EMC TEST REPORT

No. 160801917SHA-001

Applicant	:	LUMI LEGEND ELECTRICAL CO., LTD. NO.18 LANE 239, BEIHAI ROAD, JIANGBEI, NINGBO 315032 CHINA
Manufacturer	:	LUMI LEGEND ELECTRICAL CO., LTD. NO.18 LANE 239, BEIHAI ROAD, JIANGBEI, NINGBO 315032 CHINA
Product Name	:	REC Wall Switch/US
Type/Model	:	AW51011
TEST RESULT	**:**	**PASS**

SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

47CFR Part 15 (2015): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Date of issue: December 07, 2016

Prepared by: Reviewed by:

Nemo Li (*Project Engineer*) Daniel Zhao (*Reviewer*)

Description of Test Facility

Name: Intertek Testing Service Limited Shanghai
Address: Building No.86, 1198 Qinzhou Road(North), Shanghai 200233, P.R. China

FCC Registration Number: 236597
IC Assigned Code: 2402B-1

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Content

1 GENERAL INFORMATION

1.1 Description of Client

Applicant : LUMI LEGEND ELECTRICAL CO., LTD.
NO.18 LANE 239, BEIHAI ROAD, JIANGBEI,
NINGBO 315032 CHINA

Manufacturer : LUMI LEGEND ELECTRICAL CO., LTD.
NO.18 LANE 239, BEIHAI ROAD, JIANGBEI,
NINGBO 315032 CHINA

1.2 Identification of the EUT

Product Name : REC Wall Switch/US

Type/model : AW51011

FCC ID : 2AB5K-AW51011

1.3 Technical Specification

Operation Frequency Band	:	2400~2483.5 MHz;
Type of Modulation	:	CCK,BPSK,QPSK,DSSS,OFDM
EUT Modes of Modulation	:	802.11b/g; 802.11n HT20, 802.11n HT40;
Channel Number	:	11Channel for 2412MHz~2462MHz for 11b,11g,11n (HT20); 7 Channel for 2422MHz~2452MHz for 11n(HT40);
Description of EUT	:	The EUT is a switch containing Wi-Fi module and has only one model.
Antenna	:	PCB antenna, 2.18dBi
Rating	:	120V~, 15A
Category of EUT	:	Class B
EUT type	:	☒ Table top ☐ Floor standing
Sample received date	:	October 10, 2016
Date of test	:	October 10, 2016 – October 16, 2016

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2015)
ANSI C63.10 (2013)
KDB 558074 (v03r05)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

The lowest, middle and highest channel were tested as representatives.

Freq. Band	Modulation	Lowest(MHz)	Middle(MHz)	Highest(MHz)
2400-2483.5 MHz	802.11b	2412	2437	2462
	802.11g	2412	2437	2462
	802.11n(HT20)	2412	2437	2462
	802.11n(HT40)	2422	2437	2452

Data rate VS Power

The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

After this pre-scan,we choose the following table of the data rata as the worst case.

Freq. Band	Modulation	Worst case data rate
2400-2483.5MHz	802.11b	1Mbps
	802.11g	6Mbps
	802.11n(HT20)	MCS8
	802.11n(HT40)	MCS8

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	HP ProBook 6470b	100-240V AC, 50/60Hz

2.5 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESCS 30	R&S	EC 2107	2016-10-20	2017-10-19
Test Receiver	ESIB 26	R&S	EC 3045	2016-10-20	2017-10-19
Test Receiver	ESCI 7	R&S	EC4501	2016-02-24	2017-02-23
Voltage Probe	ESH2-Z3	R&S	EC 3405	2016-01-09	2017-01-08
Voltage Probe	TK9420	Schwarzbeck	EC 4888	2015-11-18	2016-11-17
A.M.N.	ESH2-Z5	R&S	EC 3119	2015-12-16	2016-12-15
A.M.N.	ENV 216	R&S	EC 3393	2016-07-31	2017-07-30
A.M.N.	ENV 216	R&S	EC 3394	2016-07-31	2017-07-30
A.M.N.	ENV4200	R&S	EC3558	2016-07-31	2017-07-30
Click meter	DDA55	AFJ	EC 5320	2015-12-24	2016-12-23
I.S.N.	FCC-TLISN -T2-02	FCC	EC3754	2016-02-16	2017-02-15
I.S.N.	FCC-TLISN -T4-02	FCC	EC3755	2016-02-16	2017-02-15
I.S.N.	FCC-TLISN -T8-02	FCC	EC3756	2016-02-16	2017-02-15
Current probe	EZ-17	R&S	EC 3221	2016-01-09	2017-01-08
Absorbing clamp	MDS 21	R&S	EC 2108	2016-01-09	2017-01-08
Tri-loop	HXYZ 9170	Schwarzbeck	EC 3384	2016-06-03	2017-06-02
Harmnic-fliker	5001ix-PACS-1	CI	EC 2110	2016-08-20	2017-08-19
Conduct immunity system	UCS 500M6B	EM TEST	EC 2958	2016-04-08	2017-04-07
Automatic transformer	MV2616	EM TEST	EC 2957	Not required	Not required
ESD generator	ditto	EM TEST	EC 2956	2016-05-15	2017-05-14
ESD generator	NSG 437	TESEQ	EC 4792-4	2016-03-04	2017-03-03
Surge generator	TSS 500M2F	EM TEST	EC 2960	2016-08-31	2017-08-30
Surge generator	TSS 500M4	EM TEST	EC 2961	2016-01-09	2017-01-08
Surge Coupling network	CNV 504M	EM TEST	EC 2958-2	2016-01-09	2017-01-08
Surge Coupling network	CNV 504S1	EM TEST	EC 2958-1	2016-01-09	2017-01-08
Signal generator	SML 01	R&S	EC 2338	2016-04-17	2017-04-16
Power amplifier	75A250	AR	EC 3043-1	2016-08-15	2017-08-14
CDN	CDN M216	Schaffner	EC 2113-2	2016-07-31	2017-07-30
CDN	CDN M316	Schaffner	EC 2113-1	2016-09-29	2017-09-28
CDN	CDN T2	EM TEST	EC 4970	2016-10-20	2017-10-19
CDN	CDN T4	EM TEST	EC 3043-4	2016-01-09	2017-01-08
CDN	CDN M1/16A	EM TEST	EC 4792-6	2016-02-16	2017-02-15
CDN	CDN M1/16A	EM TEST	EC 4792-7	2016-02-16	2017-02-15
CDN	CDN M1/32A	EM TEST	EC4792-10	2016-01-09	2017-01-08
CDN	CDN M3N/16A	EM TEST	EC 4792-12	2016-02-16	2017-02-15
CDN	CDN M3N/32A	EM TEST	EC 4792-13	2016-02-16	2017-02-15

CDN	CDN T8-RJ45	EM TEST	EC 4792-15	2016-02-16	2017-02-15
EM clamp	EM 101	EM TEST	EC 3043-6	2015-11-23	2016-11-22
Power meter	PM2002	AR	EC3043-7	2016-10-18	2017-10-17
Power sensor	PH2000	AR	EC3043-8	2015-10-18	2016-10-17
Attenuator	ATT6/75	EM TEST	EC 3043-3	2016-01-09	2017-01-08
Attenuator	68-6-44	Weinschel	EC 3043-9	2016-01-09	2017-01-08
DDC	DC 2600	AR	EC 3043-5	2016-01-09	2017-01-08
DDC	DC 6180A	AR	EC 3044-5	2015-06-31	2017-07-30
DDC	DC 7144A	AR	EC 3044-6	2016-01-09	2017-01-08
Ultra-broadband antenna	HL 562	R&S	EC 3046-1	2015-12-18	2016-12-17
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2016-06-01	2017-05-30
Horn antenna	HF 906	R&S	EC 3049	2016-09-12	2017-09-11
Horn antenna	3117	ETS	EC 4792-1	2016-08-18	2017-08-17
Horn antenna	HAP18-26W	TOYO	EC 4792-3	2016-06-12	2017-06-11
Pre-amplifier	Pre-amp 18	R&S	EC 5262	2016-05-25	2017-05-24
Pre-amplifier	Tpa0118-40	R&S	EC 4792-2	2016-04-12	2017-04-11
Log-period antenna	AT 1080	AR	EC 3044-7	2016-06-30	2017-06-29
Biconical antenna	3109PX	ETS	EC3564	2016-08-23	2017-08-22
Horn antenna	AT 4002	AR	EC 3044-8	2016-07-13	2017-07-12
Signal generator	SMR 20	R&S	EC 3044-1	2016-07-31	2017-07-30
Power amplifier	150W1000	AR	EC 3044-2	2016-06-13	2017-06-12
Power amplifier	25S1G4	AR	EC 3044-4	2016-07-31	2017-07-30
Field meter	FM 5004	AR	EC 3044-3	2016-07-31	2017-07-30
Field sensor	FP 6001	AR	EC 3044-9	2016-07-31	2017-07-30
Semi-anechoic chamber	-	Albatross project	EC 3048	2016-05-06	2017-05-05
Fully-anechoic chamber	-	Albatross project	EC 3047	2016-05-06	2017-05-05
Shielded room	-	Zhongyu	EC 2838	2016-01-09	2017-01-08
Shielded room	-	Zhongyu	EC 2839	2016-01-09	2017-01-08
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2016-01-09	2017-01-08
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2016-01-09	2017-01-08
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2016-01-09	2017-01-08
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2016-01-09	2017-01-08
Power sensor / Power meter	N1911A/N1921A	Agilent	EC4318	2016-04-11	2017-04-10
Spectrum analyzer	E7402A	Agilent	EC2254	2016-08-16	2017-08-15
EMF meter	ELT-400	NARDA	EC2928	2016-08-05	2017-08-04

Protection Network	VDHH 9502	Schwarzbeck	EC4631	2016-07-07	2017-07-06
Time relay	-	-	EC4186-1	2016-05-06	2017-05-05
DIPs generator	SKS-1130GT	SANKI	EC 5033	2016-01-09	2017-01-08
Ring wave generator	SKS-1206GB	SANKI	EC 5033-1	2016-01-09	2017-01-08
EFT generator	SKS-0404IB	SANKI	EC 5033-2	2016-01-09	2017-01-08
Surge generator	SKS-0506GB-30	SANKI	EC 5033-3	2016-01-09	2017-01-08
PXA Signal Analyzer	N9030A	Agilent	EC5338	2016-03-04	2017-03-03
Power sensor	U2021XA	Agilent	EC5338-1	2016-03-04	2017-03-03
Vector Signal Generator	N5182B	Agilent	EC5175	2016-03-04	2017-03-03
MXG Analog Signal Generator	N5181A	Agilent	EC5338-2	2016-03-04	2017-03-03
Mobile Test System	Iqxel	Litepoint	EC 5176	2016-01-09	2017-01-08
Spectrum analyzer	E7402A	Agilent	EC2254	2016-08-15	2017-08-14
Three phase Harmonic-flicker system	PFS 503N	EM TEST	EC 5383	2016-03-19	2017-03-18
	DPA 503N	EM TEST	EC 5383-1	2015-12-30	2016-12-29
	NETWAVE30	EM TEST	EC 5383-2	2016-03-19	2017-03-18

2.6 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	RESULT
Minimum 6dB Bandwidth & Occupied bandwidth	15.247(a)(2)	Pass
Maximum peak output power	15.247(b)	Pass
Power spectrum density	15.247(e)	Pass
Radiated emission	15.205 & 15.209	Pass
Emission outside the frequency band	15.247(d)	Pass
Power line conducted emission	15.207	Pass
Antenna requirement	15.203	Pass

Notes: 1: NA =Not Applicable

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2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

TEST ITEM	MEASUREMENT UNCERTAINTY
Maximum peak output power	± 0.74dB
Radiated Emissions in restricted frequency bands below 1GHz	± 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 5.02dB
Emission outside the frequency band	± 2.89dB
Power line conducted emission	± 3.19dB

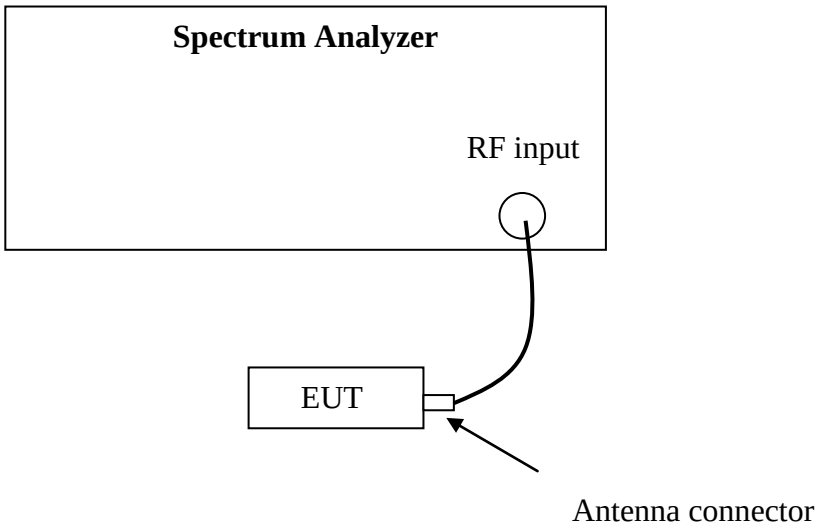
3 Minimum 6dB Bandwidth

Test result: Pass

3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Test Configuration



3.3 Test Procedure and test setup

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" for compliance to FCC 47CFR 15.247 requirements(clause 8.2).

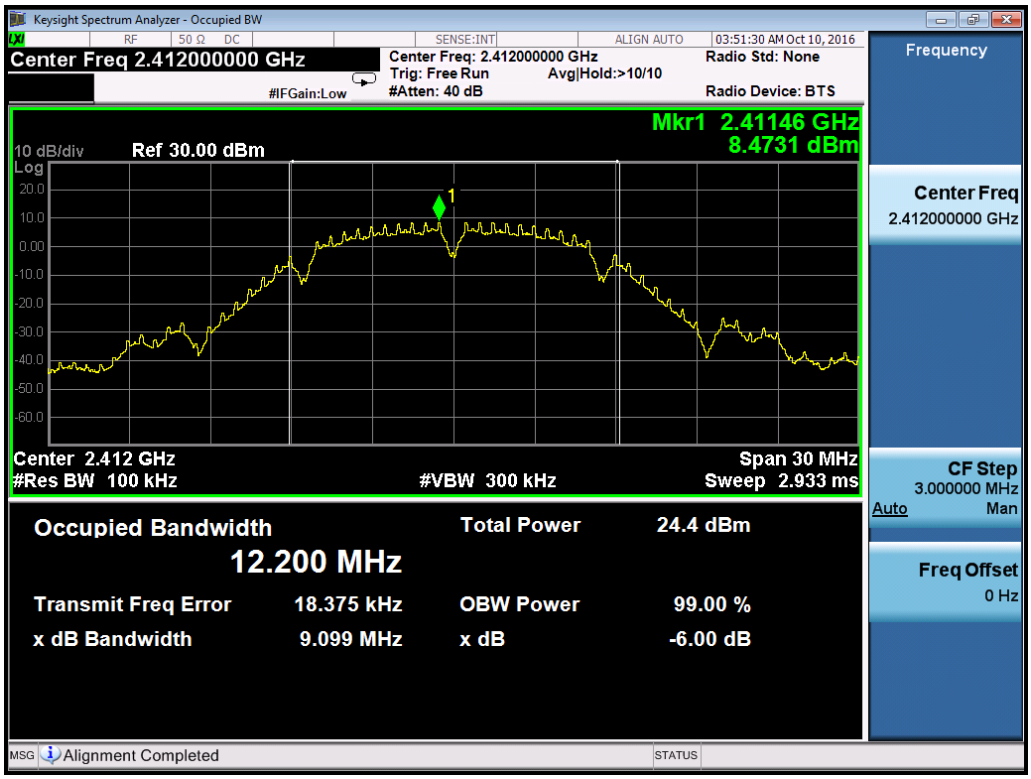
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points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

3.4 Test Protocol

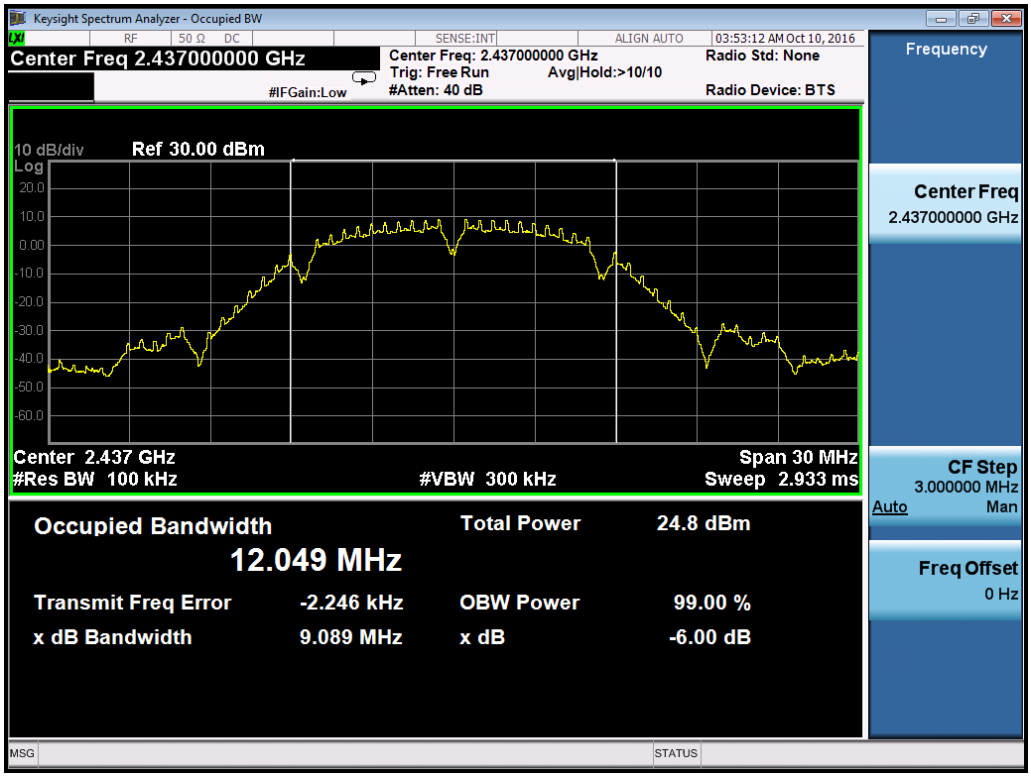
Temperature: 25 °C
Relative Humidity: 55 %

Mode	Channel	Minimum 6dB Bandwidth (MHz)			Limits (MHz)
		Port0	Port 1	Port 2	
802.11b	L	9.099	-	-	> 0.5
	M	9.089	-	-	> 0.5
	H	9.094	-	-	> 0.5

