

# TEST REPORT

OF

## FCC Part 24E and Part 15

FCC ID : UBUITWELL-XPDA-S

Equipment Under Test : PDA  
Model Name : XPDA-S  
Serial No. : 0982994  
Applicant : ITWell Co., Ltd.  
Manufacturer : ITWell Co., Ltd.  
Date of Test(s) : 2007-03-05 ~ 2007-04-05  
Date of Issue : 2007-04-09

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

Tested By:



Date:

2007-04-09

Feel Jeong

Approved By:



Date:

2007-04-09

James Kwon

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## 1. General Information

### 1-1. Testing Laboratory

SGS Testing Korea Co., Ltd.  
Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040  
[www.electrolab.kr.sgs.com](http://www.electrolab.kr.sgs.com)  
Telephone : +82 +31 428 5700  
FAX : +82 +31 427 2371

### 1-2. Details of Applicant

Applicant : ITWell Co., Ltd.  
Address : Room 505, Gayang Techno-Town, 1487, Gayang 3-dong, Gangseo-gu, Seoul, Korea, 157-810  
Contact Person : Hyung-Jun Lim  
Phone No. : 82-2-360-2354  
Fax No. : 82-2-360-2339

### 1-3. Description of EUT

Kind of Product	PDA
Model Name	XPDA-S
Serial Number	0982994
Power Supply	DC 7.4 V(Li-Ion), 1900 mA
Frequency Range	TX: 1851.25 ~ 1908.75 MHz RX: 1931.25 ~ 1988.75 MHz
Transmit Power	US PCS :EIRP 20.72 dBm (118.03 mW)
Modulation Technique	OQPSK, QPSK
Number of Channels	48 CH for US PCS
Emission Designation	1M42F9W(PCS)
Operating Conditions	-30 ~60
Antenna Type	Helical Antenna

### 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 2007
Spectrum Analyzer	Agilent	E4440A	May 2007
Spectrum Analyzer	H.P	8593E	Sep. 2007
Power Meter	Agilent	E4416A	May 2007
Power Sensor	Agilent	E9327A	May 2007
DC Power Supply	Agilent	6674A	May 2007
Attenuator	Agilent	8494B	May 2007
Two-Line V-Network	NNB 41	Schaffner	Sep. 2007
Test Receiver	Rohde & Schwarz	ESVS10	May 2007
Test Receiver	Rohde & Schwarz	ESHS10	Aug. 2007
Ultra-Broadband Antenna	Rohde & Schwarz	HL562	Sep. 2007
Horn Antenna	Electro-Metrics	RGA-60	Dec. 2007
Horn Antenna	SCHWARZBECK	BBHA9120D(0600)	Jul. 2007
Dipole Antenna	VHAP/UHAP	975/958	Jun. 2007
Communication Antenna	AR	AT 4002	N.C.R
Band Reject Filter	Wainwright	WRCG824/849-814/85960/10SS	May 2007
Highpass Filter	Wainwright	WHK3.0/18G-10SS	Dec.2007
Mobile Test Unit	Agilent	E5515C	May 2007

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EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Pulse Limiter	Rohde & Schwarz	EHS3-Z2	Jan.2008
Preamplifier	Agilent	8449B	May 2007
Preamplifier	Agilent	8447F	Jun.2007
Dual Directional Coupler	Agilent	778D	Dec. 2007
Anechoic Chamber	SY Corporation	L W H 9.6 6.4 6.4	Aug. 2007

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## 1.6. Summary of Test Results

Description of Test	FCC Rule	Result
AC Power Line Conducted Emissions	§15.107	Complied
Field Strength of Radiated Emission	§15.109(a)	Complied
Spurious Radiated Emission	§24.238(a)	Complied
RF Radiated Output Power	§2.1046 §24.232(c)	Complied
Conducted Output Power	§2.1046(a) §24.232(c)	Complied
Occupied Bandwidth	§2.1049(h) (i)	Complied
Spurious Emission at Antenna Terminal	§2.1051 §24.238(a)	Complied
Frequency Stability	§2.1055 §24.235	Complied
Band Edge	§24.229	Complied

## 1.7. Description of Support Units

Product	Model No.	Serial No.	Manufacturer
Note PC	R40e	99-F1442	LG IBM

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## 2. AC Power Line Conducted Emissions

### 2.1. Limit

According to §15.107(a) for an intentional radiator 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 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

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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## 2.2. Test Procedure

1. The test procedure is performed in a 6.5 m × 3.6 m × 3.6 m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(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. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
3. 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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## 2.3. Test Result

