RF TEST REPORT

Test item	:	DIGITAL CAR AVN SYSTEM
Model No.	:	ATB30E4AN
Order No.	:	DEMC1401-00087
Date of receipt	:	2014-01-09
Test duration	:	2014-01-14~ 2014-01-27
Date of issue	:	2014-02-07
Use of report	:	FCC Original Grant

Applicant : Hyundai Mobis Co., Ltd.
203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977

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

Test specification	:	FCC Part 15 Subpart C 247 KDB558074 v03r01
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
HyunSu Son

Reviewed by:

Deputy General Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1402-0153	Feb. 07, 2014	Initial issue

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1. GENERAL INFORMATION

Applicant	:	Hyundai Mobis Co., Ltd.
Address	:	203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977
FCC ID	:	TQ8-ATB30E4AN
EUT	:	DIGITAL CAR AVN SYSTEM
Model	:	ATB30E4AN
Additional Model(s)	:	N/A
Data ofTest	:	2014-01-14 ~ 2014-01-27
Contact person	:	Seung Hoon Choe

2. EUT DESCRIPTION

Product	DIGITAL CAR AVN SYSTEM
Model Name	ATB30E4AN
Power Supply	DC 14.4 V
Frequency Range	2.4GHz Band ▪ 802.11b/g/n(20MHz): 2412 MHz ~ 2462 MHz
Max. RF Output Power	2.4GHz Band ▪ 802.11b: 18.00 dBm ▪ 802.11g: 22.54 dBm ▪ 802.11n (HT20): 22.36 dBm
Modulation Type	802.11b: DSSS/CCK 802.11g/n: OFDM
Antenna Specification	Internal Antenna (1TX ,1RX) ▪ 2.4GHz Band Max. peak gain : 4.25 dBi

3. SUMMARY OF TESTS

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.247(a)	RSS-210 [A8.2]	6 dB Bandwidth	> 500 kHz	Conducted	**C**
15.247(b)	RSS-210 [A8.4]	Transmitter Output Power	< 1Watt		**C**
15.247(d)	RSS-210 [A8.5]	Out of Band Emissions / Band Edge	20dBc in any 100kHz BW		**C**
15.247(e)	RSS-210 [A8.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz		**C**
-	RSS Gen [4.6.1]	Occupied Bandwidth (99%)	RSS-Gen(4.6.1)		**NA**
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< FCC 15.209 limits	Radiated	**C**
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	< FCC 15.207 limits	AC Line Conducted	**NA** Note.2
15.203	-	Antenna Requirements	FCC 15.203	-	**C**

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

Note 2: This device is installed in a car. Therefore the power source is a battery of car.

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 v03r1. And ANSI C63.10-2009 was used for EUT setup 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 engineering 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

According to the requirements in Section 6.2 of ANSI C63.10, the EUT is placed on the turntable, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable 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 axes according to the requirements in Section 6.3 of ANSI C63.10.

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 38, 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 : 678747

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

According to FCC 47 CFR §15.203& RSS-Gen [7.1.2]:

“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 external antennas used a unique coupling to the intentional radiator.

Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 6dB Bandwidth

Test Requirements and limit, §15.247(a) & RSS-210 [A8.2]

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 v03r1**.

1. Set resolution bandwidth (RBW) = 100 KHz
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
   (RBW:100KHz/VBW:300KHz)
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.

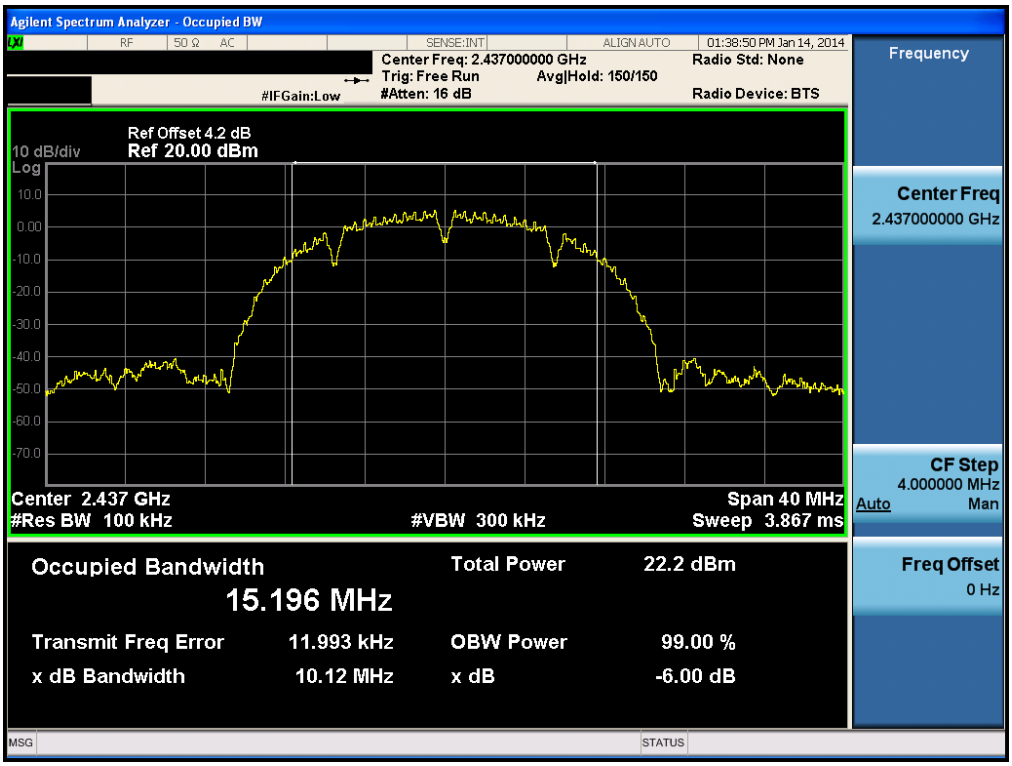
▣ TEST RESULTS: Comply

Test Mode	Data Rate	Frequency [MHz]	Test Results[MHz]
802.11b	**1Mbps**	2412	**10.120**
		2437	**10.120**
		2462	**10.120**
802.11g	**6Mbps**	2412	**16.360**
		2437	**16.360**
		2462	**16.360**
802.11n (20MHz)	**MCS0**	2412	**17.080**
		2437	**17.080**
		2462	**17.080**

▣ RESULT PLOTS

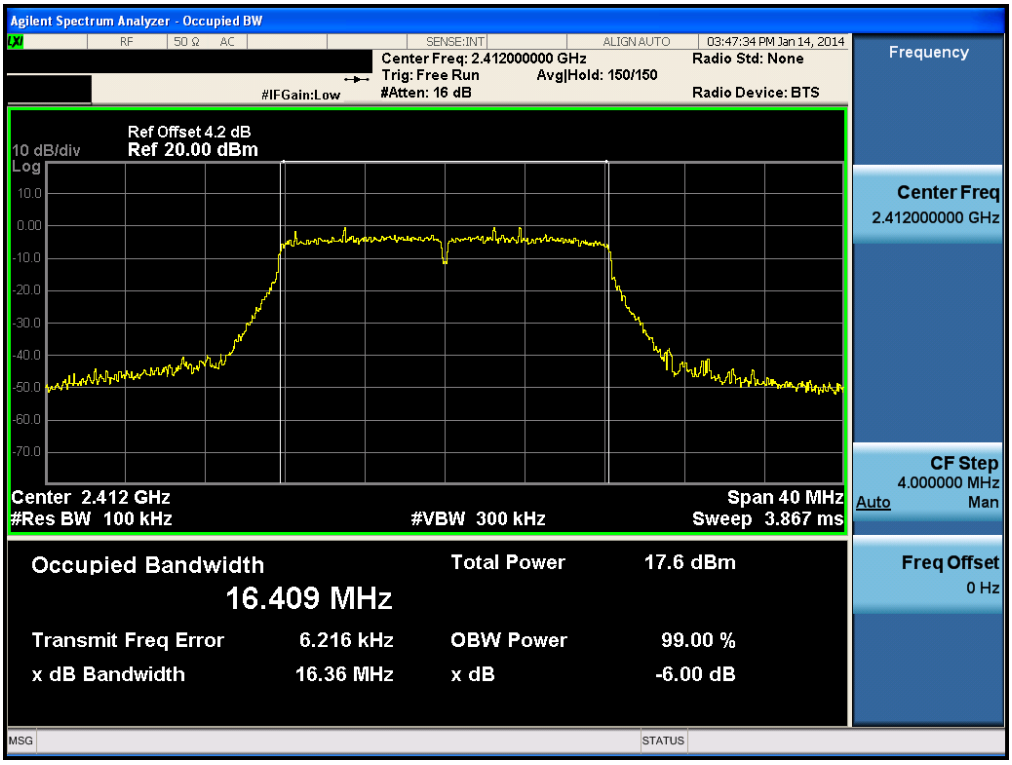
6 dB Bandwidth Test Mode: 802.11b & 1Mbps & 2412MHz

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

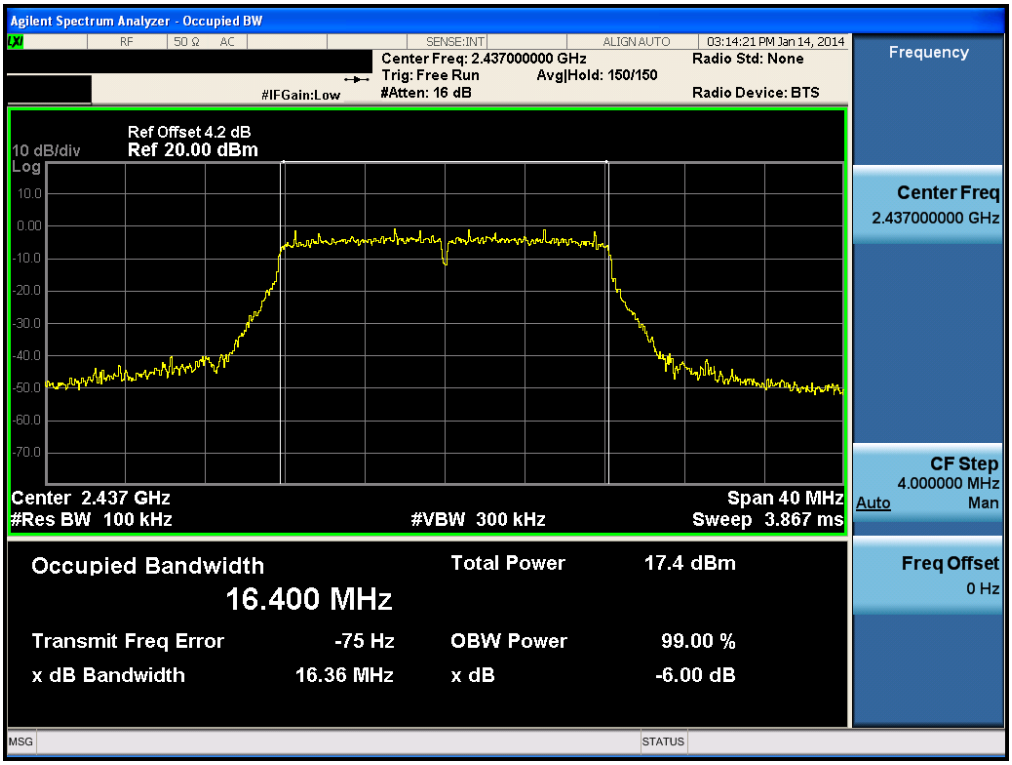


6 dB Bandwidth Test Mode: 802.11b & 1Mbps & 2462MHz

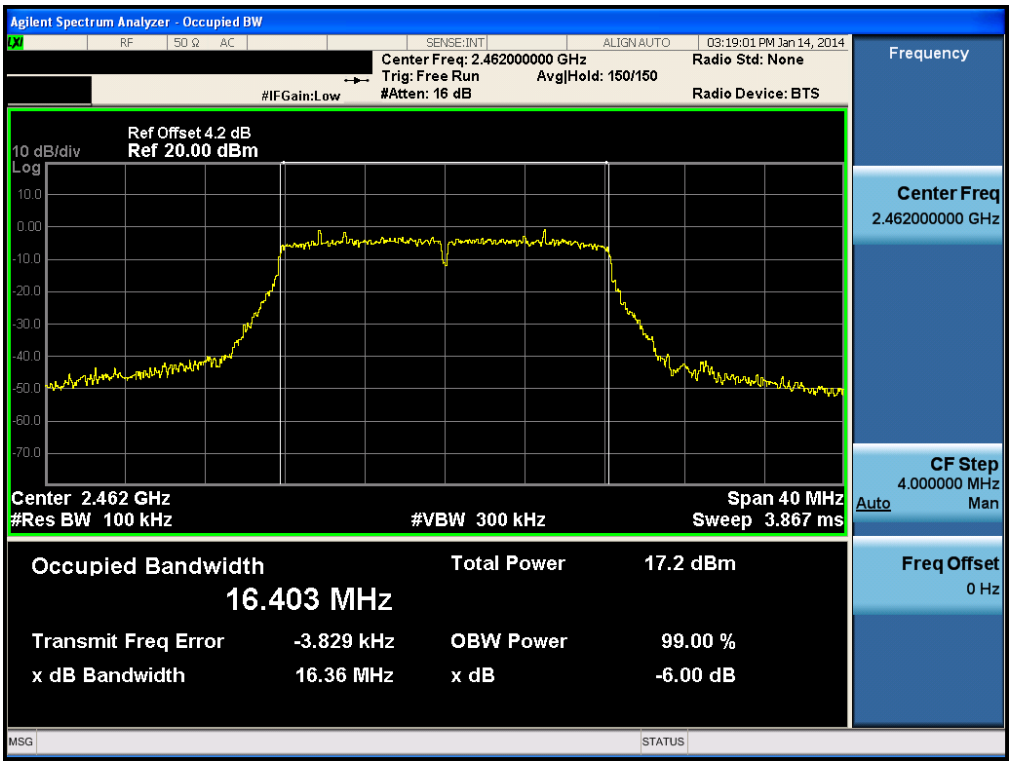
6 dB Bandwidth Test Mode: 802.11g & 6Mbps & 2412MHz



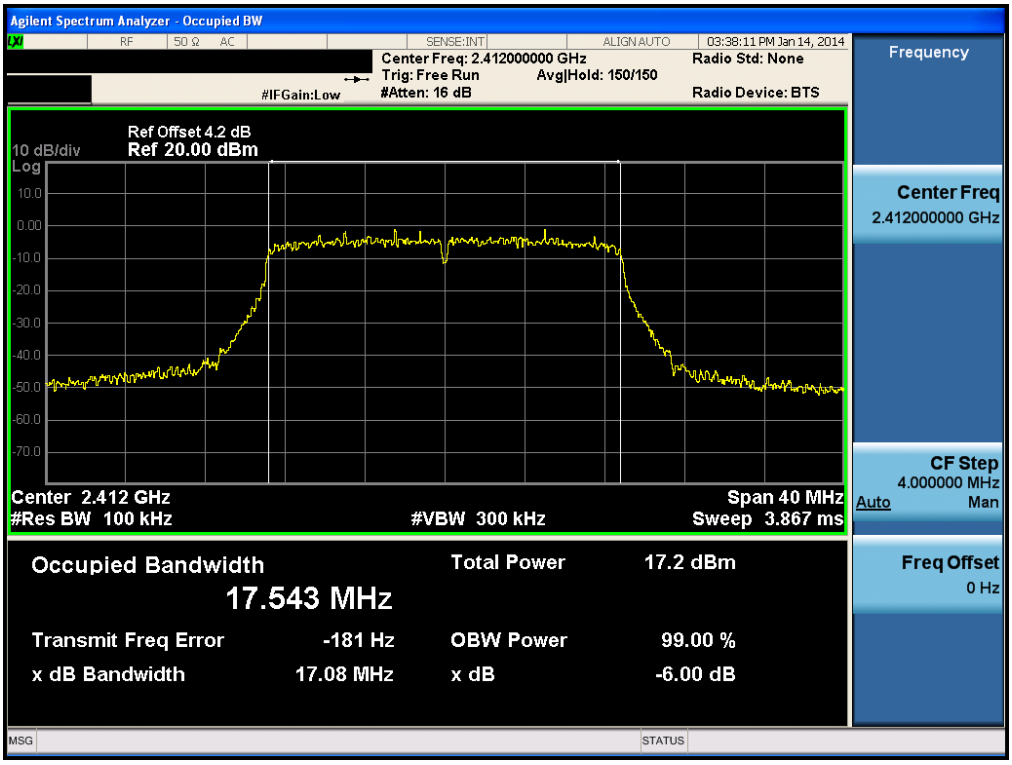
6 dB Bandwidth Test Mode: 802.11g & 6Mbps & 2437MHz



