FCC PART 22 TYPE APPROVAL
EMI MEASUREMENT AND TEST REPORT

For

Telular Corporation

580 Old Willets Path, Hauppauge, NY 11788

FCC ID: MTFSX6P200260C

This Report Concerns:	Equipment Type:
☒ Original Report	CDMA 800MHz Wireless Deskphone

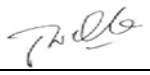
Test Engineer:	Daniel Deng / 
Report No.:	R0510193
Report Date:	2005-11-01
Reviewed By:	Richard Lee / 
Prepared By:	Bay Area Compliance Laboratory Corporation (BACL) 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Telular Corporation 's* product, FCC ID: MTFSX6P200260C or the "EUT" as referred to in this report is a CDMA 800MHz Wireless Deskphone, which measures approximately 217.0mm L x 180.5mm W x 71.3mm H. The antenna gain is 3dBi.

** The test data gathered are from typical production sample, serial number: 96030101 provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Telular Corporation* in accordance with Part 2, Subpart J, Part 22 Subpart H of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for conducted output power, RF output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, field strength of spurious radiation, frequency stability, band edge, and radiated emission.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 22 Subpart H - Public Mobile Services

Applicable Standards: TIA EIA 98-E, TIA603-C, and ANSI 63.4-2003.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA with registration number: 90464.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC), Industry Canada (IC), and Voluntary Control Council for Interference (VCCI).

The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2, IC registration number:

3062A, and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603.

The final qualification test was performed with the EUT operating at normal mode.

Block Diagram

Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

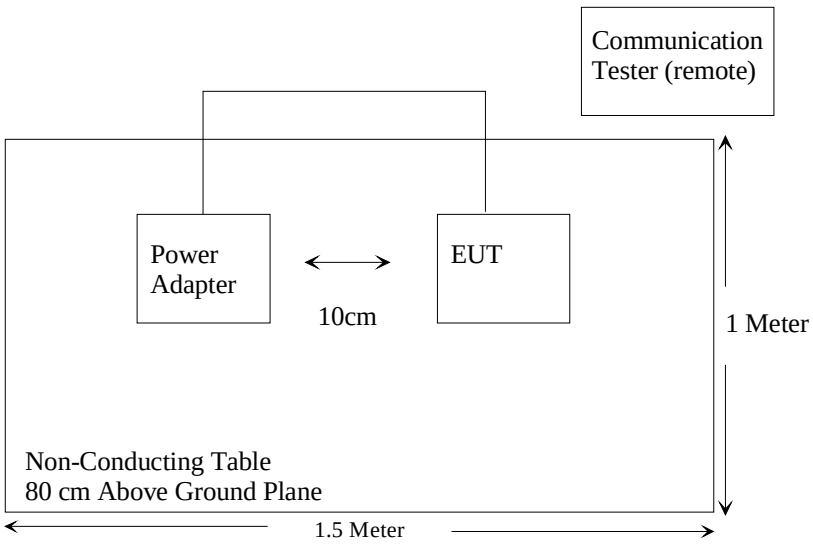
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Telular	Power adapter	AP1015-US(01)	0502000045AA	DOC

Remote Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Agilent	Communication Tester	8960	GB44051221	None

Configuration of Test System



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1047	Modulation Characteristics	Compliant
§ 2.1053	Field Strength of Spurious Radiation	Compliant
§2.1091	RF Exposure	Compliant
§ 2.1046, § 22.912 (d)	RF Output Power	Compliant
§ 2.1046, § 22.913 (a)	Conducted Output Power	Compliant
§ 2.1049 § 22.917 § 22.905	Out of Band Emission, Occupied Bandwidth	Compliant
§ 2.1051, § 22.917	Spurious Emissions at Antenna Terminals	Compliant
§ 2.1055 (a) § 2.1055 (d) § 22.355	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 22.917	Band Edge	Compliant

§2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

Requirement: FCC § 2.1047.

Test Procedure

CDMA digital mode generated by software is used by EUT. Connect EUT to Simulator and spectrum analyzer, check the waveform.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

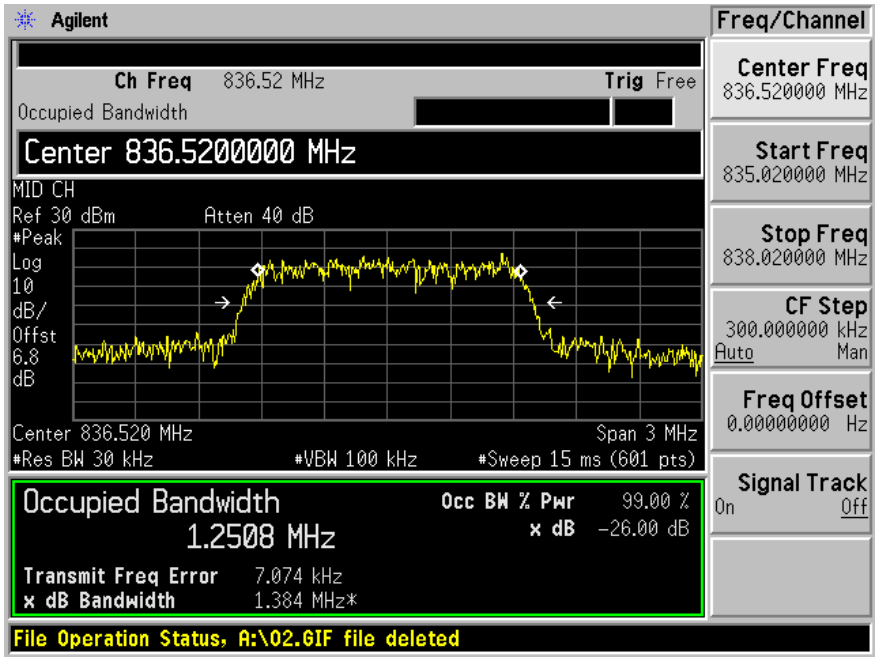
* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

