FCC RF TEST REPORT

Test Laboratory:
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Test Report Number: SKTRFC-130913-013

Date of issue: September 13, 2013

Applicant:	**HITRON SYSTEMS INC.** 5953-85, SEODONG-DAERO, SAMJUG-MYEON, ANSEONG-SI, GYEONGGI-DO, KOREA
Manufacturer:	**HITRON SYSTEMS INC.** 5953-85, SEODONG-DAERO, SAMJUG-MYEON, ANSEONG-SI, GYEONGGI-DO, KOREA
Product:	Network Dome Camera
Model:	NDT-7202 (please see P5 for all the model numbers)
FCC ID:	LLINDT72
File number:	SKTEU13-0982
EUT received:	July 5, 2013

Applied standards:	ANSI C63.10-2009 and ANSI C63.4-2009 558074 D01 DTS Meas Guidance v03r01
Rule parts:	FCC Part 15 Subpart C - Intentional radiators
Equipment Class:	DTS - Part 15 Digital Transmission System

Remarks to the standards:	None

The above equipment has been tested by SK Tech Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product or system, which was tested.

Inyong Song **/ Testing Engineer**

Jongsoo Yoon **/ Technical Manager**

Revision History of Report

Rev.	Revisions	Effect page	Reviewed by	Date
-	Initial issue	All	Jongsoo Yoon	September 13, 2013

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1 Summary of test results

Requirement	CFR 47 Section	Result
Antenna Requirement	15.203, 15.247(b)(4)	Meets the requirements
6dB Bandwidth	15.247(a)(2)	Meets the requirements
Maximum Peak Output Power	15.247(b)(3), (4)	Meets the requirements
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.205(a), 15.209(a)	Meets the requirements
Peak Power Spectral Density	15.247(e)	Meets the requirements
AC power line Conducted emissions	15.207(a)	Meets the requirements

2 Description of equipment under test (EUT)

Product:	Network Dome Camera
Model:	NDT-7202
Serial number:	None (prototype)

Model differences:

Model name	Difference	Tested (checked)
NDT-7202	Original	☒
GND20L, CD71PW, VIP2P1N, PNC-303, 2M-D3W	For marketing purpose	

Note: *All the differences were compared with the test sample*

Technical data:

Power source	DC 12 V Power over Ethernet
Local Oscillator or X-Tal	XTAL: 32.768 kHz, 24 MHz, 25 MHz, 37.125 MHz (WLAN module) 40 MHz
Transmit Frequency	IEEE 802.11b: 2412 MHz ~ 2462 MHz (11 channels) IEEE 802.11g: 2412 MHz ~ 2462 MHz (11 channels) IEEE 802.11n HT20: 2412 MHz ~ 2462 MHz (11 channels) IEEE 802.11n HT40: 2422 MHz ~ 2452 MHz (7 channels)
Antenna Type	Omni-directional antenna, peak gain : 0.23 dBi
Type of Modulation	IEEE 802.11b: DSSS (DBPSK, DQPSK, CCK) IEEE 802.11g/n HT20/40: OFDM(64QAM, 16QAM, QPSK, BPSK)
RF Output power	20.35 dBm PEAK (measured)

NOTE *The test report for the compliance with FCC Part 15B as a digital device was issued with other test report number*

I/O port	Type	Q'ty	Remark
DC power input	Jack	1	
LAN (Ethernet)	RJ-45	1	
Alarm In/Out	4-wires	1	

NOTE *The test report for the compliance with FCC Part 15B as a digital device was issued with other test report number*

Equipment Modifications

none

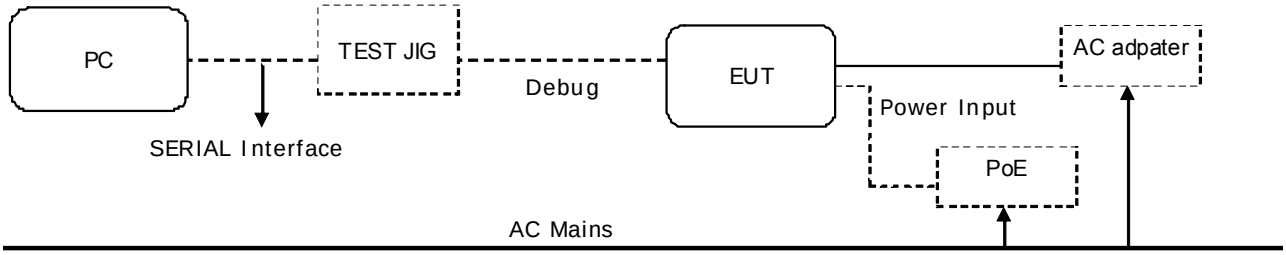
Submitted Documents

Block diagram, Schematic diagram, Antenna Specification, Part List, User manual

3 Test and measurement conditions

3.1. Test configuration (arrangement of EUT)

The measurements were taken in continuous transmitting mode using the TEST MODE. For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.



3.2. Description of support units (accessory equipment)

The following support units or accessories were used to form a representative test configuration during the tests.

#	Equipment	Manufacturer	Model No.	Serial No.
1	PC	DELL INC.	DCNE	7XH86BX
2.	TEST JIG	provided by the applicant	-	-
3	AC adapter	LI SHIN	LSE0107A1240	L21109010038
4	PoE	NETGEAR	GS724TPS V1H1	23P40C3M0000C

Note: *1) The PC was used for control of the RF module via SERIAL interface at the Debug port in the EUT.*
2) For radiated spurious emission measurements, the measurements were performed without PC after setting the radio module to TEST MODE.
3) The AC adapter and PoE were provided by the applicant for the purpose of testing

3.3. Interconnection and I/O cables

The following support units or accessories were used to form a representative test configuration during the tests.

#	Start		End		Cable	
	Name	I/O port	Name	I/O port	length (m)	shielded (Y/N)
1	EUT	DC IN	AC adapter	DC OUT	2.3	N
2	AC adapter	AC IN	AC Mains	AC Mains	1.5	N
3	EUT	LAN	PoE	LAN	2.0	N
4	PoE	AC IN	AC Mains	AC Mains	1.8	N

Note: *1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.4. Measurement Uncertainty (*U*)

Measurement Item	Combined Standard Uncertainty *Uc*	Expanded Uncertainty $U = k \times Uc$ ($k = 2$)
Conducted RF power	±1.49 dB	±2.98 dB
Radiated disturbance	±2.30 dB	±4.60 dB
Conducted disturbance	±1.96 dB	±3.92 dB

3.5. Test date

Date Tested	July 17, 2013 – September 2, 2013

4 Facilities and accreditations

4.1. Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd
Site I: 820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, Korea
Site II: 688-8, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, Korea

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-4. The sites comply with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The measuring apparatus and ancillary equipment conform to CISPR 16-1 series.

4.2. Accreditations

The laboratory has been also notified to FCC by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Declaration of Conformity (DOC) and Certification under Parts 15 and 18 of the FCC Rules.

Designation No. KR0007

4.3. List of test and measurement instruments

No	Description	Manufacturer	Model	Serial No.	Cal. due	Use
1	Spectrum Analyzer	Agilent	E4405B	US40520856	2014.03.07	
2	Spectrum Analyzer	Agilent	E4440A	MY46186322	2014.03.18	☒
3	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2014.07.08	
4	EMI Test Receiver	Rohde&Schwarz	ESPI7	101026	2014.07.08	☒
5	EMI Test Receiver	Rohde&Schwarz	ESHS10	835871/002	2014.07.08	☒
6	Artificial Mains Network	Rohde&Schwarz	ESH2-Z5	834549/011	2014.07.08	☒
7	Pre-amplifier	HP	8447F	3113A05153	2014.07.08	☒
8	Pre-amplifier	MITEQ	AFS44	1116321	2013.12.15	
9	Pre-amplifier	MITEQ	AFS44	1116322	2014.03.08	☒
10	Power Meter	Agilent	E4417A	MY45100426	2014.07.09	
11	Power Meter	Agilent	E4418B	US39402176	2014.07.09	
12	Power Sensor	Agilent	E9327A	MY44420696	2014.07.09	
13	Power Sensor	Agilent	8485A	3318A13916	2014.07.09	
14	Attenuator (10dB)	HP	8491B	38072	2014.07.08	☒
15	High Pass Filter	Wainwright	WHKX3.0/18G	8	2014.07.08	☒
16	VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	2013.10.04	
17	UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 990	2013.10.04	
18	Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	2013.12.22	☒
19	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	230	2014.05.21	☒
20	Horn Antenna	AH Systems	SAS-200/571	304	N/A	
21	Horn Antenna	EMCO	3115	00040723	2014.03.26	☒
22	Horn Antenna	EMCO	3115	00056768	2014.09.05	
23	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170318	2013.09.28	☒
24	Vector Signal Generator	Agilent	E4438C	MY42080359	2014.07.09	
25	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2014.07.09	
26	DC Power Supply	HP	6622A	3348A03223	2014.07.09	
27	Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	2014.07.12	☒
28	Temperature/Humidity Chamber	All Three	ATM-50M	20030425	2014.03.08	

5 Test and measurements

5.1. Antenna requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result: PASS

The transmitter has the internal antenna. The directional gain of the antenna is 0.23 dBi.

5.2. Test Configuration of Equipment Under Test

Pre-Scanned RF Power

The RF power output was set to '38' as the maximum power output as declared by the applicant.
The RF signals were continuously transmitted without off-time interval; duty cycle was 100 %.

Preliminary tests were performed in different data rate as below table and the highest power data rates (11b, 11g, 11g/n (BW 20MHz), 11g/n (BW 40MHz) modes) were chosen for full test in the following sections to demonstrate compliance to the limits.

Measured peak power (dBm) operating 802.11b mode

	1 Mbps	2 Mbps	5.5 Mbps	**11 Mbps**
2412 MHz	17.53	17.61	17.43	**19.49**
2437 MHz	18.13	18.22	18.23	**20.05**
2462 MHz	17.91	18.03	17.99	**19.88**

Measured peak power (dBm) operating 802.11g mode

	6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	**54 Mbps**
2412 MHz	18.06	18.16	18.44	17.92	18.72	18.54	18.58	**18.84**
2437 MHz	18.93	19.00	19.24	18.63	19.42	19.16	19.15	**19.54**
2462 MHz	18.82	18.88	19.05	18.50	19.19	18.89	18.97	**19.35**

Measured peak power (dBm) operating 802.11n(HT20) mode

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	**MCS7**
2412 MHz	18.05	18.10	18.08	18.46	18.45	18.49	18.47	**18.62**
2437 MHz	18.99	18.89	18.73	19.10	18.98	19.09	19.14	**19.21**
2462 MHz	18.89	18.75	18.63	18.92	18.75	18.99	19.05	**19.16**

Measured peak power (dBm) operating 802.11n(HT40) mode

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	**MCS7**
2422 MHz	18.05	18.15	18.27	18.55	18.62	18.82	18.93	**19.02**
2437 MHz	18.65	18.49	18.52	18.80	18.84	19.02	19.11	**19.19**
2452 MHz	18.61	18.47	18.45	18.68	18.76	18.98	19.10	**19.21**

5.3. 6 dB bandwidth

5.3.1 Regulation

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

5.3.2 Test Procedure

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
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 outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.3 Test Results: PASS

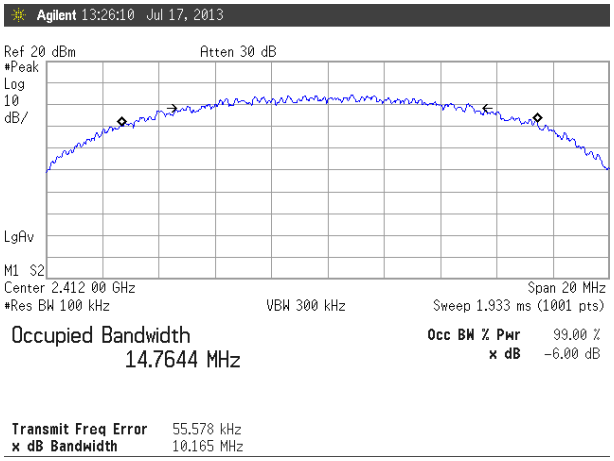
Table 1: Measured values of the 6 dB Bandwidth

Modulation	Operating frequency	Transfer Rate	Occupied Bandwidth (99%)	6dB Bandwidth	Limit
802.11b	2412 MHz	11 Mbps	14.76 MHz	10.17 MHz	≥ 500 kHz
	2437 MHz	11 Mbps	14.76 MHz	10.19 MHz	≥ 500 kHz
	2462 MHz	11 Mbps	14.80 MHz	10.19 MHz	≥ 500 kHz
802.11g	2412 MHz	54 Mbps	16.42 MHz	16.53 MHz	≥ 500 kHz
	2437 MHz	54 Mbps	16.42 MHz	16.53 MHz	≥ 500 kHz
	2462 MHz	54 Mbps	16.42 MHz	16.53 MHz	≥ 500 kHz
802.11n HT20	2412 MHz	MCS7	17.62 MHz	17.78 MHz	≥ 500 kHz
	2437 MHz	MCS7	17.61 MHz	17.78 MHz	≥ 500 kHz
	2462 MHz	MCS7	17.61 MHz	17.78 MHz	≥ 500 kHz
802.11n HT40	2422 MHz	MCS7	36.24 MHz	36.26 MHz	≥ 500 kHz
	2437 MHz	MCS7	36.23 MHz	36.28 MHz	≥ 500 kHz
	2452 MHz	MCS7	36.29 MHz	36.37 MHz	≥ 500 kHz

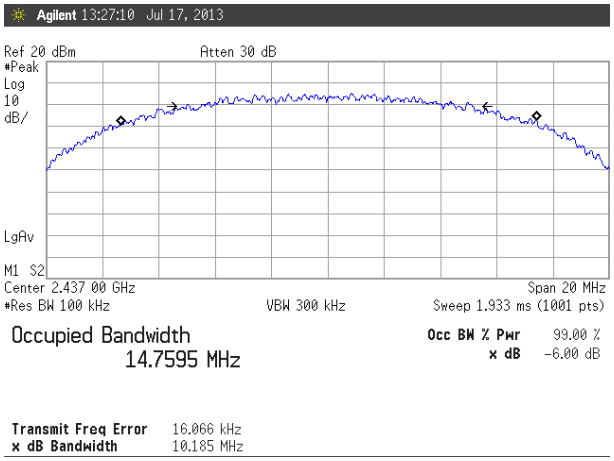
Figure 1. Plot of the 6dB Bandwidth & Occupied Bandwidth (99%)

802.11b mode:

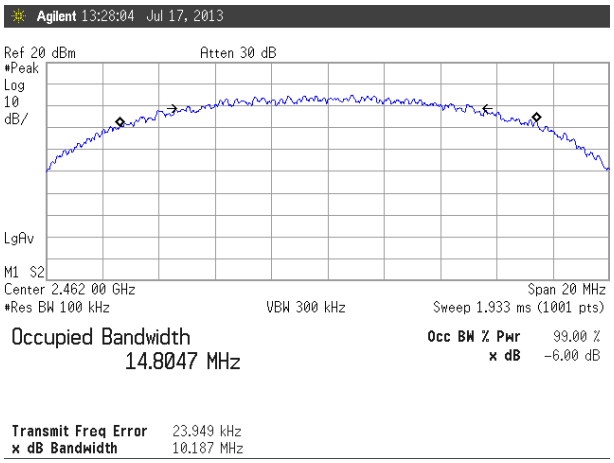
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

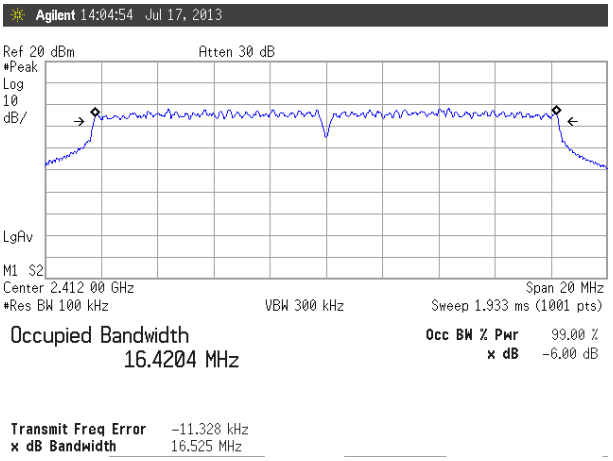


Highest Channel (2462 MHz)

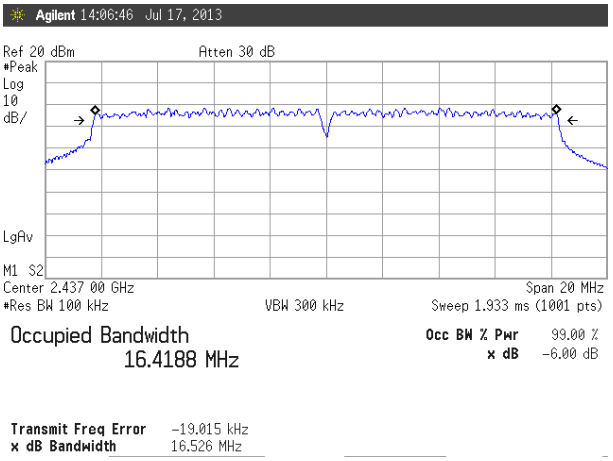


802.11g mode:

Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



Highest Channel (2462 MHz)

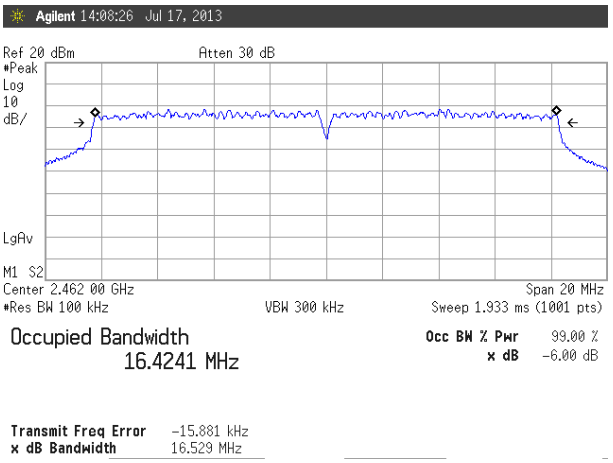
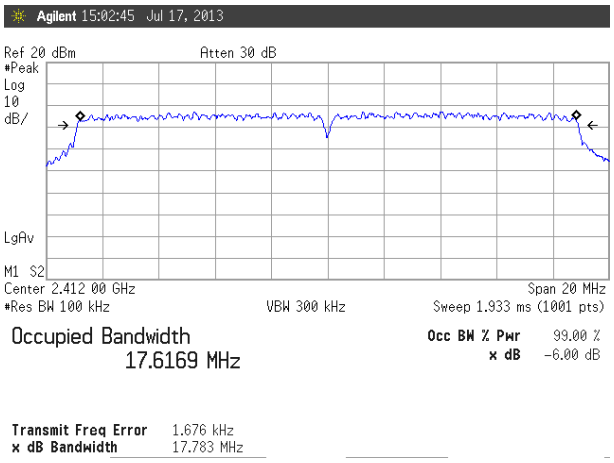


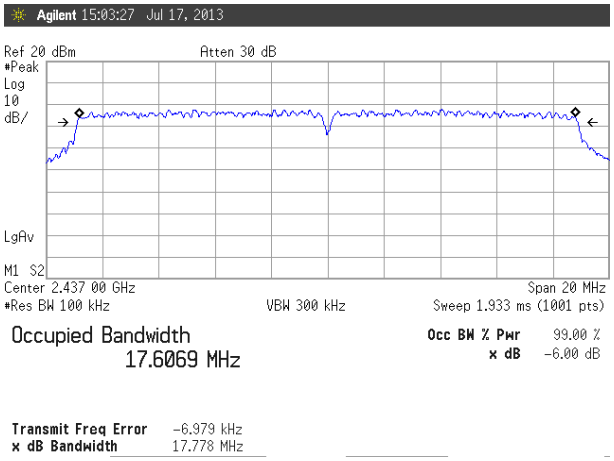
Figure 1. Plot of the 6dB Bandwidth & Occupied Bandwidth (99%) *(continued)*

802.11n HT20 mode:

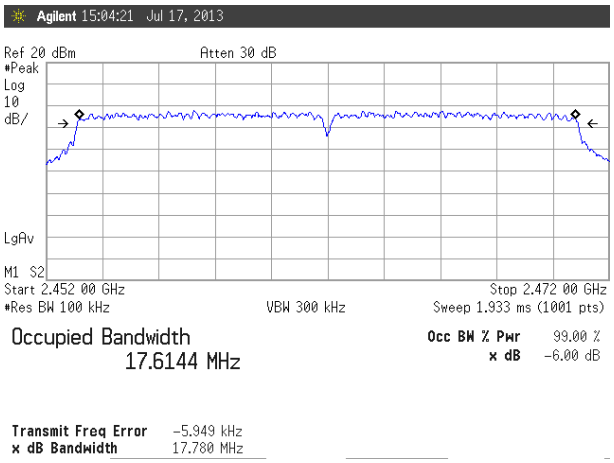
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

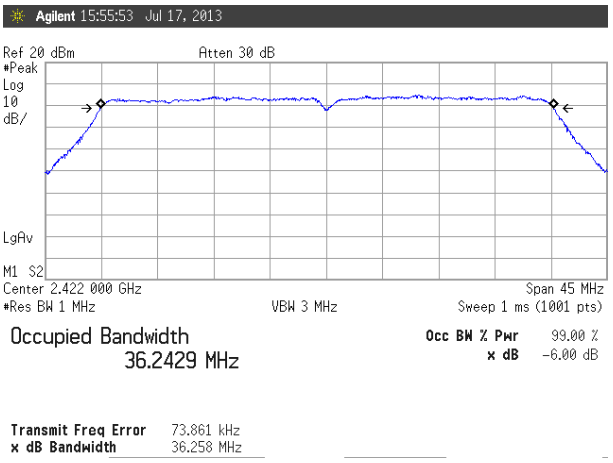


Highest Channel (2462 MHz)

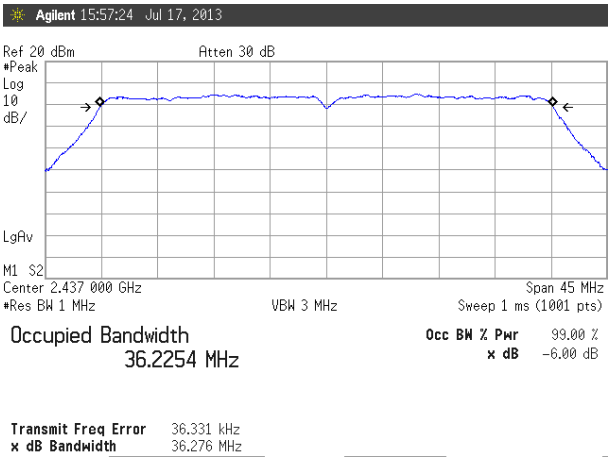


802.11n HT40 mode:

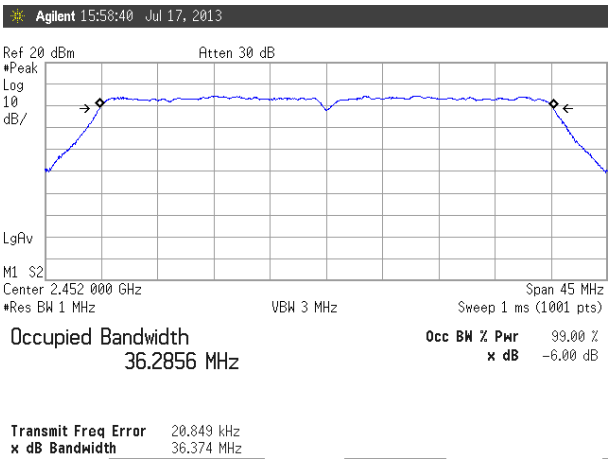
Lowest Channel (2422 MHz)



Middle Channel (2437 MHz)



Highest Channel (2452 MHz)



5.4. Maximum peak output power

5.4.1 Regulation

According to §15.247(b)(3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.4.2 Test Procedure

1. Set the RBW = 1 MHz.
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 1.5 x DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

5.4.3 Test Results: PASS

Table 2: Measured values of the Maximum Peak Conducted Output Power

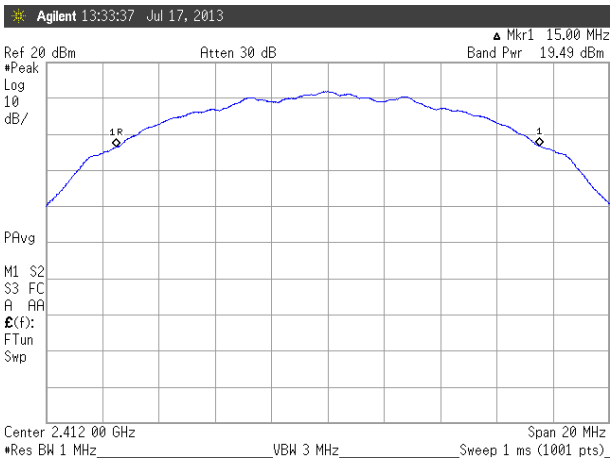
Modulation	Operating Frequency	Transfer Rate	Peak Power		Average Power [dBm] (NOTE)	Limit
			[dBm]	W		
802.11b	2412 MHz	11 Mbps	19.49	0.089	14.39	1 W
	2437 MHz		20.05	0.101	15.00	1 W
	2462 MHz		19.88	0.097	14.82	1 W
802.11g	2412 MHz	54 Mbps	18.84	0.077	10.35	1 W
	2437 MHz		19.54	0.090	10.94	1 W
	2462 MHz		19.35	0.086	10.70	1 W
802.11n HT20	2412 MHz	MCS7	18.62	0.073	10.37	1 W
	2437 MHz		19.21	0.083	10.93	1 W
	2462 MHz		19.16	0.082	10.69	1 W
802.11n HT40	2422 MHz	MCS7	19.02	0.080	10.21	1 W
	2437 MHz		19.19	0.083	10.39	1 W
	2452 MHz		19.21	0.083	10.45	1 W

NOTE The Average power were measured using AVGSA- 1 method as the reference only.

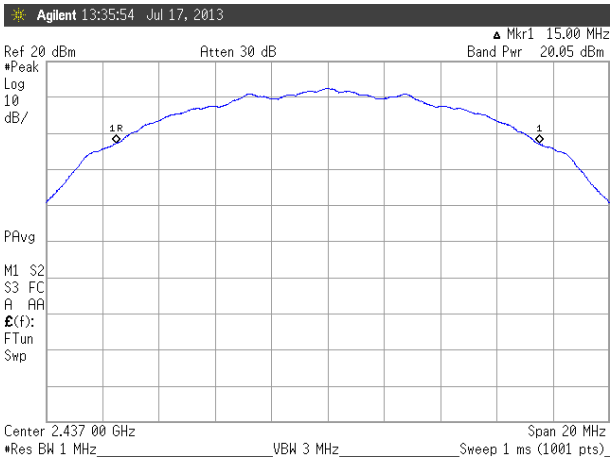
Figure 2. Plot of the Maximum Peak Conducted Output Power

802.11b mode:

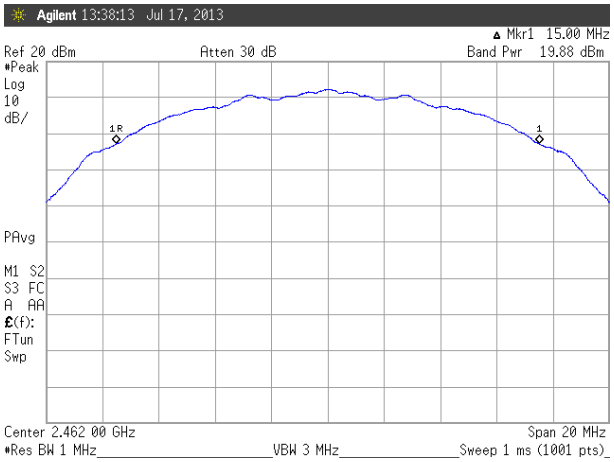
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

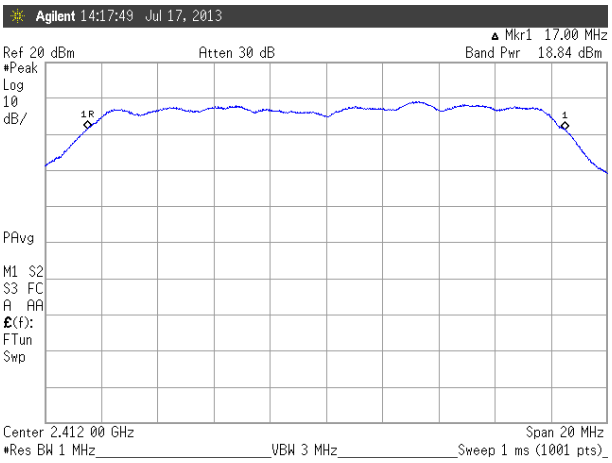


Highest Channel (2462 MHz)

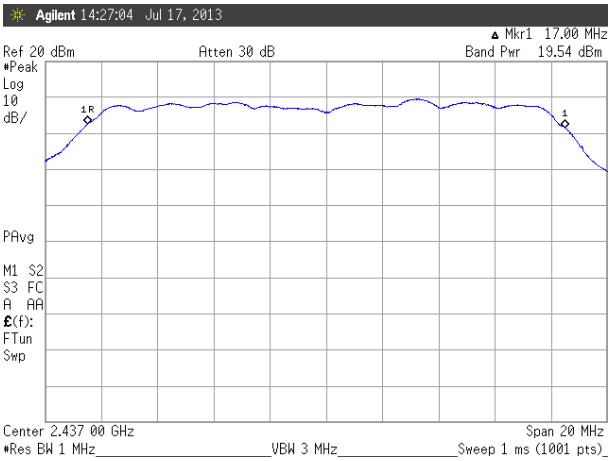


802.11g mode:

Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



Highest Channel (2462 MHz)

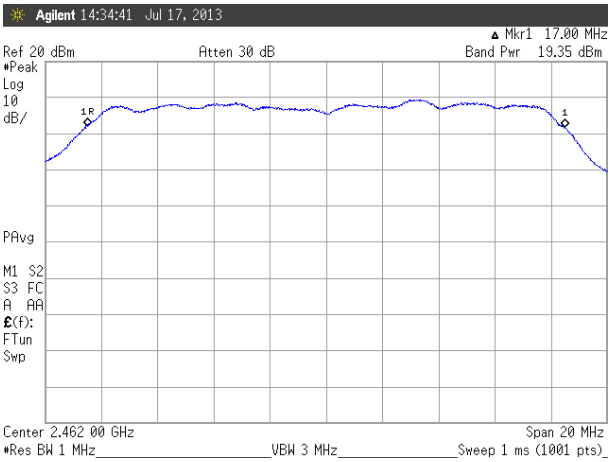
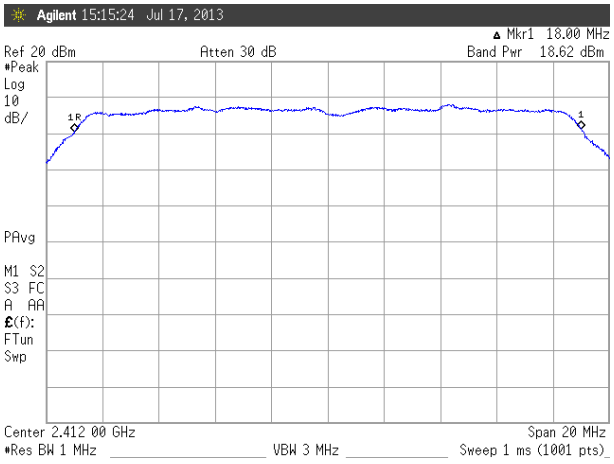


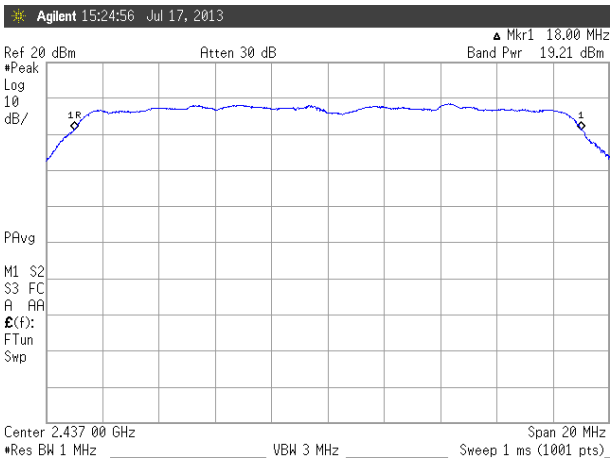
Figure 2. Plot of the Maximum Peak Conducted Output Power *(continued)*

802.11n HT20 mode:

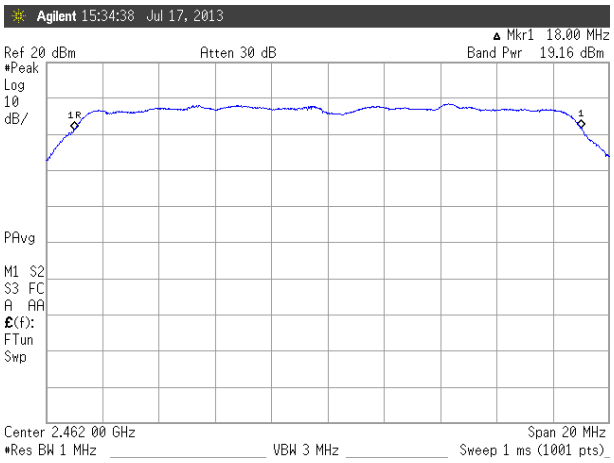
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

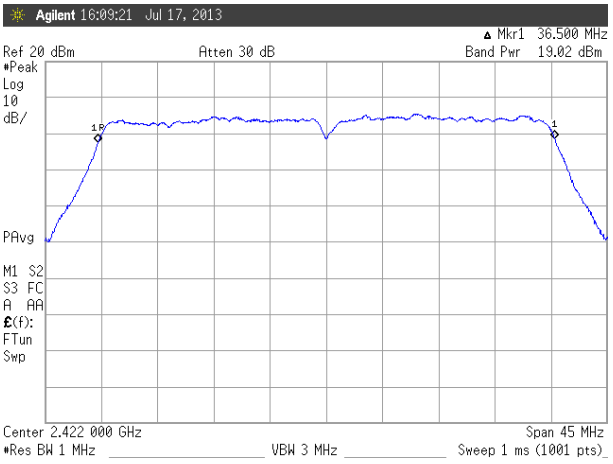


Highest Channel (2462 MHz)

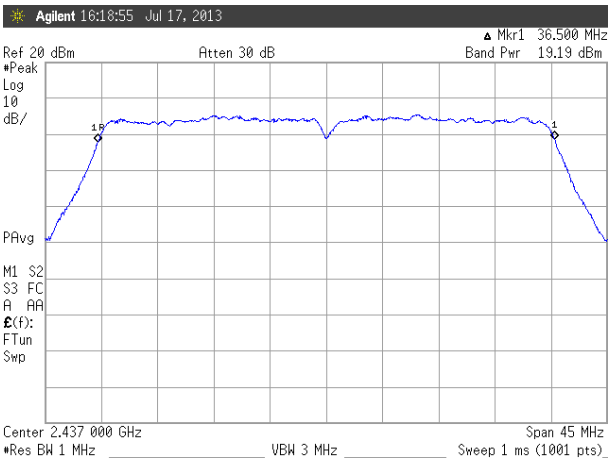


802.11n HT40 mode:

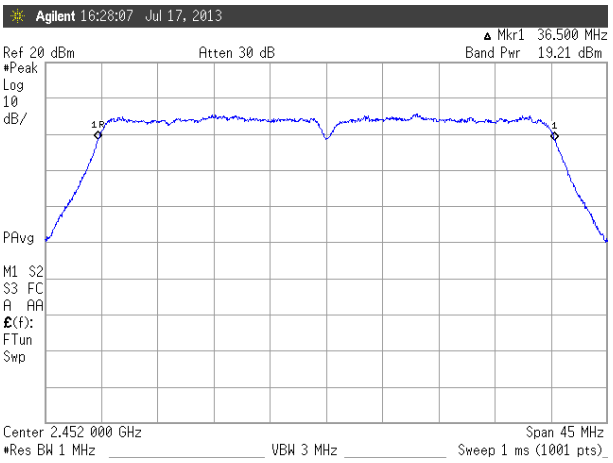
Lowest Channel (2422 MHz)



Middle Channel (2437 MHz)



Highest Channel (2452 MHz)



5.5. Spurious emissions, Band edge, and Restricted bands

5.5.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

5.5.2 Test Procedure

1) Band-edge measurements for RF conducted emissions

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation
   RBW ≥ 1 % of spectrum analyzer display span
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter / 3 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function specified in 6.3 and 6.4, 6.5, or 6.6, as applicable, and the appropriate regulatory requirements for the frequency being measured.43
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to approximately 1 % to 5 % of the total span, unless otherwise specified, with a video bandwidth equal to or greater than the RBW.
   Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an absolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
3. Subtract the delta measured in b) from the field strengths measured in a). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance of the restricted bands, described in 5.9.
4. The above “delta” measurement technique may be used for measuring emissions that are up to two “standard” bandwidths away from the band edge, where a “standard” bandwidth is the bandwidth specified by 4.2.3.2 for the frequency being measured. For example, band-edge measurements in the restricted band that begins at 2483.5 MHz require a measurement bandwidth of at least 1 MHz.
   Therefore the “delta” technique for measuring emissions up to 2 MHz removed from the band edge may be used. Radiated emissions that are removed by more than two “standard” bandwidths shall be measured in the conventional manner.