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

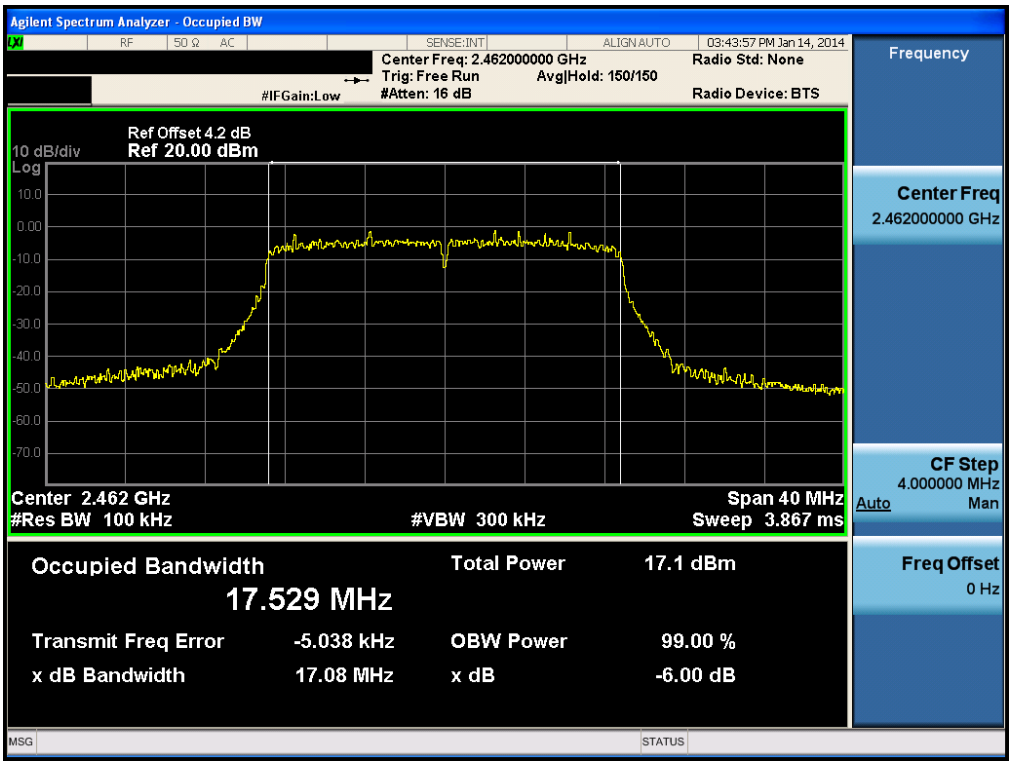


6 dB Bandwidth Test Mode: 802.11n & MCS0 & 2412MHz



6 dB Bandwidth Test Mode: 802.11n & MCS0 & 2437MHz

6 dB Bandwidth Test Mode: 802.11n & MCS0 & 2462MHz

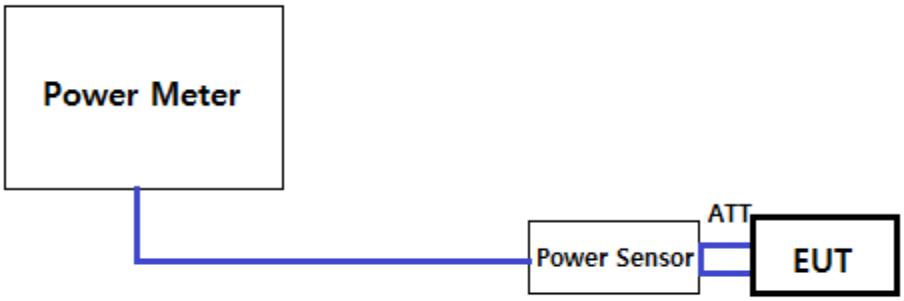


8.2 Maximum Peak Conducted Output Power

Test Requirements and limit, §15.247(b) & RSS-210 [A8.4]

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

▣ **TEST CONFIGURATION**



▣ **TEST PROCEDURE:**

1. **PKPM1 Peak power meter method of KDB558074 v03r1**
   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 v03r1**
   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	N/A	N/A	N/A	N/A
802.11b	1	2412	PK	17.98	17.92	17.86	17.84	-	-	-	-
			AV	15.45	15.41	15.36	15.31	-	-	-	-
	6	2437	PK	17.95	17.92	17.89	17.86	-	-	-	-
			AV	15.45	15.43	15.38	15.35	-	-	-	-
	11	2462	PK	**18.00**	17.94	17.89	17.83	-	-	-	-
			AV	15.48	15.46	15.41	15.36	-	-	-	-

Mode	Channel	Frequency [MHz]	Detector	Test Result [dBm]							
				DATA RATE [Mbps]							
				6	9	12	18	24	36	48	54
802.11g	1	2412	PK	**22.54**	22.41	22.23	21.92	21.84	21.69	21.45	21.34
			AV	11.62	11.45	11.43	11.39	11.32	11.24	11.17	11.08
	6	2437	PK	22.22	22.15	22.12	21.96	21.76	21.70	21.48	21.26
			AV	11.45	11.27	11.18	11.12	11.08	11.01	10.97	10.94
	11	2462	PK	22.04	22.00	21.91	21.86	21.82	21.74	21.69	21.62
			AV	11.21	11.14	11.10	11.02	10.96	10.87	10.79	10.72

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	**22.36**	22.30	22.21	22.15	22.08	22.01	21.92	21.84
			AV	11.33	11.25	11.15	11.08	11.01	10.94	10.89	10.83
	6	2437	PK	22.06	22.01	21.94	21.87	21.83	21.76	21.72	21.68
			AV	11.26	11.19	11.11	11.03	10.97	10.89	10.82	10.77
	11	2462	PK	22.26	22.22	22.14	22.07	22.00	21.92	21.84	21.76
			AV	11.16	11.08	11.01	10.96	10.90	10.85	10.78	10.71

8.3 Maximum Power Spectral Density

Test requirements and limit, §15.247(e) & RSS-210 [A8.2]

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:

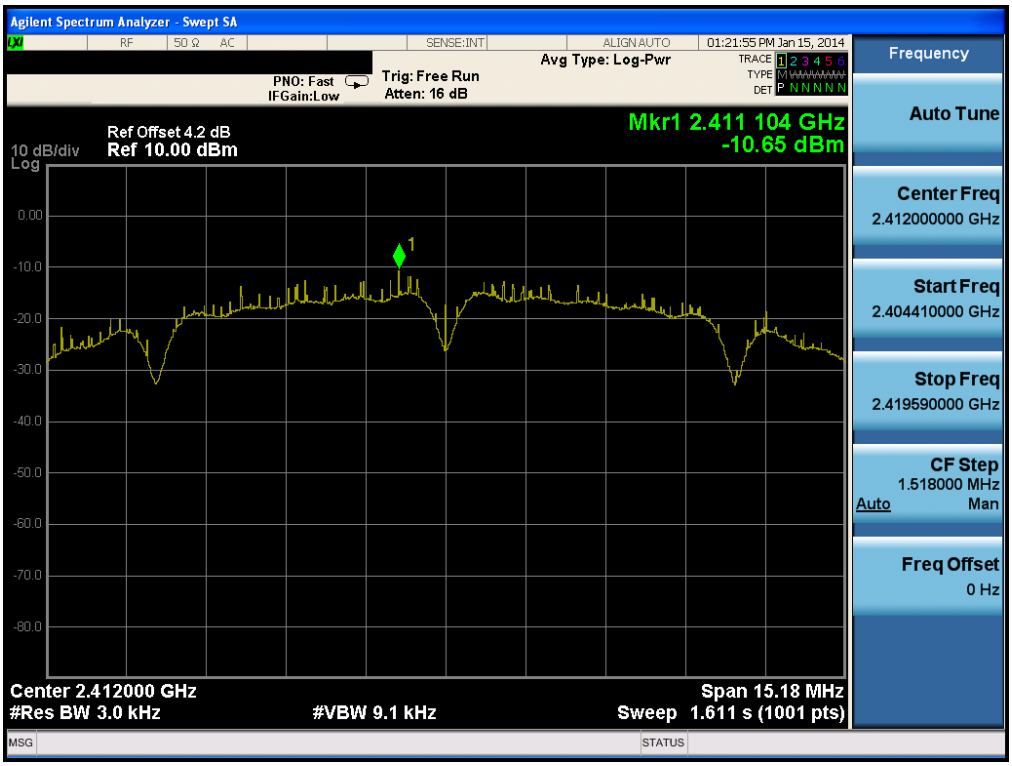
Method PKPSD of KDB558074 v03r1 is used.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW to: **3 kHz ≤ RBW ≤ 100 kHz**.
4. Set the VBW ≥ **3 x RBW.**
5. Detector = **peak.**
6. Sweep time = **auto couple.**
7. Trace 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

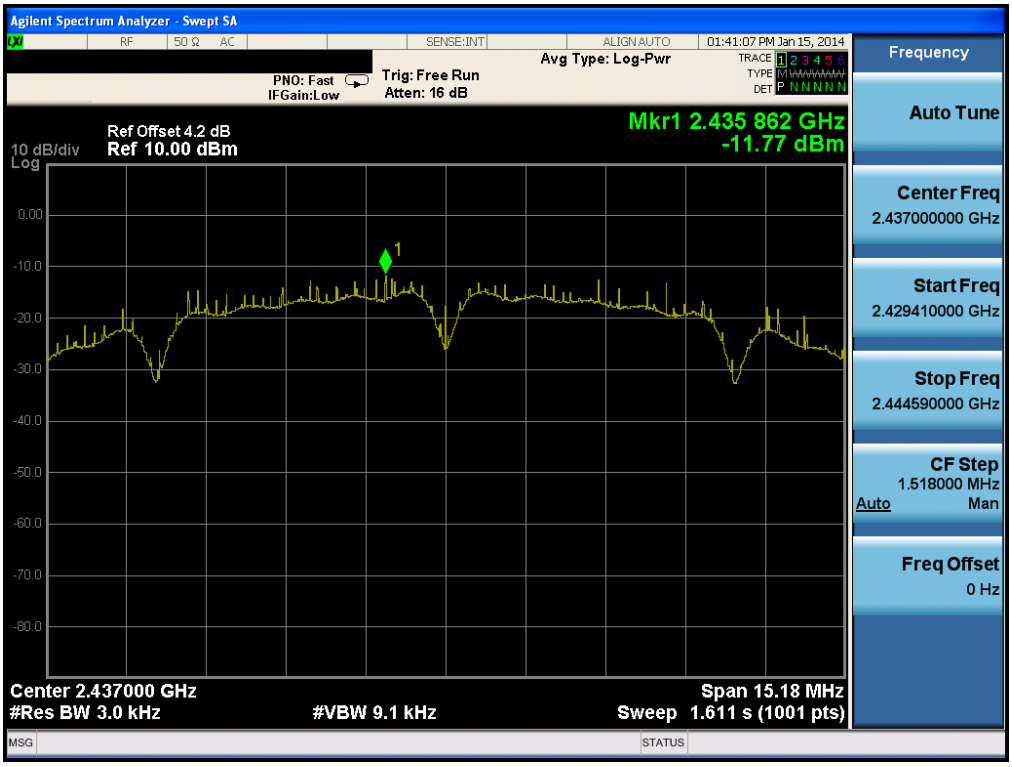
Test Mode	Data Rate	Frequency [MHz]	RBW	PKPSD [dBm]
802.11b	1Mbps	2412	3 kHz	- 10.65
		2437	3 kHz	- 11.77
		2462	3 kHz	- 10.62
802.11g	6Mbps	2412	3 kHz	- 16.28
		2437	3 kHz	- 16.99
		2462	3 kHz	- 15.61
802.11n HT20	MCS0	2412	3 kHz	- 15.60
		2437	3 kHz	- 15.76
		2462	3 kHz	- 16.75

▣ RESULT PLOTS

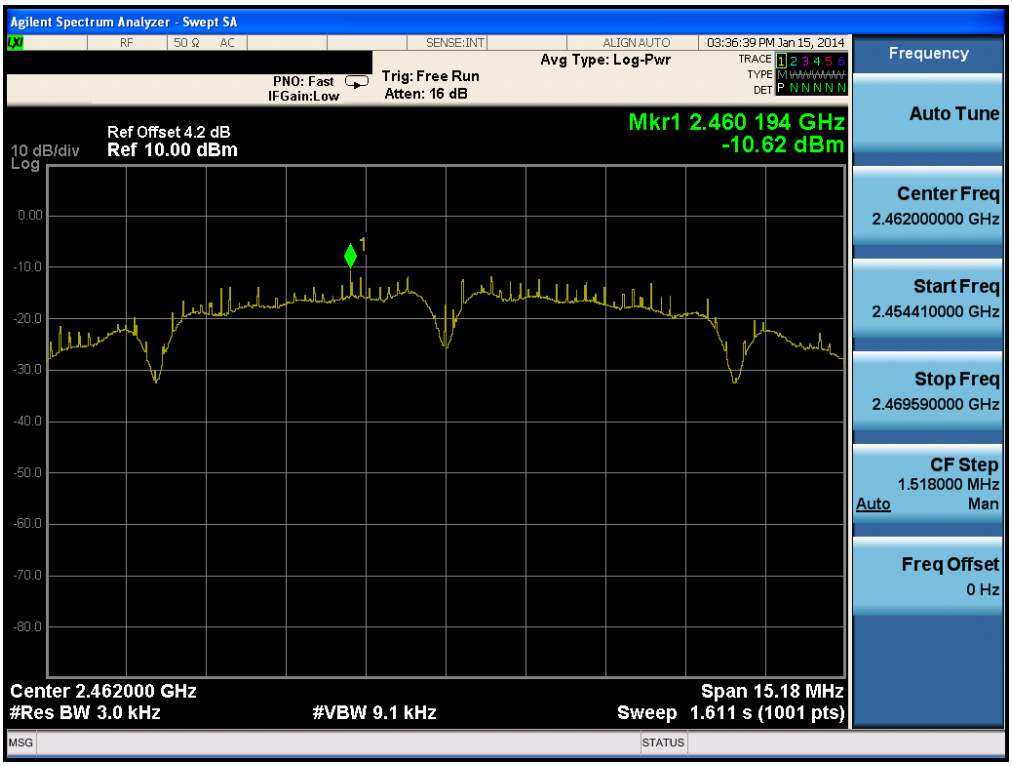
Maximum PKPSD Test Mode: 802.11b & 1Mbps & 2412MHz



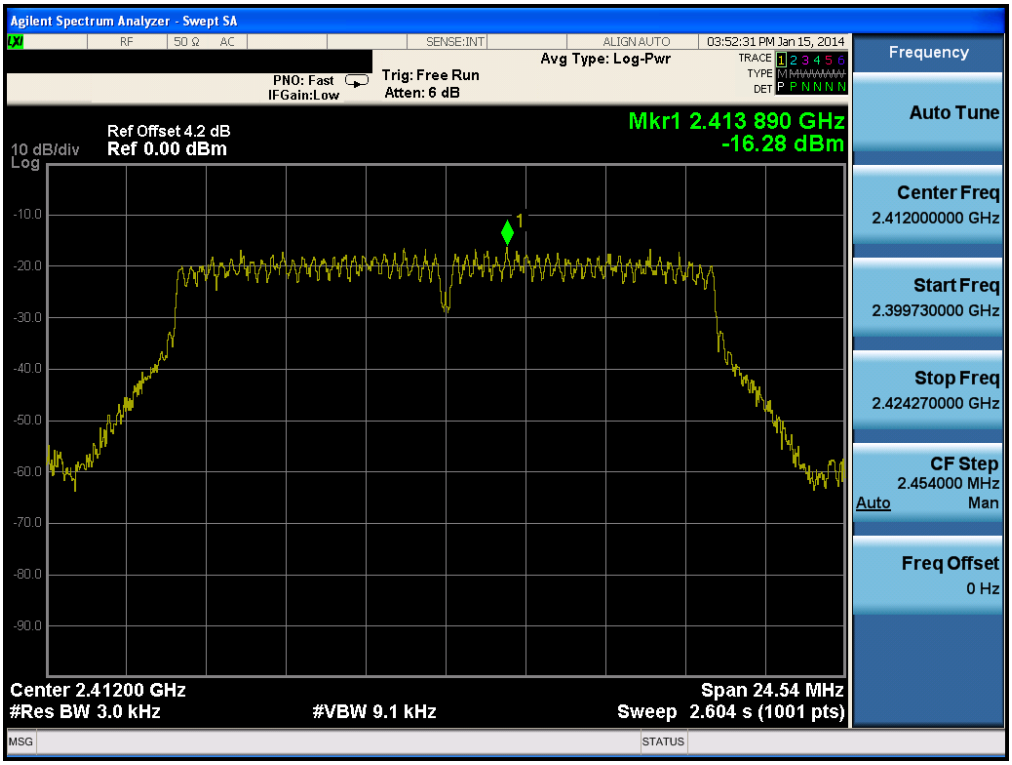
Maximum PKPSD Test Mode: 802.11b & 1Mbps & 2437MHz



