FCC Part 22
Transmitter Certification

Test Report

FCC ID: DNY0A1EKOMINI8

FCC Rule Part: CFR 47 Part 22 Subpart H

ACS Report Number: 05-0373-22H

Manufacturer: EMS Wireless
Equipment Type: Cellular Bi-Directional Booster
Model: EKOMINI-8

Test Begin Date: October 25, 2005
Test End Date: October 28, 2005

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FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J and Part 22 Subpart H of the FCC's Code of Federal Regulations.

1.2 Product Description

The EkoMini is a band selective, bi-directional amplifier unit and was designed to provide enhanced RF coverage for wireless systems in small facilities. Usage includes providing coverage in retail stores, offices, warehouses, restaurants, homes, etc. The EkoMini is housed in an indoor mountable enclosure, and is powered with a regulated wall mountable power supply.

Detailed photographs of the EUT are filed separately with this filing.

1.3 Technical Specifications

Table 1.3-1: Specifications

Frequency - Models	Uplink	Downlink
EkoMini 8 - 11 CA, Cellular A	824 to 835 MHz	869 to 880 MHz
EkoMini 8 - 14 CB, Cellular B	835 to 849 MHz	880 to 894 MHz
EkoMini 8 - 1.5 CAE, Cellular AE	824 to 835 MHz	869 to 880 MHz
	845 to 846.5 MHz	890 to 891.5 MHz
EkoMini 8 - 1.5 CBE, Cellular BE	835 to 845 MHz	880 to 890 MHz
	846.5 to 849 MHz	891.5 to 894 MHz
EkoMini 8 - 24C, Cellular Full	824 to 849 MHz	869 to 894 MHz
Channel Bandwidth	1.5, 3, 11, 14, 15, 18 or 25 MHz	1.5, 3, 11, 14, 15, 18 or 25 MHz
Number of Channels	Single or Multiple	Single or Multiple
Gain, Maximum	70 dB Nominal	70 dB Nominal
Gain Range	30 dB	30 dB
Gain Steps	2 dB	2 dB

1.4 EUT Operating Configuration and Test Conditions

The EUT was configured and tested utilizing the maximum input drive level resulting in maximum gain conditions for all tests. If the maximum input drive level is exceeded, internal attenuators are activated to produce a level RF output and eliminate the device from operating beyond the maximum RF output power that is below the saturated RF output power.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

