TEST REPORT

Report Number: 30475761
Project Number: 3047576
Report Date: August 29, 2003

Testing performed on the
PCS Base Station
FCC ID: RCEICELL1900P-1

to
FCC Part 24

for
TELOS Technology

Test Performed by:
Intertek Testing Services
1365 Adams Court
Menlo Park, CA 94025

Test Authorized by:
TELOS Technology
4600 Jacombs Road
Richmond, BC, V6V3B1

Tested by:	Bruce Gordon, Test Engineer
Reviewed by:	David Chernomordik, EMC Technical Manager

Review Date: 09/09/2003

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1.0 Job Description

1.1 Applicant information

Applicant name & address	TELOS Technology 4600 Jacombs Road Richmond, BC, V6V3B1, Canada
Contact info	Mr. Richard LaLau
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Fax:	604=880-0957
Email	rlalau@telostech.com

1.2 Test Summary

FCC Rule	Description of Test	Result	Page
2.1046	RF Power Output	Complies 49 mW - average	6
24.232	EIRP	Complies	10
2.1047	Modulation Requirements	Not Applicable	-
2.1049	Occupied Bandwidth, Emission Designator	1M25F9W	11
2.1051, 24.238	Out of Band Emissions at Antenna Terminals	Complies	13
2.1053	Field Strength of Spurious Radiation	Complies	16
2.1055	Frequency Stability vs. Temperature and Voltage	Complies, see separate file	-
2.1091	RF Exposure	Complies	19

The test results in this report pertain only to the item tested.

1.3 Product Description

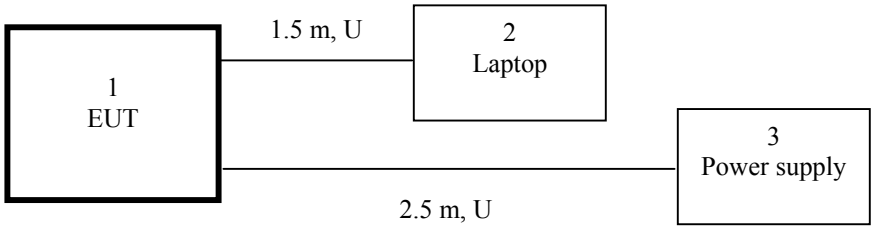
The iCell1900 Pico BSS is a low power, wall mountable CDMA Base Station intended for small network coverage locations such as a commercial campus or shopping mall. This industrial grade product acts as infill coverage to relieve the Macro network in congested locations.

For more information, please refer to the attached product description.

Use of Product	Base Station
Cellular Phone standards	CDMA
Type(s) of Emission	1M25F9W
Rated RF Output Power	16 dBm (average)
Frequency Range	1930 - 1990 MHz
Antenna(e) & Gain	Typically a –2 dBd mini whip.
DC voltage and current into the final RF stage	6.2 V, 1 A
External input	Digital Data

EUT receive date:	August 25, 2003
EUT receive condition:	The EUT was received in good condition with no apparent damage.
Test start date:	August 25, 2003
Test completion date:	August 29, 2003

1.3 Test Configuration



Item #	Description	Make	Model No.	Serial No.
1	EUT	TELOS Technology	iCell	Not labeled
2	Laptop	Compaq	Armada 1750	6333/T/6400/D/M/1
3	Power supply	Apx Technologies Inc.	P/N SP130948R	Not labeled

1.4 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible).

The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

1.5 Mode of Operation

The EUT was setup to transmit continuously a CDMA signal on selected channels.

1.6 Related Submittal(s) Grants

None

1.7 Test Facility

The test site and conducted measurement facility used to collect the radiated data is site 1 (10 m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

2.0 RF Power Output
FCC 2.1046

2.1 Test Procedure

The transmitter output was connected to a spectrum analyzer. The resolution and video bandwidths of the spectrum analyzer were set up to 30 kHz and 300 Hz accordingly, and the spectrum analyzer reading was recorded. The average value of the output power was calculated by adding a bandwidth correction factor equal 10Log(1250/30) = 16.2 dB to the spectrum analyzer reading.

Tests were performed at three frequencies (low, middle, and high channels) in Cellular band.

