TEST REPORT

of

FCC Part 22, 24, 15 Subpart B
RSS-128 Issue 2, RSS-133 Issue 3, RSS-Gen Issue 2

FCC ID/IC Certification: LW5SP5700/3114-SP5700

Equipment Under Test	:	Industrial Mobile Computer
Model Name	:	OptimusPDA SP5700 Series
Serial No.	:	N/A
Applicant	:	Metrologic Instruments, Inc.
Manufacturer	:	InnoTeletek, Inc.
Date of Test(s)	:	2007-11- 20~ 2008-01-10
Date of Issue	:	2008-02-04

In the configuration tested, the EUT complied with the standards specified above.

Tested By:  **Date** **2008-02-04**

Feel Jeong

Approved By  **Date** **2008-02-04**

Denny Ham

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1. General Information

1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.
- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.
www.electrolab.kr.sgs.com
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2. Details of Applicant

Applicant : Metrologic Instruments,. Inc.
Address : P.O. Box 307, Bellmawr, New Jersey, USA
Contact Person : Sandeep Unni
Phone No. : +1 856 228 8100
Fax No. : +1 856 228 6673

1.3. Description of EUT

Kind of Product	Industrial Mobile Computer
Model Name	OptimusPDA SP5700 Series
Serial Number	N/A
GSM module FCC ID/IC	QIPMC56/267W-MC56
Power Supply	DC 3.7 V
Frequency Range	2412 MHz ~ 2462 MHz(11b/g), 2402 MHz ~ 2480 MHz(Bluetooth) 824.2 MHz ~ 848.8 MHz(GSM 850), 1850.2 MHz ~ 1909.8 MHz(GSM 1900)
Modulation Technique	DSSS(11b), OFDM(11g), FHSS(Bluetooth), GMSK
Number of Channels	11 CH(11b/g), 79 CH(Bluetooth), 300(GSM 1900), 125(GSM 850)
Operating Conditions	-20 ℃ ~ 55 ℃
Antenna Type	Polded Type(GSM), Plate Type(W-LAN), Chip Type(BT)
Antenna Gain	-1.24 dBi(GSM 850), -0.38dBi(GSM 1900)1.86 dBi(BT),-2.47 dBi(W-LAN)

* This sample uses one of each Symbol laser scan engine (Model: SE-955), HHP scan engine (Model: 5000 LED Aimer), and VuQuest scan engine (Model: IS4910). These 3 kind of scan engine doesn't give any effect on radio characteristics, so we evaluated EMI test only for these 3 kind of scan engines.

1.4. Details of modification

-N/A

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1.5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Signal Generator	Agilent	E4438C	May 2008
Spectrum Analyzer	Agilent	E4440A	May 2008
Spectrum Analyzer	H.P	8593E	Sep. 2008
Two-Line V-Network	Rohde & Schwarz	ENV216	Jan. 2009
Test Receiver	Rohde & Schwarz	ESVS10	Apr. 2008
Test Receiver	Rohde & Schwarz	ESHS10	Sep. 2008
Ultra-Broadband Antenna	Rohde & Schwarz	HL562	Oct. 2009
Horn Antenna	Electro-Metrics	RGA-60	Jul. 2008
Dipole Antenna	VHAP/UHAP	975/958	Jun. 2008
Communication Antenna	AR	AT 4002	N.C.R
Band Reject Filter	Wainwright	WRCG824/849-814/85960/10SS	May 2008
Amplifier	HP	8447F	Sep. 2008
Power Amplifier	EMPOWER	2001-BBS3Q7ECK	May 2008

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EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Highpass Filter	Wainwright	WHK3.0/18G-10SS	Dec.2008
Biconcai Antenna	R&S	HK116	May 2009
Log-Periodic Antenna	R&S	HL223	May 2009
Mobile Test Unit	Agilent	E5515C	May 2008
Anechoic Chamber	SY Corporation	L x W x H 6.5 x 3.5 x 3.5	Aug. 2008

1.6. Conclusion of worst-case and operation mode

The EUT has three type of Scan Engine (Symbol laser, hhp scanner, VuQuest scanner).
The test was tested to the worst case of three type of Scan Engine (Symbol laser, hhp scanner, VuQuest scanner).
The field strength of spurious emission was measured in three orthogonal EUT positions(X-axis, Y-axis and Z-axis).
The highest emission of EUT position is Z-axis.

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1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part 22, 24,15 Subpart B RSS-128 Issue 2,RSS-133 Issue 3, RSS-Gen Issue2			
Section in FCC 15	**Section in RSS-128 RSS-133 RSS-Gen**	**Test Item**	**Result**
15.107	RSS-Gen 7.2.2	Receiver AC Power Line Conducted Emission	Complied
15.109(a)	RSS-Gen 6	Receiver Radiated Spurious Emission	Complied
22.913(a) 24.232(c)	RSS-128 RSS-133	RF Radiated Output Power	Complied
22.917(a) 24.238(a)	RSS-128 RSS-133	Spurious Radiated Emission	Complied

