

# EMC TEST REPORT

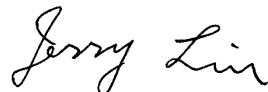
**Report No.** : EME-031043  
**Model No.** : ZPlus-B290  
**Issued Date** : Oct. 2, 2003

**Applicant** : ZINWELL CORPORATION  
No. 2 Wen-Hua Road, Hsinchu Industrial Park,  
Hsinchu Hsien 303, Taiwan

**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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Project Engineer



Jerry Liu

Reviewed By



Elton Chen

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**Summary of Tests****Wireless USB Pen-Type Adapter-Model: ZPlus-B290  
FCC ID: RIW-ZWX-B290**

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 : ZINWELL CORPORATION  
Product : Wireless USB Pen-Type Adapter  
Model No. : ZPlus-B290  
FCC ID. : RIW-ZWX-B290  
Frequency Range : 2412MHz to 2462MHz  
Channel Number : 11  
Frequency of Each Channel : 2412MHz, 2417MHz, 2422MHz, 2427MHz,  
2432MHz, 2437MHz, 2442MHz, 2447MHz,  
2452MHz, 2457MHz, 2462MHz  
Type of Modulation : CCK (11Mps, 5.5Mbps), DQPSK (2Mbps),  
DBPSK (1Mbps)  
Rated Power : 5Vdc  
Power Cord : N/A  
Sample Received : Sep. 9, 2003  
Test Date(s) : Sep. 9, 2003 to Sep. 16, 2003

A FCC DoC report has been generated for the client.

### 1.2 Additional information about the EUT

This USB device is a Wireless LAN Adapter with a rate of 1, 2, 5.5, and 11 Mbps operating in the ISM band using Direct Sequence Spread Spectrum (DSSS) transmission, conforming the IEEE 802.11b standard.

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 : 2.5(peak) dBi max

Antenna Type : Ceramic antenna

Connector Type : N/A

### 1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
PC	HP	P5661AV	SG20400774	FCC DoC Approved
Key Board	HP	SK-2502C	M011234429	FCC DoC Approved
Monitor	HP	D8897	CN14835153	ARSCM560S
Mouse	HP	M-S48a	5670990	FCC DoC Approved
Printer	HP	C2642A	TH86K1N2ZB	FCC DoC Approved
Modem	Dynalink	V1456VQE	00V230A00051494	FCC DoC Approved
Access Point	Z-COM	XI-1450	AF16001-00242	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 C63.4/1992.

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**

Connect the EUT to PC by a USB cable(100cm)

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

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

### 2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Series No.	Last Cal.Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	825788/014	Feb. 18, 2003
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	825428/005	June 10, 2003
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	100137	July 10, 2003
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	100186	Oct. 9, 2002
Horn Antenna	EMCO	1GHz~18GHz	3115	9906-5890	Sep. 19, 200
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	159	June 21, 2003
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	3133	Feb. 21, 2003
Turn Table	HDGmbH	N/A	DS 420S	420/669/01	N/A
Antenna Tower	HDGmbH	N/A	MA 240	240/573	N/A
Microwave Amplifier	Agilent	2GHz~26.5GHz	8348A	3111A00567	Dec. 20, 2002
Crystal Detector	Agilent	10MHz~18GHz	8472B	MY42240243	N/A
Signal Generator	Rohde & Schwarz	20MHz~27GHz	SMR27	100036	Aug. 15, 2003
Two Channel Digital Storage Oscilloscope	Tektronix	N/A	TDS1012	C031679	Aug. 16, 2003

Note:

1. The calibration interval of the above instruments is 12 months.

### 3. Minimum 6dB Bandwidth test

#### 3.1 Operating environment

Temperature: 20 °C  
Relative Humidity: 52 %  
Atmospheric Pressure 1023 hPa

#### 3.2 Test setup & procedure

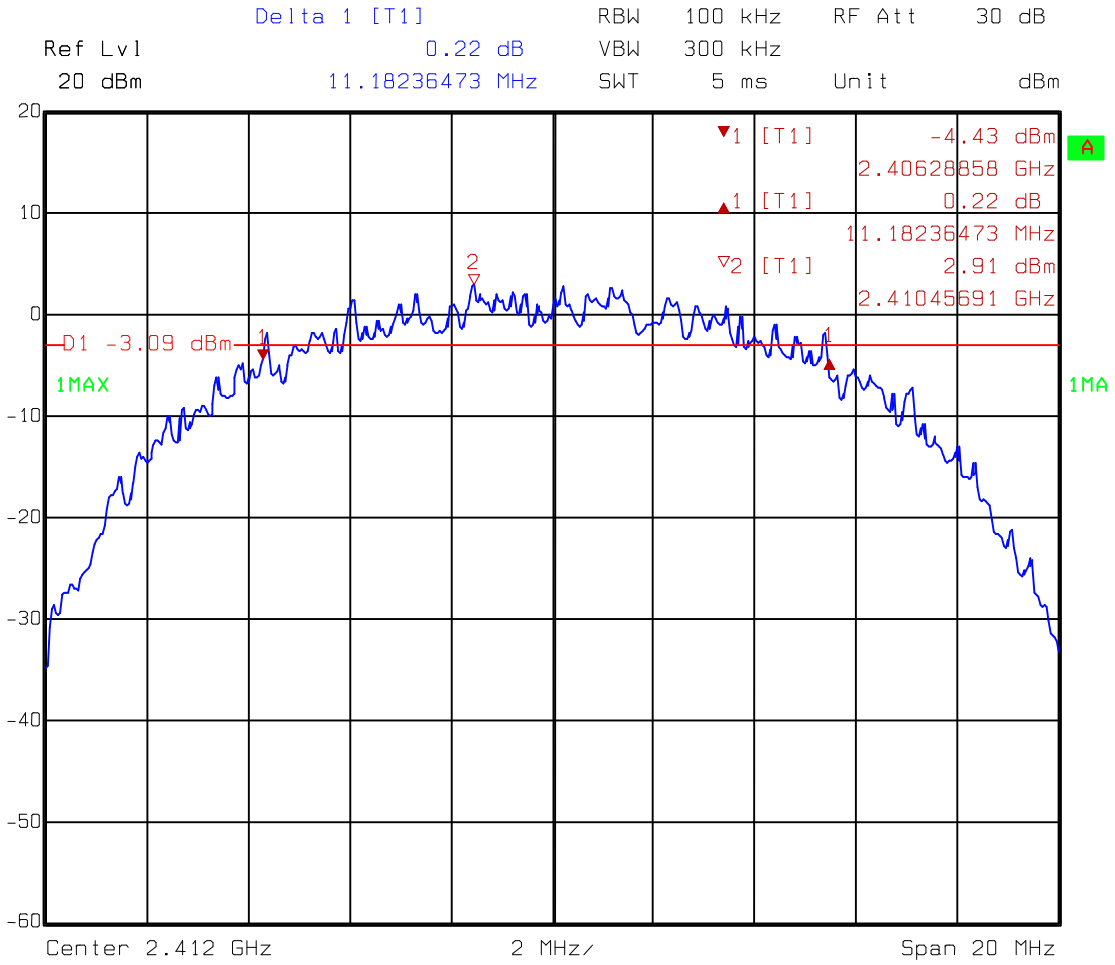
The minimum 6dB bandwidth per FCC §15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel). The minimum 6-dB modulation bandwidth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

