

FCC TEST REPORT

for

YICHEN (SHENZHEN) TECHNOLOGY CO., LTD

750M Wi-Fi Range Extender Repeater

Model Number: U28

Serial Number: U26, JWA-AC2500, JWA-AC2600,

JWA-AC2319R, JWA-AC2316R, JWA-AC2326R, JWA-AC2329R

FCC ID:2AJSTU28

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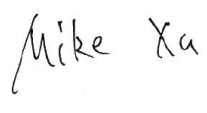

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Report No. : 16KWE094397F
Date of Test : Aug.18~Oct.17,2016
Date of Report : Oct.18, 2016

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Keyway Testing Technology Co., Ltd.

Applicant: Address:	YICHEN (SHENZHEN) TECHNOLOGY CO., LTD 23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road, Taoyuan Street, Nanshan District, Shenzhen, China		
Manufacturer: Address:	YICHEN (SHENZHEN) TECHNOLOGY CO., LTD 23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road, Taoyuan Street, Nanshan District, Shenzhen, China		
E.U.T:	750M Wi-Fi Range Extender Repeater		
Model Number:	U28		
Serial Model:	U26, JWA-AC2500, JWA-AC2600, JWA-AC2319R, JWA-AC2316R, JWA-AC2326R, JWA-AC2329R		
Trade Name:	 JCG	Serial No.:	-----
Date of Receipt:	Aug. 17 , 2016	Date of Test:	Aug.18~Oct.17,2016
Test Specification:	FCC Part 15, Subpart 15.247: Oct. 1, 2015 ANSI C63.10:2013 KDB558074 D01 DTS Meas Guidance v03r05		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: Oct.18, 2016			
Tested by:	Reviewed by:	Approved by:	
			
_____ Keven Wu / Engineer	_____ Mike Xu / Supervisor	_____ Andy Gao / Supervisor	
Other Aspects:	None.		
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.			

1.TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.205(a)/15.209/15.247(d)	PASS
6dB&99% Bandwidth	15.247(a)(2)	PASS
Power density	15.247(e)	PASS
Maximum Peak Output Power	15.247(b)(3)	PASS
Emissions from out of band	15.247(d)	PASS
Antenna Requirement	15.203	PASS

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	750M Wi-Fi Range Extender Repeater
Model No.:	U28
Serial Model:	U26, JWA-AC2500, JWA-AC2600, JWA-AC2319R, JWA-AC2316R, JWA-AC2326R, JWA-AC2329R
Model Difference	All the models are the same circuit and RF module, except the model names and colour.
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(H20)) 2422MHz~2452MHz (802.11n(H40))
Channel numbers:	11 for 802.11b/802.11g/802.11n(H20) ,7 for 802.11n(H40)
Modulation technology:	Direct Sequence Spread Spectrum (DSSS) for (IEEE 802.11b) Orthogonal Frequency Division Multiplexing(OFDM) for (IEEE 802.11g/802.11n)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps
Data speed (IEEE 802.11n):	Up to 300Mbps
Antenna Type:	PIFA antenna
Antenna gain:	2.0dBi , MIMO the antenna gain is 5.01dBi
Power supply:	AC 120V/60Hz
Adapter:	N/A

2.3. Independent Operation Modes

The basic operation modes are:

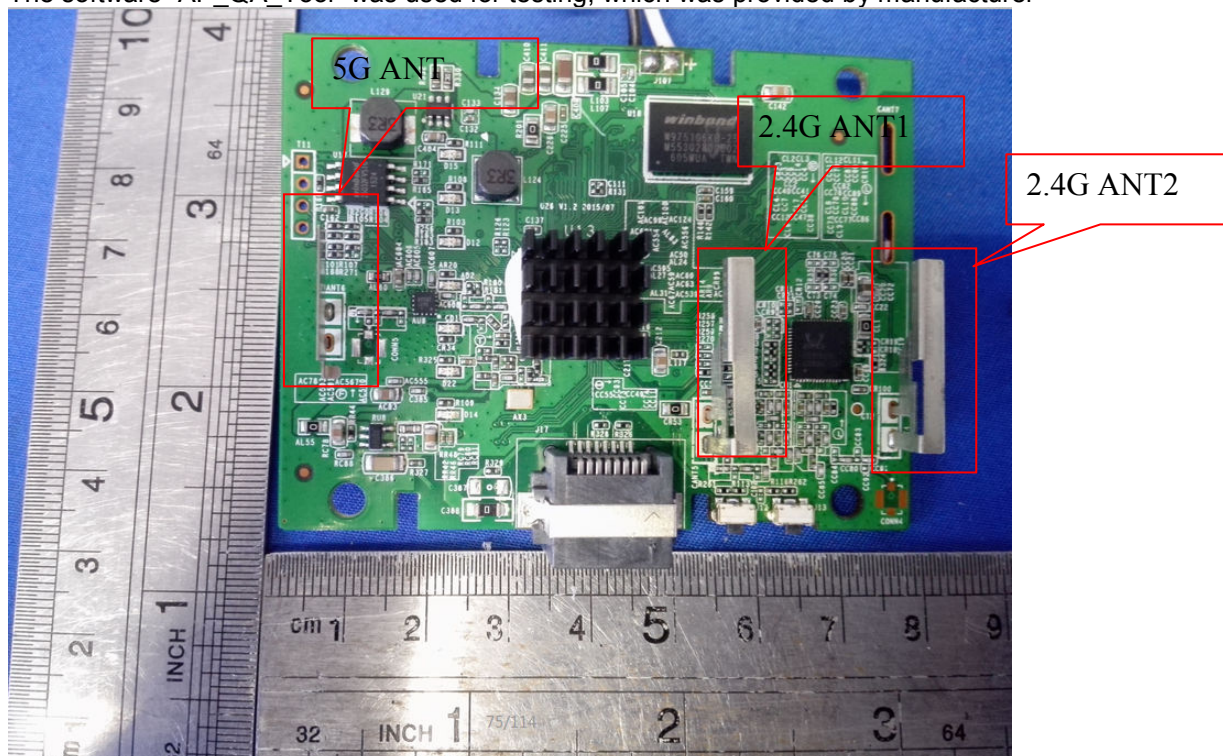
2.3.1. EUT work WFI TX mode, and frequency as below:

Mode	Standard	Frequency
		Frequency
Mode 1	802.11b	2412MHz
		2437MHz
		2462MHz
Mode 2	802.11g	2412MHz
		2437MHz
		2462MHz
Mode 3	802.11n(HT20)	2412MHz
		2437MHz
		2462MHz
Mode 4	802.11 n(HT40)	2422MHz
		2437MHz
		2452MHz
Mode 5	LINK Mode	

Note:

802.11b mode:1Mbps ,802.11g mode:6Mbps , 802.11n HT20 mode:MCS0, 802.11n HT40 mode:MCS0 was test.

The software “AP_QA_Tool” was used for testing, which was provided by manufacturer



The software “AP_QA_Tool” was used for testing, which was provided by manufacturer
 The Control software can control antenna 1/ 2,
 antenna 1/ 2 are transmitting, two antennas simultaneously transmit.
 For MIMO mode , Directional gain= $G_{ANT} + 10\log(N)\text{dbi} = 2 + 10\log 2 = 5.01\text{dbi}$ in 2.4GHz
 802.11n 2.4GHz has MIMO mode

2.4. Test Supporting System

None.

2.5. TEST SITES

2.5.1. Test Facilities

Lab Qualifications : Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February 21, 2012

Certificated by CNAS China
Registration No.: CNAS L5783
Date of registration: August 8, 2012

2.6. List of Test and Measurement Instruments

2.6.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 09,17
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 09,16	Apr. 09,17
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 09,16	Apr. 09,17
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 09,16	Apr. 09,17

2.6.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 09,17
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 09,16	Apr. 09,17
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 09,16	Apr. 09,17
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 09,16	Apr. 09,17
Signal Amplifier	SONOMA	310	187016	Apr. 09,16	Apr. 09,17
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 09,16	Apr. 09,17
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 09,16	Apr. 09,17
Attenuation	MCE	24-10-34	BN9258	Apr. 09,16	Apr. 09,17
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 09,16	Apr. 09,17
High Pass filter	Micro	HPM50111	324216	Apr. 09,16	Apr. 09,17
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 09,16	Apr. 09,17
Attenuation	MCE	24-10-34	BN9258	Apr. 02,16	Apr. 02,17
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 02,16	Apr. 02,17
Power Meter	Anritsu	ML2495A	1204003	Apr. 24,16	Apr. 24,17
Power Sensor	Anritsu	MA2411B	1126150	Apr. 24,16	Apr. 24,17

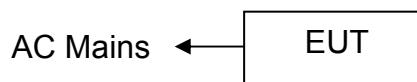
3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: 750M Wi-Fi Range Extender Repeater)

3.3. Special Accessories and Auxiliary Equipment

N/A

3.4. Countermeasures to Achieve EMC Compliance

N/A.

4. EMISSION TEST RESULTS

4.1. Conducted Emission at the Mains Terminals Test

4.1.1. Limit 15.209 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

4.1.2. Test Setup

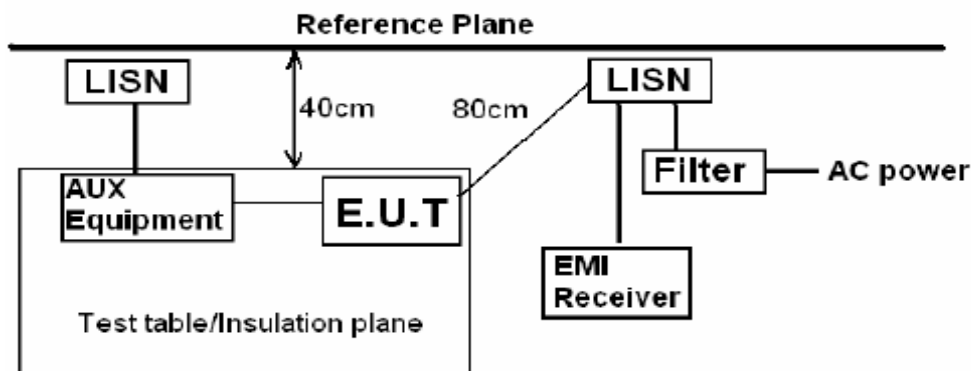
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the centre so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

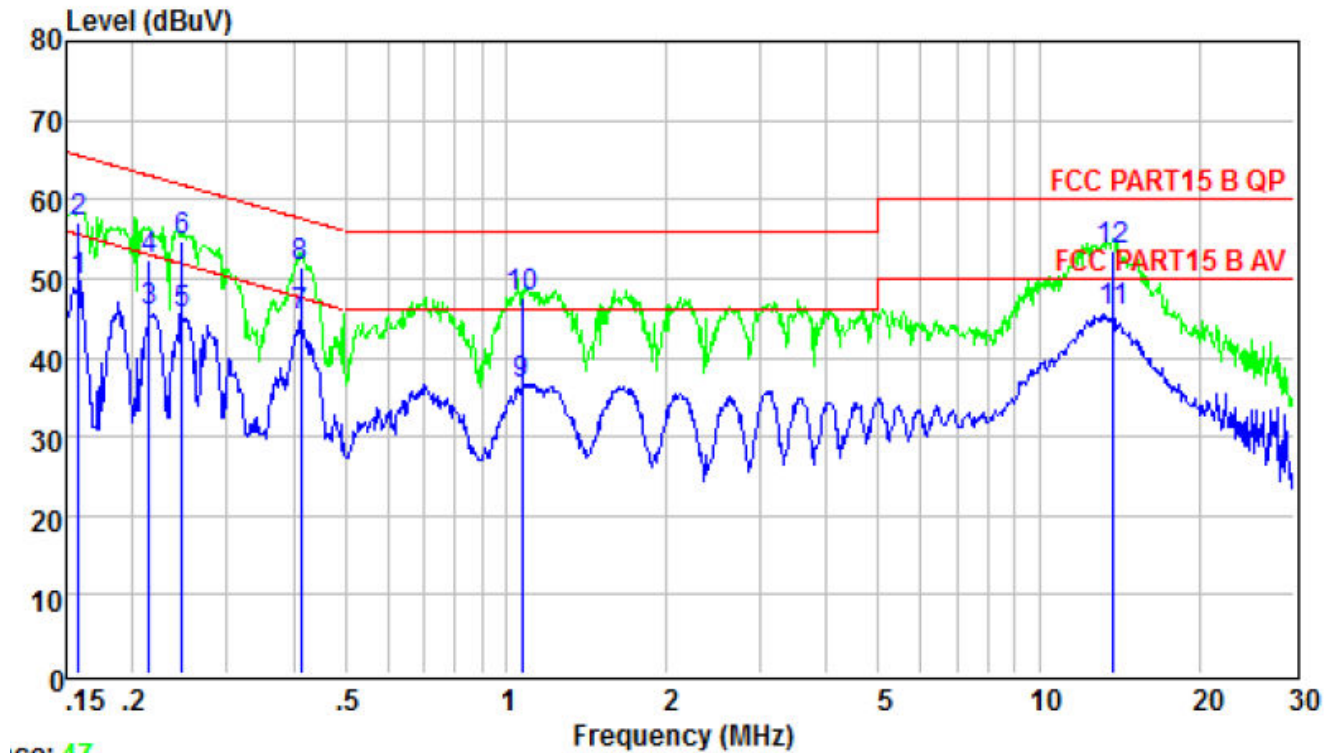
The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedance Stabilization Network
Test table height=0.8m

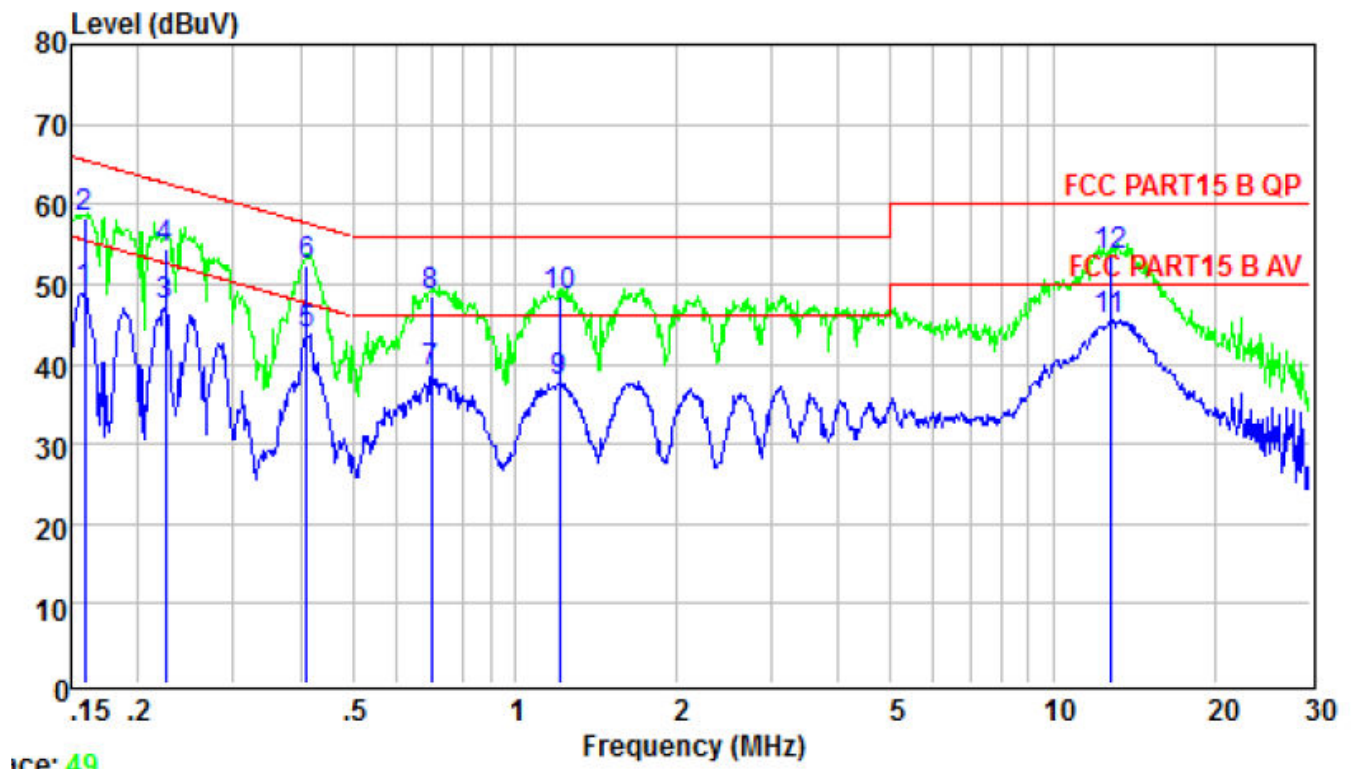
EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC 120V/60Hz	Test Mode :	Mode 5



ice: 47

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.158	49.81	55.56	-5.75	Average
2	0.158	57.23	65.56	-8.33	QP
3	0.215	45.65	53.01	-7.36	Average
4	0.215	52.43	63.01	-10.58	QP
5	0.247	45.63	51.86	-6.23	Average
6	0.247	54.76	61.86	-7.10	QP
7	0.413	45.17	47.59	-2.42	Average
8	0.413	51.32	57.59	-6.27	QP
9	1.071	36.66	46.00	-9.34	Average
10	1.071	47.67	56.00	-8.33	QP
11	13.768	45.67	50.00	-4.33	Average
12	13.768	53.65	60.00	-6.35	QP

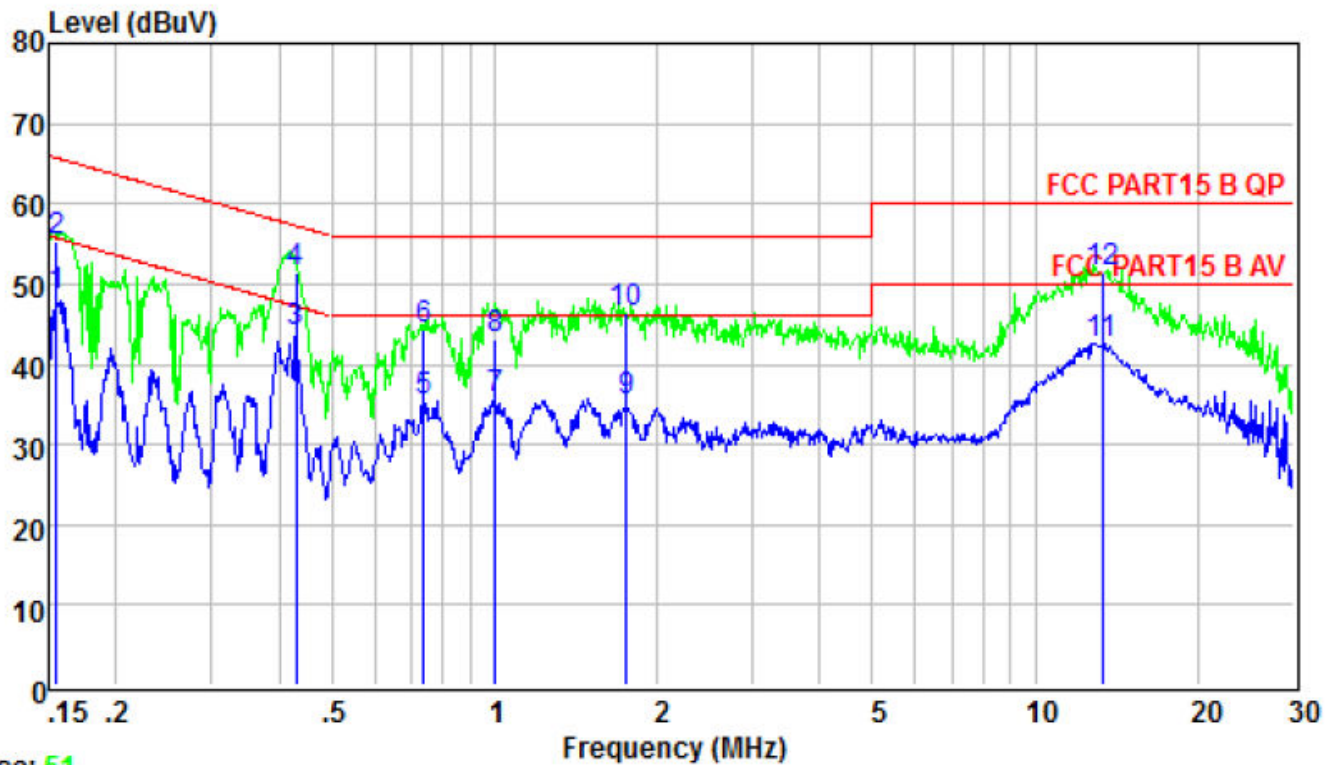
EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC 120V/60Hz	Test Mode :	Mode 5



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.159	49.21	55.52	-6.31	Average
2	0.159	58.43	65.52	-7.09	QP
3	0.224	47.19	52.66	-5.47	Average
4	0.224	54.32	62.66	-8.34	QP
5	0.410	43.69	47.64	-3.95	Average
6	0.410	52.34	57.64	-5.30	QP
7	0.701	38.84	46.00	-7.16	Average
8	0.701	48.45	56.00	-7.55	QP
9	1.210	37.65	46.00	-8.35	Average
10	1.210	48.43	56.00	-7.57	QP
11	12.784	45.59	50.00	-4.41	Average
12	12.784	53.43	60.00	-6.57	QP

EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC 240V/60Hz	Test Mode :	Mode 5

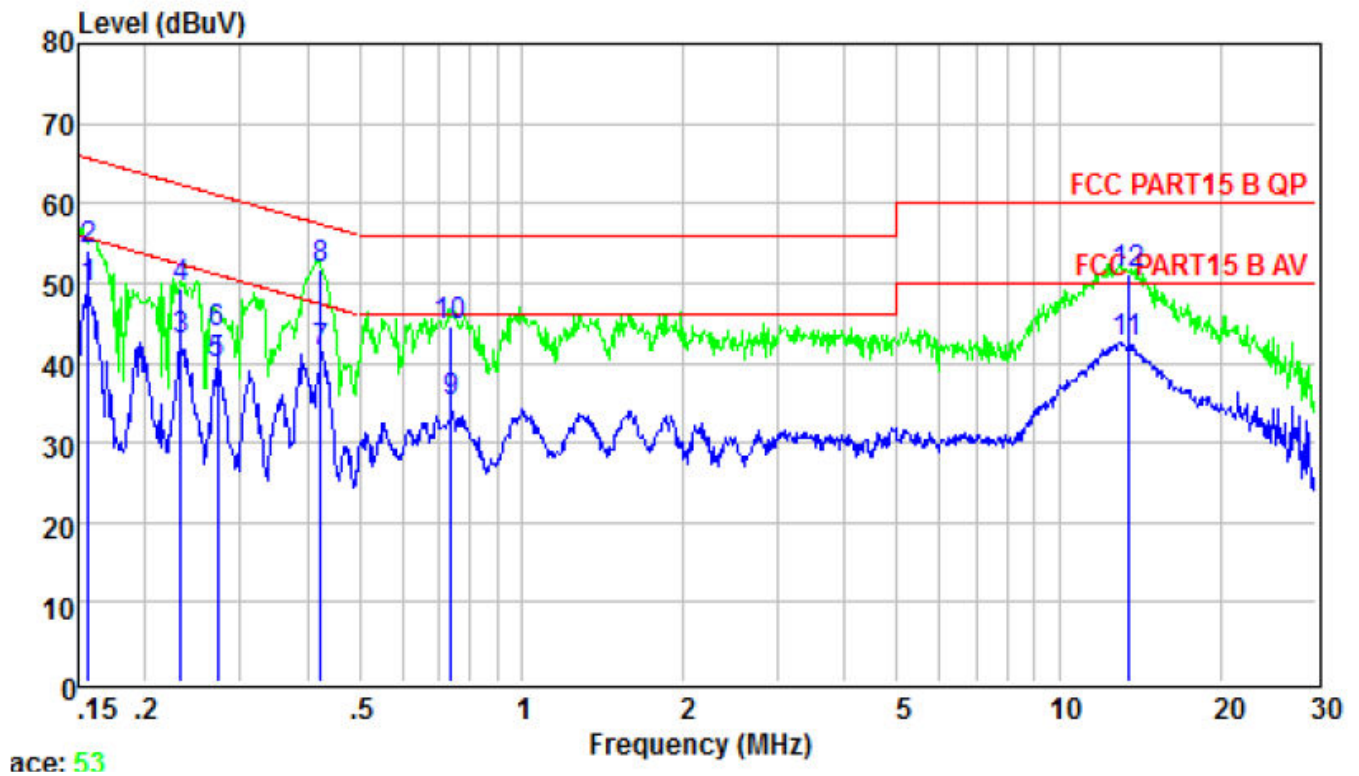
Line:



Trace: 51

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.155	48.53	55.74	-7.21	Average
2	0.155	55.43	65.74	-10.31	QP
3	0.431	43.89	47.24	-3.35	Average
4	0.431	51.42	57.24	-5.82	QP
5	0.739	35.27	46.00	-10.73	Average
6	0.739	44.34	56.00	-11.66	QP
7	1.005	35.54	46.00	-10.46	Average
8	1.005	43.23	56.00	-12.77	QP
9	1.753	35.40	46.00	-10.60	Average
10	1.753	46.47	56.00	-9.53	QP
11	13.267	42.61	50.00	-7.39	Average
12	13.267	51.43	60.00	-8.57	QP

EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC 240V/60Hz	Test Mode :	Mode 5



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.156	49.31	55.65	-6.34	Average
2	0.156	54.11	65.65	-11.54	QP
3	0.233	42.70	52.35	-9.65	Average
4	0.233	49.43	62.35	-12.92	QP
5	0.273	39.80	51.03	-11.23	Average
6	0.273	43.82	61.03	-17.21	QP
7	0.424	41.40	47.37	-5.97	Average
8	0.424	51.66	57.37	-5.71	QP
9	0.739	35.10	46.00	-10.90	Average
10	0.739	44.54	56.00	-11.46	QP
11	13.408	42.63	50.00	-7.37	Average
12	13.408	51.09	60.00	-8.91	QP

4.2. Radiated Emission Test

4.2.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

4.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

4.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m (above 1GHz, the high was 1.5m) above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, Both PK and AV measure, PK detector is used.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.

