

EMC TEST REPORT

Report No. : EME-050490

Model No. : UCW2000


Issued Date : May 17, 2005

Applicant : AboCom Syatems, Inc.
1F, No. 21, Yanfa 2nd Road, SBIP, Hsinchu City 300, Taiwan

Test By : Intertek Testing Services Taiwan Ltd.
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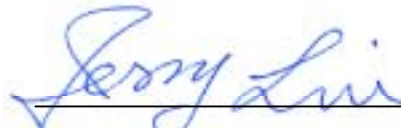
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Project Engineer



Marx Yan

Reviewed By



Jerry Liu

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Summary of Tests**CPSCB1 Chalkboard-Model: UCW2000
FCC ID: MQ4UCW2000**

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	: AboCom Syatems, Inc.
Product	: CPSCB1 Chalkboard
Model No.	: UCW2000
FCC ID.	: MQ4UGW2000
Frequency Range	: 2402MHz ~ 2478MHz
Channel Number	: 77 channels
Frequency of Each Channel	: 2402MHz + k MHz k= 0~76
Type of Modulation	: DSSS
Rated Power	: 120Vac, 60Hz with adapter (Model: MKD-410500500R)
Power Cord	: N/A
Sample Received	: May 12, 2005
Test Date(s)	: May 11, 2005 ~ May 12, 2005

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

By using the advanced RF technology, a 360° of operation is possible, and no line-of-sight is required between the receiver and the chalkboard. The chalkboard, with the high performance and long distance, will bring users the best operation accuracy and efficiency.

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 : -1dBi max

Antenna Type : Printed antenna

Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook PC	DELL	PP01L	CN-06P83-48643-33V-0112	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

During conducted emission test, the EUT was in normal mode communicating with receiver. While in other test, it worked in the status of continuously transmitting.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	04/13/2006
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	07/14/2005
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	07/13/2005
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	10/18/2005
Horn Antenna	EMCO	1GHz~18GHz	3115	EC338	08/16/2005
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	07/08/2005
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	EC368	05/20/2005
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	04/13/2006
Pre-Amplifier	MITEQ	26GHz~40GHz	828825	EC374	01/28/2006
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2497A/ MA2491A	EC396	10/18/2005
Controller	HDGmbH	N/A	HD 100	EP317-1	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP317-2	N/A
Turn Table	HDGmbH	N/A	DS 420S	EP317-3	N/A
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	01/14/2006

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

3. Minimum 6dB Bandwidth test

3.1 Operating environment

Temperature: 25
Relative Humidity: 58 %
Atmospheric Pressure: 1023 hPa

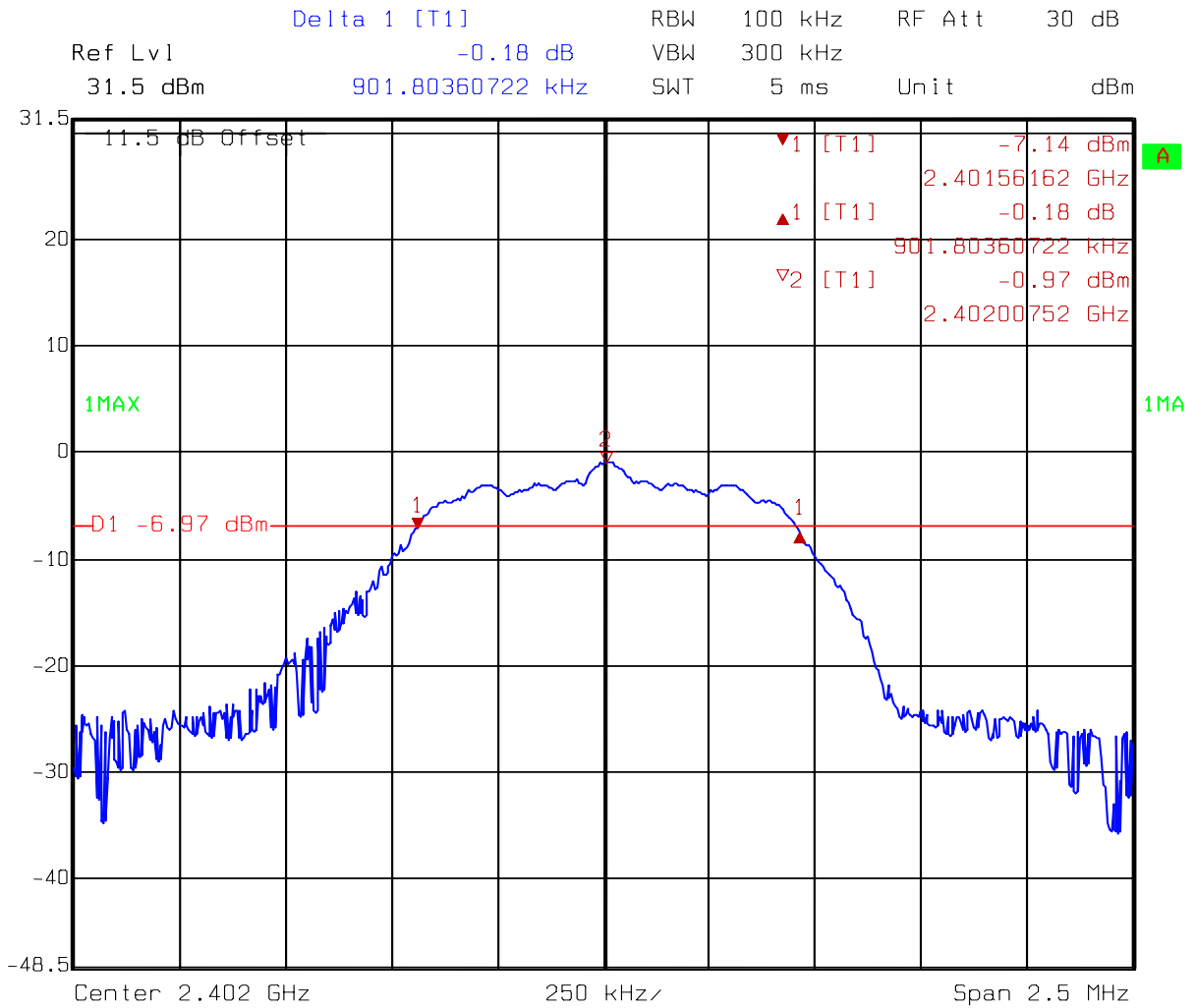
3.2 Test setup & procedure

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.

