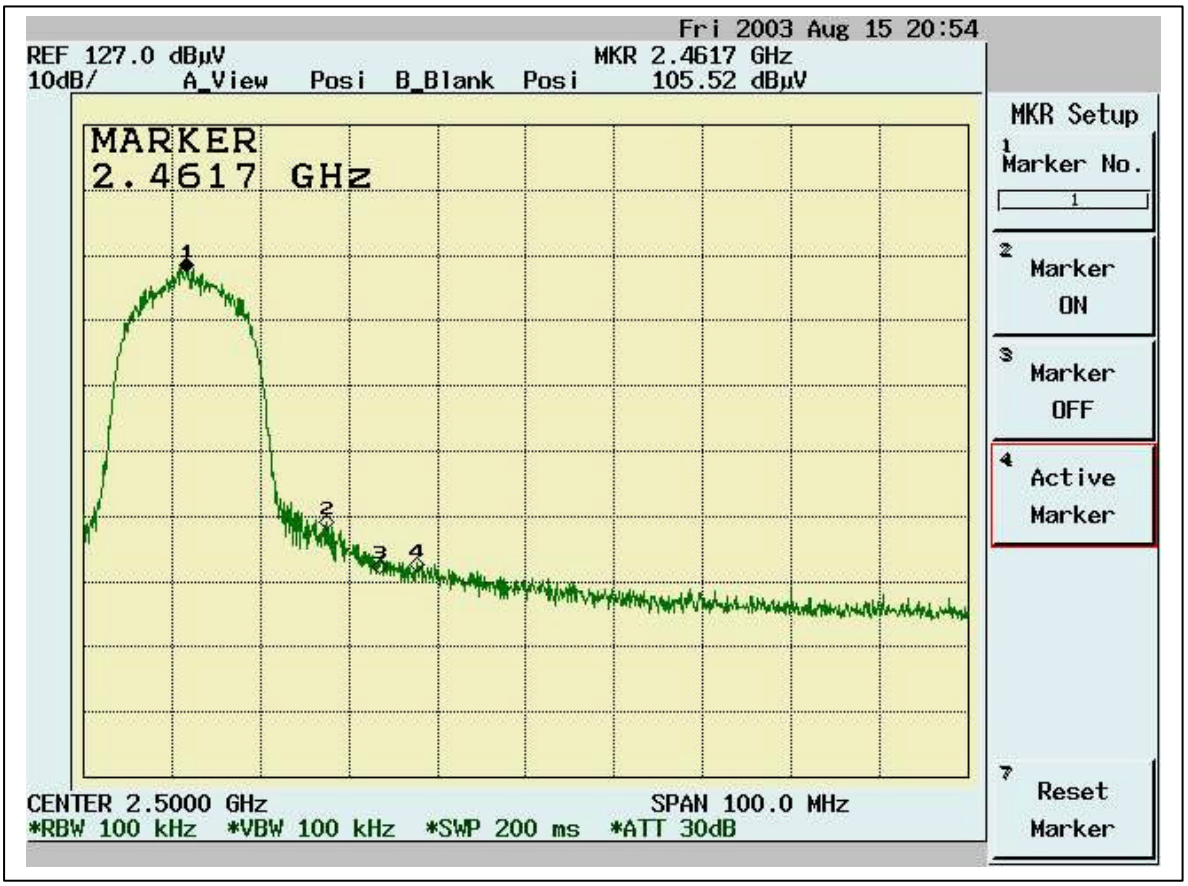
Band Edge Conducted Measurement



5.5.4 Test Procedure (Radiated)

1. Antenna and Turntable test procedure same as Radiated Emission Measurement.
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN: 100MHz
   RBW: 100KHz
   VBW: 100KHz
   Center frequency: 2.395GHz, 2.48 GHz.

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.

4. For peak frequency emission level measurement in Restricted Band ,
   Change RBW: 1MHz ,
   VBW: 10Hz,
   Span: 100MHz.
5. Get the spectrum reading after Maximum Hold function is completed.

5.5.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

5.5.6 Test Data:

Table 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 or Fail
1(peak mode)	2411.2	77.85	31.67	109.52	---	-----	100KHz	-----
Outside band	23999	51.25	31.67	82.92	26.60	-----	100KHz	Pass
1(average mode)	2412.7	73.29	31.67	104.96	---	-----	10Hz	-----
Restricted band	2390.0	19.99	31.67	51.66	-----	54	10Hz	Pass
11(peak mode)	2461.2	75.58	31.64	107.22	----	-----	100KHz	-----
Outside band	2474.6	50.13	31.64	81.77	25.45	-----	100KHz	Pass
11(average mode)	2462.7	72.01	31.64	103.65	----	-----	10Hz	-----
Restricted band	2483.5	19.09	31.64	50.73	-----	54	10Hz	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
Both Horizontal and Vertical polarization have been tested and
the worst data is listed above.