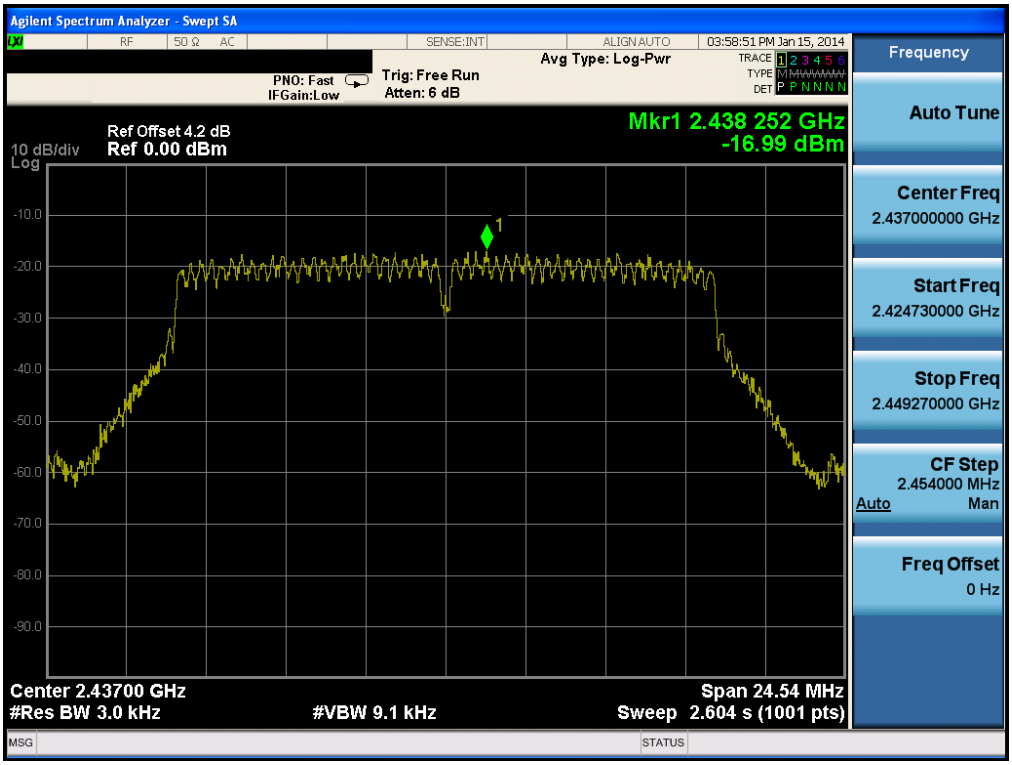
Maximum PKPSD Test Mode: 802.11b & 1Mbps & 2462MHz



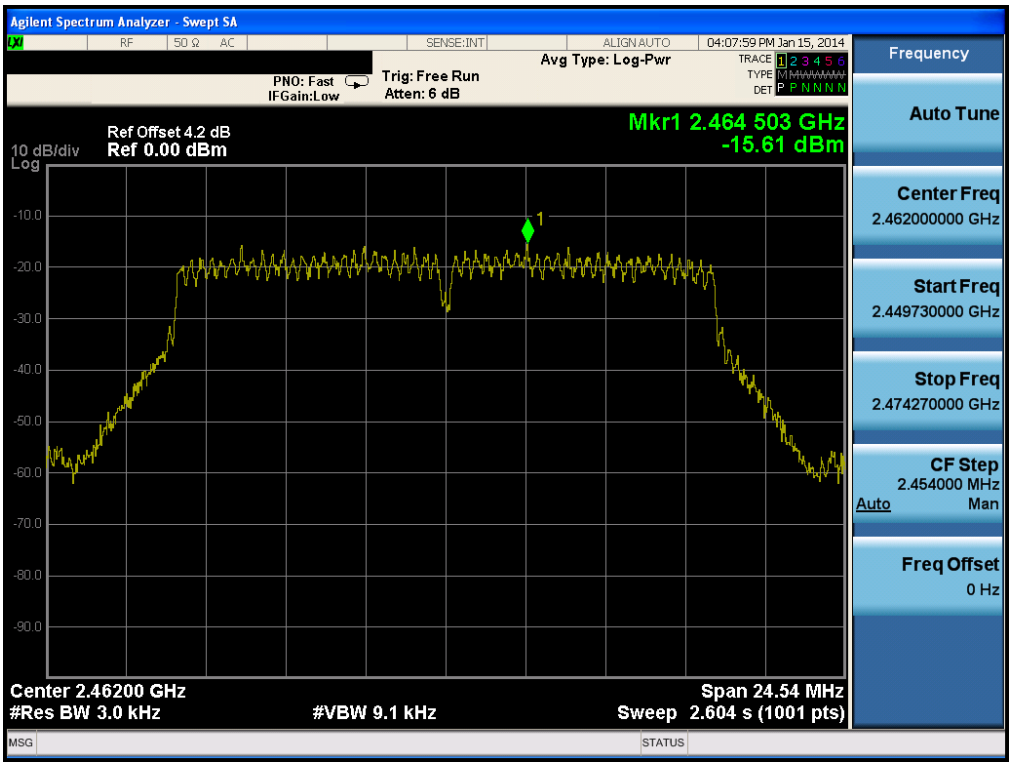
Maximum PKPSD Test Mode: 802.11g & 6Mbps & 2412MHz



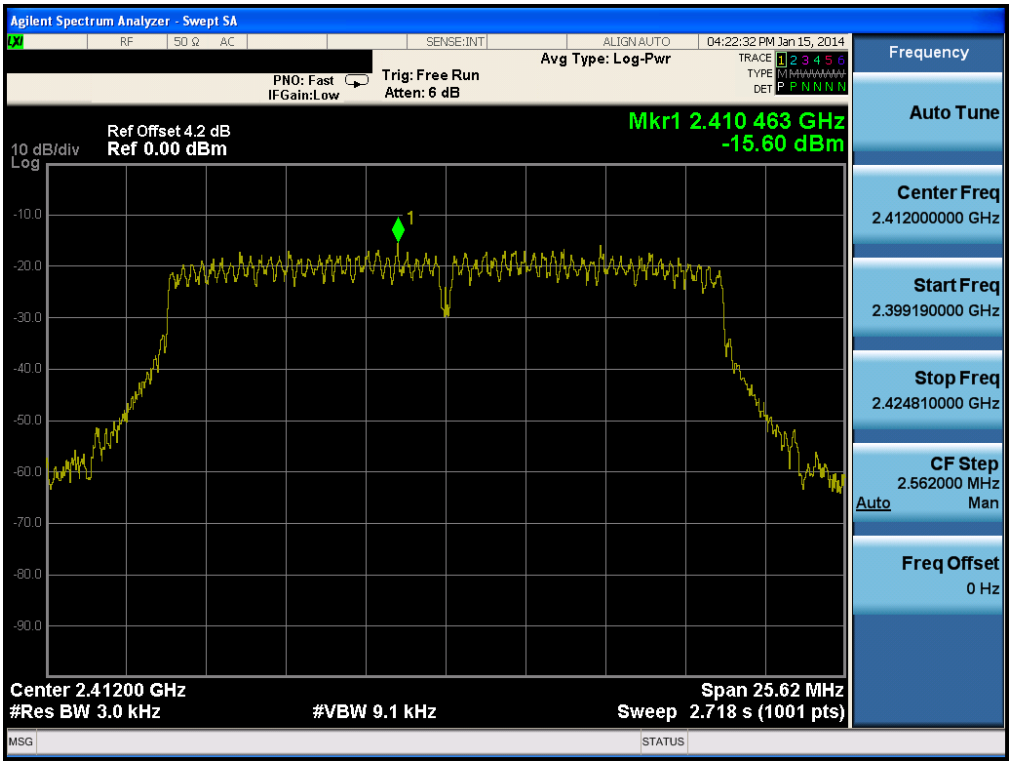
Maximum PKPSD Test Mode: 802.11g & 6Mbps & 2437MHz



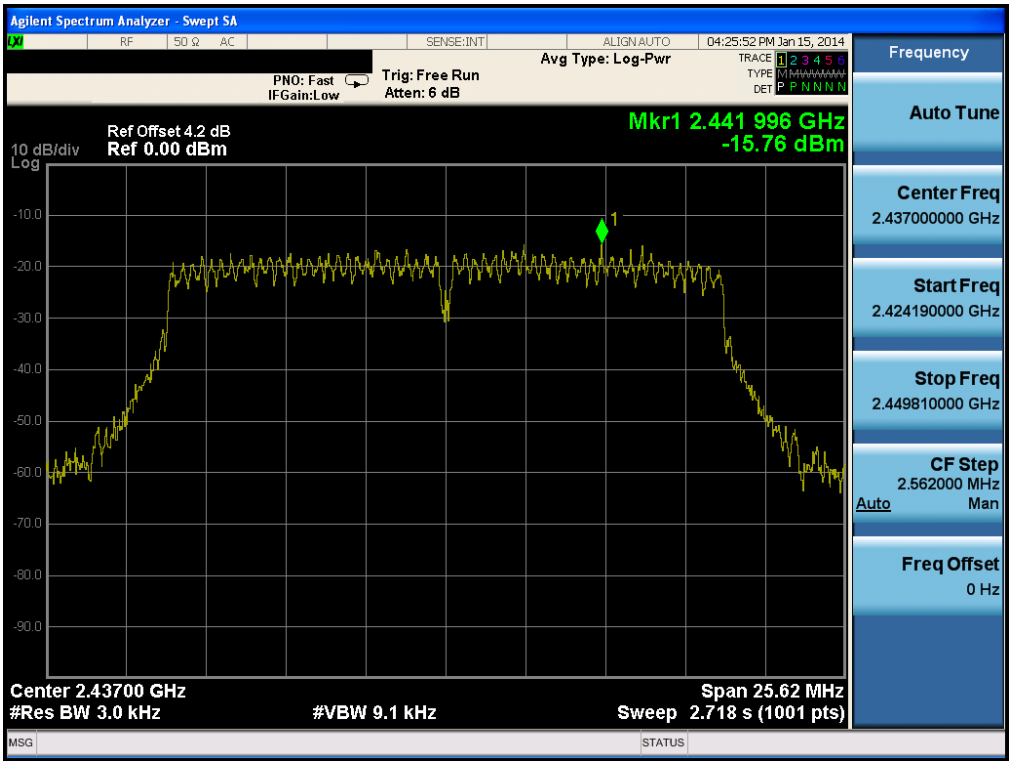
Maximum PKPSD Test Mode: 802.11g & 6Mbps & 2462MHz



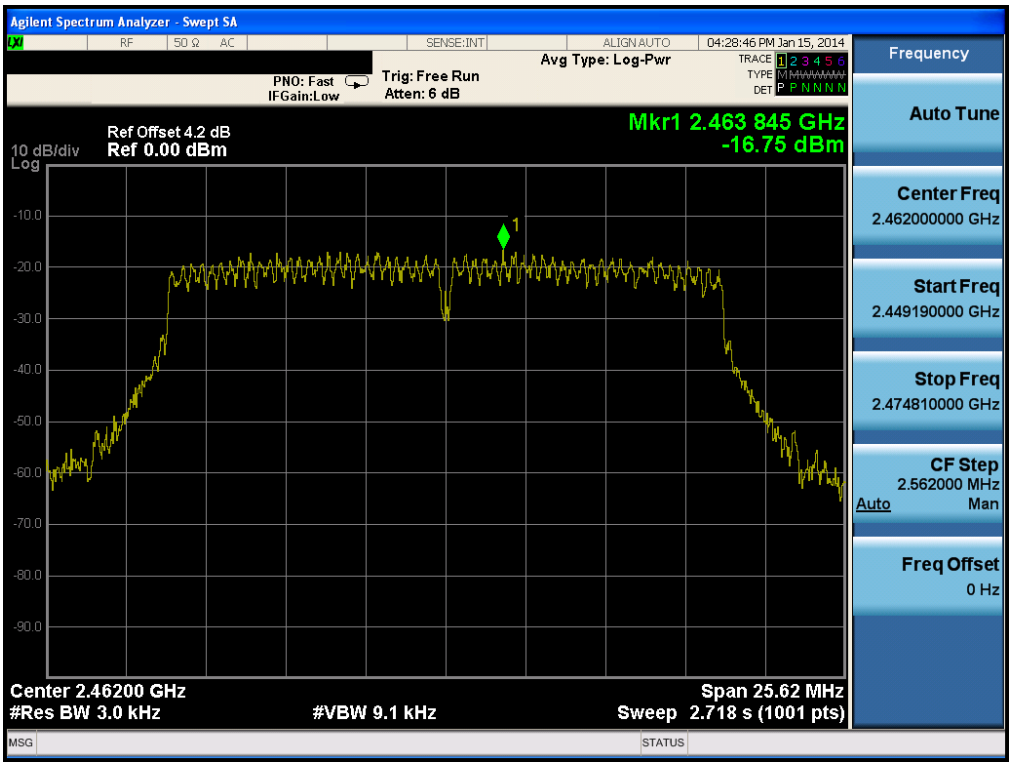
Maximum PKPSD Test Mode: 802.11n(HT20) & MCS0 & 2412MHz



Maximum PKPSD Test Mode: 802.11n(HT20) & MCS0 & 2437MHz



Maximum PKPSD Test Mode: 802.11n(HT20) & MCS0 & 2462MHz



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 unwanted emission was tested using S/A's spurious measurement function with total 11 measurement sub ranges.
The each of the 11 measurement sub ranges of the S/A's spurious measurement function were set as below.

RBW= 1 MHz, VBW= 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD,
SPAN = Max 3 GHz for each sub range below 15 GHz and Max 5 GHz for each sub range above 15 GHz ,
BINS = At least 9001 for each sub range below 15 GHz and At least 10001 for each sub range above 15 GHz,
Therefore BINS for each measurement sub range must be greater than 2 x SPAN/RBW.

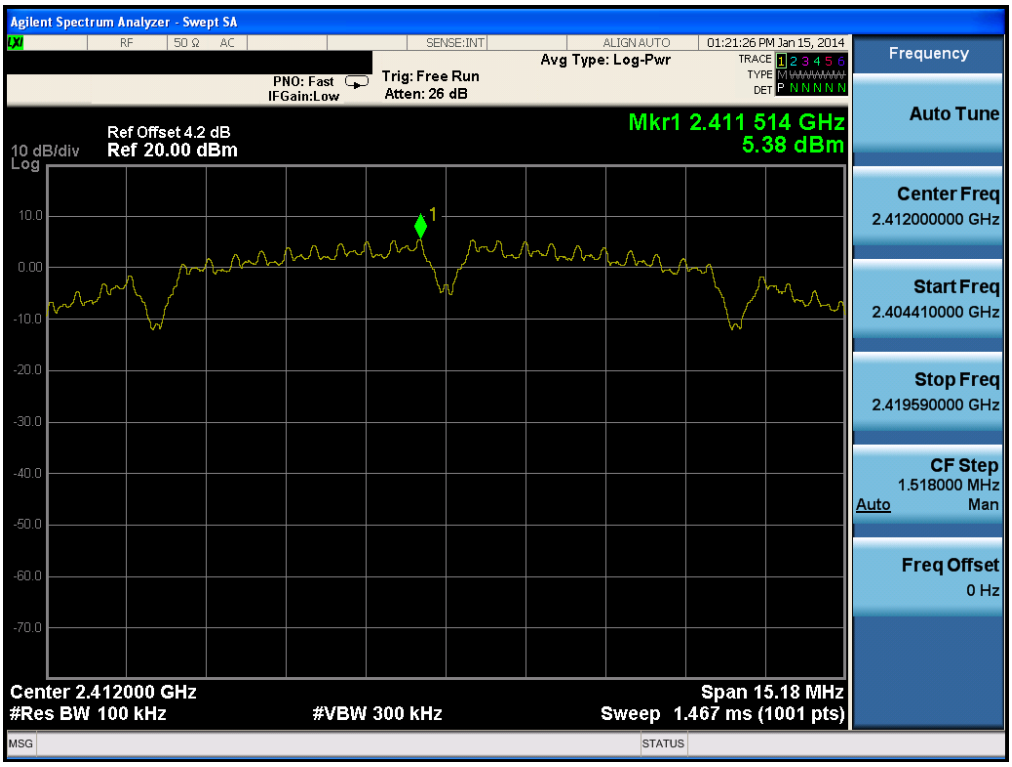
If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 KHz, VBW = 300KHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 KHz BW.