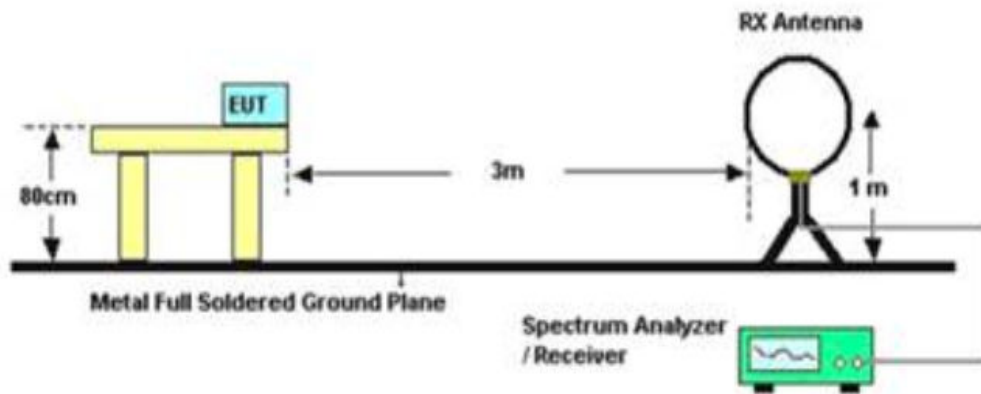
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.

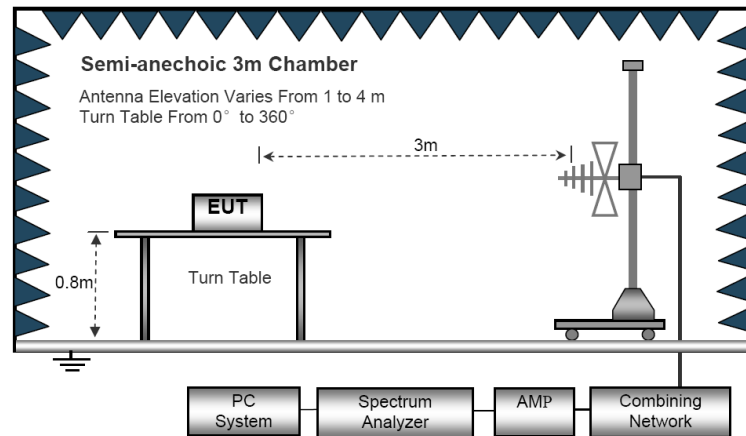
5. For Both PK and AV value above 1GHz, PK detector is used.

6. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).

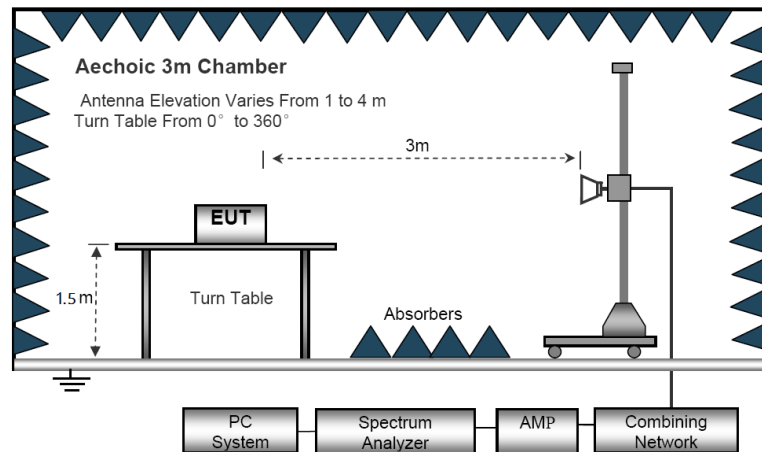
Radiated Emission Test-Up Frequency Below 30MHz



Below 1GHz



Above 1GHz



EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX
Test Voltage :	AC 120V/60Hz		

Below 30MHz

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

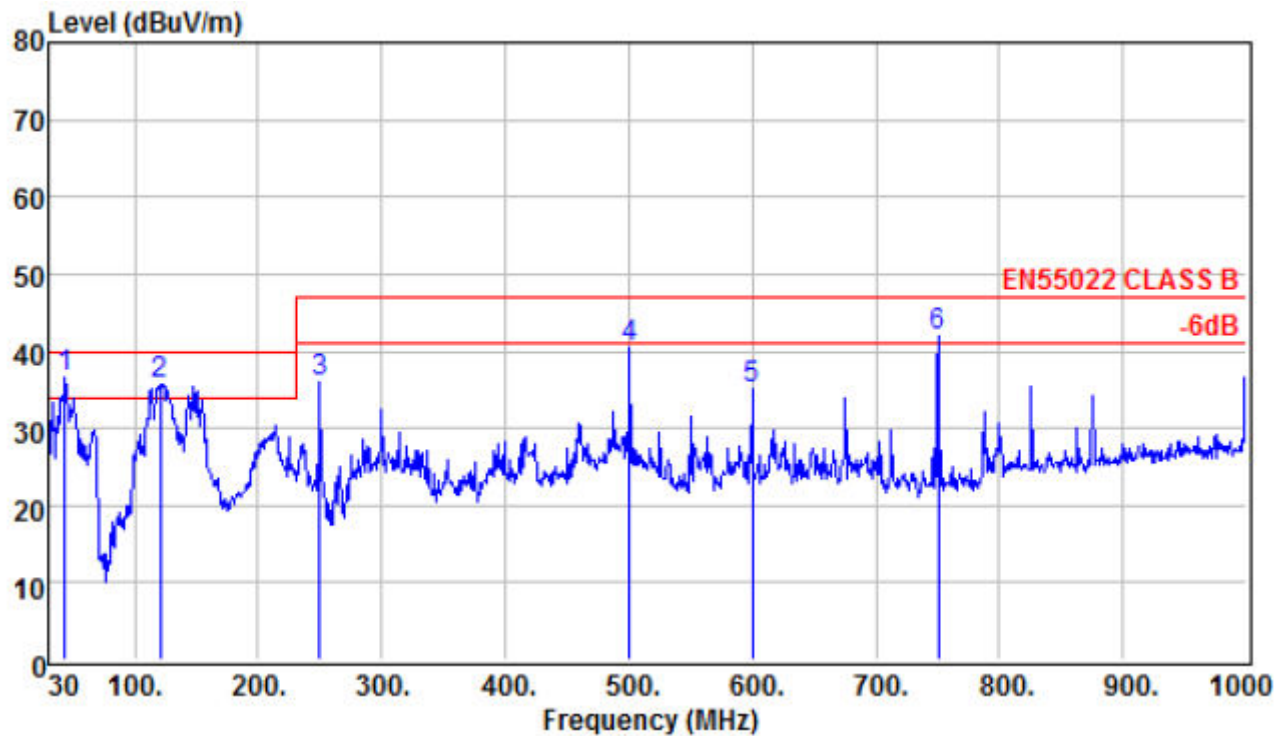
Distance extrapolation factor = $40 \log (\text{specific distance/test distance})(\text{dB})$;

Limit line = specific limits(dBuv) + distance extrapolation factor.

Below 1GHz

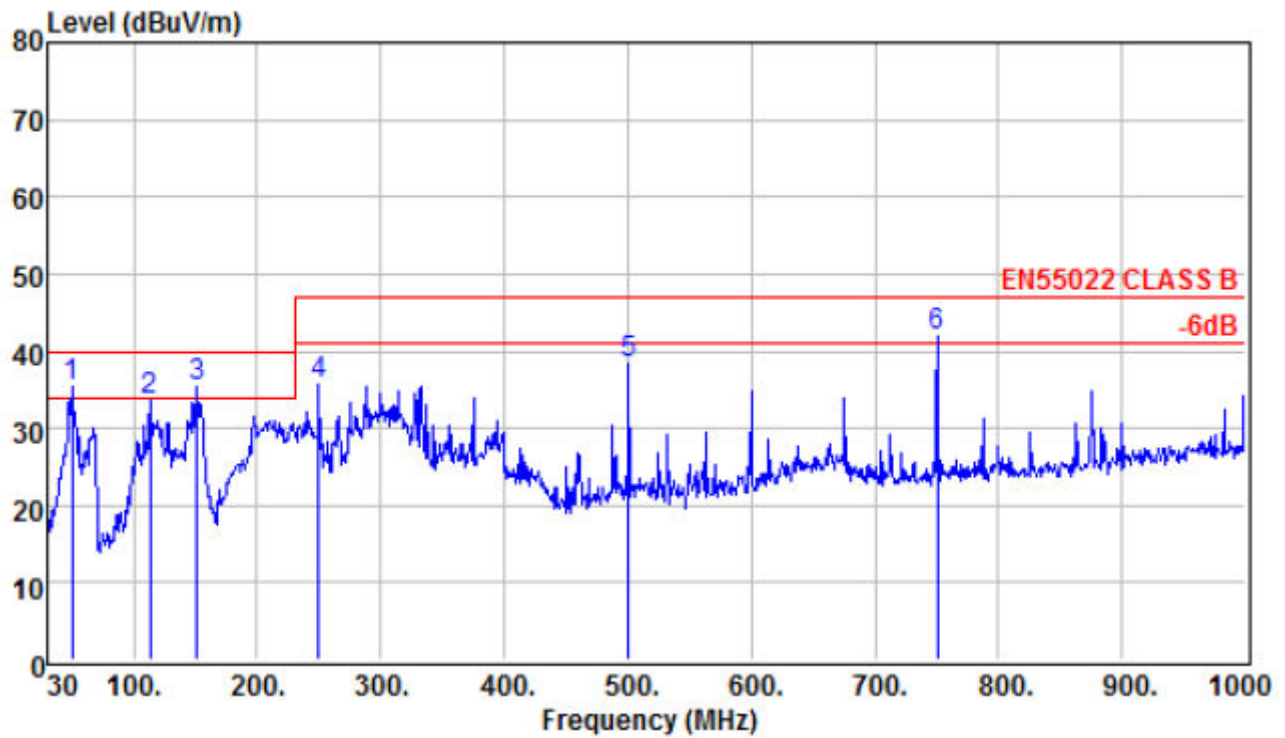
EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX
Test Voltage :	AC 120V/60Hz		

Vertical



		ReadAntenna	Cable	Preamp		Limit	Over	
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1 !	43.580	56.13	11.43	0.56	31.39	36.73	40.00	-3.27 QP
2 !	120.210	57.38	8.50	1.12	31.24	35.76	40.00	-4.24 QP
3	250.190	52.37	12.90	1.70	30.97	36.00	47.00	-11.00 QP
4	500.450	49.35	18.71	2.85	30.60	40.31	47.00	-6.69 QP
5	600.360	41.75	20.61	3.29	30.62	35.03	47.00	-11.97 QP
6 !	750.710	45.59	22.80	4.12	30.67	41.84	47.00	-5.16 QP

Horizontal



		ReadAntenna	Cable	Preamp		Limit	Over	
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1 !	50.370	57.37	8.74	0.75	31.38	35.48	40.00	-4.52 QP
2	113.420	54.79	9.03	1.03	31.29	33.56	40.00	-6.44 QP
3 !	151.250	56.42	9.02	1.22	31.25	35.41	40.00	-4.59 QP
4	250.190	52.02	12.90	1.70	30.97	35.65	47.00	-11.35 QP
5	500.450	47.45	18.71	2.85	30.60	38.41	47.00	-8.59 QP
6 !	750.710	45.73	22.80	4.12	30.67	41.98	47.00	-5.02 QP

NOTE:

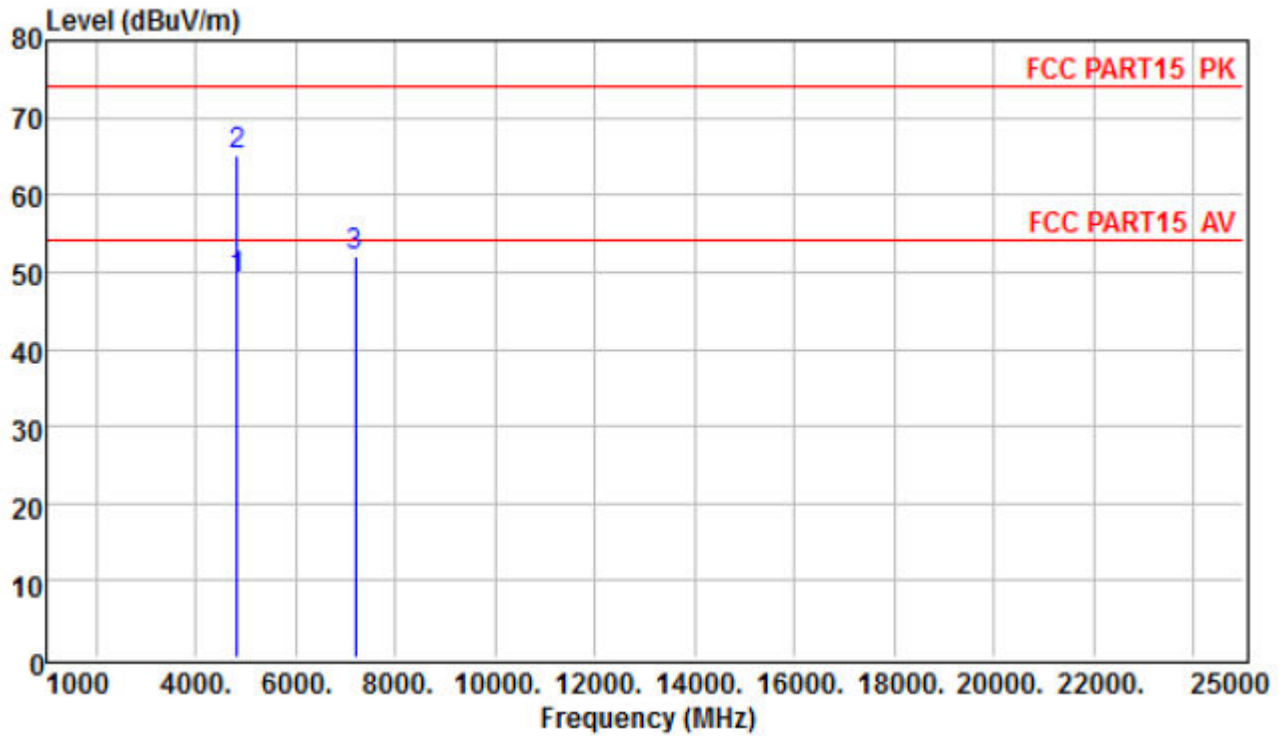
Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor,

Over Limit= Absolute Level – Limit

Above 1GHz

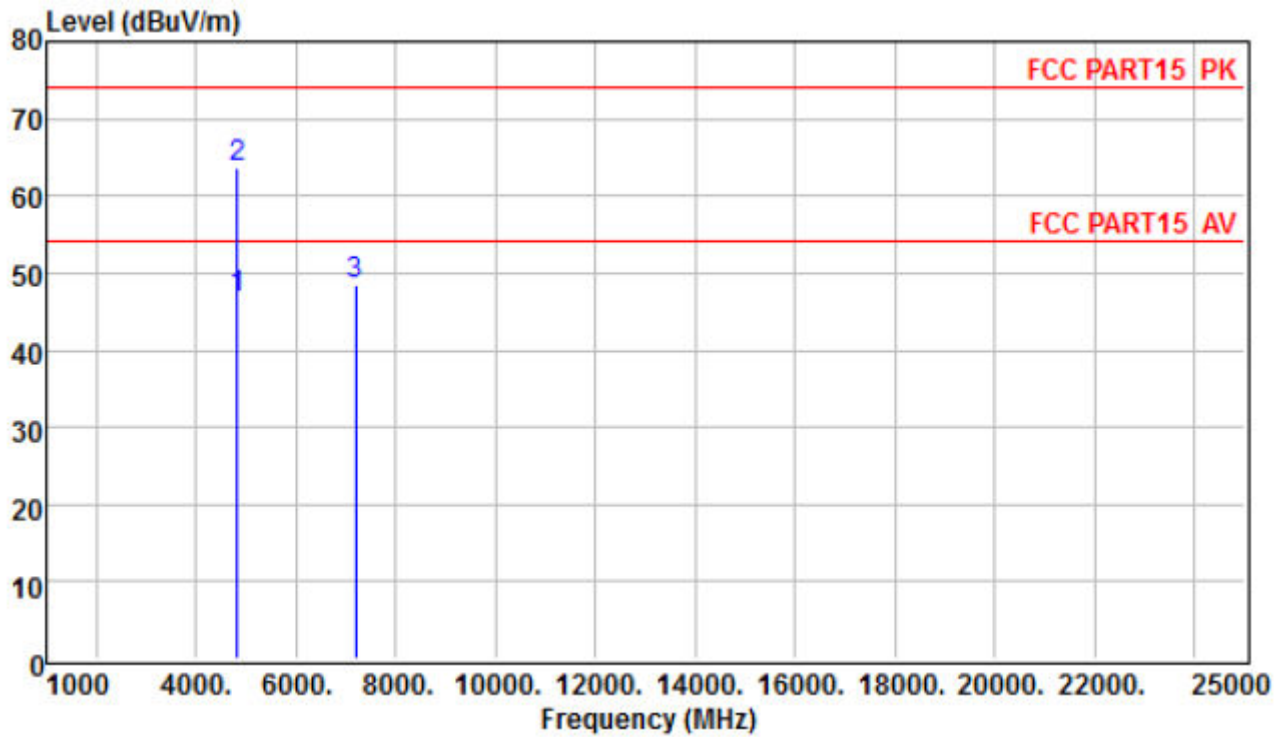
EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX-2412
Test Voltage :	AC 120V/60Hz		

Vertical



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Limit Level	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	4824.000	32.64	31.99	12.01	27.50	49.14	54.00	-4.86 Average
2	4824.000	48.64	31.99	12.01	27.50	65.14	74.00	-8.86 Peak
3	7206.000	37.99	25.28	16.61	27.94	51.94	74.00	-22.06 Peak

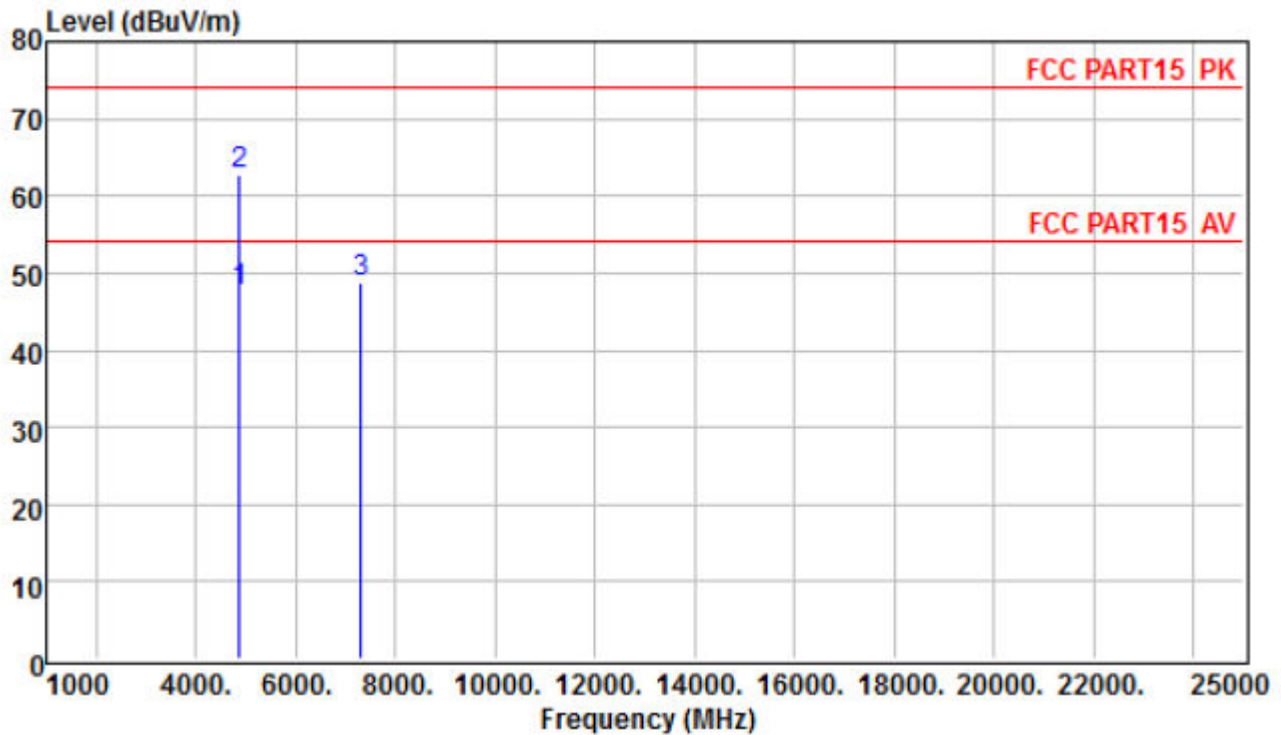
Horizontal



	Freq	Read	Antenna	Cable	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	dBuV/m	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4824.000	30.29	31.99	12.01	27.50	46.79	54.00	-7.21	Average
2	4824.000	47.10	31.99	12.01	27.50	63.60	74.00	-10.40	Peak
3	7206.000	34.54	25.28	16.61	27.94	48.49	74.00	-25.51	Peak

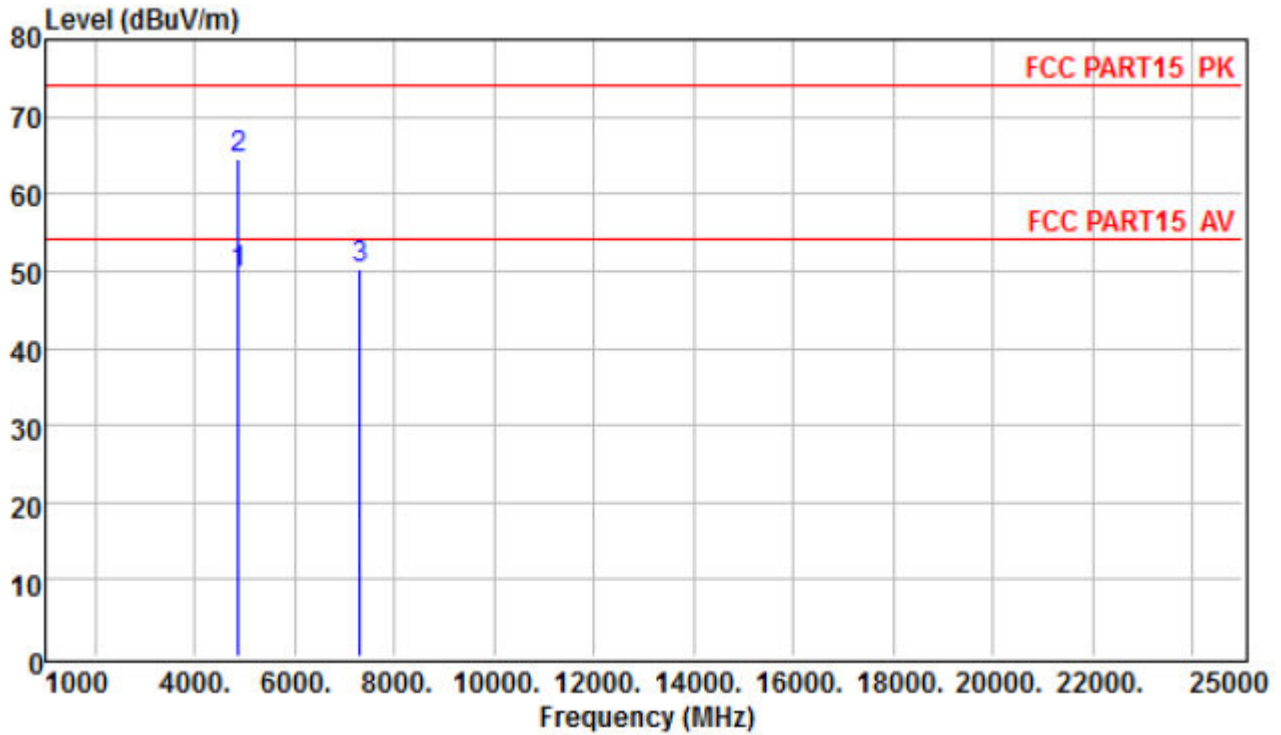
EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX-2437
Test Voltage :	AC 120V/60Hz		