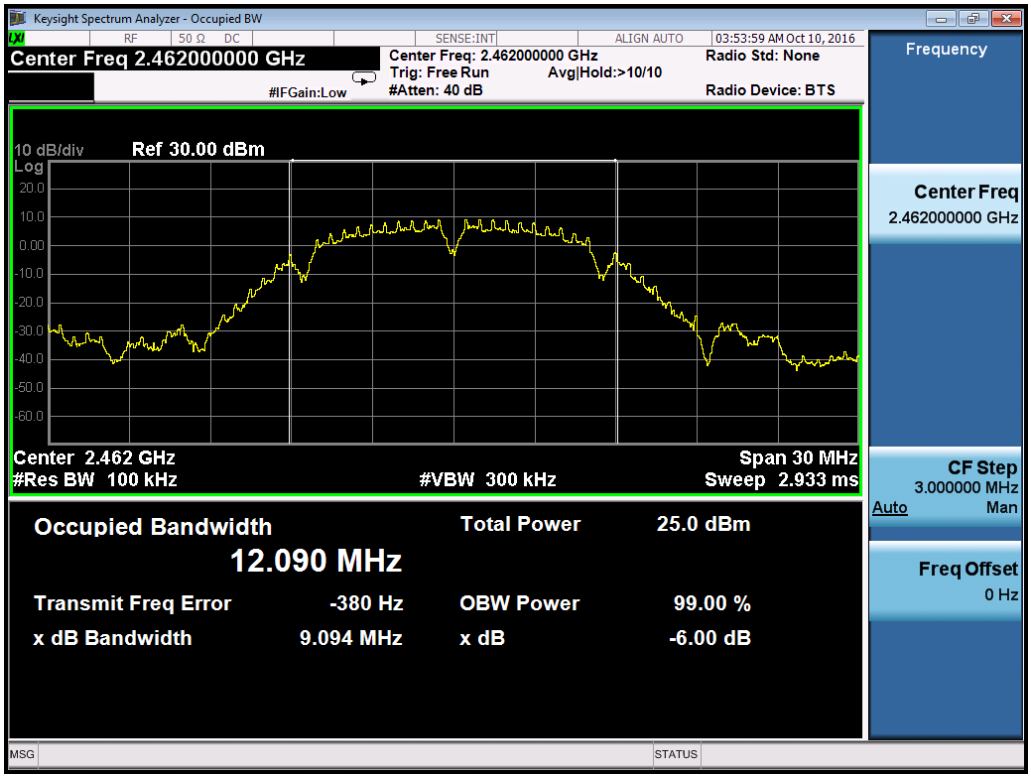
Channel L



Channel M

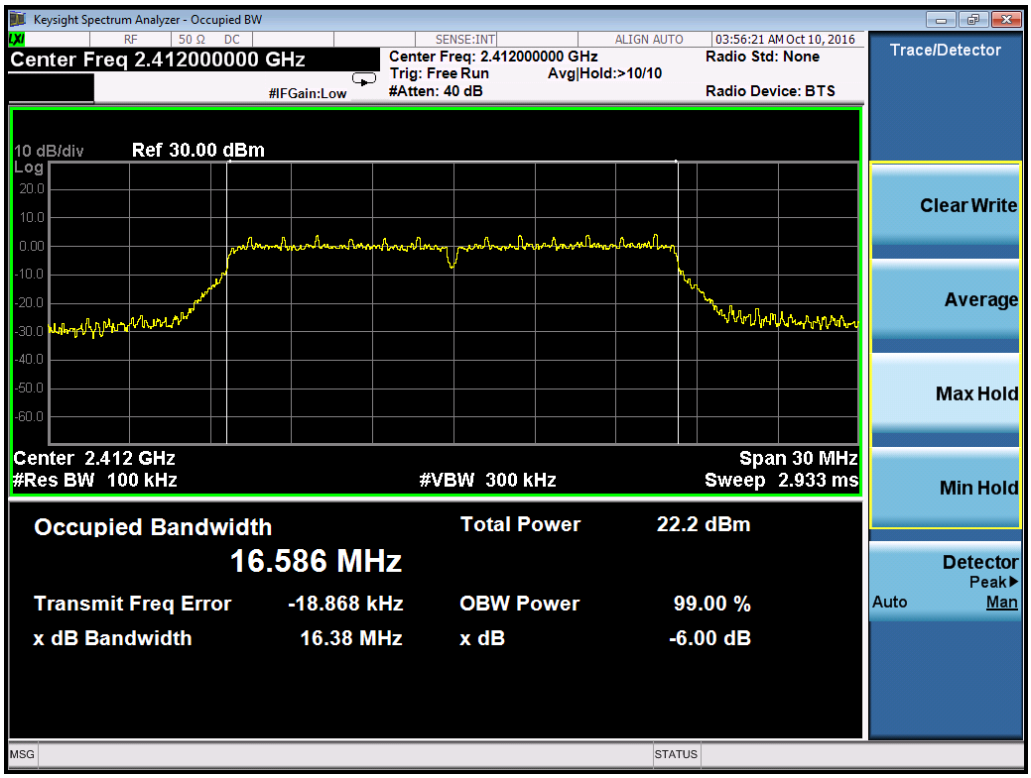


Channel H

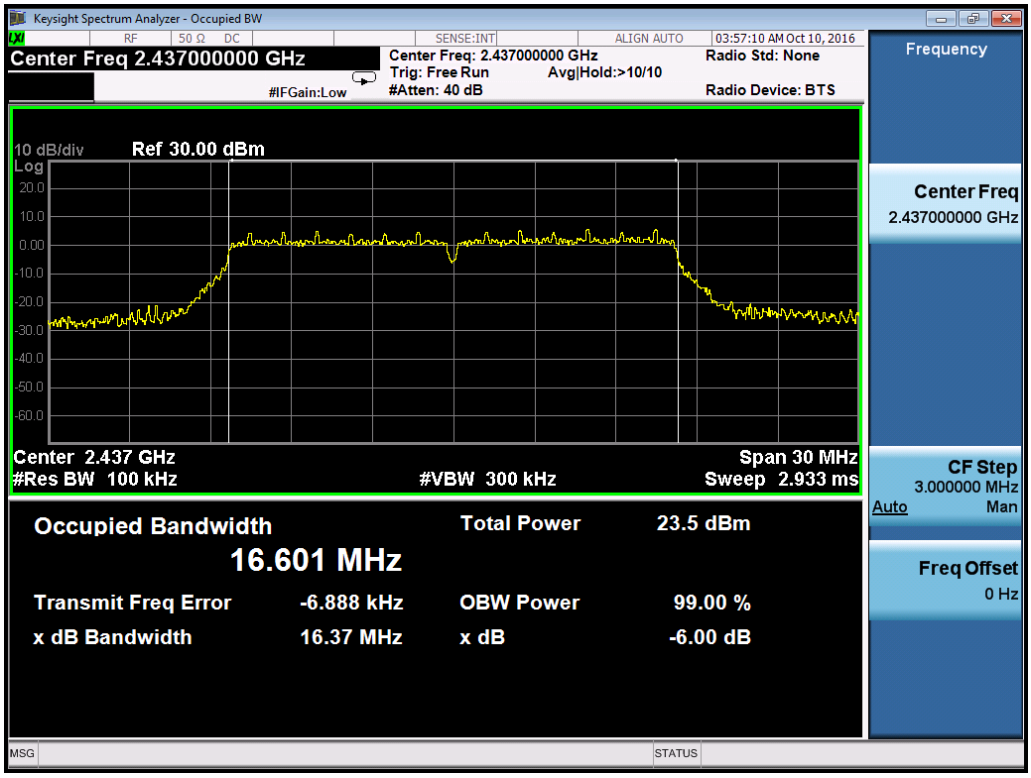


Mode	Channel	Minimum 6dB Bandwidth (MHz)			Limits (MHz)
		Port0	Port 1	Port 2	
802.11g	L	16.38	-	-	> 0.5
	M	16.37	-	-	> 0.5
	H	16.38	-	-	> 0.5

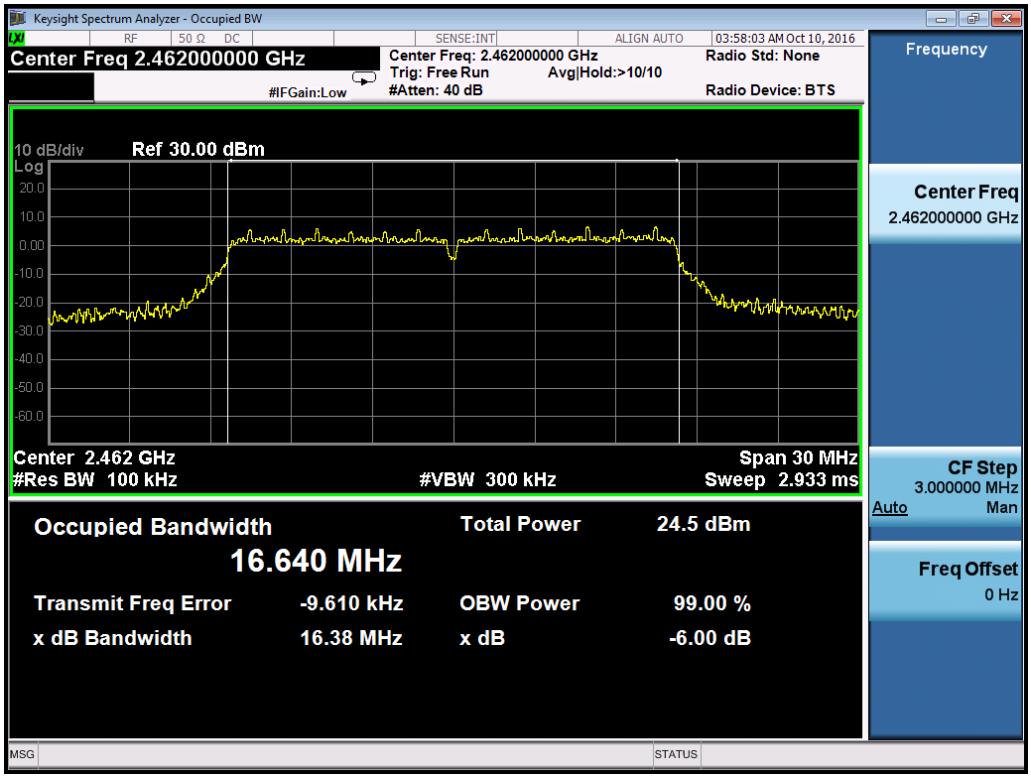
Channel L



Channel M

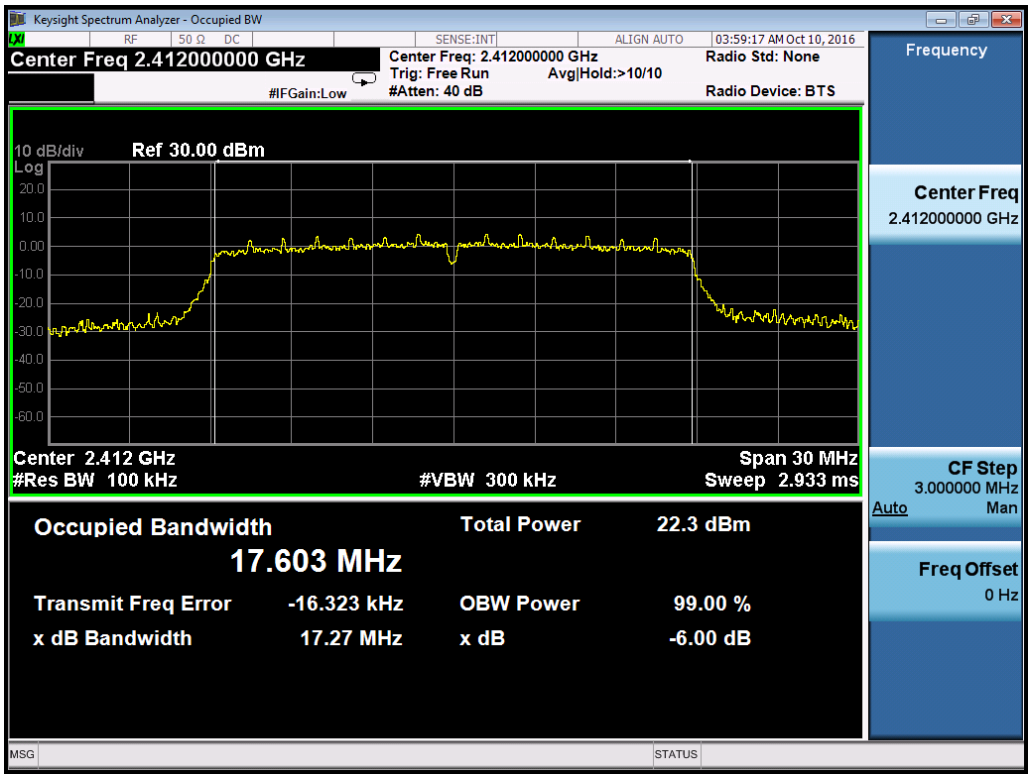


Channel H

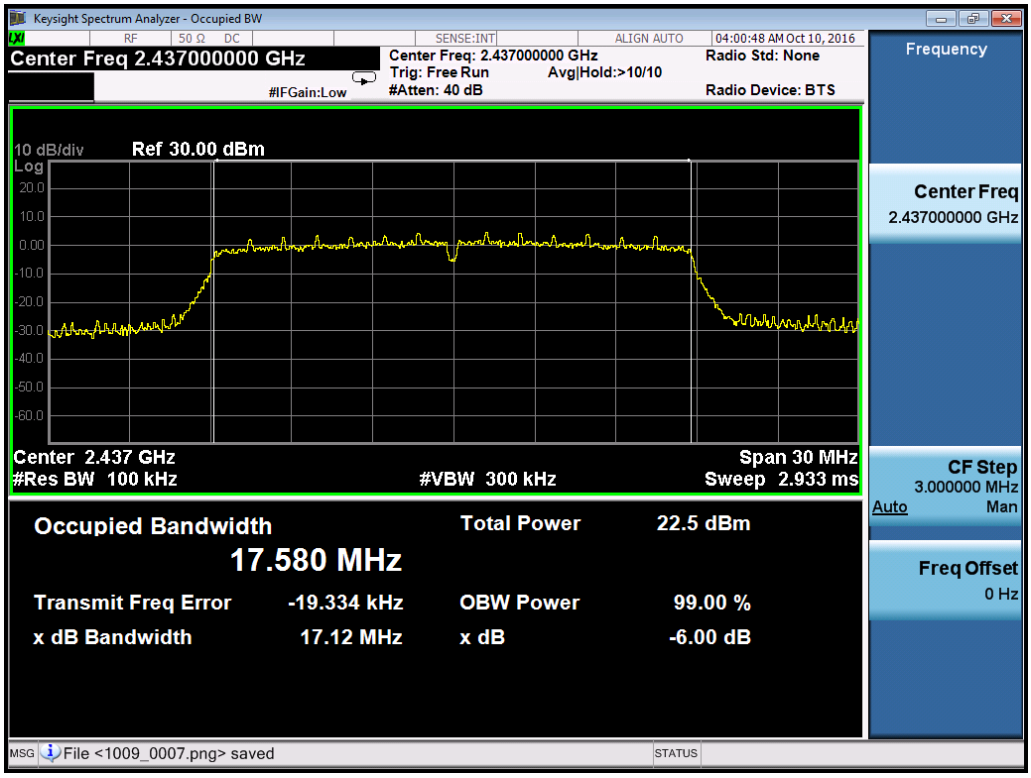


Mode	Channel	Minimum 6dB Bandwidth (MHz)			Limits (MHz)
		Port0	Port 1	Port 2	
802.11n(HT20)	L	17.27	-	-	> 0.5
	M	17.12	-	-	> 0.5
	H	17.28	-	-	> 0.5

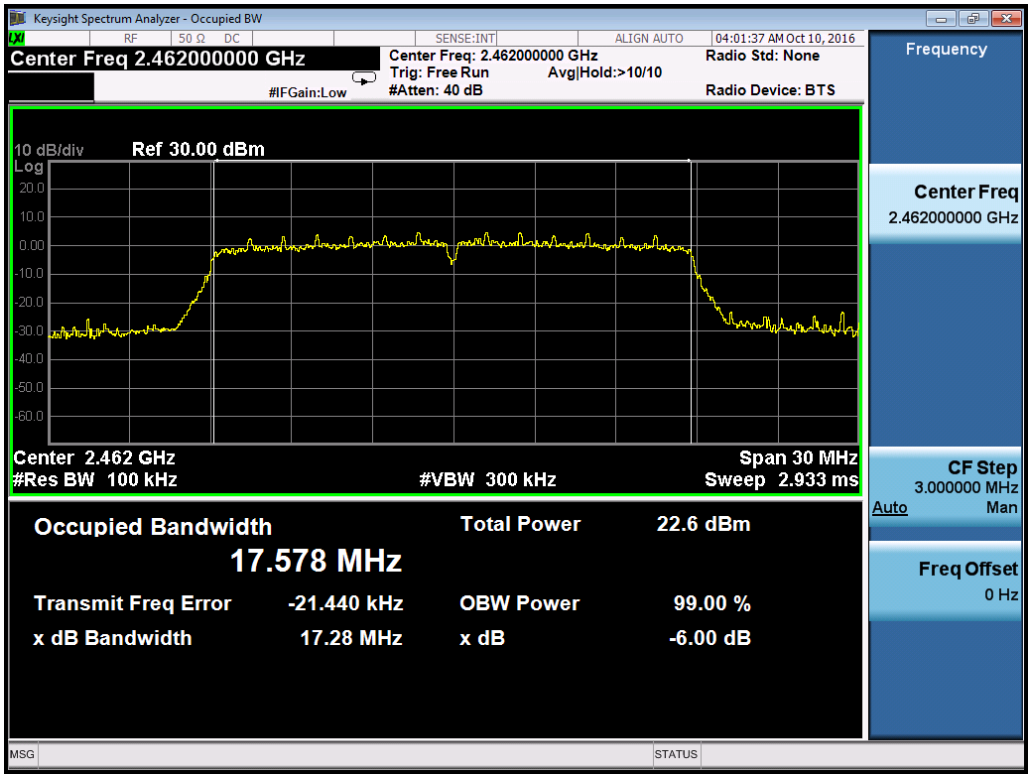
Channel L



Channel M

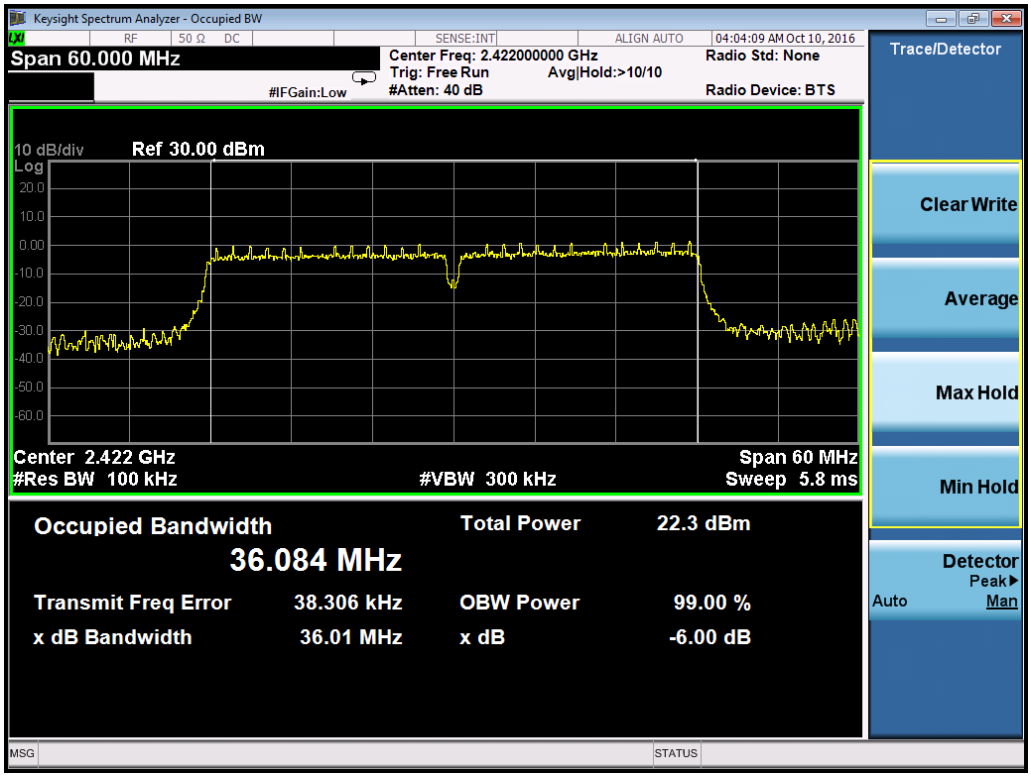


Channel H

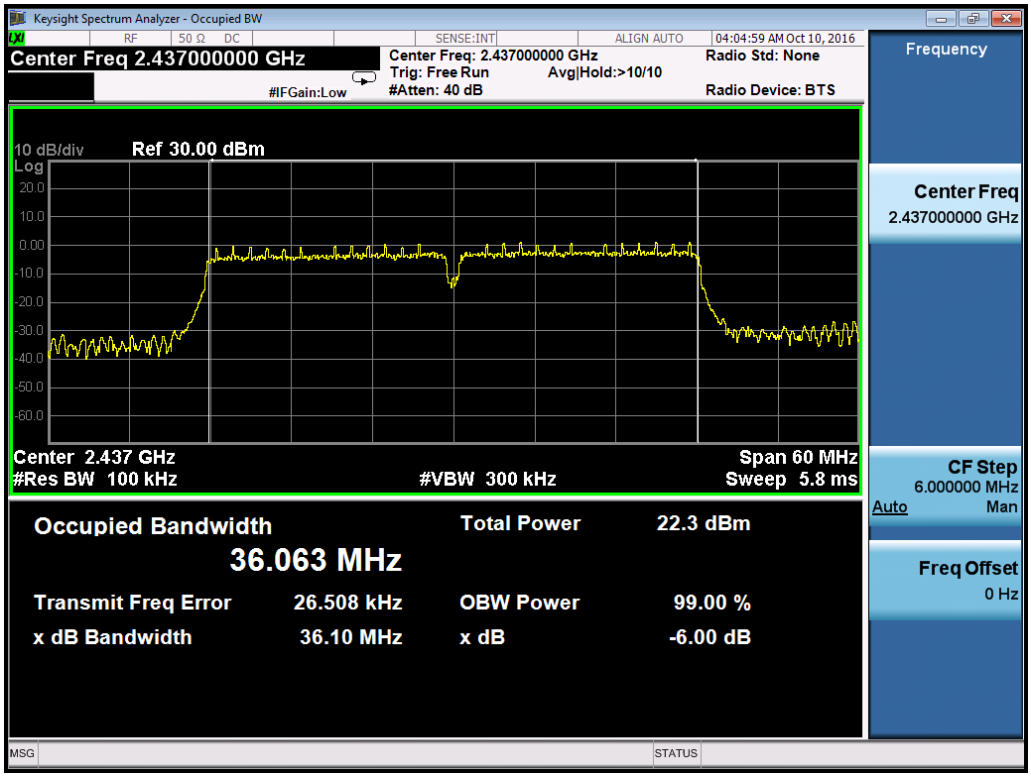


Mode	Channel	Minimum 6dB Bandwidth (MHz)			Limits (MHz)
		Port0	Port 1	Port 2	
802.11n(HT40)	L	36.01	-	-	> 0.5
	M	36.10	-	-	> 0.5
	H	36.10	-	-	> 0.5

