



**FCC CFR47 PART 22 SUBPART H  
AND PART 24 SUBPART E  
CERTIFICATION TEST REPORT**

**FOR**

**PCA, EVDO REV. A, MINI-PCI EXPRESS CARD CDMA MODEM**

**MODEL NUMBER: MC5725**

**FCC ID: N7N-MC5725-L**

**REPORT NUMBER: 07U10870-1**

**ISSUE DATE: FEBRUARY 28, 2007**

*Prepared for*  
**SIERRA WIRELESS  
2290 COSMOS CT.  
CARLSBAD, CA, 92010 U.S.A.**

*Prepared by*  
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**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/28/07	Initial Issue	T. C.

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SIERRA WIRELESS  
2290 COSMOS CT.  
CARLSBAD, CA, 92010 U.S.A.

**EUT DESCRIPTION:** PCA, EVDO REV. A, MINI-PCI EXPRESS CARD CDMA MODEM

**MODEL:** MC5725

**SERIAL NUMBER:** 11S4210880Z1ZCTT710D00C

**DATE TESTED:** JAN 9 – FEB 15, 2007

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22 SUBPART H	NO NON-COMPLIANCE NOTED
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:



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THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

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CHIN PANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA/EIA 603C (2004), ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15 and FCC CFR 47 Part 22H and 24E.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, 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 EUT is a dual band 800/1900MHz PCA, EVDO REV. A, Mini-PCI Express Card CDMA Modem, and the module is manufactured by Sierra Wireless, Inc.

### 5.2. MAXIMUM OUTPUT POWER

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

824 to 849 MHz Authorized Band

Frequency Range (MHz)	Modulation	Conducted Average Power (dBm)	Conducted Average Power (mW)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)
Low CH - 824.7	1 x EVDO, Rev A	24.85	305.49	30.21	1049.54
Mid CH - 836.5		24.95	312.61	30.66	1164.13
High CH - 848.3		24.83	304.09	30.18	1042.32

1850 to 1910 MHz Authorized Band

Frequency Range (MHz)	Modulation	Conducted Average Power (dBm)	Conducted Average Power (mW)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)
Low CH - 1851.25	1 x EVDO, Rev A	24.95	312.61	29.51	893.31
Mid CH - 1880		24.92	310.46	29.29	849.18
High CH - 1908.75		24.9	309.03	29.04	801.68

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an Inverted F antenna with a maximum gain of -0.37 dBi for Cellular band and 0.96 dBi for PCS bands.

### 5.4. SOFTWARE AND FIRMWARE

The EUT is linked with Agilent Communication Test Set.

## 5.5. WORST-CASE CONFIGURATION AND MODE

### PROCEDURE USED TO ESTABLISH TEST SIGNAL

#### 3G-CDMA2000 1xEV-DO Revision A (Rev A)

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

Application	Rev, License
1xEV-DO Terminal Test	A.06.06, L

#### FETAP

- Call Setup > Shift & Preset
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > FETAP
- FTAP Rate > 307.2 kbps (2 Slot, QPSK)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 0
- Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Rvs Power Ctrl > All Up bits (to get the maximum power)

#### RETAP

- Call Setup > Shift & Preset
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > RETAP
- F-Traffic Format > 4 (1024, 2, 128) Canonical (307.2k, QPSK)
- R-Data Pkt Size > 4096 (for PCS band), 12288 (for Cellular band)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2  
> PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots  
> ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

#### Worst-case Measurement Result @ Low, Middle and High Channel

Cellular Band - RETAP					Cellular Band - FETAP				
Channel	f (MHz)	R-Data Pkt Size	Conducted power (dBm)		Channel	f (MHz)	FTAP Rate	Conducted power (dBm)	
			Average	Peak				Average	Peak
1013	824.70	4096	24.85	30.21	1013	824.70	307.2 (2 slot)	24.55	30.05
384	836.52		24.95	30.66	384	836.52		24.64	30.21
777	848.31		24.79	30.18	777	848.31		24.50	29.96

PCS Band - RETAP					PCS Band - FETAP				
Channel	f (MHz)	R-Data Pkt Size	Conducted power (dBm)		Channel	f (MHz)	FTAP Rate	Conducted power (dBm)	
			Average	Peak				Average	Peak
25	1851.25	4096	24.95	29.51	25	1851.25	307.2 (2 slot)	24.60	29
600	1880.00		<b>24.92</b>	<b>29.29</b>	600	1880.00		24.65	29.10
1175	1908.75		24.90	29.04	1175	1908.75		24.52	28.70

**3G-CDMA2000 1xEV-DO Revision A (Rev A)**

Preliminary Measurement Results @ Middle channel

Cellular Band - RETAP					Cellular Band - FETAP				
Channel	f (MHz)	R-Data Pkt Size	Conducted power (dBm)		Channel	f (MHz)	FTAP Rate	Conducted power (dBm)	
			Average	Peak				Average	Peak
384	836.52	128	23.90	30.14	384	836.52	307.2 (2 slot)	24.64	
		256	24	30.21			307.2 (4 slot)	24.60	
		512	24.10	30.28					
		768	24.27	30.33					
		1024	24.28	30.14					
		1536	24.32	30.35					
		2048	24.40	30.14					
		3072	24.70	30.56					
		<b>4096</b>	<b>24.95</b>	<b>30.66</b>					
		6144	23.60	30.37					
		8192	23.60	30.40					
		12288	23.70	30.38					

PCS Band - RETAP					PCS Band - FETAP				
Channel	f (MHz)	R-Data Pkt Size	Conducted power (dBm)		Channel	f (MHz)	FTAP Rate	Conducted power (dBm)	
			Average	Peak				Average	Peak
600	1880.00	128	24.10	28.91	600	1880	307.2 (2 slot)	24.65	
		256	24.16	29.20			307.2 (4 slot)	24.58	
		512	24.32	28.90					
		768	24.35	28.77					
		1024	24.50	28.76					
		1536	24.58	28.83					
		2048	24.60	28.86					
		3072	24.75	29.13					
		<b>4096</b>	<b>24.92</b>	<b>29.29</b>					
		6144	24.64	29.26					
		8192	24.68	29.24					
		12288	24.70	29.27					



Cellular Band	Avg. Output Power (dBm)	99% BW (MHz)	26 dB BW (MHz)	Band edge (dBm)	
	Mid CH	Mid CH	Mid CH	Low CH	High CH
Protocol-FETAP	24.64	1.2617	1.399	-18.444	-16.241
Protocol-RETAP	<b>24.95</b>	<b>1.2707</b>	<b>1.422</b>	<b>-17.835</b>	<b>-14.779</b>

EV-DO, Rev A Protocol RETAP, PCS Band	Avg. Output Power (dBm)	99% BW (MHz)	26 dB BW (MHz)	Band edge (dBm)	
	Mid CH	Mid CH	Mid CH	Low CH	High CH
Protocol-FETAP	24.65	1.265	1.408	-32.836	-31.471
Protocol-RETAP	<b>24.92</b>	<b>1.257</b>	<b>1.409</b>	<b>-30.468</b>	<b>-29.349</b>

### **EV-DO REV A Worst Case Data**

Based on the above results from the different modulations, EV-DO, REV A Protocol RETAP to be the worst-case scenario for all measurements.

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at mid channel for Cell band and low channel for PCS band.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

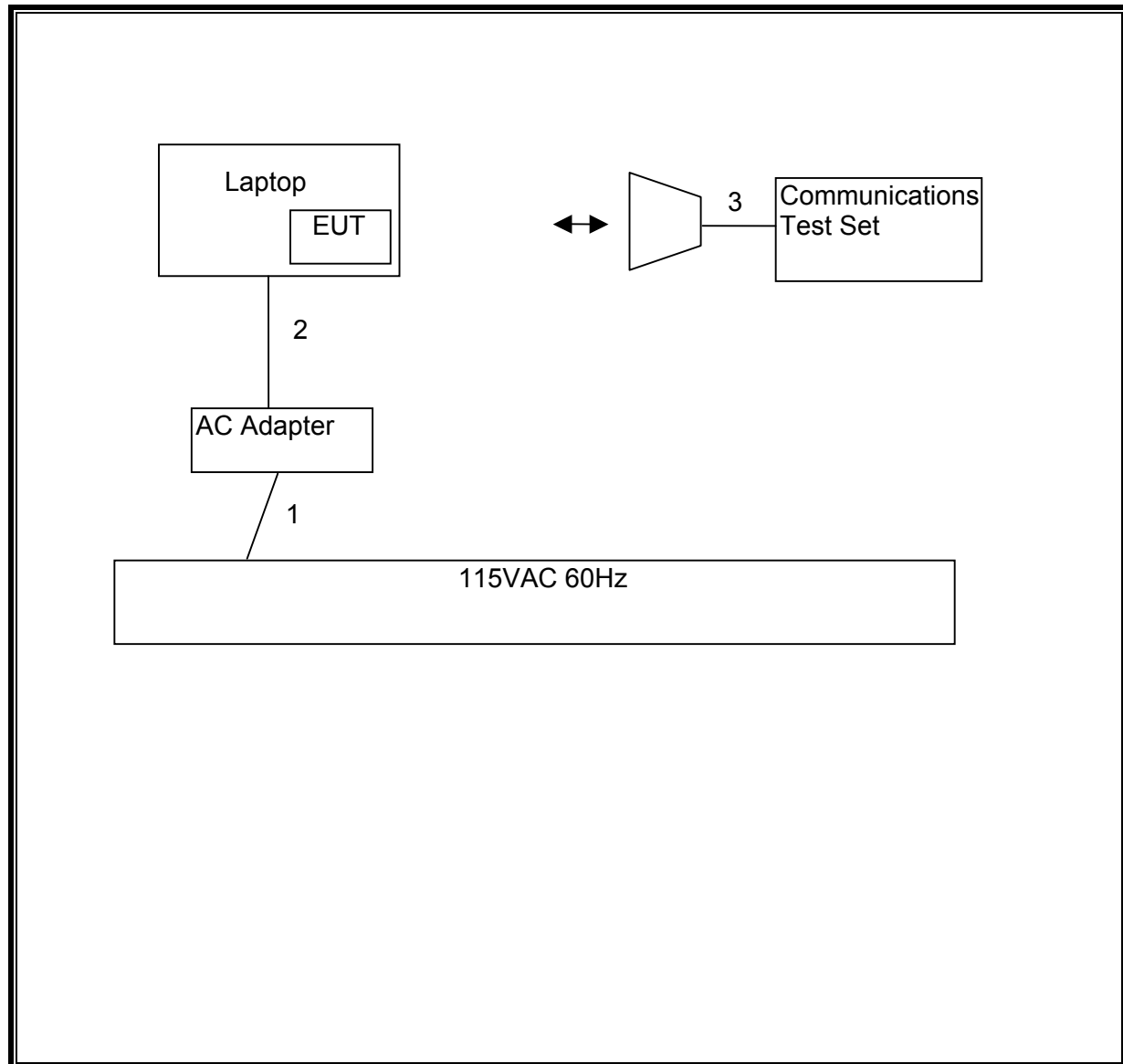
PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	ThinkPad T61 14.1-inch	ZZBC196	DoC
AC Adapter	Lenovo	92P1103	D5918E001MODF Rev D	DoC
Wireless Communications Test Set	Agilent	E5515C	10092	DoC

### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2 m	NA
2	DC	1	DC	Un-shielded	2m	Ferrite on DC end
3	RF In/Out	1	SMA	Un-shielded	1m	NA

### TEST SETUP

The EUT is installed inside a Lenovo ThinkPad T61 14.1-inch Laptop during the tests. The Wireless Communication test set exercised the EUT.

