FCC 47 CFR PART 22H AND 24E

CERTIFICATION TEST REPORT

FOR

PORTABLE COMPUTING DEVICE WITH WWAN, 802.11B/G/A/N AND BLUETOOTH RADIOS

MODEL: 1573

FCC ID: C3K1573

REPORT NUMBER: 13U15414-11, REVISION A

ISSUE DATE: FEBRUARY 18, 2014

Prepared for
MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052, U.S.A.

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/20/13	Initial Issue	T. Chan
A	02/18/14	Correction on Section 5.1	C. Pang

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 4

2. TEST METHODOLOGY 5

3. FACILITIES AND ACCREDITATION 5

4. CALIBRATION AND UNCERTAINTY 5

4.1. MEASURING INSTRUMENT CALIBRATION 5

4.2. SAMPLE CALCULATION 5

4.3. MEASUREMENT UNCERTAINTY 5

5. EQUIPMENT UNDER TEST 6

5.1. DESCRIPTION OF EUT 6

5.2. MAXIMUM OUTPUT POWER 6

5.3. DESCRIPTION OF AVAILABLE ANTENNAS 7

5.4. SOFTWARE AND FIRMWARE 7

5.5. WORST-CASE CONFIGURATION AND MODE 7

5.6. DESCRIPTION OF TEST SETUP 8

6. TEST AND MEASUREMENT EQUIPMENT 10

7. RF POWER OUTPUT VERIFICATION 11

7.1. GPRS/EGPRS 11

7.2. UMTS REL99 14

7.3. HSDPA REL 5 16

7.4. HSPA REL 6 (HSDPA & HSUPA) 18

8. CONDUCTED TEST RESULTS 20

8.1. OCCUPIED BANDWIDTH 20

8.2. BAND EDGE 38

8.3. OUT OF BAND EMISSIONS 47

8.4. PEAK-TO-AVERAGE RATIO 60

8.5. FREQUENCY STABILITY 64

9. RADIATED TEST RESULTS 68

9.1. RADIATED POWER (ERP & EIRP) 68

9.2. FIELD STRENGTH OF SPURIOUS RADIATION 79

10. SETUP PHOTOS 89

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	MICROSOFT 1 MICROSOFT WAY REDMOND, WA, 98052, USA
EUT DESCRIPTION:	PORTABLE COMPUTING DEVICE WITH WWAN, 802.11B/G/A/N AND BLUETOOTH RADIOS
MODEL:	1573
SERIAL NUMBER:	027093733852
DATE TESTED:	OCTOBER 22 - NOVEMBER 20, 2013

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H AND 24E	Pass

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:

Thu Chan
WiSE Operations Manager
UL Verification Services Inc.

Tested By:

Mona Hua
WiSE Lab Technician
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, Part 15, Part 22, Part 24, and ANSI C63.10-2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☒ Chamber D
☐ Chamber B	☒ Chamber E
☐ Chamber C	☐ Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.UL.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 (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/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 EUT is a portable computing device with GSM, WCDMA, LTE, 802.11b/g/a/n and Bluetooth radios. Its model is 1573.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted and ERP / EIRP output powers; average detector is used for UMTS mode of Cellular band, while peak detector is used for GSM mode of Cellular and all GSM/UMTS PCS bands as follows:

GSM

Part 22 /24					
Frequency range (MHz)	Modulation	Conducted(Peak)		ERP/EIRP (Peak)	
		dBm	mW	dBm	mW
824.2 - 848.8	GPRS	33.55	2264.6	34.06	2546.8
	EGPRS	32.38	1729.8	29.79	952.8
1850.2-1909.8	GPRS	31.66	1465.5	32.55	1798.9
	EGPRS	30.60	1148.2	31.53	1422.3

WCDMA

Part 22/24		Conducted				ERP/EIRP			
Frequency range (MHz)	Modulation	Peak		Average		Peak		Average	
		dBm	mW	dBm	mW	dBm	mW	dBm	mW
826.4-846.6	REL 99			23.43	220.3			25.09	322.8
	HSDPA			23.40	218.8			24.49	281.2
1852.4 - 1907.6	REL 99			24.34	271.6			27.17	521.2
	HSDPA			24.32	270.4			26.03	400.9

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a band gap type integral antenna with peak gain for different bands as follow:

Frequency (MHz)	Antenna Gain (dBi)
CELL Band, 824 - 849	1.6
PCS Band, 1850 - 1910	2.9

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 11B433

The EUT is linked with Agilent 8960 Communication and CMW500 Test Set.

5.5. WORST-CASE CONFIGURATION AND MODE

For the fundamental investigation, since the EUT is a portable device that has three orientations; an X, Y and Z orientations and the worst-case among an X, Y, and Z with AC/DC adapter and headset have been investigated. After the investigations the worst case was found to be at X-position without AC/DC adapter and keyboard for Cell and Y-position (back stand second level opened) with keyboard for PCS band.

For the device, all tests were performed as below,
Both conducted and radiated emissions measurement in both bands performed on the following modes:

- For Cellular and PCS band: GSM, GPRS and EGPRS
- For Cellular and PCS band: UMTS, REL 99 and HSDPA

5.6. DESCRIPTION OF TEST SETUP

I/O CABLES (RF CONDUCTED TEST)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	RF Out	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	Shielded	1.0m	NA

I/O CABLES (RF RADIATED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	DC	Un-Shielded	1.2m	NA
2	Jack	1	Headset	Un-Shielded	1m	NA
3	RF In/Out	1	Horn	Shielded	5m	NA

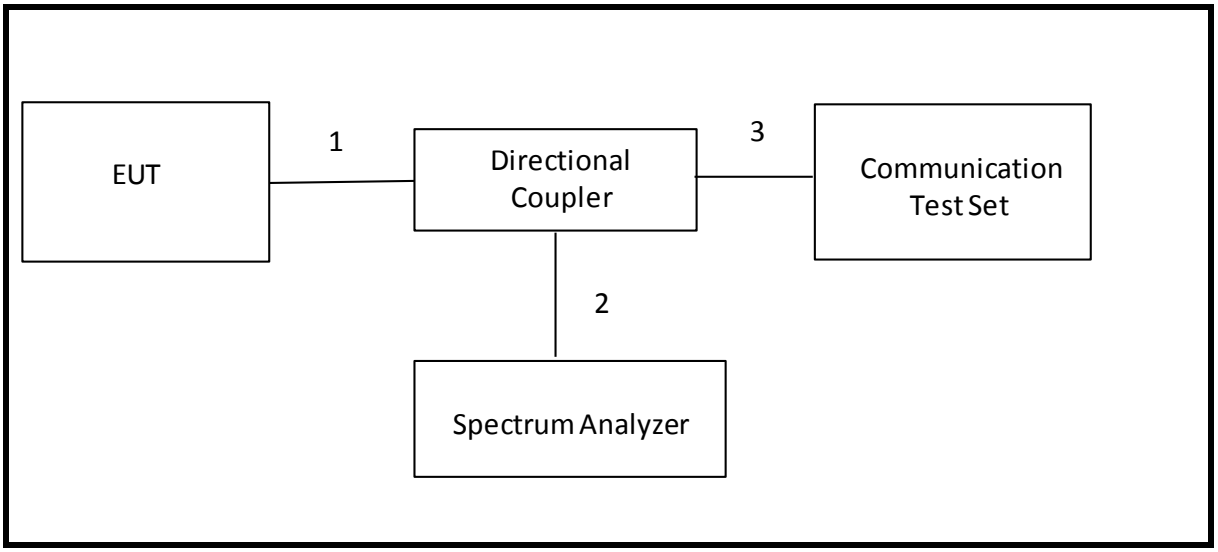
SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
AC/DC Adapter	Microsoft	1512	0D130100H2D37
DC Power Supply	Sorensen	XT 15-4	1319A02780

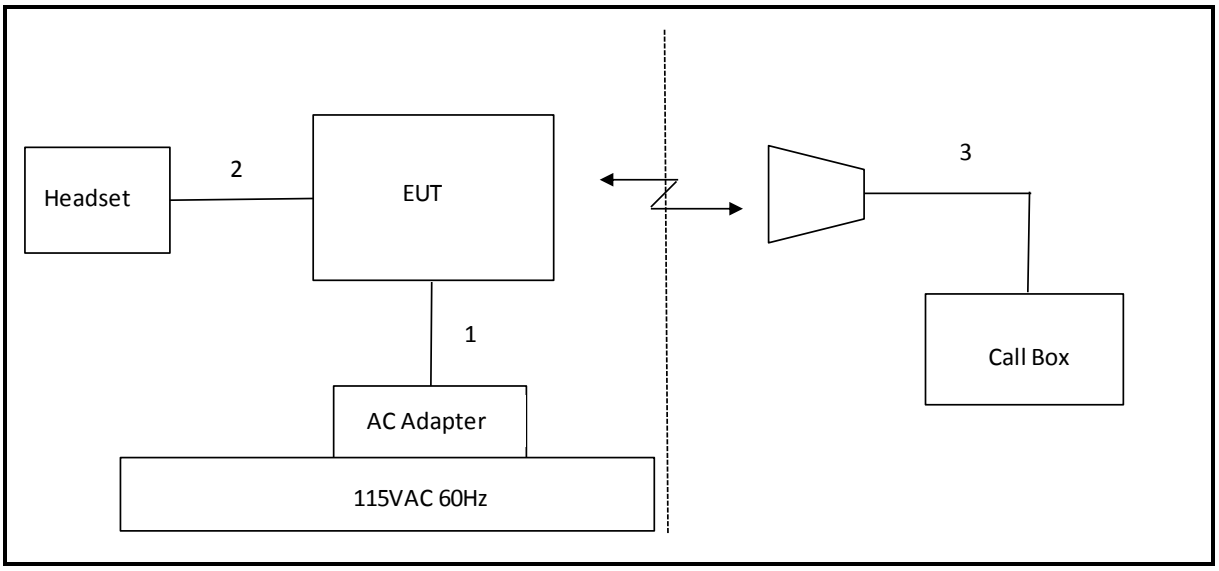
TEST SETUP

The EUT is a stand-alone device. The Communication test set exercised the EUT.

SETUP DIAGRAM FOR RF CONDUCTED 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**
Communication Test Set	R & S	CMW500	F00014	02/21/14
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	01/09/14
Vector signal generator, 6 GHz	Agilent / HP	E4438C	F00037	07/06/14
Horn Antenna	ETS Lindgren	3117	F00131	02/19/14
PreAmp 1-18GHz	Agilent/HP	8449B	C01063	03/18/14
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02686	CNR
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02688	CNR
Antenna, Tuned Dipole 400~1000 MHz	ETS Lindgren	3121C DB4	C00994	07/12/14
Spectrum Analyzer, 44GHz	Agilent	N9030A	F00129	02/21/14
Directional Coupler	Krytar	1817	N02656	CNR
Bilog, 30-1GHz	Sunol Science	A0222813-1	C01011	03/07/14
Peak Power Meter	Boonton	4541	C01189	06/20/14
Peak Power Sensor	Boonton	57006	C01202	05/29/14
PreAmp 30-1000MHz	Sonama	310	981661	11/06/14

7. RF POWER OUTPUT VERIFICATION

7.1. GPRS/EGPRS

Using CMU200 Communication Test Set

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 >	CS 4 (GPRS) and MCS5-9 (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	

Using Agilent 8960A Communication Test Set

System Config:	GSM/GPRS Mobile Test	
	E1968A	A.06.31
Call Parms:	BCH ➔	Cell Band: GSM850/PCS
	TCH ➔	Traffic Band: GSM850/PCS
		Traffic Channel: 128/192/251 or 512/661/810
		MS Tx Level: 0
	PDTCH ➔	Traffic Band: GSM850/PCS
		Traffic Channel: 128/192/251 512/661/810
		MS Tx Level: 0
		Coding Scheme: CS-4 (GPRS)
		Coding Scheme: MCS-5 to 9 (EGPRS)
		MultiSlot Config: 1up, 1 down (Assuming that the highest

conducted power)

Control:	Active Cell ➔	GSM/GPRS

Part 22 850MHz Band					
Channel	Frequency (MHz)	GPRS			
		Peak Power (dBm)			
		1 slot		2 slot	
		Peak Power (dBm)	Average Power (dBm)	Peak Power (dBm)	Average Power (dBm)
128	824.2	33.33	32.95	30.31	29.93
190	836.6	33.40	32.97	30.80	29.92
251	848.8	**33.55**	32.90	30.77	29.84

Channel	Frequency (MHz)	EGPRS			
		Peak Power (dBm)			
		1 slot		2 slot	
		Peak Power (dBm)	Average Power (dBm)	Peak Power (dBm)	Average Power (dBm)
128	824.2	32.32	27.20	26.34	23.74
190	836.6	32.31	26.93	26.10	23.42
251	848.8	**32.38**	26.60	25.92	23.28

Part 24 1900MHz Band					
Channel	Frequency (MHz)	GPRS			
		Peak Power (dBm)			
		1 slot		2 slot	
		Peak Power (dBm)	Average Power (dBm)	Peak Power (dBm)	Average Power (dBm)
512	1850.2	31.46	29.87	27.28	26.87
661	1880.0	**31.66**	30.18	27.32	27.18
810	1909.8	31.46	30.00	27.77	26.98

Channel	Frequency (MHz)	EGPRS			
		Peak Power (dBm)			
		1 slot		2 slot	
		Peak Power (dBm)	Average Power (dBm)	Peak Power (dBm)	Average Power (dBm)
512	1850.2	30.12	25.75	26.63	22.29
661	1880.0	30.13	26.01	25.69	22.52
810	1909.8	**30.60**	26.10	26.91	22.66

7.2. UMTS REL99

TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW ≥ RBW.≥ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

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
	βc	Not Applicable
	βd	Not Applicable
	βec	Not Applicable
	βc/βd	8/15
	βhs	Not Applicable
	βed	Not Applicable

RESULTS

Part 22 850MHz					
Band	**UL Channel**	**DL Channel**	**Frequency (MHz)**	**Peak Power (dBm)**	**Average Power (dBm)**
UMTS Rel. 99 850MHz	4132	4357	826.4	25.78	23.2
	4183	4408	836.0	25.55	**23.43**
	4233	4458	846.6	**25.79**	23.33

Part 24 1900MHz Band					
Band	**UL Channel**	**DL Channel**	**Frequency (MHz)**	**Peak Power (dBm)**	**Average Power (dBm)**
UMTS Rel. 99 1900MHz	9262	9662	1852.4	26.58	23.53
	9400	9800	1880.0	26.44	23.42
	9538	9938	1907.6	**27.12**	**24.34**

7.3. HSDPA REL 5

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121.

Summary of settings are illustrated below:

	Mode	Rel5 HSDPA			
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =βhs/βc	30/15			

RESULT

Part 22 850MHz						
Band	**Subtest**	**UL Channel**	**DL Channel**	**Frequency (MHz)**	**Peak Power (dBm)**	**Avearge Power (dBm)**
UMTS HSDPA 850MHz	1	4132	4357	826.4	25.94	23.19
		4183	4408	836.0	25.66	**23.40**
		4233	4458	846.6	25.96	23.31
	2	4132	4357	826.4	25.92	23.18
		4183	4408	836.0	25.66	23.38
		4233	4458	846.6	25.96	23.31
	3	4132	4357	826.4	25.84	23.18
		4183	4408	836.0	25.63	23.39
		4233	4458	846.6	25.96	23.30
	4	4132	4357	826.4	25.94	23.19
		4183	4408	836.0	25.65	23.39
		4233	4458	846.6	**25.97**	23.30

Par 24 1900MHz						
Band		**UL Channel**	**DL Channel**	**Frequency (MHz)**	**Peak Power (dBm)**	**Average Power (dBm)**
UMTS HSDPA 1900MHz	1	9262	9662	1852.4	26.49	23.52
		9400	9800	1880.0	26.40	23.40
		9538	9938	1907.6	**27.00**	**24.32**
	2	9262	9662	1852.4	26.47	23.51
		9400	9800	1880.0	26.41	23.37
		9538	9938	1907.6	26.88	24.32
	3	9262	9662	1852.4	26.48	23.51
		9400	9800	1880.0	26.39	23.36
		9538	9938	1907.6	26.88	24.31
	4	9262	9662	1852.4	26.47	23.52
		9400	9800	1880.0	26.38	23.37
		9538	9938	1907.6	26.89	24.32

7.4. HSPA REL 6 (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				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	-
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	1309/225	94/75	47/15 47/15	56/75	47/15
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	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 92 E-TFCI PO 18	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

Part 22 850MHz						
Band	**Subtest**	**UL Channel**	**DL Channel**	**Frequency (MHz)**	**Peak Power (dBm)**	**Average Power (dBm)**
UMTS HSUPA 850MHz	1	4132	4357	826.4	25.88	23.15
		4183	4408	836.0	25.61	**23.39**
		4233	4458	846.6	25.87	23.31
	2	4132	4357	826.4	25.88	23.19
		4183	4408	836.0	25.59	23.38
		4233	4458	846.6	25.90	23.31
	3	4132	4357	826.4	25.86	23.17
		4183	4408	836.0	25.63	23.38
		4233	4458	846.6	**25.99**	23.28
	4	4132	4357	826.4	25.89	23.17
		4183	4408	836.0	25.56	23.39
		4233	4458	846.6	25.82	23.30
	5	4132	4357	826.4	25.76	23.15
		4183	4408	836.0	25.63	23.39
		4233	4458	846.6	25.90	23.31

Part 24 1900MHz						
Band		**UL Channel**	**DL Channel**	**Frequency (MHz)**	**Peak Power (dBm)**	**Average Power (dBm)**
UMTS HSUPA 1900MHz	1	9262	9662	1852.4	26.56	23.48
		9400	9800	1880.0	26.35	23.40
		9538	9938	1907.6	26.78	24.31
	2	9262	9662	1852.4	26.45	23.47
		9400	9800	1880.0	26.40	23.36
		9538	9938	1907.6	26.75	24.31
	3	9262	9662	1852.4	26.41	23.47
		9400	9800	1880.0	26.33	23.37
		9538	9938	1907.6	**26.80**	**24.31**
	4	9262	9662	1852.4	26.44	23.46
		9400	9800	1880.0	26.33	23.37
		9538	9938	1907.6	26.78	24.31
	5	9262	9662	1852.4	26.45	23.46
		9400	9800	1880.0	26.33	23.37
		9538	9938	1907.6	26.78	24.31

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

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

- GSM, GPRS and EGPRS
- UMTS, REL 99 and HSDPA

RESULTS

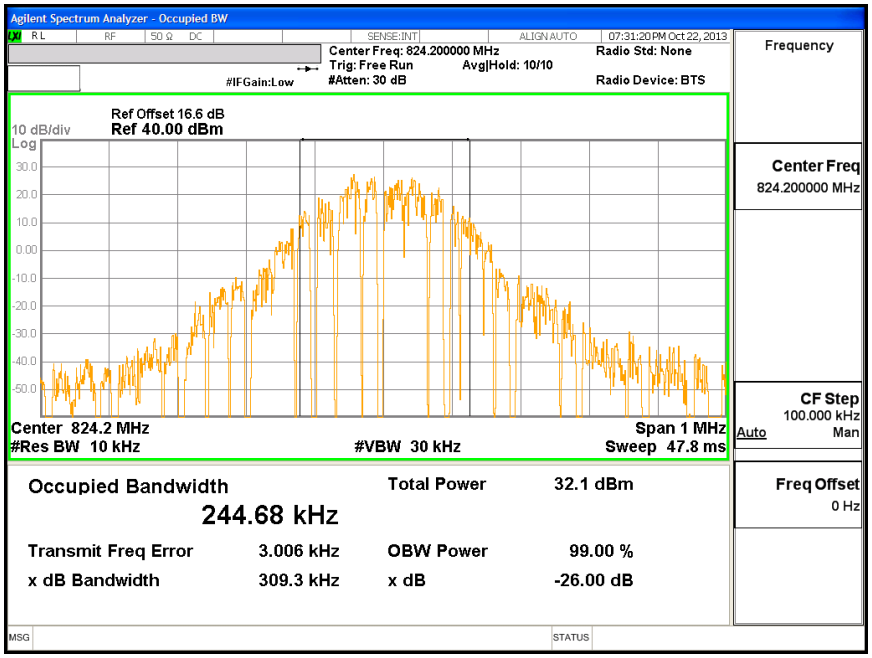
Part 22 850MHz Band					
Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
CELL	GPRS	128	824.2	244.68	309.3
		190	836.6	244.92	297.8
		251	848.8	246.45	309.8
	EGPRS	128	824.2	244.54	305.7
		190	836.6	240.40	267.9
		251	848.8	244.47	293.1
Part 24 1900MHz Band					
Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
PCS	GPRS	512	1850.2	245.92	295.4
		661	1880.0	244.68	312.7
		810	1909.8	245.58	309.0
	EGPRS	512	1850.2	241.42	306.5
		661	1880.0	241.55	322.1
		810	1909.8	247.21	289.2

Part 22, 24					
Band	Mode	DL Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
850MHz	UMTS Rel. 99	4357	826.40	4.1600	4.590
		4408	836.60	4.1278	4.699
		4458	846.60	4.1484	4.666
1900MHz		9662	1852.40	4.1571	4.637
		9800	1880.00	4.1570	4.587
		9938	1907.60	4.1904	4.672