5.5.3 Test Results: PASS

Band-edge compliance of RF conducted/radiated emissions was shown in the Figure 3 and 4.
Spurious RF conducted emissions were shown in the Figure 5.
Emission plot for the preliminary radiated measurements were shown in the Figure 6.

NOTE 1: for conducted measurement, we took the insertion loss of the cable loss into consideration within the measuring instrument. And for radiated measurement, the results were calibrated to the field strength within the measuring instrument; Table 3 contains the correction factors at the operating frequencies such as antenna factor, cable loss, etc.

NOTE 2: The preliminary radiated measurements were performed in the anechoic chamber in order to find the frequency, which falls in the restricted bands as defined in Section 15.205, and the results for the final measurements were indicated in the Table 3.

Table 3: Measured values of the Field strength of spurious emission (Radiated)

BELOW 1 GHz

Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Average/Peak/Quasi-peak data, emissions below 30 MHz												
Quasi-peak data, emissions below 1000 MHz												
248.84	120	H	1.00	196	46.57	27.85	-	11.59	1.95	32.26	46.00	13.74
248.84	120	V	1.88	107	52.00	27.85	-	11.59	1.95	37.69	46.00	8.31
274.99	120	H	1.05	184	44.25	27.80	-	12.55	2.04	31.04	46.00	14.96
274.99	120	V	1.70	238	49.66	27.80	-	12.55	2.04	36.45	46.00	9.55
450.00	120	H	1.00	188	46.10	28.77	-	16.88	2.64	36.85	46.00	9.15
450.00	120	V	1.54	100	42.84	28.77	-	16.88	2.64	33.59	46.00	12.41
500.00	120	H	1.00	175	44.99	29.09	-	18.09	2.80	36.79	46.00	9.21
500.00	120	V	1.49	109	42.16	29.09	-	18.09	2.80	33.96	46.00	12.04

No Radiated Spurious Emissions Found

Margin (dB) = Limit – Actual
[Actual = Reading – Amp Gain + Attenuator + AF + CL]
1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
PEAK data, emissions above 1000 MHz **(802.11b mode)**												
2412.4	1000	H	1.00	94	-	48.46	10.23	28.19	6.52	91.49	Not Applicable	
2412.4	1000	V	1.31	69	-	48.46	10.23	28.19	6.52	90.76		
2336.4	1000	H	1.00	94	-	48.44	10.24	27.94	6.40	51.49	74.00	22.51
2338.8	1000	V	1.31	69	-	48.44	10.24	27.95	6.40	52.84	74.00	21.16
4829.6	1000	H	1.00	139	65.21	49.01	0.41	33.14	9.71	59.46	74.00	14.54
4818.5	1000	V	1.00	34	65.21	49.00	0.42	33.13	9.70	59.46	74.00	14.54
2442.4	1000	H	1.05	90	-	48.48	10.23	28.28	6.56	89.56	Not Applicable	
2442.4	1000	V	1.10	68	-	48.48	10.23	28.28	6.56	89.95		
4868.6	1000	H	1.01	133	63.80	49.02	0.39	33.16	9.75	58.08	74.00	15.92
4868.6	1000	V	1.04	34	62.92	49.02	0.39	33.16	9.75	57.20	74.00	16.80
2462.4	1000	H	1.15	86	-	48.49	10.23	28.35	6.59	88.26	Not Applicable	
2459.2	1000	V	1.00	67	-	48.49	10.23	28.33	6.58	88.98		
2486.4	1000	H	1.15	86	-	48.50	10.23	28.42	6.62	50.27	74.00	23.73
2493.6	1000	V	1.00	67	-	48.50	10.23	28.44	6.63	51.03	74.00	22.97
4918.5	1000	H	1.00	134	63.10	49.03	0.36	33.20	9.79	57.42	74.00	16.58
4918.6	1000	V	1.07	37	64.20	49.03	0.36	33.20	9.79	58.52	74.00	15.48
PEAK data, emissions above 1000 MHz **(802.11g mode)**												
2415.2	1000	H	1.00	94	-	48.47	10.23	28.19	6.52	87.24	Not Applicable	
2415.2	1000	V	1.31	69	-	48.47	10.23	28.19	6.52	86.36		
2338.8	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	51.20	74.00	22.80
2338.8	1000	V	1.31	69	-	48.44	10.24	27.95	6.40	53.06	74.00	20.94
4830.6	1000	H	1.00	138	59.26	49.01	0.41	33.14	9.71	53.51	74.00	20.49
4817.6	1000	V	1.00	35	59.22	49.00	0.42	33.13	9.70	53.47	74.00	20.53
2445.2	1000	H	1.10	90	-	48.48	10.23	28.29	6.56	85.14	Not Applicable	
2445.2	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	86.15		
4868.5	1000	H	1.01	133	57.86	49.02	0.39	33.16	9.75	52.14	74.00	21.86
4858.6	1000	V	1.03	35	57.02	49.01	0.40	33.16	9.74	51.31	74.00	22.69
2465.2	1000	H	1.15	85	-	48.49	10.23	28.35	6.59	83.91	Not Applicable	
2465.2	1000	V	1.02	66	-	48.49	10.23	28.35	6.59	85.07		
2497.2	1000	H	1.15	85	-	48.50	10.23	28.46	6.64	50.83	74.00	23.17
2489.6	1000	V	1.02	66	-	48.50	10.23	28.43	6.63	50.62	74.00	23.38
4917.6	1000	H	1.00	133	57.16	49.03	0.36	33.20	9.79	51.48	74.00	22.52
4918.6	1000	V	1.05	36	58.28	49.03	0.36	33.20	9.79	52.60	74.00	21.40

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 4 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
AVERAGE data, emissions above 1000 MHz **(802.11b mode)**												
2412.4	1000	H	1.00	94	-	48.46	10.23	28.19	6.52	84.47	Not Applicable	
2412.4	1000	V	1.31	69	-	48.46	10.23	28.19	6.52	83.45		
2336.4	1000	H	1.00	94	-	48.44	10.24	27.94	6.40	37.04	54.00	16.96
2338.8	1000	V	1.31	69	-	48.44	10.24	27.95	6.40	37.36	54.00	16.64
4829.6	1000	H	1.00	139	55.39	49.01	0.41	33.14	9.71	49.64	54.00	4.36
4818.5	1000	V	1.00	34	55.43	49.00	0.42	33.13	9.70	49.68	54.00	4.32
2442.4	1000	H	1.05	90	-	48.48	10.23	28.28	6.56	82.25	Not Applicable	
2442.4	1000	V	1.10	68	-	48.48	10.23	28.28	6.56	82.36		
4868.6	1000	H	1.01	133	53.84	49.02	0.39	33.16	9.75	48.12	54.00	5.88
4868.6	1000	V	1.04	34	52.98	49.02	0.39	33.16	9.75	47.26	54.00	6.74
2462.4	1000	H	1.15	86	-	48.49	10.23	28.35	6.59	80.97	Not Applicable	
2459.2	1000	V	1.00	67	-	48.49	10.23	28.33	6.58	80.28		
2486.4	1000	H	1.15	86	-	48.50	10.23	28.42	6.62	37.04	54.00	16.96
2493.6	1000	V	1.00	67	-	48.50	10.23	28.44	6.63	37.38	54.00	16.62
4918.5	1000	H	1.00	134	52.95	49.03	0.36	33.20	9.79	47.27	54.00	6.73
4918.6	1000	V	1.07	37	52.43	49.03	0.36	33.20	9.79	48.75	54.00	5.25
AVERAGE data, emissions above 1000 MHz **(802.11g mode)**												
2415.2	1000	H	1.00	94	-	48.47	10.23	28.19	6.52	77.32	Not Applicable	
2415.2	1000	V	1.31	69	-	48.47	10.23	28.19	6.52	76.20		
2338.8	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	37.04	54.00	16.96
2338.8	1000	V	1.31	69	-	48.44	10.24	27.95	6.40	37.61	54.00	16.39
4830.6	1000	H	1.00	138	46.38	49.01	0.41	33.14	9.71	40.63	54.00	13.37
4817.6	1000	V	1.00	35	46.38	49.00	0.42	33.13	9.70	40.63	54.00	13.37
2445.2	1000	H	1.10	90	-	48.48	10.23	28.29	6.56	75.50	Not Applicable	
2445.2	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	76.10		
4868.5	1000	H	1.01	133	44.79	49.02	0.39	33.16	9.75	39.07	54.00	14.93
4858.6	1000	V	1.03	35	43.97	49.01	0.39	33.16	9.75	38.26	54.00	15.74
2465.2	1000	H	1.15	85	-	48.49	10.23	28.35	6.59	73.69	Not Applicable	
2465.2	1000	V	1.02	66	-	48.49	10.23	28.35	6.59	74.85		
2497.2	1000	H	1.15	85	-	48.50	10.23	28.46	6.64	37.18	54.00	16.82
2489.6	1000	V	1.02	66	-	48.50	10.23	28.43	6.63	37.18	54.00	16.82
4917.6	1000	H	1.00	133	43.90	49.03	0.36	33.20	9.79	38.22	54.00	15.78
4918.6	1000	V	1.05	36	45.37	49.03	0.36	33.20	9.79	39.69	54.00	14.31

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 4 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
PEAK data, emissions above 1000 MHz **(802.11n HT20 mode)**												
2408.8	1000	H	1.00	94	-	48.46	10.23	28.17	6.51	86.67	Not Applicable	
2416.4	1000	V	1.31	69	-	48.47	10.23	28.20	6.52	86.24		
2338.4	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	52.35	74.00	21.65
2333.6	1000	V	1.31	69	-	48.44	10.24	27.93	6.39	52.97	74.00	21.03
4832.8	1000	H	1.00	138	59.15	49.01	0.41	33.14	9.71	53.40	74.00	20.60
4815.2	1000	V	1.00	34	59.14	49.00	0.42	33.13	9.70	53.39	74.00	20.61
2446.4	1000	H	1.10	90	-	48.48	10.23	28.29	6.56	84.95	Not Applicable	
2446.4	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	85.90		
4855.6	1000	H	1.01	135	57.66	49.01	0.40	33.16	9.74	51.95	74.00	22.05
4855.6	1000	V	1.00	34	56.90	49.01	0.40	33.16	9.74	51.19	74.00	22.81
2466.4	1000	H	1.15	85	-	48.49	10.23	28.36	6.59	83.70	Not Applicable	
2466.4	1000	V	1.02	65	-	48.49	10.23	28.36	6.59	85.07		
2498.0	1000	H	1.15	85	-	48.50	10.23	28.46	6.64	50.96	74.00	23.04
2493.2	1000	V	1.02	65	-	48.50	10.23	28.44	6.63	50.76	74.00	23.24
4932.8	1000	H	1.00	134	57.10	49.04	0.35	33.21	9.81	51.43	74.00	22.57
4932.8	1000	V	1.03	37	58.15	49.04	0.35	33.21	9.81	52.48	74.00	21.52
PEAK data, emissions above 1000 MHz **(802.11n HT40 mode)**												
2416.4	1000	H	1.00	105	-	48.47	10.23	28.20	6.52	81.11	Not Applicable	
2425.2	1000	V	1.25	69	-	48.47	10.23	28.23	6.54	82.43		
2335.6	1000	H	1.00	105	-	48.44	10.24	27.94	6.40	51.64	74.00	17.89
2338.0	1000	V	1.27	69	-	48.44	10.24	27.95	6.40	53.30	74.00	16.39
2440.2	1000	H	1.10	90	-	48.48	10.23	28.27	6.56	80.67	Not Applicable	
2445.4	1000	V	1.14	67	-	48.48	10.23	28.29	6.56	81.33		
2455.2	1000	H	1.18	88	-	48.48	10.23	28.32	6.58	80.15	Not Applicable	
2444.8	1000	V	1.02	70	-	48.48	10.23	28.29	6.56	81.96		
2484.8	1000	H	1.00	274	-	48.50	10.23	28.42	6.62	50.57	74.00	16.93
2492.8	1000	V	1.10	258	-	48.50	10.23	28.44	6.63	50.85	74.00	16.75

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 4 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
AVERAGE data, emissions above 1000 MHz **(802.11n HT20 mode)**												
2408.8	1000	H	1.00	94	-	48.46	10.23	28.17	6.51	76.86	Not Applicable	
2416.4	1000	V	1.31	69	-	48.47	10.23	28.20	6.52	75.86		
2338.4	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	37.28	54.00	16.72
2333.6	1000	V	1.31	69	-	48.44	10.24	27.93	6.39	37.08	54.00	16.92
4832.8	1000	H	1.00	138	46.30	49.01	0.41	33.14	9.71	40.55	54.00	13.45
4815.2	1000	V	1.00	34	46.26	49.00	0.42	33.13	9.70	40.51	54.00	13.49
2446.4	1000	H	1.10	90	-	48.48	10.23	28.29	6.56	74.61	Not Applicable	
2446.4	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	75.72		
4855.6	1000	H	1.01	135	44.71	49.01	0.40	33.16	9.74	39.00	54.00	15.00
4855.6	1000	V	1.00	34	43.90	49.01	0.40	33.16	9.74	38.19	54.00	15.81
2466.4	1000	H	1.15	85	-	48.49	10.23	28.36	6.59	73.27	Not Applicable	
2466.4	1000	V	1.02	65	-	48.49	10.23	28.36	6.59	74.61		
2498.0	1000	H	1.15	85	-	48.50	10.23	28.46	6.64	37.18	54.00	16.82
2493.2	1000	V	1.02	65	-	48.50	10.23	28.44	6.63	37.28	54.00	16.72
4932.8	1000	H	1.00	134	42.83	49.04	0.35	33.21	9.81	37.16	54.00	16.84
4932.8	1000	V	1.03	37	45.20	49.04	0.35	33.21	9.81	39.53	54.00	14.47
AVERAGE data, emissions above 1000 MHz **(802.11n HT40 mode)**												
2416.4	1000	H	1.00	105	-	48.47	10.23	28.20	6.52	71.22	Not Applicable	
2425.2	1000	V	1.25	69	-	48.47	10.23	28.23	6.54	72.44		
2335.6	1000	H	1.00	105	-	48.44	10.24	27.94	6.40	36.11	54.00	17.89
2338.0	1000	V	1.27	69	-	48.44	10.24	27.95	6.40	37.61	54.00	16.39
2440.2	1000	H	1.10	90	-	48.48	10.23	28.27	6.56	71.68	Not Applicable	
2445.4	1000	V	1.14	67	-	48.48	10.23	28.29	6.56	72.16		
2455.2	1000	H	1.18	88	-	48.48	10.23	28.32	6.58	70.16	Not Applicable	
2444.8	1000	V	1.02	70	-	48.48	10.23	28.29	6.56	71.99		
2484.8	1000	H	1.00	274	-	48.50	10.23	28.42	6.62	37.07	54.00	16.93
2492.8	1000	V	1.10	258	-	48.50	10.23	28.44	6.63	37.25	54.00	16.75

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 4 included all the correction factors; those values are the final ('Actual') values.

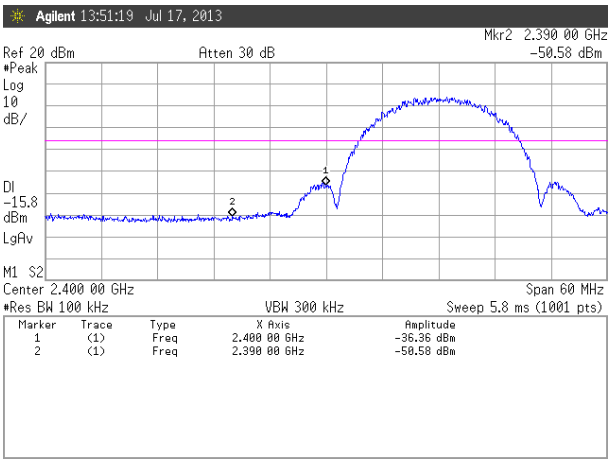
2. "---" means the emission level was too low to be measured or in the noise floor.

.

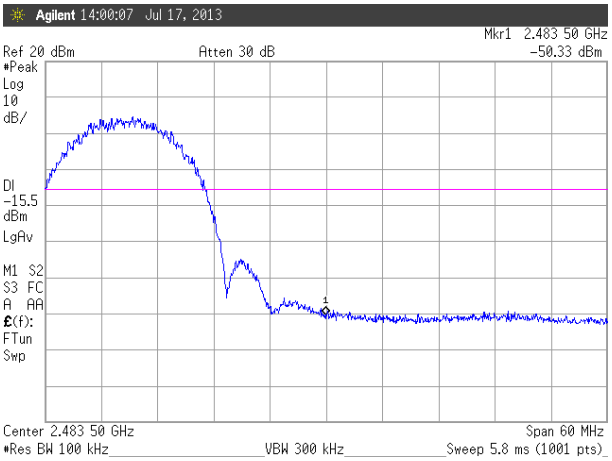
Figure 3. Plot of the Band Edge (Conducted)

802.11b mode:

Lowest Channel (2412 MHz)

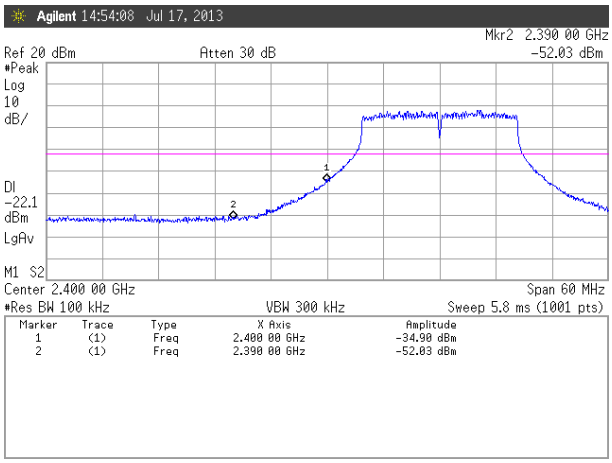


Highest Channel (2462 MHz)

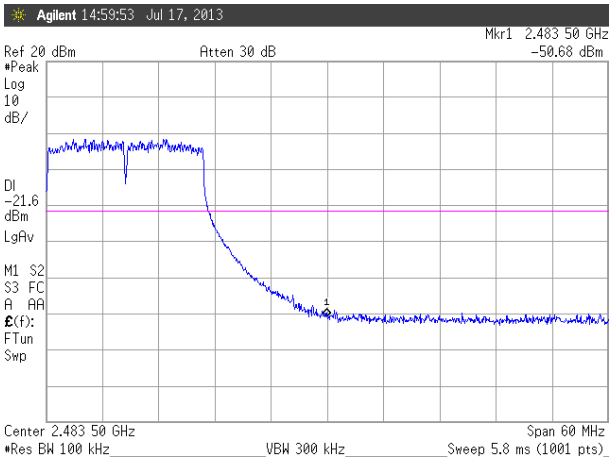


802.11g mode:

Lowest Channel (2412 MHz)



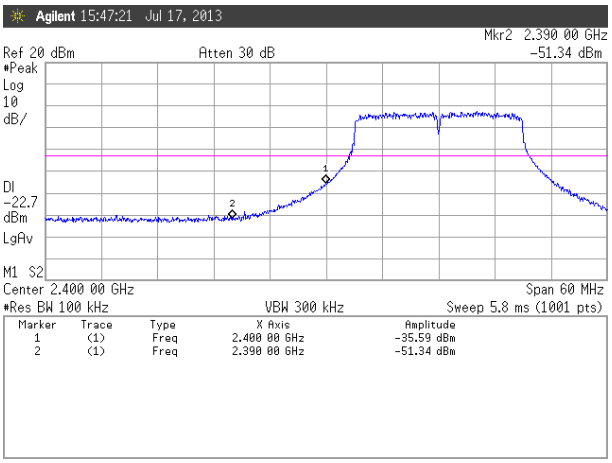
Highest Channel (2462 MHz)



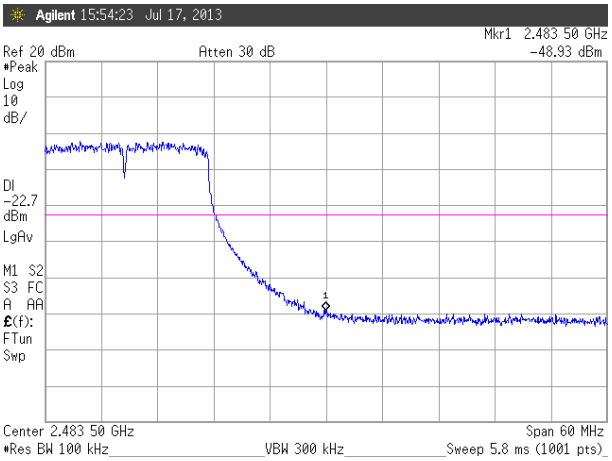
Plot of the Band Edge (Conducted) (continued)

802.11n HT20 mode:

Lowest Channel (2412 MHz)

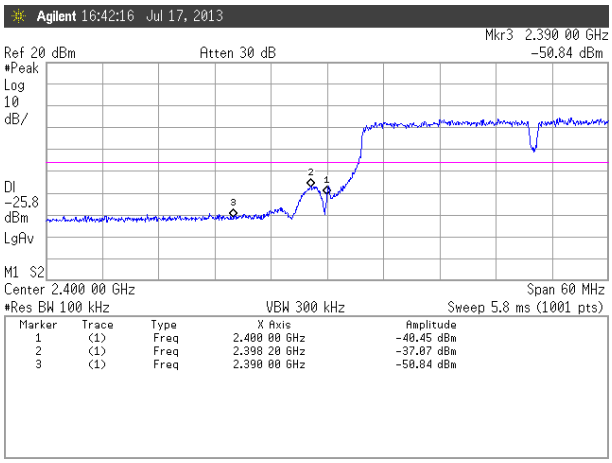


Highest Channel (2462 MHz)



802.11n HT40 mode:

Lowest Channel (2422 MHz)



Highest Channel (2452 MHz)

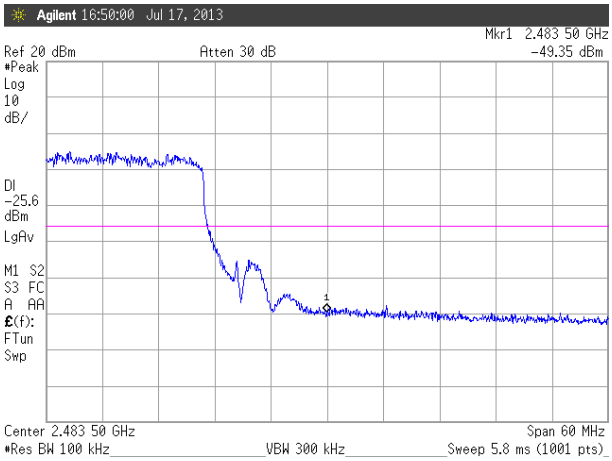
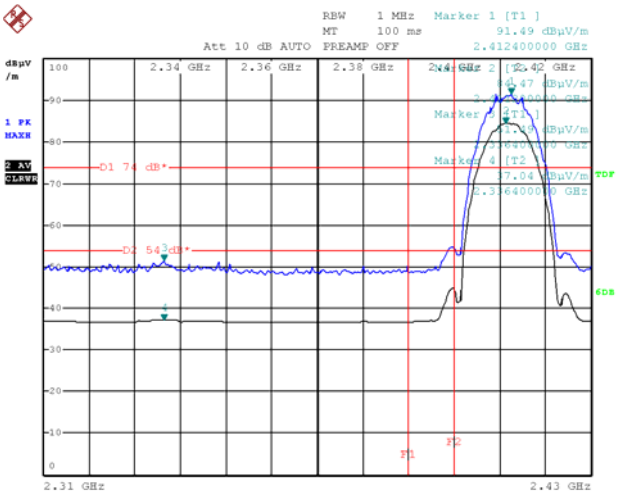


Figure 4. Plot of the Band Edge (Radiated)

802.11b mode:

Lowest Channel (2412 MHz)

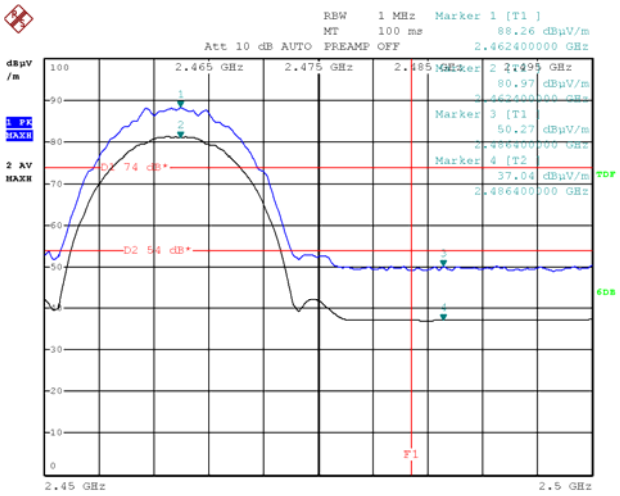
Horizontal



Date: 2.SEP.2013 09:15:52

Highest Channel (2462 MHz)

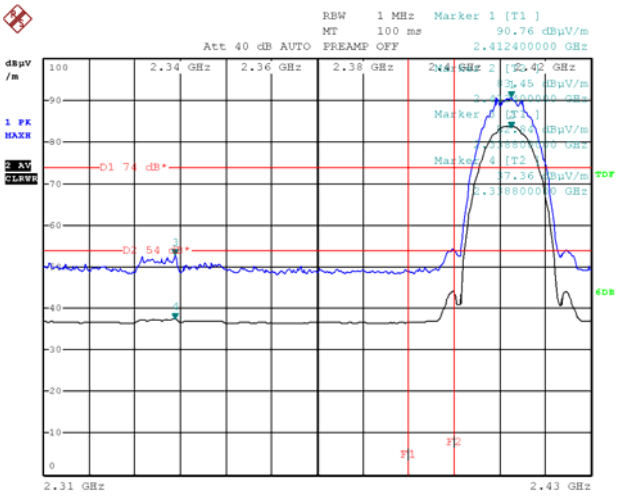
Horizontal



Date: 2.SEP.2013 11:30:12

Lowest Channel (2412 MHz)

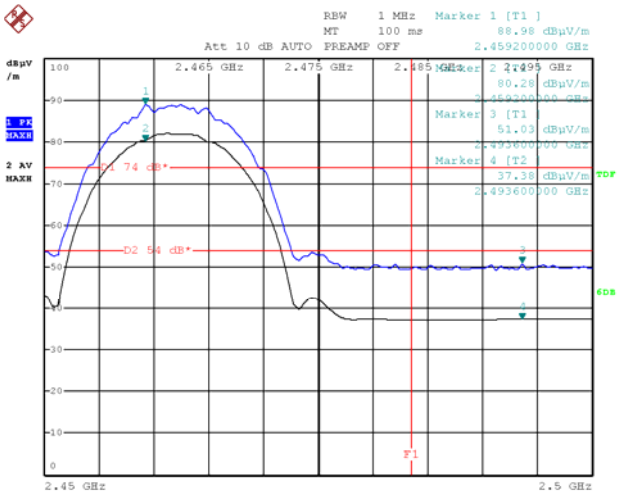
Vertical



Date: 2.SEP.2013 10:22:51

Highest Channel (2462 MHz)

Vertical



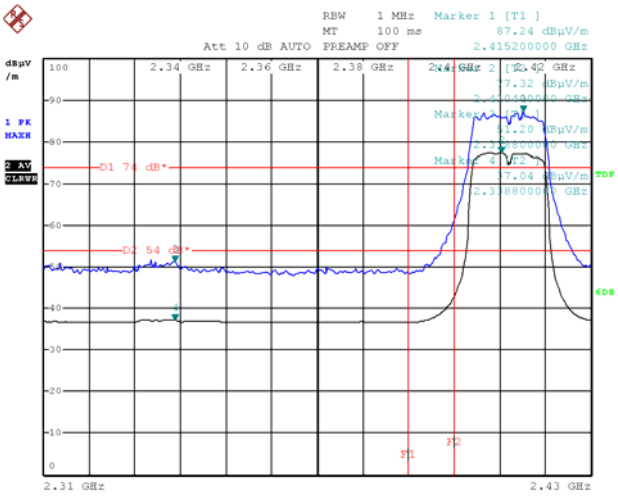
Date: 2.SEP.2013 10:51:10

Plot of the Band Edge (Radiated) *(continued)*

802.11g mode:

Lowest Channel (2412 MHz)

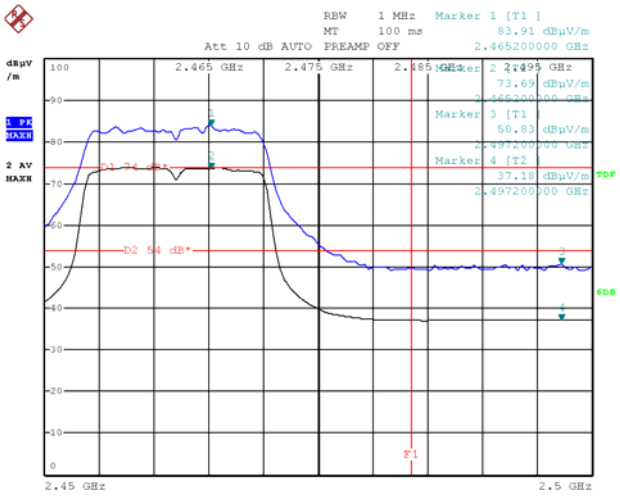
Horizontal



Date: 2.SEP.2013 09:27:50

Highest Channel (2462 MHz)

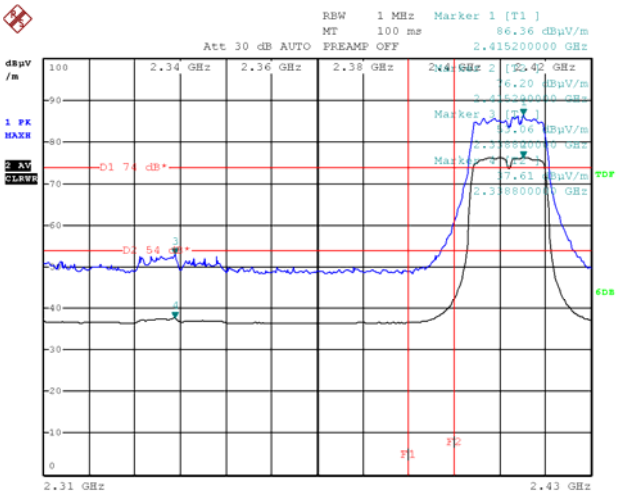
Horizontal



Date: 2.SEP.2013 11:36:30

Lowest Channel (2412 MHz)

