

FCC TEST REPORT

for

47 CFR Part 15 Subpart C

Equipment : Wireless LAN Outdoor Bridge

Model No. : ZWA-B191-OD

FCC ID : RIW-ZWA-B191-OD

Filing Type : Certification

Applicant : ZINWELL CORPORATION
2,Wen-Hua Road, Hsinchu Industrial Park
Hsinchu Hsien 303,Taiwan.

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SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

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History of this test report

Original Report Issue Date: Mar. 04, 2004

No additional attachment.

Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

CERTIFICATE OF COMPLIANCE
for
47 CFR Part 15 Subpart C

Equipment : **Wireless LAN Outdoor Bridge**
Model No. : **ZWA-B191-OD**
FCC ID : **RIW-ZWA-B191-OD**
Filing Type : **Certification**
Applicant : **ZINWELL CORPORAFTION**
2,Wen-Hua Road, Hsinchu Industrial Park
Hsinchu Hsien 303,Taiwan.

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** and the equipment under test was **passed** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Mar. 03, 2004 at **SPORTON International Inc.** LAB.



Daniel Lee
Manager

SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

1. General Description of Equipment under Test

1.1. Applicant

ZINWELL CORPORAFTION
2,Wen-Hua Road, Hsinchu Industrial Park Hsinchu Hsien 303,Taiwan.

1.2 Manufacturer

Same as 1.1

1.3 Basic Description of Equipment under Test

Equipment	: Wireless LAN Outdoor Bridge
Trade Name	: ZINWELL
Model No.	: ZWA-B191-OD
Power Supply Type	: Switching, AC 100~240V, DC 48V
AC Power Cord	: Non-shielded, wall-mounted, 1.2 meter,3pin
DC Power Cable	: Non-shielded, 1.7 meter, 2 pin

1.4 Feature of Equipment under Test

Product Feature & Specification				
1. Host/Radio Interface	RJ-45			
2. Type of Modulation	11b: CCK, DQPSK, DBPSK			
3. Number of Channels	USA/Canada: 11	V	European: 13	V
	Japan: 13,14.	X	Other:	
4. Frequency Band	11b: 2.400GHz ~ 2.4835GHz			
5. Carrier Frequency of each channel	2412+5*(N-1)MHz; N=1~13			
6. Channel Spacing	5MHz			
7. Maximum Output Power to Antenna	27.4dBm			
8. Type of Antenna Connector	N-Type			
9. Antenna Type / Gain	Dipole / 6dBi / 9dBi			
10. Function Type	Transmitter		Transceiver	V
11. Power Rating (DC/AC , Voltage)	DC 48V/0.7A			
12. Temperature Range (Operating)	-20°C ~ 70°C			

2 Test Configuration of Equipment under Test

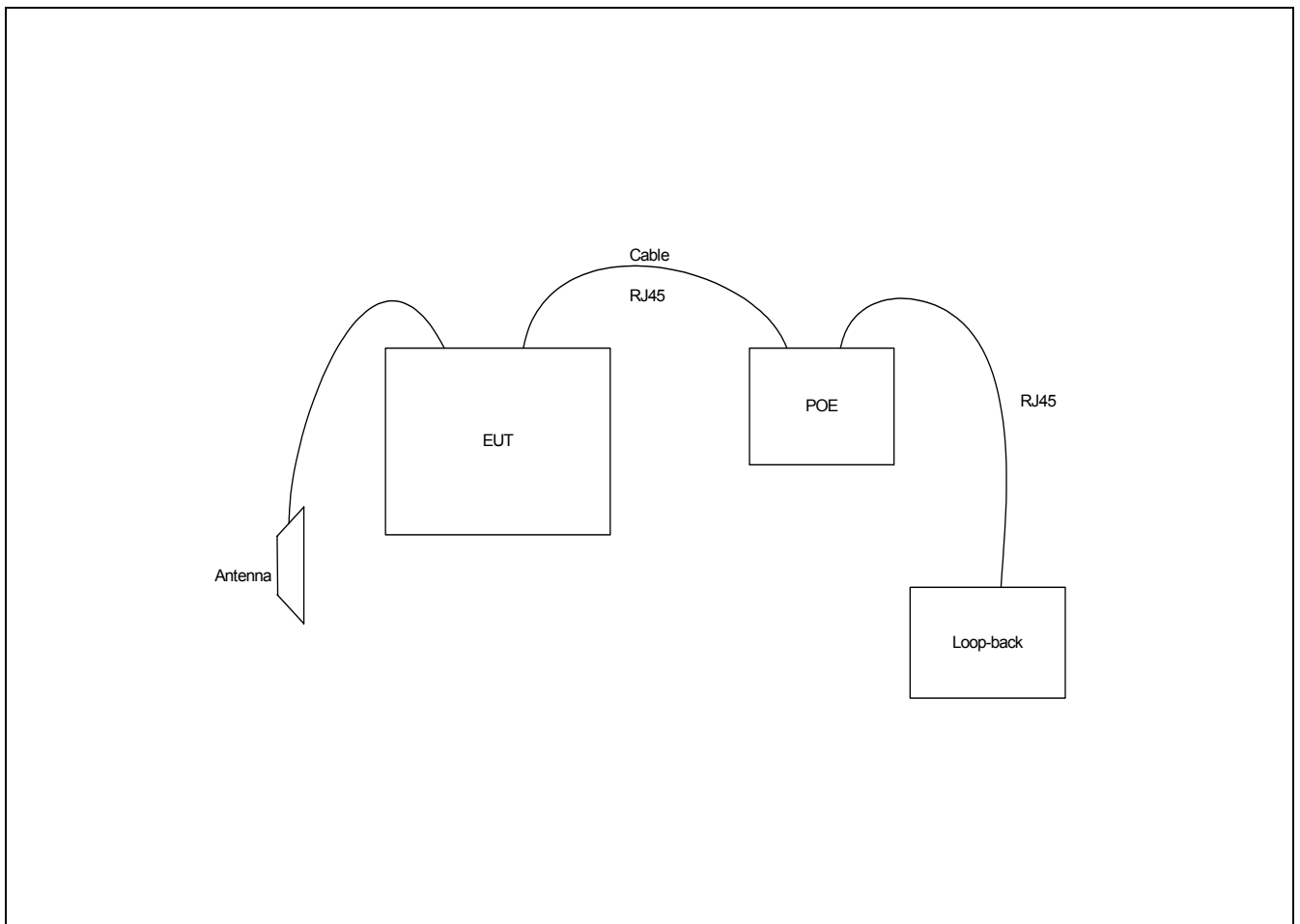
2.1 Test Manner

- a. The EUT has been associated with peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner tended to maximize its emission characteristics in a typical application.
- b. The complete test system included Loop-back as remote workstation for EMI test.
- c. The EUT can operate on eleven channels from 2412MHz to 2462MHz. (as listed in section 1.4).
- d. The following test modes were pretested for conduction test:
 - Mode 1:Tx CH01(2412 MHz)
 - Mode 2:Tx CH06(2437 MHz)
 - Mode 3:Tx CH11(2462 MHz)
- e. The following test modes were pretested for radiation test:
 - Mode 1:Tx CH01(2412 MHz) based on 9dBi antenna
 - Mode 2:Tx CH06(2437 MHz) based on 9dBi antenna
 - Mode 3:Tx CH11(2462 MHz) based on 9dBi antenna
- f. Frequency range investigated: conduction 150 kHz to 30 MHz, radiation 30 MHz to 25000MHz.

2.2 Description of Test System

Support Unit 1. – Loop-back - local workstation

2.3 Connection Diagram of Test System



3 Operation of Equipment under Test

An executive program, EMCTEST.EXE on WIN2000 continuously generating a complete line of "H" pattern, was used as the test software.

The program was executed as follows:

- a. Turn on the power of all equipment.
- b. The PC reads the test program from the hard disk drive and runs it.
- c. The PC sends "H" messages to the monitor, and the monitor displays "H" patterns on the screen.
- d. The PC sends "H" messages to the printer, then the printer prints them on the paper.
- e. The PC sends "H" messages to the internal hard disk , and the hard disk reads and writes the message.
- f. Repeat the steps from c to e.

At the same time, the following program was executed:

"WLAN HW Tool" sends continuous Tx.

4 General Information of Test

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,
Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
TEL : 886-3-327-3456
FAX : 886-3-318-0055

Test Site No : CO01-HY, 03CH03-HY

4.1 Test Voltage

110V/ 60Hz

4.2 Standard for Methods of Measurement

ANSI C63.4-2001

4.3 Test in Compliance with

47 CFR Part 15 Subpart C

4.4 Frequency Range Investigated

- a. Conduction: from 150 kHz to 30 MHz
- b. Radiation: from 30 MHz to 25000 MHz

4.5 Test Distance

The test distance of radiated emission from antenna to EUT is 3 m.

5 Report of Measurements and Examinations

5.1 List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.207	Conducted Emission	Pass
15.247(a)(2)	6dB Bandwidth	Pass
15.247(b)	Maximum Peak Output Power	Pass
15.209(a)	Radiated Emission	Pass
15.247 (c)	100kHz Bandwidth of Frequency Band Edges	Pass
15.247(d)	Power Spectral Density	Pass
15.203	Antenna Requirement	Pass
15.247(b)(4), 1.1307	RF Exposure	Pass

5.2 6dB Bandwidth

5.2.1 Measuring Instruments :

As described in chapter 7 of this test report.

5.2.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100kHz and VBW to 100kHz.
3. The 6 dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 6dB.