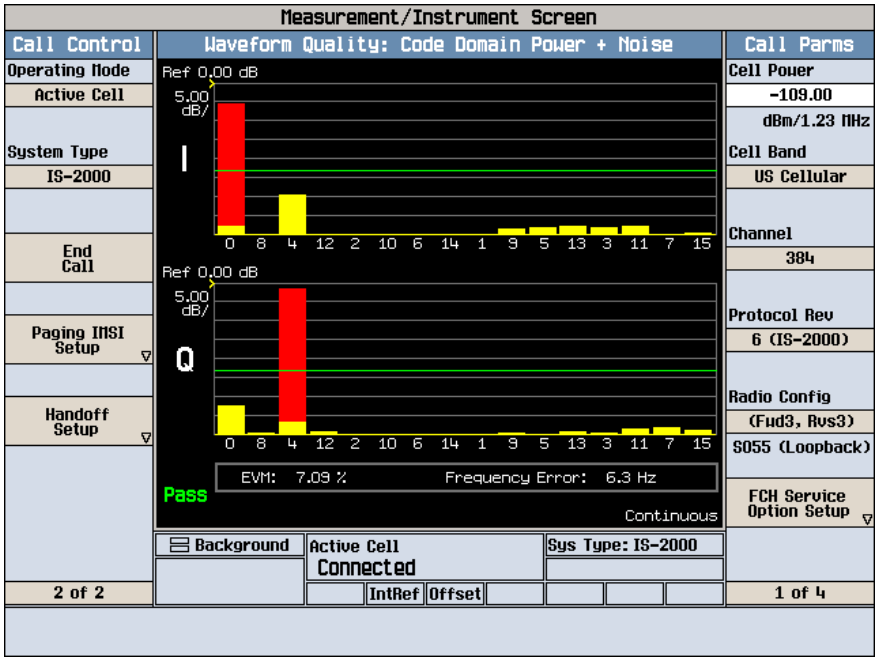
Environmental Conditions

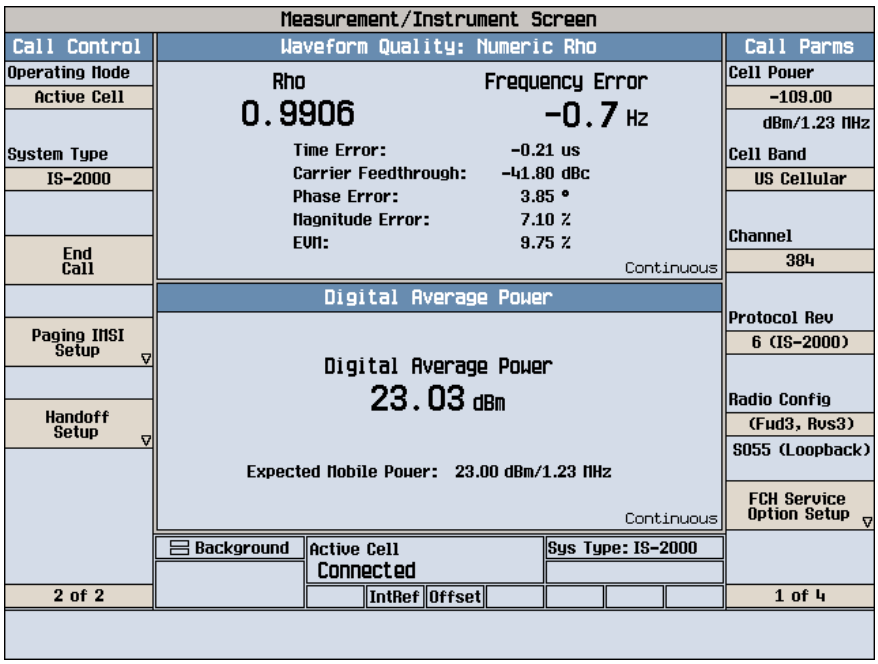
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Daniel Deng on 2005-10-22.