**SETUP DIAGRAM FOR TESTS**

## 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
Quasi-Peak Adaptor	Agilent / HP	85650A	2521A01038	01/11/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08
Preamp 30-1000MHz	Sonoma Instrument	310N	185623	01/20/08
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	08/13/07
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	05/03/07
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	04/22/07
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	04/22/07
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00369	08/17/07
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	29800	06/10/07
Wireless Communications Test Set	Agilent	E5515C	10092	10/19/07
2.7GHz HPF	MicroTronic	HPM13194	2	CNR
1.5GHz HPF	MicroTronic	HPM13195	1	CNR
Signal Generator 2 -40 GHz	R & S	SMP04	DE 34210	06/02/07
Signal Generator 1024 MHz	R & S	SMY01	DE 12311	05/11/07
Dipole	EMCO	3121C-DB2	22435	03/25/07
Power Splitter	Picosecond Pulse Lab	5350-216	55564214C	N/A

## 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 -26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal -26 dB bandwidth function is utilized.

#### RESULTS

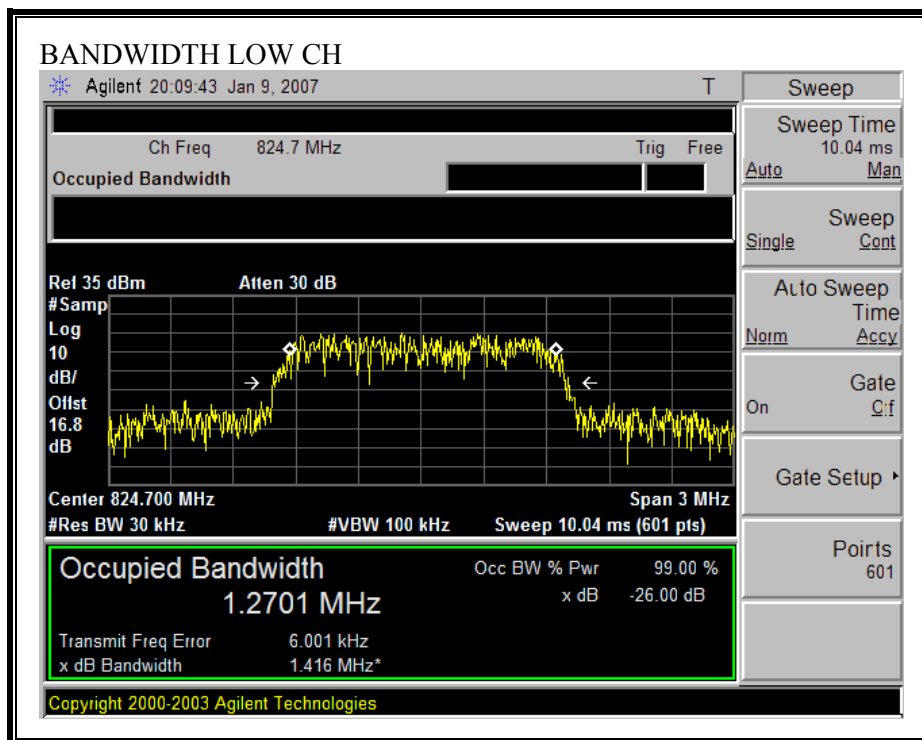
No non-compliance noted:

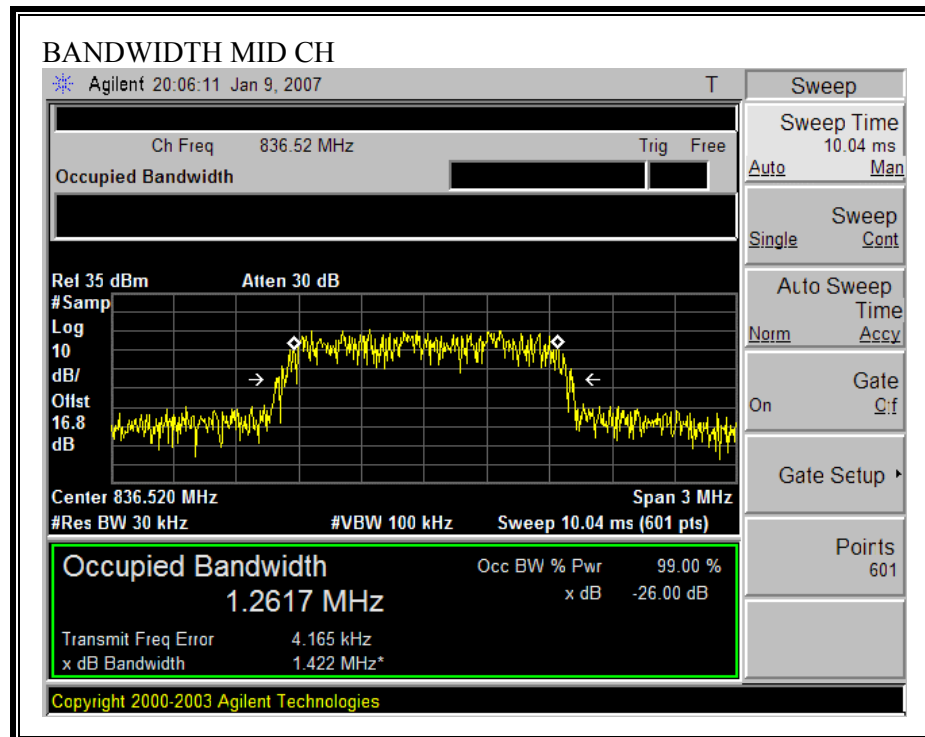
##### CDMA Modulation

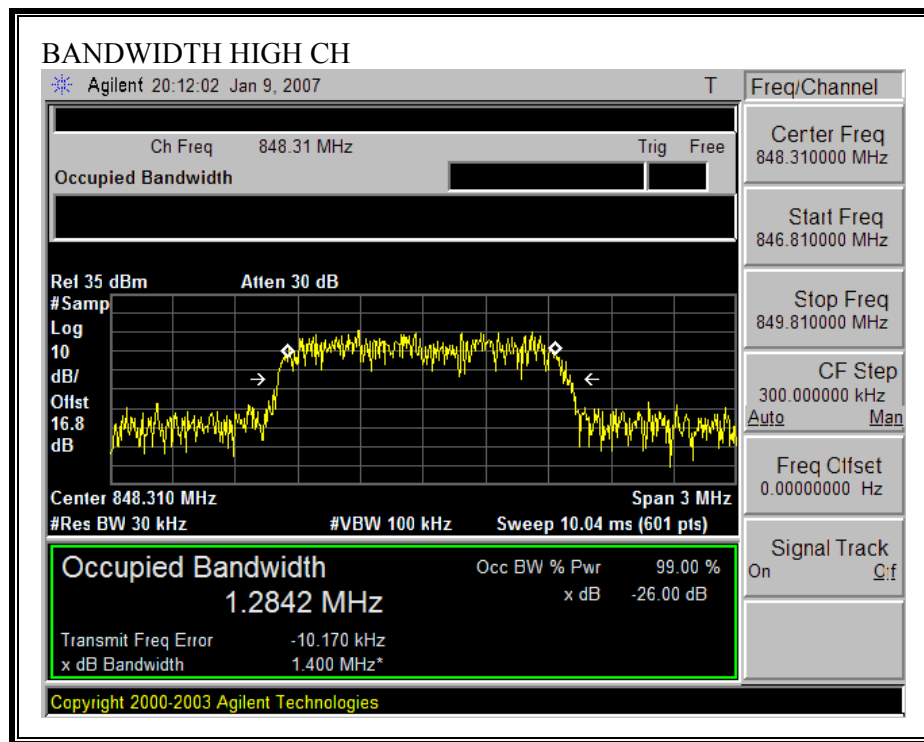
Channel	Frequency (MHz)	99% BW (MHz)	26dB BW (MHz)
Low	824.70	1.2701	1.416
Middle	836.52	1.2617	1.422
High	848.31	1.2842	1.400

##### PCS Modulation

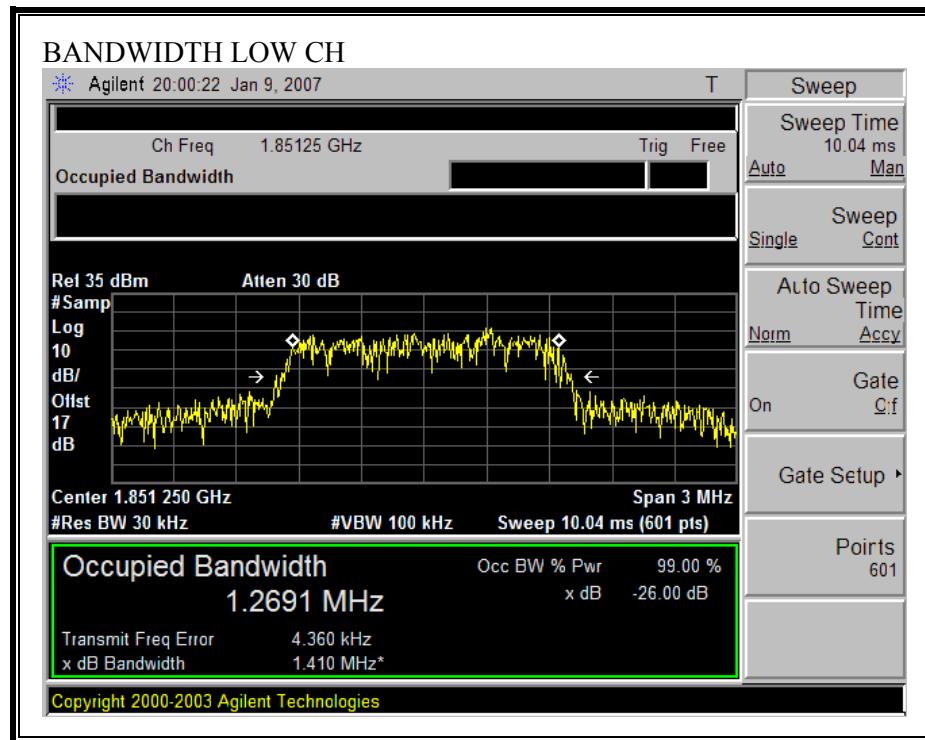
Channel	Frequency (MHz)	99% BW (MHz)	26dB BW (MHz)
Low	1851.25	1.2691	1.410
Middle	1880.00	1.2864	1.409
High	1908.75	1.2818	1.413