#### 3.3 Measured data of Minimum 6dB Bandwidth test results

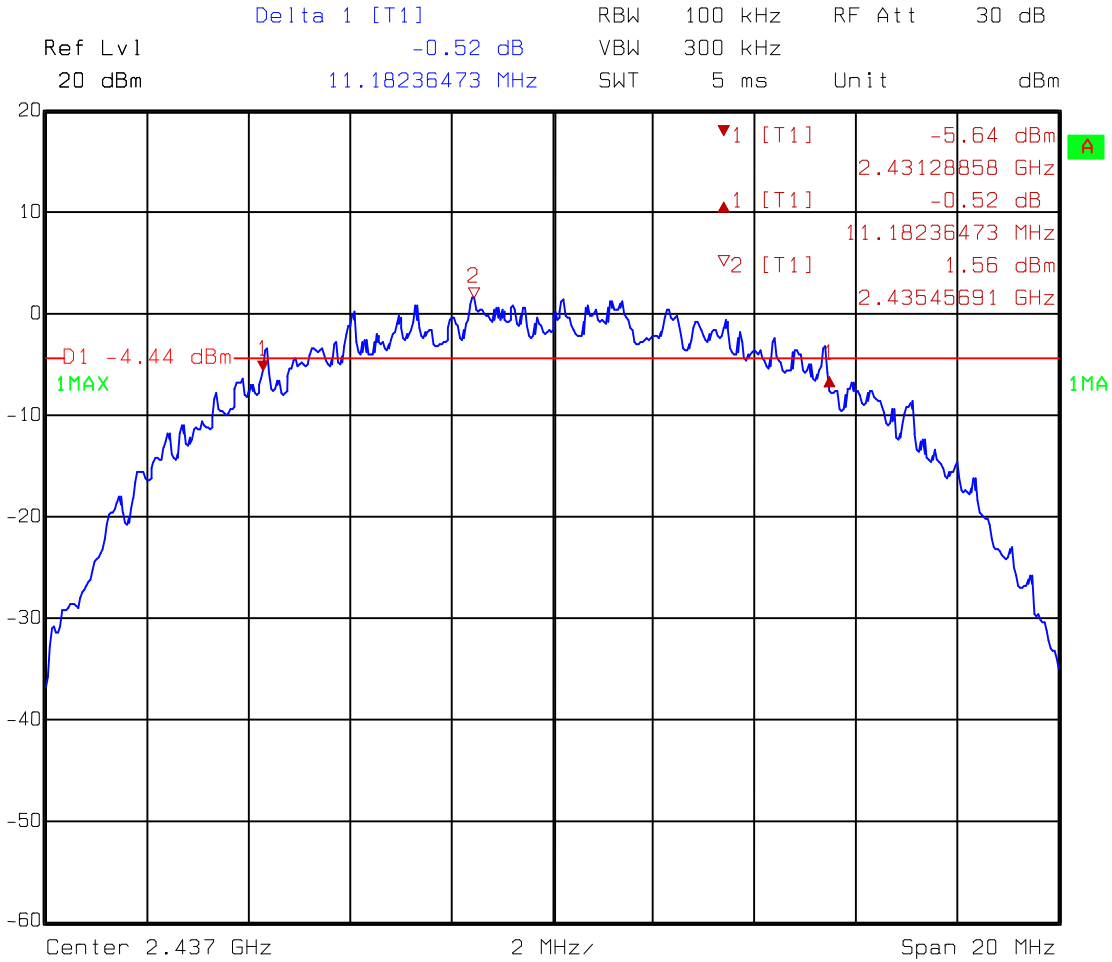
Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
Low	2412	11.18236	> 500kHz
Middle	2434	11.18236	> 500kHz
High	2462	11.22244	> 500kHz

Please see the plot below.

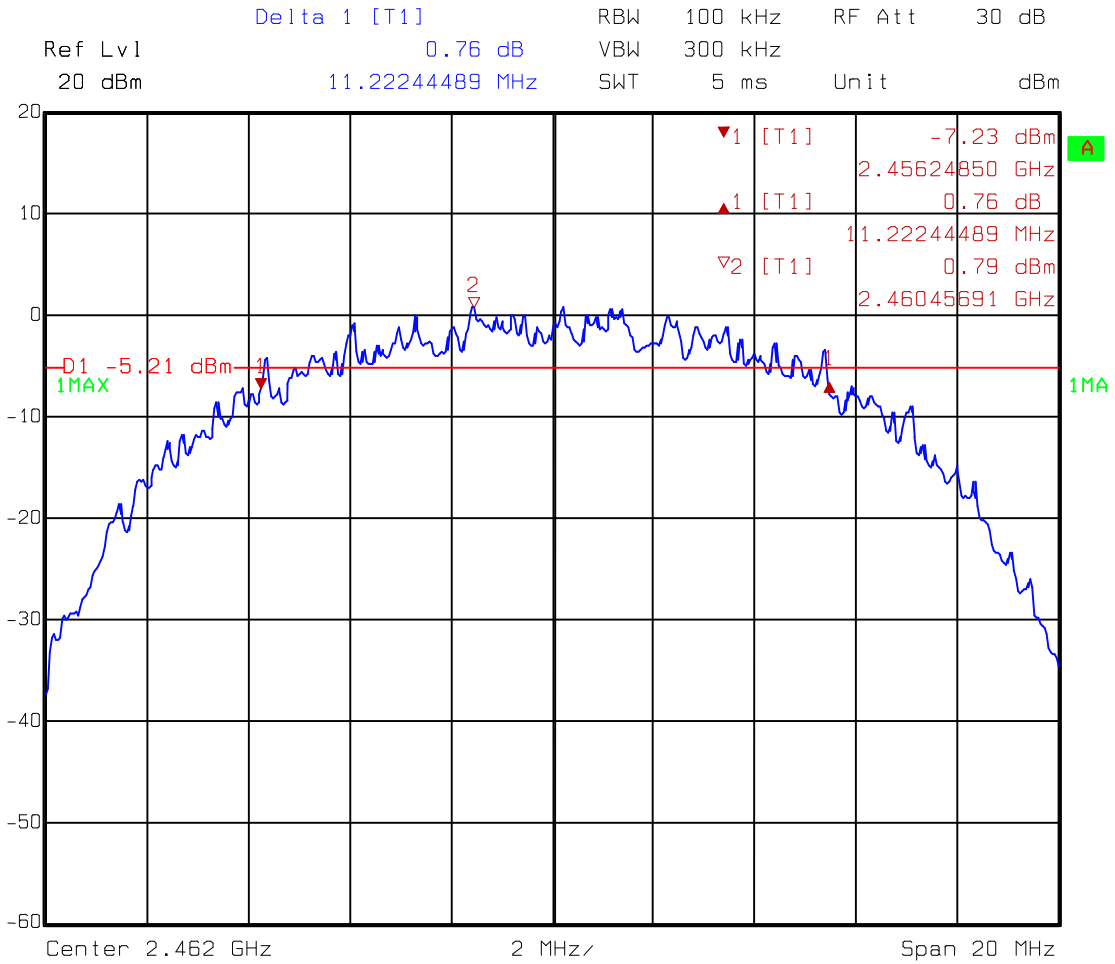




Comment A: 6dB bandwidth at low channel (EC365)  
 Date: 07.OCT.2003 19:06:42



Comment A: 6dB bandwidth at middle channel (EC365)  
 Date: 07.OCT.2003 19:10:33



Comment A: 6dB bandwidth at high channel (EC365)  
Date: 07.OCT.2003 19:13:10

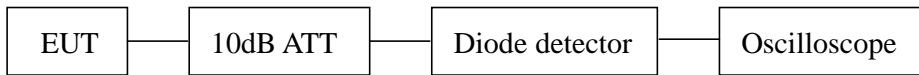
#### 4. Maximum Output Power test

##### 4.1 Operating environment

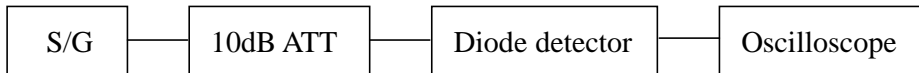
Temperature: 20 °C  
 Relative Humidity: 52 %  
 Atmospheric Pressure 1023 hPa