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 Restricted Band(Radiated)

Peak Mode (Channel 11)

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

Average Mode (Channel 11)

5.6 RF Exposure Measurement [Section 15.247(b)(4) & 1.1307(b)]

5.6.1 Applied Standards

FCC 47 CFR Part 15 Section 15.247(b)(5) & Part 1 Section 1.1307(b)(1)

5.6.2 Limits for Maximum Permissible Exposure (MPE)

A. Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (S) (mW/cm2)	Averagine Time (Minutes)
300-1500	----	-----	f/300	6
1500-100,000	----	-----	5	6

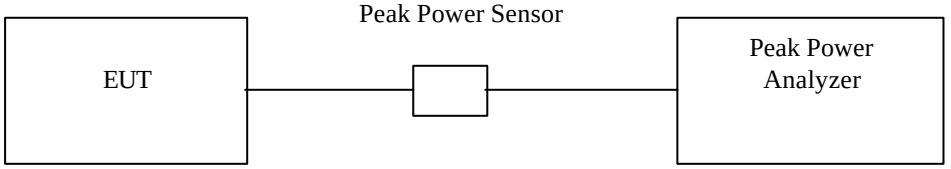
B. Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (S) (mW/cm2)	Averagine Time (Minutes)
300-1500	----	-----	f/1500	30
1500-100,000	----	-----	1.0	30

5.6.3 Test Procedure

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

5.6.4 Test Setup



5.6.5 Test Data:

Table Maximum Peak Output Power

Chennel	Frequency (MHz)	Peak Power Output (mW)	Peak Power Output (dBm)
1	2412	34.261	15.348
6	2437	156.96	21.958
11	2462	31.996	15.051

5.6.6 RF Exposure Calculations:

From FCC 1.1310, the maximum permissible RF exposure for an uncontrolled environment is 1 mW/cm2.

The Minimum Allowable Distance ,R, of EUT is calculated as follows:

Friis Transmission Formula: $Pd = (Pout*G)/(4* ð*R^2)$

$R= [(Pout*G)/(4* ð*Pd)]^{1/2}$

Where Pd = power density in mW/cm^2 = $1mW/ cm^2$
Maxmium Peak Gain at 2.4GHz: (refer to antenna spec.)
G = antenna numeric gain = Log^{-1}(dB gain/10)
Pout = output power to antenna in mW (Refer to table 4.3.1)
ð = 3.1416

Since the host equipment is a notebook computer, the normal use distance is more than 20cm, the suitable standard for RF exposure is §1.1307(b)(1) MPE test. According to the result of 4.3.1, the calculated minimum allowance distance of EUT is listed below:

Table 5.2.1 MPE Minimum Allowance Distance of EUT

Channel	Frequency (MHz)	Maximum output power (mW)	Minimum Allowance Distance (cm)
1	2412	34.261	1.715
7	2442	156.96	3.670
11	2462	31.996	1.657

Note: Antenna gain=0.33dBi

The minimum allowable distance is very close to the enclosure of the antenna and also very far away from the human being under normal use condition. So, the RF exposure warning or SAR Measurement is not needed.

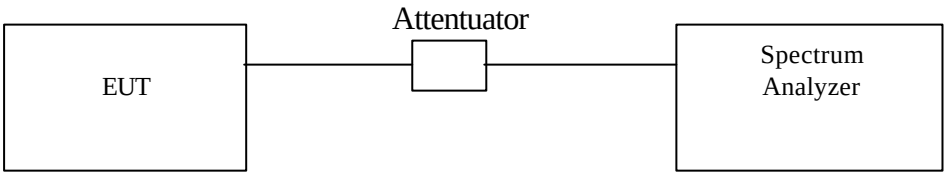
5.7 DSSS Peak Power Spectral Density [Section 15.247(d)]

