



**FCC CFR47 PART 24 SUBPART E
CERTIFICATION
TEST REPORT**

FOR

EUT: CDMA CELLULAR BASESTATION

MODEL NUMBER: WAVE2000BS PLUS

FCC ID: OEW-AGBB-M1

REPORT NUMBER: 04U3009-1

ISSUE DATE: NOVEMBER 15, 2000

Prepared for
**INTERWAVE COMMUNICATIONS
2495 LEGHORN STREET
MOUNTAIN VIEW, CA 94043
USA**

Prepared by
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NVLAP[®]
LAB CODE:200065-0

Revision History

<u>Rev.</u>	<u>Revisions</u>	<u>Revised By</u>
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: INTERWAVE COMMUNICATIONS
2495 LEGHORN STREET
MOUNTAIN VIEW, CA 94043, USA

EUT DESCRIPTION: CDMA CELLULAR BASESTATION

MODEM NAME: Wave2000 BS Plus

DATE TESTED: NOVEMBER 09 TO 11, 2004

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 24 SUBPART E	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES



VIEN TRAN
EMC TECHNICIAN
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA/EIA 603A, ANSI C63.4, FCC CFR 47 Part 2, FCC CFR 47 Part 15 and FCC CFR 47 Part 24.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The 1900MHz CDMA Cellular Base Station has:

- Average RF conducted output power 32.5dBm
- Transmitting of frequency range 1930 ~ 1990MHz

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power and ERP as follows:

1930 to 1990 MHz Authorized Band

Frequency Range (MHz)	Modulation	Average RF Conducted Output Power (dBm)	Average RF Conducted Output Power (mW)
1930 - 1990	CDMA	32.5	1778.28

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

There is no antenna including in the product.

5.4. SOFTWARE AND FIRMWARE

Client provided the firmware & driver installed in the host support equipment. The software from the laptop will control operating state of EUT via Ethernet cable

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 1988.75 MHz.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
LAPTOP	Compaq	1456VQL1N	N/A	DoC
AC ADAPTER	Compaq	LE9702A	N/A	DoC
AC ADAPTER	3COM	7900-000-044-1	N/A	DoC
DOCKSTATION	Belkin	F5U216	N/A	DoC
HUB	3COM	0200/7-2F174294	N/A	DoC
30dB ATTENUATOR	N/A	N/A	N/A	DoC
GPS ANTENNA	NAIS	CCAH32ST01	N/A	N/A

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	3	US115	UNSHIELDED	2m	NO
2	DC	2	DC	UNSHIELDED	2m	NO
3	AC	1	US115	UNSHIELDED	2m	NO
4	USB	1	USB	SHIELDED	1m	YES
5	ETHERNET	2	RJ45	UNSHIELDED	10m	YES
6	SMA CABLE	3	N-TYPE	SHIELDED	1.5m	YES
7	COAX	1	NTC	SHIELDED	1.5m	YES

TEST SETUP

The software from the laptop will control operating state of EUT via Ethernet cable.

The diagram illustrates the test setup for the EUT WAVE 2000 BS. The components and their connections are as follows:

- GPS ANTENNA**: Connected to the **EUT WAVE 2000 BS** via a dashed box labeled **7**.
- EUT WAVE 2000 BS**: The central device under test.
- 30 dB Antennuator**: Three units connected to the EUT WAVE 2000 BS via dashed boxes labeled **6**.
- Transformer 115Vac to 230Vac**: Connected to the EUT WAVE 2000 BS via a dashed box labeled **3**.
- FOR SETUP PURPOSE ONLY**: A dashed box enclosing the following components:
 - HUB**: Connected to the EUT WAVE 2000 BS via a dashed box labeled **5**.
 - DOCKSTATION**: Connected to the HUB via a dashed box labeled **5**.
 - LAPTOP**: Connected to the DOCKSTATION via a dashed box labeled **4**.
 - AC ADAPTER**: Two units, each connected to the HUB and DOCKSTATION via dashed boxes labeled **2**.
- Power Source**: A common source at the bottom providing **115VAC / 60Hz** and **230VAC / 50Hz**. It is connected to the Transformer and the two AC ADAPTERS via dashed boxes labeled **1**.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Cal Due
Peak Power Meter	Agilent	E4416A	GB41291160	11/7/2005
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/04
RF Filter Section	HP	85420E	3705A00256	11/21/04
30MHz---- 2Ghz	Sunol Sciences	JB1 Antenna	A121003	12/22/04
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	10/13/05
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/13/05
Site A Line Stabilizer / Conditioner	Tripplite	LC-1800a	A0051681	CNR
Preamplifier, 1 ~ 26.5 GHz	HP	8449B	3008A00369	4/25/05
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	2/4/05
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924342	4/25/05
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	29800	5/30/05
2.7GHz HI Pass Filter	MICRO-TRONICS	MP13194	1	N/A
Spectrum Analyzer 20 Hz ~ 44 GHz	Agilent	E4446A	US42070220	4/1/05

7. LIMITS AND RESULTS

7.1. OCCUPIED BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the -26dBc bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal -26dBc bandwidth function is utilized.