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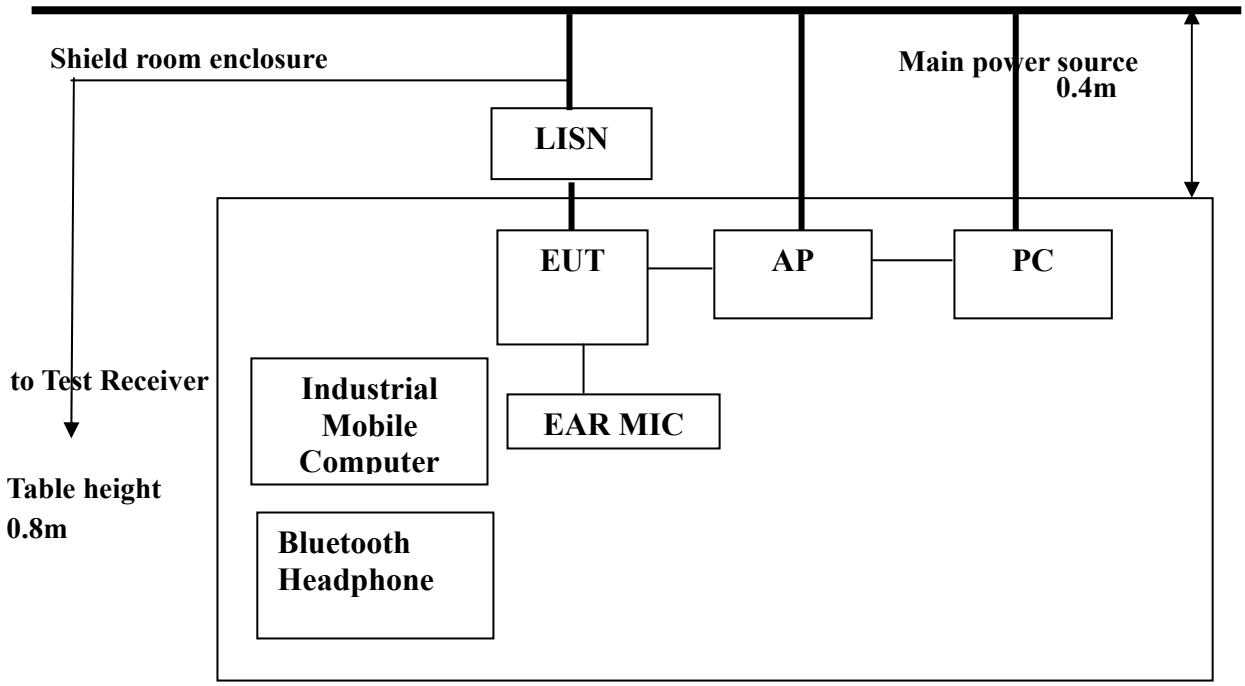
2. Conducted Power Line Test

2.1. Test Setup



2.2. Limit

According to §15.107(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5m × 3.6m× 3.6m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0m(W)× 1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

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2.4. Test Results(Worst Case)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line; Addition,
Ambient temperature : 22 ℃ Relative humidity : 43 %

Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

FREQ.	LEVEL(dBuV)		LINE	LIMIT(dBuV)		MARGIN(dB)	
(MHz)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.190	46.30	36.20	N	64.04	54.04	17.74	17.84
0.330	34.10	25.40	N	59.45	49.45	25.35	24.05
1.790	30.20	24.10	N	56.00	46.00	25.80	21.90
1.980	31.20	26.20	N	56.00	46.00	24.80	19.80
14.150	41.20	37.10	N	60.00	50.00	18.80	12.90
14.510	38.90	33.50	N	60.00	50.00	21.10	16.50
0.190	49.30	37.80	H	64.04	54.04	14.74	16.24
0.330	33.70	24.50	H	59.45	49.45	25.75	24.95
1.790	29.80	25.40	H	56.00	46.00	26.20	20.60
1.980	30.10	25.60	H	56.00	46.00	25.90	20.40
14.150	39.20	37.80	H	60.00	50.00	20.80	12.20
14.510	37.00	34.10	H	60.00	50.00	23.00	15.90

