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Compliance test report ID **193659-1TRFWL**

Date of issue
April 30, 2012

FCC 47 CFR Part 15 Subpart C, §15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz.

Applicant **Edgewater Wireless**
Product **Wireless Access Point [Indoor and Outdoor unit]**
Model **EAP3030-I , EAP3030-O, EAP3031-I, EAP3031-O**
FCC ID **ATX-EAP3030R01**

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation

SCC Accredited LAB
LAB Accrédité CCN

Test location

Nemko Canada Inc.
303 River Road
Ottawa, ON, K1V 1H2
Canada
Test site FCC ID: 176392 (3 m semi anechoic chamber)

Telephone +1 613 737 9680
Facsimile +1 613 737 9691
Toll free +1 800 563 6336
Website www.nemko.com

Tested by Andrey Adelberg, Senior Wireless/EMC Specialist
Predrag Golic, EMC Specialist

Reviewed by Kevin Rose, Wireless/EMC Specialist

April 30, 2012
Date

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

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Section 1 Report summary

1.1 Applicant and manufacturer

Edgewater Wireless
1125 Innovation Drive
Ottawa Ontario
K2K 3G6
Canada

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Chapter 15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz.

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.4 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2 Summary of test results

2.1 FCC Part 15 Subpart C – general requirements, test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass[1]
§15.31(m)	Number of operating frequencies	Pass[2]
§15.203	Antenna requirement	Pass[3]

Notes:
[1] Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed
[2] Since the frequency band was wider than 10 MHz, three channels (1 near top, 1 near middle and 1 near bottom) were selected for the testing.
[3] The EUT is equipped with reverse SMA connector.

2.2 FCC Part 15 Subpart C – Intentional Radiators, test results

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(b)(4)	Maximum peak output power	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Pass
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Pass
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Section 3 Equipment under test (EUT) details

3.1 Sample information

Receipt date	December 12, 2011
Nemko sample ID number	1, and 2

3.2 EUT information

Product name	Wireless Access Point [Indoor and Outdoor unit]
Model	1)EAP3030-O 2)EAP3031-O 3)EAP3030-I 4)EAP3031-I
Serial number	Pre-production assemblies no serial numbers assigned. Card S/N are: NEO (Digital processing board) EWP111025001860; B/G radio EWP111025G00018; XA-DMB-09907006, KPA09907006-01658 623AH.
Part number	1) 900-00012 2) 900-00011 3) 900-00013 4) 900-00010

3.3 Technical information

Operating band	2400–2483.5 MHz
Operating frequency	2412–2462 MHz
Modulation type	802.11b/g
Occupied bandwidth	20 MHz
Emission designator	W7D
Power requirements	120 V_{AC} / 60 Hz
Antenna information	1) Indoor Unit 2.4 GHz Pedal antenna, Alpha APA-M04 7 dBi 2) Indoor Unit 2.4 GHz Patch antenna, ALLNET 2.4 GHz 10 dBi Flat Patch 3) Indoor Unit 2.4 GHz Whip antenna, Nearson S151AH-2450 5 dBi 4) Outdoor Unit 2.4 GHz Rod antennas: OD24M-9 (9 dBi), OD24M-7 (7 dBi) and OD24M-5 (5 dBi) 5) Outdoor Unit 2.4 GHz Sector antenna, Laird Technologies SA24-120-16-WB 16 dBi The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

Edgewater Wireless APs utilize wideband RF and high-performance data conversion technology, based on our unique silicon solutions, permitting simultaneous access to the full 802.11 wireless spectrum. Wideband spectrum processing enables WISP access points to simultaneously communicate on multiple 802.11 bands. Additionally, wide spectrum visibility allows the Access Point to function as a network monitor/analyzer, offering the ability to identify the presence and class of other devices in the 802.11 RF environment.

3.5 EUT exercise details

1) Ethernet port: Continuous pings to the Eth MAC/PHY
2) 802.11b/g RTP (Radio Test Program) enabling access to Radio registers to set frequency, power levels and modulation type

3.6 EUT setup diagram

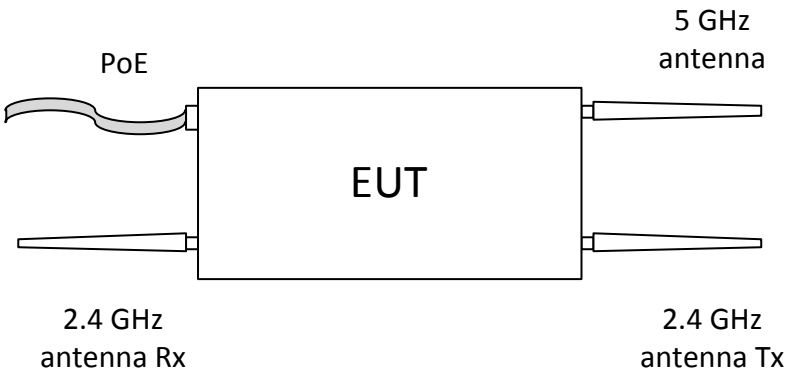


Diagram 3.6-1: Setup diagram

3.7 EUT sub assemblies

Description	Brand name	Model/Part number	Serial number	Rev.
NEO digital PCB	Edgewater Wireless	None	EWP111025001860	None
802.11b/g	Edgewater Wireless	None	EWP111025G00018	None
802.11a	ZCOM	XA-623AH	KPA09907006-01658 623AH	H/W: V0.4
Contains: FCC ID: M4Y-XA623AHV04				

3.8 Support equipment

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop	Dell	Latitude D620	80045-647-364-537	

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature: 15–30 °C
Relative humidity: 20–75 %
Air pressure: 86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7 Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/12
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Power supply	California Inst.	3001I	FA001021	1 year	Jan. 26/12
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	April 27/12
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Jan. 04/12
Bilog antenna	Sunol	JB3	FA002108	1 year	Jan. 31/12
Horn antenna #2	EMCO	3115	FA000825	1 year	Feb. 04/12
Horn antenna 18–40 GHz	EMCO	3116	FA001847	1 year	May 20/12
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	Aug. 15/12
18–26 GHz pre-amplifier	Narda	BBS-1826N612	FA001550	—	VOU
Note: NCR - no calibration required, VOU - verify on use					

Section 8 Testing data

8.1 Clause 15.207(a) Conducted limits

8.1.1 Definitions and limits

Except as shown in paragraphs (b) and (c) of this section, 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 50 µH/50 Ω 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.

Table 8.1-1: Conducted emissions limit

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50
* - Decreases with the logarithm of the frequency.		

8.1.2 Test summary

Test date	December 12, 2011	**Test engineer**	Predrag Golic	**Verdict**	Pass
Temperature	24 °C	**Air pressure**	1015 mbar	**Relative humidity**	25 %

8.1.3 Observations/special notes

The EUT was set up as floor standing and tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

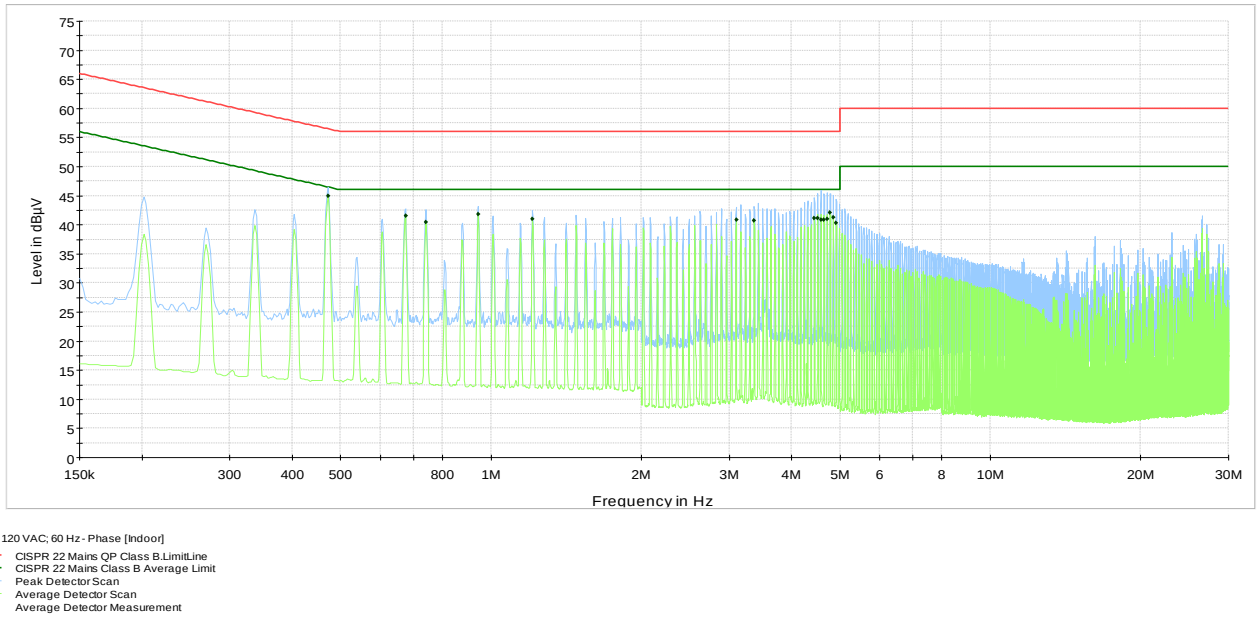
Receiver/spectrum analyzer settings

Preview measurements – Receiver:
Peak and Average detector (Max hold), RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms
Final measurements – Receiver:
Q-Peak and Average detector, RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms

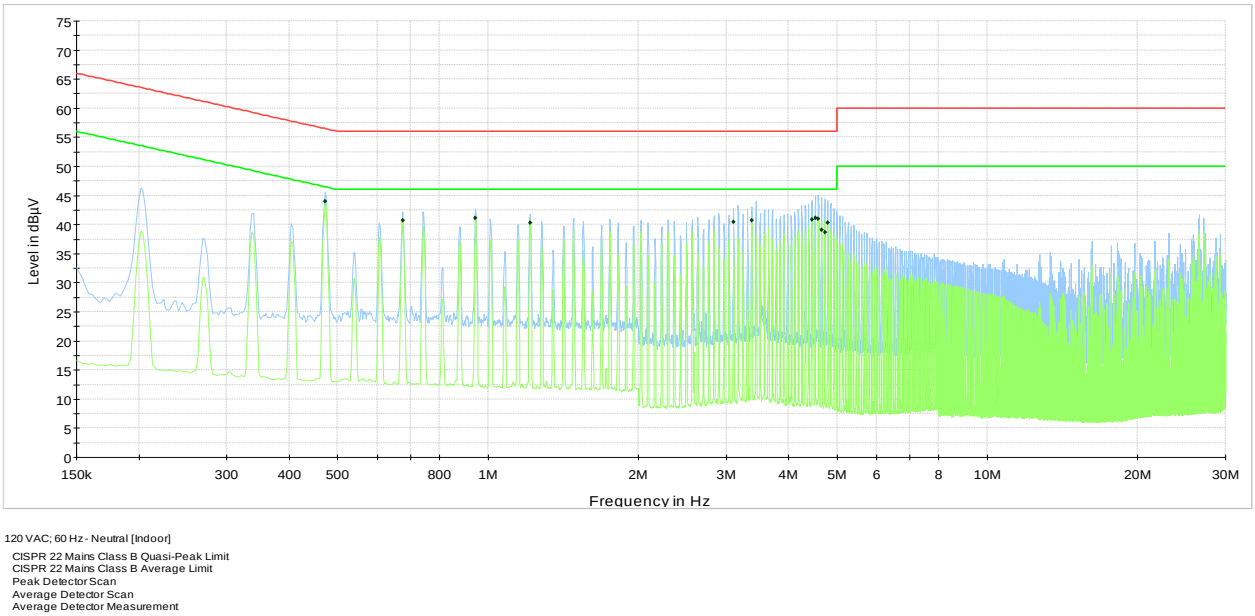
Measurement details

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement. The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

