RF TEST REPORT

Test item	:	Smart Beam Laser
Model No.	:	LB-UH6CB, LB-KH6CB, LB-EH6CB
Order No.	:	DTNC1503-01363
Date of receipt	:	2015-03-26
Test duration	:	2015-05-15 ~ 2015-05-29
Date of issue	:	2015-07-02
Use of report	:	FCC Original Grant

Applicant : CREMOTECH Co., Ltd.
401 202 Yemiji Bldg, 31 Hwangsaeul-ro 258beon-gil, Seongnam-si, Bundang-gu, Gyeonggi-do, South Korea

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15 Subpart C 247
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
HyunSu Son

Reviewed by:

Technical Manager
GeunKi Son

Test Report Version

Test Report No.	Date	Description
DRTFCC1507-0156	Jul. 02, 2015	Initial issue

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1. GENERAL INFORMATION

Applicant	:	CREMOTECH Co., Ltd.
Address	:	401 202 Yemiji Bldg, 31 Hwangsaeul-ro 258beon-gil, Seongnam-si, Bundang-gu, Gyeonggi-do, South Korea
FCC ID	:	2AEQF-LB-UH6CB
EUT	:	Smart Beam Laser
Model	:	LB-UH6CB
Additional Model(s)	:	LB-KH6CB, LB-EH6CB
Date of Test	:	2015-05-15 ~ 2015-05-29
Contact person	:	Yoon Ho LEE

2. EUT DESCRIPTION

Product	Smart Beam Laser
Model Name	LB-UH6CB
Serial Number	Identical prototype
Power Supply	DC 3.7 V
Battery type	Standard Battery: Lithium Ion Battery
Frequency Range	2.4GHz Band ▪ 802.11b/g/n(20 MHz) : 2412 MHz ~ 2462 MHz
Max. RF Output Power	2.4GHz Band ▪ 802.11b : 16.85 dBm ▪ 802.11g : 16.48 dBm ▪ 802.11n(HT20) : 16.29 dBm
Modulation Type	802.11b : DSSS/CCK 802.11g/n : OFDM
Antenna Specification	Internal Antenna (1TX ,1RX) ▪ 2.4 GHz Band Max. peak gain : 2.44 dBi

3. SUMMARY OF TESTS

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)				
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	**C**
15.247(b)	Transmitter Output Power	< 1 Watt		**C**
15.247(d)	Out of Band Emissions / Band Edge	20 dBc in any 100 kHz BW		**C**
15.247(e)	Transmitter Power Spectral Density	< 8 dBm / 3 kHz		**C**
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	<FCC 15.209 limits	Radiated	**C** Note 2/Note 3
15.207	AC Conducted Emissions	< FCC 15.207 limits	AC Line Conducted	**C**
15.203	Antenna Requirements	FCC 15.203	-	**C**

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This test item was performed in each axis and the worst case data was reported.

Note 3 : For emission measurements above 1 GHz, the table height is 1.5 m.
Because FCC indicated test has permitted the use of the 1.5m table as an alternative.

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 D01 v03r2. And ANSI C63.10-2009 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The EUT was operated in the test mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB 558074 D01 v03r2. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15MHz and 30MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB 558074 D01 DTS Meas. Guidance v03r2. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10 as stated on section 12.1 of the KDB 558074 D01 DTS Meas. Guidance v03r2.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

4.4 DESCRIPTION OF TEST MODES

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics.

A test program is used to control the EUT for staying in continuous transmitting mode.

5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

The open area test site (OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number : 165783

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.

The antenna is permanently attached. (Refer to Internal photo file.)
Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 6 dB Bandwidth

Test Requirements and limit, §15.247(a)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6dB bandwidth is 500 kHz.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB558074 D01 v03r2**.

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
   (RBW:100 kHz/VBW:300 kHz)
3. Detector = **Peak**.
4. Trace mode = **max hold**.
5. Sweep = **auto couple**.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outer most amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

▣TEST RESULTS: Comply

Test Mode	Data Rate	Frequency [MHz]	Test Results [MHz]
802.11b	1 Mbps	2412	7.120
		2437	7.120
		2462	7.120
802.11g	6 Mbps	2412	15.160
		2437	15.200
		2462	15.160
802.11n (20 MHz)	MCS 0	2412	15.200
		2437	15.200
		2462	15.200

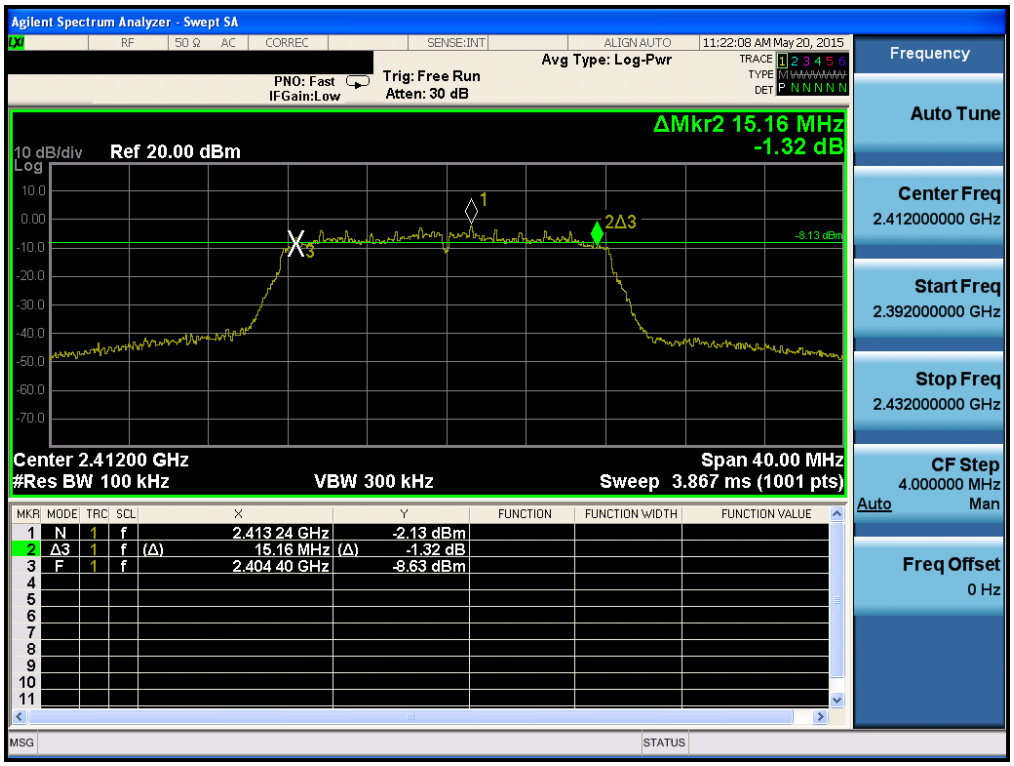
▣ RESULT PLOTS

6 dB Bandwidth Test Mode: 802.11b & 1 Mbps & 2412 MHz

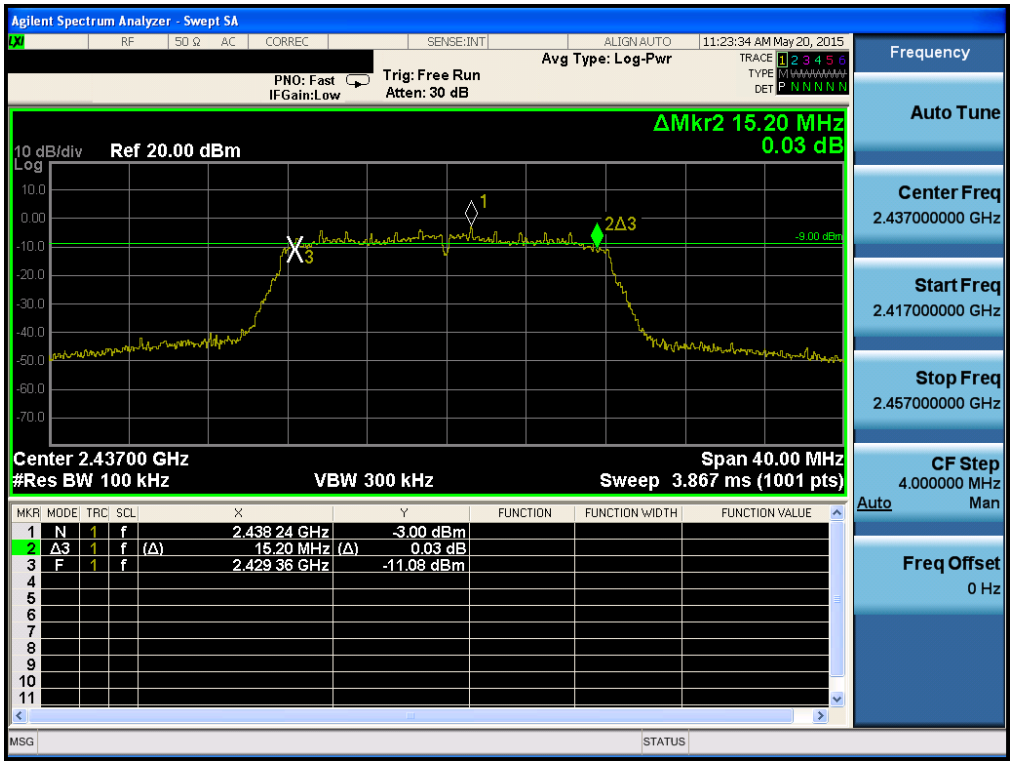
6 dB Bandwidth Test Mode: 802.11b & 1 Mbps & 2437 MHz

6 dB Bandwidth Test Mode: 802.11b & 1 Mbps & 2462 MHz

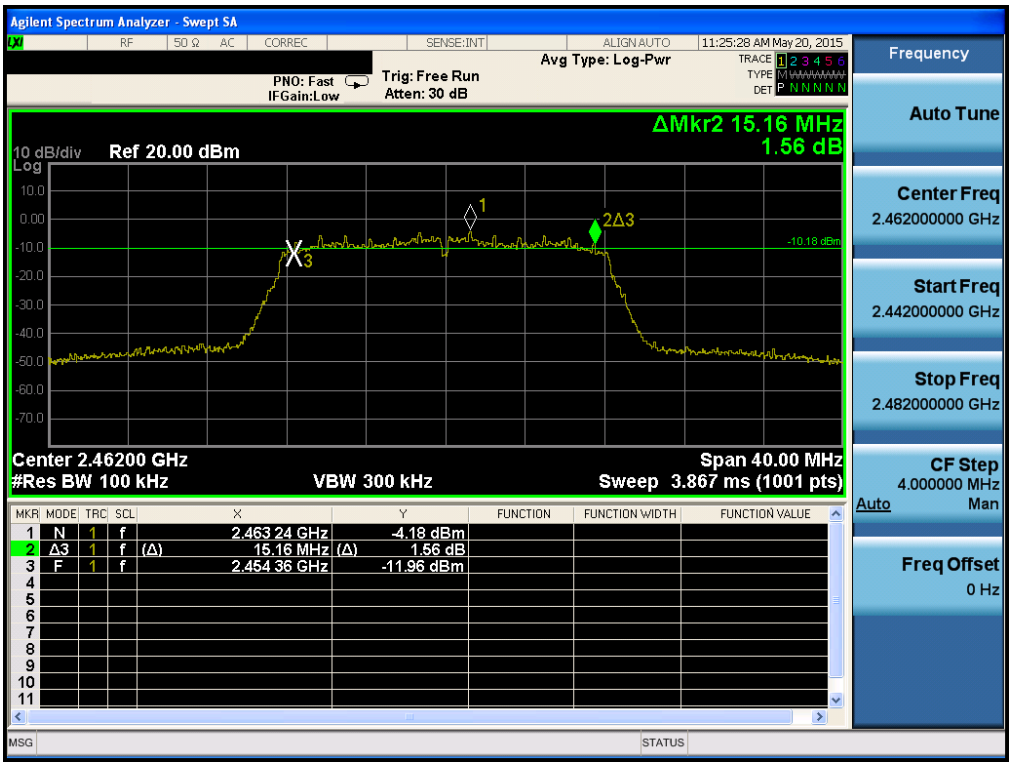
6 dB Bandwidth Test Mode: 802.11g & 6 Mbps & 2412 MHz



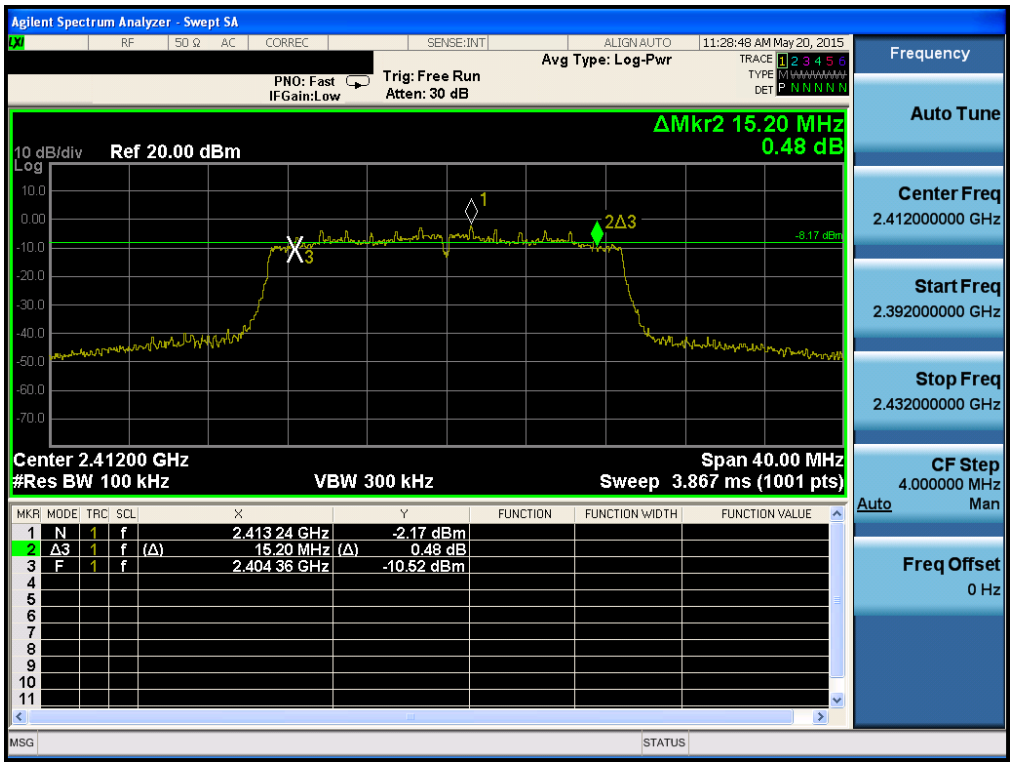
6 dB Bandwidth Test Mode: 802.11g & 6 Mbps & 2437 MHz



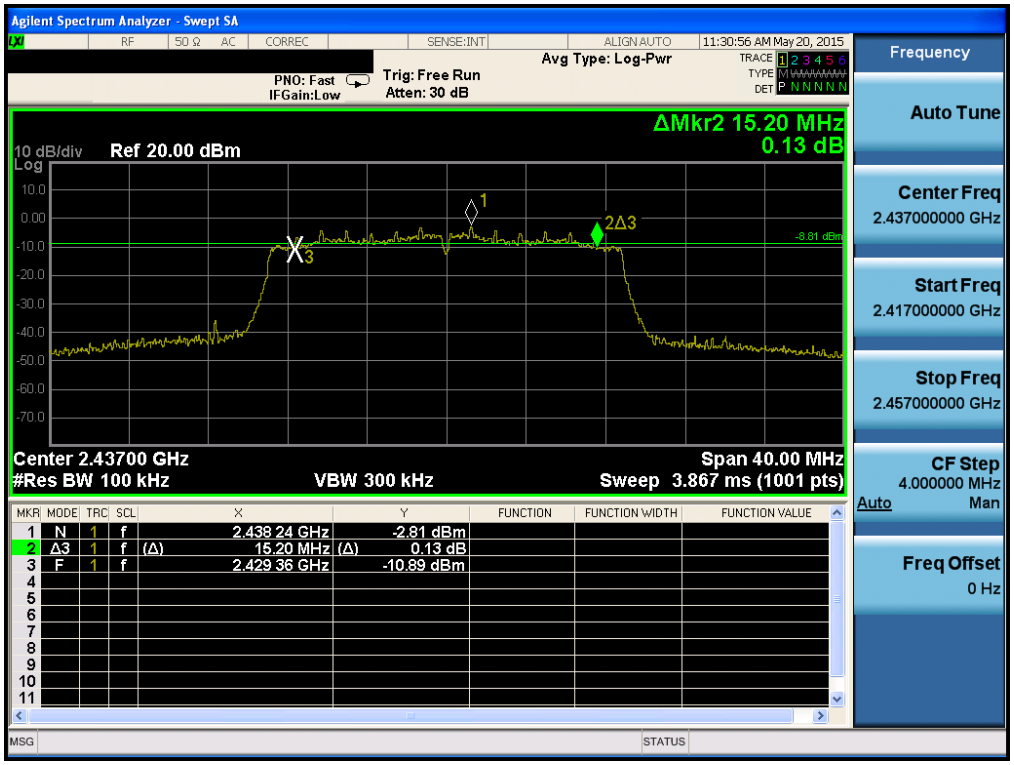
6 dB Bandwidth Test Mode: 802.11g & 6 Mbps & 2462 MHz



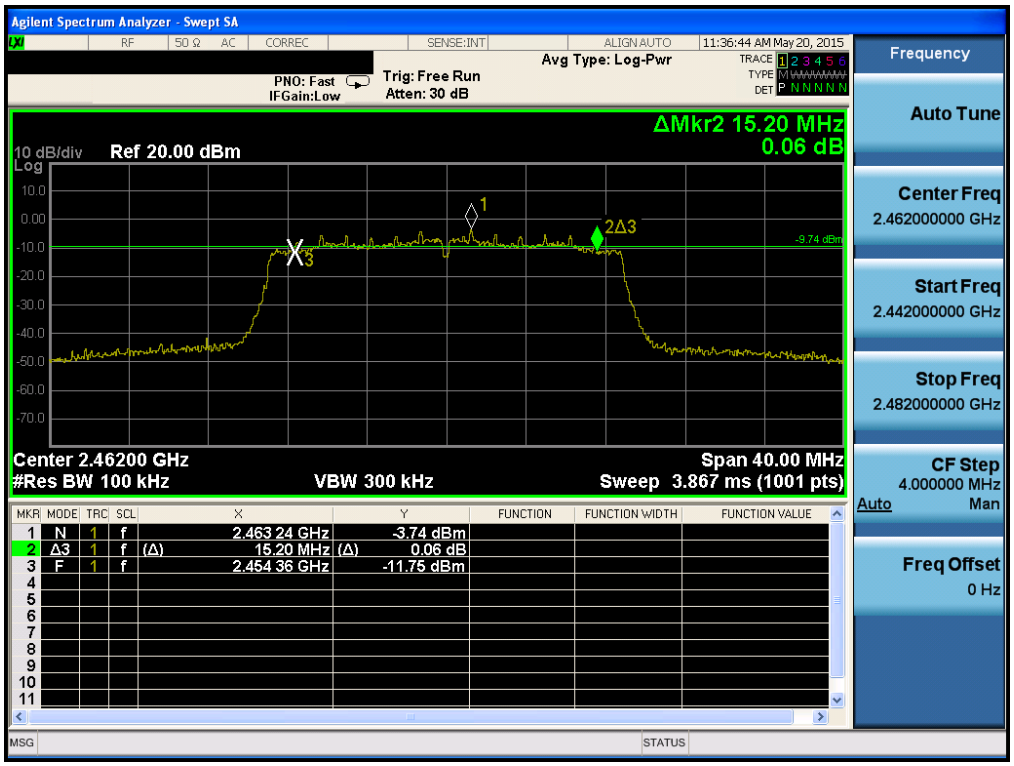
6 dB Bandwidth Test Mode: 802.11n(HT20) & MCS 0 & 2412 MHz



6 dB Bandwidth Test Mode:802.11n(HT20) & MCS 0 & 2437 MHz



6 dB Bandwidth Test Mode: 802.11n(HT20) & MCS 0 & 2462 MHz

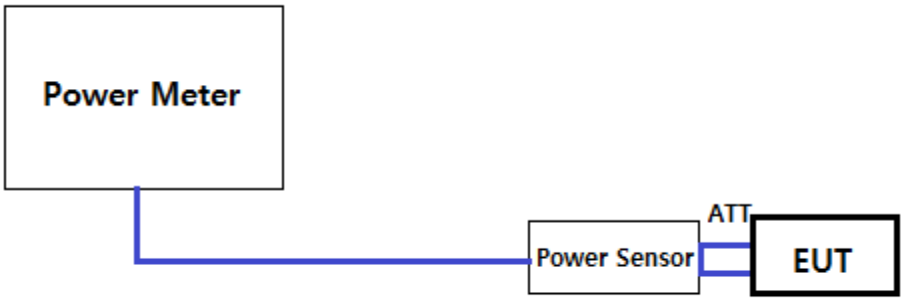


8.2 Maximum Peak Conducted Output Power

Test Requirements and limit, §15.247(b)

The maximum permissible conducted output power is **1 Watt**.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE:

1. **PKPM1 Peak power meter method of KDB558074 D01 v03r2**
   The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.

