Test Report

FOR

FCC Part 15 Subpart B & C

of

Notebook Personal Computer
(with 802.11b WLAN module EM9-NB inside)

Model

BQ12

(Brand: Wistron NeWeb)

Applied by:

Wistron NeWeb Corporation
No. 10-1, Li-hsin Road I,
Science-based Inductrial Park Hsinchu 300,
Taiwan, R. O. C.

Test Performed by:

(NVLAP Lab. Code: 200234-0)

International Standards Laboratory

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Report Number: ISL-03LR003FC **Test Date: 2003/02/12**
NVLAP Lab. Code: 200234-0; VCCI: R-1435, C-1440; NEMKO Aut. No: ELA 113; BSMI Lab. Code: SL2-IN-E-0013

Contents of Report

1. . General

1.1 Certification of Accuracy of Test Data

The electromagnetic interference tests which this report describes were conducted by an independent electromagnetic compatibility consultant, International Standards Laboratory in accordance with the test procedure specified in CFR 47 Part 15 Subpart C (Section 15.247), Subpart B and ANSI C63.4 Rules.

The test results contained in this report accurately represent the measurements of the EMC characteristics and the energy generated by sample equipment under test at the time of the test.

Equipment Tested:	Notebook Personal Computer (with 802.11b WLAN module EM9-NB inside) Model:BQ12 Applied by Wistron NeWeb Corp.	
Sample received Date:	2003/02/10	
Final test Date :	2003/02/12	
Test Site:		Chamber 02, Conduction 02
Temperature	23º C(Conduction Test);	23º C (Radiation Test)
Humidity:	52% (Conduction Test);	52% (Radiation Test)
Test Engineer:	Jerry Chiou	

The results show that the sample equipment tested as described in this report is in compliance with the Class B conducted and radiated emission limits of FCC Rules Part 15 Subpart B; and the limits of FCC Part 15 Subpart C (Section 15.247).

Approve & Signature

Eddy Hsiung

Eddy Hsiung/Director

This test data shown below is traceable to NIST or national or international standard. International Standards Laboratory certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

1.2 Description of Equipment Under Test (EUT)

Description:	Notebook Personal Computer (with 802.11b WLAN module EM9-NB inside)
Model No.:	BQ12
FCC ID:	NKRBQ12B
Brand:	acer
EUT Power Rating:	DCV from Power Adapter
AC power :	100-240VAC / 50-60Hz to Power Adapter
AC Power Adapter Manufacturer:	LITEON PA-1900-05 (Input: 100-240VAC, 50-60Hz, 1.4A) (Output: 19VDC, 4.74A)
AC Power Cord Type:	Unshielded, 1.8m (Detachable) to Power Adapter
DC Power Cable Type:	Unshielded, 1.8m (Non-Detachable) at Power Adapter(With a Core)
CPU Manufacturer:	Intel Model: P4 3.06 GHz
OSC/Clock Frequencies:	133MHz
Memory Capacity:	Samsung 512MB
15'' SXGA LCD Panel Manufacturer:	IBM ITSX95C
FDD Manufacturer:	NEC Model: FD3238T-207
HDD Manufacturer:	IBM Model: IC25N020ATCS04-0 (20 GB)
CD- ROM Manufacturer:	Teac Model: CD-224E
Battery Manufacturer (Li-Ion):	Sanyo Model: BATBCLL (6300mAh)9-cells
MDC Modem Manufacturer:	CONEXANT Model: RD01-D480
I/O Port of EUT:	One Parallel Port One PS/2 Keyboard Port One Video Port One Line Out Port One Microphone Port One Line In Port One LAN Port Three USB Port One 1394 Port One S-Video Port

Wireless LAN Manufacturer:	WNC Model: EM9-NB
Frequency Range:	2.412~2.462 GHz
Support channel:	11 Channels
Modulation Skill:	DBPSK(1Mbps), DQPSK(2Mbps), CCK(5.5/11Mbps)
Antennas Type:	Dual PIFA Type in Metal made by Wistron NeWeb Corp.
Antenna Connected:	Connected to RF connector on the PCB of the 802.11b WLAN Adapter. The user is not possible to change the antenna without disassembling the notebook computer.
Antenna peak Gain:	2.33 dBi
Power Type:	5V DC from Notebook PC

The EUT is a Notebook PC built with a 2.4GHz WLAN module EM9-NB. This 2.4GHz WLAN module is a 802.11b WLAN Adapter, and its operation frequency is from 2412MHz to 2462MHz. DSSS modulation is used, and there are 11 channels for data communication. The data rate is 1Mbps(DBPSK), 2Mbps(DQPSK), 5.5Mbps(CCK),and 11Mbps(CCK). The channel and the operation frequency listed below:

Channel	Frequency(MHz)	Channel	Frequency(MHz)
01	2412	07	2442
02	2417	08	2447
03	2422	09	2452
04	2427	10	2457
05	2432	11	2462
06	2437		

1.3 Test Standards and Procedure

Test Specification: FCC Part 15 subpart C (Section 15.247) and subpart B and/or CISPR 22/EN55022, RSS210

Test Procedure: ANSI C63.4, CFR 47 Sec. 15.247, as detailed in Appendices

1.4 Frequency and Channel

Channel	Frequency (GHz)
1	2.412
2	2.417
3	2.422
4	2.427
5	2.432
6	2.437
7	2.442
8	2.447
9	2.452
10	2.457
11	2.462

Note: The operating frequencies are in 2.412 GHz to 2.462GHz. According to FCC Part 15 Sec. 15.31 (m), all the items as followed in this testing report are need to test three frequencies: top: channel 1; middle: channel 6; bottom: channel 11.

1.5 General Test Conditions

During the test, the EUT was set in high power and continuously transmitting mode that Controlled by notebook computer. The channel 1, 6, 11 of EUT were all tested.

2. Powerline Conducted Emissions [Section 15.207]

2.1 Configuration and Procedure

2.1.1 EUT Configuration

The conducted emission test setups are in accordance with Figs 9, 10(a) and 10(b) of ANSI C63.4-1992, CFR 47 Part 15 Subpart B; or EN55022: 1994/ A1: 1995/A2:1997; CISPR 22:1993/A1: 1995/A2: 1996.

The EUT was set up on the non-conductive table that is 1.0 by 1.5 meter, 80cm above ground. The wall of the shielded room was located 40cm to the rear of the EUT.

Power to the EUT was provided through the LISN. The impedance vs. frequency characteristic of the LISN is complied with the limit shown on the figure 1 of ANSI C63.4-1992.

Both lines (neutral and hot) were connected to the LISN in series at testing. A coaxial-type connector which provides one 50 ohms terminating impedance was provided for connecting the test instrument. The excess length of the power cord was folded back and forth at the center of the lead so as to form a bundle not exceeding 40cm in length.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

If the EUT is a Personal Computer or a peripheral of personal computer, and the personal computer has an auxiliary AC outlet which can be used for providing power to an external monitor, then all measurements will be made with the monitor power from first the computer-mounted AC outlet and then a floor-mounted AC outlet.

2.1.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. The main power line conducted EMI tests were run on the hot and neutral conductors of the power cord and the results were recorded. The effect of varying the position of the interface cables has been investigated to find the configuration that produces maximum emission.

At the frequencies where the peak values of the emissions were higher than 6dß below the applicable limits, the emissions were also measured with the quasi-peak detectors. At the frequencies where the quasi-peak values of the emissions were higher than 6dß below the applicable average limits, the emissions were also measured with the average detectors.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

2.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	150KHz--30MHz
Detector Function:	Quasi-Peak / Average Mode
Bandwidth (RBW):	9KHz

2.2 Test Data:

Table 2.2.1 Power Line Conducted Emissions (Hot) Channel 1, 6, 11

	Corrective Factor		Quasi-Peak		
Frequency (MHz)	LISN Loss (dB)	Cable Loss (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
0.90193,	0.47,	0.34,	39.50,	47.96,	-8.46
1.17488,	0.44,	0.35,	39.20,	47.96,	-8.76
1.63913,	0.44,	0.36,	39.36,	47.96,	-8.60
1.88463,	0.45,	0.37,	40.20,	47.96,	-7.76
2.00388,	0.45,	0.37,	38.45,	47.96,	-9.51
2.53196,	0.45,	0.40,	37.77,	47.96,	-10.19
2.87016,	0.45,	0.41, 3	7.48,	47.96,	-10.48
4.28883,	0.46,	0.47,	36.80,	47.96	-11.16
12.4208,	0.74,	0.59, 3	5.40,	47.96	-12.56
17.0709,	1.02,	0.64,	33.82,	47.96	-14.14

