SK TECH CO., LTD.

TEST REPORT

Test Report No.:	**SKTRFC-110125-003**		
Applicant:	**Aircell BA Services, LLC**		
Applicant Address:	303 S. Technology Ct., Bldg A, Broomfield CO, 80021, United States		
Manufacturer:	**NetCodec Co., Ltd.**		
Manufacturer Address:	408 IT Venture Town, 694 Tamnip-dong, Yusung-gu, Daejeon, 305-510 South Korea		
Device Under Test:	**WiFi SIP Handset**		
FCC ID:	**Y7A- SIPWFHS**	**Model Name:**	**SIPWFHS**
Brand/Trade Name:	-		
Receipt No.:	SKTEU10-1306	**Date of receipt:**	December 17, 2010
Date of Issue:	January 25, 2011		
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, 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*

January 25, 2011

Signature *Date*

Approved by: *Jongsoo Yoon*

January 25, 2011

Signature *Date*

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

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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 5429A-1)

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	2011.05	
2	Spectrum Analyzer	Agilent	E4440A	MY46186322	2011.05	
3	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2011.03	☒
4	EMI Test Receiver	Rohde&Schwarz	ESIB40	100277	2011.03	☒
5	EMI Test Receiver	Rohde&Schwarz	ESHS10	862970/019	2011.07	
6	Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	836679/018	2011.07	
7	Pre-amplifier	HP	8447F	3113A05153	2011.07	☒
8	Pre-amplifier	MITEQ	AFS44	1116321	2010.12	
9	Pre-amplifier	MITEQ	AFS44	1116322	2011.07	☒
10	Power Meter	Agilent	E4417A	MY45100426	2011.07	☒
11	Power Meter	Agilent	E4418B	US39402176	2011.07	
12	Power Sensor	Agilent	E9327A	MY44420696	2011.07	☒
13	Power Sensor	Agilent	8482A	MY41094094	2011.07	
14	Attenuator (10dB)	HP	8491B	38067	2011.07	☒
15	Attenuator (20dB)	Weinschel	44	AH6967	2011.07	
16	High Pass Filter	Wainwright	WHKX3.0/18G	8	2011.07	☒
17	VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	2011.05	
18	UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 990	2011.05	
19	Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	2011.11	☒
20	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	230	2011.07	☒
21	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	189	2011.05	
22	Horn Antenna	AH Systems	SAS-200/571	304	N/A	
23	Horn Antenna	EMCO	3115	00040723	2011.04	☒
24	Horn Antenna	EMCO	3115	00056768	2010.09	
25	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170318	2013.09	☒
26	Vector Signal Generator	Agilent	E4438C	MY42080359	2011.08	
27	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2011.07	
28	DC Power Supply	HP	6633A	3448A032223	2011.08	
29	DC Power Supply	HP	6268B	2542A-07856	2011.07	
30	Temperature/Humidity Chamber	DAEJIN	DJ-THC02	06071	2011.03	
31	Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	2011.07	☒

2.3 Test Date

Date of Test: January 7, 2011 ~ January 14, 2011

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 4.8 V(Nickel-metal hydride battery)
Local Oscillator or X-Tal	X-Tal: 32.768 kHz , 40 MHz
Transmit Frequency	IEEE 802 11b: 2412 MHz ~ 2462 MHz (11 channels, 5 MHz step) IEEE 802 11g: 2412 MHz ~ 2462 MHz (11 channels, 5 MHz step)
Antenna Type	Integral (chip antenna, Declared PEAK Gain: -1.89 dBi)
Type of Modulation	IEEE 802.11b: DSSS (DBPSK, DQPSK, CCK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)
RF Output power	12.96 dBm PEAK (measured)
External Ports	DC Input for charging the intenal battery.

3.2 Equipment Modifications

None

3.3 Submitted Documents

Block diagram

Schematic diagram

Antenna Specification

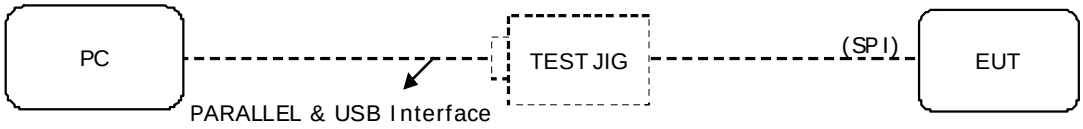
Part List

User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The measurements were taken in continuous transmitting/receiving mode provided by the applicant. 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]

Test software used: wlangui.exe, ver 1.0.0.1, RF power setting: 0a90

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	S/N
PC **	SAMSUNG	DM-V750	371F97BA100188D
TEST JIG **	NetCodec Co., Ltd.	-	-

** For control of the RF module via SPI and UART interface in the EUT.

4.3 Type of Used Cables

#	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
1	EUT	SPI	TEST JIG	SPI	0.1	NO
2	TEST JIG	PARALLEL	PC	LPT	1.5	NO
3	TEST JIG	USB	PC	USB	0.3	NO
4	PC	AC Input	AC mains	-	0.8	NO

4.4 Uncertainty

Measurement Item	Combined Standard Uncertainty *Uc*	Expanded Uncertainty $U = k \times Uc$ ($k = 1.96$)
Conducted RF power	± 0.71 dB	± 1.40 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)	N/A	N/A**
RF Exposure	15.247(i), 1.1307(b)(1)	5.6	PASS

**The EUT is powered from the internal battery. The cradle for charging the battery is also powered from DC voltage.

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 chip antenna. The directional gain of the antenna is -1.89 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

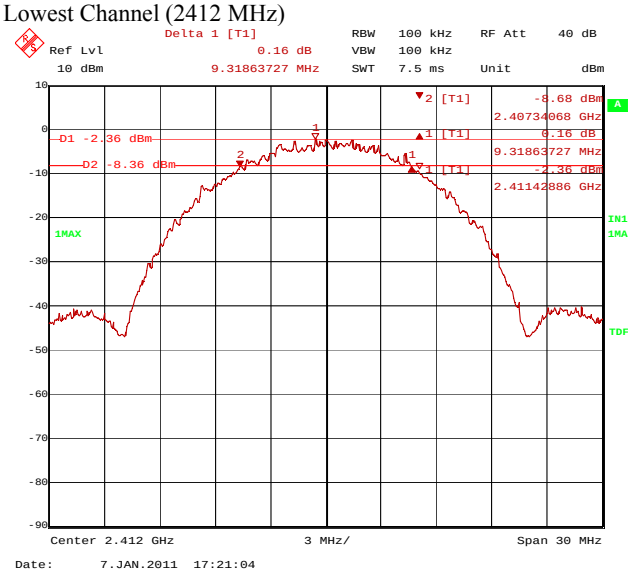
Table 1: Measured values of the 6dB Bandwidth

Modulation	Operating frequency	Transfer Rate	Occupied Bandwidth (99%)	6dB Bandwidth	Limit
802.11b	2412 MHz	11 Mbps	14.31 MHz	9.32 MHz	≥ 500 kHz
	2437 MHz	11 Mbps	14.25 MHz	9.31 MHz	≥ 500 kHz
	2462 MHz	11 Mbps	14.25 MHz	9.31 MHz	≥ 500 kHz
802.11g	2412 MHz	54 Mbps	16.41 MHz	16.26 MHz	≥ 500 kHz
	2437 MHz	54 Mbps	16.41 MHz	16.26 MHz	≥ 500 kHz
	2462 MHz	54 Mbps	16.35 MHz	16.26 MHz	≥ 500 kHz

Figure 1. Plot of the 6dB Bandwidth *(continued)*

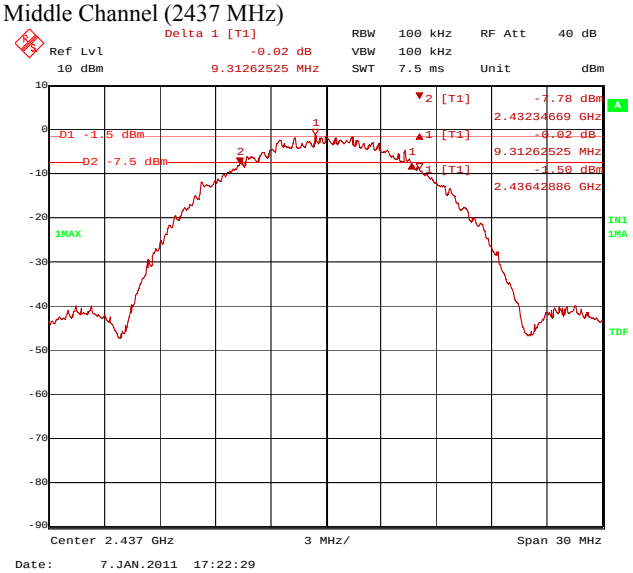
802.11b mode:

Lowest Channel (2412 MHz)



Date: 7.JAN.2011 17:21:04

Middle Channel (2437 MHz)



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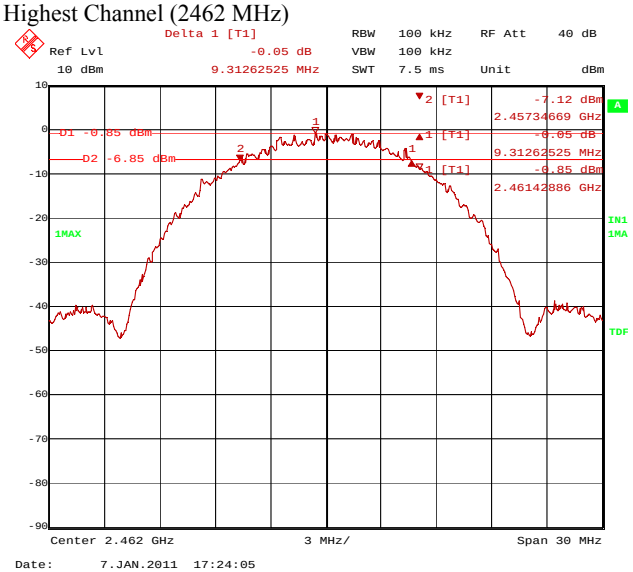
Highest Channel (2462 MHz)



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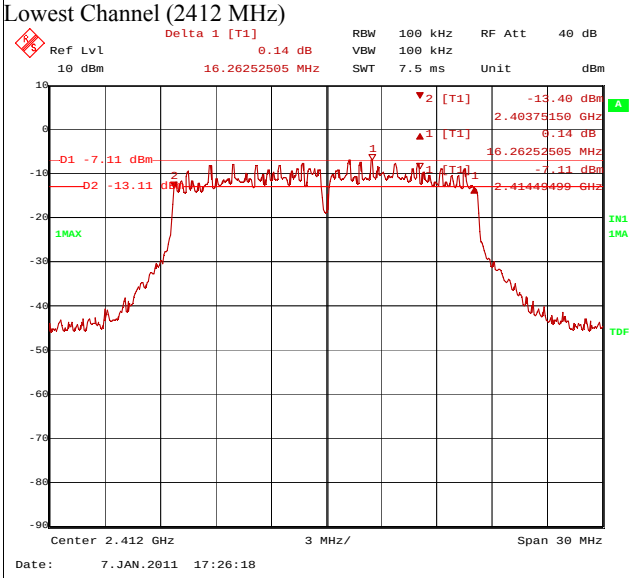
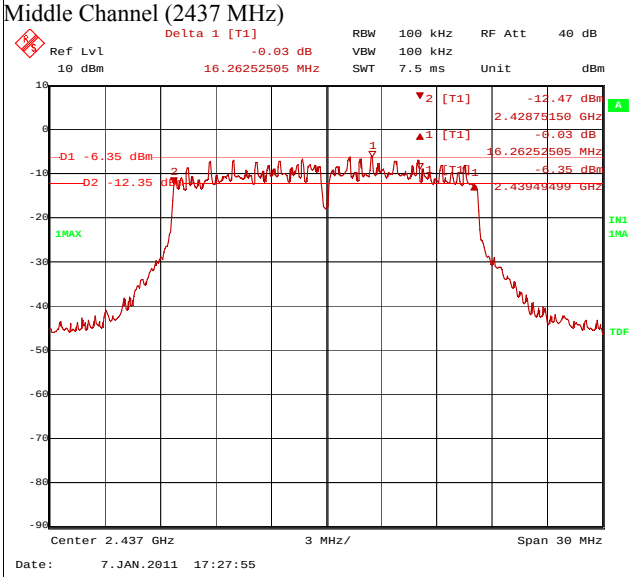
802.11g mode:

Lowest Channel (2412 MHz)



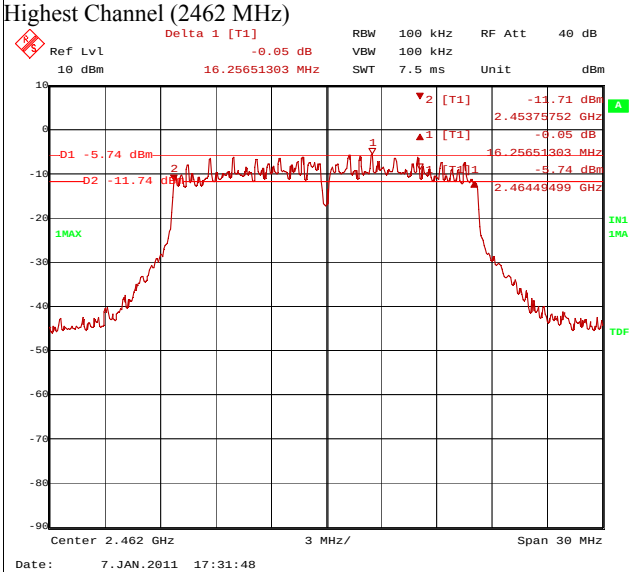
Date: 7.JAN.2011 17:26:18

Middle Channel (2437 MHz)