2. **Method AVGPM-G (Measurement using a gated RF average power meter) of KDB558074 D01 v03r2**
   The average conducted output powers were measured using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

▣ **TEST RESULTS: Comply**

- **Measurement Data: Comply**

- Test Results

Mode	Channel	Frequency [MHz]	Detector	Test Result [dBm]							
				DATA RATE [Mbps]							
				1	2	5.5	11	NA	NA	NA	NA
802.11b	1	2412	PK	**16.85**	16.74	16.73	16.45	-	-	-	-
			AV	14.01	13.98	13.94	13.86	-	-	-	-
	6	2437	PK	16.27	16.19	16.13	16.11	-	-	-	-
			AV	13.41	13.38	13.36	13.28	-	-	-	-
	11	2462	PK	15.35	15.31	15.30	15.18	-	-	-	-
			AV	12.53	12.52	12.50	12.41	-	-	-	-

Mode	Channel	Frequency [MHz]	Detector	Test Result [dBm]							
				DATA RATE [Mbps]							
				6	9	12	18	24	36	48	54
802.11g	1	2412	PK	**16.48**	16.44	16.47	16.31	16.33	16.14	16.11	16.04
			AV	7.32	7.30	7.29	7.22	7.23	7.10	7.08	7.01
	6	2437	PK	15.83	15.78	15.77	15.53	15.48	15.31	15.33	15.17
			AV	6.57	6.56	6.51	6.44	6.41	6.34	6.33	6.25
	11	2462	PK	15.44	15.43	15.41	15.28	15.29	15.14	15.12	15.03
			AV	6.05	6.04	6.01	5.94	5.95	5.86	5.85	5.80

Mode	Channel	Frequency [MHz]	Detector	Test Result [dBm]							
				DATA RATE [MCS]							
				0	1	2	3	4	5	6	7
802.11n (HT20)	1	2412	PK	**16.29**	16.24	16.22	16.14	16.13	16.01	15.97	15.87
			AV	7.06	7.05	7.02	6.94	6.95	6.87	6.85	6.79
	6	2437	PK	15.34	15.33	15.30	15.22	15.23	15.18	15.13	15.04
			AV	6.35	6.33	6.32	6.27	6.25	6.13	6.12	6.03
	11	2462	PK	14.91	14.88	14.86	14.74	14.77	14.65	14.62	14.55
			AV	5.87	5.84	5.83	5.76	5.74	5.66	5.67	5.60

8.3 Maximum Power Spectral Density

Test requirements and limit, §15.247(e)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz Band segment within the fundamental EBW during any time interval of continuous transmission.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE:

Method PKPSD of KDB558074 D01 v03r2 is used.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW to: **3 kHz ≤ RBW ≤ 100 kHz**.
4. Set the VBW ≥ **3 x 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 within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

▣ TEST RESULTS : Comply

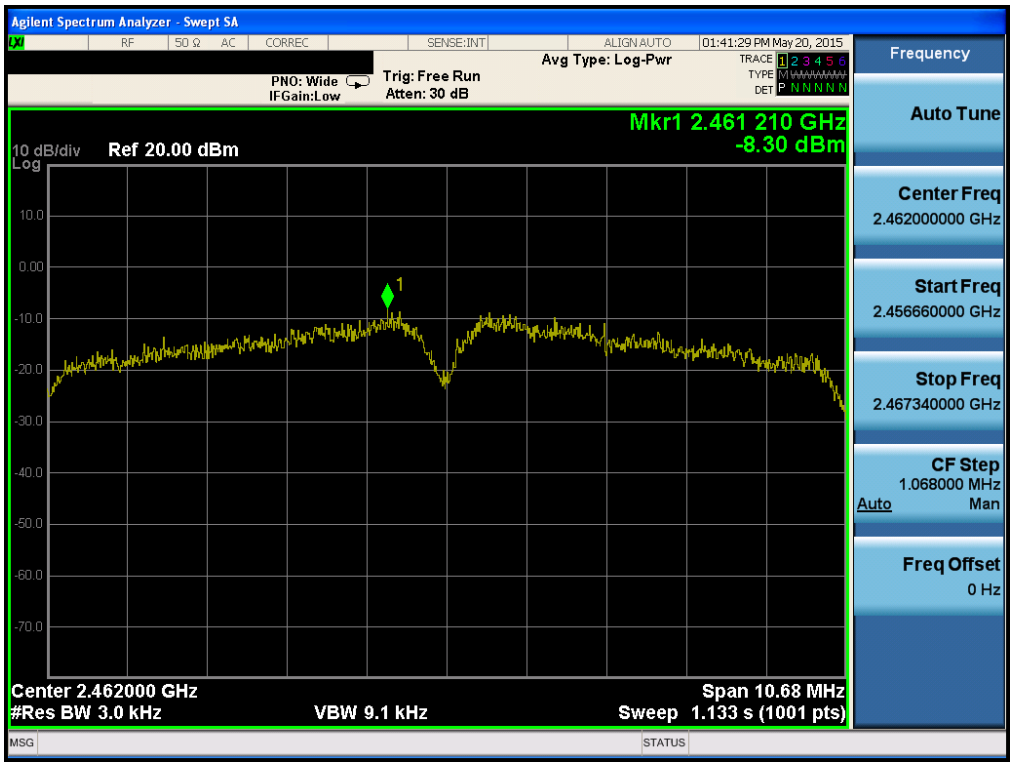
Test Mode	Data Rate	Frequency [MHz]	RBW	PKPSD [dBm]
802.11b	1 Mbps	2412	3 kHz	-6.26
		2437	3 kHz	-7.81
		2462	3 kHz	-8.30
802.11g	6 Mbps	2412	3 kHz	-16.85
		2437	3 kHz	-17.35
		2462	3 kHz	-17.38
802.11n HT20	MCS 0	2412	3 kHz	-15.73
		2437	3 kHz	-16.76
		2462	3 kHz	-17.56

▣ RESULT PLOTS

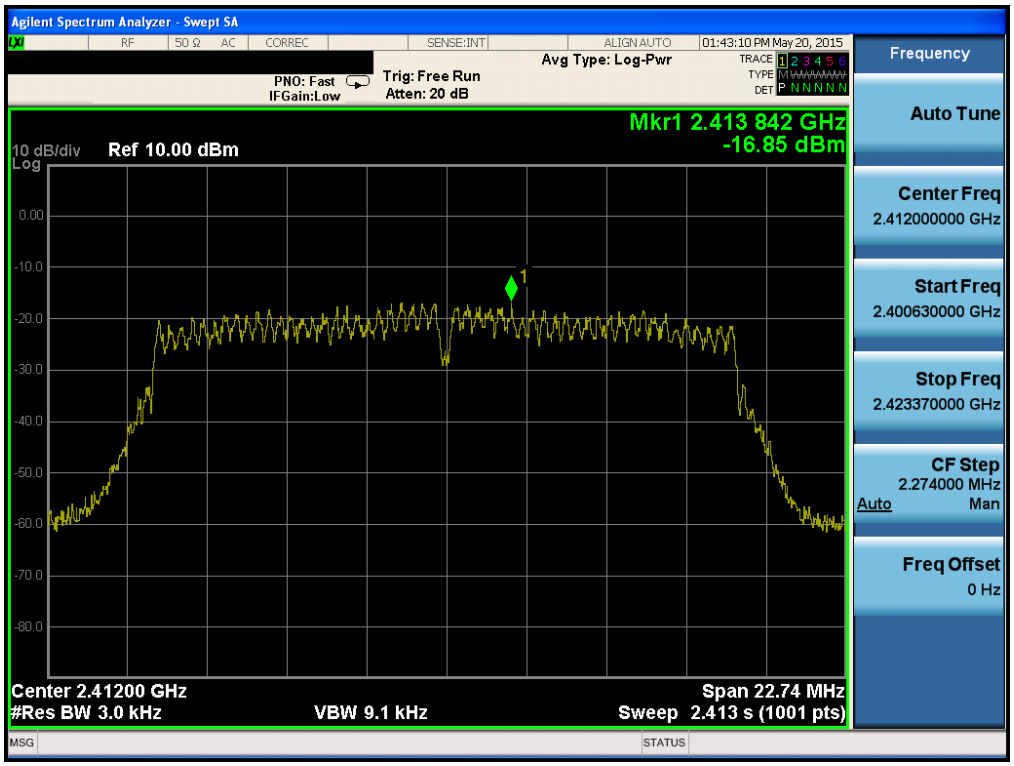
Maximum PKPSD Test Mode: 802.11b & 1 Mbps & 2412 MHz

Maximum PKPSD Test Mode: 802.11b & 1 Mbps & 2437 MHz

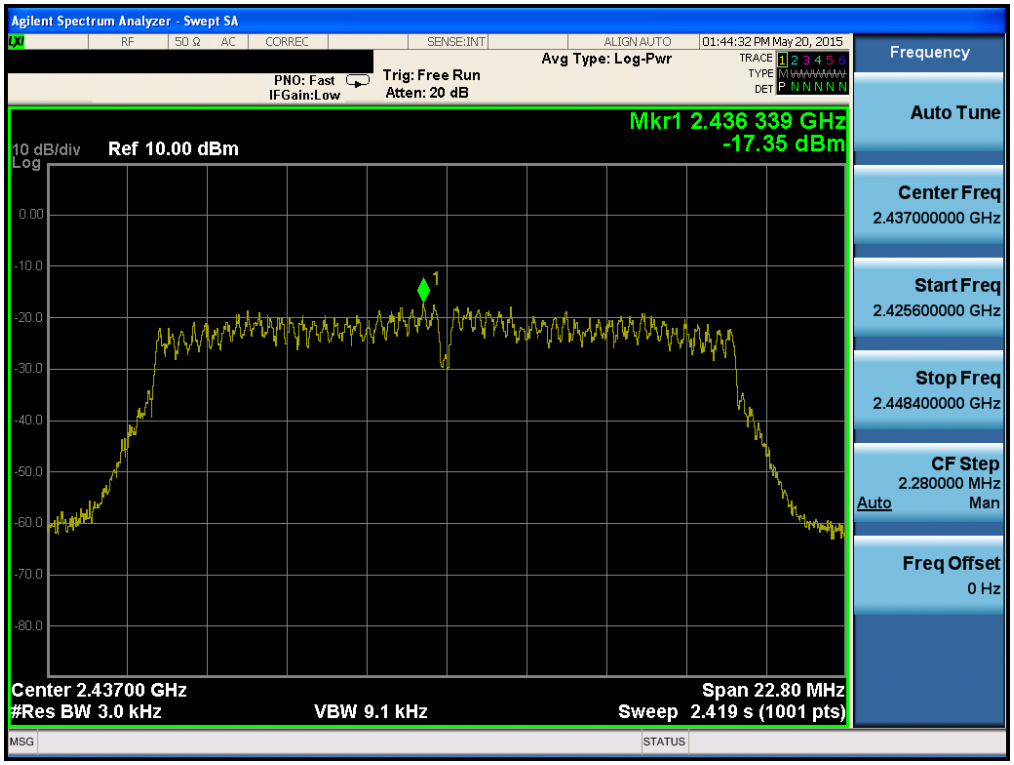
Maximum PKPSD Test Mode: 802.11b & 1 Mbps & 2462 MHz



Maximum PKPSD Test Mode: 802.11g & 6 Mbps & 2412 MHz

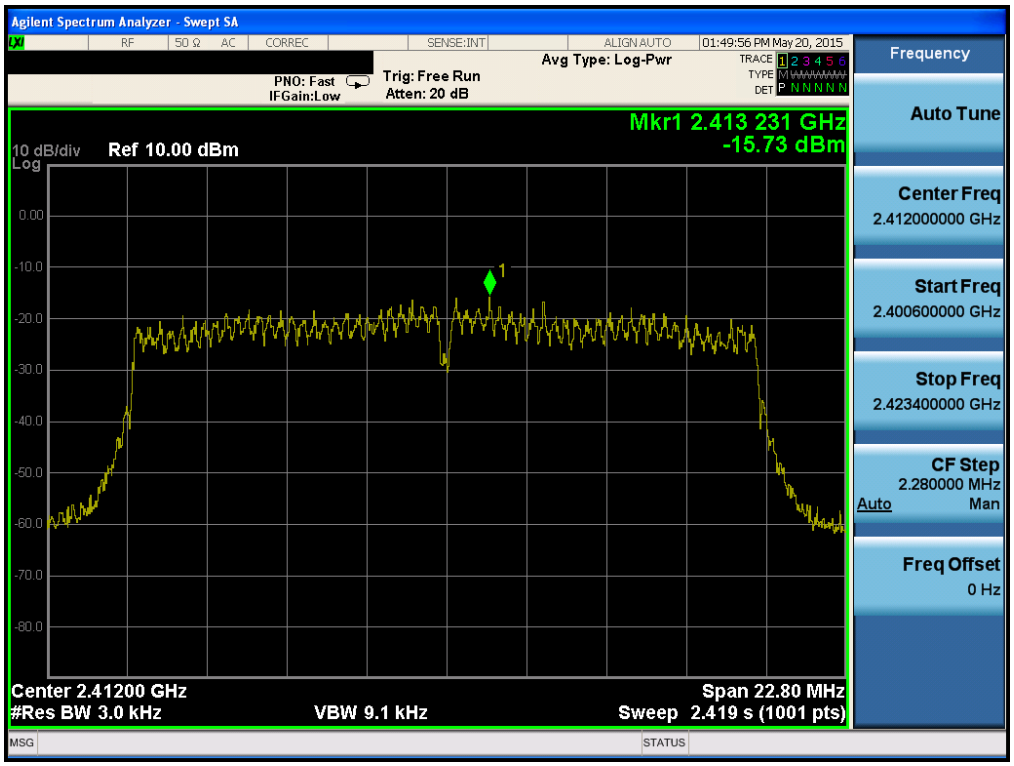


Maximum PKPSD Test Mode: 802.11g & 6 Mbps & 2437 MHz

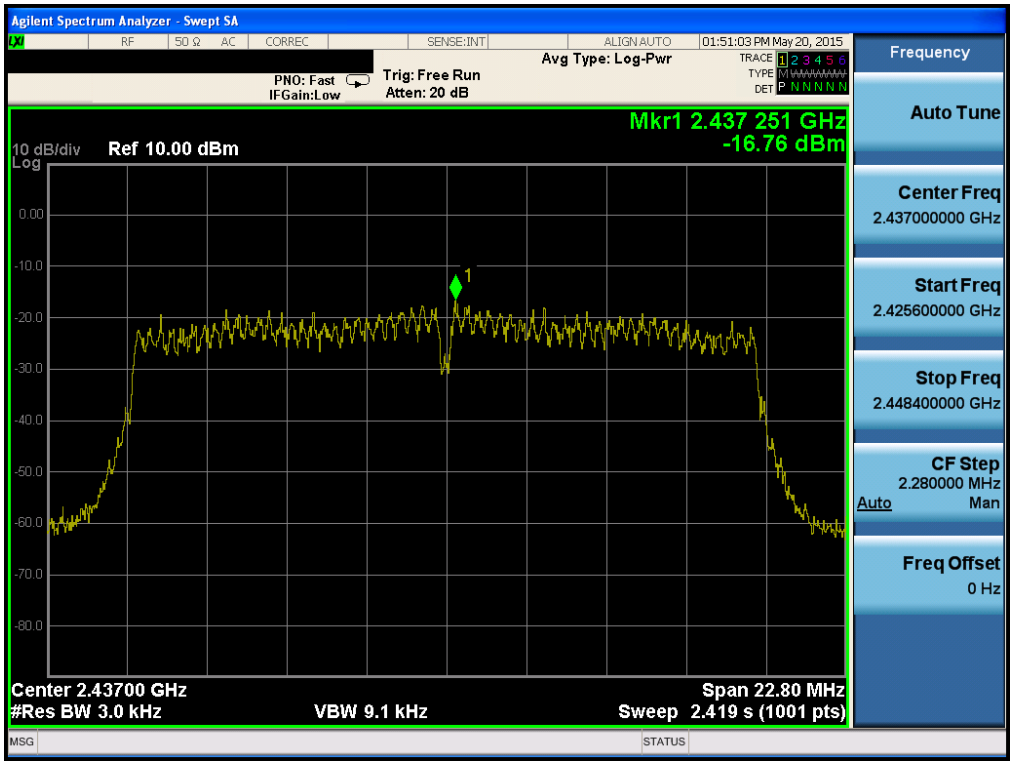


Maximum PKPSD Test Mode: 802.11g & 6 Mbps & 2462 MHz

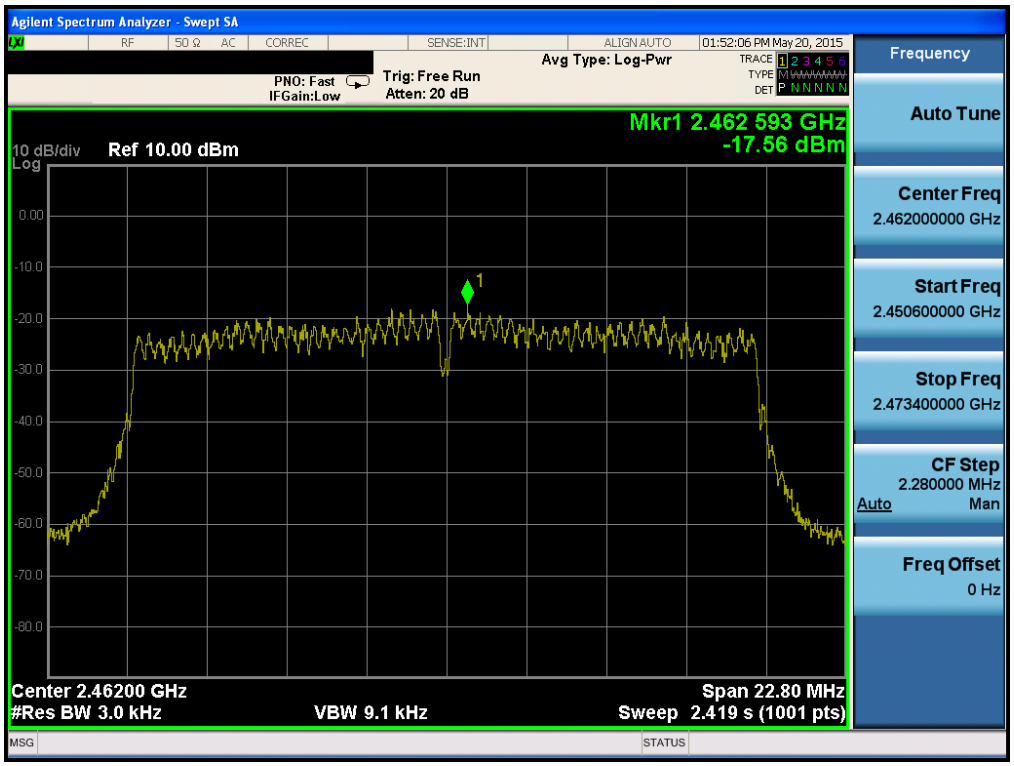
Maximum PKPSD Test Mode: 802.11n(HT20) & MCS 0 & 2412 MHz



Maximum PKPSD Test Mode: 802.11n(HT20) & MCS 0 & 2437 MHz



Maximum PKPSD Test Mode: 802.11n(HT20) & MCS 0 & 2462 MHz



8.4 Out of Band Emissions at the Band Edge / Conducted Spurious Emissions

Test requirements and limit, §15.247(d)

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in band average PSD level.

In either case, attenuation to levels below the general emission limits specified in **§15.209(a)** is not required.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = 100 kHz.
4. Set the VBW ≥ 3 x 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 PSD level

- Measurement Procedure 2 - Unwanted Emissions

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = **100 kHz.(Actual 1 MHz , See below note)**
3. Set the VBW **≥3 x RBW.(Actual 3 MHz, See below note)**
4. Detector = **peak**.
5. Ensure that the number of measurement points ≥ span / RBW
6. Sweep time = **auto couple.**
7. Trace mode = **max hold.**
8. **Allow the trace to stabilize** (this may take some time, depending on the extent of the span).
9. Use the peak marker function to determine the maximum amplitude level.