##### 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

Channel	Frequency (MHz)	Reading (dBm)	Output Power		Limit (W)
			(dBm)	(mW)	
Lowest	2412	15.33	15.33	34.119	30
Middle	2437	15.63	15.63	36.559	30
Highest	2462	14.73	14.73	29.716	30

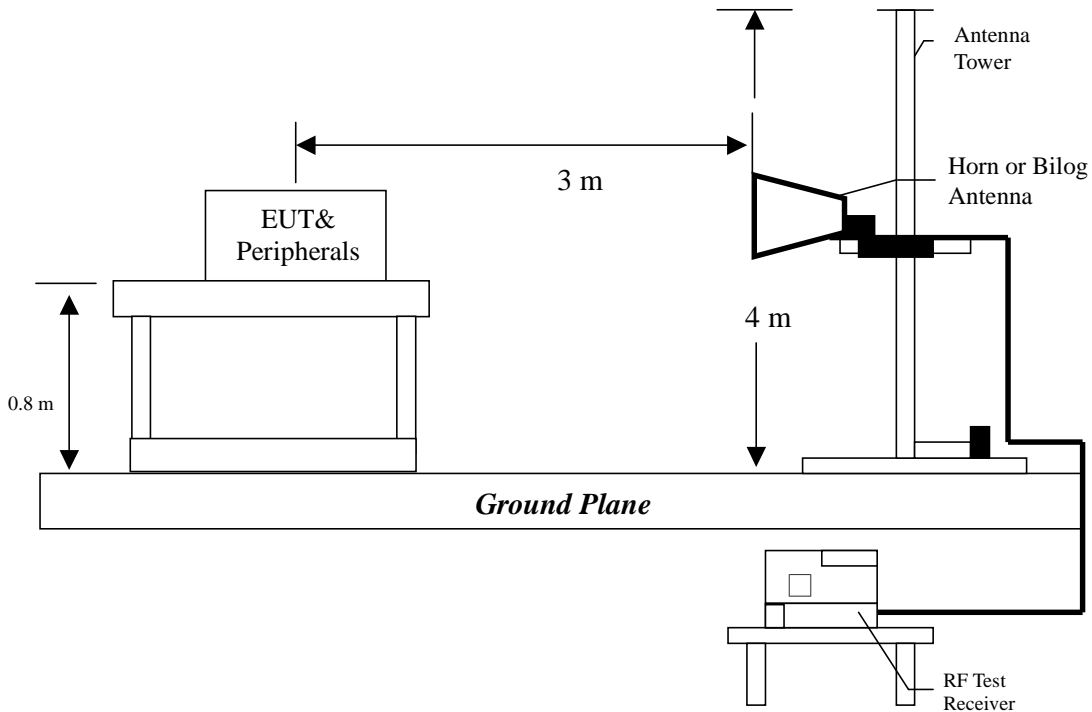
**5. Radiated Emission test**

**5.1 Operating environment**

Temperature:	25	°C	(10-40°C)
Relative Humidity:	57	%	(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 $\mu$ 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  $\pm 4.98$  dB.

Expanded uncertainty (k=2) of conducted emission measurement is  $\pm 2.02$  dB.

**5.4 Radiated spurious emission test data**

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

EUT : ZPlus-B290  
Worst caes Condition : 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)
65.97000	QP	V	12.94	19.69	32.63	40.00	-7.37	100	133
109.99000	QP	V	10.92	12.18	23.10	43.50	-20.40	100	22
133.38000	QP	V	13.34	10.86	24.20	43.50	-19.30	101	360
197.97000	QP	V	12.03	13.80	25.83	43.50	-17.67	100	322
395.98000	QP	V	16.40	9.54	25.94	46.00	-20.06	196	0
794.41000	QP	V	23.49	5.70	29.19	46.00	-16.81	109	355
65.97000	QP	H	12.94	15.38	28.32	40.00	-11.68	371	324
197.99000	QP	H	12.03	17.28	29.31	43.50	-14.19	134	101
249.99000	QP	H	12.85	23.65	36.50	46.00	-9.50	105	138
329.98000	QP	H	14.99	11.90	26.89	46.00	-19.11	180	84
396.72000	QP	H	16.40	19.36	35.76	46.00	-10.24	175	181
645.98000	QP	H	21.32	10.45	31.77	46.00	-14.23	100	169

**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
9648.05	-2.56
9748.05	-4.42

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

EUT : ZPlus-B290

Test Condition : 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)
1729.1	PK	V	0	28.542	27.338	55.88	74	-18.12	100.00	166.00
1729.1	AV	V	0	28.542	13.528	42.07	54	-11.93	100.00	166.00
9648.05	PK	V	35.753	43.384	51.3485	58.98	74	-15.02	124.00	139.00
9648.05	AV	V	35.753	43.384	43.8085	51.44	54	-2.56	124.00	139.00
1726.3	PK	H	0	28.542	28.378	56.92	74	-17.08	102.00	216.00
1726.3	AV	H	0	28.542	13.978	42.52	54	-11.48	102.00	216.00
9648.09	PK	H	35.753	43.384	49.3585	56.99	74	-17.01	149.00	47.00
9648.09	AV	H	35.753	43.384	39.5385	47.17	54	-6.83	149.00	47.00

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: 50dBuV  
3GHz-14GHz: 54dBuV  
14GHz-26.5GHz: 60dBuV

For AV:

1GHz-3GHz: 41.5dBuV  
3GHz-14GHz: 46dBuV  
14GHz-26.5GHz: 46.5dBuV



EUT : ZPlus-B290  
Test Condition : 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)
1730.5	PK	V	0	28.542	27.938	56.48	74	-17.52	100.00	268.00
1730.5	AV	V	0	28.542	13.548	42.09	54	-11.91	100.00	268.00
9748.05	PK	V	35.753	43.384	50.7085	58.34	74	-15.66	203.00	132.00
9748.05	AV	V	35.753	43.384	41.9485	49.58	54	-4.42	203.00	132.00
1725.8	PK	H	0	28.542	28.278	56.82	74	-17.18	104.00	218.00
1725.8	AV	H	0	28.542	13.878	42.42	54	-11.58	104.00	218.00
9748.07	PK	H	35.753	43.384	47.8185	55.45	74	-18.55	150.00	196.00
9748.07	AV	H	35.753	43.384	37.3585	44.99	54	-9.01	150.00	196.00

**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: 50dBuV  
3GHz-14GHz: 54dBuV  
14GHz-26.5GHz: 60dBuV

**For AV:**

1GHz-3GHz: 41.5dBuV  
3GHz-14GHz: 46dBuV  
14GHz-26.5GHz: 46.5dBuV

EUT : ZPlus-B290  
Test Condition : 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)
1726.3	PK	V	0	28.542	26.898	55.44	74	-18.56	103.00	16.00
1726.3	AV	V	0	28.542	13.598	42.14	54	-11.86	103.00	16.00
9848.03	PK	V	35.753	43.384	49.3685	57.00	74	-17.00	208.00	133.00
9848.03	AV	V	35.753	43.384	40.3785	48.01	54	-5.99	208.00	133.00
1727.7	PK	H	0	28.542	28.318	56.86	74	-17.14	103.00	222.00
1727.7	AV	H	0	28.542	13.808	42.35	54	-11.65	103.00	222.00
9848.03	PK	H	35.753	43.384	48.4085	56.04	74	-17.96	155.00	202.00
9848.03	AV	H	35.753	43.384	37.2885	44.92	54	-9.08	155.00	202.00