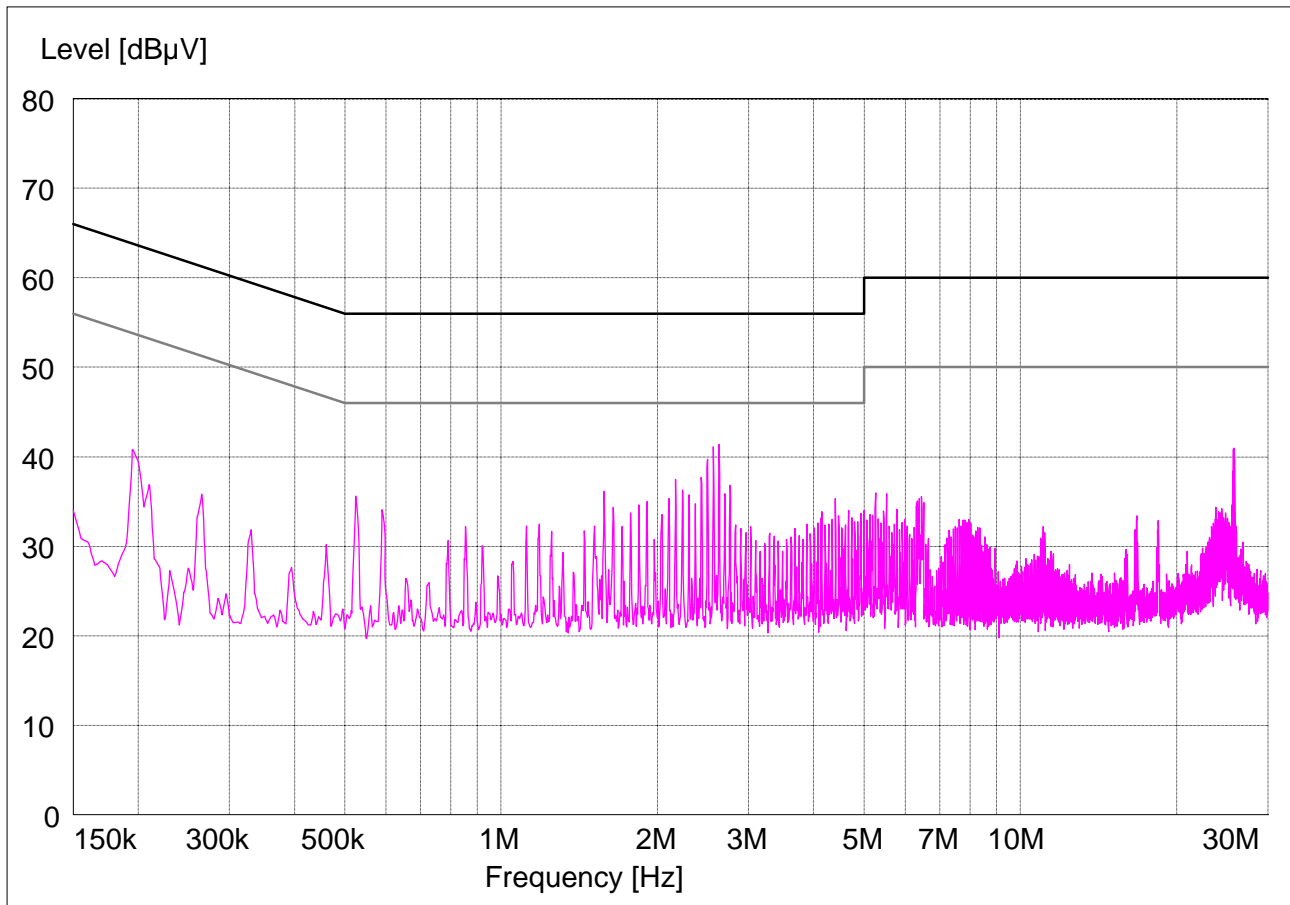
### PCS 1900

FREQ. (MHz)	LEVEL(dB $\mu$ V)		LINE	LIMIT(dB $\mu$ V)		MARGIN(dB)	
	Q-Peak	Average	LINE	Q-Peak	Average	Q-Peak	Average
0.15	30.4	23.7	H	66.0	56.0	35.6	32.3
0.20	39.1	34.6	H	63.8	53.8	24.7	19.2
0.53	35.7	33.1	H	56.0	46.0	20.3	12.9
1.58	29.4	26.9	H	56.0	46.0	26.6	19.1
2.63	38.7	30.9	H	56.0	46.0	17.3	15.1
25.83	27.4	23.7	H	60.0	50.0	32.6	26.3
0.20	44.2	36.8	N	63.8	53.8	19.6	17.0
0.27	35.2	28.5	N	61.3	51.3	26.1	22.8
0.53	34.8	31.8	N	56.0	46.0	21.2	14.2
2.50	37.0	29.1	N	56.0	46.0	19.0	16.9
2.57	38.2	32.6	N	56.0	46.0	17.8	13.4
23.63	28.4	22.4	N	60.0	50.0	31.6	27.6

Please refer to the following plots.

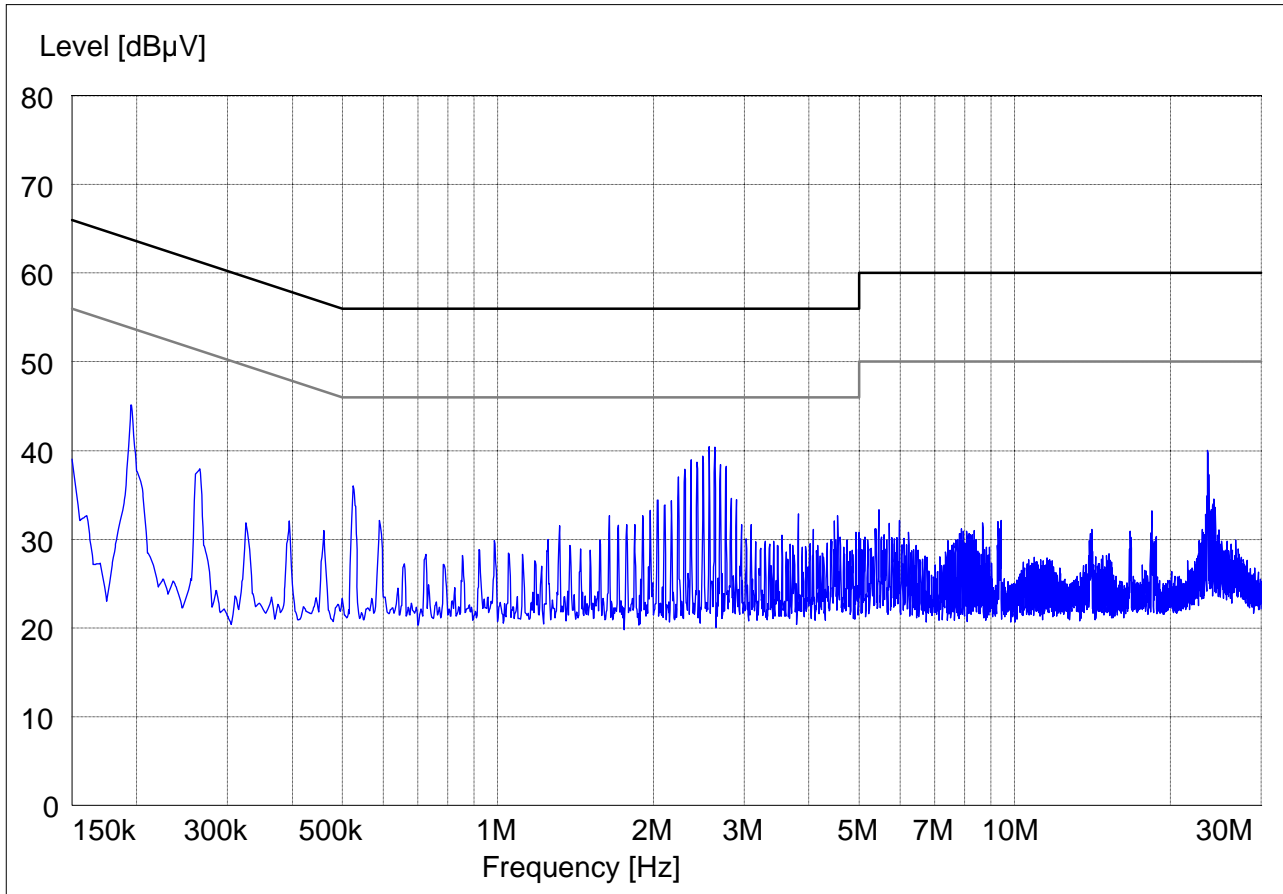
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## Neutral



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## HOT



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### 3. RF Radiated Output Power

#### 3.1. Limit

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.