2.2 Test Equipment

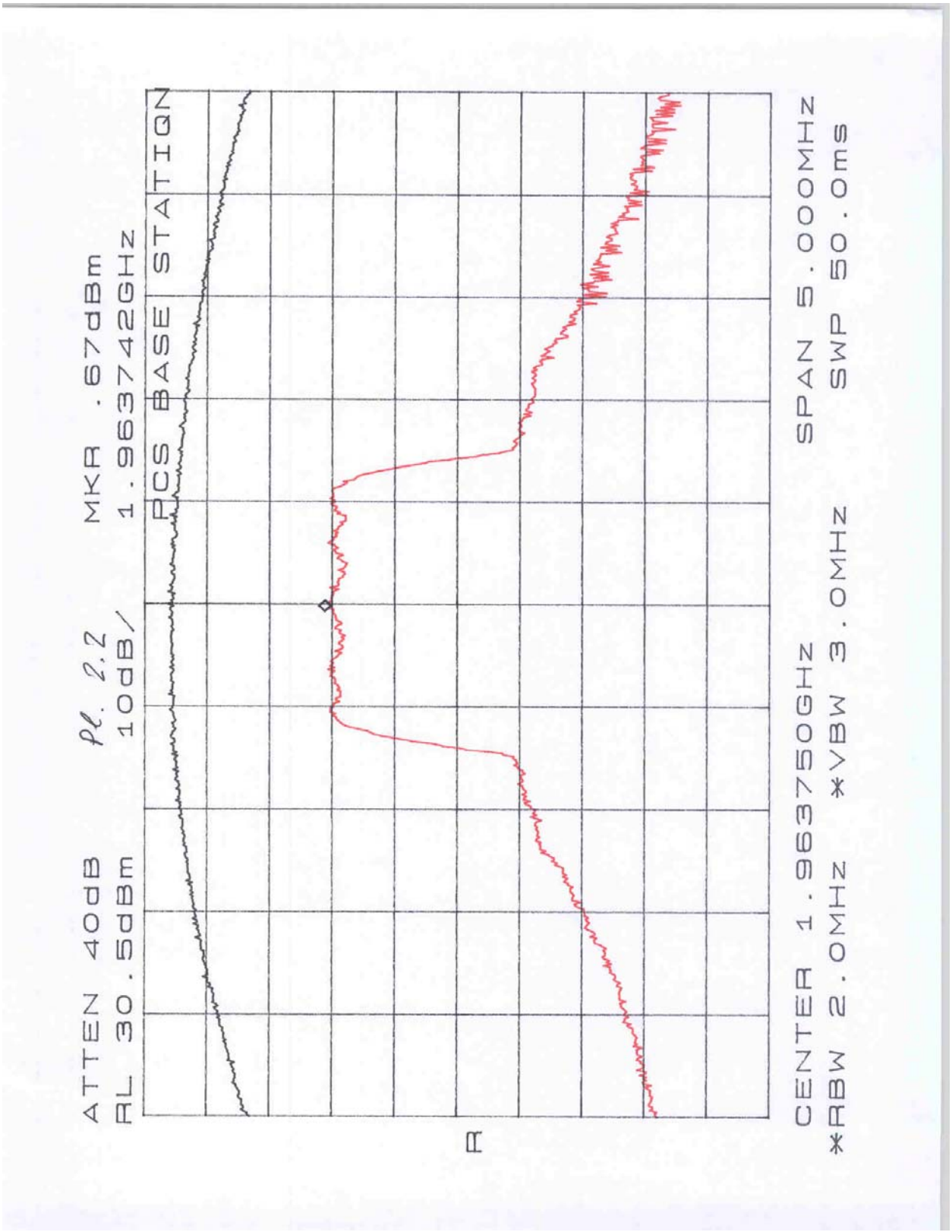
HP8565E Spectrum Analyzer

2.3 Test Results

Frequency MHz	Average Power dBm	Average Power mW	Plot Number
1931.25	14.9	30.9	2.1
1963.75	16.9	49.0	2.2
1988.75	14.4	27.5	2.3

For more details refer to the attached plots.