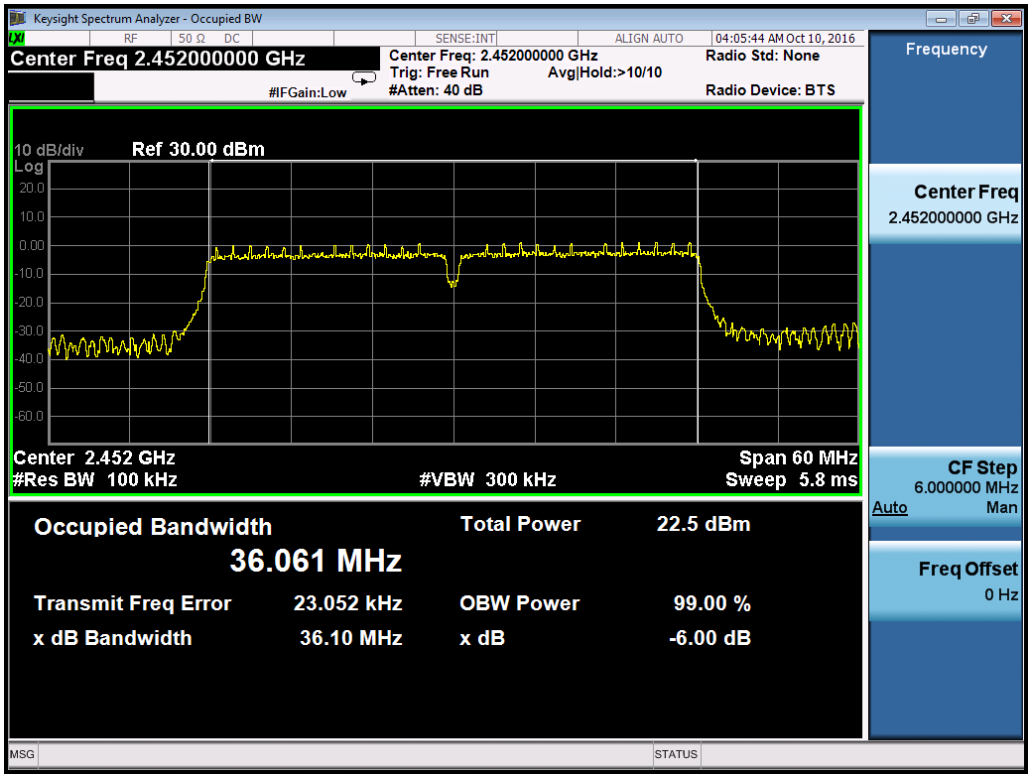
Channel L



Channel M



Channel H



4 Maximum Conducted Output power

Test result: Pass

4.1 Test limit

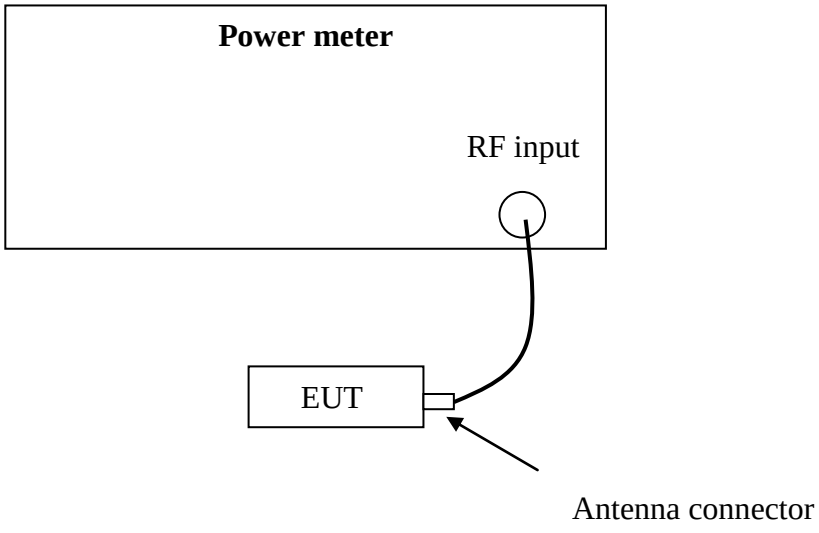
☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt

☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

4.2 Test Configuration



4.3 Test procedure and test setup

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" for compliance to FCC 47CFR 15.247 requirements.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

4.4 Test protocol

Temperature: 25 °C
Relative Humidity: 55 %

Mode	Channel	Reading (dBm)			Total Power (dBm)	Limit (dBm)
		Port0	Port 1	Port 2		
802.11b	L	17.92	-	-	17.92	30
	M	18.27	-	-	18.27	30
	H	18.57	-	-	18.57	30

Mode	Channel	Reading (dBm)			Total Power (dBm)	Limit (dBm)
		Port0	Port 1	Port 2		
802.11g	L	17.30	-	-	17.30	30
	M	17.65	-	-	17.65	30
	H	17.78	-	-	17.78	30

Mode	Channel	Reading (dBm)			Total Power (dBm)	Limit (dBm)
		Port0	Port 1	Port 2		
802.11n (HT20)	L	14.66	-	-	14.66	30
	M	14.92	-	-	14.92	30
	H	15.10	-	-	15.10	30

Mode	Channel	Reading (dBm)			Total Power (dBm)	Limit (dBm)
		Port0	Port 1	Port 2		
802.11n (HT40)	L	13.35	-	-	13.35	30
	M	13.40	-	-	13.40	30
	H	13.45	-	-	13.45	30

Note:

Reading port x (mW) = 10 ^ (reading port x (dBm)/10
x = 0, 1, 2.
Total Power (mW) = reading port 0 (mW) + reading port 1 (mW) + reading port 2 (mW)
Total power (dBm) = 10 * log (Total power (mW))

5 Power spectrum density

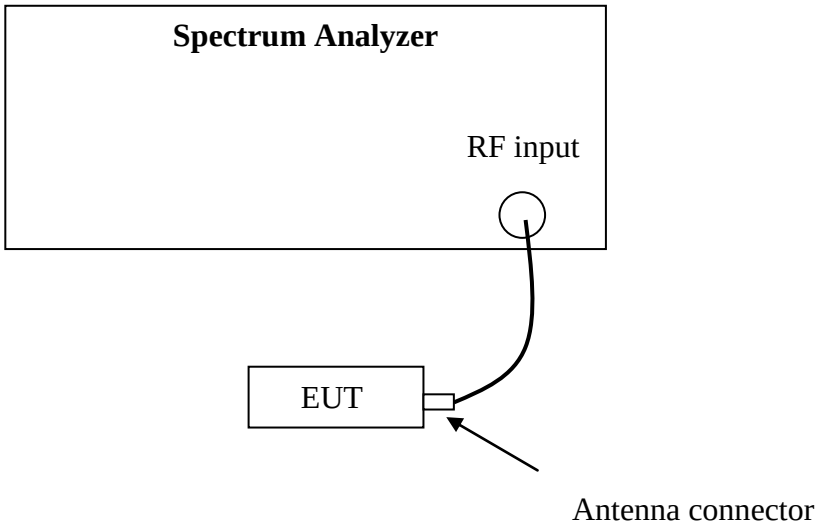
Test result: **Pass**

5.1 Test limit

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

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and 8+ (6 –antenna gain-beam forming gain).

5.2 Test Configuration



5.3 Test procedure and test setup

The power output per FCC §15.247(e) was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 10.2) for compliance to FCC 47CFR 15.247 requirements.

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

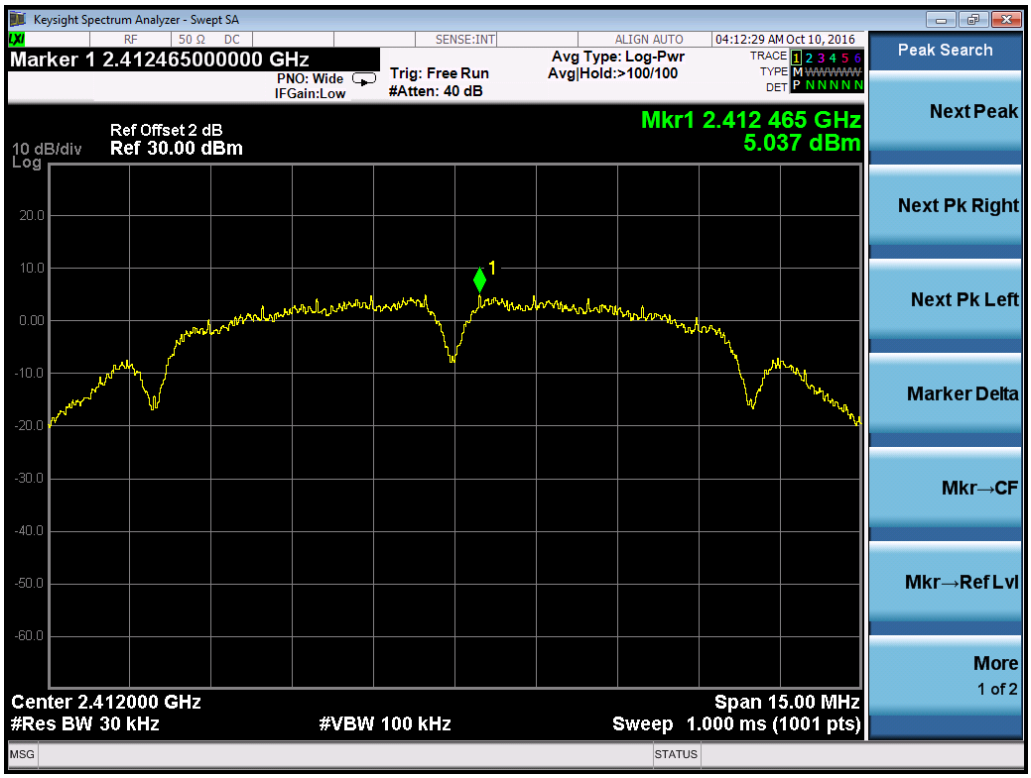
5.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

Mode	Channel	PSD (dBm)			Total PSD (dBm)	Limit (dBm)
		Port 0	Port 1	Port 2		
802.11b	L	5.037	-	-	5.037	8
	M	6.124	-	-	6.124	8
	H	5.360	-	-	5.360	8

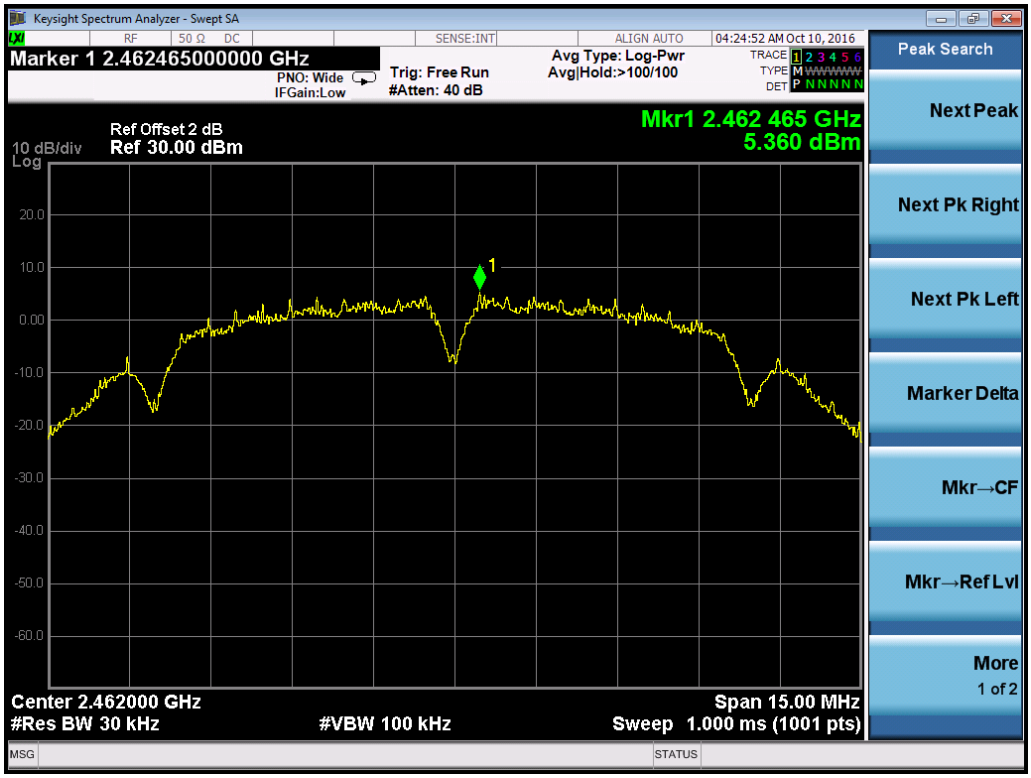
Note 1:
PSD port x (mW) = 10 ^ (PSD port x (dBm)/10; x = 0, 1, 2.
Total PSD (mW) = PSD port 0 (mW) + PSD port 1 (mW) + PSD port 2 (mW)
Total PSD (dBm) = 10 * log (Total PSD (mW))

Channel L



Channel M

Channel H

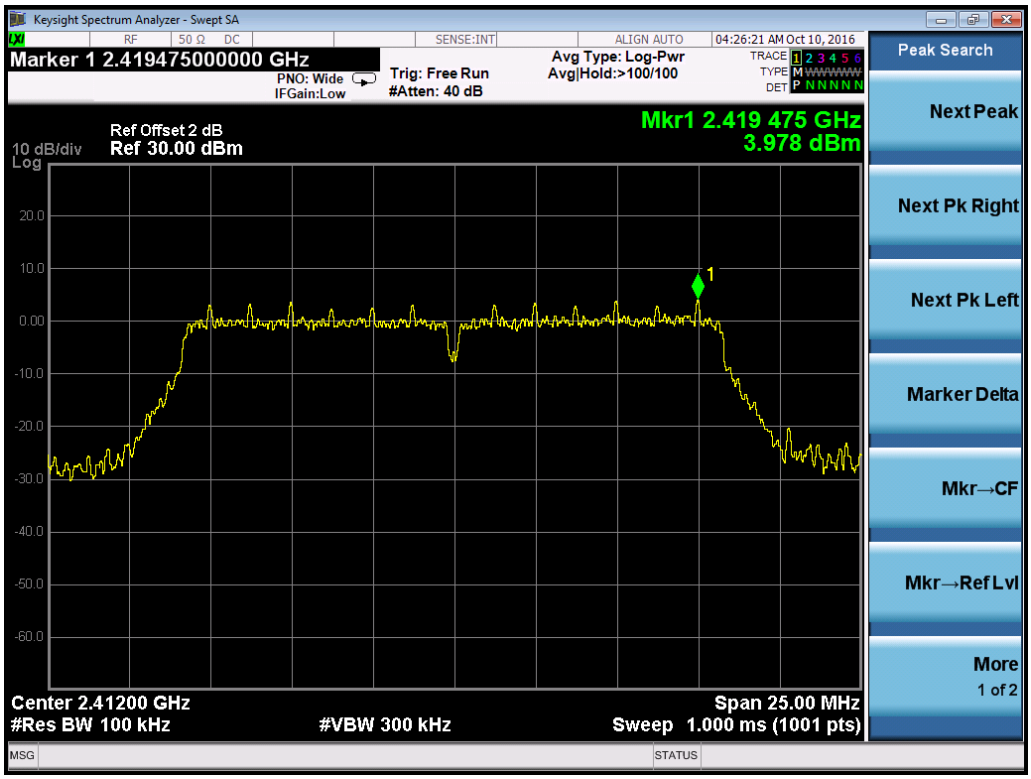


Mode	Channel	PSD (dBm)			Total PSD (dBm)	Limit (dBm)
		Port 0	Port 1	Port 2		
802.11g	L	3.978	-	-	3.978	8
	M	5.400	-	-	5.400	8
	H	6.343	-	-	6.343	8

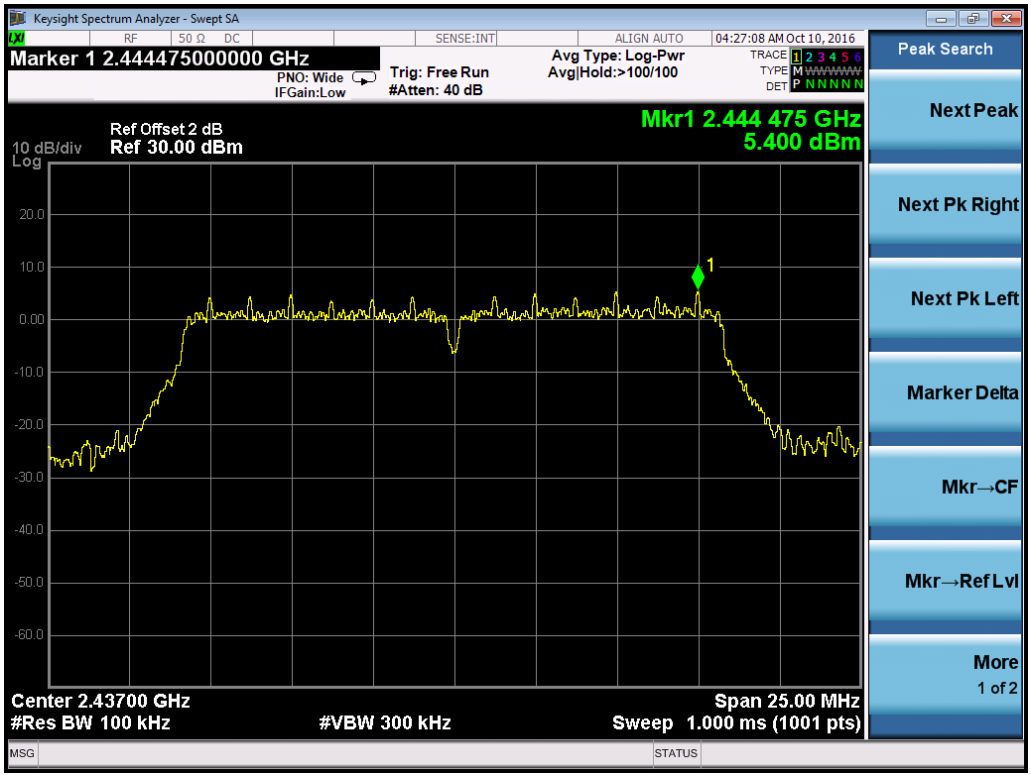
Note 1:

PSD port x (mW) = 10 ^ (PSD port x (dBm)/10; x = 0, 1, 2.
Total PSD (mW) = PSD port 0 (mW) + PSD port 1 (mW) + PSD port 2 (mW)
Total PSD (dBm) = 10 * log (Total PSD (mW))

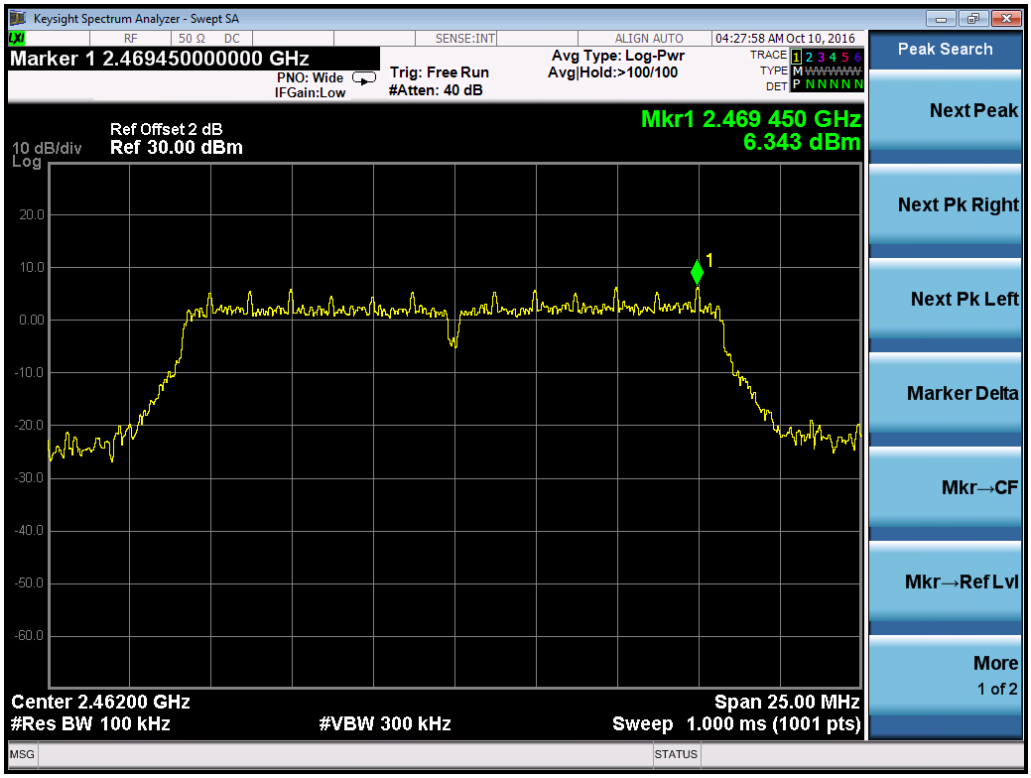
Channel L



Channel M



Channel H

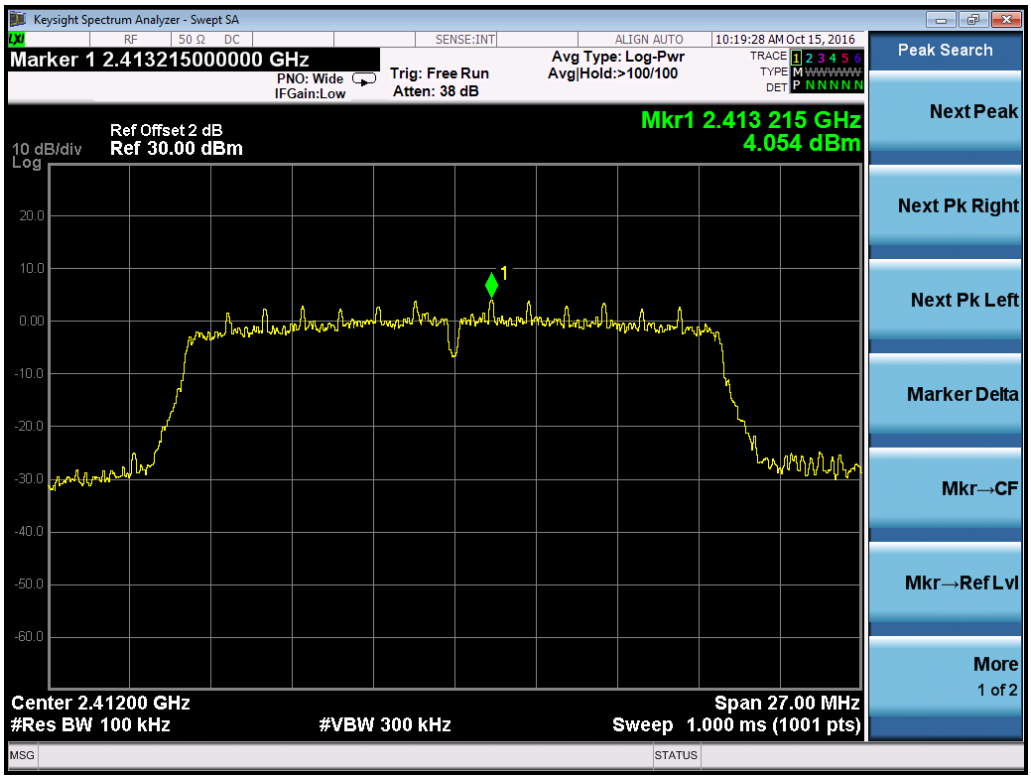


Mode	Channel	PSD (dBm)			Total PSD (dBm)	Limit (dBm)
		Port 0	Port 1	Port 2		
802.11n (HT20)	L	4.054	-	-	4.054	8
	M	4.055	-	-	4.055	8
	H	4.303	-	-	4.303	8