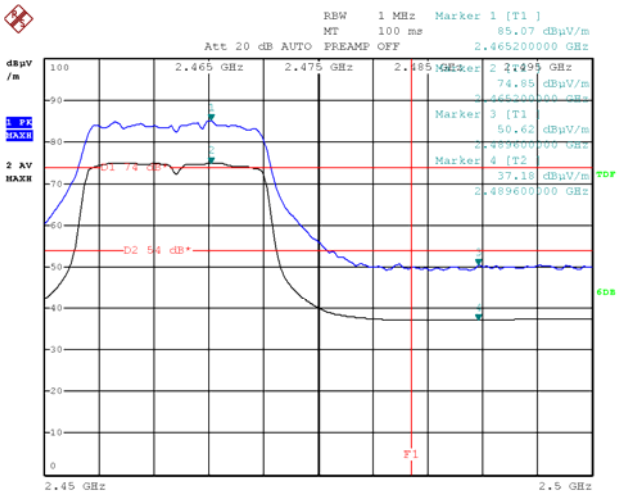
Vertical



Date: 2.SEP.2013 10:28:31

Highest Channel (2462 MHz)

Vertical



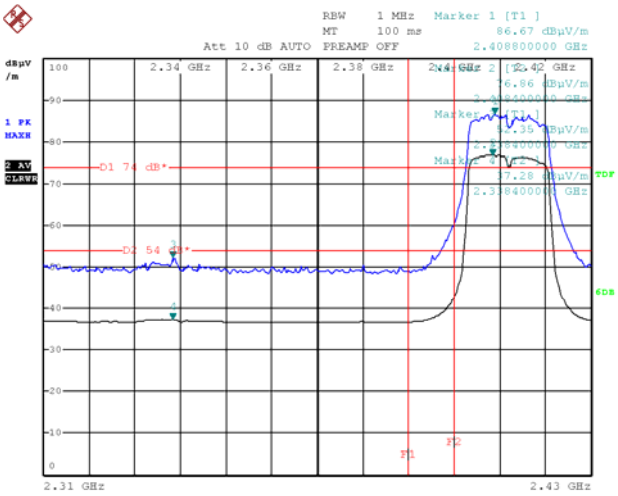
Date: 2.SEP.2013 10:59:48

Plot of the Band Edge (Radiated) *(continued)*

802.11n HT20 mode:

Lowest Channel (2412 MHz)

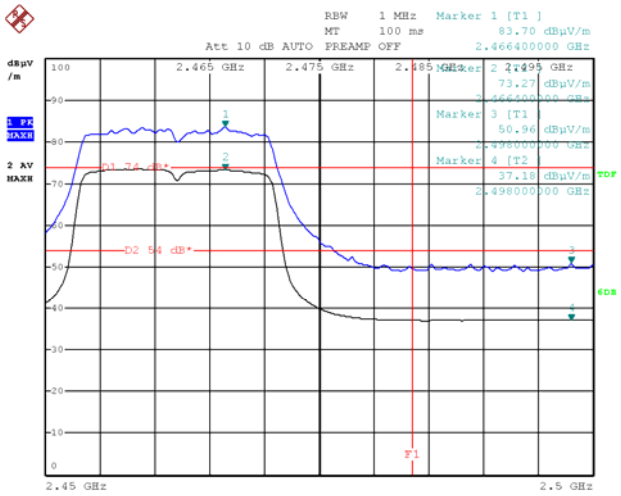
Horizontal



Date: 2.SEP.2013 09:39:23

Highest Channel (2462 MHz)

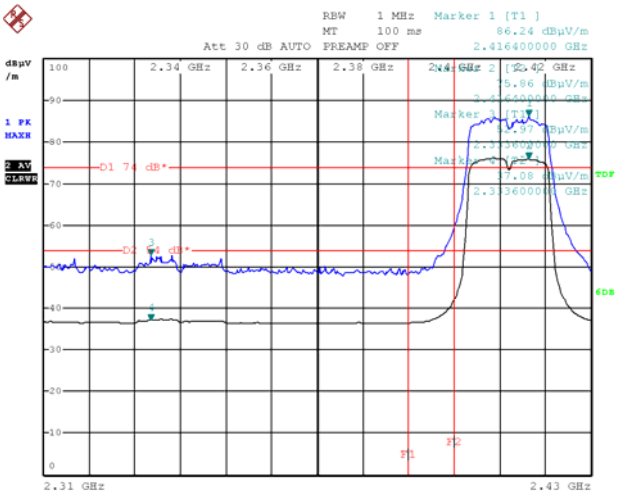
Horizontal



Date: 2.SEP.2013 11:43:42

Lowest Channel (2412 MHz)

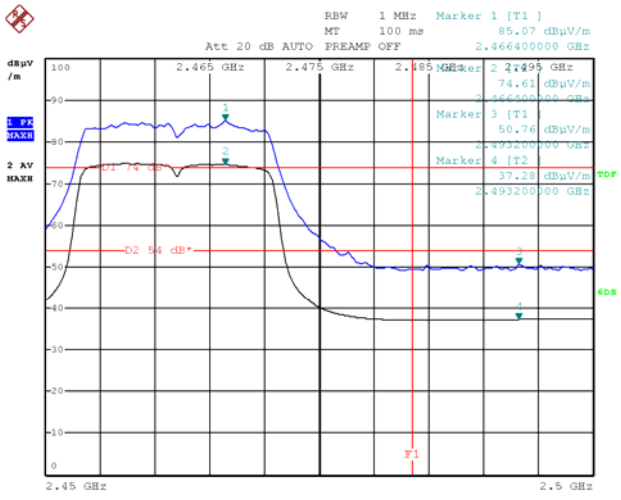
Vertical



Date: 2.SEP.2013 10:36:31

Highest Channel (2462 MHz)

Vertical



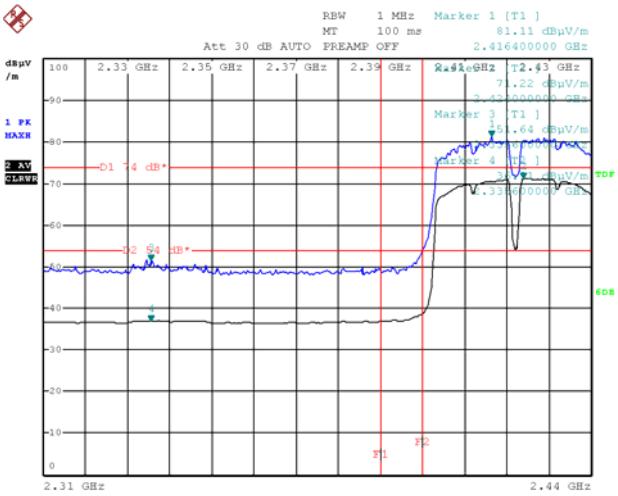
Date: 2.SEP.2013 11:10:38

Plot of the Band Edge (Radiated) *(continued)*

802.11n HT40 mode:

Lowest Channel (2422 MHz)

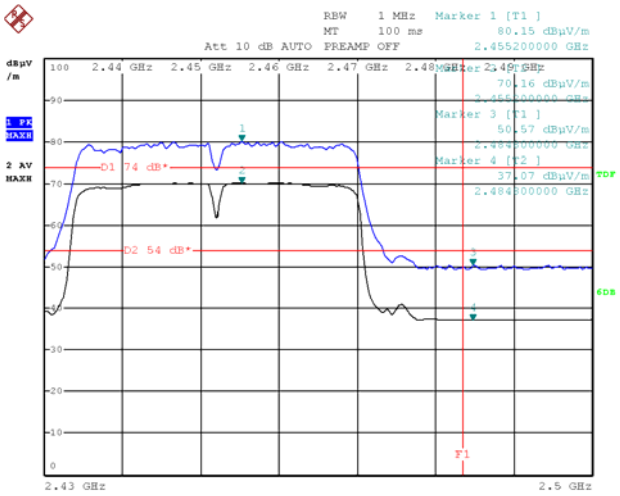
Horizontal



Date: 2.SEP.2013 10:02:00

Highest Channel (2452 MHz)

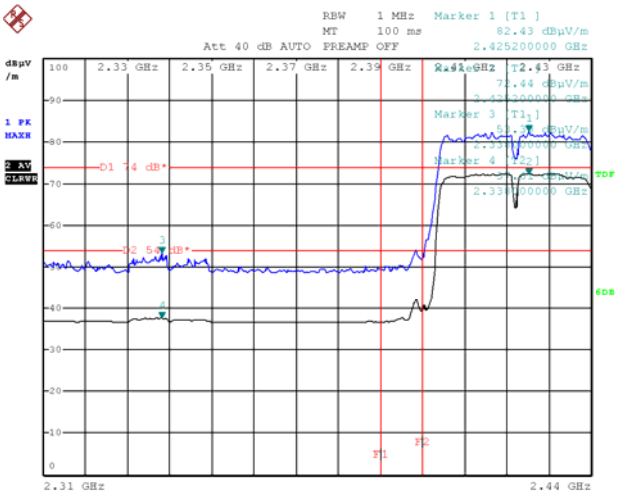
Horizontal



Date: 2.SEP.2013 11:55:53

Lowest Channel (2422 MHz)

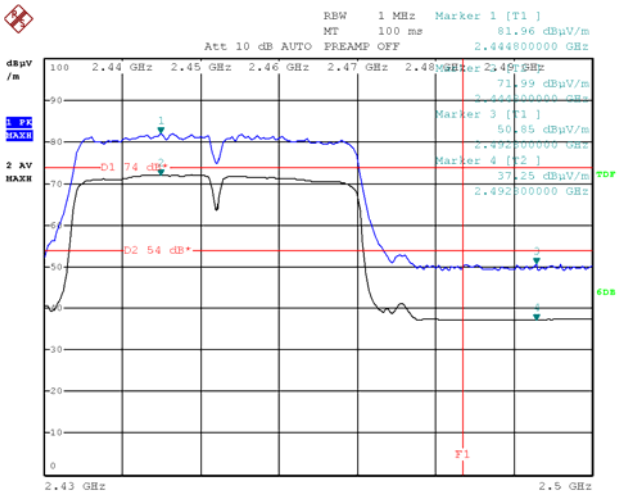
Vertical



Date: 2.SEP.2013 10:15:47

Highest Channel (2452 MHz)

Vertical

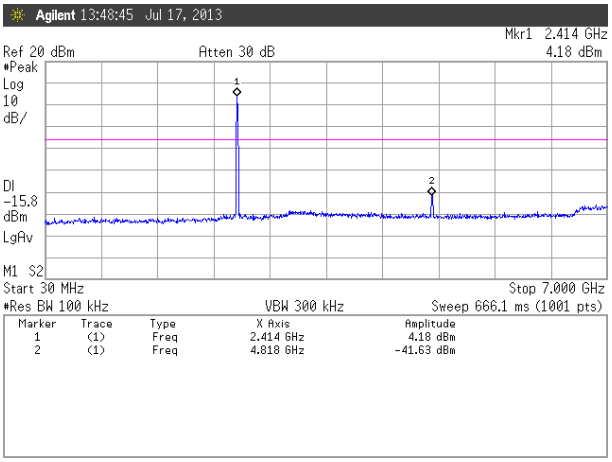


Date: 2.SEP.2013 11:18:34

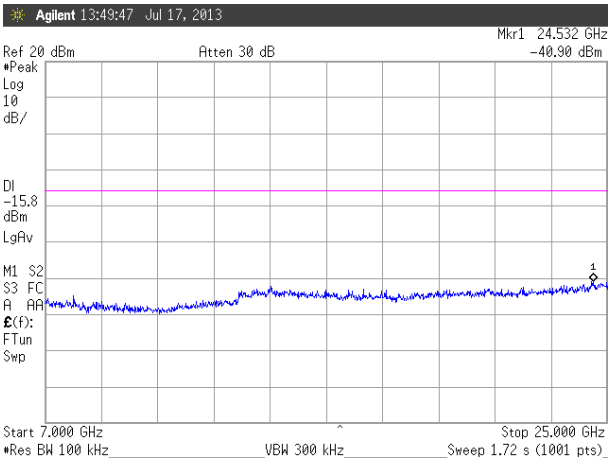
Figure 5. Spurious RF conducted emissions

802.11b mode:

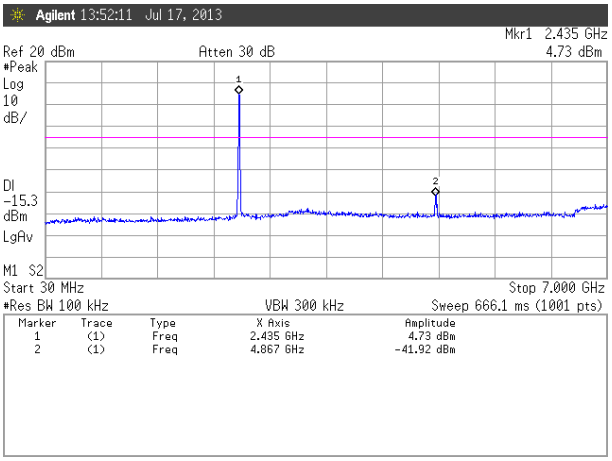
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



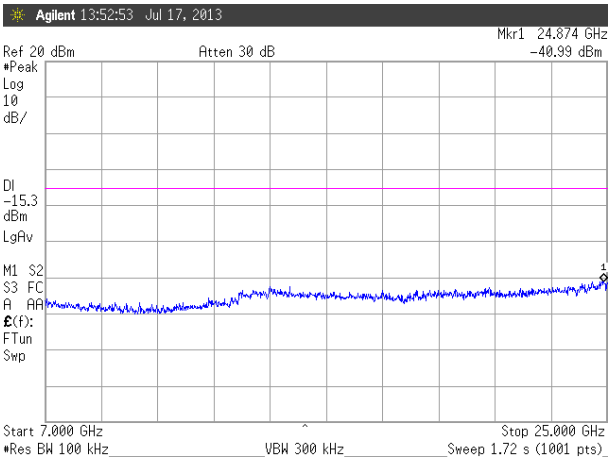
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



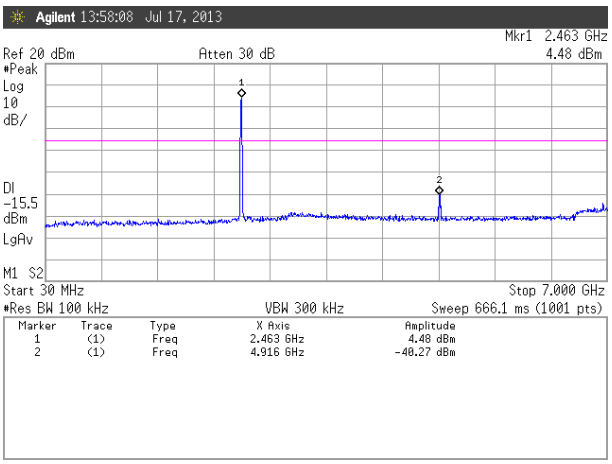
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



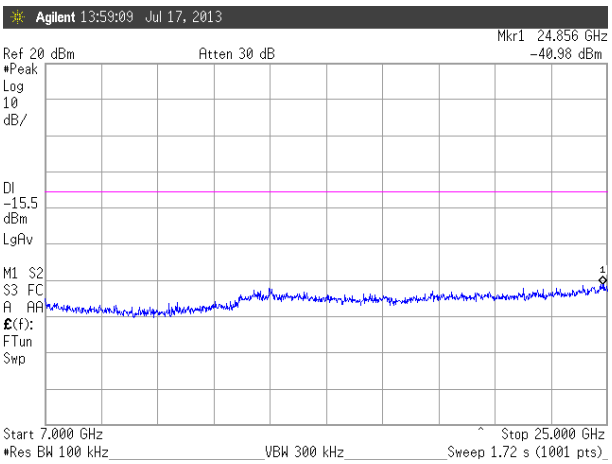
Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2462 MHz): 30 MHz ~ 7 GHz



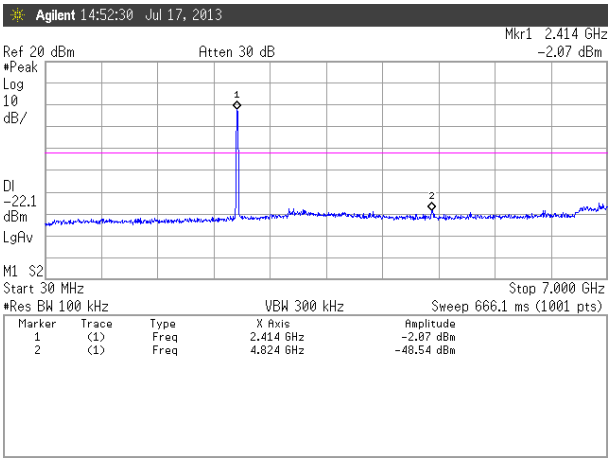
Highest Channel (2462 MHz): 7 GHz ~ 25 GHz



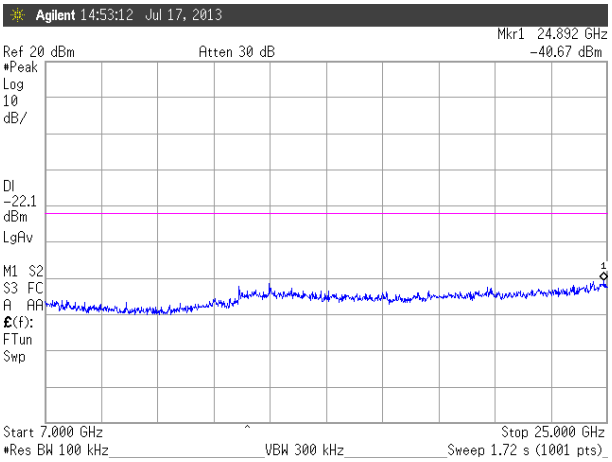
Spurious RF conducted emissions *(continued)*

802.11g mode:

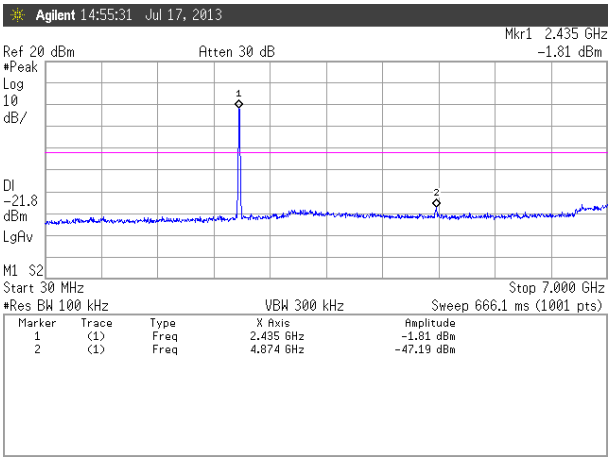
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



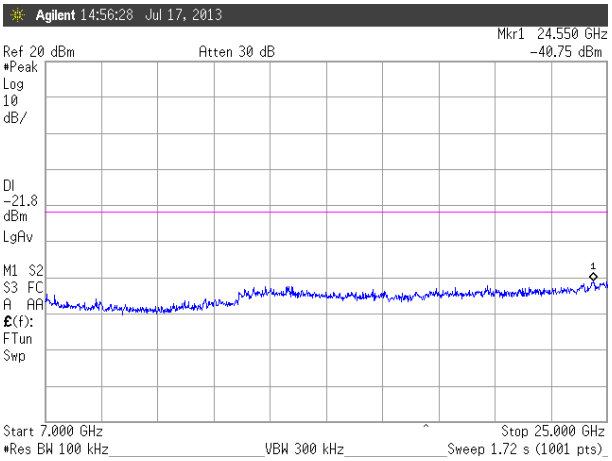
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



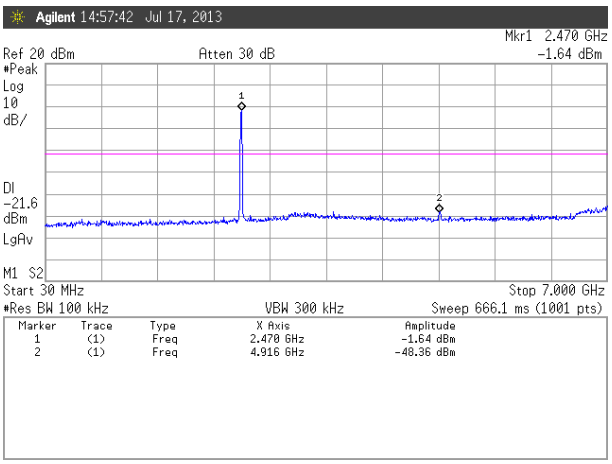
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



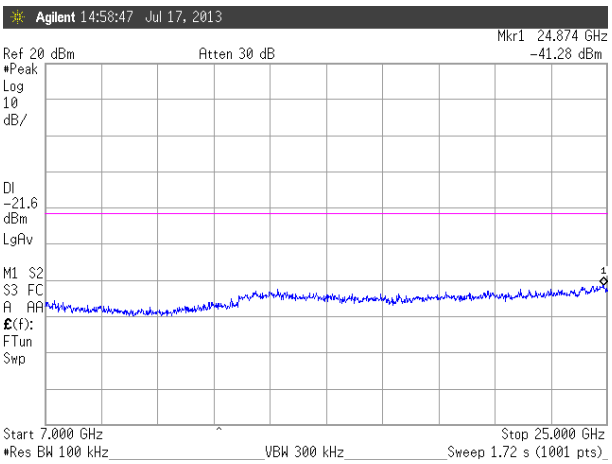
Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2462 MHz): 30 MHz ~ 7 GHz



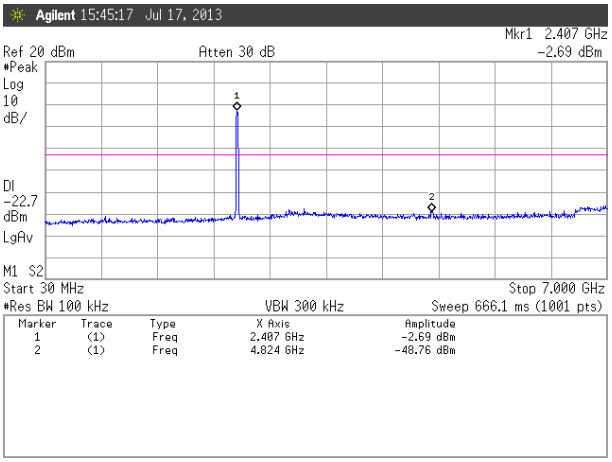
Highest Channel (2462 MHz): 7 GHz ~ 25 GHz



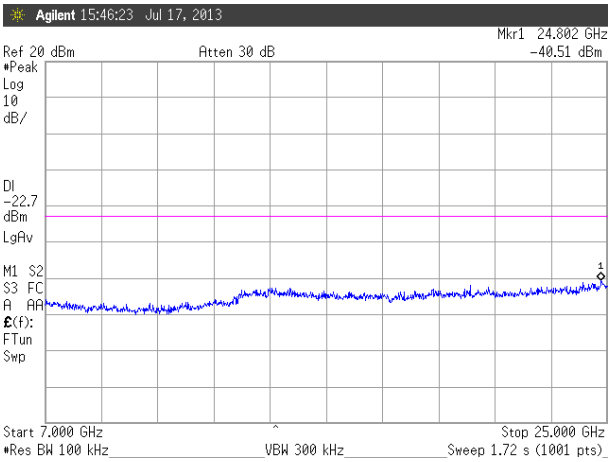
Spurious RF conducted emissions (continued)

802.11n HT20 mode:

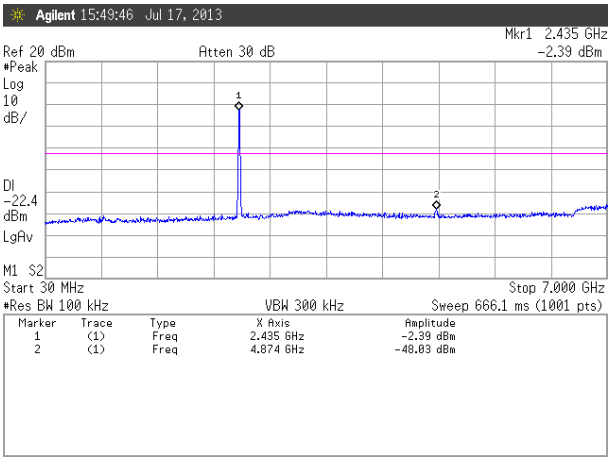
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



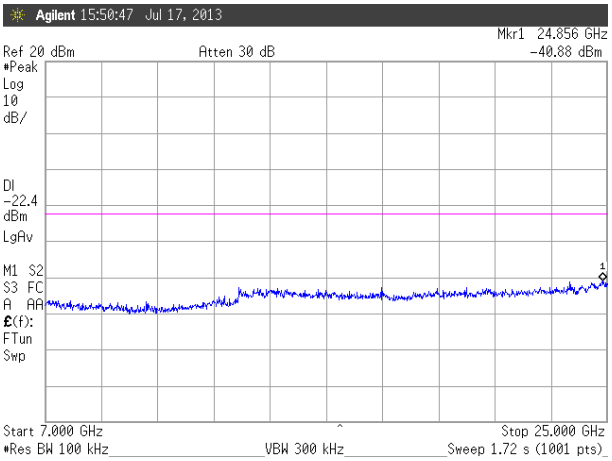
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



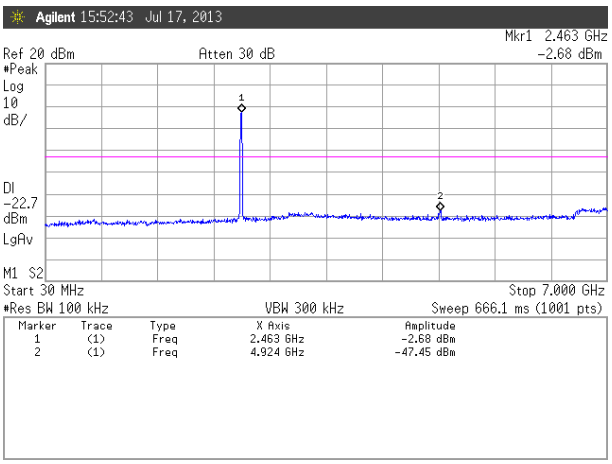
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



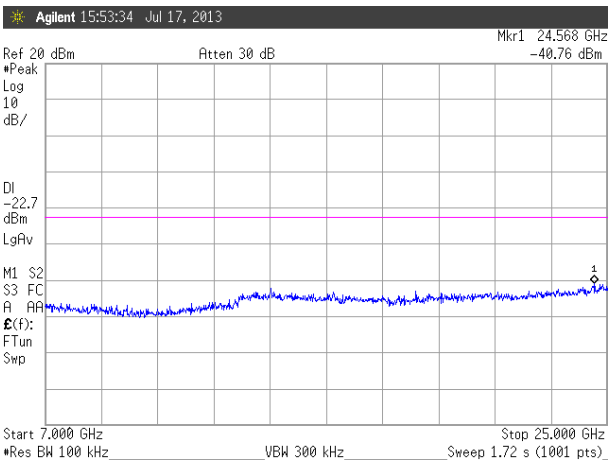
Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2462 MHz): 30 MHz ~ 7 GHz



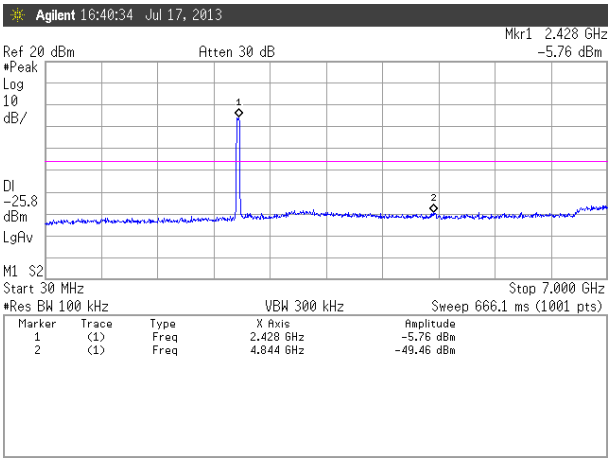
Highest Channel (2462 MHz): 7 GHz ~ 25 GHz



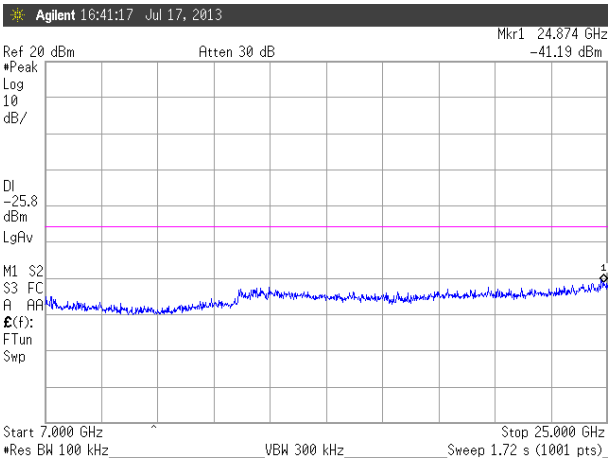
Spurious RF conducted emissions *(continued)*

802.11n HT40 mode:

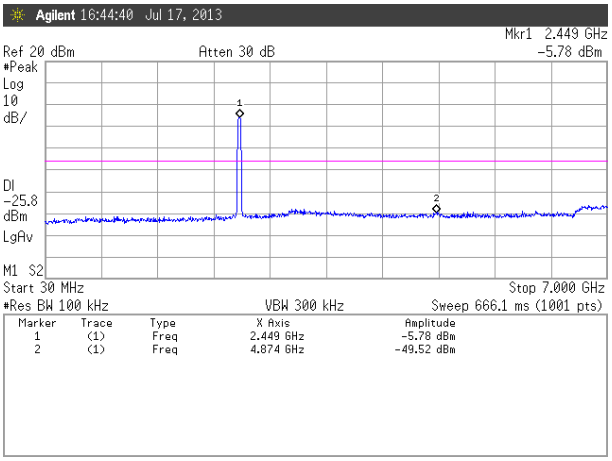
Lowest Channel (2422 MHz): 30 MHz ~ 7 GHz



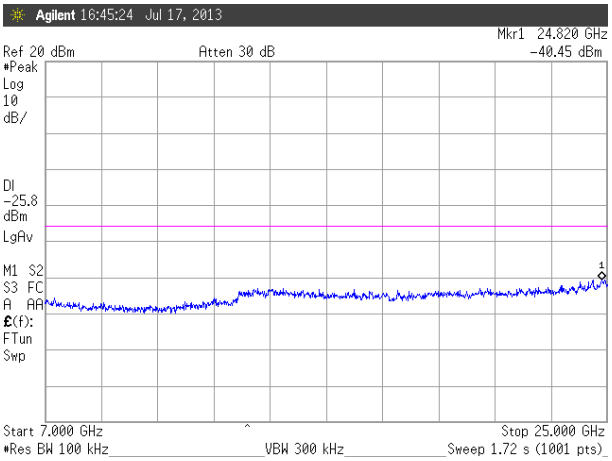
Lowest Channel (2422 MHz): 7 GHz ~ 25 GHz



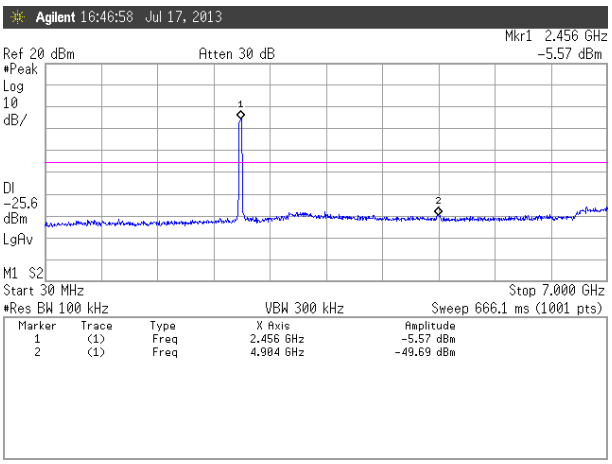
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2452 MHz): 30 MHz ~ 7 GHz



Highest Channel (2452 MHz): 7 GHz ~ 25 GHz

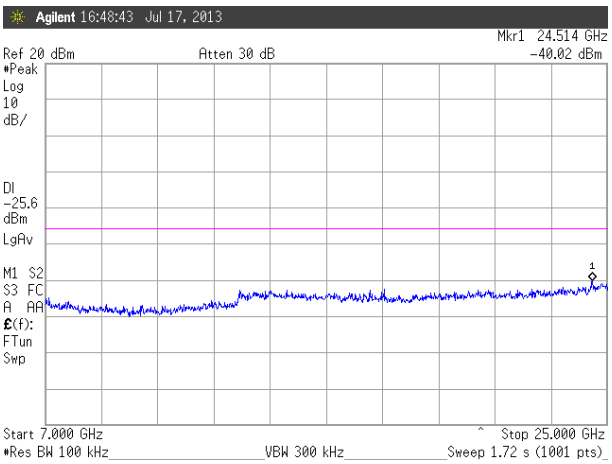
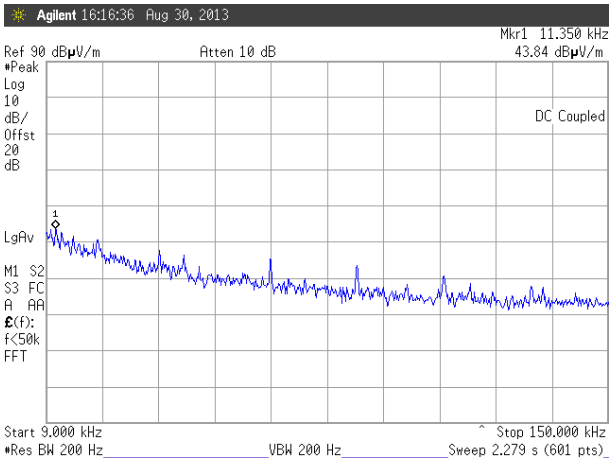
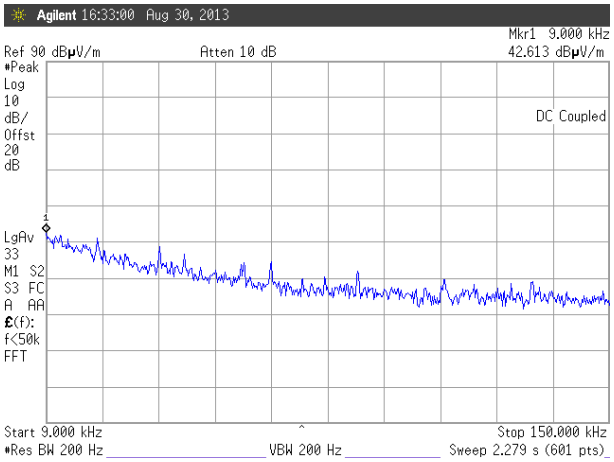