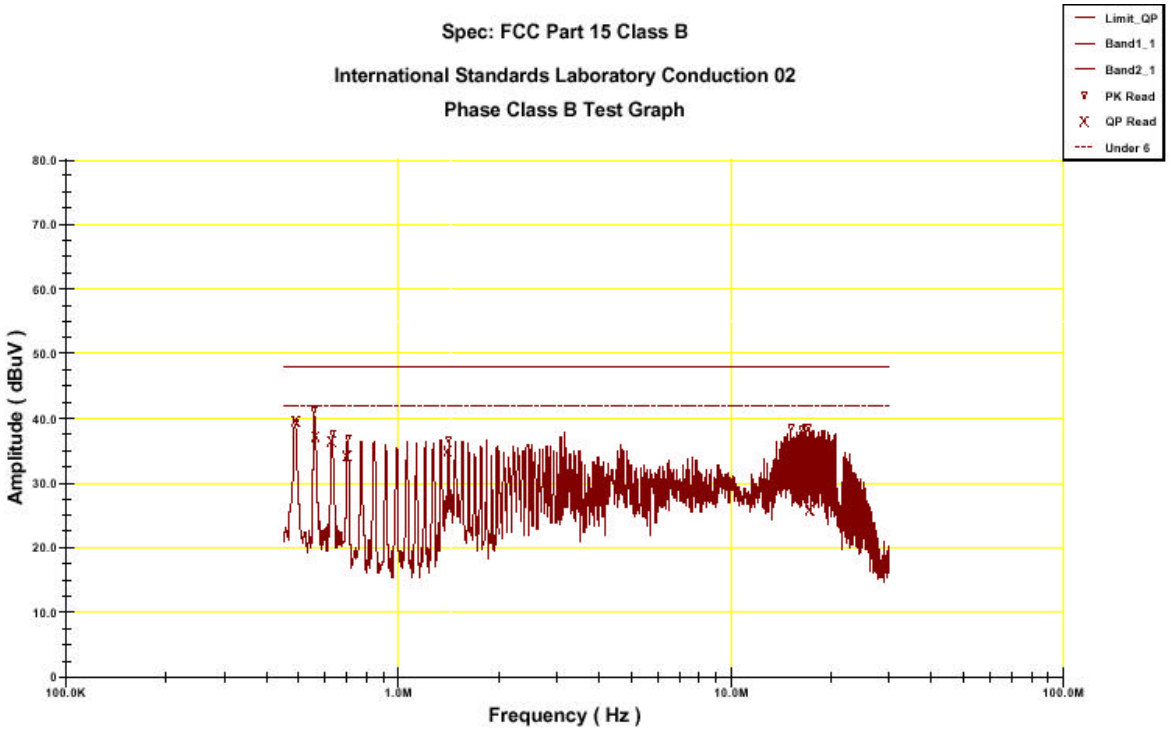
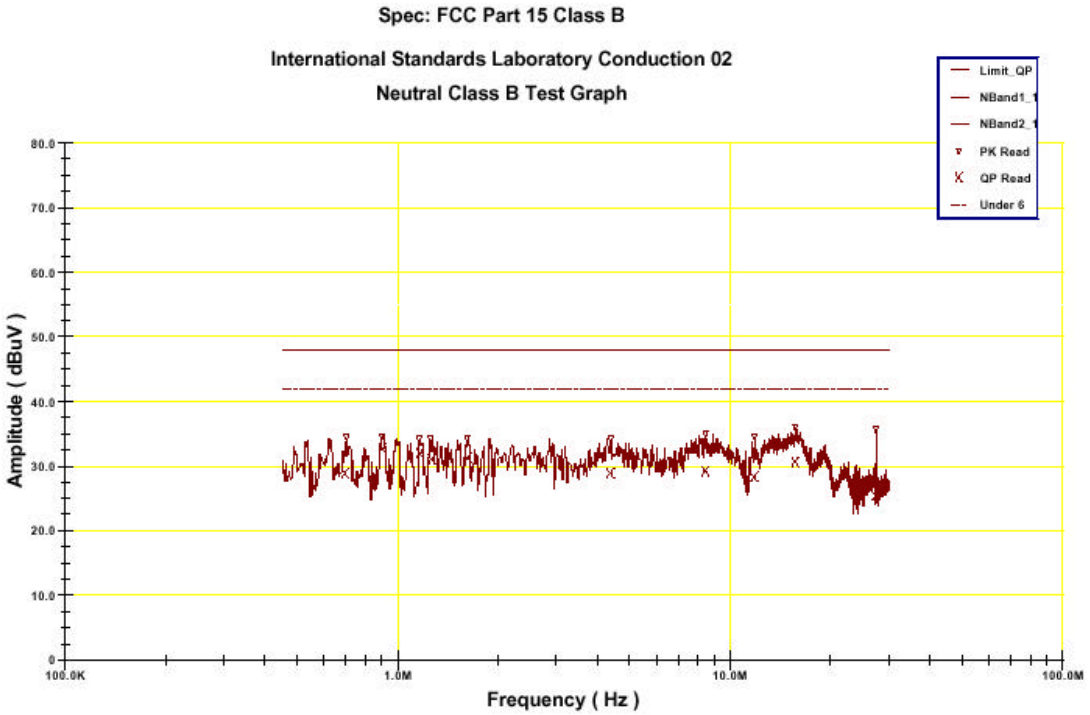


Table 2.2.2 Power Line Conducted Emissions (Neutral) Channel 1, 6, 11

	Corrective Factor		Quasi-Peak		
Frequency (MHz)	LISN Loss (dB)	Cable Loss (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
0.69565,	0.53,	0.33,	28.84,	47.96,	-19.12
0.90335,	0.45,	0.34,	32.61,	47.96,	-15.35
1.17021,	0.41,	0.35,	31.86,	47.96,	-16.10
1.26605,	0.41,	0.35,	30.96,	47.96,	-17.00
1.62473,	0.41,	0.36,	31.27,	47.96,	-16.69
4.3926,	0.44,	0.48,	28.79,	47.96	,-19.17
8.40602,	0.54,	0.54,	29.21,	47.96	,-18.75
11.8725,	0.67,	0.59,	28.38,	47.96	,-19.58
15.6921,	0.84,	0.63,	30.65,	47.96,	-17.31
27.3901,	1.37,	0.67,	25.51,	47.96,	-22.45



* NOTE: During the test, the EMI receiver was set to Max. Hold then switch the EUT Channel between 1 , 6, 11 to get the maximum reading of all these channels.
Margin = Amplitude + Insertion Loss- Limit
A margin of -8dB means that the emission is 8dB below the limit

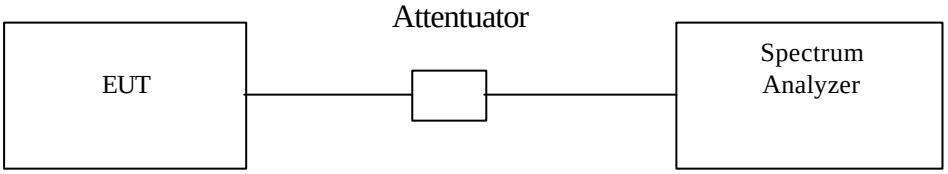
3. Bandwidth for DSSS [Section 15.247 (a)(2)]

3.1 Test Procedure

The Transmitter output of EUT was connected to the spectrum analyzer through an attenuator. The 6 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

Equipment mode: Spectrum analyzer
Detector function: Peak mode
RBW: 100KHz
VBW: 100KHz

3.2 Test Setup



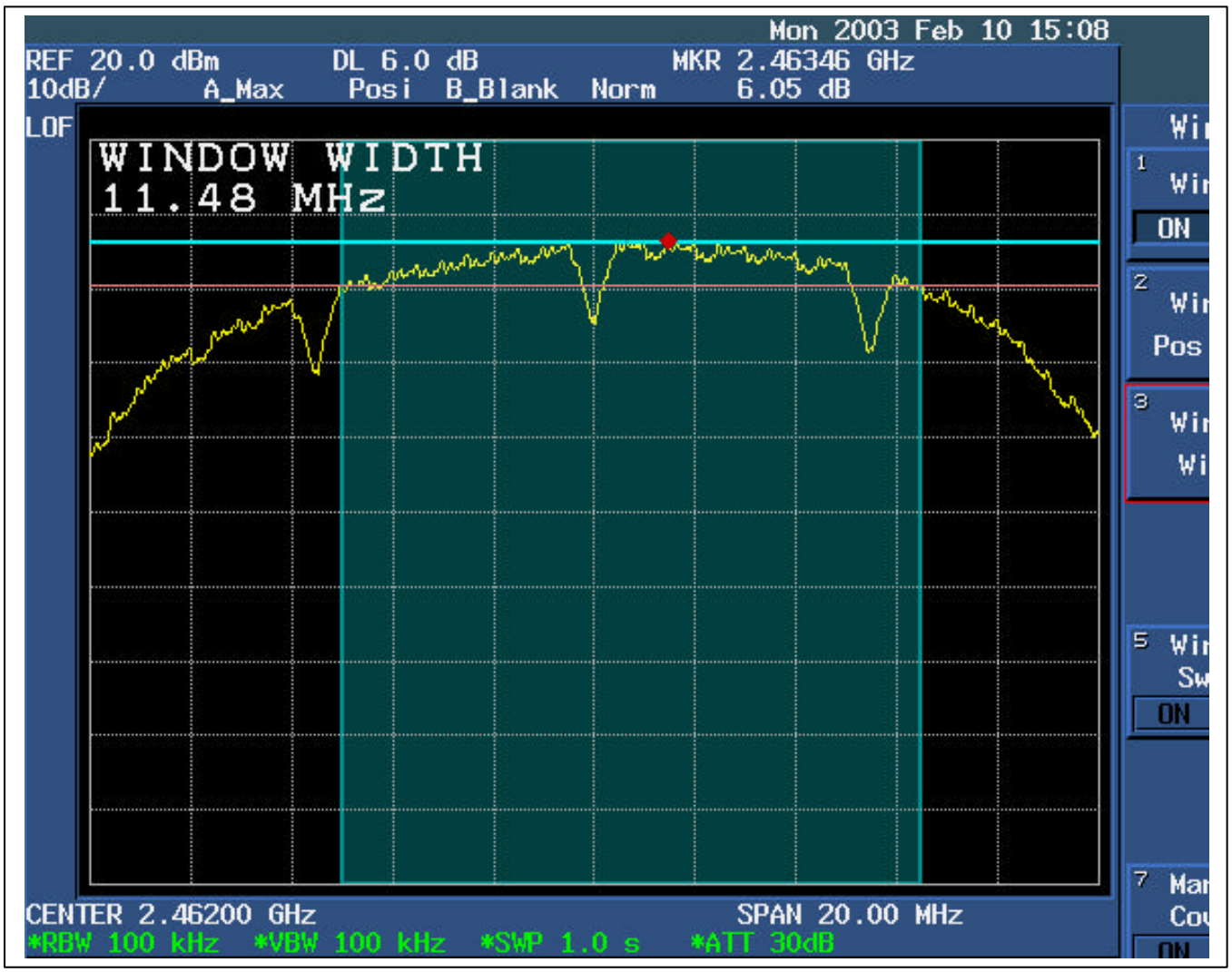
3.3 Test Data:

Table 3.3.1 6dB Bandwidth

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	11.52	0.5	Pass
6	2437	11.56	0.5	Pass
11	2462	11.48	0.5	Pass


Mon 2003 Feb 10 15:13
REF 20.0 dBm
DL 6.0 dB
MKR 2.41346 GHz
10dB/
A_View
Posi
B_Blank
Norm
5.95 dB
LOF
WINDOW WIDTH
11.52 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 2.41200 GHz
SPAN 20.00 MHz
*RBW 100 kHz
*VBW 100 kHz
*SWP 1.0 s
*ATT 30dB


Wed 2003 Feb 12 15:14
REF 20.0 dBm
DL 6.0 dB
MKR 2.43796 GHz
10dB/
A_View
Posi
B_Blank
Norm
6.01 dB
WINDOW WIDTH
11.56 MHz
Window
1 Window
ON
OFF
2 Window Position
3 Window Width
5 Window Sweep
ON
OFF
7 Marker Couple
ON
OFF
CENTER 2.43700 GHz
SPAN 20.00 MHz
*RBW 100 kHz
*VBW 100 kHz
*SWP 1.0 s
*ATT 30dB

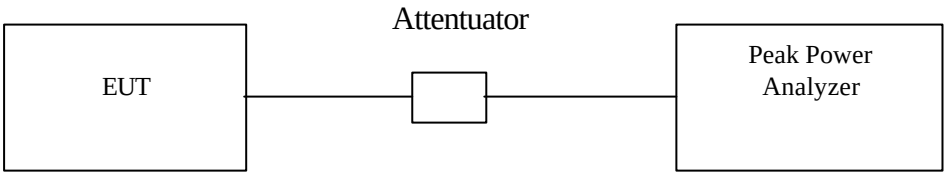

Mon 2003 Feb 10 15:08
REF 20.0 dBm
DL 6.0 dB
MKR 2.46346 GHz
10dB/
A_Max
Posi
B_Blank
Norm
6.05 dB
LOF
WINDOW WIDTH
11.48 MHz
CENTER 2.46200 GHz
SPAN 20.00 MHz
*RBW 100 kHz
*VBW 100 kHz
*SWP 1.0 s
*ATT 30dB
ON
ON

4. DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]

4.1 Test Procedure

1. The Transmitter output of EUT was connected to the peak power analyzer through an attenuator.

4.2 Test Setup



4.3 Test Data:

Table 4.3.1 Maximum Peak Output Power

Chennel	Frequency (MHz)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	50.35	17.02	30	Pass
6	2437	48.42	16.85	30	Pass
11	2462	50.69	17.05	30	Pass

5. RF Exposure Measurement [Section 15.247(b)(4) & 1.1307(b)(1) MPE]

Refer to SAR Test Report

6. Radiated Emission Measurement [Section [15.247(c)(4)]

6.1 EUT Configuration

The equipment under test was set up on the 10 meter chamber with measurement distance of 3 meters. The EUT was placed on a non-conductive table 80cm above ground.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

6.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. We found the maximum readings by varying the height of antenna and then rotating the turntable. Both polarization of antenna, horizontal and vertical, are measured.