Date: 7.JAN.2011 17:27:55

Highest Channel (2462 MHz)

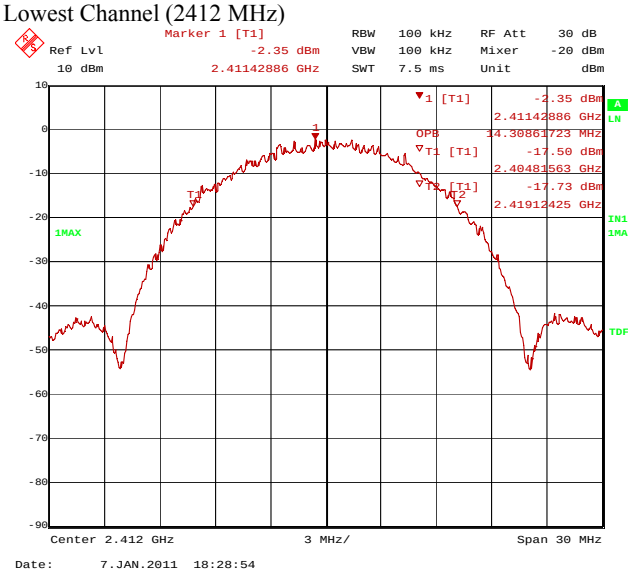


Date: 7.JAN.2011 17:31:48

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

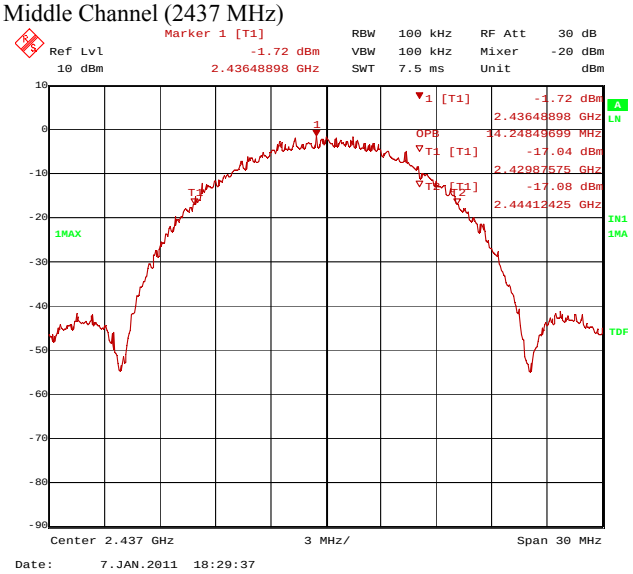
802.11b mode:

Lowest Channel (2412 MHz)



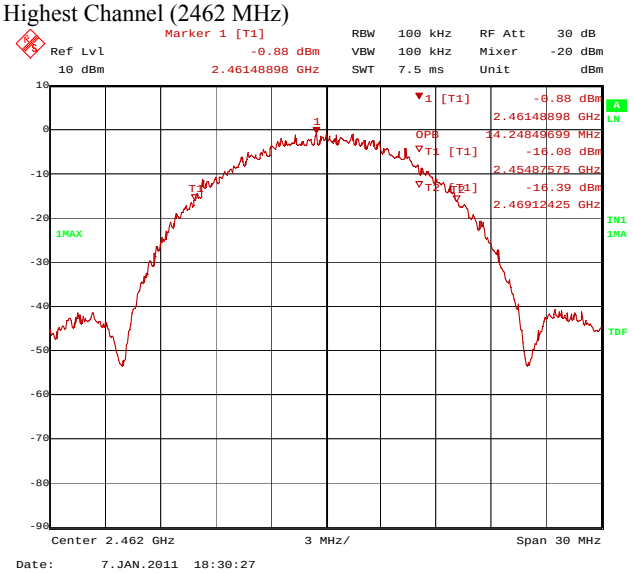
Date: 7.JAN.2011 18:28:54

Middle Channel (2437 MHz)



Date: 7.JAN.2011 18:29:37

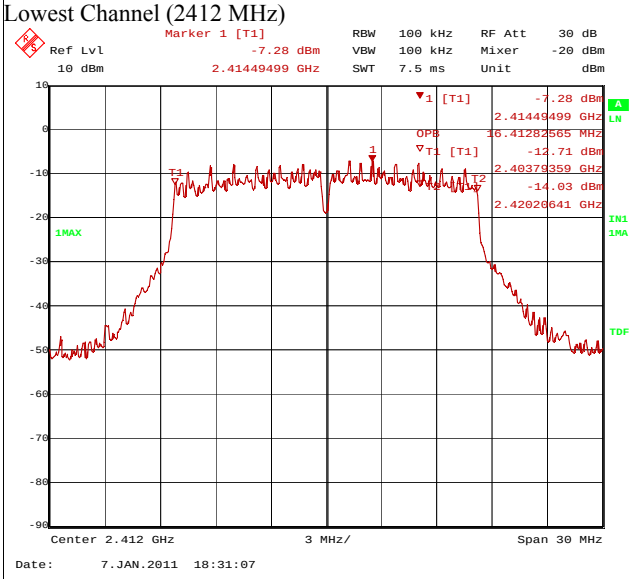
Highest Channel (2462 MHz)



Date: 7.JAN.2011 18:30:27

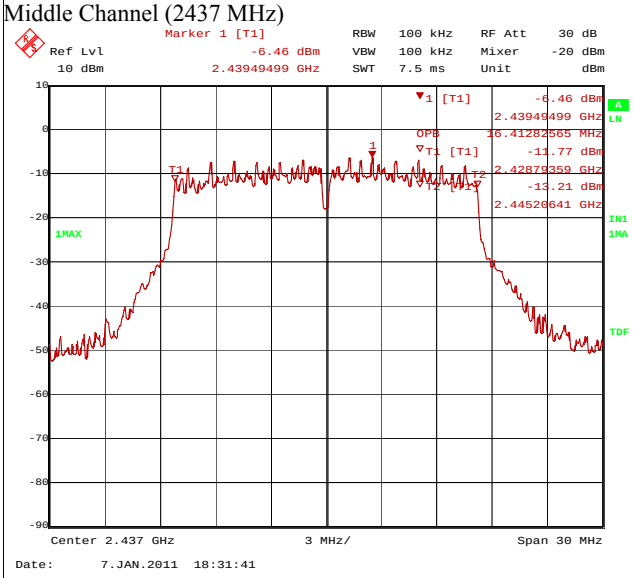
802.11g mode:

Lowest Channel (2412 MHz)



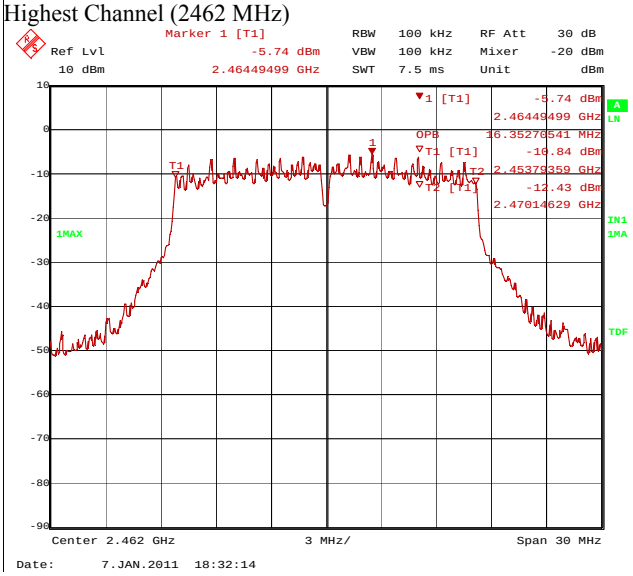
Date: 7.JAN.2011 18:31:07

Middle Channel (2437 MHz)



Date: 7.JAN.2011 18:31:41

Highest Channel (2462 MHz)



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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]	
802.11b	2412 MHz	11 Mbps	7.47	0.0056	9.28	0.0085	1 W
	2437 MHz		8.33	0.0068	10.16	0.0104	1 W
	2462 MHz		9.07	0.0081	10.90	0.0123	1 W
802.11g	2412 MHz	54 Mbps	4.90	0.0031	11.26	0.0134	1 W
	2437 MHz		5.75	0.0038	12.16	0.0164	1 W
	2462 MHz		6.43	0.0044	12.96	0.0198	1 W

NOTE: The average RF power was measured during ON time intervals excluding OFF time intervals by the using trigger function of the power meter

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 for above 30 MHz, and at 1 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.

5.4.3 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.
Emission plot for the preliminary radiated measurements were shown in the Figure 6.

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

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

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

BELOW 1 GHz

Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Average/Peak/Quasi-peak data, emissions below 30 MHz												
Quasi-peak data, emissions below 1000 MHz(802.11 b/g mode)												
206.89	120	V	1	0	---	27.73	-	10.56	1.41	---	43.50	---
206.89	120	H	1.42	277	49.98	27.73	-	10.56	1.41	34.22	43.50	9.28
311.86	120	V	1	0	---	27.59	-	12.74	1.73	---	46.00	---
311.86	120	H	1.46	273	48.12	27.59	-	12.74	1.73	35.00	46.00	11.00
335.19	120	V	1	0	---	27.76	-	13.04	1.80	---	46.00	---
335.19	120	H	1.44	275	45.84	27.76	-	13.04	1.80	32.92	46.00	13.08

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
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
Remark 1. "---" 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												
2412.6	1000	H	1.57	13	101.05	48.18	10.26	28.00	5.05	96.18	Not Applicable (802.11b signals)	
2412.6	1000	V	1.21	297	104.67	48.18	10.26	28.00	5.05	99.80		
2437.6	1000	H	1.59	51	100.23	48.19	10.26	28.08	5.09	95.47		
2436.5	1000	V	1.26	127	103.11	48.19	10.26	28.08	5.09	98.35		
2461.5	1000	H	1.54	252	99.05	48.19	10.27	28.16	5.11	94.40		
2461.5	1000	V	1.26	281	103.19	48.19	10.27	28.16	5.11	98.54		
2390.0	1000	H	1.57	13	-	48.18	10.26	28.00	5.05	36.47	54.00	17.53
2389.6	1000	V	1.21	297	-	48.18	10.26	28.00	5.05	37.27	54.00	16.73
2483.6	1000	H	1.54	252	-	48.19	10.27	28.16	5.11	36.60	54.00	17.40
2483.6	1000	V	1.26	281	-	48.19	10.27	28.16	5.11	37.00	54.00	17.00
2414.8	1000	H	1.55	43	92.00	48.18	10.26	28.01	5.06	87.15	Not Applicable (802.11g signals)	
2414.3	1000	V	1.25	290	94.63	48.18	10.26	28.01	5.06	89.78		
2435.2	1000	H	1.53	4	93.05	48.19	10.26	28.08	5.09	88.29		
2439.9	1000	V	1.26	125	94.79	48.19	10.26	28.09	5.09	90.04		
2460.3	1000	H	1.50	231	93.28	48.19	10.27	28.16	5.11	88.63		
2460.0	1000	V	1.61	284	95.67	48.19	10.27	28.16	5.11	91.02		
2390.0	1000	H	1.55	43	-	48.18	10.26	28.01	5.06	37.93	54.00	16.07
2390.0	1000	V	1.25	290	-	48.18	10.26	28.01	5.06	40.33	54.00	13.67
2483.6	1000	H	1.50	231	-	48.19	10.27	28.16	5.11	40.15	54.00	13.85
2483.6	1000	V	1.61	284	-	48.19	10.27	28.16	5.11	42.82	54.00	11.18

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.