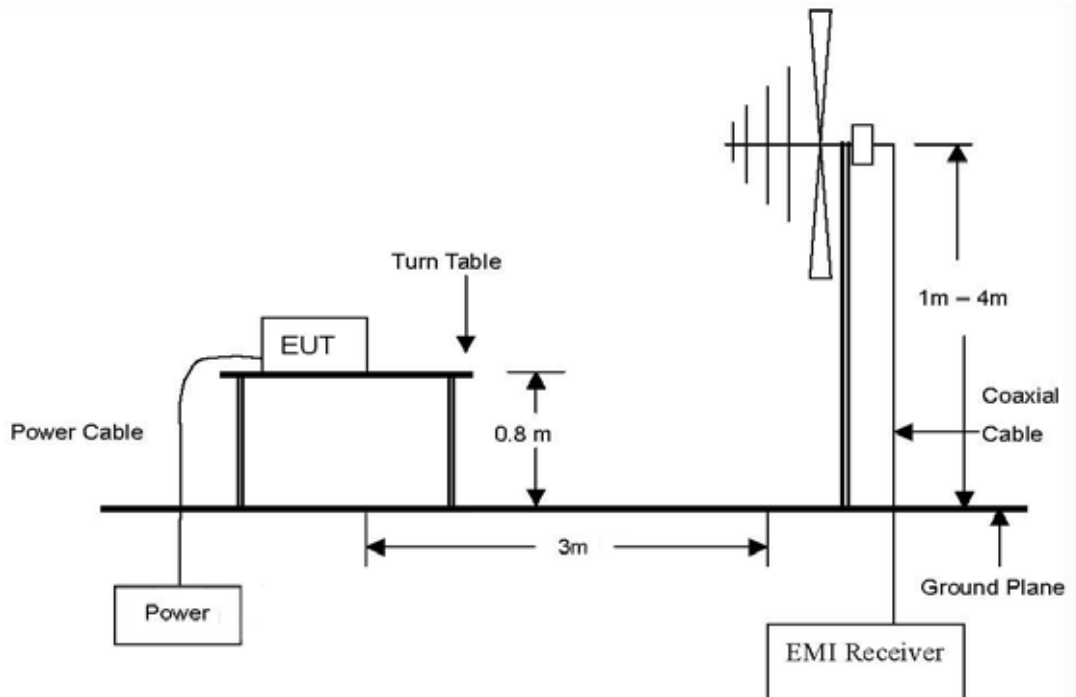
#### 3.2. Test Procedure

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 3m 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 be 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 the 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 receiver, 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 ERP/EIPR test under Fwd5, Rvs4

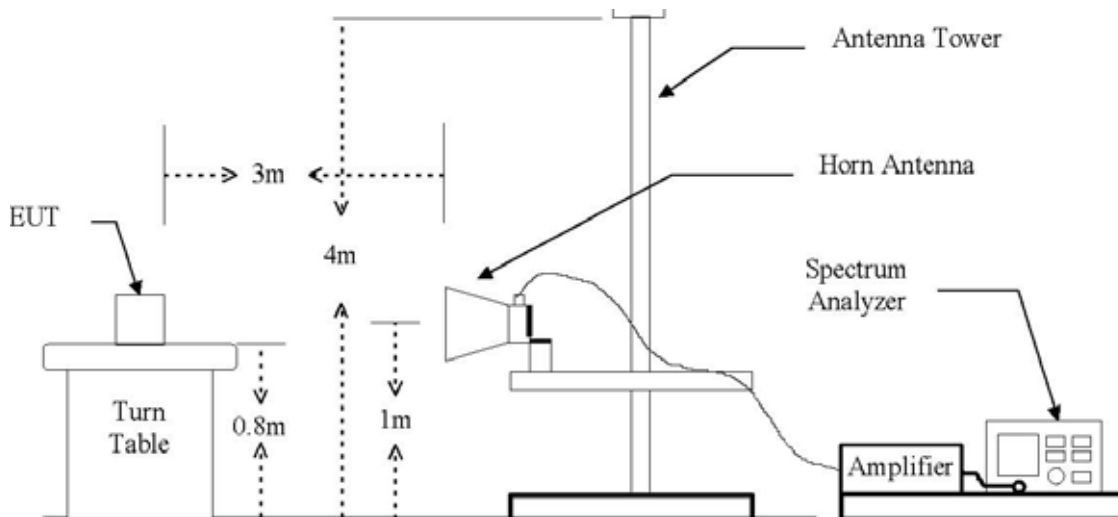
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The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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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### 3.3. Test Results

EIRP : PCS 1900

Frequency (MHz)	Ant. Pol. (H/V)	Amp- C.L (dB)	S.G. Reading (dBm)	Antenna Gain (dBi)	E. I. R. P.	
					(dBm)	(mW)
1851.25	V	33.91	-24.64	9.02	18.29	67.45
	H	33.91	-29.46	9.02	13.47	22.23
1880.00	V	33.91	-22.25	9.06	20.72	118.03
	H	33.91	-27.35	9.06	15.62	36.48
1908.75	V	33.91	-24.34	9.09	18.66	73.45
	H	33.91	-28.76	9.09	14.24	26.55

Remake: 1. EIRP= SG Reading +Amp-C.L. +Gain

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## 4. Spurious Radiated Emission

### 4.1. Limit

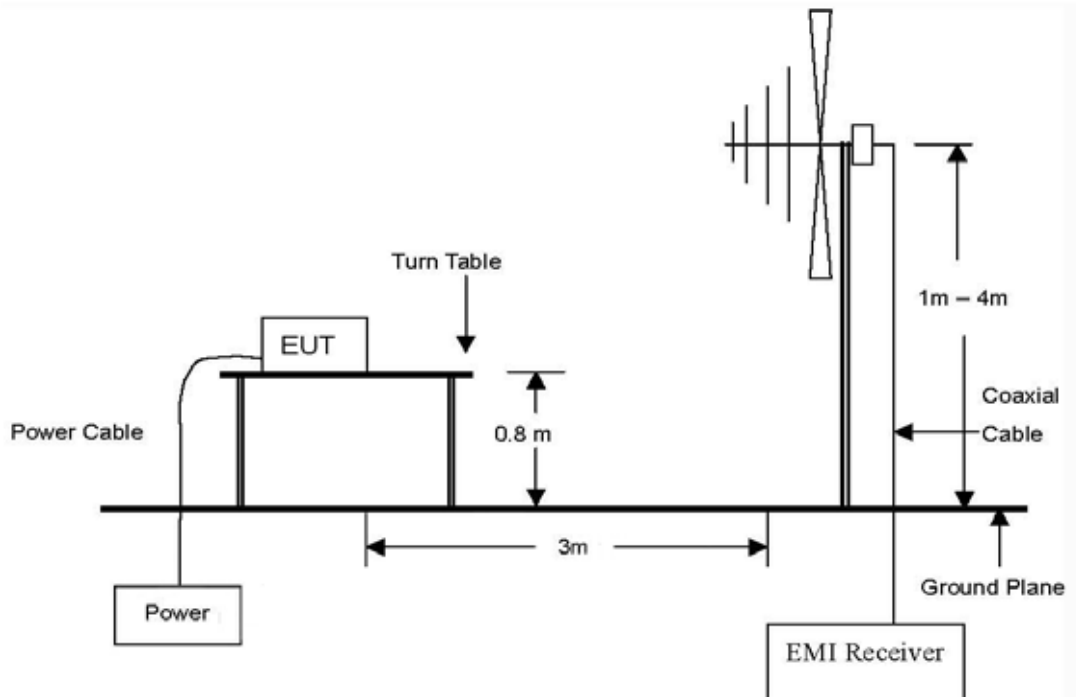
§24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least  $43+10*\log(P)$ dB.

