TEST REPORT

Reference No.	:	WTX21X07067229W-1
FCC ID	:	2AUI4-K32-1901-OS
Applicant	:	Universal Ubiquitous Co., Ltd.
Address	:	Room 658, Building 1, No.1, Lvting Road, Cangqian Street, Yuhang District, Hangzhou City
Product Name	:	FACE RECOGNITION TERMINAL
Test Model	:	K32-1901-OS-TDC
Standards	:	FCC Part 15.247
Date of Receipt sample	:	Jul. 07, 2021
Date of Test	:	Jul. 07, 2021 to Jul. 20, 2021
Date of Issue	:	Jul. 20, 2021
Test Result	:	**Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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Report version

Version No.	Date of issue	Description
Rev.00	Jul. 20, 2021	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Universal Ubiquitous Co., Ltd.
Address of applicant:	Room 658, Building 1, No.1, Lvting Road, Cangqian Street, Yuhang District, Hangzhou City
Manufacturer:	Universal Ubiquitous Co., Ltd.
Address of manufacturer:	Room 658, Building 1, No.1, Lvting Road, Cangqian Street, Yuhang District, Hangzhou City

General Description of EUT	
Product Name:	FACE RECOGNITION TERMINAL
Trade Name:	宇泛智能
Model No.:	K32-1901-OS-TDC
Adding Model(s):	K32-1901-OS-T
Rated Voltage:	DC5V
Power Adapter Model:	MODEL: XED-CE050200CU INPUT: AC100-240V, 0.3A, 50/60Hz; OUTPUT: DC5V, 2A 10.0W
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 K32-1901-OS-TDC, 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:	15.59dBm (Conducted)
Type of Modulation:	DBPSK,BPSK,DQPSK,QPSK,16QAM,64QAM
Quantity of Channels:	11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
Channel Separation:	5MHz
Type of Antenna:	FPC Antenna
Antenna Gain:	-0.8dBi

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 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.
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 undersection 15.247 of the Fcc rules.
662911 D01 Multiple Transmitter Output v02r01: Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
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, KDB 662911 D01 Multiple Transmitter Output v02r01
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, Block 70 Bao'an District, Shenzhen, Guangdong, China

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 maintain ed 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

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
TM4	802.11n-HT40	Low:2422MHz, Middle:2437MHz,High:2452MHz

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	45~55 %.
ATM Pressure:	1019 mbar

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
AC CABLE	1.2	Unshielded	Without Ferrite

Special 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
		6-26GHz ±3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
SEMT-1075	Communication Tester	Rohde & Schwarz	CMW500	148650	2021-03-27	2022-03-26
SEMT-1063	GSM Tester	Rohde & Schwarz	CMU200	114403	2021-03-27	2022-03-26
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2021-03-27	2022-03-26
SEMT-1079	Spectrum Analyzer	Agilent	N9020A	US47140102	2021-03-27	2022-03-26
SEMT-1080	Signal Generator	Agilent	83752A	3610A01453	2021-03-27	2022-03-26
SEMT-1081	Vector Signal Generator	Agilent	N5182A	MY47070202	2021-03-27	2022-03-26
SEMT-1028	Power Divider	Weinschel	1506A	PM204	2021-03-27	2022-03-26
SEMT-1082	Power Divider	RF-Lambda	RFLT4W5M18G	14110400027	2021-03-27	2022-03-26
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2021-03-27	2022-03-26
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2021-03-27	2022-03-26
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2021-04-12	2022-04-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2021-04-12	2022-04-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2021-03-19	2023-03-18
SEMT-1068	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2021-03-19	2023-03-18
SEMT-1042	Horn Antenna	ETS	3117	00086197	2021-03-19	2023-03-18
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2021-04-27	2023-04-26
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2021-04-27	2022-04-26
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2021-03-27	2022-03-26
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2021-03-27	2022-03-26
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2021-03-19	2023-03-18
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	/	/
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	/	/
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	/	/
SEMT-C004	Cable	Zheng DI	2M0RFC	/	/	/
SEMT-C005	Cable	Zheng DI	1M0RFC	/	/	/
SEMT-C006	Cable	Zheng DI	1M0RFC	/	/	/

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
§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. Antenna Requirement

3.1 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.

3.2 Evaluation Information

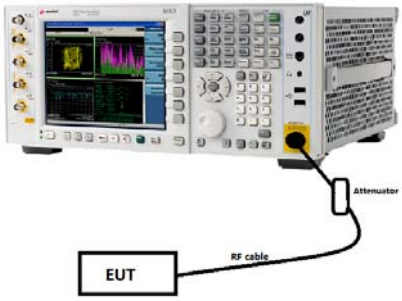
This product has an FPC Antenna, fulfill the requirement of this section.

4. Power Spectral Density

4.1 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 8dBm in any 3kHz band during any time interval of continuous transmission.

4.2 Test Setup Block Diagram



4.3 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: 3kHz ≤ RBW ≤ 100kHz. .
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).

4.4 Summary of Test Results/Plots

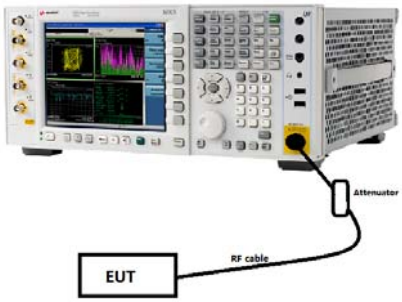
Please refer to Appendix A

5. DTS Bandwidth

5.1 Standard Applicable

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

5.2 Test Setup Block Diagram



5.3 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 = 100kHz.
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.

5.4 Summary of Test Results/Plots

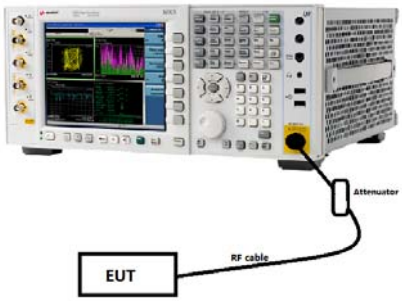
Please refer to Appendix B

6. RF Output Power

6.1 Standard Applicable

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

6.2 Test Setup Block Diagram



6.3 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 1MHz.
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.

6.4 Summary of Test Results/Plots

Please refer to Appendix C

7. Field Strength of Spurious Emissions

7.1 Standard Applicable

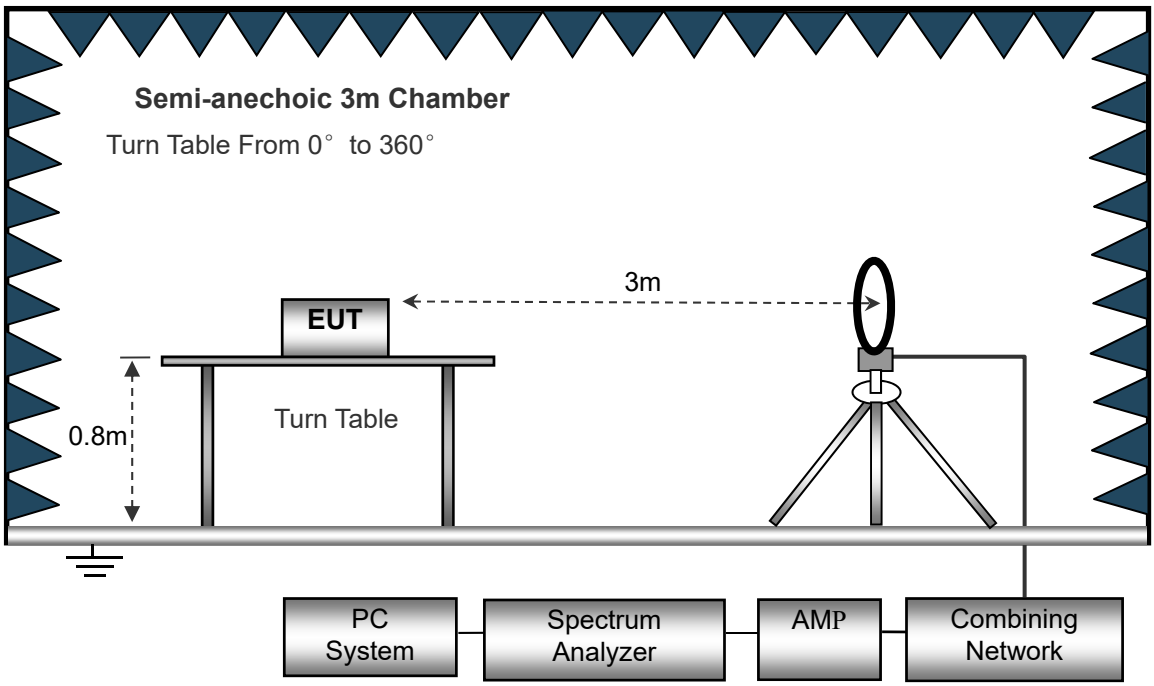
According to §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the 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 30dB instead of 20dB. 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.

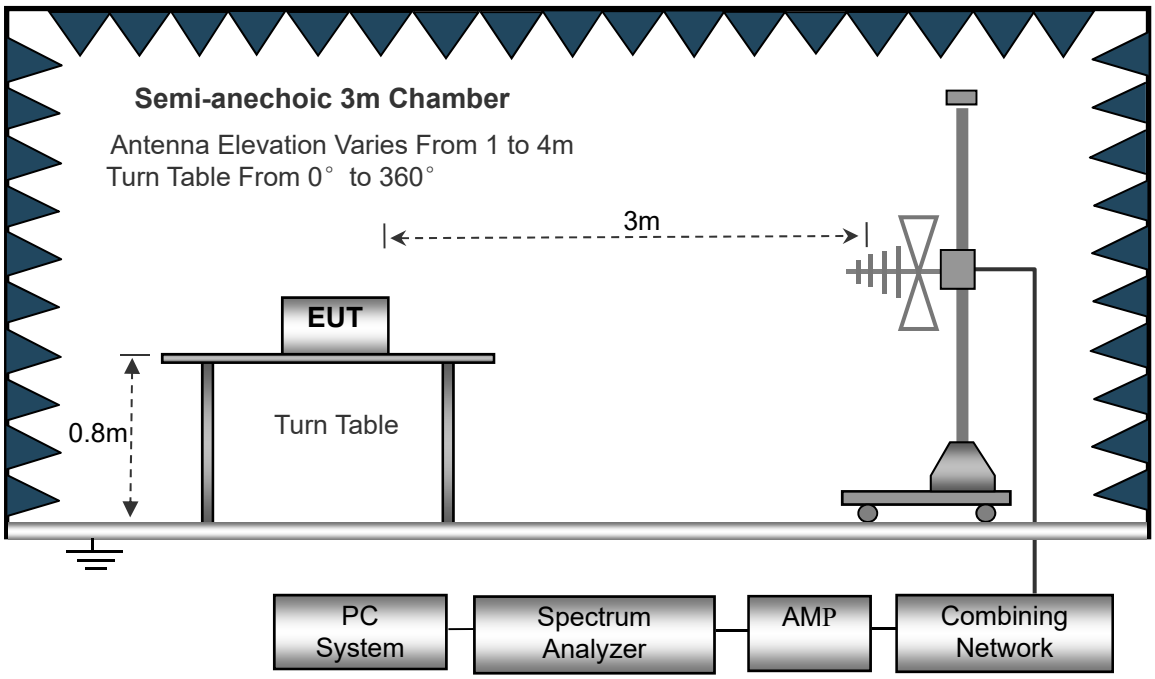
7.2 Test Procedure

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 40cm long in the middle.
The spacing between the peripherals was 10cm.

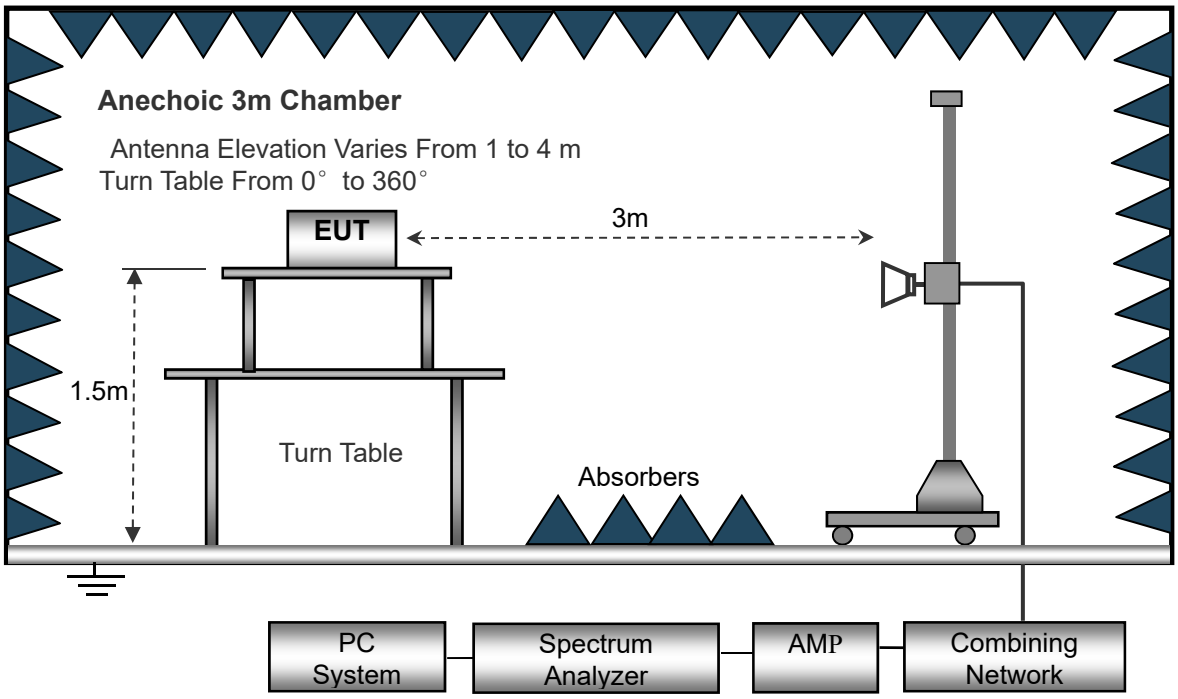
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30MHz to 1GHz.



The test setup for emission measurement above 1GHz.



Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	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

7.3 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:

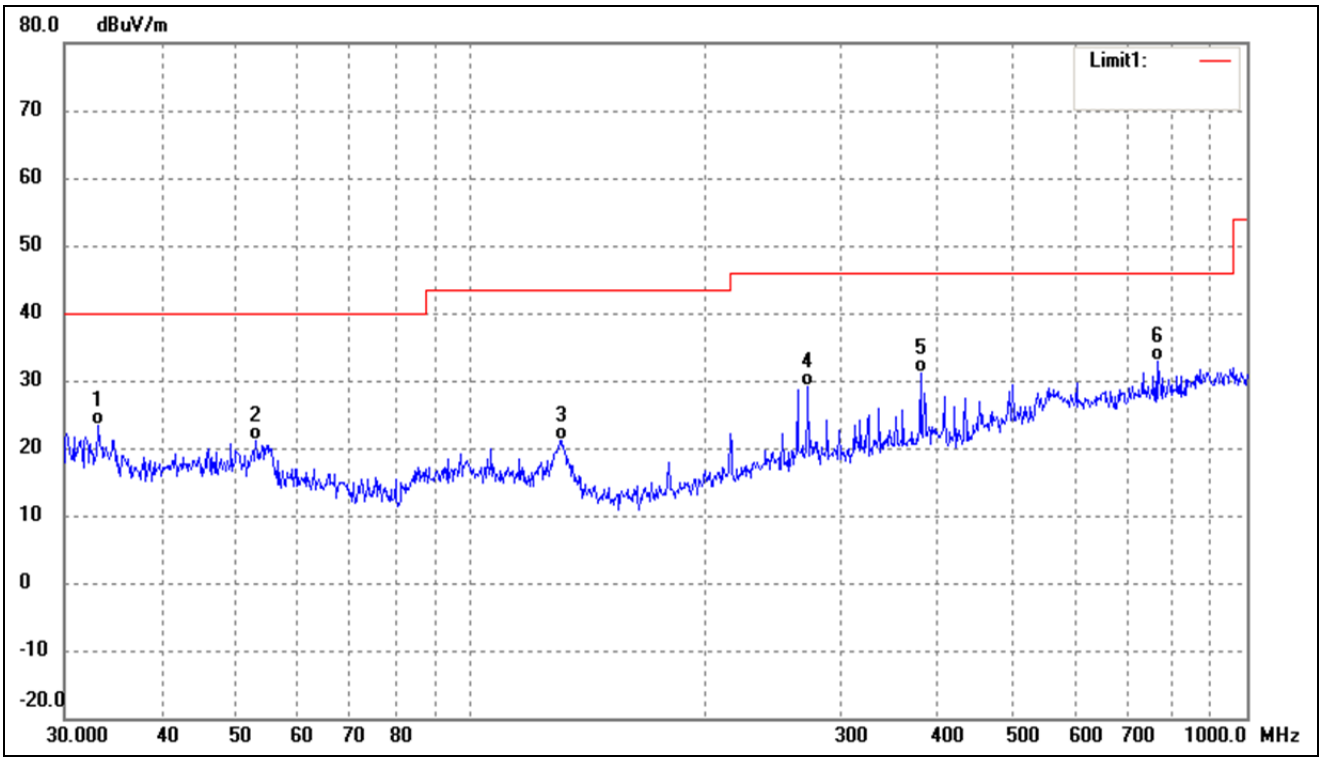
Margin = Corr. Ampl. – FCC Part 15 Limit

7.4 Summary of Test Results/Plots

Note: 1.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.

