

EMC TEST REPORT

Report No. : EME-040443

Model No. : ZyAIR G-220

Issued Date : May 14, 2004

Applicant : ZyXEL Communications Corporation
No. 6, Innovation Rd. II, Science-Based Industrial Park,
Hsin-Chu, Taiwan

Test By : Intertek Testing Services Taiwan Ltd.
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Project Engineer



Clay Chen

Reviewed By



Victor Wen

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Summary of Tests**802.11g Wireless USB Adapter-Model: ZyAIR G-220
FCC ID: I88G220**

Test	Reference	Results
Minimum 6dB Bandwidth test	15.247(a)(2)	Complies
Maximum Output Power test	15.247(b)	Complies
Radiated Spurious Emission test	15.205, 15.209	Complies
Power Spectrum Density test	15.247(d)	Complies
Power Line Conducted Emission test	15.207	Complies

1. General information

1.1 Identification of the EUT

Applicant	: ZyXEL Communications Corporation
Product	: 802.11g Wireless USB Adapter
Model No.	: ZyAIR G-220
FCC ID.	: I88G220
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(EUT)	: 5Vdc
Rated Power(Notebook)	: 120Vac/60Hz
Power Cord	: N/A
Sample Received	: May 4, 2004
Test Date(s)	: May 6, 2004 ~ May 11, 2004

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The EUT is an 802.11g Wireless USB Adapter, and was defined as information technology equipment.

The model G220 is identical to model ZyAIR G-220 (EUT), the different model number for different marketing strategy.

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 : 0 dBi max

Antenna Type : Ceramic

Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook	Dell	PP02X	8Y210A04	FCC DoC Approved
Modem	Dynalink	V1456VQE	00V230A00051494	FCC DoC Approved
Printer	C2642A	TH86K1N2ZB	N/A	FCC DoC Approved
Access Point	SMC	WG 4005-17 2 (A3)	C-G 3030232-1-1-3*1000	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 C63.4/2001.

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

During the conduction test, the EUT was linked with the Access Point.
During the other tests, the EUT was transmitted continuously.

After verifying the maximum output power, we found the maximum output power was occurred at low channel with 11Mbps data rate in 802.11b and at low channel with 24Mbps data rate in 802.11g. The final test was executed under this condition and recorded in this report individually.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Last Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	6/16/2003
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	6/24/2003
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	7/19/2003
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	10/20/2003
Horn Antenna	EMCO	1GHz~18GHz	3115	EC332	10/15/2003
Horn Antenna	SCHWARZBECK	15GHz~40GHz	BBHA 9170	EC351	6/21/2003
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	EC350	6/21/2003
Turn Table	HDGmbH	N/A	DS 420S	EP317-3	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP317-2	N/A
Pre-Amplifier	MITER	100MHz~26.5GHz	919981	EC373	5/13/2004
Crystal Detector	Agilent	10MHz~18GHz	8472B	-	N/A
Signal Generator	Rohde & Schwarz	20MHz~27GHz	SMR27	EC354	8/16/2003
Two Channel Digital Storage Oscilloscope	Tektronix	N/A	TDS1012	-	8/16/2003
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	1/20/2004

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

3. Minimum 6dB Bandwidth test

3.1 Operating environment

Temperature: 24
 Relative Humidity: 54 %
 Atmospheric Pressure 1023 hPa

3.2 Test setup & procedure

The minimum 6dB bandwidth per FCC §15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel). The minimum 6-dB modulation bandwidth is in the following Table.

3.3 Measured data of Minimum 6dB Bandwidth test results

Test Mode: 802.11b operation mode (DSSS Modulation)

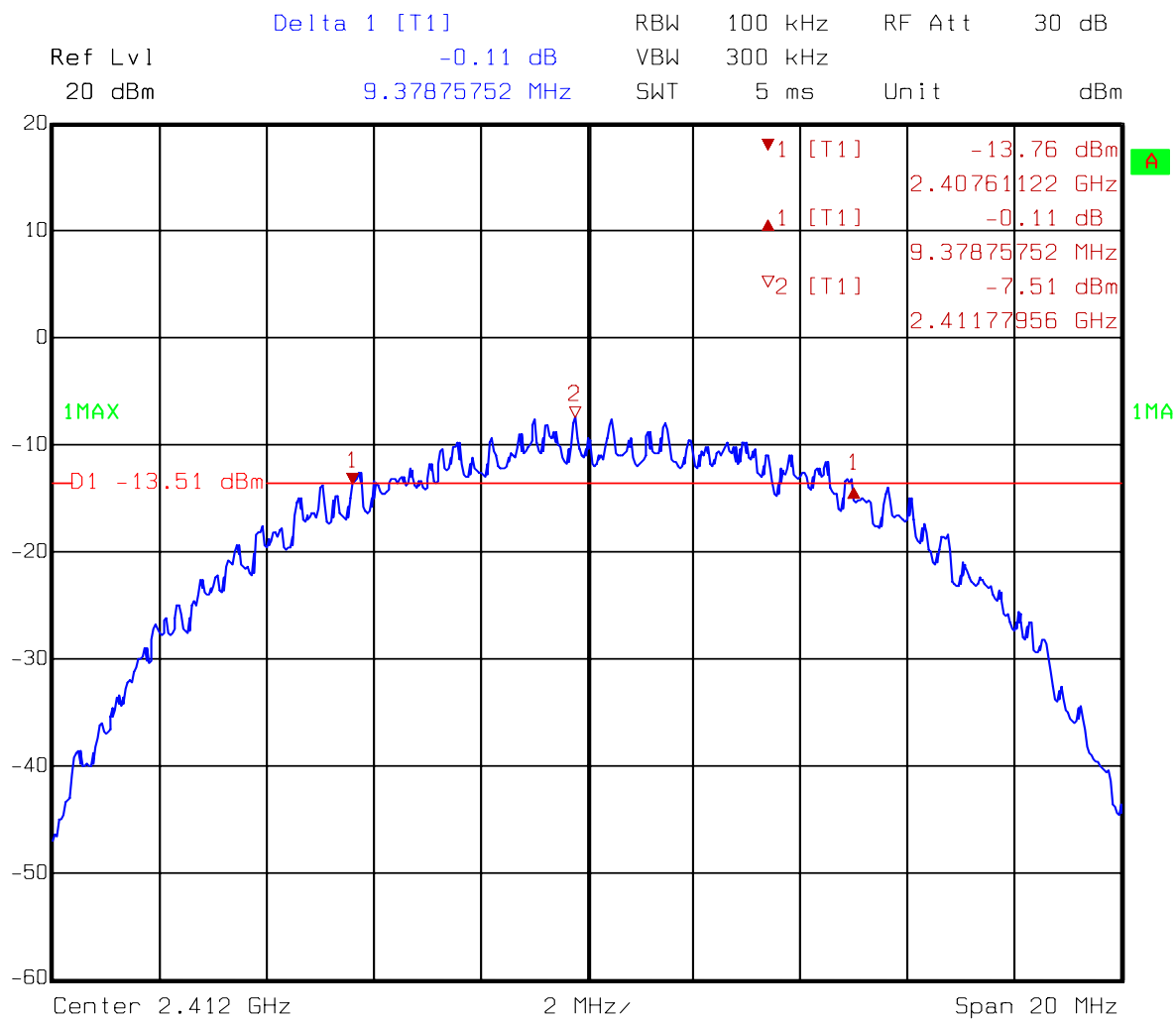
Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
Low	2412	9.37876	> 500kHz
Middle	2437	9.09820	> 500kHz
High	2462	9.01804	> 500kHz

Test Mode: 802.11g operation mode (OFDM Modulation)

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
Low	2412	16.55311	> 500kHz
Middle	2437	16.59319	> 500kHz
High	2462	16.55311	> 500kHz

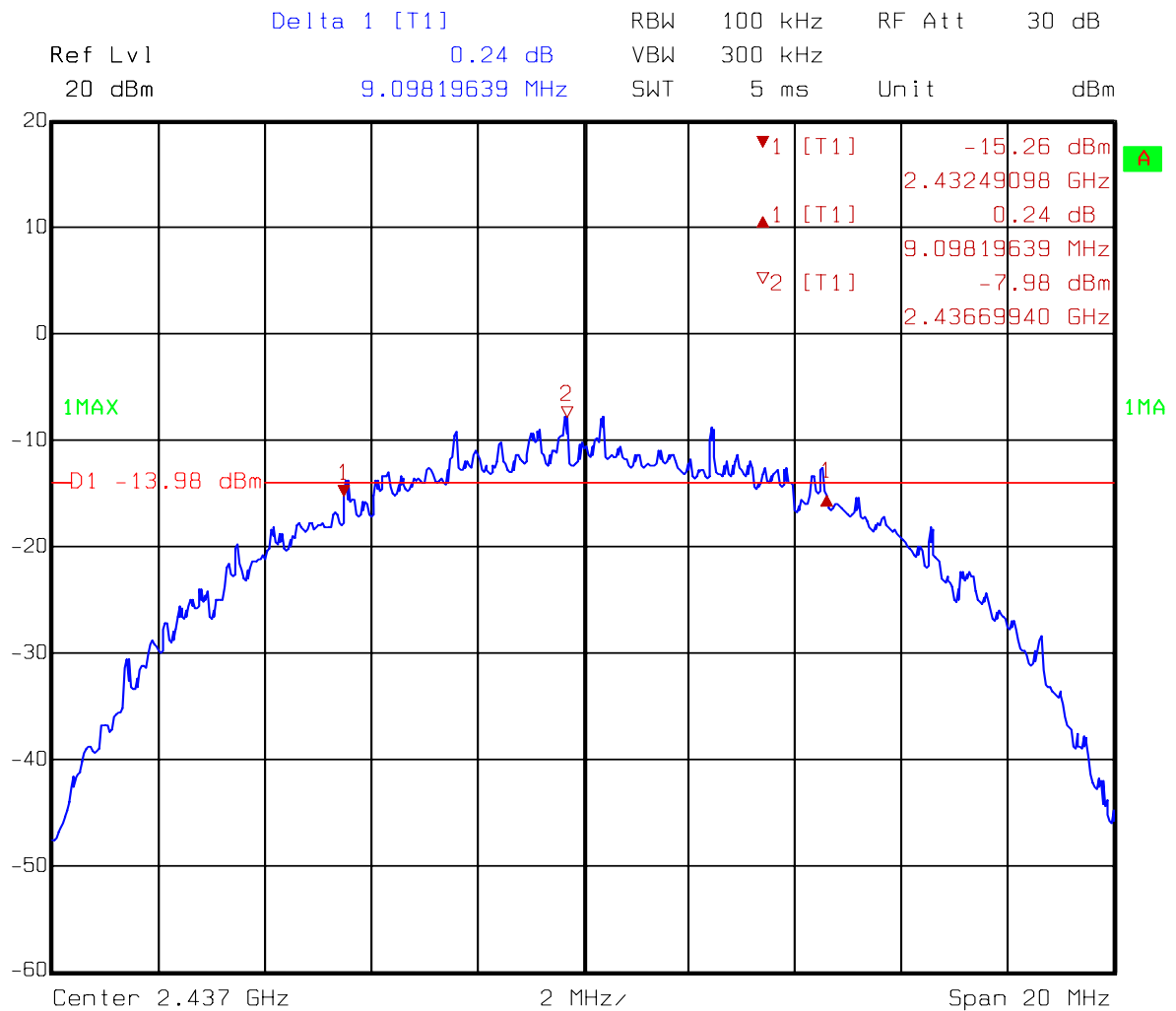
Please see the plot below.

Test Mode: 802.11b operation mode (DSSS Modulation)



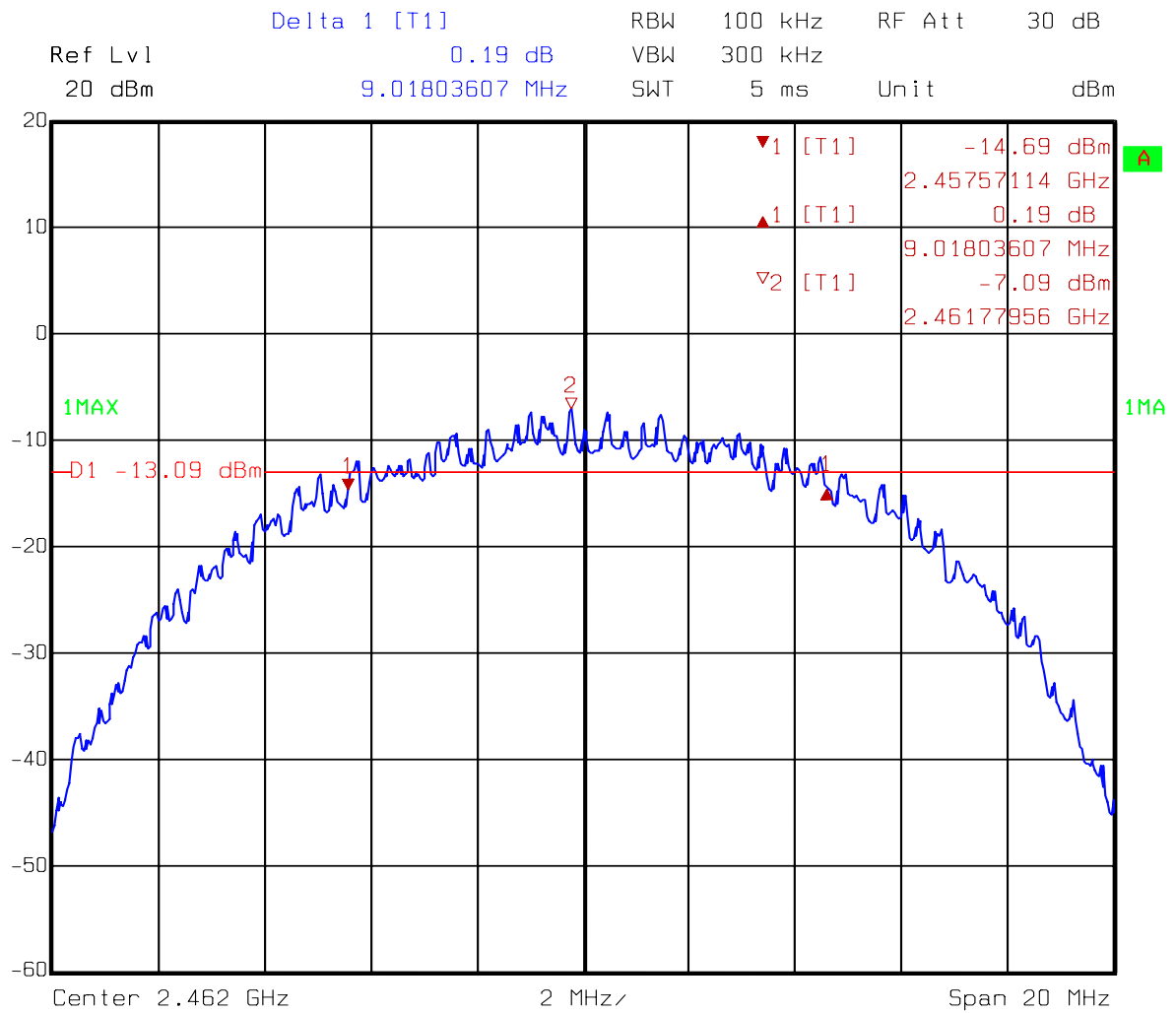
Comment A: 6dB bandwidth at low channel (EC365) 802.11b