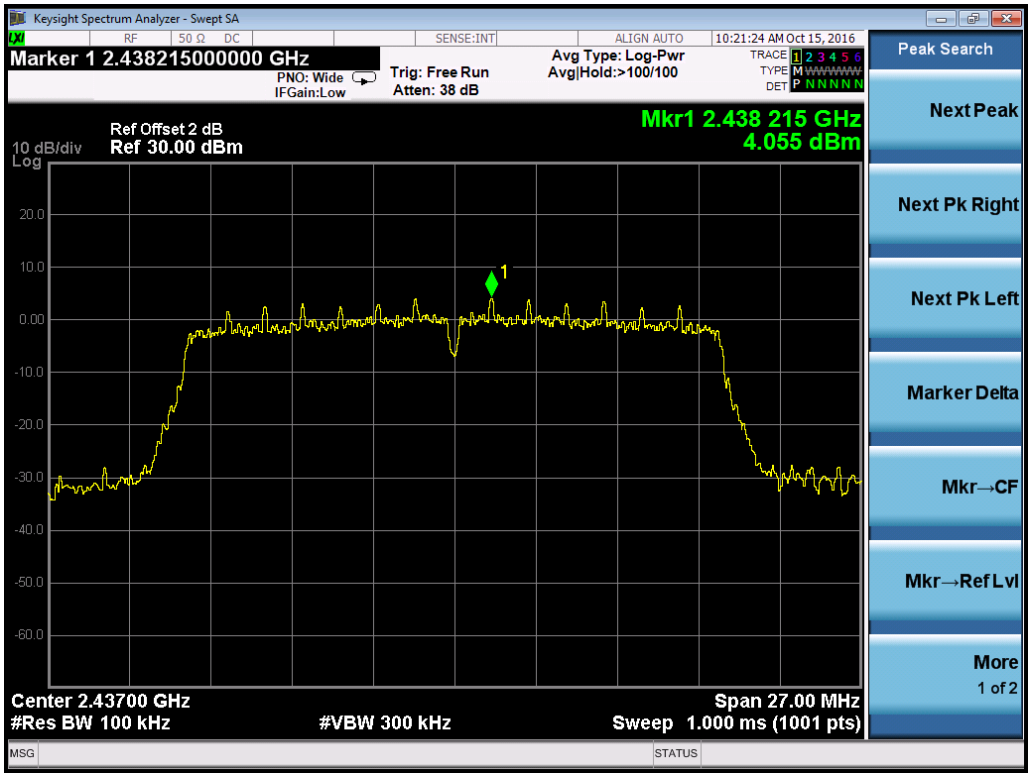
Note 1:

PSD port x (mW) = 10 ^ (PSD port x (dBm)/10; x = 0, 1, 2.
Total PSD (mW) = PSD port 0 (mW) + PSD port 1 (mW) + PSD port 2 (mW)
Total PSD (dBm) = 10 * log (Total PSD (mW))

Channel L



Channel M



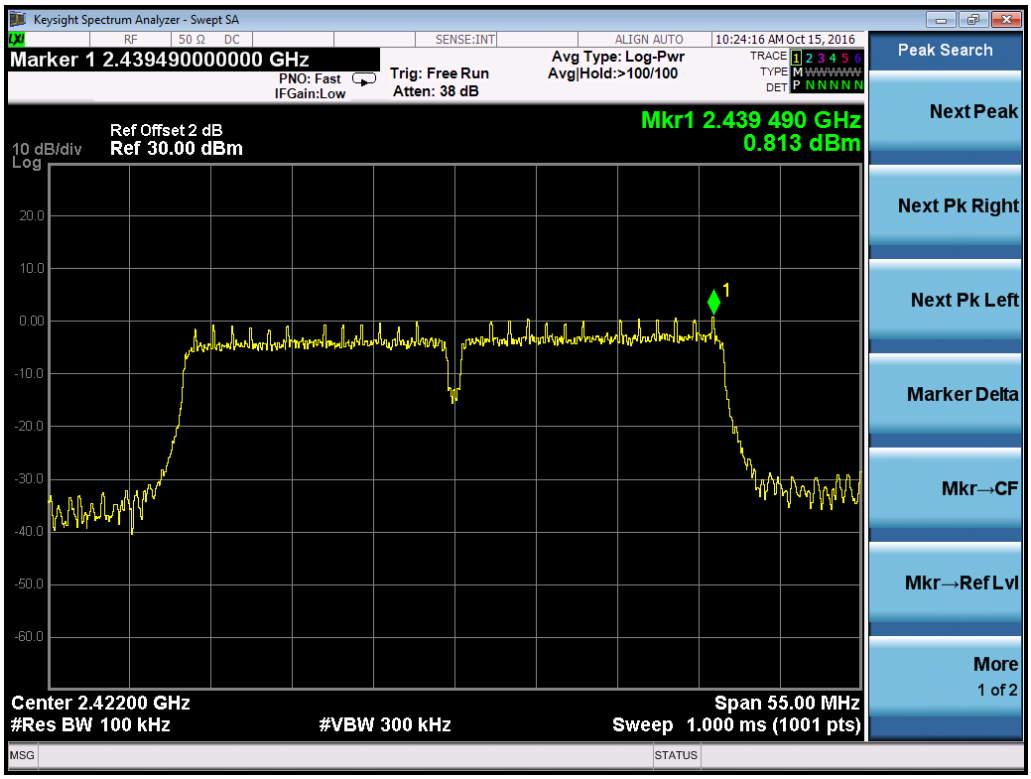
Channel H

Mode	Channel	PSD (dBm)			Total PSD (dBm)	Limit (dBm)
		Port 0	Port 1	Port 2		
802.11n (HT40)	L	0.813	-	-	0.813	8
	M	0.561	-	-	0.561	8
	H	0.899	-	-	0.899	8

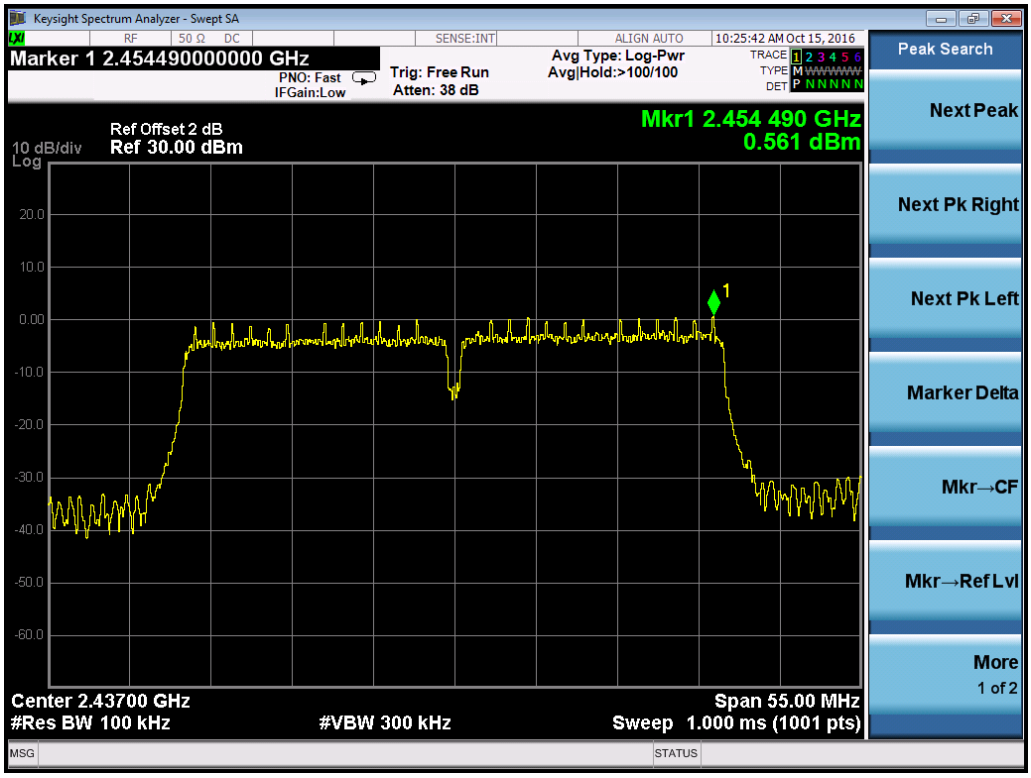
Note 1:

PSD port x (mW) = 10 ^ (PSD port x (dBm)/10; x = 0, 1, 2.
Total PSD (mW) = PSD port 0 (mW) + PSD port 1 (mW) + PSD port 2 (mW)
Total PSD (dBm) = 10 * log (Total PSD (mW))

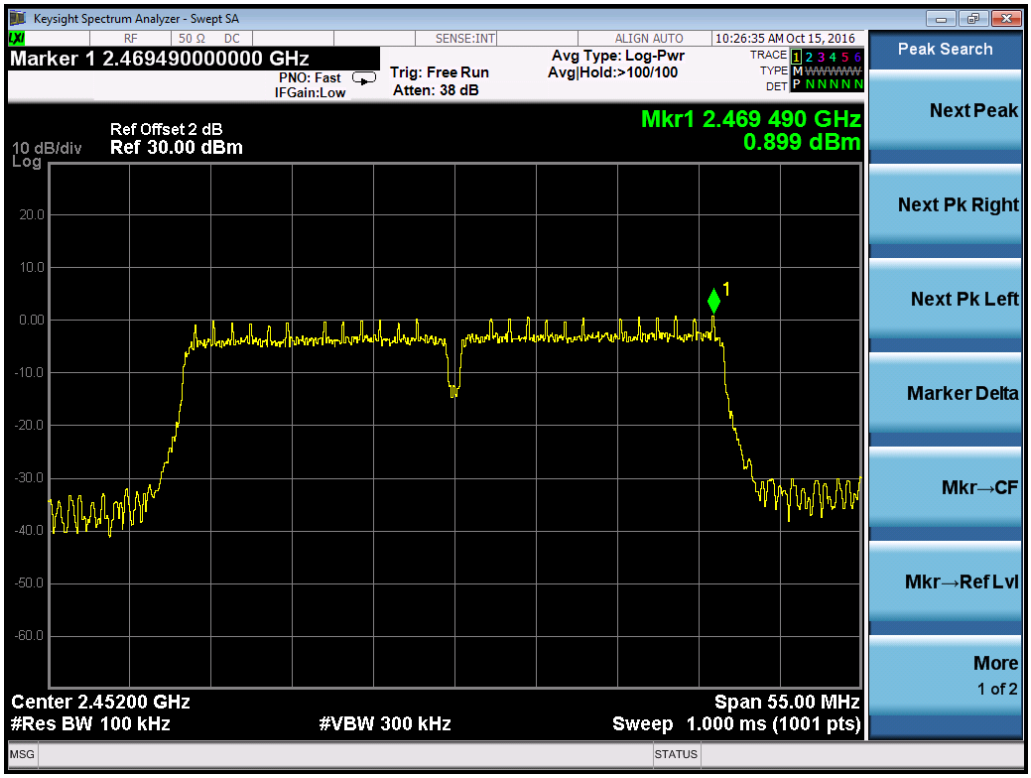
Channel L



Channel M



Channel H



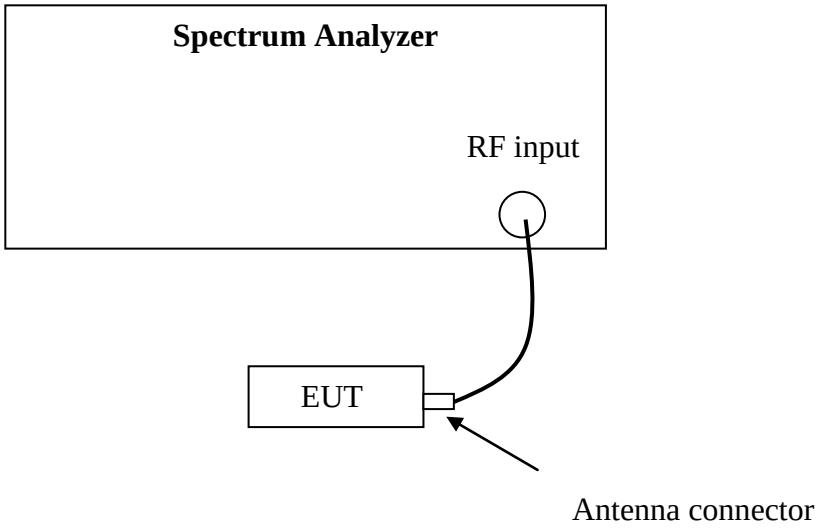
6 Emission outside the frequency band

Test result: **Pass**

6.1 Test limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

6.2 Test Configuration



6.3 Test procedure and test setup

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

Reference level measurement

Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the *DTS bandwidth*.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.

h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Emission level measurement
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ 3 x 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.

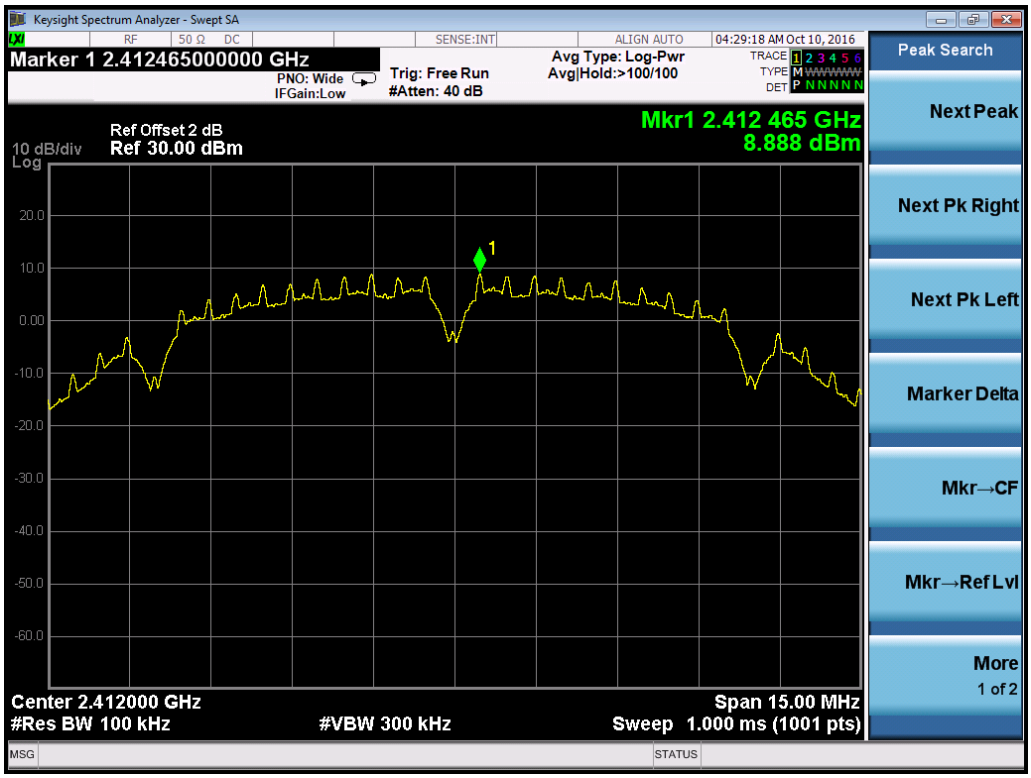
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

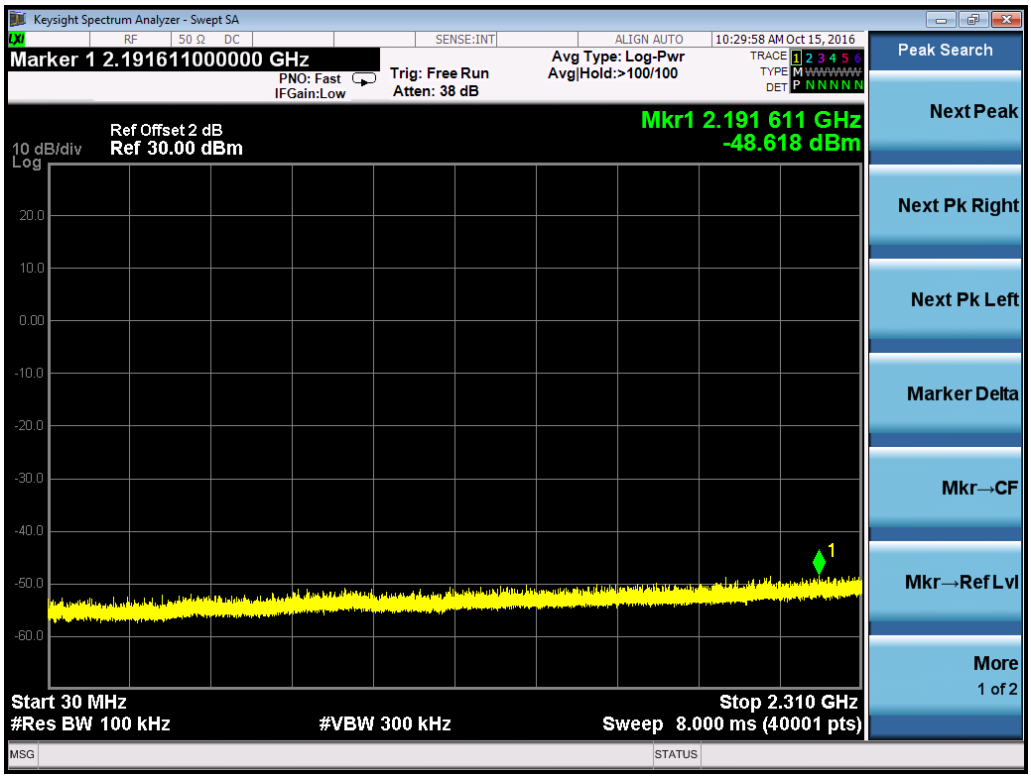
6.4 Test Protocol

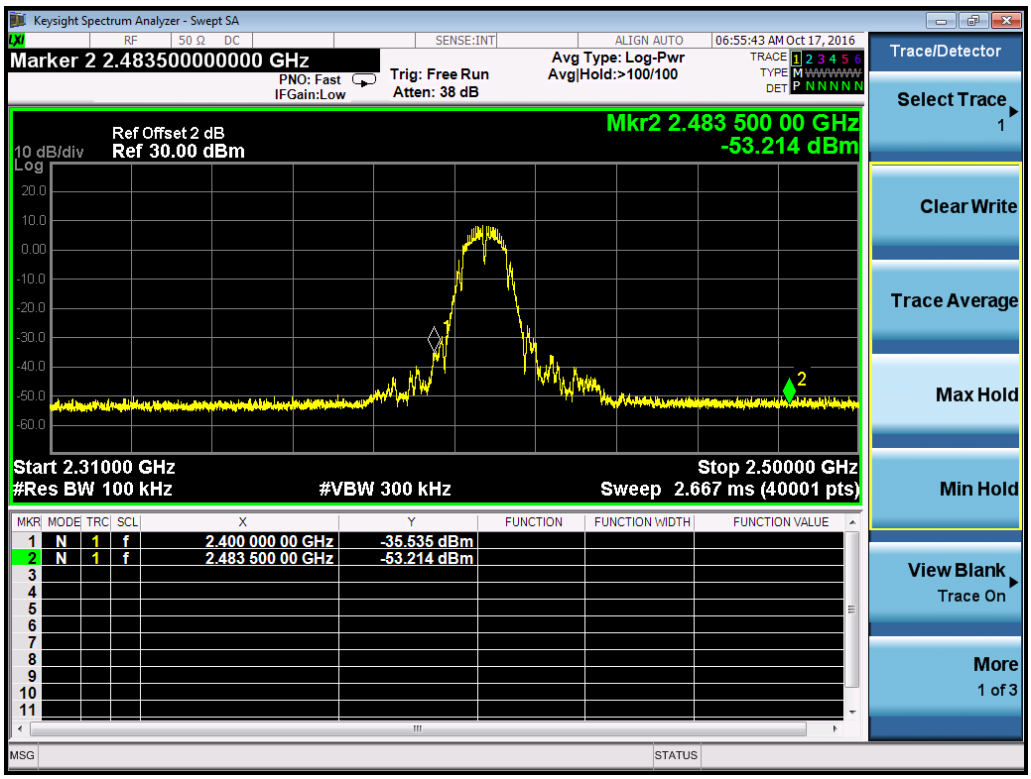
Temperature: 25 °C
Relative Humidity: 55 %