Vertical



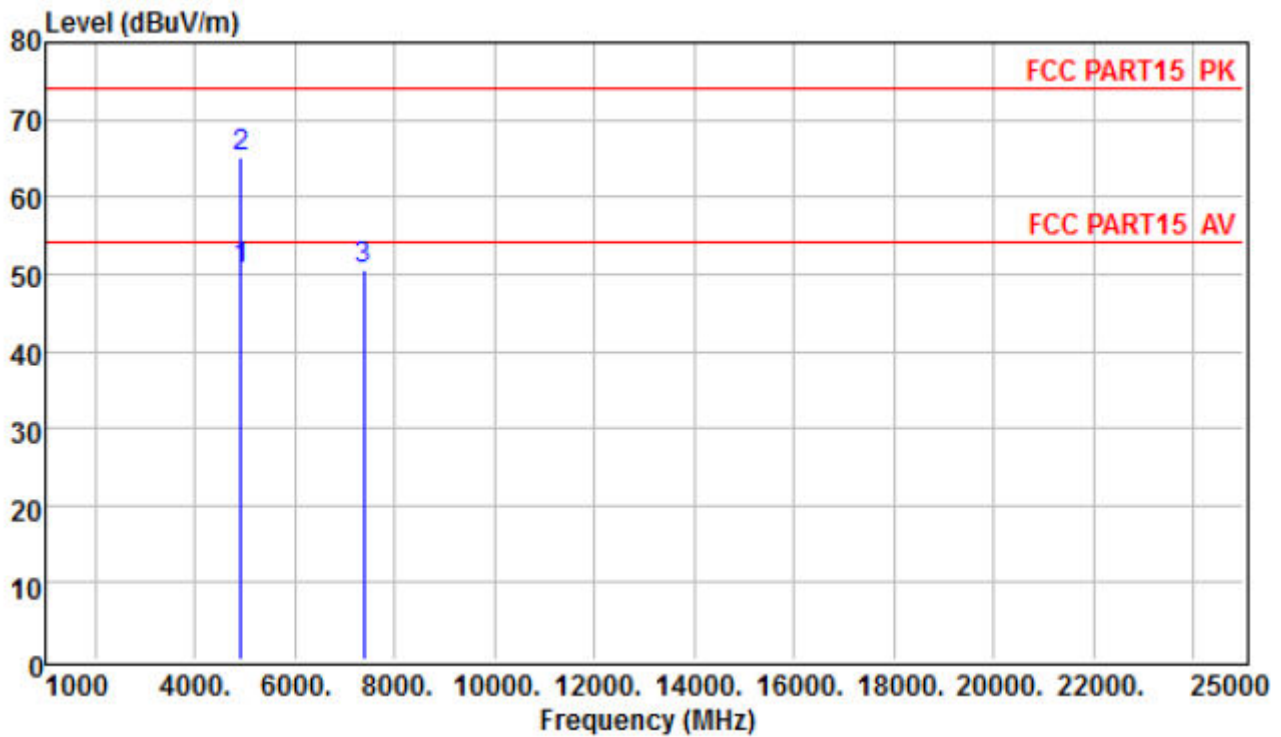
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4874.000	30.76	32.11	12.14	27.53	47.48	54.00	-6.52	Average
2	4874.000	46.11	32.11	12.14	27.53	62.83	74.00	-11.17	Peak
3	7311.000	35.76	24.32	16.62	27.96	48.74	74.00	-25.26	Peak

Horizontal



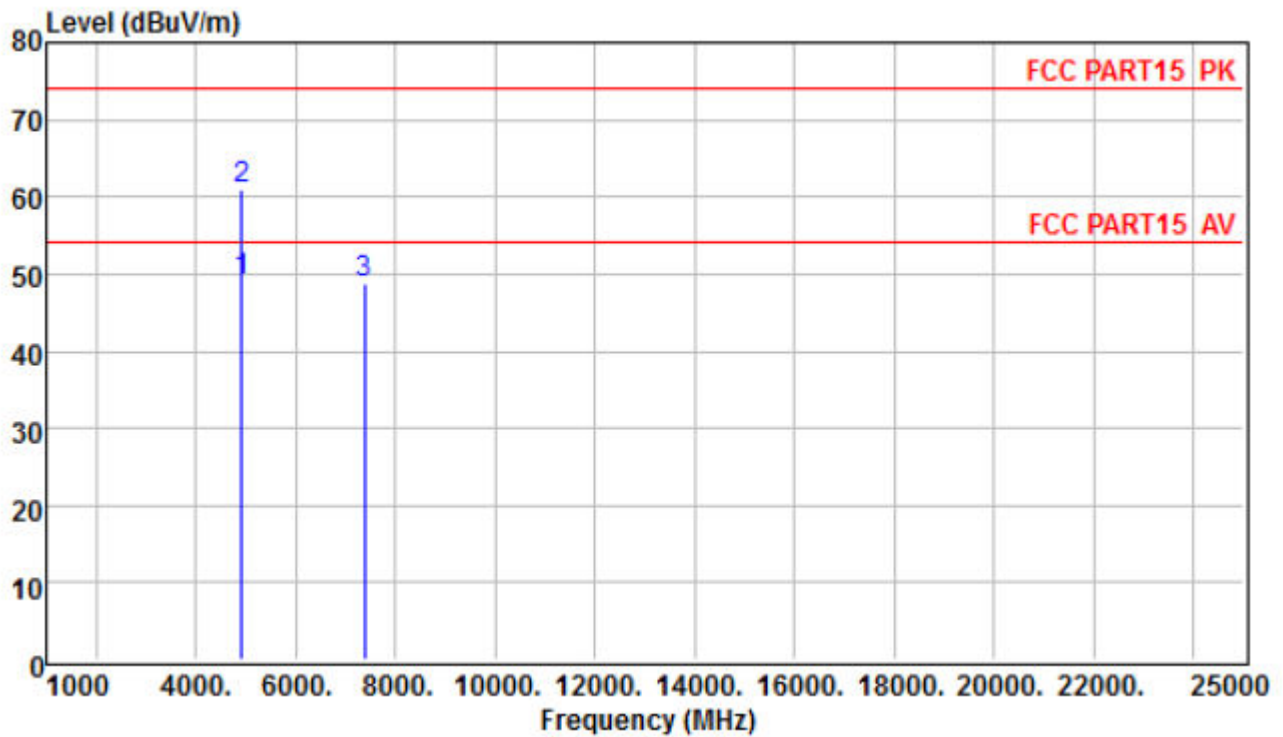
	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4874.000	32.87	32.11	12.14	27.53	49.59	54.00	-4.41	Average
2	4874.000	47.92	32.11	12.14	27.53	64.64	74.00	-9.36	Peak
3	7311.000	37.32	24.32	16.62	27.96	50.30	74.00	-23.70	Peak

EUT :	750M Wi-Fi Range Extender Repeater	Model Name :	U28
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX-2462
Test Voltage :	AC 120V/60Hz		

Vertical

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4924.000	33.54	32.23	12.28	27.56	50.49	54.00	-3.51	Average
2	4924.000	48.04	32.23	12.28	27.56	64.99	74.00	-9.01	Peak
3	7386.000	37.44	24.36	16.62	27.98	50.44	74.00	-23.56	Peak

Horizontal



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4924.000	32.11	32.23	12.28	27.56	49.06	54.00	-4.94	Average
2	4924.000	43.87	32.23	12.28	27.56	60.82	74.00	-13.18	Peak
3	7386.000	35.65	24.36	16.62	27.98	48.65	74.00	-25.35	Peak

Note: "802.11b" mode is the worst mode. When PK value is lower than the Average value limit, average didn't record. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

Spurious Emission in Restricted Band (1-25G) :

All the modulation modes have been tested and all other emissions more than 20dB below the limit, the worst result was report as below:

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	antenna Factor (dB)	cable loss (dB)	preamp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
802.11b									
Vertical	3264.000	31.27	30.26	9.96	26.63	44.86	74	-29.14	Pk
Horizontal	3264.000	32.31	30.26	9.96	26.63	45.9	74	-28.1	PK
Vertical	3336.000	32.12	30.33	9.96	26.66	45.75	74	-28.25	Pk
Horizontal	3336.000	31.09	30.33	9.96	26.66	44.72	74	-29.28	PK
Vertical	4100.000	33.08	31.64	10.61	27.06	48.27	74	-25.73	Pk
Horizontal	4100.000	32.11	31.64	10.61	27.06	47.3	74	-26.7	PK
Vertical	11764.000	32.05	26.64	17.32	28.98	47.03	74	-26.97	Pk
Horizontal	11764.000	32.32	26.64	17.32	28.98	47.3	74	-26.7	PK
Vertical	17732.000	30.17	26.27	22.01	30.39	48.06	74	-25.94	Pk
Horizontal	17732.000	31.23	26.27	22.01	30.39	49.12	74	-24.88	PK
802.11g									
Vertical	3264.000	32.75	30.26	9.96	26.63	46.34	74	-27.66	Pk
Horizontal	3264.000	32.21	30.26	9.96	26.63	45.8	74	-28.2	PK
Vertical	3336.000	31.84	30.33	9.96	26.66	45.47	74	-28.53	Pk
Horizontal	3336.000	31.94	30.33	9.96	26.66	45.57	74	-28.43	PK
Vertical	4100.000	34.99	31.64	10.61	27.06	50.18	74	-23.82	Pk
Horizontal	4100.000	32.42	31.64	10.61	27.06	47.61	74	-26.39	PK
Vertical	11764.000	30.21	26.64	17.32	28.98	45.19	74	-28.81	Pk
Horizontal	11764.000	32.54	26.64	17.32	28.98	47.52	74	-26.48	PK
Vertical	17732.000	31.22	26.27	22.01	30.39	49.11	74	-24.89	Pk
Horizontal	17732.000	32.65	26.27	22.01	30.39	50.54	74	-23.46	PK
802.11n(20)									
Vertical	3264.000	30.20	30.26	9.96	26.63	43.79	74	-30.21	Pk
Horizontal	3264.000	30.76	30.26	9.96	26.63	44.35	74	-29.65	PK
Vertical	3336.000	31.54	30.33	9.96	26.66	45.17	74	-28.83	Pk
Horizontal	3336.000	31.87	30.33	9.96	26.66	45.5	74	-28.5	PK
Vertical	4100.000	32.55	31.64	10.61	27.06	47.74	74	-26.26	Pk
Horizontal	4100.000	30.48	31.64	10.61	27.06	45.67	74	-28.33	PK
Vertical	11764.000	31.98	26.64	17.32	28.98	46.96	74	-27.04	Pk
Horizontal	11764.000	31.65	26.64	17.32	28.98	46.63	74	-27.37	PK
Vertical	17732.000	29.44	26.27	22.01	30.39	47.33	74	-26.67	Pk
Horizontal	17732.000	29.55	26.27	22.01	30.39	47.44	74	-26.56	PK
802.11n(40)									
Vertical	3264.000	31.20	30.26	9.96	26.63	44.79	74	-29.21	Pk
Horizontal	3264.000	30.53	30.26	9.96	26.63	44.12	74	-29.88	PK
Vertical	3336.000	31.09	30.33	9.96	26.66	44.72	74	-29.28	Pk
Horizontal	3336.000	31.54	30.33	9.96	26.66	45.17	74	-28.83	PK
Vertical	4100.000	32.54	31.64	10.61	27.06	47.73	74	-26.27	Pk
Horizontal	4100.000	32.22	31.64	10.61	27.06	47.41	74	-26.59	PK
Vertical	11764.000	31.34	26.64	17.32	28.98	46.32	74	-27.68	Pk
Horizontal	11764.000	31.06	26.64	17.32	28.98	46.04	74	-27.96	PK
Vertical	17732.000	29.45	26.27	22.01	30.39	47.34	74	-26.66	Pk
Horizontal	17732.000	29.54	26.27	22.01	30.39	47.43	74	-26.57	PK

If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

Spurious Emission in Band Edge:

Frequency	Meter Reading	antenna Factor	cable loss	preamp factor	Emission Level	Limits	Margin	Detector Type	Comment
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
802.11b									
2390	38.23	30.44	8.94	26.32	51.29	74	-22.71	peak	Vertical
2390	37.98	30.44	8.94	26.32	51.04	74	-22.96	peak	Horizontal
2483.5	38.76	30.05	9.07	26.34	51.54	74	-22.46	peak	Vertical
2483.5	37.73	30.05	9.07	26.34	50.51	74	-23.49	peak	Horizontal
802.11g									
2390	37.11	30.44	8.94	26.32	50.17	74	-23.83	peak	Vertical
2390	34.32	30.44	8.94	26.32	47.38	74	-26.62	peak	Horizontal
2483.5	36.09	30.05	9.07	26.34	48.87	74	-25.13	peak	Vertical
2483.5	37.35	30.05	9.07	26.34	50.13	74	-23.87	peak	Horizontal
802.11n(HT20)									
2390	34.42	30.44	8.94	26.32	47.48	74	-26.52	peak	Vertical
2390	36.36	30.44	8.94	26.32	49.42	74	-24.58	peak	Horizontal
2483.5	34.53	30.05	9.07	26.34	47.31	74	-26.69	peak	Vertical
2483.5	34.14	30.05	9.07	26.34	46.92	74	-27.08	peak	Horizontal
802.11n(HT40)									
2390	34.24	30.44	8.94	26.32	47.3	74	-26.7	peak	Vertical
2390	35.34	30.44	8.94	26.32	48.4	74	-25.6	peak	Horizontal
2483.5	34.25	30.05	9.07	26.34	47.03	74	-26.97	peak	Vertical
2483.5	33.12	30.05	9.07	26.34	45.9	74	-28.1	peak	Horizontal

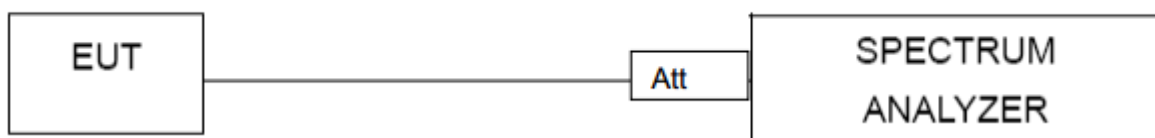
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

5. BAND EDGE COMPLIANCE TEST

5.1. Limits

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) (see §15.205(c)).

5.2. Test setup



5.3. Test Procedure

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

ANT1

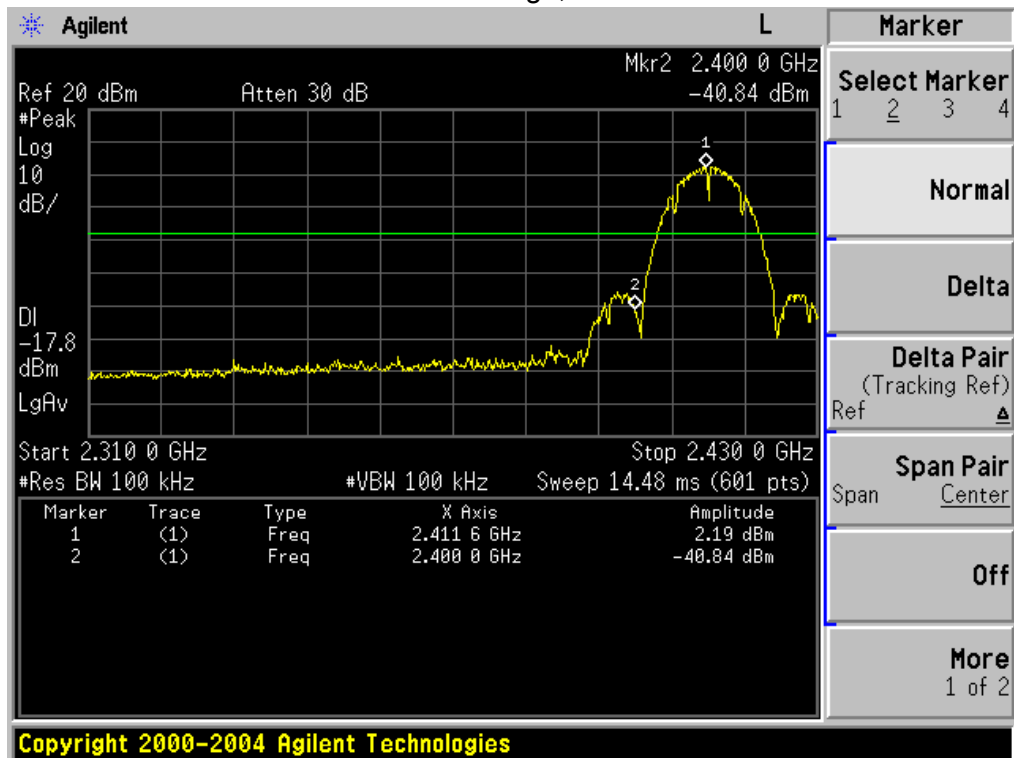
Frequency Band MHz	Delta to band emission (dBc)	> Limit (dBc)	Result
802.11b mode			
2400	43.03	20	Pass
2483.5	60.55	20	Pass
802.11g mode			
2400	31.65	20	Pass
2483.5	49.11	20	Pass
802.11n-HT20 mode			
2400	31.92	20	Pass
2483.5	45.53	20	Pass
802.11n-HT40 mode			
2400	39.65	20	Pass
2483.5	38.20	20	Pass

ANT2

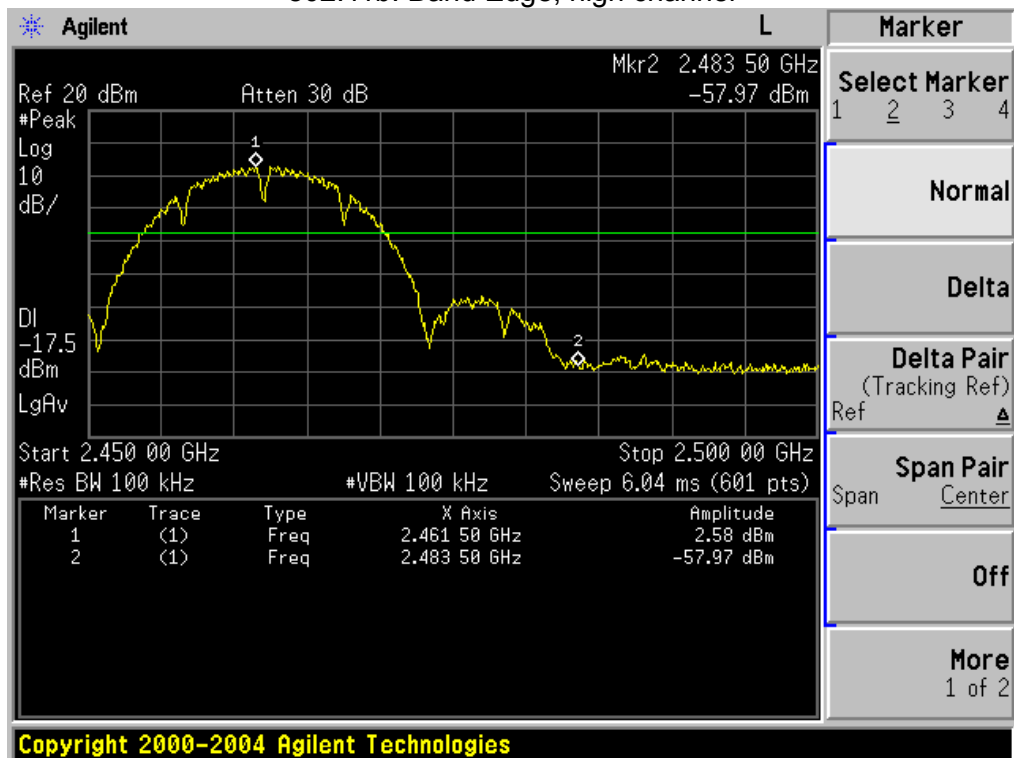
Frequency Band MHz	Delta to band emission (dBc)	> Limit (dBc)	Result
802.11b mode			
2400	41.08	20	Pass
2483.5	55.63	20	Pass
802.11g mode			
2400	33.02	20	Pass
2483.5	42.6	20	Pass
802.11n-HT20 mode			
2400	38.18	20	Pass
2483.5	42.51	20	Pass
802.11n-HT40 mode			
2400	38.18	20	Pass
2483.5	38.41	20	Pass