Date: 11.MAY 2004 10:53:49



Comment A: 6dB bandwidth at middle channel (EC365) 802.11b

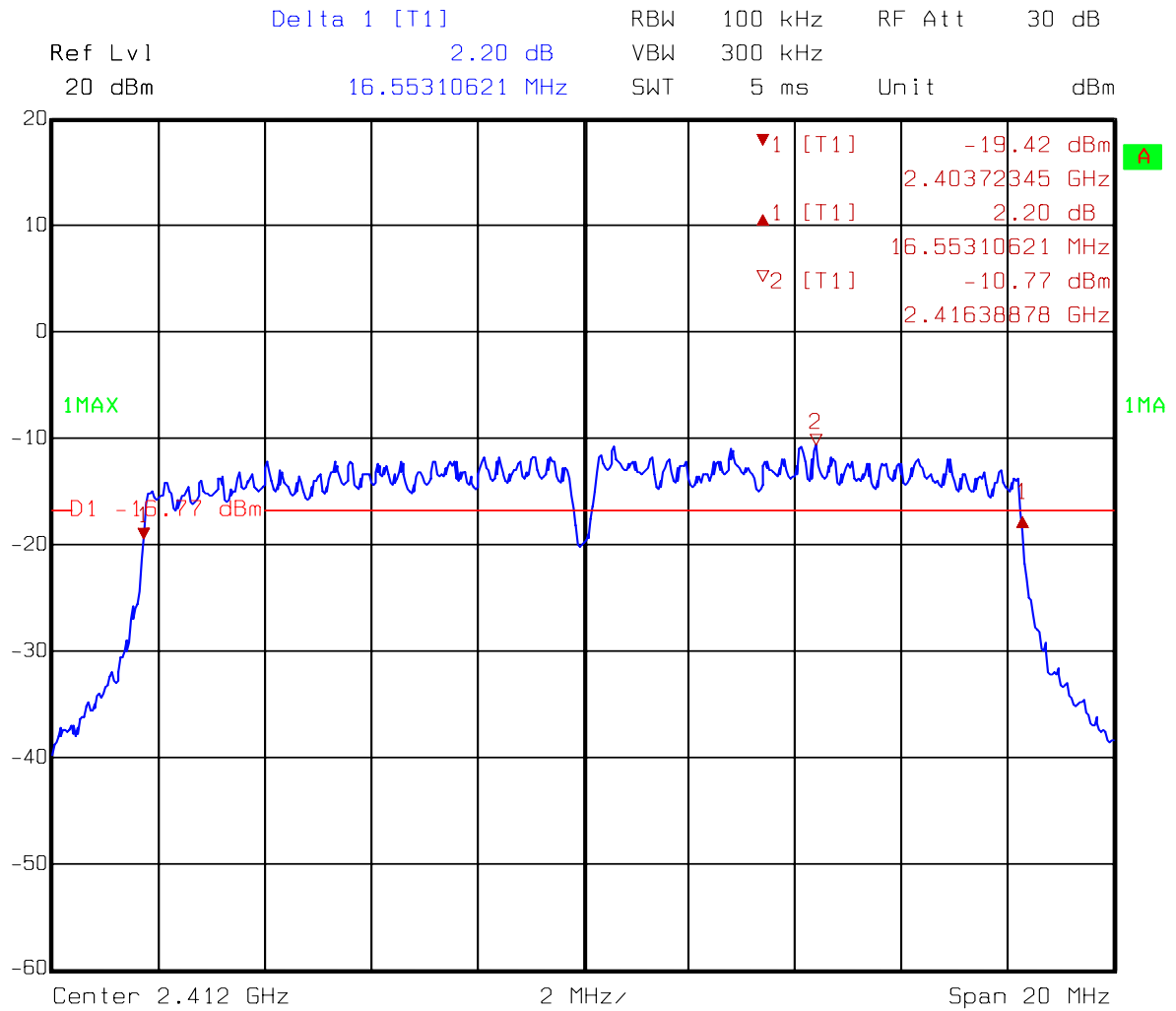
Date: 11.MAY 2004 10:55:26



Comment A: 6dB bandwidth at high channel (EC365) 802.11b

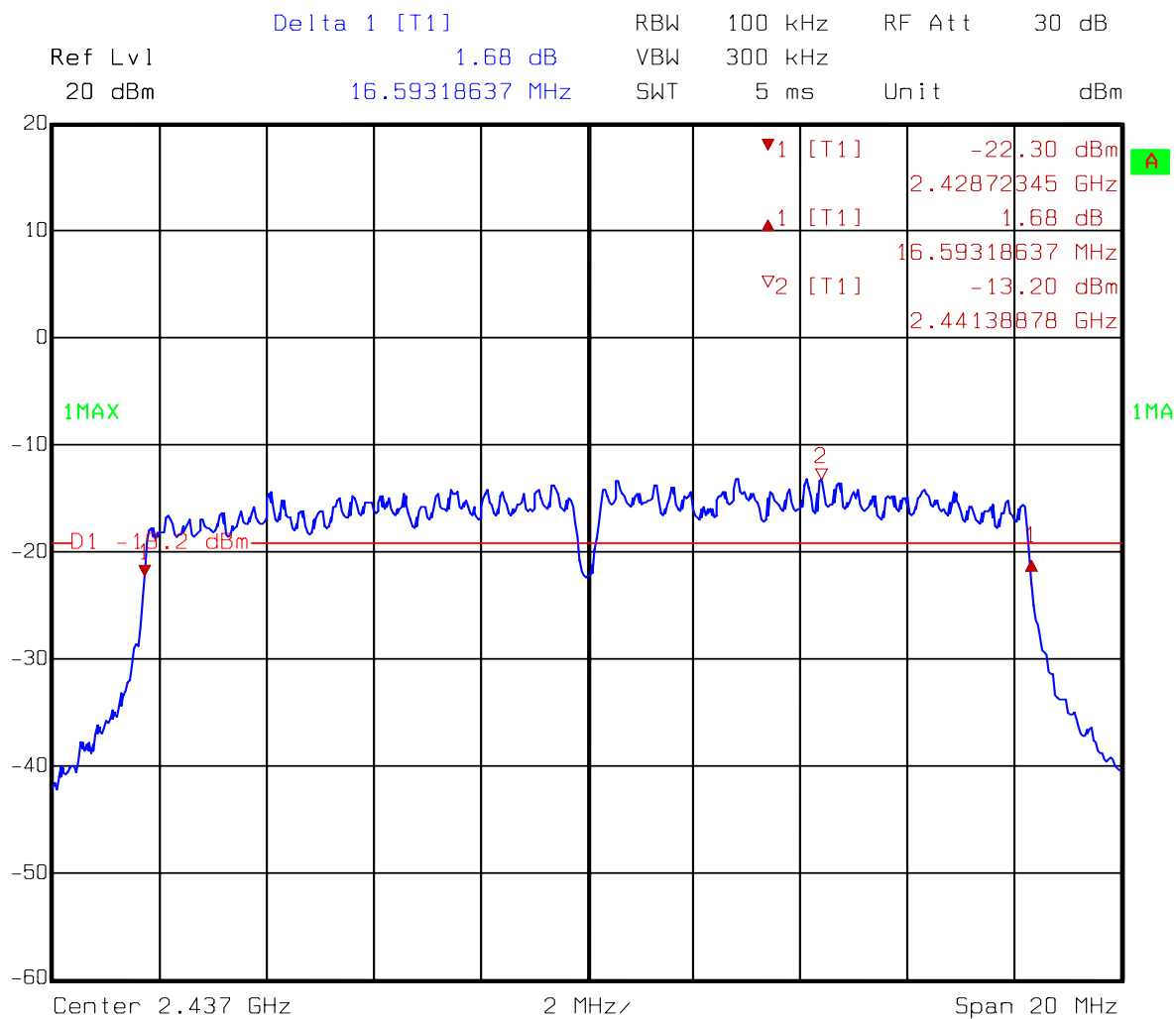
Date: 11.MAY 2004 10:57:58

Test Mode: 802.11g operation mode (OFDM Modulation)



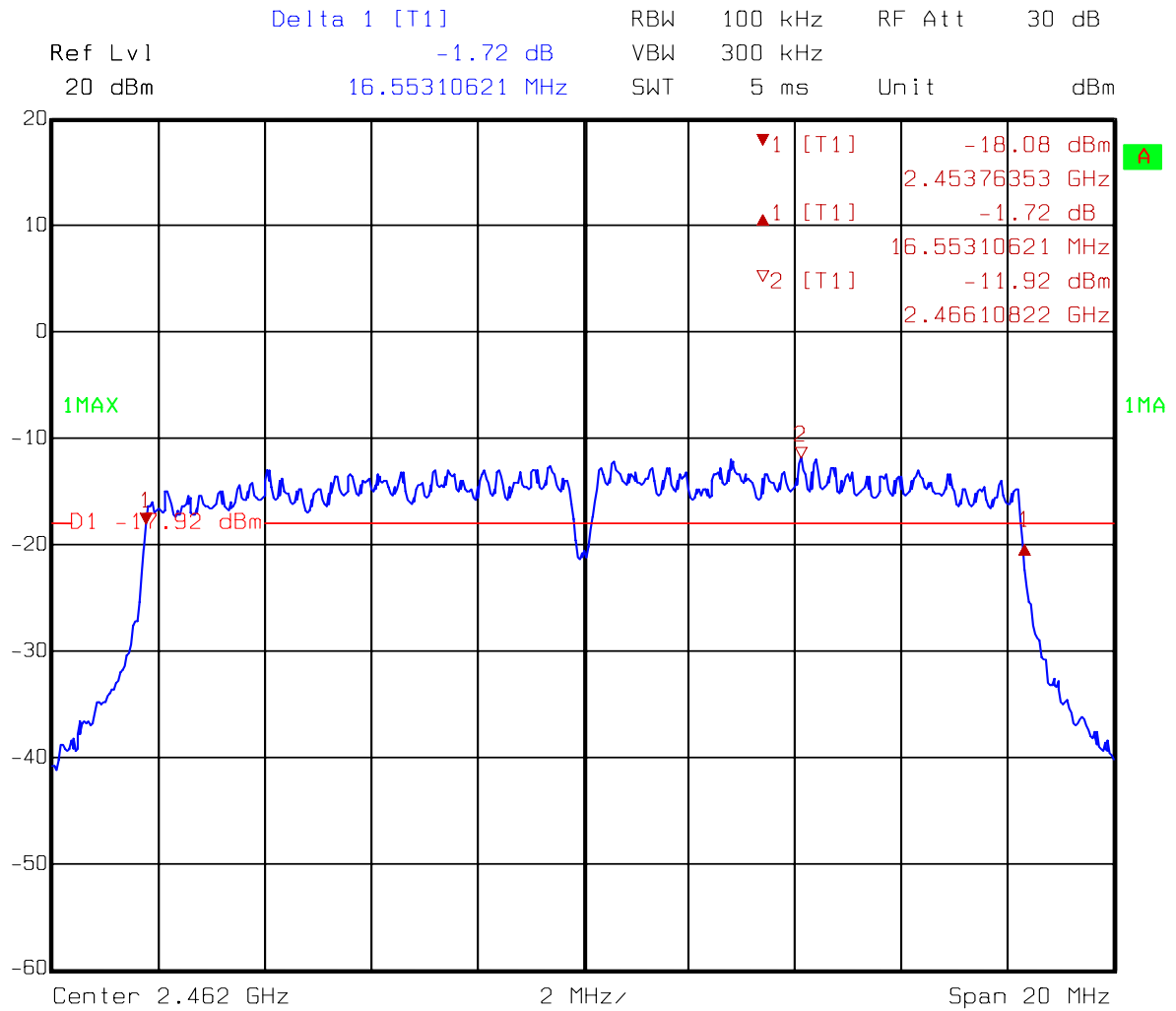
Comment A: 6dB bandwidth at low channel (EC365) 802.11g

Date: 11.MAY 2004 10:44:46



Comment A: 6dB bandwidth at middle channel (EC365) 802.11g

Date: 11.MAY 2004 10:48:00



Comment A: 6dB bandwidth at high channel (EC365) 802.11g

Date: 11.MAY 2004 10:50:13

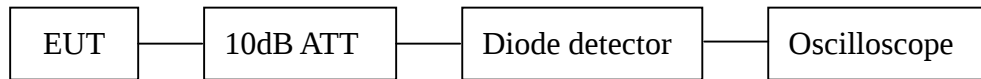
4. Maximum Output Power test

4.1 Operating environment

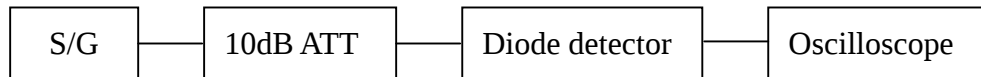
Temperature: 22
 Relative Humidity: 52 %
 Atmospheric Pressure 1023 hPa

4.2 Test setup & procedure

A:



B:



1. The output of the transmitter via a 10 dB attenuator and coupled to a diode detector.
2. The output of the diode detector connected to the vertical channel of an oscilloscope. The observed trace of the oscilloscope shall be recorded as “A”.
3. The transmitter replaced by a signal generator. The output frequency of the signal made equal to the center of the frequency range occupied by the transmitter and unmodulated.
4. The output of the signal generator raised to reach the peak of trace “A” named X.
5. The signal generator output level X (dBm) is the transmitter peak output power.

4.3 Measured data of Maximum Output Power test results

Test Mode: 802.11b operation mode (DSSS Modulation)

Channel	Frequency (MHz)	Reading (dBm)	Output Power		Limit (dBm)
			(dBm)	(mW)	
Lowest	2412	19.56	19.56	90.364	30
Middle	2437	17.22	17.22	52.722	30
Highest	2462	17.95	17.95	62.373	30

Test Mode: 802.11g operation mode (OFDM Modulation)

Channel	Frequency (MHz)	Reading (dBm)	Output Power		Limit (dBm)
			(dBm)	(mW)	
Lowest	2412	19.47	19.47	88.511	30
Middle	2437	16.42	16.42	43.137	30
Highest	2462	17.88	17.88	61.376	30

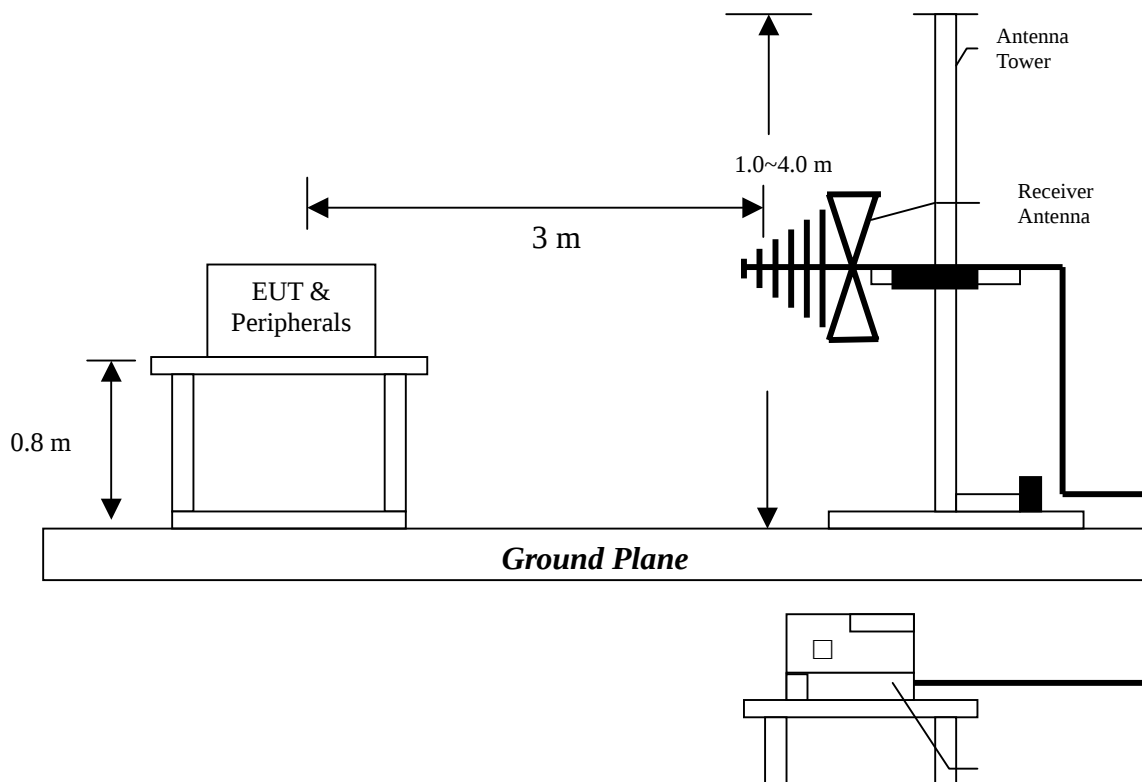
5. Radiated Emission test

5.1 Operating environment

Temperature:	23	(10-40)
Relative Humidity:	65	% (10-90%)
Atmospheric Pressure	1023	hPa (860-1060hPa)

5.2 Test setup & procedure

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



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 three meter reading using inverse scaling with distance.

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

5.3 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.

Expanded uncertainty (k=2) of conducted emission measurement is ± 2.02 dB.