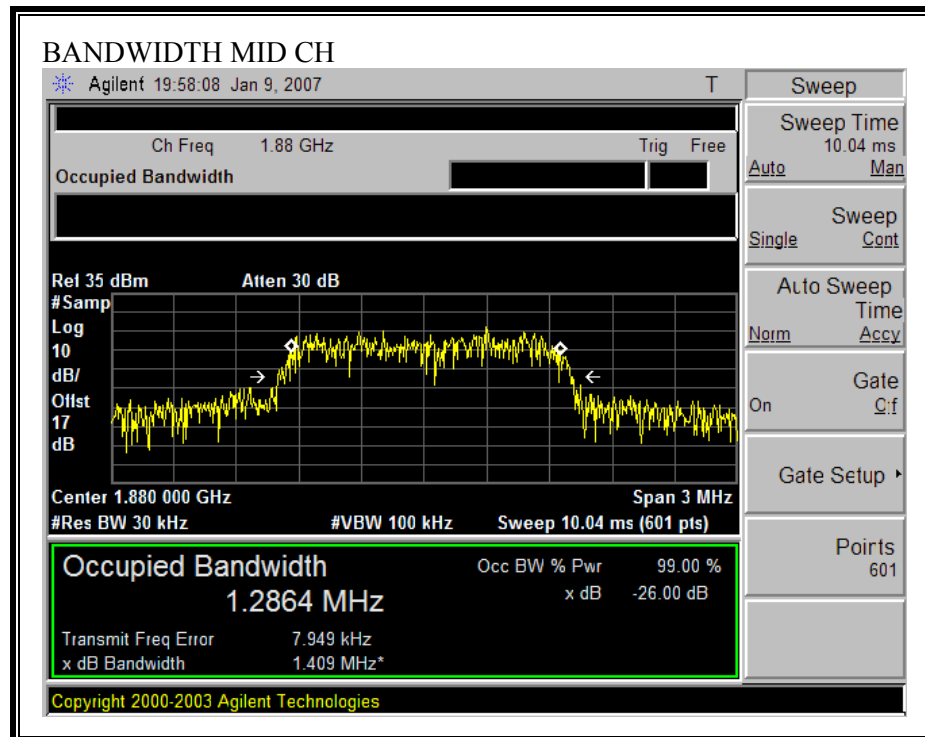
**CELL, CDMA 26 dB BANDWIDTH**

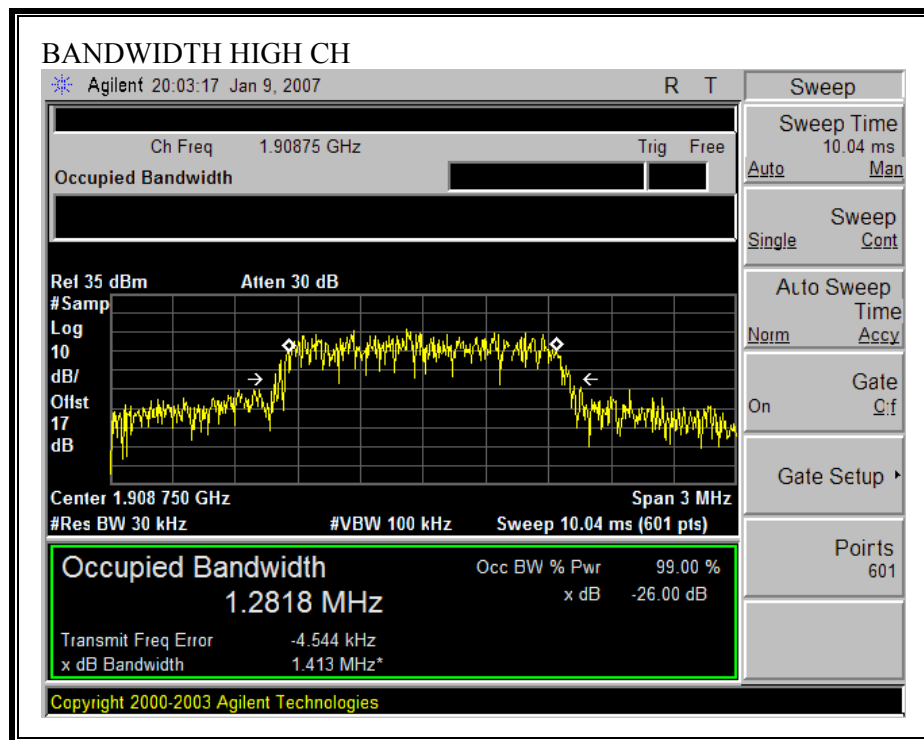






**PCS, CDMA 26 dB BANDWIDTH**





## 7.2. RF POWER OUTPUT

### LIMIT

22.913(a) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(b) 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.

### TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17

### RESULTS

No non-compliance noted.

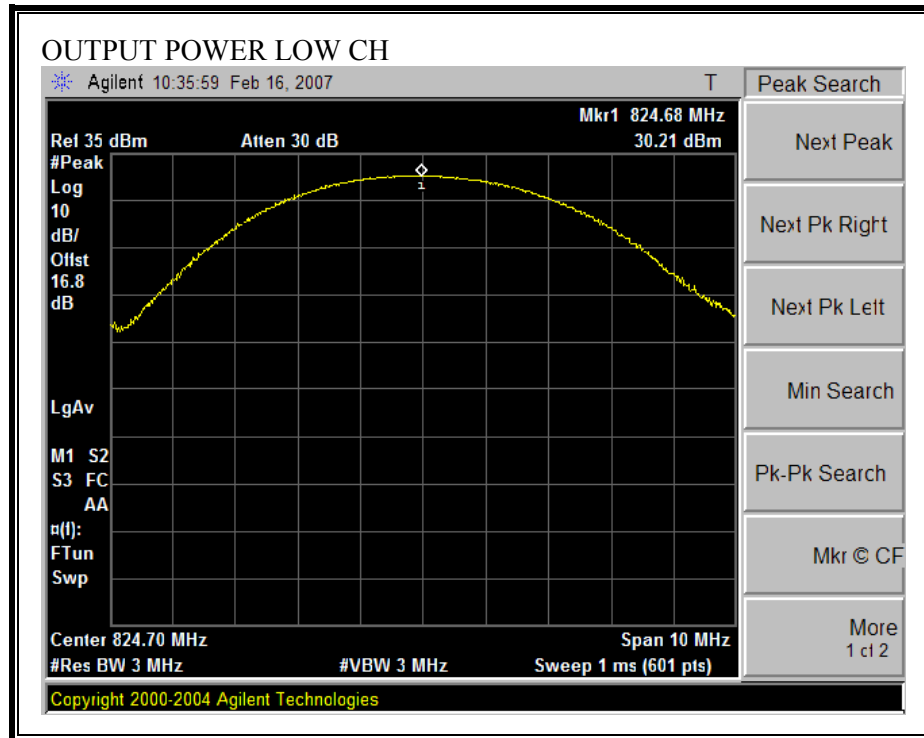
#### 800MHz CELL CDMA Modulation

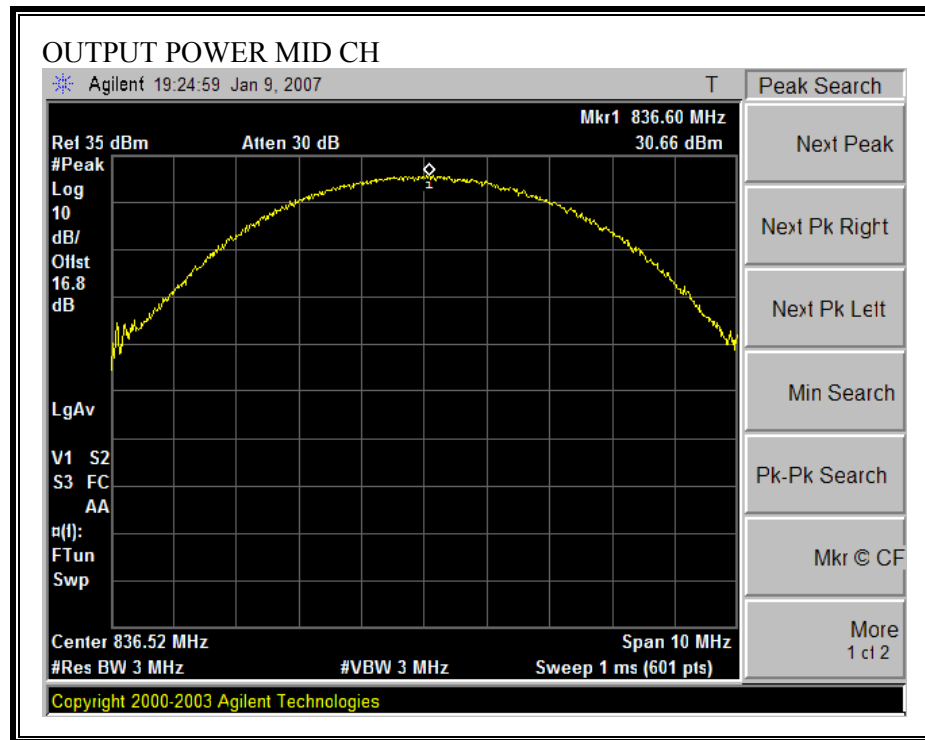
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)	ERP Peak Power (dBm)	ERP Peak Power (mW)
Low	824.7	30.21	1049.54	26.20	416.87
Middle	836.5	30.66	1164.13	26.50	446.68
High	848.3	30.18	1042.32	26.20	416.87

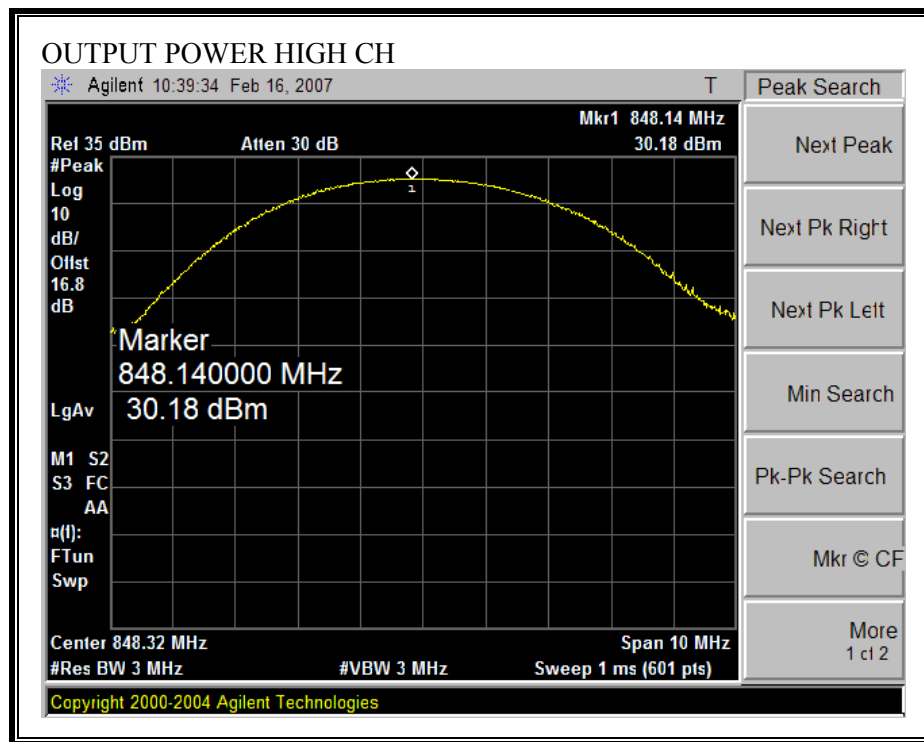
#### 1900MHz PCS Modulation

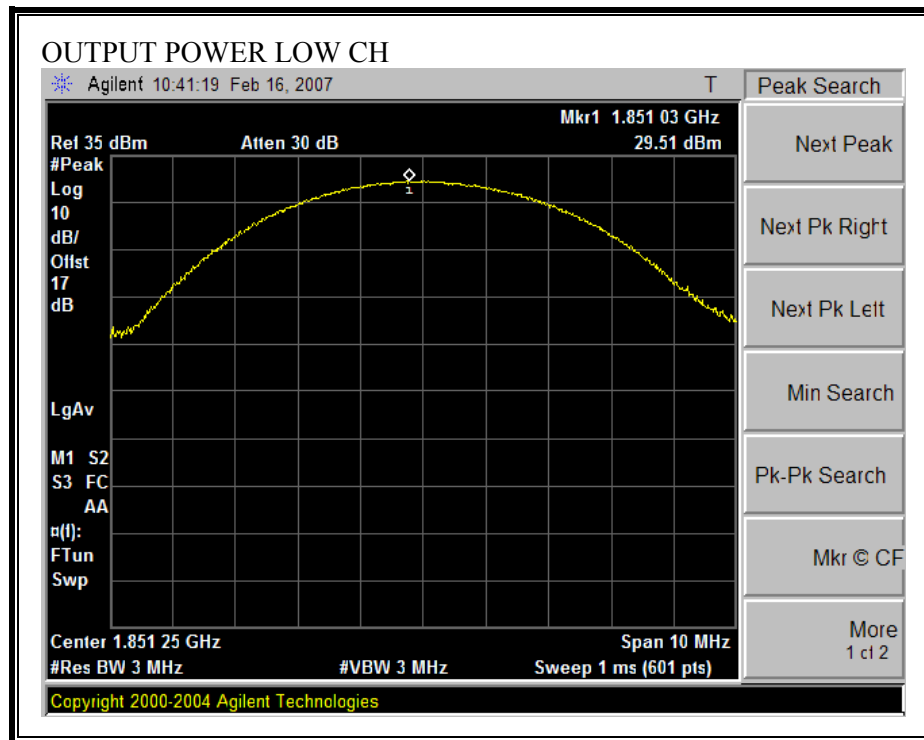
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)	EIRP Peak Power (dBm)	EIRP Peak Power (mW)
Low	1851.25	29.51	893.31	29.30	851.14
Middle	1880.00	29.29	849.18	28.30	676.08
High	1908.75	29.04	801.68	28.30	676.08