### 4.2. Test Procedure

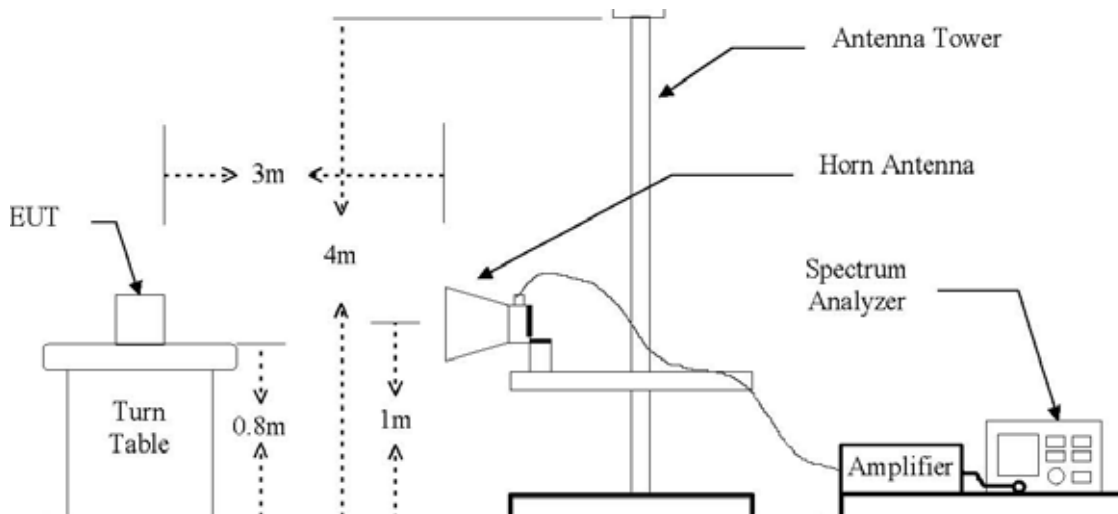
1. On a test site, the EUT shall be placed at 0.8cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output 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 be 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 the 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 receiver, 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. Spurious radiated emission was tested under Fwd5, Rvs4.

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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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### 4.3. Test Result

#### PCS 1900

Frequency (MHz)	Ant.Pol. (H/V)	S.G. reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
<b>TX LOW channel (1851.25 MHz)</b>								
3702.50	H	-25.44	1.53	11.14	8.99	-17.98	-13	4.98
	V	-33.16	1.53	11.14	8.99	-25.70	-13	12.70
5553.75	H	-57.01	2.20	11.56	9.41	-49.80	-13	36.80
	V	-47.44	2.20	11.56	9.41	-40.23	-13	27.23
<b>TX MID Channel (1880.00 MHz)</b>								
3760.00	H	-24.68	1.53	11.18	9.03	-17.18	-13	4.18
	V	-32.52	1.53	11.19	9.03	-25.02	-13	12.02
5640.00	H	-56.19	2.20	11.62	9.47	-48.92	-13	35.92
	V	-46.19	2.20	11.62	9.47	-38.92	-13	25.92
<b>TX HIGH Channel (1908.75 MHz)</b>								
3817.50	H	-26.16	1.53	11.22	9.07	-18.62	-13	5.62
	V	-33.37	1.53	11.22	9.07	-25.83	-13	12.83
5726.25	H	-57.54	2.20	11.68	9.53	-50.21	-13	37.21
	V	-47.44	2.20	11.68	9.53	-40.11	-13	27.11

Remake: 1. No more harmonic above 3<sup>rd</sup> harmonic for all channel.  
2. ERP= SG Reading –Cable Loss +Gain

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## 5. Field Strength of Radiated Emissions

### 5.1. Limit

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

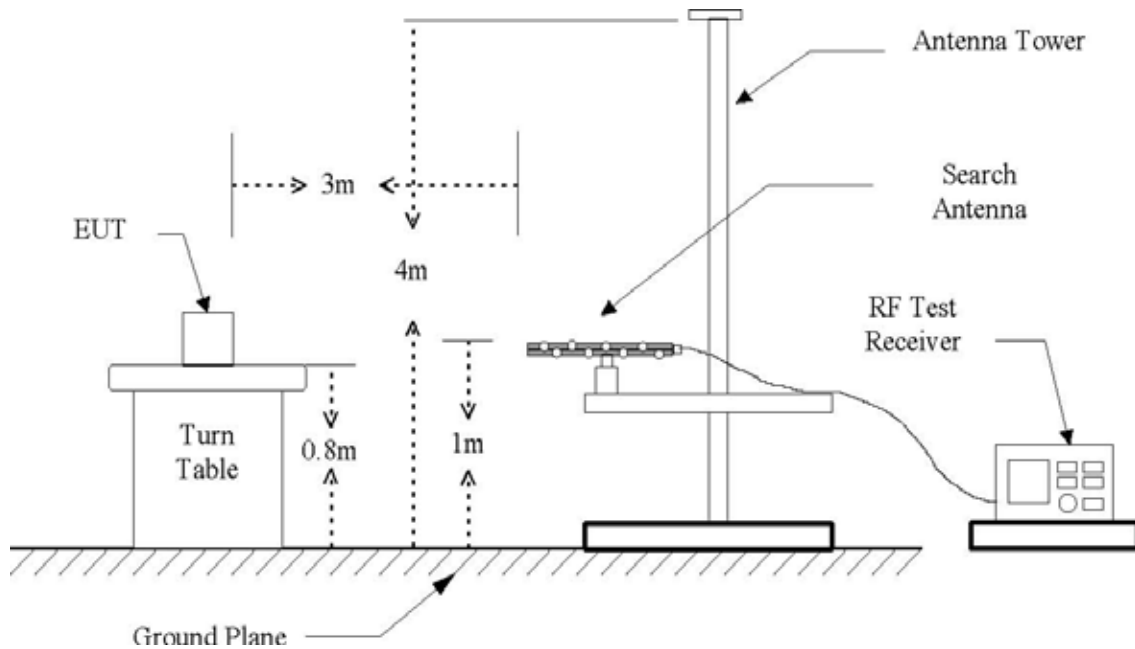
1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference-receiving 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 :

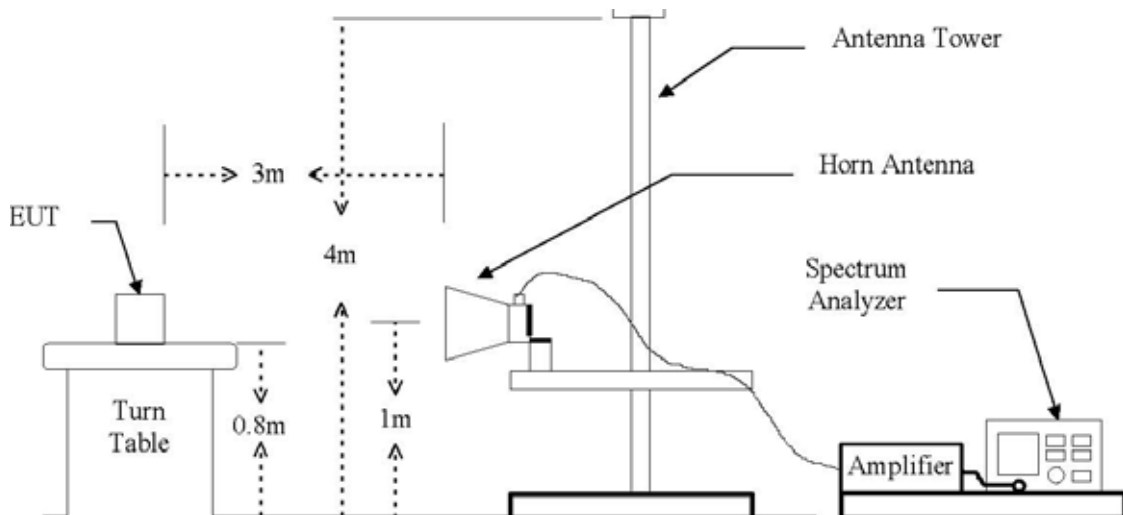
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection and frequency above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