Test Results




Measurement/Instrument Screen
Call Control
Waveform Quality: Code Domain Power + Noise
Call Parms
Operating Mode
Active Cell
System Type
IS-2000
End Call
Paging IMSI Setup
Handoff Setup
2 of 2
Ref 0.00 dB
5.00 dB/
I
0 8 4 12 2 10 6 14 1 9 5 13 3 11 7 15
Ref 0.00 dB
5.00 dB/
Q
0 8 4 12 2 10 6 14 1 9 5 13 3 11 7 15
EVM: 7.09 %
Frequency Error: 6.3 Hz
Pass
Continuous
Background
Active Cell
Connected
IntRef
Offset
Sys Type: IS-2000
Cell Power
-109.00
dBm/1.23 MHz
Cell Band
US Cellular
Channel
384
Protocol Rev
6 (IS-2000)
Radio Config
(Fwd3, Rvs3)
S055 (Loopback)
FCH Service Option Setup
1 of 4


Measurement/Instrument Screen
Call Control
Waveform Quality: Numeric Rho
Call Parms
Operating Mode
Active Cell
System Type
IS-2000
End Call
Paging IMSI Setup
Handoff Setup
2 of 2
Rho
0.9906
Frequency Error
-0.7 Hz
Time Error: -0.21 us
Carrier Feedthrough: -41.80 dBc
Phase Error: 3.85 °
Magnitude Error: 7.10 %
EVM: 9.75 %
Continuous
Digital Average Power
Digital Average Power
23.03 dBm
Expected Mobile Power: 23.00 dBm/1.23 MHz
Continuous
Background
Active Cell
Connected
IntRef
Offset
Sys Type: IS-2000
Cell Power
-109.00
dBm/1.23 MHz
Cell Band
US Cellular
Channel
384
Protocol Rev
6 (IS-2000)
Radio Config
(Fwd3, Rvs3)
S055 (Loopback)
FCH Service Option Setup
1 of 4

§2.1053 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

Requirements: CFR 47, § 2.1053.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

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 test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 log (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004
ETS	Antenna, Log-Periodic	3148	4-1155	12/14/2004
ETS	Antenna, Biconical	3110B	9603-2315	12/14/2004
HP	Amplifier, Pre	8447D	2944A10198	8/17/2005
HP	Amplifier, Pre, Microwave	8449B	3147A00400	8/10/2005
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	4/20/2005
HP	Generator, Signal	83650B	3614A00276	5/10/2005
A.R.A.	Antenna, Horn	DRG-118/A	1132	8/17/2005
Wainwright	Filter, Band Reject	WRCG823/850-813/860-40/8SS	2	8/11/2004

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	22° C
Relative Humidity:	45%
ATM Pressure:	1016 mbar

The testing was performed by Daniel Deng on 2005-10-24.

Test Result

The worse case reading is

-37.1 dB at 1673.04 MHz in Vertical Polarization

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Gain Correction	Loss dB	Level dBm	dBm	dB
1673.04	53.24	330	1.5	v	1673.04	-57.1	8.3	1.3	-50.1	-13	-37.1
1673.04	51.08	0	1.6	h	1673.04	-58.9	8.3	1.3	-51.9	-13	-38.9
2509.56	38.9	0	1.5	v	2509.56	-64.5	9.4	1.6	-56.7	-13	-43.7
3346.08	35.7	0	1.8	v	3346.08	-66.1	10	2.2	-58.3	-13	-45.3
3346.08	35.6	0	1.6	h	3346.08	-66.3	10	2.2	-58.5	-13	-45.5
2509.56	35.6	0	1.6	h	2509.56	-67.1	9.4	1.6	-59.3	-13	-46.3
1533.3	39.6	180	1.7	v	1533.3	-72.6	8.3	1.3	-65.6	-13	-52.6
1533.3	37.7	180	1.6	h	1533.3	-74.1	8.3	1.3	-67.1	-13	-54.1

§2.1046, §22.913(a) – CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

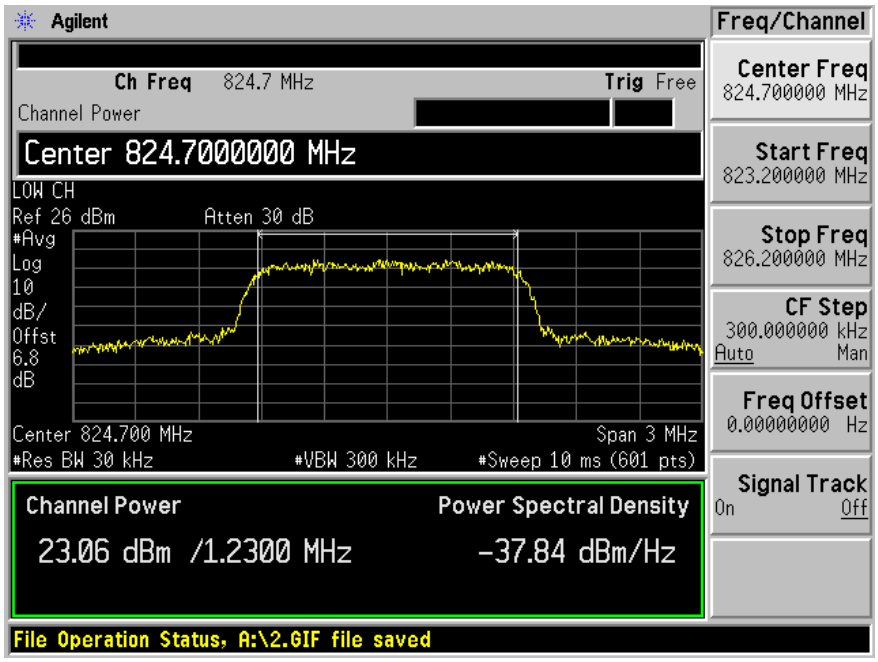
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Daniel Deng on 2005-10-22.