ATTEN 40dB
RL 30.5dBm
Pl. 2.1
10dB/
MKR -1.33dBm
1.9309950GHz
PCS BASE STATION
CENTER 1.9312500GHz
*RBW 30KHz
*VBW 300Hz
SPAN 5.000MHz
SWP 1.40sec


ATTEN 40dB
RL 30.5dBm
pl. 2.2
10dB/
MKR .67dBm
1.963742GHz
PCS BASE STATION
CENTER 1.963750GHz
*RBW 2.0MHz
*VBW 3.0MHz
SPAN 5.000MHz
SWP 50.0ms


ATTEN 40dB
RL 30.5dBm
Pk. 2.3
10dB/
MKR -1.83dBm
1.9882225GHz
PCS BASE STATION
D
R
CENTER 1.9887500GHz
*RBW 30KHz
*VBW 300Hz
SPAN 5.000MHz
SWP 1.40sec

3.0 Radiated Power

FCC 24.232

Requirement

The Equivalent Isotropically Radiated Power (EIRP) of base stations must not exceed 1640 Watts.

Result

The EIRP may be calculated by adding the antenna gain (in dBi) to the output power in dBm. In normal operation the EUT is typically used a -2dBd (0 dBi) gain mini whip antenna. Therefore, the EIRP is not to exceed 50 mW (17 dBm).

4.0 Occupied Bandwidth

FCC 2.1049

4.1 Test Procedure

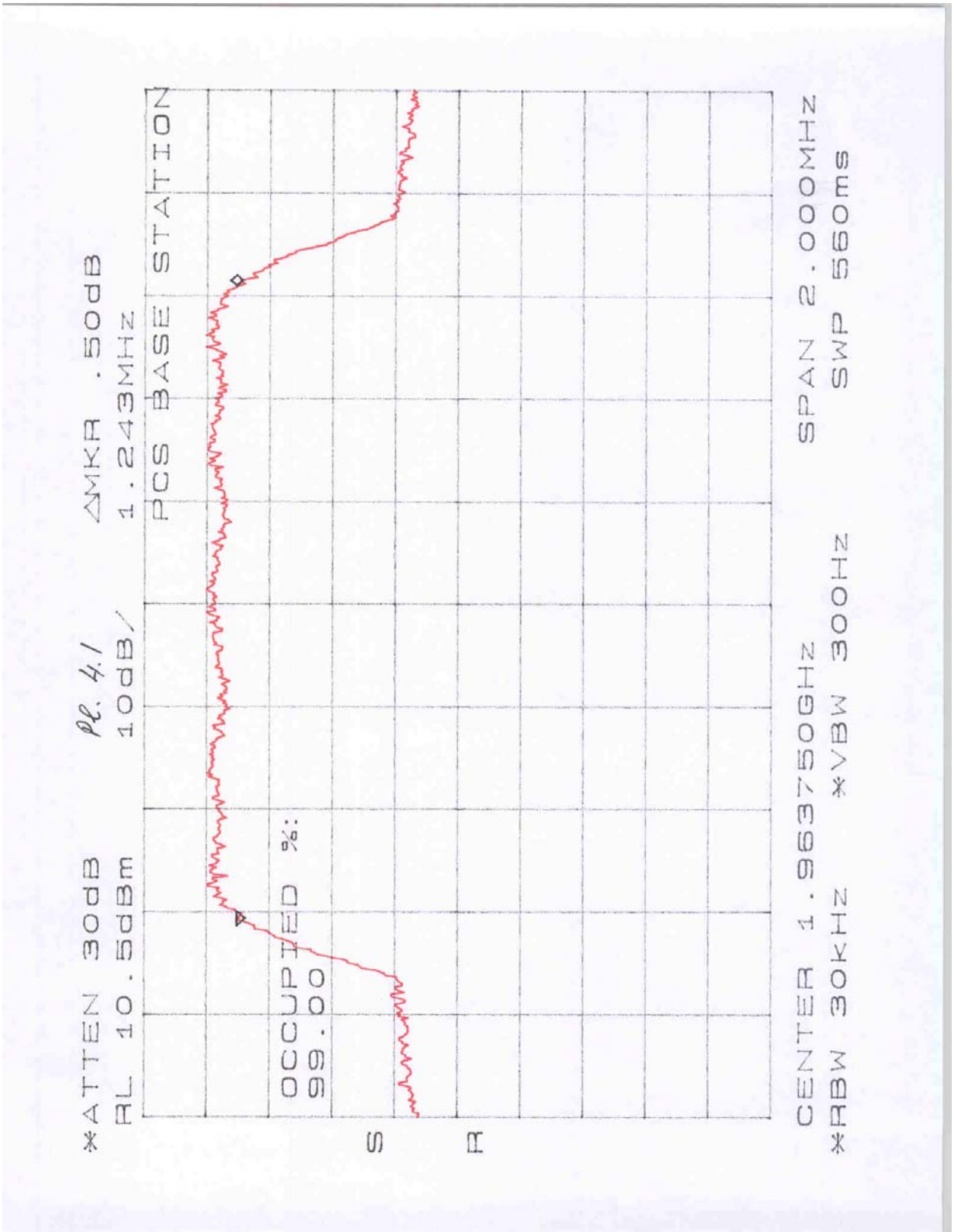
The transmitter output was connected to a spectrum analyzer. The Occupied Bandwidth (defined as the 99% Power Bandwidth) was measured with the HP8565E Spectrum Analyzer.

