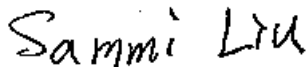


EMC TEST REPORT

Report No. : EME-070598/01**Model No. : NWD670****Issued Date : Jun. 30, 2008****Applicant : ZyXEL Communications Corporation**
6, Innovation Rd II, Science-Based Industrial Park,
Hsin-Chu, Taiwan**Test Method/ Standard : FCC Part 15 Subpart C Section §15.205、 §15.207、 §**
15.209、 §15.247 and ANSI C63.4/2003.**Test By : Intertek Testing Services Taiwan Ltd.**
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

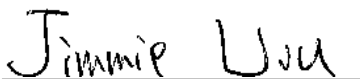
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Report Engineer



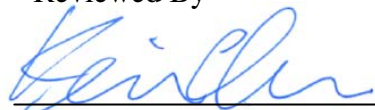
Sammi Liu

Project Engineer



Jimmie Liu

Reviewed By



Kevin Chen



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Summary of Tests

802.11b/g Wireless MiniPCI Card-Model: NWD670
FCC ID: I88NWD670

Test	Reference	Results
Radiated Spurious Emission test	15.205, 15.209	Pass
Emission on the Band Edge test	15.247(d)	Pass



1. General information

1.1 Identification of the EUT

Applicant : ZyXEL Communications Corporation
Product : 802.11 b/g Wireless MiniPCI Card
Model No. : NWD670
FCC ID. : I88NWD670
Frequency Range : 2412MHz ~ 2462MHz
Channel Number : 11 channels
Frequency of Each Channel : 2412MHz, 2417MHz, 2422MHz, 2427MHz, 2432MHz,
2437MHz, 2442MHz, 2447MHz, 2452MHz, 2457MHz,
2462MHz
Type of Modulation : DSSS, OFDM
Rated Power : DC 3.3V
Power Cord : N/A
Sample Received : May 22, 2008
Test Date(s) : Jun. 20, 2008

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The EUT is an 802.11 b/g Wireless MiniPCI Card, and was defined as information technology equipment.

The EUT meets special requirements for full modular approval on FCC Public Notice DA 00-1407 and the device is only for OEM integrator, please refer the test result in this report

Modification (01) to test report No.: EME-070598 (Verification No.: EME-070598)
The original Test Report Ref. No.: EME-070598, dated Jun. 27, 2007 was modified on Jun. 30, 2008 to include the following changes and/or additions, which were considered technical modifications:

Add a PCB antenna, gain 3.6dBi. (Model No.: 65-031-010104B)

After engineering judgment, two tests were considered necessary. See the “Test summary”.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”



1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 3.6dBi max
Antenna Type : PCB antenna
Connector Type : MHF

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook PC	DELL	PP01L	CN-03P83-48643-33O-3930	FCC DoC Approved

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section § 15.205, §15.207, §15.209, §15.247 and ANSI C63.4/2003.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT was supplied with 3.3Vdc from Notebook PC and it was running in operating mode.

The EUT was transmitted continuously during the test.

With individual verifying, the maximum output power was found out 1Mbps data rate for 802.11b mode and 6Mbps data rate for 802.11g mode. The final tests were executed under these conditions and recorded in this report individually.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30
Horn Antenna	SCHWARZBECK	1GHz~18GHz	BBHA 9120 D
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9168
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981
Pre-Amplifier	MITEQ	26GHz~40GHz	828825
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2487A/ MA2491A
Controller	HDGmbH	N/A	HD 100
Antenna Tower	HDGmbH	N/A	MA 240
Turn Table	HDGmbH	N/A	DS 420S
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5

Note: The above equipments are within the valid calibration period.