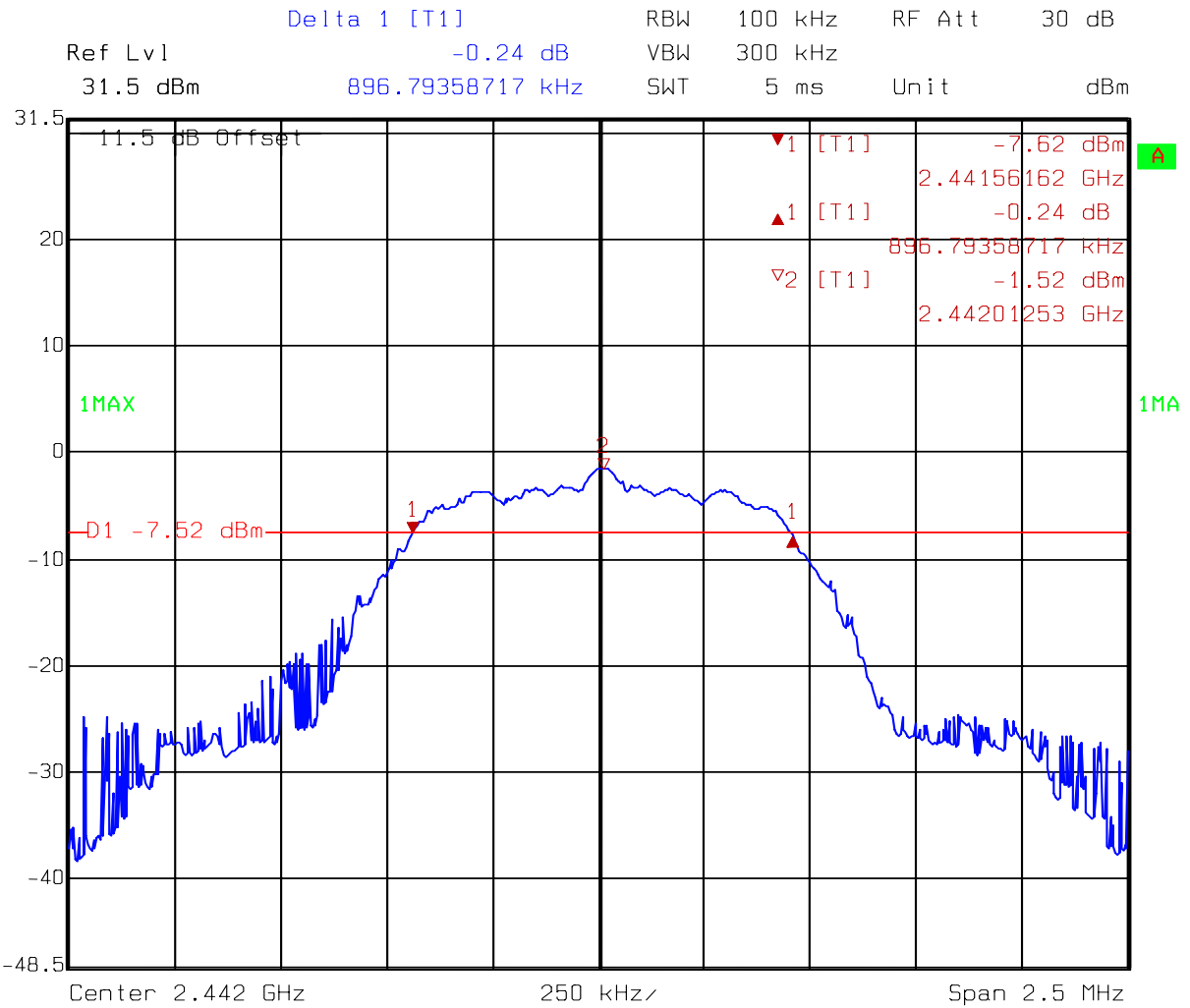
3.3 Measured data of Minimum 6dB Bandwidth test results

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
1 (lowest)	2402	0.9018	> 500kHz
40 (middle)	2442	0.8968	> 500kHz
77 (highest)	2478	0.8968	> 500kHz

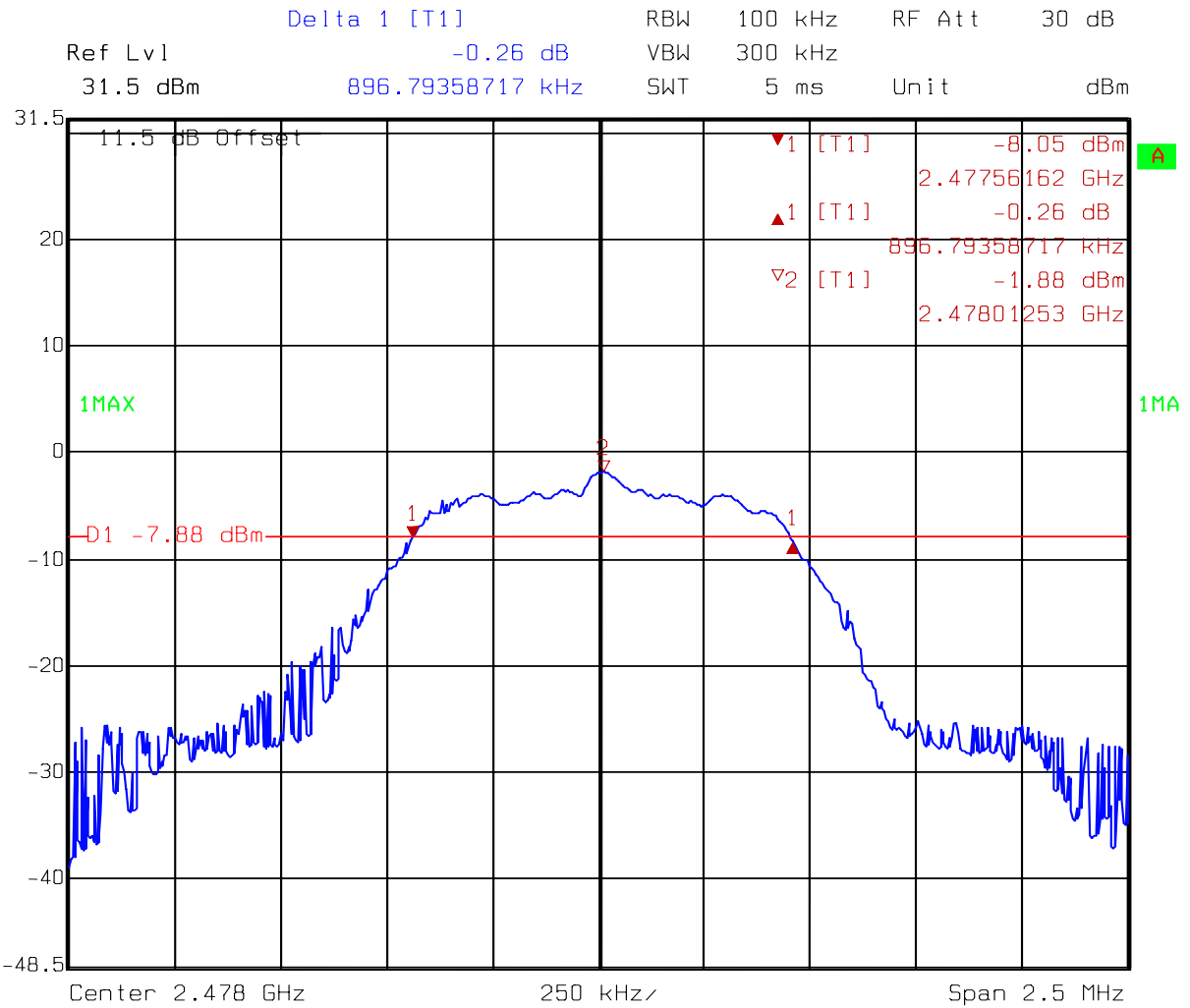
Please see the plot below.



Comment A: 6dB bandwidth at 2402MHz (EC365)
Date: 12.MAY 2005 14:04:31



Comment A: 6dB bandwidth at 2442MHz (EC365)
Date: 12.MAY 2005 14:13:38



Comment A: 6dB bandwidth at 2478MHz (EC365)
Date: 12.MAY 2005 14:06:09

4. Maximum Output Power test

4.1 Operating environment

Temperature: 25
 Relative Humidity: 58 %
 Atmospheric Pressure: 1023 hPa

4.2 Test setup & procedure

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to peak power meter via power sensor. Power was read directly and cable loss correction (1.5 dB) 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).

