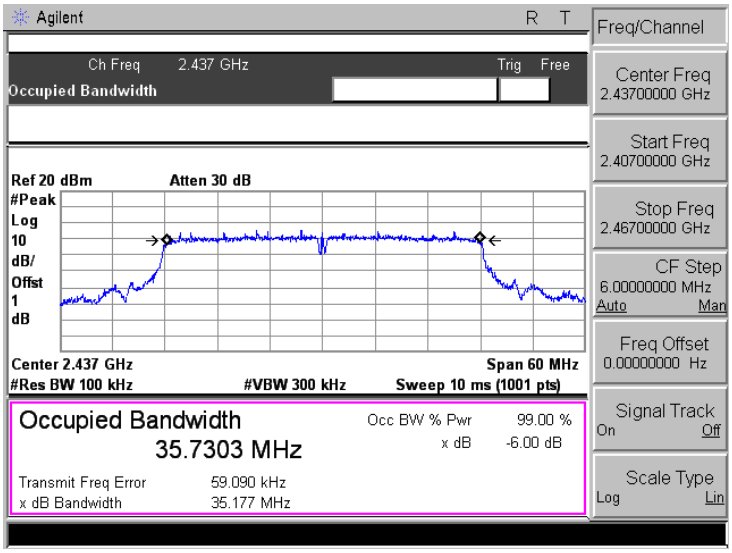
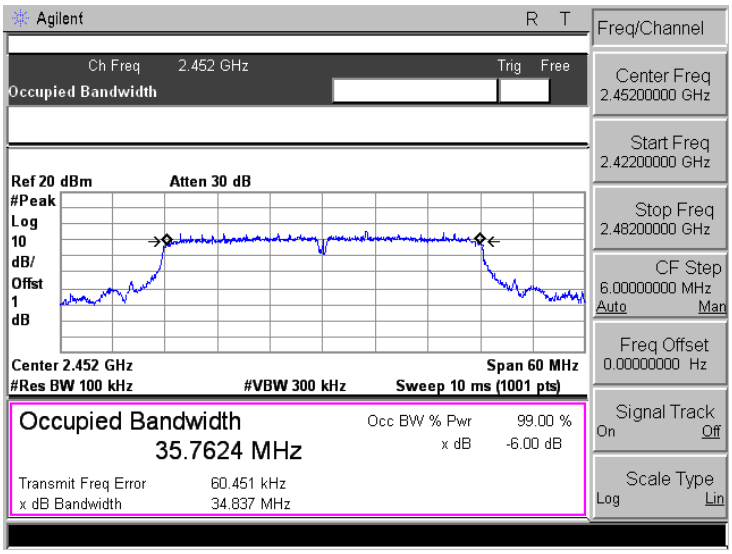
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	Limit kHz
802.11b_11Mbps	2412	9.114	≥500
	2437	9.586	≥500
	2462	9.080	≥500
802.11g_54Mbps	2412	15.821	≥500
	2437	15.635	≥500
	2462	15.895	≥500
802.11n-HT20_MCS7	2412	15.956	≥500
	2437	16.280	≥500
	2462	15.484	≥500
802.11n-HT40_MCS7	2422	35.699	≥500
	2437	35.177	≥500
	2452	34.837	≥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	

802.11n-HT40-Low	
802.11n-HT40-Middle	
802.11n-HT40-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

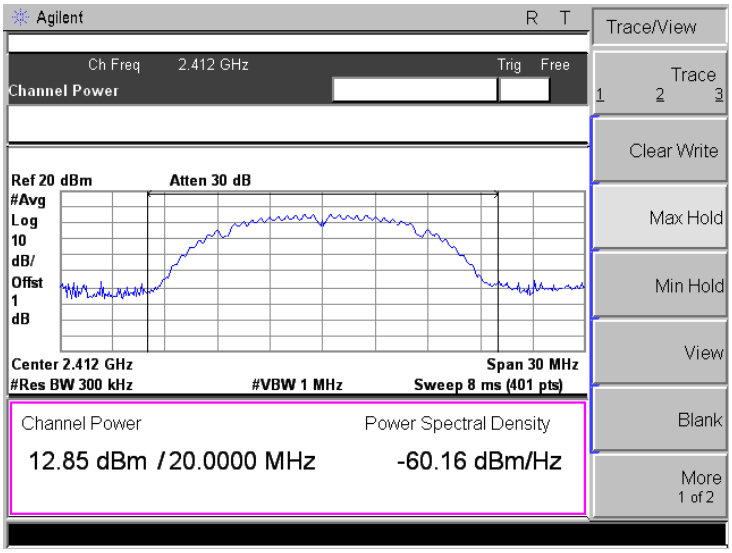
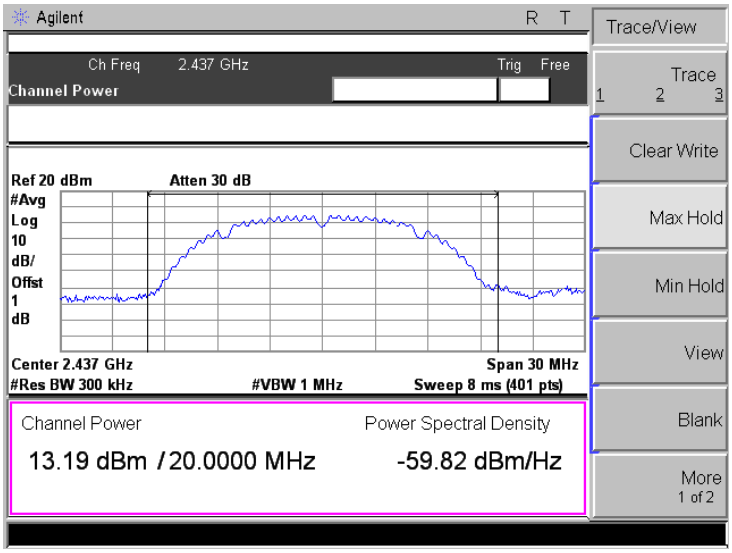
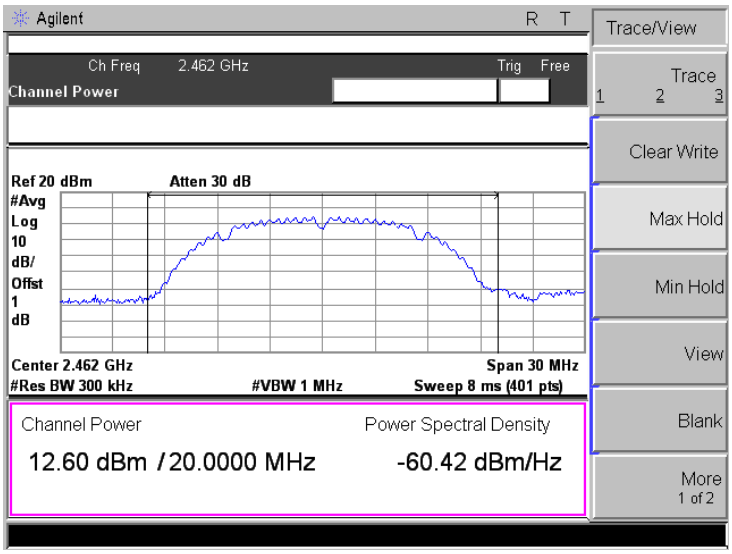
According to the KDB-558074 D01 v05r02 Subclause 8.3.2.2 and ANSI C63.10-2013 Subclause 11.9.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

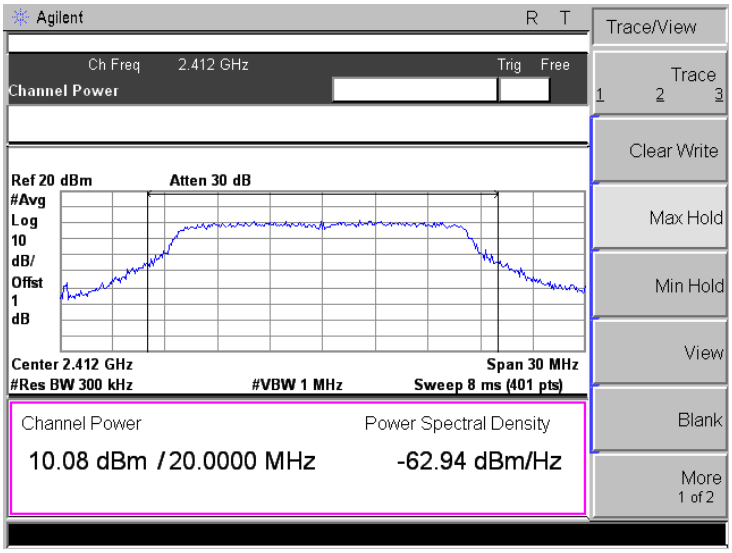
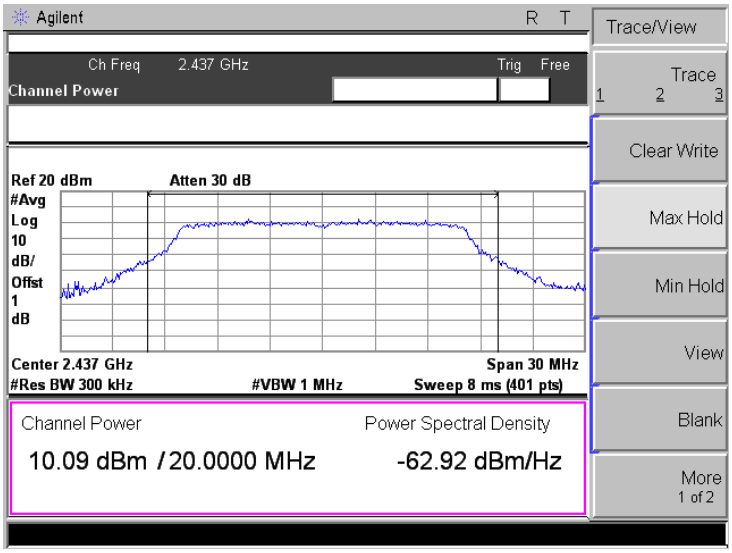
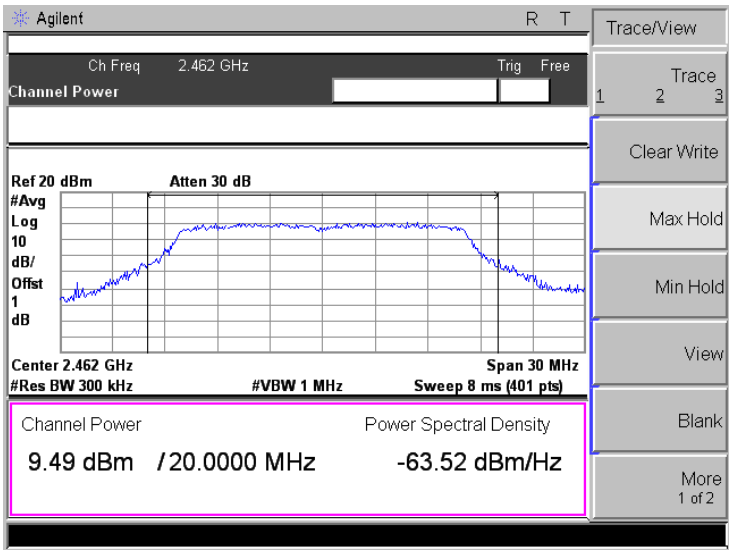
a) Set span to at least 1.5 times the OBW.
b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
c) Set VBW ≥ 3 x RBW.
d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
e) Sweep time = auto.
f) Detector = 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.

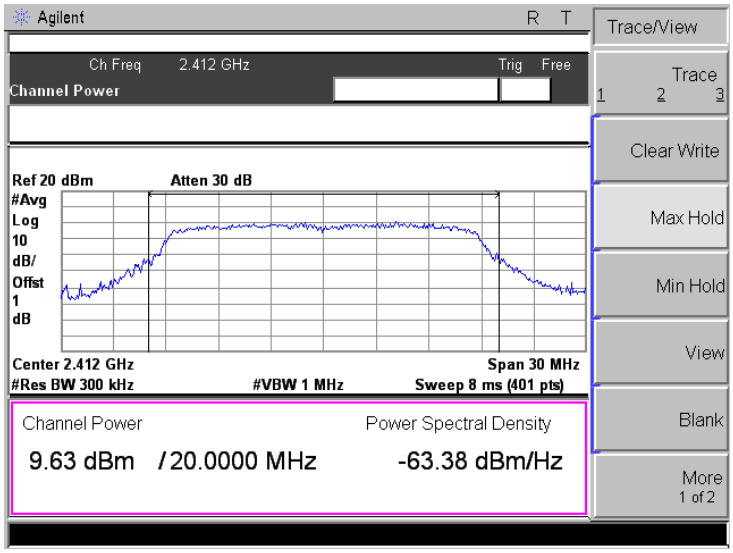
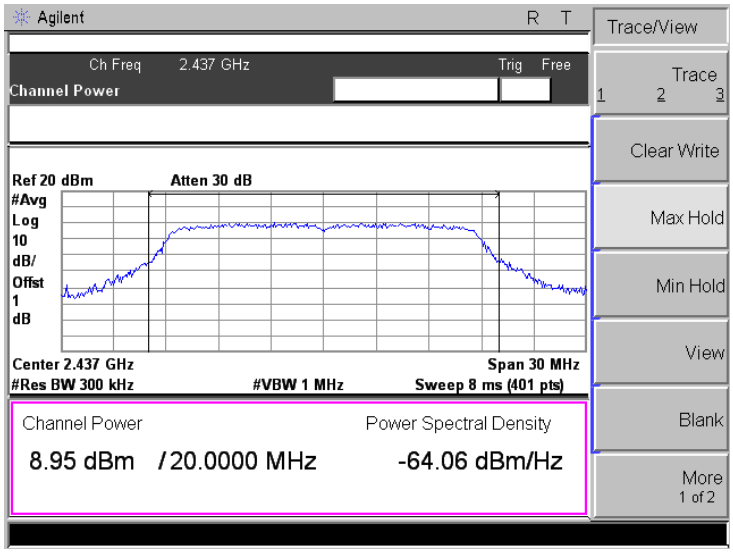
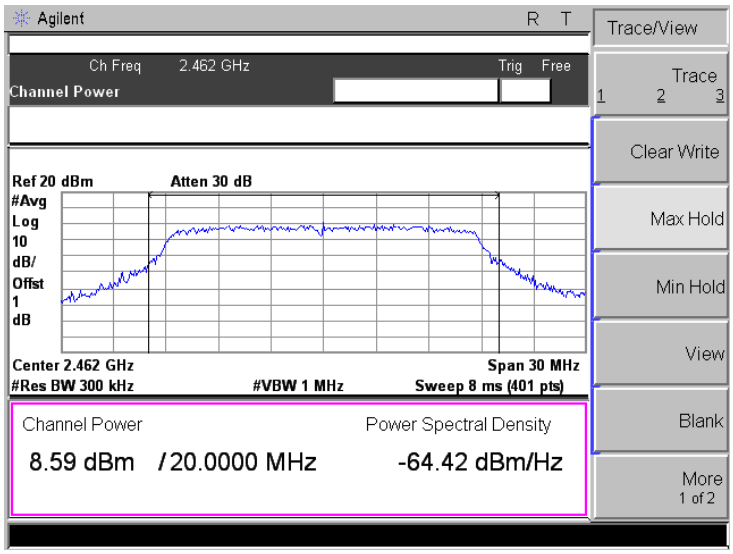
7.3 Summary of Test Results/Plots