8.1.4 Test data

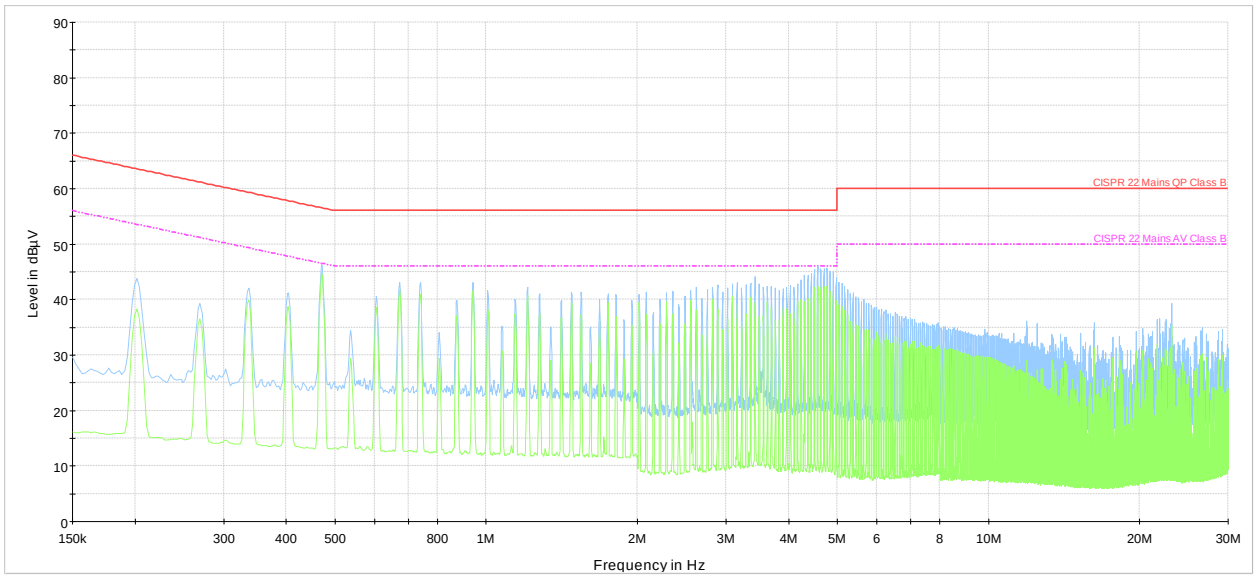


Plot 8.1-1: Conducted emissions on phase line, indoor unit



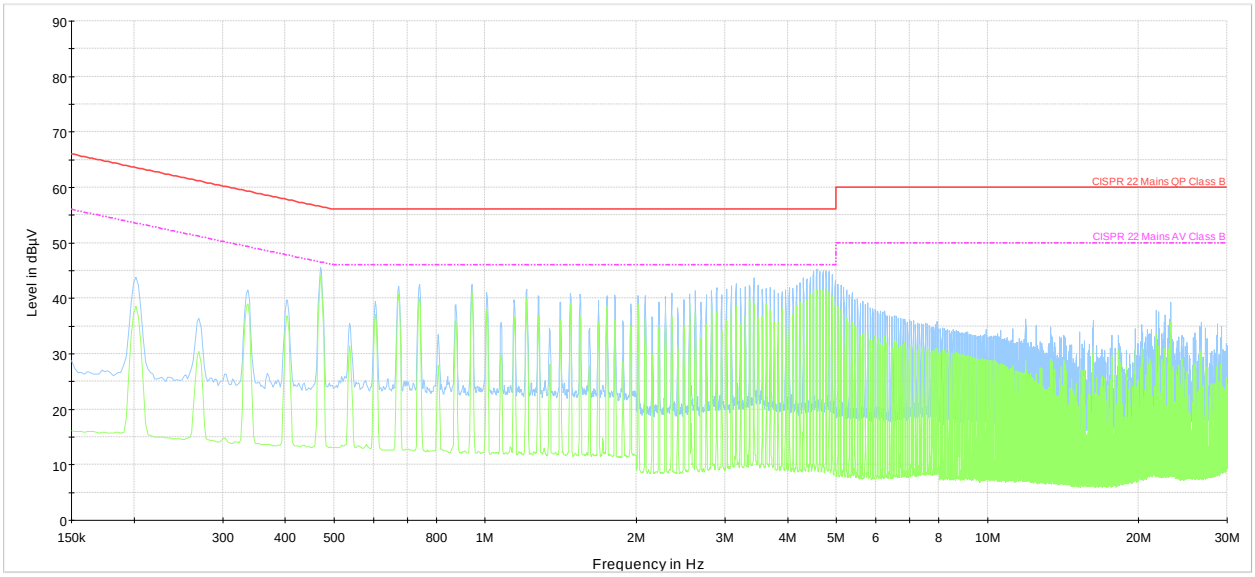
Plot 8.1-2: Conducted emissions on neutral line, indoor unit

8.1.4 Test data, continued



120 VAC; 60 Hz - Phase [Outdoor]
CISPR 22 Mains QP Class B
CISPR 22 Mains AV Class B
Peak Detector Scan
Average Detector Scan

Plot 8.1-3: Conducted emissions on phase line, outdoor unit



120 VAC; 60 Hz - Neutral [Outdoor]
CISPR 22 Mains QP Class B
CISPR 22 Mains AV Class B
Peak Detector Scan
Average Detector Scan

Plot 8.1-4: Conducted emissions on neutral line, outdoor unit

8.1.4 Test data, continued

Table 8.1-2: Quasi-Peak conducted emissions results

Frequency (MHz)	Q-Peak result (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
4.915500	40.2	100.0	9.000	On	Phase	10.2	15.8	56.0
0.741750	40.4	100.0	9.000	On	Phase	10.1	15.6	56.0
3.367500	40.7	100.0	9.000	On	Phase	10.2	15.3	56.0
3.097500	40.8	100.0	9.000	On	Phase	10.2	15.2	56.0
4.580250	40.8	100.0	9.000	On	Phase	10.3	15.2	56.0
4.647750	40.8	100.0	9.000	On	Phase	10.3	15.2	56.0
1.212000	41.0	100.0	9.000	On	Phase	10.0	15.0	56.0

Table 8.1-3: Average conducted emissions results

Frequency (MHz)	Average result (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
4.726500	38.6	100.0	9.000	On	Neutral	10.2	7.4	46.0
4.659000	39.1	100.0	9.000	On	Neutral	10.2	6.9	46.0
1.214250	40.4	100.0	9.000	On	Neutral	10.0	5.6	46.0
3.104250	40.4	100.0	9.000	On	Neutral	10.2	5.6	46.0
4.791750	40.4	100.0	9.000	On	Neutral	10.2	5.6	46.0
0.674250	40.7	100.0	9.000	On	Neutral	10.1	5.3	46.0
3.374250	40.7	100.0	9.000	On	Neutral	10.2	5.3	46.0

Sample calculation:
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
Result (dBµV) = XX dBµV (reading from receiver) + XX dB (Correction factor)

Example:
43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

8.2 Clause 15.247(a)(2) Minimum 6 dB bandwidth for systems using digital modulation techniques

8.2.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

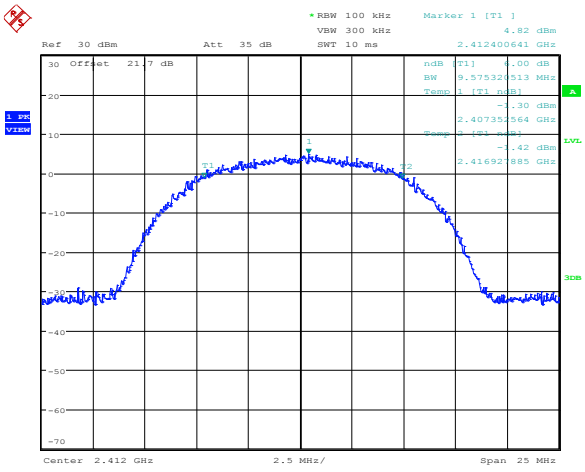
8.2.2 Test summary

Test date	December 13, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1001 mbar	**Relative humidity**	35 %

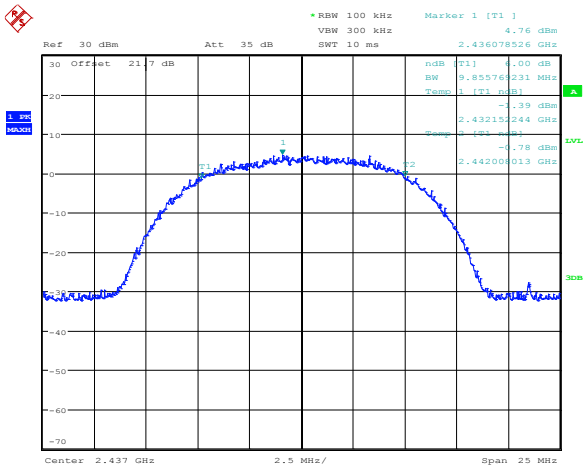
8.2.3 Observations/special notes

Measurements were performed with peak detector using 100 kHz RBW. VBW was set wider than RBW.

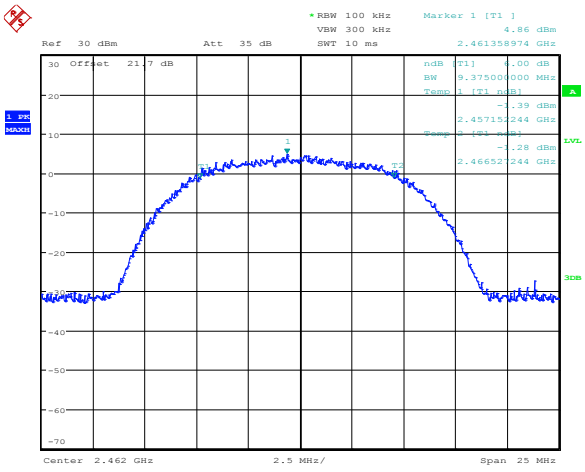
8.2.4 Test data



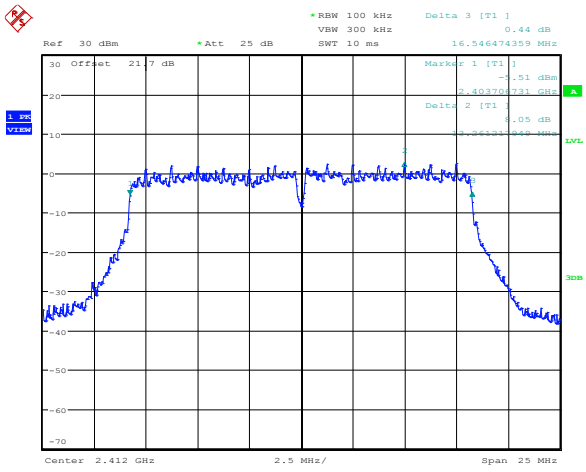
Plot 8.2-1: 6 dB bandwidth – 802.11b, Low channel



Plot 8.2-2: 6 dB bandwidth – 802.11b, Mid channel

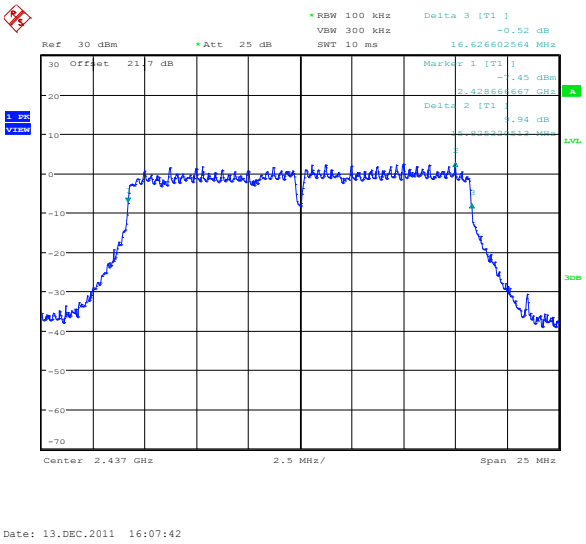


Plot 8.2-3: 6 dB bandwidth – 802.11b, High channel

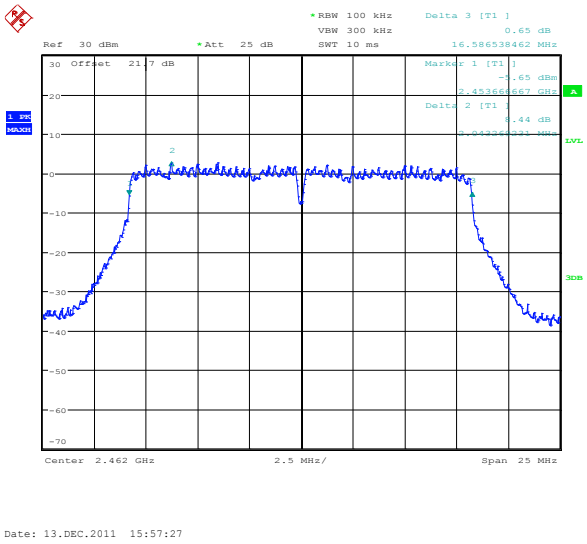


Plot 8.2-4: 6 dB bandwidth – 802.11g, Low channel

8.2.4 Test data, continued



Plot 8.2-5: 6 dB bandwidth – 802.11g, Mid channel



Plot 8.2-6: 6 dB bandwidth – 802.11g, High channel

Table 8.2-1: 6 dB BW, 80211b results

Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
2412	9.575	> 0.5	9.075
2437	9.856	> 0.5	9.356
2462	9.375	> 0.5	8.875

Table 8.2-2: 6 dB BW, 80211g results

Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
2412	16.546	> 0.5	16.046
2437	16.627	> 0.5	16.127
2462	16.587	> 0.5	16.087

8.3 Clause 15.247(b) Maximum peak conducted output power

8.3.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) 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.

(2) 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.

(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

8.3.2 Test summary

Test date	December 13, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1001 mbar	**Relative humidity**	35 %

8.3.3 Observations/special notes

The peak detector was used with RBW wider that 20 dB bandwidth.
The span was wider than RBW.

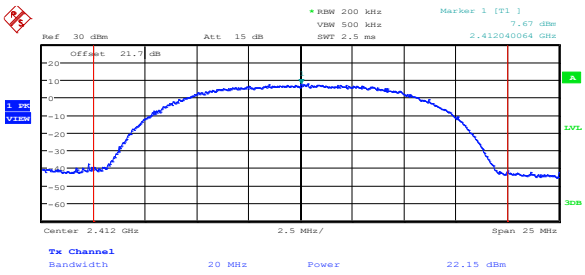
8.3.4 Test data

Section (3) Results

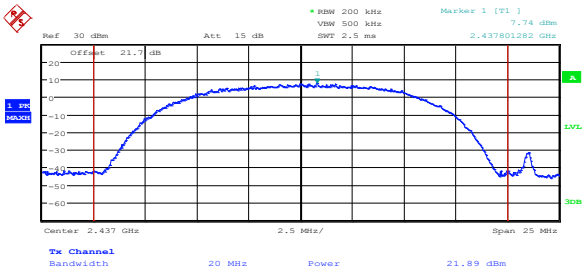
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 watt (30 dBm). As an alternative to a peak power measurement, compliance with the 1 watt (30 dBm) limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling 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.