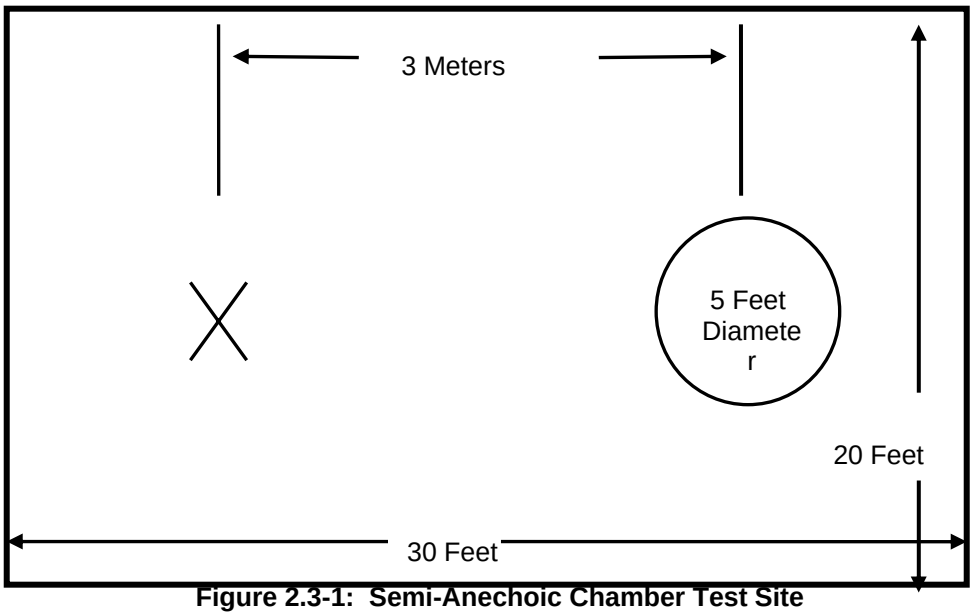

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

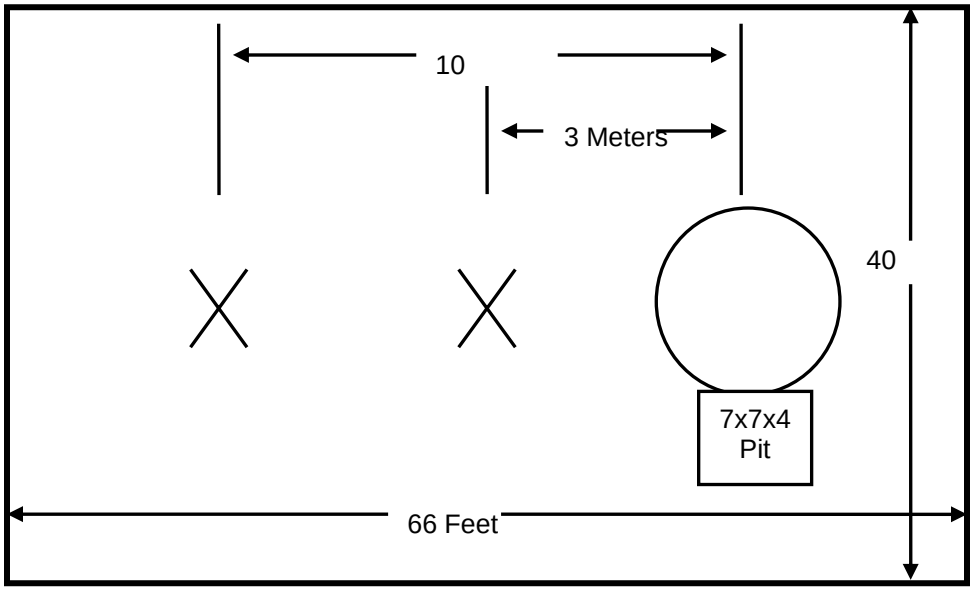

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is a shielded room with the following dimensions:

- Height: 3.0 Meters
- Width: 3.6 Meters
- Length: 4.9 Meters

The room is manufactured by Rayproof Corporation and installed by Panashield, Inc. Earth ground is provided to the room via an 8' copper ground rod. Each panel of the room is connected electrically at intervals of 4".

Power to the room is filtered to prevent ambient noise from coupling to the EUT and measurement equipment. Filters are models 1B42-60P manufactured by Rayproof Corporation.

The room is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 2.4-1:

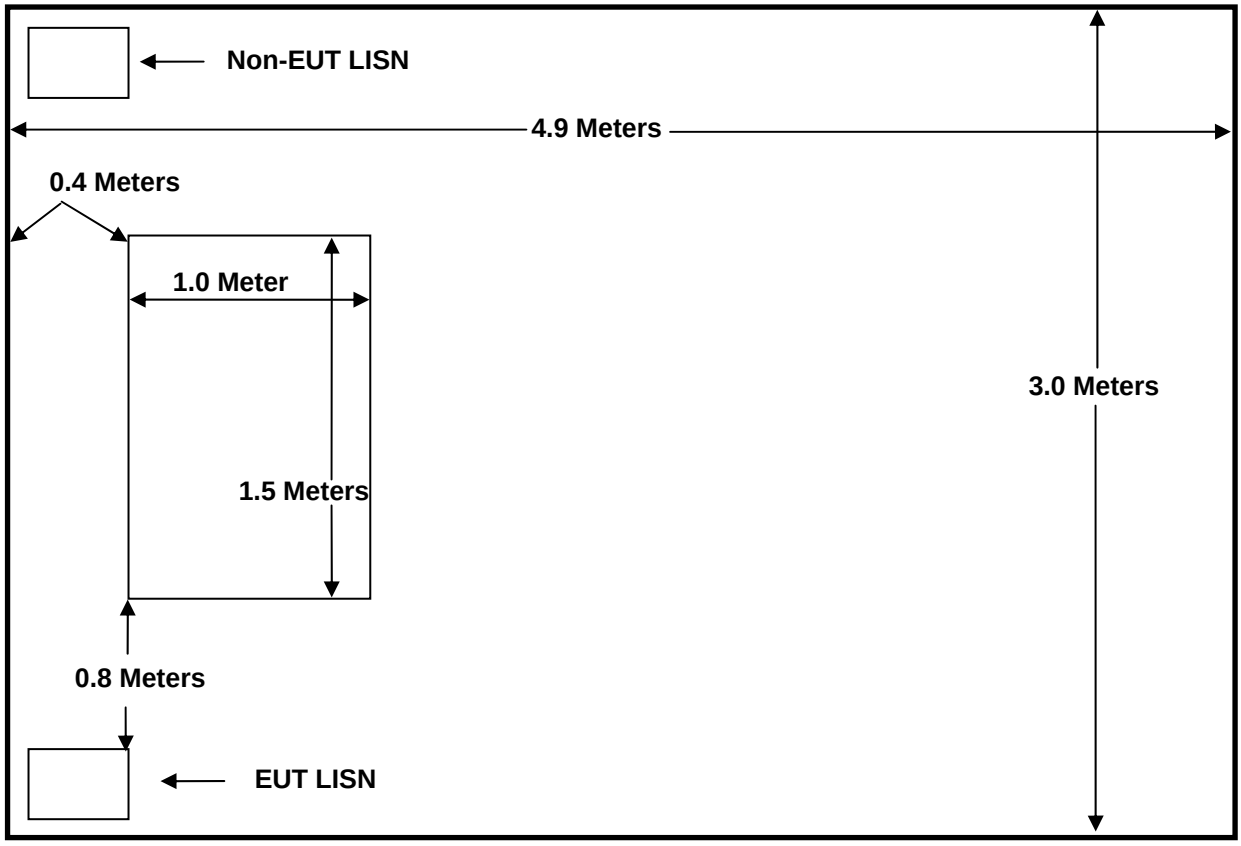

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

1 - ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz

2 - US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures (October 2004)

3 - US Code of Federal Regulations (CFR): Title 47, Part 22, Subpart H: Cellular Radiotelephone Service (October 2004)

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
25	Chase	Bi-Log Antenna	CBL6111	1043	05/23/06
152	EMCO	LISN	3825/2	9111-1905	01/18/06
165	ACS	Conducted EMI Cable Set	RG8	165	01/06/06
22	Agilent	Pre-Amplifier	8449B	3008A00526	05/06/06
73	Agilent	Pre-Amplifier	8447D	272A05624	05/18/06
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	05/09/06
NA	EMCO	Horn Antenna	3115	9512-4636	NA
105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	06/09/06
1	Rohde & Schwarz	Receiver	804.8932.52	833771/007	02/26/06
2	Rohde & Schwarz	Receiver	1032.5640.53	839587/003	02/26/06
3	Rohde & Schwarz	ESMI Receiver	804.8932.52	839379/011	12/15/05
4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	12/15/05
NA	Agilent	Spectrum Analyzer	E7402A	US41110277	11/10/05
204	ACS	Cable	RG8	204	12/29/05
6	Harbour Industries	HF RF Cable	LL-335	00006	03/16/06
7	Harbour Industries	HF RF Cable	LL-335	00007	03/16/06
208	Harbour Industries	HF RF Cable	LL142	00208	06/24/06
237	Gigatronics	Signal Generator	900	282706	01/03/06
176	Weinschel	30 dB Attenuator	46-30-34	BN4922	1/10/06
NA	Termaline	Coaxial Resistor 50W	8085	13328	N/A
N/A	Termaline	Coaxial Resistor 100W	8164	7655	N/A
167	ACS	Chamber EMI Cable Set	RG6	167	12/29/05
204	ACS	Chamber EMI RF cable	RG8	204	01/07/06
NA	Agilent	Signal Generator	E4436B	MY41000134	08/31/07
NA	Agilent	Signal Generator	E4437B	US39260478	10/05/07