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												
2412.6	1000	H	1.57	13	108.99	48.18	10.26	28.00	5.05	104.12	Not Applicable (802.11b signals)	
2412.6	1000	V	1.21	297	112.77	48.18	10.26	28.00	5.05	107.90		
2437.6	1000	H	1.59	51	108.48	48.19	10.26	28.08	5.09	103.72		
2436.5	1000	V	1.26	127	111.50	48.19	10.26	28.08	5.09	106.74		
2461.5	1000	H	1.54	252	107.18	48.19	10.27	28.16	5.11	102.53		
2461.5	1000	V	1.26	281	111.53	48.19	10.27	28.16	5.11	106.88		
2390.0	1000	H	1.57	13	-	48.18	10.26	28.00	5.05	49.97	74.00	24.03
2389.6	1000	V	1.21	297	-	48.18	10.26	28.00	5.05	50.36	74.00	23.64
2483.6	1000	H	1.54	252	-	48.19	10.27	28.16	5.11	48.73	74.00	25.27
2483.6	1000	V	1.26	281	-	48.19	10.27	28.16	5.11	49.38	74.00	24.62
2414.8	1000	H	1.55	43	102.66	48.18	10.26	28.01	5.06	97.81	Not Applicable (802.11g signals)	
2414.3	1000	V	1.25	290	104.62	48.18	10.26	28.01	5.06	99.77		
2435.2	1000	H	1.53	4	103.07	48.19	10.26	28.08	5.09	98.31		
2439.9	1000	V	1.26	125	105.31	48.19	10.26	28.09	5.09	100.56		
2460.3	1000	H	1.50	231	103.26	48.19	10.27	28.16	5.11	98.61		
2460.0	1000	V	1.61	284	105.64	48.19	10.27	28.16	5.11	100.99		
2390.0	1000	H	1.55	43	-	48.18	10.26	28.01	5.06	53.29	74.00	20.71
2390.0	1000	V	1.25	290	-	48.18	10.26	28.01	5.06	55.70	74.00	18.30
2483.6	1000	H	1.50	231	-	48.19	10.27	28.16	5.11	54.14	74.00	19.86
2483.6	1000	V	1.61	284	-	48.19	10.27	28.16	5.11	57.12	74.00	16.88

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

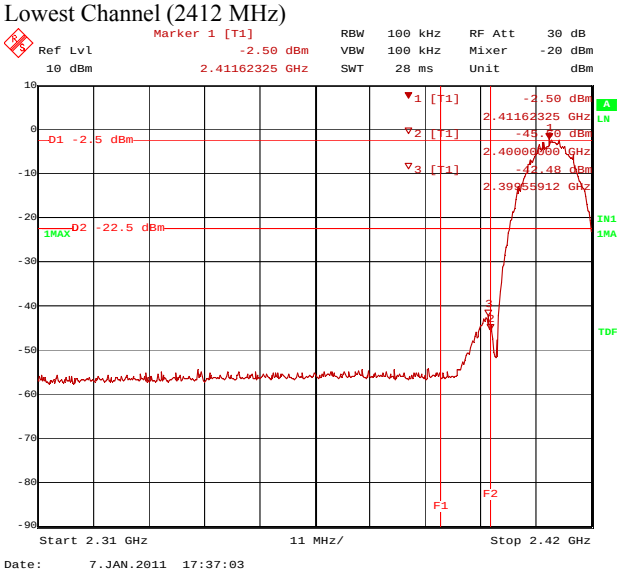
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

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.

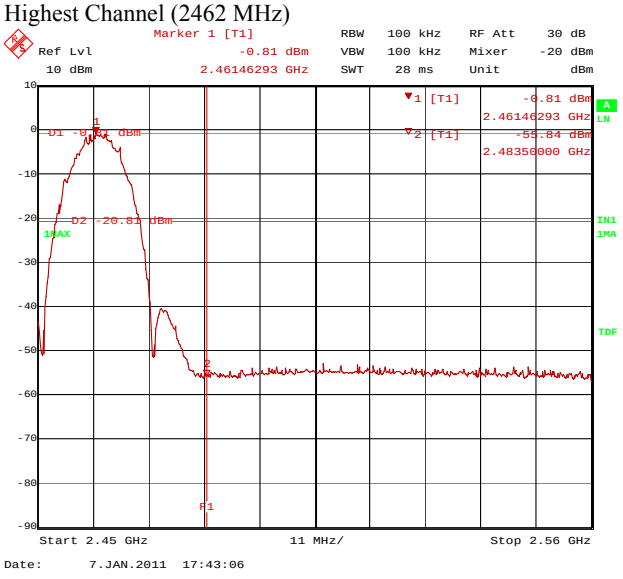
Figure 3. Plot of the Band Edge (Conducted)

802.11b mode:

Lowest Channel (2412 MHz)

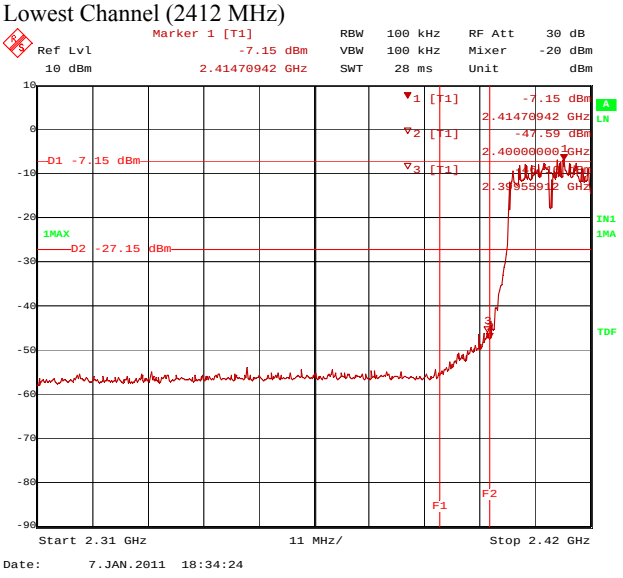


Highest Channel (2462 MHz)



802.11g mode:

Lowest Channel (2412 MHz)



Highest Channel (2462 MHz)

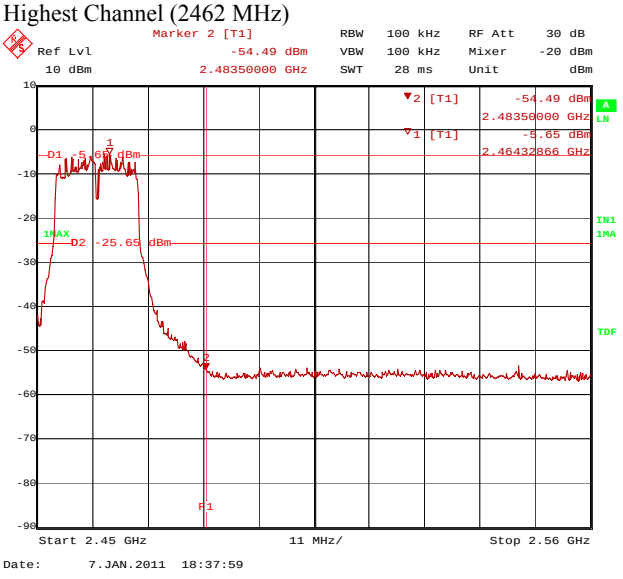
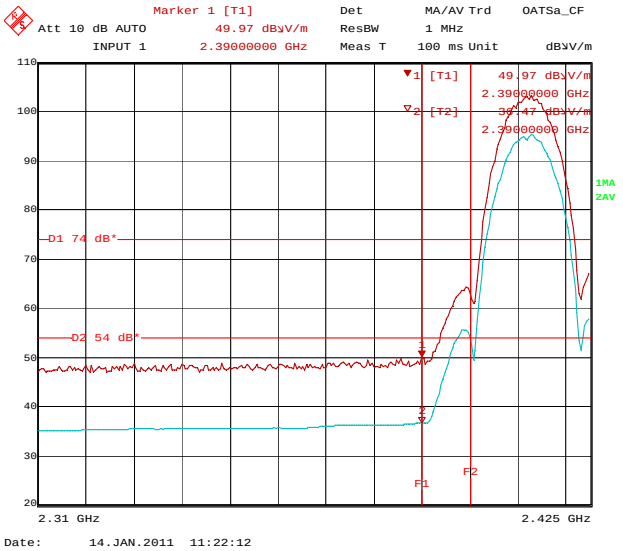


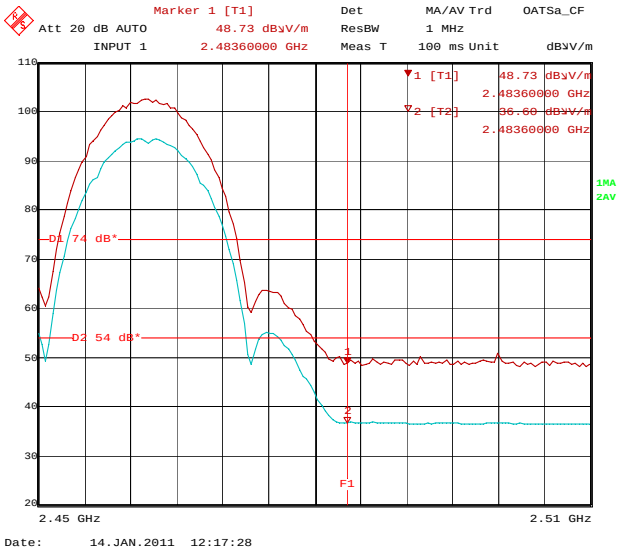
Figure 4. Plot of the Band Edge (Radiated)

802.11b mode:

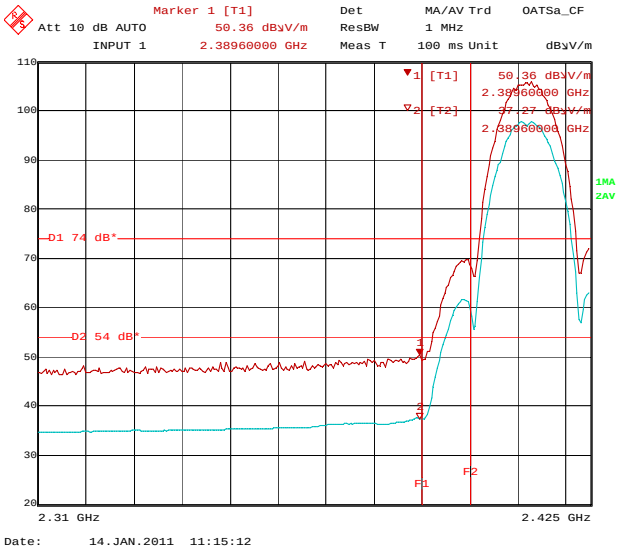
Lowest Channel (2412 MHz)
Horizontal



Highest Channel (2462 MHz)
Horizontal



Lowest Channel (2412 MHz)
Vertical



Highest Channel (2462 MHz)
Vertical

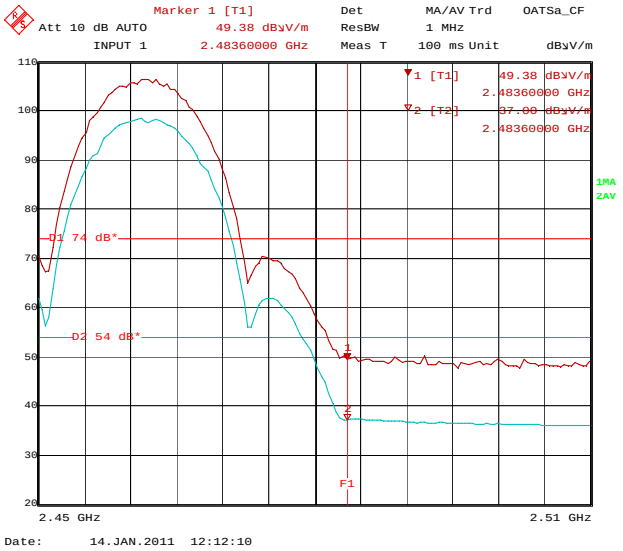
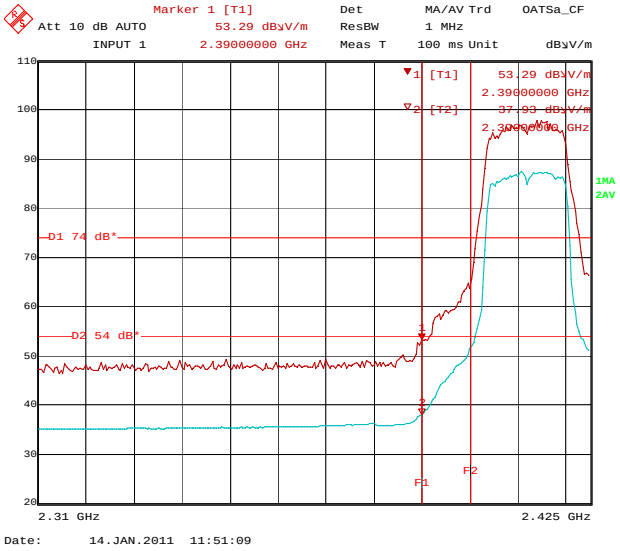


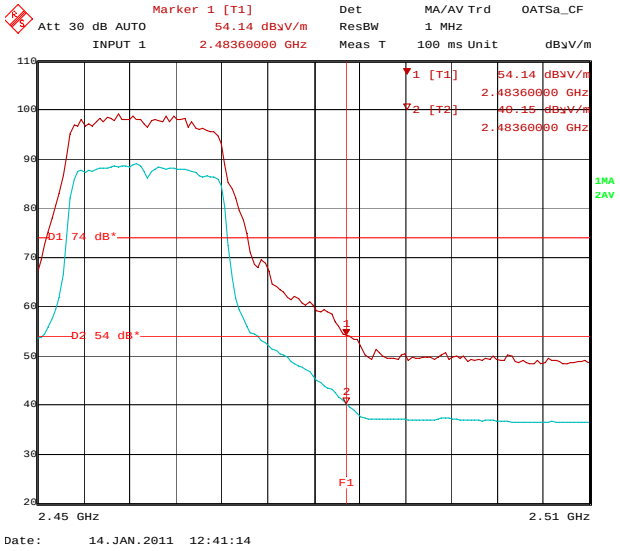
Figure 4. Plot of the Band Edge (Radiated)

802.11g mode:

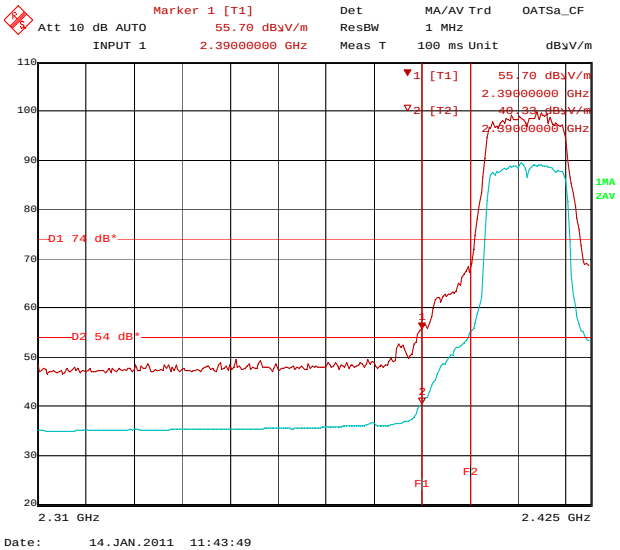
Lowest Channel (2412 MHz)
Horizontal



Highest Channel (2462 MHz)
Horizontal



Lowest Channel (2412 MHz)
Vertical



Highest Channel (2462 MHz)
Vertical

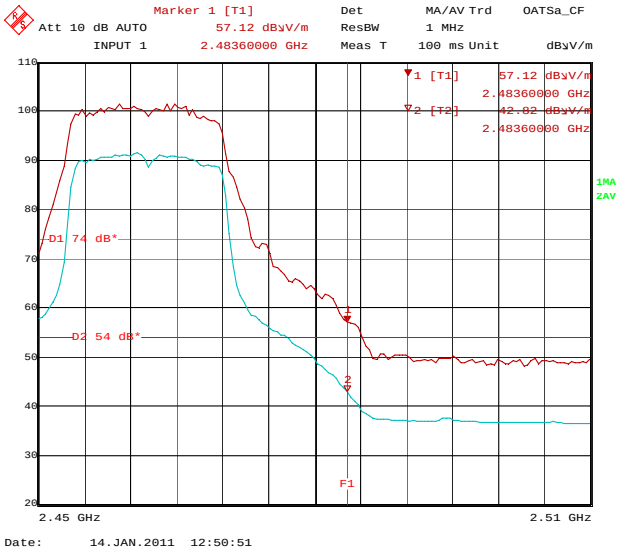
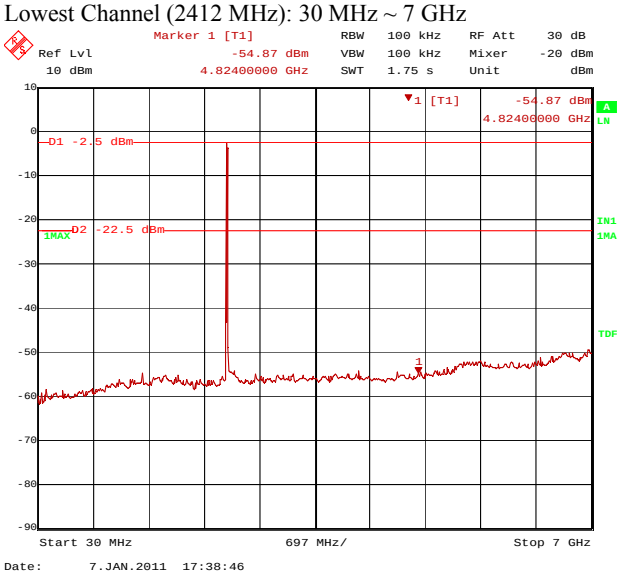


Figure 5. Spurious RF conducted emissions *(continued)*

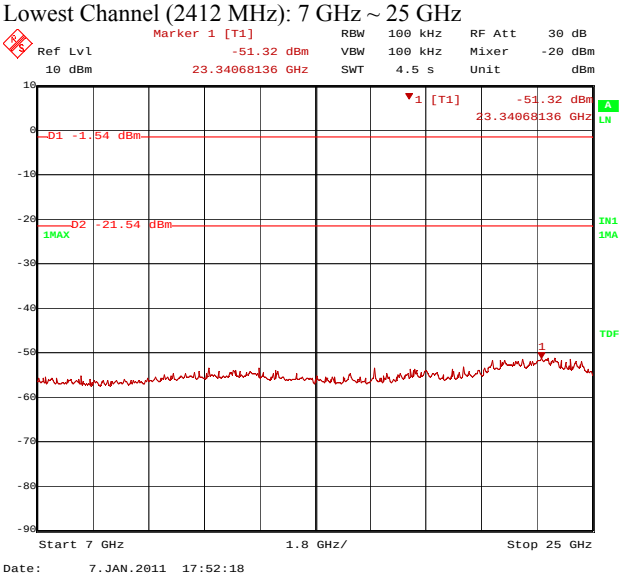
802.11b mode:

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



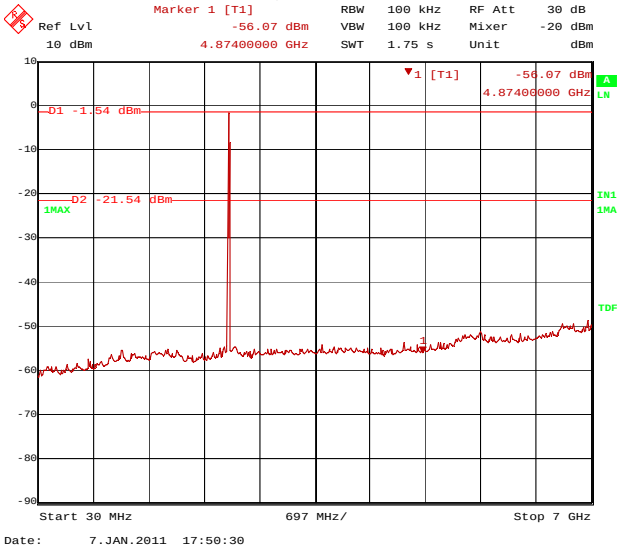
Date: 7.JAN.2011 17:38:46

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



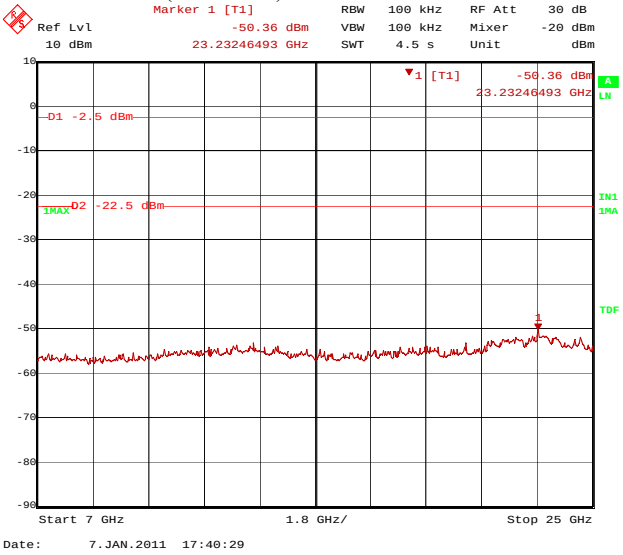
Date: 7.JAN.2011 17:52:18

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



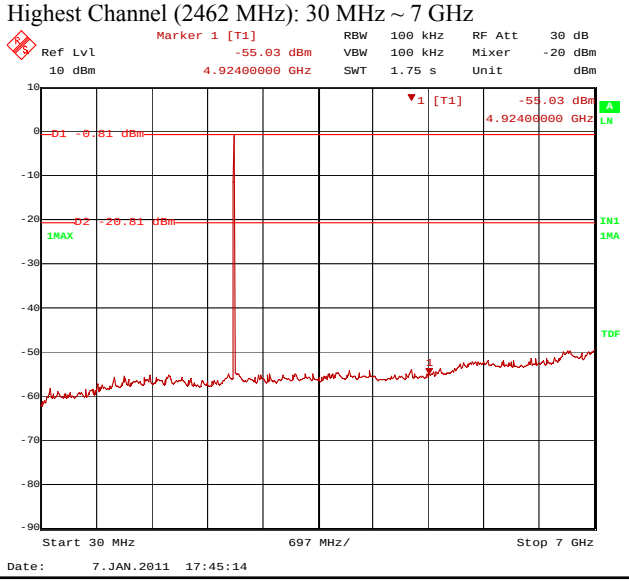
Date: 7.JAN.2011 17:50:30

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



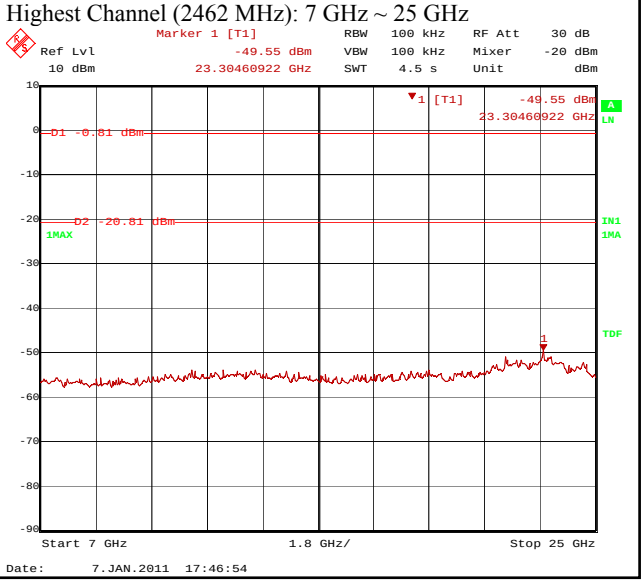
Date: 7.JAN.2011 17:40:29

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



Date: 7.JAN.2011 17:45:14

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

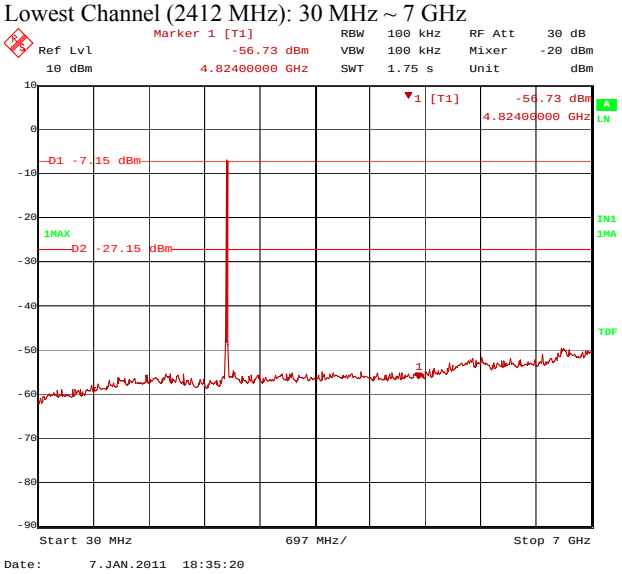


Date: 7.JAN.2011 17:46:54

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

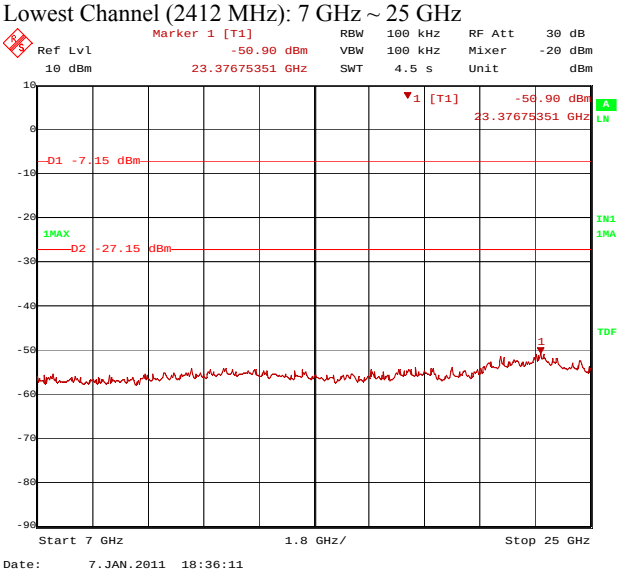
802.11g mode:

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



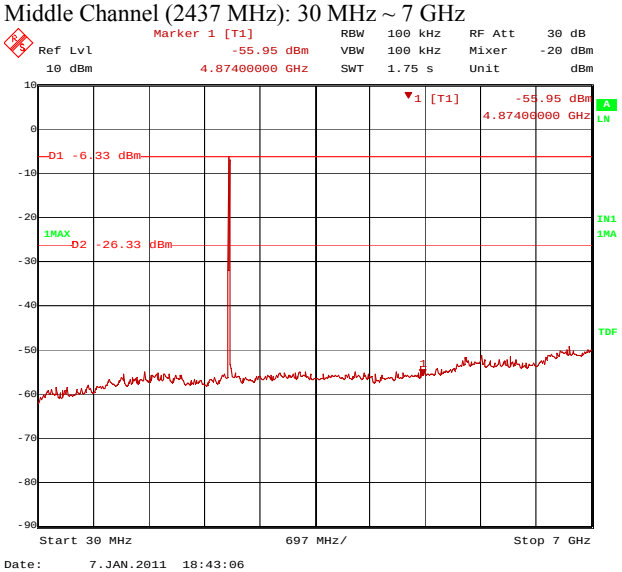
Date: 7.JAN.2011 18:35:20

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



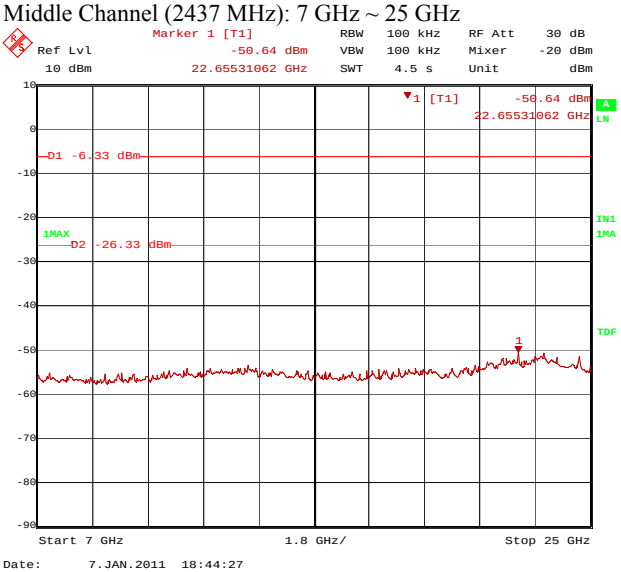
Date: 7.JAN.2011 18:36:11

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



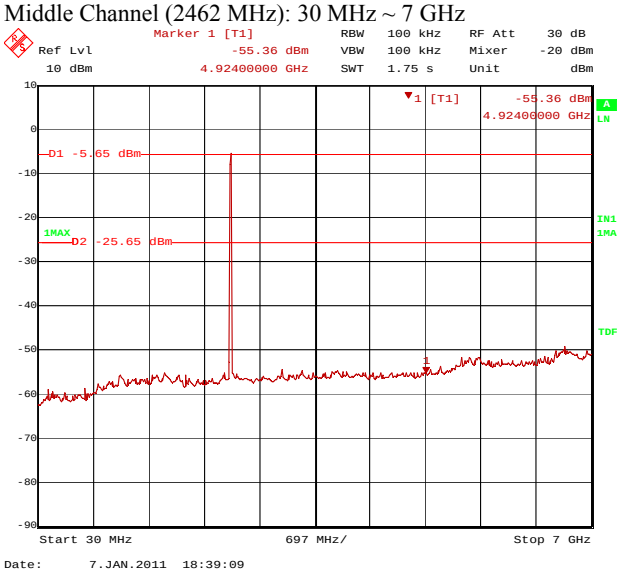
Date: 7.JAN.2011 18:43:06

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



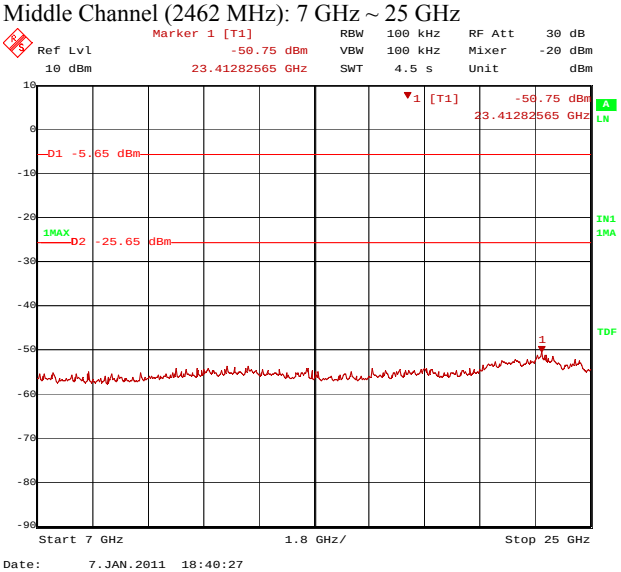
Date: 7.JAN.2011 18:44:27

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



Date: 7.JAN.2011 18:39:09

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

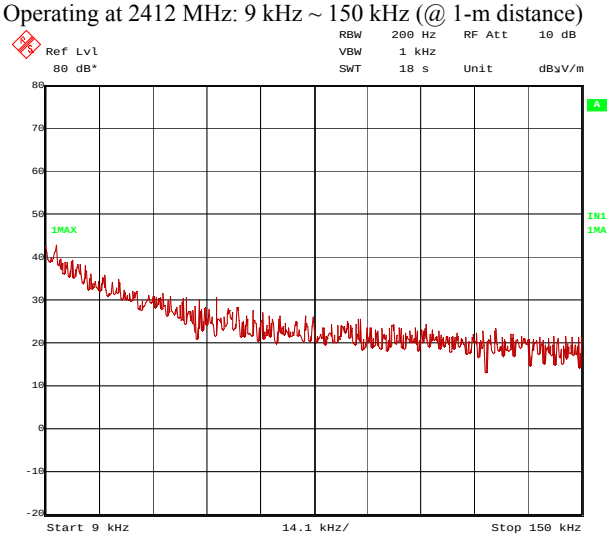


Date: 7.JAN.2011 18:40:27

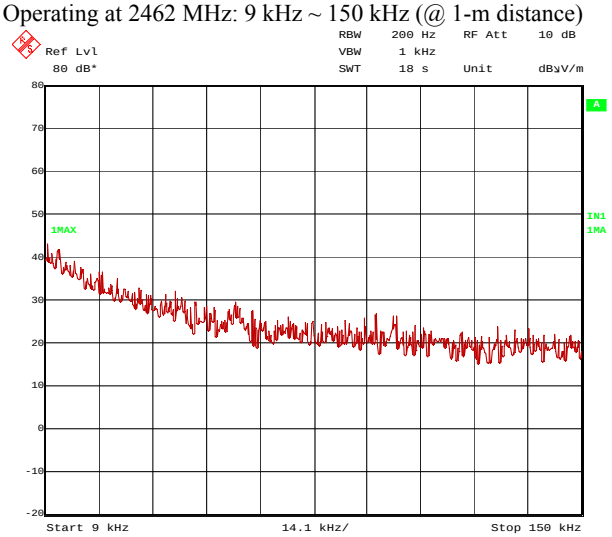
Figure 6. Emission plot for the preliminary radiated measurements

802.11b mode:

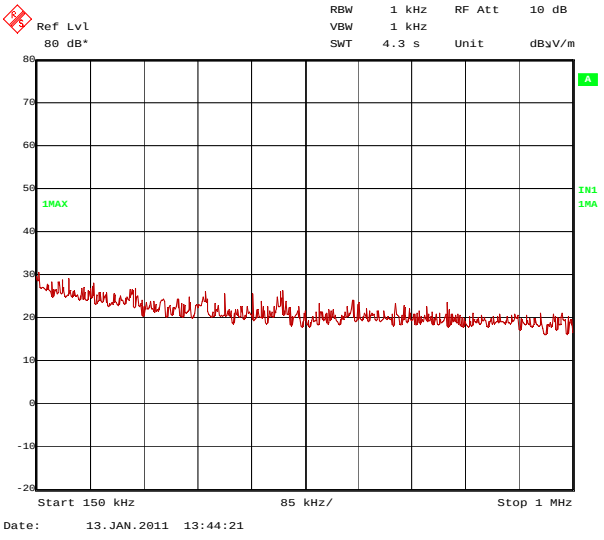
Operating at 2412 MHz: 9 kHz ~ 150 kHz (@ 1-m distance)



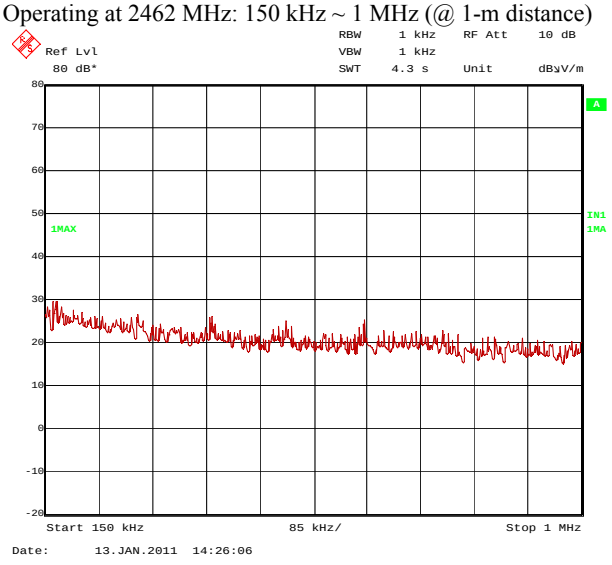
Operating at 2462 MHz: 9 kHz ~ 150 kHz (@ 1-m distance)



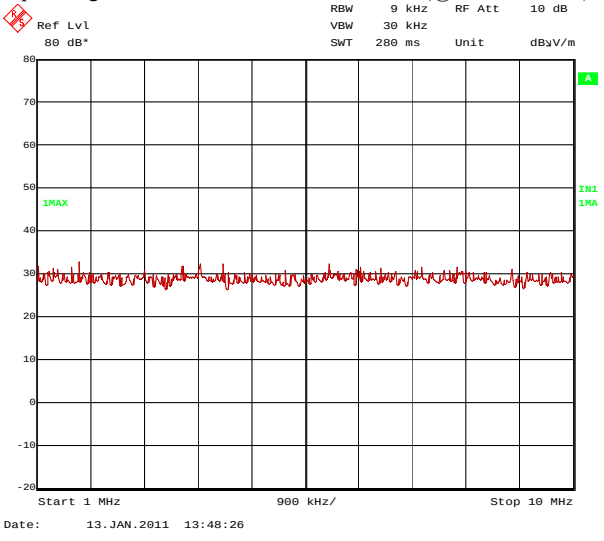
Operating at 2412 MHz: 150 kHz ~ 1 MHz (@ 1-m distance)



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



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



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

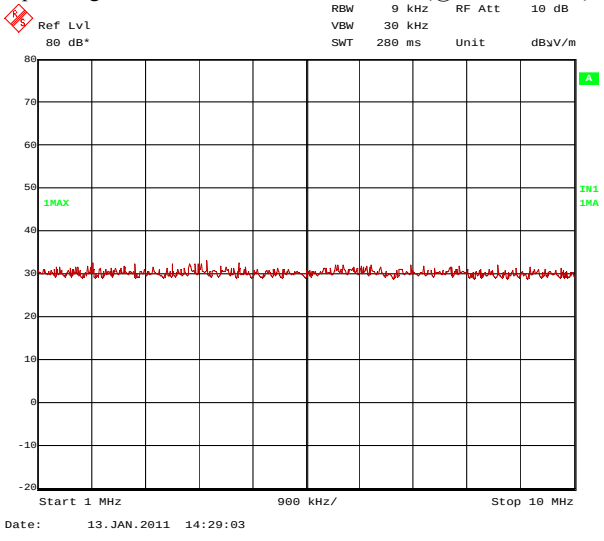
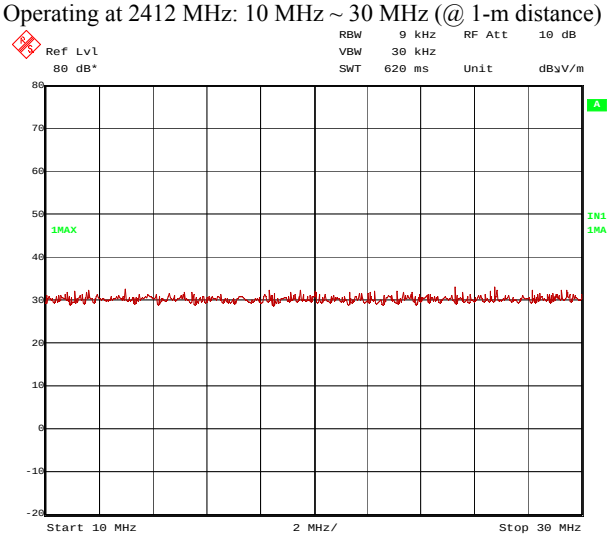


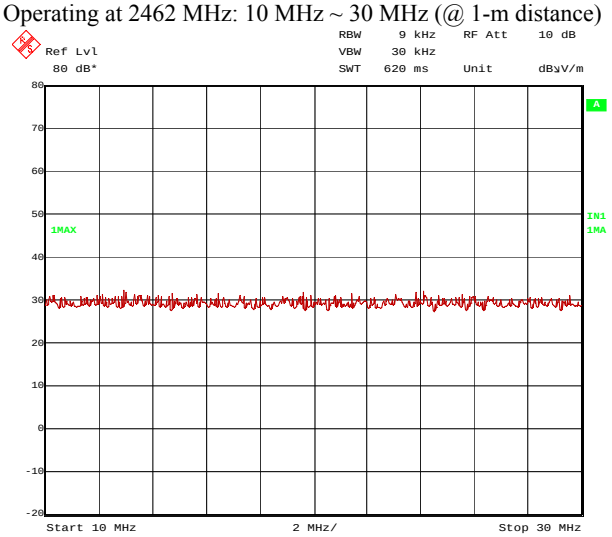
Figure 6. Emission plot for the preliminary radiated measurements

802.11b mode:

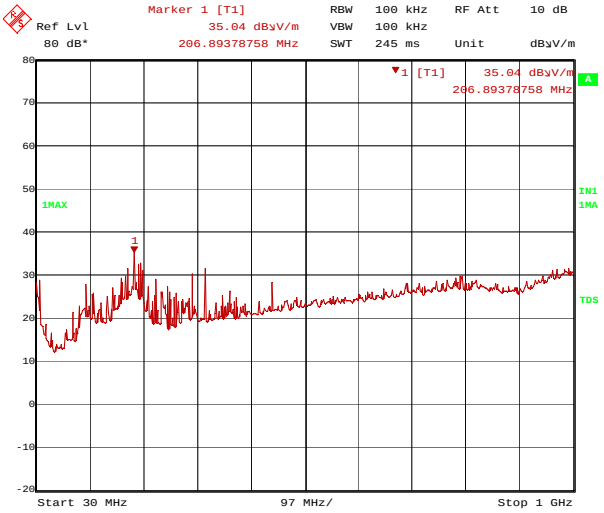
Operating at 2412 MHz: 10 MHz ~ 30 MHz (@ 1-m distance)