ANT1

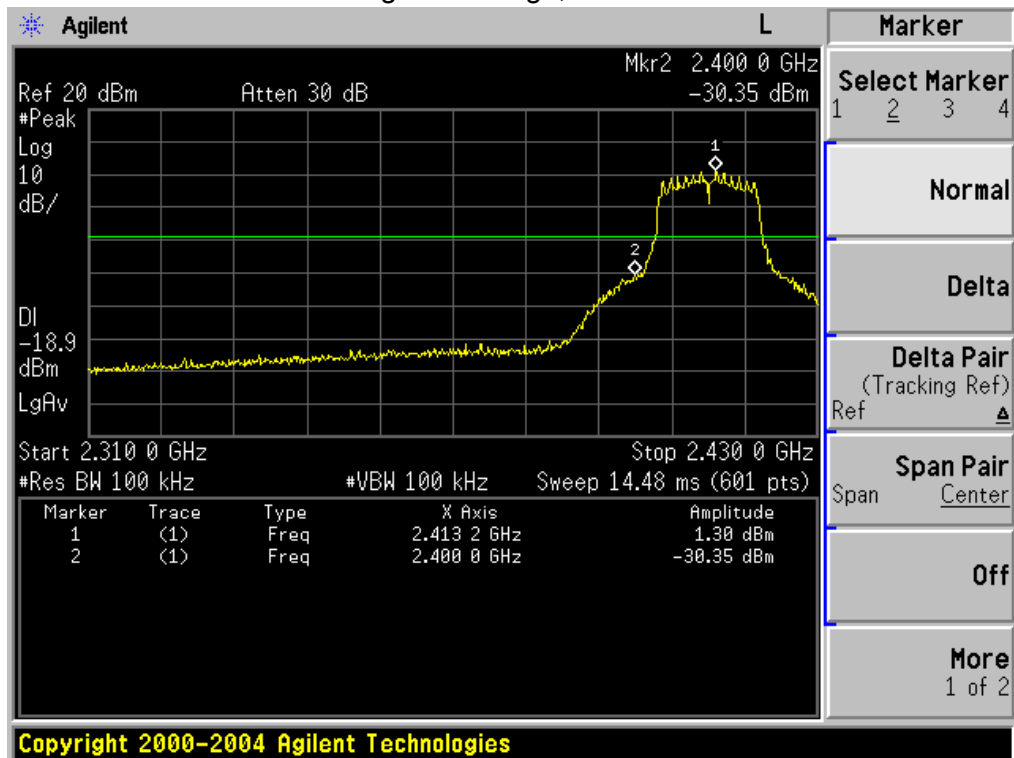
802.11b: Band Edge, low channel



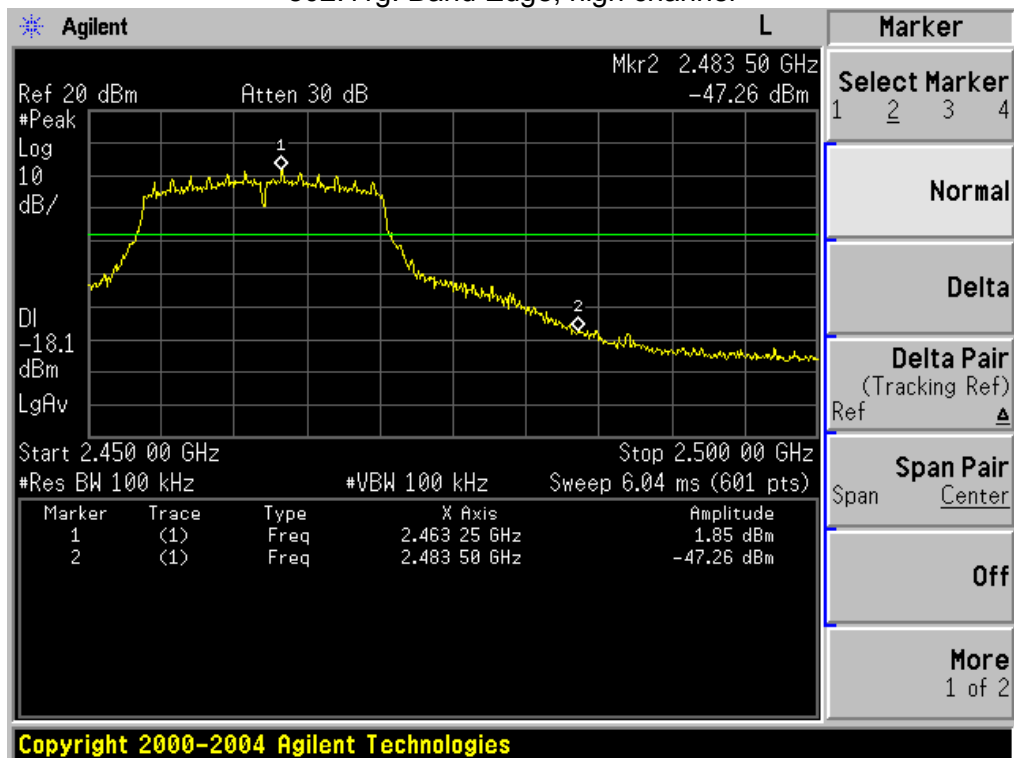
802.11b: Band Edge, high channel



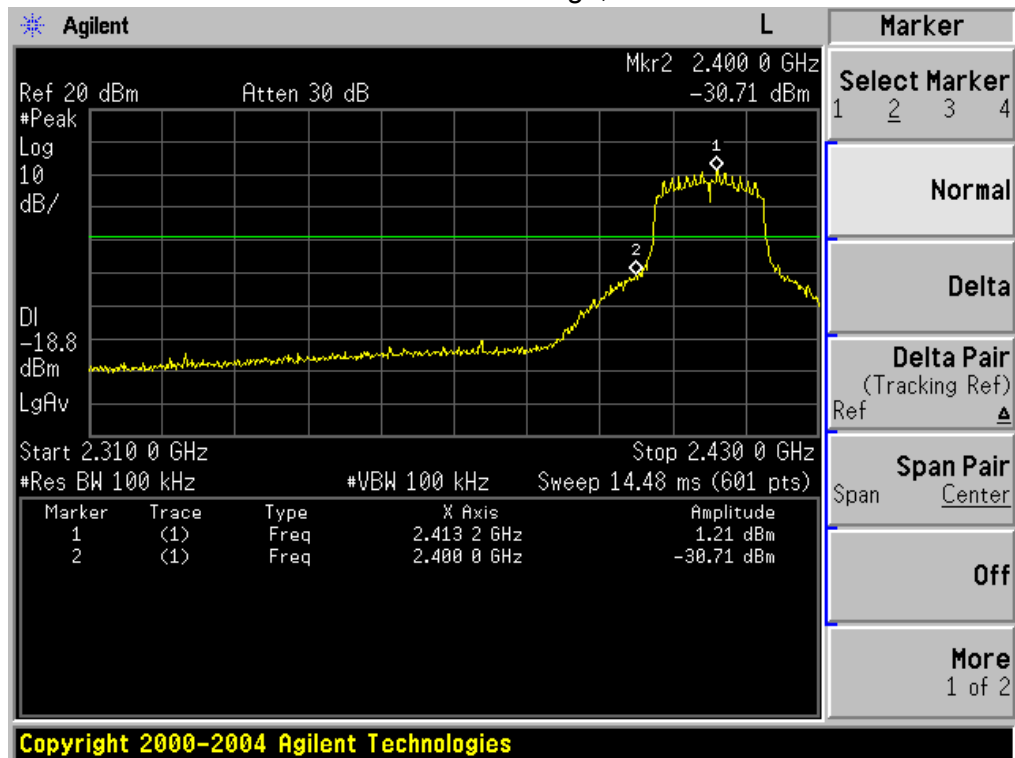
802.11g: Band Edge, low channel



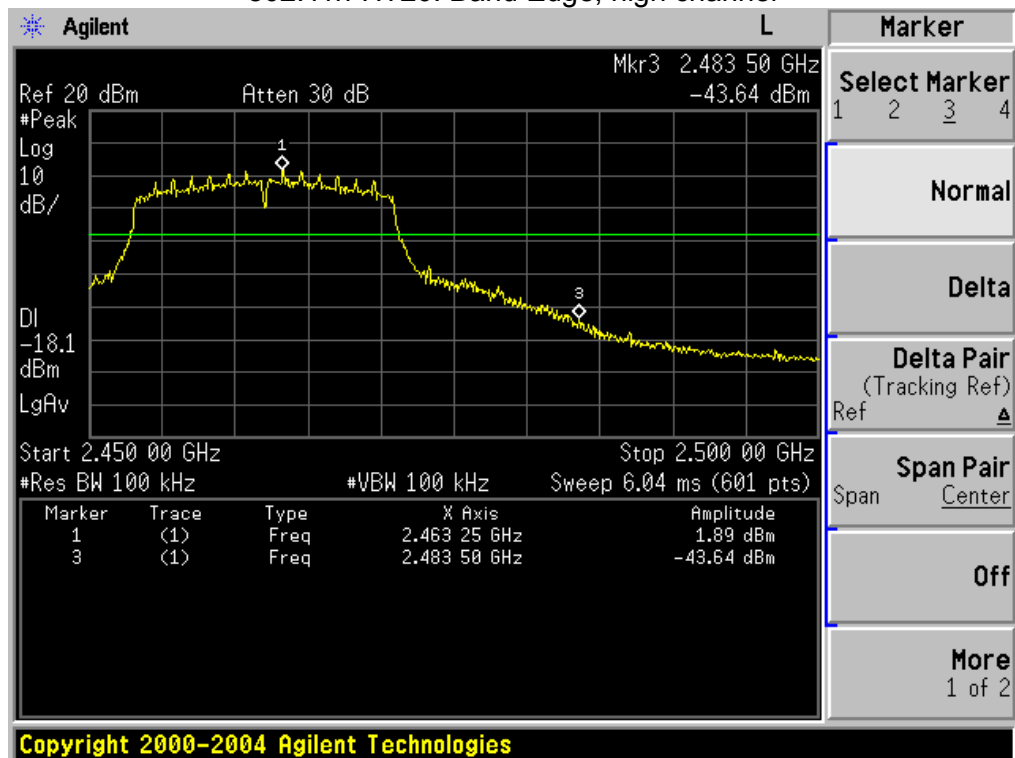
802.11g: Band Edge, high channel



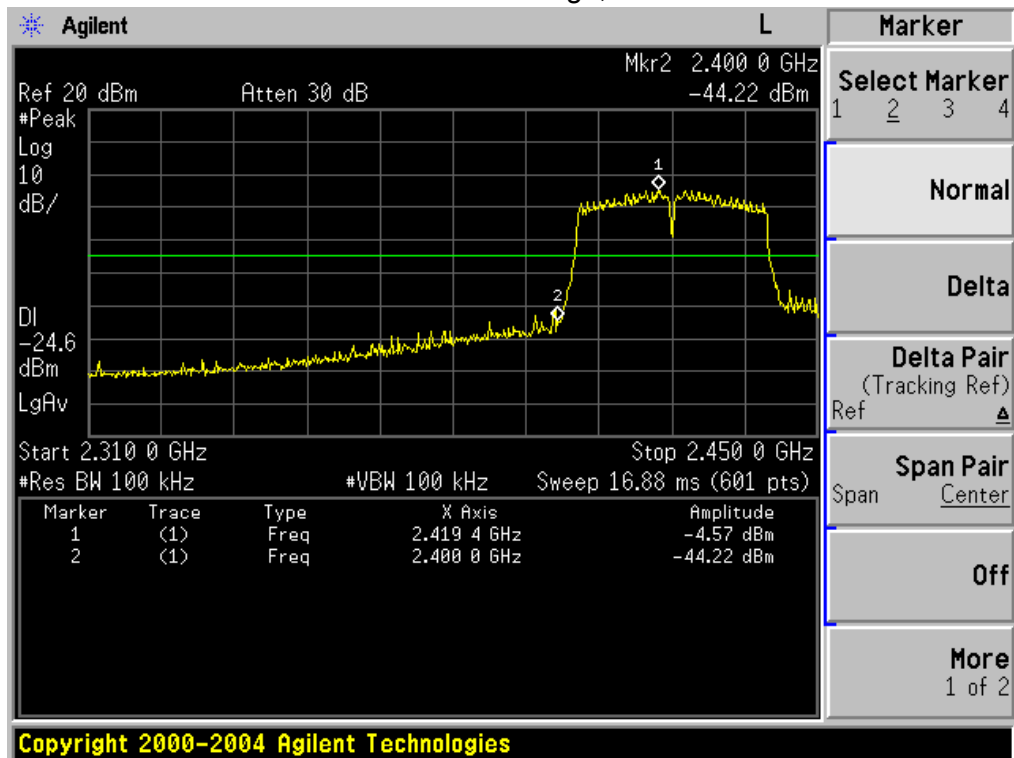
802.11n-HT20: Band Edge, low channel



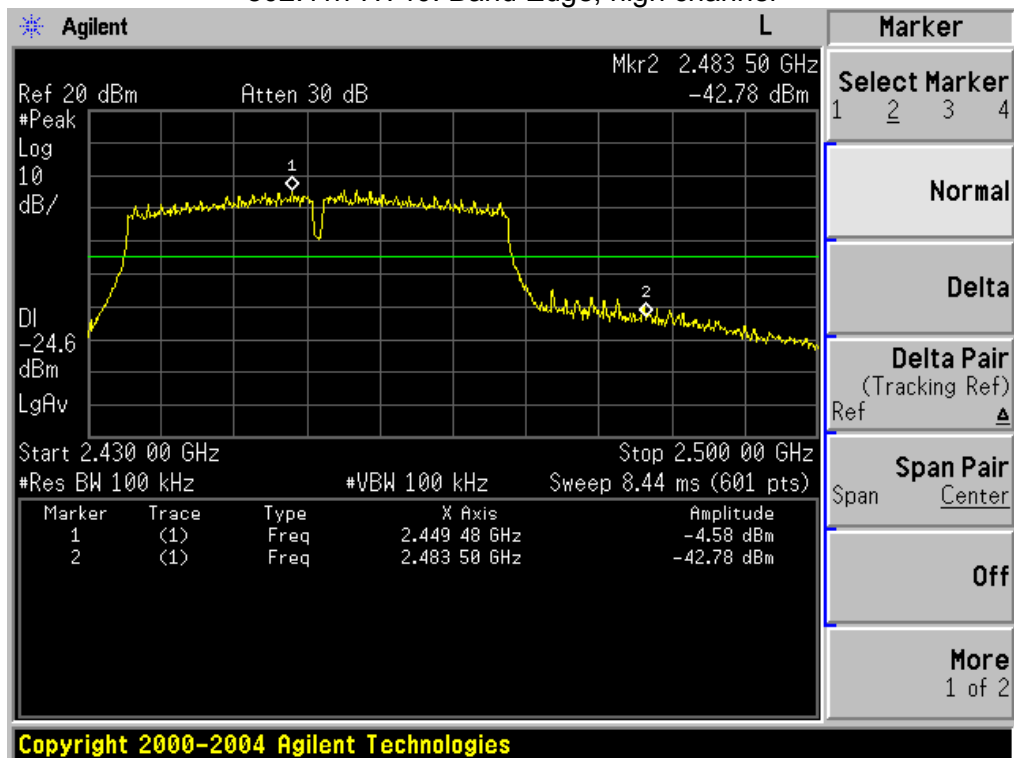
802.11n-HT20: Band Edge, high channel



802.11n-HT40: Band Edge, low channel

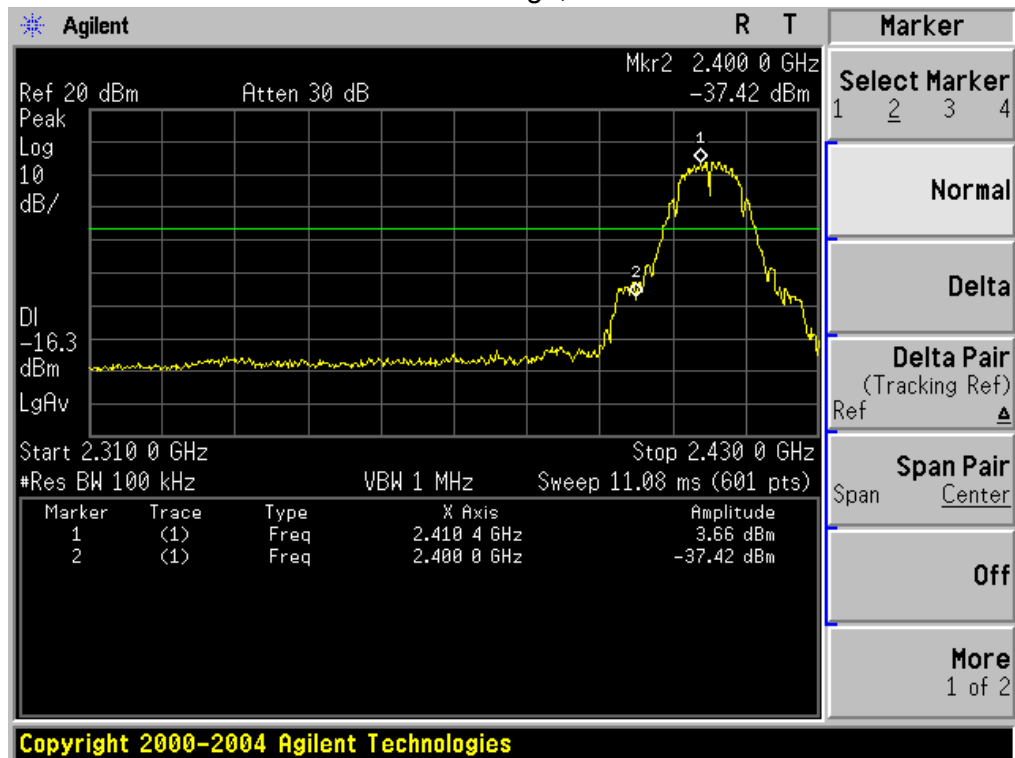


802.11n-HT40: Band Edge, high channel

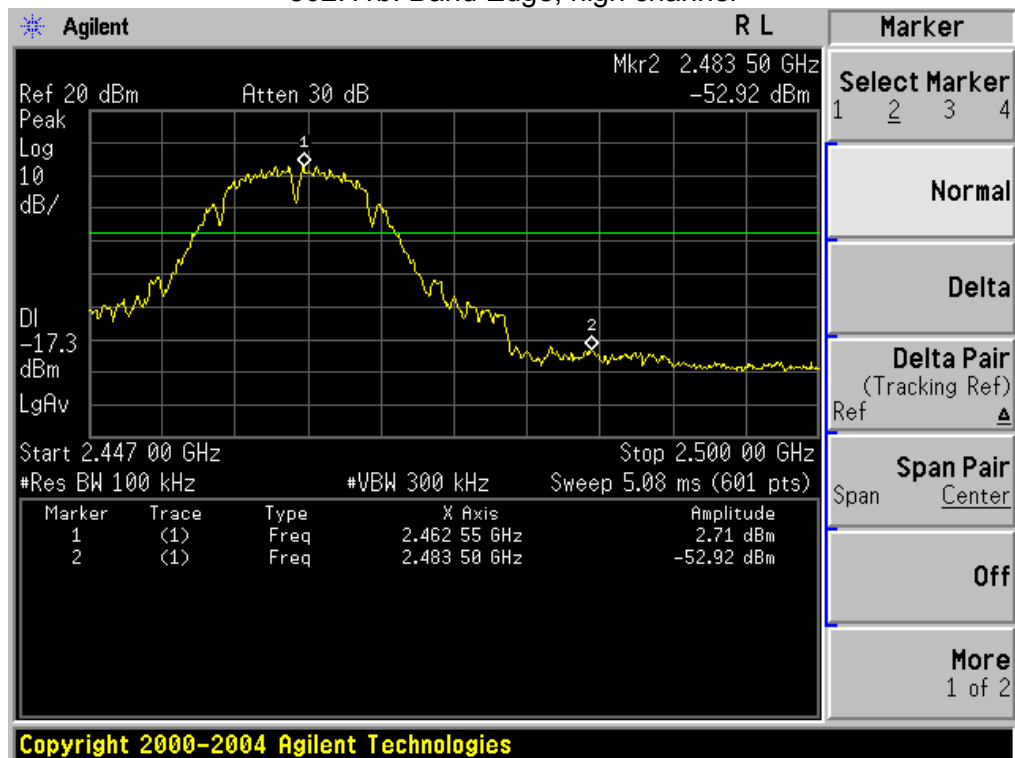


ANT2

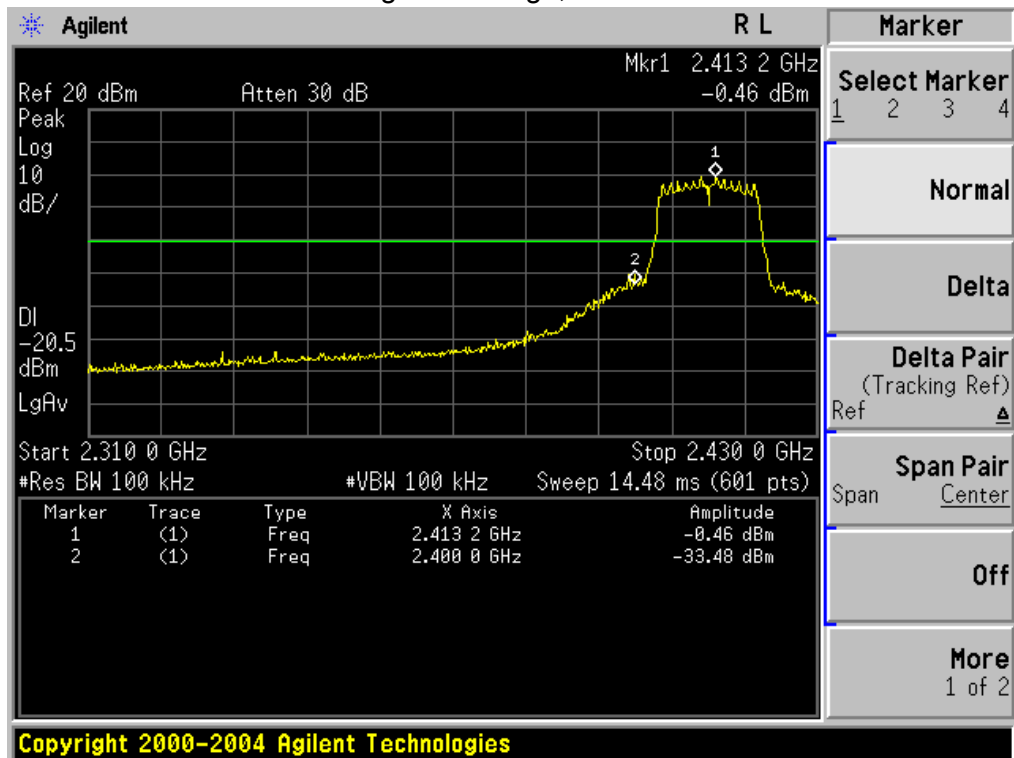
802.11b: Band Edge, low channel



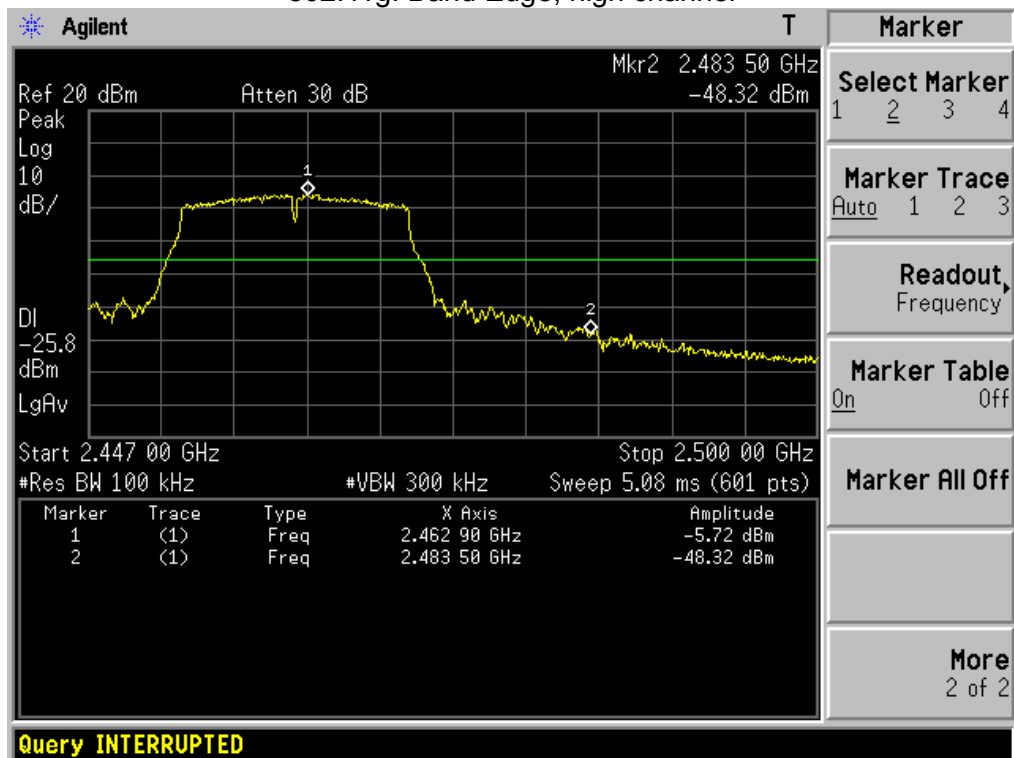
802.11b: Band Edge, high channel



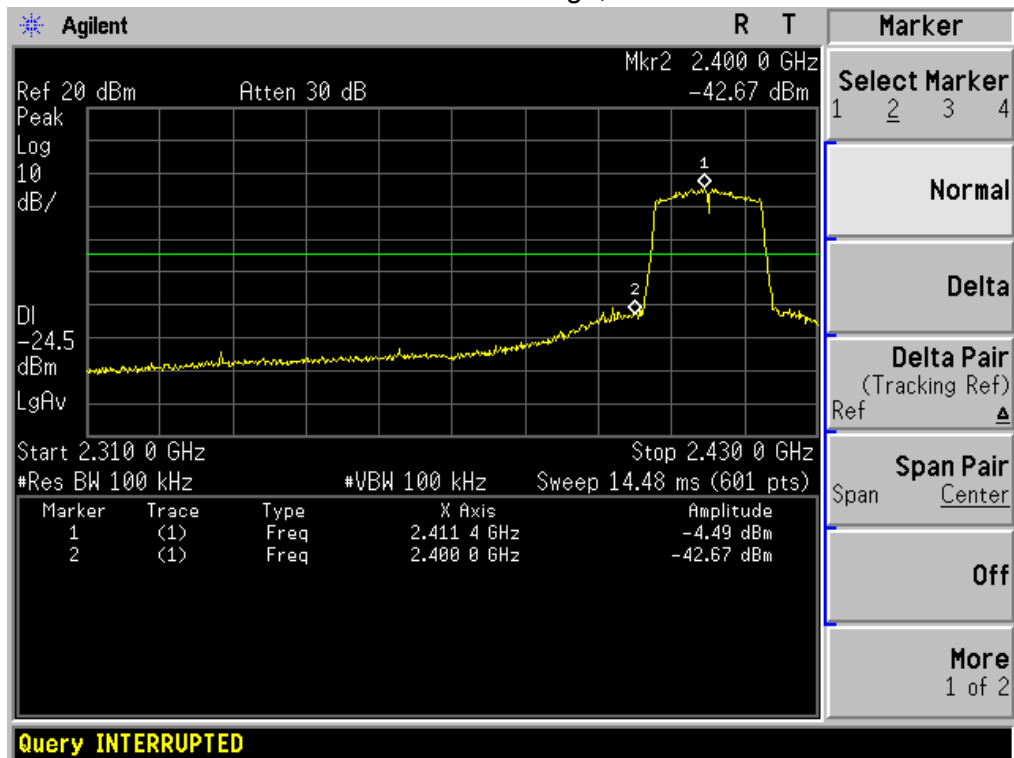
802.11g: Band Edge, low channel



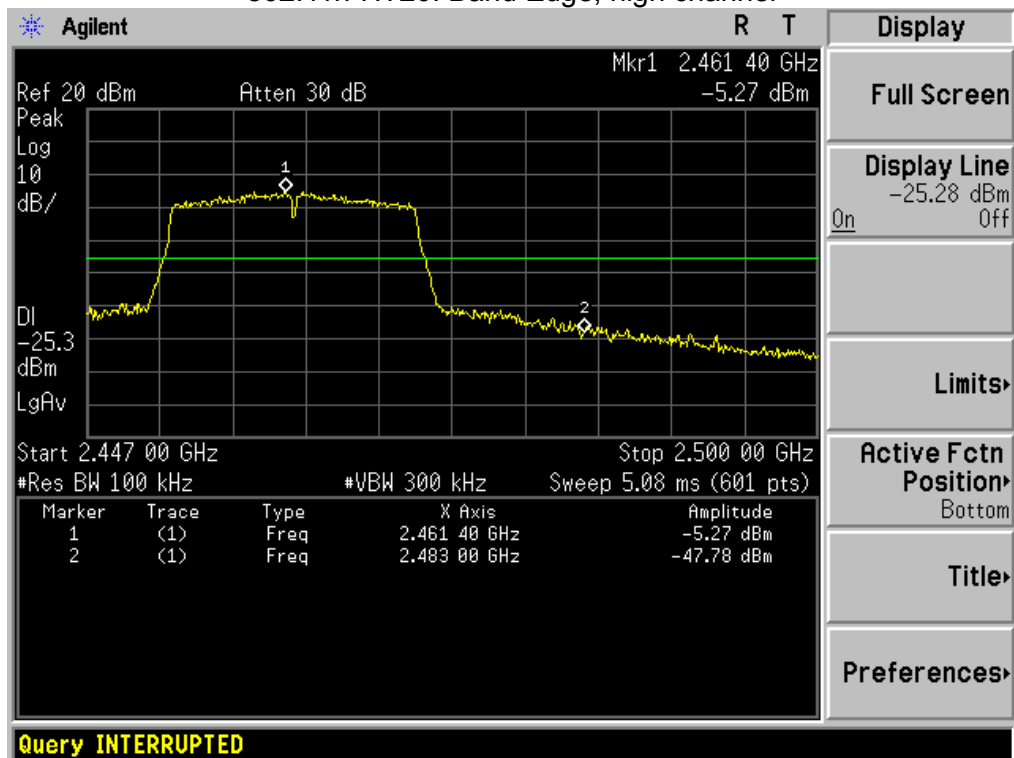
802.11g: Band Edge, high channel



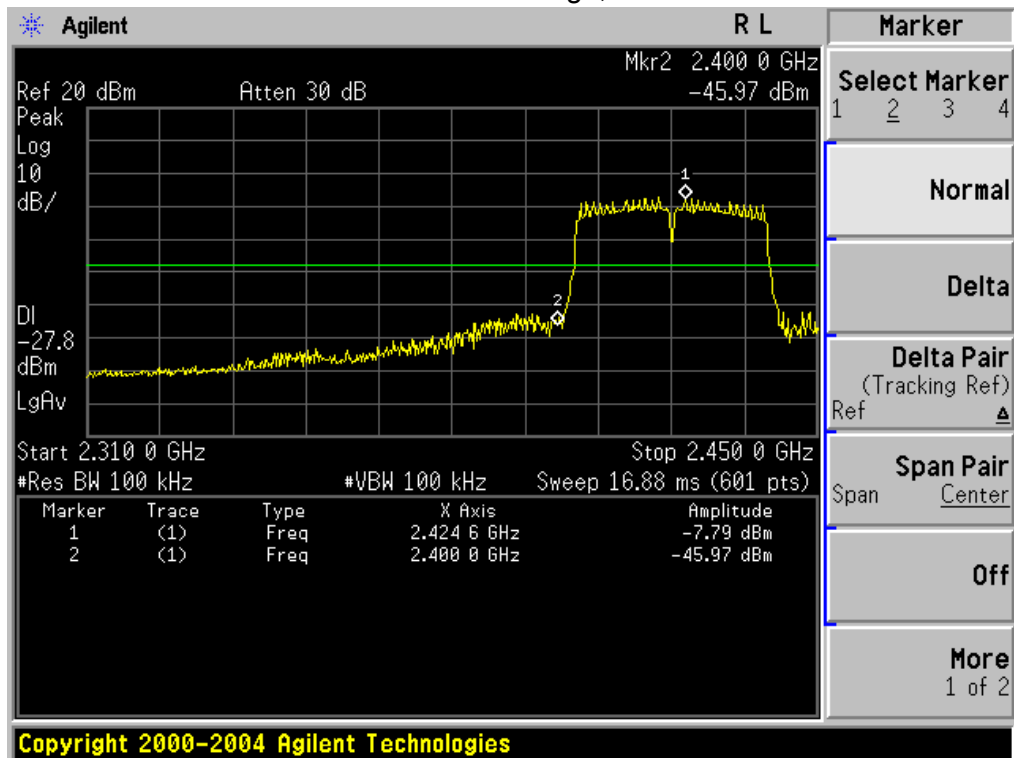
802.11n-HT20: Band Edge, low channel



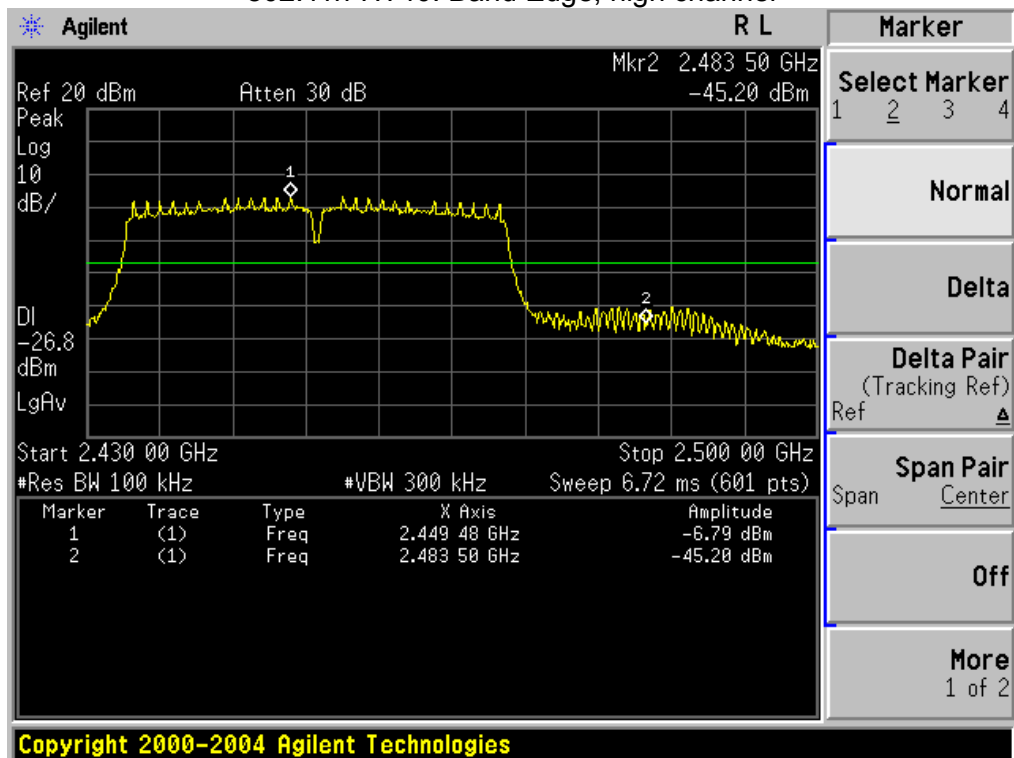
802.11n-HT20: Band Edge, high channel



802.11n-HT40: Band Edge, low channel



802.11n-HT40: Band Edge, high channel



6. 6DB&20DB BANDWIDTH TEST

6.1. Limits

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

6.2. Test Procedure

6dB bandwidth

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ 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

20dB bandwidth

C63.10 Occupied Bandwidth (OBW=20dB bandwidth)

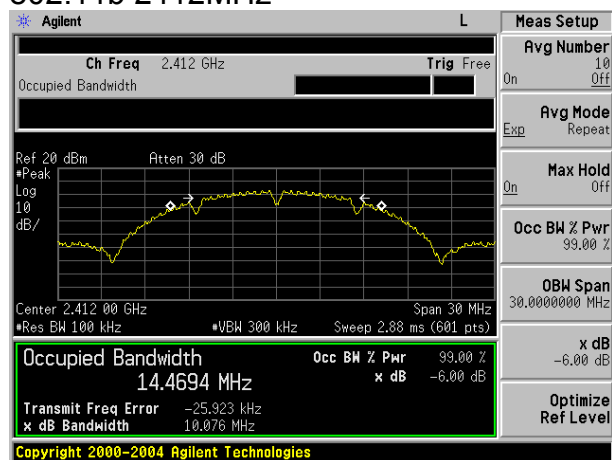
1. Set RBW = 1%-5% OBW.
 2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
 3. Set the span range between 2 times and 5 times of the OBW.
 4. Sweep time=Auto, Detector=PK, Trace=Max hold.
 5. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce the worst-case (i.e., the widest) bandwidth.
- Unless otherwise specified for an unlicensed wireless device, measure the bandwidth at the 20 dB levels with respect to the reference level

Test data:

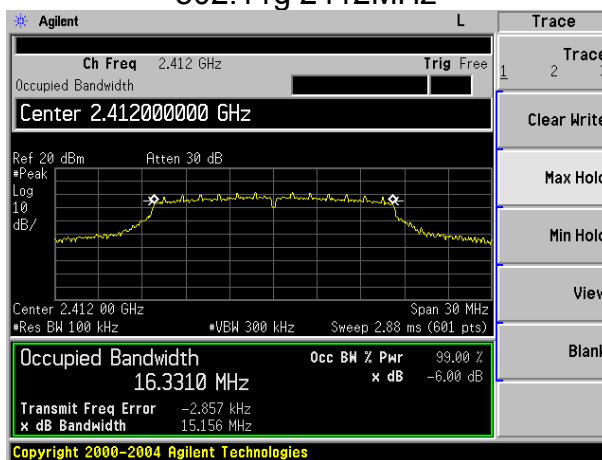
	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11b	2412	10.076	>0.5	Pass
	2437	9.638	>0.5	Pass