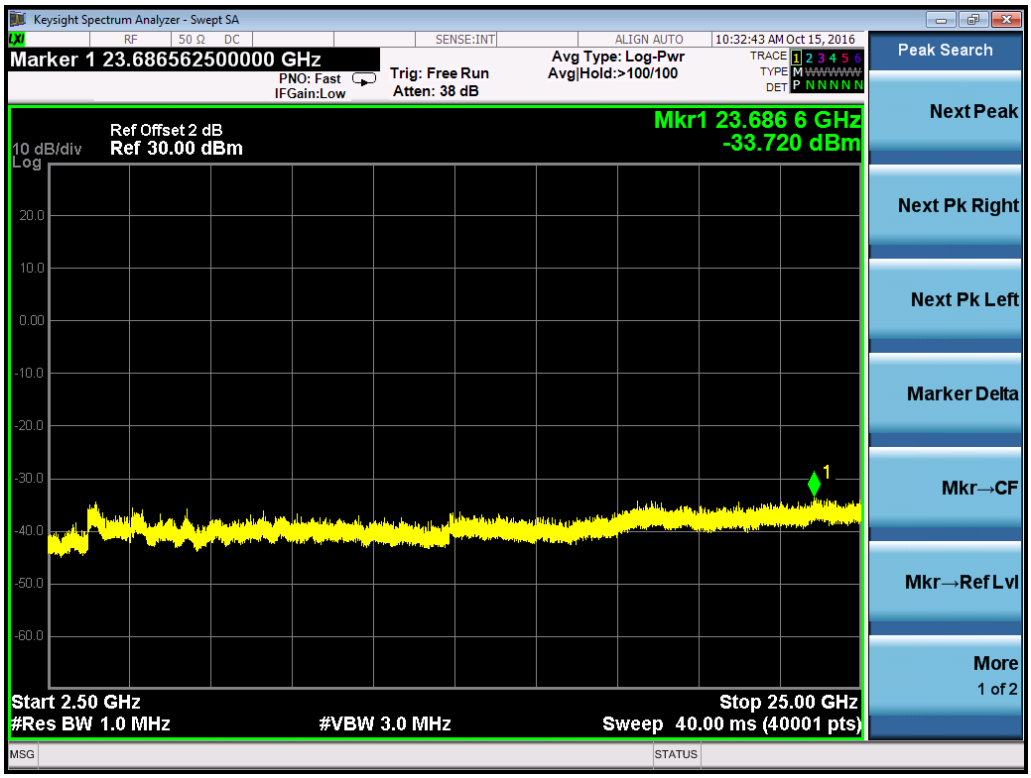
Mode	Channel	Results			Limits (dB)
		Port0	Port 1	Port 2	
802.11b	L	Pass	-	-	≥20
	M	Pass	-	-	≥20
	H	Pass	-	-	≥20

Channel L

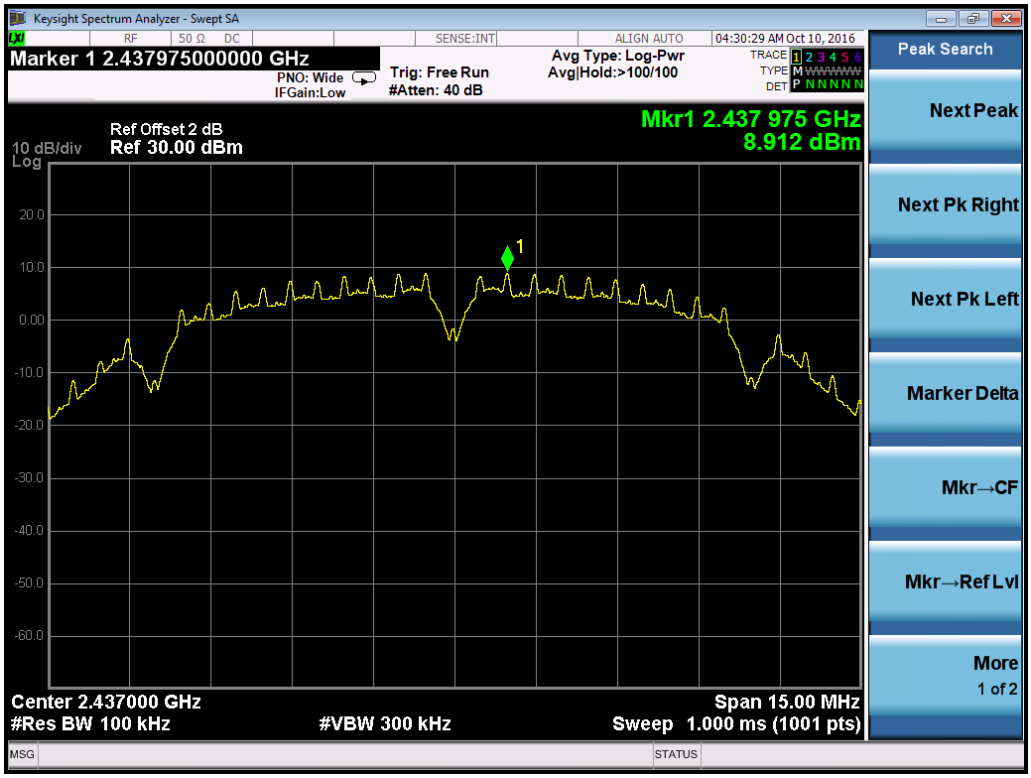


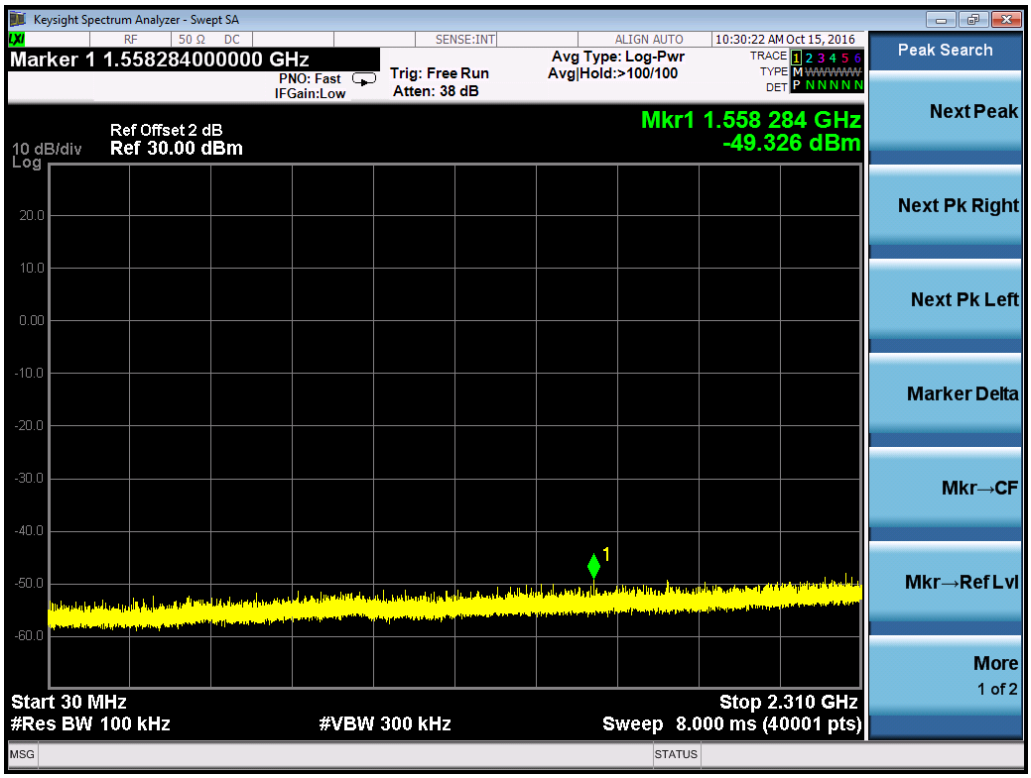


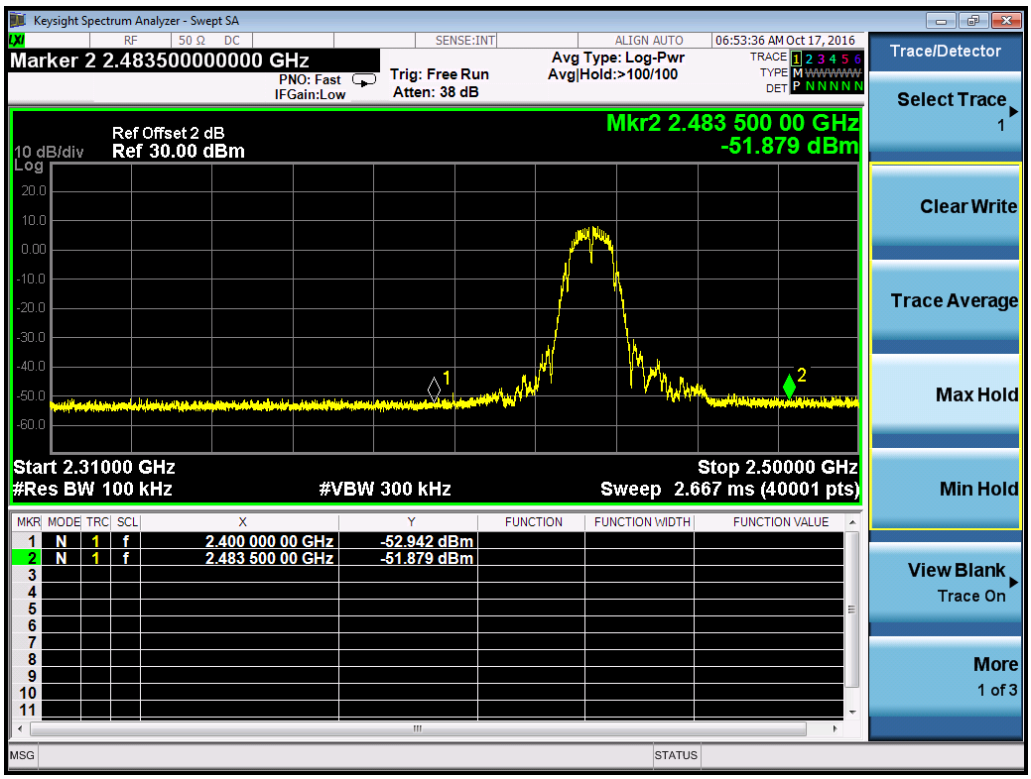




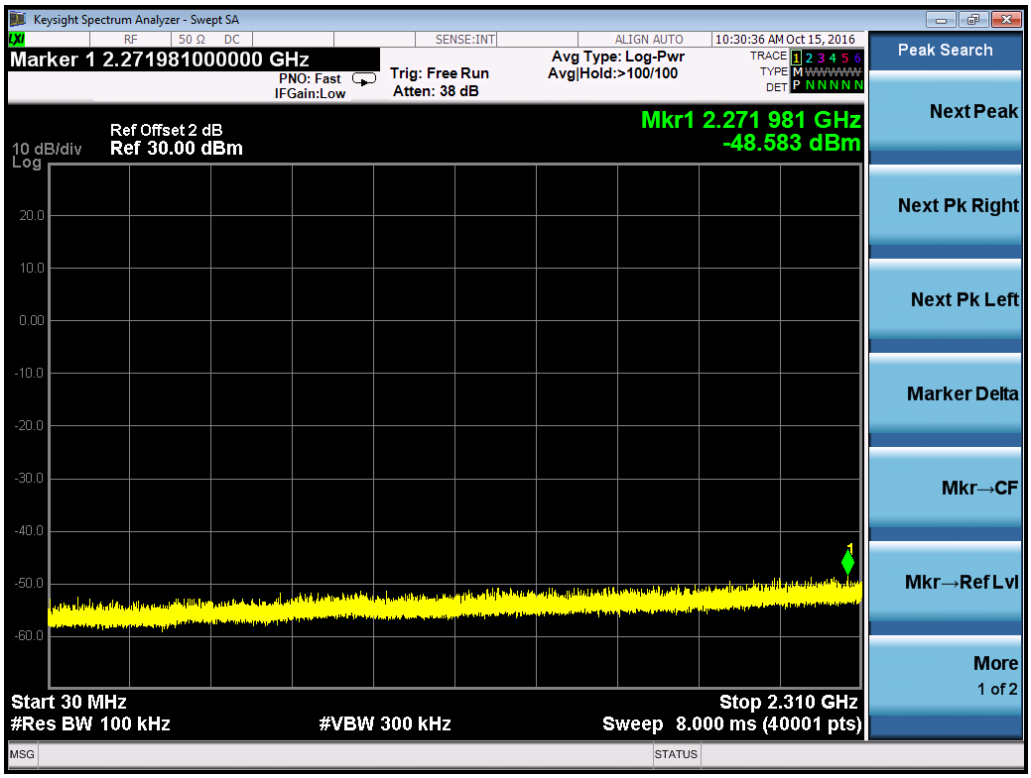
Channel M

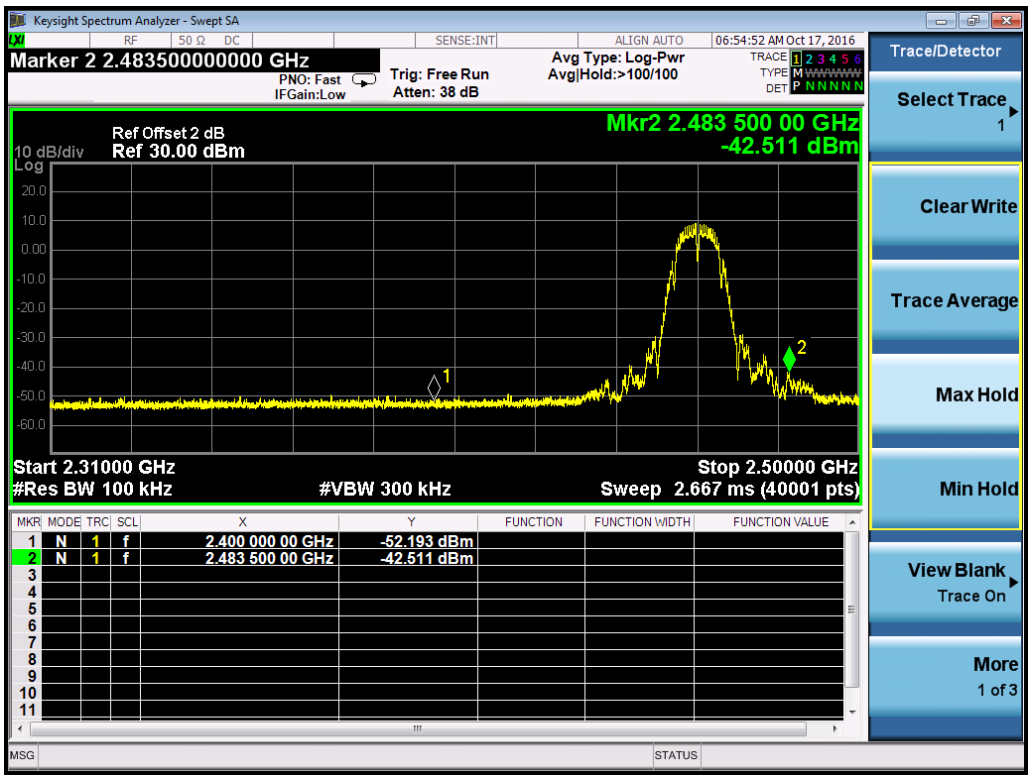






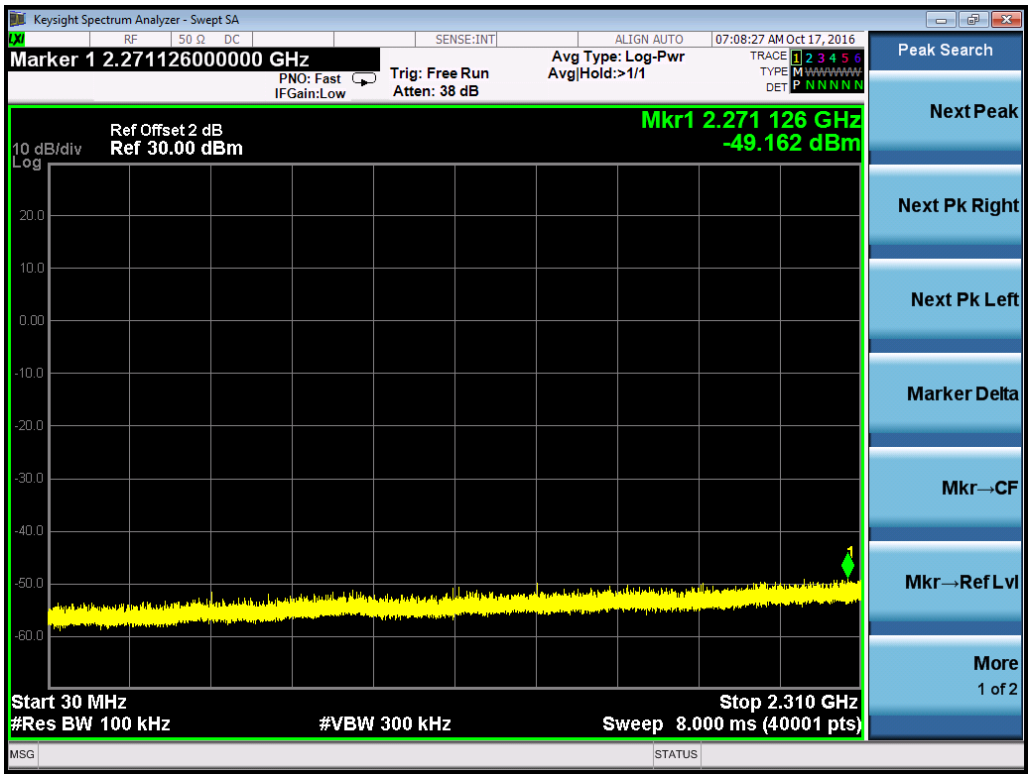
Channel H

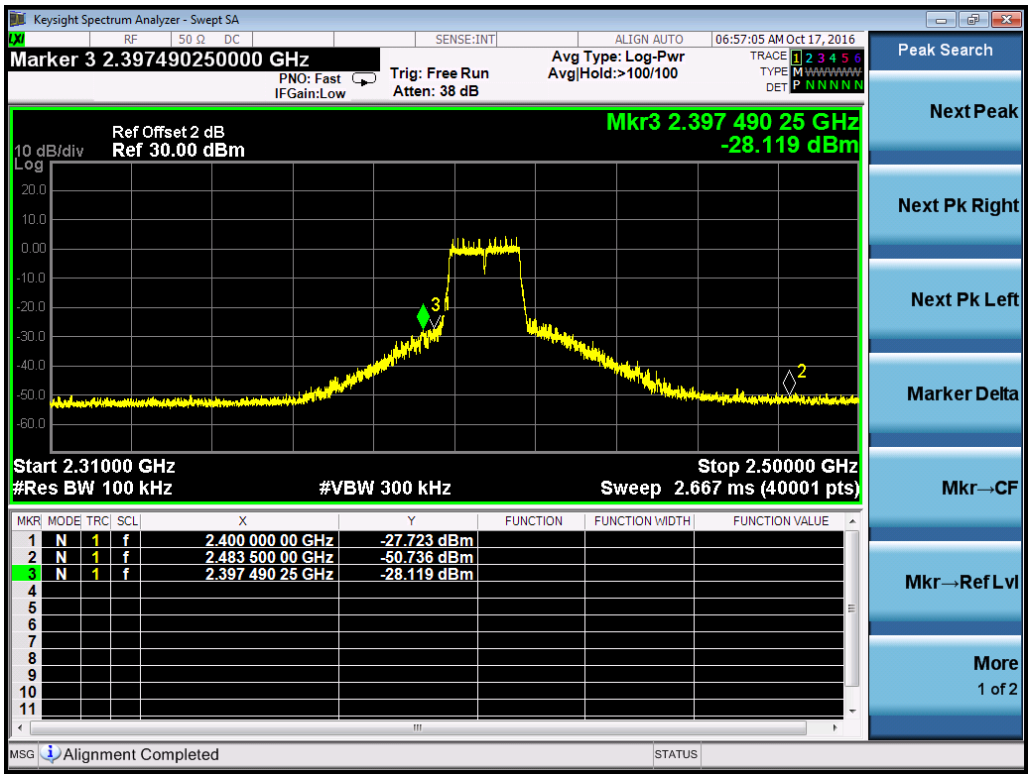


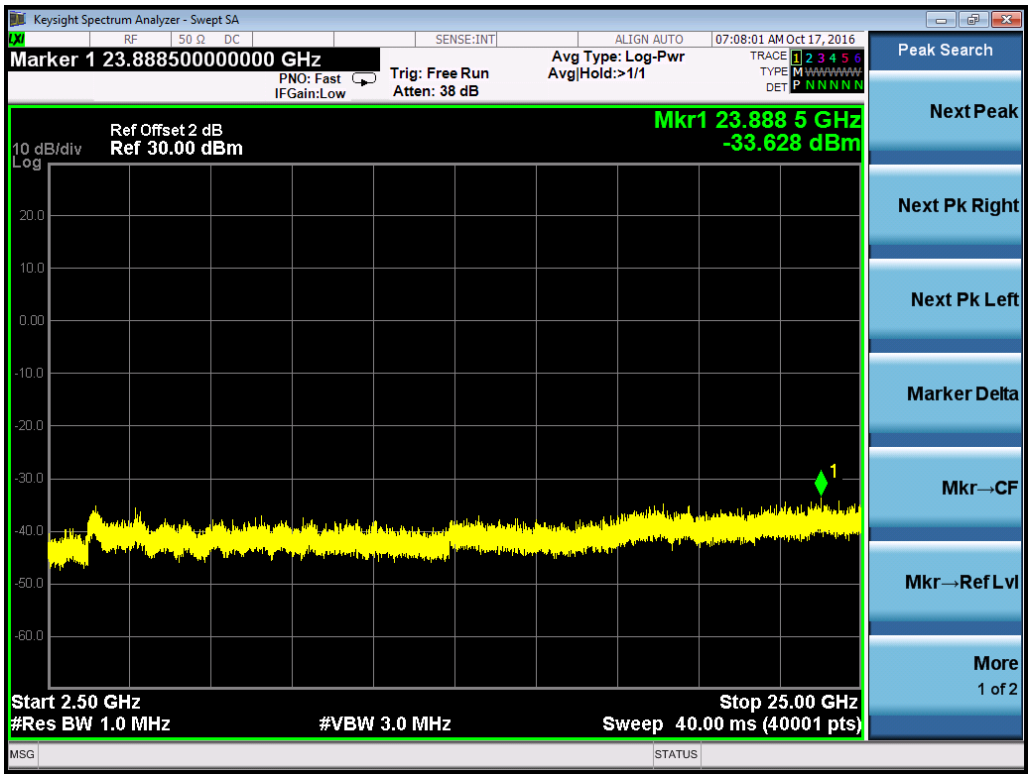


Mode	Channel	Results			Limits (dB)
		Port0	Port 1	Port 2	
802.11g	L	Pass	-	-	≥20
	M	Pass	-	-	≥20
	H	Pass	-	-	≥20

