SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTTRT-090909-010**		
Applicant:	**DVICO Inc.**		
Applicant Address:	11F, Allianzlife Bldg, 267-3,Seohyeon-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-824, REPUBLIC OF KOREA		
Manufacturer:	**1. DVICO Inc.** **2. Dongguan Jianwei Electronics Products Co., Ltd.** **3. Dongkwang Precision Co., Ltd.**		
Manufacturer Address:	1. 11F, Allianzlife Bldg, 267-3,Seohyeon-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-824, REPUBLIC OF KOREA. 2. Qing Feng Da Dao, Jin-Qiao Industry Area, Qing-Xi, Dongguan City, Guang-Dong Province PEOPLE'S REPUBLIC OF CHINA. 3. No.33 Yudi Road Chenjiang Zone Huicheng District, Huizhou City, Guang-Dong Province PEOPLE'S REPUBLIC OF CHINA.		
Device Under Test:	**Multimedia Player**		
FCC ID:	**PAH-TVIXPVRM6620N**	**Model Name:**	**TViX PVR M-6620N**
Brand/Trade Name:	-		
Receipt No.:	SKTEU09-0848	**Date of receipt:**	August 20, 2009
Date of Issue:	September 09, 2009		
Location of Testing:	**SK TECH CO., LTD.** #820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, 472-905 South Korea		
Test Procedure:	**ANSI C63.4:2003**		
Test Specification:	**47CFR, 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: *Seungtaek, Shim*

September 09, 2009

Signature *Date*

Tested & Reported by: *Jongsoo, Yoon*

September 09, 2009

Signature *Date*

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

☞

- **This test report is not permitted to copy partly and entirely without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of submitted samples of the above mentioned.**

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 for Digital Transmission System. 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: 90752)
(OPEN AREA TEST SITE INDUSTRY CANADA NUMBER: IC 5429)

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is recognized as a Conformity Assessment Body (CAB) for CAB's Designation Number: **KR0007** by FCC, is accredited by NVLAP for NVLAP Lab. Code: **200220-0**.

2.2 List of Test and Measurement Instruments

No.	Description	Manufacturer	Model No.	Serial No.	Calibrated until	Used
1	Spectrum Analyzer	Agilent	E4405B	US40520856	2010.07	
2	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2010.03	
3	EMI Test Receiver	Rohde&Schwarz	ESIB40	100277	2010.02	☒
4	EMI Test Receiver	Rohde&Schwarz	ESHS10	862970/019	2010.07	☒
5	Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	836679/018	2010.07	☒
6	Pre-amplifier	HP	8447F	3113A05153	2010.07	☒
7	Pre-amplifier	MITEQ	AFS44	1116321	2010.07	
8	Pre-amplifier	MITEQ	AFS44	1116322	2010.03	☒
9	Power Meter	Agilent	E4417A	MY45100426	2010.07	☒
10	Power Meter	Agilent	E4418B	US39402176	2010.07	
11	Power Sensor	Agilent	E9327A	MY44420696	2010.07	☒
12	Power Sensor	Agilent	8482A	MY41094094	2010.07	
13	Attenuator (10dB)	HP	8491B	38067	2010.07	☒
14	Attenuator (20dB)	Weinschel	44	AH6967	2010.07	
15	High Pass Filter	Wainwright	WHKX3.0/18G	8	2010.07	☒
16	VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	2009.12	
17	UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 990	2009.12	
18	Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	2009.11	
19	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	230	2010.07	☒
20	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	189	2009.09	
21	Horn Antenna	AH Systems	SAS-200/571	304	N/A	
22	Horn Antenna	EMCO	3115	00040723	2010.03	☒
23	Horn Antenna	EMCO	3115	00056768	2009.11	
24	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170318	2010.08	☒
25	Vector Signal Generator	Agilent	E4438C	MY42080359	2010.07	
26	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2010.07	
27	DC Power Supply	HP	6622A	3448A032223	2009.11	
28	DC Power Supply	HP	6268B	2542A-07856	2010.07	
29	Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	2010.07	☒

2.3 Test Date

Date of Test: September 1, 2009 ~ September 8, 2009

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	AC 90V ~ 250V, 50/60Hz
Local Oscillator or X-Tal	X-Tal: 40 MHz (WLAN Board)
Transmit Frequency	IEEE 802.11n HT20: 2412 MHz ~ 2462 MHz (11 channels, 5 MHz step) IEEE 802.11n HT40: 2422 MHz ~ 2452 MHz (7 channels, 5 MHz step)
Antenna Type	Integral (on PCB, Gain: -0.62 dBi)
Type of Modulation	IEEE 802.11n HT20/40: OFDM(64QAM, 16QAM, QPSK, BPSK)
RF Output power	17 dBm (declared)
External Ports **	A/V Port HDMI Port LAN Port USB Port TUNER Port OPTICAL Port

** The device should be tested and comply with the requirements as a class B digital device and a TV broadcast receiver.
The test reports for DoC and Verification should be separately issued from this test report.

*** There is a variant model 'TViX HD M-6600N' that is identical except for tuner circuit (removed).

3.2 Equipment Modifications

None

3.3 Submitted Documents

Block diagram

Schematic diagram

Antenna Specification

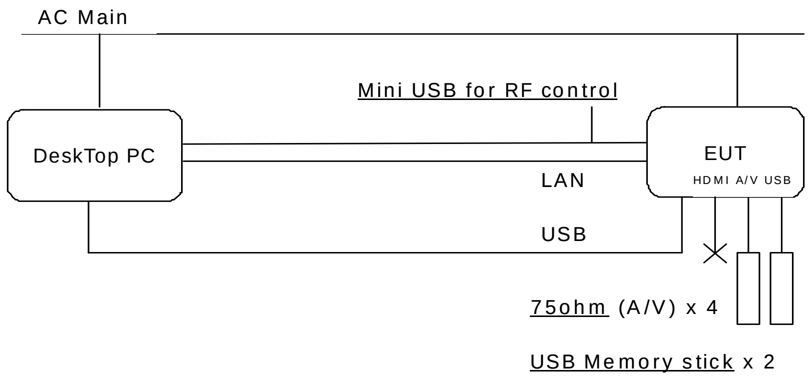
Part List

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 was provided by the applicant (Power setting value: 45).



[System Block Diagram of Test Configuration]

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	S/N
Desktop PC	Samsung	DMV50	371F97BA100133V

4.3 Type of Used Cables

#	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
1	Desktop PC	USB	EUT	USB mini	1.0	YES
2	Desktop PC	USB	EUT	USB	1.0	NO
3	Desktop PC	LAN	EUT	LAN	1.0	NO
4	Desktop PC	AC Input	AC mains	-	1.2	NO
5	EUT	AC Input	AC mains	-	1.2	NO

4.4 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty $U = k \times Uc$ ($k = 1.96$)
Conducted RF power	± 1.49 dB	± 2.92 dB
Radiated disturbance	± 2.30 dB	± 4.51 dB
Conducted disturbance	± 1.96 dB	± 3.84 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)	5.2	PASS
Maximum Peak Output Power	15.247(b)(3), (4)	5.3	PASS
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.205(a), 15.209(a)	5.4	PASS
Peak Power Spectral Density	15.247(e)	5.5	PASS
Conducted Emissions	15.207(a)	5.6	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 the integral antenna on the PCB. The directional gain of the antenna is -0.62 dBi.

5.2 6 dB BANDWIDTH

5.2.1 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.

5.2.2 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:
   RBW = 100 kHz, VBW ≥ RBW
   Span >> RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
3. Mark the peak frequency and -6dB (upper and lower) frequency.
4. Set the RBW to as close to 1% of the selected span as is possible without being below 1%.
5. Set the DETECTOR to sample where practical. [REMARK: the function of the PEAK HOLD was used]
6. Measure the 99% occupied bandwidth.
7. Repeat until all the rest channels are investigated.

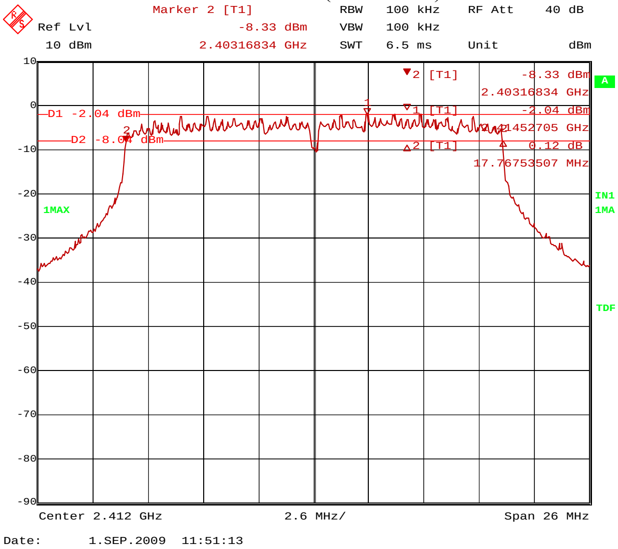
5.2.3 Test Results: PASS

Table 1: Measured values of the 6dB Bandwidth

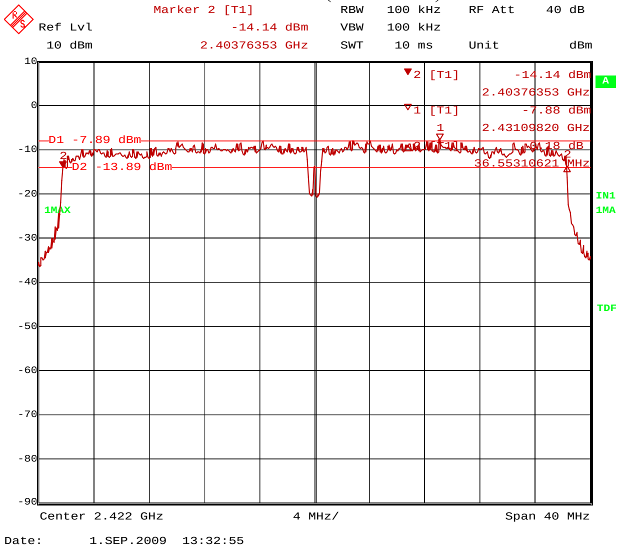
Modulation	Operating frequency	Transfer Rate	Occupied Bandwidth (99%)	6dB Bandwidth	Limit
802.11n HT20	2412 MHz	MCS 0~7	17.80 MHz	17.77 MHz	≥ 500 kHz
	2437 MHz	MCS 0~7	17.86 MHz	17.87 MHz	≥ 500 kHz
	2462 MHz	MCS 0~7	17.92 MHz	17.92 MHz	≥ 500 kHz
802.11n HT40	2422 MHz	MCS 0~7	36.17 MHz	36.55 MHz	≥ 500 kHz
	2437 MHz	MCS 0~7	36.17 MHz	36.54 MHz	≥ 500 kHz
	2452 MHz	MCS 0~7	36.17 MHz	36.53 MHz	≥ 500 kHz

Figure 1. Plot of the 6dB Bandwidth

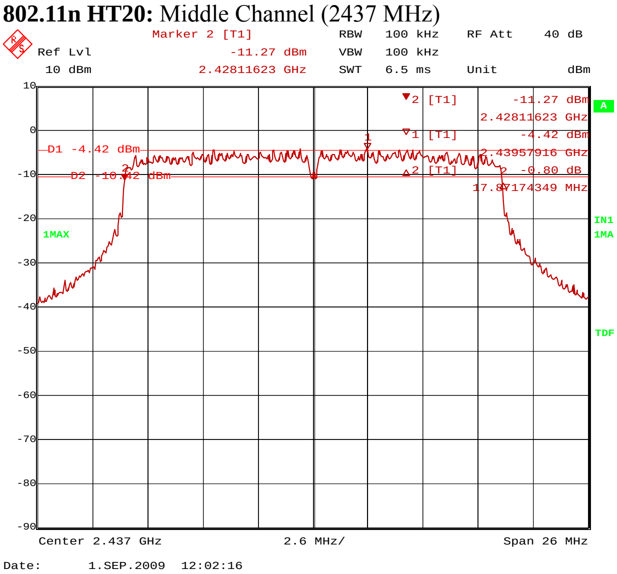
802.11n HT20: Lowest Channel (2412 MHz)



