Lab Code: 200167-0

FCC PARTS 24 AND 90
MEASUREMENT AND TEST REPORT

For

LGC WIRELESS, INC.

2840 Junction Avenue, San Jose, CA 95134, USA

FCC ID: NOOFSN-809019-2

Report Type: ☒ Original Report	**Product Type:** RF Distributed Antenna System
Test Engineer:	Choon Sian Ooi
Report Number:	R0710032
Report Date:	2007-11-02
Reviewed By:	Hans Mellberg VP of Engineering
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Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *LGC Wireless, Inc.*, product: *InterReach Fusion System* model: which includes: *Remote Access Unit (FSN-809019-2), Main Hub (FSN-1-MH-1) & Expansion Hub (FSN-EH-2)]* or the "EUT" as referred to in this report is a Multi-band RF Distributed Antenna System that operates on both PCS (1900 MHz) and IDEN 800 & 900 bands. The EUT is designed for mid-sized to large edifices containing dense, high-traffic data environments such as convention centers, sporting arenas and airports. The EUT is a system comprised of three unit types: A Main Hub that receives its radio frequency (RF) signals from a *MetroReach Focus system*, a base station or a repeater and up to 4- Expansion Hubs that connect to the Main Hub via Single-mode or Multi-Mode fiber optics; and up to 32- Remote Access Units (RAUs) that connect to the Expansion Hub via CATV cabling. Each RAU sends and receives RF signals to wireless devices located within its coverage area. For the purposes of the tests and results recorded herein, the EUT comprised of one Base Station, one Main Hub, and one Expansion Hub tested together as a system.

EUT Photos

Model: FSN-809019-2 with FSN-1-MH-1 and FSN-EH-2

FSN-809019-2 (*Remote Access Unit)*

FSN-1-MH-1 *(Main Hub)*

FSN-EH-2 (*Expansion Hub)*

EUT detail photos in exhibit C

1.2 Mechanical Description

Each component of the EUT system was housed within separate chassis. The Remote Unit measured 133.5mm H x 438 mm L x 381 mm W, and each Hub measured 54 mm H x 286 mm L x 281 mm W.

** The test data gathered are from production samples provided by the manufacturer, serial numbers: Remote Unit F0100HYR, Main Hub: FR1014RA, Expansion Hub: FR220AH.*

1.3 Objective

This type approval report is prepared on behalf of *LGC Wireless, Inc.* in accordance with Part 2, Subpart J, Part 90 Subpart I, and Part 24 Subpart E of the Federal Communication Commissions rules.

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

1.4 Related Submittal(s)/Grant(s)

No Related Submittals

1.5 Test Methodology

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

Part 90 Subparts I – Public Land Mobile Radio Services
Part 24 Subpart E - PCS

Applicable Standards: TIA EIA 98-C, TIA/EIA603-C, ANSI C63.4-2003.

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

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

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

2 SYSTEM TEST CONFIGURATION

2.1 Justification

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

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

2.2 Equipment Modifications

No modifications were made to the EUT.

2.3 Power Supply and Line Filters

2.3.1 Expansion Hub

Manufacturer	Description	Model	Serial Number
Digital Power Corp	Switching P/S	ef0306-14B	0605103
Digital Power Corp	Switching P/S	ef0306-14B	0605082
The Power Solution	AC-DC Power supply	AM-120UR-T211-145 REV. X2	NA
Schaffner	EMI Power Filter	FN9222+0-06	NA

2.3.2 Main Hub

Manufacturer	Description	Model	Serial Number
The Power Solution	AC-DC Power supply	AM-120UR-T211-145 REV. X2	NA
Schaffner	EMI Power Filter	FN9222+0-06	NA

2.4 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwartz	Signal Generator	SMIQ03	849192/0085 2006-10-18
Agilent	Signal Generator	E4438C	MY45092500
LGC Wireless	Main Hub	FSN-1-MH-1	FR1014RA
LGC Wireless	Expansion Hub	FSN-1-EH-2	FR220AHN

2.5 Interface Ports and Cabling

Cable Description	Length (M)	From	To
RF cable	0.2	Signal Generator	Main Hub
RF cable	0.2	Expansion Hub	Remote Unit (EUT)

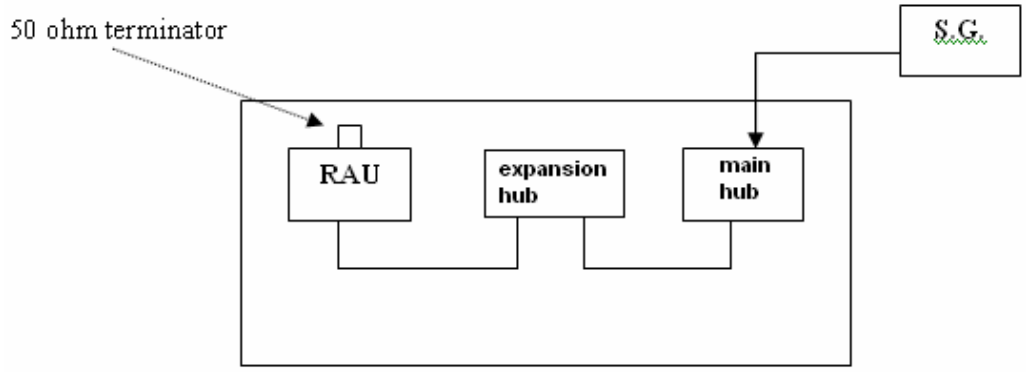
Mode of Operation

Uplink mode: Simulation signal is being generated from Signal Generator then feed into Antenna port of RAU. Output is monitored by Spectrum analyzer through Hub's uplink port.

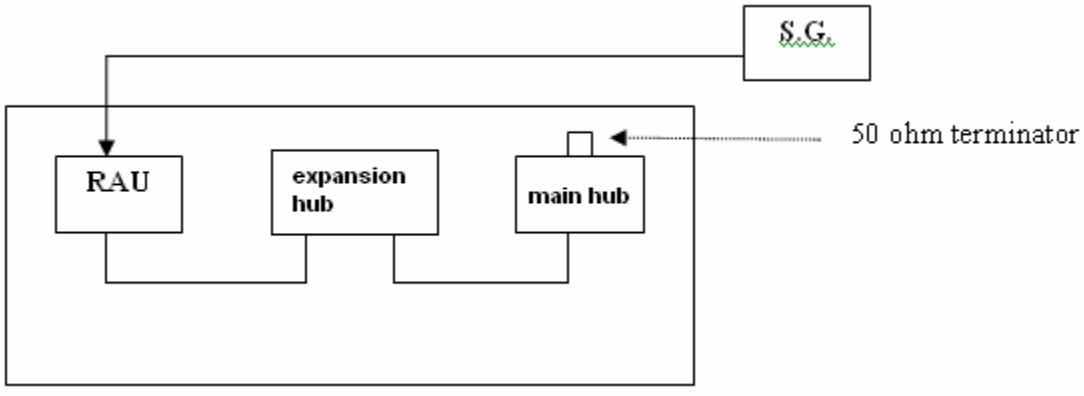
Downlink Mode: Simulation signal is being generated from Signal Generator then feed into downlink port of main hub. Output is monitored by Spectrum analyzer through RAU Antenna port.

2.6 Test Setup Block Diagram

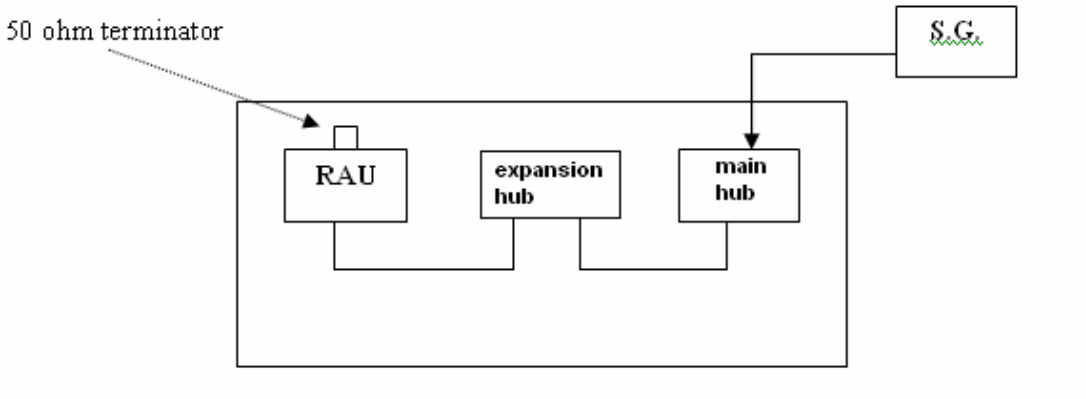
2.6.1 Radiated Emission – Downlink



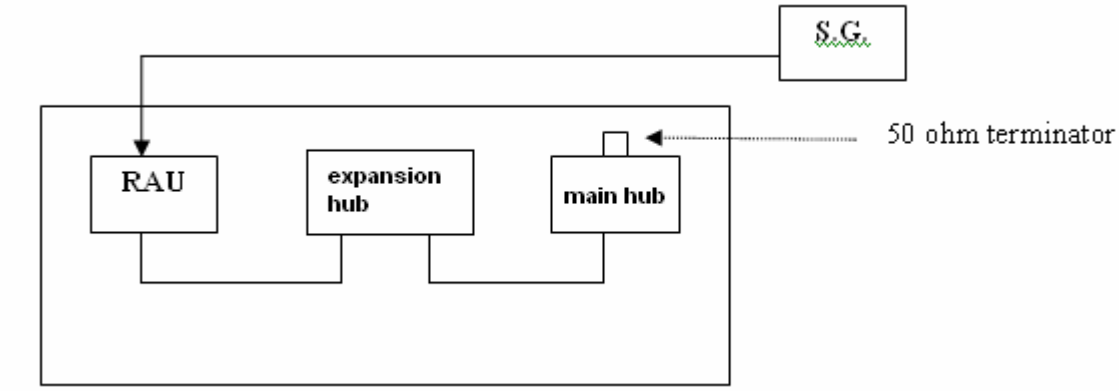
2.6.2 Radiated Emission – Uplink



2.6.3 Conducted Emission – Downlink



2.6.4 Conducted Emission – Uplink



3 SUMMARY OF TEST RESULTS

FCC Part 24 / 90

FCC Rules	Description of Test	Result	Note
§ 2.1047	Modulation Characteristics	Not Applicable	Digital Modulation
§ 2.1053	Field Strength of Spurious Radiation	Compliant	-
§2.1091	RF Exposure	Compliant	-
§ 2.1046, § 90.205 § 24.232	RF Output Power	Compliant	-
§ 2.1049 § 90.209	Out of Band Emissions, Occupied Bandwidth	Compliant	-
§ 2.1051, § 90.210 § 24.238(a)	Spurious Emissions at Antenna Terminals	Compliant	-
§ 2.1055 (a) § 2.1055 (d) § 90.213 § 24.238	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant	-
2-11-04/EAB/RF	Out of Band Rejection	Compliant	-

FCC Part15B

FCC Rules	Description of Test	Result
§ 15.109	Conducted Emission	Compliant
§ 15.107	Radiated Emission	Compliant

4 §2.1047 - MODULATION CHARACTERISTIC

4.1 4.1 Applicable Standard

According to FCC § 2.1047(d), part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

5 §2.1053 - SPURIOUS RADIATED EMISSIONS

5.1 Applicable Standard

Requirements: CFR 47, § 2.1053

For PCS Band and IDEN 800 and 900 Bands

5.2 Test Procedure

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

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

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

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

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

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

5.2.1 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	55 %
ATM Pressure:	102.0 kPa

** The testing was performed by Choon Sian Ooi on 2007-10-13.*

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
HP	Amplifier, Pre	8447D	2944A10198	2007-01-08
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2007-06-07
HP	Generator, Signal	83650B	3614A00276	2007-05-18
A.R.A.	Antenna, Horn	DRG-118/A	1132	2007-06-18

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

5.4 Test Result

PCS Band, Part24:

Low Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
3860	52	180	150	V	3860	-43.5	10.30	2	-35.2	-13	-22.2
3860	49.8	169	136	H	3860	-44.82	9.32	2	-37.5	-13	-24.5
5790	43.7	134	147	V	5790	-42.16	10.36	2.4	-34.2	-13	-21.2
5790	41.0	179	162	H	5790	-40.62	10.12	2.4	-32.9	-13	-19.9

Middle Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
3925	54.5	175	155	V	3925	-41.5	10.30	2	-33.2	-13	-20.2
3925	51.2	163	152	H	3925	-41.82	9.32	2	-34.5	-13	-21.5
5887.5	42.9	144	159	V	5887.5	-43.06	10.36	2.4	-35.1	-13	-22.1
588.75	42.6	189	150	H	588.75	-42.62	10.12	2.4	-34.9	-13	-21.9

High Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
3990	53.1	165	155	V	3990	-45.8	10.30	2	-37.5	-13	-24.5
3990	52.3	143	152	H	3990	-44.02	9.32	2	-36.7	-13	-23.7
5985	43	154	159	V	5985	-45.76	10.36	2.4	-.37.8	-13	-24.8
5985	46.4	169	150	H	5985	-45.22	10.12	2.4	-37.5	-13	-24.5

IDEN 800

Low Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
1702	47.8	170	150	V	1702	-45.88	8.68	1.1	-38.3	-13	-25.3
1702	46.9	159	176	H	1702	-47.43	8.33	1.1	-40.2	-13	-27.2
2553	44.8	178	187	V	2553	-49.68	8.68	1.5	-42.5	-13	-29.5
2553	42.6	189	122	H	2553	-52.2	9.40	1.5	-.44.3	-13	-31.3

Middle Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
1720	47.4	166	150	V	1720	-47.08	8.68	1.1	-39.5	-13	-26.5
1720	47.8	169	170	H	1720	-46.03	8.33	1.1	-38.8	-13	-25.8
2580	44.2	178	160	V	2580	-48.98	8.68	1.5	-41.8	-13	-28.8
2580	42.7	180	152	H	2580	-52	9.40	1.5	-44.1	-13	-31.1

High Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
1738	46.8	166	150	V	1738	-47.68	8.68	1.1	-40.1	-13	-27.1
1738	47.4	159	170	H	1738	31.87	8.33	1.1	39.1	-13	52.1
2607	43.8	168	160	V	2607	-49.48	8.68	1.5	-42.3	-13	-29.3
2607	43.6	180	152	H	2607	-50.8	9.40	1.5	-42.9	-13	-29.9

IDEN 900

Low Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
1870	48.6	160	150	V	1870	-42.28	8.68	1.1	-34.7	-13	-21.7
1870	47.1	179	156	H	1870	-43.03	8.33	1.1	-35.8	-13	-22.8
2805	50.1	168	157	V	2805	-39.68	8.68	1.5	-32.5	-13	-19.5
2805	49.3	180	152	H	2805	-41.7	9.40	1.5	-33.8	-13	-20.8

Middle Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
1876	49.8	160	150	V	1876	-40.78	8.68	1.1	-33.2	-13	-20.2
1876	47.3	169	150	H	1876	-42.43	8.33	1.1	-35.2	-13	-22.2
2814	50.1	188	150	V	2814	-39.68	8.68	1.5	-32.5	-13	-19.5
2814	51.3	175	150	H	2814	-39.4	9.40	1.5	-31.5	-13	-18.5

High Channel

Indicated		Table Azimuth Degrees	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar. (H/V)	Freq. (MHz)	Level (dBm)	Ant. Gain Correction (dBi)	Cable Loss (dB)			
1882	51.8	180	150	V	1876	-39.58	8.68	1.1	-32	-13	-19
1882	52.4	173	150	H	1876	-38.33	8.33	1.1	-31.1	-13	-18.1
2823	53.1	176	150	V	2814	-37.38	8.68	1.5	-30.2	-13	-17.2
2823	51.4	175	150	H	2814	-40.2	9.40	1.5	-32.3	-13	-19.3

6 §2.1091 – RF EXPOSURE

6.1 Applicability

According to §1.1307(b)(1) and §1.1307(b)(2), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

6.2 MPE Prediction

PCS Band (1930-1995 MHz)

MPE Limit Calculation:@ 1850-1995MHz; highest conducted power=26.28dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 7.72dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	26.28
Maximum peak output power at antenna input terminal (mW):	466
Prediction distance (cm):	20
Prediction frequency (MHz):	1962.5
Maximum Antenna Gain, typical (dBi):	7,72
Maximum Antenna Gain (numeric):	5.92
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.5488
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

IDEN Band (851-869 MHz)

MPE Limit Calculation:@ 809MHz-869MHz; highest conducted power=25.61dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 8.39dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	25.61
Maximum peak output power at antenna input terminal (mW):	364
Prediction distance (cm):	20
Prediction frequency (MHz):	860
Maximum Antenna Gain, typical (dBi):	8.39
Maximum Antenna Gain (numeric):	6.902
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.4997
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.58

IDEN Band (935-941 MHz)

MPE Limit Calculation:@ 896MHz-941MHz; highest conducted power=25.61dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 8.39dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	25.61
Maximum peak output power at antenna input terminal (mW):	364
Prediction distance (cm):	20
Prediction frequency (MHz):	938
Maximum Antenna Gain, typical (dBi):	8.39
Maximum Antenna Gain (numeric):	6.902
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.4997
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.58

7 §2.1046, §24.232, & §90.205 – RF OUTPUT POWER

7.1 Applicable Standard

According to FCC §2.104, §24.232, §90.205(a), in no case may the peak output power of a base station transmitter exceed 2 watt.

7.2 7.2 Test Procedure

Conducted:

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

7.2.1 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	58 %
ATM Pressure:	101.8 kPa

** The testing was performed by Choon Sian Ooi 2007-10-13.*

7.3 7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Rohde & Schwartz	Signal Generator	SMIQ03	849192/0085	2006-10-18
Agilent	Vector Signal Generator	ESG44	US44300386	-

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

7.4 Test Results

PCS band

GSM (Downlink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Limit (Watt)
LOW	1930.00	25.45	0.351	2
MID	1962.50	25.56	0.360	2
HIGH	1995.00	25.22	0.333	2

GSM (Uplink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
LOW	1850.00	-19.47	0.011
MID	1882.50	-18.15	0.015
HIGH	1915.00	-20.03	0.01

TDMA (Downlink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Limit (Watt)
LOW	1930.00	25.22	0.333	2
MID	1962.50	26.28	0.466	2
HIGH	1995.00	25.43	0.350	2

TDMA (Uplink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
LOW	1850.00	-19.47	0.0113
MID	1882.50	-18.04	0.016
HIGH	1915.00	-20.17	0.0097

CDMA (Downlink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Limit (Watt)
LOW	1930.00	23.67	0.238	2
MID	1962.50	25.71	0.329	2
HIGH	1995.00	24.16	0.261	2

CDMA (Uplink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
LOW	1850.00	-19.24	0.012
MID	1882.50	-19.96	0.010
HIGH	1915.00	-20.24	0.009

IDEN 800

(Downlink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Limit (Watt)
LOW	851.00	24.90	0.309	2
MID	860.00	25.61	0.364	2
HIGH	869.00	24.06	0.255	2

(Uplink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
LOW	809.00	-19.01	0.013
MID	815.00	-21.10	0.008
HIGH	824.00	-19.87	0.01

IDEN 900

(Downlink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Limit (Watt)
LOW	935.00	24.15	0.260	2
MID	938.00	25.61	0.364	2
HIGH	941.00	25.53	0.357	2

(Uplink)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
LOW	896.00	-21.08	0.007
MID	899.00	-20.91	0.008
HIGH	902.00	-22.00	0.006

8 §2.1049, §24.238, & §90.209 - OCCUPIED BANDWIDTH

8.1 Applicable Standard

Requirements: CFR 47, Section 2.1049, Section 90.209

8.2 Test Procedure

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

8.2.1 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	58 %
ATM Pressure:	101.8 kPa

** The testing was performed by Choon Sian Ooi on 2007-10-15.*

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Rohde & Schwartz	Signal Generator	SMIQ03	849192/0085	2006-10-18
Agilent	Vector Signal Generator	ESG44	US44300386	-

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

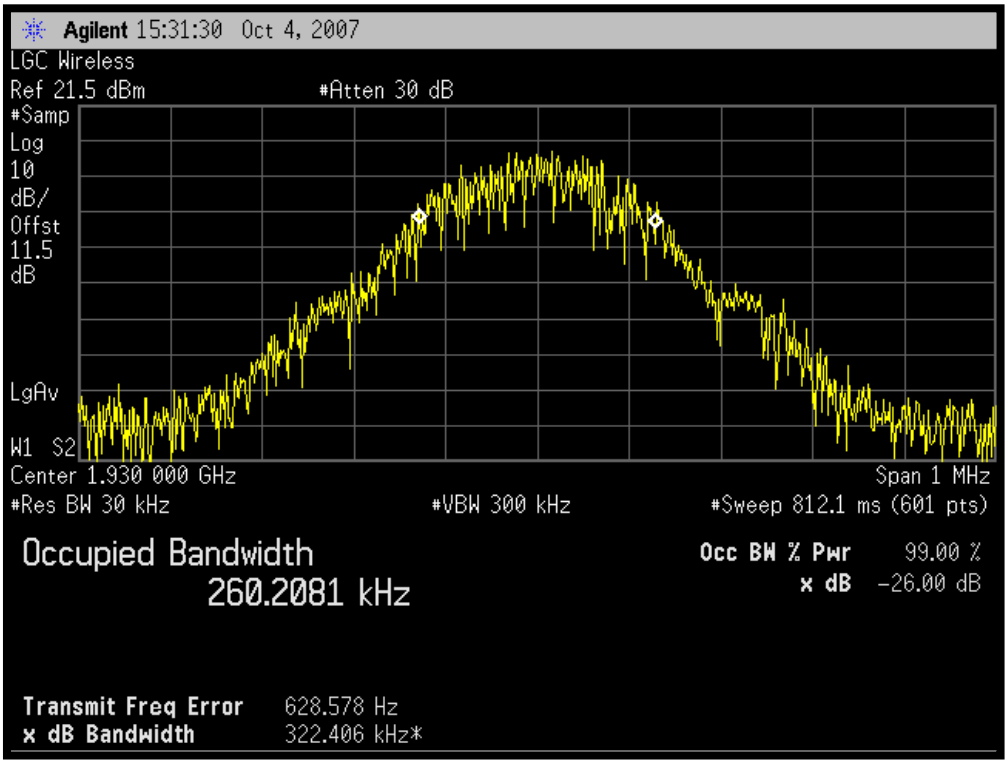
8.4 Test Results

Please refer to the following plots.

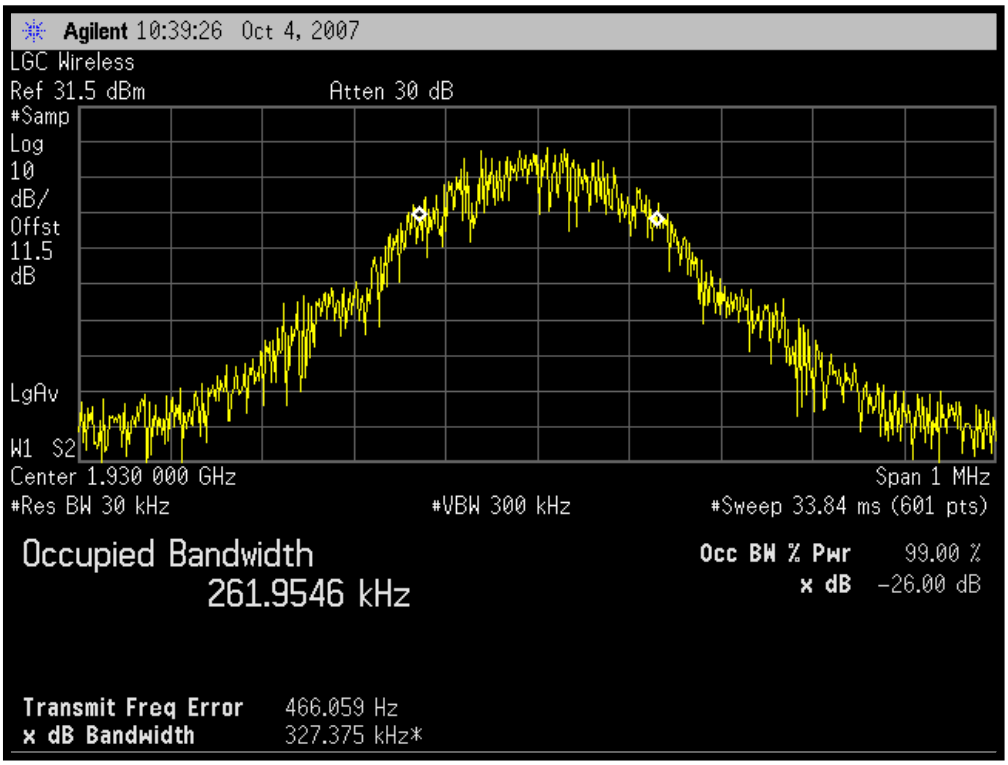
PCS Band: Downlink

GSM

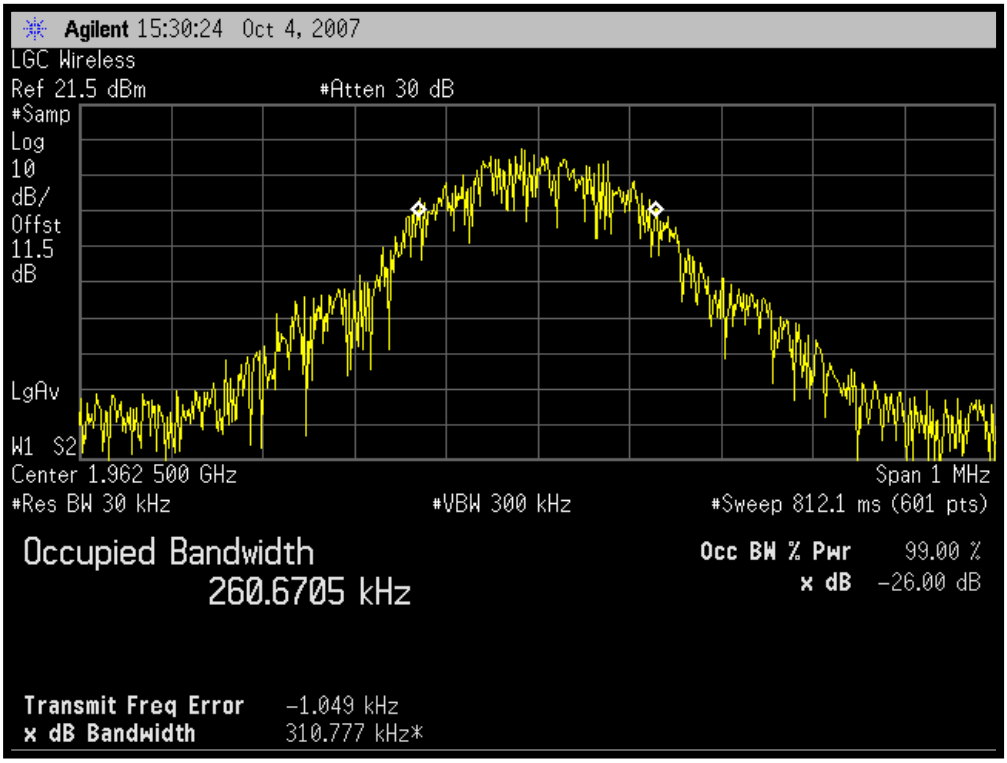
Low Channel (Input)



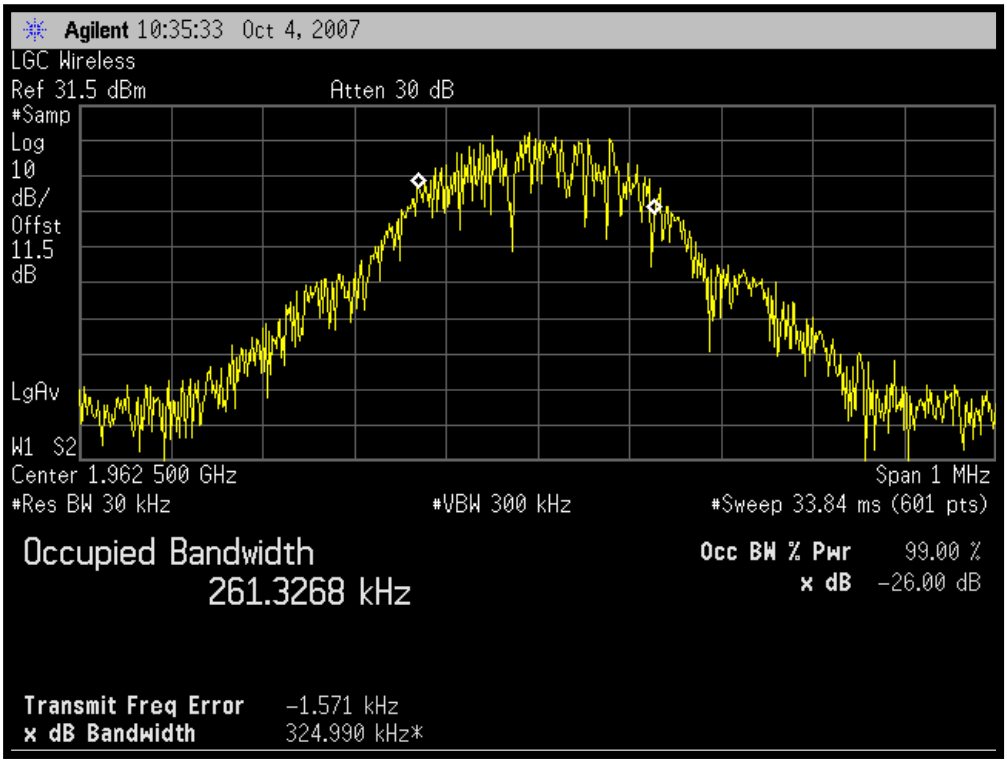
Low Channel (Output)



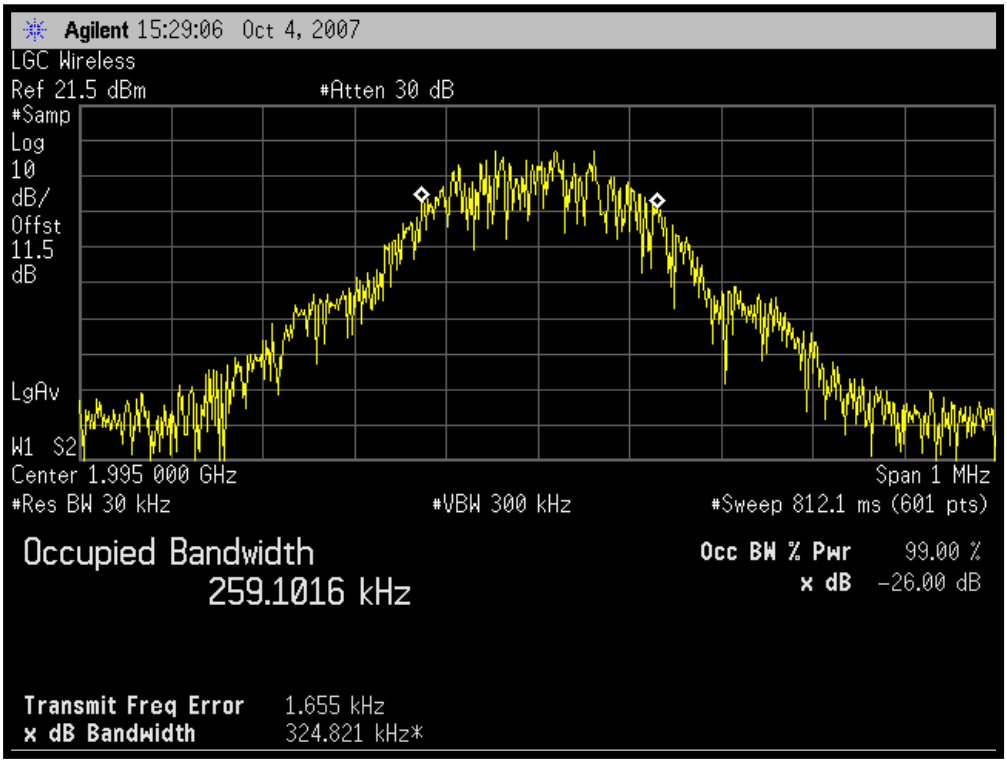
Middle Channel (Input)



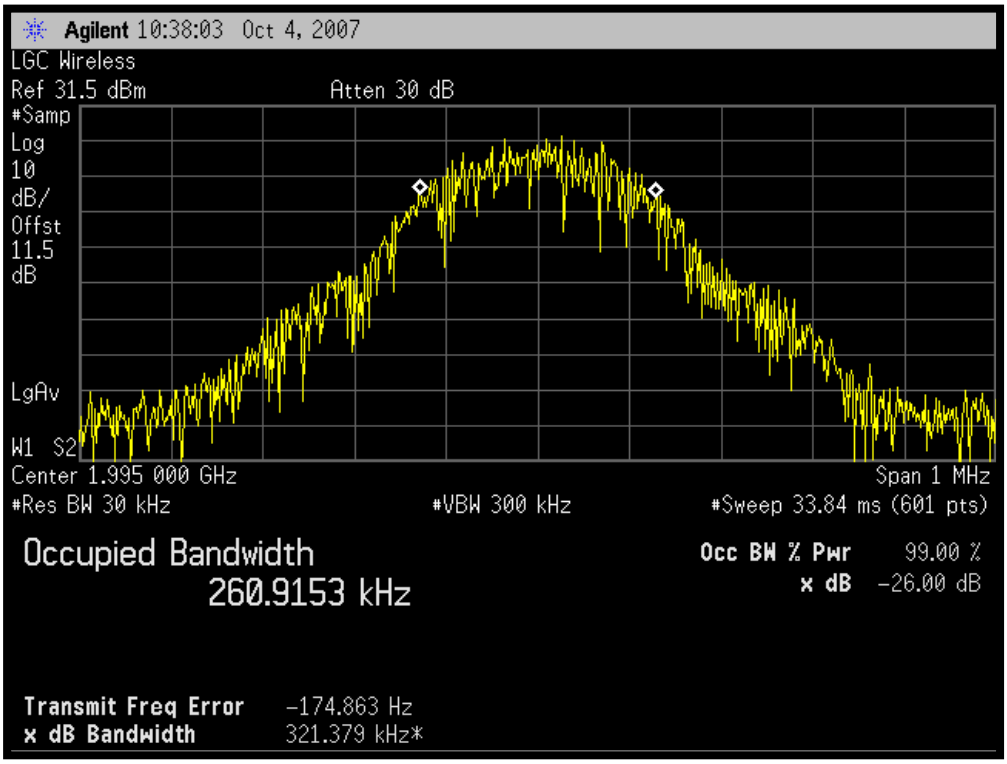
Middle Channel (Output)



High Channel (Input)

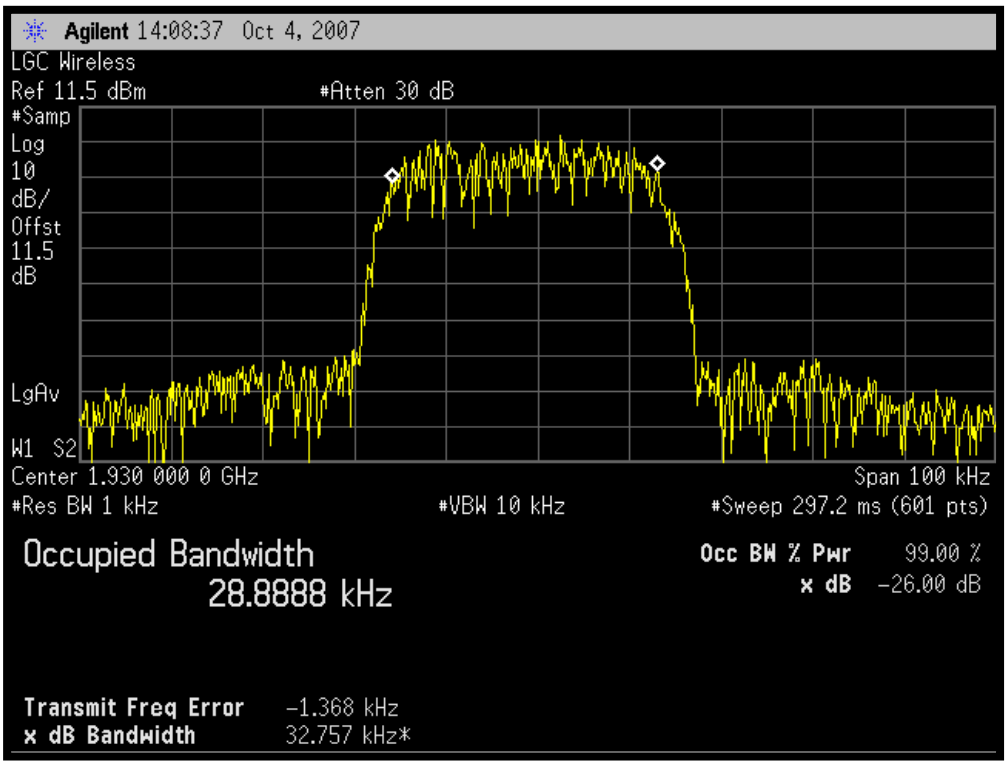


High Channel (Output)

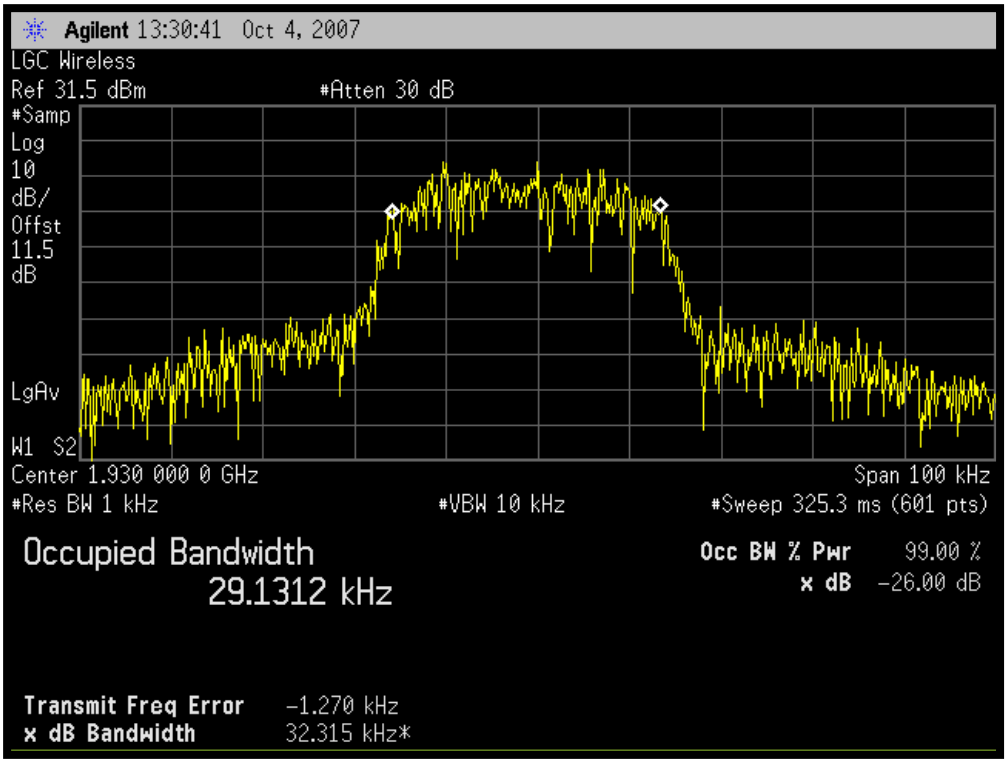


TDMA

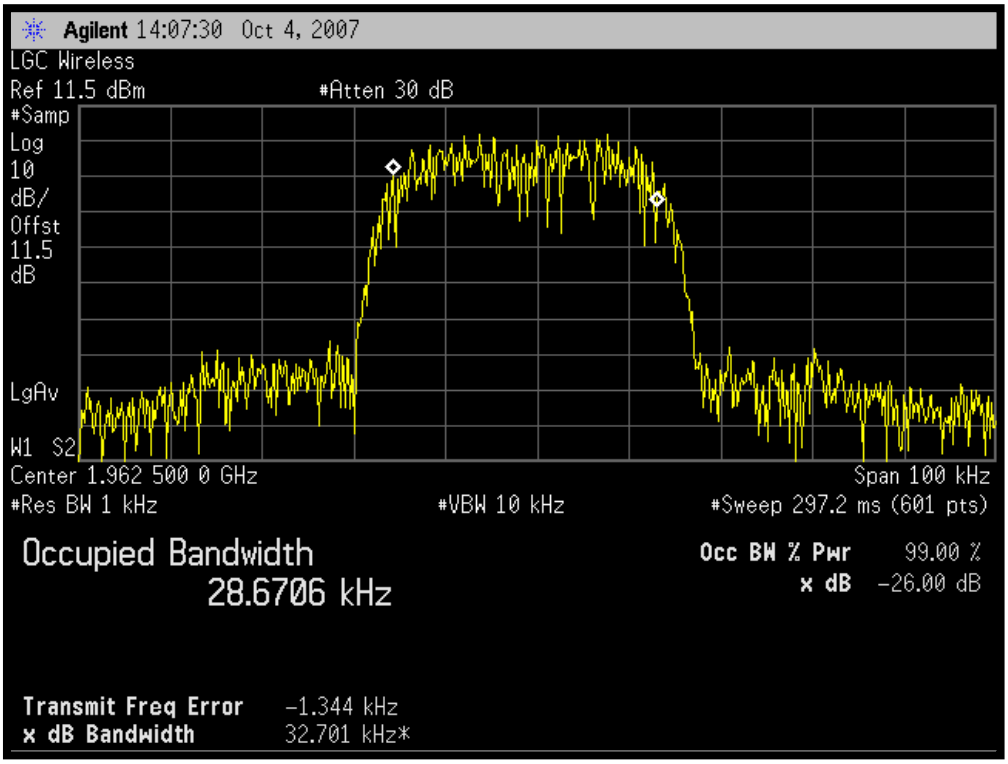
Low Channel (Input)