#### PCS 1900

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
174.15	25.1	Q.P.	H	7.61	1.54	34.25	44	9.75
298.65	29.4	Q.P.	V	10.96	2.00	42.36	46	3.64
330.55	20.0	Q.P.	H	11.79	2.12	33.91	46	12.09
401.00	15.9	Q.P.	H	13.54	2.35	31.79	46	14.21
422.85	18.9	Q.P.	H	14.41	2.41	35.72	46	10.28
Not detect								

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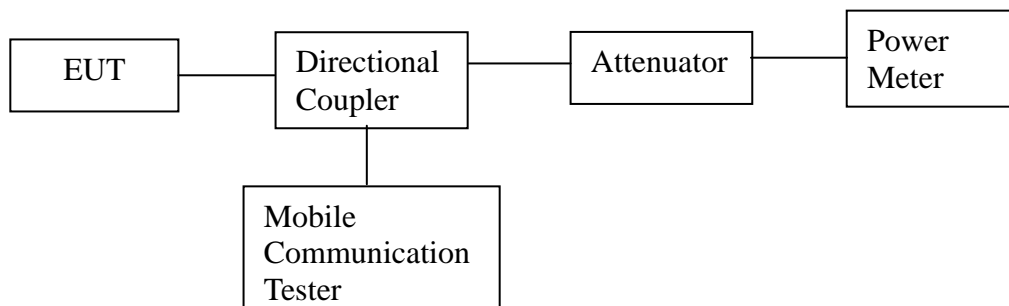
## 6. Conducted Output Power

### 6.1. Limit

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.

### 6.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The Agilent 8960 Test Set has the following procedure.
  - Call Setup > Shift & Preset
  - Protocol Rev > 6 (IS-2000-0)
  - Radio Config.(RC) > RC 54(Fwd5, Rvs4)
  - Traffic Data Rate > Full
  - Cell Info > Cell Parameters > System ID(SID) > 2236  
> Network ID(NID) > 140
3. Once "Active Cell" show "Connected" then change "Rvs. Power Ctrl" from "Active bits" to "All Up bits" to get the maximum power.



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### 6.3. Test Results

#### Preliminary Measurement Results @ Middle channel

##### Average Power Output Table (CDMA 1xRTT)

Band	Channel	CDMA2000 RC	S02 (dBm)	S09 (dBm)	S032(+SCH) (dBm)	S032(+F-SCH) (dBm)	S055 (dBm)
PCS 1900	600	(Fwd1,Rvs1)	23.12				23.41
		(Fwd2,Rvs2)		23.21			23.50
		(Fwd3,Rvs3)	23.17		23.31	23.11	23.51
		(Fwd4,Rvs3)	23.30		23.34	23.27	23.43
		(Fwd5,Rvs4)		23.27			23.65

##### Peak Power Output Table (CDMA 1xRTT)

Band	Channel	CDMA2000 RC	S02 (dBm)	S09 (dBm)	S032(+SCH) (dBm)	S032(+F-SCH) (dBm)	S055 (dBm)
PCS 1900	600	(Fwd1,Rvs1)	26.00				26.21
		(Fwd2,Rvs2)		26.11			26.19
		(Fwd3,Rvs3)	26.07		26.29	26.14	26.08
		(Fwd4,Rvs3)	26.11		26.24	26.00	26.29
		(Fwd5,Rvs4)		26.24			26.37

##### PCS 1900 (1xRTT)

Channel	Frequency (MHz)	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (W)
LOW	1851.25	26.00	398	2
MIDDLE	1880.00	26.37	434	2
HIGH	1908.75	26.15	412	2

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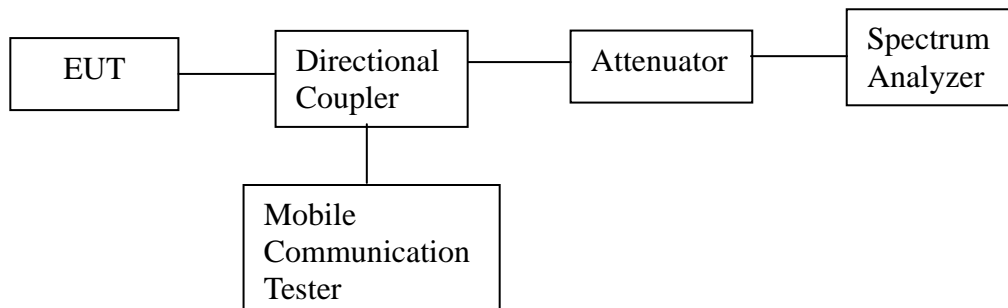
## 7. Occupied Bandwidth 26 dB

### 7.1. Limit

Requirements: CFR 47, Section §2.1049.

### 7.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 30 kHz.
3. Occupied Bandwidth 6 dB was tested under Fwd5, Rvs4.



### 7.3 Test Results

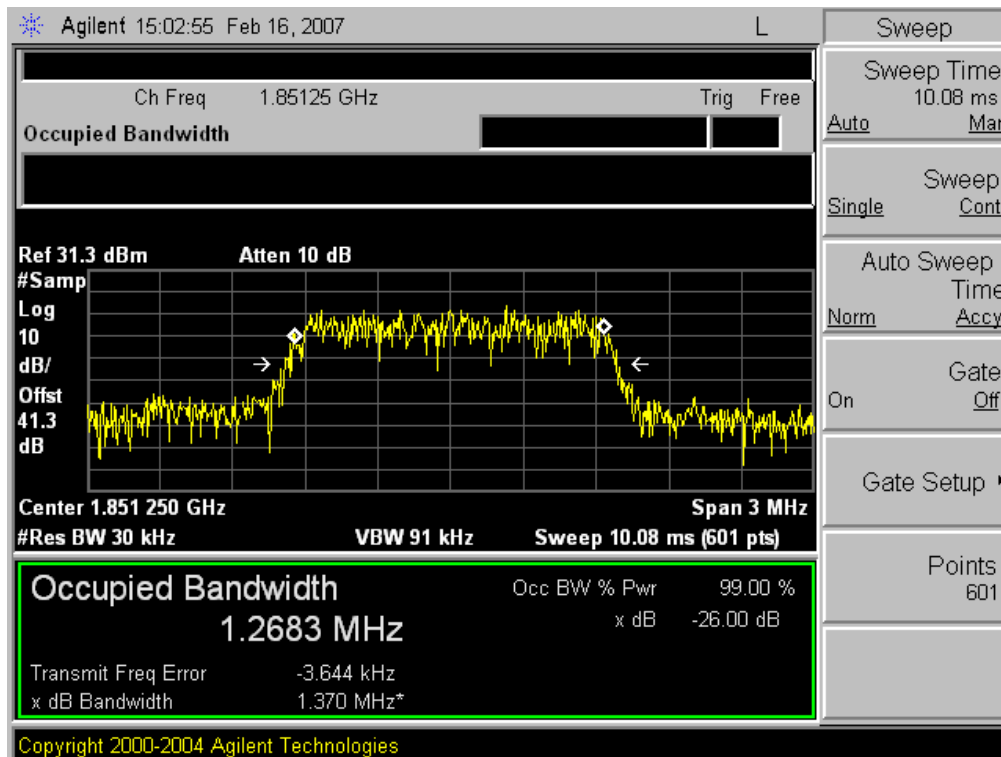
#### PCS 1900

Channel	Frequency(MHz)	-26 dB Bandwidth(MHz)
LOW	1851.25	1.37
MIDDLE	1880.00	1.39
HIGH	1908.75	1.42