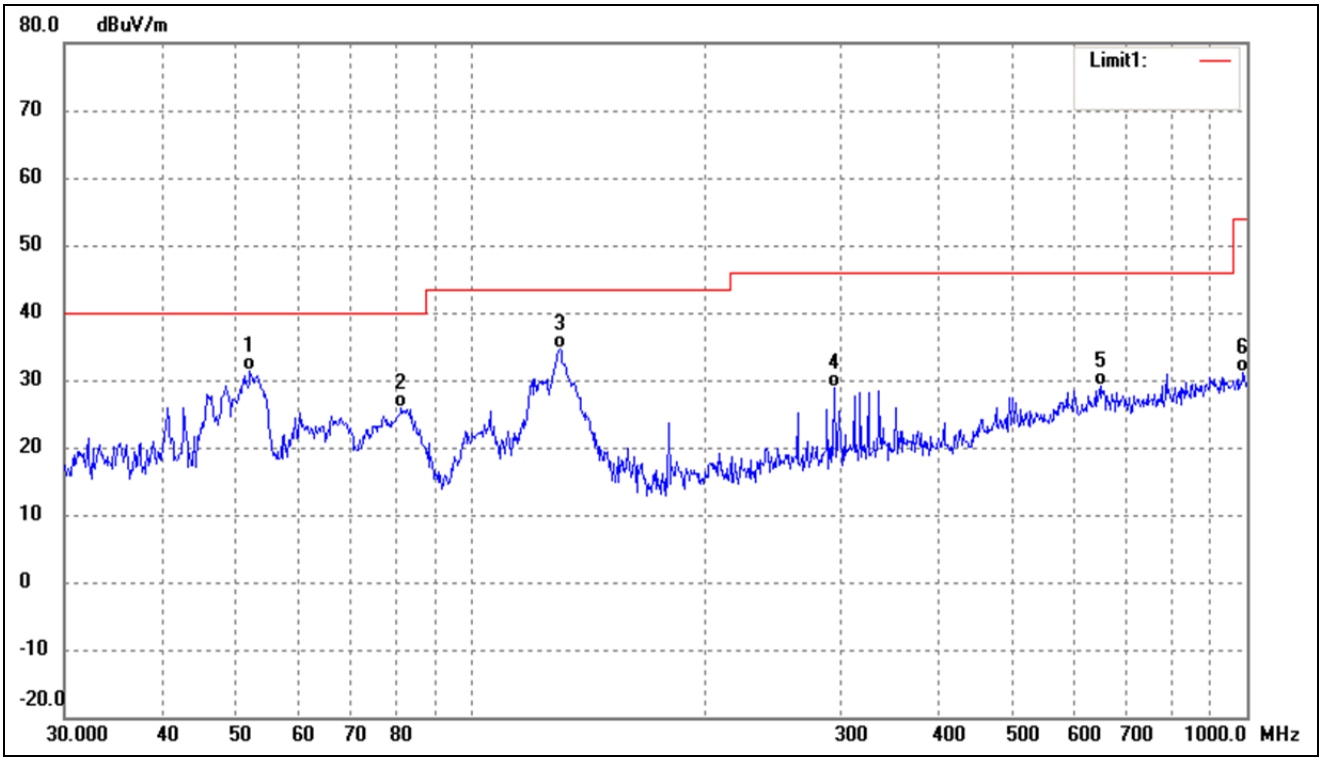
➢ Spurious Emissions Below 1GHz

802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal



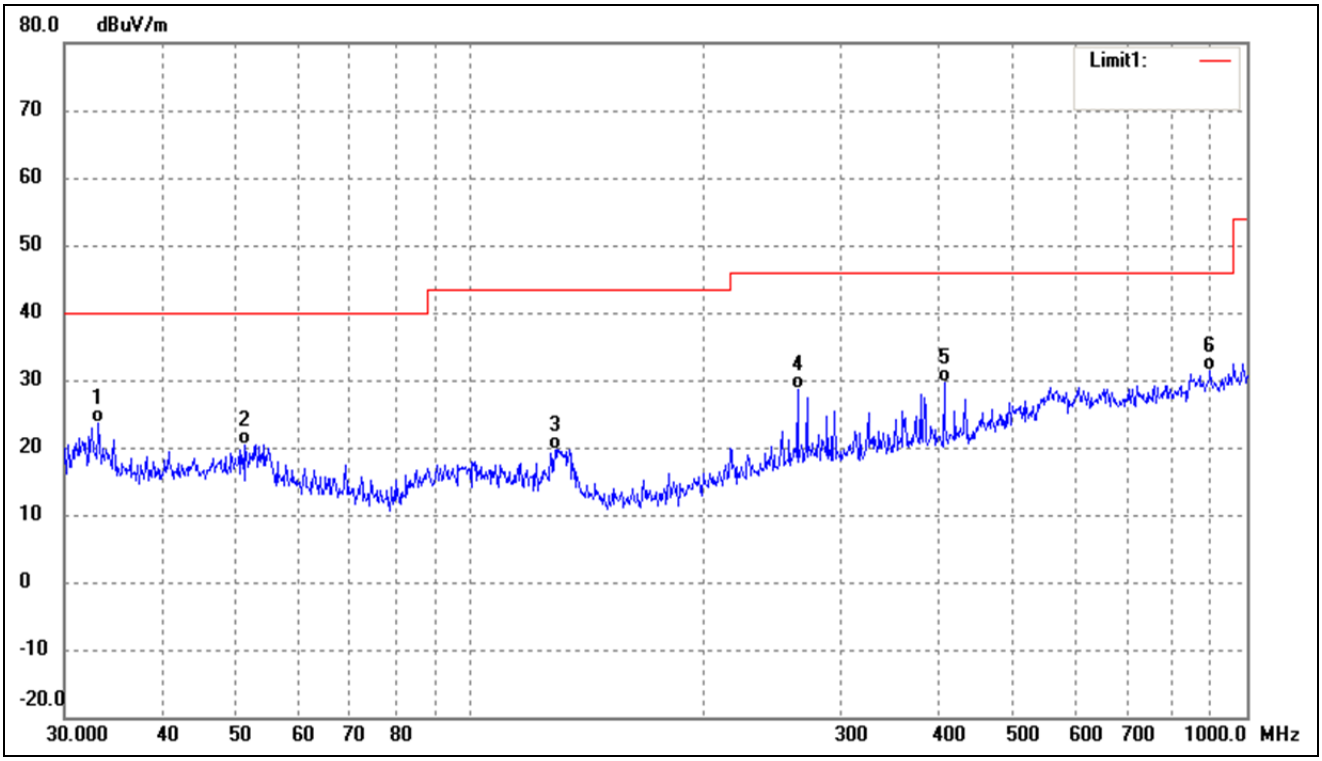
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	33.2112	32.73	-9.40	23.33	40.00	-16.67	-	-	QP
2	52.9453	29.60	-8.49	21.11	40.00	-18.89	-	-	QP
3	131.2965	32.33	-11.23	21.10	43.50	-22.40	-	-	QP
4	272.2776	35.29	-6.18	29.11	46.00	-16.89	-	-	QP
5	379.9141	35.42	-4.21	31.21	46.00	-14.79	-	-	QP
6	766.0572	31.57	1.32	32.89	46.00	-13.11	-	-	QP

802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical



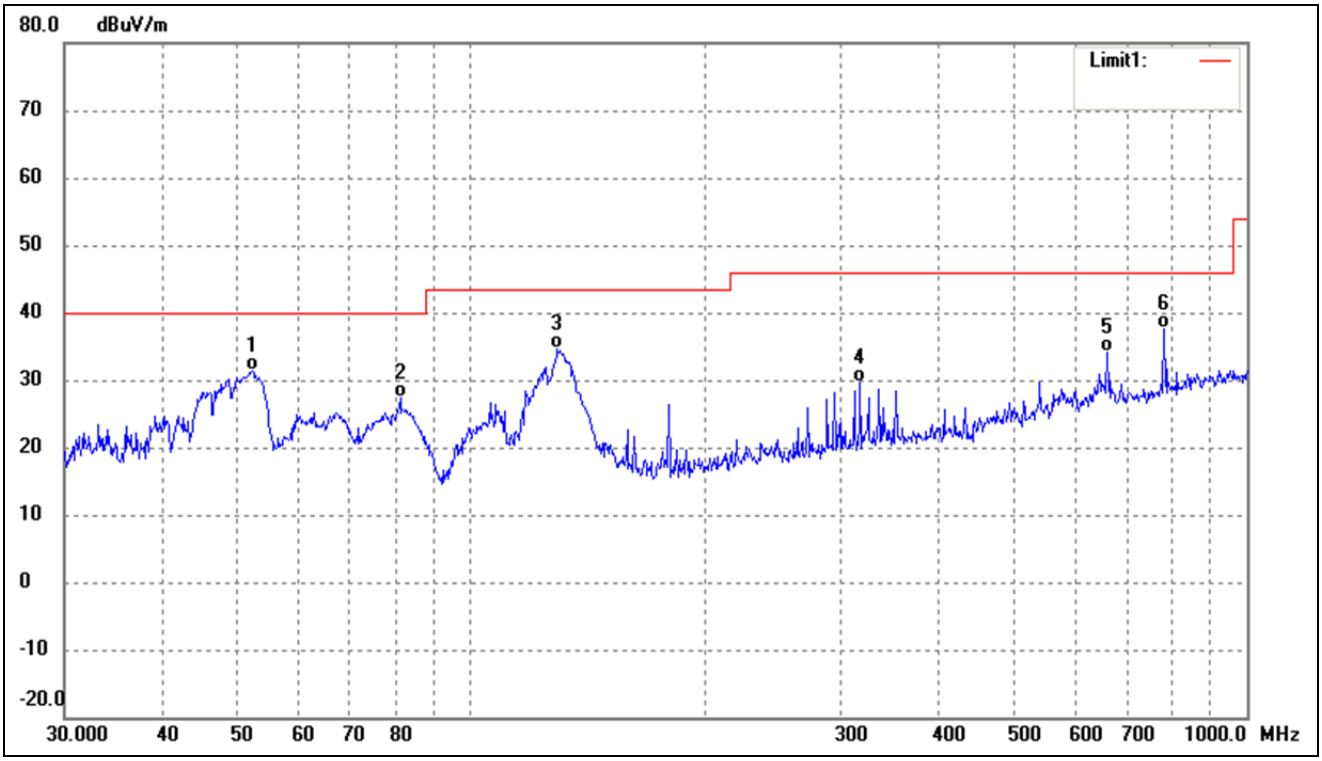
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	52.0251	39.64	-8.33	31.31	40.00	-8.69	-	-	QP
2	81.4970	38.24	-12.24	26.00	40.00	-14.00	-	-	QP
3	130.3789	45.81	-11.16	34.65	43.50	-8.85	-	-	QP
4	294.1137	34.73	-5.75	28.98	46.00	-17.02	-	-	QP
5	647.3856	29.17	-0.15	29.02	46.00	-16.98	-	-	QP
6	989.5355	26.94	4.25	31.19	54.00	-22.81	-	-	QP

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Horizontal



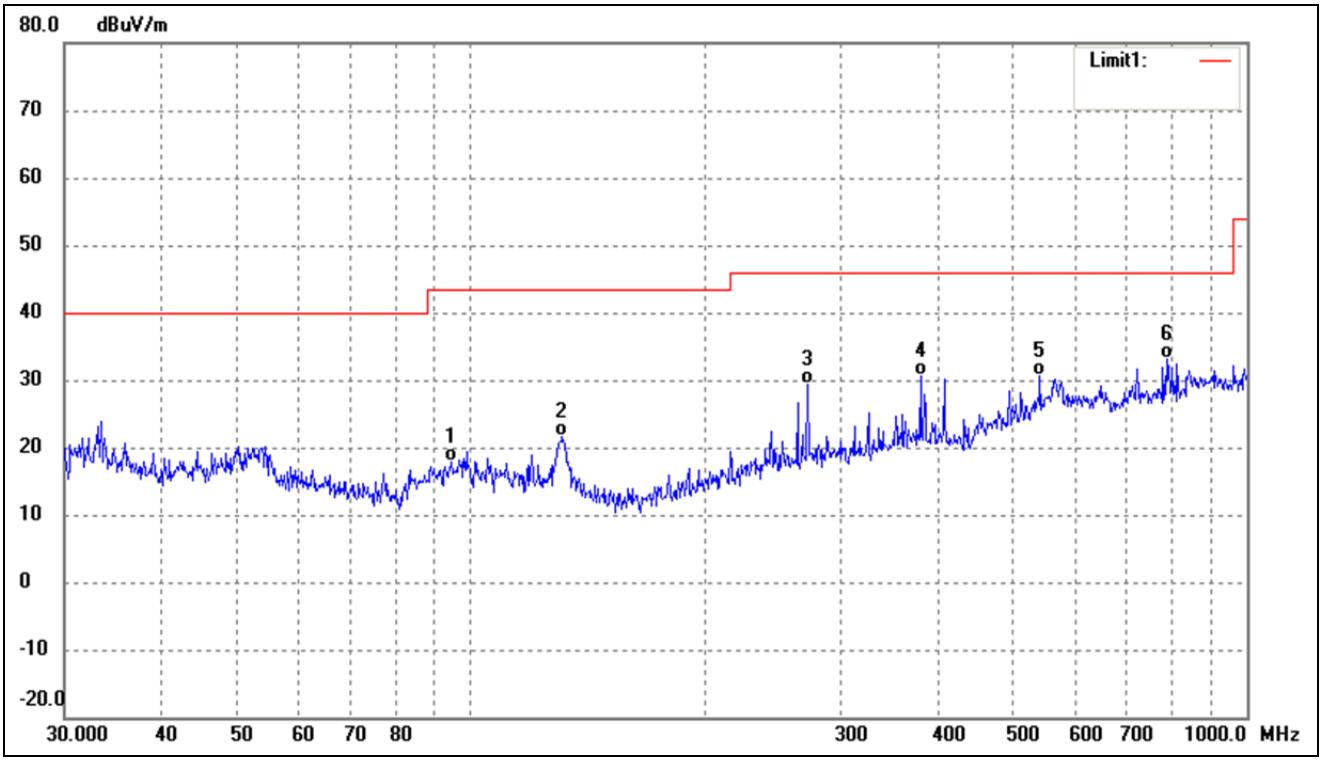
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	33.2112	33.12	-9.40	23.72	40.00	-16.28	-	-	QP
2	51.3005	28.58	-8.22	20.36	40.00	-19.64	-	-	QP
3	128.5630	30.63	-10.88	19.75	43.50	-23.75	-	-	QP
4	263.8190	34.93	-6.35	28.58	46.00	-17.42	-	-	QP
5	407.5145	33.62	-4.02	29.60	46.00	-16.40	-	-	QP
6	896.9965	27.99	3.42	31.41	46.00	-14.59	-	-	QP

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Vertical



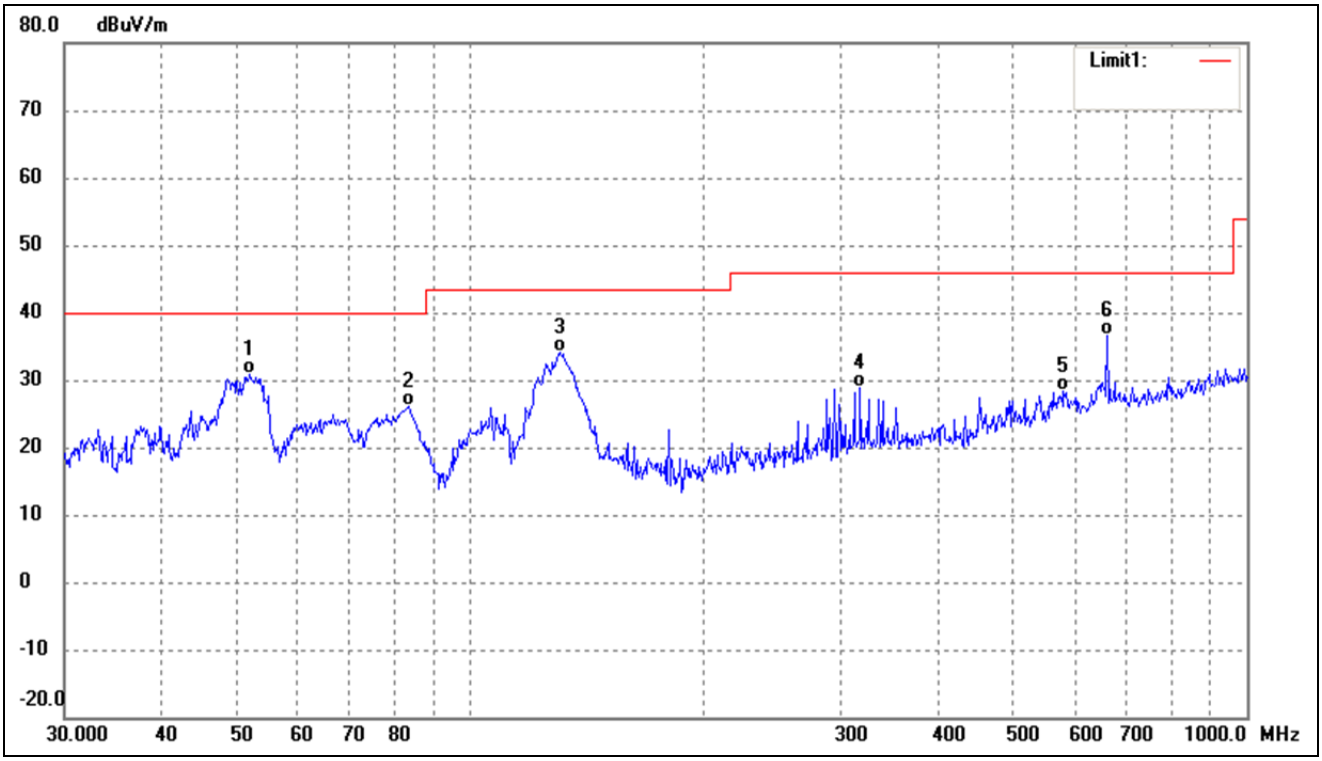
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	52.3913	39.78	-8.40	31.38	40.00	-8.62	-	-	QP
2	81.2117	39.70	-12.26	27.44	40.00	-12.56	-	-	QP
3	129.4678	45.70	-11.03	34.67	43.50	-8.83	-	-	QP
4	317.7011	34.83	-5.32	29.51	46.00	-16.49	-	-	QP
5	661.1505	34.15	0.06	34.21	46.00	-11.79	-	-	QP
6	782.3453	36.24	1.50	37.74	46.00	-8.26	-	-	QP

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	94.4284	28.06	-10.15	17.91	43.50	-25.59	-	-	QP
2	131.2965	32.93	-11.23	21.70	43.50	-21.80	-	-	QP
3	271.3246	35.47	-6.19	29.28	46.00	-16.72	-	-	QP
4	379.9141	34.93	-4.21	30.72	46.00	-15.28	-	-	QP
5	541.3725	32.54	-1.93	30.61	46.00	-15.39	-	-	QP
6	787.8513	31.57	1.55	33.12	46.00	-12.88	-	-	QP

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	52.0251	39.14	-8.33	30.81	40.00	-9.19	-	-	QP
2	83.2298	38.10	-12.05	26.05	40.00	-13.95	-	-	QP
3	130.3789	45.22	-11.16	34.06	43.50	-9.44	-	-	QP
4	317.7011	34.27	-5.32	28.95	46.00	-17.05	-	-	QP
5	580.7026	29.62	-1.22	28.40	46.00	-17.60	-	-	QP
6	661.1505	36.57	0.06	36.63	46.00	-9.37	-	-	QP

Remark: '-'Means' the test Degree and Height are 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	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	54.17	-3.87	50.30	74	-23.70	H	PK
4824.000	48.72	-3.87	44.85	54	-9.15	H	AV
7236.000	49.58	1.14	50.72	74	-23.28	H	PK
7236.000	43.29	1.19	44.48	54	-9.52	H	AV
4824.000	49.66	-3.86	45.80	74	-28.20	V	PK
4824.000	45.17	-3.86	41.31	54	-12.69	V	AV
7236.000	49.95	1.10	51.05	74	-22.95	V	PK
7236.000	43.22	1.10	44.32	54	-9.68	V	AV
Middle Channel-2437MHz							
4874.000	53.56	-3.74	49.82	74	-24.18	H	PK
4874.000	48.68	-3.74	44.94	54	-9.06	H	AV
7311.000	49.65	1.47	51.12	74	-22.88	H	PK
7311.000	43.33	1.47	44.80	54	-9.20	H	AV
4874.000	50.32	-3.74	46.58	74	-27.42	V	PK
4874.000	45.97	-3.74	42.23	54	-11.77	V	AV
7311.000	49.97	1.47	51.44	74	-22.56	V	PK
7311.000	43.22	1.47	44.69	54	-9.31	V	AV
High Channel-2462MHz							
4924.000	53.61	-3.59	50.02	74	-23.98	H	PK
4924.000	48.65	-3.59	45.06	54	-8.94	H	AV
7386.000	50.25	1.79	52.04	74	-21.96	H	PK
7386.000	43.44	1.79	45.23	54	-8.77	H	AV
4924.000	49.56	-3.59	45.97	74	-28.03	V	PK
4924.000	45.11	-3.59	41.52	54	-12.48	V	AV
7386.000	50.08	1.79	51.87	74	-22.13	V	PK
7386.000	42.53	1.79	44.32	54	-9.68	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.

8. Out of Band Emissions

8.1 Standard Applicable

According to §15.247(d), in any 100kHz 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 20dB below that in the 100kHz 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 30dB instead of 20dB. 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).