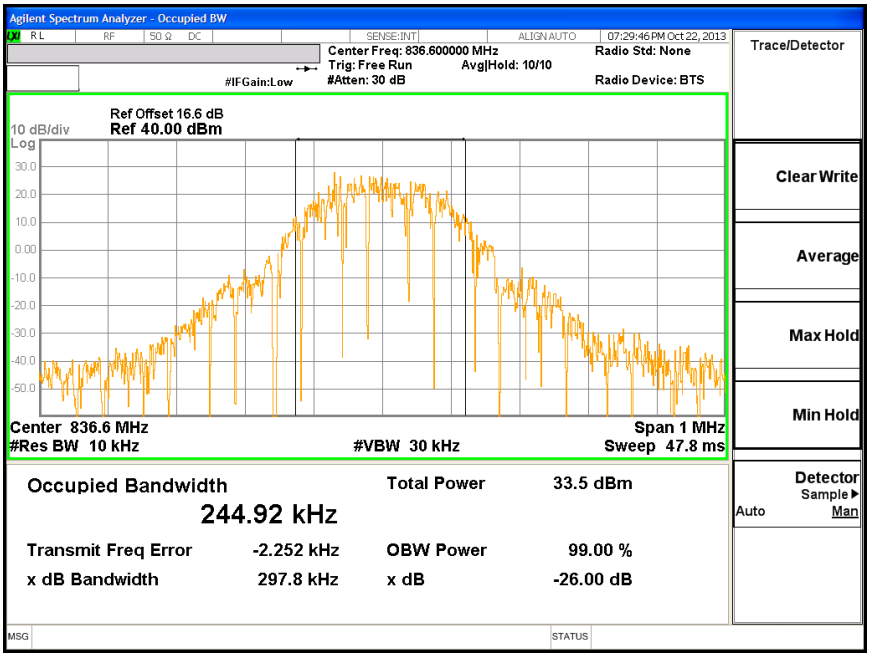
Part 22, 24					
Band	Mode	DL Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
850MHz	UMTS HSDPA	4357	826.40	4.1535	4.642
		4408	836.60	4.1750	4.643
		4458	846.60	4.1775	4.628
1900MHz		9662	1852.40	4.1591	4.608
		9800	1880.00	4.1630	4.640
		9938	1907.60	4.1837	4.714