Note ;
Line (H) : Hot
Line (N) : Neutral

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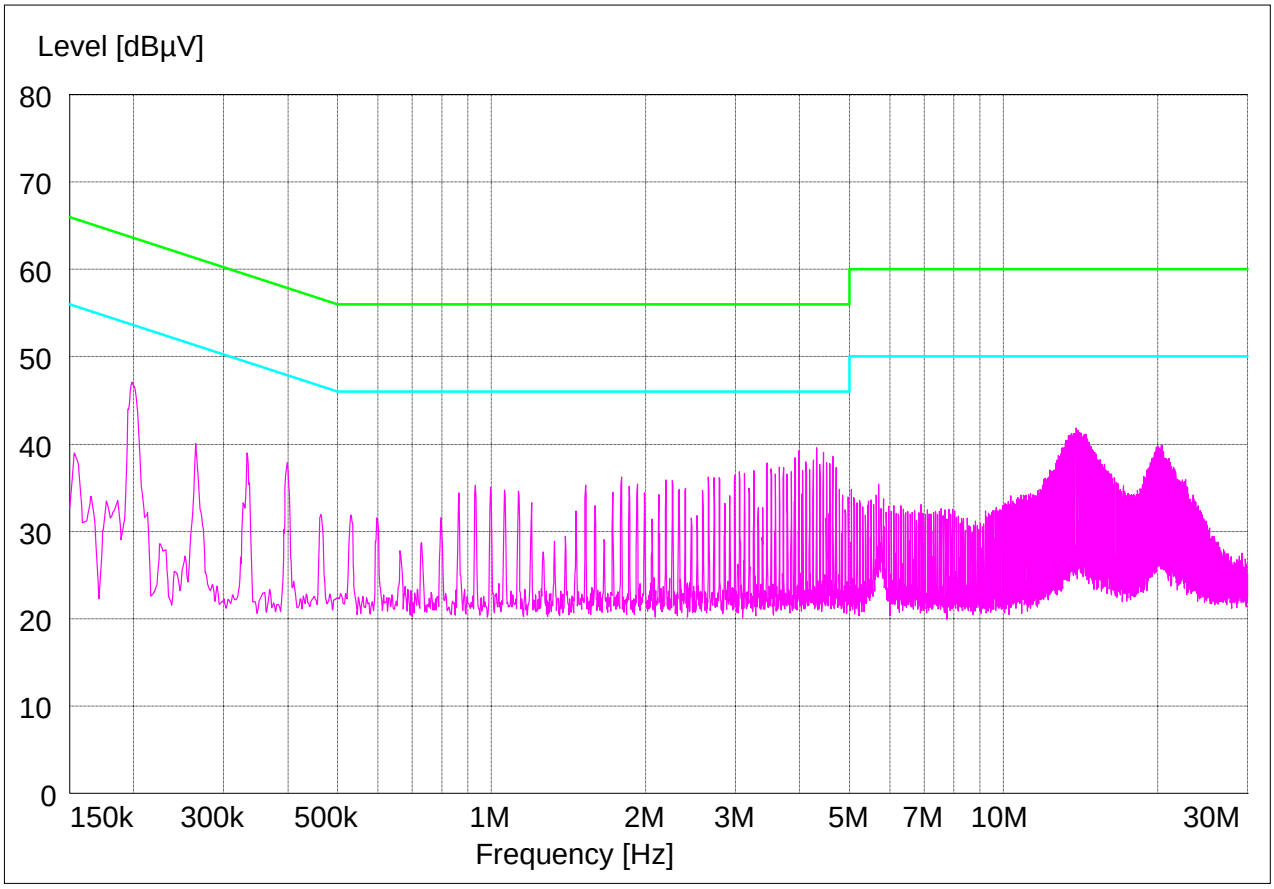
Plot of Conducted Power line

Test mode : (Hot)



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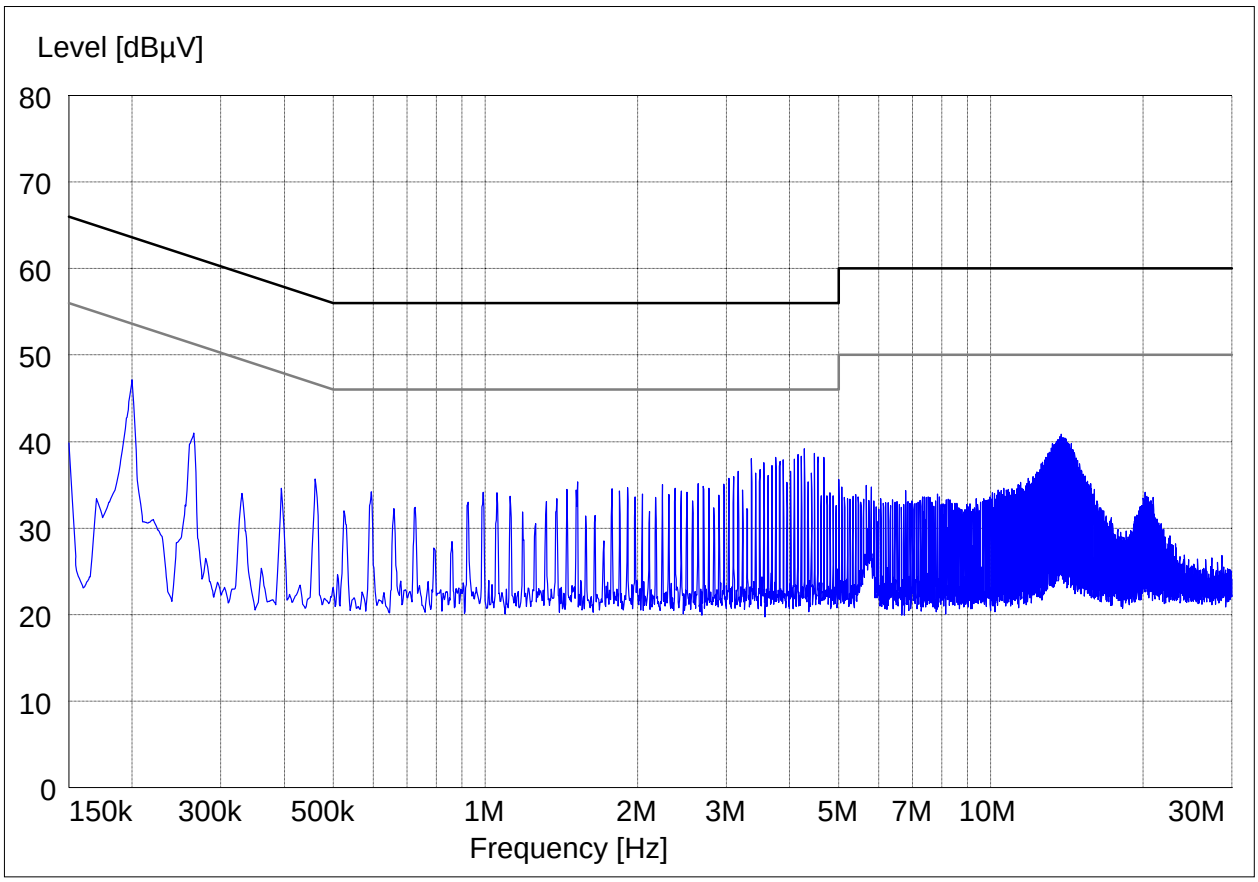
Test mode : (Neutral)