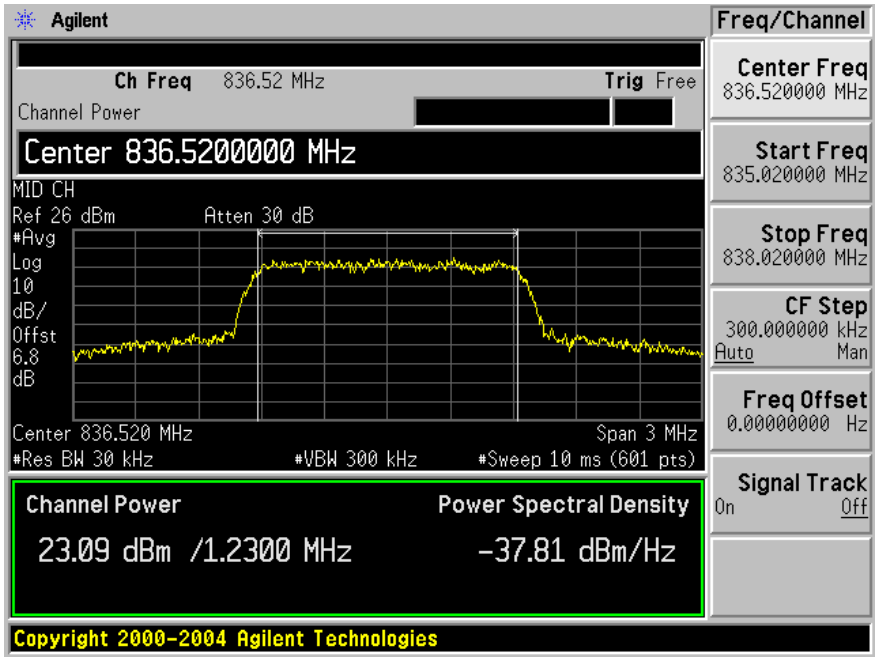
Test Results

Channel	Frequency (MHz)	Output Power in dBm	Output Power in W	Limit in W
LOW	824.70	23.09	0.204	7
MIDDLE	836.52	23.09	0.204	7
HIGH	848.31	23.01	0.200	7

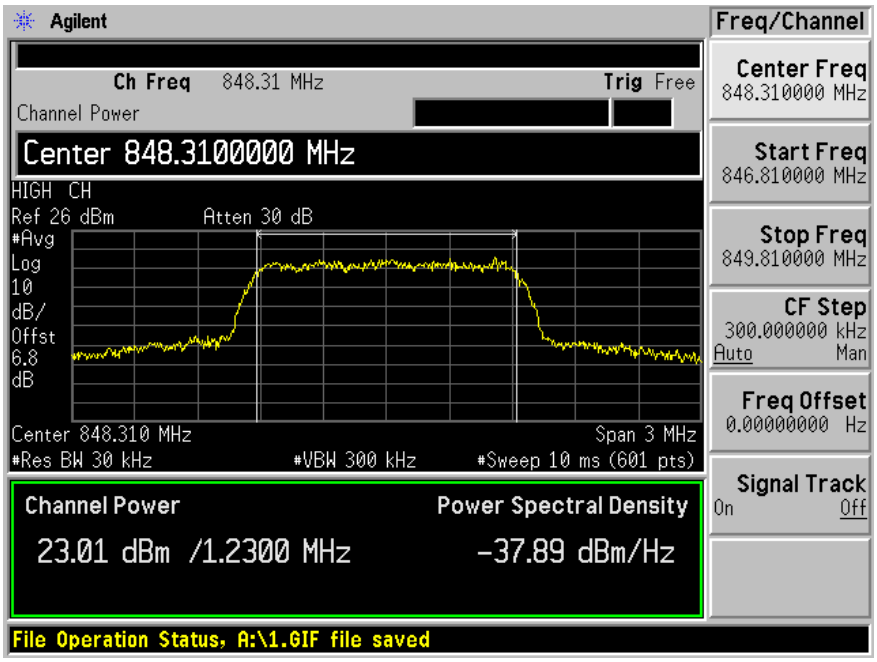
Low Channel



Middle Channel



High Channel



§2.1049, §22.917(d) - OCCUPIED BANDWIDTH

Applicable Standard

Requirements: CFR 47, Section 2.1049 and 22.917(d).

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 30 KHz and the 26 dB bandwidth was recorded.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