Figure 6. Emission plot for the preliminary radiated measurements

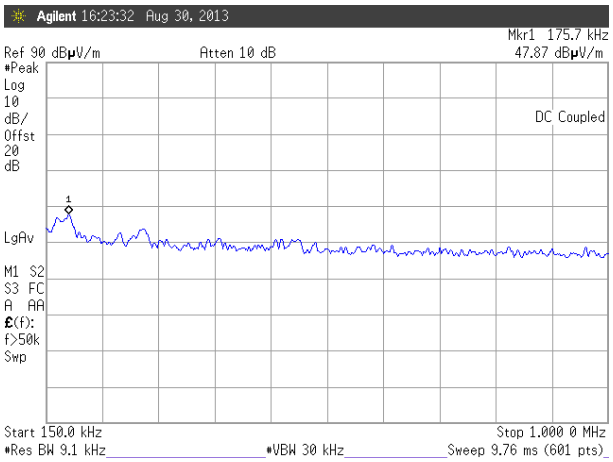
Operating at 2412 MHz: 9 kHz ~ 150 kHz (@ 3-m distance)



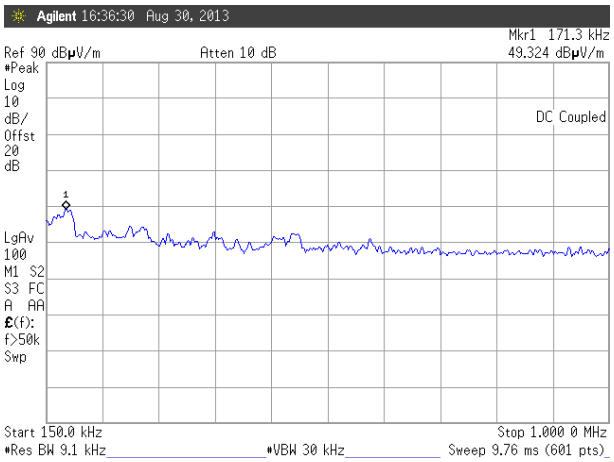
Operating at 2462 MHz: 9 kHz ~ 150 kHz (@ 3-m distance)



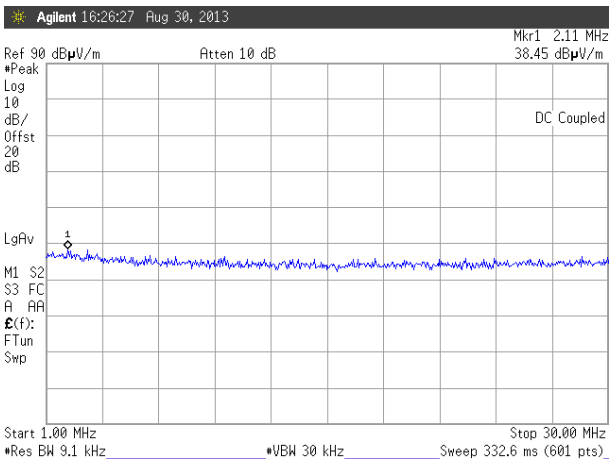
Operating at 2412 MHz: 150 kHz ~ 1 MHz (@ 3-m distance)



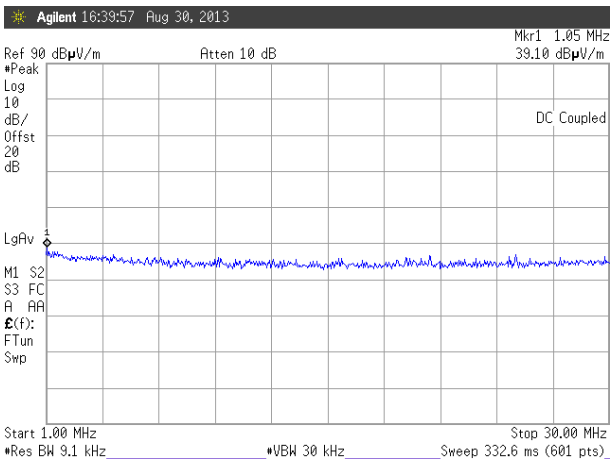
Operating at 2462 MHz: 150 kHz ~ 1 MHz (@ 3-m distance)



Operating at 2412 MHz: 1 MHz ~ 30 MHz (@ 3-m distance)

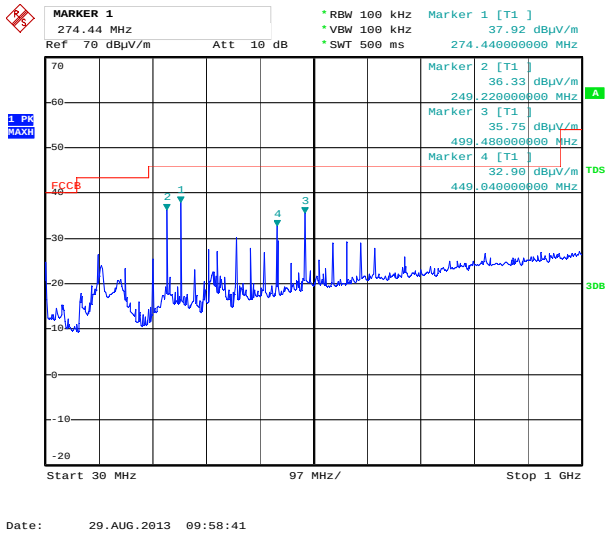


Operating at 2462 MHz: 1 MHz ~ 30 MHz (@ 3-m distance)

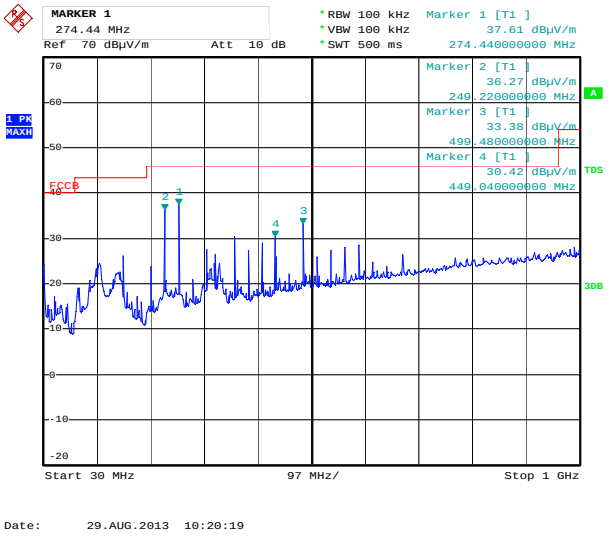


Emission plot for the preliminary radiated measurements *(continued)*

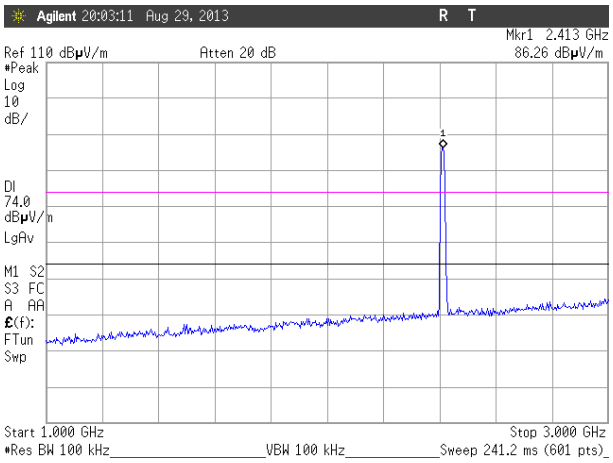
Operating at 2412 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



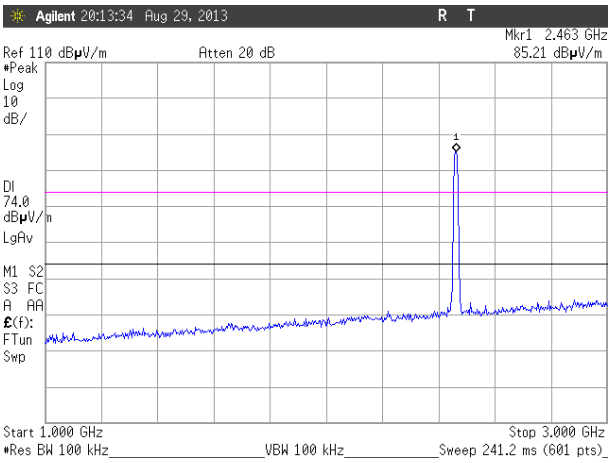
Operating at 2462 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



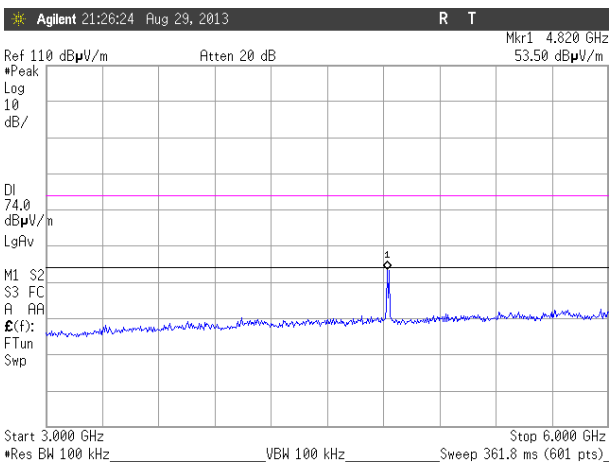
Operating at 2412 MHz: 1 GHz ~ 3 GHz (@ 3-m distance)



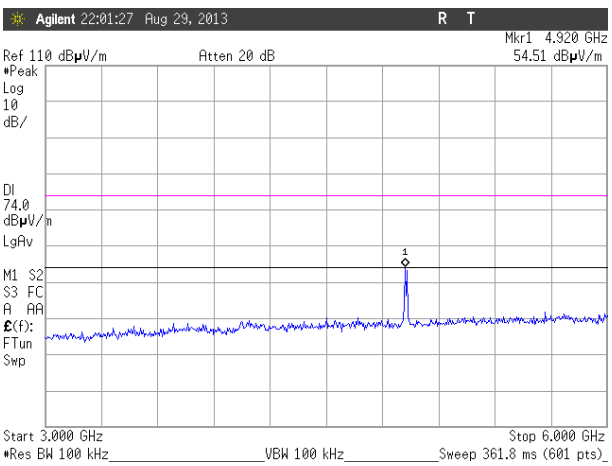
Operating at 2462 MHz: 1 GHz ~ 3 GHz (@ 3-m distance)



Operating at 2412 MHz: 3 GHz ~ 6 GHz (@ 3-m distance)

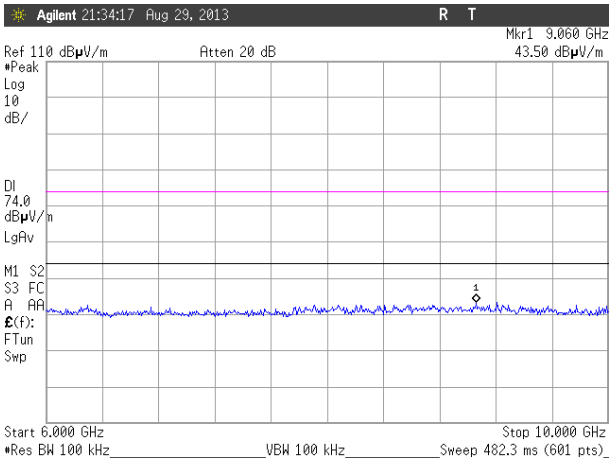


Operating at 2462 MHz: 3 GHz ~ 6 GHz (@ 3-m distance)

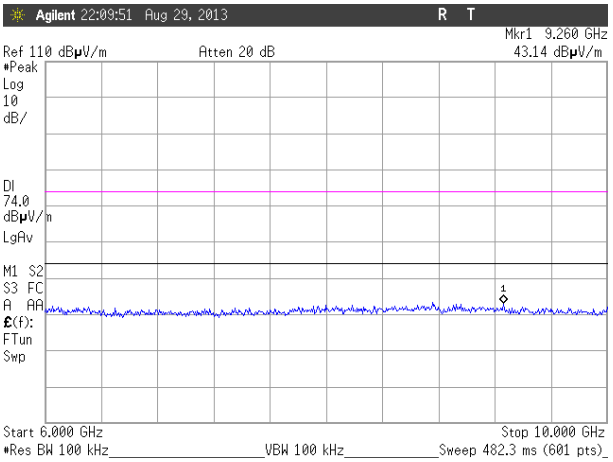


Emission plot for the preliminary radiated measurements *(continued)*

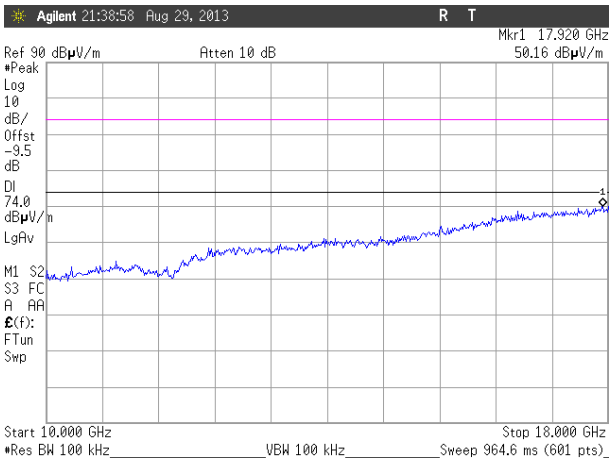
Operating at 2412 MHz: 6 GHz ~ 10 GHz (@ 3-m distance)



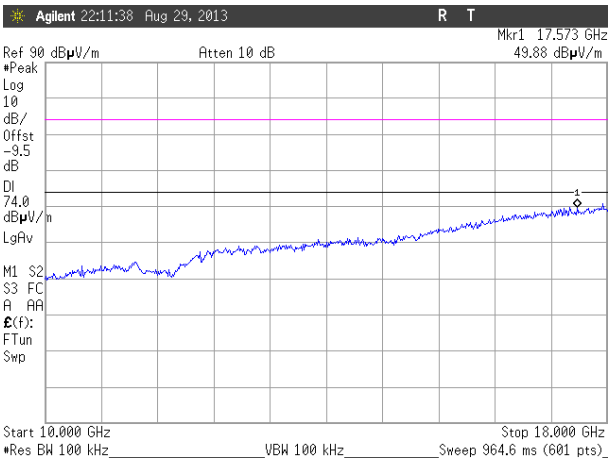
Operating at 2462 MHz: 6 GHz ~ 10 GHz (@ 3-m distance)



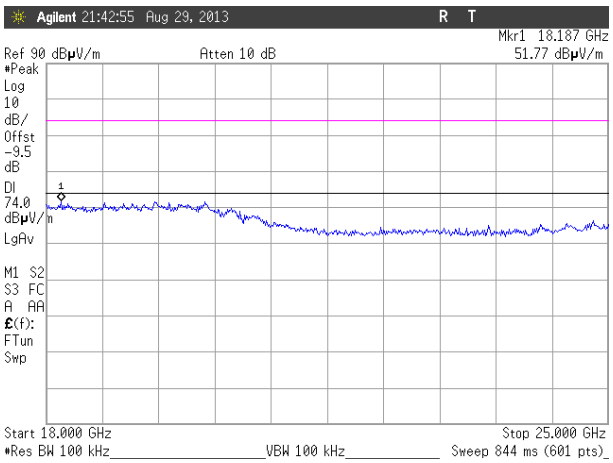
Operating at 2412 MHz: 10 GHz ~ 18 GHz (@ 1-m distance)



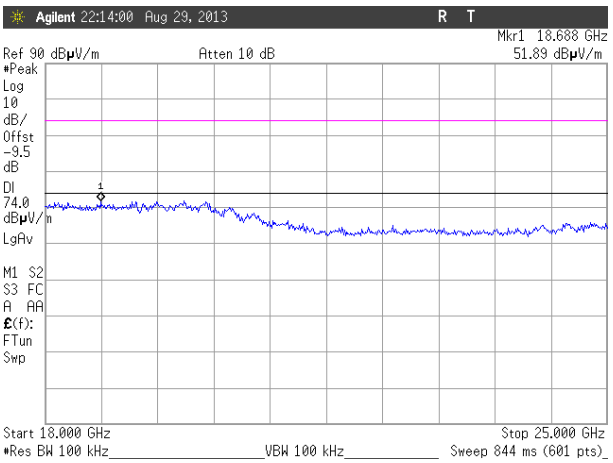
Operating at 2462 MHz: 10 GHz ~ 18 GHz (@ 1-m distance)



Operating at 2412 MHz: 18 GHz ~ 25 GHz (@ 1-m distance)



Operating at 2462 MHz: 18 GHz ~ 25 GHz (@ 1-m distance)



5.6. Peak power spectral density

5.6.1 Regulation

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.6.2 Test Procedure(peak PSD)

Set the spectrum analyzer as follows:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the 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.

5.6.3 Test Results: PASS

Table 4: Measured values of the Peak Power Spectral Density (Conducted)

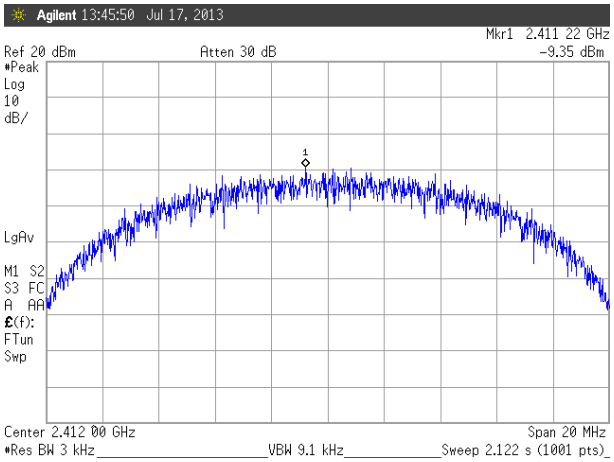
Modulation	Operating frequency	Transfer Rate	PSD/3 kHz (dBm)	Limit (dBm)
802.11b	2412 MHz	11 Mbps	-9.35	8
	2437 MHz	11 Mbps	-8.74	8
	2462 MHz	11 Mbps	-9.09	8
802.11g	2412 MHz	54 Mbps	-15.94	8
	2437 MHz	54 Mbps	-15.44	8
	2462 MHz	54 Mbps	-15.69	8
802.11n HT20	2412 MHz	MCS7	-16.36	8
	2437 MHz	MCS7	-15.85	8
	2462 MHz	MCS7	-16.06	8
802.11n HT40	2422 MHz	MCS7	-18.11	8
	2437 MHz	MCS7	-18.17	8
	2452 MHz	MCS7	-18.07	8

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

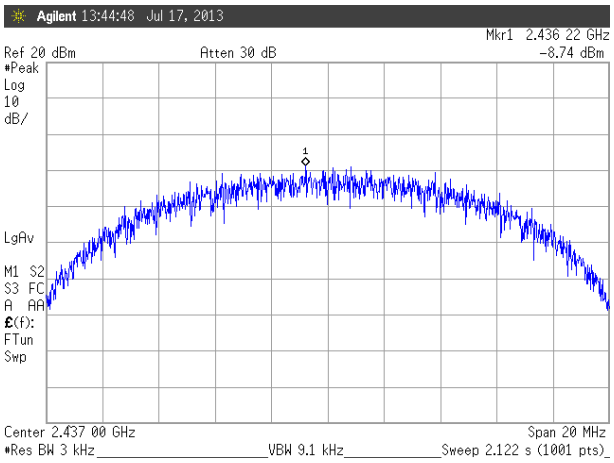
Figure 7. Plot of the Peak Power Spectral Density

802.11b mode:

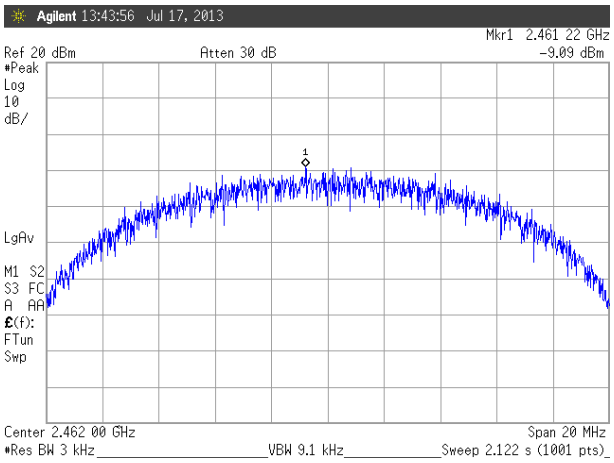
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

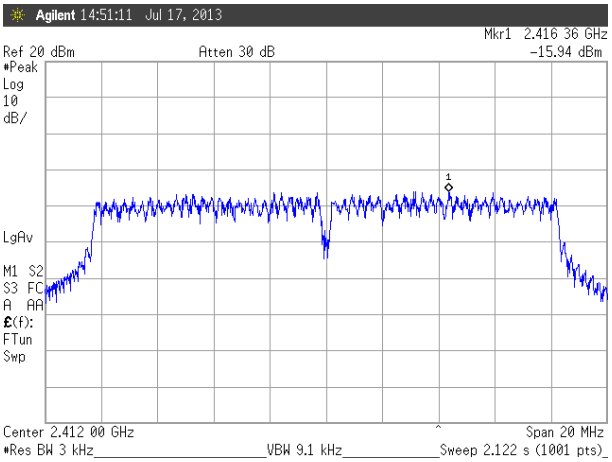


Highest Channel (2462 MHz)

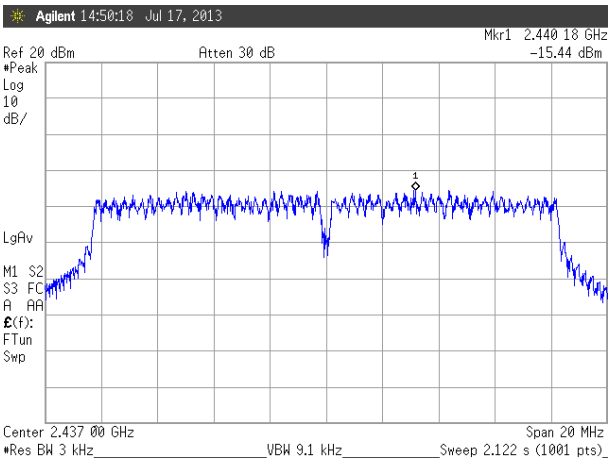


802.11g mode:

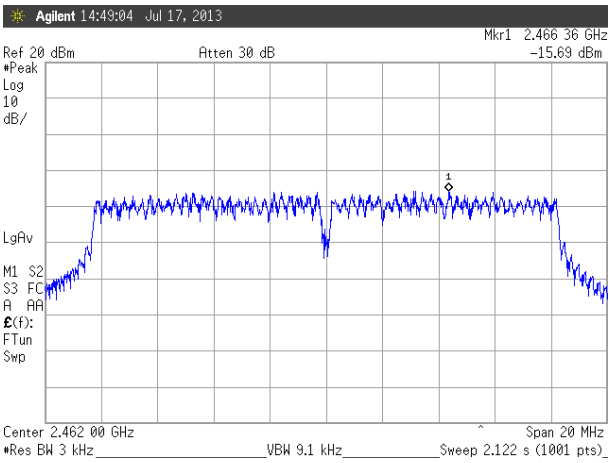
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



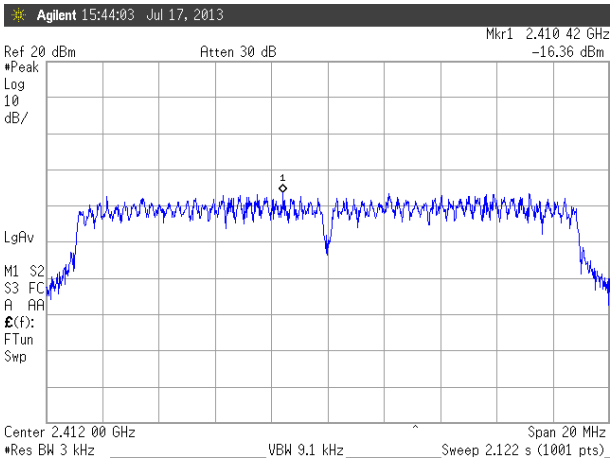
Highest Channel (2462 MHz)



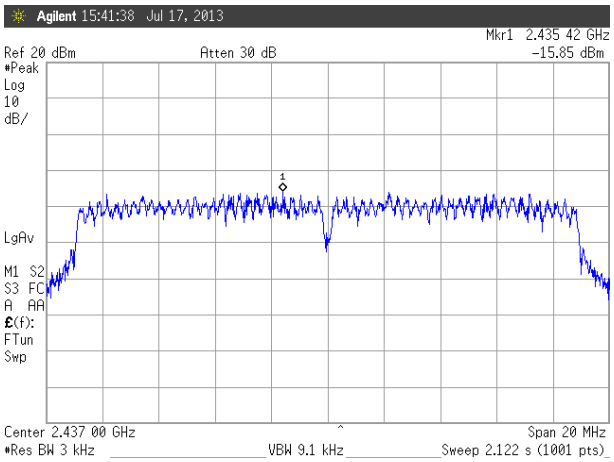
Plot of the Peak Power Spectral Density (continued)

802.11n HT20 mode:

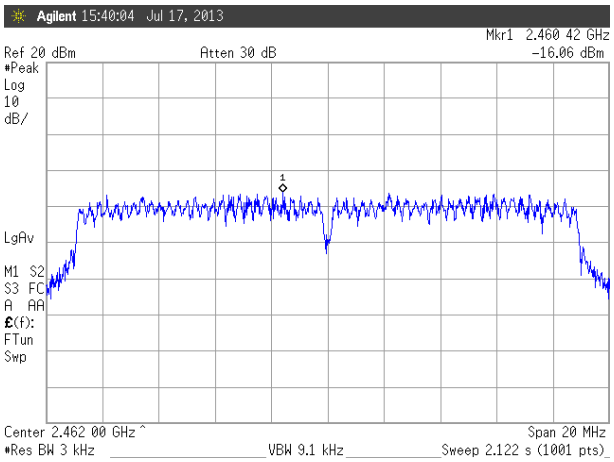
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

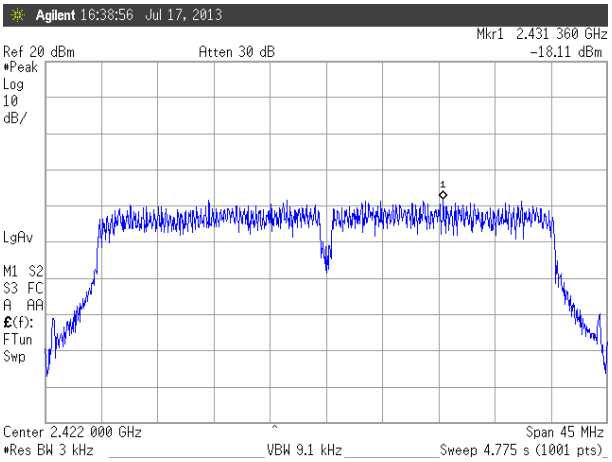


Highest Channel (2462 MHz)

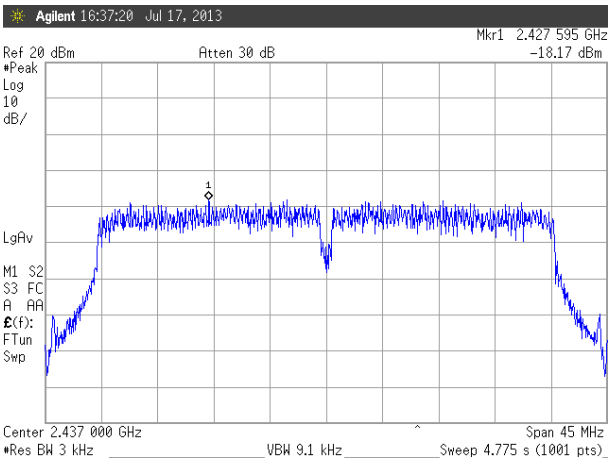


802.11n HT40 mode:

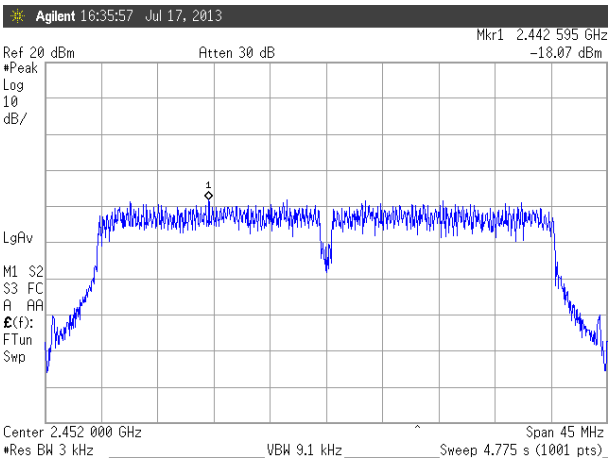
Lowest Channel (2422 MHz)



Middle Channel (2437 MHz)



Highest Channel (2452 MHz)



5.7. AC power line conducted emissions

5.7.1 Regulation

According to §15.207(a), for an intentional radiator that 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 the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.7.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.7.3 Test Results: PASS

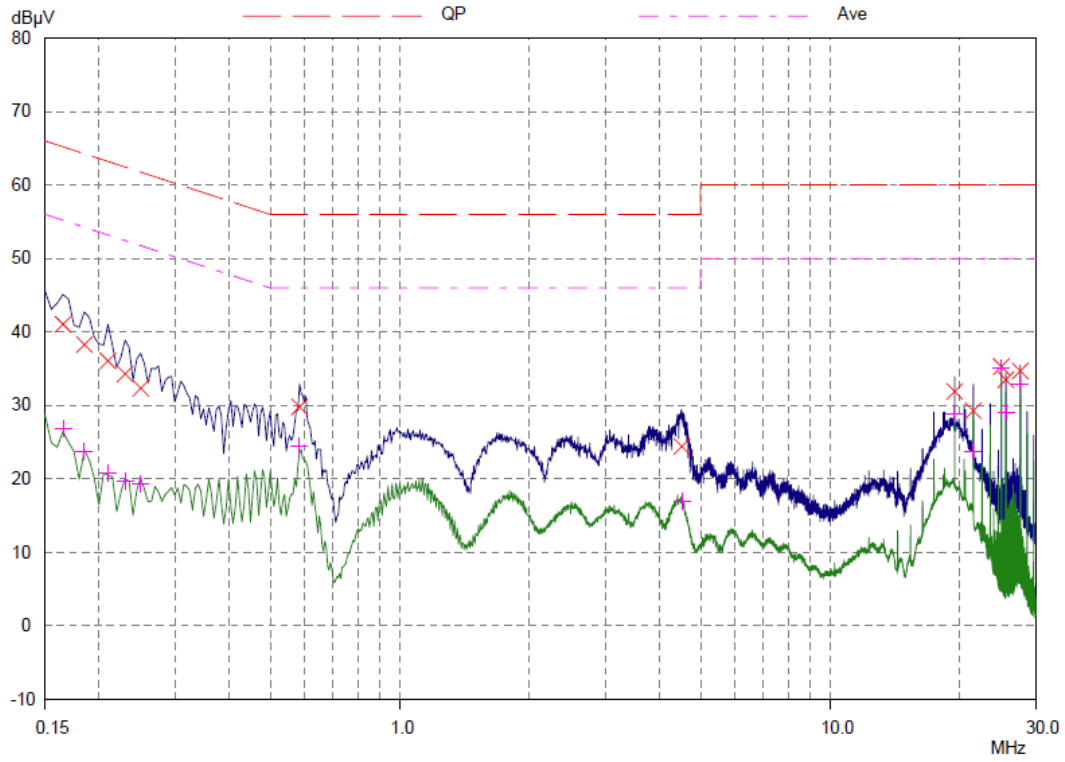
Table 5: Measured values of the AC Power Line Conducted Emissions							
Frequency [MHz]	Reading [dBμV]	L / N	CF [dB]	CL [dB]	Actual [dBμV]	Limit [dBμV]	Margin [dB]
QUASI-PEAK DATA							
0.165	41.05	L	0.12	0.01	41.18	65.21	24.03
0.185	38.28	L	0.12	0.01	38.41	64.26	25.85
0.210	36.07	L	0.12	0.01	36.20	63.21	27.01
0.230	34.28	L	0.13	0.01	34.42	62.45	28.03
0.250	32.36	L	0.13	0.01	32.50	61.76	29.26
0.590	30.39	N	0.09	0.02	30.50	56.00	25.50
4.520	24.39	L	0.28	0.12	24.79	56.00	31.21
19.455	31.80	N	0.95	0.25	33.00	60.00	27.00
19.465	31.90	L	1.01	0.25	33.16	60.00	26.84
21.505	31.64	N	1.07	0.26	32.97	60.00	27.03
21.520	29.28	L	1.17	0.26	30.71	60.00	29.29
25.000	35.83	N	1.25	0.29	37.37	60.00	22.63
25.615	33.50	L	1.47	0.29	35.26	60.00	24.74
27.660	34.69	L	1.62	0.30	36.61	60.00	23.39
AVERAGE DATA							
0.165	26.77	L	0.12	0.01	26.90	55.21	28.31
0.185	23.72	L	0.12	0.01	23.85	54.26	30.41
0.210	20.76	L	0.12	0.01	20.89	53.21	32.32
0.230	19.69	L	0.13	0.01	19.83	52.45	32.62
0.250	19.36	L	0.13	0.01	19.50	51.76	32.26
0.590	25.14	N	0.09	0.02	25.25	46.00	20.75
4.520	16.98	L	0.28	0.12	17.38	46.00	28.62
19.455	28.79	N	0.95	0.25	29.99	50.00	20.01
19.465	28.88	L	1.01	0.25	30.14	50.00	19.86
21.505	29.54	N	1.07	0.26	30.87	50.00	19.13
21.520	23.73	L	1.17	0.26	25.16	50.00	24.84
25.000	35.56	N	1.25	0.29	37.10	50.00	12.90
25.615	29.02	L	1.47	0.29	30.78	50.00	19.22
27.660	32.94	L	1.62	0.30	34.86	50.00	15.14

Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

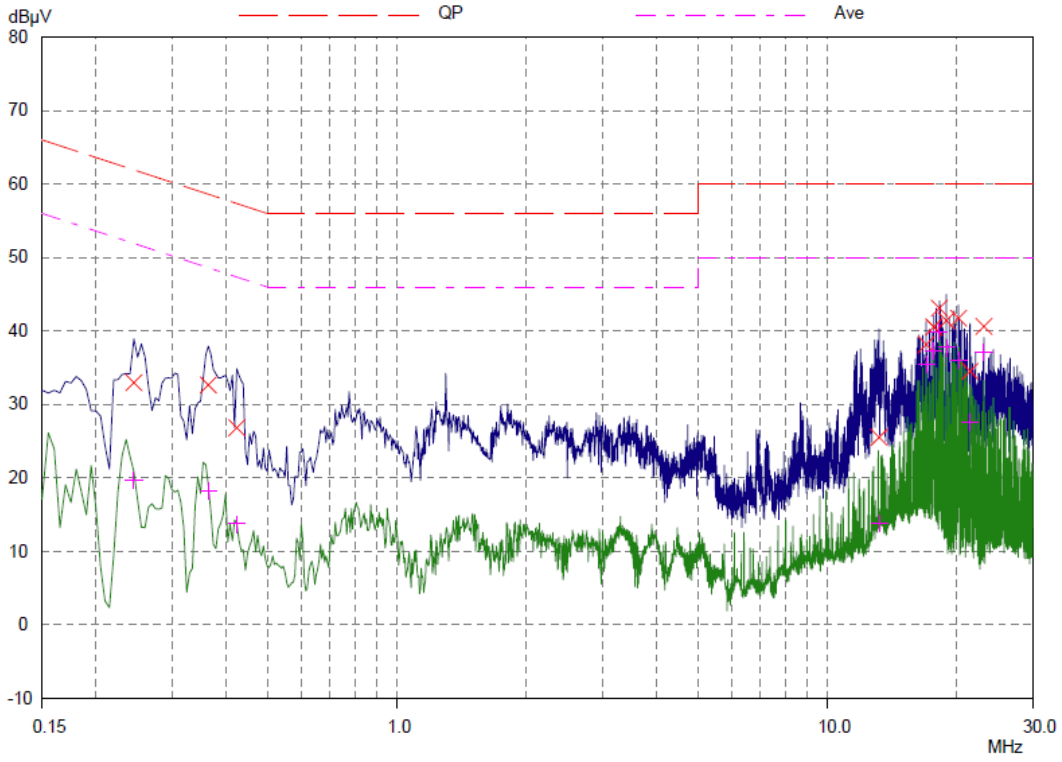
NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

Figure 8. Plot of the AC Power Line Conducted Emissions

Line – PE (Peak and Average detector used)



Neutral – PE (Peak and Average detector used)



6 Test and measurements (PoE)

6.1. Test Configuration of Equipment Under Test

Pre-Scanned RF Power

The RF power output was set to '38' as the maximum power output as declared by the applicant.
The RF signals were continuously transmitted without off-time interval; duty cycle was 100 %.