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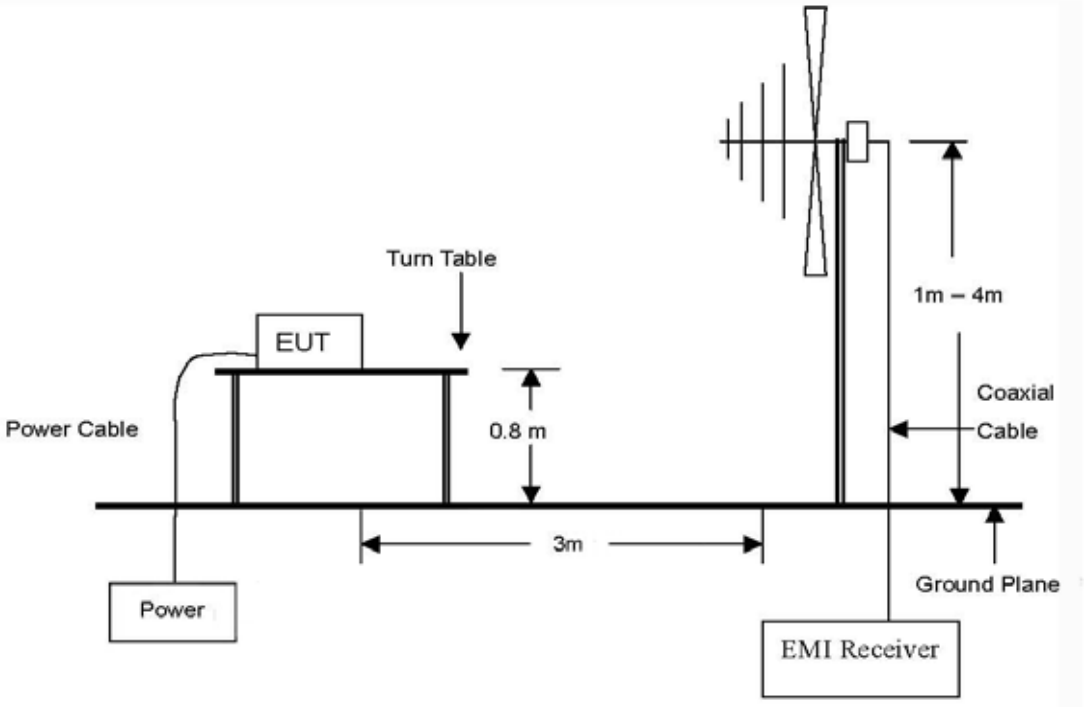
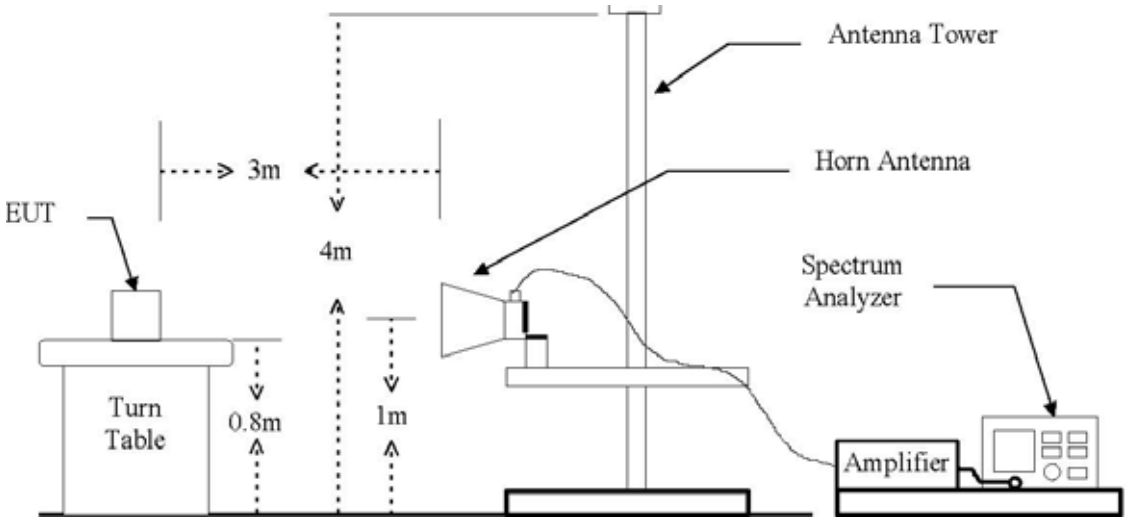
3. RF Radiated Output Power

3.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



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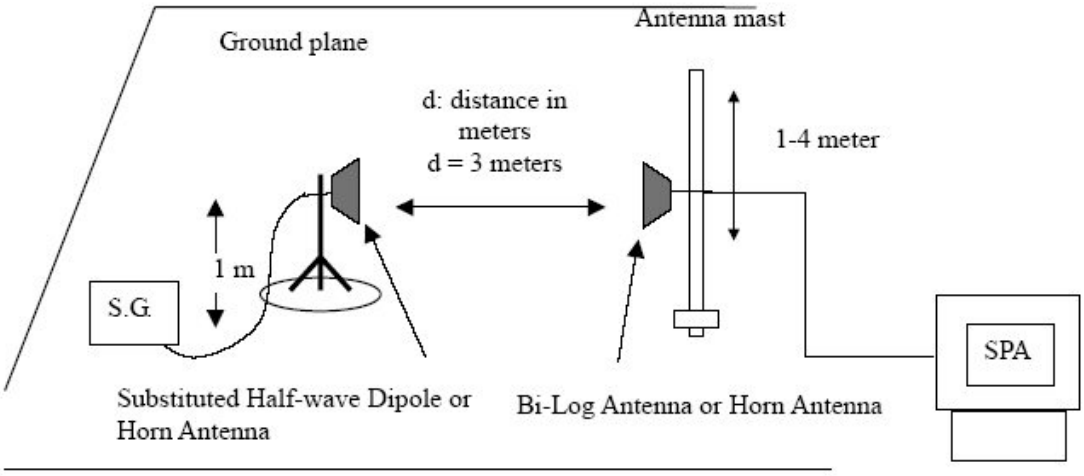
The diagram below shows the test setup for substituted method