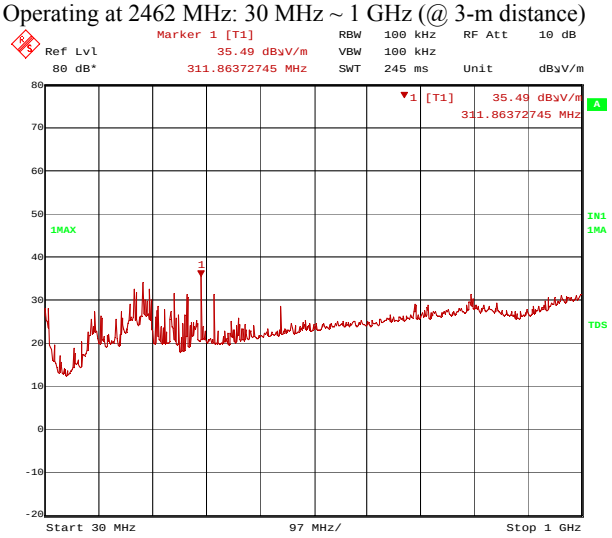
Operating at 2462 MHz: 10 MHz ~ 30 MHz (@ 1-m distance)



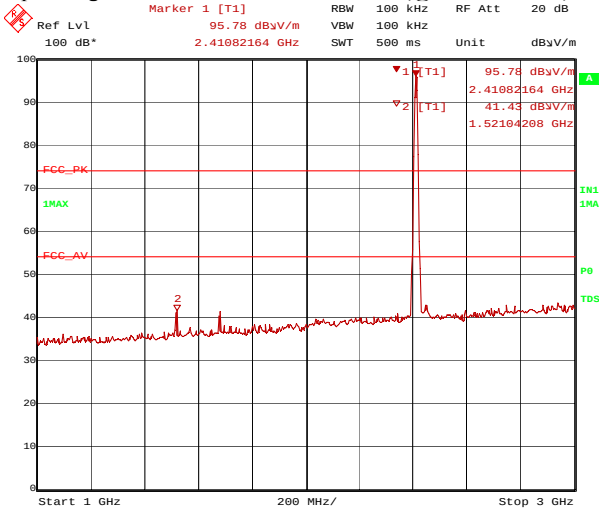
Operating at 2412 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



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)

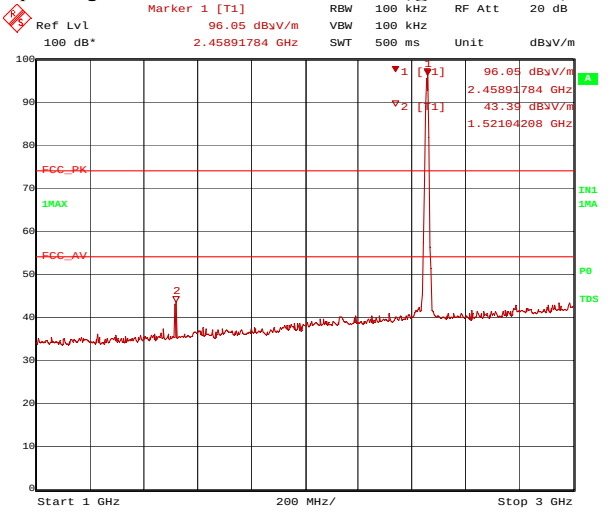
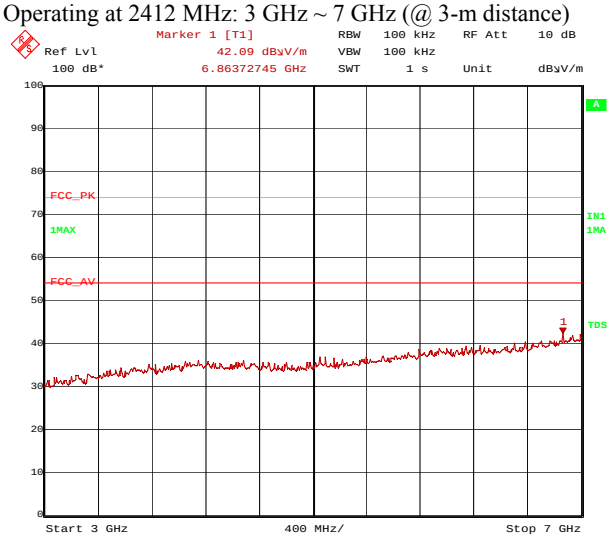


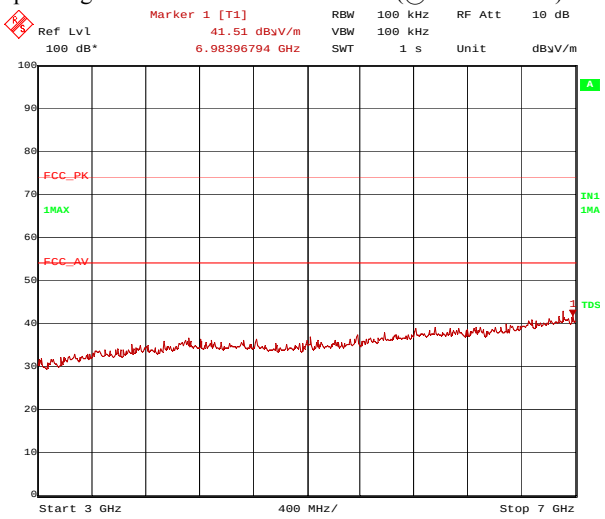
Figure 6. Emission plot for the preliminary radiated measurements

802.11b mode:

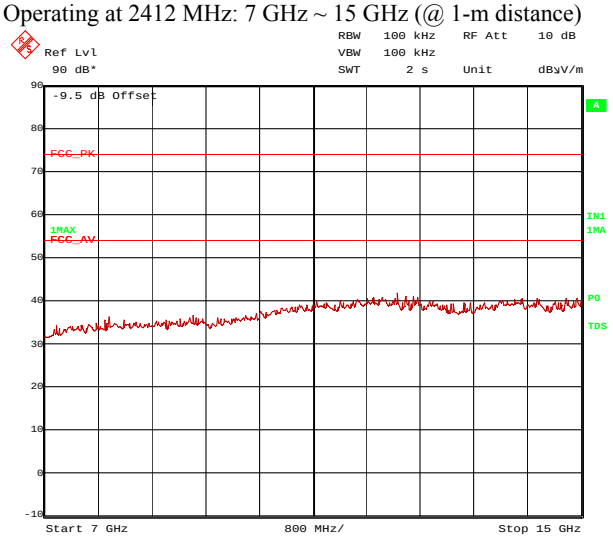
Operating at 2412 MHz: 3 GHz ~ 7 GHz (@ 3-m distance)



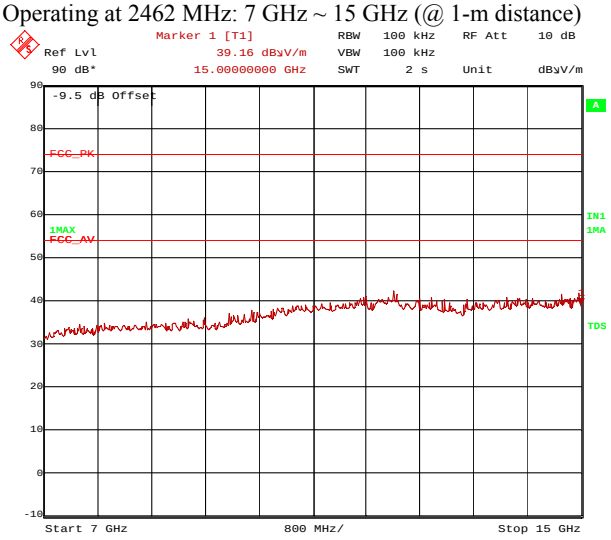
Operating at 2462 MHz: 3 GHz ~ 7 GHz (@ 3-m distance)



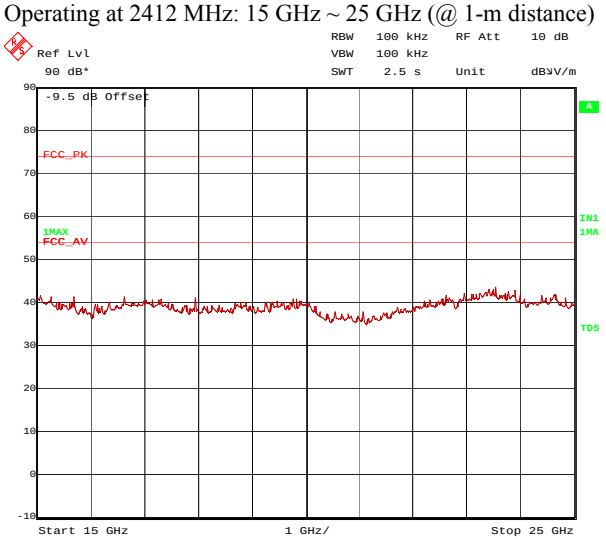
Operating at 2412 MHz: 7 GHz ~ 15 GHz (@ 1-m distance)



Operating at 2462 MHz: 7 GHz ~ 15 GHz (@ 1-m distance)



Operating at 2412 MHz: 15 GHz ~ 25 GHz (@ 1-m distance)



Operating at 2462 MHz: 15 GHz ~ 25 GHz (@ 1-m distance)

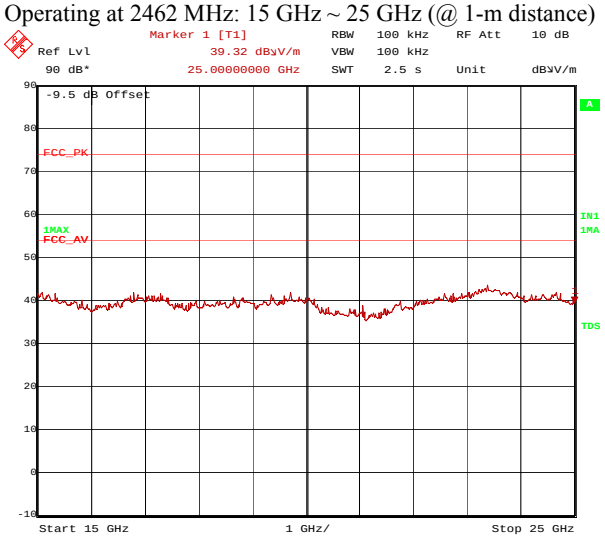
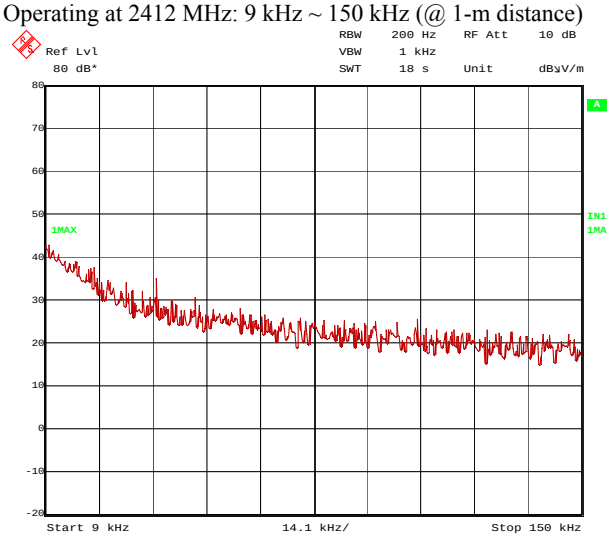


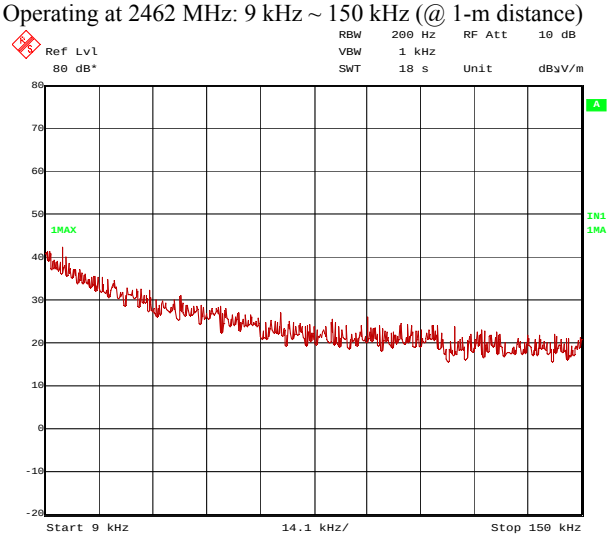
Figure 6. Emission plot for the preliminary radiated measurements

802.11g mode:

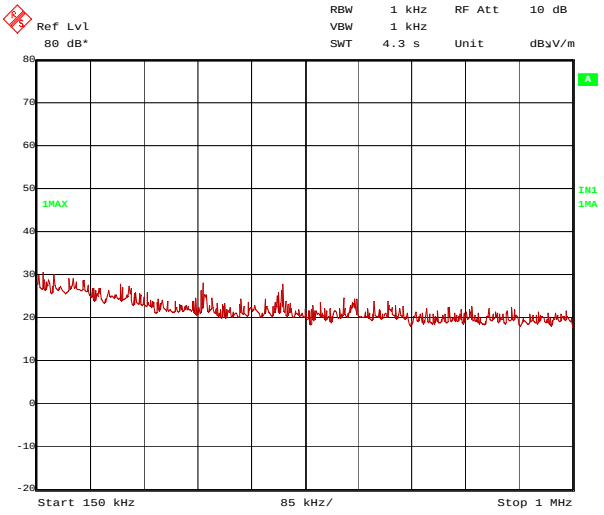
Operating at 2412 MHz: 9 kHz ~ 150 kHz (@ 1-m distance)