NOTE: RBW=VBW=3MHz

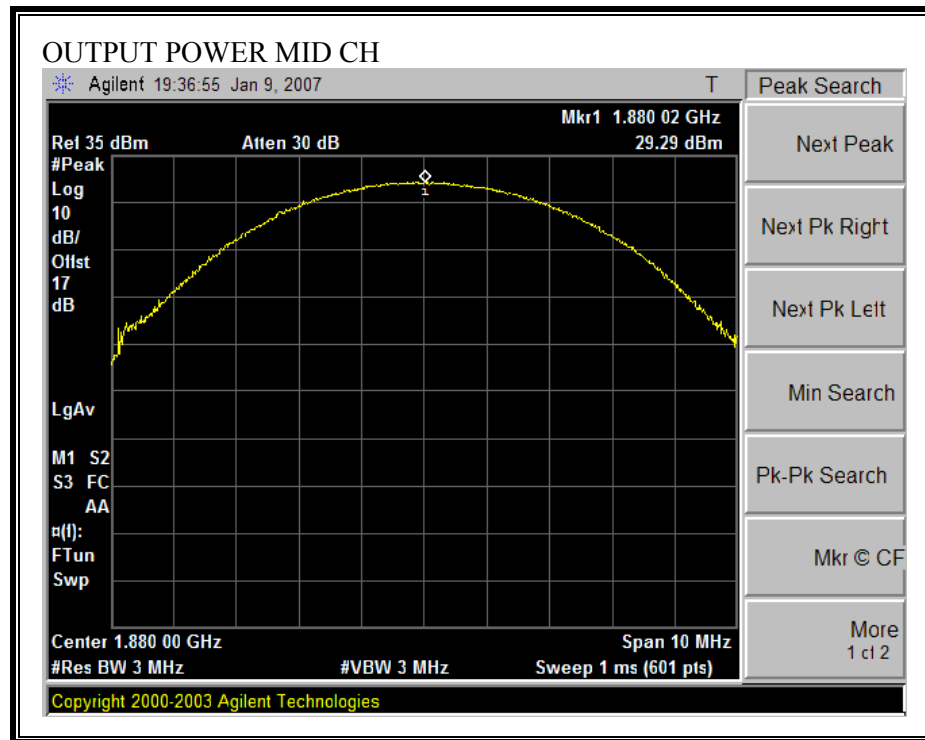
**800MHz CELLULAR (RF CONDUCTED OUTPUT POWER)**

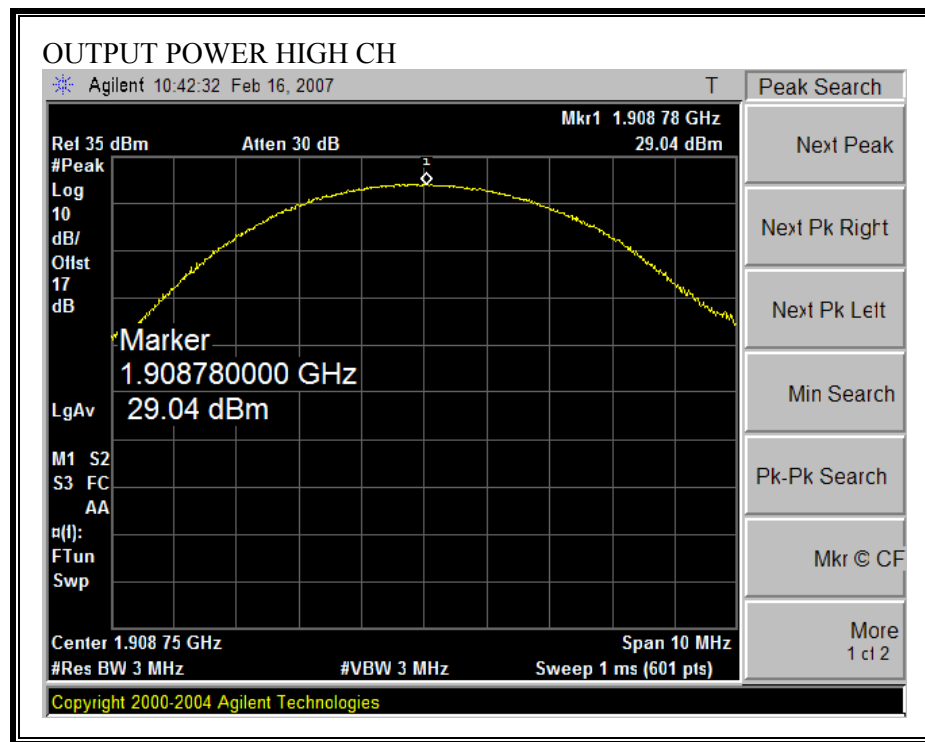




**1900MHz PCS (RF CONDUCTED OUTPUT POWER)**







**Cellular Output Power (ERP)**

High Frequency Substitution Measurement

Compliance Certification Services, Morgan Hill 5m Chamber Site

Company:

Sierra Wireless

Project #:

07U10870

Date:

2/15/2007

Test Engineer:

Frank Ibrahim

Configuration:

Stand Alone EUT

Mode:

TX ON PCS

Test Equipment:

Receiving: Sumol T122, and 5m Chamber N-type Cable (Setup this one for testing EUT)

Substitution: Dipole S/N: 00022117, and 4ft SMA Cable Warehouse S/N: 177081002

f MHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Channel (824.7 MHz)									
824.70	91.5	V	17.9	0.5	0.0	17.4	38.5	-21.0	
824.70	102.0	H	26.7	0.5	0.0	26.2	38.5	-12.2	
Mid Channel (836.52 MHz)									
836.52	90.0	V	17.0	0.6	0.0	16.4	38.5	-22.0	
836.52	102.2	H	27.1	0.6	0.0	26.5	38.5	-11.9	
High Channel (848.31 MHz)									
848.31	91.8	V	18.6	0.7	0.0	17.9	38.5	-20.5	
848.31	102.4	H	26.9	0.7	0.0	26.2	38.5	-12.2	

**PCS Output Power (EIRP)**

High Frequency Fundamental Measurement

Compliance Certification Services, Morgan Hill 5m Chamber Site

Company:

Project #:

Date:

Test Engineer:

Configuration:

Mode:

Sierra Wireless

07U10870

2/15/2007

Frank Ibrahim

Stand Alone EUT

TX ON PCS

Test Equipment:

Receiving: Horn T73, and 12ft S/N: 197209005 (Setup this one for testing EUT)

Substitution: Horn T60 Substitution, 4ft SMA Cable Warehouse S/N: 177081002

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Channel (1851.25 MHz)									
1.85125	95.27	V	21.9	0.9	8.3	29.3	33.0	-3.7	
1.85125	94.61	H	20.7	0.9	8.3	28.1	33.0	-4.9	
Mid Channel (1880 MHz)									
1.88000	95.20	V	20.9	0.9	8.3	28.3	33.0	-4.7	
1.88000	94.36	H	19.6	0.9	8.3	27.0	33.0	-6.0	
High Channel (1908.75 MHz)									
1.90875	91.98	V	18.7	0.9	8.4	26.2	33.0	-6.8	
1.90875	93.64	H	20.8	0.9	8.4	28.3	33.0	-4.7	

### **7.3. SPURIOUS EMISSION AT ANTENNA TERMINAL**

#### **LIMIT**

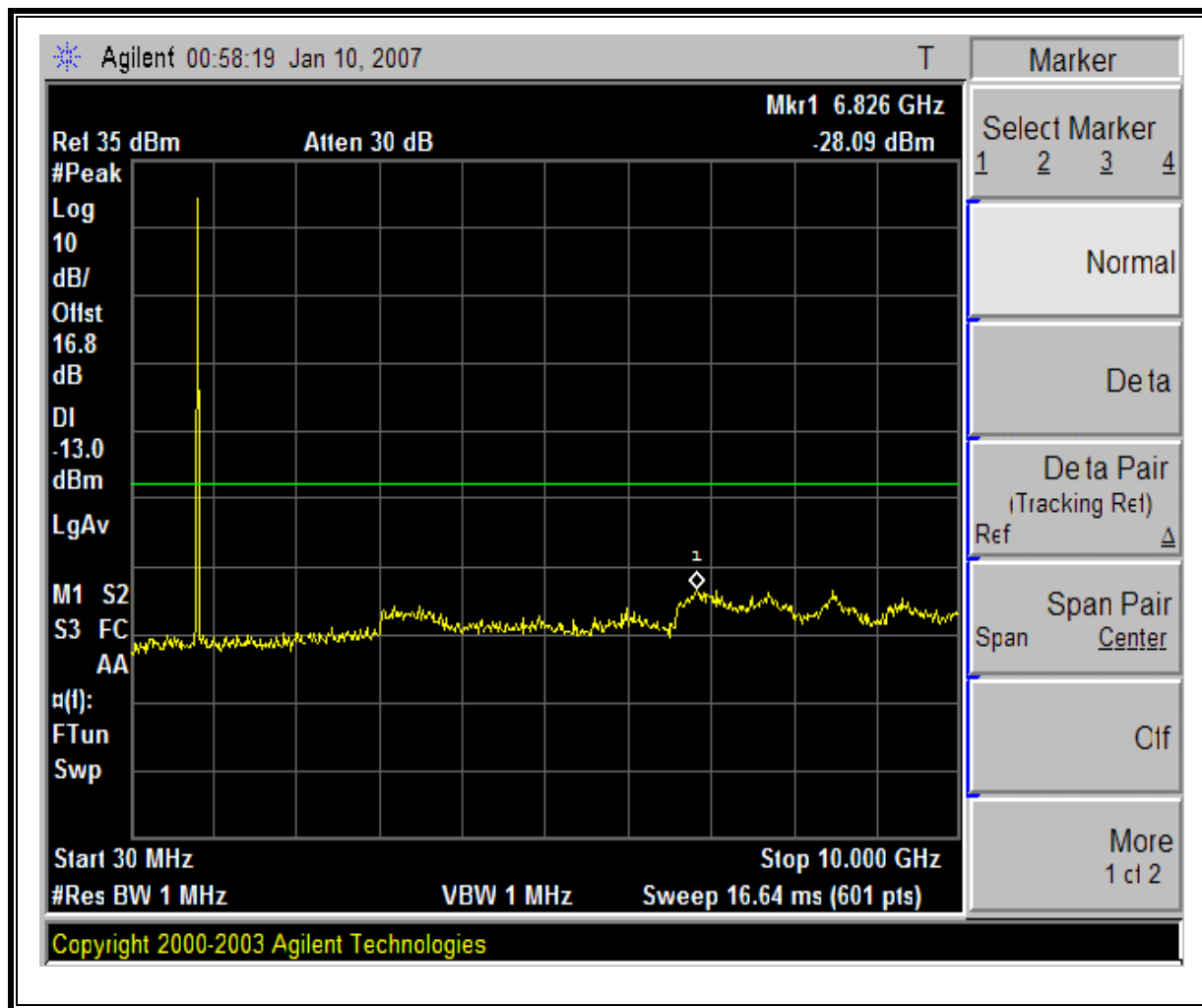
§22.917 (e) & §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