**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: 50dBuV  
3GHz-14GHz: 54dBuV  
14GHz-26.5GHz: 60dBuV

**For AV:**

1GHz-3GHz: 41.5dBuV  
3GHz-14GHz: 46dBuV  
14GHz-26.5GHz: 46.5dBuV

## 6. Power Spectrum Density test

### 6.1 Operating environment

Temperature: 25 °C  
Relative Humidity: 57 %  
Atmospheric Pressure 1023 hPa

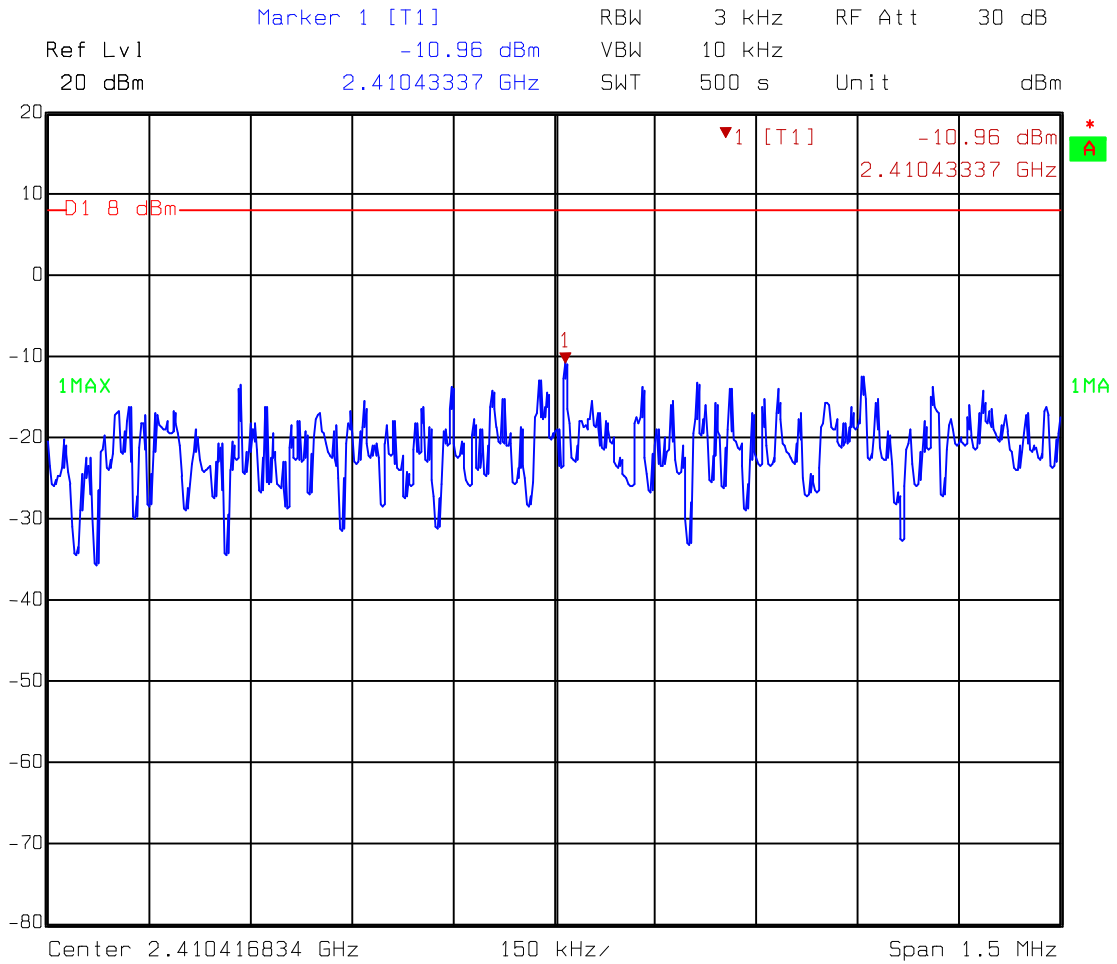
### 6.2 Test setup & procedure

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 (2.63dB) 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

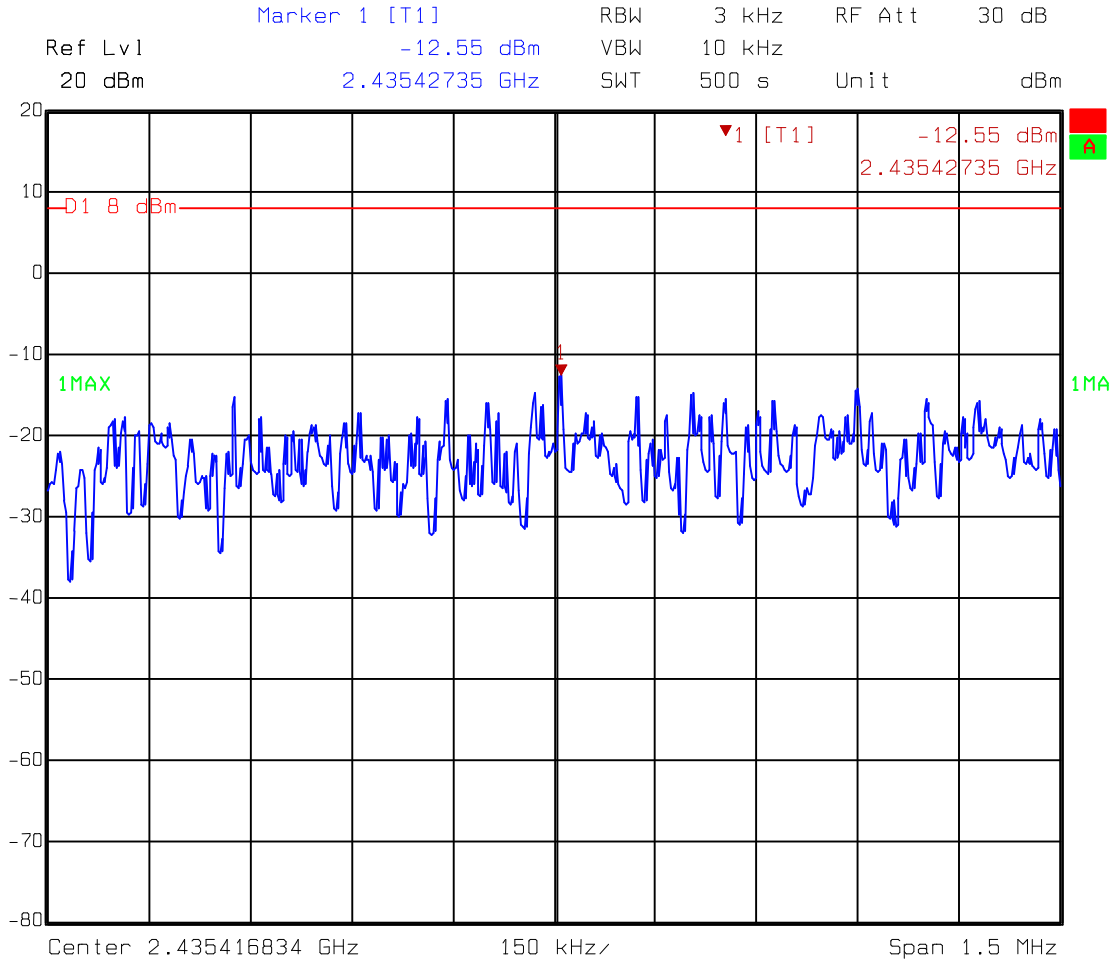
Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
Low	2412	-8.33	8
Middle	2437	-9.92	8
High	2462	-11.41	8

Please see the plot below.