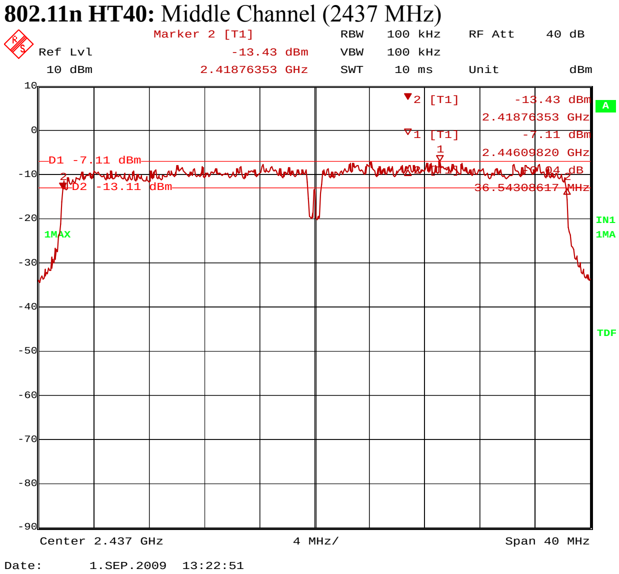
802.11n HT40: Lowest Channel (2422 MHz)



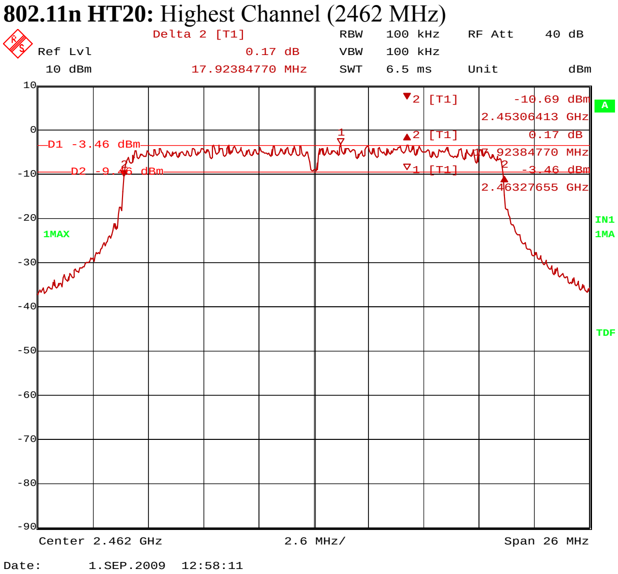
802.11n HT20: Middle Channel (2437 MHz)



802.11n HT40: Middle Channel (2437 MHz)



802.11n HT20: Highest Channel (2462 MHz)



802.11n HT40: Highest Channel (2452 MHz)

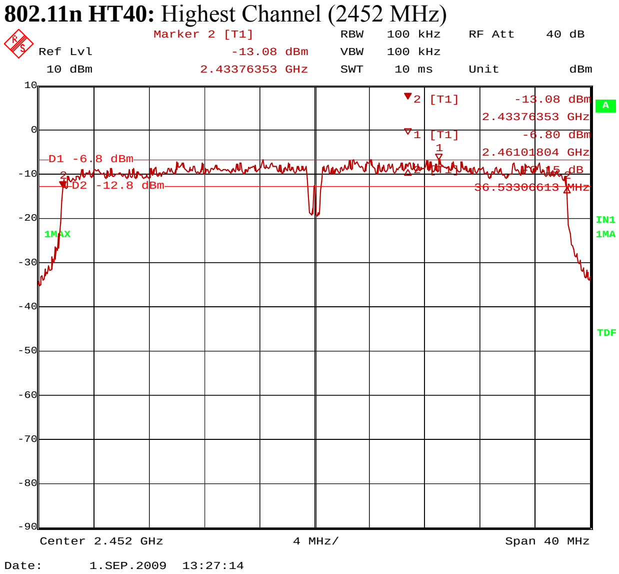
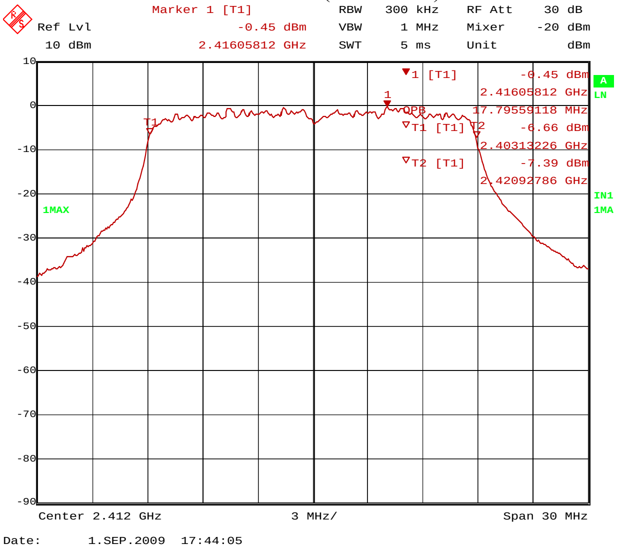
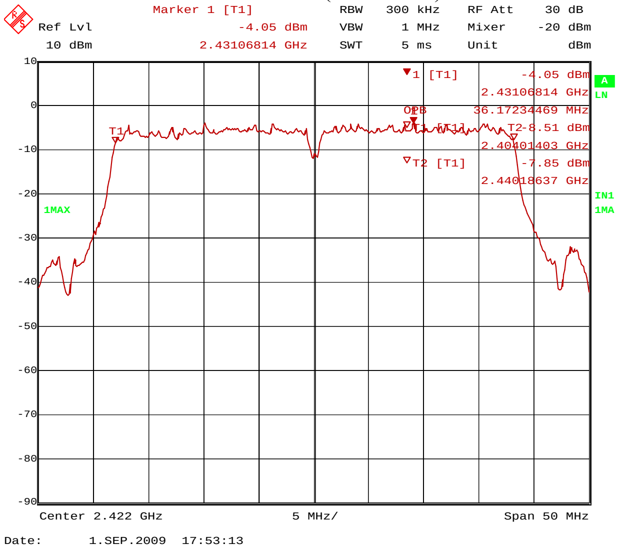


Figure 2. Plot of the Occupied Bandwidth (99%)

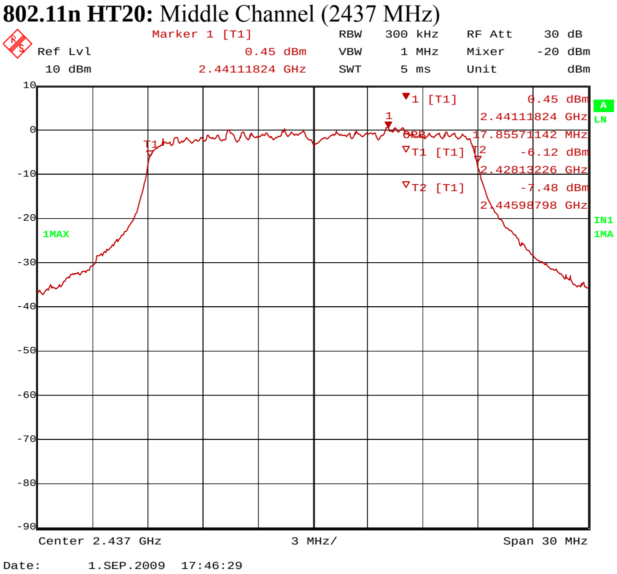
802.11n HT20: Lowest Channel (2412 MHz)



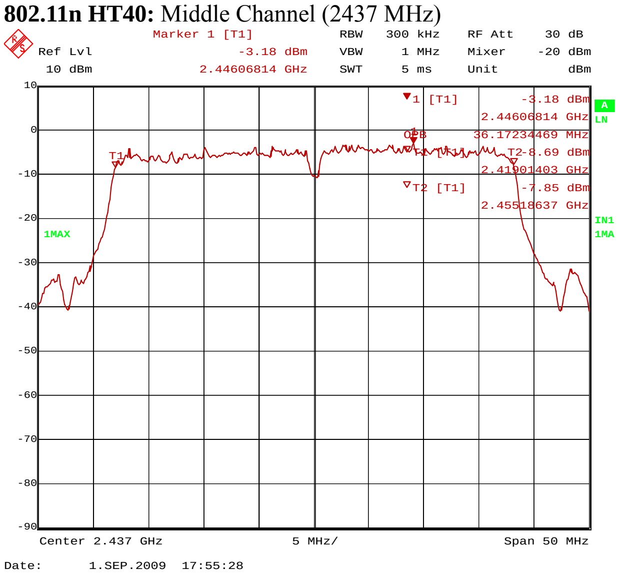
802.11n HT40: Lowest Channel (2412 MHz)



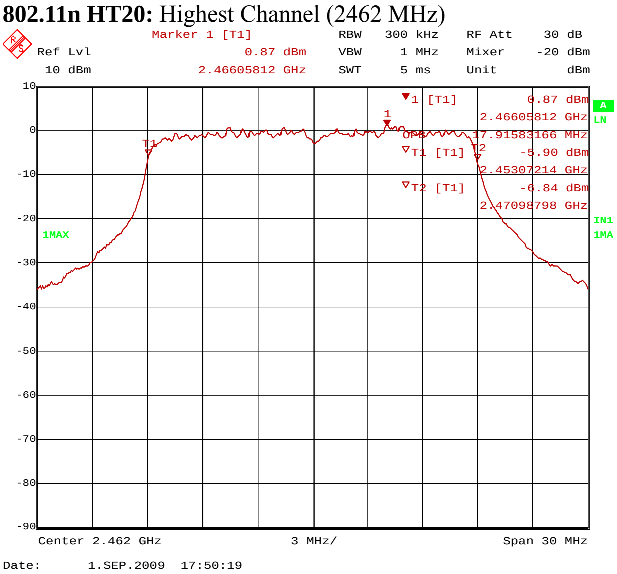
802.11n HT20: Middle Channel (2437 MHz)



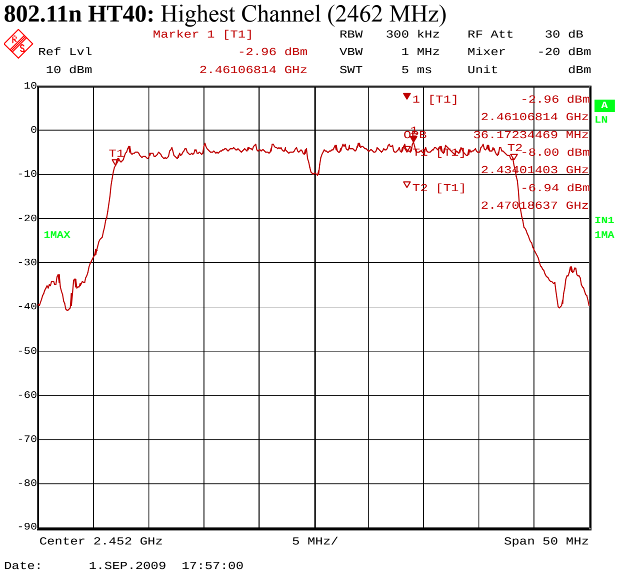
802.11n HT40: Middle Channel (2437 MHz)



802.11n HT20: Highest Channel (2462 MHz)



802.11n HT40: Highest Channel (2462 MHz)



5.3 MAXIMUM PEAK OUTPUT POWER

5.3.1 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.

5.3.2 Test Procedure

Conducted output power measurements were directly made by using Peak-Average power meter with peak power sensor.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Connect the antenna port of the EUT to RF input on peak power meter via a low loss cable and attenuator.
3. Measure the peak output power.