30M to 1GHz: The highest emissions between 30 MHz to 1000 MHz were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission.

1GHz – 25GHz: The highest emissions were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in peak mode to determine the precise amplitude of the emission. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission. During test the EMI receiver and spectrum was setup according to para. 6.3.
For the test of 2^{nd} to 10^{th} harmonics frequencies , the equipment setup was also refer to para.6.3. The frequencies were tested using Peak mode first, if the test data is higher than the emissions limit, an additional measurement using Average mode will be performed and the average reading will be compared to the limit and record in test report.

6.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range Tested:	30MHz~1000MHz
Detector Function:	Quasi-Peak Mode
Resolution Bandwidth (RBW):	120KHz
Video Bandwidth (VBW)	1MHz

Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Peak Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	1MHz

Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Average Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	100 Hz

6.4 Test Data:.

Table 6.4.1 30M – 1GHz Open Field Radiated Emissions (Horizontal) Channel 1, 6, 11

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
360.77	15.68	14.52	3.57	0.00	33.77	46.00	-12.23	99.00	162.00
366.59	11.55	14.63	3.60	0.00	29.78	46.00	-16.22	99.00	355.00
399.57	14.84	15.58	3.80	0.00	34.22	46.00	-11.78	99.00	245.00
433.52	10.98	16.30	3.95	0.00	31.23	46.00	-14.77	99.00	52.00
715.79	14.20	19.29	5.24	0.00	38.74	46.00	-7.26	99.00	245.00
775.93	5.17	19.90	5.52	0.00	30.59	46.00	-15.41	99.00	272.00
833.16	3.38	20.23	5.74	0.00	29.36	46.00	-16.64	99.00	272.00
866.14	5.76	20.36	5.85	0.00	31.97	46.00	-14.03	99.00	272.00
898.15	8.11	20.40	5.96	0.00	34.47	46.00	-11.53	99.00	327.00

Table 6.4.2 30M – 1GHz Open Field Radiated Emissions (Vertical) Channel 1, 6, 11

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
360.77	15.54	14.52	3.57	0.00	33.62	46.00	-12.38	99.00	355.00
496.57	11.03	17.30	4.24	0.00	32.57	46.00	-13.43	99.00	135.00
499.48	10.91	17.30	4.26	0.00	32.47	46.00	-13.53	99.00	135.00
516.94	11.00	17.38	4.34	0.00	32.72	46.00	-13.28	99.00	217.00
540.22	8.73	18.41	4.44	0.00	31.58	46.00	-14.42	99.00	217.00
562.53	8.99	18.67	4.54	0.00	32.21	46.00	-13.79	99.00	25.00
626.55	7.86	19.00	4.84	0.00	31.70	46.00	-14.30	99.00	355.00
716.76	20.65	19.32	5.25	0.00	45.22	46.00	-0.78	99.00	217.00
720.64	19.10	19.42	5.27	0.00	43.78	46.00	-2.22	99.00	190.00

* NOTE:
During the test, the EUT was set to Channel 1 , 6, 11 respectively to get the maximum reading of all the critical emission frequencies.
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 30MHz to 1GHz have been tested

Table 6.4.7 1GHz~ 25GHz Open Field Radiated Emissions (Horizontal) Channel 1

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Position (°)
2037.5	62.52(pk)	30.10	3.50	48.32	47.80	54	-6.20	100	134
*2412.2	109.21(pk)	30.24	4.00	47.37	96.08	--	--	100	0
*2412.2	103.18(av)	30.24	4.00	47.37	90.58	--	--	100	0
4824.5	54.80(pk)	34.14	7.10	49.24	46.80	54	-7.2	100	5
7236	---	39.40	2.34	48.52	---	54	---		
9648	---	38.53	2.85	45.02	---	54	---		
12060	---	42.13	3.13	45.43	---	54	---		
14472	---	44.34	3.46	46.25	---	54	---		
16884	---	45.68	3.73	48.61	---	54	---		
19296	---	32.73	3.92	48.05	---	54	---		
21708	---	32.72	4.13	45.25	---	54	---		
24120	---	32.60	4.34	48.35	---	54	---		

Table 6.4.8 1GHz~25GHz Open Field Radiated Emissions (Vertical) Channel 1

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Position (°)
2037.4	60.02(pk)	30.10	3.50	48.32	45.30	54	-8.70	100	135
*2412.3	109.45(pk)	30.24	4.00	47.37	96.32	--	--	100	0
*2412.3	103.12(av)	30.24	4.00	47.37	89.99	--	--	100	0
4824.1	54.50(pk)	34.14	7.10	49.24	46.50	54	-7.5	100	4
7236	---	39.40	2.34	48.52	---	54	---		
9648	---	38.53	2.85	45.02	---	54	---		
12060	---	42.13	3.13	45.43	---	54	---		
14472	---	44.34	3.46	46.25	---	54	---		
16884	---	45.68	3.73	48.61	---	54	---		
19296	---	32.73	3.92	48.05	---	54	---		
21708	---	32.72	4.13	45.25	---	54	---		
24120	---	32.60	4.34	48.35	---	54	---		

Note: " * " : Fundamental Frequency

" pk": peak reading

"av": average reading

"---" : No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level + Correction Factor < Limit - 6 dB

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 1GHz to 25 GHz have been tested.

Table 6.4.9 1GHz~ 25GHz Open Field Radiated Emissions (Horizontal) Channel 6

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
2062.1	61.78(pk)	30.12	3.50	48.02	47.38	54	-6.62	100	130
*2437.0	109.27(pk)	30.22	4.12	47.50	95.99	--	--	100	2
*2437.0	103.42(av)	30.22	4.12	47.50	90.14	--	--	100	2
4874.5	54.53(pk)	34.14	7.10	49.24	46.53	54	-7.47	100	6
7311.0	---	39.51	2.35	48.50	---	54	---		
9748.0	---	38.82	2.87	45.03	---	54	---		
12185.0	---	42.57	3.15	45.45	---	54	---		
14622.0	---	44.72	3.47	46.27	---	54	---		
17059.0	---	45.82	3.75	48.60	---	54	---		
19496.0	---	32.81	3.95	48.02	---	54	---		
21933.0	---	32.69	4.16	45.28	---	54	---		
24370.0	---	32.95	4.35	48.38	---	54	---		

Table 6.4.10 1GHz~25GHz Open Field Radiated Emissions (Vertical) Channel 6

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
2062.0	61.72(pk)	30.12	3.50	48.02	47.32	54	-6.68	100	125
*2437.0	109.34(pk)	30.22	4.12	47.50	96.18	--	--	100	5
*2437.0	103.46(av)	30.22	4.12	47.50	90.30	--	--	100	5
4874.3	54.43(pk)	34.14	7.10	49.24	46.43	54	-7.57	100	10
7311.0	--	39.51	2.35	48.50	--	54	--		
9748.0	--	38.82	2.87	45.03	--	54	--		
12185.0	--	42.57	3.15	45.45	--	54	--		
14622.0	--	44.72	3.47	46.27	--	54	--		
17059.0	--	45.82	3.75	48.60	--	54	--		
19496.0	--	32.81	3.95	48.02	--	54	--		
21933.0	--	32.69	4.16	45.28	--	54	--		
24370.0	--	32.95	4.35	48.38	--	54	--		

Note: " * " : Fundamental Frequency

" pk": peak reading

"av": average reading

"---" : No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level + Correction Factor < Limit - 6 dB

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 1GHz to 25 GHz have been tested.

Table 6.4.11 1GHz~ 25GHz Open Field Radiated Emissions (Horizontal) Channel 11

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
2087.2	61.93(pk)	30.14	3.5	48.00	47.57	54	-6.43	100	133
*2462.0	109.26(pk)	30.22	4.2	47.70	95.98	--	--	100	6
*2462.0	103.23(av)	30.22	4.2	47.70	89.95	--	--	100	6
4924.4	54.03(pk)	34.3	7.3	49.26	46.37	54	-7.63	100	15
7386.0	---	39.60	2.38	48.34	---	54	---		
9848.0	---	38.91	2.90	44.95	---	54	---		
12310.0	---	42.75	3.17	45.83	---	54	---		
14772.0	---	44.94	3.51	46.34	---	54	---		
17234.0	---	46.53	3.79	48.43	---	54	---		
19696.0	---	32.85	3.97	47.85	---	54	---		
22158.0	---	32.66	4.19	45.56	---	54	---		
24620.0	---	33.25	4.38	48.42	---	54	---		

Table 6.4.12 1GHz~25GHz Open Field Radiated Emissions (Vertical) Channel 11

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
2087.4	61.90(pk)	30.14	3.5	48.00	47.54	54	-6.46	100	128
*2462.1	109.71(pk)	30.22	4.2	47.70	96.43	--	--	100	5
*2462.1	103.32(av)	30.22	4.2	47.70	90.04	--	--	100	5
4924.5	54.74(pk)	34.3	7.3	49.26	47.08	54	-6.92	100	12
7386.0	---	39.60	2.38	48.34	---	54	---		
9848.0	---	38.91	2.90	44.95	---	54	---		
12310.0	---	42.75	3.17	45.83	---	54	---		
14772.0	---	44.94	3.51	46.34	---	54	---		
17234.0	---	46.53	3.79	48.43	---	54	---		
19696.0	---	32.85	3.97	47.85	---	54	---		
22158.0	---	32.66	4.19	45.56	---	54	---		
24620.0	---	33.25	4.38	48.42	---	54	---		

Note: " * " : Fundamental Frequency

" pk": peak reading

"av": average reading

"---" : No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level + Correction Factor < Limit - 6 dB

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 1GHz to 25 GHz have been tested.