5.4 Radiated spurious emission test data

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

EUT : ZyAIR G-220

Worst Case Condition : 802.11b Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
480.120	QP	V	18.29	19.98	38.27	46.00	-7.73	115.00	213.00
507.240	QP	V	18.86	17.21	36.07	46.00	-9.93	152.00	52.00
529.970	QP	V	19.44	22.62	42.06	46.00	-3.94	105.00	212.00
575.180	QP	V	20.18	13.88	34.06	46.00	-11.94	100.00	79.00
598.970	QP	V	20.32	11.94	32.26	46.00	-13.74	117.00	269.00
799.520	QP	V	24.34	12.59	36.93	46.00	-9.07	201.00	321.00
190.210	QP	H	13.39	19.54	32.93	43.50	-10.57	214.00	144.00
230.510	QP	H	12.18	18.26	30.44	46.00	-15.56	184.00	205.00
430.540	QP	H	17.18	12.56	29.74	46.00	-16.26	100.00	21.00
480.310	QP	H	18.34	11.54	29.88	46.00	-16.12	159.00	164.00
526.770	QP	H	19.31	14.19	33.50	46.00	-12.50	301.00	333.00
768.890	QP	H	23.81	11.28	35.09	46.00	-10.91	177.00	204.00

Remark:

1. Corrected Level = Reading Level + Correction Factor

2. Correction Factor = Antenna Factor + Cable Loss

EUT : ZyAIR G-220
Worst Case Condition : 802.11g Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
399.540	QP	V	16.42	17.62	34.04	46.00	-11.96	110.00	103.00
480.110	QP	V	18.29	19.88	38.17	46.00	-7.83	250.00	147.00
507.840	QP	V	18.79	16.55	35.34	46.00	-10.66	188.00	142.00
527.970	QP	V	19.41	22.60	42.01	46.00	-3.99	100.00	215.00
683.990	QP	V	21.78	5.99	27.77	46.00	-18.23	108.00	0.00
799.360	QP	V	24.34	15.54	39.88	46.00	-6.12	119.00	210.00
229.970	QP	H	12.18	23.88	36.06	46.00	-9.94	177.00	147.00
525.780	QP	H	19.31	14.86	34.17	46.00	-11.83	152.00	111.00
532.440	QP	H	19.47	14.36	33.83	46.00	-12.17	100.00	21.00
599.240	QP	H	20.32	10.22	30.54	46.00	-15.46	158.00	144.00
664.450	QP	H	21.51	15.74	37.25	46.00	-8.75	124.00	306.00
796.240	QP	H	24.28	15.24	39.52	46.00	-6.48	177.00	251.00

Remark:

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

5.4.2 Measurement results: frequency above 1GHz

The radiated spurious emissions at

Frequency(MHz)	Margin
4825.920	-1.81

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : ZyAIR G-220

Test Condition : 802.11b Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
4825.920	PK	V	39.59	35.57	67.36	63.34	74.00	-10.66	147.00	191.00
4825.920	AV	V	39.59	35.57	56.21	52.19	54.00	-1.81	147.00	191.00
7239.700	PK	V	39.25	39.63	47.12	47.50	74.00	-26.50	144.00	213.00
7239.700	AV	V	39.25	39.63	34.52	34.90	54.00	-19.10	144.00	213.00
12060.340	PK	V	37.11	44.45	46.37	53.70	74.00	-20.30	110.00	229.00
12060.340	AV	V	37.11	44.45	35.32	42.65	54.00	-11.35	110.00	229.00
4825.960	PK	H	39.59	35.57	63.40	59.38	74.00	-14.62	135.00	214.00
4825.960	AV	H	39.59	35.57	52.09	48.07	54.00	-5.93	135.00	214.00
7239.540	PK	H	39.25	39.63	50.66	51.04	74.00	-22.96	130.00	222.00
7239.540	AV	H	39.25	39.63	38.27	38.65	54.00	-15.35	130.00	222.00
12060.540	PK	H	37.11	44.45	46.34	53.67	74.00	-20.33	115.00	213.00
12060.540	AV	H	37.11	44.45	34.65	41.98	54.00	-12.02	115.00	213.00

Remark:

1. Corrected Level = Reading Level + Correction Factor - Preamp
2. Correction Factor = Antenna Factor + Cable Loss
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.

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

The radiated spurious emissions at

Frequency(MHz)	Margin
4875.920	-1.72

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : ZyAIR G-220

Test Condition : 802.11b Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
4875.920	PK	V	39.59	35.57	67.60	63.58	74.00	-10.42	133.00	187.00
4875.920	AV	V	39.59	35.57	56.30	52.28	54.00	-1.72	133.00	187.00
7314.360	PK	V	39.25	39.63	49.53	49.91	74.00	-24.09	108.00	194.00
7314.360	AV	V	39.25	39.63	37.38	37.76	54.00	-16.24	108.00	194.00
12185.500	PK	V	37.11	44.45	46.96	54.29	74.00	-19.71	120.00	229.00
12185.500	AV	V	37.11	44.45	35.79	43.12	54.00	-10.88	120.00	229.00
4876.000	PK	H	39.59	35.57	64.16	60.14	74.00	-13.86	146.00	214.00
4876.000	AV	H	39.59	35.57	52.60	48.58	54.00	-5.42	146.00	214.00
7314.360	PK	H	39.25	39.63	51.36	51.74	74.00	-22.26	129.00	225.00
7314.360	AV	H	39.25	39.63	39.09	39.47	54.00	-14.53	129.00	225.00
12185.300	PK	H	37.11	44.45	44.71	52.04	74.00	-21.96	166.00	186.00
12185.300	AV	H	37.11	44.45	31.65	38.98	54.00	-15.02	166.00	186.00

Remark:

1. Corrected Level = Reading Level + Correction Factor - Preamp
2. Correction Factor = Antenna Factor + Cable Loss
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.

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

The radiated spurious emissions at

Frequency(MHz)	Margin
4925.960	-1.03

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : ZyAIR G-220

Test Condition : 802.11b Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
4925.960	PK	V	39.59	35.57	68.37	64.35	74.00	-9.65	142.00	190.00
4925.960	AV	V	39.59	35.57	56.99	52.97	54.00	-1.03	142.00	190.00
9847.990	PK	V	37.89	42.95	45.87	50.92	74.00	-23.08	126.00	248.00
9847.990	AV	V	37.89	42.95	38.45	43.50	54.00	-10.50	126.00	248.00
4925.920	PK	H	39.59	35.57	63.10	59.08	74.00	-14.92	143.00	215.00
4925.920	AV	H	39.59	35.57	51.40	47.38	54.00	-6.62	143.00	215.00

Remark:

1. Corrected Level = Reading Level + Correction Factor - Preamp
2. Correction Factor = Antenna Factor + Cable Loss
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.

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

EUT : ZyAIR G-220

Test Condition : 802.11g Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
4825.680	PK	V	39.59	35.57	62.87	58.85	74.00	-15.15	143.00	193.00
4825.680	AV	V	39.59	35.57	51.22	47.20	54.00	-6.80	143.00	193.00
4825.600	PK	H	39.59	35.57	58.96	54.94	74.00	-19.06	135.00	215.00
4825.600	AV	H	39.59	35.57	47.25	43.23	54.00	-10.77	135.00	215.00

Remark:

1. Corrected Level = Reading Level + Correction Factor - Preamp
2. Correction Factor = Antenna Factor + Cable Loss
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.

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

EUT : ZyAIR G-220

Test Condition : 802.11g Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
4875.750	PK	V	39.59	35.57	63.19	59.17	74.00	-14.83	157.00	177.00
4875.750	AV	V	39.59	35.57	51.91	47.89	54.00	-6.11	157.00	177.00
4875.480	PK	H	39.59	35.57	59.38	55.36	74.00	-18.64	148.00	212.00
4875.480	AV	H	39.59	35.57	47.60	43.58	54.00	-10.42	148.00	212.00

Remark:

1. Corrected Level = Reading Level + Correction Factor - Preamp
2. Correction Factor = Antenna Factor + Cable Loss
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.

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

EUT : ZyAIR G-220

Test Condition : 802.11g Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
4925.160	PK	V	39.59	35.57	63.48	59.46	74.00	-14.54	142.00	185.00
4925.160	AV	V	39.59	35.57	51.94	47.92	54.00	-6.08	142.00	185.00
4925.640	PK	H	39.59	35.57	58.41	54.39	74.00	-19.61	144.00	201.00
4925.640	AV	H	39.59	35.57	46.69	42.67	54.00	-11.33	144.00	201.00

Remark:

1. Corrected Level = Reading Level + Correction Factor - Preamp
2. Correction Factor = Antenna Factor + Cable Loss
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.

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

6. Power Spectrum Density test

6.1 Operating environment

Temperature: 22
 Relative Humidity: 60 %
 Atmospheric Pressure 1023 hPa

6.2 Test setup & procedure

The power spectrum density per FCC §15.247(d) was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 10kHz, a span of 1.5 MHz, and the sweep time set at 500 seconds. Power Density was read directly and cable loss (2.13dB)/external attenuator (4dB) correction was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel). The Power Spectral Density measured result is in the following table.

6.3 Measured data of Power Spectrum Density test results

Test Mode: 802.11b operation mode (DSSS Modulation)

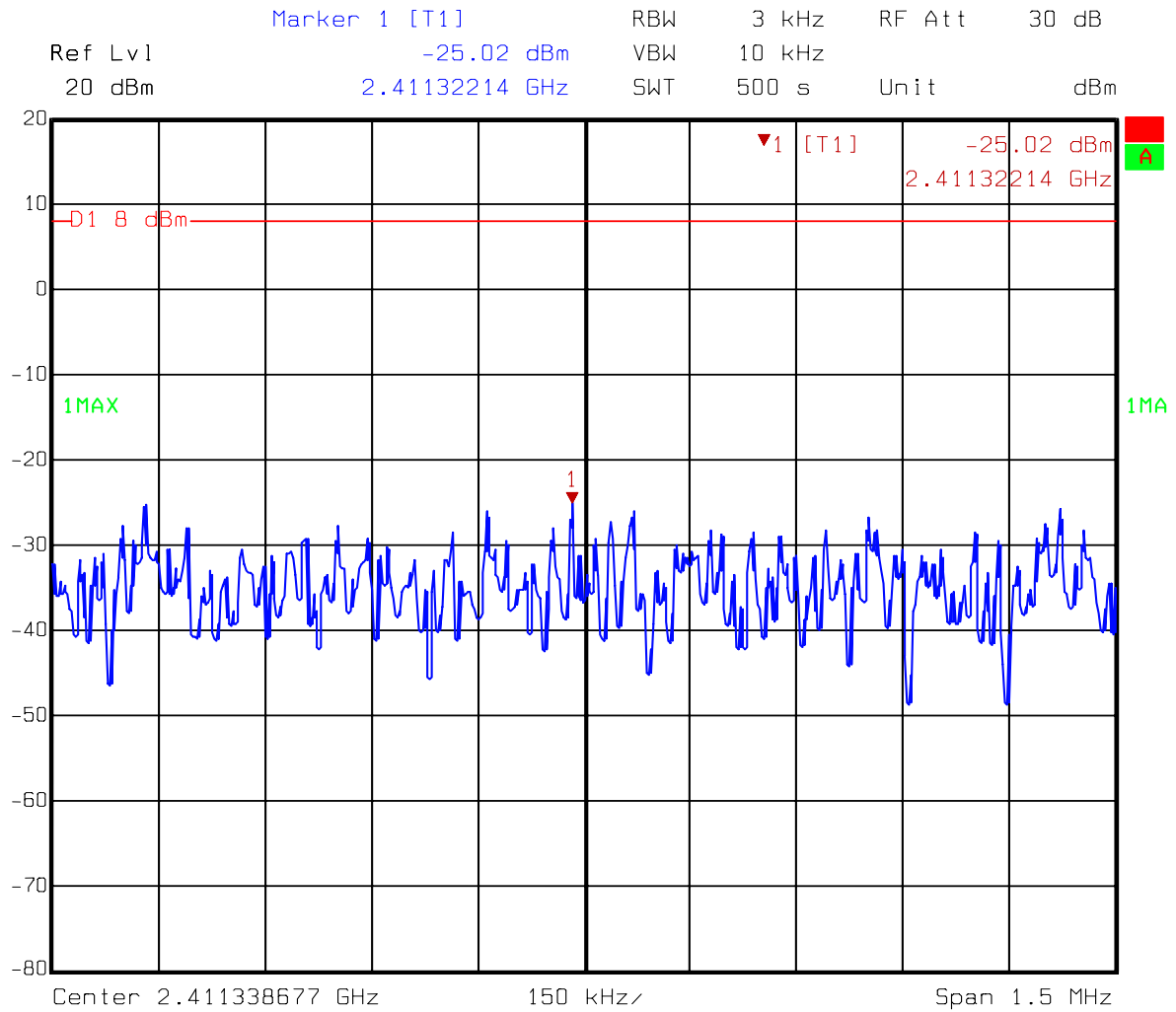
Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
Low	2412	-18.89	8
Middle	2437	-17.94	8
High	2462	-16.59	8

Test Mode: 802.11g operation mode (OFDM Modulation)

Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
Low	2412	-23.07	8
Middle	2437	-21.83	8
High	2462	-13.50	8

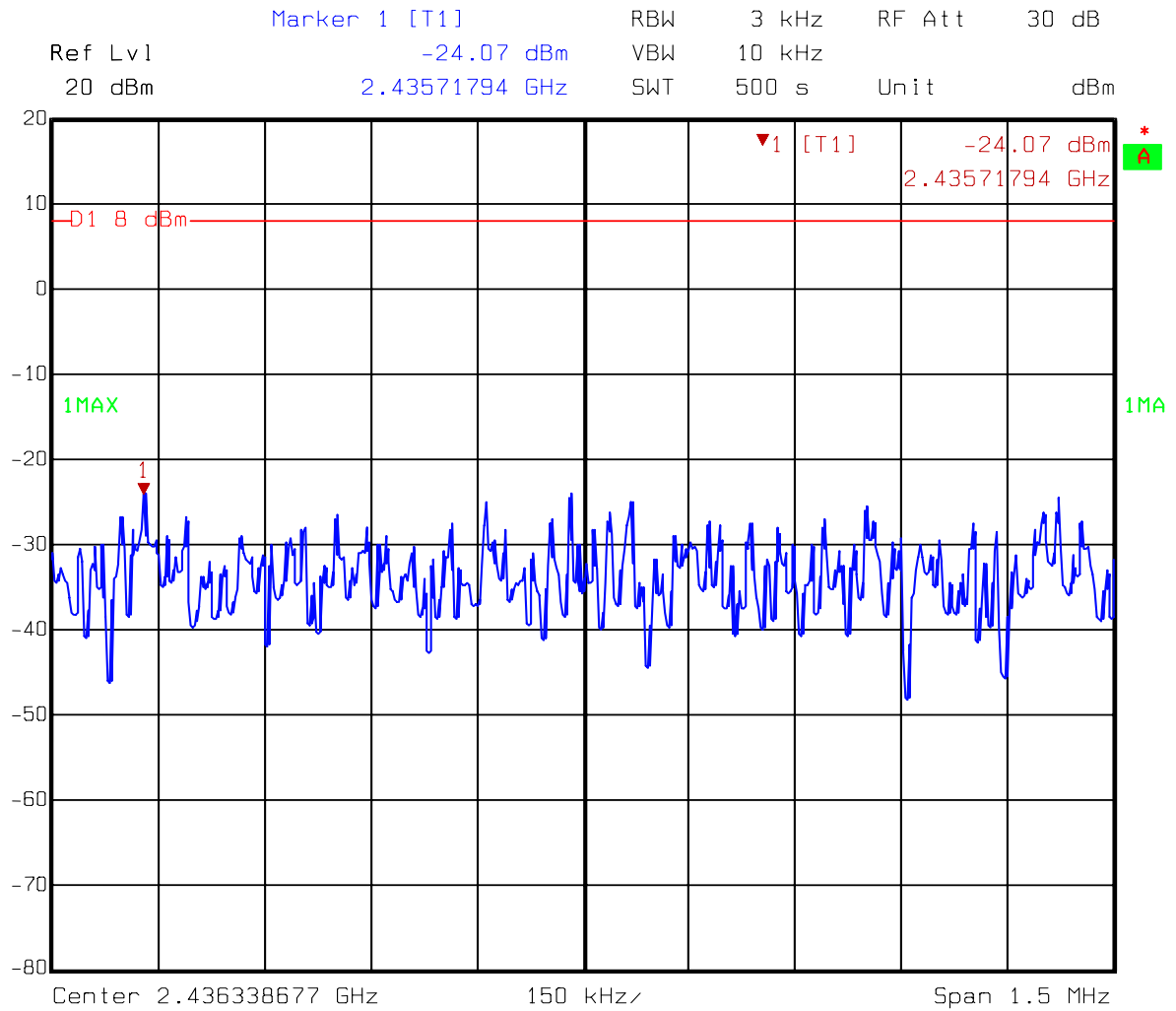
Please see the plot below.