5.2.3 Test Setup Layout :



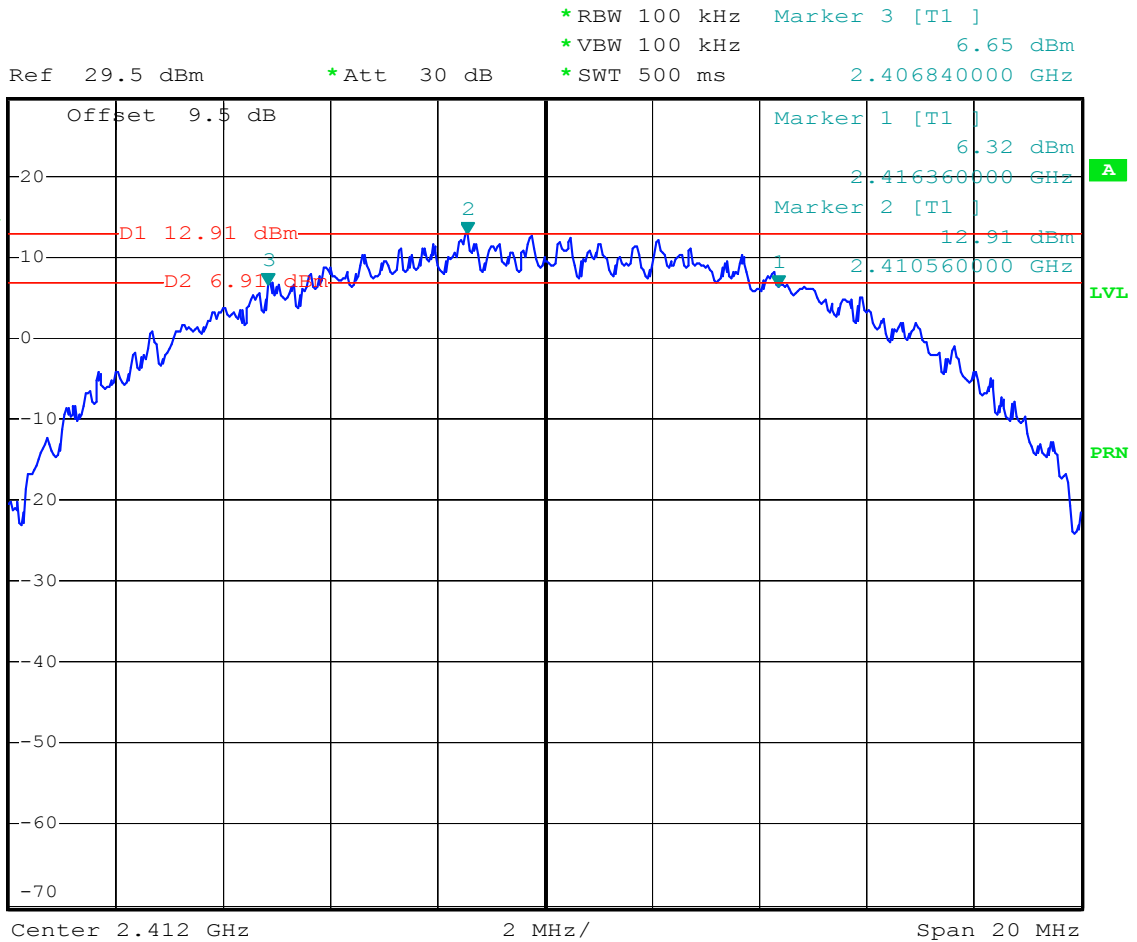
5.2.4 Test Result :

- Mode 1~3 : WLAN 802.11b
- Temperature : 24°C
- Relative Humidity : 50%

Channel	Frequency (MHz)	6dB Emission bandwidth (MHz)	Limits (MHz)	Plot Ref. No.
01	2412	9.5	0.5	Mode 1
06	2437	9.5	0.5	Mode 2
11	2462	9.4	0.5	Mode 3

5.2.5 Emission Bandwidth

Mode1 : 11b CH01 (2412MHz)



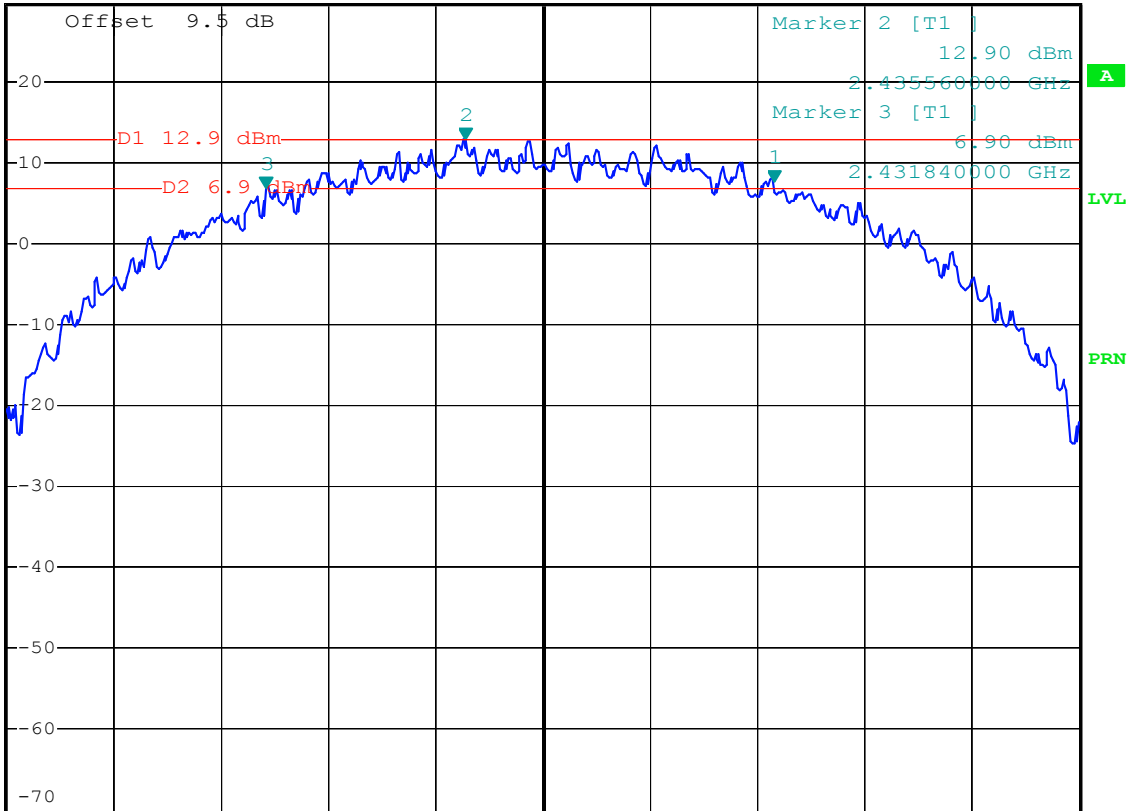
Mode 2 : 11b CH6 (2437MHz)



*RBW 100 kHz Marker 1 [T1]
 *VBW 100 kHz 7.57 dBm
 *SWT 500 ms 2.441320000 GHz

Ref 29.5 dBm *Att 30 dB

1 PK*
 VIEW



Center 2.437 GHz 2 MHz/ Span 20 MHz

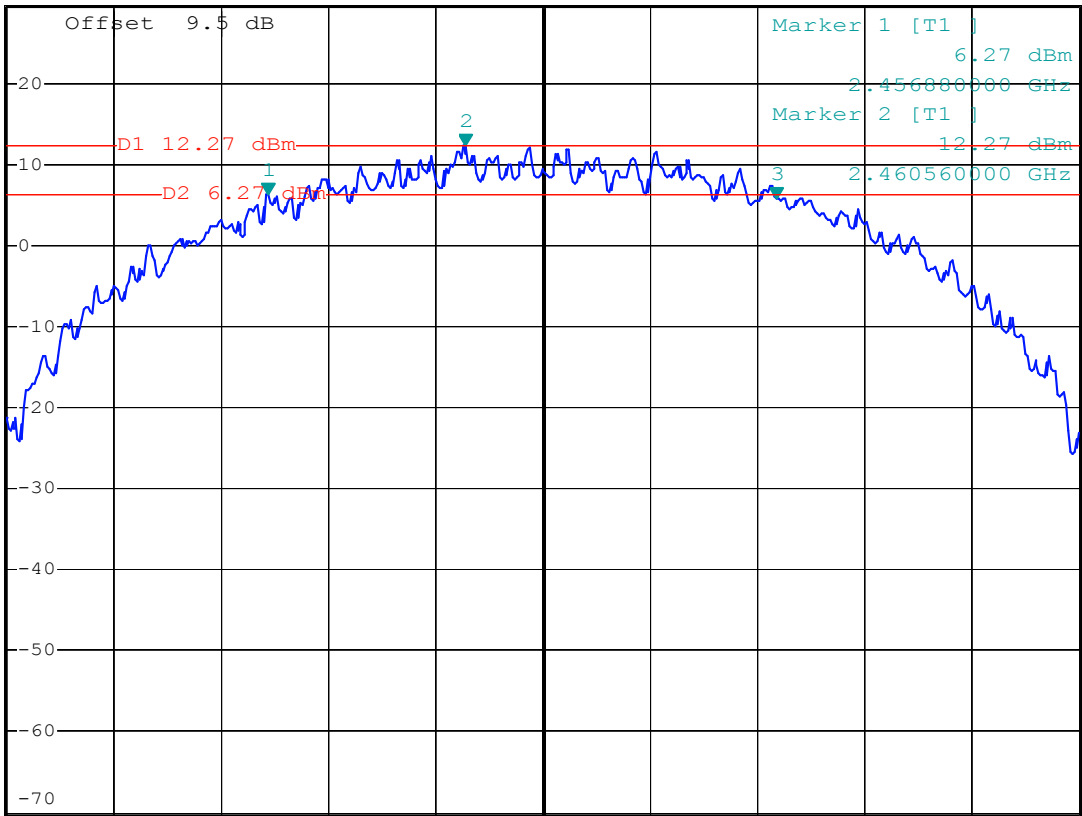
Mode 3 : 11b CH11 (2462MHz)



*RBW 100 kHz Marker 3 [T1]
 *VBW 100 kHz 5.80 dBm
 *SWT 500 ms 2.466360000 GHz

Ref 29.5 dBm *Att 30 dB

1 PK*
 VIEW



Center 2.462 GHz 2 MHz/ Span 20 MHz

5.3 Power Spectral Density

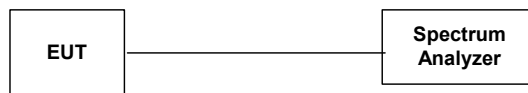
5.3.1 Measuring Instruments :

As described in chapter 7 of this test report.

5.3.2 Test Procedure :

1. The transmitter output was connected to spectrum analyzer through an attenuator.
2. The spectrum analyzer's resolution bandwidth was set at 3kHz RBW and 30kHz VBW as that of the fundamental frequency. Set the sweep time=span/3kHz.
3. The power spectral density was measured and recorded.
4. The sweep time is allowed to be longer than span/3kHz for a full response of the mixer in the spectrum analyzer.