Note : The conducted spurious emission was tested with below settings.

Frequency range: 9 kHz ~ 30 MHz

RBW= 100 kHz, VBW= 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT: 40001

Frequency range: 30 MHz ~ 10 GHz, 10 GHz~25 GHz

RBW= 1MHz, VBW= 3MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT: 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

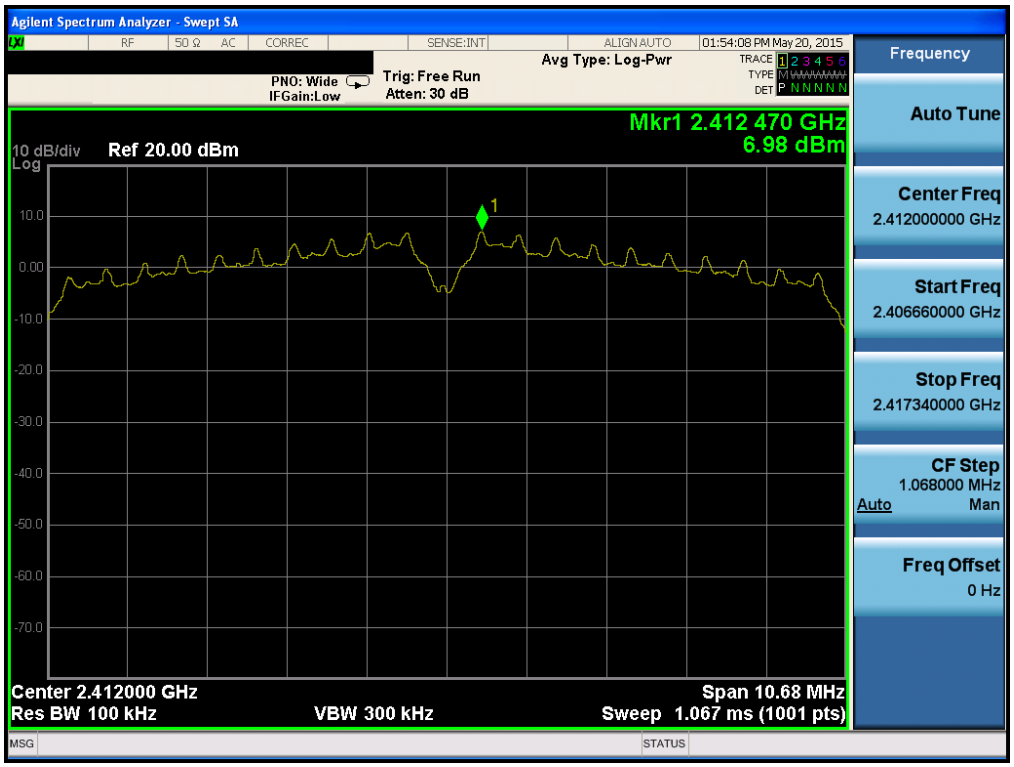
If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