8.2 Test Procedure

According to the KDB 558074D01 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 = 100kHz.
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

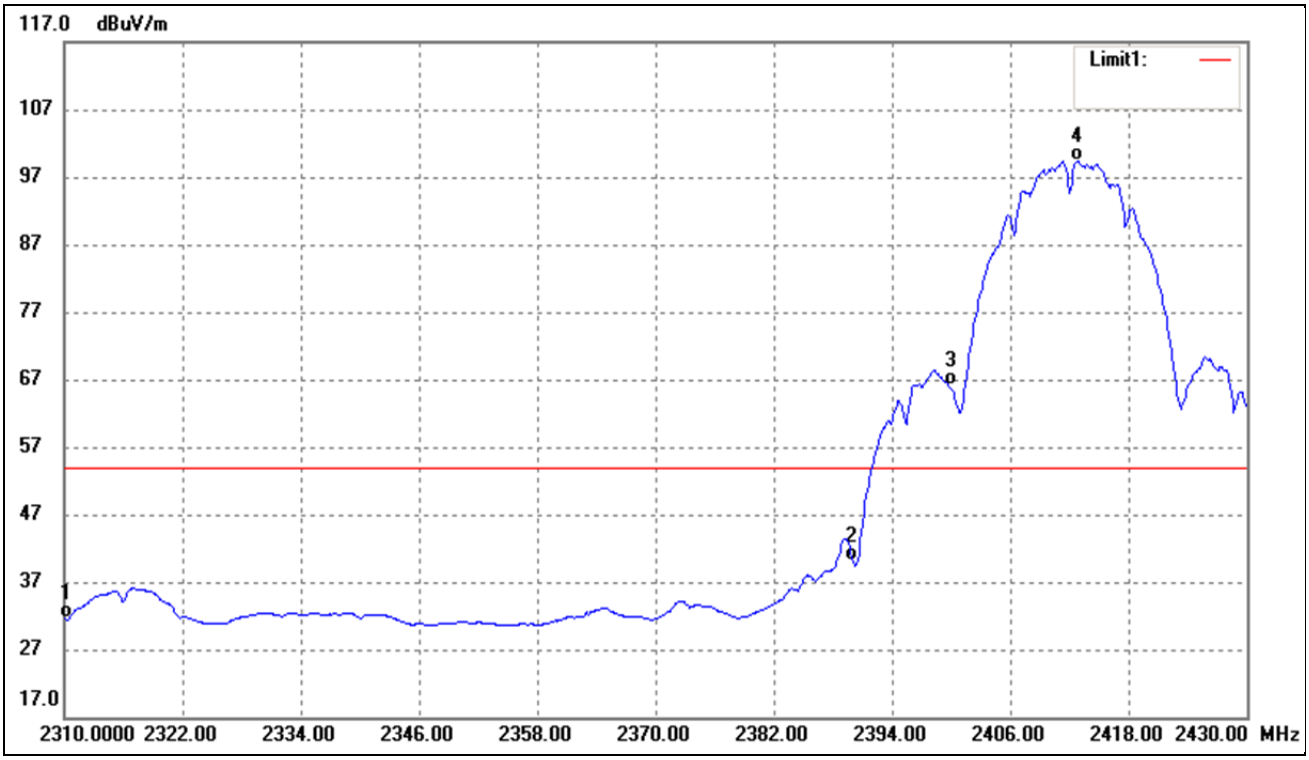
If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

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.

8.3 Summary of Test Results/Plots

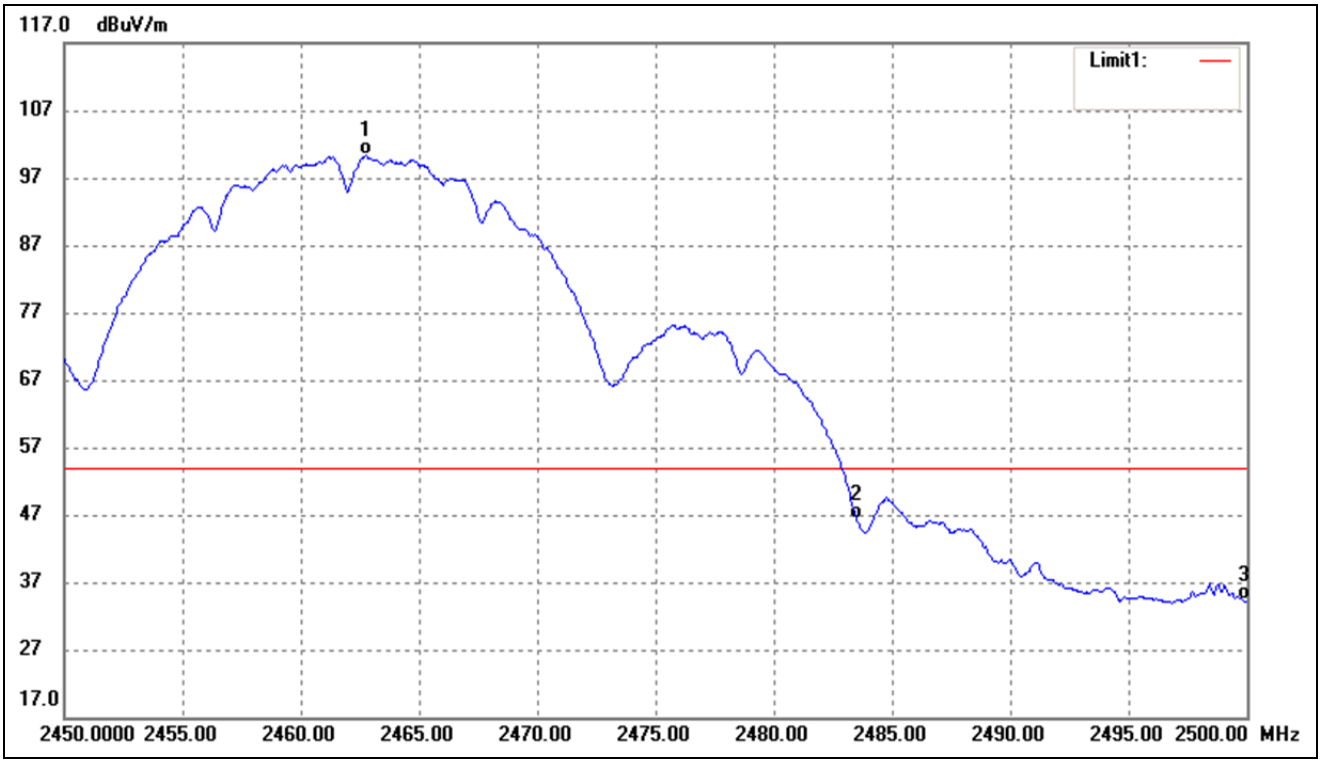
➢ Radiated test

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



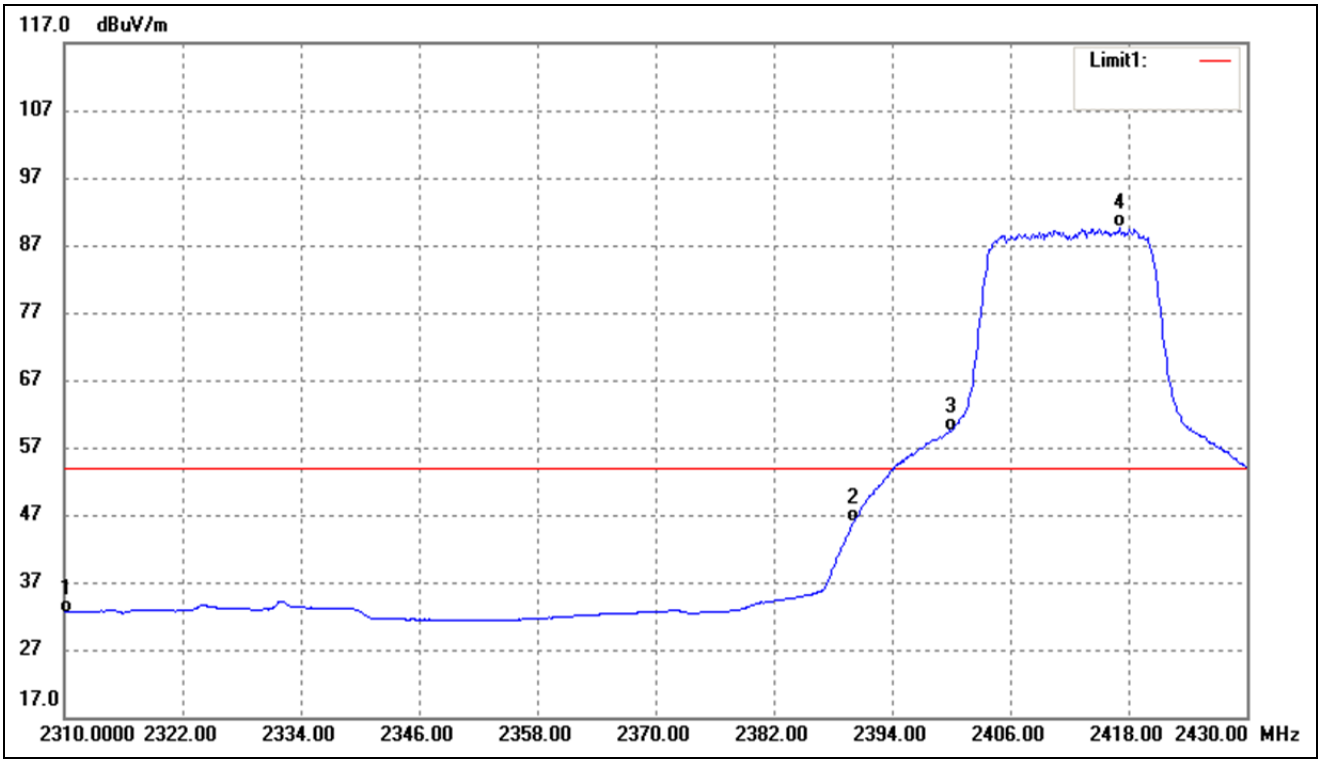
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	41.26	-9.66	31.60	54.00	-22.40	Average Detector
	2310.000	53.63	-9.66	43.97	74.00	-30.03	Peak Detector
2	2390.000	49.54	-9.50	40.04	54.00	-13.96	Average Detector
	2390.000	64.76	-9.50	55.26	74.00	-18.74	Peak Detector
3	2400.000	75.66	-9.48	66.18	Delta=33.20dBc		Average Detector
4	2412.720	108.84	-9.46	99.38			Average Detector

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



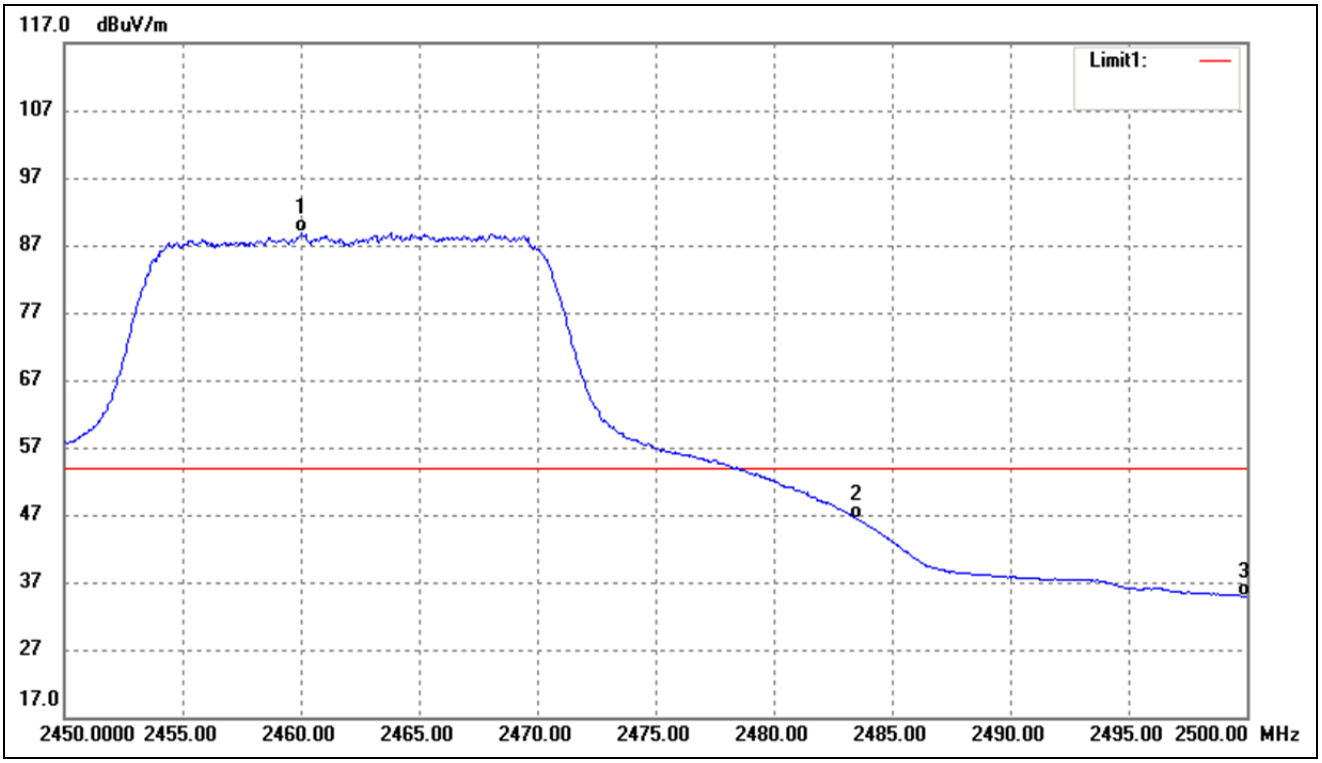
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2462.750	109.69	-9.36	100.33	/	/	Average Detector
	2463.500	114.65	-9.35	105.30	/	/	Peak Detector
2	2483.500	55.78	-9.31	46.47	54.00	-7.53	Average Detector
	2483.500	66.59	-9.31	57.28	74.00	-16.72	Peak Detector
3	2500.000	43.54	-9.28	34.26	54.00	-19.74	Average Detector
	2500.000	55.56	-9.28	46.28	74.00	-27.72	Peak Detector

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



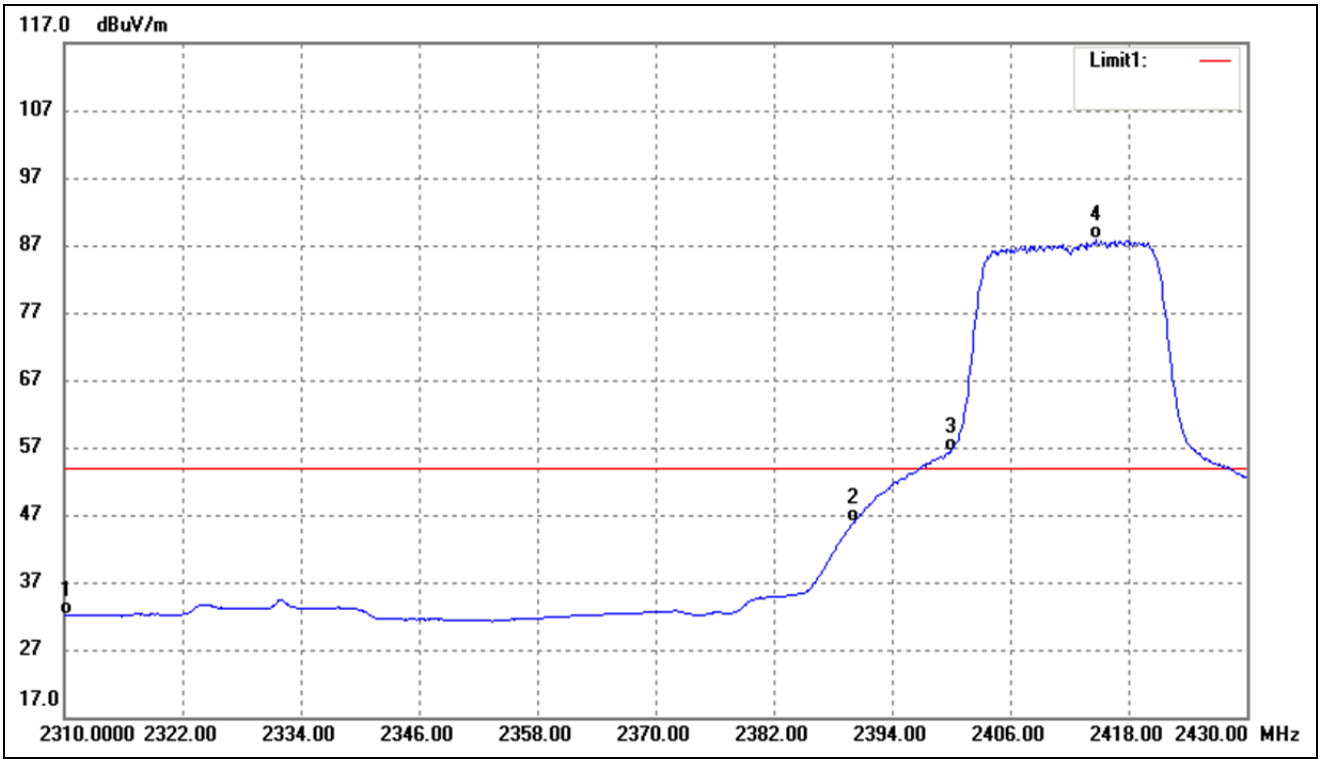
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	42.16	-9.66	32.50	54.00	-21.50	Average Detector
	2310.000	54.47	-9.66	44.81	74.00	-29.19	Peak Detector
2	2390.000	55.26	-9.50	45.76	54.00	-8.24	Average Detector
	2390.000	75.50	-9.50	66.00	74.00	-8.00	Peak Detector
3	2400.000	68.89	-9.48	59.41	Delta=30.15dBc		Average Detector
4	2417.160	99.01	-9.45	89.56			Average Detector

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



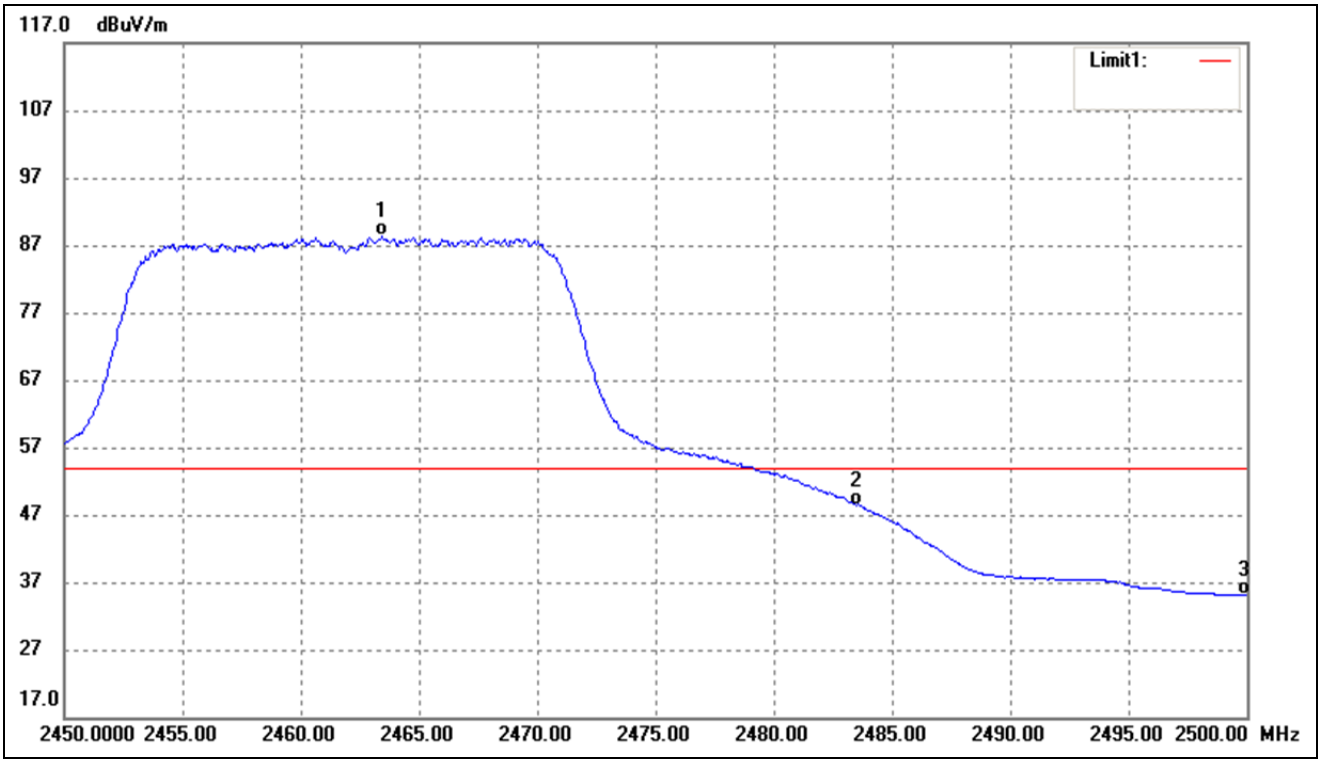
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2460.050	98.12	-9.35	88.77	/	/	Average Detector
	2465.100	111.02	-9.35	101.67	/	/	Peak Detector
2	2483.500	55.80	-9.31	46.49	54.00	-7.51	Average Detector
	2483.500	77.70	-9.31	68.39	74.00	-5.61	Peak Detector
3	2500.000	44.27	-9.28	34.99	54.00	-19.01	Average Detector
	2500.000	57.41	-9.28	48.13	74.00	-25.87	Peak Detector