– The test was performed using guidelines of ANSI C63.10-2009, Clause 10.2.2.

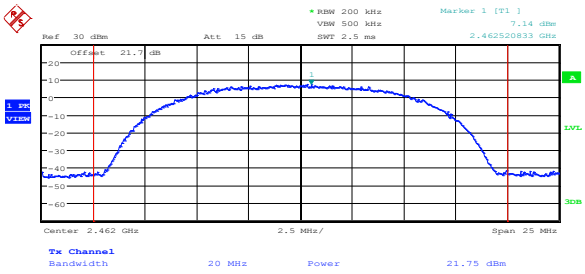
Power option 1 was used for the power output measurements: RBW was set wider than emission bandwidth.
Automatic settings were used for analyzer sweep time.



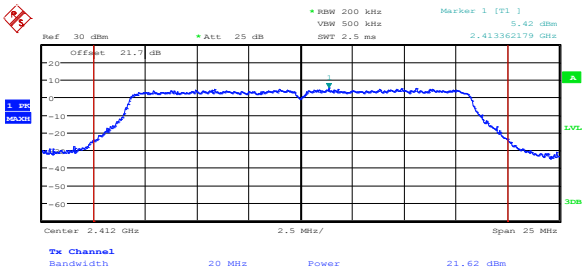
Plot 8.3-1: Output power – 802.11b, Low channel for antennas below 16 dBi



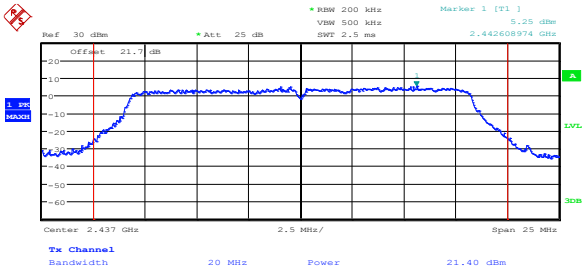
Plot 8.3-2: Output power – 802.11b, Mid channel for antennas below 16 dBi



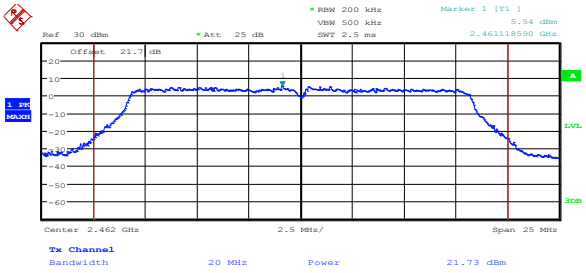
Plot 8.3-3: Output power – 802.11b, High channel for antennas below 16 dBi



Plot 8.3-4: Output power – 802.11g, Low channel for antennas below 16 dBi

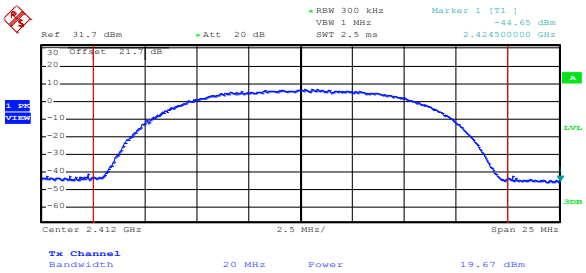


Plot 8.3-5: Output power – 802.11g, Mid channel for antennas below 16 dBi

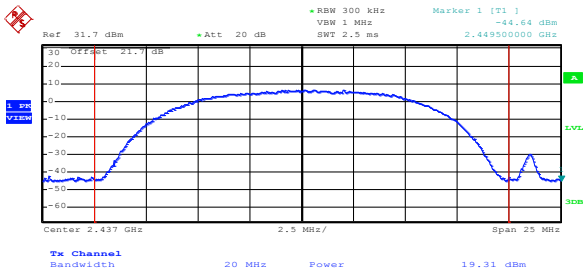


Plot 8.3-6: Output power – 802.11g, High channel for antennas below 16 dBi

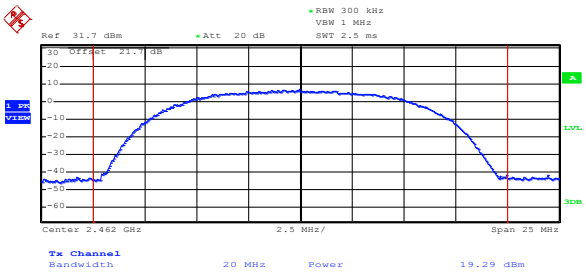
8.3.4 Test data, continued



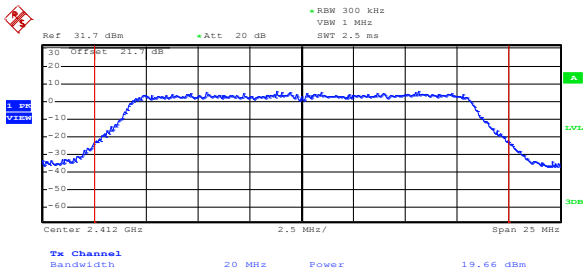
Plot 8.3-7: Output power – 802.11b, Low channel for 16 dBi antenna



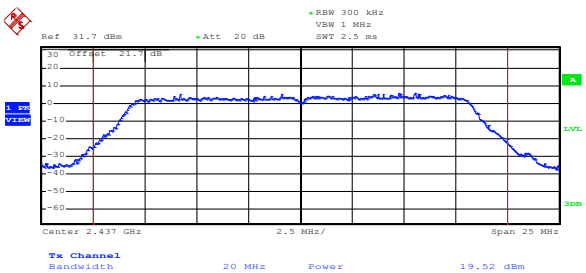
Plot 8.3-8: Output power – 802.11b, Mid channel for 16 dBi antenna



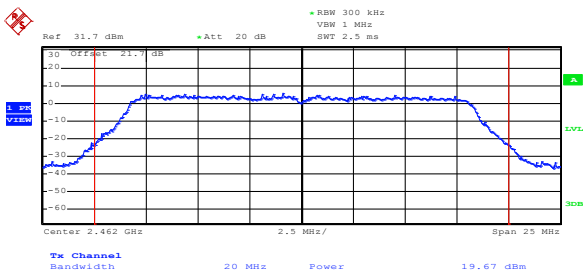
Plot 8.3-9: Output power – 802.11b, High channel for 16 dBi antenna



Plot 8.3-10: Output power – 802.11g, Low channel for 16 dBi antenna



Plot 8.3-11: Output power – 802.11g, Mid channel for 16 dBi antenna



Plot 8.3-12: Output power – 802.11g, High channel for 16 dBi antenna

8.3.4 Test data, continued

Table 8.3-1: 802.11b Conducted output power results for antennas below 16 dBi

Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
2412	22.15	30.0	7.85
2437	21.89	30.0	8.11
2462	21.75	30.0	8.25

Table 8.3-2: 802.11b Conducted output power results for 16 dBi antenna

Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
2412	19.67	30.0	10.33
2437	19.31	30.0	10.69
2462	19.29	30.0	10.71

Table 8.3-3: 802.11b EIRP calculation results

Frequency (MHz)	Conducted output power, (dBm)	Antenna gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Indoor unit					
2412	22.15	7.0	29.15	36.0	6.85
2437	21.89	7.0	28.89	36.0	7.11
2462	21.75	7.0	28.75	36.0	7.25
2412	22.15	5.0	27.15	36.0	8.85
2437	21.89	5.0	26.89	36.0	9.11
2462	21.75	5.0	26.75	36.0	9.25
2412	22.15	10.0	32.15	36.0	3.85
2437	21.89	10.0	31.89	36.0	4.11
2462	21.75	10.0	31.75	36.0	4.25
Outdoor unit					
2412	22.15	9.0[1]	31.15	36.0	4.85
2437	21.89	9.0[1]	30.89	36.0	5.11
2462	21.75	9.0[1]	30.75	36.0	5.25
2412	19.67	16.0	35.67	36.0	0.33
2437	19.31	16.0	35.31	36.0	0.69
2462	19.29	16.0	35.29	36.0	0.71

[1] The EUT can utilize Rod antennas with 3 different gains: 5, 7 and 9 dBi. Since these antennas are of the same type, therefore highest antenna gain was used for the calculation.

8.3.4 Test data, continued

Table 8.3-4: 802.11g Conducted output power results for antennas below 16 dBi

Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
2412	21.62	30.0	8.38
2437	21.40	30.0	8.60
2462	21.73	30.0	8.27

Table 8.3-5: 802.11g Conducted output power results for 16 dBi antenna

Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
2412	19.66	30.0	10.34
2437	19.52	30.0	10.48
2462	19.67	30.0	10.33

Table 8.3-6: 802.11g EIRP calculation results

Frequency (MHz)	Conducted output power, (dBm)	Antenna gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Indoor unit					
2412	21.62	7.0	28.62	36.0	7.38
2437	21.40	7.0	28.40	36.0	7.60
2462	21.73	7.0	28.73	36.0	7.27
2412	21.62	5.0	26.62	36.0	9.38
2437	21.40	5.0	26.40	36.0	9.60
2462	21.73	5.0	26.73	36.0	9.27
2412	21.62	10.0	31.62	36.0	4.38
2437	21.40	10.0	31.40	36.0	4.60
2462	21.73	10.0	31.73	36.0	4.27
Outdoor unit					
2412	21.62	9.0[1]	30.62	36.0	5.38
2437	21.40	9.0[1]	30.40	36.0	5.60
2462	21.73	9.0[1]	30.73	36.0	5.27
2412	19.66	16.0	35.66	36.0	0.34
2437	19.52	16.0	35.52	36.0	0.48
2462	19.67	16.0	35.67	36.0	0.33

[1] The EUT can utilize Rod antennas with 3 different gains: 5, 7 and 9 dBi. Since these antennas are of the same type, therefore highest antenna gain was used for the calculation.

8.4 Clause 15.247(d) Spurious emissions

8.4.1 Definitions and limits

15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.4.2 Test summary

Test date	December 13, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1001 mbar	**Relative humidity**	35 %

8.4.3 Observations/special notes

Table 8.4-1: §15.209 – Radiated emission limits

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009–0.490	2400/F	$67.6-20\times\log_{10}(F)$	300
0.490–1.705	24000/F	$87.6-20\times\log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

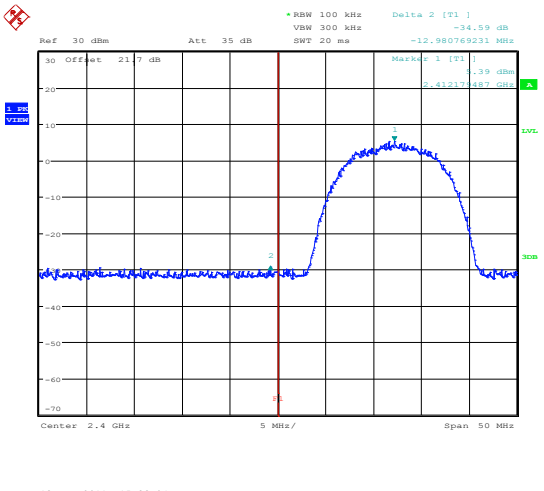
- The spectrum was searched from 30 MHz to the 10th harmonic.
- All radiated measurements were performed at a distance of 3 m.
- All measurements were performed:
- within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
- above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
- and using peak detector with 1 MHz/10 Hz RBW/VBW for average results.
- Transmit output power was measured while supply voltage was varied from 102 VAC to 138 VAC (85 % to 115 % of the nominal rated supply voltage). No change in transmit output power was observed.

