



FCC CFR47 PART 22H AND 24E  
INDUSTRY CANADA RSS-132 ISSUE 2  
INDUSTRY CANADA RSS-133 ISSUE 5

CERTIFICATION TEST REPORT  
FOR  
IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE  
MODEL NUMBER: A1430

FCC ID: BCGA1430  
IC: 579C-A1430

REPORT NUMBER: 11U14054-1

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*Prepared for*  
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Revision History

Rev.	Date	Revisions	Revised By
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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE  
 1 INFINITE LOOP  
 CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE

**MODEL:** A1430

**SERIAL NUMBER:** PT713734

**DATE TESTED:** SEPTEMBER 27 - DECEMBER 10, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H and 24E	Pass
IC RSS132 AND IC RSS133	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:



THU CHAN  
 ENGINEERING MANAGER  
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CHIN PANG  
 EMC ENGINEER  
 UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, FCC CFR 47 Part 22, FCC CFR Part 24, RSS-132 Issue 2, and RSS-133 Issue 5.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL 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. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dB<sub>uV/m</sub>) = Measured Voltage (dB<sub>uV</sub>) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

$$36.5 \text{ dB}_uV + 18.7 \text{ dB}/m + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dB}_uV/m$$

### 4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The Apple iPad is a tablet device with iPod functions (music application support and video), 802.11 a/b/b/n radio, Bluetooth radio function, and cellular using GSM 2G/3G/LTE data functions. The rechargeable battery is not user accessible

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted and ERP / EIRP output powers as follows:

#### PEAK READING

Part 22 Cellular Band					
Frequency range (MHz)	Modulation	Conducted		ERP	
		dBm	mW	dBm	mW
824.2 – 848.8	GPRS	33.71	2349.6	32.40	1737.8
824.2 – 848.8	EGPRS	32.20	1659.6	32.10	1621.8
826.4 – 846	UMTS, Rel 99	28.00	631.0	26.60	457.1
826.4 – 846	UMTS, HSDPA	28.10	645.7	27.20	524.8

Part 24 PCS Band					
Frequency range (MHz)	Modulation	Conducted		EIRP	
		dBm	mW	dBm	mW
1850.2-1909.8	GPRS	31.00	1258.9	32.83	1918.7
1850.2-1909.8	EGPRS	31.42	1386.8	32.33	1710.0
1852.4-1907.6	UMTS, Rel 99	26.40	436.5	28.74	748.2
1852.4-1907.6	UMTS, HSDPA	26.90	489.8	28.89	774.5

### 5.3. SOFTWARE AND FIRMWARE

The test software used during testing was 9B87

The EUT is link to CMU200 and Anritsu MT8820C during test.

### 5.4. MAXIMUM ANTENNA GAIN

Please see table below:

Modulation Bands	Antenna Gain (dBi)
GSM, Cell	-1.00
GSM, PCS	1.73
UMTS, Cell	-1.24
UMTS, PCS	2.34

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions below 1GHz tests is channel with highest RF output power.

Based on the investigation results, the highest peak power and enhanced data rate is the worst-case scenario for all measurements.

Worst-case modes:

- GPRS (GMSK)
- EGPRS (8PSK)
- UMTS Rel 99 and HSDPA Sub 2

For the fundamental investigation, the EUT is investigated for vertical and horizontal antenna orientations and the worst case was determined to be at Z-position for both cell and PCS band.

## 5.6. DESCRIPTION OF TEST SETUP

### RADIATED TESTS SUPPORT EQUIPMENT

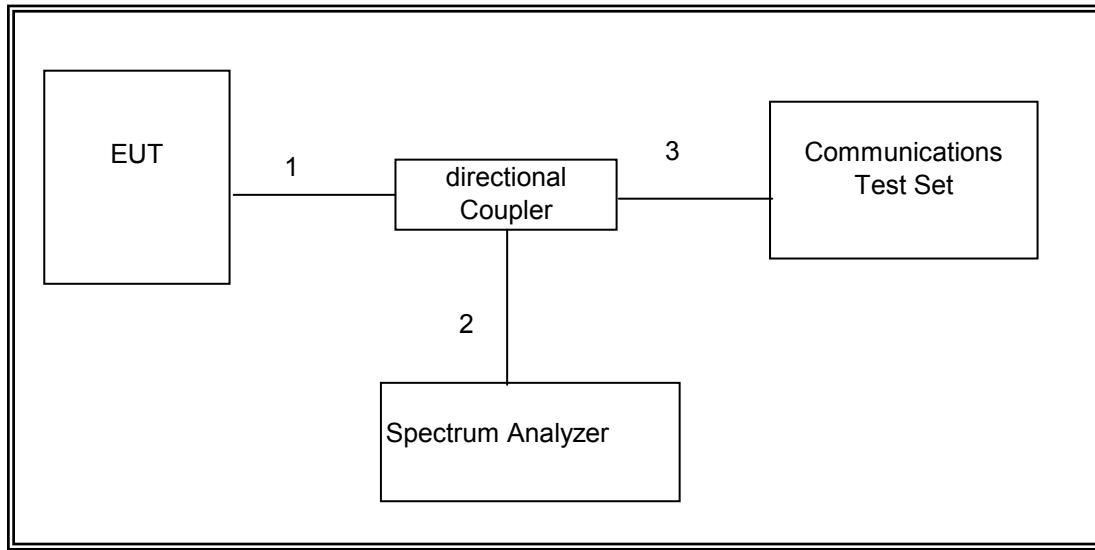
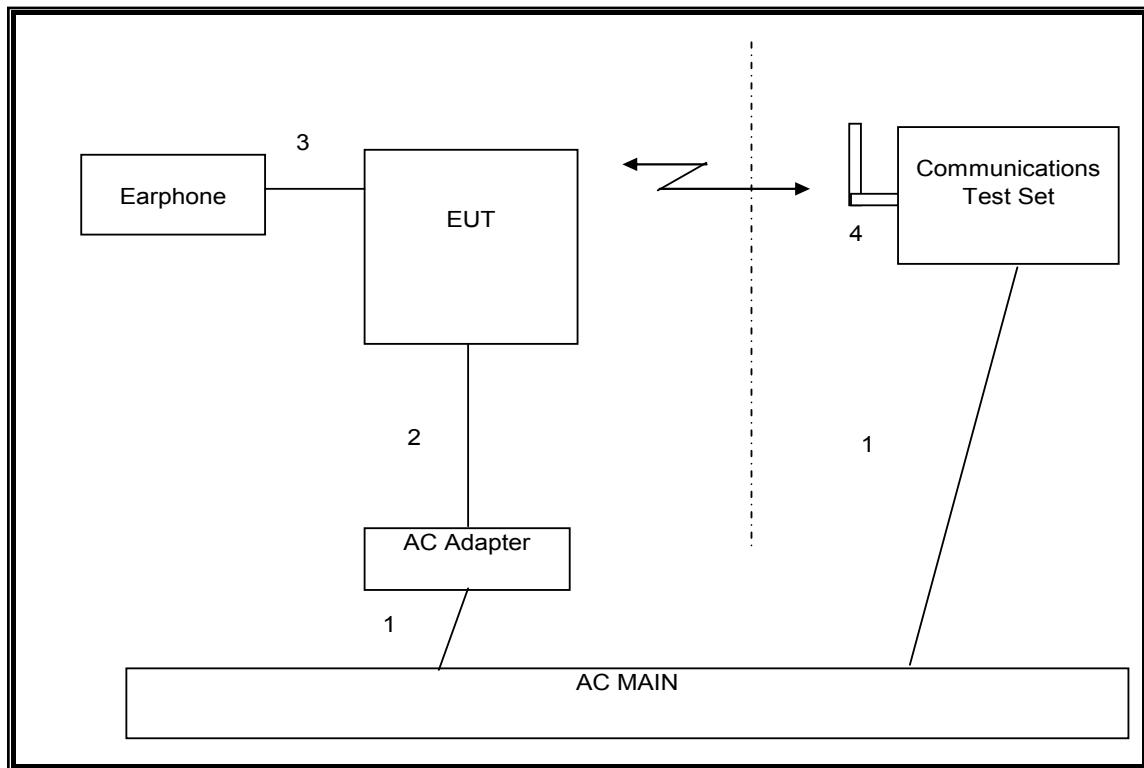
PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Earphone	Apple	NA	NA
AC adapter	Apple	A1344	NA

### I/O CABLES ( RF Conducted Test)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	RFOut	1	Directional Coupler	Un-shielded	0.1m	NA
2	RF In/Out	1	Spectrum Analyzer	Un-shielded	None	NA
3	RF In/Out	1	Communications Test Set	Un-shielded	1.2m	NA

### I/O CABLES (RF Radiated Test)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US 115V	Un-shielded	2m	NA
2	DC	1	US 115V	Un-shielded	1m	NA
3	Jack	1	Earphone	Un-shielded	0.5m	NA
4	RF In/Out	1	Antenna	Un-shielded	none	NA

**TEST SETUP****CONDUCTED SETUP DIAGRAM FOR TESTS****RADIATED 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	Asset	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	04/07/12
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/30/12
Antenna, Horn, 18 GHz	EMCO	3115	C00783	06/29/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/12/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/12
Radio Communication Analyzer	Anritsu	MT8820C	None	09/17/12
Communication Test Set	R & S	CMW500	N/A	05/17/12
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	10/20/12
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689`	CNR
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Directional Coupler	RF-Lambda	RFDC5M06G15	NA	CNR
Signal Generator, 20 GHz	Agilent / HP	83732B	C00774	07/14/12
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121C DB4	C00993	07/10/12

## 7. RF POWER OUTPUT VERIFICATION

### 7.1. RF POWER OUTPUT FOR GSM MODE

#### TEST PROCEDURE

##### GPRS/EGPRS

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press Connection control to choose the different menus

Press RESET > choose all to reset all settings

Connection Press Signal Off to turn off the signal and change settings

Network Support > GSM+GPRS or GSM+EGPRS

Main Service > Packet Data

Service selection > Test Mode A – Auto Slot Config. off

MS Signal Press Slot Config bottom on the right twice to select and change the number of time slots and power setting

> Slot configuration > Uplink/Gamma

> 33 dBm for GPRS 850/900

> 27 dBm for EGPRS 850/900

> 30 dBm for GPRS1800/1900

> 26 dBm for EGPRS1800/1900

BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset > + 0 Hz

Mode > BCCH and TCH

BCCH Level > -85 dBm (May need to adjust if link is not stable)

BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off

P0> 4 dB

Slot Config > Unchanged (if already set under MS Signal)

TCH > choose desired test channel

Hopping > Off

Main Timeslot > 3 (Default)

Network Coding Scheme > CS4 (GPRS) and MCS9 (EGPRS)

Bit Stream > 2E9-1PSR Bit Pattern

AF/RF Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input

Connection Press Signal On to turn on the signal and change settings

#### RESULTS

**GPRS for Cell and PCS Band**

Mode	Ch.	f (MHz)	1 time slots		2 time slots	
			Peak	Average	peak	Average
GPRS	128	824.2	33.71	33.50	33.10	32.9
	190	836.6	33.43	33.30	32.90	32.7
	251	848.8	33.56	33.40	33.00	32.8
GPRS	512	1850.2	30.90	30.80	28.70	28.5
	661	1880	30.90	30.80	28.90	28.8
	810	1909.8	31.00	30.80	29.00	28.9

**EGPRS for Cell and PCS Band**

Mode	Ch.	f (MHz)	1 time slots		2 time slots	
			Peak	Average	Peak	Average
EGPRS	128	824.2	32.20	28.80	32.10	28.60
	190	836.6	32.20	28.80	32.10	28.6
	251	848.8	32.20	28.80	32.10	28.70
EGPRS	512	1850.2	31.32	27.80	30.97	27.8
	661	1880	31.31	27.86	31.15	27.77
	810	1909.8	31.42	28.00	31.35	27.89

**RF POWER OUTPUT FOR UMTS REL99****TEST PROCEDURE**

The following summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	$\beta_c$	Not Applicable
	$\beta_d$	Not Applicable
	$\beta_{ec}$	Not Applicable
	$\beta_c/\beta_d$	8/15
	$\beta_{hs}$	Not Applicable
	$\beta_{ed}$	Not Applicable

Band	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
				Peak	Average
UMTS 850	4132	4357	826.4	28.00	24.90
	4180	4405	836.4	27.90	24.90
	4230	4455	846.6	27.90	24.80

Band	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
				Peak	Average
UMTS 1900	9262	9662	1852.4	26.23	22.88
	9400	9800	1880.0	26.40	22.99
	9538	9938	1907.6	26.20	22.96

**RF POWER OUTPUT FOR UMTS Rel 6 HSDPA****TEST PROCEDURE**

The following summary of these settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	HSUPA Test	Not Applicable			
	Power Control Algorithm	Algorithm 2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	$\beta_{ec}$	-	-	-	-
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
HSDPA Specific Settings	$\beta_{hs}$	4/15	24/15	30/15	30/15
	$\beta_{ed}$	Not Applicable			
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
CQI Feedback (Table 5.2B.4)					
CQI Repetition Factor (Table 5.2B.4)					
$A_{hs} = \beta_{hs}/\beta_c$					
30/15					

**RESULT**

**RF OUTPUT POWER RESULT FOR UMTS HSDPA**

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Peak	Average
UMTS850 (Band V)	1	4132	4357	826.4	27.60	25.00
		4180	4405	836.0	27.65	25.00
		4230	4455	846.0	27.60	24.97
	2*	4132	4357	826.4	27.87	24.85
		4180	4405	836.0	27.85	24.91
		4230	4455	846.0	28.10	24.92
	3	4132	4357	826.4	28.03	24.59
		4180	4405	836.0	27.90	24.51
		4230	4455	846.0	27.86	24.58
	4	4132	4357	826.4	28.07	24.62
		4180	4405	836.0	27.99	24.55
		4230	4455	846.0	28.02	24.55
UMTS1900 (Band II)	1	9262	9662	1852.4	26.12	22.92
		9400	9800	1880.0	26.40	23.00
		9538	9938	1907.6	26.15	22.98
	2*	9262	9662	1852.4	26.50	22.90
		9400	9800	1880.0	26.67	22.91
		9538	9938	1907.6	26.90	22.95
	3	9262	9662	1852.4	26.23	22.56
		9400	9800	1880.0	26.44	22.55
		9538	9938	1907.6	26.48	22.57
	4	9262	9662	1852.4	26.34	22.53
		9400	9800	1880.0	26.49	22.55
		9538	9938	1907.6	26.52	22.63

## 7.2. RF POWER OUTPUT FOR UMTS DUAL CARRIER HSDPA

### TEST PROCEDURE

The following summary of these settings are illustrated below:

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Peak	Average
UMTS850 (Band V)	1	4132	4357	826.4	27.77	24.72
		4180	4405	836.0	27.78	24.65
		4230	4455	846.0	27.05	24.68
	2*	4132	4357	826.4	27.82	24.60
		4180	4405	836.0	27.59	24.80
		4230	4455	846.0	27.21	24.64
	3	4132	4357	826.4	27.56	24.13
		4180	4405	836.0	27.62	24.17
		4230	4455	846.0	27.36	24.25
	4	4132	4357	826.4	27.52	24.13
		4180	4405	836.0	27.56	24.17
		4230	4455	846.0	27.25	24.25
UMTS1900 (Band II)	1	9262	9662	1852.4	26.25	22.75
		9400	9800	1880.0	26.68	22.85
		9538	9938	1907.6	26.72	22.75
	2*	9262	9662	1852.4	26.14	22.70
		9400	9800	1880.0	26.55	22.88
		9538	9938	1907.6	26.74	22.80
	3	9262	9662	1852.4	25.92	22.36
		9400	9800	1880.0	26.25	22.40
		9538	9938	1907.6	26.34	22.35
	4	9262	9662	1852.4	25.90	22.36
		9400	9800	1880.0	26.06	22.38
		9538	9938	1907.6	26.26	22.35

### 7.3. RF POWER OUTPUT UMTS Rel 6 HSPA (HSDPA & HSUPA)

#### TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	
	Subtest	1	2	3	4	5	
WCDMA General Settings	Loopback Mode	Test Mode 1					
	Rel99 RMC	12.2kbps RMC					
	HSDPA FRC	H-Set1					
	HSUPA Test	HSUPA Loopback					
	Power Control Algorithm	Algorithm2					
	$\beta_c$	11/15	6/15	15/15	2/15	15/15	
	$\beta_d$	15/15	15/15	9/15	15/15	0	
	$\beta_{ec}$	209/225	12/15	30/15	2/15	5/15	
HSDPA Specific Settings	$\beta_c/\beta_d$	11/15	6/15	15/9	2/15	-	
	$\beta_{hs}$	22/15	12/15	30/15	4/15	5/15	
	$\beta_{ed}$	1309/225	94/75	47/15	56/75	47/15	
	DACK	8					
	DNAK	8					
	DCQI	8					
HSUPA Specific Settings	Ack-Nack repetition factor	3					
	CQI Feedback (Table 5.2B.4)	4ms					
	CQI Repetition Factor (Table 5.2B.4)	2					
	$A_{hs} = \beta_{hs}/\beta_c$	30/15					
	D E-DPCCH	6	8	8	5	7	
	DHARQ	0	0	0	0	0	
HSUPA Specific Settings	AG Index	20	12	15	17	12	
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67	
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9	
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27			E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		

#### RESULTS

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)	
					Peak	Average
UMTS850 (Band V)	1	4132	4357	826.4	27.79	24.7
		4180	4405	836.0	27.95	24.6
		4230	4455	846.0	27.55	24.4
	2	4132	4357	826.4	27.92	22.8
		4180	4405	836.0	27.75	22.6
		4230	4455	846.0	27.90	22.8
	3	4132	4357	826.4	27.80	23.5
		4180	4405	836.0	27.95	23.5
		4230	4455	846.0	27.74	23.4
	4	4132	4357	826.4	27.75	23.2
		4180	4405	836.0	27.85	23.1
		4230	4455	846.0	27.56	23.2
	5	4132	4357	826.4	27.80	24.5
		4180	4405	836.0	27.90	24.5
		4230	4455	846.0	27.80	24.6
UMTS1900 (Band II)	1	9262	9662	1852.4	26.56	22.8
		9400	9800	1880.0	26.45	22.7
		9538	9938	1907.6	26.45	22.7
	2	9262	9662	1852.4	26.06	20.8
		9400	9800	1880.0	26.13	20.7
		9538	9938	1907.6	25.96	20.9
	3	9262	9662	1852.4	26.18	21.8
		9400	9800	1880.0	26.24	21.8
		9538	9938	1907.6	26.25	21.8
	4	9262	9662	1852.4	26.15	20.9
		9400	9800	1880.0	25.85	20.8
		9538	9938	1907.6	26.15	20.8
	5	9262	9662	1852.4	26.25	22.8
		9400	9800	1880.0	26.50	22.8
		9538	9938	1907.6	26.33	22.8

## 8. CONDUCTED TEST RESULTS

### 8.1. OCCUPIED BANDWIDTH

#### RULE PART(S)

FCC: §2.1049

IC: RSS-132, 4.5; RSS-133, 6.5

#### LIMITS

For reporting purposes only

#### TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

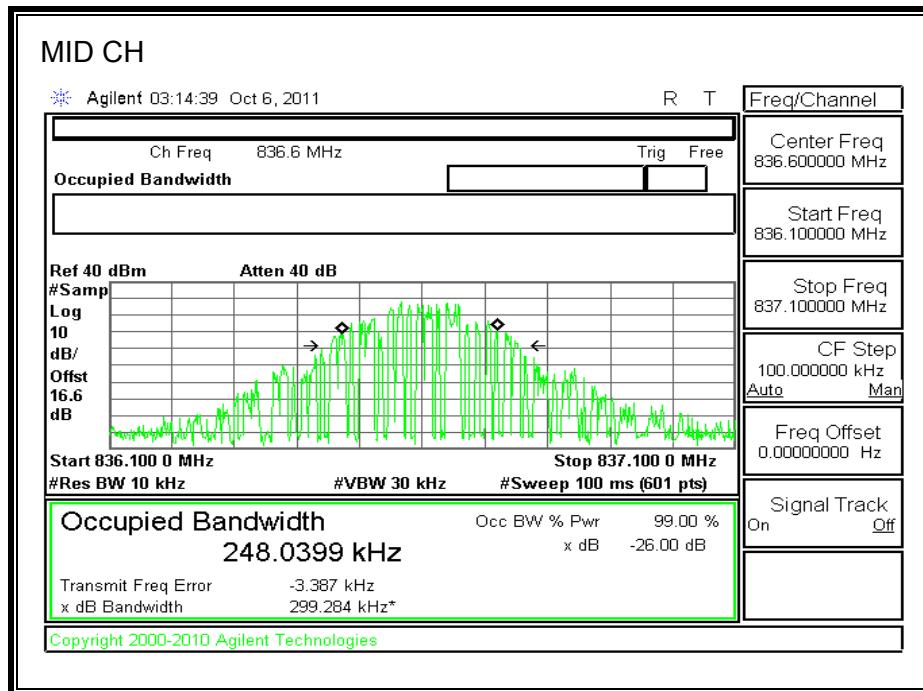
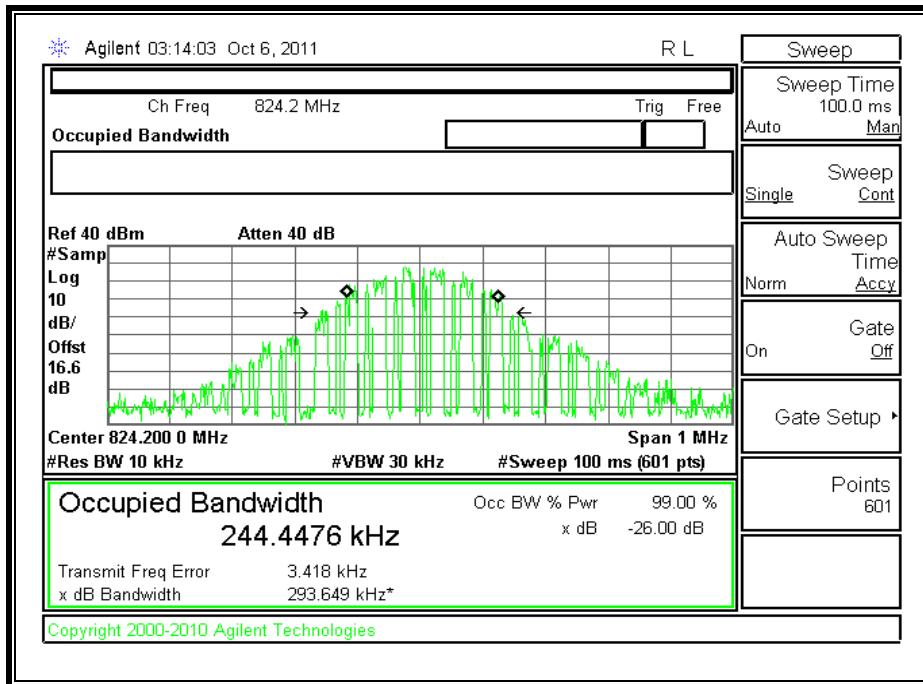
#### MODES TESTED

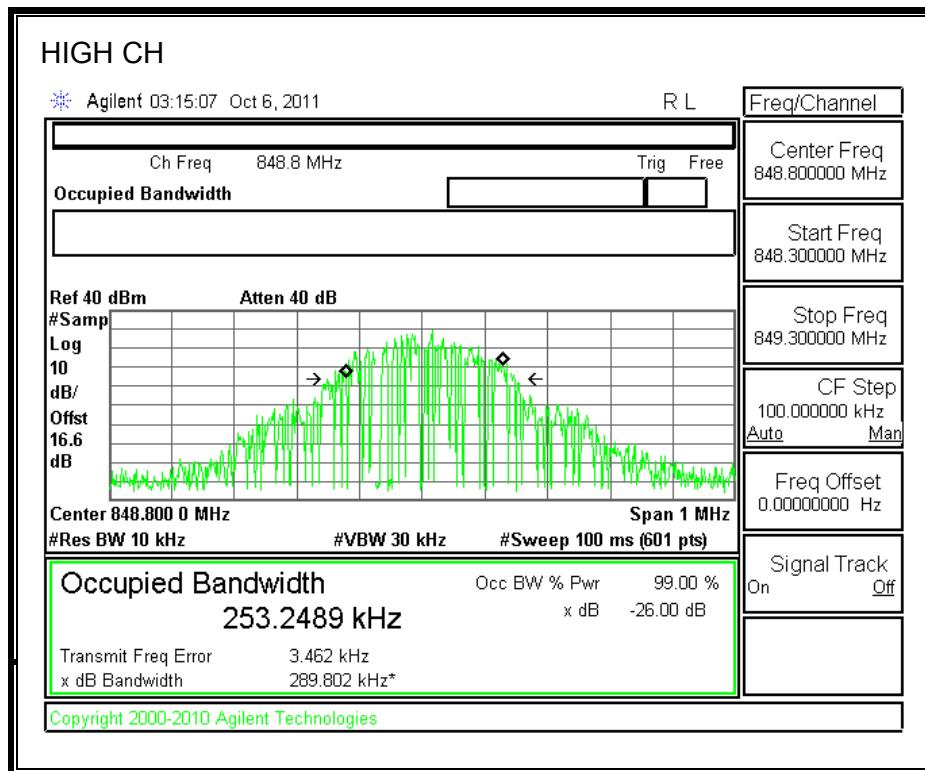
- GPRS and EGPRS
- WCDMA REL. 99 and HSDPA