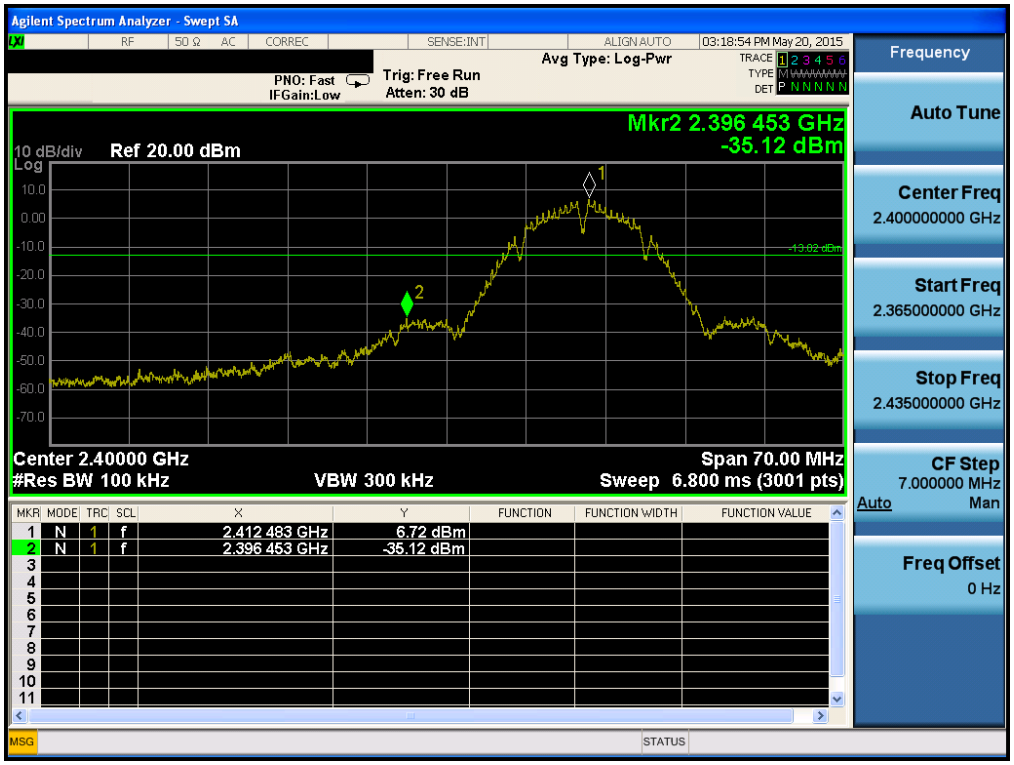
▣ RESULT PLOTS

802.11b & 1 Mbps & 2412 MHz

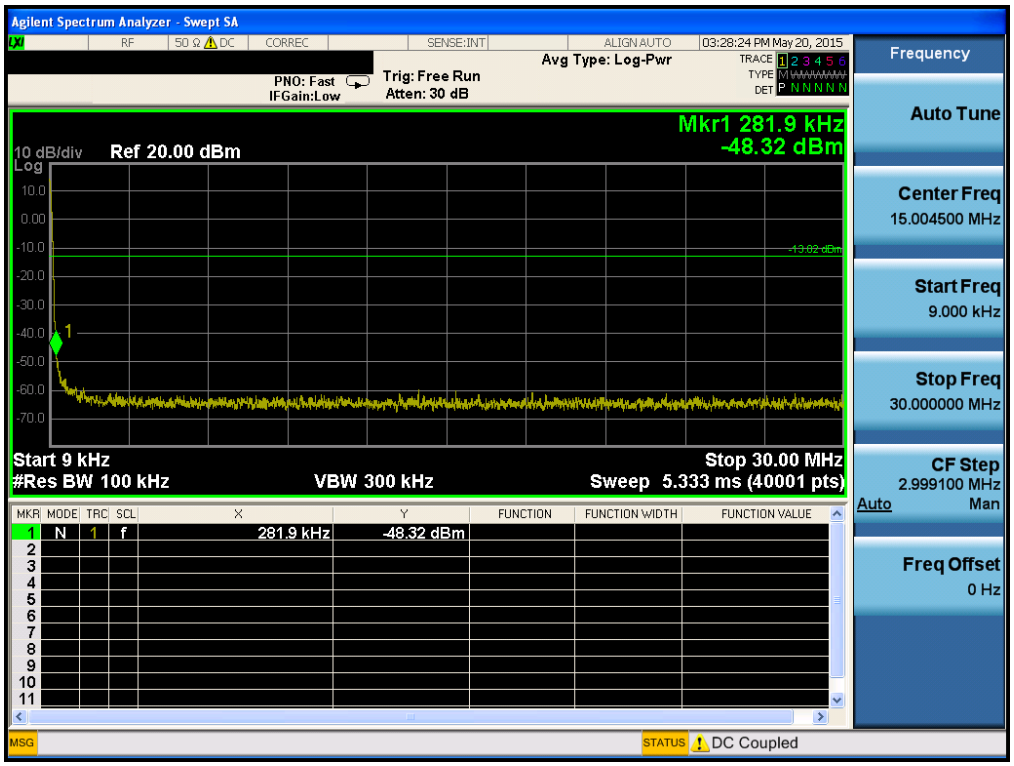
Reference

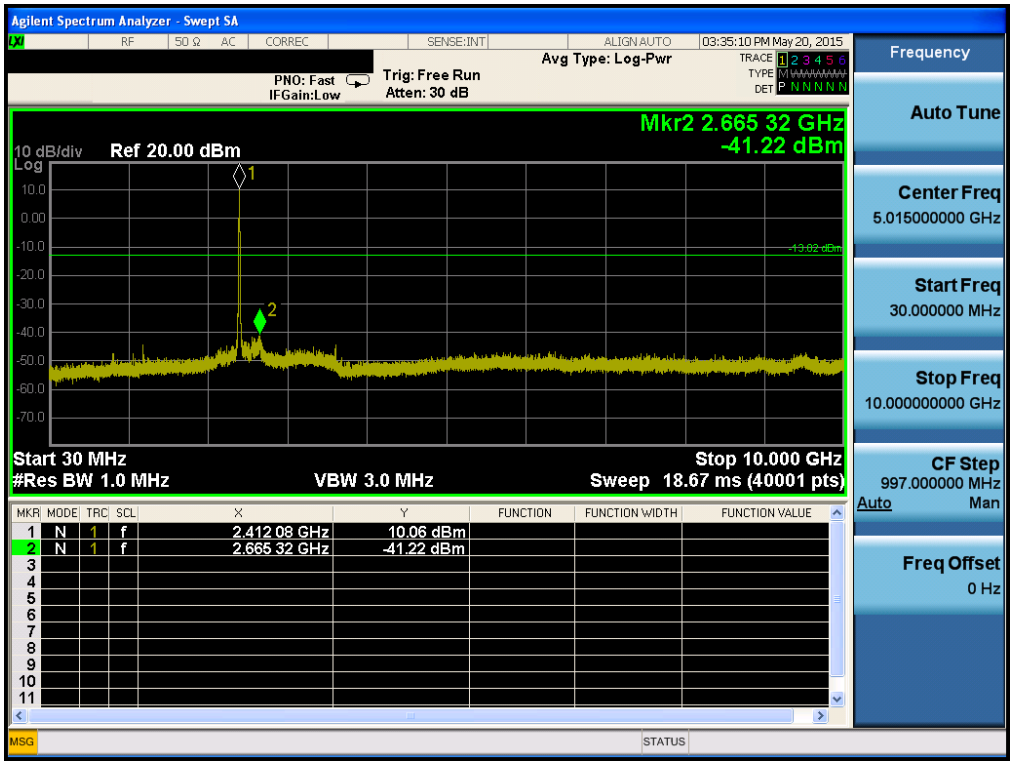


Low Band-edge

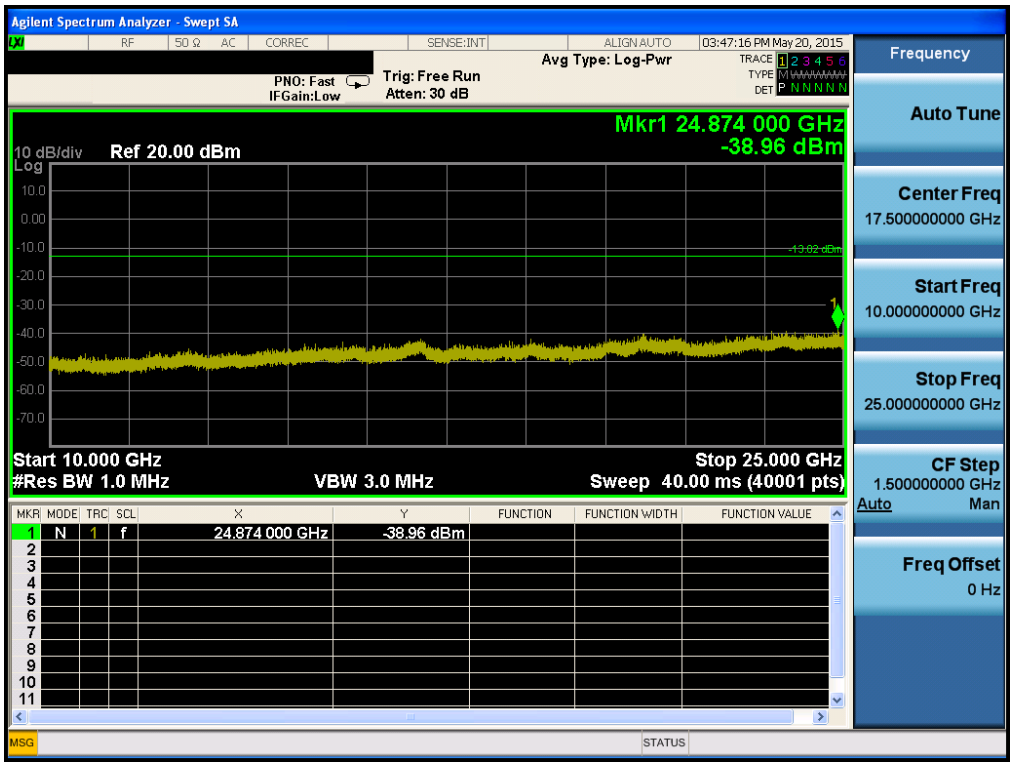


Conducted Spurious Emissions



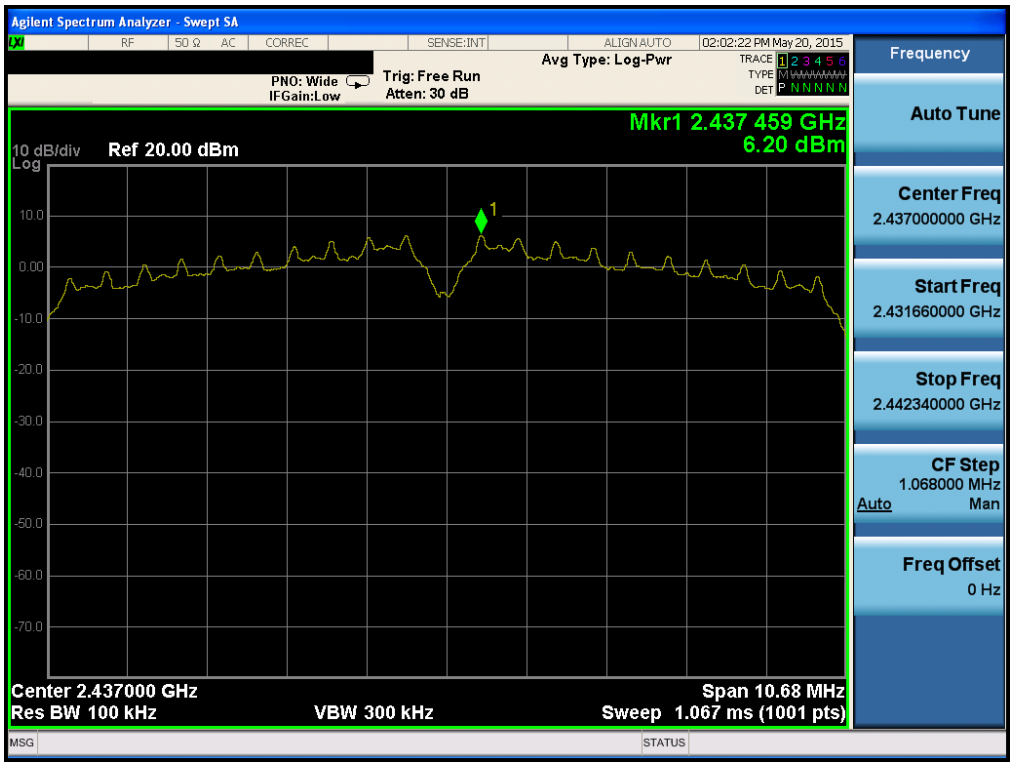


Conducted Spurious Emissions

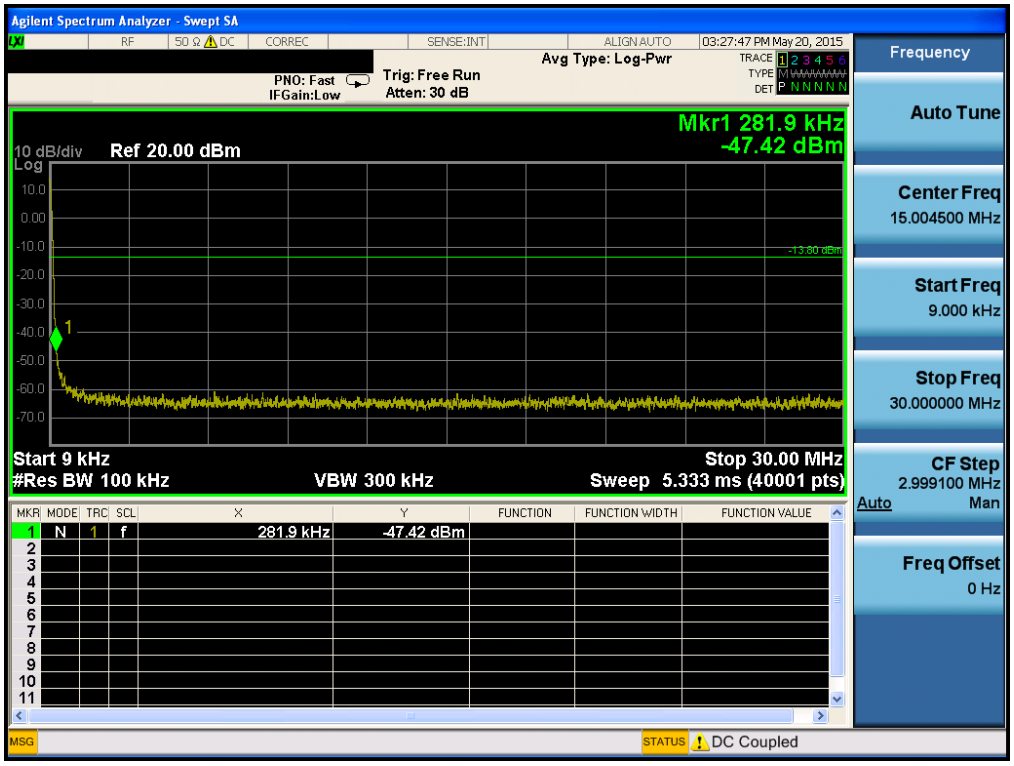


802.11b & 1 Mbps & 2437 MHz

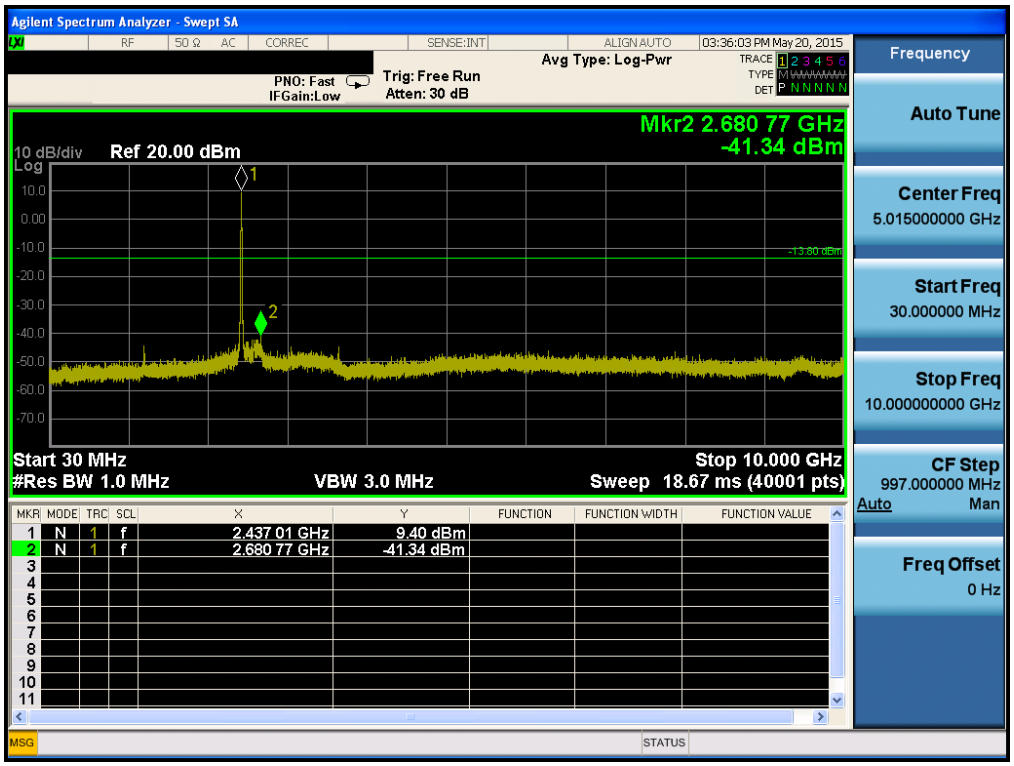
Reference

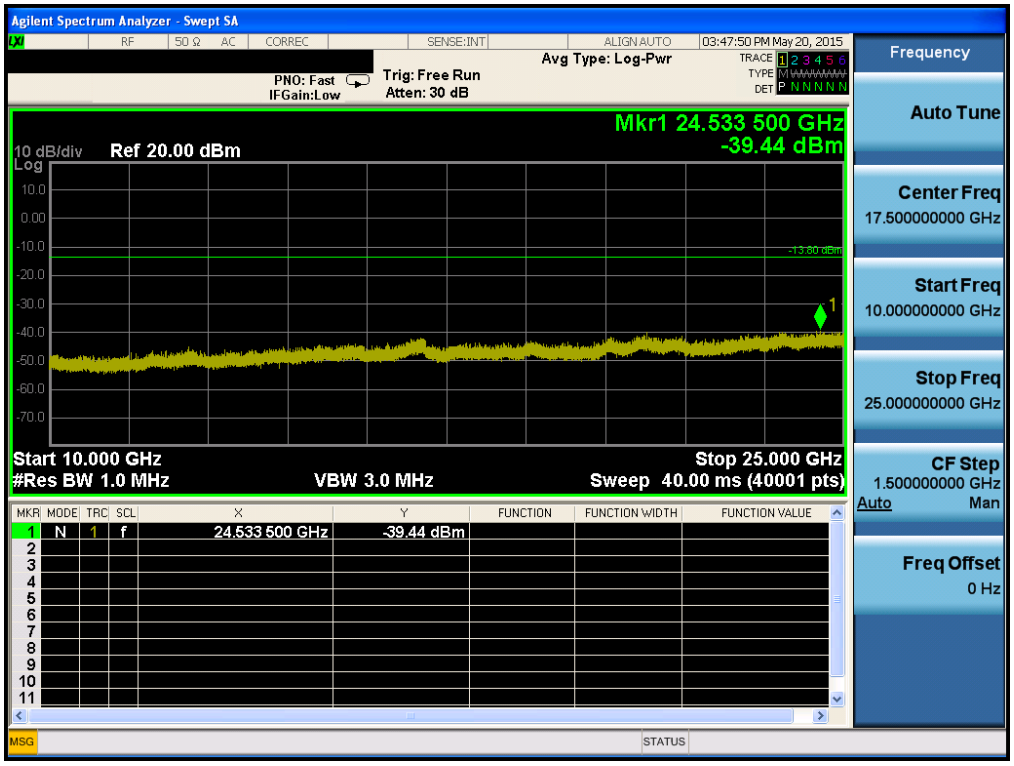


Conducted Spurious Emissions



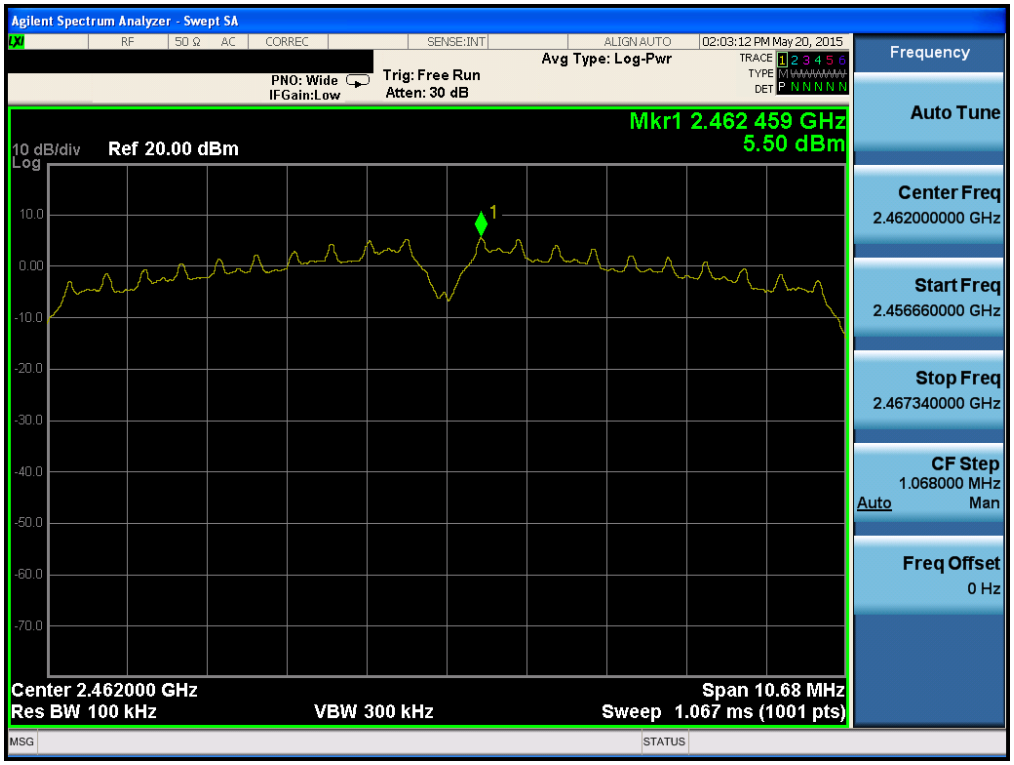
Conducted Spurious Emissions



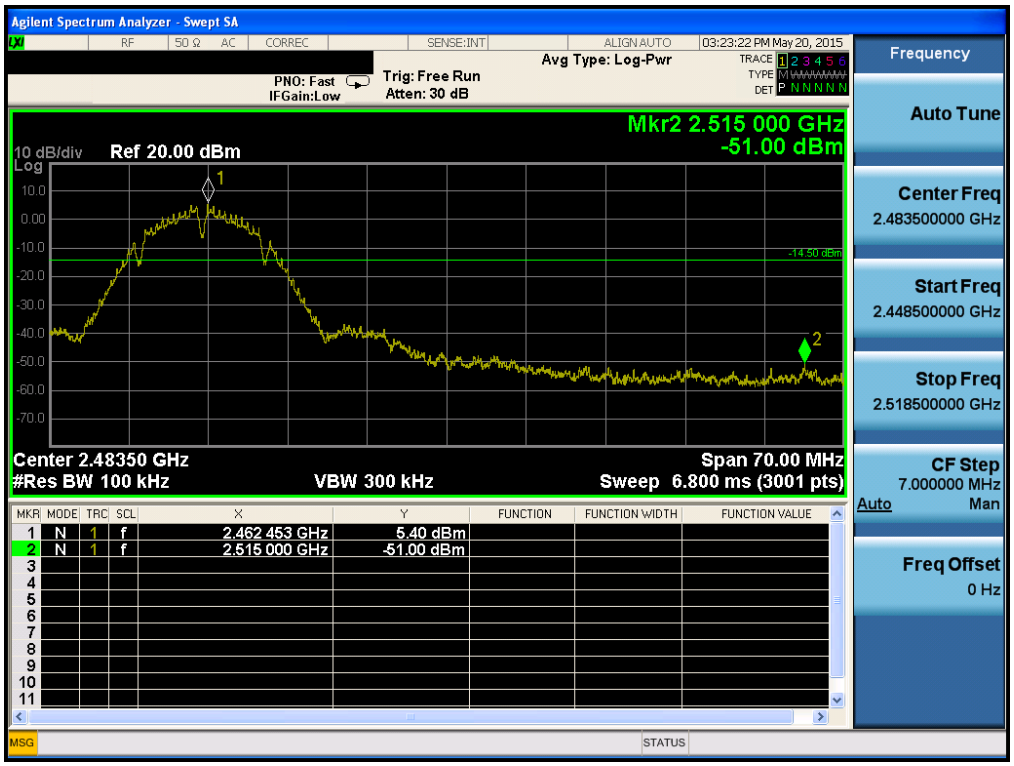


802.11b & 1 Mbps & 2462 MHz

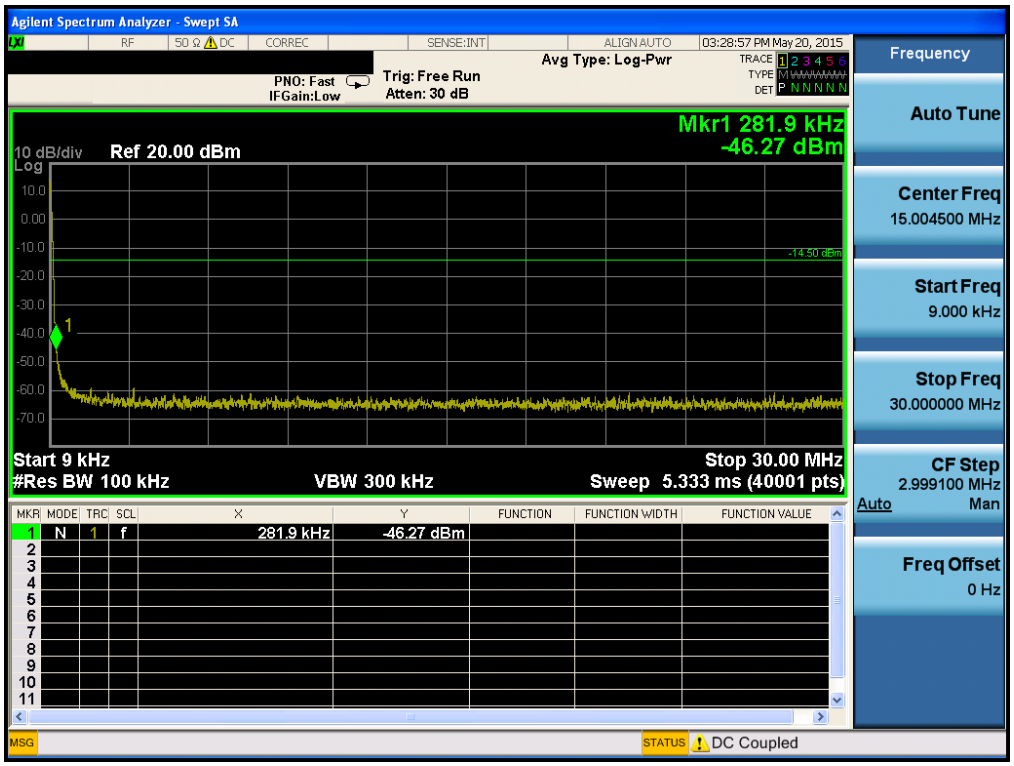
Reference

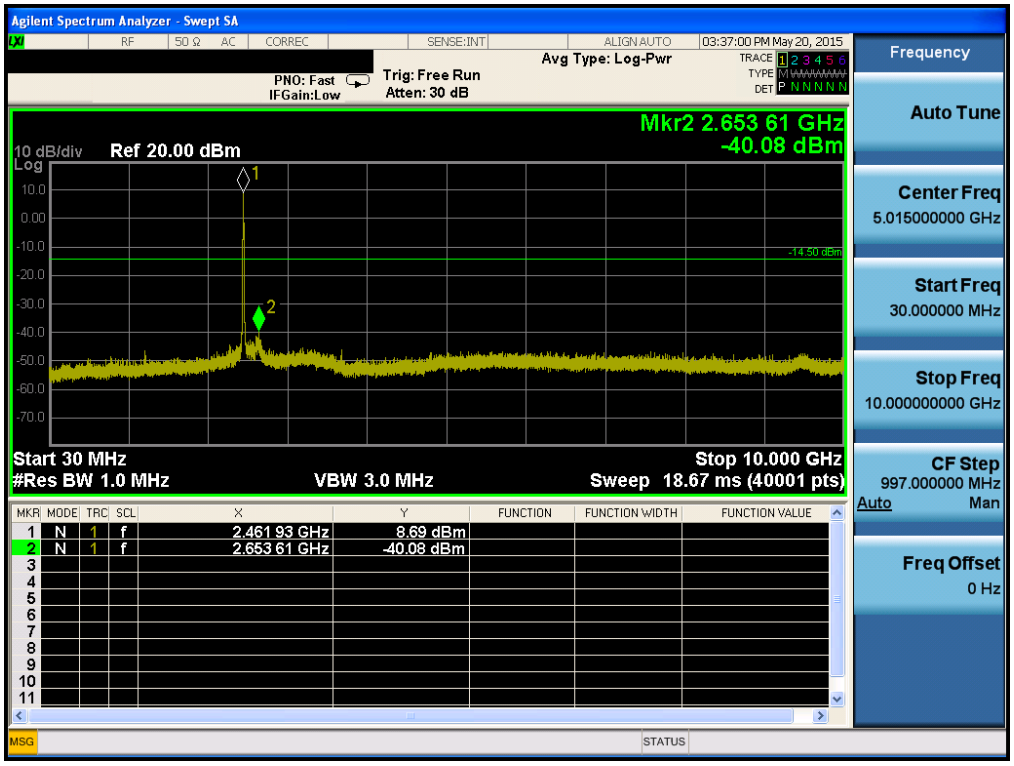


High Band-edge

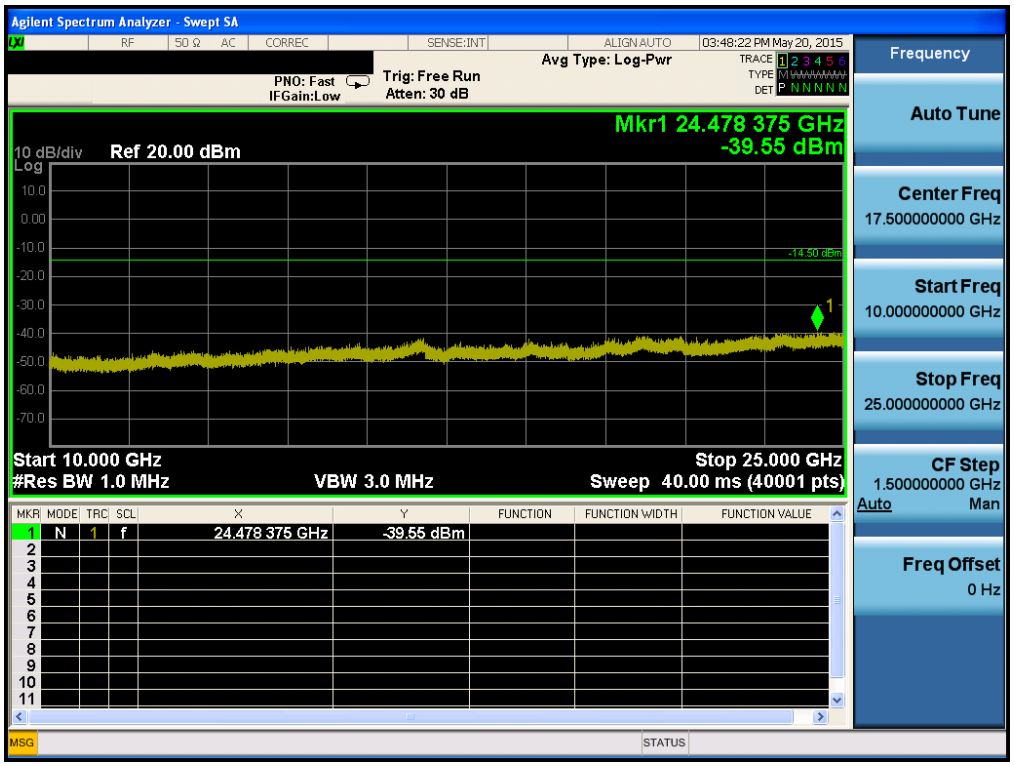