5.3.3 Test Setup Layout :



5.3.4 Test Result :

- Mode 1~3: WLAN 802.11b
- Temperature : 24°C,
- Relative Humidity : 50%

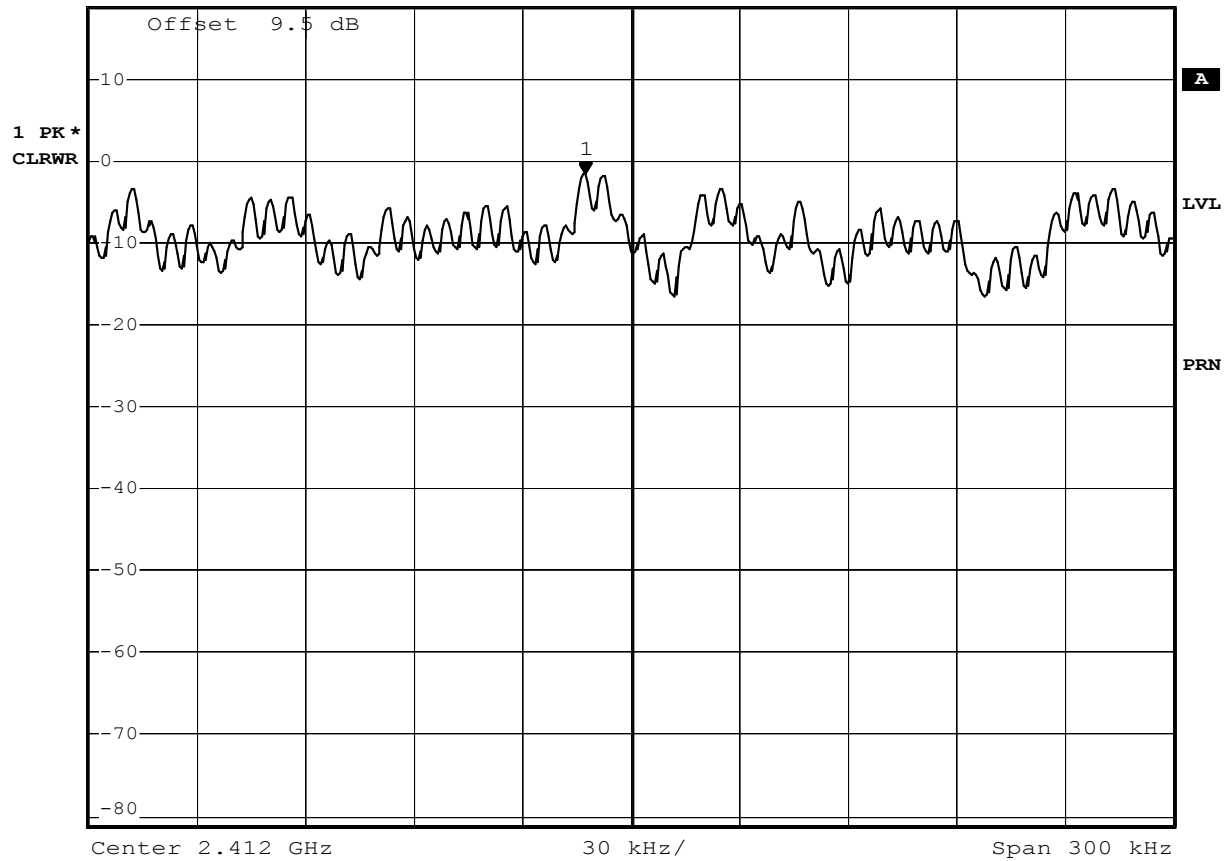
Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limits (dBm)	Plot Ref. No.
01	2412	-1.52	8	Mode 1
06	2437	-1.31	8	Mode 2
11	2462	-1.86	8	Mode 3

5.3.5 Peak Power Spectral Density

Mode 1 : 11b CH01 (2412MHz)



Ref 18.7 dBm *Att 30 dB *RBW 3 kHz Marker 1 [T1]
*VBW 30 kHz -1.52 dBm
*SWT 100 s 2.411987400 GHz

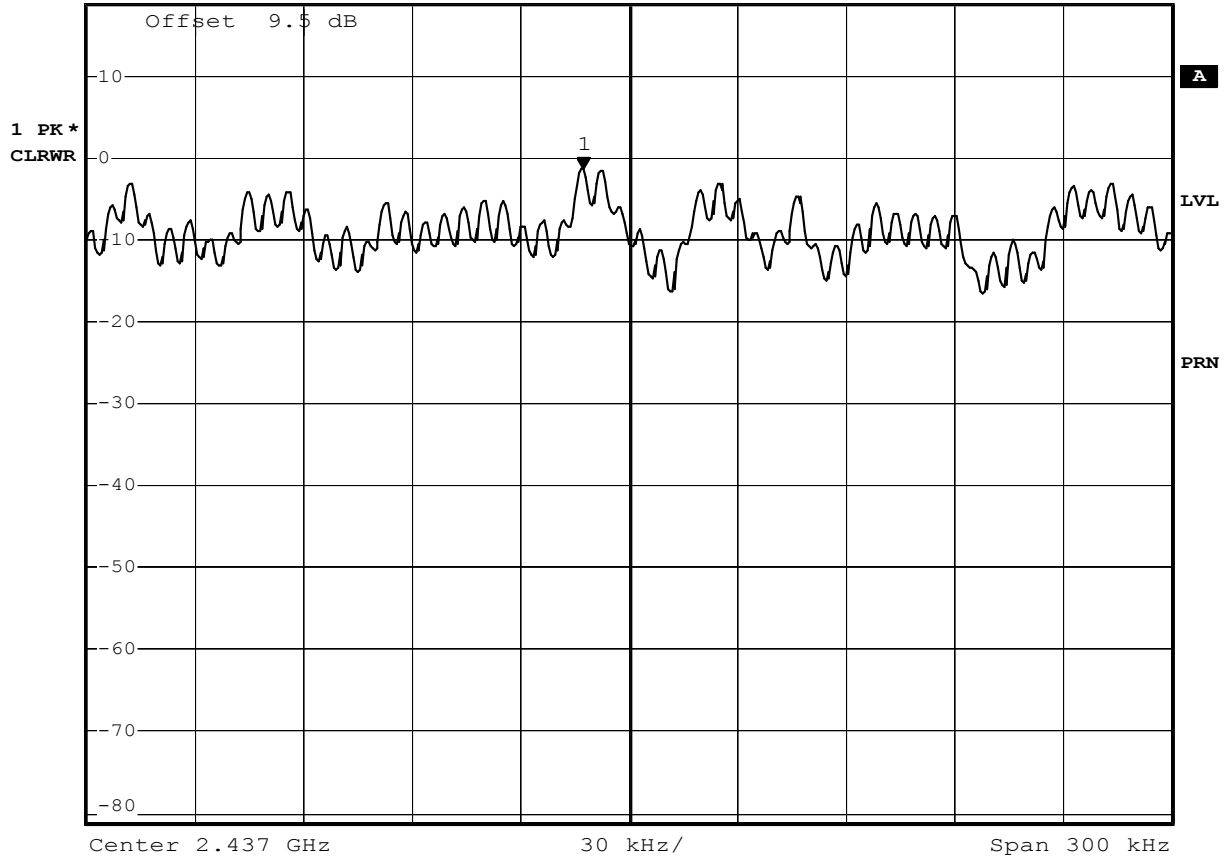


Mode 2 : 11b CH06 (2437MHz)



*RBW 3 kHz Marker 1 [T1]
*VBW 30 kHz -1.31 dBm
*SWT 100 s 2.436987400 GHz

Ref 18.7 dBm *Att 30 dB

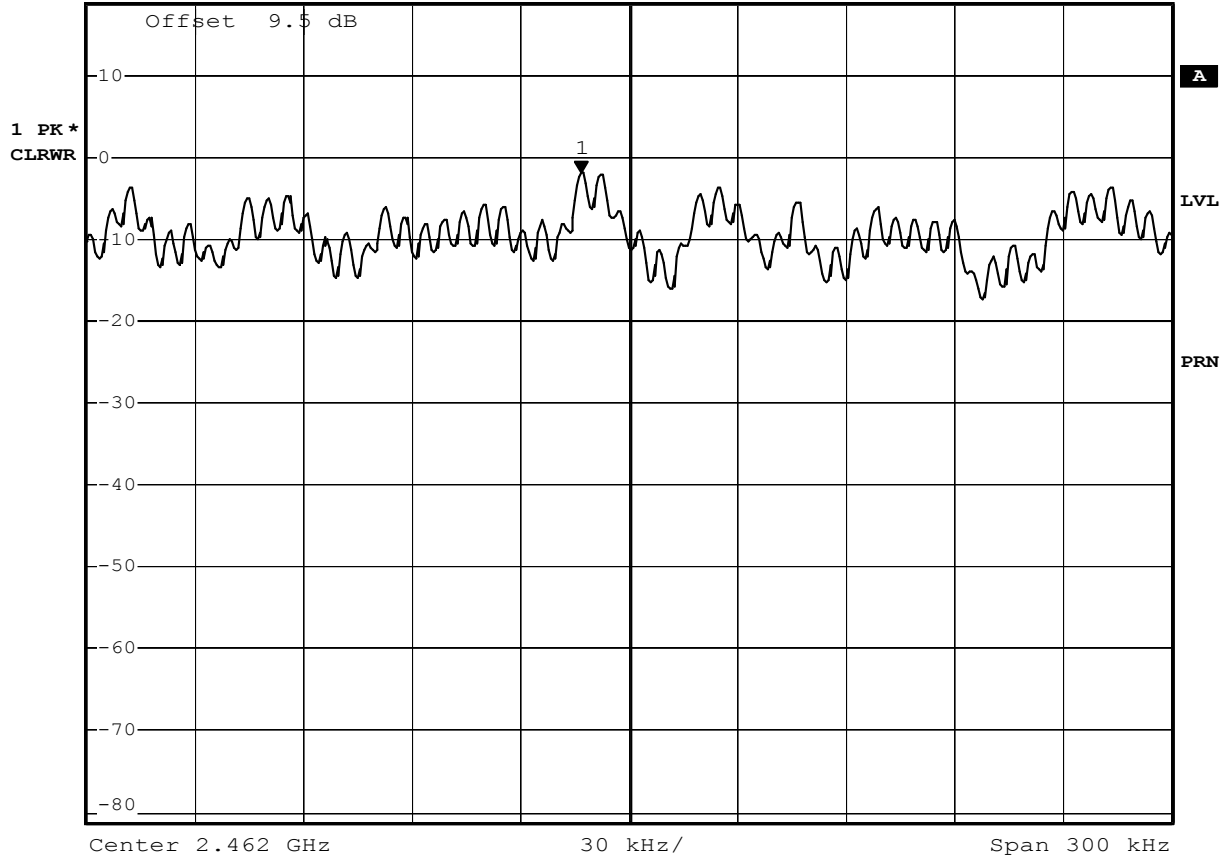


Mode 3 : 11b CH11(2462MHz)



*RBW 3 kHz Marker 1 [T1]
*VBW 30 kHz -1.86 dBm
*SWT 100 s 2.461986800 GHz

Ref 18.7 dBm *Att 30 dB



5.4 Band Edges Measurement

5.4.1 Measuring Instruments :

As described in chapter 7 of this test report.