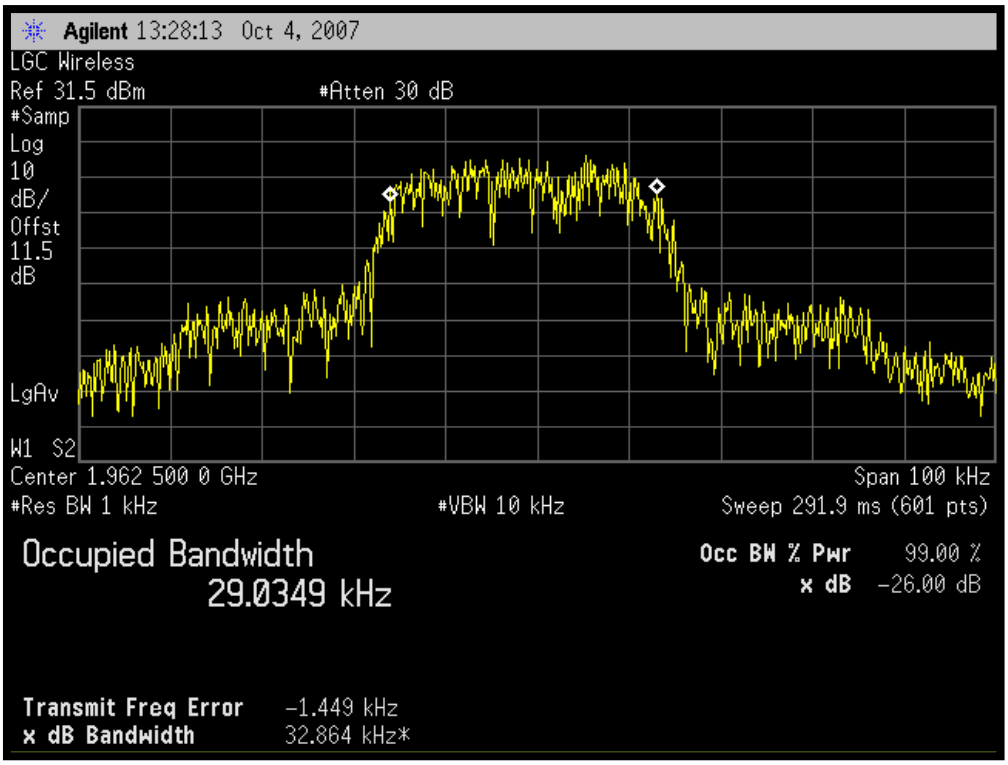
Low Channel (Output)



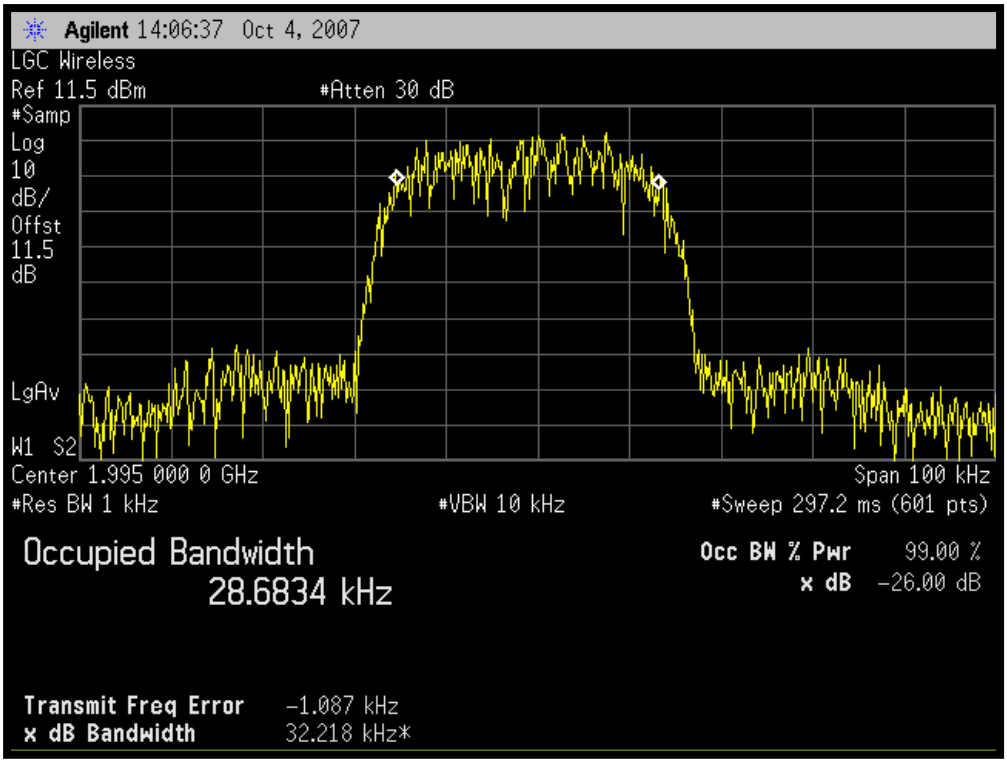
Middle Channel Input)



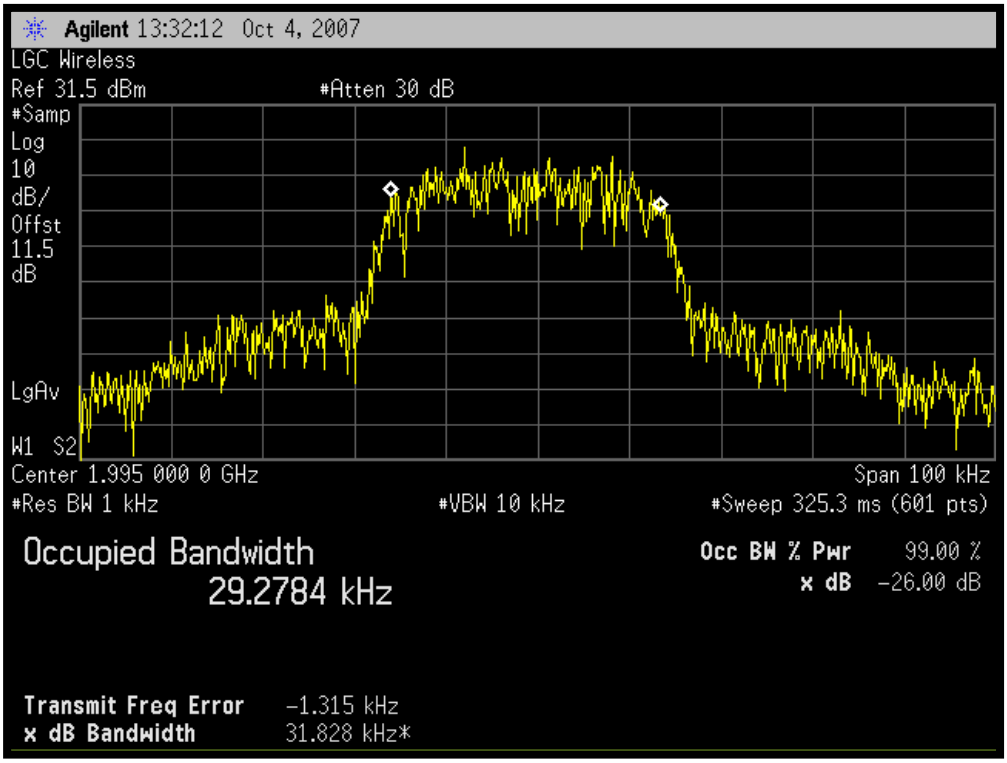
Middle Channel (Output)



High Channel (Input)

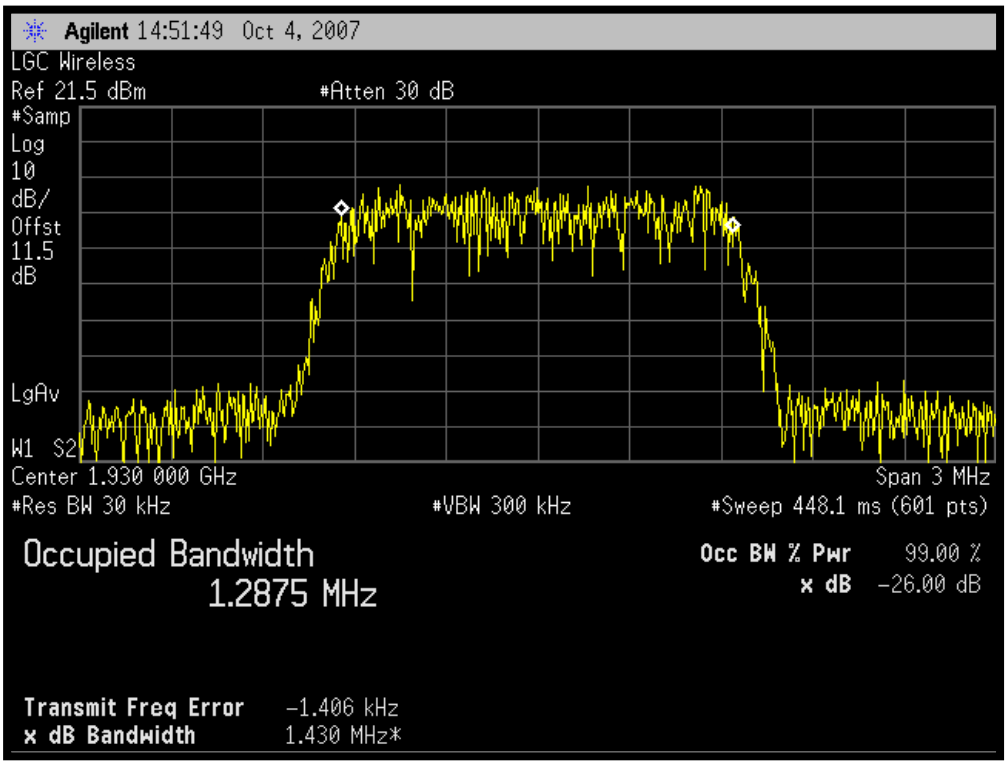


High Channel (Output)

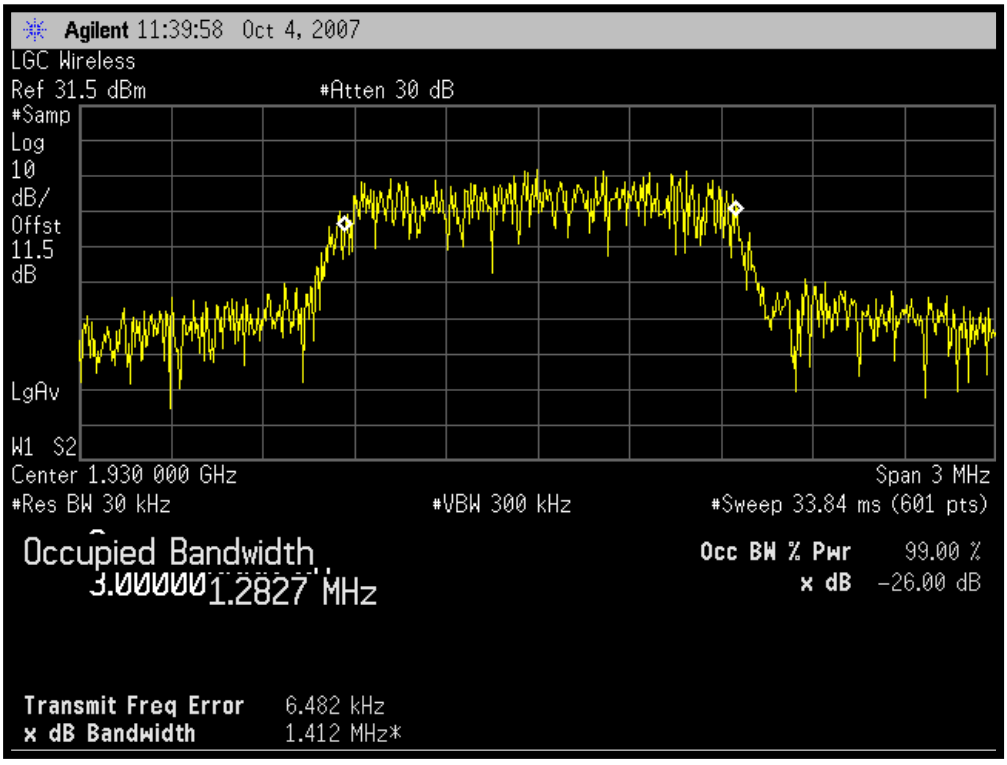


CDMA

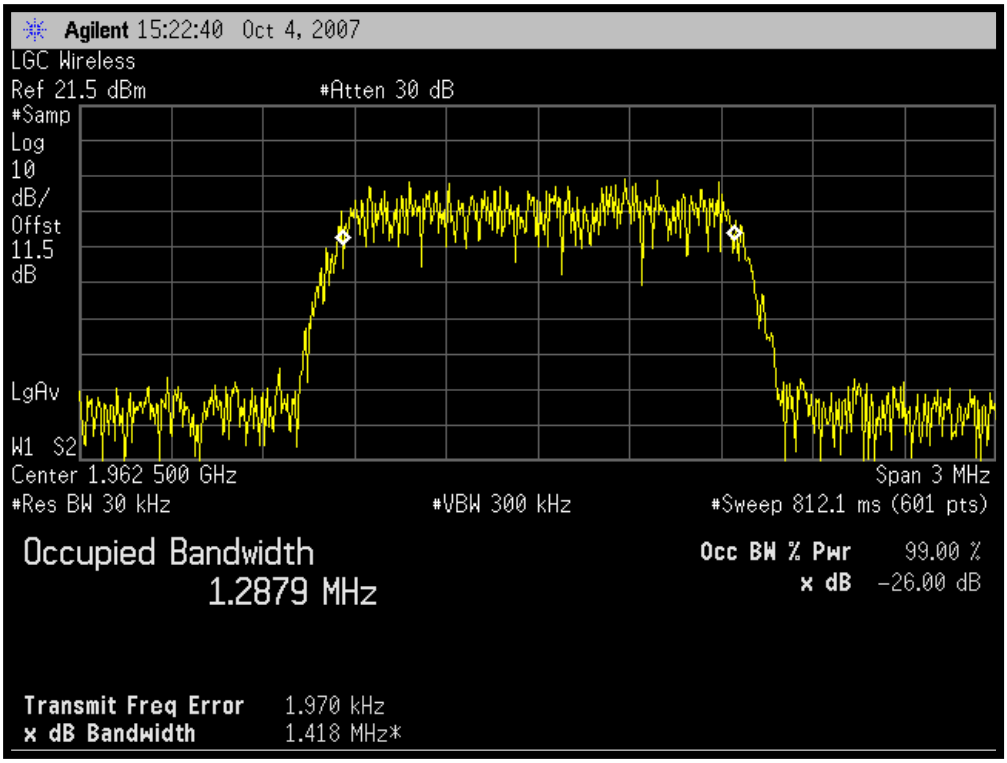
Low Channel (Input)



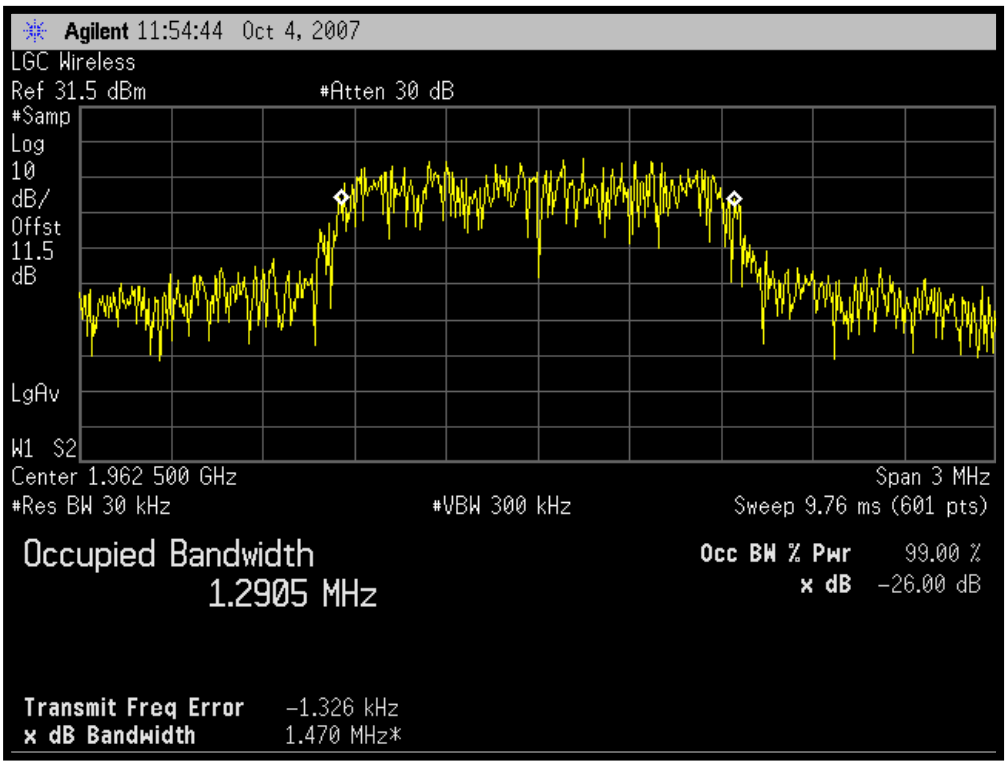
Low Channel (Output)



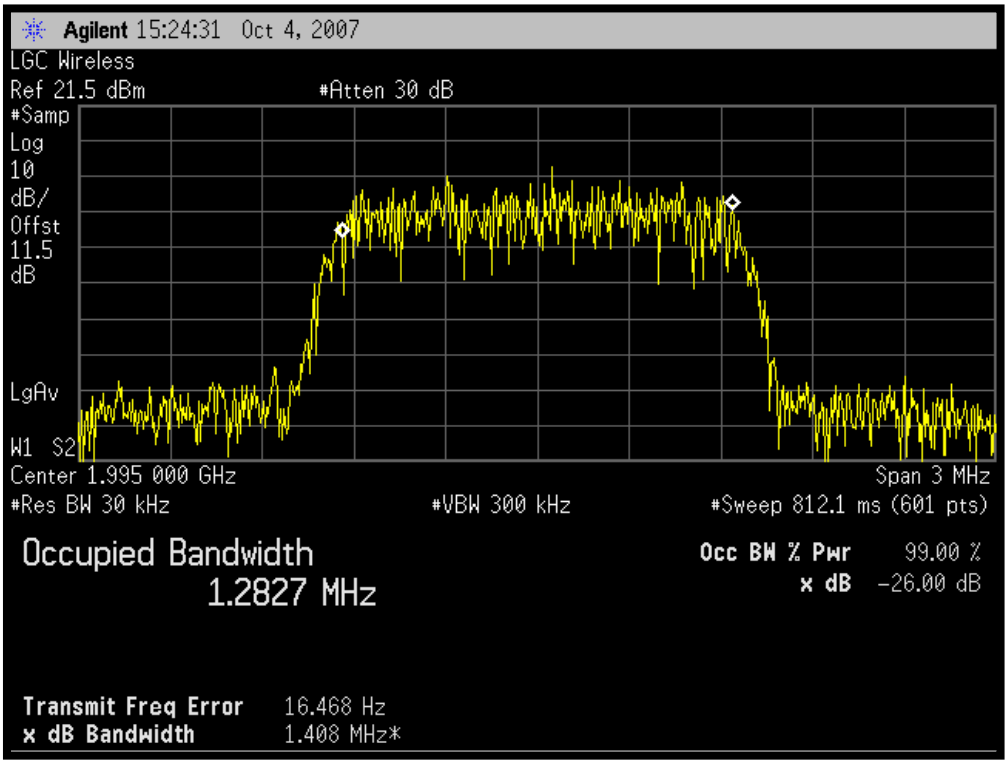
Middle Channel (Input)



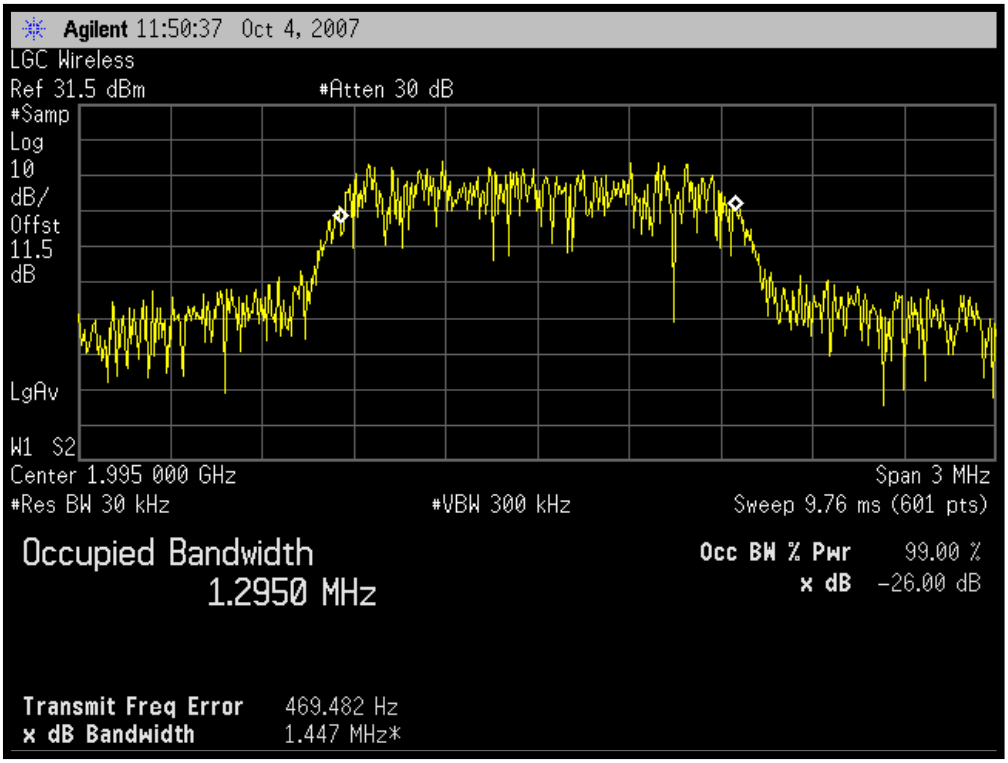
Middle Channel (Output)



High Channel (Input)

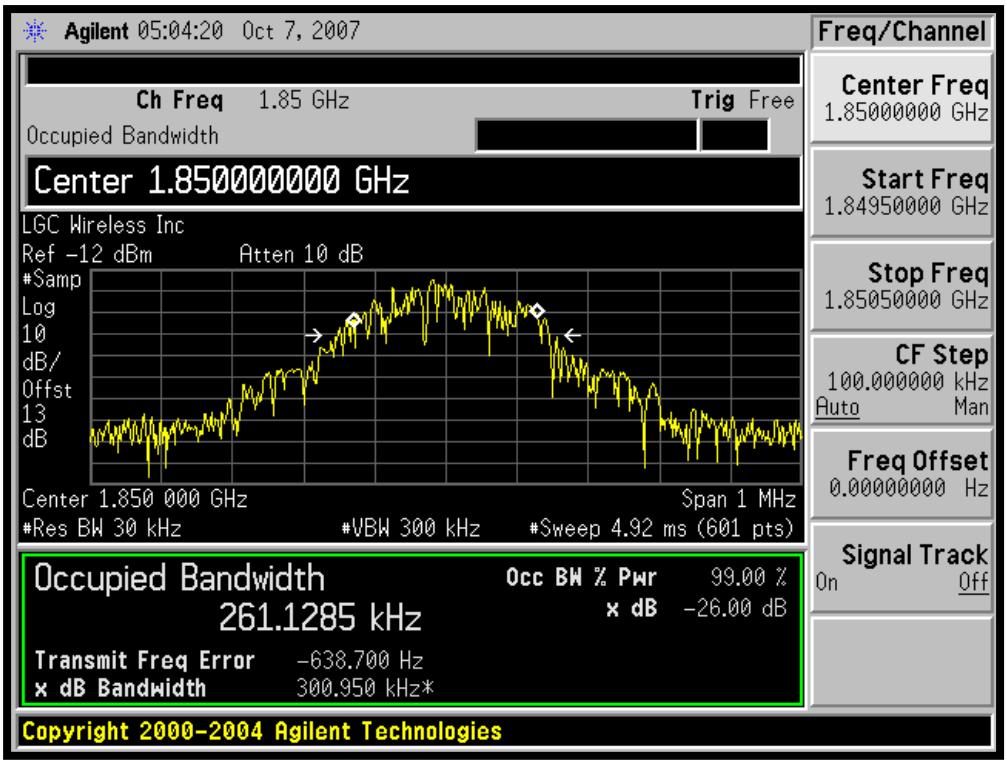


High Channel (Output)

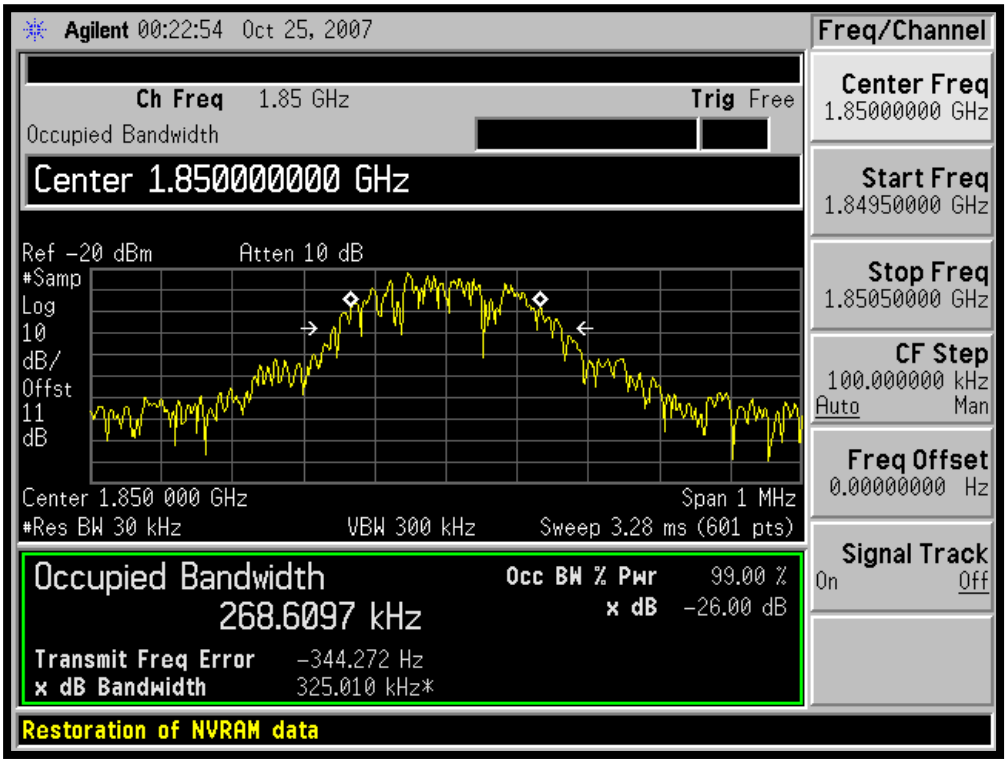


PCS Band: Uplink

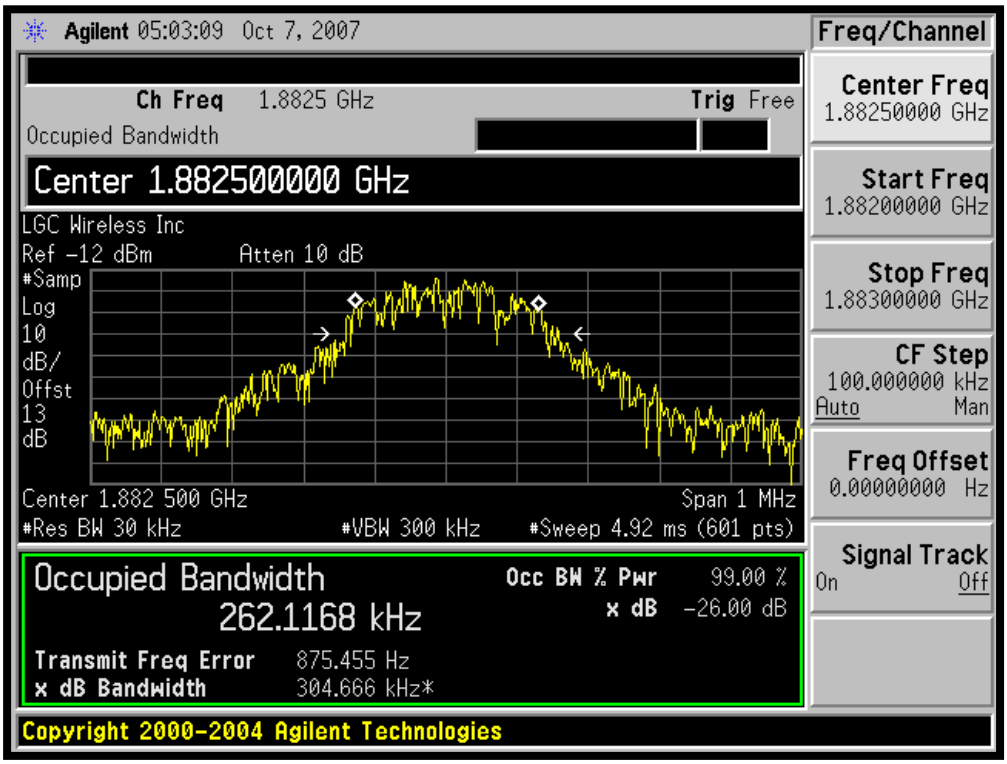
GSM **Low Channel (Input)**



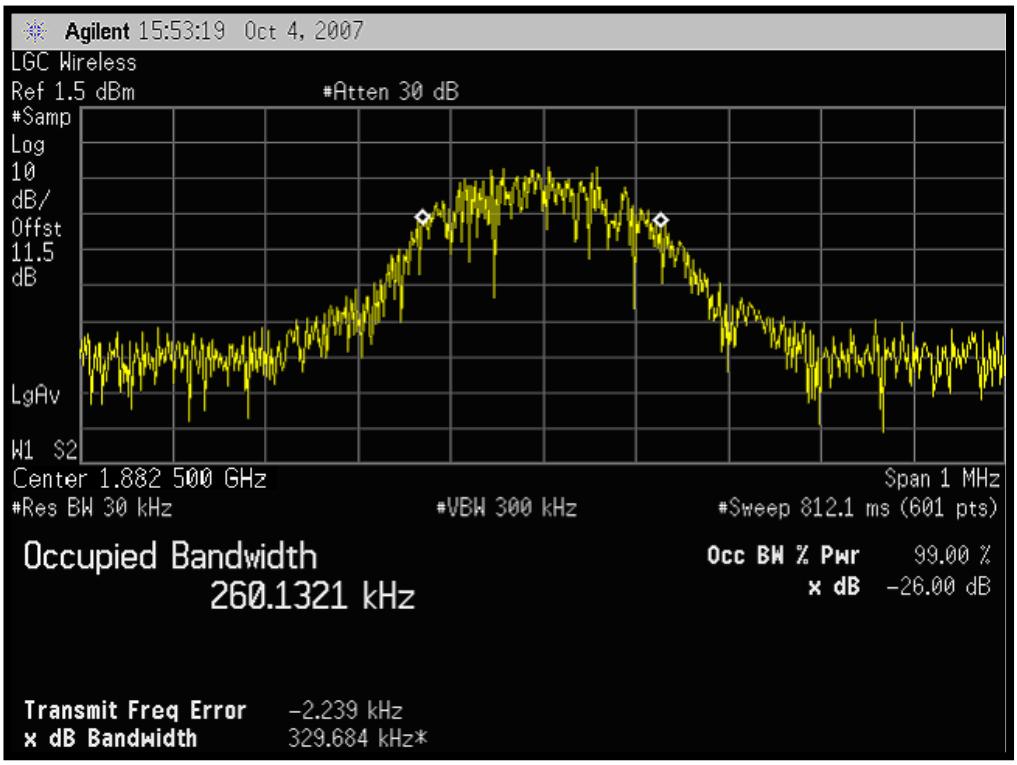
Low Channel (Output)



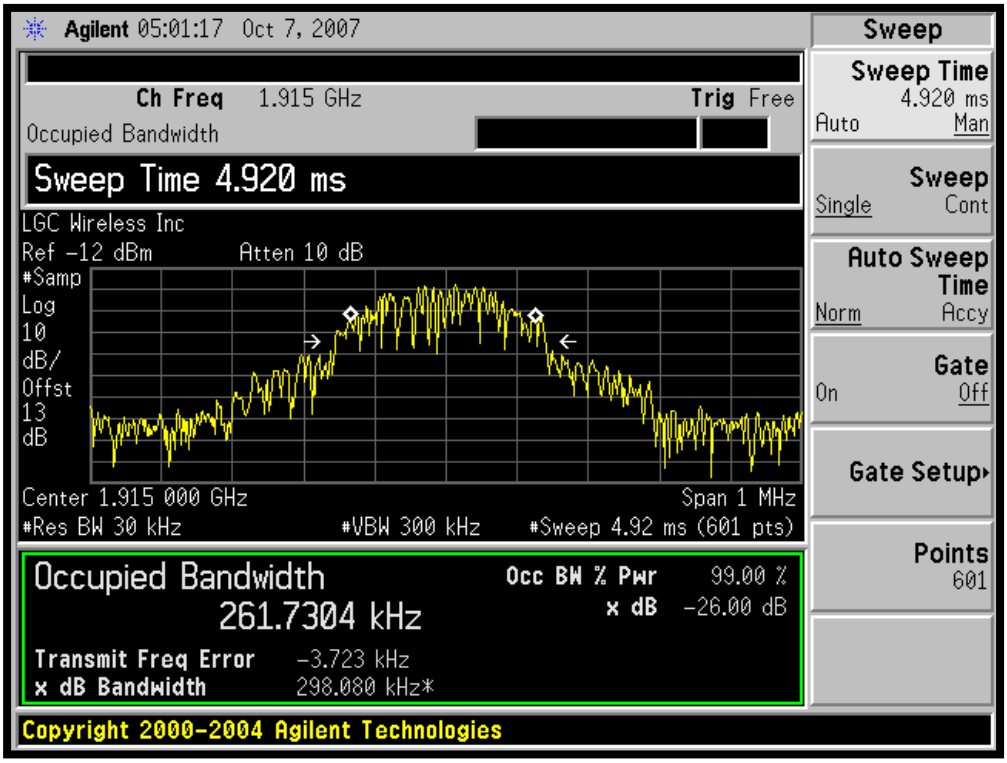
Middle Channel (input)



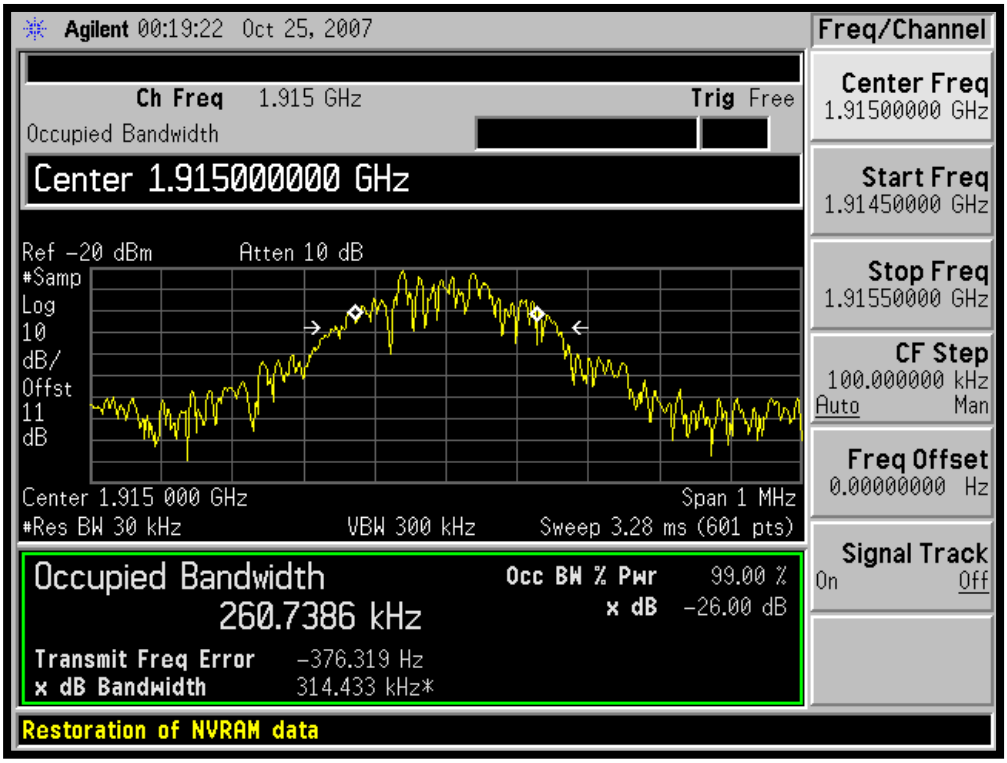
Middle Channel (Output)



High Channel (Input)

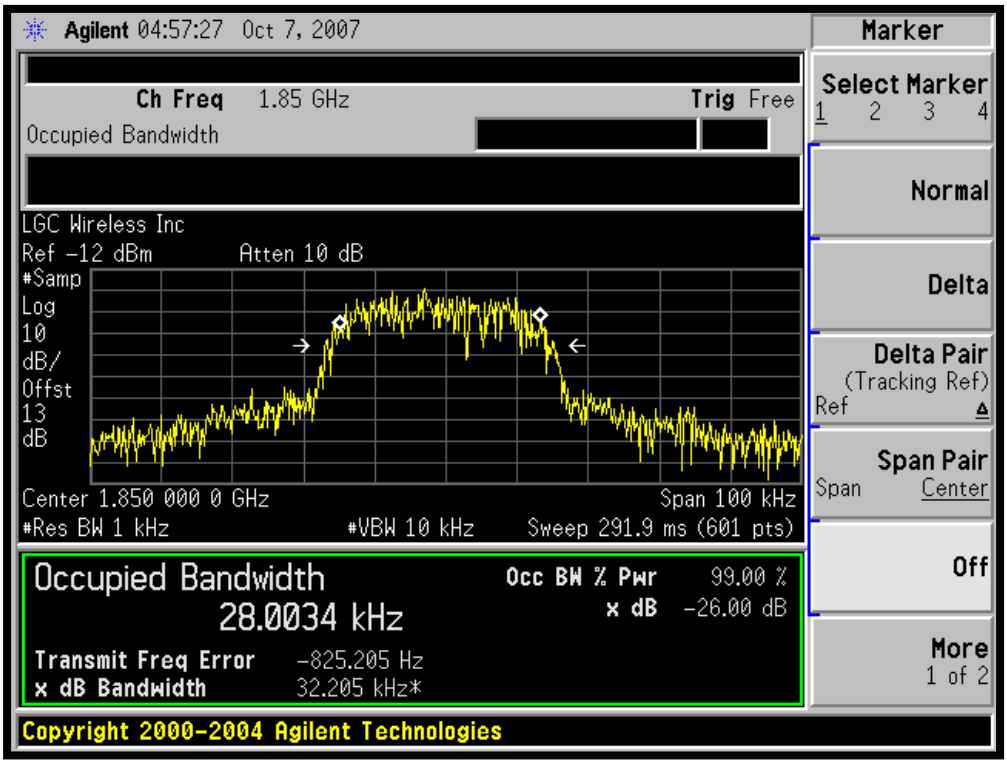


High Channel (Output)