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

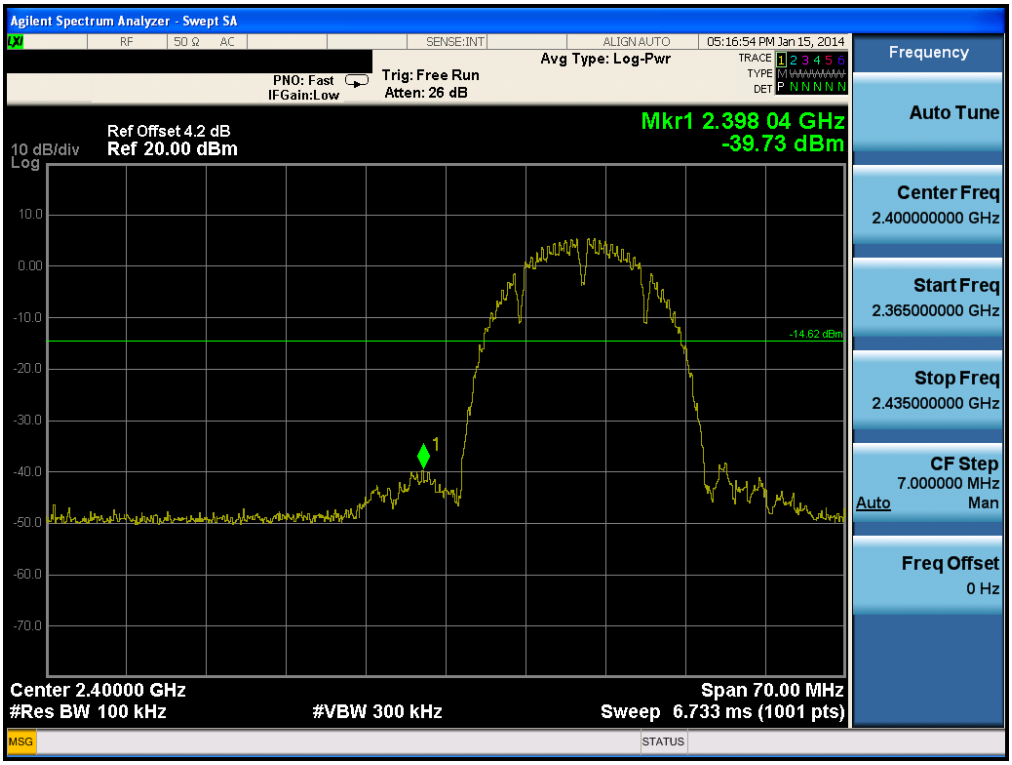
▣ RESULT PLOTS

802.11b & 1Mbps & 2412MHz

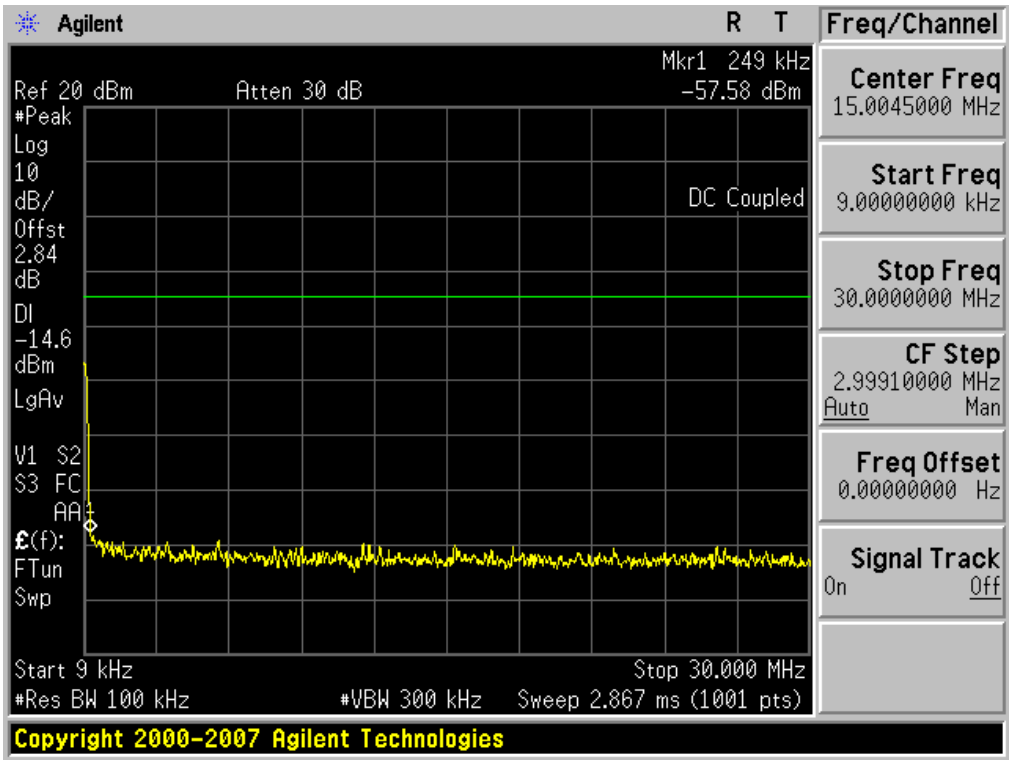
Reference

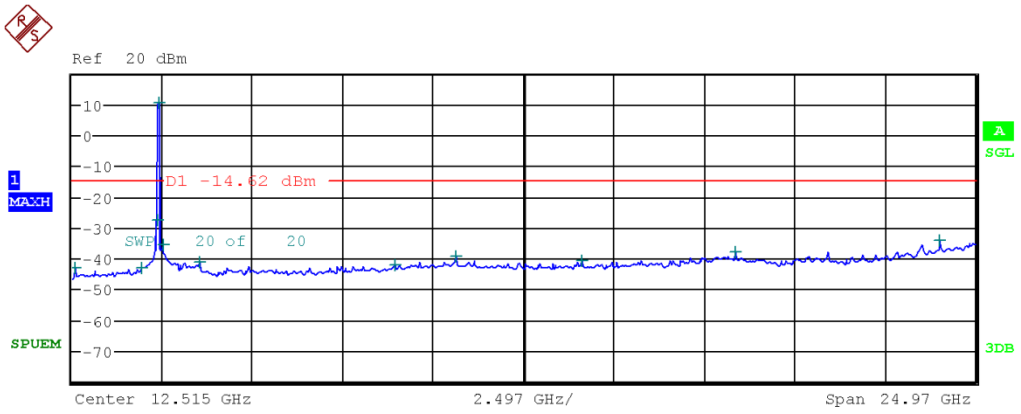


Low Band-edge



Conducted Spurious Emissions

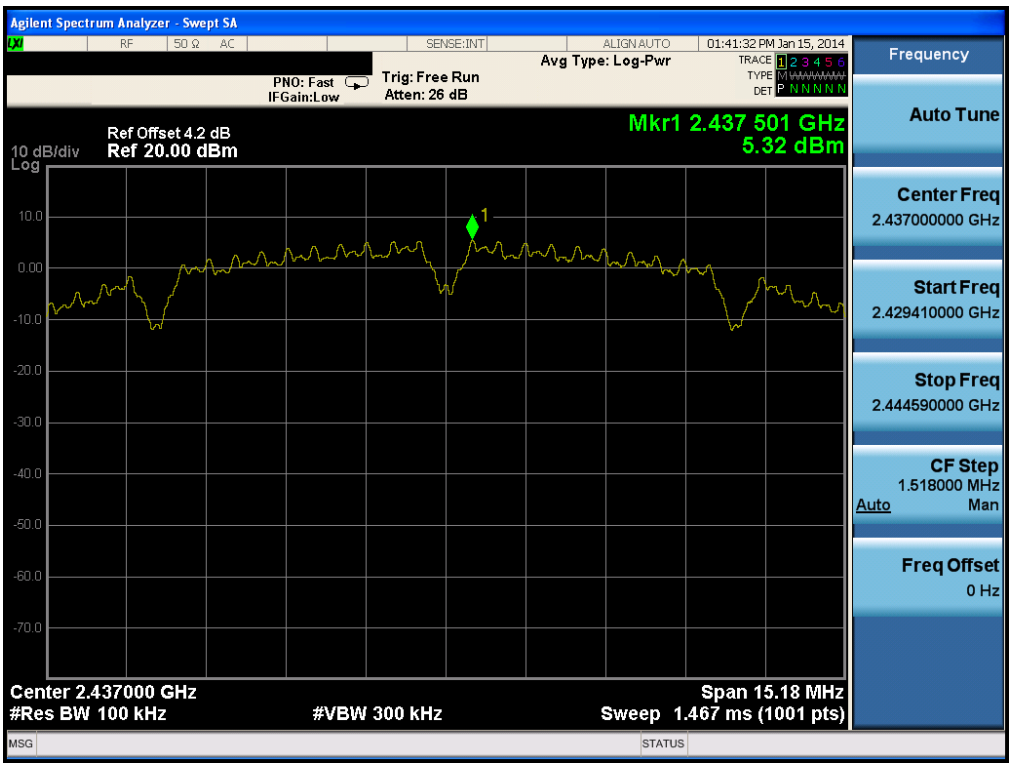




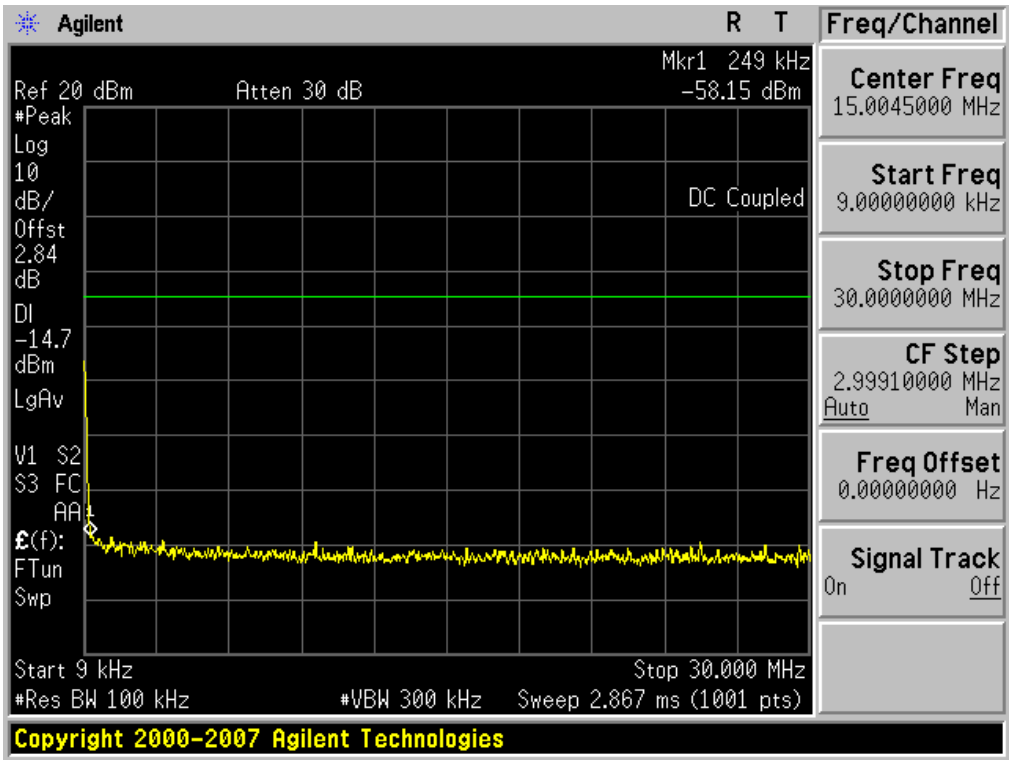
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	97.576667 M	-43.36
1.000 G	2.000 G	1.00 M	1.969333 G	-43.22
2.000 G	2.400 G	1.00 M	2.396400 G	-27.57
2.400 G	2.483 G	1.00 M	2.413110 G	10.24
2.483 G	3.000 G	1.00 M	2.536751 G	-35.73
3.000 G	6.000 G	1.00 M	3.570667 G	-41.40
6.000 G	9.000 G	1.00 M	8.972000 G	-42.39
9.000 G	12.000 G	1.00 M	10.632333 G	-39.38
12.000 G	15.000 G	1.00 M	14.120667 G	-40.92
15.000 G	20.000 G	1.00 M	18.359500 G	-38.22
20.000 G	25.000 G	1.00 M	24.005000 G	-34.43

802.11b & 1Mbps & 2437MHz

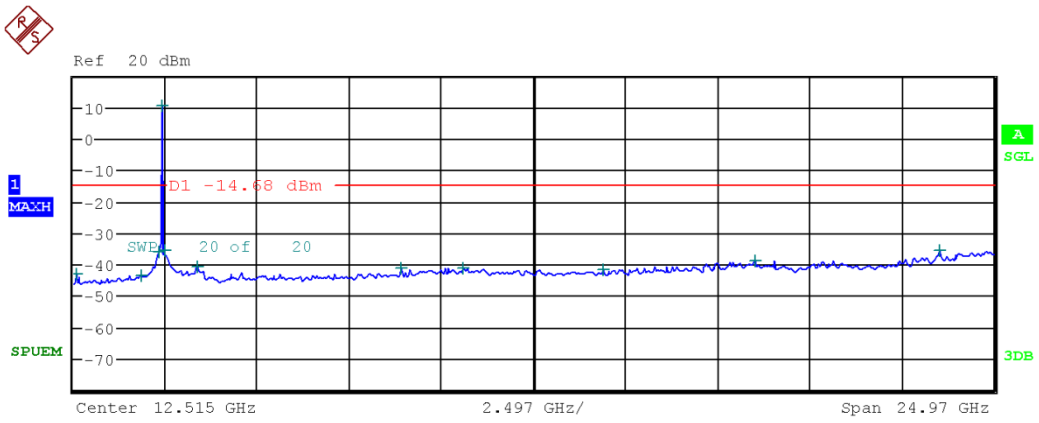
Reference



Conducted Spurious Emissions



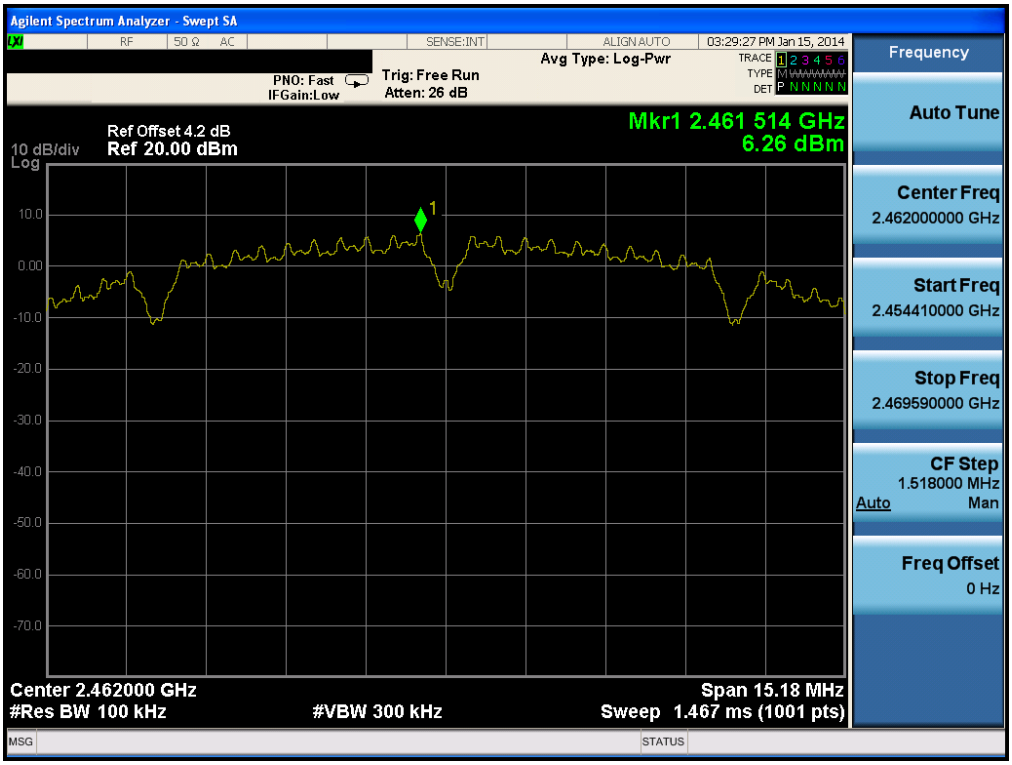
Conducted Spurious Emissions



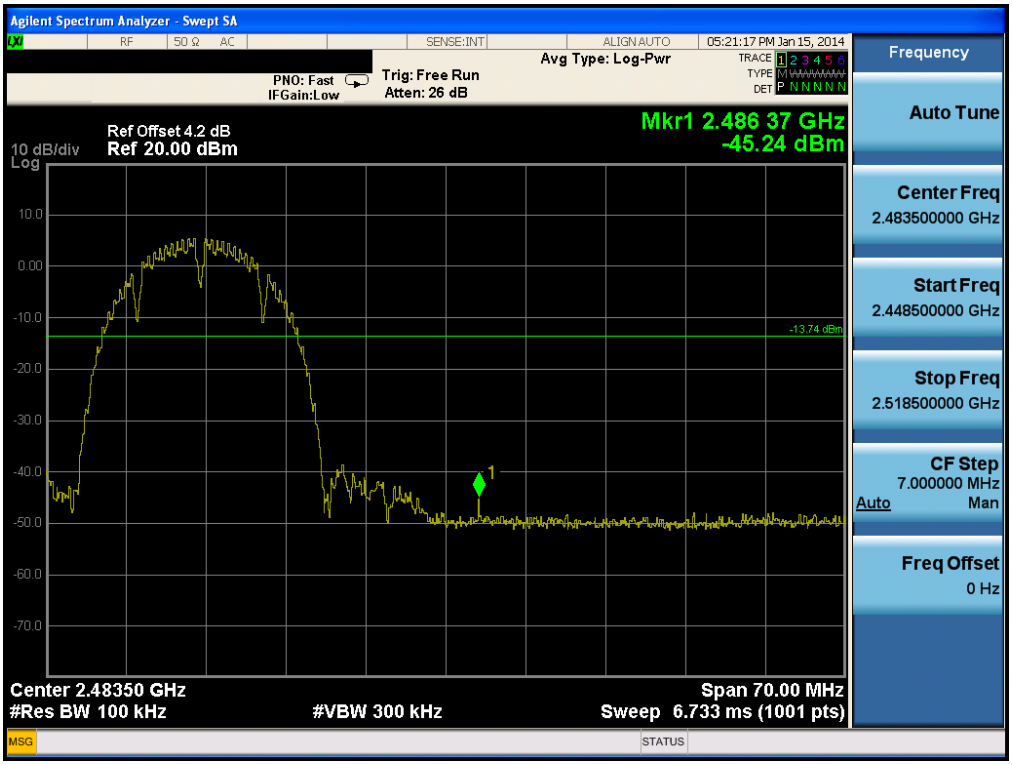
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	122.796667 M	-43.34
1.000 G	2.000 G	1.00 M	1.864000 G	-43.66
2.000 G	2.400 G	1.00 M	2.355640 G	-36.07
2.400 G	2.483 G	1.00 M	2.435571 G	10.51
2.483 G	3.000 G	1.00 M	2.512166 G	-35.83
3.000 G	6.000 G	1.00 M	3.391667 G	-40.97
6.000 G	9.000 G	1.00 M	8.924333 G	-41.42
9.000 G	12.000 G	1.00 M	10.605333 G	-41.14
12.000 G	15.000 G	1.00 M	14.394333 G	-41.63
15.000 G	20.000 G	1.00 M	18.529500 G	-38.90
20.000 G	25.000 G	1.00 M	23.510500 G	-35.67