5.4.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100 kHz bandwidth from band edge.
3. The band edges was measured and recorded.

5.4.3 Test Result :

- Mode 1 and 3 : WLAN 802.11b
- Temperature : 24°C,
- Relative Humidity : 50%

- Test Result in lower band (Channel 1) : PASS
- Test Result in higher band (Channel 11) : PASS

5.4.4 Note on Band Edge Emission

The band edge emission plot shows 54.66 dB delta between carrier maximum power and local maximum emission in the restricted band (2.390GHz).

The band edge emission plot shows 56.56 dB delta between carrier maximum power and local maximum emission in the restricted band (2.4835GHz).

Channel	Polarity	The emission of carrier power strength	Frequency	The emission of band edge power strength	Limit	Margin	Remark	Result
		(dB μ V/m)		(dB μ V/m)	(dB μ V/m)	(dB)		
01	V	113.18	2389.20	58.52	74	-15.48	Peak	Pass
	V	105.02	2389.20	50.36	54	-3.64	Average	Pass
	H	102.80	2389.20	48.14	74	-25.86	Peak	Pass
	H	94.25	2389.20	39.59	54	-14.41	Average	Pass
11	V	119.17	2487.30	62.61	74	-11.39	Peak	Pass
	V	109.03	2487.30	52.47	54	-1.53	Average	Pass
	H	104.19	2487.30	47.63	74	-26.37	Peak	Pass
	H	96.45	2487.30	39.89	54	-14.11	Average	Pass

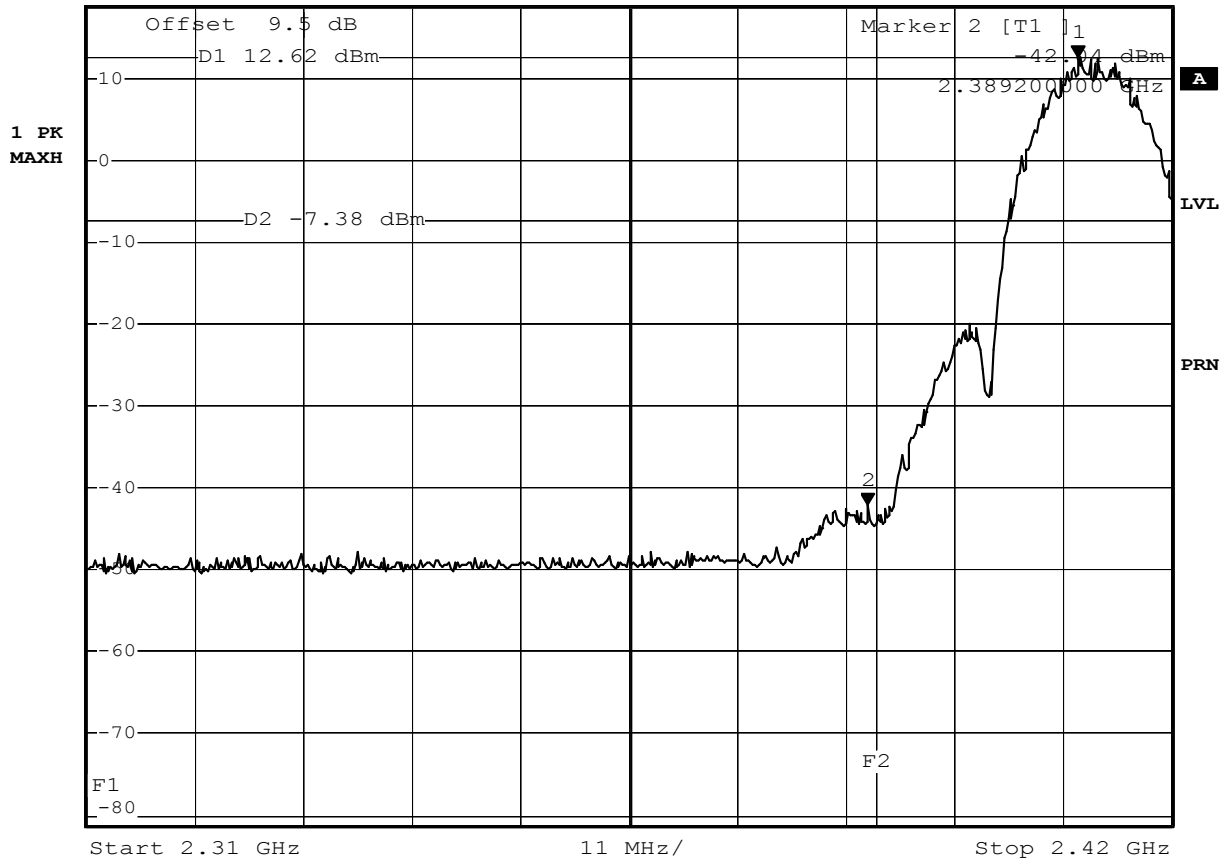
Remark: The data above can refer to radiated emission in section 7.

5.4.5 Band Edges Measurement

Mode 1 : 11b CH01 (2412MHz)



Ref 18.7 dBm *Att 30 dB *RBW 100 kHz Marker 1 [T1] 12.62 dBm
 *VBW 100 kHz
 *SWT 500 ms 2.410540000 GHz

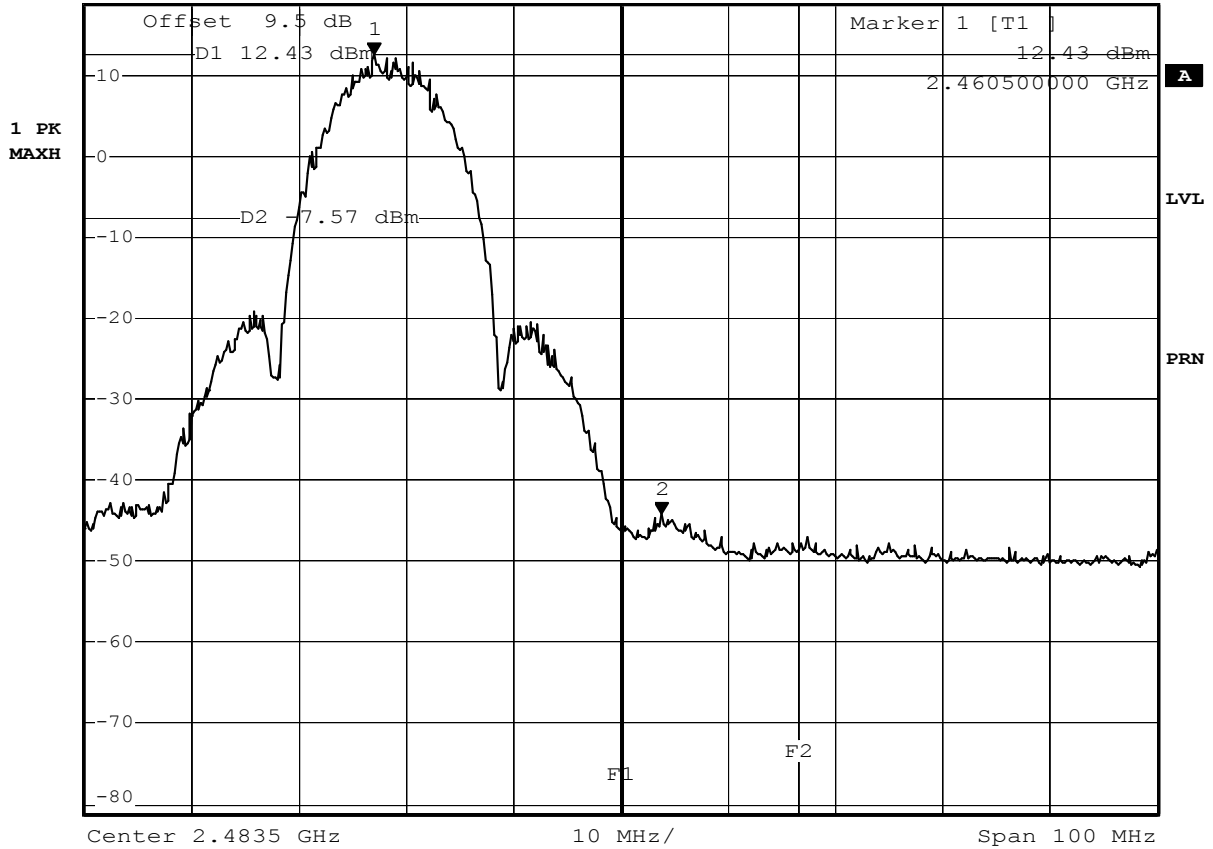


Mode 2 : 11b CH11(2462MHz)



*RBW 100 kHz Marker 2 [T1]
 *VBW 100 kHz -44.13 dBm
 *SWT 500 ms 2.487300000 GHz

Ref 18.7 dBm *Att 30 dB



5.5 Peak Output Power

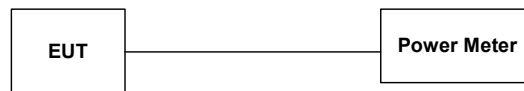
5.5.1 Measuring Instruments :

As described in chapter 7 of this test report.

5.5.2 Test Procedure :

The antenna port (RF output) of the EUT was connected to the input (RF input) of a power meter.
The power is equal to the reading level on power meter plus cable loss at the EUT antenna terminal.