5.3.3 Test Results: PASS

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

Modulation	Operating Frequency	Transfer Rate	AVERAGE POWER		PEAK POWER		Limit
			[dBm]	[W]	[dBm]	[W]	
802.11n HT20	2412 MHz	MCS 0~7	7.73	0.005 93	15.14	0.032 66	1 W
	2437 MHz		8.52	0.007 11	16.70	0.046 77	1 W
	2462 MHz		9.53	0.008 97	17.34	0.054 20	1 W
802.11n HT40	2422 MHz	MCS 0~7	7.38	0.005 47	13.40	0.021 88	1 W
	2437 MHz		7.97	0.006 27	14.32	0.027 04	1 W
	2452 MHz		8.44	0.006 98	14.56	0.028 58	1 W

5.4 SPURIOUS EMISSIONS, BAND EDGE, AND RESTRICTED BANDS

5.4.1 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.

5.4.2 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.
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 30 to 1000 MHz using the TRILOG broadband antenna, and above 1000 MHz 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.

5.4.3 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.

Table 3: Measured values of the Field strength of spurious emission (Radiated) Operating 802.11n HT20

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Antenna Height [m]	Turn Table [degree]	Reading [dB(μV)]	Amp Gain [dB]	ATT [dB]	AF [dB(1/m)]	CL [dB]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-peak data, emissions below 1000 MHz												
270.95	120	V	2.18	46	49.35	26.44	0.0	12.02	1.88	36.81	46.00	9.19
270.95	120	H	1.27	141	40.81	26.44	0.0	12.02	1.88	28.27	46.00	17.73
655.93	120	V	1.63	277	37.28	27.51	0.0	20.01	2.64	32.42	46.00	13.58
655.93	120	H	2.20	252	33.50	27.51	0.0	20.01	2.64	28.64	46.00	17.36
960.06	120	V	1.59	34	39.79	26.96	0.0	23.76	3.11	39.70	54.00	14.30
960.06	120	H	1.00	309	42.50	26.96	0.0	23.76	3.11	42.41	54.00	11.59
AVERAGE data, emissions above 1000 MHz												
2412.0	1000	V	1.37	264	82.68	47.05	10.09	27.93	4.96	78.61	-	-
2412.0	1000	H	2.01	322	80.12	47.05	10.09	27.93	4.96	76.05	-	-
2341.9	1000	V	1.37	264	-	47.04	10.09	27.60	5.02	43.15	54.00	12.85
2342.4	1000	H	2.01	322	-	47.04	10.09	27.60	5.02	41.99	54.00	12.01
4824.0	1000	V	1.00	0	39.17	47.72	0.69	33.20	7.04	32.38	54.00	21.62
4824.0	1000	H	1.00	0	39.15	47.72	0.69	33.20	7.04	32.36	54.00	21.64
2437.0	1000	V	1.15	269	82.52	47.05	10.09	27.93	4.96	78.45	-	-
2437.0	1000	H	1.97	314	80.23	47.05	10.09	27.93	4.96	76.16	-	-
4874.0	1000	V	1.00	0	39.04	47.76	0.69	33.31	7.16	32.44	54.00	21.56
4874.0	1000	H	1.00	0	39.03	47.76	0.69	33.31	7.16	32.43	54.00	21.57
2462.0	1000	V	1.10	271	80.17	47.07	10.09	28.26	5.22	76.67	-	-
2462.0	1000	H	1.22	275	75.34	47.07	10.09	28.26	5.22	71.84	-	-
2483.5	1000	V	1.10	271	-	47.07	10.09	28.26	5.22	41.61	54.00	12.39
2491.8	1000	H	1.22	275	-	47.07	10.09	28.26	5.22	41.41	54.00	12.59
4924.0	1000	V	1.00	0	39.48	47.76	0.69	33.31	7.16	32.88	54.00	21.12
4924.0	1000	H	1.00	0	39.48	47.76	0.69	33.31	7.16	32.88	54.00	21.12
PEAK data, emissions above 1000 MHz												
2412.0	1000	V	1.37	264	92.62	47.05	10.09	27.93	4.96	88.55	-	-
2412.0	1000	H	2.01	322	89.62	47.05	10.09	27.93	4.96	85.55	-	-
2348.5	1000	V	1.37	264	-	47.04	10.09	27.60	5.02	60.93	74.00	13.07
2342.4	1000	H	2.01	322	-	47.04	10.09	27.60	5.02	58.95	74.00	11.05
4824.0	1000	V	1.00	0	52.75	43.90	0.69	33.20	7.04	49.78	74.00	24.22
4824.0	1000	H	1.00	0	53.12	43.90	0.69	33.20	7.04	50.15	74.00	23.85
2437.0	1000	V	1.15	269	92.20	47.05	10.09	27.93	4.96	88.13	-	-
2437.0	1000	H	1.97	314	89.58	47.05	10.09	27.93	4.96	85.51	-	-
4874.0	1000	V	1.00	0	51.87	47.76	0.69	33.31	7.16	45.27	74.00	28.73
4874.0	1000	H	1.00	0	53.09	47.76	0.69	33.31	7.16	46.49	74.00	27.51
2462.0	1000	V	1.10	271	89.54	47.07	10.09	28.26	5.22	86.04	-	-
2462.0	1000	H	1.22	275	84.72	47.07	10.09	28.26	5.22	81.22	-	-
2495.3	1000	V	1.10	271	-	47.07	10.09	28.26	5.22	56.87	74.00	13.13
2488.4	1000	H	1.22	275	-	47.07	10.09	28.26	5.22	56.37	74.00	13.63
4924.0	1000	V	1.00	0	53.09	47.76	0.69	33.31	7.16	46.49	74.00	27.51
4924.0	1000	H	1.00	0	52.60	47.76	0.69	33.31	7.16	46.00	74.00	28.00

Table 3: Measured values of the Field strength of spurious emission (Radiated) Operating 802.11n HT40

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Antenna Height [m]	Turn Table [degree]	Reading [dB(μV)]	Amp Gain [dB]	ATT [dB]	AF [dB(1/m)]	CL [dB]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-peak data, emissions below 1000 MHz												
270.95	120	V	2.18	46	47.95	26.44	0.0	12.02	1.88	35.41	46.00	10.59
270.95	120	H	1.27	141	40.53	26.44	0.0	12.02	1.88	27.99	46.00	18.01
655.93	120	V	1.63	277	36.96	27.51	0.0	20.01	2.64	32.10	46.00	13.90
655.93	120	H	2.20	252	34.57	27.51	0.0	20.01	2.64	29.71	46.00	16.29
960.06	120	V	1.58	34	39.59	26.96	0.0	23.76	3.11	39.50	54.00	14.50
960.06	120	H	1.00	309	42.26	26.96	0.0	23.76	3.11	42.17	54.00	11.83
AVERAGE data, emissions above 1000 MHz												
2422.0	1000	V	1.15	272	76.55	47.05	10.09	27.93	4.96	72.48	-	-
2422.0	1000	H	1.97	309	74.23	47.05	10.09	27.93	4.96	70.16	-	-
2342.3	1000	V	1.37	264	-	47.04	10.09	27.60	5.02	42.75	54.00	11.25
2341.9	1000	H	2.01	322	-	47.04	10.09	27.60	5.02	41.86	54.00	12.14
4844.0	1000	V	1.00	0	39.24	47.72	0.69	33.20	7.04	32.45	54.00	21.55
4844.0	1000	H	1.00	0	39.27	47.72	0.69	33.20	7.04	32.48	54.00	21.52
2437.0	1000	V	1.14	270	75.70	47.05	10.09	27.93	4.96	71.63	-	-
2437.0	1000	H	1.91	277	69.71	47.05	10.09	27.93	4.96	65.64	-	-
4874.0	1000	V	1.00	0	39.30	47.76	0.69	33.31	7.16	32.70	54.00	21.30
4874.0	1000	H	1.00	0	39.27	47.76	0.69	33.31	7.16	32.67	54.00	21.33
2452.0	1000	V	1.11	272	73.34	47.07	10.09	28.26	5.22	69.84	-	-
2452.0	1000	H	1.21	273	66.72	47.07	10.09	28.26	5.22	63.22	-	-
2483.6	1000	V	1.10	271	-	47.07	10.09	28.26	5.22	41.99	54.00	12.01
249.0.3	1000	H	1.22	275	-	47.07	10.09	28.26	5.22	41.52	54.00	12.48
4904.0	1000	V	1.00	0	39.28	47.76	0.69	33.31	7.16	32.68	54.00	21.32
4904.0	1000	H	1.00	0	39.24	47.76	0.69	33.31	7.16	32.64	54.00	21.36
PEAK data, emissions above 1000 MHz												
2422.0	1000	V	1.15	272	87.07	47.05	10.09	27.93	4.96	83.00	-	-
2422.0	1000	H	1.97	309	84.61	47.05	10.09	27.93	4.96	80.54	-	-
2342.4	1000	V	1.37	264	-	47.04	10.09	27.60	5.02	60.58	74.00	13.42
2345.3	1000	H	2.01	322	-	47.04	10.09	27.60	5.02	58.49	74.00	15.51
4844.0	1000	V	1.00	0	53.10	47.72	0.69	33.20	7.04	46.31	74.00	27.69
4844.0	1000	H	1.00	0	53.12	47.72	0.69	33.20	7.04	46.33	74.00	27.67
2437.0	1000	V	1.14	270	86.02	47.05	10.09	27.93	4.96	81.95	-	-
2437.0	1000	H	1.91	277	80.16	47.05	10.09	27.93	4.96	76.09	-	-
4874.0	1000	V	1.00	0	53.09	47.76	0.69	33.31	7.16	46.49	74.00	27.51
4874.0	1000	H	1.00	0	52.98	47.76	0.69	33.31	7.16	46.38	74.00	27.62
2452.0	1000	V	1.11	272	83.94	47.07	10.09	28.26	5.22	80.44	-	-
2452.0	1000	H	1.21	273	77.20	47.07	10.09	28.26	5.22	73.70	-	-
2487.8	1000	V	1.10	271	-	47.07	10.09	28.26	5.22	56.07	74.00	17.93
2484.7	1000	H	1.22	275	-	47.07	10.09	28.26	5.22	55.81	74.00	18.19
4904.0	1000	V	1.00	0	52.84	47.76	0.69	33.31	7.16	46.24	74.00	27.76
4904.0	1000	H	1.00	0	52.88	47.76	0.69	33.31	7.16	46.28	74.00	27.72

Margin (dB) = Limit – Actual

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

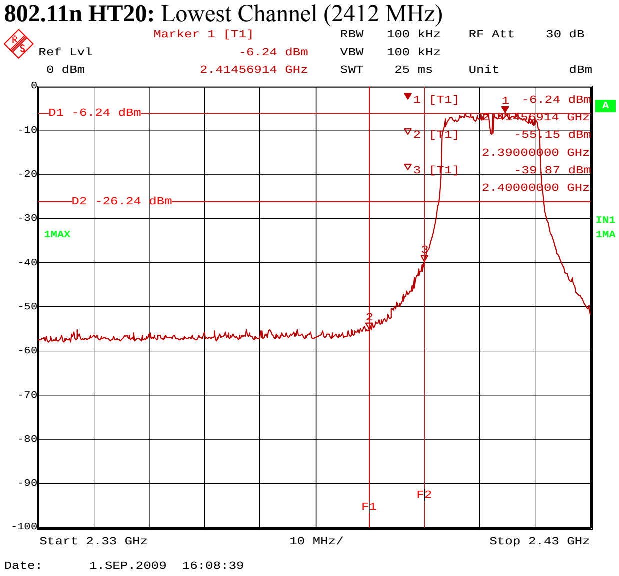
1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

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

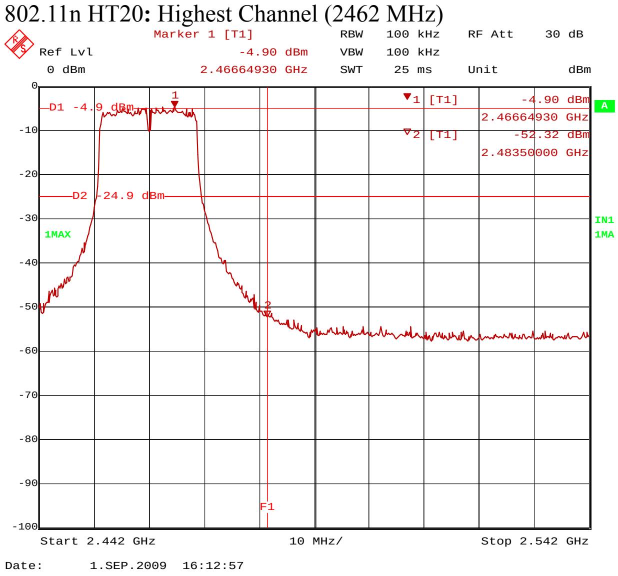
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Figure 3. Plot of the Band Edge (Conducted)