802.11b & 1Mbps & 2462MHz

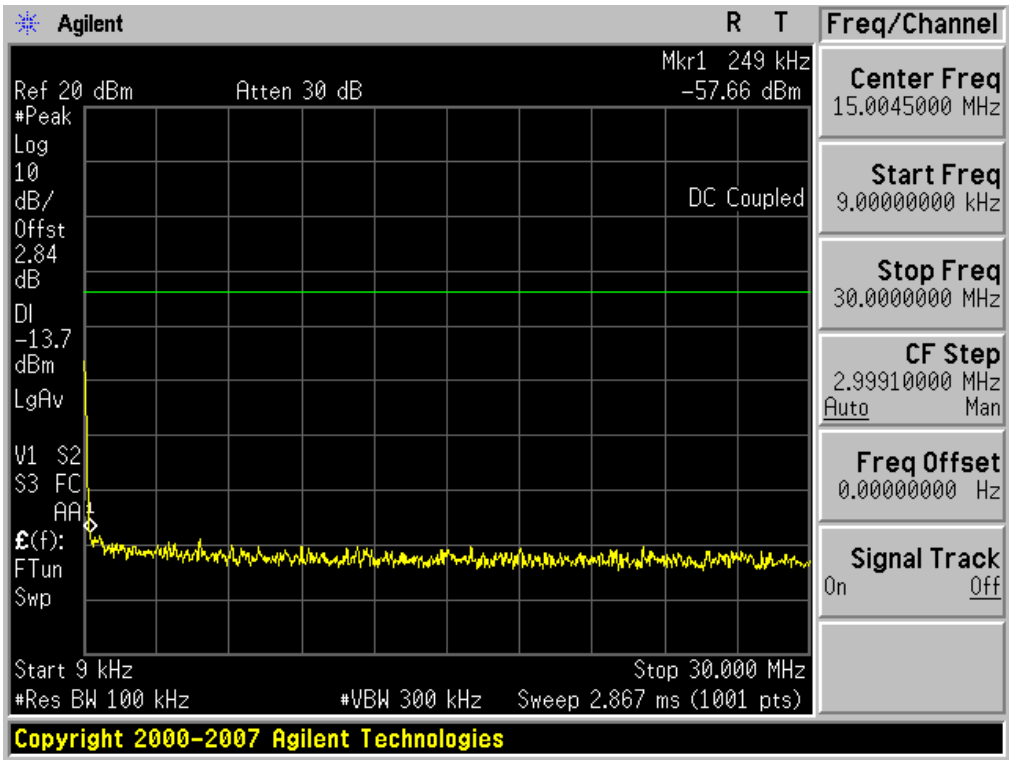
Reference

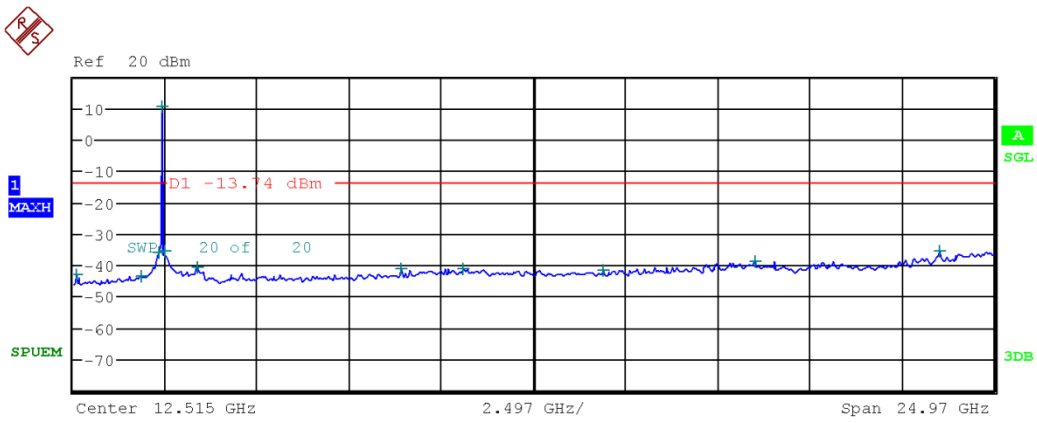


High Band-edge



Conducted Spurious Emissions

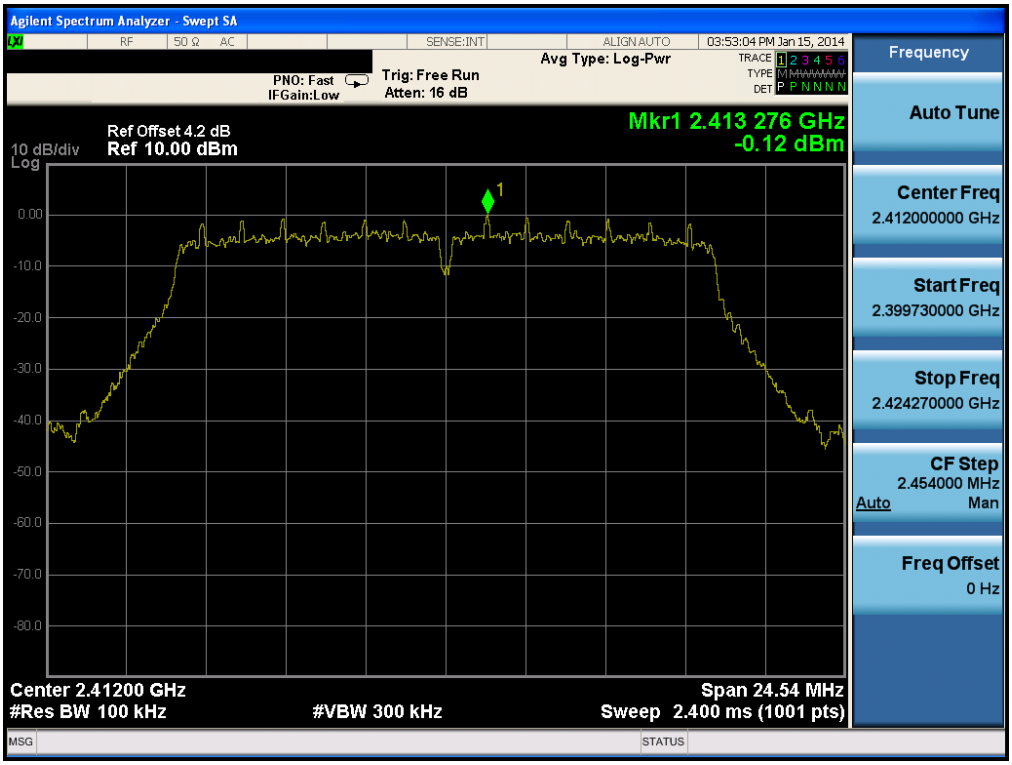




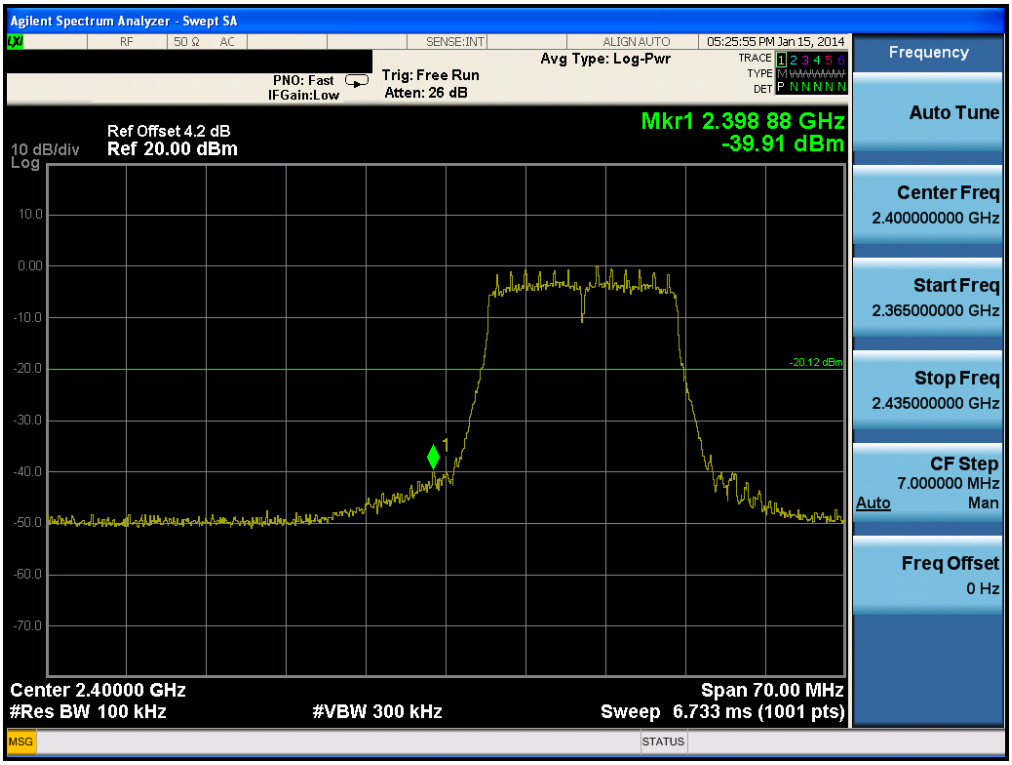
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	122.796667 M	-43.34
1.000 G	2.000 G	1.00 M	1.864000 G	-43.66
2.000 G	2.400 G	1.00 M	2.355640 G	-36.07
2.400 G	2.483 G	1.00 M	2.435571 G	10.51
2.483 G	3.000 G	1.00 M	2.512166 G	-35.83
3.000 G	6.000 G	1.00 M	3.391667 G	-40.97
6.000 G	9.000 G	1.00 M	8.924333 G	-41.42
9.000 G	12.000 G	1.00 M	10.605333 G	-41.14
12.000 G	15.000 G	1.00 M	14.394333 G	-41.63
15.000 G	20.000 G	1.00 M	18.529500 G	-38.90
20.000 G	25.000 G	1.00 M	23.510500 G	-35.67