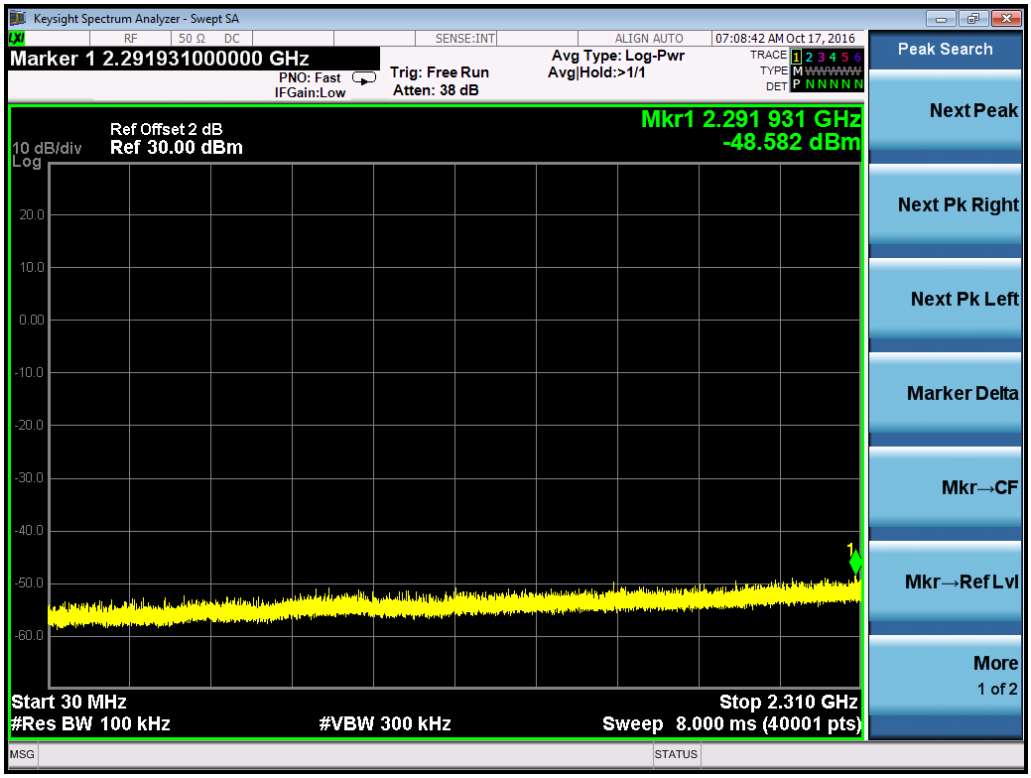
Channel L

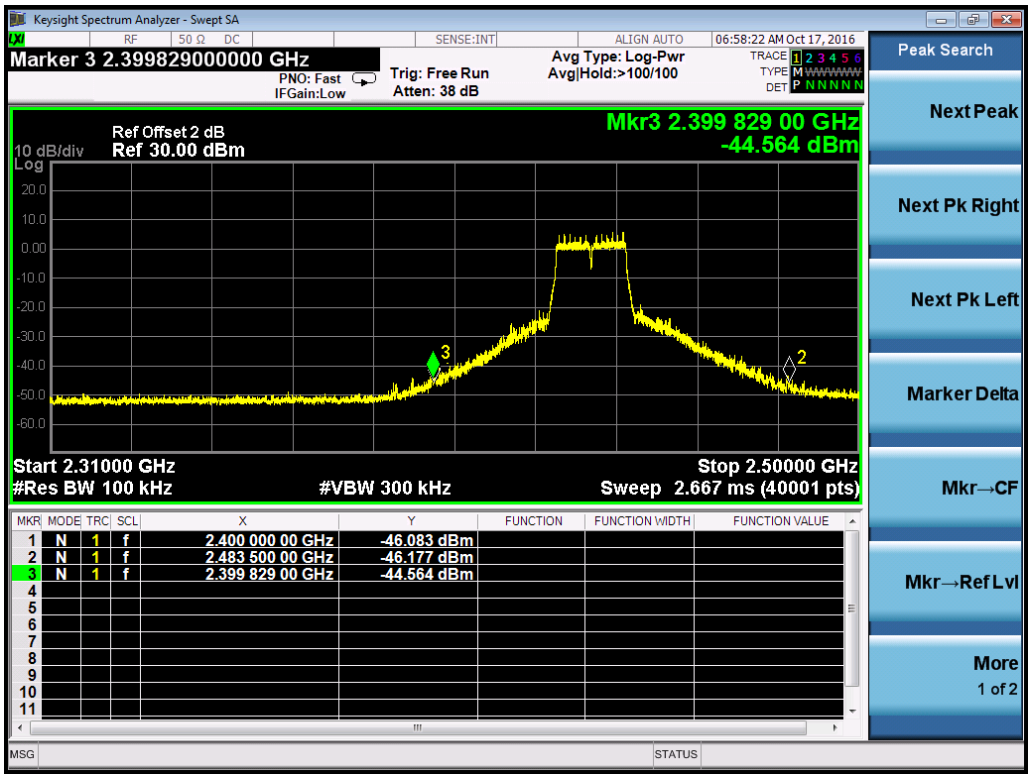






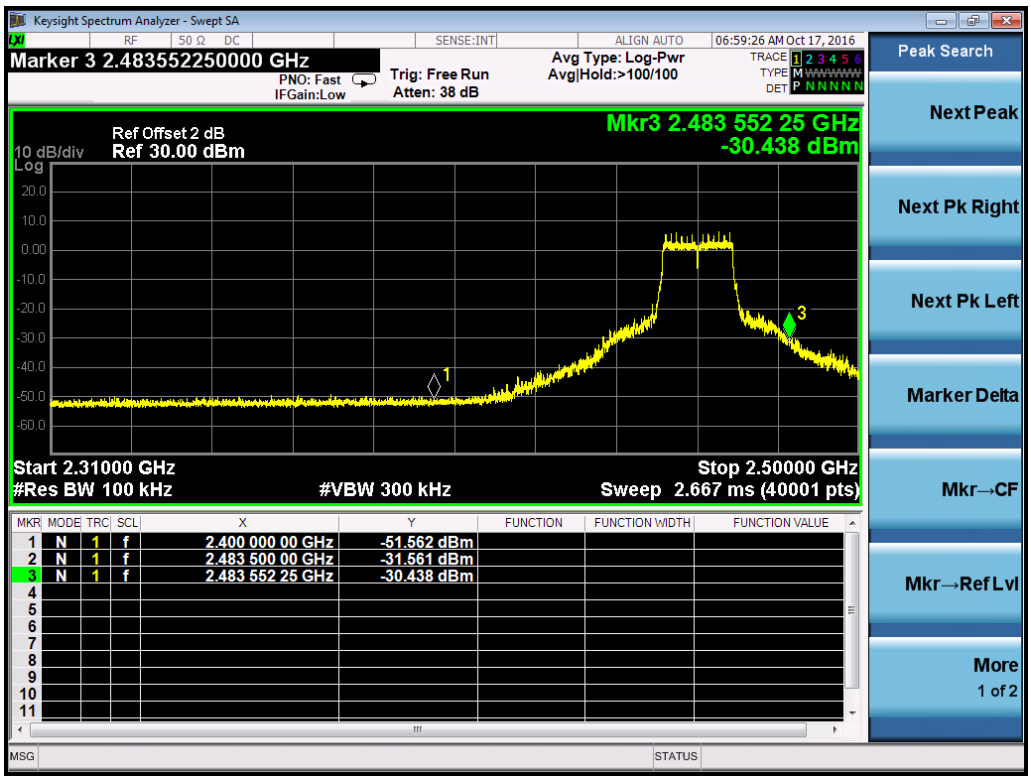
Channel M





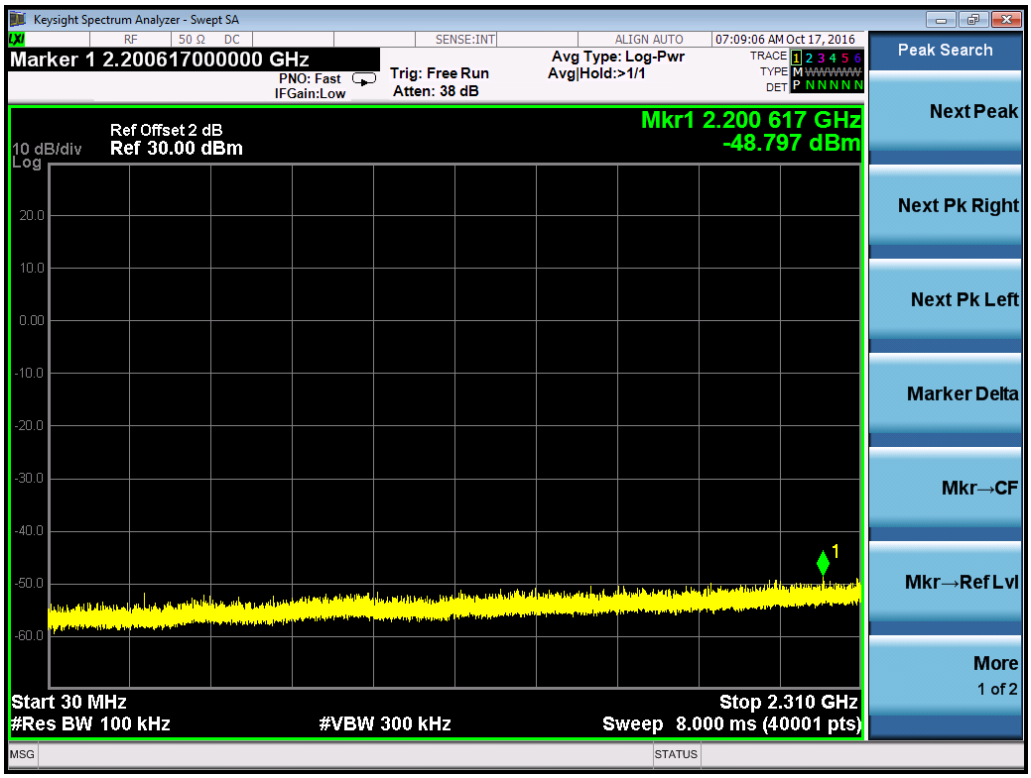
Channel H

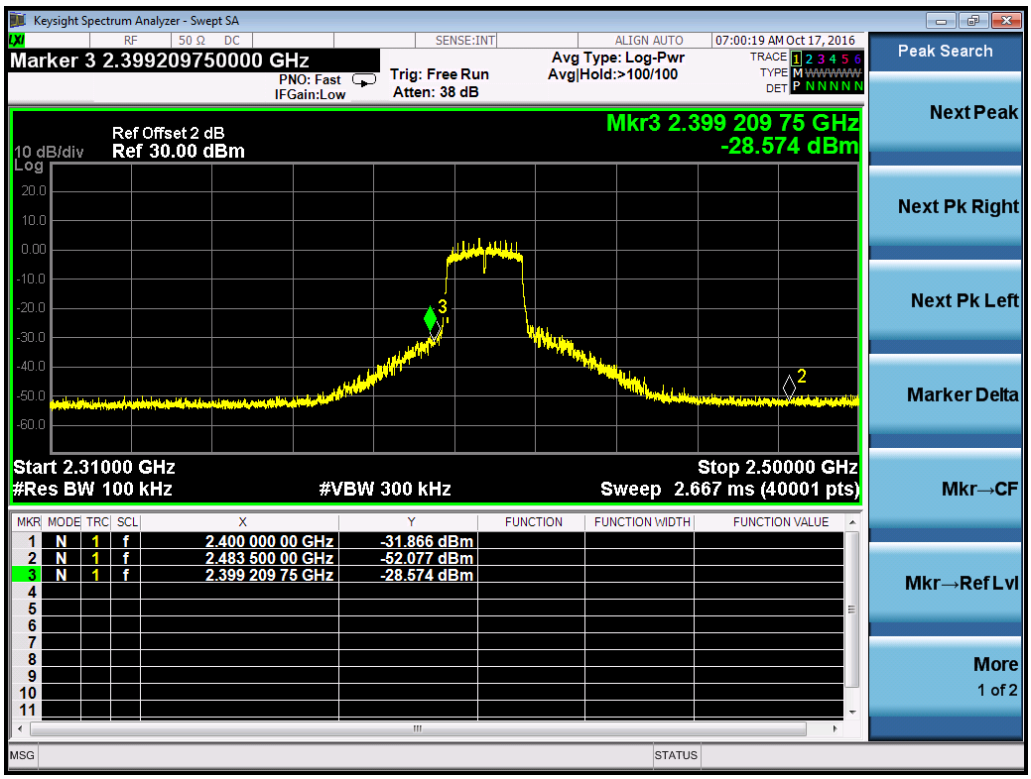

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
07:08:54 AM Oct 17, 2016
Marker 1 2.054697000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>1/1
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.054 697 GHz
-48.215 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
06:59:26 AM Oct 17, 2016
Marker 3 2.483552250000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr3 2.483 552 25 GHz
-30.438 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.400 000 00 GHz -51.562 dBm
2 N 1 f 2.483 500 00 GHz -31.561 dBm
3 N 1 f 2.483 552 25 GHz -30.438 dBm
4
5
6
7
8
9
10
11
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Mode	Channel	Results (dB)			Limits (dB)
		Port0	Port 1	Port 2	
802.11n (HT20)	L	Pass	-	-	≥20
	M	Pass	-	-	≥20
	H	Pass	-	-	≥20

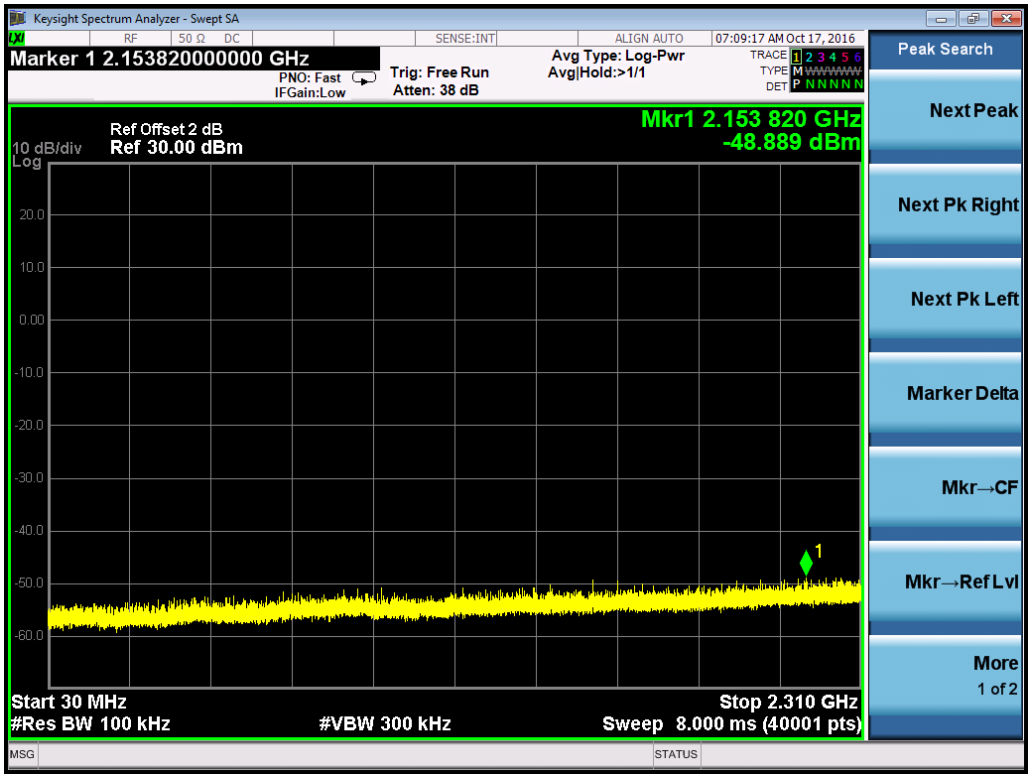
Channel L

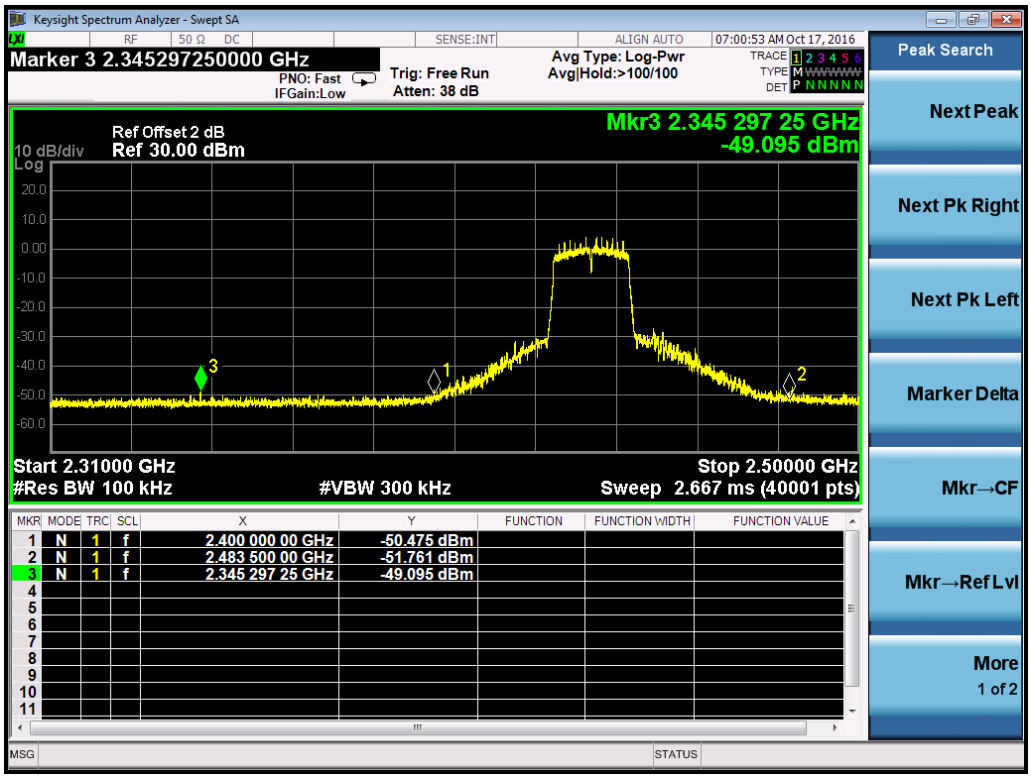


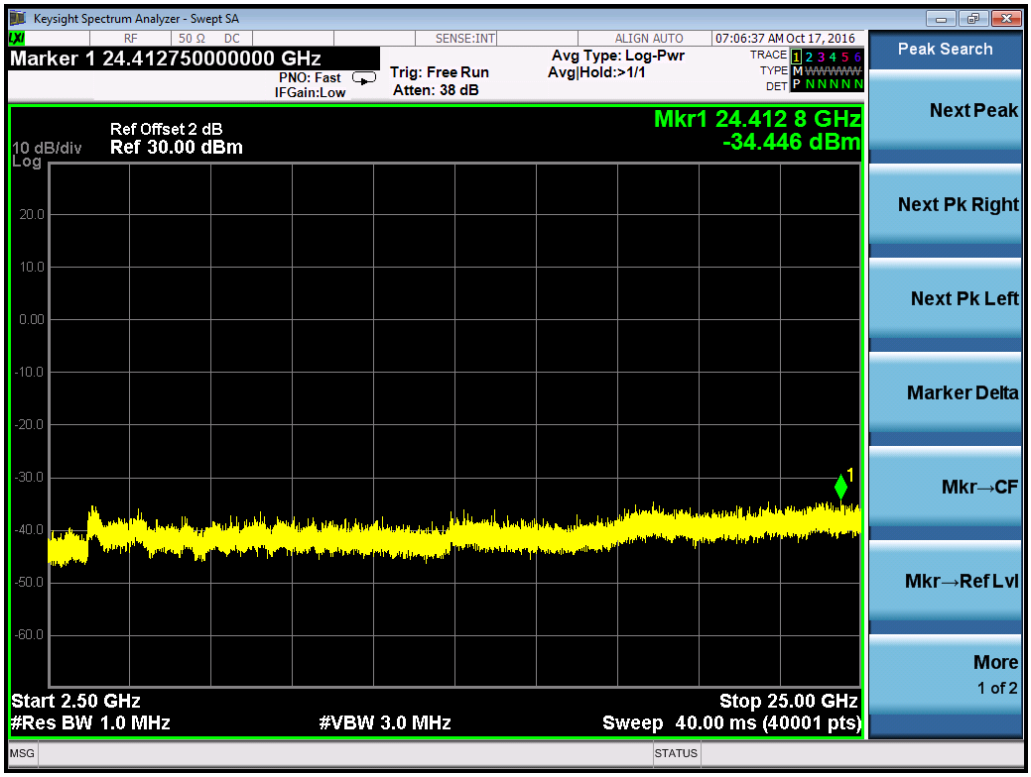


MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.400 000 00 GHz	-31.866 dBm			
2	N	1	f	2.483 500 00 GHz	-52.077 dBm			
3	N	1	f	2.399 209 75 GHz	-28.574 dBm			
4								
5								
6								
7								
8								
9								
10								
11								