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3.2. Limit

FCC §22.913(a), the ERP of mobile transmitters must not exceed 7 watts. FCC §24.232(c) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

3.3. Test Procedure: Based on TIA-603C 2004

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 4m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase he sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
18. The spectrum analyzer reading was recorded and ERP/EIRP was calculated as follows:
    ERP = S.G.output(dBm) + Antenna Gain(dBd) - Cable(dB)
    EIRP = S.G.output(dBm) + Antenna Gain(dBi) - Cable(dB)

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3.4. Test Results

Ambient temperature : 20 ℃ Relative humidity : 50 %

GSM 850

Frequency (MHz)	Ant. Pol. (H/V)	Amp-C.L (dB)	S.G Power Level (dBm)	Antenna Gain (dBd)	E. R. P.	
					(dBm)	(W)
824.2	H	30.30	-9.63	4.59	25.26	0.336
836.6	H	30.30	-8.17	4.58	26.71	0.469
848.8	H	30.30	-6.20	4.57	28.67	0.736

GPRS 850

Frequency (MHz)	Ant. Pol. (H/V)	Amp-C.L (dB)	S.G Power Level (dBm)	Antenna Gain (dBd)	E. R. P.	
					(dBm)	(W)
824.2	H	30.30	-9.69	4.59	25.20	0.331
836.6	H	30.30	-8.08	4.58	26.80	0.479
848.8	H	30.30	-5.93	4.57	28.94	0.783

Remake: 1. ERP= SG Power Level +Amp-C.L. +Antenna Gain

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GSM 1900

Frequency (MHz)	Ant. Pol. (H/V)	Amp-C.L (dB)	S.G Power Level (dBm)	Antenna Gain (dBi)	E. I. R. P.	
					(dBm)	(W)
1850.2	V	32.90	-15.21	6.60	24.29	0.269
1880.0	V	32.90	-11.13	6.60	28.37	0.687
1909.8	V	32.90	-10.20	6.60	29.30	0.851

GPRS 1900

Frequency (MHz)	Ant. Pol. (H/V)	Amp-C.L (dB)	S.G Power Level (dBm)	Antenna Gain (dBi)	E. I. R. P.	
					(dBm)	(W)
1850.2	V	32.90	-15.30	6.60	24.20	0.263
1880.0	V	32.90	-11.18	6.60	28.32	0.679
1909.8	V	32.90	-10.28	6.60	29.22	0.835