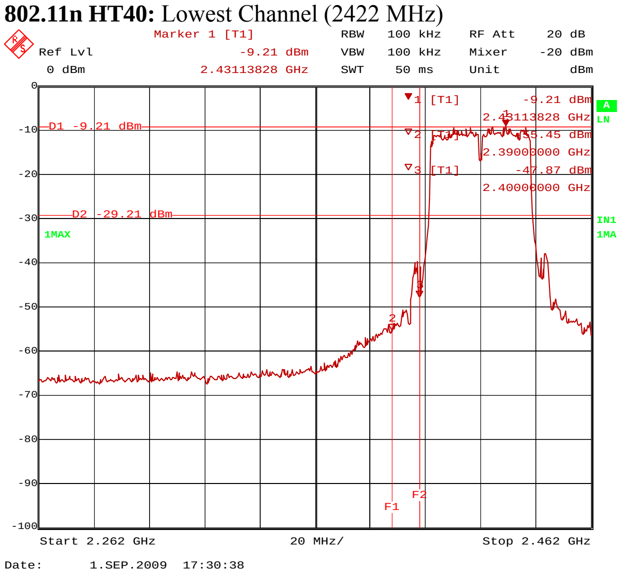
802.11n HT20: Lowest Channel (2412 MHz)



802.11n HT20**:** Highest Channel (2462 MHz)



802.11n HT40: Lowest Channel (2422 MHz)



802.11n HT40: Highest Channel (2452 MHz)

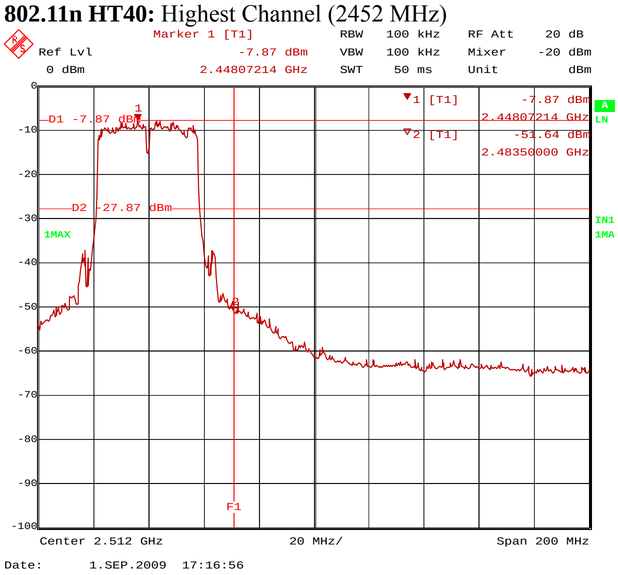
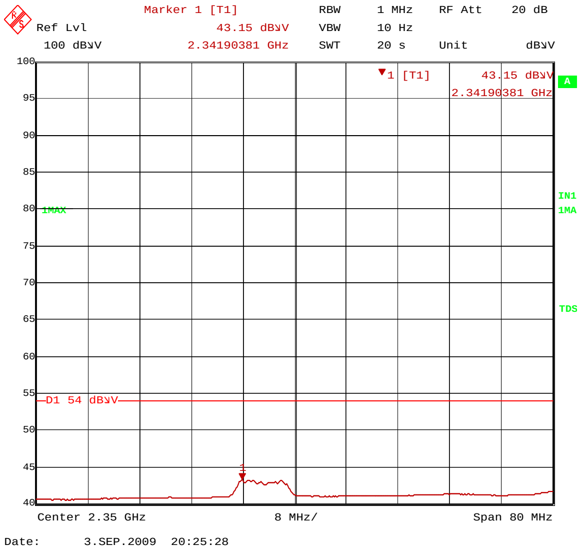
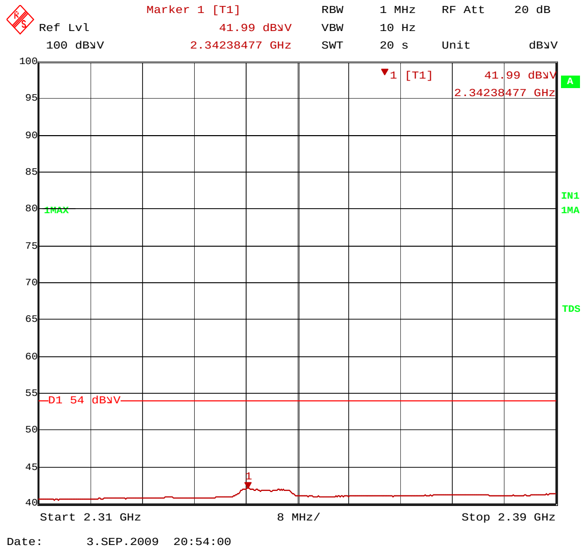


Figure 4. Plot of the Band Edge (Radiated)

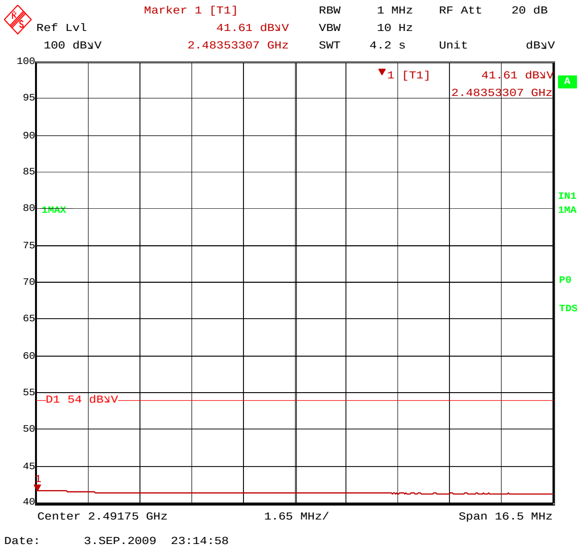
802.11n HT20: Lowest Channel (2412 MHz): AVERAGE
Vertical



802.11n HT20: Lowest Channel (2412 MHz): AVERAGE
Horizontal



802.11n HT20: Highest Channel (2462 MHz): AVERAGE
Vertical



802.11n HT20: Highest Channel (2462 MHz): AVERAGE
Horizontal

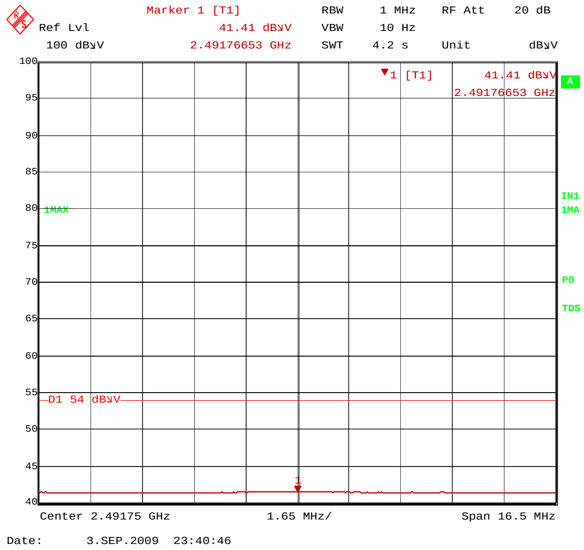
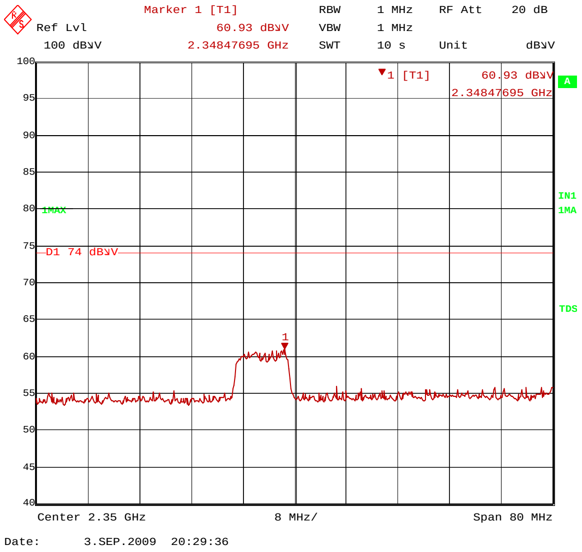
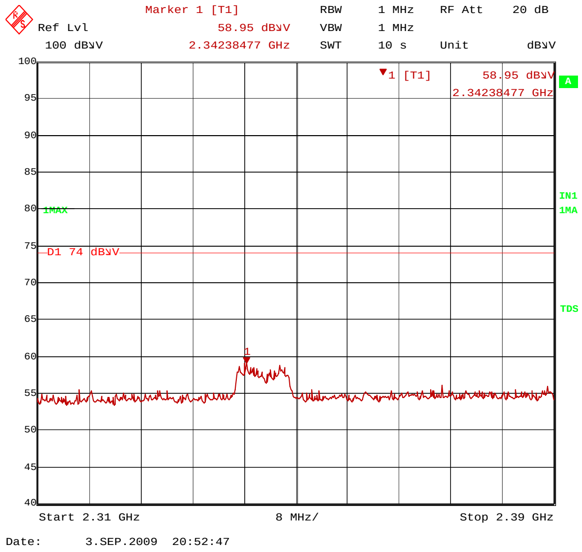


Figure 4. Plot of the Band Edge (Radiated) (cont.)

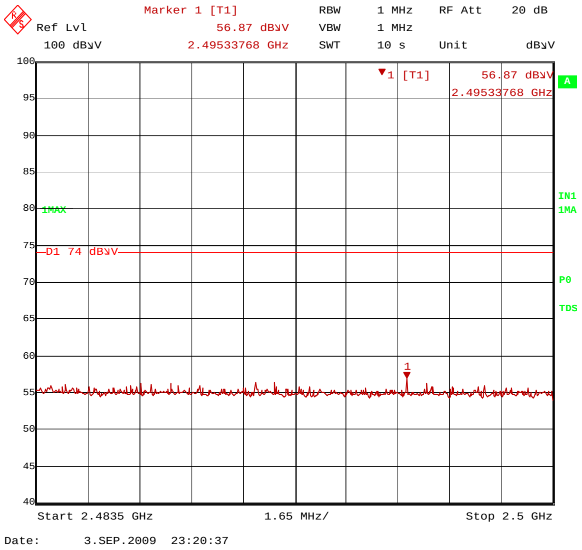
802.11n HT20: Lowest Channel (2412 MHz): PEAK
Vertical