Test Mode: 802.11b operation mode (DSSS Modulation)



Comment A: Power spectrum density at low channel
 ATT=4dB CL=2.13dB (EC365) 802.11b

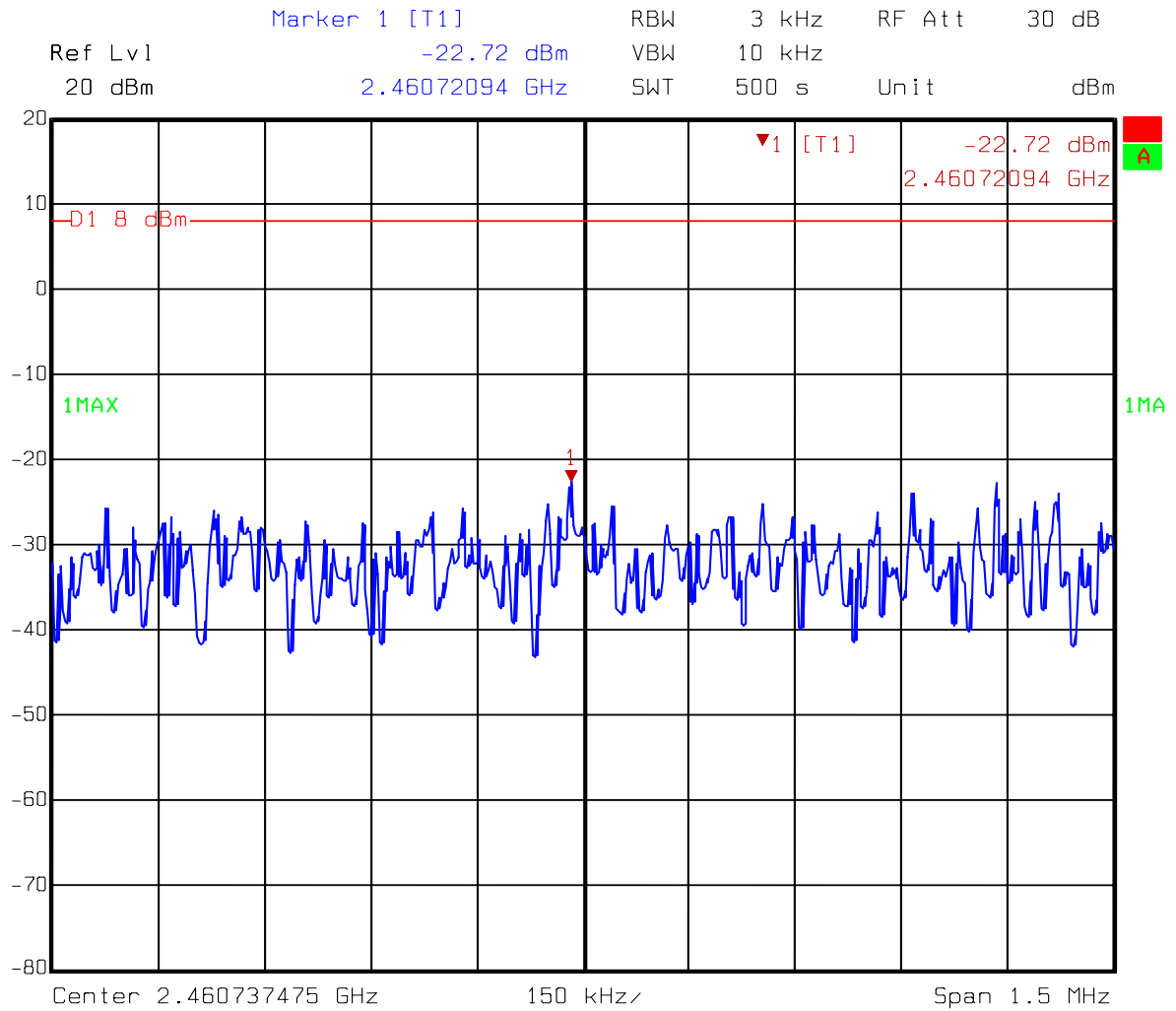
Date: 11.MAY 2004 11:09:37



Comment A: Power spectrum density at middle channel

ATT=4dB CL=2.13dB (EC365) 802.11b

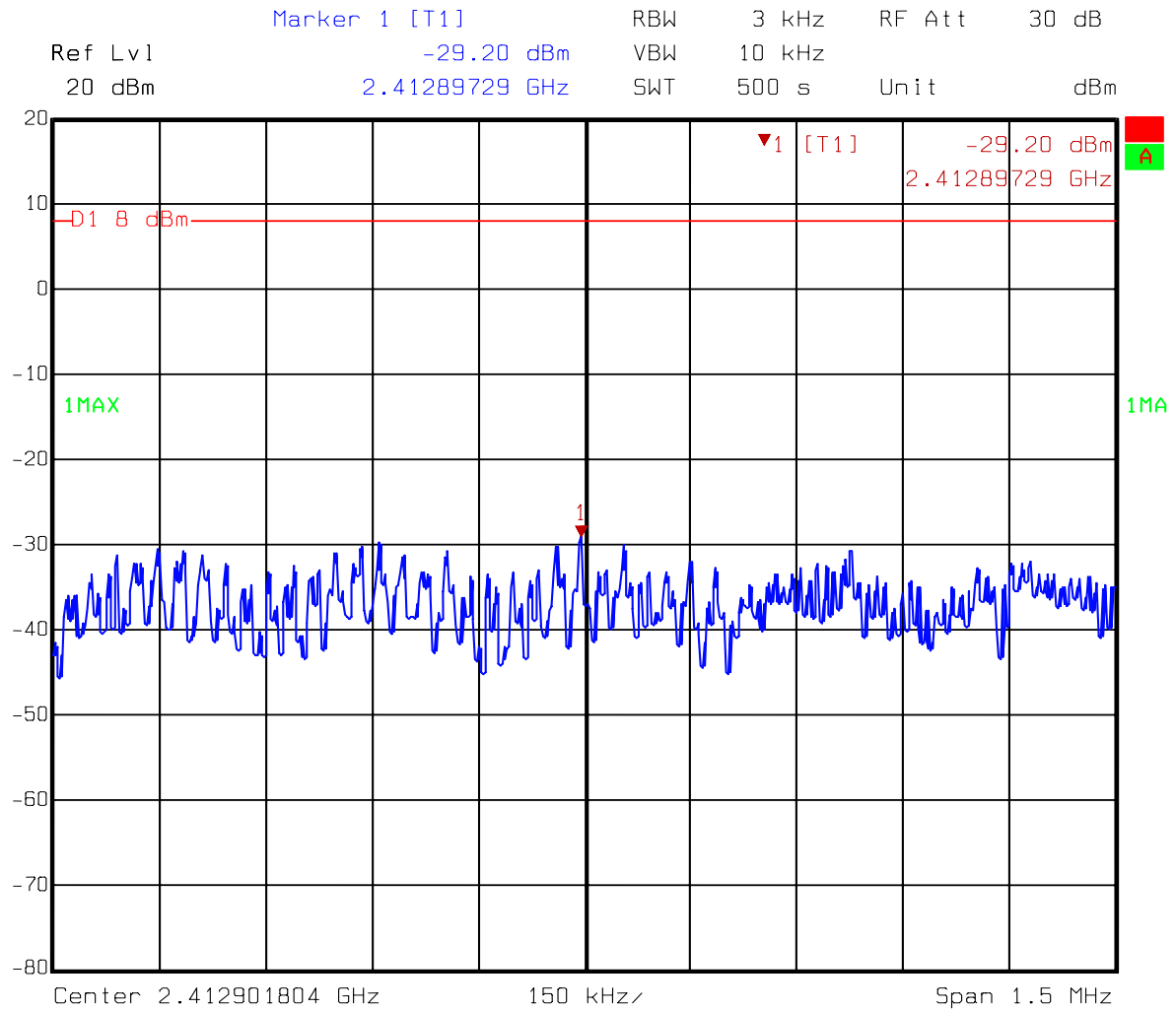
Date: 11.MAY 2004 11:11:20



Comment A: Power spectrum density at high channel
 ATT=4dB CL=2.13dB (EC365) 802.11b

Date: 11.MAY 2004 11:12:54

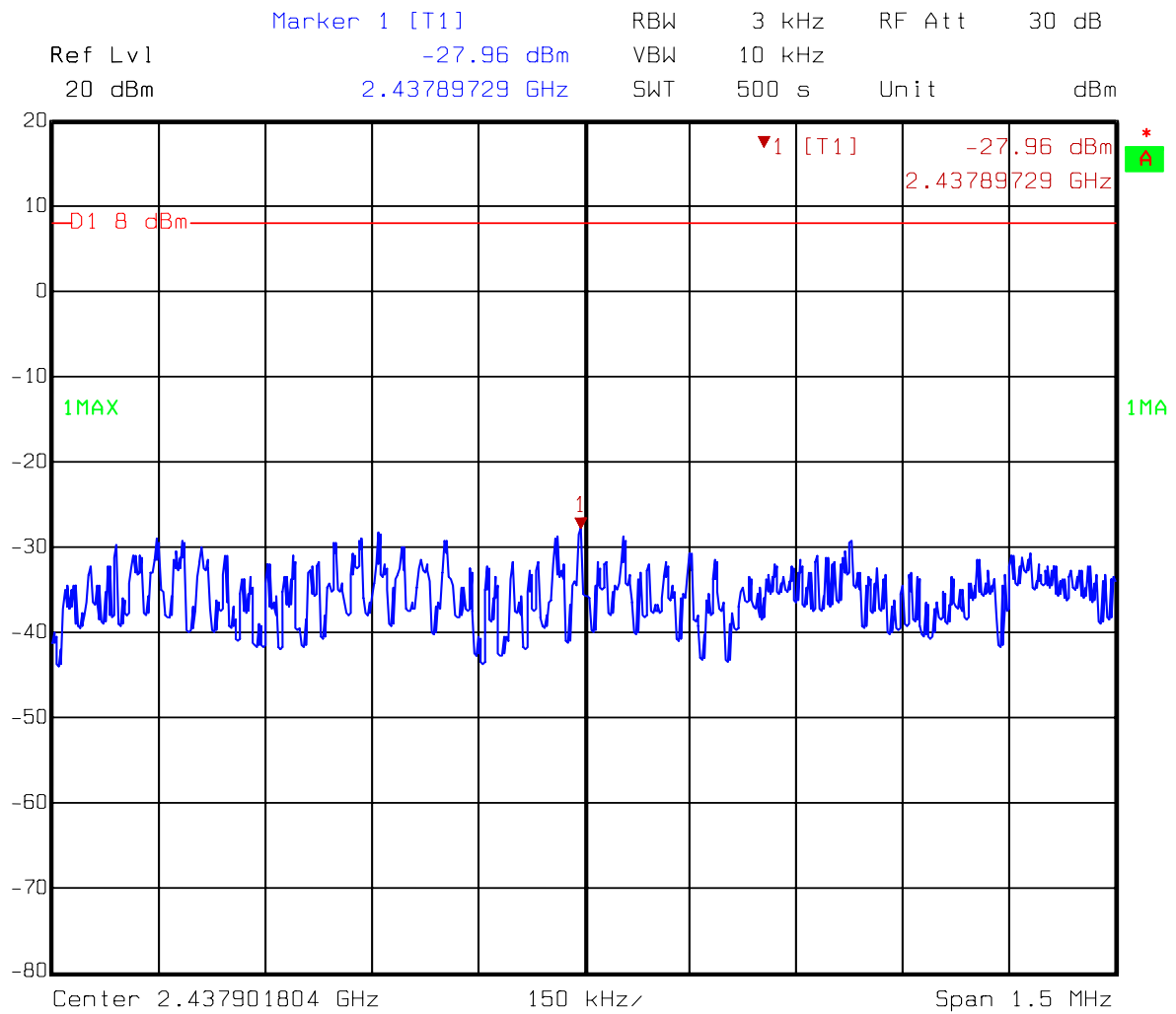
Test Mode: 802.11g operation mode (OFDM Modulation)



Comment A: Power spectrum density at low channel

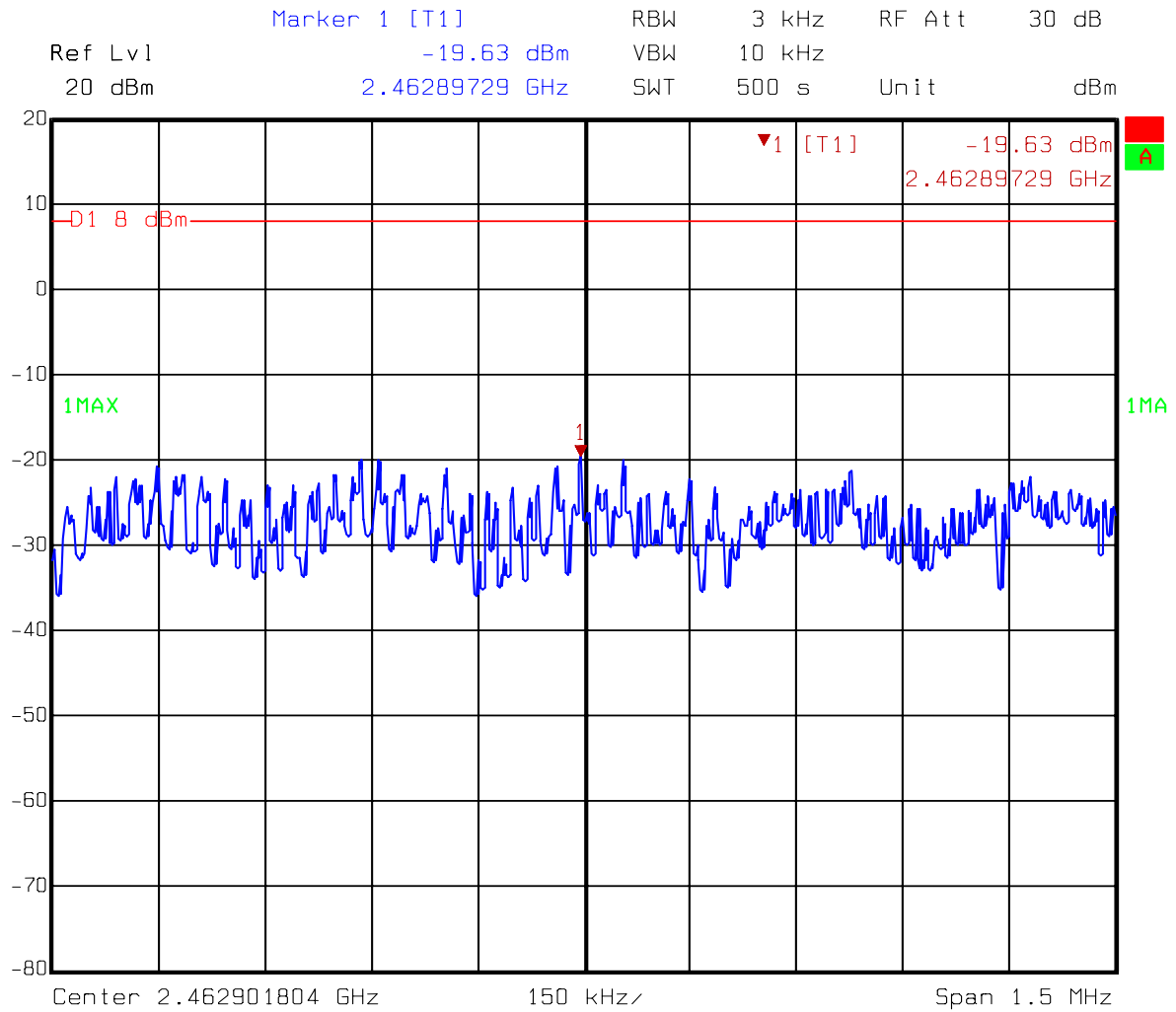
ATT=4dB CL=2.13dB (EC365) 802.11g

Date: 11.MAY 2004 11:23:30



Comment A: Power spectrum density at middle channel
 ATT=4dB CL=2.13dB (EC365) 802.11g

Date: 11.MAY 2004 11:21:56



Comment A: Power spectrum density at high channel
 ATT=4dB CL=2.13dB (EC365) 802.11g