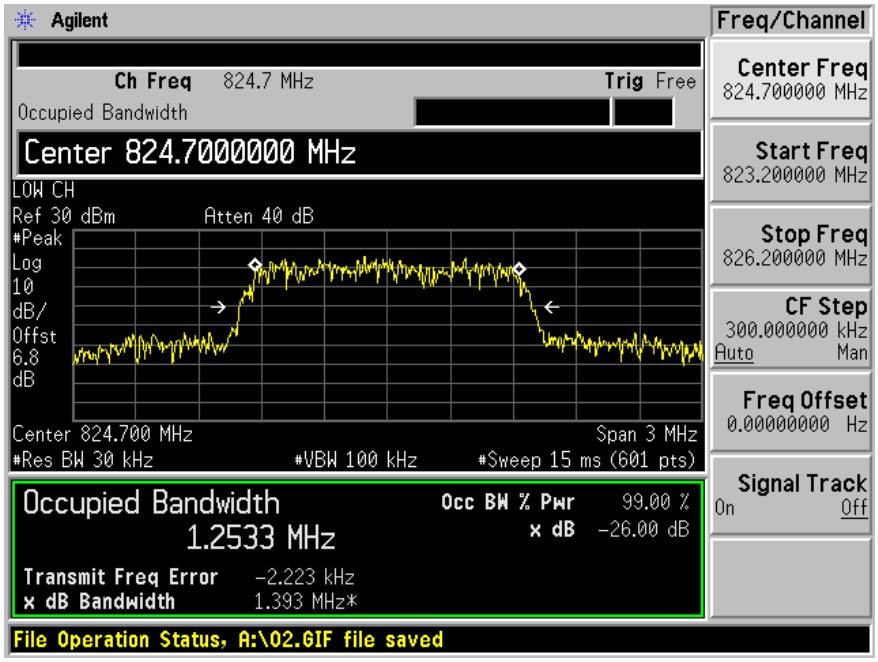
Environmental Conditions

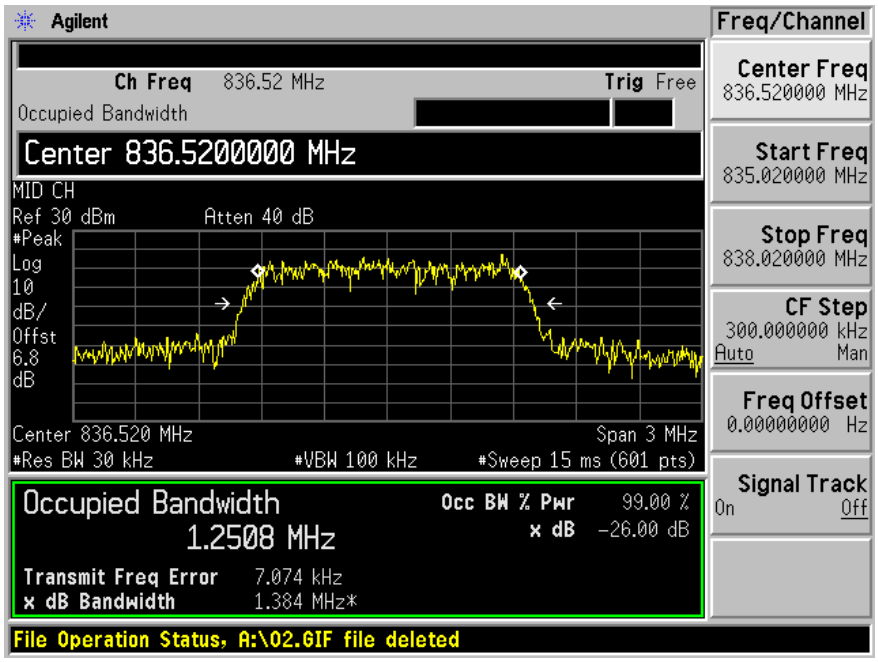
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

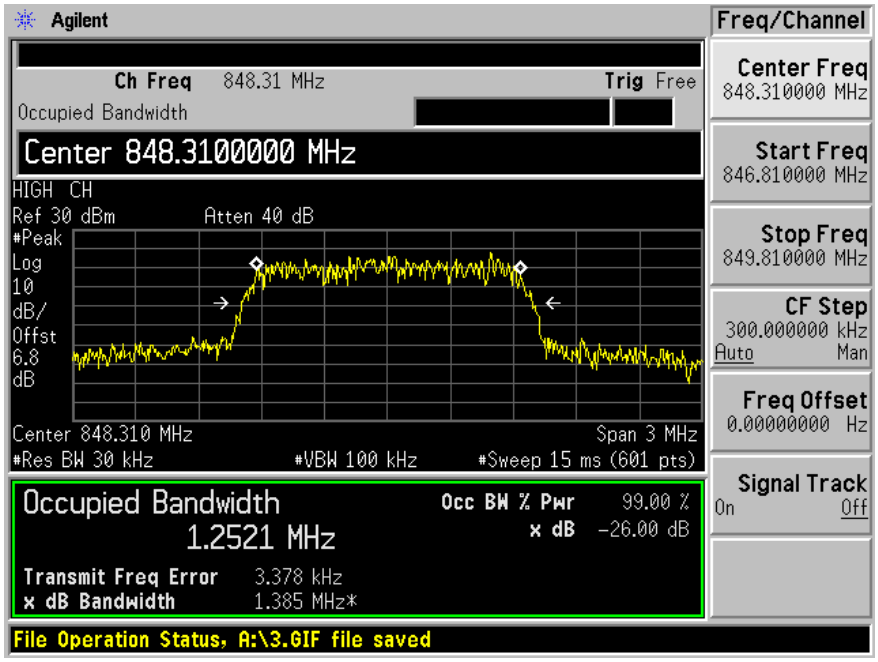
The testing was performed by Daniel Deng on 2005-10-22.

Test Results

Please refer to the following plots.