Remake: 1. E.I.R.P.= S.G. Power Level +Amp-C.L. +Antenna Gain

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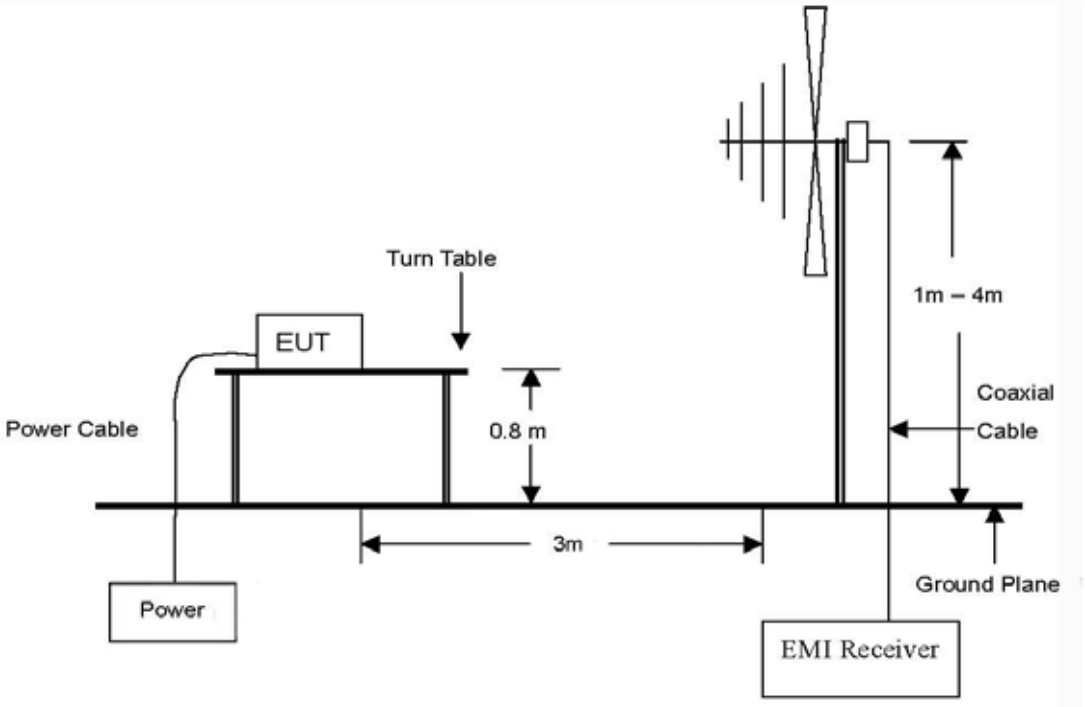
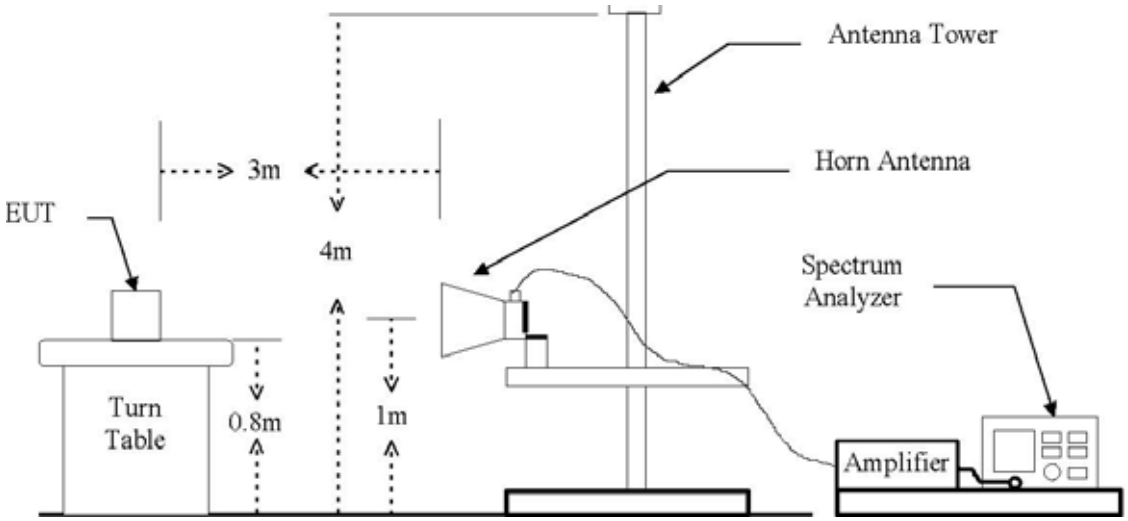
4. Spurious Radiated Emission

4.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



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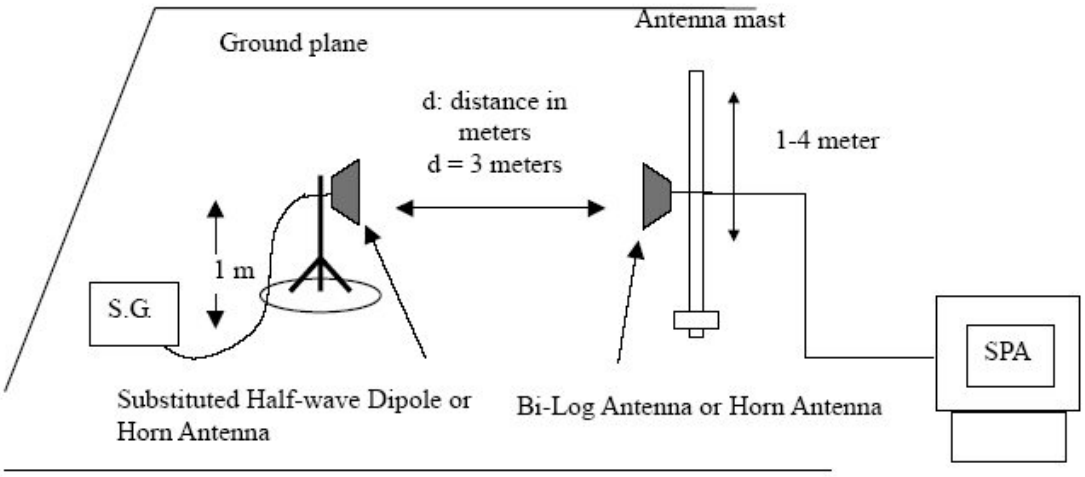
The diagram below shows the test setup for substituted method



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4.2. Limit

§ 22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least 43+10log(P)dB.

4.3. Test Procedure

1. On a test site, the EUT shall be placed at 0.8cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 4m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase he sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary

    ERP = S.G.output(dBm) + Antenna Gain(dBd) - Cable(dB)
    EIRP = S.G.output(dBm) + Antenna Gain(dBi) - Cable(dB)

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4.4. Test Results

Ambient temperature : 20 ℃ Relative humidity : 50 %

GSM 850

Frequency (MHz)	Ant.Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	E.R.P. (dBm)	Limit (dBm)	Margin (dB)
TX LOW channel (824.2 MHz)							
1648.4	V	-64.21	1.02	6.07	-59.16	-13.00	46.16
2472.6	V	-66.00	1.06	7.77	-59.29	-13.00	46.29
TX MID Channel (836.6 MHz)							
1673.2	V	-63.51	1.02	6.15	-58.38	-13.00	45.38
2509.8	V	-65.87	1.06	7.81	-59.12	-13.00	46.12
TX HIGH Channel (848.8 MHz)							
1697.6	V	-62.89	1.02	6.24	-57.67	-13.00	44.67
2546.4	V	-65.00	1.06	7.86	-58.20	-13.00	45.20

Remake: 1. No more harmonic above 3rd harmonic for all channel.
2. E.R.P.= SG Reading –Cable Loss +Gain
3. The effective radiated power record the largest level between the two levels with Ant.Pol.(H/V)