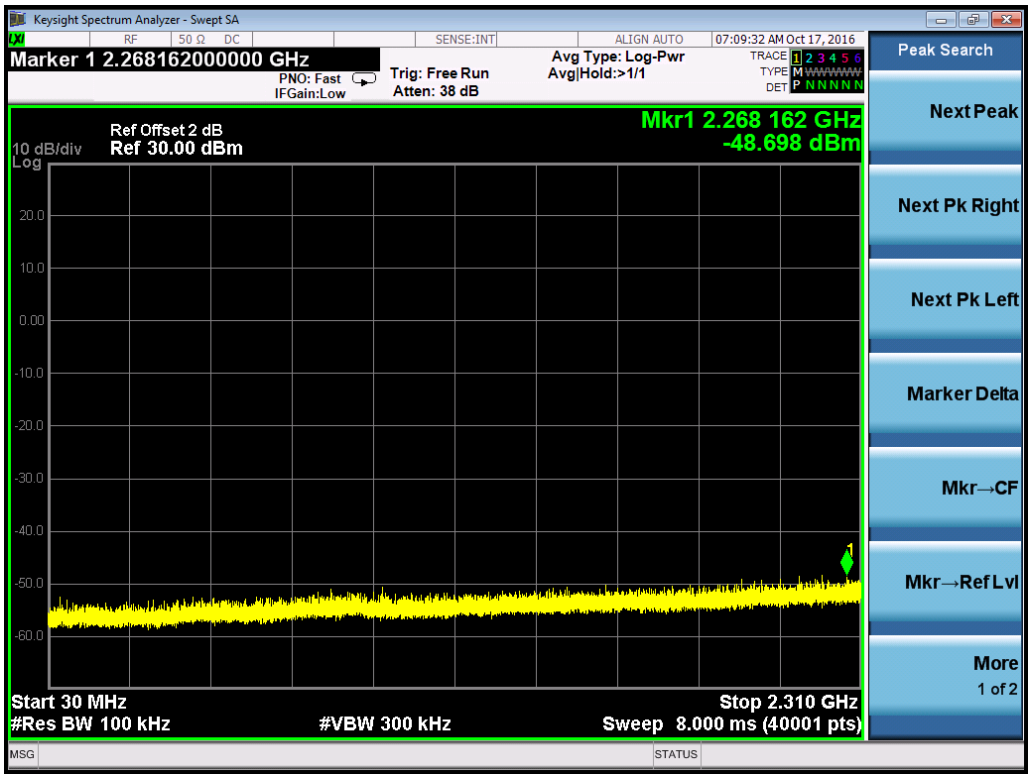
Channel M

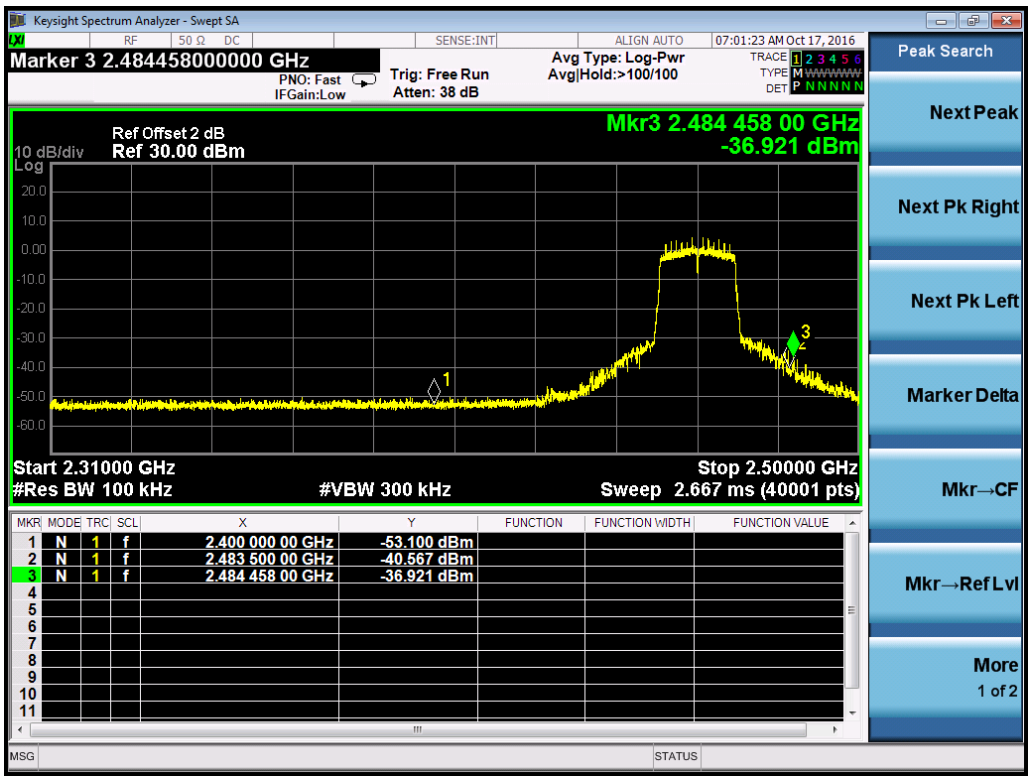


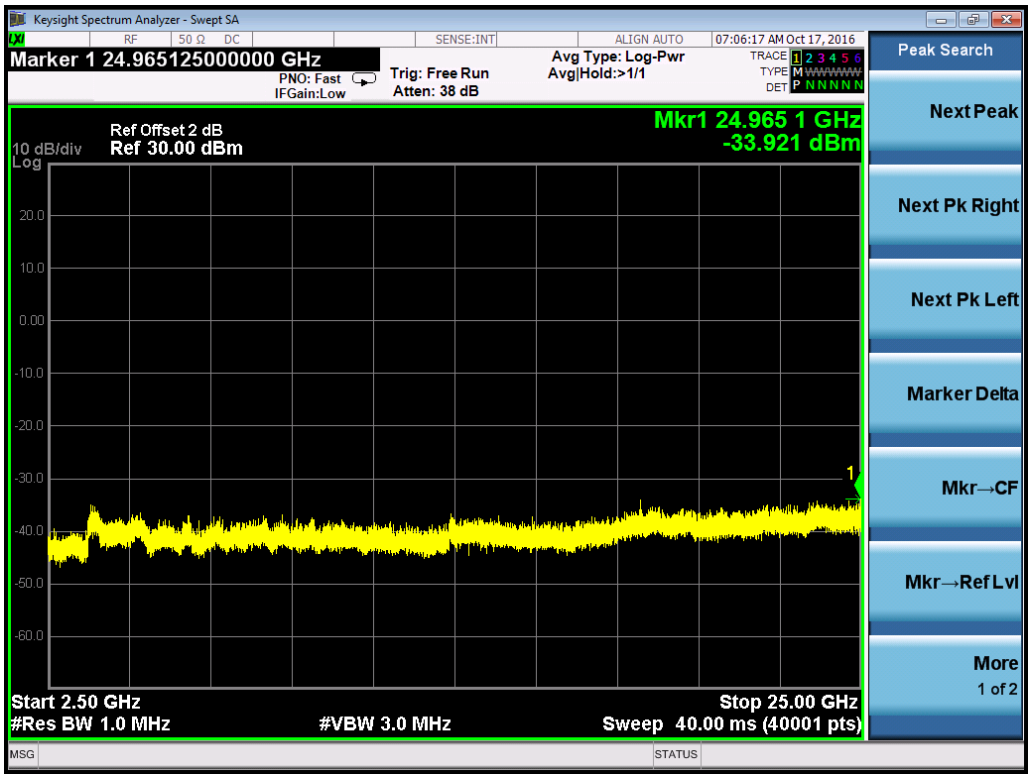




Channel H

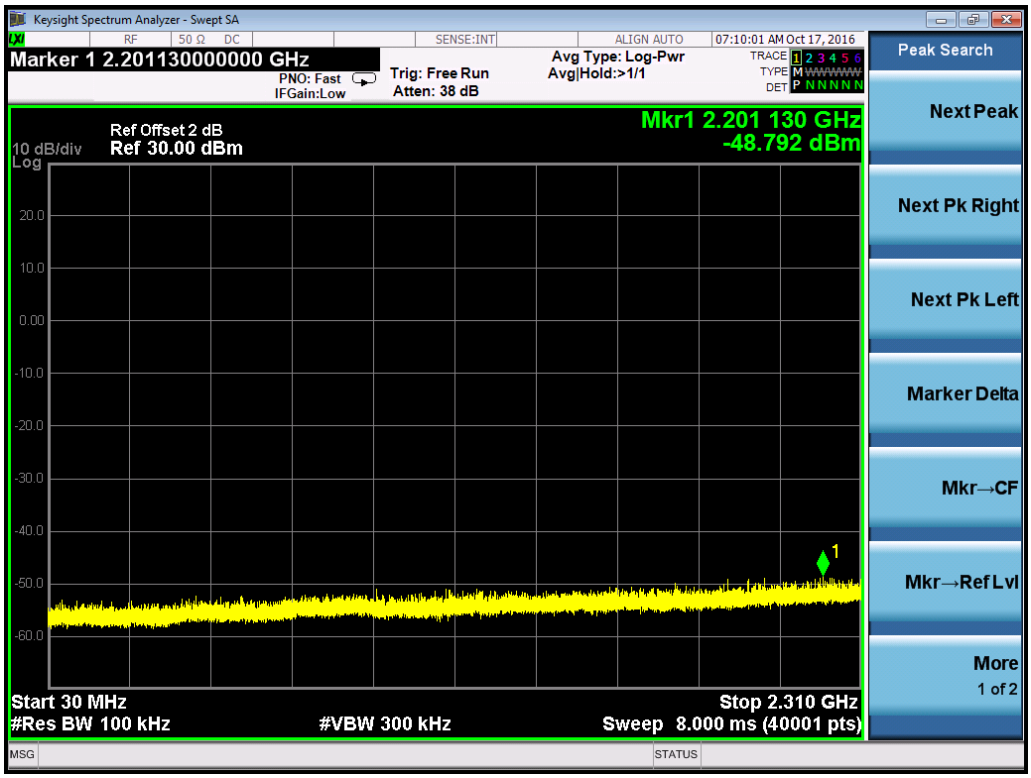

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
07:09:32 AM Oct 17, 2016
Marker 1 2.268162000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>1/1
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.268 162 GHz
-48.698 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

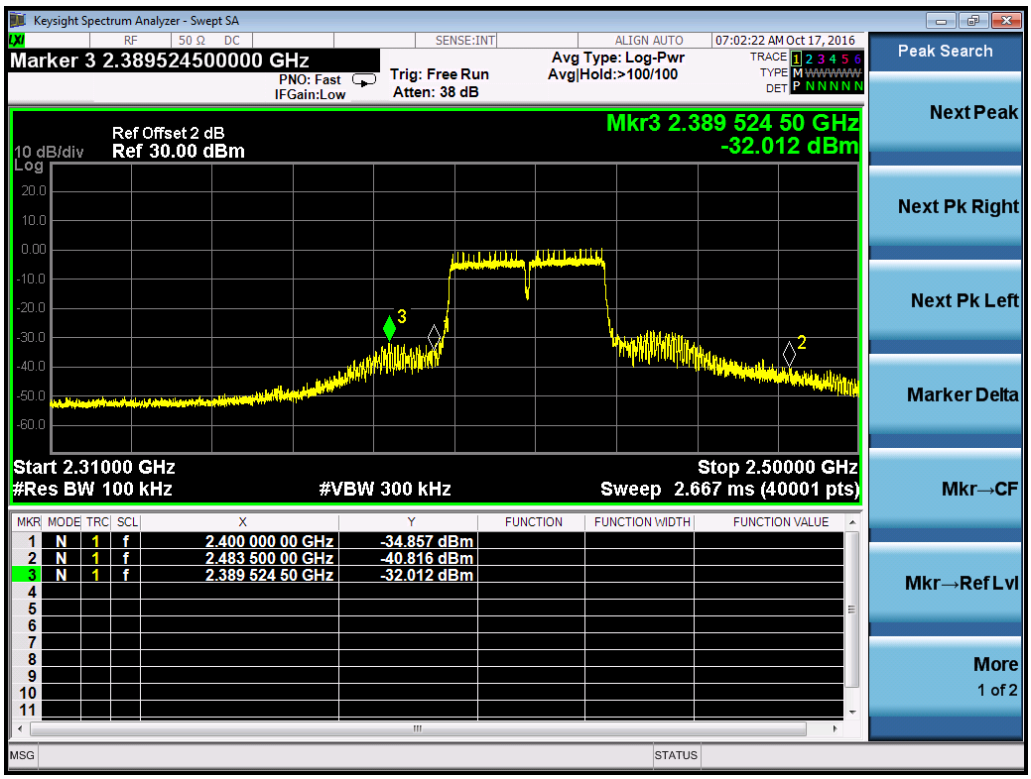

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
07:01:23 AM Oct 17, 2016
Marker 3 2.484458000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr3 2.484 458 00 GHz
-36.921 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.400 000 00 GHz -53.100 dBm
2 N 1 f 2.483 500 00 GHz -40.567 dBm
3 N 1 f 2.484 458 00 GHz -36.921 dBm
4
5
6
7
8
9
10
11
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

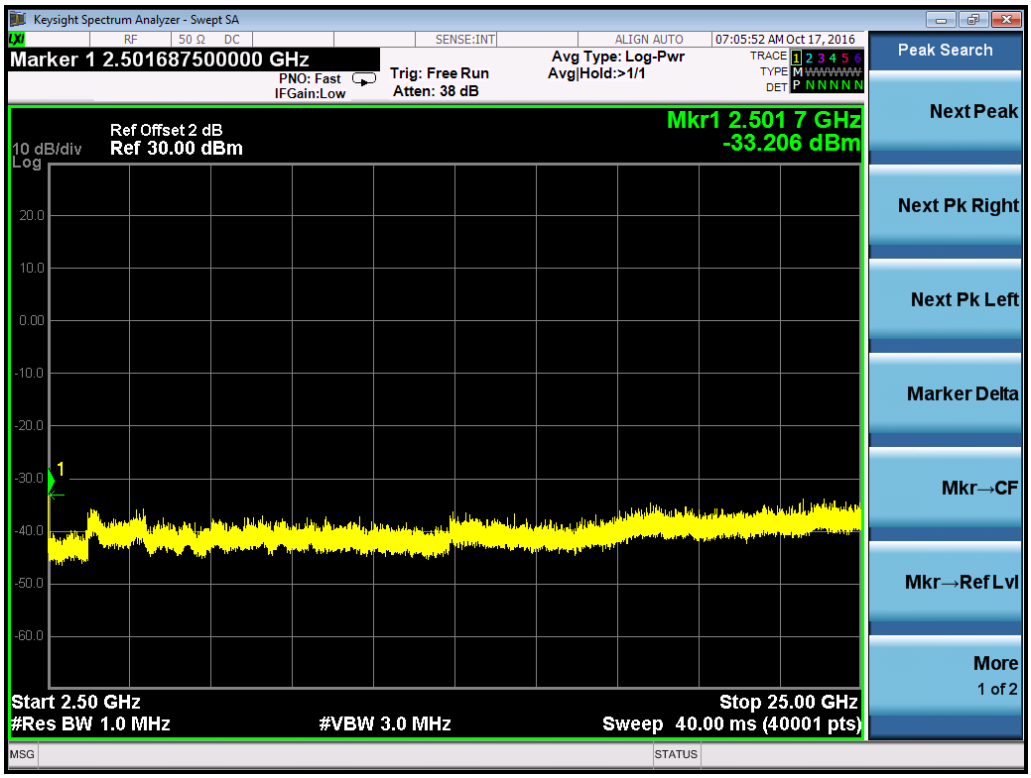


Mode	Channel	Results (dB)			Limits (dB)
		Port0	Port 1	Port 2	
802.11n (HT40)	L	Pass	-	-	≥20
	M	Pass	-	-	≥20
	H	Pass	-	-	≥20