802.11n HT20: Lowest Channel (2412 MHz): PEAK
Horizontal



802.11n HT20: Highest Channel (2462 MHz): PEAK
Vertical



802.11n HT20: Highest Channel (2462 MHz): PEAK
Horizontal

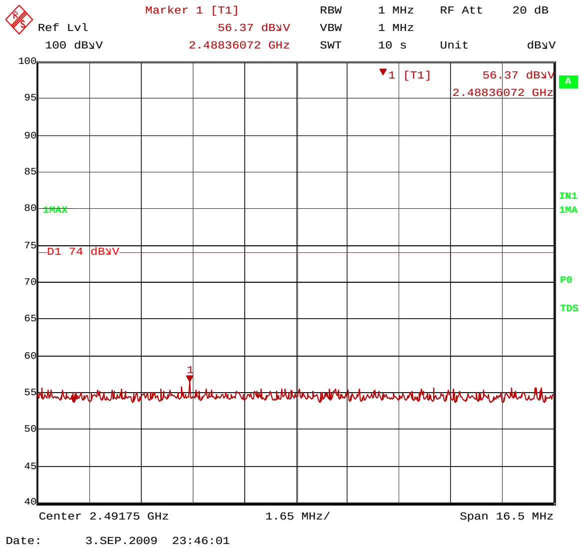
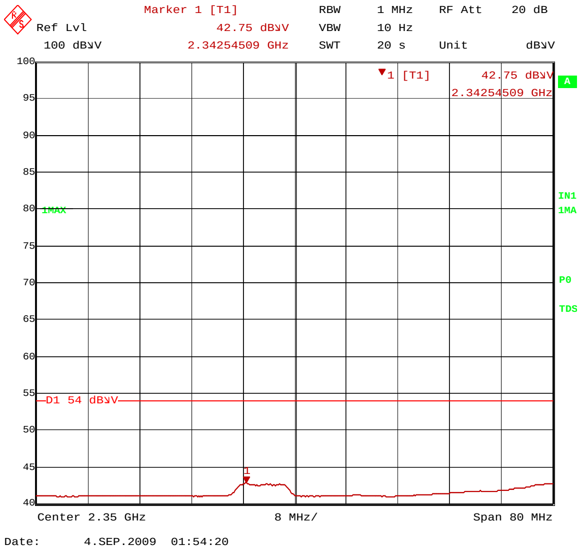
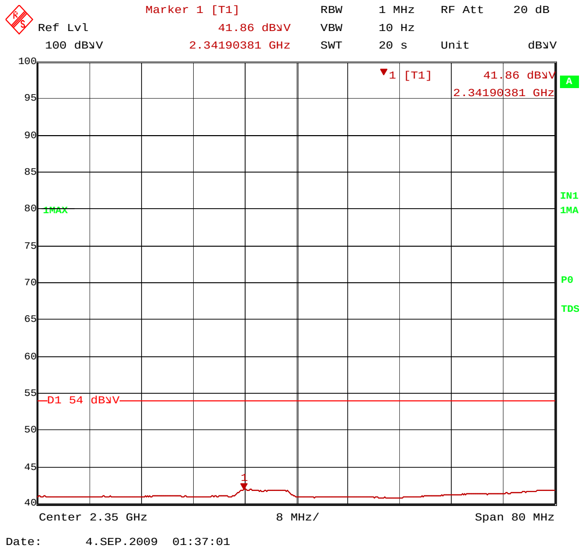


Figure 4. Plot of the Band Edge (Radiated) (cont.)

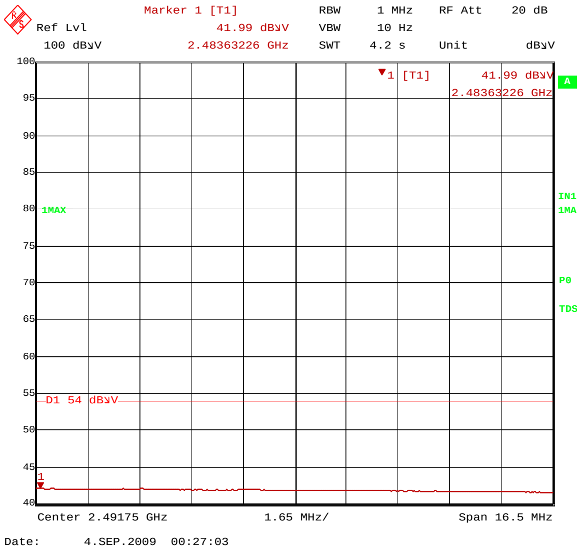
802.11n HT40: Lowest Channel (2422 MHz): AVERAGE
Vertical



802.11n HT40: Lowest Channel (2422 MHz): AVERAGE
Horizontal



802.11n HT40: Highest Channel (2452 MHz): AVERAGE
Vertical



802.11n HT40: Highest Channel (2452 MHz): AVERAGE
Horizontal

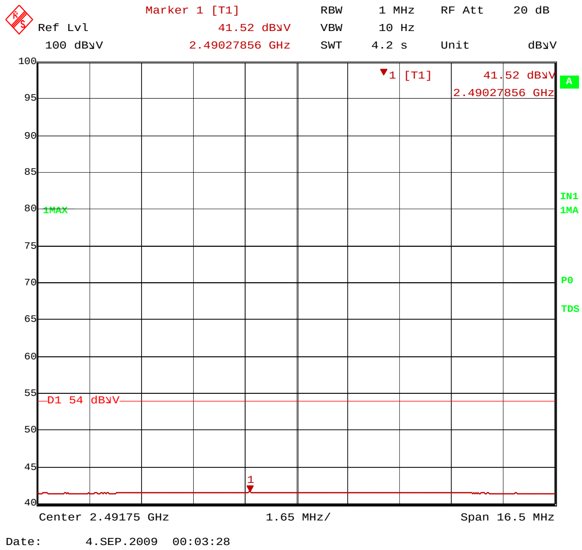
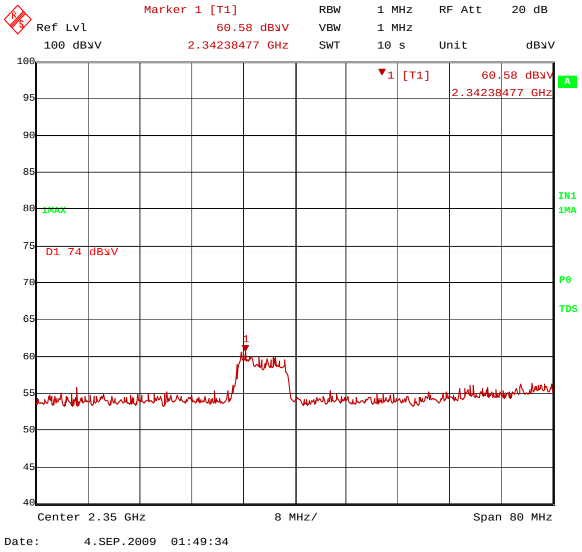
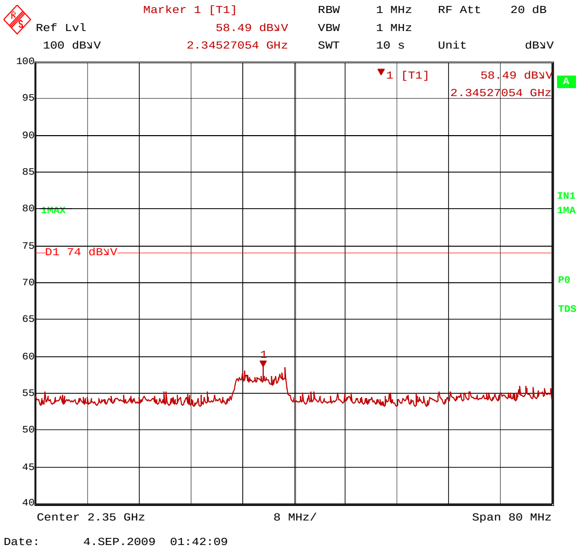


Figure 4. Plot of the Band Edge (Radiated) (cont.)

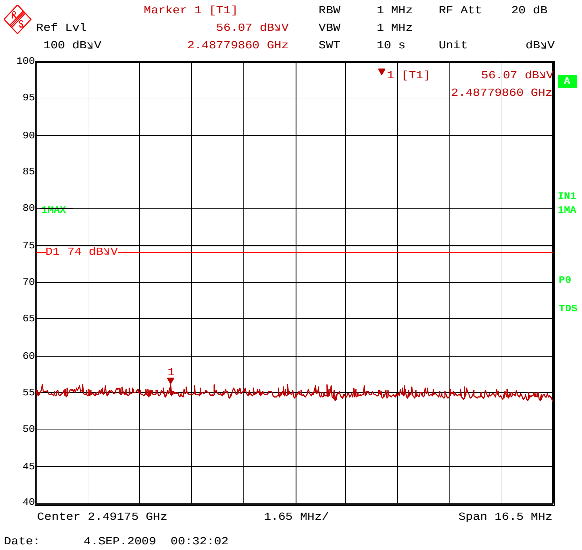
802.11n HT20: Lowest Channel (2422 MHz): PEAK
Vertical



802.11n HT20: Lowest Channel (2422 MHz): PEAK
Horizontal



802.11n HT20: Highest Channel (2452 MHz): PEAK
Vertical



802.11n HT20: Highest Channel (2452 MHz): PEAK
Horizontal

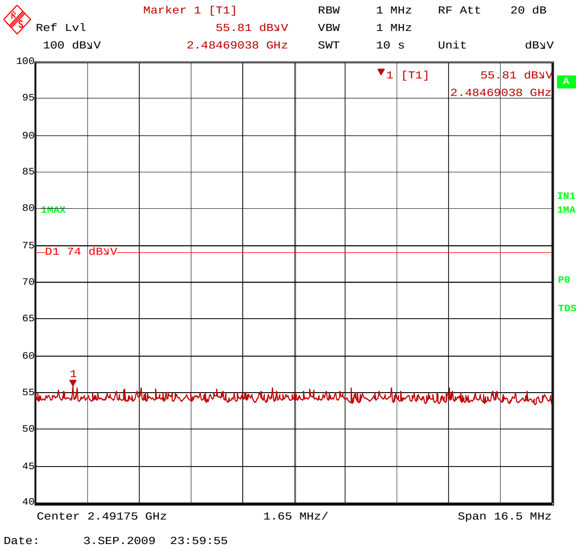
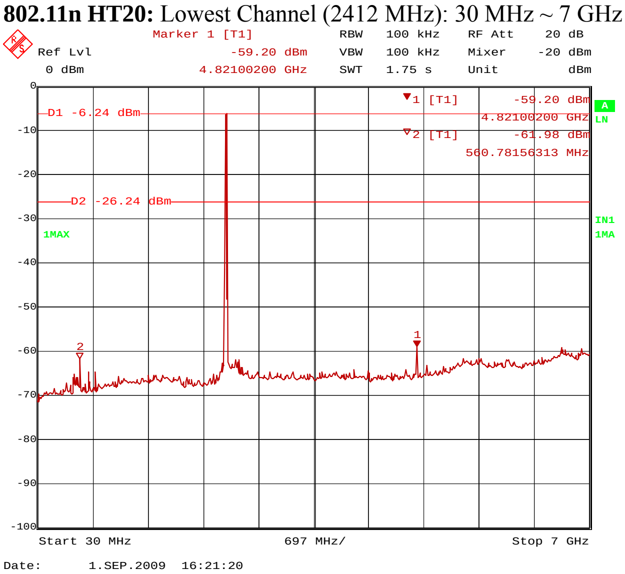
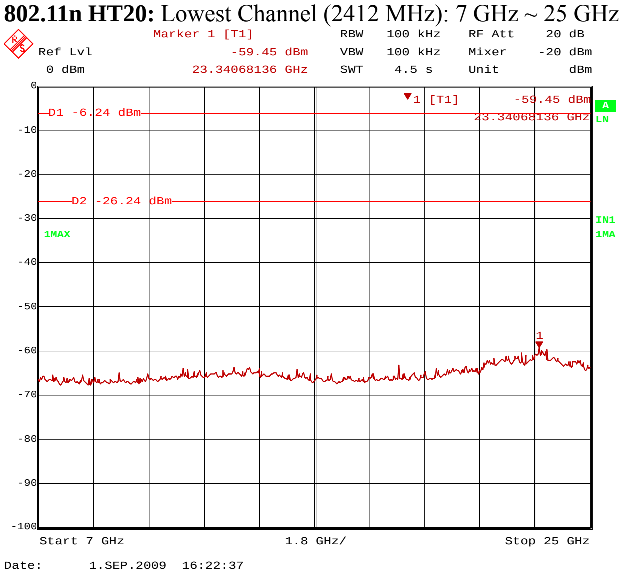