5.0 SUPPORT EQUIPMENT AND ACCESSORIES

Table 5-1: Support Equipment and Accessories

Diagram #	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	apx Technologies Inc.	100-240 V Switching Power Supply	SP60909L	NA	NA
2	Agilent	Signal Generator	E4437B	US39260478	NA

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6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

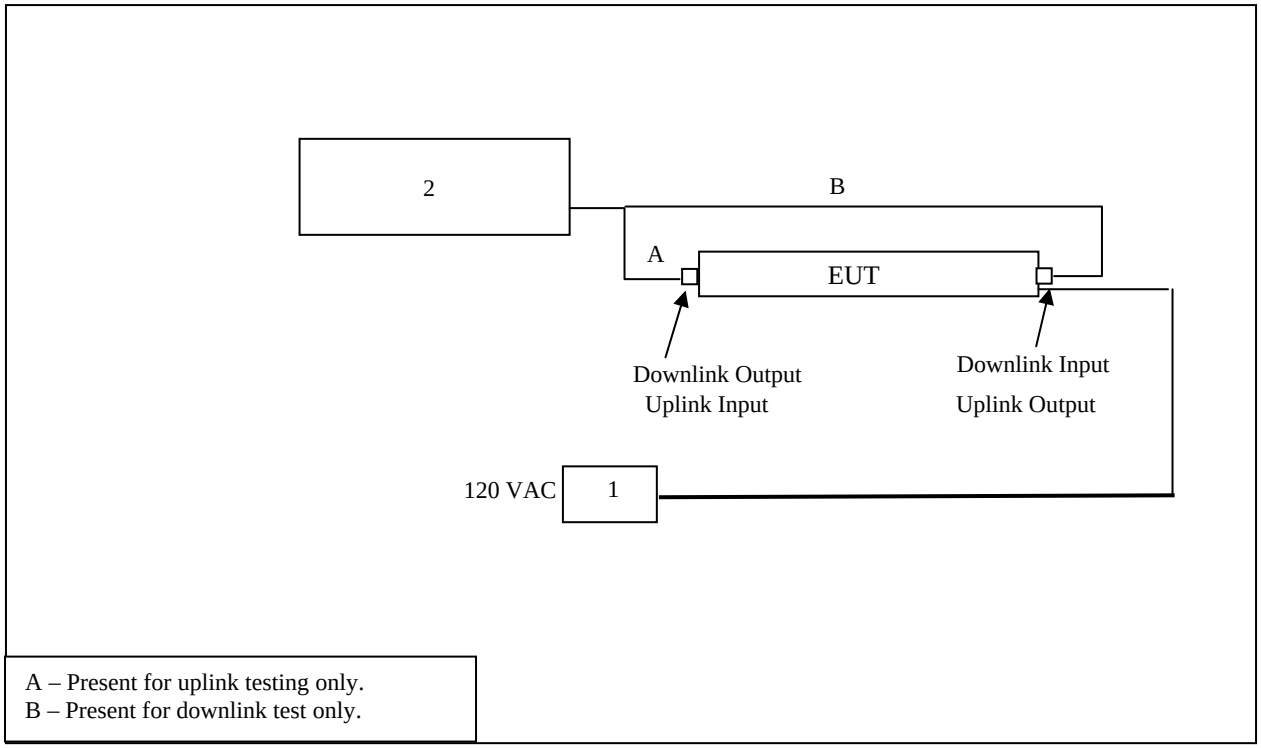

Figure 6-1: EUT Test Setup

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document. Data plots can be found in the test report appendix 05-0373-22H-A.

7.1 RF Power Output

7.1.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The resolution and video bandwidths of the spectrum analyzer were set at sufficient levels, >> emission bandwidth, to produce accurate results. The analyzer was set for Max Hold using a peak detector. Results for uplink and downlink configurations are shown below in Table 7.1-1.

