SK TECH CO., LTD.

TEST REPORT

Test Report No.:	**SKTRFC-121206-026**		
Applicant:	**HITRON SYSTEMS INC.**		
Applicant Address:	5953-85, SEODONG-DAERO, SAMJUG-MYEON, ANSEONG-SI, GYEONGGI-DO, KOREA		
Manufacturer:	**HITRON SYSTEMS INC.**		
Manufacturer Address:	5953-85, SEODONG-DAERO, SAMJUG-MYEON, ANSEONG-SI, GYEONGGI-DO, KOREA		
Device Under Test:	**Cube Network Camera**		
FCC ID:	**LLINCT525**	**Model Name:**	**NCT-5251**
Variant Model Name:	**NCT-5221, NCT-2211, PNC-101S**		
Brand/Trade Name:	HITRON		
Receipt No.:	SKTEU12-1560	**Date of receipt:**	November 13, 2012
Date of Issue:	December 6, 2012		
Location of Testing:	**SK TECH CO., LTD.** #820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, 472-905 South Korea		
Test Procedure:	**ANSI C63.10-2009 and ANSI C63.4-2009,** **KDB 558074 D01 DTS Meas Guidance v02**		
Test Specification:	**47CFR, FCC Part 15 Rules**		
FCC Equipment Class:	**DTS - Part 15 Digital Transmission System**		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Jungtae Kim*

December 6, 2012

Signature *Date*

Approved by: *Jongsoo Yoon*

December 6, 2012

Signature *Date*

Other Aspects:	**-**
Abbreviations:	**· OK, Pass = passed · Fail = failed · N/A = not applicable**

>> CONTENTS <<

(Continued)

1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.10-2009 and ANSI C63.4-2009 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK TECH CO., LTD. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them..

2. TEST SITE

SK TECH CO., LTD.

2.1 Location

#820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, 472-905 South Korea
(FCC Registered Test Site Number: 938639)
(OPEN AREA TEST SITE INDUSTRY CANADA NUMBER: IC 5429A-1)

This laboratory is 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 number: KR0007

2.2 List of Test and Measurement Instruments

No.	Description	Manufacturer	Model No.	Serial No.	Calibrated until	Used
1	Spectrum Analyzer	Agilent	E4405B	US40520856	2013.03.07	
2	Spectrum Analyzer	Agilent	E4440A	MY46186322	2013.03.08	☒
3	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2013.07.09	
4	EMI Test Receiver	Rohde&Schwarz	ESPI7	101206	2013.07.10	☒
5	EMI Test Receiver	Rohde&Schwarz	ESHS10	835871/002	2013.09.18	☒
6	Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	836679/018	2013.07.09	☒
7	Pre-amplifier	HP	8447F	3113A05153	2013.07.10	☒
8	Pre-amplifier	MITEQ	AFS44	1116321	2012.12.22	☒
9	Pre-amplifier	MITEQ	AFS44	1116322	2013.07.10	
10	Power Meter	Agilent	E4417A	MY45100426	2013.07.10	
11	Power Meter	Agilent	E4418B	US39402176	2013.07.10	
12	Power Sensor	Agilent	E9327A	MY44420696	2013.07.10	
13	Power Sensor	Agilent	8482A	MY41094094	2013.07.10	
14	Attenuator (10dB)	HP	8491B	38072	2013.07.09	☒
15	High Pass Filter	Wainwright	WHKX3.0/18G	8	2013.07.09	☒
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	2012.12.22	☒
19	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	189	2013.05.31	☒
20	Horn Antenna	AH Systems	SAS-200/571	304	N/A	
21	Horn Antenna	EMCO	3115	00040723	2013.05.31	
22	Horn Antenna	EMCO	3115	00056768	2013.09.06	☒
23	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170318	2013.09.28	☒
24	Vector Signal Generator	Agilent	E4438C	MY42080359	2013.07.09	
25	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2013.07.10	
26	DC Power Supply	HP	6622A	3348A03223	2013.07.10	
27	DC Power Supply	HP	6633A	3325A04972	2013.07.10	
28	Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	2013.07.18	☒
29	Temperature/Humidity Chamber	All Three	ATM-50M	20030425	2013.03.07	
30	Temperature/Humidity Chamber	DAEJIN	DJ-THC02	06071	2013.03.08	

2.3 Test Date

Date of Test: November 13, 2012 ~ December 3, 2012

2.4 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user's manual.

3.1 Rating and Physical Characteristics

Power source	DC 5 V (from AC/DC adapter)
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)
X-tal or Oscillator	XTAL: 24 MHz, 25 MHz (WLAN module) 40 MHz
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	19.81 dBm PEAK (measured)
External Ports **	LAN (Ethernet), Micro SD

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

Model differences:

Model name	Difference	Tested (checked)
NCT-5251	Original	☒
NCT-5221	This model is electrically identical to the tested sample with the exception of removing some components related to Audio, PIR sensor and illumination LED.	

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

Description of the buyer and multiple model:

Model name	Difference
NCT-2211, PNC-101S	Added for the marketing purpose

3.2 Equipment Modifications

The firmware (software) stored in the EUT was modified in order to support the RF test software for controlling the RF parameter.

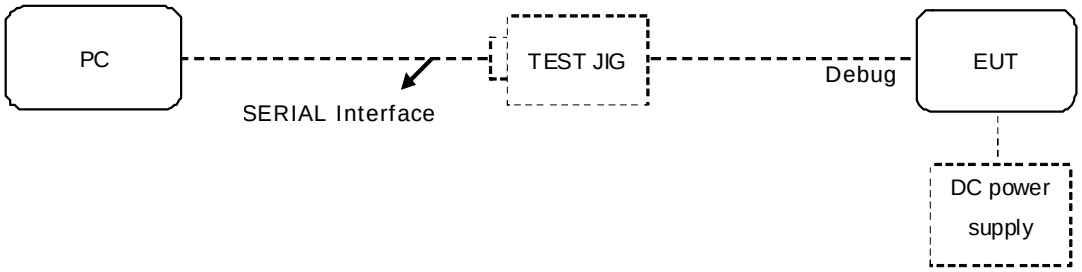
3.3 Submitted Documents

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

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

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.



[System Block Diagram of Test Configuration]

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	S/N
Personal Computer**	DELL INC.	DCNE	7XH86BX
TEST JIG **	provided by the applicant	-	-
Micro SD card	-	-	-

** *For control of the RF module via SERIAL interface at the Debug port in the EUT.*
For radiated spurious emission measurements, the measurements were performed without PC after setting the radio module to TEST MODE.

4.3 Type of Used Cables

#	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
1	EUT	DC input	DC power supply	DC Output	1.9	NO
2	EUT	LAN	External network	LAN	20.0	NO
3	DC power supply	AC Input	AC mains	AC mains	1.2	NO

4.4 Uncertainty

Measurement Item	Combined Standard Uncertainty *Uc*	Expanded Uncertainty *U* = *kUc* (*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

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	CFR 47 Section	Report Section	Test Result
Antenna Requirement	15.203, 15.247(b)(4)	5.1	PASS
6dB Bandwidth	15.247(a)(2)	5.3	PASS
Maximum Peak Output Power	15.247(b)(3), (4)	5.4	PASS
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.205(a), 15.209(a)	5.5	PASS
Peak Power Spectral Density	15.247(e)	5.6	PASS
AC power line Conducted emissions	15.207(a)	5.7	PASS
RF Exposure	15.247(i), 1.1307(b)(1)	5.8	PASS

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 an integral Omni-directional antenna. The directional gain of the antenna is 0.23 dBi.

5.2 Test Configuration of Equipment Under Test

Pre-Scanned RF Power & Duty cycle

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	15.91	17.13	18.41	**19.47**
2437 MHz	16.53	17.03	18.25	**19.35**
2462 MHz	16.60	17.25	18.56	**19.81**

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	16.39	16.60	16.87	16.89	17.01	16.98	17.13	**17.15**
2437 MHz	16.72	16.73	16.99	16.41	17.06	16.15	17.08	**17.12**
2462 MHz	17.01	16.90	17.00	16.74	17.30	17.17	17.22	**17.64**

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

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	**MCS7**
2412 MHz	16.48	16.30	16.41	16.62	16.52	16.73	16.70	**16.84**
2437 MHz	16.27	16.32	16.25	16.63	16.60	16.72	16.83	**16.97**
2462 MHz	16.60	16.70	16.58	16.96	16.90	17.13	17.41	**17.49**

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

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	**MCS7**
2412 MHz	16.21	16.27	16.11	16.41	16.42	16.58	16.63	**16.74**
2437 MHz	16.28	16.16	16.50	16.73	16.43	16.57	16.54	**17.09**
2452 MHz	16.40	16.32	16.23	16.64	16.50	16.79	16.88	**17.23**

5.3 6dB 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. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable.
2. Set the spectrum analyzer as follows:
   1) Set resolution bandwidth (RBW) = 1-5% or DTS BW, not to exceed 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) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.3 Test Results: PASS

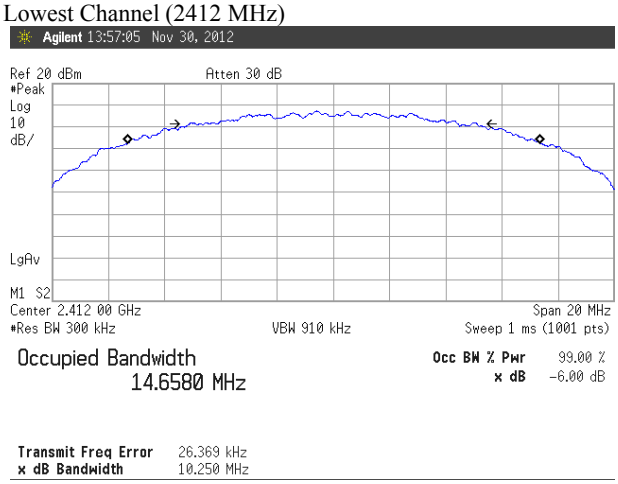
Table 1: Measured values of the 6 dB Bandwidth

Modulation	Operating frequency	Transfer Rate	Occupied Bandwidth (99%)	6dB Bandwidth	Limit
802.11b	2412 MHz	11 Mbps	14.658 MHz	10.250 MHz	≥ 500 kHz
	2437 MHz	11 Mbps	14.697 MHz	10.249 MHz	≥ 500 kHz
	2462 MHz	11 Mbps	14.681 MHz	10.246 MHz	≥ 500 kHz
802.11g	2412 MHz	54 Mbps	16.584 MHz	16.509 MHz	≥ 500 kHz
	2437 MHz	54 Mbps	16.592 MHz	16.517 MHz	≥ 500 kHz
	2462 MHz	54 Mbps	16.577 MHz	16.489 MHz	≥ 500 kHz
802.11n HT20	2412 MHz	MCS 7	17.694 MHz	17.567 MHz	≥ 500 kHz
	2437 MHz	MCS 7	17.699 MHz	17.570 MHz	≥ 500 kHz
	2462 MHz	MCS 7	17.692 MHz	17.630 MHz	≥ 500 kHz
802.11n HT40	2422 MHz	MCS 7	36.200 MHz	36.258 MHz	≥ 500 kHz
	2437 MHz	MCS 7	36.224 MHz	36.232 MHz	≥ 500 kHz
	2452 MHz	MCS 7	36.184 MHz	36.211 MHz	≥ 500 kHz

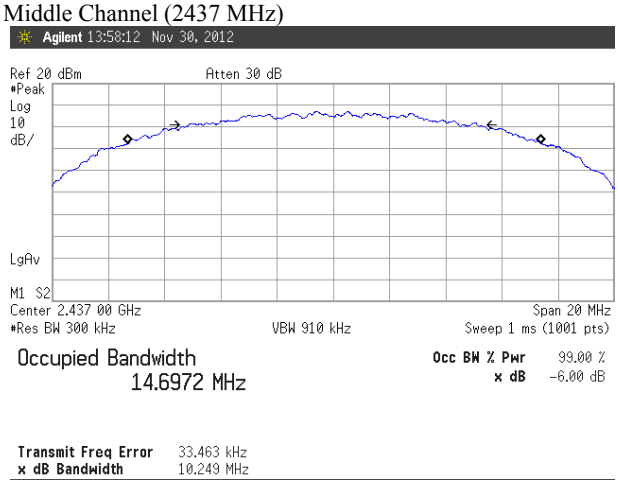
Figure 1. Plot of the 6dB Bandwidth

802.11b mode:

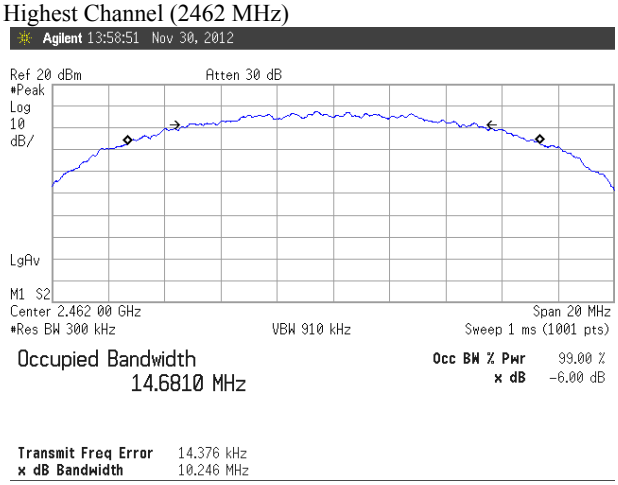
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

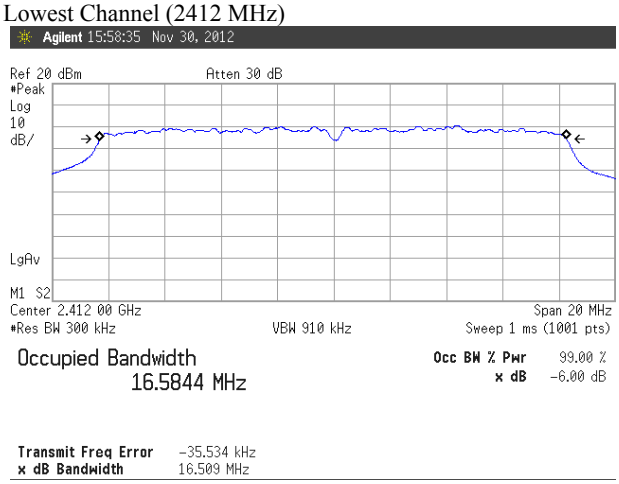


Highest Channel (2462 MHz)

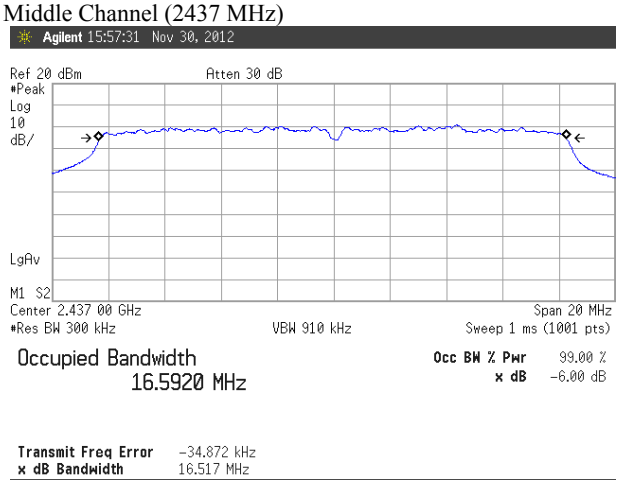


802.11g mode:

Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



Highest Channel (2462 MHz)

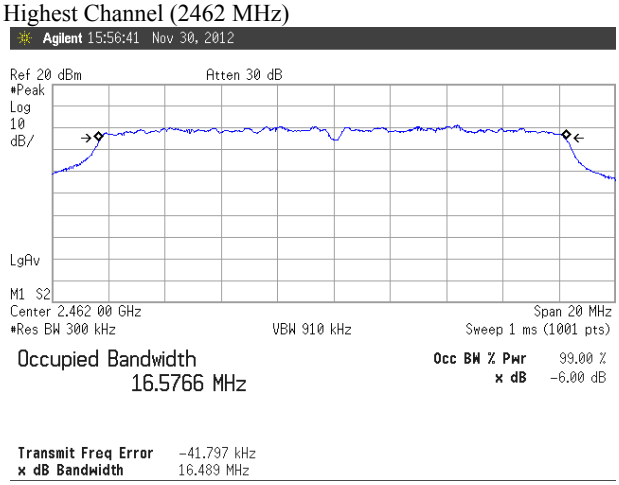
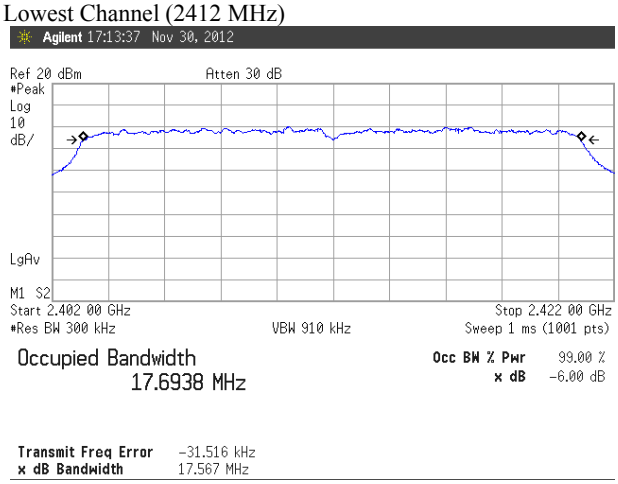