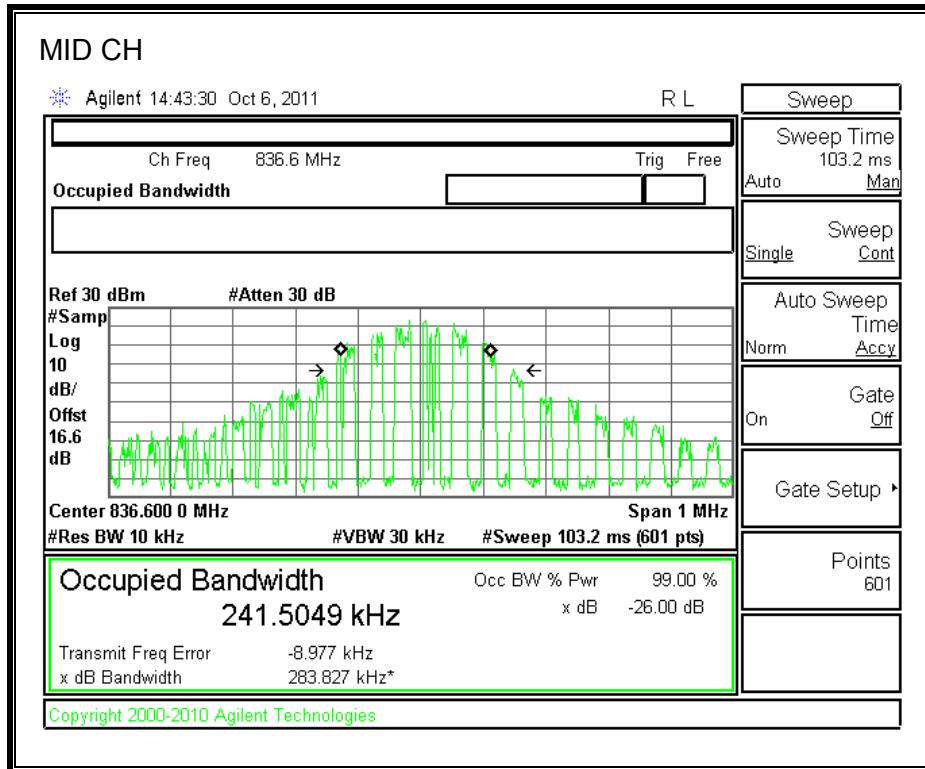
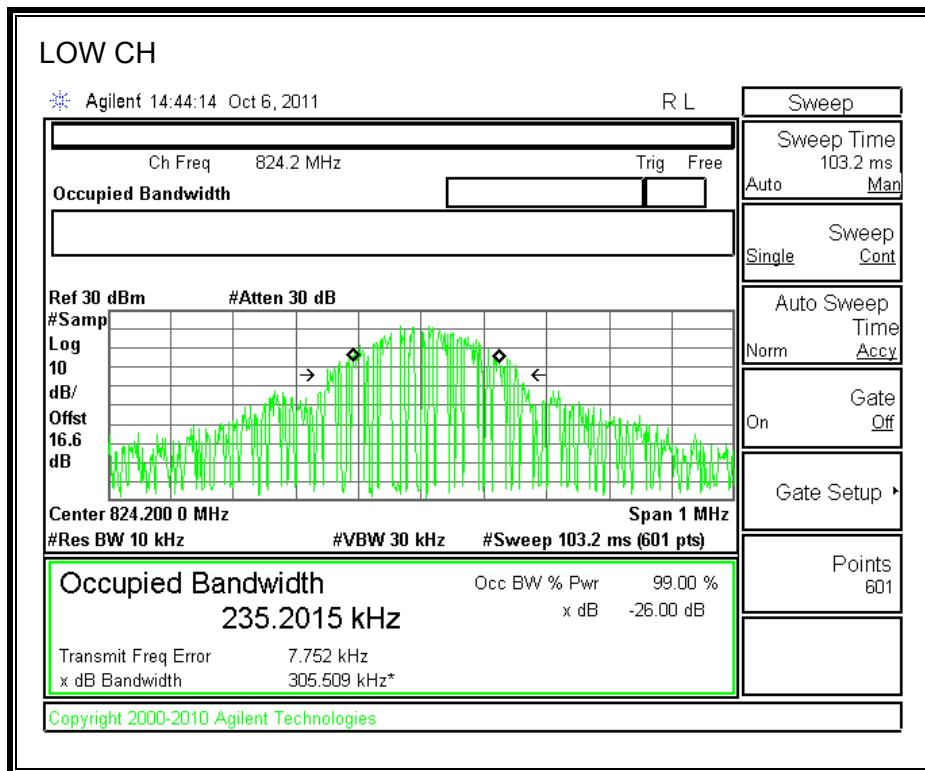
**RESULTS**

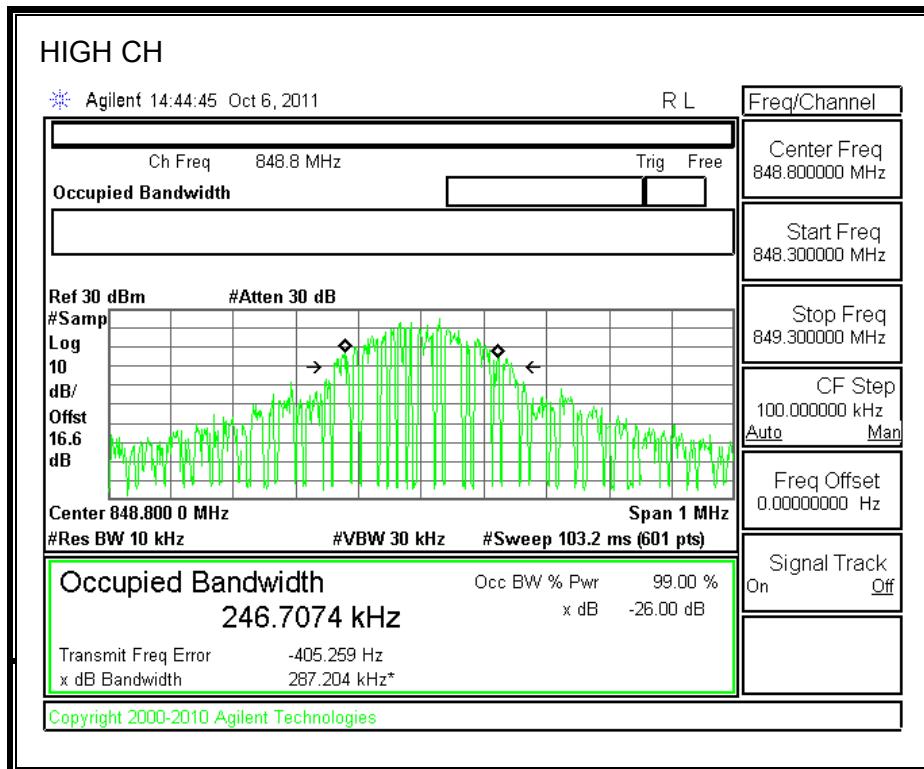
Band	Mode	Channel	f (MHz)	99% BW (kHz)	-26dB BW (kHz)
Cellular	GPRS	128	824.2	244.4476	293.649
		190	836.6	248.0399	299.284
		251	848.8	253.2489	289.802
	EGPRS	128	824.2	235.2015	305.509
		190	836.6	241.5049	283.827
		251	848.8	248.7074	287.204
PCS	GPRS	512	1850.2	246.4116	282.823
		661	1880.0	241.0293	304.816
		810	1909.8	243.9580	320.975
	EGPRS	512	1850.2	233.3366	285.756
		661	1880.0	242.2807	299.345
		810	1909.8	245.7117	290.210

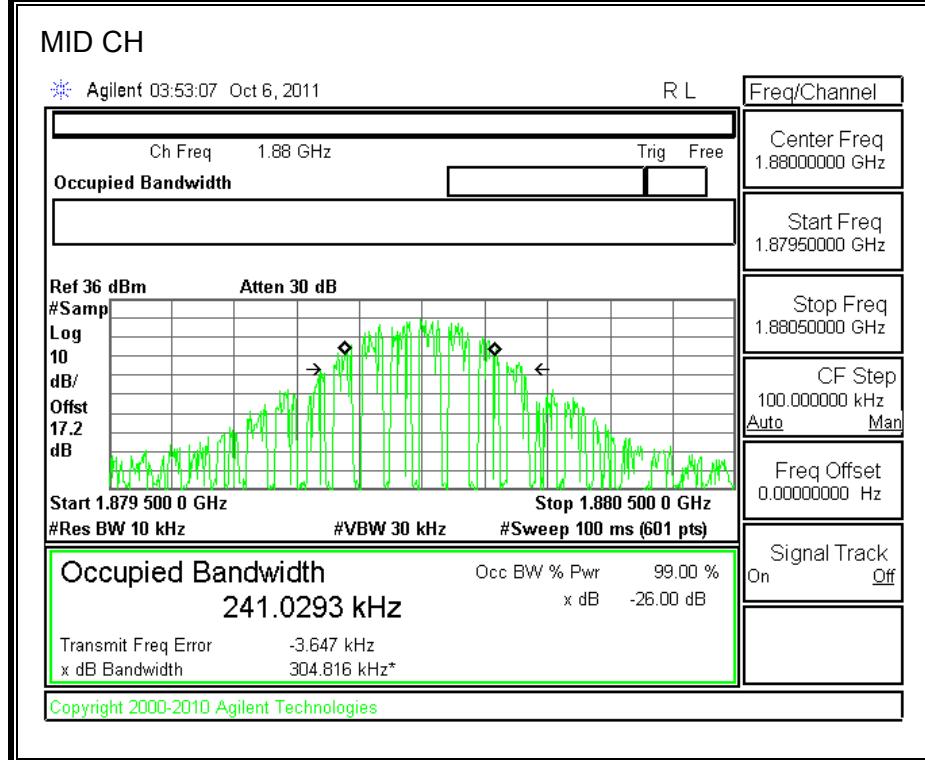
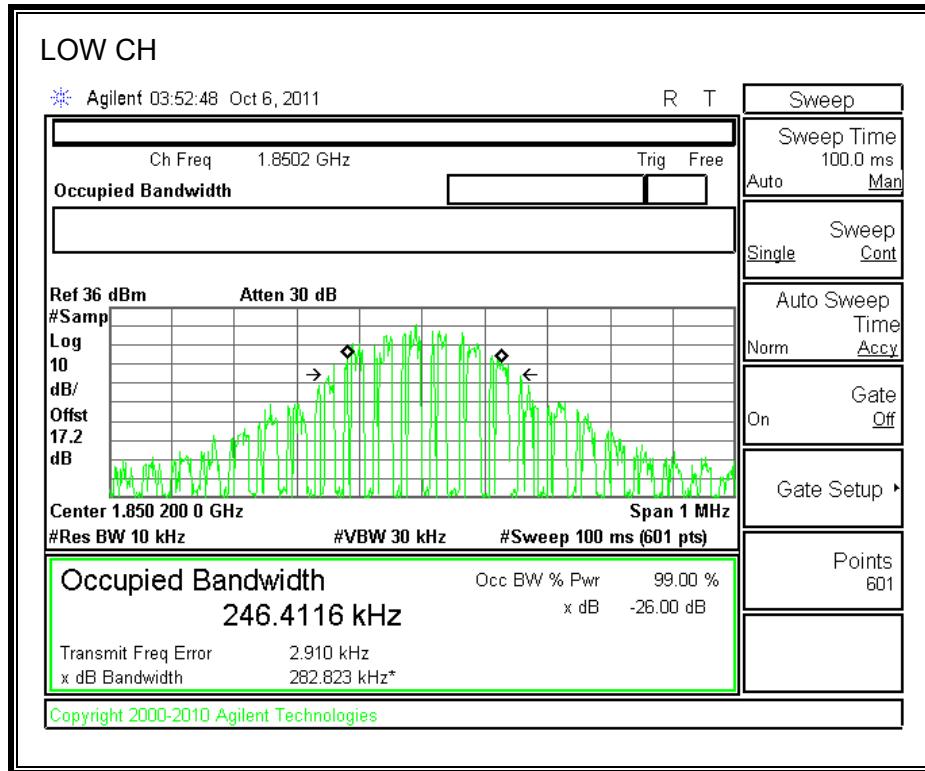
Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
Cell	WCDMA, REL 99	4357	826.4	4.1221	4.554
		4405	836.0	4.2244	4.587
		4455	846.0	4.1557	4.550
	HSDPA REL 6	4357	826.4	4.1122	4.479
		4405	836.0	4.1765	4.624
		4455	846.0	4.1938	4.574
PCS	WCDMA, REL 99	9662	1852.4	4.1539	4.571
		9800	1880.0	4.2206	4.531
		9938	1907.6	4.2016	4.508
	HSDPA REL 6	9662	1852.4	4.1202	4.538
		9800	1880.0	4.1428	4.547
		9938	1907.6	4.1603	4.620

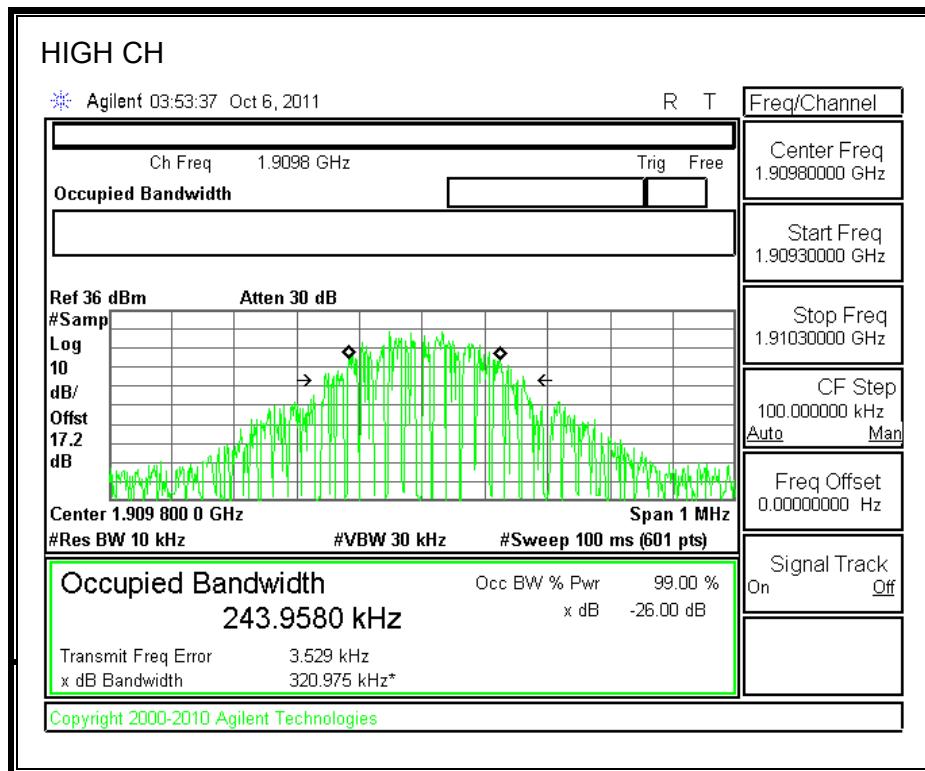
**99% BANDWIDTH and 26dB****GPRS850 BAND**

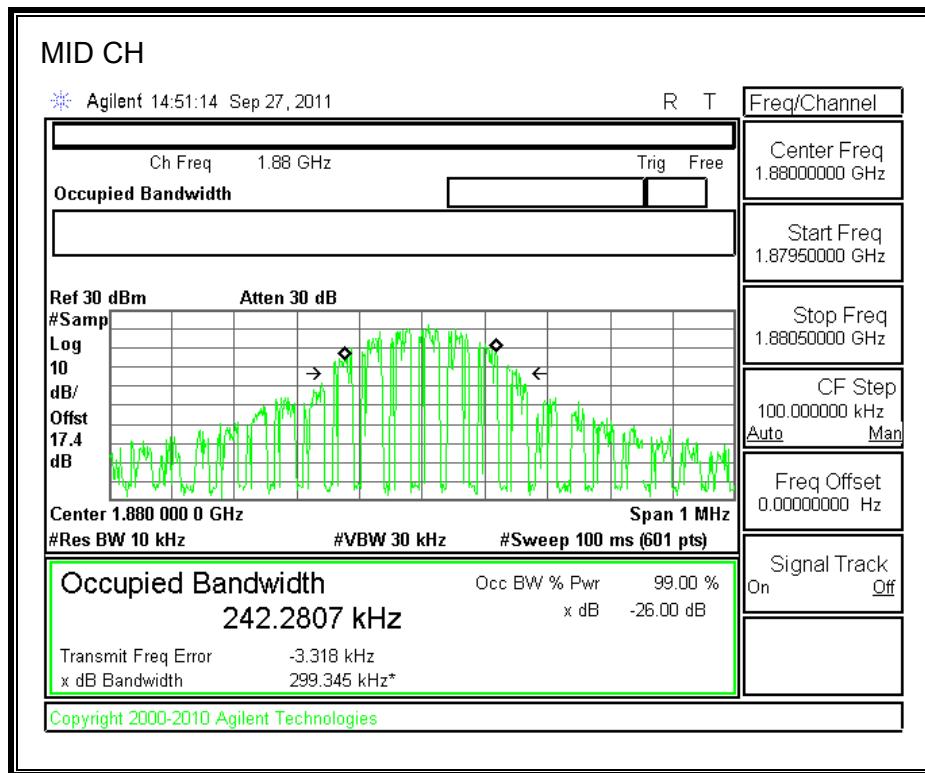
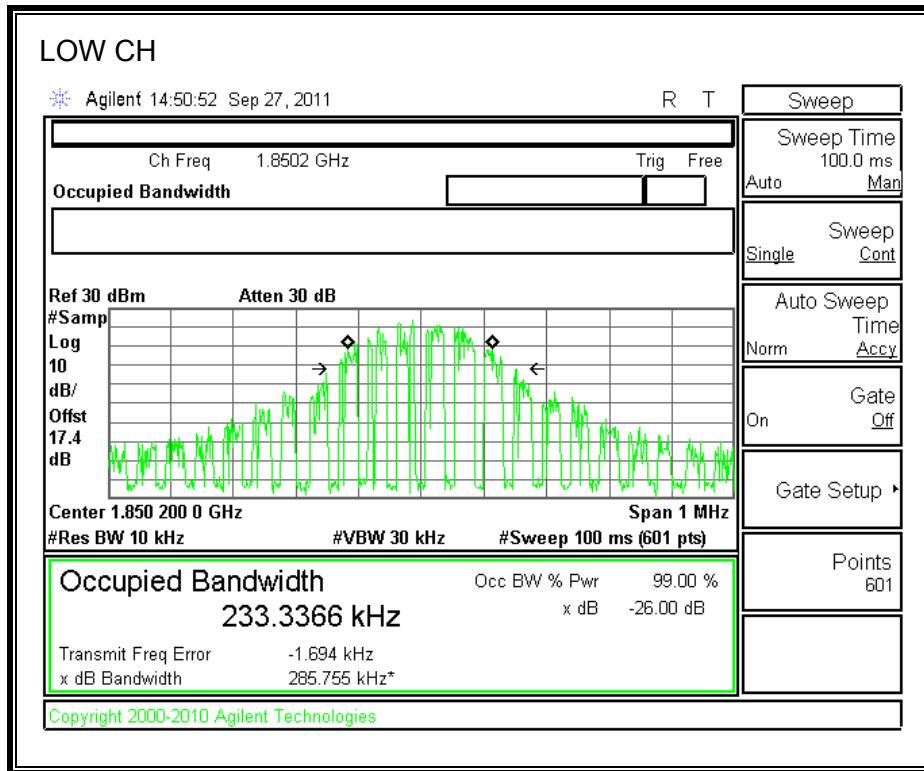


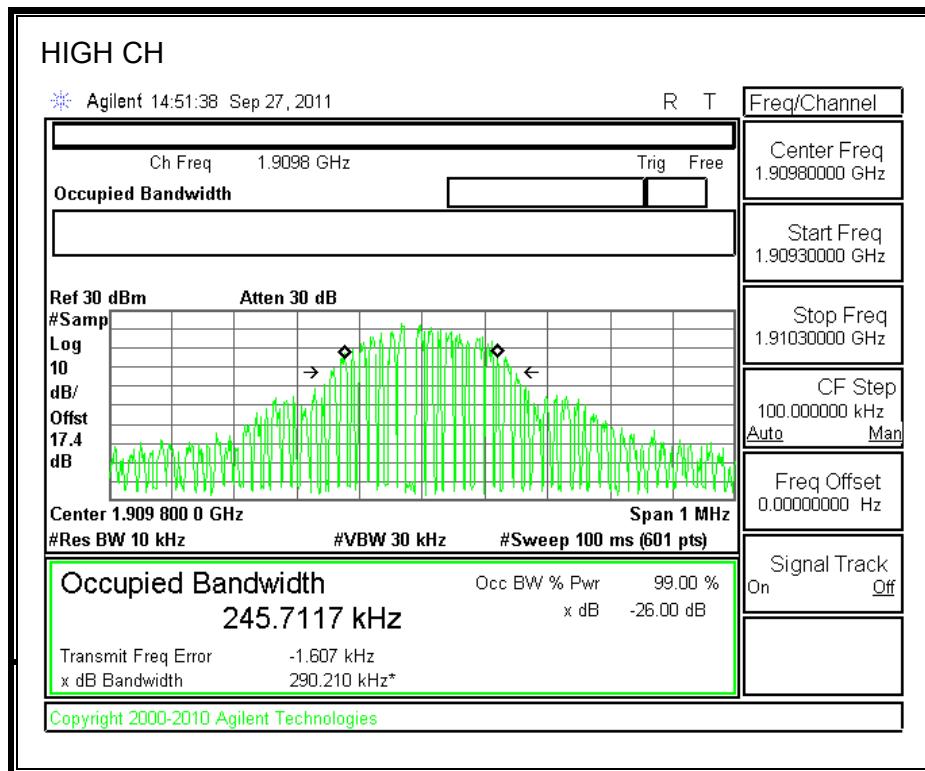


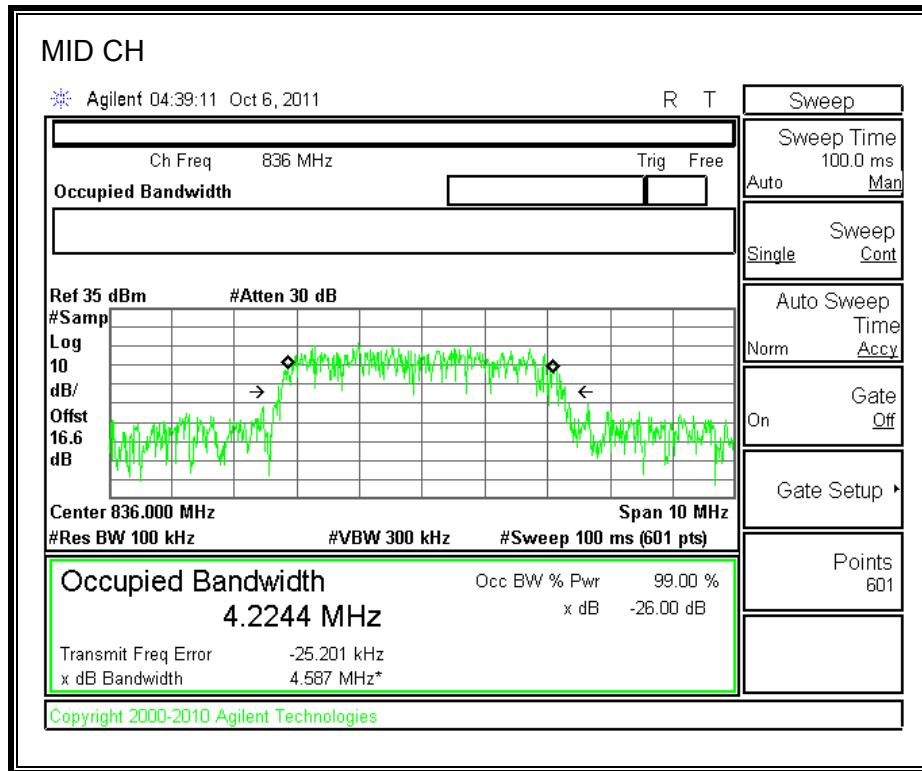
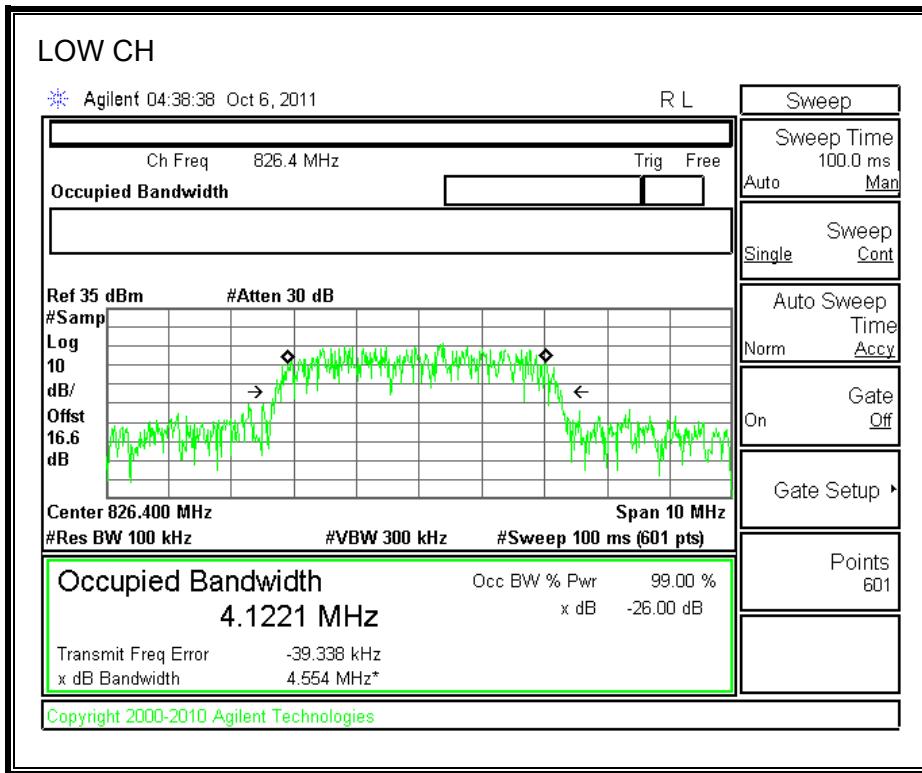