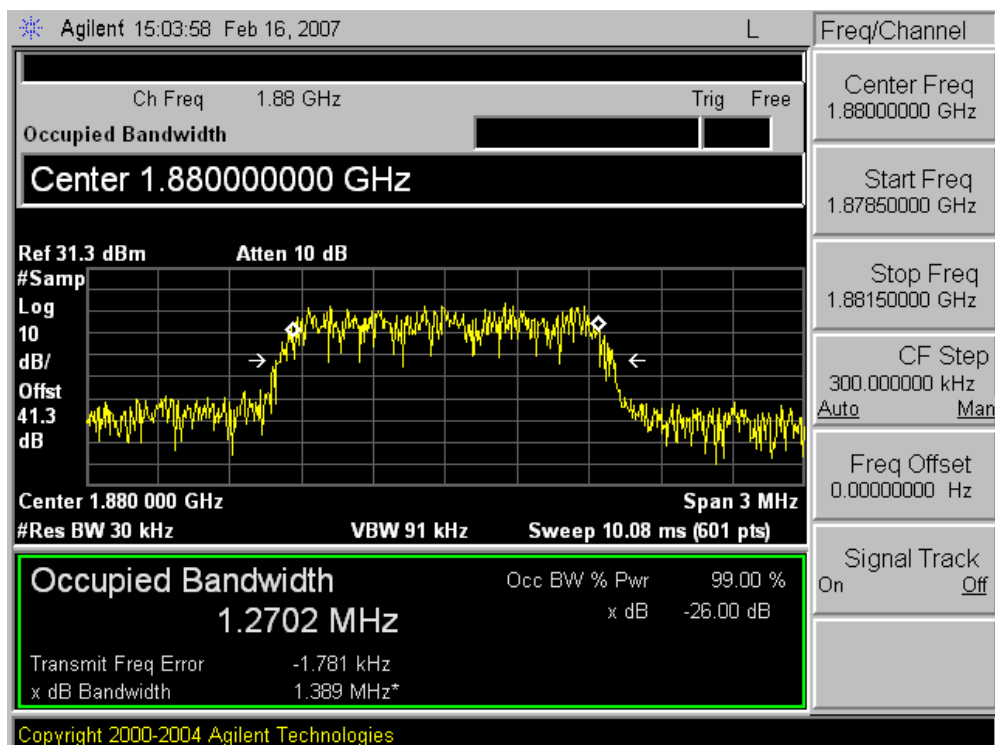
Please refer to the following plots.

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## Low Channel



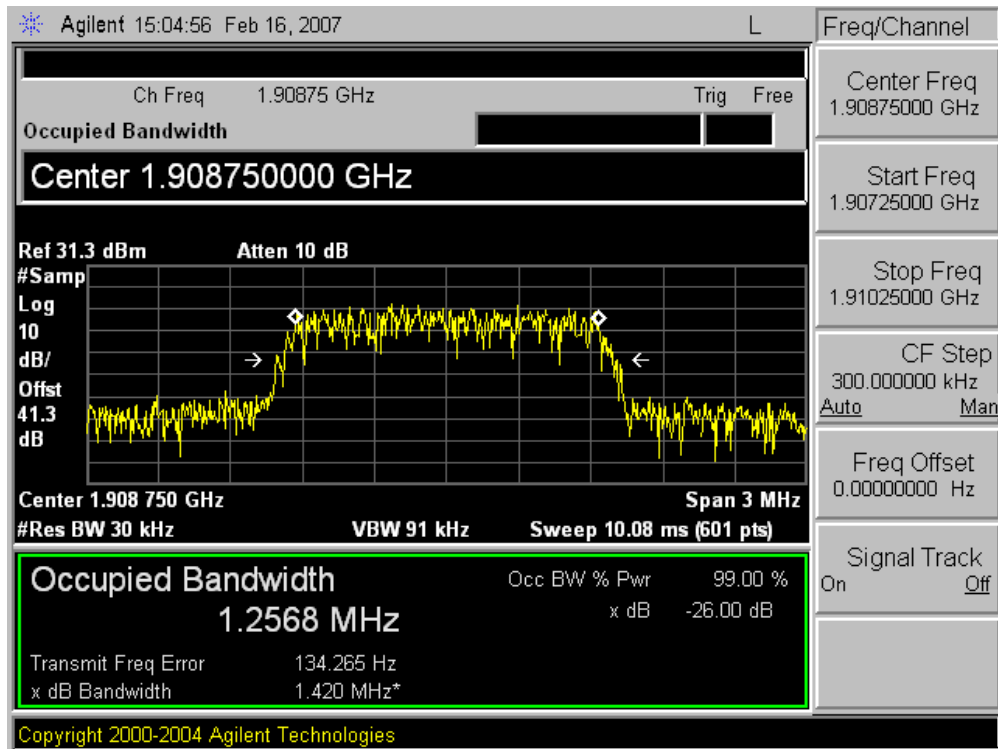
## Middle Channel



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## High Channel



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## 8. Spurious Emissions at Antenna Terminal

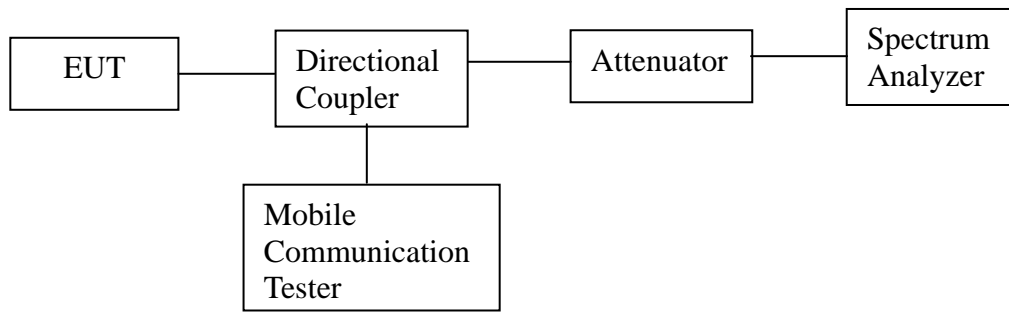
### 8.1. Limit

Requirements: CFR 47, § 2.1051. §24.238 (a) Out of band emissions.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