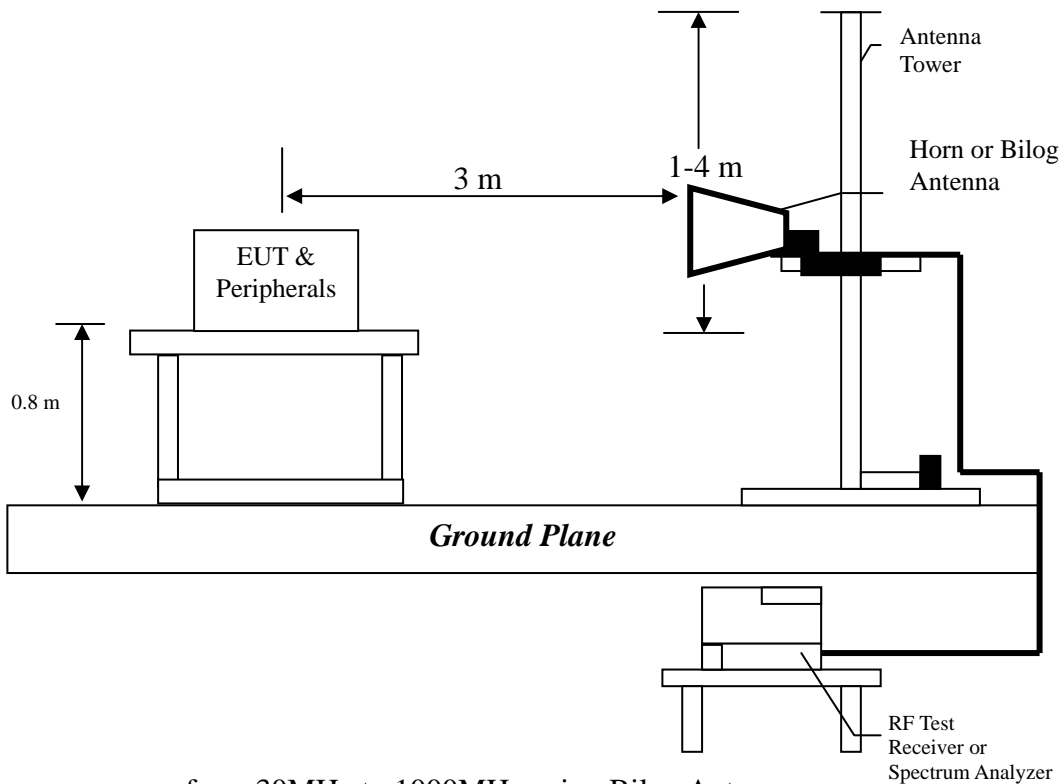
3. Radiated Emission test

3.1 Operating environment

Temperature: 24
 Relative Humidity: 52 %
 Atmospheric Pressure: 1023 hPa

3.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



The frequency range from 30MHz to 1000MHz using Bilog Antenna.
 The frequency range over 1GHz using Horn Antenna.

Radiated emissions were investigated cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1MHz RBW/VBW) recorded also on the report.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meter reading using inverse scaling with distance.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

3.3 Emission limits

The spurious Emission shall test through the 10th harmonic. 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).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.
Expanded uncertainty (k=2) of radiated emission measurement is ± 4.98 dB.

3.4 Radiated spurious emission test data

3.4.1 Measurement results: frequencies equal to or less than 1 GHz

The test was performed on EUT under 802.11b and 802.11g continuously transmitting mode. Channel 1, 6, 11 were verified. The worst case occurred at 802.11b Tx channel 1.

EUT : NWD670
 Worst Case : 802.11b Tx at channel 1

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
V	631.400	QP	21.53	10.28	31.81	46.00	-14.19
V	765.260	QP	22.81	8.07	30.88	46.00	-15.12
V	797.270	QP	23.19	10.80	33.99	46.00	-12.01
V	842.860	QP	23.62	11.69	35.31	46.00	-10.69
V	855.470	QP	23.70	9.67	33.37	46.00	-12.63
V	931.130	QP	25.13	14.83	39.96	46.00	-6.05
H	630.430	QP	21.55	12.46	34.01	46.00	-12.00
H	664.380	QP	21.52	11.82	33.34	46.00	-12.67
H	797.270	QP	23.52	13.33	36.85	46.00	-9.15
H	841.890	QP	24.04	10.23	34.27	46.00	-11.74
H	874.870	QP	24.12	10.23	34.35	46.00	-11.66
H	929.170	QP	25.33	9.24	34.57	46.00	-11.43

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor



3.4.2 Measurement results: frequency above 1GHz

EUT : NWD670
Test Condition : 802.11b Tx at channel 1

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4824.00	PK	V	36.07	37.77	38.26	39.96	54	-14.04
4824.00	PK	H	36.07	37.77	38.33	40.03	54	-13.97

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the noise floor, the others please refer to noise floor level.



EUT : NWD670
Test Condition : 802.11b Tx at channel 6

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4874.00	PK	V	36.07	37.77	37.70	39.40	54	-14.60
4874.00	PK	H	36.07	37.77	37.54	39.24	54	-14.76

Remark:

- 1 Correction Factor = Antenna Factor + Cable Loss
- 2 Corrected Level = Reading + Correction Factor – Preamp. Gain
- 3 The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

EUT : NWD670
 Test Condition : 802.11b Tx at channel 11

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4924.00	PK	V	36.07	37.77	37.39	39.09	54	-14.91
4924.00	PK	H	36.07	37.77	37.61	39.31	54	-14.69

Remark:

- 1 Correction Factor = Antenna Factor + Cable Loss
- 2 Corrected Level = Reading + Correction Factor – Preamp. Gain
- 3 The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the noise floor, the others please refer to noise floor level.



EUT : NWD670
Test Condition : 802.11g Tx at channel 1

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
3210.00	PK	V	35.54	34.62	43.63	42.71	54	-11.29
4824.00	PK	V	36.07	37.77	36.93	38.63	54	-15.37
3210.00	PK	H	35.54	34.62	45.95	45.03	54	-8.97
4824.00	PK	H	36.07	37.77	37.78	39.48	54	-14.52

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the noise floor, the others please refer to noise floor level.



EUT : NWD670
Test Condition : 802.11g Tx at channel 6

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
3240.00	PK	V	35.54	34.62	43.7	42.78	54	-11.22
4874.00	PK	V	36.07	37.77	37.52	39.22	54	-14.78
3240.00	PK	H	35.54	34.62	43.81	42.89	54	-11.11
4874.00	PK	H	36.07	37.77	37.08	38.78	54	-15.22

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the noise floor, the others please refer to noise floor level.



EUT : NWD670
Test Condition : 802.11g Tx at channel 11

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
3270.00	PK	V	35.54	34.62	42.14	41.22	54	-12.78
4924.00	PK	V	36.07	37.77	36.91	38.61	54	-15.39
3270.00	PK	H	35.54	34.62	41.14	40.22	54	-13.78
4924.00	PK	H	36.07	37.77	36.98	38.68	54	-15.32

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

4. Emission on the band edge

In any 100kHz 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. Radiated emissions, which fall in the restricted band, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

4.1 Operating environment

Temperature:	23	
Relative Humidity:	54	%
Atmospheric Pressure	1023	hPa

4.2 Test setup & procedure

Please refer to the clause 3.2 of this report.