7.1.2 Measurement Results

Table 7.1-1: Peak Output Power

Configuration	Modulation	Channel	Frequency (MHz)	RF Power Output (dBm)
Uplink	CDMA	Low	824.70	26.98
Uplink	CDMA	Middle	836.52	27.32
Uplink	CDMA	High	848.31	27.61
Uplink	TDMA	Low	824.04	26.52
Uplink	TDMA	Middle	836.52	26.96
Uplink	TDMA	High	848.97	27.12
Uplink	GSM	Low	824.20	24.98
Uplink	GSM	Middle	836.60	25.08
Uplink	GSM	High	848.80	25.22
Downlink	CDMA	Low	869.70	28.00
Downlink	CDMA	Middle	881.52	28.15
Downlink	CDMA	High	893.31	27.50
Downlink	TDMA	Low	869.04	26.97
Downlink	TDMA	Middle	881.52	27.18
Downlink	TDMA	High	893.97	26.48
Downlink	GSM	Low	869.20	25.23
Downlink	GSM	Middle	881.60	25.05
Downlink	GSM	High	893.80	24.79

7.2 Occupied Bandwidth (Emission Limits)

7.2.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The spectrum analyzer resolution and video bandwidths were set to 1% the emission bandwidth. The analyzer was set for Max Hold using a peak detector. Both the input and output bandwidths were evaluated to show similar characteristics of the emissions. Results for uplink and downlink configurations are shown below in Table 7.2-1.

7.2.2 Measurement Results

Occupied bandwidth plots are listed below and are supplied in the test report appendix 05-0373-22H-A.

Table 7.2-1: Occupied Bandwidth

Configuration	Modulation	Channel	Frequency (MHz)	Plot Reference
Uplink	CDMA	Middle	836.52	Figure 1.
Uplink	TDMA	Middle	836.52	Figure 2.
Uplink	GSM	Middle	836.60	Figure 3.
Downlink	CDMA	Middle	881.52	Figure 4.
Downlink	TDMA	Middle	881.52	Figure 5.
Downlink	GSM	Middle	881.60	Figure 6.

7.3 Spurious Emissions at Antenna Terminals and Inter-modulation Products

7.3.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. For inter-modulation products the three tone method was used with the device operating at maximum drive levels. Three tones were placed at the lower band-edge and adjusted such that the third order harmonics were maximized and within the operating frequency band. Inter-modulation products were tested using TDMA, CDMA, and CW signals. CW covers FM (GSM and F1D) for inter-modulation products. The spectrum analyzer resolution and video bandwidths were set to 1% the emission bandwidth

For out of band spurious emissions the spectrum analyzer resolution and video bandwidths were set to 1 MHz according to Section 22.917 (b). The spectrum was investigated for the 30 MHz to 10 GHz in accordance to CFR 47 Part 2.1057. The analyzer was set for Max Hold using a peak detector. Spurious emissions were evaluated for all modulation modes.

7.3.2 Measurement Results

Emission plots are listed below in Table 7.3-1 and Table 7.3-2 and plots are supplied in the test report appendix 05-0373-22H-A.

Table 7.3-1: Spurious Emissions - Uplink

Configuration	Modulation	Channel	Frequency Range (MHz)	Plot Reference
Uplink	CDMA	Low	In Band	Figure 7.
Uplink	CDMA	Low	30 – 2900	Figure 8.
Uplink	CDMA	Low	2900 - 20000	Figure 9.
Uplink	CDMA	Middle	30 – 2900	Figure 10.
Uplink	CDMA	Middle	2900 - 20000	Figure 11.
Uplink	CDMA	High	30 – 2900	Figure 12.
Uplink	CDMA	High	2900 - 20000	Figure 13.
Uplink	TDMA	Low	In Band	Figure 14.
Uplink	TDMA	Low	30 – 2900	Figure 15.
Uplink	TDMA	Low	2900 - 20000	Figure 16.
Uplink	TDMA	Middle	30 – 2900	Figure 17.
Uplink	TDMA	Middle	2900 - 20000	Figure 18.
Uplink	TDMA	High	30 – 2900	Figure 19.
Uplink	TDMA	High	2900 - 20000	Figure 20.
Uplink	CW	Low	In Band	Figure 21.
Uplink	CW	Low	30 – 2900	Figure 22.
Uplink	CW	Low	2900 - 20000	Figure 23.
Uplink	GSM	Low	30 – 2900	Figure 24.
Uplink	GSM	Low	2900 - 20000	Figure 25.
Uplink	GSM	Middle	30 – 2900	Figure 26.
Uplink	GSM	Middle	2900 - 20000	Figure 27.
Uplink	GSM	High	30 – 2900	Figure 28.
Uplink	GSM	High	2900 - 20000	Figure 29.