GPRS 850MHz

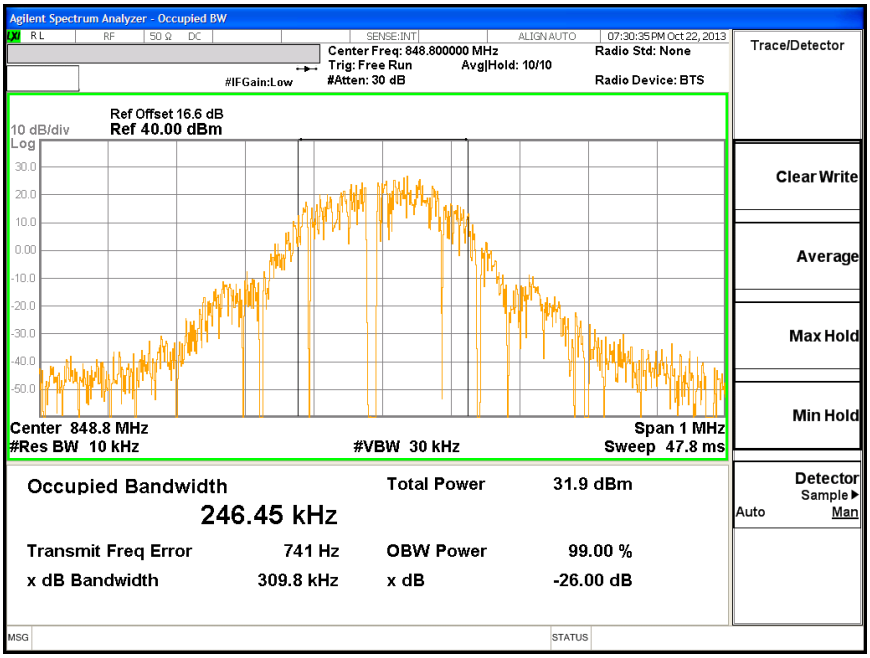
LOW CH



MID CH

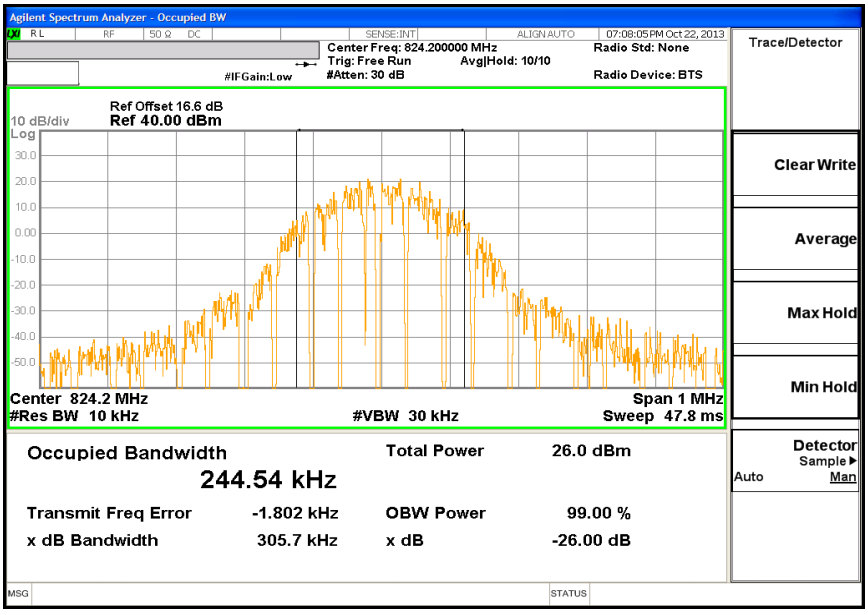


HIGH CH

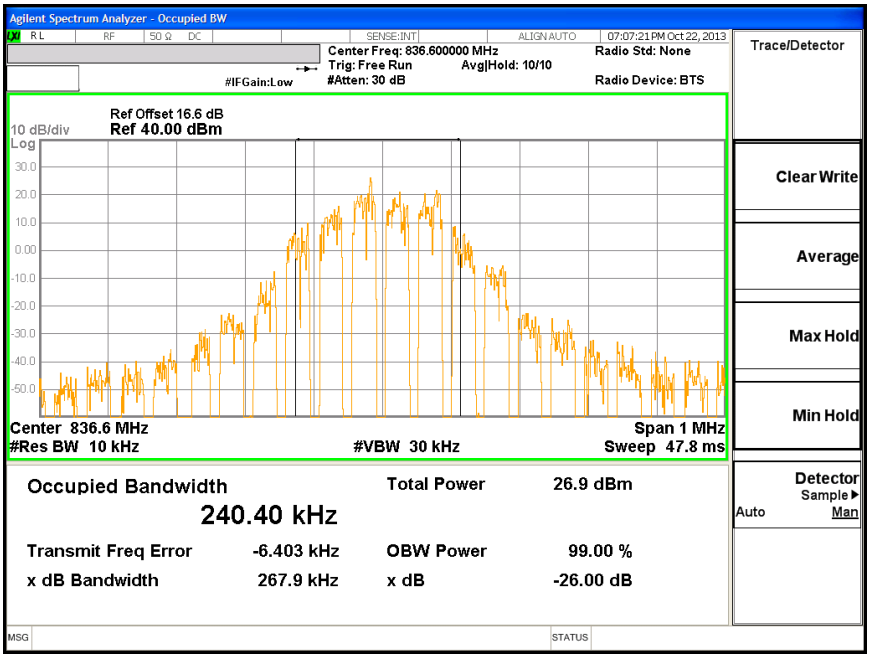


EGPRS 850MHz

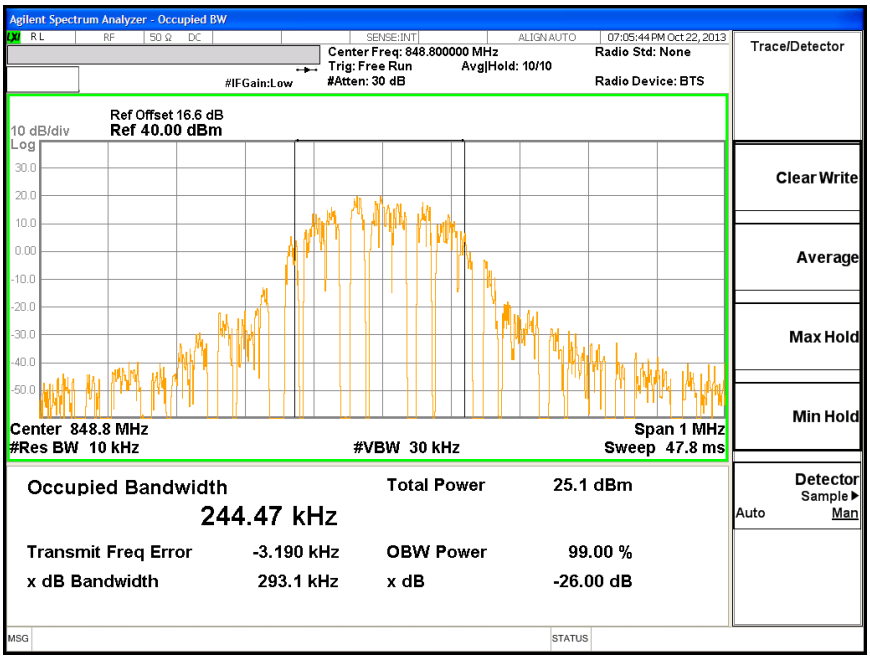
LOW CH



MID CH

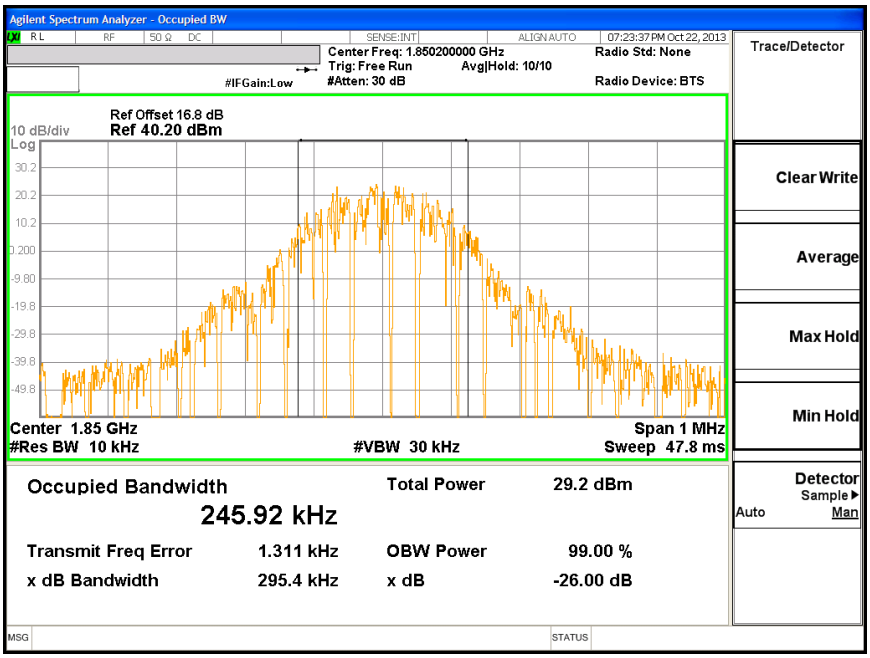


HIGH CH

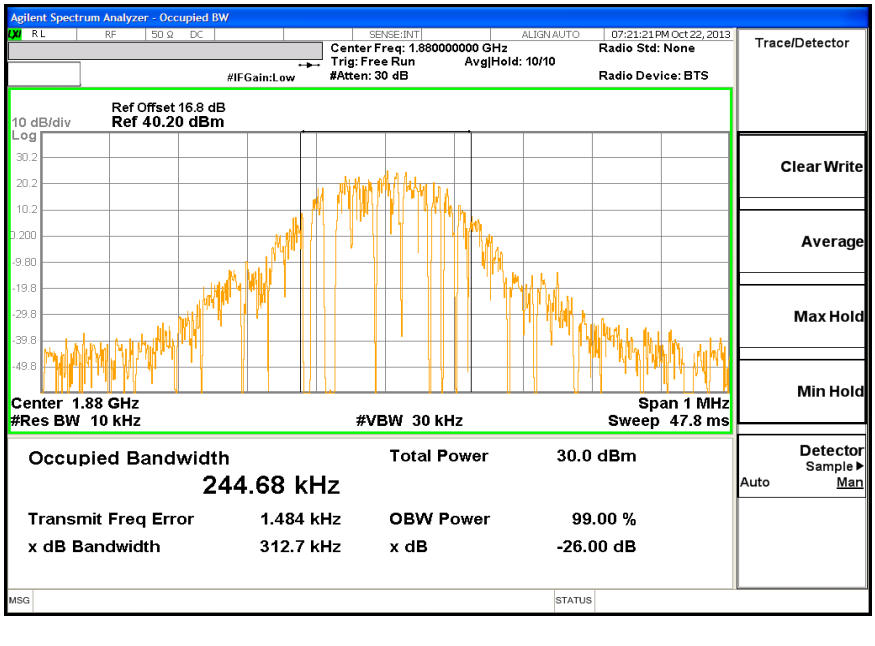


GPRS 1900MHz

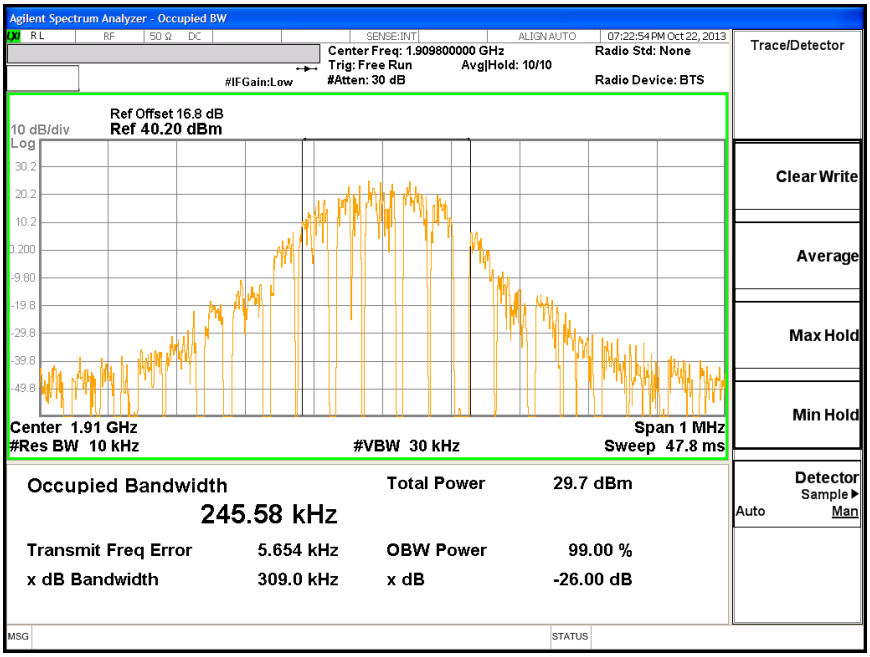
LOW CH



MID CH

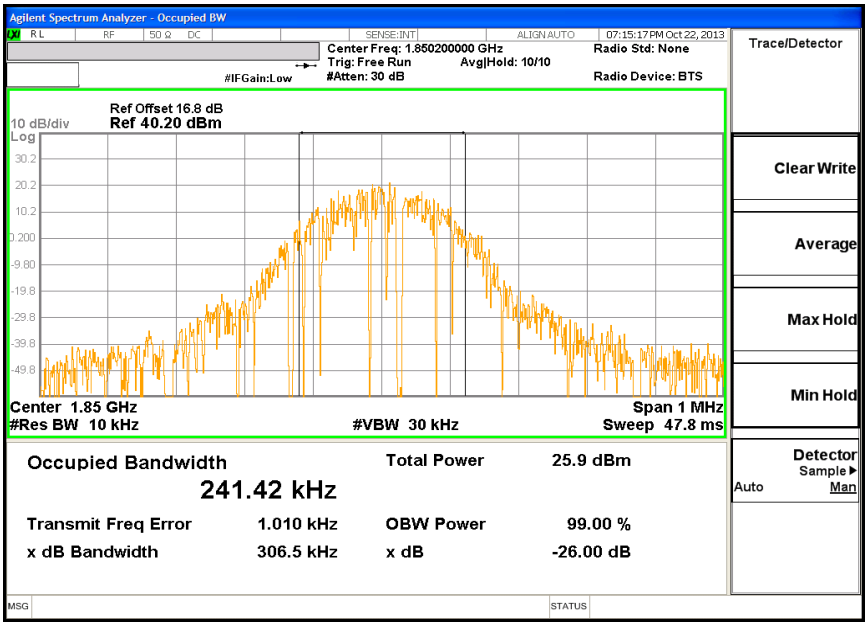


HIGH CH

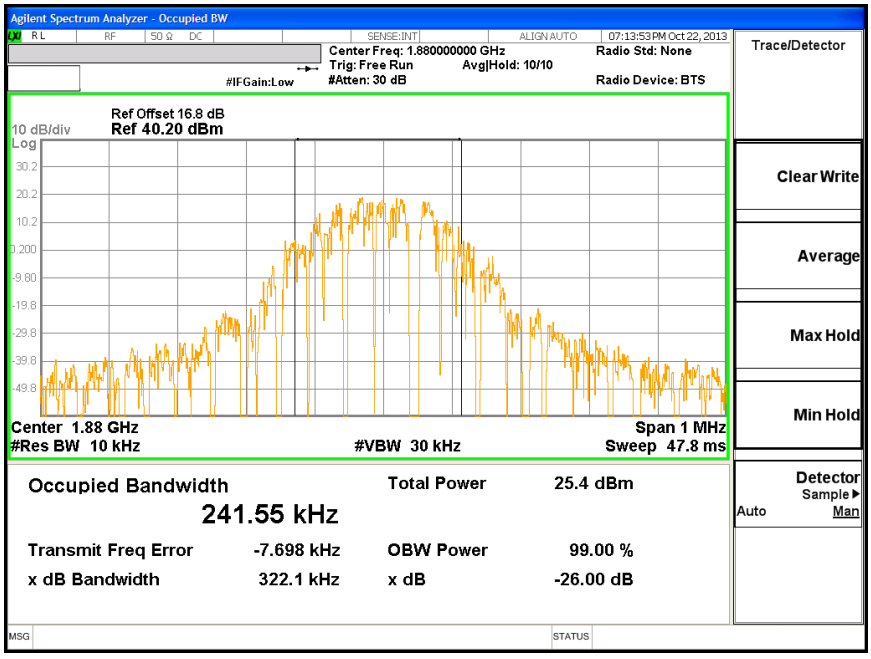


EGPRS 1900MHz

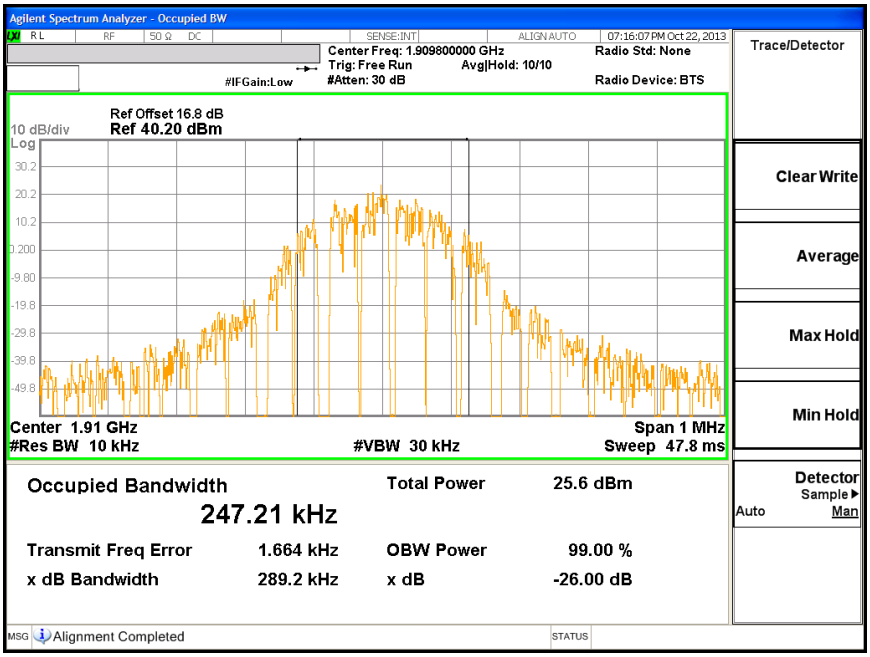
LOW CH



MID CH

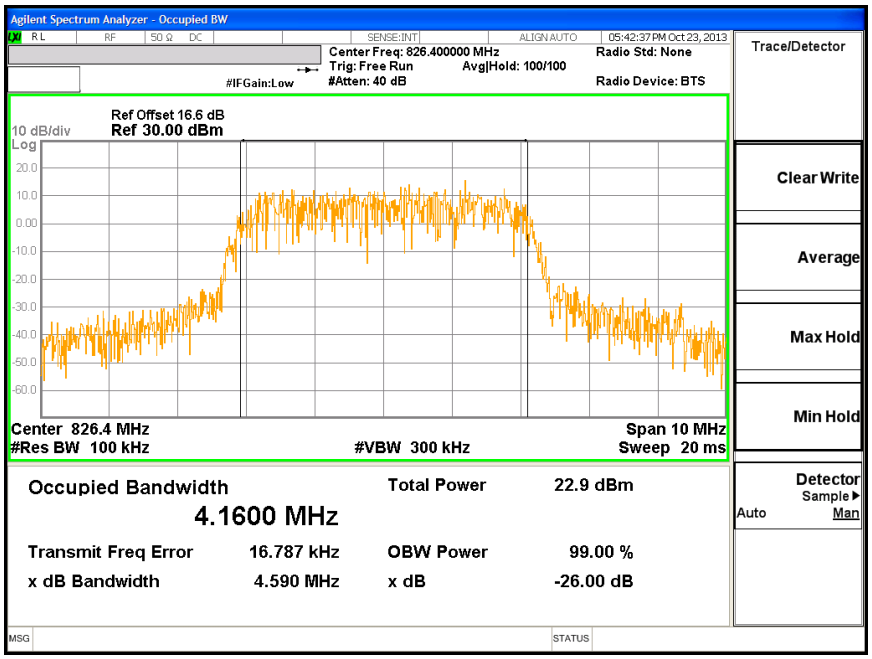


HIGH CH

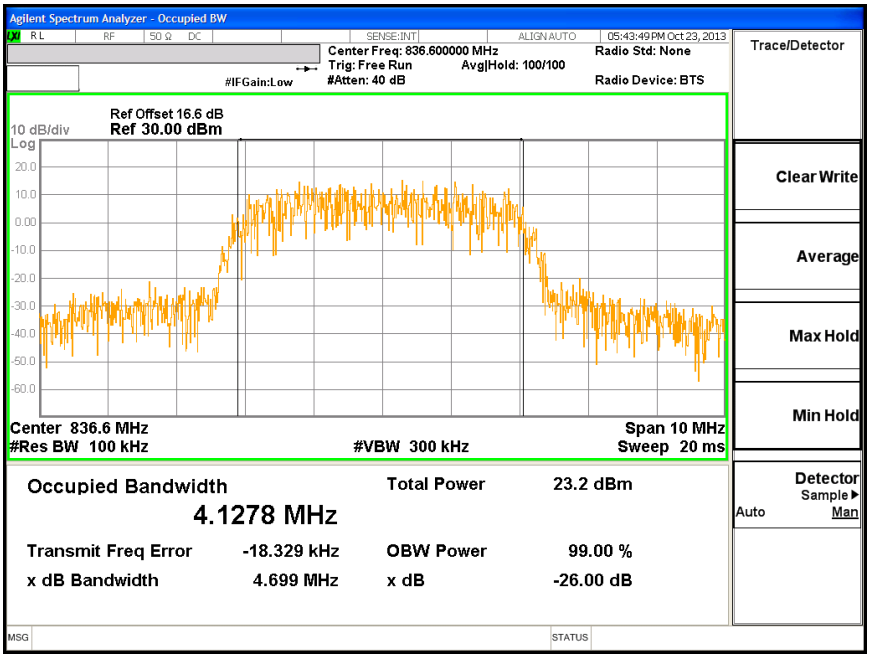


REL 99 850MHz

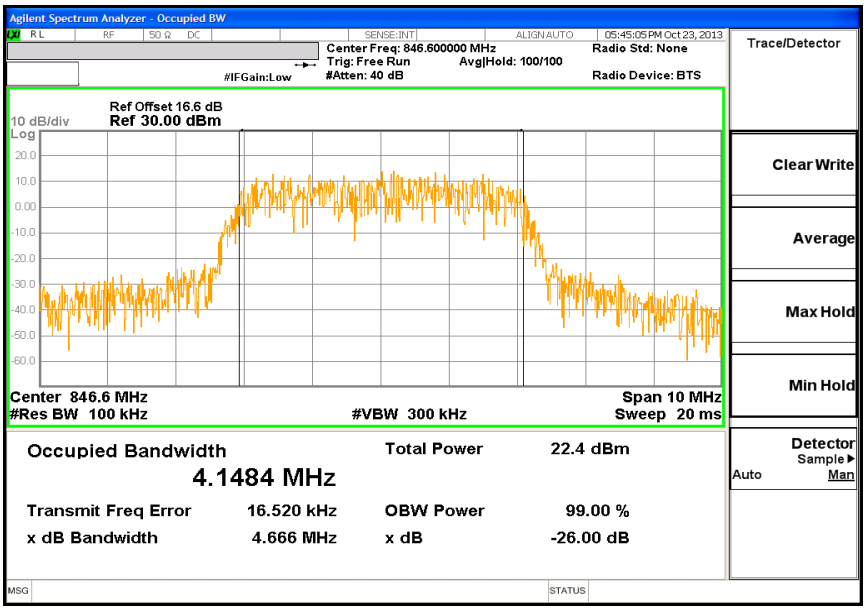
LOW CH



MID CH

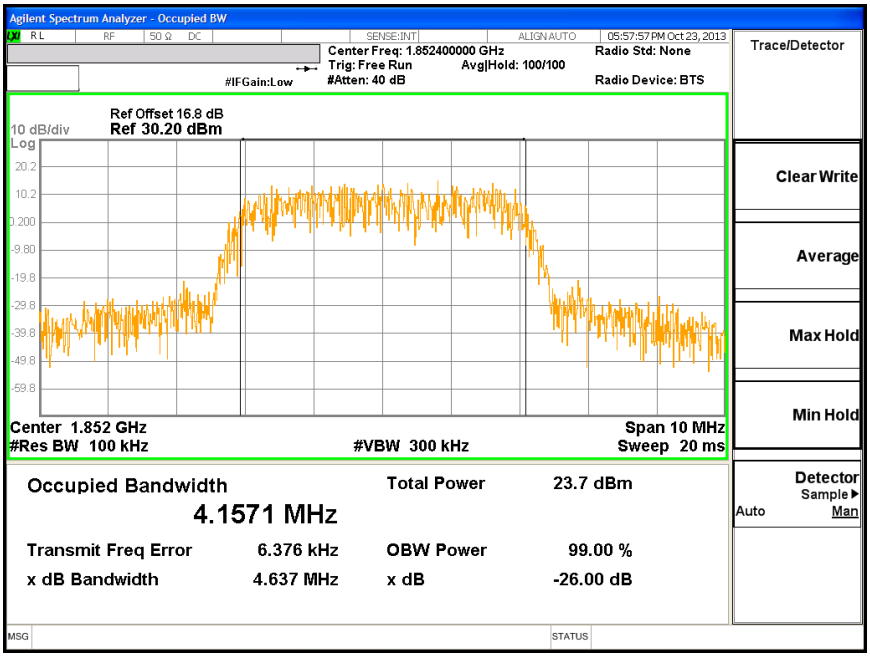