5.7.1 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=1.13dB

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

5.7.2 Test Setup

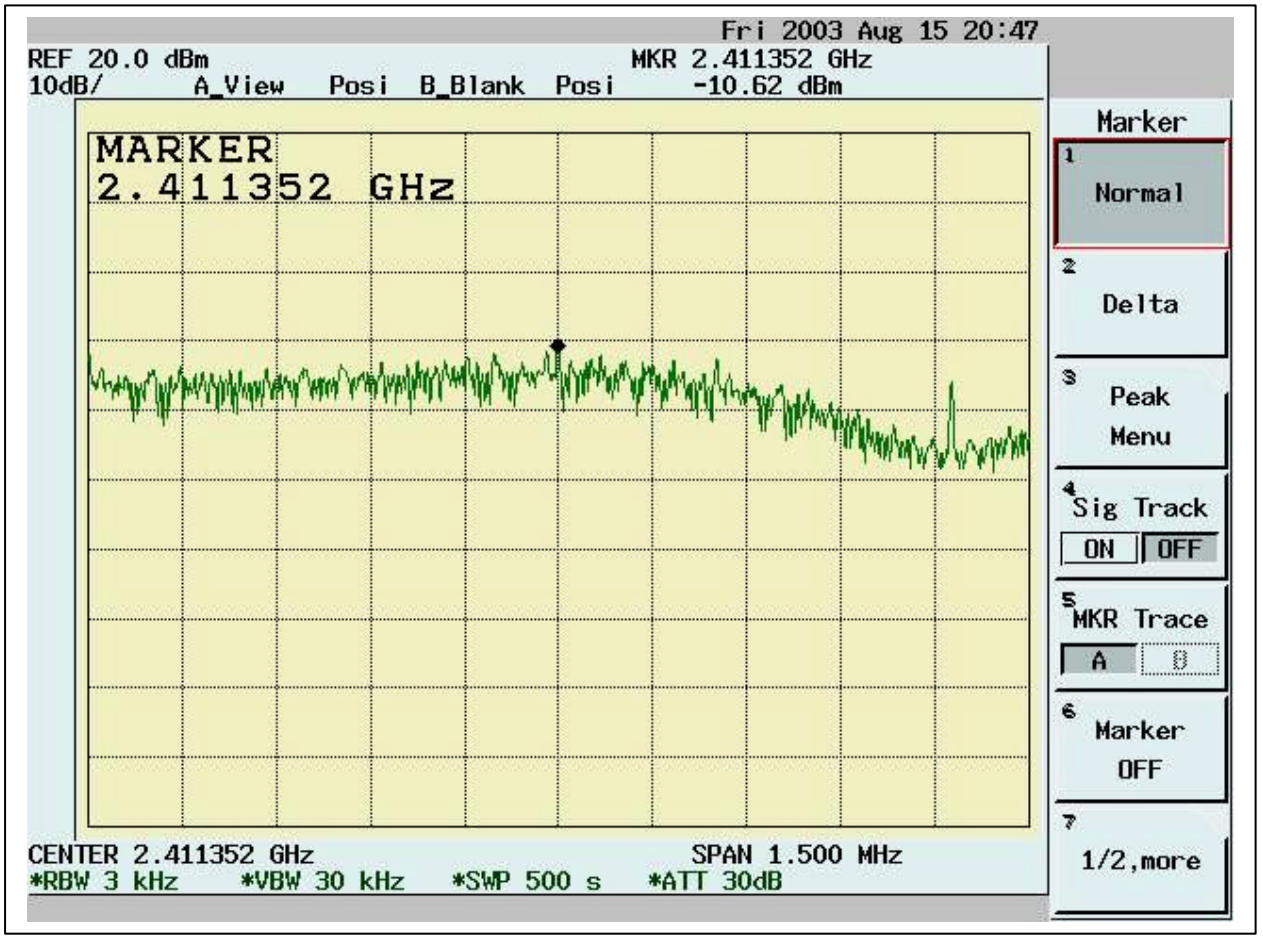


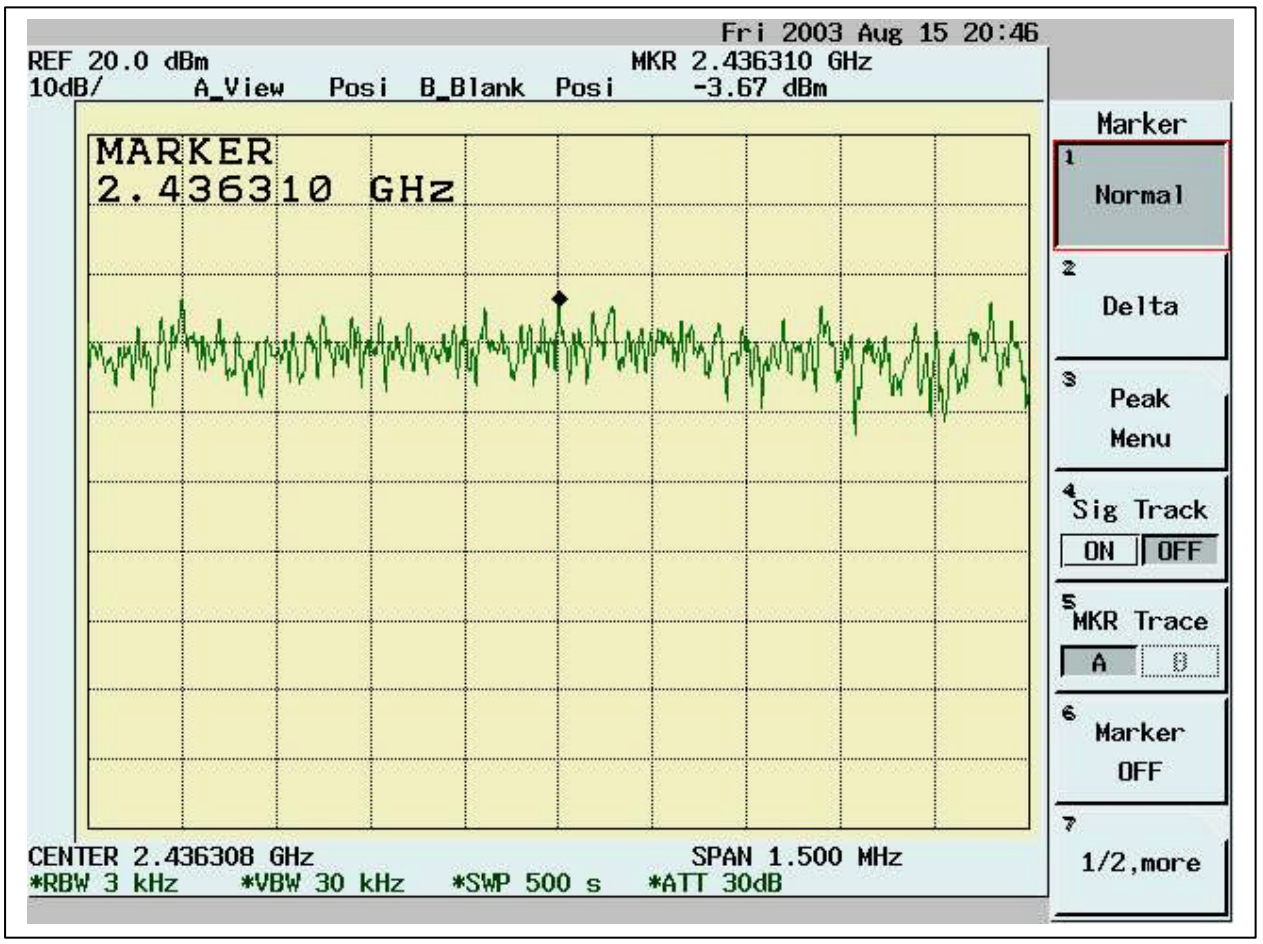
5.7.3 Test Data:

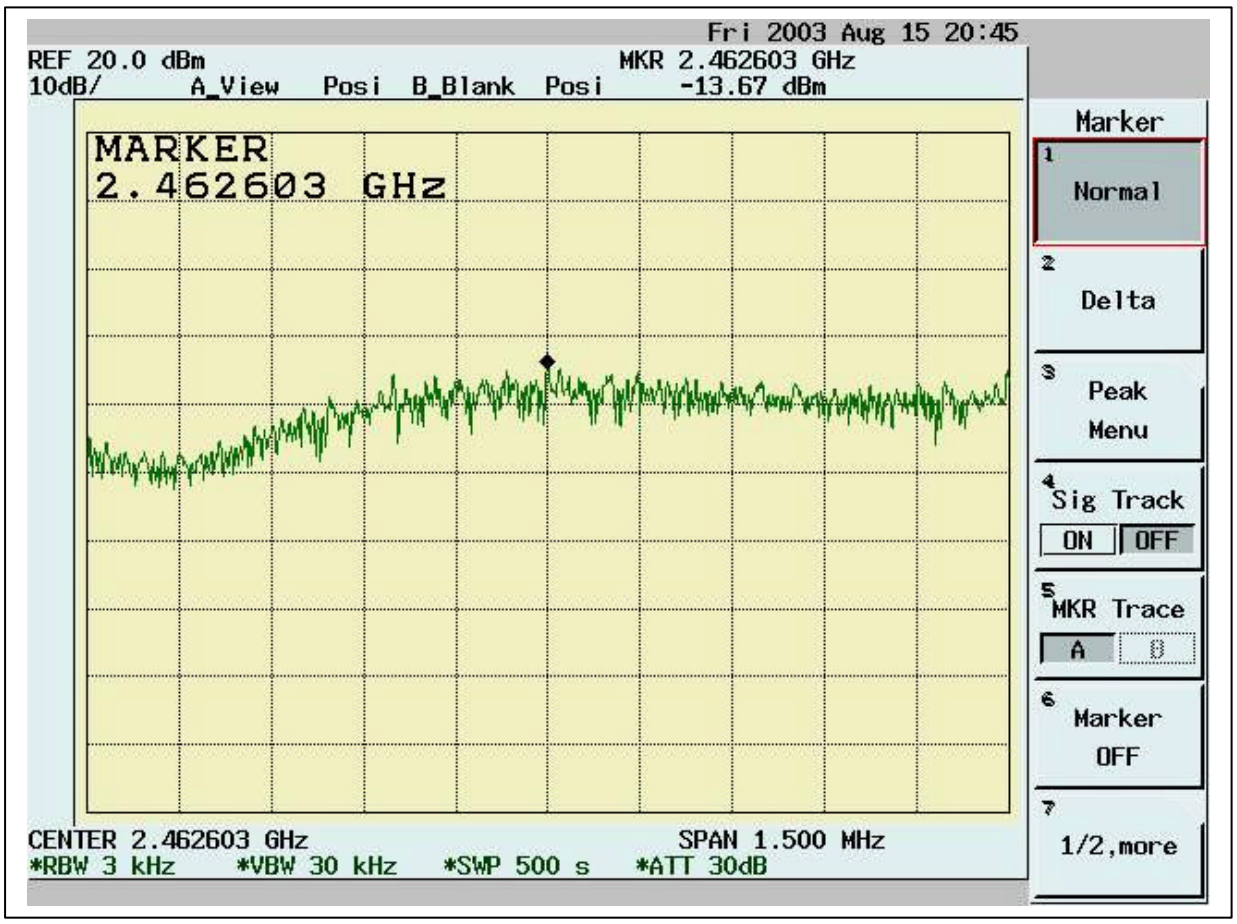
Table Maximum Peak Output Power Density

Chennel	Frequency (MHz)	Peak Power Output (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
1	2412	-9.49	8	Pass
6	2437	-2.54	8	Pass
11	2462	-12.54	8	Pass

Cable loss=1.13dB


Fri 2003 Aug 15 20:47
REF 20.0 dBm
10dB/ A_View Posi B_Blank Posi
MKR 2.411352 GHz
-10.62 dBm
MARKER
2.411352 GHz
CENTER 2.411352 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB
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


Fri 2003 Aug 15 20:46
REF 20.0 dBm
MKR 2.436310 GHz
10dB/ A_View Posi B_Blank Posi -3.67 dBm
MARKER
2.436310 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 2.436308 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB


Fri 2003 Aug 15 20:45
REF 20.0 dBm
10dB/
A_View
Posi
B_Blank
Posi
MKR 2.462603 GHz
-13.67 dBm
MARKER
2.462603 GHz
CENTER 2.462603 GHz
SPAN 1.500 MHz
*RBW 3 kHz
*VBW 30 kHz
*SWP 500 s
*ATT 30dB
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

6. Appendix

6.1 Appendix A: Measurement Procedure for Powerline Conducted Emissions

The EUT is set up in accordance with the suggested configuration given in ANSI C63.4-2001, CFR 47 Part 15 Subpart B; or EN55022:1994/ A1:1995/A2:1997; CISPR 22:1993/A1:1995/A2:1996. 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 C63.4-2001 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 C63.4-2001, 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.