4.3 Test Result

Test Mode: 802.11b mode

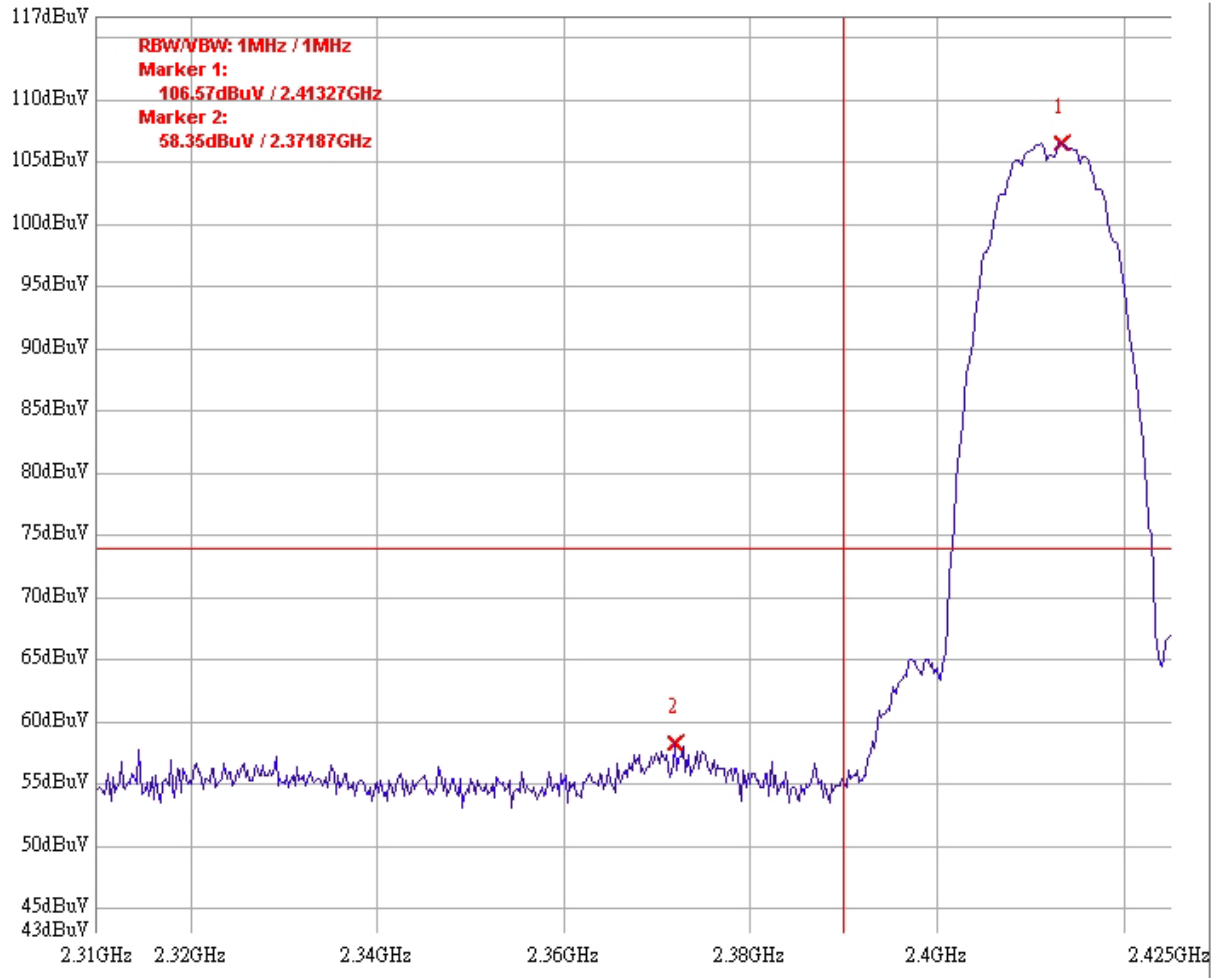
Channel	Measurement Freq.Band (MHz)	Detector	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
1 (lowest)	2310-2390	PK	58.35	74	-15.65
		AV	48.37	54	-5.63
11 (highest)	2483.5-2500	PK	57.10	74	-16.90
		AV	47.49	54	-6.51

Test Mode: 802.11g mode

Channel	Measurement Freq.Band (MHz)	Detector	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
1 (lowest)	2310-2390	PK	61.22	74	-12.78
		AV	49.11	54	-4.89
11 (highest)	2483.5-2500	PK	63.68	74	-10.32
		AV	50.97	54	-3.03