Figure 5. Spurious RF conducted emissions

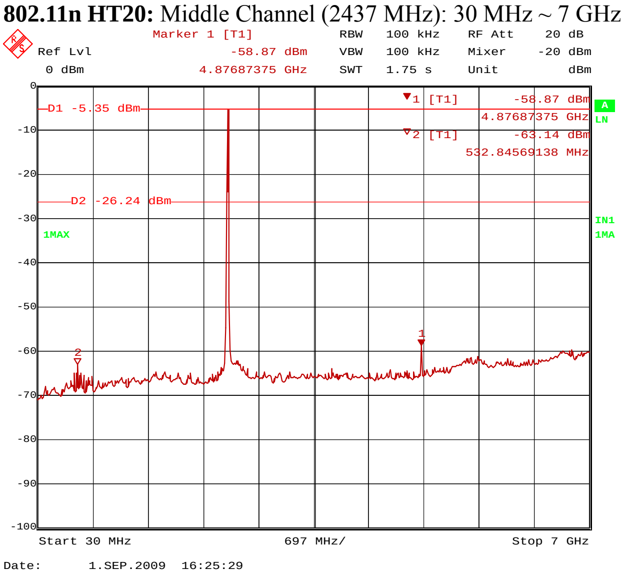
802.11n HT20: Lowest Channel (2412 MHz): 30 MHz ~ 7 GHz



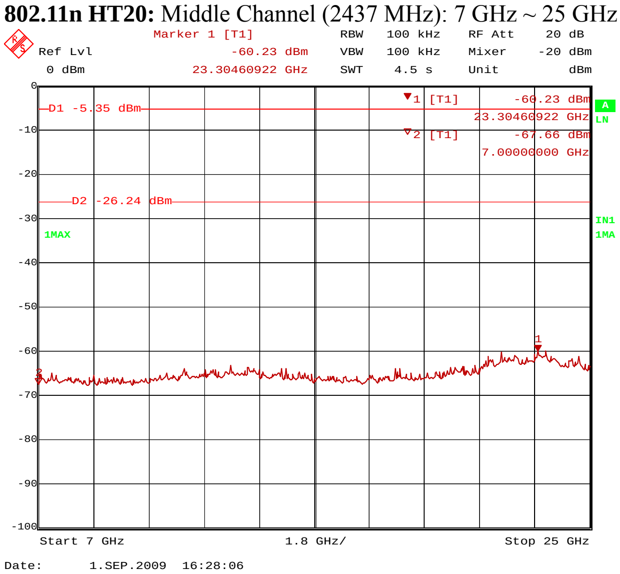
802.11n HT20: Lowest Channel (2412 MHz): 7 GHz ~ 25 GHz



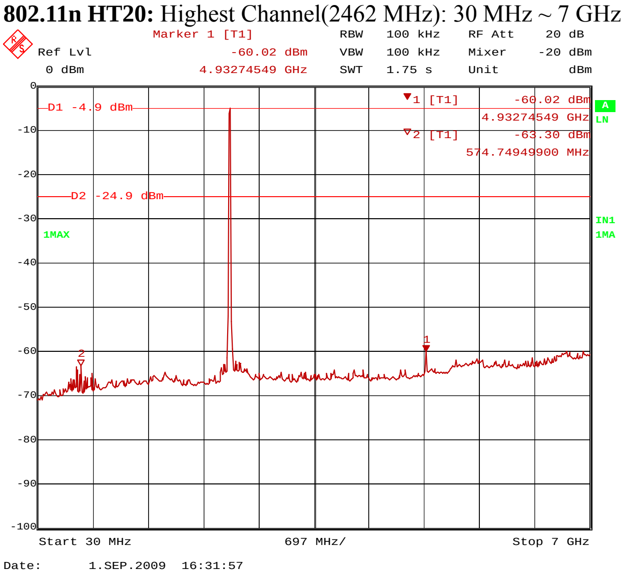
802.11n HT20: Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



802.11n HT20: Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



802.11n HT20: Highest Channel(2462 MHz): 30 MHz ~ 7 GHz



802.11n HT20: Highest Channel (2462 MHz): 7 GHz ~ 25 GHz

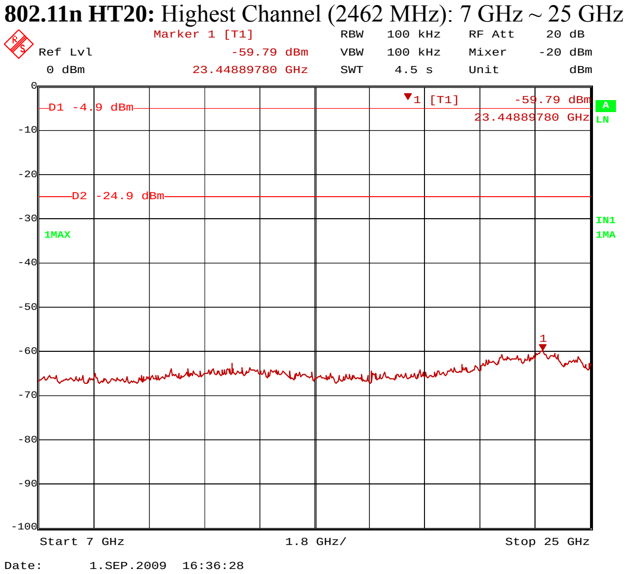
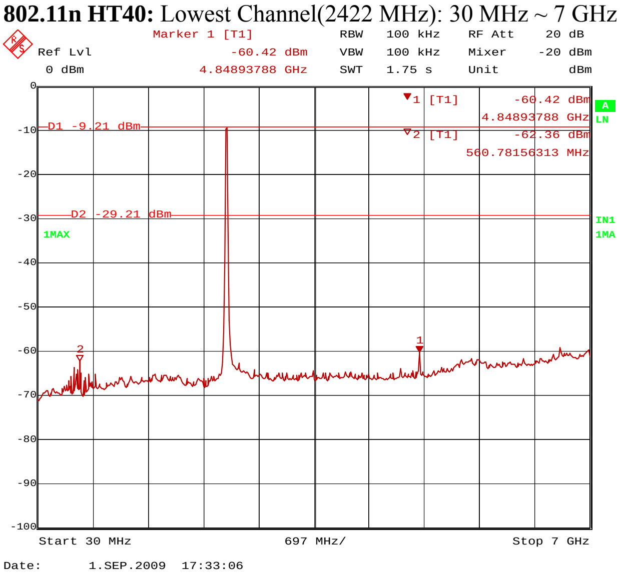
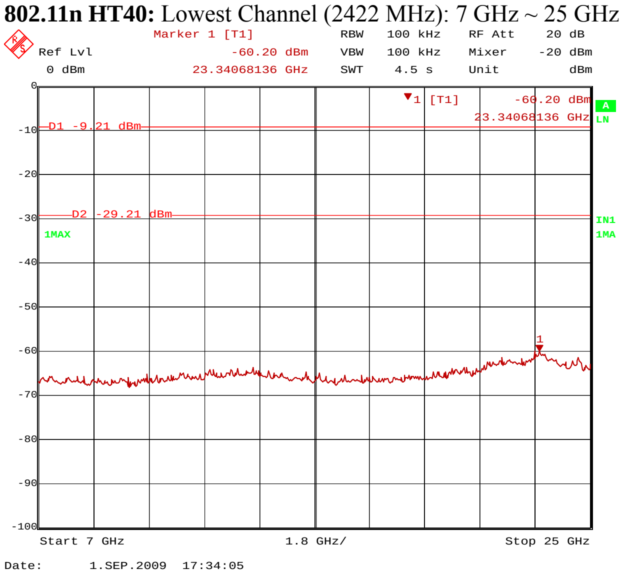


Figure 5. Spurious RF conducted emissions (cont.)

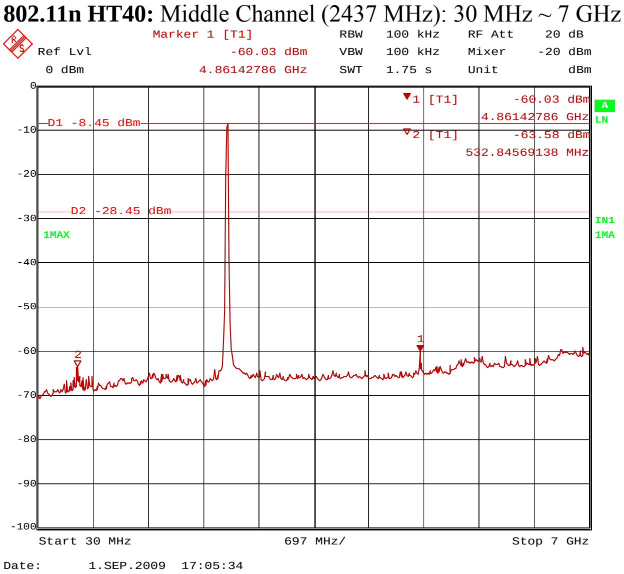
802.11n HT40: Lowest Channel(2422 MHz): 30 MHz ~ 7 GHz



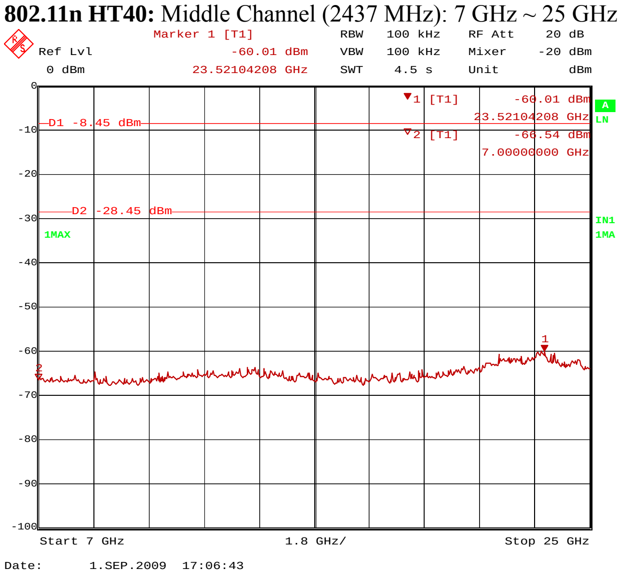
802.11n HT40: Lowest Channel (2422 MHz): 7 GHz ~ 25 GHz



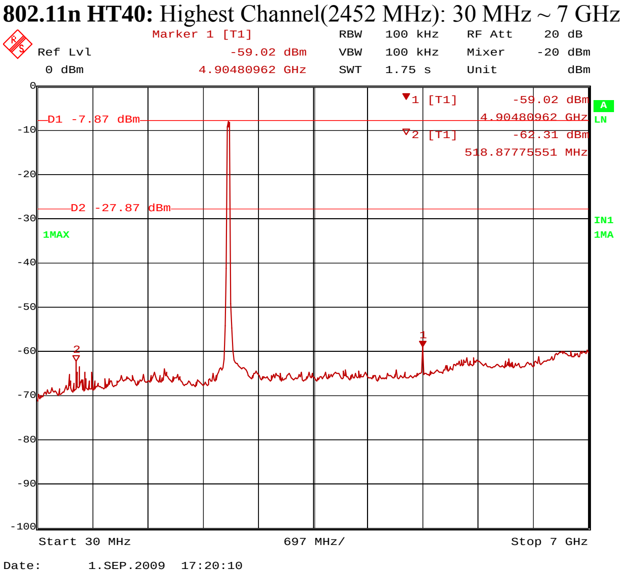
802.11n HT40: Middle Channel (2437 MHz): 30 MHz ~ 7 GHz



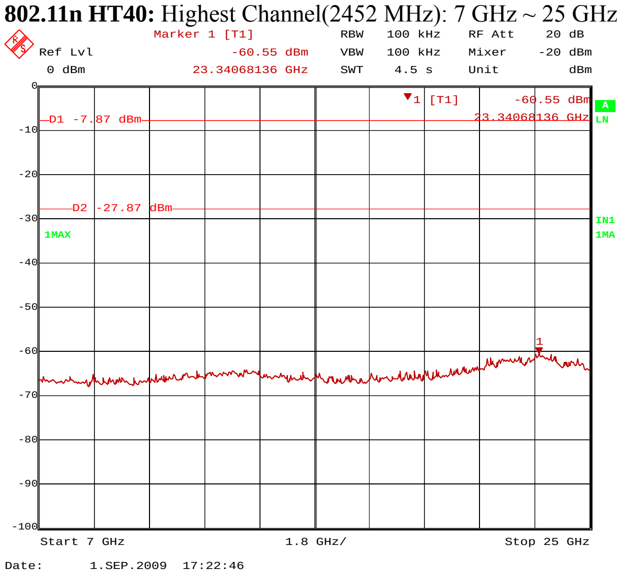
802.11n HT40: Middle Channel (2437 MHz): 7 GHz ~ 25 GHz



802.11n HT40: Highest Channel(2452 MHz): 30 MHz ~ 7 GHz



802.11n HT40: Highest Channel(2452 MHz): 7 GHz ~ 25 GHz



5.5 PEAK POWER SPECTRAL DENSITY

5.5.1 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.