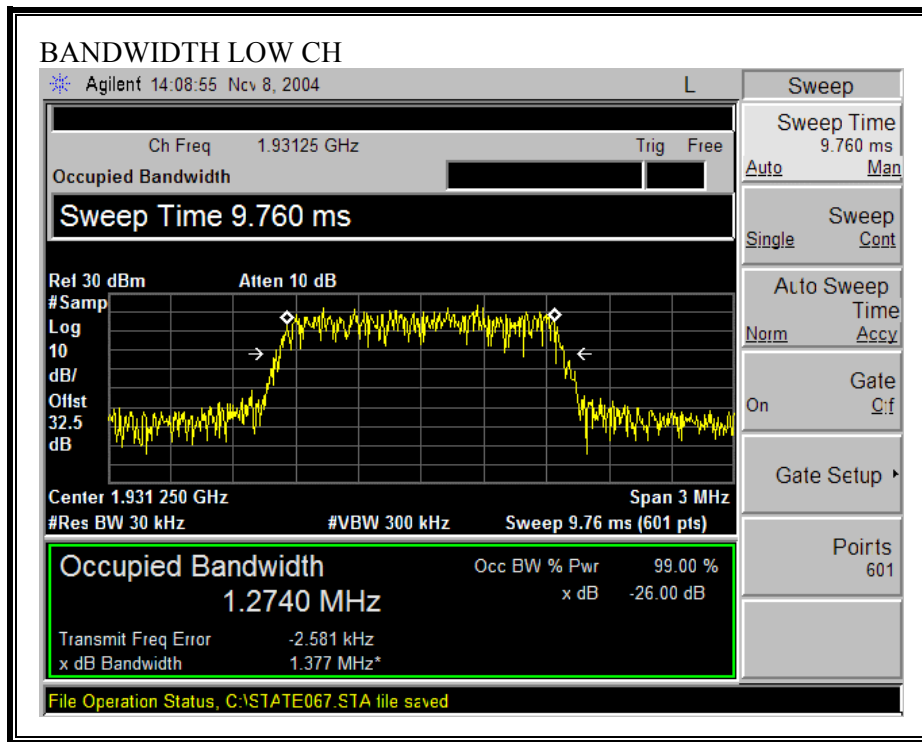
RESULTS

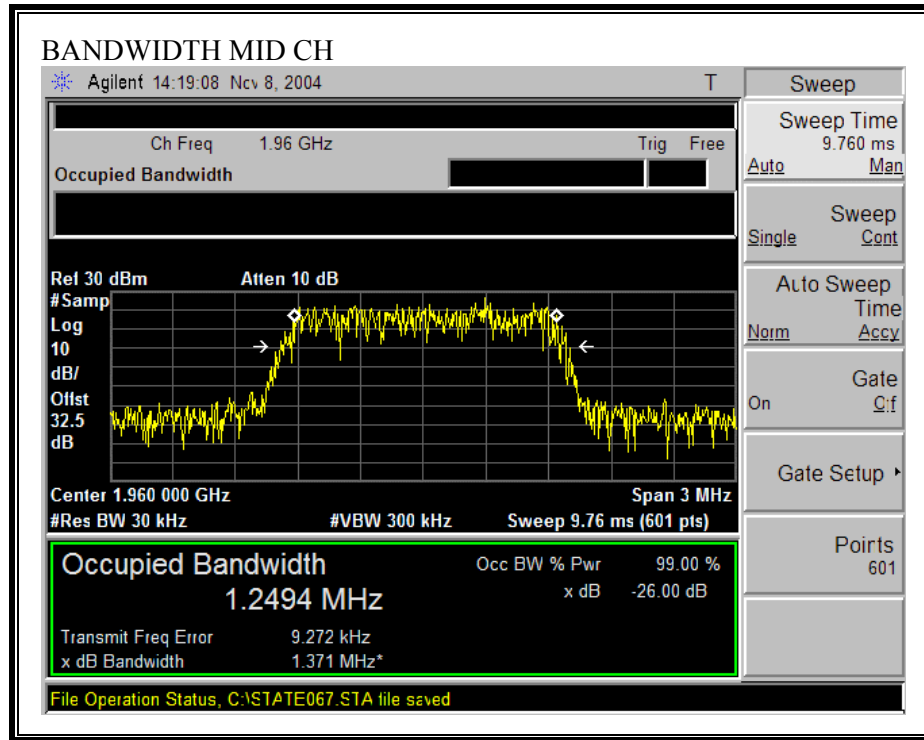
No non-compliance noted:

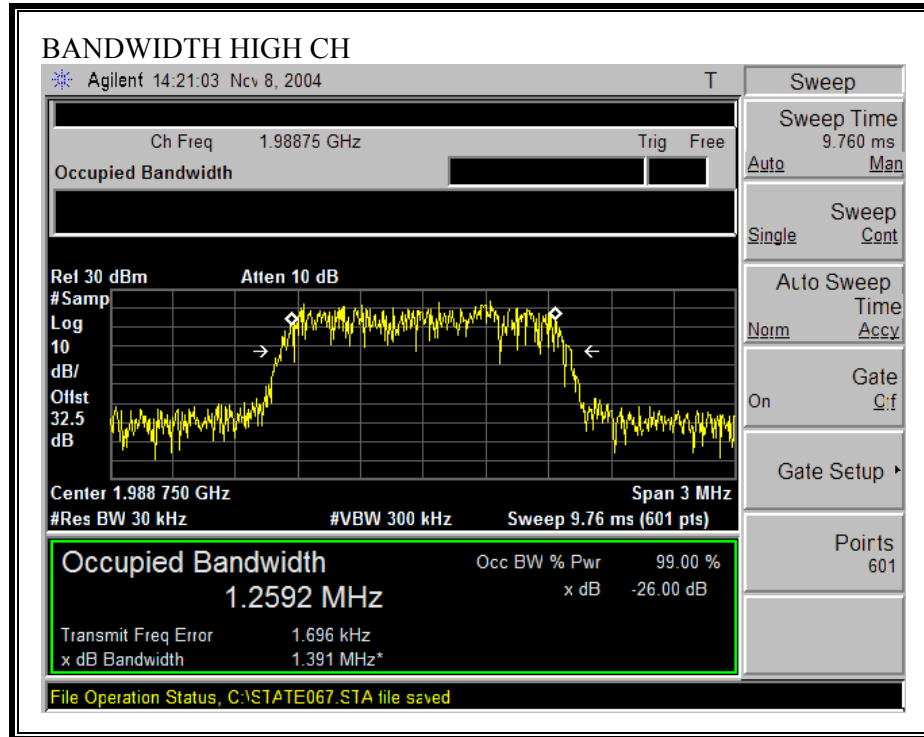
CDMA Modulation

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	1931.25	1.377
Middle	1960.00	1.371
High	1988.75	1.391

26 dB BANDWIDTH







7.2. MODULATION CHARACTERISTICS

Not applicable.

7.1. RF POWER OUTPUT

LIMIT

24.232 (a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. See § 24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power; see Table 1 of this section. In no case may the peak output power of a base station transmitter exceed 100 watts.

TABLE 1—REDUCED POWER FOR BASE STATION
ANTENNA HEIGHTS OVER 300 METERS

HAAT in meters	Maximum e.i.r.p. (watts)
≤300	1,640
≤500	1,070
≤1,000	490
≤1,500	270
≤2,000	160

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17

RESULTS

No non-compliance noted.

CDMA Modulation

Channel	Frequency (MHz)	Average RF Conducted Output Power (dBm)
Low	1931.25	31.34
Middle	1960.00	32.50
High	1989.75	31.00

7.3. FREQUENCY STABILITY

LIMIT

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

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

RESULTS

No non-compliance noted.

Reference Frequency: CDMA Mid Channel 1960.691875MHz @ 25°C Limit: to stay ± 2.5 ppm = 4901.730 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
48.00	50	1960.69186	0.009	± 2.5
48.00	40	1960.69298	-0.561	± 2.5
48.00	30	1960.69293	-0.536	± 2.5
48.00	25	1960.69188	0	± 2.5
48.00	20	1960.69230	-0.217	± 2.5
48.00	10	1960.69224	-0.185	± 2.5
48.00	0	1960.69209	-0.111	± 2.5
Reference Frequency: CDMA Mid Channel 1960.691875MHz @ 25°C Limit: to stay ± 2.5 ppm = 4901.730 Hz				
Power Supply (Vac)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
115.00	25	1960.69188	0	± 2.5
97.5	25	1960.69353	-0.845	± 2.5
132.25	25	1960.69100	0.445	± 2.5