Date: 11.MAY 2004 11:20:00

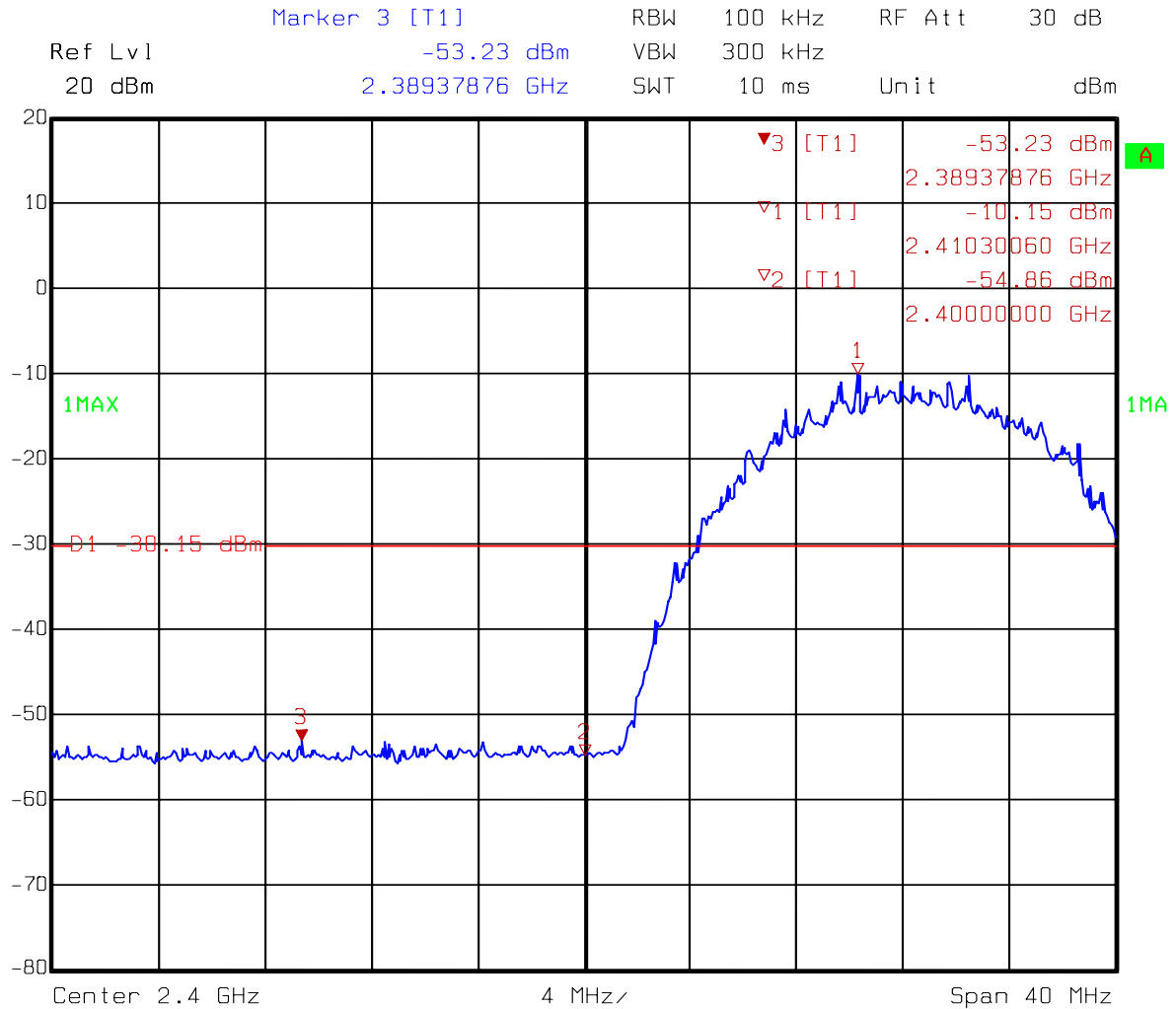
7. Emission on the band edge §FCC 15.247(C)

In any 100kHz bandwidth outside the frequency band in which the spread spectrum 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.

Please see the plot below.

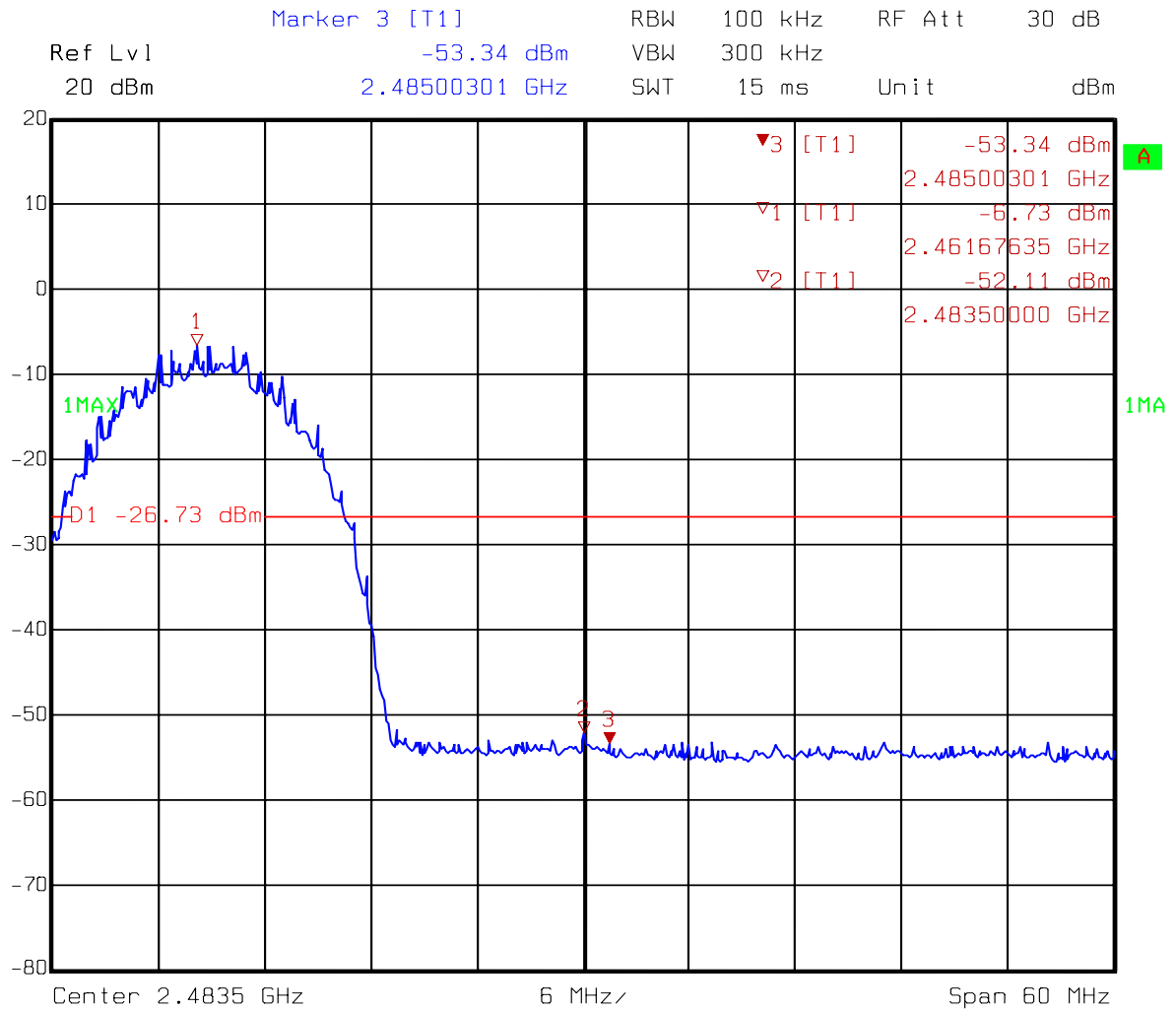
7.1 Band-edge (Conducted method)

Test Mode: 802.11b operation mode (DSSS Modulation)



Comment A: Band-edge at low channel (EC365) 802.11b

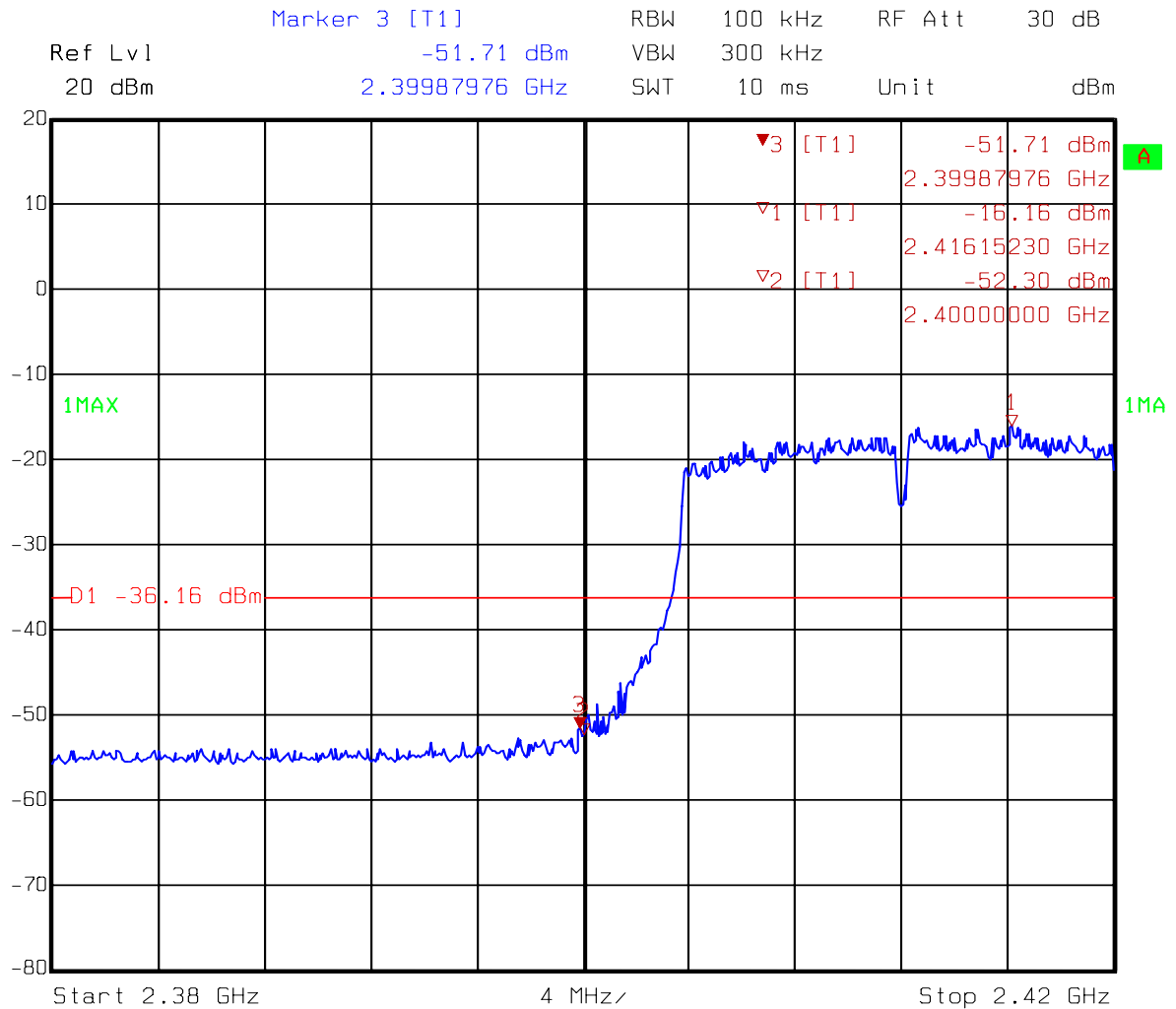
Date: 11.MAY 2004 11:04:28



Comment A: Band-edge at high channel (EC365) 802.11b

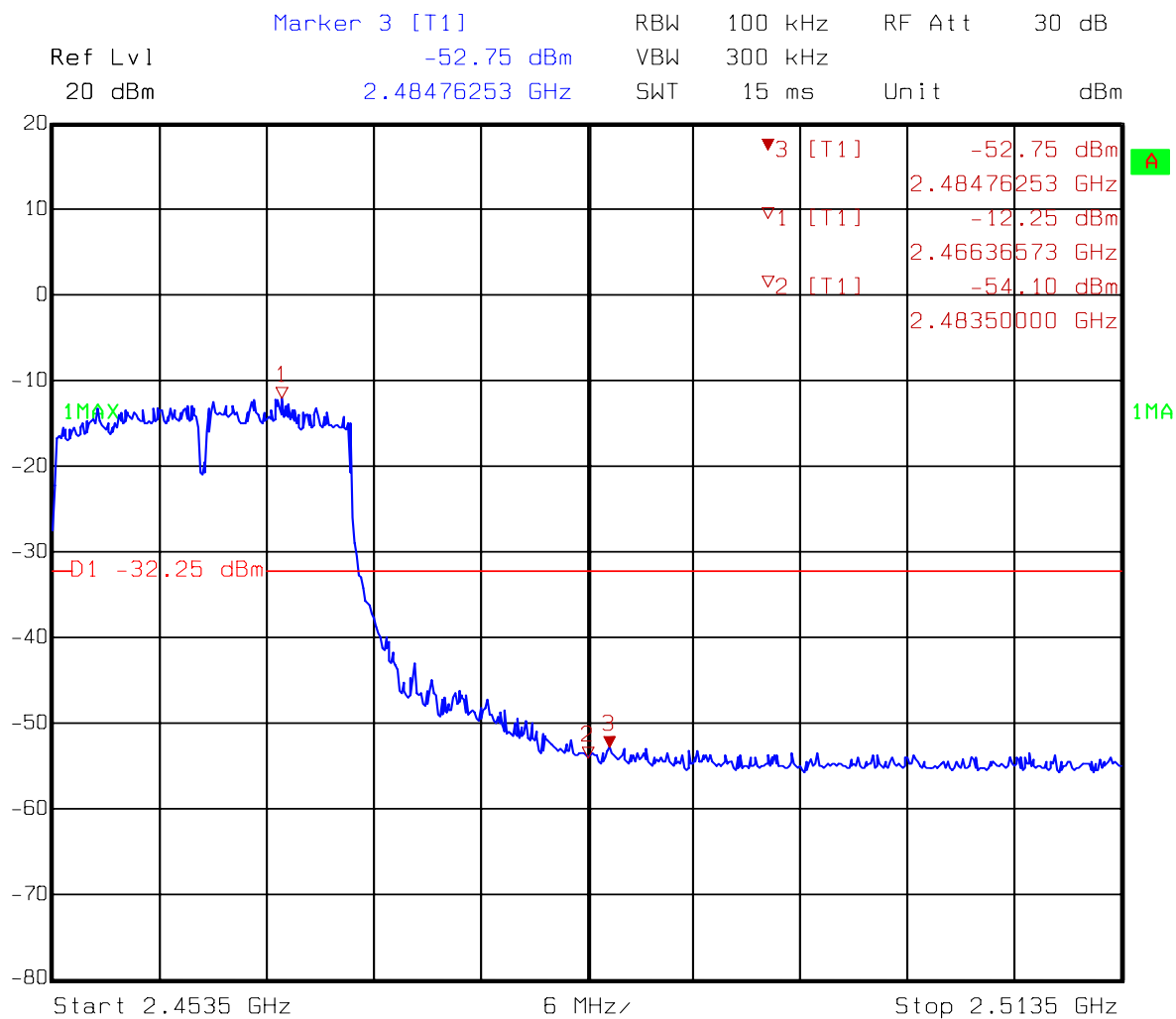
Date: 11.MAY 2004 11:07:09

Test Mode: 802.11g operation mode (OFDM Modulation)