	2462	10.057	>0.5	Pass
802.11g	2412	15.156	>0.5	Pass
	2437	15.153	>0.5	Pass
	2462	15.184	>0.5	Pass
802.11n (HT20)	2412	15.065	>0.5	Pass
	2437	15.114	>0.5	Pass
	2462	15.140	>0.5	Pass
802.11n (HT40)	2422	35.193	>0.5	Pass
	2437	35.192	>0.5	Pass
	2452	35.175	>0.5	Pass

Test plot as follows:
6dB bandwidth

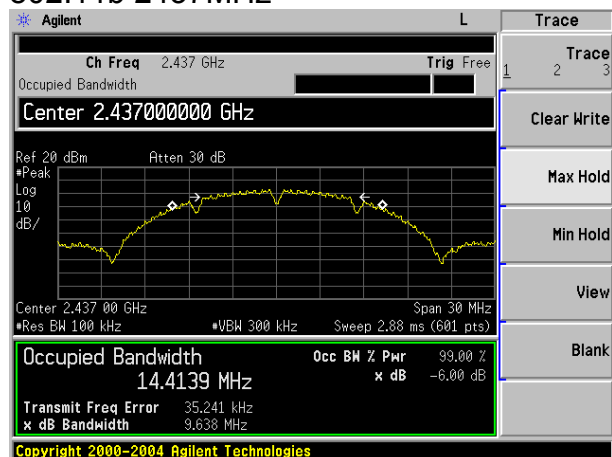
802.11b 2412MHz



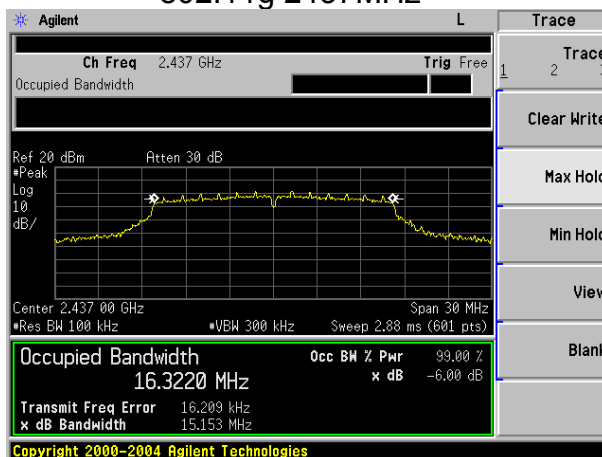
802.11g 2412MHz



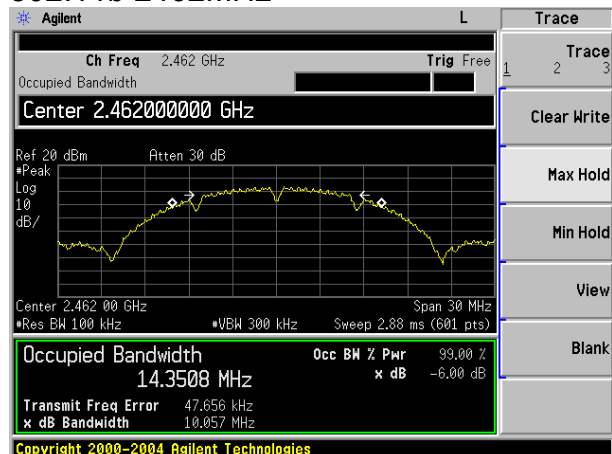
802.11b 2437MHz



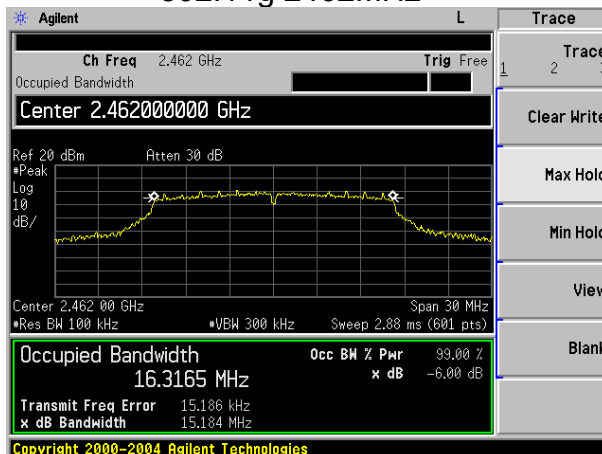
802.11g 2437MHz



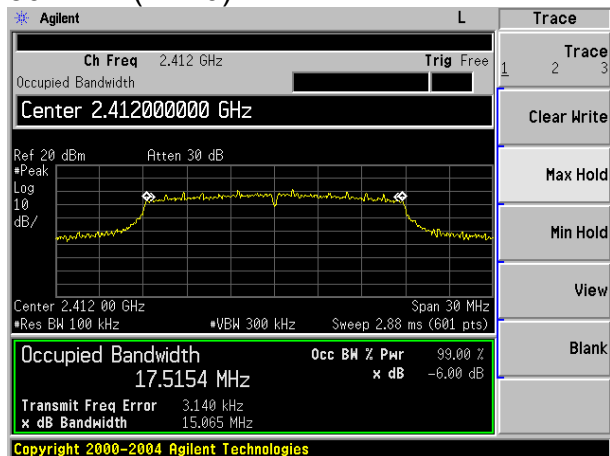
802.11b 2462MHz



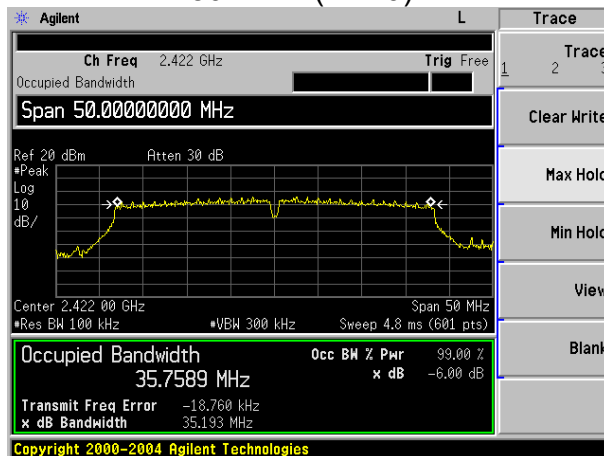
802.11g 2462MHz



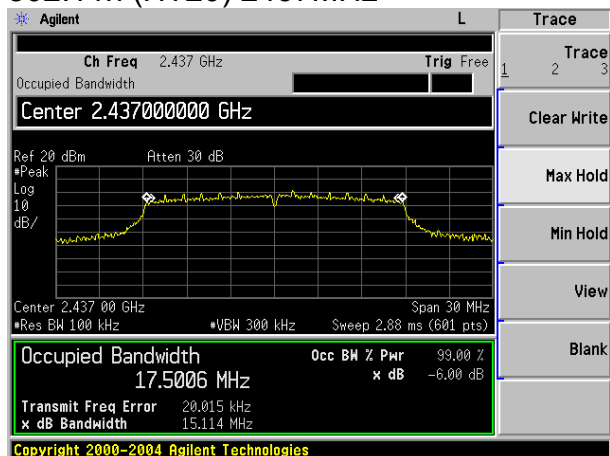
802.11n (HT20) 2412MHz



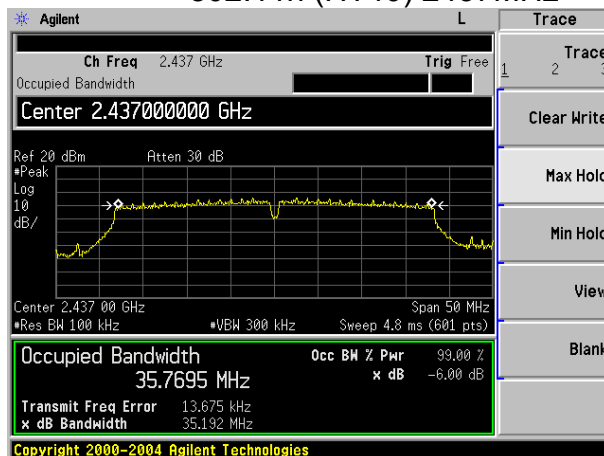
802.11n (HT40) 2422MHz



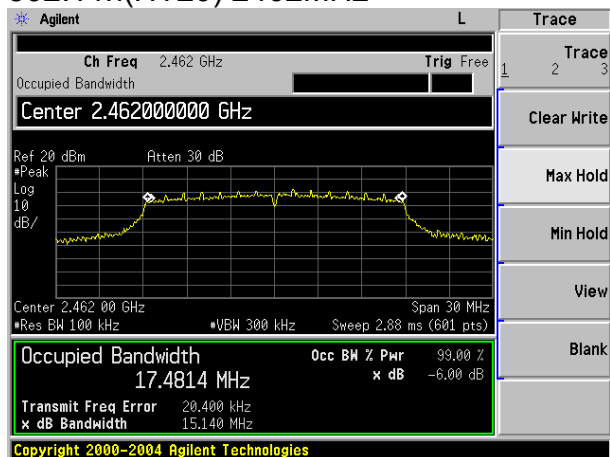
802.11n (HT20) 2437MHz



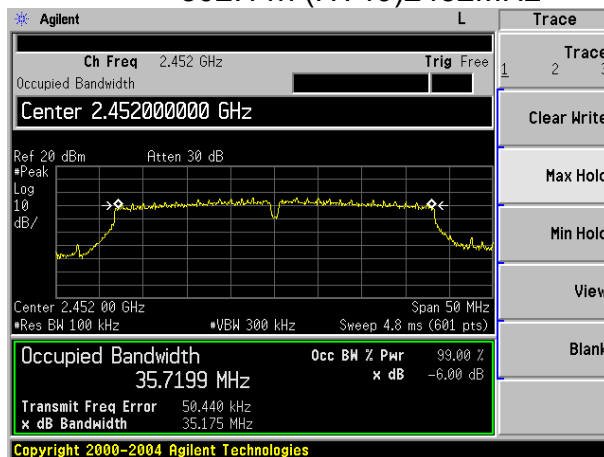
802.11n (HT40) 2437MHz



802.11n(HT20) 2462MHz



802.11n (HT40)2452MHz



7. OUTPUT POWER TEST

7.1. Limits

For systems using digital modulation in the 2400~2483.5MHz, The out put Power shall not exceed 1W (30dBm)

7.2. Test procedure

1. - The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

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

7.3. TEST SETUP



Test Channe	Frequency	Maximum Conducted Output Power ((AV)) (dBm)	Maximum Conducted Output Power (AV) (dBm)	Total power	LIMIT
	(MHz)	ANT1	ANT2	dBm	dBm
TX 802.11b Mode					
CH01	2412	15.34	14.07	-	30
CH06	2437	15.45	14.05	-	30
CH11	2462	15.56	14.18	-	30
TX 802.11g Mode					
CH01	2412	13.43	12.16	-	30
CH06	2437	13.24	12.23	-	30
CH11	2462	13.13	12.37	-	30
TX 802.11n(20) Mode					
CH01	2412	12.33	11.46	14.93	30
CH06	2437	12.09	11.23	14.69	30
CH11	2462	12.15	11.32	14.77	30
TX 802.11n(40) Mode					
CH03	2422	11.24	10.25	13.78	30
CH06	2437	11.45	10.25	13.90	30
CH09	2452	11.26	10.14	13.75	30

Note:802.11b ,802.11g mode the ANT1 and ANT2 can not TX and RX at the same time

802.11n(20),802.11n(40) mode the ANT1 and ANT2 can TX and RX at the same time

Directional gain=GANT +10log(N)dbi =2+10log2=5.01dbi

For power test the duty cycle is 100% in continous transmitting mode.