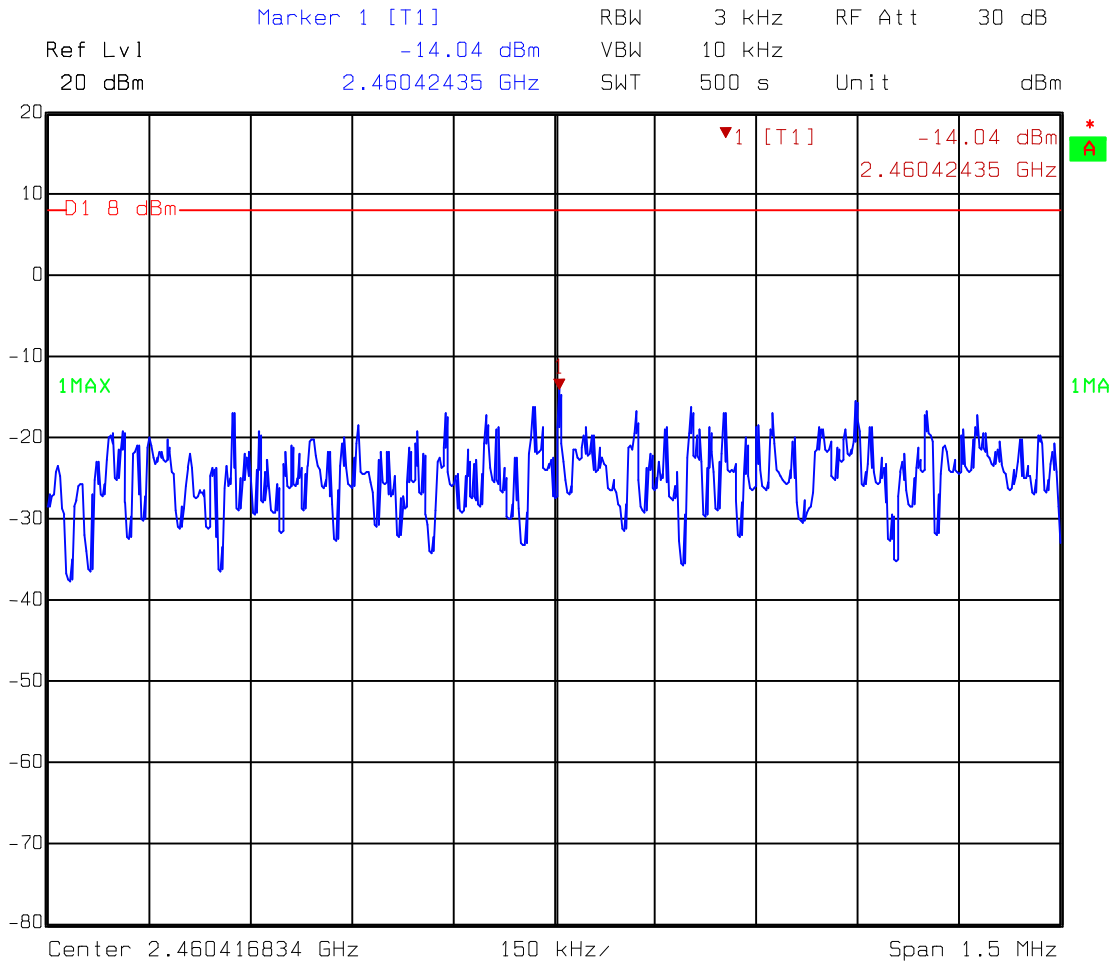


Comment A: Power spectrum density at low channel  
CL=2.63dB

Date: 15.SEP.2003 15:53:14



Comment A: Power spectrum density at middle channel  
CL=2.63dB  
Date: 15.SEP.2003 19:56:00