Preliminary tests were performed in different data rate as below table and the highest power data rates (11b, 11g, 11g/n (BW 20MHz), 11g/n (BW 40MHz) modes) were chosen for full test in the following sections to demonstrate compliance to the limits.

Measured peak power (dBm) operating 802.11b mode

	1 Mbps	2 Mbps	5.5 Mbps	**11 Mbps**
2412 MHz	17.57	17.95	17.82	**19.80**
2437 MHz	18.45	18.42	18.47	**20.31**
2462 MHz	18.16	18.33	18.26	**20.35**

Measured peak power (dBm) operating 802.11g mode

	6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	**54 Mbps**
2412 MHz	18.29	18.51	18.88	18.44	19.14	18.88	18.76	**19.32**
2437 MHz	19.09	19.12	19.43	18.89	19.79	19.55	19.49	**19.91**
2462 MHz	19.12	19.07	19.42	18.67	19.42	19.13	19.19	**19.66**

Measured peak power (dBm) operating 802.11n(HT20) mode

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	**MCS7**
2412 MHz	18.20	18.12	18.21	18.38	18.30	18.45	18.53	**18.64**
2437 MHz	18.97	18.75	18.59	18.91	18.86	19.10	19.10	**19.18**
2462 MHz	18.70	18.56	18.39	18.73	18.74	18.93	18.86	**18.97**

Measured peak power (dBm) operating 802.11n(HT40) mode

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	**MCS7**
2422 MHz	17.88	17.98	18.00	18.26	18.35	18.59	18.70	**18.75**
2437 MHz	18.40	18.31	18.43	18.59	18.57	18.77	18.81	**18.94**
2452 MHz	18.50	18.49	18.50	18.62	18.59	18.76	18.86	**18.95**

6.2. 6 dB bandwidth

6.2.1 Regulation

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

6.2.2 Test Procedure

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
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 outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.2.3 Test Results: PASS

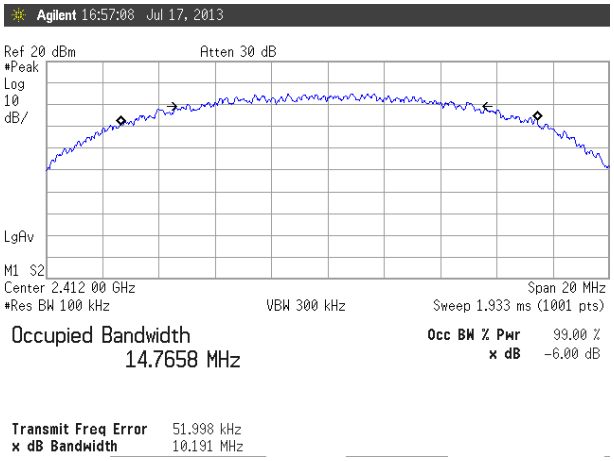
Table 6: Measured values of the 6 dB Bandwidth

Modulation	Operating frequency	Transfer Rate	Occupied Bandwidth (99%)	6dB Bandwidth	Limit
802.11b	2412 MHz	11 Mbps	14.77 MHz	10.19 MHz	≥ 500 kHz
	2437 MHz	11 Mbps	14.75 MHz	10.17 MHz	≥ 500 kHz
	2462 MHz	11 Mbps	14.79 MHz	10.18 MHz	≥ 500 kHz
802.11g	2412 MHz	54 Mbps	16.42 MHz	16.53 MHz	≥ 500 kHz
	2437 MHz	54 Mbps	16.42 MHz	16.53 MHz	≥ 500 kHz
	2462 MHz	54 Mbps	16.43 MHz	16.53 MHz	≥ 500 kHz
802.11n HT20	2412 MHz	MCS7	17.62 MHz	17.79 MHz	≥ 500 kHz
	2437 MHz	MCS7	17.61 MHz	17.78 MHz	≥ 500 kHz
	2462 MHz	MCS7	17.62 MHz	17.78 MHz	≥ 500 kHz
802.11n HT40	2422 MHz	MCS7	36.23 MHz	36.22 MHz	≥ 500 kHz
	2437 MHz	MCS7	36.23 MHz	36.24 MHz	≥ 500 kHz
	2452 MHz	MCS7	36.29 MHz	36.38 MHz	≥ 500 kHz

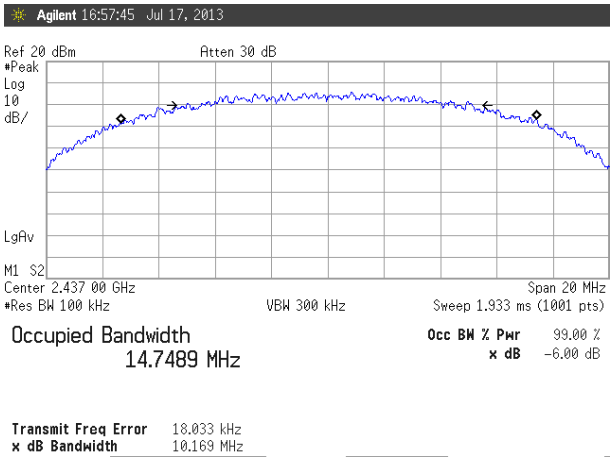
Figure 9. Plot of the 6dB Bandwidth & Occupied Bandwidth (99%)

802.11b mode:

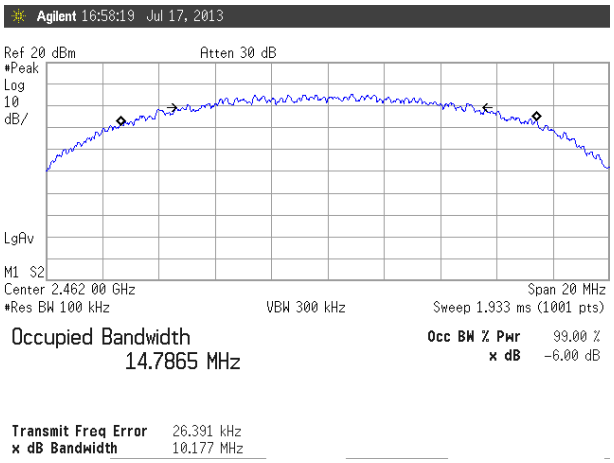
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

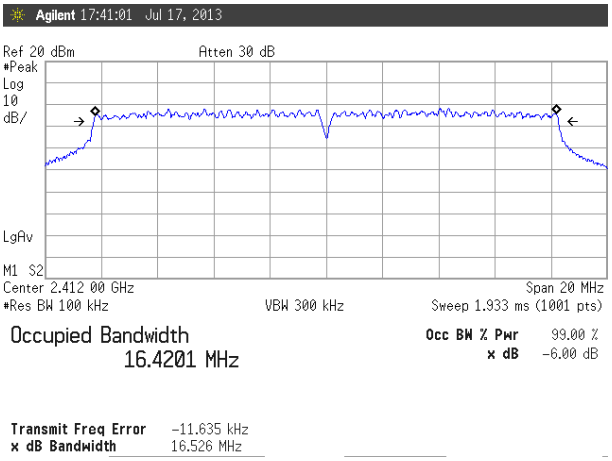


Highest Channel (2462 MHz)

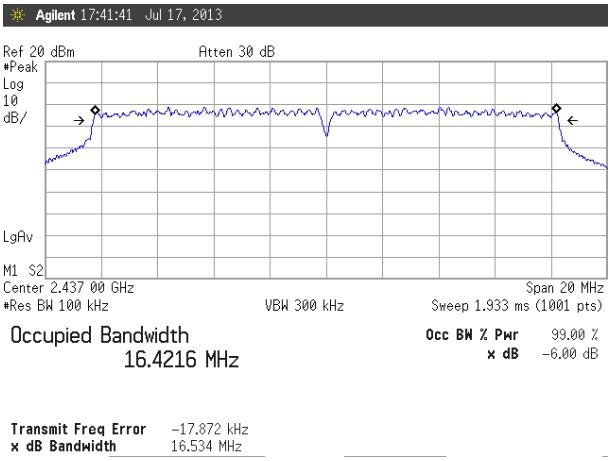


802.11g mode:

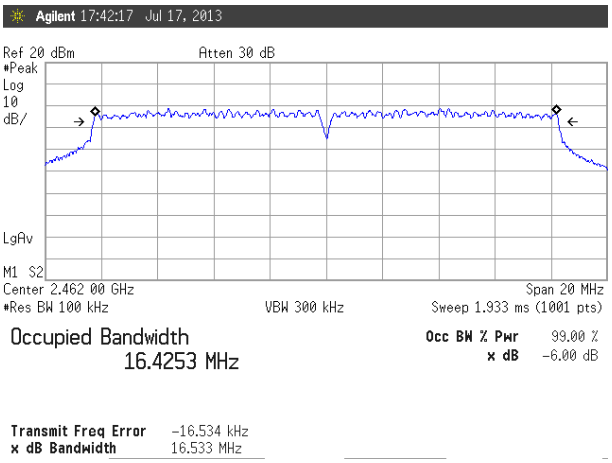
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



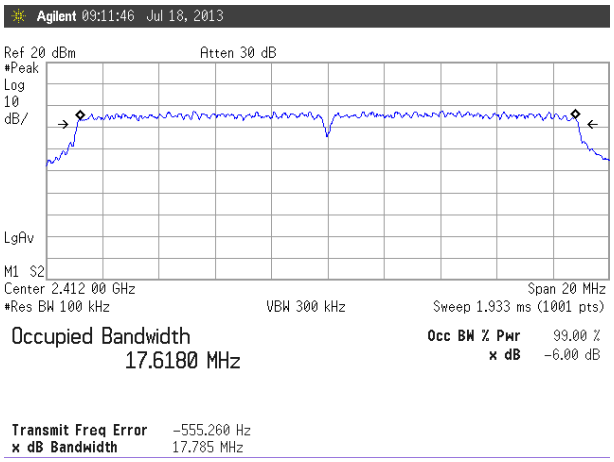
Highest Channel (2462 MHz)



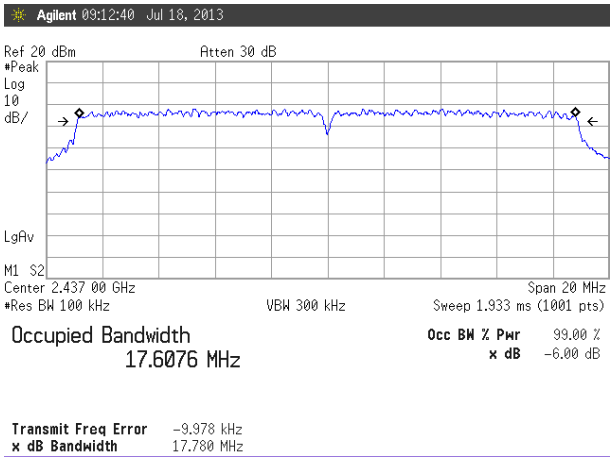
Plot of the 6dB Bandwidth & Occupied Bandwidth (99%) (continued)

802.11n HT20 mode:

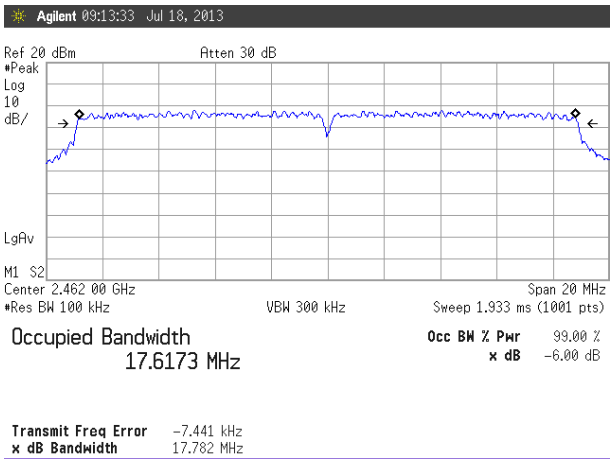
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

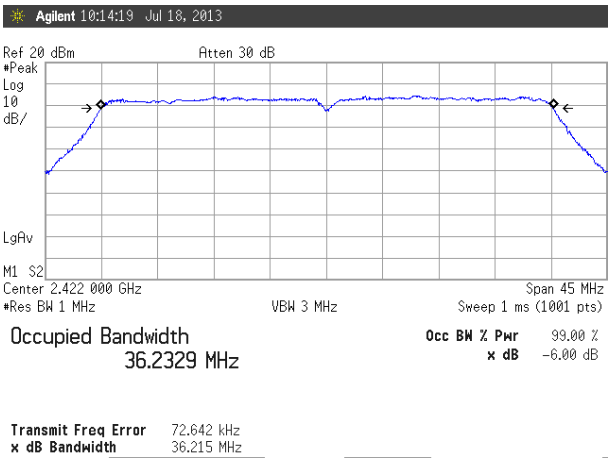


Highest Channel (2462 MHz)

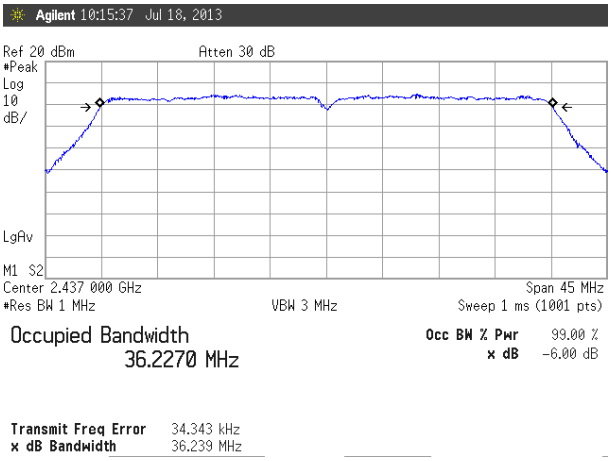


802.11n HT40 mode:

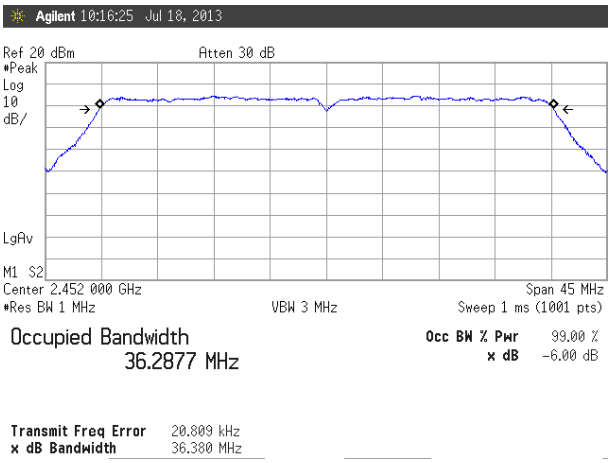
Lowest Channel (2422 MHz)



Middle Channel (2437 MHz)



Highest Channel (2452 MHz)



6.3. Maximum peak output power

6.3.1 Regulation

According to §15.247(b)(3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2 Test Procedure

1. Set the RBW = 1 MHz.
2. Set the VBW $\geq$ 3 x RBW
3. Set the span $\geq$ 1.5 x DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

6.3.3 Test Results: PASS

Table 7: Measured values of the Maximum Peak Conducted Output Power

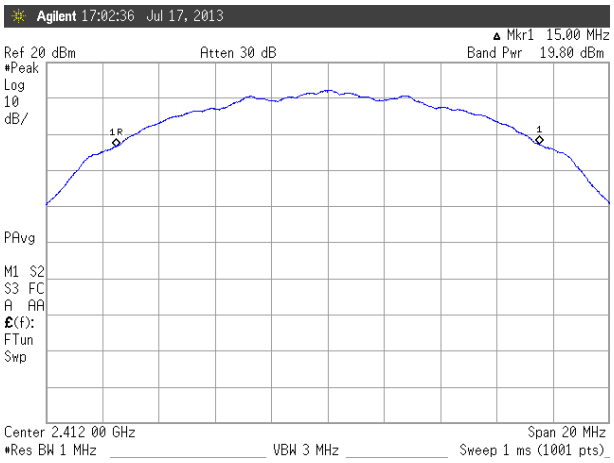
Modulation	Operating Frequency	Transfer Rate	Peak Power		Average Power [dBm] (NOTE)	Limit
			[dBm]	W		
802.11b	2412 MHz	11 Mbps	19.80	0.095	14.76	1 W
	2437 MHz		20.31	0.107	15.45	1 W
	2462 MHz		20.35	0.108	15.23	1 W
802.11g	2412 MHz	54 Mbps	19.32	0.086	10.40	1 W
	2437 MHz		19.91	0.098	10.96	1 W
	2462 MHz		19.66	0.092	10.78	1 W
802.11n HT20	2412 MHz	MCS7	18.64	0.073	10.15	1 W
	2437 MHz		19.18	0.083	10.72	1 W
	2462 MHz		18.97	0.079	10.60	1 W
802.11n HT40	2422 MHz	MCS7	18.75	0.075	10.36	1 W
	2437 MHz		18.94	0.078	10.53	1 W
	2452 MHz		18.95	0.079	10.38	1 W

NOTE The Average power were measured using AVGSA- 1 method as the reference only.

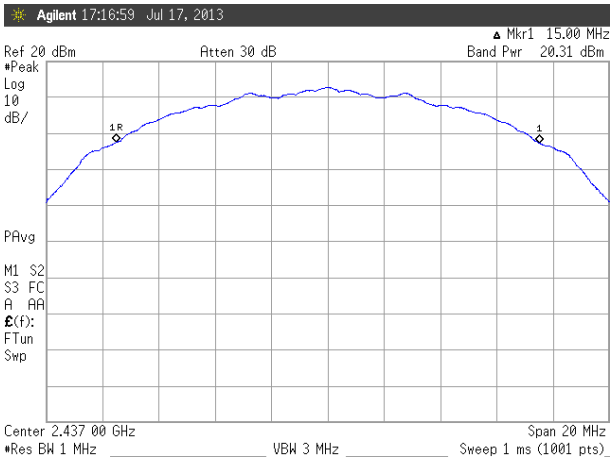
Figure 10. Plot of the Maximum Peak Conducted Output Power

802.11b mode:

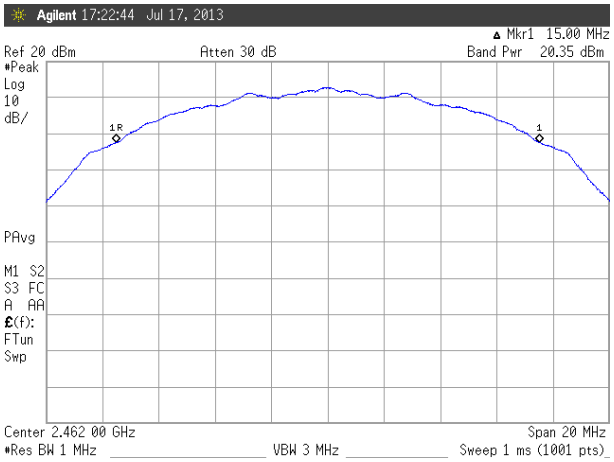
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

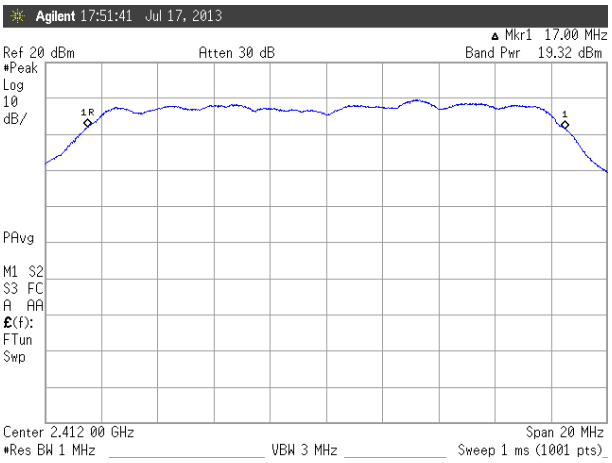


Highest Channel (2462 MHz)

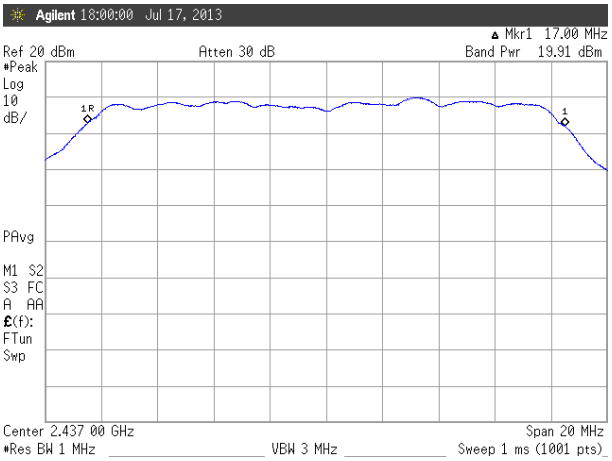


802.11g mode:

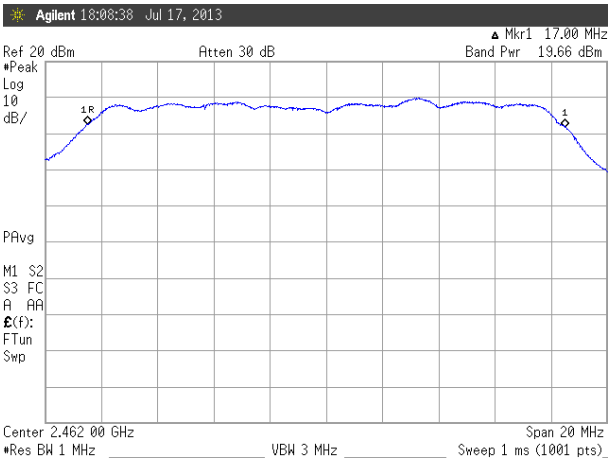
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



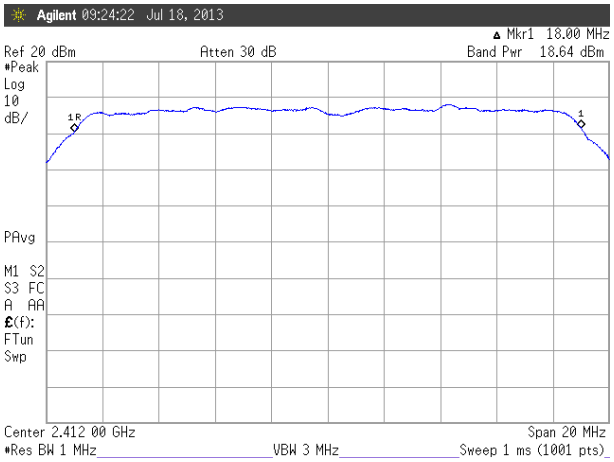
Highest Channel (2462 MHz)



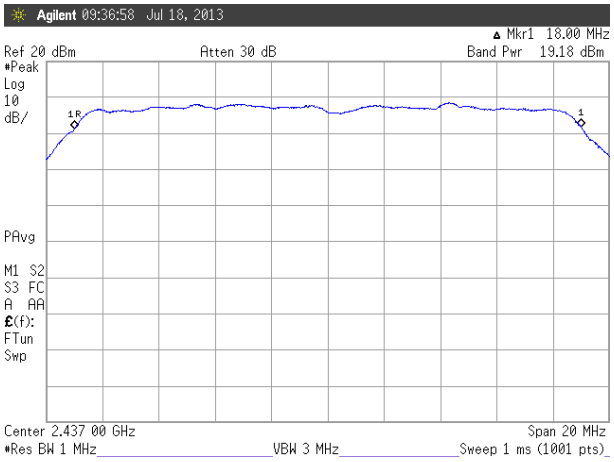
Plot of the Maximum Peak Conducted Output Power (continued)

802.11n HT20 mode:

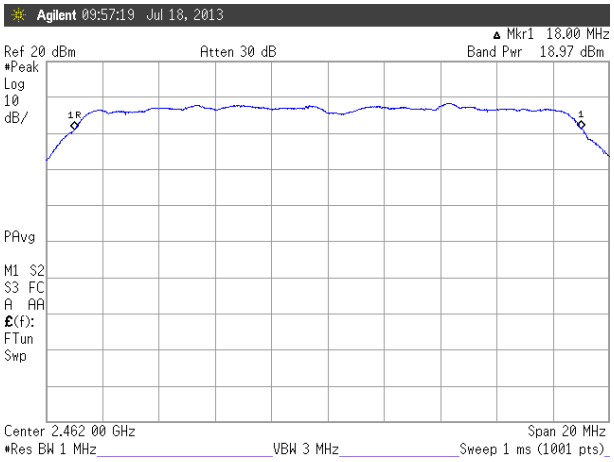
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

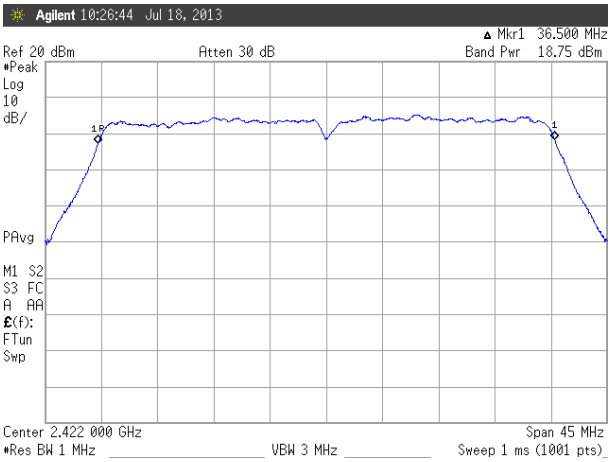


Highest Channel (2462 MHz)

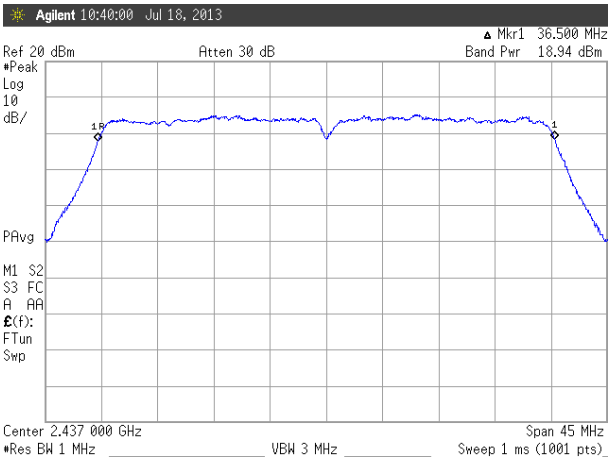


802.11n HT40 mode:

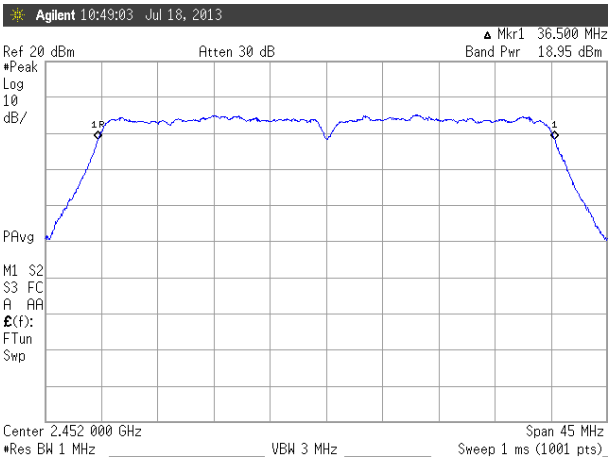
Lowest Channel (2422 MHz)



Middle Channel (2437 MHz)



Highest Channel (2452 MHz)



6.4. Spurious emissions, Band edge, and Restricted bands

6.4.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

6.4.2 Test Procedure

1) Band-edge measurements for RF conducted emissions

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation
   RBW ≥ 1 % of spectrum analyzer display span
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter / 3 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function specified in 6.3 and 6.4, 6.5, or 6.6, as applicable, and the appropriate regulatory requirements for the frequency being measured.43
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to approximately 1 % to 5 % of the total span, unless otherwise specified, with a video bandwidth equal to or greater than the RBW.
   Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an absolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
3. Subtract the delta measured in b) from the field strengths measured in a). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance of the restricted bands, described in 5.9.
4. The above “delta” measurement technique may be used for measuring emissions that are up to two “standard” bandwidths away from the band edge, where a “standard” bandwidth is the bandwidth specified by 4.2.3.2 for the frequency being measured. For example, band-edge measurements in the restricted band that begins at 2483.5 MHz require a measurement bandwidth of at least 1 MHz.
   Therefore the “delta” technique for measuring emissions up to 2 MHz removed from the band edge may be used. Radiated emissions that are removed by more than two “standard” bandwidths shall be measured in the conventional manner.

6.4.3 Test Results: PASS

Band-edge compliance of RF conducted/radiated emissions was shown in the Figure 11 and 12.
Spurious RF conducted emissions were shown in the Figure 13.
Emission plot for the preliminary radiated measurements were shown in the Figure 14.

NOTE 1: for conducted measurement, we took the insertion loss of the cable loss into consideration within the measuring instrument. And for radiated measurement, the results were calibrated to the field strength within the measuring instrument; Table 11 contains the correction factors at the operating frequencies such as antenna factor, cable loss, etc.

NOTE 2: The preliminary radiated measurements were performed in the anechoic chamber in order to find the frequency, which falls in the restricted bands as defined in Section 15.205, and the results for the final measurements were indicated in the Table 11.