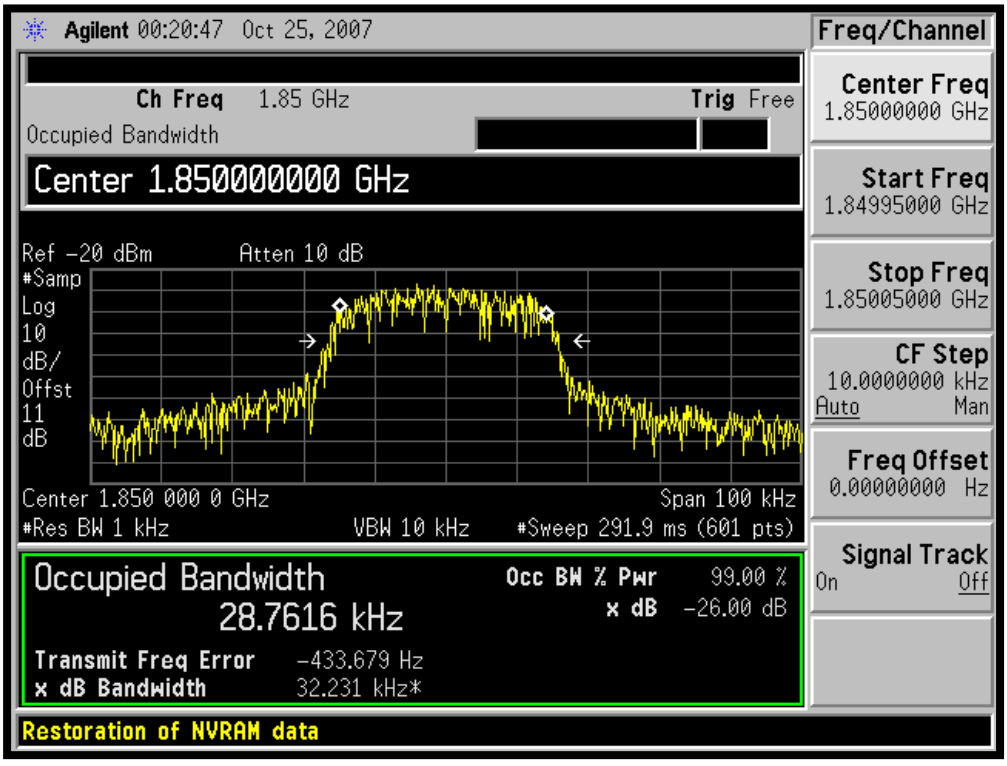


TDMA

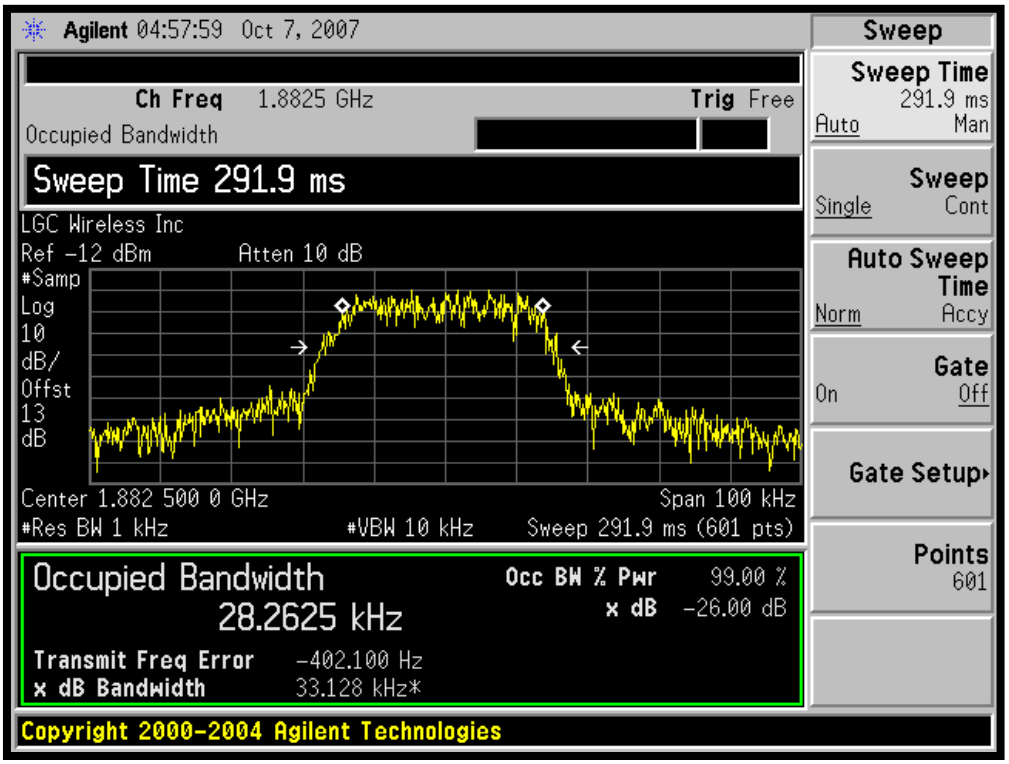
Low Channel (Input)



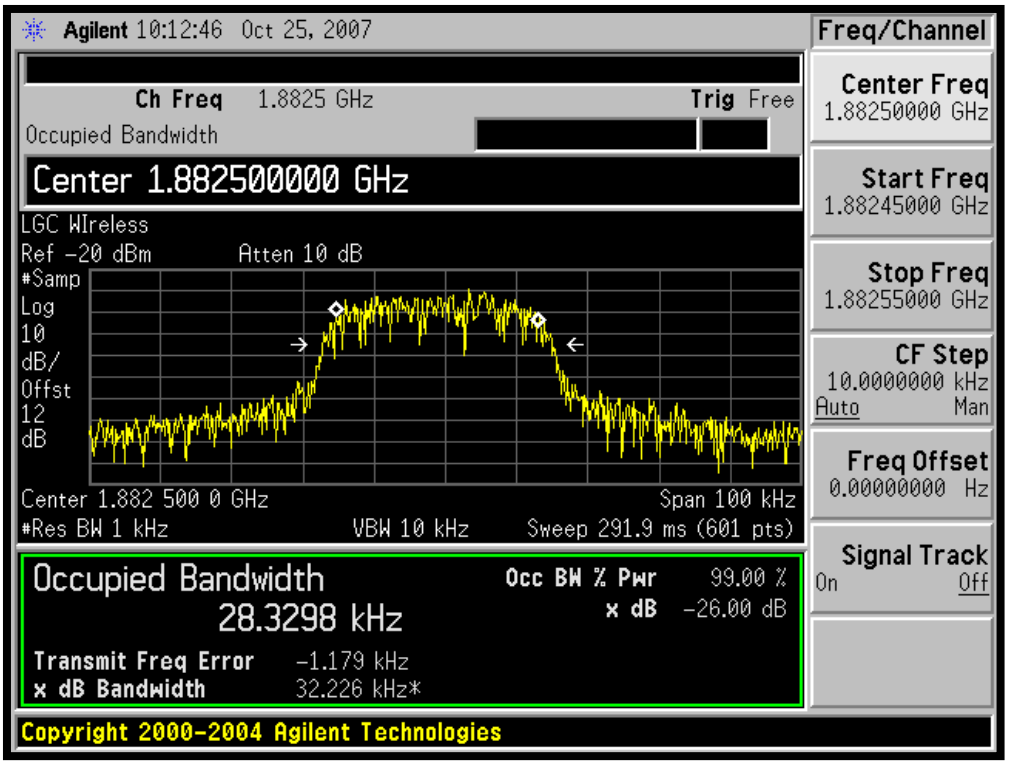
Low Channel (Output)



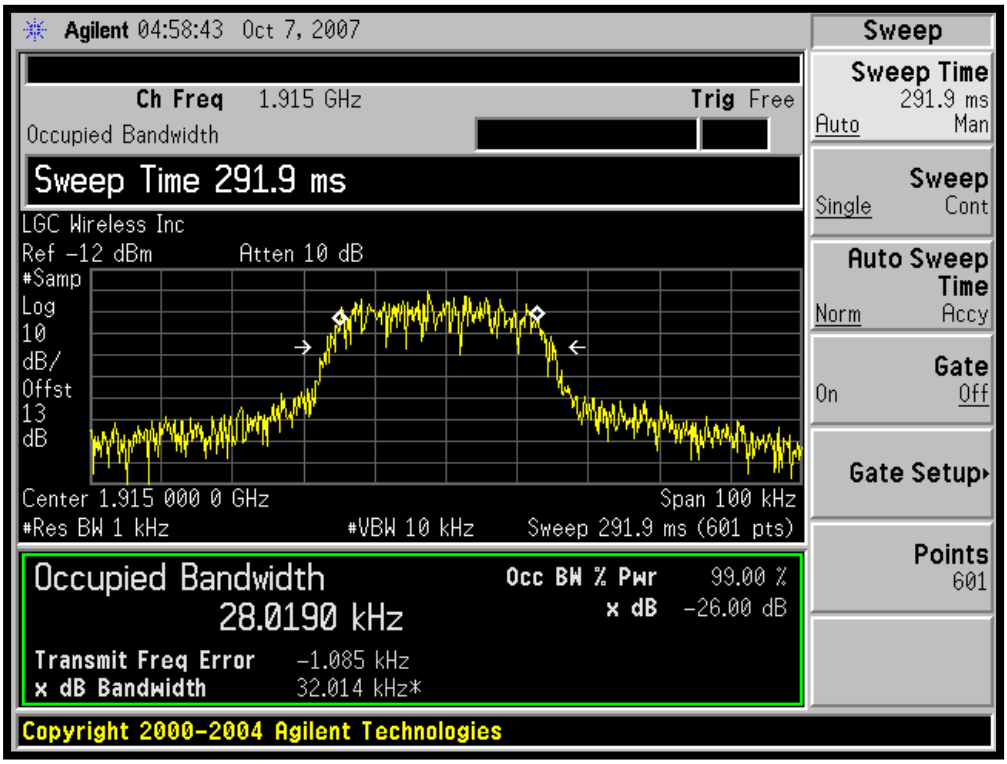
Middle Channel (Input)



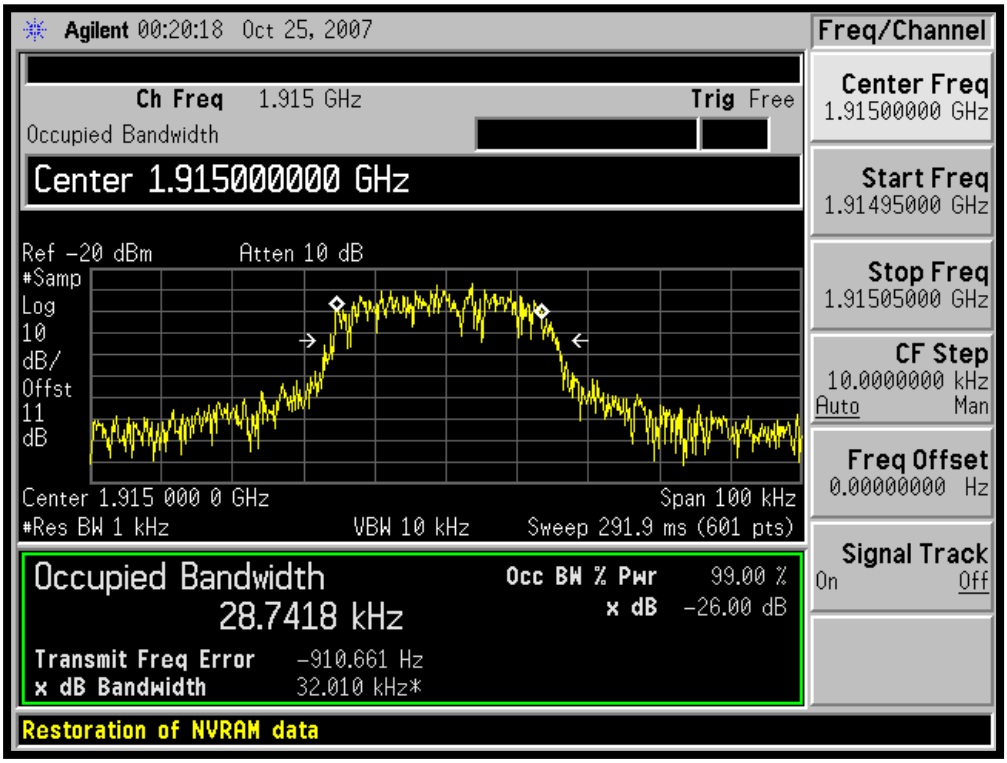
Middle Channel (Output)



High Channel (Input)

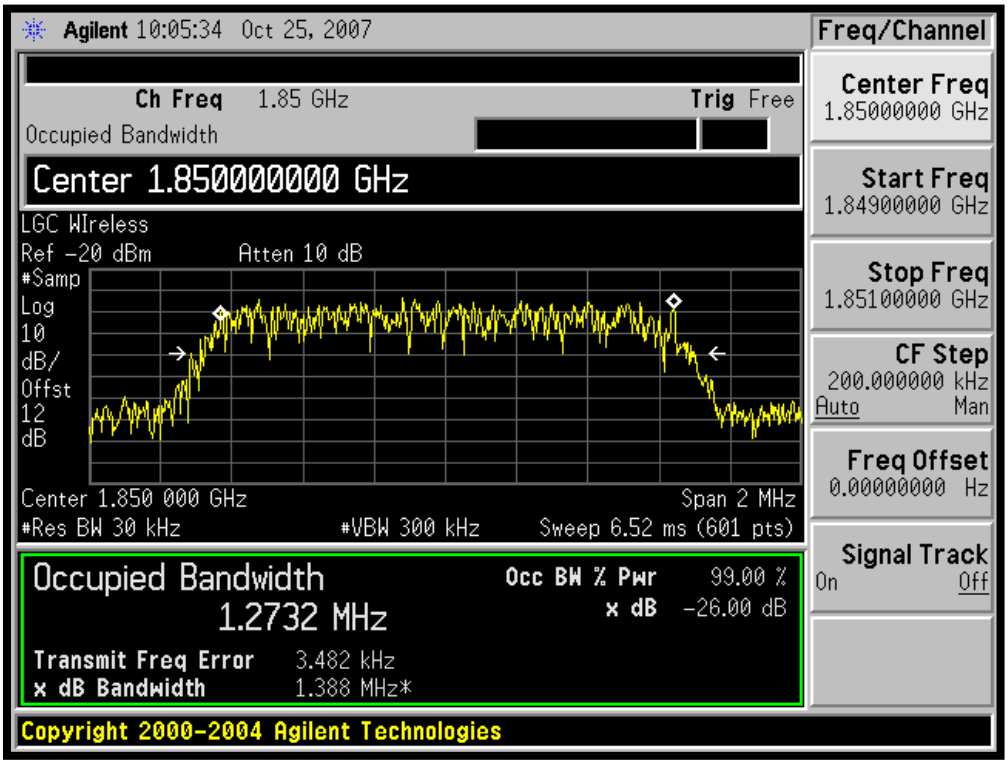


High Channel (Output)

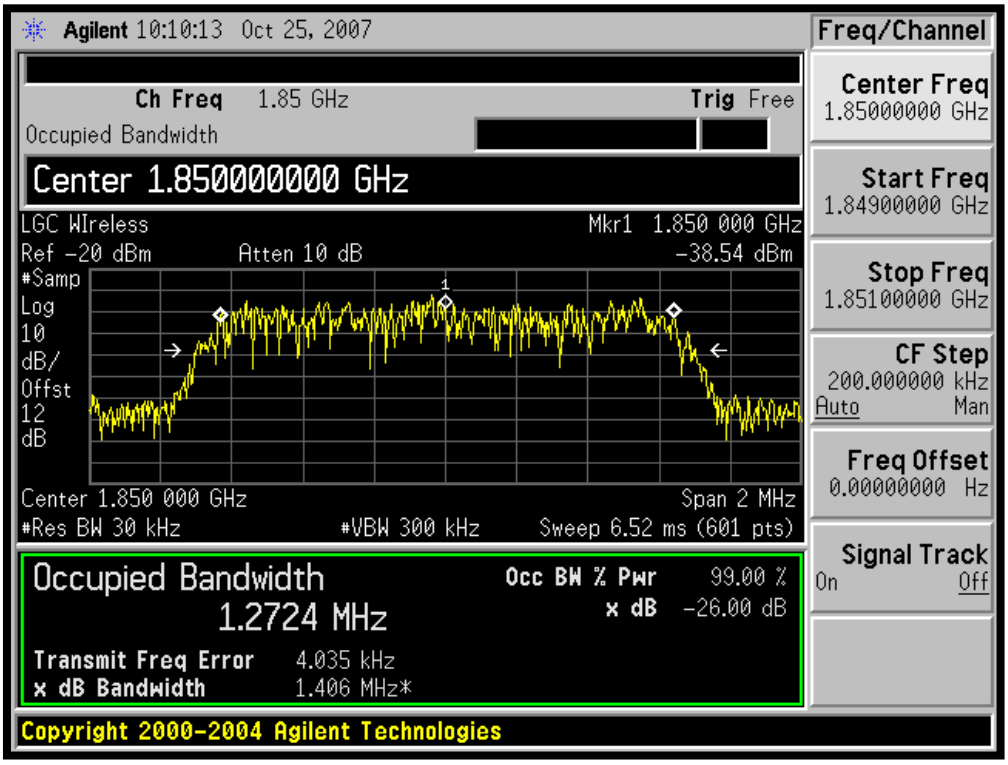


CDMA

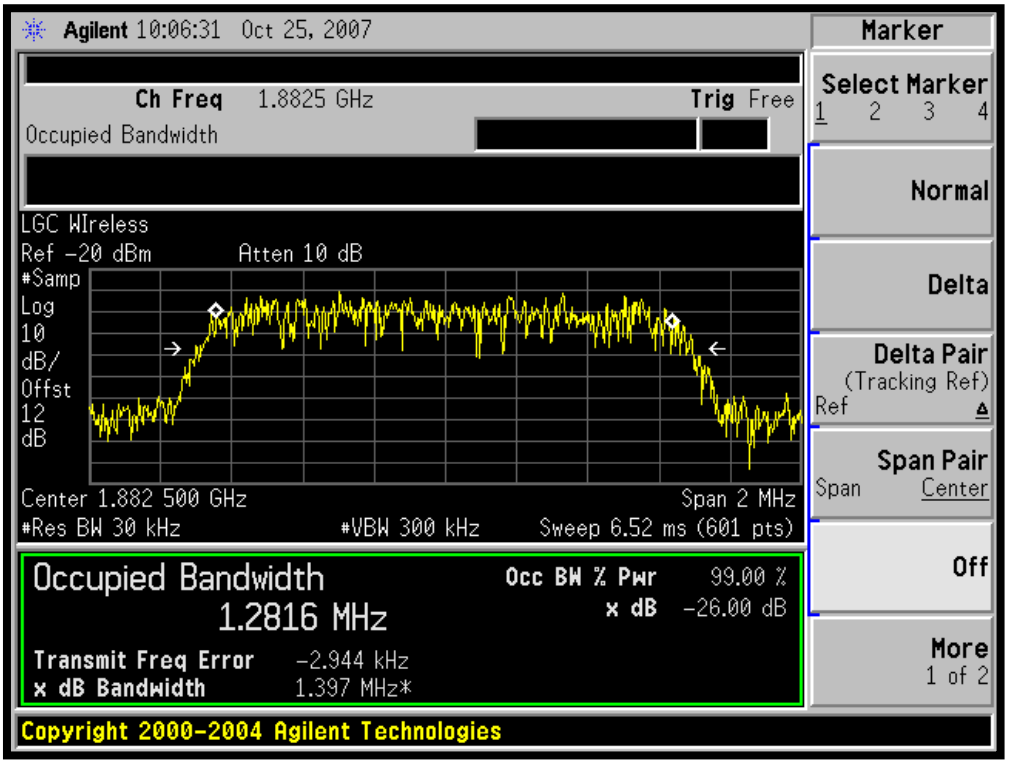
Low Channel (Input)



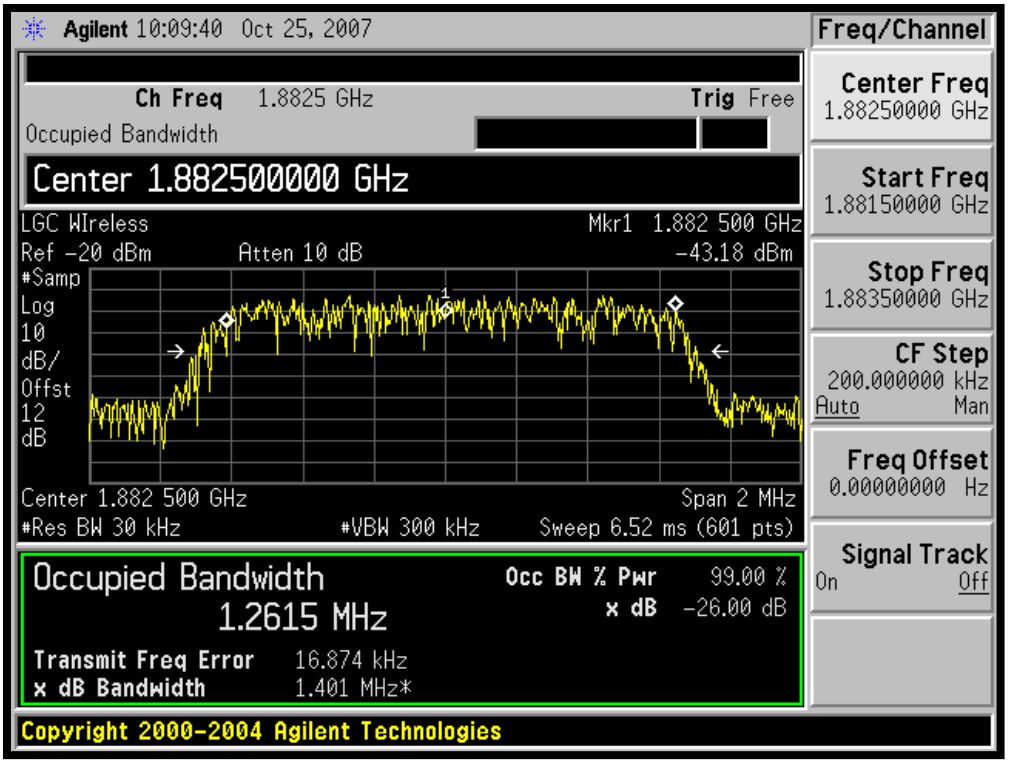
Low Channel (Output)



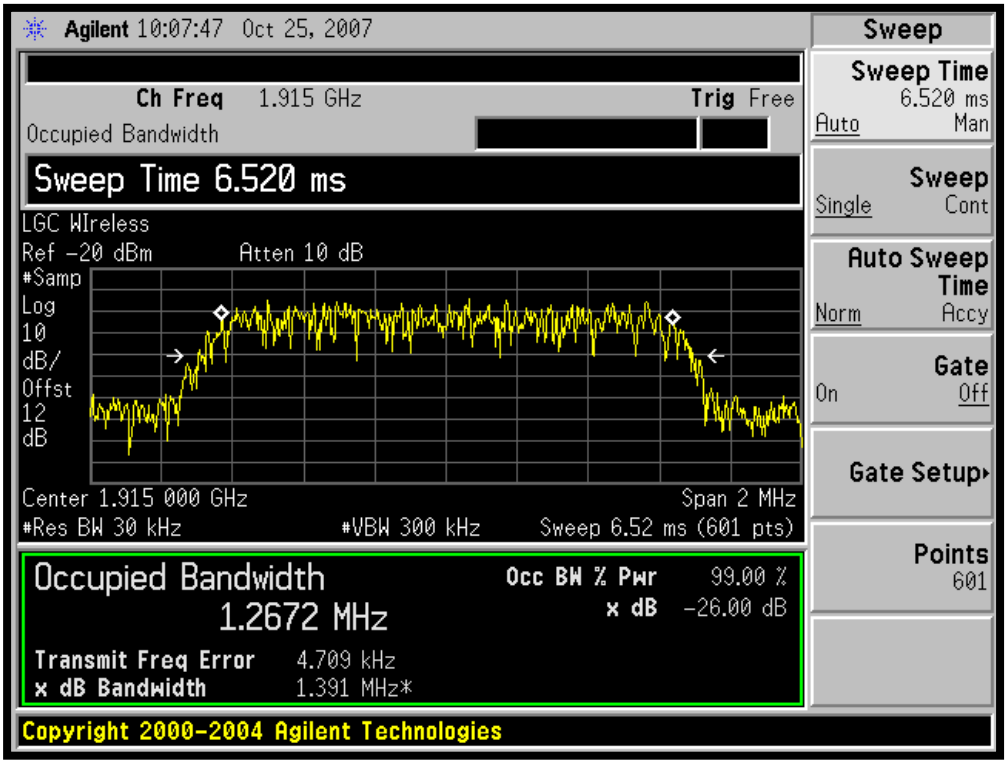
Middle Channel (Input)



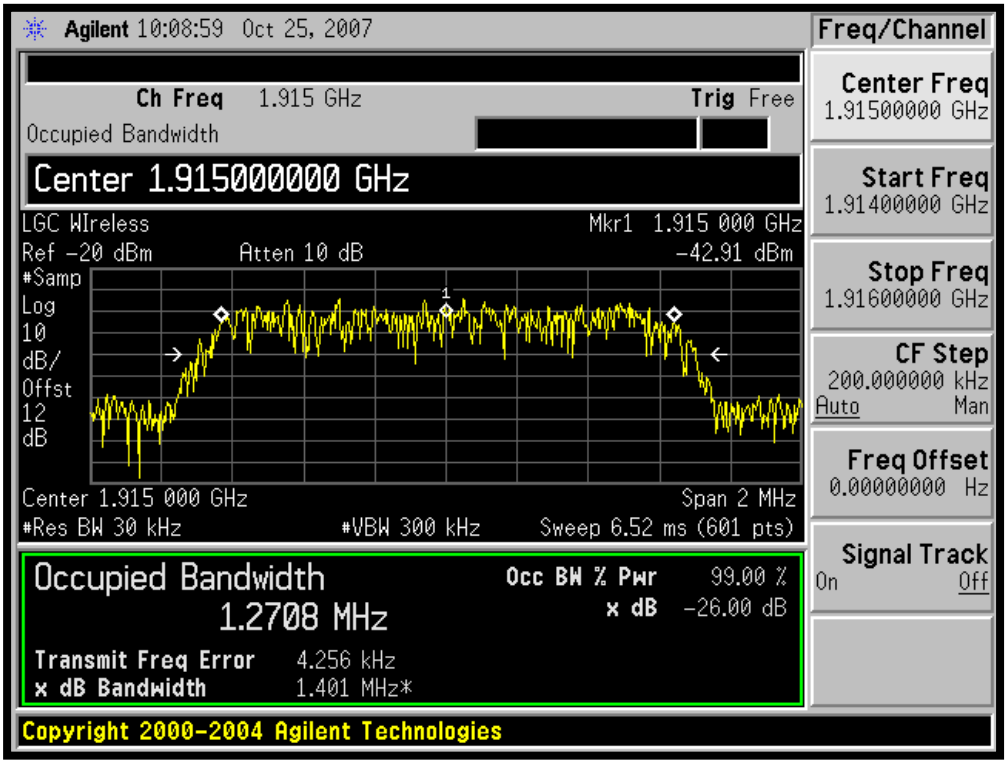
Middle Channel (Output)



High Channel (Input)

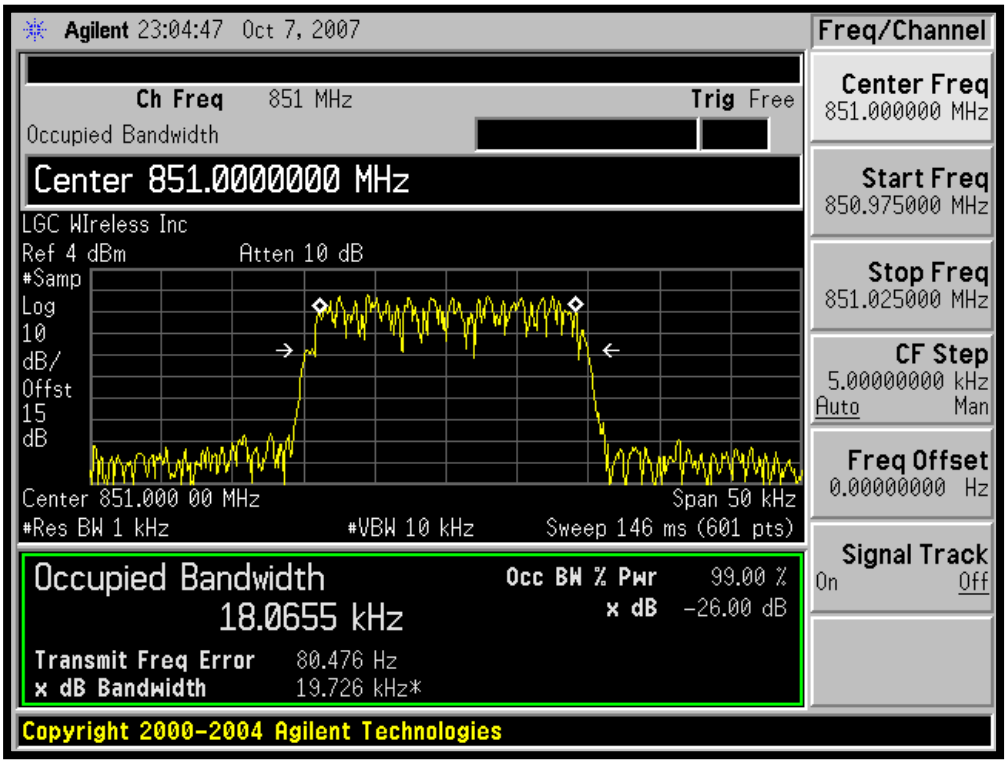


High Channel (Output)

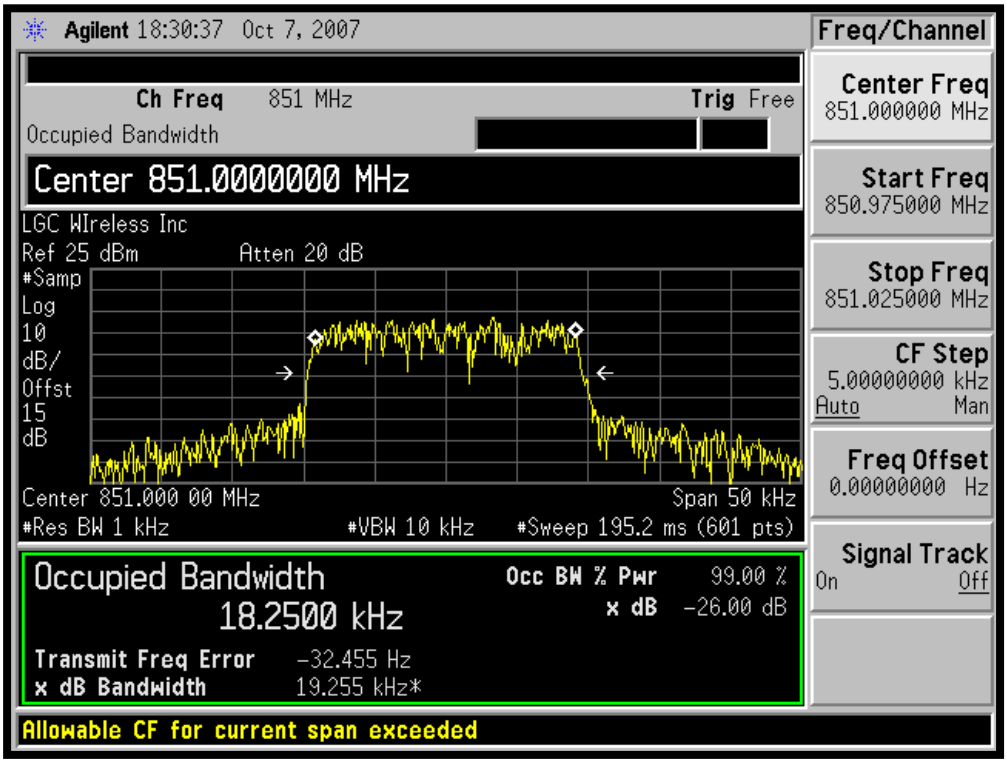


IDEN 800: Downlink

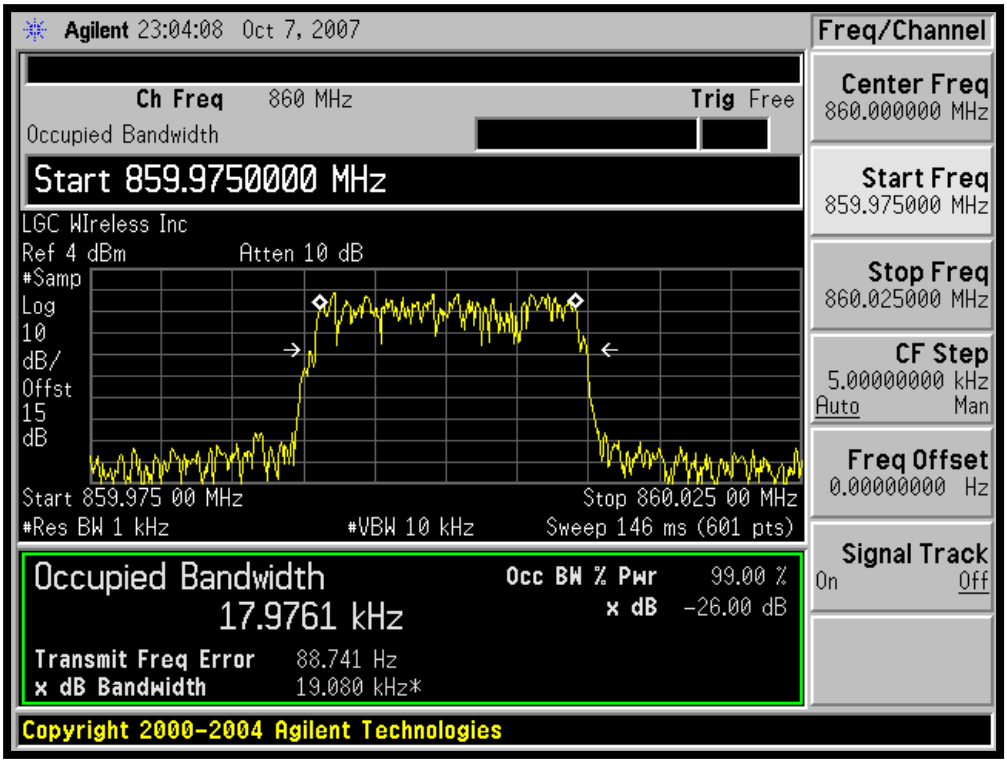
Low Channel (Input)



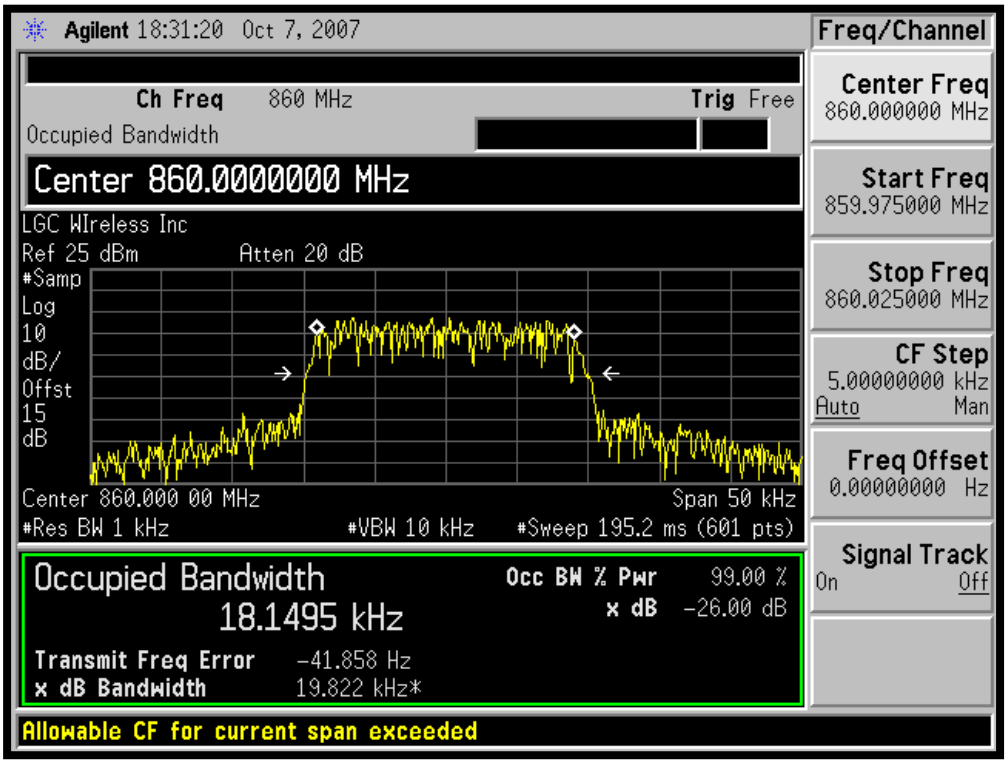
Low Channel (Output)



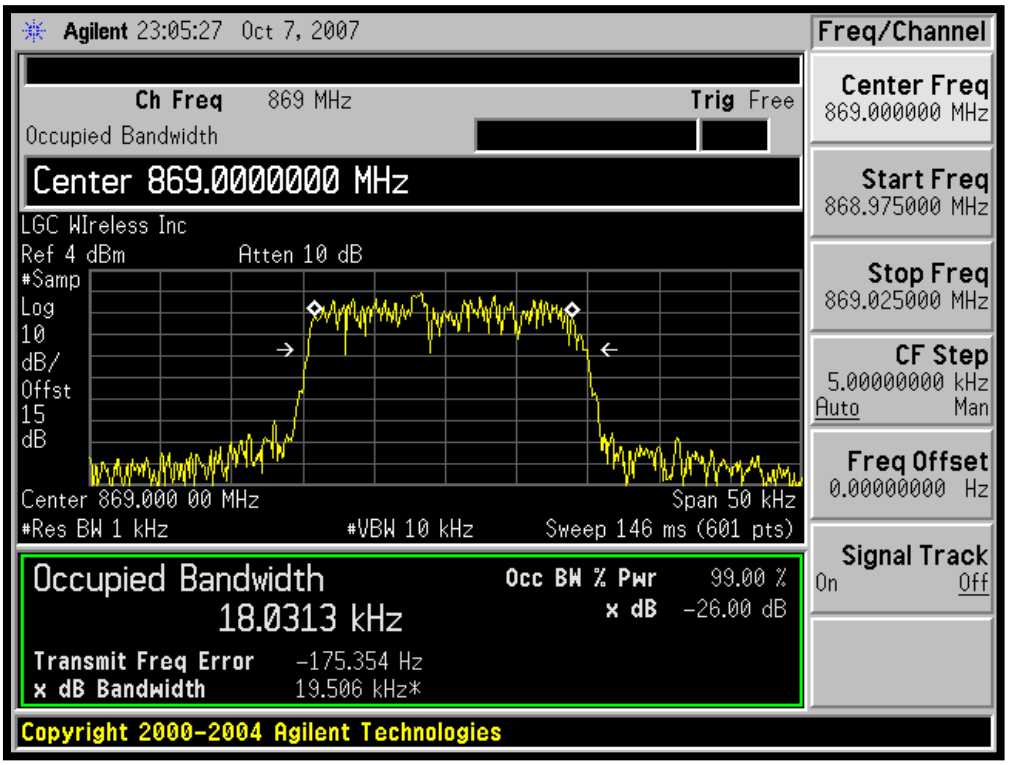
Middle Channel (Input)