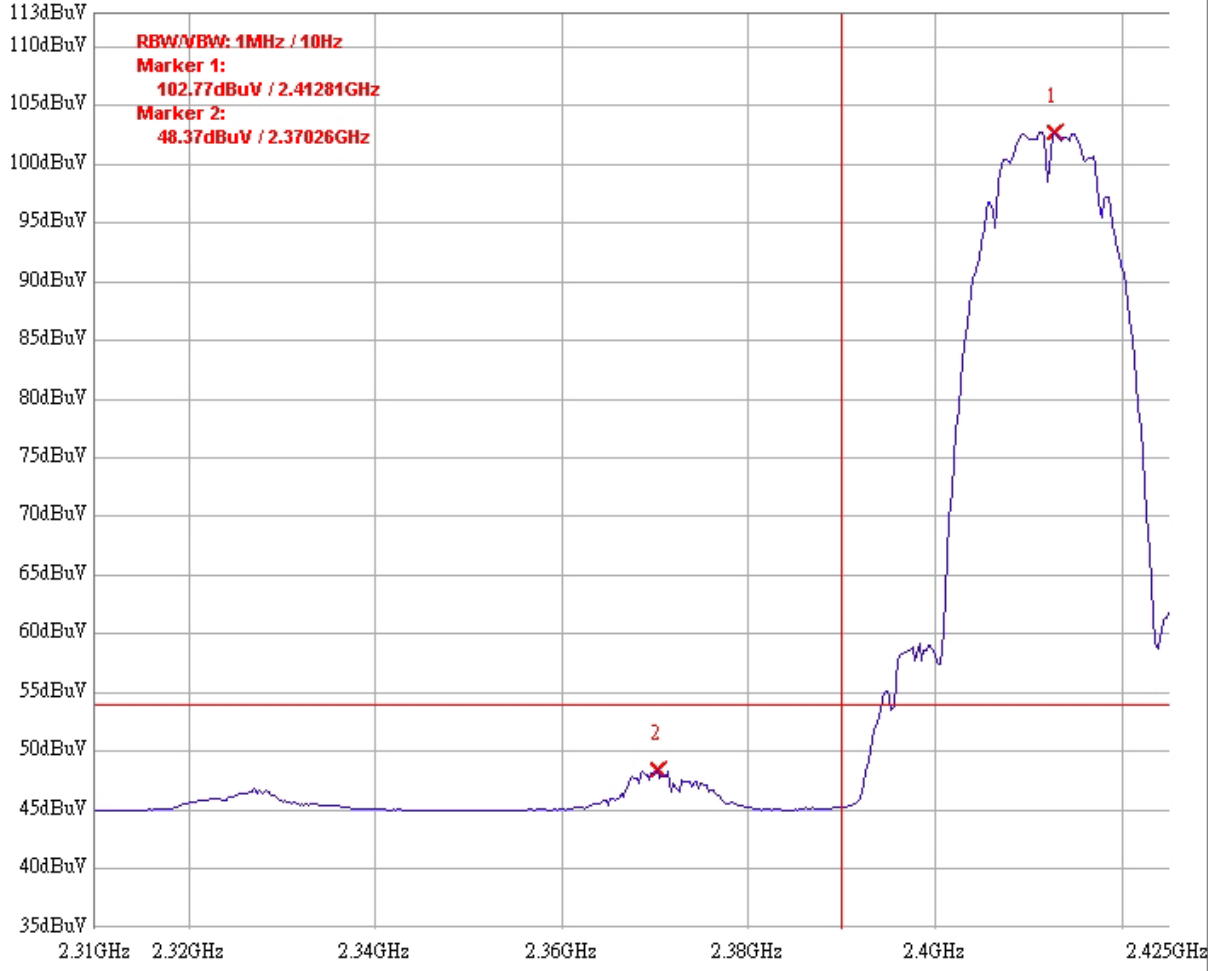
4.3.1 Radiated Method

Test Mode: 802.11b ch 1 PK



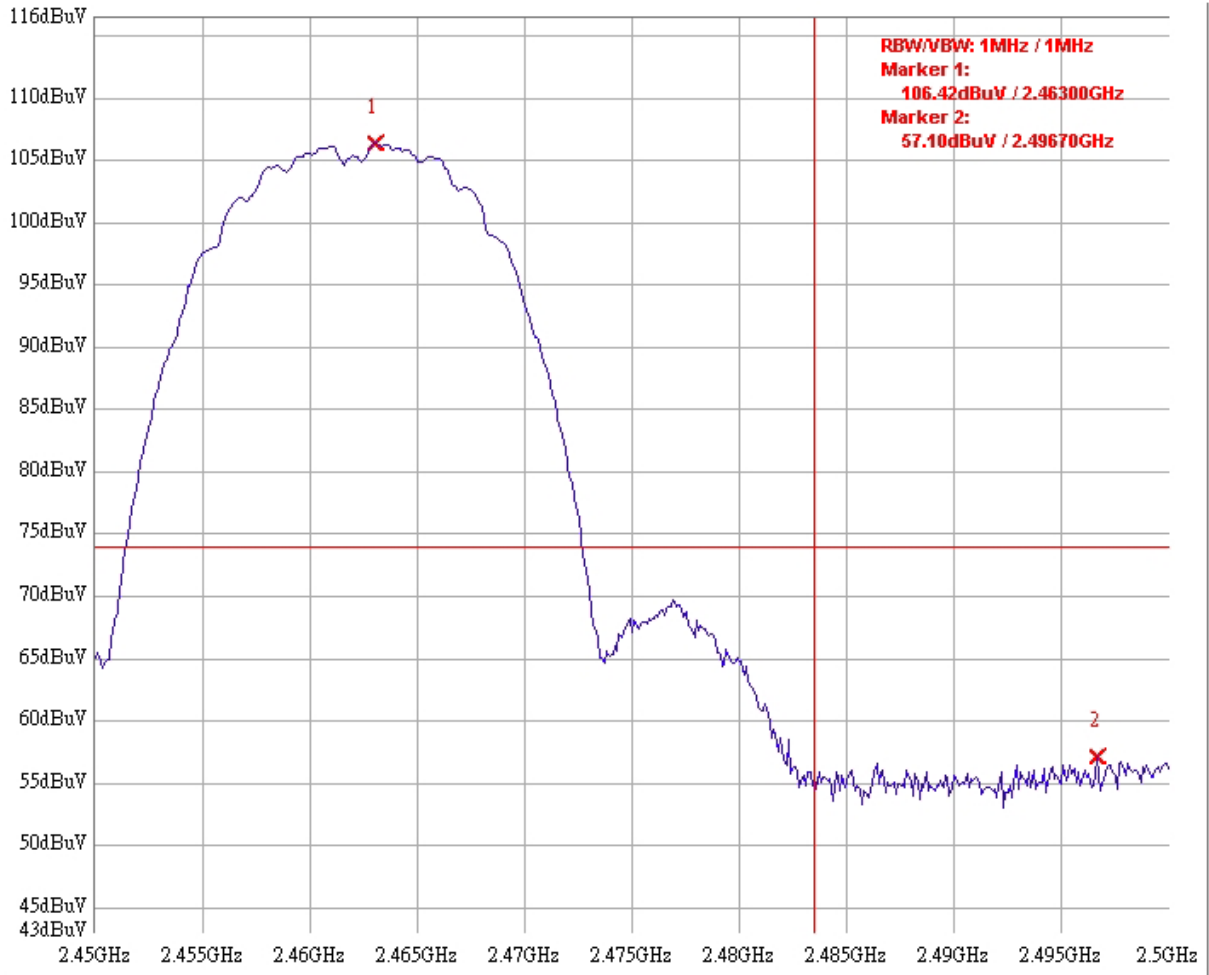
bandedge