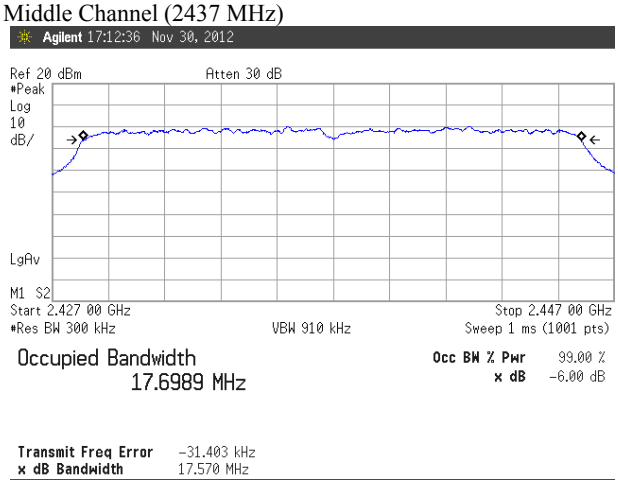
Figure 1. Plot of the 6dB Bandwidth & Occupied Bandwidth (99%) *(continued)*

802.11n HT20 mode:

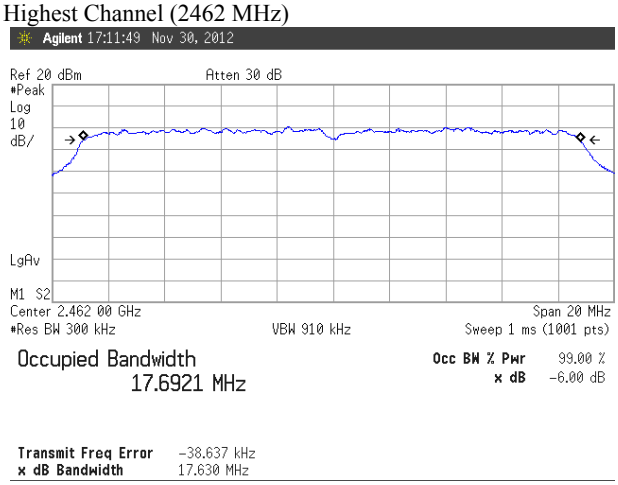
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

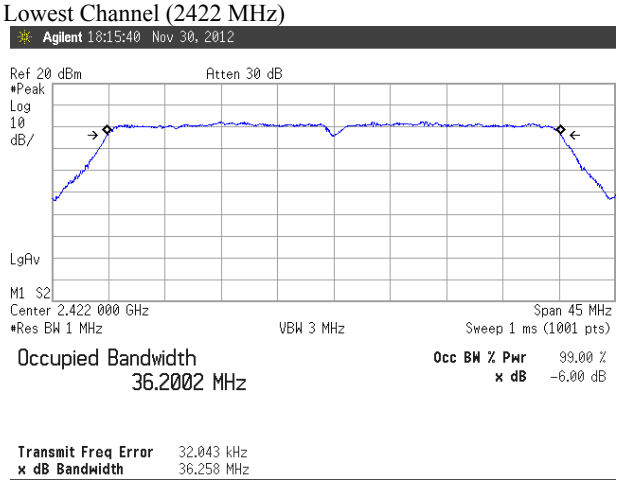


Highest Channel (2462 MHz)

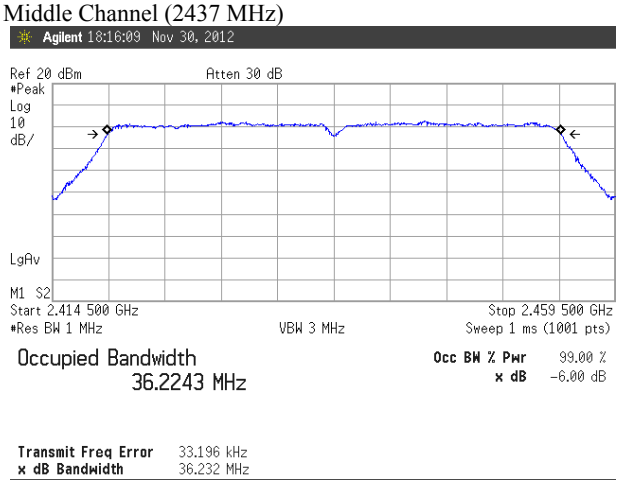


802.11n HT40 mode:

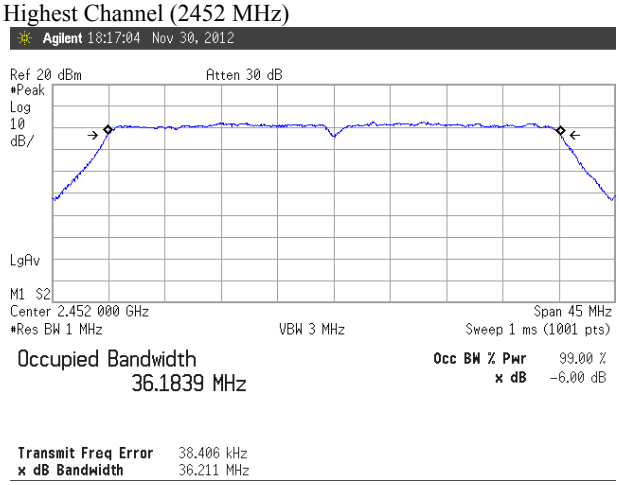
Lowest Channel (2422 MHz)



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(Measurement Procedure Option2)

1. Set the RBW = maximum available (at least 1 MHz).
2. Set the VBW = 3 x RBW or maximum available setting (must be ≥ RBW).
3. Set the span to fully encompass the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the spectrum analyzer's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some analyzers, this may require a manual override to ensure use of peak detector). If the spectrum analyzer 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 channel bandwidth.

5.4.3 Test Results: PASS

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

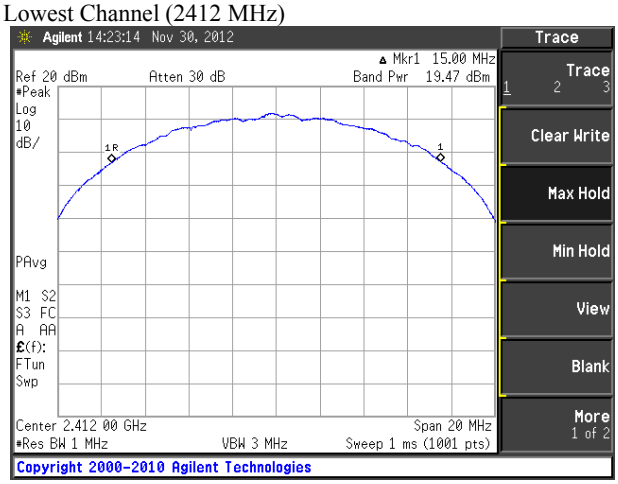
Modulation	Operating Frequency	Transfer Rate	Peak Power		Average Power* [dBm]	Limit
			[dBm]	W		
802.11b	2412 MHz	11 Mbps	19.47	0.089	12.99	1 W
	2437 MHz		19.35	0.086	13.06	1 W
	2462 MHz		19.81	0.096	13.48	1 W
802.11g	2412 MHz	54 Mbps	17.15	0.052	8.47	1 W
	2437 MHz		17.12	0.052	8.54	1 W
	2462 MHz		17.64	0.058	8.80	1 W
802.11n HT20	2412 MHz	MCS 7	16.84	0.048	8.38	1 W
	2437 MHz		16.97	0.050	8.40	1 W
	2462 MHz		17.49	0.056	8.77	1 W
802.11n HT40	2422 MHz	MCS 7	16.74	0.047	8.00	1 W
	2437 MHz		17.09	0.051	8.13	1 W
	2452 MHz		17.23	0.053	8.40	1 W

The Average power were measured using AVG 1 method as the reference only.

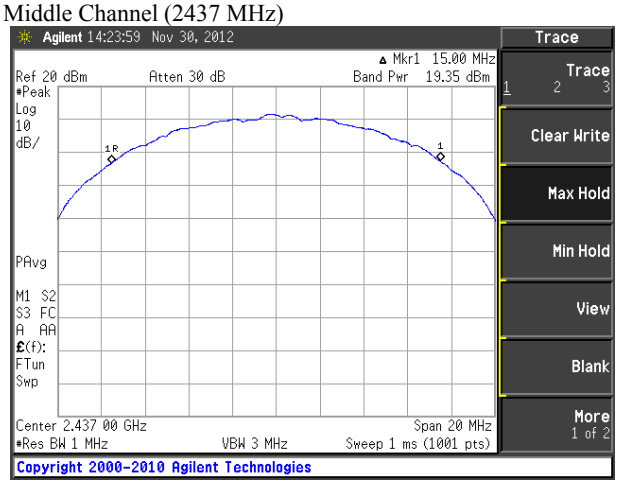
Figure 2. Plot of the Maximum Peak Conducted Output Power

802.11b mode:

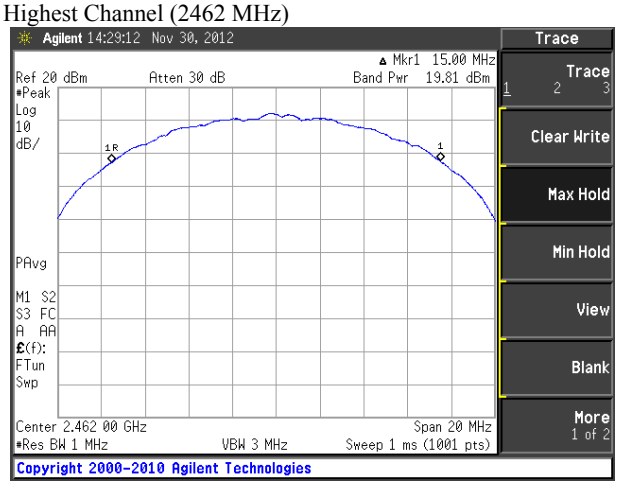
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

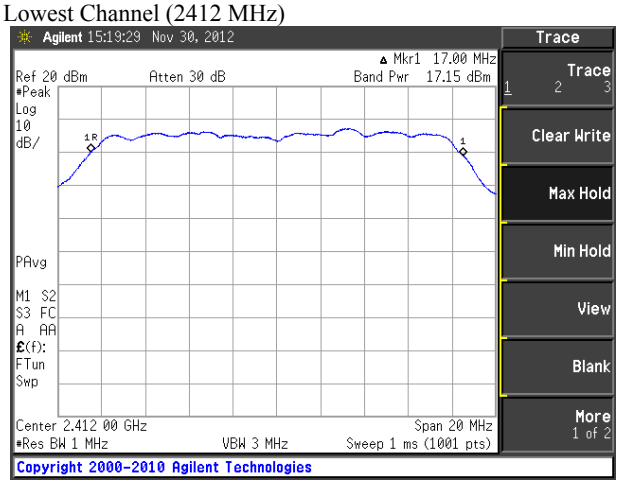


Highest Channel (2462 MHz)

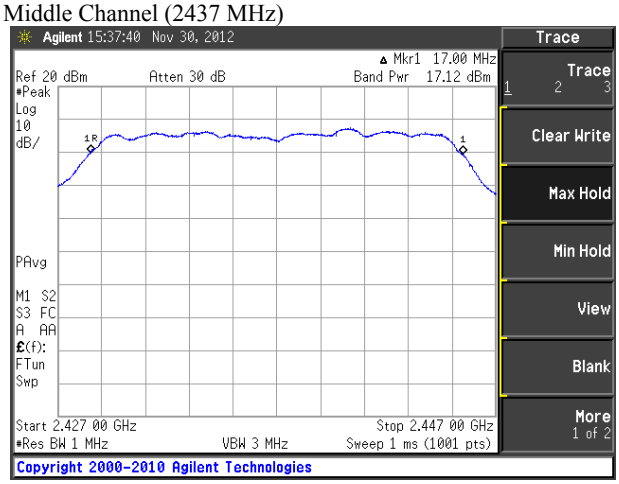


802.11g mode:

Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



Highest Channel (2462 MHz)

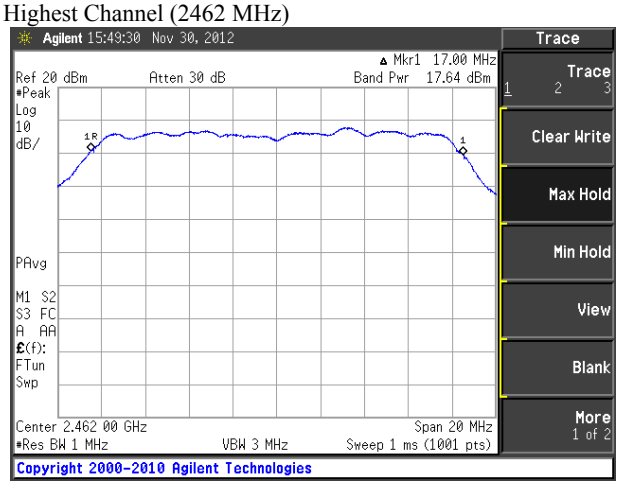
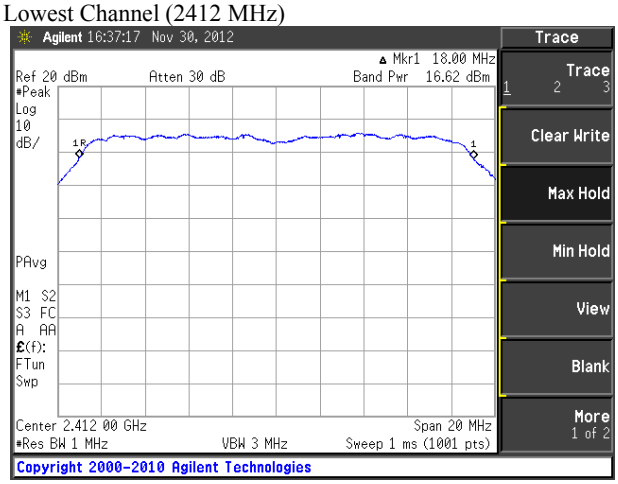


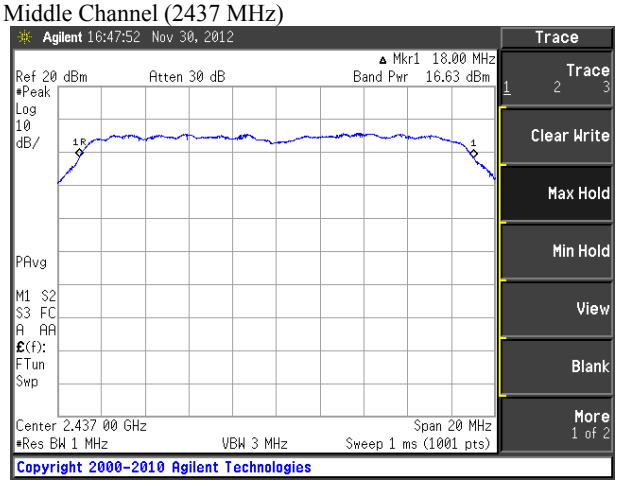
Figure 2. Plot of the Maximum Peak Conducted Output Power *(continued)*

802.11n HT20 mode:

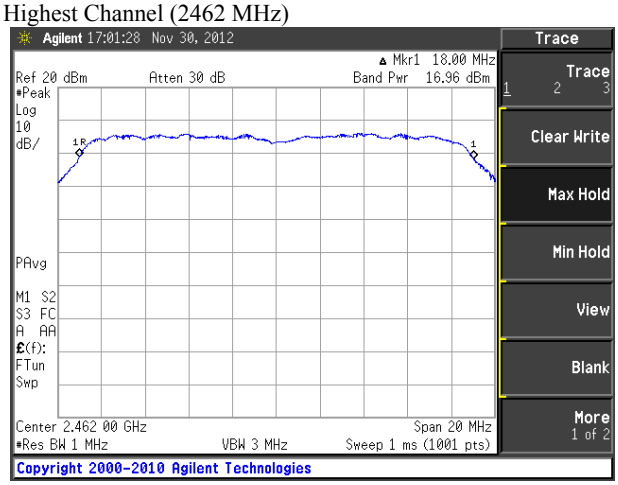
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

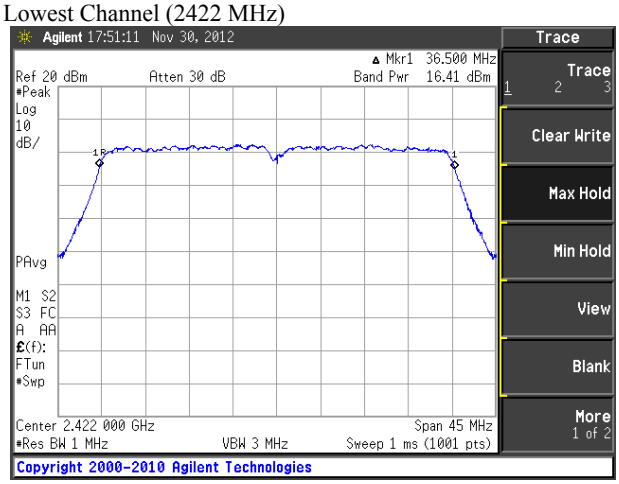


Highest Channel (2462 MHz)

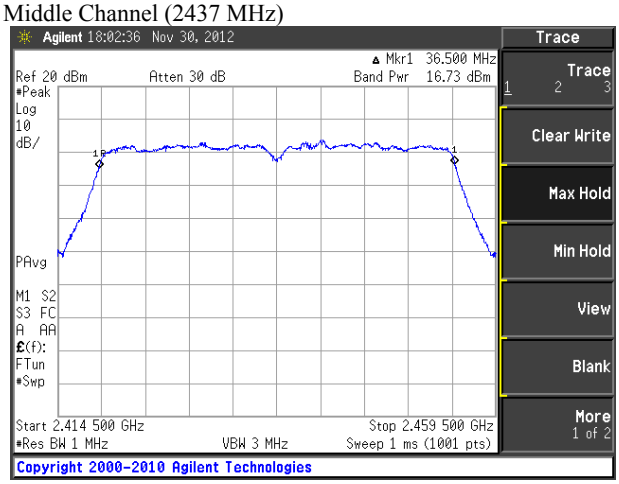


802.11n HT40 mode:

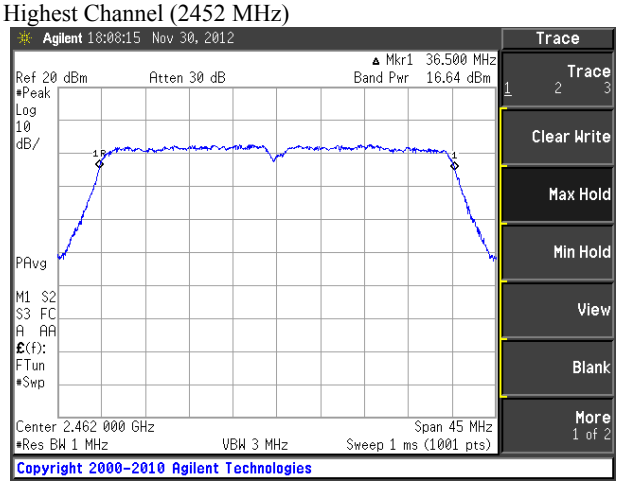
Lowest Channel (2422 MHz)



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 Compliance of 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 bandedge, as well as any modulation products which fall outside of the authorized band of operation
   RBW ≥ 1% of the 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 as the above Spurious Radiated Emissions test procedure.
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 1% of the total span (but never less than 30 kHz) 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 a 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 step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
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 C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

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.