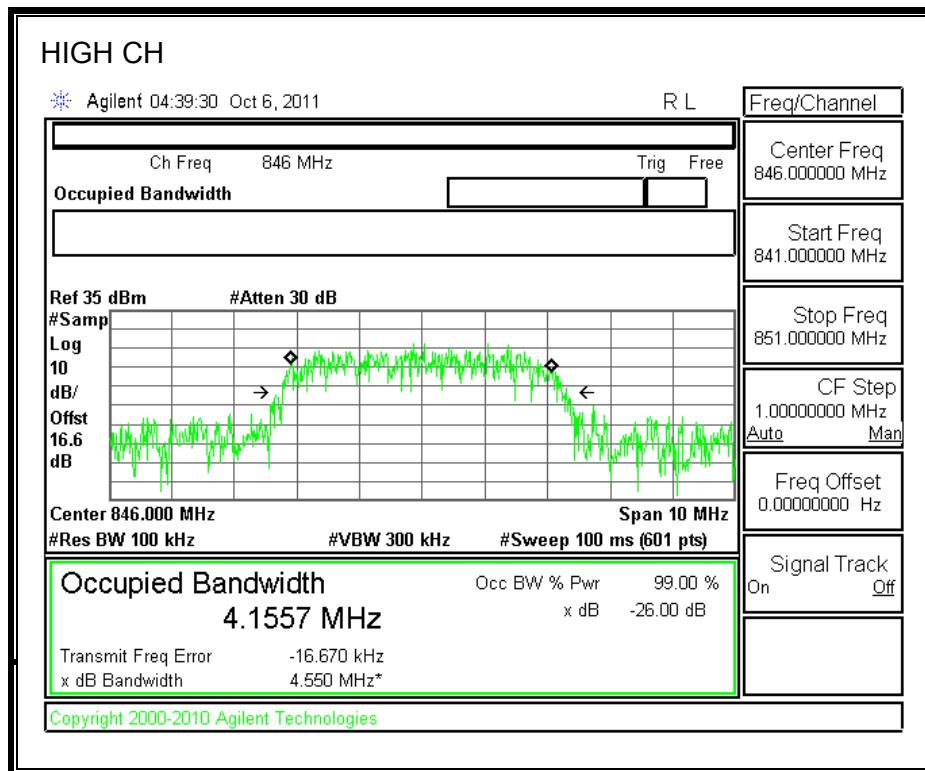
**GPRS1900 BAND**

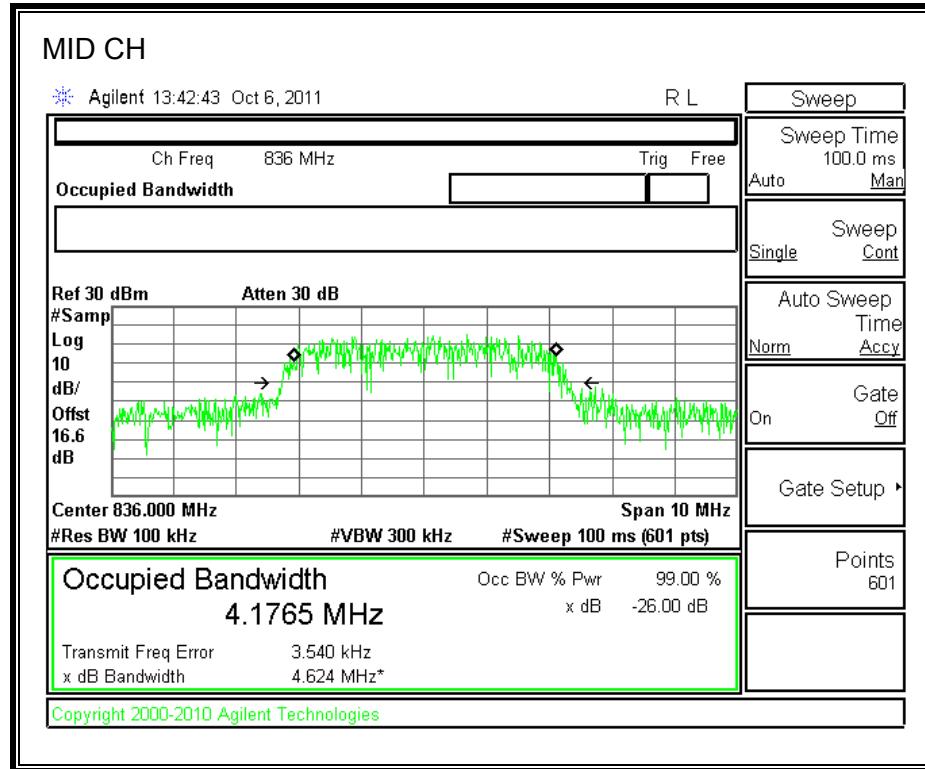
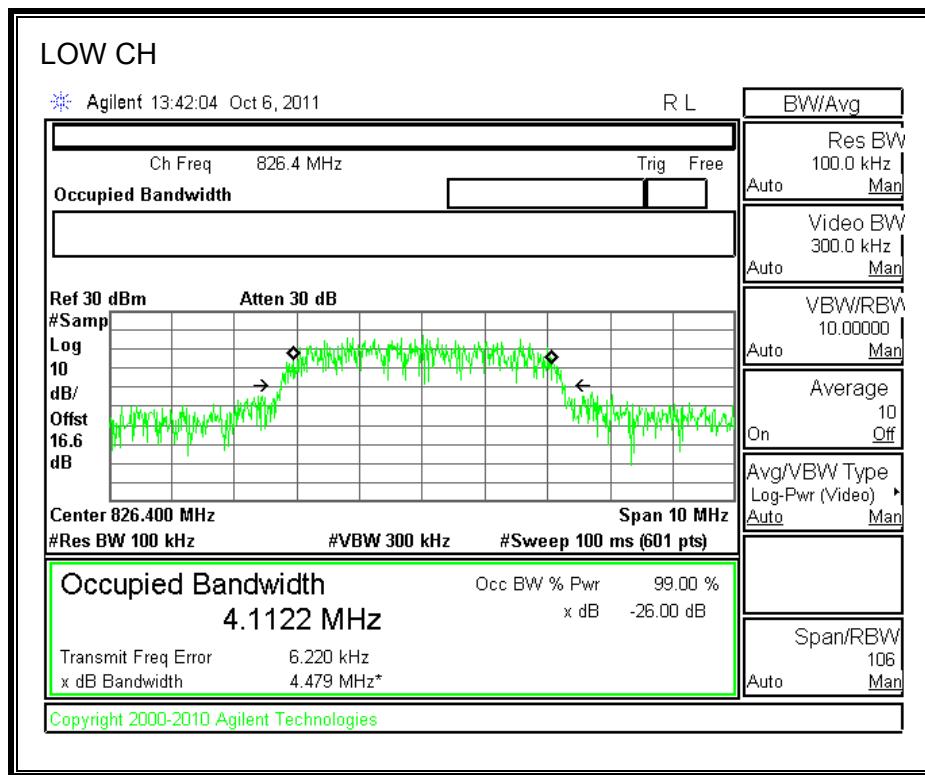


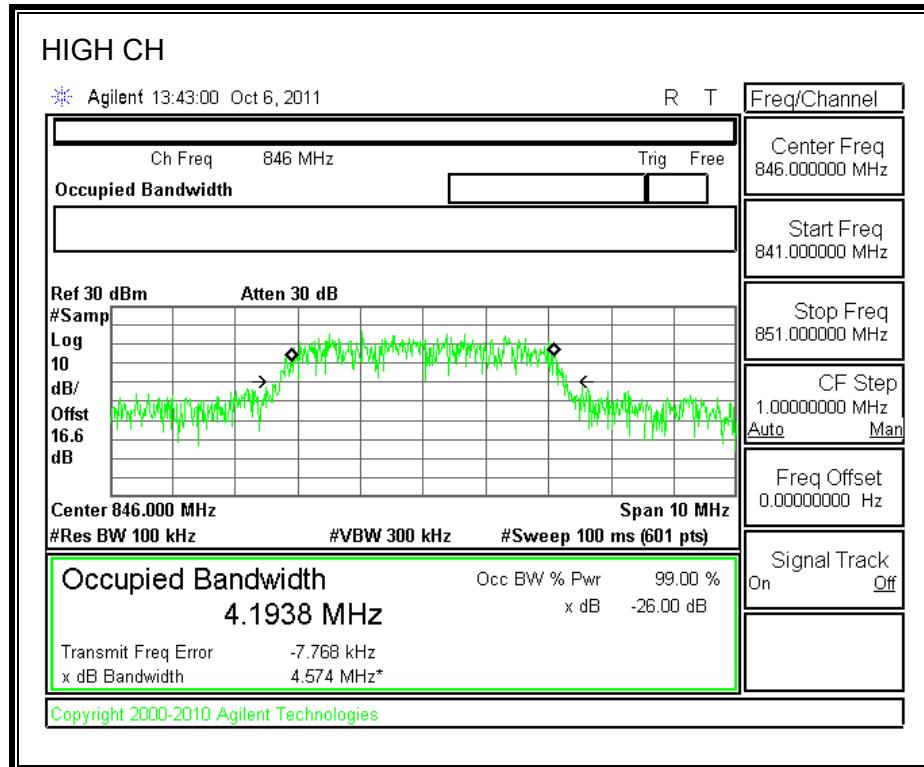


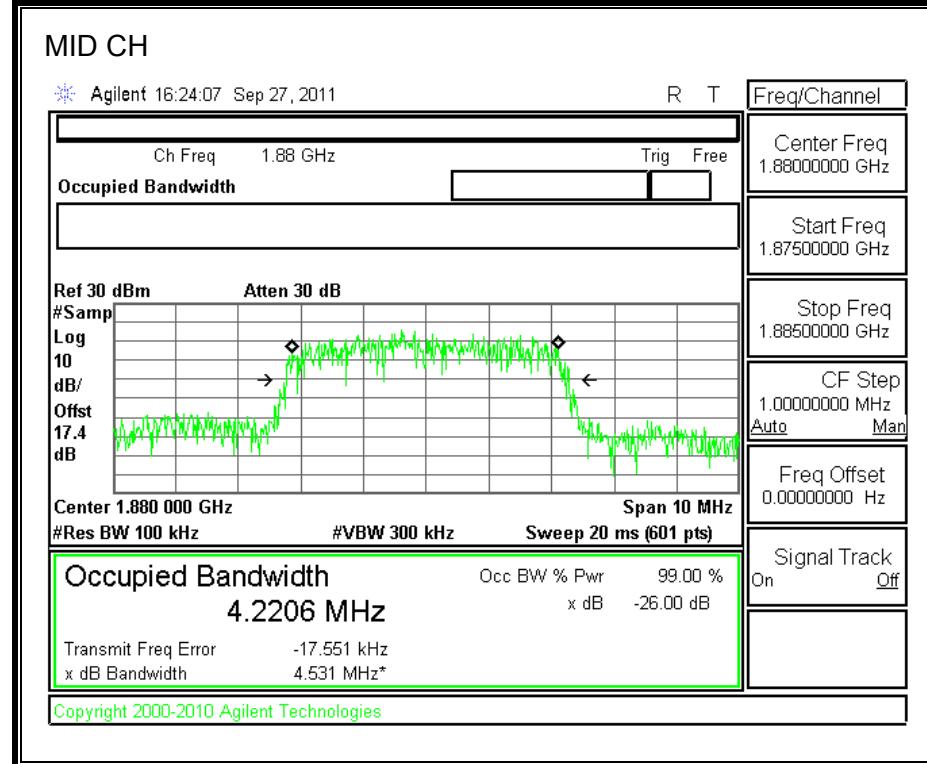
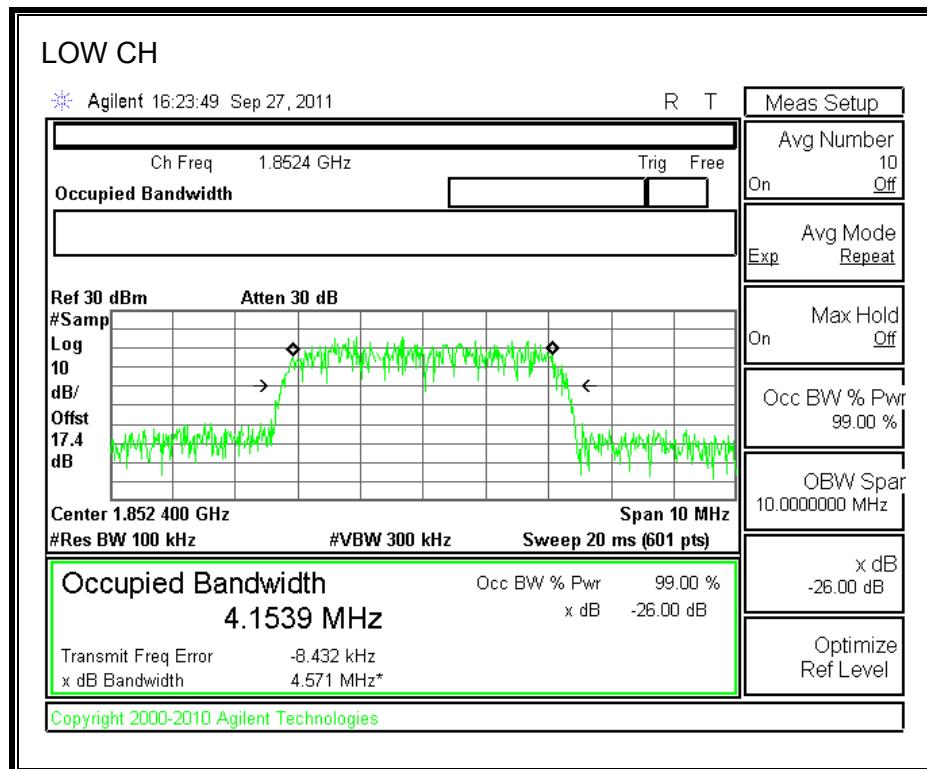


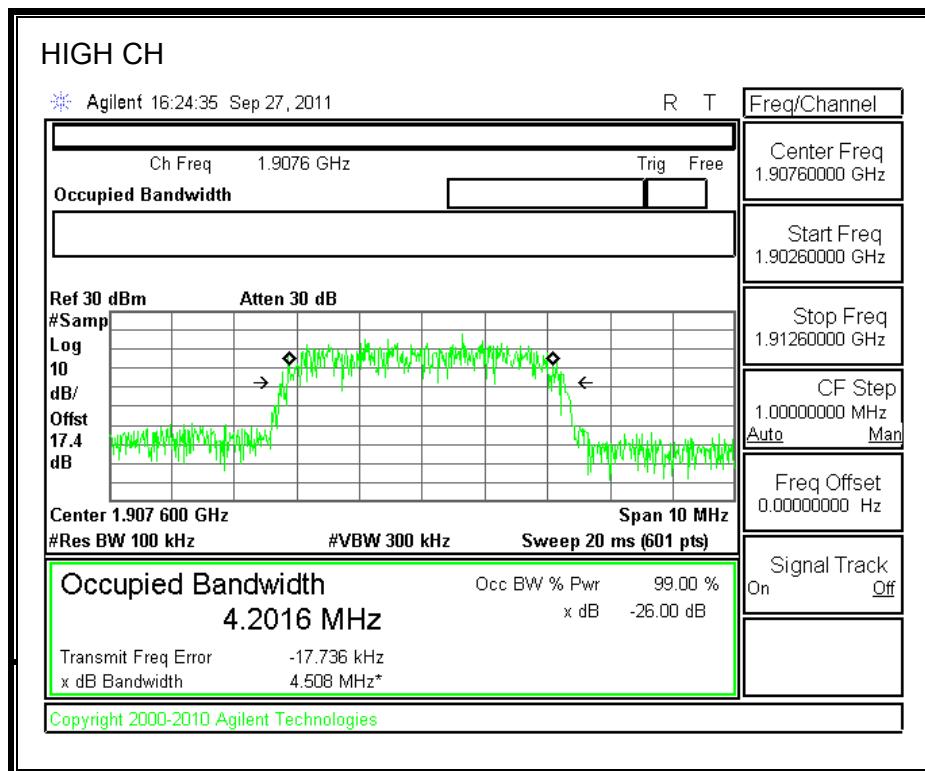


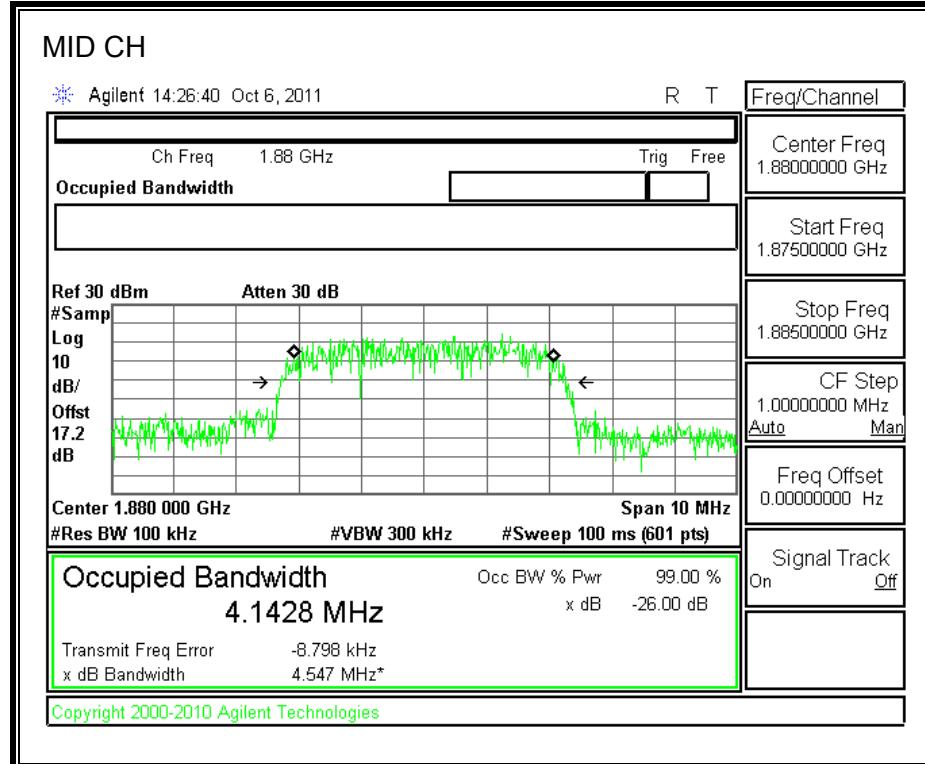
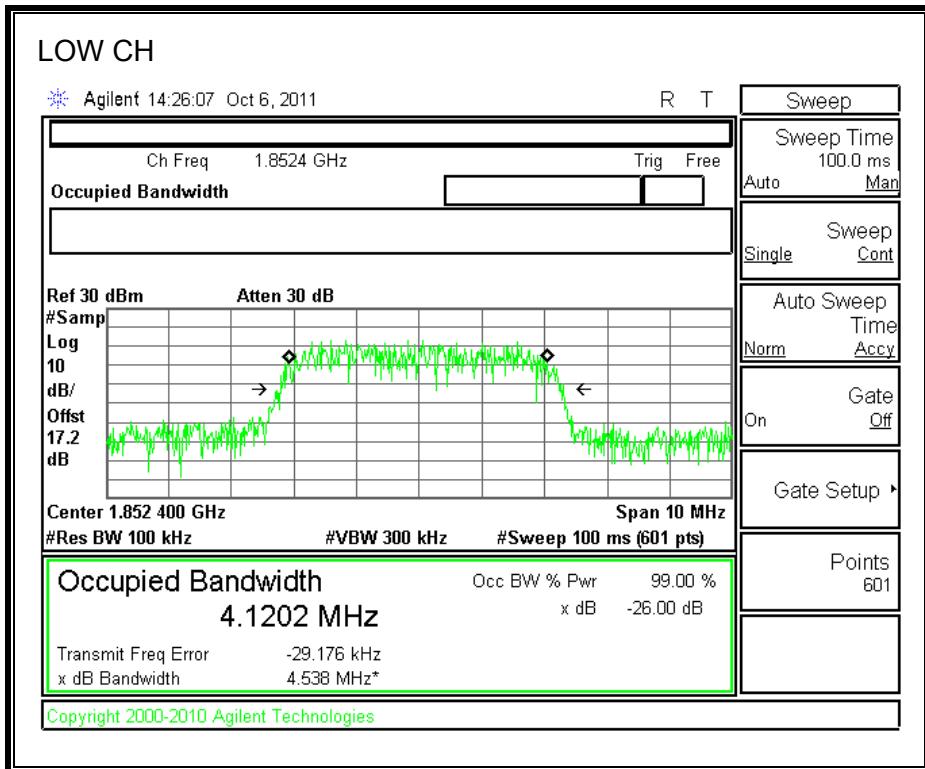


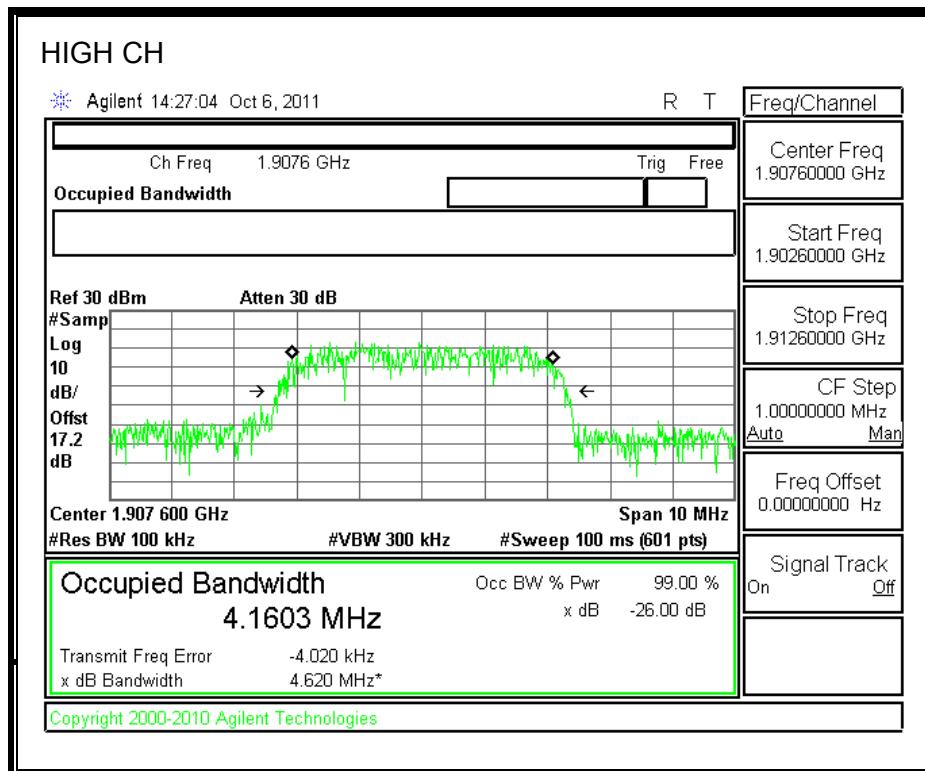




**UMTS WCDMA REL 99. PCS Band**



UMTS HSDPA Rel 6., PCS Band



## 8.2. BAND EDGE

### RULE PART(S)

FCC: §22.359, 24.238

IC: RSS-132, 4.5; RSS-133, 6.5

### LIMITS

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 transmitter output was connected to CMU200 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

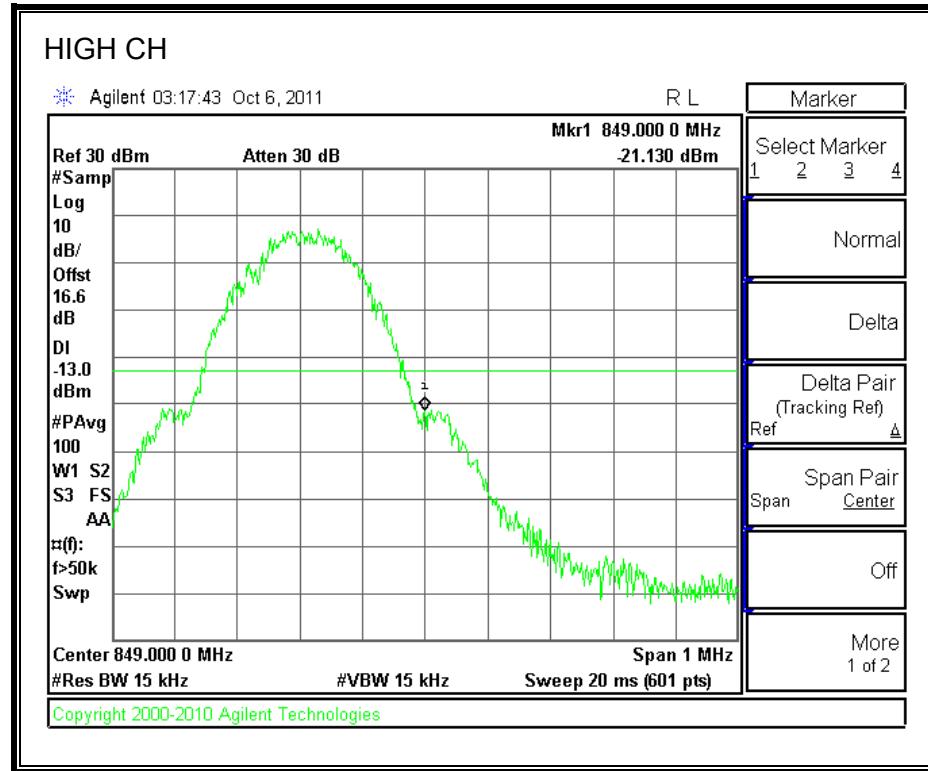
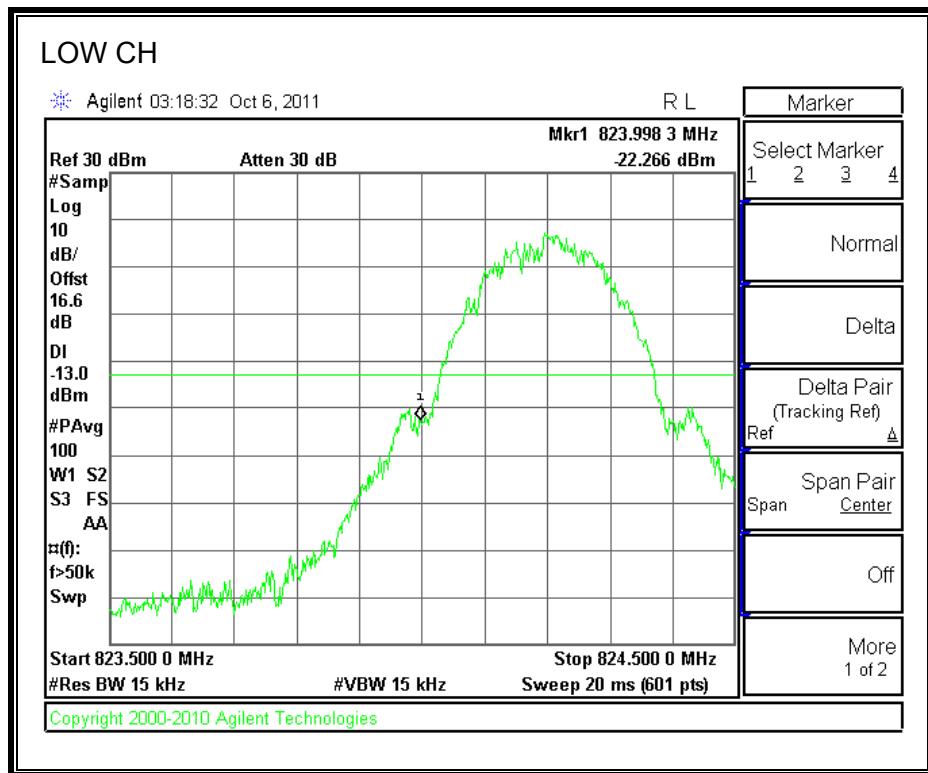
For each band edge measurement:

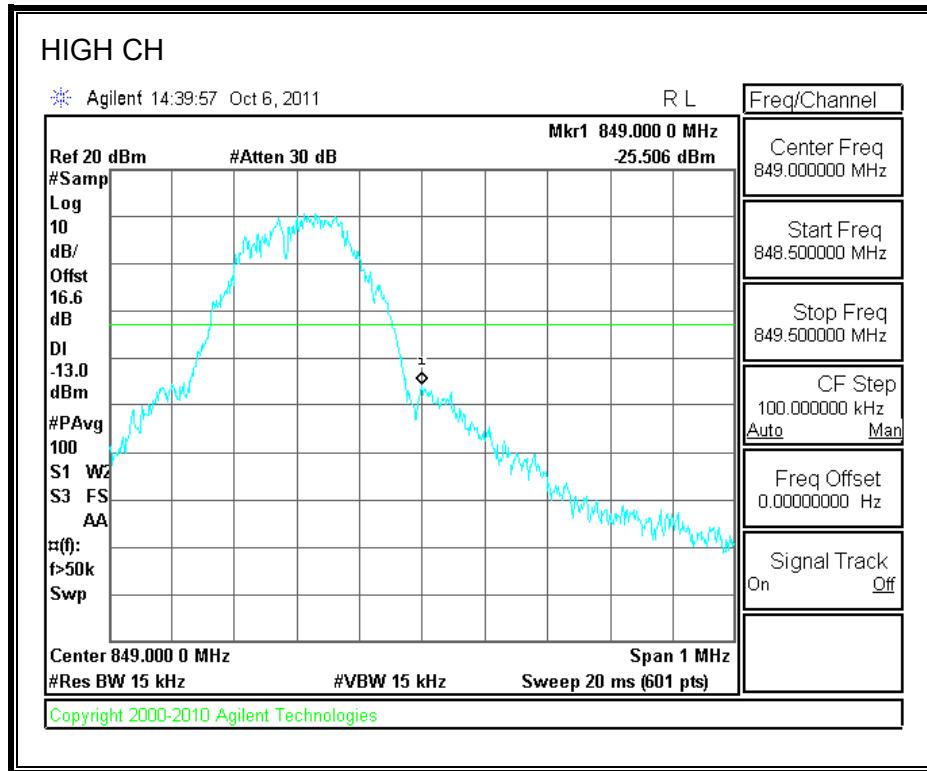
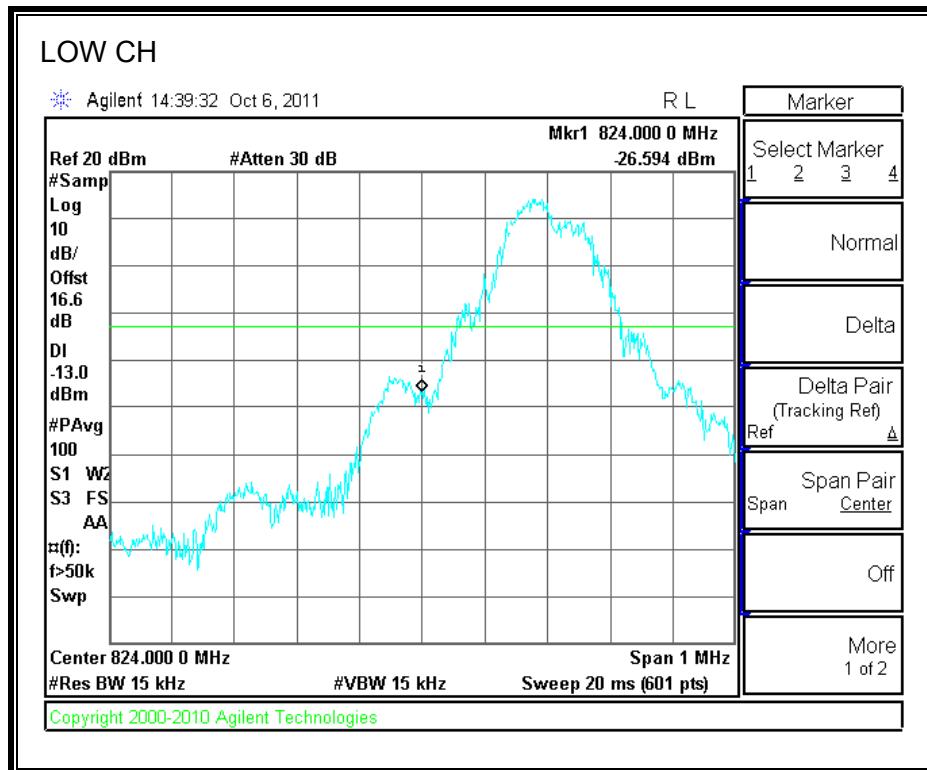
- Set the spectrum analyzer span to include the block edge frequency (824, 849, 1850, 1910MHz)
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

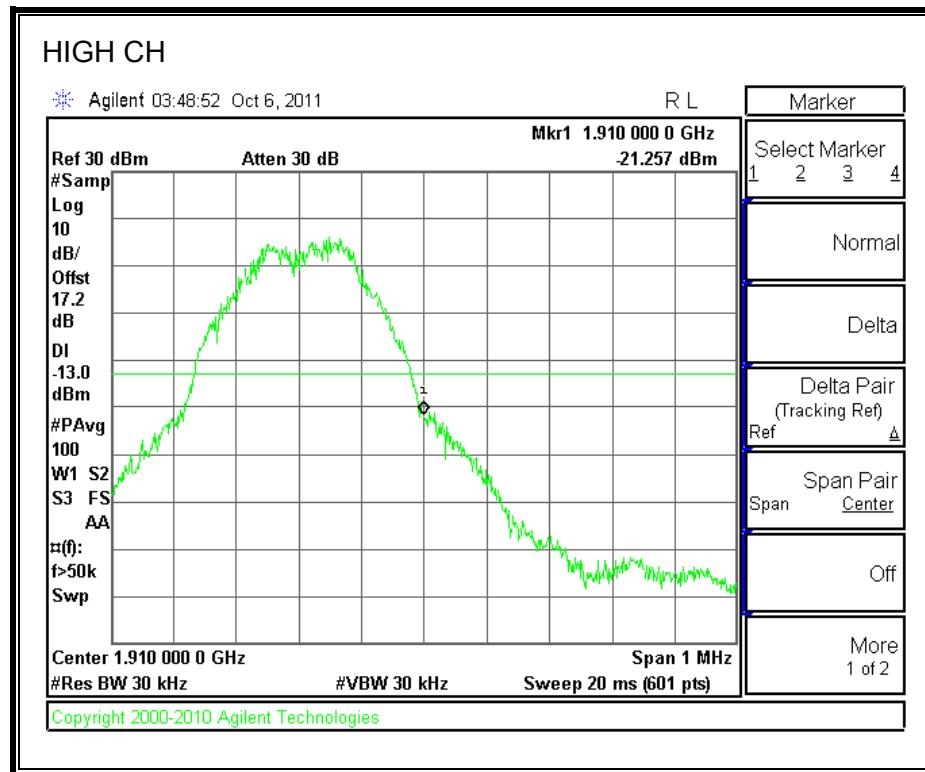
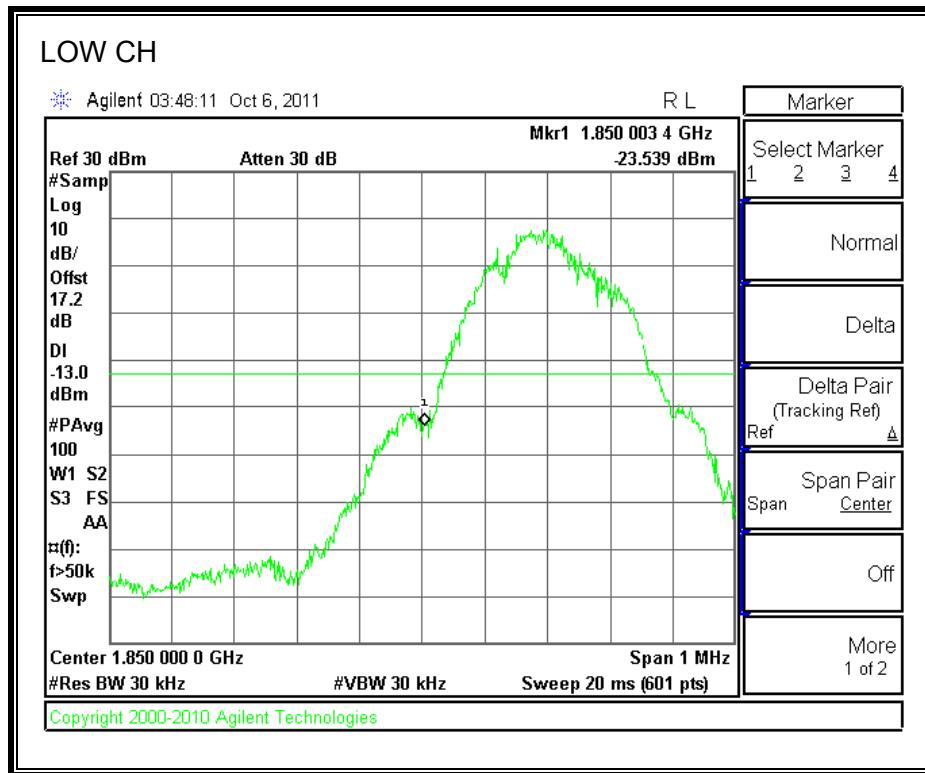
### MODES TESTED

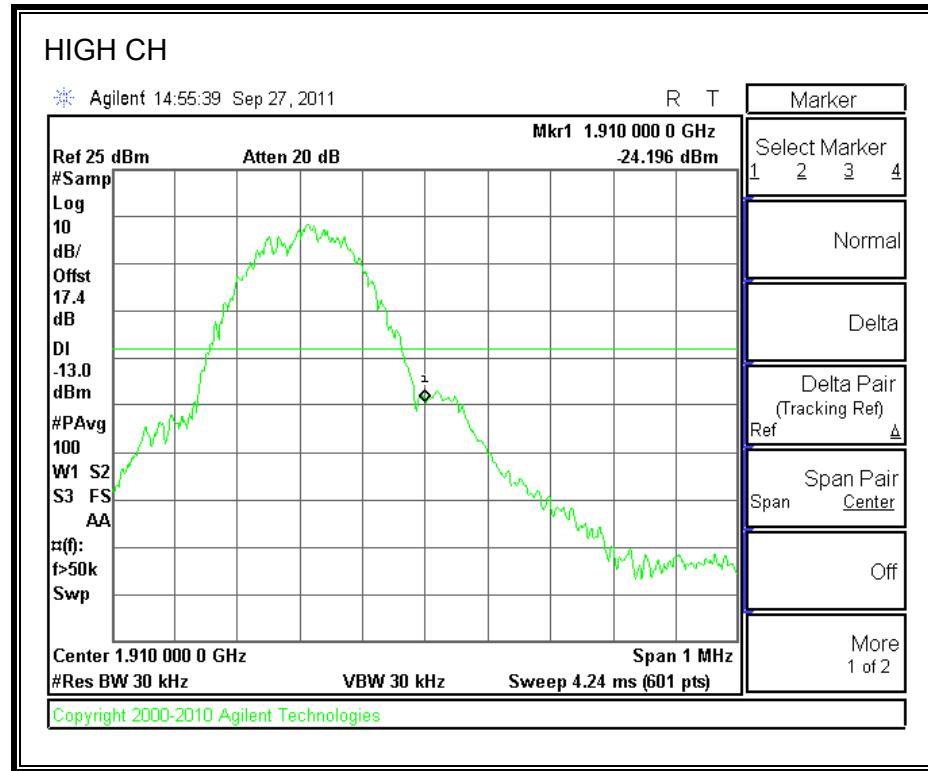
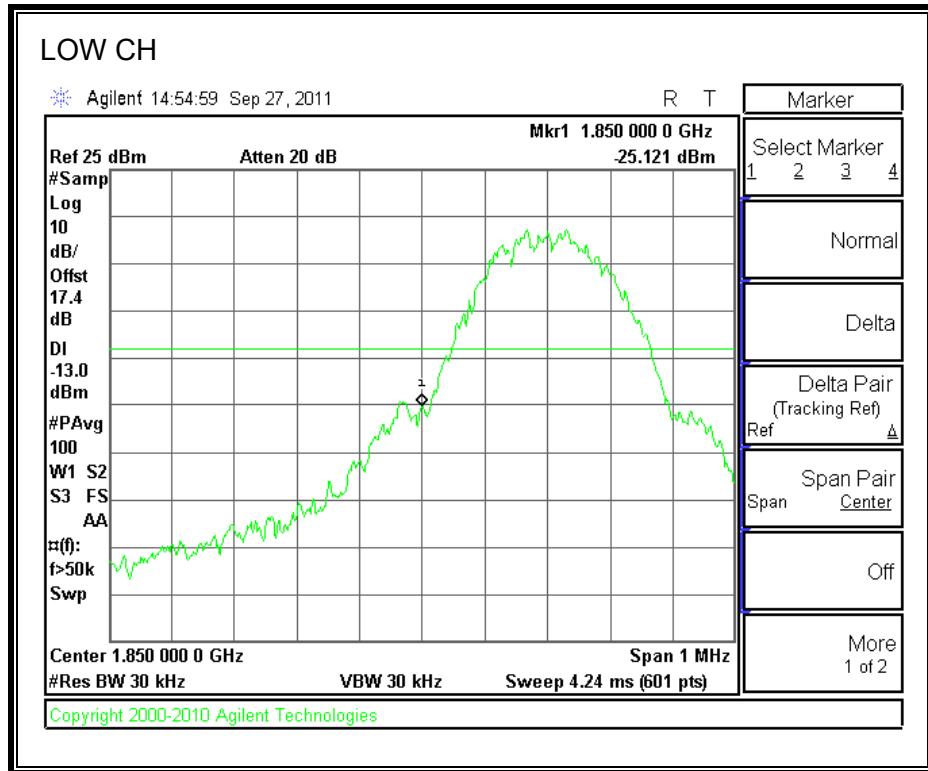
- GPRS and EGPRS
- WCDMA REL. 99 and HSDPA

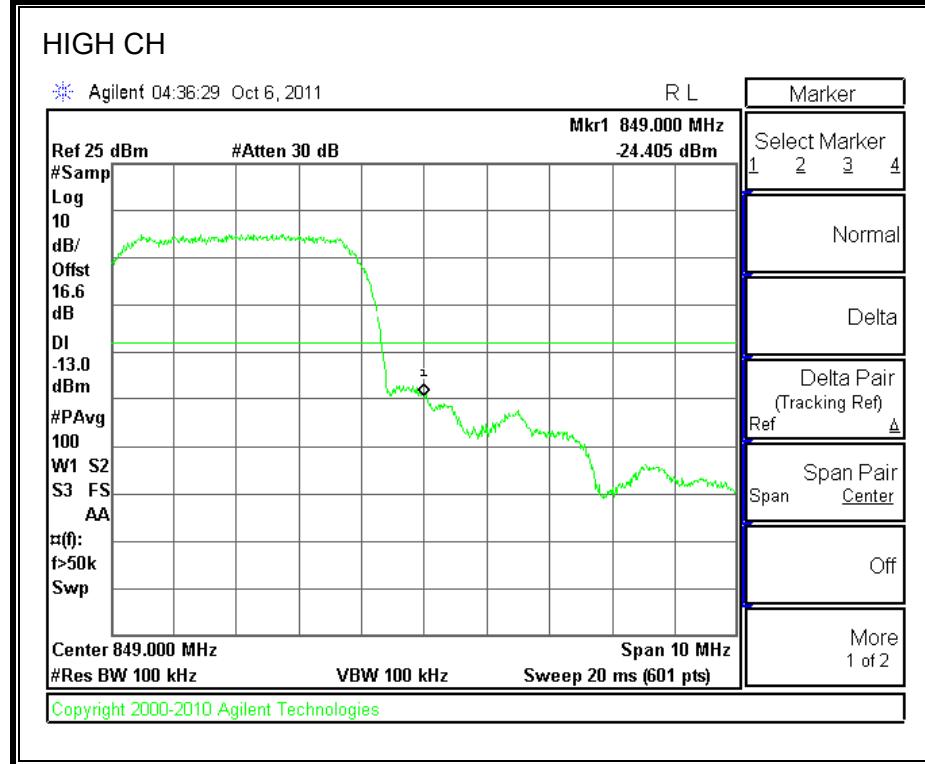
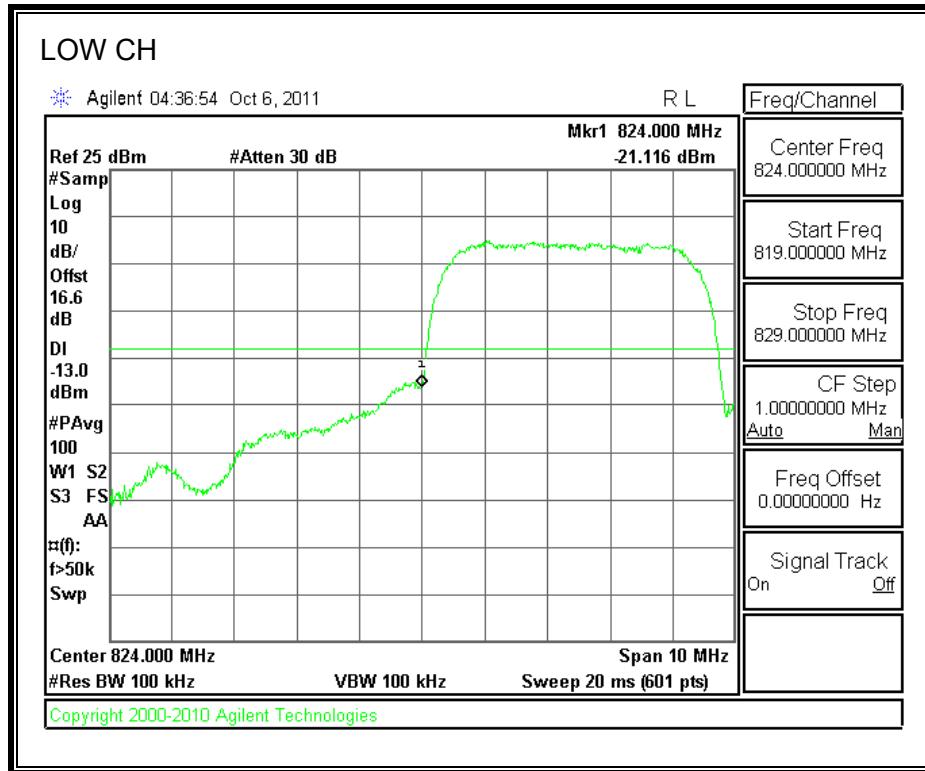
### RESULTS

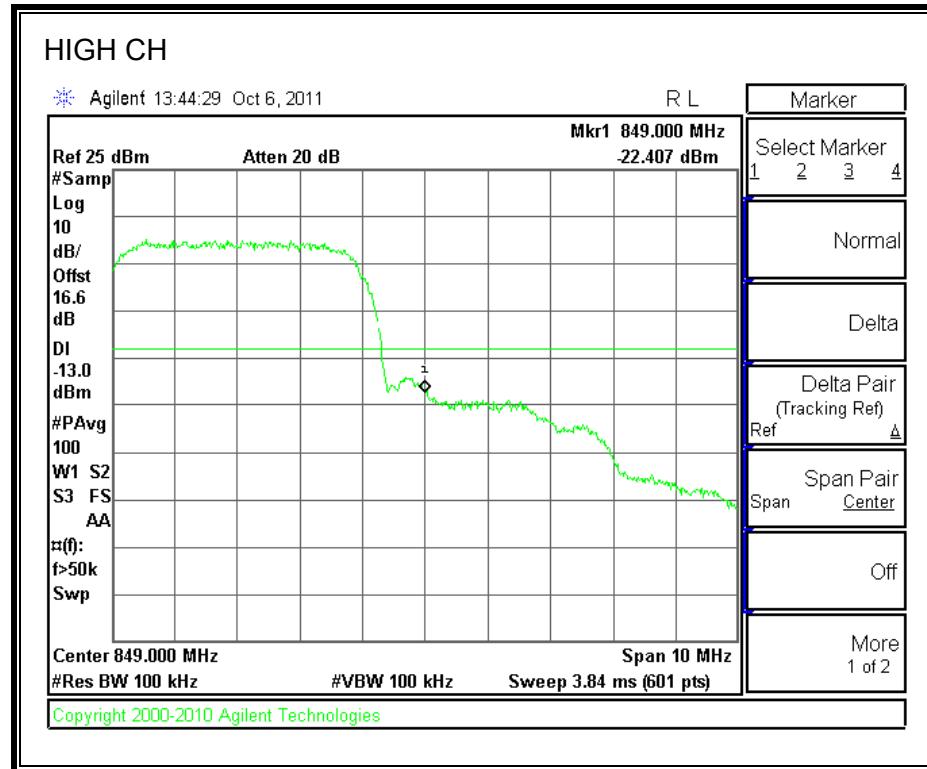
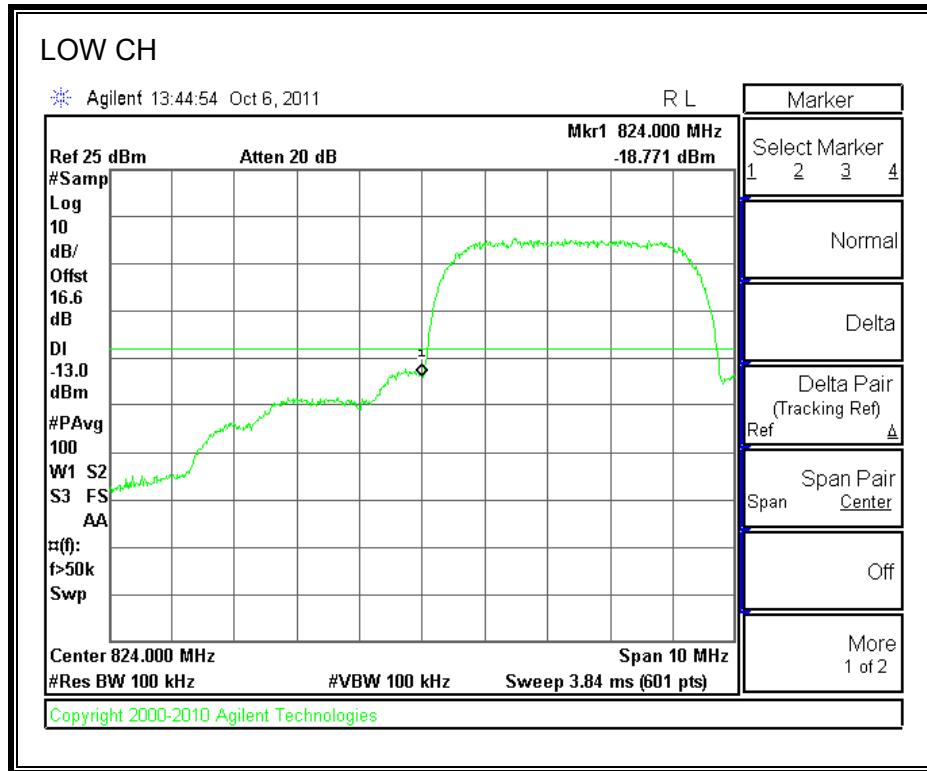
**GPRS850 BAND**

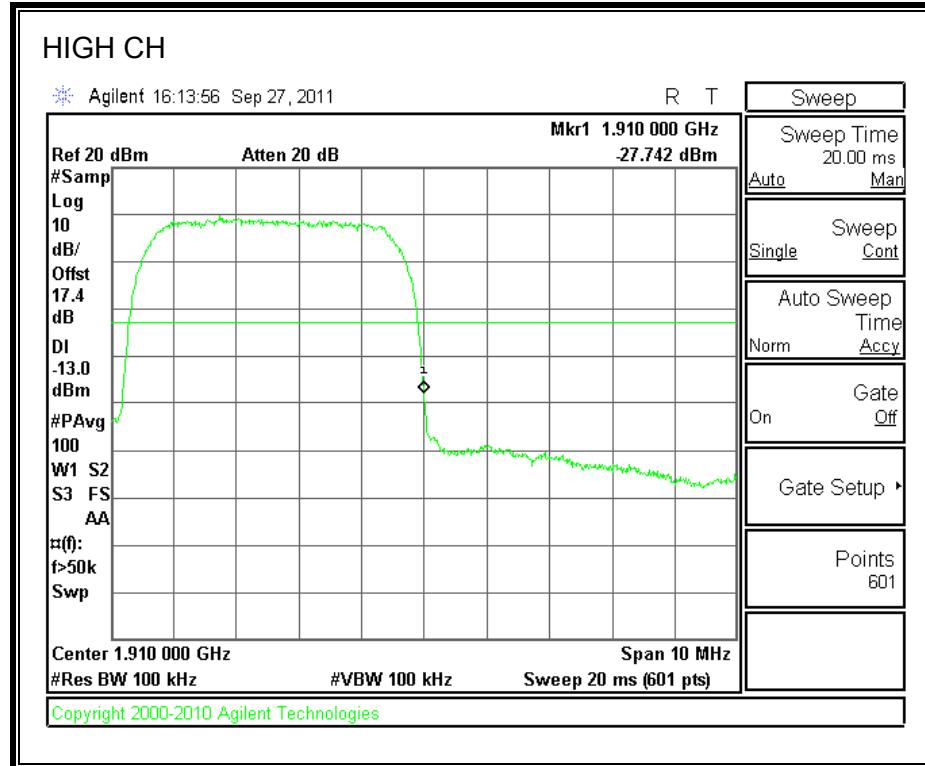
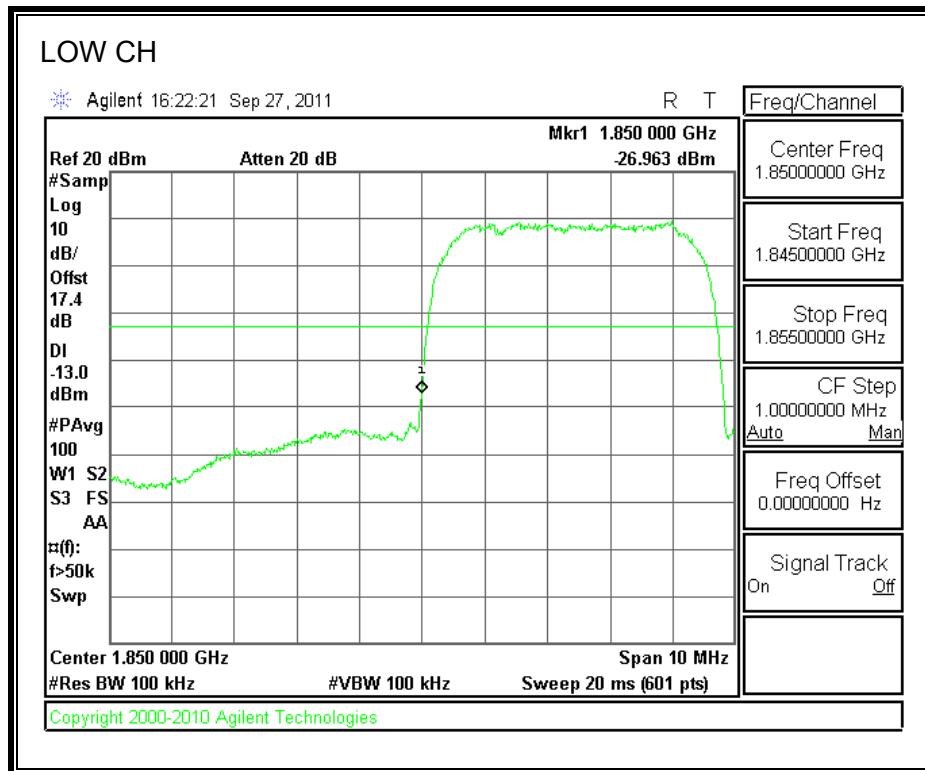
**EGPRS850 BAND**