4.3 Measured data of Maximum Output Power test results

Channel	Freq. (MHz)	C.L. (dB)	Reading (dBm)	Conducted Peak Output Power		Limit (dBm)
				(dBm)	(mW)	
1 (lowest)	2402	1.5	-0.10	1.40	1.38038	30
40 (middle)	2442	1.5	-0.39	1.11	1.28824	30
77 (highest)	2478	1.5	-0.72	0.78	1.19674	30

Remark:

Conducted Peak Output Power = Reading + C.L.

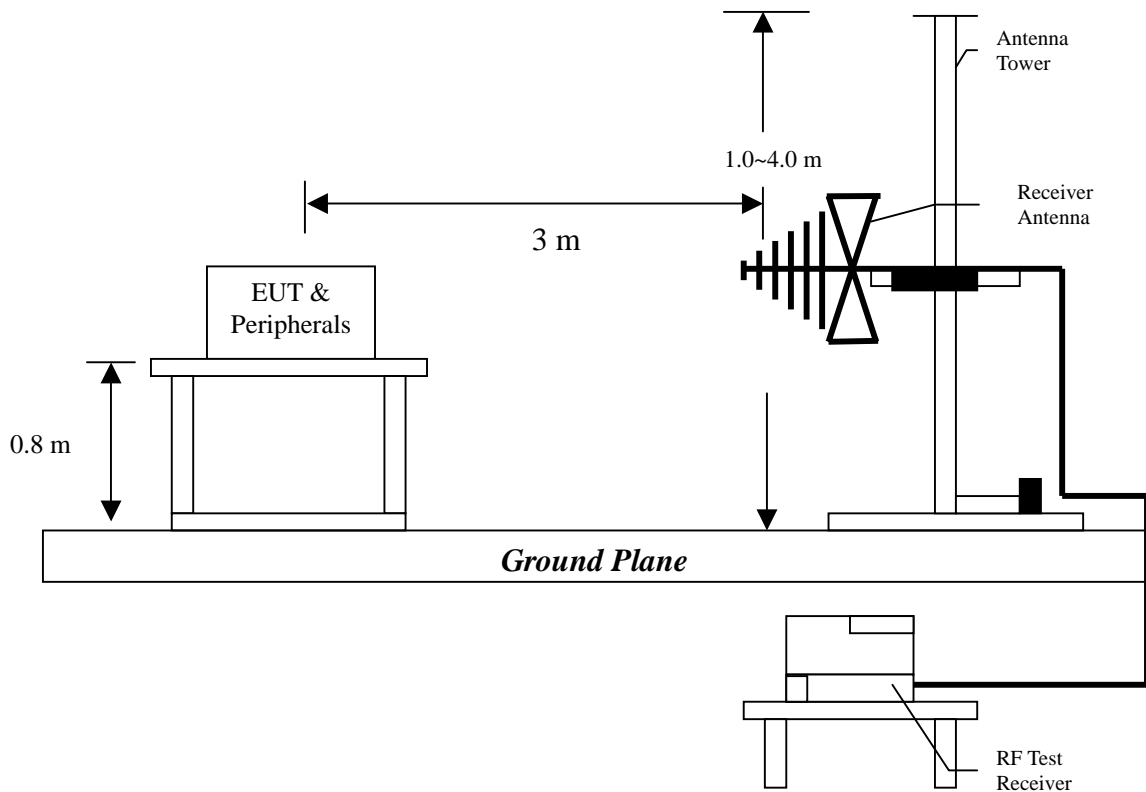
5. Radiated Emission test

5.1 Operating environment

Temperature: 23
Relative Humidity: 58 %
Atmospheric Pressure: 1023 hPa

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.

5.4 Radiated spurious emission test data

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

The test was performed on EUT under continuously transmitting mode. Tx at 2402MHz, 2442MHz and 2478MHz were verified. The worst case occurred at 2402MHz.

EUT : UCW2000
 Worst Case : Tx at 2402MHz

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 (m)	Turn Table angle (degree)
84.320	QP	V	8.09	26.21	34.30	40.00	-5.70	1.00	334.49
398.600	QP	V	16.43	20.62	37.05	46.00	-8.95	1.00	75.24
431.580	QP	V	17.23	24.17	41.40	46.00	-4.60	1.00	277.42
565.440	QP	V	19.91	15.84	35.75	46.00	-10.25	1.00	153.96
598.420	QP	V	20.71	16.40	37.11	46.00	-8.89	1.00	86.91
632.370	QP	V	21.24	15.83	37.07	46.00	-8.93	2.43	81.48
84.320	QP	H	8.74	23.79	32.53	40.00	-7.47	2.30	271.83
95.960	QP	H	8.37	28.32	36.69	43.50	-6.81	2.01	184.58
397.630	QP	H	16.75	19.36	36.11	46.00	-9.89	2.19	145.65
431.580	QP	H	17.66	23.60	41.26	46.00	-4.74	1.85	52.02
765.260	QP	H	23.20	13.06	36.26	46.00	-9.74	1.74	295.08
898.150	QP	H	24.57	15.04	39.61	46.00	-6.39	3.00	10.36

Remark:

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

5.4.2 Measurement results: frequency above 1GHz

EUT : UCW2000

Test Condition : Tx at 2402MHz, 2442MHz, 2478MHz

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.

The noise floor are listed as below:

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: 23
Relative Humidity: 58 %
Atmospheric Pressure 1023 hPa