Conducted Spurious Emissions



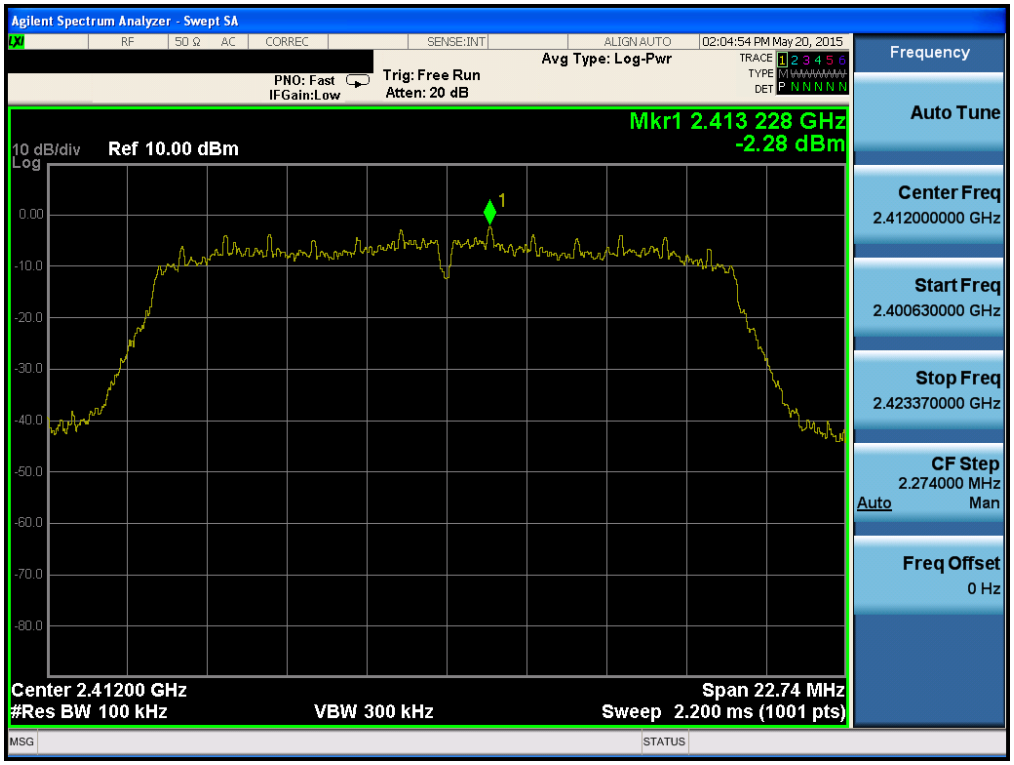


Conducted Spurious Emissions



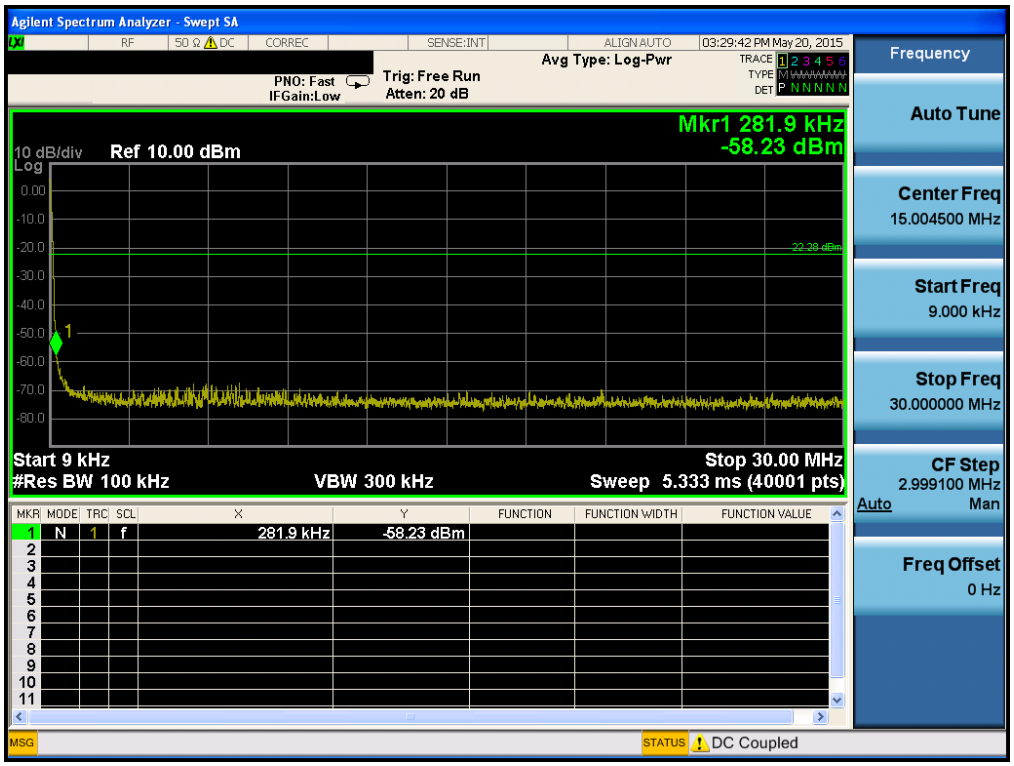
802.11g & 6 Mbps & 2412 MHz

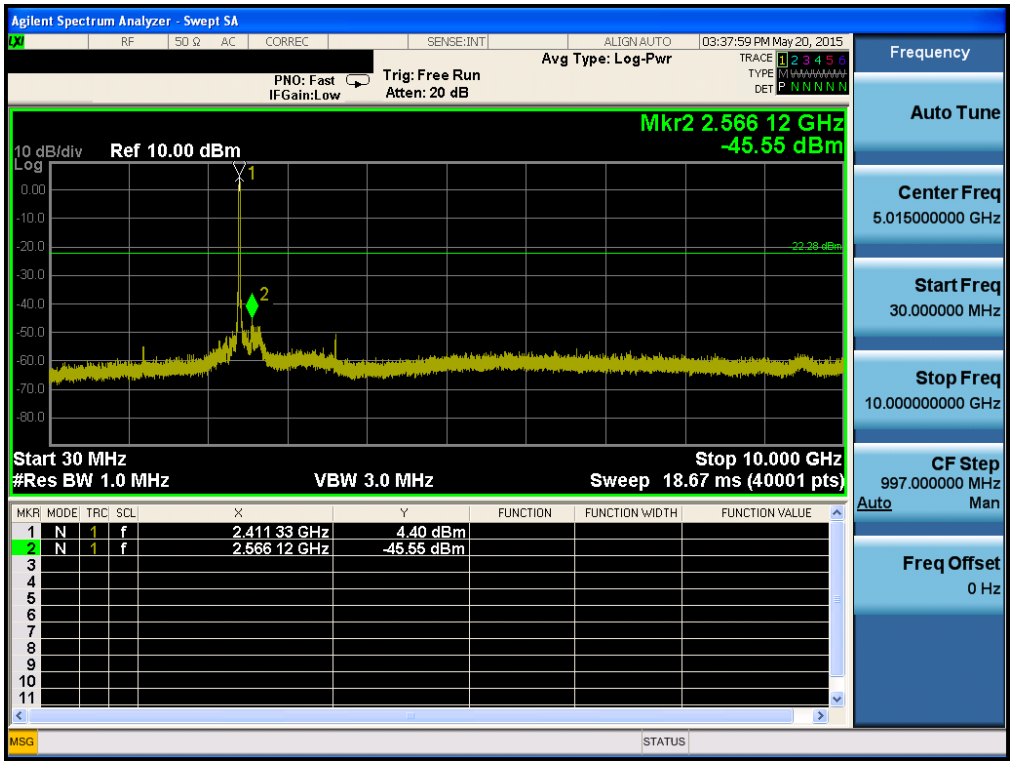
Reference



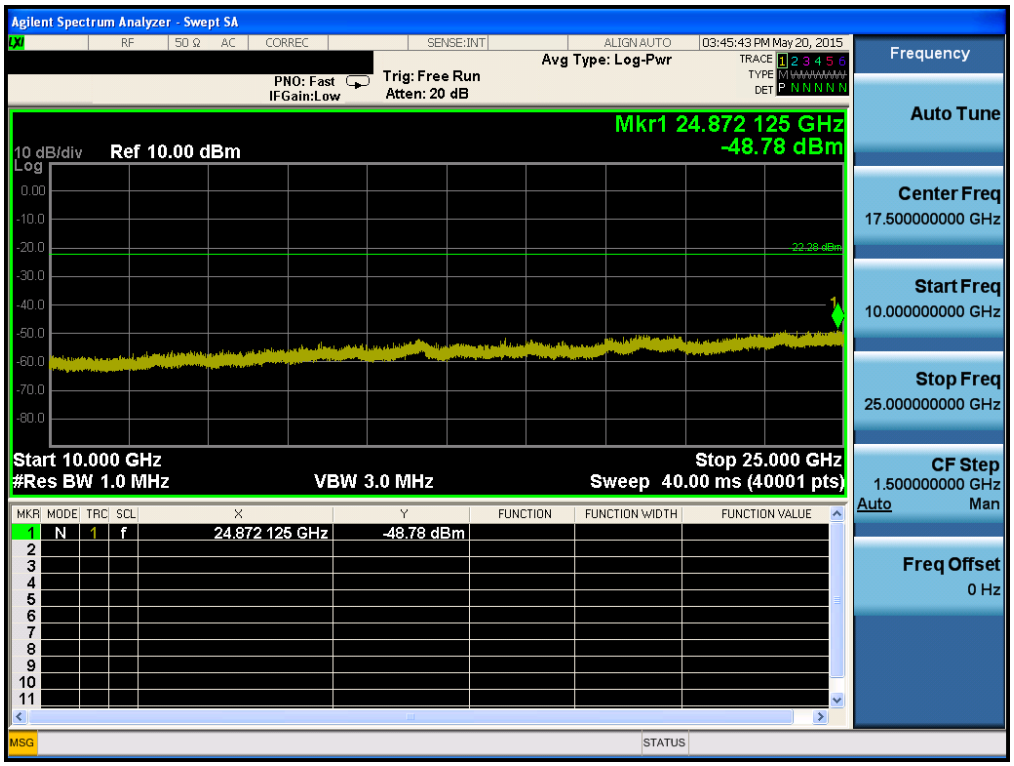
Low Band-edge

Conducted Spurious Emissions



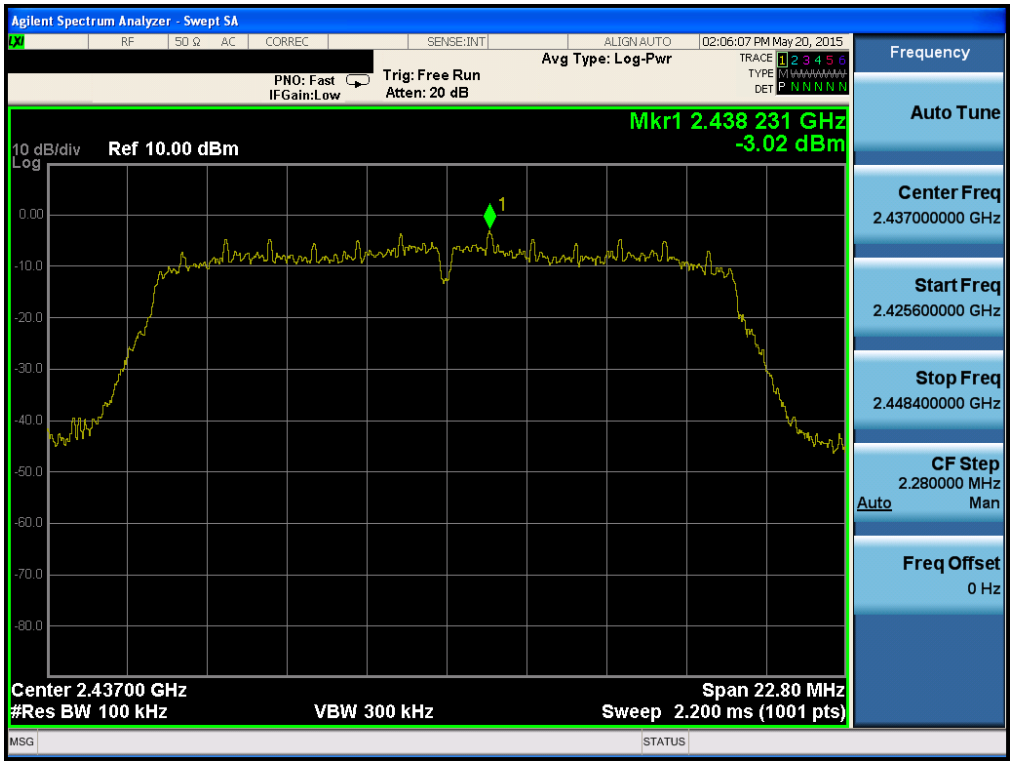


Conducted Spurious Emissions

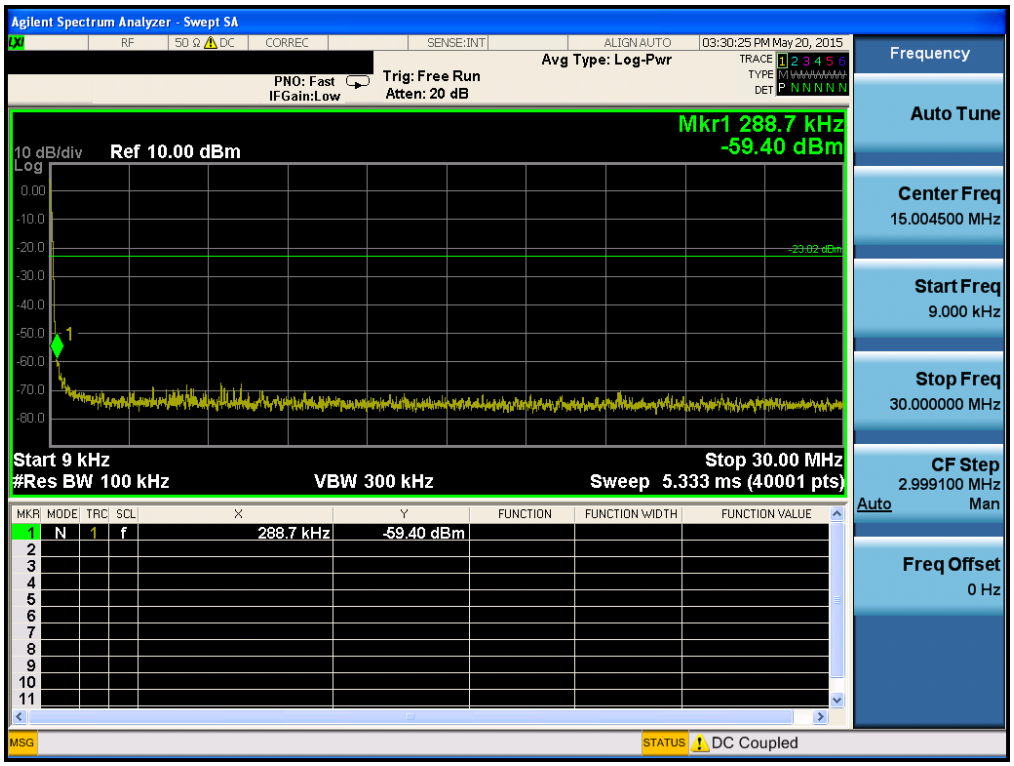


802.11g & 6 Mbps & 2437 MHz

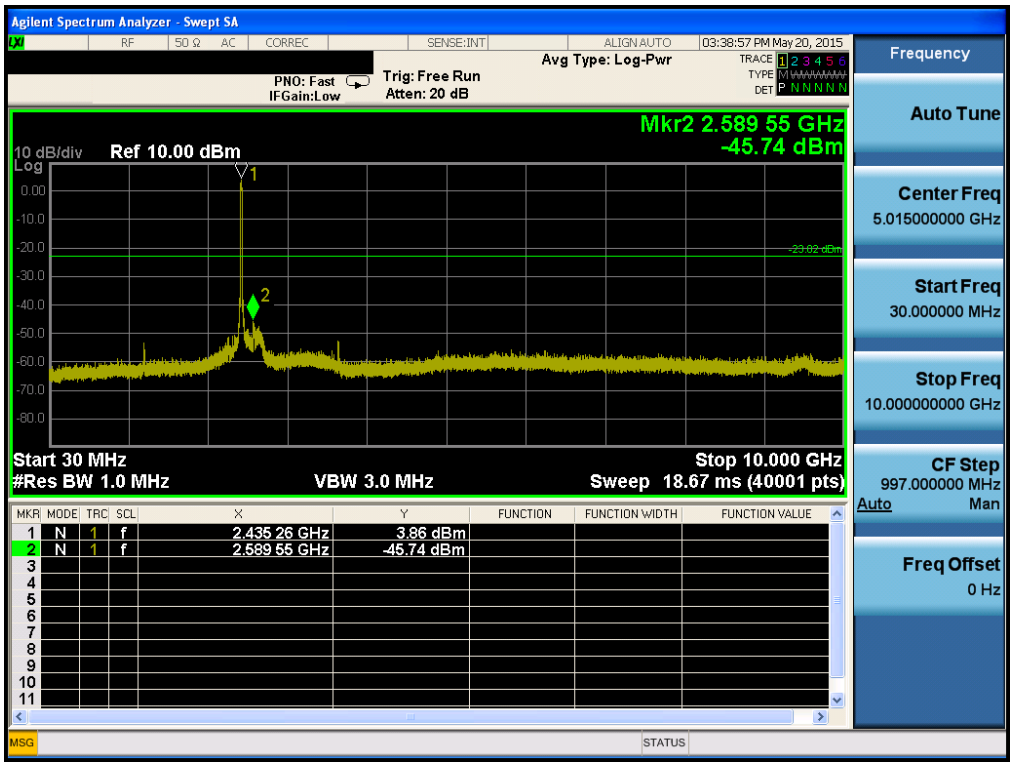
Reference

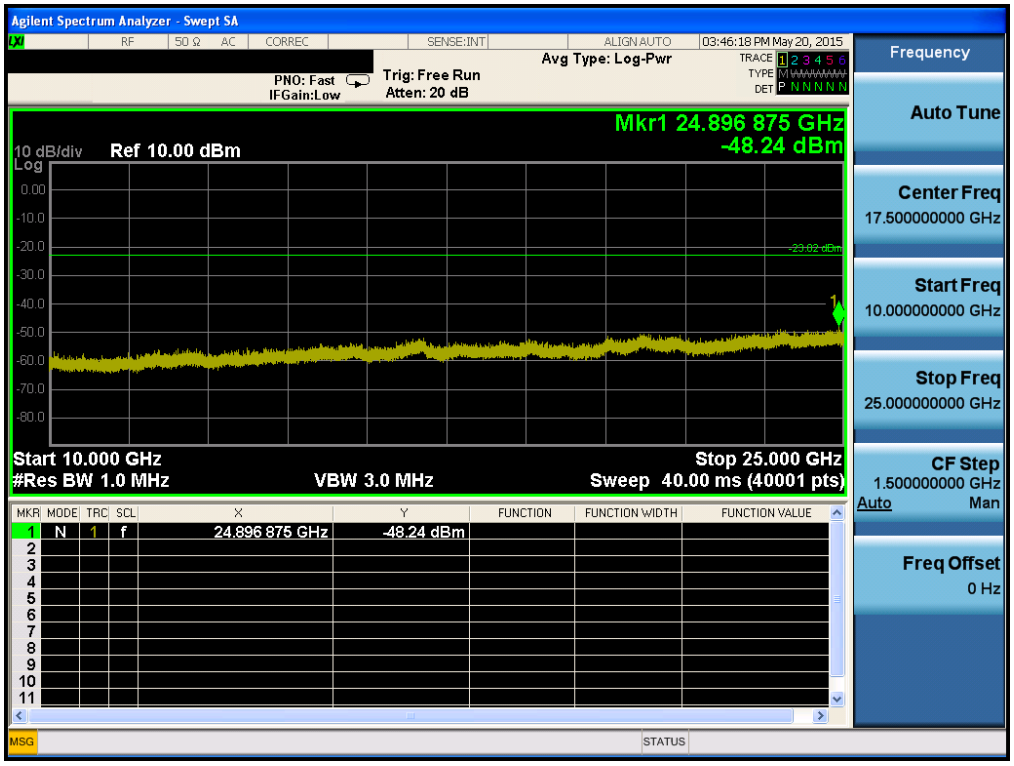


Conducted Spurious Emissions



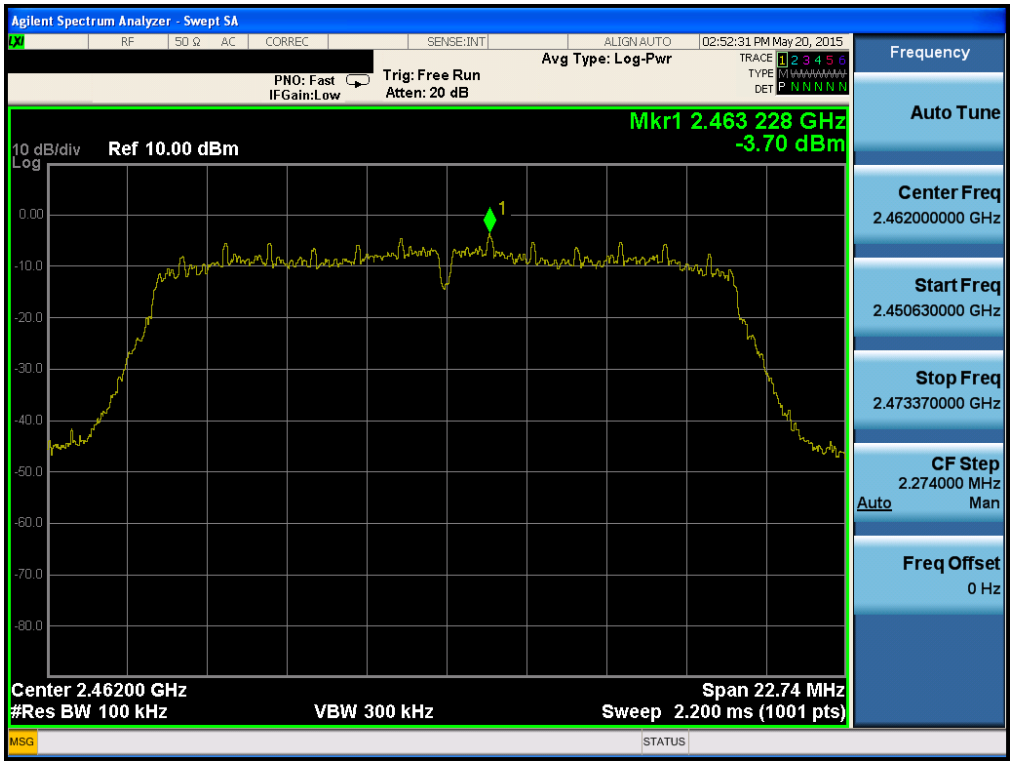
Conducted Spurious Emissions





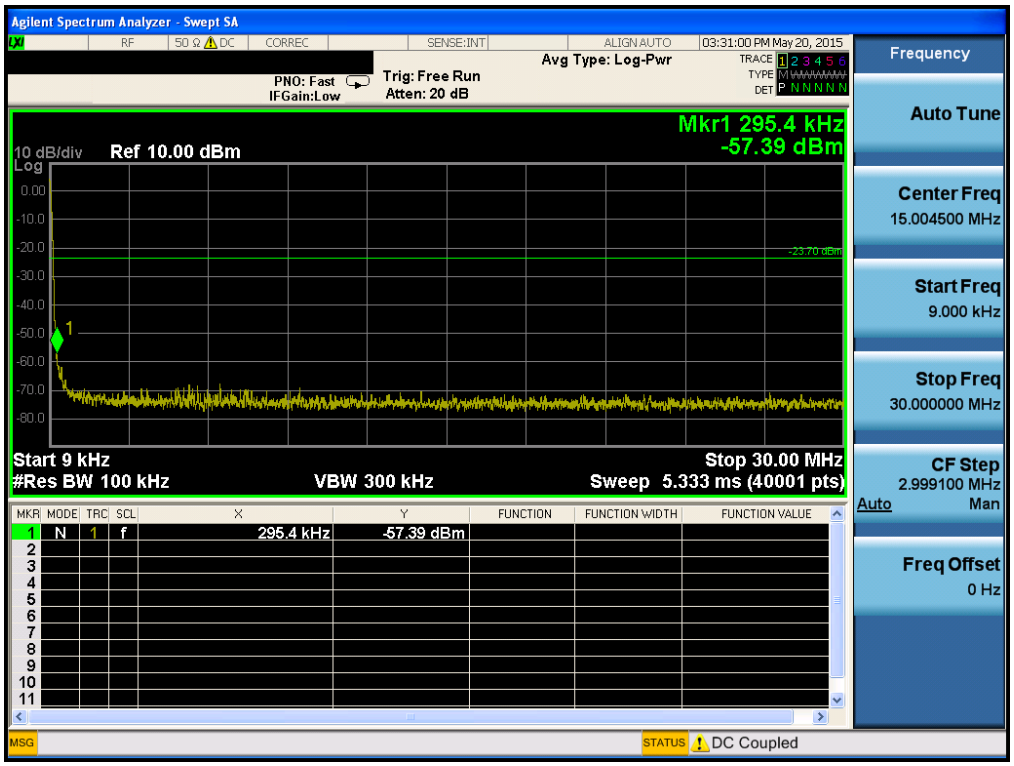
802.11g & 6 Mbps & 2462 MHz

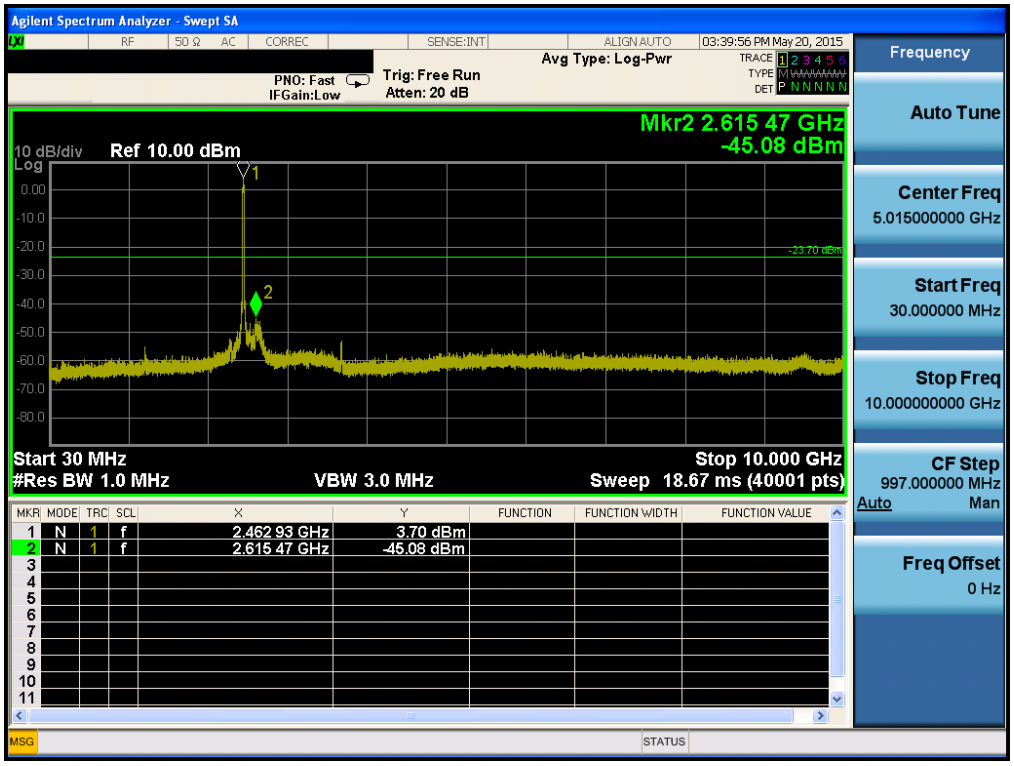
Reference



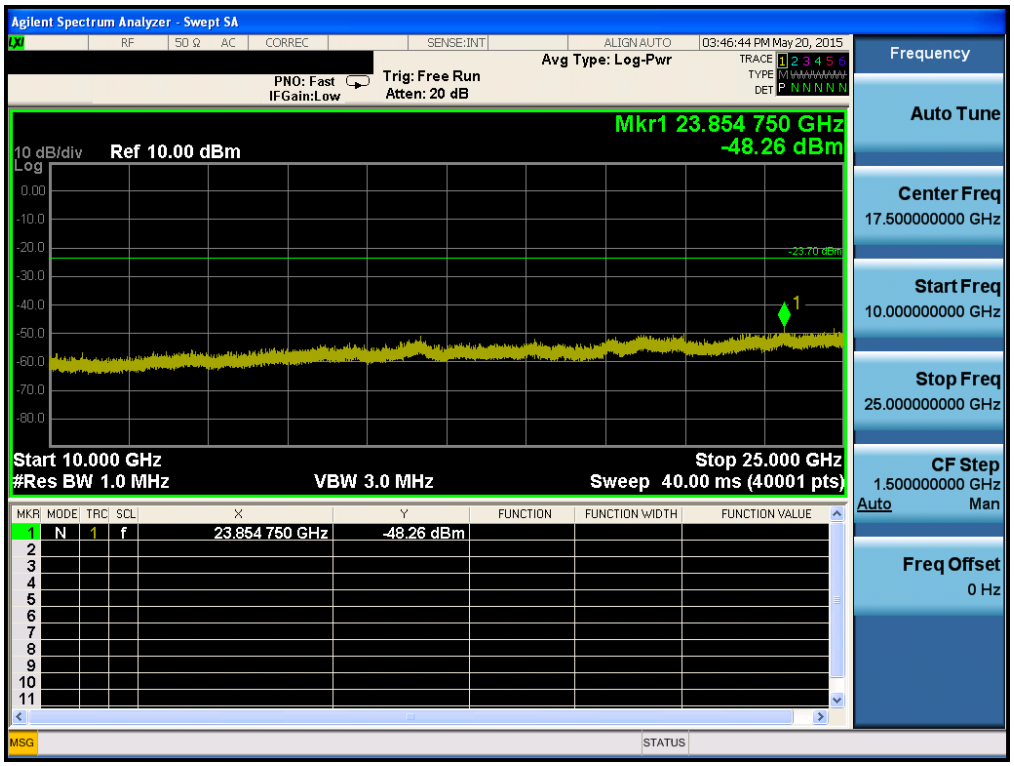