7.4. SPURIOUS EMISSION AT ANTENNA TERMINAL

LIMIT

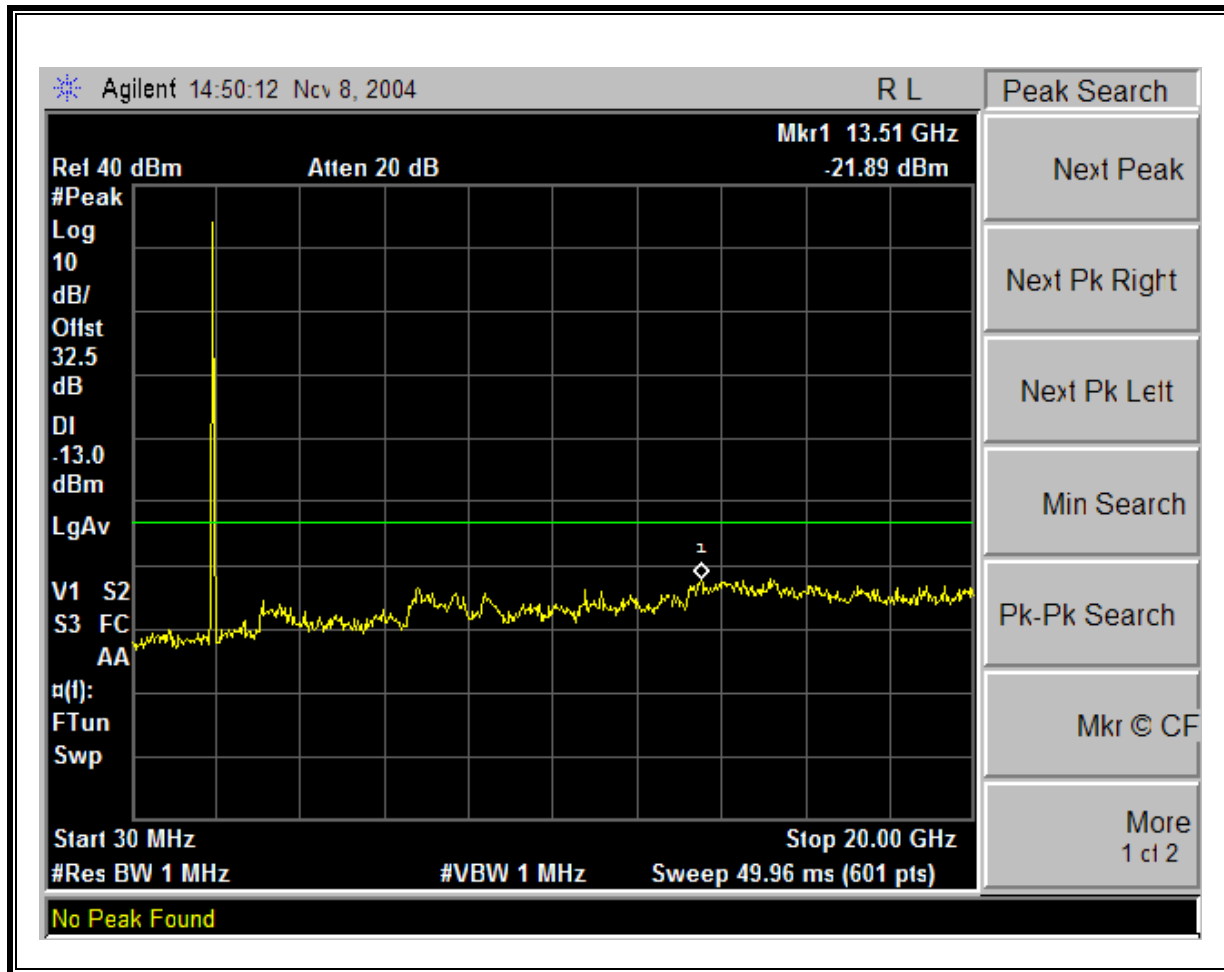
§24.238 (a) *Out of band emissions*. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