Comment A: Power spectrum density at high channel  
CL=2.63dB

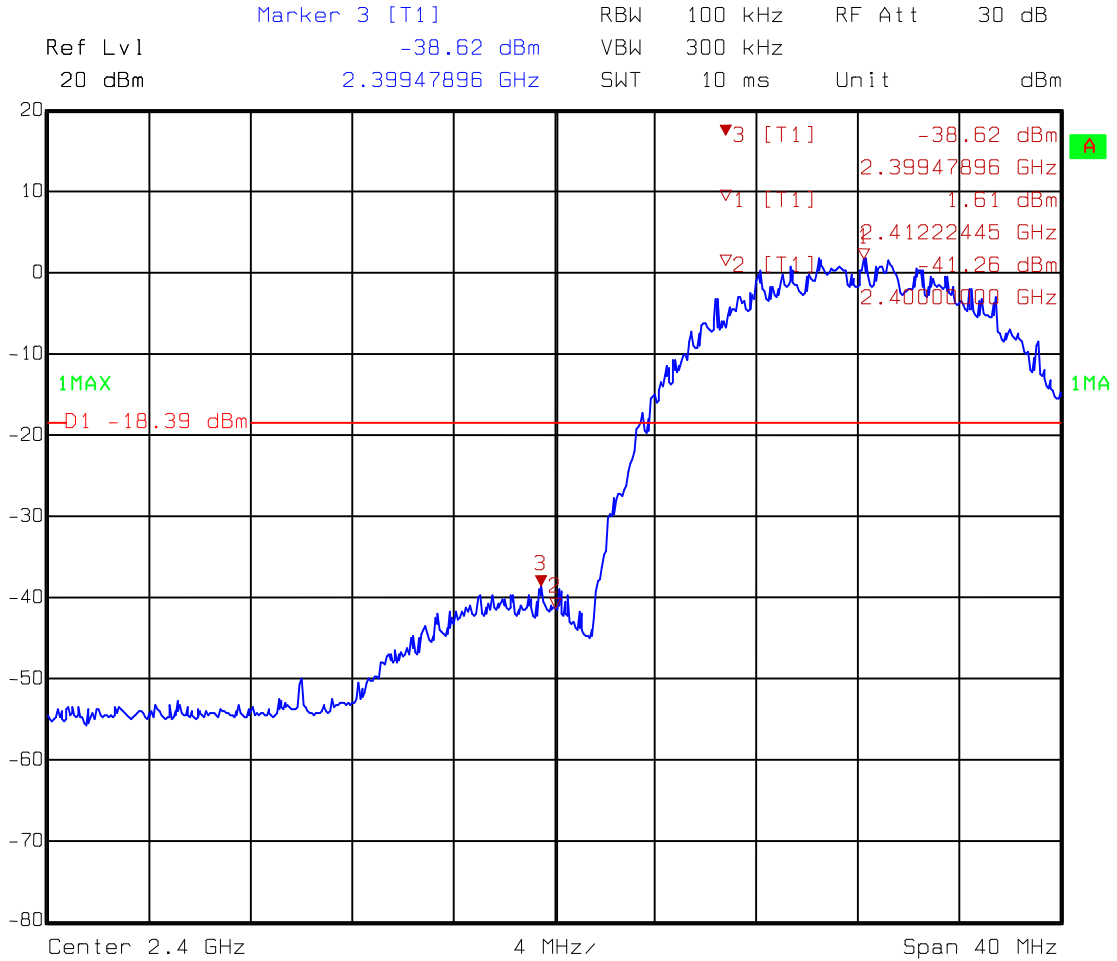
Date: 15.SEP.2003 19:58:45

**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.

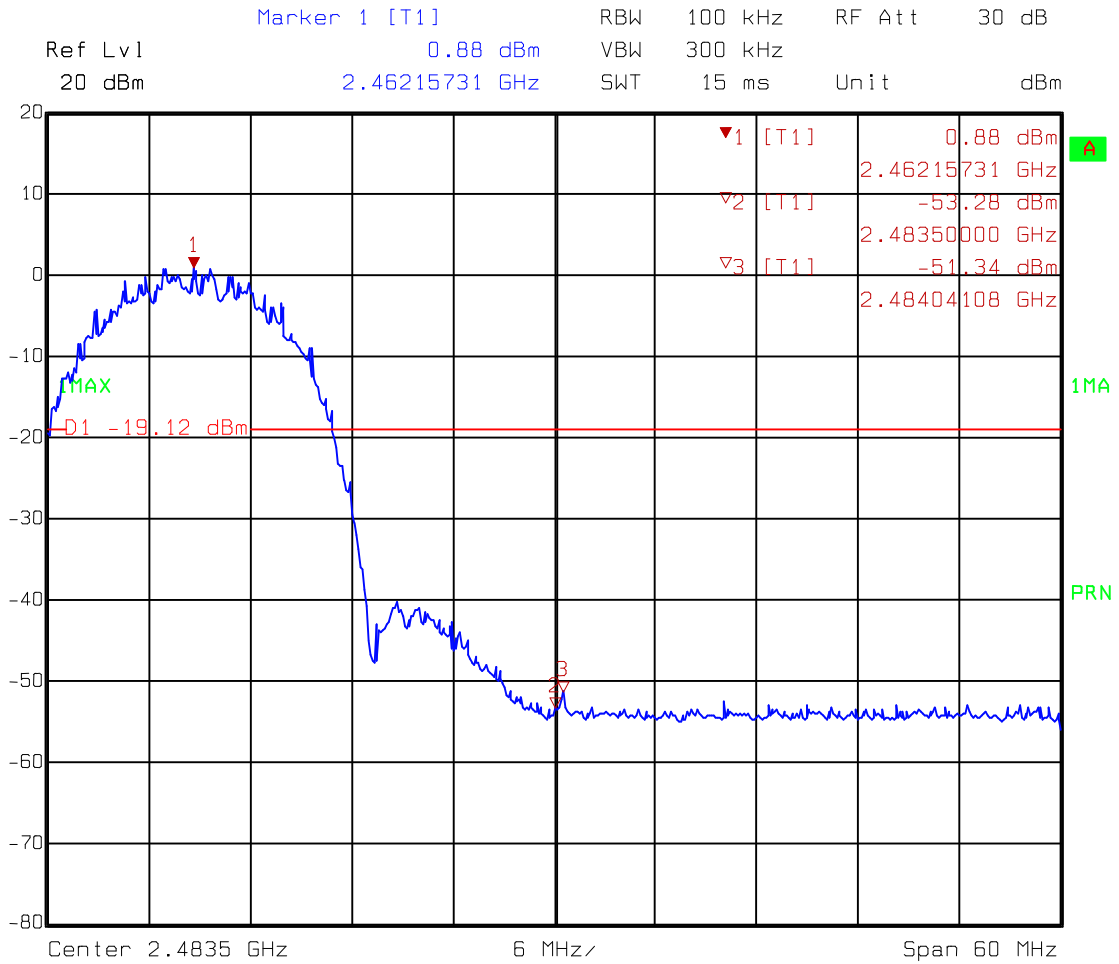
Please see the plot below.

## 7.1 Band-edge (Conducted method)



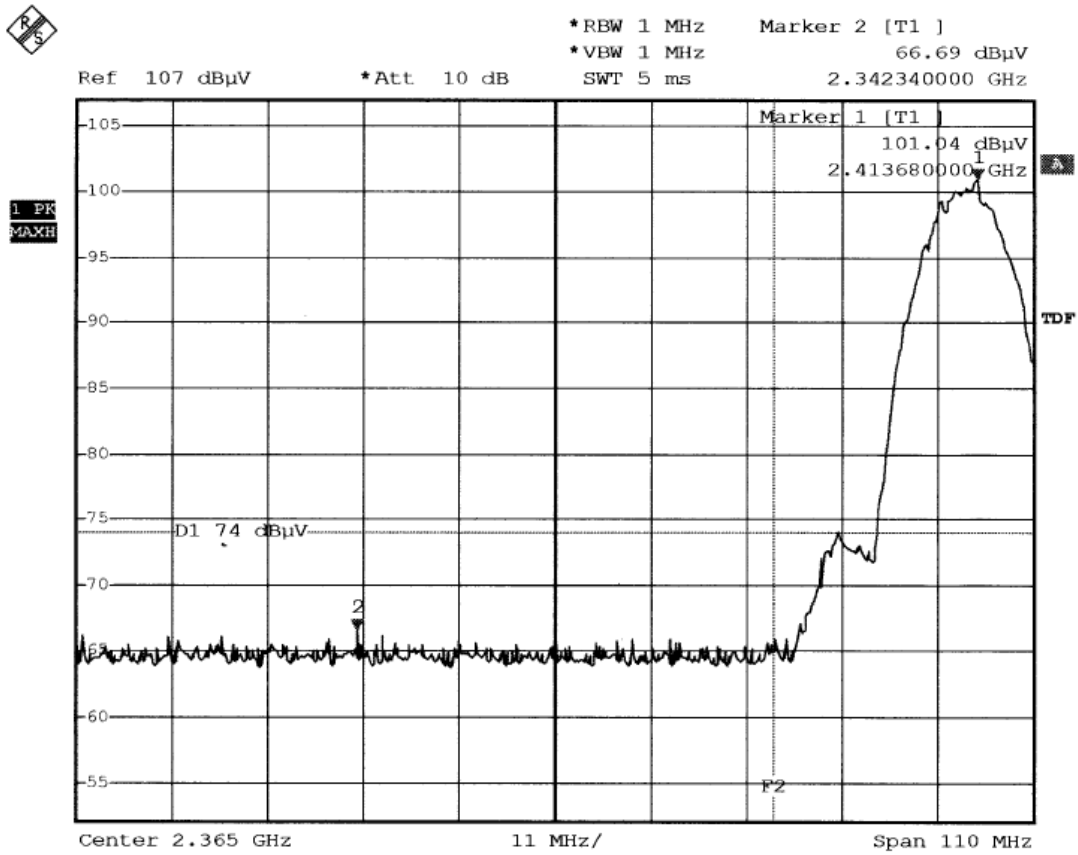
Comment A: Band-edge at low channel  
Date: 15.SEP.2003 16:02:18