Table 8: Measured values of the Field strength of spurious emission (Radiated)

BELOW 1 GHz

Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Average/Peak/Quasi-peak data, emissions below 30 MHz												
Quasi-peak data, emissions below 1000 MHz												
324.72	100	H	1.02	200	48.26	27.92	-	14.00	2.08	36.42	46.00	9.58
324.72	100	V	1.44	163	45.63	27.92	-	14.00	2.08	33.79	46.00	12.21
450.00	100	H	1.00	188	46.03	28.77	-	16.88	2.49	36.63	46.00	9.37
450.00	100	V	1.54	100	42.80	28.77	-	16.88	2.49	33.40	46.00	12.60
500.00	100	H	1.00	175	44.86	29.09	-	18.09	2.63	36.49	46.00	9.51
500.00	100	V	1.49	109	42.01	29.09	-	18.09	2.63	33.64	46.00	12.36
524.96	100	H	1.00	0	38.15	29.09	-	18.61	2.68	30.35	46.00	15.65
524.96	100	V	1.55	110	44.12	29.09	-	18.61	2.68	36.32	46.00	9.68

No Radiated Spurious Emissions Found

Margin (dB) = Limit – Actual
[Actual = Reading – Amp Gain + Attenuator + AF + CL]
1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
PEAK data, emissions above 1000 MHz **(802.11b mode)**												
2412.4	1000	H	1.00	94	-	48.46	10.23	28.19	6.52	91.22	Not Applicable	
2412.4	1000	V	1.31	69	-	48.46	10.23	28.19	6.52	90.76		
2338.4	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	50.22	74.00	23.78
2333.6	1000	V	1.31	69	-	48.44	10.24	27.93	6.39	52.48	74.00	21.52
4829.6	1000	H	1.00	139	65.16	49.01	0.41	33.14	9.71	59.41	74.00	14.59
4818.5	1000	V	1.00	34	65.18	49.00	0.42	33.13	9.70	59.43	74.00	14.57
2442.4	1000	H	1.05	91	-	48.48	10.23	28.28	6.56	89.64	Not Applicable	
2442.4	1000	V	1.10	68	-	48.48	10.23	28.28	6.56	89.98		
4868.6	1000	H	1.01	133	63.81	49.02	0.39	33.16	9.75	58.09	74.00	15.91
4868.6	1000	V	1.04	34	62.91	49.02	0.39	33.16	9.75	57.19	74.00	16.81
2462.4	1000	H	1.15	86	-	48.49	10.23	28.35	6.59	88.42	Not Applicable	
2459.2	1000	V	1.00	67	-	48.49	10.23	28.33	6.58	88.98		
2498.4	1000	H	1.15	86	-	48.50	10.23	28.46	6.64	51.54	74.00	22.46
2496.4	1000	V	1.00	67	-	48.50	10.23	28.45	6.63	50.92	74.00	23.08
4918.5	1000	H	1.00	134	63.05	49.03	0.36	33.20	9.79	57.37	74.00	16.63
4918.6	1000	V	1.07	37	64.15	49.03	0.36	33.20	9.79	58.47	74.00	15.53
PEAK data, emissions above 1000 MHz **(802.11g mode)**												
2415.2	1000	H	1.00	94	-	48.47	10.23	28.19	6.52	87.21	Not Applicable	
2415.2	1000	V	1.31	69	-	48.47	10.23	28.19	6.52	86.33		
2342.0	1000	H	1.00	94	-	48.44	10.24	27.96	6.41	51.18	74.00	22.82
2333.6	1000	V	1.31	69	-	48.44	10.24	27.93	6.39	53.52	74.00	20.48
4830.6	1000	H	1.00	138	59.13	49.01	0.41	33.14	9.71	53.38	74.00	20.62
4817.6	1000	V	1.00	35	59.11	49.00	0.42	33.13	9.70	53.36	74.00	20.64
2445.2	1000	H	1.10	89	-	48.48	10.23	28.29	6.56	85.10	Not Applicable	
2445.2	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	86.13		
4868.5	1000	H	1.01	133	57.85	49.02	0.39	33.16	9.75	52.13	74.00	21.87
4858.6	1000	V	1.03	35	57.06	49.01	0.40	33.16	9.74	51.35	74.00	22.65
2465.2	1000	H	1.15	85	-	48.49	10.23	28.35	6.59	83.91	Not Applicable	
2465.2	1000	V	1.02	66	-	48.49	10.23	28.35	6.59	85.16		
2494.4	1000	H	1.15	85	-	48.50	10.23	28.45	6.63	50.95	74.00	23.05
2493.2	1000	V	1.02	66	-	48.50	10.23	28.44	6.63	50.82	74.00	23.18
4917.6	1000	H	1.00	133	57.12	49.03	0.36	33.20	9.79	51.44	74.00	22.56
4918.6	1000	V	1.05	36	58.22	49.03	0.36	33.20	9.79	52.54	74.00	21.46

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 12 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
AVERAGE data, emissions above 1000 MHz **(802.11b mode)**												
2414.2	1000	H	1.00	94	-	48.46	10.23	28.19	6.52	84.15	Not Applicable	
2412.4	1000	V	1.31	69	-	48.46	10.23	28.19	6.52	83.47		
2338.4	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	37.04	54.00	16.96
2333.6	1000	V	1.31	69	-	48.44	10.24	27.93	6.39	37.07	54.00	16.93
4829.6	1000	H	1.00	139	55.35	49.01	0.41	33.14	9.71	49.60	54.00	4.40
4818.5	1000	V	1.00	34	55.40	49.00	0.42	33.13	9.70	49.65	54.00	4.35
2442.4	1000	H	1.05	91	-	48.48	10.23	28.28	6.56	82.30	Not Applicable	
2442.4	1000	V	1.10	68	-	48.48	10.23	28.28	6.56	82.37		
4868.6	1000	H	1.01	133	53.78	49.02	0.39	33.16	9.75	48.06	54.00	5.94
4868.6	1000	V	1.04	34	52.92	49.02	0.39	33.16	9.75	47.20	54.00	6.80
2462.4	1000	H	1.15	86	-	48.49	10.23	28.35	6.59	81.07	Not Applicable	
2459.2	1000	V	1.00	67	-	48.49	10.23	28.33	6.58	80.25		
2498.4	1000	H	1.15	86	-	48.50	10.23	28.46	6.64	37.24	54.00	16.76
2496.4	1000	V	1.00	67	-	48.50	10.23	28.45	6.63	37.40	54.00	16.60
4918.5	1000	H	1.00	134	52.97	49.03	0.36	33.20	9.79	47.29	54.00	6.71
4918.6	1000	V	1.07	37	54.43	49.03	0.36	33.20	9.79	48.75	54.00	5.25
AVERAGE data, emissions above 1000 MHz **(802.11g mode)**												
2415.6	1000	H	1.00	94	-	48.47	10.23	28.19	6.52	77.04	Not Applicable	
2415.2	1000	V	1.31	69	-	48.47	10.23	28.19	6.52	76.17		
2342.0	1000	H	1.00	94	-	48.44	10.24	27.96	6.41	36.96	54.00	17.04
2333.6	1000	V	1.31	69	-	48.44	10.24	27.93	6.39	37.52	54.00	16.48
4830.6	1000	H	1.00	138	46.35	49.01	0.41	33.14	9.71	40.60	54.00	13.40
4817.6	1000	V	1.00	35	46.36	49.00	0.42	33.13	9.70	40.61	54.00	13.39
2445.2	1000	H	1.10	89	-	48.48	10.23	28.29	6.56	75.44	Not Applicable	
2445.2	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	76.05		
4868.5	1000	H	1.01	133	44.76	49.02	0.39	33.16	9.75	39.04	54.00	14.96
4858.6	1000	V	1.03	35	43.93	49.01	0.40	33.16	9.74	38.22	54.00	15.78
2465.2	1000	H	1.15	85	-	48.49	10.23	28.35	6.59	73.66	Not Applicable	
2465.2	1000	V	1.02	66	-	48.49	10.23	28.35	6.59	74.84		
2494.4	1000	H	1.15	85	-	48.50	10.23	28.45	6.63	37.16	54.00	16.84
2493.2	1000	V	1.02	66	-	48.50	10.23	28.44	6.63	37.30	54.00	16.70
4917.6	1000	H	1.00	133	43.88	49.03	0.36	33.20	9.79	38.20	54.00	15.80
4918.6	1000	V	1.05	36	45.36	49.03	0.36	33.20	9.79	39.68	54.00	14.32

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 12 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
PEAK data, emissions above 1000 MHz **(802.11n HT20 mode)**												
2408.8	1000	H	1.00	94	-	48.46	10.23	28.17	6.51	86.42	Not Applicable	
2416.4	1000	V	1.31	69	-	48.47	10.23	28.20	6.52	86.33		
2338.0	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	51.86	74.00	22.14
2334.0	1000	V	1.31	69	-	48.44	10.24	27.94	6.39	53.49	74.00	20.51
4832.8	1000	H	1.00	138	59.10	49.01	0.41	33.14	9.71	53.35	74.00	20.65
4815.2	1000	V	1.00	34	59.08	49.00	0.42	33.13	9.70	53.33	74.00	20.67
2446.4	1000	H	1.10	90	-	48.48	10.23	28.29	6.56	84.83	Not Applicable	
2446.4	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	85.82		
4855.6	1000	H	1.01	135	57.60	49.01	0.40	33.16	9.74	51.89	74.00	22.11
4855.6	1000	V	1.00	34	56.88	49.01	0.40	33.16	9.74	51.17	74.00	22.83
2466.4	1000	H	1.15	85	-	48.49	10.23	28.36	6.59	83.76	Not Applicable	
2466.4	1000	V	1.02	65	-	48.49	10.23	28.36	6.59	84.83		
2486.8	1000	H	1.15	85	-	48.50	10.23	28.42	6.62	50.98	74.00	23.02
2486.0	1000	V	1.02	65	-	48.50	10.23	28.42	6.62	50.91	74.00	23.09
4932.8	1000	H	1.00	134	57.03	49.04	0.35	33.21	9.81	51.36	74.00	22.64
4932.8	1000	V	1.03	37	58.06	49.04	0.35	33.21	9.81	52.39	74.00	21.61
PEAK data, emissions above 1000 MHz **(802.11n HT40 mode)**												
2416.4	1000	H	1.00	105	-	48.47	10.23	28.20	6.52	82.43	Not Applicable	
2425.2	1000	V	1.25	69	-	48.47	10.23	28.23	6.54	82.19		
2334.0	1000	H	1.00	105	-	48.44	10.24	27.94	6.39	51.17	74.00	22.83
2338.0	1000	V	1.27	69	-	48.44	10.24	27.95	6.40	53.12	74.00	20.88
2440.2	1000	H	1.10	90	-	48.48	10.23	28.27	6.56	80.68	Not Applicable	
2445.4	1000	V	1.14	67	-	48.48	10.23	28.29	6.56	81.15		
2455.2	1000	H	1.18	88	-	48.48	10.23	28.32	6.58	80.12	Not Applicable	
2436.0	1000	V	1.02	70	-	48.47	10.23	28.26	6.55	80.98		
2490.4	1000	H	1.18	88	-	48.50	10.23	28.43	6.63	51.51	74.00	22.49
2491.6	1000	V	1.02	70	-	48.50	10.23	28.44	6.63	50.90	74.00	23.10

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 12 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
AVERAGE data, emissions above 1000 MHz **(802.11n HT20 mode)**												
2408.8	1000	H	1.00	94	-	48.46	10.23	28.17	6.51	76.71	Not Applicable	
2416.4	1000	V	1.31	69	-	48.47	10.23	28.20	6.52	75.92		
2338.0	1000	H	1.00	94	-	48.44	10.24	27.95	6.40	37.35	54.00	16.65
2334.0	1000	V	1.31	69	-	48.44	10.24	27.94	6.39	37.23	54.00	16.77
4832.8	1000	H	1.00	138	46.21	49.01	0.41	33.14	9.71	40.46	54.00	13.54
4815.2	1000	V	1.00	34	46.20	49.00	0.42	33.13	9.70	40.45	54.00	13.55
2446.4	1000	H	1.10	90	-	48.48	10.23	28.29	6.56	74.50	Not Applicable	
2446.4	1000	V	1.15	68	-	48.48	10.23	28.29	6.56	75.65		
4855.6	1000	H	1.01	135	44.66	49.01	0.40	33.16	9.74	38.95	54.00	15.05
4855.6	1000	V	1.00	34	43.88	49.01	0.40	33.16	9.74	38.17	54.00	15.83
2466.4	1000	H	1.15	85	-	48.49	10.23	28.36	6.59	73.33	Not Applicable	
2466.4	1000	V	1.02	65	-	48.49	10.23	28.36	6.59	74.45		
2486.8	1000	H	1.15	85	-	48.50	10.23	28.42	6.62	37.07	54.00	16.93
2486.0	1000	V	1.02	65	-	48.50	10.23	28.42	6.62	37.14	54.00	16.86
4932.8	1000	H	1.00	134	42.79	49.04	0.35	33.21	9.81	37.12	54.00	16.88
4932.8	1000	V	1.03	37	45.18	49.04	0.35	33.21	9.81	39.51	54.00	14.49
AVERAGE data, emissions above 1000 MHz **(802.11n HT40 mode)**												
2420.0	1000	H	1.00	105	-	48.47	10.23	28.20	6.52	72.42	Not Applicable	
2425.2	1000	V	1.25	69	-	48.47	10.23	28.23	6.54	72.16		
2334.0	1000	H	1.00	105	-	48.44	10.24	27.94	6.39	37.00	54.00	17.00
2338.0	1000	V	1.27	69	-	48.44	10.24	27.95	6.40	37.28	54.00	16.72
2440.2	1000	H	1.10	90	-	48.48	10.23	28.27	6.56	71.49	Not Applicable	
2445.4	1000	V	1.14	67	-	48.48	10.23	28.29	6.56	72.02		
2455.2	1000	H	1.18	88	-	48.48	10.23	28.32	6.58	70.15	Not Applicable	
2436.0	1000	V	1.02	70	-	48.47	10.23	28.26	6.55	70.88		
2490.4	1000	H	1.18	88	-	48.50	10.23	28.43	6.63	37.13	54.00	16.87
2491.6	1000	V	1.02	70	-	48.50	10.23	28.44	6.63	37.22	54.00	16.78

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + Attenuator + AF + CL]

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Remark 1. The measured value at the band-edge plots as shown Figure 12 included all the correction factors; those values are the final ('Actual') values.

2. "---" means the emission level was too low to be measured or in the noise floor.

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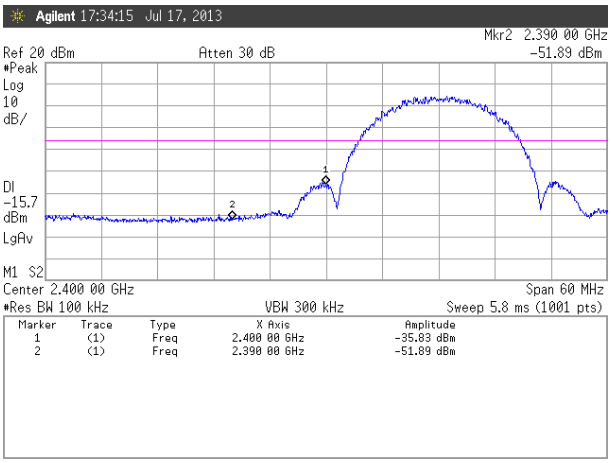
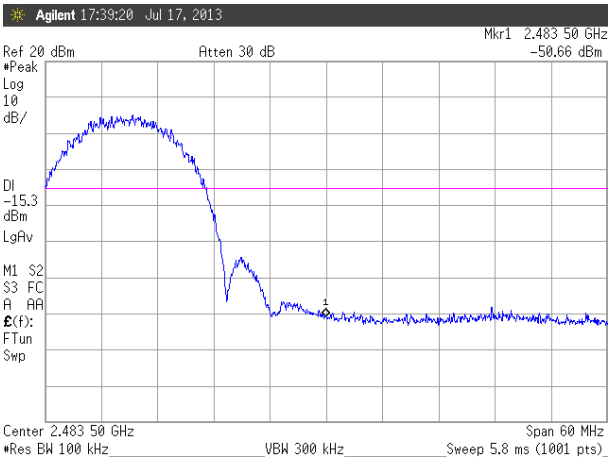
Figure 11. Plot of the Band Edge (Conducted)

802.11b mode:

Lowest Channel (2412 MHz)

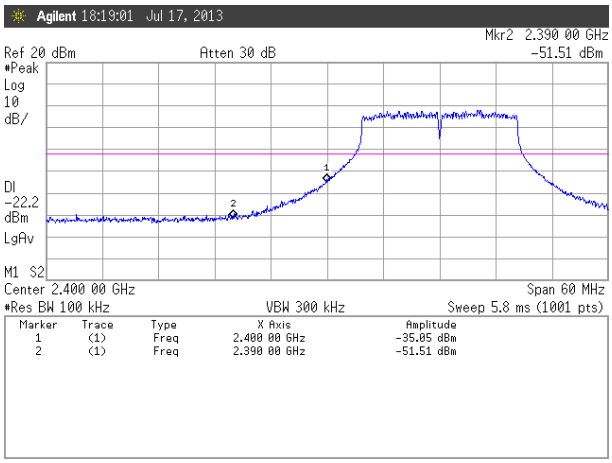


Highest Channel (2462 MHz)

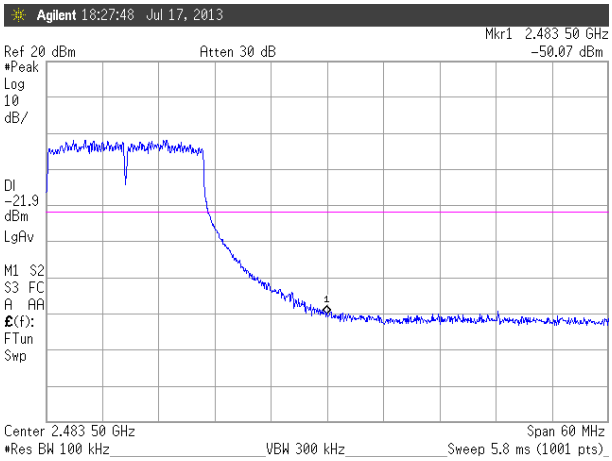


802.11g mode:

Lowest Channel (2412 MHz)



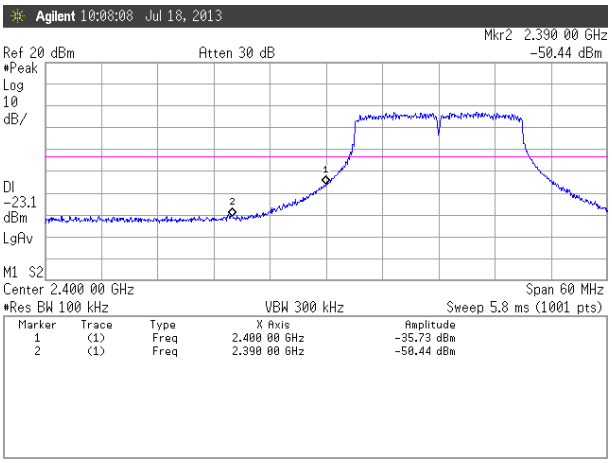
Highest Channel (2462 MHz)



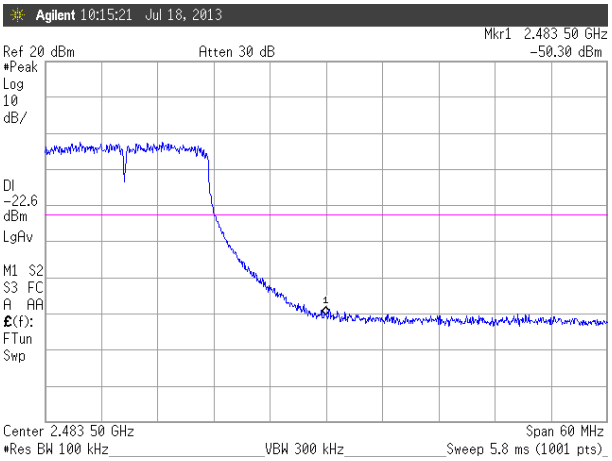
Plot of the Band Edge (Conducted) (continued)

802.11n HT20 mode:

Lowest Channel (2412 MHz)

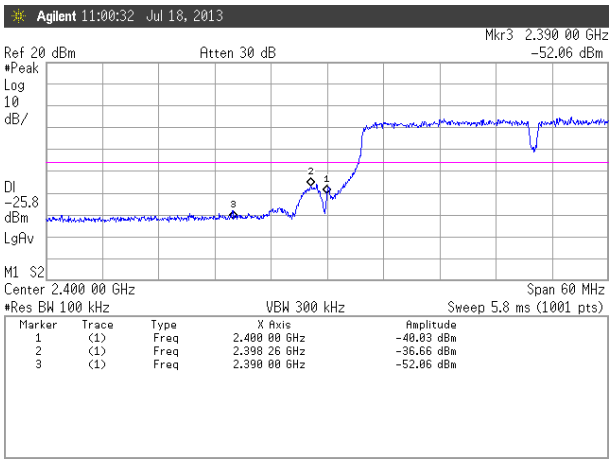


Highest Channel (2462 MHz)



802.11n HT40 mode:

Lowest Channel (2422 MHz)



Highest Channel (2452 MHz)

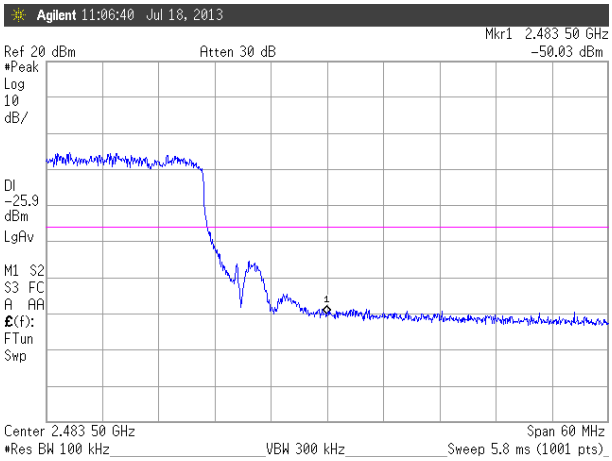
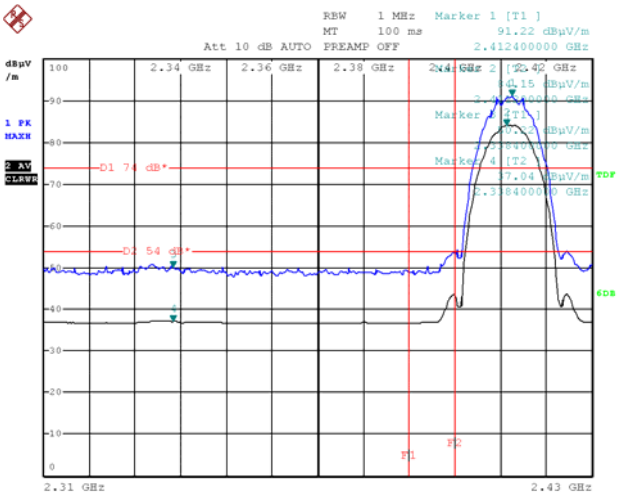


Figure 12. Plot of the Band Edge (Radiated)

802.11b mode:

Lowest Channel (2412 MHz)

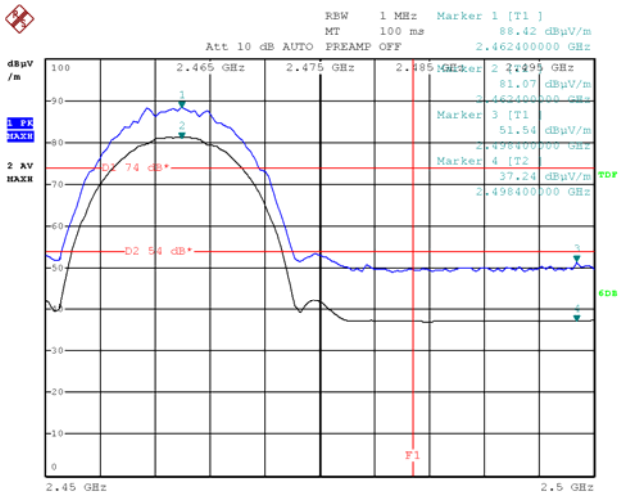
Horizontal



Date: 2.SEP.2013 13:17:31

Highest Channel (2462 MHz)

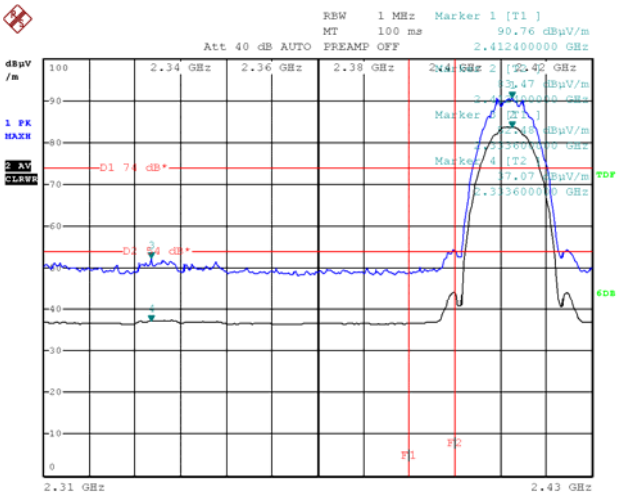
Horizontal



Date: 2.SEP.2013 15:38:42

Lowest Channel (2412 MHz)

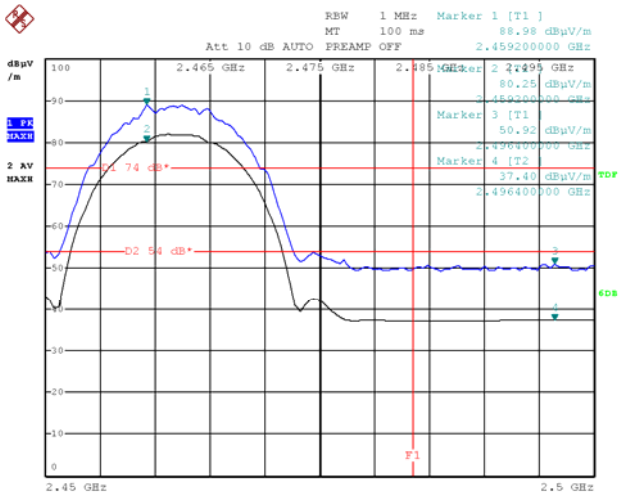
Vertical



Date: 2.SEP.2013 14:36:44

Highest Channel (2462 MHz)

Vertical



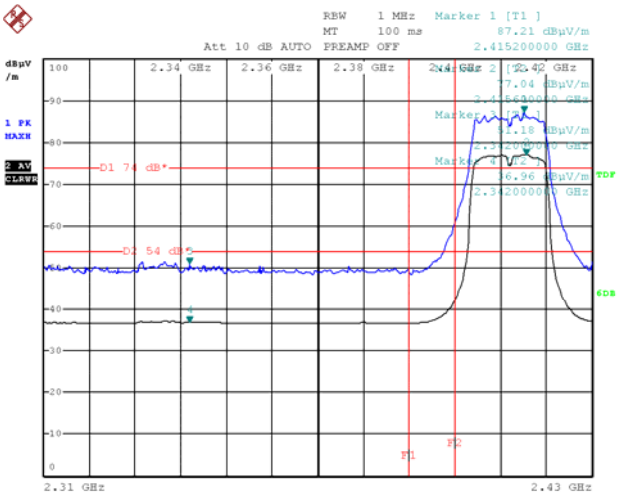
Date: 2.SEP.2013 14:54:16

Plot of the Band Edge (Radiated) *(continued)*

802.11g mode:

Lowest Channel (2412 MHz)

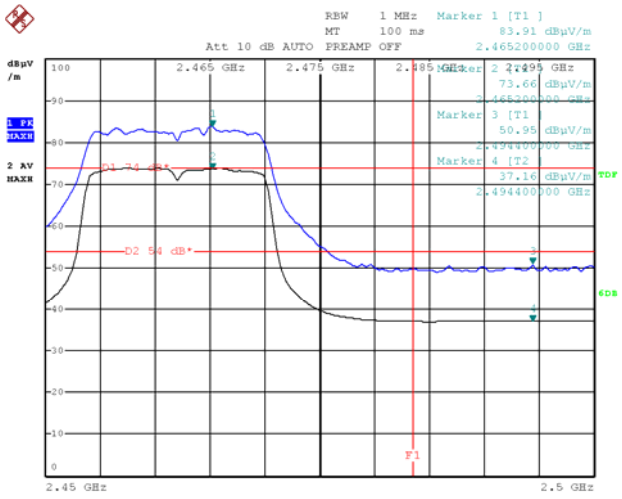
Horizontal



Date: 2.SEP.2013 13:26:01

Highest Channel (2462 MHz)

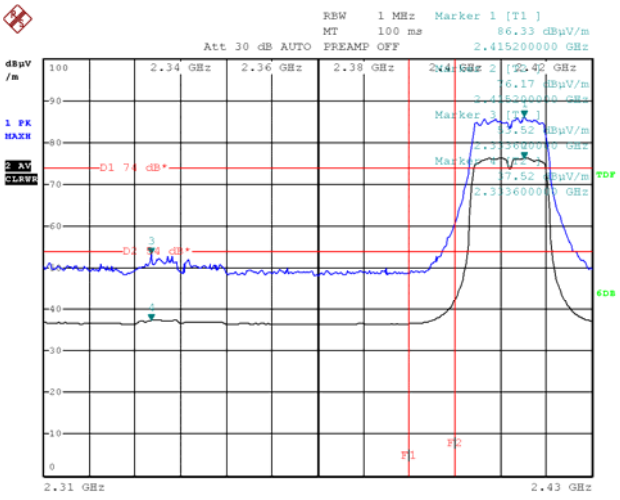
Horizontal



Date: 2.SEP.2013 15:44:56

Lowest Channel (2412 MHz)

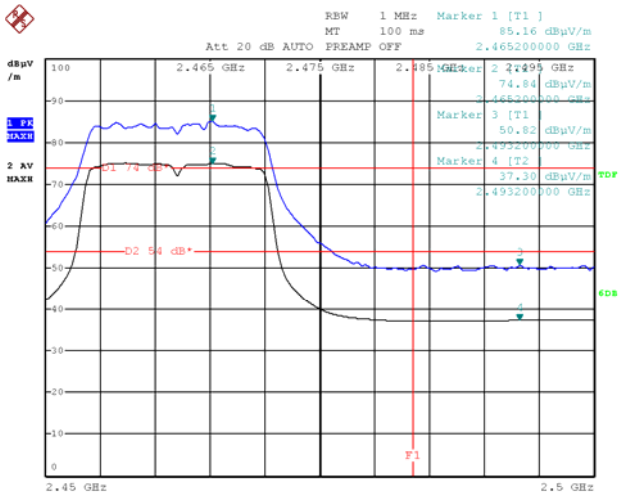
Vertical



Date: 2.SEP.2013 14:42:36

Highest Channel (2462 MHz)

Vertical



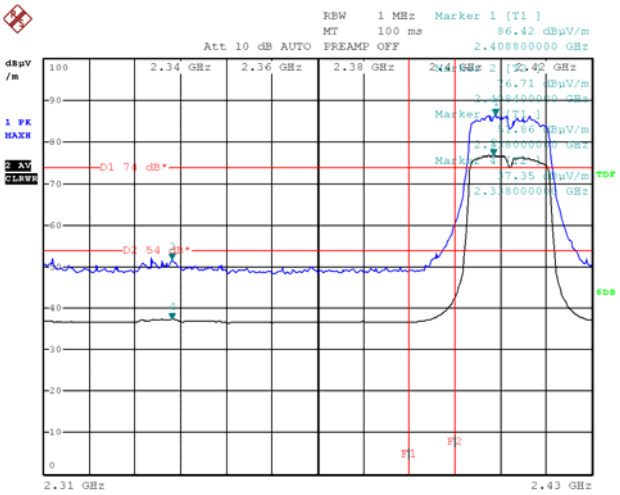
Date: 2.SEP.2013 15:10:59

Plot of the Band Edge (Radiated) *(continued)*

802.11n HT20 mode:

Lowest Channel (2412 MHz)

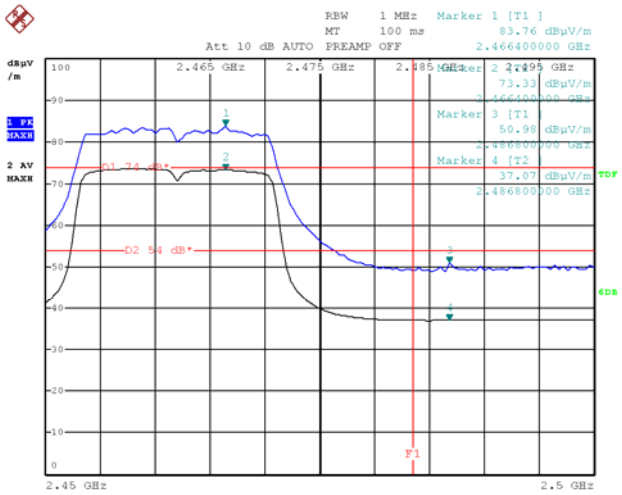
Horizontal



Date: 2.SEP.2013 13:45:38

Highest Channel (2462 MHz)

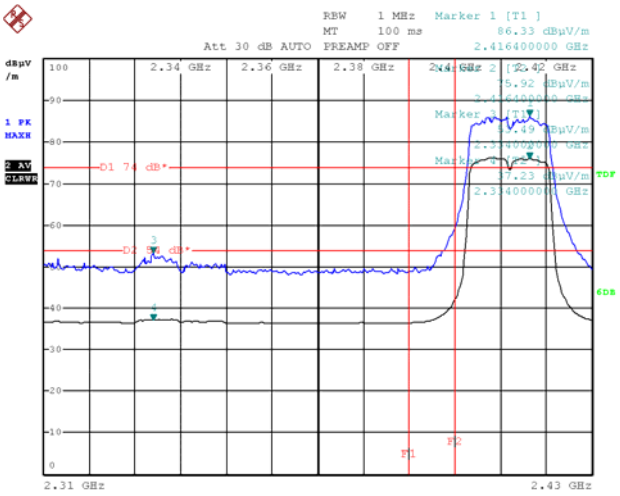
Horizontal



Date: 2.SEP.2013 15:52:18

Lowest Channel (2412 MHz)

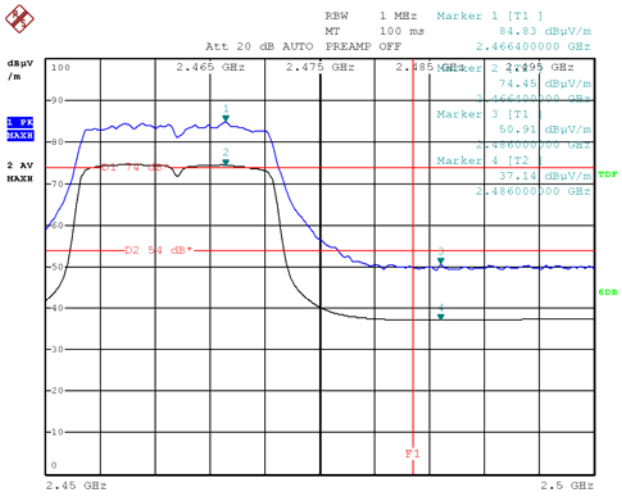
Vertical



Date: 2.SEP.2013 14:48:22

Highest Channel (2462 MHz)