8. DUTY CYCLE

8.1. Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW \geq RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 1MHz

VBW =3MHz

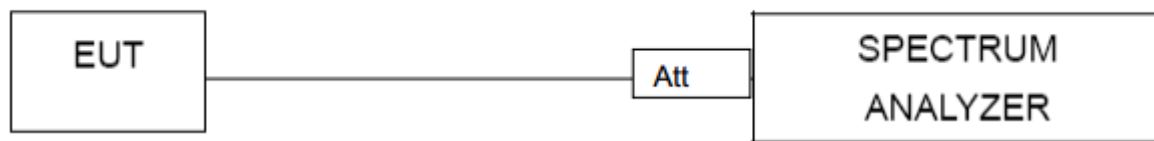
Number of points in Sweep >100

Detector function = peak

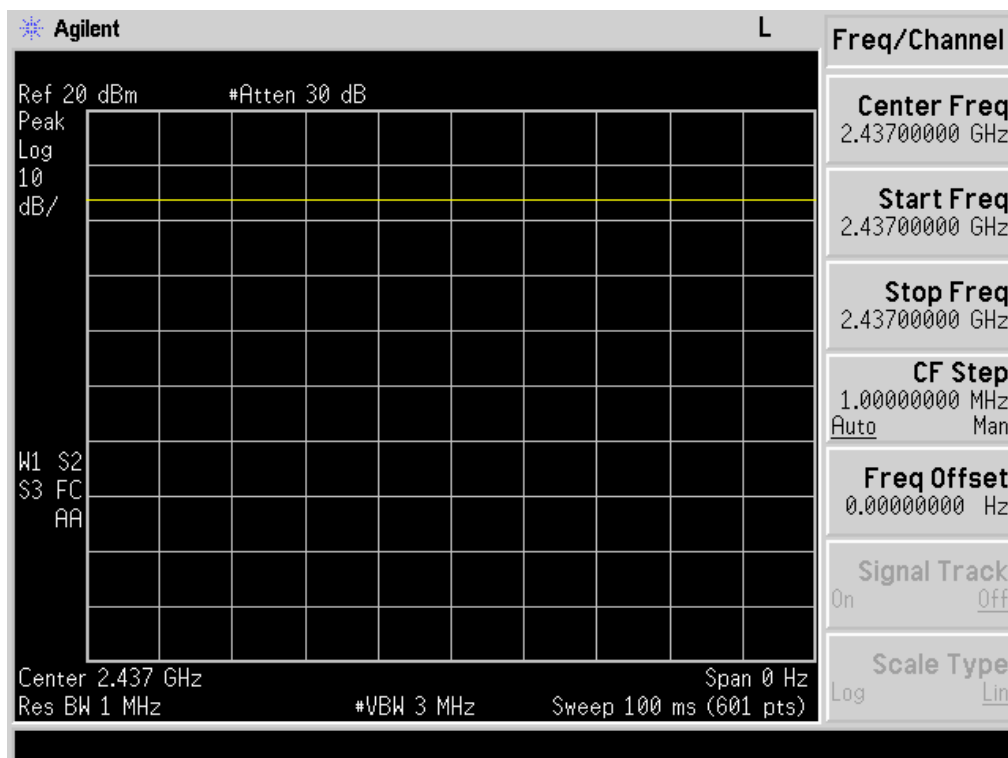
Trace = Clear write Measure T_{total} and T_{on}

Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$

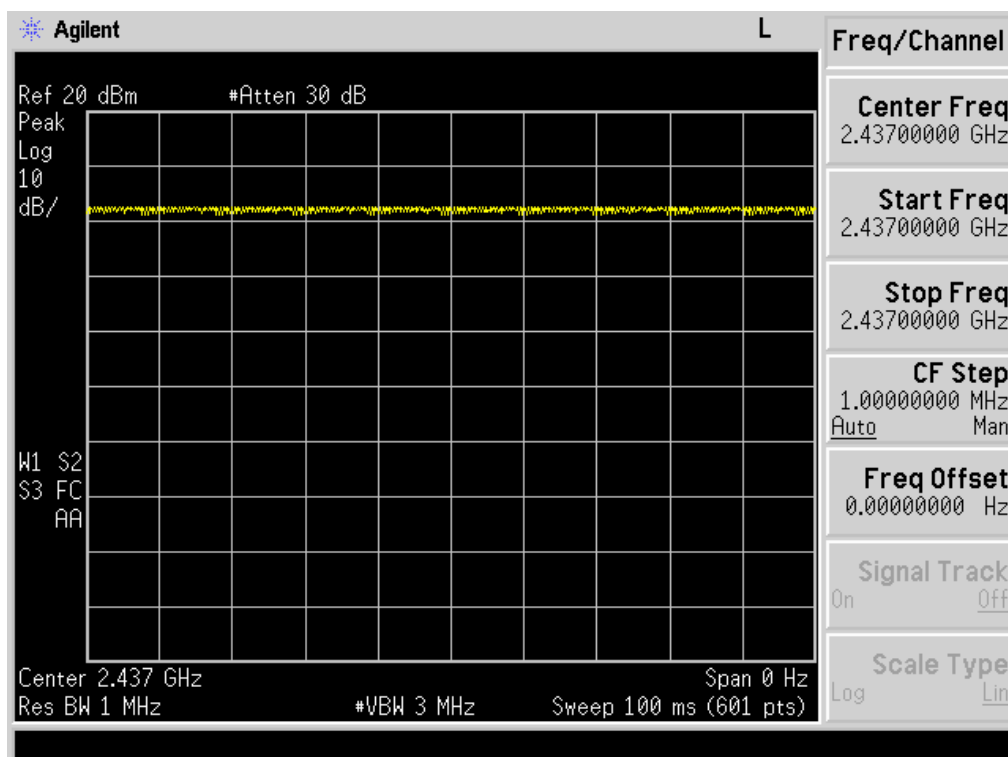
8.2. TEST SETUP



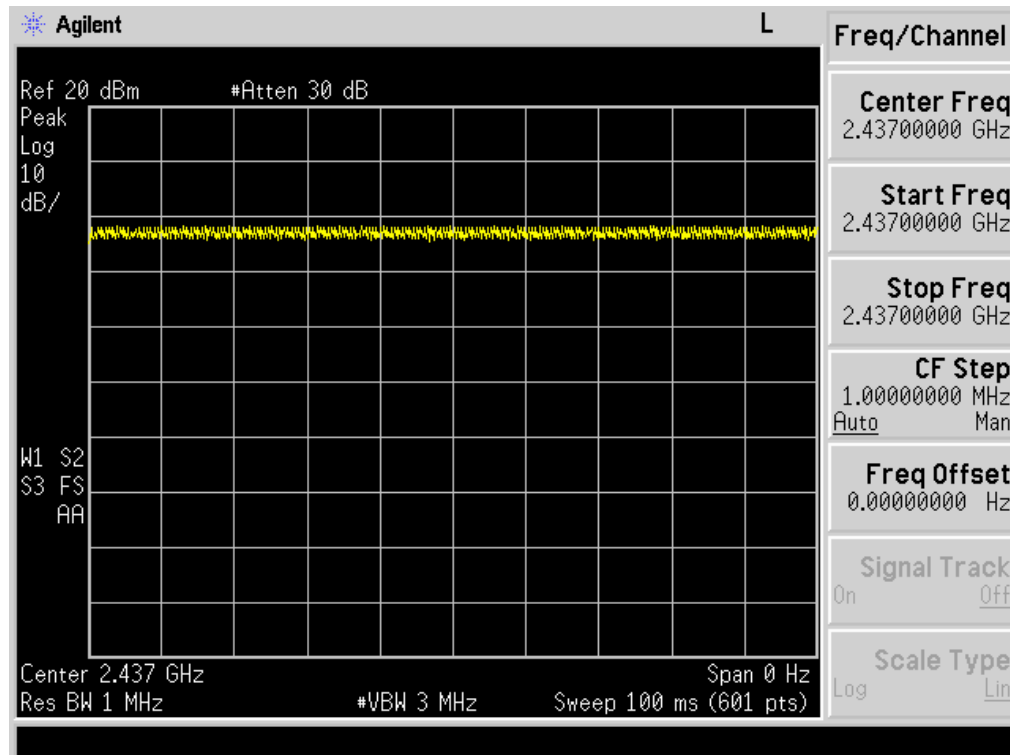
Test plot of Duty Cycle for 802.11b



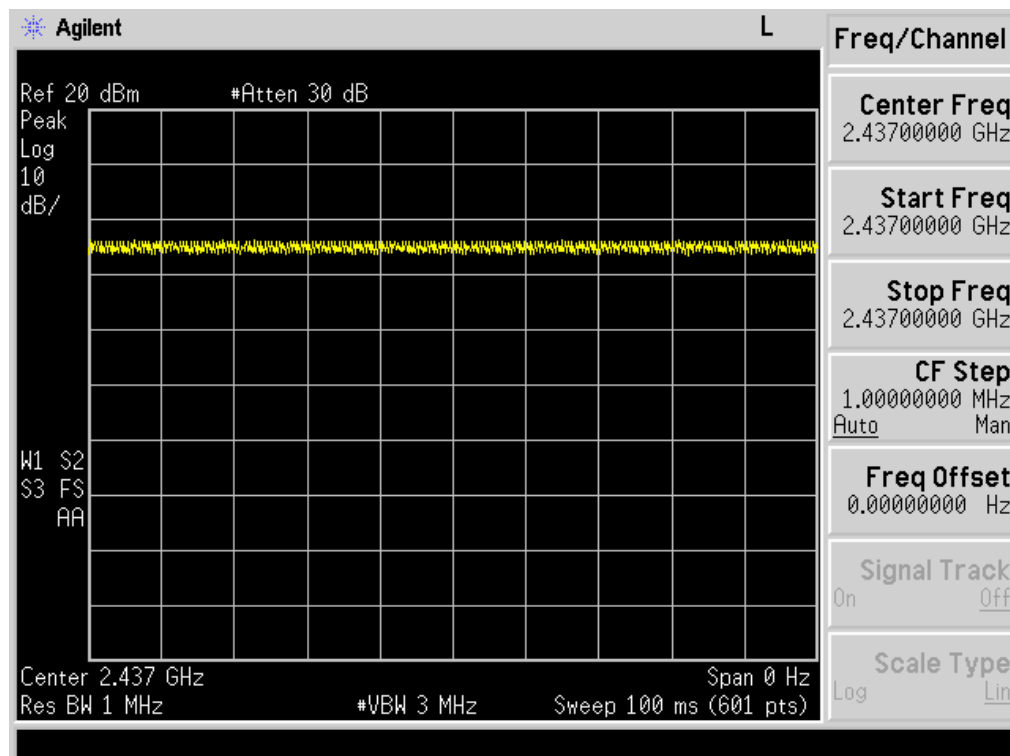
Test plot of Duty Cycle for 802.11g



Test plot of Duty Cycle for 802.11n(HT20)



Test plot of Duty Cycle for 802.11n(HT40)



9. POWER SPECTRAL DENSITY TEST

9.1. Limits

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.

9.2. Test setup

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW =3kHz.
4. Set the VBW ≥ 3 times RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

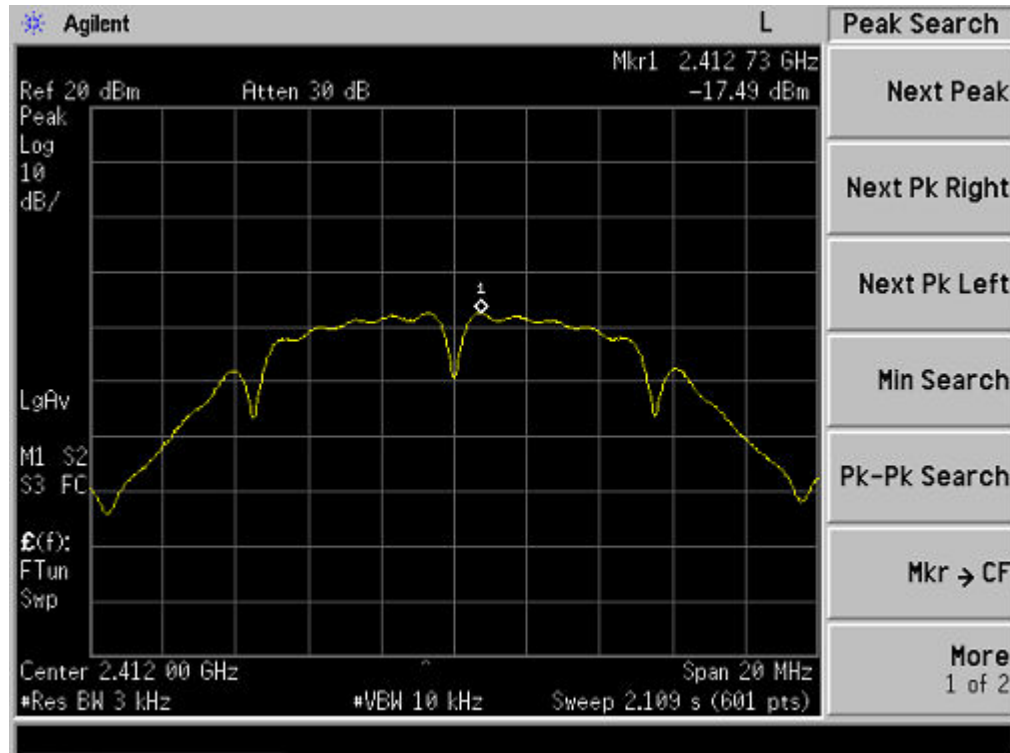
9.3. Test result

Mode	Channel Frequency (MHz)	Power density (dBm/3 kHz) ANT1	Power density (dBm/3 kHz) ANT2	Total PSD	Limit (dBm/3 kHz)	Result
802.11b	2412	-17.49	-20.02	-	8	Pass
	2437	-17.08	-11.96	-	8	Pass
	2462	-16.70	-19.33	-	8	Pass
802.11g	2412	-17.05	-22.32	-	8	Pass
	2437	-17.28	-22.44	-	8	Pass
	2462	-18.13	-21.48	-	8	Pass
802.11n (HT20)	2412	-18.20	-22.59	-20.13	8	Pass
	2437	-17.94	-22.67	-20.51	8	Pass
	2462	-17.21	-22.02	-19.49	8	Pass
802.11n (HT40)	2422	-21.91	-29.32	-26.70	8	Pass
	2437	-18.35	-29.26	-26.80	8	Pass
	2452	-21.00	-29.33	-26.94	8	Pass

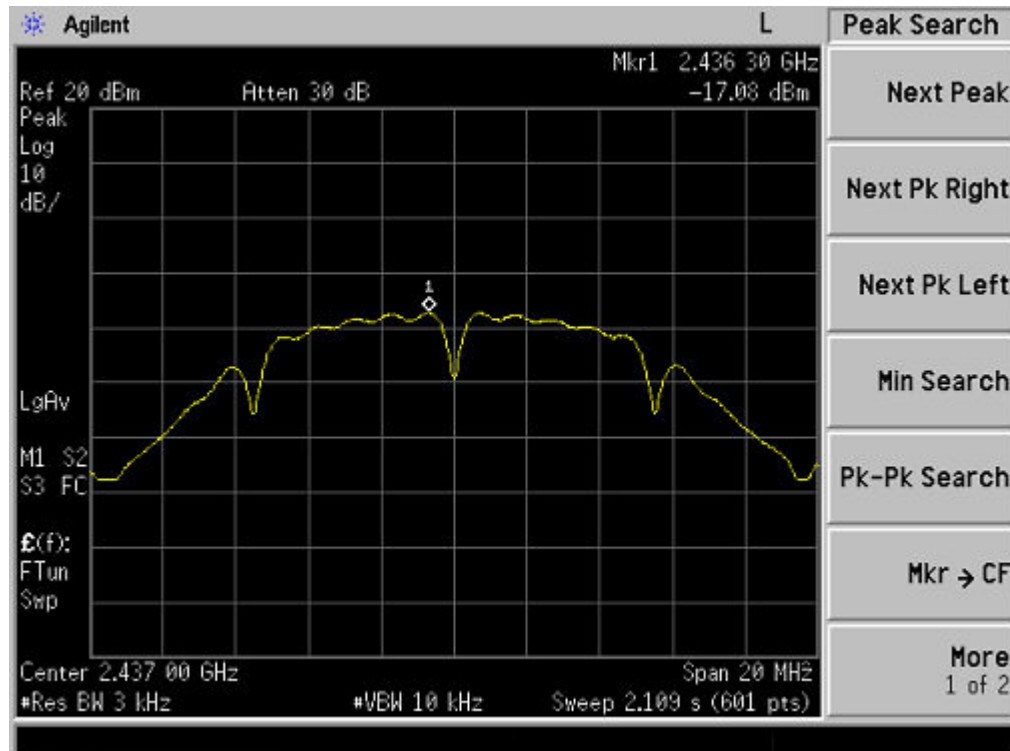
Note: 802.11b, 802.11g mode the ANT1 and ANT2 can not TX and RX at the same time

802.11n(20), 802.11n(40) mode the ANT1 and ANT2 can TX and RX at the same time

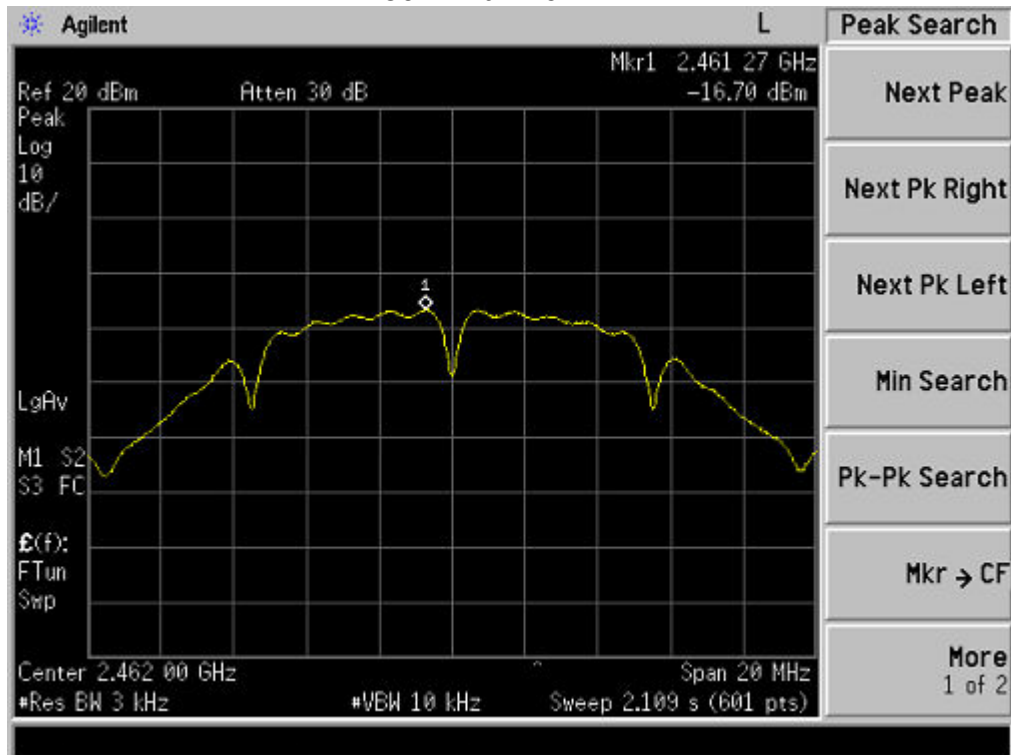
Directional gain = $G_{ANT} + 10\log(N) \text{ dBi} = 2 + 10\log 2 = 5.01 \text{ dBi}$