11b ch1
PK

Test Mode: 802.11b ch 1 AV



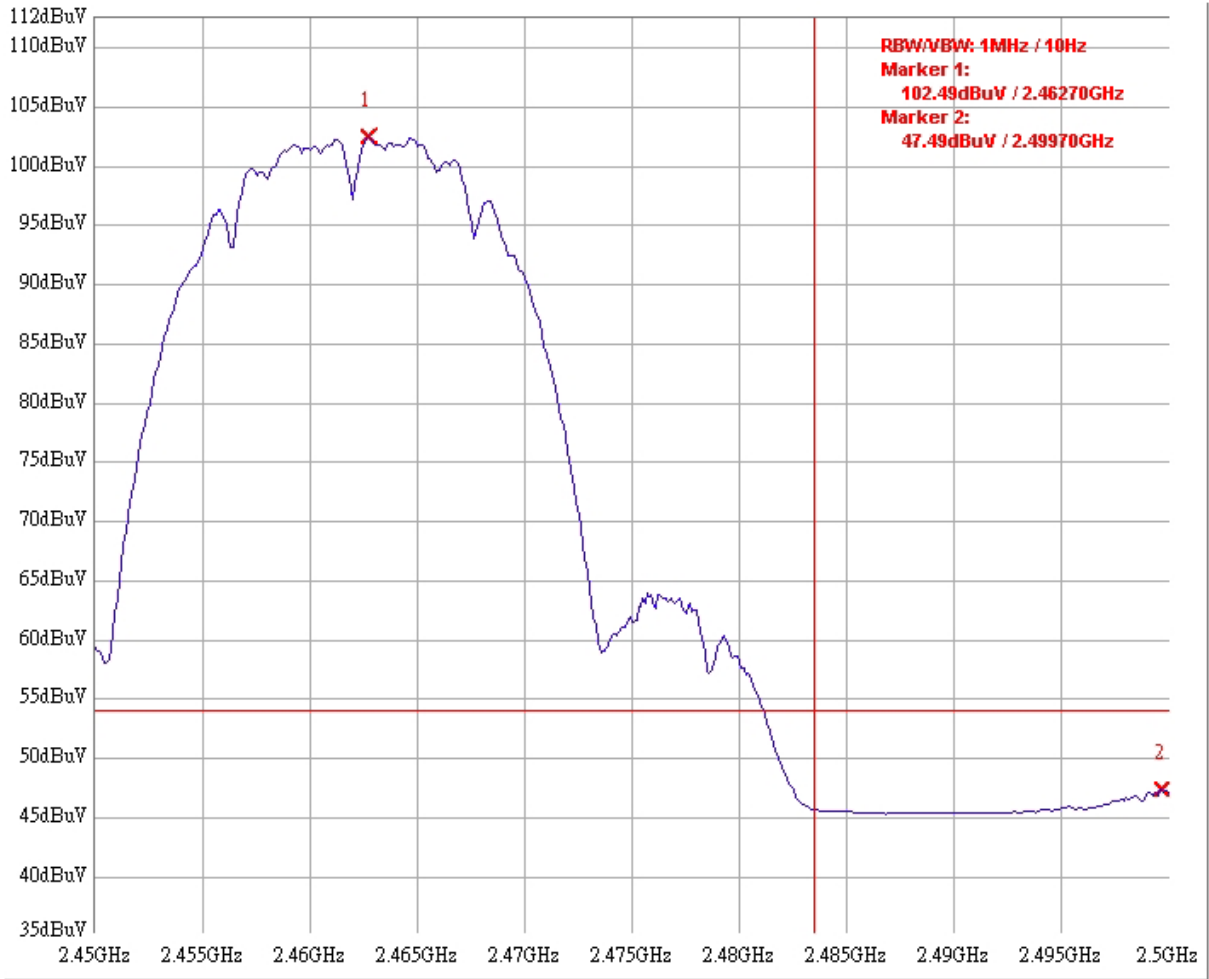
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11b chl
AV