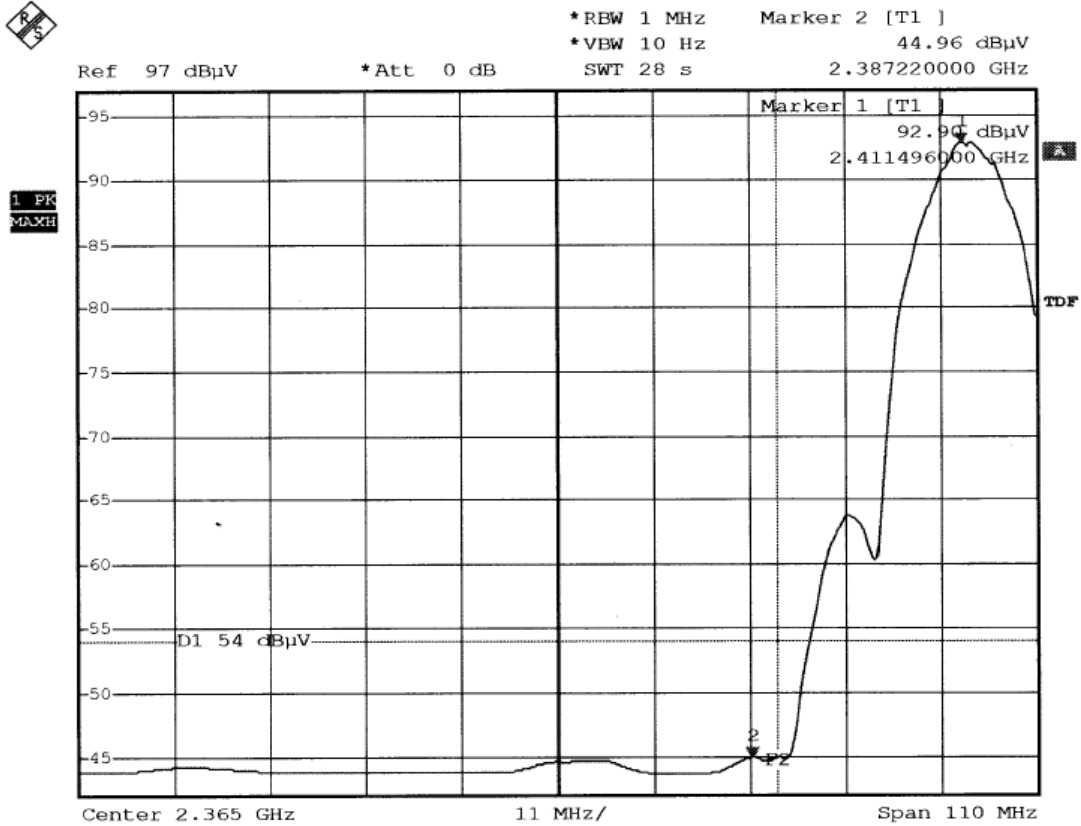


Comment A: Band-edge at high channel  
Date: 15.SEP.2003 15:59:18

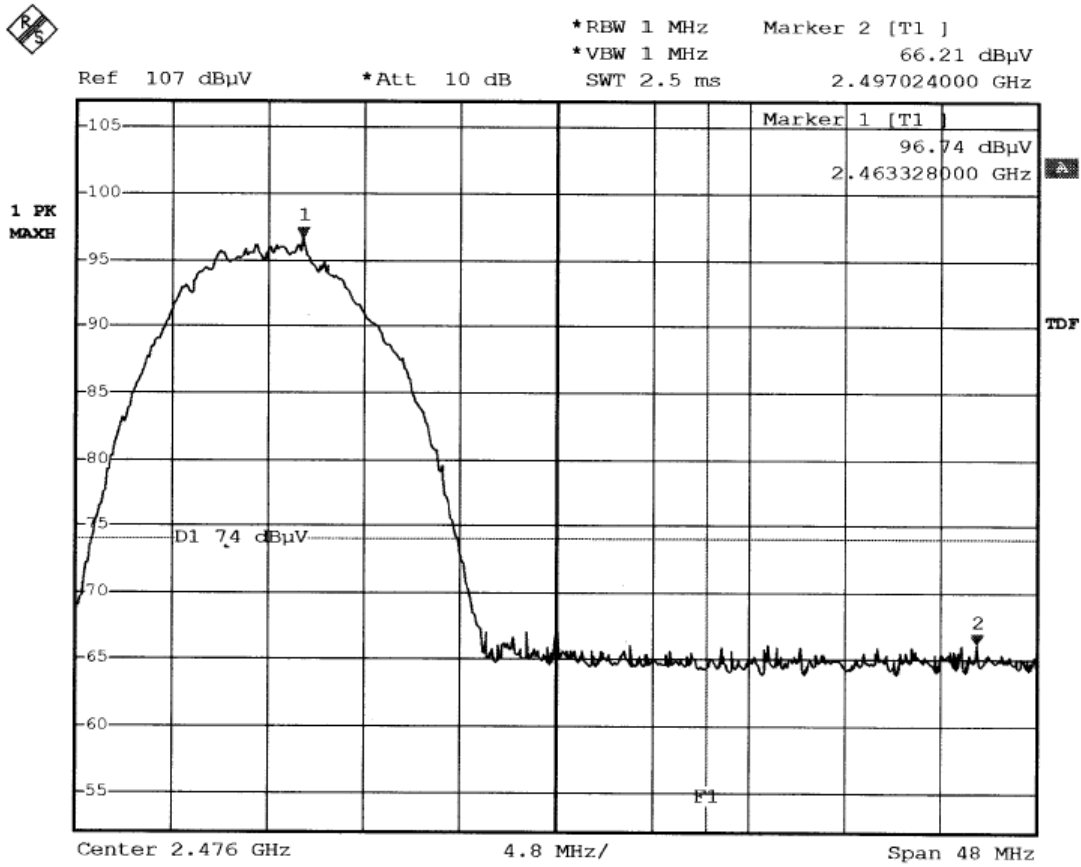
## 7.2 Band-edge (Radiated method)



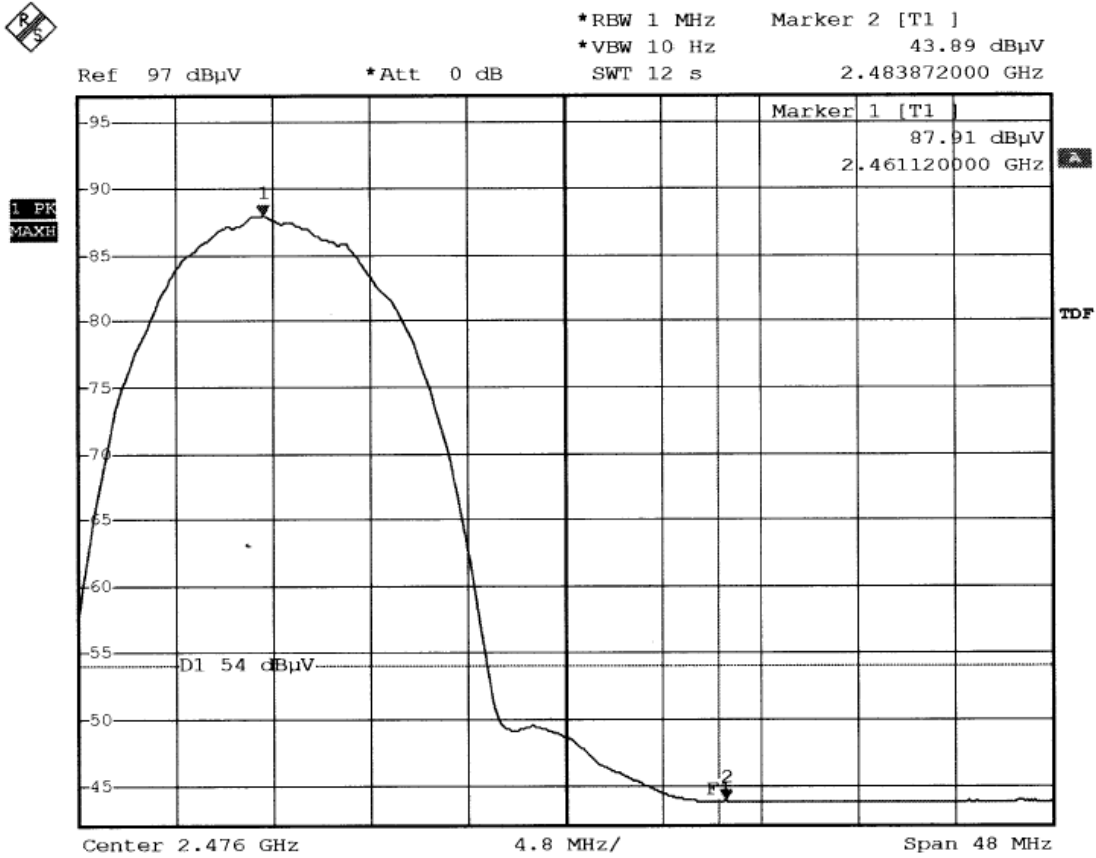
Comment A: Band-edge test at low channel EN B  
 Peak detector F2=2390MHz