ANT 1
802.11b 2412MHz

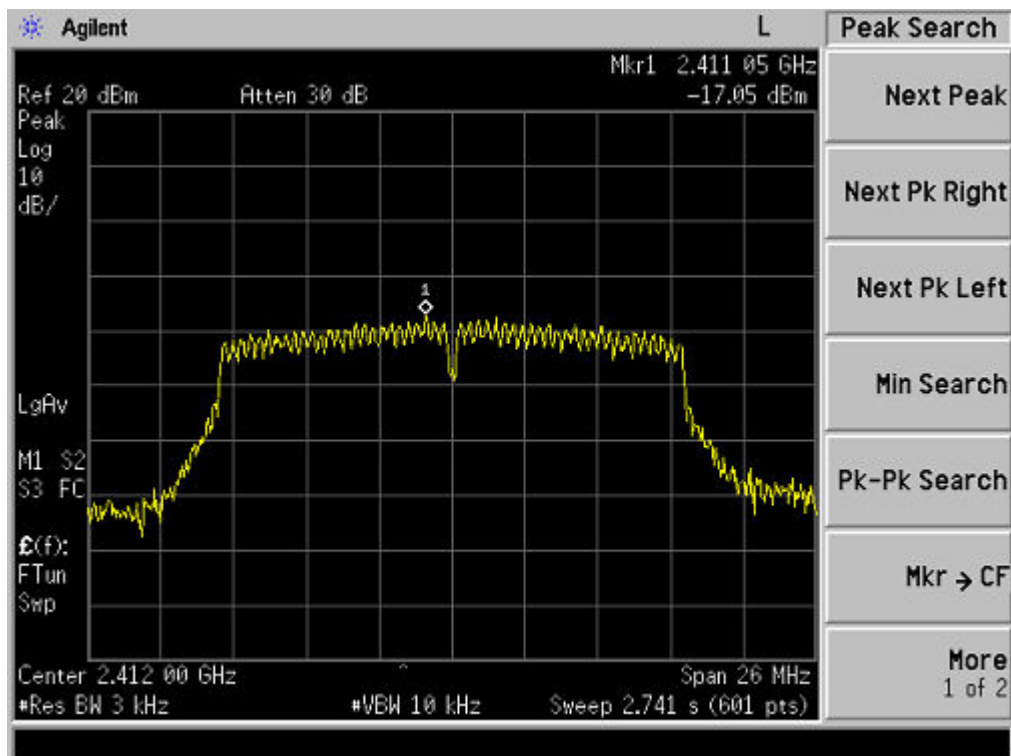
802.11b 2437MHz



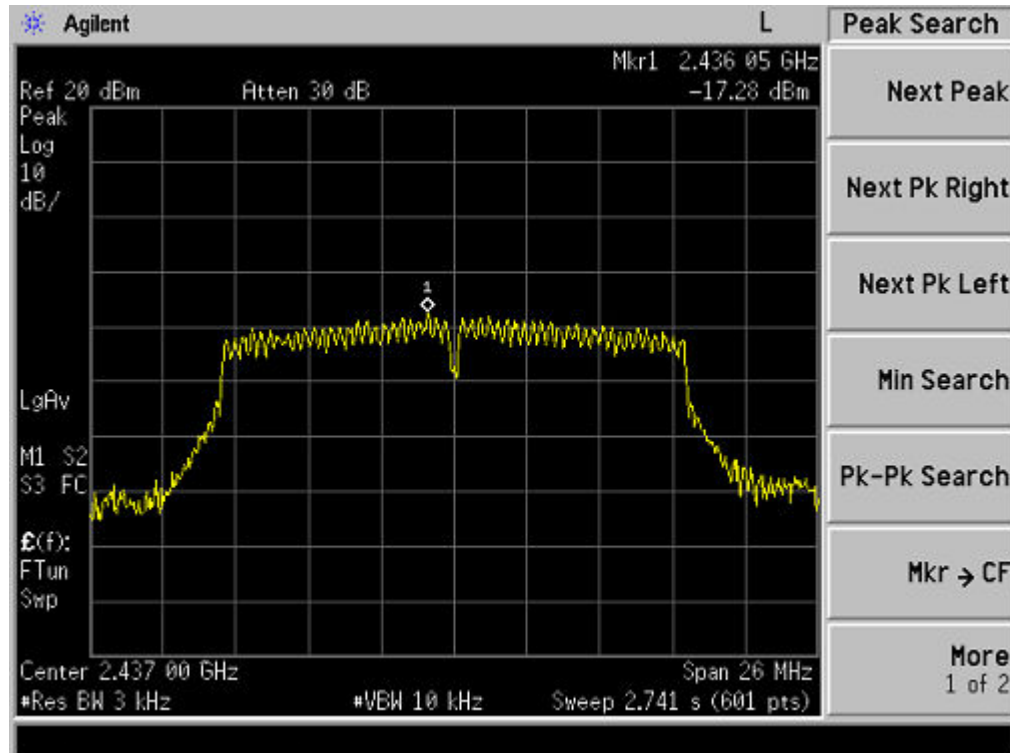
802.11b 2462MHz



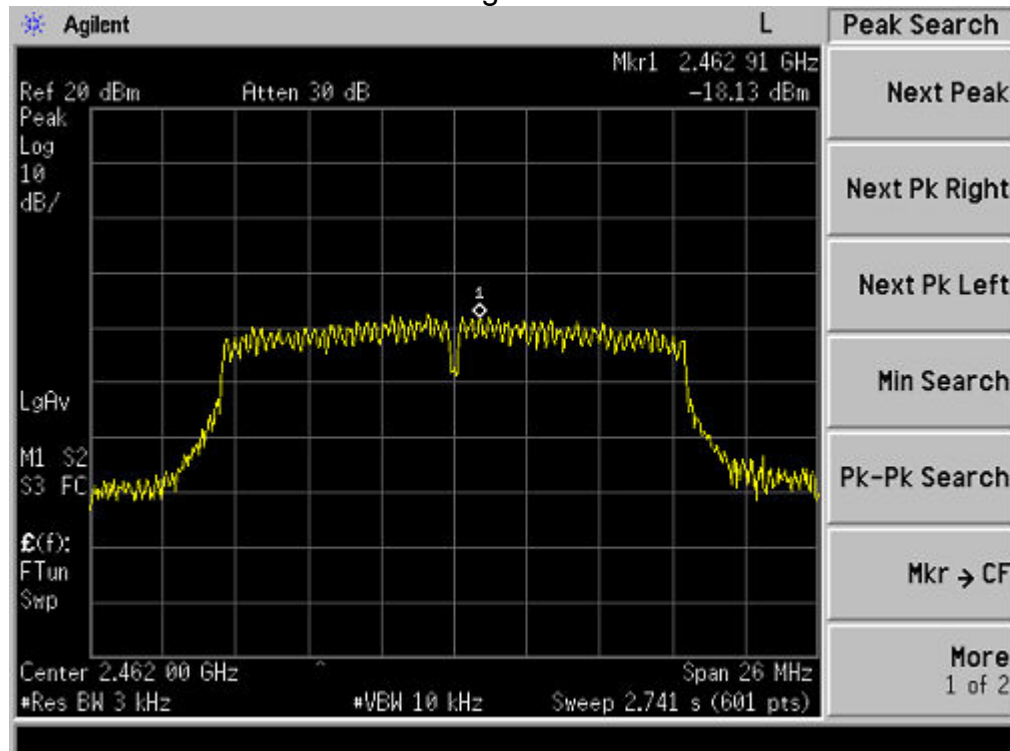
802.11g 2412MHz



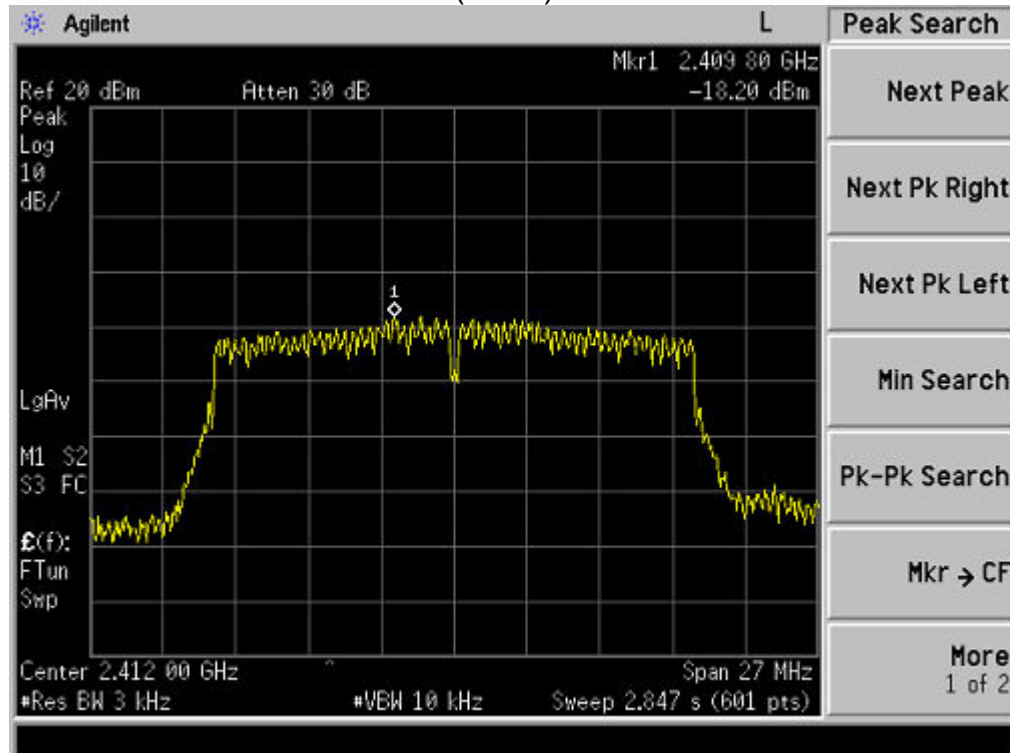
802.11g 2437MHz



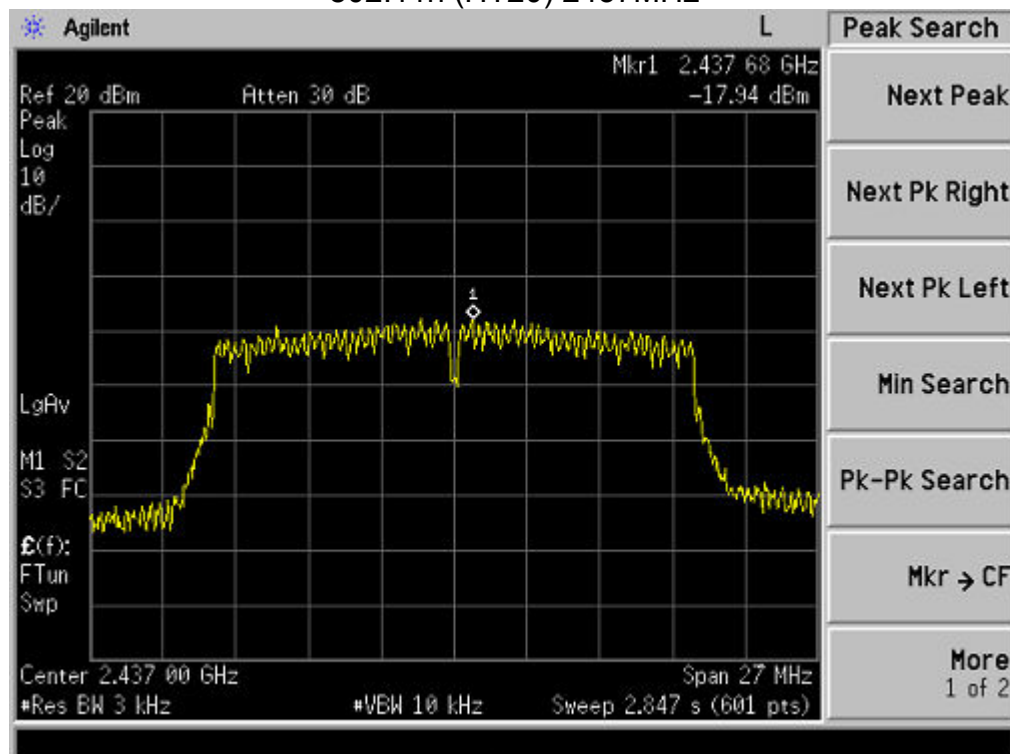
802.11g 2462MHz



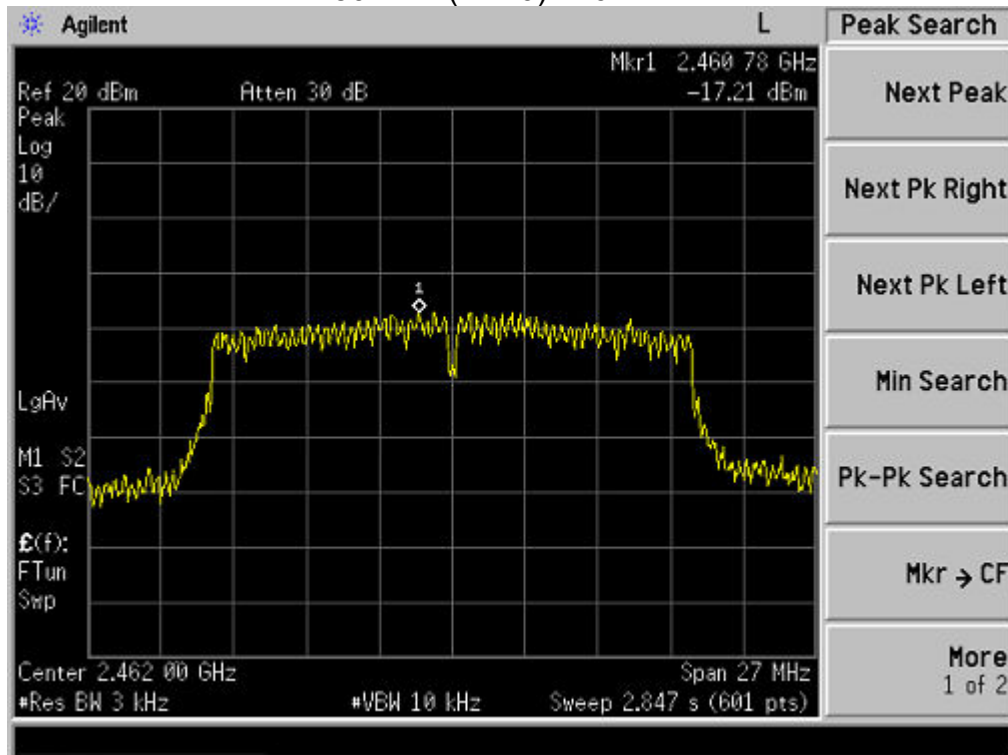
802.11n (HT20) 2412MHz



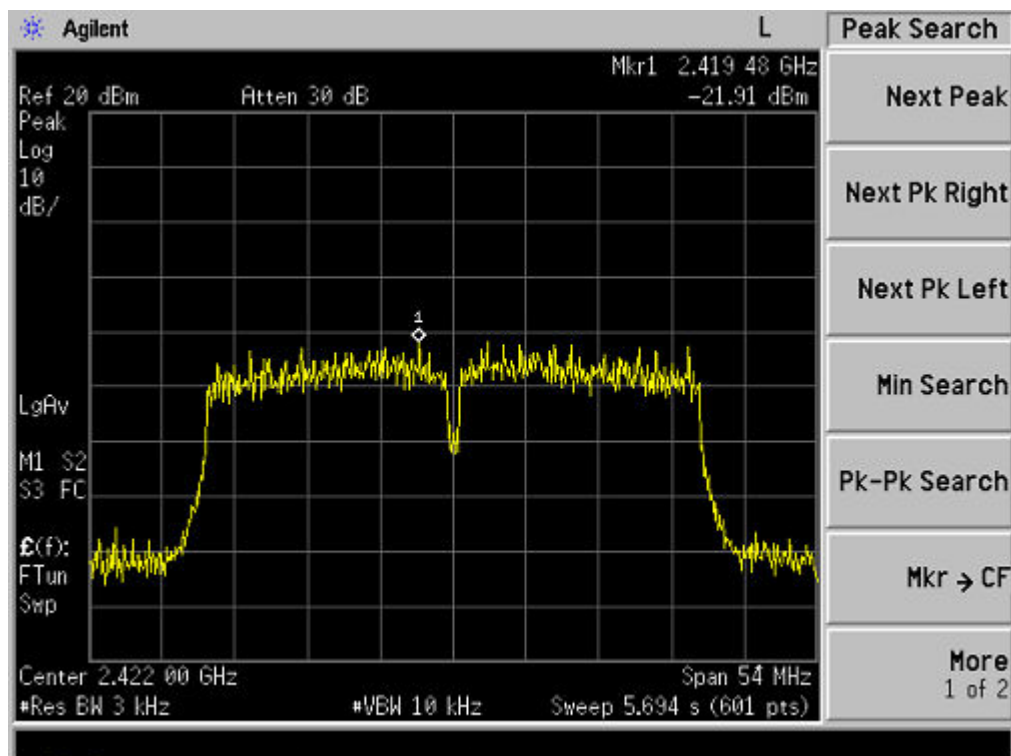
802.11n (HT20) 2437MHz



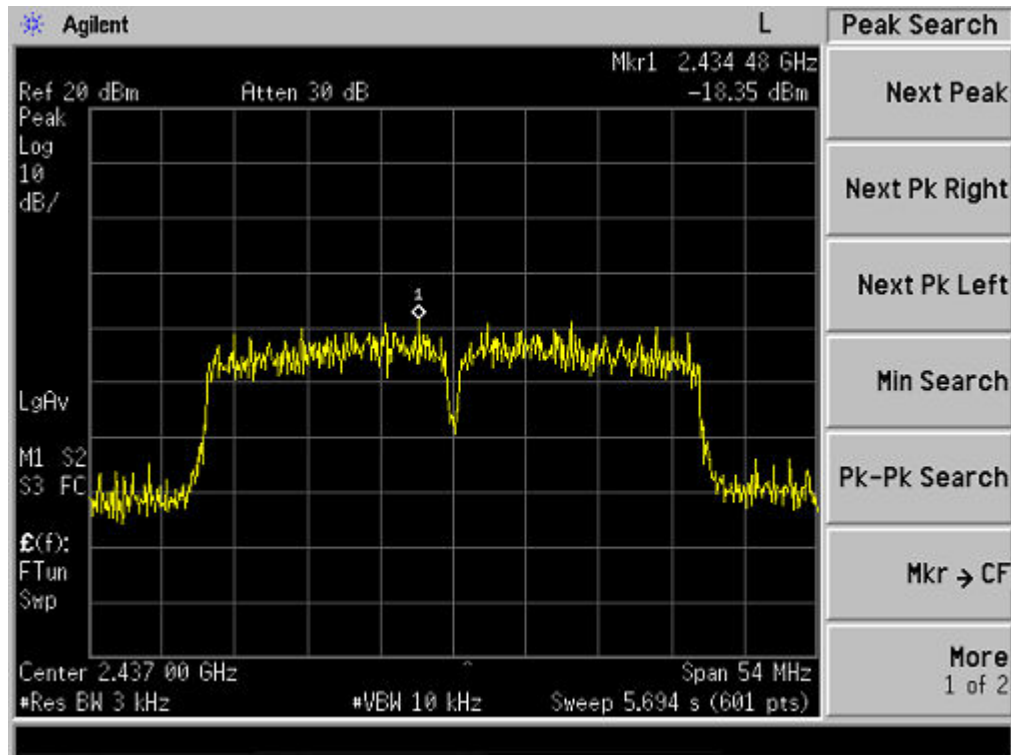
802.11n(HT20) 2462MHz



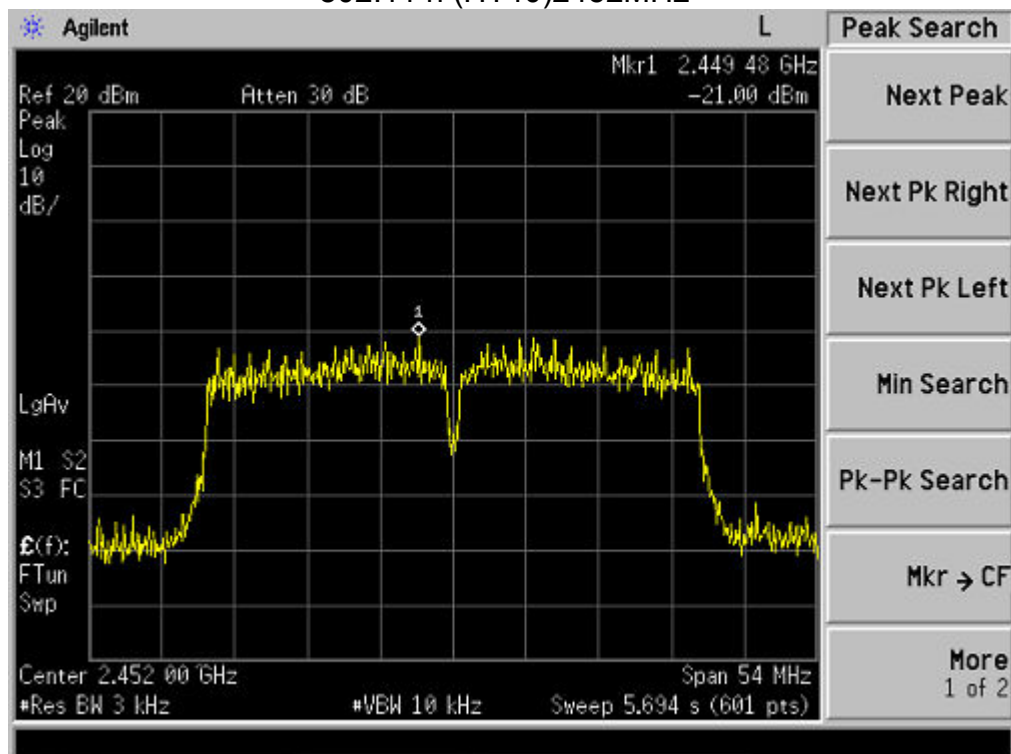
802.11 n (HT40) 2422MHz



802.11 n (HT40) 2437MHz

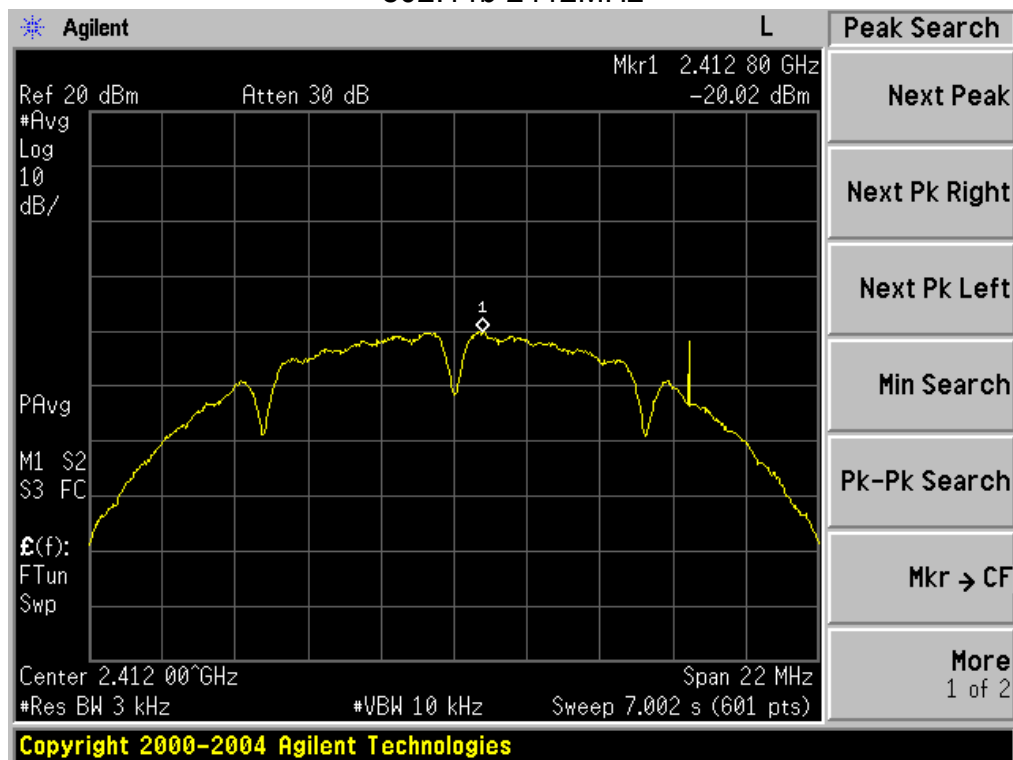


802.11 n (HT40) 2452MHz

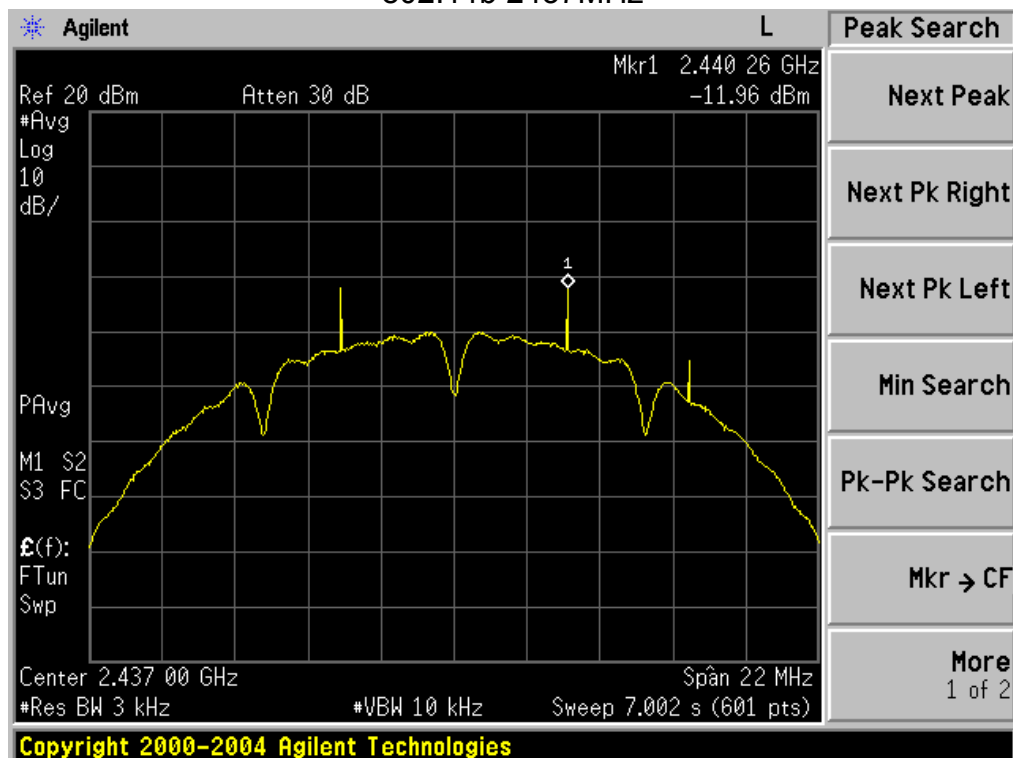


ANT2

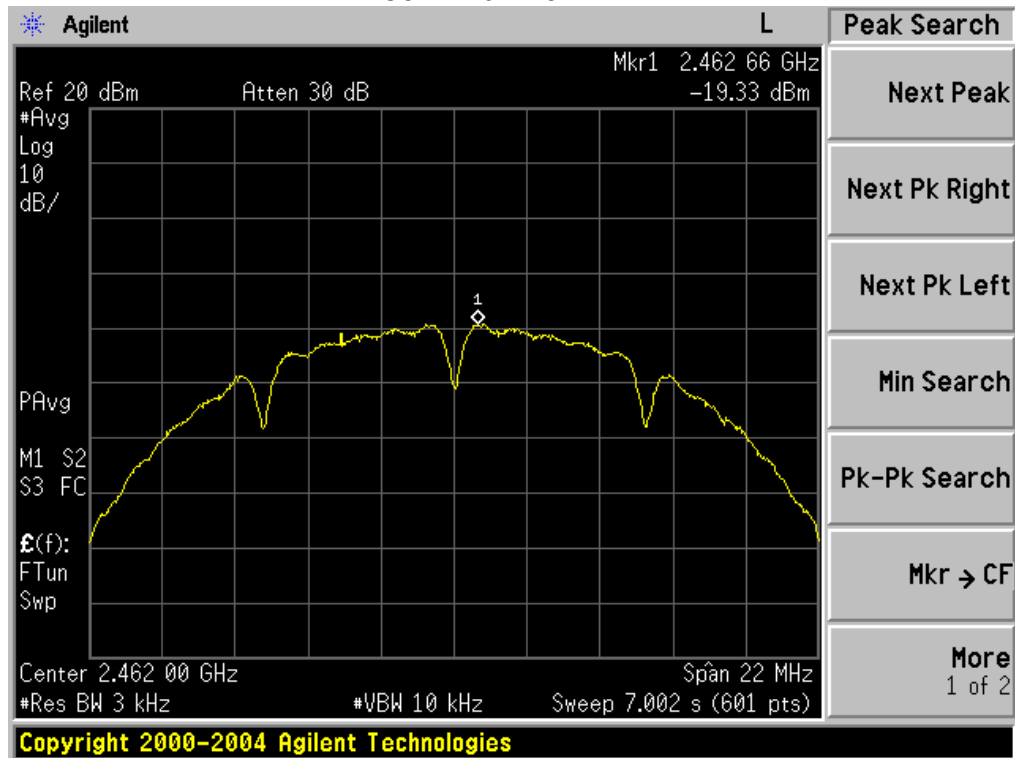
802.11b 2412MHz



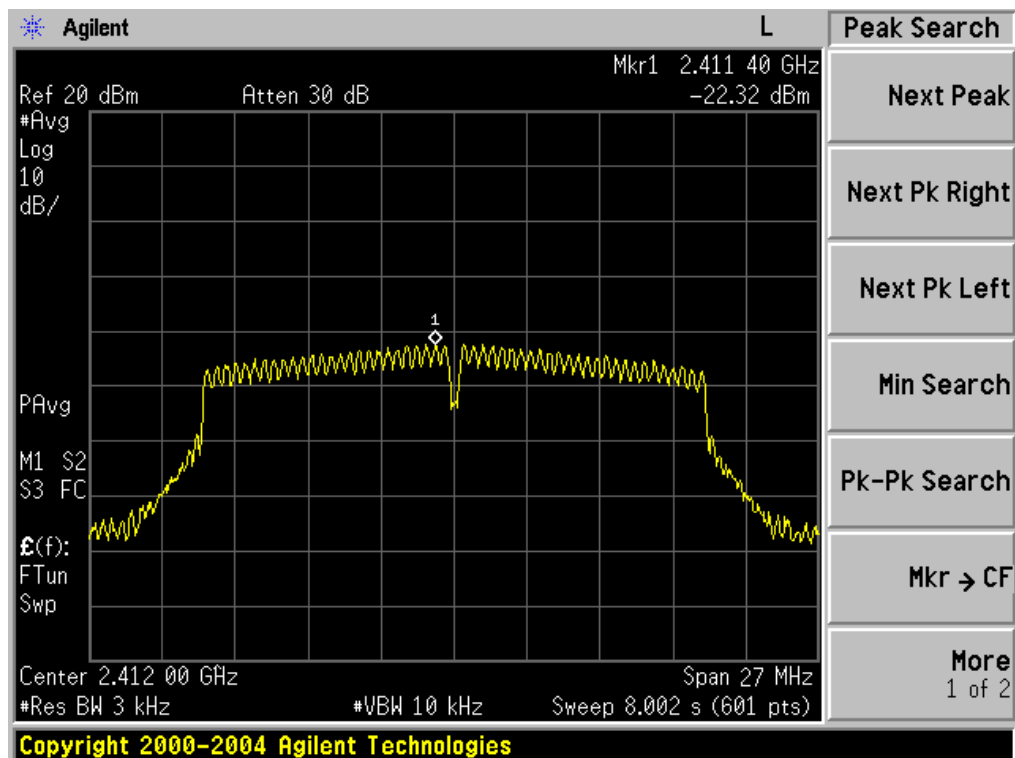
802.11b 2437MHz



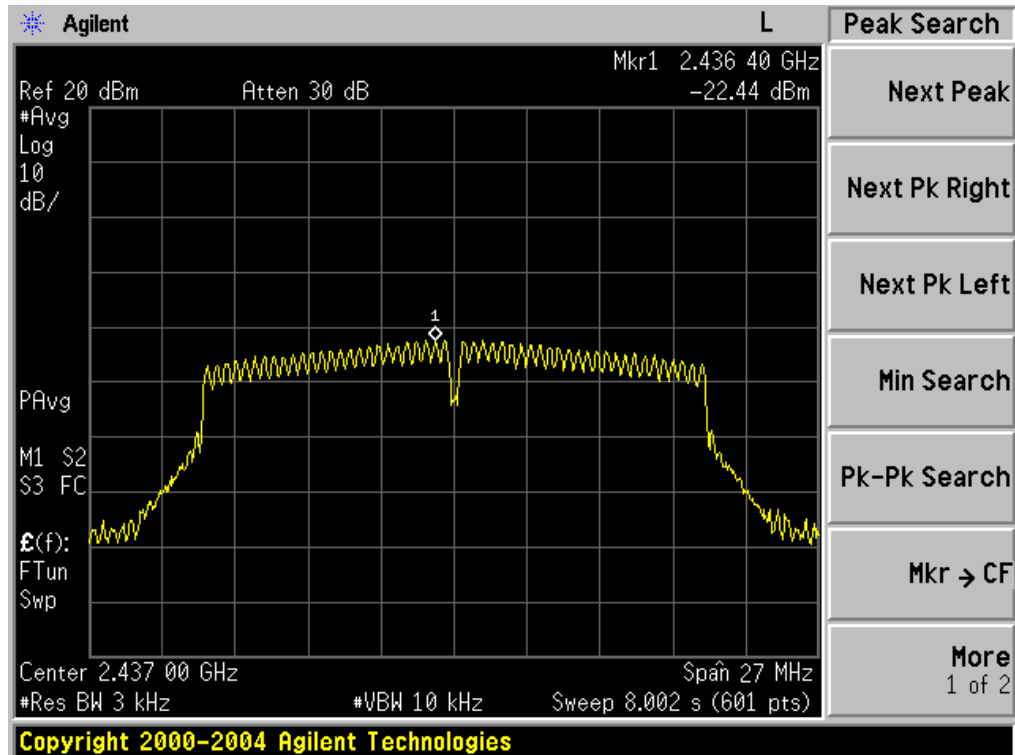
802.11b 2462MHz



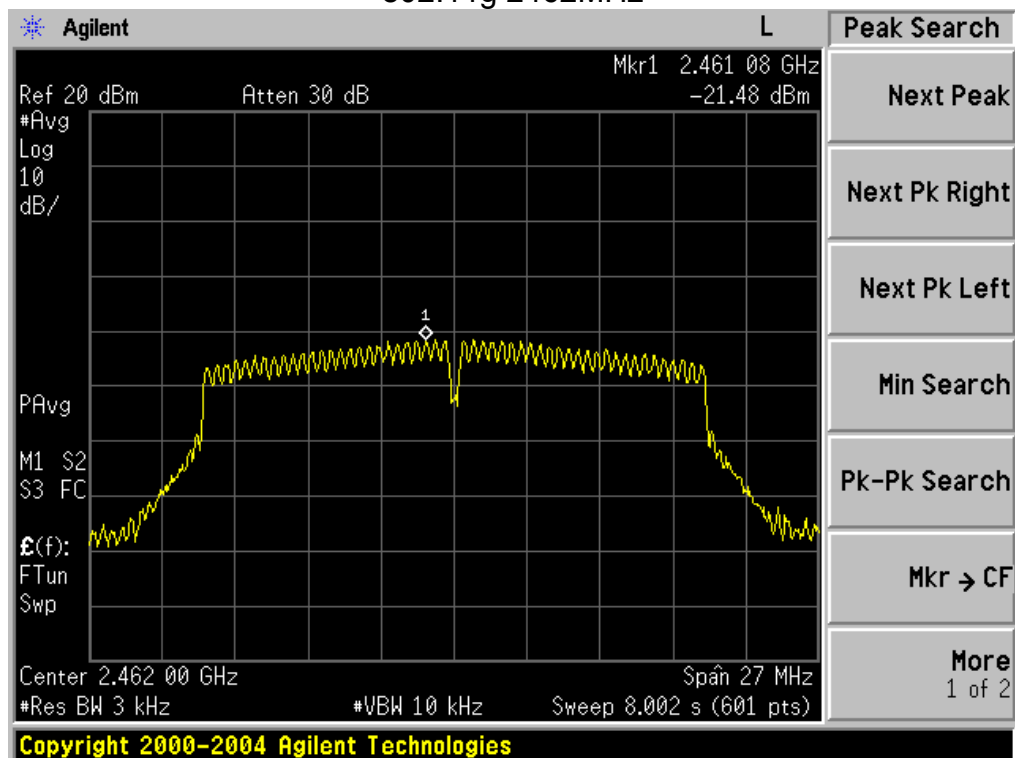