Agilent
Freq/Channel
Ch Freq 824.7 MHz
Trig Free
Occupied Bandwidth
Center 824.7000000 MHz
LOW CH
Ref 30 dBm
Atten 40 dB
#Peak
Log
10
dB/
Offst
6.8
dB
Center 824.700 MHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
#Sweep 15 ms (601 pts)
Occupied Bandwidth
1.2533 MHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error -2.223 kHz
x dB Bandwidth 1.393 MHz*
File Operation Status, A:\02.GIF file saved
Center Freq
824.700000 MHz
Start Freq
823.200000 MHz
Stop Freq
826.200000 MHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off


Agilent
Freq/Channel
Ch Freq 836.52 MHz
Trig Free
Occupied Bandwidth
Center 836.5200000 MHz
MID CH
Ref 30 dBm
Atten 40 dB
#Peak
Log
10
dB/
Offst
6.8
dB
Center 836.520 MHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
#Sweep 15 ms (601 pts)
Occupied Bandwidth
1.2508 MHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error 7.074 kHz
x dB Bandwidth 1.384 MHz*
File Operation Status, A:\02.GIF file deleted
Center Freq
836.520000 MHz
Start Freq
835.020000 MHz
Stop Freq
838.020000 MHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off


Agilent
Freq/Channel
Ch Freq 848.31 MHz
Trig Free
Occupied Bandwidth
Center 848.3100000 MHz
HIGH CH
Ref 30 dBm
Atten 40 dB
#Peak
Log
10
dB/
Offst
6.8
dB
Center 848.310 MHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
#Sweep 15 ms (601 pts)
Occupied Bandwidth
1.2521 MHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error 3.378 kHz
x dB Bandwidth 1.385 MHz*
Center Freq
848.310000 MHz
Start Freq
846.810000 MHz
Stop Freq
849.810000 MHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
File Operation Status, A:\3.GIF file saved

§2.1051, §22.917 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

Requirements: CFR 47, § 2.1051, § 22.917.
The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

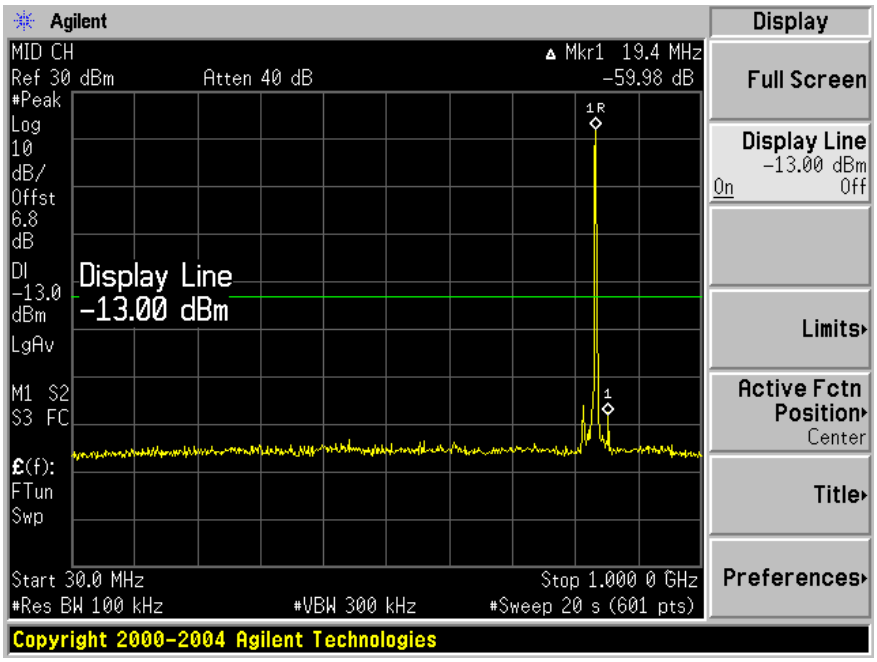
Environmental Conditions

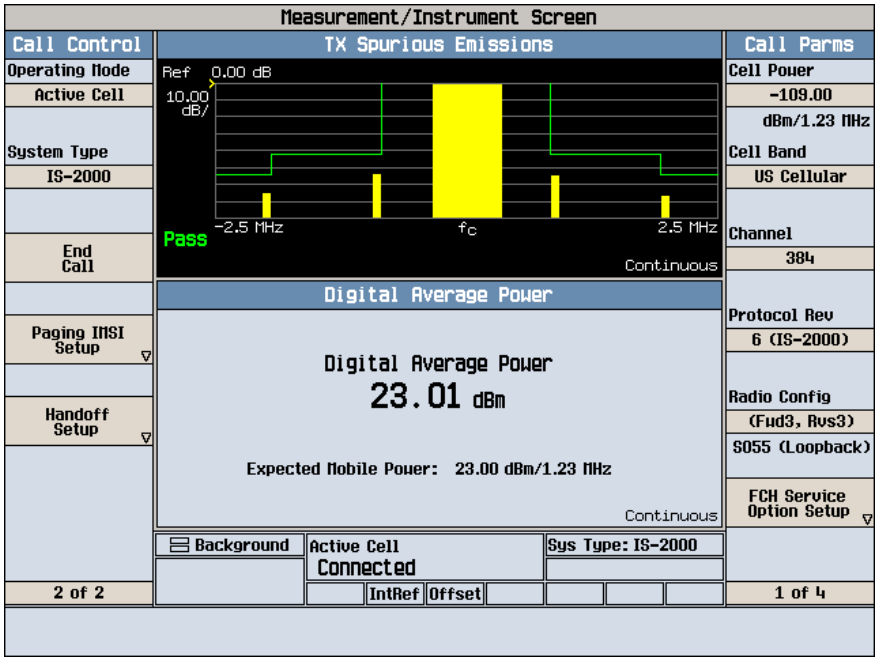
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