5.5.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable and attenuator.
3. Turn on the EUT and locate and zoom in on emission peak(s) within the passband.
4. Set the spectrum analyzer as follows:
   RBW = 3 kHz, VBW ≥ RBW
   Span = 1.5 MHz
   Sweep = 500 seconds
   Detector function = peak
   Trace = max hold
5. Measure the highest amplitude appearing on spectral display and record the level to calculate results.

5.5.3 Test Results: PASS

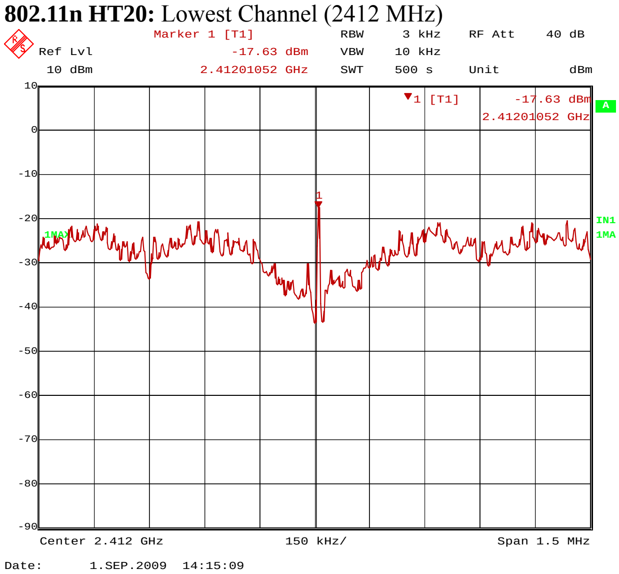
Table 4: Measured values of the Peak Power Spectral Density (Conducted)

Modulation	Operating frequency	Transfer Rate	Reading (PPSD)	Cable Loss	Actual	Limit
802.11n HT20	2412 MHz	MCS 0~7	-17.63 dBm	1.10 dB	-16.53 dBm	8.0 dBm
	2437 MHz	MCS 0~7	-16.99 dBm	1.14 dB	-15.85 dBm	8.0 dBm
	2462 MHz	MCS 0~7	-16.09 dBm	1.15 dB	-14.94 dBm	8.0 dBm
802.11n HT40	2422 MHz	MCS 0~7	-17.39 dBm	1.10 dB	-16.29 dBm	8.0 dBm
	2437 MHz	MCS 0~7	-17.00 dBm	1.14 dB	-15.86 dBm	8.0 dBm
	2452 MHz	MCS 0~7	-16.12 dBm	1.15 dB	-14.97 dBm	8.0 dBm

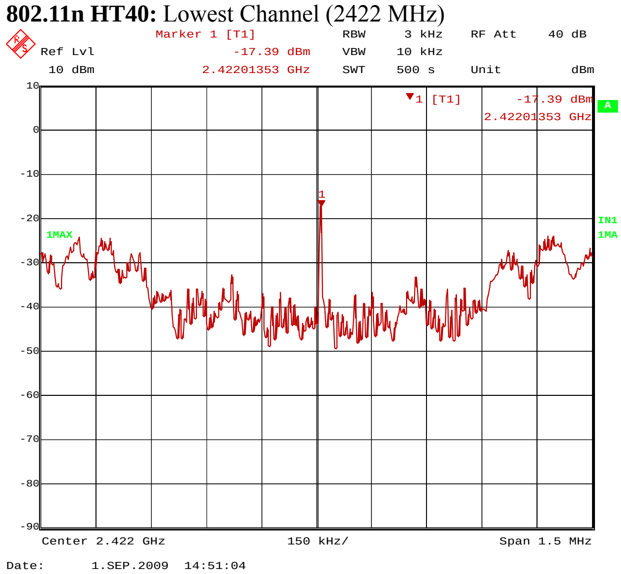
Actual = Reading – Cable Loss

Figure 6. Plot of the Peak Power Spectral Density (Conducted)

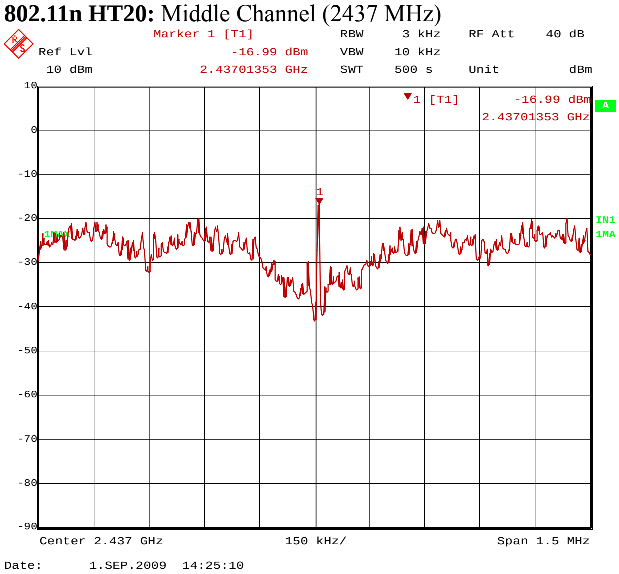
802.11n HT20: Lowest Channel (2412 MHz)



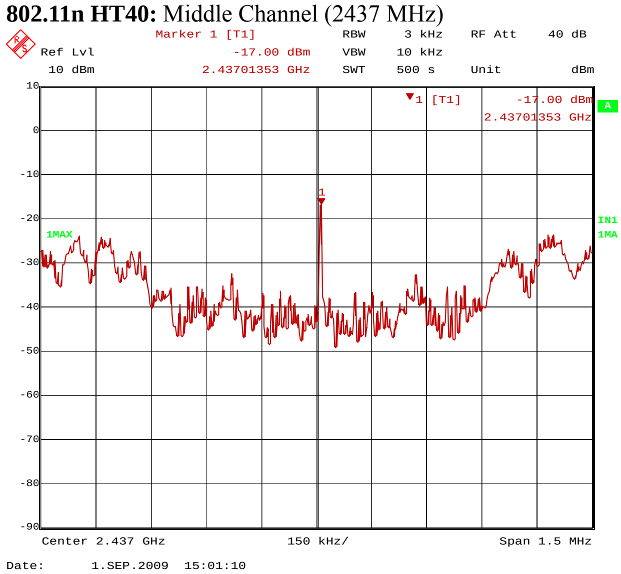
802.11n HT40: Lowest Channel (2422 MHz)



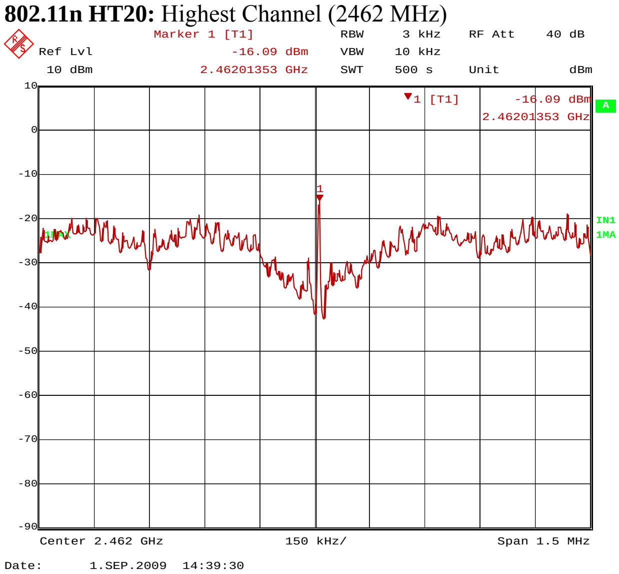
802.11n HT20: Middle Channel (2437 MHz)



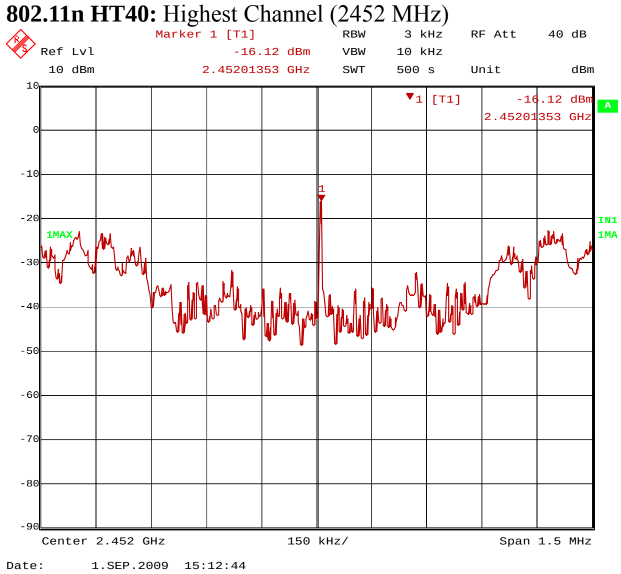
802.11n HT40: Middle Channel (2437 MHz)



802.11n HT20: Highest Channel (2462 MHz)



802.11n HT40: Highest Channel (2452 MHz)



5.6 AC POWER LINE CONDUCTED EMISSIONS

5.6.1 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.

5.6.2 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.

5.6.3 Test Results: PASS

Table 5: Measured values of the AC Power Line Conducted Emissions Operating 802.11n HT20

Frequency [MHz]	Reading [dBµV]	L / N	CF [dB]	CL [dB]	Actual [dBµV]	Limit [dBµV]	Margin [dB]
QUASI-PEAK DATA							
0.199	53.73	L	0.29	0.05	54.07	63.65	9.58
0.267	44.78	L	0.28	0.05	45.11	61.23	16.12
0.333	37.81	L	0.27	0.05	38.14	59.37	21.23
0.400	39.88	L	0.26	0.06	40.20	57.84	17.64
0.468	38.23	L	0.25	0.06	38.54	56.55	18.01
4.429	37.27	L	0.59	0.17	38.03	56.00	17.97
6.575	37.47	L	0.67	0.20	38.33	60.00	21.67
15.699	37.07	N	0.95	0.30	38.32	60.00	21.68
AVERAGE DATA							
0.199	40.64	L	0.29	0.05	40.98	53.65	12.67
0.267	31.50	L	0.28	0.05	31.83	51.23	19.40
0.333	27.44	L	0.27	0.05	27.76	49.37	21.61
0.400	32.91	L	0.26	0.06	33.23	47.84	14.61
0.468	30.37	L	0.25	0.06	30.68	46.55	15.87
4.429	29.30	L	0.59	0.17	30.06	46.00	15.94
6.575	28.49	L	0.67	0.20	29.36	50.00	20.64
15.699	29.54	N	0.95	0.30	30.79	50.00	19.21

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.