HIGH CH

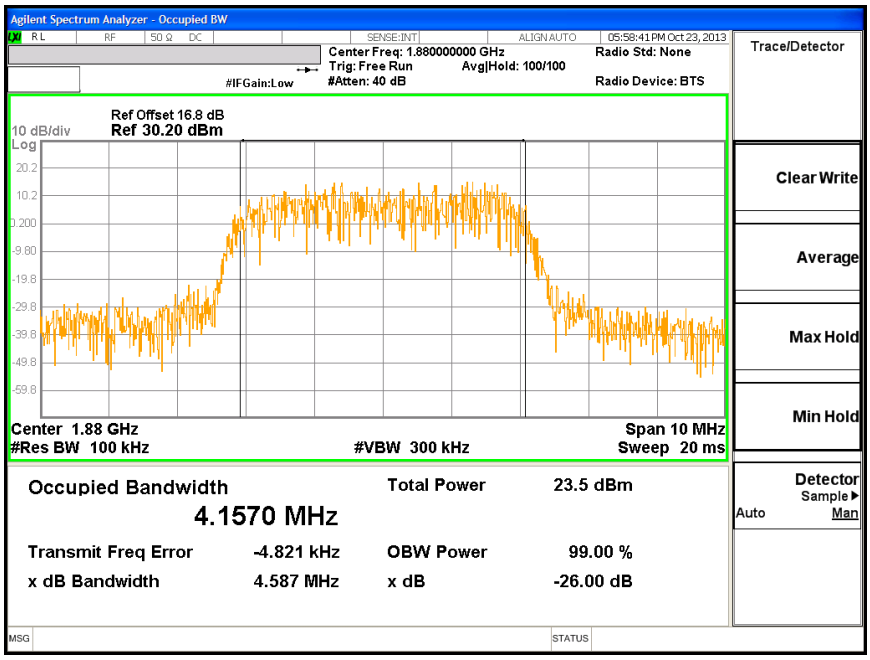


REL 99 1900MHz

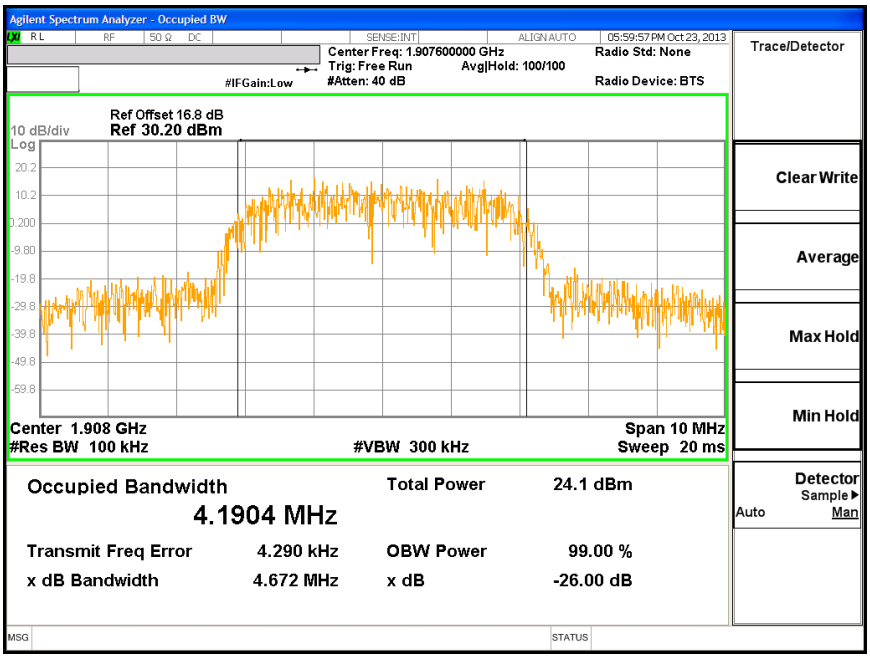
LOW CH



MID CH

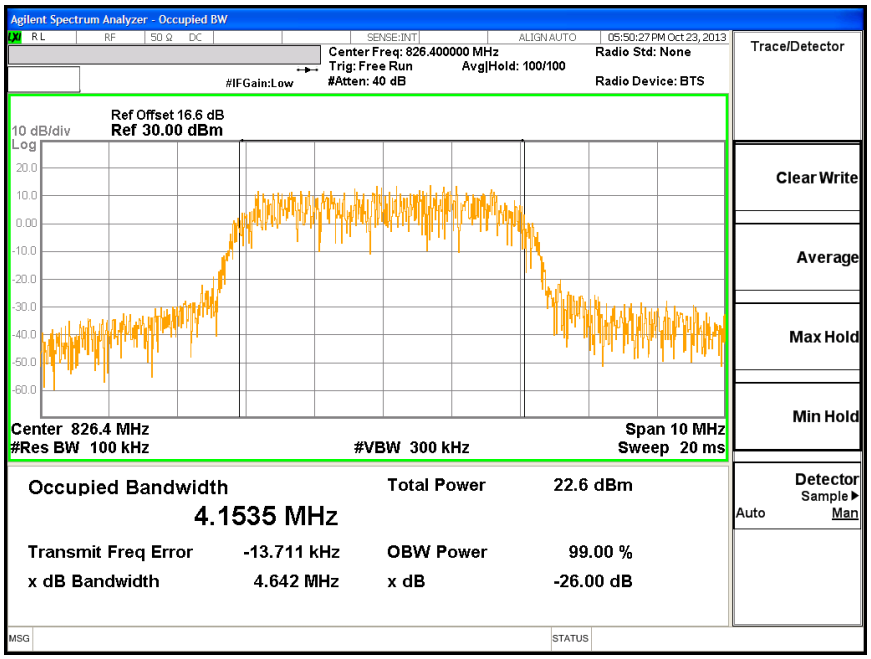


HIGH CH

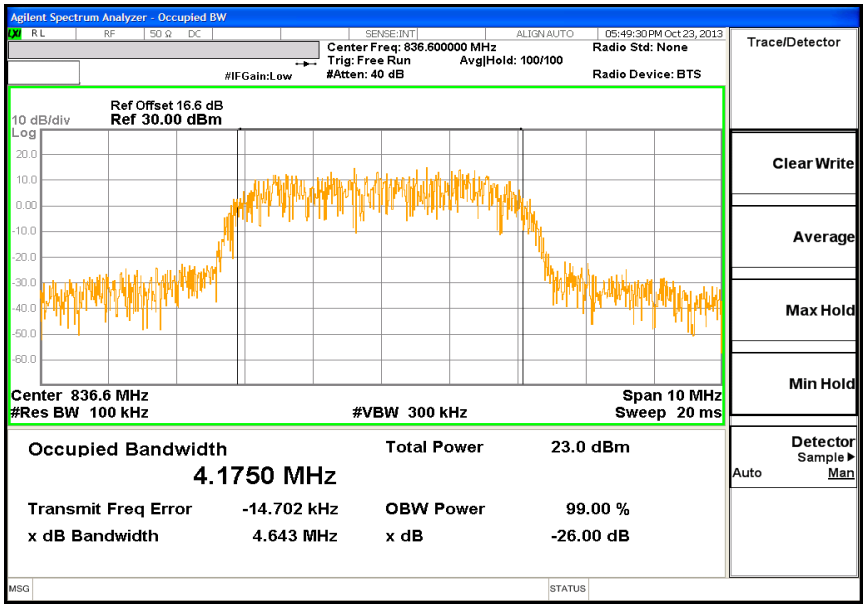


HSDPA 850MHz

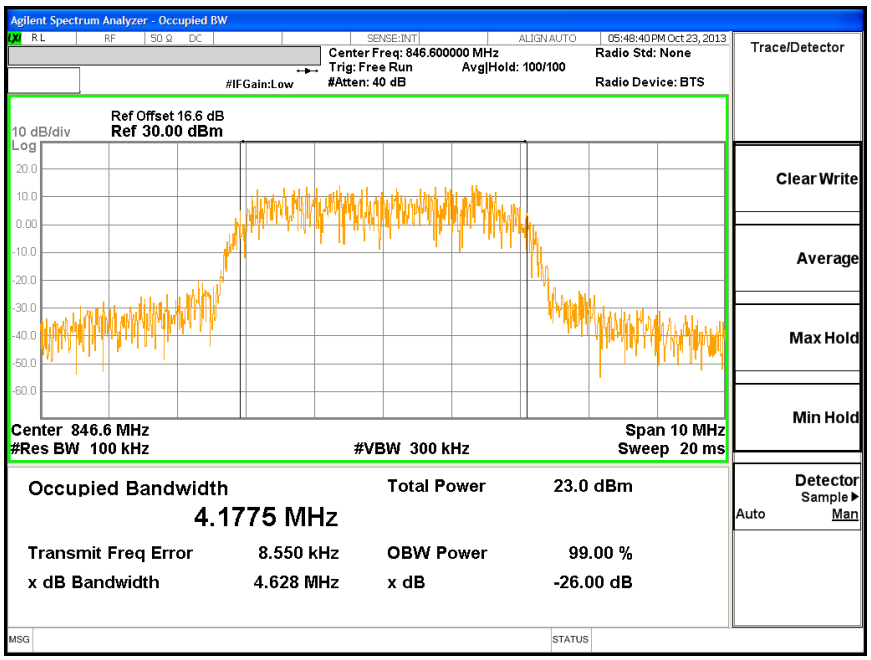
LOW CH



MID CH

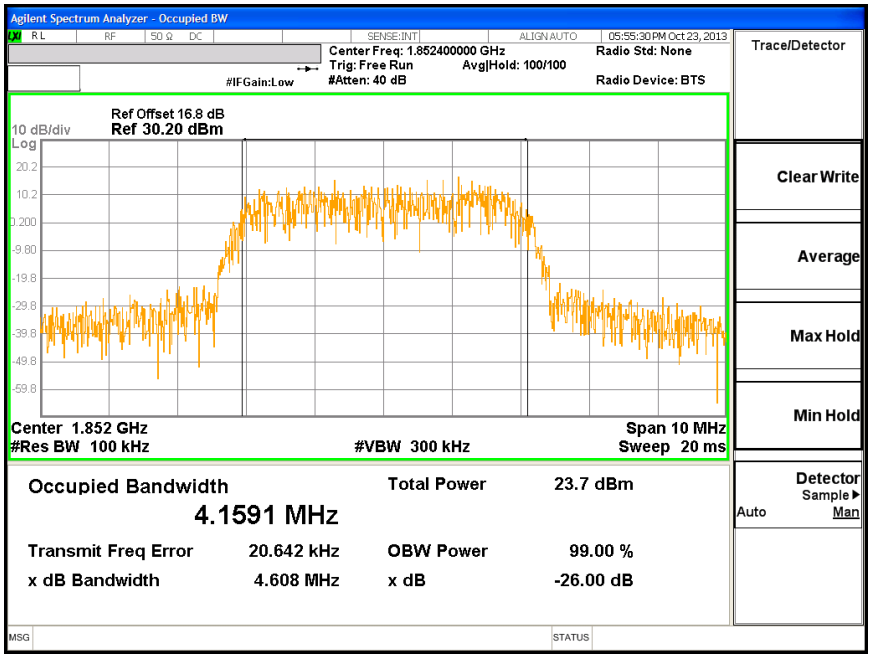


HIGH CH

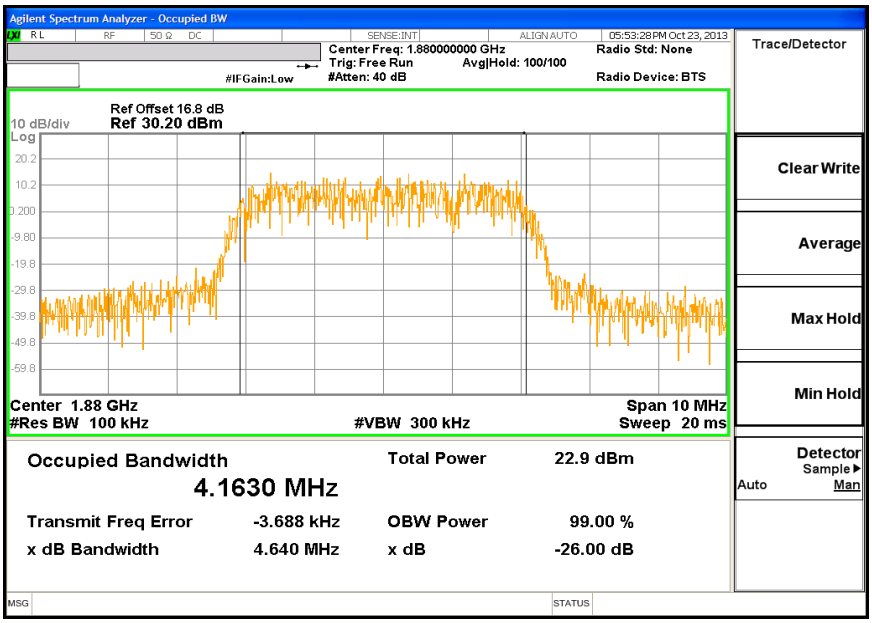


HSDPA 1900MHz

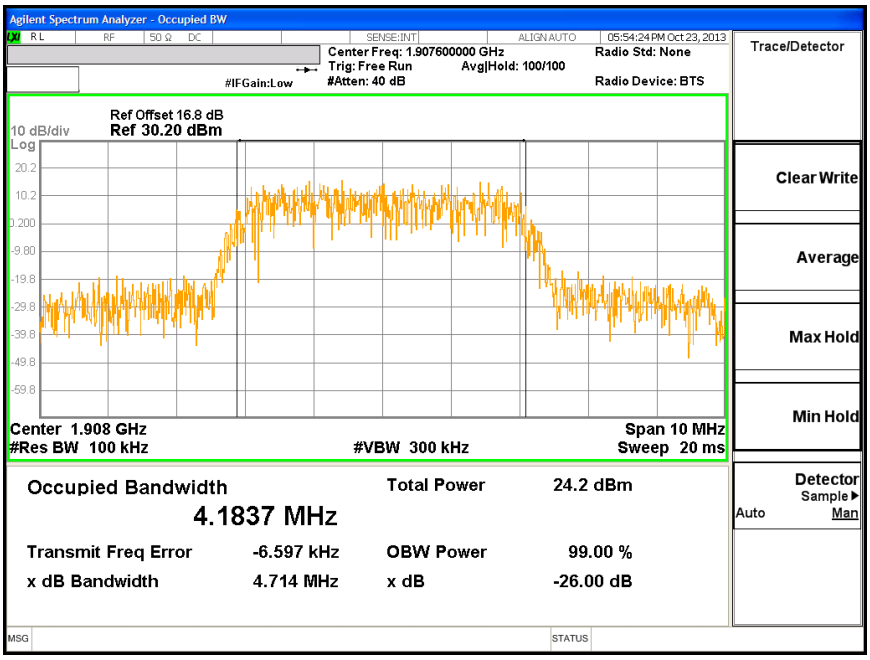
LOW CH



HIGH CH



HIGH CH



8.2. BAND EDGE

RULE PART(S)

FCC: §22.359, 24.238

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 a Agilent 8960 Test Set and configured to operate at maximum power. The bandedge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.
For each bandedge measurement:

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

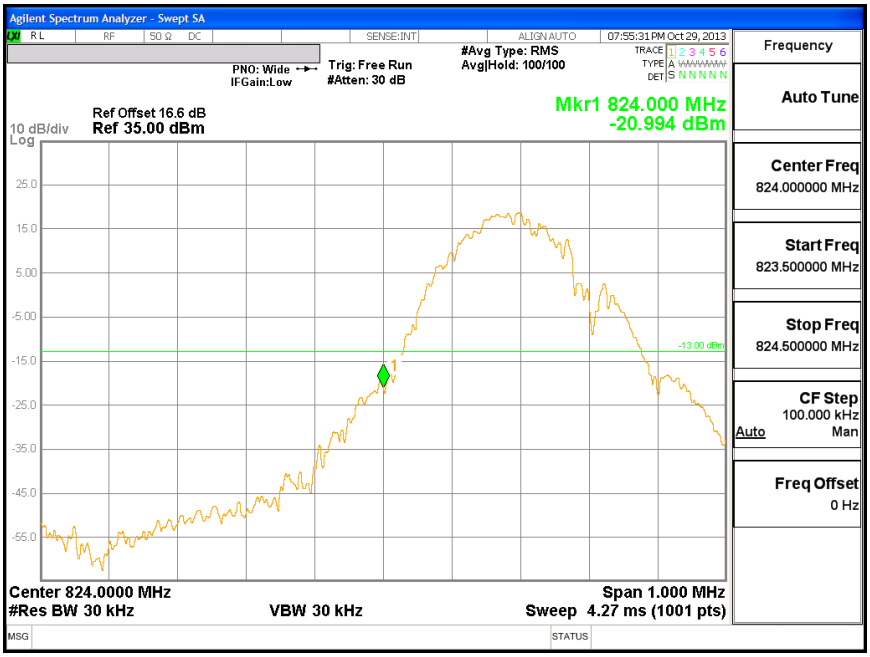
MODES TESTED

- GSM, GPRS and EGPRS
- UMTS, REL 99 and HSDPA

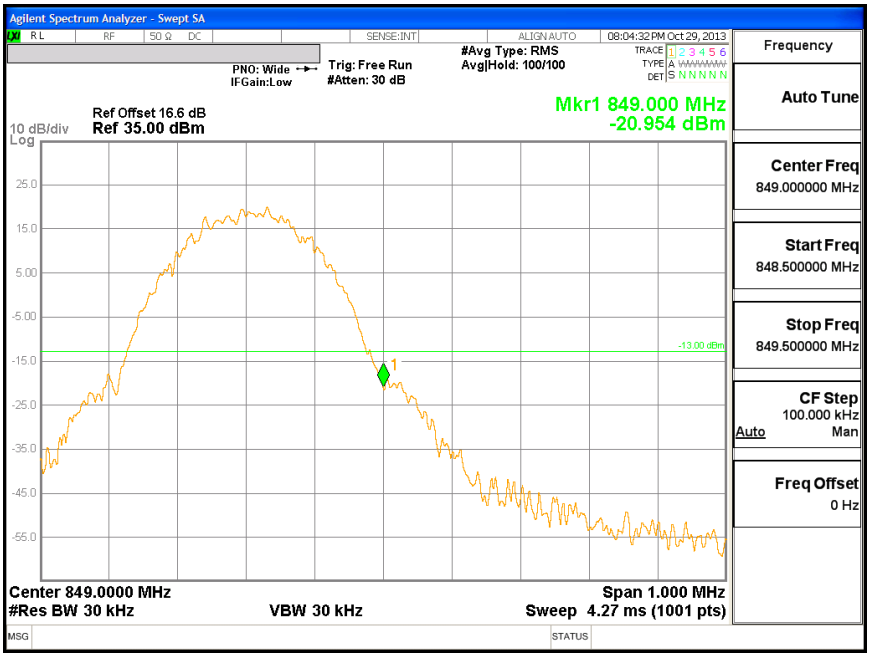
RESULTS

GPRS850MHz

LOW CH

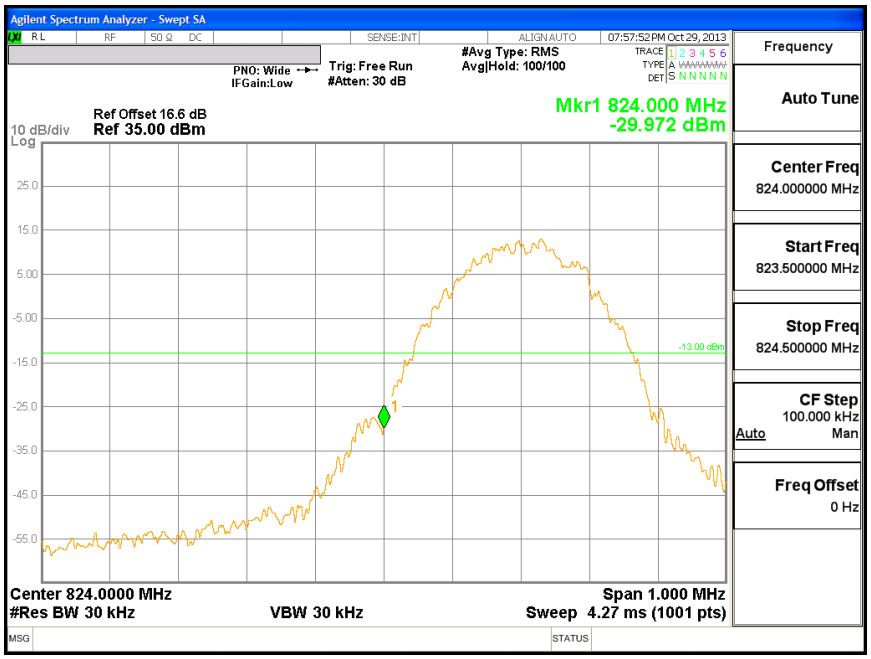


HIGH CH

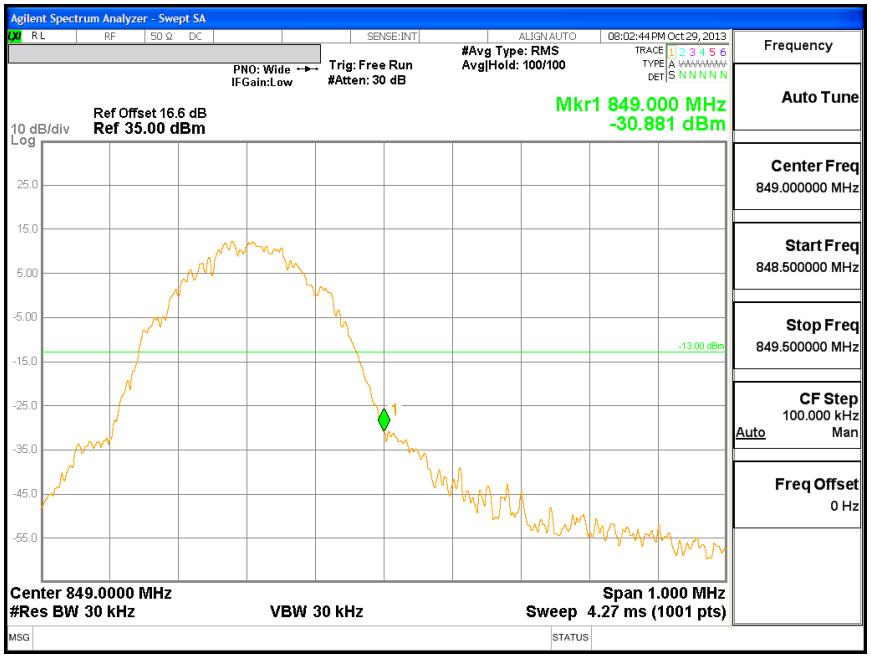


EGPRS850MHz

LOW CH

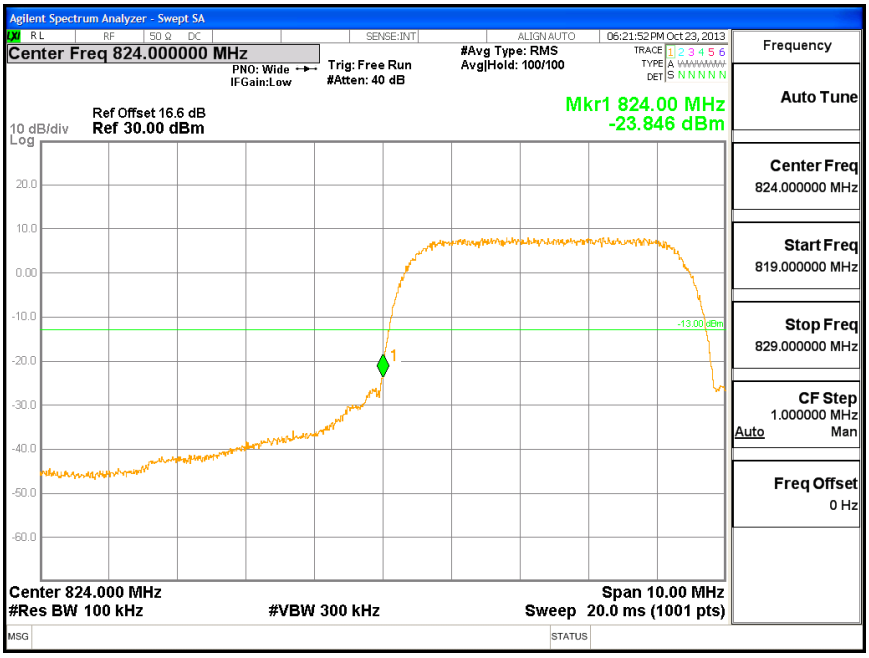


HIGH CH

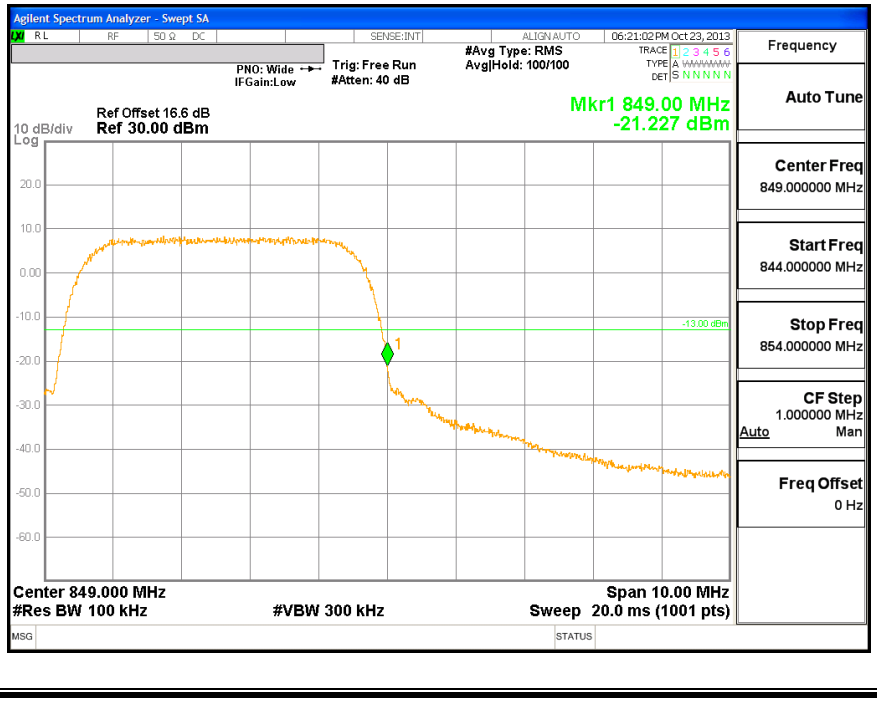


REL99 850MHz

LOW CH

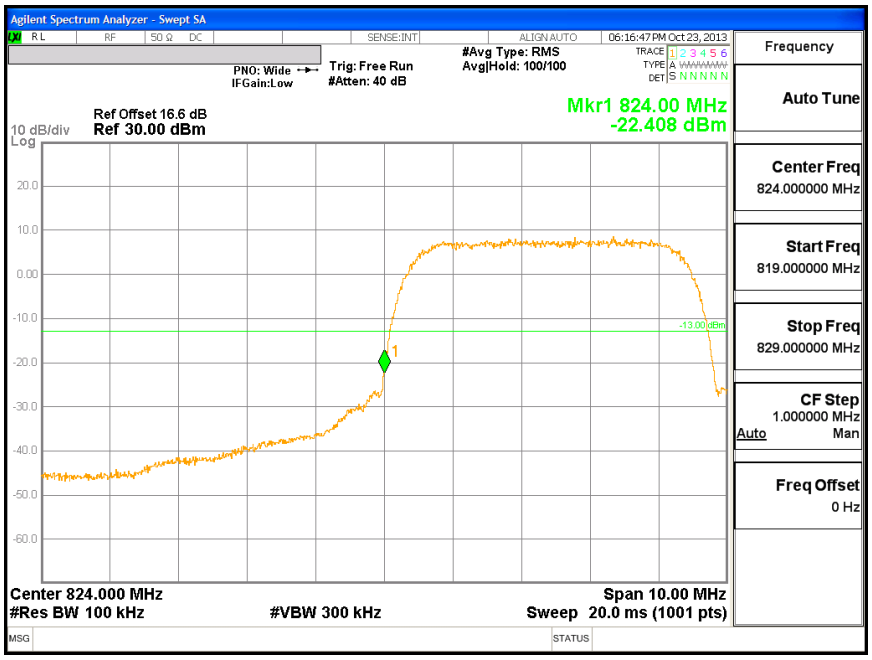


HIGH CH

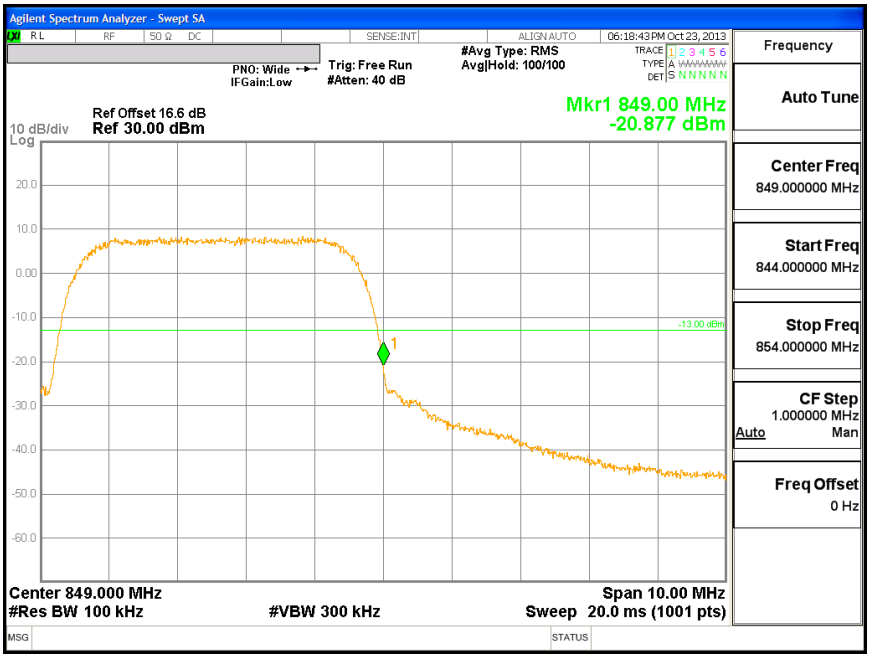


HSDPA 850MHz

LOW CH

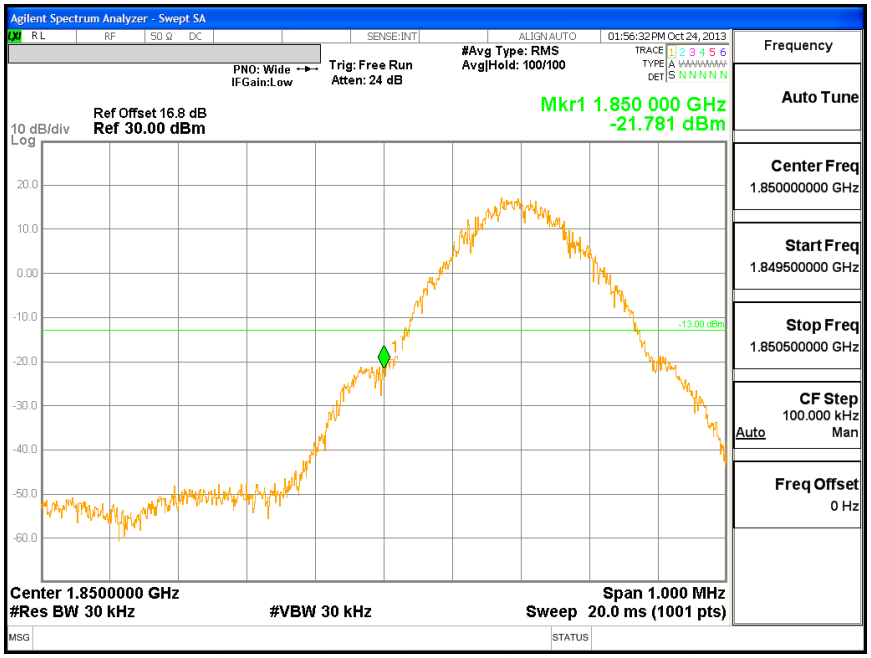


HIGH CH

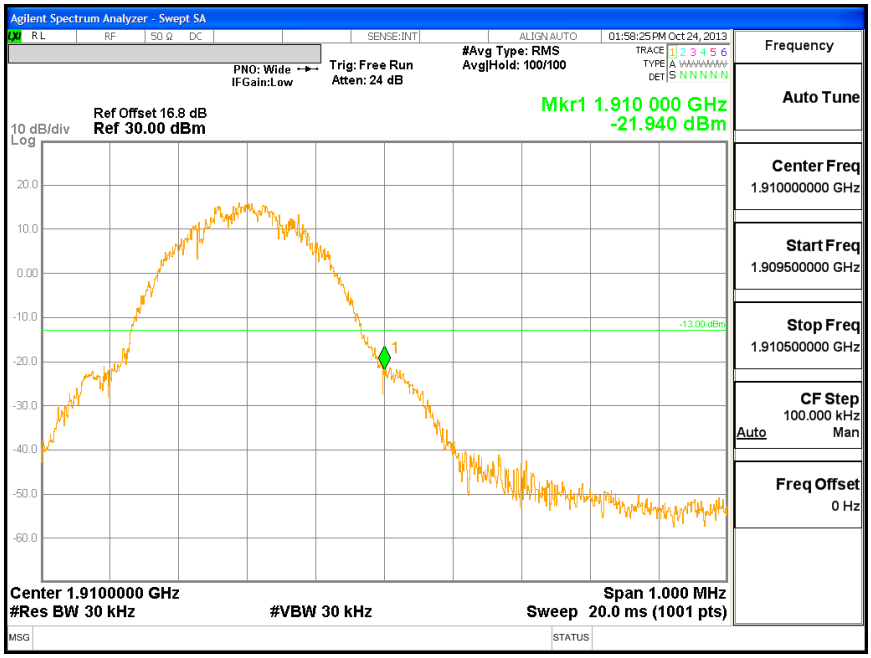


GPRS1900MHz

LOW CH

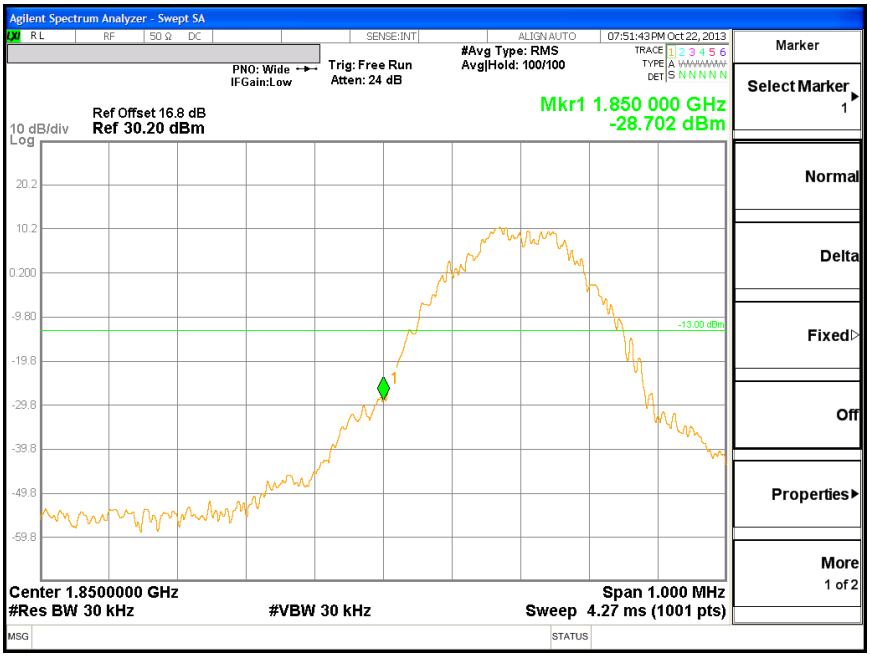


HIGH CH

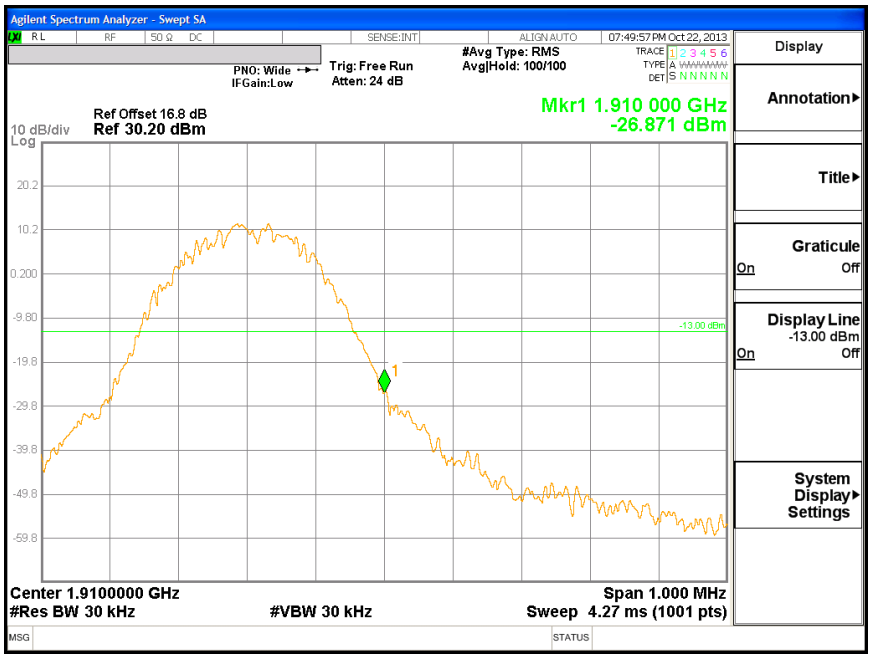


EGPRS1900MHz

LOW CH

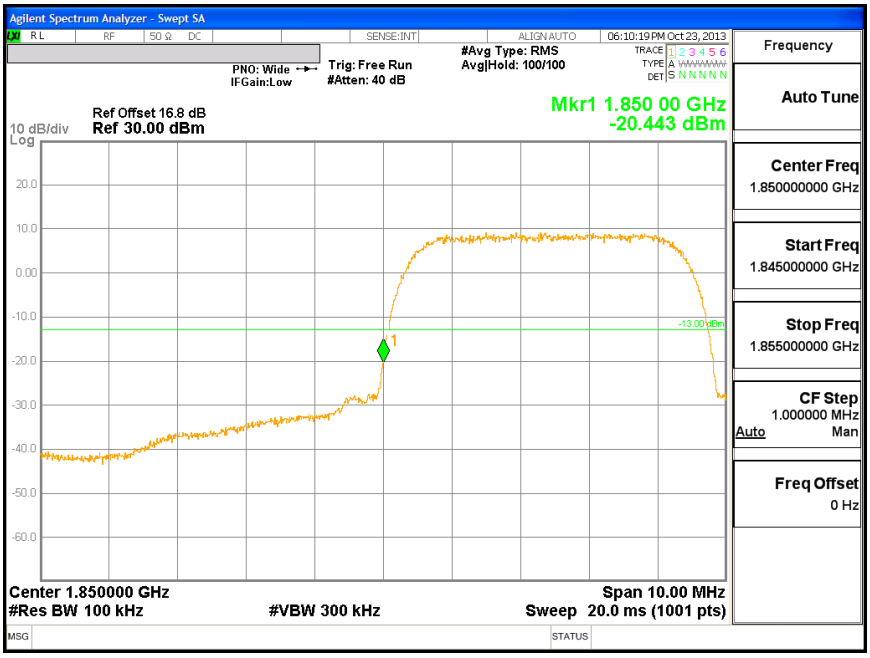


HIGH CH

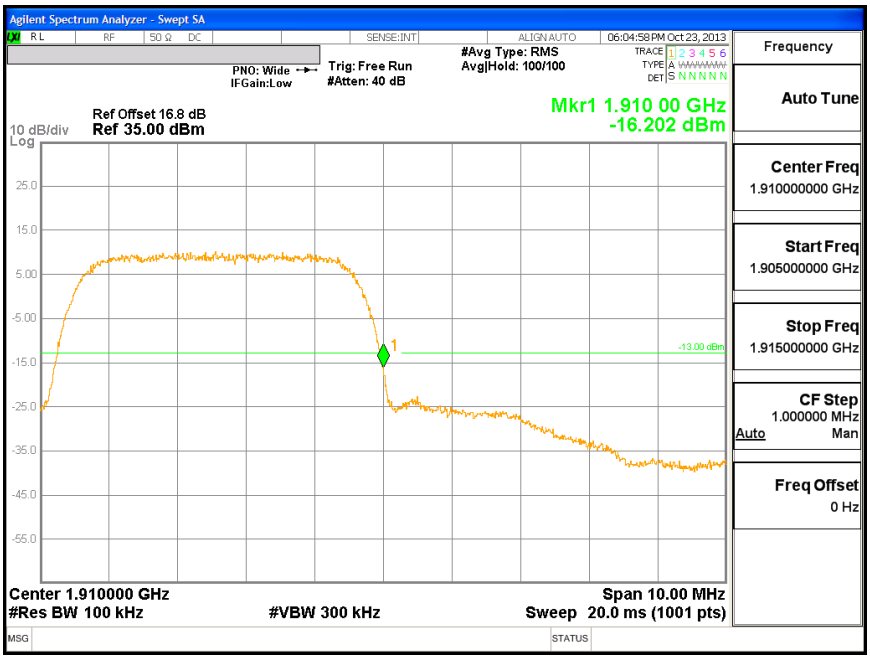


REL99 1900MHz

LOW CH

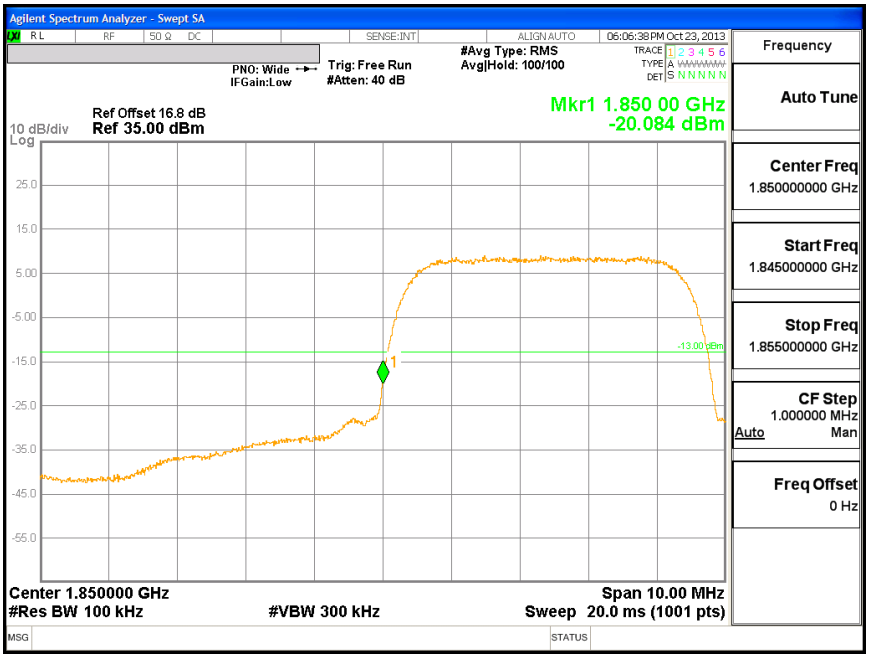


HIGH CH

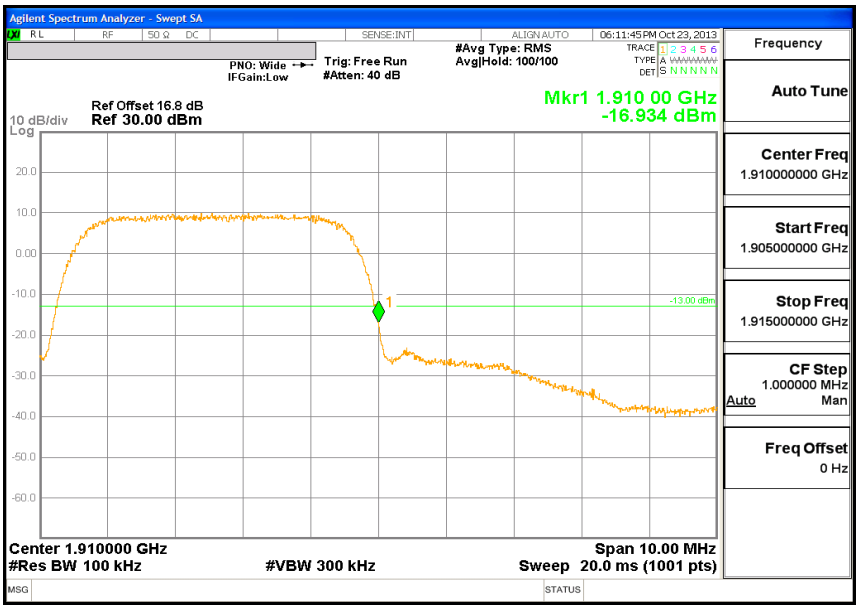


HSDPA 1900MHz

LOW CH



HIGH CH



8.3. OUT OF BAND EMISSIONS

RULE PART(S)

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

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.