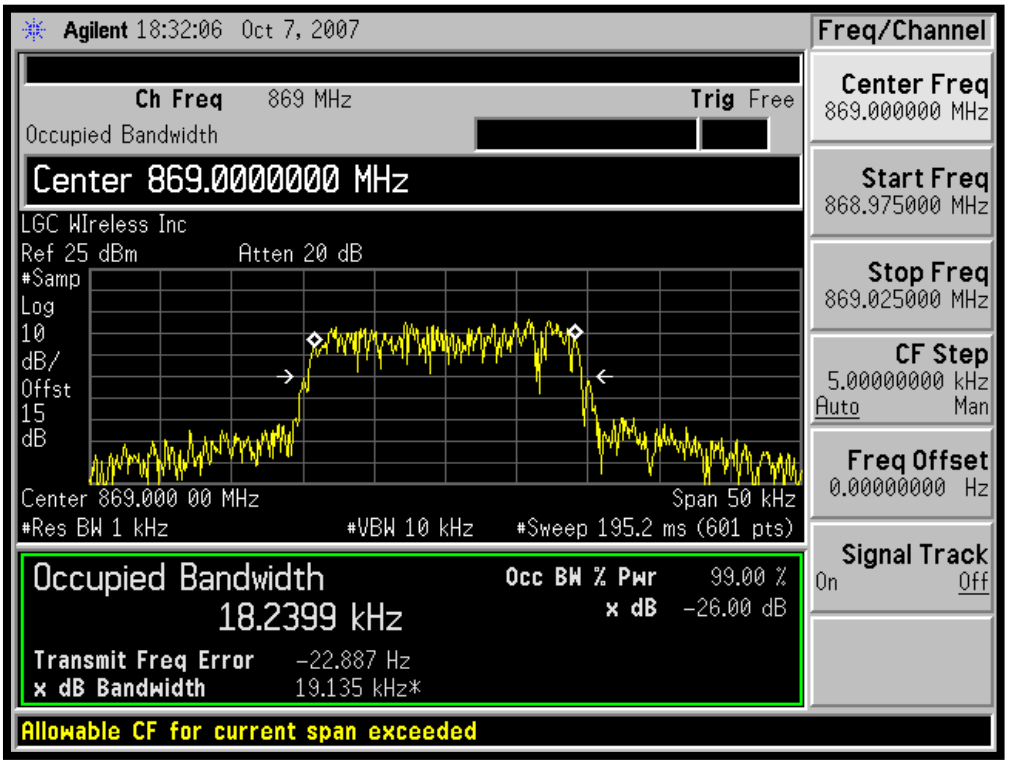
Middle Channel (Output)



High Channel (Input)

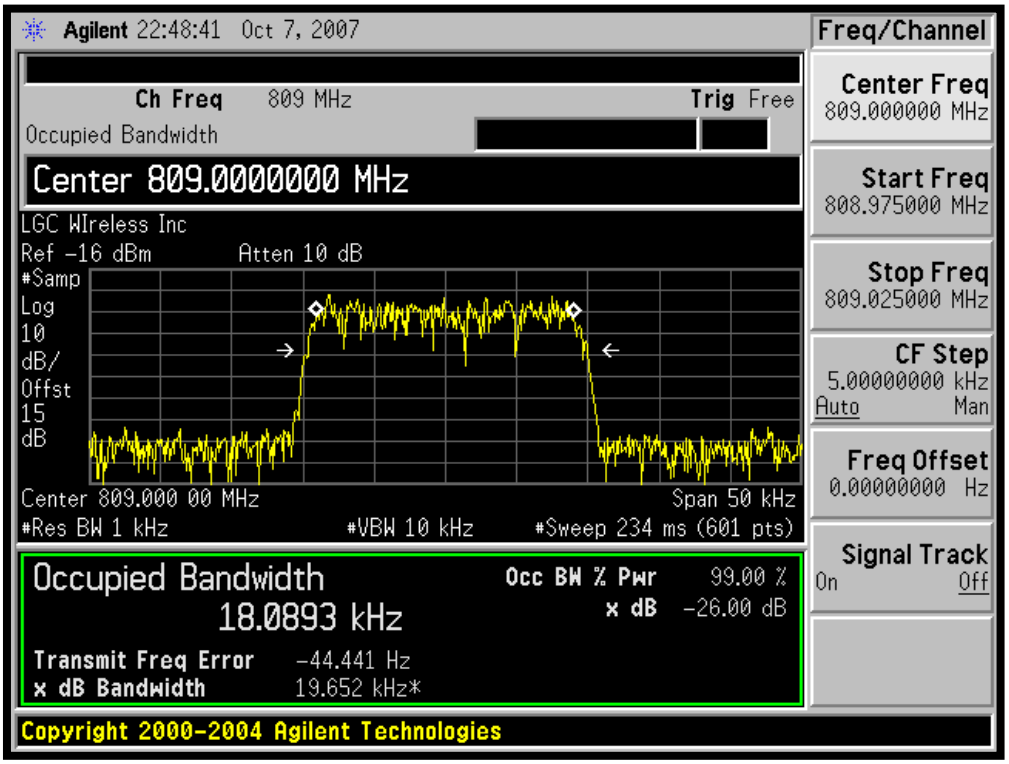


High Channel (Output)

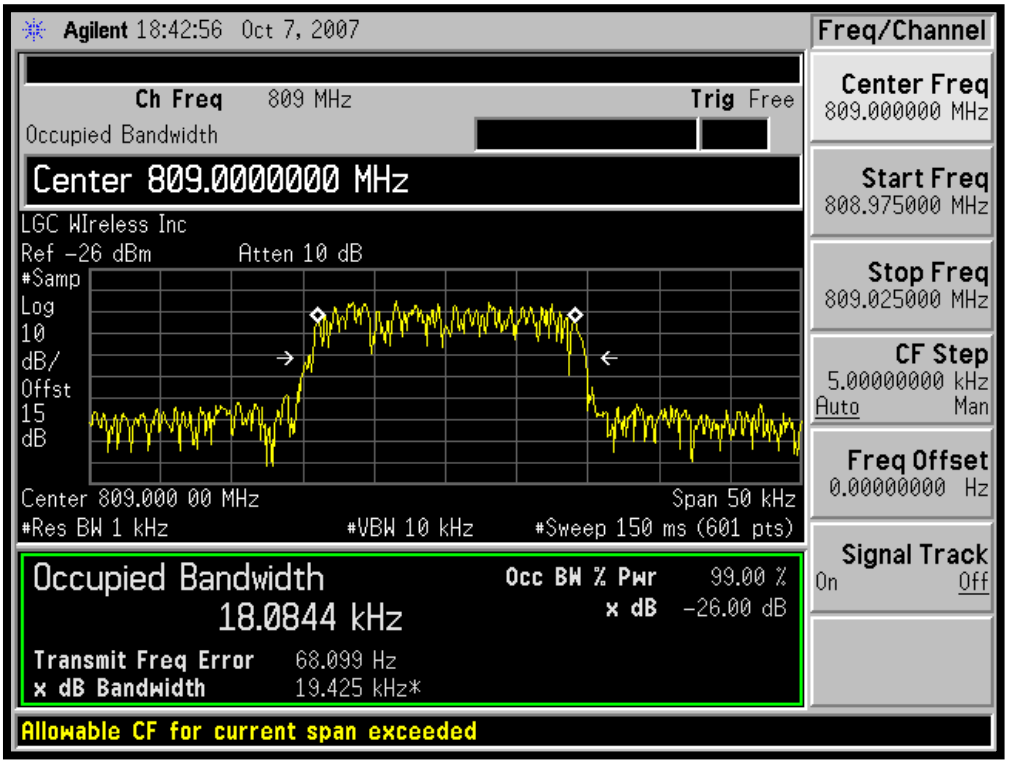


IDEN 800: Uplink

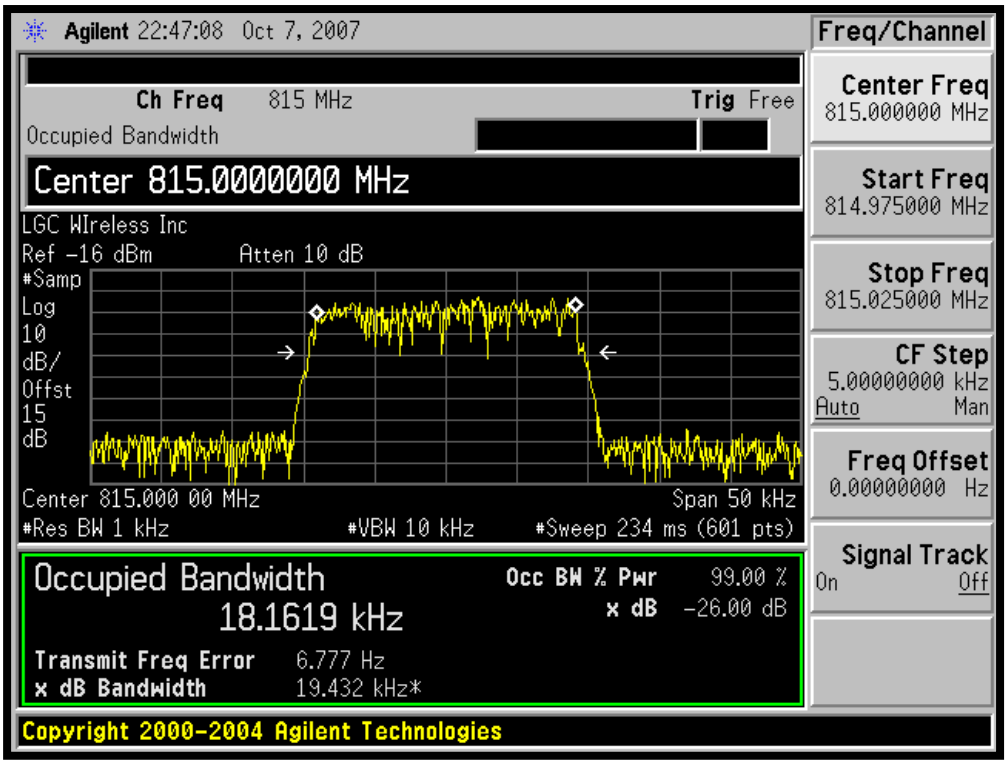
Low Channel (Input)



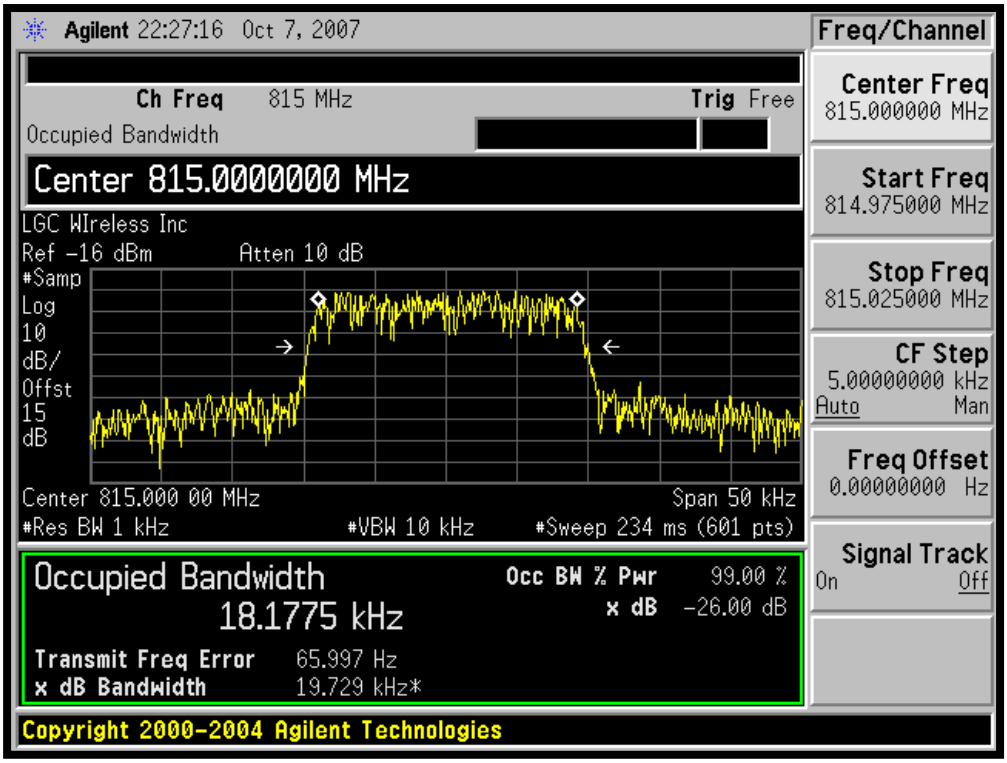
Low Channel (Output)



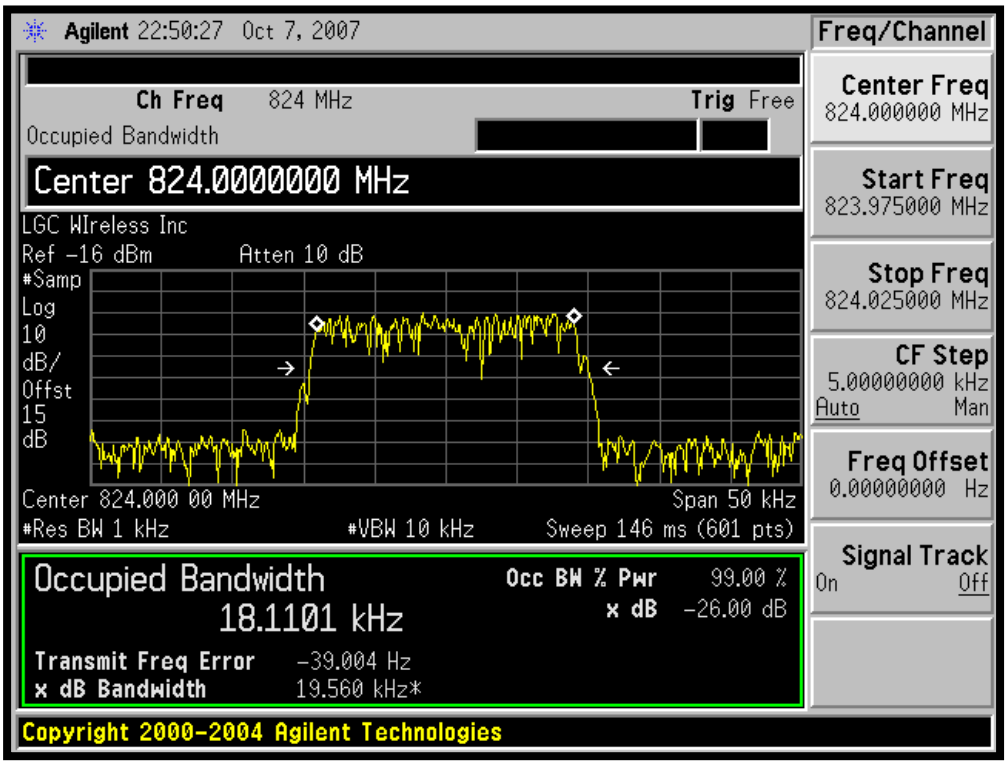
Middle Channel (Input)



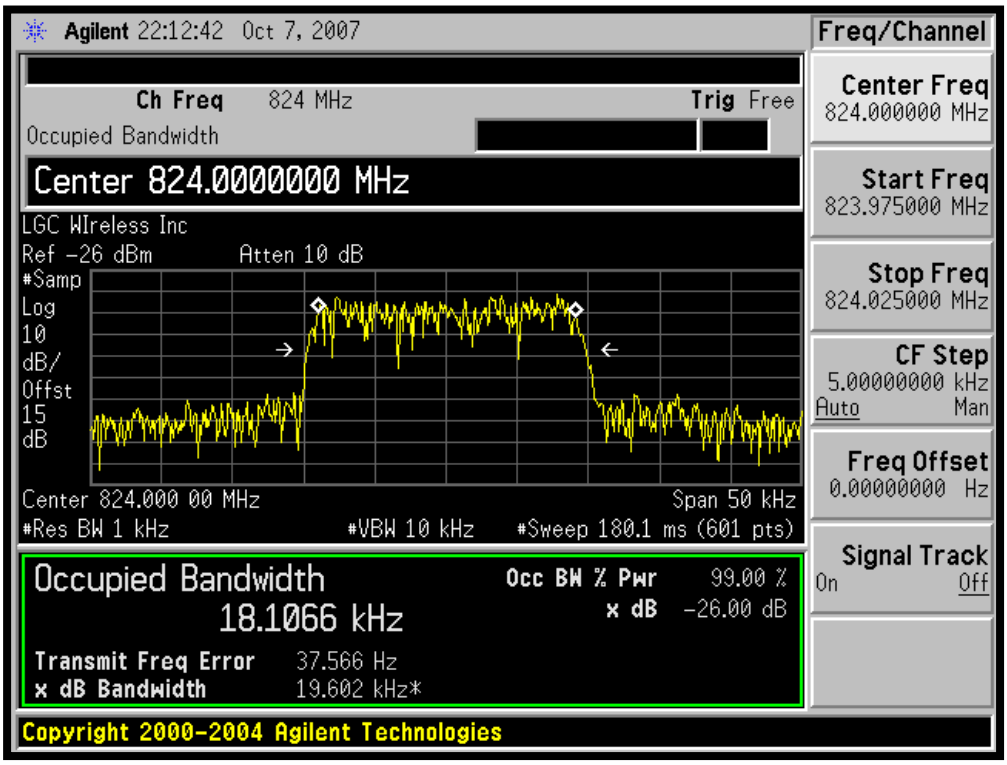
Middle Channel (Output)



High Channel (Input)

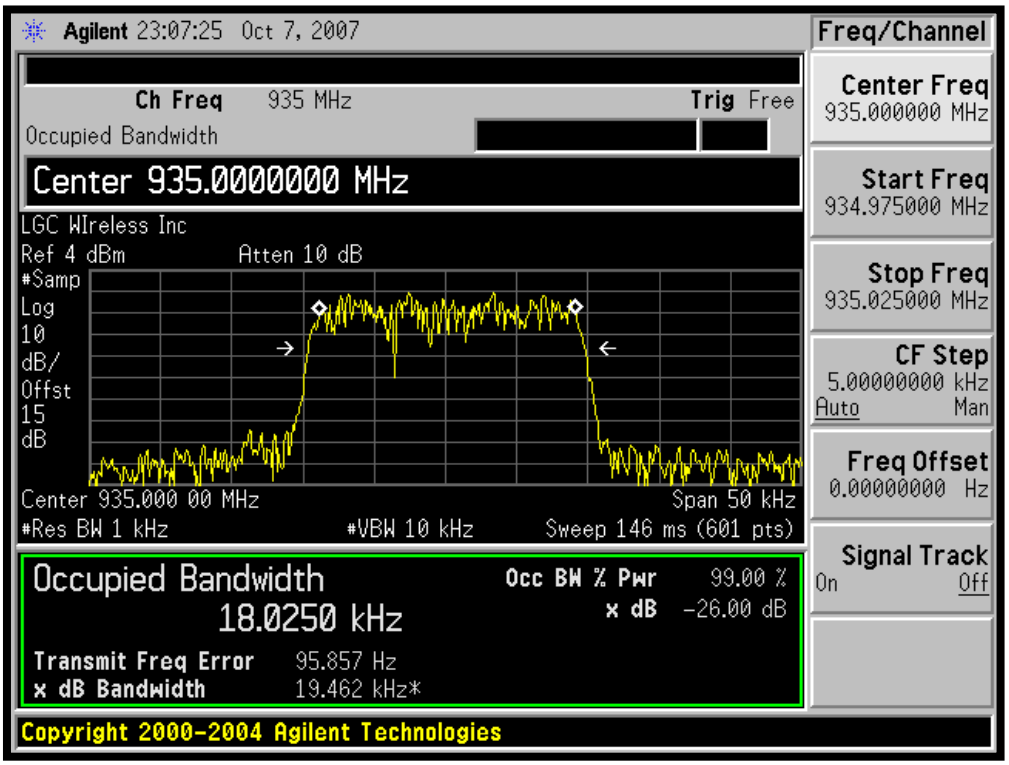


High Channel (Output)

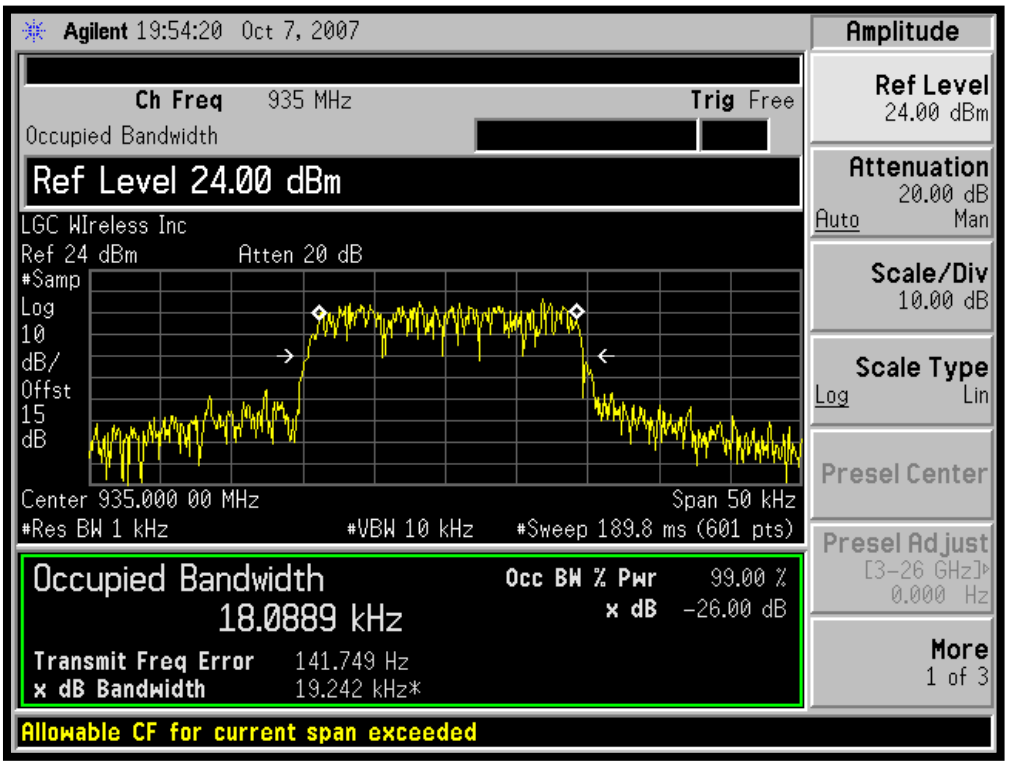


IDEN 900: Downlink

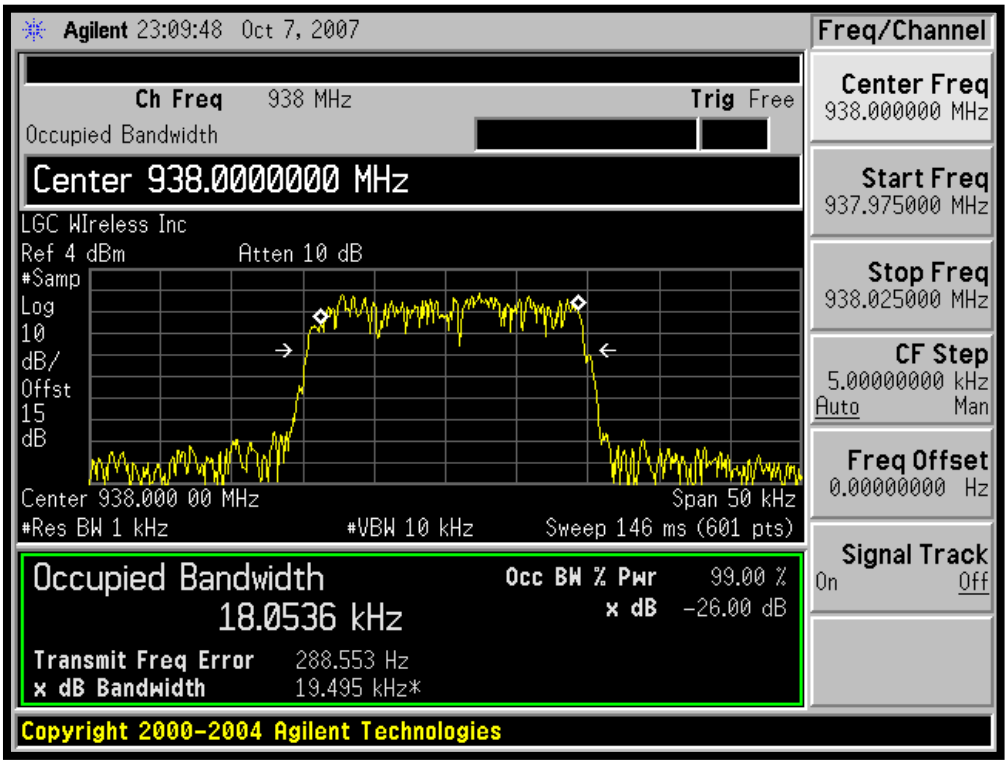
Low Channel (Input)



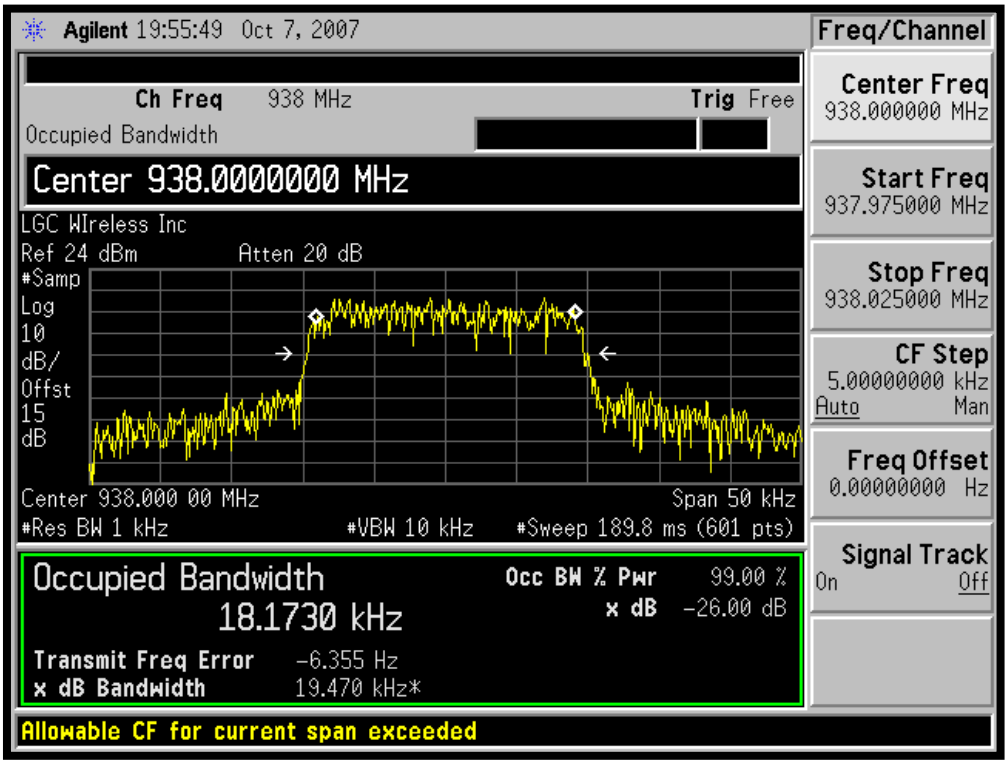
Low Channel (Output)



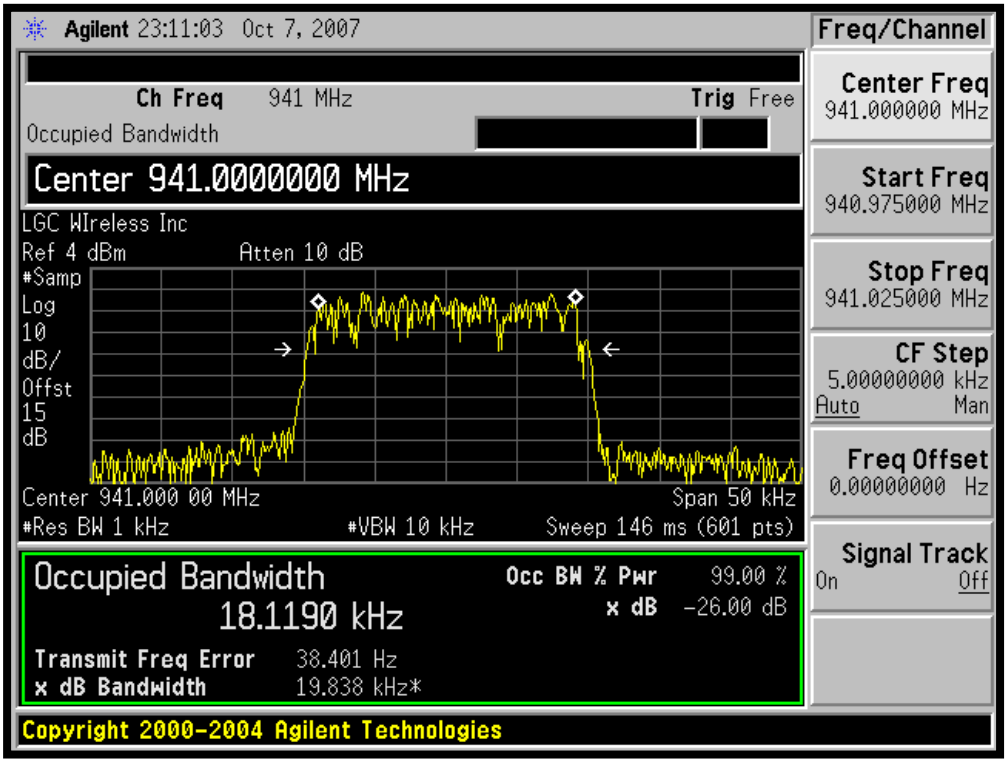
Middle Channel (Input)



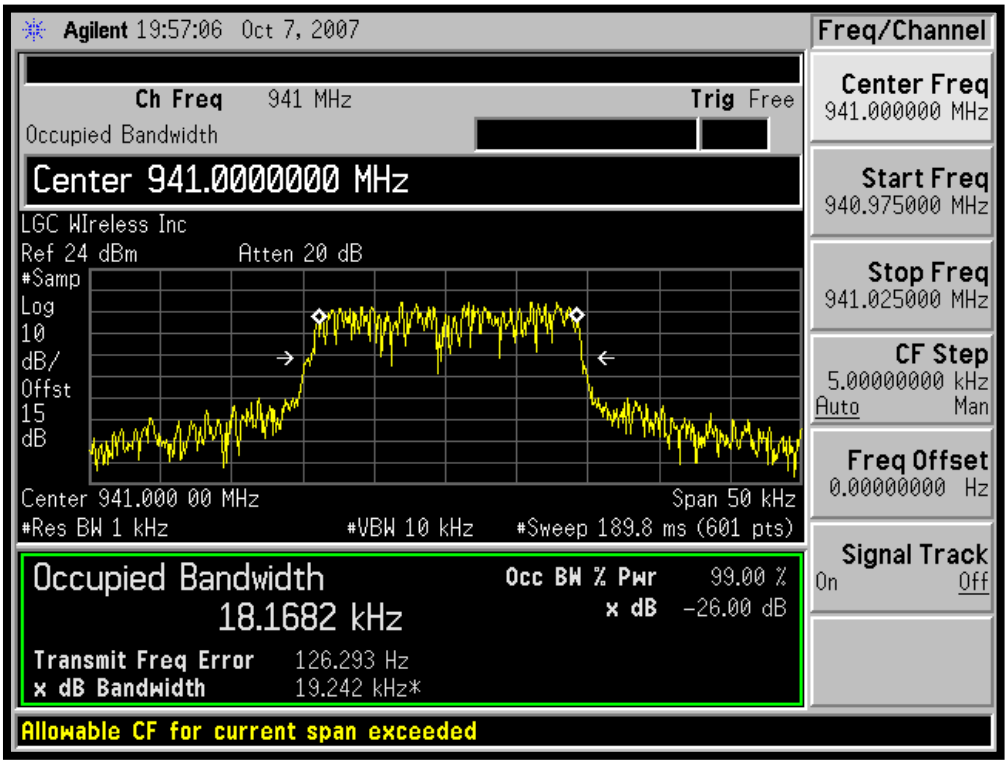
Middle Channel (Output)



High Channel (Input)

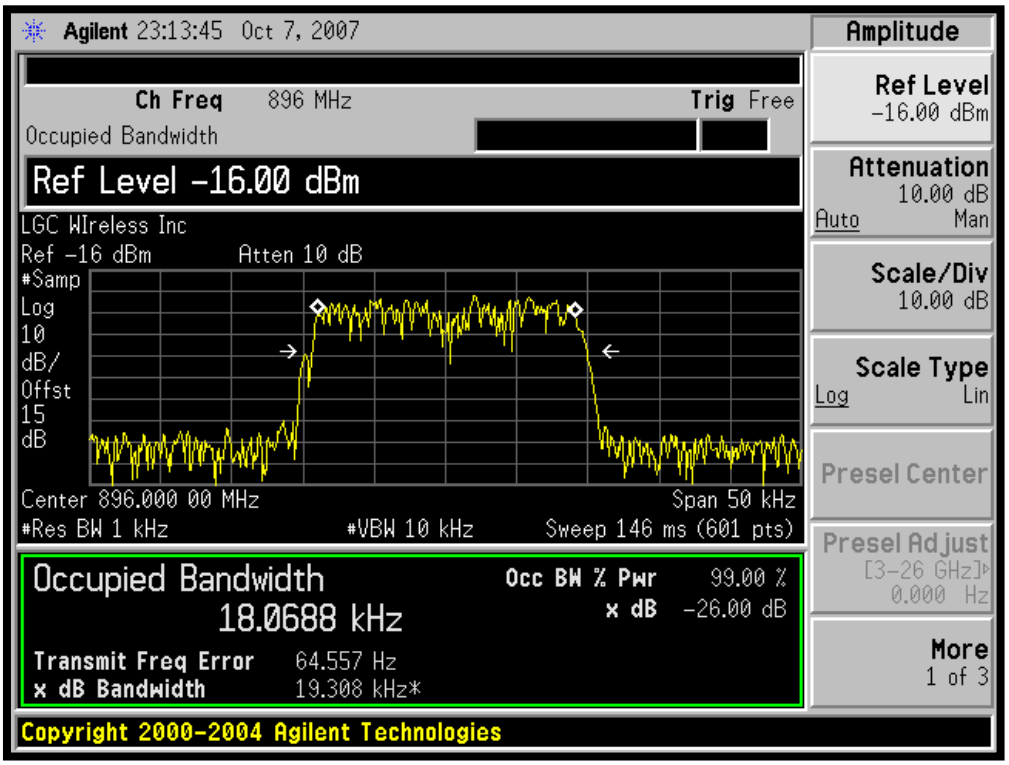


High Channel (Output)

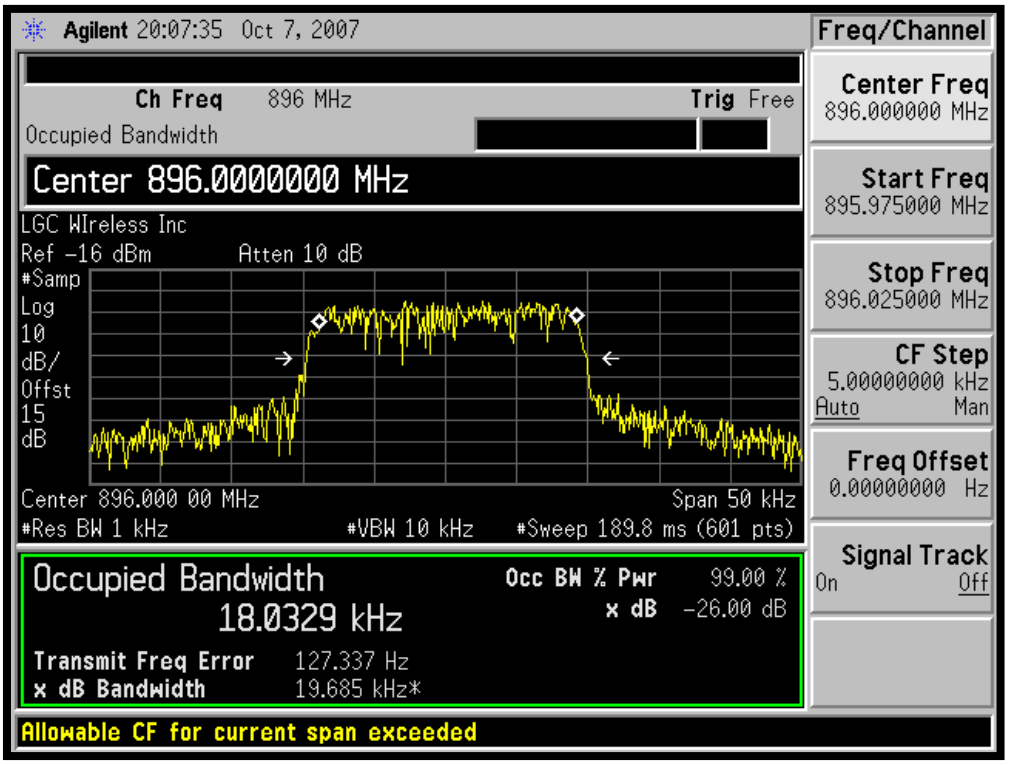


IDEN 900: Uplink

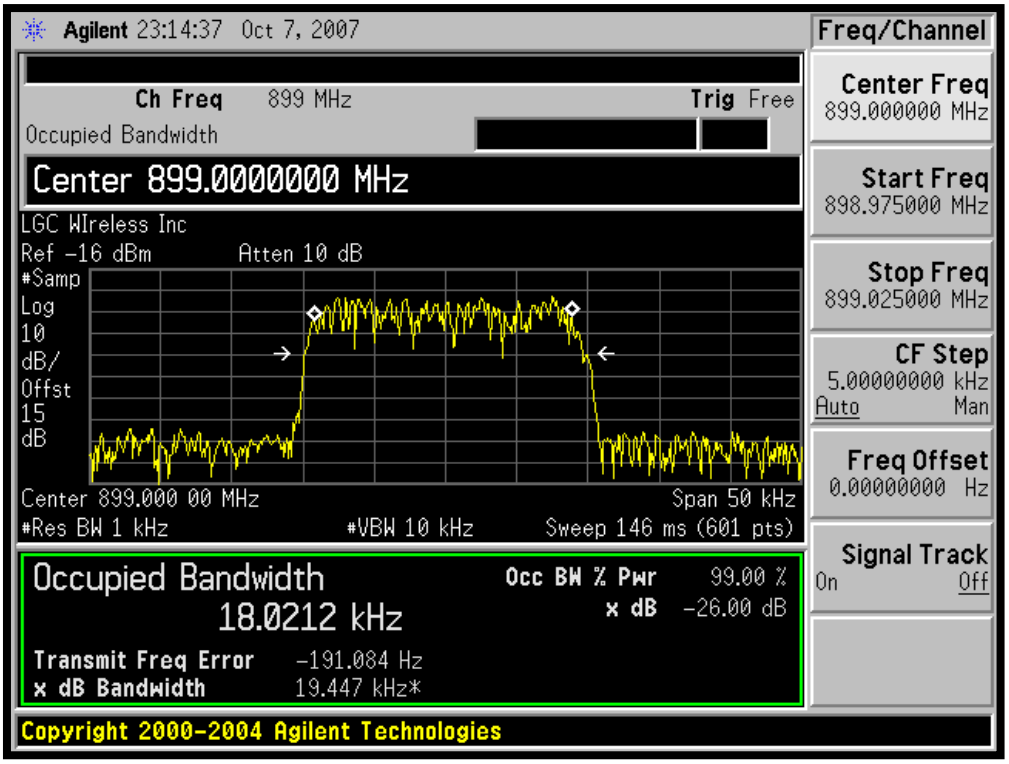
Low Channel (Input)



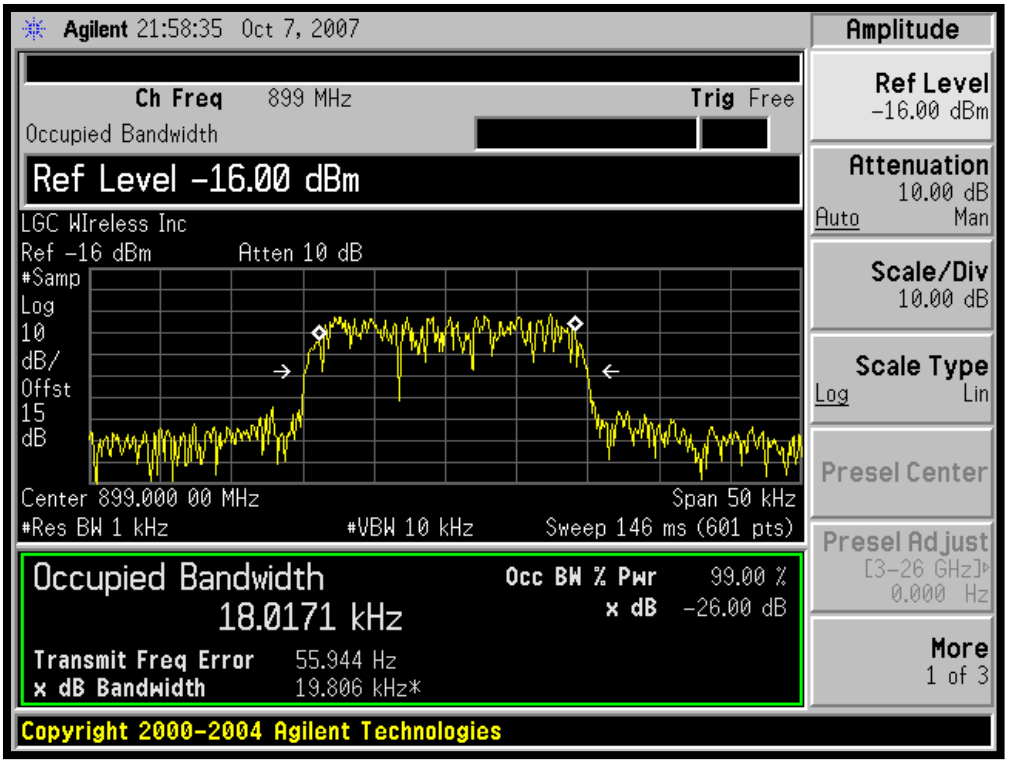
Low Channel (Output)