802.11g & 6Mbps & 2412MHz

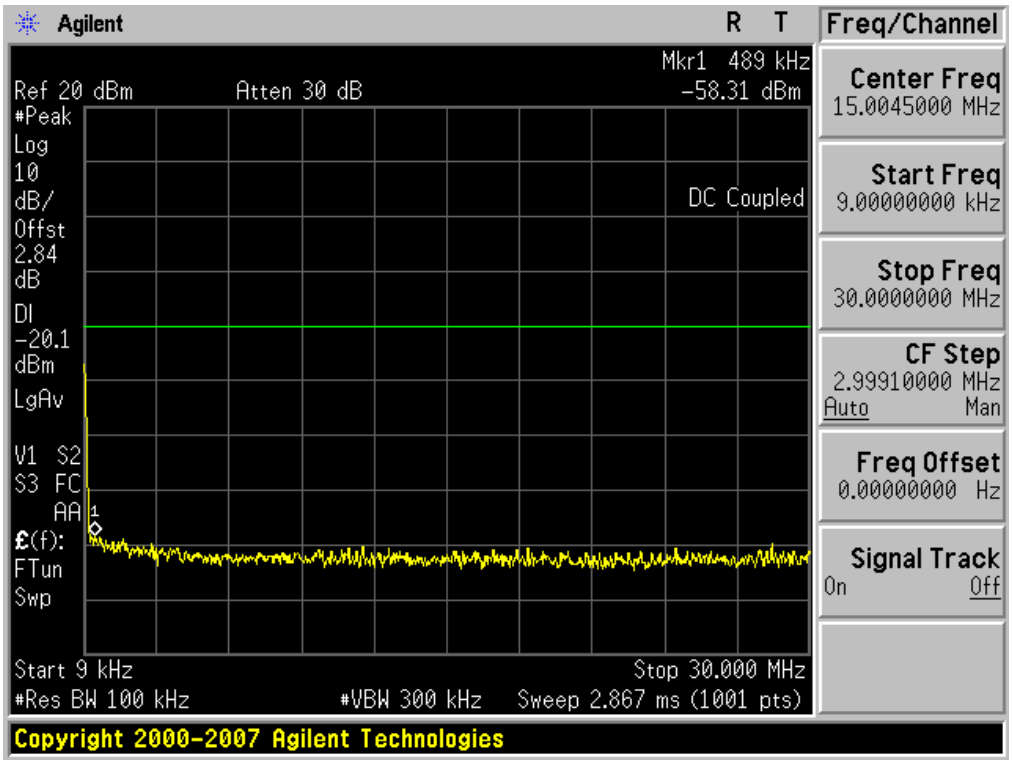
Reference

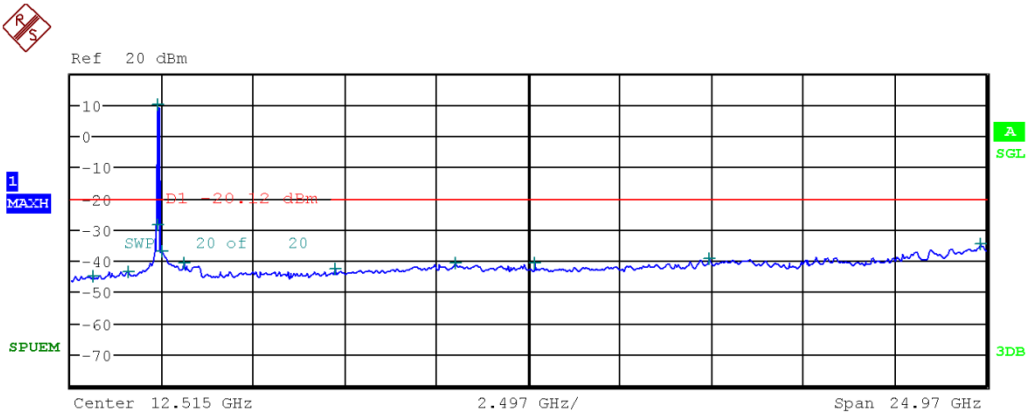


Low Band-edge



Conducted Spurious Emissions

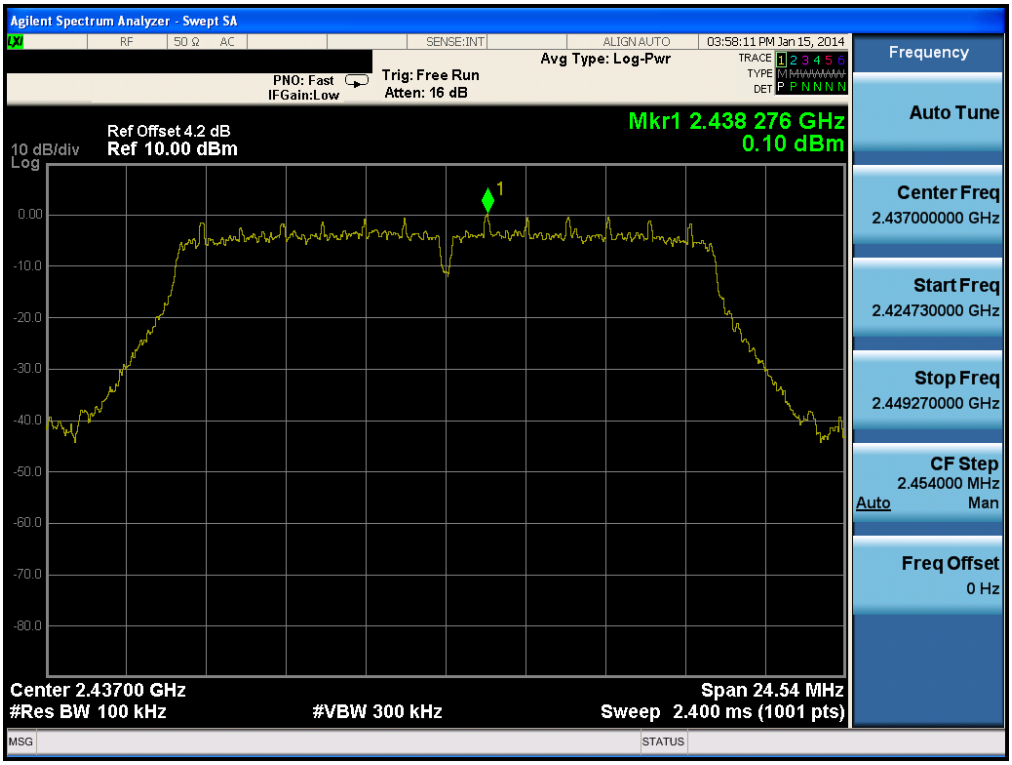




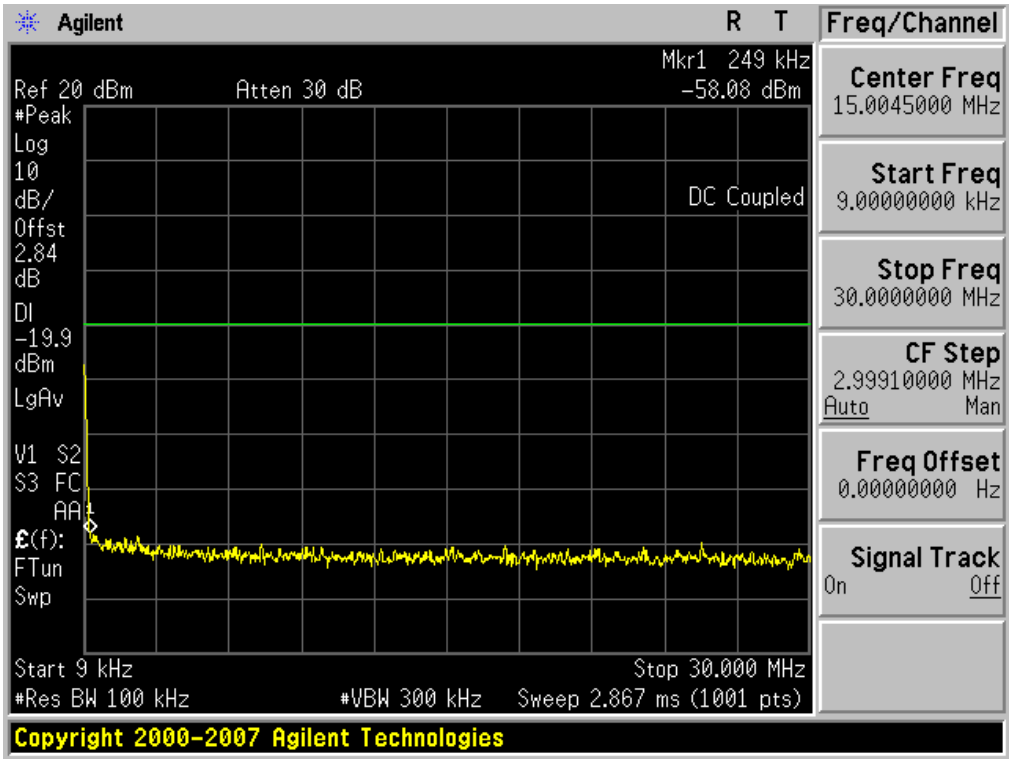
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	647.243333 M	-45.02
1.000 G	2.000 G	1.00 M	1.576000 G	-43.54
2.000 G	2.400 G	1.00 M	2.399880 G	-28.79
2.400 G	2.483 G	1.00 M	2.407223 G	9.72
2.483 G	3.000 G	1.00 M	2.498324 G	-37.00
3.000 G	6.000 G	1.00 M	3.107000 G	-40.91
6.000 G	9.000 G	1.00 M	7.249667 G	-42.61
9.000 G	12.000 G	1.00 M	10.496667 G	-40.96
12.000 G	15.000 G	1.00 M	12.655667 G	-40.69
15.000 G	20.000 G	1.00 M	17.438000 G	-39.50
20.000 G	25.000 G	1.00 M	24.831000 G	-34.93

802.11g & 6Mbps & 2437MHz

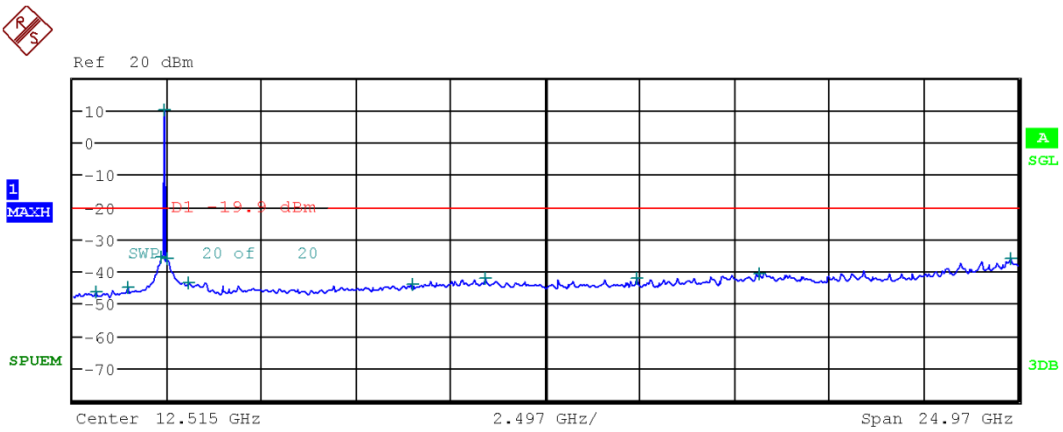
Reference



Conducted Spurious Emissions



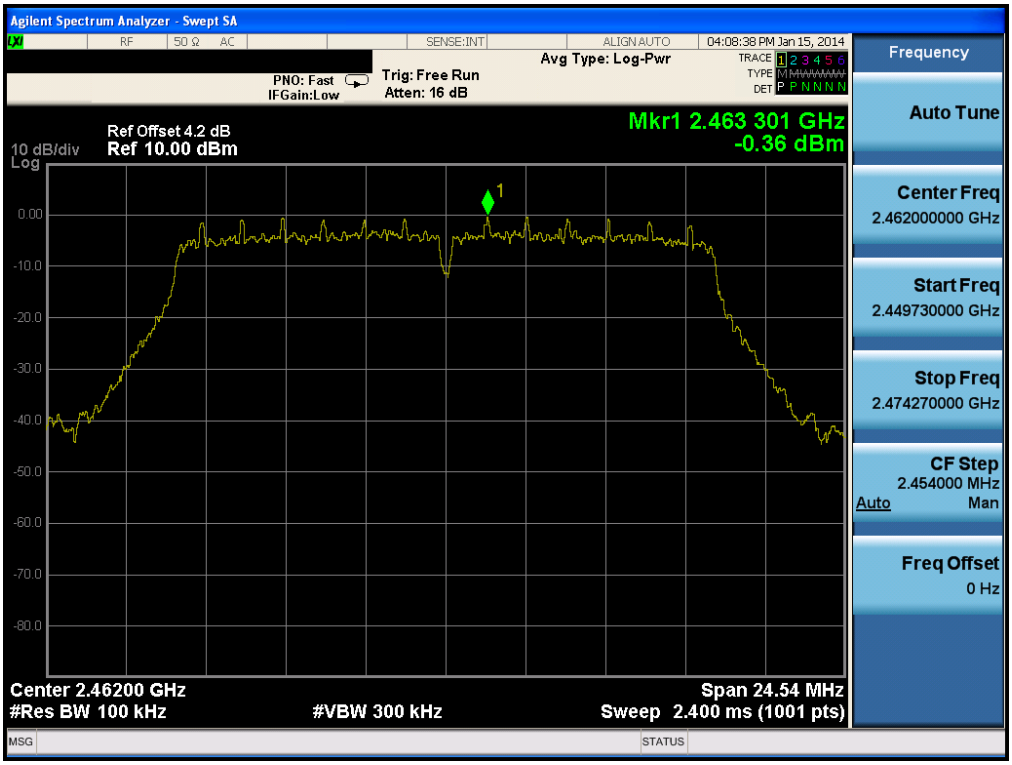
Conducted Spurious Emissions



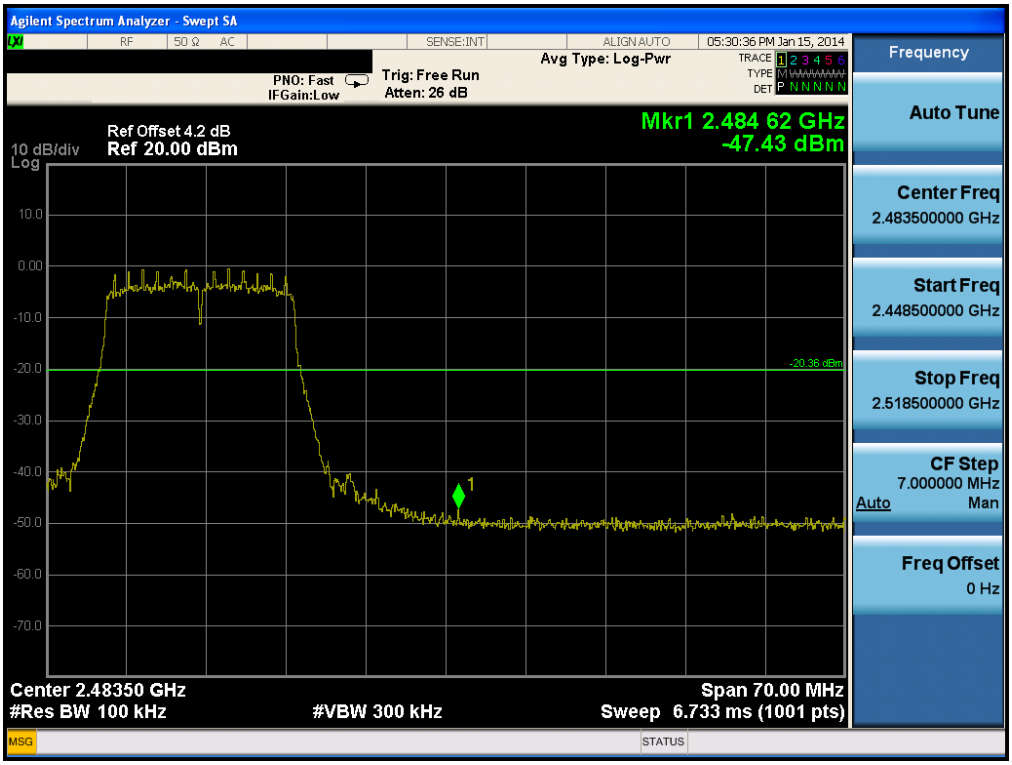
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	626.226667 M	-46.59
1.000 G	2.000 G	1.00 M	1.465000 G	-45.18
2.000 G	2.400 G	1.00 M	2.351400 G	-35.55
2.400 G	2.483 G	1.00 M	2.432348 G	10.14
2.483 G	3.000 G	1.00 M	2.521618 G	-36.13
3.000 G	6.000 G	1.00 M	3.087667 G	-43.61
6.000 G	9.000 G	1.00 M	8.996333 G	-43.87
9.000 G	12.000 G	1.00 M	10.921667 G	-42.42
12.000 G	15.000 G	1.00 M	14.916000 G	-42.41
15.000 G	20.000 G	1.00 M	18.168000 G	-40.70
20.000 G	25.000 G	1.00 M	24.810500 G	-36.15