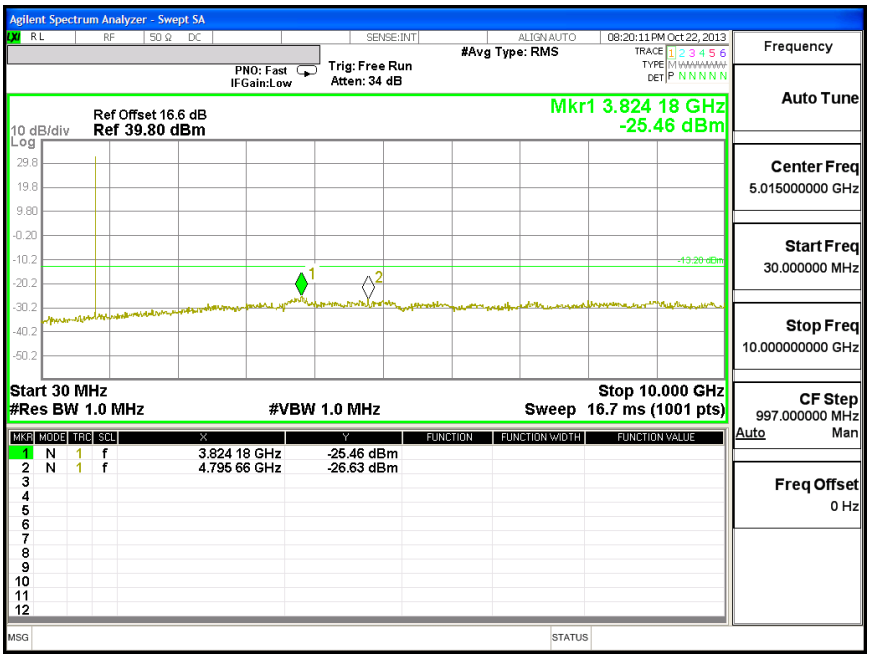
MODES TESTED

- GSM, GPRS and EGPRS
- UMTS, REL 99 and HSDPA

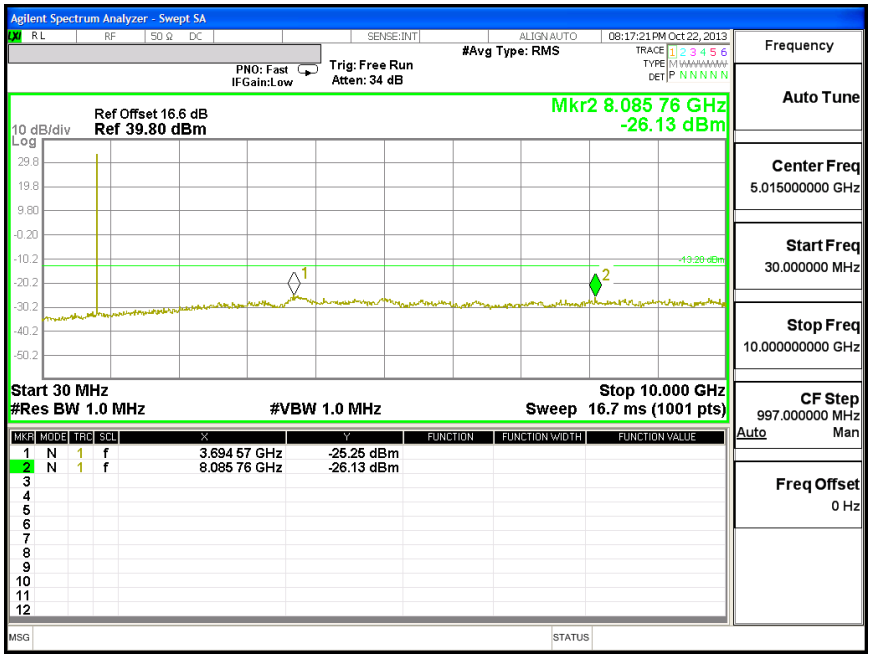
RESULTS

GPRS850MHz

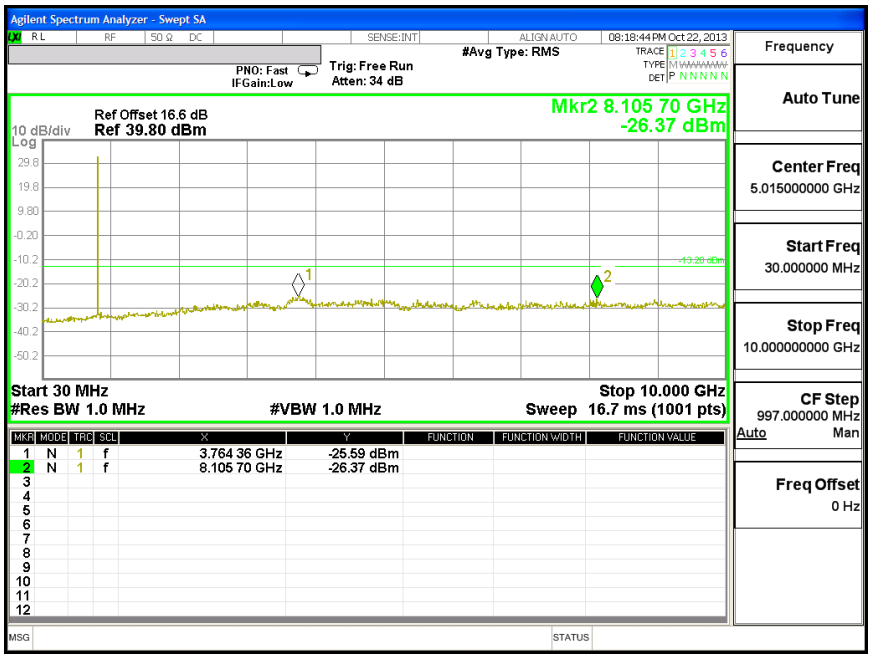
LOW CH



MID CH

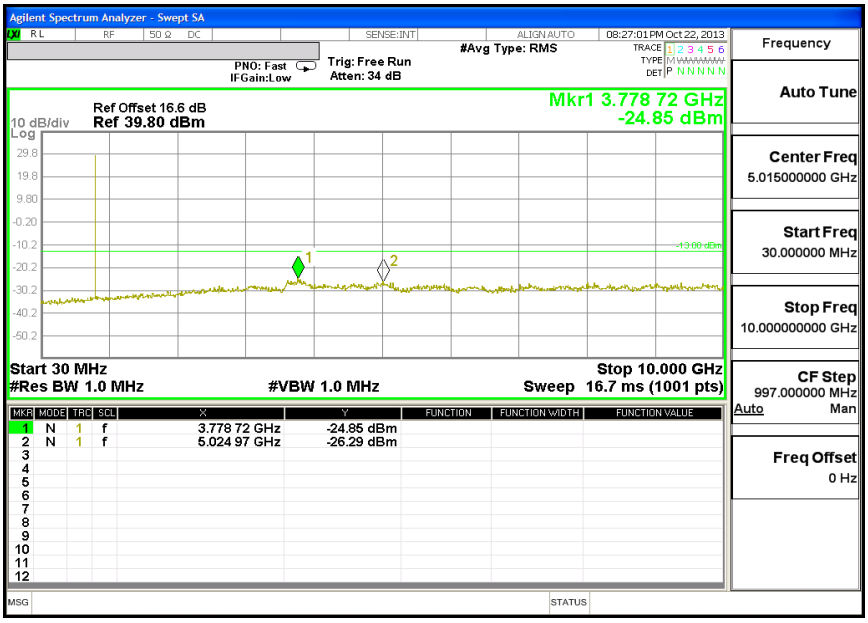


HIGH CH

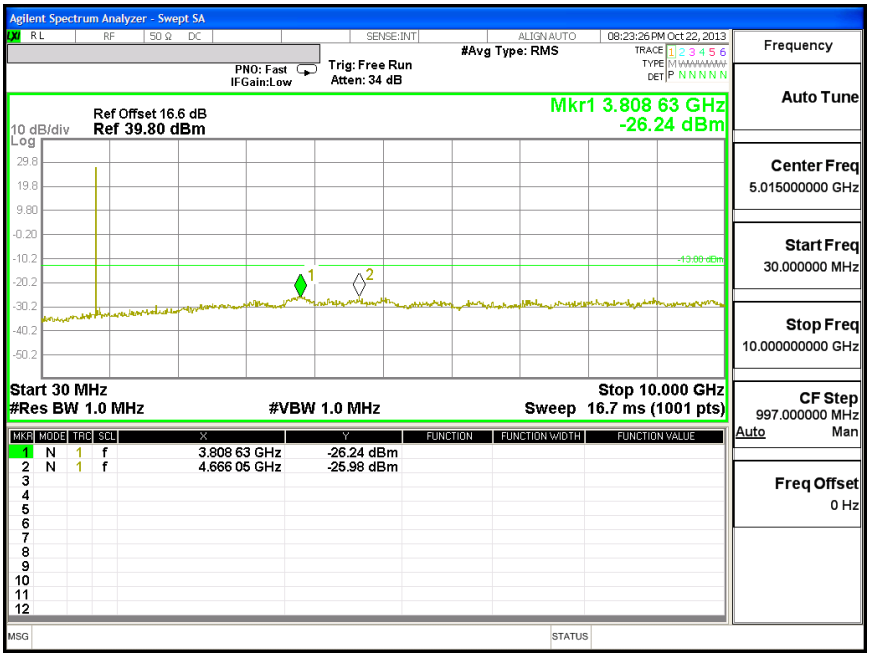


EGPRS850MHz

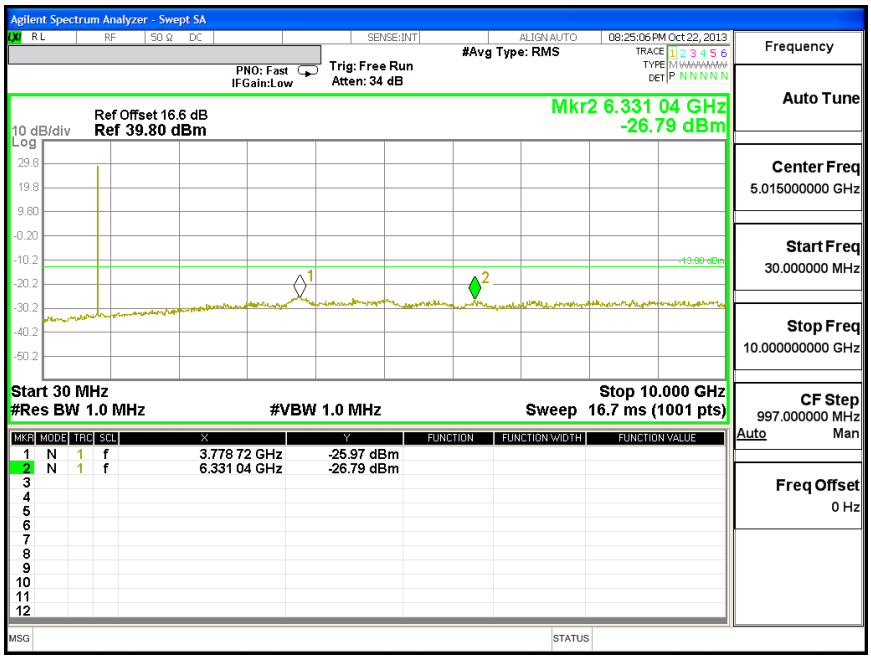
LOW CH



MID CH



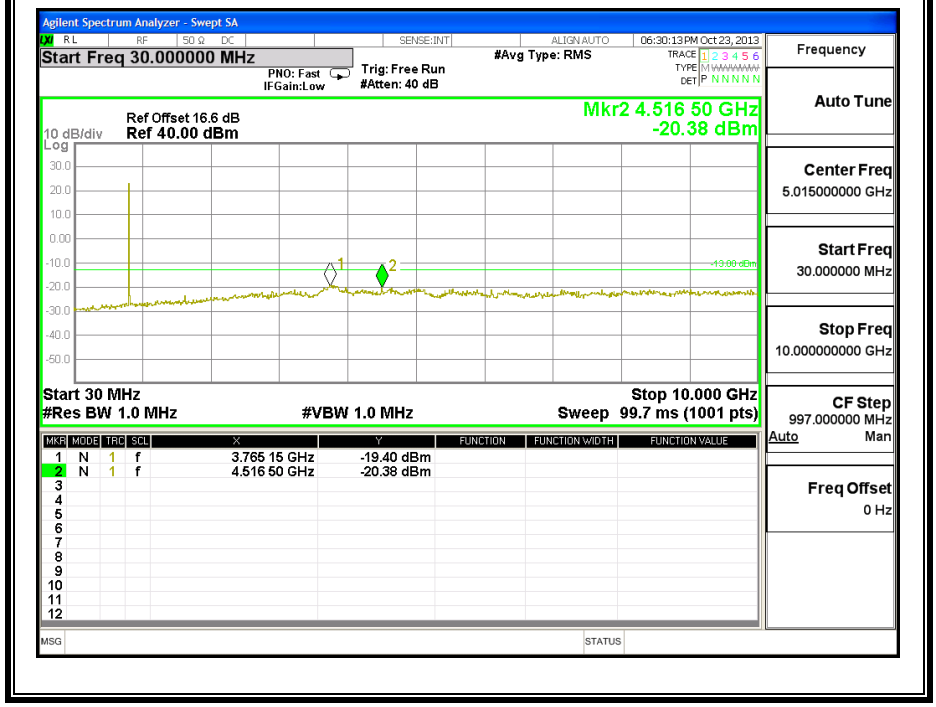
HIGH CH



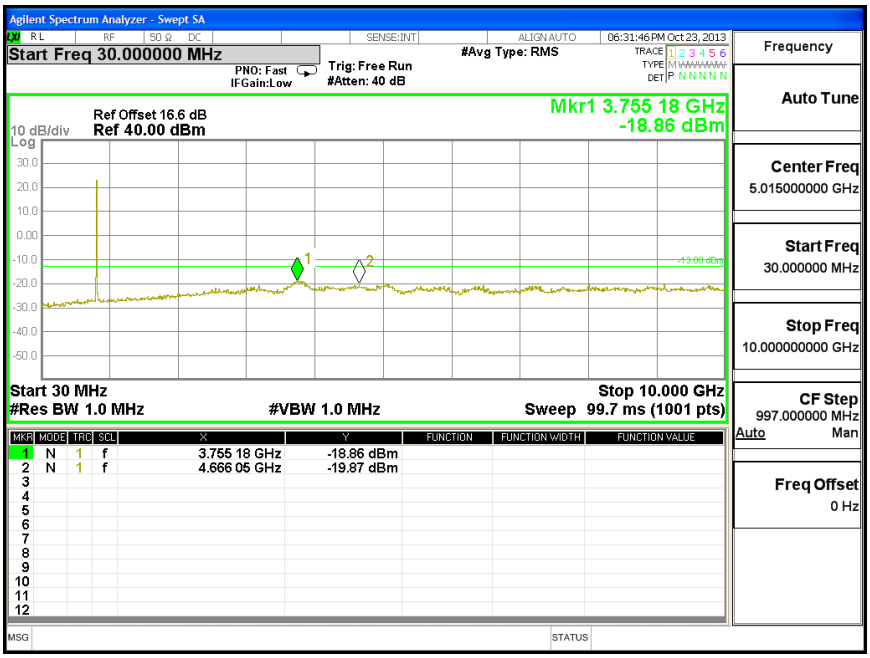
REL 99 850MHz

LOW CH

MID CH

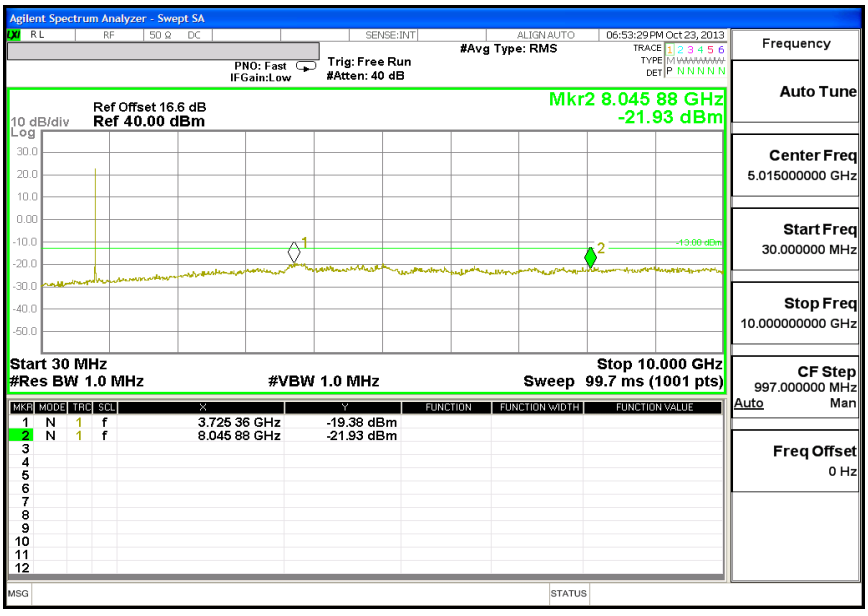


HIGH CH

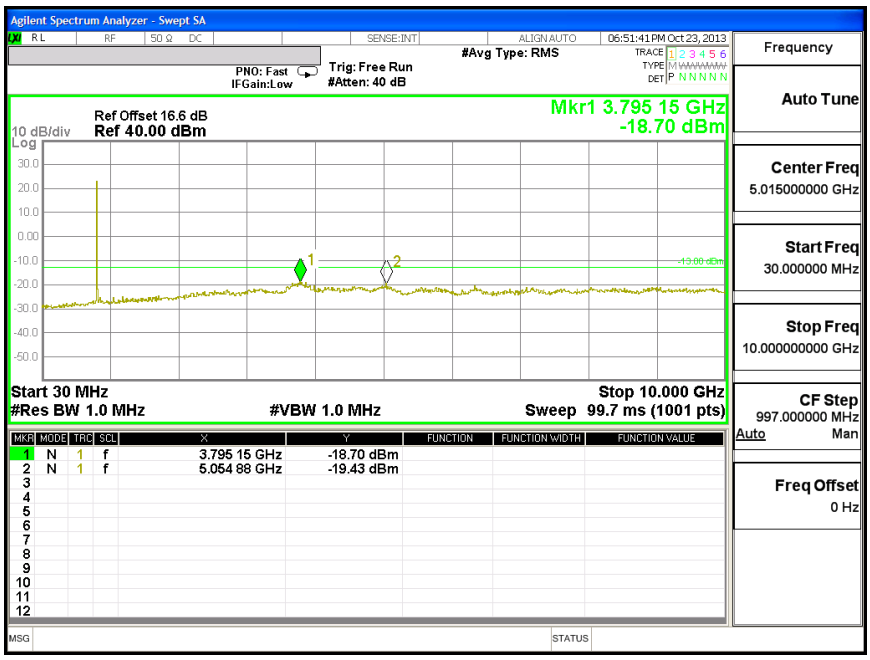


HSDPA 850MHz

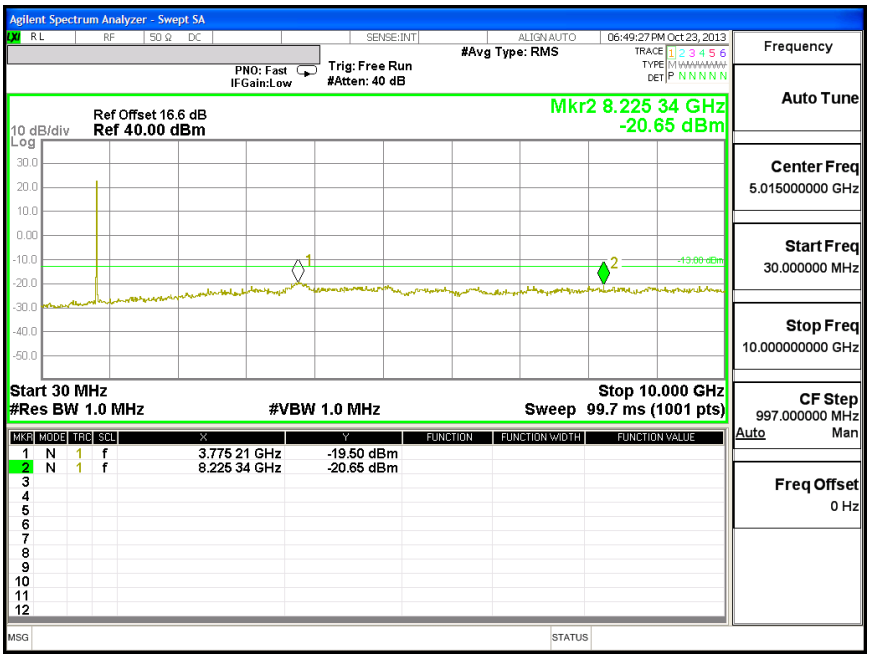
LOW CH



MID CH

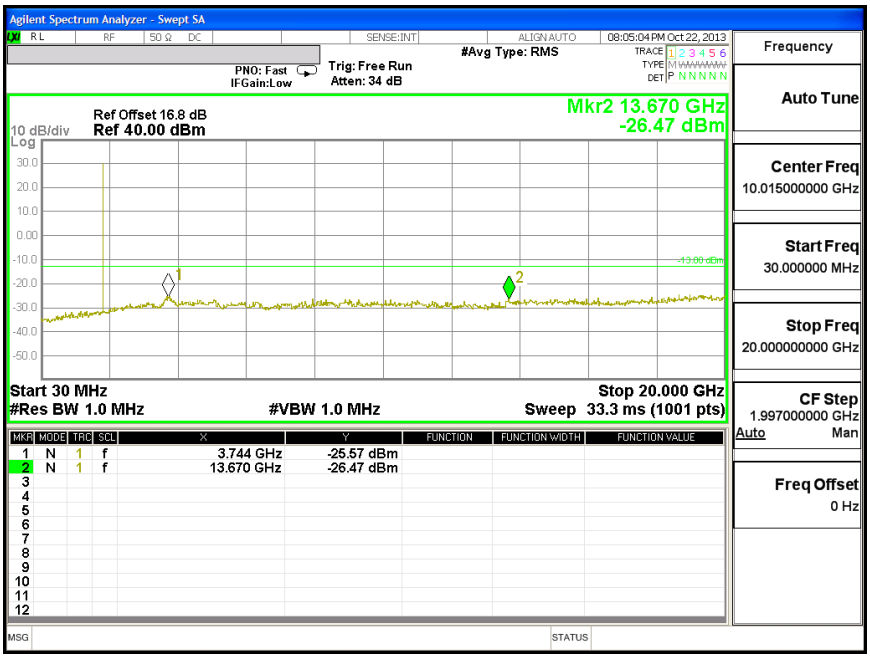


HIGH CH

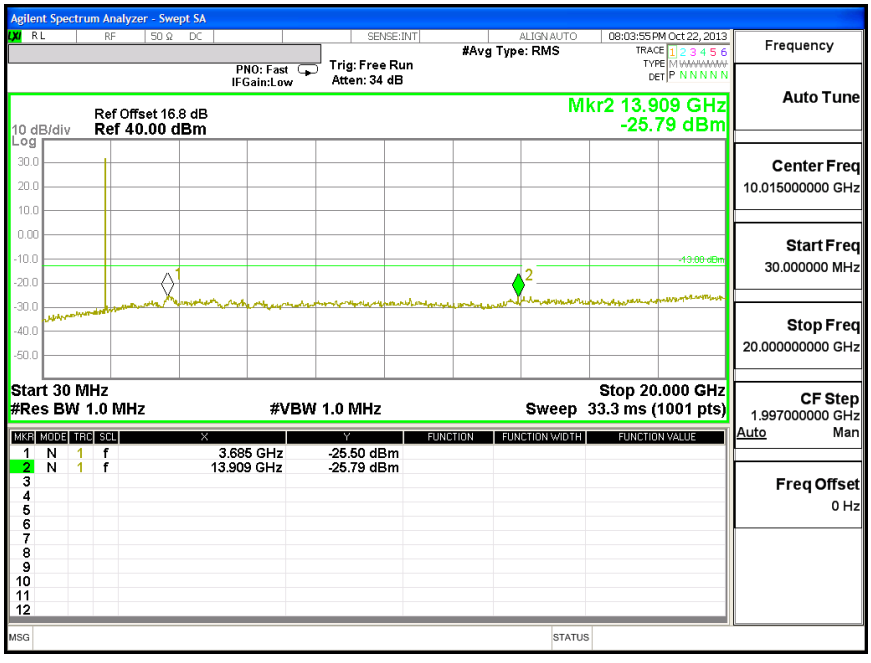


GPRS1900MHz

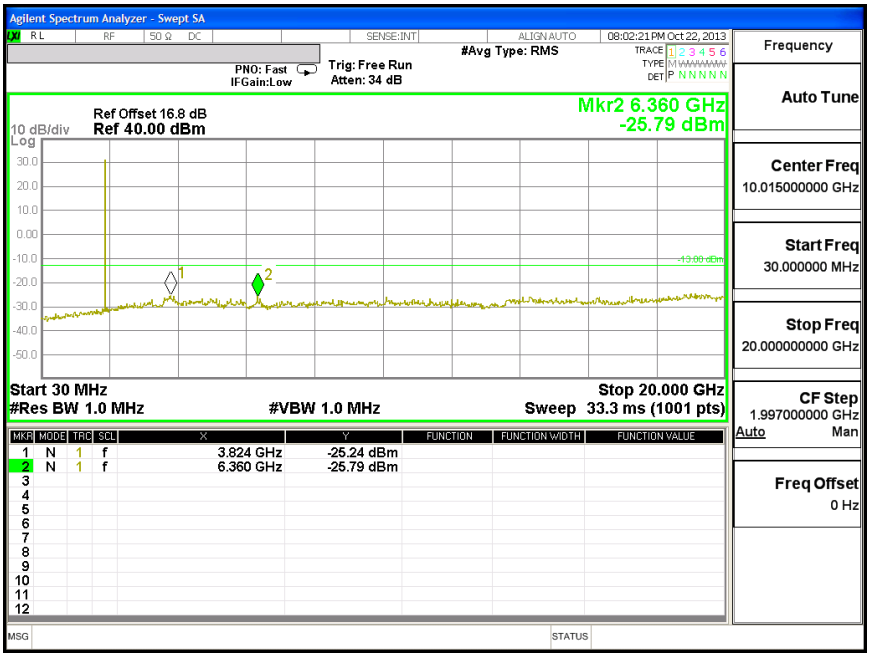
LOW CH



MID CH

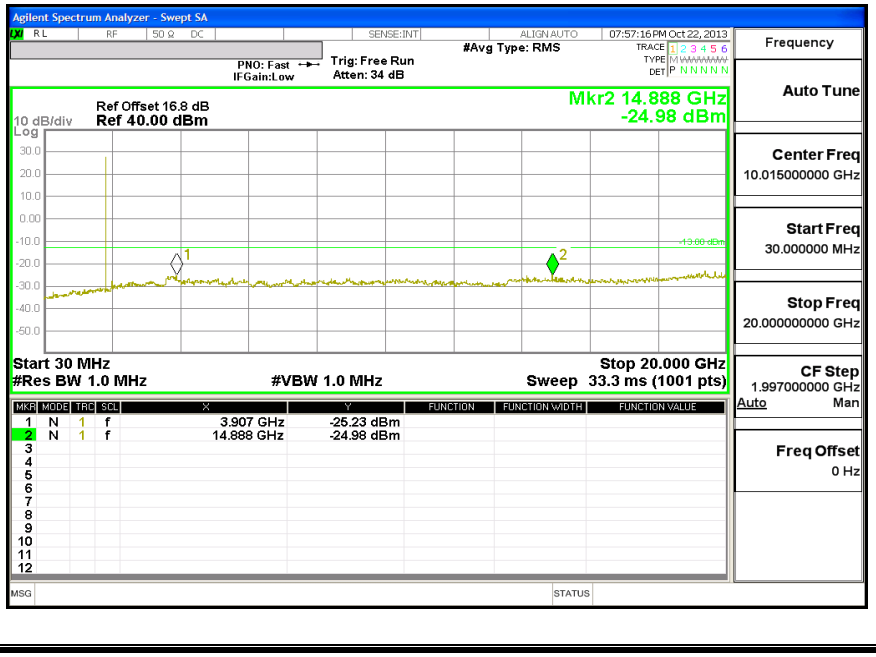


HIGH CH

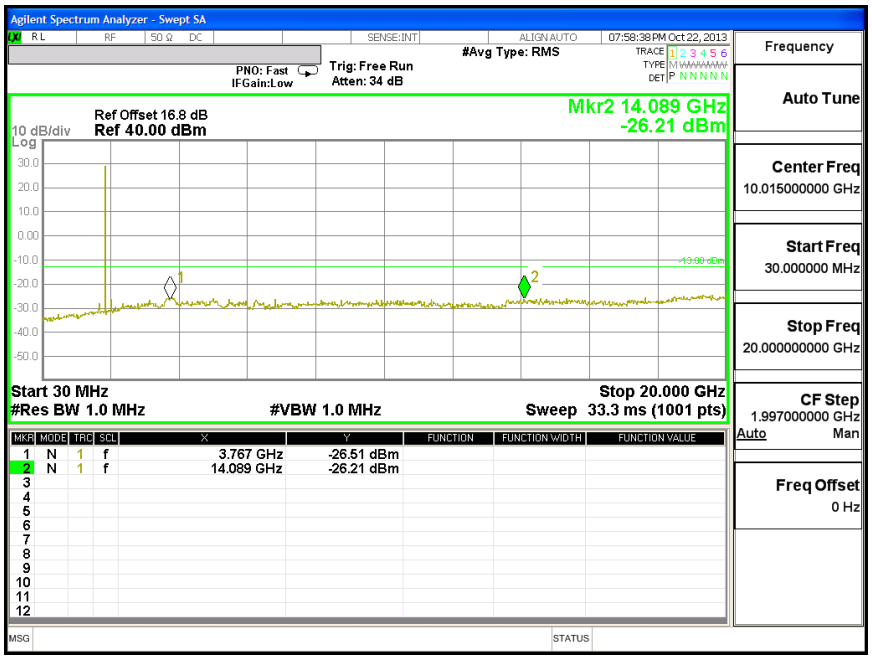


EGPRS 1900MHz

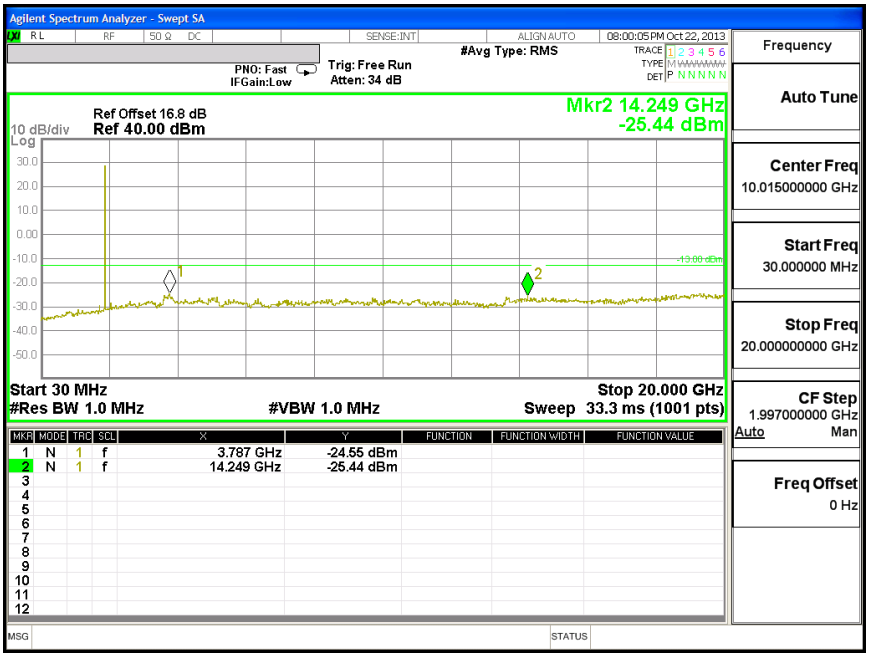
LOW CH



MID CH

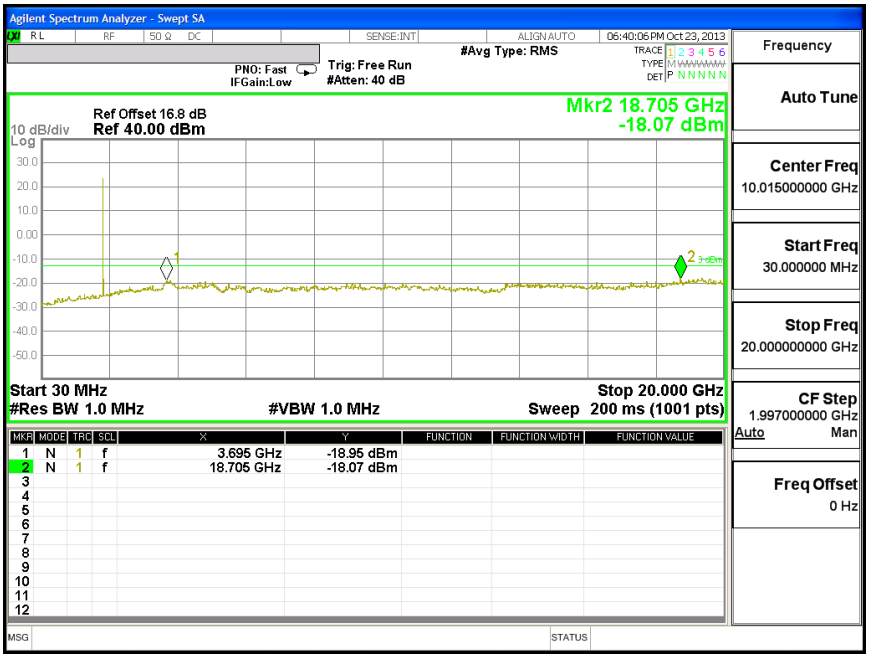


HIGH CH

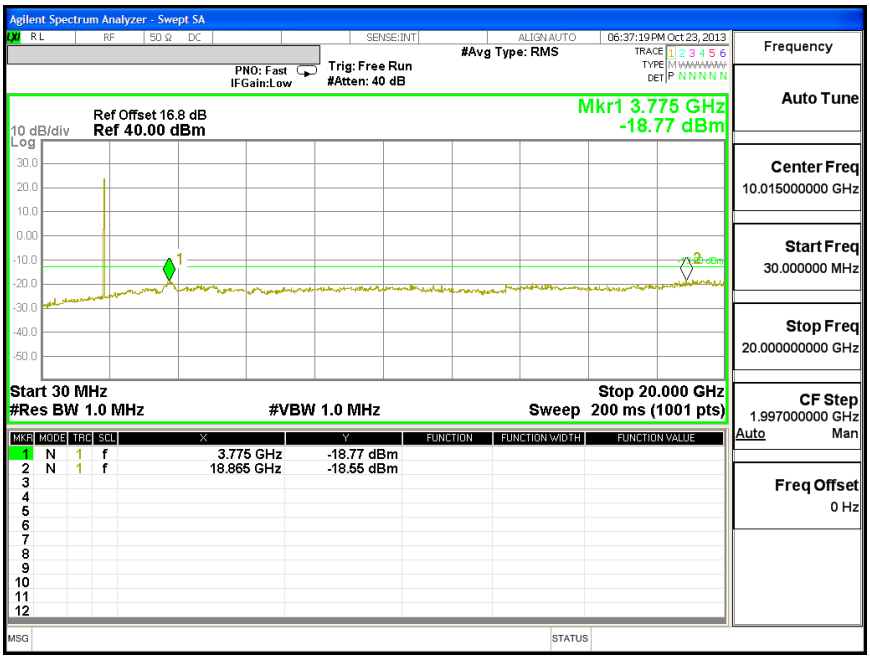


REL 99 1900MHz

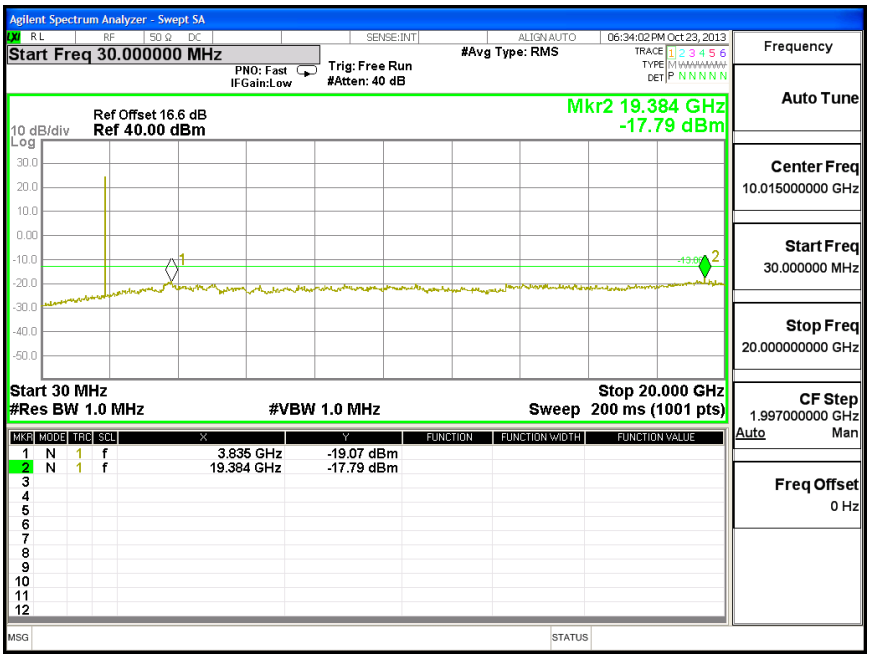
LOW CH



MID CH

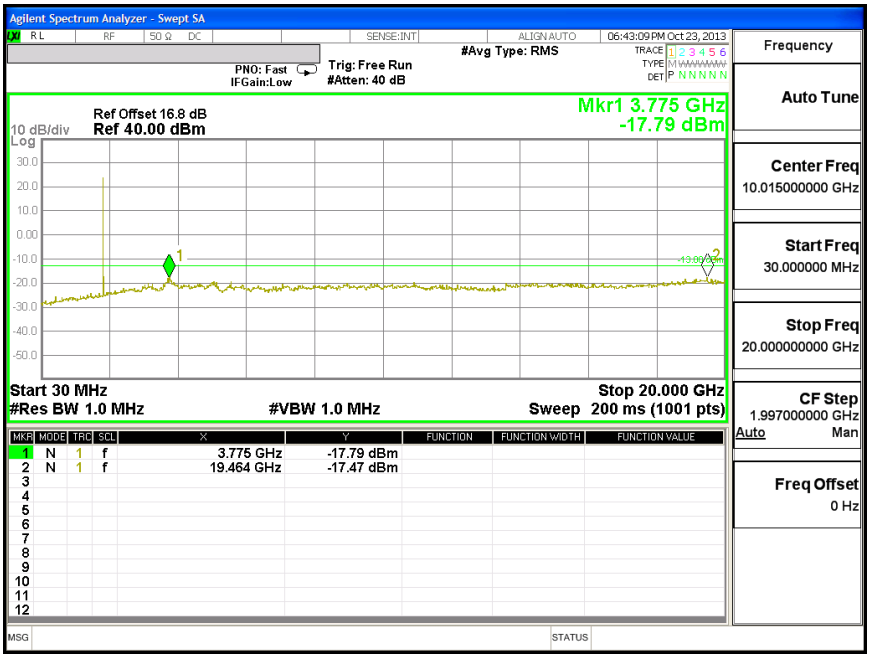


HIGH CH

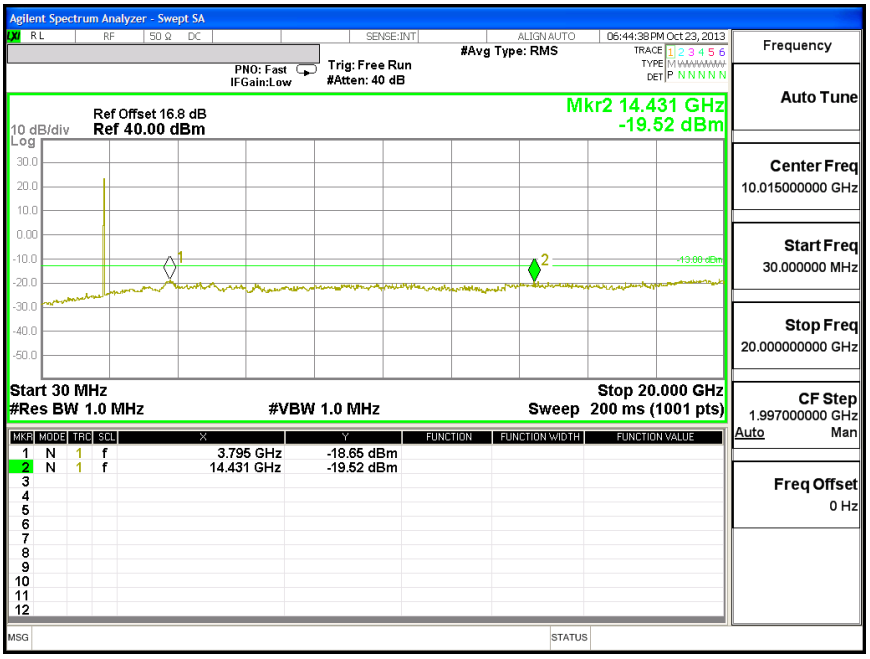


HSDPA 1900MHz

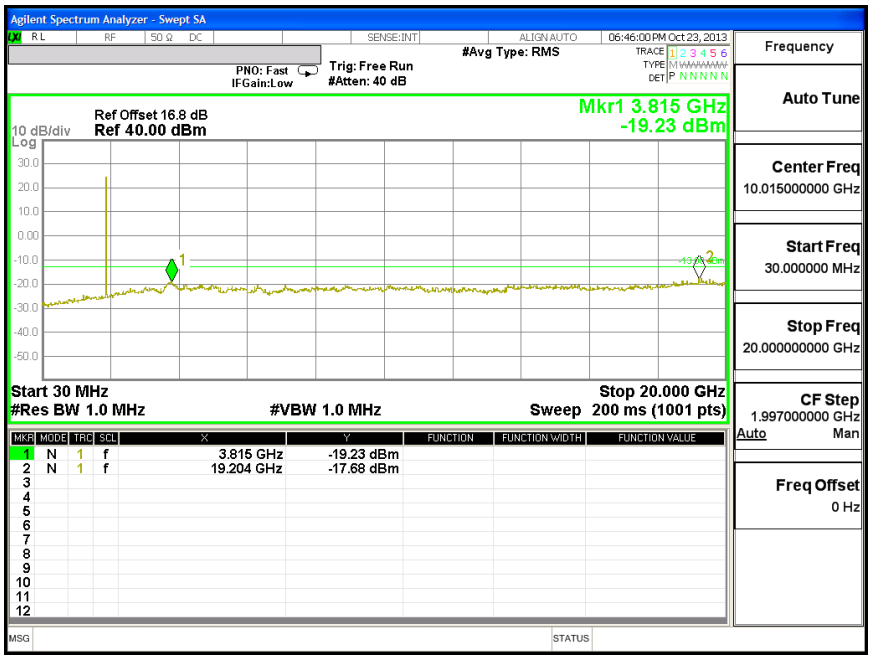
LOW CH



MID CH



HIGH CH



8.4. PEAK-TO-AVERAGE RATIO

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13dB.

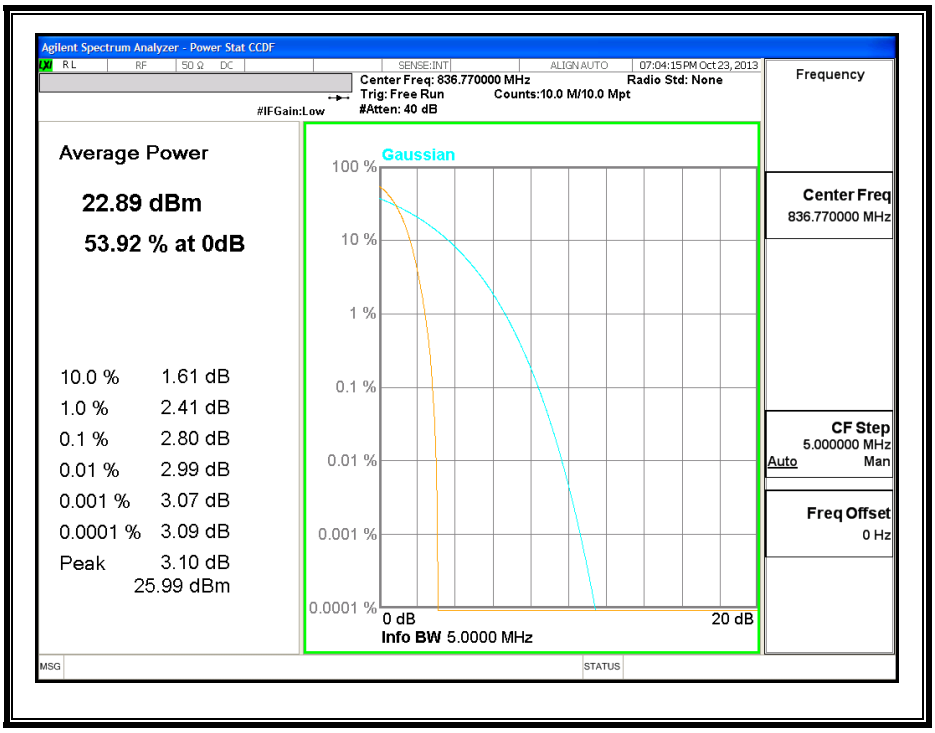
Peak-To-Average Ratio:

Mode	Modulation	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
		*Peak	Average	
UMTS B5	REL99	26.53	23.43	3.10

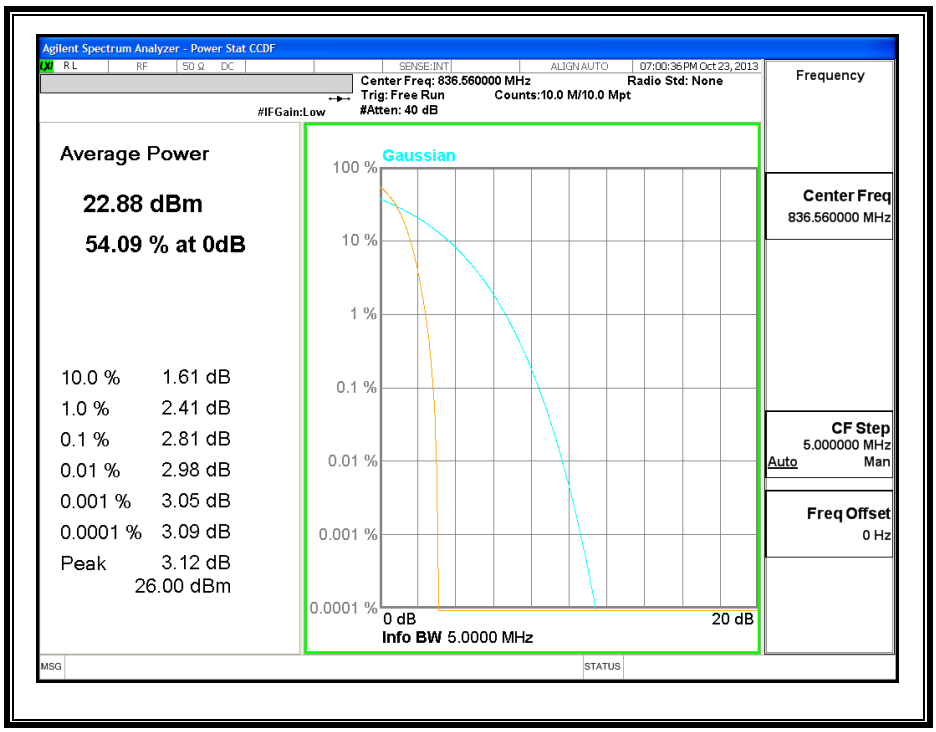
Mode	Ch. No.	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
		*Peak	Average	
UMTS B5	HSDPA	26.52	23.40	3.12

*Peak Reading = Average Reading + Peak-to-Average Ratio

UMTS850, REL 99



UMTS850, HSDPA

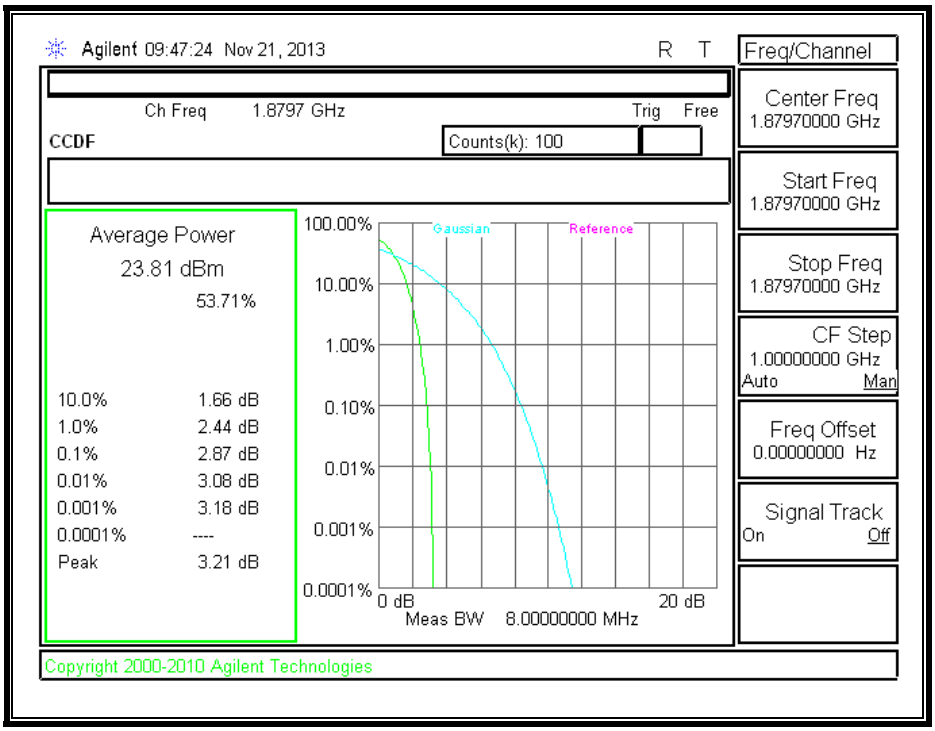


Mode	Modulation	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
		*Peak	Average	
UMTS B2	REL99	27.02	23.81	3.21

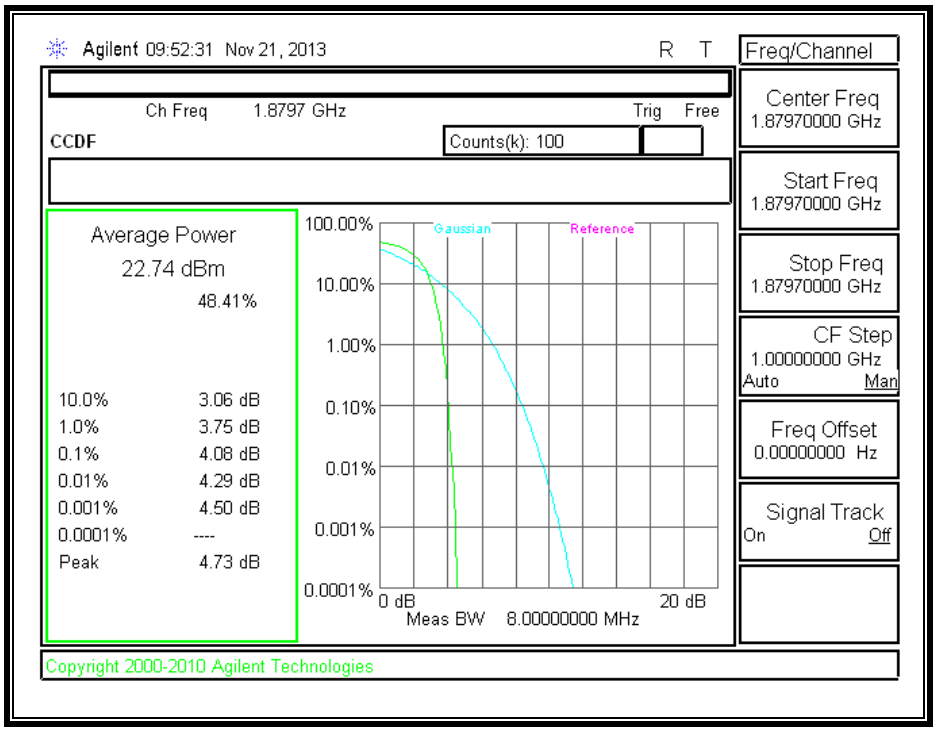
Mode	Ch. No.	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
		*Peak	Average	
UMTS B2	HSDPA	27.47	22.74	4.73

*Peak Reading = Average Reading + Peak-to-Average Ratio

UMTS1900, REL 99



UMTS1900, HSDPA



8.5. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235

LIMITS

- §22.355 - The carrier frequency shall not depart from the reference frequency in excess of ±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° to +50°C
- Voltage = (85% - 115%)

Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to 20ºC 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 +50ºC is reached.

Frequency Stability vs Voltage:

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

MODES TESTED

- GSM, GPRS and EGPRS
- UMTS, REL 99 and HSDPA

RESULTS

See the following pages.

CELL, GPRS MODULATION – MID CHANNEL

Reference Frequency: Cellular Mid Channel 836.599988 MHz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (°C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	50	836.599987	0.000	2.5
12.00	40	836.599988	0.000	2.5
12.00	30	836.599988	0.000	2.5
12.00	***20***	***836.599988***	***0***	***2.5***
12.00	10	836.599991	-0.003	2.5
12.00	0	836.599985	0.004	2.5
12.00	-10	836.599989	-0.001	2.5
12.00	-20	836.599988	-0.001	2.5
12.00	-30	836.599988	0.000	2.5

Reference Frequency: Cellular Mid Channel 836.599988MHz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (°C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	***20***	***836.599988***	***0***	***2.5***
13.20	20	836.600015	*-0.032*	2.5
10.80	20	836.600011	*-0.027*	2.5
End Voltage(7.5Vdc)	20	836.599982	*0.007*	2.5

PCS, GPRS MODULATION – MID CHANNEL

Reference Frequency: PCS Mid Channel 1879.999978 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	50	1879.999971	0.004	2.5