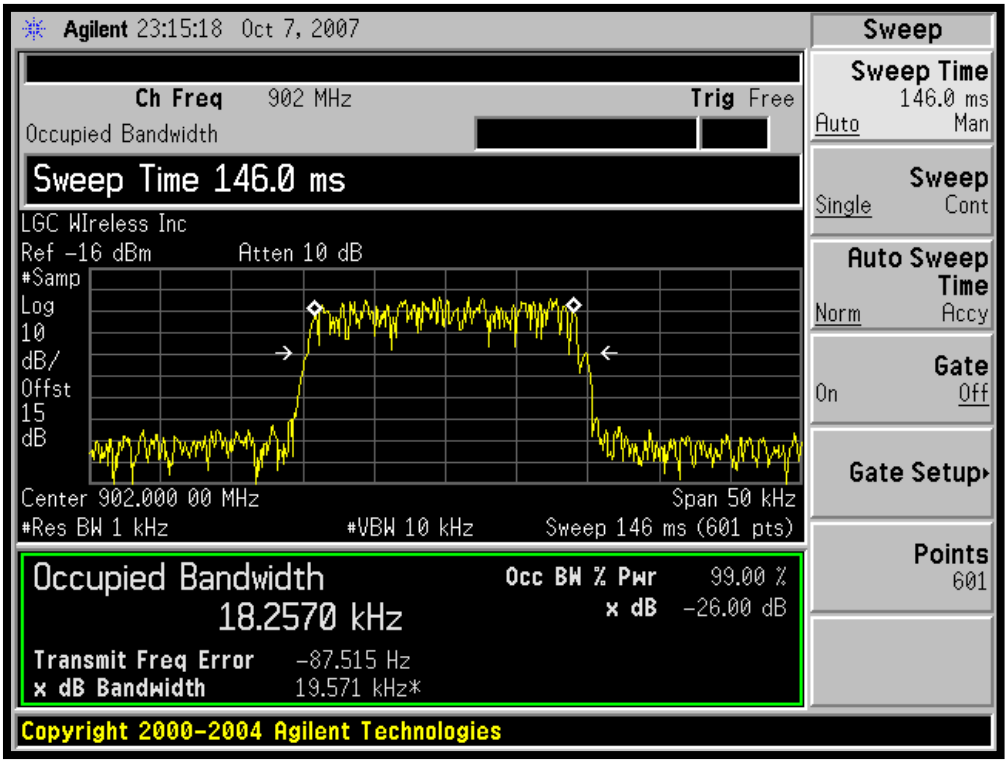
Middle Channel (Input)



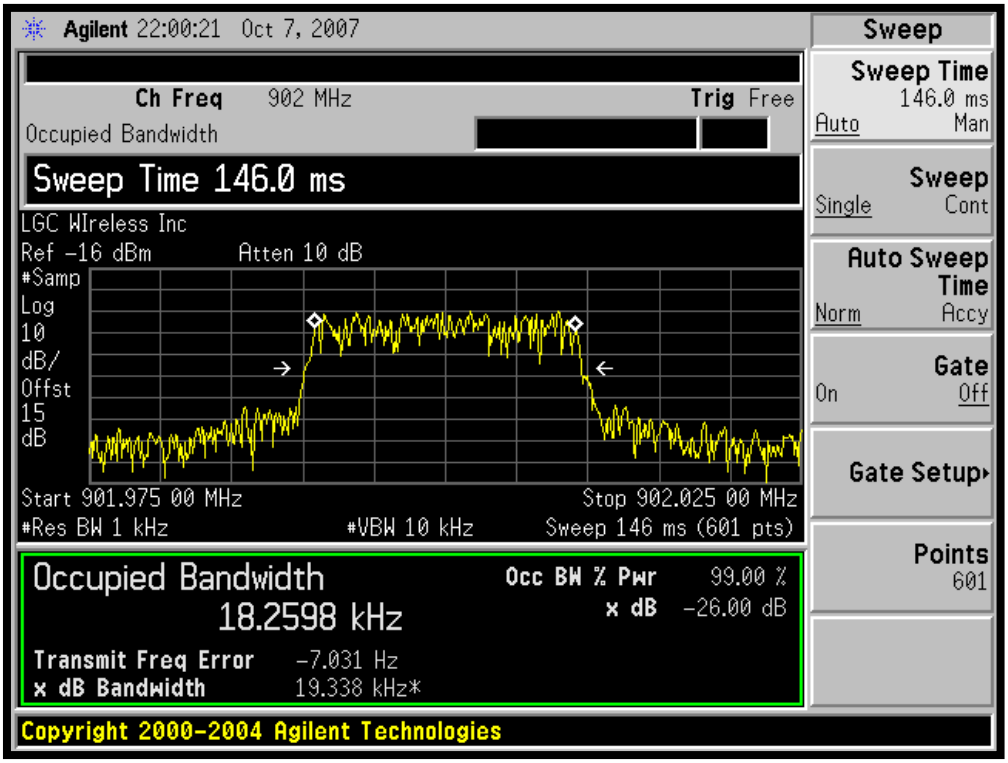
Middle Channel (Output)



High Channel (Input)



High Channel (Output)



9 §2.1051 §24.238(a) & § 90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

9.1 Applicable Standard

Requirements: CFR 47, § 2.1051. § 90.210 & §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

9.2 Test Procedure

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

9.2.1 Environmental Conditions

Temperature:	20°C
Relative Humidity:	58 %
ATM Pressure:	101.8 kPa

** The testing was performed by Choon Sian Ooi on 2007-10-16.*

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Rohde & Schwartz	Signal Generator	SMIQ03	849192/0085	2006-10-18
Agilent	Vector Signal Generator	ESG44	US44300386	-

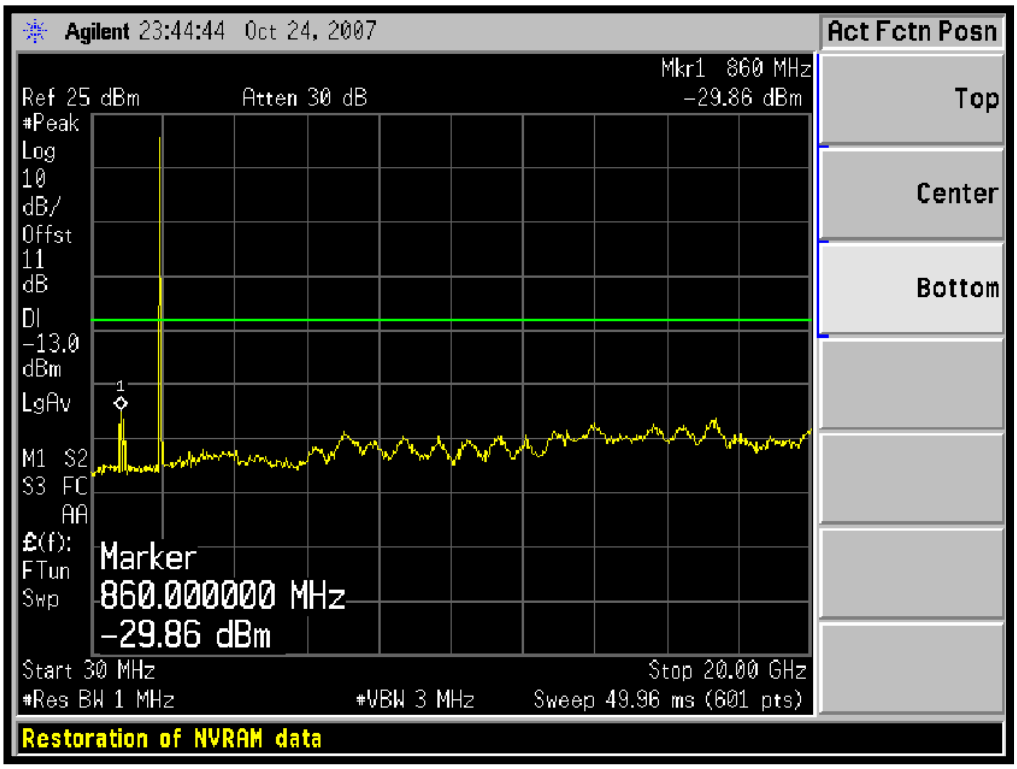
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

9.4 Test Results

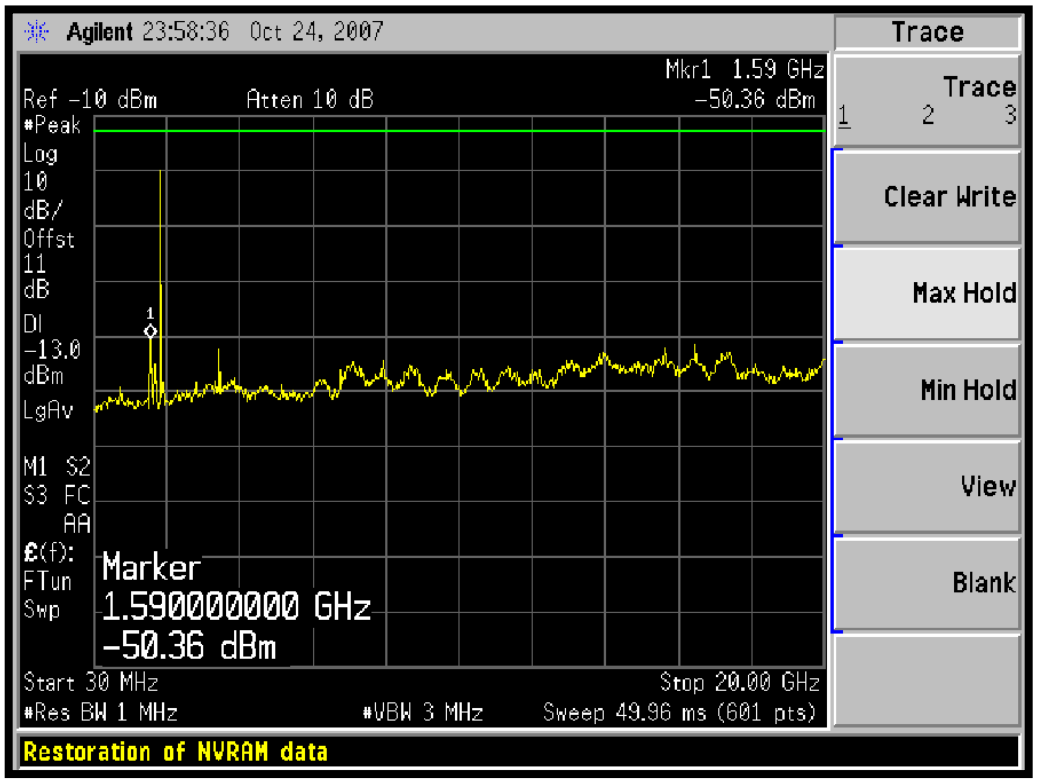
Please refer to the hereinafter plots.

GSM

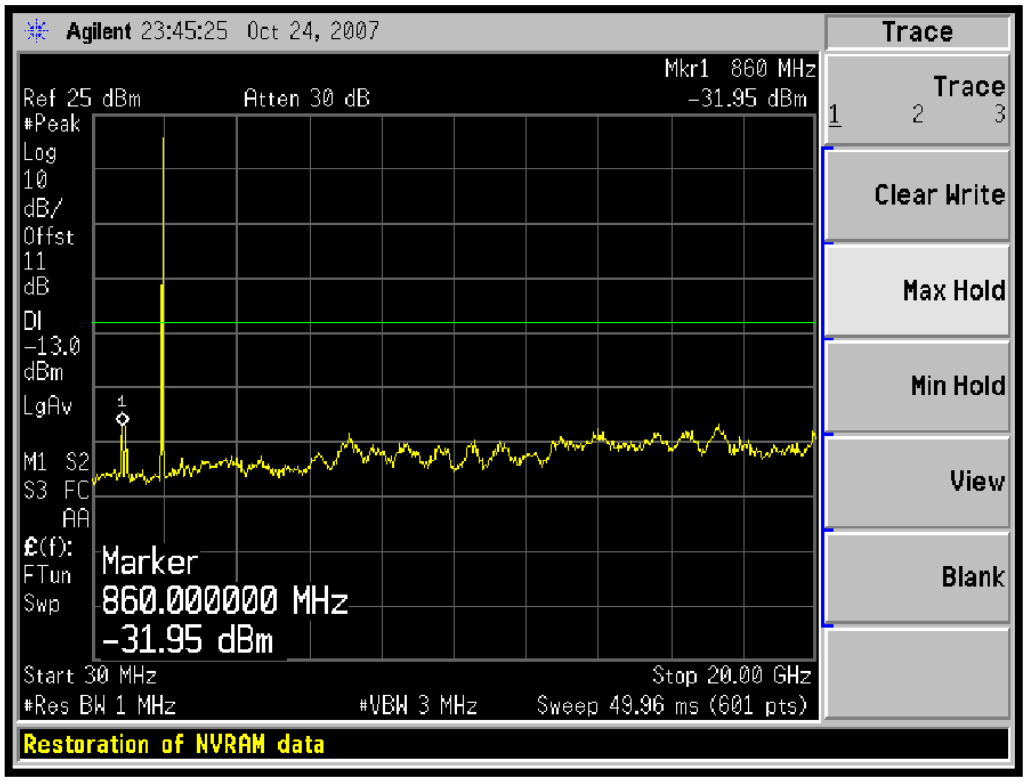
Low Channel (Downlink)



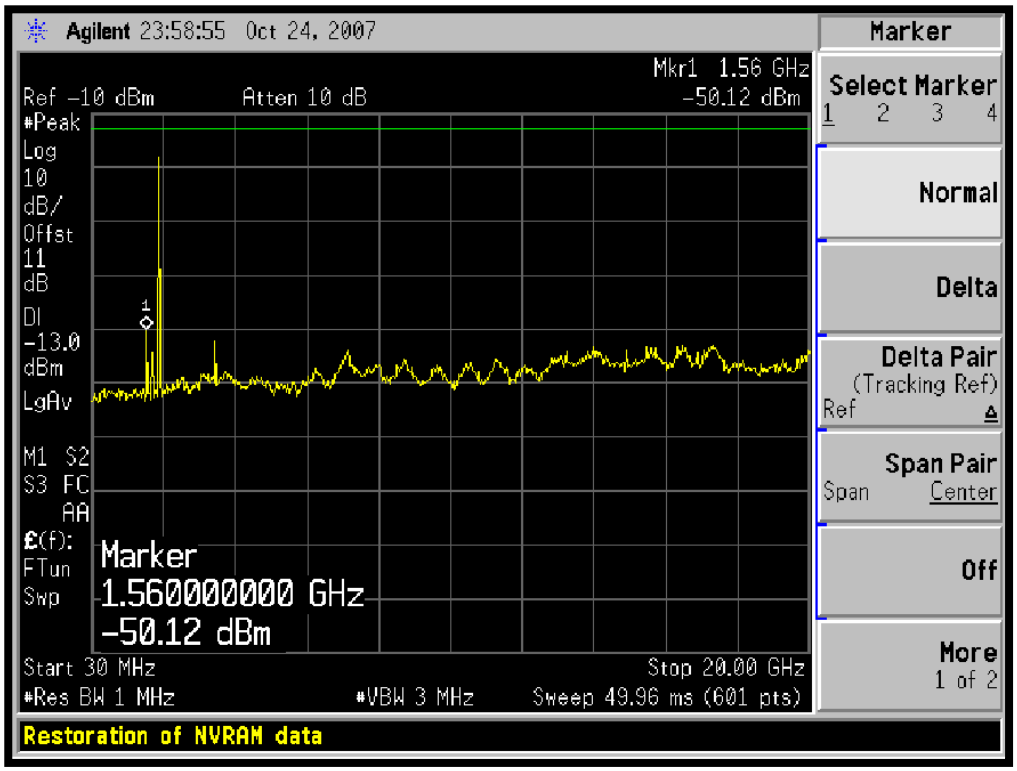
Low Channel (Uplink)



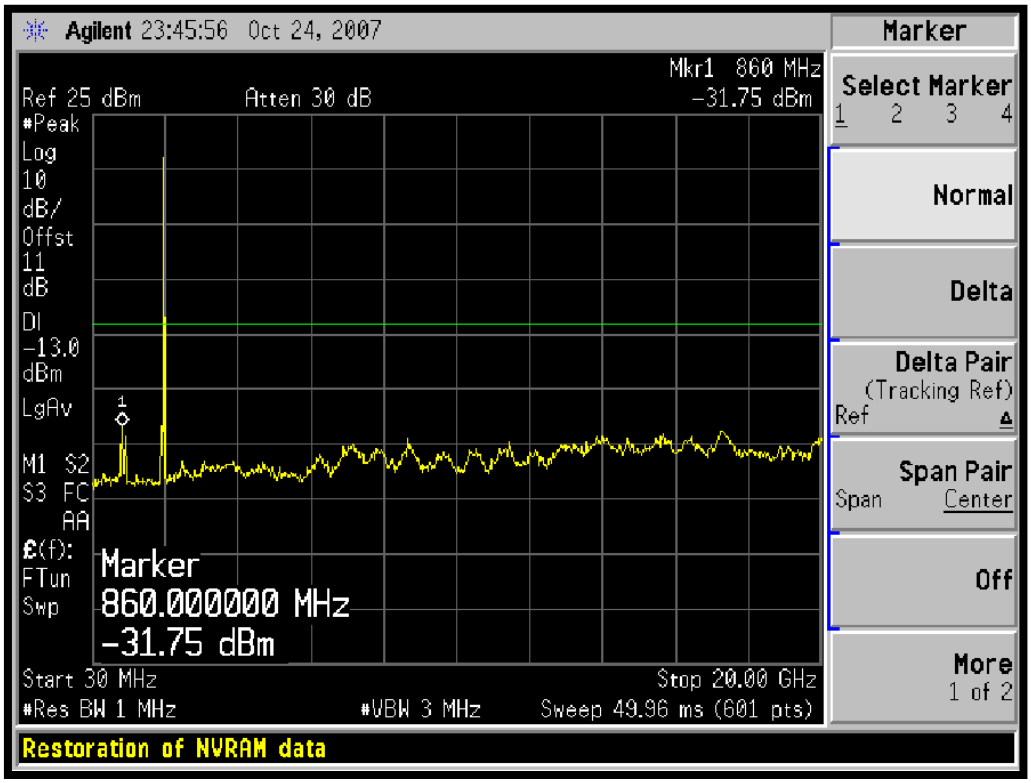
Middle Channel (Downlink)



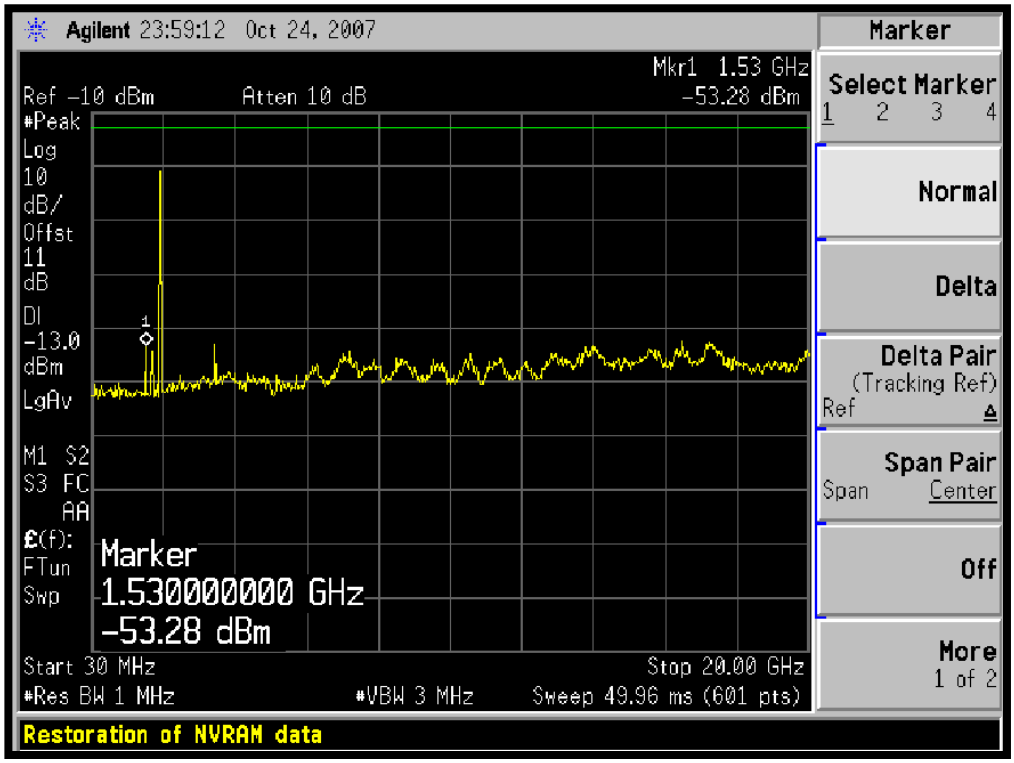
Middle Channel (Uplink)



High Channel (Downlink)

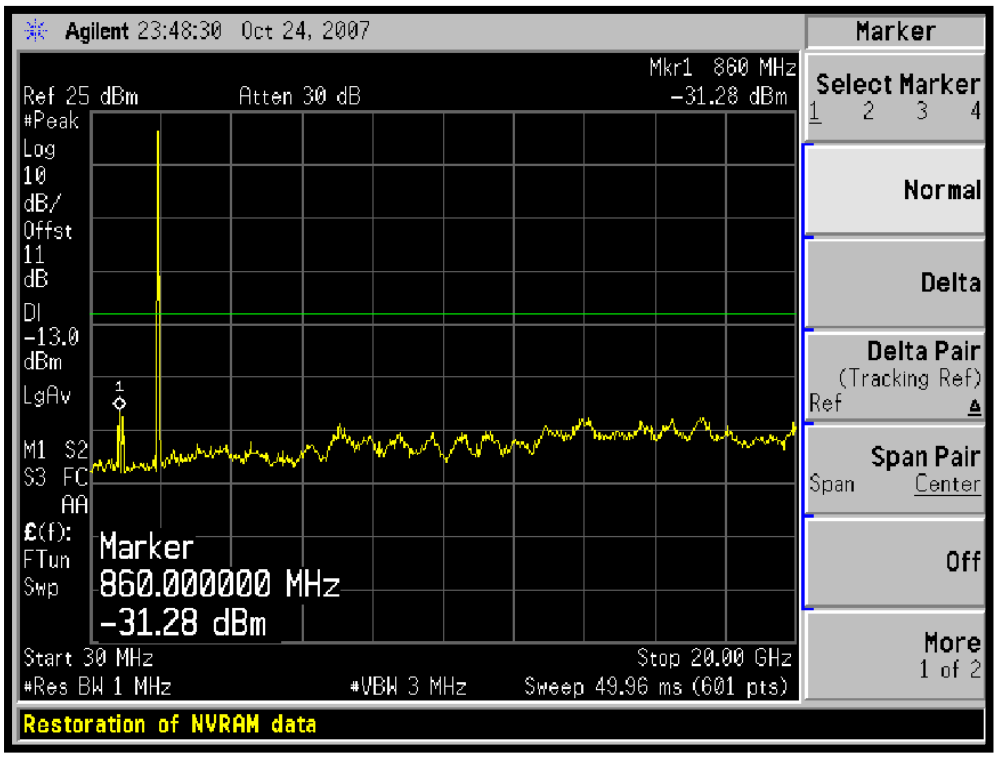


High Channel (Uplink)

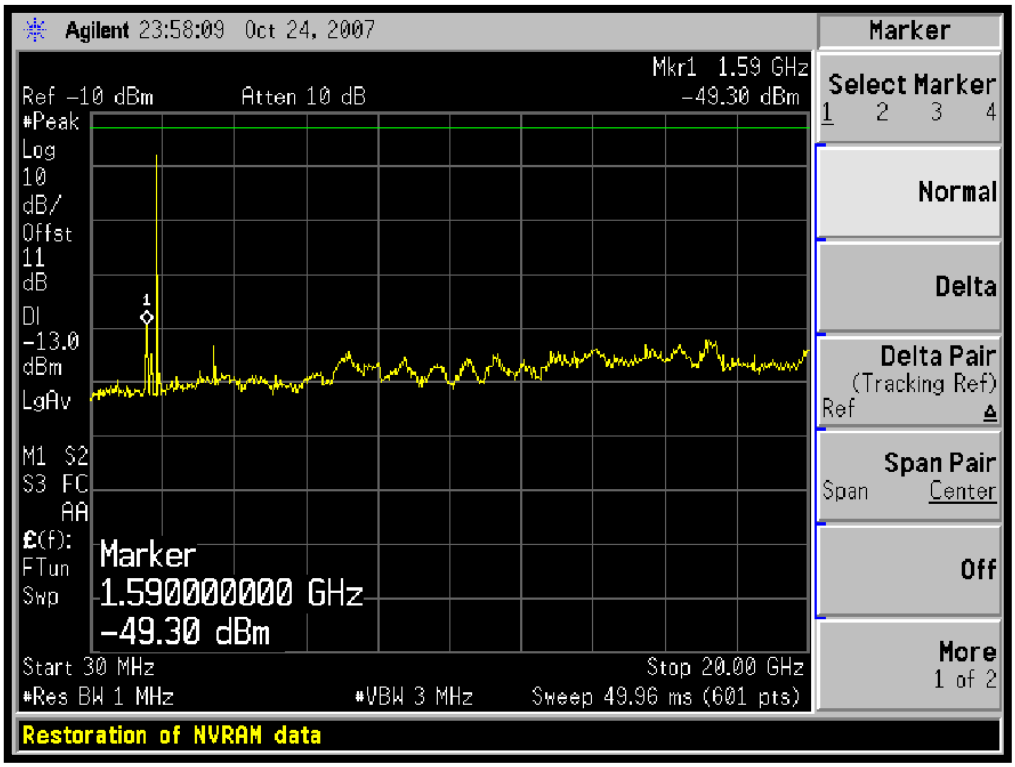


TDMA

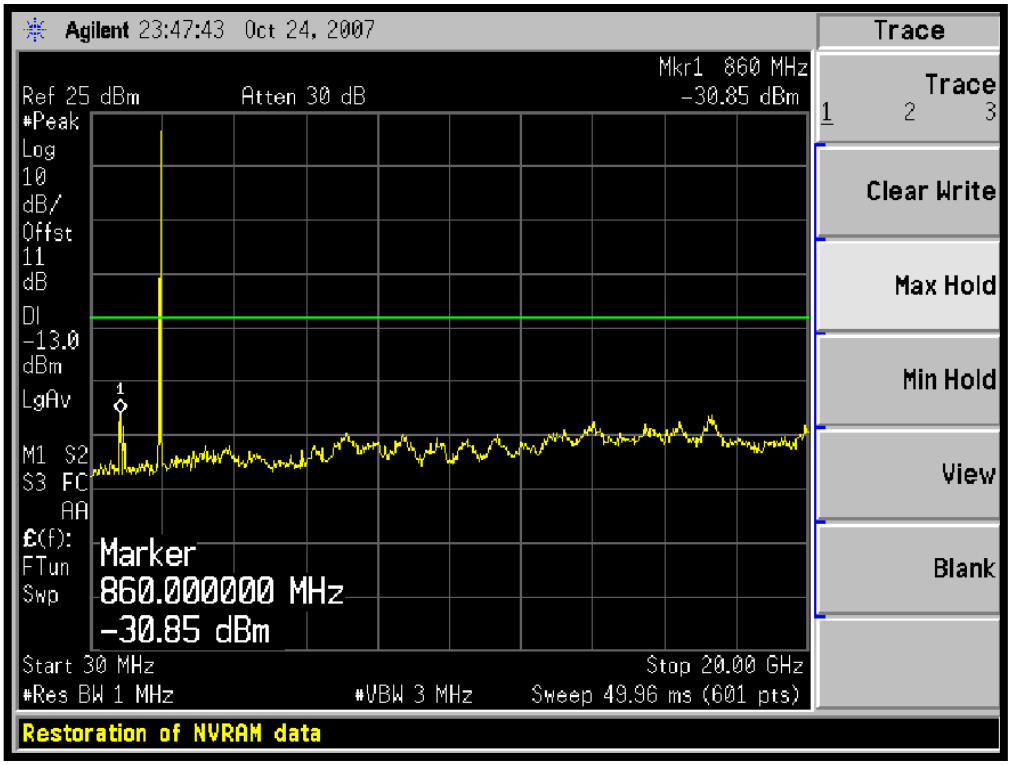
Low Channel (Downlink)



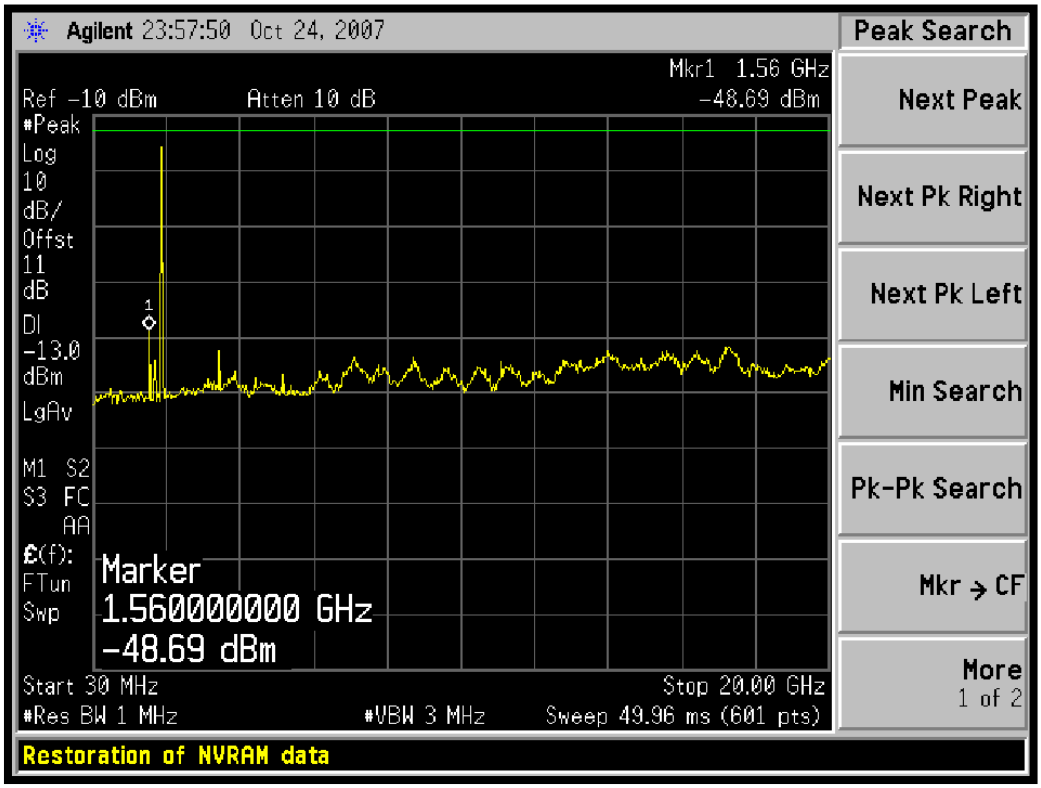
Low Channel (Uplink)



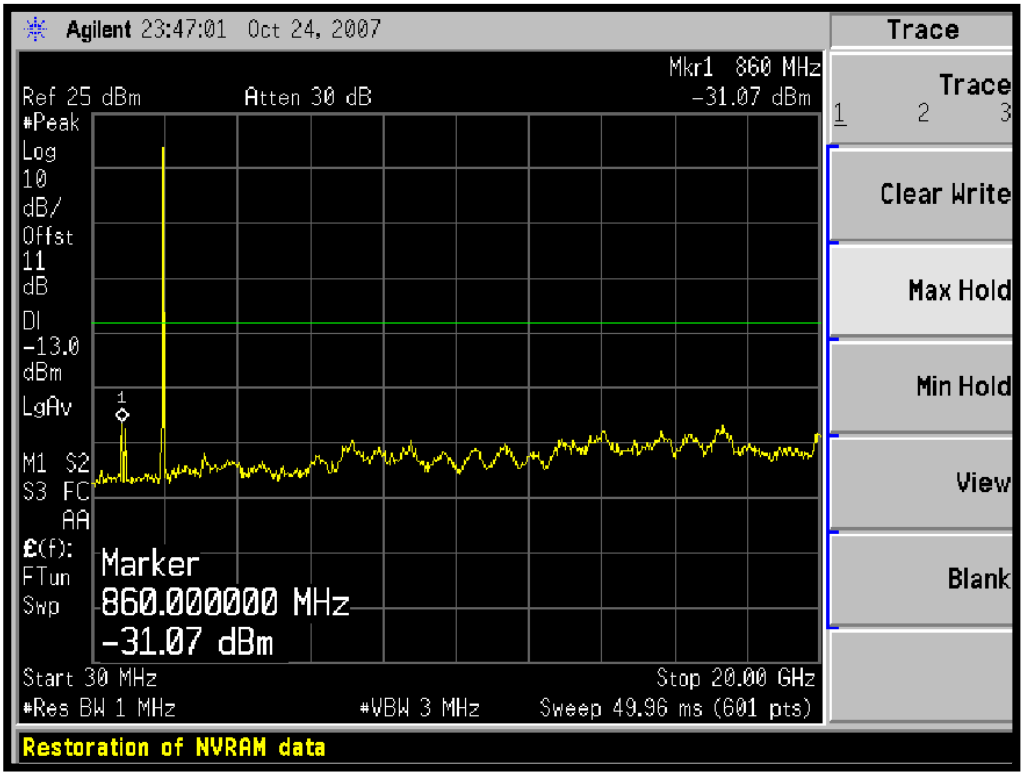
Middle Channel (Downlink)



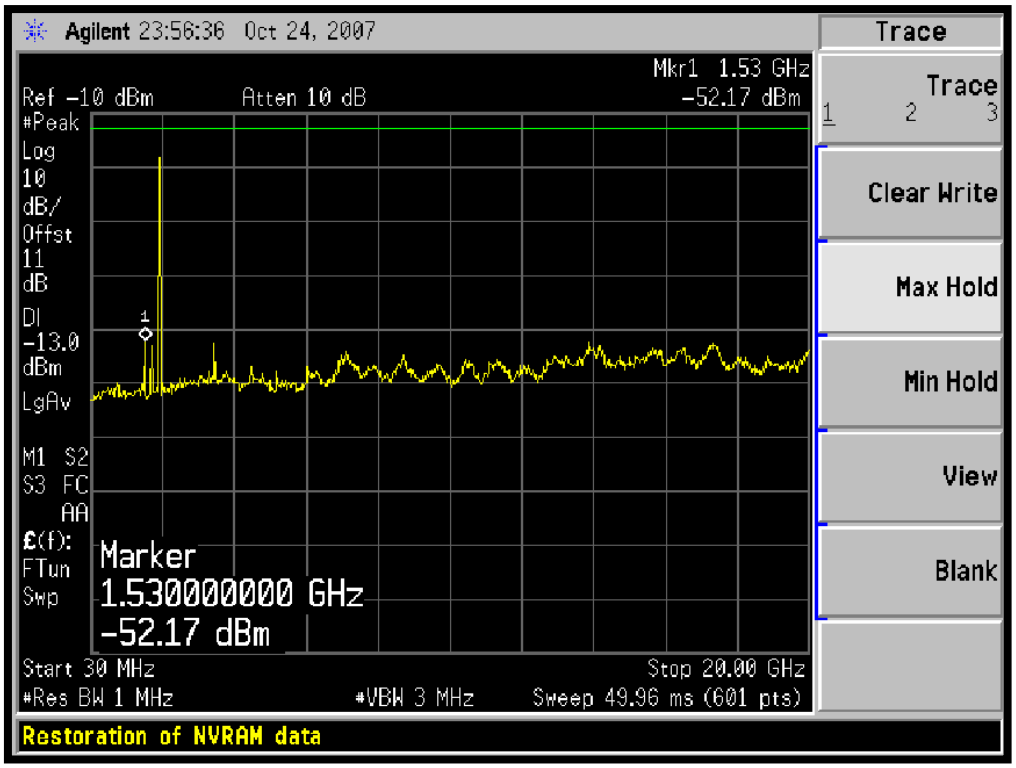
Middle Channel (Uplink)



High Channel (Downlink)

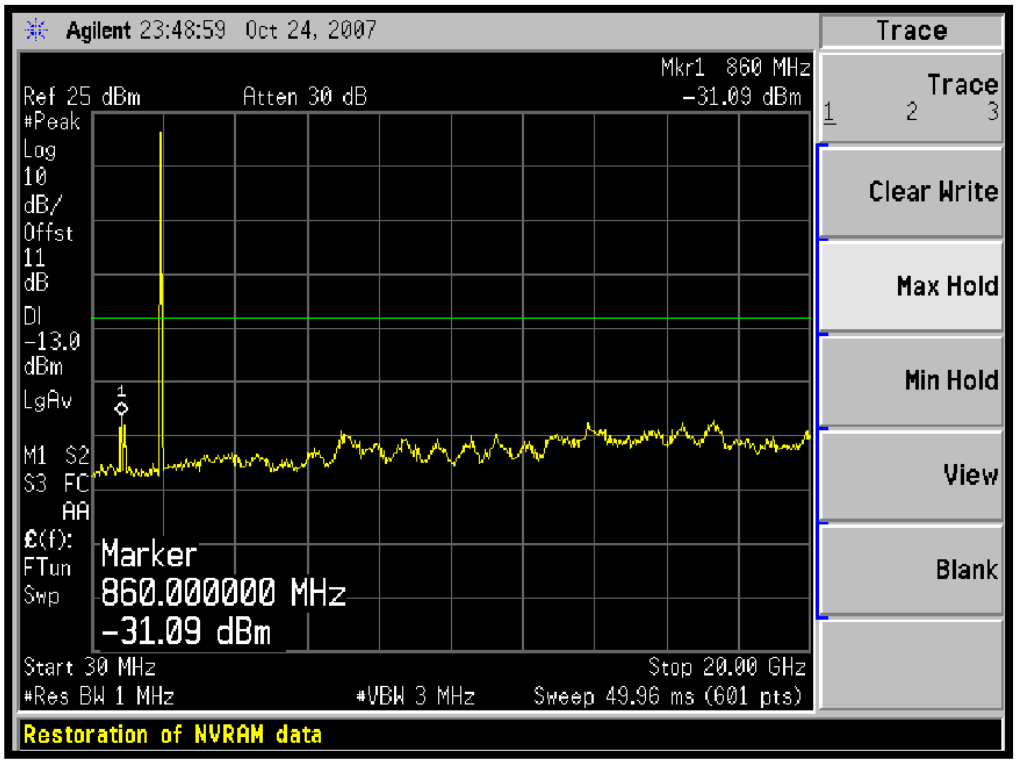


High Channel (Uplink)