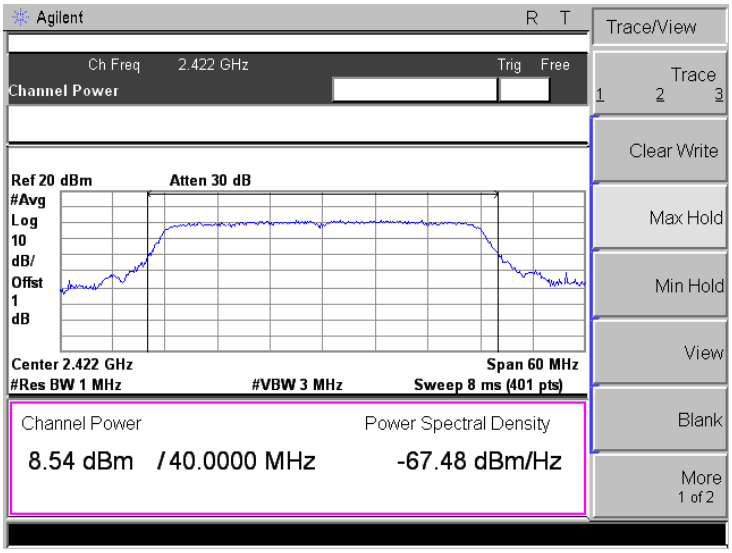
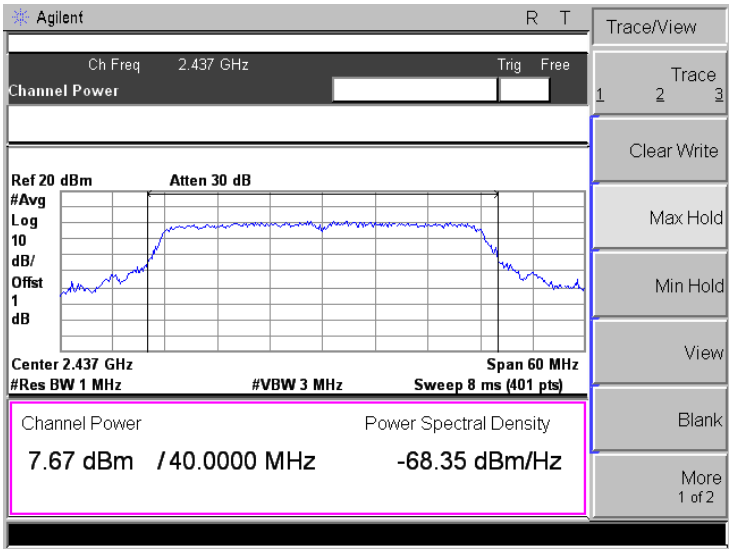
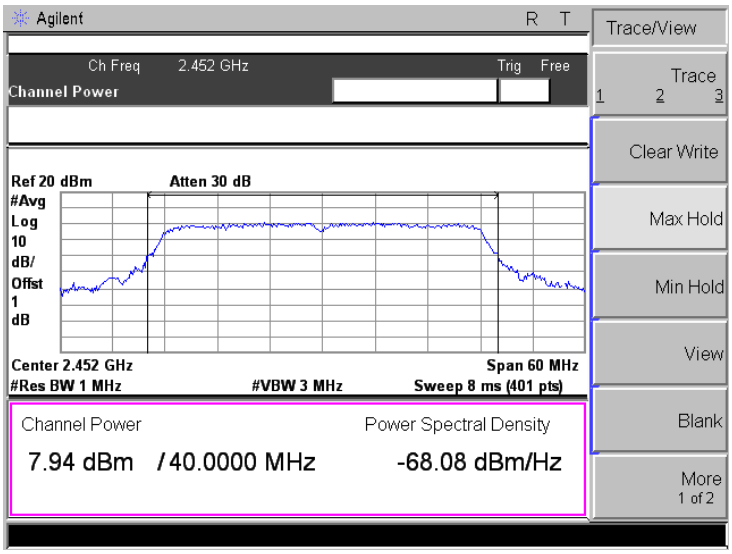
Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	12.85	19.28	1000
	2437	13.19	20.84	1000
	2462	12.60	18.20	1000
802.11g_54Mbps	2412	10.08	10.19	1000
	2437	10.09	10.21	1000
	2462	9.49	8.89	1000
802.11n HT20_MCS7	2412	9.63	9.18	1000
	2437	8.95	7.85	1000
	2462	8.59	7.23	1000
802.11n HT40_MCS7	2422	8.54	7.14	1000
	2437	7.67	5.85	1000
	2452	7.94	6.22	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	

802.11n-HT40-Low MCS7	
802.11n-HT40-Middle MCS7	
802.11n-HT40-High MCS7	

8. Field Strength of Spurious Emissions

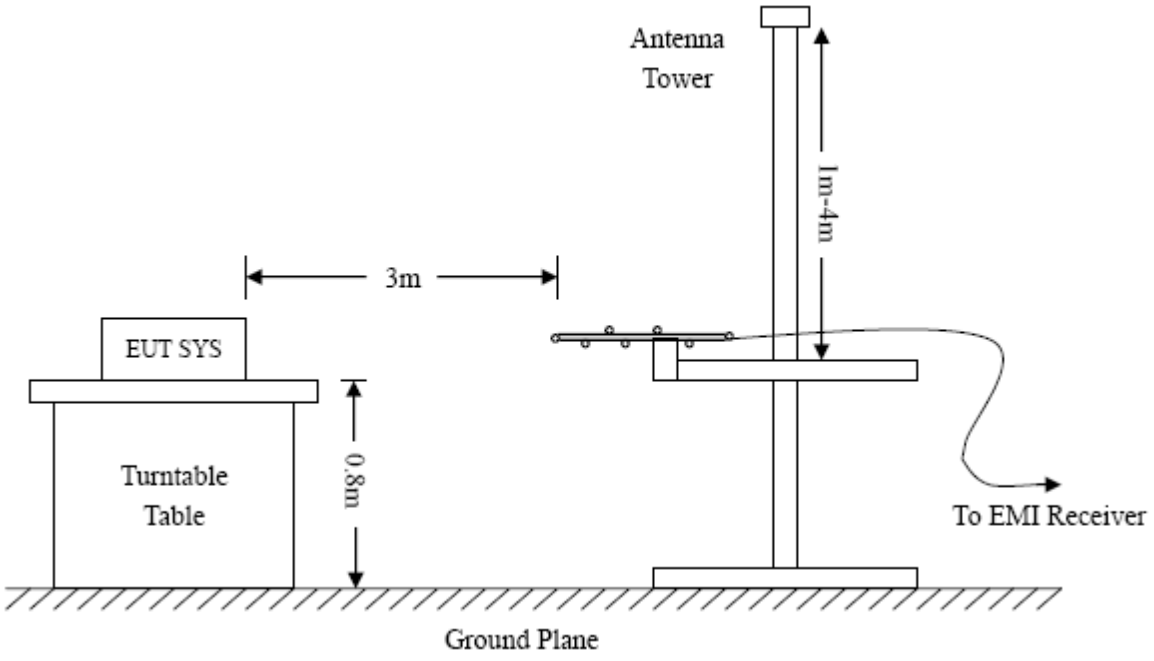
8.1 Standard Applicable

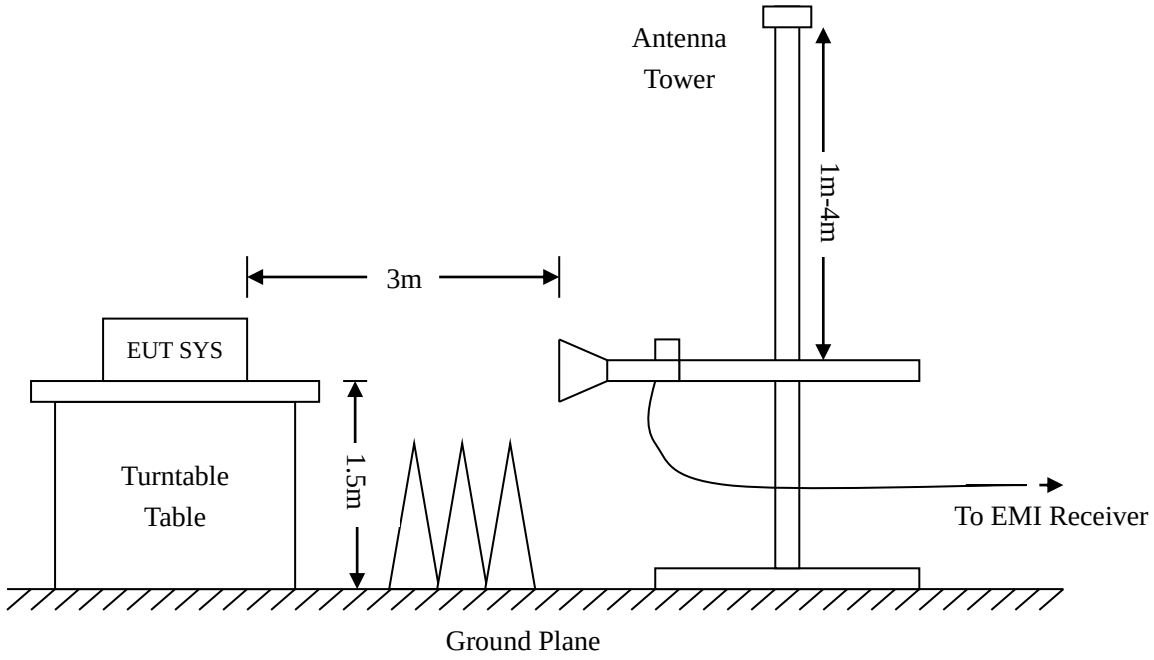
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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:

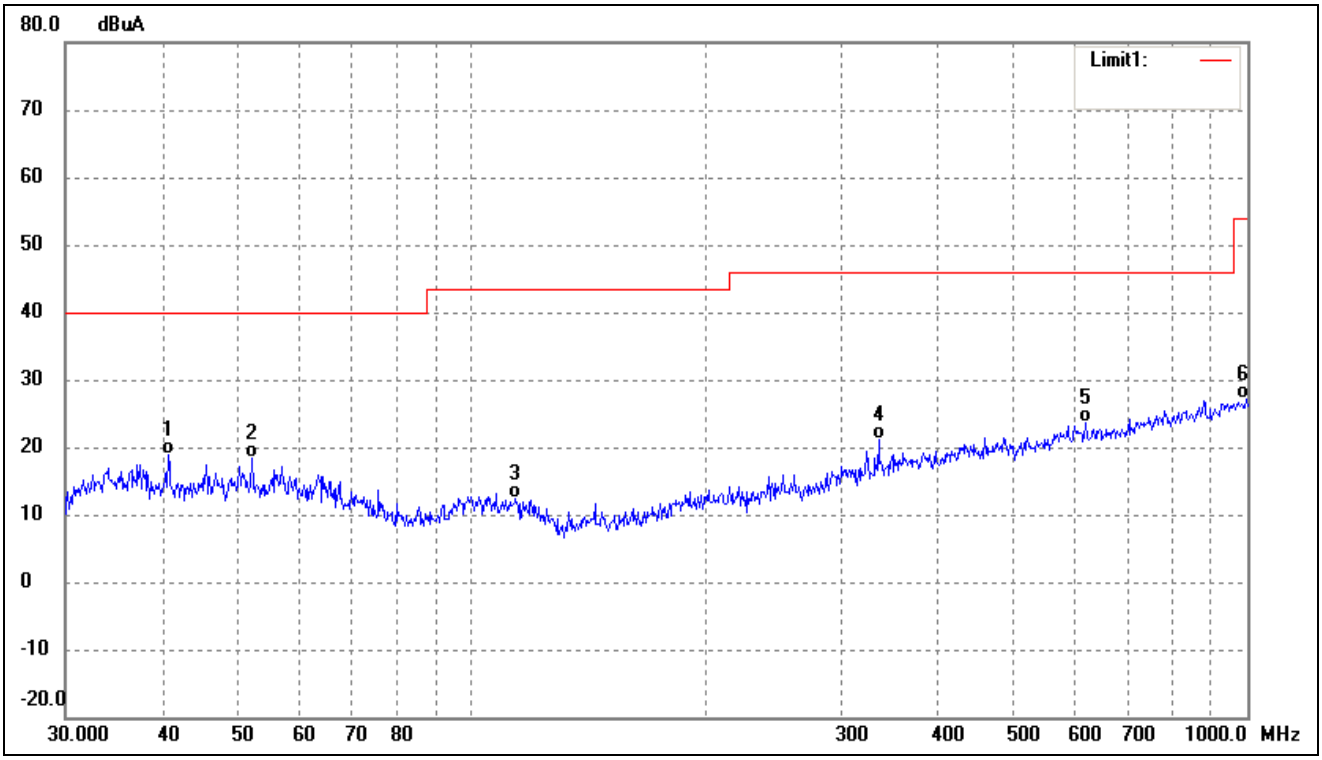
Margin = Corr. Ampl. – FCC Part 15 Limit

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（802.11b_ 11Mbps） is recorded in this report.

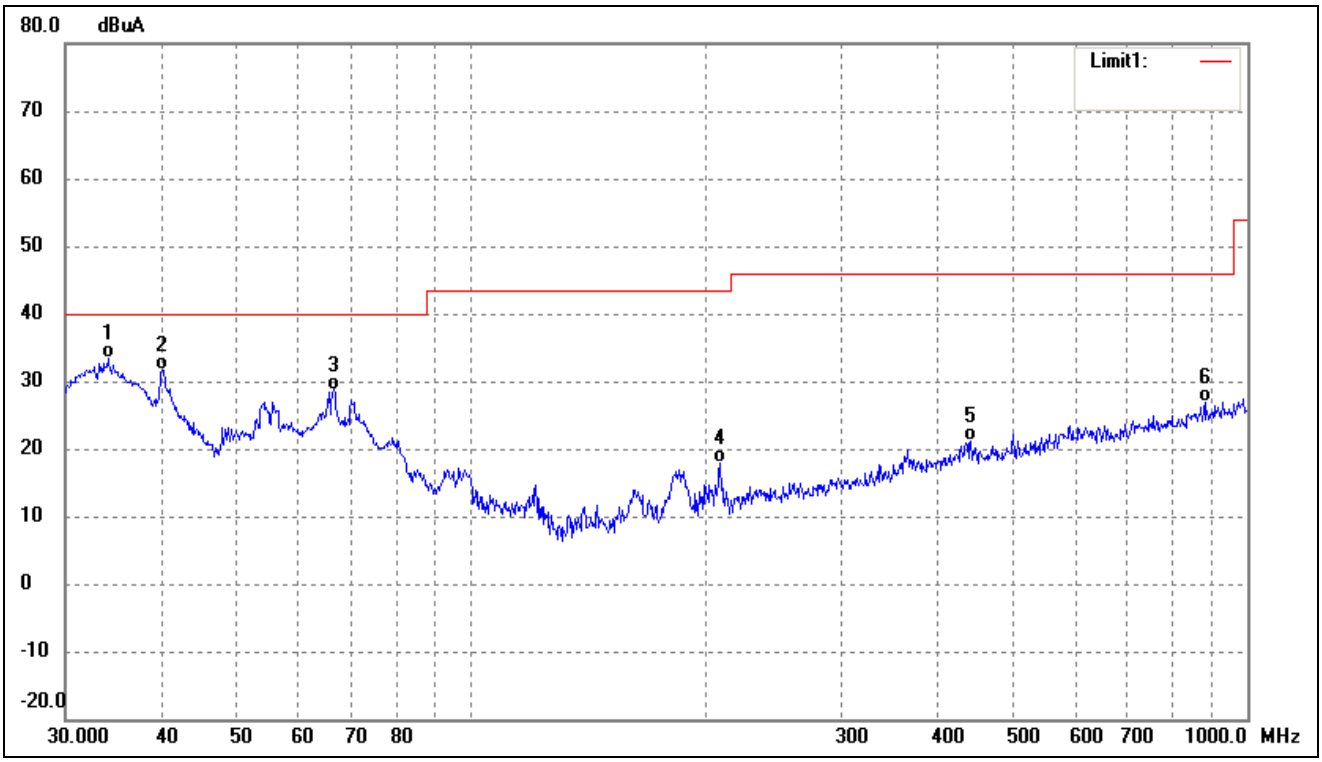
➢ Spurious Emissions Below 1GHz

802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal



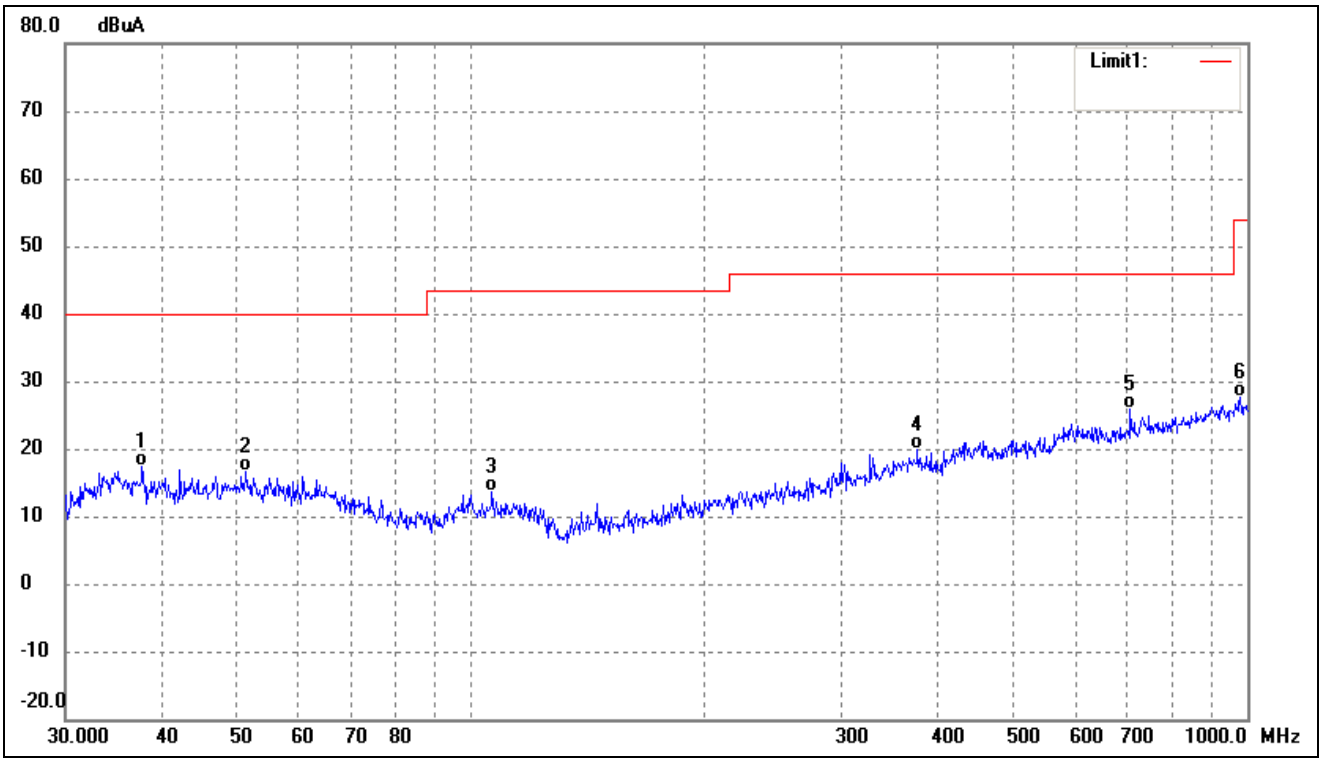
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuA)	dB	(dBuA)	(dBuA)	(dB)	( )	(cm)	
1	40.7016	31.34	-12.35	18.99	40.00	-21.01	-	-	QP
2	52.2079	29.80	-11.50	18.30	40.00	-21.70	-	-	QP
3	114.1138	25.83	-13.48	12.35	43.50	-31.15	-	-	QP
4	334.8589	30.08	-8.89	21.19	46.00	-24.81	-	-	QP
5	618.5369	27.62	-4.10	23.52	46.00	-22.48	-	-	QP
6	996.4996	26.70	0.55	27.25	54.00	-26.75	-	-	QP