12.00	40	1879.999977	0.001	2.5
12.00	30	1879.999979	-0.001	2.5
12.00	***20***	***1879.999978***	***0***	***2.5***
12.00	10	1879.999976	0.001	2.5
12.00	0	1879.999979	0.000	2.5
12.00	-10	1879.999978	0.000	2.5
12.00	-20	1879.999978	0.000	2.5
12.00	-30	1879.999978	0.000	2.5

Reference Frequency: PCS Mid Channel 1879.999978 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	***20***	1879.999978	***0***	***2.5***
13.20	20	1879.999979	*-0.00030*	2.5
10.80	20	1879.999991	*-0.00696*	2.5
End voltage(7.5)	20	1879.999972	*0.00319*	2.5

CELL, EGPRS MODULATION – MID CHANNEL

Reference Frequency: Cellular Mid Channel 836.599986 MHz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (°C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	50	836.599993	-0.008	2.5
12.00	40	836.600012	-0.031	2.5
12.00	30	836.600011	-0.030	2.5
12.00	***20***	***836.599986***	***0***	***2.5***
12.00	10	836.599989	-0.003	2.5
12.00	0	836.599987	-0.001	2.5
12.00	-10	836.599989	-0.003	2.5
12.00	-20	836.599988	-0.003	2.5
12.00	-30	836.599988	-0.002	2.5

Reference Frequency: Cellular Mid Channel 836.599986MHz @ 20°C Limit: to stay +- 2.5 ppm = 2091.500 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (°C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	***20***	***836.599986***	***0***	***2.5***
10.80	20	836.599993	*-0.008*	2.5
13.20	20	836.599987	*-0.001*	2.5
End Voltage(7.5)	20	836.599981	*0.006*	2.5

PCS, EGPRS MODULATION – MID CHANNEL

Reference Frequency: PCS Mid Channel 1879.999982MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	50	1879.999970	0.006	2.5
12.00	40	1879.999971	0.006	2.5
12.00	30	1879.999972	0.005	2.5
12.00	***20***	***1879.999982***	***0***	***2.5***
12.00	10	1879.999981	0.000	2.5
12.00	0	1879.999978	0.002	2.5
12.00	-10	1879.999975	0.004	2.5
12.00	-20	1879.999974	0.004	2.5
12.00	-30	1879.999971	0.006	2.5

Reference Frequency: PCS Mid Channel 1879.999982 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	***20***	1879.999982	***0***	***2.5***
13.20	20	1879.999986	*-0.00226*	2.5
10.80	20	1879.999989	*-0.00348*	2.5
End Voltage(7.5)	20	1879.999981	*0.00053*	2.5

CELL WCDMA – MID CHANNEL (836.0 MHz)

Reference Frequency: CELL Mid Channel 835.999995 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 2090.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	50	835.999991	0.004	2.5
12.00	40	835.999993	0.002	2.5
12.00	30	835.999994	0.001	2.5
12.00	***20***	***835.999995***	***0***	***2.5***
12.00	10	835.999991	0.004	2.5
12.00	0	835.999992	0.003	2.5
12.00	-10	835.999993	0.002	2.5
12.00	-20	835.999992	0.003	2.5
12.00	-30	835.999992	0.003	2.5

Reference Frequency: CELL Mid Channel 835.999995 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 2090.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	***20***	***835.999995***	***0***	***2.5***
10.80	20	836.600005	*-717.71532*	2.5
13.20	20	836.000012	*-0.02033*	2.5
End Voltage(7.5)	20	835.999991	*0.00478*	2.5

PCS, WCDMA – MID CHANNEL (1880.0 MHz)

Reference Frequency: PCS Mid Channel 1879.999979 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	50	1880.000011	-0.017	2.5
12.00	40	1879.999983	-0.002	2.5
12.00	30	1879.999982	-0.002	2.5
12.00	***20***	***1879.999979***	***0***	***2.5***
12.00	10	1879.999983	-0.002	2.5
12.00	0	1879.999980	0.000	2.5
12.00	-10	1879.999983	-0.002	2.5
12.00	-20	1879.999981	-0.001	2.5
12.00	-30	1879.999984	-0.002	2.5

Reference Frequency: PCS Mid Channel 1879.999979 MHz @ 20ºC Limit: within the authorized block or +- 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
12.00	***20***	1879.999979	***0***	***2.5***
13.20	20	1880.000004	*-0.01330*	2.5
10.80	20	1880.000006	*-0.01436*	2.5
End Voltage(7.5)	20	1879.999976	*0.00160*	2.5

9. RADIATED TEST RESULTS

9.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, & §24.232.