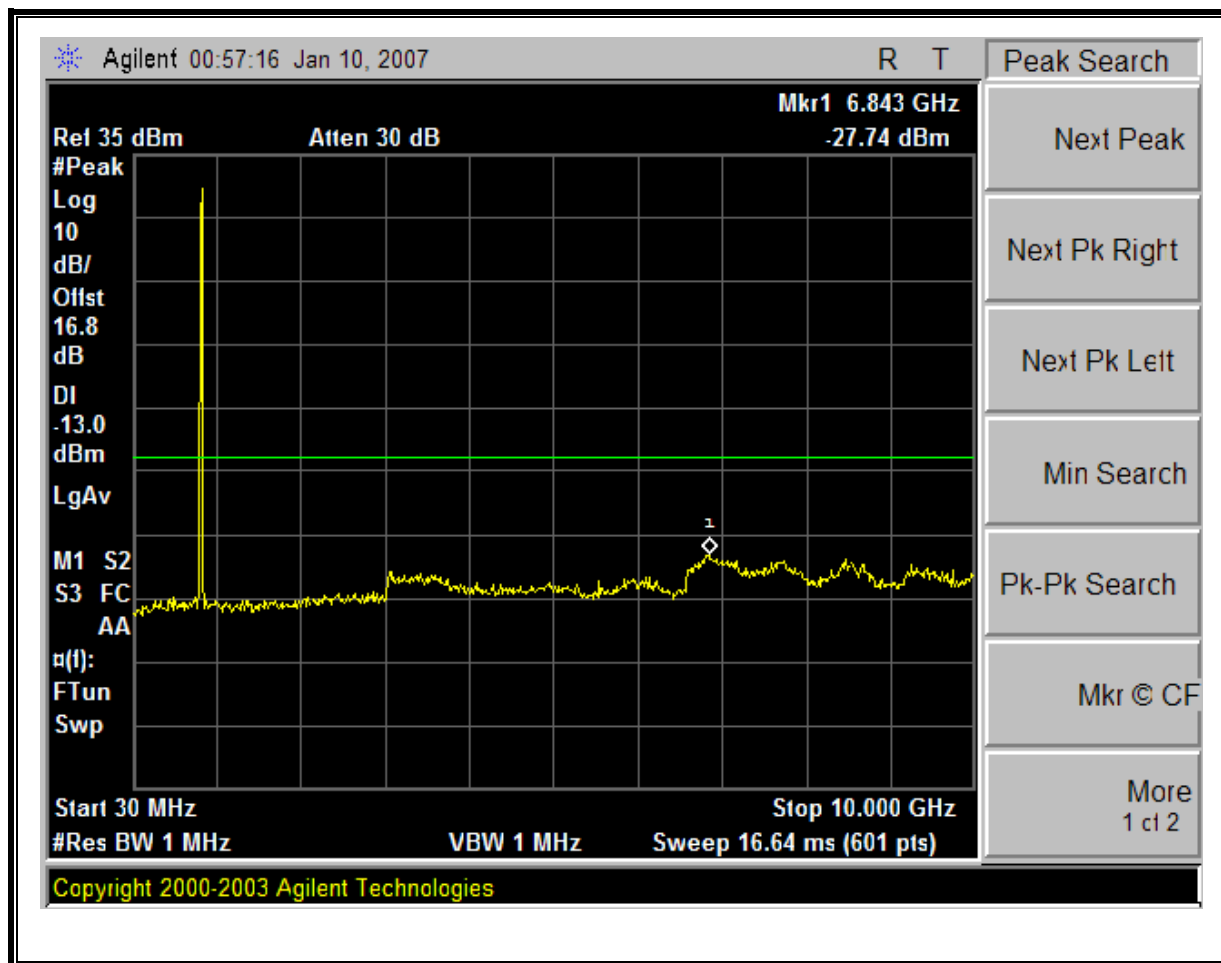
#### **TEST PROCEDURE**

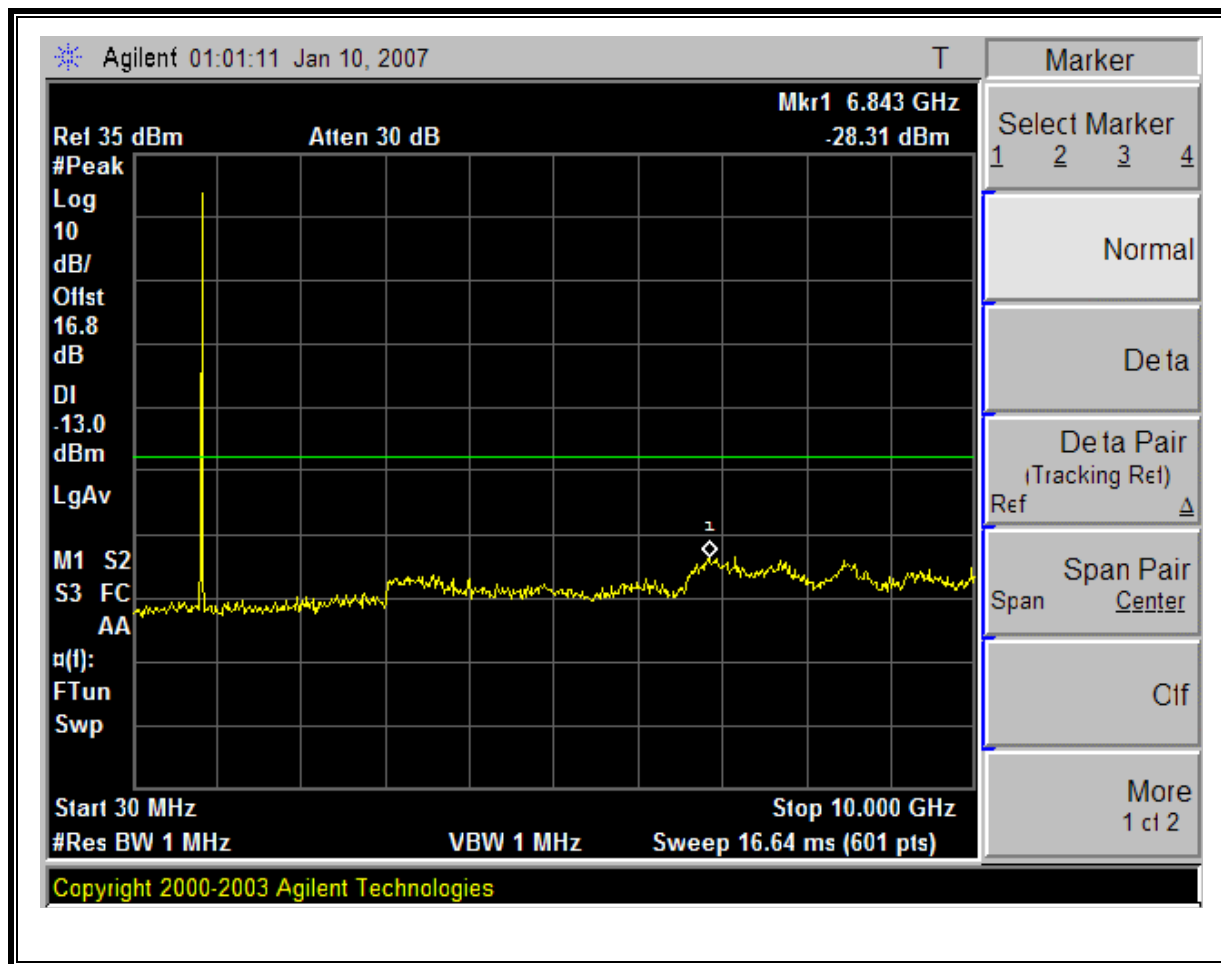
ANSI / TIA / EIA 603C Clause 2.2.12, FCC 22.917 (h), & FCC 24.238 (b)

#### **RESULTS**

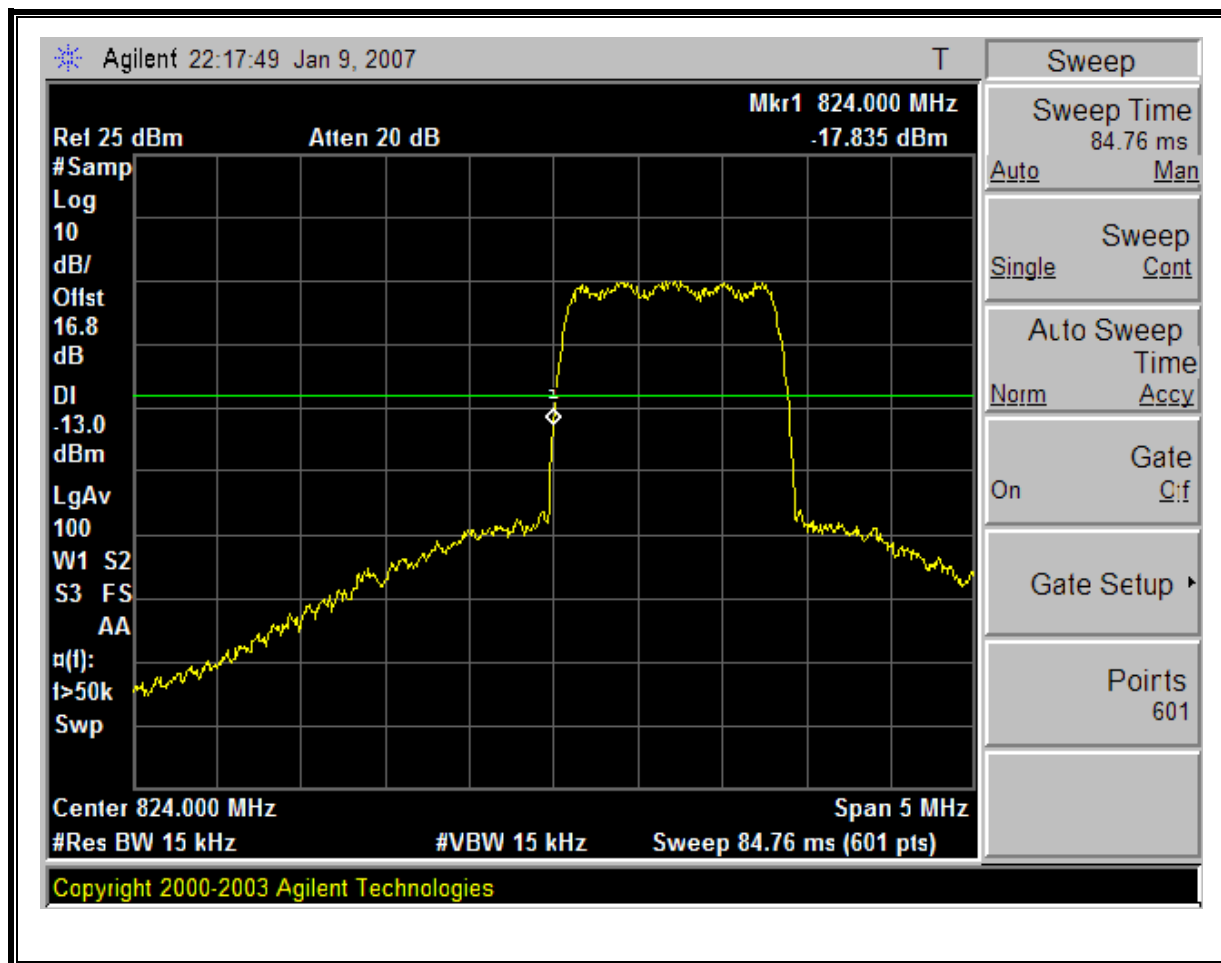
No non-compliance noted.