802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical



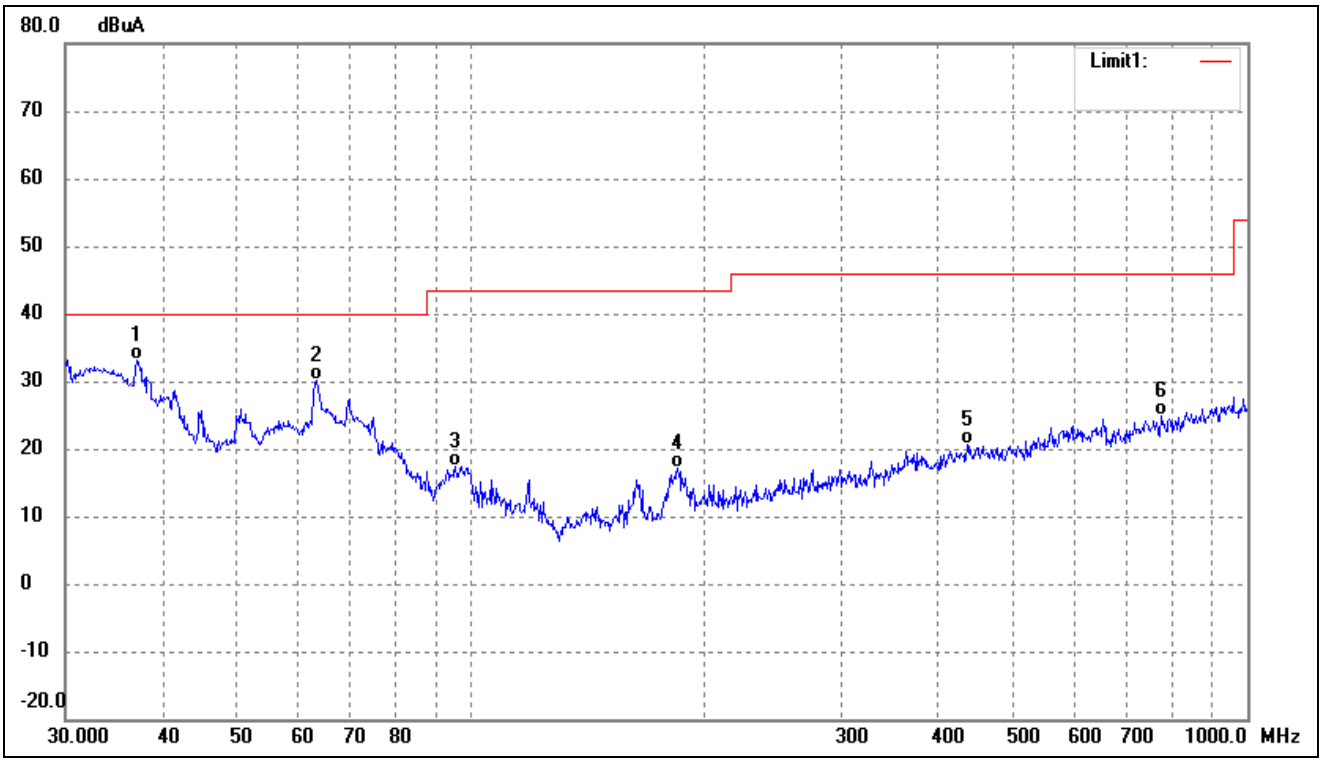
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuA)	dB	(dBuA)	(dBuA)	(dB)	( )	(cm)	
1	34.0365	46.90	-13.58	33.32	40.00	-6.68	-	-	QP
2	39.9942	44.14	-12.51	31.63	40.00	-8.37	-	-	QP
3	66.4989	43.15	-14.40	28.75	40.00	-11.25	-	-	QP
4	209.3129	30.33	-12.56	17.77	43.50	-25.73	-	-	QP
5	440.1963	27.30	-6.20	21.10	46.00	-24.90	-	-	QP
6	881.4067	27.88	-0.88	27.00	46.00	-19.00	-	-	QP

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Horizontal



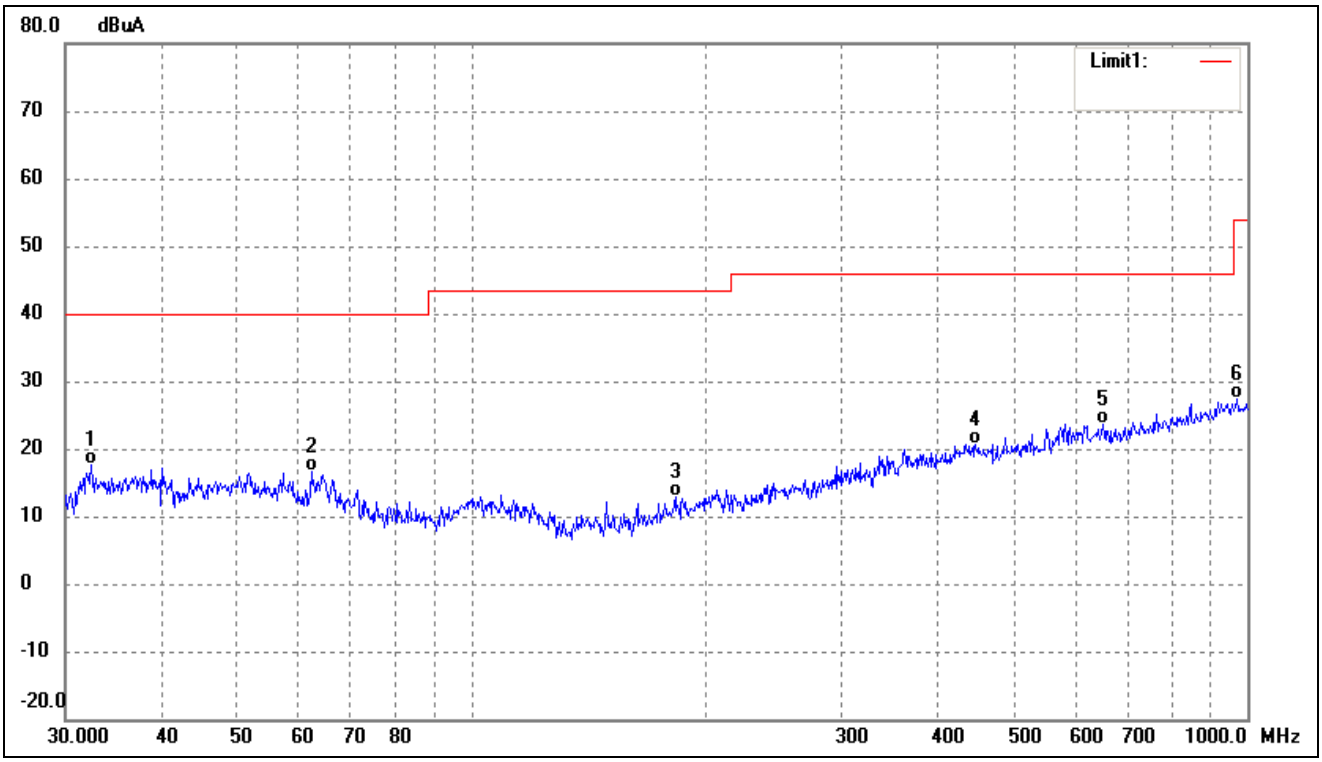
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuA)	dB	(dBuA)	(dBuA)	(dB)	( )	(cm)	
1	37.6798	30.18	-12.89	17.29	40.00	-22.71	-	-	QP
2	51.3005	27.86	-11.29	16.57	40.00	-23.43	-	-	QP
3	106.3850	26.59	-13.08	13.51	43.50	-29.99	-	-	QP
4	375.9385	27.46	-7.58	19.88	46.00	-26.12	-	-	QP
5	706.6999	29.59	-3.66	25.93	46.00	-20.07	-	-	QP
6	979.1804	27.31	0.35	27.66	54.00	-26.34	-	-	QP

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Vertical



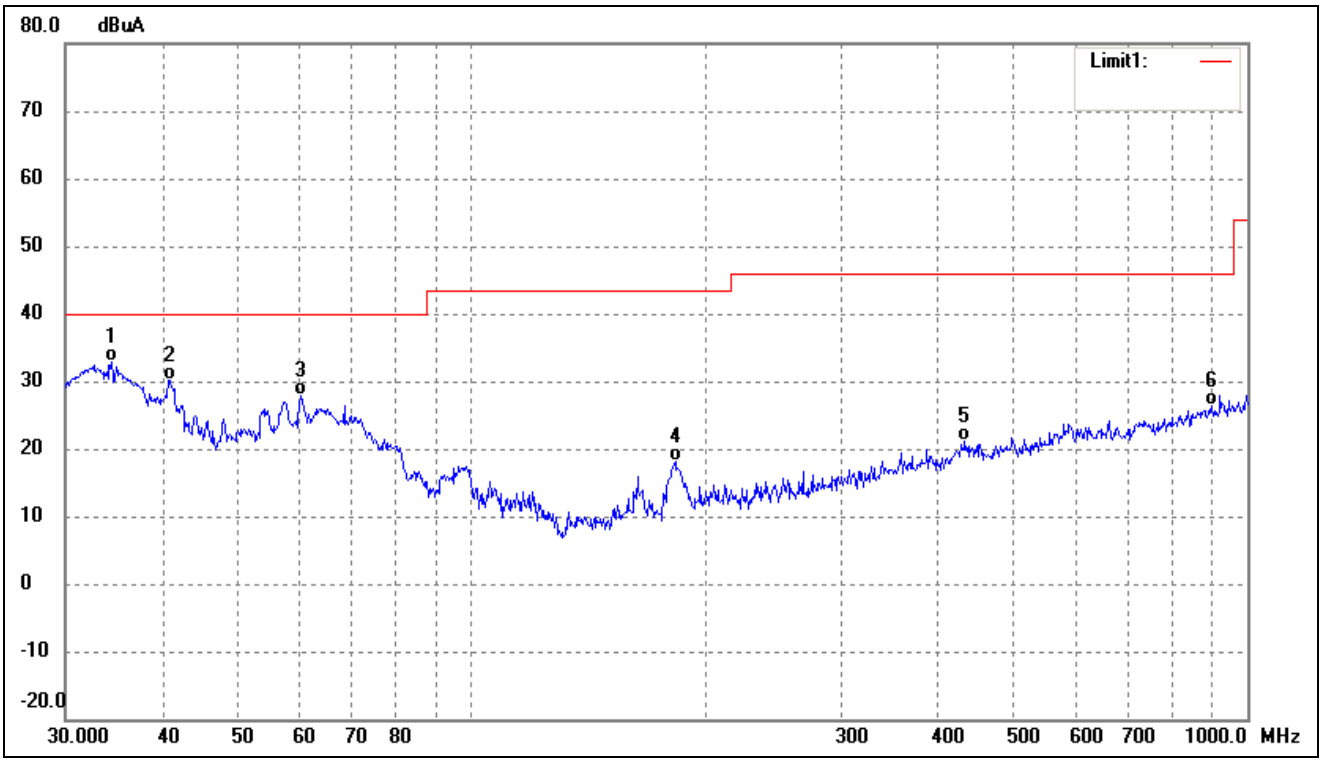
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuA)	dB	(dBuA)	(dBuA)	(dB)	( )	(cm)	
1	37.1550	46.12	-12.99	33.13	40.00	-6.87	-	-	QP
2	63.3132	43.84	-13.82	30.02	40.00	-9.98	-	-	QP
3	95.4270	31.64	-14.21	17.43	43.50	-26.07	-	-	QP
4	184.4898	31.11	-14.07	17.04	43.50	-26.46	-	-	QP
5	435.5898	26.75	-6.20	20.55	46.00	-25.45	-	-	QP
6	774.1584	27.31	-2.40	24.91	46.00	-21.09	-	-	QP

802.11b_11Mbps			
Test Channel	High	Polarity:	Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuA)	dB	(dBuA)	(dBuA)	(dB)	( )	(cm)	
1	32.4059	31.68	-13.98	17.70	40.00	-22.30	-	-	QP
2	62.2128	30.17	-13.66	16.51	40.00	-23.49	-	-	QP
3	183.2005	27.07	-14.22	12.85	43.50	-30.65	-	-	QP
4	446.4141	26.99	-6.31	20.68	46.00	-25.32	-	-	QP
5	651.9417	27.87	-4.24	23.63	46.00	-22.37	-	-	QP
6	968.9338	27.15	0.25	27.40	54.00	-26.60	-	-	QP

802.11b_11Mbps			
Test Channel	High	Polarity:	Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuA)	dB	(dBuA)	(dBuA)	(dB)	( )	(cm)	
1	34.3964	46.26	-13.49	32.77	40.00	-7.23	-	-	QP
2	40.8446	42.45	-12.31	30.14	40.00	-9.86	-	-	QP
3	60.2801	41.21	-13.37	27.84	40.00	-12.16	-	-	QP
4	183.2005	32.27	-14.22	18.05	43.50	-25.45	-	-	QP
5	432.5457	27.40	-6.19	21.21	46.00	-24.79	-	-	QP
6	900.1474	27.02	-0.57	26.45	46.00	-19.55	-	-	QP

Remark: '-'Means' the test Degree and Height is not recorded by the test software and only show the worst case in the test report.

- Spurious Emissions Above 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							
4824.00	65.19	-3.86	61.33	74	-12.67	H	PK
4824.00	43.37	-3.86	39.51	54	-14.49	H	AV
7236.00	57.89	1.10	58.99	74	-15.01	H	PK
7236.00	40.13	1.10	41.23	54	-12.77	H	AV
4824.00	61.41	-3.86	57.55	74	-16.45	V	PK
4824.00	40.70	-3.86	36.84	54	-17.16	V	AV
7236.00	57.82	1.10	58.92	74	-15.08	V	PK
7236.00	41.95	1.10	43.05	54	-10.95	V	AV
Middle Channel-2437MHz							
4874.00	64.48	-3.74	60.74	74	-13.26	H	PK
4874.00	42.78	-3.74	39.04	54	-14.96	H	AV
7311.00	58.18	1.47	59.65	74	-14.35	H	PK
7311.00	39.48	1.47	40.95	54	-13.05	H	AV
4874.00	65.27	-3.74	61.53	74	-12.47	V	PK
4874.00	43.21	-3.74	39.47	54	-14.53	V	AV
7311.00	57.09	1.47	58.56	74	-15.44	V	PK
7311.00	37.97	1.47	39.44	54	-14.56	V	AV
High Channel-2462MHz							
4924.00	63.99	-3.63	60.36	74	-13.64	H	PK
4924.00	41.48	-3.63	37.85	54	-16.15	H	AV
7386.00	57.41	1.62	59.03	74	-14.97	H	PK
7386.00	43.54	1.62	45.16	54	-8.84	H	AV
4924.00	62.37	-3.63	58.74	74	-15.26	V	PK
4924.00	37.55	-3.63	33.92	54	-20.08	V	AV
7386.00	54.89	1.62	56.51	74	-17.49	V	PK
7386.00	40.44	1.62	42.06	54	-11.94	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 558074 D01 v05r02 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 v05r02 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

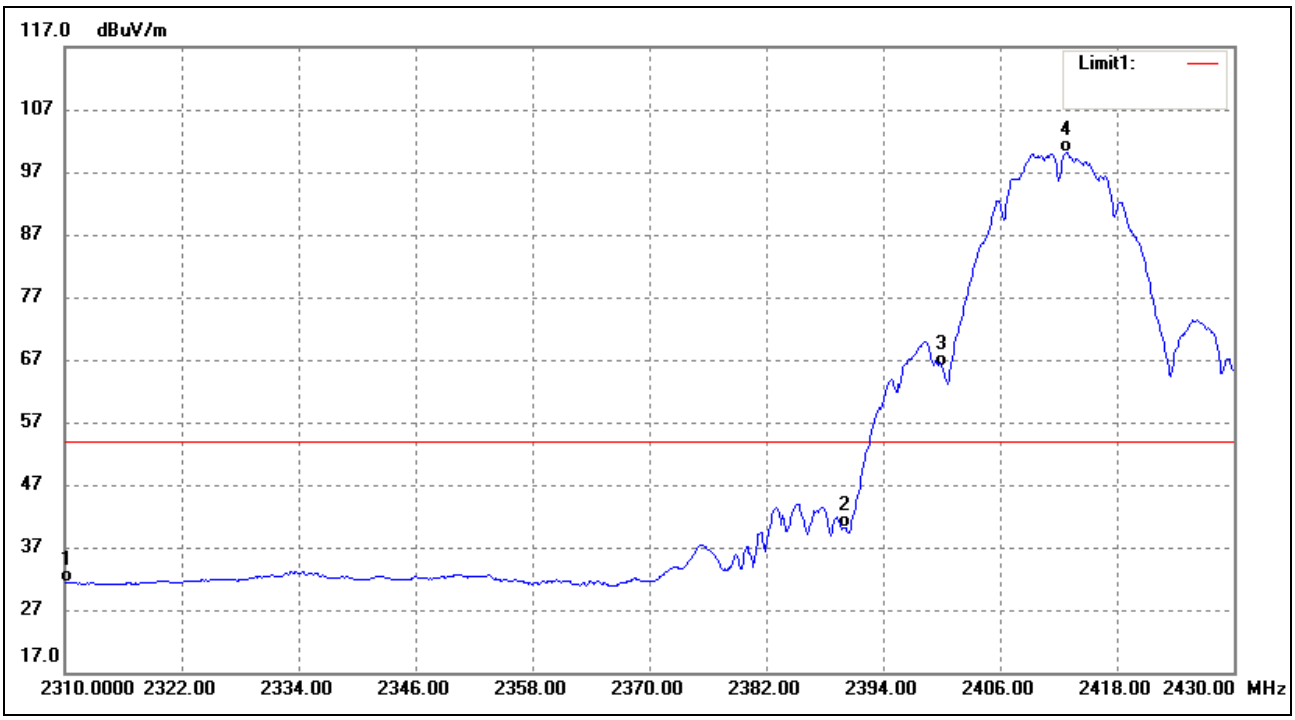
If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