Comment A: Band-edge at low channel (EC365) 802.11g

Date: 11.MAY 2004 11:25:51

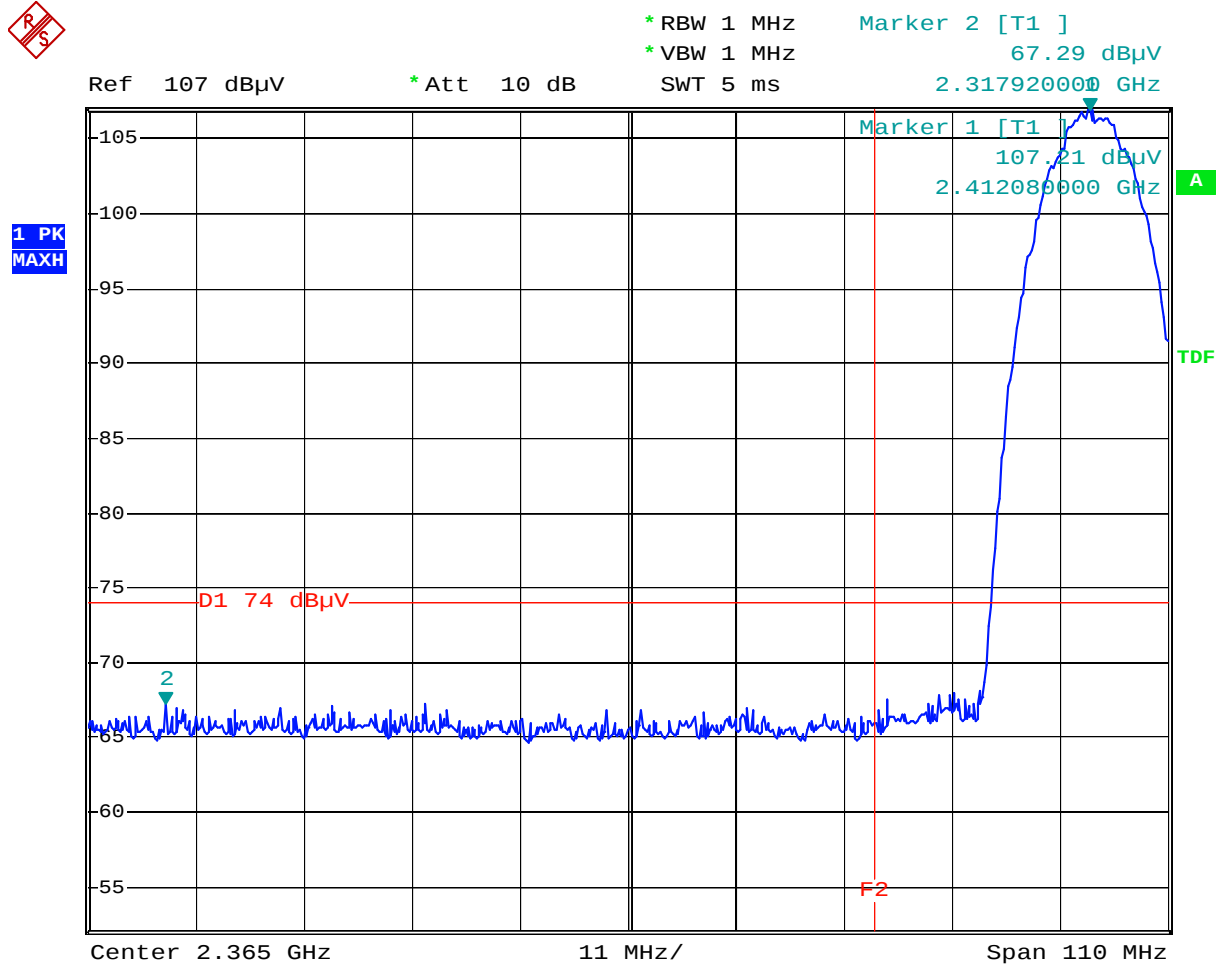


Comment A: Band-edge at high channel (EC365) 802.11g

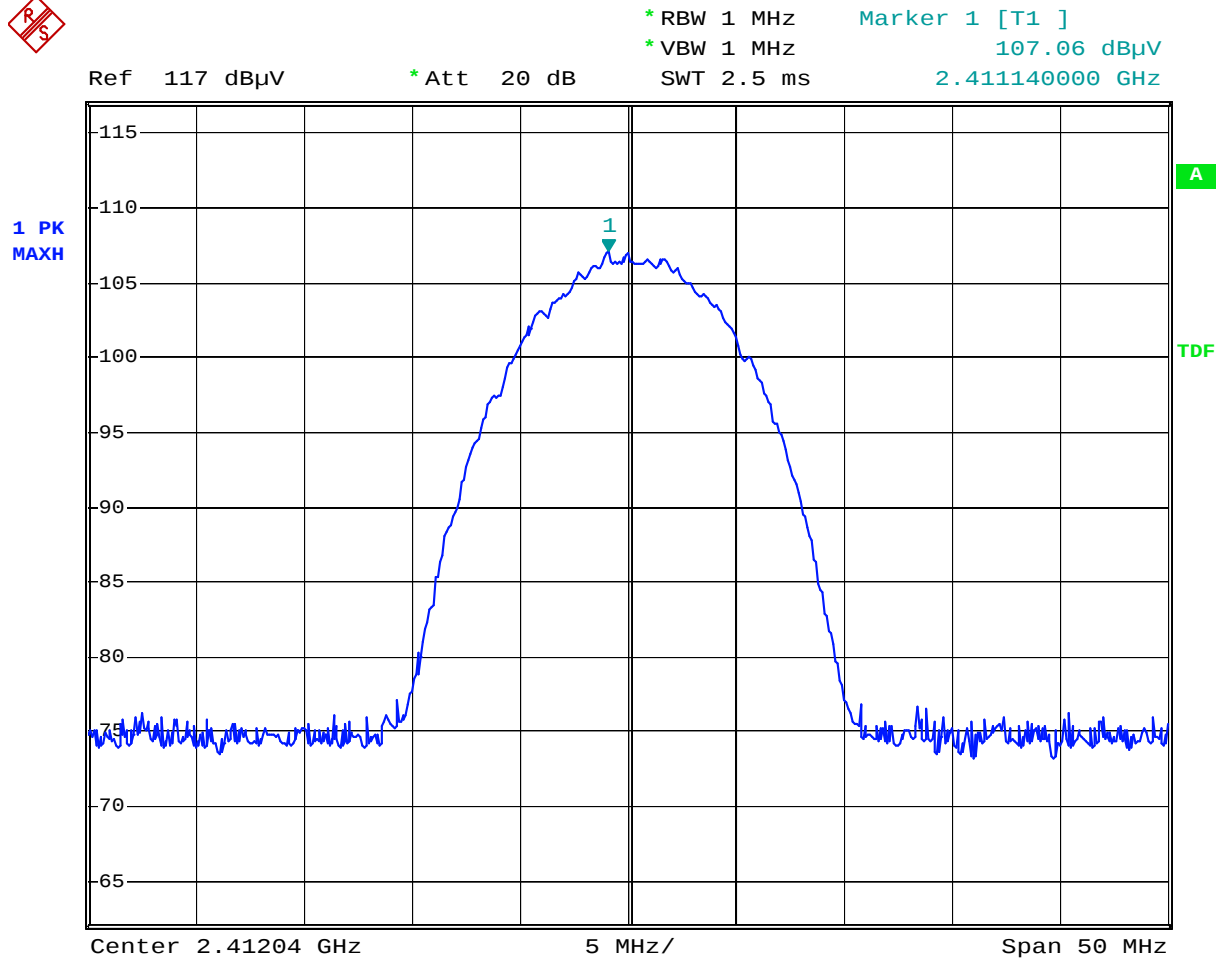
Date: 11.MAY 2004 11:28:14

7.2 Band-edge (Radiated method)

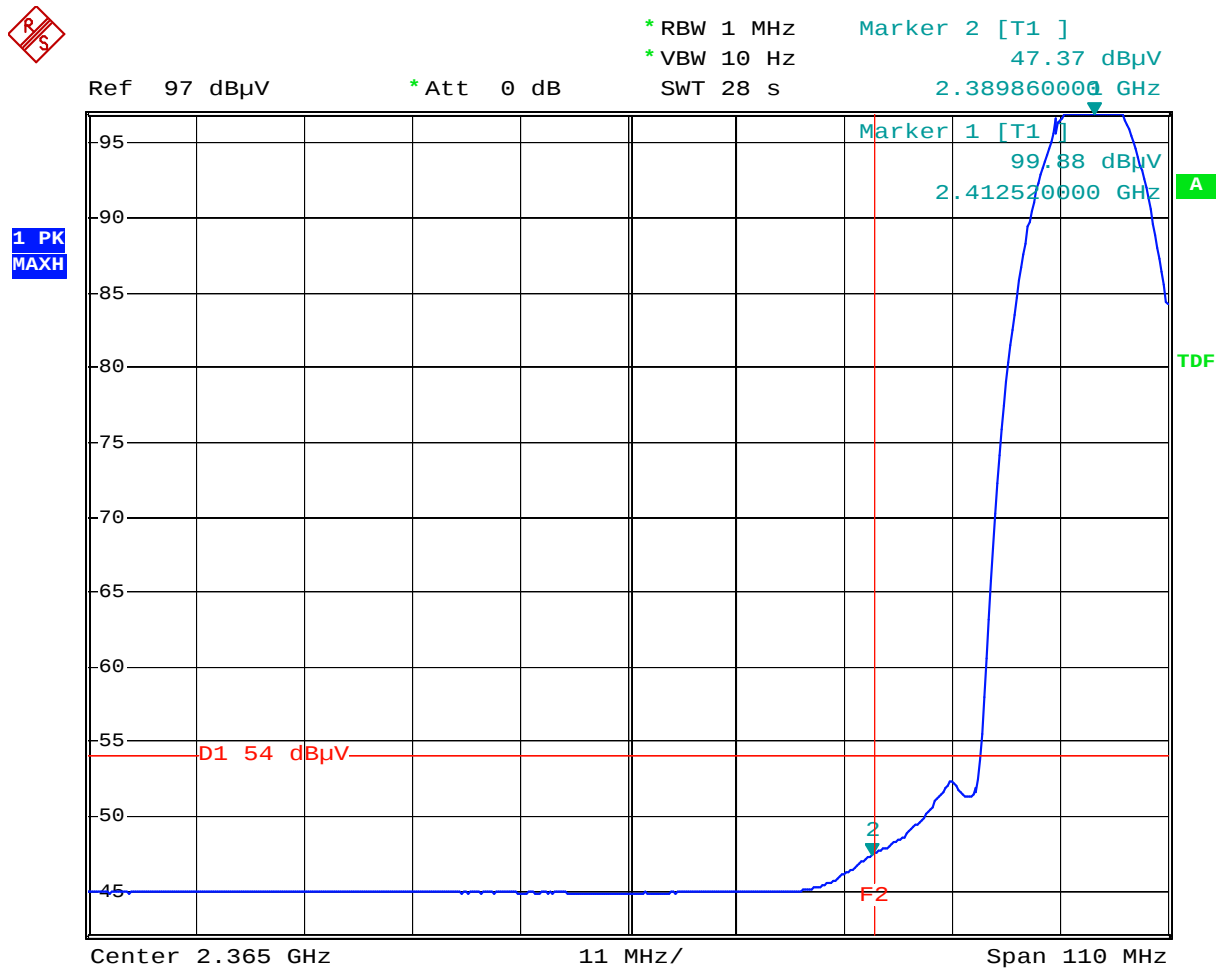
Test Mode: 802.11b operation mode (DSSS Modulation)



Comment: Band-edge test at low channel
 Comment: Peak detector F2=2390MHz 802.11b
 Date: 6.MAY.2004 17:45:50



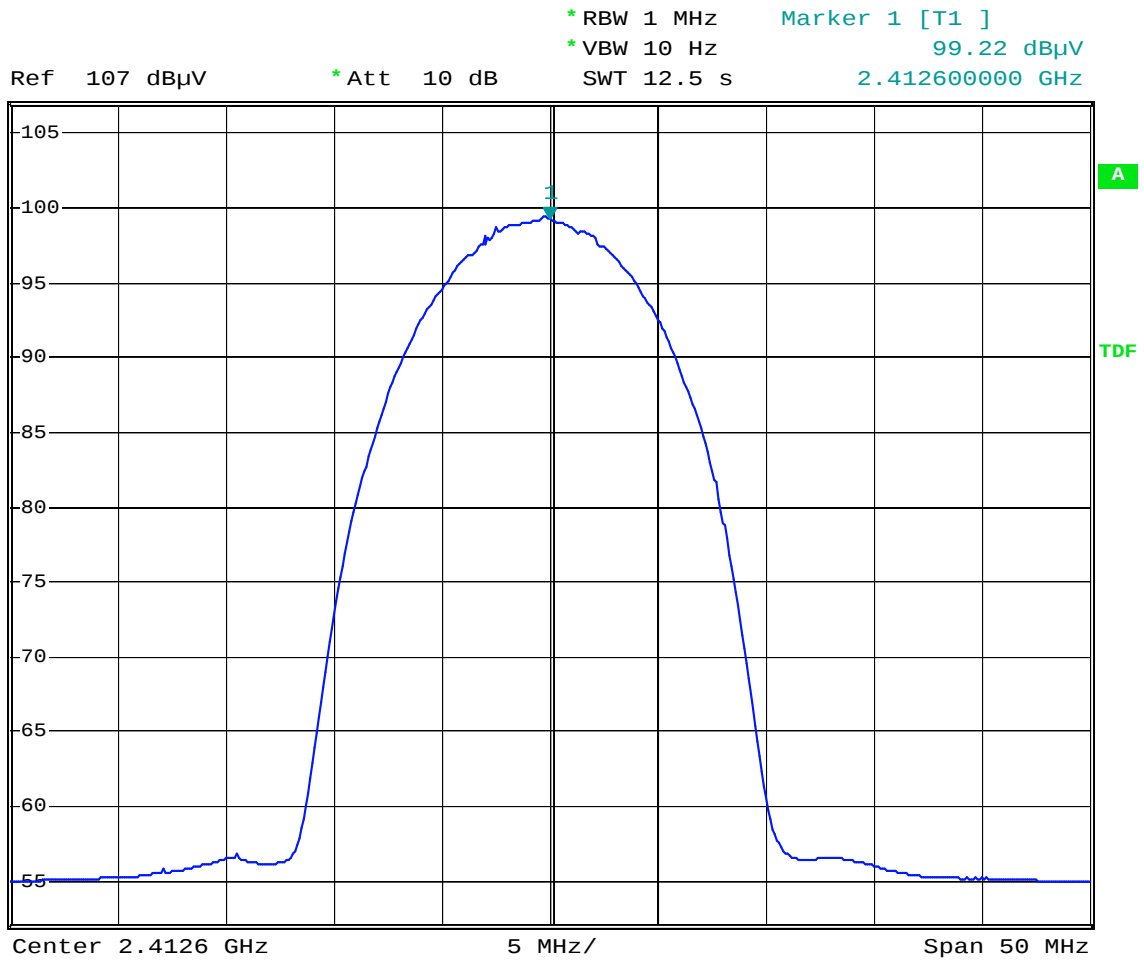
Comment: Band-edge test at low channel
 Comment: Peak detector F2=2390MHz 802.11b
 Date: 6.MAY.2004 17:44:16



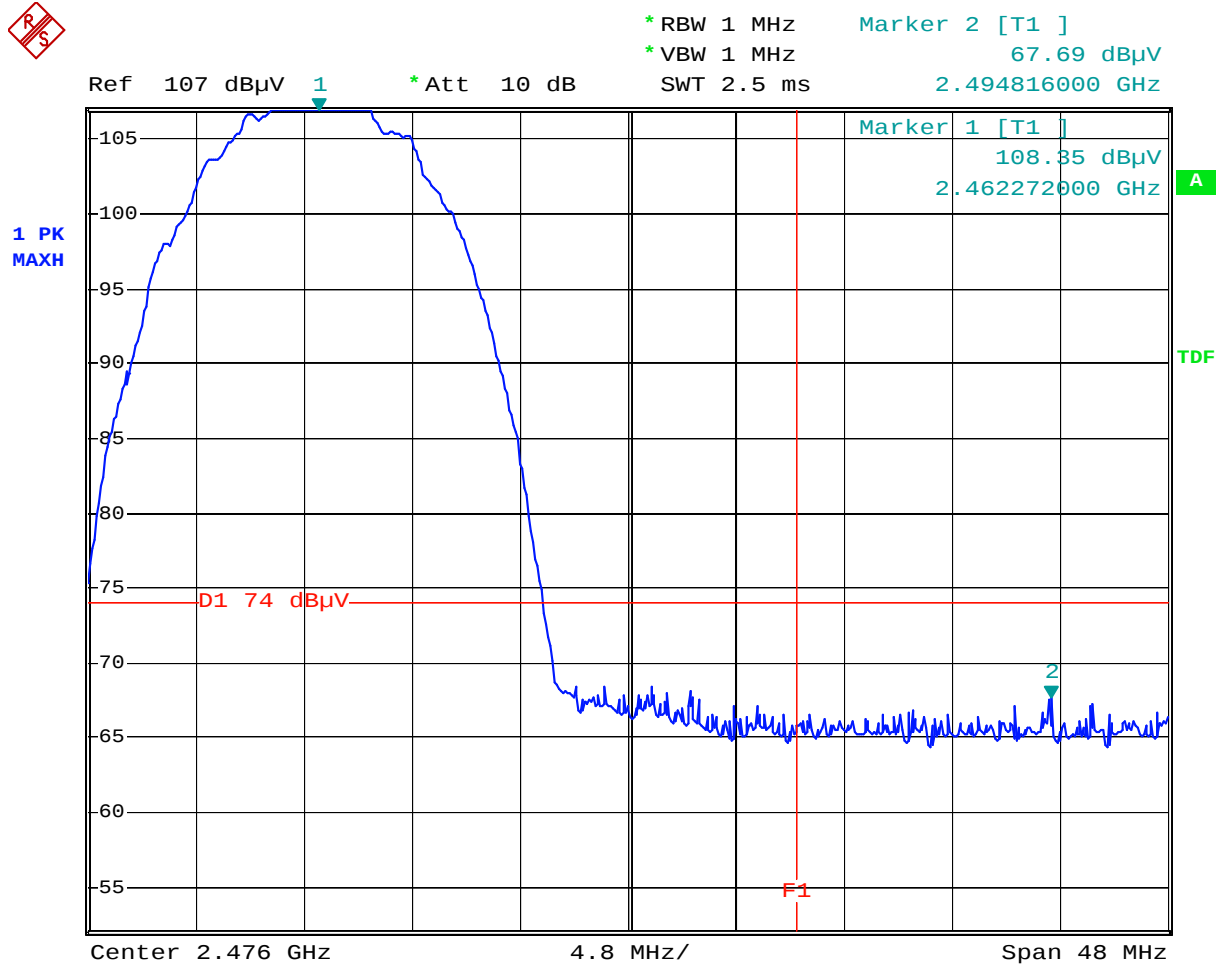
Comment: Band-edge test at low channel
 Comment: Average detector F2=2390MHz 802.11b
 Date: 6.MAY.2004 17:49:28