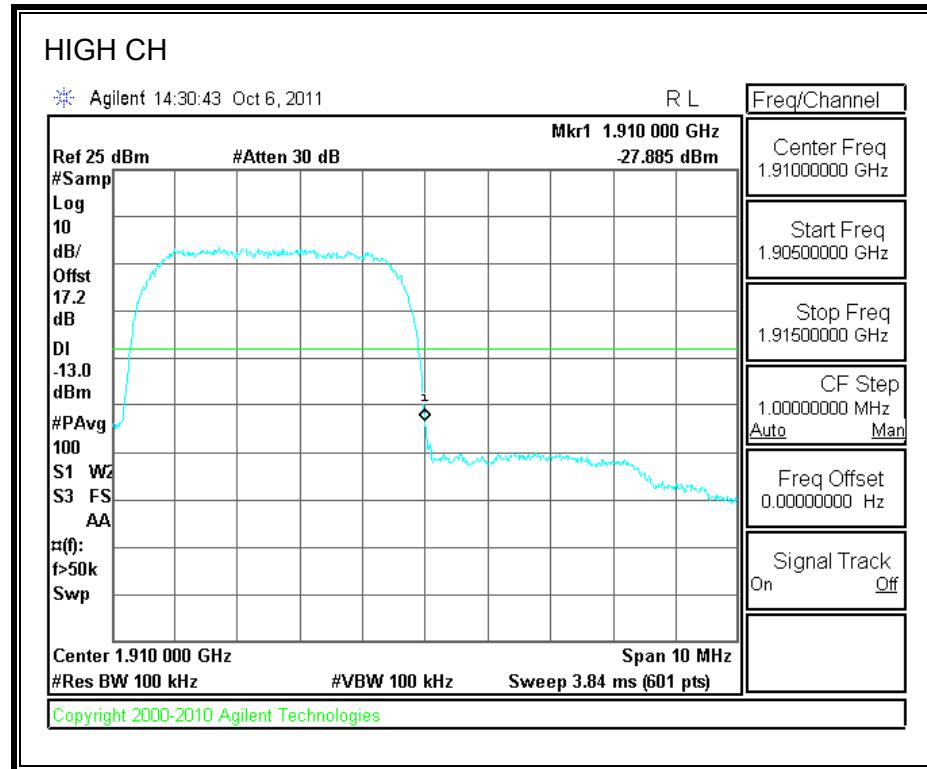
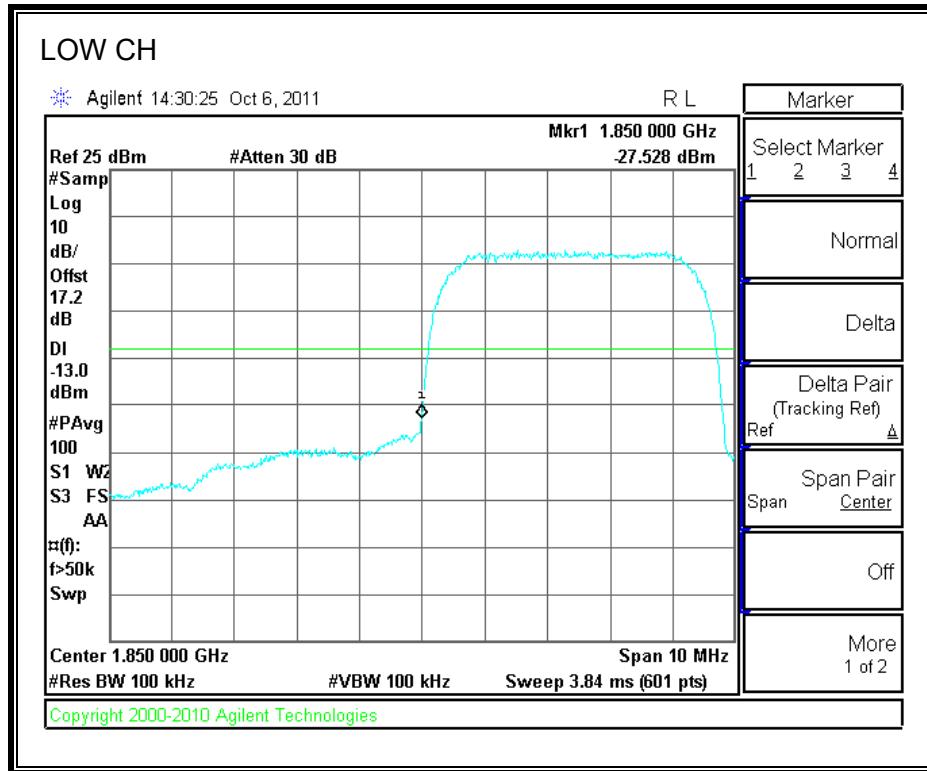
**GPRS1900 BAND**

**EGPRS1900 BAND**

**UMTS WCDMA REL 99 CELL BAND**

**UMTS HSDPA REL 6 CELL BAND**

**UMTS WCDMA REL 99 PCS Band**

**UMTS HSDPA REL 6 PCS Band**

### 8.3. OUT OF BAND EMISSIONS

#### RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238

IC: RSS-132, 4.5; RSS-133, 6.5

#### LIMITS

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 a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

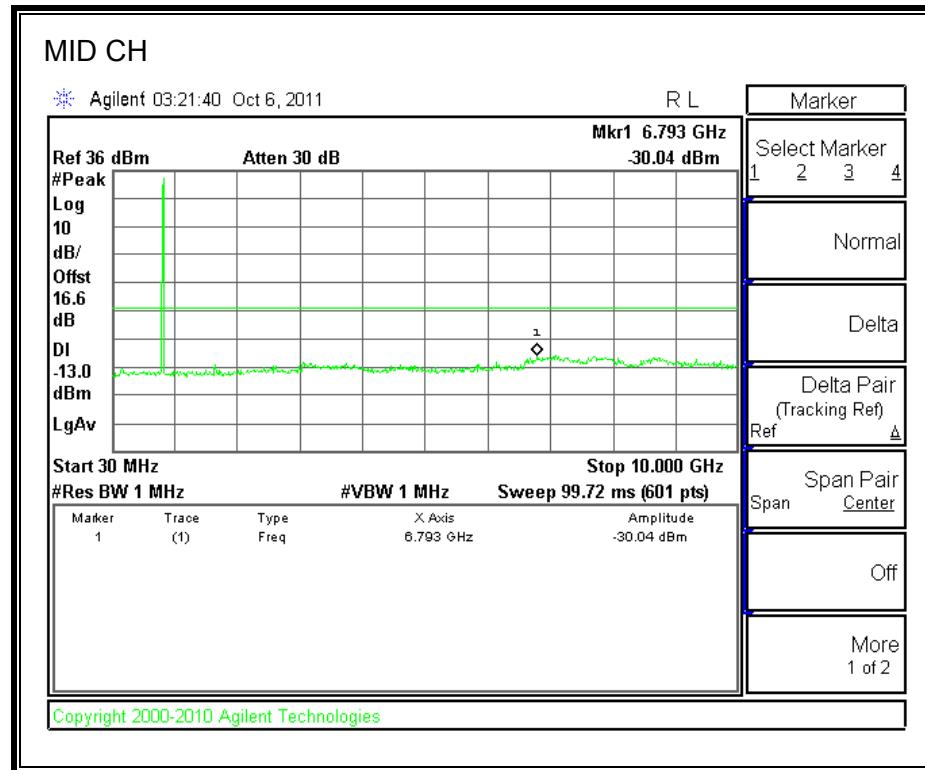
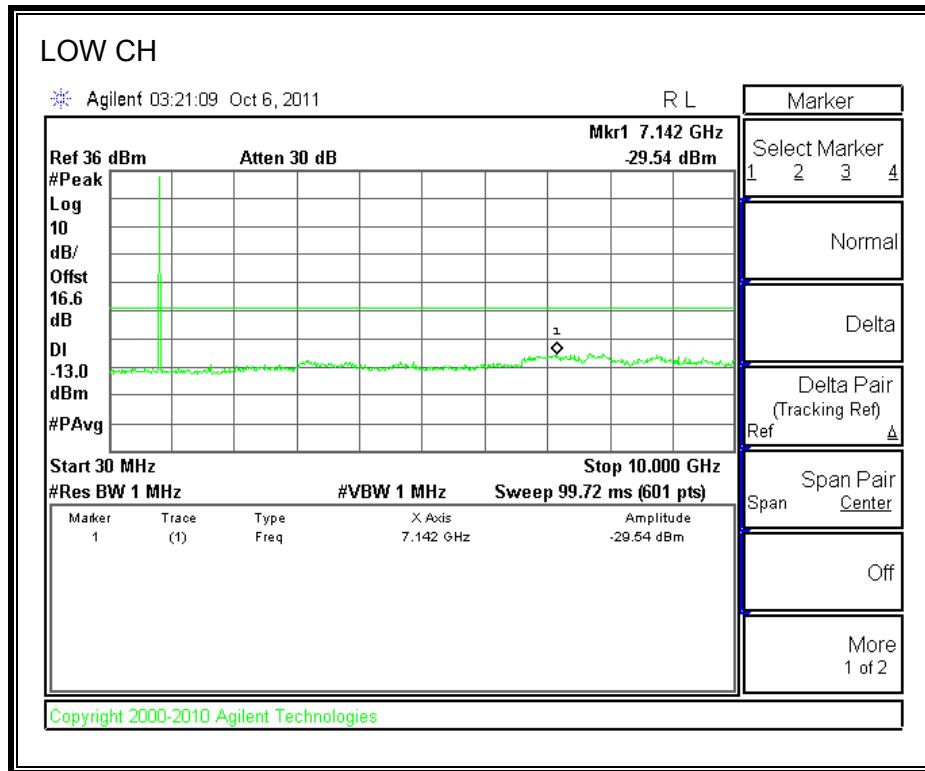
For each out of band emissions measurement:

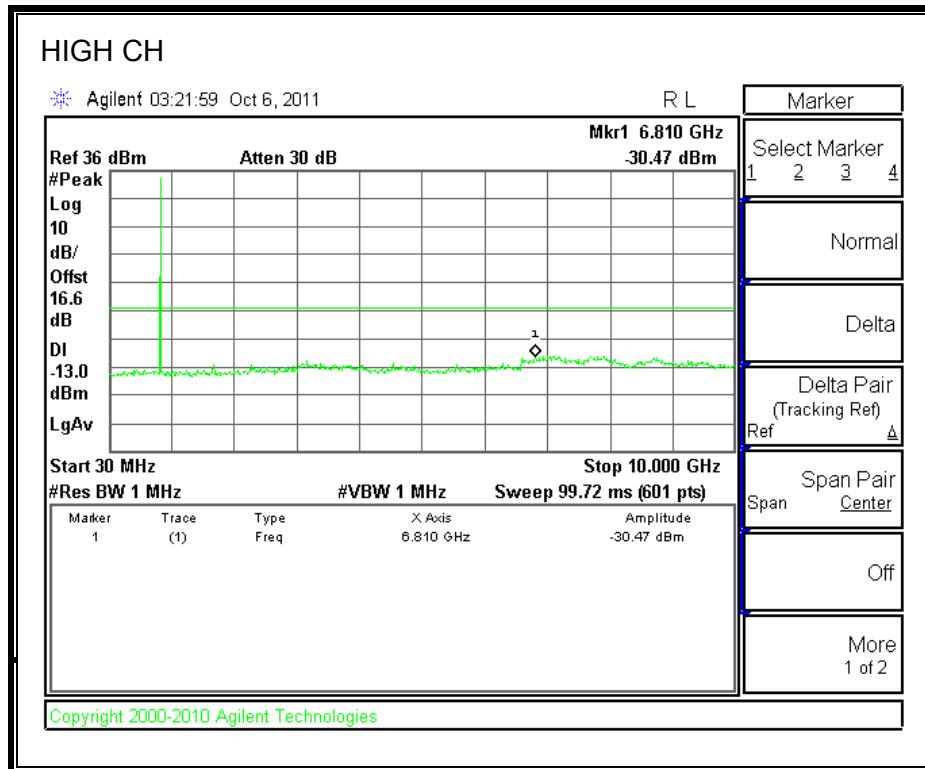
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

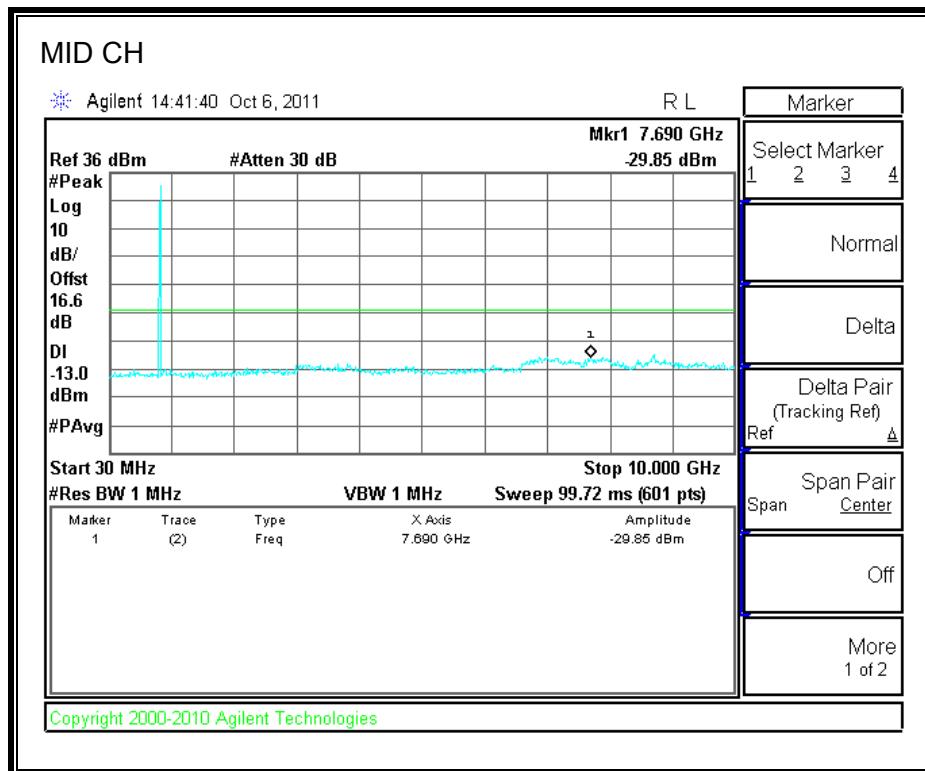
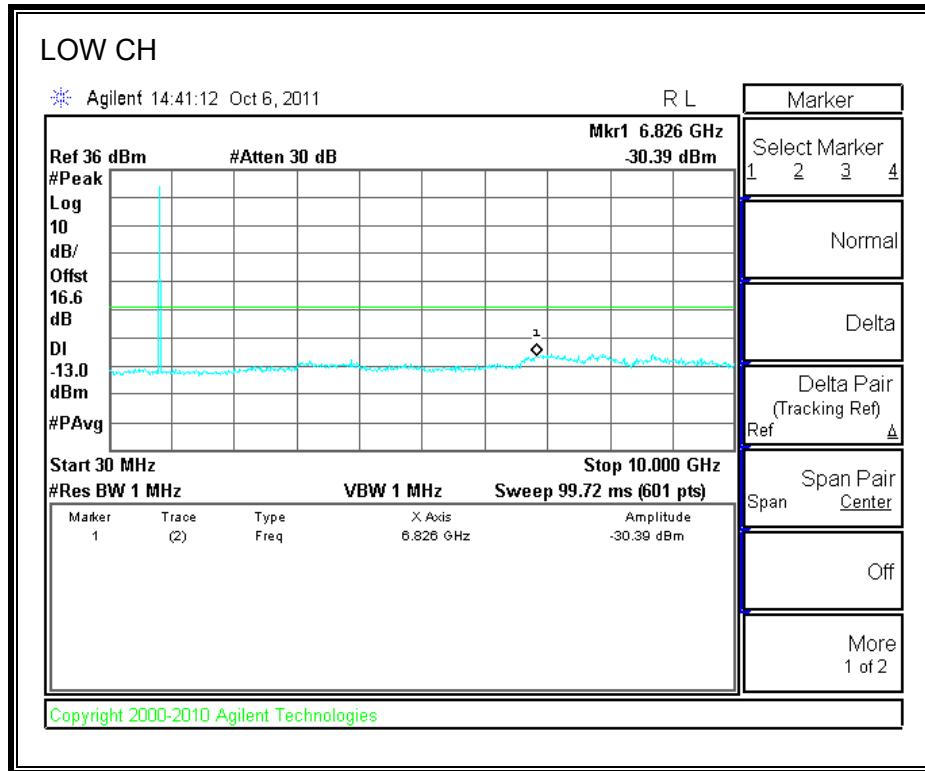
#### MODES TESTED

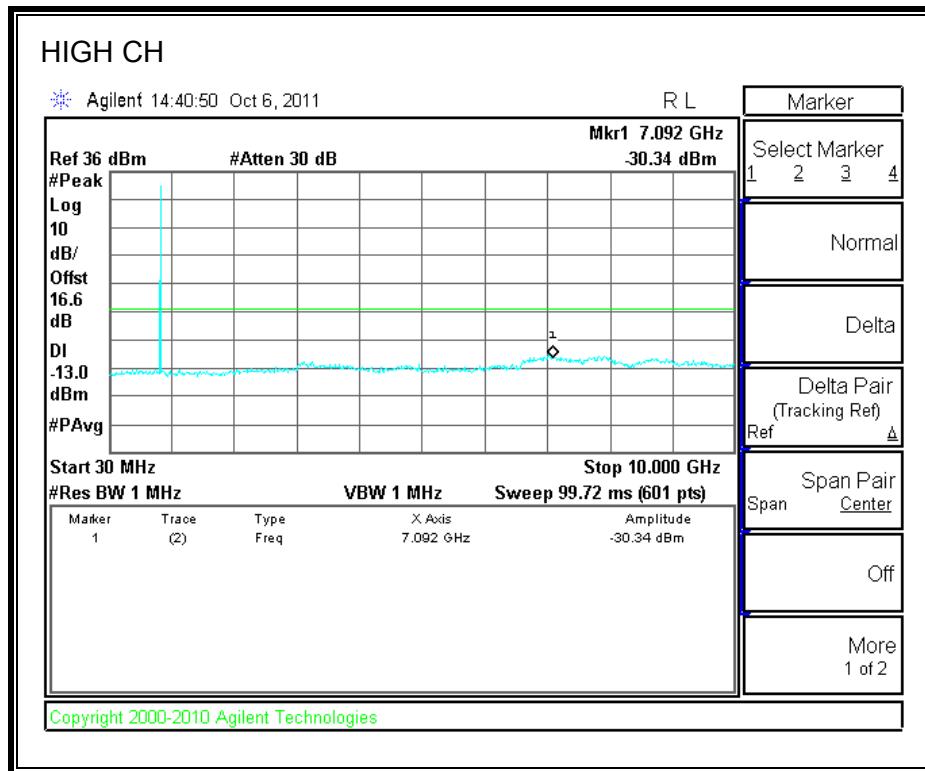
- GPRS and EGPRS
- WCDMA REL. 99 and HSDPA

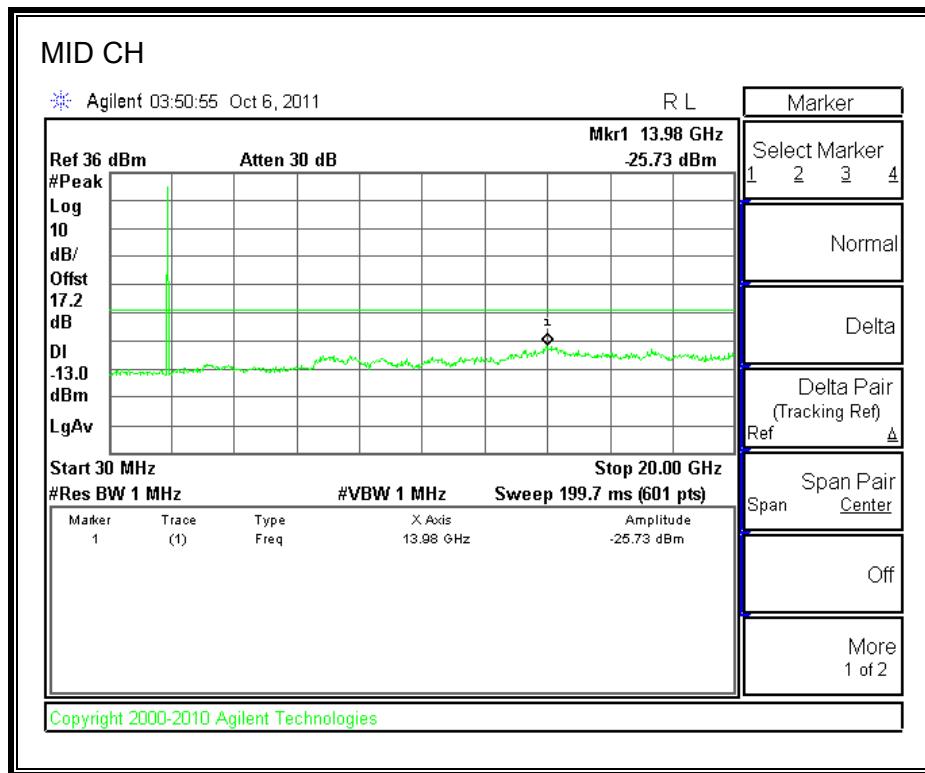
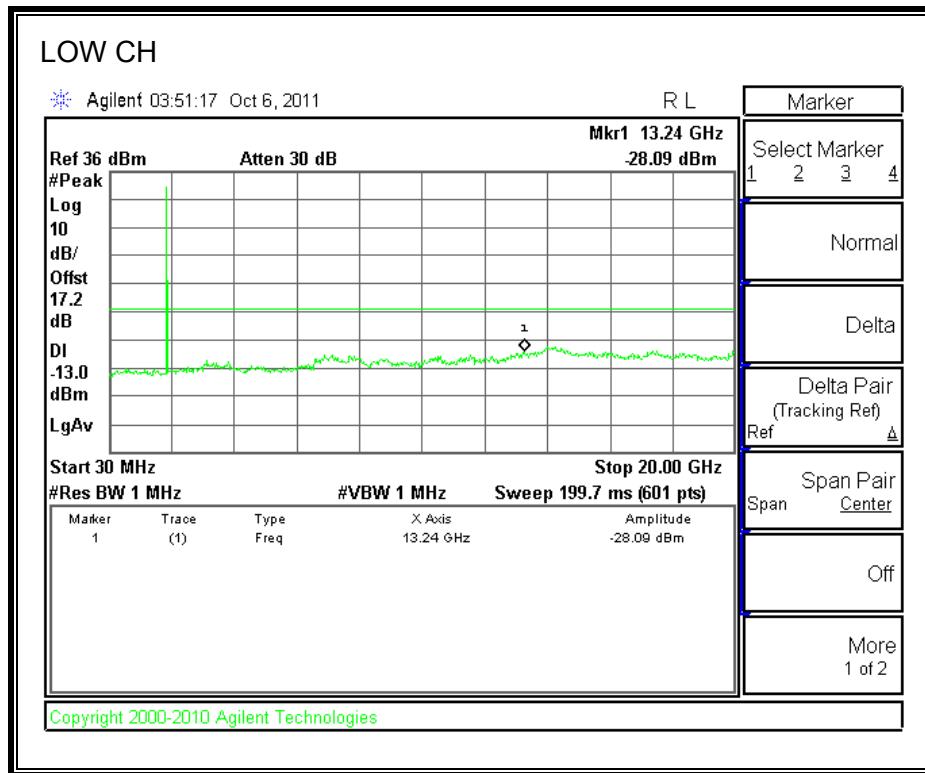
#### RESULTS