Table 7.3-1: Spurious Emissions - Downlink

Configuration	Modulation	Channel	Frequency Range (MHz)	Plot Reference
Downlink	CDMA	Low	In Band	Figure 30.
Downlink	CDMA	Low	30 – 2900	Figure 31.
Downlink	CDMA	Low	2900 - 20000	Figure 32.
Downlink	CDMA	Middle	30 – 2900	Figure 33.
Downlink	CDMA	Middle	2900 - 20000	Figure 34.
Downlink	CDMA	High	30 – 2900	Figure 35.
Downlink	CDMA	High	2900 - 20000	Figure 36.
Downlink	TDMA	Low	In Band	Figure 37.
Downlink	TDMA	Low	30 – 2900	Figure 38.
Downlink	TDMA	Low	2900 - 20000	Figure 39.
Downlink	TDMA	Middle	30 – 2900	Figure 40.
Downlink	TDMA	Middle	2900 - 20000	Figure 41.
Downlink	TDMA	High	30 – 2900	Figure 42.
Downlink	TDMA	High	2900 - 20000	Figure 43.
Downlink	CW	Low	In Band	Figure 44.
Downlink	CW	Low	30 – 2900	Figure 45.
Downlink	CW	Low	2900 - 20000	Figure 46.
Downlink	GSM	Low	30 – 2900	Figure 47.
Downlink	GSM	Low	2900 - 20000	Figure 48.
Downlink	GSM	Middle	30 – 2900	Figure 49.
Downlink	GSM	Middle	2900 - 20000	Figure 50.
Downlink	GSM	High	30 – 2900	Figure 51.
Downlink	GSM	High	2900 - 20000	Figure 52.

7.4 Band-edge Compliance

7.4.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The spectrum analyzer resolution and video bandwidths were set to 1% the emission bandwidth. The analyzer was set for Max Hold using a peak detector. The center frequency was set to both the upper and lower cellular frequency block edges.

7.4.2 Measurement Results

Band-edge plots in are listed in Table 7.4-1below and are supplied in the test report appendix 05-0373-22H-A.

Table 7.4-1: Band-edge

Configuration	Modulation	Channel	Frequency (MHz)	Plot Reference
Uplink	CDMA	Low	824.70	Figure 53.
Uplink	CDMA	High	848.31	Figure 54.
Uplink	TDMA	Low	824.04	Figure 55.
Uplink	TDMA	High	848.97	Figure 56.
Uplink	GSM	Low	824.20	Figure 57.
Uplink	GSM	High	848.80	Figure 58.
Downlink	CDMA	Low	869.70	Figure 59.
Downlink	CDMA	High	893.31	Figure 60.
Downlink	TDMA	Low	869.04	Figure 61.
Downlink	TDMA	High	893.97	Figure 62.
Downlink	GSM	Low	869.20	Figure 63.
Downlink	GSM	High	893.80	Figure 64.

7.5 Field Strength of Spurious Emissions

7.5.1 Measurement Procedure

The equipment under test is placed on the Open Area Test Site (described in section 2.1) on a wooden table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded.

The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated in accordance to CFR 47 Part 2.1057. A CW was used for both uplink and downlink for low, middle and high channels. The worst case emissions are reported of both uplink and downlink configurations. All emissions not reported were below the noise floor of the measurement equipment.

Results of the test are shown below in Table 7.5-1.