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



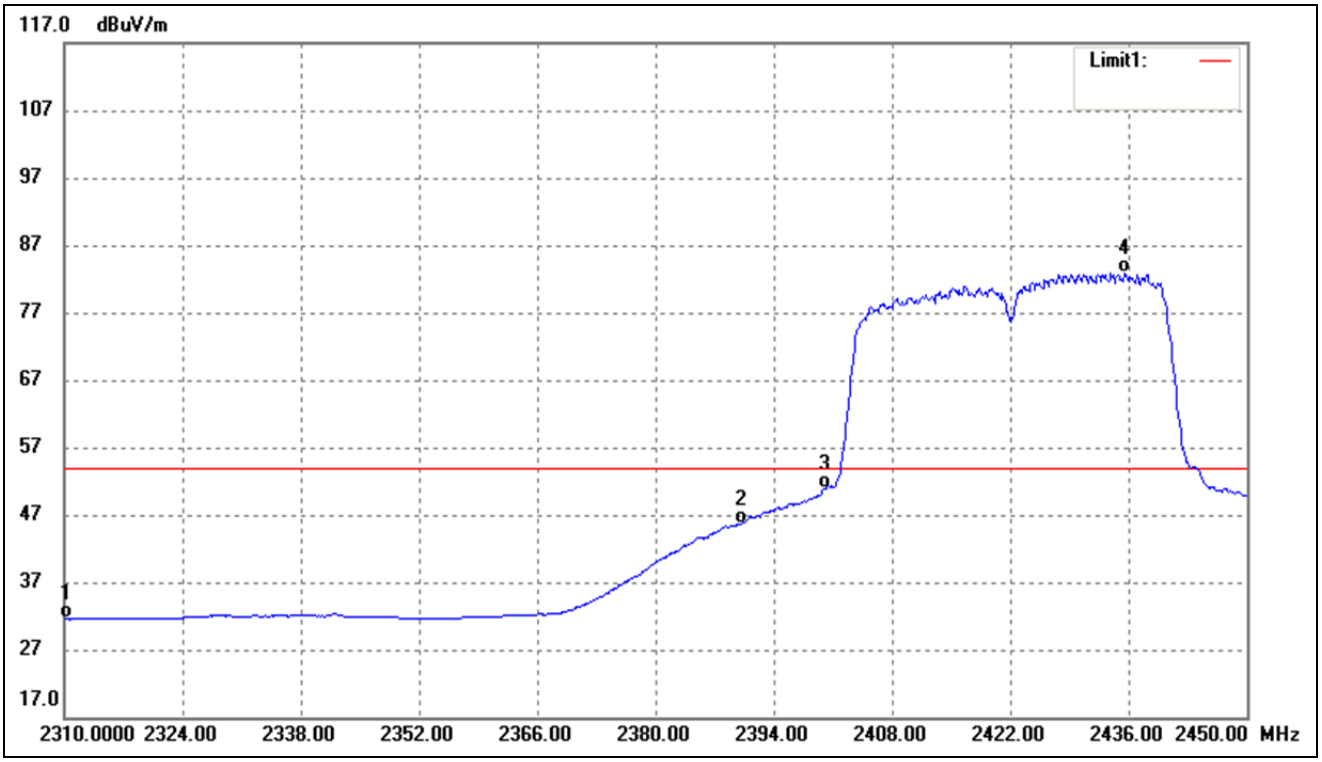
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	41.72	-9.66	32.06	54.00	-21.94	Average Detector
	2310.000	53.50	-9.66	43.84	74.00	-30.16	Peak Detector
2	2390.000	55.41	-9.50	45.91	54.00	-8.09	Average Detector
	2390.000	77.30	-9.50	67.80	74.00	-6.20	Peak Detector
3	2400.000	65.91	-9.48	56.43	Delta=31.33dBc		Average Detector
4	2414.640	97.21	-9.45	87.76			Average Detector

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



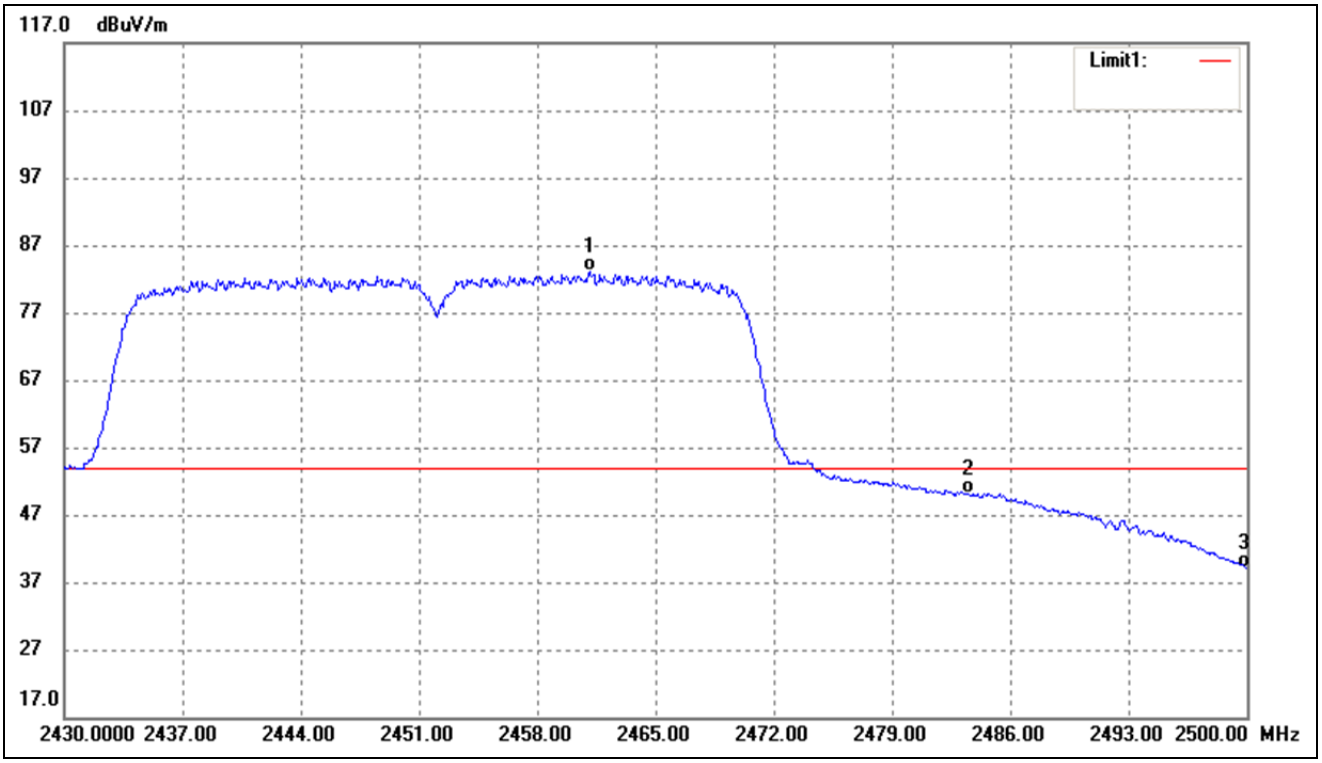
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2463.450	97.67	-9.36	88.31	/	/	Average Detector
	2468.050	110.64	-9.34	101.30	/	/	Peak Detector
2	2483.500	57.80	-9.31	48.49	54.00	-5.51	Average Detector
	2483.500	76.53	-9.31	67.22	74.00	-6.78	Peak Detector
3	2500.000	44.36	-9.28	35.08	54.00	-18.92	Average Detector
	2500.000	57.27	-9.28	47.99	74.00	-26.01	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	41.17	-9.66	31.51	54.00	-22.49	Average Detector
	2310.000	53.55	-9.66	43.89	74.00	-30.11	Peak Detector
2	2390.000	55.21	-9.50	45.71	54.00	-8.29	Average Detector
	2390.000	76.65	-9.50	67.15	74.00	-6.85	Peak Detector
3	2400.000	60.40	-9.48	50.92	Delta=31.91dBc		Average Detector
4	2435.440	92.24	-9.41	82.83			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	2461.080	92.38	-9.36	83.02	/	/	Average Detector
	2455.550	107.81	-9.37	98.44	/	/	Peak Detector
2	2483.500	59.33	-9.31	50.02	54.00	-3.98	Average Detector
	2483.500	77.26	-9.31	67.95	74.00	-6.05	Peak Detector
3	2500.000	48.50	-9.28	39.22	54.00	-14.78	Average Detector
	2500.000	67.45	-9.28	58.17	74.00	-15.83	Peak Detector

- Conducted test

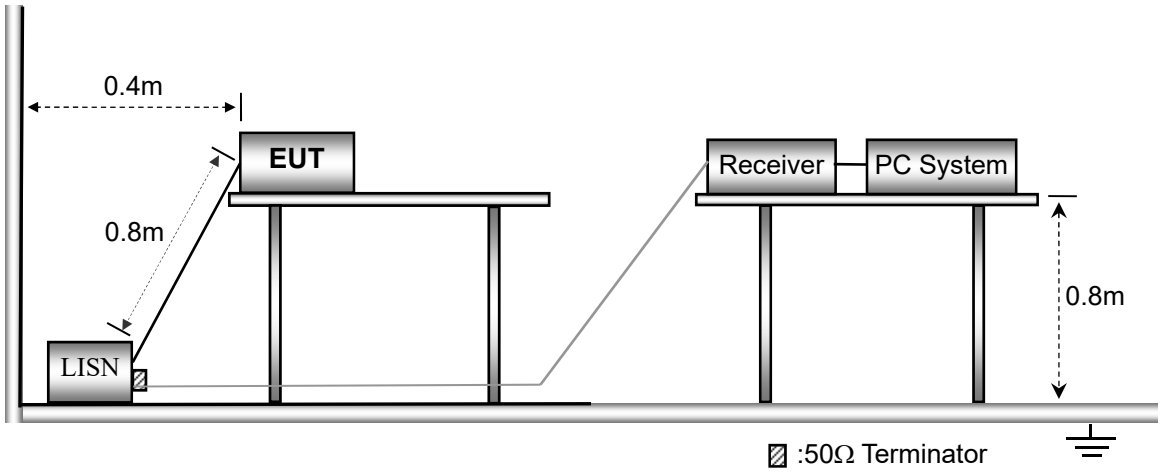
Please refer to Appendix D

9. Conducted Emissions

9.1 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 40cm long in the middle.
The spacing between the peripherals was 10cm.

9.2 Basic Test Setup Block Diagram



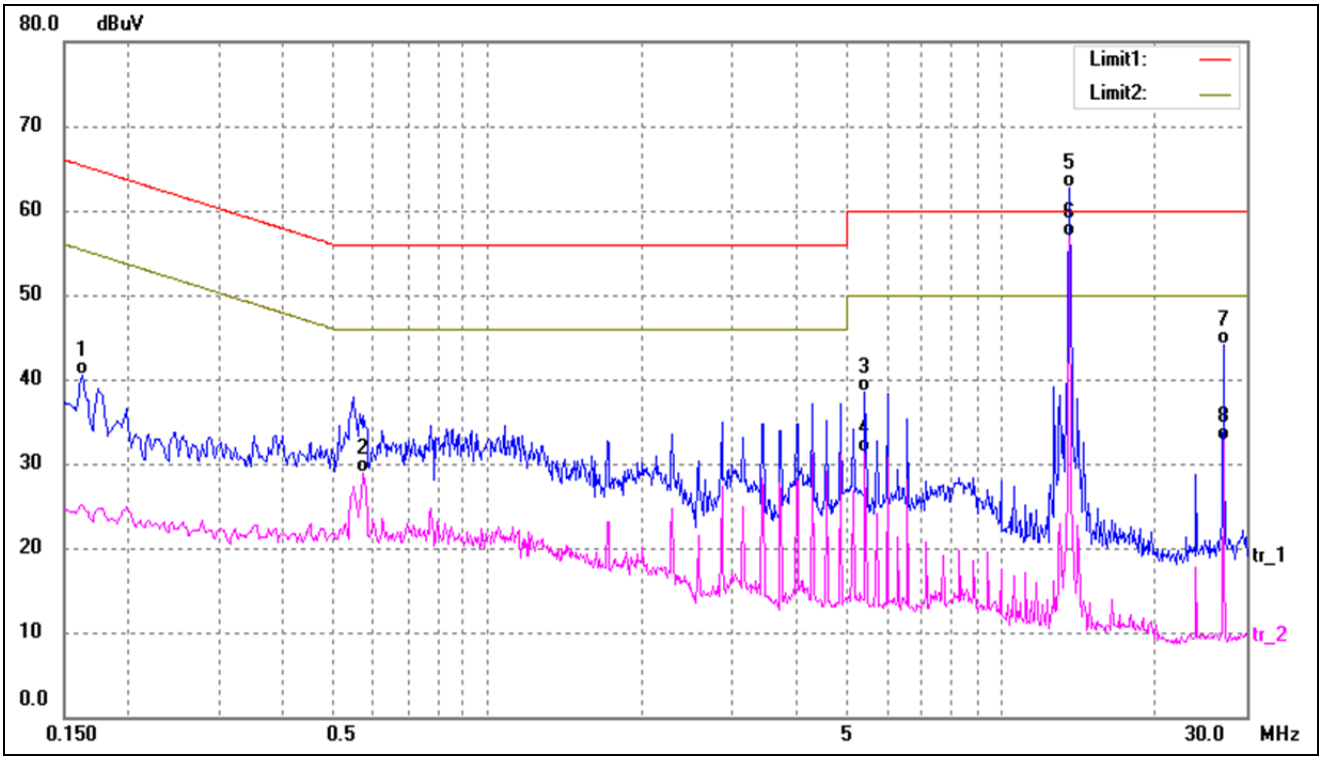
9.3 Test Receiver Setup

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

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

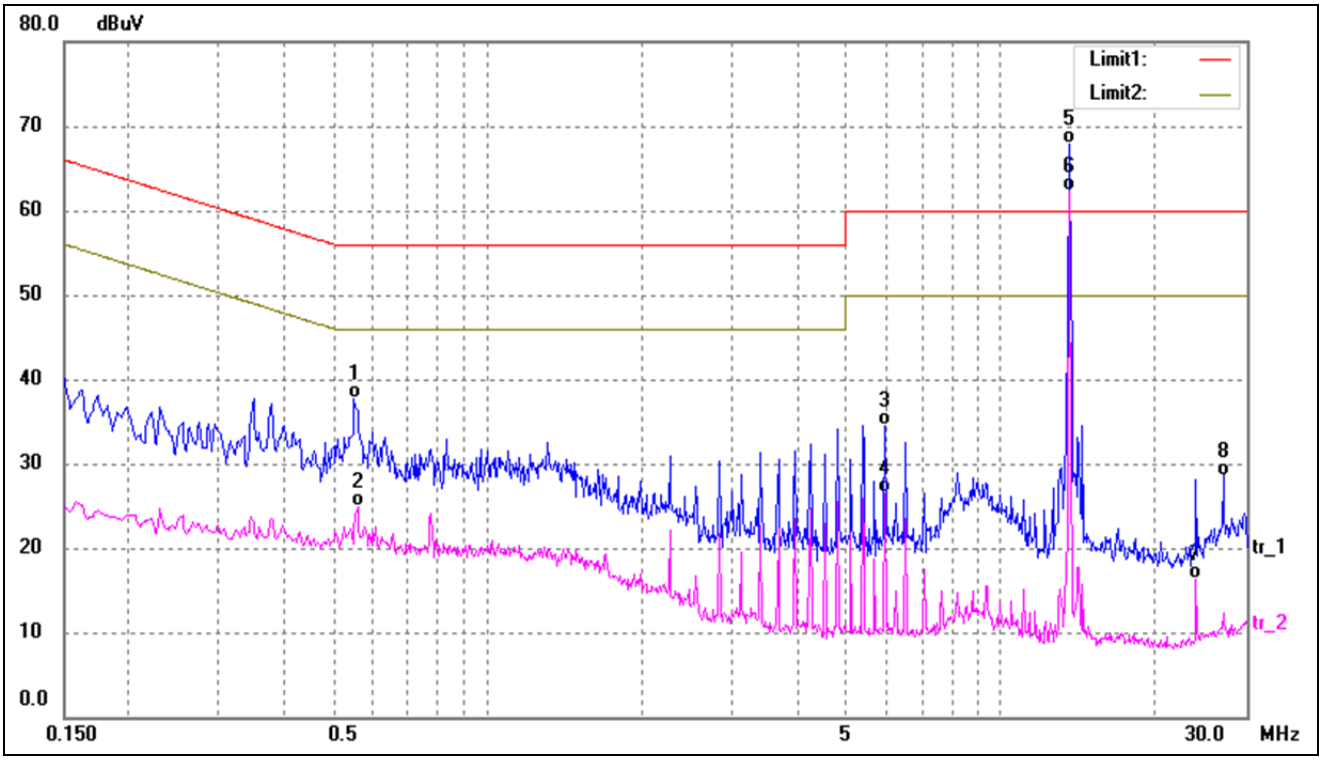
9.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1620	30.25	10.26	40.51	65.36	-24.85	QP
2	0.5740	18.70	10.21	28.91	46.00	-17.09	AVG
3	5.4340	28.23	10.23	38.46	60.00	-21.54	QP
4	5.4340	21.05	10.23	31.28	50.00	-18.72	AVG
5X	13.5660	52.25	10.50	62.75	NFC Fundamental		QP
6*	13.5660	46.35	10.50	56.85			AVG
7	27.1220	33.47	10.65	44.12	60.00	-15.88	QP
8	27.1220	22.00	10.65	32.65	50.00	-17.35	AVG

Test Mode	Communication	AC120V 60Hz	Polarity:	Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.5500	27.40	10.21	37.61	56.00	-18.39	QP
2	0.5580	14.70	10.21	24.91	46.00	-21.09	AVG
3	5.9500	24.34	10.23	34.57	60.00	-25.43	QP
4	5.9500	16.22	10.23	26.45	50.00	-23.55	AVG
5X	13.5620	57.47	10.50	67.97	NFC Fundamental		QP
6*	13.5620	51.77	10.50	62.27			AVG
7	23.9980	5.72	10.60	16.32	50.00	-33.68	AVG
8	27.1140	17.95	10.65	28.60	60.00	-31.40	QP