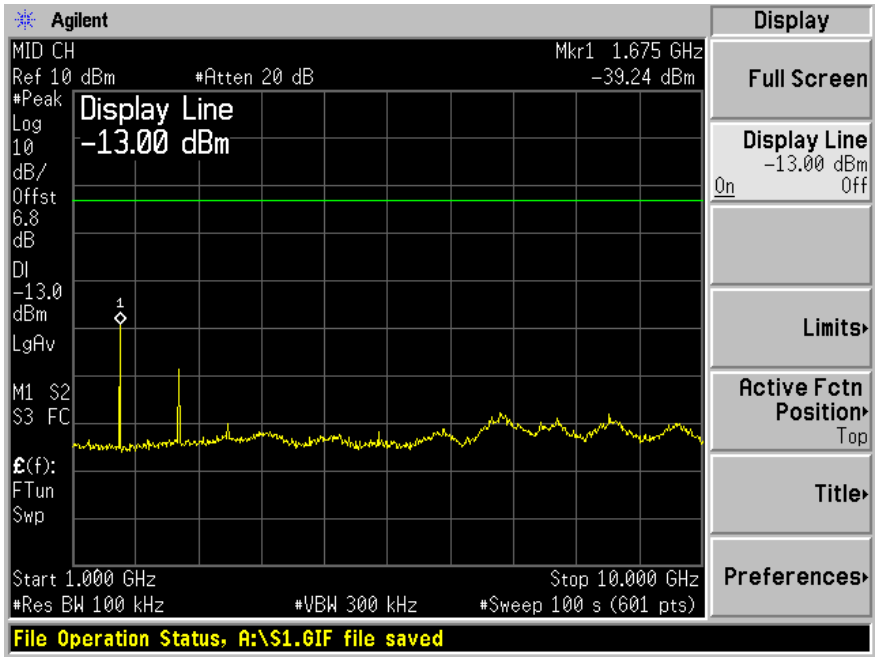
The testing was performed by Daniel Deng on 2005-10-22.

Test Results

Please refer to the hereinafter plots.


Agilent
MID CH
Ref 30 dBm
Atten 40 dB
Mkr1 19.4 MHz
-59.98 dB
#Peak
Log
10
dB/
Offst
6.8
dB
Dl
-13.0
dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Display Line
-13.00 dBm
1R
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.000 0 GHz
#Sweep 20 s (601 pts)
Display
Full Screen
Display Line
-13.00 dBm
On Off
Limits
Active Fctn
Position
Center
Title
Preferences
Copyright 2000-2004 Agilent Technologies


Measurement/Instrument Screen
Call Control
Operating Mode
Active Cell
System Type
IS-2000
End Call
Paging IMSI Setup
Handoff Setup
2 of 2
TX Spurious Emissions
Ref 0.00 dB
10.00 dB/
-2.5 MHz
fc
2.5 MHz
Pass
Continuous
Digital Average Power
Digital Average Power
23.01 dBm
Expected Mobile Power: 23.00 dBm/1.23 MHz
Continuous
Background
Active Cell
Connected
IntRef
Offset
Sys Type: IS-2000
Call Parms
Cell Power
-109.00
dBm/1.23 MHz
Cell Band
US Cellular
Channel
384
Protocol Rev
6 (IS-2000)
Radio Config
(Fwd3, Rvs3)
S055 (Loopback)
FCH Service Option Setup
1 of 4


Agilent
MID CH
Ref 10 dBm
#Atten 20 dB
Mkr1 1.675 GHz
-39.24 dBm
#Peak
Log
10
dB/
Offst
6.8
dB
Dl
-13.0
dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Display Line
-13.00 dBm
Start 1.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
#Sweep 100 s (601 pts)
Display
Full Screen
Display Line
-13.00 dBm
On Off
Limits
Active Fctn
Position
Top
Title
Preferences
File Operation Status, A:\S1.GIF file saved

§2.1055 (a), §2.1055 (d), §22.355 - FREQUENCY STABILITY

Applicable Standard

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

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1_Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Base, fixed (ppm)	Mobile [SU][le][/ SU]3 watts (ppm)	Mobile [le]3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	n/a	n/a
929 to 960	1.5	n/a	n/a
2110 to 2220	10.0	n/a	n/a

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a communication test set via feed-through attenuators. 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.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. 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. The output frequency was recorded for each battery voltage.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004
Tenney	Oven, Temperature	VersaTenn	12.222-193	6/4/2004

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Daniel Deng on 2005-10-22.

Test Results

Frequency Stability Versus Temperature

Reference Frequency: 836.52 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VAc)	Frequency Measure with Time Elapsed	
		Frequency error (HZ)	PPM Error
50	120	6.2	0.007
40	120	7.3	0.009
30	120	6.5	0.008
20	120	4.2	0.005
10	120	3.5	0.004
0	120	4.7	0.006
-10	120	3.6	0.004
-20	120	5.1	0.006
-30	120	2.9	0.003

Frequency Stability Versus Voltage

Reference Frequency: 836.52 MHz, Limit: 2.5ppm			
Power Supplied (VAc)	Environment Temperature (°C)	Frequency error (HZ)	PPM Error
102	20	4.8	0.006
138	20	4.1	0.005

§22.917 – BAND EDGE

Applicable Standard

According to § 22.917, 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

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency, RBW set to 30KHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