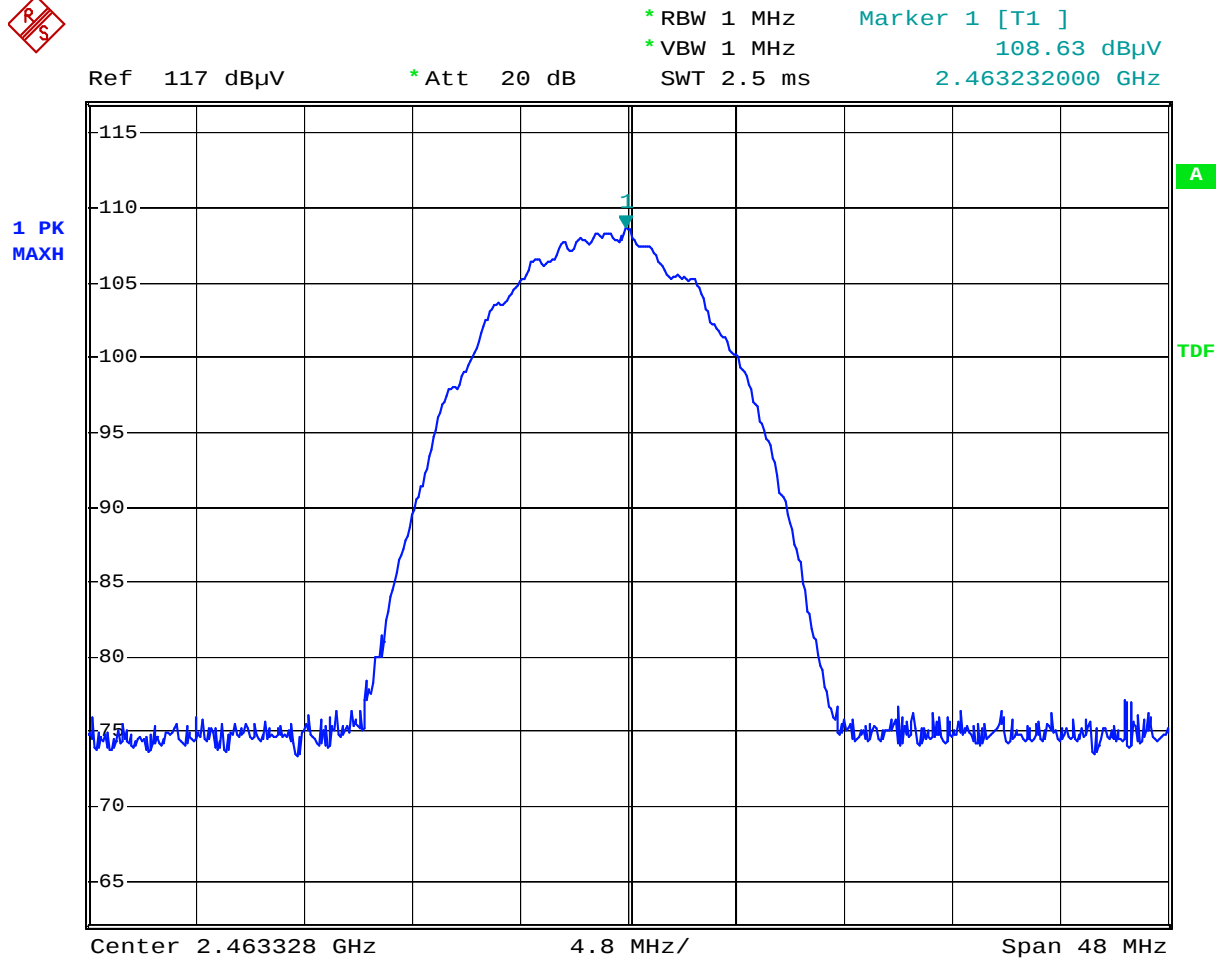
1 PK
MAXH



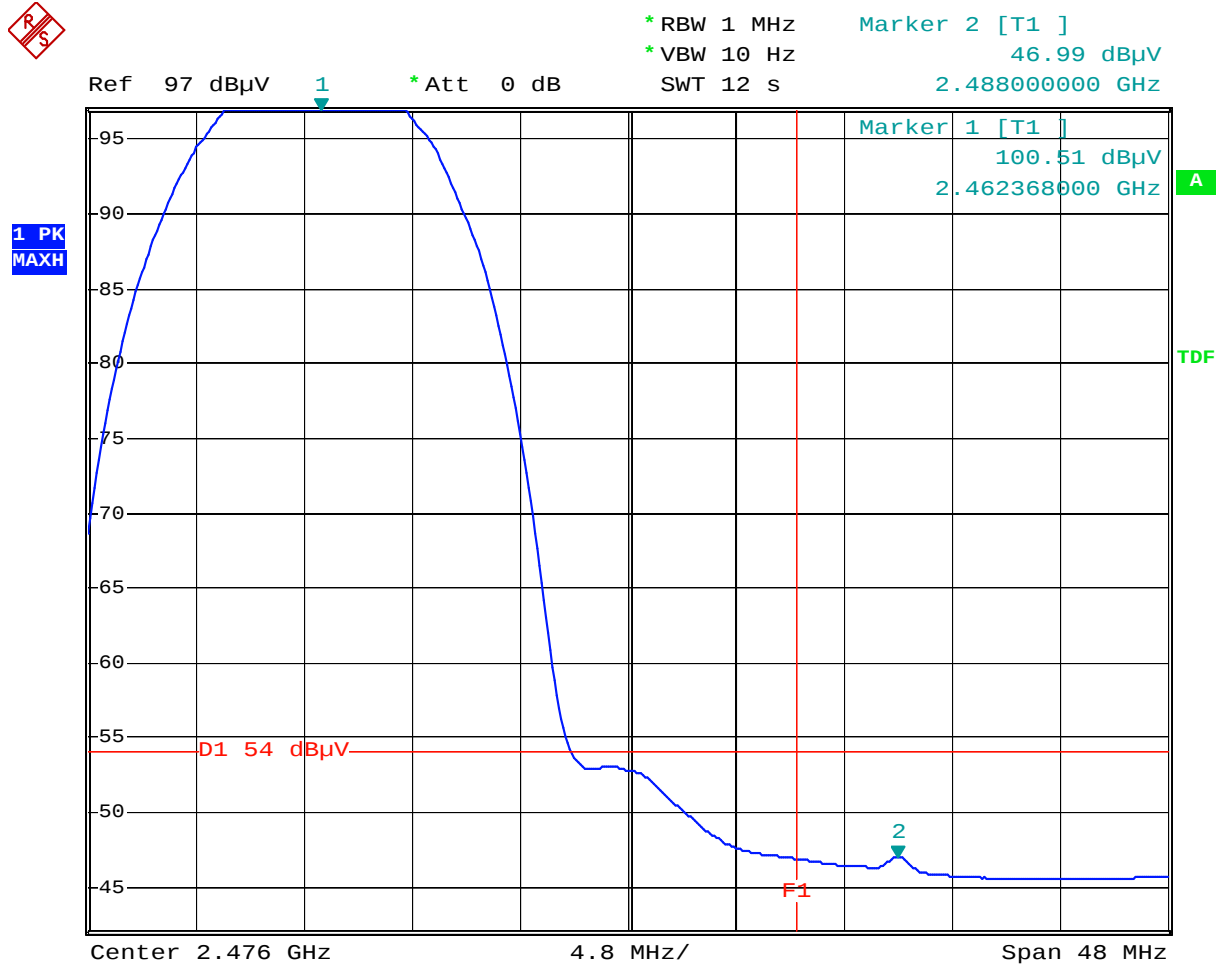
Comment: Band-edge test at low channel
Comment: Average detector F2=2390MHz 802.11b
Date: 6.MAY.2004 17:47:29



Comment: Band-edge test at high channel
 Comment: Peak detector F1=2483.5MHz 802.11b
 Date: 6.MAY.2004 17:54:45



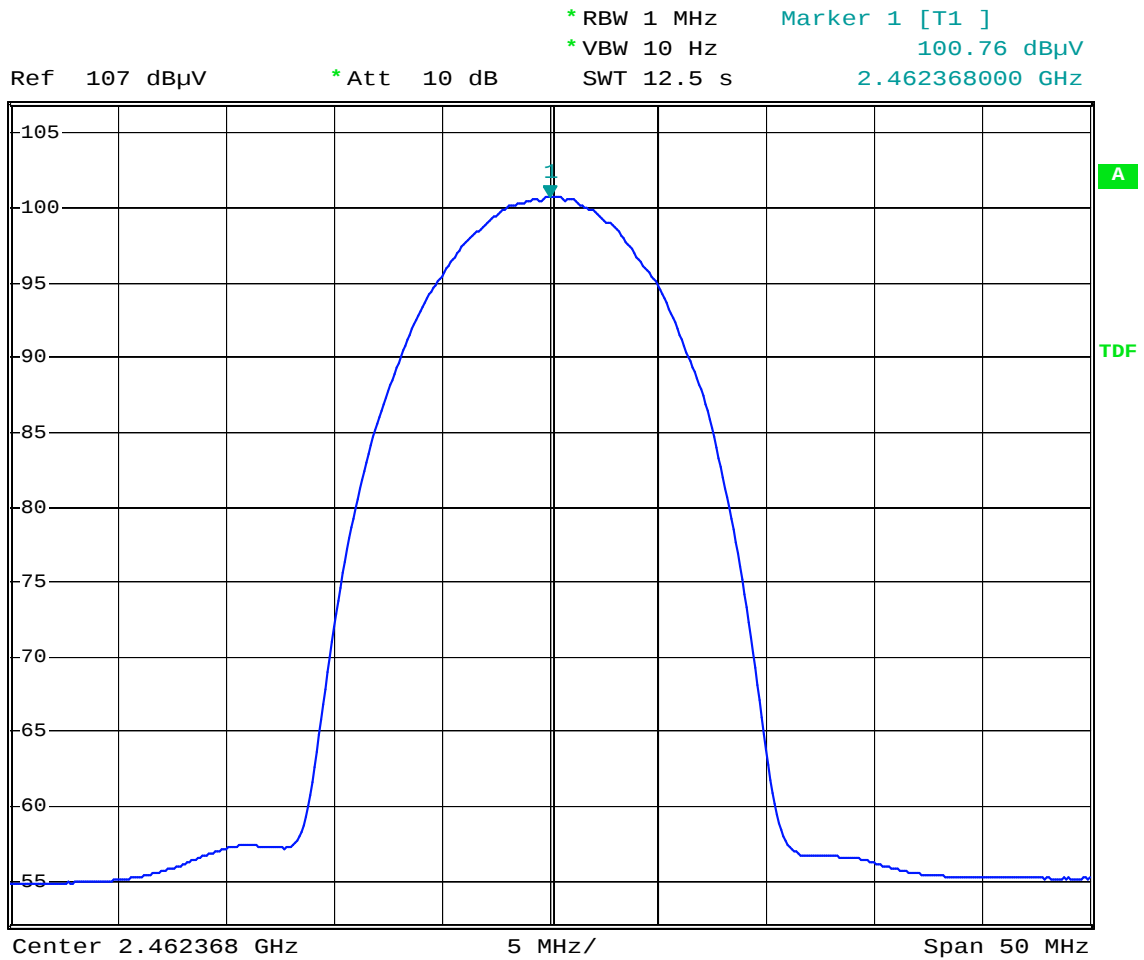
Comment: Band-edge test at high channel
 Comment: Peak detector F1=2483.5MHz 802.11b
 Date: 6.MAY.2004 17:53:17



Comment: Band-edge test at high channel
 Comment: Average detector F1=2483.5MHz 802.11b
 Date: 6.MAY.2004 17:57:38