High Band-edge

Conducted Spurious Emissions



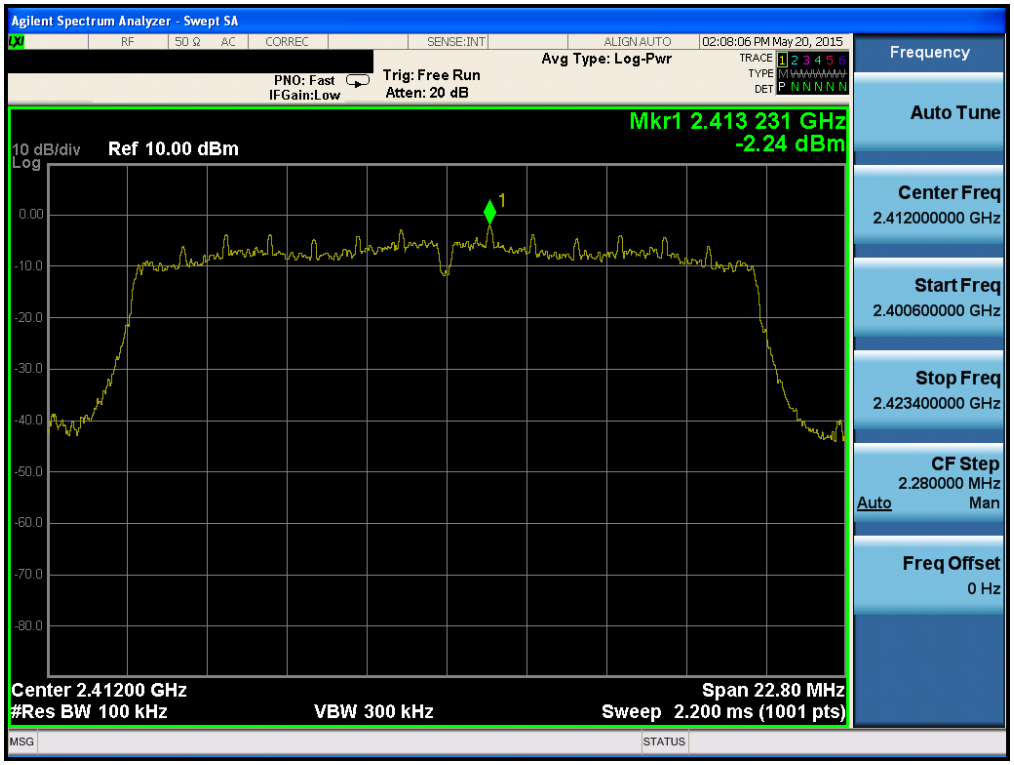


Conducted Spurious Emissions

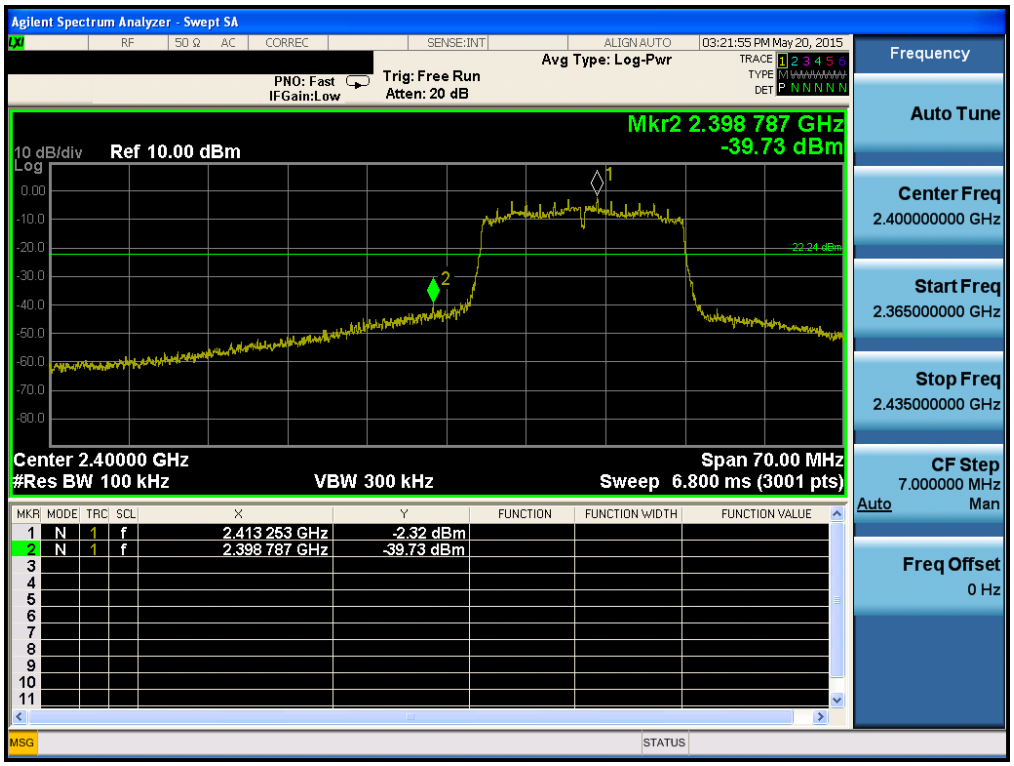


802.11n(HT20) & MCS 0 & 2412 MHz

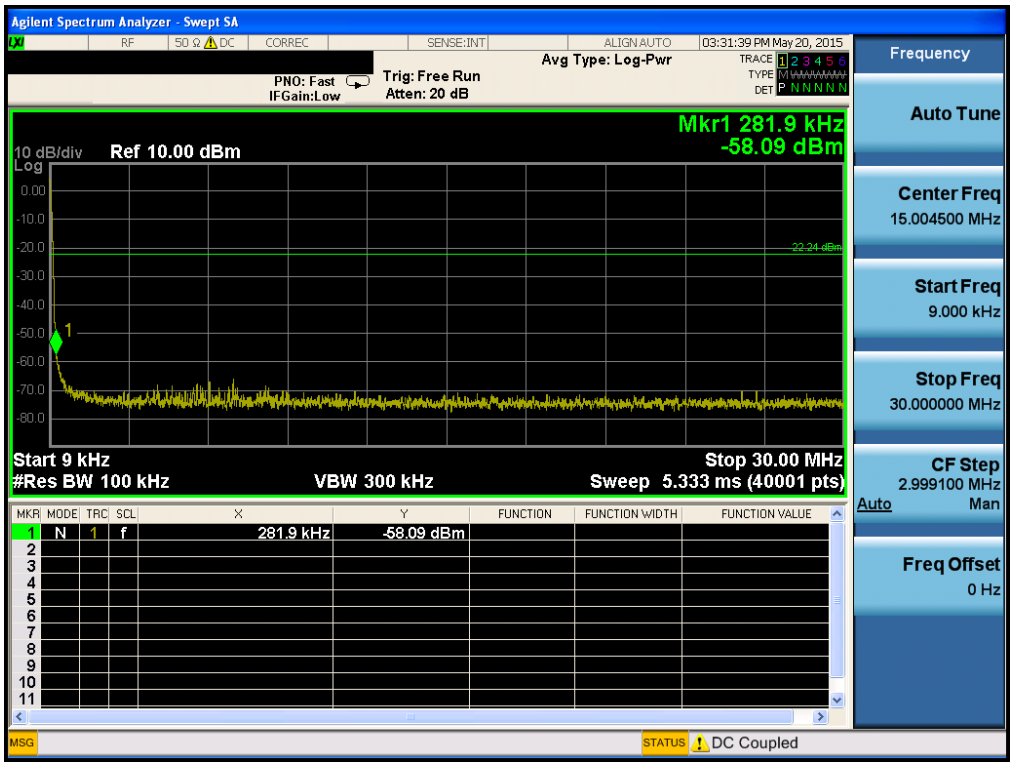
Reference

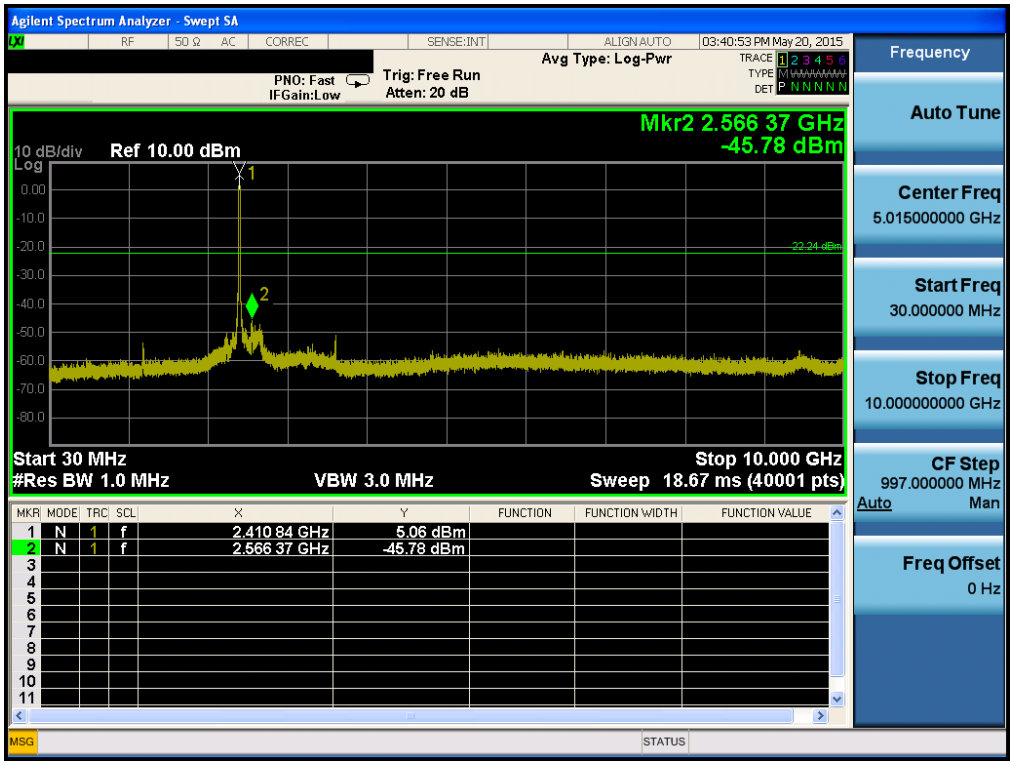


Low Band-edge

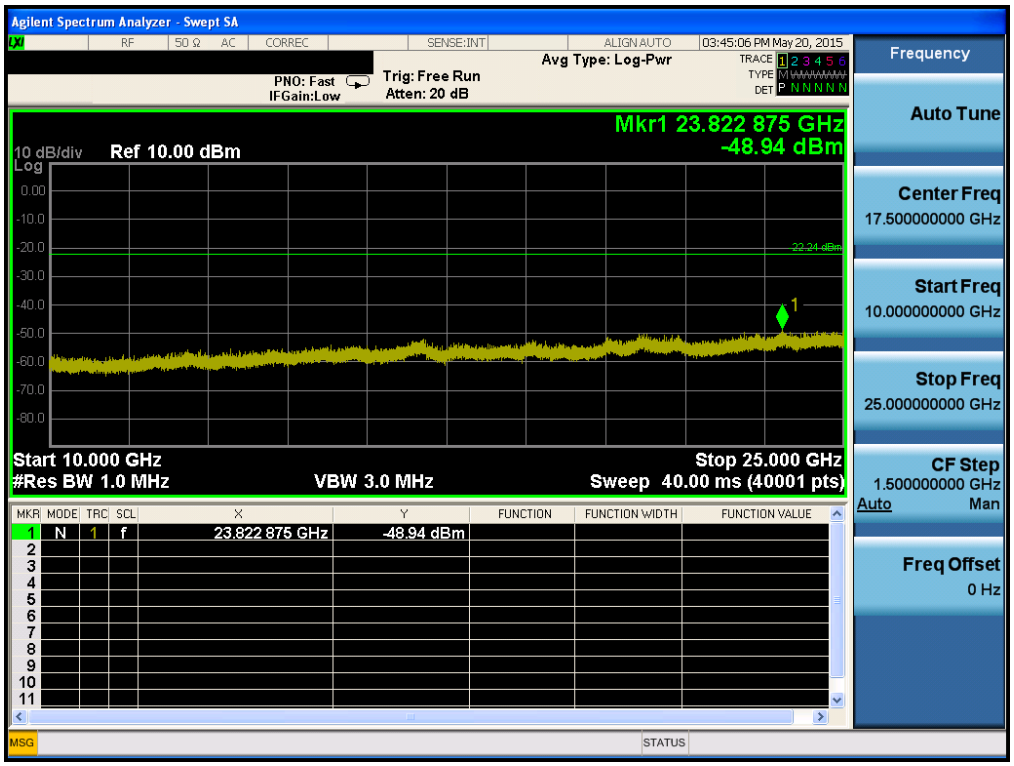


Conducted Spurious Emissions



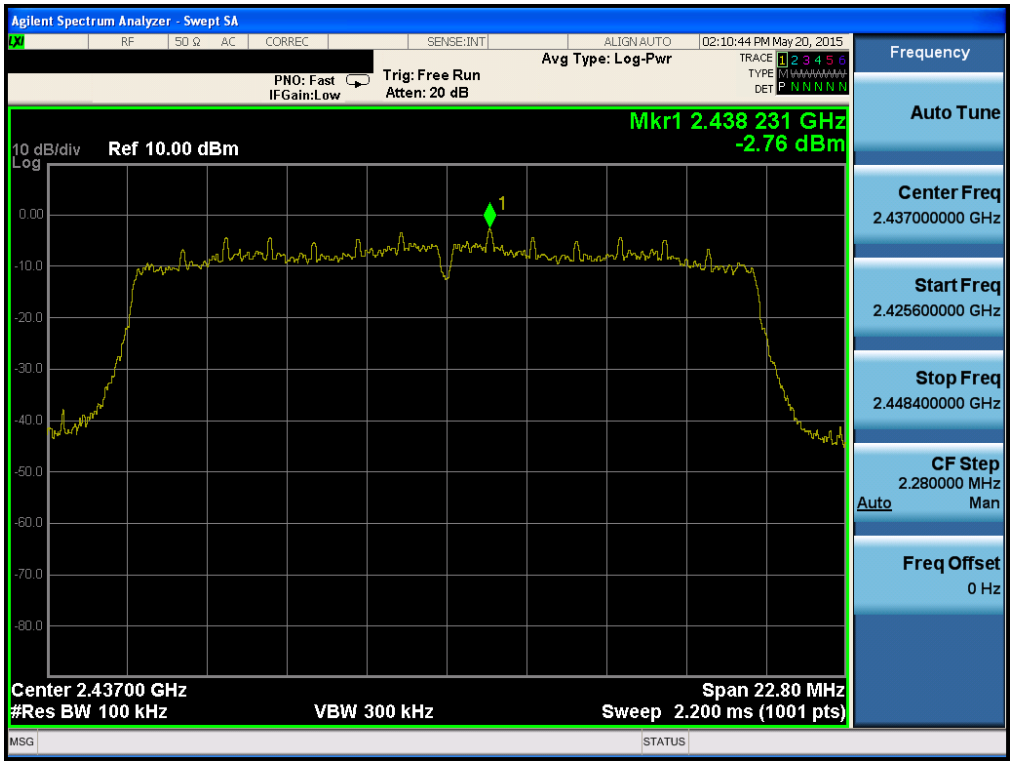


Conducted Spurious Emissions



802.11n(HT20) & MCS 0 & 2437 MHz

Reference



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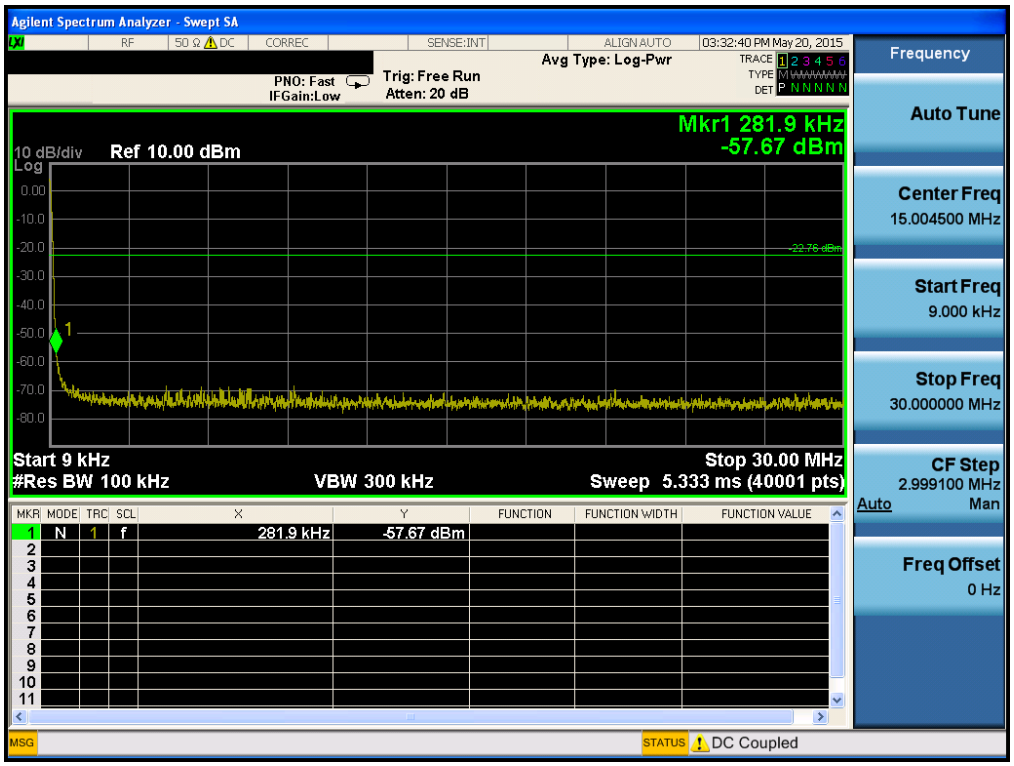
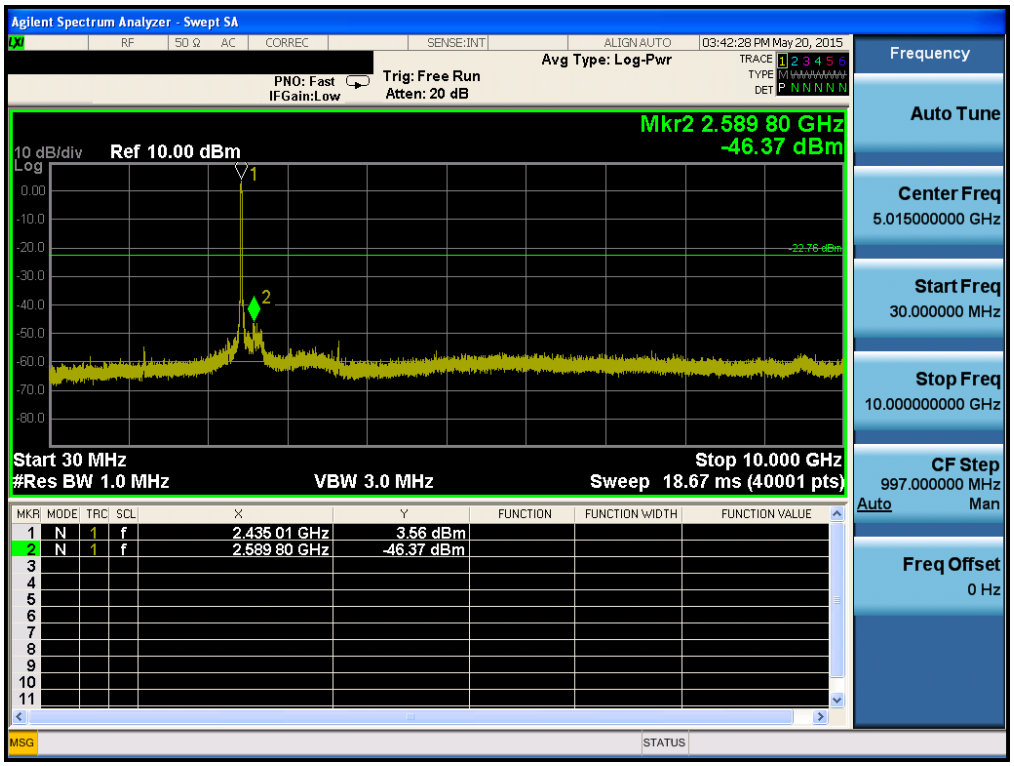
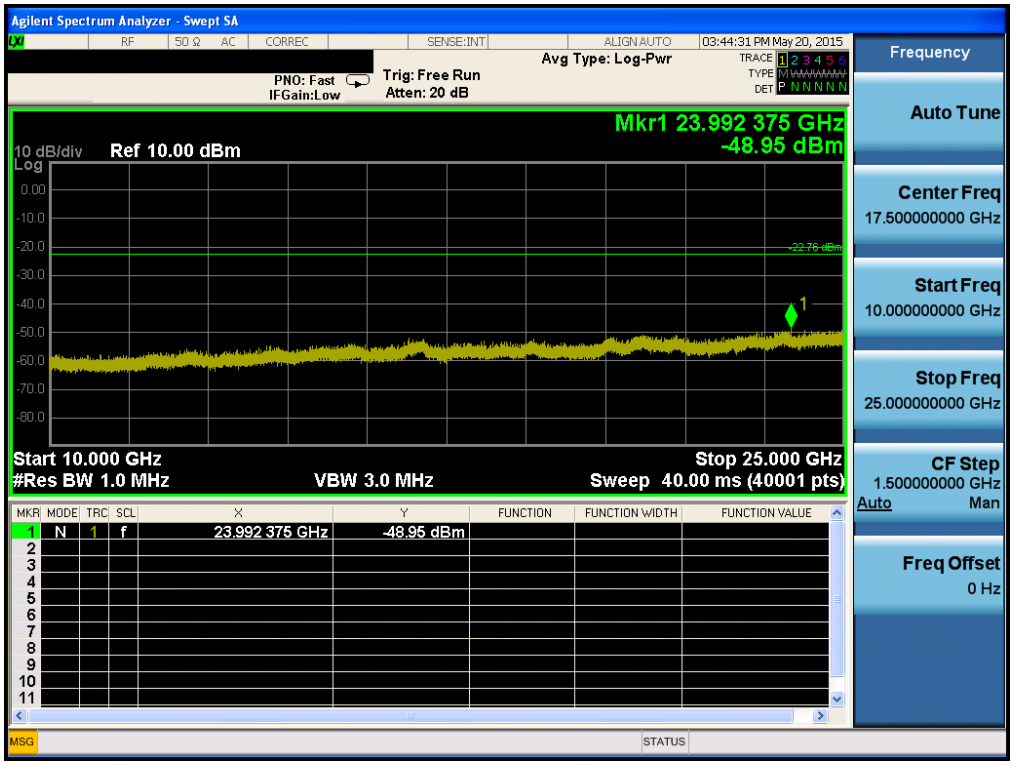


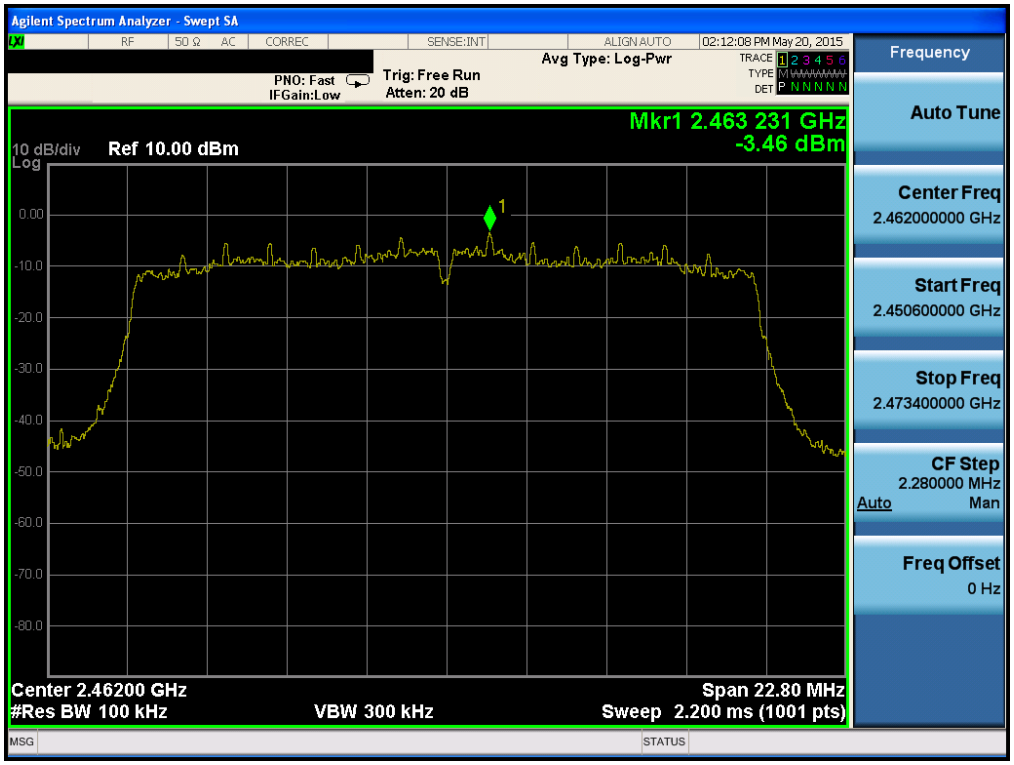
Conducted Spurious Emissions



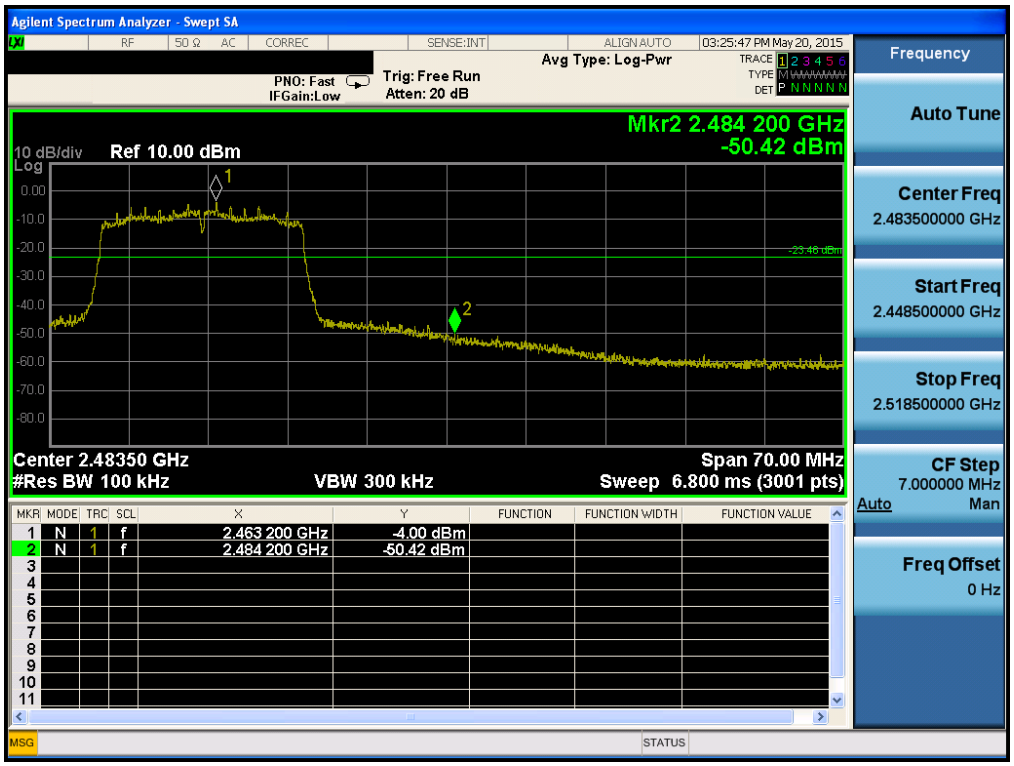


802.11n(HT20) & MCS 0 & 2462 MHz