5.5.3 Test Setup Layout :



5.5.4 Test Result :

- Mode 1~3 : WLAN 802.11b
- Temperature : 24°C
- Relative Humidity : 50 %

Channel	Frequency (MHz)	Measured Output Power (dBm)	Limits (Watt/dBm)
01	2412	25.8	1W/30 dBm
06	2437	27.4	1W/30 dBm
11	2462	22.8	1W/30 dBm

6. Test of Conducted Emission

Conducted emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 kHz and return leads of the EUT according to the methods defined in ANSI C63.4-2001 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

6.1. Major Measuring Instruments :

● Test Receiver	(R&S ESCS 30)
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

6.2. Test Procedures :

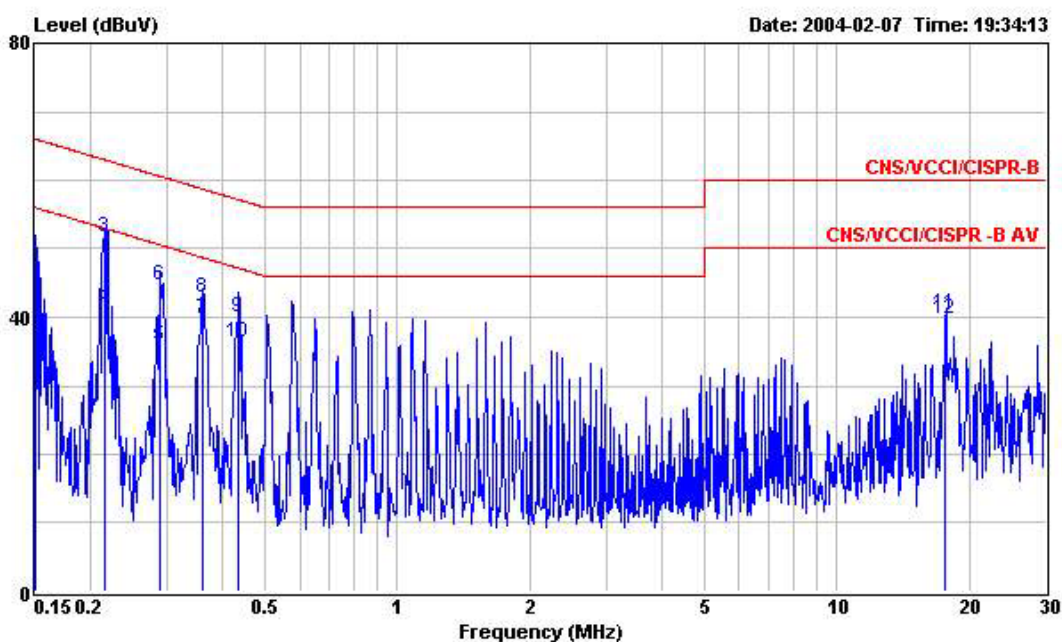
- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power port of the line impedance stabilization network (LISN).
- c. All the support units are connect to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

6.3. Test Result of Conducted Emission :

6.3.1 Frequency Range of Test : 150kHz to 30 MHz

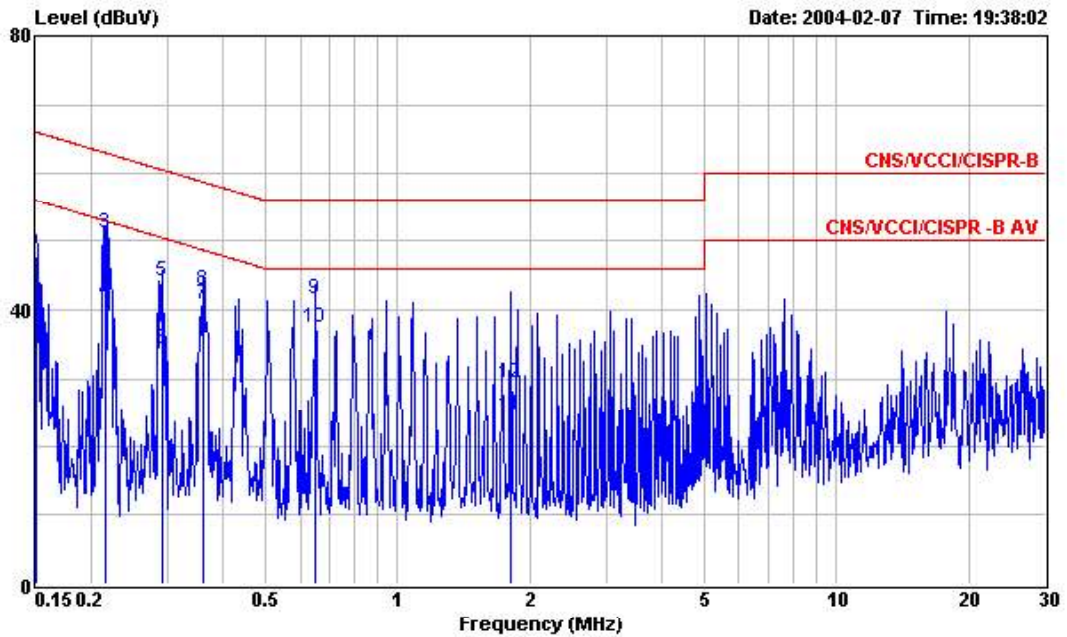
- Test Mode : Mode 1 (TX CH01 2412MHz)
- Temperature : 21°C
- Relative Humidity : 47 %

■ The test that passed at minimum margin was marked by the frame in the following table.



Site : CO01-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : AC 110V / 60Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.150	48.91	-17.09	66.00	48.70	0.10	0.11	QP
2	0.150	38.79	-17.21	56.00	38.58	0.10	0.11	Average
3	0.216	51.79	-11.18	62.97	51.56	0.10	0.13	QP
4	0.216	41.31	-11.66	52.97	41.08	0.10	0.13	Average
5	0.289	35.78	-14.77	50.55	35.59	0.10	0.09	Average
6	0.289	44.74	-15.81	60.55	44.55	0.10	0.09	QP
7	0.361	39.74	-8.97	48.71	39.59	0.10	0.05	Average
8	0.361	42.83	-15.88	58.71	42.68	0.10	0.05	QP
9	0.435	39.94	-17.22	57.16	39.80	0.10	0.04	QP
10	0.435	36.27	-10.89	47.16	36.13	0.10	0.04	Average
11	17.700	40.56	-19.44	60.00	40.11	0.26	0.19	QP
12	17.700	39.69	-10.31	50.00	39.24	0.26	0.19	Average



Site : CO01-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : AC 110V / 60Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

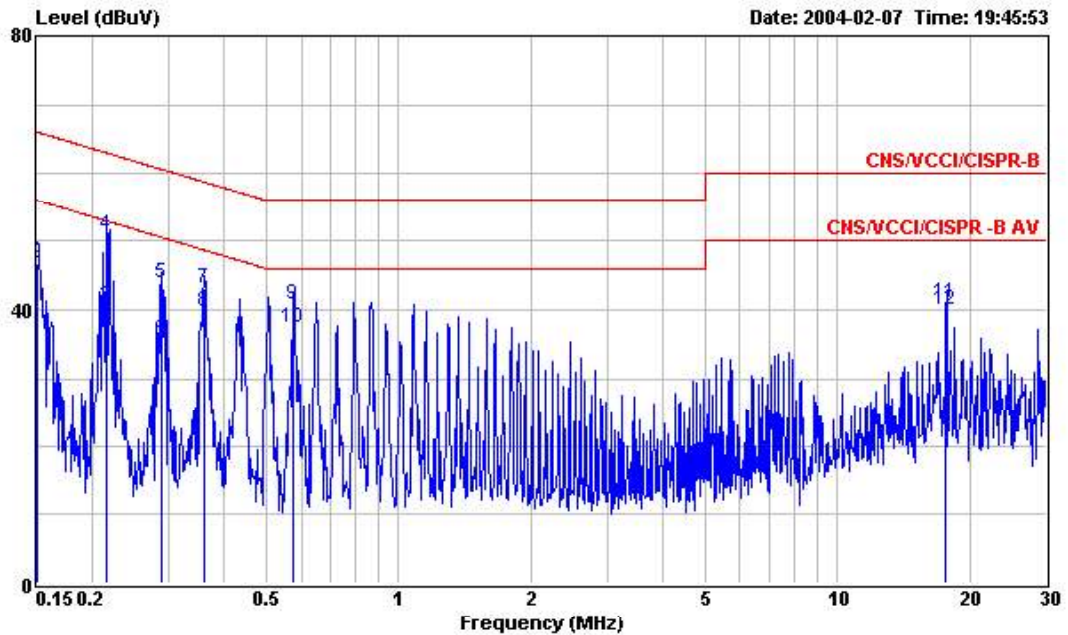
	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.150	47.91	-18.09	66.00	47.70	0.10	0.11	QP
2	0.150	38.07	-17.93	56.00	37.86	0.10	0.11	Average
3	0.217	51.06	-11.88	62.94	50.83	0.10	0.13	QP
4	0.217	41.39	-11.55	52.94	41.16	0.10	0.13	Average
5	0.291	44.07	-16.43	60.50	43.88	0.10	0.09	QP
6	0.291	34.18	-16.32	50.50	33.99	0.10	0.09	Average
7	0.361	40.71	-8.00	48.71	40.56	0.10	0.05	Average
8	0.361	42.85	-15.86	58.71	42.70	0.10	0.05	QP
9	0.651	41.63	-14.37	56.00	41.49	0.10	0.04	QP
10	0.651	37.35	-8.65	46.00	37.21	0.10	0.04	Average
11	1.810	24.66	-21.34	46.00	24.50	0.10	0.06	Average
12	1.810	29.32	-26.68	56.00	29.16	0.10	0.06	QP

Test Engineer : Jay
 Jay

6.3.2 Frequency Range of Test : 150kHz to 30 MHz

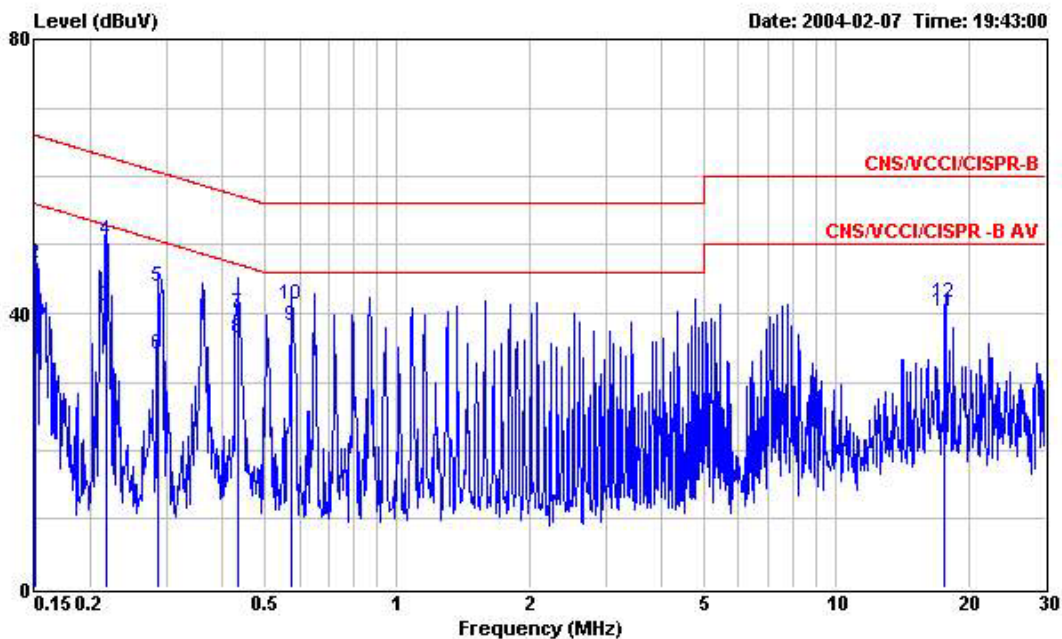
- Test Mode : Mode 2 (TX CH06 2437MHz)
- Temperature : 21°C
- Relative Humidity : 47 %

■ The test that passed at minimum margin was marked by the frame in the following table.