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.

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 5.

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 (9 kHz ~ 30 MHz)												
Quasi-peak data, emissions below 1000 MHz (802.11 b/g/n HT20/HT40 mode)												
325.00	120	H	1.00	338	51.09	27.97	-	14.27	2.22	39.61	46.00	6.39
325.00	120	V	1.18	311	49.34	27.97	-	14.27	2.22	37.86	46.00	8.14
350.00	120	H	1.00	4	52.66	28.04	-	14.72	2.30	41.64	46.00	4.36
350.00	120	V	1.00	183	52.11	28.04	-	14.72	2.30	41.09	46.00	4.91
375.01	120	H	1.00	16	51.09	28.11	-	15.16	2.39	40.53	46.00	5.47
375.01	120	V	1.29	295	49.84	28.11	-	15.16	2.39	39.28	46.00	6.72
399.99	120	H	1.00	114	49.05	28.18	-	15.60	2.48	38.95	46.00	7.05
399.99	120	V	1.38	121	50.02	28.18	-	15.60	2.48	39.92	46.00	6.08

No Spurious Radiated 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

***** The spurious emission at the frequency does not fall in the restricted bands.

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

Table 3: 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												
2412.8	1000	H	1.30	282	-	44.44	10.15	28.08	6.52	80.10	Not applicable (802.11b signals)	
2412.8	1000	V	1.23	258	-	44.44	10.15	28.08	6.52	84.91		
2462.8	1000	H	1.27	284	-	44.53	10.14	28.26	6.59	81.01		
2461.6	1000	V	1.17	273	-	44.53	10.14	28.26	6.59	83.04		
2336.8	1000	H	1.30	282	-	44.31	10.15	27.79	6.40	35.93	54.00	18.07
2332.4	1000	V	1.23	258	-	44.30	10.15	27.78	6.39	36.49	54.00	17.51
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	35.74	54.00	18.26
2483.6	1000	V	1.17	273	-	44.57	10.14	28.34	6.62	35.85	54.00	18.15
4824.6	1000	H	1.00	232	50.76	45.17	0.41	33.50	9.70	49.20	54.00	4.80
4824.6	1000	V	1.52	286	48.51	45.17	0.41	33.50	9.70	46.95	54.00	7.05
4881.8	1000	H	1.05	224	49.38	45.15	0.39	33.57	9.76	47.95	54.00	6.05
4881.8	1000	V	1.63	273	45.00	45.15	0.39	33.57	9.76	43.57	54.00	10.43
4920.4	1000	H	1.03	247	49.59	45.13	0.38	33.61	9.80	48.25	54.00	5.75
4920.4	1000	V	1.55	263	45.96	45.13	0.38	33.61	9.80	44.62	54.00	9.38
2416.0	1000	H	1.30	282	-	44.45	10.15	28.09	6.52	73.37	Not applicable (802.11g signals)	
2416.0	1000	V	1.23	258	-	44.45	10.15	28.09	6.52	77.57		
2466.0	1000	H	1.27	284	-	44.54	10.14	28.27	6.59	74.13		
2466.0	1000	V	1.17	273	-	44.54	10.14	28.27	6.59	76.64		
2336.0	1000	H	1.30	282	-	44.30	10.15	27.79	6.40	35.90	54.00	18.10
2338.8	1000	V	1.23	258	-	44.31	10.15	27.80	6.40	36.59	54.00	17.41
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	35.77	54.00	18.23
2483.6	1000	V	1.17	273	-	44.57	10.14	28.34	6.62	35.88	54.00	18.12
4820.1	1000	H	1.00	232	56.07	45.17	0.41	33.50	9.70	54.51	54.00	11.50
4820.1	1000	V	1.52	286	52.81	45.17	0.41	33.50	9.70	51.25	54.00	13.86
4880.3	1000	H	1.05	224	54.75	45.15	0.39	33.56	9.76	53.31	54.00	13.18
4880.3	1000	V	1.63	273	50.20	45.15	0.39	33.56	9.76	48.76	54.00	17.58
4921.8	1000	H	1.03	247	54.76	45.13	0.38	33.61	9.80	53.42	54.00	13.13
4921.8	1000	V	1.55	263	51.27	45.13	0.38	33.61	9.80	49.93	54.00	16.74

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.

Table 3: 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												
2412.0	1000	H	1.30	282	-	44.44	10.15	28.08	6.52	88.21	Not applicable (802.11b signals)	
2412.0	1000	V	1.23	258	-	44.44	10.15	28.08	6.52	93.00		
2461.6	1000	H	1.27	284	-	44.53	10.14	28.26	6.59	89.47		
2461.6	1000	V	1.17	273	-	44.53	10.14	28.26	6.59	91.30		
2336.8	1000	H	1.30	282	-	44.31	10.15	27.79	6.40	52.77	74.00	21.23
2332.4	1000	V	1.23	258	-	44.30	10.15	27.78	6.39	54.71	74.00	19.29
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	48.46	74.00	25.54
2483.6	1000	V	1.17	273	-	44.57	10.14	28.34	6.62	49.07	74.00	24.93
4824.6	1000	H	1.00	232	62.87	45.17	0.41	33.50	9.70	61.31	74.00	12.69
4824.6	1000	V	1.52	286	59.87	45.17	0.41	33.50	9.70	58.31	74.00	15.69
4881.8	1000	H	1.05	224	61.87	45.15	0.39	33.57	9.76	60.44	74.00	13.56
4881.8	1000	V	1.63	273	57.34	45.15	0.39	33.57	9.76	55.91	74.00	18.09
4920.4	1000	H	1.03	247	62.14	45.13	0.38	33.61	9.80	60.80	74.00	13.20
4920.4	1000	V	1.55	263	58.63	45.13	0.38	33.61	9.80	57.29	74.00	16.71
2415.2	1000	H	1.30	282	-	44.45	10.15	28.09	6.52	83.22	Not applicable (802.11g signals)	
2414.8	1000	V	1.23	258	-	44.45	10.15	28.09	6.52	87.52		
2465.2	1000	H	1.27	284	-	44.54	10.14	28.27	6.59	84.35		
2464.8	1000	V	1.17	273	-	44.54	10.14	28.27	6.59	86.58		
2336.0	1000	H	1.30	282	-	44.30	10.15	27.79	6.40	52.00	74.00	22.00
2338.8	1000	V	1.23	258	-	44.31	10.15	27.80	6.40	53.57	74.00	20.43
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	47.94	74.00	26.06
2483.6	1000	V	1.17	273	-	44.57	10.14	28.34	6.62	48.40	74.00	25.60
4820.1	1000	H	1.00	232	56.07	45.17	0.41	33.50	9.70	54.51	74.00	19.49
4820.1	1000	V	1.52	286	52.81	45.17	0.41	33.50	9.70	51.25	74.00	22.75
4880.3	1000	H	1.05	224	54.75	45.15	0.39	33.56	9.76	53.31	74.00	20.69
4880.3	1000	V	1.63	273	50.20	45.15	0.39	33.56	9.76	48.76	74.00	25.24
4921.8	1000	H	1.03	247	54.76	45.13	0.38	33.61	9.80	53.42	74.00	20.58
4921.8	1000	V	1.55	263	51.27	45.13	0.38	33.61	9.80	49.93	74.00	24.07

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.

Table 3: 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												
2416.4	1000	H	1.30	282	-	44.45	10.15	28.09	6.52	72.86	Not applicable (802.11n HT20 signals)	
2416.0	1000	V	1.23	258	-	44.45	10.15	28.09	6.52	75.78		
2466.4	1000	H	1.27	284	-	44.54	10.14	28.28	6.59	73.78		
2466.0	1000	V	1.17	275	-	44.54	10.14	28.27	6.59	76.62		
2336.0	1000	H	1.30	282	-	44.30	10.15	27.79	6.40	35.95	54.00	18.05
2347.2	1000	V	1.23	258	-	44.32	10.15	27.83	6.42	36.13	54.00	17.87
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	35.83	54.00	18.17
2483.6	1000	V	1.17	275	-	44.57	10.14	28.34	6.62	36.02	54.00	17.98
4821.3	1000	H	1.02	230	43.43	45.17	0.41	33.50	9.70	41.87	54.00	12.13
4821.3	1000	V	1.50	276	41.08	45.17	0.41	33.50	9.70	39.52	54.00	14.48
4881.4	1000	H	1.08	210	41.60	45.15	0.39	33.57	9.76	40.17	54.00	13.83
4881.4	1000	V	1.66	277	37.19	45.15	0.39	33.57	9.76	35.76	54.00	18.24
4920.5	1000	H	1.00	239	41.60	45.13	0.38	33.61	9.80	40.26	54.00	13.74
4920.5	1000	V	1.52	278	37.99	45.13	0.38	33.61	9.80	36.65	54.00	17.35
2412.4	1000	H	1.30	282	-	44.44	10.15	28.07	6.52	69.11	Not applicable (802.11n HT40 signals)	
2416.4	1000	V	1.21	275	-	44.45	10.15	28.09	6.52	72.61		
2455.2	1000	H	1.27	284	-	44.52	10.14	28.23	6.58	70.44		
2446.4	1000	V	1.17	275	-	44.50	10.14	28.20	6.56	73.47		
2336.8	1000	H	1.30	282	-	44.31	10.15	27.79	6.40	36.18	54.00	17.82
2345.2	1000	V	1.21	275	-	44.32	10.15	27.82	6.41	36.04	54.00	17.96
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	35.95	54.00	18.05
2483.6	1000	V	1.17	275	-	44.57	10.14	28.34	6.62	36.02	54.00	17.98
4840.4	1000	H	1.09	238	39.66	45.16	0.40	33.52	9.72	38.14	54.00	15.86
4840.4	1000	V	1.58	286	37.51	45.16	0.40	33.52	9.72	35.99	54.00	18.01
4879.1	1000	H	1.09	220	37.94	45.15	0.39	33.56	9.76	36.50	54.00	17.50
4879.1	1000	V	1.55	263	33.41	45.15	0.39	33.56	9.76	31.97	54.00	22.03
4900.7	1000	H	1.09	240	38.11	45.14	0.39	33.59	9.78	36.73	54.00	17.27
4900.7	1000	V	1.60	267	34.33	45.14	0.39	33.59	9.78	32.95	54.00	21.05

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.

Table 3: 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												
2416.4	1000	H	1.30	282	-	44.45	10.15	28.09	6.52	83.22	Not applicable (802.11n HT20 signals)	
2416.4	1000	V	1.23	258	-	44.45	10.15	28.09	6.52	86.06		
2466.4	1000	H	1.27	284	-	44.54	10.14	28.28	6.59	84.45		
2466.4	1000	V	1.17	275	-	44.54	10.14	28.27	6.59	86.98		
2336.0	1000	H	1.30	282	-	44.30	10.15	27.79	6.40	52.41	74.00	21.59
2347.2	1000	V	1.23	258	-	44.32	10.15	27.83	6.42	53.23	74.00	20.77
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	48.12	74.00	25.88
2483.6	1000	V	1.17	275	-	44.57	10.14	28.34	6.62	49.68	74.00	24.32
4821.3	1000	H	1.02	230	55.44	45.17	0.41	33.50	9.70	53.88	74.00	20.12
4821.3	1000	V	1.50	276	52.19	45.17	0.41	33.50	9.70	50.63	74.00	23.37
4881.4	1000	H	1.08	210	54.09	45.15	0.39	33.57	9.76	52.66	74.00	21.34
4881.4	1000	V	1.66	277	49.53	45.15	0.39	33.57	9.76	48.10	74.00	25.90
4920.5	1000	H	1.00	239	54.15	45.13	0.38	33.61	9.80	52.81	74.00	21.19
4920.5	1000	V	1.52	278	50.66	45.13	0.38	33.61	9.80	49.32	74.00	24.68
2414.8	1000	H	1.30	282	-	44.44	10.15	28.07	6.52	79.07	Not applicable (802.11n HT40 signals)	
2416.4	1000	V	1.21	275	-	44.45	10.15	28.09	6.52	82.49		
2460.0	1000	H	1.27	284	-	44.52	10.14	28.23	6.58	80.89		
2444.8	1000	V	1.17	275	-	44.50	10.14	28.20	6.56	83.43		
2336.8	1000	H	1.30	282	-	44.31	10.15	27.79	6.40	51.52	74.00	22.48
2345.2	1000	V	1.21	275	-	44.32	10.15	27.82	6.41	52.40	74.00	21.60
2483.6	1000	H	1.27	284	-	44.57	10.14	28.34	6.62	48.98	74.00	25.02
2483.6	1000	V	1.17	275	-	44.57	10.14	28.34	6.62	48.12	74.00	25.88
4840.4	1000	H	1.09	238	51.67	45.16	0.40	33.52	9.72	50.15	74.00	23.85
4840.4	1000	V	1.58	286	48.62	45.16	0.40	33.52	9.72	47.10	74.00	26.90
4879.1	1000	H	1.09	220	50.43	45.15	0.39	33.56	9.76	48.99	74.00	25.01
4879.1	1000	V	1.55	263	45.75	45.15	0.39	33.56	9.76	44.31	74.00	29.69
4900.7	1000	H	1.09	240	50.66	45.14	0.39	33.59	9.78	49.28	74.00	24.72
4900.7	1000	V	1.60	267	47.00	45.14	0.39	33.59	9.78	45.62	74.00	28.38

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.

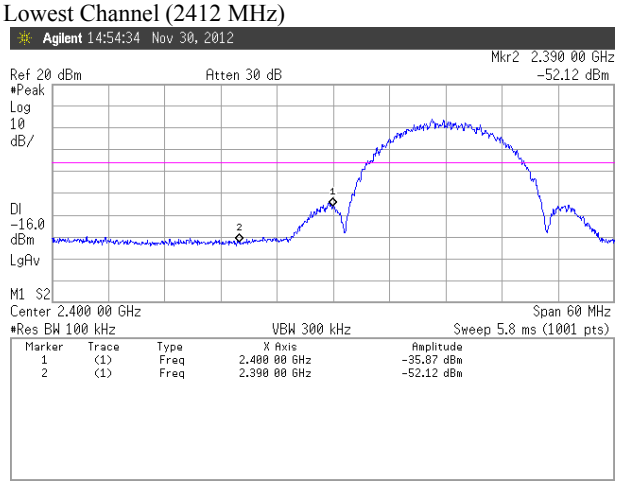
Remark 1. The measured value at the band-edge plots as shown Figure 4 included all the correction factors; those values are the final ('Actual') values.