802.11g 2412MHz



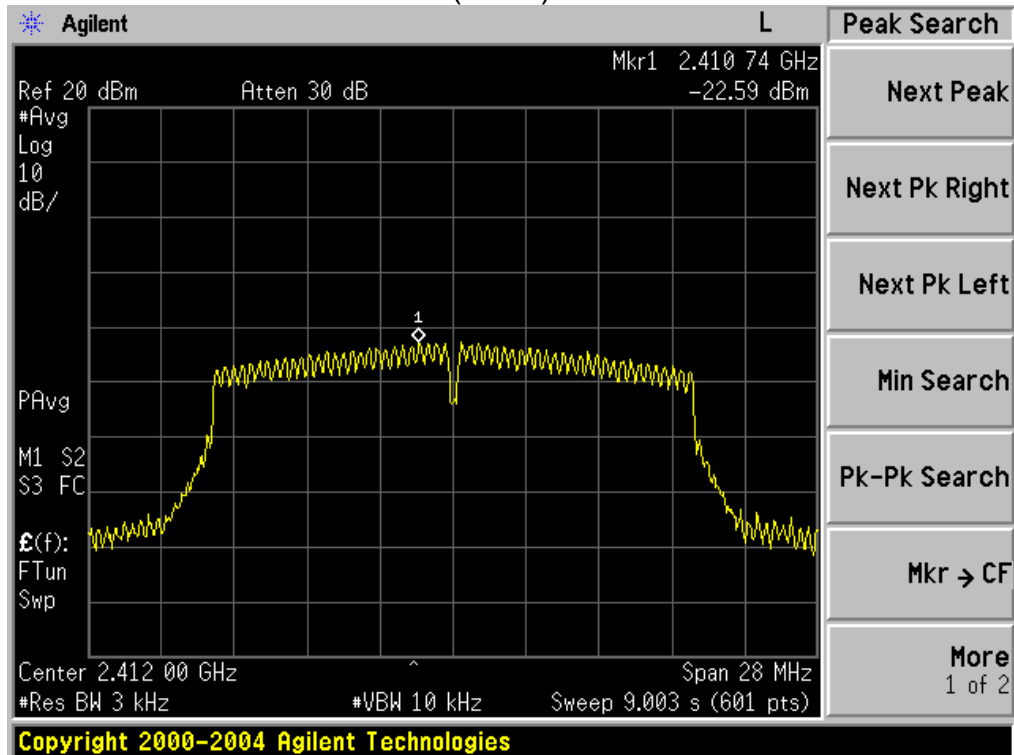
802.11g 2437MHz



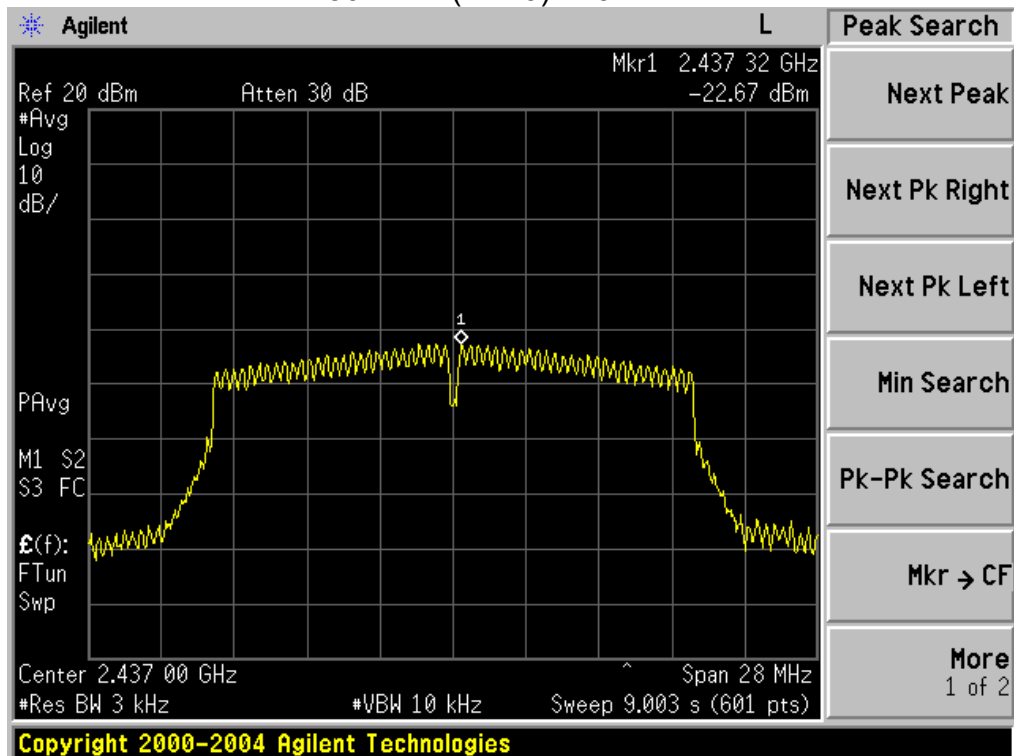
802.11g 2462MHz



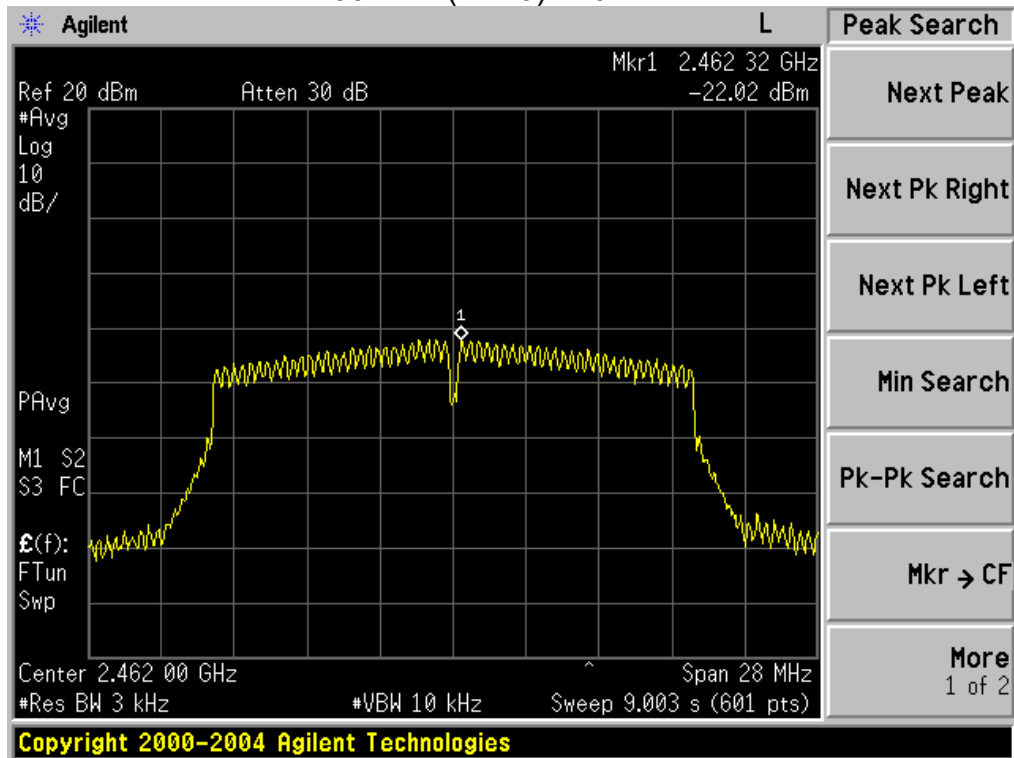
802.11n (HT20) 2412MHz



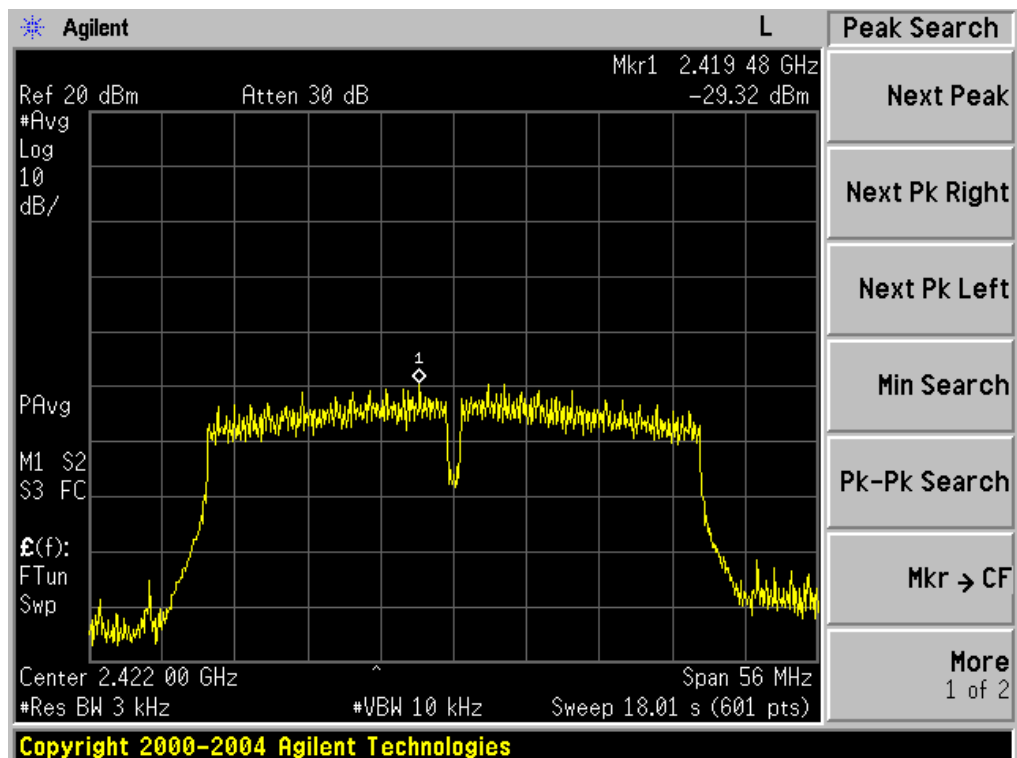
802.11n (HT20) 2437MHz



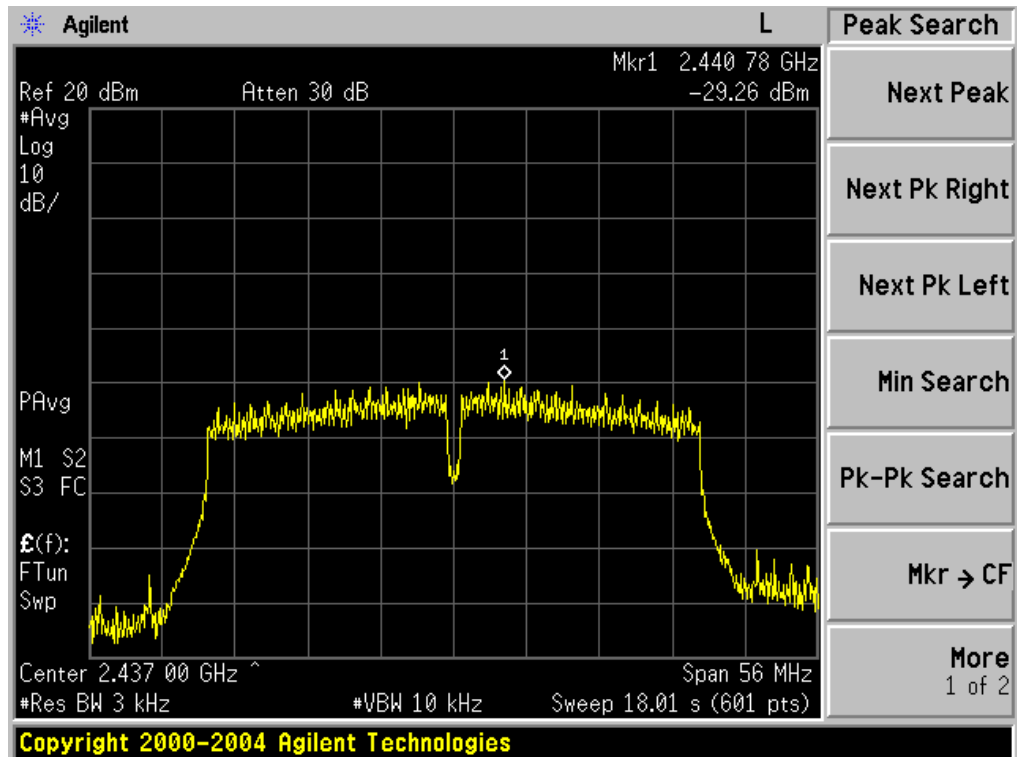
802.11n(HT20) 2462MHz



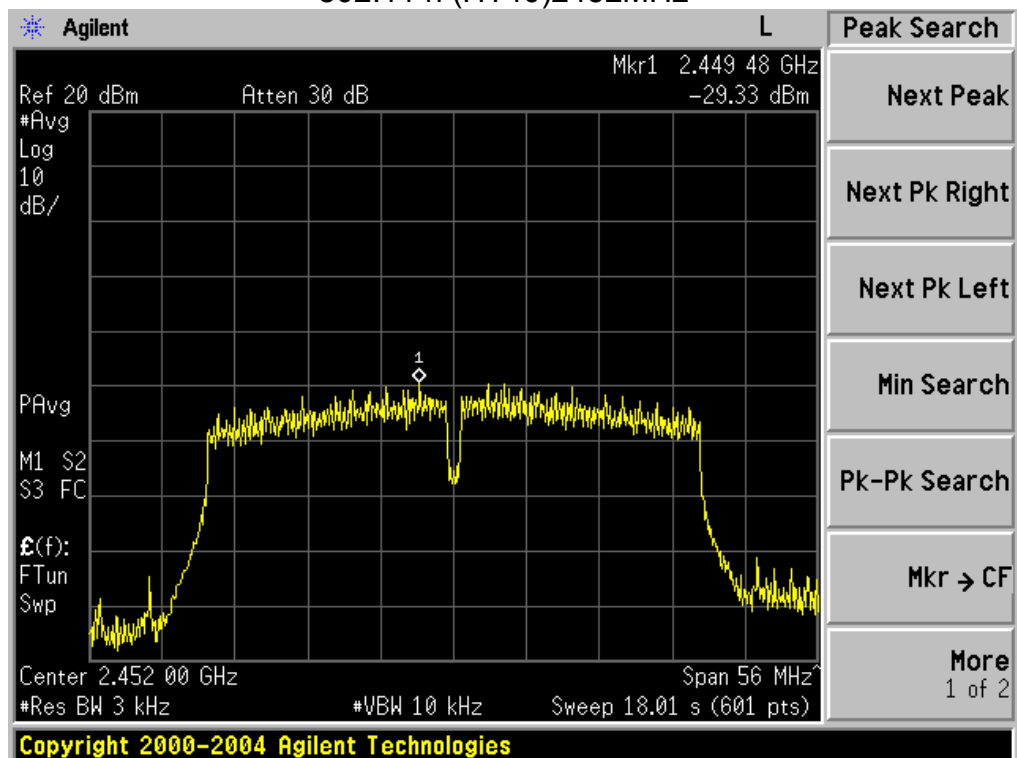
802.11 n (HT40) 2422MHz



802.11 n (HT40) 2437MHz



802.11 n (HT40)2452MHz



10. ANTENNA REQUIREMENTS

10.1. Limits

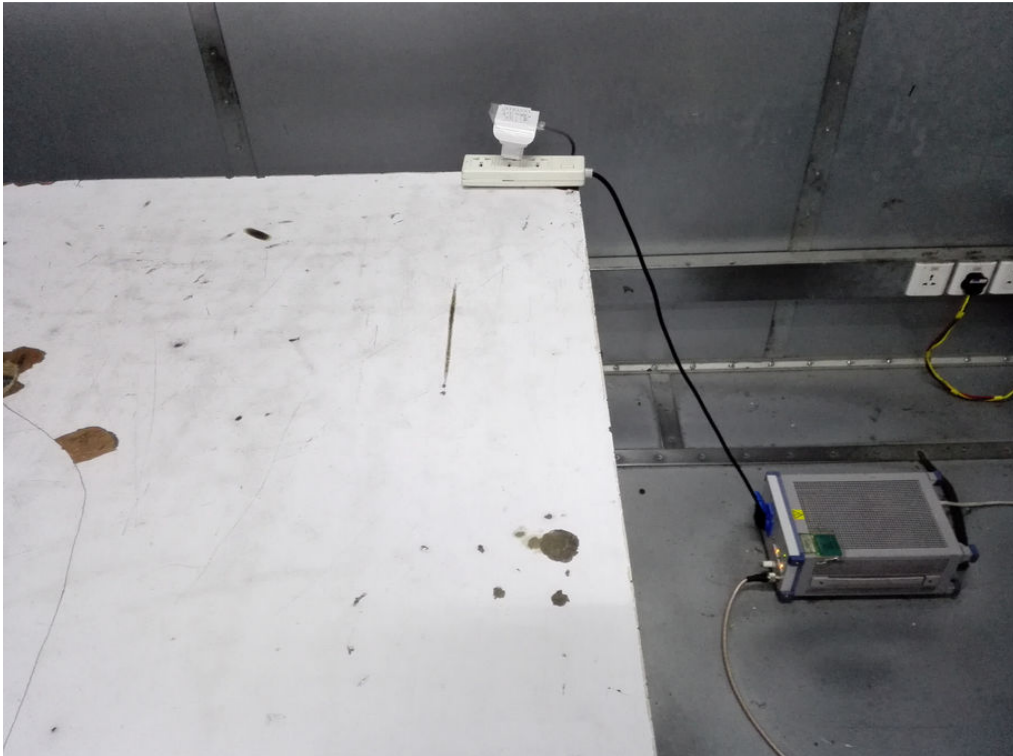
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

10.2. Result

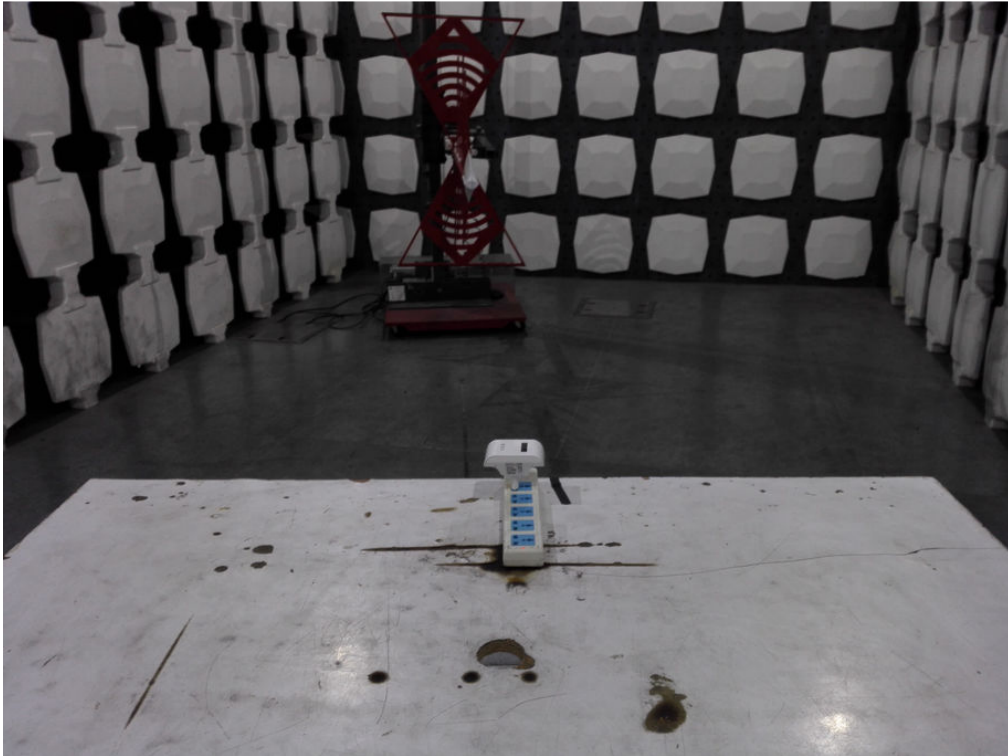
The antennas used for this product is PIFA antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.0dBi.

11. PHOTOGRAPHS OF TEST SET-UP

Conducted Emission



Radiated Emission Test



12. PHOTOGRAPHS OF THE EUT

Reference to the test report No. 16KWE094398F.

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