4.2 Test Equipment

Hewlett Packard HP8565E Spectrum Analyzer

4.3 Test Results

See attached plots 4.1. The test result shows that the bandwidth is 1.243 MHz, which is 0.5% less than the theoretical bandwidth for CDMA - 1.25 MHz. The Emission Designator was determined as 1M25F9W


*ATTEN 30dB
RL 10.5dBm
OCCUPIED %:
99.00
pk. 4.1
10dB/
ΔMKR .50dB
1.243MHz
PCS BASE STATION
S
R
CENTER 1.96375GHz
*RBW 30KHz
*VBW 300Hz
SPAN 2.000MHz
SWP 560ms

5.0 Out of Band Emissions at Antenna Terminals

FCC 2.1051, 24.238

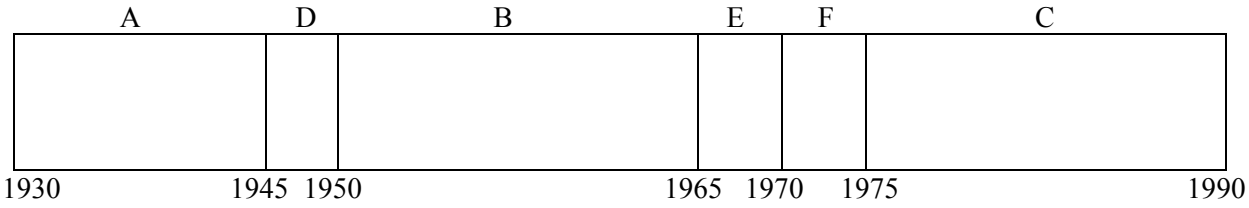
Out of Band Emissions:

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB.

5.1 Test Procedure

According to FCC requirements, the following six frequency Blocks must be considered to show compliance with requirements of out-of-band emissions including emissions on the band-edge frequencies:

BLOCK 1: 1930 – 1945 MHz (A)
BLOCK 2: 1945 – 1950 MHz (D)
BLOCK 3: 1950 – 1965 MHz (B)
BLOCK 4: 1965 – 1970 MHz (E)
BLOCK 5: 1970 – 1975 MHz (F)
BLOCK 6: 1975 – 1990 MHz (C)



The following channels/frequencies were selected for out-of-band/band-edge emission tests:

Channel	Frequency, MHz
25	1931.25
275	1943.75
325	1946.25
375	1948.75
425	1951.25
675	1963.75
725	1966.25
775	1968.75
825	1971.25
875	1973.75
925	1976.25
1175	1988.75

The RF output of the transmitter was connected to a spectrum analyzer. For the channels 25, 675 and 1175 scans were taken to show the out-of-band emissions from 10 MHz to 20 GHz, for the other channels scans were taken to show compliance on the band-edge frequencies for each selected blocks.