Table 5: Measured values of the AC Power Line Conducted Emissions (cont.)
Operating 802.11n HT40

Frequency [MHz]	Reading [dBμV]	L / N	CF [dB]	CL [dB]	Actual [dBμV]	Limit [dBμV]	Margin [dB]
QUASI-PEAK DATA							
0.199	53.79	L	0.29	0.05	54.13	63.65	9.52
0.267	44.84	L	0.28	0.05	45.17	61.23	16.06
0.333	37.89	L	0.27	0.05	38.22	59.37	21.15
0.402	39.78	L	0.26	0.06	40.10	57.81	17.71
0.468	38.44	L	0.25	0.06	38.75	56.55	17.80
6.575	37.23	L	0.67	0.20	37.23	60.00	22.77
15.636	37.45	N	0.95	0.30	37.45	60.00	22.55
15.699	36.77	L	0.95	0.30	38.02	60.00	21.98
AVERAGE DATA							
0.199	40.71	L	0.29	0.05	41.05	53.65	12.60
0.267	31.55	L	0.28	0.05	31.88	51.23	19.35
0.333	27.49	L	0.27	0.05	27.81	49.37	21.56
0.402	32.57	L	0.26	0.06	32.89	47.81	14.92
0.468	30.48	L	0.25	0.06	30.79	46.55	15.76
6.575	28.75	L	0.67	0.20	29.62	50.00	20.38
15.636	30.33	N	0.95	0.30	31.58	50.00	18.42
15.699	30.38	L	0.95	0.30	31.63	50.00	18.37

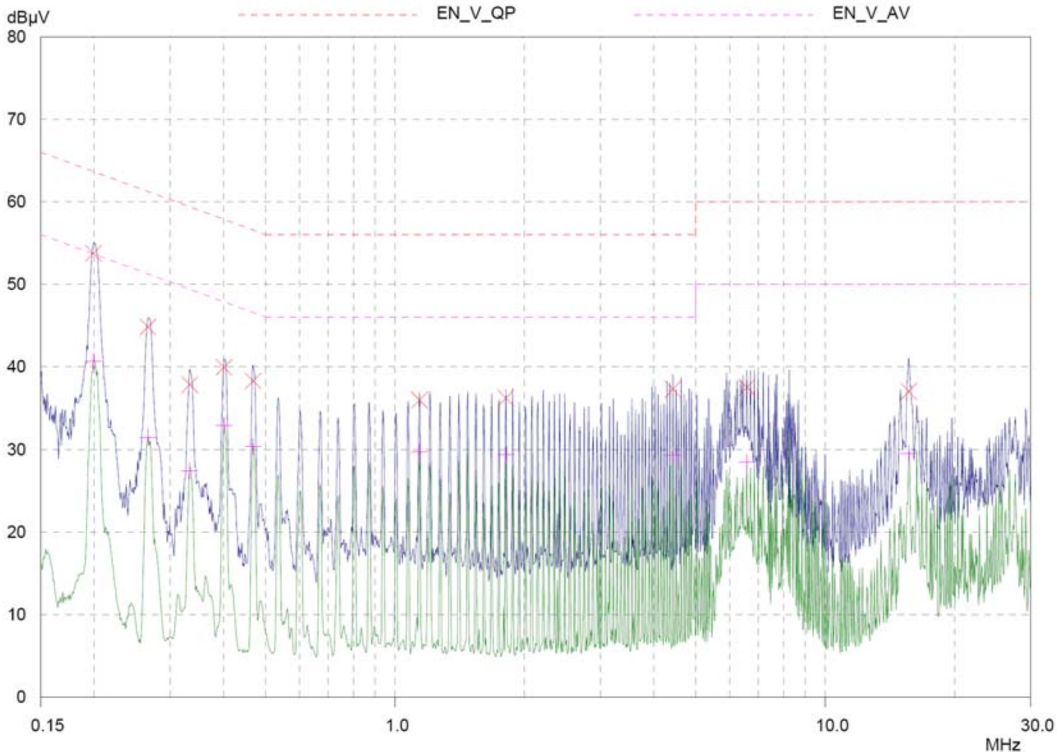
Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

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 7. Plot of the AC Power Line Conducted Emissions

Operating 802.11n HT20

Line – PE(Peak and Average detector used)



Neutral – PE(Peak and Average detector used)

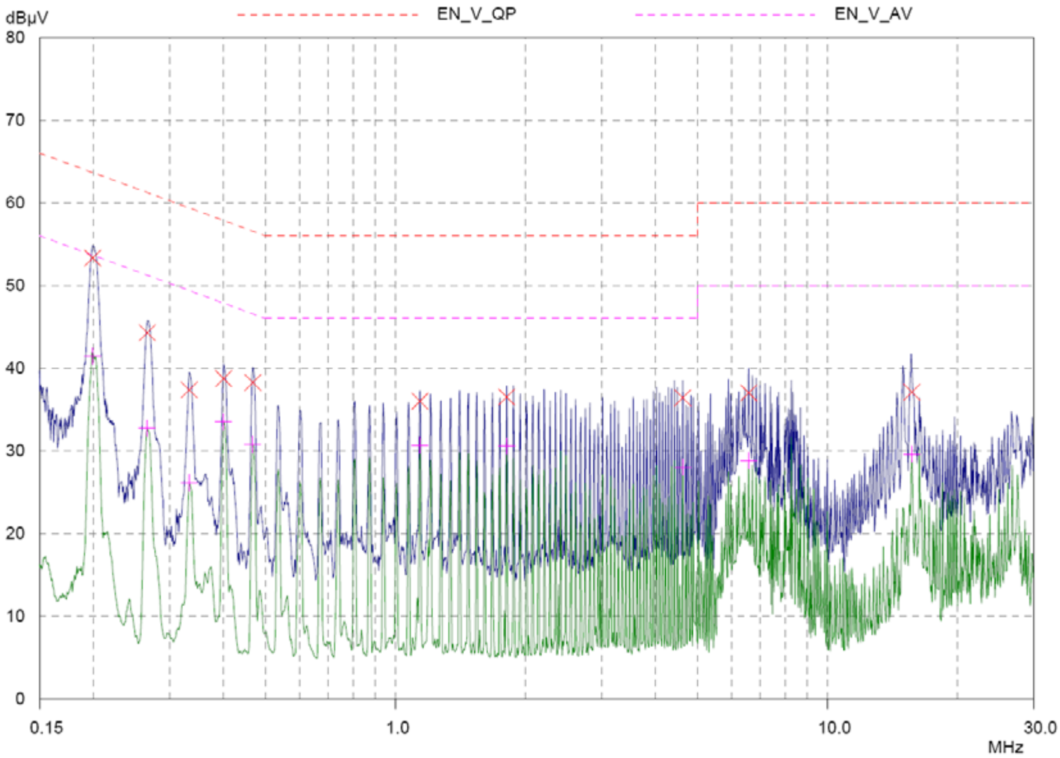
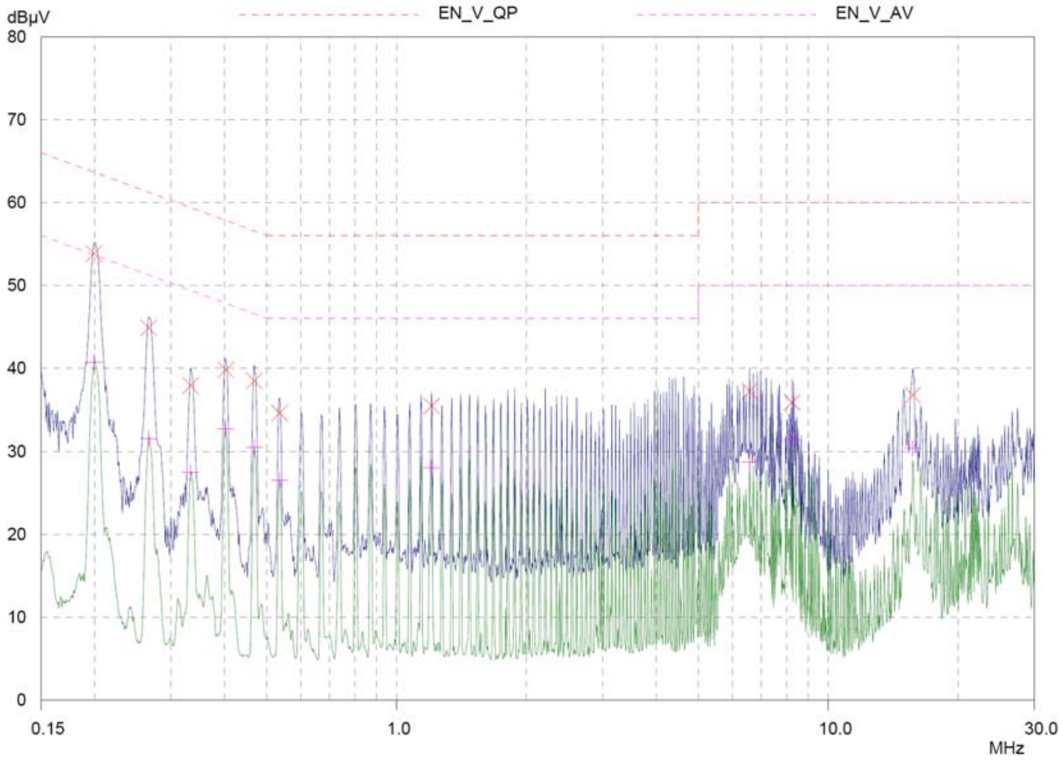


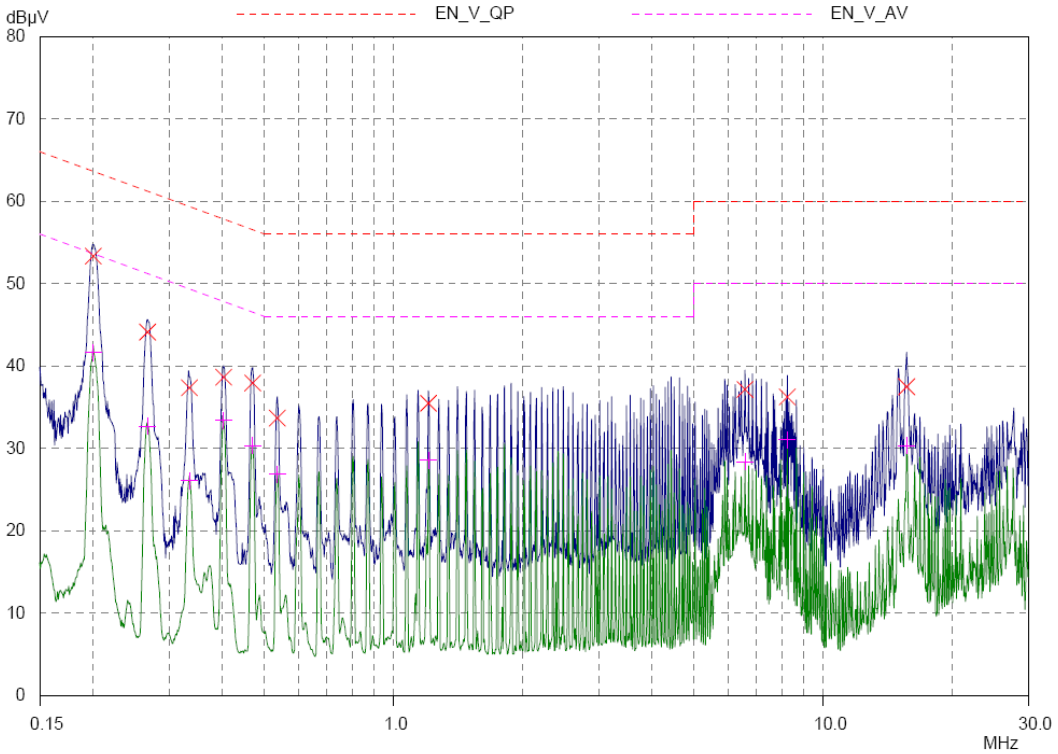
Figure 7. Plot of the AC Power Line Conducted Emissions (cont.)

Operating 802.11n HT40

Line – PE(Peak and Average detector used)



Neutral – PE(Peak and Average detector used)



5.7 RF Exposure

5.7.1 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 = 54 [mW](= 17.34 dBm) & Antenna gain =0.87 (= -0.62 [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]
54 mW, at 20 cm from the antenna -0.62 [dBi]	$S = PG/4\pi R^2 = 0.0093$ [mW/cm^2] < 1.0 [mW/cm^2]
54 mW, at 2.5 cm from the antenna -0.62 [dBi]	$S = PG/4\pi R^2 = 0.5982$ [mW/cm^2]

5.7.2 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: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter."