MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
33439 WESTERN AVENUE ! UNION CITY, CALIFORNIA 94587-3201 ! PHONE (510) 489-6300 ! FAX (510) 489-6372

LGC Wireless
2540 Junction Avenue
San Jose, CA 95134

March 15, 2007

Dear Tom Macall,

Enclosed is the EMC test report for compliance testing of the LGC Wireless, InterReach Unison AWS, tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 27 Subpart C and L for Portable Devices and Part 15 Subpart B for a Class A Digital Device.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,

MET LABORATORIES, INC.

Jennifer Sanchez
Documentation Department

Reference: (\LGC Wireless\EMCS80036-FCC27)

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33439 WESTERN AVENUE ! UNION CITY, CALIFORNIA 94587-3201 ! PHONE (510) 489-6300 ! FAX (510) 489-6372

Electromagnetic Compatibility Criteria Test Report

For the

LGC Wireless
InterReach Unison AWS
Model UNS-AWS-1

Tested under

FCC Certification Rules
Title 47 of the CFR, Part 27 C and L and Part 15 Subpart B for a Class A

MET Report: EMCS80036-FCC27

March 15, 2007

Prepared For:

LGC Wireless
2540 Junction Avenue
San Jose, CA 95134

Prepared By:
MET Laboratories, Inc.
4855 Patrick Henry Dr., Building 6,
Santa Clara, CA 95054

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MET Report: EMCS80036-FCC

Shawn McMillen
Project Engineer, Electromagnetic Compatibility Lab

Jennifer Sanchez
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 27 C & L and Part 15 Subpart B of the FCC Rules under normal use and maintenance.

Tony Permsombut,
Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	March 15, 2007	Initial Issue.

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List of Terms and Abbreviations

AC	**Alternating Current**
ACF	**Antenna Correction Factor**
Cal	**Calibration**
d	**Measurement Distance**
dB	**Decibels**
dBµV	**dB micro Volts**
dBµV/m	**dB micro Volt per meter**
DC	**Direct Current**
DCF	**Distance Correction Factor**
E	**Electric Field**
EUT	**Equipment Under Test**
EIRP	**Effective Isotropic Radiated Power**
f	**Frequency**
FCC	**Federal Communications Commission**
GHz	**Giga Hertz**
Hz	**Hertz**
IEC	**International Electro-technical Commission**
kHz	**kilohertz**
kV	**kilo Volt**
LISN	**Line Impedance Stabilization Network**
MHz	**Mega Hertz**
RF	**Radio Frequency**
RMS	**Root-Mean-Square**
SNF	**Spectrum Analyzer Noise Floor**
V/m	**Volts per meter**

1. Testing Summary

Name of Test	FCC Rule Part/Section	Results
RF Power Output	2.1046; 27.50(d)	Compliant
Modulation Characteristics	2.1047	N/A
Occupied Bandwidth	2.1049	Compliant
Spurious Emissions at Antenna Terminals	2.1051; 27.53(g)	Compliant
Radiated Spurious Emissions	2.1053; 27.53(g)	Compliant
Frequency Stability over Temperature Variations	2.1055; 27.54	Compliant
Conducted Emission, Class B	15.107 (a)	Compliant
Radiated Emission Class B	15.109 (a)	Compliant

Table 1. Summary of Test Results

2. Equipment Configuration

2.1. Overview

MET Laboratories, Inc. was contracted by LGC Wireless to perform testing on InterReach Unison AWS, under LGC Wireless purchase order number 70019220.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the LGC Wireless, InterReach Unison AWS.

In accordance with §2.955(a) (3), the following data is presented in support of the verification of the LGC Wireless, InterReach Unison AWS.

LGC Wireless should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the InterReach Unison AWS has been **permanently** discontinued, as per §2.955(b).

The results obtained relate only to the item(s) tested.

Model(s) Tested:	InterReach Unison AWS	
Model(s) Covered:	InterReach Unison AWS	
EUT Specifications:	Primary Power: 54VDC @0.8A Power supplied by Expansion Hub	
	FCC ID: NOOUNS-AWS-1	
	Type of Modulations:	CDMA (F9W)
		TDMA (DXW)
		GSM (GXW)
		AMPS (F1D)
	Average Output Power:	DownLink: 19.11dBm
		UpLink: -28.76dBm
	Equipment Code:	PCB
	EUT Frequency Ranges:	DownLink – 2110-2155MHz UpLink – 1710-1755
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Shawn McMillen	
Date(s):	March 15, 2007	

2.2. Test Site

All testing was performed at MET Laboratories, Inc., 4855 Patrick Henry Dr., Building 6, Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

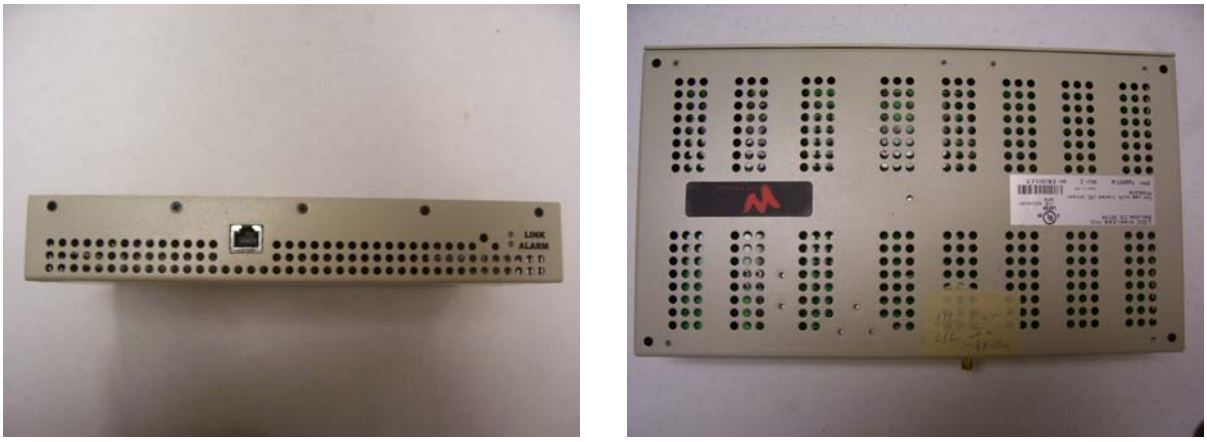
Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a) (3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by A2LA (Certificate Number 591.02).

2.3. Description of Test Sample

The InterReach Unison remote, model UNS-AWS-1, is the transmitter component of the InterReach Unison system; distributed antenna system for in-building access of wireless signals.

The UNS-AWS-1 receives or transmits (via cat-5 cable) an IF signal from and to the InterReach Unison expansion hub.

Basic InterReach Unison system operation:
The Unison main hub receives a RF signal, via coax, from a base station. The RF signal is converted to IF, and then transmitted via fiber to the expansion hub. The expansion hub transmits the IF signal to the UNS-AWS-1 remote, via cat-5 cable, which then converts the IF back to RF signal. The remote sends the RF signal to an external antenna, via coax, for transmission. The remote is powered by DC voltage, also supplied through the cat-5 cable from the expansion hub.
The remote will also take a received antenna RF signal in the Uplink direction through the expansion hub and main hub, and back to the base station.



Photograph 1. Photograph of EUT

2.4. Equipment Configuration

The EUT was set up as outlined in Figure 1 and Figure 2. All equipment incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Part Number	Serial Number
C	RAU (Main board)	740557-0	FR101LC5

Table 2. Equipment Configuration

2.5. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
A	Expansion Hub	LGC Wireless	UNS-EH-2	P0101AW3
B	Main Hub	LGC Wireless	UNS-1-MH-1	P01007DG
D	Spectrum Analyzer	HP	E4407B	MY45102898
E	Signal Generator	HP	E4432B	US38080117
F	Laptop	Sony	PCG-F490	-
G	50 Ohms Terminator	Narda	375BNB	07
H	50 Ohms Terminator	Narda	375BNB	07

Table 3. Support Equipment

2.6. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded Y/N	Termination Box ID & Port ID
Conducted Measurement (Uplink)						
1	A Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
2	B Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
3	B Back, Port 1 UpLink	Fiber Optic	1	1.5	No	A Front Uplink
4	B Back, Port 1 DownLink	Fiber Optic	1	1.5	No	A Front Downlink
5	B Front	VGA	1	2	Yes	F
6	C, Ethernet Port	CAT 5	1	10	Yes	A Front
7	C, Antenna Port	Coax	1	5	Yes	D
8	B Back, Uplink	Coax	1	1	Yes	E
9	B Back, Downlink	Direct Connect	1			G
Conducted Measurement (Downlink)						
1	A Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
2	B Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
3	B Back, Port 1 UpLink	Fiber Optic	1	1.5	No	A Front Uplink
4	B Back, Port 1 DownLink	Fiber Optic	1	1.5	No	A Front Downlink
5	B Front	VGA	1	2	Yes	F
6	C, Ethernet Port	CAT 5	1	10	Yes	A Front
7	C, Antenna Port	Coax	1	5	Yes	E
8	B Back, Downlink	Coax	1	1	Yes	D
9	B Back, Uplink	Direct Connect	1			G
Radiated Emission (Uplink)						
1	A Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
2	B Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
3	B Back, Port 1 UpLink	Fiber Optic	1	1.5	No	A Front Uplink
4	B Back, Port 1 DownLink	Fiber Optic	1	1.5	No	A Front Downlink
5	B Front	VGA	1	2	Yes	F
6	C, Ethernet Port	CAT 5	1	10	Yes	A Front
7	B Back, Uplink	Coax	1	1	Yes	E
8	B Back, Downlink	Direct Connect	1			G
9	C, Antenna Port	Direct Connect	1			H

Radiated Emission (Downlink)						
1	A Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
2	B Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
3	B Back, Port 1 UpLink	Fiber Optic	1	1.5	No	A Front Uplink
4	B Back, Port 1 DownLink	Fiber Optic	1	1.5	No	A Front Downlink
5	B Front	VGA	1	2	Yes	F
6	C, Ethernet Port	CAT 5	1	10	Yes	A Front
7	C, Antenna Port	Coax	1	5	Yes	E
8	B Back, Uplink	Direct Connect	1			G
9	B Back, Downlink	Direct Connect	1			G
Unintentional						
1	A Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
2	B Back, AC Input	AC PWR Cord	1	2	No	AC PWR Outlet
3	B Back, Port 1 UpLink	Fiber Optic	1	1.5	No	A Front Uplink
4	B Back, Port 1 DownLink	Fiber Optic	1	1.5	No	A Front Downlink
5	B Front	VGA	1	2	Yes	F
6	C, Ethernet Port	CAT 5	1	10	Yes	A Front
7	C, Antenna Port	Direct Connect	1			H
8	B Back, Uplink	Direct Connect	1			G
9	B Back, Downlink	Direct Connect	1			G

Table 4. Ports and Cabling Information

Unintentional

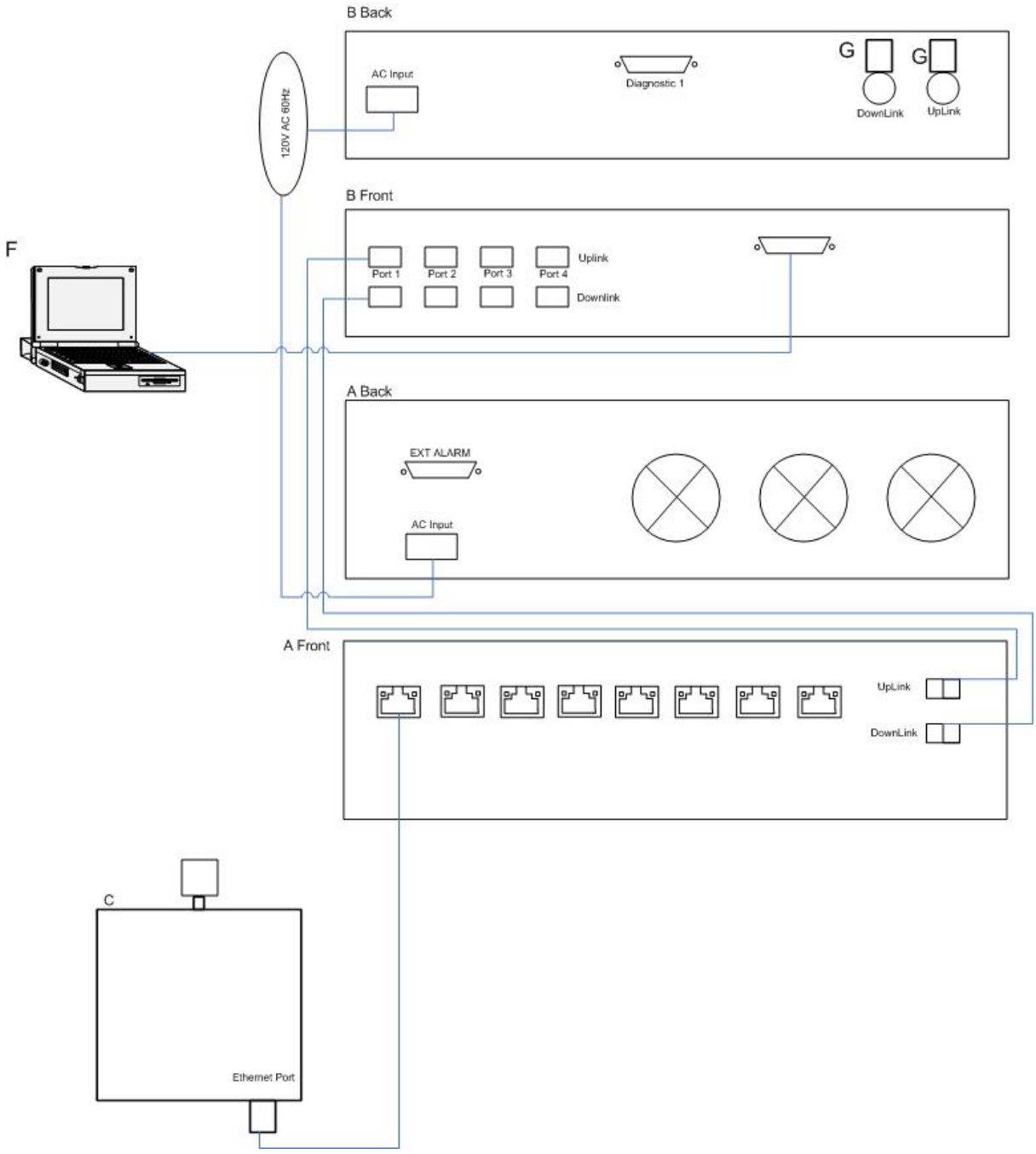


Figure 1: Block Diagram of Test Configuration (Unintentional)

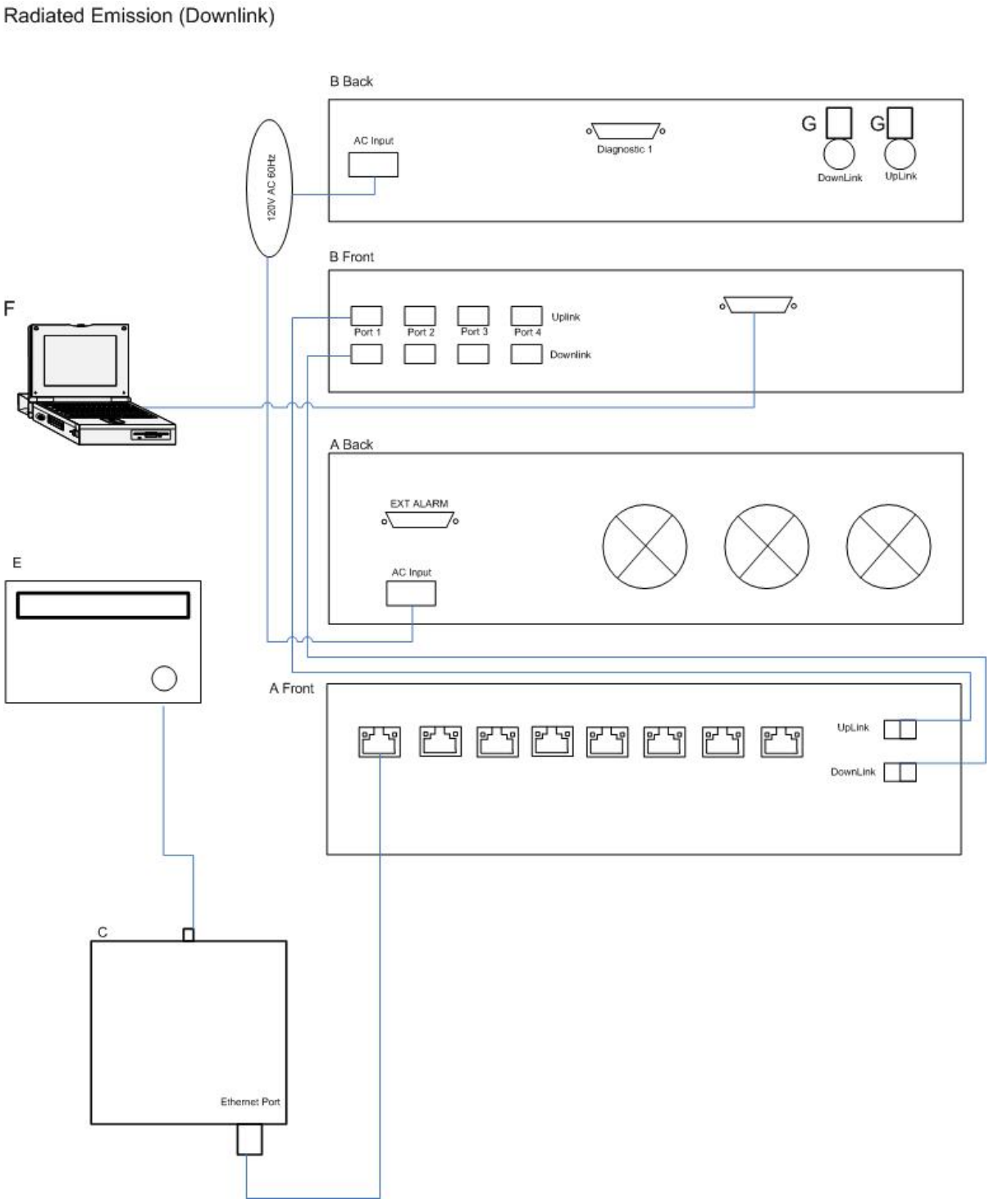


Figure 2: Block Diagram of Test Configuration (Radiated Emissions Downlink)

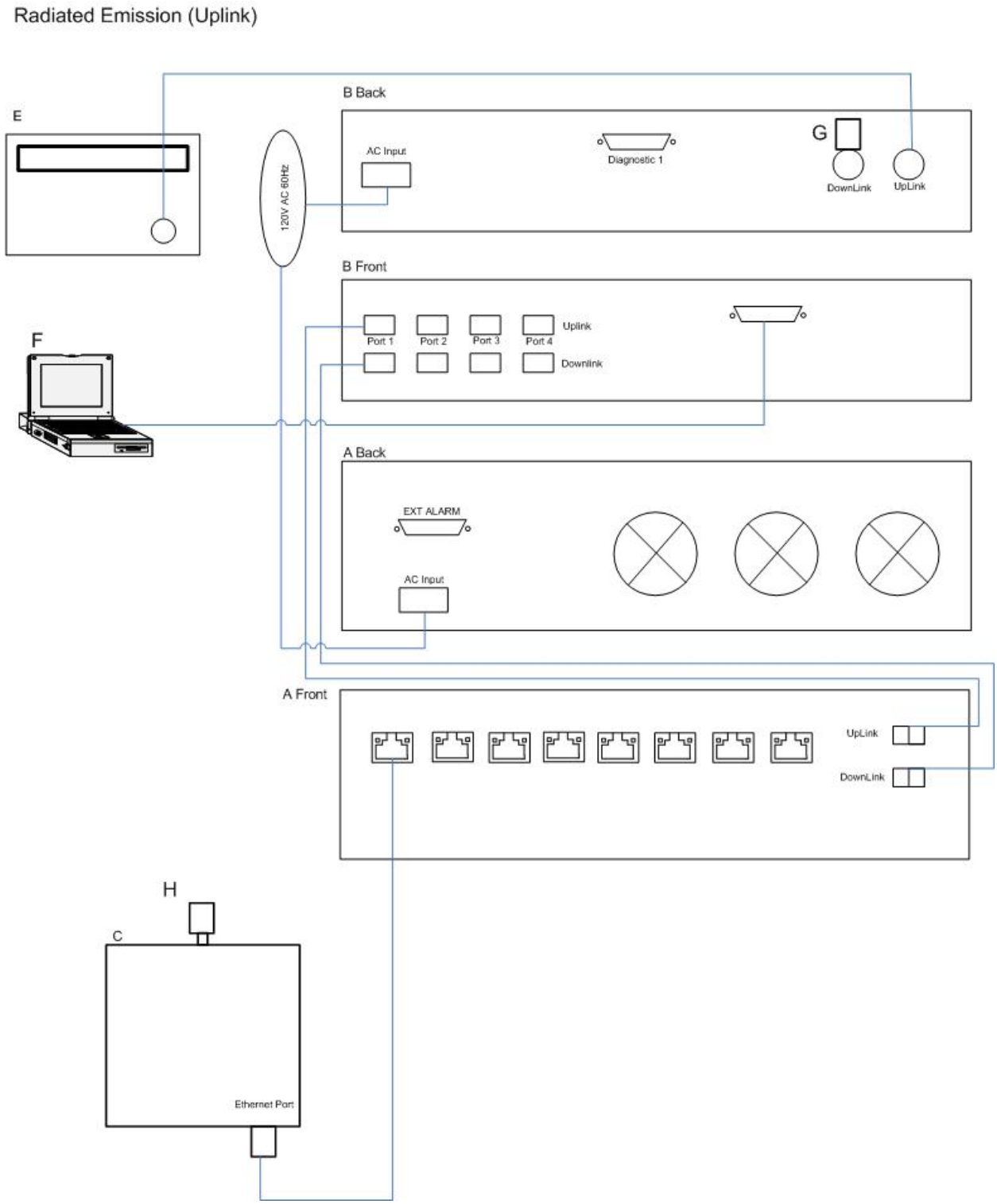


Figure 3. Block Diagram of Test Configuration (Radiated Emissions Uplink)

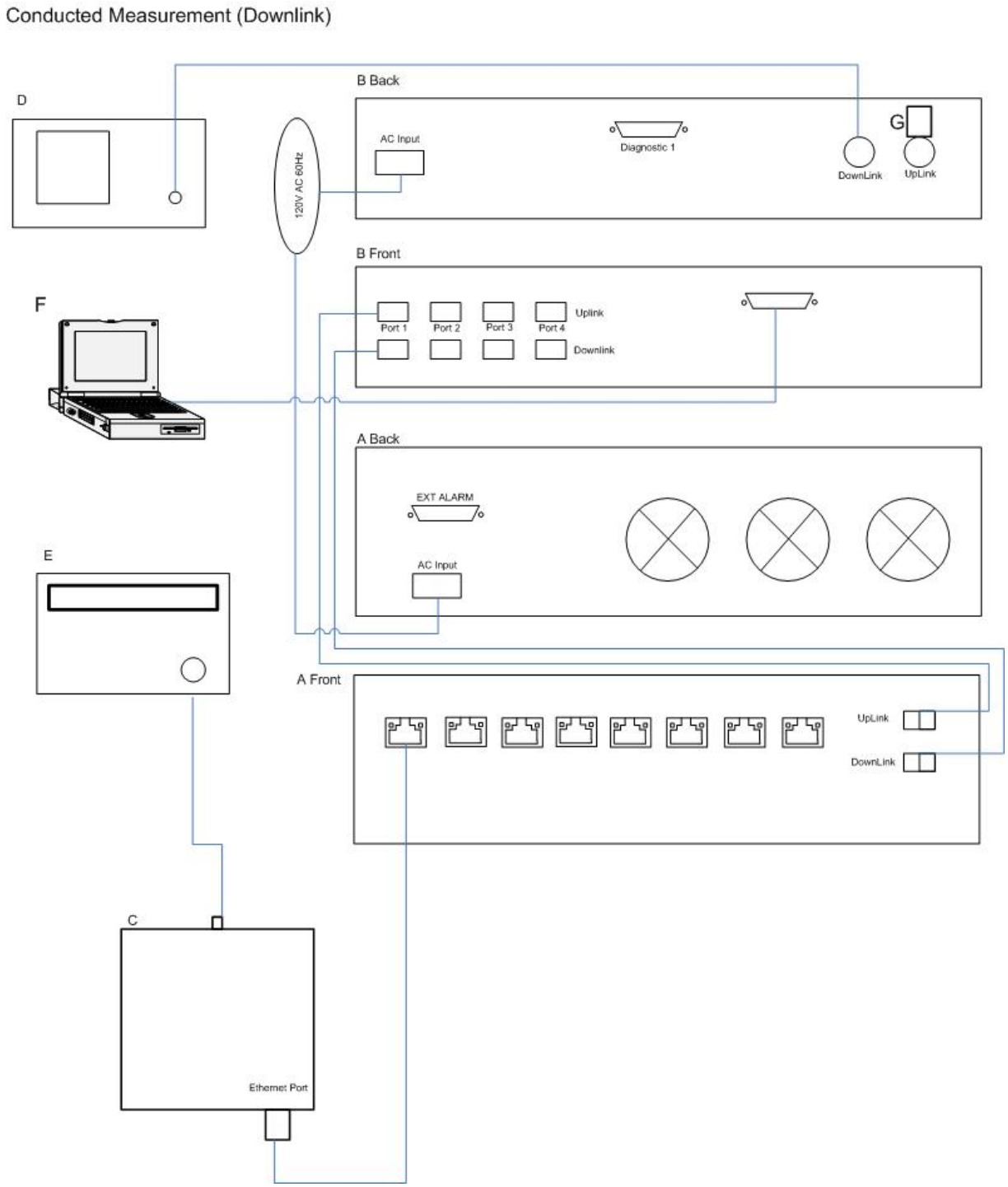


Figure 4. Block Diagram of Test Configuration (Conducted Measurements Downlink)

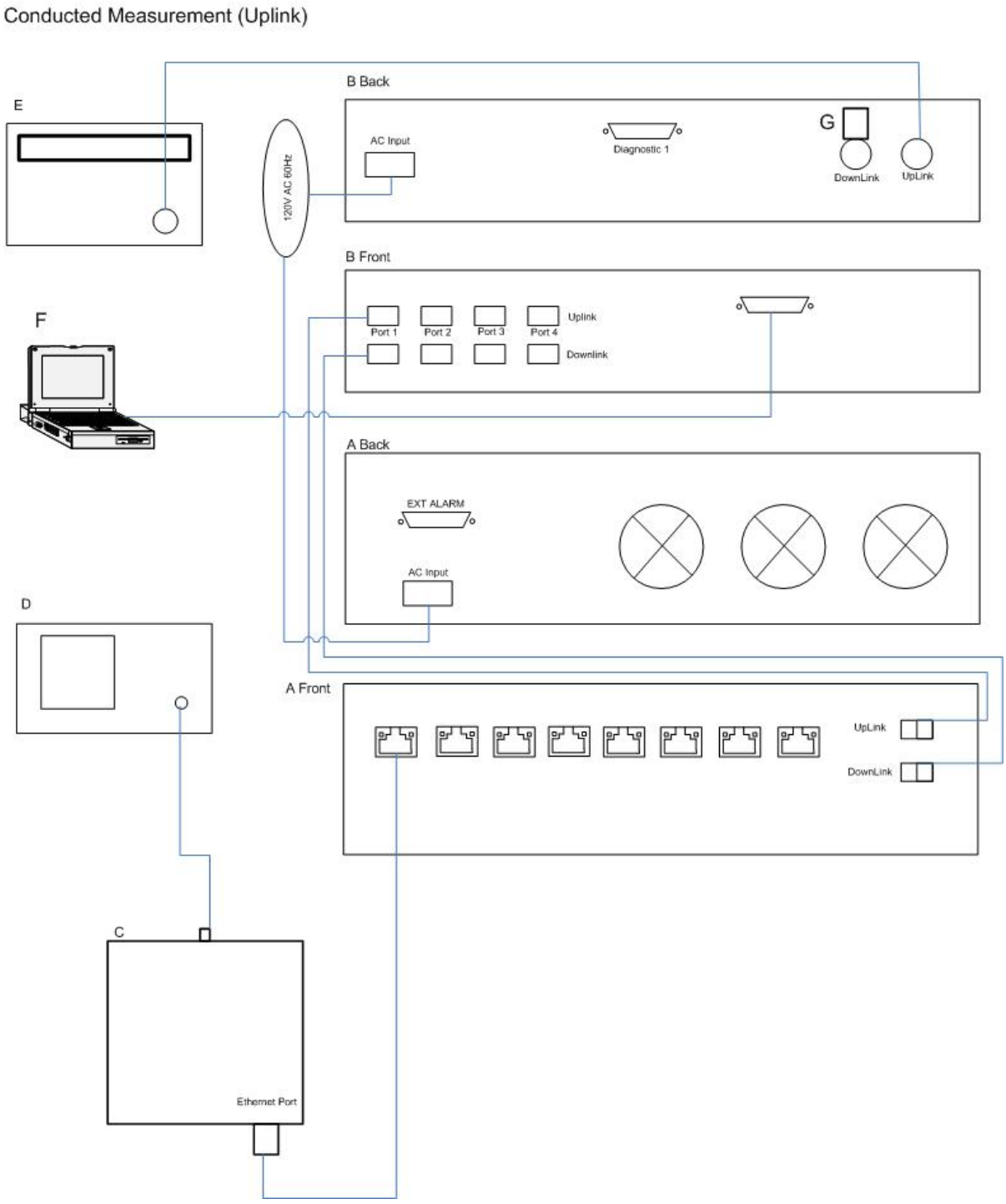


Figure 5. Block Diagram of Test Configuration (Conducted Measurements Uplink)

2.7. Mode of Operation

One mode of operation. RF signal is input into either the downlink of the Main Hub and RF signal is monitored at the antenna port of the remote unit. Also, in the uplink direction, an RF signal can be input into the antenna port of the remote and the signal is monitored at the uplink port of the main hub.

2.8. Method of Monitoring EUT Operation

A Spectrum Analyzer and a Power Meter was use to monitor the EUT's transmitter channel and power output.

2.9. Modifications

2.9.1) Modifications to the EUT

No modifications were made to the EUT.

2.9.2) Modifications to the Test Standard

No modifications were made to the test standard.

2.10 Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electro-Magnetic Compatibility Lab for testing was returned LGC Wireless upon completion of testing.

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3. Electromagnetic Compatibility Unintentional Radiators

3.1. Conducted Emission Limits

Test Requirement(s):

15.107 (a) "Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals."

15.107 (b) "For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges."

Frequency range (MHz)	15.107(b), Class A Limits (dBµV)		15.107(a), Class B Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.5	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies.				
Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.				

Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b)

Test Procedures:

The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50µH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

Test Results:

The EUT does not possess AC power ports.

3. Electromagnetic Compatibility Unintentional Radiators

3.2. Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 6.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 6.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a),Class B Limit (dBµV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 6. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was installed in a standard Telco rack inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 10 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Test Results: The EUT was found to comply with the Class A requirement(s) of this section.

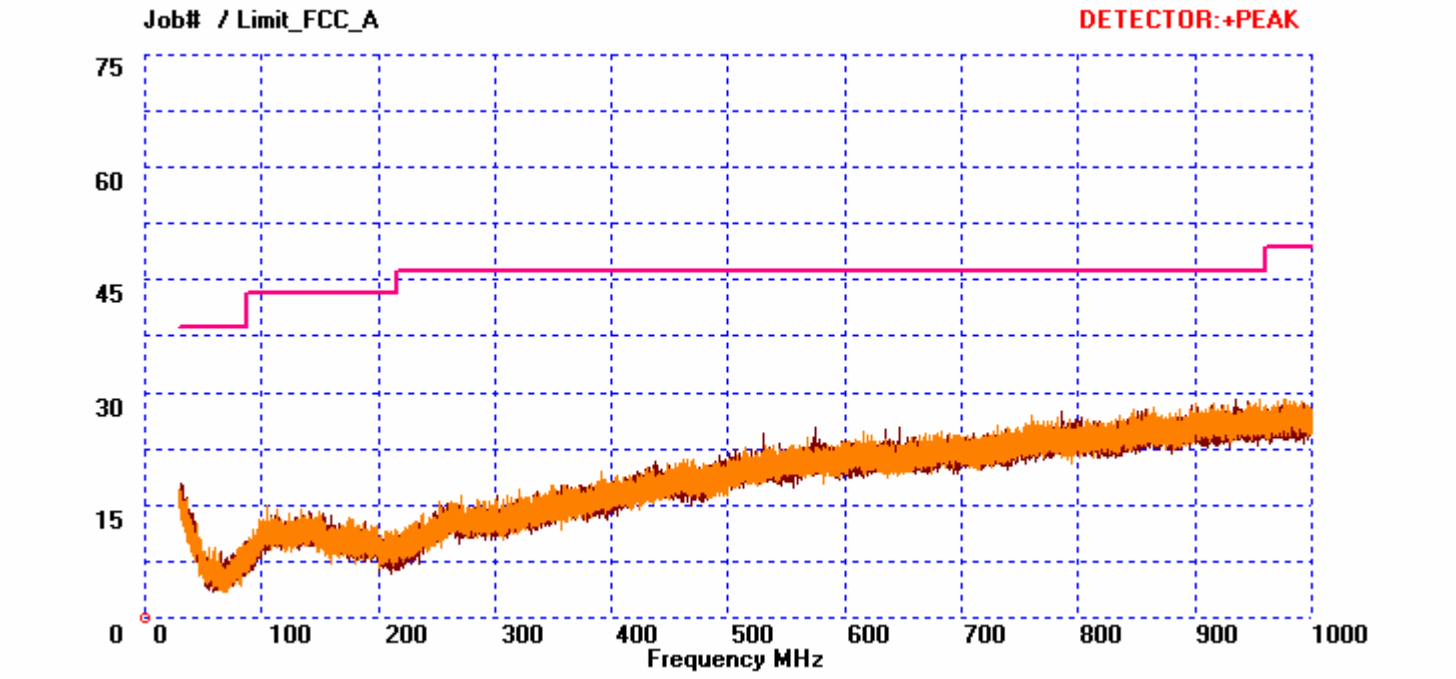
Test Engineer(s): Tony Permsombut

Test Date(s): March 14, 2007

Radiated Emissions Limits Test Results, 30 MHz to 1 GHz, Class A

Frequency (MHz)	Antenna Polarity (H/V)	EUT Azimuth (Degrees)	Antenna Height (m)	Uncorrected Amplitude QP Detector (dBuv)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
106.55	V	0	1	1.92	11.00	1.74	14.66	43.50	-28.84
271.13	V	0	1	4.04	9.70	2.53	16.27	43.50	-27.23
392.85	V	0	1	3.07	13.20	2.93	19.20	46.40	-27.20
530	H	0	2	2.42	18.20	4.20	24.81	46.40	-21.59
575	H	0	2	1.90	19.00	4.45	25.35	46.40	-21.05
645	H	0	2	1.73	19.10	4.79	25.61	46.40	-20.79

Table 7. Radiated Emissions Limits Test Results, 30 MHz to 1 GHz, Class A



Radiated Emissions Limits Test Setup

Radiated Emissions Limits Test Results, 1 GHz to10 GHz, Class A

Freq. (GHz)	Azimuth (Degrees)	Antenna Polarity (H/V)	Height (m)	Raw Amp. @ 3 m (Avg)	P.Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	Dist. Cor. Factor (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit per FCC pt.15 @ 3 m (dBuV/m)	Delta (dB)
1.66	246	H	1	59.63	35.21	26.34	2.76	10.46	43.06	49.5	-6.44
1.665	234	V	1	58.63	35.22	27.05	2.77	10.46	42.77	49.5	-6.73
1.967	148	H	1	44.63	35.14	27.69	3.21	10.46	29.92	49.5	-19.58
1.969	204	V	1	49.63	35.14	28.29	3.21	10.46	35.53	49.5	-13.97
***3.94**	**248**	**H**	**1.56**	**55.63**	**35.17**	**33.11**	**4.69**	**10.46**	**47.81**	**49.5**	**-1.69**
3.94	181	V	1.12	52.47	35.17	33.71	4.69	10.46	45.24	49.5	-4.26
9.2	191	H	1.31	44.61	35.45	38.23	7.69	10.46	44.62	49.5	-4.88
9.225	214	V	1.49	44.21	35.44	38.07	7.70	10.46	44.08	49.5	-5.42
9.35	136	V	1.69	35.47	35.48	38.12	7.77	10.46	35.42	49.5	-14.08
9.375	109	H	1.47	39.67	35.51	38.11	7.79	10.46	39.60	49.5	-9.90
10	0	H	1	32.03	35.51	38.70	8.12	10.46	32.88	49.5	-16.62
10	0	V	1	32.13	35.51	38.70	8.12	10.46	32.98	49.5	-16.52

Table 8. Radiated Emissions Limits Test Results, 1 GHz to 10 GHz

Note 1: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

Note 2: The EUT was tested at 1 m. The data has been corrected for comparison with the 3 m limit using the formula: 20log (3 m/1 m) as expressed in the 'Distance Correction' column.

Radiated Emission Limits Test Setup

Photograph 2. Radiated Emission Limits Test Setup

4. Electromagnetic Compatibility Criteria Intentional Radiators

4.1. RF Power Output

Test Requirement(s): §2.1046 and §27.50(d)

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurement* was made at the RF output terminal using a Power Meter with a Power Sensor capable of measuring a modulated carrier.

Test Results: Equipment complies with 47CFR 2.1046 and 27.50(d). The InterReach Unison AWS does not exceed 100 Watts peak (EIRP) at the carrier frequency.

The following page show measurements of RF Power output which is recorded below:

Test Engineer(s): Shawn McMillen

Test Date(s): March 16, 2007

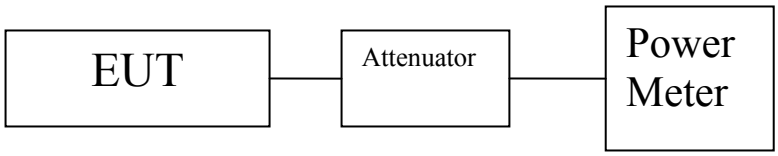


Figure 6. Block Diagram of Maximum Power Output Test Setup

Down Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
CDMA	2110.0	0dBm	18.08
CDMA	2132.5	0dBm	19.11
CDMA	2155.0	0dBm	17.05

Down Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
WCDMA	2110.0	0dBm	13.50
WCDMA	2132.5	0dBm	14.44
WCDMA	2155.0	0dBm	16.64

Down Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
TDMA	2110.0	0dBm	14.06
TDMA	2132.5	0dBm	15.02
TDMA	2155.0	0dBm	17.07

Down Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
GSM	2110.0	0dBm	13.91
GSM	2132.5	0dBm	14.71
GSM	2155.0	0dBm	16.91

Up Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
CDMA	1710.0	-40dBm	-28.46
CDMA	1732.5	-40dBm	-27.52
CDMA	1755.0	-40dBm	-26.69

Up Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
WCDMA	1710.0	-40dBm	-28.60
WCDMA	1732.5	-40dBm	-27.55
WCDMA	1755.0	-40dBm	-26.91

Up Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
TDMA	1710.0	-40dBm	-28.35
TDMA	1732.5	-40dBm	-27.32
TDMA	1755.0	-40dBm	-26.66

Up Link			
Modulation	**Frequency (MHz)**	**Input Power (dBm)**	**Modulated Average Output Power (dBm)**
GSM	1710.0	-40dBm	-28.76
GSM	1732.5	-40dBm	-27.87
GSM	1755.0	-40dBm	-26.76

4. Electromagnetic Compatibility Intentional Radiators

4.3. § 2.1049 Occupied Bandwidth

Test Requirement(s): **§ 2.1049 Measurements required: Occupied bandwidth:** The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

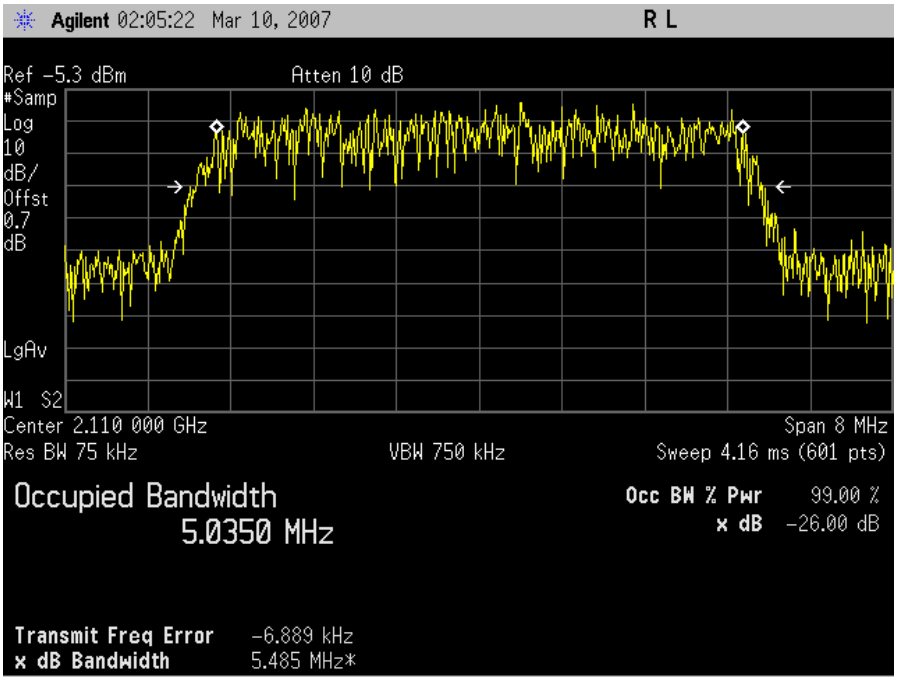
Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports for both Uplink and Downlink

The modulation characteristics of signal generator's carrier was measured first at a maximum RF level prescribed by the OEM. The signal generator was then connected to either the Uplink or Downlink input at the appropriate RF level. The resulting modulated signal through the EUT was measured and compared against the original signal.

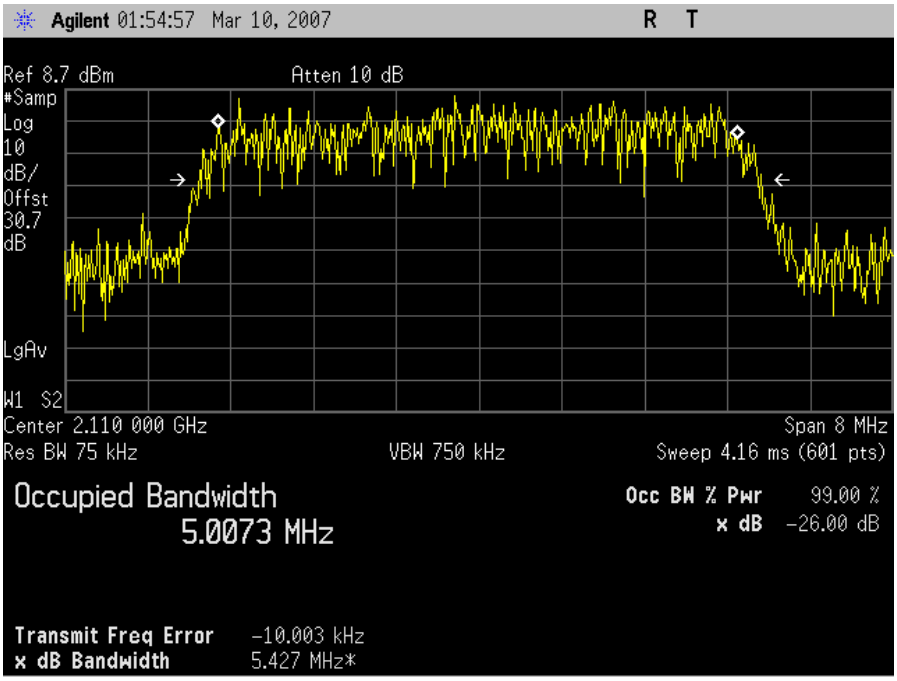
Test Results: Equipment complies with Section 2.1049. The following pages show measurements of 99% Occupied Bandwidth plots:

Test Engineer(s): Shawn McMillen

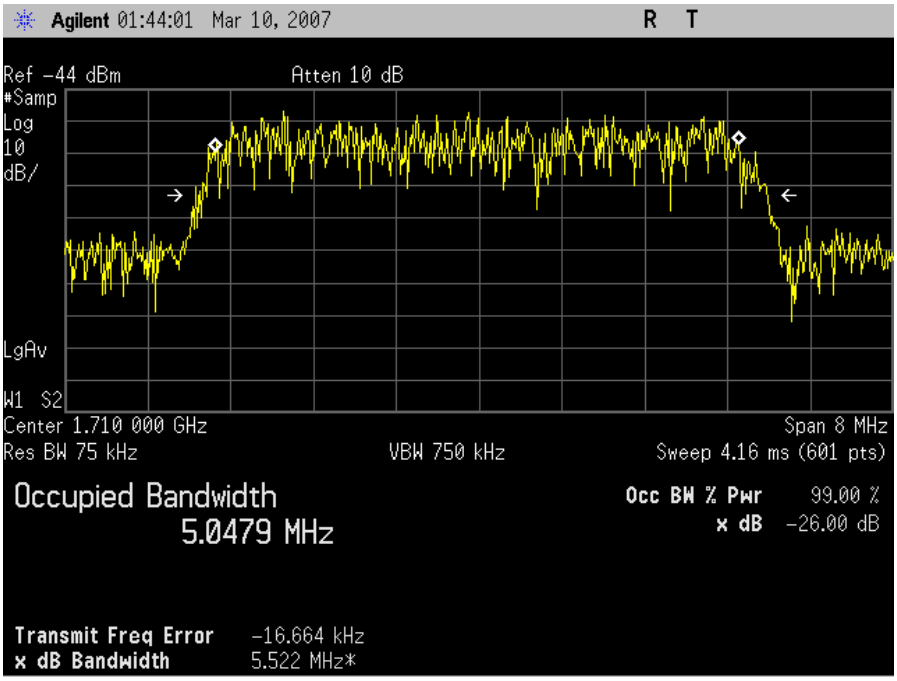
Test Date(s): March 9, 2007



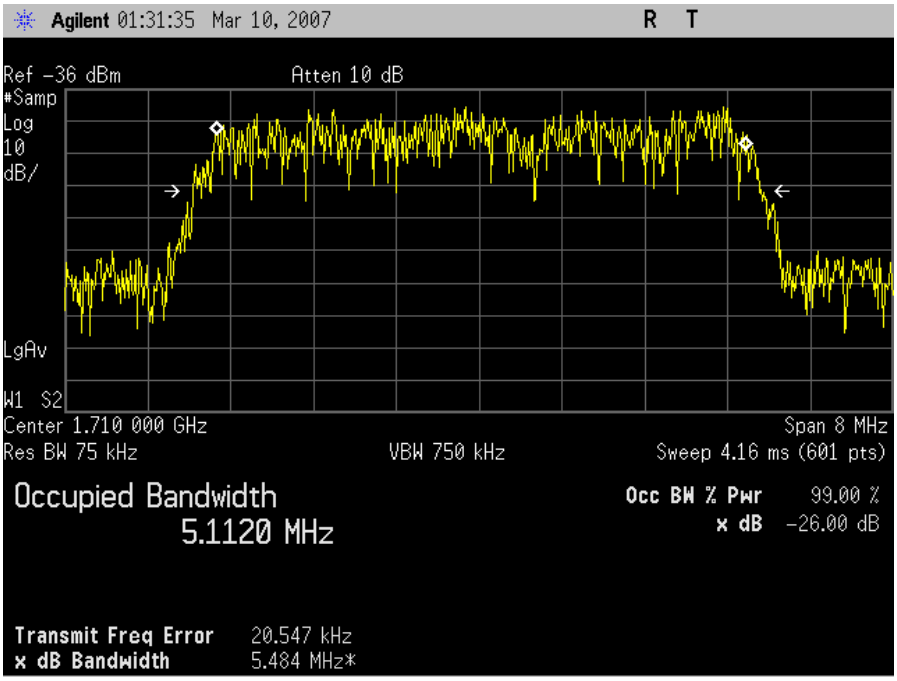
WCDMA Downlink Input (Low Channel)



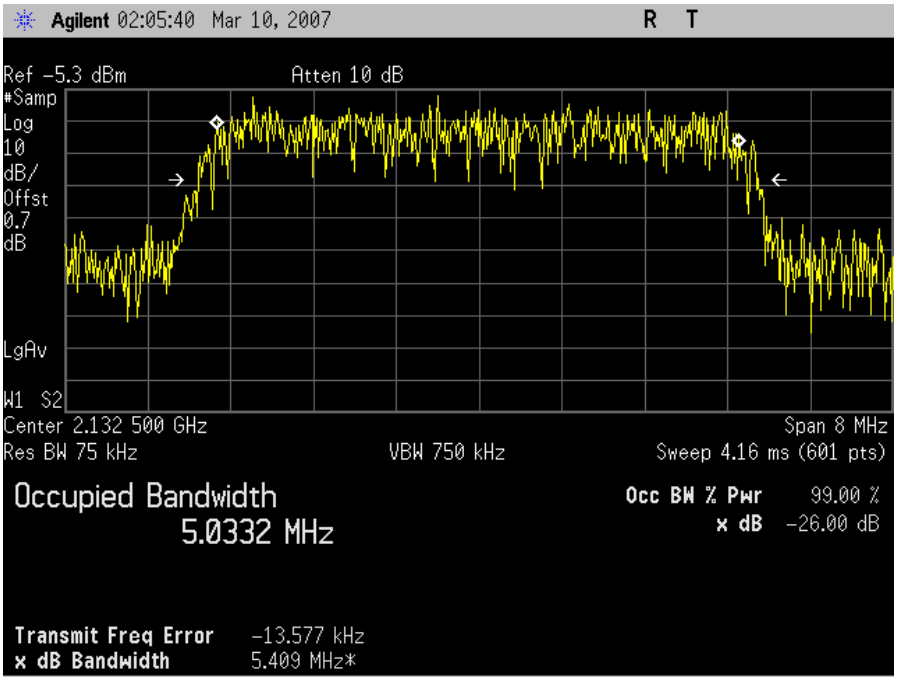
WCDMA Downlink Output (Low Channel)



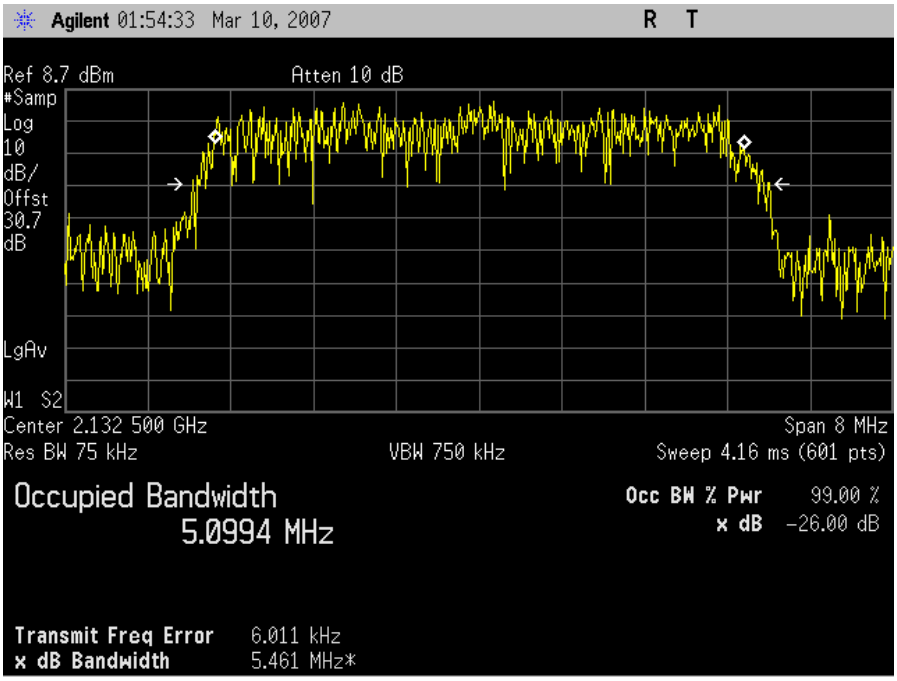
WCDMA Uplink Input (Low Channel)



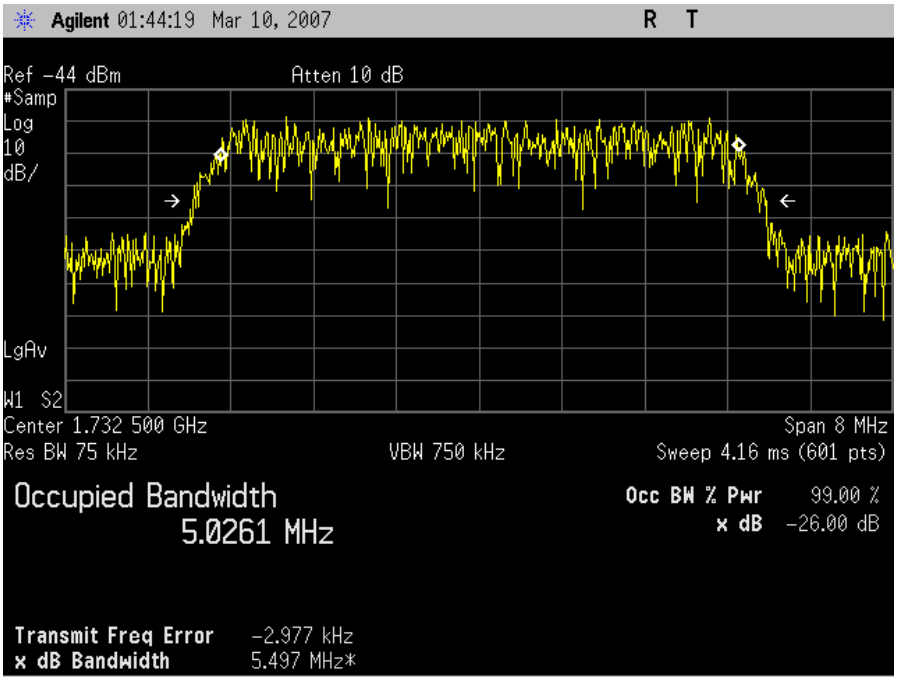
WCDMA Uplink Output (Low Channel)



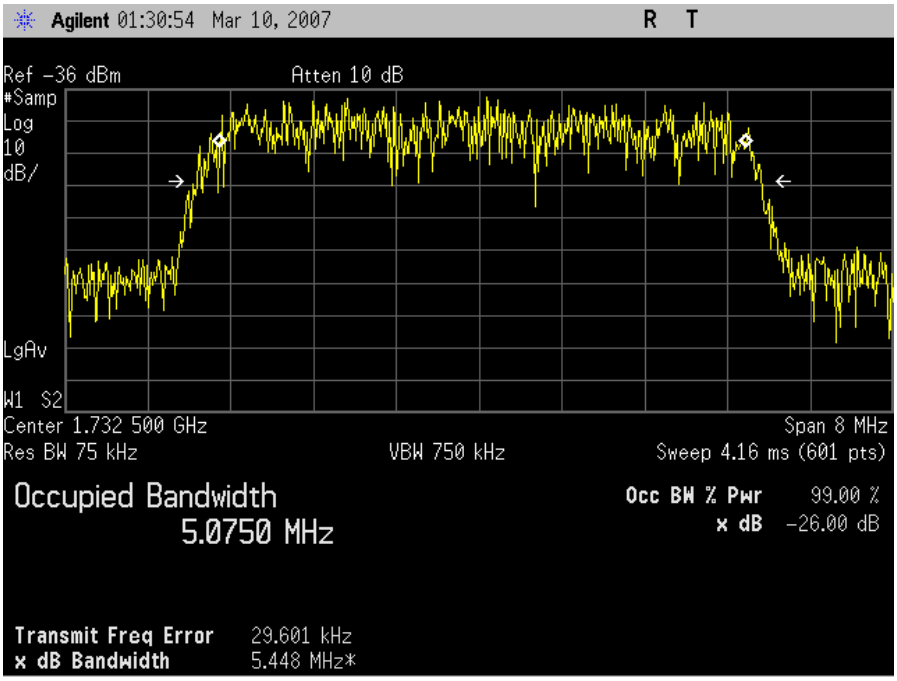
WCDMA Downlink Input (Mid Channel)



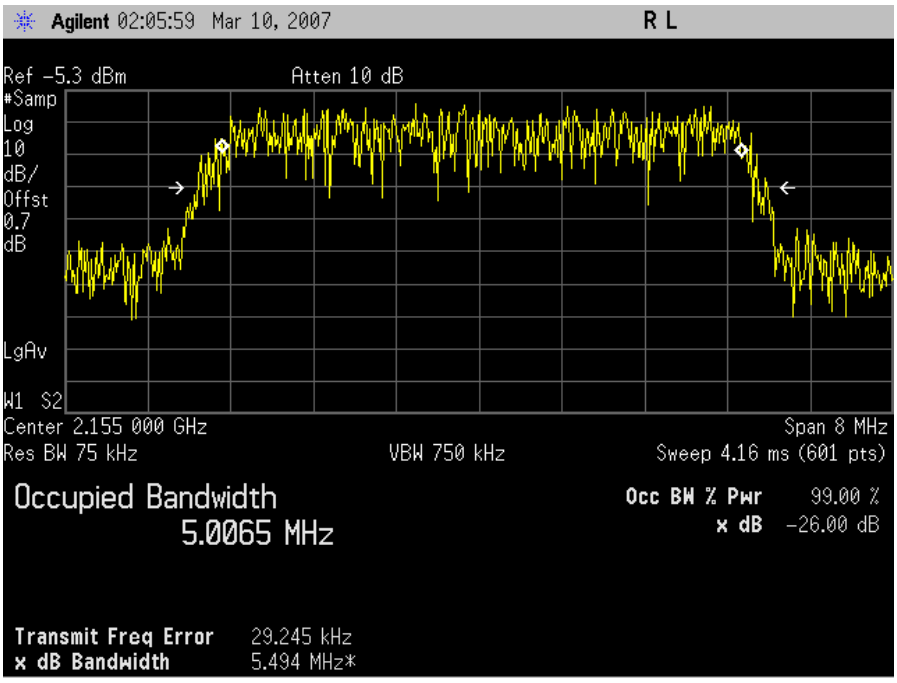
WCDMA Downlink Output (Mid Channel)



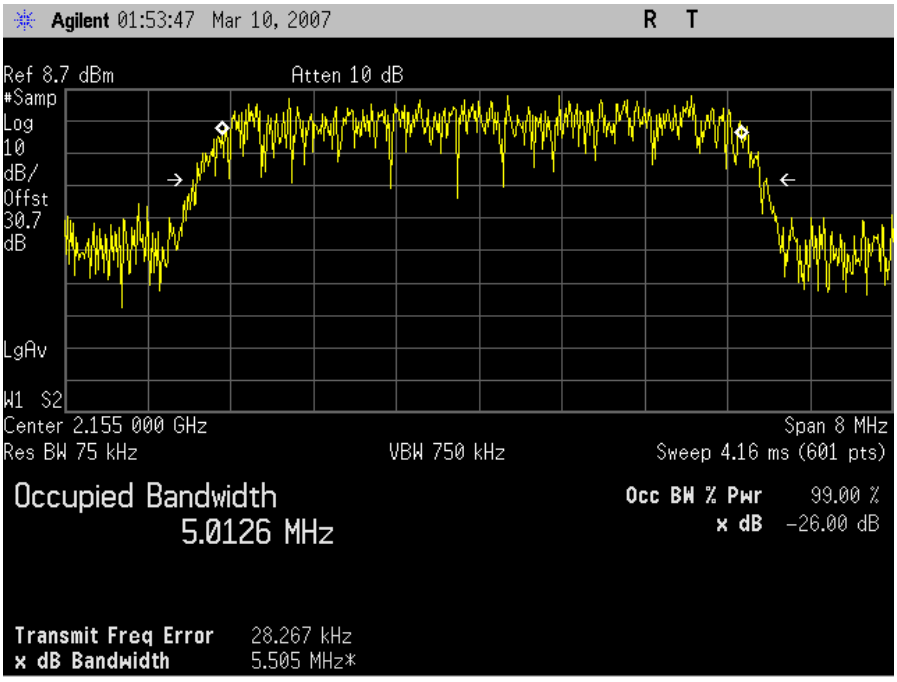
WCDMA Uplink Input (Mid Channel)



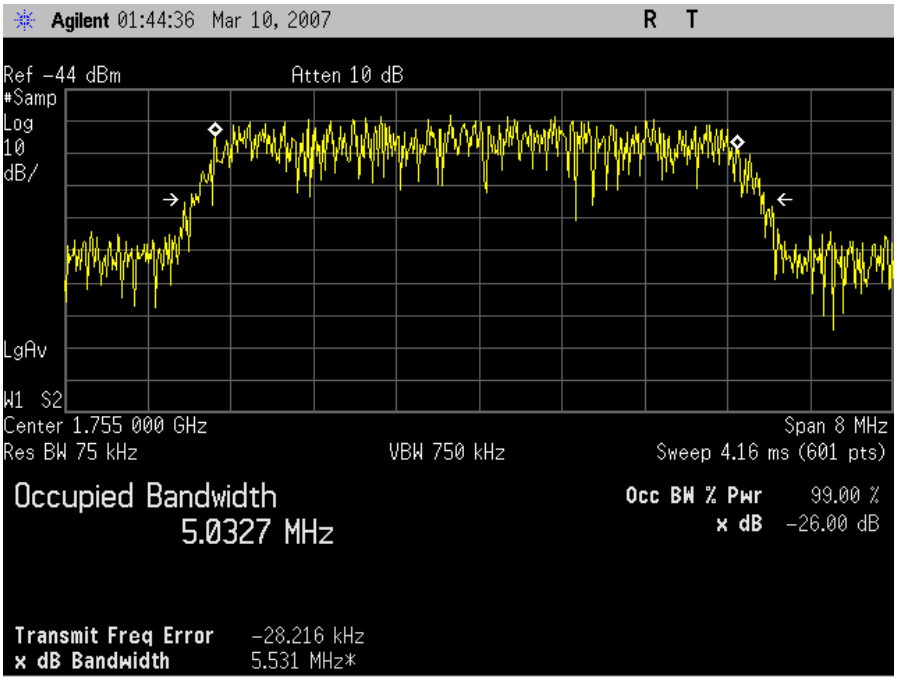
WCDMA Uplink Output (Mid Channel)



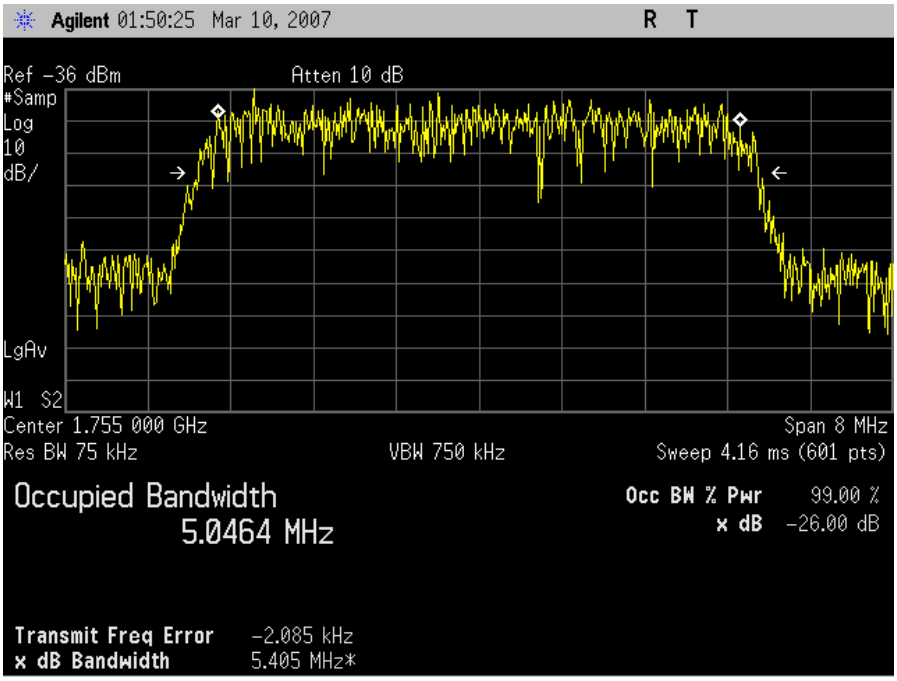
WCDMA Downlink Input (High Channel)



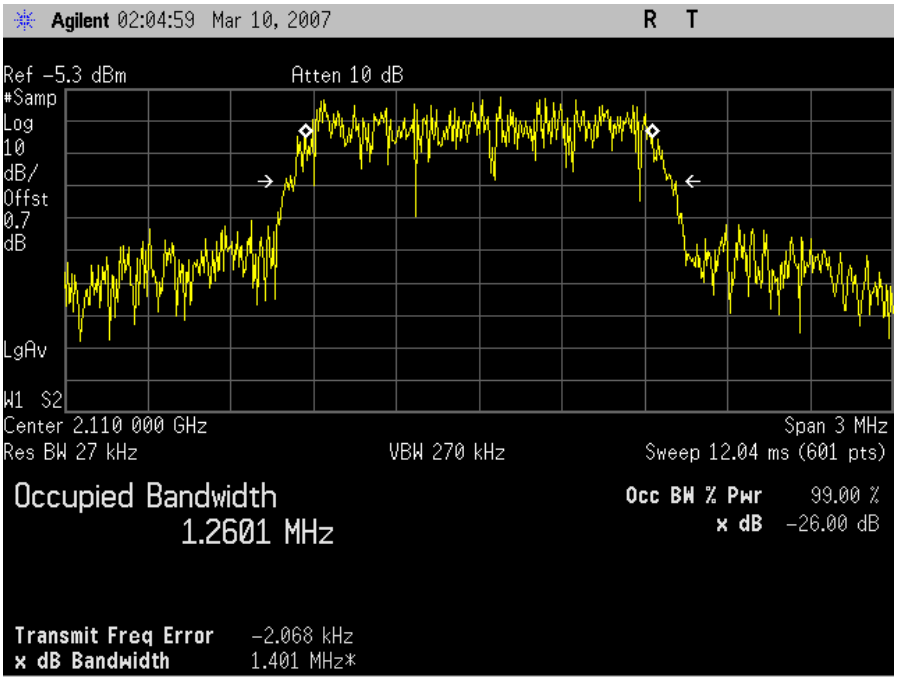
WCDMA Downlink Output (High Channel)



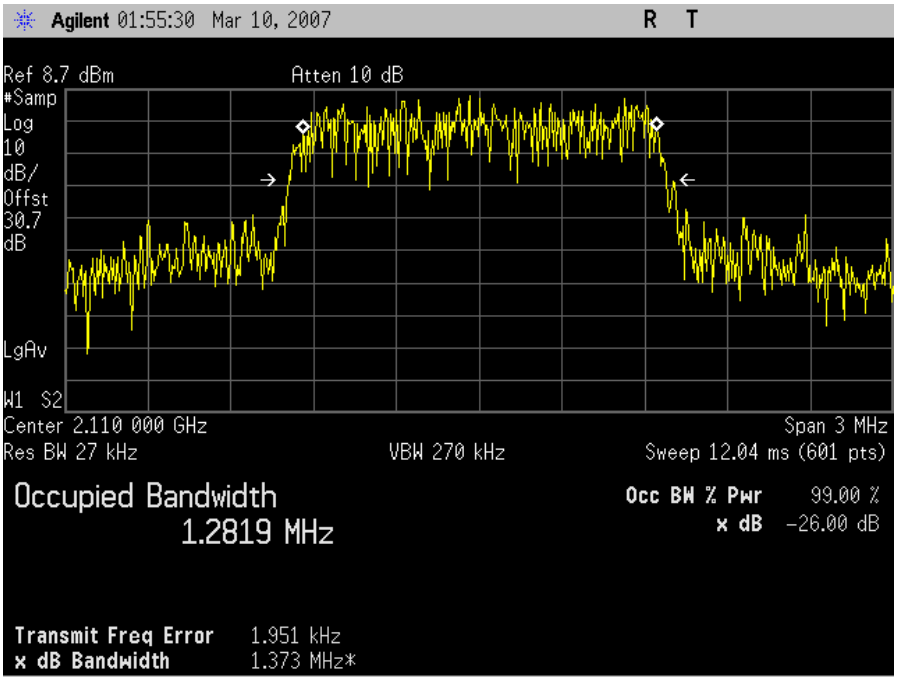
WCDMA Uplink Input (High Channel)



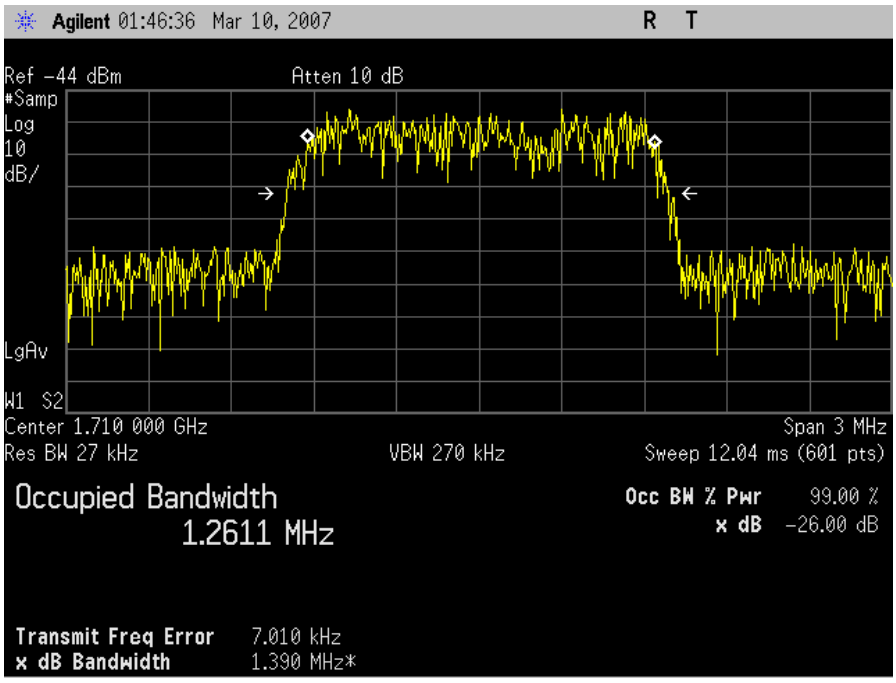
WCDMA Uplink Output (High Channel)



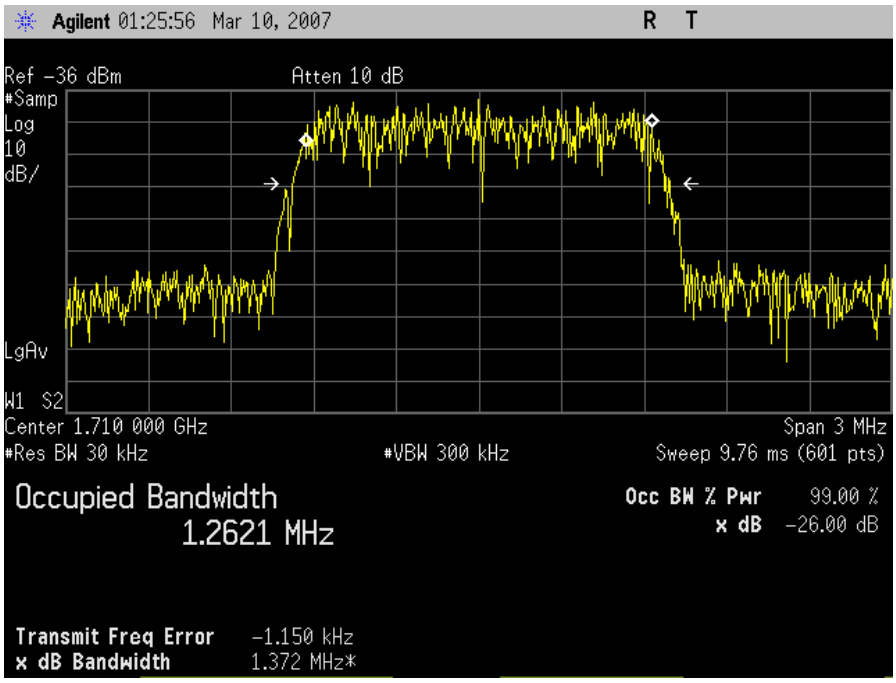
CDMA Downlink Input (Low Channel)



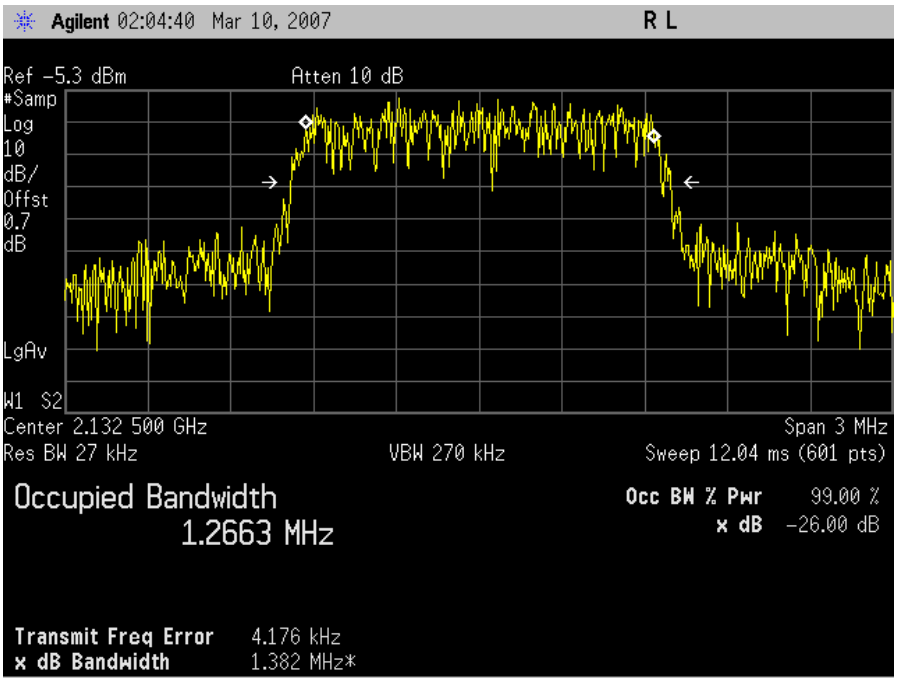
CDMA Downlink Output (Low Channel)



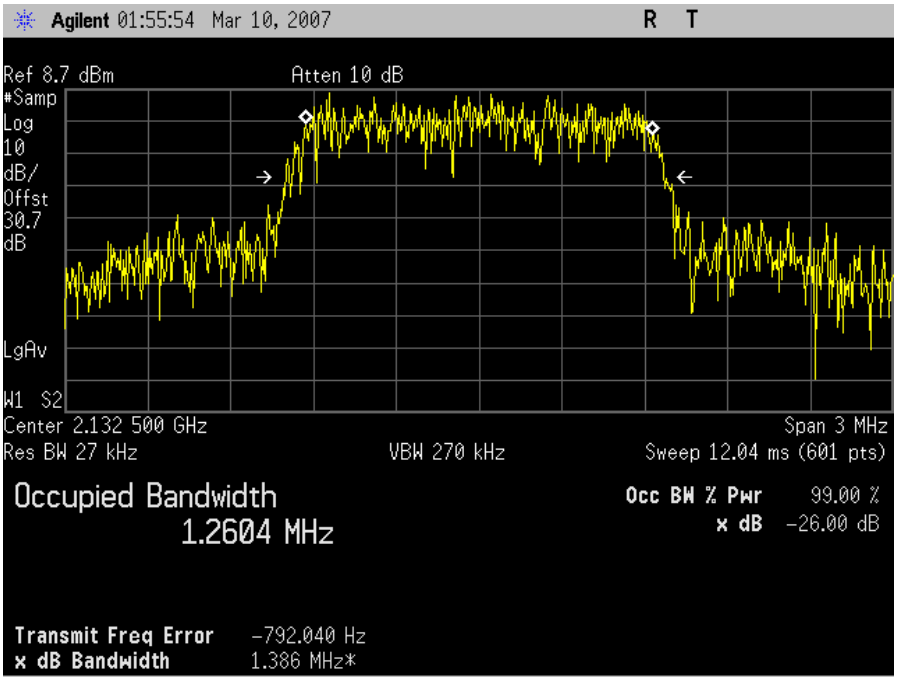
CDMA Uplink Input (Low Channel)



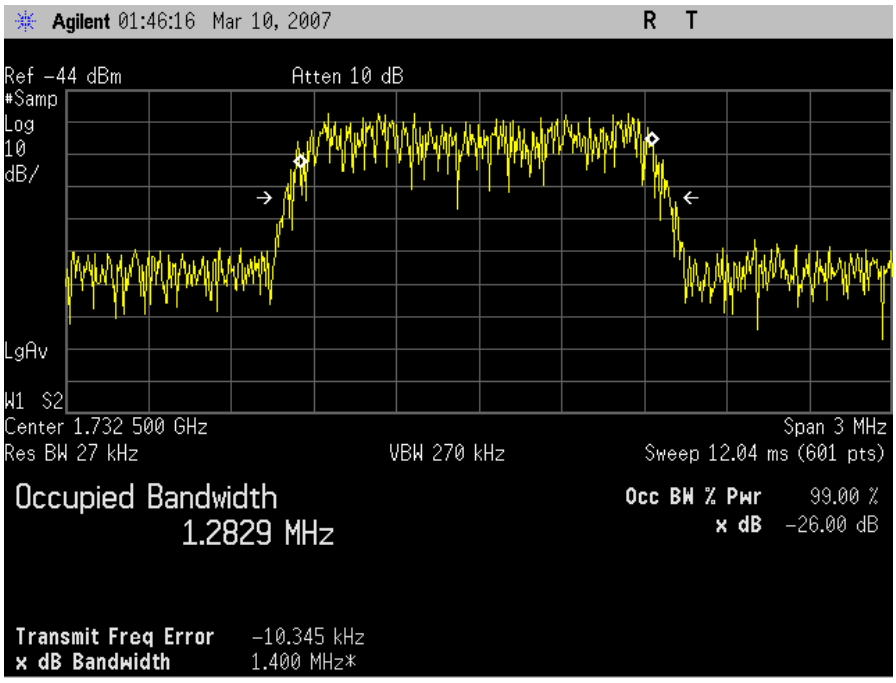
CDMA Uplink Output (Low Channel)



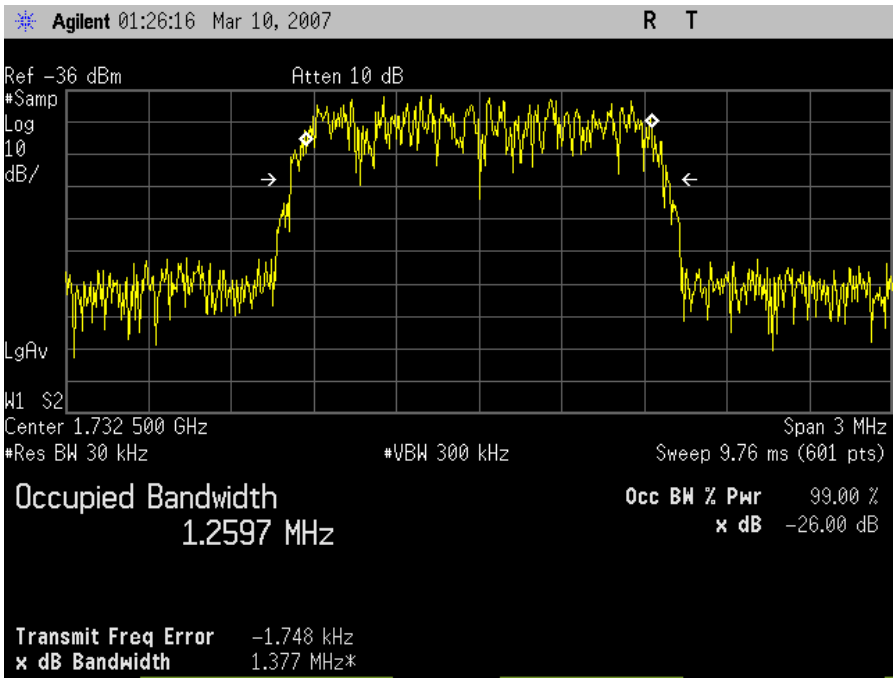
CDMA Downlink Input (Mid Channel)



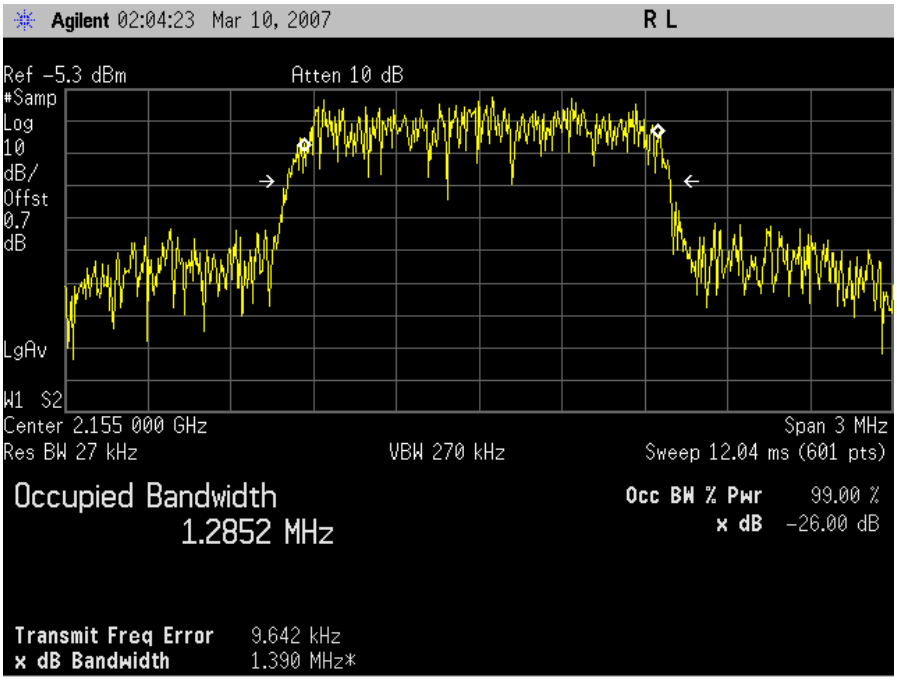
CDMA Downlink Output (Mid Channel)



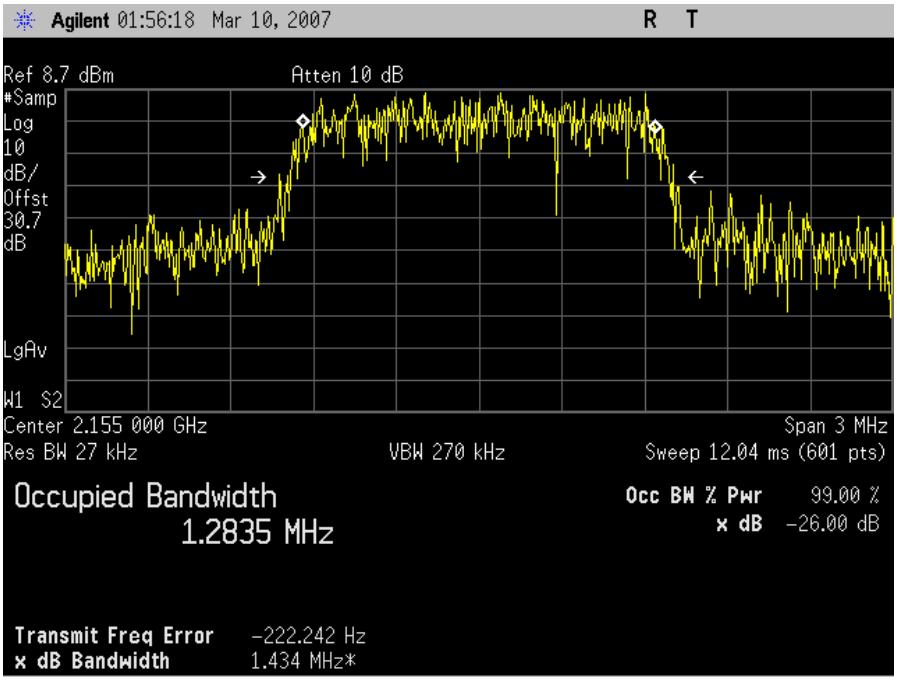
CDMA Uplink Input (Mid Channel)



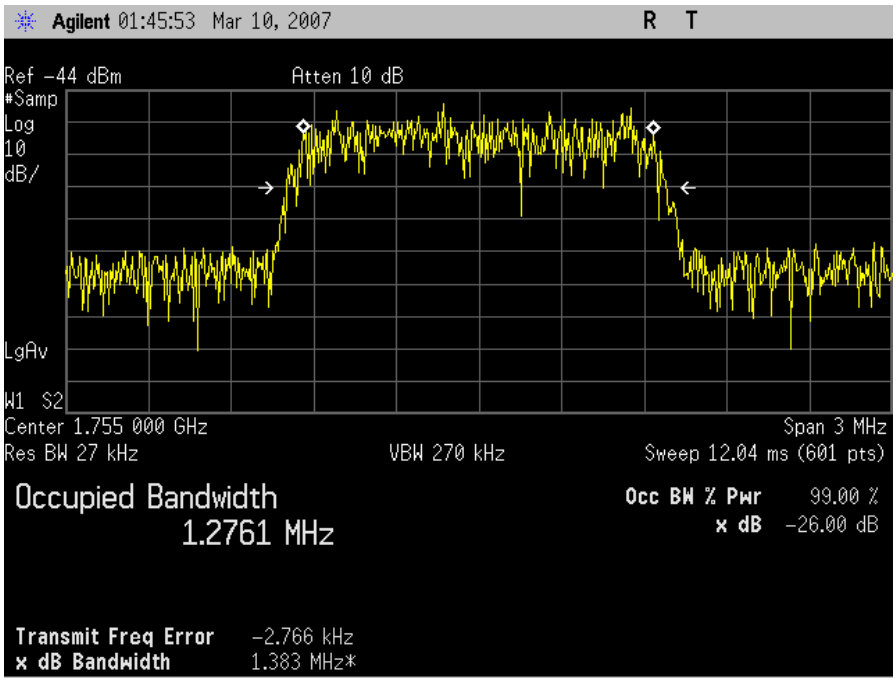
CDMA Uplink Output (Mid Channel)



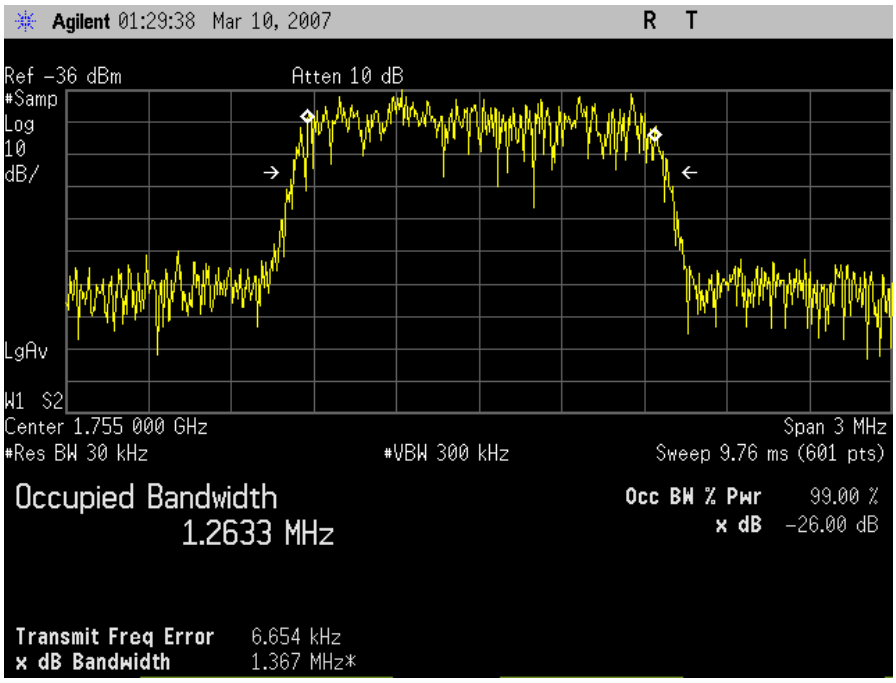
CDMA Downlink Input (High Channel)



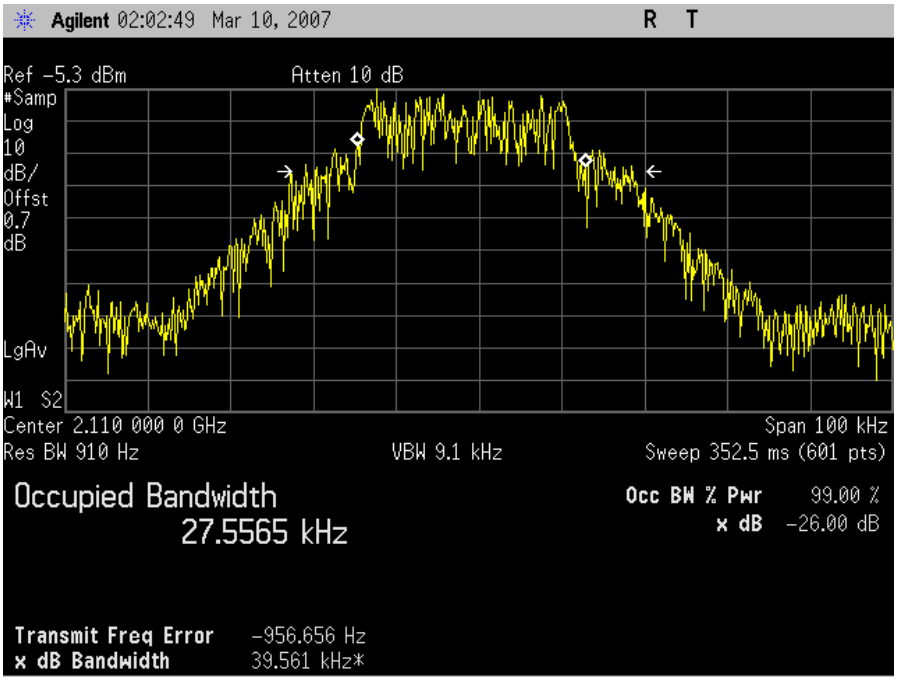
CDMA Downlink Output (High Channel)



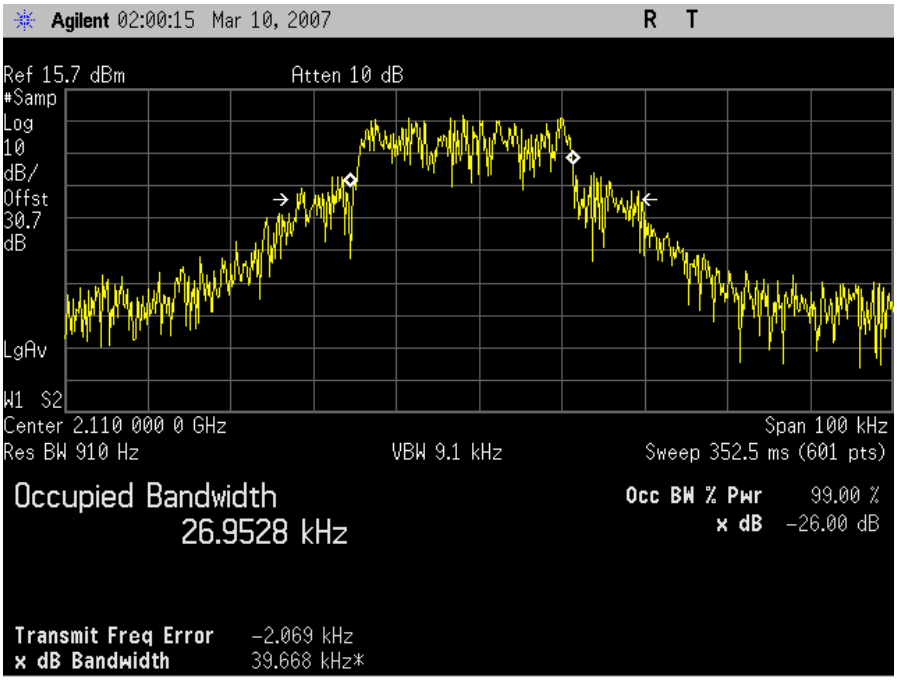
CDMA Uplink Input (High Channel)



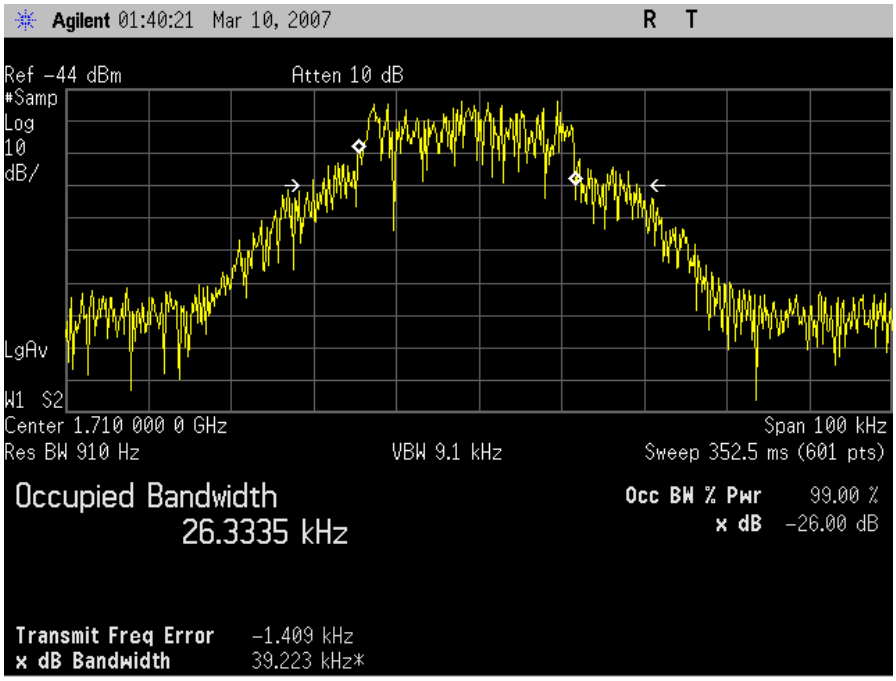
CDMA Uplink Output (High Channel)



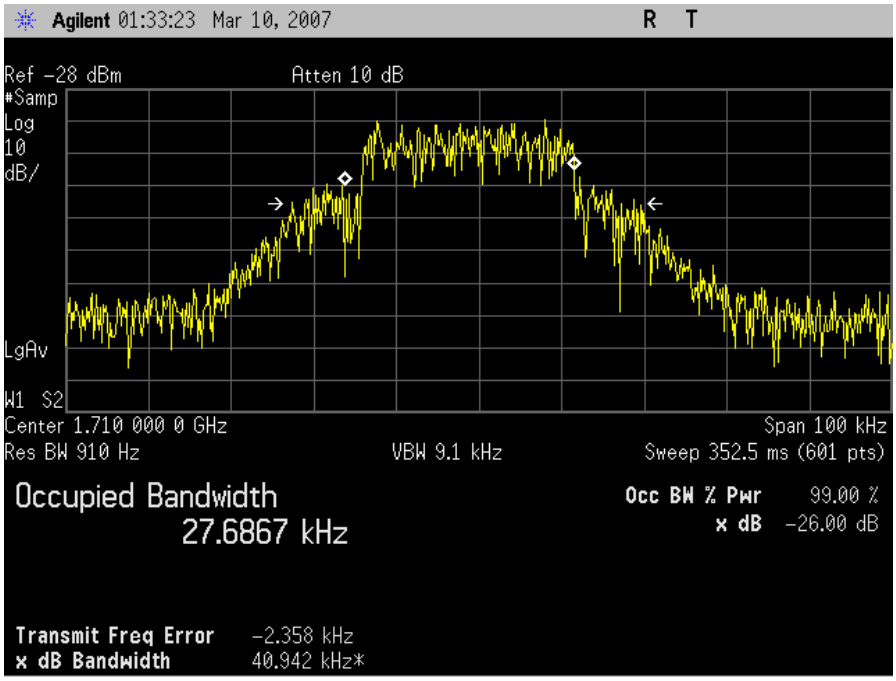
TDMA Downlink Input (Low Channel)



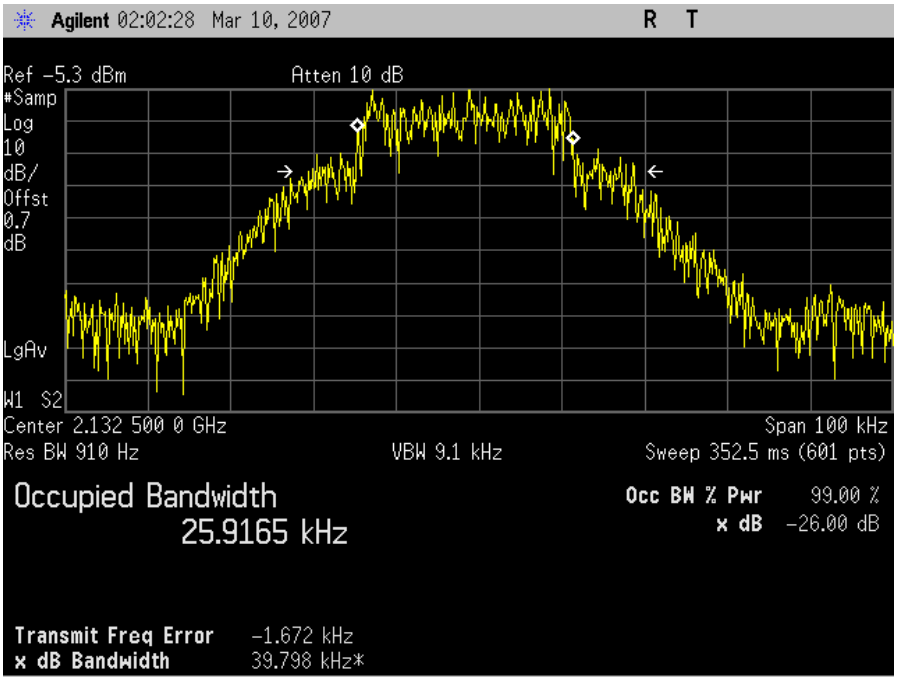
TDMA Downlink Output (Low Channel)



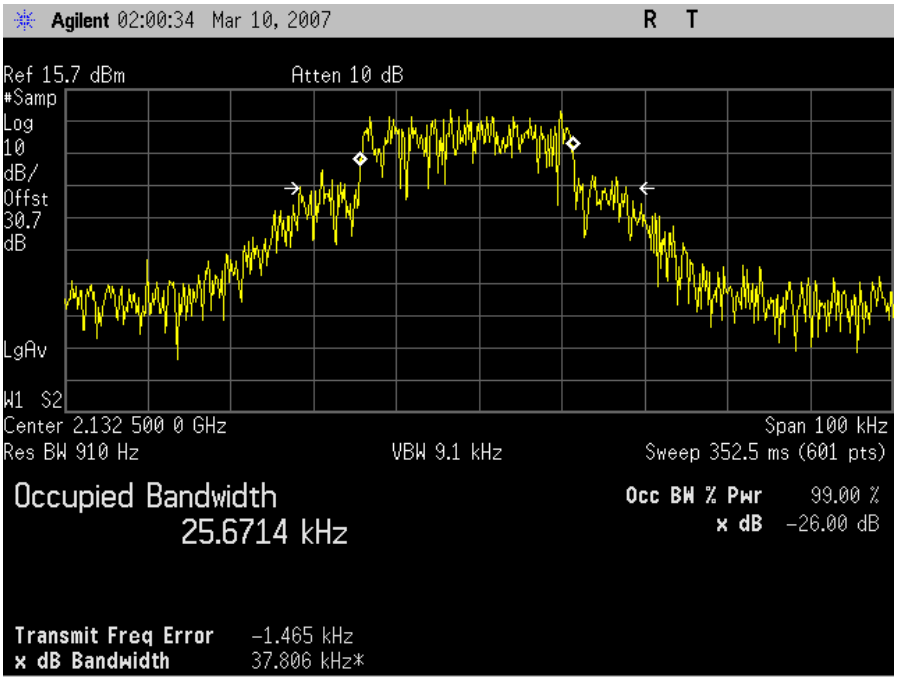
TDMA Uplink Input (Low Channel)



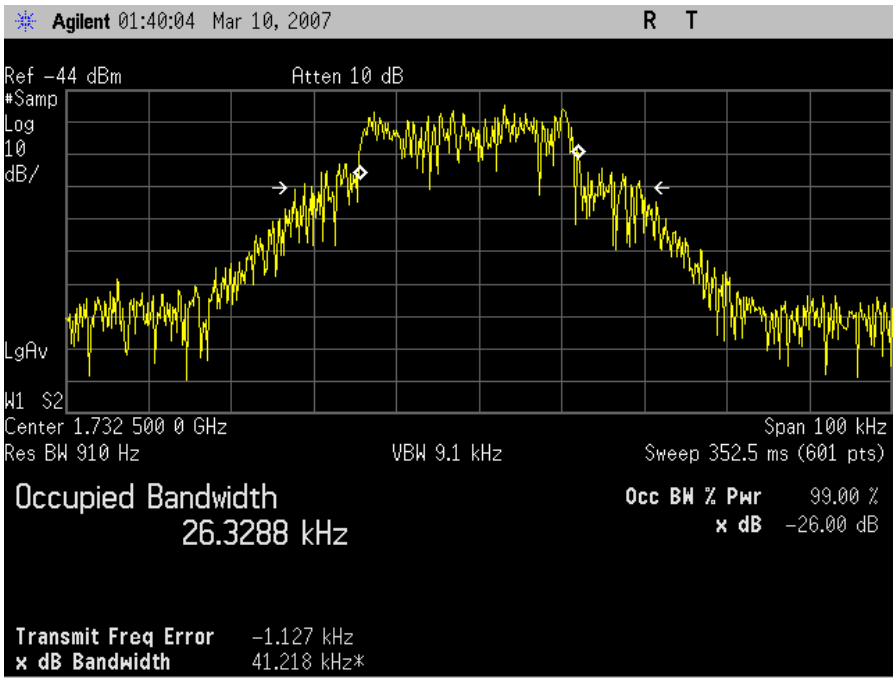
TDMA Uplink Output (Low Channel)



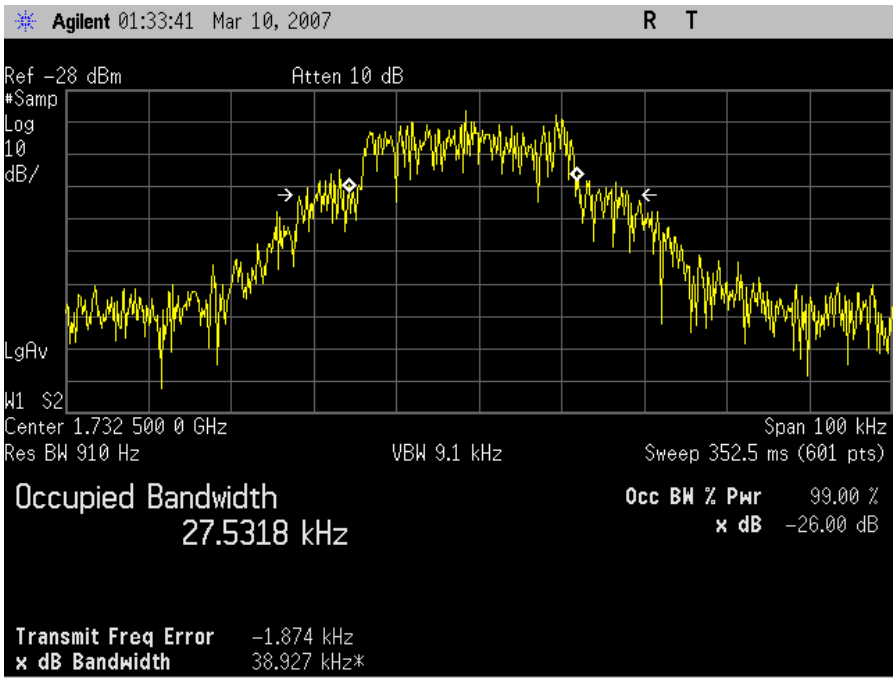
TDMA Downlink Input (Mid Channel)



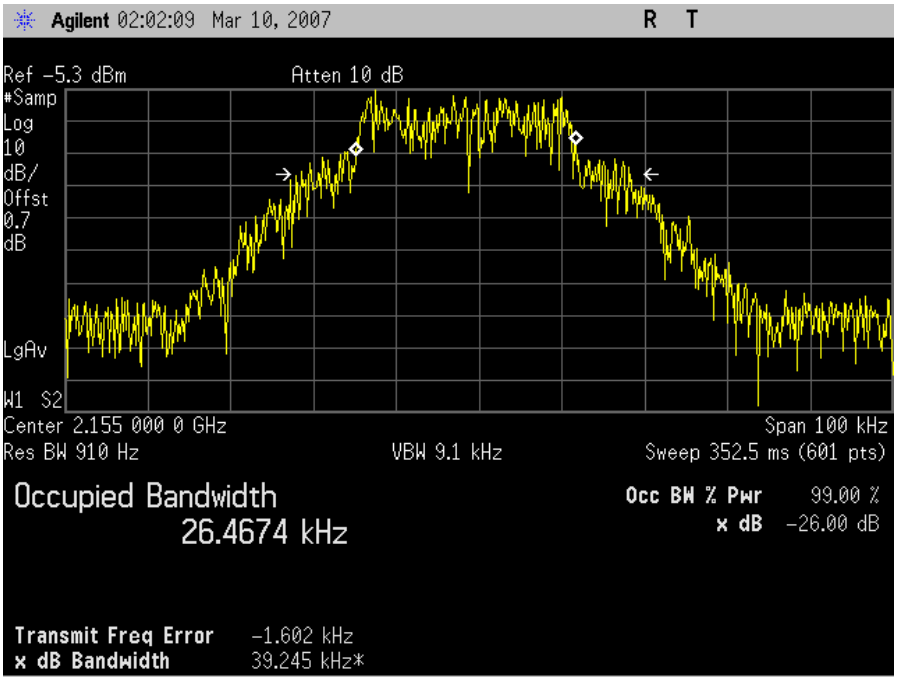
TDMA Downlink Output (Mid Channel)



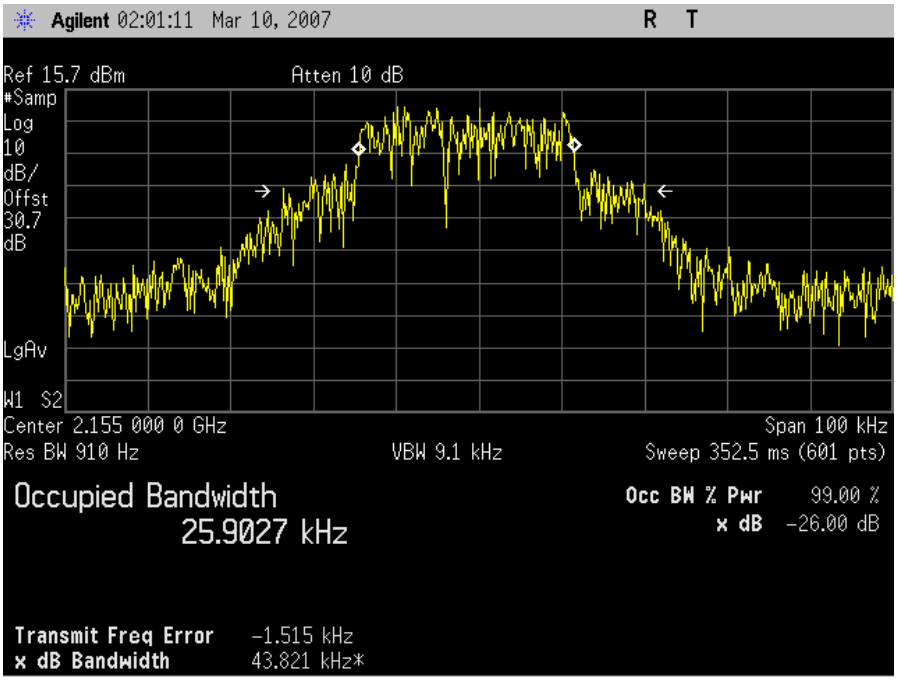
TDMA Uplink Input (Mid Channel)



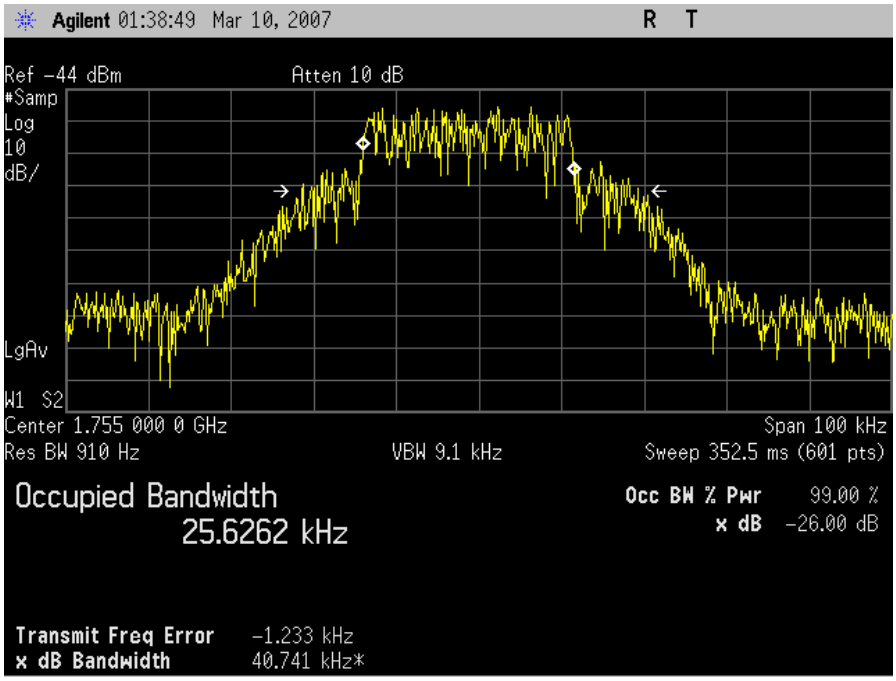
TDMA Uplink Output (Mid Channel)



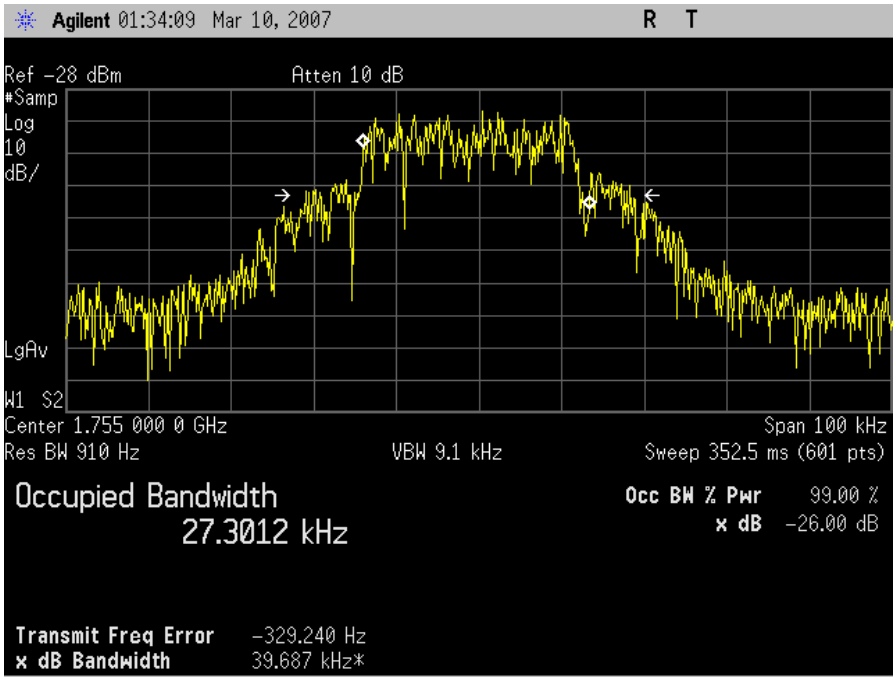
TDMA Downlink Input (High Channel)



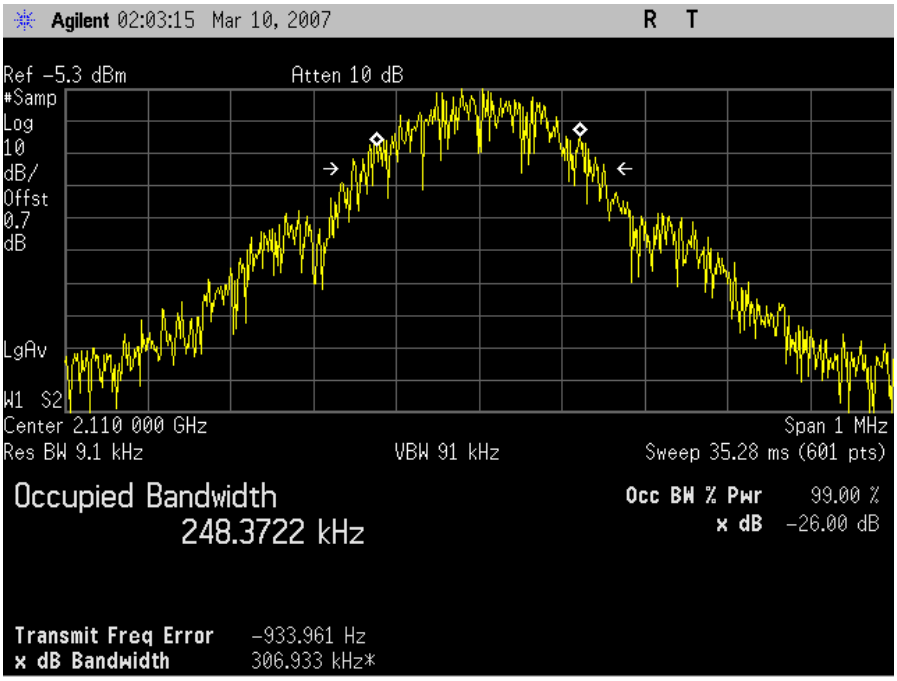
TDMA Downlink Output (High Channel)



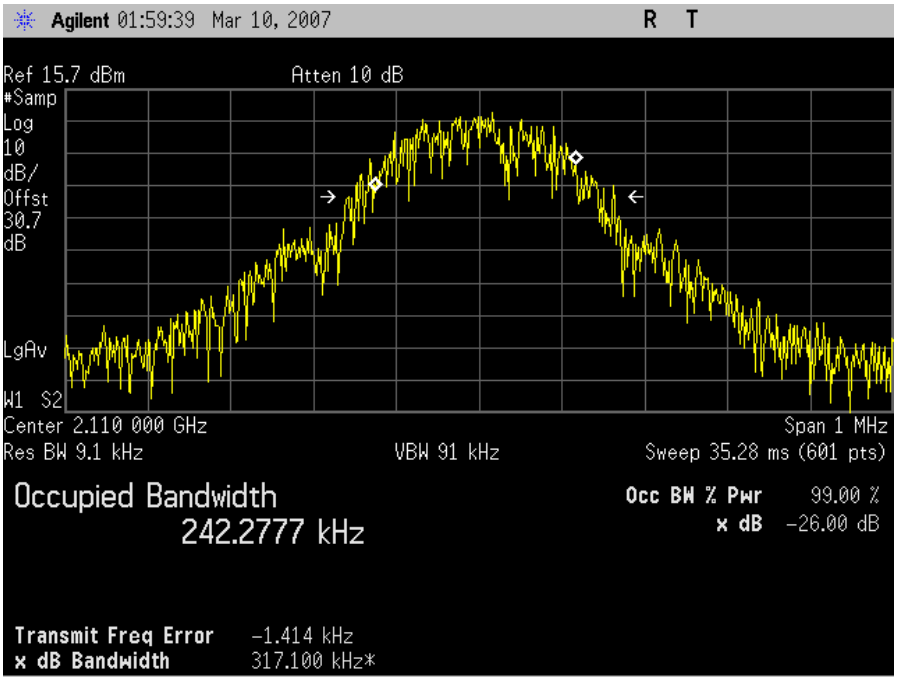
TDMA Uplink Input (High Channel)



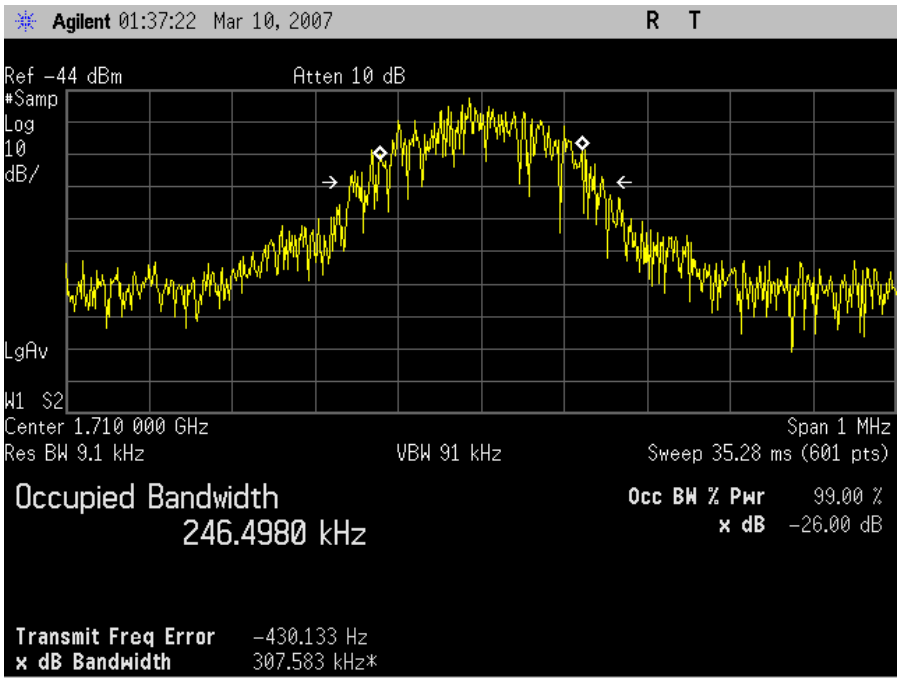
TDMA Uplink Output (High Channel)



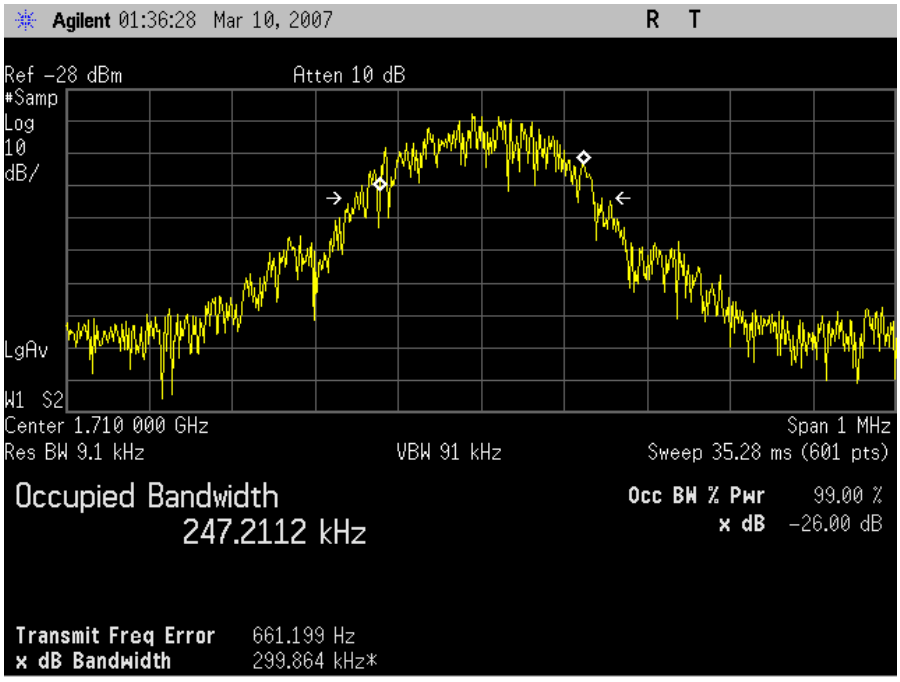
GSM Downlink Input (Low Channel)



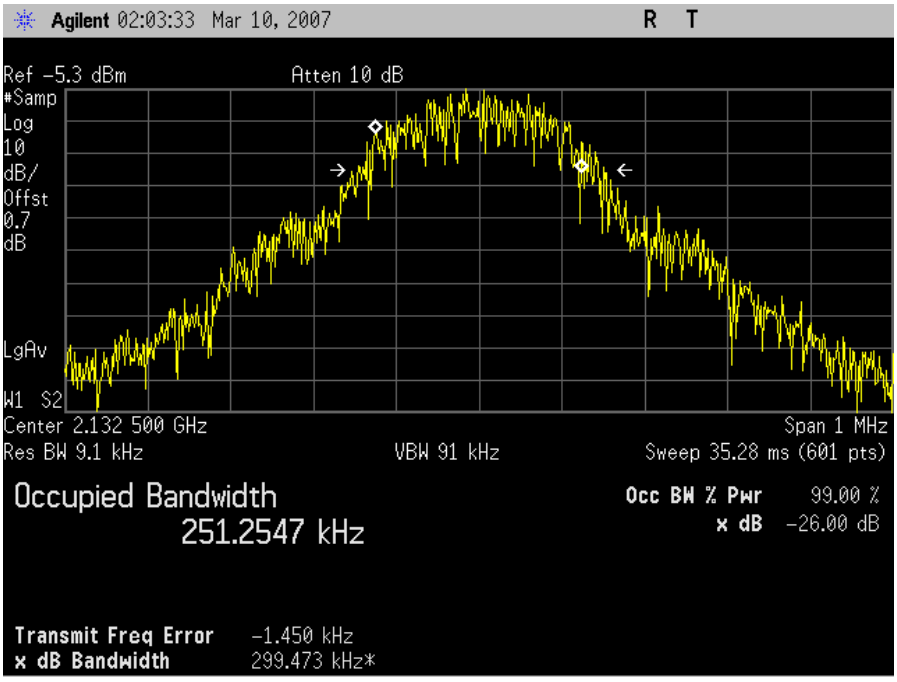
GSM Downlink Output (Low Channel)



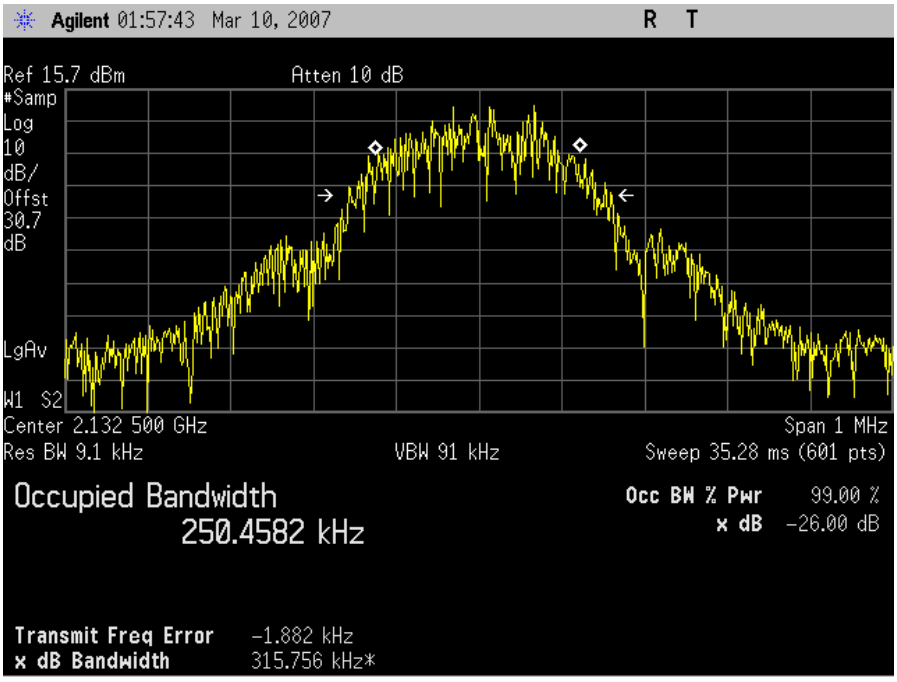
GSM Uplink Input (Low Channel)



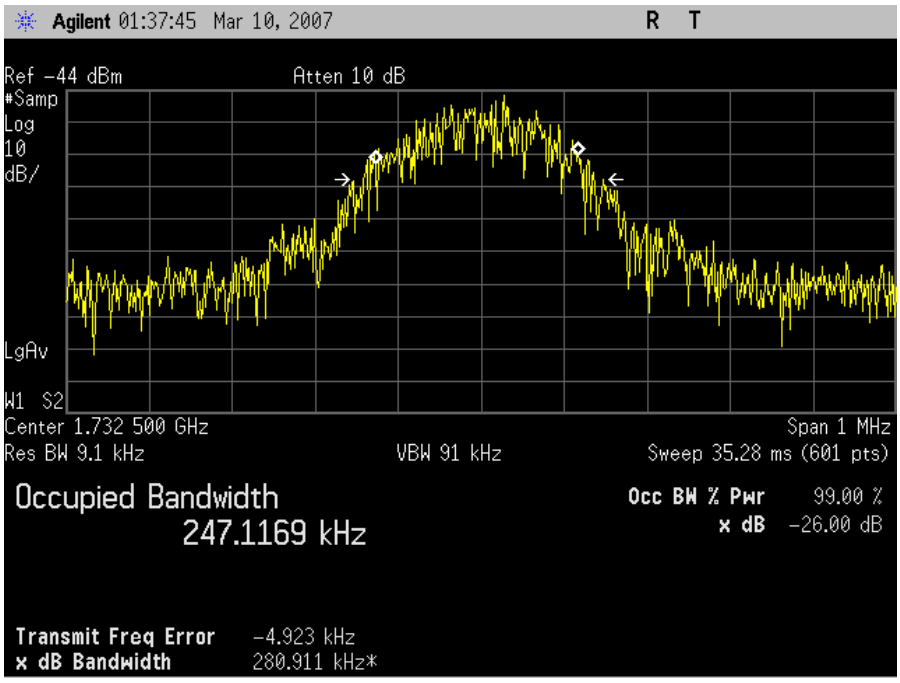
GSM Uplink Output (Low Channel)



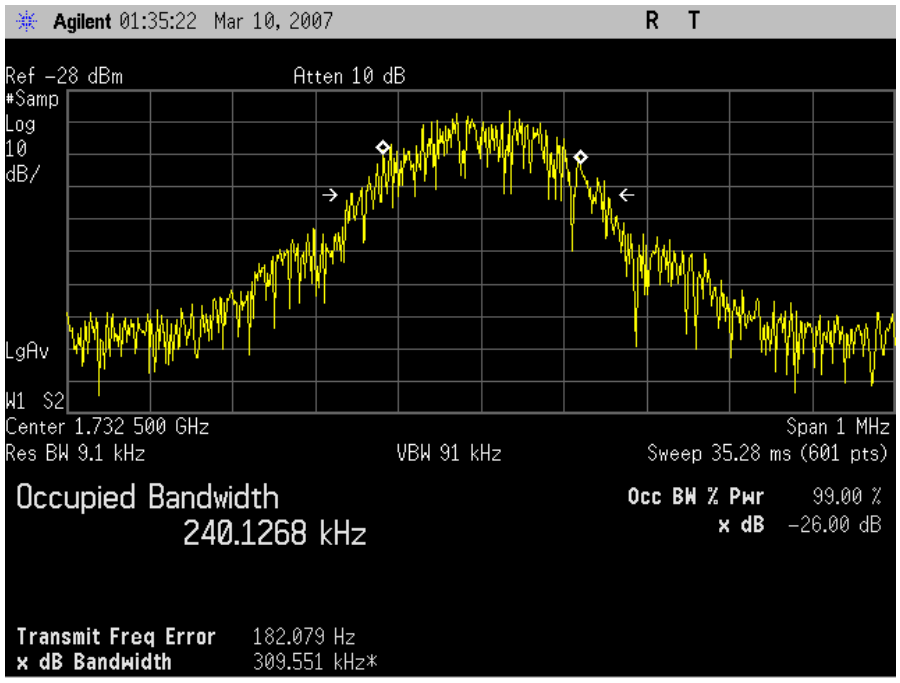
GSM Downlink Input (Mid Channel)



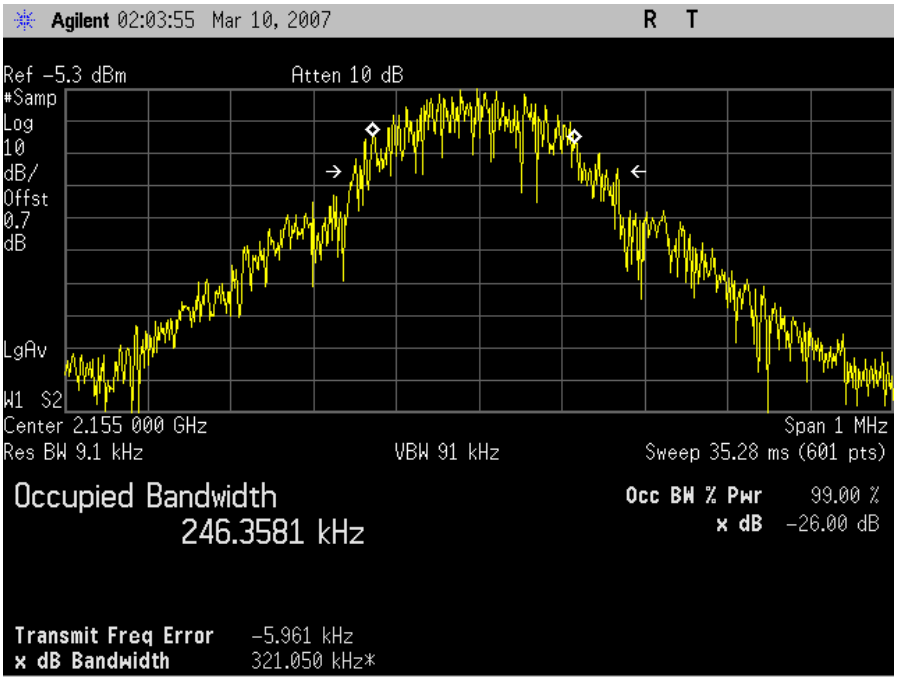
GSM Downlink Output (Mid Channel)



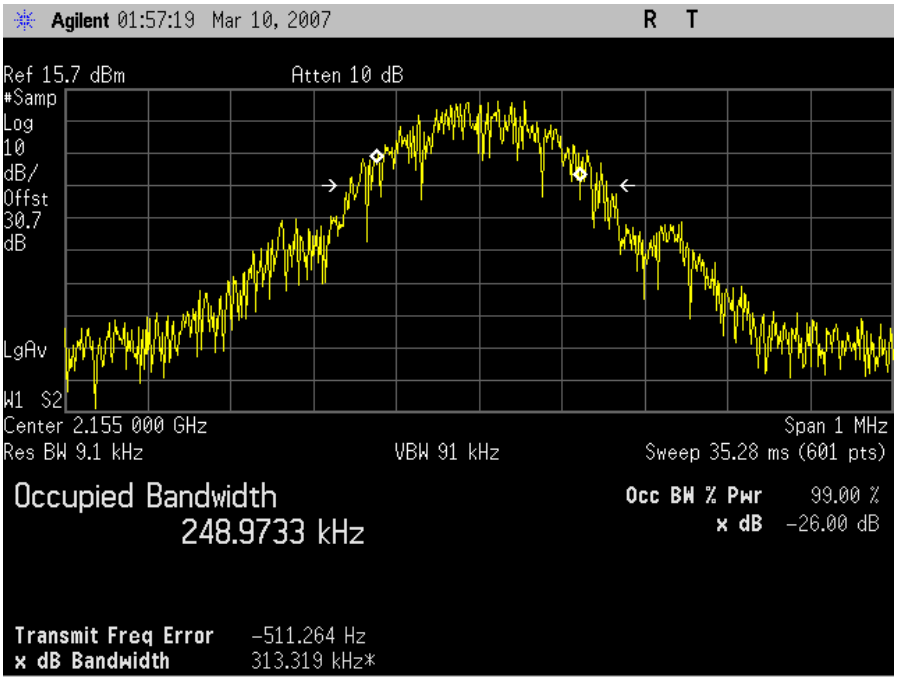
GSM Uplink Input (Mid Channel)



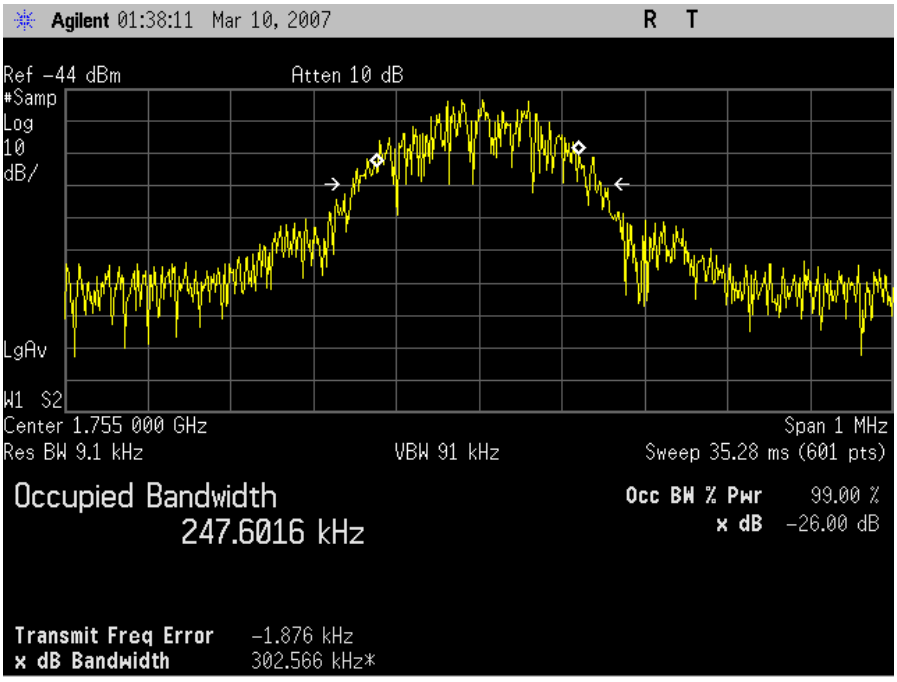
GSM Uplink Output (Mid Channel)



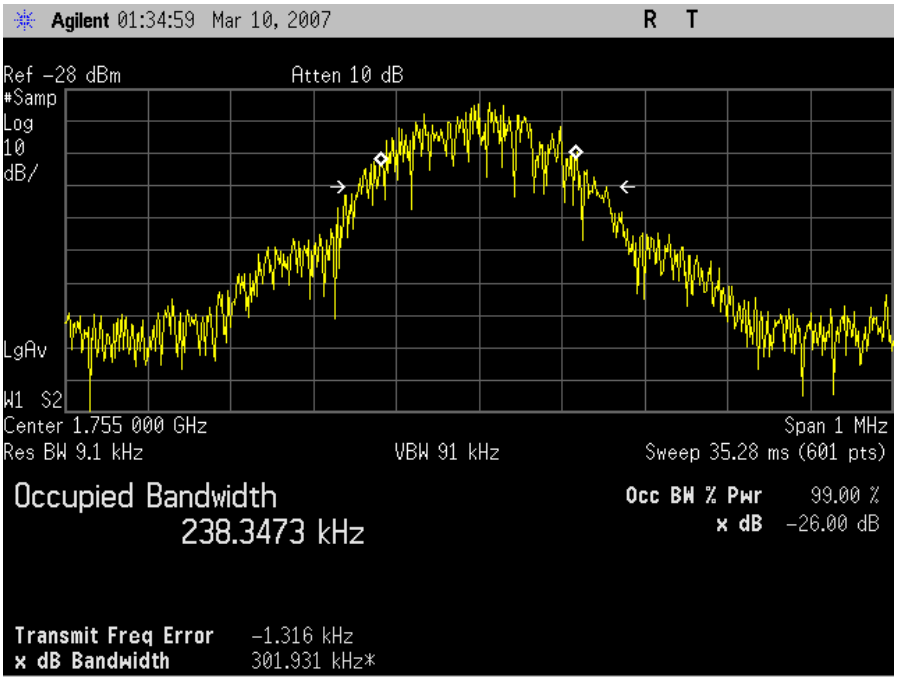
GSM Downlink Input (High Channel)



GSM Downlink Output (High Channel)



GSM Uplink Input (High Channel)



GSM Uplink Output (High Channel)

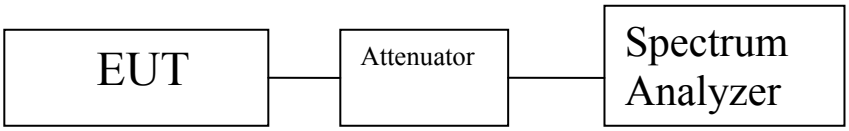


Figure 7. Block Diagram of Occupied Bandwidth Test Setup

4. Electromagnetic Compatibility Intentional Radiators

4.4. § 2.1051 Spurious Emissions at Antenna Terminals

Test Requirement(s): **§ 2.1051and 27.50(g) Measurements required: Spurious emissions at antenna terminals:** The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

Test Procedures: A modulated carrier generated by the signal generator carrier was connected to either the Uplink or Downlink RF port at a maximum level as determined by the OEM A spectrum analyzer was connected to either the Uplink or Downlink port depending on the circuitry being measured. The spectrum analyzer was set to 1MHz RBW and 3MHz VBW. The spectrum was investigated from 30MHz to the 10th harmonic of the carrier.

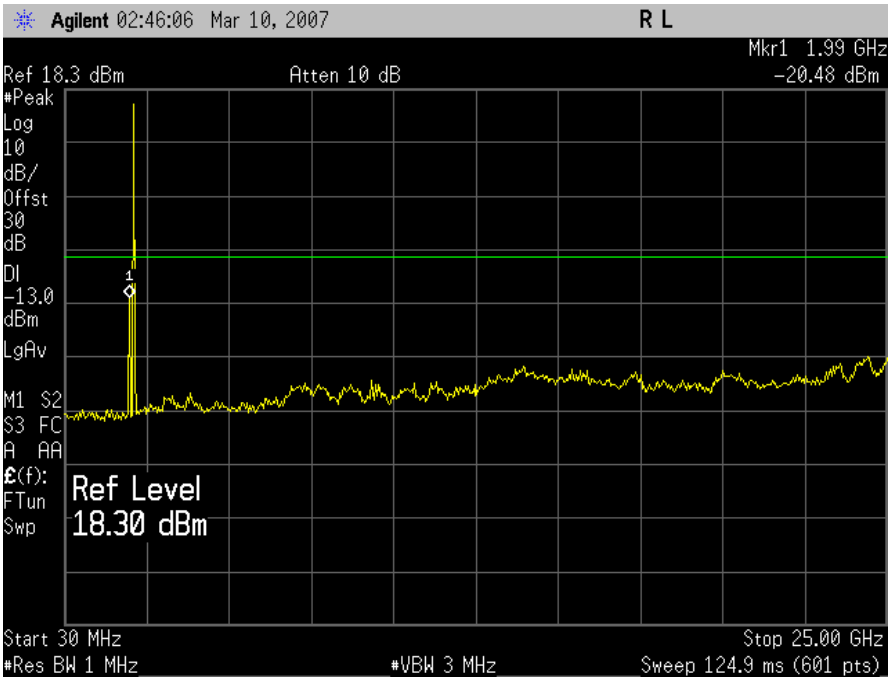
The inter-modulation requirements were performed in a similar manner as described above. The spectrum analyzer was set to 100KHz RBW and 300KHz VBW. Two modulated carriers were injected into the EUT. One carrier was set at the band edge of either the Uplink or Downlink band and the other at carrier set at 6MHz deviation from the first carrier. The in band spurious emissions were investigated.

Test Results: Equipment complies with Section 2.1051 and 27.53(g). The following pages show measurements of Spurious Emission plots

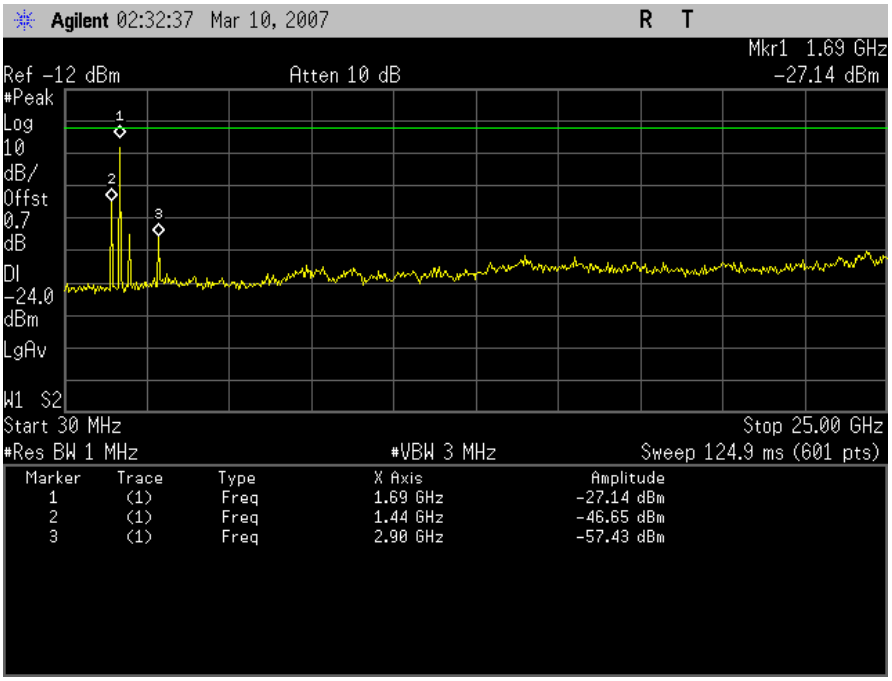
The following analysis and plots are included below to illustrate compliance with the required rule parts.

Test Engineer(s): Shawn McMillen

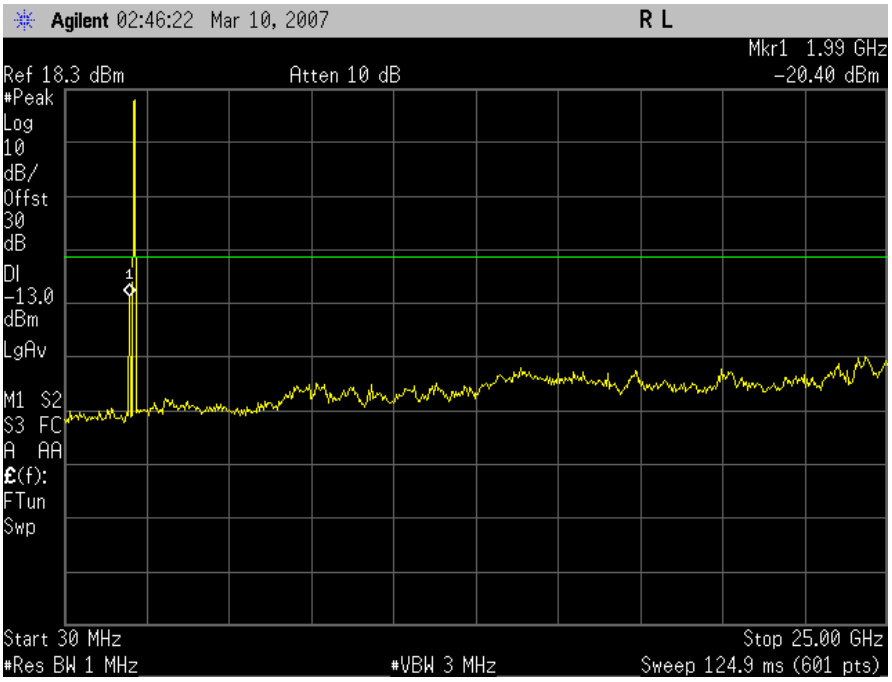
Test Date(s): March 9, 2007



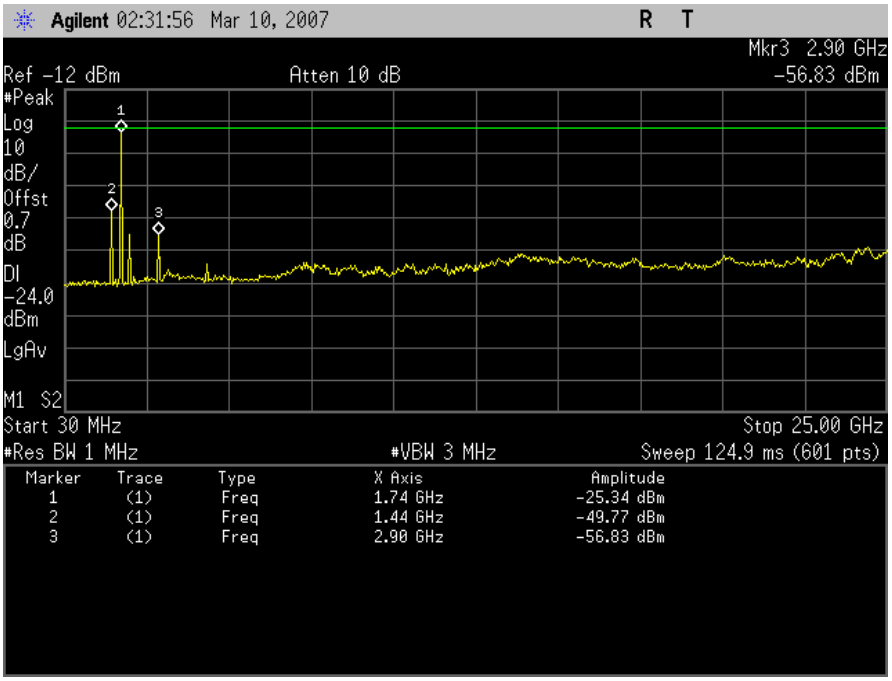
WCDMA Downlink Conducted Emissions 30 MHz – 10 GHz (Low Channel



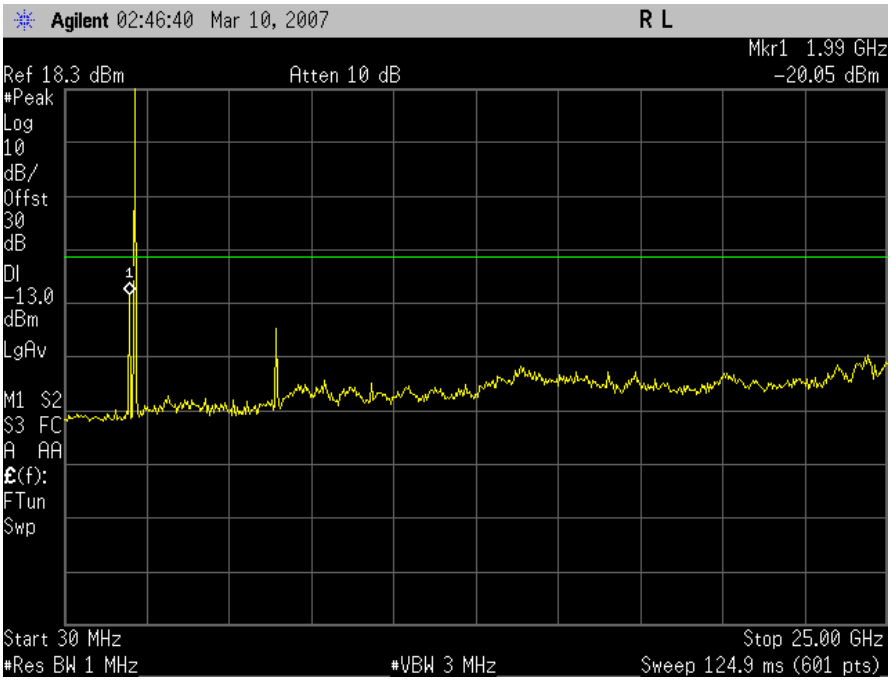
WCDMA Uplink Conducted Emissions 30 MHz – 10 GHz (Low Channel)



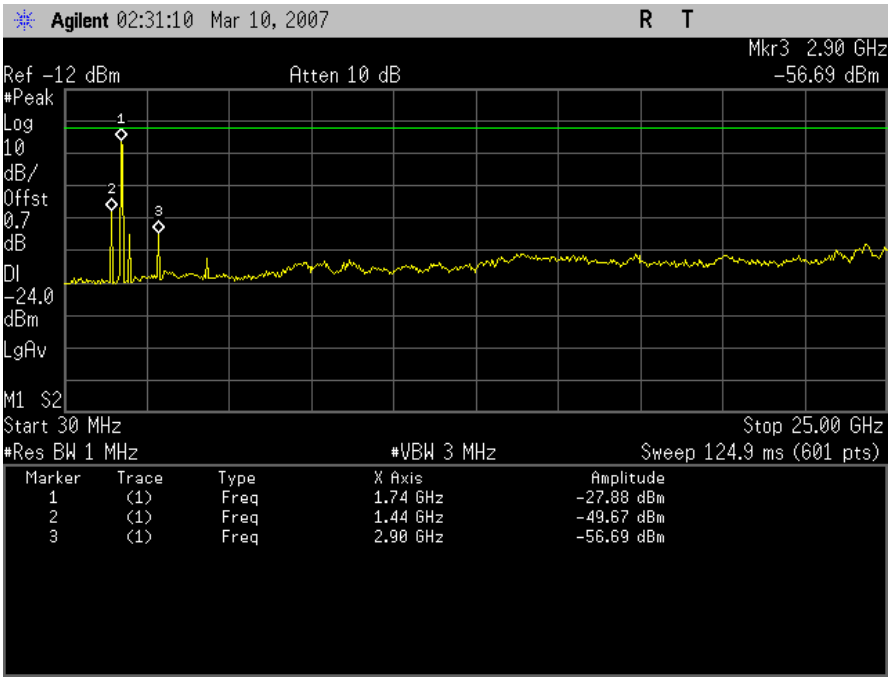
WCDMA Downlink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



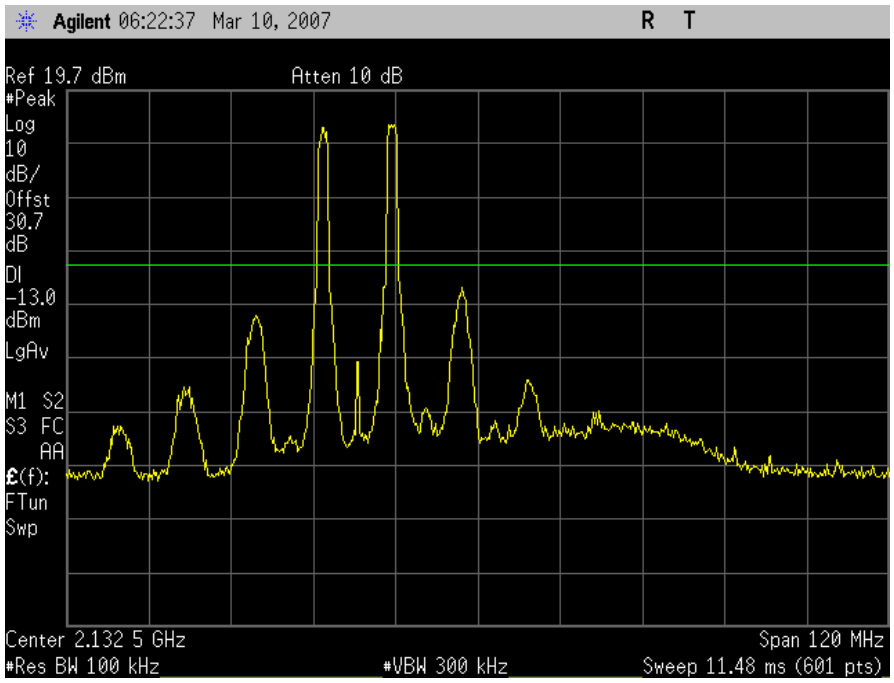
WCDMA Uplink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



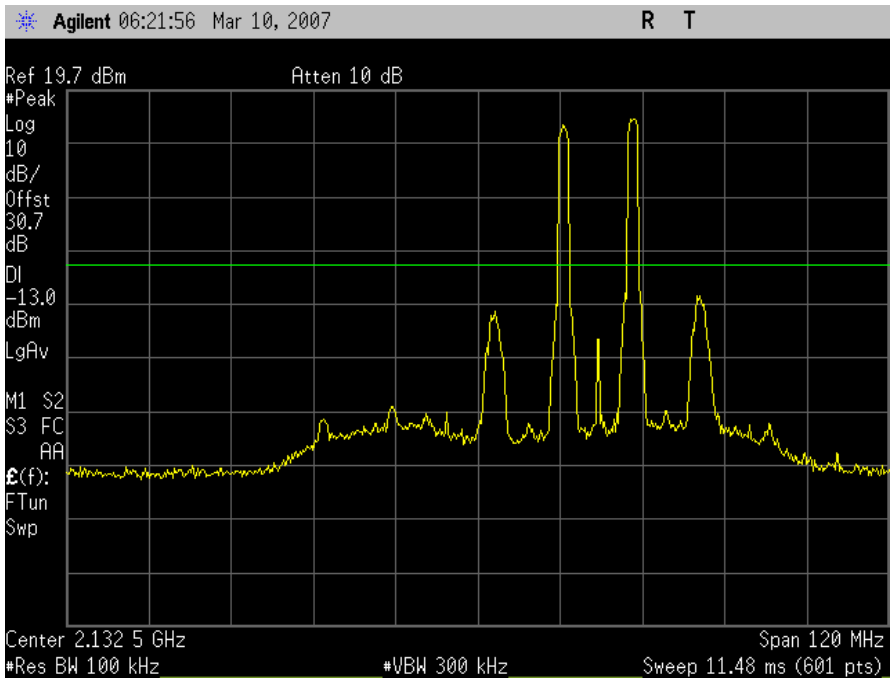
WCDMA Downlink Conducted Emissions 30 MHz – 10 GHz (High Channel)



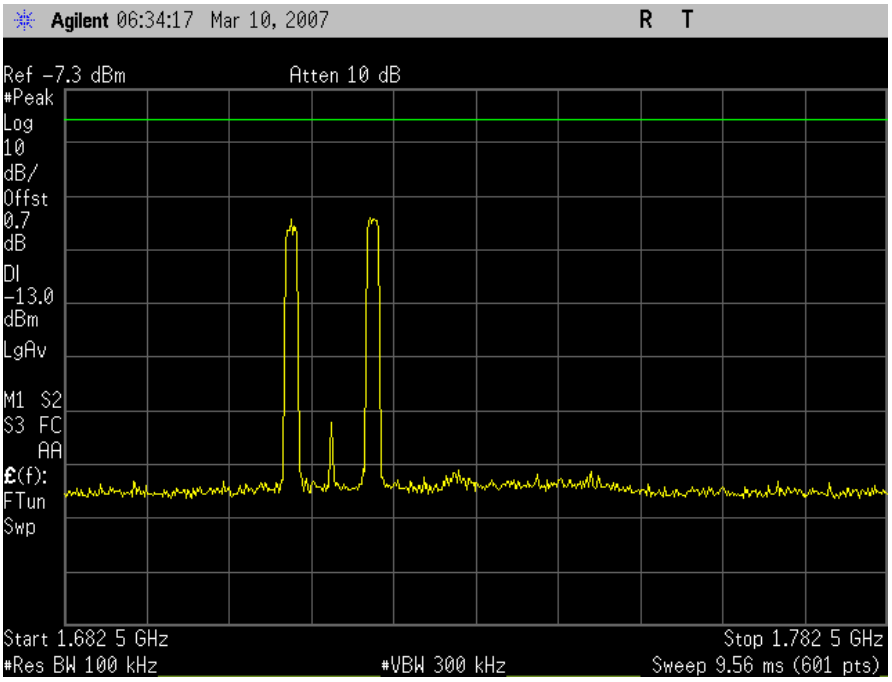
WCDMA Uplink Conducted Emissions 30 MHz – 10 GHz (High Channel)



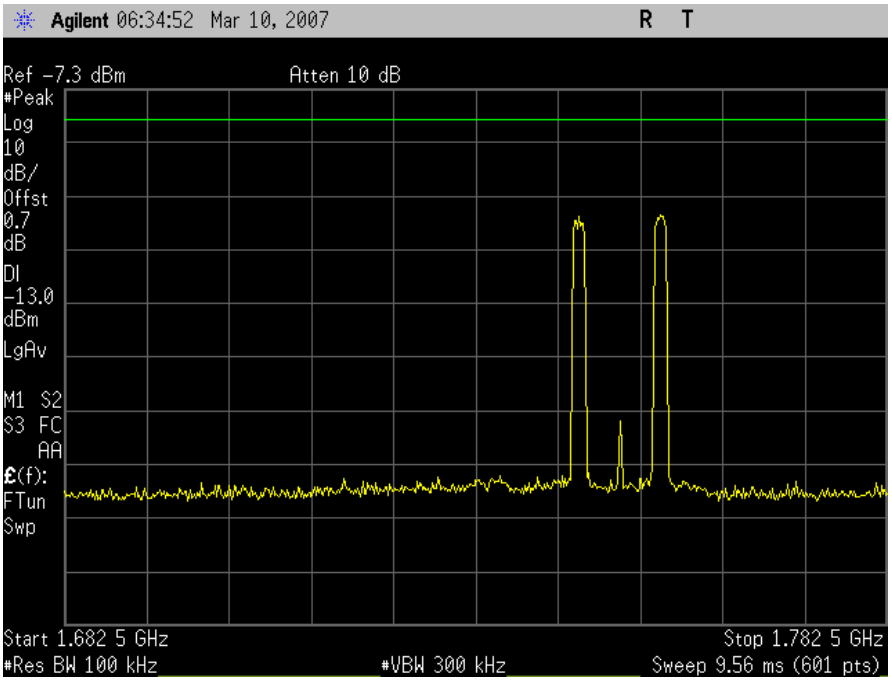
WCDMA Downlink Intermodulation, Low End



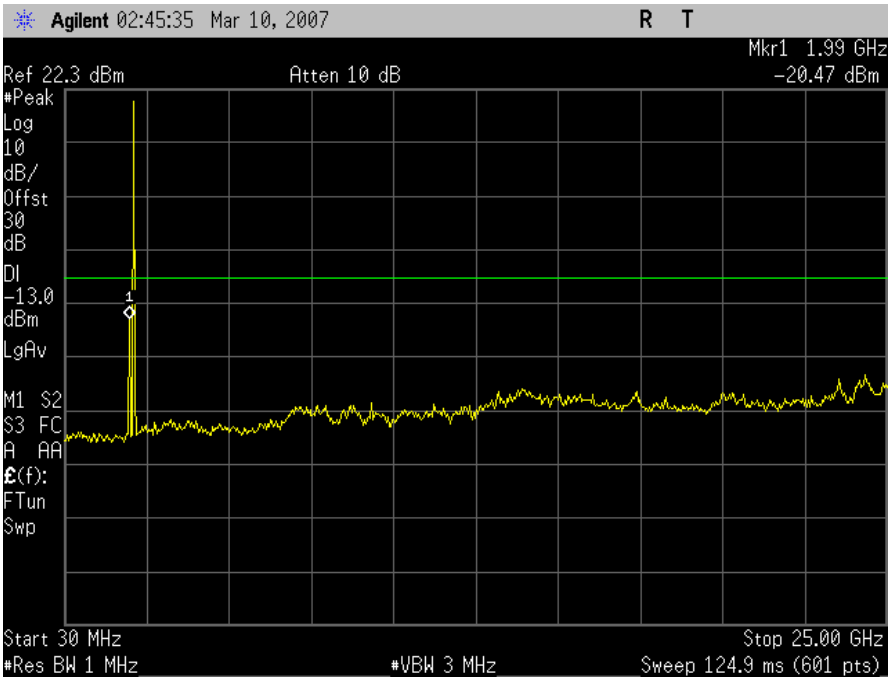
WCDMA Downlink Intermodulation, High End



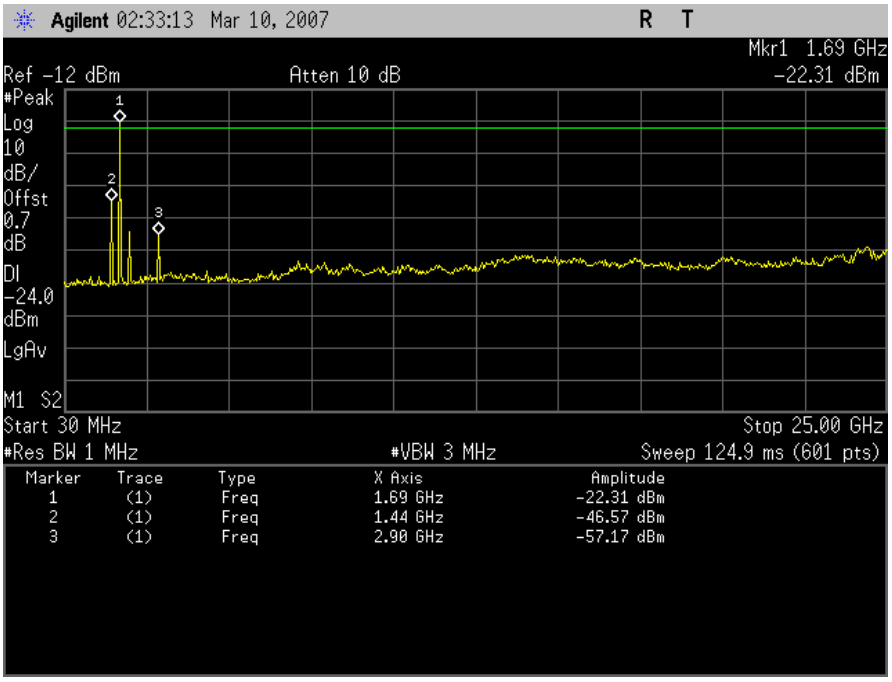
WCDMA Uplink Intermodulation Low End



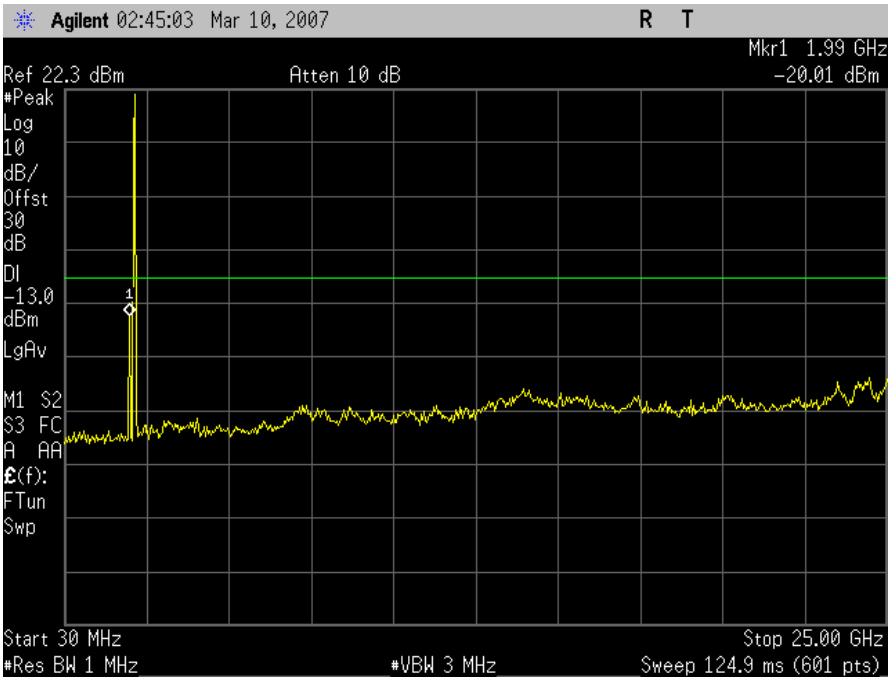
WCDMA Uplink Intermodulation High End



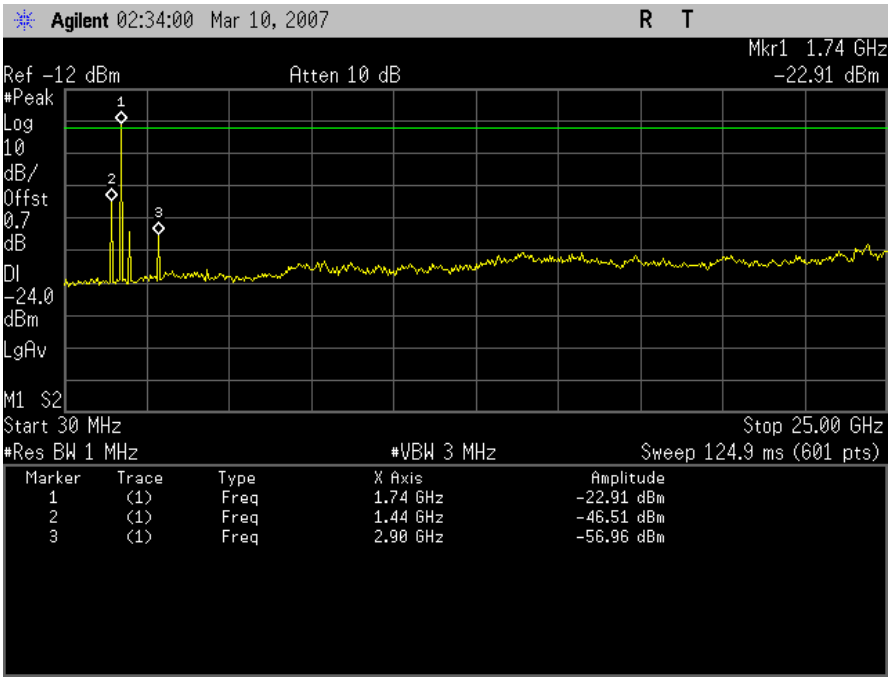
CDMA Downlink Conducted Emissions 30 MHz – 10 GHz (Low Channel



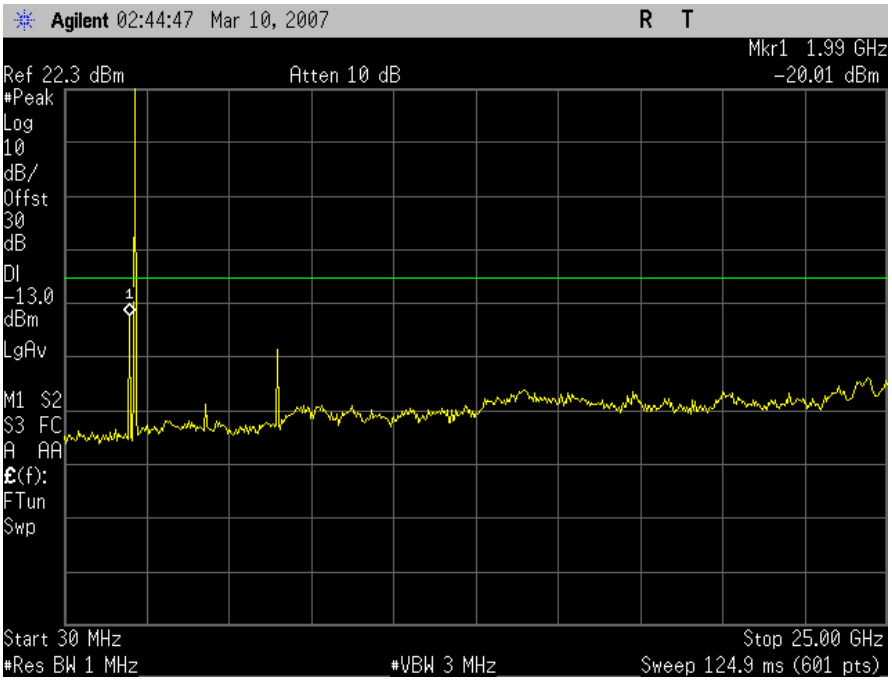
CDMA Uplink Conducted Emissions 30 MHz – 10 GHz (Low Channel)



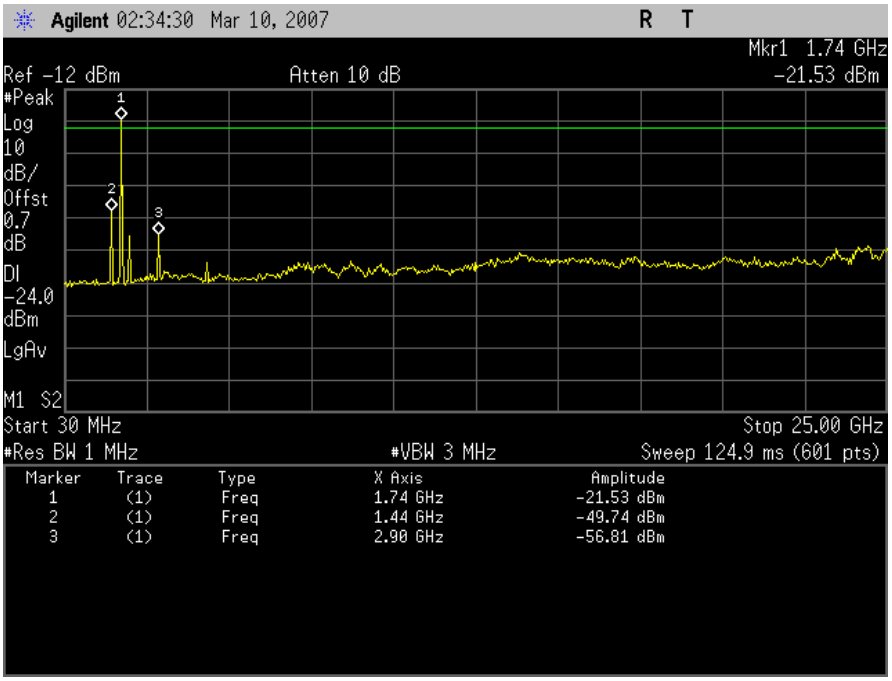
CDMA Downlink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



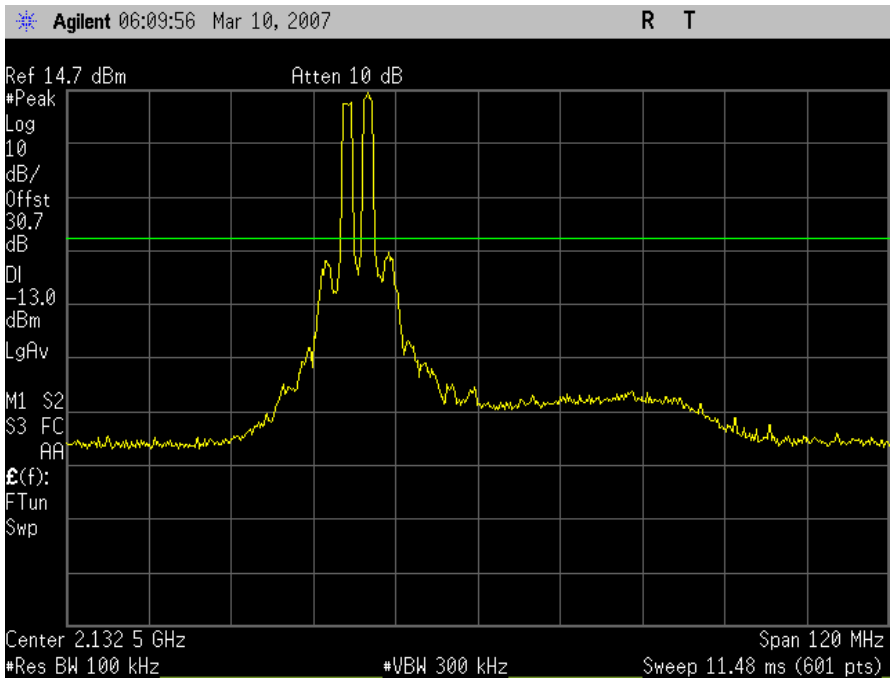
CDMA Uplink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



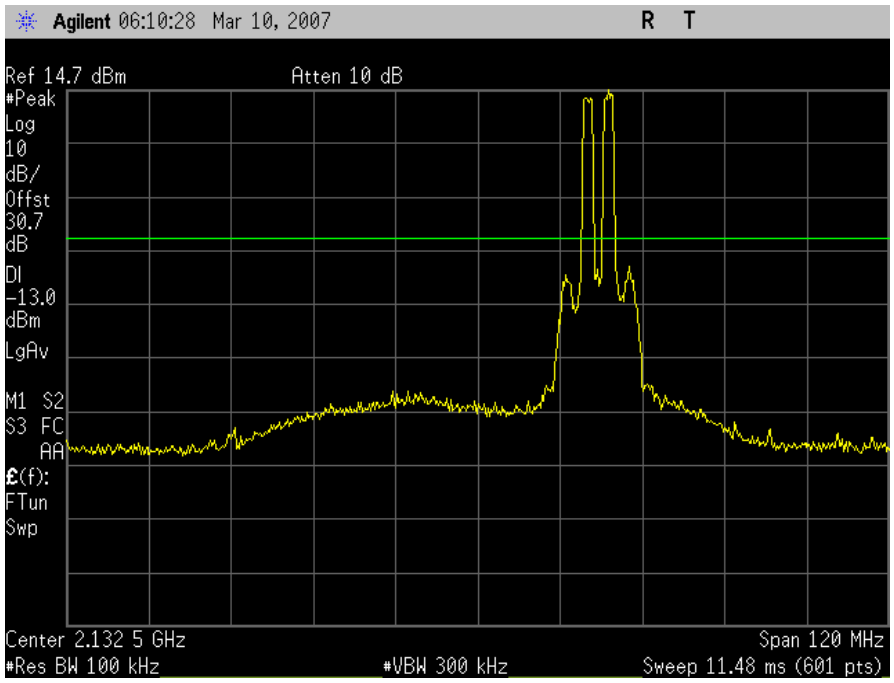
CDMA Downlink Conducted Emissions 30 MHz – 10 GHz (High Channel)