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.

Table—Equivalent Power and Antenna Heights for Base Stations in the 851–869 MHz and 935–940 MHz Bands Which Have a Requirement for a 32 km (20 mi) Service Area Radius

Antenna height (ATT) meters (feet)	Effective radiated power (watts)[1,2,4]
Above 1,372 (4,500)	65
Above 1,220 (4,000) to 1,372 (4,500)	70
Above 1,067 (3,500) to 1,220 (4,000)	75
Above 915 (3,000) to 1,067 (3,500)	100
Above 763 (2,500) to 915 (3,000)	140
Above 610 (2,000) to 763 (2,500)	200
Above 458 (1,500) to 610 (2,000)	350
Above 305 (1,000) to 458 (1,500)	600
Up to 305 (1,000)	31,000

1. Power is given in terms of effective radiated power (ERP).

2 Applicants in the Los Angeles, CA, area who demonstrate a need to serve both the downtown and fringe areas will be permitted to utilize an ERP of 1 kw at the following mountaintop sites: Santiago Park, Sierra Peak, Mount Lukens, and Mount Wilson.

3 Stations with antennas below 305 m (1,000 ft) (AAT) will be restricted to a maximum power of 1 kw (ERP).

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

TEST PROCEDURE

ANSI / TIA / EIA 603C Clause 2.2.17

KDB 971168 v02r01 RF Power output using broadband peak and average power meter method

MODES TESTED

- GPRS and EGPRS
- UMTS, REL 99 and HSDPA

Part 22 850MHz Band					
Band	Mode	Channel	f (MHz)	ERP	
				dBm	mW
CELL	GPRS	128	824.2	32.81	1909.85
		190	836.6	33.09	2037.04
		251	848.8	**34.06**	2546.83
	EGPRS	128	824.2	**29.79**	952.80
		190	836.6	29.06	805.38
		251	848.8	29.65	922.57

Part 24 1900MHz Band					
Band	Mode	Channel	f (MHz)	EIRP	
				dBm	mW
PCS	GPRS	512	1850.2	**32.55**	1798.87
		661	1880.0	32.40	1737.80
		810	1909.8	32.22	1667.25
	EGPRS	512	1850.2	**31.53**	1422.33
		661	1880.0	31.18	1312.20
		810	1909.8	30.51	1124.60

Part 22 850MHz Band					
Band	Mode	Channel	f (MHz)	ERP	
				dBm	mW
CELL	UMTS,REL 99	4357	826.40	**25.09**	322.85
		4405	836.00	24.19	262.42
		4455	846.60	23.98	250.03
	UMTS, HSDPA	4357	826.40	**24.49**	281.19
		4405	836.00	23.39	218.27
		4455	846.60	23.68	233.35

Part 24 1900MHz Band					
Band	Mode	Channel	f (MHz)	EIRP	
				dBm	mW
PCS	UMTS, REL 99	9662	1852.40	**27.17**	521.19
		9800	1880.00	26.48	444.63
		9938	1907.60	26.51	447.71
	UMTS, HSDPA	9662	1852.40	**26.03**	400.87
		9800	1880.00	25.75	375.84
		9938	1907.60	24.81	302.69

GPRS 850MHz(ERP)

High Frequency Substitution Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/22/13
Test Engineer: R.ZHENG
Configuration: EUT only
Mode: GSM 850MHz

Test Equipment:
Receiving: Sunol T407, and Chamber D Cable
Substitution: Dipole S/N: 00022117, 8ft SMA Cable

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	28.01	V	0.6	0.0	27.39	38.5	-11.1	
824.20	33.43	H	0.6	0.0	32.81	38.5	-5.6	
Mid Ch								
836.60	28.71	V	0.6	0.0	28.09	38.5	-10.4	
836.60	33.71	H	0.6	0.0	33.09	38.5	-5.4	
High Ch								
848.80	29.41	V	0.6	0.0	28.79	38.5	-9.7	
848.80	34.68	H	0.6	0.0	34.06	38.5	-4.4	

Rev. 10.15.13

EGPRS 850MHz (ERP)

High Frequency Substitution Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/22/13
Test Engineer: R.ZHENG
Configuration: EUT only
Mode: EDGE 850MHz

Test Equipment:
Receiving: Sunol T407, and Chamber D Cable
Substitution: Dipole S/N: 00022117, 8ft SMA Cable

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	24.91	V	0.6	0.0	24.29	38.5	-14.2	
824.20	30.41	H	0.6	0.0	29.79	38.5	-8.7	
Mid Ch								
836.60	25.11	V	0.6	0.0	24.49	38.5	-14.0	
836.60	29.68	H	0.6	0.0	29.06	38.5	-9.4	
High Ch								
848.80	25.20	V	0.6	0.0	24.58	38.5	-13.9	
848.80	30.27	H	0.6	0.0	29.65	38.5	-8.8	

Rev. 10.15.13

GPRS 1900MHz (EIRP)

High Frequency Fundamental Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/22/13
Test Engineer: R.ZHENG
Configuration: EUT with keyboard
Mode: GSM 1900MHz

Test Equipment:
Receiving: Horn T344 and Chamber D SMA Cables
Substitution: Horn T60 Substitution, 8ft SMA Cable 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								
1.851	21.3	V	0.98	7.93	28.25	33.0	-4.8	
1.851	25.6	H	0.98	7.93	32.55	33.0	-0.5	
Mid Ch								
1.880	21.0	V	0.98	7.48	27.53	33.0	-5.5	
1.880	25.9	H	0.98	7.48	32.40	33.0	-0.6	
High Ch								
1.910	21.5	V	0.98	7.10	27.64	33.0	-5.4	
1.910	26.1	H	0.98	7.10	32.22	33.0	-0.8	

Rev. 10.15.13

EGPRS 1900MHz (EIRP)

High Frequency Fundamental Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/22/13
Test Engineer: R.ZHENG
Configuration: EUT with keyboard
Mode: EDGE 1900MHz

Test Equipment:
Receiving: Horn T344 and Chamber D SMA Cables
Substitution: Horn T60 Substitution, 8ft SMA Cable 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								
1.851	19.7	V	0.98	7.93	26.65	33.0	-6.4	
1.851	24.6	H	0.98	7.93	31.53	33.0	-1.5	
Mid Ch								
1.880	19.5	V	0.98	7.48	26.00	33.0	-7.0	
1.880	24.7	H	0.98	7.48	31.18	33.0	-1.8	
High Ch								
1.910	19.7	V	0.98	7.10	25.82	33.0	-7.2	
1.910	24.4	H	0.98	7.10	30.51	33.0	-2.5	

Rev. 10.15.13

REL 99, 850 MHz (ERP)

High Frequency Substitution Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/23/13
Test Engineer: R.ZHENG
Configuration: EUT only
Mode: WCDMA Rel 99 850MHz

Test Equipment:
Receiving: Sunol T407, and Chamber D Cable
Substitution: Dipole S/N: 00022117, 8ft SMA Cable

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	20.01	V	0.6	0.0	19.39	38.5	-19.1	
826.40	25.71	H	0.6	0.0	25.09	38.5	-13.4	
Mid Ch								
836.00	19.21	V	0.6	0.0	18.59	38.5	-19.9	
836.00	24.81	H	0.6	0.0	24.19	38.5	-14.3	
High Ch								
846.00	19.80	V	0.6	0.0	19.18	38.5	-19.3	
846.00	24.60	H	0.6	0.0	23.98	38.5	-14.5	

Rev. 10.15.13

HSDPA 850MHz (ERP)

High Frequency Substitution Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/23/13
Test Engineer: R.ZHENG
Configuration: EUT only
Mode: WCDMA DC HSDPA 850MHz

Test Equipment:
Receiving: Sunol T407, and Chamber D Cable
Substitution: Dipole S/N: 00022117, 8ft SMA Cable

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	19.21	V	0.6	0.0	18.59	38.5	-19.9	
826.40	25.11	H	0.6	0.0	24.49	38.5	-14.0	
Mid Ch								
836.00	18.81	V	0.6	0.0	18.19	38.5	-20.3	
836.00	24.01	H	0.6	0.0	23.39	38.5	-15.1	
High Ch								
846.00	19.60	V	0.6	0.0	18.98	38.5	-19.5	
846.00	24.30	H	0.6	0.0	23.68	38.5	-14.8	

Rev. 10.15.13

REL 99, 1900 MHz (EIRP)

High Frequency Fundamental Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/23/13
Test Engineer: R.ZHENG
Configuration: EUT with keyboard
Mode: WCDMA Rel 99 1900MHz

Test Equipment:
Receiving: Horn T344 and Chamber D SMA Cables
Substitution: Horn T60 Substitution, 8ft SMA Cable 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	15.2	V	0.98	7.93	22.15	33.0	-10.9	
1.852	20.2	H	0.98	7.93	27.17	33.0	-5.8	
Mid Ch								
1.880	14.0	V	0.98	7.48	20.50	33.0	-12.5	
1.880	20.0	H	0.98	7.48	26.48	33.0	-6.5	
High Ch								
1.908	15.9	V	0.98	7.10	22.04	33.0	-11.0	
1.908	20.4	H	0.98	7.10	26.51	33.0	-6.5	

Rev. 10.15.13

HSDPA 1900MHz (EIRP)

High Frequency Fundamental Measurement
Compliance Certification Services Chamber D

Main

Company: Microsoft
Project #: 13U15414
Date: 10/23/13
Test Engineer: R.ZHENG
Configuration: EUT with keyboard
Mode: WCDMA DC HSDPA 1900MHz

Test Equipment:
Receiving: Horn T344 and Chamber D SMA Cables
Substitution: Horn T60 Substitution, 8ft SMA Cable 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	13.7	V	0.98	7.93	20.65	33.0	-12.4	
1.852	19.1	H	0.98	7.93	26.03	33.0	-7.0	
Mid Ch								
1.880	13.7	V	0.98	7.48	20.20	33.0	-12.8	
1.880	19.3	H	0.98	7.48	25.78	33.0	-7.2	
High Ch								
1.908	13.9	V	0.98	7.10	20.02	33.0	-13.0	
1.908	18.7	H	0.98	7.10	24.81	33.0	-8.2	

Rev. 10.15.13

9.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, & §24.238.

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.

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10 (f/6.1) decibels or 50 + 10 Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

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. 1 MHz 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
- UMTS, REL 99 and HSDPA

RESULTS

GPRS 850MHz (ERP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT only
Mode:	GPRS CELL

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 22

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (824.2MHz)									
1.648	-10.5	V	3.0	32.7	1.0	-42.2	-13.0	-29.2	
2.473	-20.6	V	3.0	31.4	1.0	-51.0	-13.0	-38.0	
1.648	-10.6	H	3.0	32.7	1.0	-42.3	-13.0	-29.3	
2.473	-22.2	H	3.0	31.4	1.0	-52.6	-13.0	-39.6	
Mid Ch, (836.6MHz)									
1.673	-10.8	V	3.0	32.6	1.0	-42.4	-13.0	-29.4	
2.510	-20.9	V	3.0	31.5	1.0	-51.4	-13.0	-38.4	
1.673	-10.7	H	3.0	32.6	1.0	-42.3	-13.0	-29.3	
2.510	-22.5	H	3.0	31.5	1.0	-53.0	-13.0	-40.0	
High Ch, (848.8MHz)									
1.698	-10.9	V	3.0	32.5	1.0	-42.4	-13.0	-29.4	
2.546	-20.6	V	3.0	31.4	1.0	-51.1	-13.0	-38.1	
1.698	-11.2	H	3.0	32.5	1.0	-42.7	-13.0	-29.7	
2.546	-22.4	H	3.0	31.4	1.0	-52.8	-13.0	-39.8	

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

EGPRS 850MHz (ERP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT only
Mode:	EGPRS CELL

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 22

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (824.2MHz)									
1.648	-24.4	V	3.0	32.7	1.0	-56.1	-13.0	-43.1	
2.473	-21.6	V	3.0	31.4	1.0	-52.0	-13.0	-39.0	
1.648	-26.5	H	3.0	32.7	1.0	-58.2	-13.0	-45.2	
2.473	-23.3	H	3.0	31.4	1.0	-53.7	-13.0	-40.7	
Mid Ch, (836.6MHz)									
1.673	-24.3	V	3.0	32.6	1.0	-55.9	-13.0	-42.9	
2.510	-21.0	V	3.0	31.5	1.0	-51.5	-13.0	-38.5	
1.673	-26.9	H	3.0	32.6	1.0	-58.5	-13.0	-45.5	
2.510	-23.1	H	3.0	31.5	1.0	-53.6	-13.0	-40.6	
High Ch, (848.8MHz)									
1.698	-24.7	V	3.0	32.5	1.0	-56.2	-13.0	-43.2	
2.546	-21.5	V	3.0	31.4	1.0	-52.0	-13.0	-39.0	
1.698	-26.8	H	3.0	32.5	1.0	-58.3	-13.0	-45.3	
2.546	-23.4	H	3.0	31.4	1.0	-53.8	-13.0	-40.8	

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

REL 99 850MHz (ERP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT only
Mode:	REL 99 CELL

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 22

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (826.4MHz)									
1.653	-25.6	V	3.0	32.7	1.0	-57.3	-13.0	-44.3	
2.479	-22.4	V	3.0	31.4	1.0	-52.8	-13.0	-39.8	
1.653	-27.6	H	3.0	32.7	1.0	-59.2	-13.0	-46.2	
2.479	-23.6	H	3.0	31.4	1.0	-54.0	-13.0	-41.0	
Mid Ch, (836.6MHz)									
1.673	-25.3	V	3.0	32.6	1.0	-56.9	-13.0	-43.9	
2.510	-21.9	V	3.0	31.5	1.0	-52.4	-13.0	-39.4	
1.673	-27.3	H	3.0	32.6	1.0	-58.9	-13.0	-45.9	
2.510	-24.2	H	3.0	31.5	1.0	-54.7	-13.0	-41.7	
High Ch, (846.6MHz)									
1.688	-25.2	V	3.0	32.6	1.0	-56.7	-13.0	-43.7	
2.532	-22.2	V	3.0	31.5	1.0	-52.7	-13.0	-39.7	
1.688	-27.6	H	3.0	32.6	1.0	-59.2	-13.0	-46.2	
2.532	-23.3	H	3.0	31.5	1.0	-53.8	-13.0	-40.8	

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

HSDPA 850MHz (ERP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT only
Mode:	HSDPA CELL

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 22

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (826.4MHz)									
1.653	-25.0	V	3.0	32.7	1.0	-56.7	-13.0	-43.7	
2.479	-21.8	V	3.0	31.4	1.0	-52.2	-13.0	-39.2	
1.653	-27.8	H	3.0	32.7	1.0	-59.4	-13.0	-46.4	
2.479	-23.4	H	3.0	31.4	1.0	-53.8	-13.0	-40.8	
Mid Ch, (836.6MHz)									
1.673	-25.7	V	3.0	32.6	1.0	-57.3	-13.0	-44.3	
2.510	-22.2	V	3.0	31.5	1.0	-52.7	-13.0	-39.7	
1.673	-27.9	H	3.0	32.6	1.0	-59.5	-13.0	-46.5	
2.510	-23.7	H	3.0	31.5	1.0	-54.2	-13.0	-41.2	
High Ch, (846.6MHz)									
1.688	-25.9	V	3.0	32.6	1.0	-57.4	-13.0	-44.4	
2.532	-21.8	V	3.0	31.5	1.0	-52.3	-13.0	-39.3	
1.688	-25.8	V	3.0	32.6	1.0	-57.3	-13.0	-44.3	
2.532	-21.8	V	3.0	31.5	1.0	-52.3	-13.0	-39.3	

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

GPRS 1900MHz(EIRP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT with keyboard
Mode:	GPRS PCS

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 24

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1850.2 MHz)									
3.700	-24.9	V	3.0	30.2	1.0	-54.1	-13.0	-41.1	
7.401	-23.2	V	3.0	26.5	1.0	-48.7	-13.0	-35.7	
3.700	-25.0	H	3.0	30.2	1.0	-54.2	-13.0	-41.2	
7.401	-22.0	H	3.0	26.5	1.0	-47.5	-13.0	-34.5	
Mid Ch, (1880 MHz)									
3.760	-25.1	V	3.0	30.1	1.0	-54.3	-13.0	-41.3	
7.520	-22.9	V	3.0	26.3	1.0	-48.2	-13.0	-35.2	
3.760	-25.7	H	3.0	30.1	1.0	-54.8	-13.0	-41.8	
7.520	-22.1	H	3.0	26.3	1.0	-47.4	-13.0	-34.4	
High Ch, (1909.8 MHz)									
3.819	-25.3	V	3.0	30.1	1.0	-54.4	-13.0	-41.4	
7.639	-23.0	V	3.0	26.2	1.0	-48.1	-13.0	-35.1	
3.819	-25.3	H	3.0	30.1	1.0	-54.4	-13.0	-41.4	
7.639	-22.2	H	3.0	26.2	1.0	-47.4	-13.0	-34.4	

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

EGPRS 1900MHz(EIRP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Microsoft
Project #: 13U15414
Date: 10/28/13
Test Engineer: R.Zheng
Configuration: EUT with keyboard
Mode: EGPRS PCS

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 24

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1850.2 MHz)									
3.700	-25.1	V	3.0	30.2	1.0	-54.3	-13.0	-41.3	
7.401	-23.5	V	3.0	26.5	1.0	-49.0	-13.0	-36.0	
3.700	-25.2	H	3.0	30.2	1.0	-54.4	-13.0	-41.4	
7.401	-22.2	H	3.0	26.5	1.0	-47.7	-13.0	-34.7	
Mid Ch, (1880 MHz)									
3.760	-25.4	V	3.0	30.1	1.0	-54.6	-13.0	-41.6	
7.520	-23.2	V	3.0	26.3	1.0	-48.5	-13.0	-35.5	
3.760	-26.0	H	3.0	30.1	1.0	-55.1	-13.0	-42.1	
7.520	-22.4	H	3.0	26.3	1.0	-47.7	-13.0	-34.7	
High Ch, (1909.8 MHz)									
3.819	-25.7	V	3.0	30.1	1.0	-54.8	-13.0	-41.8	
7.639	-23.3	V	3.0	26.2	1.0	-48.4	-13.0	-35.4	
3.819	-25.6	H	3.0	30.1	1.0	-54.7	-13.0	-41.7	
7.639	-22.4	H	3.0	26.2	1.0	-47.6	-13.0	-34.6	

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

REL 99 1900MHz(EIRP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT with keyboard
Mode:	REL 99 PCS

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 24

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1852.4 MHz)									
3.705	-25.9	V	3.0	30.2	1.0	-55.1	-13.0	-42.1	
7.410	-24.0	V	3.0	26.5	1.0	-49.4	-13.0	-36.4	
3.705	-26.2	H	3.0	30.2	1.0	-55.4	-13.0	-42.4	
7.410	-22.4	H	3.0	26.5	1.0	-47.9	-13.0	-34.9	
Mid Ch, (1880 MHz)									
3.760	-25.7	V	3.0	30.1	1.0	-54.9	-13.0	-41.9	
7.520	-23.5	V	3.0	26.3	1.0	-48.8	-13.0	-35.8	
3.760	-26.0	H	3.0	30.1	1.0	-55.1	-13.0	-42.1	
7.520	-23.1	H	3.0	26.3	1.0	-48.4	-13.0	-35.4	
High Ch, (1907.6 MHz)									
3.815	-25.5	V	3.0	30.1	1.0	-54.6	-13.0	-41.6	
7.630	-23.7	V	3.0	26.2	1.0	-48.9	-13.0	-35.9	
3.815	-26.3	H	3.0	30.1	1.0	-55.4	-13.0	-42.4	
7.630	-22.5	H	3.0	26.2	1.0	-47.7	-13.0	-34.7	

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

HSDPA 1900MHz(EIRP)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company:	Microsoft
Project #:	13U15414
Date:	10/28/13
Test Engineer:	R.Zheng
Configuration:	EUT with keyboard
Mode:	HSDPA PCS

Chamber	Pre-amplifer	Filter	Limit
3m Chamber D	T145 8449B	Filter 1	Part 24

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (1852.4 MHz)									
3.705	-26.1	V	3.0	30.2	1.0	-55.3	-13.0	-42.3	
7.410	-24.5	V	3.0	26.5	1.0	-49.9	-13.0	-36.9	
3.705	-26.3	H	3.0	30.2	1.0	-55.5	-13.0	-42.5	
7.410	-22.8	H	3.0	26.5	1.0	-48.3	-13.0	-35.3	
Mid Ch, (1880 MHz)									
3.760	-25.9	V	3.0	30.1	1.0	-55.1	-13.0	-42.1	
7.520	-23.8	V	3.0	26.3	1.0	-49.1	-13.0	-36.1	
3.760	-26.2	H	3.0	30.1	1.0	-55.3	-13.0	-42.3	
7.520	-23.6	H	3.0	26.3	1.0	-48.9	-13.0	-35.9	
High Ch, (1907.6 MHz)									
3.815	-25.7	V	3.0	30.1	1.0	-54.8	-13.0	-41.8	
7.630	-23.9	V	3.0	26.2	1.0	-49.1	-13.0	-36.1	
3.815	-26.2	H	3.0	30.1	1.0	-55.3	-13.0	-42.3	
7.630	-22.9	H	3.0	26.2	1.0	-48.1	-13.0	-35.1	

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