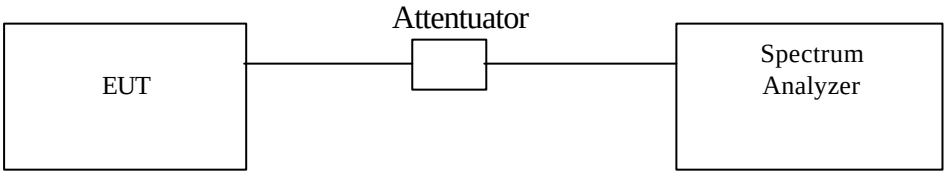
7. DSSS Peak Power Spectral Density [Section 15.247(d)]

7.1 Test Procedure

1. The Transmitter output of EUT was connected to the spectrum analyzer.
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN:1.5MHz
   RBW: 3KHz
   VBW: 30KHz
   Center frequency: fundamental frequency tested.
   Sweep time= 500 sec.
   Cable loss=0.5dB

2. Using Peak Search to read the peak power after Maximun Hold function is completed.

7.2 Test Setup

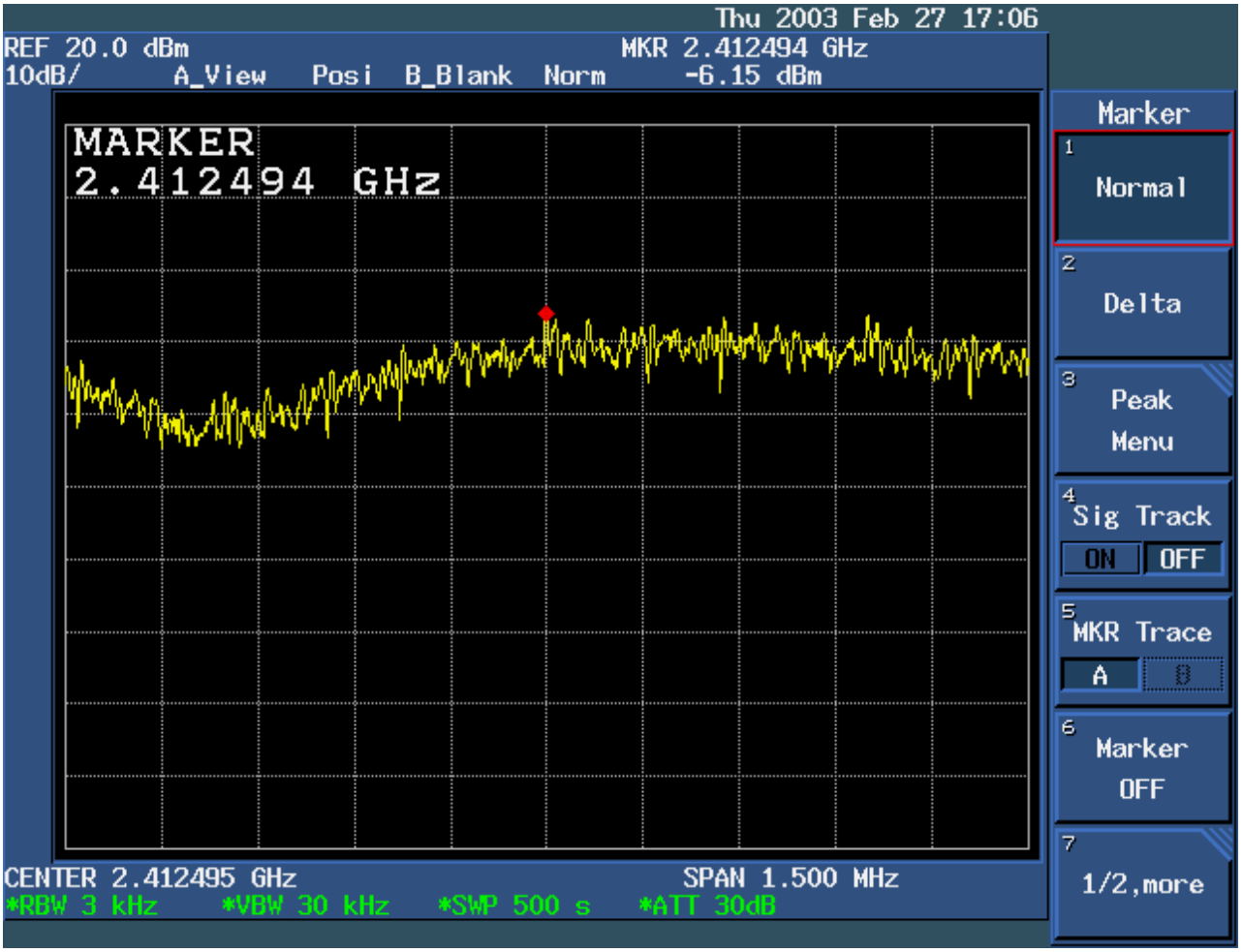


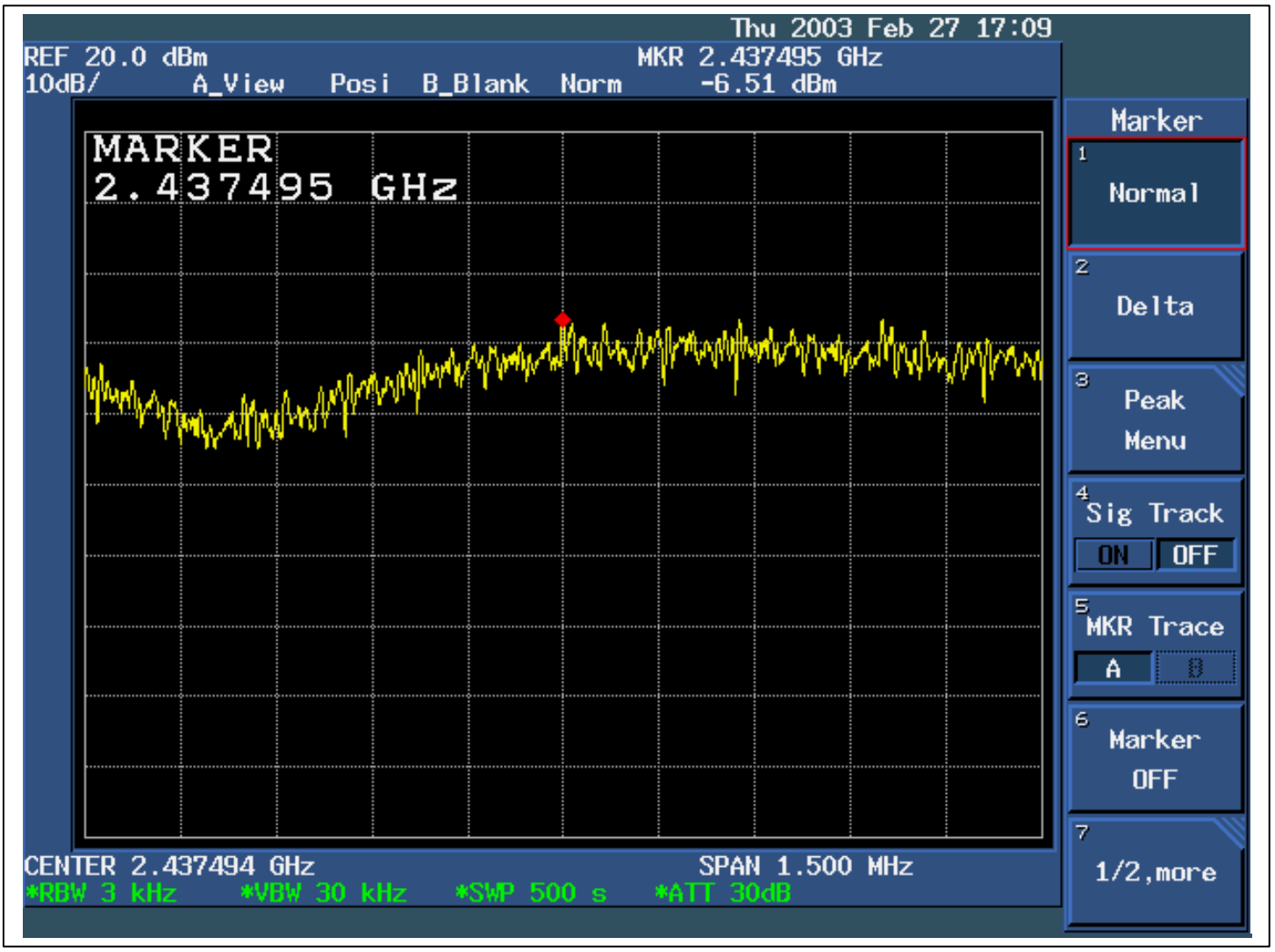
7.3 Test Data:

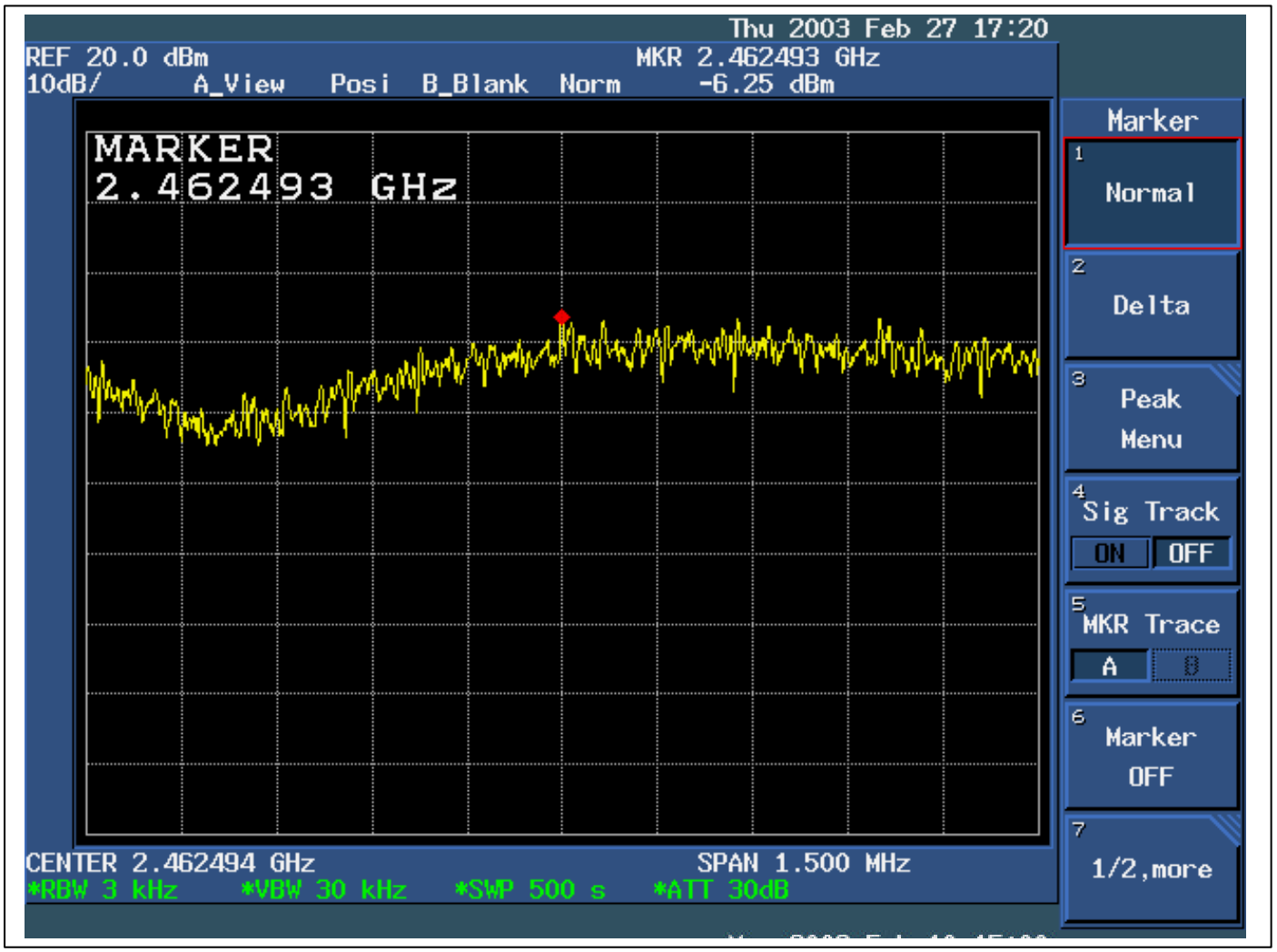
Table 7.3.1 Maxmum Peak Output Power Density

Chennel	Frequency (MHz)	Peak Power Output (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
1	2412.5	-5.65	8	Pass
6	2437.5	-6.01	8	Pass
11	2462.5	-5.75	8	Pass

@ Cable Lose=0.5dB


Thu 2003 Feb 27 17:06
REF 20.0 dBm
MKR 2.412494 GHz
10dB/ A_View Posi B_Blank Norm -6.15 dBm
MARKER
2.412494 GHz
Marker
1 Normal
2 Delta
3 Peak Menu
4 Sig Track ON OFF
5 MKR Trace A B
6 Marker OFF
7 1/2,more
CENTER 2.412495 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB


Thu 2003 Feb 27 17:09
REF 20.0 dBm
MKR 2.437495 GHz
10dB/ A_View Posi B_Blank Norm -6.51 dBm
MARKER
2.437495 GHz
Marker
1 Normal
2 Delta
3 Peak Menu
4 Sig Track ON OFF
5 MKR Trace A B
6 Marker OFF
7 1/2,more
CENTER 2.437494 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB


Thu 2003 Feb 27 17:20
REF 20.0 dBm
MKR 2.462493 GHz
10dB/ A_View Posi B_Blank Norm -6.25 dBm
MARKER
2.462493 GHz
Marker
1 Normal
2 Delta
3 Peak Menu
4 Sig Track
ON OFF
5 MKR Trace
A B
6 Marker OFF
7 1/2,more
CENTER 2.462494 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB

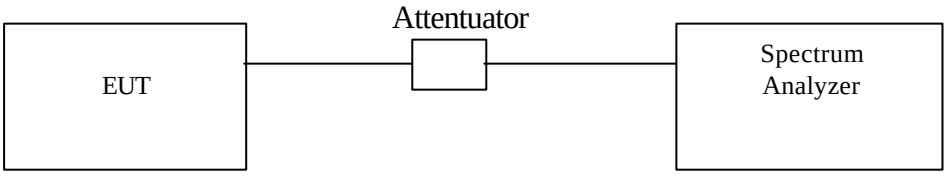
8. Band Edge Measurement

8.1 Test Procedure (Conducted)

1. The Transmitter output of EUT was connected to the spectrum analyzer.
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN: 100MHz
   RBW: 100KHz
   VBW: 100KHz
   Center frequency: 2.4GHz, 2.4835GHz.
   Sweep time= 1 sec.

2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.
3. Find the next peak frequency outside the operation frequency band.

8.2 Test Setup (Conducted)

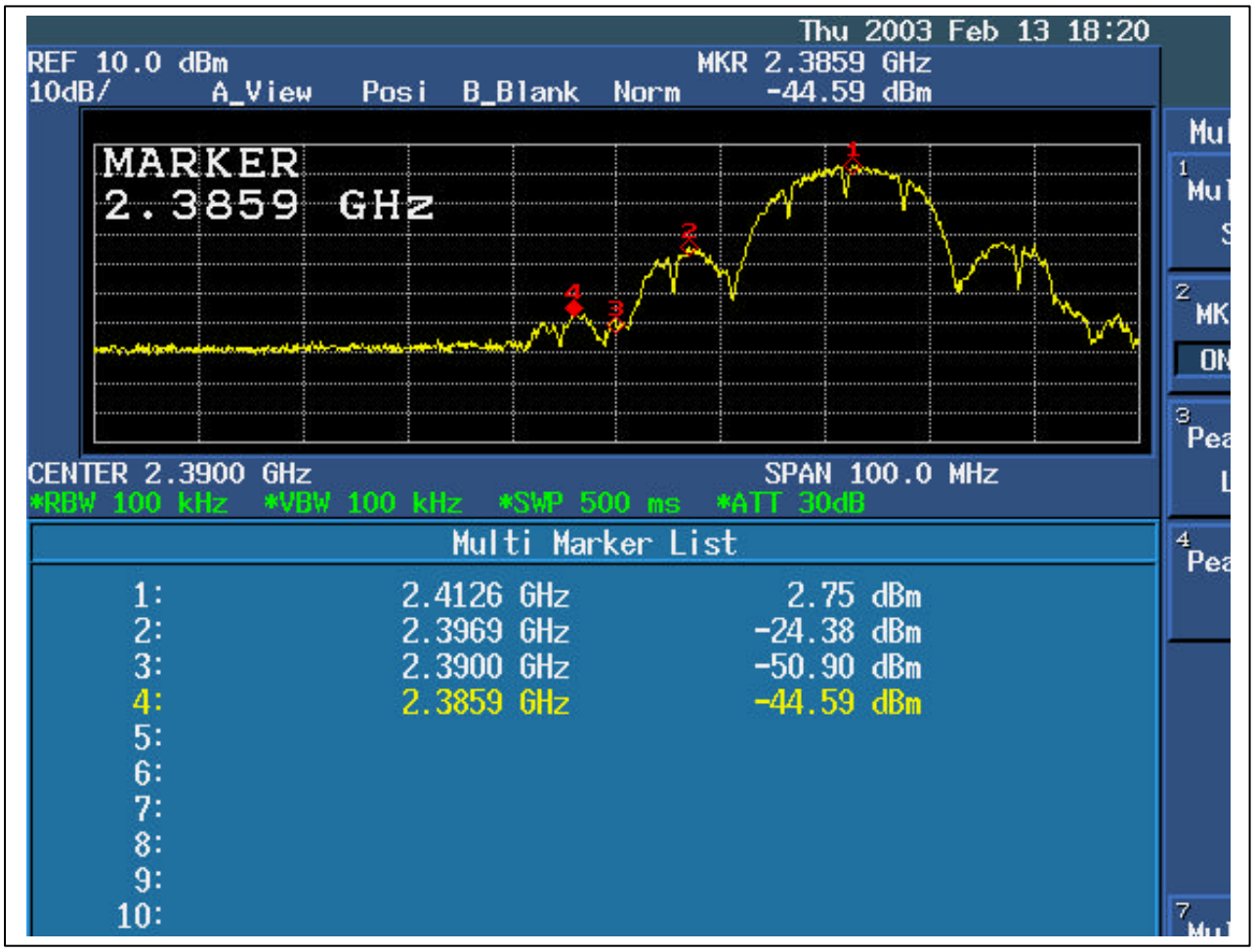


8.3 Test Data:

Table 8.3.1 Band Edge measurement (Conducted)

Channel	Frequency (MHz)	Spectrum Reading (dBm)	Carrier - Outsideband Limit: > 20dB (dB)	Pass/Fail
1	2412.6	2.75	---	
Outside band	2396.9	-24.38	27.13	Pass
11	2462.9	3.35	---	
Outside band	2476.9	-22.13	25.48	Pass

Band Edge Conducted measurement



Band Edge Conducted Measurement

8.4 Test Procedure (Radiated)

1. Antenna and Turntable test procedure same as Para. 6.2.
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN: 50MHz
   RBW: 100KHz
   VBW: 100KHz
   Center frequency: 2.395GHz, 2.48 GHz.
   Sweep time= 1 sec.

2. Using Peak Search to read the peak power of Carrier frequencies after Maximun Hold function is completed.
3. Find the next peak frequency outside the operation frequency band.

4. For peak frequency emission level measurement in Restricted Band ,
   Change RBW: 1MHz ,
   VBW: 100Hz,
   Sweep time: 5 Sec.
   Span: 50MHz.
5. Get the spectrum reading after Maximun Hold function is completed.

8.5 Test Setup (Radiated)

Same as para. 9.5.2

8.6 Test Data:

Table 8.3.1 Band Edge measurement (Radiated)

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit: > 20dB (dBC)	Limit (dBuV/m)	Equip. Setup VBW	Pass/Fai
1(peak mode)	2412.9	103.34	-13.12	90.22	---		100KHz	
Outside band	2396.9	76.97	-13.11	63.85	26.37	-----	100KHz	Pass
1(average mode)	2413.8	103.68	-13.12	90.56	---		100Hz	
Restricted band	2386.5	57.56	-13.11	44.45	-----	54	100Hz	Pass
11(peak mode)	2462.9	103.45	-13.28	89.77	----		100KHz	
Outside band	2477.0	76.98	-13.48	63.5	26.27	-----	100KHz	Pass
11(average mode)	2463.7	103.73	-13.28	90.35	----		100Hz	
Restricted band	2483.5	59.67	-13.48	46.19	-----	54	100Hz	Pass

Note: The Spectrum plot of emission level measurement in Restricted band is attached.