Site : CO01-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : AC 110V / 60Hz
 Model : ZWA-B191-OD
 Memo : TX CH06 2437MHz

	Over	Limit	Read	Probe	Cable		
Freq	Level	Limit	Line	Level	Factor	Loss	Remark
MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.150	37.04	-18.96	56.00	36.83	0.10	0.11 Average
2	0.150	46.81	-19.19	66.00	46.60	0.10	0.11 QP
3	0.215	40.55	-12.46	53.01	40.32	0.10	0.13 Average
4	0.215	50.88	-12.13	63.01	50.65	0.10	0.13 QP
5	0.288	43.80	-16.78	60.58	43.61	0.10	0.09 QP
6	0.288	35.48	-15.10	50.58	35.29	0.10	0.09 Average
7	0.361	43.06	-15.65	58.71	42.91	0.10	0.05 QP
8	0.361	39.74	-8.97	48.71	39.59	0.10	0.05 Average
9	0.576	40.84	-15.16	56.00	40.70	0.10	0.04 QP
10	0.576	37.41	-8.59	46.00	37.27	0.10	0.04 Average
11	17.696	41.13	-18.87	60.00	40.68	0.26	0.19 QP
12	17.696	39.91	-10.09	50.00	39.46	0.26	0.19 Average



Site : CO01-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : AC 110V / 60Hz
 Model : ZWA-B191-OD
 Memo : TX CH06 2437MHz

	Freq	Level	Over	Limit	Read	Probe	Cable	
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	Remark
1	0.150	37.60	-18.40	56.00	37.39	0.10	0.11	Average
2	0.150	47.32	-18.68	66.00	47.11	0.10	0.11	QP
3	0.217	41.15	-11.78	52.93	40.92	0.10	0.13	Average
4	0.217	50.65	-12.28	62.93	50.42	0.10	0.13	QP
5	0.286	43.78	-16.86	60.64	43.59	0.10	0.09	QP
6	0.286	34.06	-16.58	50.64	33.87	0.10	0.09	Average
7	0.435	39.96	-17.20	57.16	39.82	0.10	0.04	QP
8	0.435	36.27	-10.89	47.16	36.13	0.10	0.04	Average
9	0.576	38.24	-17.76	56.00	38.10	0.10	0.04	QP
10	0.576	41.31	-14.69	56.00	41.17	0.10	0.04	QP
11	17.696	40.24	-9.76	50.00	39.75	0.30	0.19	Average
12	17.696	41.49	-18.51	60.00	41.00	0.30	0.19	QP

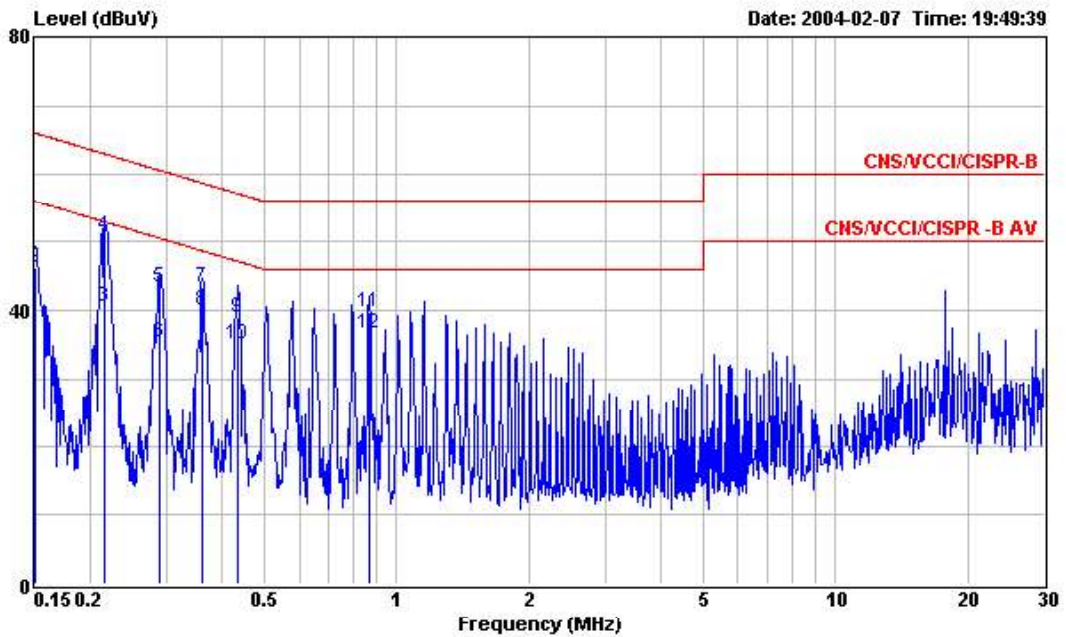
Test Engineer : 

Jay

6.3.3 Frequency Range of Test : 150kHz to 30 MHz

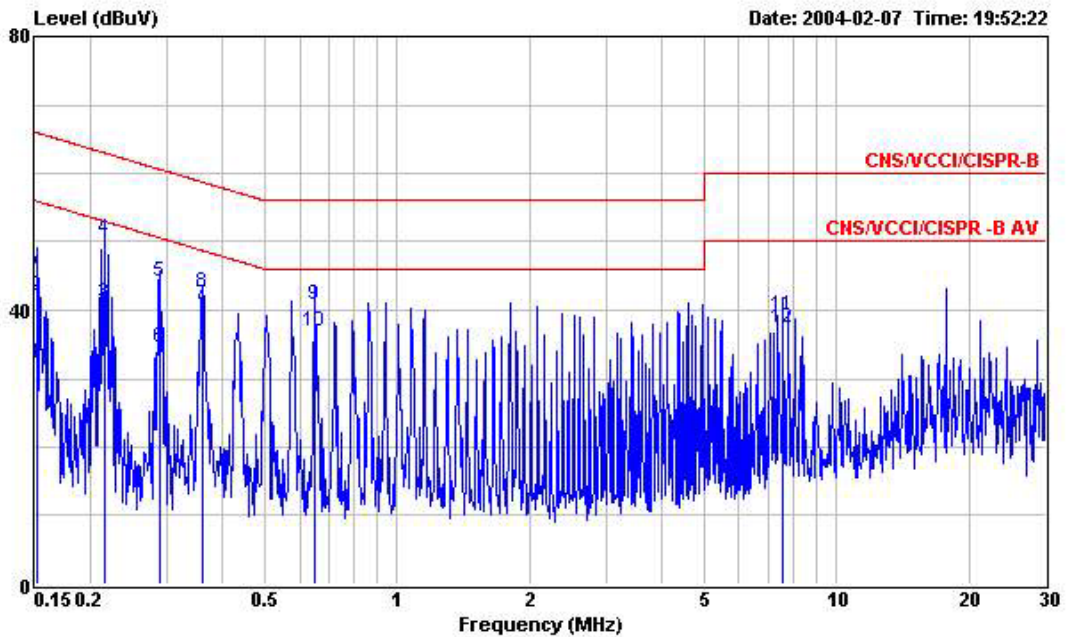
- Test Mode : Mode 3 (TX CH11 2462MHz)
- Temperature : 21°C
- Relative Humidity : 47%

■ The test that passed at minimum margin was marked by the frame in the following table.




Site : CO01-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : AC 110V / 60Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over	Limit	Read	Probe	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.150	36.71	-19.29	56.00	36.50	0.10	0.11	Average
2	0.150	46.35	-19.65	66.00	46.14	0.10	0.11	QP
3	0.216	40.55	-12.42	52.97	40.32	0.10	0.13	Average
4	0.216	50.83	-12.14	62.97	50.60	0.10	0.13	QP
5	0.289	43.36	-17.19	60.55	43.17	0.10	0.09	QP
6	0.289	35.40	-15.15	50.55	35.21	0.10	0.09	Average
7	0.360	43.29	-15.44	58.73	43.13	0.10	0.06	QP
8	0.360	39.93	-8.80	48.73	39.77	0.10	0.06	Average
9	0.435	38.94	-18.22	57.16	38.80	0.10	0.04	QP
10	0.435	35.15	-12.01	47.16	35.01	0.10	0.04	Average
11	0.866	39.84	-16.16	56.00	39.70	0.10	0.04	QP
12	0.866	36.71	-9.29	46.00	36.57	0.10	0.04	Average



Site : CO01-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : AC 110V / 60Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over	Limit	Read	Probe	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.151	32.20	-23.74	55.94	31.99	0.10	0.11	Average
2	0.151	42.20	-23.74	65.94	41.99	0.10	0.11	QP
3	0.215	40.98	-12.03	53.01	40.75	0.10	0.13	Average
4	0.215	50.31	-12.70	63.01	50.08	0.10	0.13	QP
5	0.289	44.05	-16.50	60.55	43.86	0.10	0.09	QP
6	0.289	34.66	-15.89	50.55	34.47	0.10	0.09	Average
7	0.361	40.71	-8.00	48.71	40.56	0.10	0.05	Average
8	0.361	42.51	-16.20	58.71	42.36	0.10	0.05	QP
9	0.651	40.82	-15.18	56.00	40.68	0.10	0.04	QP
10	0.651	36.92	-9.08	46.00	36.78	0.10	0.04	Average
11	7.566	39.14	-20.86	60.00	38.81	0.20	0.13	QP
12	7.566	37.31	-12.69	50.00	36.98	0.20	0.13	Average

Test Engineer : 
 Jay

7. Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defined in ANSI C63.4-2001. The EUT was placed, 0.8 meter above the ground plane, as shown in section 5.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

The radiation measurements were based on 9dBi antenna.