Vertical



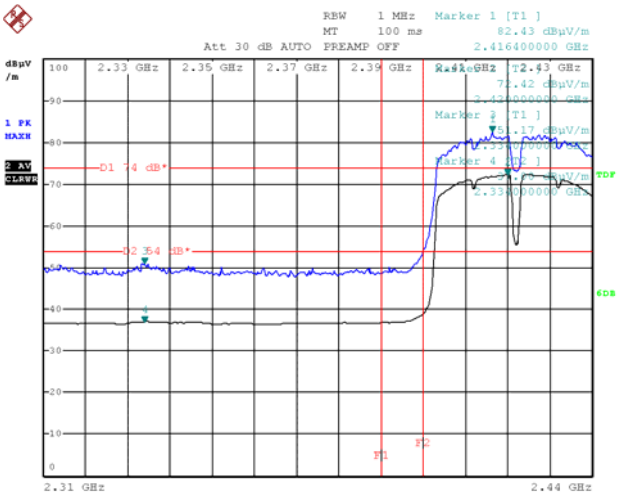
Date: 2.SEP.2013 15:20:20

Plot of the Band Edge (Radiated) *(continued)*

802.11n HT40 mode:

Lowest Channel (2422 MHz)

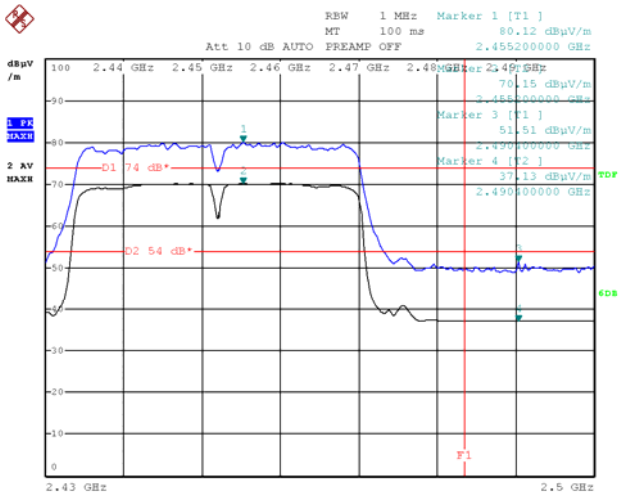
Horizontal



Date: 2.SEP.2013 14:07:14

Highest Channel (2452 MHz)

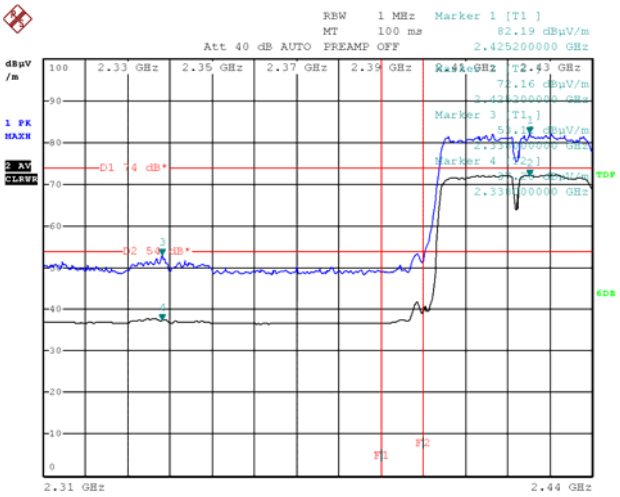
Horizontal



Date: 2.SEP.2013 16:00:23

Lowest Channel (2422 MHz)

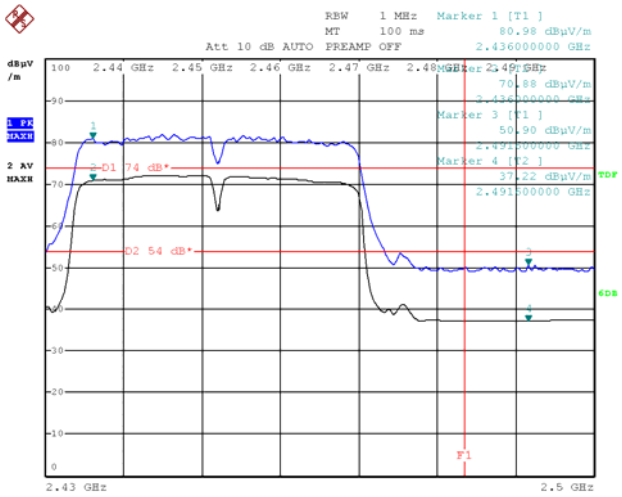
Vertical



Date: 2.SEP.2013 14:19:28

Highest Channel (2452 MHz)

Vertical

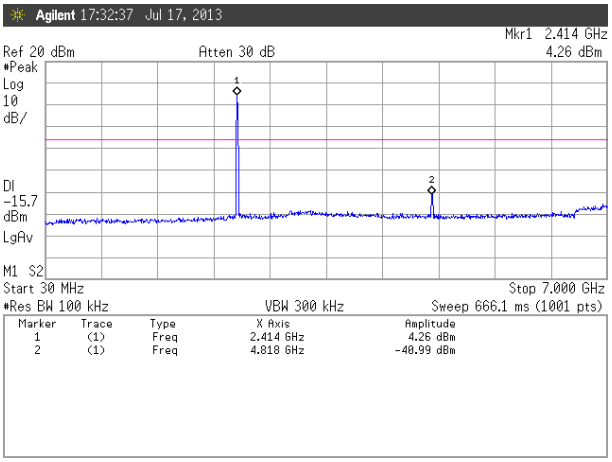


Date: 2.SEP.2013 15:26:22

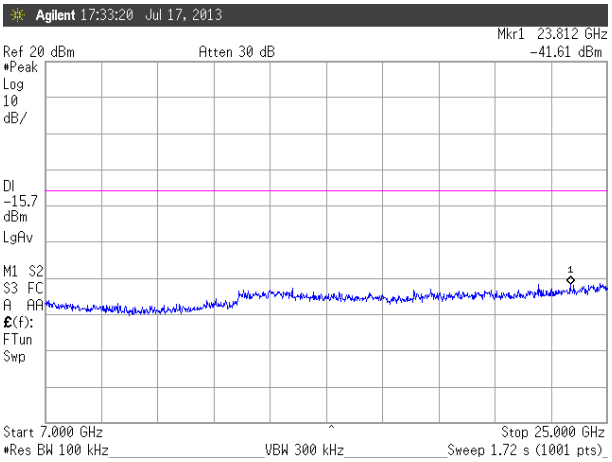
Figure 13. Spurious RF conducted emissions

802.11b mode:

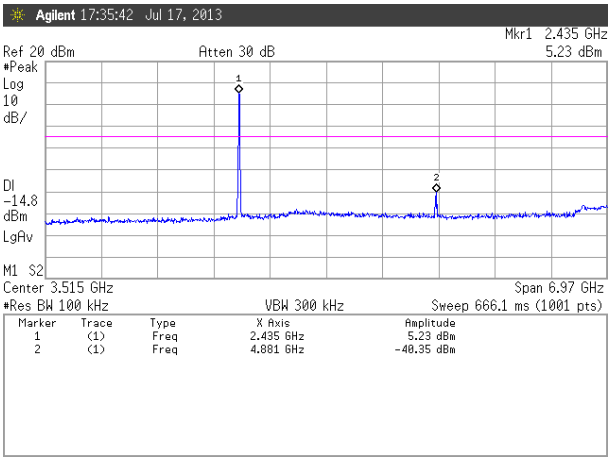
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



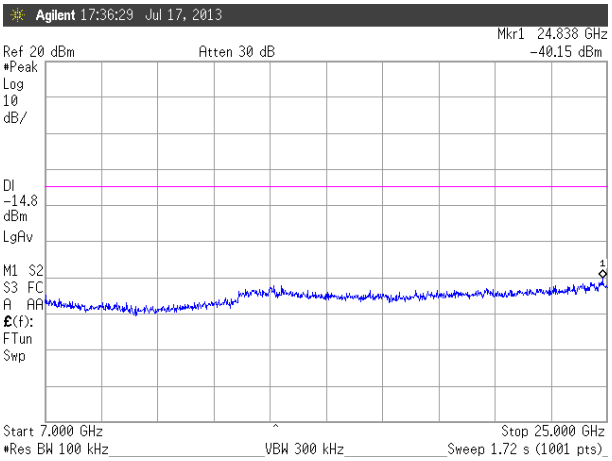
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



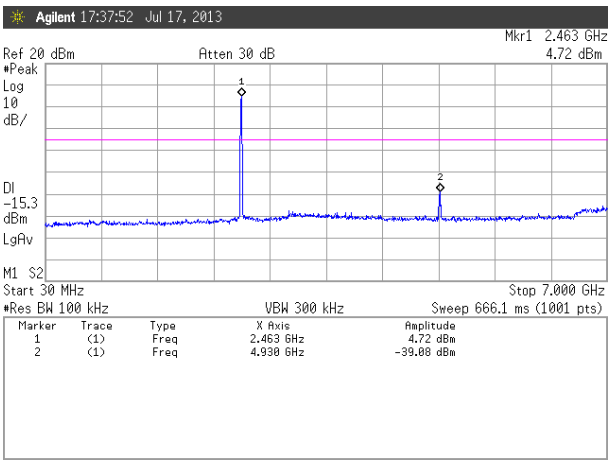
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



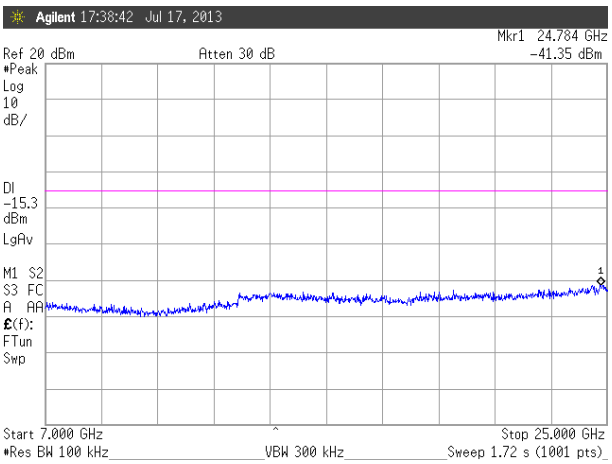
Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2462 MHz): 30 MHz ~ 7 GHz



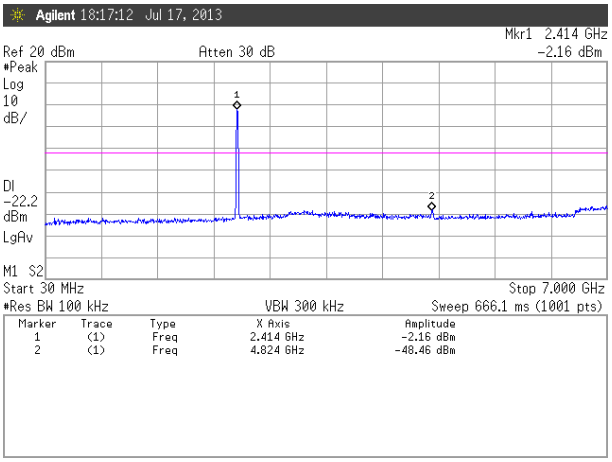
Highest Channel (2462 MHz): 7 GHz ~ 25 GHz



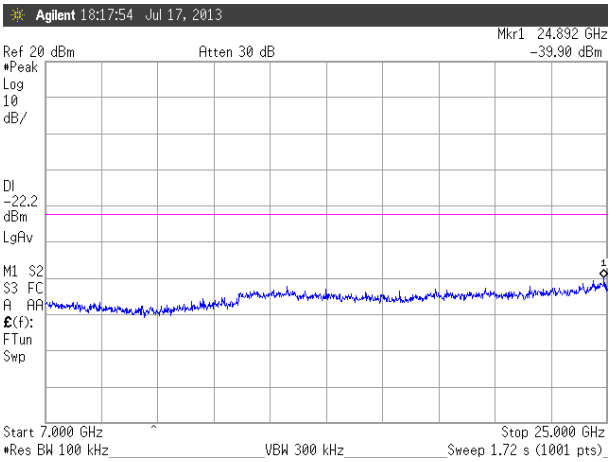
Spurious RF conducted emissions *(continued)*

802.11g mode:

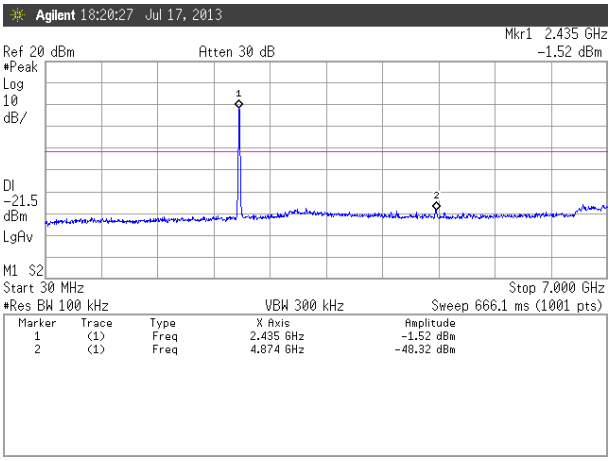
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



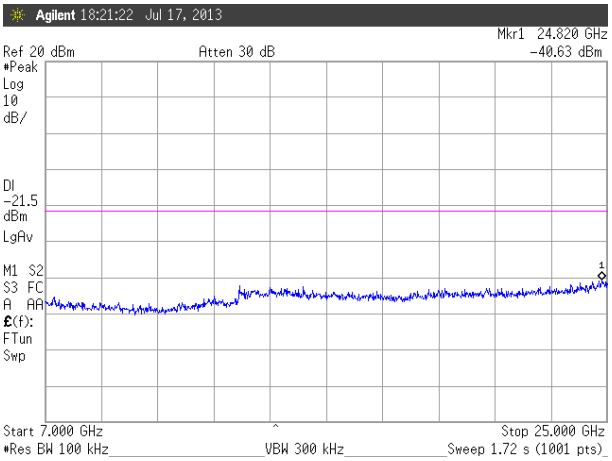
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



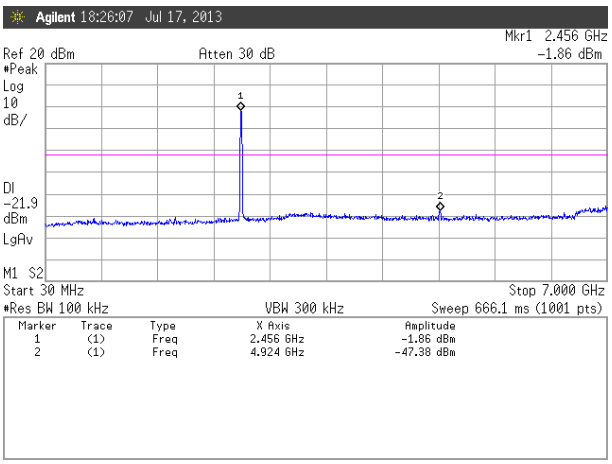
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



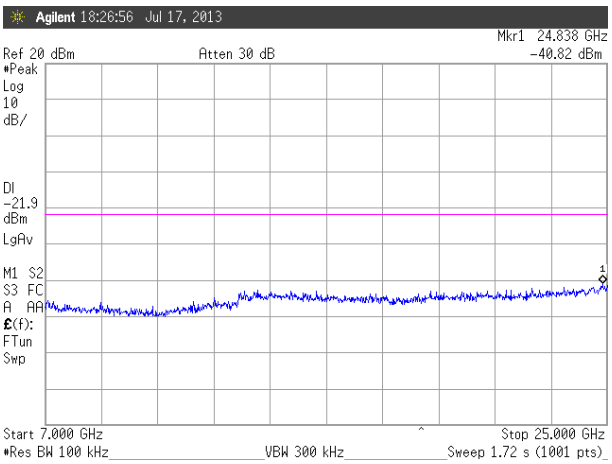
Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2462 MHz): 30 MHz ~ 7 GHz



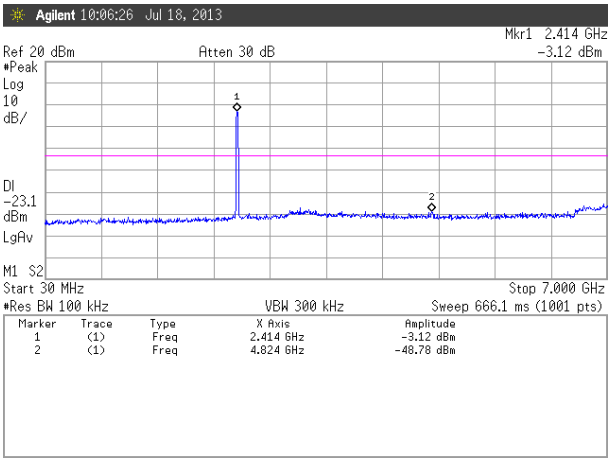
Highest Channel (2462 MHz): 7 GHz ~ 25 GHz



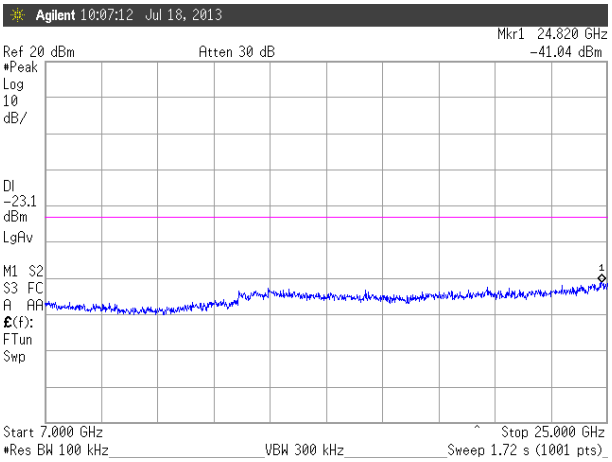
Spurious RF conducted emissions (continued)

802.11n HT20 mode:

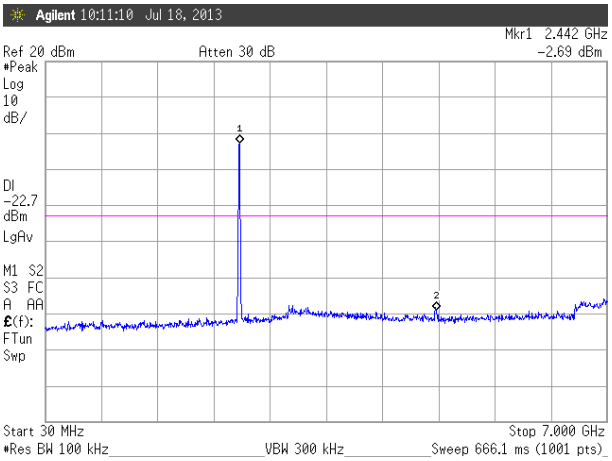
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



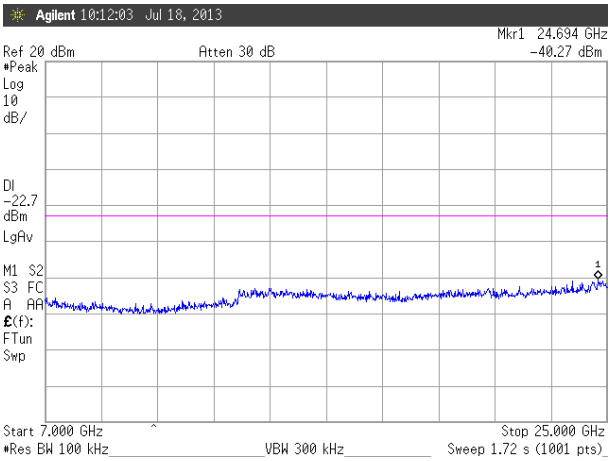
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



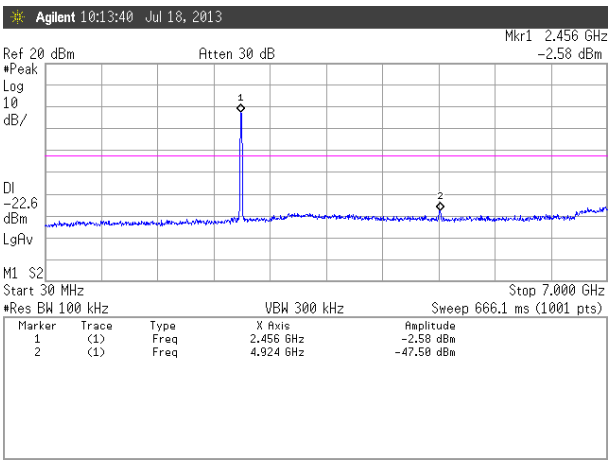
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



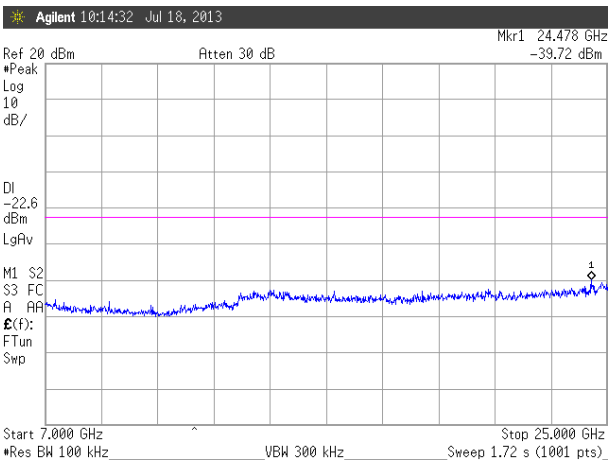
Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2462 MHz): 30 MHz ~ 7 GHz



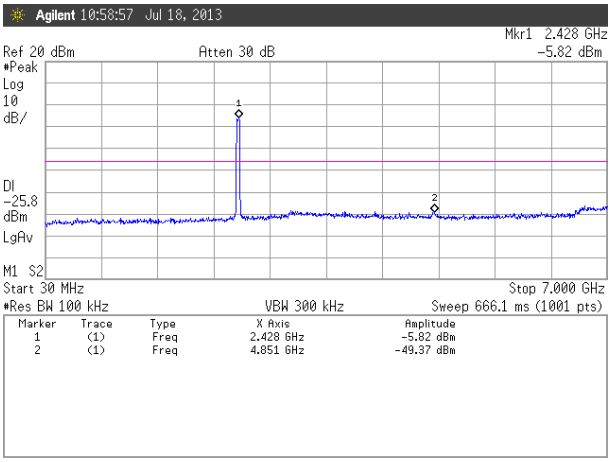
Highest Channel (2462 MHz): 7 GHz ~ 25 GHz



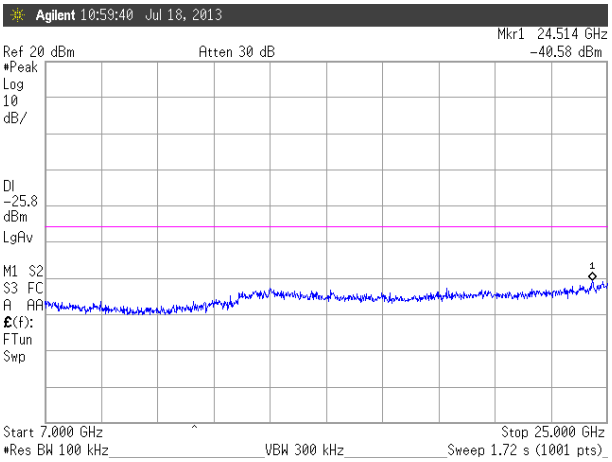
Spurious RF conducted emissions *(continued)*

802.11n HT40 mode:

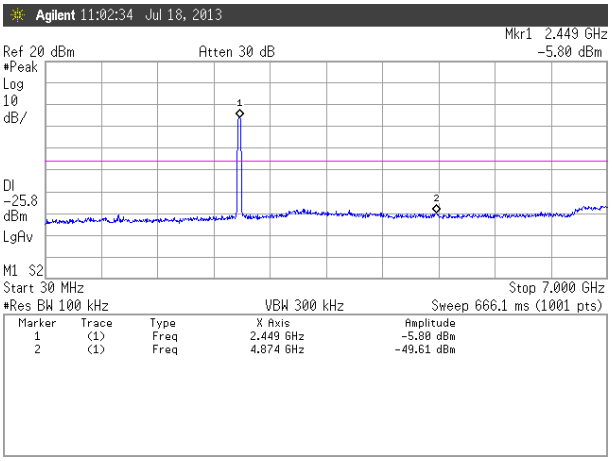
Lowest Channel (2422 MHz): 30 MHz ~ 7 GHz



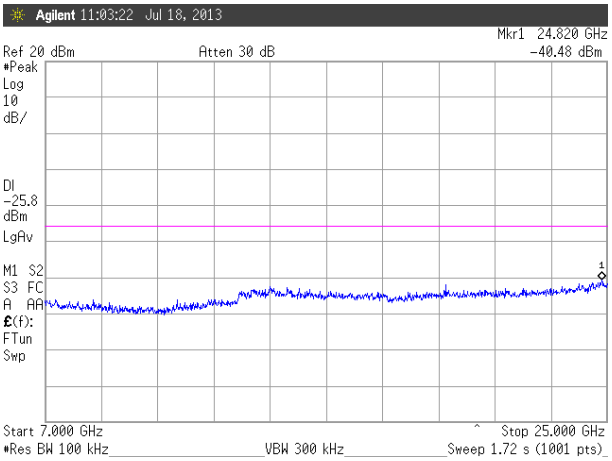
Lowest Channel (2422 MHz): 7 GHz ~ 25 GHz



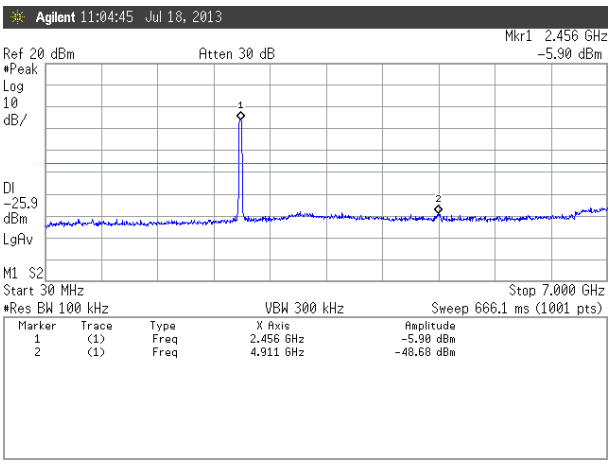
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



Highest Channel (2452 MHz): 30 MHz ~ 7 GHz



Highest Channel (2452 MHz): 7 GHz ~ 25 GHz

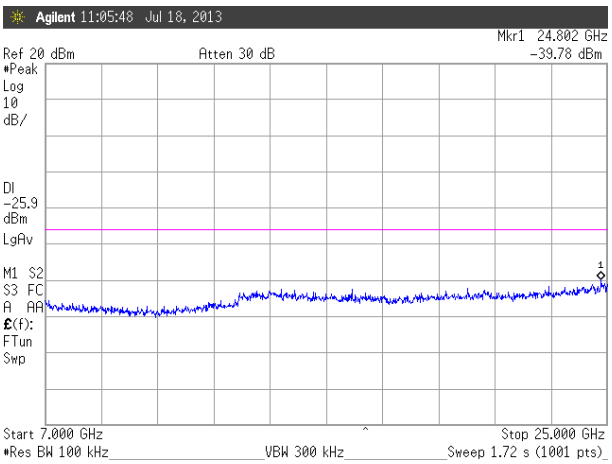
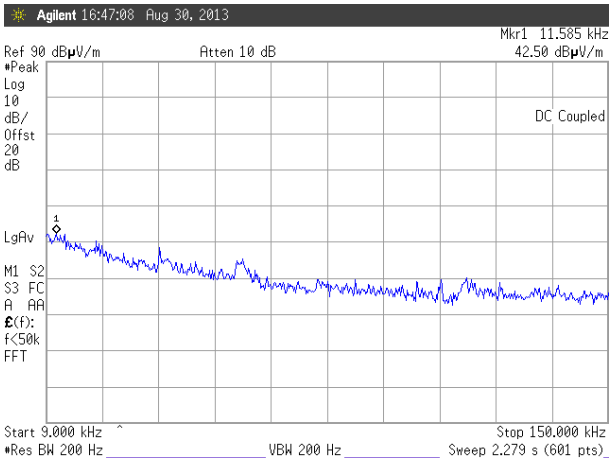
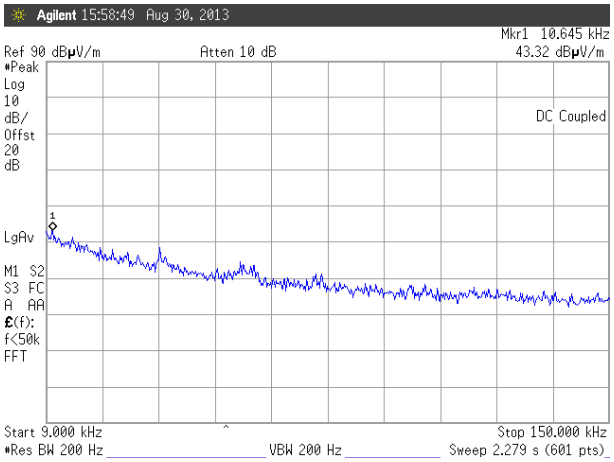


Figure 14. Emission plot for the preliminary radiated measurements

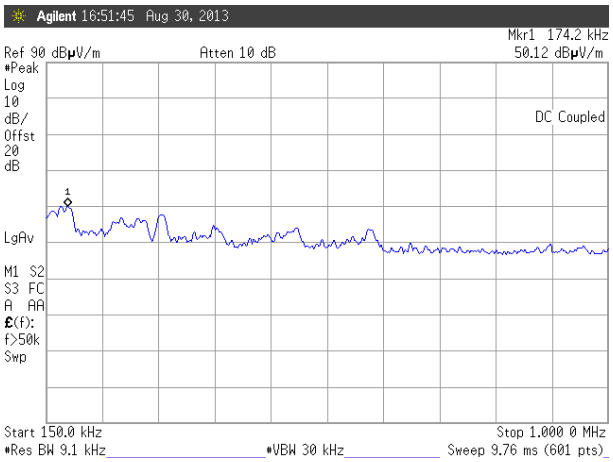
Operating at 2412 MHz: 9 kHz ~ 150 kHz (@ 3-m distance)



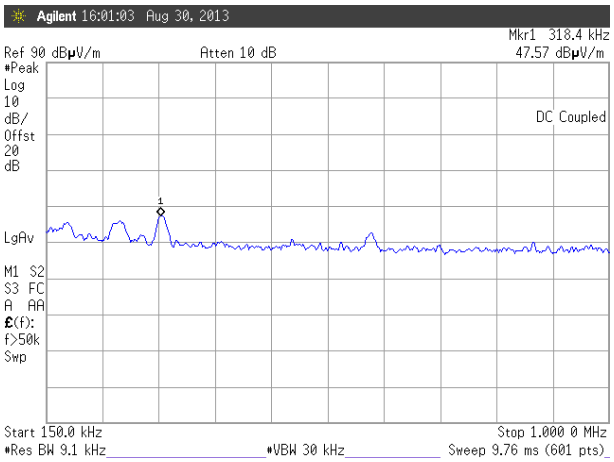
Operating at 2462 MHz: 9 kHz ~ 150 kHz (@ 3-m distance)



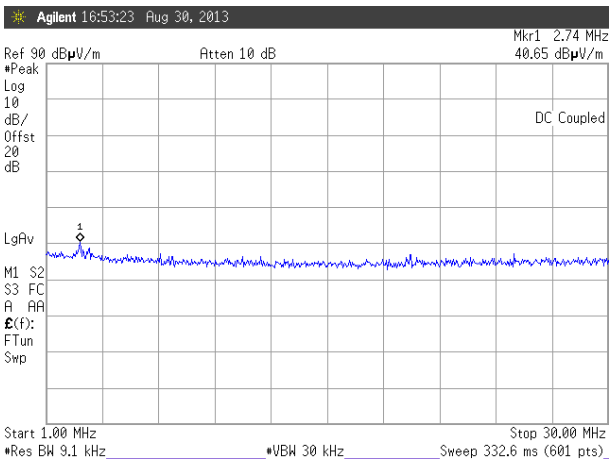
Operating at 2412 MHz: 150 kHz ~ 1 MHz (@ 3-m distance)



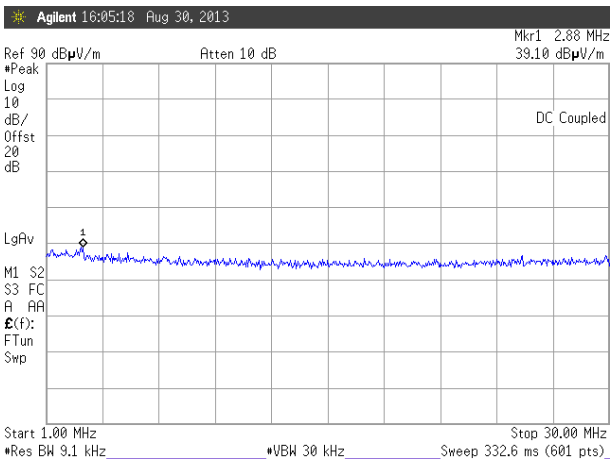
Operating at 2462 MHz: 150 kHz ~ 1 MHz (@ 3-m distance)



Operating at 2412 MHz: 1 MHz ~ 30 MHz (@ 3-m distance)