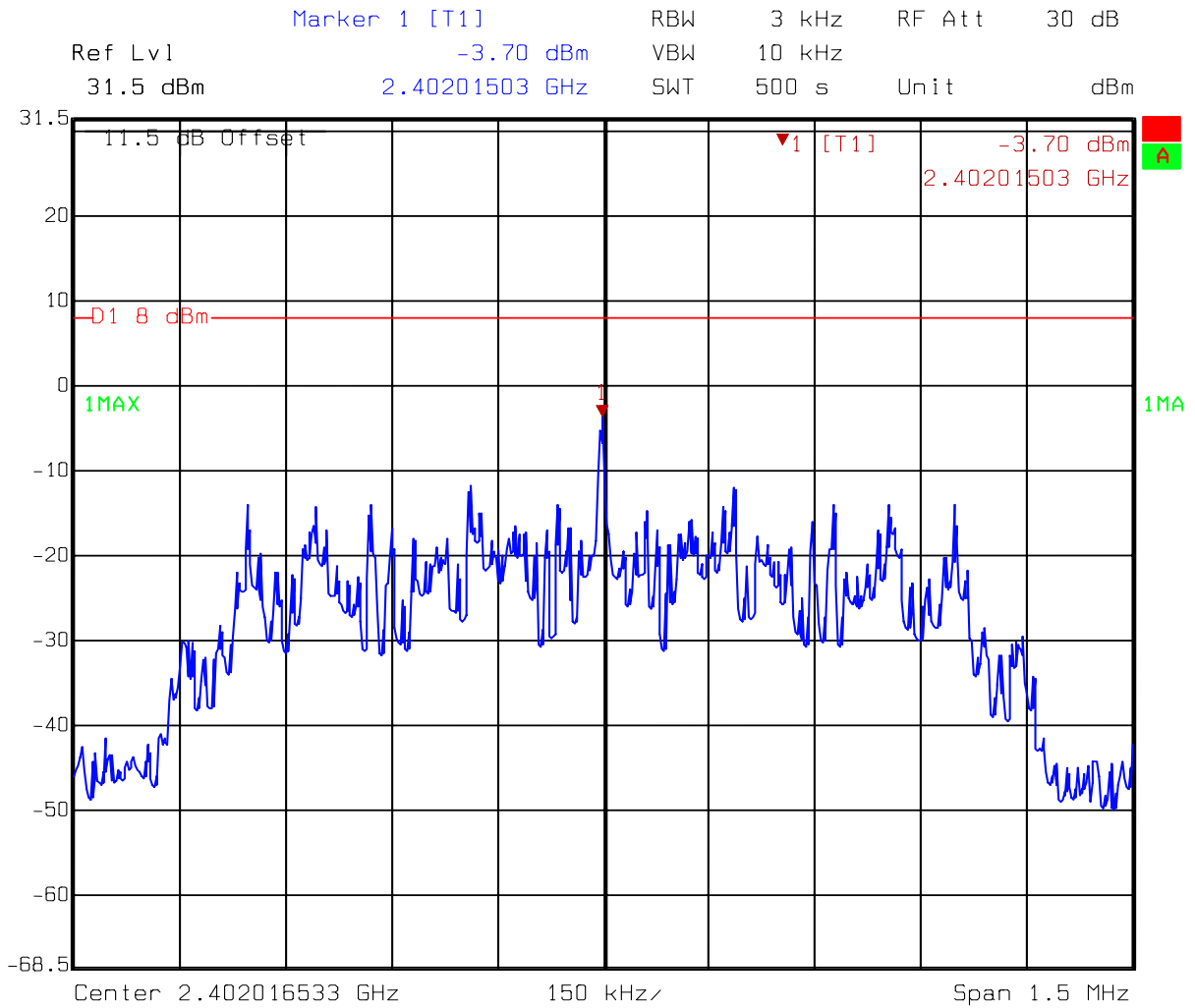
6.2 Test setup & procedure

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 (1.5dB)/external attenuator (10dB) 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

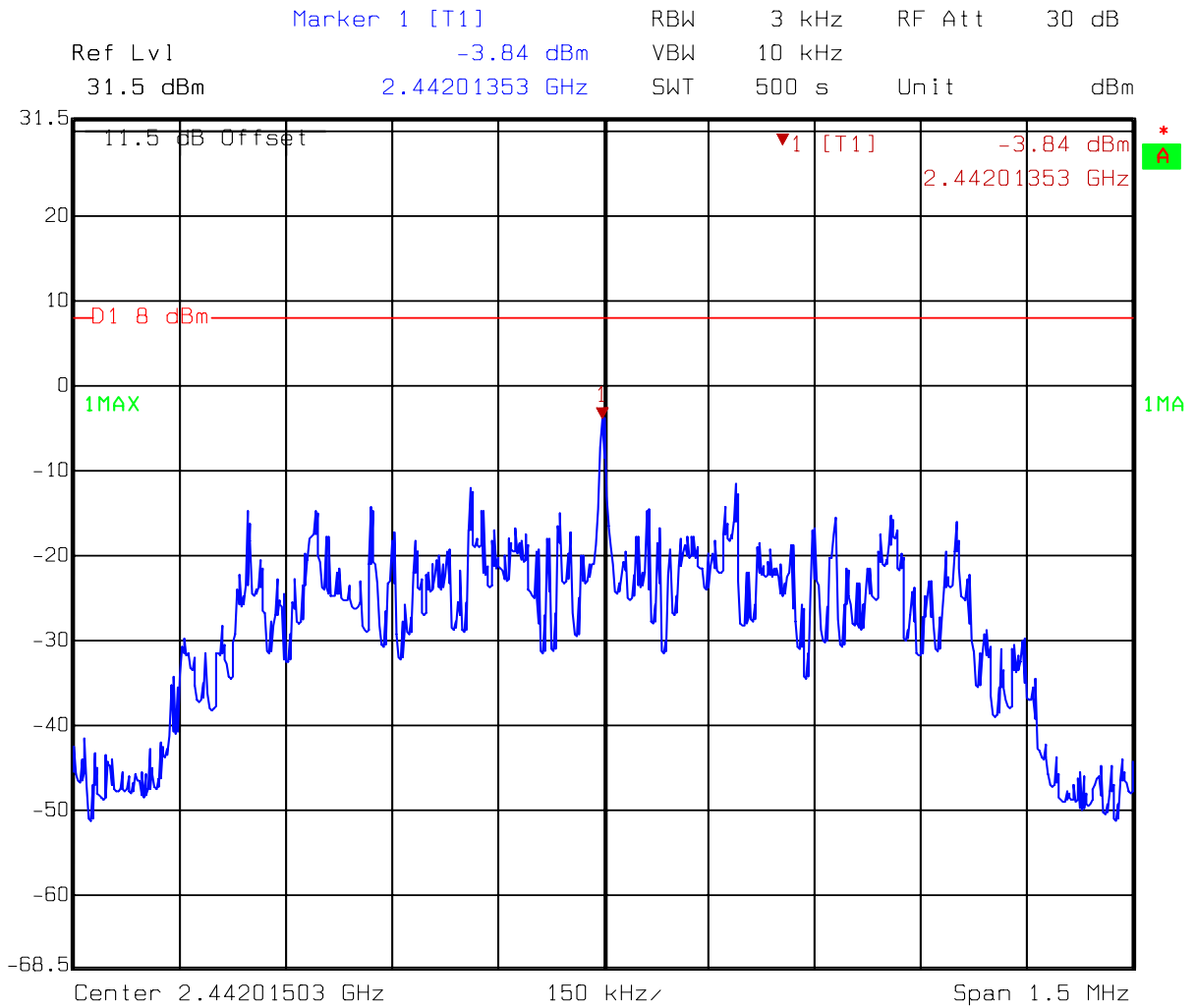
Channel	Frequency (MHz)	Power spectrum density (dBm)	Limit (dBm)
1 (lowest)	2402MHz	-3.70	8
40 (middle)	2442MHz	-3.84	8
77 (highest)	2478MHz	-4.45	8

Please see the plot below.