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

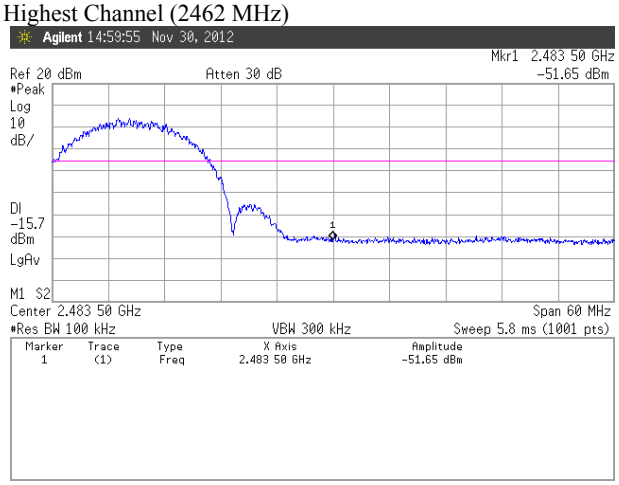
Figure 3. Plot of the Band Edge (Conducted)

802.11b mode:

Lowest Channel (2412 MHz)

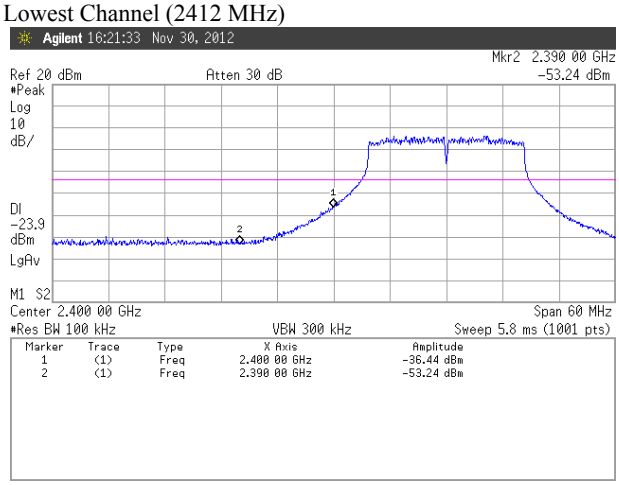


Highest Channel (2462 MHz)



802.11g mode:

Lowest Channel (2412 MHz)



Highest Channel (2462 MHz)

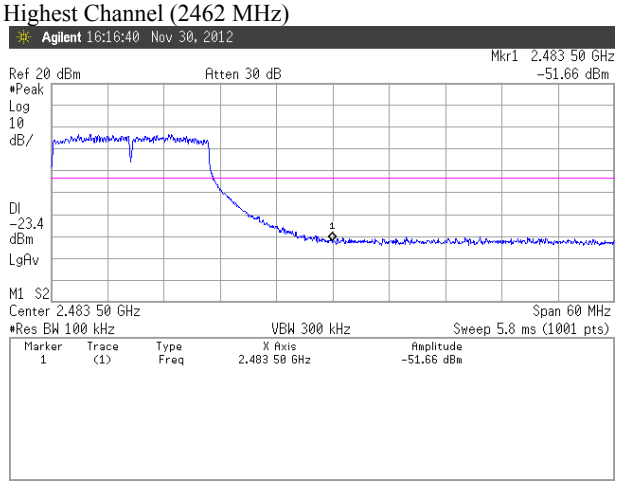
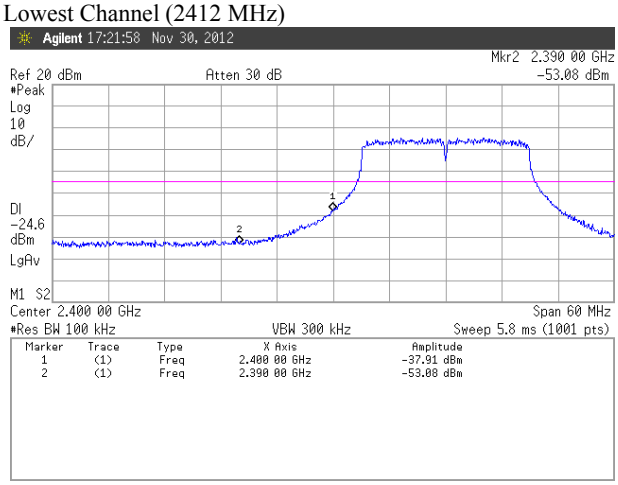


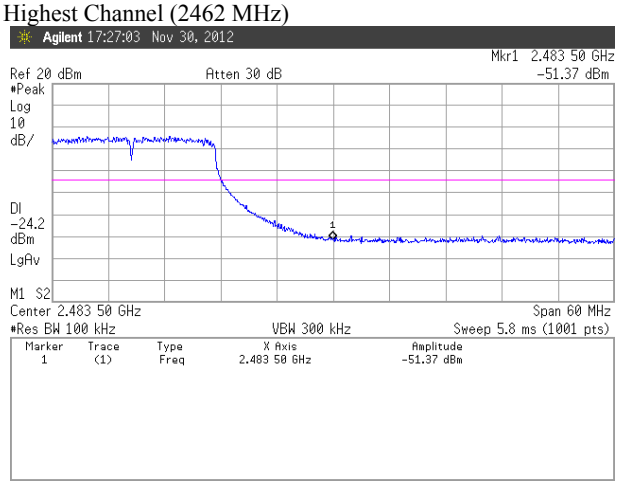
Figure 3. Plot of the Band Edge (Conducted)

802.11n HT20 mode:

Lowest Channel (2412 MHz)

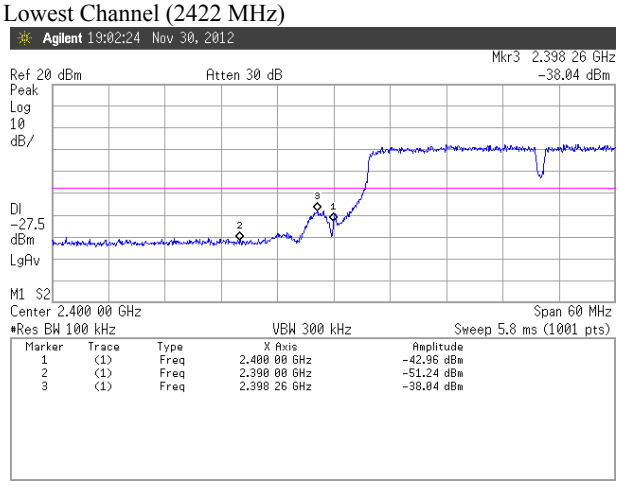


Highest Channel (2462 MHz)



802.11n HT40 mode:

Lowest Channel (2422 MHz)



Highest Channel (2452 MHz)

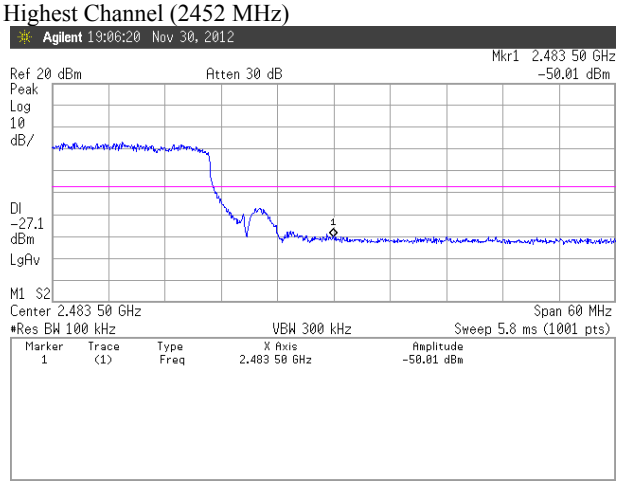
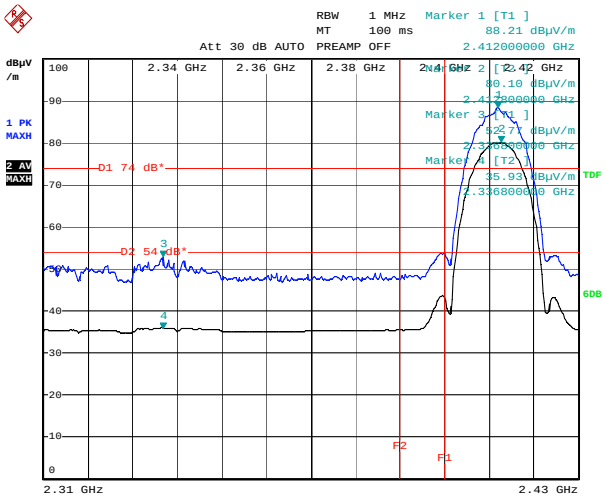


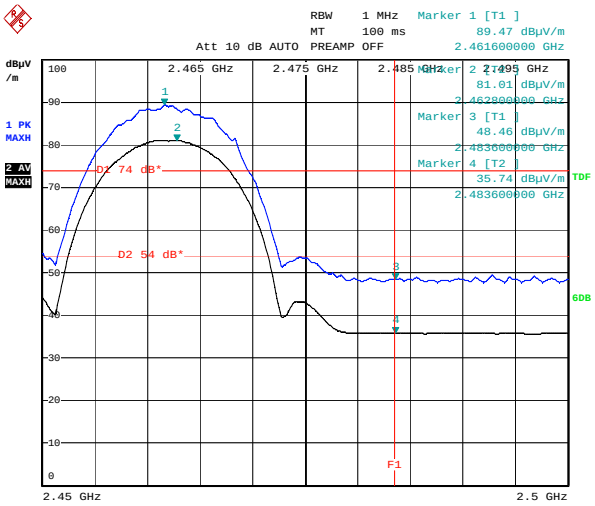
Figure 4. Plot of the Band Edge (Radiated)

802.11b mode:

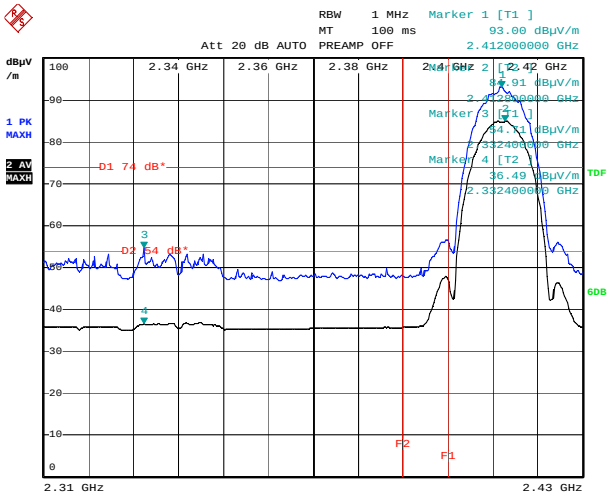
Lowest Channel (2412 MHz)
Horizontal



Highest Channel (2462 MHz)
Horizontal



Lowest Channel (2412 MHz)
Vertical



Highest Channel (2462 MHz)
Vertical

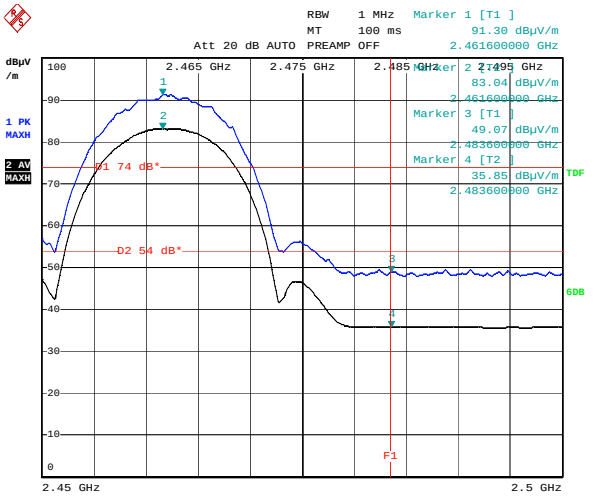
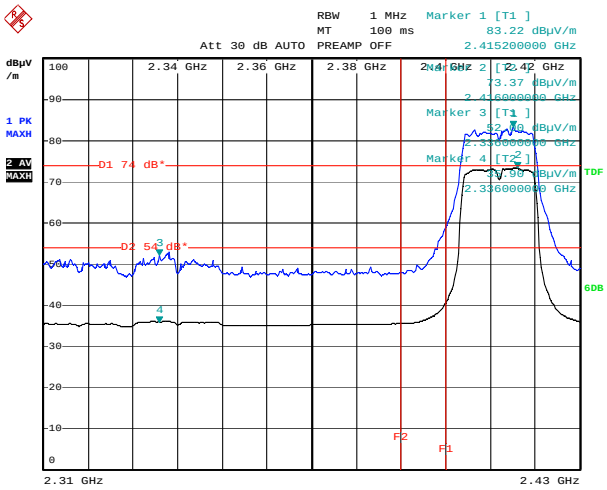


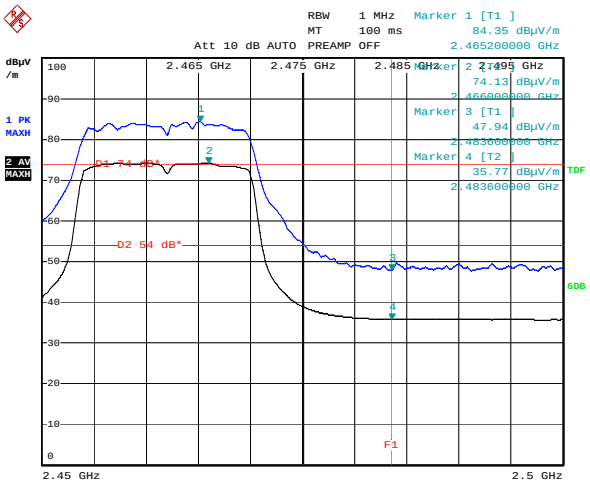
Figure 4. Plot of the Band Edge (Radiated)

802.11g mode:

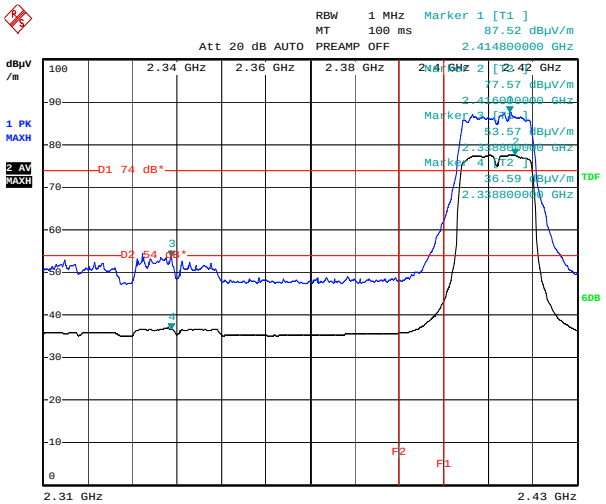
Lowest Channel (2412 MHz)
Horizontal



Highest Channel (2462 MHz)
Horizontal



Lowest Channel (2412 MHz)
Vertical



Highest Channel (2462 MHz)
Vertical

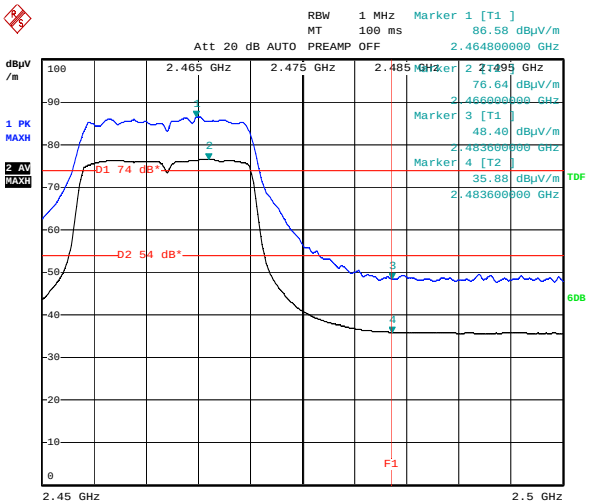
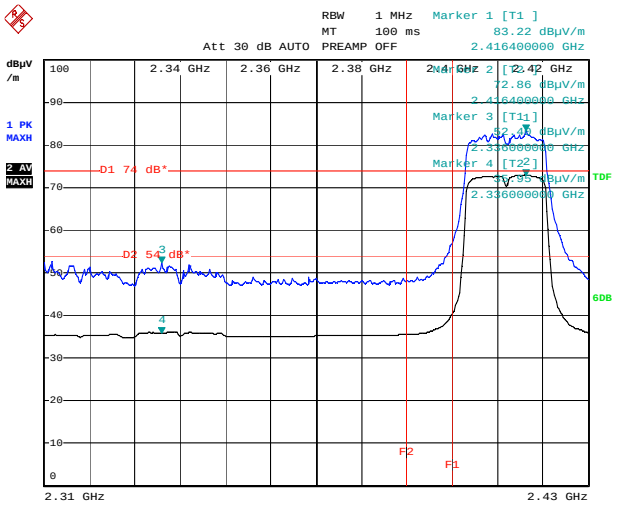


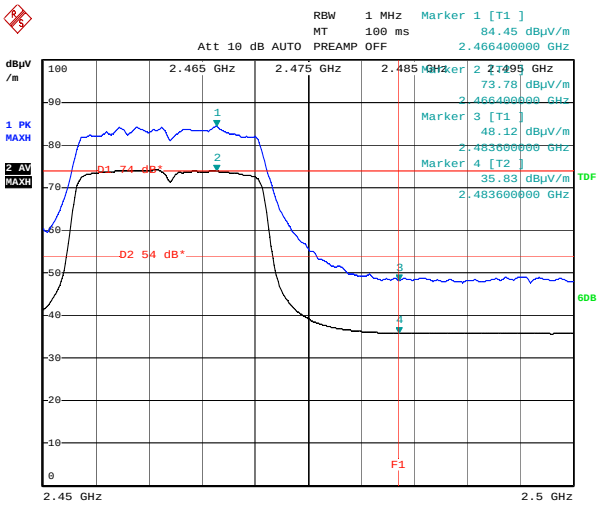
Figure 4. Plot of the Band Edge (Radiated)

802.11n HT20 mode:

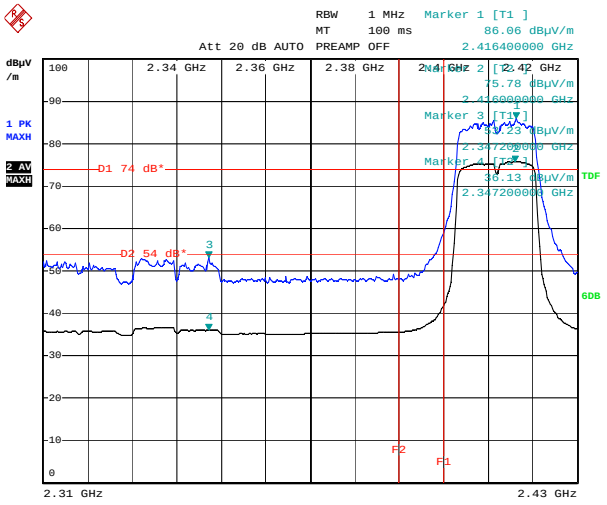
Lowest Channel (2412 MHz)
Horizontal



Highest Channel (2462 MHz)
Horizontal



Lowest Channel (2412 MHz)
Vertical



Highest Channel (2462 MHz)
Vertical

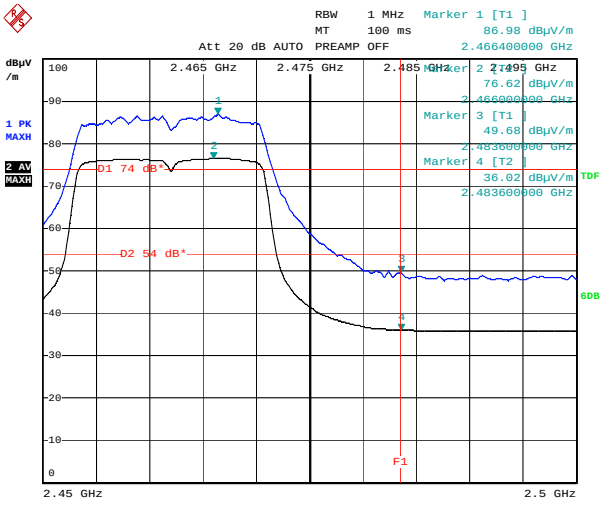
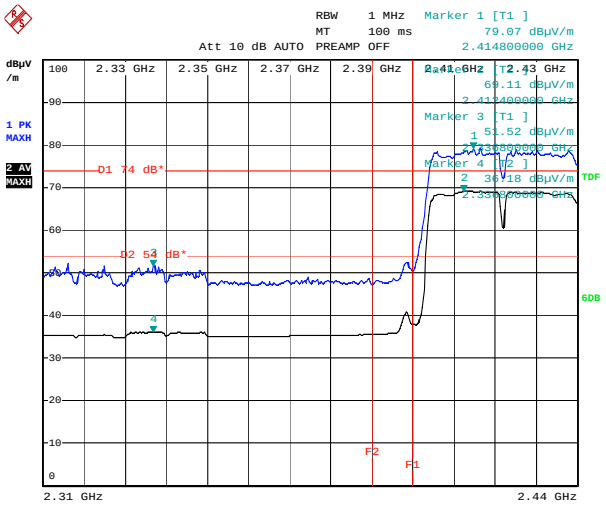