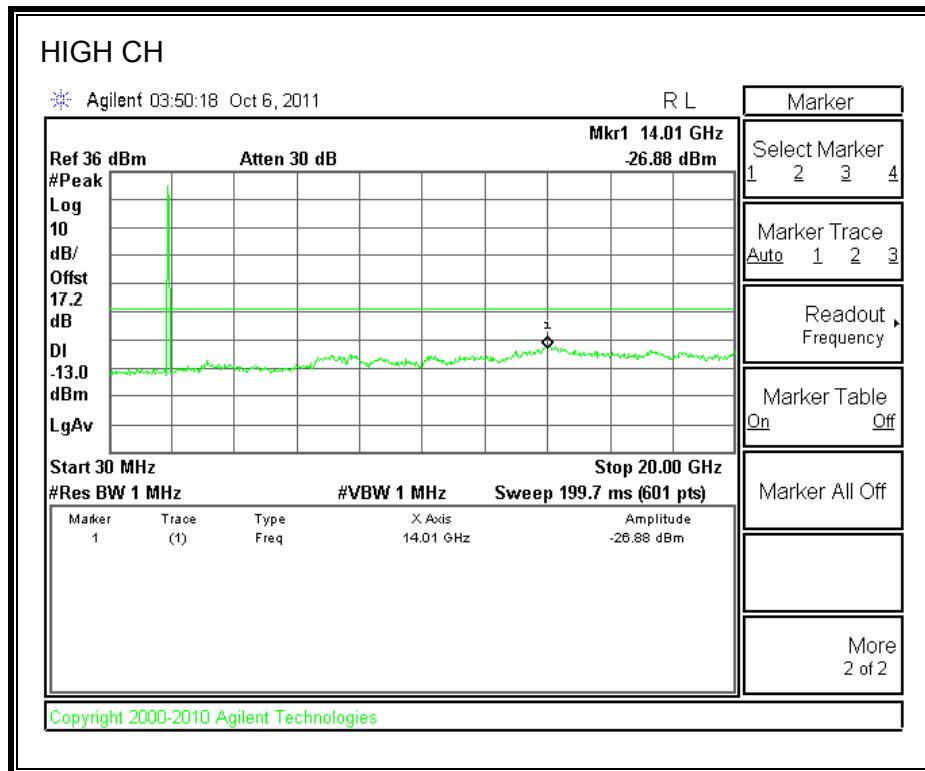
**GPRS850 BAND**

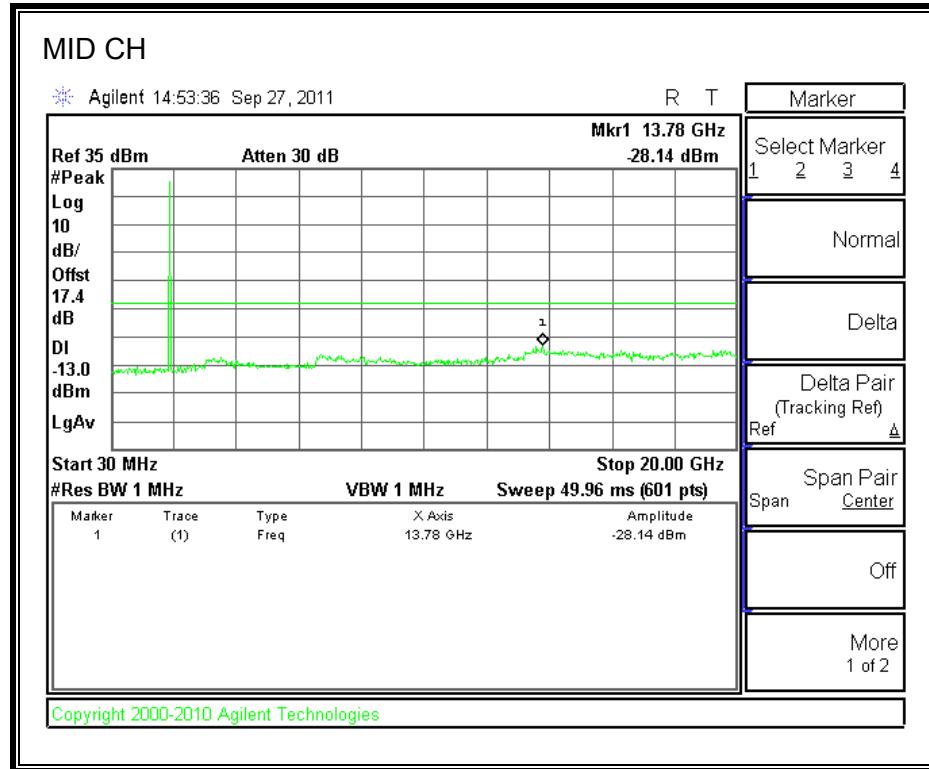
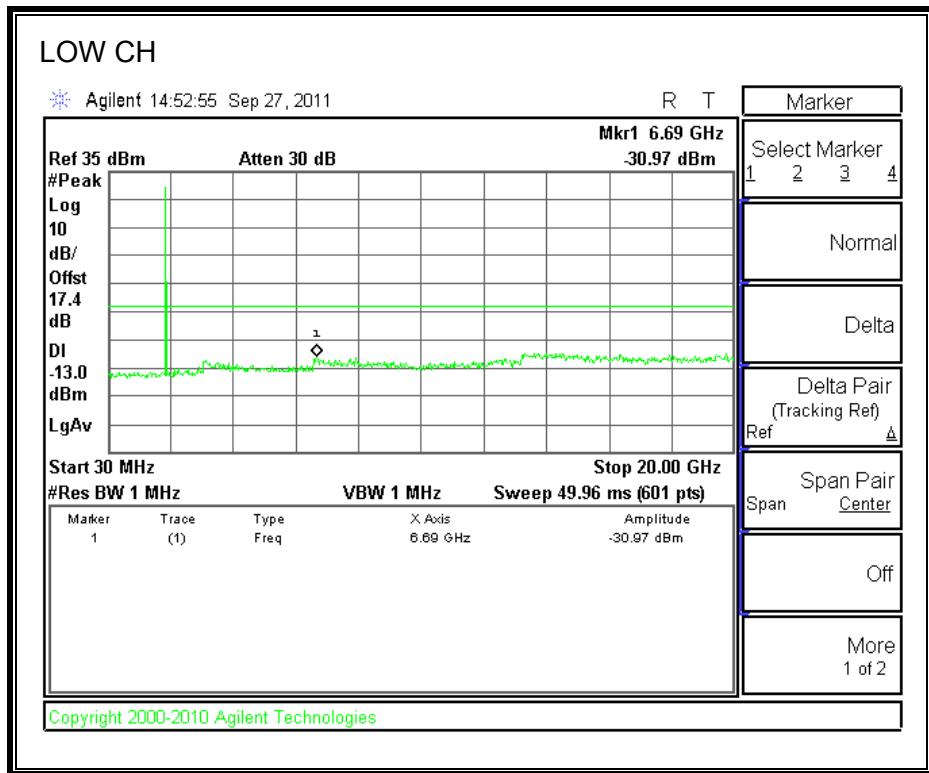


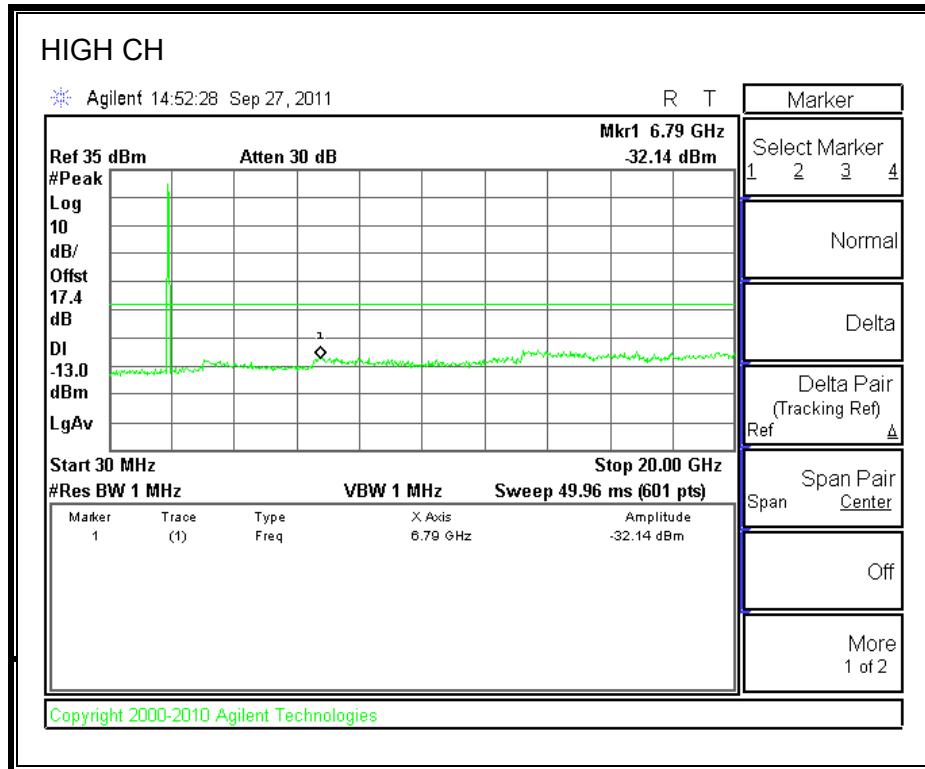
**EGPRS850 BAND**

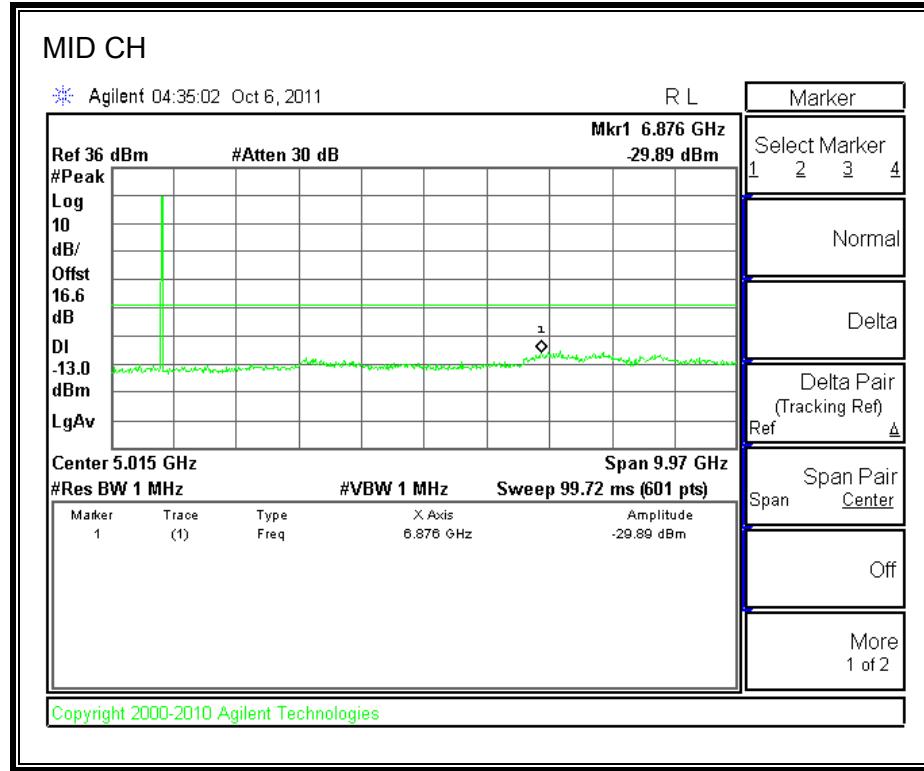
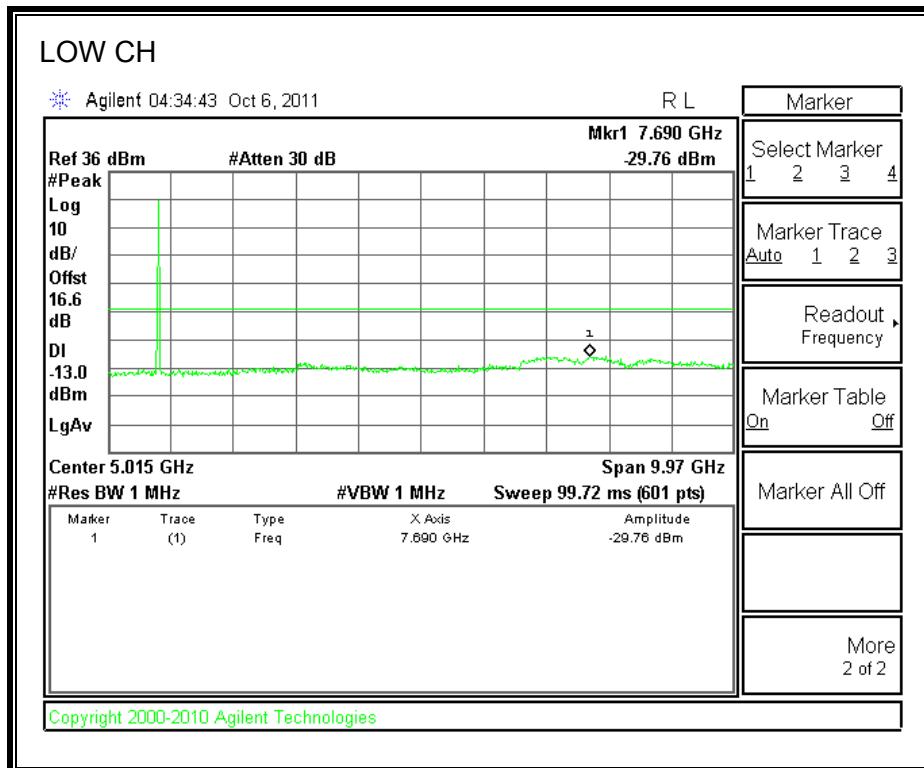


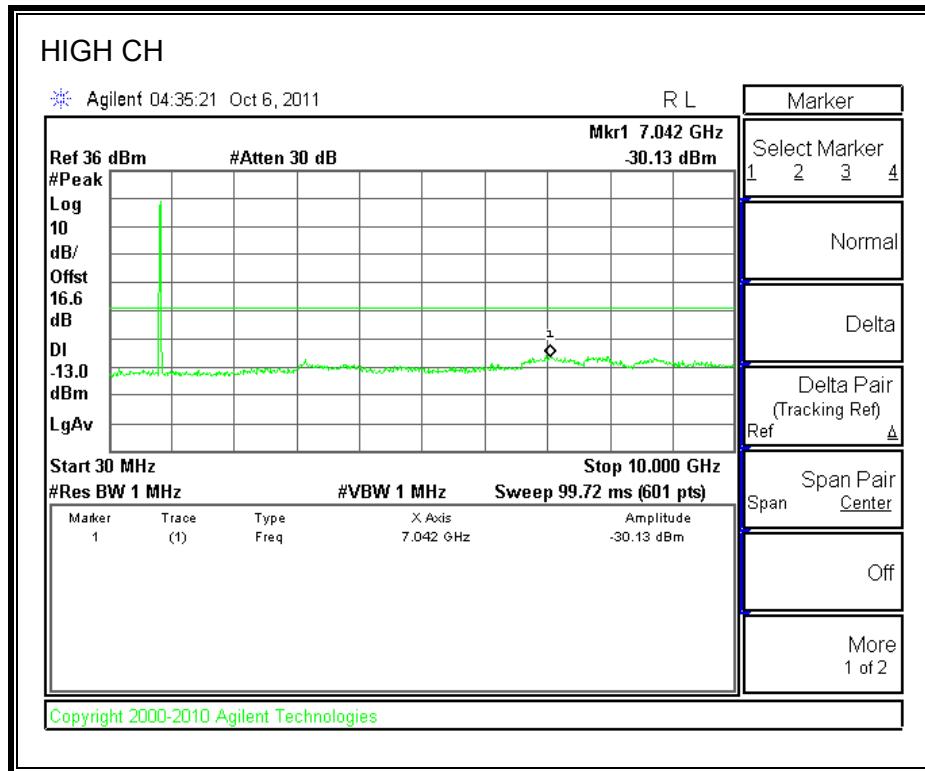
**GPRS1900 BAND**

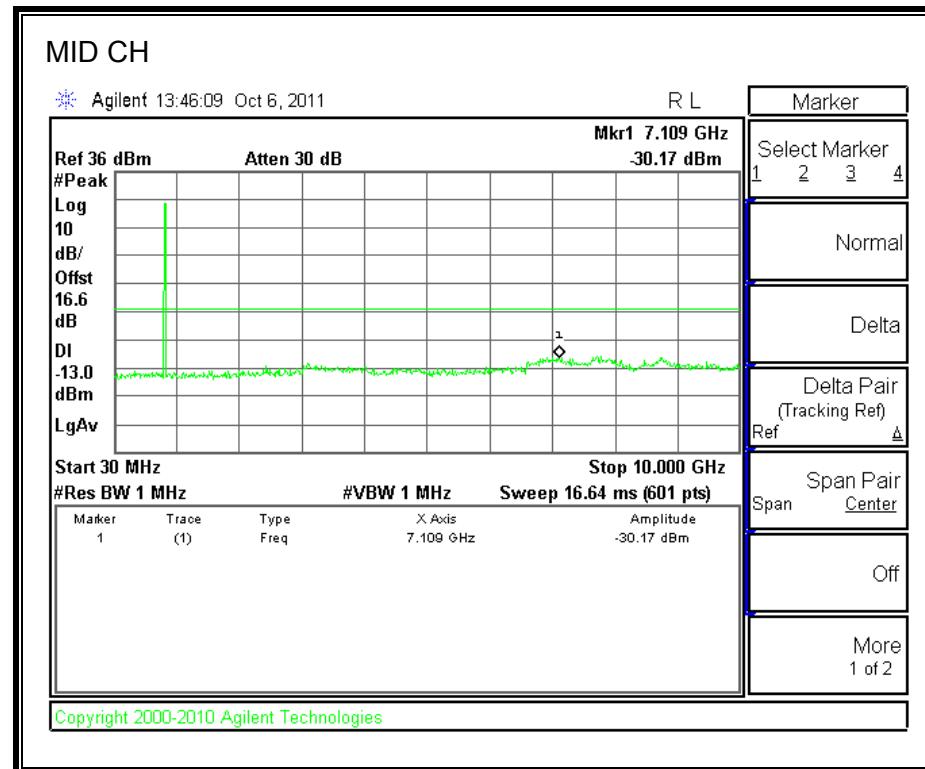
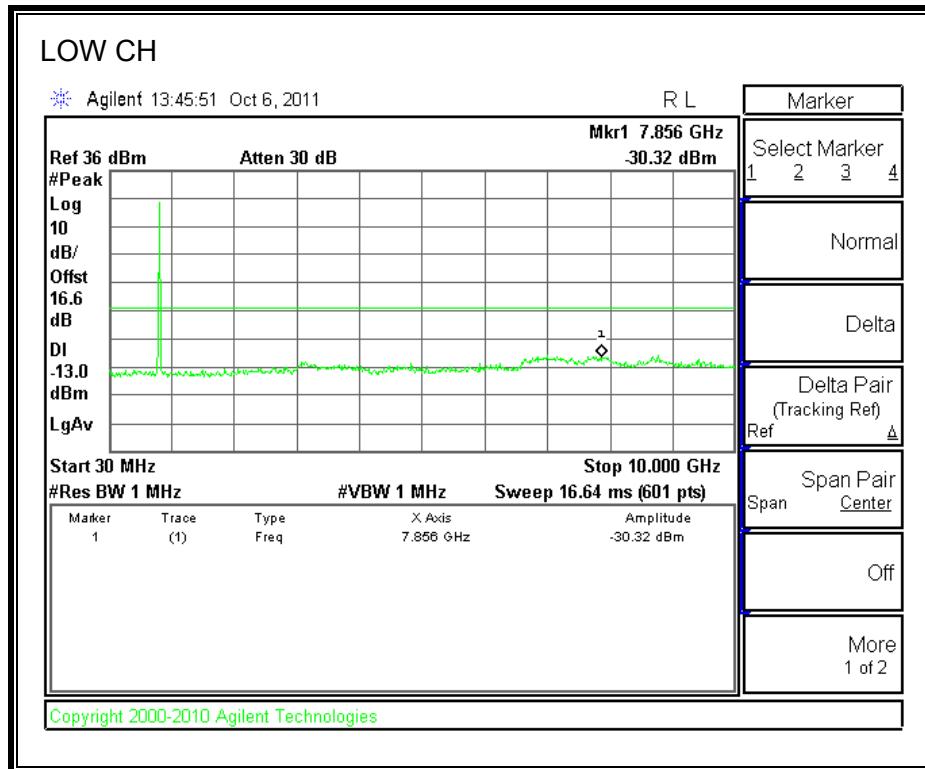


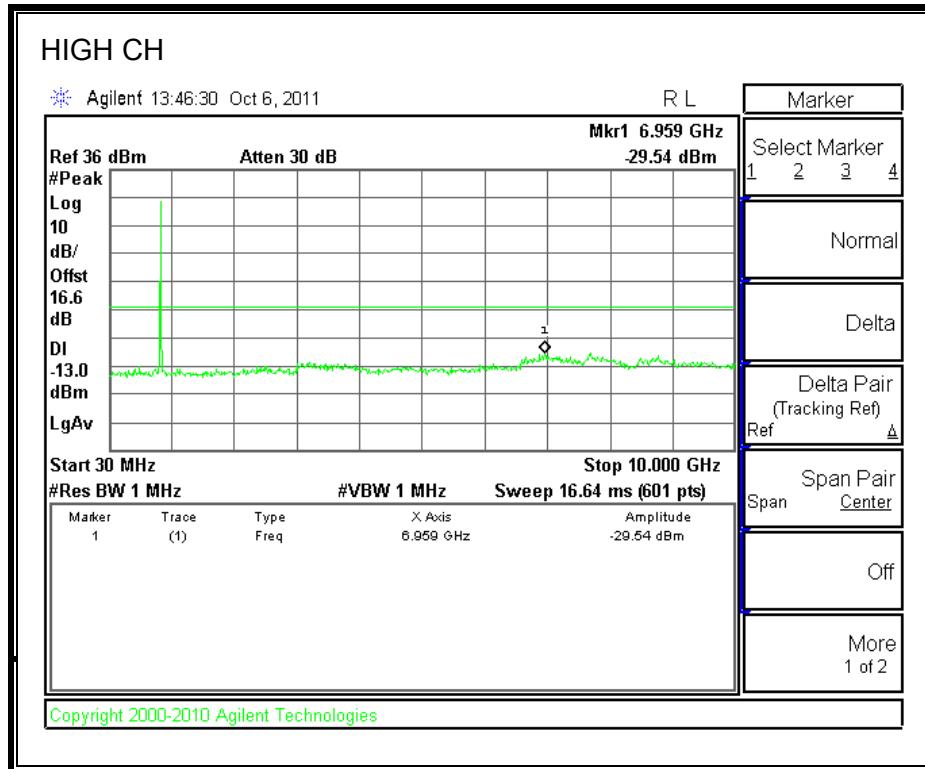
**EGPRS1900 BAND**

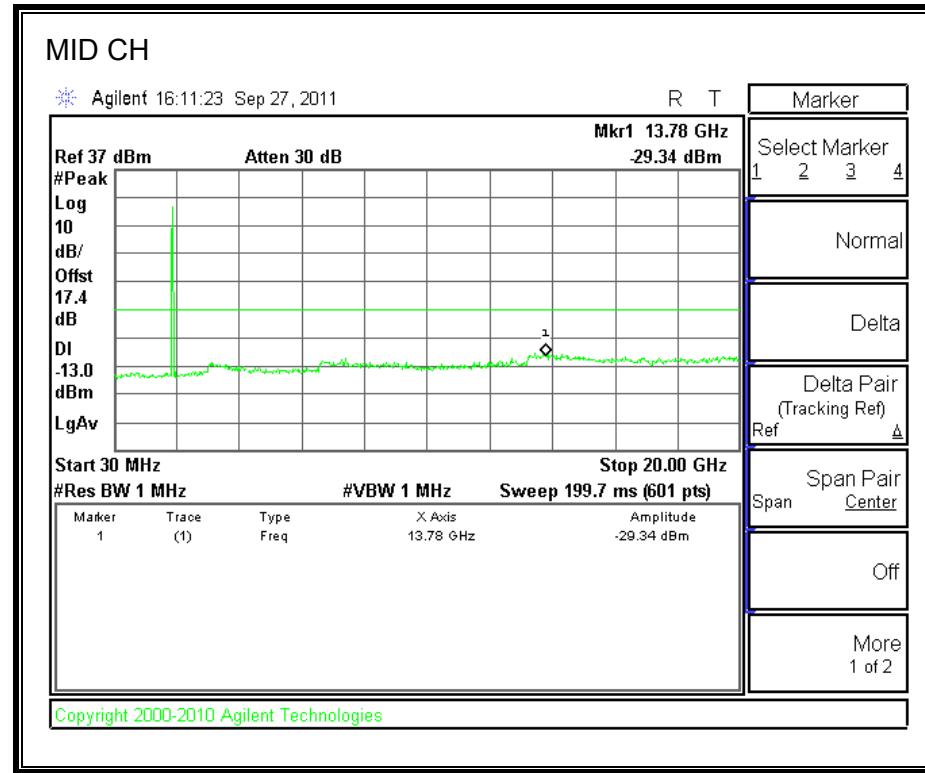
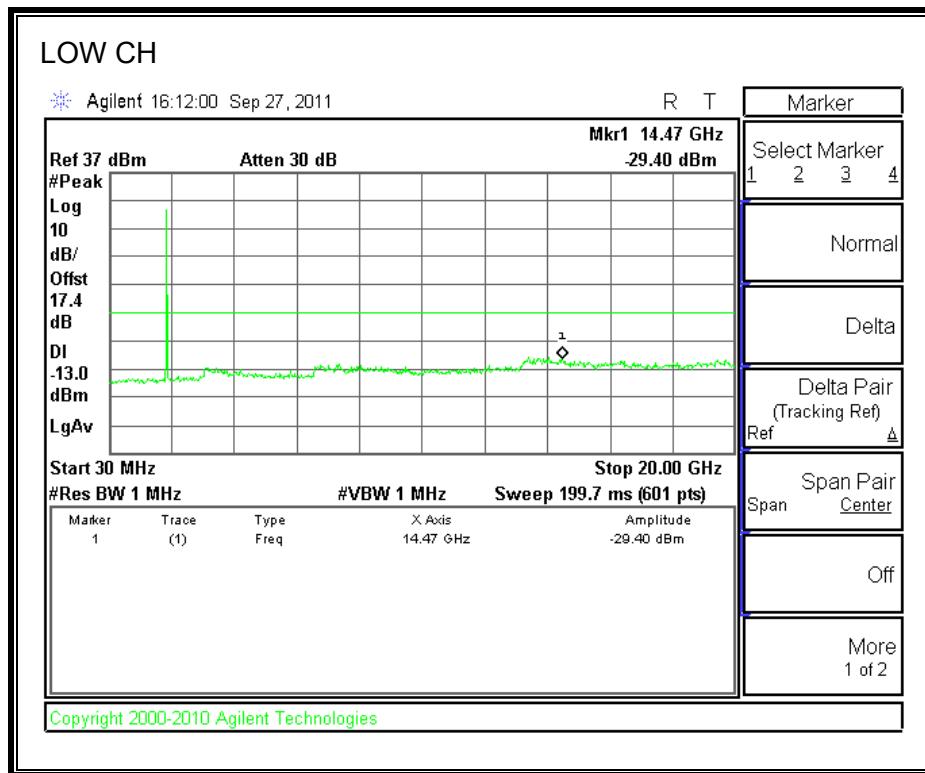