802.11g & 6Mbps & 2462MHz

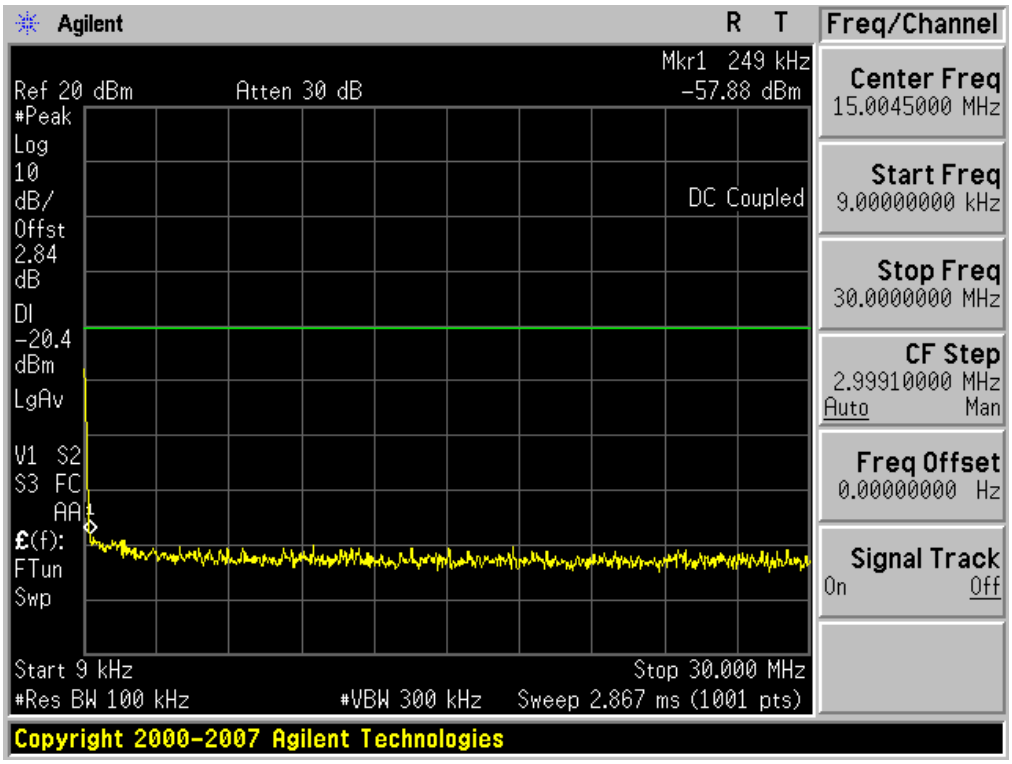
Reference

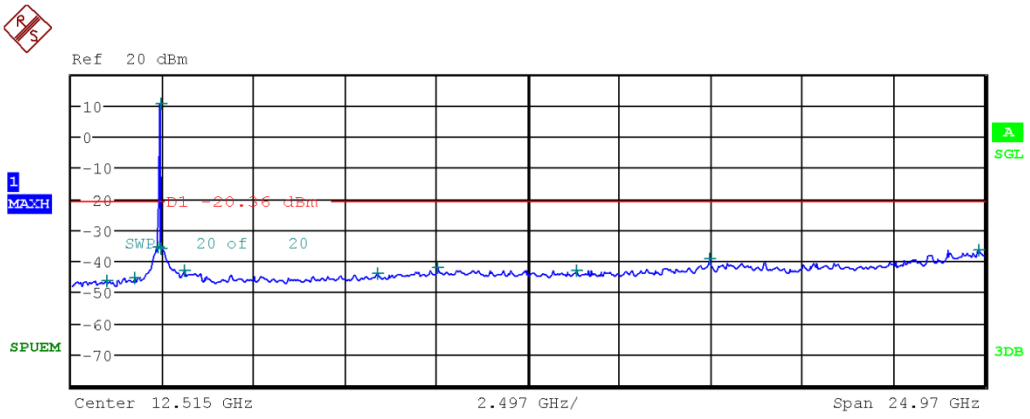


High Band-edge



Conducted Spurious Emissions

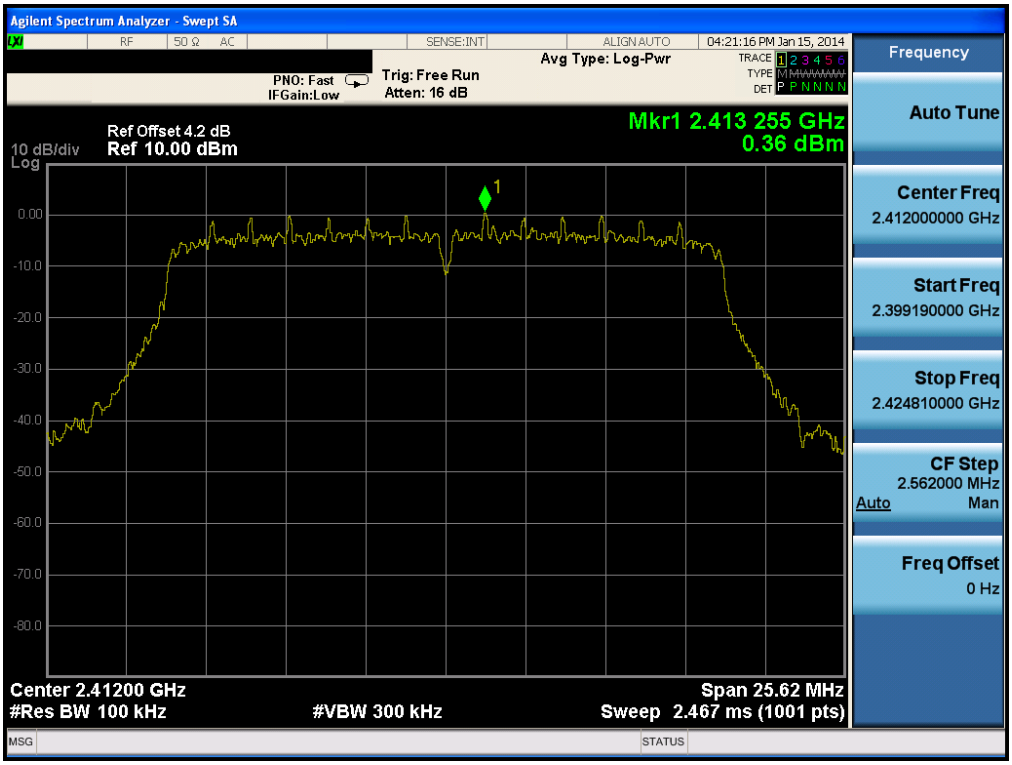




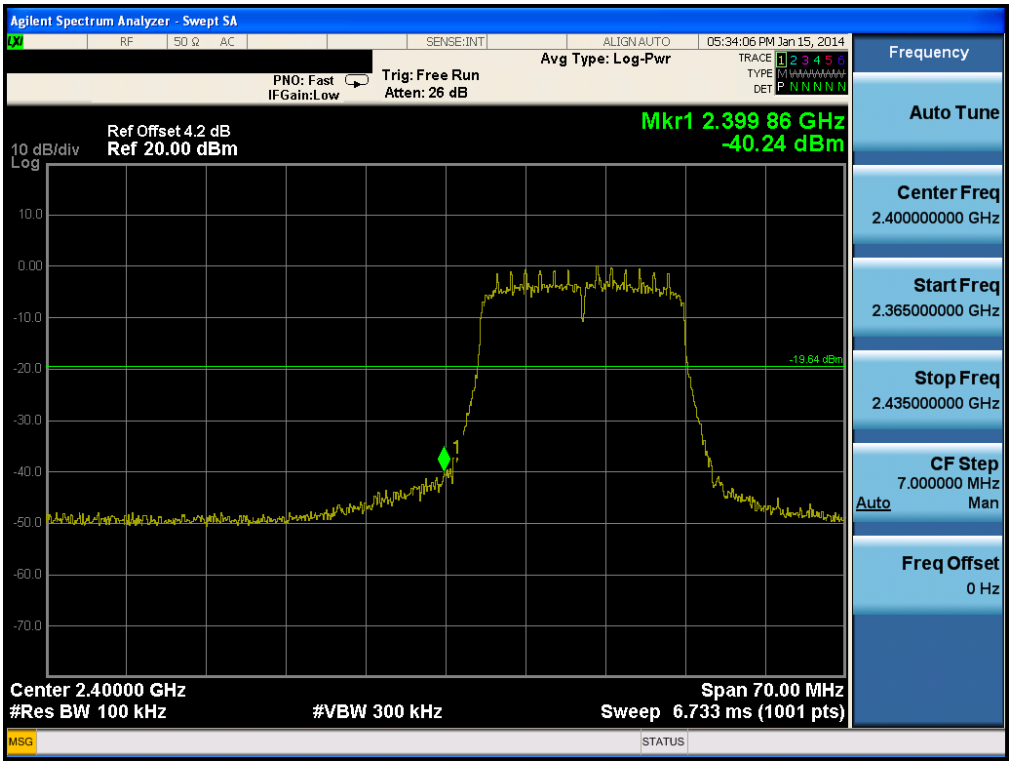
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	999.353333 M	-46.45
1.000 G	2.000 G	1.00 M	1.770000 G	-45.34
2.000 G	2.400 G	1.00 M	2.382000 G	-35.83
2.400 G	2.483 G	1.00 M	2.457106 G	10.43
2.483 G	3.000 G	1.00 M	2.488717 G	-36.32
3.000 G	6.000 G	1.00 M	3.116667 G	-43.25
6.000 G	9.000 G	1.00 M	8.407333 G	-44.24
9.000 G	12.000 G	1.00 M	10.051000 G	-42.42
12.000 G	15.000 G	1.00 M	13.837000 G	-42.91
15.000 G	20.000 G	1.00 M	17.461000 G	-39.43
20.000 G	25.000 G	1.00 M	24.837500 G	-36.37

802.11n(HT20) & MCS0 & 2412MHz

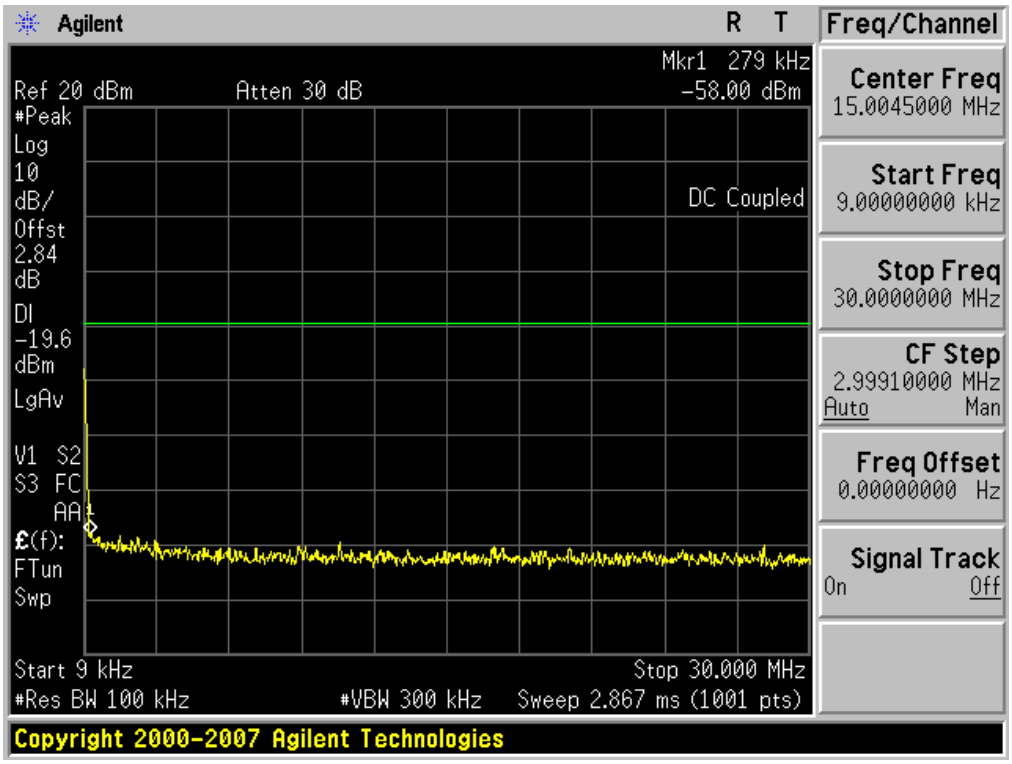
Reference

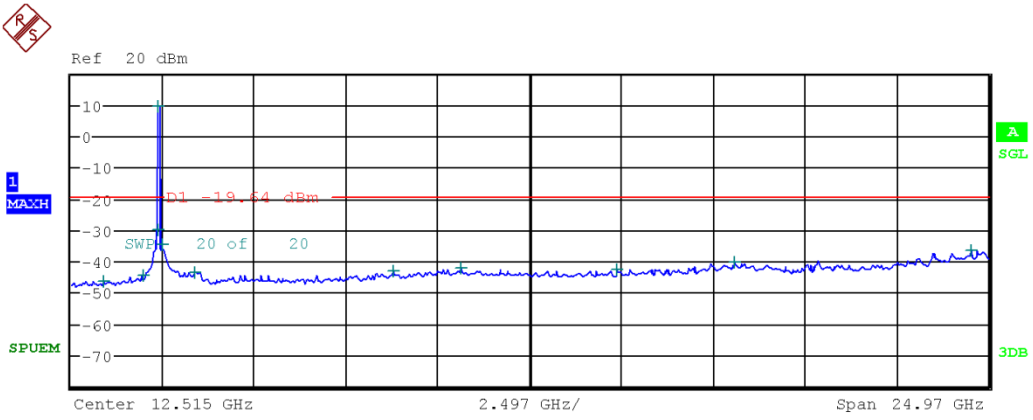


Low Band-edge



Conducted Spurious Emissions

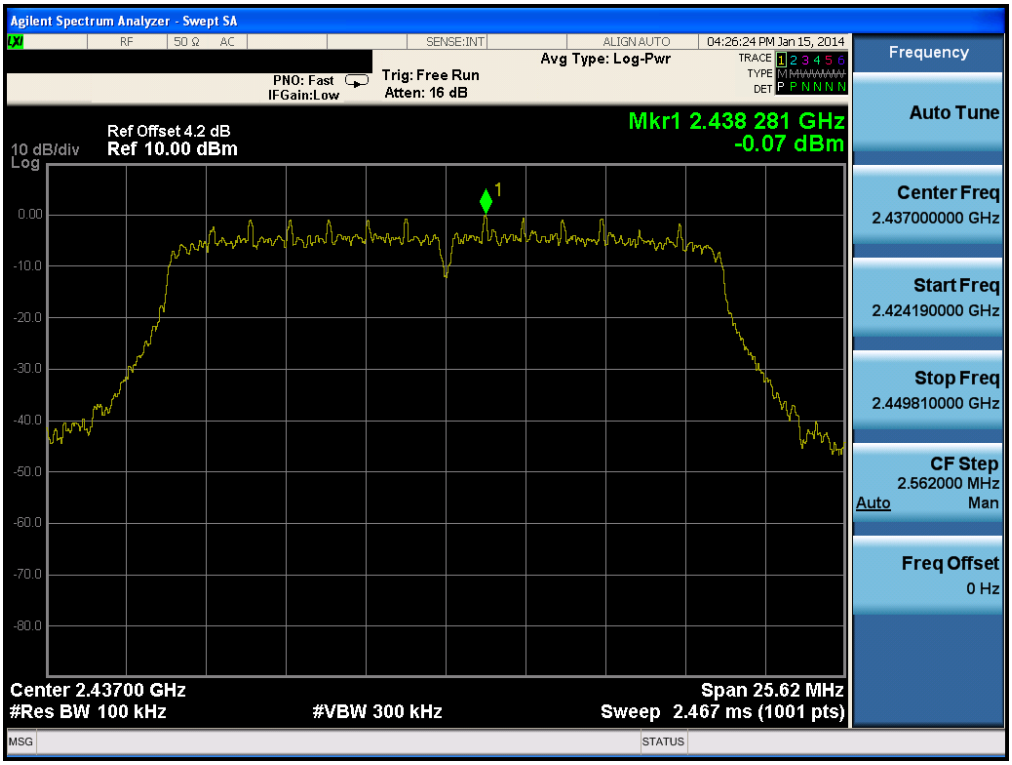




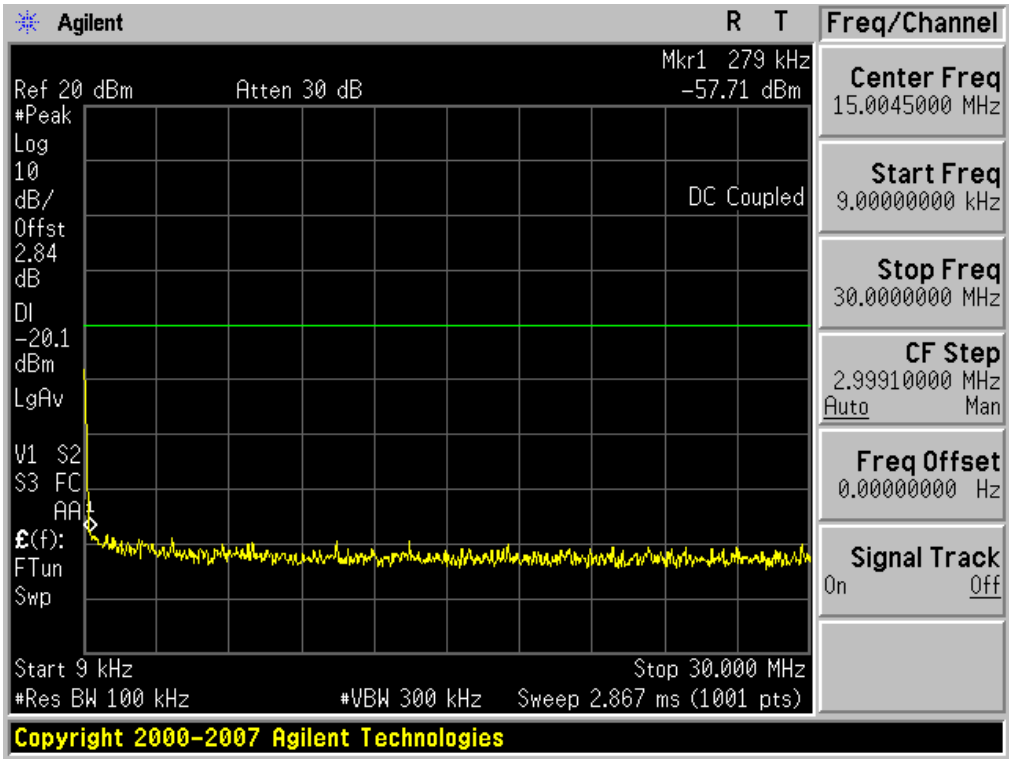
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	918.843333 M	-46.21
1.000 G	2.000 G	1.00 M	1.979333 G	-44.66
2.000 G	2.400 G	1.00 M	2.398280 G	-29.94
2.400 G	2.483 G	1.00 M	2.408517 G	9.56
2.483 G	3.000 G	1.00 M	2.494656 G	-34.87
3.000 G	6.000 G	1.00 M	3.390000 G	-43.39
6.000 G	9.000 G	1.00 M	8.799000 G	-43.37
9.000 G	12.000 G	1.00 M	10.642333 G	-42.04
12.000 G	15.000 G	1.00 M	14.886333 G	-42.91
15.000 G	20.000 G	1.00 M	18.072000 G	-40.33
20.000 G	25.000 G	1.00 M	24.526000 G	-36.59