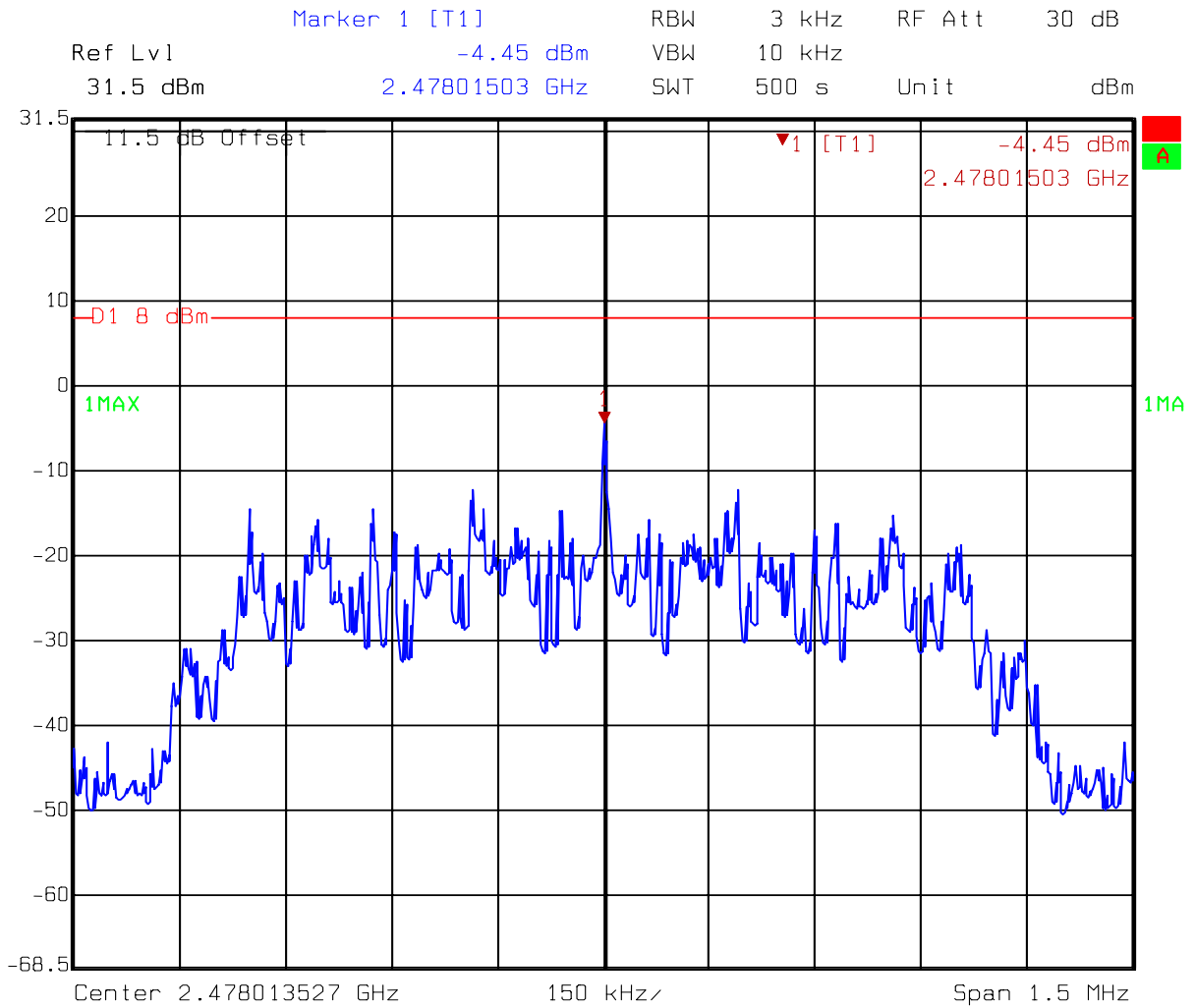
Comment A: Power spectrum density at 2402MHz
ATT=10dB CL=1.5dB (EC365)

Date: 12.MAY 2005 14:11:06



Comment A: Power spectrum density at 2442MHz
ATT=10dB CL=1.5dB (EC365)

Date: 12.MAY 2005 14:09:18



Comment A: Power spectrum density at 2478MHz
ATT=10dB CL=1.5dB (EC365)