6.2 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 C63.4-2001, 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.

6.3 Appendix C: Test Equipment

6.3.1 Test Equipment List

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
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	06/03/2003	06/03/2004
Conduction	Digital Hygro-Thermometer Conduct	MicroLife	HT-2126G	ISL-Conduction02	12/16/2001	12/16/2003
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	LISN 01	R&S	ESH2-Z5	890485/013	05/07/2003	05/07/2004
Conduction	LISN 03	R&S	ESH3-Z5 831.5518.52	828874/D10	10/31/2002	10/31/2003
Radiation	Spectrum Analyzer 06	Advantest	R3162	91700295	09/25/2002	09/24/2003
Radiation	EMI Receiver 05	AFJ	ER 55CR	55390143234	11/07/2002	11/07/2003
Radiation	BILOG Antenna 08	Schaffner	CBL6112B	2756	06/04/2003	06/04/2004
Radiation	Microwave Cable Chmb 02 3M	HUBER+SUHNER AG.	Sucoflex 103	42731/3 & 42729/3	03/21/2003	03/21/2004
Radiation	Coaxial Cable Chmb 02-10M	Belden	RG-8/U	Chmb 02-10M	01/14/2003	01/14/2004
Radiation	Digital Hygro-Thermometer Chmb 02	MicroLife	HT-2126G	Chmb 02	02/07/2003	02/07/2004
Rad. Above 1Ghz	Horn Antenna 02	Com-Power	AH-118	10088	02/25/2003	02/25/2004
Rad. Above 1Ghz	Horn Antenna 04	Com-Power	AH-826	081-001	10/17/2002	10/17/2003
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
Rad. Above 1Ghz	Preamplifier 02	MITEQ	AFS44-00102650-40-10P-44	728229	05/07/2003	05/07/2004
Rad. Above 1Ghz	Preamplifier 09	MITEQ	AFS44-00102650-40-10P-44	858687	02/28/2003	02/28/2004

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
RF	Peak Power Analyzer	HP	8990A	3621A01269	09/12/2002	09/12/2003
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	02/05/2003	02/05/2004
Rad. Above 1Ghz	Signal Generator 04	Anritsu	MG3692A	020311	02/06/2002	02/06/2004
Rad. Above 1Ghz	Spectrum Analyzer 07	Advantest	R3182	110600649	10/17/2002	10/17/2003

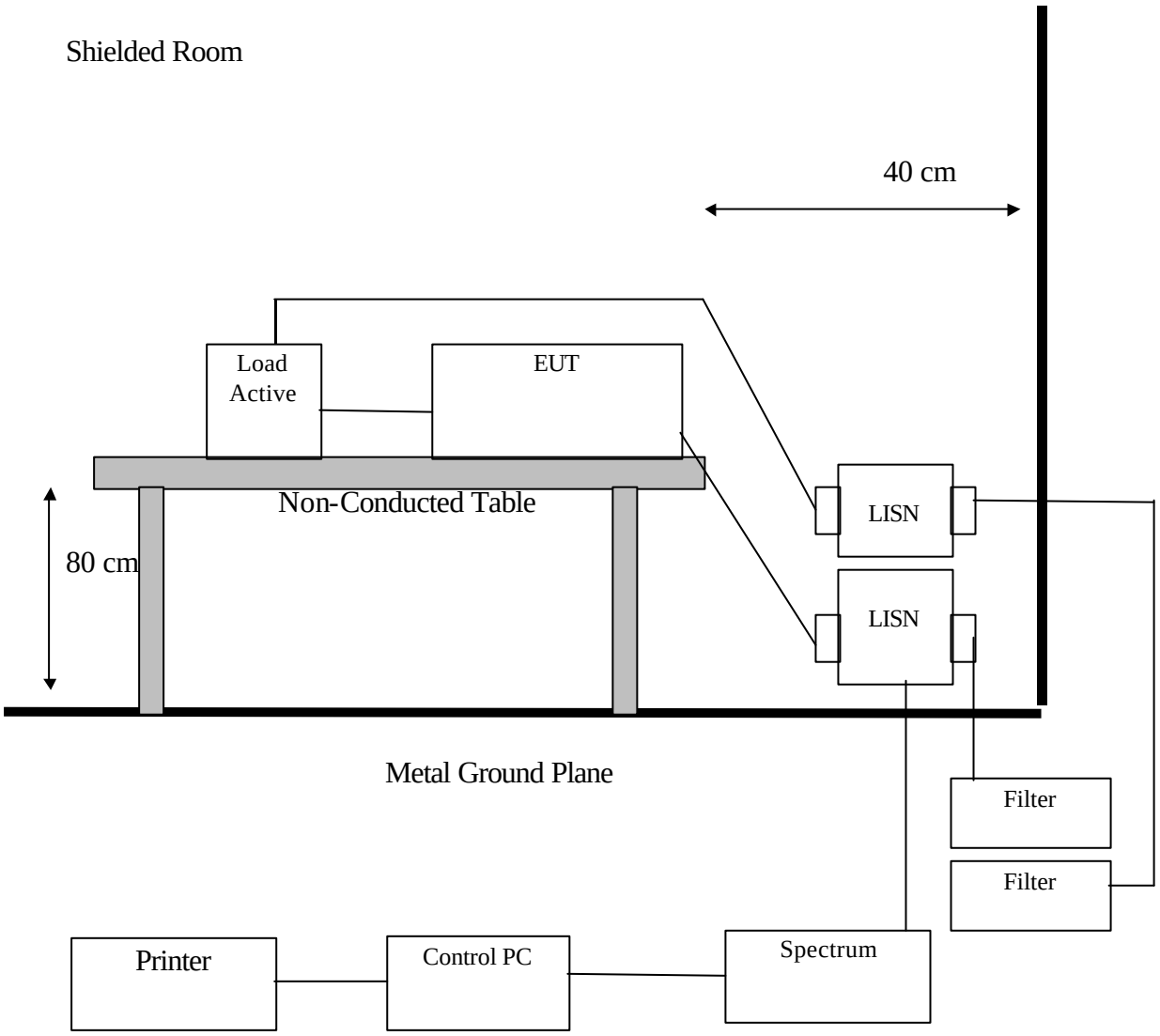
Note: Calibration traceable to NIST or national or international standards.