802.11n(HT20) & MCS0 & 2437MHz

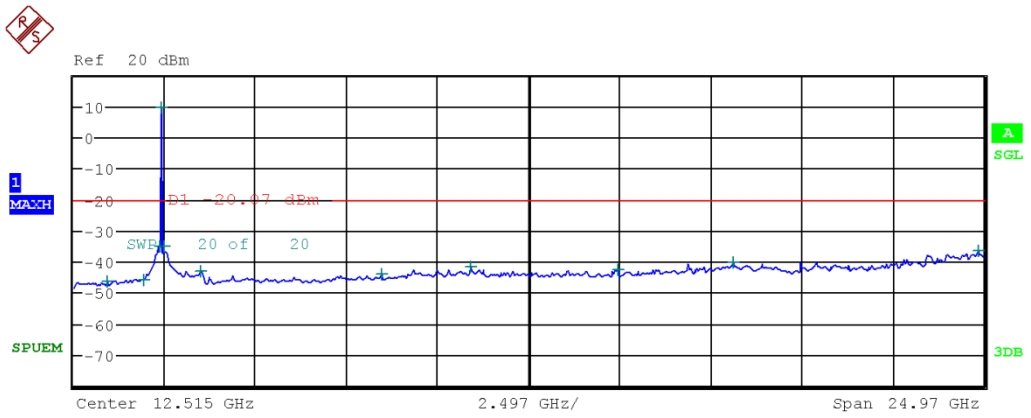
Reference



Conducted Spurious Emissions



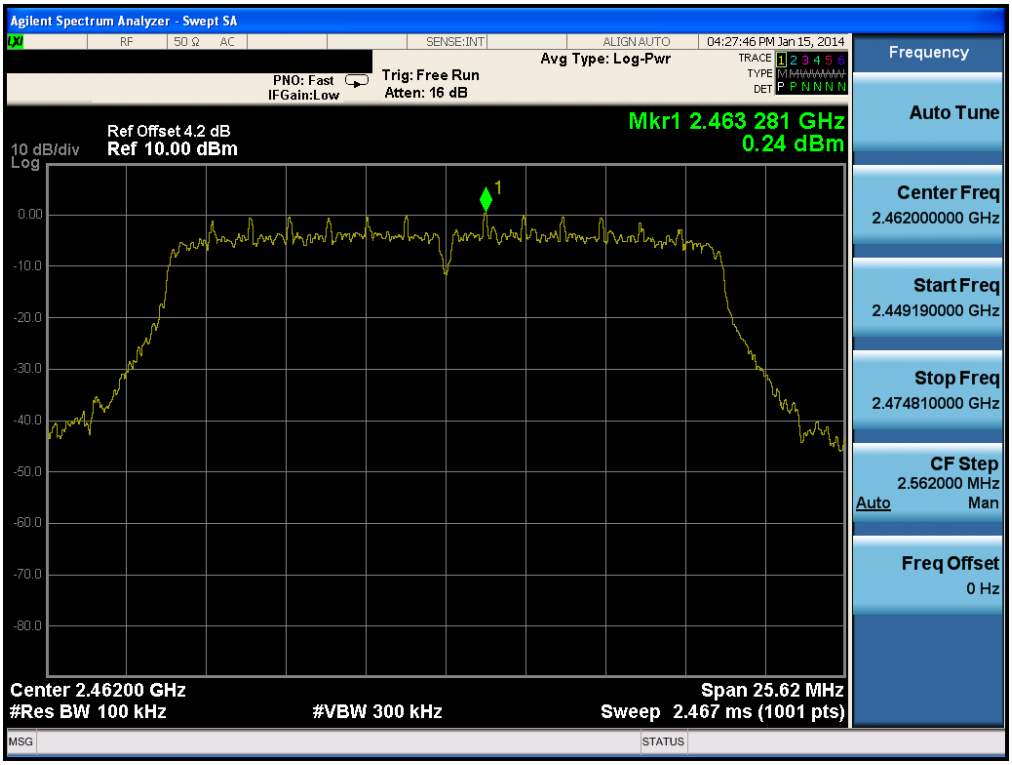
Conducted Spurious Emissions



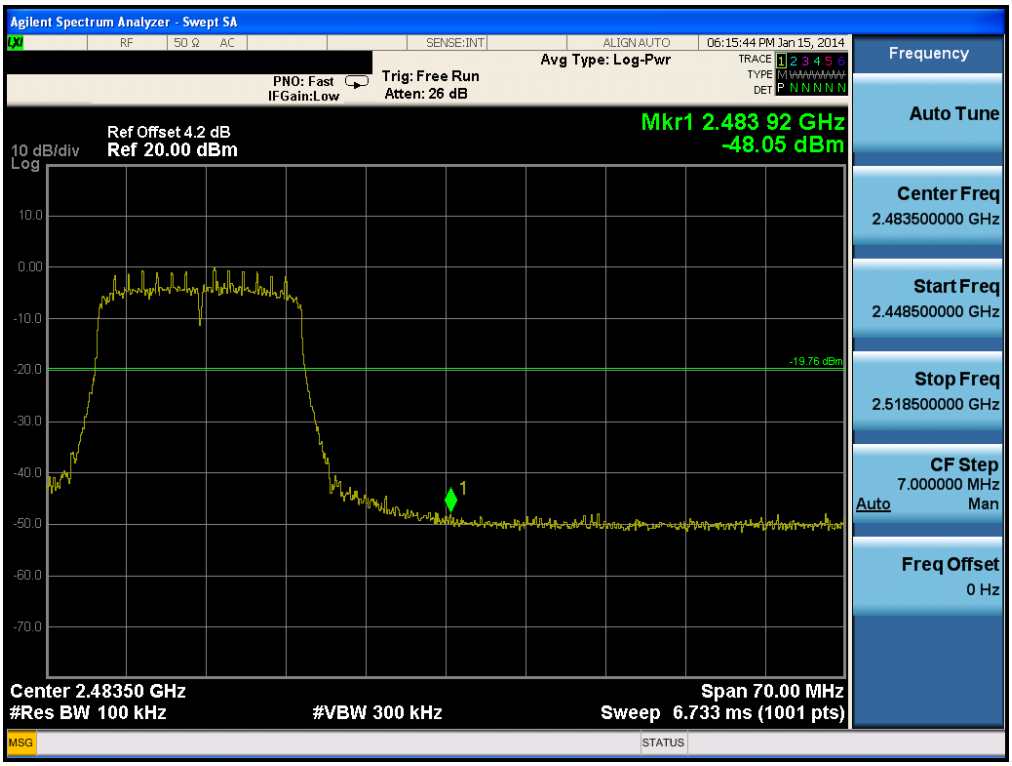
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	955.056667 M	-46.24
1.000 G	2.000 G	1.00 M	1.933667 G	-45.92
2.000 G	2.400 G	1.00 M	2.397800 G	-35.25
2.400 G	2.483 G	1.00 M	2.439003 G	9.23
2.483 G	3.000 G	1.00 M	2.494656 G	-35.02
3.000 G	6.000 G	1.00 M	3.521667 G	-42.97
6.000 G	9.000 G	1.00 M	8.459667 G	-43.93
9.000 G	12.000 G	1.00 M	10.906333 G	-41.71
12.000 G	15.000 G	1.00 M	14.936667 G	-42.65
15.000 G	20.000 G	1.00 M	18.119500 G	-40.31
20.000 G	25.000 G	1.00 M	24.826500 G	-36.79

802.11n(HT20) & MCS0 & 2462MHz

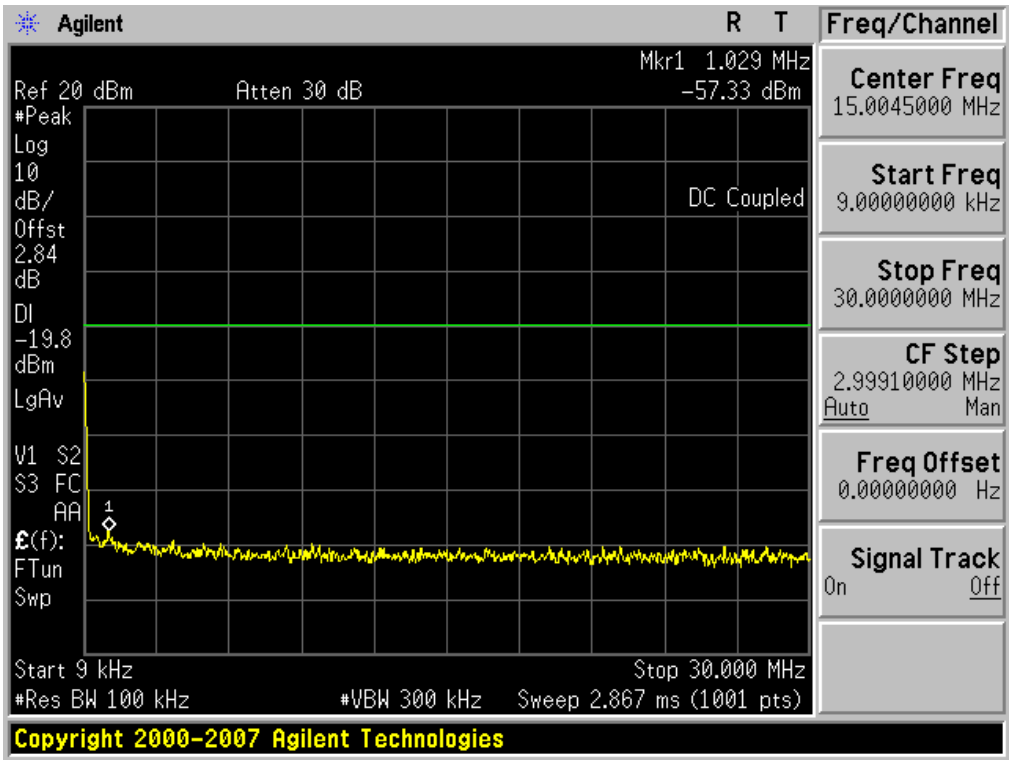
Reference

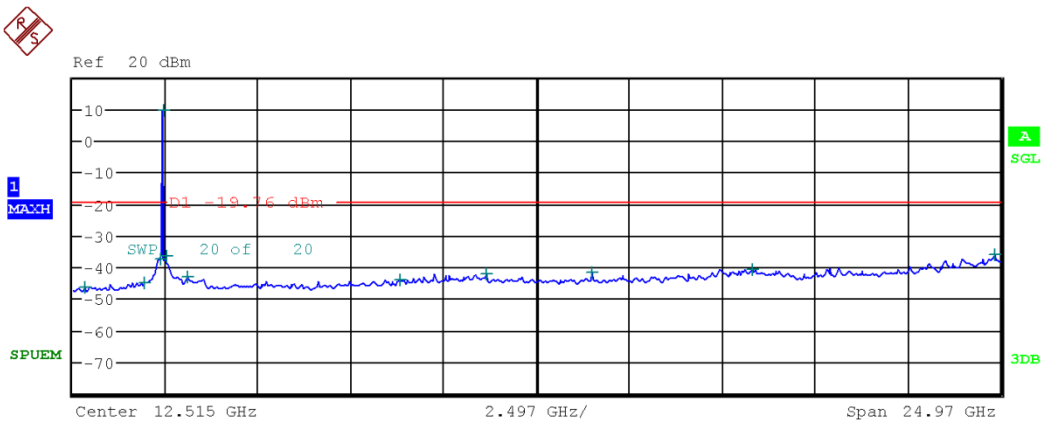


High Band-edge



Conducted Spurious Emissions





Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]
30.000 M	1.000 G	1.00 M	339.430000 M	-46.52
1.000 G	2.000 G	1.00 M	1.965000 G	-44.82
2.000 G	2.400 G	1.00 M	2.379680 G	-37.37
2.400 G	2.483 G	1.00 M	2.458625 G	9.24
2.483 G	3.000 G	1.00 M	2.547546 G	-36.60
3.000 G	6.000 G	1.00 M	3.117333 G	-43.35
6.000 G	9.000 G	1.00 M	8.841667 G	-43.88
9.000 G	12.000 G	1.00 M	11.161333 G	-42.00
12.000 G	15.000 G	1.00 M	13.987667 G	-41.73
15.000 G	20.000 G	1.00 M	18.314500 G	-40.89
20.000 G	25.000 G	1.00 M	24.821000 G	-35.97

8.5 Radiated Spurious Emissions

Test Requirements and limit,§15.247(d), §15.205, §15.209& RSS-210 [A8.5], RSS-Gen [7.2.2]

In any 100kHz 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

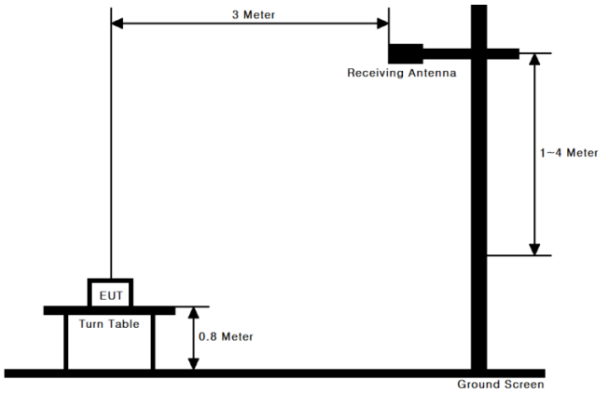
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part,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



▣ TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable 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 1m to 4m 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.

Peak Measurement : 12.2.4 of KDB 558074 v03r1

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 : 12.2.5 of KDB 558074 v03r1

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.

Band	Duty Cycle (%)	T_{on}(ms)	T_{on}+ T_{off} (ms)	DCF = 10log(1/Duty) (dB)
802.11b	**99.74**	18.840	18.890	0.01
802.11g	**98.58**	3.126	3.171	0.06
2.4GHz 802.11n(HT20)	**98.57**	2.904	2.946	0.06
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

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

▪ 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)
2336.72	H	X	PK	67.10	- 3.38	-	-	63.72	74.00	10.28
2336.72	H	X	AV	56.27	- 3.38	-	-	52.89	54.00	1.11
4823.84	H	X	PK	46.48	5.43	-	-	51.91	74.00	22.09
4824.00	H	X	AV	38.30	5.43	-	-	43.73	54.00	10.27
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ 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)
4873.99	H	X	PK	46.55	5.64	-	-	52.19	74.00	21.81
4873.94	H	X	AV	37.92	5.64	-	-	43.56	54.00	10.44
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ 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)
2484.14	H	X	PK	69.00	- 2.79	-	-	66.21	74.00	7.79
2483.71	H	X	AV	53.94	- 2.79	-	-	51.15	54.00	2.85
4923.84	H	X	PK	46.31	5.99	-	-	52.30	74.00	21.70
4923.88	H	X	AV	39.19	5.99	-	-	45.18	54.00	8.82

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.

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

▪ 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)
2326.08	H	X	PK	67.29	- 3.38	-	-	63.91	74.00	10.09
2326.08	H	X	AV	56.04	- 3.38	-	-	52.66	54.00	1.34
4823.94	H	X	PK	43.46	5.43	-	-	48.89	74.00	25.11
4823.93	H	X	AV	32.75	5.43	-	-	38.18	54.00	15.82
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ 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)
4873.96	H	X	PK	43.53	5.64	-	-	49.17	74.00	24.83
4873.88	H	X	AV	32.87	5.64	-	-	38.51	54.00	15.49
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ 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)
2484.70	H	X	PK	64.97	- 2.79	-	-	62.18	74.00	11.82
2484.34	H	X	AV	53.62	- 2.79	-	-	50.83	54.00	3.17
4924.32	H	X	PK	43.83	5.99	-	-	49.82	74.00	24.18
4924.34	H	X	AV	32.87	5.99	-	-	38.86	54.00	15.14

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.

9KHz ~ 25GHz Data(*802.11n HT20 & MCS0*)

▪ 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)
2338.08	H	X	PK	68.61	- 3.38	-	-	65.23	74.00	8.77
2338.16	H	X	AV	56.33	- 3.38	-	-	52.95	54.00	1.05
4823.84	H	X	PK	44.63	5.43	-	-	50.06	74.00	23.94
4823.70	H	X	AV	33.17	5.43	-	-	38.60	54.00	15.40
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ 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)
4873.84	H	X	PK	43.93	5.64	-	-	49.57	74.00	24.43
4873.97	H	X	AV	33.26	5.64	-	-	38.90	54.00	15.10
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ 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)
2483.87	H	X	PK	70.49	- 2.79	-	-	67.70	74.00	6.30
2483.81	H	X	AV	55.53	- 2.79	-	-	52.74	54.00	1.26
4924.05	H	X	PK	43.97	5.99	-	-	49.96	74.00	24.04
4923.98	H	X	AV	32.78	5.99	-	-	38.77	54.00	15.23

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& RSS-Gen [7.2.2]

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 Configuration

See test photographs for the actual connections between EUT and support equipment.

Test Mode

The all modes of EUT operation were investigated and the worst case mode was reported.

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: N/A**

8.7 Occupied Bandwidth

Test Requirements, RSS-Gen [4.6.1]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%.
The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted.
Where practical,a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

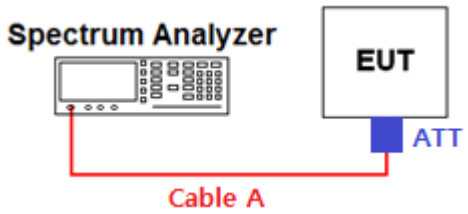
▣ TEST RESULTS: N/A

9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	E4440A	13/10/24	14/10/24	US45303051
Spectrum Analyzer	Agilent	N9020A	13/04/10	14/04/10	MY50200816
Spectrum Analyzer	Rohde Schwarz	FSQ26	13/02/14	14/02/14	200445
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A/ MA2411B	13/09/16	14/09/16	1111002 / 011290
DC Power Supply	SM techno	SDP30-5D	13/02/14	14/02/14	305DLJ204
Multimeter	H.P	34401A	13/02/27	14/02/27	3146A13475
Vector Signal Generator	Rohde Schwarz	SMBV100A	14/01/07	15/01/07	255571
Signal Generator	Rohde Schwarz	SMF100A	13/07/22	14/07/22	102341
Thermohygrometer	BODYCOM	BJ5478	13/06/01	14/06/01	120612-2
High-pass Filter	Wainwright Instruments	WHKX3.0	13/09/12	14/09/12	9
Loop Antenna	Schwarzbeck	FMZB1513	12/09/24	14/09/24	1513-128
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
Horn Antenna	ETS	3115	13/02/28	15/02/28	00021097
Horn Antenna	A.H.Systems Inc.	SAS-574	13/03/20	15/03/20	154
Attenuator (3dB)	WEINSCHEL	56-3	13/09/12	14/09/12	Y2342
Amplifier (22dB)	H.P	8447E	14/01/08	15/01/08	2945A02865
Amplifier (30dB)	Agilent	8449B	13/02/27	14/02/27	3008A00370
EMI TEST RECEIVER	R&S	ESU	14/01/08	15/01/08	100014

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	2.84	15	5.32
1	3.56	20	5.50
2412& 2437 & 2462	4.20	25	5.71
5	4.47	-	-
10	5.26	-	-

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 + ATT (Attenuator, Applied only when it was used externally)
Note. 2: For conducted spurious emissions, the path loss values were saved as the transducer factor on the spurious measurement function of the spectrum analyzer and the transducer factor of tested frequency is calculated and corrected automatically by the spectrum analyzer's measurement function.