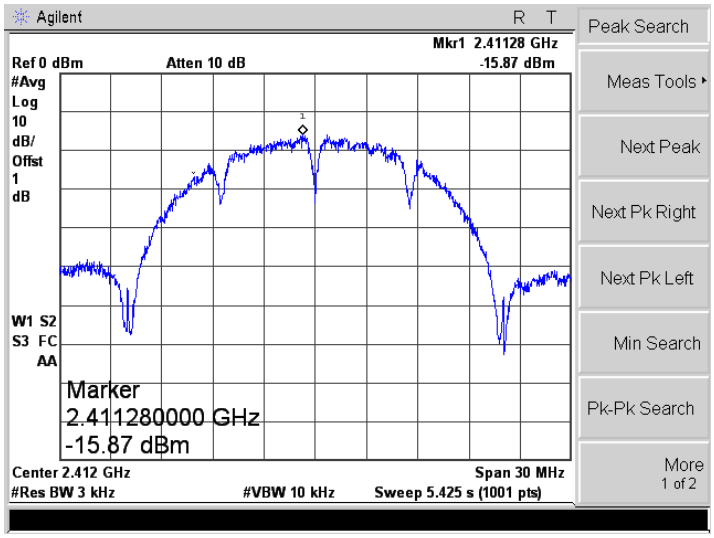
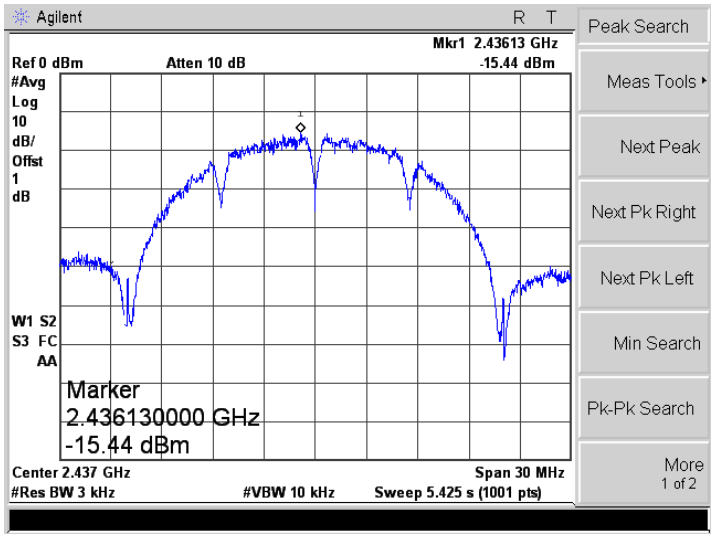
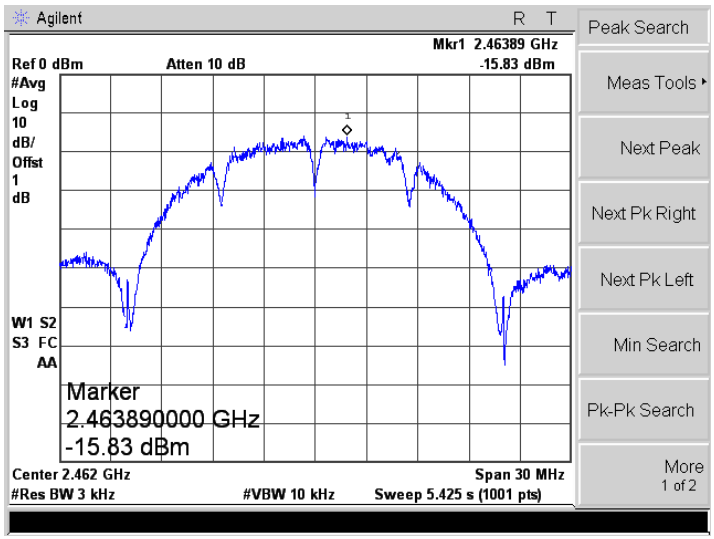
APPENDIX SUMMARY

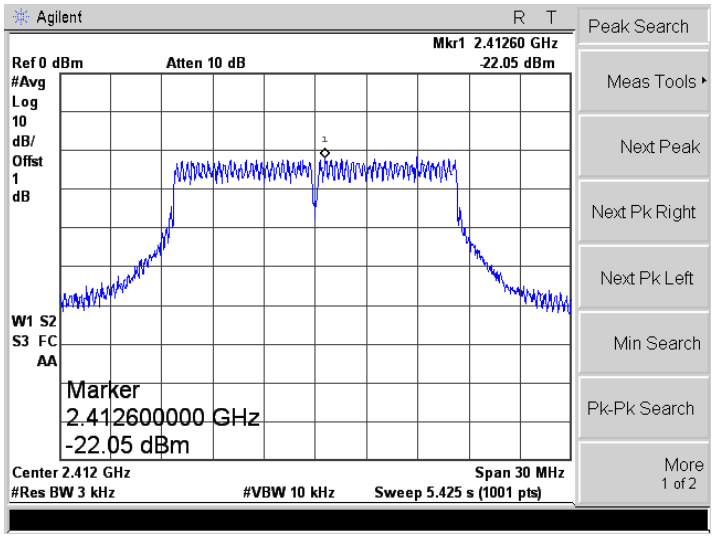
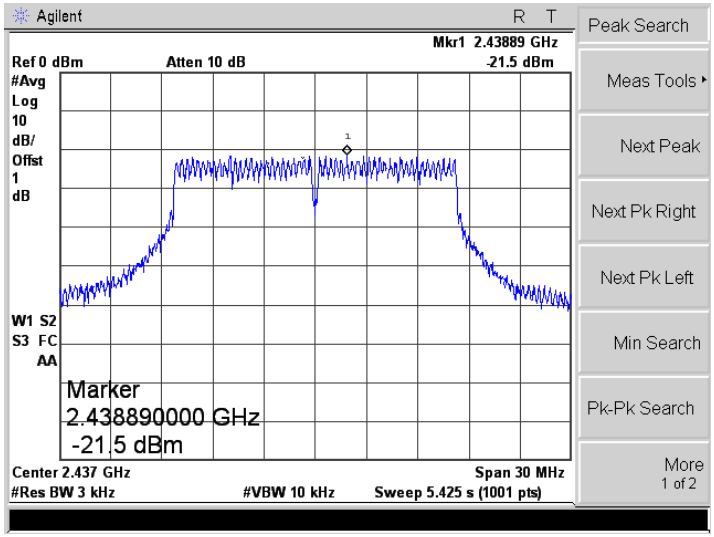
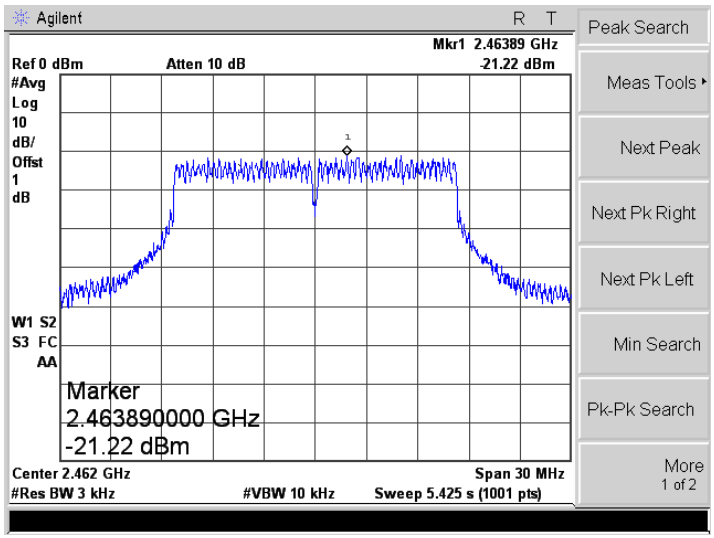
Project No.	WTX21X07067229W	Test Engineer	Adam.Wu
Start date	2021/7/14	Finish date	2021/7/14
Temperature	23.2℃	Humidity	46%
RF specifications	WIFI-2.4G		

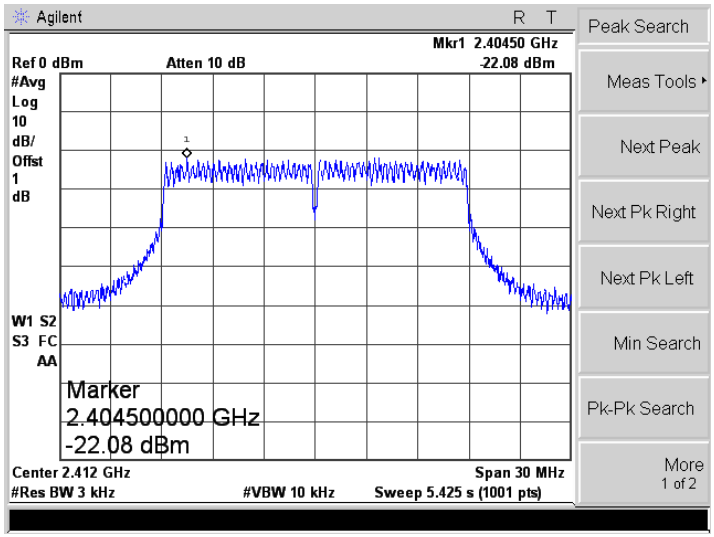
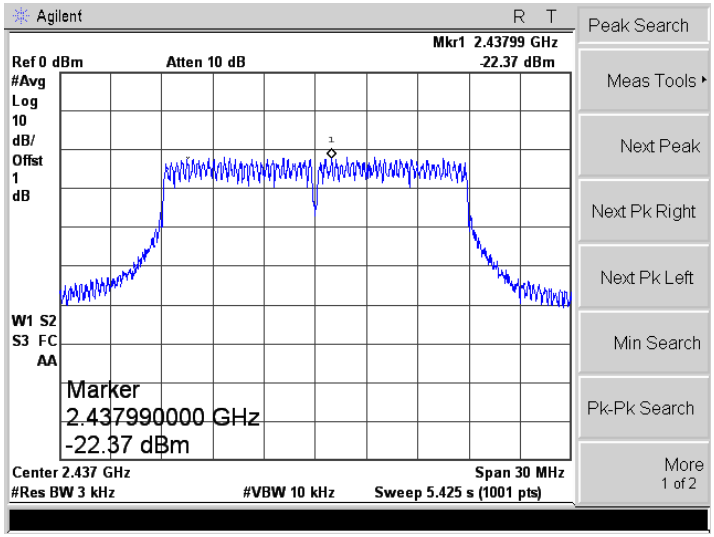
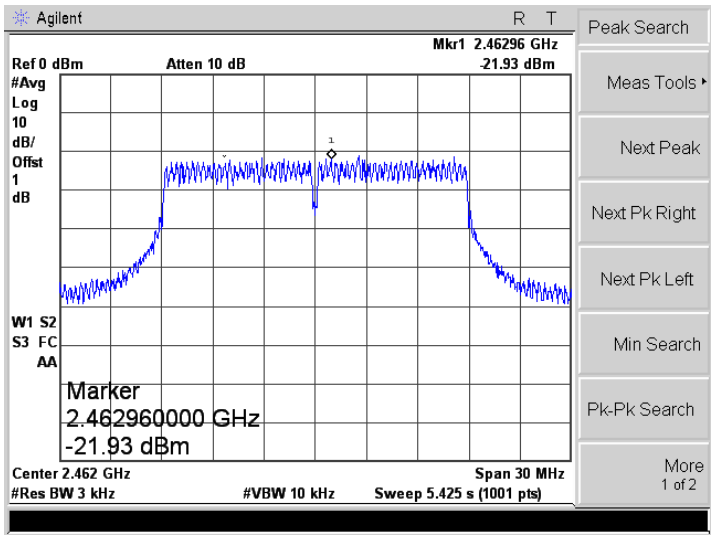
APPENDIX	Description of Test Item	Result
A	Power Spectral Density	Compliant
B	DTS Bandwidth	Compliant
C	RF Output Power	Compliant
D	Conducted Out of Band Emissions	Compliant

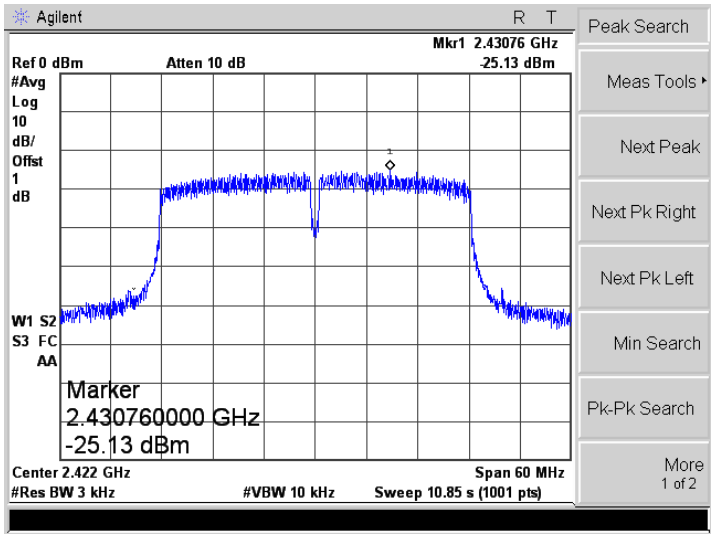
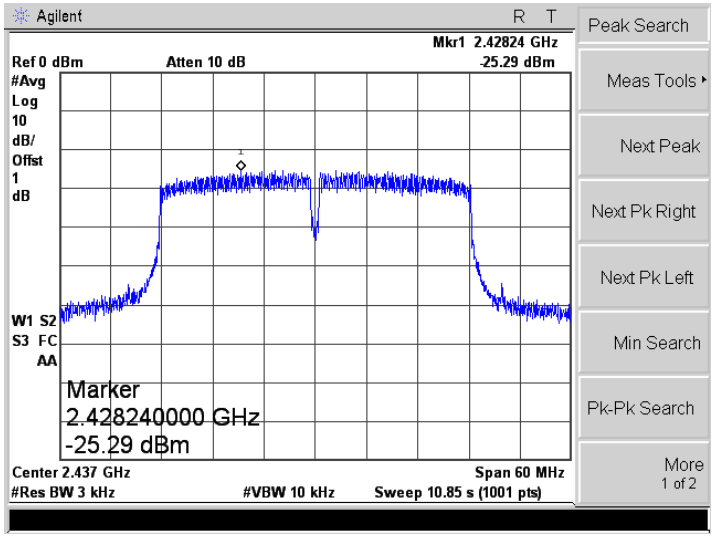
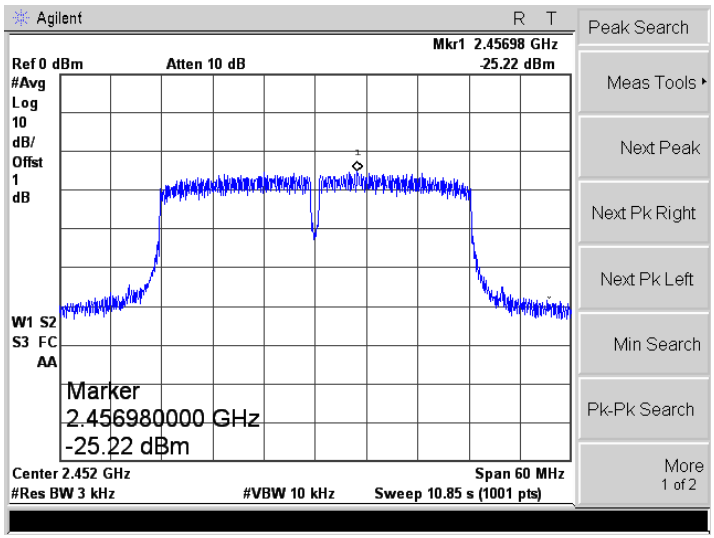
APPENDIX A

Power Spectral Density			
Test Mode	**Test Channel MHz**	**Power Spectral Density dBm/3kHz**	**Limit dBm/3kHz**
802.11b_11Mbps	2412	-15.87	8
	2437	-15.44	8
	2462	-15.83	8
802.11g_54Mbps	2412	-22.05	8
	2437	-21.50	8
	2462	-21.22	8
802.11n-HT20_MCS7	2412	-22.08	8
	2437	-22.37	8
	2462	-21.93	8
802.11n-HT40_MCS7	2422	-25.13	8
	2437	-25.29	8
	2452	-25.22	8

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

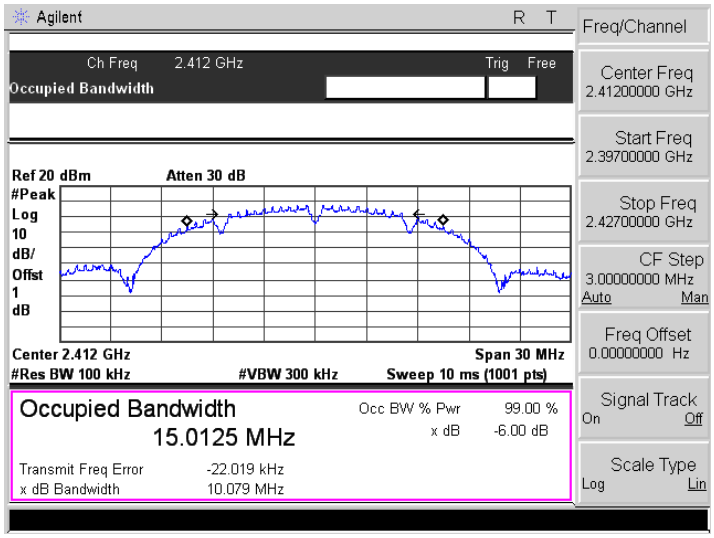
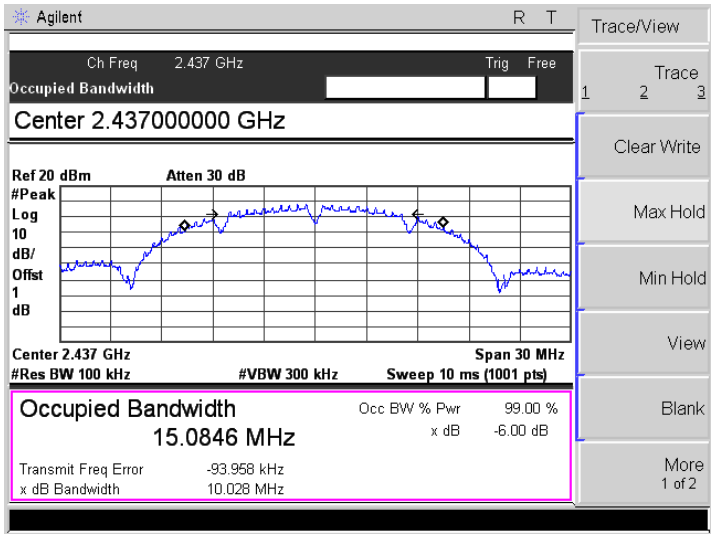
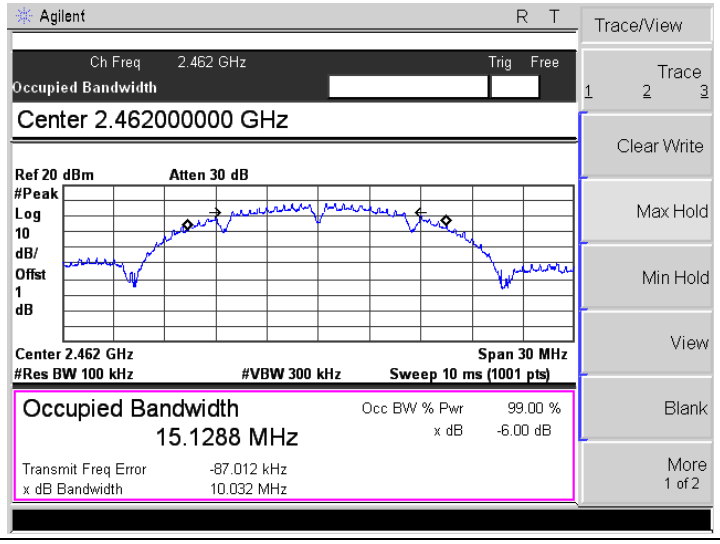
802.11g-Low	
802.11g-Middle	
802.11g-High	