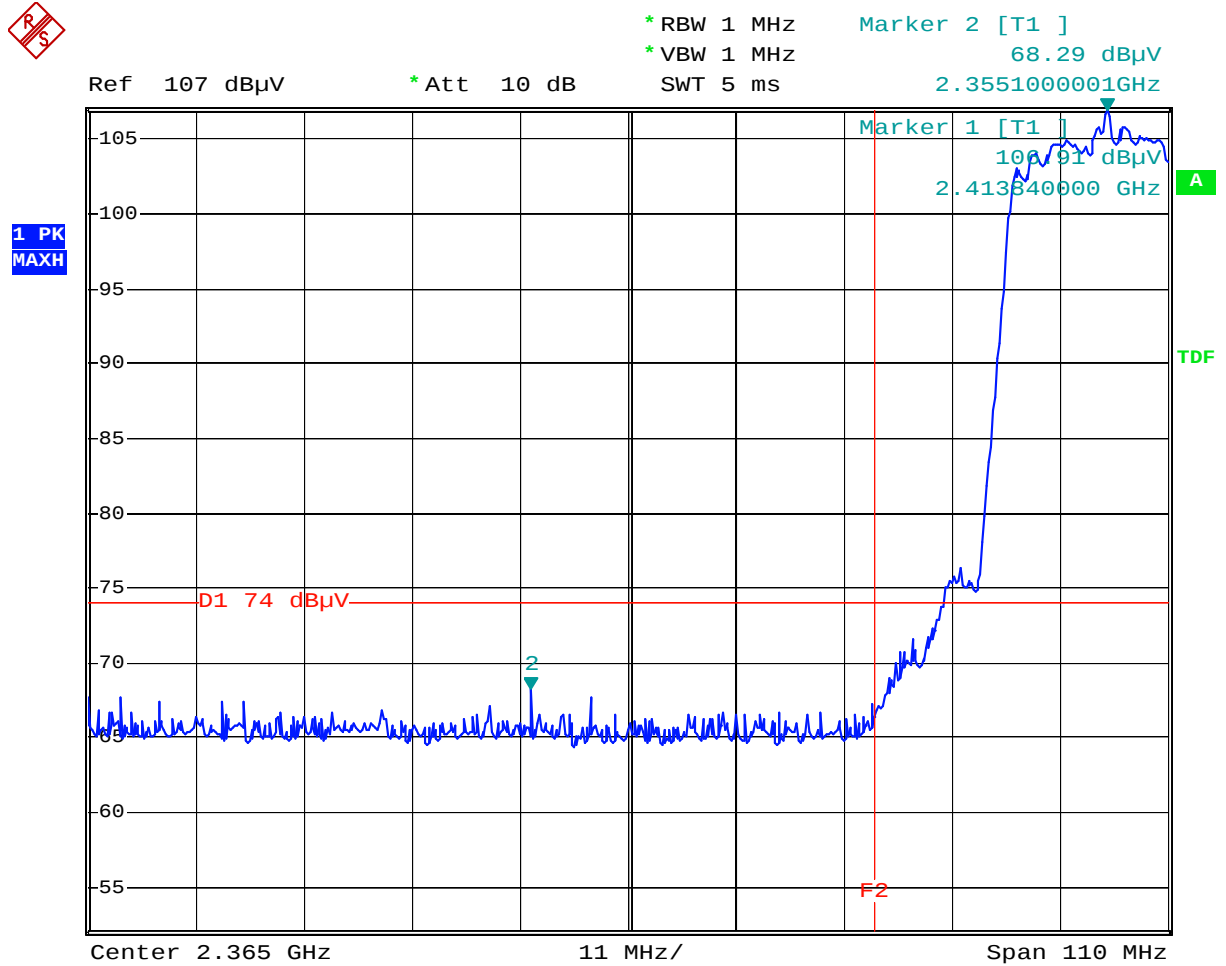


1 PK
MAXH

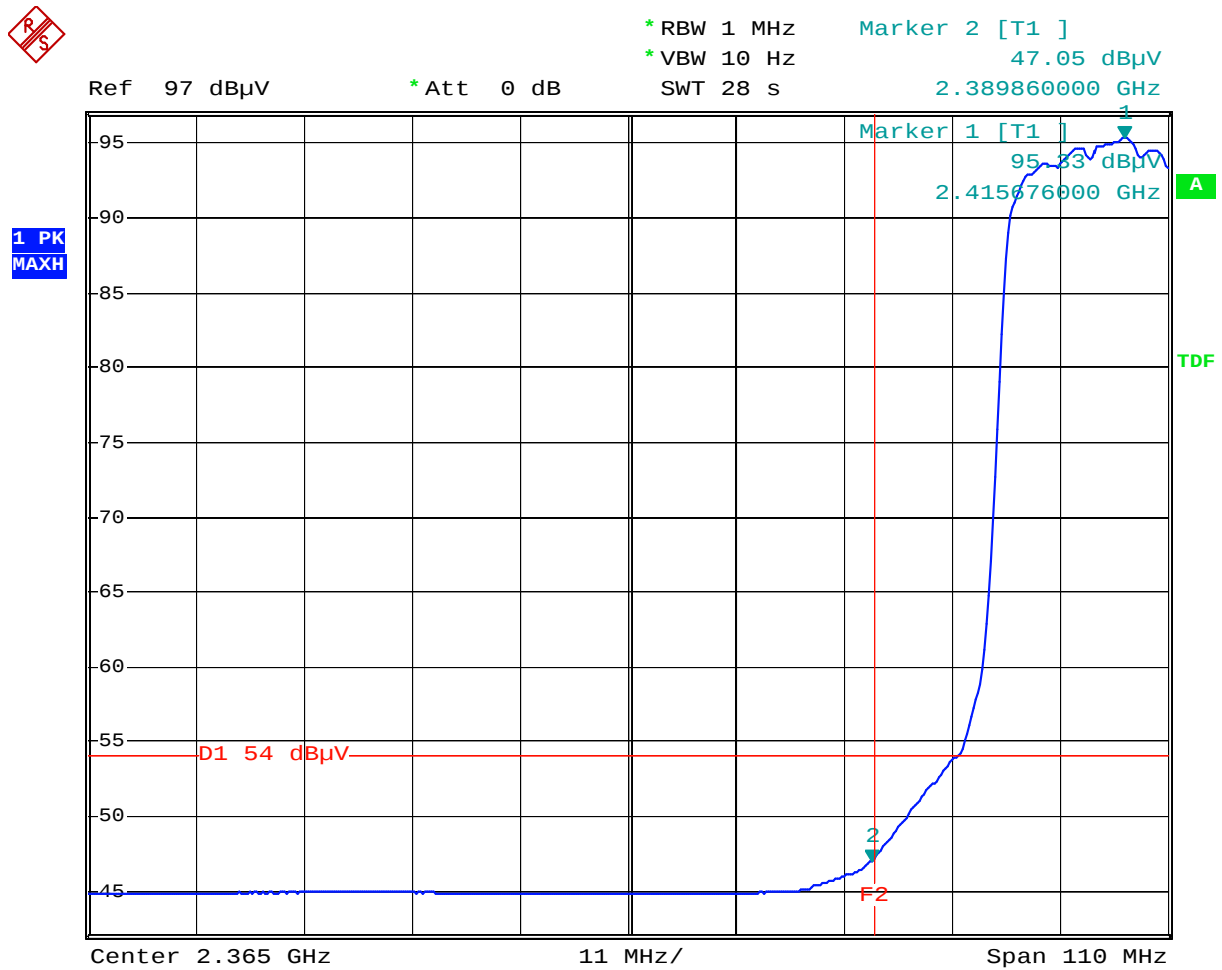


Comment: Band-edge test at high channel
Comment: Average detector F1=2483.5MHz 802.11b
Date: 6.MAY.2004 17:56:01

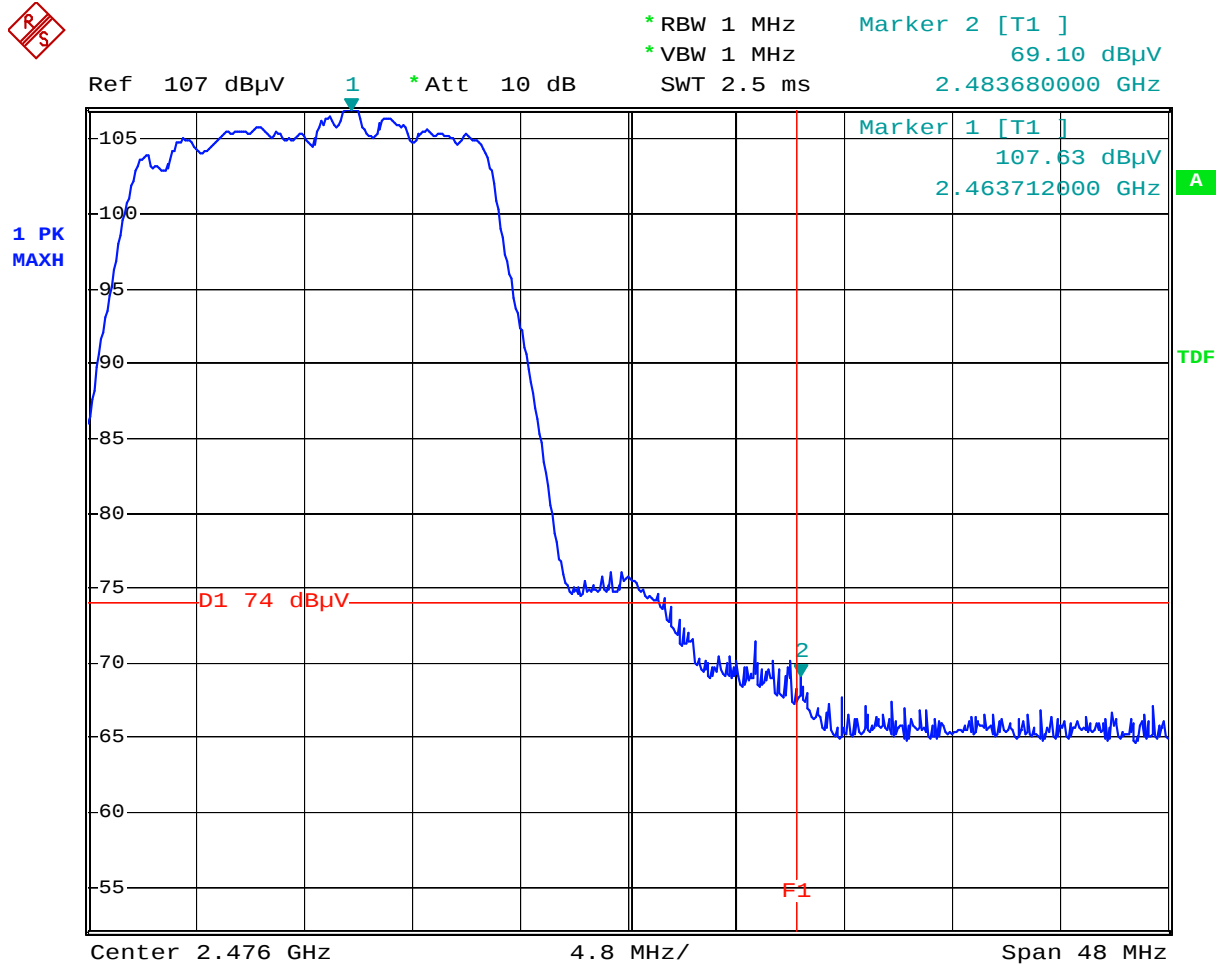
Test Mode: 802.11g operation mode (OFDM Modulation)



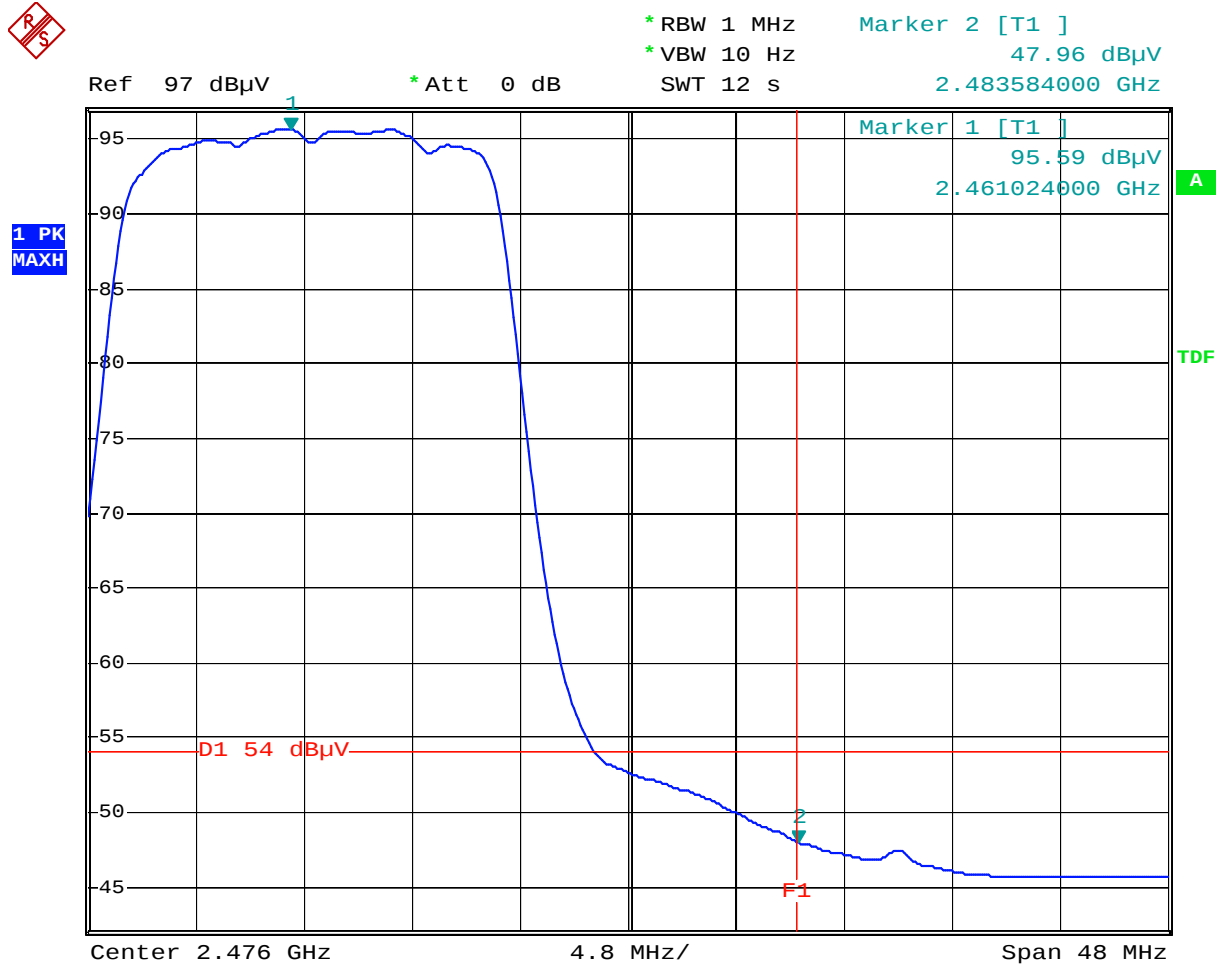
Comment: Band-edge test at low channel
 Comment: Peak detector F2=2390MHz 802.11g
 Date: 6.MAY.2004 18:06:00



Comment: Band-edge test at low channel
 Comment: Average detector F2=2390MHz 802.11g
 Date: 6.MAY.2004 18:07:31



Comment: Band-edge test at high channel
 Comment: Peak detector F1=2483.5MHz 802.11g
 Date: 6.MAY.2004 18:01:36



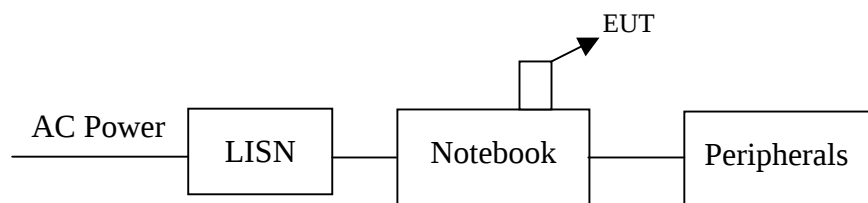
Comment: Band-edge test at high channel
 Comment: Average detector F1=2483.5MHz 802.11g
 Date: 6.MAY.2004 18:02:49

8. Power Line Conducted Emission test §FCC 15.207

8.1 Operating environment

Temperature:	22		(10-40)
Relative Humidity:	52	%	(10-90%)
Atmospheric Pressure	1023	hPa	(860-1061hPa)

8.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/1992 on conducted measurement. The AC power conducted emissions was investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz. (15.207 paragraph)

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

Please see the plot below.

Emission Limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

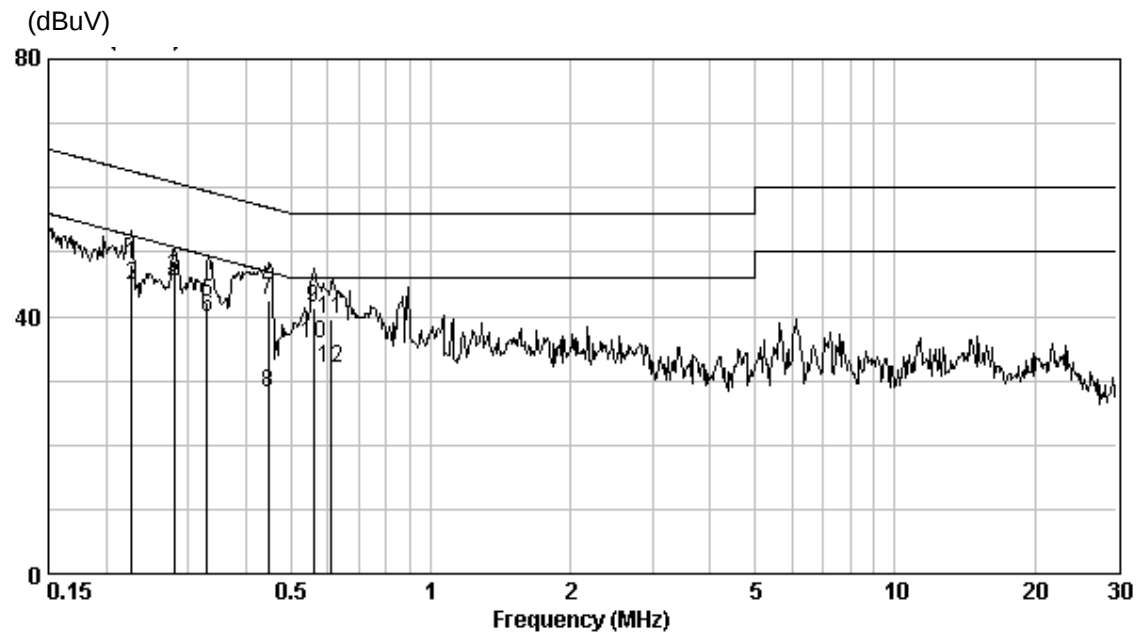
8.3 Power Line Conducted Emission test data

Phase: Line
Model No.: ZyAIR G-220
Test Condition: Normal operation mode

Freq. (MHz)	Correction Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.227	0.10	47.93	62.56	-14.63	QP
0.227	0.10	44.72	52.56	-7.84	AVERAGE
0.279	0.10	45.88	60.84	-14.96	QP
0.279	0.10	44.91	50.84	-5.93	AVERAGE
0.330	0.10	42.19	59.45	-17.26	QP
0.330	0.10	39.97	49.45	-9.48	AVERAGE
0.447	0.10	42.63	56.93	-14.30	QP
0.447	0.10	28.15	46.93	-18.78	AVERAGE
0.559	0.10	41.37	56.00	-14.63	QP
0.559	0.10	35.62	46.00	-10.38	AVERAGE
0.610	0.10	39.62	56.00	-16.38	QP
0.610	0.10	32.07	46.00	-13.93	AVERAGE

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
 Model No.: ZyAIR G-220
 Test Condition: Normal operation mode

Freq. (MHz)	Correction Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.220	0.10	50.45	62.82	-12.37	QP
0.220	0.10	40.63	52.82	-12.19	AVERAGE
0.279	0.10	46.28	60.84	-14.56	QP
0.279	0.10	44.53	50.84	-6.31	AVERAGE
0.335	0.10	44.71	59.32	-14.61	QP
0.335	0.10	44.14	49.32	-5.18	AVERAGE
0.447	0.10	45.56	56.93	-11.37	QP
0.447	0.10	29.01	46.93	-17.92	AVERAGE
0.559	0.10	44.48	56.00	-11.52	QP
0.559	0.10	36.16	46.00	-9.84	AVERAGE
0.894	0.10	40.02	56.00	-15.98	QP
0.894	0.10	31.20	46.00	-14.80	AVERAGE

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