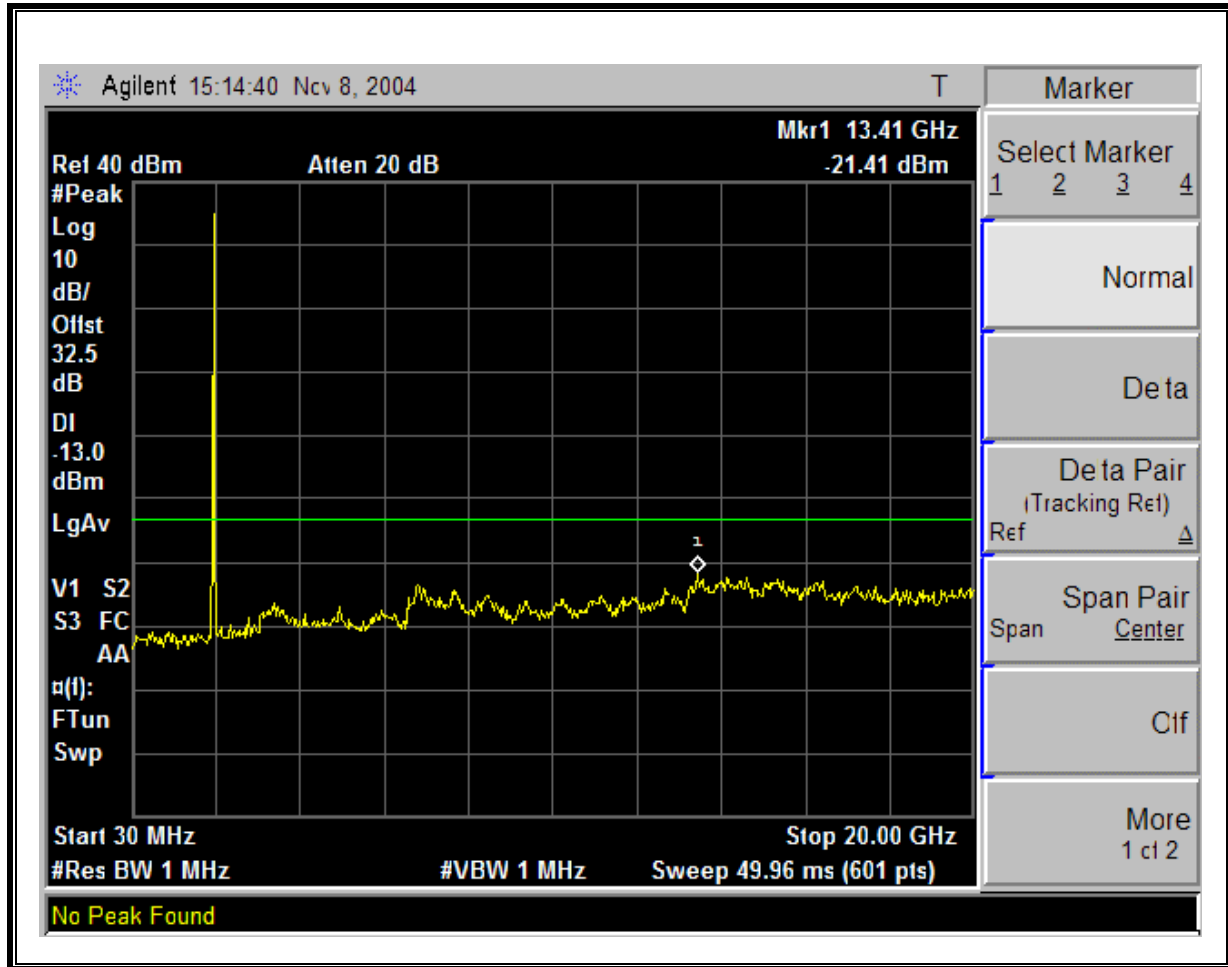
TEST PROCEDURE

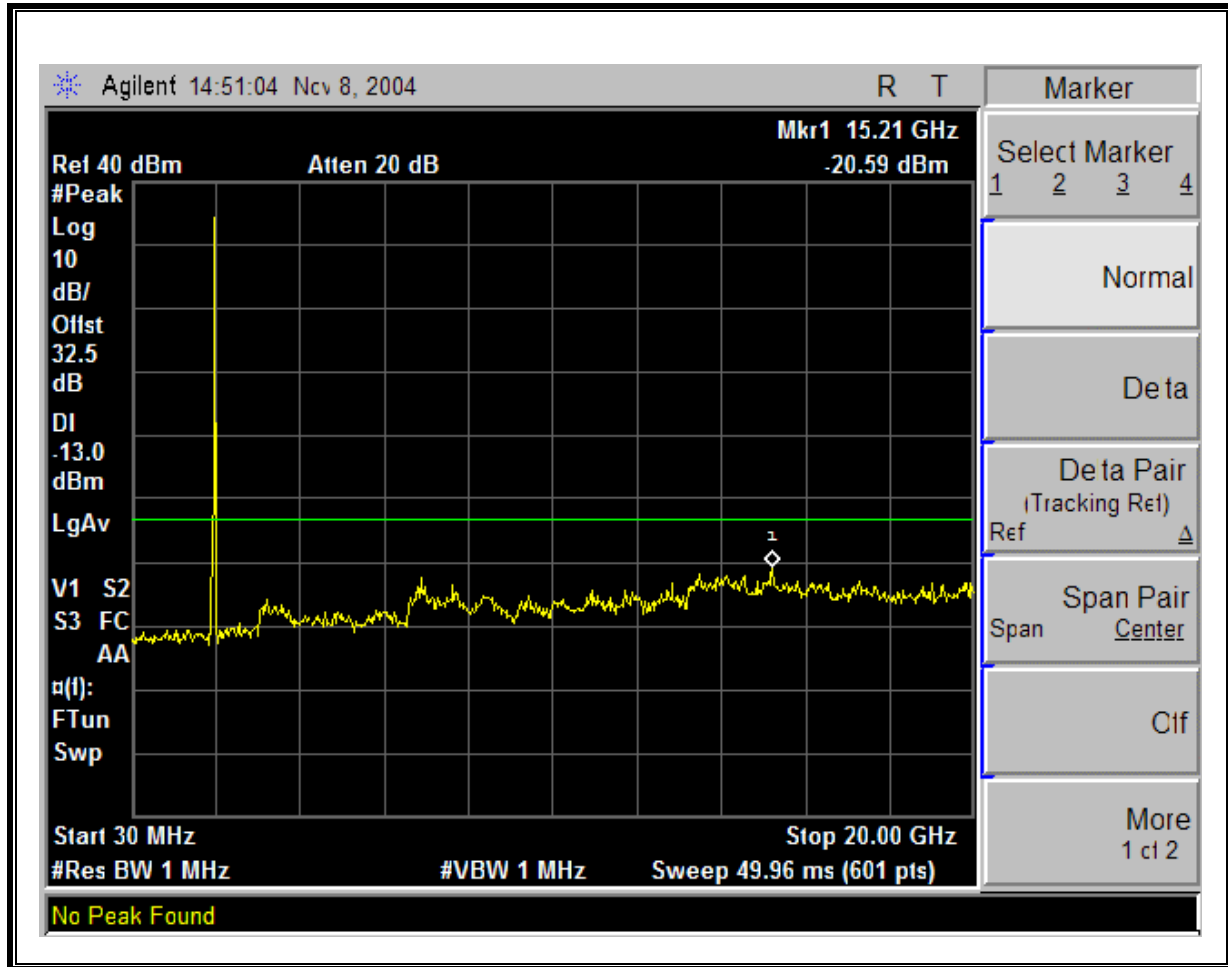
ANSI / TIA / EIA 603 Clause 3.2.12 & FCC 24.238 (b)