8.4.4 Test data

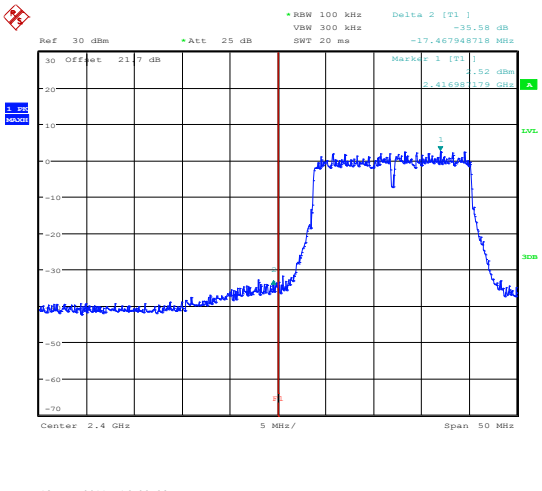
Table 8.4-2: Restricted bands of operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

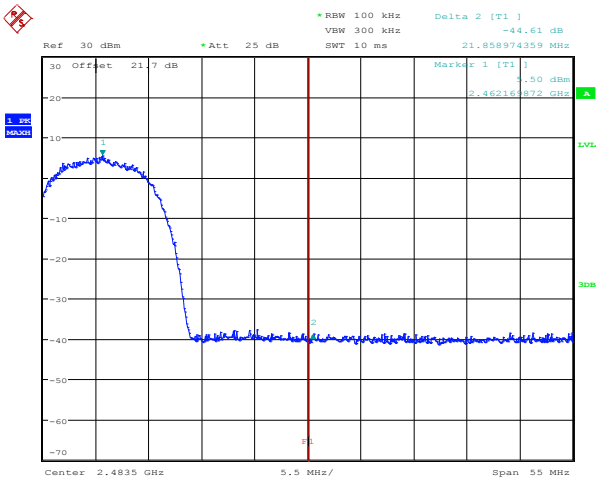
8.4.4 Test data, continued



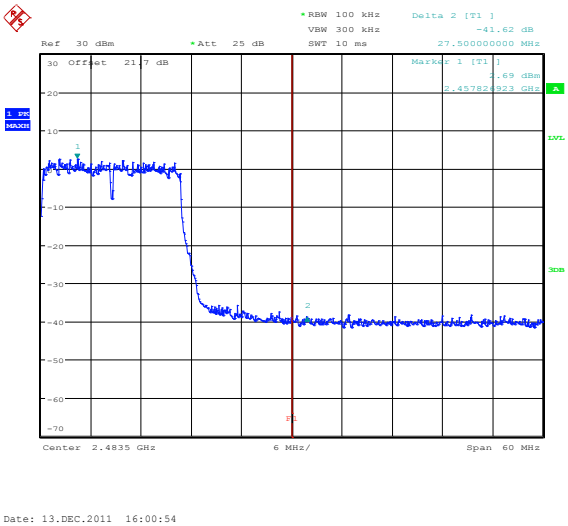
Plot 8.4-1: Lower band edge for 802.11b



Plot 8.4-2: Lower band edge for 802.11g

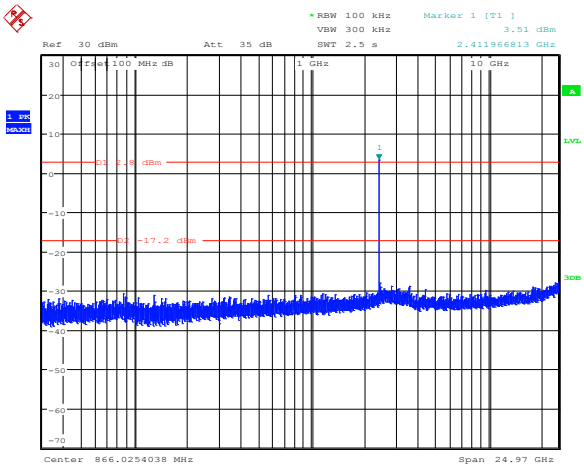


Plot 8.4-3: Upper band edge for 802.11b

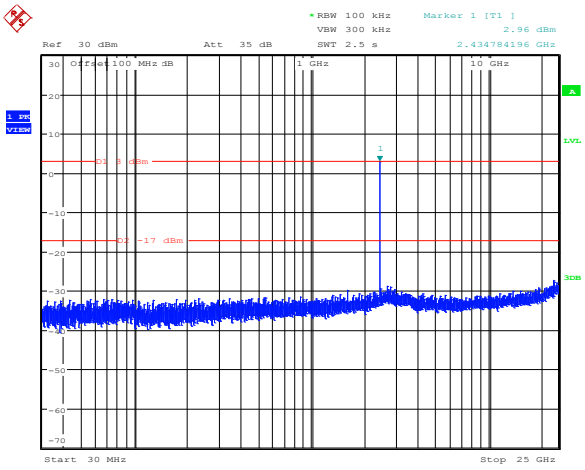


Plot 8.4-4: Upper band edge for 802.11g

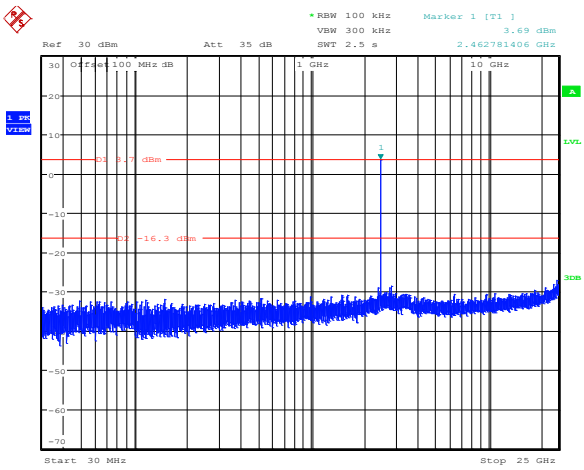
8.4.4 Test data, continued



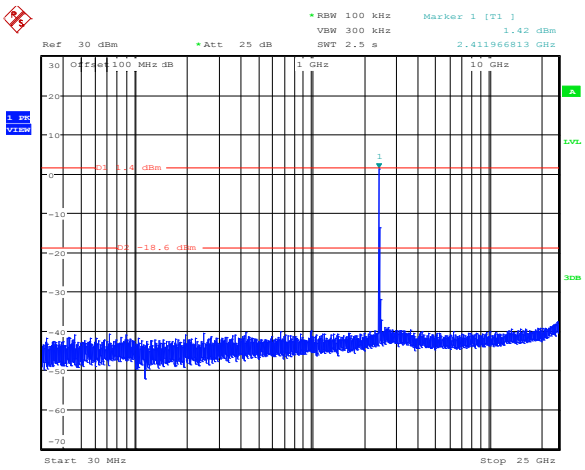
Plot 8.4-5: Conducted spurious 30 MHz to 10th harmonic, 802.11b, low channel



Plot 8.4-6: Conducted spurious 30 MHz to 10th harmonic, 802.11b, mid channel

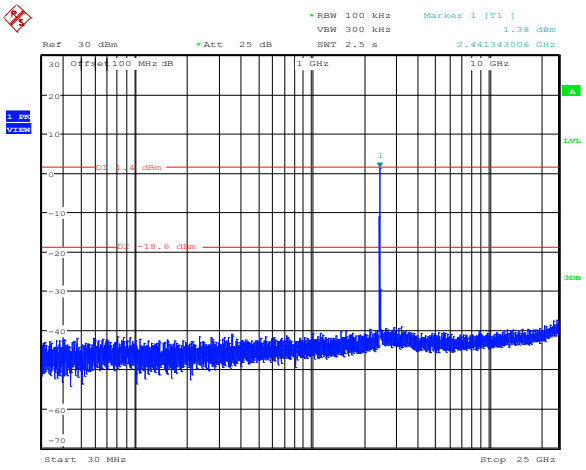


Plot 8.4-7: Conducted spurious 30 MHz to 10th harmonic, 802.11b, high channel

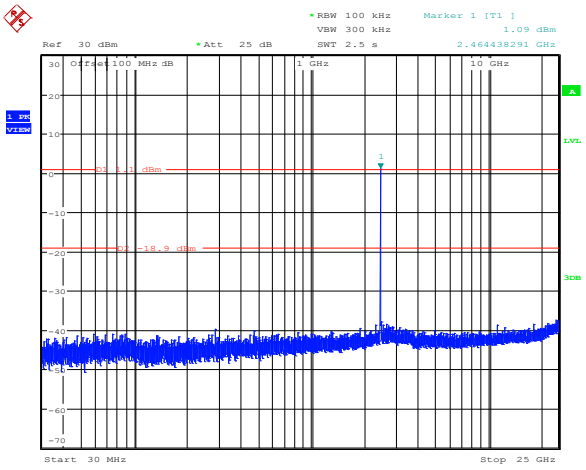


Plot 8.4-8: Conducted spurious 30 MHz to 10th harmonic, 802.11g, low channel

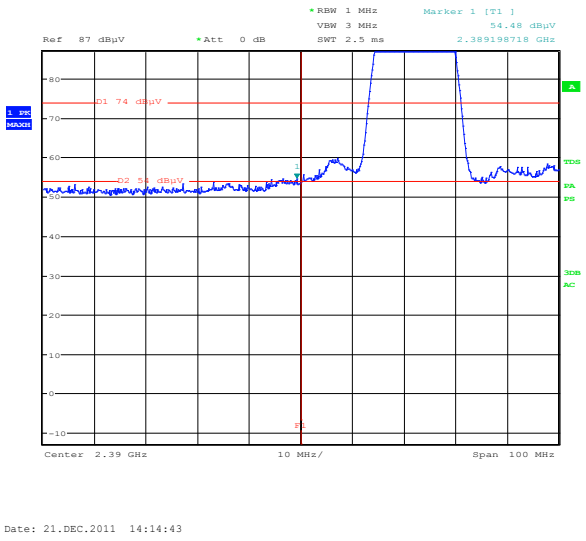
8.4.4 Test data, continued



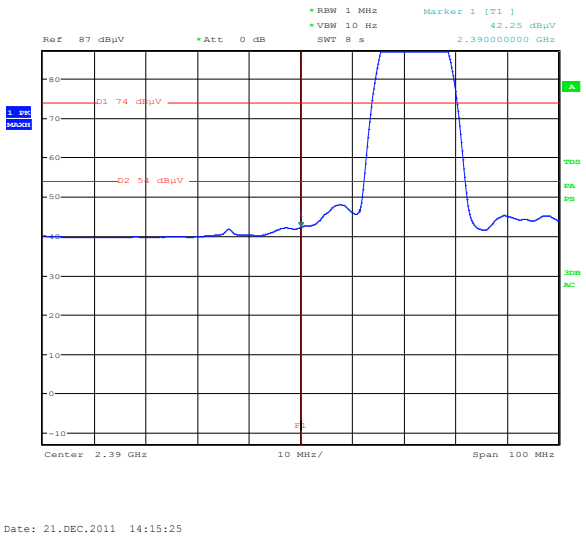
Plot 8.4-9: Conducted spurious 30 MHz to 10th harmonic, 802.11g, mid channel



Plot 8.4-10: Conducted spurious 30 MHz to 10th harmonic, 802.11g, high channel

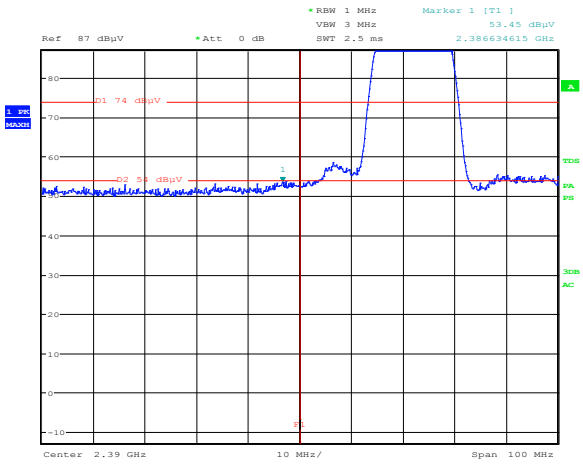


Plot 8.4-11: Lower band edge, 802.11b, IDU, patch antenna, peak

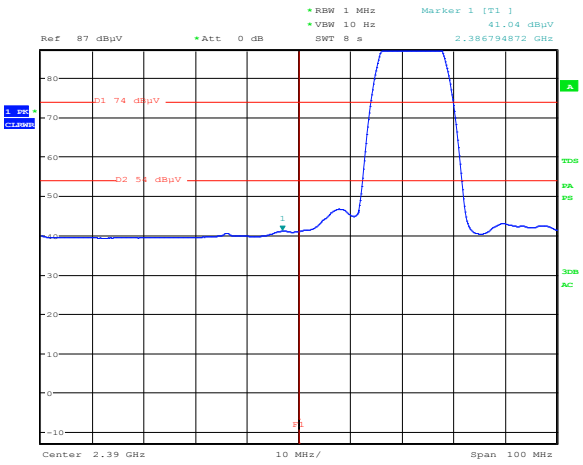


Plot 8.4-12: Lower band edge, 802.11b, IDU, patch antenna, average

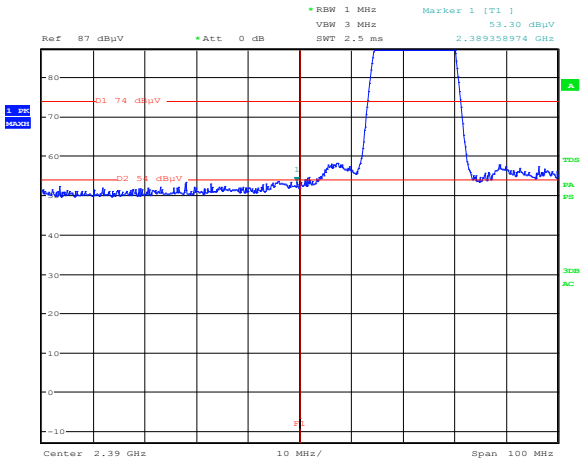
8.4.4 Test data, continued



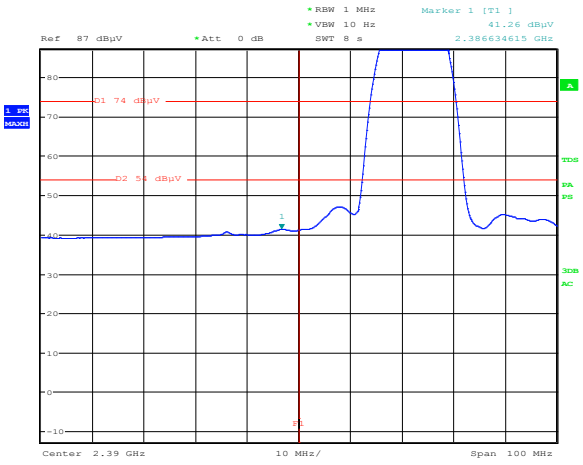
Plot 8.4-13: Lower band edge, 802.11b, IDU, pedal antenna, peak