### 8.2. Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.
3. Spurious Emission was tested under Fwd5, Rvs4



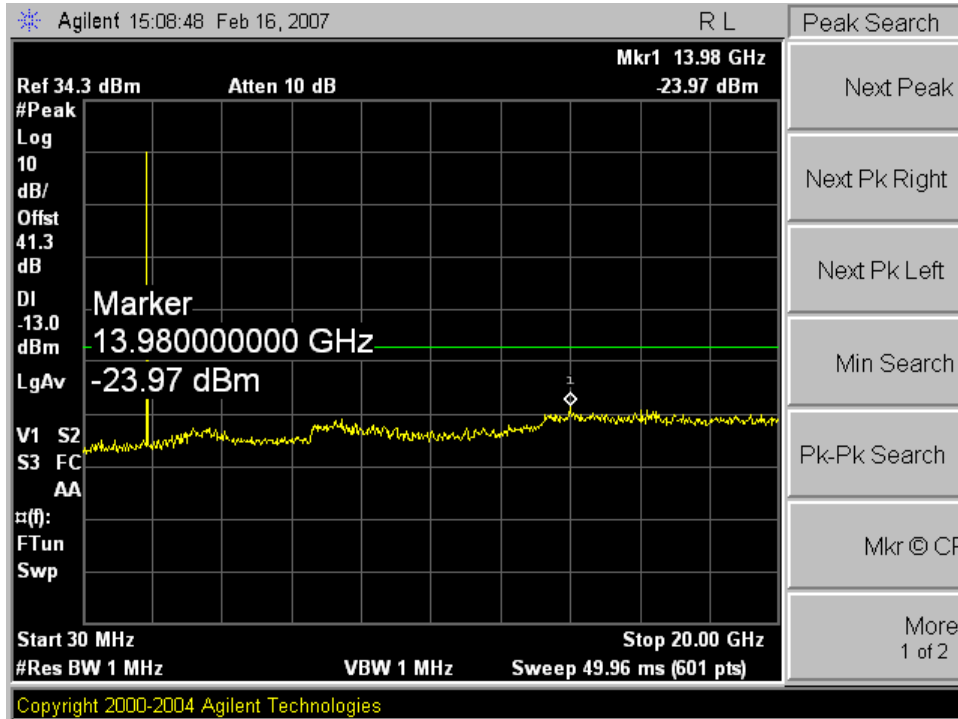
### 8.3. Test Results

Please refer to the following plots.

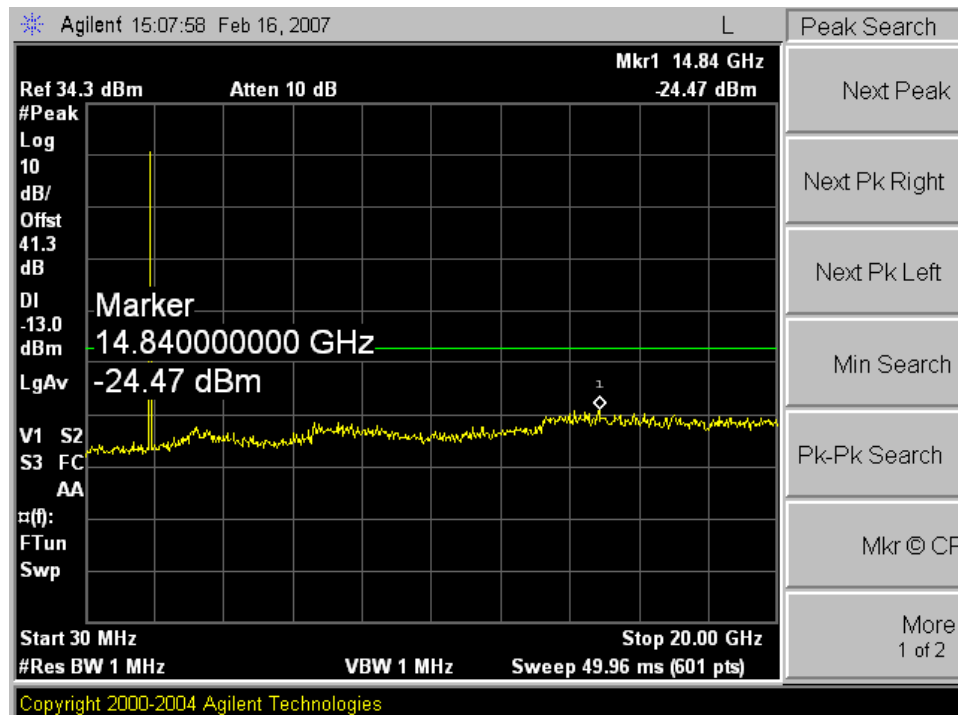
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## PCS 1900

### Low Channel

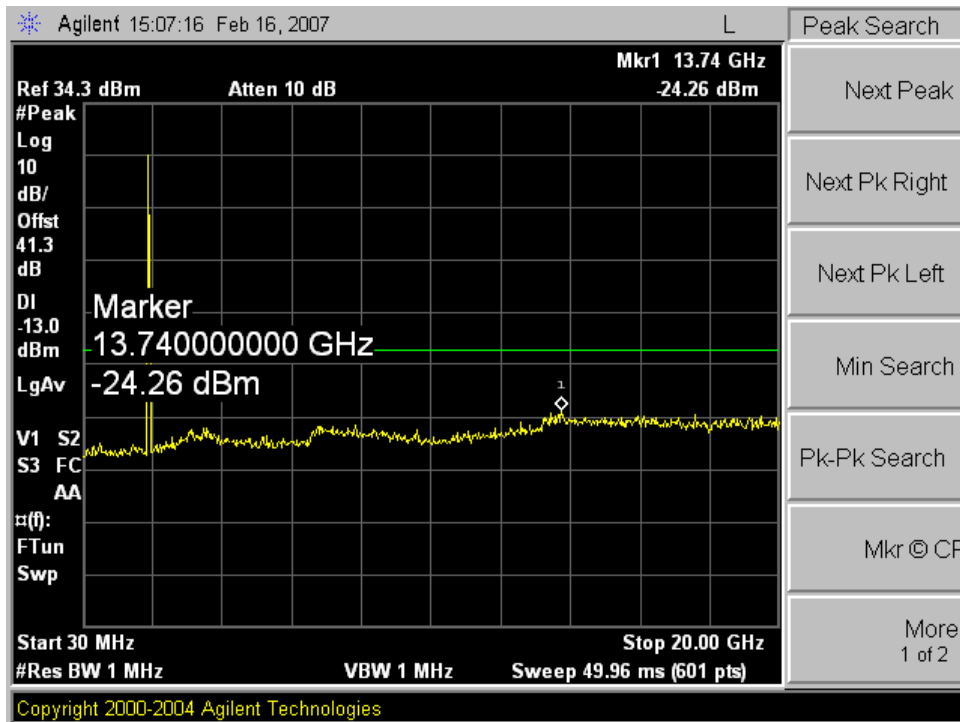


### Middle Channel



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## High Channel



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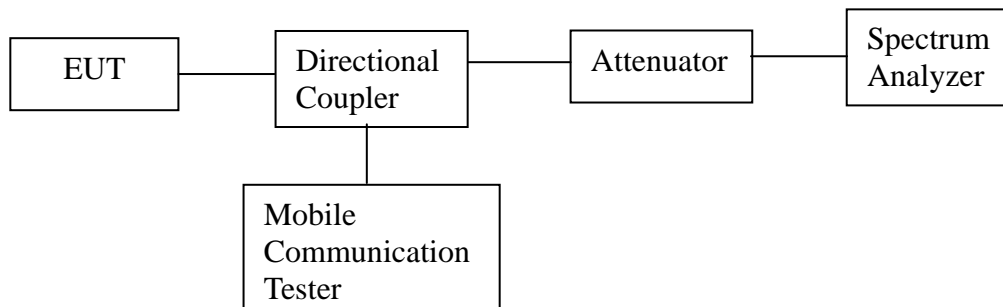
## 9. Band Edge

### 9.1. Limit

§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  $43+10\log(P)$ dB.

### 9.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The center of the spectrum analyzer was set to block edge frequency, RBW set to 30 kHz.