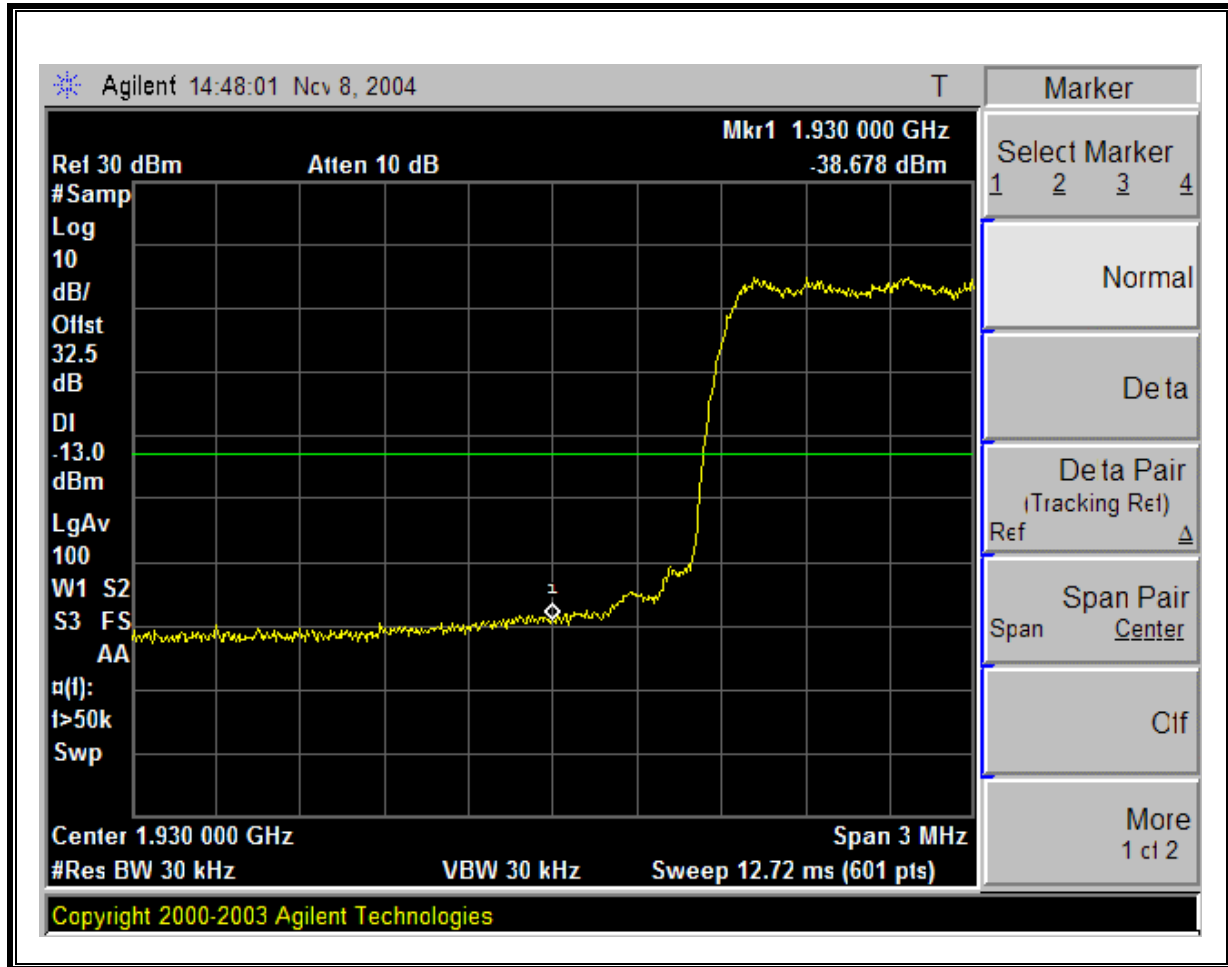
RESULTS

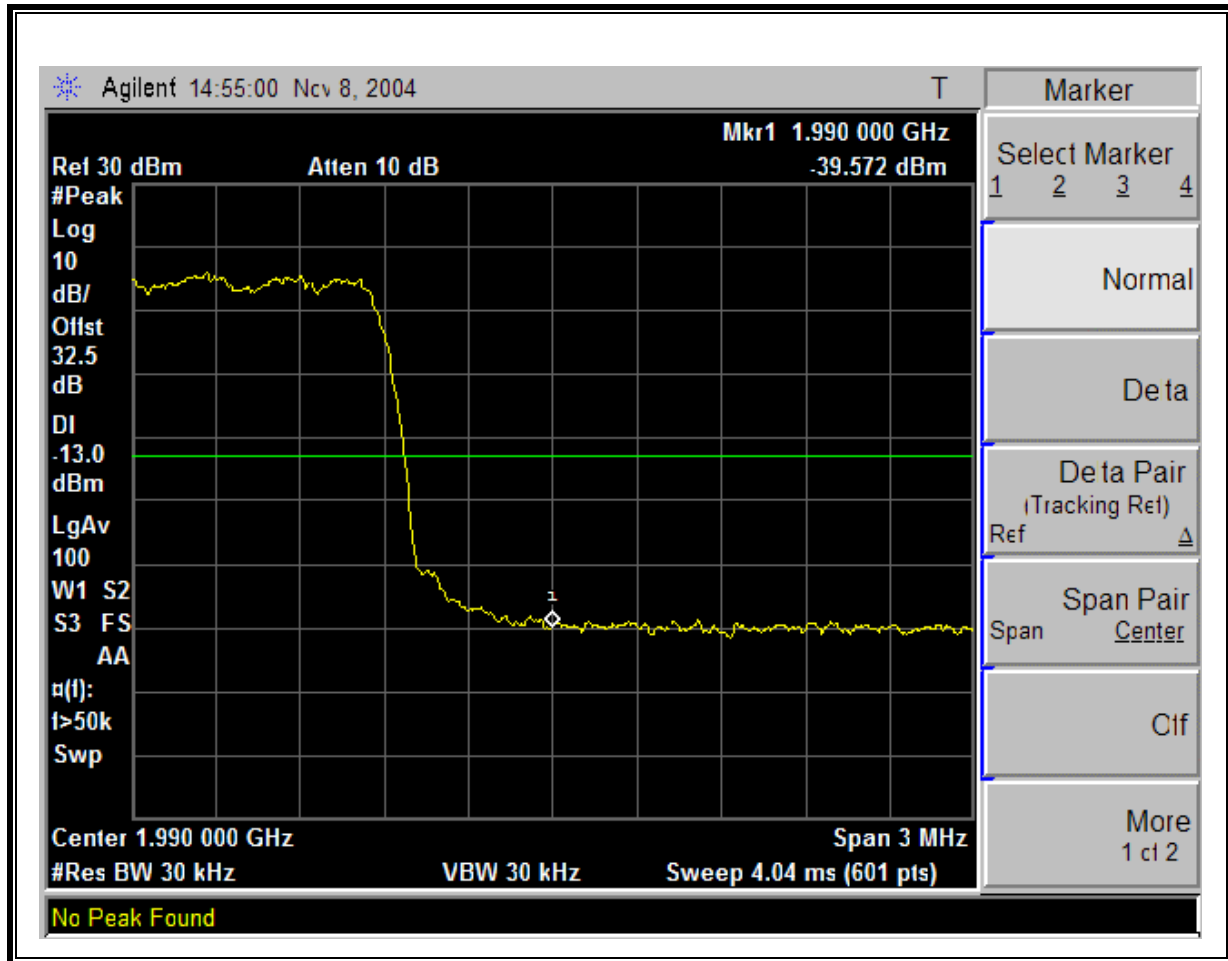
No non-compliance noted.

Low Channel, Out-Of-Band Emissions









7.5. FIELD STRENGTH OF SPURIOUS RADIATION

LIMIT

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

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 3.2.12 & FCC 24.238 (b)

RESULTS

No non-compliance noted.

11/09/04 High Frequency Substitution Measurement
Compliance Certification Services, Morgan Hill 5m Chamber Site

Test Engr: VIEN TRAN
Project #: 04U3009-1
Company: INTERWAVE
EUT Descrip.: CDMA CELL BASESTATION
EUT M/N: WAVE2000 BS PLUS
Test Target: FCC 24
Mode Oper: TX LOW, MID & HI CHANNELS_HARMONIC, SPUR EMISSIONS

Test Equipment:

EMCO Horn 1-18GHz T59; S/N: 3245 @3m	Horn > 18GHz	Limit EIRP	☒ High Pass Filter
Hi Frequency Cables ☐ (2 ft) ☐ (2 ~ 3 ft) ☒ (4 ~ 6 ft) ☒ (12 ft)		Pre-amplifier 1-26GHz T63 Miteq 646456	Pre-amplifier 26-40GHz

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
LOW CH 25, 1931.25MHz										
3.862	43.0	V	-53.0	3.3	9.6	7.4	-46.8	-13.0	-33.8	
3.862	42.0	H	-53.9	3.3	9.6	7.4	-47.7	-13.0	-34.7	
MID CH 600 1960MHz										
3.920	69.2	V	-26.6	3.4	9.6	7.5	-20.4	-13.0	-7.4	
5.880	53.9	V	-37.5	4.4	11.5	9.3	-30.4	-13.0	-17.4	
7.840	45.0	V	-42.1	5.0	11.4	9.2	-35.7	-13.0	-22.7	
3.920	67.8	H	-27.9	3.4	9.6	7.5	-21.7	-13.0	-8.7	
5.880	48.9	H	-41.5	4.4	11.5	9.3	-34.4	-13.0	-21.4	
7.840	45.0	H	-41.3	5.0	11.4	9.2	-34.9	-13.0	-21.9	
HI CH 1175, 1988.75MHz										
3.975	68.4	V	-27.3	3.4	9.7	7.5	-21.0	-13.0	-8.0	
5.965	53.0	V	-38.2	4.4	11.5	9.3	-31.1	-13.0	-18.1	
7.840	47.0	V	-40.1	5.0	11.4	9.2	-33.7	-13.0	-20.7	
3.975	65.5	H	-30.1	3.4	9.7	7.5	-23.8	-13.0	-10.8	
5.965	46.8	H	-43.4	4.4	11.5	9.3	-36.3	-13.0	-23.3	
7.840	44.0	H	-42.3	5.0	11.4	9.2	-35.9	-13.0	-22.9	
NO OTHER EMISSIONS WERE FOUND UPTO 10TH HARMONIC.										
Both ports in low channels:										
LOW CH 25, 1931.25MHz & LOW CH 35, 1936.25MHz										
3.864	52.1	V	-43.9	3.3	9.6	7.4	-37.6	-13.0	-24.6	
3.864	47.0	H	-48.9	3.3	9.6	7.4	-42.6	-13.0	-29.6	
Both ports in high channels:										
HI CH 1965, 1984.75MHz & HI CH 1175, 1988.75MHz										
3.978	70.1	V	-25.6	3.4	9.7	7.5	-19.3	-13.0	-6.3	
5.963	53.9	V	-37.3	4.4	11.5	9.3	-30.3	-13.0	-17.3	
3.978	67.4	H	-28.2	3.4	9.7	7.5	-21.9	-13.0	-8.9	
5.963	48.6	H	-41.6	4.4	11.5	9.3	-34.6	-13.0	-21.6	

7.6. RADIATED EMISSIONS BELOW 1 GHz

LIMIT

§15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Limits for radiated disturbance of Class A ITE at measuring distance of 10 m	
Frequency range (MHz)	Quasi-peak limits (dB μ V/m)
30 to 88	39
88 to 216	43.5
216 to 960	46.4
Above 960 MHz	49.5
Note: The lower limit shall apply at the transition frequency.	