Plot 8.4-14: Lower band edge, 802.11b, IDU, pedal antenna, average

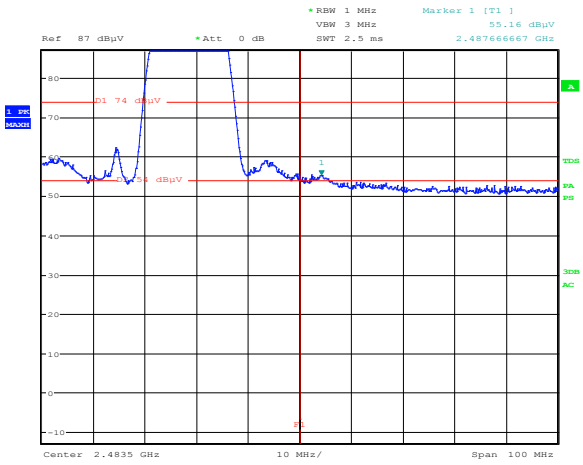


Plot 8.4-15: Lower band edge, 802.11b, IDU, whip antenna, peak

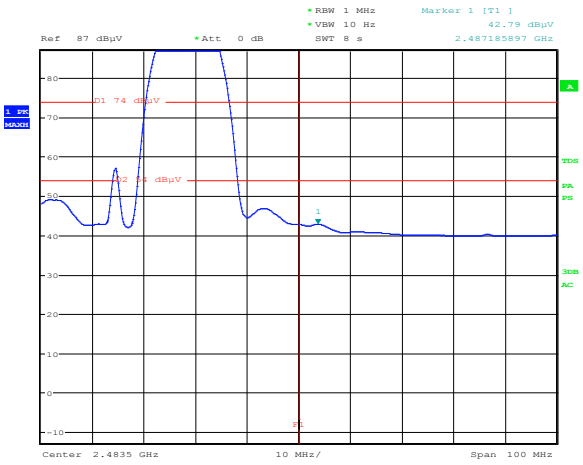


Plot 8.4-16: Lower band edge, 802.11b, IDU, whip antenna, average

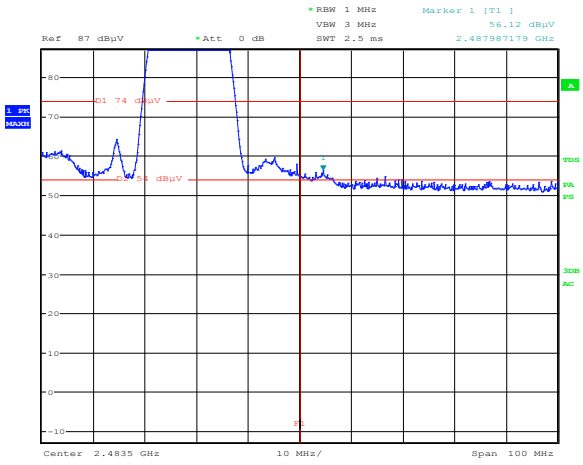
8.4.4 Test data, continued



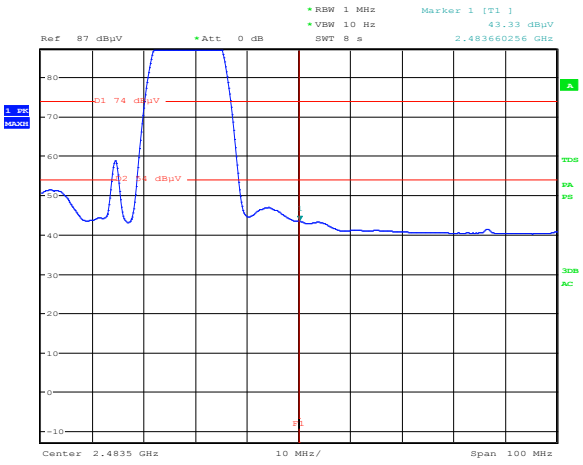
Plot 8.4-17: Upper band edge, 802.11b, IDU, pedal antenna, peak



Plot 8.4-18: Upper band edge, 802.11b, IDU, pedal antenna, average

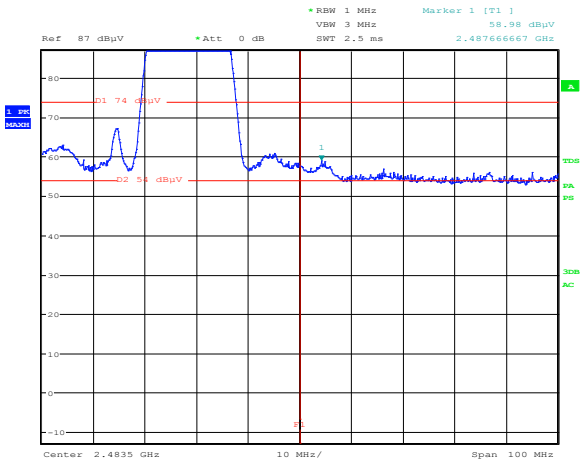


Plot 8.4-19: Upper band edge, 802.11b, IDU, whip antenna, peak

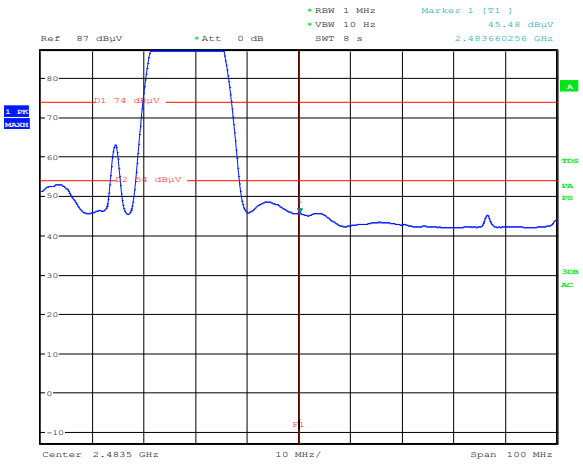


Plot 8.4-20: Upper band edge, 802.11b, IDU, whip antenna, average

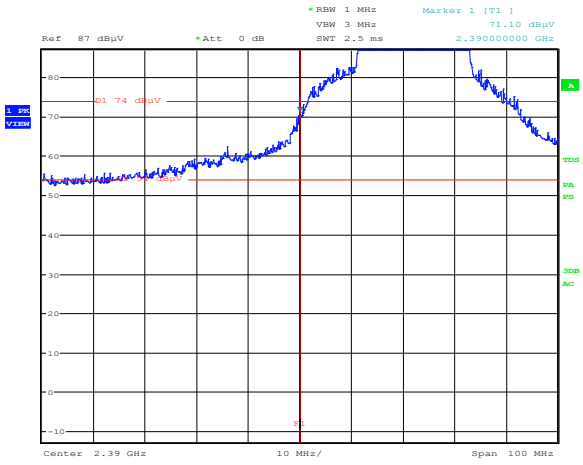
8.4.4 Test data, continued



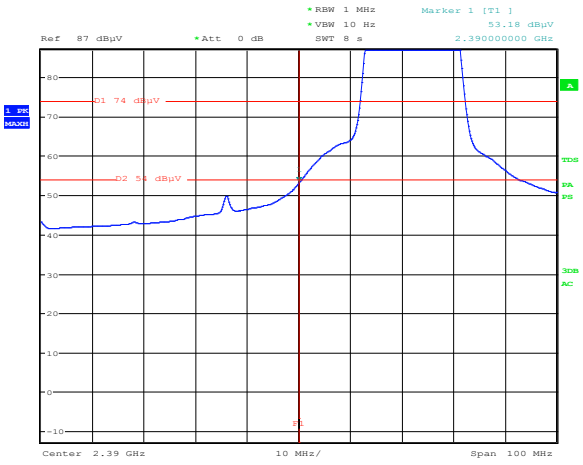
Plot 8.4-21: Upper band edge, 802.11b, IDU, patch antenna, peak



Plot 8.4-22: Upper band edge, 802.11b, IDU, patch antenna, average

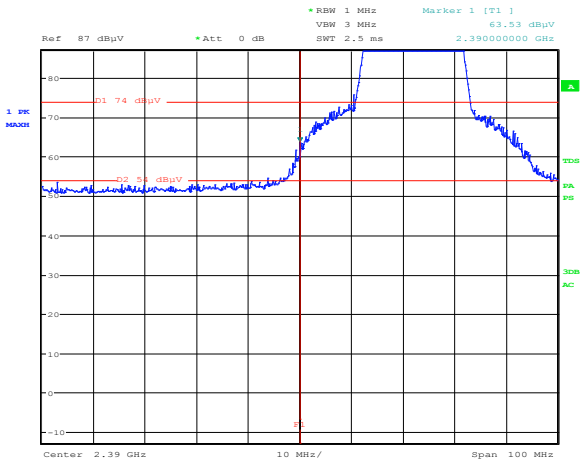


Plot 8.4-23: Lower band edge, 802.11g, IDU, patch antenna, peak

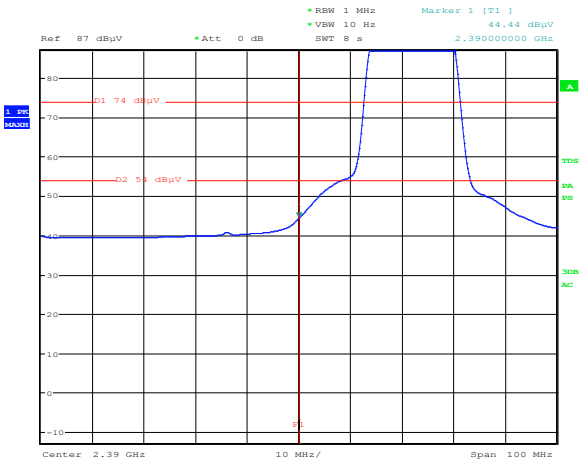


Plot 8.4-24: Lower band edge, 802.11g, IDU, patch antenna, average

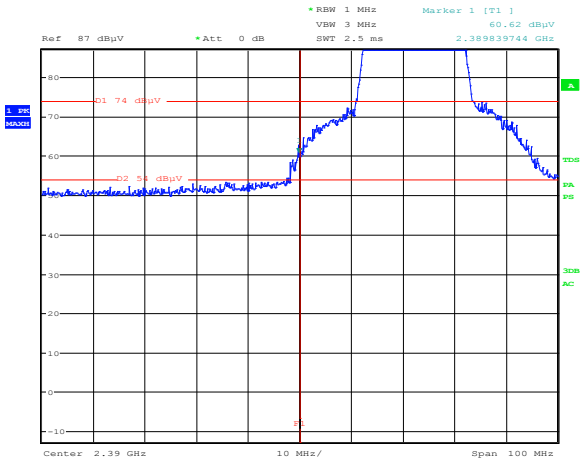
8.4.4 Test data, continued



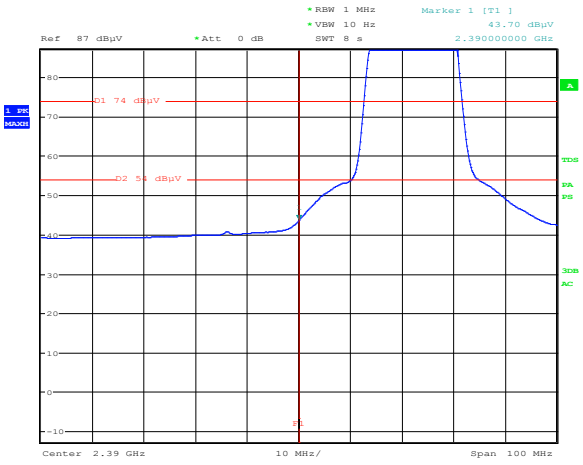
Plot 8.4-25: Lower band edge, 802.11g, IDU, pedal antenna, peak