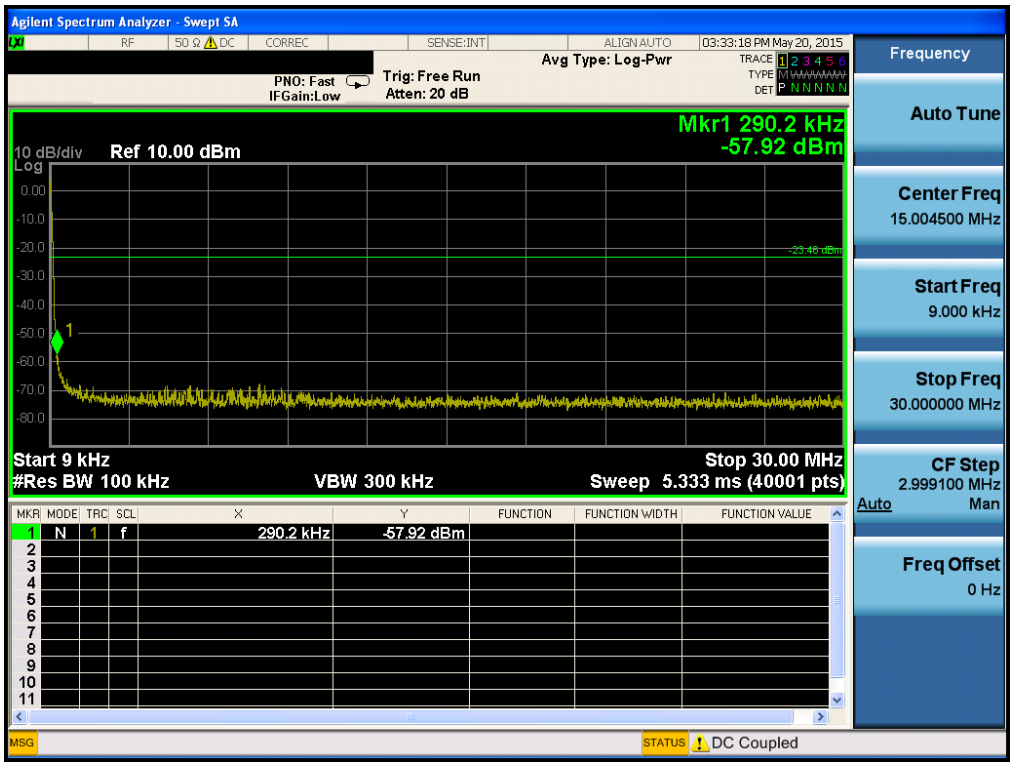
Reference

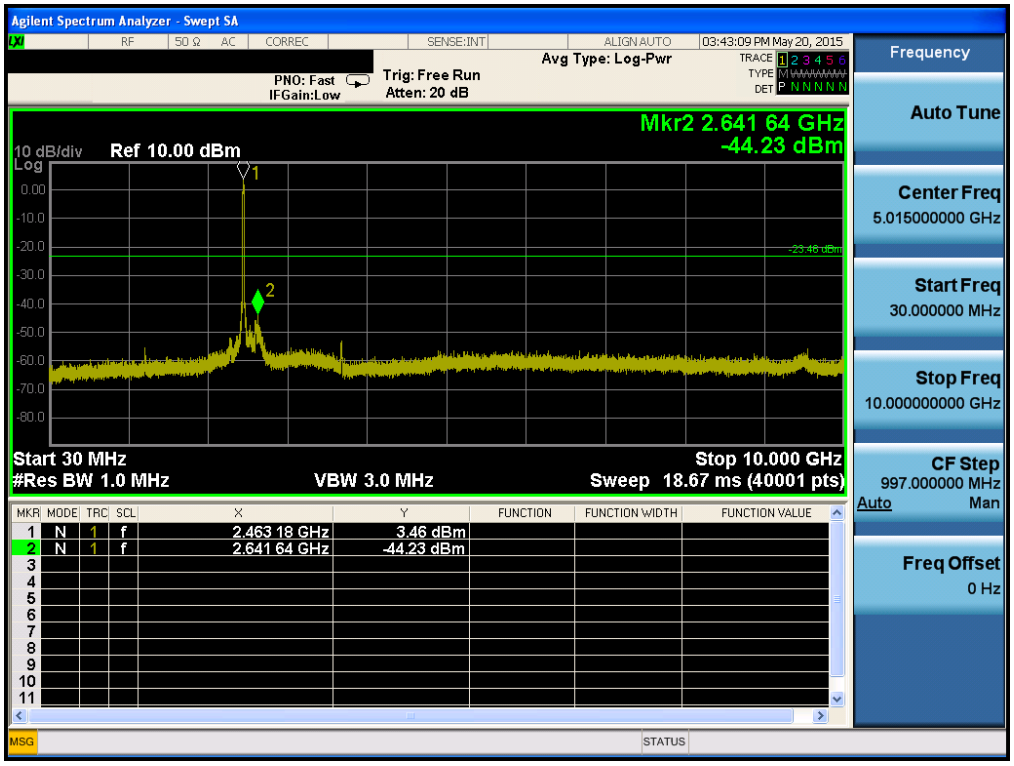


High Band-edge

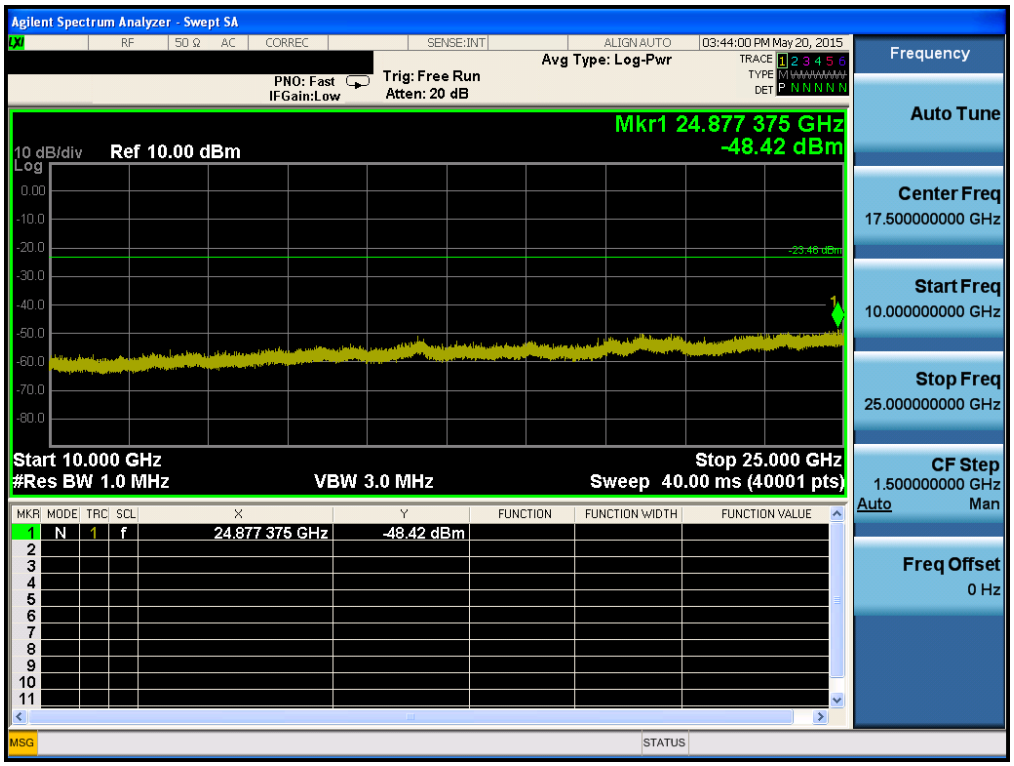


Conducted Spurious Emissions





Conducted Spurious Emissions



8.5 Radiated Spurious Emissions

Test Requirements and limit,

§15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
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

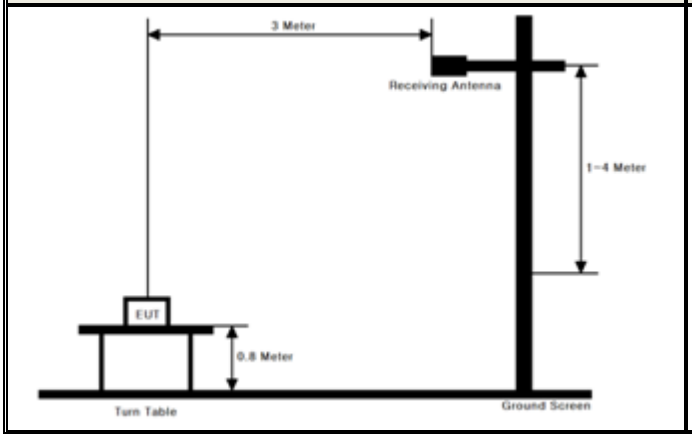
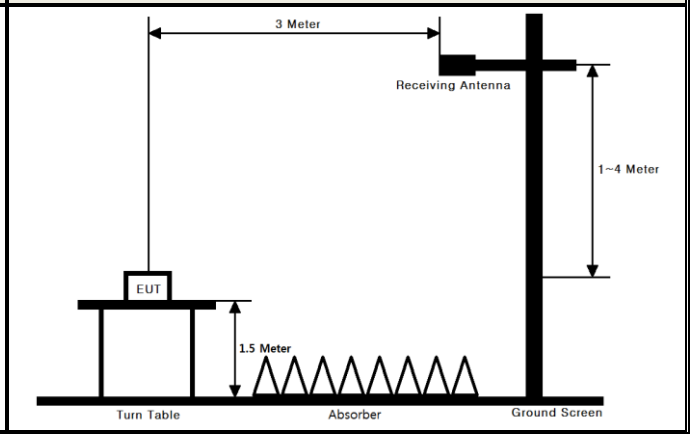
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4400		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

Test Configuration

Below 1GHz	Above 1GHz
	

▣ Test Procedure

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turn table shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

▣ Measurement Instrument Setting for Radiated Emission Measurements.