Emission Level = Spectrum Reading + Correction Factor

Correction Factor = Antenna Factor + cable loss – amplifier gain

Band Edge measurement for radiated emission in Restricted Band(Radiated)

Peak Mode (Channel 1)

Band Edge measurement for radiated emission in Restricted Band(Radiated)

Average Mode (Channel 1)

Band Edge measurement for radiated emission in Ristricted Band(Radiated)

Peak Mode (Channel 11)

Band Edge measurement for radiated emission in Ristricted Band(Radiated)

Average Mode (Channel 11)

9. Appendix

9.1 Appendix A: Measurement Procedure for Powerline Conducted Emissions

The EUT is set up in accordance with the suggested configuration given in ANSI C63.4-1992, CFR 47 Part 15 Subpart B; or EN55022: 1994/ A1: 1995/A2:1997; CISPR 22:1993/A1: 1995/A2: 1996 or AS/NZS 3548:1995 /A1:1997 /A2:1997. The measurements are performed in a 3.5m x 3.4m x 2.5m shielded room, which referred as Conduction 01 test site, or a 3m x 3m x 2.3m test site, which referred as Conduction 02 test site. The EUT was placed on non-conduction 1.0m x 1.5m table, which is 0.8 meters above an earth-grounded.

Power to the EUT was provided through the LISN which has the Impedance (50ohm/50uH) vs. Frequency Characteristic in accordance with the Figure 1 of the ANSI C63.4-1992 or CISPR16. Power to the LISNs were filtered to eliminate ambient signal interference and these filters were bonded to the ground plane. Peripheral equipment required to provide a functional system (support equipment) for EUT testing was powered from the second LISN through a ganged, metal power outlet box which is bonded to the ground plane at the LISN.

If the EUT is supplied with a flexible power cord, the power cord length in excess of the distance separating the EUT from the LISN shall be folded back and forth at the center of the lead so as to form a bundle not exceeding 40cm in length. If the EUT is provided with a permanently coiled power cord, bundling of the cord is not required. If the EUT is supplied without a power cord, the EUT shall be connected to the LISN by a power cord of the type specified by the manufacturer which shall not be longer than 1 meter. The excess power cord shall be bundled as described above. If a non-flexible power cord is provided with the EUT, it shall be cut to the length necessary to attach the EUT to the LISN and shall not be bundled.

The interconnecting cables were arranged and moved to get the maximum according to ANSI C63.4-1992, CFR 47 Part 15 Subpart B; or EN55022: 1994/ A1: 1995/A2:1997; CISPR 22:1993/A1: 1995/A2: 1996. Both the line of power cord, hot and neutral, were measured.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

9.2 Appendix B: Test Procedure for Radiated Emissions

Preliminary Measurements in the Anechoic Chamber

The radiated emissions are initially measured in the anechoic chamber at a measurement distance of 3 meters. Desktop EUT are placed on a wooden stand 0.8 meter in height. The measurement antenna is 3 meters from the EUT. The test setup in anechoic chamber is the same as open site. The turntable rotated 360°C. The antenna height is varied from 1-2.5m. The primary objective of the radiated measurements in the anechoic chamber is to identify the frequency spectrum in the absence of the electromagnetic environment existing on the open test site. The frequencies can then be pre-selected on the open test site to obtain the corresponding amplitude. The initial scan is made with the spectrum analyzer in automatic sweep mode. The spectrum peaks are then measured manually to determine the exact frequencies.

Measurements on the Open Site or 10m EMC Chamber

The radiated emissions test will then be repeated on the open site or 10m EMC chamber to measure the amplitudes accurately and without the multiple reflections existing in the shielded room. The EUT and support equipment are set up on the turntable of one of the 3 or 10 meter open field sites. Desktop EUT are set up on a wooden stand 0.8 meter above the ground.

For the initial measurements, the receiving antenna is varied from 1-4 meter height and is changed in the vertical plane from vertical to horizontal polarization at each frequency. Both reading are recorded with the quasi-peak detector with 120KHz bandwidth. For frequency between 30 MHz and 1000MHz, the reading is recorded with peak detector or quasi-peak detector. For frequency above 1 GHz, the reading is recorded with peak detector or average detector with 1 MHz bandwidth.

At the highest amplitudes observed, the EUT is rotated in the horizontal plane while changing the antenna polarization in the vertical plane to maximize the reading. The interconnecting cables were arranged and moved to get the maximum according to ANSI C63.4-1992, CFR 47 Part 15 Subpart B; or EN55022: 1994/ A1: 1995/A2:1997; CISPR 22:1993/A1: 1995/A2: 1996. Once the maximum reading is obtained, the antenna elevation and polarization will be varied between specified limits to maximize the readings.

9.3 Appendix C: Test Equipment

9.3.1 Test Equipment List

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction	Digital Hygro-Thermometer Conduct	MicroLife	HT-2126G	ISL-Conduction02	12/04/2002	12/04/2004
Conduction	50 Ohms Load Conduction 02	EMCO	N/A	ISL-50ohms conduction 02	11/21/2002	11/21/2003
Conduction	Coaxial Cable 1F-C2	Harbourindustries	RG400	1F-C2	06/03/2002	06/03/2003
Conduction	EMI Receiver 02	HP	85460A	3448A00183	08/21/2002	08/21/2003
Conduction	ISN T4	Schaffner	ISN T400	16593	08/20/2002	08/20/2004
Conduction	ISN T4 02	FCC	F-CMISN-CAT5	02003	12/17/2002	12/17/2003
Conduction	CISPR22 Voltage Probe	FCC	F-CVP-1	68	12/18/2002	12/18/2003
Conduction	Current Probe	Schaffner	SMZ 11	18030	01/09/2003	01/09/2004
Conduction	LISN 01	R&S	ESH2-Z5	890485/013	05/07/2002	05/07/2003
Conduction	LISN 04	EMCO	3810/2	9604-1429	12/17/2002	12/16/2003
Radiation	Digital Hygro-Thermometer Chmb 02	MicroLife	HT-2126G	Chmb 02	12/04/2002	12/04/2004
Radiation	Spectrum Analyzer 06	Advantest	R3162	91700295	09/25/2002	09/24/2003
Radiation	EMI Receiver 04	AFJ	ER 55CR	55390143233	10/28/2002	10/27/2003
Radiation	BILOG Antenna 08	Schaffner	CBL6112B	2756	06/04/2002	06/04/2003
Radiation	Coaxial Cable Chmb 02-10M	Belden	RG-8/U	Chmb 02-10M	10/03/2002	10/03/2003
Radiation	Microwave Cable Chmb 02 3M	HUBER+SUHNER AG.	Sucoflex 103	42731/3 & 42729/3	03/21/2002	03/21/2003
Rad. Above 1Ghz	Spectrum Analyzer 07	Advantest	R3182	110600649	10/17/2002	10/17/2003
Rad. Above 1Ghz	Horn Antenna 02	Com-Power	AH-118	10088	02/06/2003	02/05/2004
Rad. Above 1Ghz	Horn Antenna 04	Com-Power	AH-826	081-001	12/10/2002	12/09/2003
Rad. above 1Ghz	Horn Antenna 05	Com-Power	AH-640	100A	09/13/2001	09/13/2003
Rad. above 1Ghz	Microwave Cable Chmb 05	HUBER+SUHNER AG.	Sucoflex 103	42726/3 & 42727/3	09/11/2002	09/11/2003

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Rad. Above 1Ghz	Preamplifier 02	MITEQ	AFS44-00102650-40-10P-44	728229	05/07/2002	05/07/2003
Rad. Above 1Ghz	Preamplifier 09	MITEQ	AFS44-00102650-40-10P-44	858687	02/28/2002	02/28/2003
Rad. Above 1Ghz	Preamplifier 10	MITEQ	JS-26004000-27-5A	818471	02/28/2002	02/28/2004
Rad. Above 1Ghz	Signal Generator 03	Anritsu	MG3642A	6200162550	02/10/2003	02/09/2004
Rad. Above 1Ghz	Signal Generator 04	Anritsu	MG3692A	020311	02/06/2002	02/06/2004
Rad. Above 1Ghz	Peak Power Analyzer	HP	8990A	3621A01269	12/09/2002	12/09/2003
Rad. Above 1Ghz	Power Sensor Radar	HP	84815A	3318A01828	11/12/2001	11/12/2003

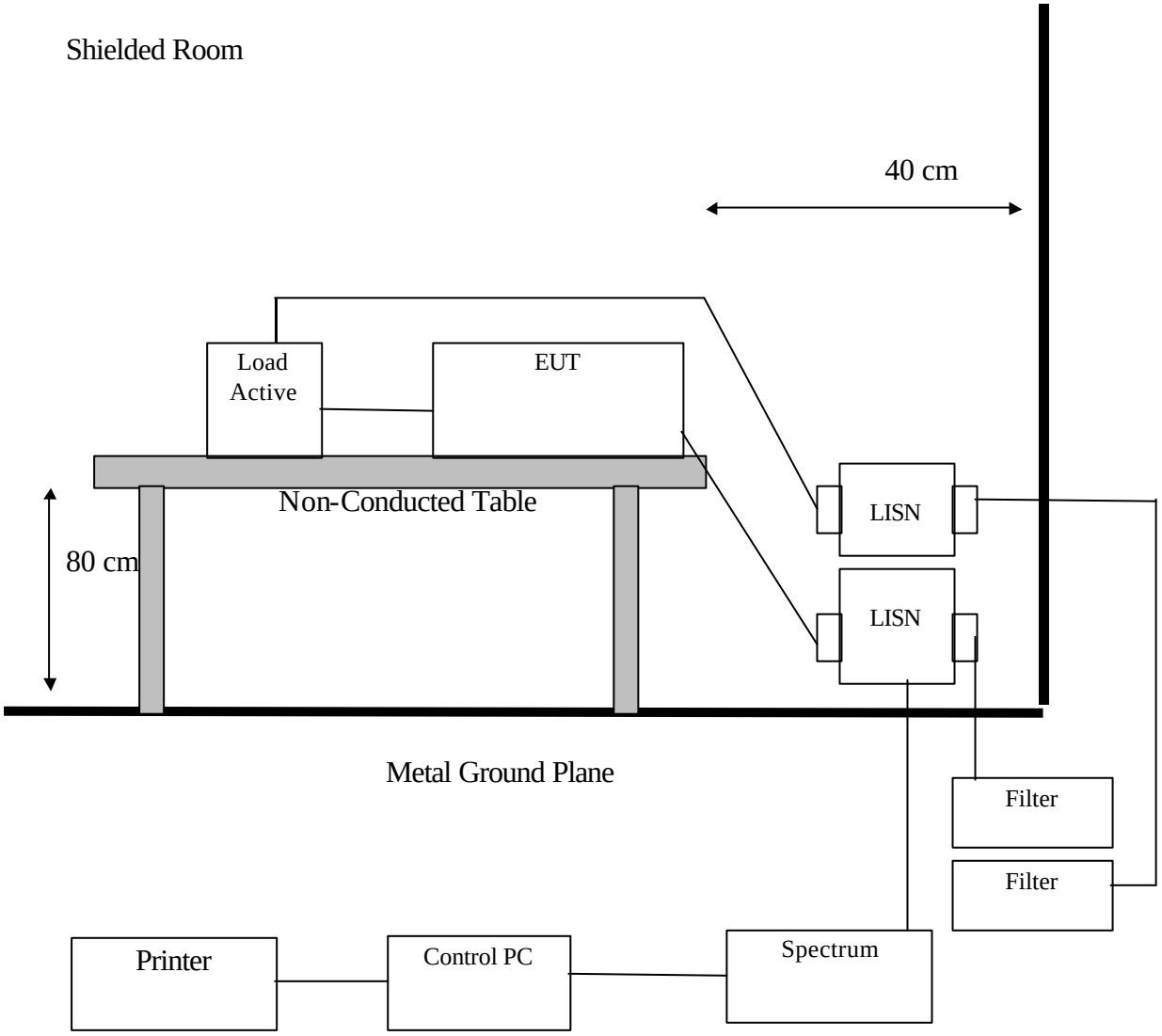
Note: Calibration traceable to NIST or national or international standards.