Plot 8.4-26: Lower band edge, 802.11g, IDU, pedal antenna, average

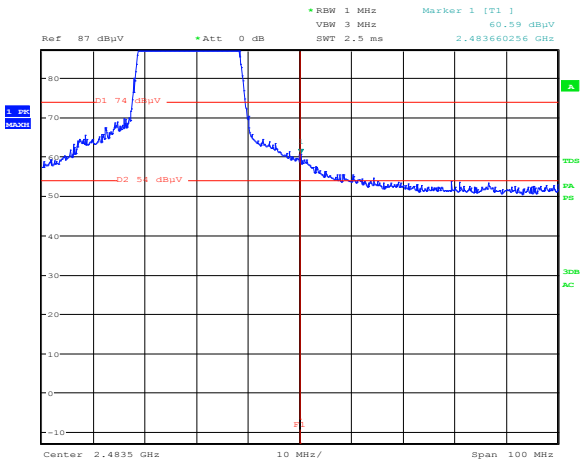


Plot 8.4-27: Lower band edge, 802.11g, IDU, whip antenna, peak

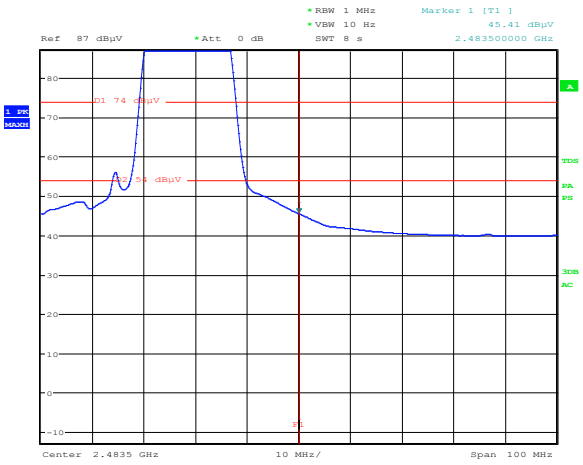


Plot 8.4-28: Lower band edge, 802.11g, IDU, whip antenna, average

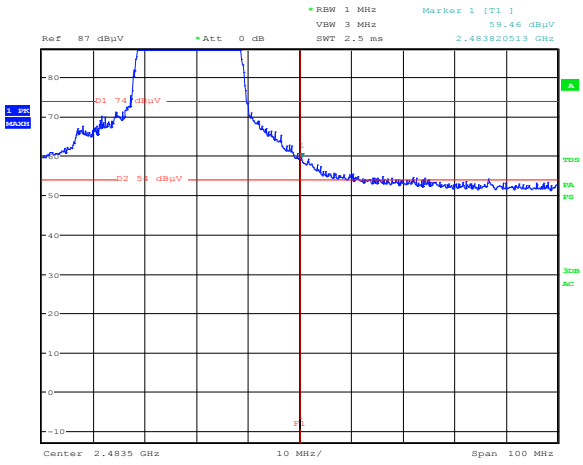
8.4.4 Test data, continued



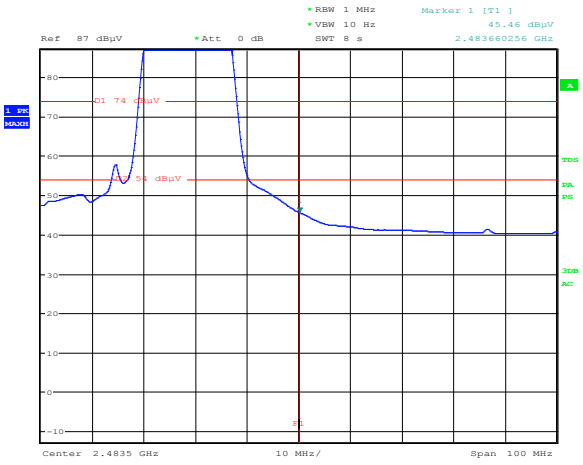
Plot 8.4-29: Upper band edge, 802.11g, IDU, pedal antenna, peak



Plot 8.4-30: Upper band edge, 802.11g, IDU, pedal antenna, average

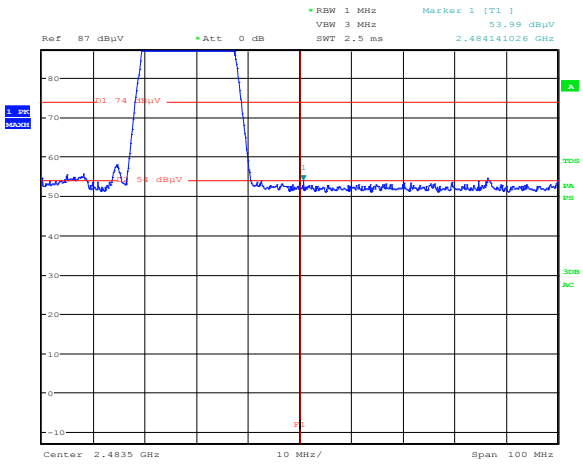


Plot 8.4-31: Upper band edge, 802.11g, IDU, whip antenna, peak

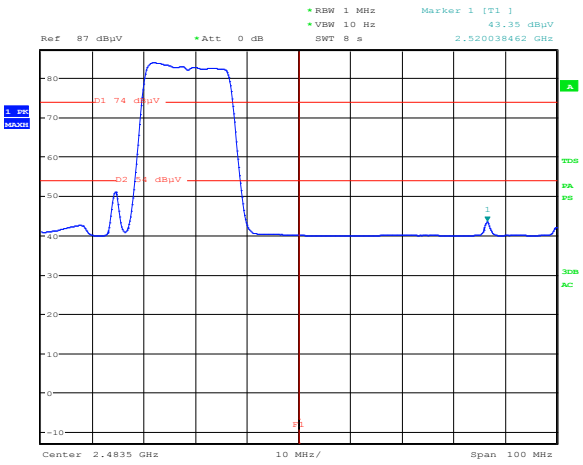


Plot 8.4-32: Upper band edge, 802.11g, IDU, whip antenna, average

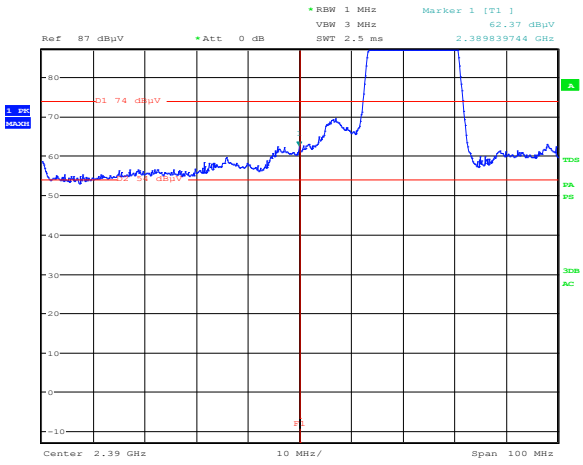
8.4.4 Test data, continued



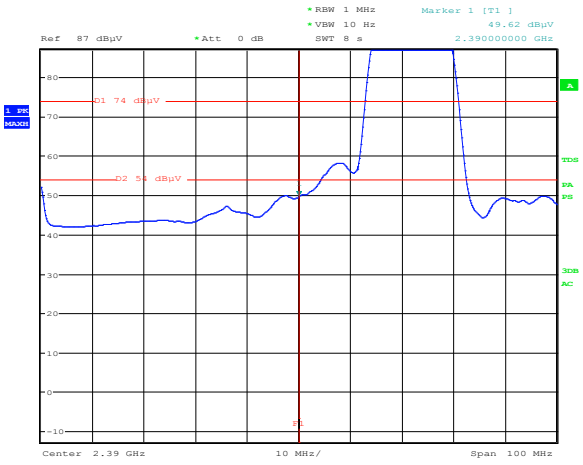
Plot 8.4-33: Upper band edge, 802.11g, IDU, patch antenna, peak



Plot 8.4-34: Upper band edge, 802.11g, IDU, patch antenna, average

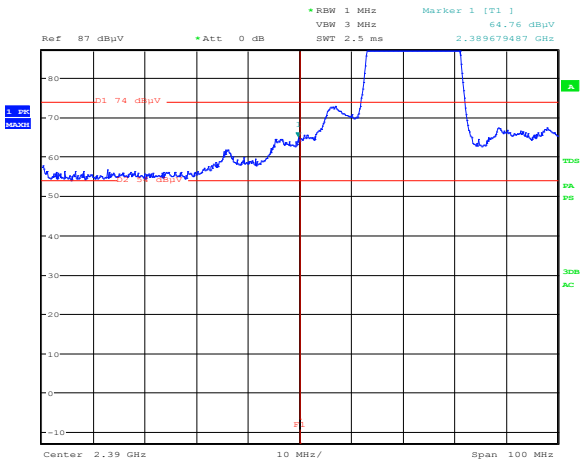


Plot 8.4-35: Lower band edge, 802.11b, ODU, rod antenna, peak

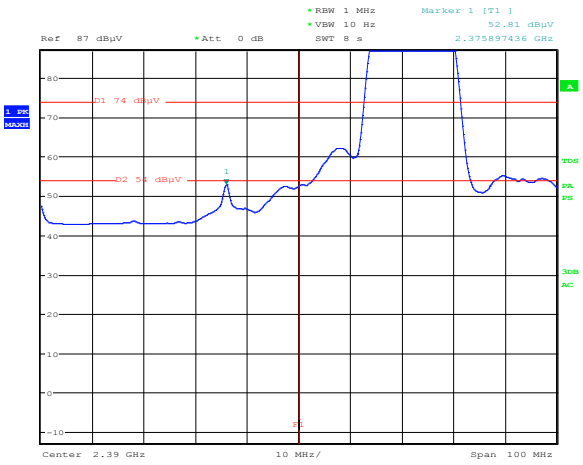


Plot 8.4-36: Lower band edge, 802.11b, ODU, rod antenna, average

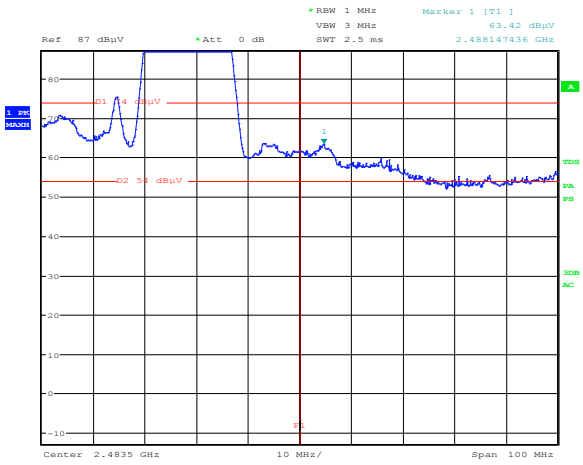
8.4.4 Test data, continued



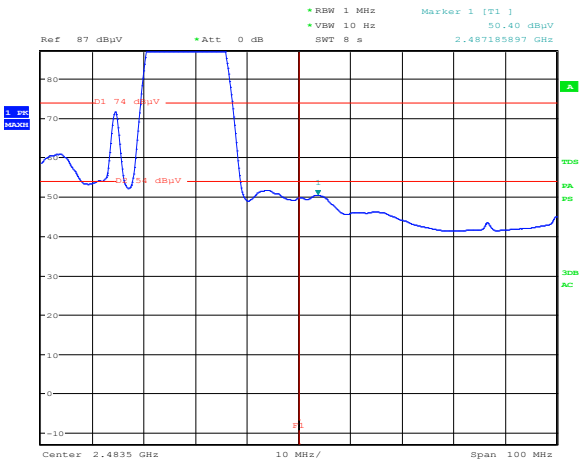
Plot 8.4-37: Lower band edge, 802.11b, ODU, sector antenna, peak



Plot 8.4-38: Lower band edge, 802.11b, ODU, sector antenna, average

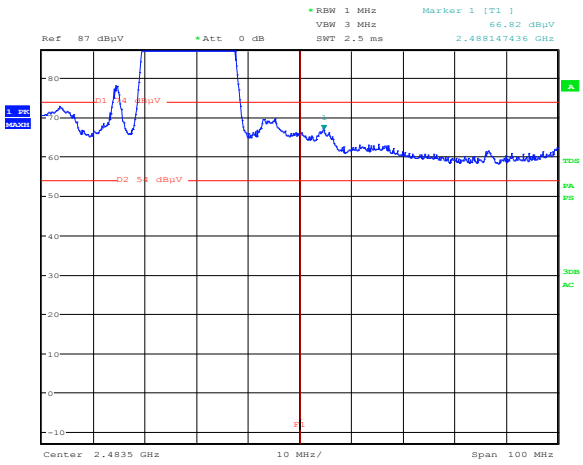


Plot 8.4-39: Upper band edge, 802.11b, ODU, rod antenna, peak

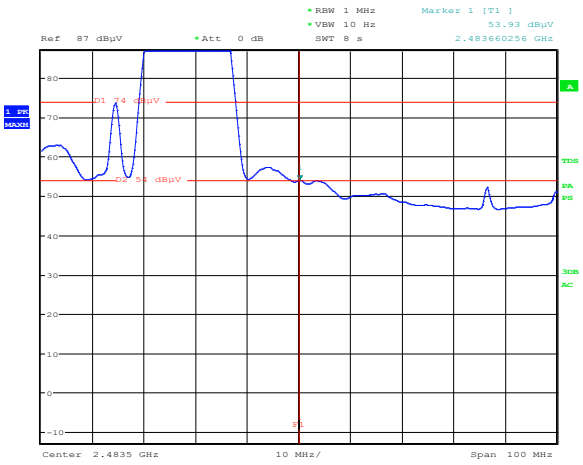


Plot 8.4-40: Upper band edge, 802.11b, ODU, rod antenna, average

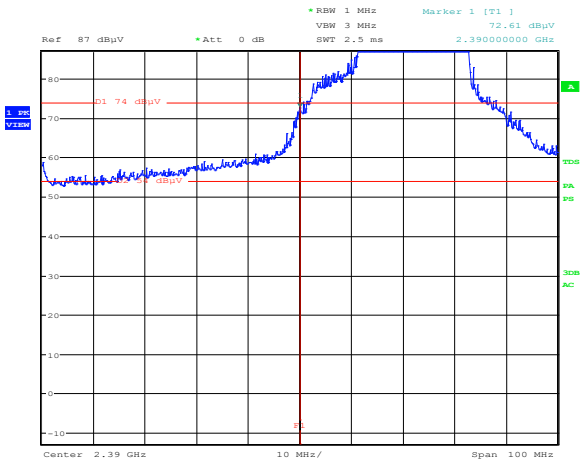
8.4.4 Test data, continued



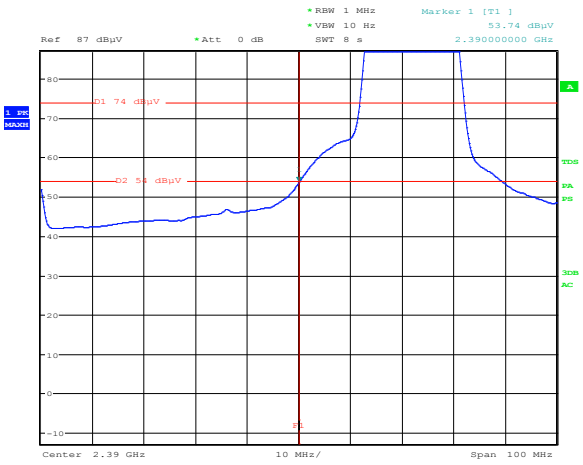
Plot 8.4-41: Upper band edge, 802.11b, ODU, sector antenna, peak