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

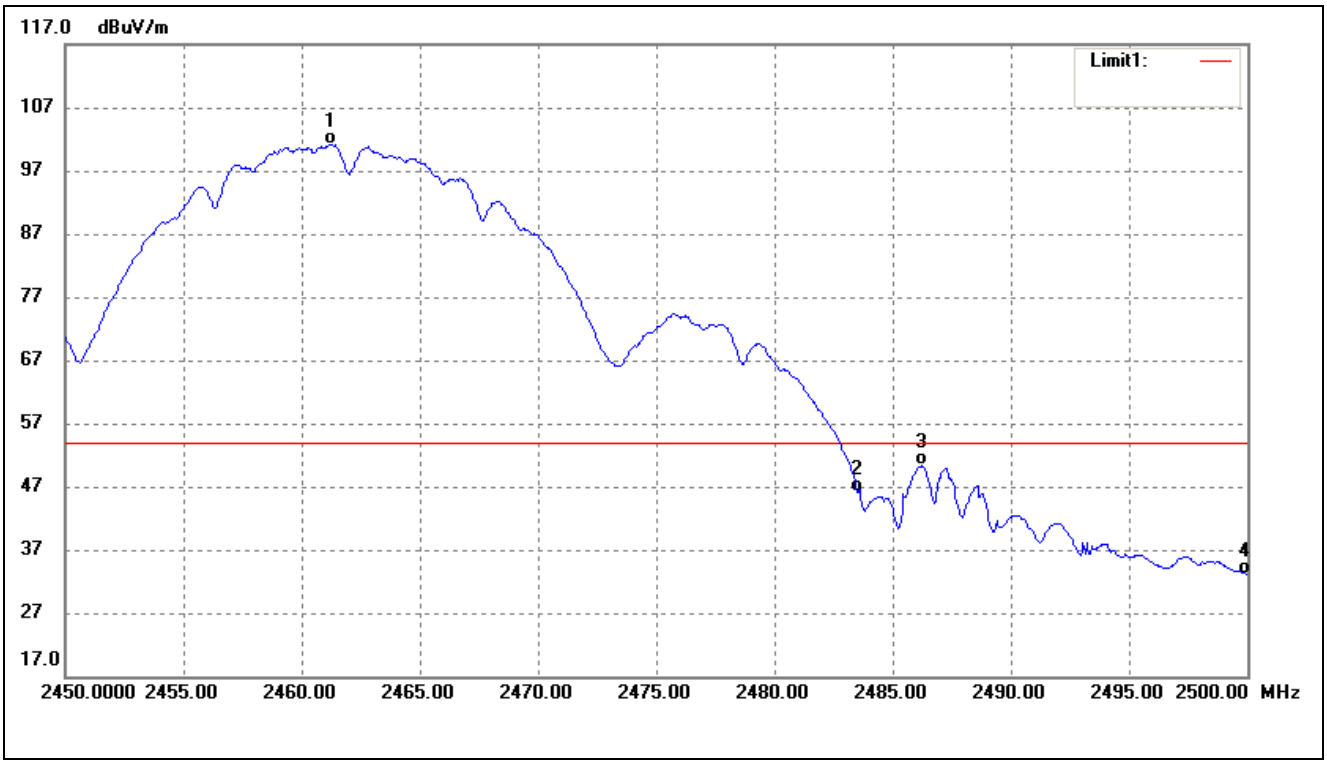
➢ Radiated test

802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal worst case)



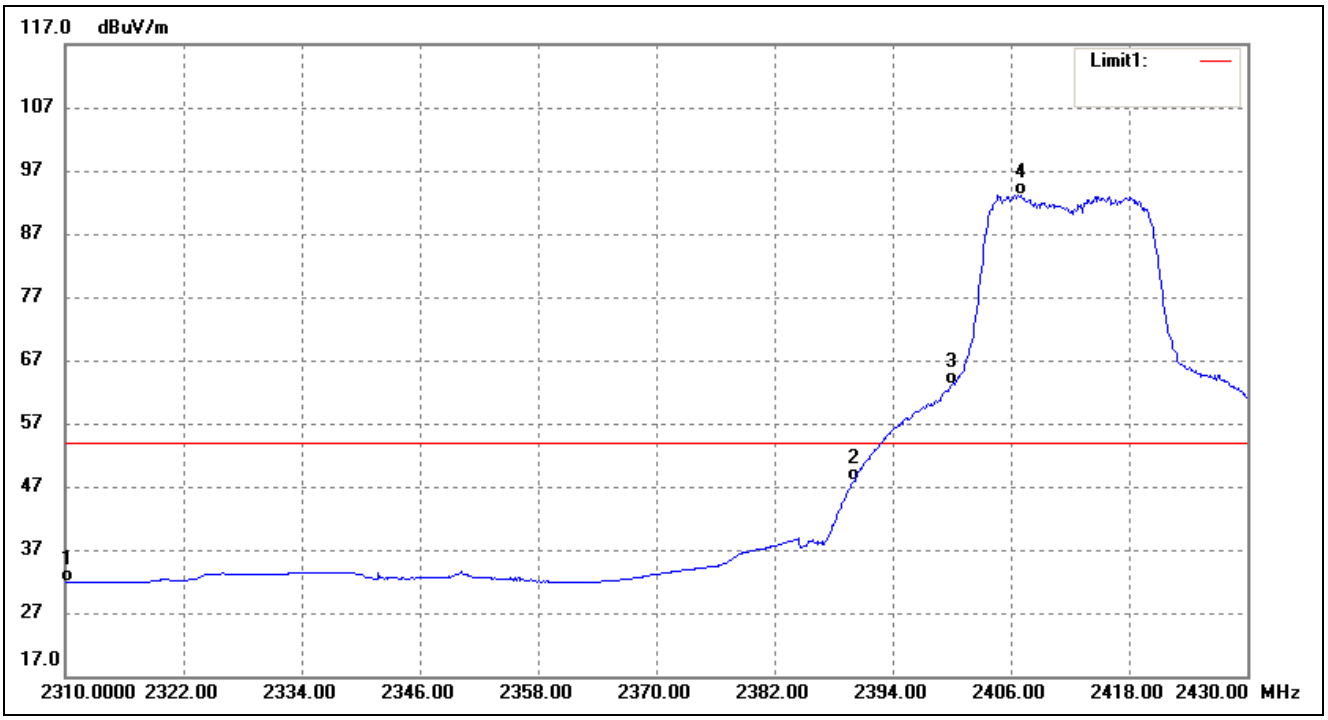
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	41.02	-9.66	31.36	54.00	-22.64	Average Detector
	2310.000	51.68	-9.66	42.02	74.00	-31.98	Peak Detector
2	2390.000	49.69	-9.50	40.19	54.00	-13.81	Average Detector
	2390.000	60.78	-9.50	51.28	74.00	-22.72	Peak Detector
3	2400.000	75.48	-9.48	66.00	Delta=34.25dBc		Average Detector
4	2412.840	109.71	-9.46	100.25			Average Detector

802.11b_11Mbps			
Test Channel	High	Polarity:	Horizontal worst case)



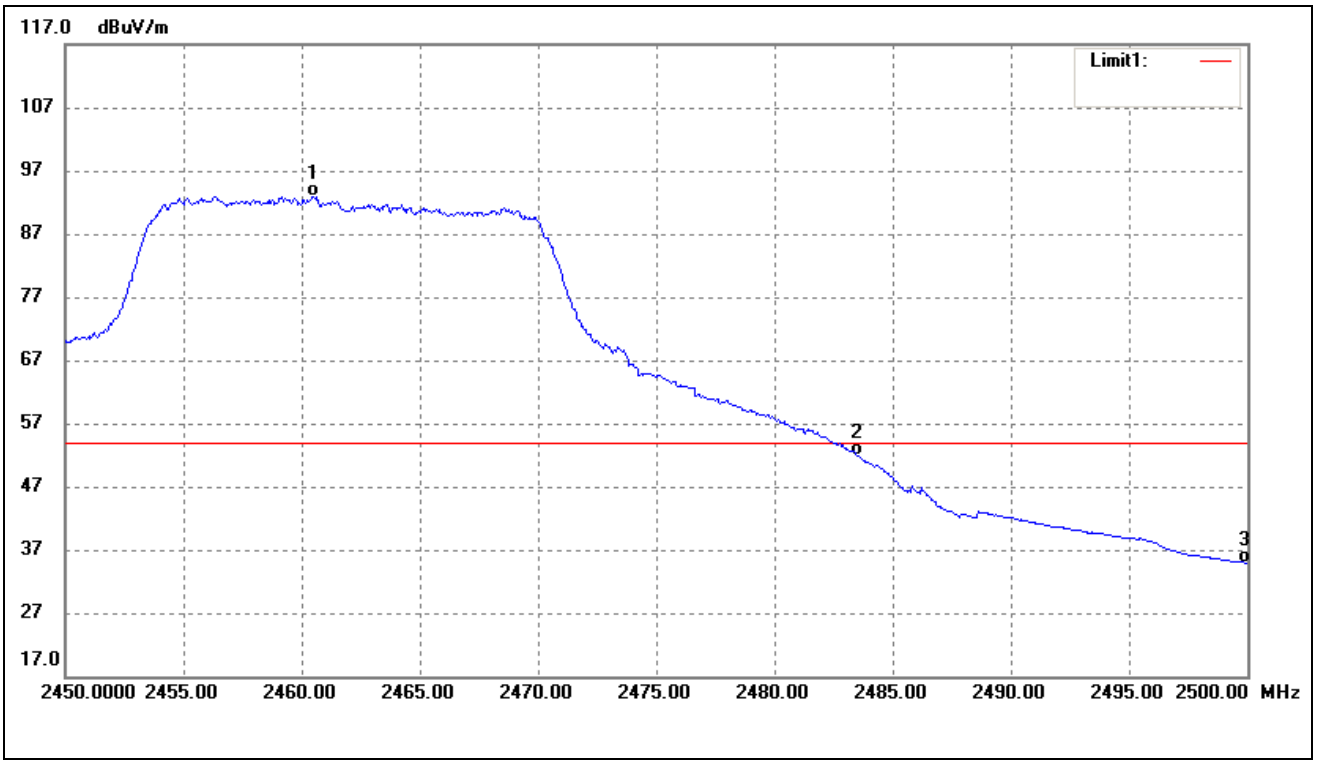
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2461.200	110.59	-9.36	101.23	/	/	Average Detector
	2460.850	115.60	-9.36	106.24	/	/	Peak Detector
2	2483.500	55.55	-9.31	46.24	54.00	-7.76	Average Detector
	2483.500	65.35	-9.31	56.04	74.00	-17.96	Peak Detector
3	2486.200	59.59	-9.31	50.28	54.00	-3.72	Average Detector
	2486.200	73.84	-9.31	64.53	74.00	-9.47	Peak Detector
4	2500.000	42.44	-9.28	33.16	54.00	-20.84	Average Detector
	2500.000	53.94	-9.28	44.66	74.00	-29.34	Peak Detector

802.11g_54Mbps			
Test Channel	Low	Polarity:	Horizontal worst case)



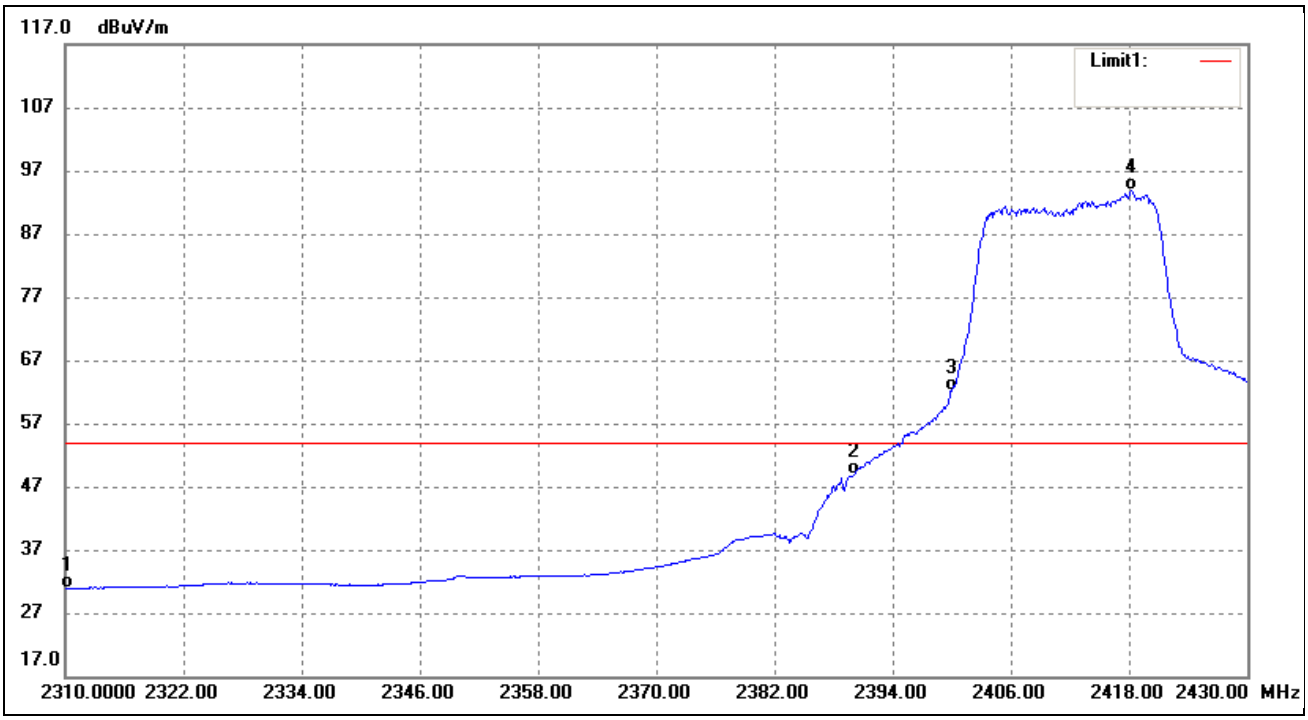
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	41.58	-9.66	31.92	54.00	-22.08	Average Detector
	2310.000	54.01	-9.66	44.35	74.00	-29.65	Peak Detector
2	2390.000	57.28	-9.50	47.78	54.00	-6.22	Average Detector
	2390.000	78.50	-9.50	69.00	74.00	-5.00	Peak Detector
3	2400.000	72.53	-9.48	63.05	Delta=30.18dBc		Average Detector
4	2406.960	102.70	-9.47	93.23			Average Detector

802.11g_54Mbps			
Test Channel	High	Polarity:	Horizontal worst case)