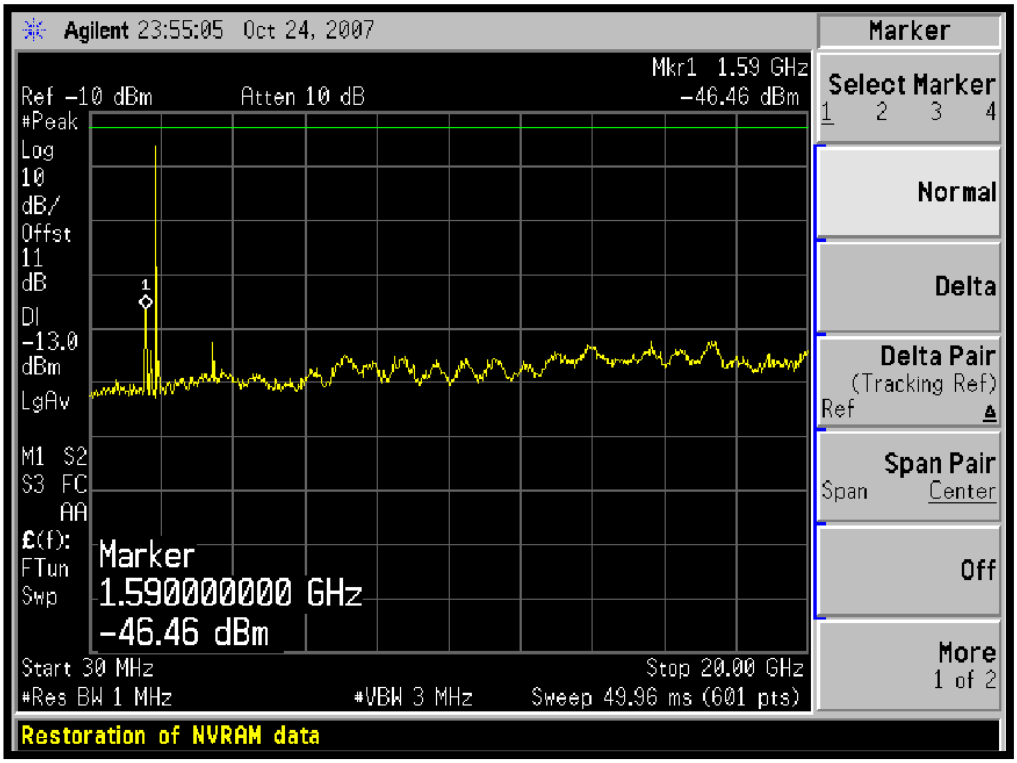


CDMA

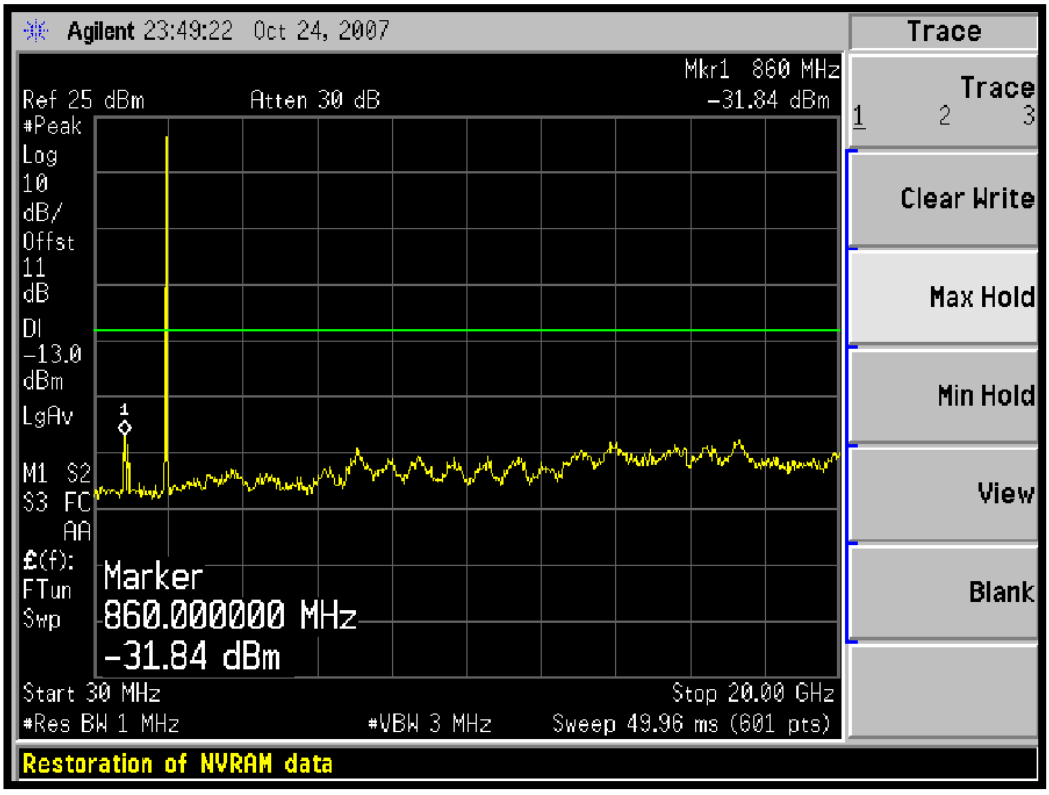
Low Channel (Downlink)



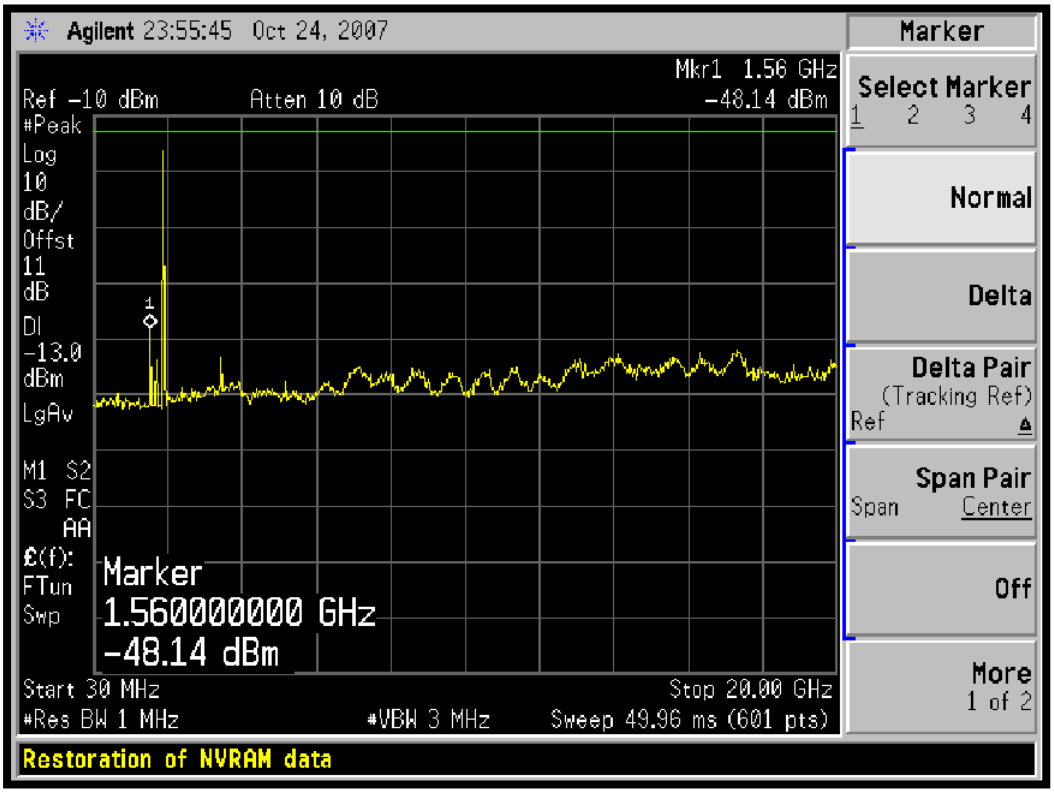
Low Channel (Uplink)



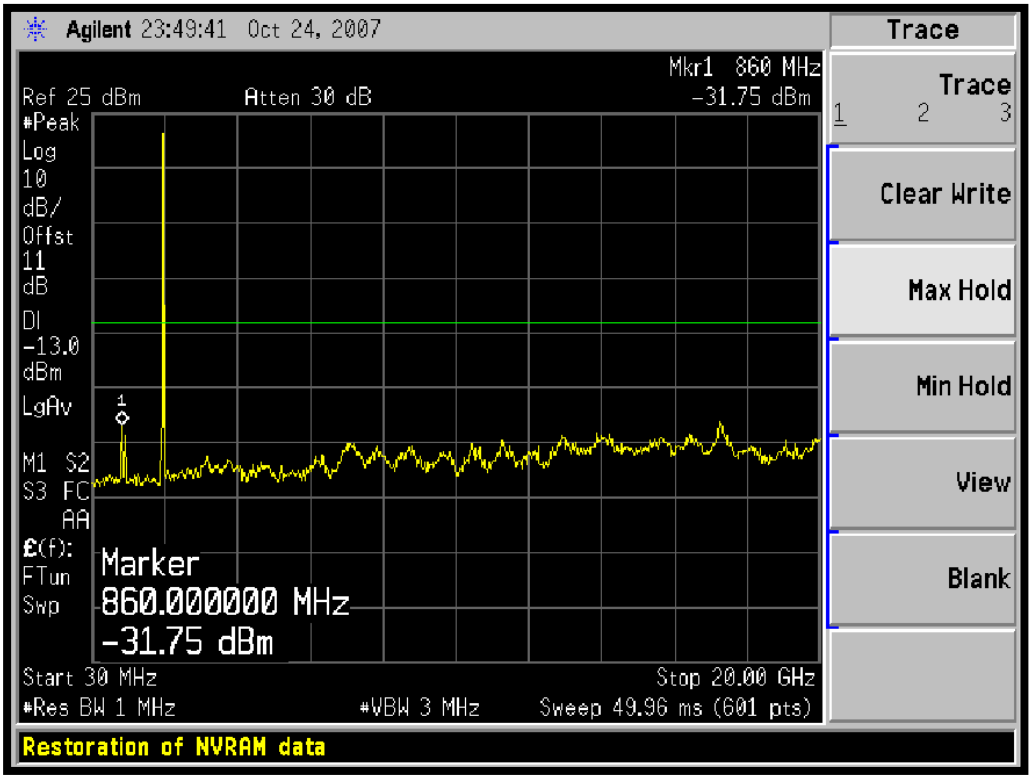
Middle Channel (Downlink)



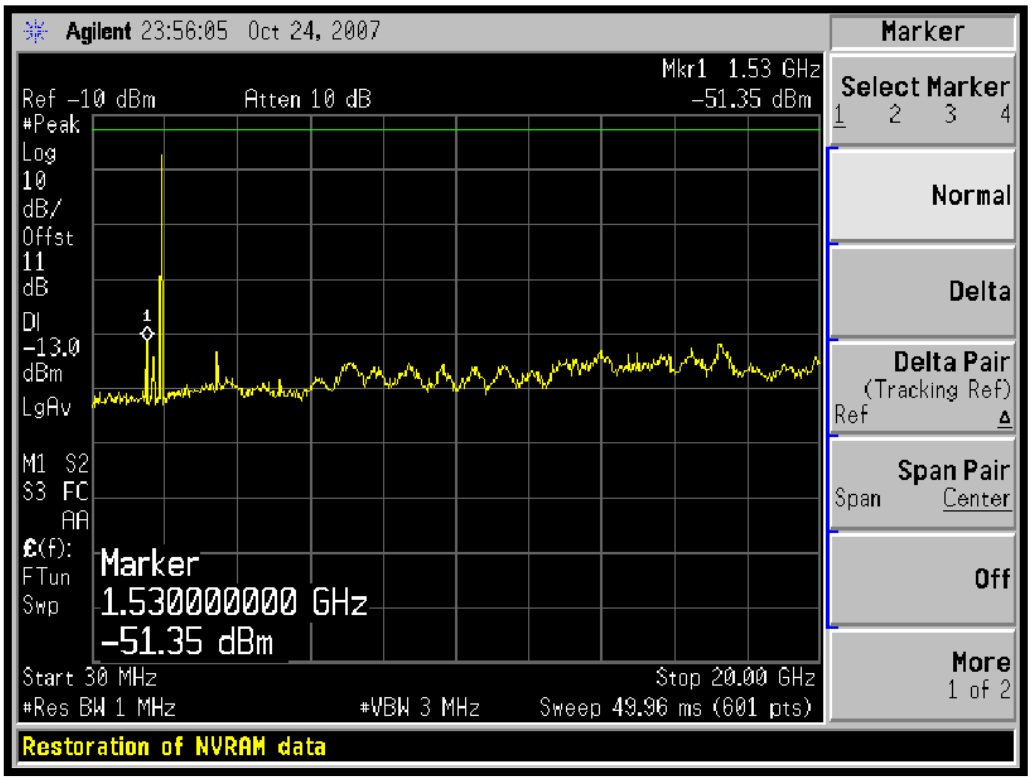
Middle Channel (Uplink)



High Channel (Downlink)

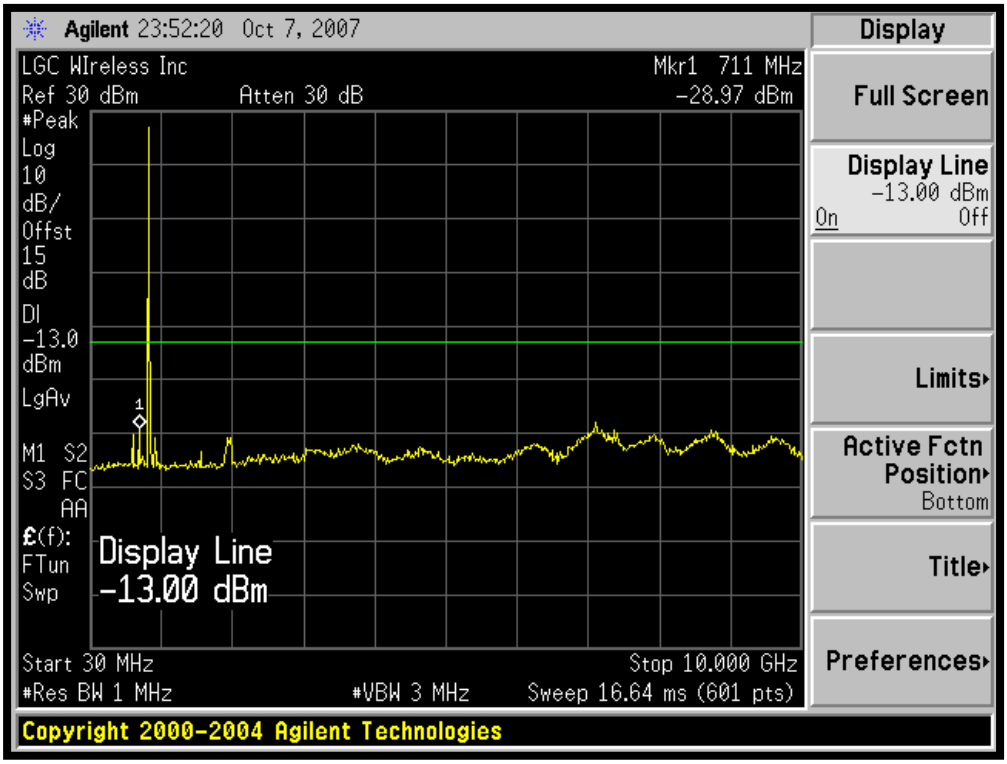


High Channel (Uplink)

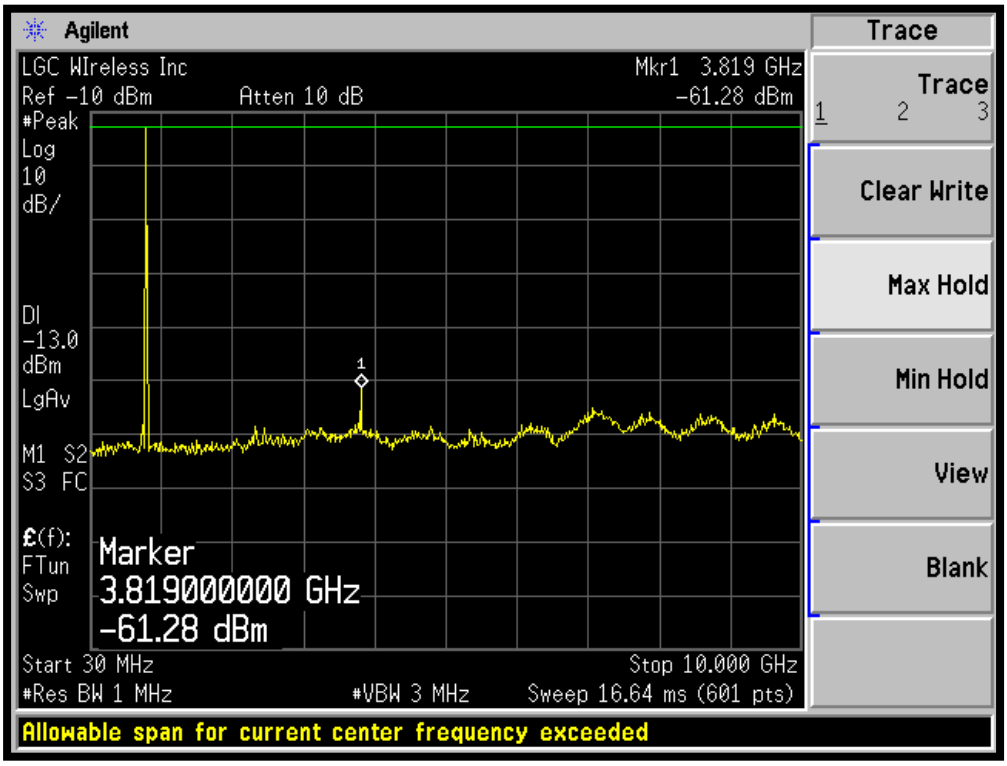


Plots of Spurious Emissions for IDEN 800 Band

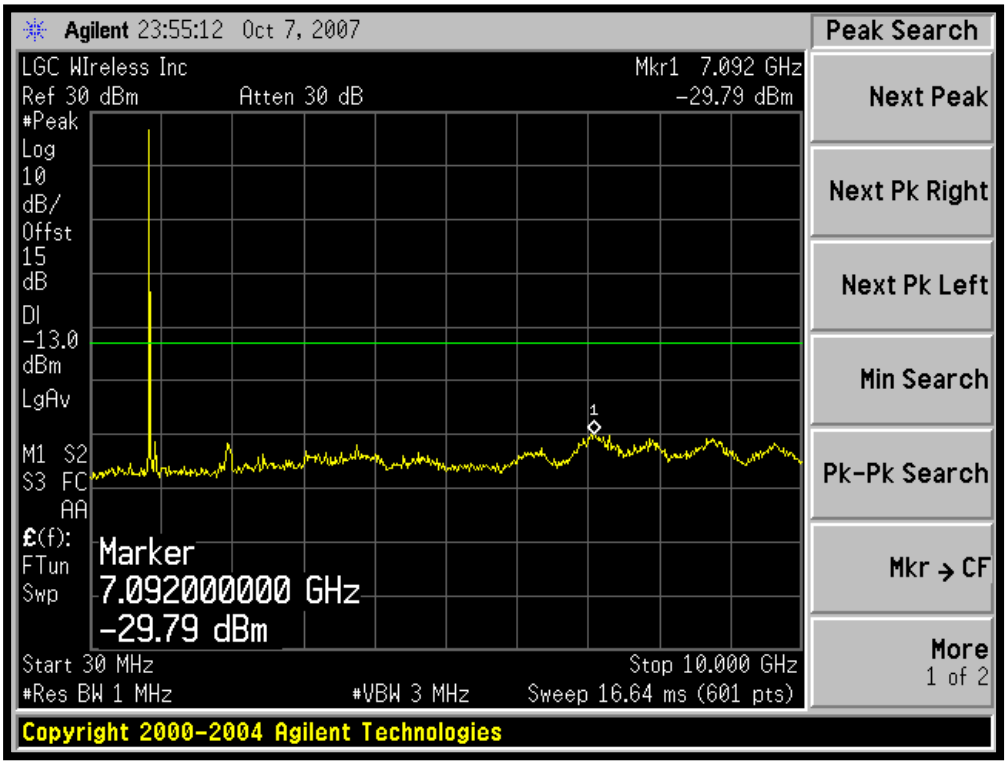
Low Channel (Downlink)



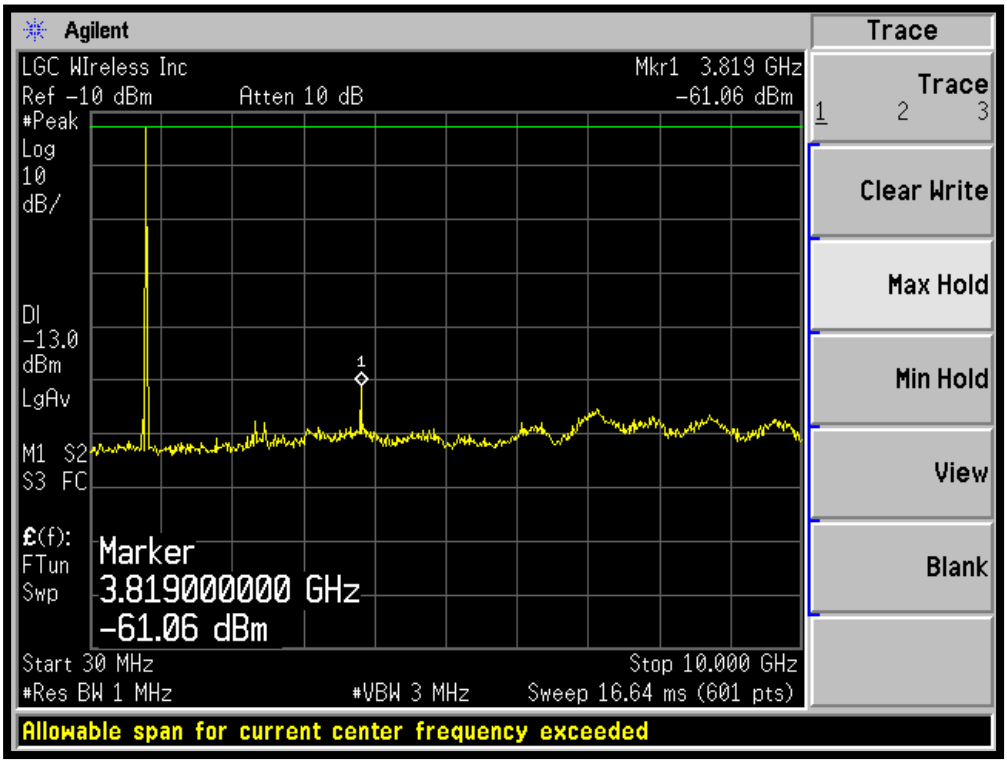
Low Channel (Uplink)



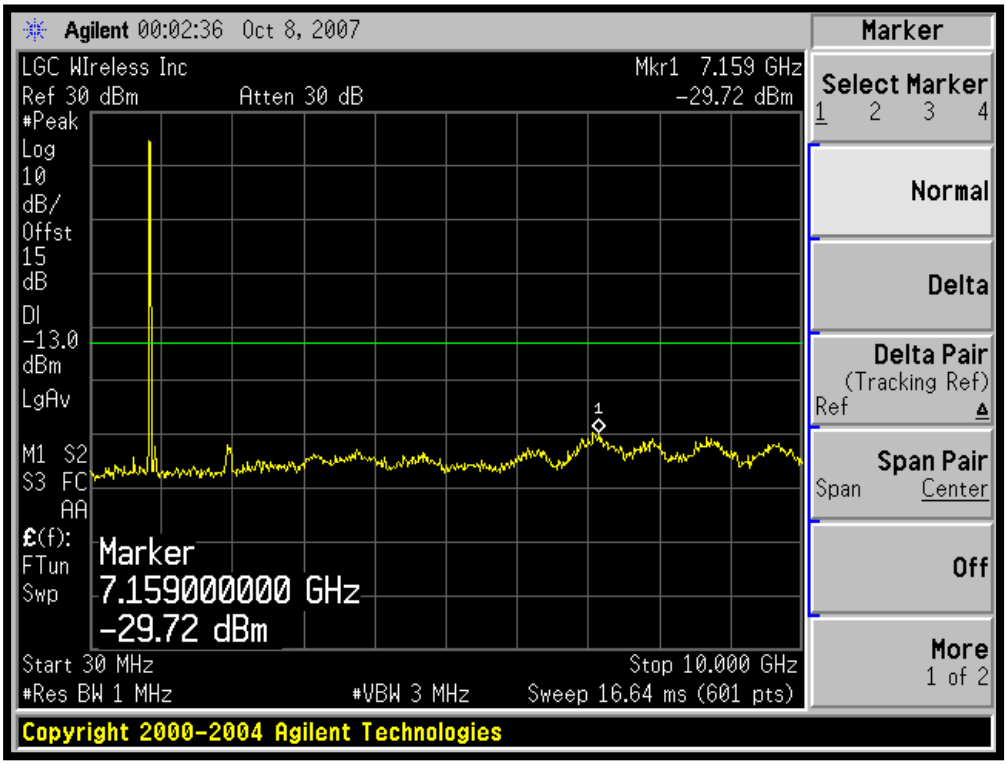
Middle Channel (Downlink)



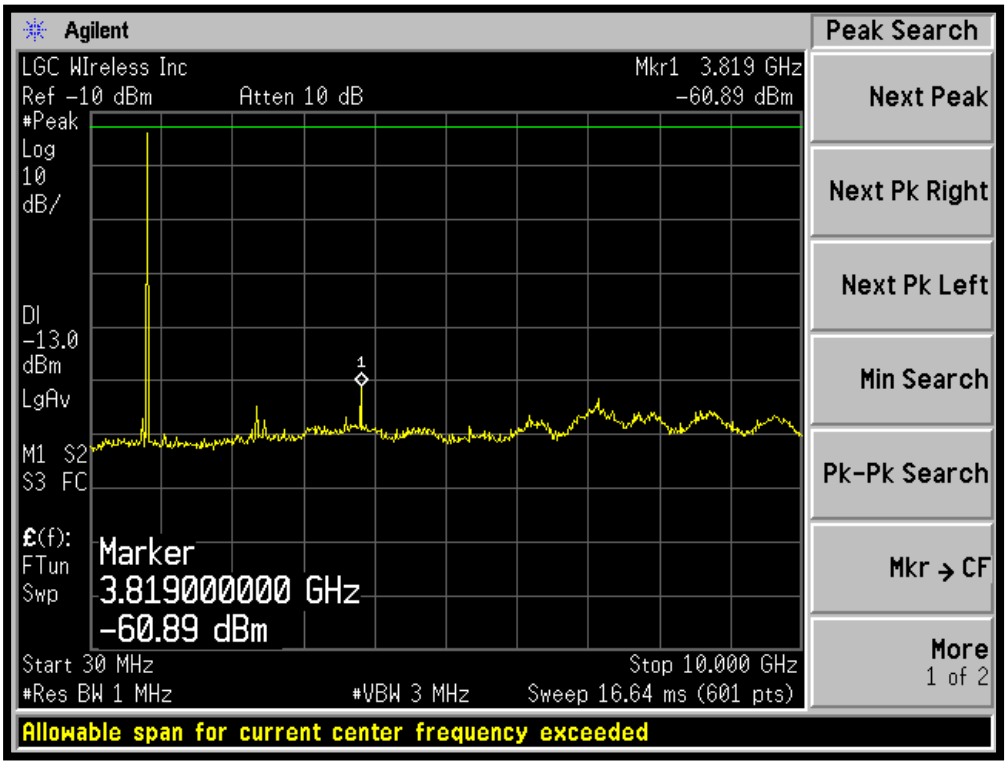
Middle Channel (Uplink)



High Channel (Downlink)

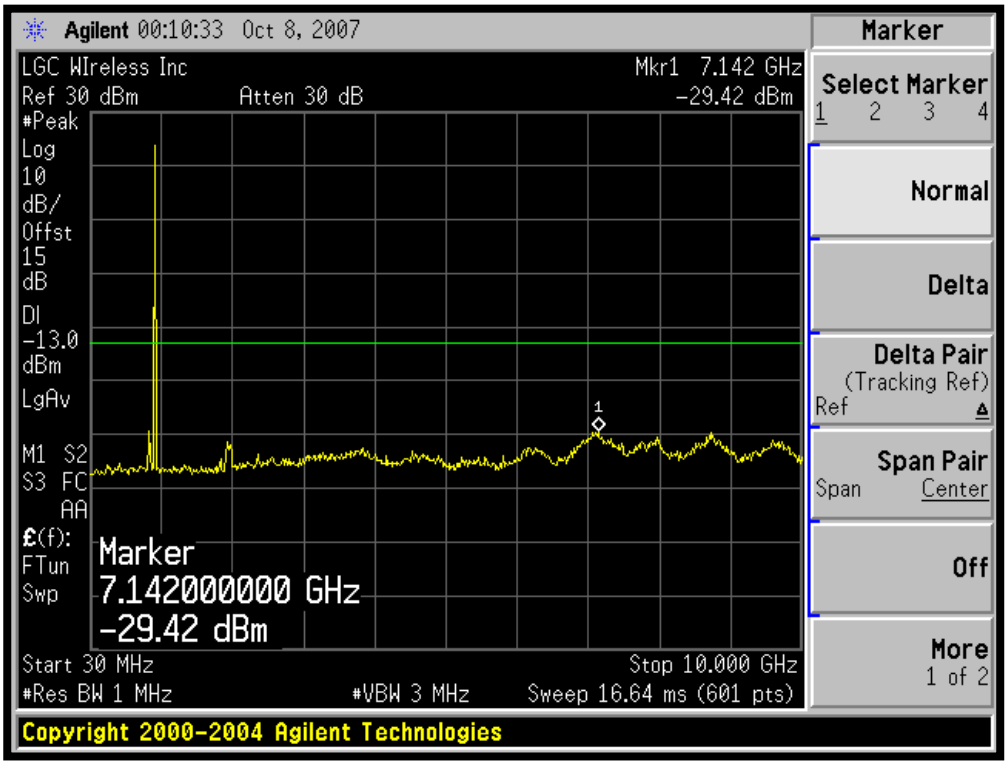


High Channel (Uplink)

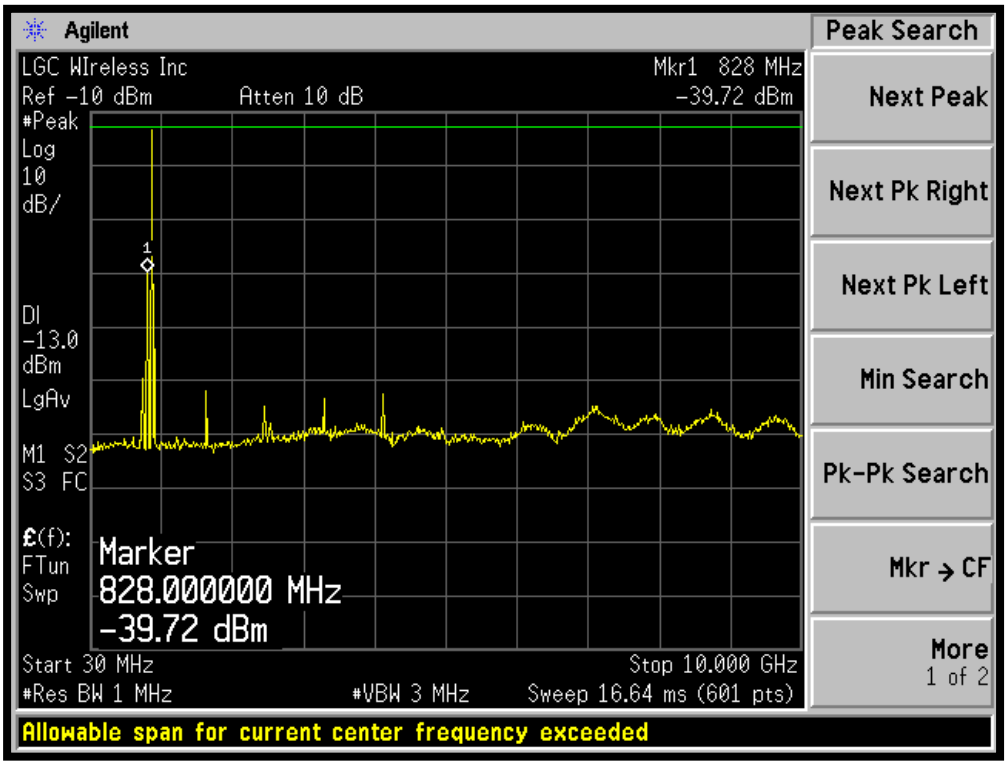


Plots of Spurious Emissions for IDEN 900 Band

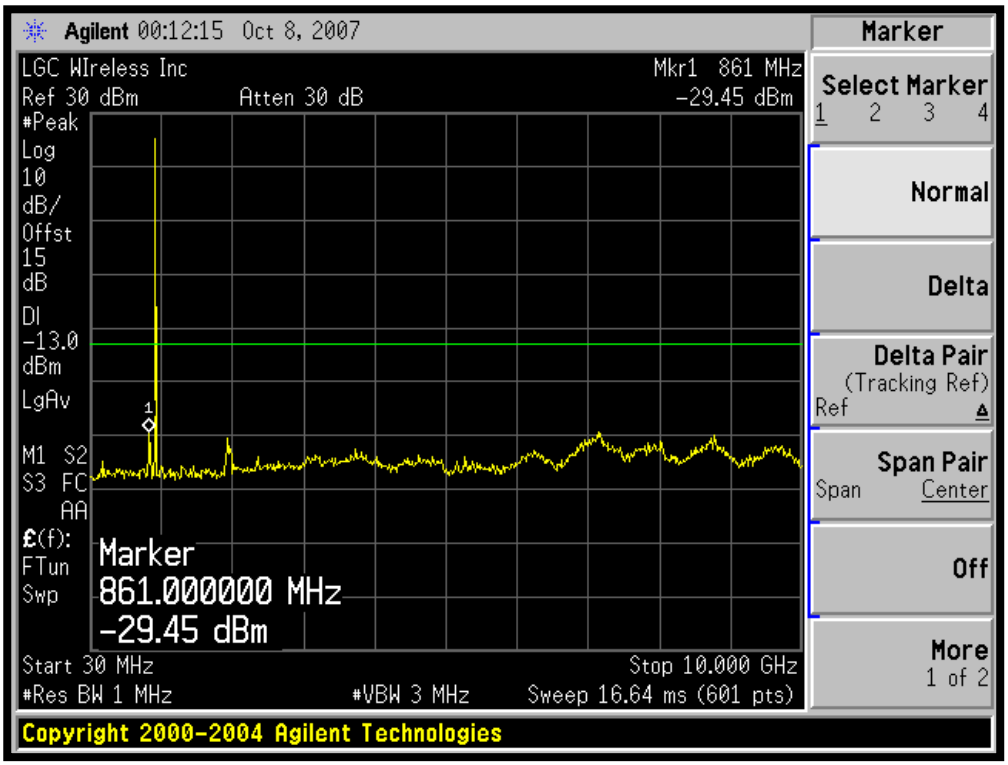
Low Channel (Downlink)



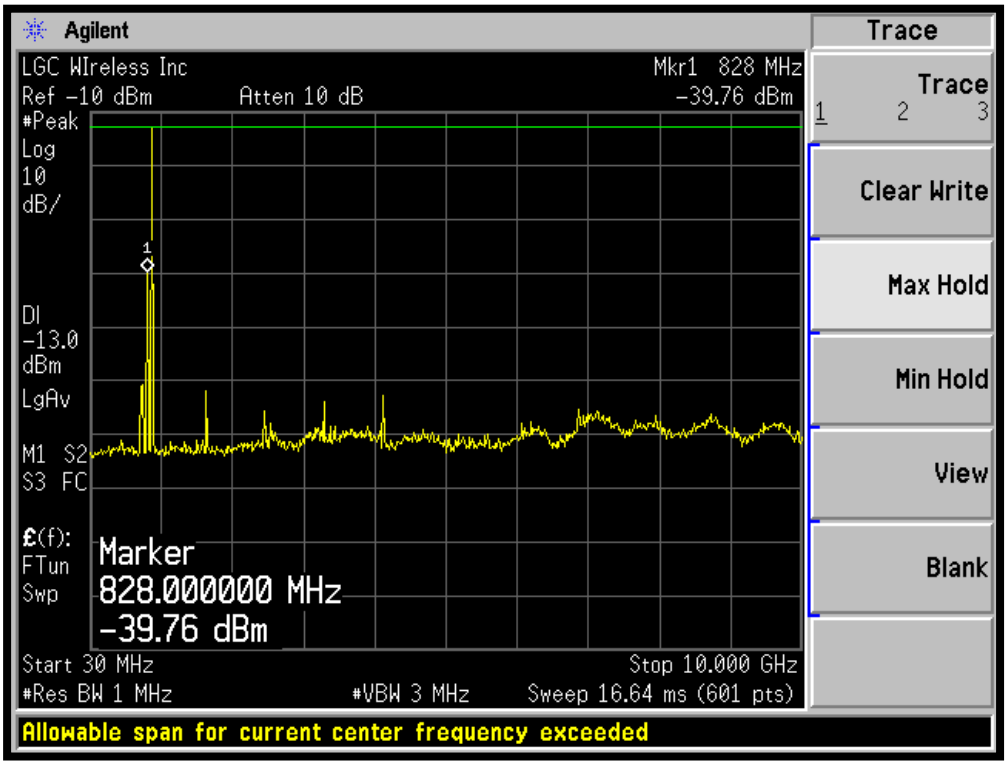
Low Channel (Uplink)



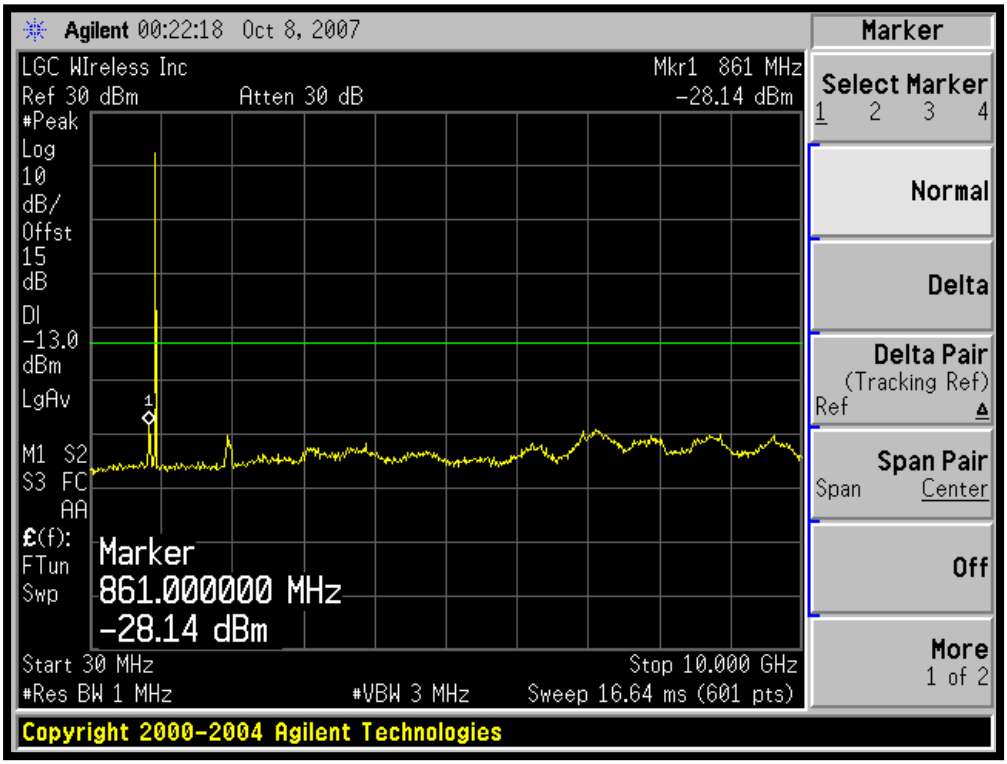
Middle Channel (Downlink)



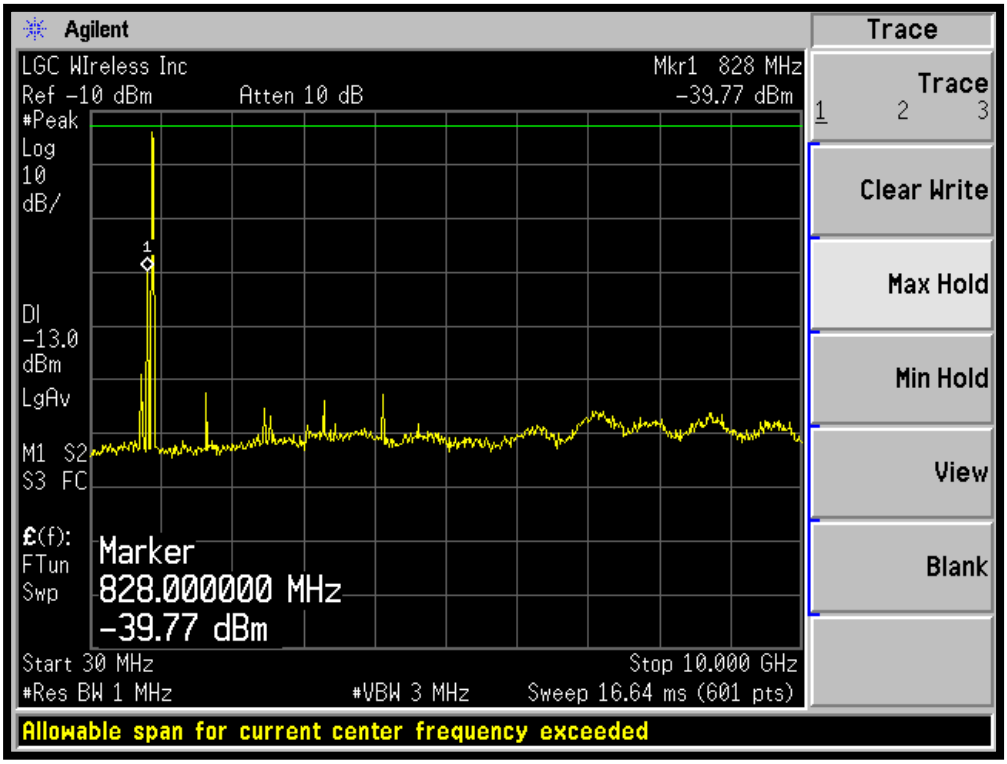
Middle Channel (Uplink)



High Channel (Downlink)



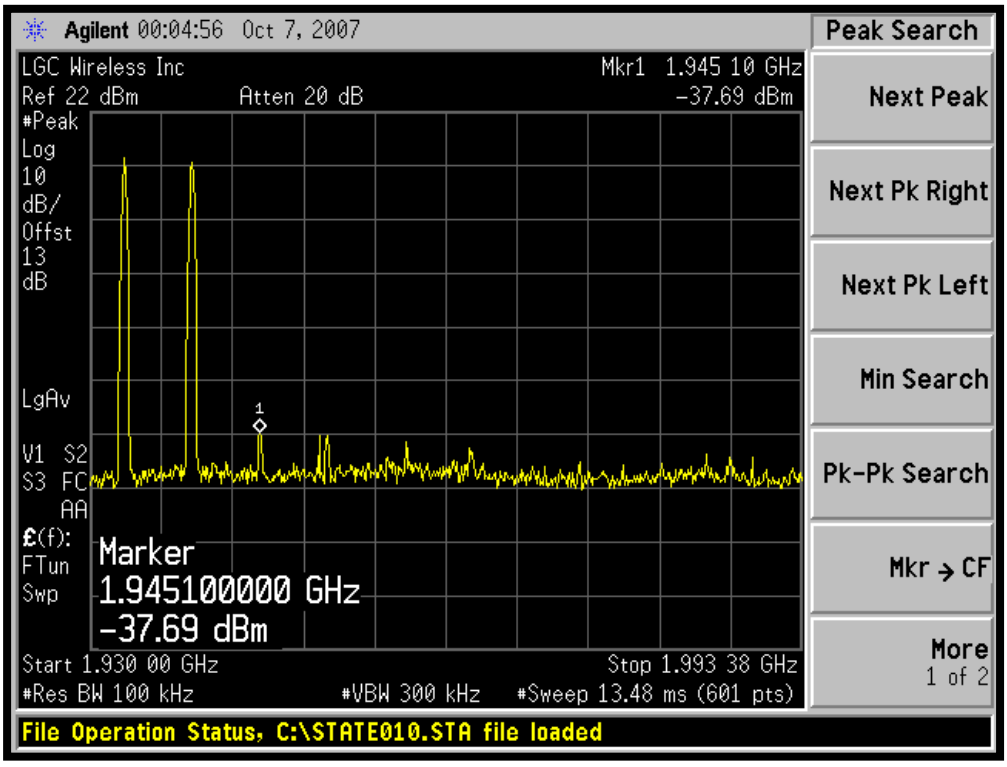
High Channel (Uplink)



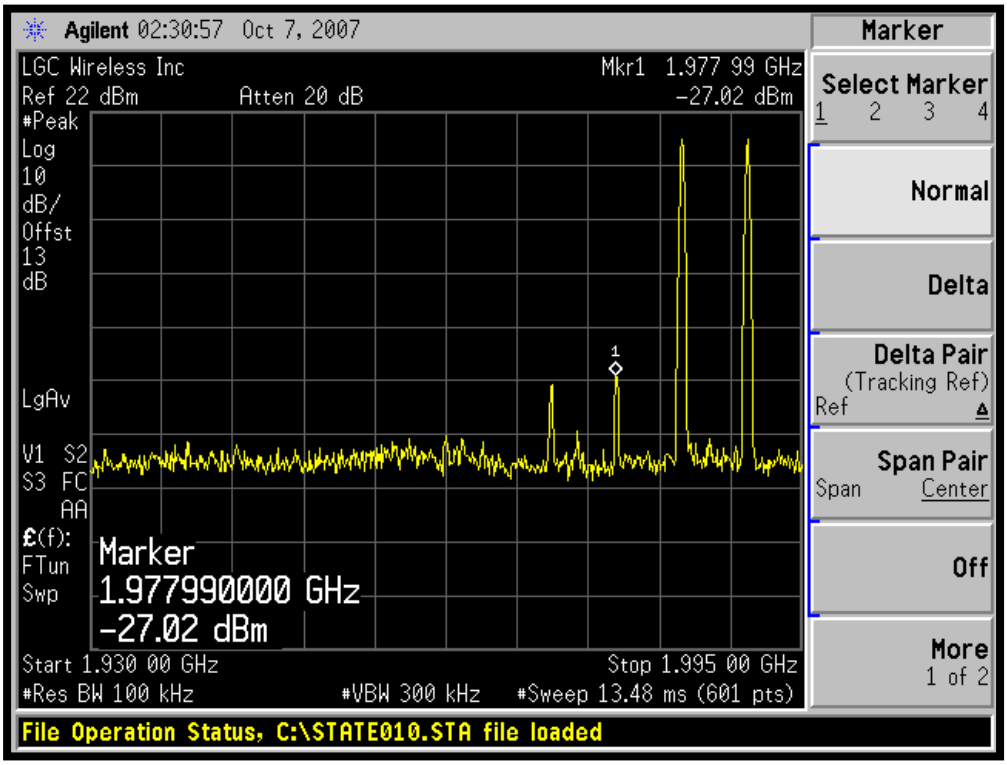
Plots of Inter-modulation Spurious Emission for PCS Band

GSM (Downlink)

Low band Edge

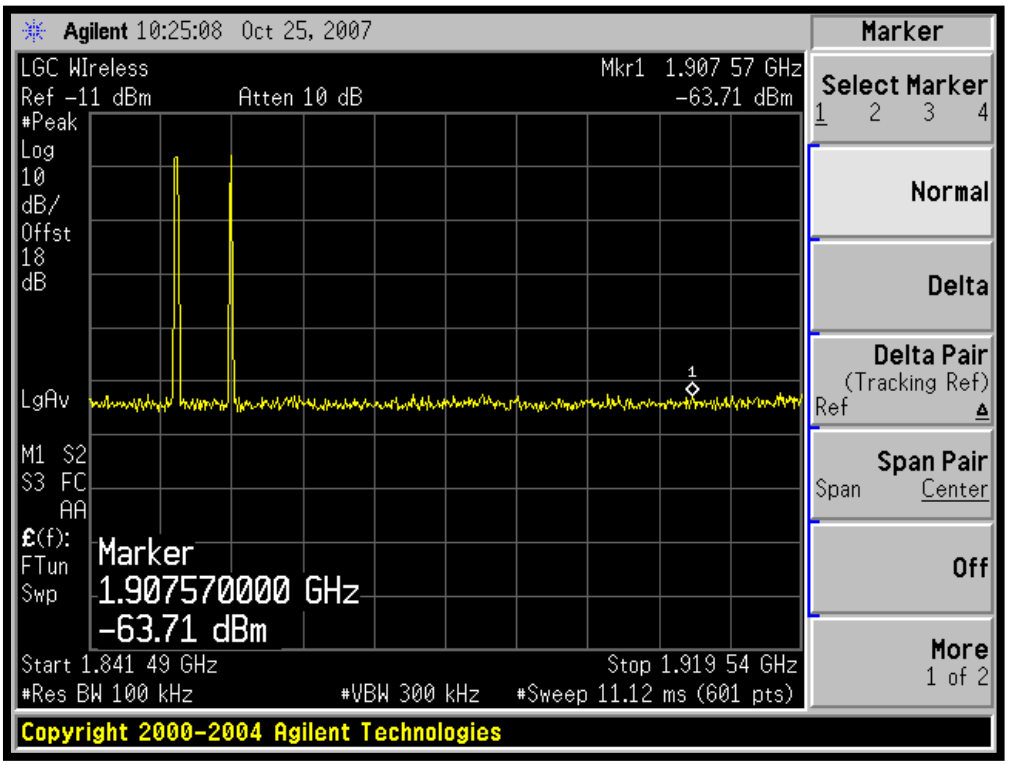


High Band Edge

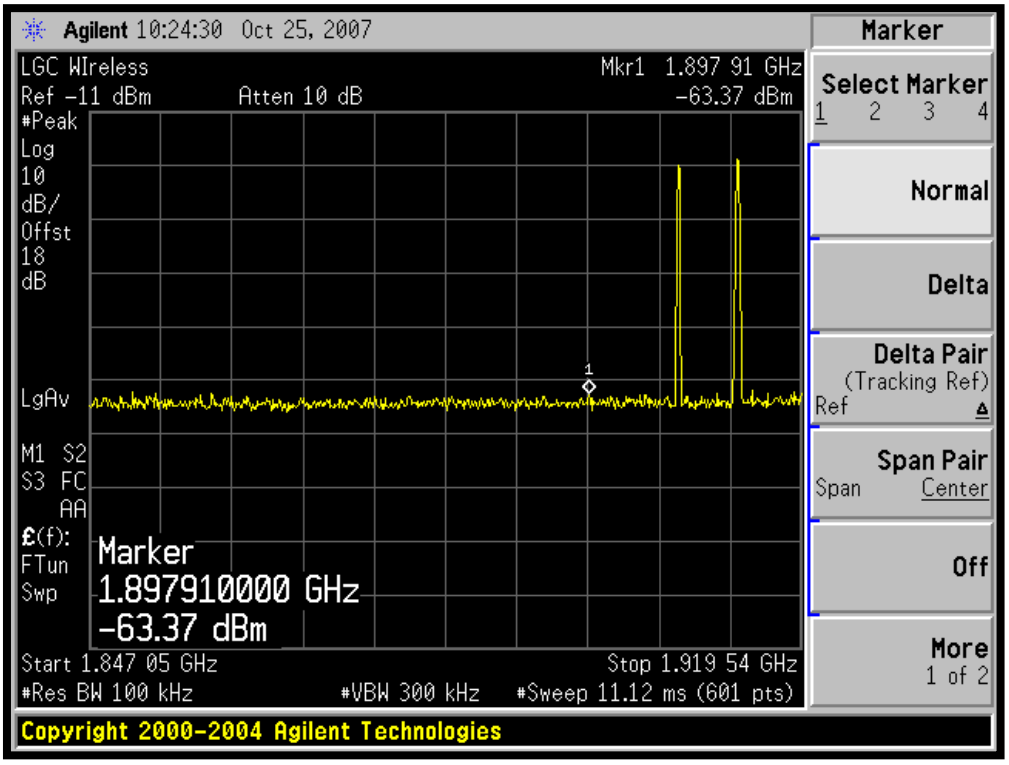


GSM (Uplink)

Low Band Edge

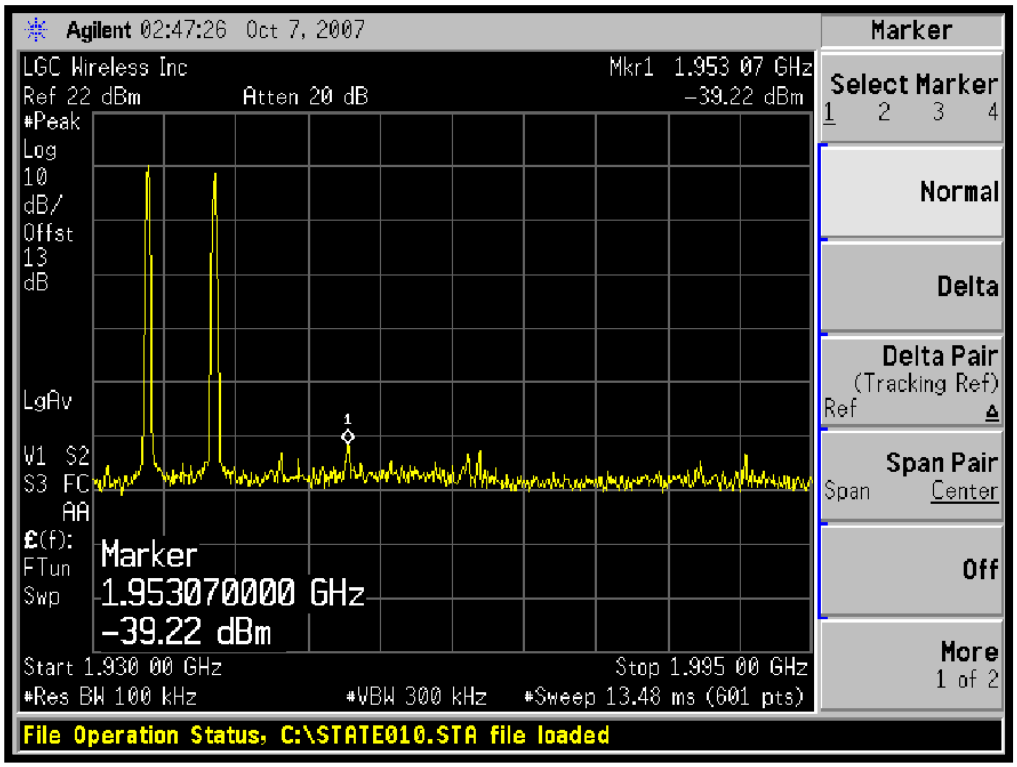


High Band Edge

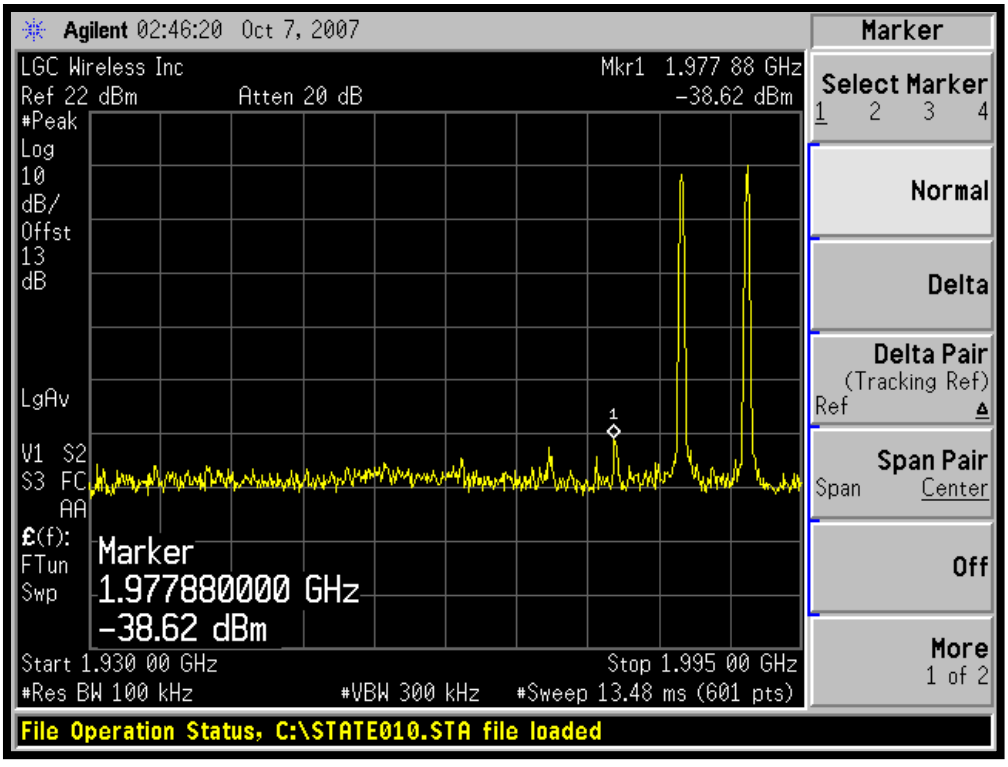


TDMA (Downlink)

Low Band Edge

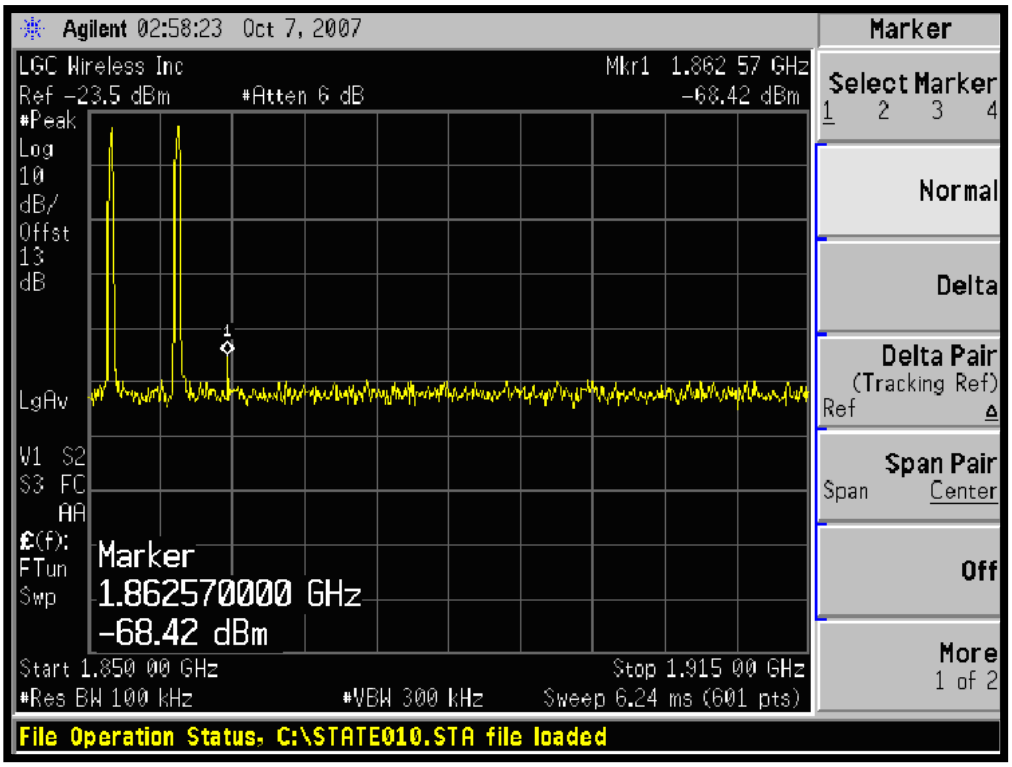


High Band Edge

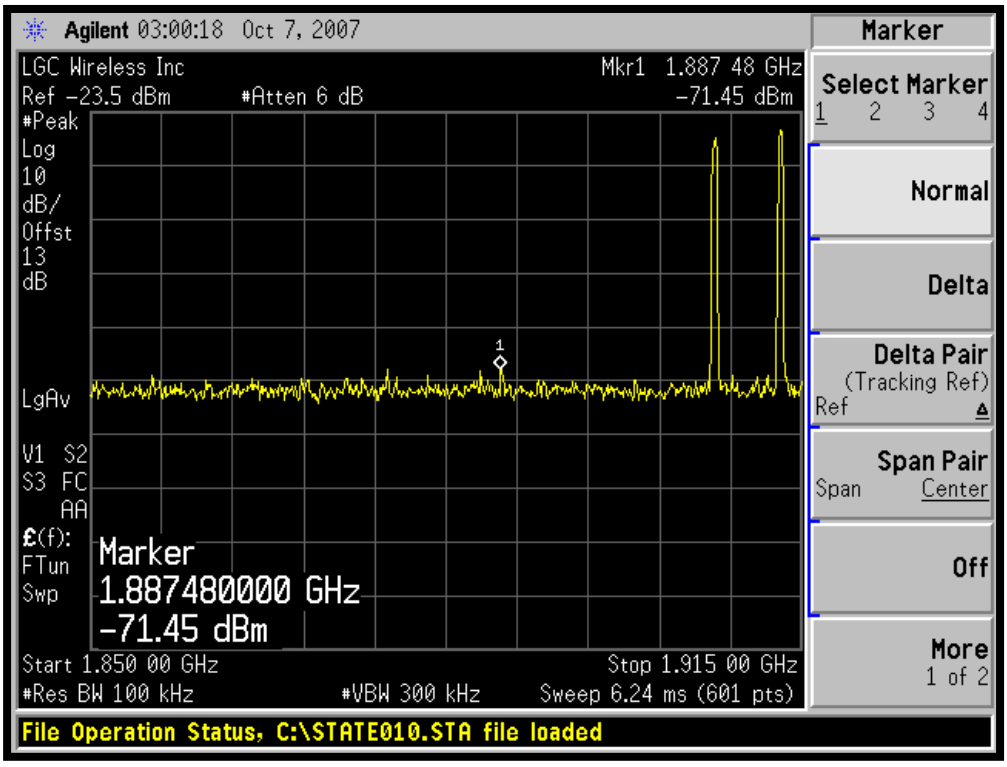


TDMA (Uplink)

Low Band Edge

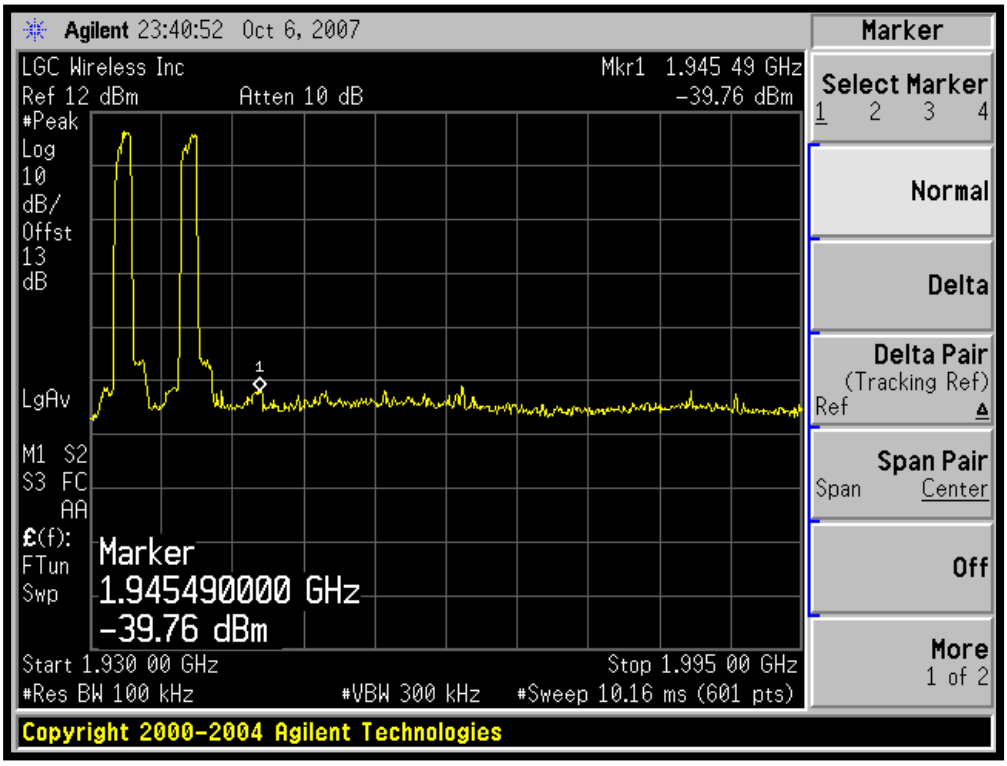


High Band Edge

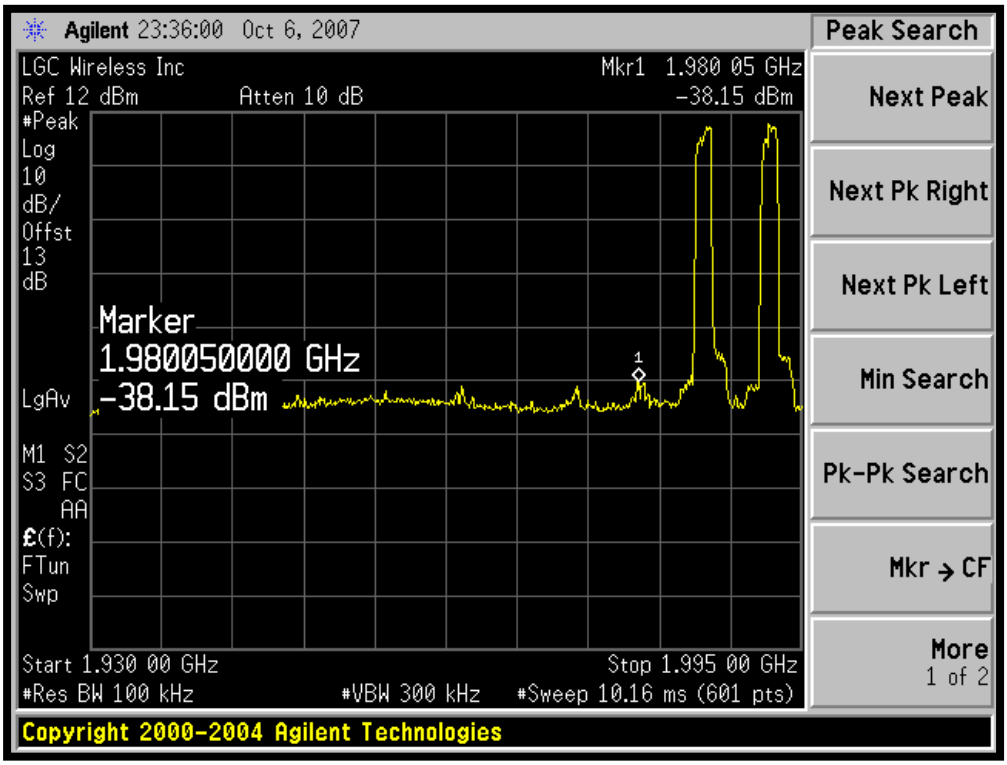


CDMA (Downlink)

Low Band Edge

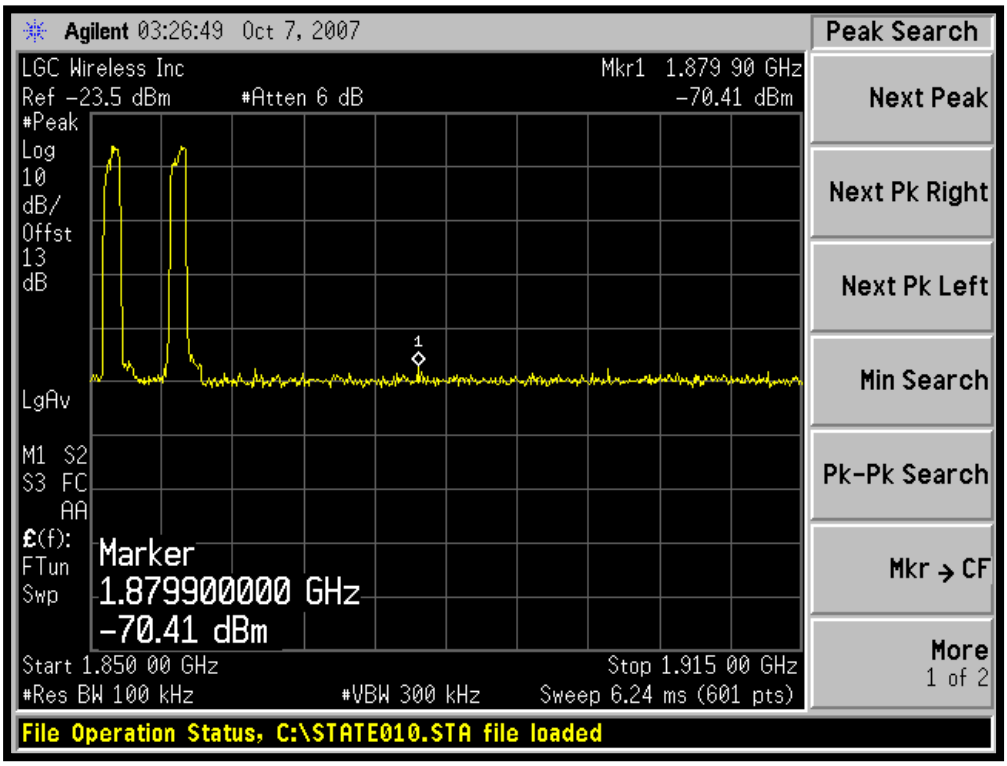


High Band Edge

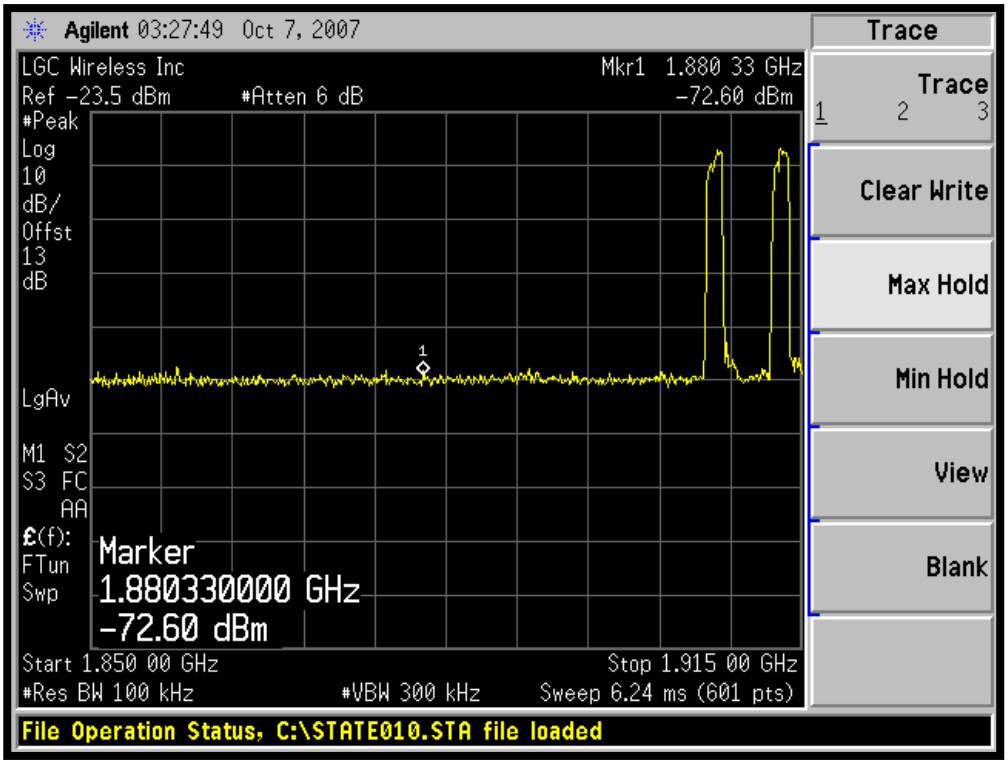


CDMA

Low Band Edge



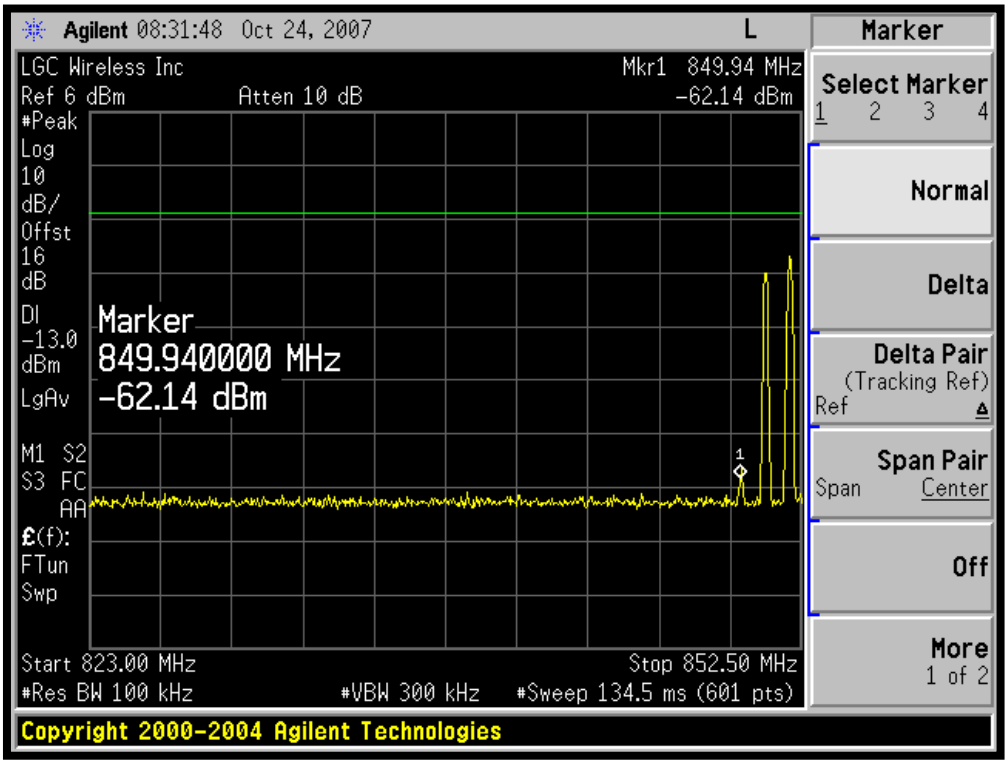
High Band Edge



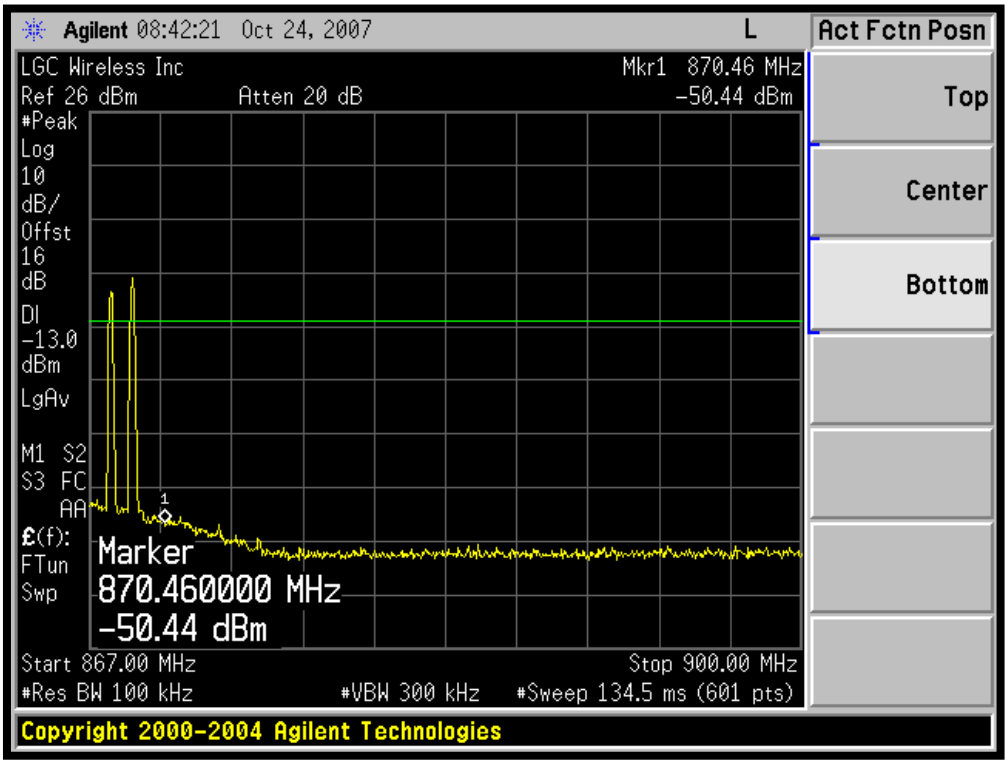
Plots of Inter-modulation Spurious Emission for IDEN Bands

IDEN 800 (Downlink)

Low Band Edge

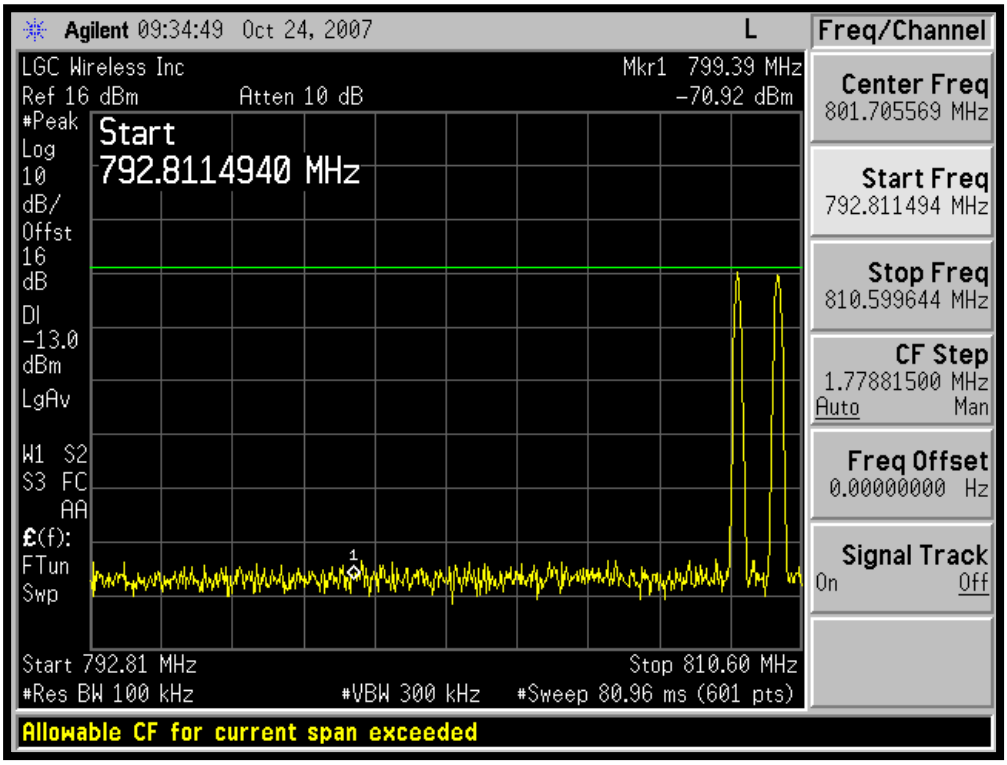


High Band Edge

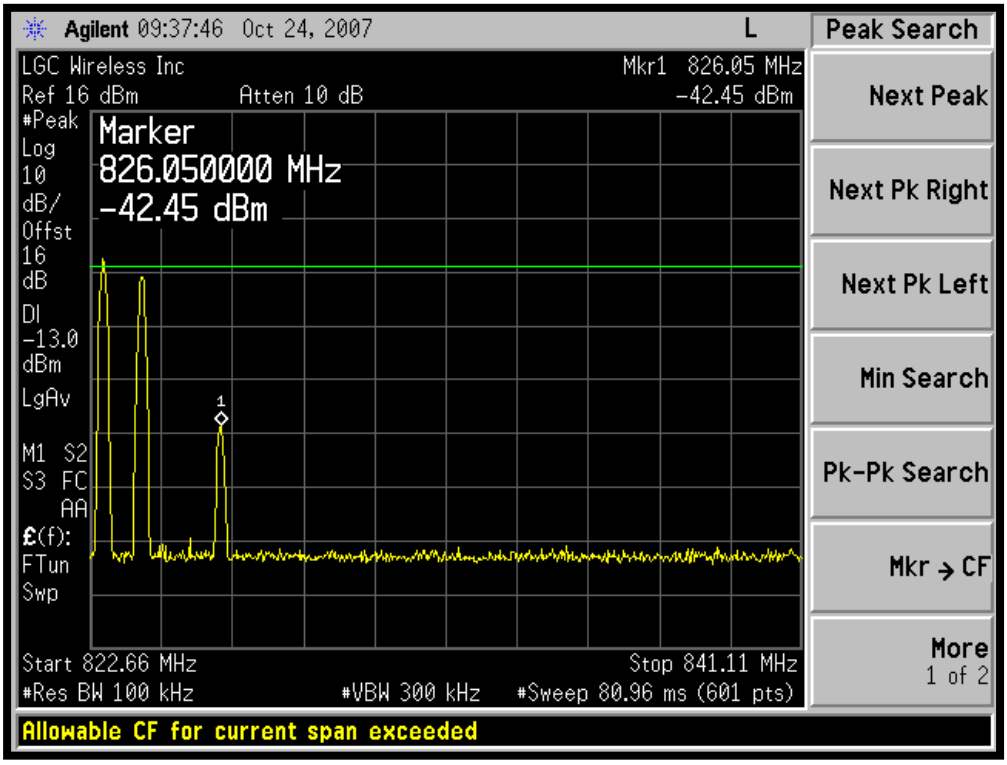


IDEN 800 (Uplink)