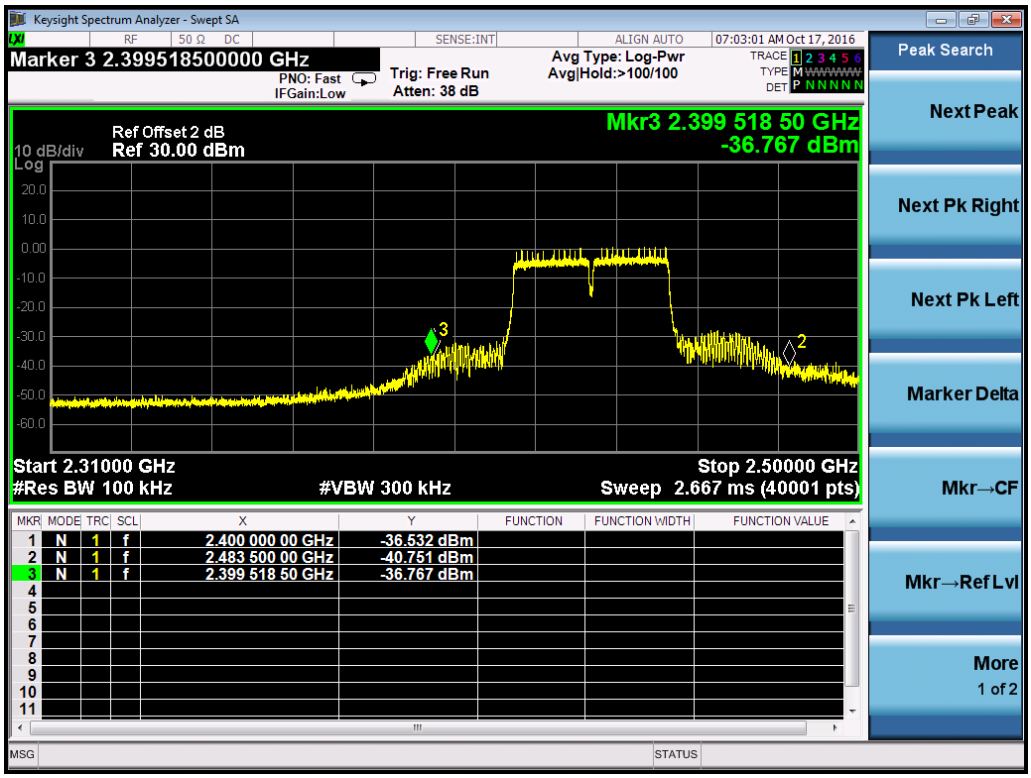
Channel L

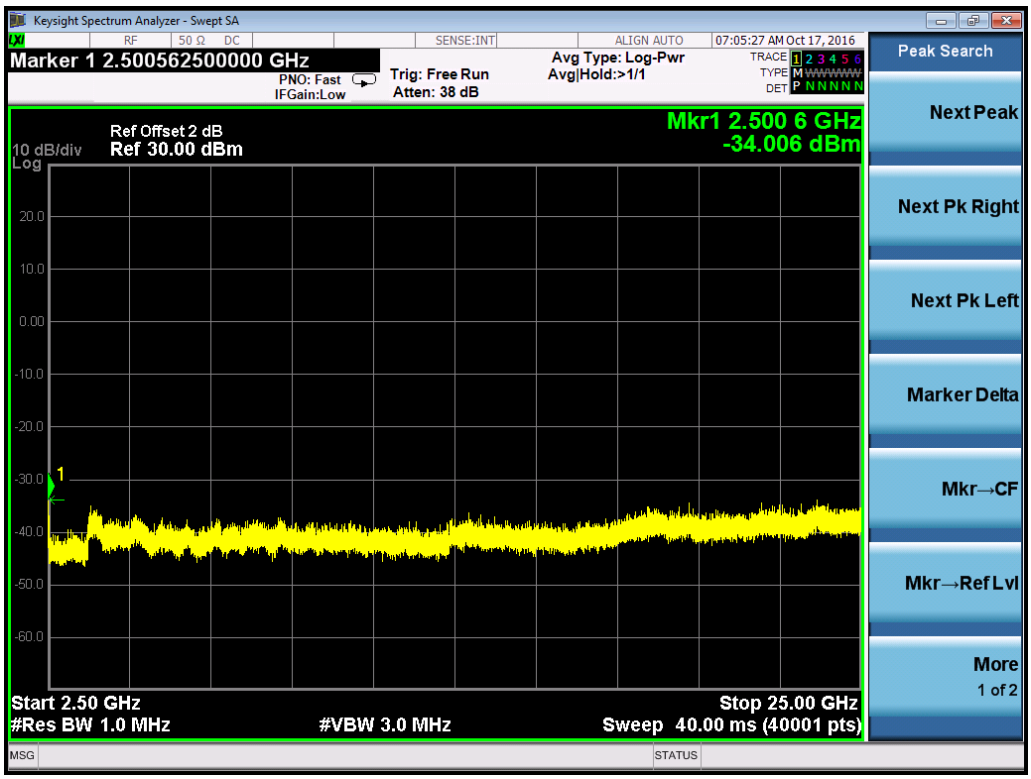




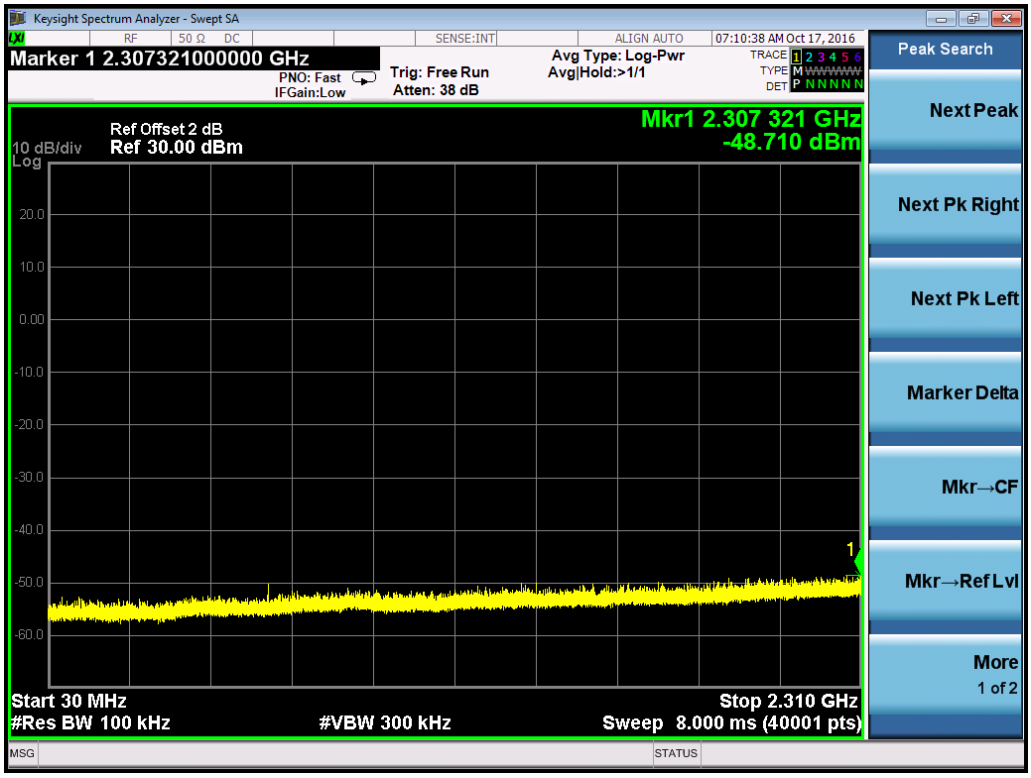


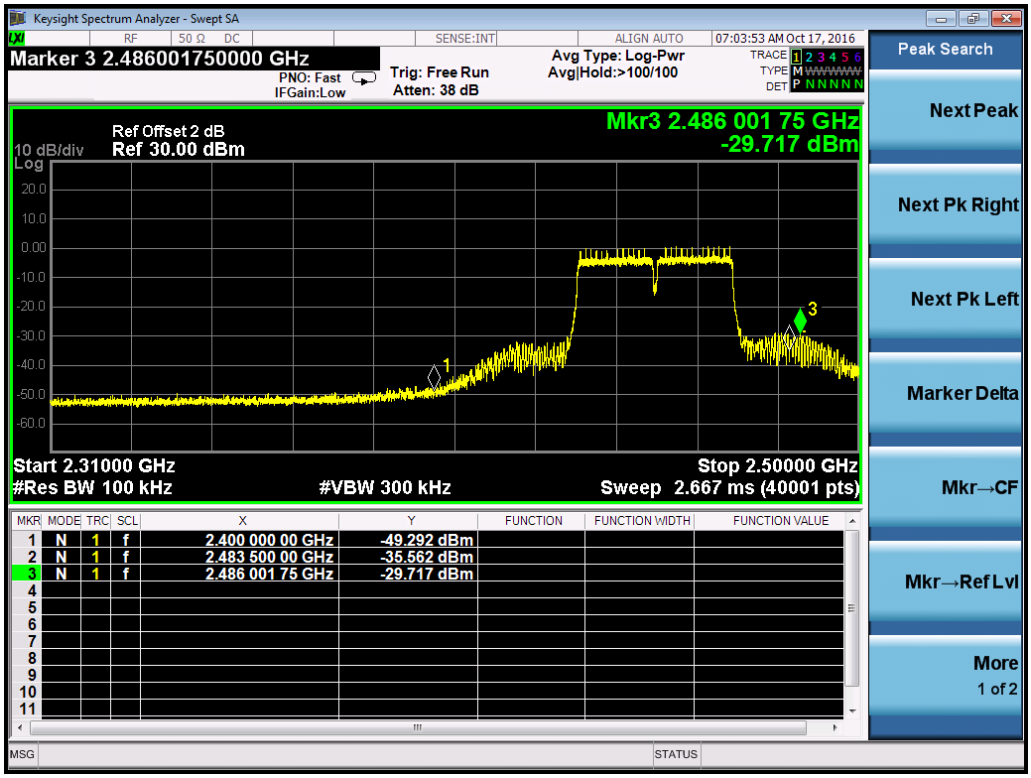
Channel M

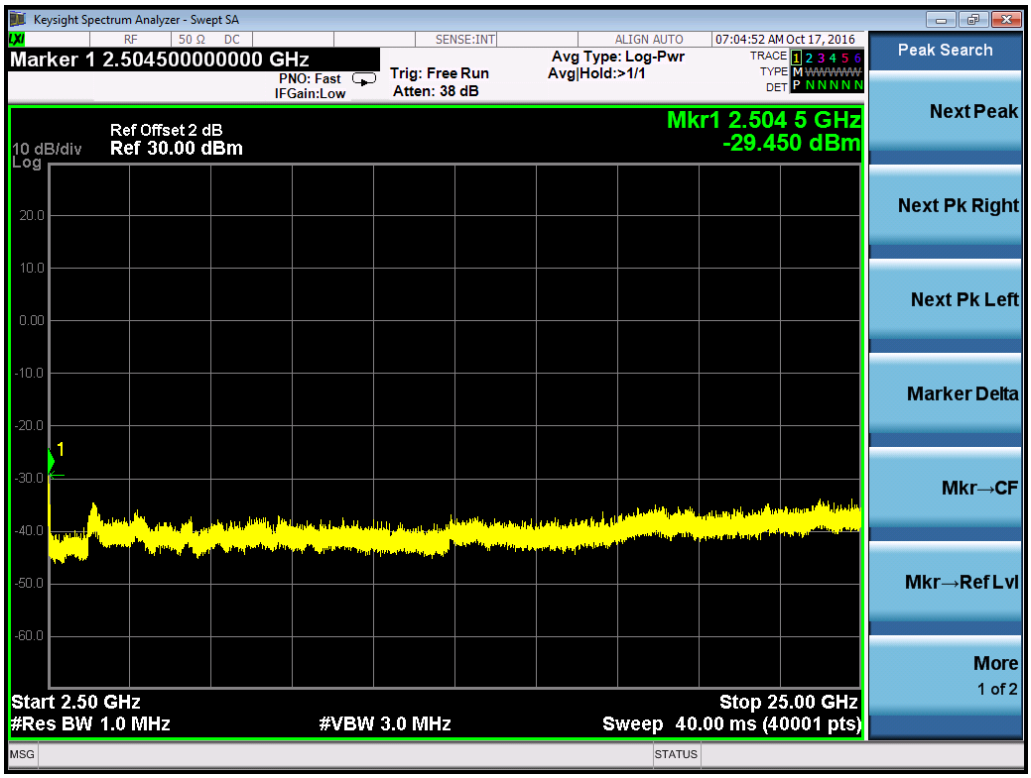




Channel H


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.307321000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>1/1
07:10:38 AM Oct 17, 2016
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.307 321 GHz
-48.710 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
Marker 3 2.486001750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
07:03:53 AM Oct 17, 2016
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr3 2.486 001 75 GHz
-29.717 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.400 000 00 GHz -49.292 dBm
2 N 1 f 2.483 500 00 GHz -35.562 dBm
3 N 1 f 2.486 001 75 GHz -29.717 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω DC
SENSE:INT
ALIGN AUTO
07:04:52 AM Oct 17, 2016
Marker 1 2.504500000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
Avg|Hold:>1/1
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.504 5 GHz
-29.450 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
1
Start 2.50 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 40.00 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

7 Radiated Emissions in restricted frequency bands

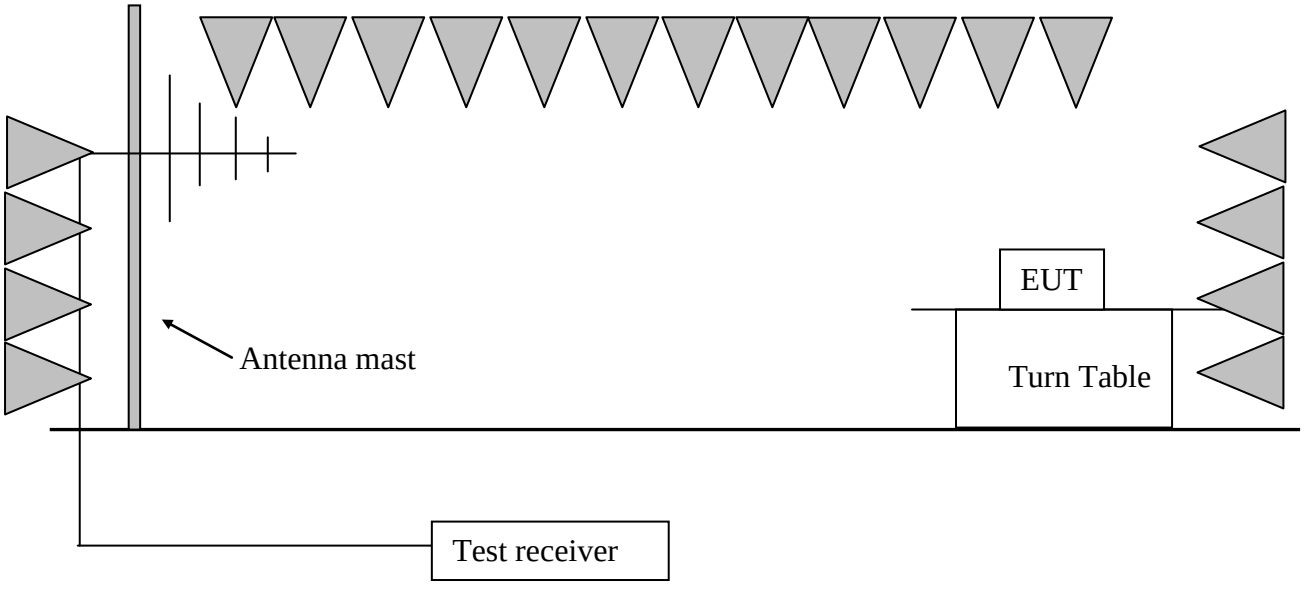
Test result: **Pass**

7.1 Test limit

The 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) showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

7.2 Test Configuration



7.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The EUT was tested according to DTS test procedure of KDB558074 D01 DTS "Meas Guidance" for compliance to FCC 47CFR 15.247 requirements.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);
RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

Remark:
1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Measured level = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m,
Measured level = 10.20dBuV/m, then Margin = 54 - 10.20 = 43.80dBuV/m.

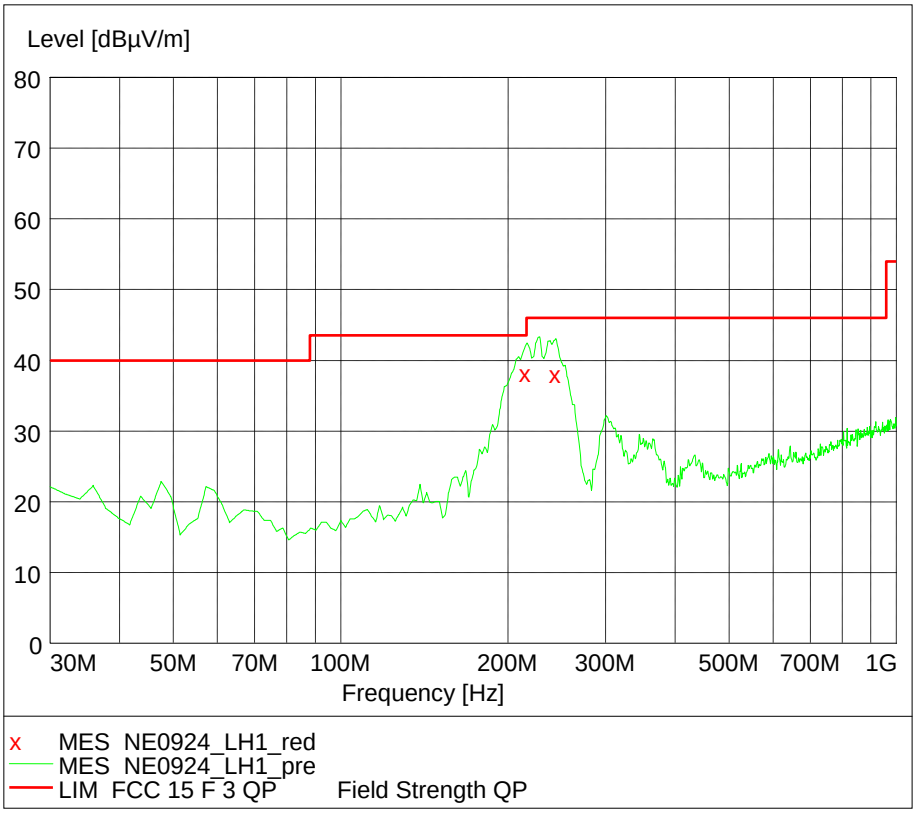
7.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

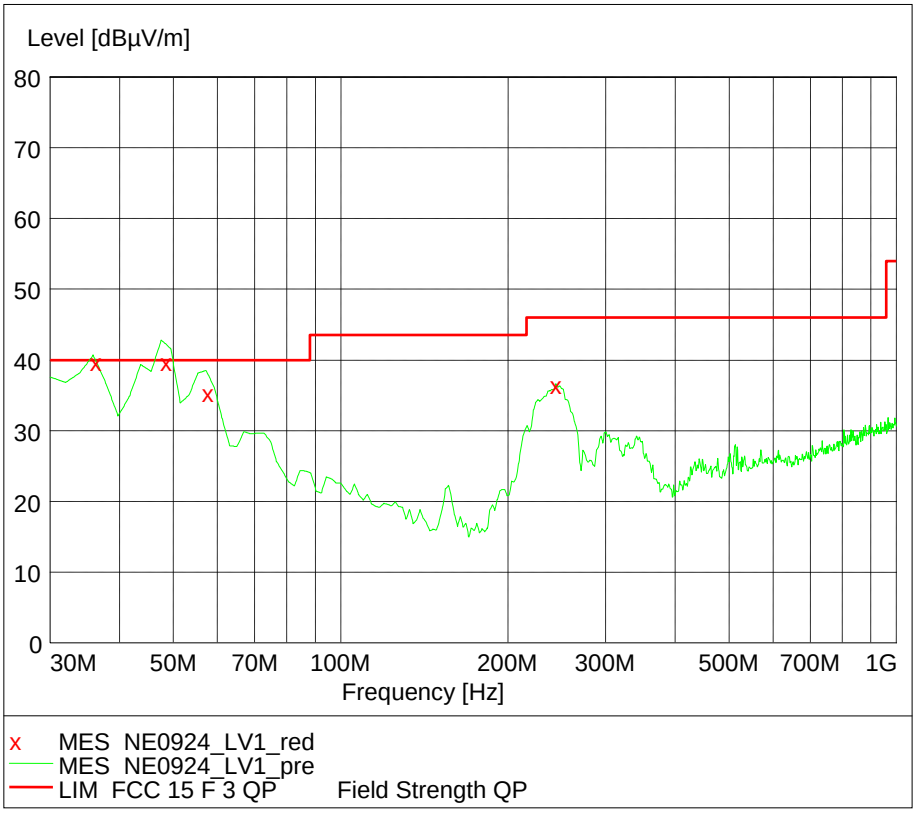
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



Note: The worst test result of channel L (802.11b, 2412MHz) was chosen to list in the report as representative.

Test result from 30MHz to 1000MHz:

Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	214.31	38.40	12.0	43.50	5.10	QP
	242.61	38.30	14.4	46.00	7.70	QP
V	36.23	39.80	16.7	40.00	0.20	QP
	48.52	39.75	10.9	40.00	0.25	QP
	57.62	35.50	8.0	40.00	4.50	QP
	243.83	36.60	14.1	46.00	9.40	QP

Test result above 1GHz:

Channel	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2412.20	103.10	34.34	Fundamental	/	PK
	H	2386.20	51.20	34.29	74.00	22.80	PK
	H	4824.61	47.20	2.10	74.00	26.80	PK
M	H	2437.30	103.70	34.48	Fundamental	/	PK
	H	4874.26	47.50	2.10	74.00	26.50	PK
H	H	2462.56	103.60	34.62	Fundamental	/	PK
	H	2483.55	58.90	34.63	74.00	20.10	PK
	H	2483.55	52.90	34.63	74.00	1.10	PK
	H	4924.81	47.80	2.10	74.00	26.20	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit – Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m, then
Margin = 54 -10.20 = 43.80dBuV/m

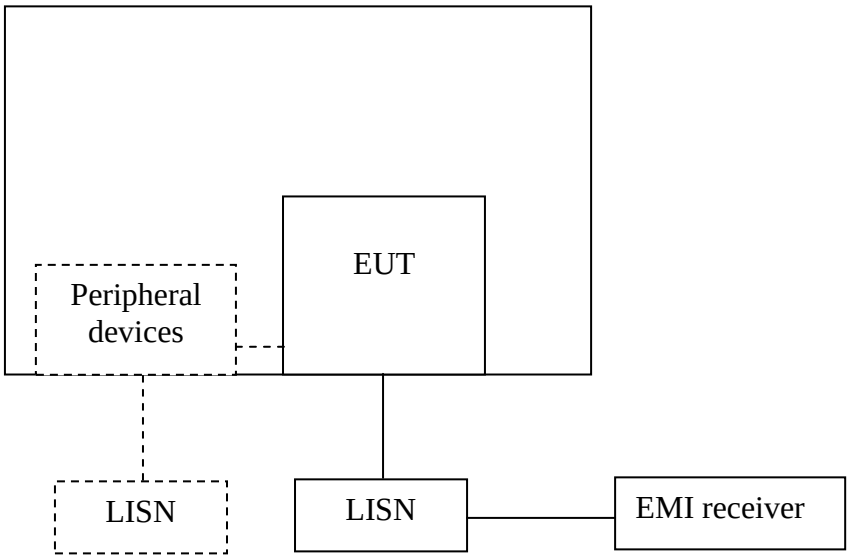
8 Power line conducted emission

Test result: **Pass**

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

8.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

8.3 Test procedure and test set up

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

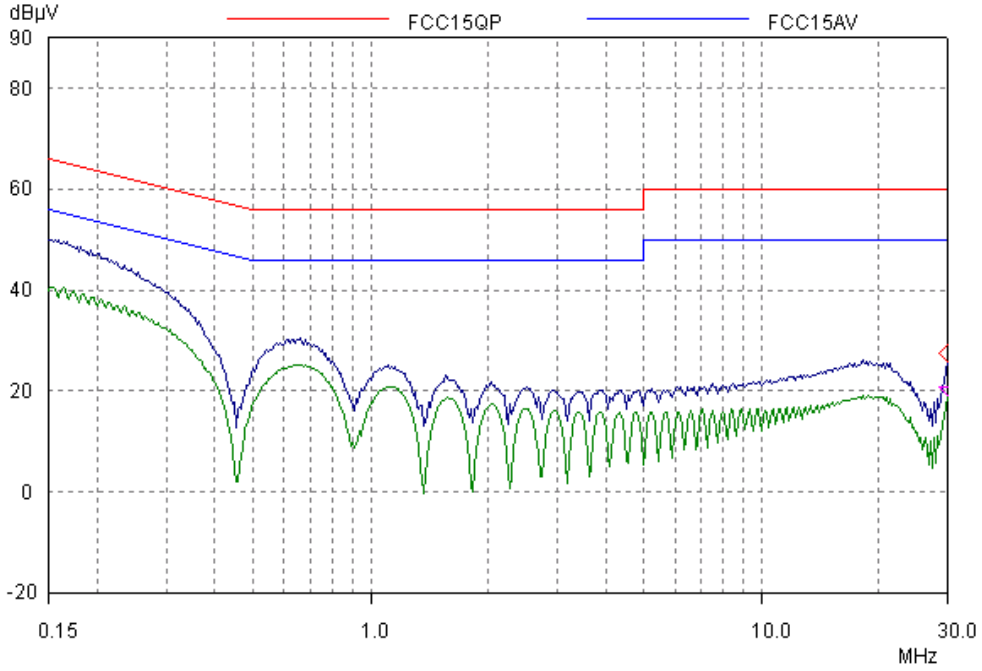
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

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

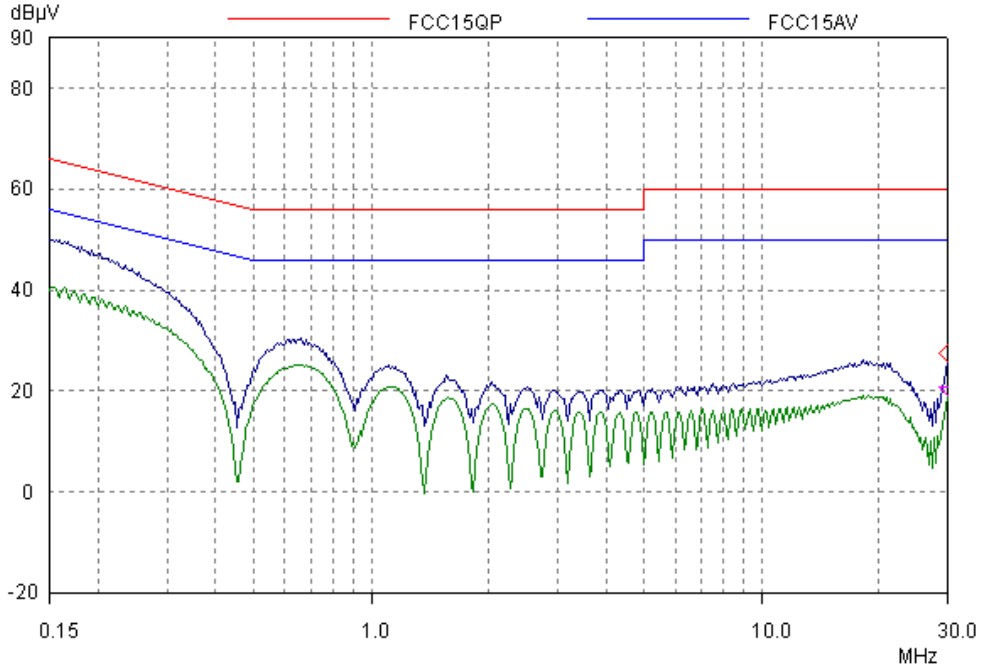
8.4 Test protocol

Temperature: 25 °C
Relative Humidity: 55 %

L Line:



N Line:



9 Antenna requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Result:
EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section