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GPRS 850

Frequency (MHz)	Ant.Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	E.R.P. (dBm)	Limit (dBm)	Margin (dB)
TX LOW channel (824.2 MHz)							
1648.4	V	-64.33	1.02	6.07	-59.28	-13.00	46.28
2472.6	V	-66.20	1.06	7.77	-59.49	-13.00	46.49
TX MID Channel (836.6 MHz)							
1673.2	V	-63.54	1.02	6.15	-58.41	-13.00	45.41
2509.8	V	-65.20	1.06	7.81	-58.45	-13.00	45.45
TX HIGH Channel (848.8 MHz)							
1697.6	V	-61.20	1.02	6.24	-55.98	-13.00	42.98
2546.4	V	-64.25	1.06	7.86	-57.45	-13.00	44.45

Remake: 1. No more harmonic above 3rd harmonic for all channel.
2. E.R.P.= SG Reading –Cable Loss +Gain
3. The effective radiated power record the largest level between the two levels with Ant.Pol.(H/V)

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GSM 1900

Frequency (MHz)	Ant.Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	E.R.P. (dBm)	Limit (dBm)	Margin (dB)
TX LOW channel (1850.2 MHz)							
3700.4	V	-57.20	1.53	9.06	-49.67	-13.00	36.67
5550.6	H	-51.15	2.20	9.40	-43.95	-13.00	30.95
TX MID Channel (1880.0 MHz)							
3760	V	-58.58	1.53	9.11	-51.00	-13.00	38.00
5640	H	-52.00	2.34	9.42	-44.92	-13.00	31.92
TX HIGH Channel (1909.8 MHz)							
3819.6	V	-57.47	1.53	9.17	-49.83	-13.00	36.83
5729.4	H	-52.98	2.34	9.49	-45.83	-13.00	32.83

Remake: 1. No more harmonic above 3rd harmonic for all channel.
2. E.R.P.= SG Reading –Cable Loss +Gain
3. The effective radiated power record the largest level between the two levels with Ant.Pol.(H/V)

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GPRS 1900

Frequency (MHz)	Ant.Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	E.R.P. (dBm)	Limit (dBm)	Margin (dB)
TX LOW channel (1850.2 MHz)							
3700.4	V	-57.50	1.53	9.06	-49.97	-13.00	36.97
5550.6	H	-51.00	2.20	9.40	-43.80	-13.00	30.80
TX MID Channel (1880.0 MHz)							
3760	V	-58.67	1.53	9.11	-51.09	-13.00	38.09
5640	H	-52.20	2.34	9.42	-45.12	-13.00	32.12
TX HIGH Channel (1909.8 MHz)							
3819.6	V	-57.57	1.53	9.17	-49.93	-13.00	36.93
5729.4	H	-52.60	2.34	9.49	-45.45	-13.00	32.45

Remake: 1. No more harmonic above 3rd harmonic for all channel.
2. E.R.P.= SG Reading –Cable Loss +Gain
3. The effective radiated power record the largest level between the two levels with Ant.Pol.(H/V)

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5. Field Strength of Radiated Emissions

5.1. Limit

According to §15.109(a), Except for Class A digital devices, the field strength of radiated emission from unintentional radiator at a distance of 3 m shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

5.2. Test Procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE：

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection and frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

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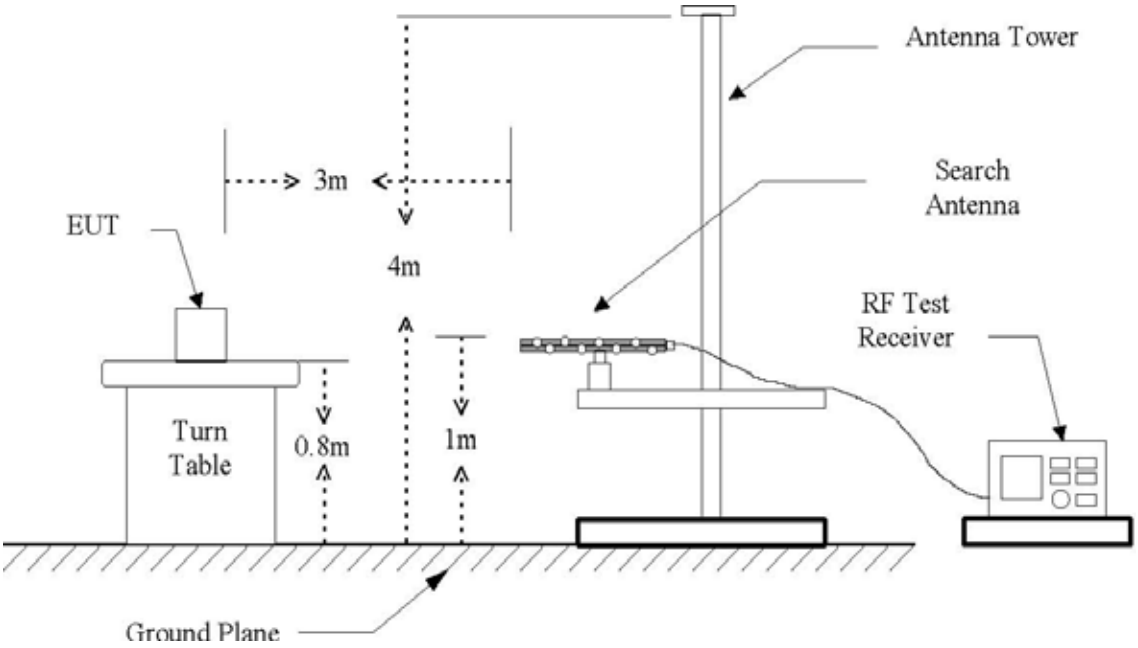
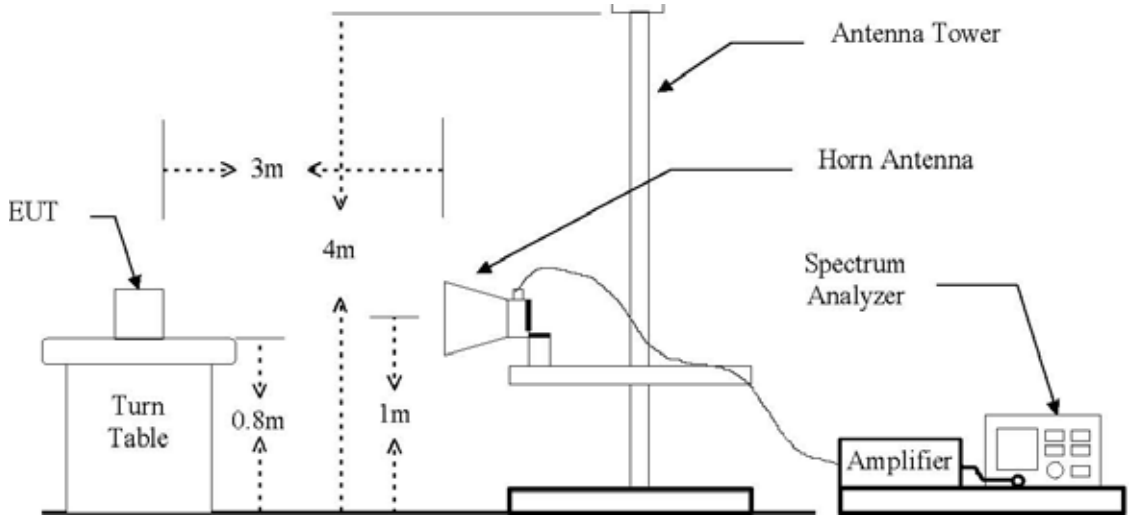
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 40 GHz Emissions.