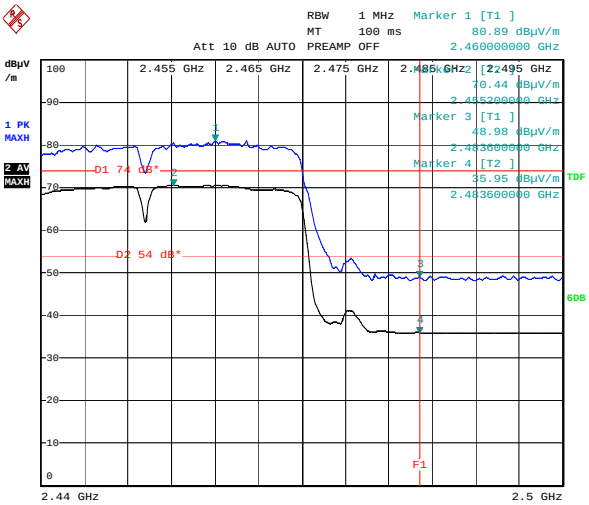
Figure 4. Plot of the Band Edge (Radiated)

802.11n HT40 mode:

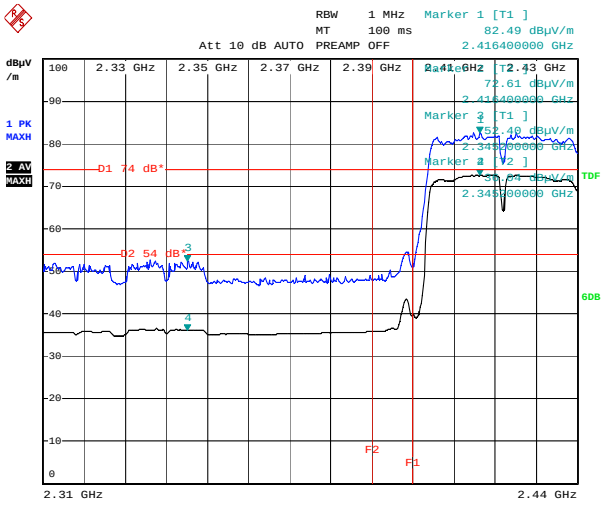
Lowest Channel (2422 MHz)
Horizontal



Highest Channel (2452 MHz)
Horizontal



Lowest Channel (2422 MHz)
Vertical



Highest Channel (2452 MHz)
Vertical

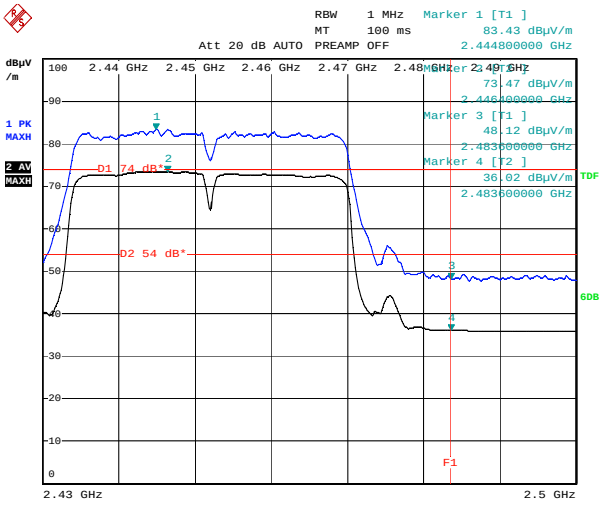
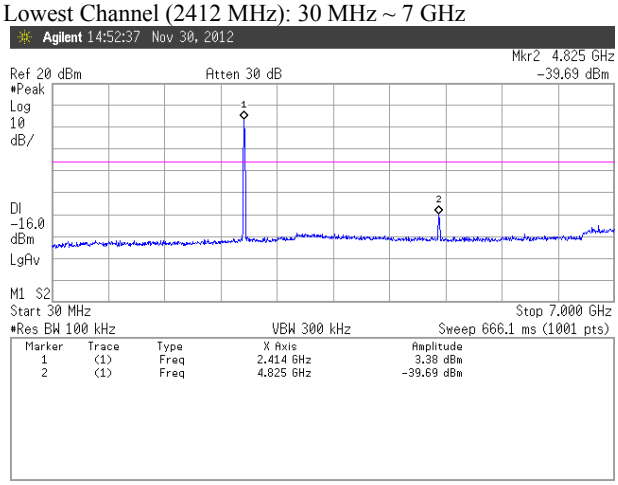


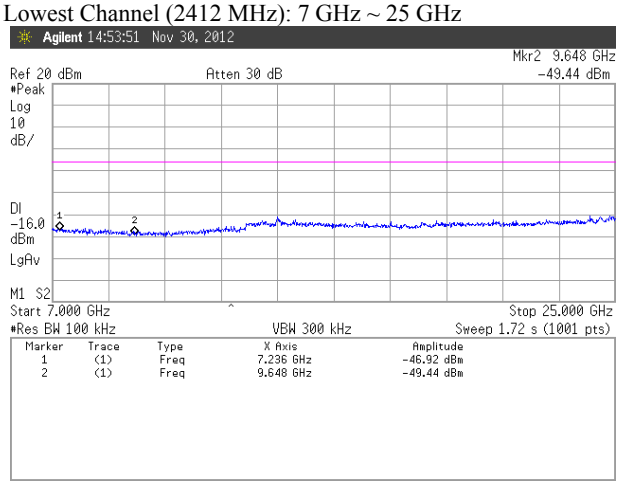
Figure 5. Spurious RF conducted emissions

802.11b mode:

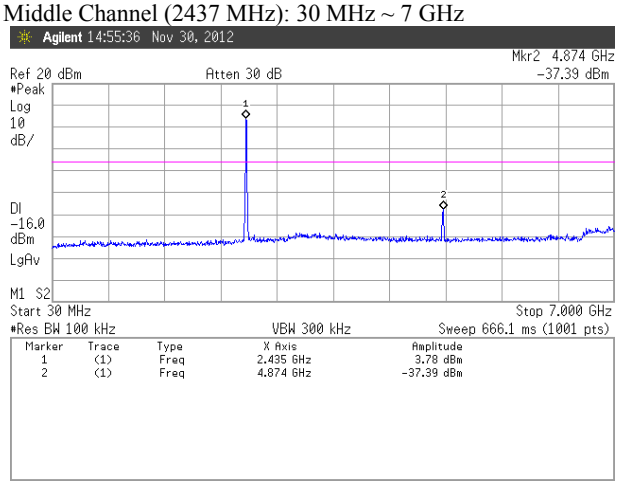
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



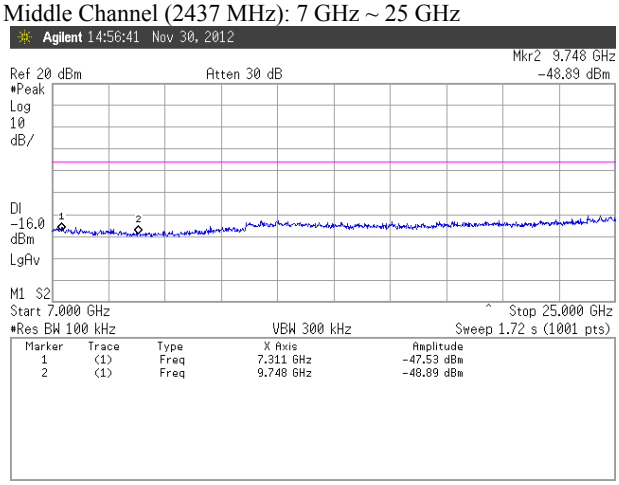
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



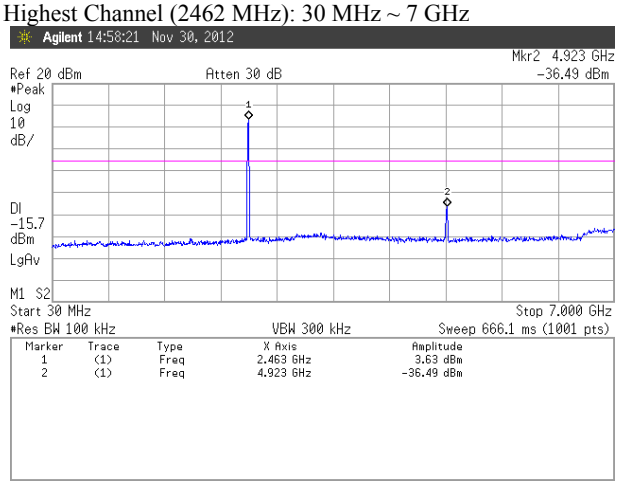
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



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



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



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

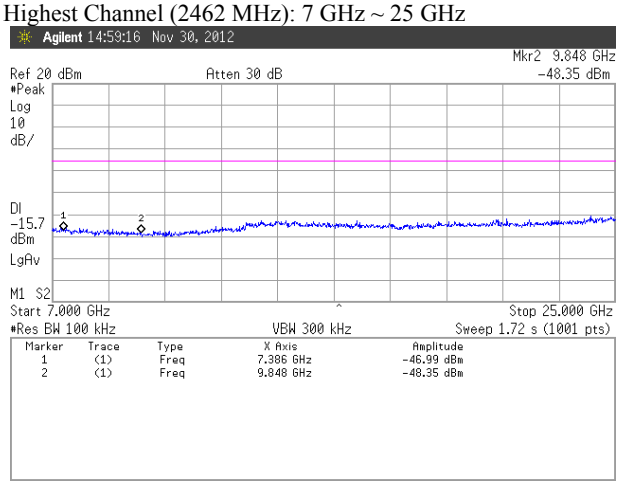
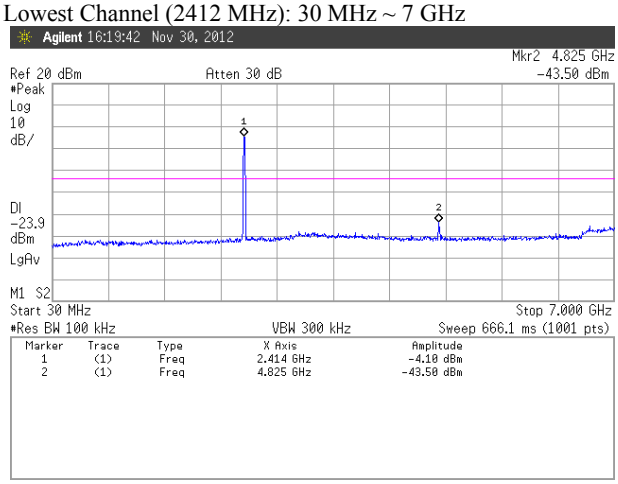


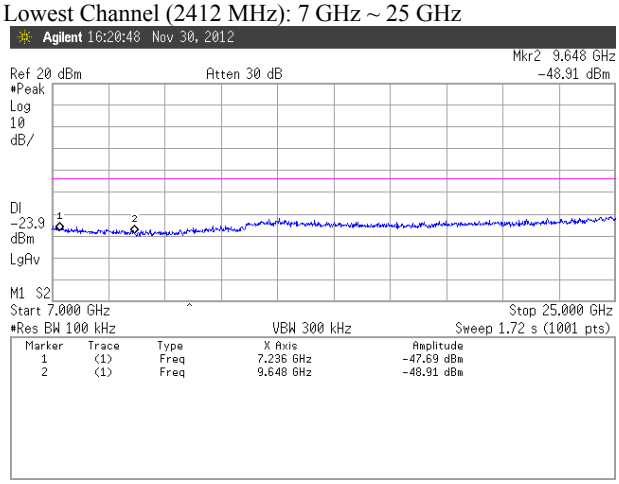
Figure 5. Spurious RF conducted emissions *(continued)*

802.11g mode:

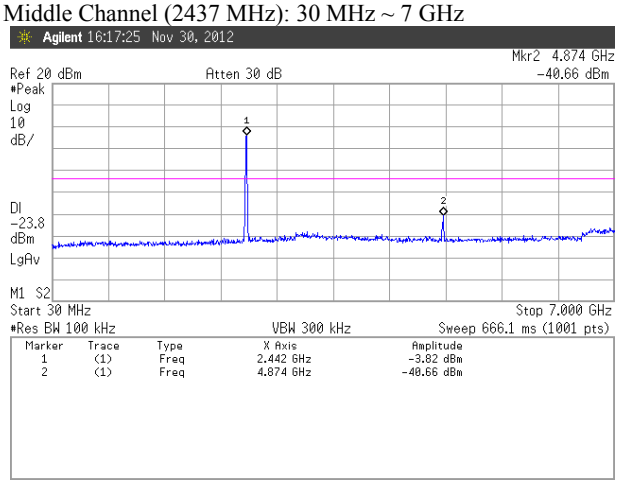
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



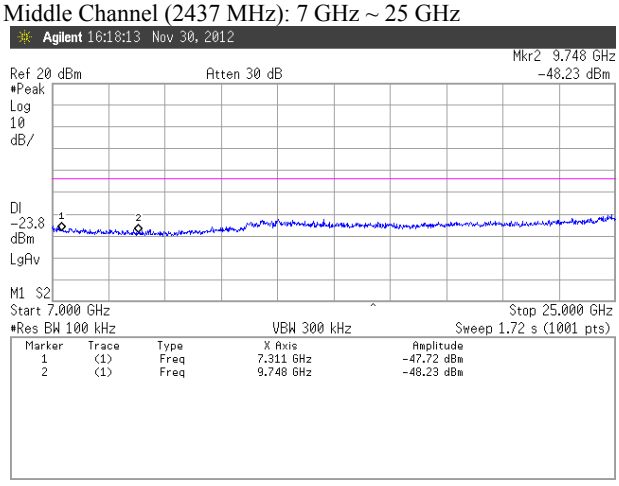
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



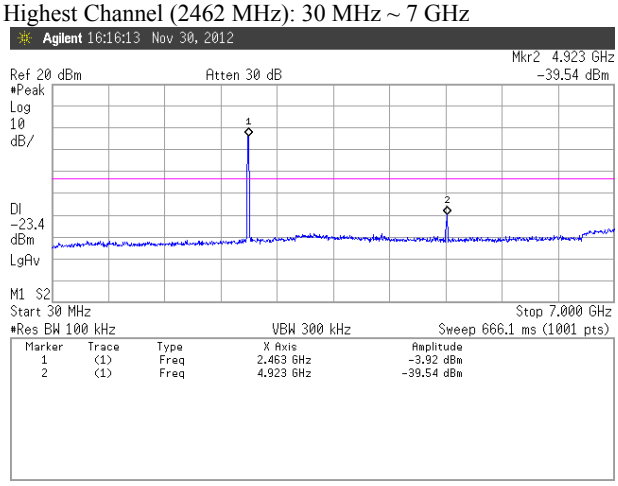
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



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



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



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

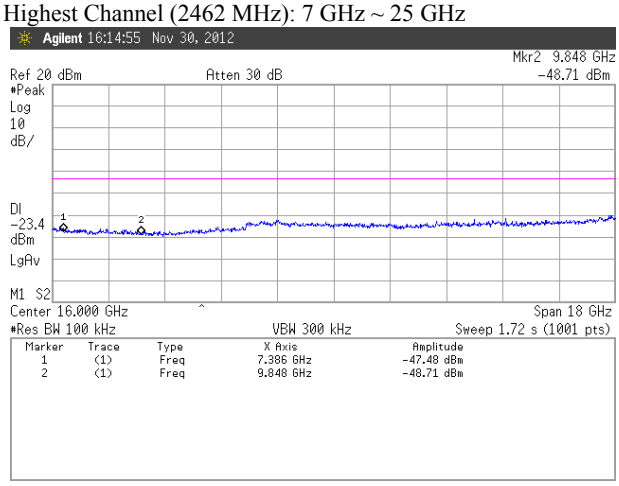
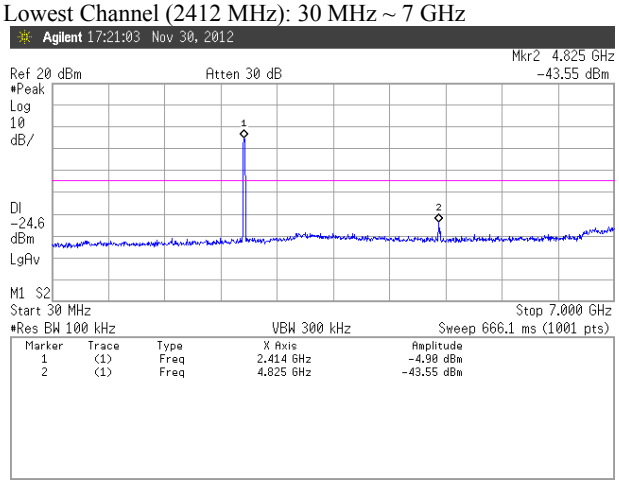