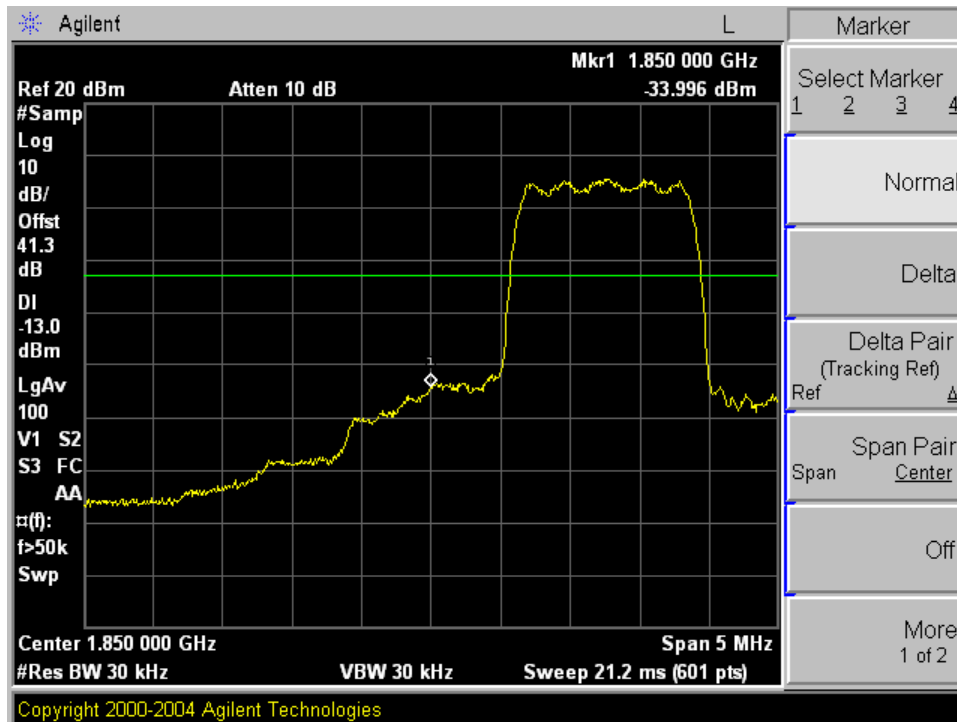
### 9.3. Test Results

Please refer to the following plots.

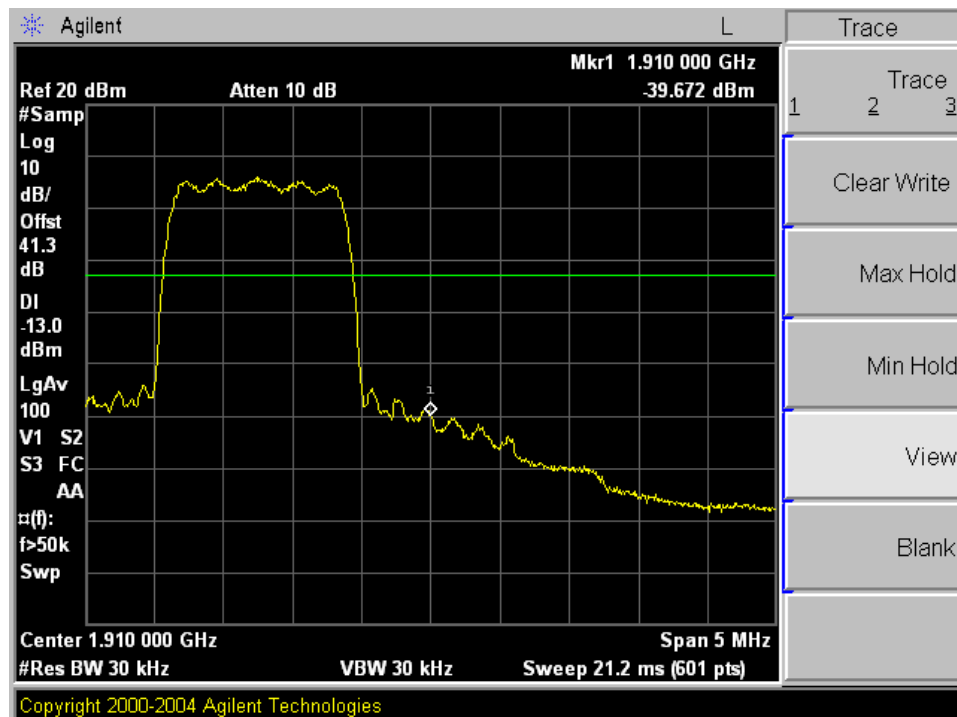
*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

## PCS 1900

### Low Channel



### High Channel



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## 10. Frequency Stability

### 10.1. Limit

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:

§24.235 The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

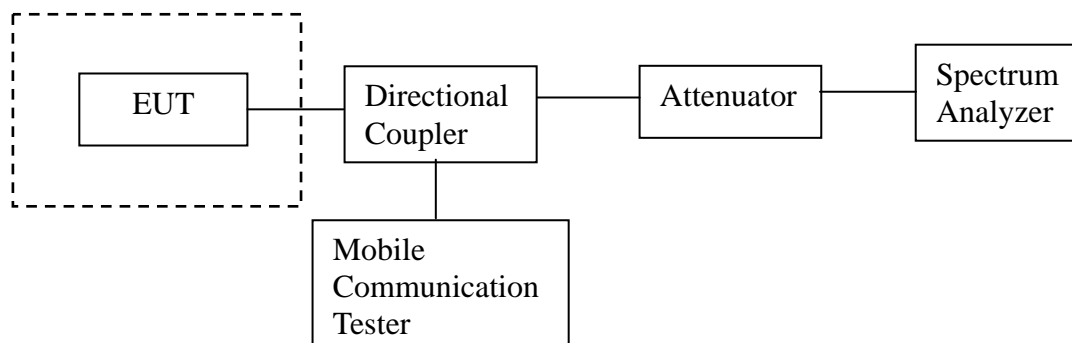
### 10.2. Test Procedure

Frequency Stability vs. Temperature:

1. The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators.
2. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Frequency Stability vs. Voltage:

1. An external variable DC power supply was connected to the battery terminals of the equipment under test.
2. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point.
3. The output frequency was recorded for each battery voltage.



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### 10.3. Test Results

#### Frequency Stability versus Temperature

PCS 1900

Reference Frequency: 1880.00 MHz, Limit: 2.5 ppm			
Environment Temperature ( )	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
22(Ref.)	7.4	13	0.007
60	7.4	20	0.011
50	7.4	20	0.011
40	7.4	14	0.007
30	7.4	11	0.006
20	7.4	-9	-0.005
10	7.4	-10	-0.005
0	7.4	-27	-0.014
-10	7.4	-10	-0.005
-20	7.4	20	0.011
-30	7.4	30	0.016

#### Frequency Stability versus Battery Voltage

PCS 1900

Reference Frequency:1880.00 MHz, Limit:2.5ppm			
Power Supplied (Vdc)	Environment Temperature ( )	Frequency Error (Hz)	ppm
6.29	22	8	0.004
8.51	22	10	0.005

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## Appendix A. Photos of AC Power Line Conducted Emissions Test

### Front View of Conducted Emission



### Rear View of Conducted Emission



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## Appendix B. Photos of Field Strength Radiated Emission Test

Front View



Rear View



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## Appendix C. Photo of RF Rated output power & Spurious Emission Test



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