7.1. Major Measuring Instruments

- Amplifier (MITEQ AFS44)
 - RF Gain 40 dB
 - Signal Input 100 MHz to 26.5 GHz

- Amplifier (HP8447D)
 - RF Gain 30 dB
 - Signal Input 100 MHz to 1.3 GHz

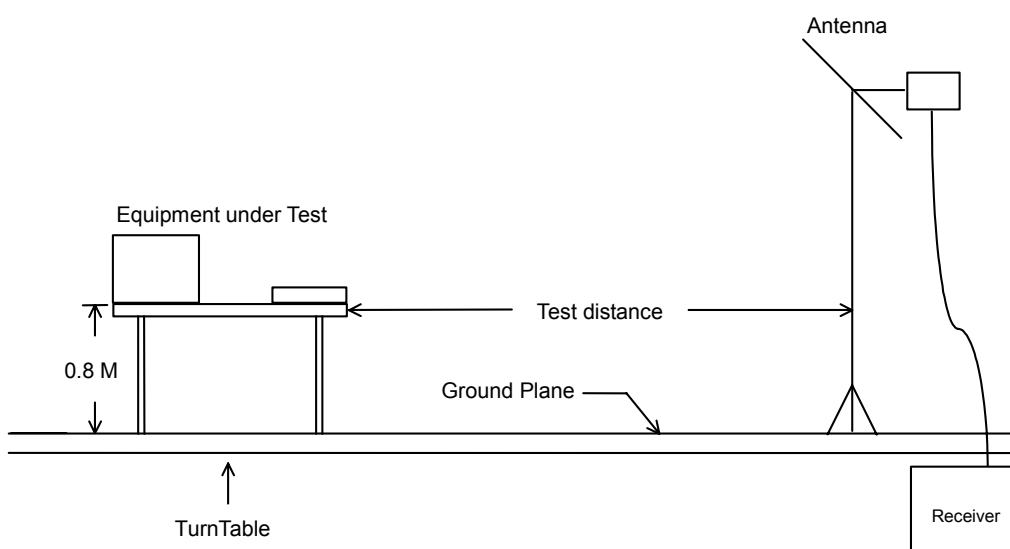
- Spectrum analyzer (R&S FSP40)
 - Attenuation 10 dB
 - Start Frequency 1 GHz
 - Stop Frequency 25 GHz
 - Resolution Bandwidth 1 MHz
 - Video Bandwidth 1 MHz
 - Signal Input 9 kHz to 40 GHz

- Spectrum analyzer (R&S FSP40)
 - Attenuation 10 dB
 - Start Frequency 30MHz
 - Stop Frequency 1 GHz
 - Resolution Bandwidth 120 KHz
 - Video Bandwidth 300KHz
 - Signal Input 9 kHz to 40 GHz

7.2. Test Procedures

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

7.3. Typical Test Setup Layout of Radiated Emission



7.4. Test Result of Radiated Emission

7.4.1 Test Mode: Mode 1 (TX CH01 2412MHz)

- Test Distance : 3 m
- Temperature : 22°C
- Relative Humidity :50 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ The test that passed at minimum margin was marked by the frame in the following table.

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	2390.000	62.73	-11.27	74.00	73.95	28.20	1.72	41.14	Peak	100	32
2	2390.000	51.43	-2.57	54.00	62.65	28.20	1.72	41.14	Average	100	32
3	2410.000	113.18	39.18	74.00	124.35	28.24	1.74	41.15	Peak	100	67
4	2410.000	105.02	51.02	54.00	116.19	28.24	1.74	41.15	Average	100	67
5	2484.390	42.86	-11.14	54.00	53.85	28.39	1.82	41.20	Average	100	0
6	2484.391	55.09	-18.91	74.00	66.08	28.39	1.82	41.20	Peak	100	0

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4821.000	46.88	-27.12	74.00	53.71	33.06	2.47	42.36	Peak	128	360
2	4821.000	35.68	-18.32	54.00	42.51	33.06	2.47	42.36	Average	128	360

FCC TEST REPORT

Report No. : F421104

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	2348.760	46.84	-27.16	74.00	58.16	28.12	1.68	41.12	Peak	121	323
2	2348.760	33.84	-20.16	54.00	45.16	28.12	1.68	41.12	Average	121	323
3 X	2412.000	102.80	28.80	74.00	113.97	28.24	1.74	41.15	Peak	121	323
4 X	2412.000	94.25	40.25	54.00	105.42	28.24	1.74	41.15	Average	121	323
5	2485.560	46.59	-27.41	74.00	57.57	28.40	1.82	41.20	Peak	120	320
6	2485.560	32.17	-21.83	54.00	43.15	28.40	1.82	41.20	Average	120	320

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4821.000	45.87	-28.13	74.00	52.70	33.06	2.47	42.36	Peak	121	320
2	4821.000	38.42	-15.58	54.00	45.25	33.06	2.47	42.36	Average	121	320

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	7233.000	51.21	-22.79	74.00	55.13	35.88	2.91	42.71	Peak	121	315
2	7233.000	41.34	-12.66	54.00	45.26	35.88	2.91	42.71	Average	121	315

Site : 03CH03-HY
Condition : FCC CLASS-B 3m HORN-ANT-6741 HORIZONTAL
EUT : IEEE 802.11b WLAN Outdoor Bridge
Power : 110 Vac / 50 Hz
Model : ZWA-B191-OS
Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	9648.000	56.89	-17.11	74.00	54.77	38.25	3.71	39.84	Peak	120	312
2	9648.000	48.30	-5.70	54.00	46.18	38.25	3.71	39.84	Average	120	312

For 9.648GHz ~ 25GHz

Frequency from 9648MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Emission (dBuV/m)	Margin (dB)	Detect Mode
2410.000	V	28.24	1.74	83.20	-	113.18	-	Peak
2410.000	V	28.24	1.74	75.04	-	105.02	-	AV
2412.000	H	28.24	1.74	72.82	-	102.80	-	Peak
2412.000	H	28.24	1.74	64.27	-	94.25	-	AV
4821.000	V	33.06	2.47	11.35	74	46.88	-27.12	Peak
4821.000	V	33.06	2.47	0.15	54	35.68	-18.32	AV
4821.000	H	33.06	2.47	10.34	74	45.87	-28.13	Peak
4821.000	H	33.06	2.47	2.89	54	38.42	-15.58	AV
7233.000	H	35.88	2.91	12.42	74	51.21	-22.79	Peak
7233.000	H	35.88	2.91	2.55	54	41.34	-12.66	AV
9648.000	H	38.25	3.71	14.93	74	56.89	-17.11	Peak
9648.000	H	38.25	3.71	6.34	54	48.30	-5.70	AV
12060.000	V/H	-	-	-	-	-	-	AV/Peak
14472.000	V/H	-	-	-	-	-	-	AV/Peak
16884.000	V/H	-	-	-	-	-	-	AV/Peak
19296.000	V/H	-	-	-	-	-	-	AV/Peak
21708.000	V/H	-	-	-	-	-	-	AV/Peak
24120.000	V/H	-	-	-	-	-	-	AV/Peak

Remark:

1. The emission emitted by the EUT is too low to be measured except the emission listed above,
2. Reading = Reading on SA-Preamp Factor

Test Engineer : 

Jay

7.4.2 Test Mode: Mode 2 (TX CH06 2437MHz)

- Test Distance : 3 m
- Temperature : 22°C
- Relative Humidity :50 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

The test that passed at minimum margin was marked by the frame in the following table.

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH06 2437MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	2390.000	61.10	-12.90	74.00	72.32	28.20	1.72	41.14	Peak	195	336
2 !	2390.000	48.68	-5.32	54.00	57.90	30.20	1.72	41.14	Average	195	336
3 X	2436.780	113.38	59.38	54.00	122.64	30.15	1.76	41.17	Average	194	5
4 X	2436.780	121.38	47.38	74.00	130.64	30.15	1.76	41.17	Peak	194	5
5	2483.500	60.27	-13.73	74.00	71.26	28.39	1.82	41.20	Peak	192	345
6	2483.500	46.95	-7.05	54.00	57.94	28.39	1.82	41.20	Average	192	345

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH06 2437MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	2390.000	57.33	-16.67	74.00	68.55	28.20	1.72	41.14	Peak	191	282
2	2390.000	45.10	-8.90	54.00	56.32	28.20	1.72	41.14	Average	191	282
3 X	2436.330	94.53	40.53	54.00	105.65	28.29	1.76	41.17	Average	193	286
4 X	2436.330	102.53	28.53	74.00	113.65	28.29	1.76	41.17	Peak	193	286
5	2483.500	58.43	-15.57	74.00	69.42	28.39	1.82	41.20	Peak	190	288
6	2483.500	47.44	-6.56	54.00	58.43	28.39	1.82	41.20	Average	190	288

For 2.483GHz ~ 25GHz


Frequency from 2483MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency (MHz)	Antenna Polarity	Cable Factor (dB/m)	Reading Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Emission (dBuV/m)	Margin (dB)	Detect Mode
2436.780	V	30.15	1.76	89.47	-	121.38	-	Peak
2436.780	V	30.15	1.76	81.47	-	113.38	-	AV
2436.330	H	28.29	1.76	72.48	-	102.53	-	Peak
2436.330	H	28.29	1.76	64.48	-	94.53	-	AV
4822.000	V/H	-	-	-	-	-	-	AV/Peak
7236.000	V/H	-	-	-	-	-	-	AV/Peak
9648.000	V/H	-	-	-	-	-	-	AV/Peak
12060.000	V/H	-	-	-	-	-	-	AV/Peak
14472.000	V/H	-	-	-	-	-	-	AV/Peak
16884.000	V/H	-	-	-	-	-	-	AV/Peak
19296.000	V/H	-	-	-	-	-	-	AV/Peak
21708.000	V/H	-	-	-	-	-	-	AV/Peak
24120.000	V/H	-	-	-	-	-	-	AV/Peak

Remark:

1. The emission emitted by the EUT is too low to be measured except the emission listed above,
2. Reading = Reading on SA-Preamp Factor

Test Engineer : 
 Jay

7.4.3 Test Mode: Mode 3 (TX CH11 2462MHz)

- Test Distance : 3 m
- Temperature : 22°C
- Relative Humidity :50 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ The test that passed at minimum margin was marked by the frame in the following table.