9.3.2 Software for Controlling Spectrum/Receiver and Calculating Test Data

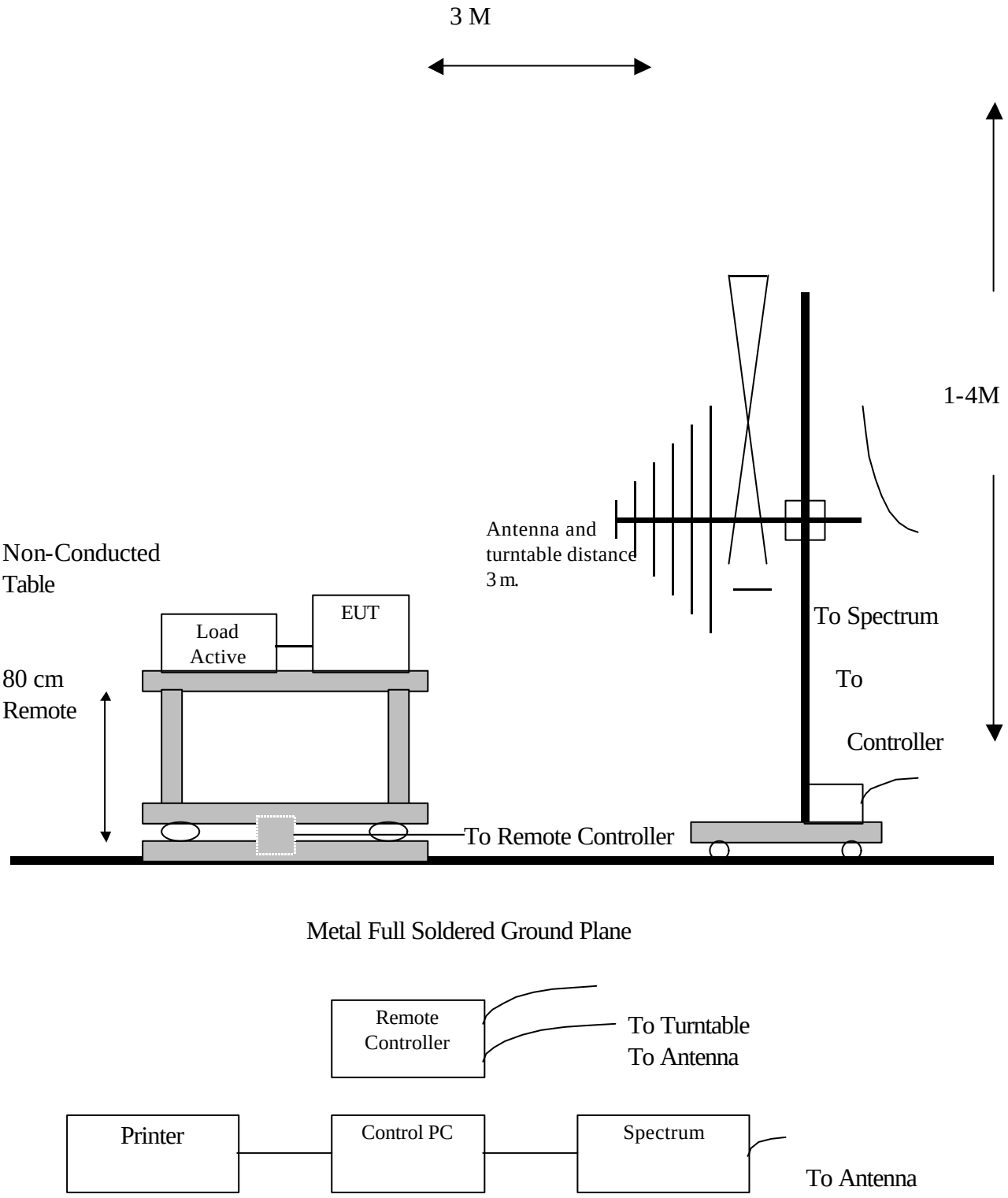
Radiation/Conduction	Filename	Version	Issued Date
Conduction	Tile.exe	1.12E	7/7/2000
Radiation	Tile.exe	1.12C	6/16/2000

9.4 Appendix D: Layout of EUT and Support Equipment

9.4.1 General Conducted Test Configuration



9.4.2 General Radiation Test Configuration



9.5 Appendix E: Description of Support Equipment

9.5.1 Description of Support Equipment

Support Unit 1.

Description:	Acer USB Keyboard
Model Number:	6511-UV
Serial Number:	N/A
Power Supply Type:	N/A
Power Cord:	N/A
FCC ID:	N/A (comply with FCC DOC)

Support Unit 2.

Description:	HP Printer (for parallel interface port)
Model Number:	C2642A
Serial Number:	TH84T1N3J3
Power Supply Type:	AC Adaptor (HP Model: C2175A)
Power Cord:	Non-shielded, Detachable
Data Cable:	Shielded, Detachable, With Metal Hood
FCC ID:	B94C2642X

Support Unit 3.

Description:	Acer USB Speaker
Model Number:	90.38H12.001
Serial Number:	401677
Power Supply Type:	N/A
Power Cord:	N/A
FCC ID:	(Comply with FCC DOC)

Support Unit 4.

Description:	SONY radio cassette player
Model Number:	WM-FX50
Serial Number:	N/A
Power Supply Type:	N/A
Power Cord:	N/A

Support Unit 5.

Description:	Logitech USB Mouse
Model Number:	M-u48a
Serial Number:	LZE02050204
Power Supply Type:	N/A
Power Cord:	N/A
FCC ID:	JNZ211360

Support Unit 6.

Description:	Acer Monitor
Model:	G781
Serial Number:	9990071012144004457T7AA31T
Power Cord:	Non-shielded, Detachable
FCC ID:	(Comply with FCC Standards)

9.5.2 Software for Controlling Support Unit

Test programs exercising various part of EUT were used. The programs were executed as follows:

A. Read and write to the disk drives.
B. Send H pattern to the parallel port device (Printer).
C. Send audio signal to the speaker.
D. Receive audio signal from walkman.
E. Send H pattern to the video port device (Monitor).
F. Repeat the above steps.

	Filename	Issued Date
Monitor	HH.bat	8/20/1991
Printer1	Wordpad.exe	11/11/1999

9.5.3 I/O Cable Condition of EUT and Support Units

Description	Path	Cable Length	Cable Type	Connector Type
AC Power Cord	110V (~240V) to AC Power Cord Inlet (3-pin)	1.8M	Nonshielded, Detachable	Plastic Head
Monitor Data Cable	Monitor to PC VGA port	1.6M	Shielded, Un-detachable	Metal Head
USB Mouse Data Cable	USB Mouse to PC USB port	1.8M	Shielded, Un-detachable	Metal Head
Audio-in Data Cable	Walkman to PC Line In Port	1.5M	Non-shielded, Detachable	Plastic Head
USB Speaker Data Cable	USB Speaker to PC USB port	1.5M	Shielded, Un-detachable	Metal Head
USB Speaker Data Cable	USB Speaker to PC Line out port	1.5M	Non-shielded, Un-detachable	Plastic Head
Printer Data Cable	Printer to PC Parallel port	1.5M	Shielded, Detachable	Metal Head
USB Keyboard Data Cable	USB Keyboard to PC USB port	1.8M	Shielded, Undetachable	Metal Head

9.6 Appendix F: Accuracy of Measurement

Test Site: Conduction 02

Item	Source of Uncertainty	Probability Distribution	Total Uncertainties (dB)		Standard Uncertainty (dB)	
1	Systematic Effects: (Assessment from 20 repeat observation; 1 reading on EUT)	Normal	k=2	0.104	k=1	0.052
2	Random Effects: (Assessment from 20 random observations; 1 reading on EUT)	Normal	k=2	0.330	k=1	0.165
3	Receiver Calibration	Rectangular	k=1.73	1.000	k=1	0.577
4	LISN Factor Calibration	Normal	k=2	1.200	k=1	0.600
5	Cable Loss Calibration	Normal	k=2	1.000	k=1	0.500
6	Combined Standard Uncertainty Uc(y)	Normal			k=1	0.850
7	**Total Uncertainty @95% mim. Confidence Level**	**Normal**	**k=2**	**1.701**		

Measurement Uncertainty Calculations:

Uc (y) = square root (u_1 (y)^2 + u_2 (y)^2 + ...+u_n (y)^2)
U = 2 * Uc (y)

Note: The measurement Uncertainties mentioned above also refer to NIS 81-1994 of NAMAS : The treatment of Uncertainty in EMC Measurement.