TEST PROCEDURE

ANSI C63.4

RESULTS

No non-compliance noted:

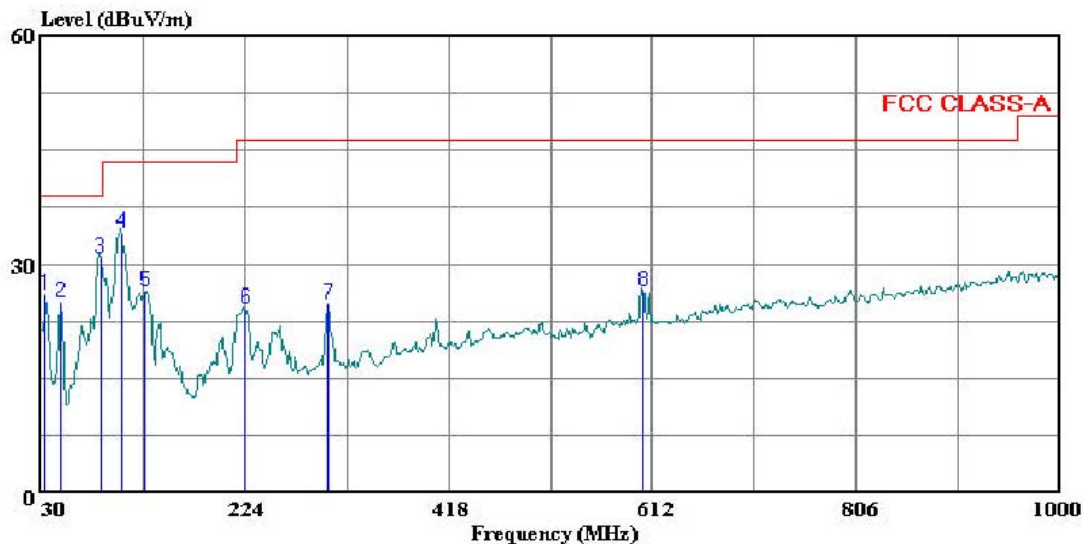
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 6 File#: BELOW 1GHZ.EMI Date: 11-08-2004 Time: 18:17:24



(Auxiliary ATC)

Trace: 5

Ref Trace:

Condition: FCC CLASS-A HORIZONTAL
Test Operator: : VIEN TRAN
Project #: : 04u3009-1
Company: : INTERWAVE
EUT: : CDMA CELL BASESTATION
Model No: : WAVE2000 BS PLUS
Configuration: : EUT
Target of Test: : FCC CLASS A
Mode of Operation: Pining & Tx

HORIZONTAL DATA

	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	33.880	Peak	4.86	21.07	25.93	39.00	-13.07
2	48.430	Peak	14.00	10.97	24.97	39.00	-14.03
3	86.260	Peak	21.39	9.40	30.79	39.00	-8.21
4	106.630	Peak	21.02	12.94	33.96	43.50	-9.54
5	128.940	Peak	10.50	15.90	26.40	43.50	-17.10
6	224.970	Peak	10.59	13.43	24.02	46.40	-22.38
7	303.540	Peak	8.30	16.36	24.66	46.40	-21.74
8	603.270	Peak	4.06	22.34	26.40	46.40	-20.00

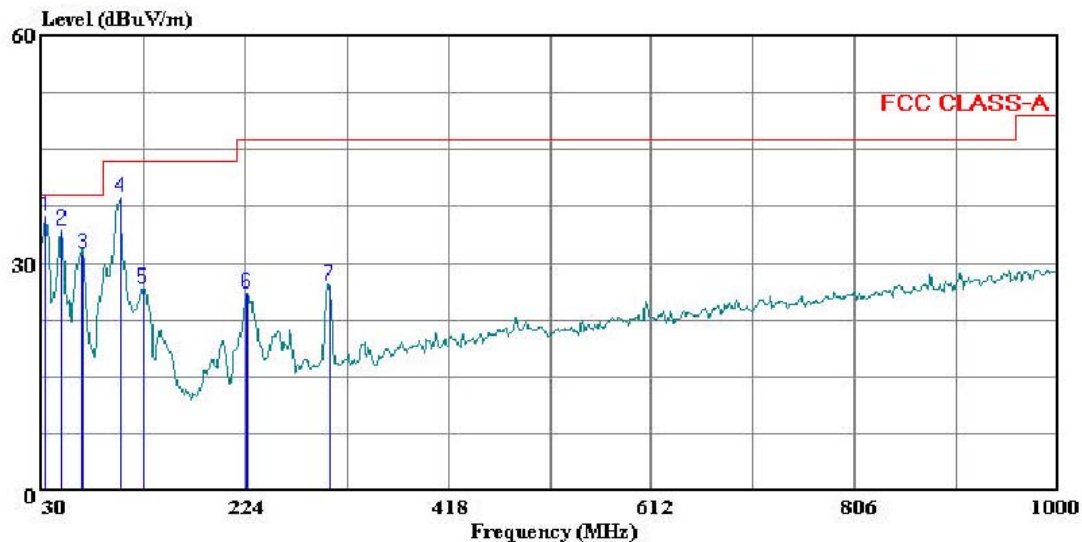
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST CONFIGURATION, VERTICAL)

VERTICAL PLOT



561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 3 File#: BELOW 1GHZ.EMI Date: 11-08-2004 Time: 18:01:27



(Auxiliary ATC)

Trace: 2

Ref Trace:

Condition: FCC CLASS-A VERTICAL
Test Operator: : VIEN TRAN
Project #: : 04u3009-1
Company: : INTERWAVE
EUT: : CDMA CELL BASESTATION
Model No: : WAVE2000 BS PLUS
Configuration: : EUT
Target of Test: : FCC CLASS A
Mode of Operation: Pinging & Tx

VERTICAL DATA

	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	33.880	Peak	15.10	21.07	36.17	39.00	-2.83
2	48.430	Peak	23.27	10.97	34.24	39.00	-4.76
3	68.800	Peak	21.32	9.74	31.07	39.00	-7.93
4	104.690	Peak	26.10	12.48	38.58	43.50	-4.92
5	127.000	Peak	10.70	15.87	26.57	43.50	-16.93
6	225.940	Peak	12.44	13.48	25.92	46.40	-20.48
7	304.510	Peak	10.58	16.38	26.96	46.40	-19.44

7.7. POWERLINE CONDUCTED EMISSIONS

LIMIT

§15.107 (b) For a Class A digital device 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 μ H/50 ohms 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 boundary between the frequency ranges.

Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	79	66
0.50 to 30	73	60
Note: The lower limit shall apply at the transition frequencies		

TEST PROCEDURE

ANSI C63.4

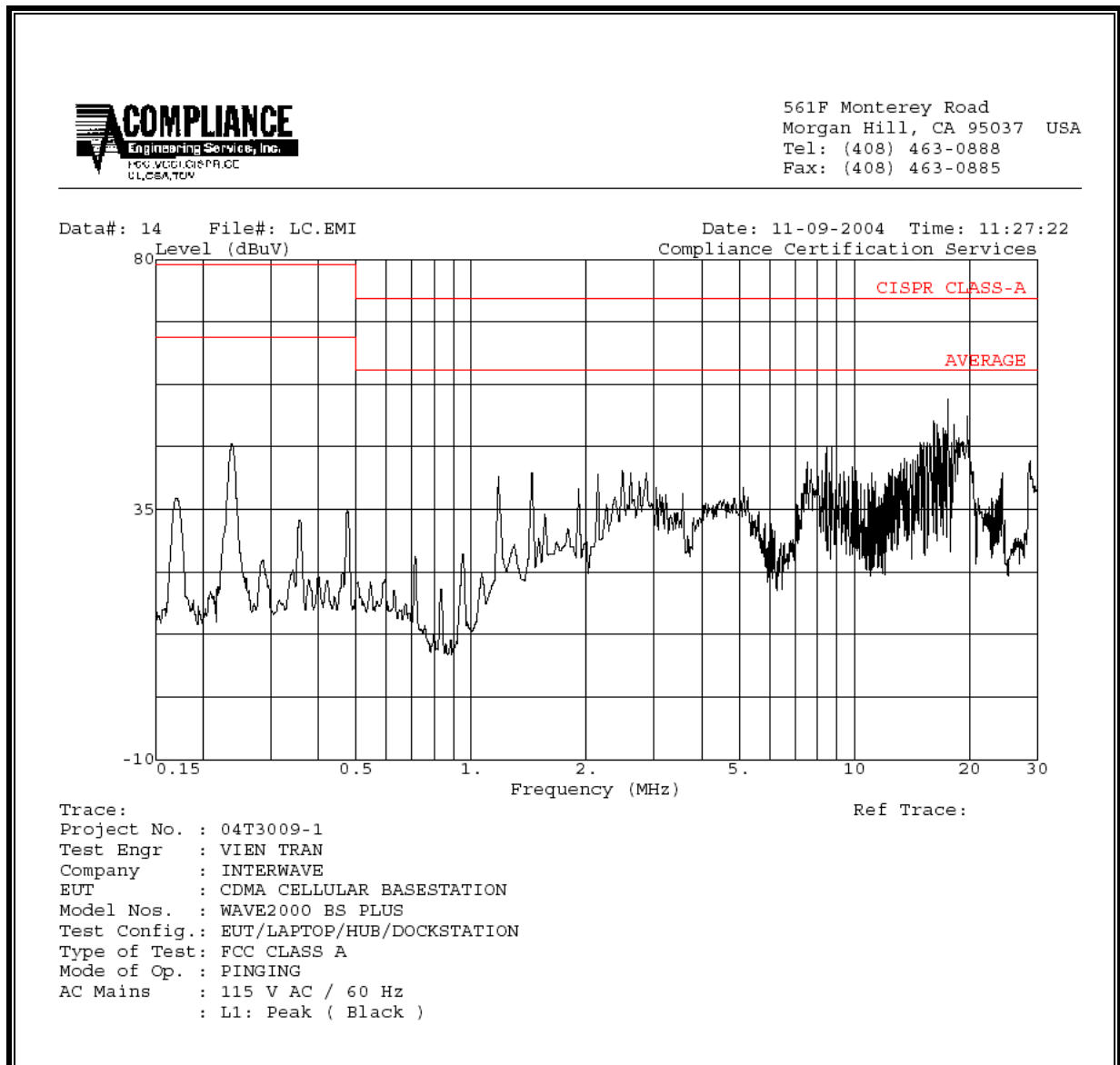
RESULTS

No non-compliance noted:

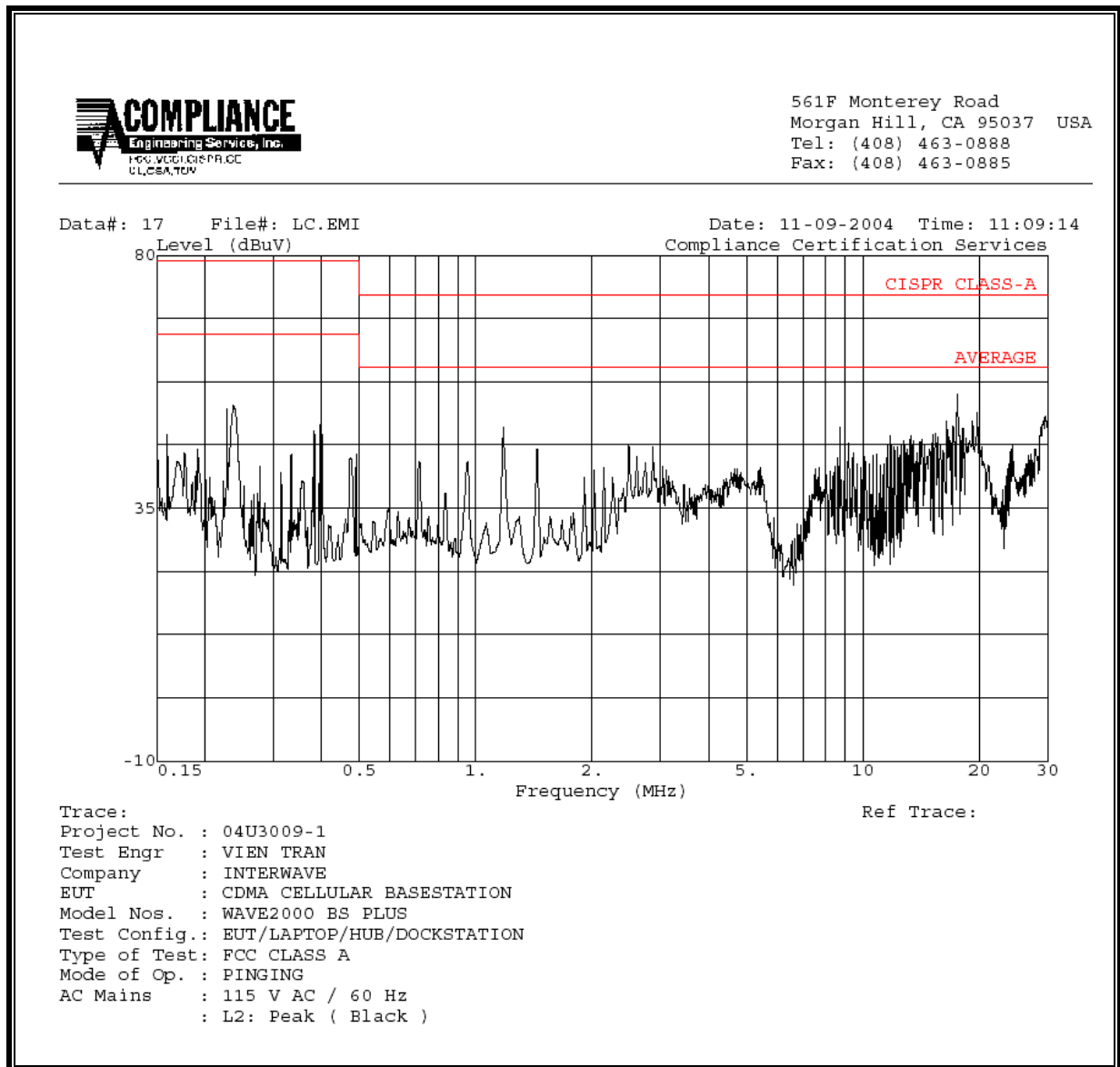
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC A	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.24	46.56	--	--	0.00	79.00	66.00	-32.44	-19.44	L1
8.73	46.42	--	--	0.00	73.00	60.00	-26.58	-13.58	L1
15.57	54.88	--	--	0.00	73.00	60.00	-18.12	-5.12	L1
0.24	52.96	--	--	0.00	79.00	66.00	-26.04	-13.04	L2
8.73	49.44	--	--	0.00	73.00	60.00	-23.56	-10.56	L2
15.57	55.40	--	--	0.00	73.00	60.00	-17.60	-4.60	L2
6 Worst Data									