6.3.2 Software for Controlling Spectrum/Receiver and Calculating Test Data

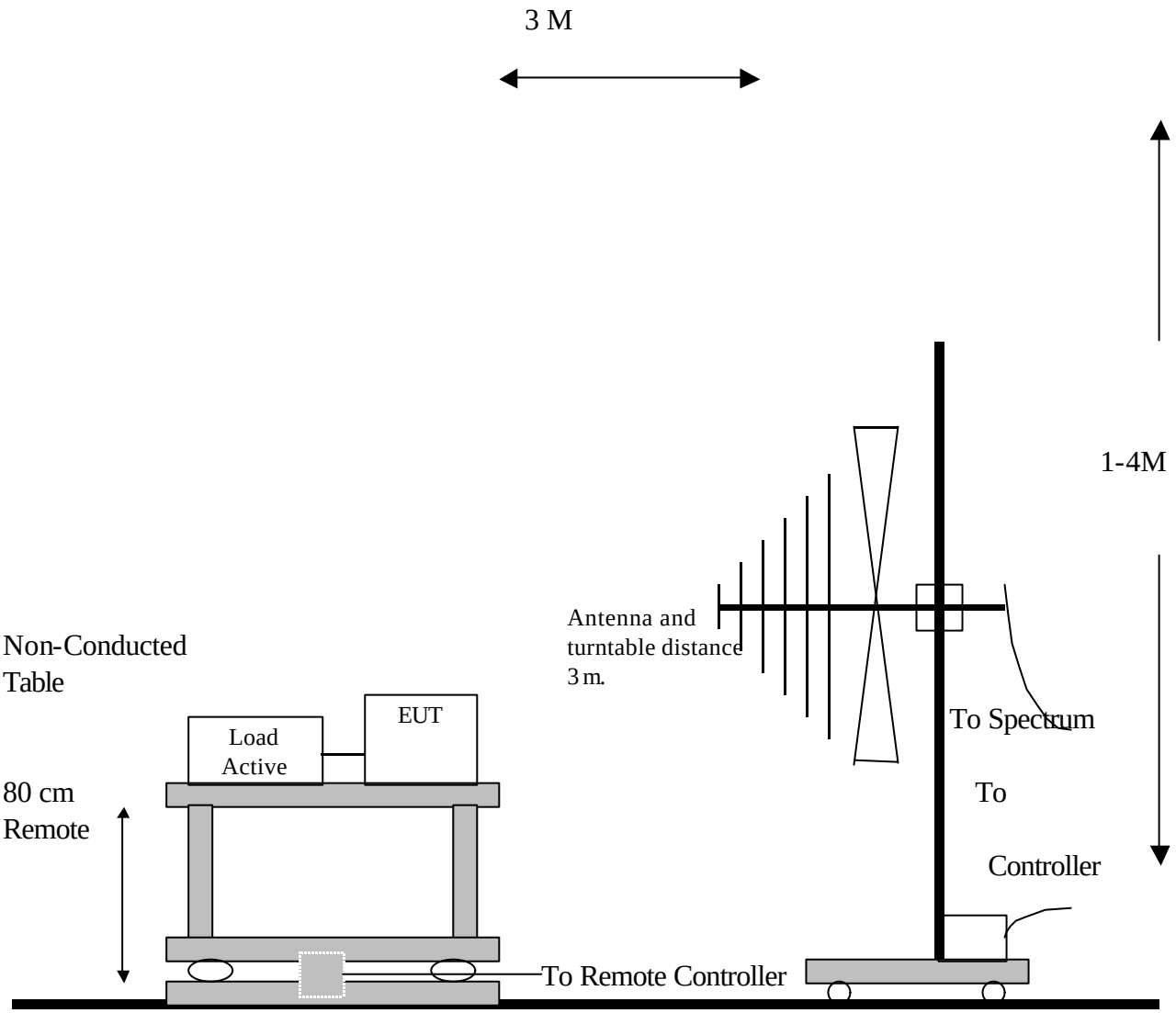
Radiation/Conduction	Filename	Version	Issued Date
Conduction	Tile.exe	1.12E	7/7/2000
Radiation	Tile.exe	1.12C	6/16/2000