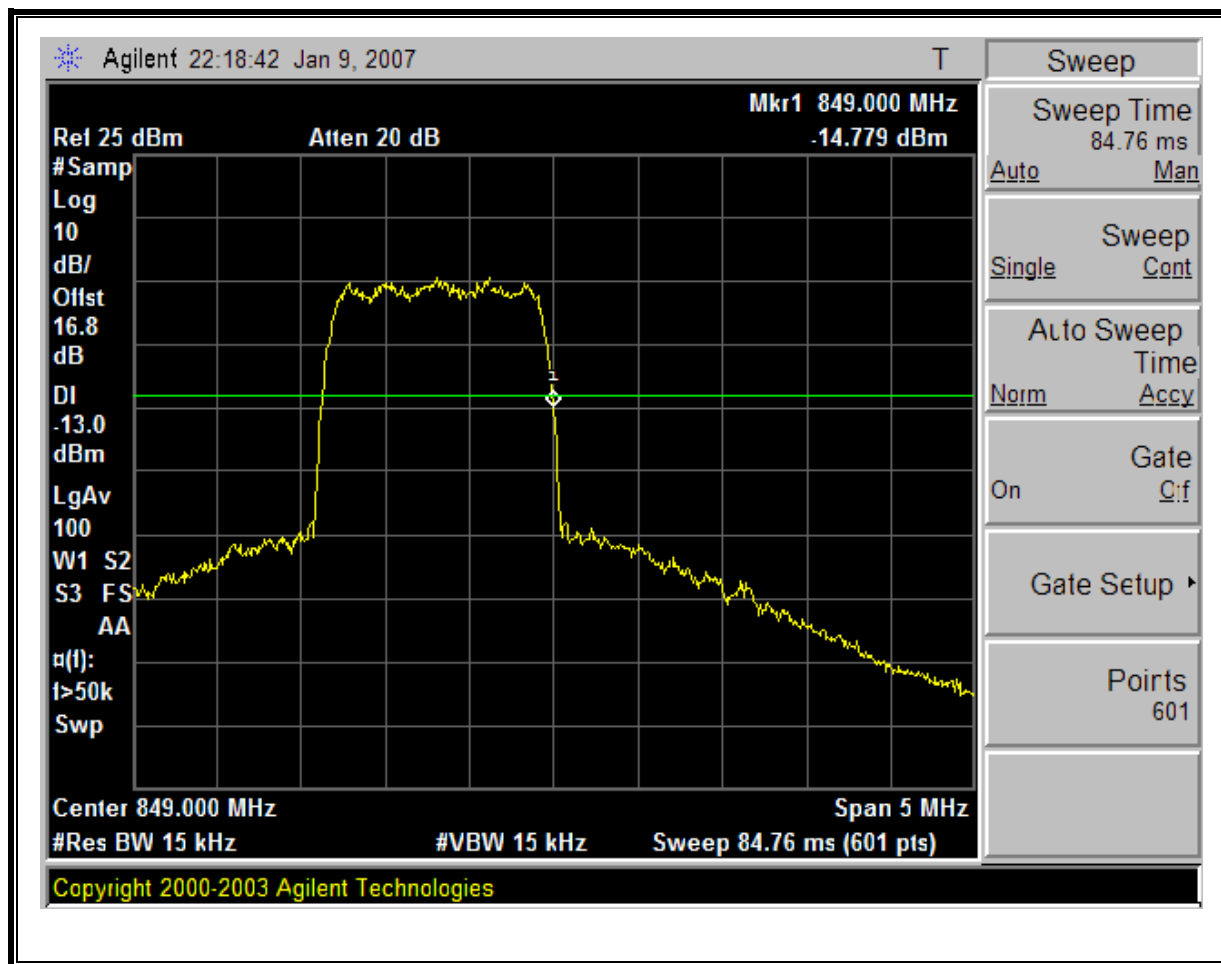
**CDMA MODULATION RESULTS****CDMA Modulation: Low Channel, Out-Of-Band Emissions**

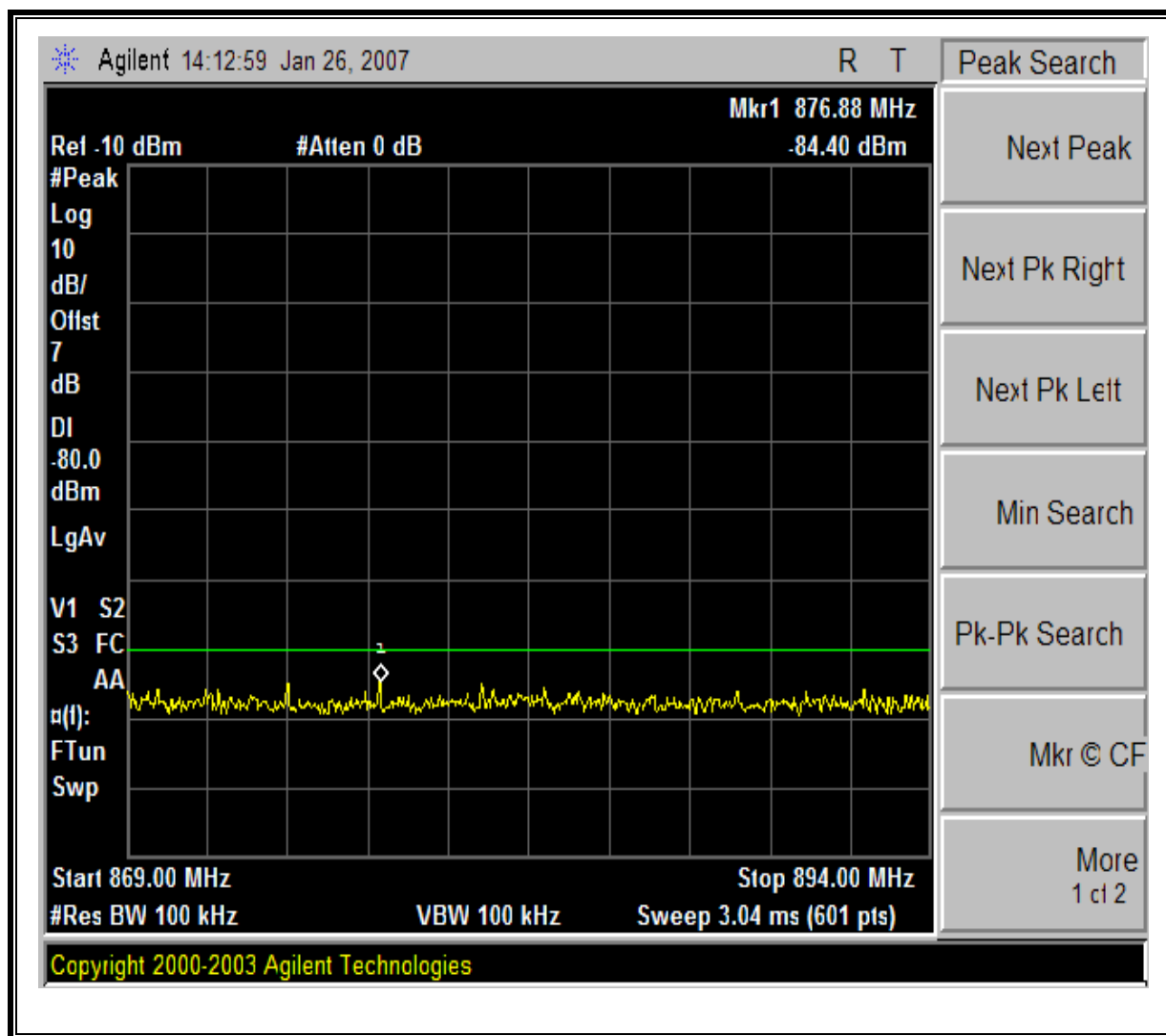
**CDMA Modulation: Mid Channel, Out-Of-Band Emissions**

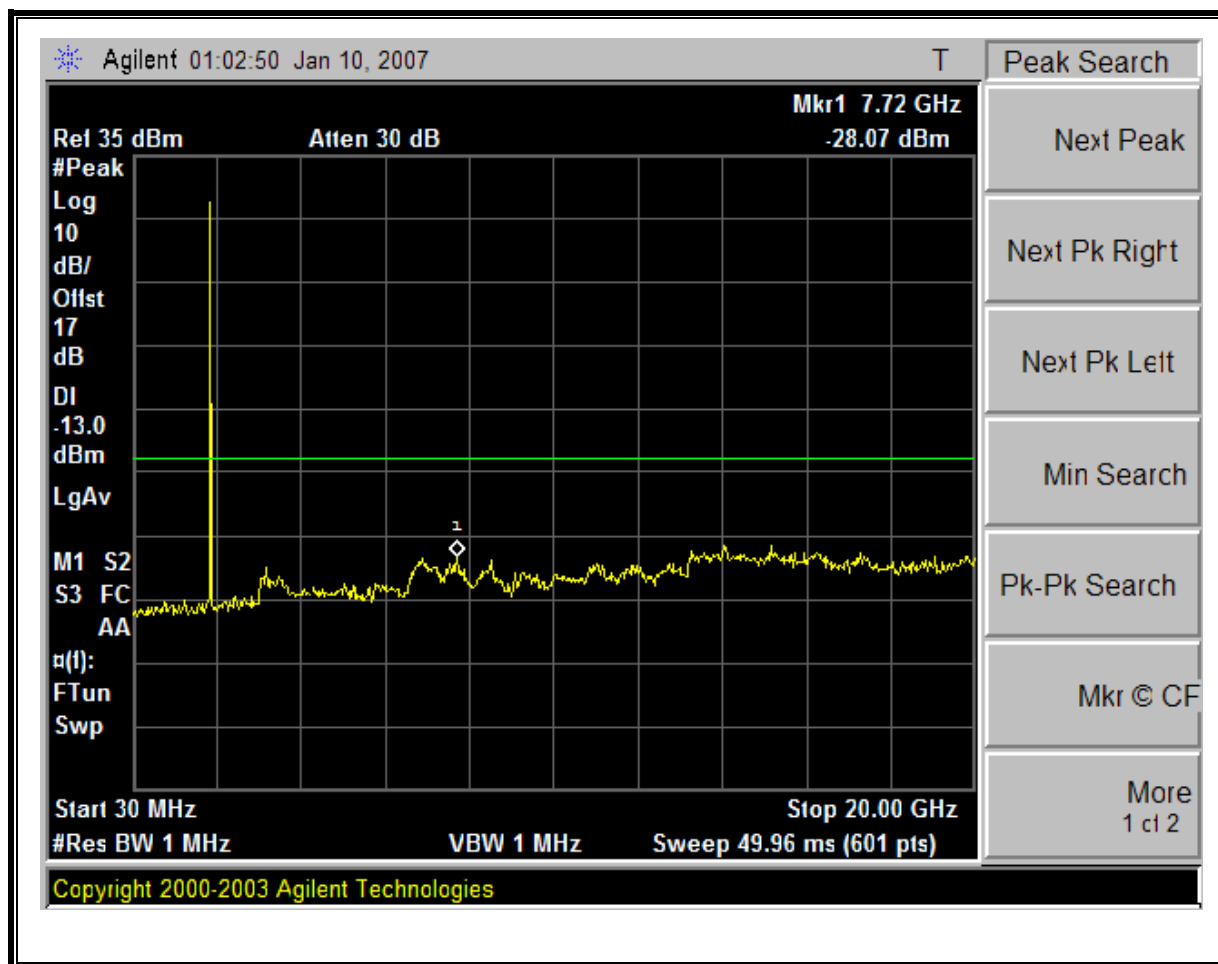
**CDMA Modulation: High Channel, Out-Of-Band Emissions**