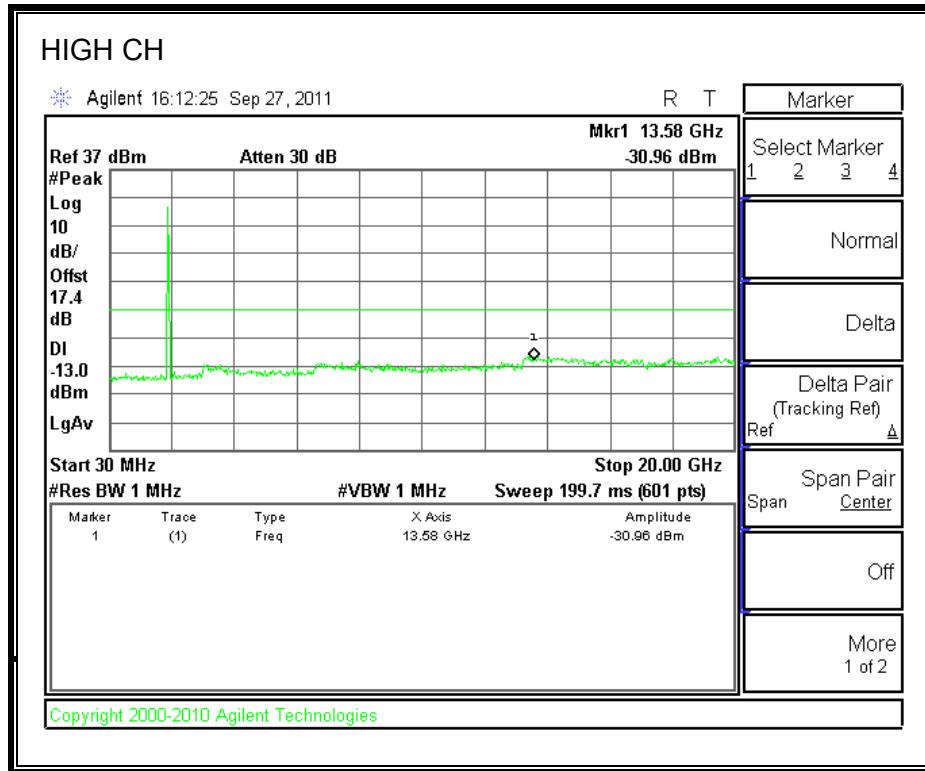
**UMTS WCDMA REL 99, Cell Band**

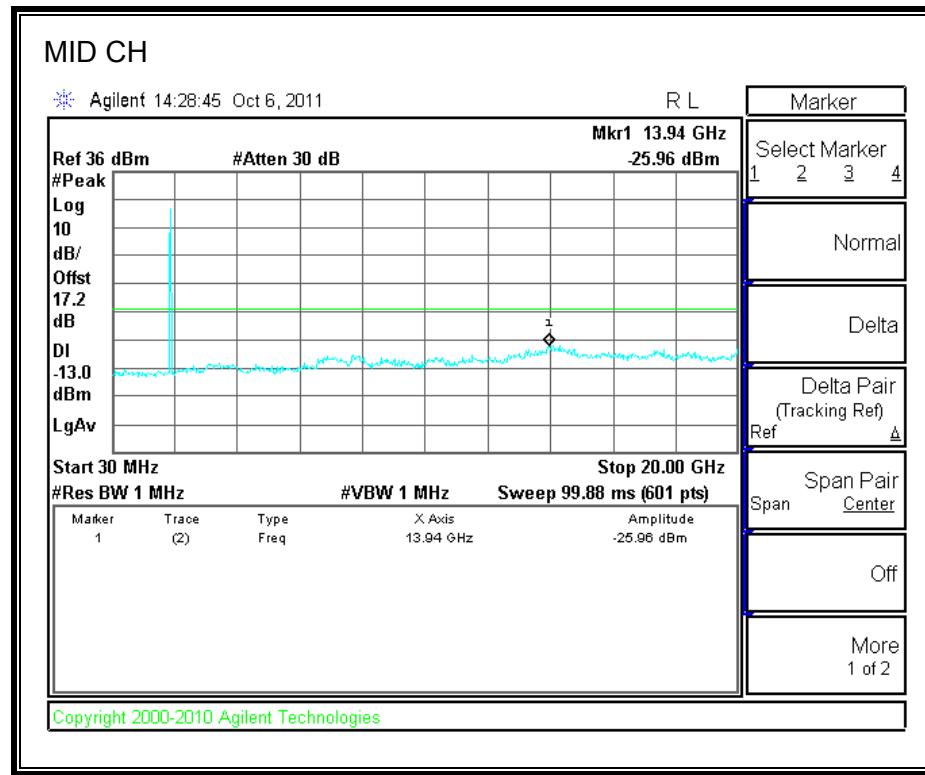
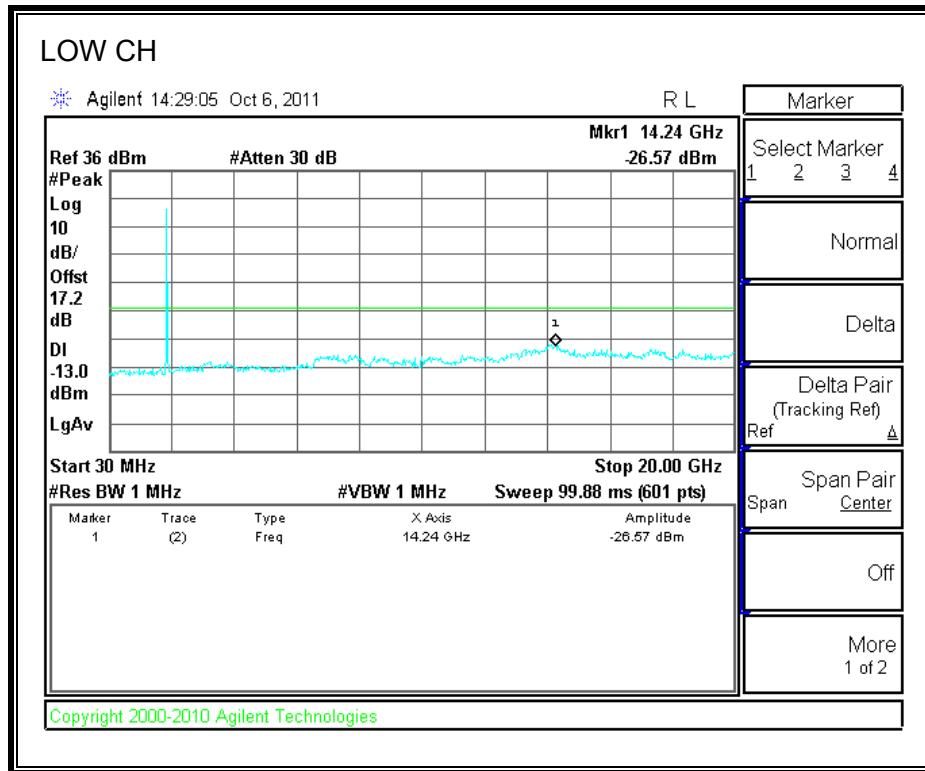


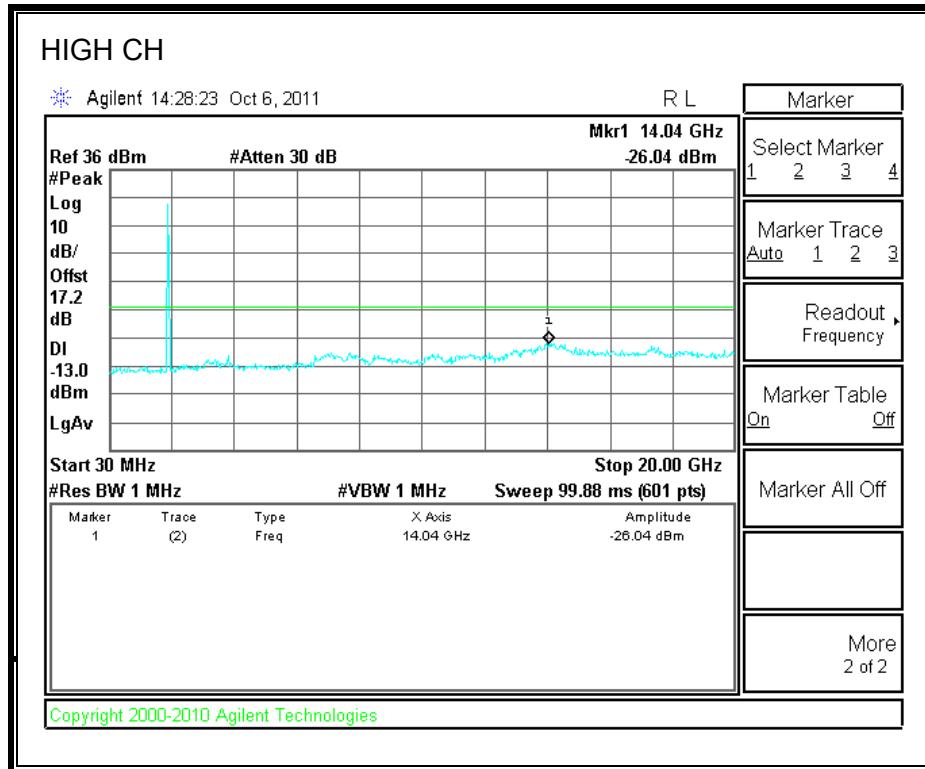
**UMTS HSDPA Rel 6, Cell Band**



**UMTS WCDMA REL 99, PCS Band**



UMTS HSDPA Rel 6, PCS Band



## 8.4. FREQUENCY STABILITY

### RULE PART(S)

FCC: §2.1055, §22.355, §24.235  
RSS132 & RSS133

### LIMITS

§22.355 & RSS-132 4.3 - The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

RSS-133 6.3 - The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

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

### TEST PROCEDURE

Use Agilent 8960 and CMW 500 with Frequency Error measurement capability.

- Temp. =  $-30^{\circ}$  to  $+50^{\circ}\text{C}$
- Voltage = 3.8 Vdc (85% - 115%)

#### **Frequency Stability vs Temperature:**

The EUT is place inside a temperature chamber. The temperature is set to  $20^{\circ}\text{C}$  and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until  $+50^{\circ}\text{C}$  is reached.

#### **Frequency Stability vs Voltage:**

The peak frequency error is recorded (worst-case).

### MODES TESTED

- GPRS and EGPRS
- UMTS, Rel 99 and HSDPA

### RESULTS

See the following pages.

CELL GSM – MID CHANNEL (GPRS)

Reference Frequency: Cellular Mid Channel 836.600044Hz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	836.600024	0.024	2.5
	40	836.599972	0.086	2.5
	30	836.599980	0.077	2.5
	<b>20</b>	<b>836.600044</b>	<b>0</b>	2.5
	10	836.600035	0.011	2.5
	0	836.600048	-0.005	2.5
	-10	836.600023	0.025	2.5
	-20	836.600043	0.001	2.5
	-30	836.600042	0.002	2.5

Reference Frequency: Cellular Mid Channel 836.600044MHz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	20	836.600044	<b>0.000</b>	2.5
	20	836.600025	0.023	2.5
	20	836.600586	-0.648	2.5
	20	836.600024	0.024	2.5

PCS, GSM – MID CHANNEL (GPRS)

Reference Frequency: PCS Mid Channel 1880.000059MHz @ 20°C Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1880.000055	0.002	2.5
	40	1880.000046	0.007	2.5
	30	1880.000065	-0.003	2.5
	<b>20</b>	<b>1880.000059</b>	<b>0</b>	<b>2.5</b>
	10	1880.000075	-0.009	2.5
	0	1880.000099	-0.021	2.5
	-10	1880.000102	-0.023	2.5
	-20	1880.000116	-0.030	2.5
	-30	1880.000078	-0.010	2.5

Reference Frequency: PCS Mid Channel 1880.000059MHz @ 20°C Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	<b>20</b>	<b>1880.000059</b>	<b>0</b>	<b>2.5</b>
	20	1880.000055	0.002	2.5
	20	1880.000054	0.003	2.5
	20	1880.000420	-0.192	2.5

CELL GSM – MID CHANNEL (EGPRS)

Reference Frequency: Cellular Mid Channel 836.599982Hz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	836.599961	0.025	2.5
3.80	40	836.599961	0.025	2.5
3.80	30	836.599972	0.012	2.5
<b>3.80</b>	<b>20</b>	<b>836.599982</b>	<b>0</b>	<b>2.5</b>
3.80	10	836.599960	0.026	2.5
3.80	0	836.600017	-0.042	2.5
3.80	-10	836.600013	-0.037	2.5
3.80	-20	836.600019	-0.044	2.5
3.80	-30	836.600036	-0.065	2.5

Reference Frequency: Cellular Mid Channel 836.599982MHz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	<b>20</b>	<b>836.599982</b>	<b>0.000</b>	<b>2.5</b>
3.40	20	836.599957	0.030	2.5
4.20	20	836.600006	-0.029	2.5
3.0 (end point voltage)	20	836.599964	0.022	2.5

PCS, GSM – MID CHANNEL (EGPRS)

Reference Frequency: PCS Mid Channel 1880.000042MHz @ 20°C Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1880.000017	0.013	2.5
3.80	40	1880.000028	0.007	2.5
3.80	30	1880.000023	0.010	2.5
<b>3.80</b>	<b>20</b>	<b>1880.000042</b>	<b>0</b>	<b>2.5</b>
3.80	10	1880.000067	-0.013	2.5
3.80	0	1880.000800	-0.403	2.5
3.80	-10	1880.000096	-0.029	2.5
3.80	-20	1880.000119	-0.041	2.5
3.80	-30	1880.000016	0.014	2.5

Reference Frequency: PCS Mid Channel 1880.000042MHz @ 20°C Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	<b>20</b>	<b>1880.000042</b>	<b>0</b>	<b>2.5</b>
3.40	20	1880.000029	0.007	2.5
4.20	20	1880.000064	-0.012	2.5
3.2V (End Point)	20	1880.000160	-0.063	2.5

CELL UMTS, HSDPA – MID CHANNEL

Reference Frequency: Cellular Mid Channel 836.000005Hz @ 20°C Limit: to stay +- 2.5 ppm = 2090.000 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	835.999986	0.023	2.5
3.80	40	836.000007	-0.002	2.5
3.80	30	836.000006	-0.001	2.5
<b>3.80</b>	<b>20</b>	<b>836.000005</b>	<b>0</b>	<b>2.5</b>
3.80	10	835.999992	0.016	2.5
3.80	0	835.999978	0.032	2.5
3.80	-10	836.000008	-0.004	2.5
3.80	-20	836.000007	-0.002	2.5
3.80	-30	836.000007	-0.002	2.5

Reference Frequency: Cellular Mid Channel 836.000005MHz @ 20°C Limit: to stay +- 2.5 ppm = 2090.000 Hz				
DC Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	<b>20</b>	<b>836.000005</b>	<b>0.000</b>	<b>2.5</b>
3.40	20	835.999986	0.023	2.5
4.26	20	836.000009	-0.005	2.5
3.3 (end point voltage)	20	835.999998	0.009	2.5

PCS, HSDPA – MID CHANNEL

Reference Frequency: PCS Mid Channel 1880.000008MHz @ 20°C Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1880.000010	-0.001	2.5
3.80	40	1880.000009	-0.001	2.5
3.80	30	1879.999990	0.010	2.5
<b>3.80</b>	<b>20</b>	<b>1880.000008</b>	<b>0</b>	<b>2.5</b>
3.80	10	1880.000011	-0.002	2.5
3.80	0	1880.000010	-0.001	2.5
3.80	-10	1880.000011	-0.002	2.5
3.80	-20	1880.000010	-0.001	2.5
3.80	-30	1880.000008	0.000	2.5

Reference Frequency: PCS Mid Channel 1880.000008MHz @ 20°C Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	<b>1880.000008</b>	<b>0</b>	<b>2.5</b>
3.40	20	1880.000005	0.002	2.5
4.20	20	1879.999985	0.012	2.5
3.3V (End Point)	20	1879.999995	0.007	2.5

## 9. RADIATED TEST RESULTS

### 9.1. RADIATED POWER (ERP & EIRP)

#### RULE PART(S)

FCC: §2.1046, §22.913, §24.232

RSS132 & RSS133

#### LIMITS

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

24.232(c) - 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 603C Clause 2.2.17

#### MODES TESTED

- GPRS and EGPRS
- WCDMA REL. 99 and HSDPA

#### RESULTS

**CELLULAR BAND (ERP)**

Mode	Channel	f (MHz)	ERP	
			dBm	mW
GPRS	128	824.20	32.20	1659.59
	192	836.60	32.40	1737.80
	251	848.80	32.20	1659.59
EGPRS	128	824.20	32.00	1584.89
	192	836.60	32.10	1621.81
	251	848.80	31.80	1513.56
WCDMA, Rel 99	4357	826.40	26.60	457.09
	4405	836.00	26.40	436.52
	4455	846.00	26.30	426.58
WCDMA, HSDPA	4357	826.40	27.20	524.81
	4405	836.00	27.10	512.86
	4455	846.00	26.70	467.74

**PCS BAND (EIRP)**

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
GPRS	512	1850.20	32.55	1798.87
	661	1880.00	32.83	1918.67
	810	1909.80	32.64	1836.54
EGPRS	512	1850.20	32.35	1717.91
	661	1880.00	32.33	1710.02
	810	1909.80	32.29	1694.34
WCDMA,REL 99	9626	1852.40	28.33	680.77
	9800	1880.00	28.74	748.17
	9938	1907.60	28.39	690.24
WCDMA, HSDPA	9662	1852.40	28.35	683.91
	9800	1880.00	28.83	763.84
	9938	1907.60	28.89	774.46

**GPRS850 BAND**

High Frequency Substitution Measurement Compliance Certification Services Chamber B																
Company:	Apple															
Project #:	11U14054															
Date:	11/28/11															
Test Engineer:	Chin Pang															
Configuration:	EUT only															
Mode:	TX, CELL BAND GPRS Peak															
Test Equipment:																
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)																
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.																
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes								
<b>Low Ch</b>																
824.20	32.70	V	0.5	0.0	32.20	38.5	6.2									
824.20	24.90	H	0.5	0.0	24.40	38.5	-14.0									
<b>Mid Ch</b>																
836.60	32.90	V	0.5	0.0	32.40	38.5	6.0									
836.60	24.40	H	0.5	0.0	23.90	38.5	-14.5									
<b>High Ch</b>																
848.80	32.70	V	0.5	0.0	32.20	38.5	6.2									
848.80	24.40	H	0.5	0.0	23.90	38.5	-14.5									

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**ERP EGPRS850 BAND**

High Frequency Substitution Measurement Compliance Certification Services Chamber B																
Company:	Apple															
Project #:	11U14054															
Date:	12/08/11															
Test Engineer:	Chin Pang															
Configuration:	EUT only															
Mode:	TX, CELL BAND EGPRS Peak															
Test Equipment:																
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)																
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.																
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes								
Low Ch																
824.20	32.50	V	0.5	0.0	32.00	38.5	-6.4									
824.20	25.20	H	0.5	0.0	24.70	38.5	-13.7									
Mid Ch																
836.60	32.60	V	0.5	0.0	32.10	38.5	-6.3									
836.60	25.10	H	0.5	0.0	24.60	38.5	-13.8									
High Ch																
848.80	32.30	V	0.5	0.0	31.80	38.5	-6.6									
848.80	24.50	H	0.5	0.0	24.00	38.5	-14.4									
Rev. 3.17.11																

**ERP WCDMA 850MHz BAND, REI 99**

High Frequency Substitution Measurement Compliance Certification Services Chamber B																
Company:	Apple															
Project #:	11U14054															
Date:	12/08/11															
Test Engineer:	Chin Pang															
Configuration:	EUT and AC Adapter															
Mode:	TX, CELL BAND WCDMA, Rel 99															
Peak																
Test Equipment:																
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)																
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.																
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes								
Low Ch																
826.40	27.10	V	0.5	0.0	26.60	38.5	-11.8									
826.40	24.50	H	0.5	0.0	24.00	38.5	-14.4									
Mid Ch																
836.00	26.90	V	0.5	0.0	26.40	38.5	-12.0									
836.00	24.20	H	0.5	0.0	23.70	38.5	-14.7									
High Ch																
846.00	26.80	V	0.5	0.0	26.30	38.5	-12.1									
846.00	24.40	H	0.5	0.0	23.90	38.5	-14.5									

Rev. 3.17.11

**ERP WCDMA 850MHz HSDPA**

High Frequency Substitution Measurement Compliance Certification Services Chamber B																
Company:	Apple															
Project #:	11U14054															
Date:	12/08/11															
Test Engineer:	Chin Pang															
Configuration:	EUT and AC Adapter															
Mode:	TX, CELL BAND WCDMA, HSDPA															
Peak																
<u>Test Equipment:</u>																
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)																
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.																
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes								
<b>Low Ch</b>																
826.40	27.70	V	0.5	0.0	27.20	38.5	-11.2									
826.40	24.30	H	0.5	0.0	23.80	38.5	-14.6									
<b>Mid Ch</b>																
836.00	27.60	V	0.5	0.0	27.10	38.5	-11.3									
836.00	24.10	H	0.5	0.0	23.60	38.5	-14.8									
<b>High Ch</b>																
846.00	27.20	V	0.5	0.0	26.70	38.5	-11.7									
846.00	23.80	H	0.5	0.0	23.30	38.5	-15.1									
Rev. 3.17.11																

**EIRP GPRS1900 BAND**

**High Frequency Fundamental Measurement  
Compliance Certification Services Chamber B**

**Company:** Apple  
**Project #:** 11U14054  
**Date:** 12/08/11  
**Test Engineer:** Chin Pang  
**Configuration:** EUT with AC Adapter  
**Mode:** TX, PCS BAND GPRS ERP  
 Peak

**Test Equipment:**

Receiving: Horn T59, and Camber B SMA Cables

Substitution: Horn T60 Substitution, 6ft SMA Cable (208947003) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low</b>								
1.850	25.1	V	0.85	8.30	32.55	33.0	-0.5	
1.850	14.9	H	0.85	8.27	22.32	33.0	-10.7	
<b>Mid</b>								
1.880	25.5	V	0.85	8.18	32.83	33.0	-0.2	
1.880	15.5	H	0.85	8.19	22.84	33.0	-10.2	
<b>High</b>								
1.910	25.4	V	0.85	8.14	32.64	33.0	-0.4	
1.910	15.8	H	0.85	8.17	23.12	33.0	-9.9	

Rev. 3.17.11

**EIRP EGPRS1900 BAND**

High Frequency Fundamental Measurement Compliance Certification Services Chamber B								
Company:	Apple							
Project #:	11U14054							
Mode:	TX, PCS BAND EGPRS ERP Peak							
Test Equipment:								
Receiving: Horn T59, and Camber B SMA Cables								
Substitution: Horn T60 Substitution, 6ft SMA Cable (208947003) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low								
1.850	24.9	V	0.85	8.30	32.35	33.0	-0.7	
1.850	15.7	H	0.85	8.27	23.12	33.0	-9.9	
Mid								
1.880	25.0	V	0.85	8.18	32.33	33.0	-0.7	
1.880	16.1	H	0.85	8.19	23.44	33.0	-9.6	
High								
1.910	25.0	V	0.85	8.14	32.29	33.0	-0.7	
1.910	17.3	H	0.85	8.17	24.62	33.0	-8.4	
Rev. 3.17.11								

**EIRP WCDMA PCS Band, REL. 99**

High Frequency Fundamental Measurement Compliance Certification Services Chamber B																
Company:	Apple															
Project #:	11U13938															
Date:	10/25/11															
Test Engineer:	Chin Pang															
Configuration:	EUT and AC Adapter															
Mode:	TX, PCS BAND WCDMA, Rel 99 Peak															
<u>Test Equipment:</u>																
Receiving: Horn T59, and Chamber B SMA Cables																
Substitution: Horn T60 Substitution, 6ft SMA Cable (208947003) Warehouse																
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes								
Low Ch																
1.852	20.9	V	0.85	8.30	28.33	33.0	-4.7									
1.852	12.8	H	0.85	8.27	20.22	33.0	-12.8									
Mid Ch																
1.880	21.4	V	0.85	8.18	28.74	33.0	-4.3									
1.880	12.8	H	0.85	8.19	20.14	33.0	-12.9									
High Ch																
1.908	21.1	V	0.85	8.14	28.39	33.0	-4.6									
1.908	13.1	H	0.85	8.17	20.42	33.0	-12.6									
Rev. 3.17.11																

**EIRP WCDMA PCS Band HSDPA**

**High Frequency Fundamental Measurement  
Compliance Certification Services Chamber B**

**Company:** Apple  
**Project #:** 11U13938  
**Date:** 10/25/11  
**Test Engineer:** Chin Pang  
**Configuration:** EUT and AC Adapter  
**Mode:** TX, PCS BAND WCDMA, HSDPA  
 Peak

**Test Equipment:**

Receiving: Horn T59, and Camber B SMA Cables

Substitution: Horn T60 Substitution, 6ft SMA Cable (208947003) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch</b>								
1.852	20.9	V	0.85	8.30	28.35	33.0	-4.7	
1.852	12.8	H	0.85	8.27	20.22	33.0	-12.8	
<b>Mid Ch</b>								
1.880	21.5	V	0.85	8.18	28.83	33.0	-4.2	
1.880	13.6	H	0.85	8.19	20.94	33.0	-12.1	
<b>High Ch</b>								
1.908	21.6	V	0.85	8.14	28.89	33.0	-4.1	
1.908	14.0	H	0.85	8.17	21.32	33.0	-11.7	

Rev. 3.17.11

## 9.2. FIELD STRENGTH OF SPURIOUS RADIATION

### RULE PART(S)

FCC: §2.1053, §22.917, §24.238

IC: RSS-132, 4.5; RSS-133, 6.5

### 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

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### MODES TESTED

- GPRS and EGPRS
- WCDMA REL. 99 and HSDPA

### RESULTS

**ERP GPRS850 BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/07/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT with AC Adapter								
<b>Mode:</b>	TX, CELL BAND GPRS								
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch. (824.2MHz)</b>									
1.648	-14.2	V	3.0	35.5	1.0	48.8	-13.0	-35.8	
2.473	-10.3	V	3.0	35.4	1.0	44.7	-13.0	-31.7	
1.648	-16.8	H	3.0	35.5	1.0	51.3	-13.0	-38.3	
2.473	-6.0	H	3.0	35.4	1.0	40.4	-13.0	-27.4	
<b>Mid Ch. (836.6MHz)</b>									
1.673	-15.9	V	3.0	35.5	1.0	50.4	-13.0	-37.4	
2.510	-3.2	V	3.0	35.4	1.0	37.6	-13.0	-24.6	
1.673	-17.5	H	3.0	35.5	1.0	52.1	-13.0	-39.1	
2.510	-5.1	H	3.0	35.4	1.0	39.5	-13.0	-26.5	
<b>High Ch. (848.8MHz)</b>									
1.698	-16.6	V	3.0	35.5	1.0	51.1	-13.0	-38.1	
2.546	-5.0	V	3.0	35.4	1.0	39.5	-13.0	-26.5	
1.698	-15.9	H	3.0	35.5	1.0	50.4	-13.0	-37.4	
2.546	-5.9	H	3.0	35.4	1.0	40.3	-13.0	-27.3	
Rev. 03.03.09 Note: No other emissions were detected above the system noise floor.									