Test Mode: 802.11b ch 11 PK



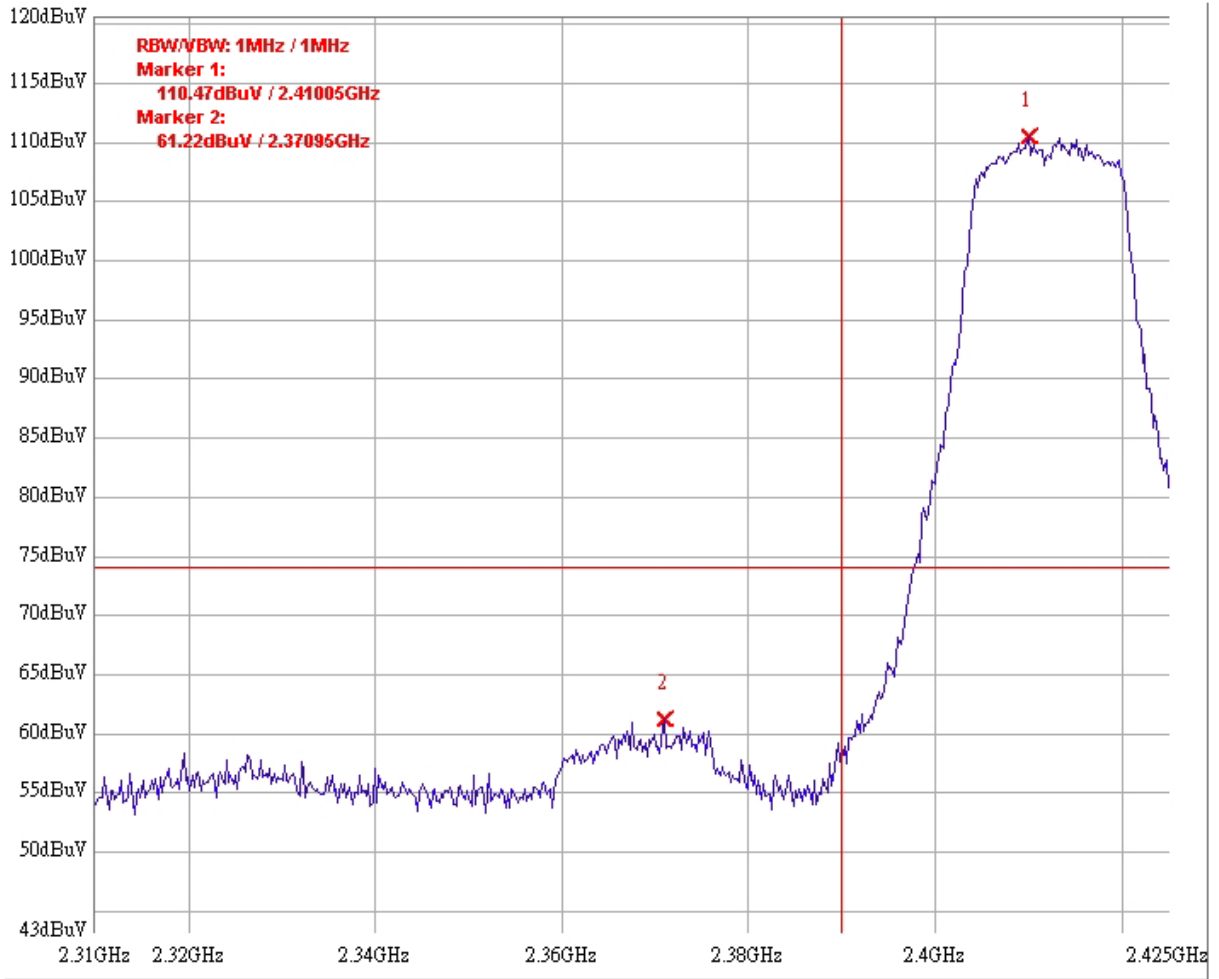
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11b ch11
PK