Plot 8.4-42: Upper band edge, 802.11b, ODU, sector antenna, average

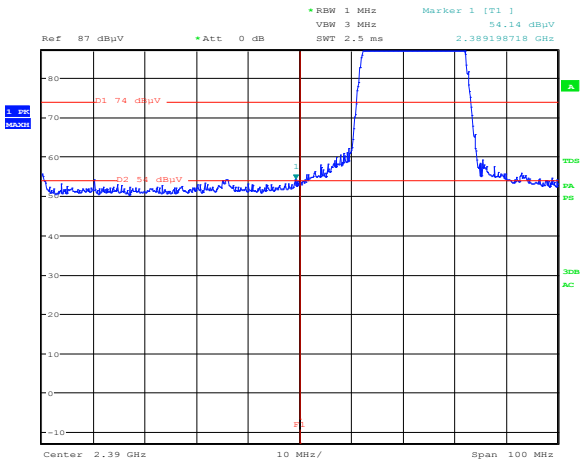


Plot 8.4-43: Lower band edge, 802.11g, ODU, rod antenna, peak

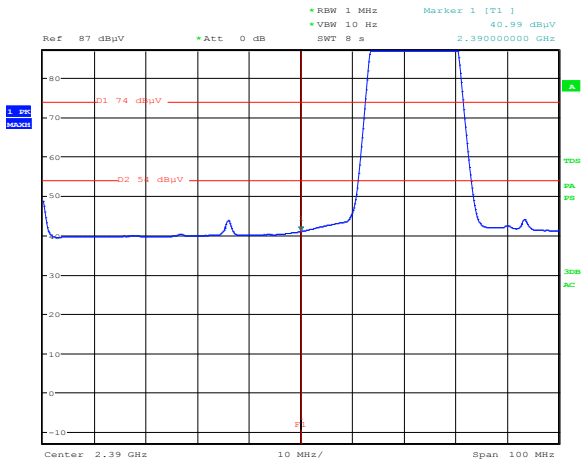


Plot 8.4-44: Lower band edge, 802.11g, ODU, rod antenna, average

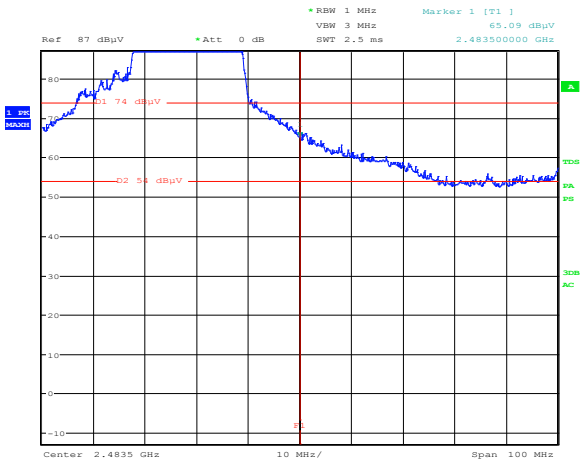
8.4.4 Test data, continued



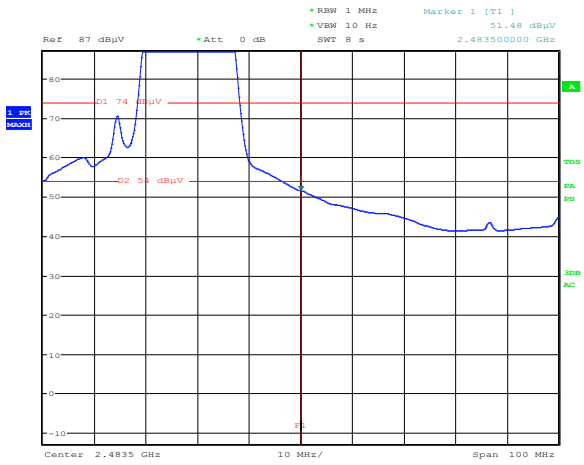
Plot 8.4-45: Lower band edge, 802.11g, ODU, sector antenna, peak



Plot 8.4-46: Lower band edge, 802.11g, ODU, sector antenna, average

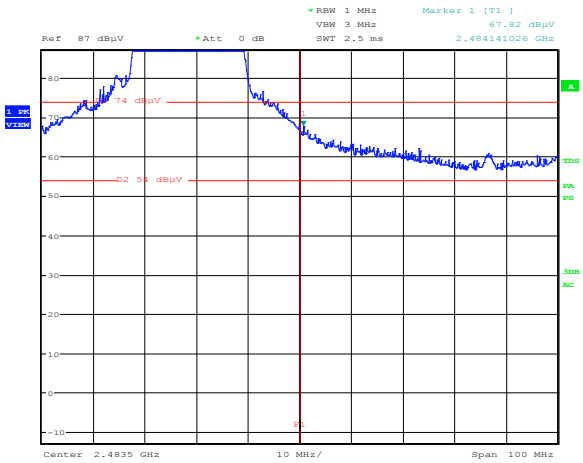


Plot 8.4-47: Upper band edge, 802.11g, ODU, rod antenna, peak



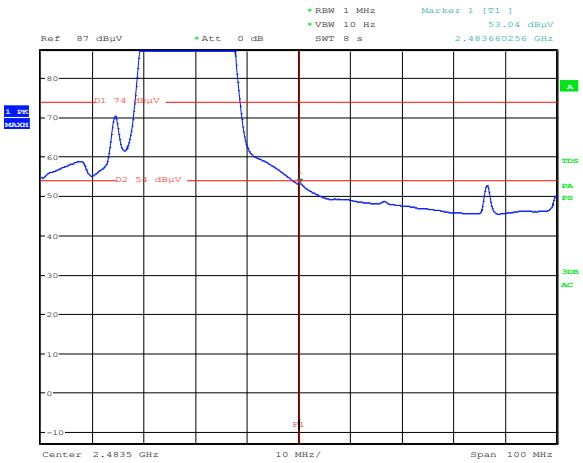
Plot 8.4-48: Upper band edge, 802.11g, ODU, rod antenna, average

8.4.4 Test data, continued



Date: 21.DEC.2011 15:27:17

Plot 8.4-49: Upper band edge, 802.11g, ODU, sector antenna, peak



Date: 21.DEC.2011 15:26:11

Plot 8.4-50: Upper band edge, 802.11g, ODU, sector antenna, average

8.5 Clause 15.247(e) Power spectral density for digitally modulated devices

8.5.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(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.

- The test was performed using guidelines of ANSI C63.10-2009, Clause 6.11.2.

- PSD option 1 was used since output power option 1 was used.
- Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set > RBW. Sweep time was set to Span/3 kHz. Peak level was measured.
- PSD option 2 was used since output power option 2 was used.
- Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set to ≥9 kHz. Sweep time was set to automatic. (Sample detector was used due to bin width < 0.5 RBW and transmission pulse remained at maximum transmit power throughout 100 sweeps of averaging.) Peak detector was used. Average tracing over 100 sweeps in power averaging mode.

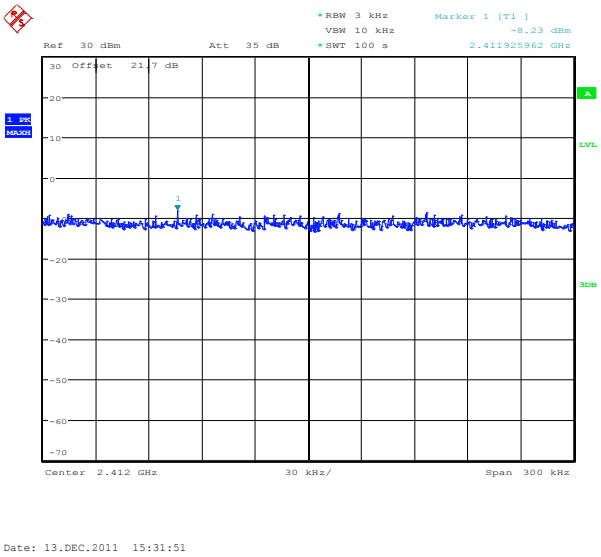
8.5.2 Test summary

Test date	December 13, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1001 mbar	**Relative humidity**	35 %

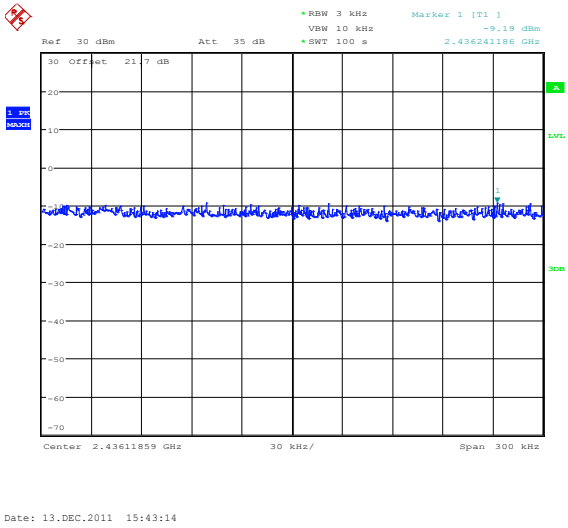
8.5.3 Observations/special notes

Sweep time was set to value of Span / RBW. Sweep time was set to 100 s (300 kHz / 3 kHz)