Comment A: Band-edge test at low channel EN B  
 Average detector F2=2390MHz



Comment A: Band-edge test at high channel N B  
 Peak detector F1=2483.5MHz



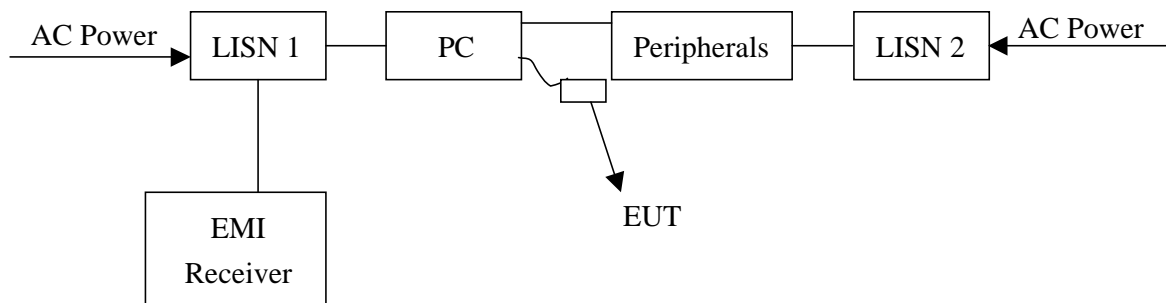
Comment A: Band-edge test at high channel B  
 Average detector F1=2483.5MHz

## 8. Power Line Conducted Emission test §FCC 15.207

### 8.1 Operating environment

Temperature:	25	°C	(10-40°C)
Relative Humidity:	57	%	(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

(1) Line

EUT : ZPlus-B290  
Worst case Condition : Normal operated mode

Freq. (MHz)	Reading (dB $\mu$ V) QP	Limit (dB $\mu$ V) QP	Reading (dB $\mu$ V) AV	Limit (dB $\mu$ V) AV	Margin (dB)	
					QP	AV
4.74200	36.6	56.00	30.2	46.00	-19.40	-15.80
5.61400	33.4	60.00	31.1	50.00	-26.60	-18.90
8.38200	38.1	60.00	34.1	50.00	-21.90	-15.90
11.03800	42.9	60.00	38.2	50.00	-17.10	-11.80
14.56600	45.9	60.00	41.7	50.00	-14.10	-8.30
19.95000	46.4	60.00	42.8	50.00	-13.60	-7.20

(2) Neutral

EUT : ZPlus-B290  
Worst case Condition : Normal operated mode

Freq. (MHz)	Reading (dB $\mu$ V) QP	Limit (dB $\mu$ V) QP	Reading (dB $\mu$ V) AV	Limit (dB $\mu$ V) AV	Margin (dB)	
					QP	AV
4.74200	36.8	56.00	30.2	46.00	-19.20	-15.80
10.99800	43.1	60.00	38.4	50.00	-16.90	-11.60
12.21400	42.3	60.00	37.5	50.00	-17.70	-12.50
14.67800	46.4	60.00	43.1	50.00	-13.60	-6.90
17.14200	43.1	60.00	39.6	50.00	-16.90	-10.40
19.83800	45.5	60.00	41.3	50.00	-14.50	-8.70

Remark:

1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81.  
Expanded uncertainty (k=2) of conducted emission measurement is  $\pm 2.6$  dB.



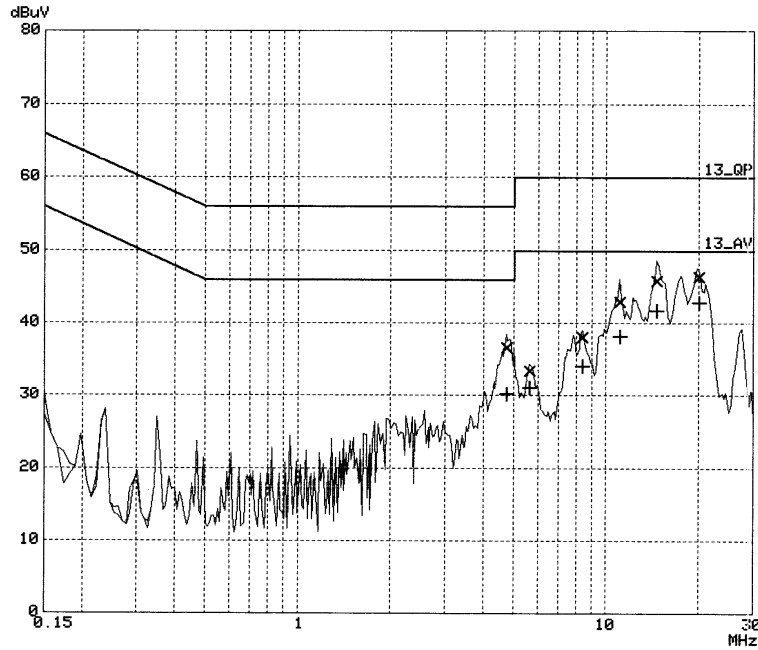
**Intertek Testing Services**  
**RF VOLTAGE**

EUT: ZPlus-B290  
 Manuf: ZINWELL  
 Op Cond: LISN-L  
 Operator: Clay  
 Test Spec: FCC P15 ClassB  
 Comment: EMI RCV:EC318 LISN:EC320  
 120V 60Hz 22°C 52%RH normal operated mode  
 Date: 15. Sep 03 18:04

Scan Settings (1 Range)

Frequencies			Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten Preamp
150k	30M	8k	9k	PK	20ms AUTO LN	OFF

Final Measurement: x QP / + AV  
 Meas Time: 1 s



**Intertek Testing Services**  
**RF VOLTAGE**

EUT: ZPlus-B290  
 Manuf: ZINWELL  
 Op Cond: LISN-N  
 Operator: Clay  
 Test Spec: FCC P15 ClassB  
 Comment: EMI RCV:EC318 LISN:EC320  
 120V 60Hz 22°C 52%RH normal operated mode  
 Date: 15. Sep 03 17:55

Scan Settings (1 Range)

----- Frequencies -----			----- Receiver Settings -----			
Start	Stop	Step	IF BW	Detector	M-Time	Atten Preamp
150k	30M	8k	9k	PK	20ms	AUTO LN OFF

Final Measurement: x QP / + AV  
 Meas Time: 1 s