Test Mode: 802.11b ch 11 AV



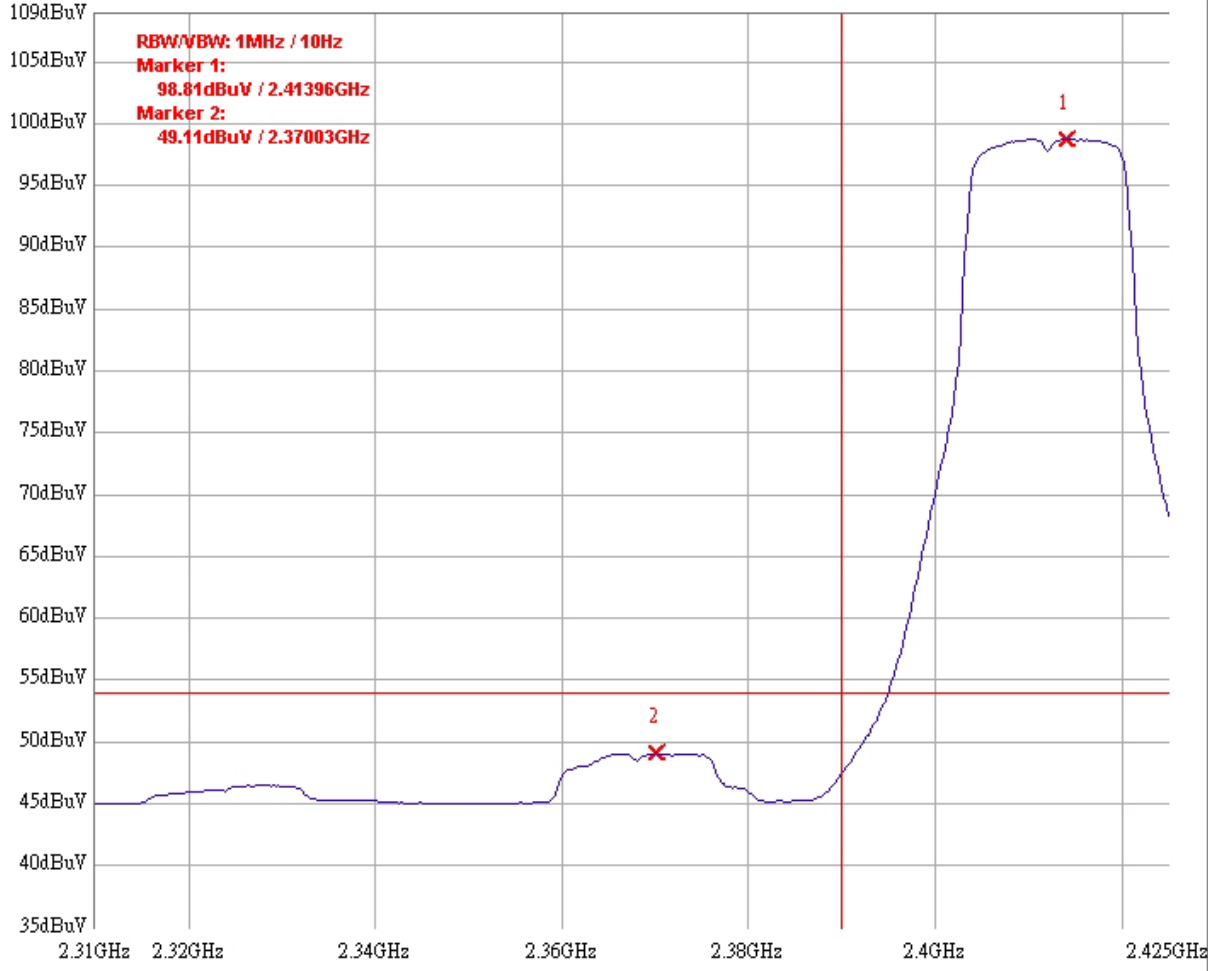
bandedge
11b ch11
AV

Test Mode: 802.11g ch 1 PK



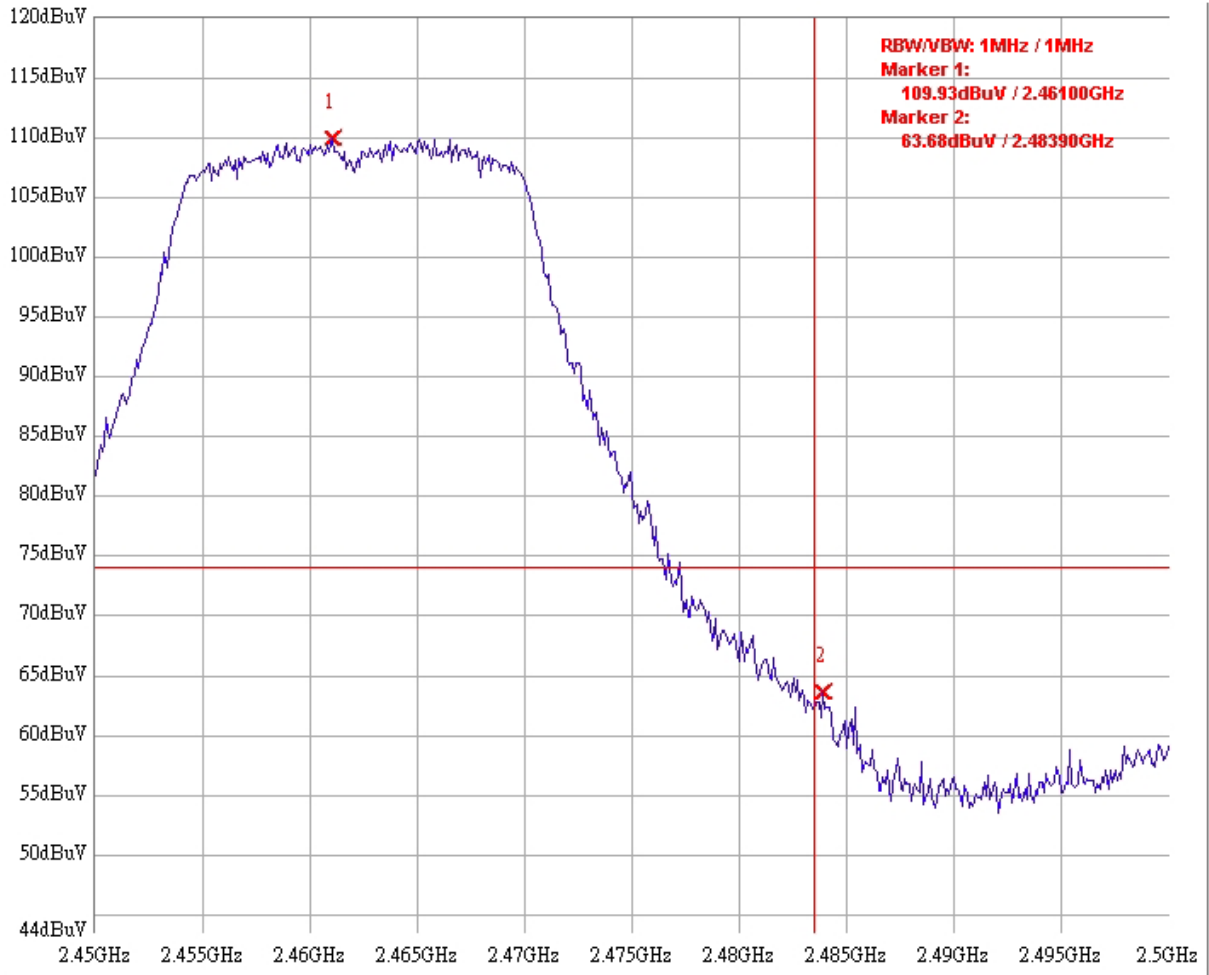
bandedge
11g chl
PK