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m BIC-9124--301 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	32.277	35.44	-4.56	40.00	49.69	13.60	0.19	28.04	QP	100	352
2	36.906	36.72	-3.28	40.00	52.09	12.44	0.22	28.03	QP	100	0
3	131.830	34.93	-8.57	43.50	50.89	11.43	0.45	27.84	Peak	---	---

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m LOG-9111-221 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	224.800	32.58	-13.42	46.00	45.53	13.79	0.86	27.60	Peak	127	312
2	394.400	31.97	-14.03	46.00	42.85	15.68	1.21	27.77	Peak	---	---
3	499.200	32.27	-13.73	46.00	42.25	17.34	1.37	28.69	Peak	---	---

FCC TEST REPORT

Report No. : F421104

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m BIC-9124--301 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	108.710	35.37	-8.13	43.50	52.36	10.35	0.54	27.88	Peak	126	325
2	143.220	32.84	-10.66	43.50	47.99	11.95	0.71	27.81	Peak	---	---
3	200.000	32.98	-10.52	43.50	44.85	14.80	1.03	27.70	Peak	---	---

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m LOG-9111-221 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	249.600	37.95	-8.05	46.00	52.17	12.38	0.90	27.50	Peak	125	311
2	307.200	33.47	-12.53	46.00	46.14	13.63	1.04	27.34	Peak	---	---
3	394.400	36.81	-9.19	46.00	47.69	15.68	1.21	27.77	Peak	---	---

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	2390.000	57.07	-16.93	74.00	68.29	28.20	1.72	41.14	Peak	127	314
2	2390.000	44.01	-9.99	54.00	55.23	28.20	1.72	41.14	Average	127	314
3	X 2462.000	109.03	55.03	54.00	120.07	28.35	1.79	41.18	Average	130	307
4	X 2462.000	119.17	45.17	74.00	130.21	28.35	1.79	41.18	Peak	130	307
5	! 2483.500	53.52	-0.48	54.00	64.51	28.39	1.82	41.20	Average	125	329
6	2483.500	65.24	-8.76	74.00	76.23	28.39	1.82	41.20	Peak	125	329

FCC TEST REPORT

Report No. : F421104

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 VERTICAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4926.000	53.68	-0.32	54.00	60.45	33.27	2.47	42.51	Average	128	305
2	4926.000	68.55	-5.45	74.00	75.32	33.27	2.47	42.51	Peak	128	305

Site : 03CH03-HY
 Condition : FCC CLASS-B 3m HORN-ANT-6741 HORIZONTAL
 EUT : IEEE 802.11b WLAN Outdoor Bridge
 Power : 110 Vac / 50 Hz
 Model : ZWA-B191-OD
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	2390.000	56.87	-17.13	74.00	68.09	28.20	1.72	41.14	Peak	128	310
2	2390.000	45.63	-8.37	54.00	56.85	28.20	1.72	41.14	Average	128	310
3	X 2462.000	96.45	42.45	54.00	107.49	28.35	1.79	41.18	Average	129	313
4	X 2462.000	104.19	30.19	74.00	115.23	28.35	1.79	41.18	Peak	129	313
5	2483.500	45.50	-8.50	54.00	56.49	28.39	1.82	41.20	Average	129	313
6	2483.500	57.86	-16.14	74.00	68.85	28.39	1.82	41.20	Peak	129	313

For 4.926GHz ~ 25GHz

Frequency from 4926MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency (MHz)	Antenna Polarity	Cable Factor	Reading Loss	Limits (dBuV)	Emission (dBuV/m)	Margin (dB)	Detect Mode
2462.000	V	28.35	1.79	89.03	-	119.17	Peak
2462.000	V	28.35	1.79	80.89	-	111.03	AV
2462.000	H	28.35	1.79	74.05	-	104.19	Peak
2462.000	H	28.35	1.79	66.31	-	96.45	AV
4926.000	V	33.27	2.47	32.81	74.00	68.55	Peak
4926.000	V	33.27	2.47	17.94	54.00	53.68	AV
7236.000	V/H	-	-	-	-	-	AV/Peak
9648.000	V/H	-	-	-	-	-	AV/Peak
12060.000	V/H	-	-	-	-	-	AV/Peak
14472.000	V/H	-	-	-	-	-	AV/Peak
16884.000	V/H	-	-	-	-	-	AV/Peak
19296.000	V/H	-	-	-	-	-	AV/Peak
21708.000	V/H	-	-	-	-	-	AV/Peak
24120.000	V/H	-	-	-	-	-	AV/Peak

Remark:

1. The emission emitted by the EUT is too low to be measured except the emission listed above,
2. Reading = Reading on SA-Preamp Factor

Test Engineer : 

Jay

8. Antenna Requirements

8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no other antenna except assembled by the responsible party shall be used with the device. However, this requirement does not apply to intentional radiators that must be professionally installed.

And according to FCC 47 CFR Section 15.247 (b), if directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

8.2. Antenna Connected Construction

The antenna used in this product is 6dBi dipole with N-type connector. The antenna of EUT can be professionally installed only as described in the users manual.

It is considered to meet the antenna requirement of FCC.

9. RF Exposure

FCC Rules and Regulations Part 1.1307,1.1310, 2.1091, 2.1093:

RF Exposure Compliance

9.1. Limit For Maximum Permissible Exposure (MPE)

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

F=frequency in MHz

*Plane-wave equivalent power density

9.2. MPE Calculations

Power Density =Pd (mW/cm²) = EIRP/4 π d²

EIRP = P · G

P=Peak output power (mW)

G=Antenna numeric gain (numeric)

d=Separation distance (cm)

Because the EUT belongs to General Population/ Uncontrolled Exposure, the limit of power density is 1.0 mW/cm².

Channel NO.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated RF Exposure at d=20cm (mW/cm ²)	Limit (mW/cm ²)
Channel 01	6	3.98	25.8	380.19	0.30	1.0
Channel 06	6	3.98	27.4	549.54	0.44	1.0
Channel 11	6	3.98	22.8	190.55	0.15	1.0

9.3. FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm during normal operation.

10. List of Measuring Equipments

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100132	9 KHz – 2.75 GHz	Jun. 12, 2003	Conduction (CO01-HY)
LISN	MessTec	NNB-2/16Z	2001-008	9 KHz – 30 MHz	Apr. 30, 2003	Conduction (CO01-HY)
LISN (Support Unit)	MessTec	NNB-2/16Z	2001-009	9 KHz – 30 MHz	Apr. 30, 2003	Conduction (CO01-HY)
EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	Conduction (CO01-HY)
EMI Filter	LINDGREN	N6006	201052	0 ~ 60 Hz	N/A	Conduction (CO01-HY)
RF Cable-CON	Suhner Switzerland	RG223/U	CB029	9KHz~30MHz	Dec. 24, 2003	Conduction (CO01-HY)
50 ohm BNC type Terminal	NOBLE	50ohm	TM013	50 ohm	Apr. 24, 2003	Conduction (CO01-HY)

※ Calibration Interval of instruments listed above is one year.

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2003	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSP40	100004	9KHZ~40GHz	Aug. 23, 2003	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Nov. 05, 2003	Radiation (03CH03-HY)
Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz –200MHz	Jul. 24, 2003	Radiation (03CH03-HY)
Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz -1GHz	Jul. 24, 2003	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Dec. 03, 2003	Radiation (03CH03-HY)
Amplifier	MITEQ	AFS44	879981	100MHz~26.5GHz	Jul. 23, 2003	Radiation (03CH03-HY)
Horn Antenna	COM-POWER	3115	6741	1GHz – 18GHz	Apr. 08, 2003	Radiation (03CH03-HY)
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
Horn Antenna	Schwarzbeck	BBHA9170	154	15GHz~40GHz	Jun. 02, 2003	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Dec. 05, 2003	Radiation (03CH03-HY)

※ Calibration Interval of instruments listed above is one year, except for Horn Antenna, BBHA9170.

※ Calibration Interval of Horn Antenna, BBHA9170, is three years.

11. Uncertainty Measurement

Uncertainty of Conducted Emission Measurement

Contribution	Uncertainty of x_i		$u(x_i)$
	dB	Probability Distribution	
Receiver reading	0.10	Normal(k=2)	0.05
Cable loss	0.10	Normal(k=2)	0.05
AMN insertion loss	2.50	Rectangular	0.63
Receiver Spec	1.50	Rectangular	0.43
Site imperfection	1.39	Rectangular	0.80
Mismatch Receiver VSWR Γ_1 = LISN VSWR Γ_2 = Uncertainty= $20\log(1-\Gamma_1\Gamma_2)$	+0.34/-0.35	U-shape	0.24
combined standard uncertainty $U_c(y)$	1.13		
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$	2.26		

$U = \sqrt{\{(1/2)^2 + (0.3/2)^2 + (2^2 + 0.5^2 + 2^2 + 0.25^2 + 2^2)/3 + (0.54)^2/2\}} = 2.2$ for 10m test distance

$U = \sqrt{\{(1/2)^2 + (0.3/2)^2 + (2^2 + 3^2 + 2^2 + 0.25^2 + 2^2)/3 + (0.54)^2/2\}} = 2.7$ for 3m test distance

Uncertainty of Conducted Emission Measurement (30MHz ~ 1000MHz)

Contribution	Uncertainty of x_i		$u(x_i)$
	dB	Probability Distribution	
Receiver reading	0.41	Normal(k=2)	0.21
Antenna factor calibration	0.83	Normal(k=2)	0.42
Cable loss calibration	0.25	Normal(k=2)	0.13
Pre Amplifier Gain calibration	0.27	Normal(k=2)	0.14
RCV/SPA specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site imperfection	1.43	Rectangular	0.83
Mismatch Receiver VSWR $\Gamma_1= 0.20$ Antenna VSWR $\Gamma_2= 0.23$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	+0.39/-0.41	U-shaped	0.28
combined standard uncertainty $Uc(y)$	1.27		
Measuring uncertainty for a level of confidence of 95% $U=2Uc(y)$	2.54		

Uncertainty of Conducted Emission Measurement (1GHz ~ 40GHz)

Contribution	Uncertainty of x_i		$u(x_i)$	C_i	$C_i * u(x_i)$
	dB	Probability Distribution			
Receiver reading	± 0.10	Normal(k=1)	0.10	1	0.10
Antenna factor calibration	± 1.70	Normal(k=2)	0.85	1	0.85
Cable loss calibration	± 0.50	Normal(k=2)	0.25	1	0.25
Receiver Correction	± 2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	± 1.50	Rectangular	0.87	1	0.87
Site imperfection	± 2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR $\Gamma_1= 0.197$ Antenna VSWR $\Gamma_2= 0.194$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2*\Gamma_3)$	+0.34/-0.35	U-shaped	0.244	1	0.244
Combined standard uncertainty $Uc(y)$	2.36				
Measuring uncertainty for a level of confidence of 95% $U=2Ue(y)$	4.72				

$U = \sqrt{\{(0.3/2)^2 + (2^2 + 1.5^2 + 0.2^2)/3 + (0.2)^2/2\}} = 1.66$