7.5.2 Measurement Results

Table 7.5.-1: Field Strength of Spurious Emissions

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
Uplink							
1648	-59.78	-65	H	5.31	-59.69	-13.00	46.69
1648	-57.3	-60	V	5.31	-54.69	-13.00	41.69
1672	-57.52	-63	H	5.32	-57.68	-13.00	44.68
1672	-54.45	-58	V	5.32	-52.68	-13.00	39.68
1696	-59.36	-65	H	5.33	-59.67	-13.00	46.67
1696	-56.75	-61	V	5.33	-55.67	-13.00	42.67
Downlink							
1738	-60.75	-65	V	5.35	-59.65	-13.00	46.65
1762	-61.17	-67	V	5.35	-61.65	-13.00	48.65

7.6 Frequency Response

7.6.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The spectrum analyzer resolution and video bandwidths were set to 100 kHz. The analyzer was set for Max Hold using a peak detector. Using a signal generator, both the uplink and downlink ports were driven with a CW signal. The frequency of the signal generator was sweep across the entire range of operation. Results of the test are shown below in and Figure 7.6-1 through 7.6-2.

7.6.2 Measurement Results

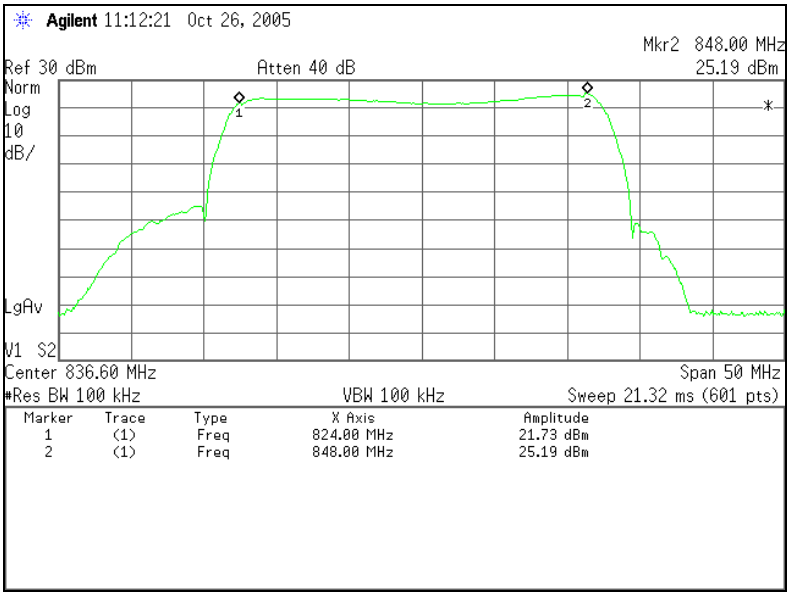

Figure 7.6-1: Frequency Response Uplink

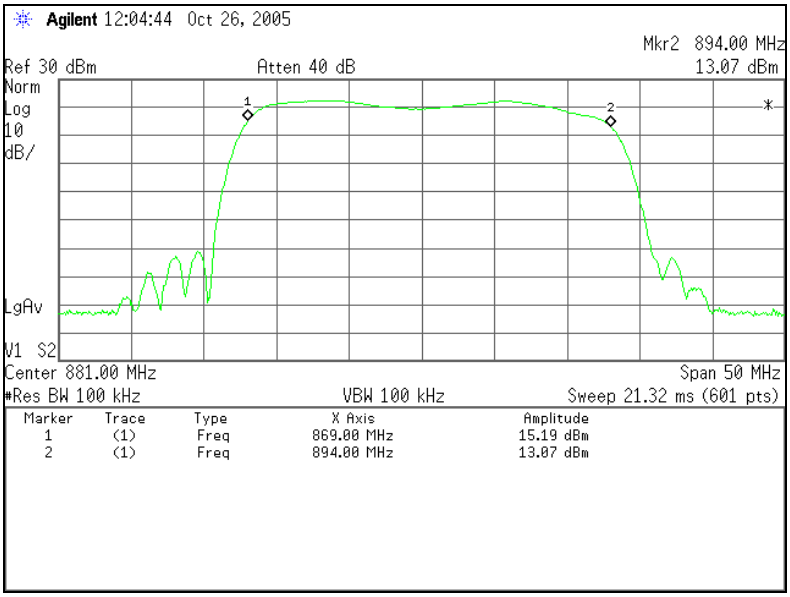

Figure 7.6-2: Frequency Response Downlink

END Report