Test Mode: 802.11g ch 1 AV



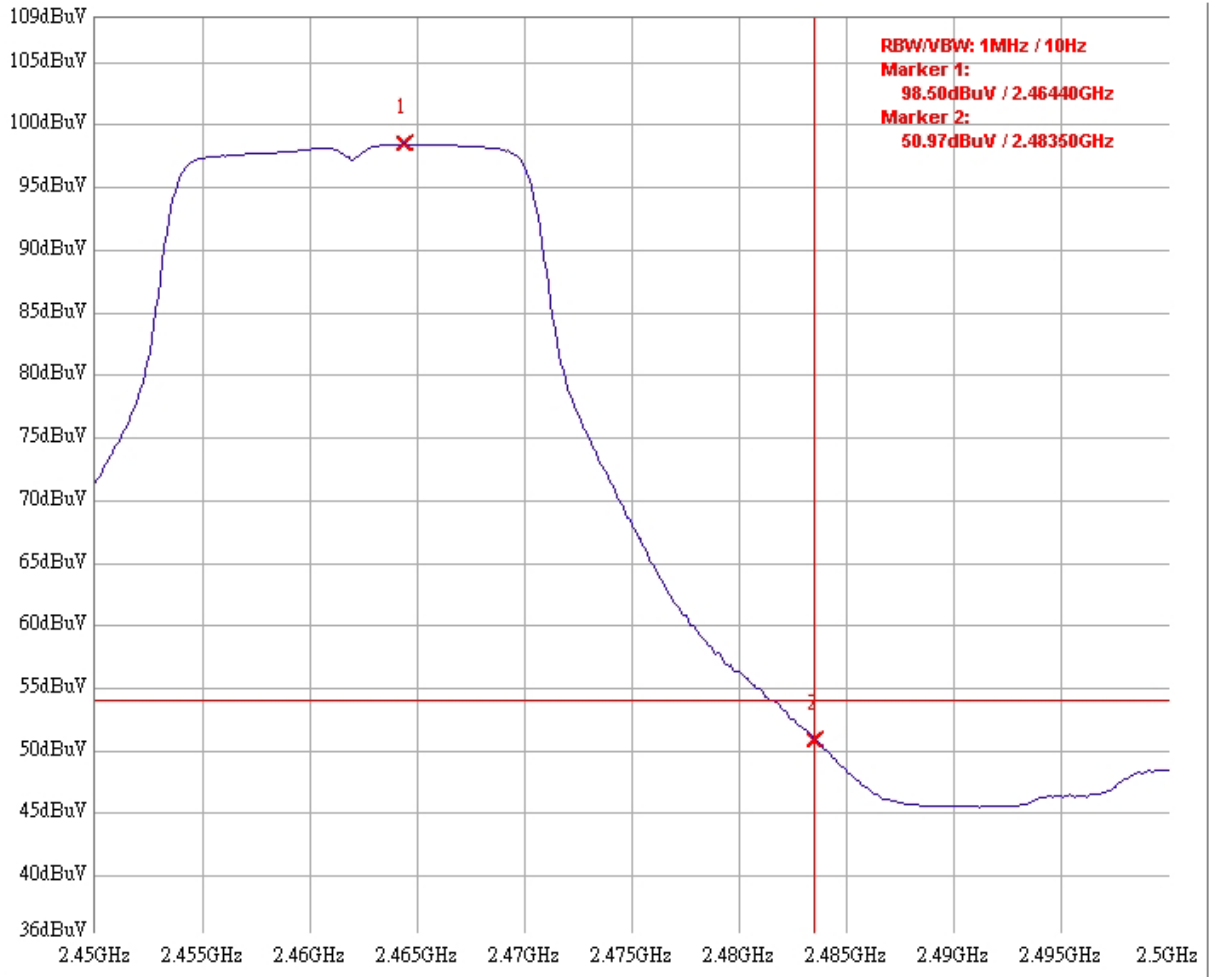
bandedge
11g chl
AV

Test Mode: 802.11g ch 11 PK



bandedge
11g ch11
PK

Test Mode: 802.11g ch 11 AV



bandedge
11g ch11
AV