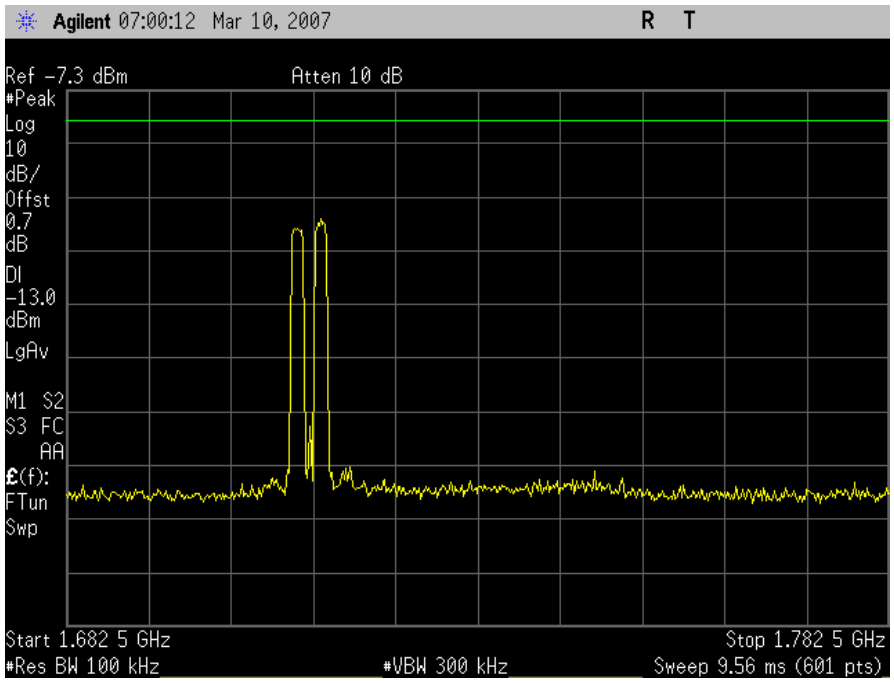
CDMA Uplink Conducted Emissions 30 MHz – 10 GHz (High Channel)



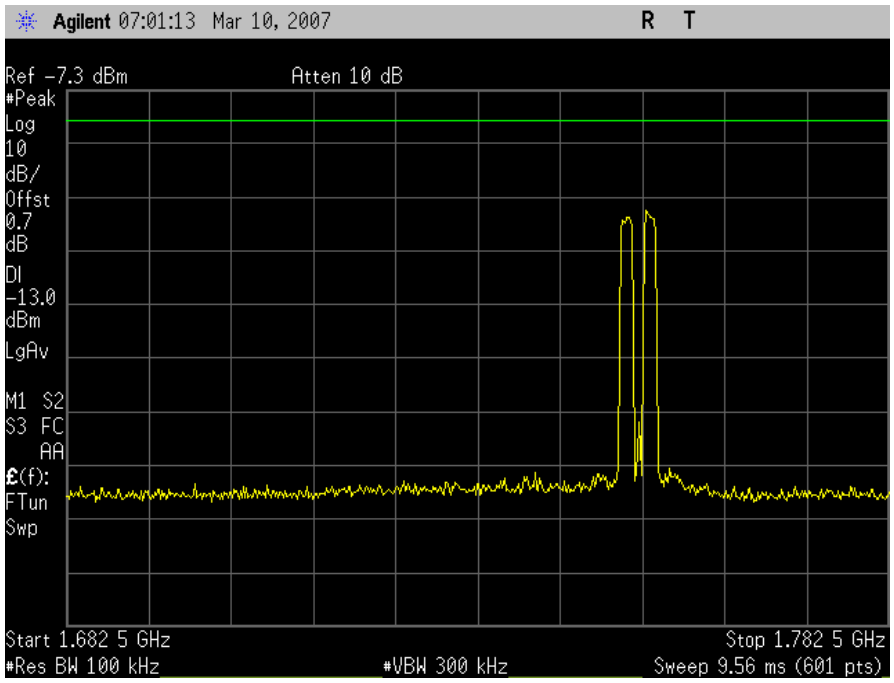
CDMA Downlink Intermodulation, Low End



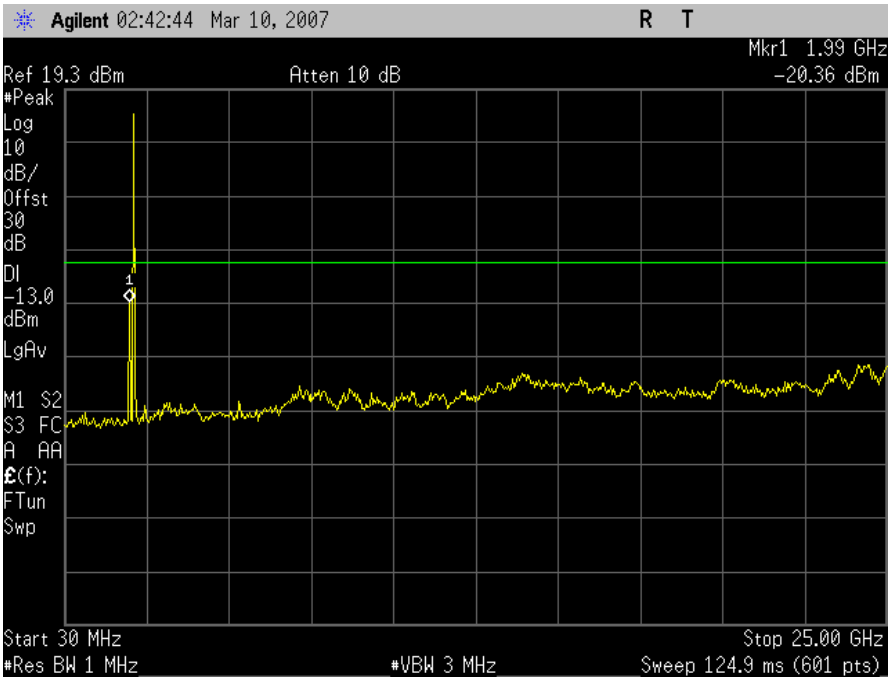
CDMA Downlink Intermodulation, High End



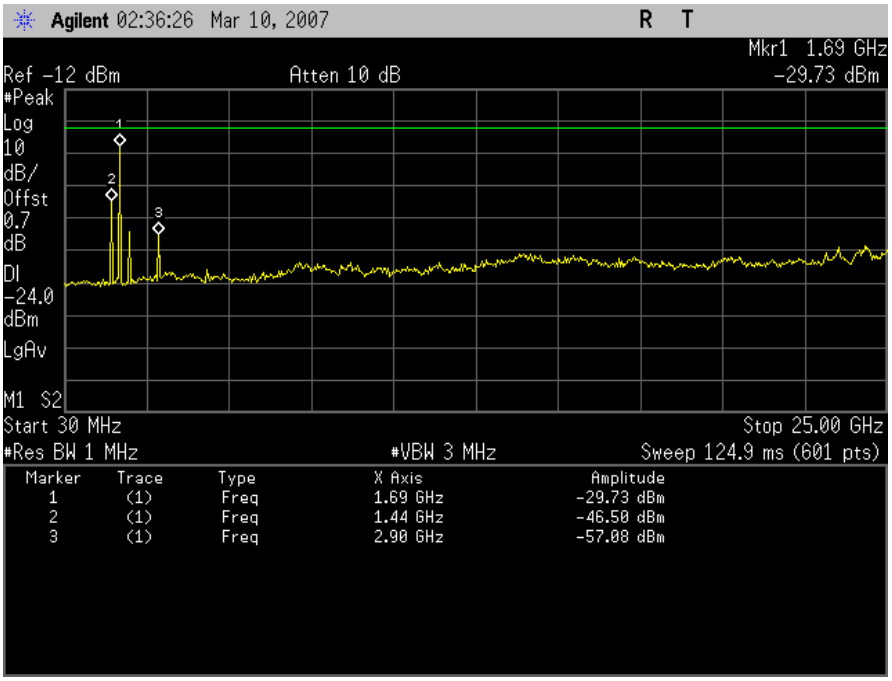
CDMA Uplink Intermodulation Low End



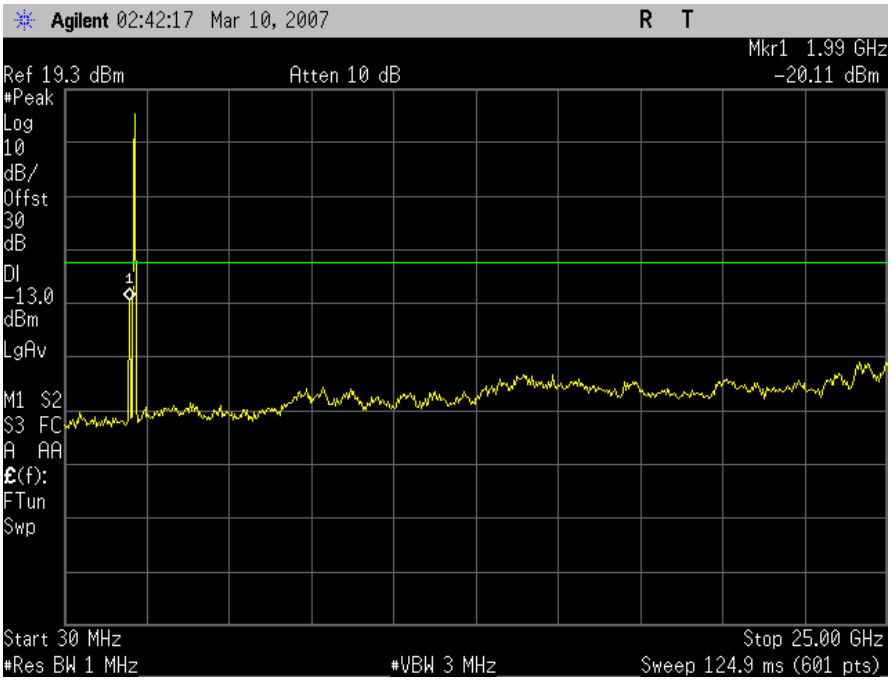
CDMA Uplink Intermodulation High End



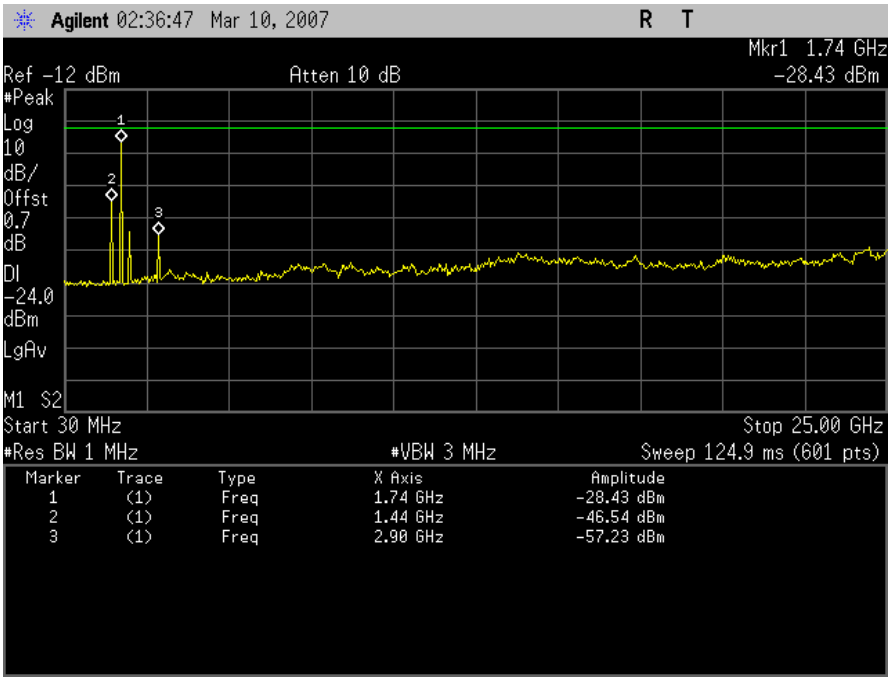
TDMA Downlink Conducted Emissions 30 MHz – 10 GHz (Low Channel



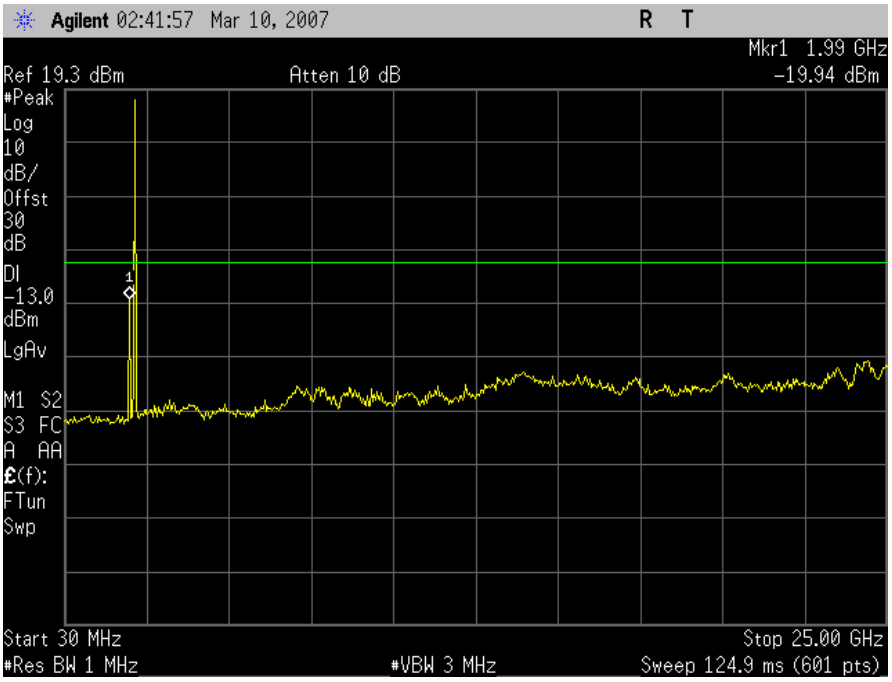
TDMA Uplink Conducted Emissions 30 MHz – 10 GHz (Low Channel)



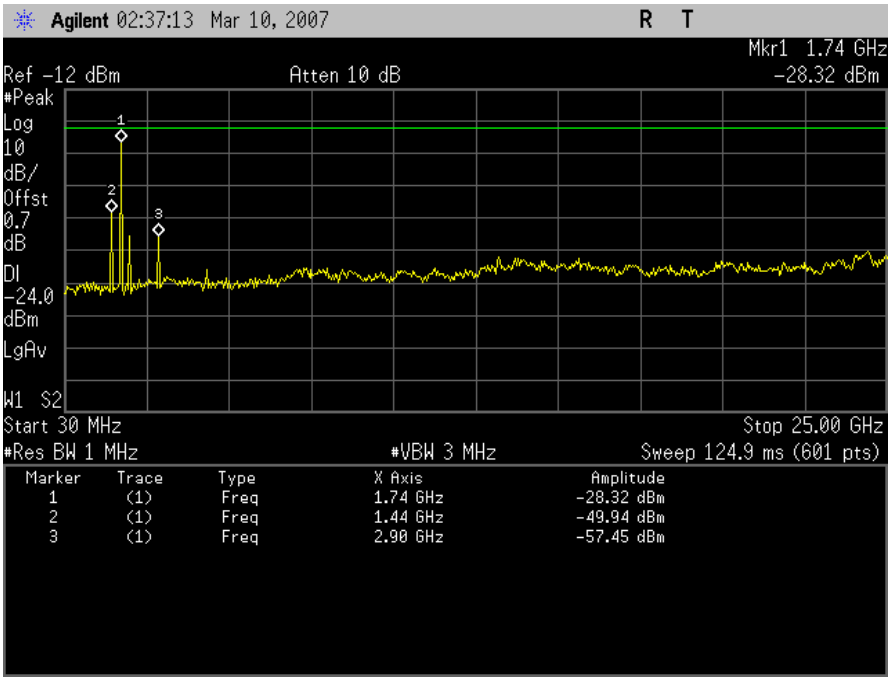
TDMA Downlink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



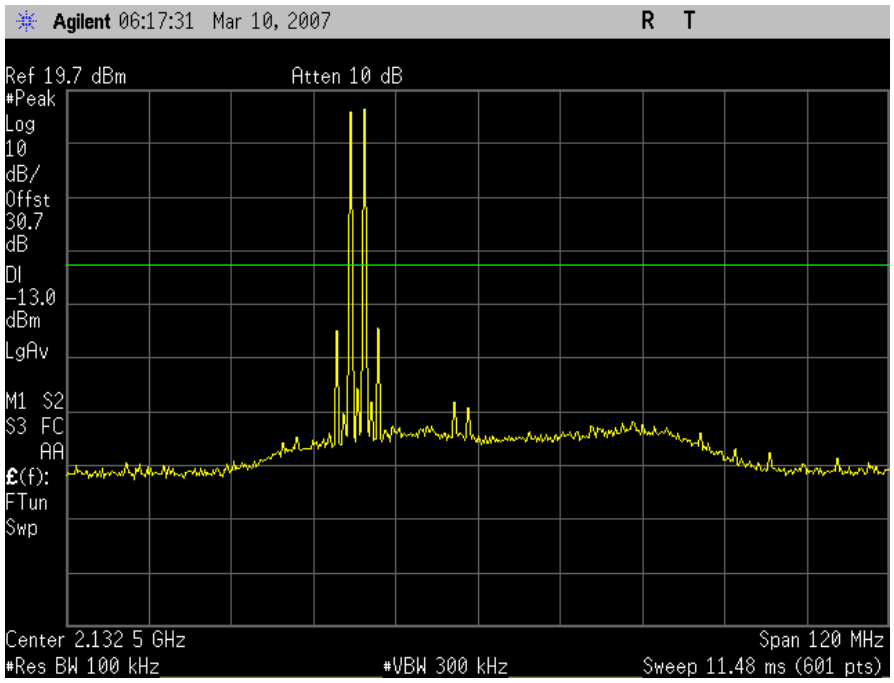
TDMA Uplink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



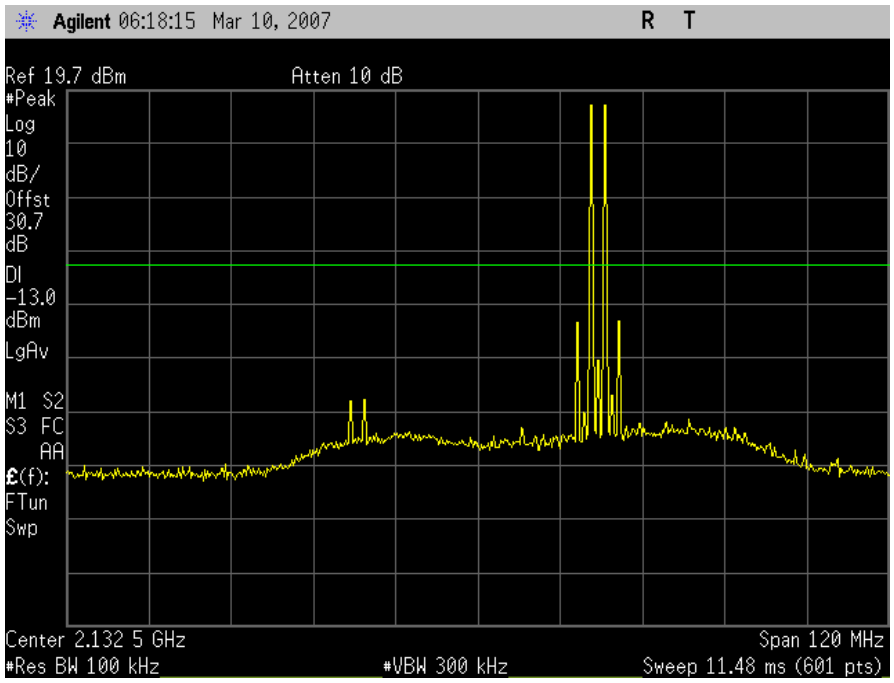
TDMA Downlink Conducted Emissions 30 MHz – 10 GHz (High Channel)



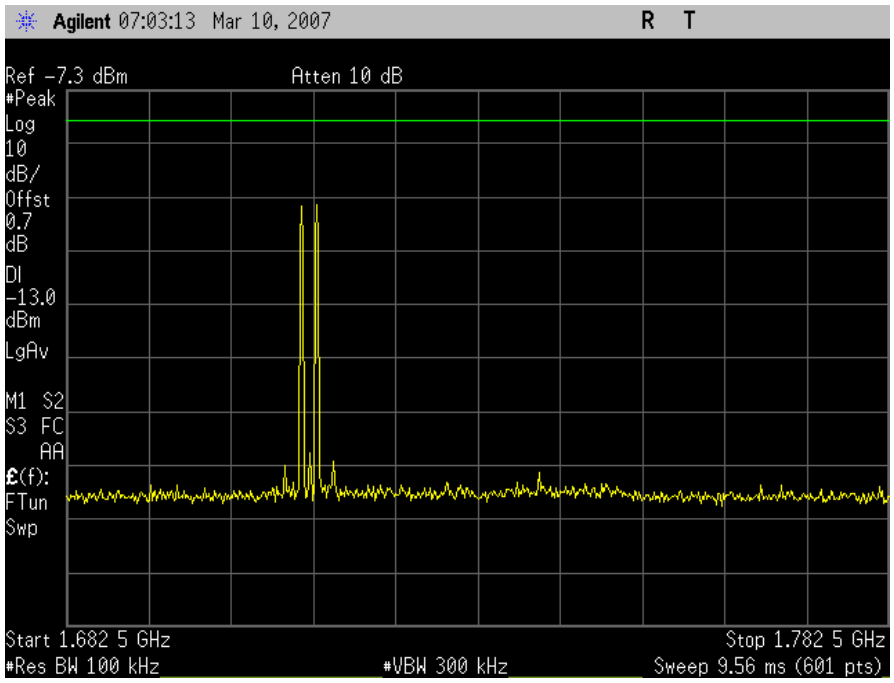
TDMA Uplink Conducted Emissions 30 MHz – 10 GHz (High Channel)



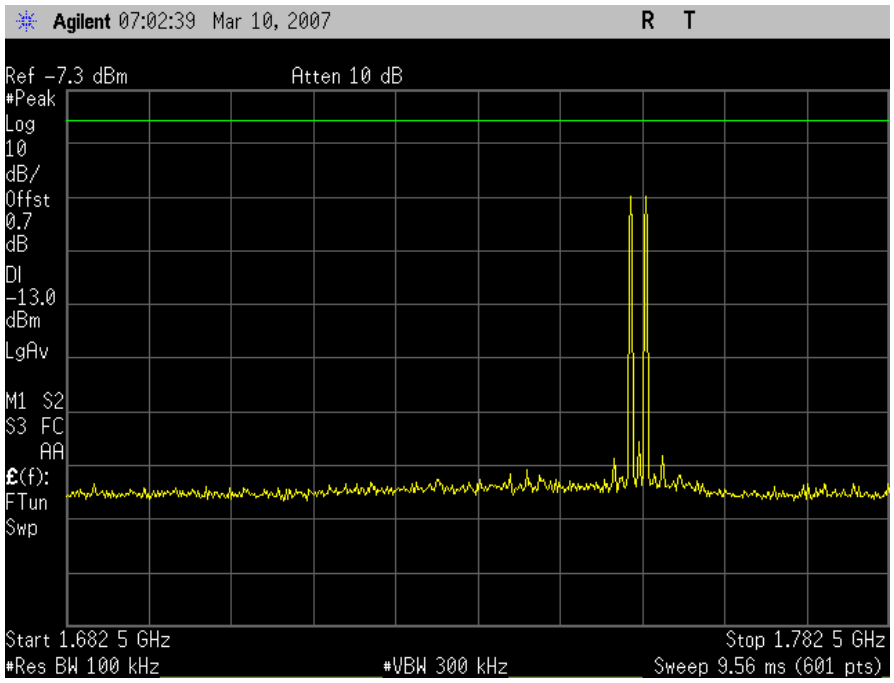
TDMA Downlink Intermodulation, Low End



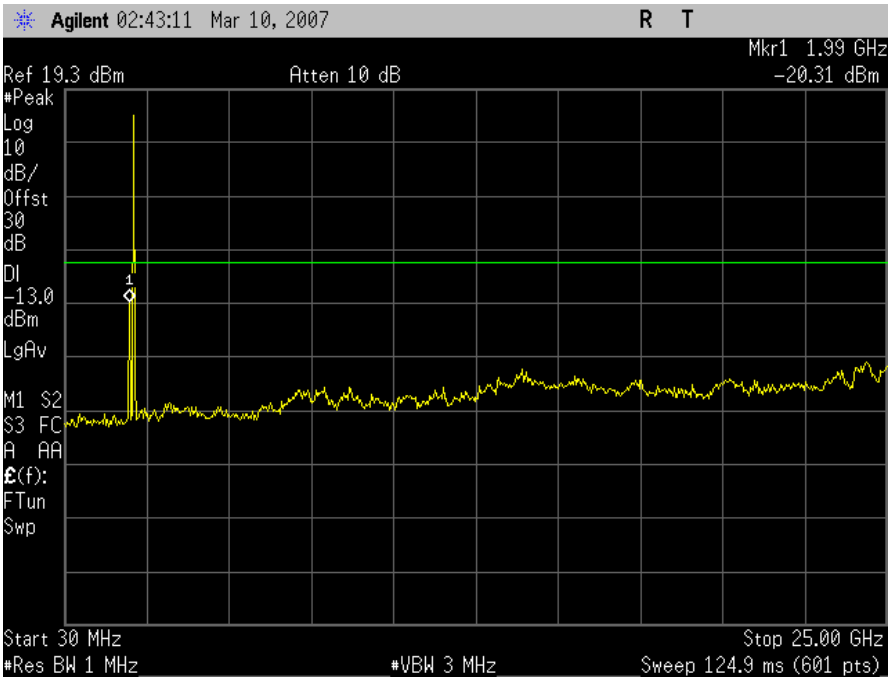
TDMA Downlink Intermodulation, High End



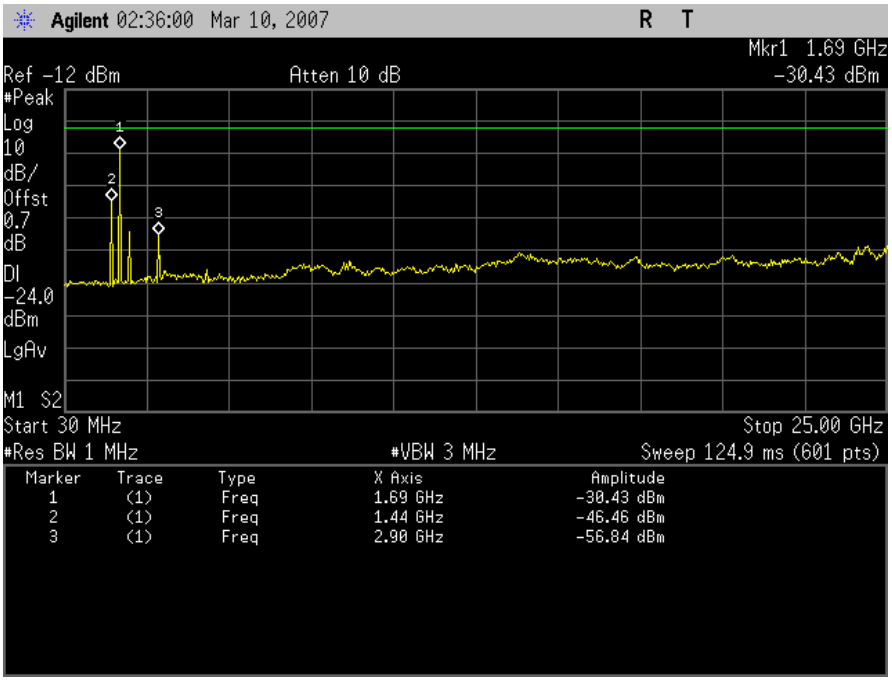
TDMA Uplink Intermodulation Low End



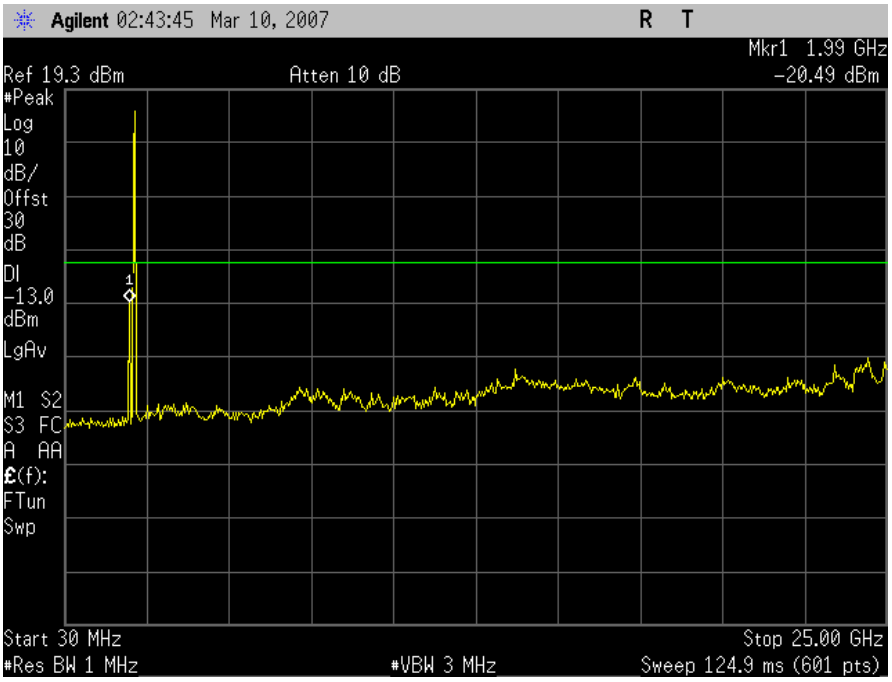
TDMA Uplink Intermodulation High End



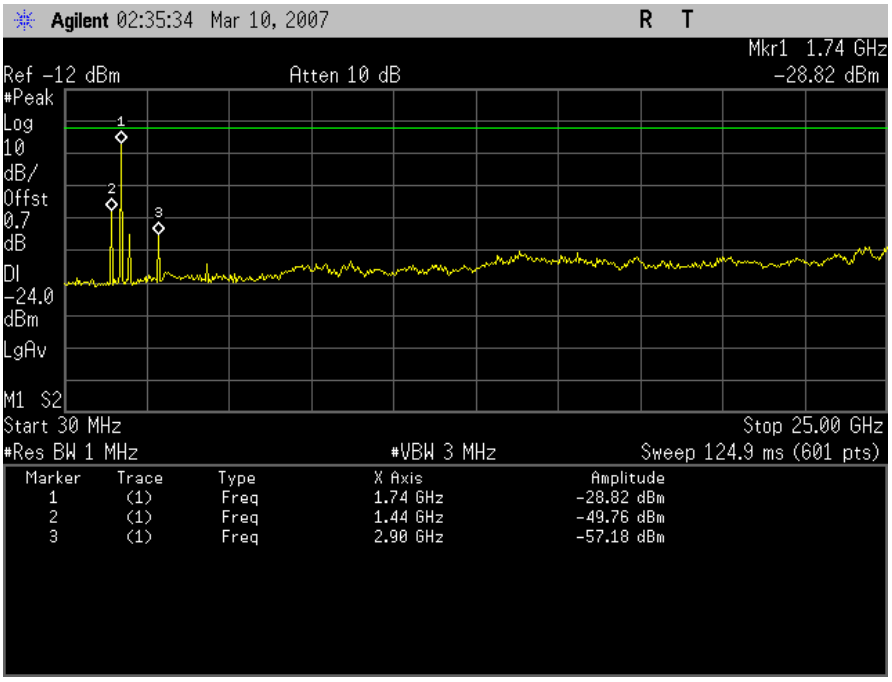
GSM Downlink Conducted Emissions 30 MHz – 10 GHz (Low Channel