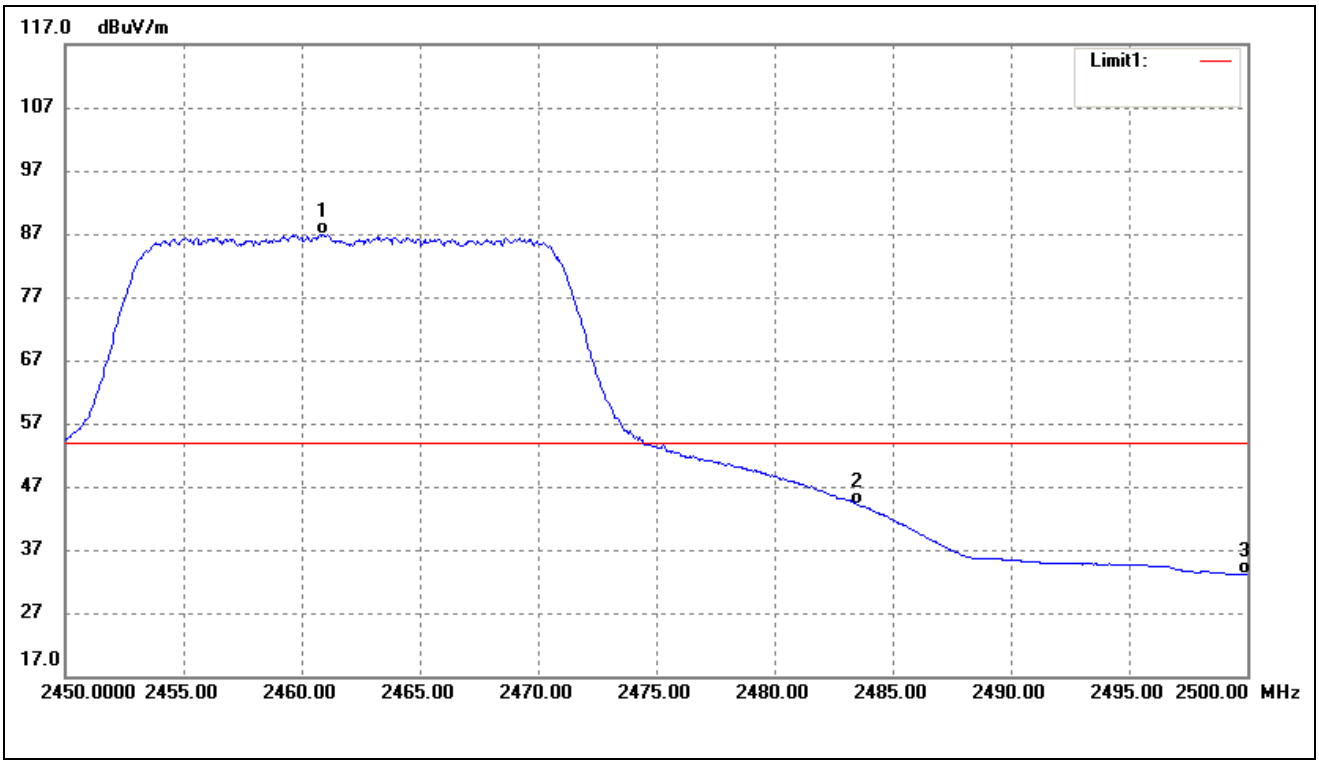
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2460.500	102.22	-9.36	92.86	/	/	Average Detector
	2466.400	110.98	-9.35	101.63	/	/	Peak Detector
2	2483.500	61.24	-9.31	51.93	54.00	-2.07	Average Detector
	2483.500	76.74	-9.31	67.43	74.00	-6.57	Peak Detector
3	2500.000	44.28	-9.28	35.00	54.00	-19.00	Average Detector
	2500.000	54.59	-9.28	45.31	74.00	-28.69	Peak Detector

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



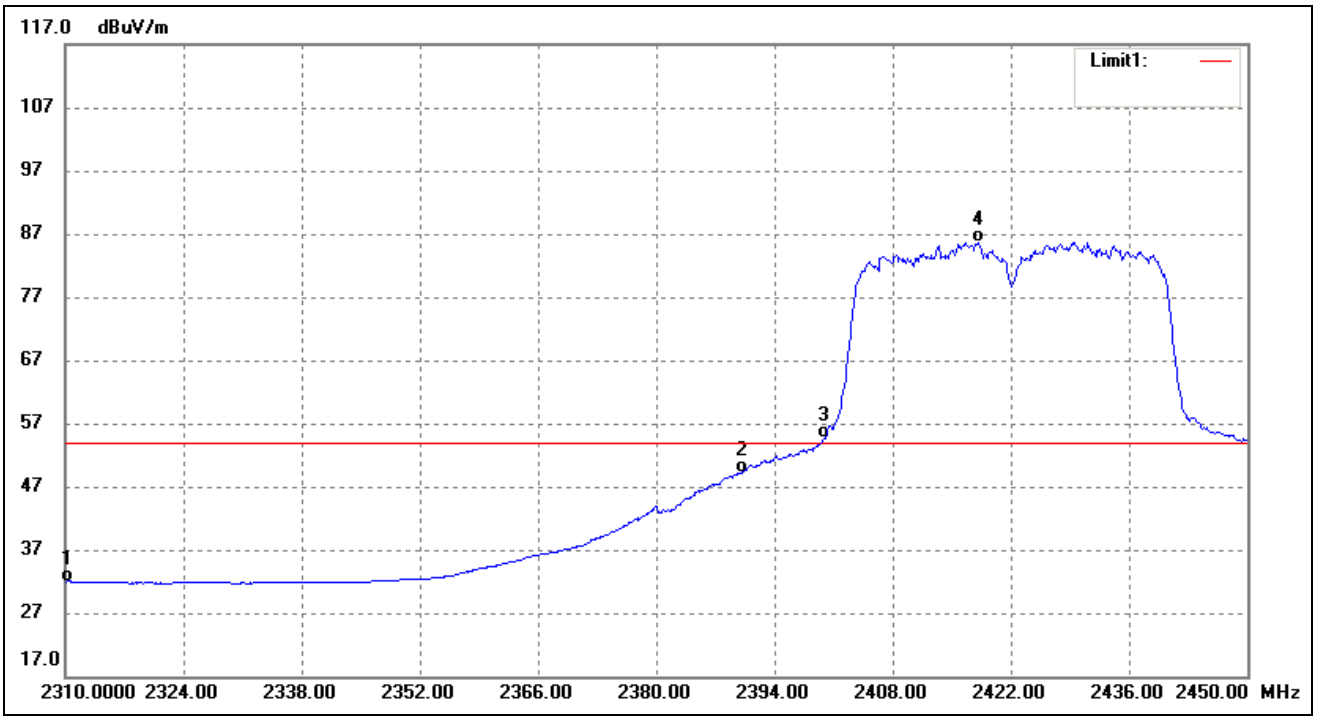
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	40.60	-9.66	30.94	54.00	-23.06	Average Detector
	2310.000	54.32	-9.66	44.66	74.00	-29.34	Peak Detector
2	2390.000	58.38	-9.50	48.88	54.00	-5.12	Average Detector
	2390.000	77.44	-9.50	67.94	74.00	-6.06	Peak Detector
3	2400.000	71.49	-9.48	62.01	Delta=31.9dBc		Average Detector
4	2418.240	103.35	-9.44	93.91			Average Detector

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



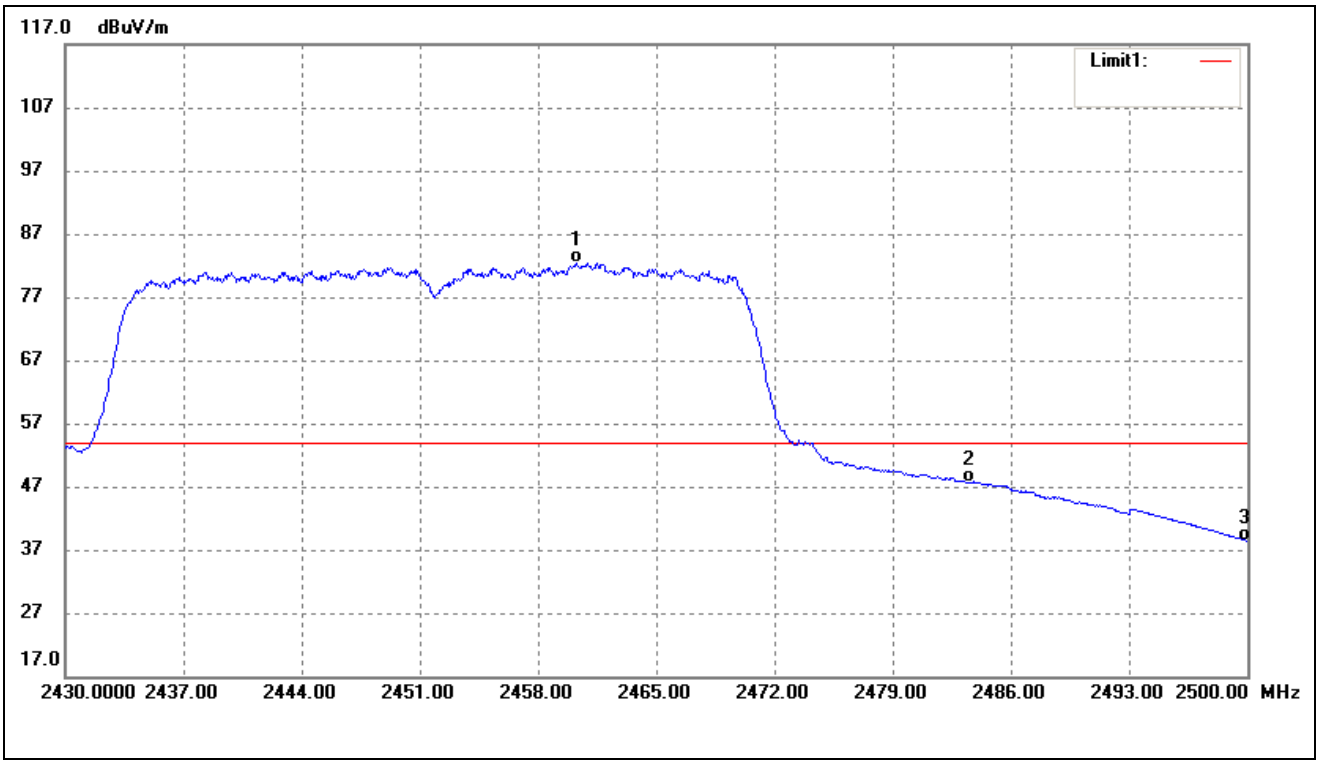
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2460.900	96.24	-9.36	86.88	/	/	Average Detector
	2463.550	109.11	-9.35	99.76	/	/	Peak Detector
2	2483.500	53.53	-9.31	44.22	54.00	-9.78	Average Detector
	2483.500	72.78	-9.31	63.47	74.00	-10.53	Peak Detector
3	2500.000	42.29	-9.28	33.01	54.00	-20.99	Average Detector
	2500.000	54.58	-9.28	45.30	74.00	-28.70	Peak Detector

802.11n-HT40_MCS7			
Test Channel	Low	Polarity:	Horizontal worst case)



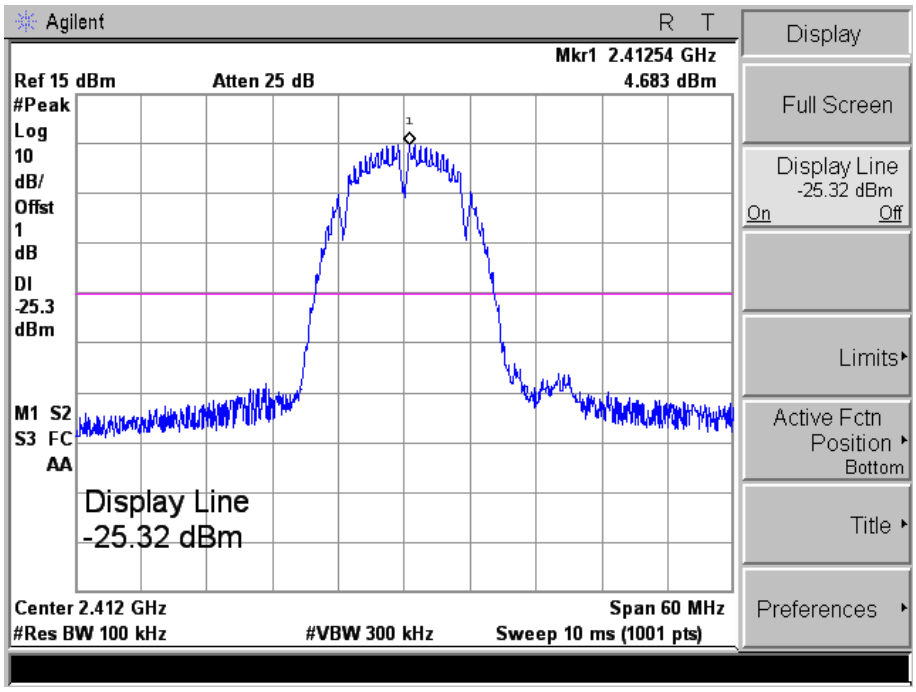
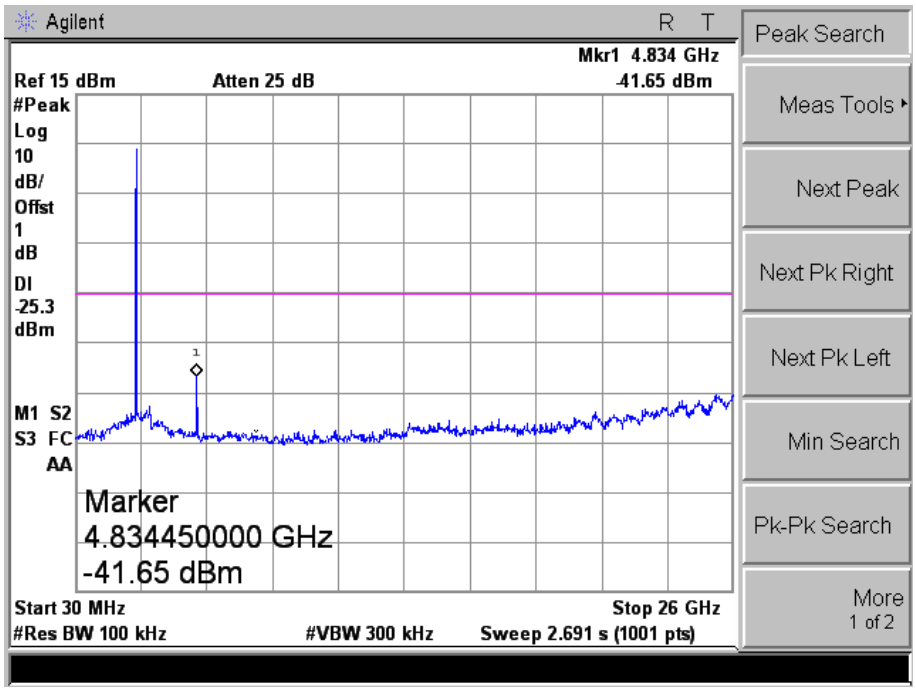
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	41.66	-9.66	32.00	54.00	-22.00	Average Detector
	2310.000	53.26	-9.66	43.60	74.00	-30.40	Peak Detector
2	2390.000	58.69	-9.50	49.19	54.00	-4.81	Average Detector
	2390.000	77.74	-9.50	68.24	74.00	-5.76	Peak Detector
3	2400.000	64.10	-9.48	54.62	Delta=31.09dBc		Average Detector
4	2418.220	95.15	-9.44	85.71			Average Detector

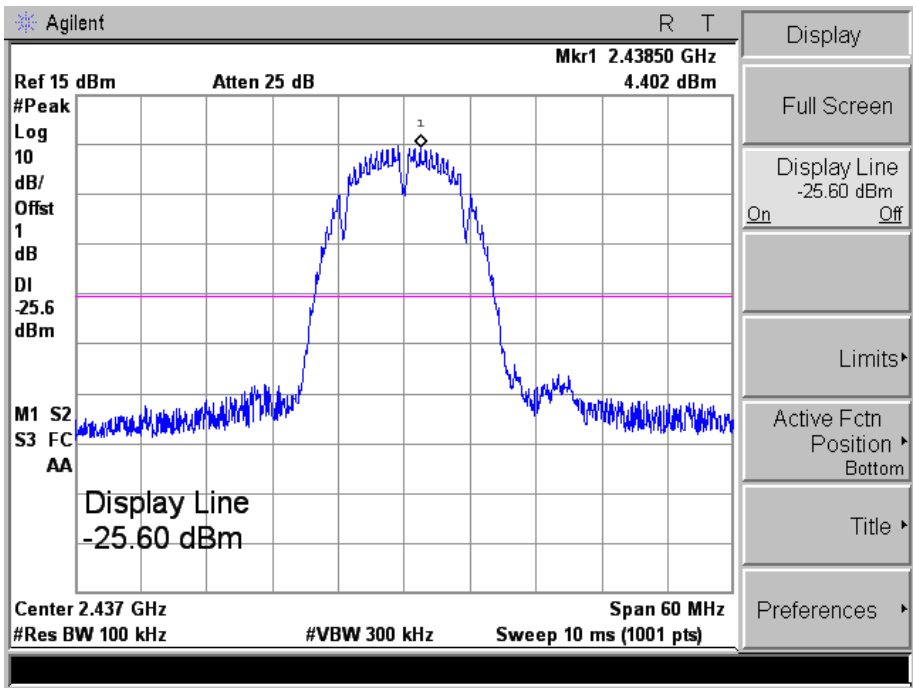
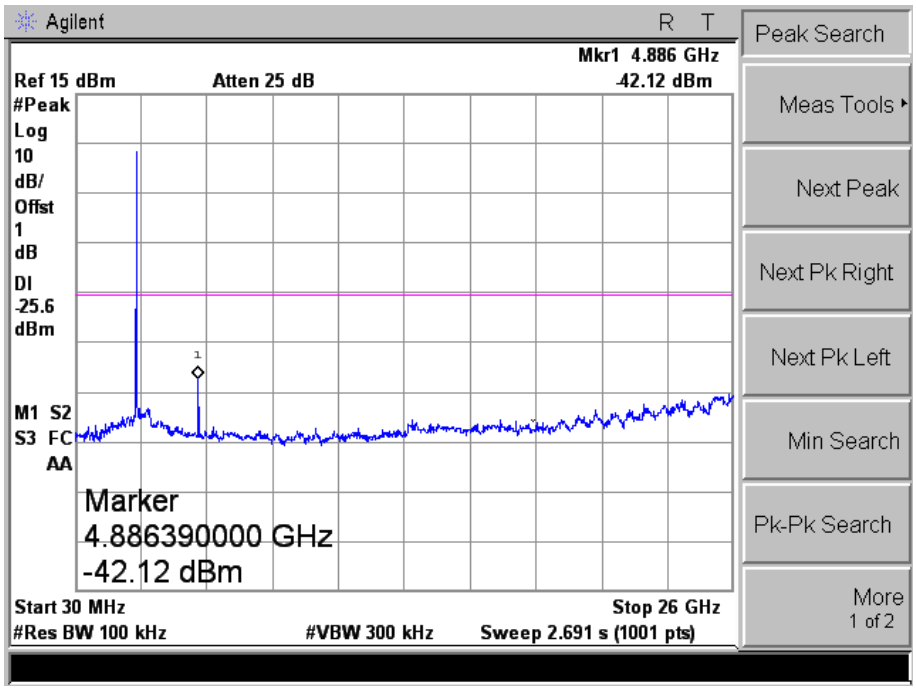
802.11n-HT40_MCS7			
Test Channel	High	Polarity:	Horizontal worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2460.240	91.83	-9.36	82.47	/	/	Average Detector
	2460.380	107.08	-9.36	97.72	/	/	Peak Detector
2	2483.500	56.85	-9.31	47.54	54.00	-6.46	Average Detector
	2483.500	76.28	-9.31	66.97	74.00	-7.03	Peak Detector
3	2500.000	47.72	-9.28	38.44	54.00	-15.56	Average Detector
	2500.000	68.01	-9.28	58.73	74.00	-15.27	Peak Detector

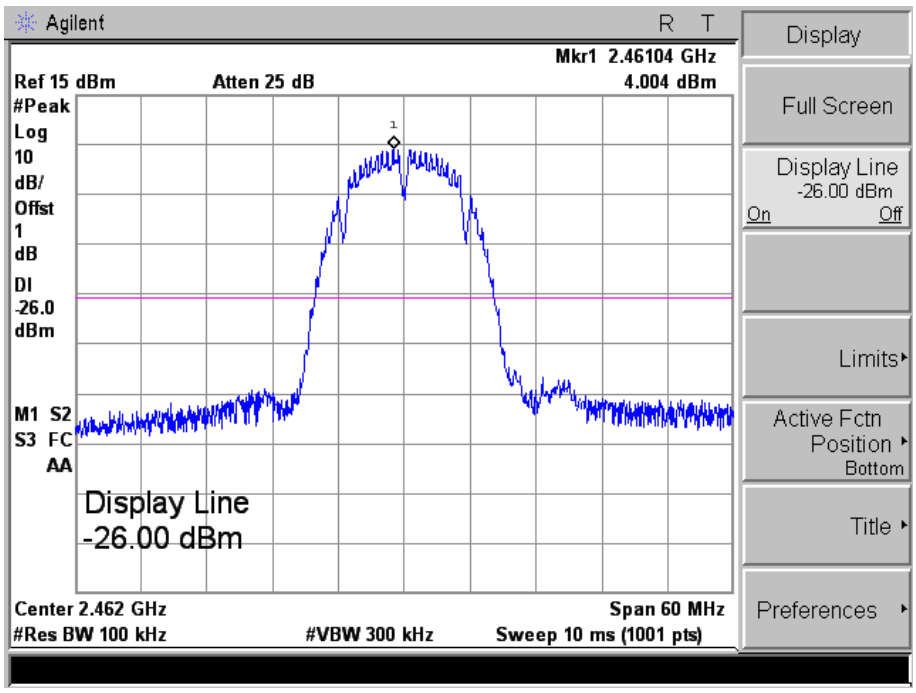
➢ Conducted test

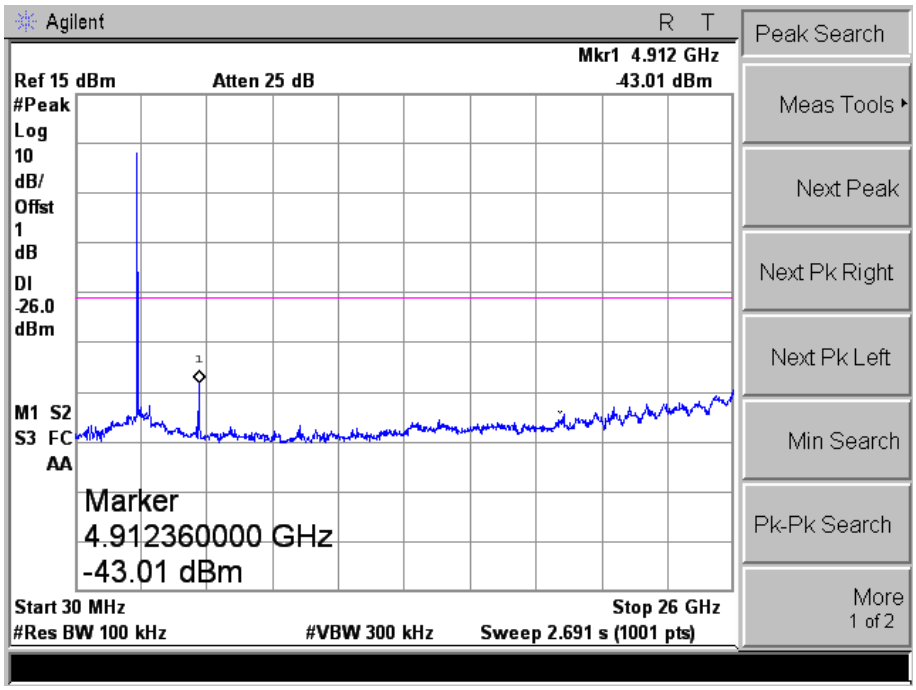
802.11b_11Mbps	
Low	 

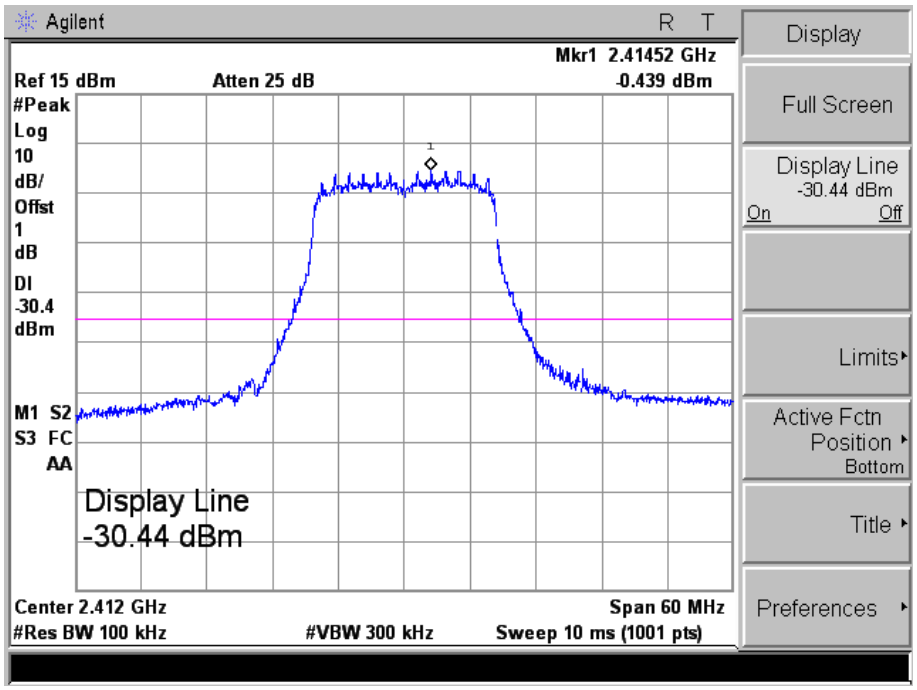
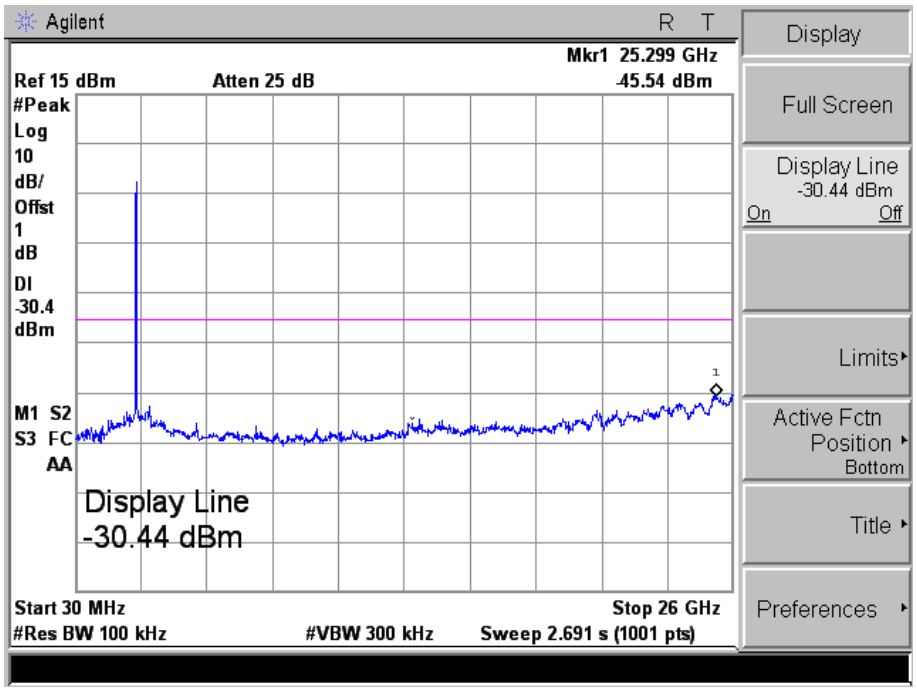
802.11b_11Mbps	
Middle	 

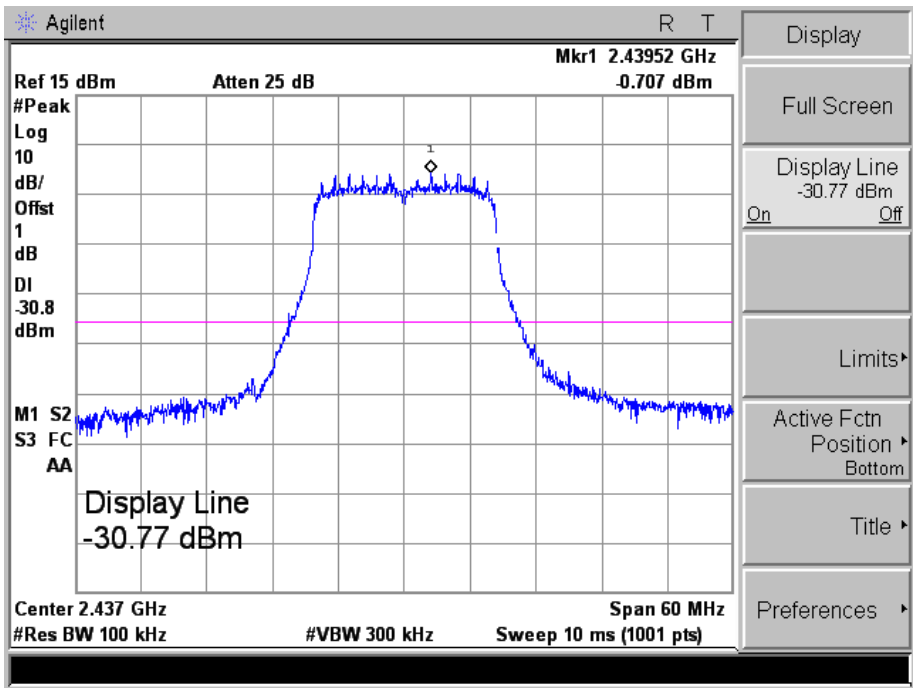
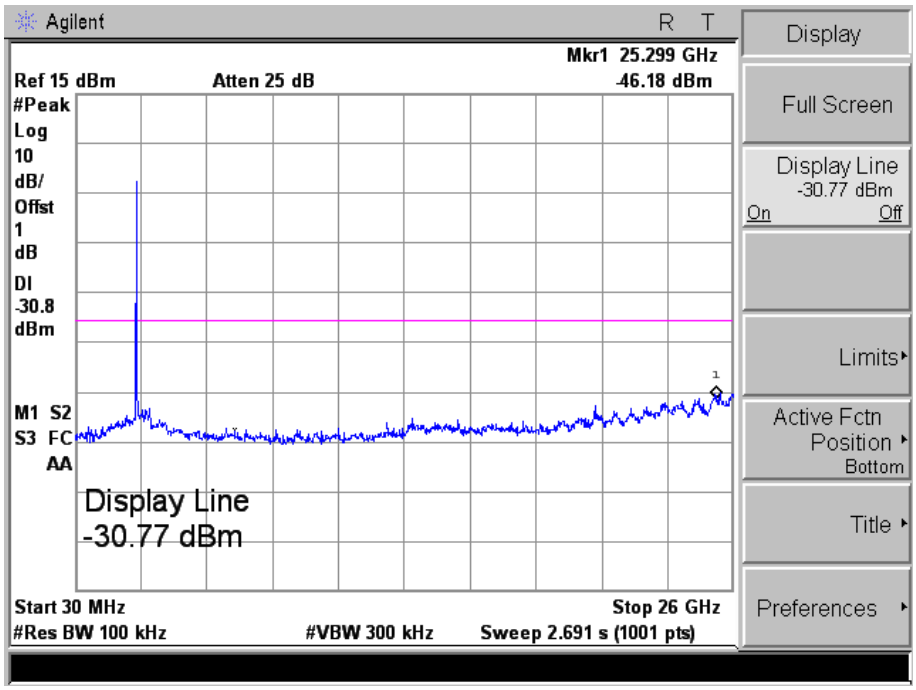
802.11b_11Mbps

High



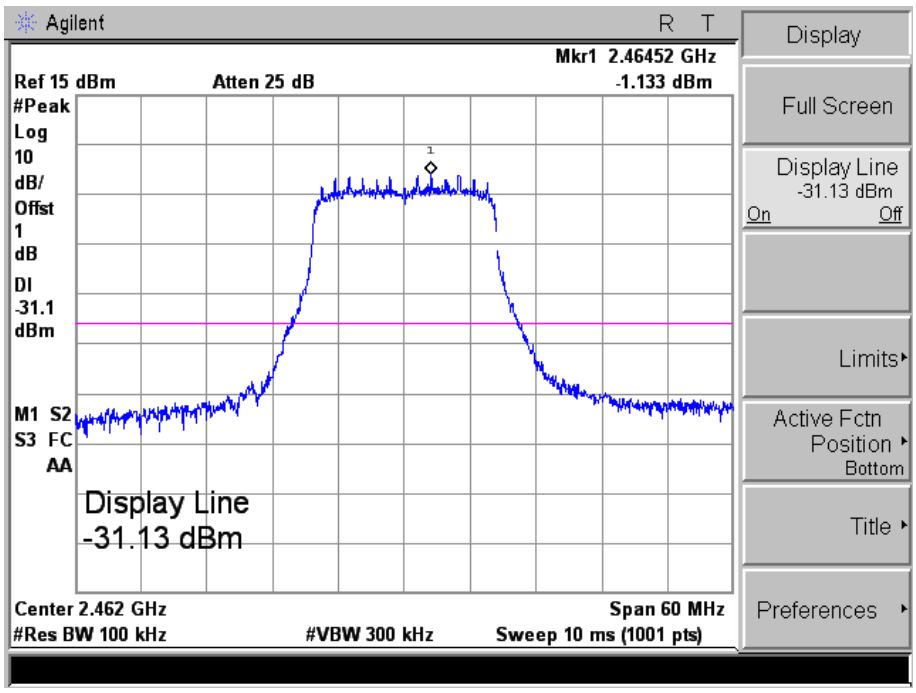


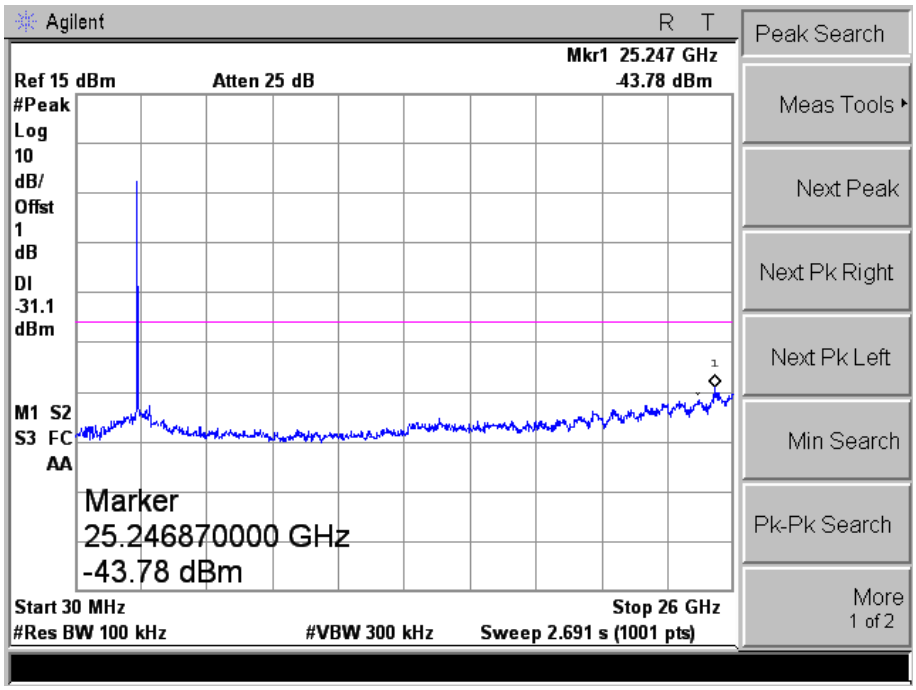
802.11g_54Mbps	
Low	 

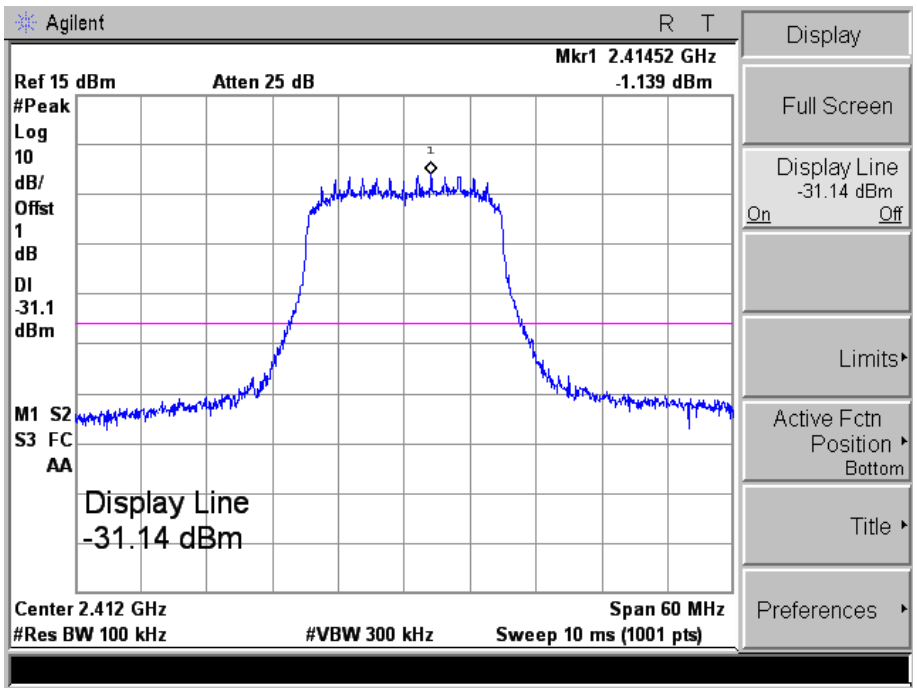
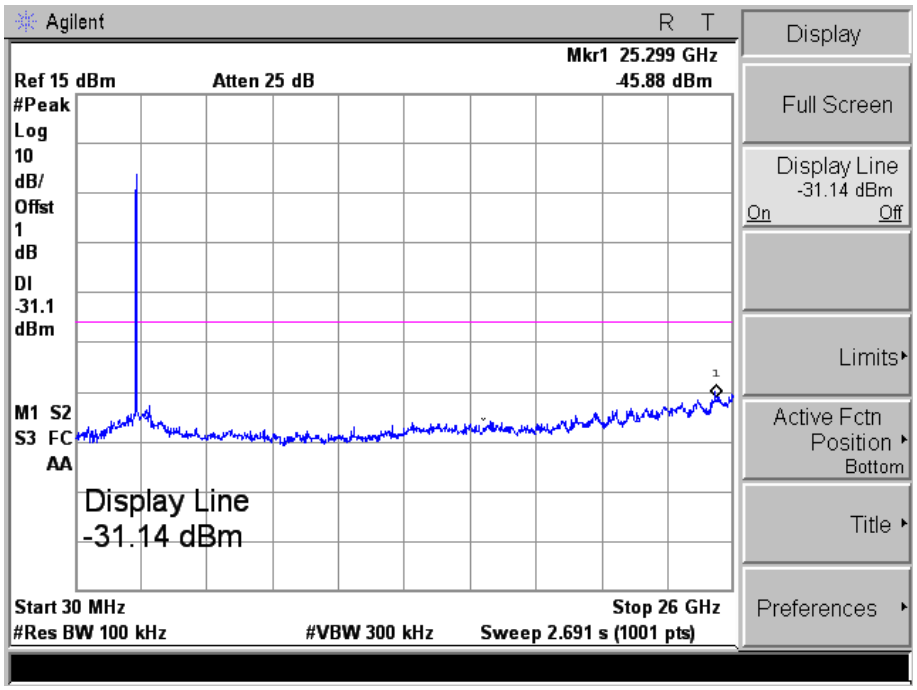
802.11g_54Mbps	
Middle	 

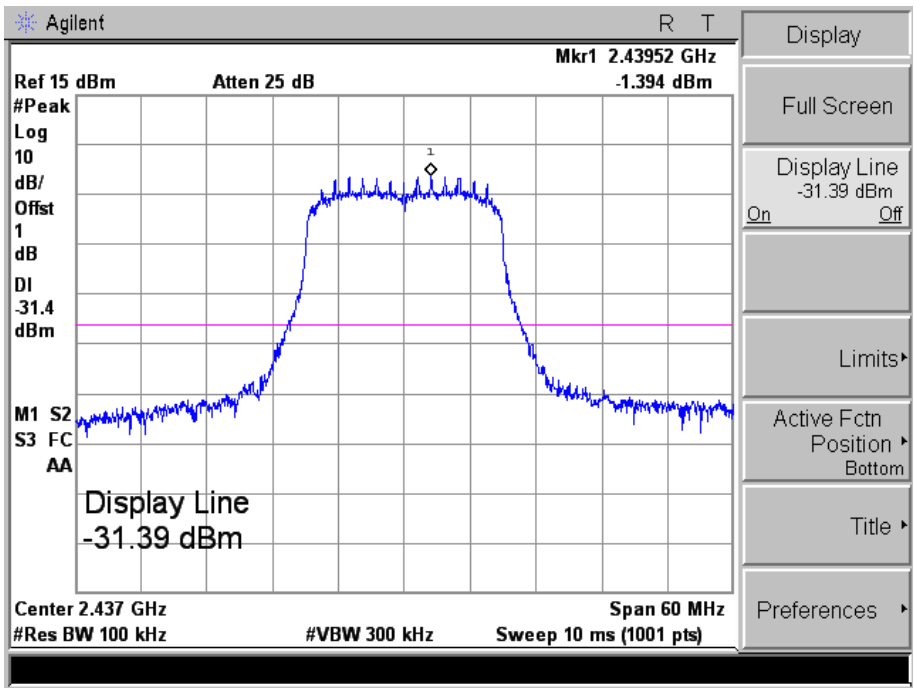
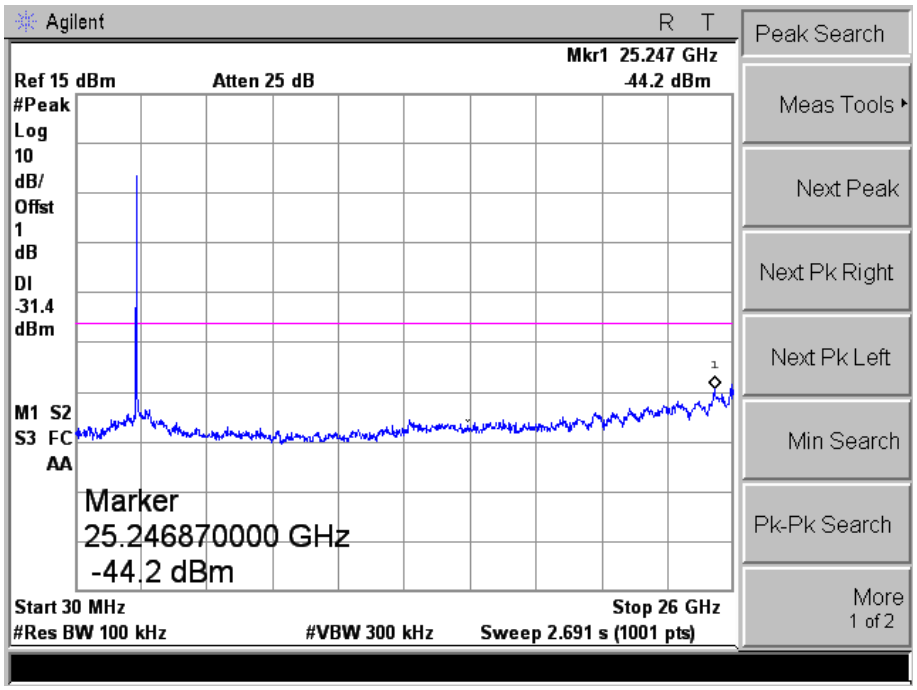
802.11g_54Mbps

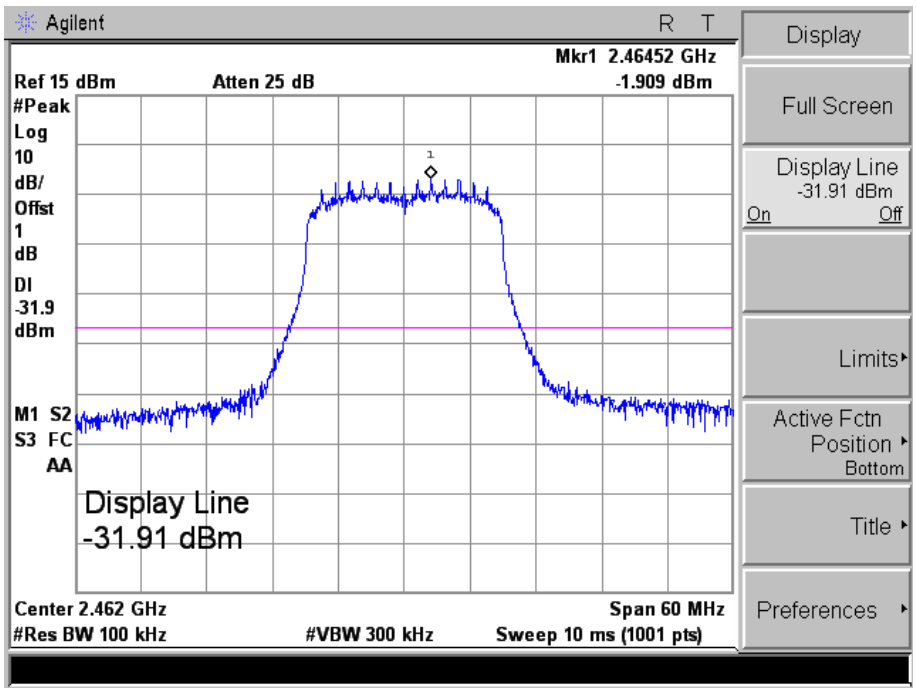
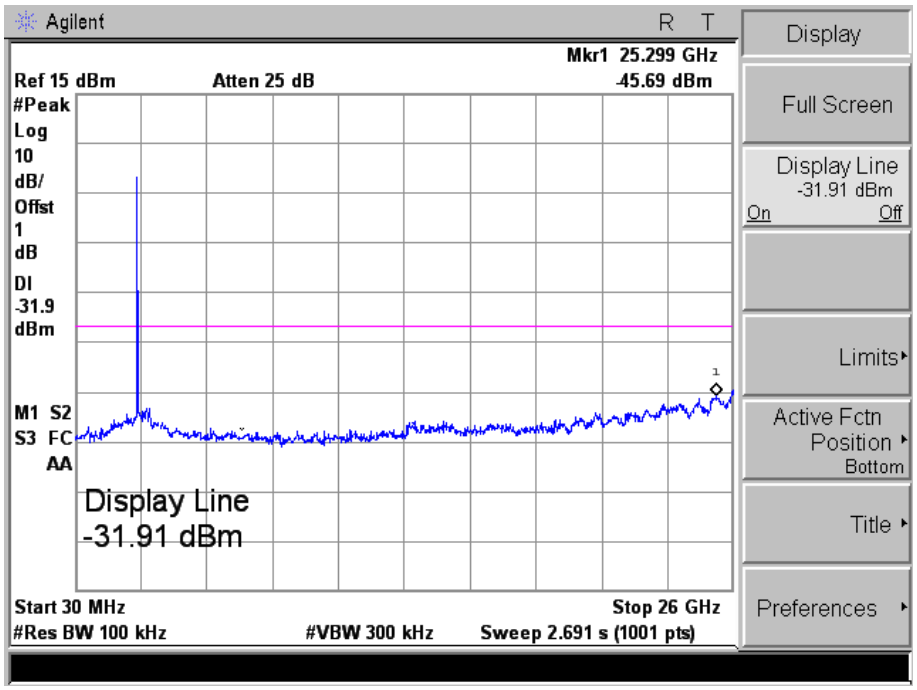
High

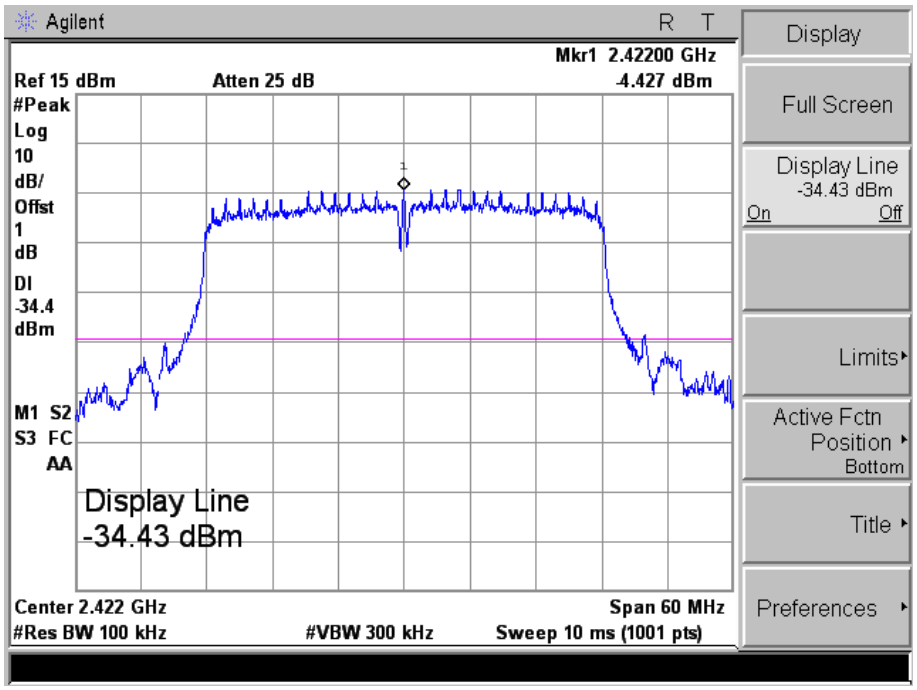
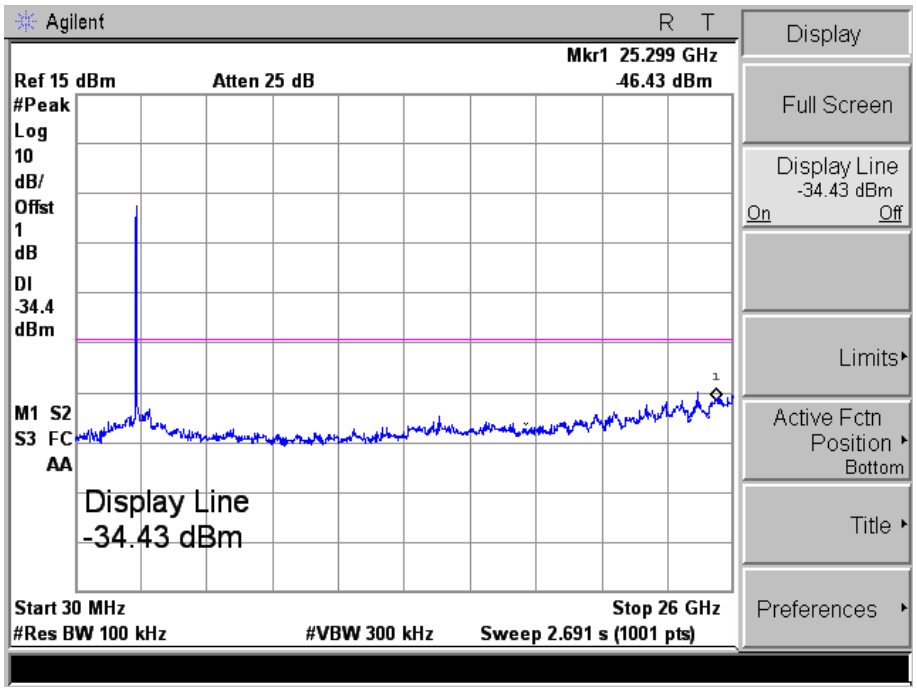


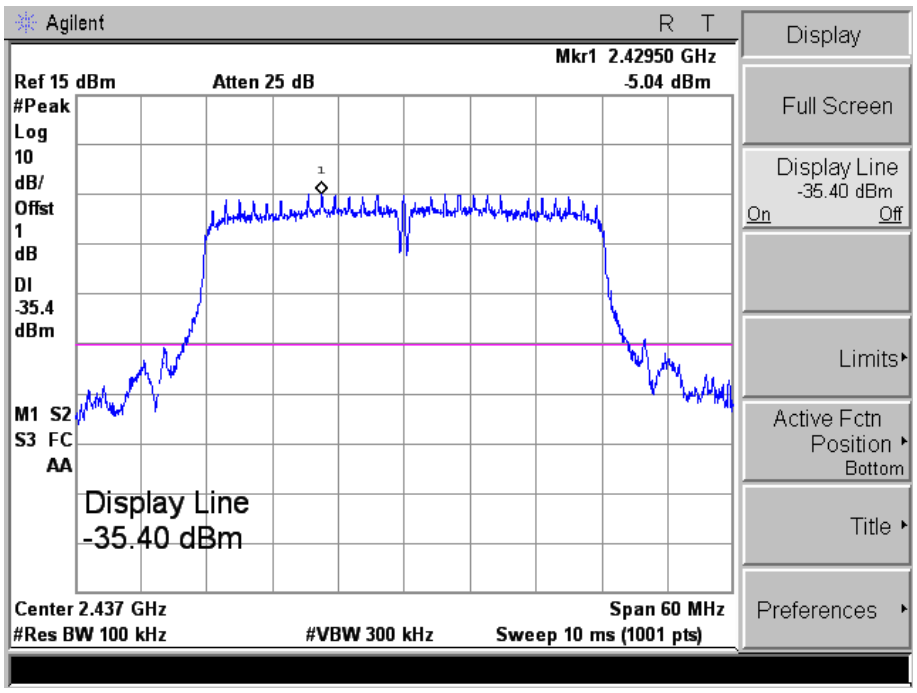
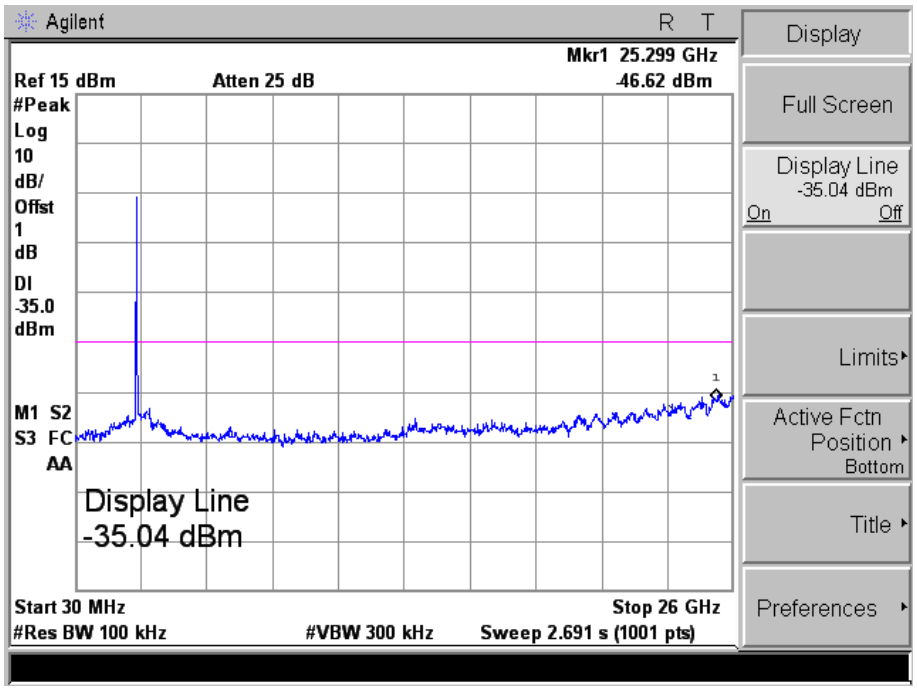


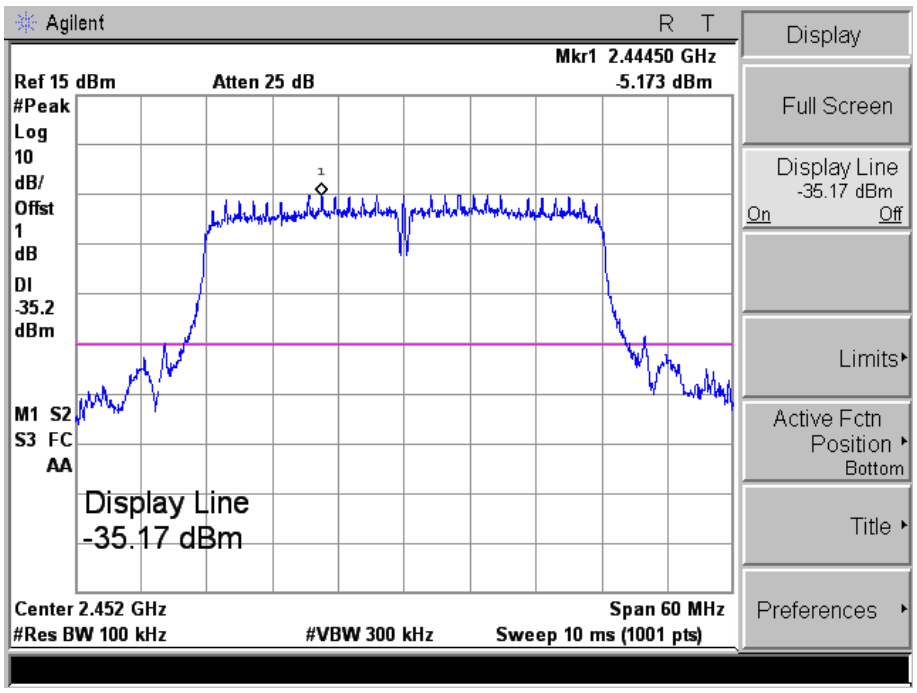
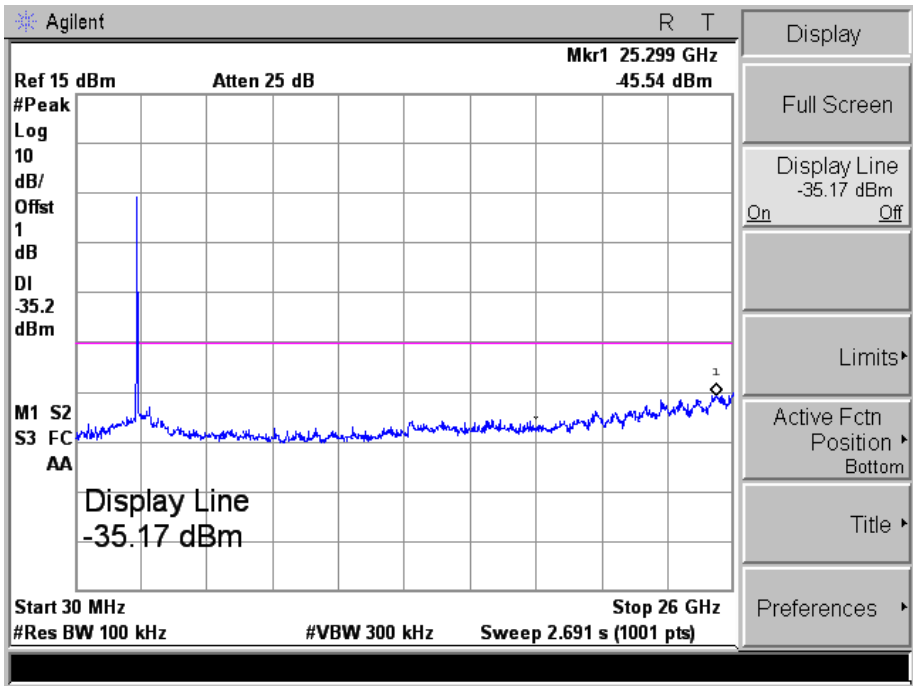
802.11n-HT20_MCS7	
Low	 

802.11n-HT20_MCS7	
Middle	 

802.11n-HT20_MCS7	
High	 

802.11n-HT40_MCS7	
Low	 

802.11n-HT40_MCS7	
Middle	 

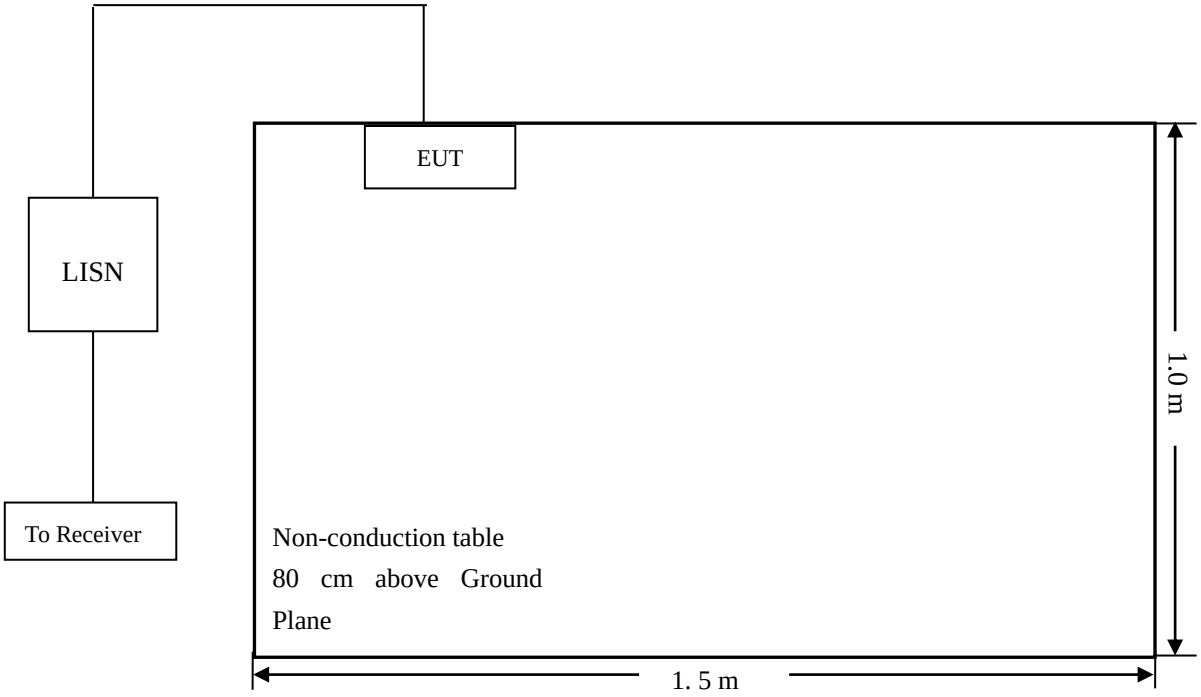
802.11n-HT40_MCS7	
High	 

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



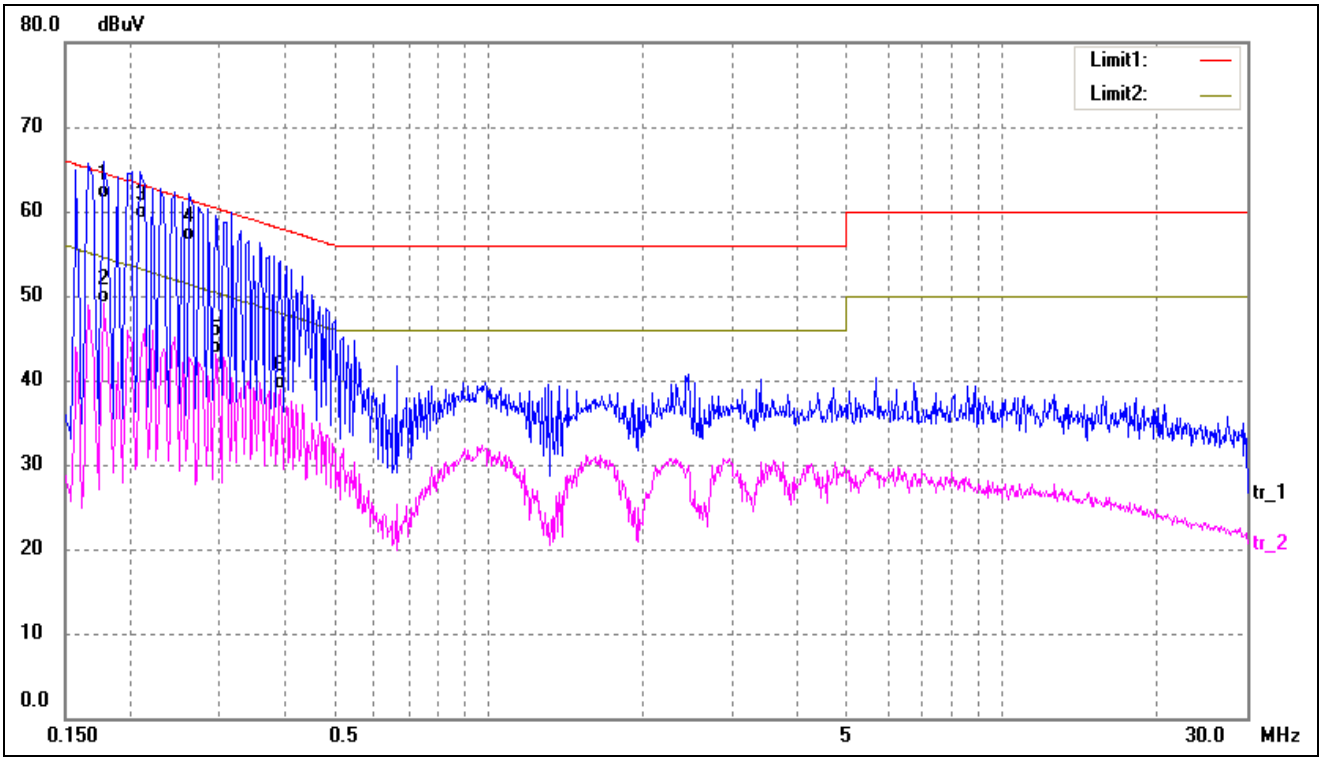
10.3 Test Receiver Setup

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

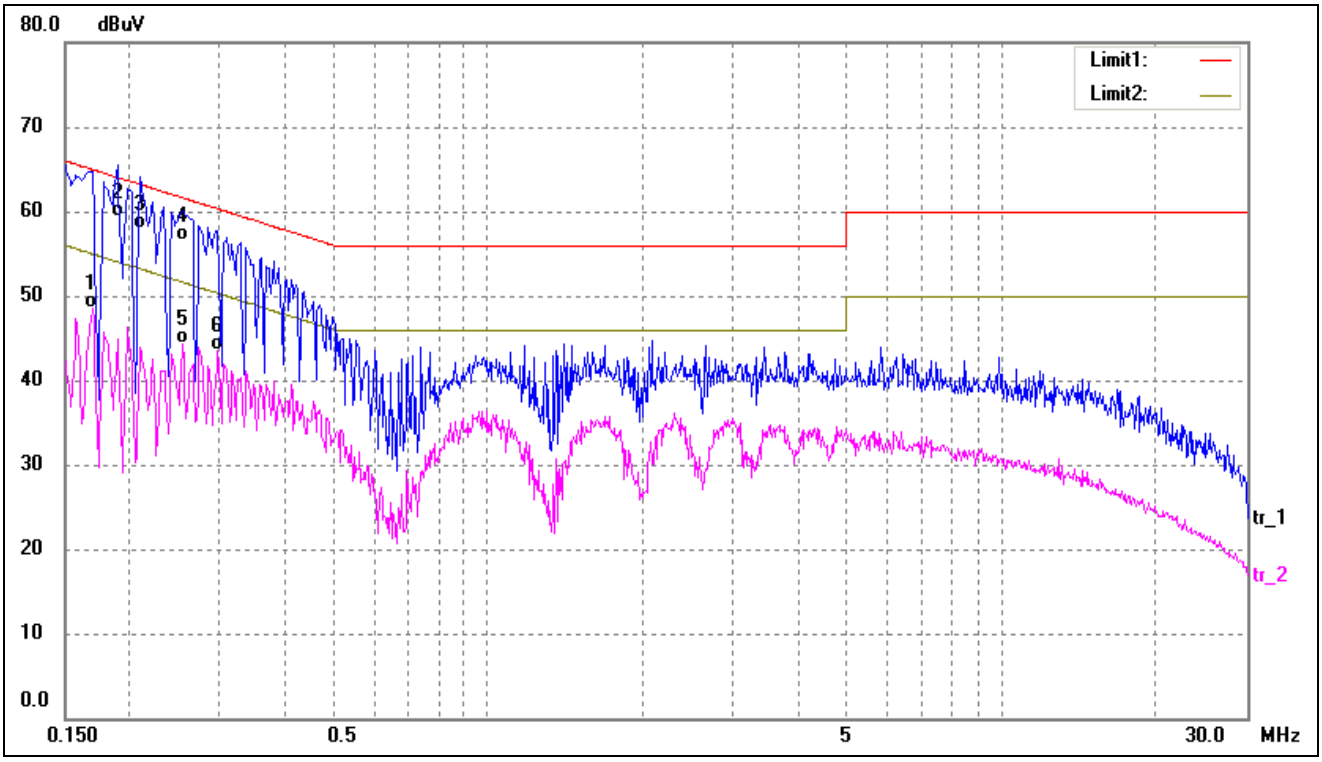
10.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.1780	51.53	9.96	61.49	64.57	-3.08	QP
2	0.1780	39.22	9.96	49.18	54.57	-5.39	AVG
3	0.2100	49.03	9.98	59.01	63.20	-4.19	QP
4	0.2620	46.55	10.02	56.57	61.36	-4.79	QP
5	0.2940	33.08	10.01	43.09	50.41	-7.32	AVG
6	0.3940	28.95	10.01	38.96	47.98	-9.02	AVG

Test Mode	Communication	AC120V 60Hz	Polarity:	Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1700	38.54	9.95	48.49	54.96	-6.47	AVG
2*	0.1900	49.37	9.96	59.33	64.04	-4.71	QP
3	0.2100	47.98	9.98	57.96	63.21	-5.25	QP
4	0.2540	46.41	10.02	56.43	61.63	-5.20	QP
5	0.2540	34.25	10.02	44.27	51.63	-7.36	AVG
6	0.2980	33.41	10.01	43.42	50.30	-6.88	AVG

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