**ERP EGPRS850 BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/07/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT with AC Adapter								
<b>Mode:</b>	TX, CELL BAND EGPRS								
<b>Chamber</b>		<b>Pre-amplifier</b>		<b>Filter</b>		<b>Limit</b>			
5m Chamber B		T145 8449B		Filter 1		Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (824.2MHz)</b>									
1.648	-17.2	V	3.0	35.5	1.0	51.8	-13.0	-38.8	
2.473	-13.3	V	3.0	35.4	1.0	47.7	-13.0	-34.7	
1.648	21.8	H	3.0	35.5	1.0	56.3	-13.0	-43.3	
2.473	-6.2	H	3.0	35.4	1.0	40.6	-13.0	-27.6	
<b>Mid Ch, (836.6MHz)</b>									
1.673	-18.9	V	3.0	35.5	1.0	53.4	-13.0	-40.4	
2.510	9.2	V	3.0	35.4	1.0	43.6	-13.0	-30.6	
1.673	-19.5	H	3.0	35.5	1.0	54.1	-13.0	-41.1	
2.510	-10.1	H	3.0	35.4	1.0	44.5	-13.0	-31.5	
<b>High Ch, (848.8MHz)</b>									
1.698	-18.6	V	3.0	35.5	1.0	53.1	-13.0	-40.1	
2.546	9.0	V	3.0	35.4	1.0	43.5	-13.0	-30.5	
1.698	20.3	H	3.0	35.5	1.0	54.8	-13.0	-41.8	
2.546	-10.7	H	3.0	35.4	1.0	45.1	-13.0	-32.1	
Rev. 03.03.09 Note: No other emissions were detected above the system noise floor.									

**ERP WCDMA Rel 99, CELL BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/08/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT with AC Adapter								
<b>Mode:</b>	TX, WCDMA 850, Rel 99								
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (826.4MHz)</b>									
1.653	-12.7	V	3.0	35.5	1.0	47.2	-13.0	34.2	
2.479	-10.8	V	3.0	35.4	1.0	45.2	-13.0	32.2	
1.653	-13.7	H	3.0	35.5	1.0	48.3	-13.0	35.3	
2.479	-12.2	H	3.0	35.4	1.0	46.6	-13.0	33.6	
<b>Mid Ch, (836MHz)</b>									
1.672	-10.9	V	3.0	35.5	1.0	45.4	-13.0	32.4	
2.508	-14.2	V	3.0	35.4	1.0	48.6	-13.0	35.6	
1.672	-11.5	H	3.0	35.5	1.0	46.1	-13.0	33.1	
2.508	-13.6	H	3.0	35.4	1.0	48.0	-13.0	35.0	
<b>High Ch, (846MHz)</b>									
1.692	-10.6	V	3.0	35.5	1.0	45.1	-13.0	32.1	
2.538	-12.1	V	3.0	35.4	1.0	46.5	-13.0	33.5	
1.692	-15.4	H	3.0	35.5	1.0	49.9	-13.0	36.9	
2.538	-13.9	H	3.0	35.4	1.0	48.4	-13.0	35.4	

Rev. 03.03.09  
Note: No other emissions were detected above the system noise floor.

**ERP HSDPA Rel 6, CELL BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/08/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT with AC Adapter								
<b>Mode:</b>	TX, WCDMA 850, HSDPA								
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (826.4MHz)</b>									
1.653	-17.2	V	3.0	35.5	1.0	51.7	-13.0	-38.7	
2.479	-18.3	V	3.0	35.4	1.0	52.7	-13.0	-39.7	
1.653	-21.7	H	3.0	35.5	1.0	56.3	-13.0	-43.3	
2.479	-19.4	H	3.0	35.4	1.0	53.8	-13.0	-40.8	
<b>Mid Ch, (836MHz)</b>									
1.672	-15.9	V	3.0	35.5	1.0	50.4	-13.0	-37.4	
2.508	-16.2	V	3.0	35.4	1.0	52.6	-13.0	-39.6	
1.672	-17.5	H	3.0	35.5	1.0	52.1	-13.0	-39.1	
2.508	-16.1	H	3.0	35.4	1.0	52.5	-13.0	-39.5	
<b>High Ch, (846MHz)</b>									
1.692	-14.6	V	3.0	35.5	1.0	49.1	-13.0	-36.1	
2.538	-18.1	V	3.0	35.4	1.0	52.5	-13.0	-39.5	
1.692	-20.4	H	3.0	35.5	1.0	54.9	-13.0	-41.9	
2.538	-18.4	H	3.0	35.4	1.0	52.9	-13.0	-39.9	

Rev. 03.03.09  
Note: No other emissions were detected above the system noise floor.

**EIRP GPRS1900 BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/07/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT with AC Adapter								
<b>Mode:</b>	TX, PCS BAND GPRS								
<b>Chamber</b>		<b>Pre-amplifier</b>		<b>Filter</b>		<b>Limit</b>			
5m Chamber B		T145 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (1850.2MHz)</b>									
3.703	-15.9	V	3.0	35.4	1.0	-50.2	-13.0	37.2	
5.555	-12.8	V	3.0	35.4	1.0	-47.2	-13.0	34.2	
3.703	-13.7	H	3.0	35.4	1.0	-48.0	-13.0	35.0	
5.555	4.0	H	3.0	35.4	1.0	-38.4	-13.0	25.4	
<b>Mid Ch, (1880.0MHz)</b>									
3.760	-13.7	V	3.0	35.3	1.0	-48.1	-13.0	35.1	
5.640	9.7	V	3.0	35.4	1.0	-44.1	-13.0	31.1	
3.760	-12.5	H	3.0	35.3	1.0	-46.8	-13.0	33.8	
5.640	-1.8	H	3.0	35.4	1.0	-36.3	-13.0	23.3	
<b>High Ch, (1909.8MHz)</b>									
3.818	-16.6	V	3.0	35.3	1.0	-50.9	-13.0	37.9	
5.726	8.6	V	3.0	35.4	1.0	-43.1	-13.0	30.1	
3.818	-16.3	H	3.0	35.3	1.0	-50.6	-13.0	37.6	
5.726	0.7	H	3.0	35.4	1.0	-35.1	-13.0	22.1	

Rev. 03.03.09  
Note: No other emissions were detected above the system noise floor.

**EIRP EGPRS1900 BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/07/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT with AC Adapter								
<b>Mode:</b>	TX, PCS BAND EGPRS								
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (1850.2MHz)</b>									
3.703	-17.9	V	3.0	35.4	1.0	52.2	-13.0	39.2	
5.555	-5.8	V	3.0	35.4	1.0	40.2	-13.0	27.2	
3.703	-16.7	H	3.0	35.4	1.0	51.0	-13.0	38.0	
5.555	-6.0	H	3.0	35.4	1.0	40.4	-13.0	27.4	
<b>Mid Ch, (1880.0MHz)</b>									
3.760	-17.7	V	3.0	35.3	1.0	52.1	-13.0	39.1	
5.640	-6.3	V	3.0	35.4	1.0	40.7	-13.0	27.7	
3.760	-16.5	H	3.0	35.3	1.0	50.8	-13.0	37.8	
5.640	-3.0	H	3.0	35.4	1.0	37.5	-13.0	24.5	
<b>High Ch, (1909.8MHz)</b>									
3.818	-18.3	V	3.0	35.3	1.0	52.6	-13.0	39.6	
5.726	-6.6	V	3.0	35.4	1.0	41.1	-13.0	28.1	
3.818	-18.5	H	3.0	35.3	1.0	52.8	-13.0	39.8	
5.726	-3.7	H	3.0	35.4	1.0	38.1	-13.0	25.1	

Rev. 03.03.09  
Note: No other emissions were detected above the system noise floor.

EIRP WCDMA Rel 99, PCS BAND

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/08/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT and AC Adapter								
<b>Mode:</b>	TX, PCS BAND WCDMA, Rel99								
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (1852.4MHz)</b>									
3.705	-16.9	V	3.0	35.4	1.0	-51.2	-13.0	38.2	
5.557	-14.3	V	3.0	35.4	1.0	-48.7	-13.0	35.7	
3.705	-18.1	H	3.0	35.4	1.0	-52.4	-13.0	39.4	
5.557	-12.0	H	3.0	35.4	1.0	-46.4	-13.0	33.4	
<b>Mid Ch, (1880.0MHz)</b>									
3.760	-16.7	V	3.0	35.3	1.0	-51.1	-13.0	38.1	
5.640	-15.7	V	3.0	35.4	1.0	-50.1	-13.0	37.1	
3.760	-14.3	H	3.0	35.3	1.0	-48.6	-13.0	35.6	
5.640	-10.8	H	3.0	35.4	1.0	-45.3	-13.0	32.3	
<b>High Ch, (1907.6MHz)</b>									
3.815	-8.6	V	3.0	35.3	1.0	-42.9	-13.0	29.9	
5.723	-10.1	V	3.0	35.4	1.0	-44.6	-13.0	31.6	
3.815	-12.3	H	3.0	35.3	1.0	-46.6	-13.0	33.6	
5.723	-9.7	H	3.0	35.4	1.0	-44.1	-13.0	31.1	

Rev. 03.03.09  
Note: No other emissions were detected above the system noise floor.

**EIRP HSDPA Rel 6; PCS BAND**

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>	Apple								
<b>Project #:</b>	11U14054								
<b>Date:</b>	12/08/11								
<b>Test Engineer:</b>	Chin Pang								
<b>Configuration:</b>	EUT and AC Adapter								
<b>Mode:</b>	TX, PCS BAND WCDMA, HSDPA								
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>Low Ch, (1852.4MHz)</b>									
3.705	-16.9	V	3.0	35.4	1.0	-51.2	-13.0	38.2	
5.557	-14.8	V	3.0	35.4	1.0	-49.2	-13.0	36.2	
3.705	-18.7	H	3.0	35.4	1.0	-53.0	-13.0	40.0	
5.557	-14.2	H	3.0	35.4	1.0	-48.6	-13.0	35.6	
<b>Mid Ch, (1880.0MHz)</b>									
3.760	-16.7	V	3.0	35.3	1.0	-51.1	-13.0	38.1	
5.640	-14.7	V	3.0	35.4	1.0	-49.1	-13.0	36.1	
3.760	-17.5	H	3.0	35.3	1.0	-51.8	-13.0	38.8	
5.640	-13.8	H	3.0	35.4	1.0	-48.3	-13.0	35.3	
<b>High Ch, (1907.6MHz)</b>									
3.815	-12.6	V	3.0	35.3	1.0	-46.9	-13.0	33.9	
5.723	-13.4	V	3.0	35.4	1.0	-47.9	-13.0	34.9	
3.815	-14.3	H	3.0	35.3	1.0	-48.6	-13.0	35.6	
5.723	-13.2	H	3.0	35.4	1.0	-47.6	-13.0	34.6	

Rev. 03.03.09  
Note: No other emissions were detected above the system noise floor.

### 9.3. RECEIVER SPURIOUS EMISSIONS

#### RULE PART(S)

FCC: N/A

#### LIMIT

RSS-Gen 7.2.2

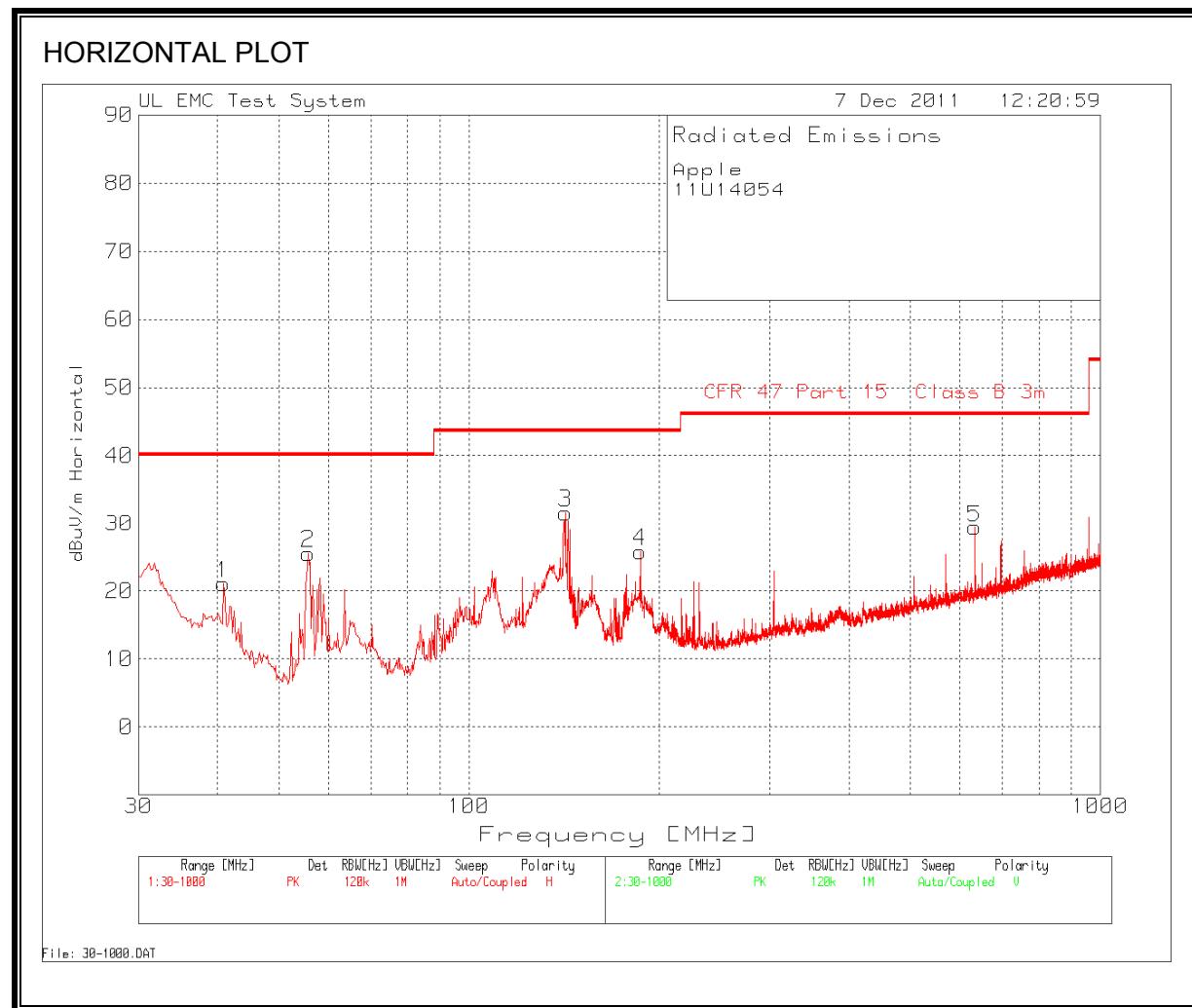
Spurious Emission Limits for Receivers:

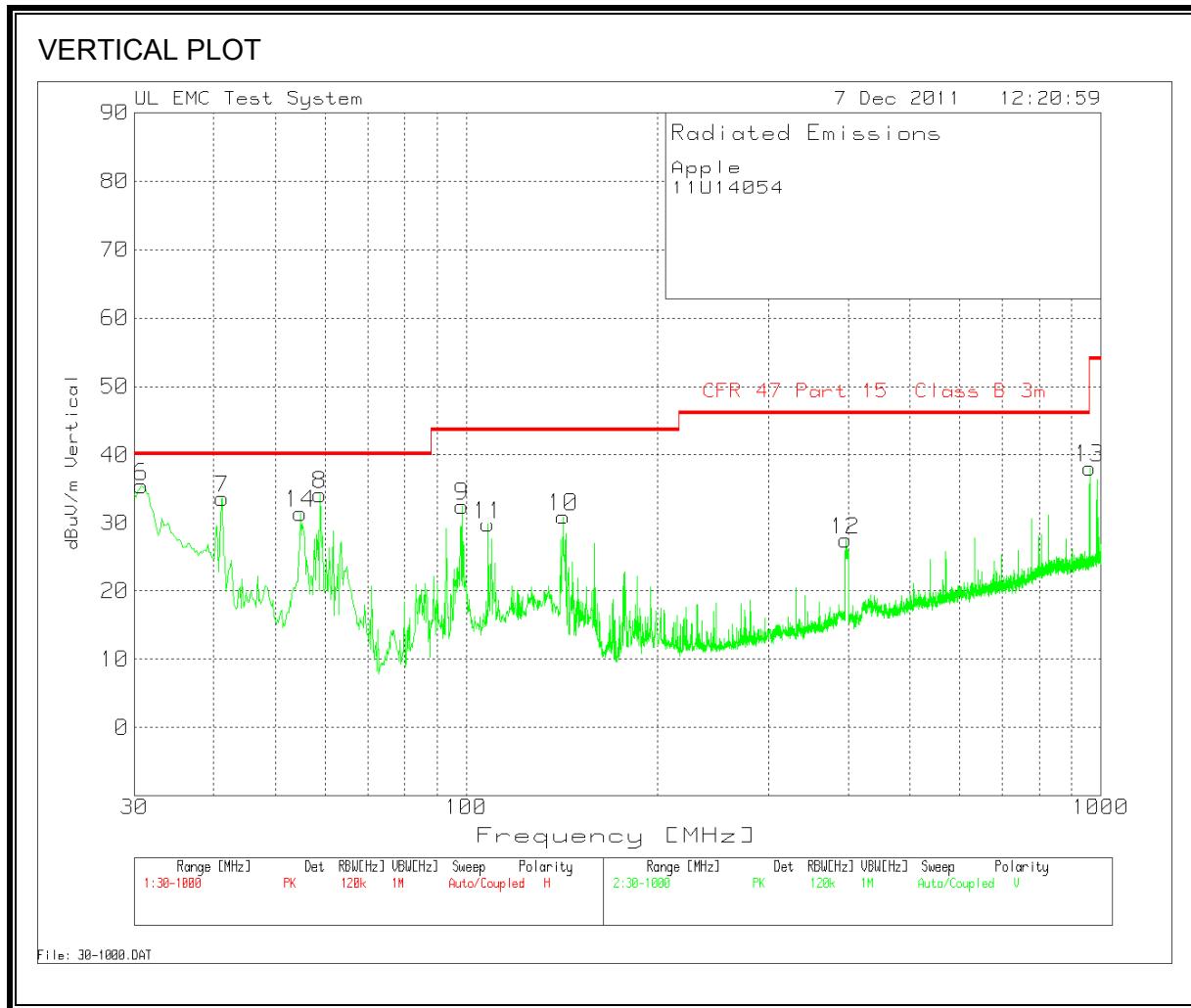
Spurious Frequency (MHz)	Field Strength (microvolts/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

#### TEST PROCEDURE

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (local oscillator frequency, intermediate frequency or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable and local oscillator frequencies.

#### RESULTS

**RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, HORIZONTAL**

RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, VERTICAL

## HORIZONTAL AND VERTICAL DATA

Apple								
11U14054								
Engineer: Chin Pang								
Date: Dec 7, 2011								
Range 1 30 - 1000MHz								
Frequency	Reading	Detector	ChmbrB Amp [dB]	Ant Factors.[dB]	dBuV/m	Part 15	B Margin	Polarity
40.8553	36.63	PK	-29.2	13.6	21.03	40	-18.97	Horz
55.5875	46.58	PK	-29	7.9	25.48	40	-14.52	Horz
142.2362	46.65	PK	-28.1	13.1	31.65	43.5	-11.85	Horz
186.8205	42.38	PK	-27.7	11.1	25.78	43.5	-17.72	Horz
633.0516	37.26	PK	-26.5	18.6	29.36	46	-16.64	Horz
Range 2 30 - 1000MHz								
Frequency	Reading	Detector	ChmbrB Amp [dB]	Ant Factors.[dB]	dBuV/m	Part 15	B Margin	Polarity
30.7754	44.75	PK	-29.3	20	35.45	40	-4.55	Vert
41.243	49.54	PK	-29.2	13.3	33.64	40	-6.36	Vert
58.8829	55.37	PK	-29	7.9	34.27	40	-5.73	Vert
98.6211	51.47	PK	-28.6	9.7	32.57	43.5	-10.93	Vert
142.2362	45.93	PK	-28.1	13.1	30.93	43.5	-12.57	Vert
108.3133	46.75	PK	-28.5	11.6	29.85	43.5	-13.65	Vert
395.9792	39.38	PK	-26.9	15	27.48	46	-18.52	Vert
961.0372	40.27	PK	-24.3	22.2	38.17	54	-15.83	Vert
54.8122	52.56	PK	-29	7.9	31.46	40	-8.54	Vert

**RECEIVER SPURIOUS EMISSIONS ABOVE 1000 MHz**

Note: No emissions were detected above the system noise floor.

## 9.4. POWER LINE CONDUCTED EMISSION

### LIMIT

RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radio communication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

Table 2 – AC Power Lines Conducted Emission Limits

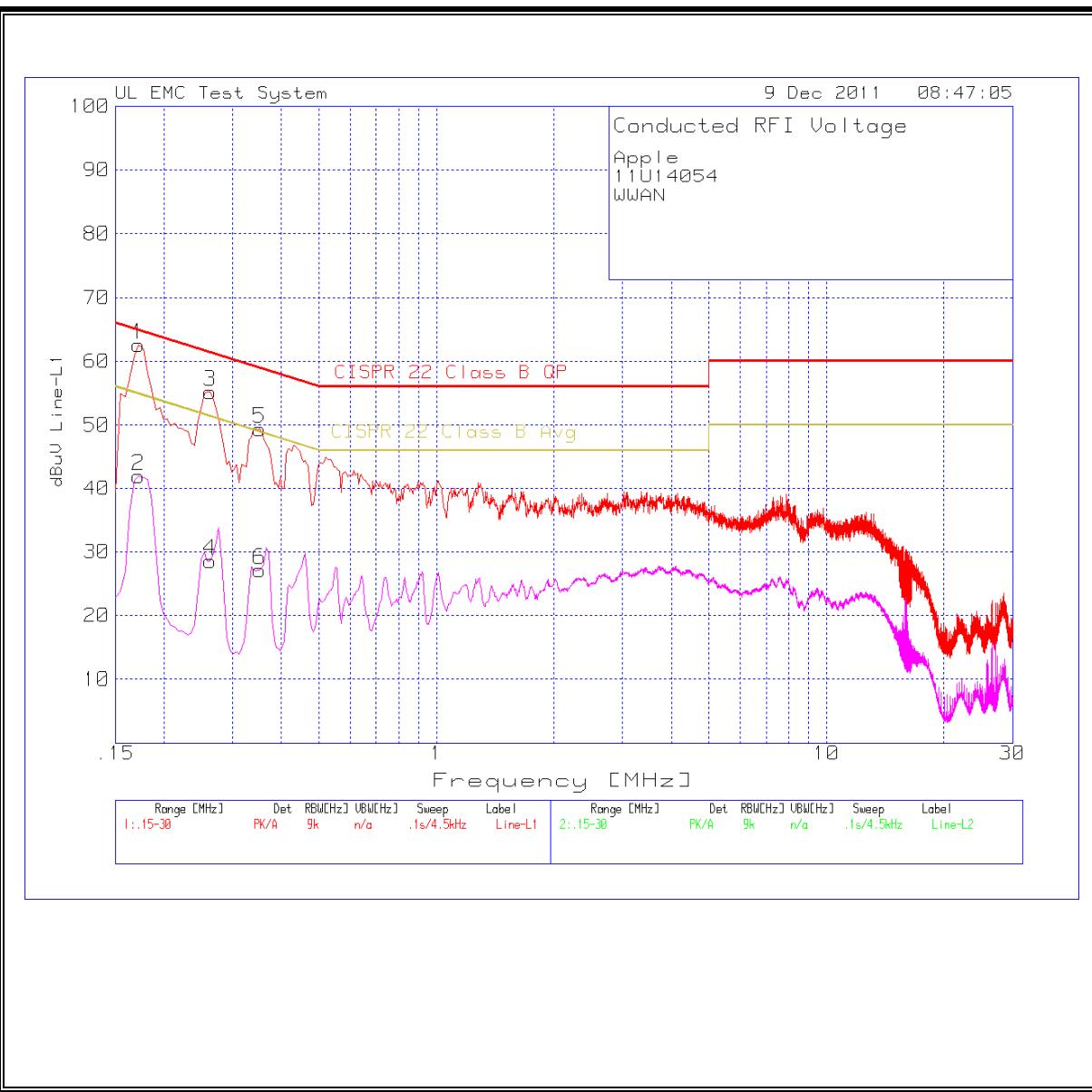
Frequency of Emission (MHz)		Conducted Limit (dBuV)	
0.15-0.5	0.5-5	Quasi-peak	
		Average	
	5-30	66 to 56 <sup>*</sup>	56 to 46 <sup>*</sup>
		56	46
		60	50

<sup>\*</sup> Decreases with the logarithm of the frequency.

### RESULTS

#### 6 WORST EMISSIONS

Apple								
11U14054								
WWAN								
12/9/2011								
Line-L1 .15 - 30MHz								
Frequency	Reading	Detector	Path Loss	dBuV	Class B QP	Margin	Class B Avg	Margin
0.1725	61.19	PK	1.4	62.59	64.8	-2.21		
0.1725	40.65	Av	1.4	42.05			54.8	-12.75
0.2625	54.47	PK	0.8	55.27	61.4	-6.13		
0.2625	27.75	Av	0.8	28.55			51.4	-22.85
0.3525	48.67	PK	0.7	49.37	58.9	-9.53		
0.3525	26.43	Av	0.7	27.13			48.9	-21.77
Line-L2 .15 - 30MHz								
Frequency	Reading	Detector	Path Loss	dBuV	Class B QP	Margin	Class B Avg	Margin
0.1725	54.59	PK	1.3	55.89	64.8	-8.91		
0.1725	37.98	Av	1.3	39.28			54.8	-15.52
0.2625	49.92	PK	0.8	50.72	61.4	-10.68		
0.2625	24.06	Av	0.8	24.86			51.4	-26.54
0.3525	46.33	PK	0.5	46.83	58.9	-12.07		
0.3525	20.64	Av	0.5	21.14			48.9	-27.76

**LINE 1 RESULTS**

**LINE 2 RESULTS**