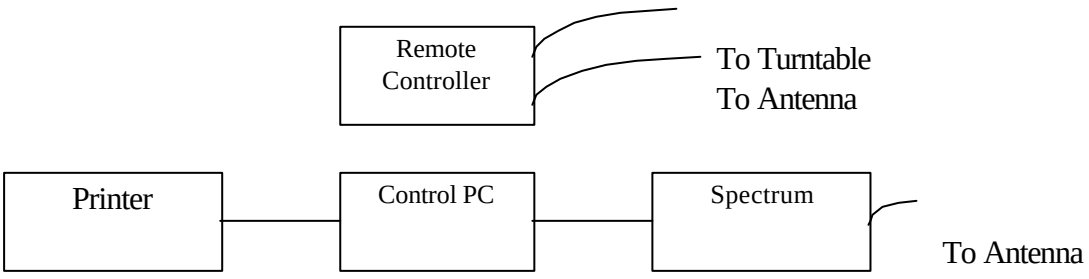
6.4 Appendix D: Layout of EUT and Support Equipment

6.4.1 General Conducted Test Configuration



6.4.2 General Radiation Test Configuration





6.5 Appendix E: Description of Support Equipment

6.5.1 Description of Support Equipment

None

6.5.2 Software for Controlling Support Unit

None

6.5.3 I/O Cable Condition of EUT and Support Units

Description	Path	Cable Length	Cable Type	Connector Type
DC Adapter Cord	Power Adapter to DC-IN port	1M	Nonshielded, Detachable	Plastic Head

6.6 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:

$Uc(y) = \text{square root}\ (u_1(y)^2 + u_2(y)^2 + \ldots\ldots\ldots + u_n(y)^2)$

$U = 2 * Uc(y)$

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**		

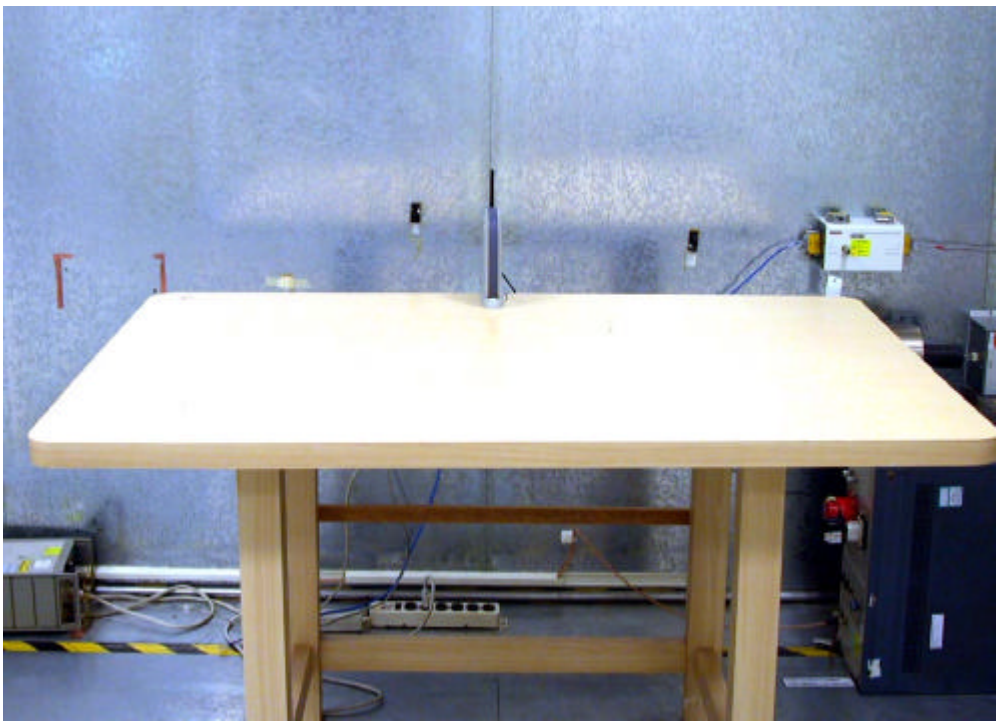
Measurement Uncertainty Calculations:

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

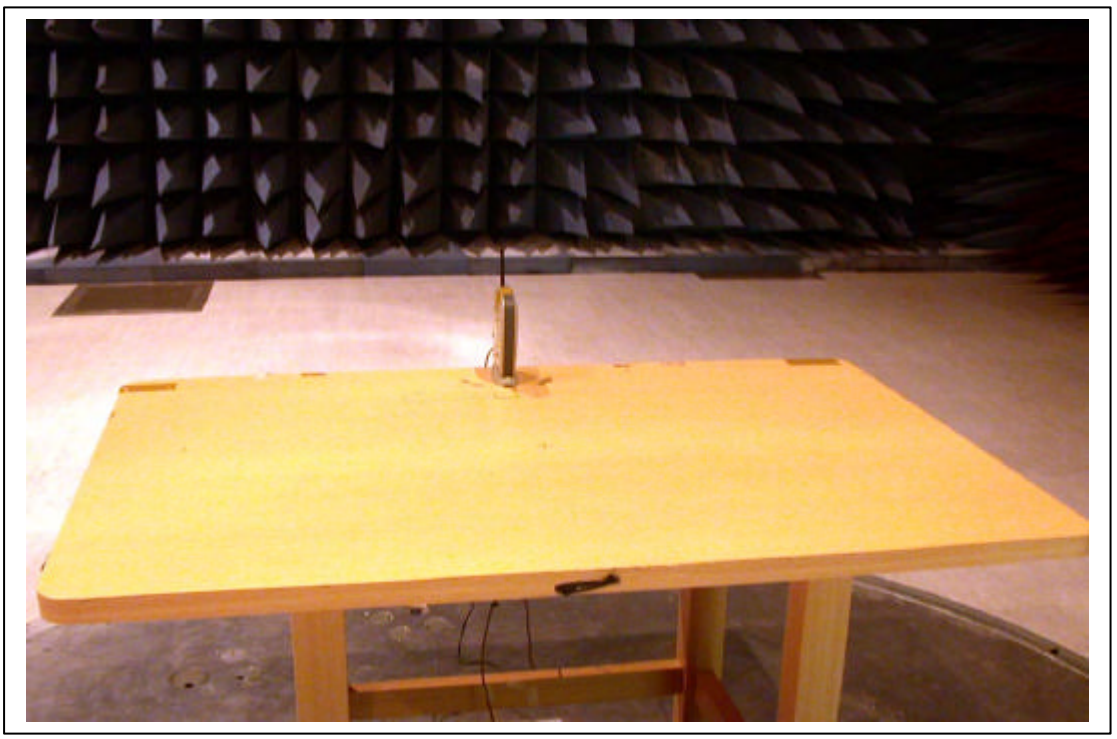
Note: The measurement Uncertainties mentioned above also refer to NIS 81-1994 of NAMAS : The treatment of Uncertainty in EMC Measurement.

6.7 Appendix G: Photographs of EUT Configuration Test Set Up

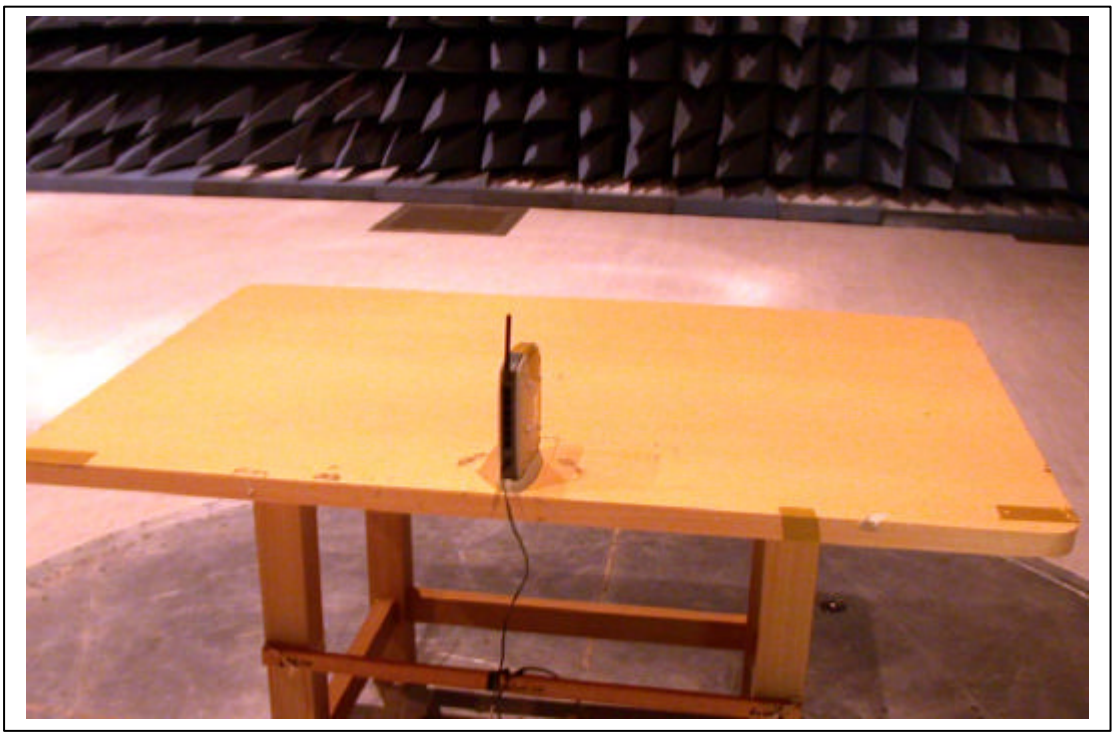
The Front View of Highest Conducted Set-up For EUT



The Front View of Highest Radiated Set-up For EUT



The Back View of Highest Radiated Set-up For EUT



6.8 Appendix H: Antenna Spec.

Please refer to the attached file.