LINE 1 RESULTS

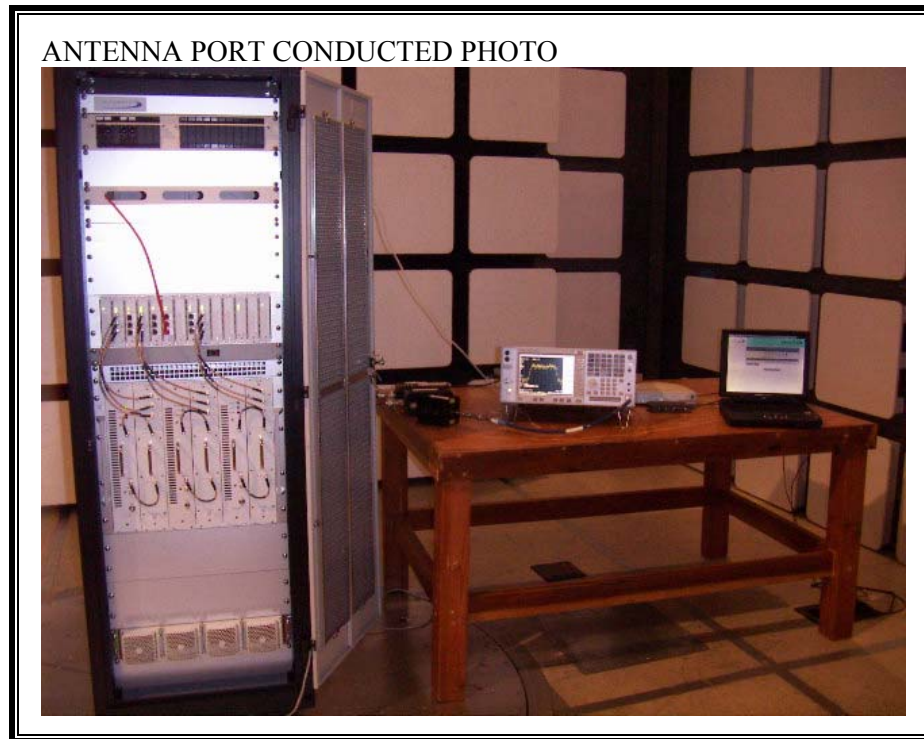


LINE 2 RESULTS

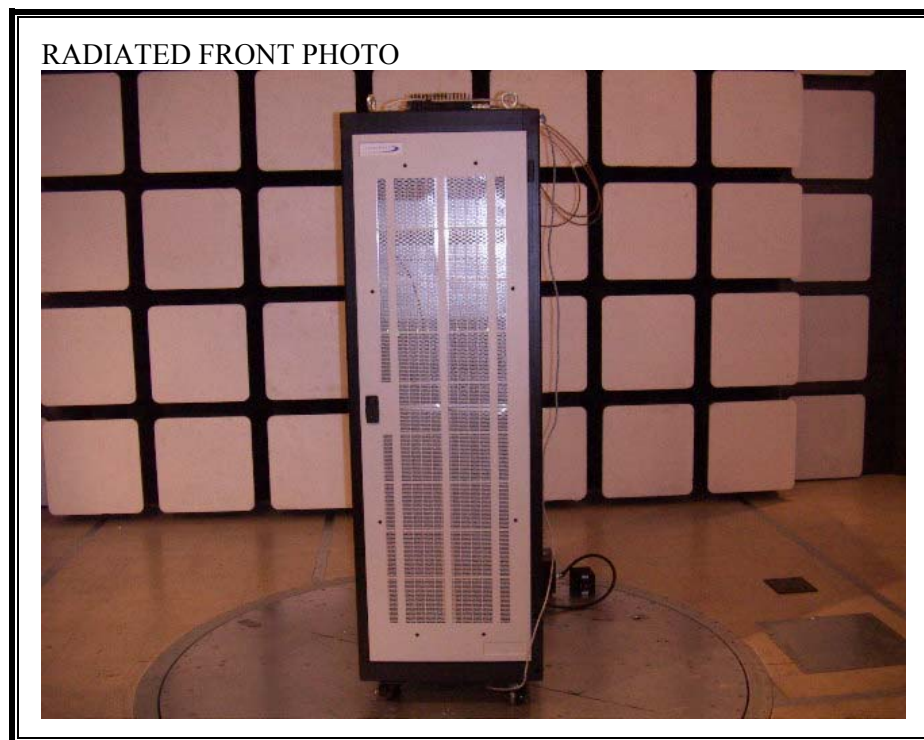


8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



RADIATED RF MEASUREMENT SETUP



RADIATED BACK PHOTO



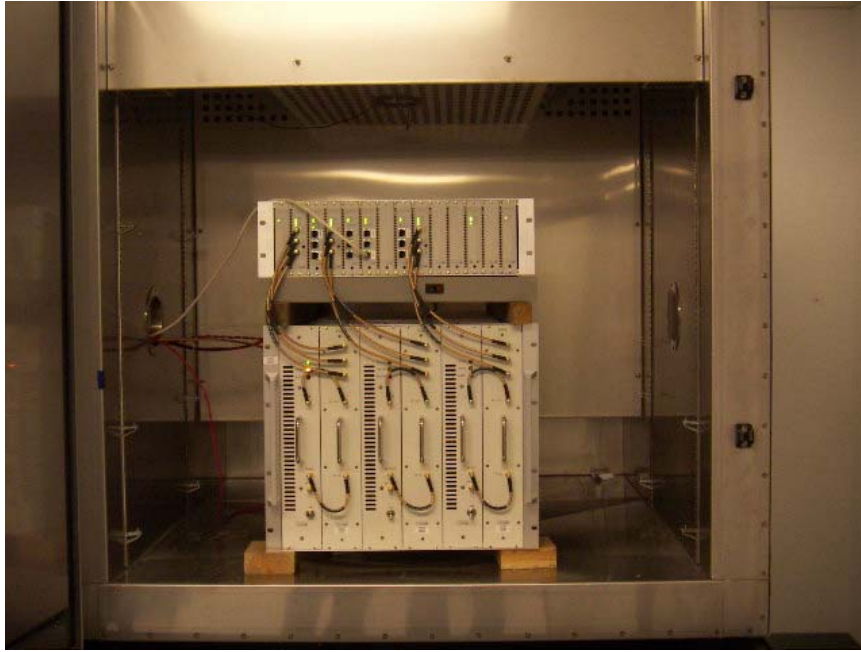
POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP



LINE CONDUCTED BACK PHOTO



TEMPERATURE CHAMBER PHOTO



END OF REPORT