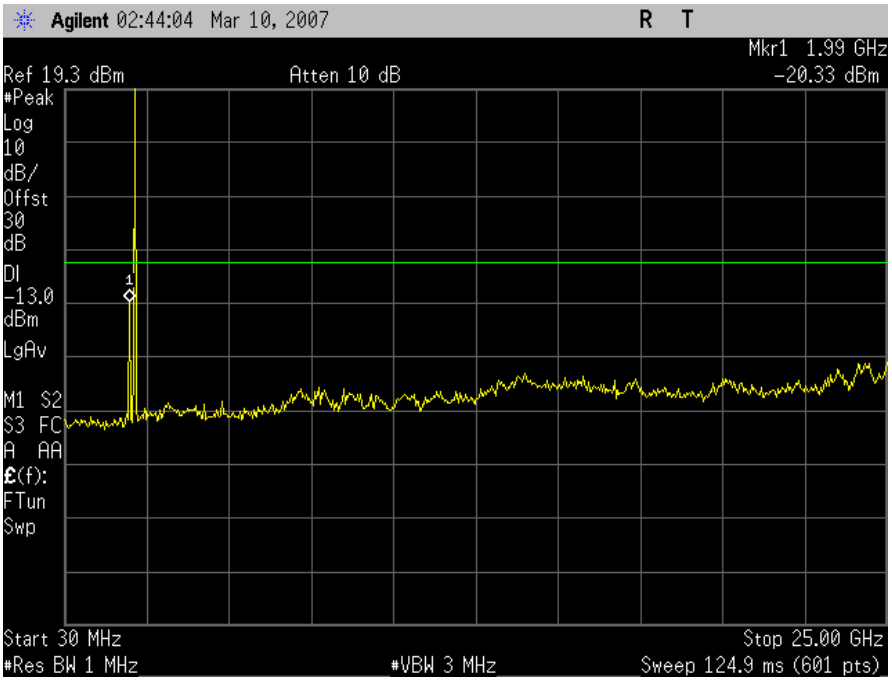
GSM Uplink Conducted Emissions 30 MHz – 10 GHz (Low Channel)



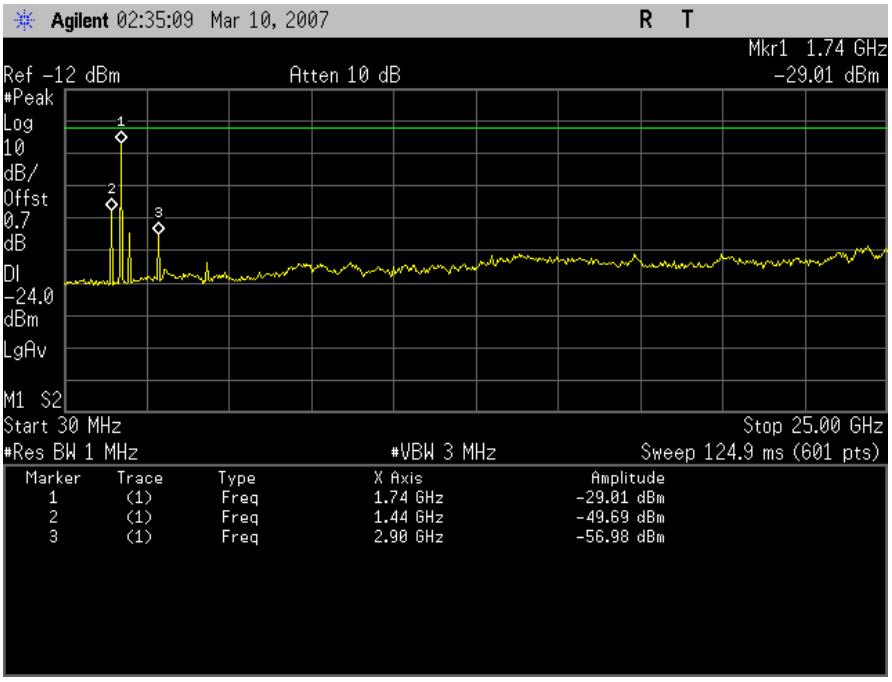
GSM Downlink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



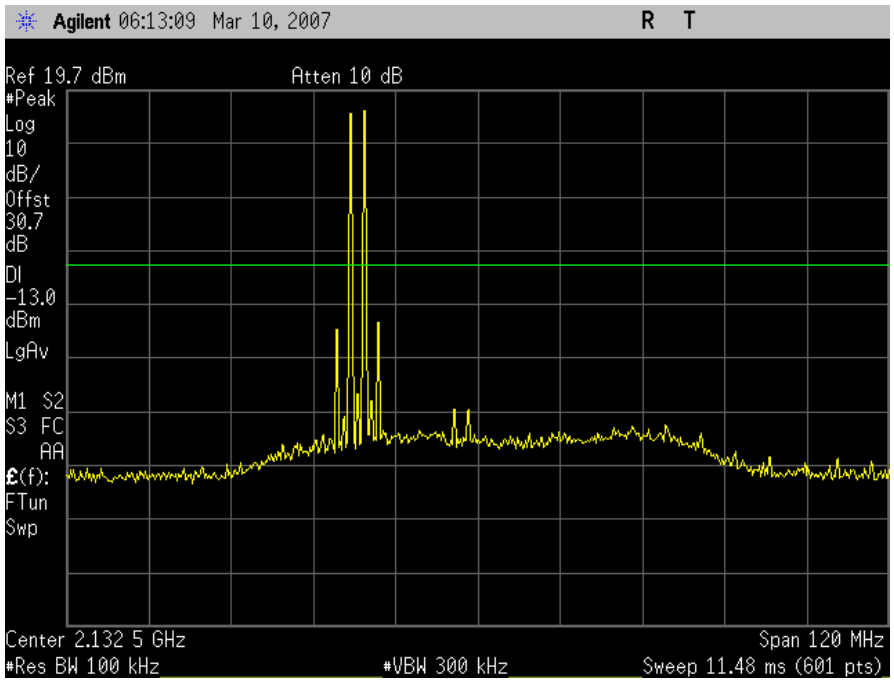
GSM Uplink Conducted Emissions 30 MHz – 10 GHz (Mid Channel)



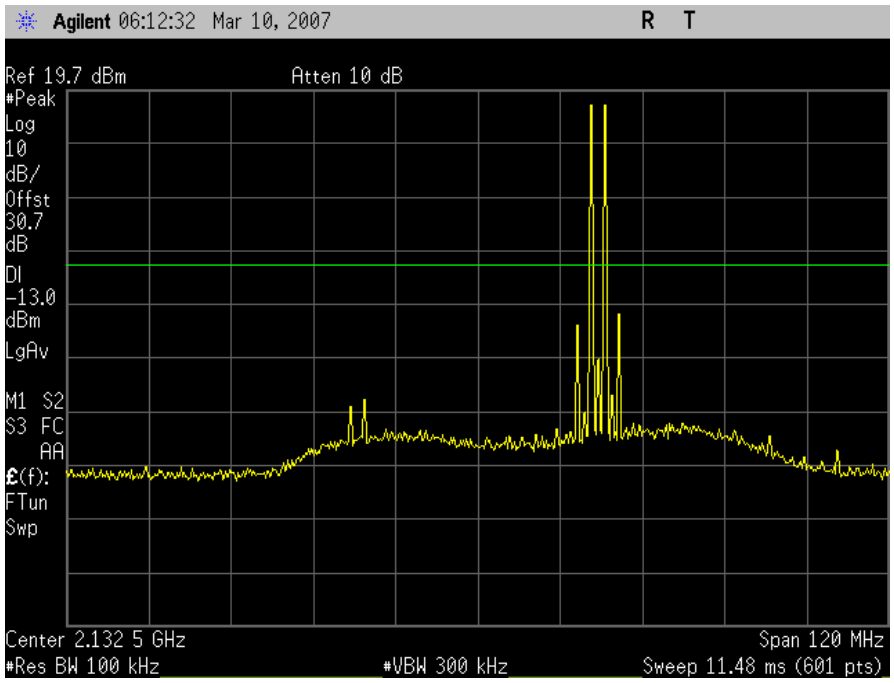
GSM Downlink Conducted Emissions 30 MHz – 10 GHz (High Channel)



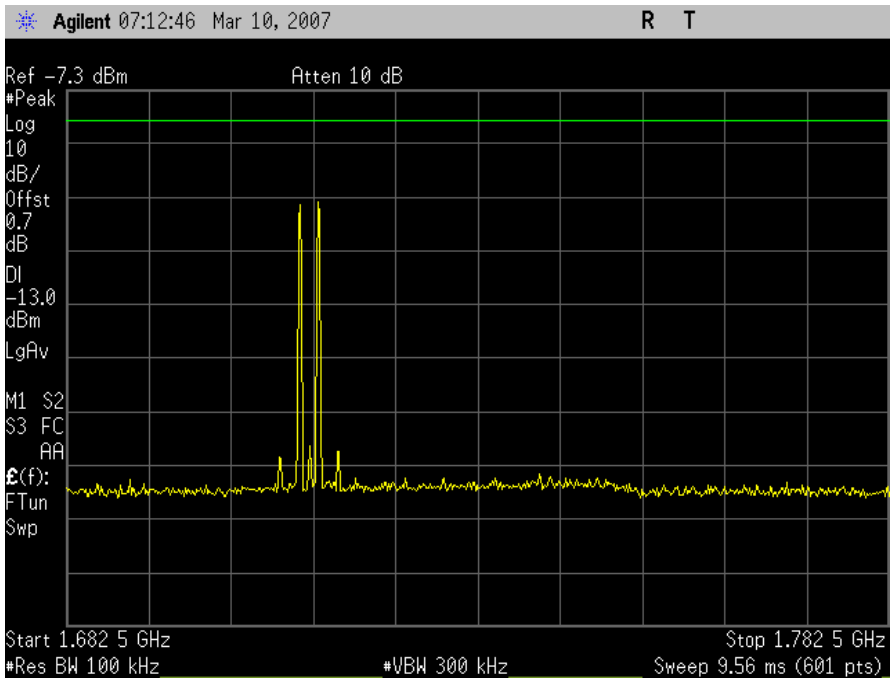
GSM Uplink Conducted Emissions 30 MHz – 10 GHz (High Channel)



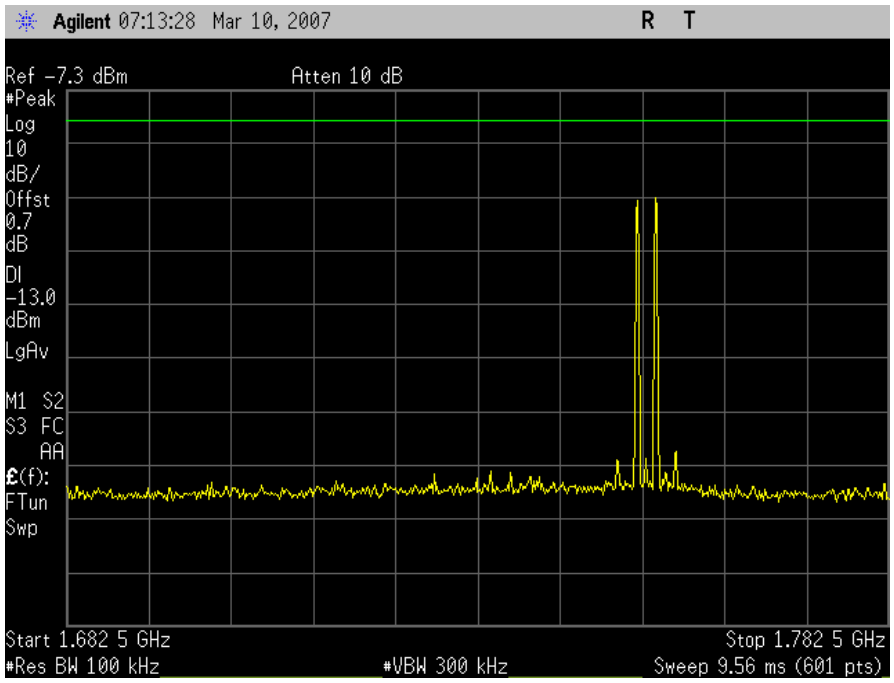
GSM Downlink Intermodulation, Low End



GSM Downlink Intermodulation, High End



GSM Uplink Intermodulation Low End



GSM Uplink Intermodulation High End

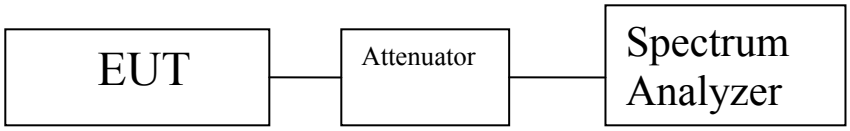
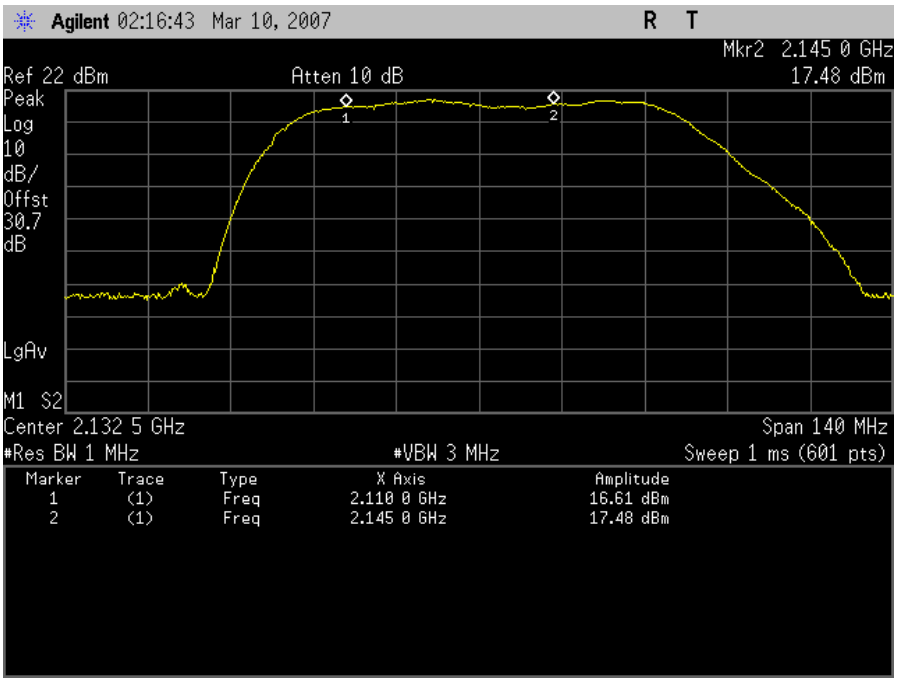


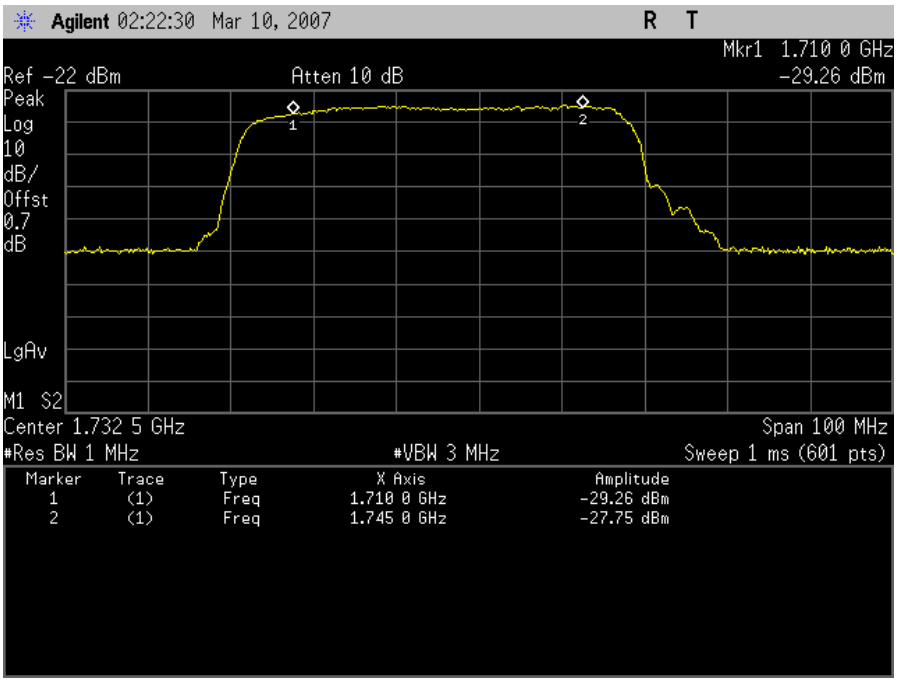
Figure 8. Block Diagram of Spurious Emissions at Antenna Terminals Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

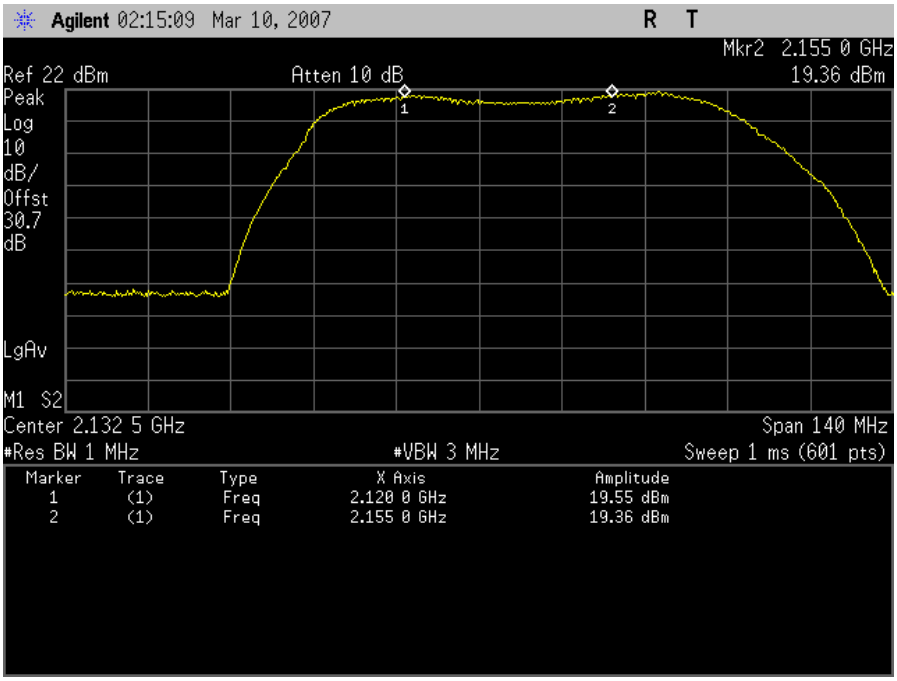
2-11-04/EAB/RF Out of Band Rejection



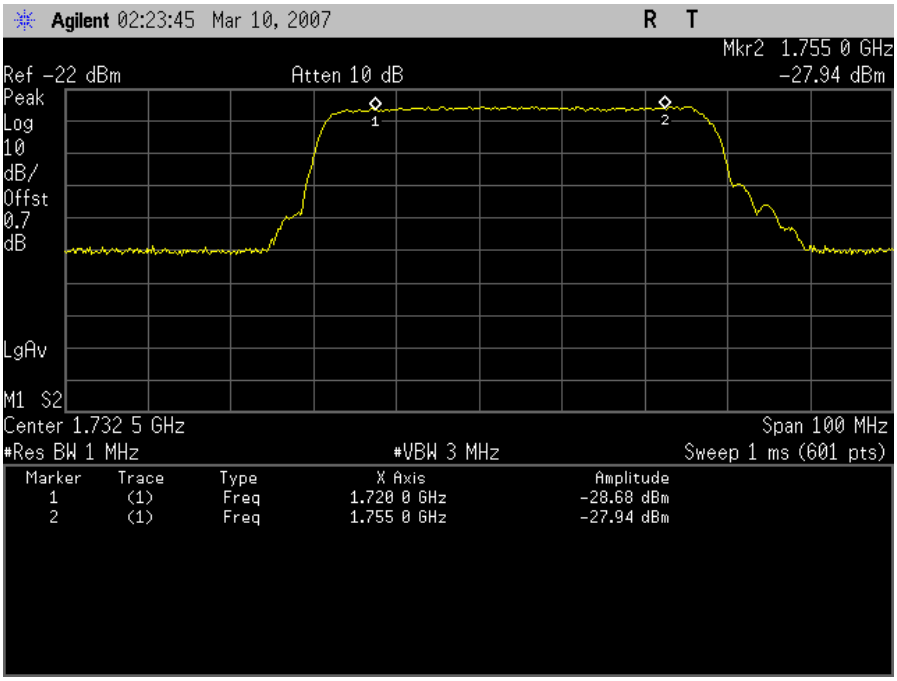
Out of Band Rejection Downlink – AWS1



Out of Band Rejection Uplink – AWS1



Out of Band Rejection Downlink – AWS2



Out of Band Rejection Uplink – AWS2

4. Electromagnetic Compatibility Intentional Radiators

4.5. Radiated Emissions (Substitution Method)

Test Requirement(s): **§ 2.1053 and § 27.53(g) Measurements required: Field strength of spurious radiation.**

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

Test Procedures:

As required by 47 CFR 2.1053, the *field strengths of radiated spurious emissions* were made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). The distance between the EUT and the test antenna was 3 meter. The EUT's RF port was connected to a dummy load. The EUT was set to transmit at its designated operating frequency range and at its maximum output power level. The intensities of the radiated emissions were maximized by rotating the turntable 360 degrees and varying the receive antenna from 1 to 4m. Measurements were made with the receive antenna in both horizontal and vertical polarizations.

In order to determine the magnitude of the radiated emissions, a calibrated antenna source was positioned in place of the EUT and fed with a modulated carrier equal to that of the EUT. The effective isotropic radiated power of each emission was determined by adding the forward power to the substitution antenna at the previously recorded amplitude, and adding the gain of the antenna at the given frequency.

The Radiated Spurious Emissions *Limit* is obtained by the following:

Test Results:

Equipment complies with Section 2.1055. All other emissions were measured at the noise floor of the spectrum analyzer. The polarization of the receive antenna which produced the highest emission was reported

Test Engineer:

Shawn McMillen

Test Date(s):

March 9, 2007

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Photograph 3. Radiated Emissions Test Setup

4. Electromagnetic Compatibility Intentional Radiators

4.6. Frequency Stability

Test Requirement(s): §2.1055 and §27.54

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was incapable of generating a CW signal in order to use a frequency counter. As a result alternative measures were taken in order to demonstrate that the fundamental emissions stayed within the authorized frequency block.

The EUT was placed in the Environmental Chamber and the support equipment was placed outside the chamber. The temperature chamber was set from -30 to 50^{C} in 10^{C} increment. The EUT was allowed sufficient time at each temperature setting in order to stabilize. At each temperature level the transmitter was set to the lowest and highest frequencies to the transmit band. The resulting carriers were captured on a spectrum analyzer in order to detect if fundamental emissions remained within the authorized frequency block.

In addition, the voltage supplied to EUT was varied by ± 15 % of nominal voltage. These tests were carried out at normal room temperatures.

Test Results: Equipment complies with Section 2.1055 and 27.54. The following plots show frequency stability compliance.

Test Engineer(s): Shawn McMillen

Test Date(s): March 14, 2007

Frequency Stability Test Results – Downlink

Reference Freq.: 2132.524475MHz at 20°C

Temperature (Celsius)	Measured Freq (MHz)	Drift ppm
50	2132.524470	0.002
40	2132.524477	0.001
30	2132.524463	0.006
20	Reference	
10	2132.524479	0.002
0	2132.524477	0.001
-10	2132.524469	0.003
-20	2132.524461	0.007
-30	2132.524478	0.001

Table 9. Temperature Vs. Frequency Test Results

Reference: 120Vac at 20°C **Freq.** = 2132.524475MHz

Measured (V) +/-15%	Measured Freq (MHz)	Drift ppm
102	2132.524470	0.002
138	2132.524481	0.003

Table 10. Frequency vs. Voltage Test Results

Frequency Stability Test Results – Uplink

Reference Freq.: 1732.500477MHzat 20°C

Temperature (Celsius)	Measured Freq (MHz)	Drift ppm
50	1732.500445	0.018
40	1732.500488	0.006
30	1732.500475	0.001
20	Reference	
10	1732.500481	0.002
0	1732.500468	0.005
-10	1732.500470	0.004
-20	1732.500469	0.005
-30	1732.500465	0.007

Table 11. Temperature Vs. Frequency Test Results

Reference: 120Vac at 20°C **Freq.** = 1732.500477MHz

Measured (V) +/-15%	Measured Freq (MHz)	Drift ppm
102	1732.500477	0.000
138	1732.500484	0.004

Table 12. Frequency vs. Voltage Test Results

5. Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2034	COUPLER, DIRECTIONAL 1-20 GHz	KRYTAR	101020020	SEE NOTE	
1S2034	COUPLER, DIRECTIONAL 1-20 GHz	KRYTAR	101020020	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	11/28/2006	11/28/2007
1S2128	Harmonic Mixer	Hewlett Packard	11970A	N/A	3/10/2007
1S2129	Harmonic Mixer	Hewlett Packard	11970K	N/A	3/10/2007
1S2184	BILOG ANTENNA	CHASE	CBL6112A	1/3/2007	1/3/2008
1S2198	ANTENNA, HORN	EMCO	3115	8/17/2006	8/17/2007
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	3/23/2004	3/23/2007
1S2263	CHAMBER, 10 METER	RANTEC	N2-14	8/15/2006	8/15/2007
1S2421	EMI RECEIVER	ROHDE&SCHWARZ	ESIB 7	3/22/2006	4/22/2007
N/A	WIDEBAND POWER METER	Agilent	E4448A	2/02/2007	2/02/2008
1S2460	Analyzer, Spectrum 9 kHz-40GHz	Agilent	E4407B	7/06/2005	7/06/2008
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

6. Certification Label & User's Manual Information

6.2. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.

[1] In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, or the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant, whichever is applicable.

§ 2.907 Certification.

a. Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart C (of Part 15), which deals with intentional radiators.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but

6.2. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(ii Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(ii A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(ii All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