Test Site: Chamber 02-3M

Item	Source of Uncertainty	Probability Distribution	Total Uncertainties (dB)		Standard Uncertainty (dB)	
1	Systematic Effects: (Assessment from 20 repeat observation; 1 reading on EUT)	Normal	k=2	0.067	k=1	0.034
2	Random Effects: (Assessment from 20 random observations; 1 reading on EUT)	Normal	k=2	0.103	k=1	0.052
3	Receiver Calibration	Rectangular	k=1.73	1.000	k=1	0.577
4	Antenna Factor Calibration	Normal	k=2	1.700	k=1	0.850
5	Cable Loss Calibration	Normal	k=2	1.000	k=1	0.500
6	Combined Standard Uncertainty Uc(y)	Normal			k=1	1.029
7	**Total Uncertainty @95% mim. Confidence Level**	**Normal**	**k=2**	**2.059**		

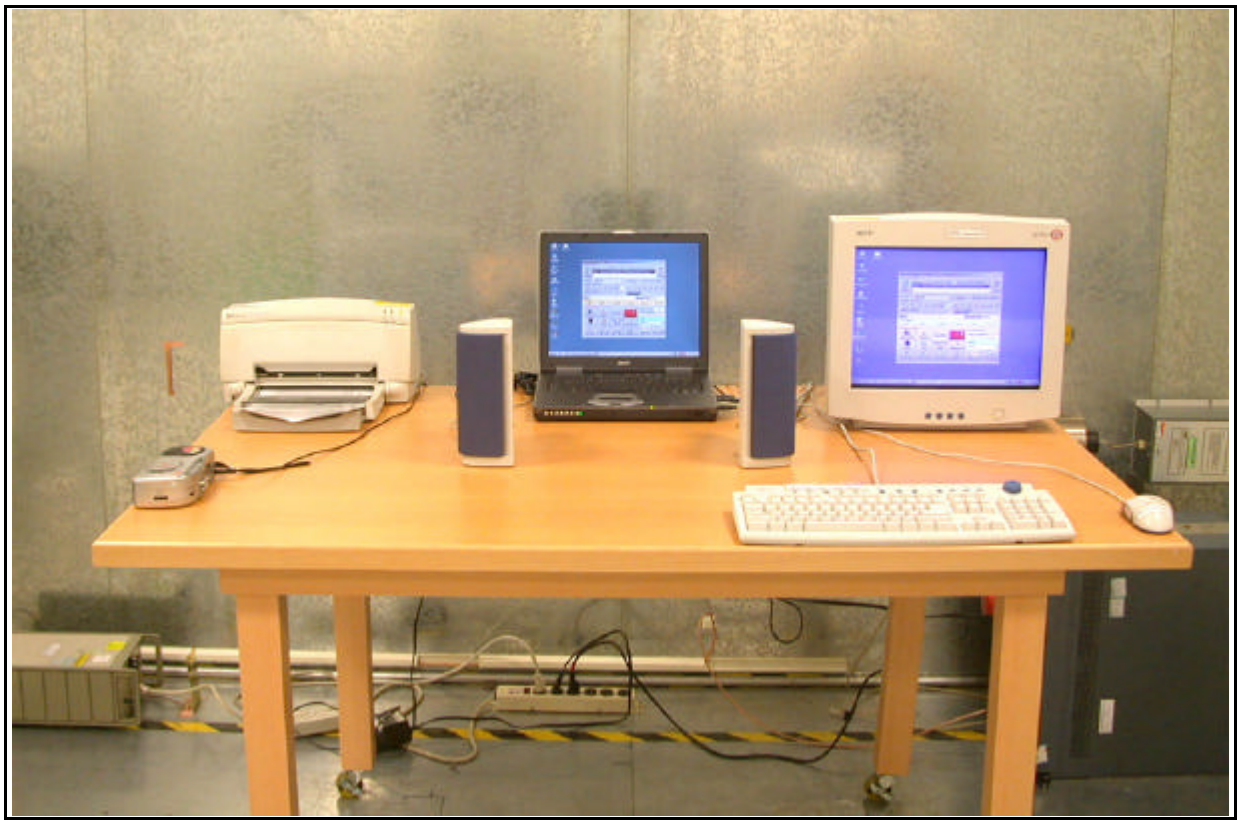
Measurement Uncertainty Calculations:

Uc (y) = square root (u_1 (y)^2 + u_2 (y)^2 + ...+u_n (y)^2)
U = 2 * Uc (y)

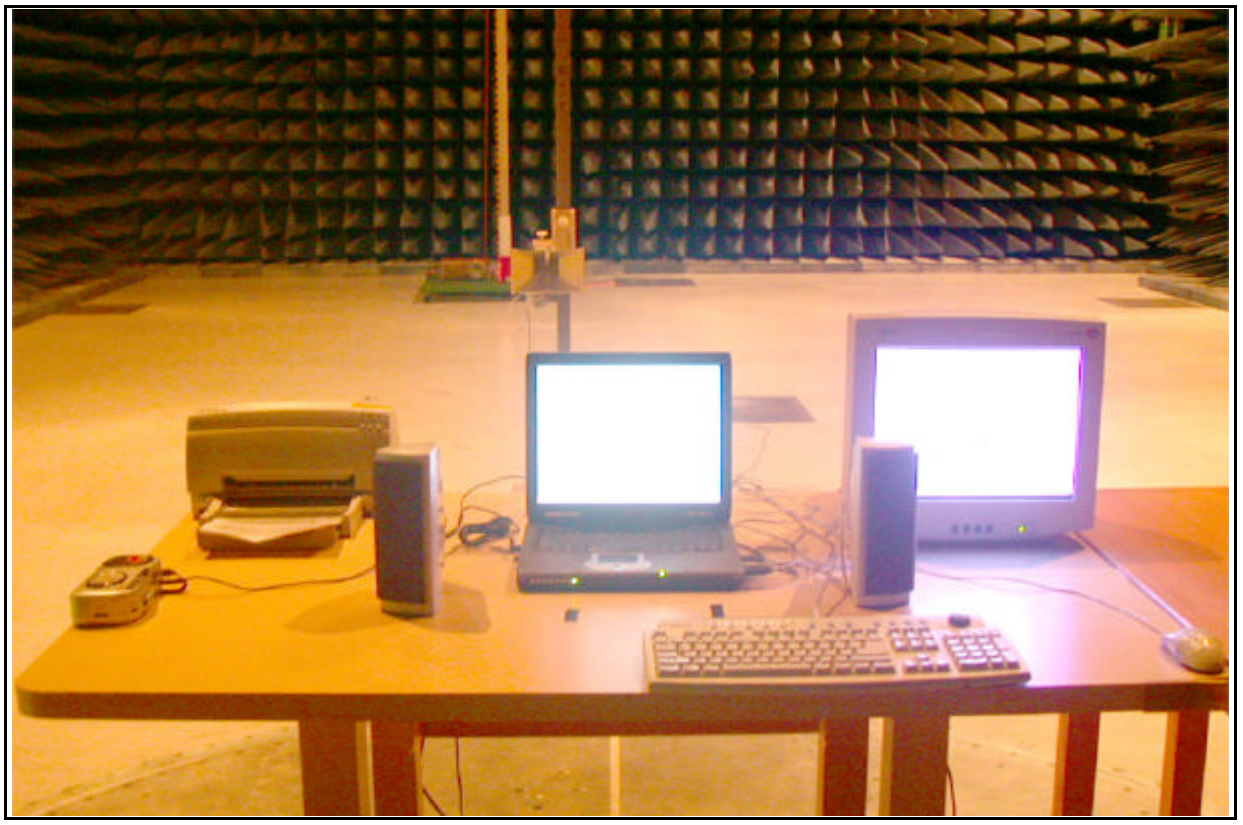
Note: The measurement Uncertainties mentioned above also refer to NIS 81-1994 of NAMAS : The treatment of Uncertainty in EMC Measurement.

9.7 Appendix G: Photographs of EUT Configuration Test Set Up

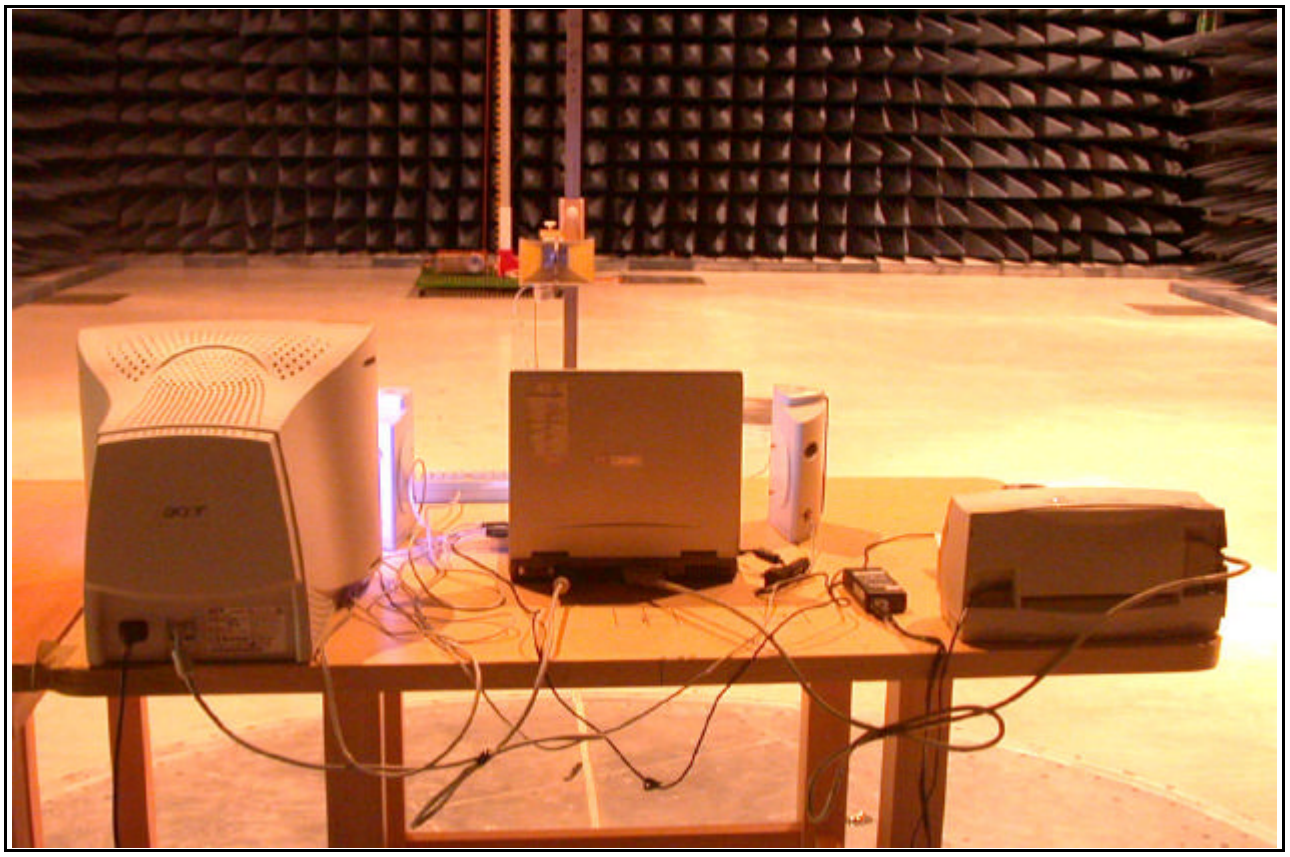
The Front View of Highest Conducted Set-up For EUT



The Front View of Highest Radiated Set-up For EUT



The Back View of Highest Radiated Set-up For EUT



9.8 *A*ppendix H: Antenna Spec.

Please refer to the attached file.