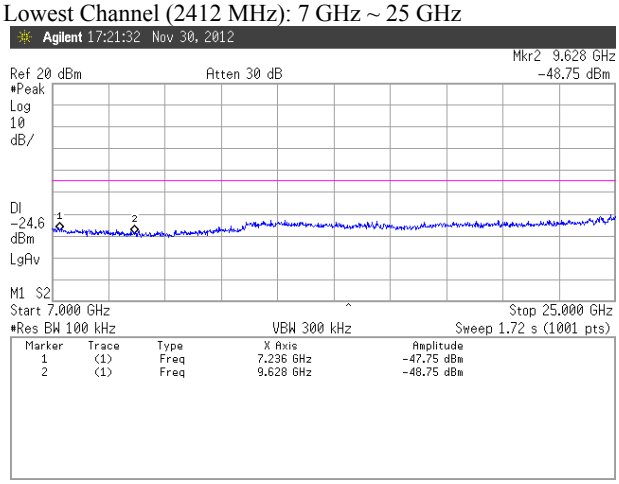
Figure 5. Spurious RF conducted emissions *(continued)*

802.11n HT20 mode:

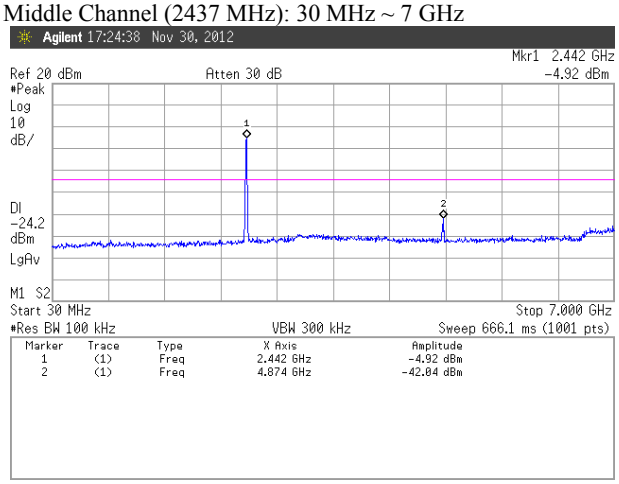
Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



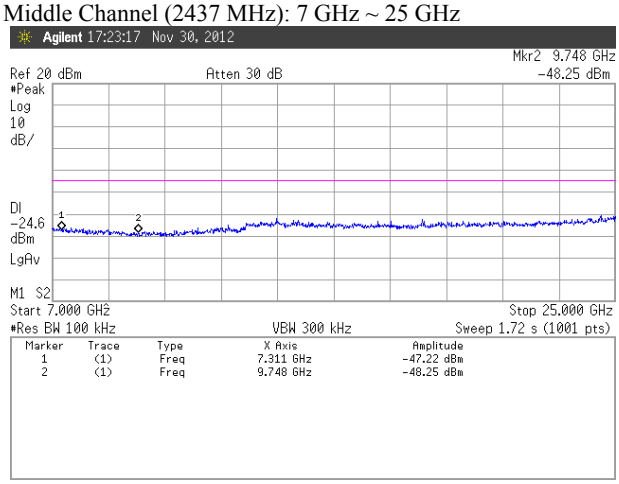
Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



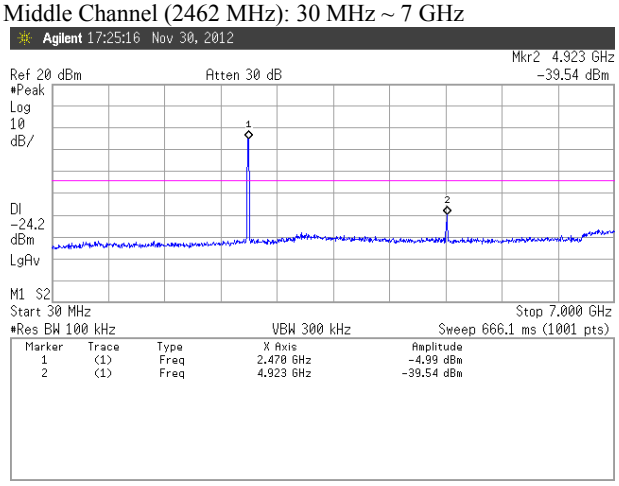
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



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



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



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

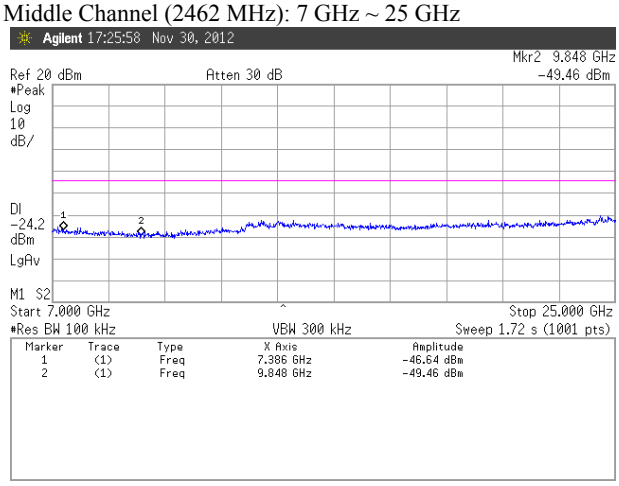
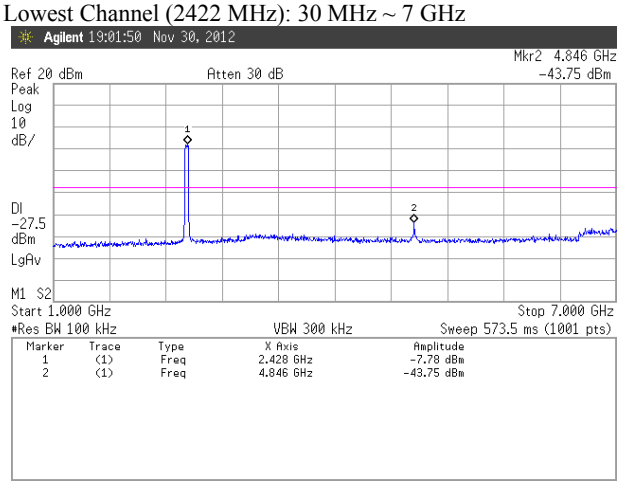


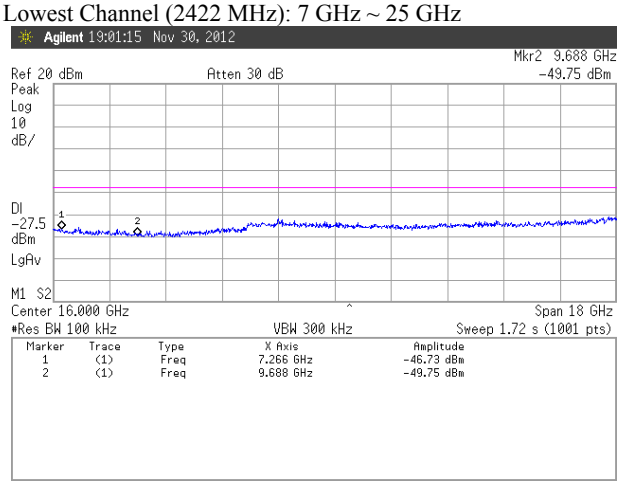
Figure 5. Spurious RF conducted emissions *(continued)*

802.11n HT40 mode:

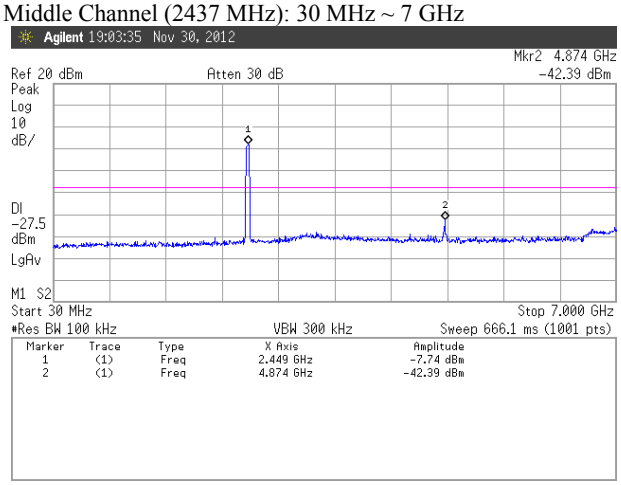
Lowest Channel (2422 MHz): 30 MHz ~ 7 GHz



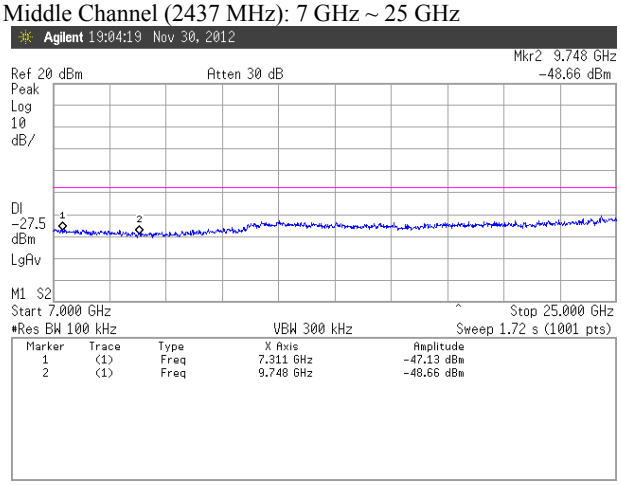
Lowest Channel (2422 MHz): 7 GHz ~ 25 GHz



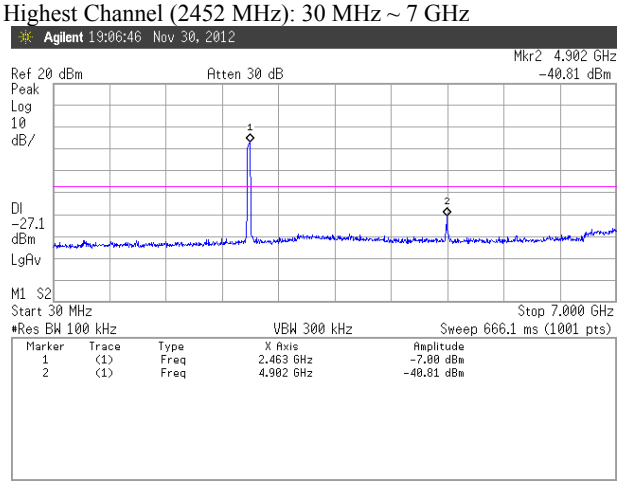
Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



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



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



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

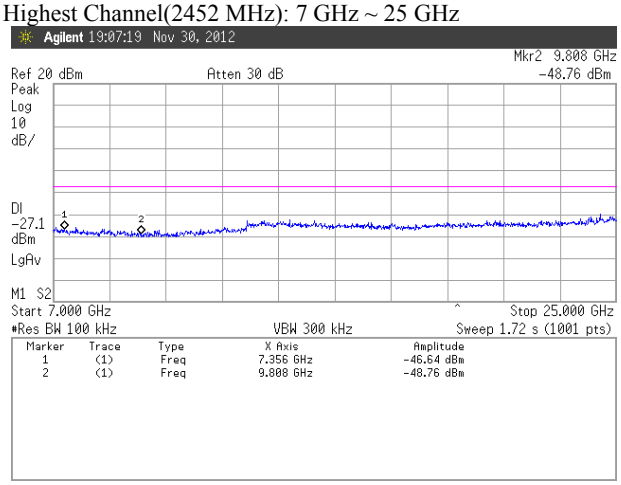
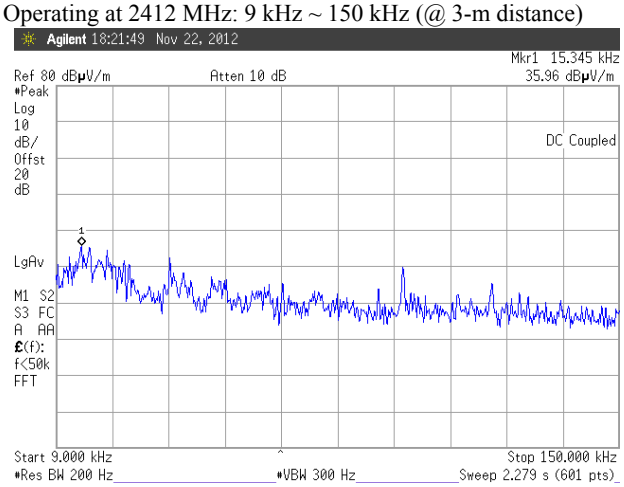
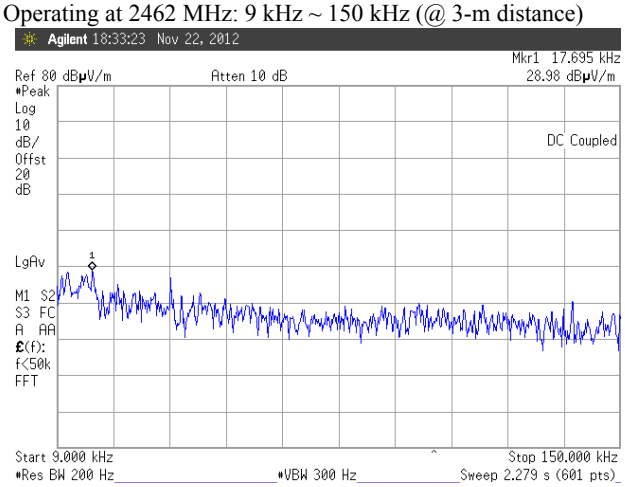


Figure 6. Emission plot for the preliminary radiated measurements

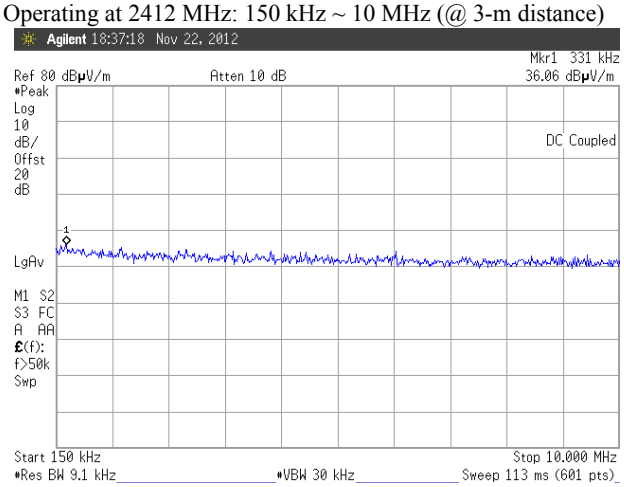
Operating at 2412 MHz: 9 kHz ~ 150 kHz (@ 3-m distance)



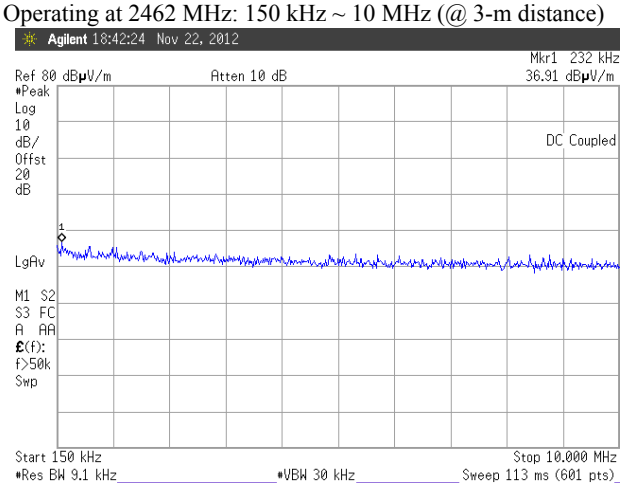
Operating at 2462 MHz: 9 kHz ~ 150 kHz (@ 3-m distance)



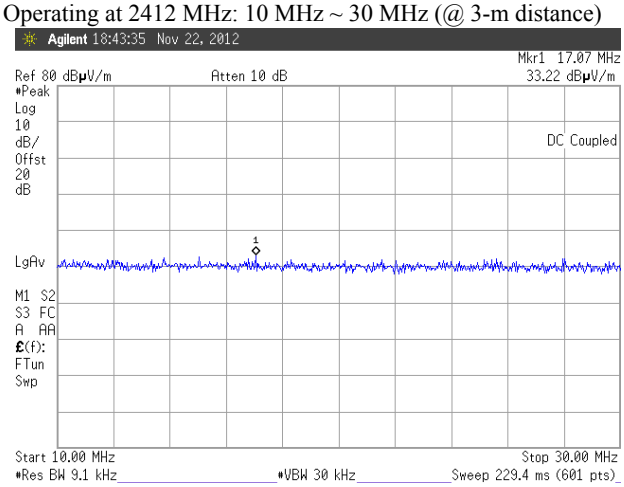
Operating at 2412 MHz: 150 kHz ~ 10 MHz (@ 3-m distance)



Operating at 2462 MHz: 150 kHz ~ 10 MHz (@ 3-m distance)



Operating at 2412 MHz: 10 MHz ~ 30 MHz (@ 3-m distance)



Operating at 2462 MHz: 10 MHz ~ 30 MHz (@ 3-m distance)