On frequencies within 1 MHz up or down from the band-edge frequency, the measurements were made with the spectrum analyzer resolution bandwidth (RBW) of 30 kHz; on some frequencies more than 1 MHz away from the band-edge frequency, the spectrum analyzer resolution bandwidth of 300 kHz was used (instead of 1 MHz), and a bandwidth correction factor (BCF) of 10Log[1000/300]=5 dB was applied.

5.2 Test Equipment

HP8565E Spectrum Analyzer

5.3 Test Results

Refer to the following plots in Appendix A:

Channel	Frequency, MHz	Description	Comments	Plot number
25	1931.25	Scan 10 MHz – 1 GHz		5.1
		Scan 1 GHz – 1.929 GHz		5.2
		Scan 1.929 GHz – 1.930 GHz	With RBW=30 kHz	5.3
		Scan 1.945 GHz – 1.990 GHz		5.4
		Scan 1.990 GHz – 6.5 GHz		5.5
		Scan 6.5 GHz – 20 GHz		5.6
275	1943.75	Scan 1 GHz – 1.930 GHz		5.7
		Scan 1.945 GHz – 1.946 GHz	With RBW=30 kHz	5.8
		Scan 1.946 GHz – 1.947 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.9
		Scan 1.947 GHz – 1.990 GHz		5.10
325	1946.25	Scan 1.930 GHz – 1.943 GHz		5.11
		Scan 1.943 GHz – 1.944 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.12
		Scan 1.944 GHz – 1.945 GHz	With RBW=30 kHz	5.13
		Scan 1.950 GHz – 1.990 GHz		5.14
375	1948.75	Scan 1.930 GHz – 1.945 GHz		5.15
		Scan 1.950 GHz – 1.951 GHz	With RBW=30 kHz	5.16
		Scan 1.951 GHz – 1.952 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.17
		Scan 1.952 GHz – 1.990 GHz		5.18
425	1951.25	Scan 1.930 GHz – 1.948 GHz		5.19
		Scan 1.948 GHz – 1.949 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.20
		Scan 1.949 GHz – 1.950 GHz	With RBW=30 kHz	5.21
		Scan 1.950 GHz – 1.990 GHz		5.22
675	1963.75	Scan 10 MHz – 1 GHz		5.23
		Scan 1 GHz – 1.930 GHz		5.24
		Scan 1.930 GHz – 1.950 GHz		5.25
		Scan 1.965 GHz – 1.966 GHz	With RBW=30 kHz	5.26
		Scan 1.966 GHz – 1.967 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.27

		Scan 1.967 GHz – 1.990 GHz		5.28
		Scan 1.990 GHz – 6.5 GHz		5.29
		Scan 6.5 GHz – 20 GHz		5.30
Channel	Frequency, MHz	Description	Comments	Plot number
725	1966.25	Scan 1.930 GHz – 1.963 GHz		5.31
		Scan 1.963 GHz – 1.964 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.32
		Scan 1.964 GHz – 1.965 GHz	With RBW=30 kHz	5.33
		Scan 1.970 GHz – 1.990 GHz		5.34
775	1968.75	Scan 1.930 GHz – 1.965 GHz		5.35
		Scan 1.970 GHz – 1.971 GHz	With RBW=30 kHz	5.36
		Scan 1.971 GHz – 1.972 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.37
		Scan 1.972 GHz – 1.990 GHz		5.38
825	1971.25	Scan 1.930 GHz – 1.968 GHz		5.39
		Scan 1.968 GHz – 1.969 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.40
		Scan 1.969 GHz – 1.970 GHz	With RBW=30 kHz	5.41
		Scan 1.975 GHz – 1.990 GHz		5.42
875	1973.75	Scan 1.930 GHz – 1.970 GHz		5.43
		Scan 1.975 GHz – 1.976 GHz	With RBW=30 kHz	5.44
		Scan 1.976 GHz – 1.977 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.45
		Scan 1.977 GHz – 1.990 GHz		5.46
925	1976.25	Scan 1.930 GHz – 1.974 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.47
		Scan 1.974 GHz – 1.975 GHz	With RBW=30 kHz	5.48
		Scan 1.990 GHz – 2.000 GHz		5.49
1175	1988.75	Scan 10 MHz – 1 GHz		5.50
		Scan 1 GHz – 1.930 GHz		5.51
		Scan 1.930 GHz – 1.975 GHz		5.52
		Scan 1.990 GHz – 1.991 GHz	With RBW=30 kHz	5.53
		Scan 1.991 GHz – 2.000 GHz	With RBW=300 kHz, BCF=5 dB is applied	5.54
		Scan 2 GHz – 6.5 GHz		5.55
		Scan 6.5 GHz – 20 GHz		5.56