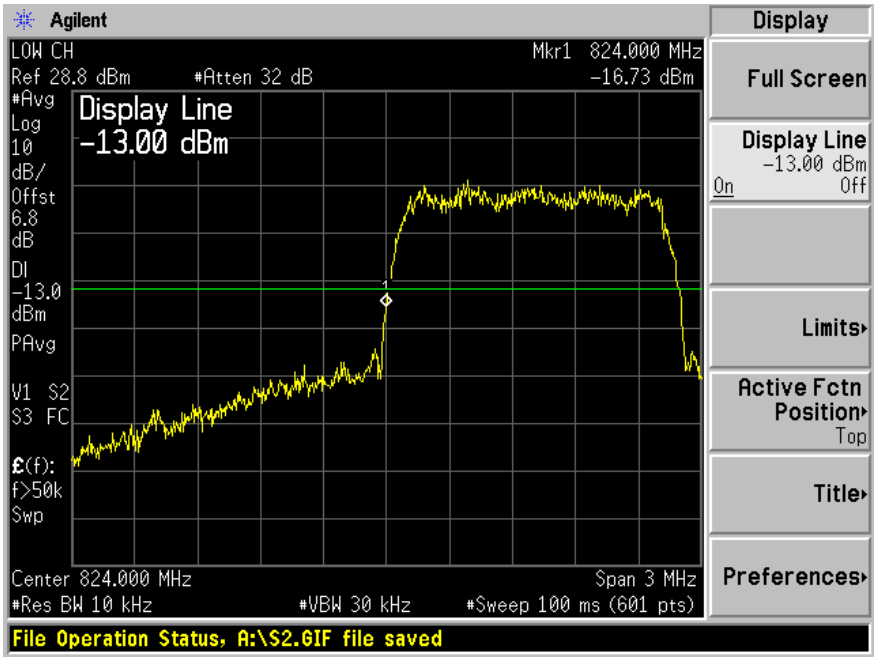
Environmental Conditions

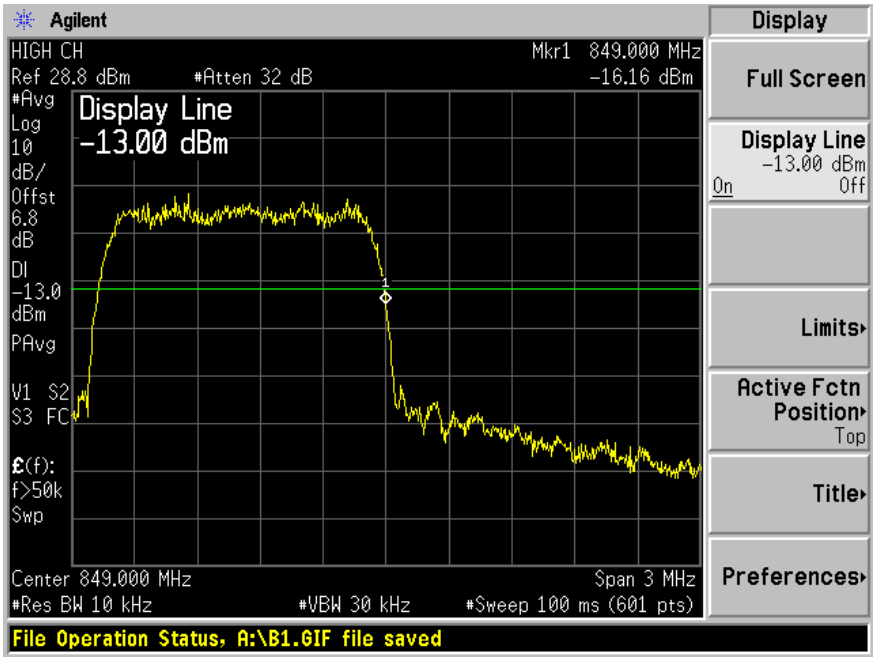
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Daniel Deng on 2005-10-22.

Test Results

Please refer to the following plots.


Agilent
LOW CH
Mkr1 824.000 MHz
Ref 28.8 dBm
#Atten 32 dB
-16.73 dBm
#Avg
Log
10
dB/
Offst
6.8
dB
Dl
-13.0
dBm
PAvg
V1 S2
S3 FC
£(f):
f>50k
Swp
Display Line
-13.00 dBm
Center 824.000 MHz
Span 3 MHz
#Res BW 10 kHz
#VBW 30 kHz
#Sweep 100 ms (601 pts)
File Operation Status, A:\S2.GIF file saved
Display
Full Screen
Display Line
-13.00 dBm
On Off
Limits
Active Fctn
Position
Top
Title
Preferences


Agilent
HIGH CH
Mkr1 849.000 MHz
Ref 28.8 dBm
#Atten 32 dB
-16.16 dBm
#Avg
Log
10
dB/
Offst
6.8
dB
Dl
-13.0
dBm
PAvg
V1 S2
S3 FC
£(f):
f>50k
Swp
Display Line
-13.00 dBm
Center 849.000 MHz
Span 3 MHz
#Res BW 10 kHz
#VBW 30 kHz
#Sweep 100 ms (601 pts)
File Operation Status, A:\B1.GIF file saved
Display
Full Screen
Display Line
-13.00 dBm
On Off
Limits
Active Fctn
Position
Top
Title
Preferences