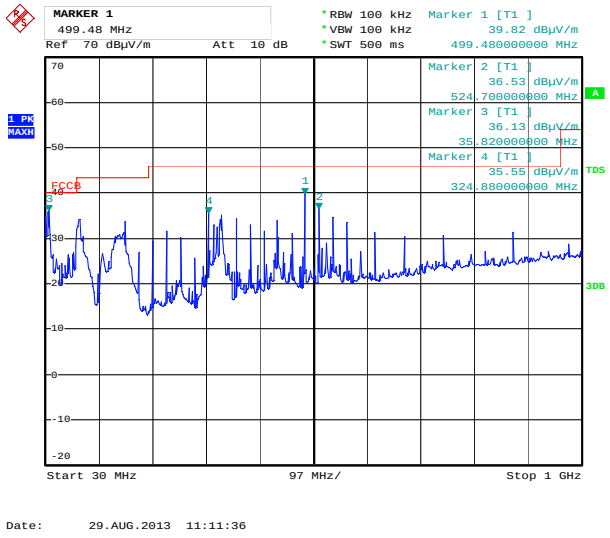


Operating at 2462 MHz: 1 MHz ~ 30 MHz (@ 3-m distance)

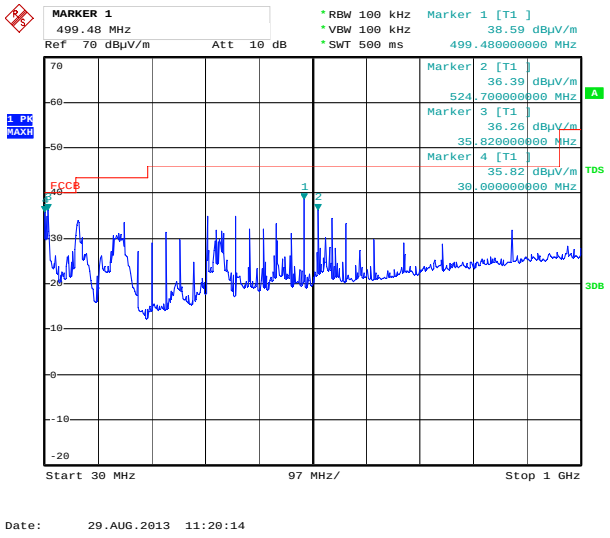


Emission plot for the preliminary radiated measurements *(continued)*

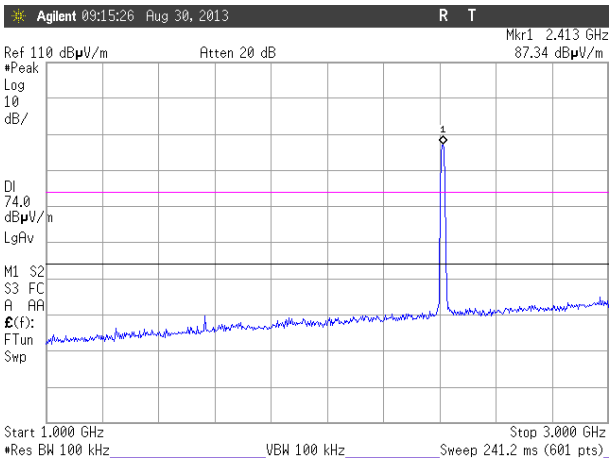
Operating at 2412 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



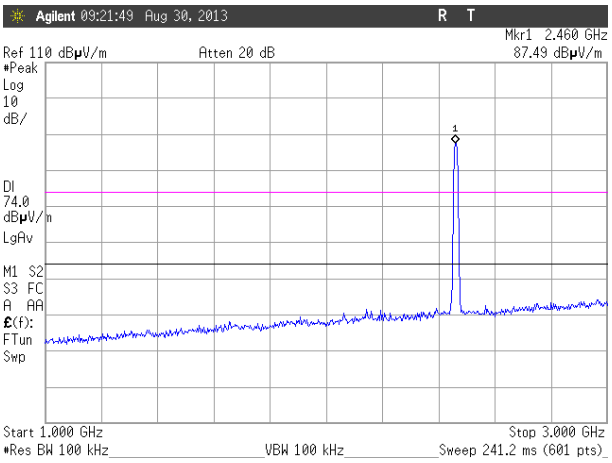
Operating at 2462 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



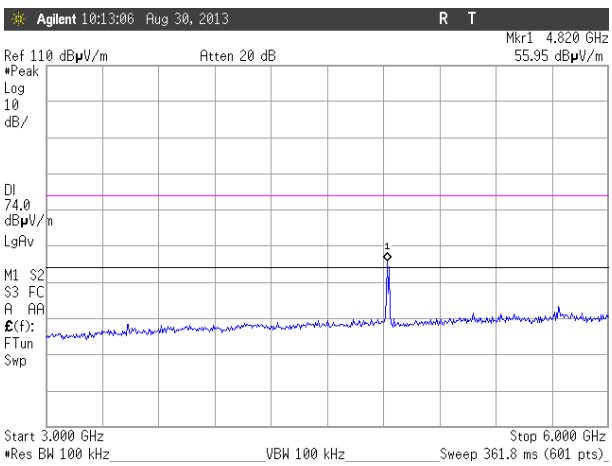
Operating at 2412 MHz: 1 GHz ~ 3 GHz (@ 3-m distance)



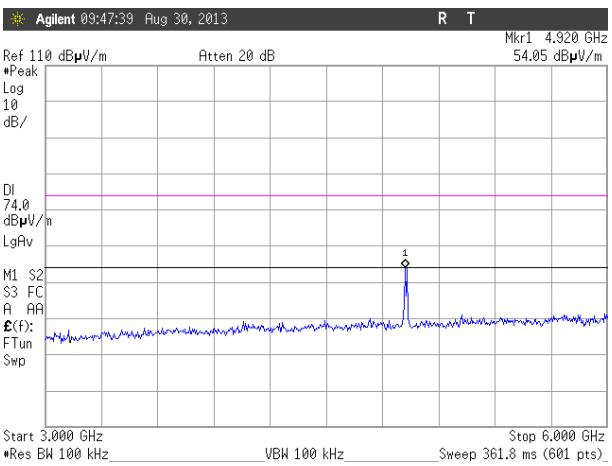
Operating at 2462 MHz: 1 GHz ~ 3 GHz (@ 3-m distance)



Operating at 2412 MHz: 3 GHz ~ 6 GHz (@ 3-m distance)

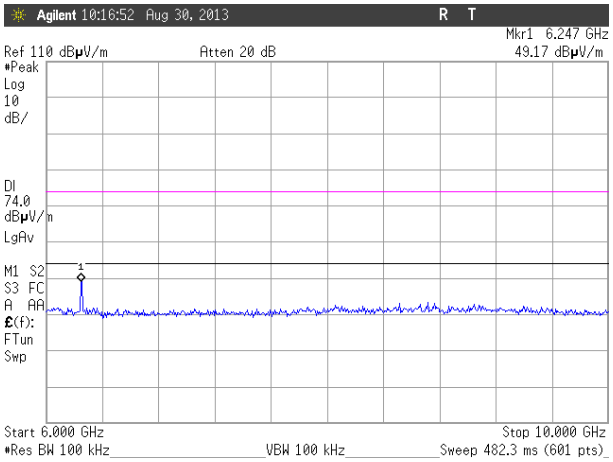


Operating at 2462 MHz: 3 GHz ~ 6 GHz (@ 3-m distance)

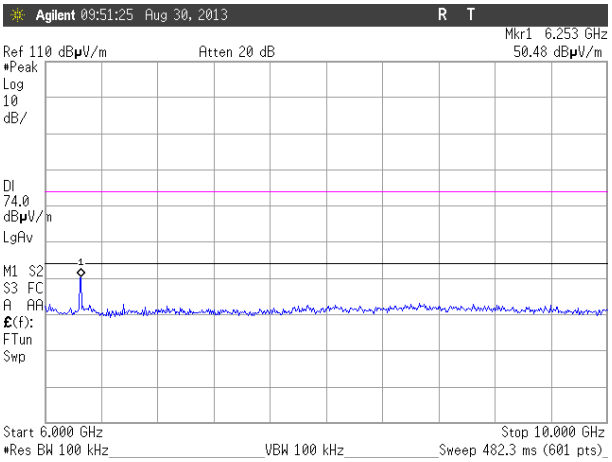


Emission plot for the preliminary radiated measurements *(continued)*

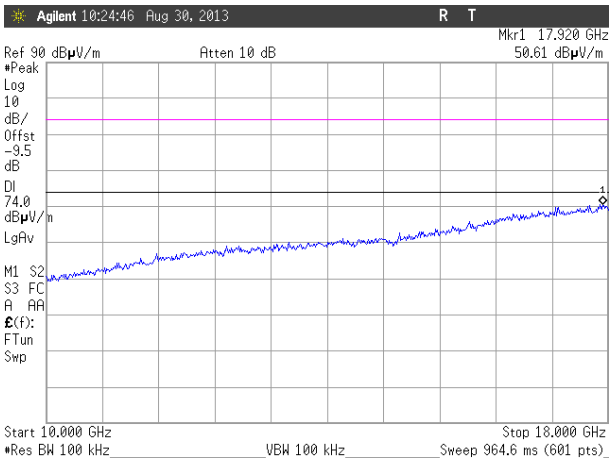
Operating at 2412 MHz: 6 GHz ~ 10 GHz (@ 3-m distance)



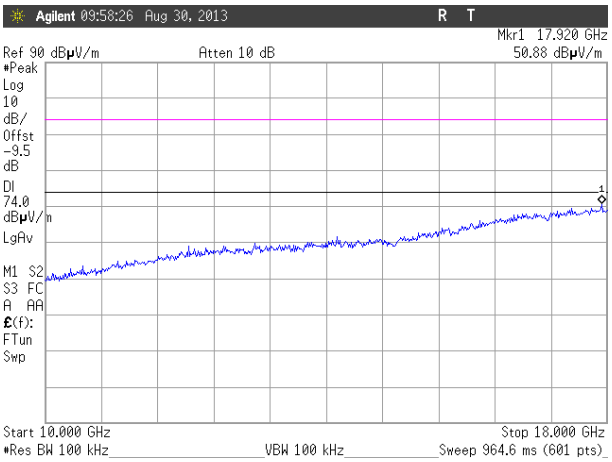
Operating at 2462 MHz: 6 GHz ~ 10 GHz (@ 3-m distance)



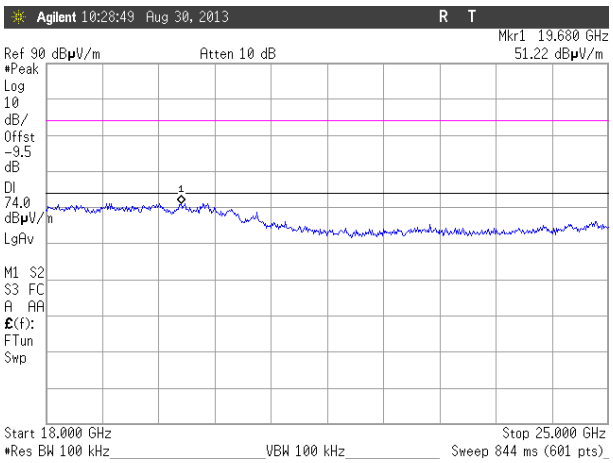
Operating at 2412 MHz: 10 GHz ~ 18 GHz (@ 1-m distance)



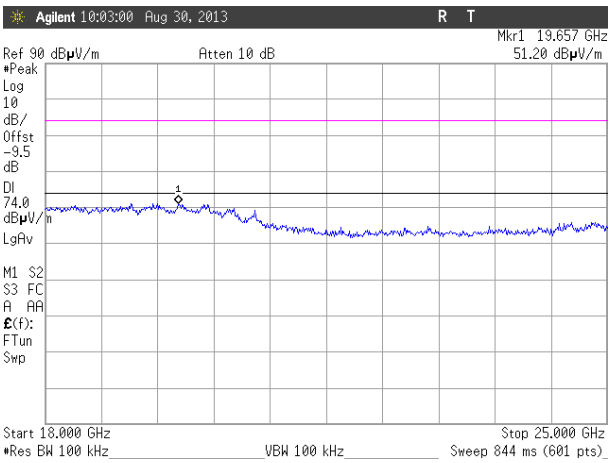
Operating at 2462 MHz: 10 GHz ~ 18 GHz (@ 1-m distance)



Operating at 2412 MHz: 18 GHz ~ 25 GHz (@ 1-m distance)



Operating at 2462 MHz: 18 GHz ~ 25 GHz (@ 1-m distance)



6.5. Peak power spectral density

6.5.1 Regulation

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.5.2 Test Procedure(peak PSD)

Set the spectrum analyzer as follows:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the 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.

6.5.3 Test Results: PASS

Table 9: Measured values of the Peak Power Spectral Density (Conducted)

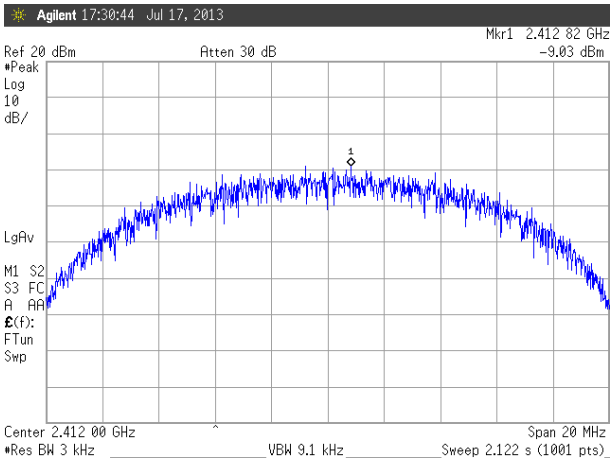
Modulation	Operating frequency	Transfer Rate	PSD/3 kHz (dBm)	Limit (dBm)
802.11b	2412 MHz	11 Mbps	-9.03	8
	2437 MHz	11 Mbps	-8.43	8
	2462 MHz	11 Mbps	-8.69	8
802.11g	2412 MHz	54 Mbps	-15.99	8
	2437 MHz	54 Mbps	-15.51	8
	2462 MHz	54 Mbps	-15.58	8
802.11n HT20	2412 MHz	MCS7	-16.53	8
	2437 MHz	MCS7	-15.97	8
	2462 MHz	MCS7	-16.14	8
802.11n HT40	2422 MHz	MCS7	-18.18	8
	2437 MHz	MCS7	-18.12	8
	2452 MHz	MCS7	-18.18	8

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

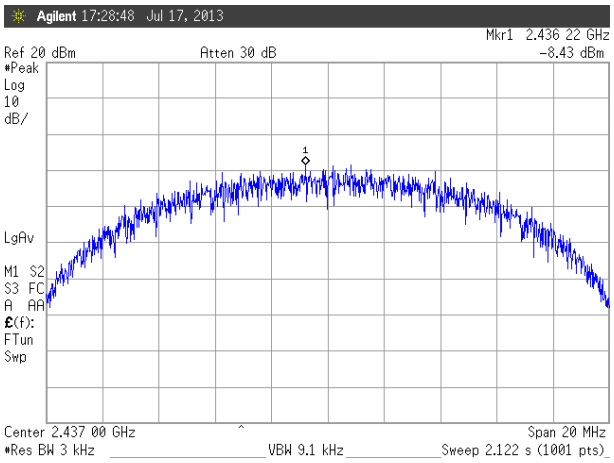
Figure 15. Plot of the Peak Power Spectral Density

802.11b mode:

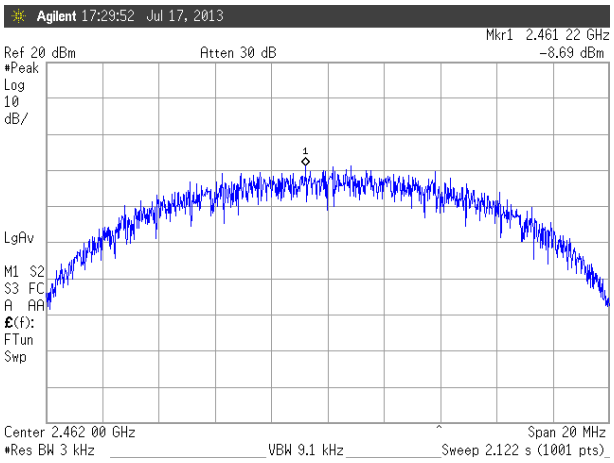
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

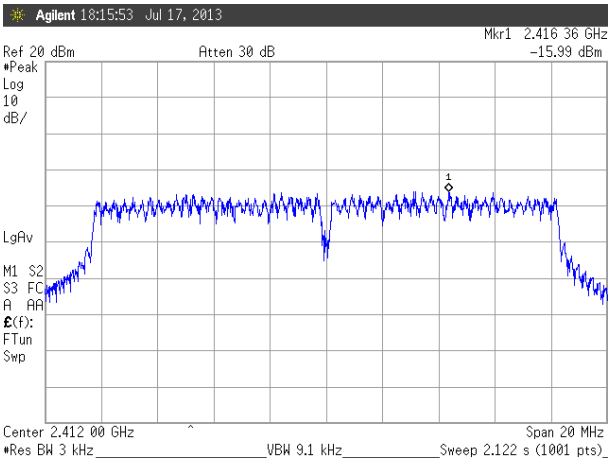


Highest Channel (2462 MHz)

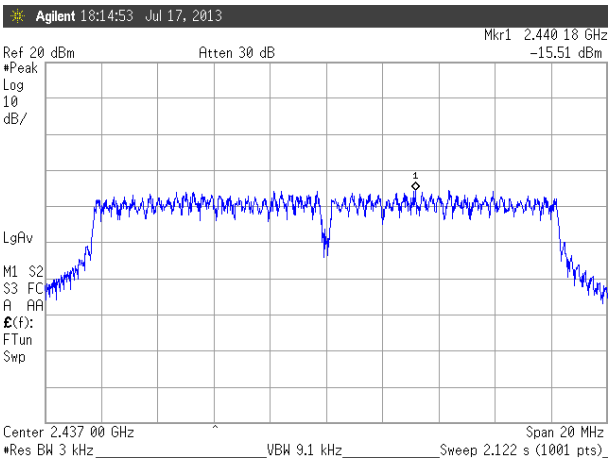


802.11g mode:

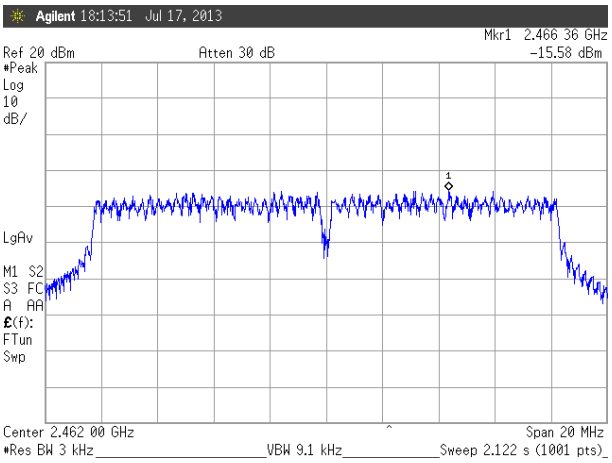
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



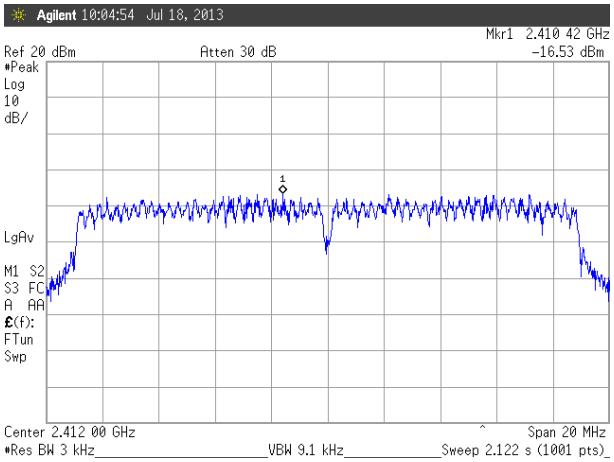
Highest Channel (2462 MHz)



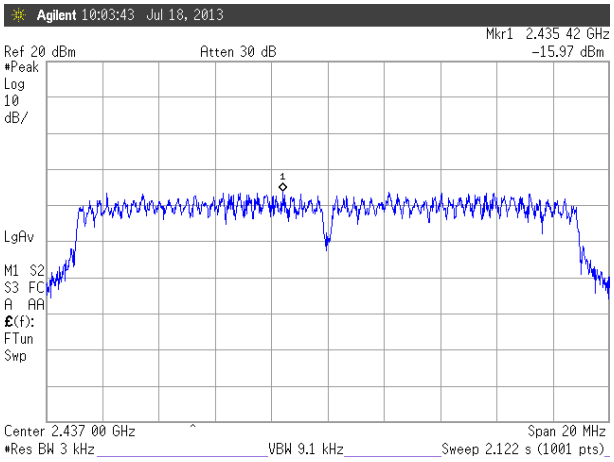
Plot of the Peak Power Spectral Density (continued)

802.11n HT20 mode:

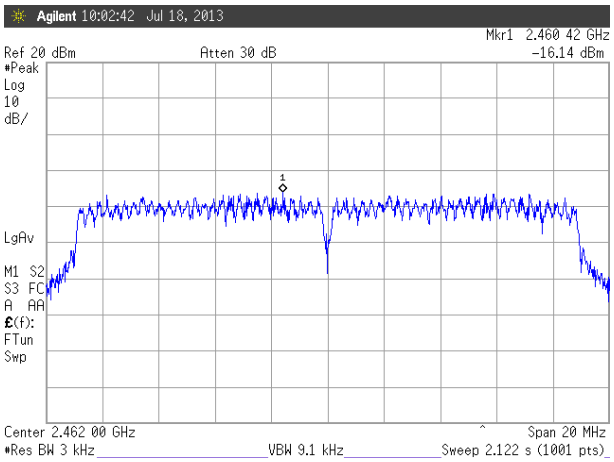
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

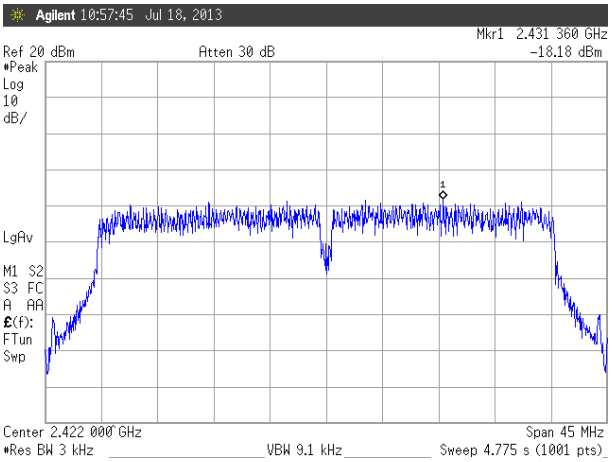


Highest Channel (2462 MHz)

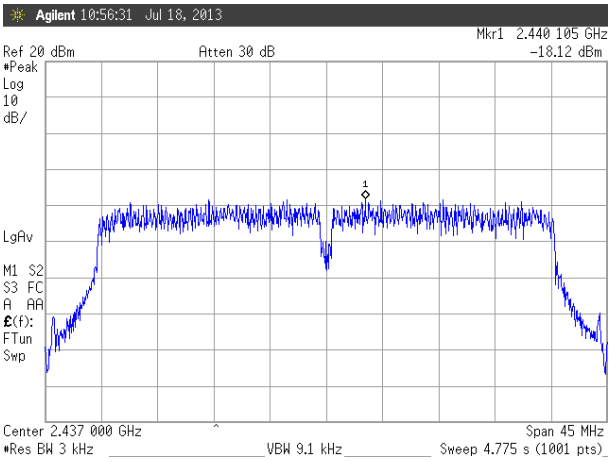


802.11n HT40 mode:

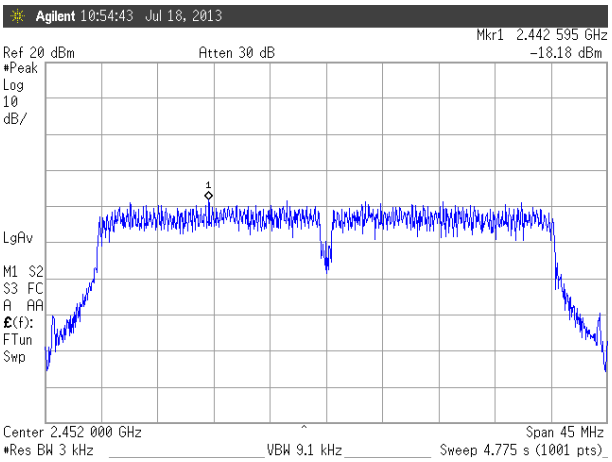
Lowest Channel (2422 MHz)



Middle Channel (2437 MHz)



Highest Channel (2452 MHz)



6.6. AC power line conducted emissions

6.6.1 Regulation

According to §15.207(a), for an intentional radiator that 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 the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

6.6.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

6.6.3 Test Results: PASS

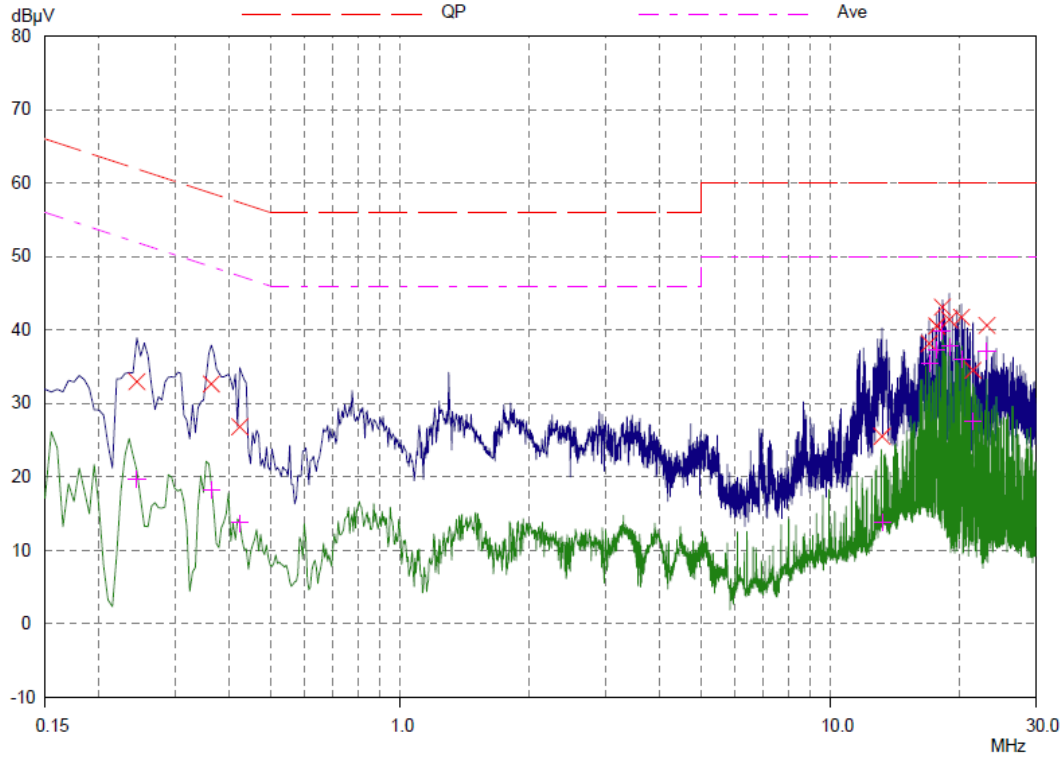
Table 10: Measured values of the AC Power Line Conducted Emissions							
Frequency [MHz]	Reading [dBμV]	L / N	CF [dB]	CL [dB]	Actual [dBμV]	Limit [dBμV]	Margin [dB]
QUASI-PEAK DATA							
0.245	32.96	L	0.13	0.01	33.10	61.92	28.82
0.255	37.23	N	0.12	0.01	37.36	61.59	24.23
0.365	32.85	N	0.10	0.01	32.96	58.61	25.65
16.665	38.54	N	0.70	0.22	39.46	60.00	20.54
16.985	38.18	L	0.80	0.23	39.21	60.00	20.79
17.695	41.07	N	0.79	0.23	42.09	60.00	17.91
18.240	43.52	N	0.84	0.24	44.60	60.00	15.40
18.915	42.51	N	0.90	0.24	43.65	60.00	16.35
19.710	42.10	N	0.97	0.25	43.32	60.00	16.68
20.195	42.62	N	1.01	0.25	43.88	60.00	16.12
21.480	34.51	L	1.17	0.26	35.94	60.00	24.06
21.660	39.91	N	1.08	0.26	41.25	60.00	18.75
23.065	38.56	N	1.15	0.27	39.98	60.00	20.02
23.125	40.61	L	1.29	0.28	42.18	60.00	17.82
AVERAGE DATA							
0.245	19.69	L	0.13	0.01	19.83	51.92	32.09
0.255	16.33	N	0.12	0.01	16.46	51.59	35.13
0.365	19.29	N	0.10	0.01	19.40	48.61	29.21
16.665	36.58	N	0.70	0.22	37.50	50.00	12.50
16.985	35.46	L	0.80	0.23	36.49	50.00	13.51
17.695	37.75	N	0.79	0.23	38.77	50.00	11.23
18.240	40.27	N	0.84	0.24	41.35	50.00	8.65
18.915	38.22	N	0.90	0.24	39.36	50.00	10.64
19.710	38.71	N	0.97	0.25	39.93	50.00	10.07
20.195	36.94	N	1.01	0.25	38.20	50.00	11.80
21.480	27.65	L	1.17	0.26	29.08	50.00	20.92
21.660	36.43	N	1.08	0.26	37.77	50.00	12.23
23.065	33.91	N	1.15	0.27	35.33	50.00	14.67
23.125	37.08	L	1.29	0.28	38.65	50.00	11.35

Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

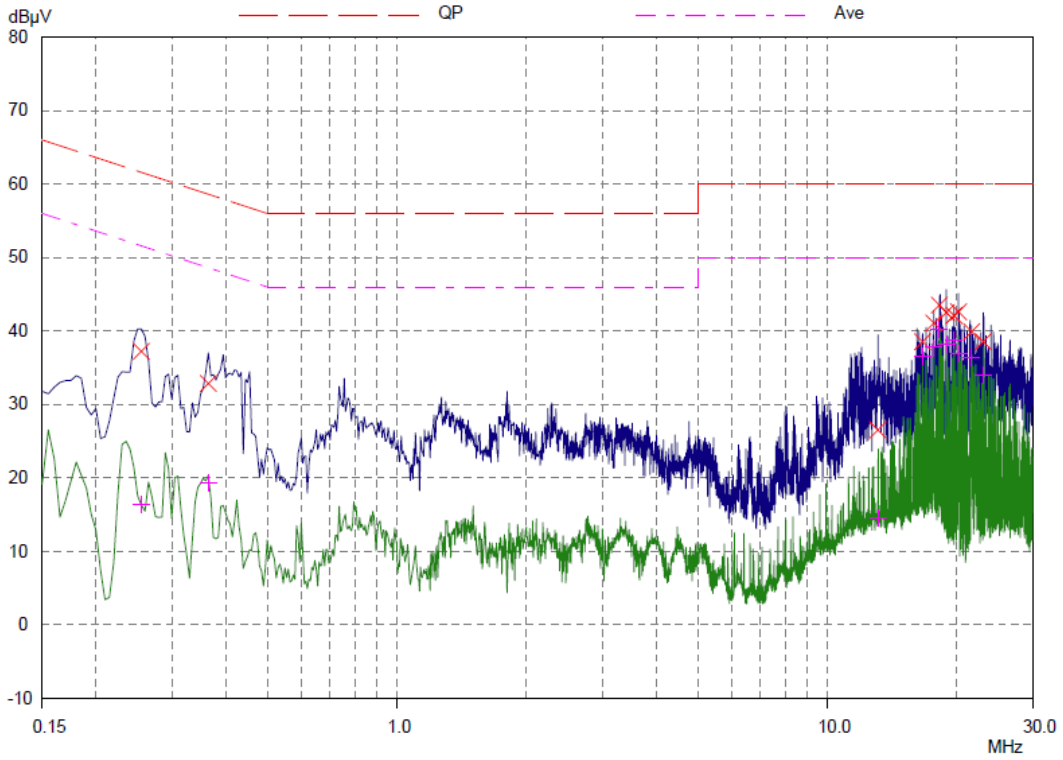
NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

Figure 16. Plot of the AC Power Line Conducted Emissions

Line – PE (Peak and Average detector used)



Neutral – PE (Peak and Average detector used)



7 RF Exposure

7.1. Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissive Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm^2]	Averaging Time [minute]
Limits for General Population/Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824/f	2.19/f	*(180/f^2)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1500	/	/	f/1500	30
1500 ~ 15000	/	/	1.0	30

f = frequency in MHz, * = Plane-wave equivalent power density

MPE (Maximum Permissive Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$ $\left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$

S = power density [mW/cm^2]
P = power input to antenna [mW]
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna [cm]

EUT: Maximum peak output power = 108.39 [mW](= 20.35 dBm) & Antenna gain = 0.23 [dBi]	
100 mW, at 20 cm from an antenna 6 [dBi]	S = PG/4πR² = 100 × 3.98 / (4 × π × 400) = 0.0792 [mW/cm^2] < 1.0 [mW/cm^2]
108.39 mW, at 20 cm from the antenna 0.23 [dBi]	S = PG/4πR² = 0.0227 [mW/cm^2] < 1.0 [mW/cm^2]

7.2. RF Exposure Compliance Issue

July 02 TCB Exclusion List: for portable transmitters,
Low threshold [(60/f_{GHZ} ≈ 25) mW, d < 2.5 cm, (120/f_{GHZ} ≈ 50) mW, d ≥ 2.5 cm], and
High threshold [(900/f_{GHZ} ≈ 370) mW, d < 20 cm], where f_{GHz}: 2.44, d: distance to a person's body

The users manual for end users must include the following information in a prominent location:
"IMPORTANT NOTE: This device is only sold for use as a Mobile Device, and not ever be used less than 20 cm from the User. To comply with FCC RF exposure compliance requirements, this device should be permanently mounted using a manufacturer supplied mounting plate. This device must be installed to provide a separation distance of at least 20 cm from all persons."