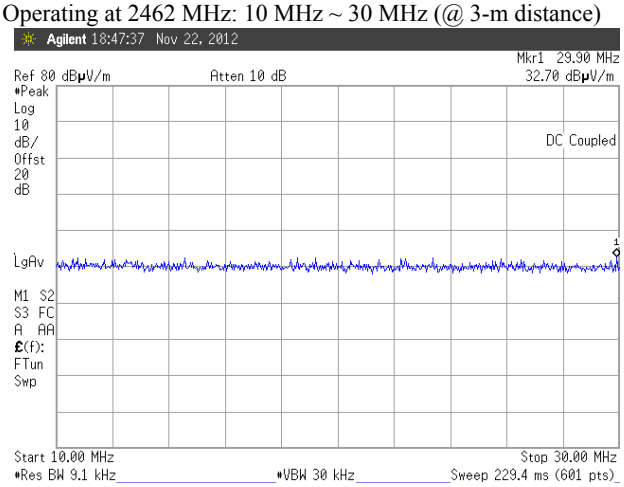
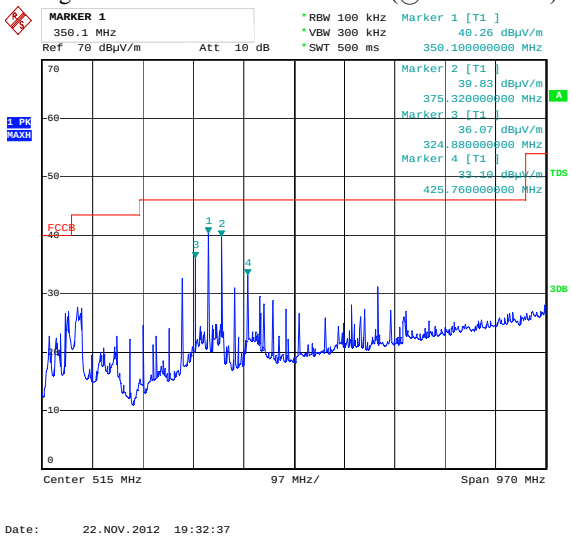
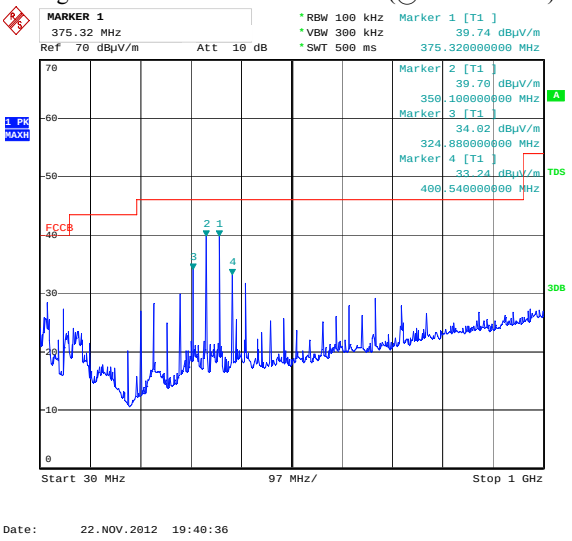


Figure 6. Emission plot for the preliminary radiated measurements*(continued)*

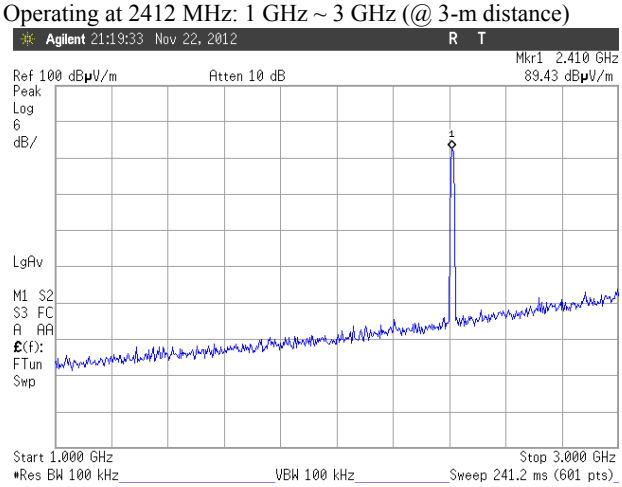
Operating at 2412 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



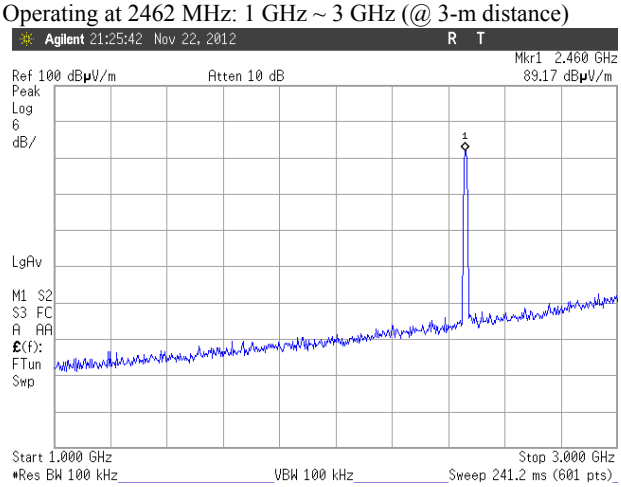
Operating at 2462 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



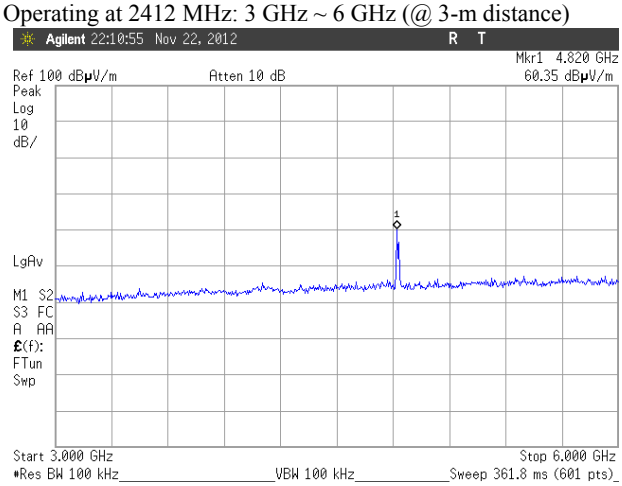
Operating at 2412 MHz: 1 GHz ~ 3 GHz (@ 3-m distance)



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



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



Operating at 2457 MHz: 3 GHz ~ 6 GHz (@ 3-m distance)

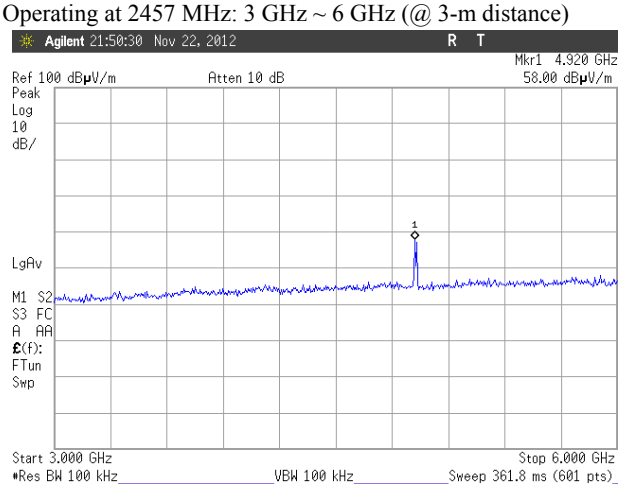
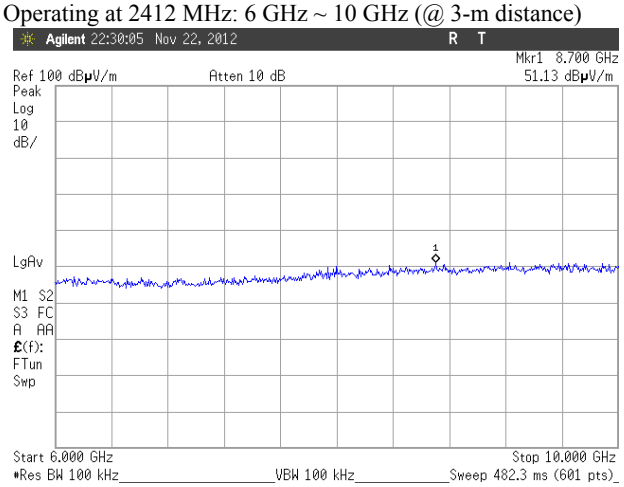
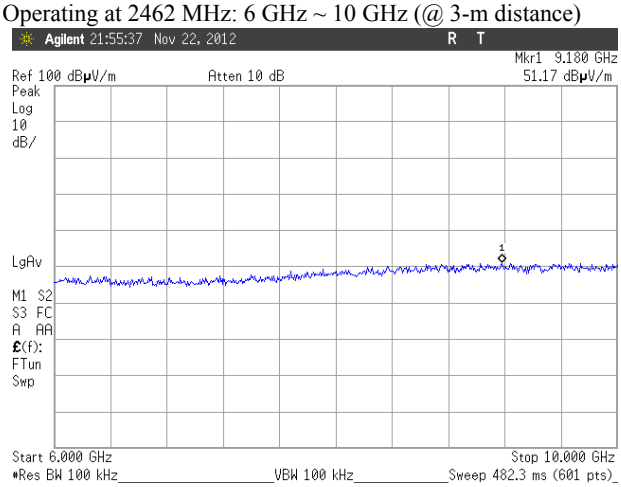


Figure 6. Emission plot for the preliminary radiated measurements*(continued)*

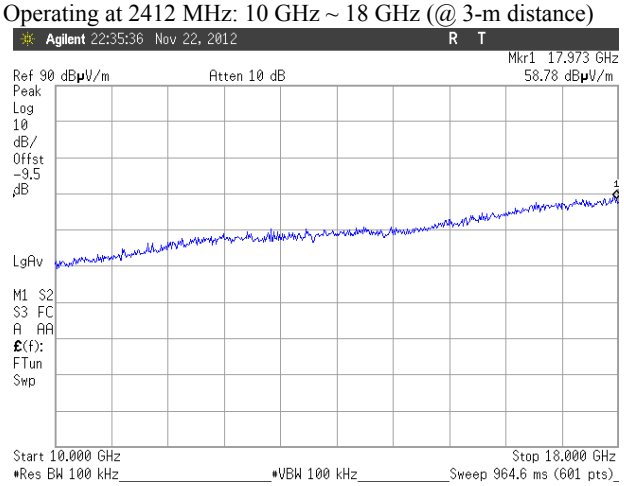
Operating at 2412 MHz: 6 GHz ~ 10 GHz (@ 3-m distance)



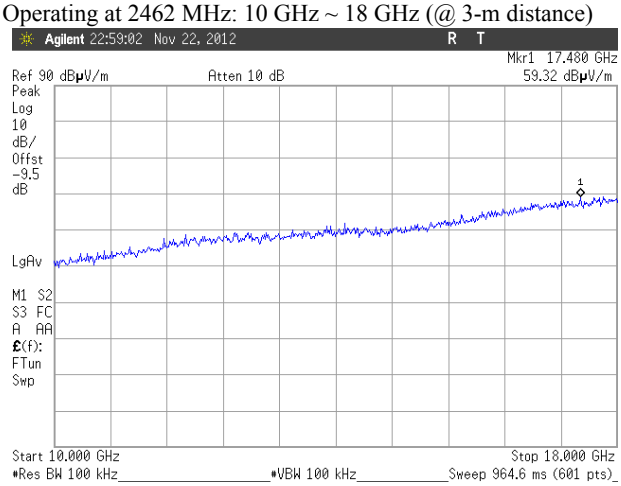
Operating at 2462 MHz: 6 GHz ~ 10 GHz (@ 3-m distance)



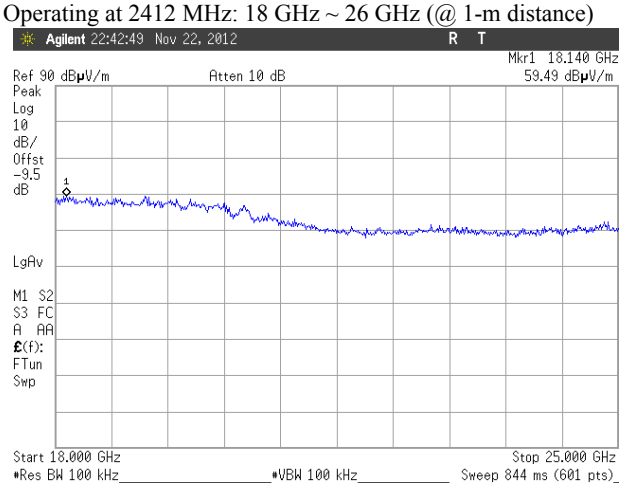
Operating at 2412 MHz: 10 GHz ~ 18 GHz (@ 3-m distance)



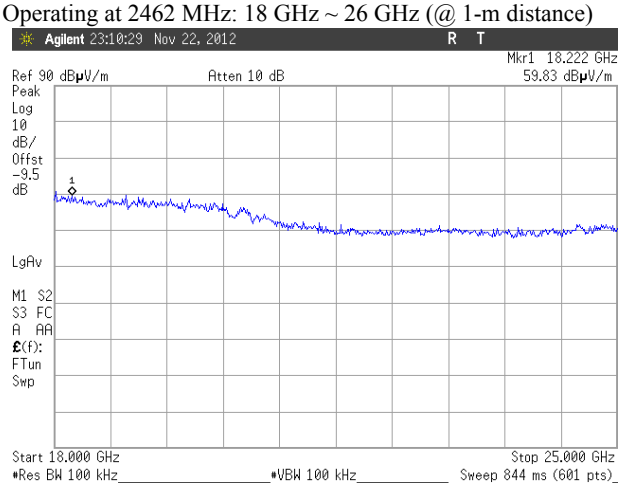
Operating at 2462 MHz: 10 GHz ~ 18 GHz (@ 3-m distance)



Operating at 2412 MHz: 18 GHz ~ 26 GHz (@ 1-m distance)



Operating at 2462 MHz: 18 GHz ~ 26 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(Measurement Procedure PKPSD, Option 1)

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 channel bandwidth.
3. Set the RBW ≥ 3 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.
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)

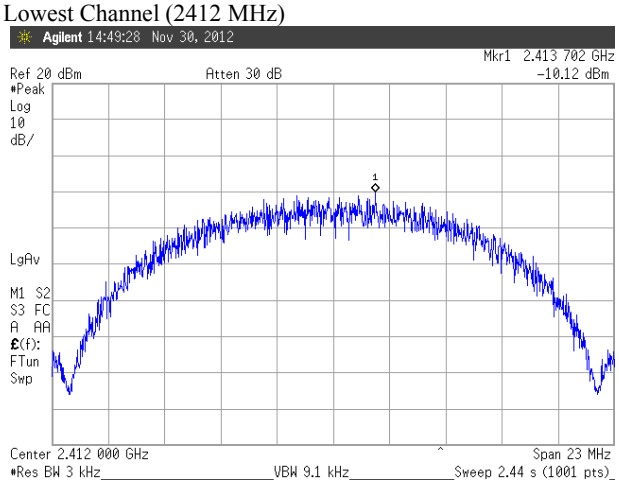
Modulation	Operating frequency	Transfer Rate	PSD/ 3kHz (dBm)	Limit (dBm)
802.11b	2412 MHz	11 Mbps	-10.12	8
	2437 MHz	11 Mbps	-10.07	8
	2462 MHz	11 Mbps	-9.73	8
802.11g	2412 MHz	54 Mbps	-17.48	8
	2437 MHz	54 Mbps	-17.55	8
	2462 MHz	54 Mbps	-17.44	8
802.11n HT20	2412 MHz	MCS 7	-18.19	8
	2437 MHz	MCS 7	-18.39	8
	2462 MHz	MCS 7	-18.09	8
802.11n HT40	2422 MHz	MCS 7	-20.21	8
	2437 MHz	MCS 7	-20.39	8
	2452 MHz	MCS 7	-20.18	8

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

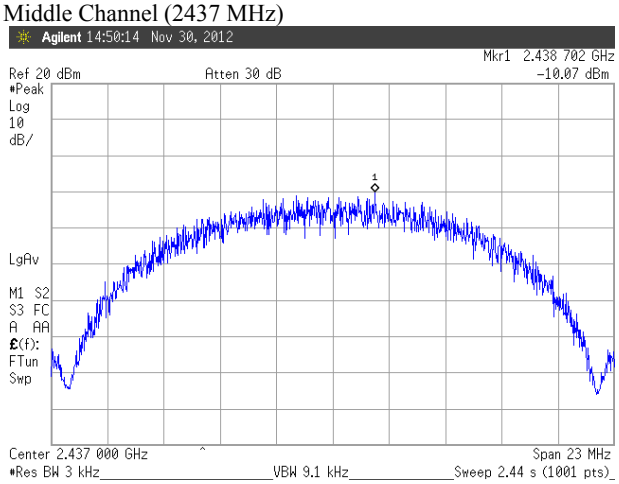
Figure 7. Plot of the Peak Power Spectral Density (Conducted)

802.11b mode:

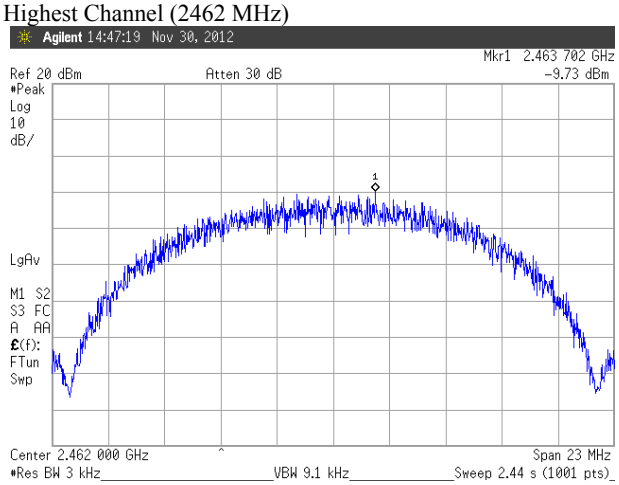
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