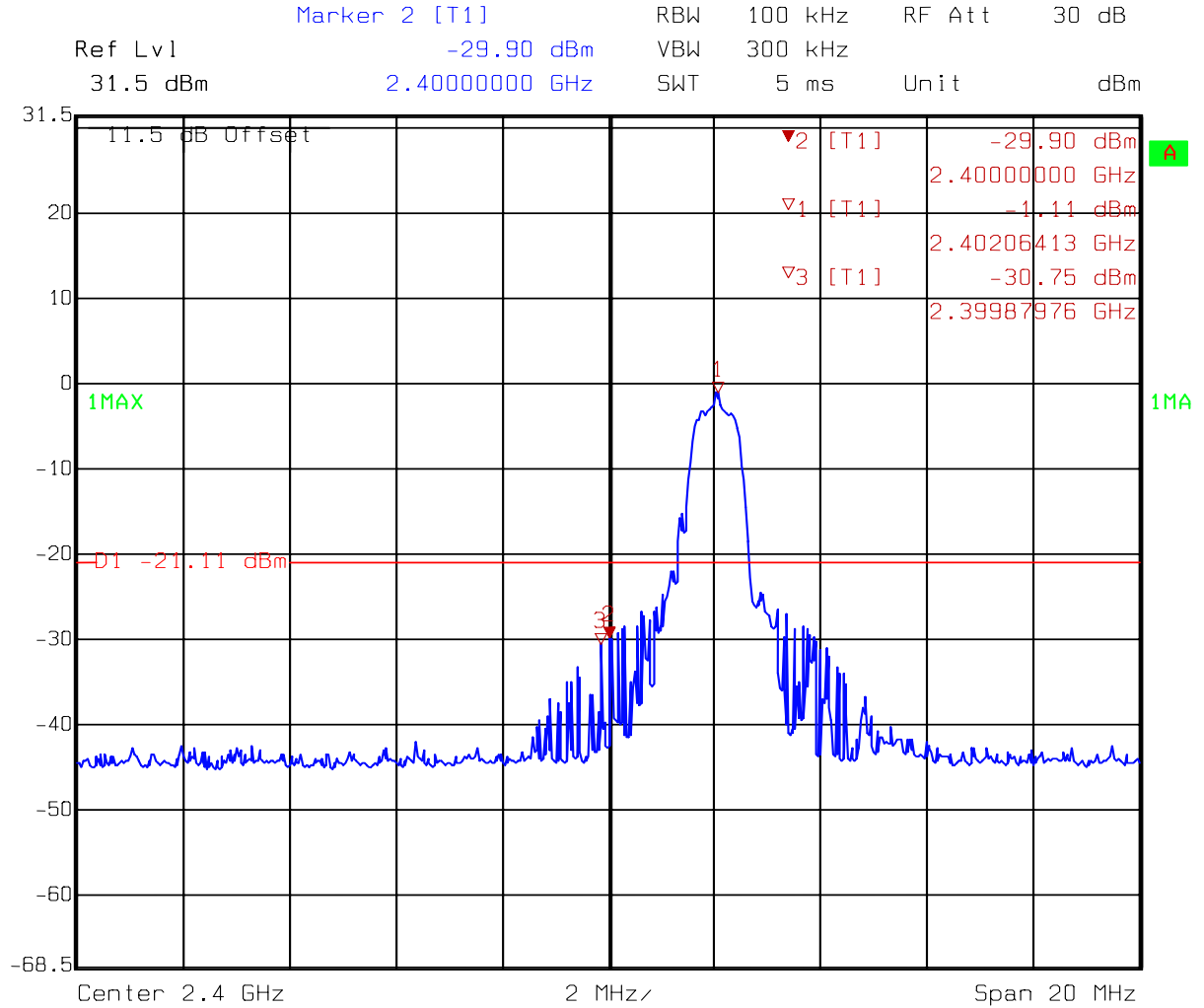
Date: 12.MAY 2005 14:10:17

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

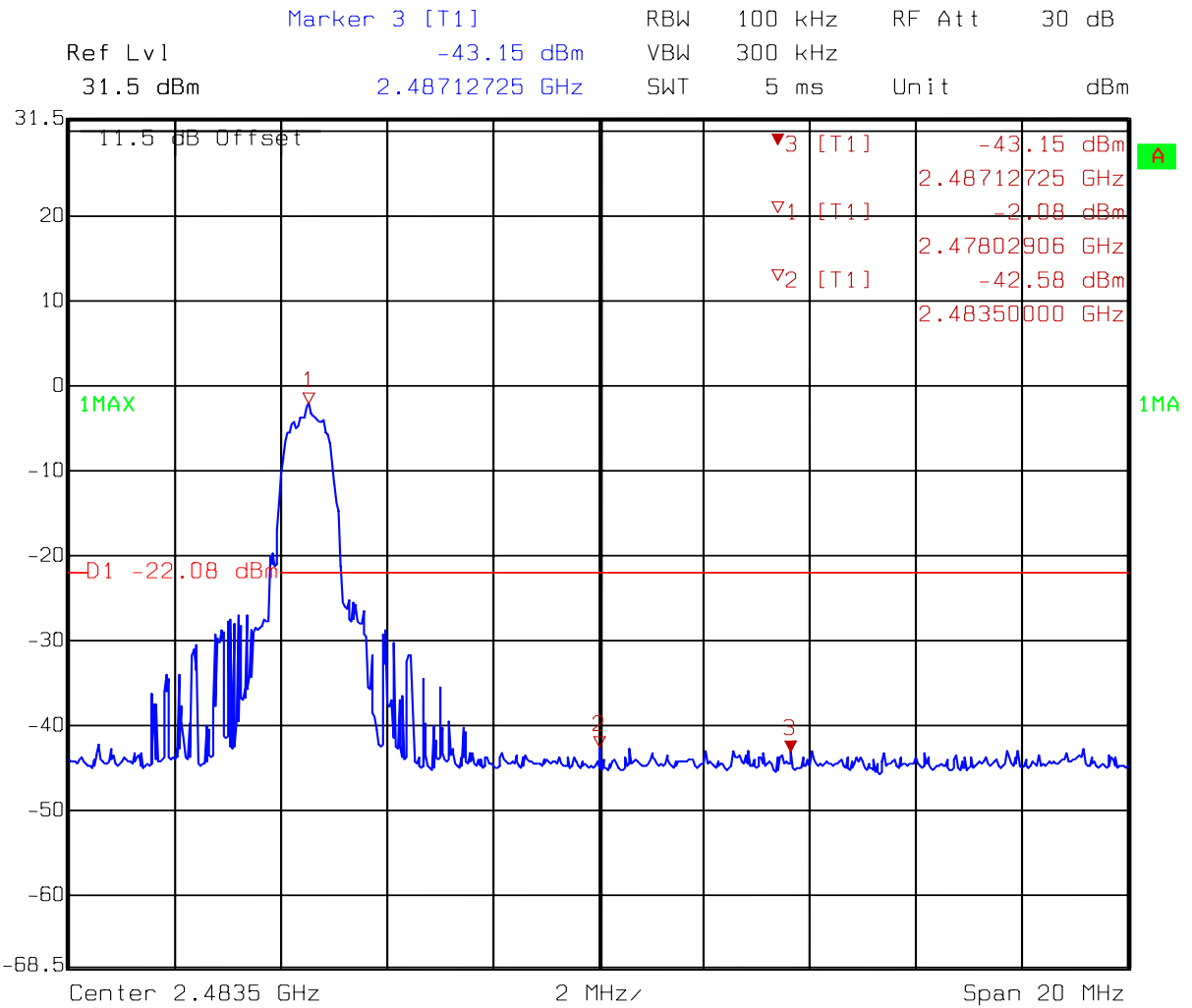
In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 KHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Please see the plot below.