Frequencies measured below 1 GHz configuration



Frequencies measured above 1 GHz configuration

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5.3. Test Results(Worst Case)

Ambient temperature : 20 ℃ Relative humidity : 50 %

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Q.P. Limit (dBuV/m)	Margin (dB)
35.62	16.30	Q.P.	V	16.76	0.77	33.83	40.00	6.17
82.36	11.50	Q.P.	H	8.08	1.15	20.73	40.00	19.27
116.52	18.50	Q.P.	V	9.78	1.38	29.66	43.50	13.84
179.65	19.60	Q.P.	H	7.92	1.72	29.24	43.50	14.26
405.00	18.70	Q.P.	H	13.52	2.70	34.92	46.00	11.08
668.74	17.40	Q.P.	H	18.12	3.45	38.97	46.00	7.01
Above 670.00	Not detected	-	-	-	-	-	-	-

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Appendix A. Photo of Radiated Emission Test

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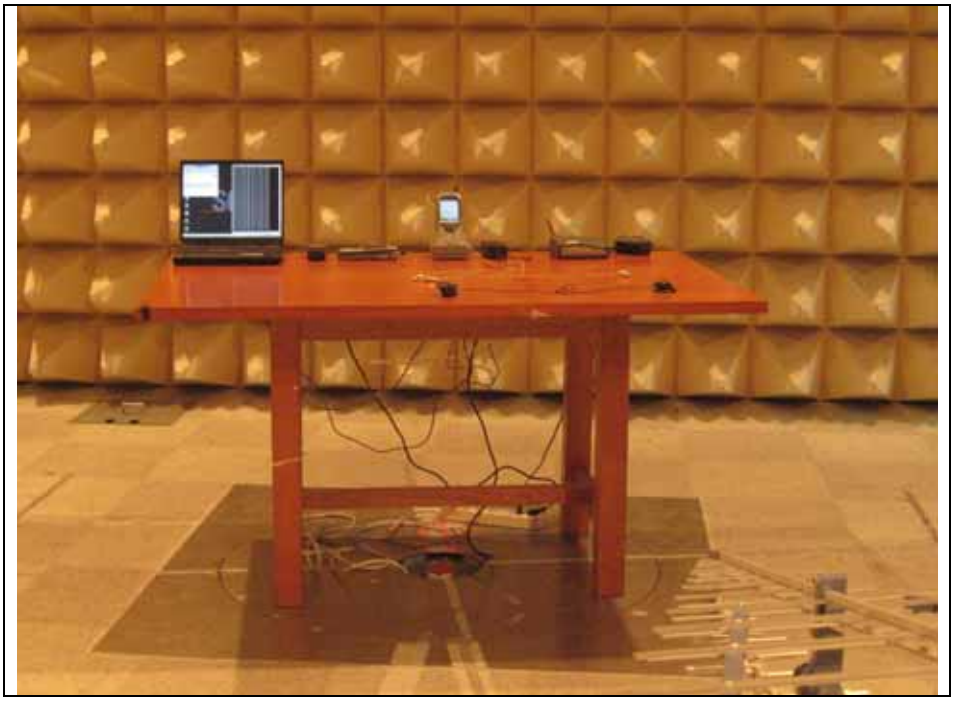
Appendix B. Photos of Field Strength Test



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Appendix C. Photos of Conducted Power Line Test

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