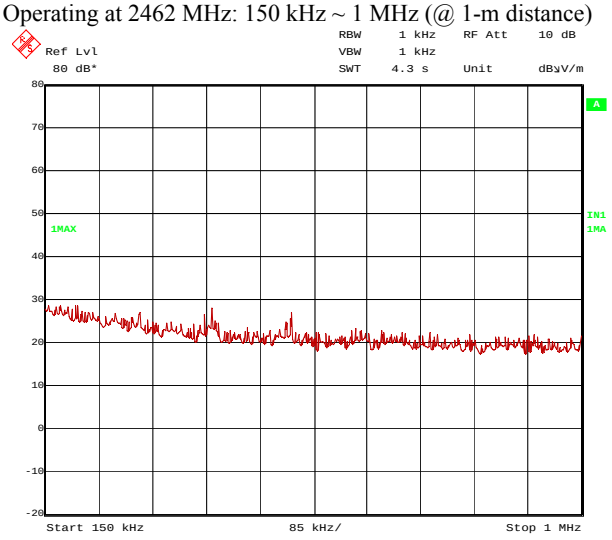
Operating at 2462 MHz: 9 kHz ~ 150 kHz (@ 1-m distance)



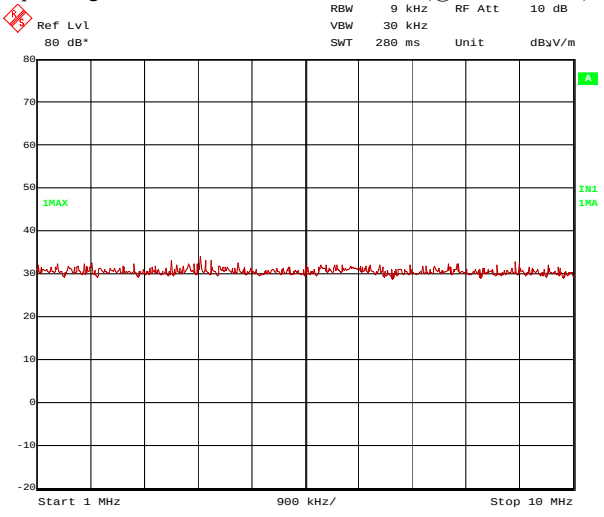
Operating at 2412 MHz: 150 kHz ~ 1 MHz (@ 1-m distance)



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



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



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

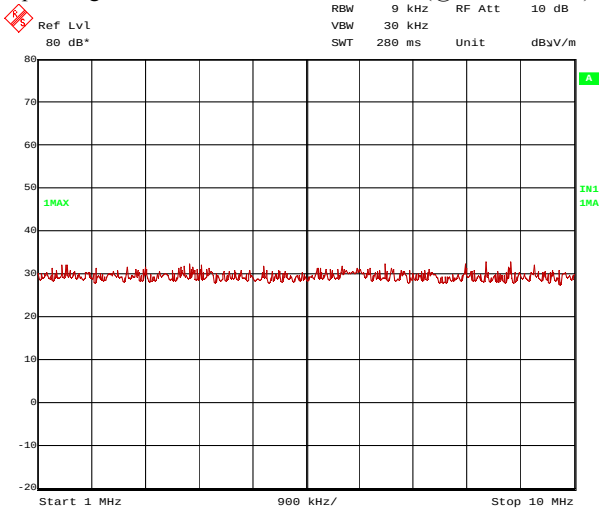
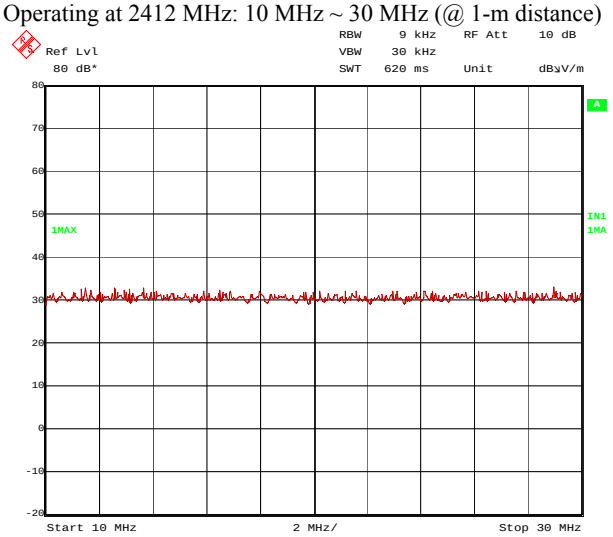


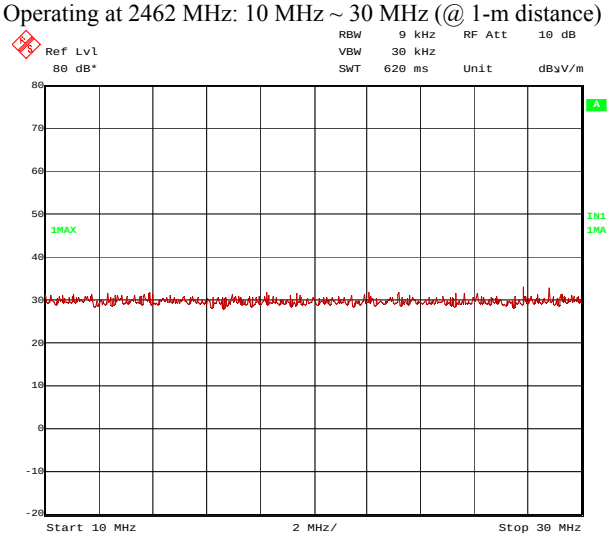
Figure 6. Emission plot for the preliminary radiated measurements

802.11g mode:

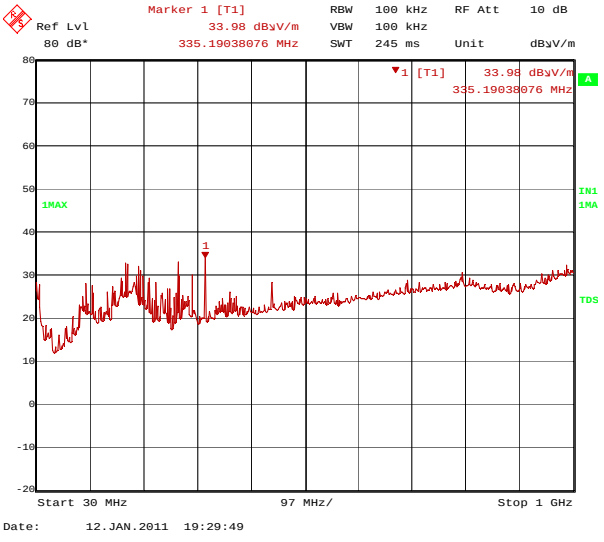
Operating at 2412 MHz: 10 MHz ~ 30 MHz (@ 1-m distance)



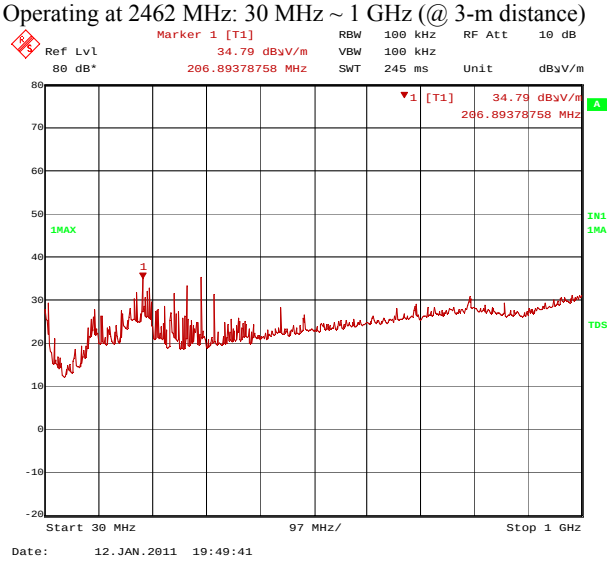
Operating at 2462 MHz: 10 MHz ~ 30 MHz (@ 1-m distance)



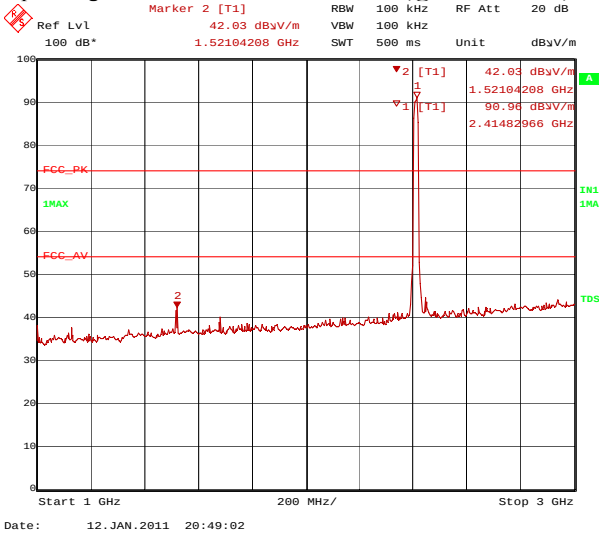
Operating at 2412 MHz: 30 MHz ~ 1 GHz (@ 3-m distance)



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)

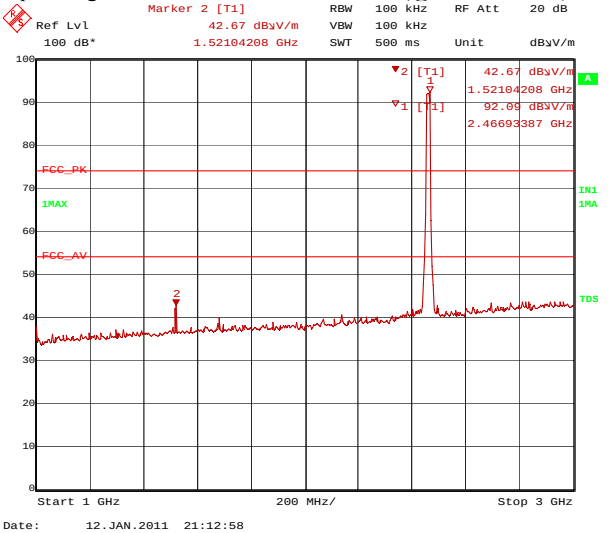
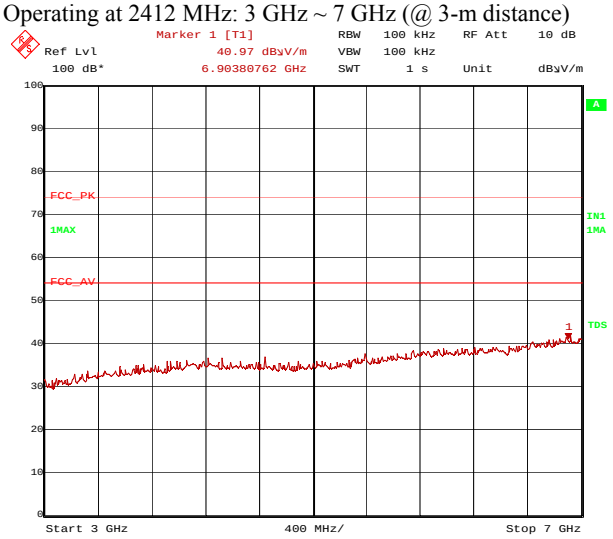


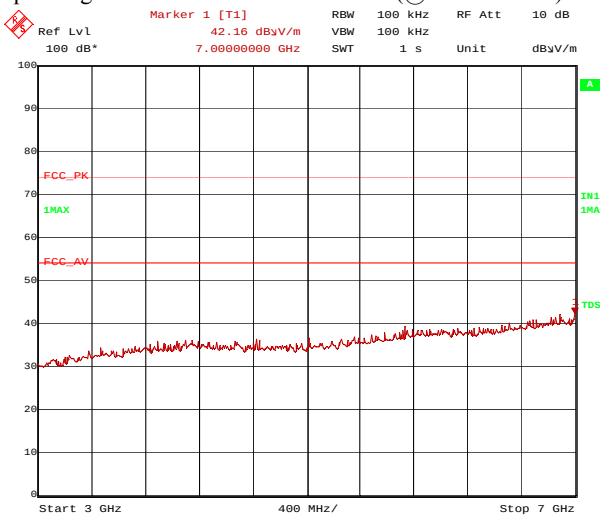
Figure 6. Emission plot for the preliminary radiated measurements

802.11g mode:

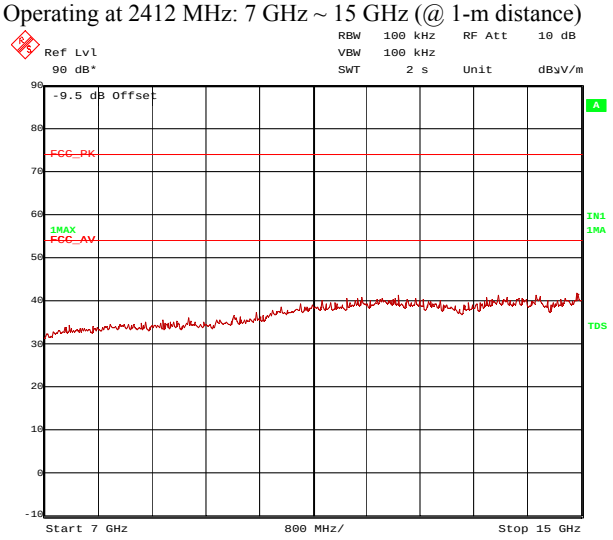
Operating at 2412 MHz: 3 GHz ~ 7 GHz (@ 3-m distance)



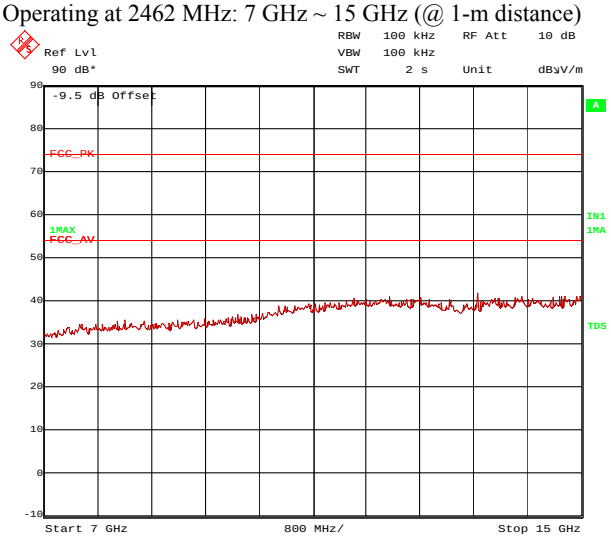
Operating at 2462 MHz: 3 GHz ~ 7 GHz (@ 3-m distance)



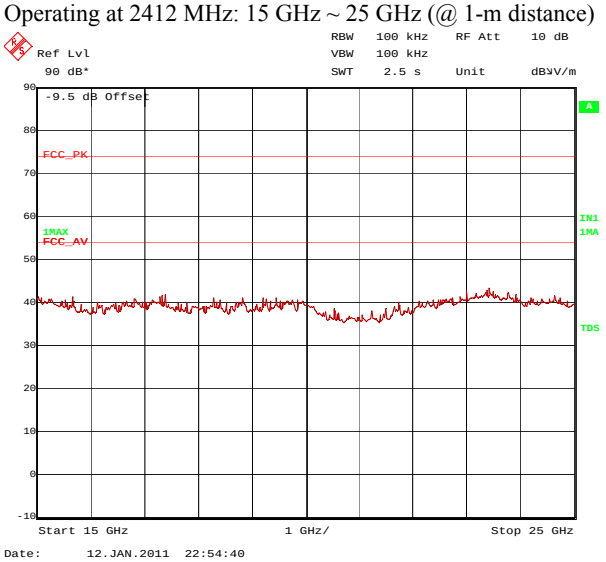
Operating at 2412 MHz: 7 GHz ~ 15 GHz (@ 1-m distance)



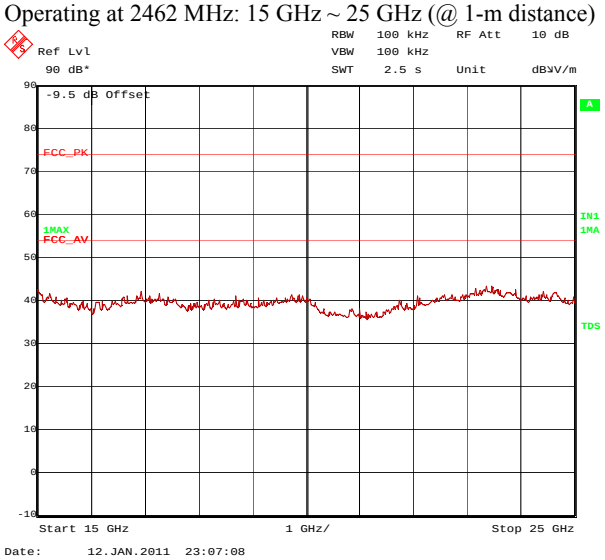
Operating at 2462 MHz: 7 GHz ~ 15 GHz (@ 1-m distance)



Operating at 2412 MHz: 15 GHz ~ 25 GHz (@ 1-m distance)



Operating at 2462 MHz: 15 GHz ~ 25 GHz (@ 1-m distance)



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)

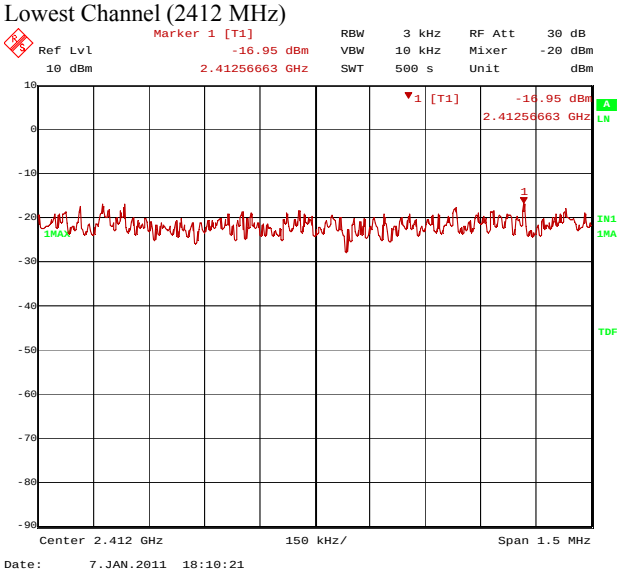
Modulation	Operating frequency	Transfer Rate	Reading (PPSD)	Limit
802.11b	2412 MHz	11 Mbps	-16.95 dBm	8.0 dBm
	2437 MHz	11 Mbps	-16.13 dBm	8.0 dBm
	2462 MHz	11 Mbps	-15.30 dBm	8.0 dBm
802.11g	2412 MHz	54 Mbps	-21.32 dBm	8.0 dBm
	2437 MHz	54 Mbps	-20.34 dBm	8.0 dBm
	2462 MHz	54 Mbps	-19.35 dBm	8.0 dBm

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

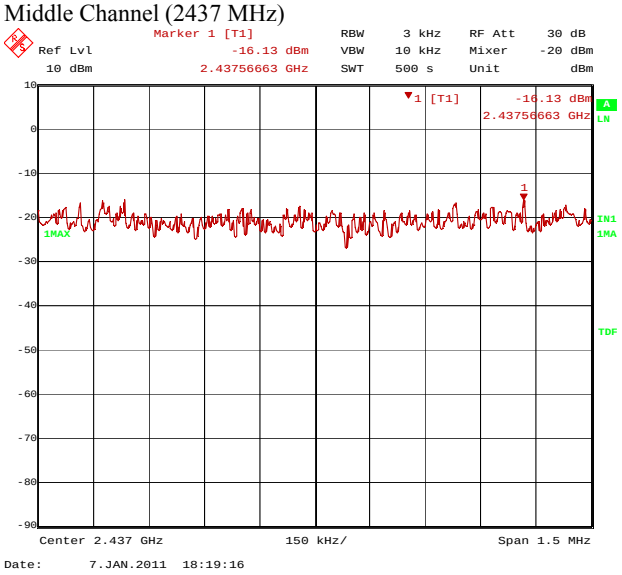
Figure 7. Plot of the Peak Power Spectral Density (Conducted)

802.11b mode:

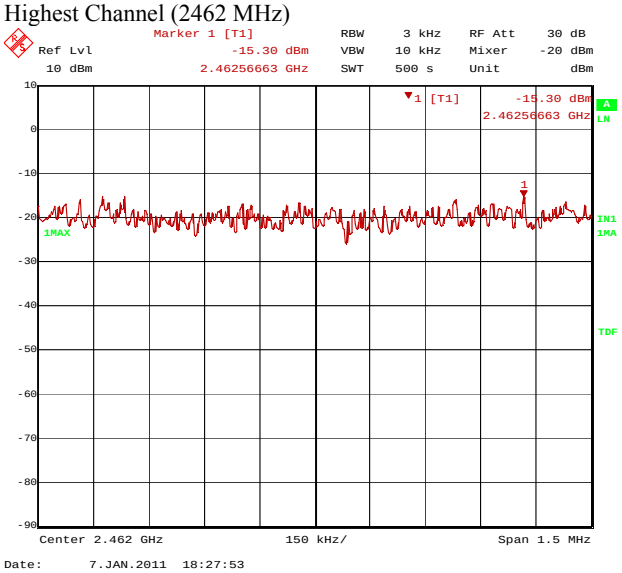
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)

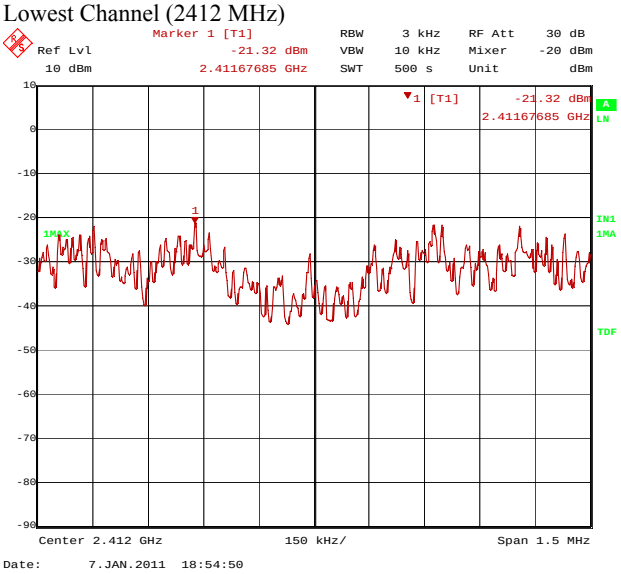


Highest Channel (2462 MHz)

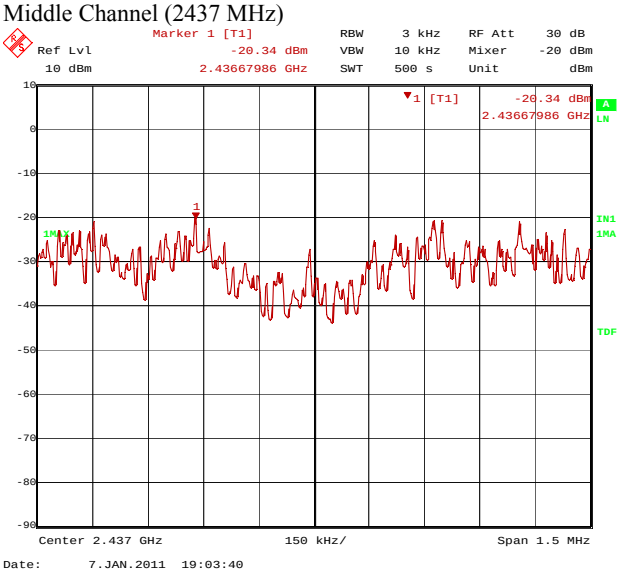


802.11g mode:

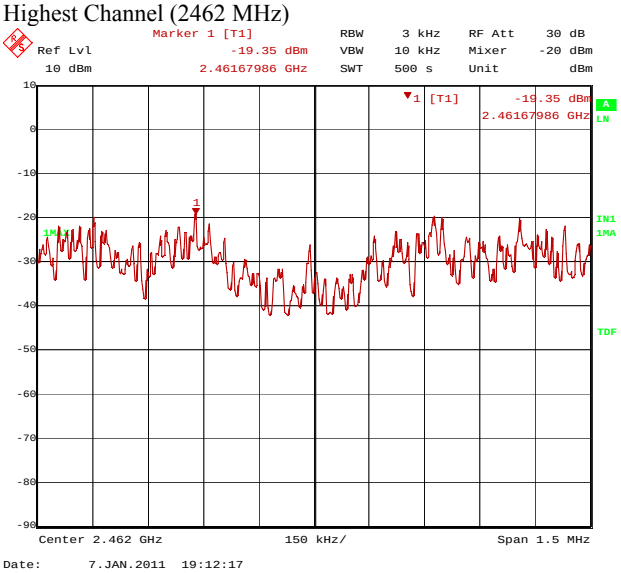
Lowest Channel (2412 MHz)



Middle Channel (2437 MHz)



Highest Channel (2462 MHz)



5.6 RF Exposure

5.6.1 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 average output power = 8.07 [mW](= 9.07 dBm) & Antenna gain =0.65 (= -1.89 [dBi])	
100 mW, at 20 cm from an antenna 6 [dBi]	S = PG/4πR² = 100 × 3.98 / (4 × π × 400) = 0.0792 [mW/cm^2] < 1.0 [mW/cm^2]
8.07 mW, at 20 cm from the antenna -1.89 [dBi]	S = PG/4πR² = 0.0010 [mW/cm^2] < 1.0 [mW/cm^2]
8.07 mW, at 2.5 cm from the antenna -1.89 [dBi]	S = PG/4πR² = 0.0665 [mW/cm^2]

5.6.2 RF Exposure Compliance Issue

July 02 TCB Exclusion List: for portable transmitters,

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

High threshold [(900/f_{GHZ} ≈ 370) mW, d < 20 cm], where f_{GHz}: 2.44, d: distance to a person's body

The (source based) average RF power output is below 20 mW, and the EUT is categorically excluded from the RF exposure(SAR) requirements.