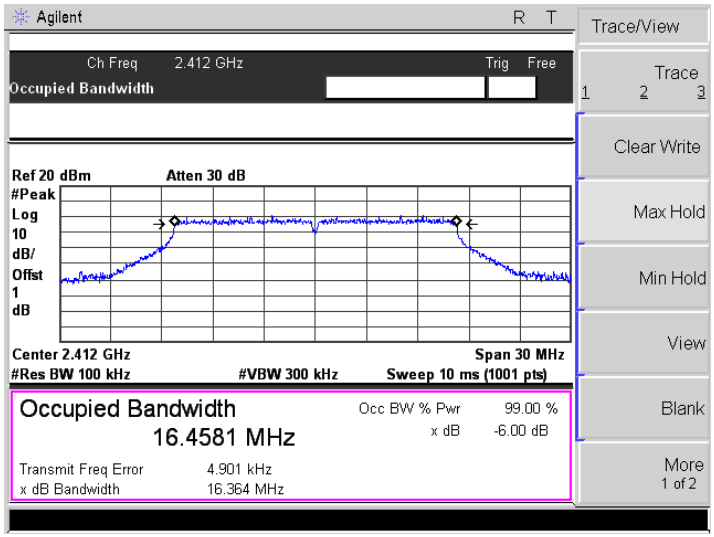
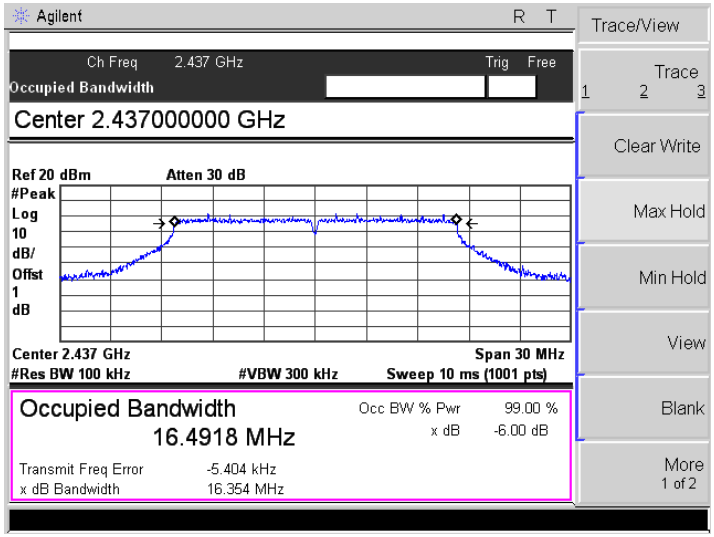
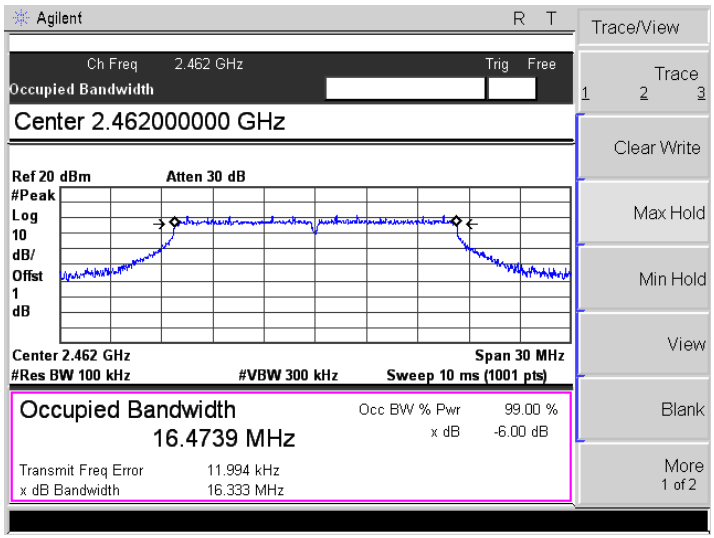
802.11n-HT20-Low	
802.11n-HT20-Middle	
802.11n-HT20-High	

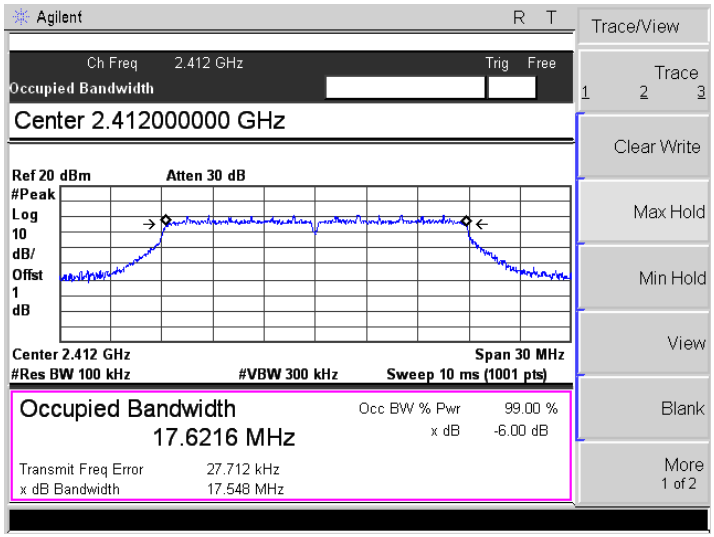
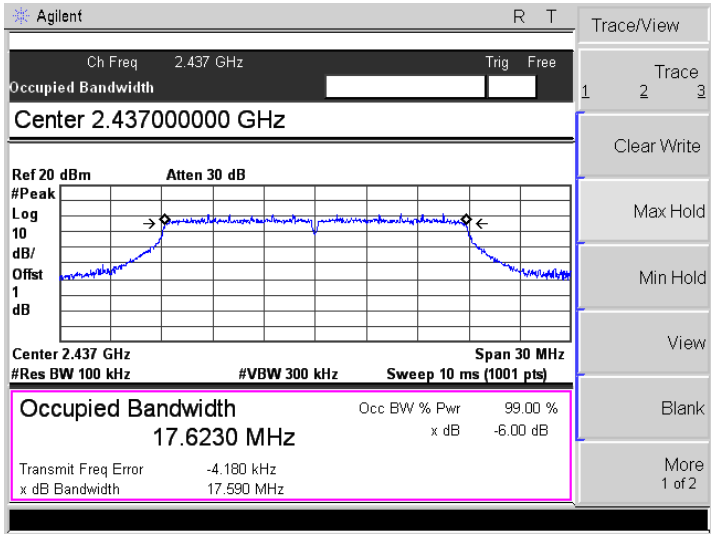
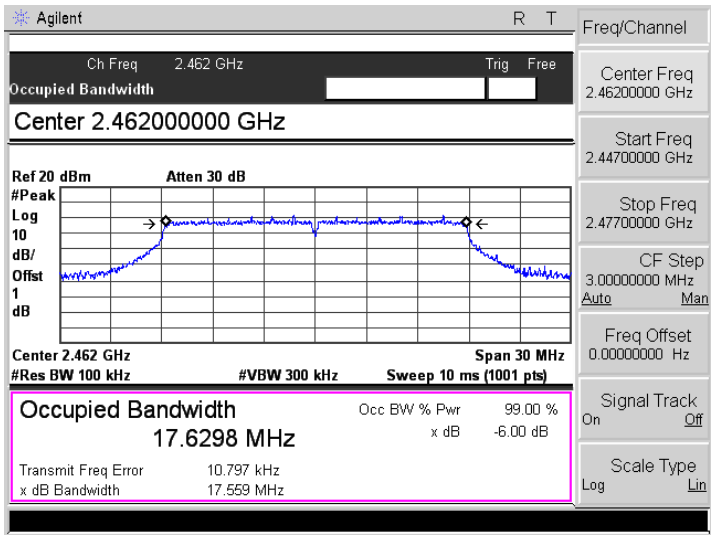
802.11n-HT40-Low	
802.11n-HT40-Middle	
802.11n-HT40-High	

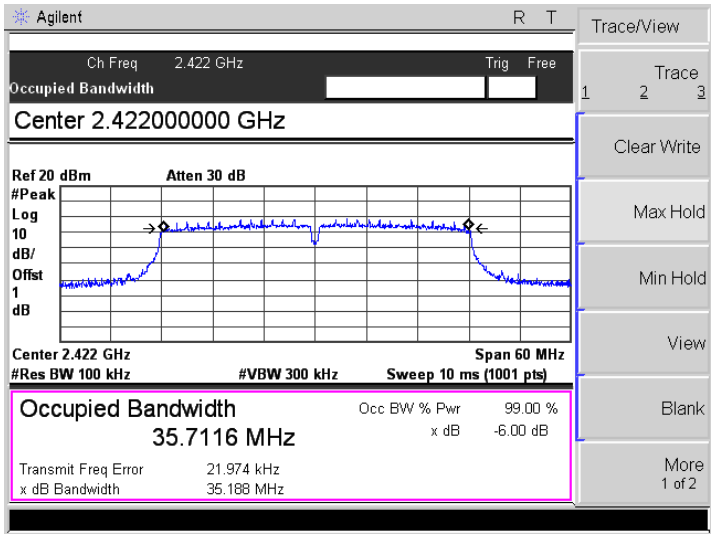
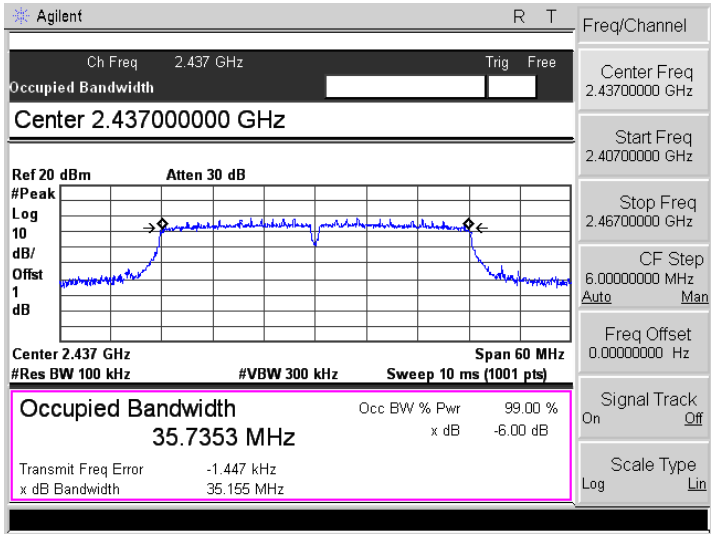
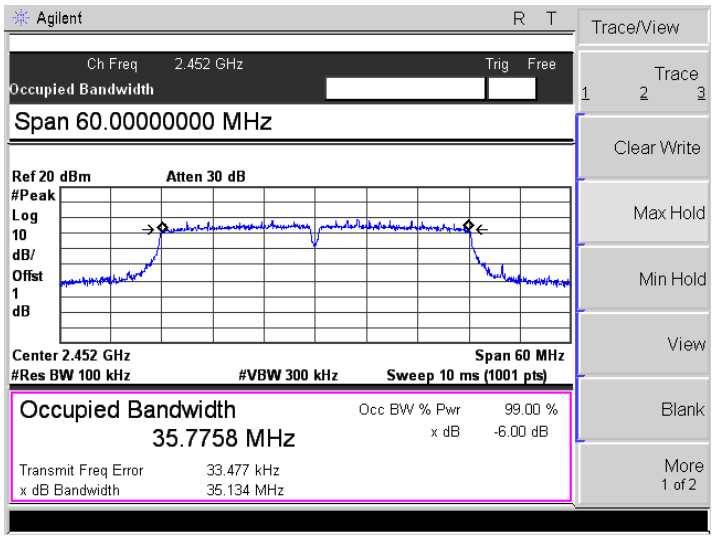
APPENDIX B

DTS Bandwidth			
Test Mode	**Test Channel MHz**	**6 dB Bandwidth MHz**	**Limit kHz**
802.11b_11Mbps	2412	10.079	≥500
	2437	10.028	≥500
	2462	10.032	≥500
802.11g_54Mbps	2412	16.365	≥500
	2437	16.354	≥500
	2462	16.333	≥500
802.11n-HT20_MCS7	2412	17.548	≥500
	2437	17.590	≥500
	2462	17.559	≥500
802.11n-HT40_MCS7	2422	35.188	≥500
	2437	35.155	≥500
	2452	35.134	≥500

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

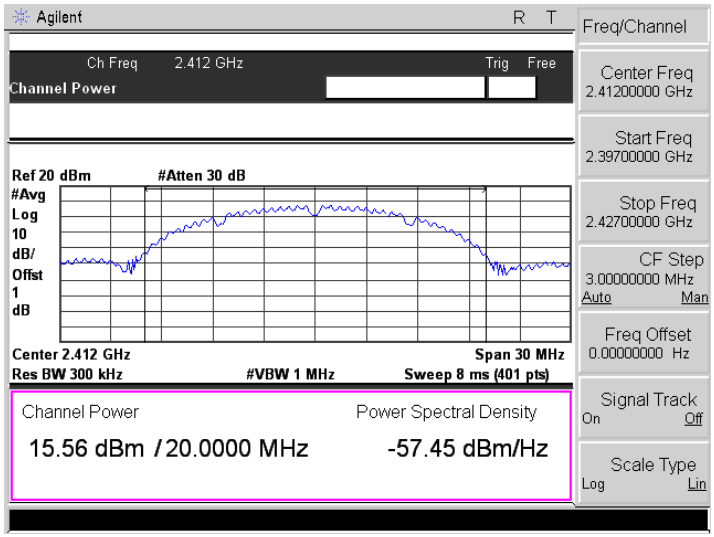
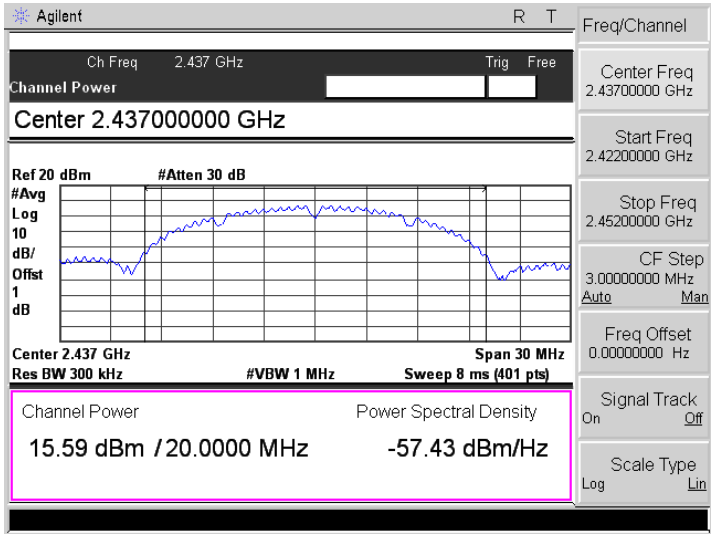
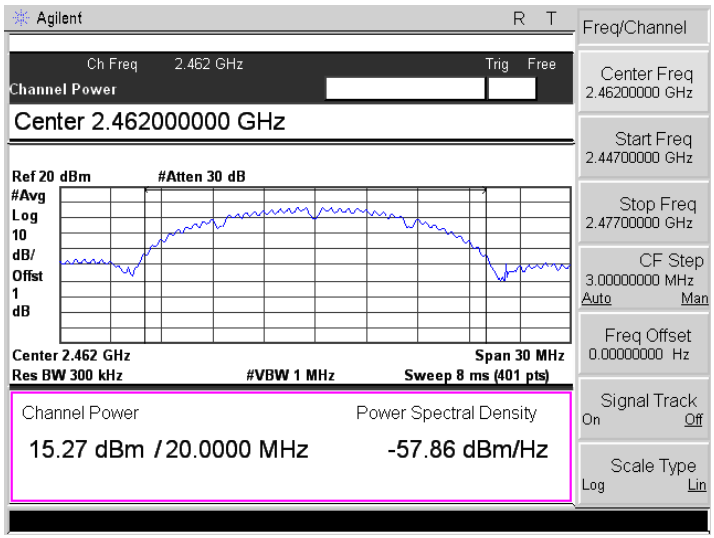
802.11g-Low	
802.11g-Middle	
802.11g-High	

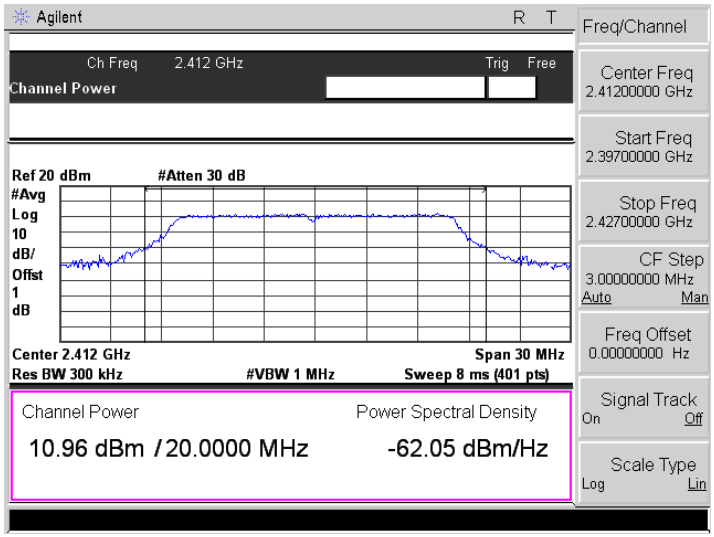
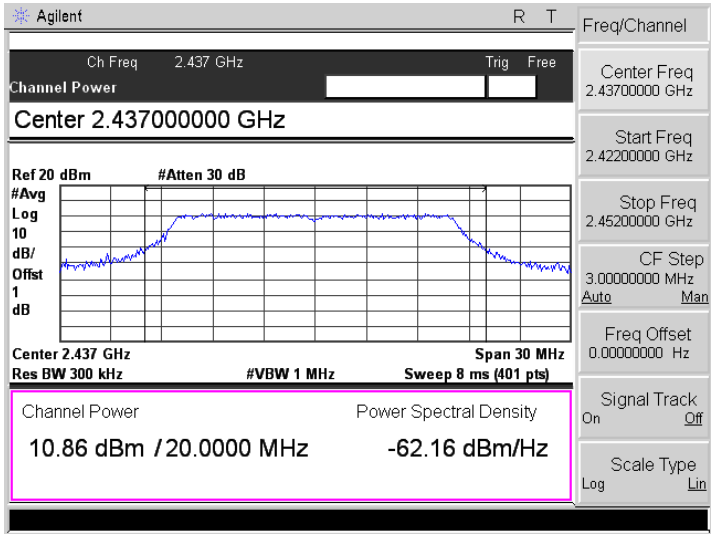
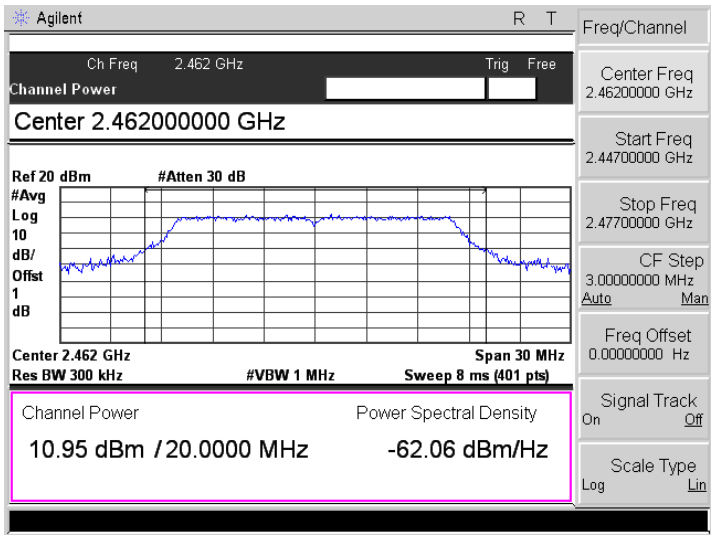
802.11n-HT20-Low	
802.11n-HT20-Middle	
802.11n-HT20-High	

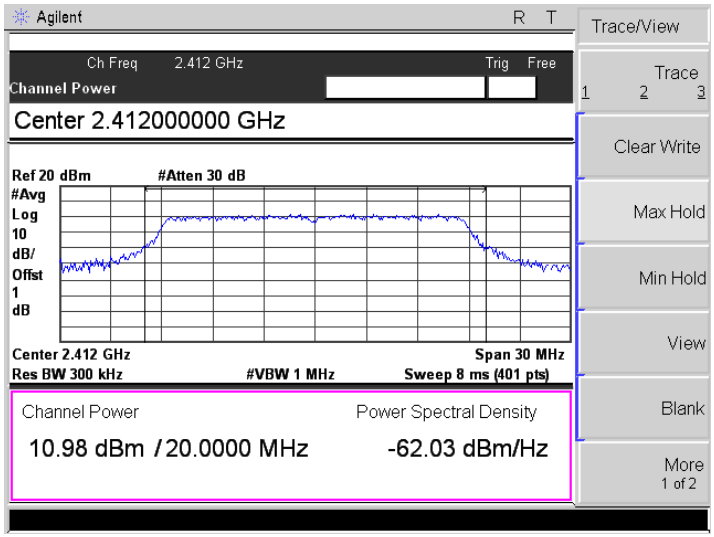
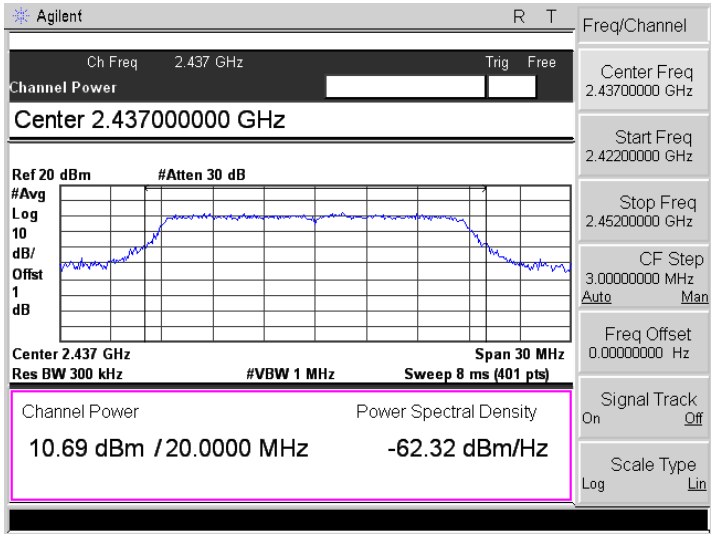
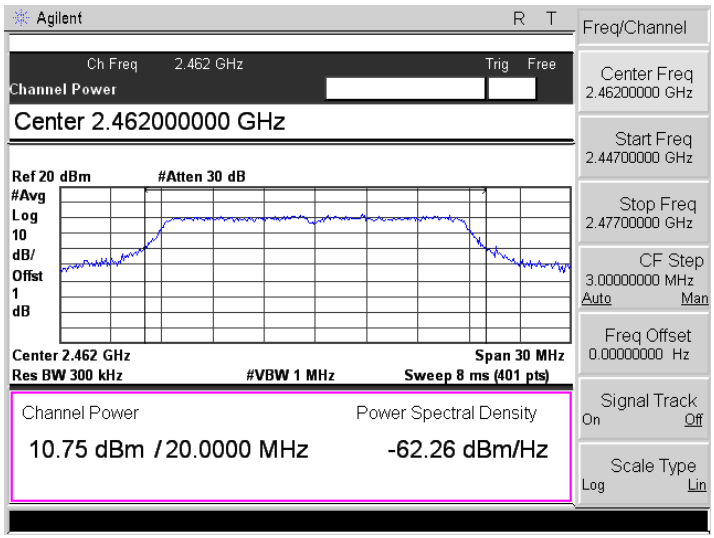
802.11n-HT40-Low	
802.11n-HT40-Middle	
802.11n-HT40-High	

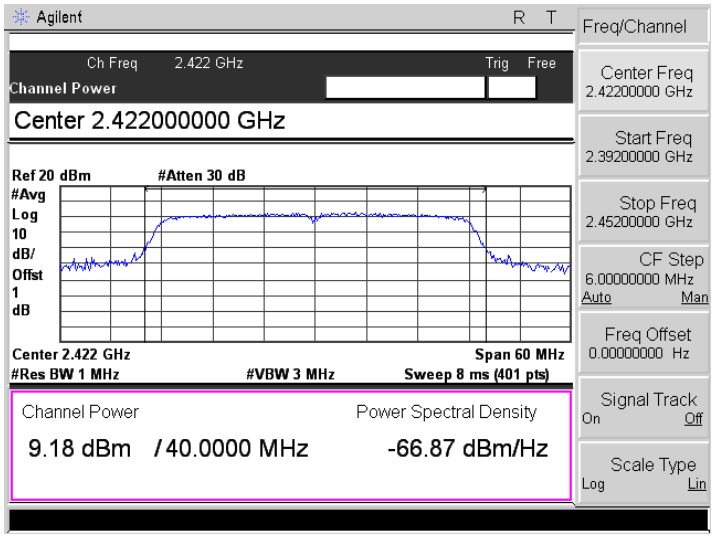
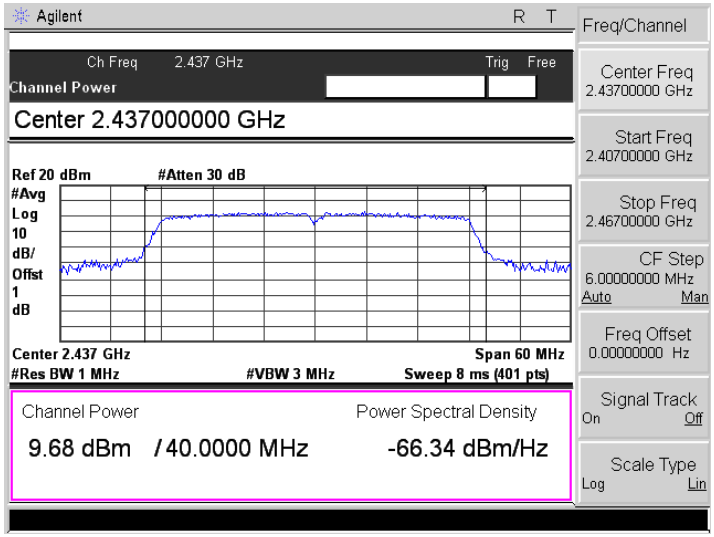
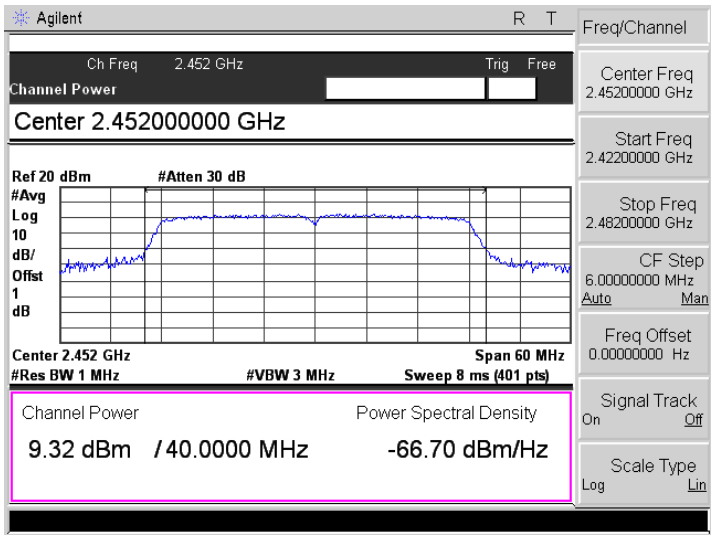
APPENDIX C

Test Mode	Frequency MHz	Reading dBm	Limit dBm
802.11b _ 11Mbps	2412	15.56	30.00
	2437	15.59	30.00
	2462	15.27	30.00
802.11g_54Mbps	2412	10.96	30.00
	2437	10.86	30.00
	2462	10.95	30.00
802.11n HT20_MCS7	2412	10.98	30.00
	2437	10.69	30.00
	2462	10.75	30.00
802.11n HT40_MCS7	2422	9.18	30.00
	2437	9.68	30.00
	2452	9.32	30.00

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

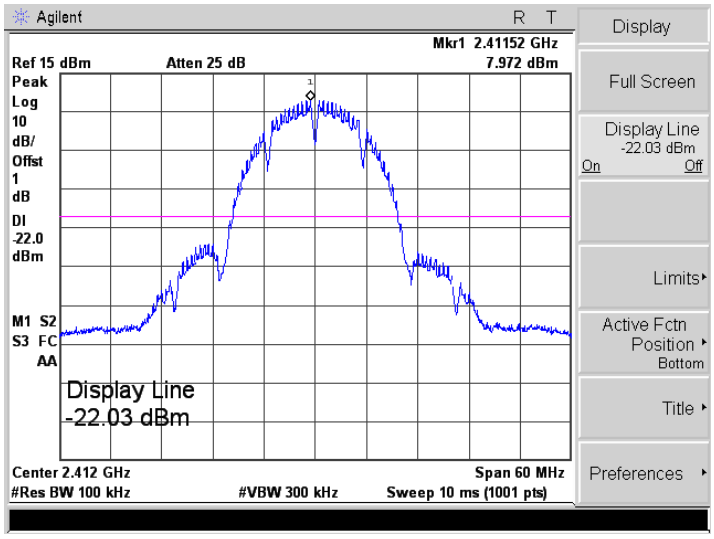
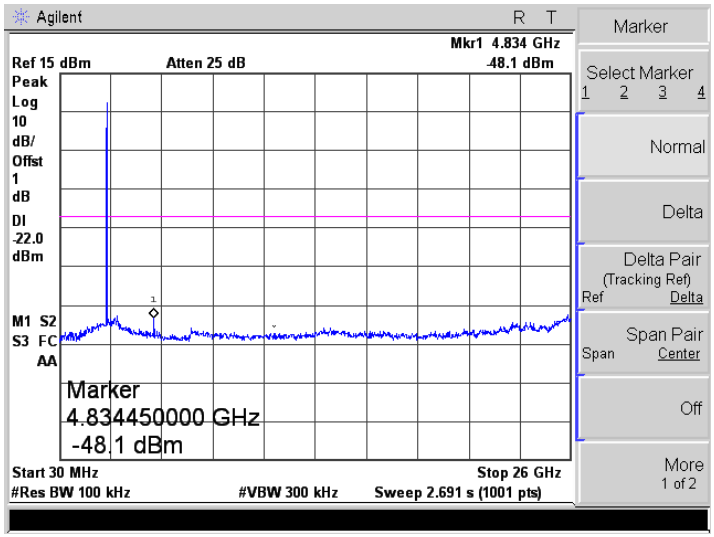
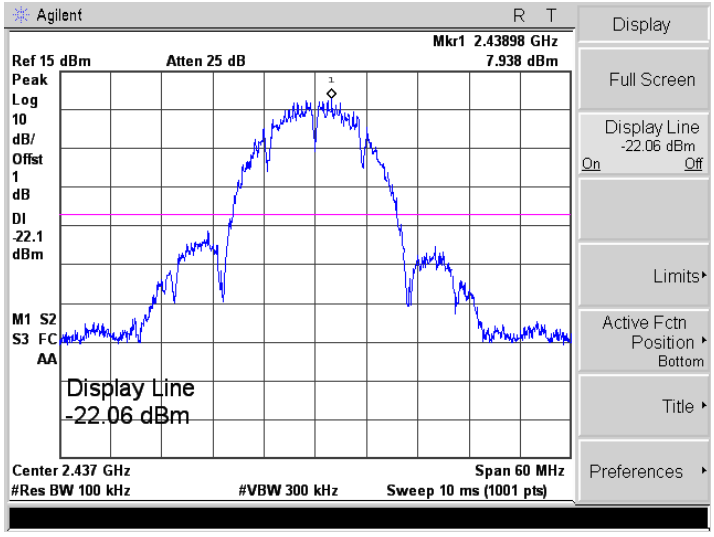
802.11g-Low	
802.11g-Middle	
802.11g-High	

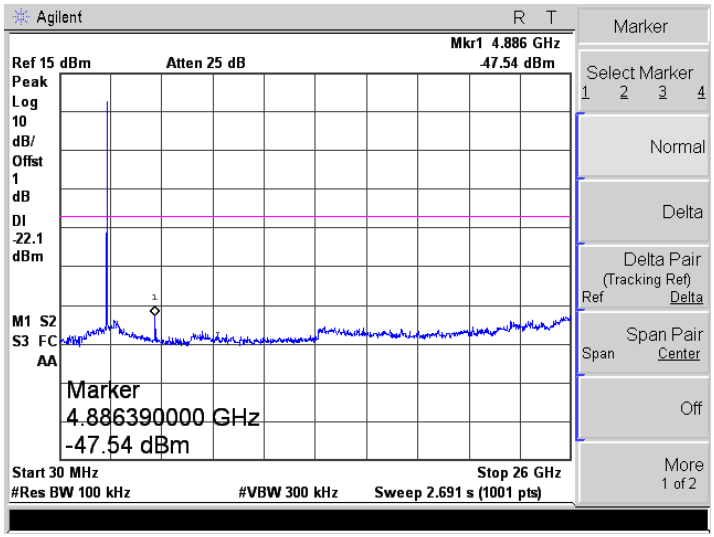
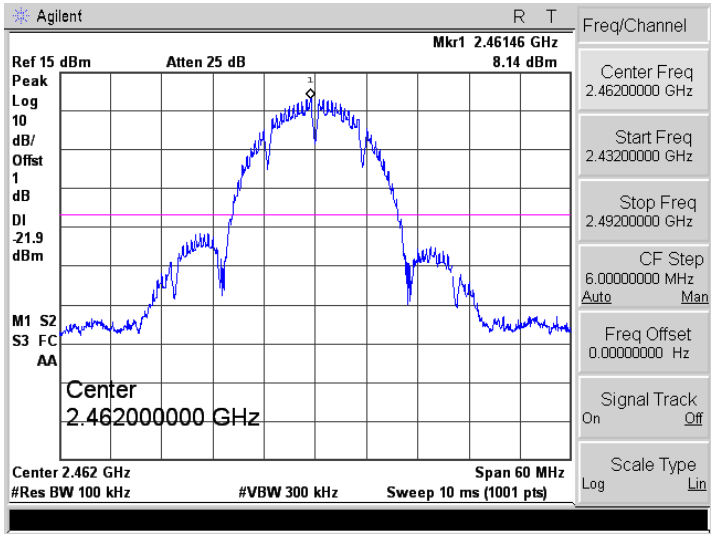
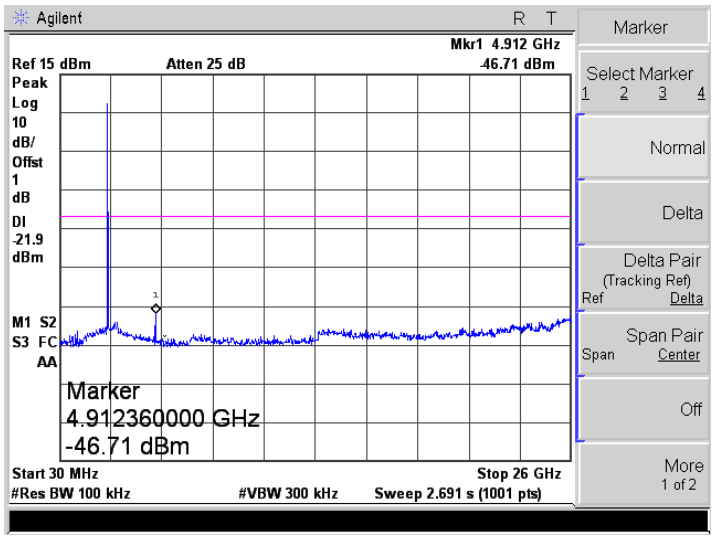
802.11n-HT20-Low	
802.11n-HT20-Middle	
802.11n-HT20-High	

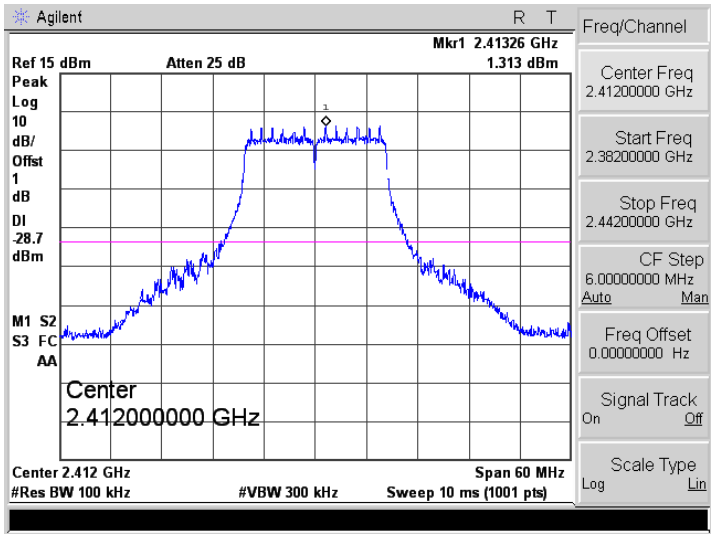
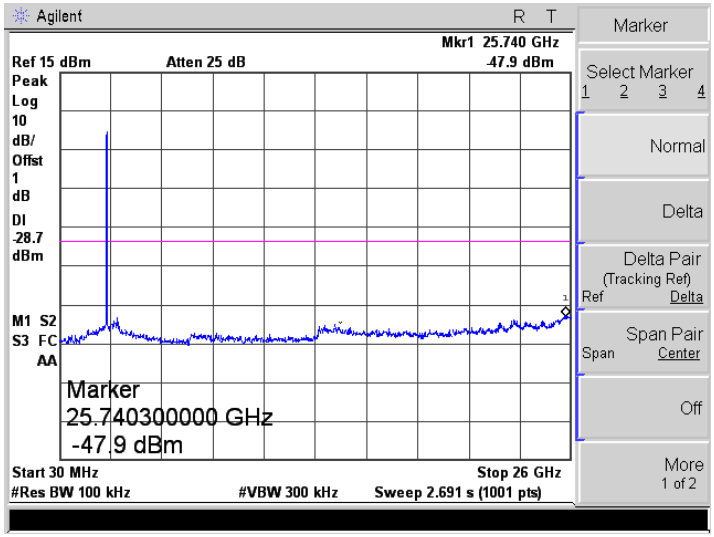
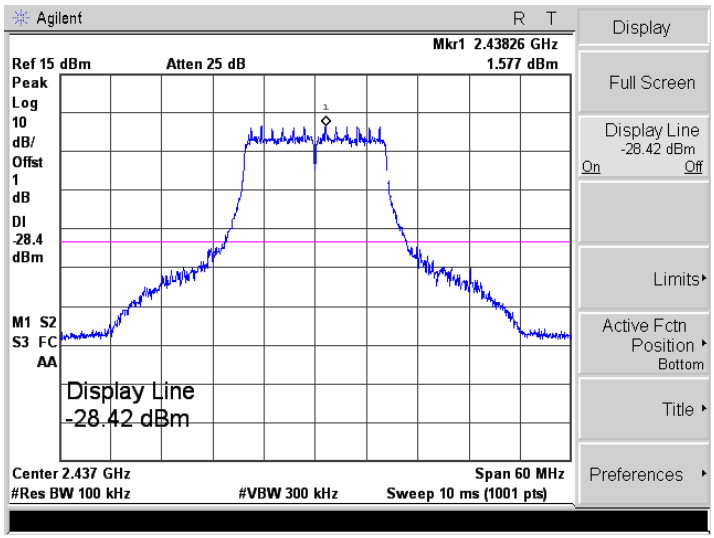
802.11n-HT40-Low	
802.11n-HT40-Middle	
802.11n-HT40-High	

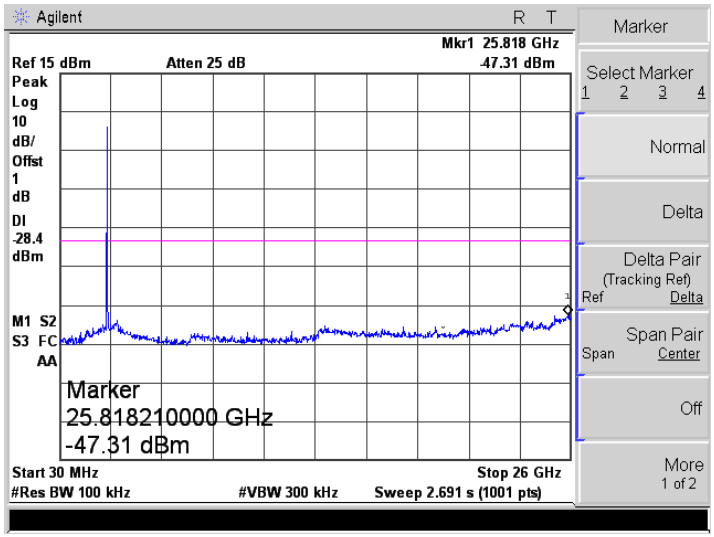
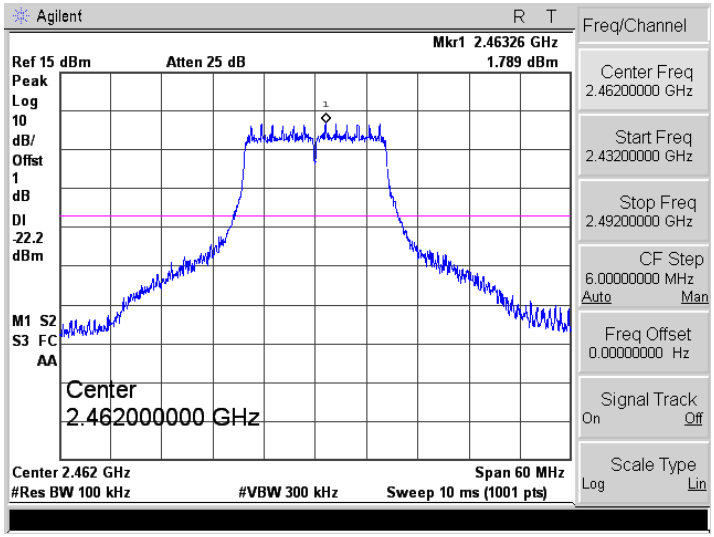
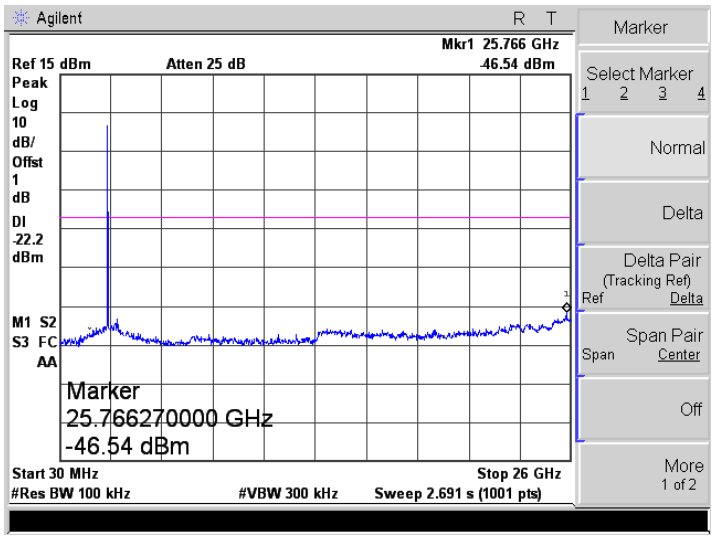
APPENDIX D

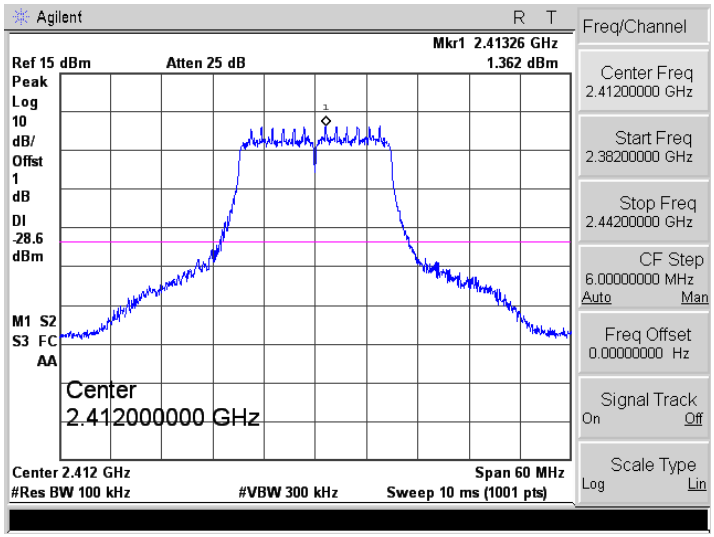
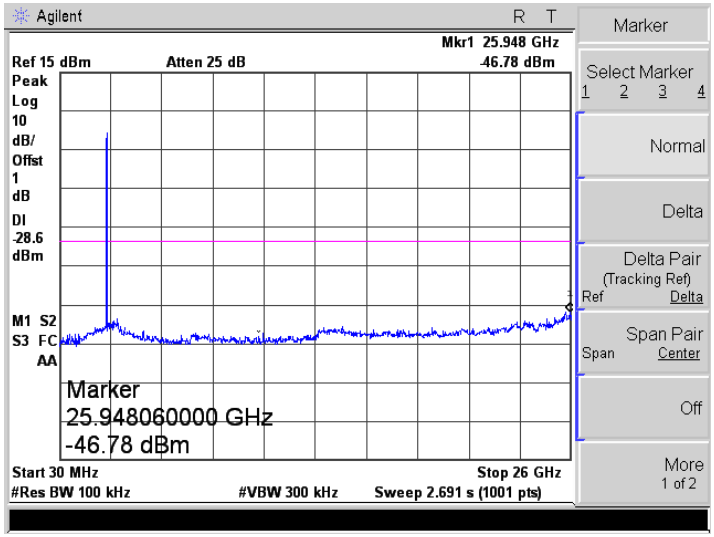
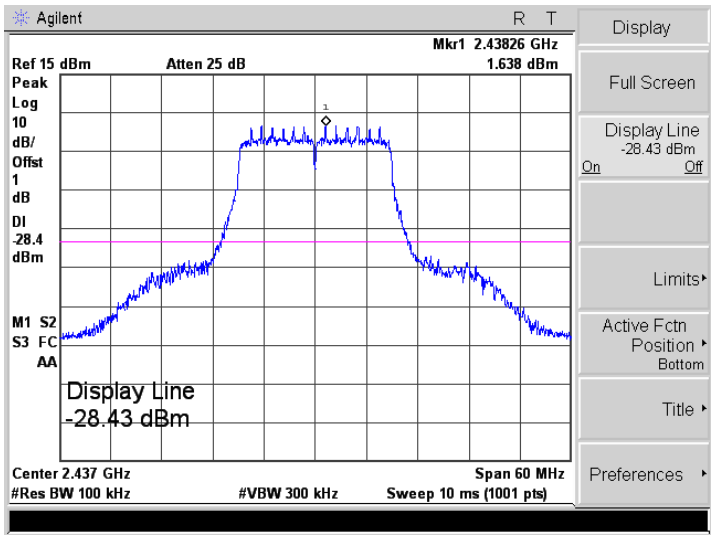
Conducted Out of Band Emissions

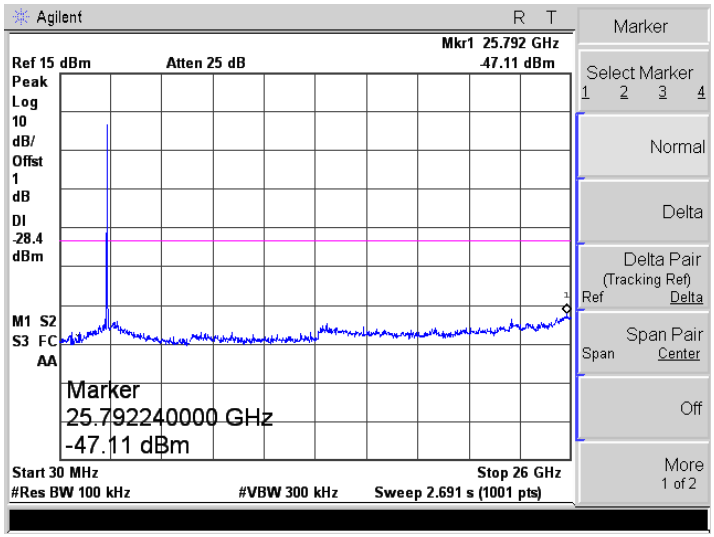
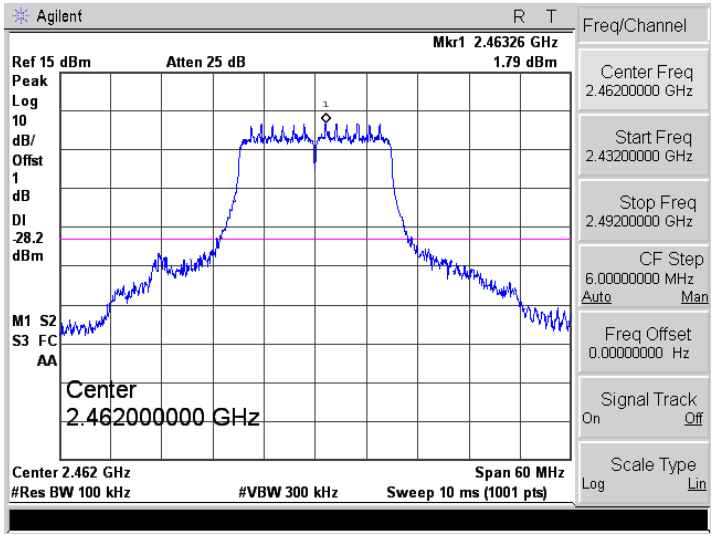
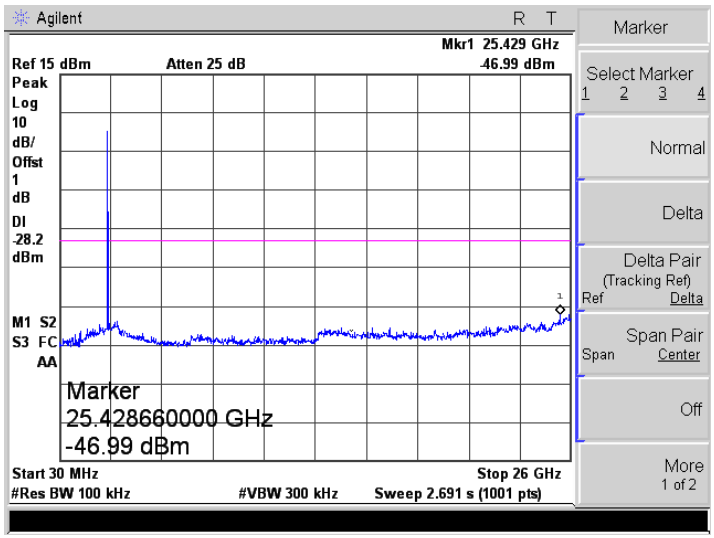
802.11b-Low	
	
802.11b-Middle	

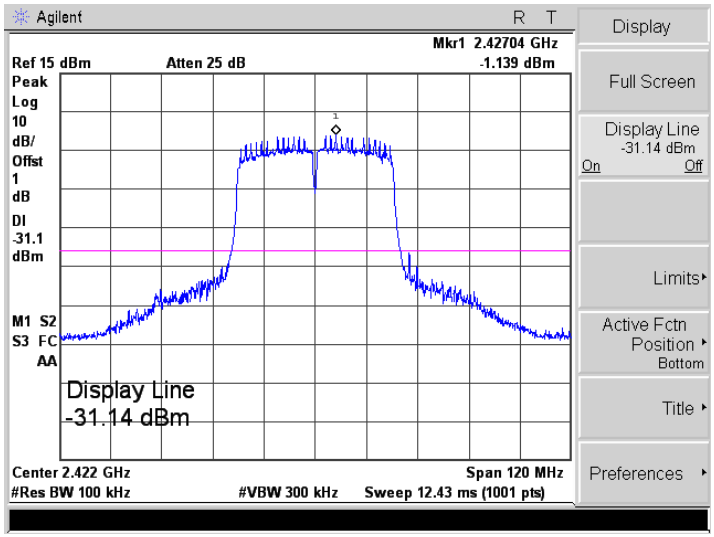
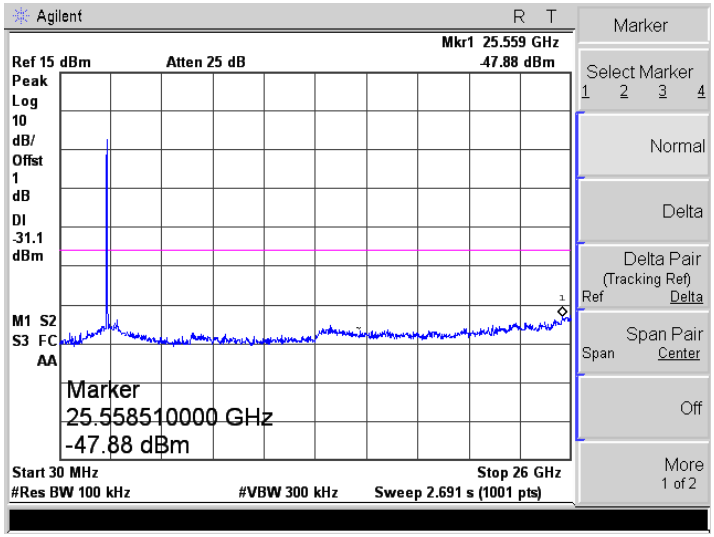
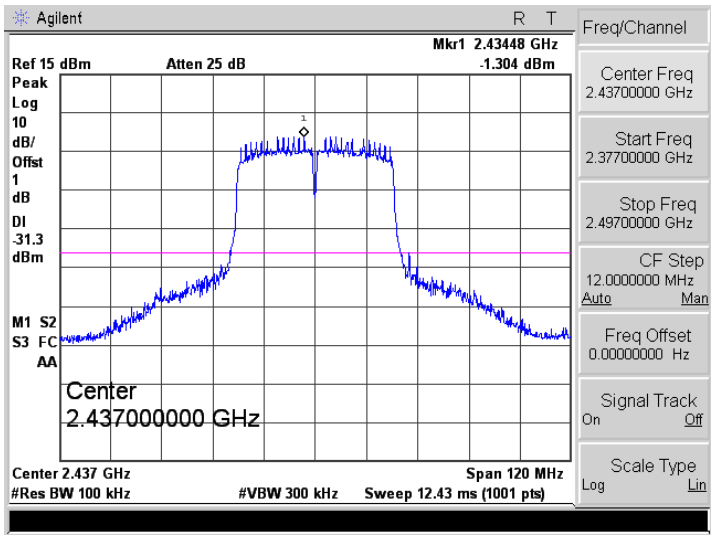
	 Agilent R T Mkr1 4.886 GHz Ref 15 dBm Atten 25 dB -47.54 dBm Peak Log 10 dB/ Offst 1 dB Dl -22.1 dBm M1 S2 S3 FC AA Marker 4.886390000 GHz -47.54 dBm Start 30 MHz Stop 26 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.691 s (1001 pts) Marker Select Marker 1 2 3 4 Normal Delta Delta Pair (Tracking Ref) Ref Delta Span Pair Span Center Off More 1 of 2
802.11b-High	 Agilent R T Mkr1 2.46146 GHz Ref 15 dBm Atten 25 dB 8.14 dBm Peak Log 10 dB/ Offst 1 dB Dl -21.9 dBm M1 S2 S3 FC AA Center 2.462000000 GHz Center 2.462 GHz Span 60 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts) Freq/Channel Center Freq 2.46200000 GHz Start Freq 2.43200000 GHz Stop Freq 2.49200000 GHz CF Step 6.00000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off Scale Type Log Lin
	 Agilent R T Mkr1 4.912 GHz Ref 15 dBm Atten 25 dB -46.71 dBm Peak Log 10 dB/ Offst 1 dB Dl -21.9 dBm M1 S2 S3 FC AA Marker 4.912360000 GHz -46.71 dBm Start 30 MHz Stop 26 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.691 s (1001 pts) Marker Select Marker 1 2 3 4 Normal Delta Delta Pair (Tracking Ref) Ref Delta Span Pair Span Center Off More 1 of 2

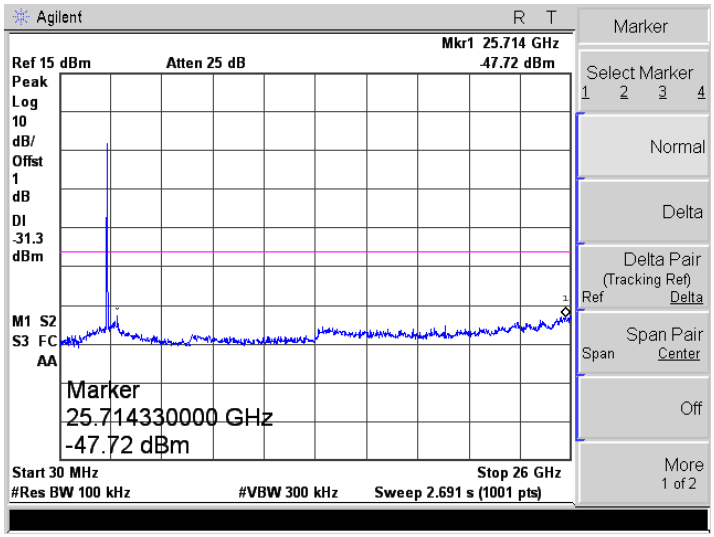
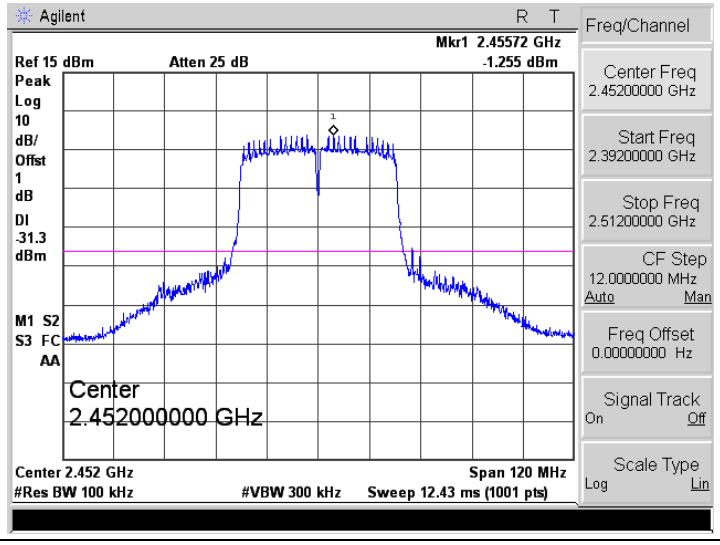
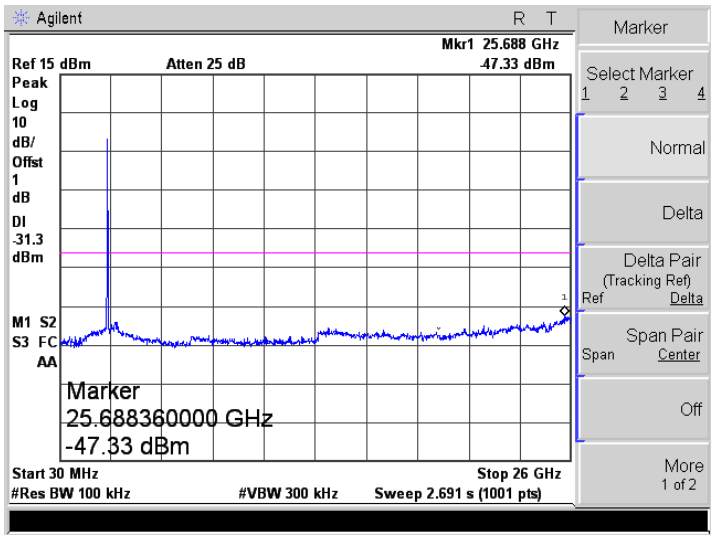
802.11g-Low	
	
802.11g-Middle	

	 Agilent R T Mkr1 25.818 GHz Ref 15 dBm Atten 25 dB -47.31 dBm Peak Log 10 dB/ Offst 1 dB Dl -28.4 dBm M1 S2 S3 FC AA Marker 25.818210000 GHz -47.31 dBm Start 30 MHz Stop 26 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.691 s (1001 pts) Marker Select Marker 1 2 3 4 Normal Delta Delta Pair (Tracking Ref) Ref Delta Span Pair Span Center Off More 1 of 2
802.11g-High	 Agilent R T Mkr1 2.46326 GHz Ref 15 dBm Atten 25 dB 1.789 dBm Peak Log 10 dB/ Offst 1 dB Dl -22.2 dBm M1 S2 S3 FC AA Center 2.462000000 GHz Center 2.462 GHz Span 60 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts) Freq/Channel Center Freq 2.46200000 GHz Start Freq 2.43200000 GHz Stop Freq 2.49200000 GHz CF Step 6.00000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off Scale Type Log Lin
	 Agilent R T Mkr1 25.766 GHz Ref 15 dBm Atten 25 dB -46.54 dBm Peak Log 10 dB/ Offst 1 dB Dl -22.2 dBm M1 S2 S3 FC AA Marker 25.766270000 GHz -46.54 dBm Start 30 MHz Stop 26 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.691 s (1001 pts) Marker Select Marker 1 2 3 4 Normal Delta Delta Pair (Tracking Ref) Ref Delta Span Pair Span Center Off More 1 of 2

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

	
802.11n-HT20-High	
	

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

	
802.11n-HT40-High	
	

APPENDIX PHOTOGRAPHS

Please refer to "ANNEX"

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