7.1 Band-edge (Conducted method)

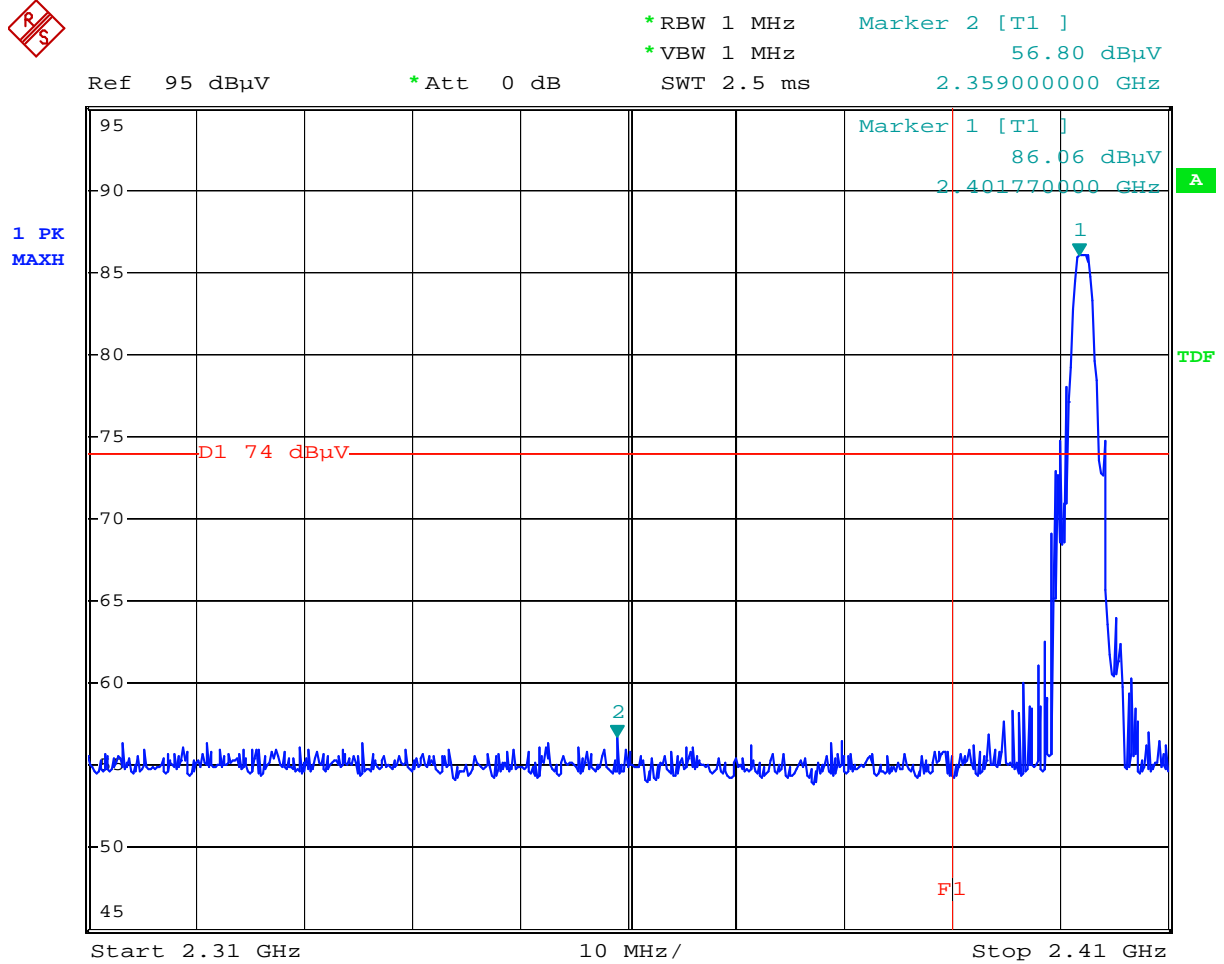


Comment A: Band-edge at 2402MHz (EC365)
Date: 12.MAY 2005 14:18:52

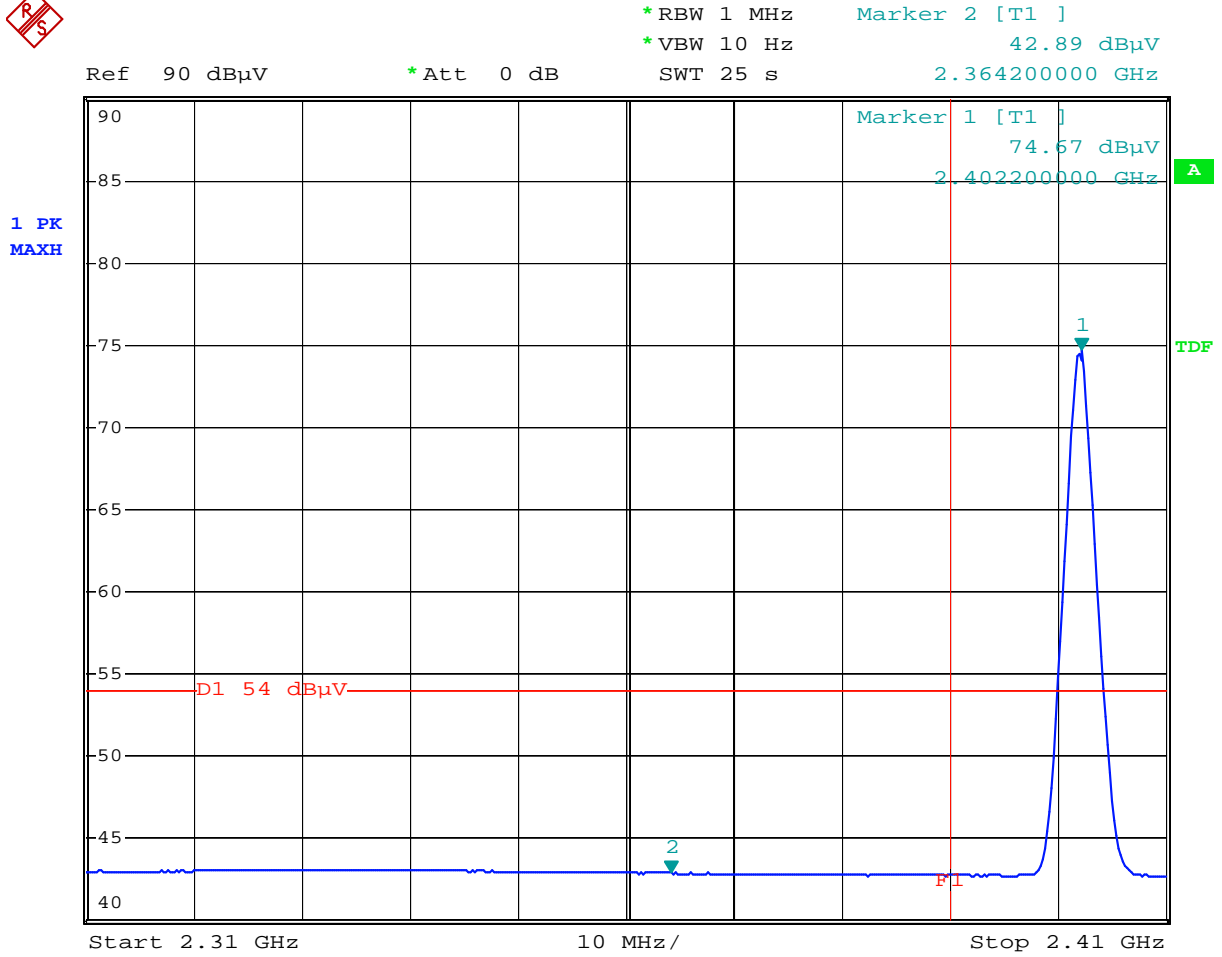


Comment A: Band-edge at 2478MHz (EC365)
Date: 12.MAY 2005 14:20:58

7.2 Band-edge (Radiated method)



Comment: Band-Edge at 2402MHz F1=2390MHz
 Comment: Peak (EC371/EC353)
 Date: 12.MAY.2005 19:10:51



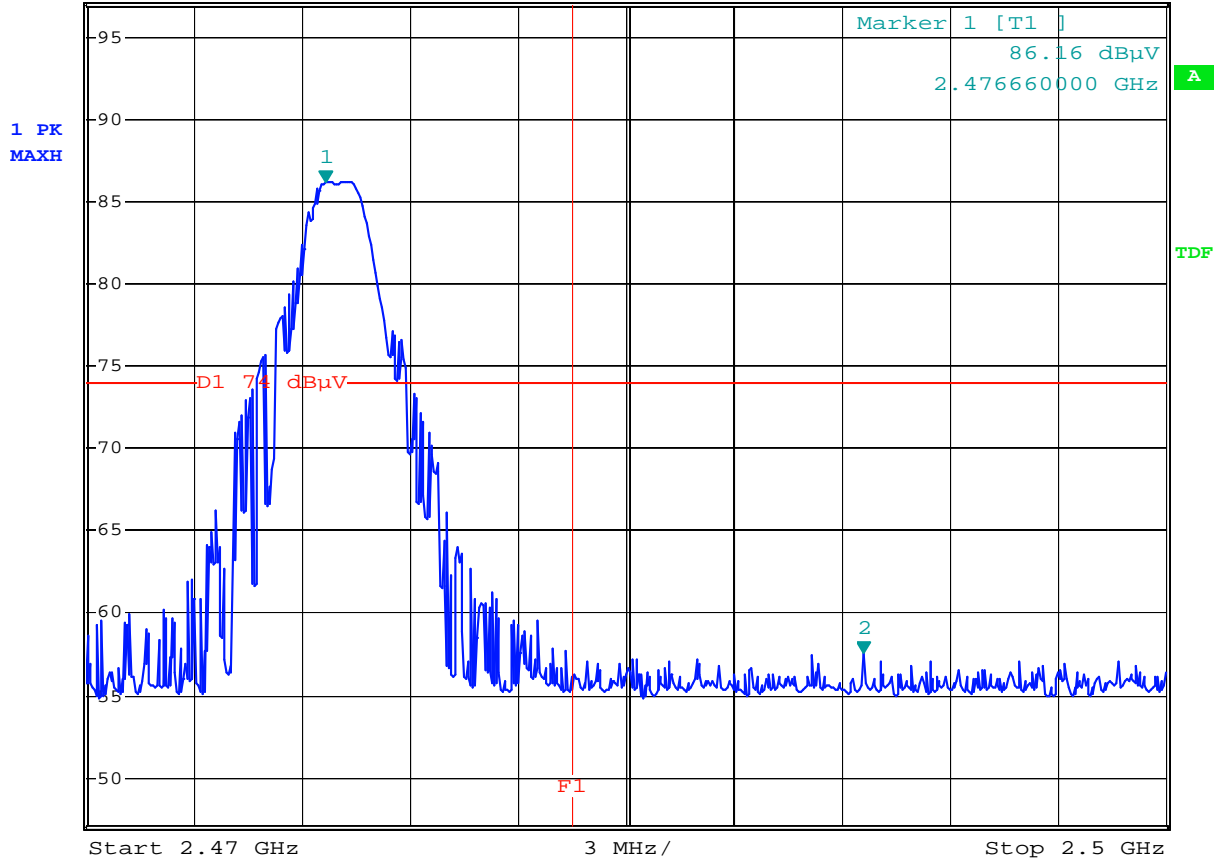
Comment: Band-Edge at 2402MHz F1=2390MHz

Comment: Average (EC371/EC353)

Date: 12.MAY.2005 19:12:47



*RBW 1 MHz Marker 2 [T1]
 *VBW 1 MHz 57.58 dBµV
 Ref 97 dBµV *Att 0 dB SWT 2.5 ms 2.491600000 GHz



Comment: Band-Edge at 2478MHz F1=2483.5MHz
 Comment: Peak (EC371/EC353)
 Date: 12.MAY.2005 19:16:12