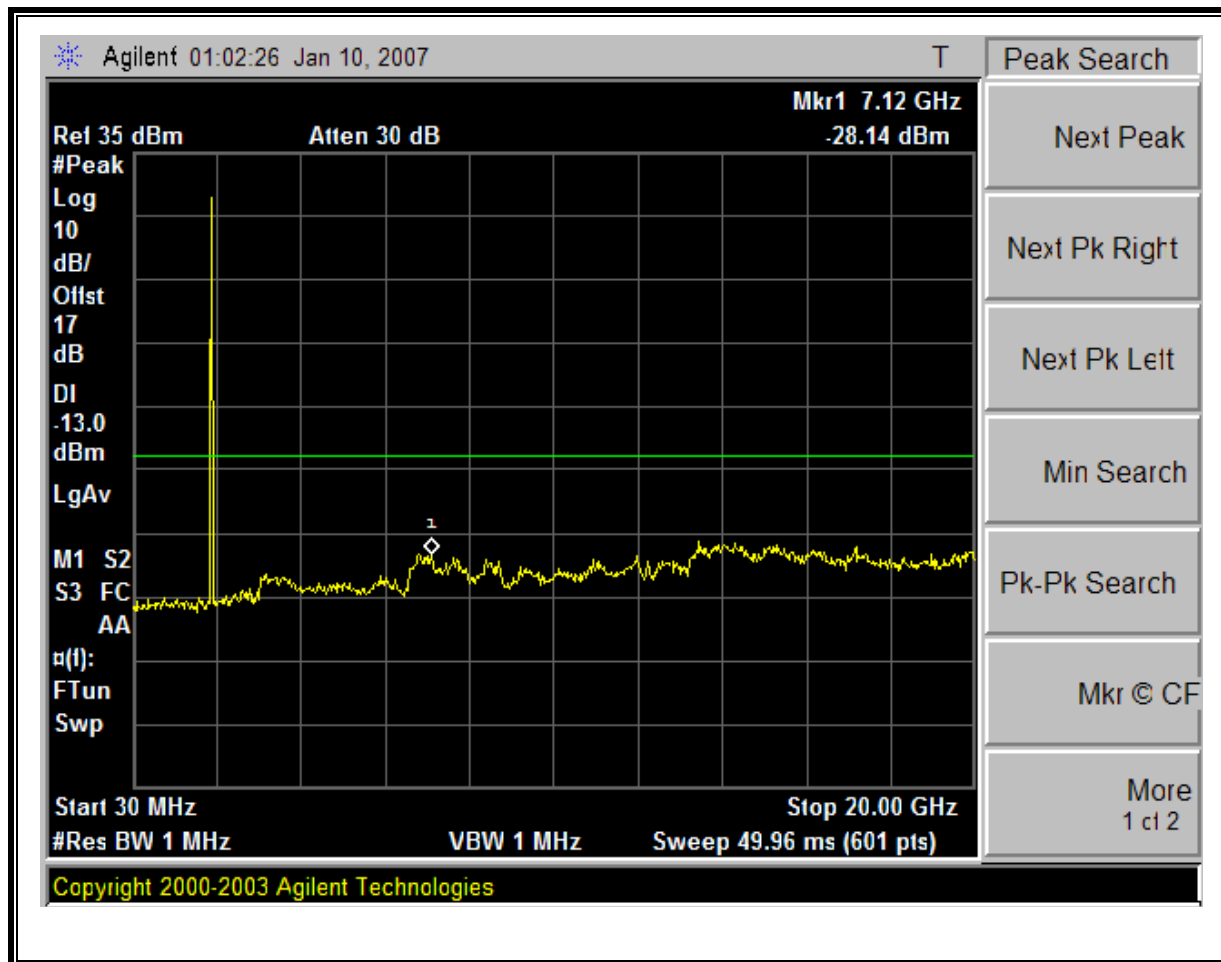


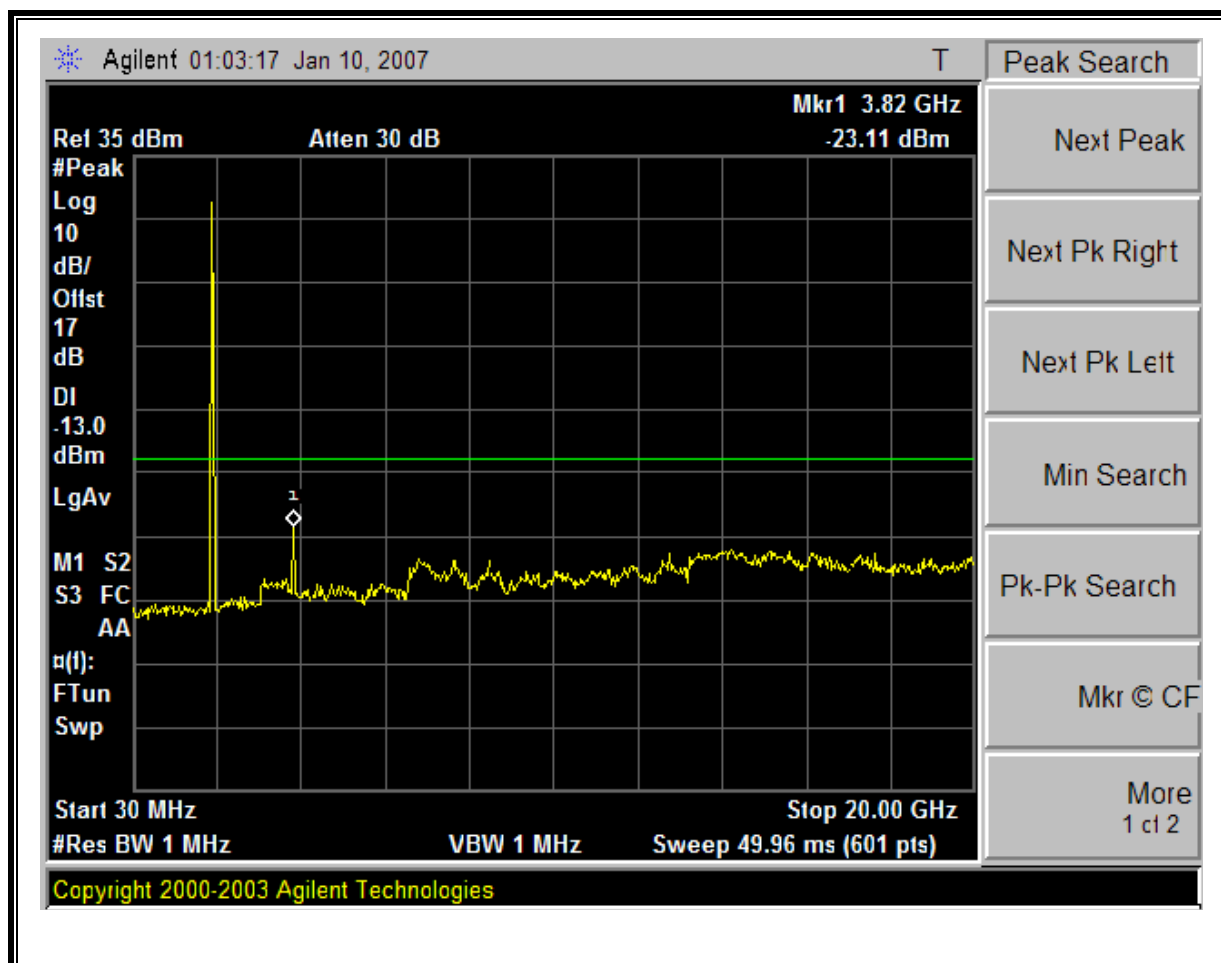
**CDMA Modulation: Low Channel Band Edge**

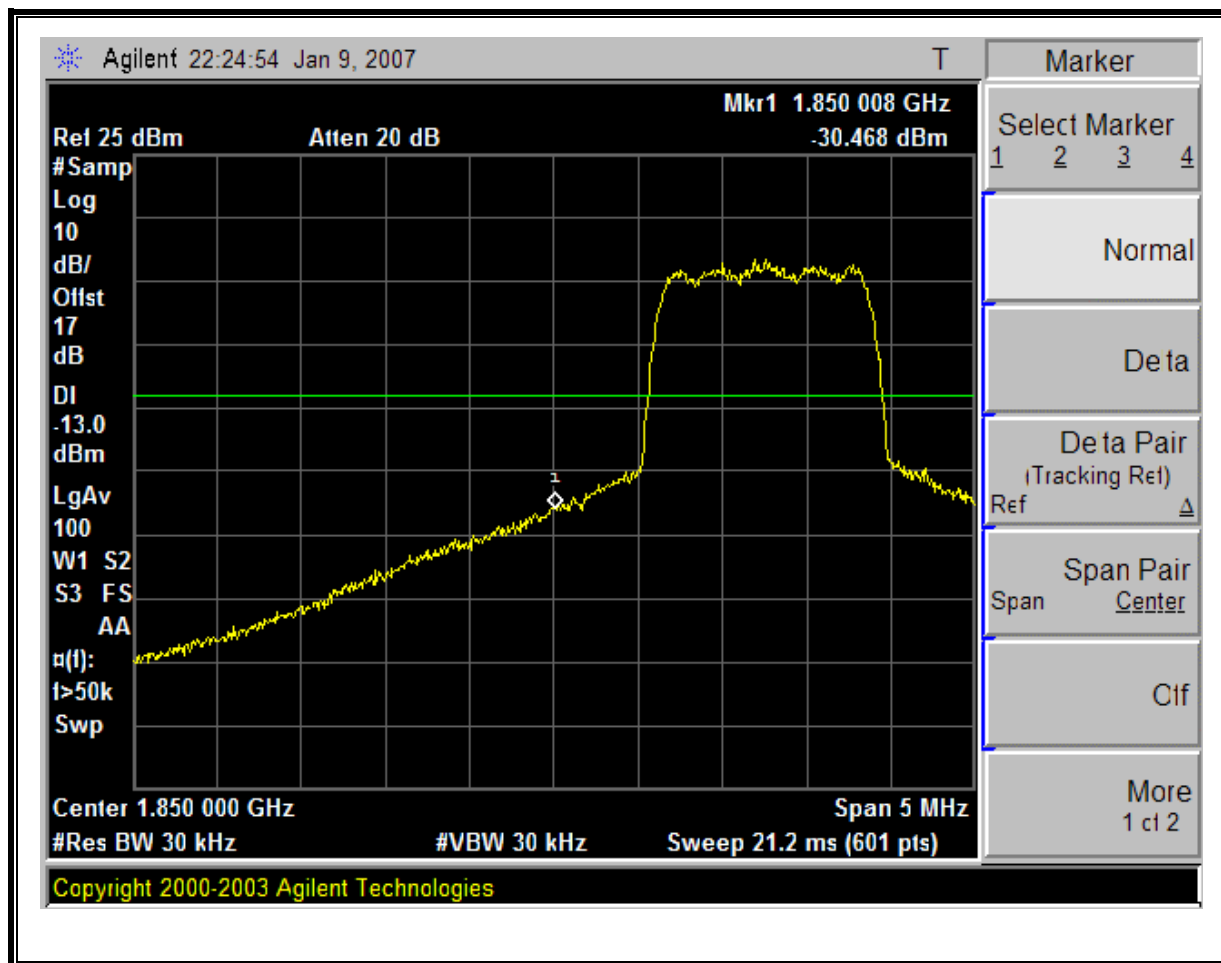
**CDMA Modulation: High Channel Band Edge**