The radiated emission was tested according to the section 6.3 6.4, 6.5 and 6.6 of the ANSI C63.10-2009 with following settings.

Peak Measurement :

RBW = As specified in below table , VBW ≥ 3 x RBW, Sweep = Auto, Detector = Peak, Trace mode = Max Hold until the trace stabilizes.

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

Average Measurement :

1.RBW = 1 MHz (unless otherwise specified).

2. VBW ≥ 3 x RBW.

3. Detector = RMS (Number of points ≥ 2 x Span / RBW)

4. Averaging type = power (i.e., RMS).

5. Sweep time = auto.

6. Perform a trace average of at least 100 traces.

7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Duty Cycle Corrections (Refer to appendix II for duty cycle measurement procedure and plots)

Band	Duty Cycle (%)	T_{on} (ms)	T_{on}+ T_{off} (ms)	DCF = 10log(1/Duty) (dB)
802.11b	99.68	8.608	8.636	-
802.11g	96.42	1.428	1.481	0.16
802.11n(HT20)	97.66	1.336	1.368	0.10

9 kHz ~ 25 GHz Data(*802.11b & 1 Mbps*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2386.32	X	V	PK	57.83	1.28	N/A	N/A	59.11	74.00	14.89
2385.92	X	V	AV	48.20	1.28	N/A	N/A	49.48	54.00	4.52
4824.64	X	V	PK	45.22	7.49	N/A	N/A	52.71	74.00	21.29
4823.04	X	V	AV	34.22	7.49	N/A	N/A	41.71	54.00	12.29
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.31	X	V	PK	44.88	7.51	N/A	N/A	52.39	74.00	21.61
4873.93	X	V	AV	33.67	7.51	N/A	N/A	41.18	54.00	12.82
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2488.38	X	V	PK	58.95	1.70	N/A	N/A	60.65	74.00	13.35
2488.14	X	V	AV	47.98	1.70	N/A	N/A	49.68	54.00	4.32
4923.29	X	V	PK	45.29	7.52	N/A	N/A	52.81	74.00	21.19
4923.26	X	V	AV	33.76	7.52	N/A	N/A	41.28	54.00	12.72
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor : - 9.54dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
DCF = Duty Cycle Correction Factor.

9 kHz ~ 25 GHz Data(*802.11g & 6 Mbps*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.60	X	H	PK	59.81	1.28	N/A	N/A	61.09	74.00	12.91
2389.76	X	H	AV	48.74	1.28	0.16	N/A	50.18	54.00	3.82
4824.44	X	H	PK	45.31	7.49	N/A	N/A	52.80	74.00	21.20
4824.49	X	H	AV	33.65	7.49	0.16	N/A	41.30	54.00	12.70
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.26	X	H	PK	44.80	7.51	N/A	N/A	52.31	74.00	21.69
4873.22	X	H	AV	33.60	7.51	0.16	N/A	41.27	54.00	12.73
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.88	X	H	PK	60.40	1.70	N/A	N/A	62.10	74.00	11.90
2483.58	X	H	AV	48.47	1.70	0.16	N/A	50.33	54.00	3.67
4924.62	X	H	PK	45.43	7.52	N/A	N/A	52.95	74.00	21.05
4923.93	X	H	AV	33.90	7.52	0.16	N/A	41.58	54.00	12.42
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor : - 9.54dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
DCF = Duty Cycle Correction Factor.

9 kHz ~ 25 GHz Data(*802.11n HT20 & MCS 0*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.76	X	H	PK	58.90	1.28	N/A	N/A	60.18	74.00	13.82
2389.84	X	H	AV	47.53	1.28	0.10	N/A	48.91	54.00	5.09
4823.91	X	H	PK	44.92	7.49	N/A	N/A	52.41	74.00	21.59
4823.61	X	H	AV	33.63	7.49	0.10	N/A	41.22	54.00	12.78
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4873.81	X	H	PK	44.75	7.51	N/A	N/A	52.26	74.00	21.74
4873.54	X	H	AV	33.71	7.51	0.10	N/A	41.32	54.00	12.68
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.68	X	H	PK	60.09	1.70	N/A	N/A	61.79	74.00	12.21
2483.57	X	H	AV	48.01	1.70	0.10	N/A	49.81	54.00	4.19
4923.65	X	H	PK	44.76	7.52	N/A	N/A	52.28	74.00	21.72
4923.42	X	H	AV	33.69	7.52	0.10	N/A	41.31	54.00	12.69
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor : - 9.54dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
DCF = Duty Cycle Correction Factor.

8.6 Power-line conducted emissions

Test Requirements and limit, §15.207

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

▣ TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to the test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

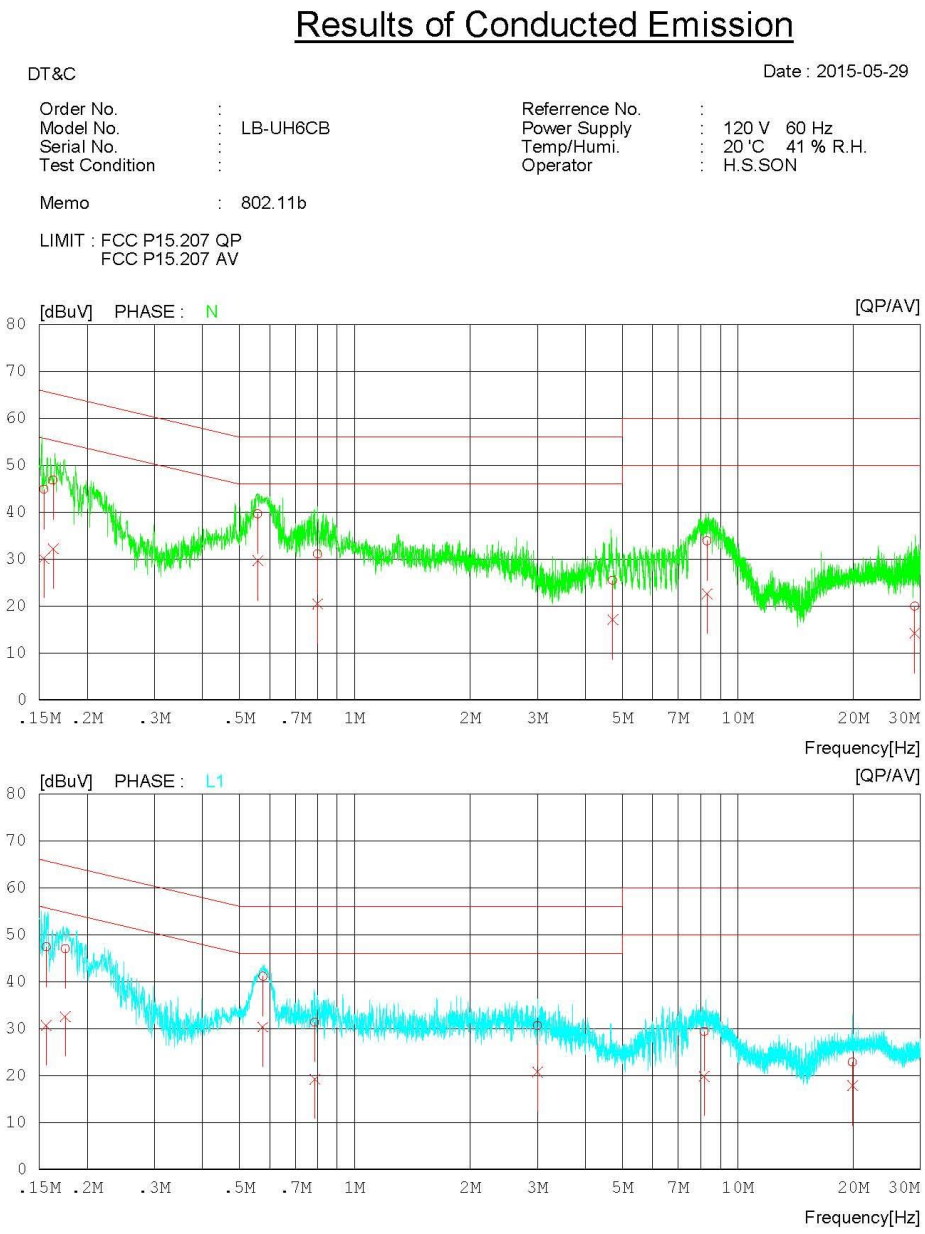
▣ Test Results: Comply(Refer to next page.)

The worst data was reported.

▣ RESULT PLOTS

AC Line Conducted Emissions (Graph)

Test Mode: 802.11b & 1 Mbps & 2437 MHz



AC Line Conducted Emissions (List)

Test Mode: 802.11b & 1 Mbps & 2437 MHz

Results of Conducted Emission

DT&C

Date : 2015-05-29

Order No.	:		Referrence No.	:	
Model No.	:	LB-UH6CB	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	20 'C 41 % R.H.
Test Condition	:		Operator	:	H.S.SON

Memo : 802.11b

LIMIT : FCC P15.207 QP
FCC P15.207 AV

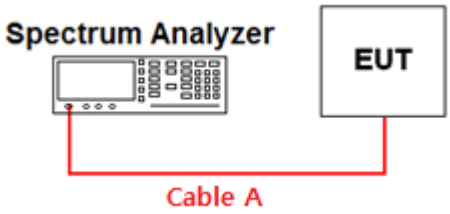
NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15435	42.9	28.2	1.9	44.8	30.1	65.8	55.8	21.0	25.7	N
2	0.16309	45.0	30.4	1.8	46.8	32.2	65.3	55.3	18.5	23.1	N
3	0.55860	38.9	28.9	0.7	39.6	29.6	56.0	46.0	16.4	16.4	N
4	0.80012	30.4	19.9	0.6	31.0	20.5	56.0	46.0	25.0	25.5	N
5	4.71780	25.0	16.5	0.5	25.5	17.0	56.0	46.0	30.5	29.0	N
6	8.32740	33.4	22.0	0.5	33.9	22.5	60.0	50.0	26.1	27.5	N
7	28.99860	19.3	13.6	0.6	19.9	14.2	60.0	50.0	40.1	35.8	N
8	0.15643	45.4	28.7	1.9	47.3	30.6	65.7	55.7	18.4	25.1	L1
9	0.17530	45.2	30.8	1.7	46.9	32.5	64.7	54.7	17.8	22.2	L1
10	0.57540	40.3	29.6	0.7	41.0	30.3	56.0	46.0	15.0	15.7	L1
11	0.78704	30.7	18.6	0.6	31.3	19.2	56.0	46.0	24.7	26.8	L1
12	3.00080	30.0	20.2	0.5	30.5	20.7	56.0	46.0	25.5	25.3	L1
13	8.16820	28.9	19.3	0.5	29.4	19.8	60.0	50.0	30.6	30.2	L1
14	19.95400	22.2	17.2	0.6	22.8	17.8	60.0	50.0	37.2	32.2	L1

9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	N9020A	14/09/03	15/09/03	MY46471622
DIGITAL MULTIMETER	Agilent	34401A	15/01/06	16/01/06	US36099541
DC Power Supply	SM techno	SDP30-5D	15/01/06	16/01/06	305DLJ204
Vector Signal Generator	Rohde Schwarz	SMBV100A	15/01/06	16/01/06	255571
Signal Generator	Rohde Schwarz	SMF100A	14/07/01	15/07/01	102341
			15/06/29	16/06/29	
10dB Attenuator	Aeroflex/Weinschel	86-10-11	14/09/12	15/09/12	446
Thermohygrometer	BODYCOM	BJ5478	15/05/08	16/05/08	120612-2
PreAmplifier	Agilent	8449B	15/02/26	16/02/26	3008A00370
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
Double-Ridged Guide Antenna	ETS	3117	14/05/12	16/05/12	140394
Horn Antenna	A.H.Systems	SAS-574	15/04/30	17/04/30	2015.01.07
TRILOG Broadband Test-Antenna(30MHz-1GHz)	Schwarzbeck	VULB 9160	14/04/30	16/04/30	3358
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	15/04/09	16/04/09	1844538
EMI TEST RECEIVER	R&S	ESR7	14/10/21	15/10/21	101109
High-pass filter	Wainwright Instruments	WHKX3.0	15/01/06	16/01/06	12
EMI TEST RECEIVER	R&S	ESCI	15/02/25	16/02/25	100364
SINGLE-PHASE MASTER	NF	4420	14/09/11	15/09/11	3049354420023
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	14/06/26	15/06/26	000WX20305
			15/06/26	16/06/26	
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	15/03/26	16/03/26	1306007 1249001

APPENDIX I
Conducted Test set up Diagram &Path loss Information

- **Conducted Measurement**



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.51	15	1.68
1	0.78	20	1.75
2412 & 2437 & 2462	0.94	25	2.34
5	1.08	-	-
10	1.42	-	-

Note. 1: The path loss from EUT to Spectrum analyzer was measured and used for test.
Path loss (= S/A's offset value) = Cable A (Attenuator, Applied only when it was used externally)

APPENDIX II
Duty cycle plots

▣ **TEST PROCEDURE**

Duty Cycle measured using **section 6.0 b) of KDB558074 D01 v03r2 :**

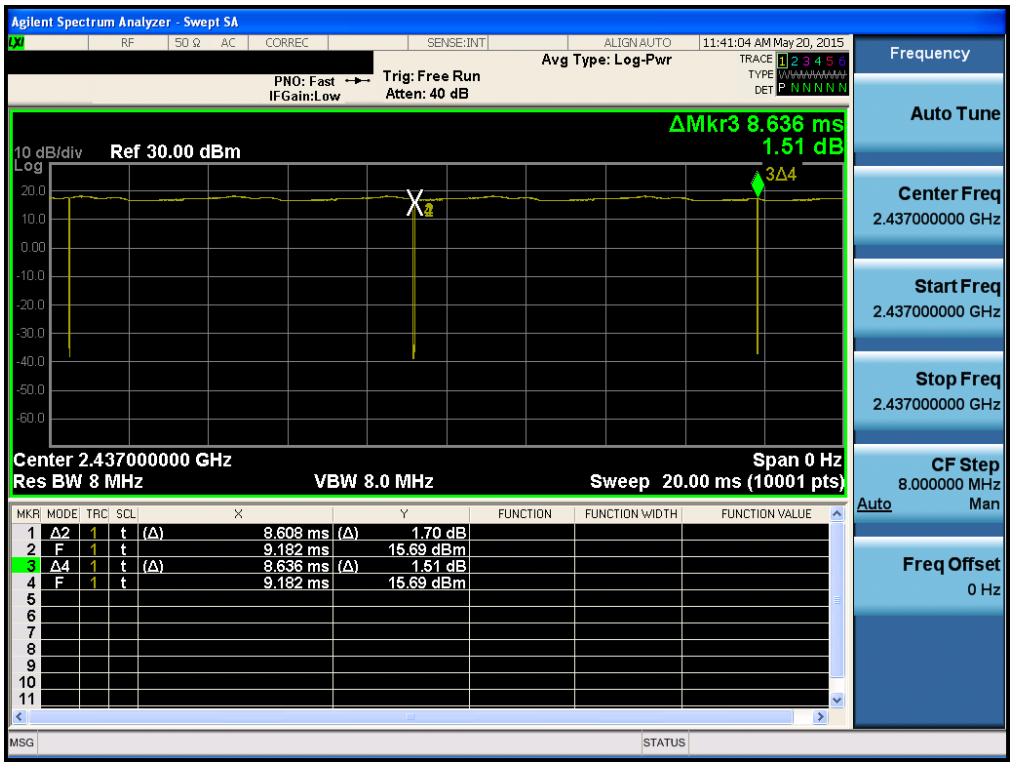
The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average.

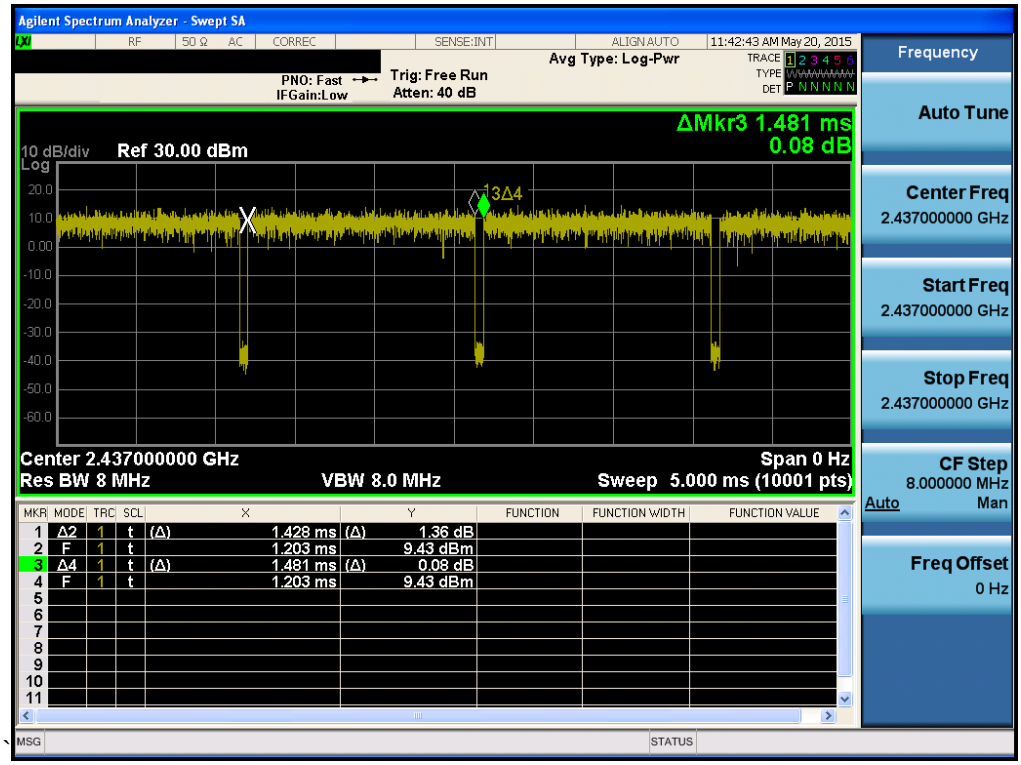
The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

Test Plots :

Duty Cycle Test Mode: 802.11b & 1 Mbps & 2437 MHz



Duty Cycle Test Mode: 802.11g & 6 Mbps & 2437 MHz



Duty Cycle Test Mode: 802.11n(HT20) & MCS 0 & 2437 MHz