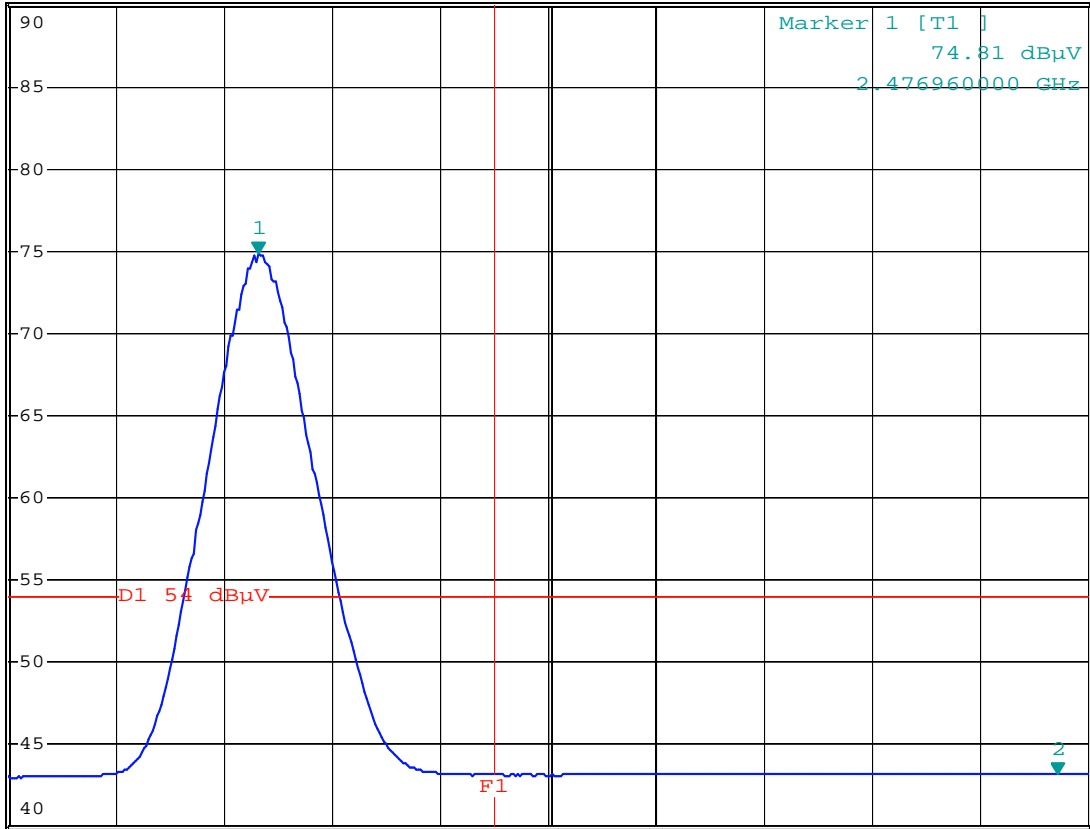


*RBW 1 MHz Marker 2 [T1]
*VBW 10 Hz 43.27 dBμV
SWT 7.6 s 2.499160000 GHz

Ref 90 dBμV

*Att 0 dB

1 PK
MAXH



Start 2.47 GHz 3 MHz/ Stop 2.5 GHz

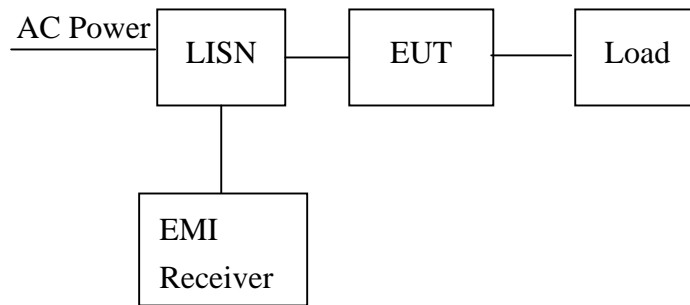
Comment: Band-Edge at 2478MHz F1=2483.5MHz
 Comment: Average (EC371/EC353)
 Date: 12.MAY.2005 19:17:23

8. Power Line Conducted Emission test §FCC 15.207

8.1 Operating environment

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

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 C63.4/2003 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

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

8.3 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.

8.4 Uncertainty of Conducted Emission

Expanded uncertainty (k=2) of conducted emission measurement is ± 2.6 dB.

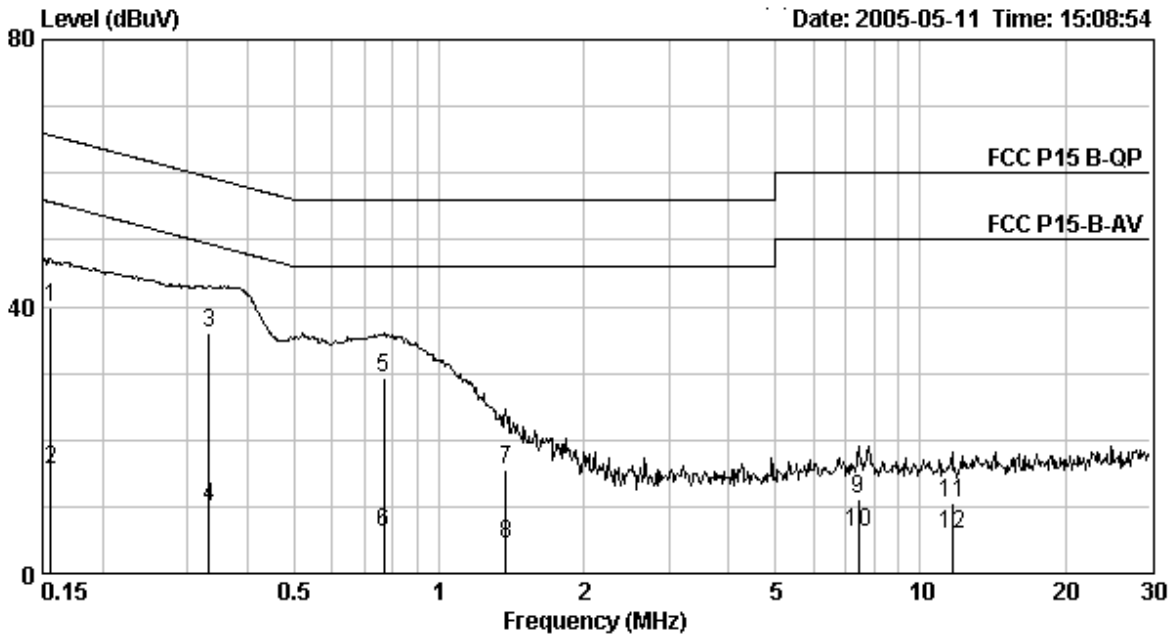
8.5 Power Line Conducted Emission test data

Phase : Line
 EUT : UCW2000
 Test Condition : Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuA)	Limit Qp (dBuA)	Level AV (dBuA)	Limit Av (dBuA)	Margin (dB)	
						Qp	Av
0.156	0.10	39.76	65.67	15.43	55.67	-25.91	-40.24
0.333	0.10	36.07	59.38	10.00	49.38	-23.31	-39.38
0.768	0.10	29.45	56.00	6.19	46.00	-26.55	-39.81
1.374	0.10	15.47	56.00	4.52	46.00	-40.53	-41.48
7.443	0.32	11.01	60.00	6.07	50.00	-49.00	-43.94
11.629	0.50	10.64	60.00	5.95	50.00	-49.36	-44.05

Remark:

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



Phase : Neutral
 EUT : UCW2000
 Test Condition : Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuA)	Limit Qp (dBuA)	Level AV (dBuA)	Limit Av (dBuA)	Margin (dB)	
						Qp	Av
0.151	0.10	39.39	65.93	17.14	55.93	-26.54	-38.79
0.279	0.10	36.03	60.84	16.99	50.84	-24.81	-33.85
1.015	0.10	11.14	56.00	3.79	46.00	-44.86	-42.21
1.574	0.10	9.53	56.00	3.81	46.00	-46.47	-42.19
2.884	0.14	8.78	56.00	3.83	46.00	-47.22	-42.17
9.230	0.20	11.60	60.00	6.90	50.00	-48.40	-43.10

Remark:

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