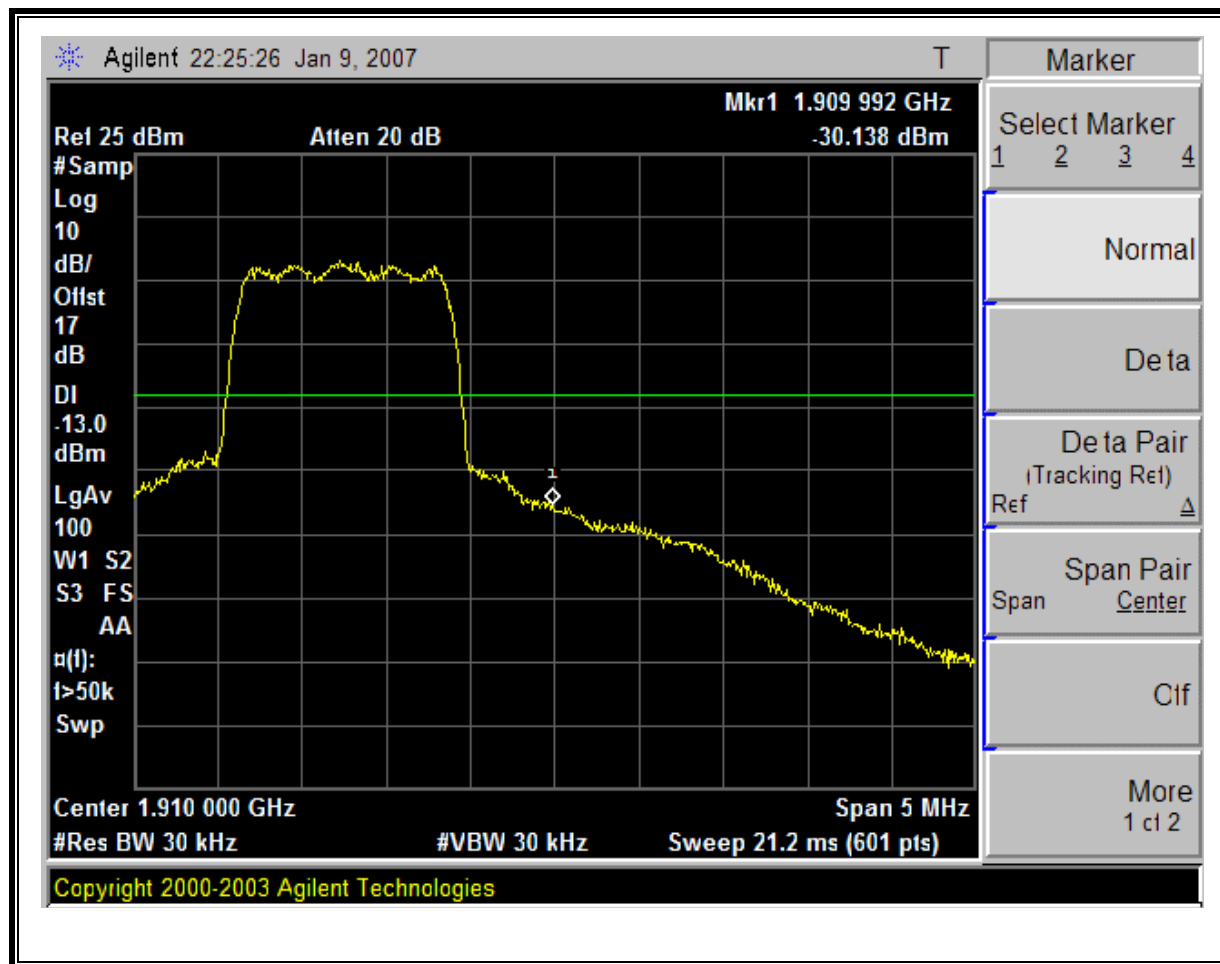
**CDMA Mobile Emissions in Base Frequency Range**

**PCS MODULATION RESULTS****Low Channel, Out-Of-Band Emissions**

**Mid Channel, Out-Of-Band Emissions**

**High Channel, Out-Of-Band Emissions**

**Low Channel Band Edge**

**High Channel Band Edge**



## **7.4. FIELD STRENGTH OF SPURIOUS RADIATION**

### **LIMIT**

§22.917 (e) and §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 603C Clause 2.2.12, FCC 22.917 (h), & FCC 24.238 (b)

### **RESULTS**

No non-compliance noted.

Note: No emissions were found within 30-1000MHz of 20dB below the system noise.

**CELL Spurious & Harmonic (ERP)**

High Frequency Substitution Measurement											
Compliance Certification Services, B- 5m Chamber Fremont Site											
Company:		Sierra Wireless									
Project #:		07U10870									
Date:		2/15/2007									
Test Engineer:		Frank Ibrahim									
Configuration:		Stand Alone EUT									
Mode:		TX ON (Cellular Band)									
<b>Test Equipment:</b>											
EMCO Horn 1-18GHz			Horn > 18GHz			Limit			High Pass Filter		
T73; S/N: 6717 @3m						FCC 22					
Hi Frequency Cables											
<input type="checkbox"/> (2 ft)			<input checked="" type="checkbox"/> (2 ~ 3 ft)			<input type="checkbox"/> (4 ~ 6 ft)			<input checked="" type="checkbox"/> (12 ft)		
Pre-amplifier 1-26GHz						Pre-amplifier 26-40GHz					
T144 Miteq 3008A00											
f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes	
<b>Low Channel (824.7 MHz)</b>											
1.6490	57.89	V	-50.4	4.2	8.0	5.8	-48.7	-13.0	-35.7		
1.6490	53.26	H	-54.3	4.2	8.0	5.8	-52.6	-13.0	-39.6		
<b>Mid Channel (836.52 MHz)</b>											
1.6730	58.42	V	-49.7	4.2	8.0	5.9	-48.0	-13.0	-35.0		
1.6730	54.02	H	-53.4	4.2	8.0	5.9	-51.7	-13.0	-38.7		
<b>High Channel (848.31 MHz)</b>											
1.6960	61.18	V	-46.8	4.2	8.1	5.9	-45.1	-13.0	-32.1		
1.6960	58.27	H	-49.0	4.2	8.1	5.9	-47.3	-13.0	-34.3		

**PCS Spurious & Harmonic (ERP)**

High Frequency Substitution Measurement											
Compliance Certification Services, B- Sm Chamber Fremont Site											
Company:		Sierra Wireless									
Project #:		07U10870									
Date:		2/15/2007									
Test Engineer:		Frank Ibrahim									
Configuration:		Stand Alone EUT									
Mode:		TX ON PCS									
<b>Test Equipment:</b>											
EMCO Horn 1-18 GHz		Horn > 18GHz				Limit		<input checked="" type="checkbox"/> High Pass Filter			
T73; S/N: 6717 @3m						FCC 24					
Hi Frequency Cables											
<input type="checkbox"/> (2 ft)		<input checked="" type="checkbox"/> (2 ~ 3 ft)		<input type="checkbox"/> (4 ~ 6 ft)		<input checked="" type="checkbox"/> (12 ft)		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz	
								T144 Miteq 3008A00			
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	
<b>Low Channel (1851.25 MHz)</b>											
3.7020	49.70	V	-48.4	6.4	9.7	7.6	-45.1	-13.0	-32.1		
7.4050	51.93	V	-38.4	9.0	12.6	10.4	-34.9	-13.0	-21.9		
3.7020	45.97	H	-52.1	6.4	9.7	7.6	-48.7	-13.0	-35.7		
7.4050	46.19	H	-43.4	9.0	12.6	10.4	-39.8	-13.0	-26.8		
<b>Mid Channel (1880 MHz)</b>											
3.7600	54.98	V	-42.8	6.4	9.7	7.6	-39.6	-13.0	-26.6		
7.5200	53.34	V	-36.9	9.1	12.6	10.5	-33.4	-13.0	-20.4		
3.7600	47.41	H	-50.3	6.4	9.7	7.6	-47.0	-13.0	-34.0		
7.5200	47.40	H	-42.1	9.1	12.6	10.5	-38.5	-13.0	-25.5		
<b>High Channel (1908.75 MHz)</b>											
3.8175	67.29	V	-30.2	6.5	9.7	7.5	-27.0	-13.0	-14.0		
7.6350	59.38	V	-30.8	9.1	12.7	10.5	-27.2	-13.0	-14.2		
3.8175	61.90	H	-35.5	6.5	9.7	7.5	-32.3	-13.0	-19.3		
7.6350	57.51	H	-31.8	9.1	12.7	10.5	-28.3	-13.0	-15.3		

## **7.5. FREQUENCY STABILITY**

### **LIMIT**

§22.355 Except as otherwise provided in this part, 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.

For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

§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 603C Clause 2.3.1 and 2.3.2

### **RESULTS**

No non-compliance noted.

**800MHz CELLULAR – MID CHANNEL**

Reference Frequency: Cellular Mid Channel 835.770000MHz @ 20°C Limit: to stay +/- 2.5 ppm = 2089.425 Hz				
DC Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
115.00	50	835.770082	-0.098	2.5
115.00	40	835.769919	0.097	2.5
115.00	30	835.769939	0.073	2.5
<b>115.00</b>	<b>20</b>	<b>835.770000</b>	<b>0</b>	2.5
115.00	10	835.770018	-0.022	2.5
115.00	0	835.770060	-0.072	2.5
115.00	-10	835.770087	-0.104	2.5
115.00	-20	835.770120	-0.144	2.5
115.00	-30	835.770128	-0.153	2.5

Reference Frequency: Cellular Mid Channel 835.770000MHz @ 20°C Limit: to stay +/- 2.5 ppm = 2089.425 Hz				
DC Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>100%</b>	<b>20</b>	<b>835.770000</b>	<b>0</b>	<b>2.5</b>
85%	20	835.770083	-0.099	2.5
115%	20	835.769943	0.068	2.5

**1900MHz PCS – MID CHANNEL**

Reference Frequency: PCS Mid Channel 1879.500000MHz @ 20°C				
Limit: within the authorized block or +/- 2.5 ppm = 4698.750 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
115.00	50	1879.499924	0.040	2.5
115.00	40	1879.499932	0.036	2.5
115.00	30	1879.499944	0.030	2.5
<b>115.00</b>	<b>20</b>	<b>1879.50000</b>	<b>0</b>	<b>2.5</b>
115.00	10	1879.499964	0.019	2.5
115.00	0	1879.500014	-0.007	2.5
115.00	-10	1879.500022	-0.012	2.5
115.00	-20	1879.500036	-0.019	2.5
115.00	-30	1879.500072	-0.038	2.5

Reference Frequency: PCS Mid Channel 1879.500000MHz @ 20 C				
Limit: within the authorized block or +/- 2.5 ppm = 4698.750 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>100%</b>	<b>20</b>	<b>1879.500000</b>	<b>0</b>	<b>2.5</b>
85%	20	1879.499964	0.019	2.5
115%	20	1879.499930	0.037	2.5

## 7.6. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

Equation (1) and the measured peak power is used to calculate the MPE distance.



**LIMITS**

From §1.1310 Table 1 (B),  $S = 1.0 \text{ mW/cm}^2$

**RESULTS**

No non-compliance noted: (MPE distance equals 20 cm)

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )
800MHz Celllar	20.0	30.66	-0.37	0.21
1900 MHz PCS	20.0	29.29	0.96	0.21

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.