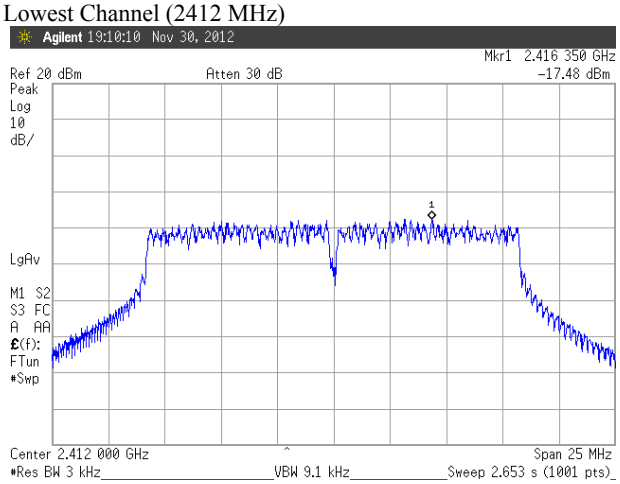


Highest Channel (2462 MHz)

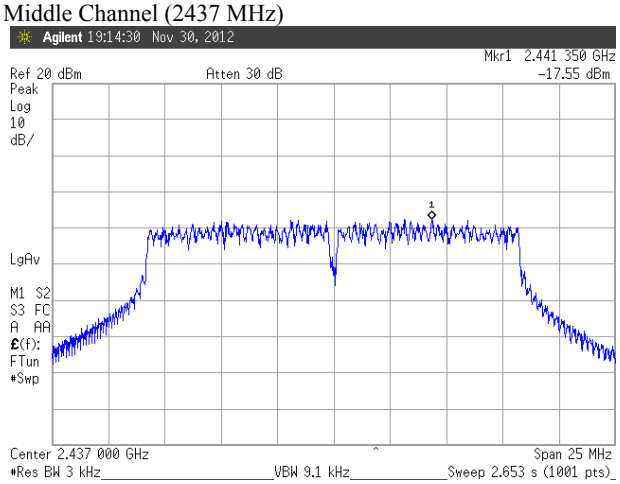


802.11g mode:

Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



Highest Channel (2462 MHz)

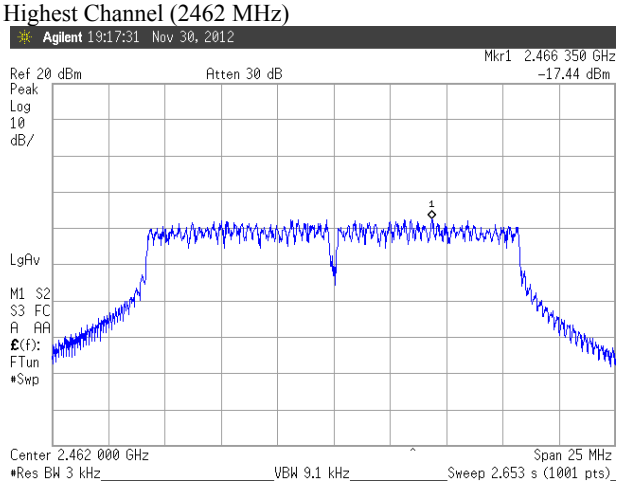
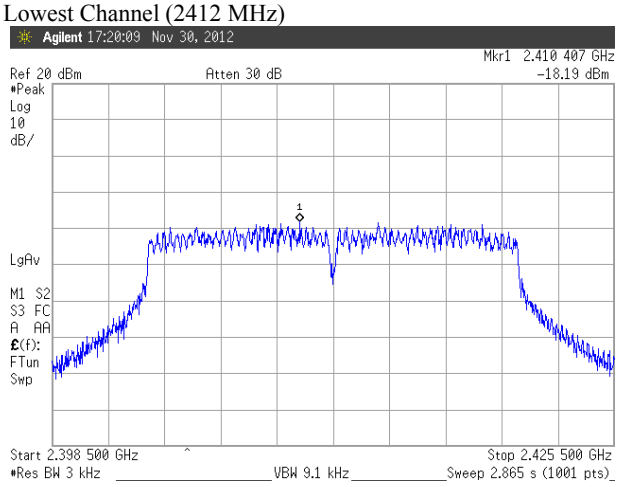


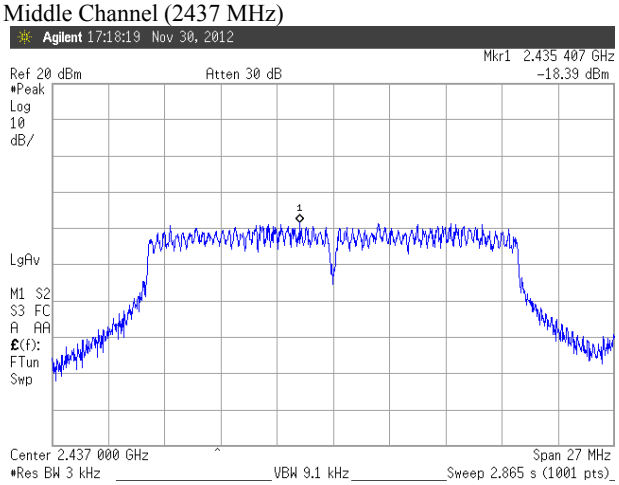
Figure 7. Plot of the Peak Power Spectral Density (Conducted) *(continued)*

802.11n HT20 mode:

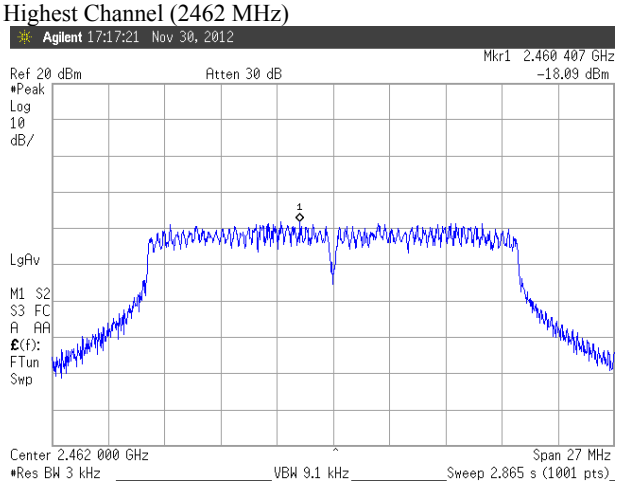
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

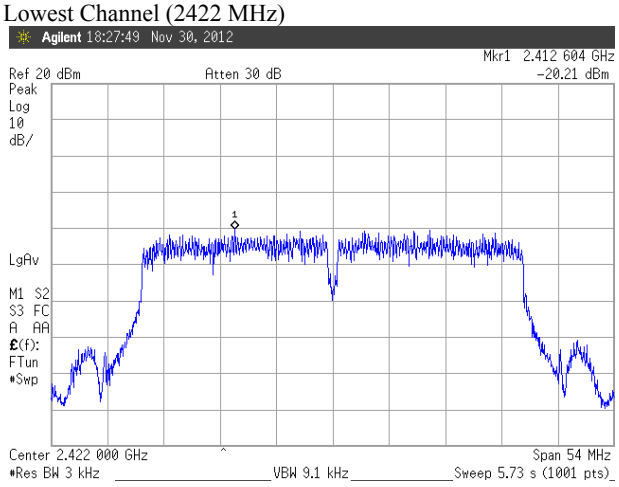


Highest Channel (2462 MHz)

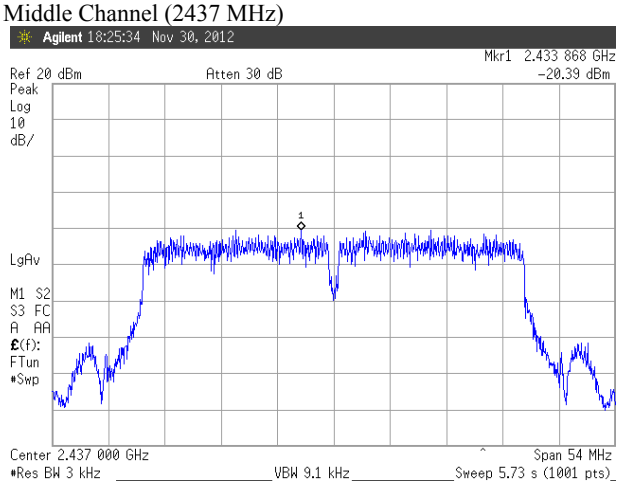


802.11n HT40 mode:

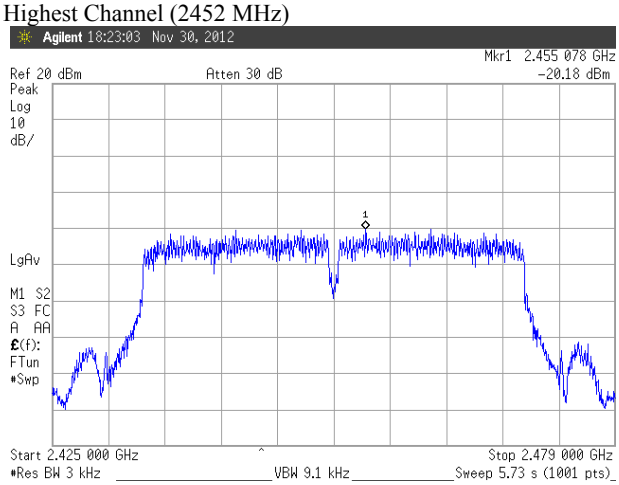
Lowest Channel (2422 MHz)



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

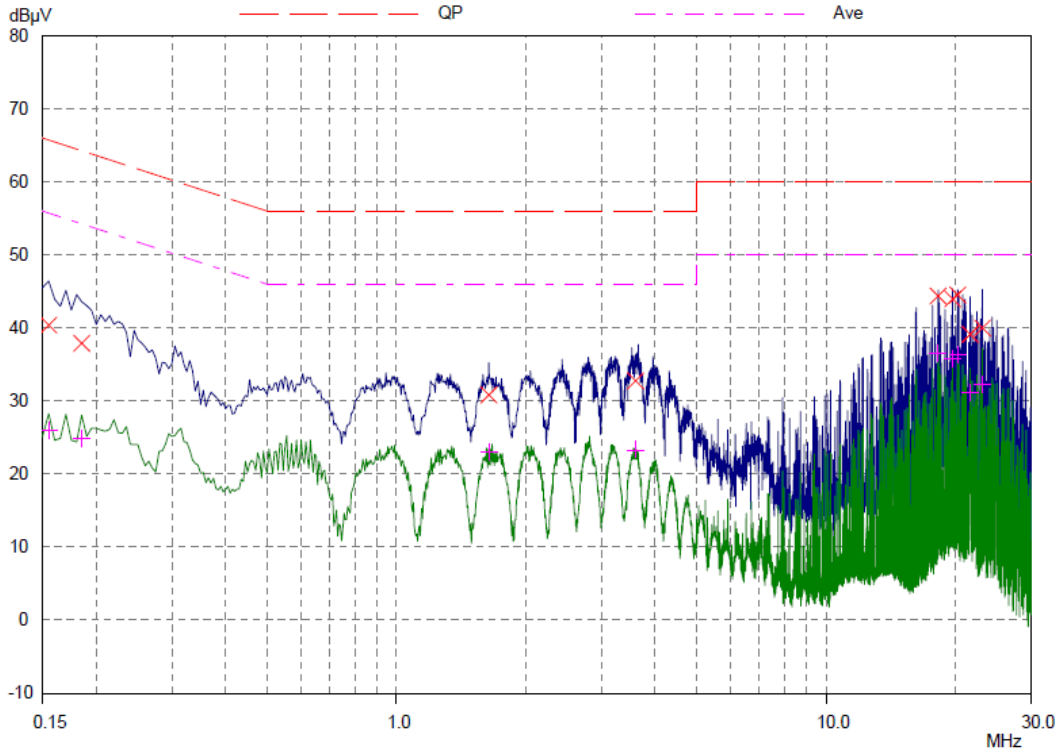
Frequency [MHz]	Reading [dBµV]	L / N	CF [dB]	CL [dB]	Actual [dBµV]	Limit [dBµV]	Margin [dB]
QUASI-PEAK DATA							
0.1550	40.40	L	0.10	0.03	40.53	65.73	25.20
0.2100	34.49	N	0.10	0.03	34.62	63.21	28.59
1.6400	30.82	L	0.16	0.07	31.05	56.00	24.95
3.6050	32.75	L	0.19	0.10	33.04	56.00	22.96
16.2250	38.32	N	0.43	0.20	38.95	60.00	21.05
18.2400	44.38	L	0.56	0.22	45.16	60.00	14.84
19.7050	43.97	L	0.62	0.23	44.82	60.00	15.18
20.2550	44.51	L	0.64	0.23	45.38	60.00	14.62
21.6600	39.15	L	0.72	0.24	40.11	60.00	19.89
23.1250	37.23	N	0.62	0.25	38.10	60.00	21.90
23.1300	39.98	L	0.81	0.25	41.04	60.00	18.96
AVERAGE DATA							
0.1550	25.90	L	0.10	0.03	26.03	55.73	29.70
0.2100	19.02	N	0.10	0.03	19.15	53.21	34.06
1.6400	23.05	L	0.16	0.07	23.28	46.00	22.72
3.6050	23.31	L	0.19	0.10	23.60	46.00	22.40
16.2250	29.92	N	0.43	0.20	30.55	50.00	19.45
18.2400	36.59	L	0.56	0.22	37.37	50.00	12.63
19.7050	35.86	L	0.62	0.23	36.71	50.00	13.29
20.2550	36.31	L	0.64	0.23	37.18	50.00	12.82
21.6600	31.12	L	0.72	0.24	32.08	50.00	17.92
23.1250	27.40	N	0.62	0.25	28.27	50.00	21.73
23.1300	32.34	L	0.81	0.25	33.40	50.00	16.60

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

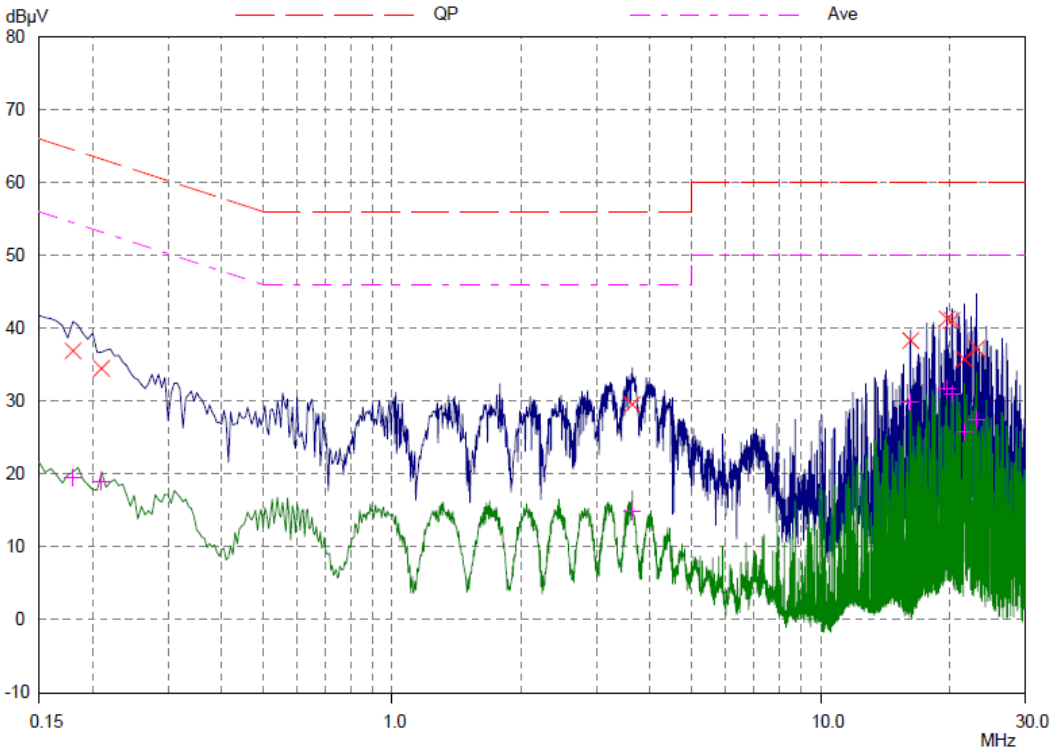
NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

Figure 8. Plot of the AC Power Line Conducted Emissions

Line – PE (Peak and Average detector used)



Neutral – PE (Peak and Average detector used)



5.8 RF Exposure

5.8.1 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

$S = PG/4\pi R^2$ 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

$\left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$ R = distance to the center of radiation of the antenna [cm]

EUT: Maximum peak output power = 95.72 [mW](= 19.81 dBm) & Antenna gain =1.06 (= 0.26 [dBi])	
100 mW, at 20 cm from an antenna 6 [dBi]	$S = PG/4\pi R^2 = 100 \times 3.98 / (4 \times \pi \times 400)$ $= 0.0792$ [mW/cm^2] < 1.0 [mW/cm^2]
95.72 mW, at 20 cm from the antenna 0.26 [dBi]	$S = PG/4\pi R^2 = 0.0202$ [mW/cm^2] < 1.0 [mW/cm^2]

5.8.2 RF Exposure Compliance Issue

July 02 TCB Exclusion List: for portable transmitters,

Low threshold [$(60/f_{GHZ} \approx 25)$ mW, d < 2.5 cm, $(120/f_{GHZ} \approx 50)$ mW, d ≥ 2.5 cm], and

High threshold [$(900/f_{GHZ} \approx 370)$ 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 in a vehicle using a manufacturer or customer supplied mounting plate. This device must be installed to provide a separation distance of at least 20 cm from all persons."