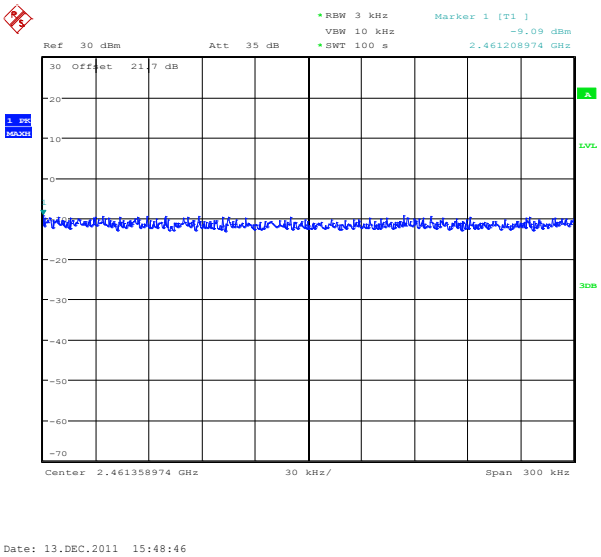
8.5.4 Test data



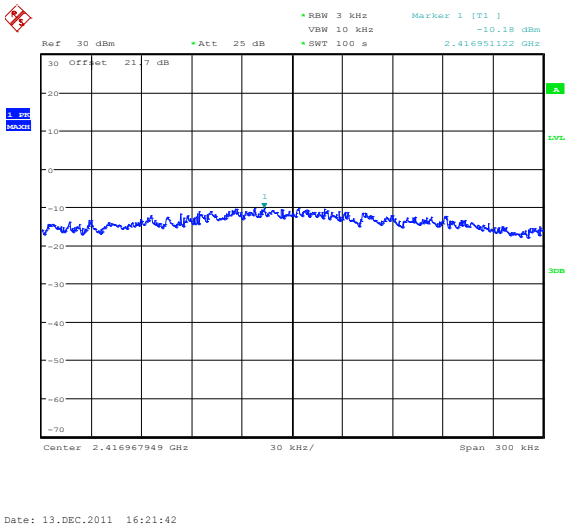
Plot 8.5-1: PSD low channel, 802.11b



Plot 8.5-2: PSD mid channel, 802.11b

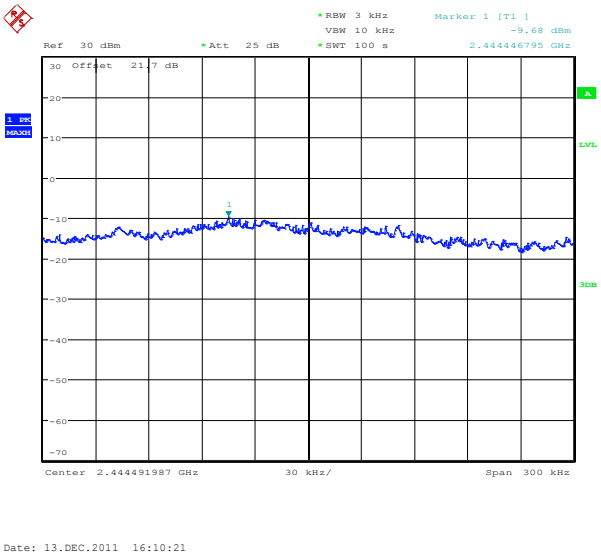


Plot 8.5-3: PSD high channel, 802.11b

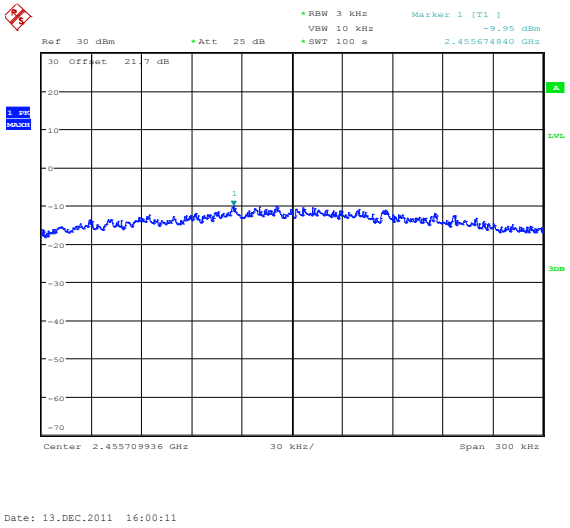


Plot 8.5-4: PSD low channel, 802.11g

8.5.4 Test data



Plot 8.5-5: PSD mid channel, 802.11g



Plot 8.5-6: PSD high channel, 802.11g

Table 8.5-1: PSD, 802.11b results

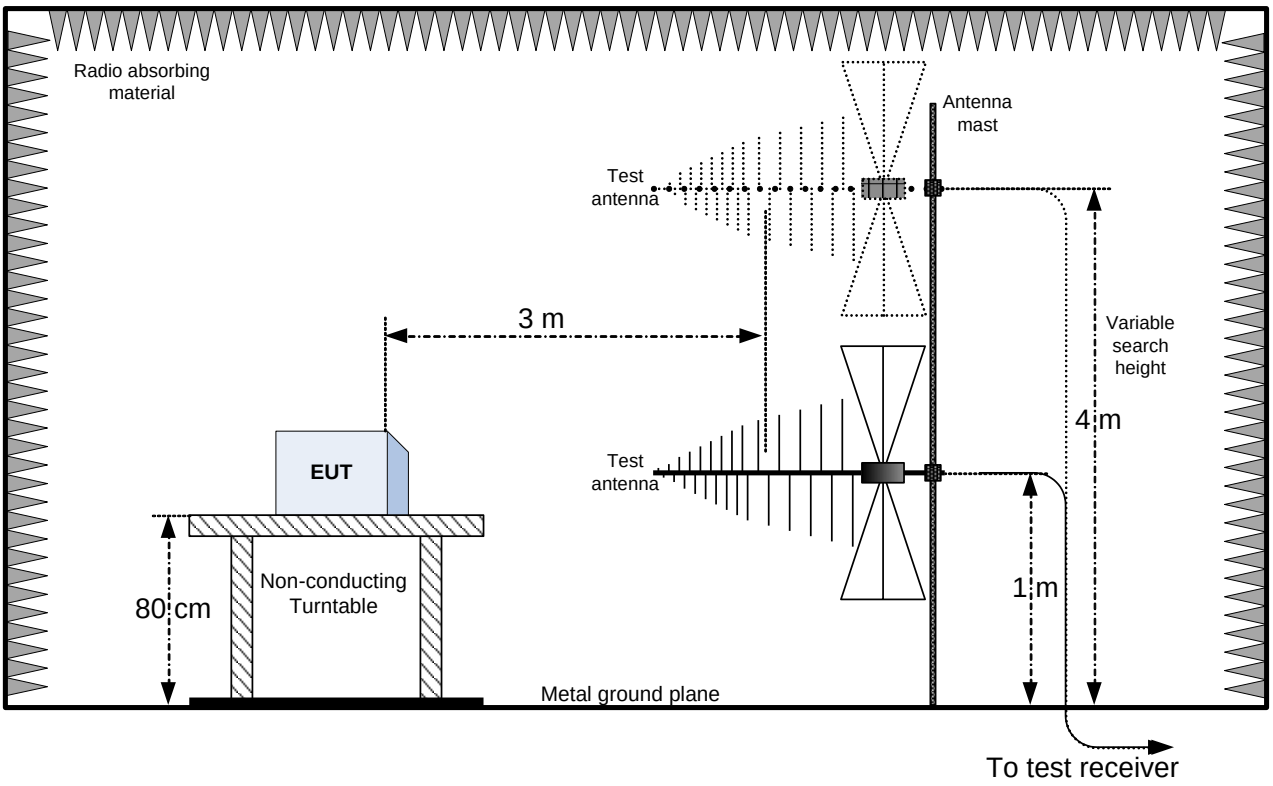
Fundamental frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)
2412	-8.23	8.0	16.23
2437	-9.19	8.0	17.19
2462	-9.09	8.0	17.09

Table 8.5-2: PSD, 802.11g results

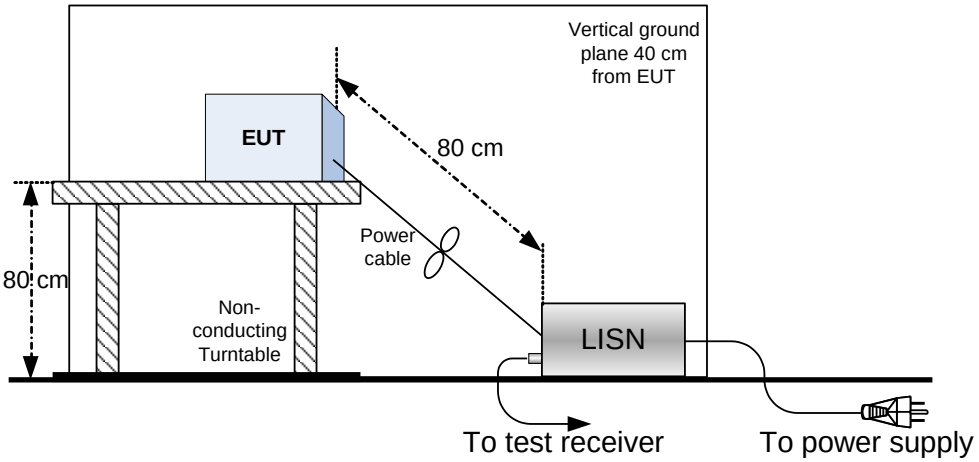
Fundamental frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)
2412	-10.18	8.0	18.18
2437	-9.68	8.0	17.68
2462	-9.95	8.0	17.95

Section 9 Block diagrams of test set-ups

9.1 Radiated emissions set-up



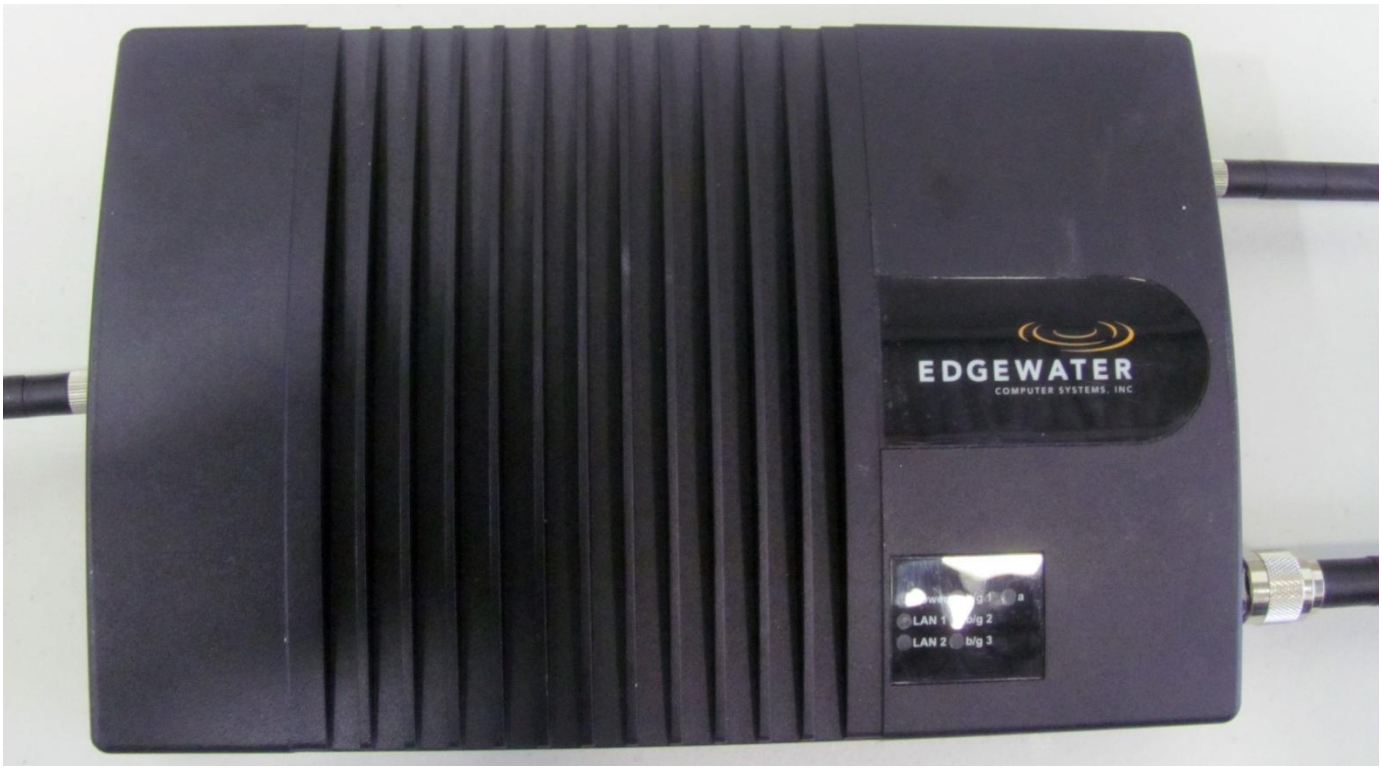
9.2 Conducted emissions set-up



Section 10 EUT photos

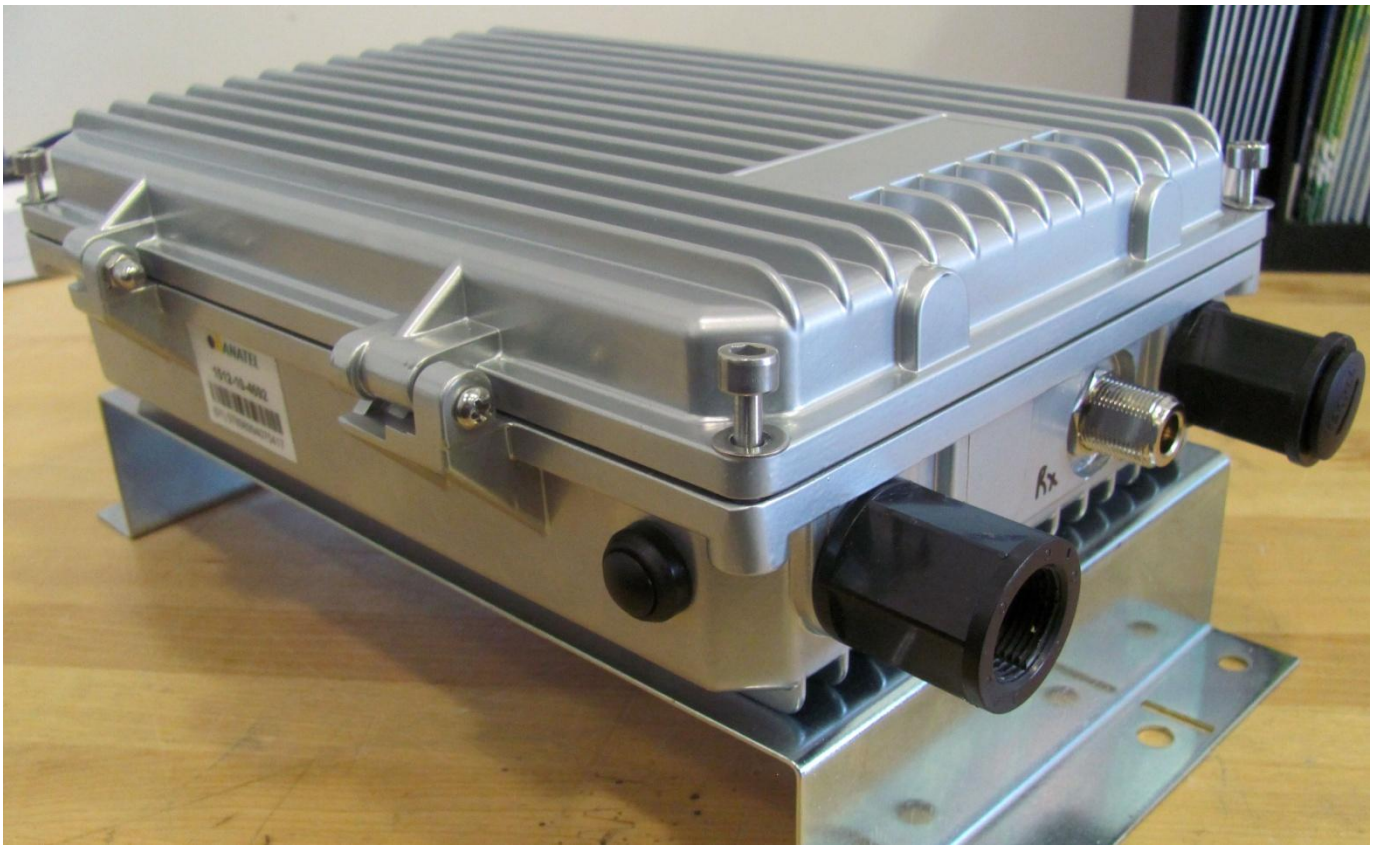
10.1 External photos

10.1.1 EUT top and bottom view (indoor model)



10.1.2 EUT side-top view (indoor model)

10.1.3 EUT side-top view (outdoor model)



10.1.4 EUT bottom-side view (outdoor model)