Complies	Passed by 13.8 dB

6.0 Field Strength of Spurious Radiation

FCC 2.1053, 24.238

6.1 Test Procedure

A dummy load was connected to the EUT antenna connector. The EUT was placed on a non-conductive turntable in the 10-m anechoic chamber.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of each of the three fundamental frequency (low, middle, and high channels) was investigated.

For spurious emissions attenuation, the substitution method was used. On each frequency the EUT was substituted by a reference antenna (half-wave dipole - below 1 GHz, or Horn antenna - above 1GHz), connected to a signal generator.

The signal generator output was adjusted to obtain the same reading as from EUT. The EIRP at the spurious emissions frequency was calculated by adding the substitution antenna gain to the recorded signal generator level. The spurious emissions attenuation was calculated as the difference between ERP at the fundamental frequency and at the spurious emissions frequency.

6.2 Test Equipment

EMCO 3115 Horn Antennas
HP 8566B Spectrum Analyzer
HP 83732A Signal Generator
High Pass Filter
Preamplifiers

6.3 Test Results

Effective Radiated Power
(Measured by Substitution Method)

Frequency	Antenna Polariz.	SA Reading (EUT)	Signal Generator Output required to have the same SA Reading as from EUT	ERP *	ERP Limit
MHz		**dBm**	**V_gdBm**	**dBm**	**dBm**
Channel 25 @1931.25 MHz					
5793.75	H	-77.0	-74.1	-62.9	-13 dBm
Channel 675 @1963.75 MHz					
5891.25	H	-76.4	-73.1	-61.9	-13 dBm
Channel 1175 @1989.50 MHz					
5968.50	H	-76.8	-73.8	-62.5	-13 dBm

* ERP is calculated as: $ERP_{(dBm)} = V_{g(dBm)} + G_{(dBd)}$
All other signals were 20 dB or greater below the limit.

Complies	Passed by more than 40 dB

7.0 Frequency Stability vs Temperature and Voltage

FCC 2.1055

See a separate file “Frequency stability”

8.0 RF exposure info

FCC 2.1091

The EUT is a device used in mobile application, at least 20 cm from any body part of the user or near by persons.

The maximum conducted power is 0.05 W; antenna gain is about 0 dBi. To show compliance with RF Exposure Requirement, the MPE is calculated.

The maximum Peak EIRP calculated is 0.05 W.
The Power Density may be calculated using the formula: $S = EIRP/ 4\pi D^2$
where: S is Power Density in W/m^2
D is the distance from the antenna.

In the table below, the calculated Power Density at 5-20 cm distances and MPE Limit for general population/uncontrolled exposure are presented.

Distance, m	Power Density, W/m^2	MPE, W/m^2
0.05	1.6	10.0
0.10	0.4	10.0
0.20	0.1	10.0

As can be seen from the data, the MPE is well below the limit at 5 cm and greater.

9.0 List of test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
BI-Log Antenna	EMCO	3143	9509-1160	12	9/19/03
Horn Antenna	EMCO	3115	9170-3712	12	6/17/04
Horn Antenna	EMCO	3115	8812-3049	12	4/08/04
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	9/06/03
Pre-Amplifier	Avantek	AFT-18855	8723H705	12	10/5/03
Spectrum Analyzer w/85650 QP Adapter	Hewlett Packard	8566B	2416A00317 2043A00251	12	10/29/03
Spectrum Analyzer Display w/85650 QP Adapter	Hewlett Packard	85662B	2403A06796	12	10/29/03
Spectrum Analyzer	Hewlett Packard	8565E	AE9674	12	5/27/04
Signal Generator	Hewlett Packard	83732A	3222A00119	12	3/04/04

10.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3047576	DC	August 30, 2003	Original document

Appendix A