Low Band Edge

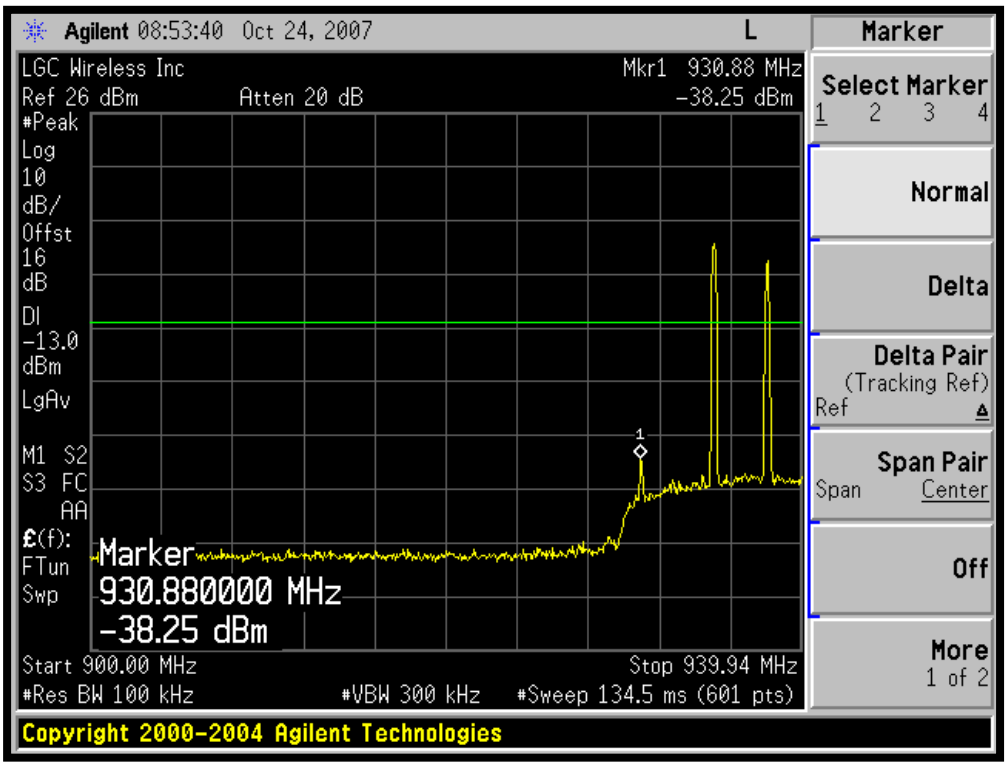


High Band Edge

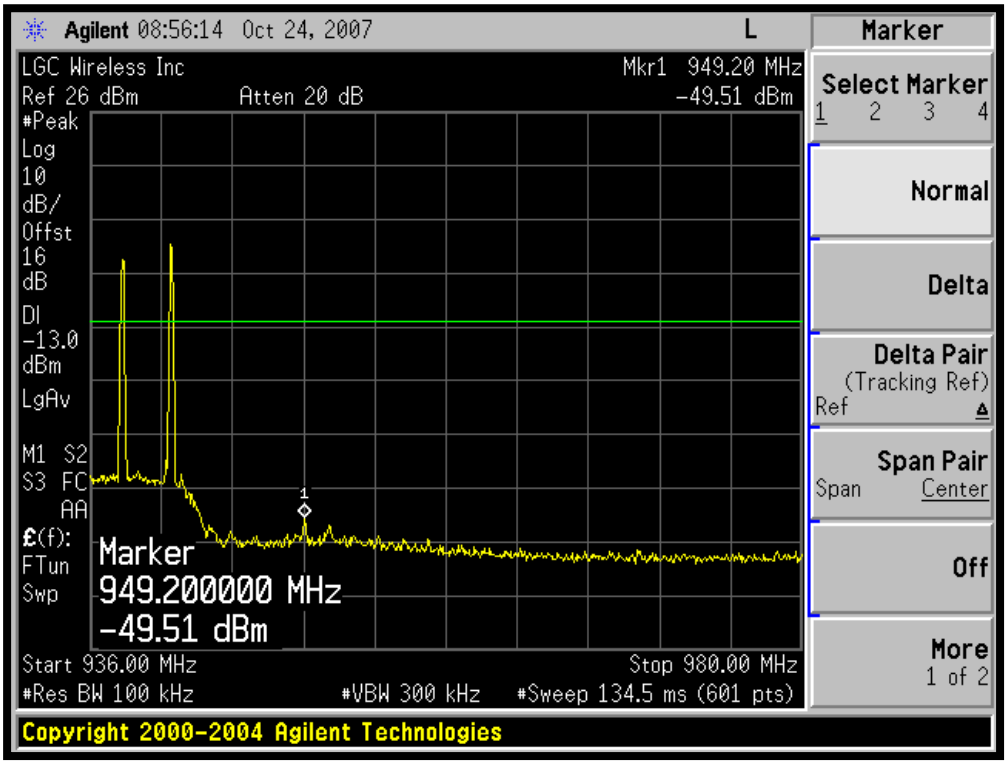


IDEN 900 (Downlink)

Low Band Edge

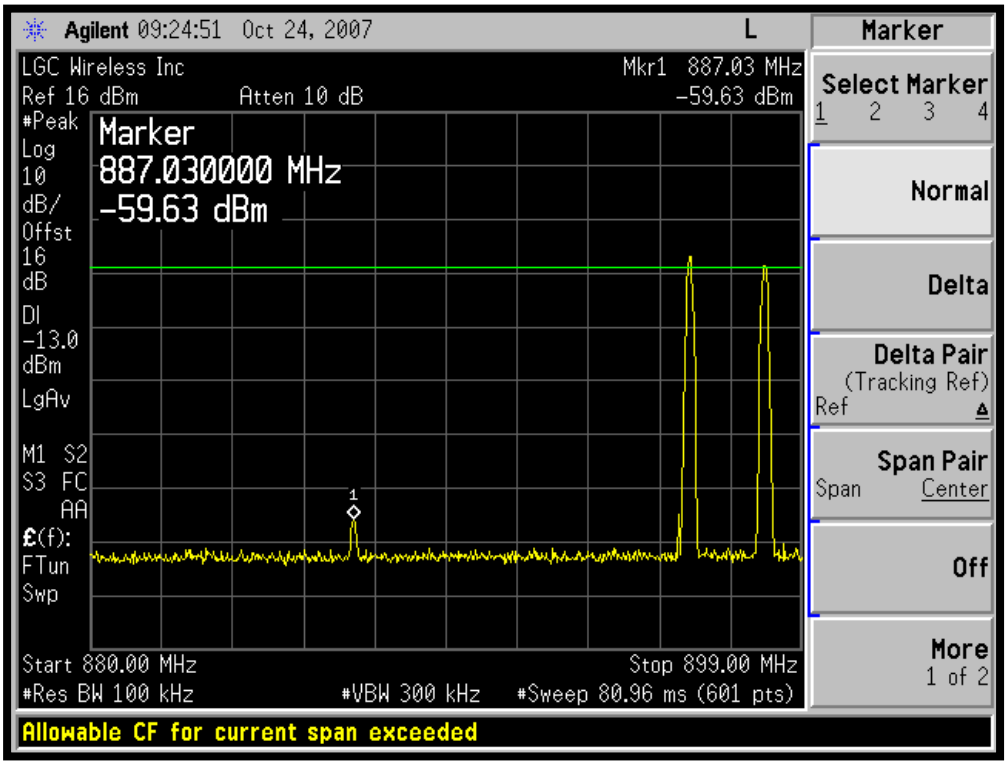


High Band Edge

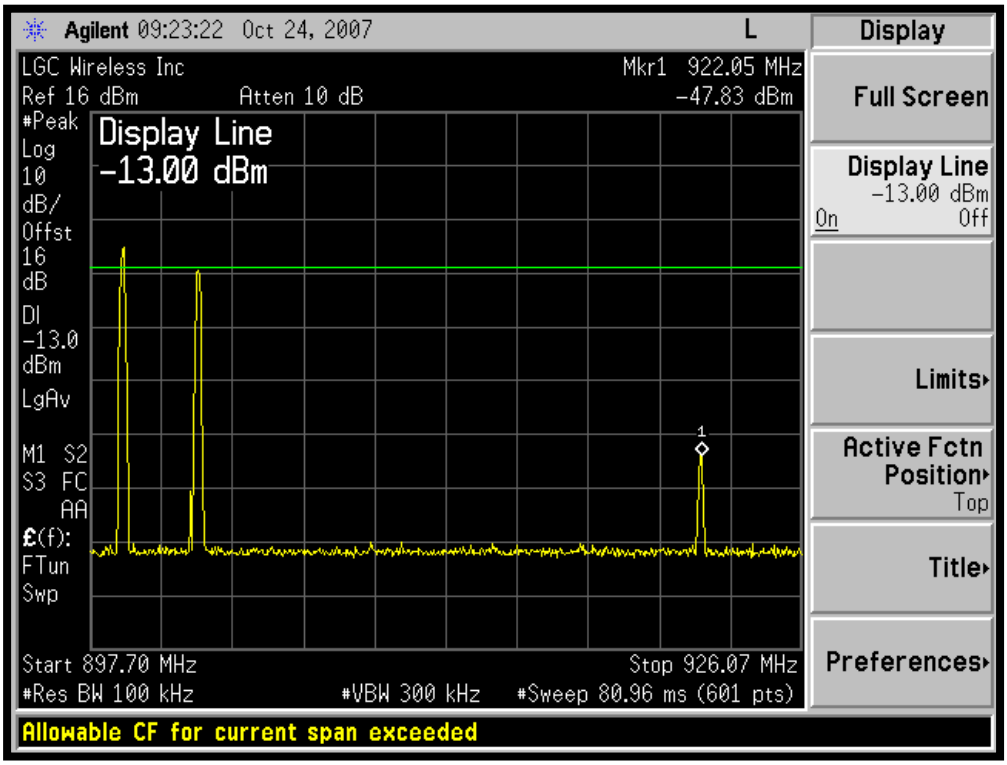


IDEN 900 (Uplink)

Low Band Edge



High Band Edge



Note: Fundamental frequencies was blocked with notch filter

10 §2.1055 (a), §2.1055 (d), §24.235, & § 90.213 – FREQUENCY STABILITY

10.1 Applicable Standard

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

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

According to §90.213, unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Frequency range (MHz)	Fixed and base stations
806–809	[14]1.0
809–824	[14]1.5
851–854	1.0
854–869	1.5
896–901	[14]0.1
902–928	2.5
902–928[13]	2.5
929–930	1.5
935–940	0.1

10.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

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

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

10.2.1 Environmental Conditions

Temperature:	20°C
Relative Humidity:	58 %
ATM Pressure:	101.8 kPa

** The testing was performed by Choon Sian Ooi on 2007-10-16*

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Tenney	Oven, Temperature	VersaTenn	12.222-193	2007-06-21

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

10.4 Test Results

PCS Band:

Frequency Stability versus Temperature

Reference Frequency: 1962.5 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Measured Frequency (MHz)	Error (ppm)
50	120	1962.50015	0.076433121
40	120	1962.50012	0.061146497
30	120	1962.50013	0.066242038
20	120	1962.50016	0.081528662
10	120	1962.50013	0.066242038
0	120	1962.50016	0.081528662
-10	120	1962.50019	0.096815287
-20	120	1962.50017	0.086624204
-30	120	1962.50016	0.081528662

Frequency Stability versus Voltage

Reference Frequency1962.5 MHz, Limit: 2.5ppm			
Power Supplied (VDC)	Environment Temperature (°C)	Measured Frequency (MHz)	Error (ppm)
102	20	1962.50016	0.081528662

IDEN 800

Frequency Stability versus Temperature

Reference Frequency: 860 MHz, Limit: 1.5ppm			
Environment Temperature (°C)	**Power Supplied (VDC)**	**Frequency Measure with Time Elapsed**	
		Measured Frequency (MHz)	**Error (ppm)**
50	120	860.000081	0.094186047
40	120	860.000061	0.070930233
30	120	860.000041	0.047674419
20	120	860.000012	0.013953488
10	120	860.000061	0.070930233
0	120	860.000052	0.060465116
-10	120	860.000061	0.070930233
-20	120	860.000075	0.087209302
-30	120	860.000082	0.095348837

Frequency Stability versus Voltage

Reference Frequency: 860 MHz, Limit: 2.5ppm			
Power Supplied (VDC)	**Environment Temperature (°C)**	**Measured Frequency (MHz)**	**Error (ppm)**
102	20	860.000052	0.060465116

IDEN 900

Frequency Stability versus Temperature

Reference Frequency: 938 MHz, Limit: 0.1ppm			
Environment Temperature (°C)	**Power Supplied (VDC)**	**Frequency Measure with Time Elapsed**	
		Measured Frequency (MHz)	**Error (ppm)**
50	120	938.0000181	0.019296375
40	120	938.0000114	0.012153518
30	120	938.0000115	0.012260128
20	120	938.0000112	0.011940299
10	120	938.0000121	0.012899787
0	120	938.0000132	0.014072495
-10	120	938.0000169	0.018017058
-20	120	938.0000172	0.018336887
-30	120	938.0000182	0.019402985

Frequency Stability versus Voltage

Reference Frequency: 938 MHz, Limit: 2.5ppm			
Power Supplied (VDC)	**Environment Temperature (°C)**	**Measured Frequency (MHz)**	**Error (ppm)**
102	20	938.0000132	0.014072495

11 2-11-04/EAB/RF OUT OF BAND REJECTION

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

11.1.1 Environmental Conditions

Temperature:	19 °C
Relative Humidity:	58 %
ATM Pressure:	101.8 kPa

** The testing was performed by Choon Sian Ooi 2007-10-25.*

11.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwartz	Receiver, EMI Test	ESCI 3	100338	2007-04-05

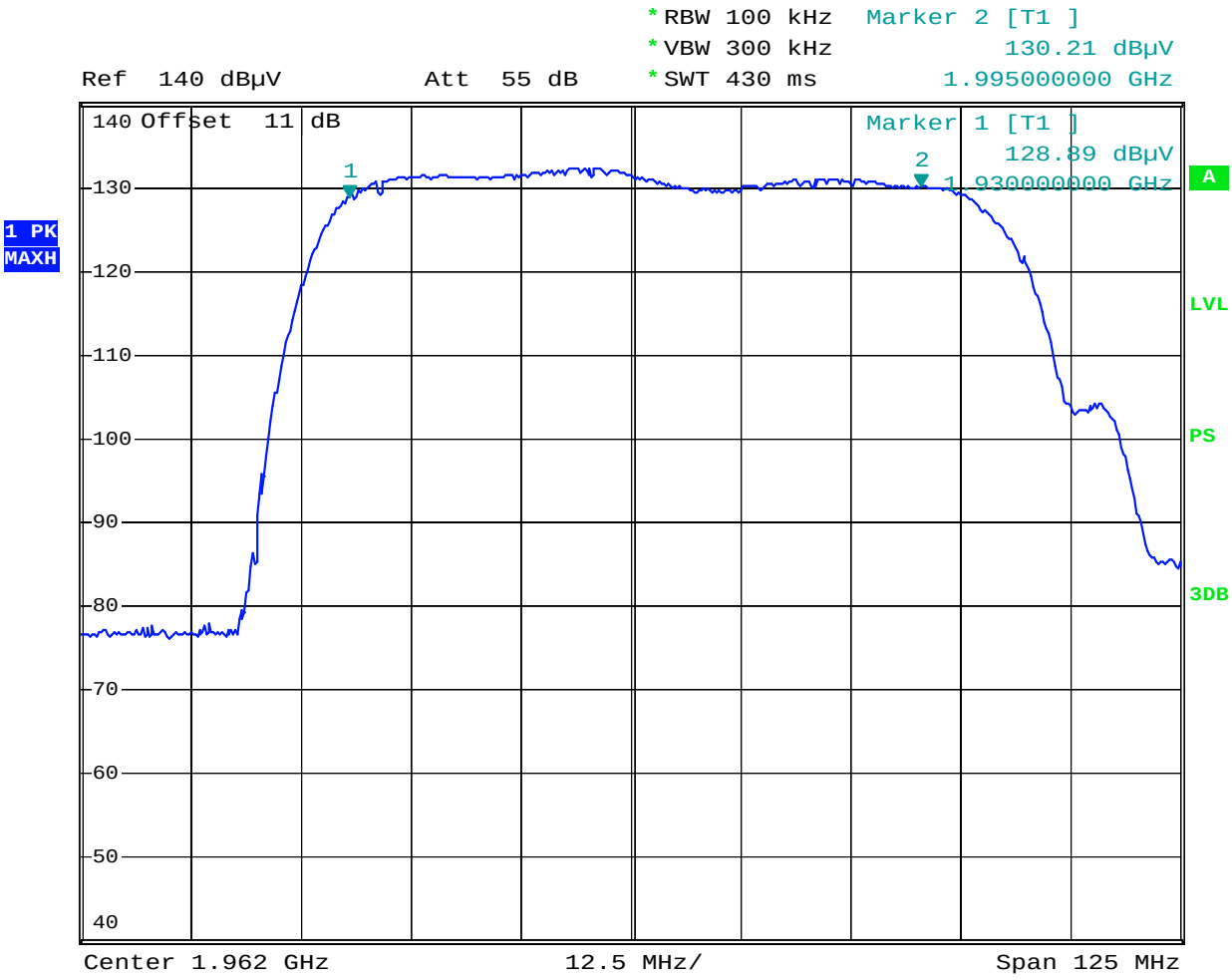
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

11.3 Test Results

Please refer to the following plots.

Plots of frequency response for PCS Band

(Downlink)



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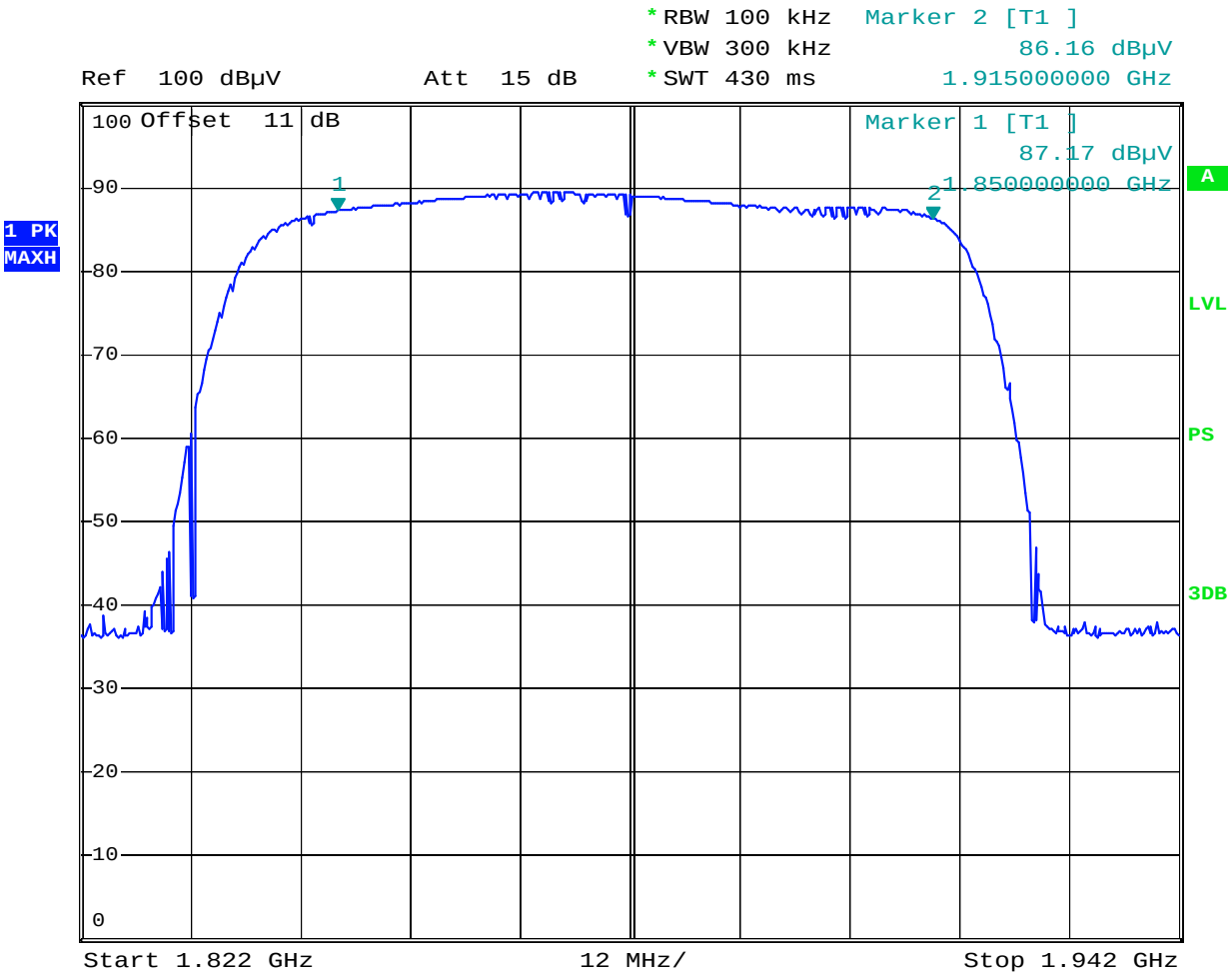

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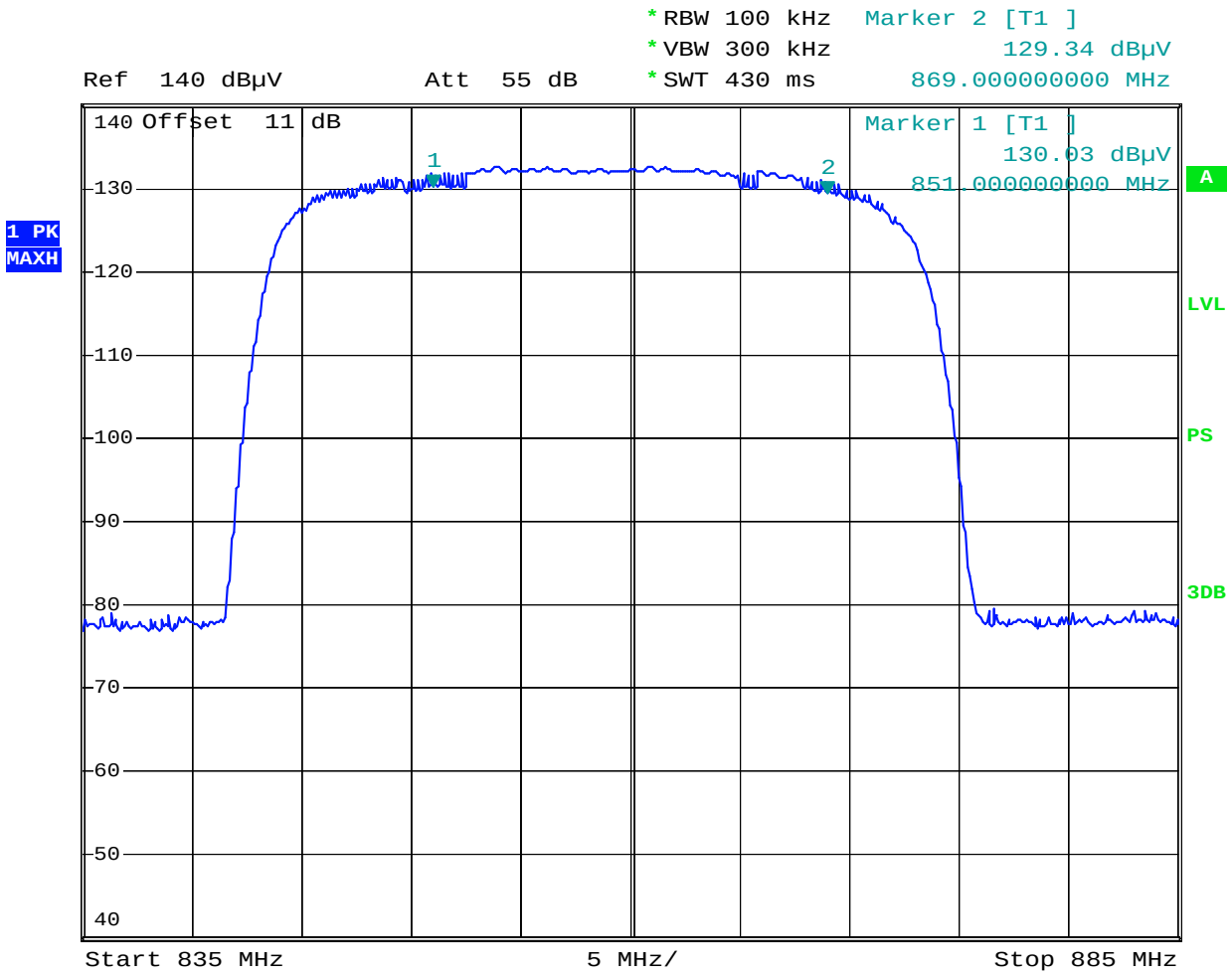
Plots of Frequency Response for IDEN 800 Bands

(Downlink)



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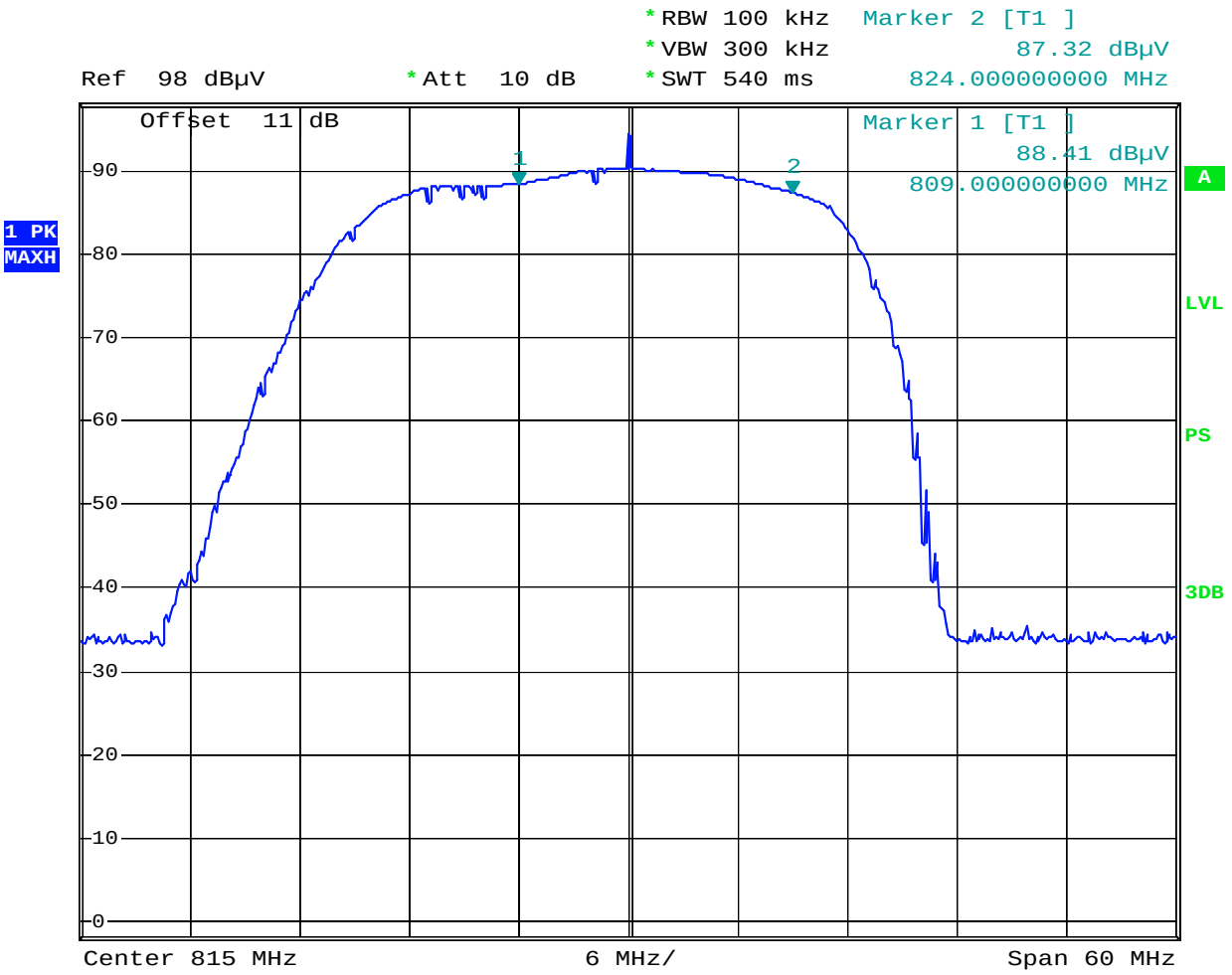
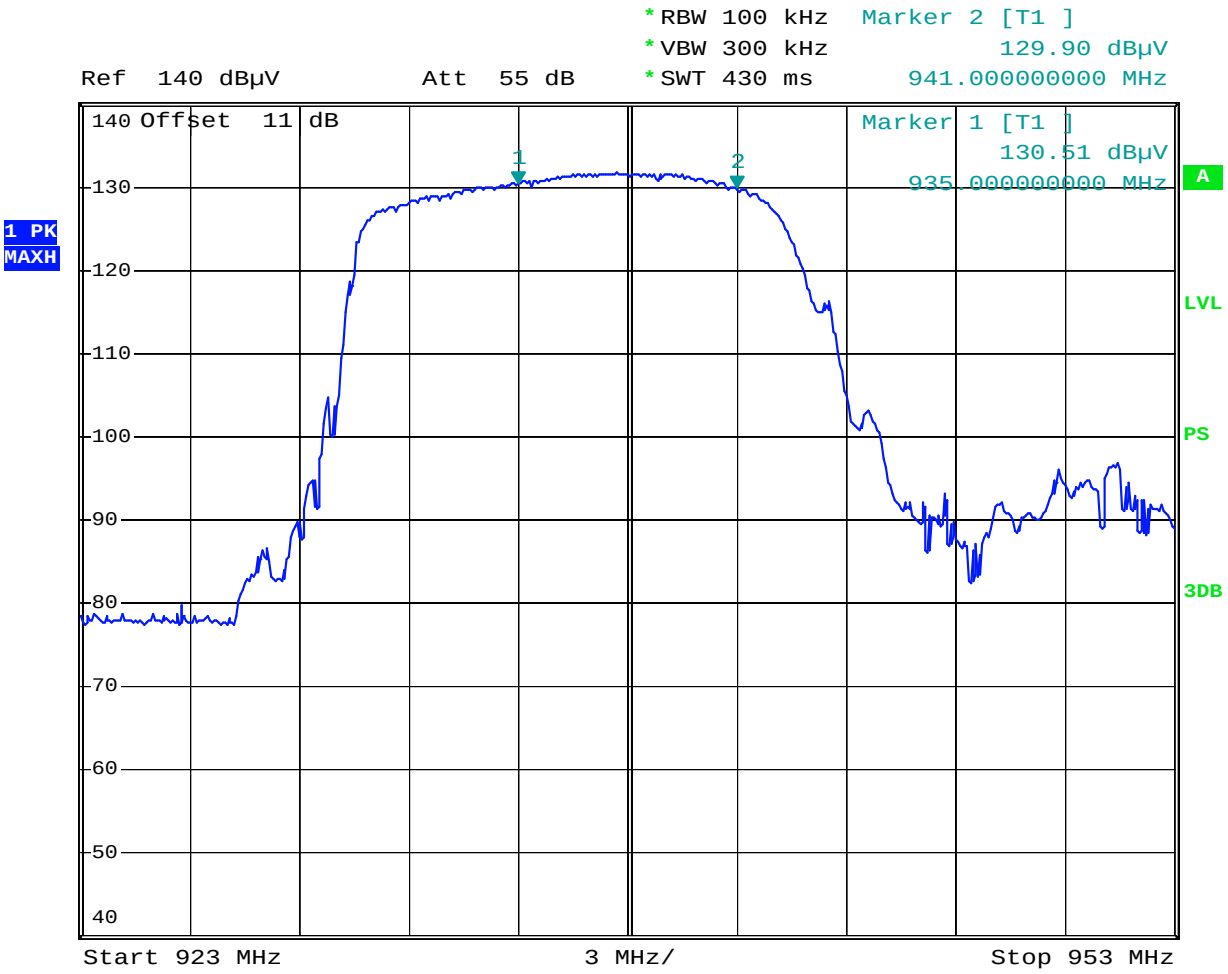


Date: 26.OCT.2007 15:17:36

Plots of Frequency Response for IDEN 900 Bands

(Downlink)



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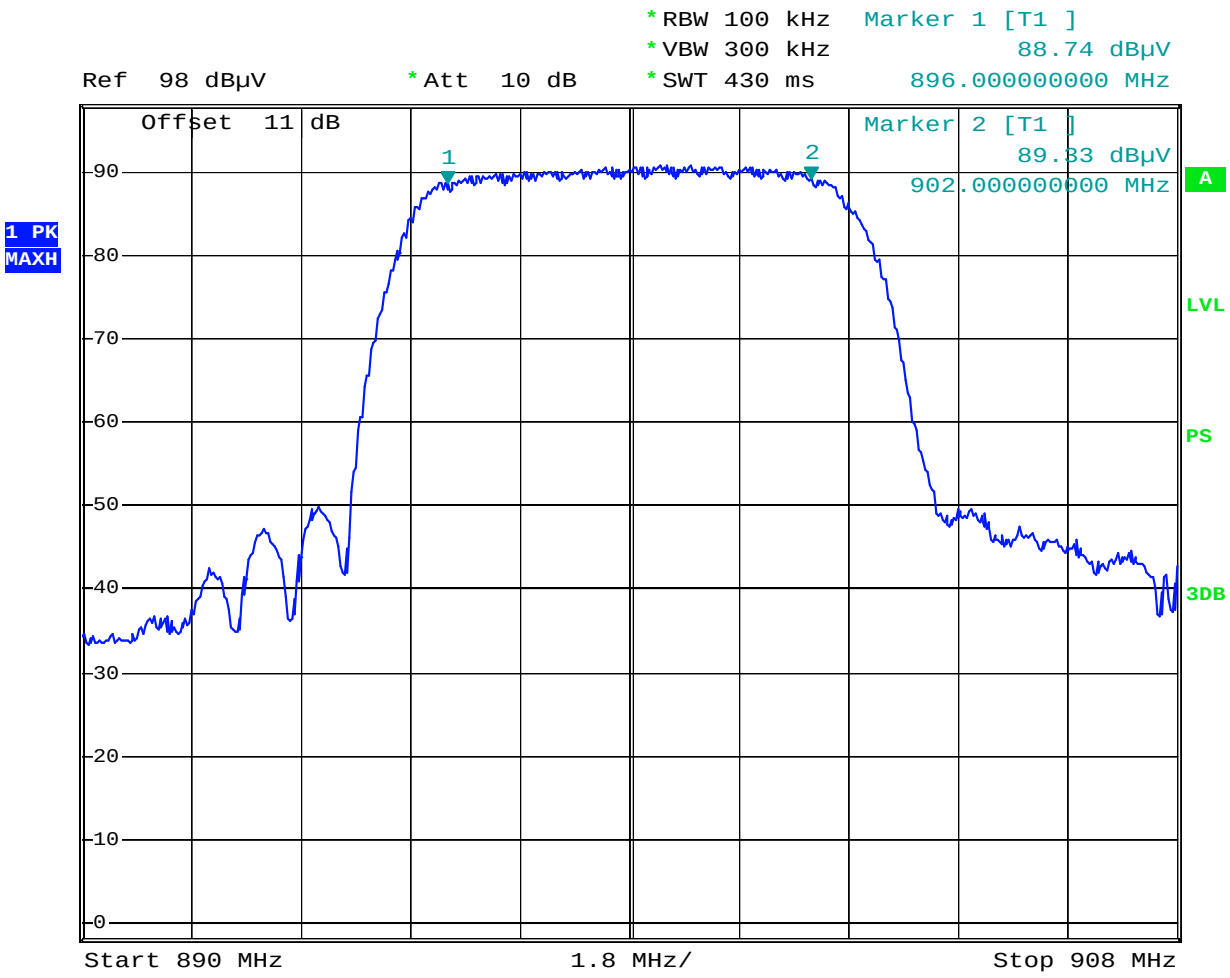
(Uplink)



Date: 26.OCT.2007 15:34:00

12 FCC §15.107 – CONDUCTED EMISSIONS

12.1 Applicable Standard

As per FCC §15.107: Conducted Limits

(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 the following table, as measured using a 50 μH/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

12.2 EUT Setup

The conducted emissions tests were performed in the 10-meter chamber, using the setup in accordance with ANSI C63.4-2003 measurement procedures. The specifications used were in accordance with FCC Part 15 Standard, Class A limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to a 120 V, 60 Hz AC line power source.

12.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics Company	Line Impedance Network	TYPE 252-50-R-24-N	0511205	2007-07-07
Rohde & Schwarz	EMI Test Receiver	ESCI 3	100337	2007-02-24

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

12.4 Test Procedure

During conducted emissions testing, the power cord of the EUT was connected to the main outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emission readings from the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Average readings are labeled "AV," and Quasi-peak readings are labeled "QP," in the test data hereinafter.

12.5 Environmental Conditions

Temperature:	22.3 º C
Relative Humidity:	35.3 %
ATM Pressure:	102.5 kPa

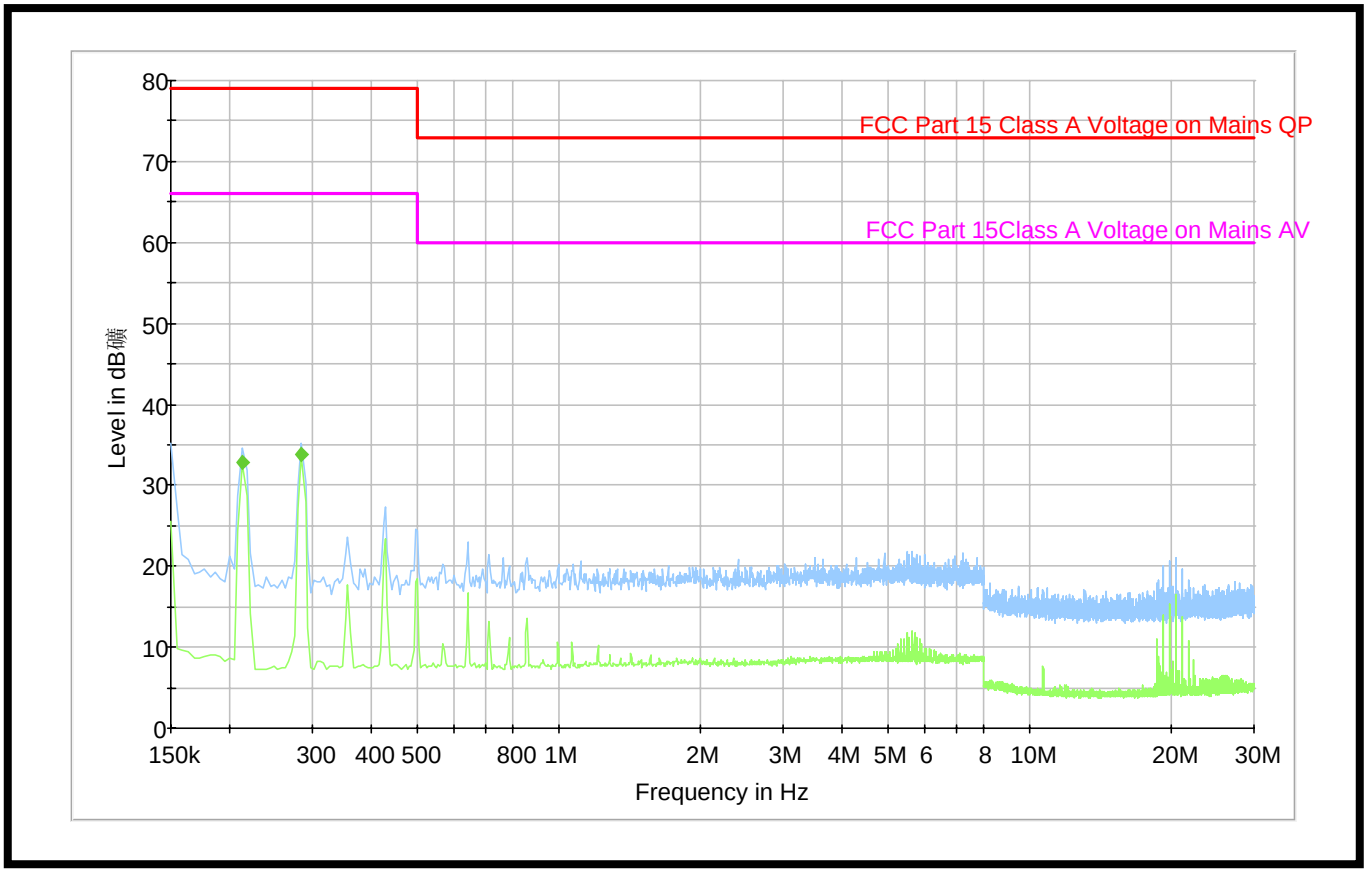
**Testing was performed by Choon Sian Ooi on 2007-10-08.*

12.6 Summary of Test Results

According to the recorded data, the EUT complied with FCC §15.107 Standard, Class A limits, and had the worst margin reading of:

12.7 Conducted Emissions Test Plots and Data

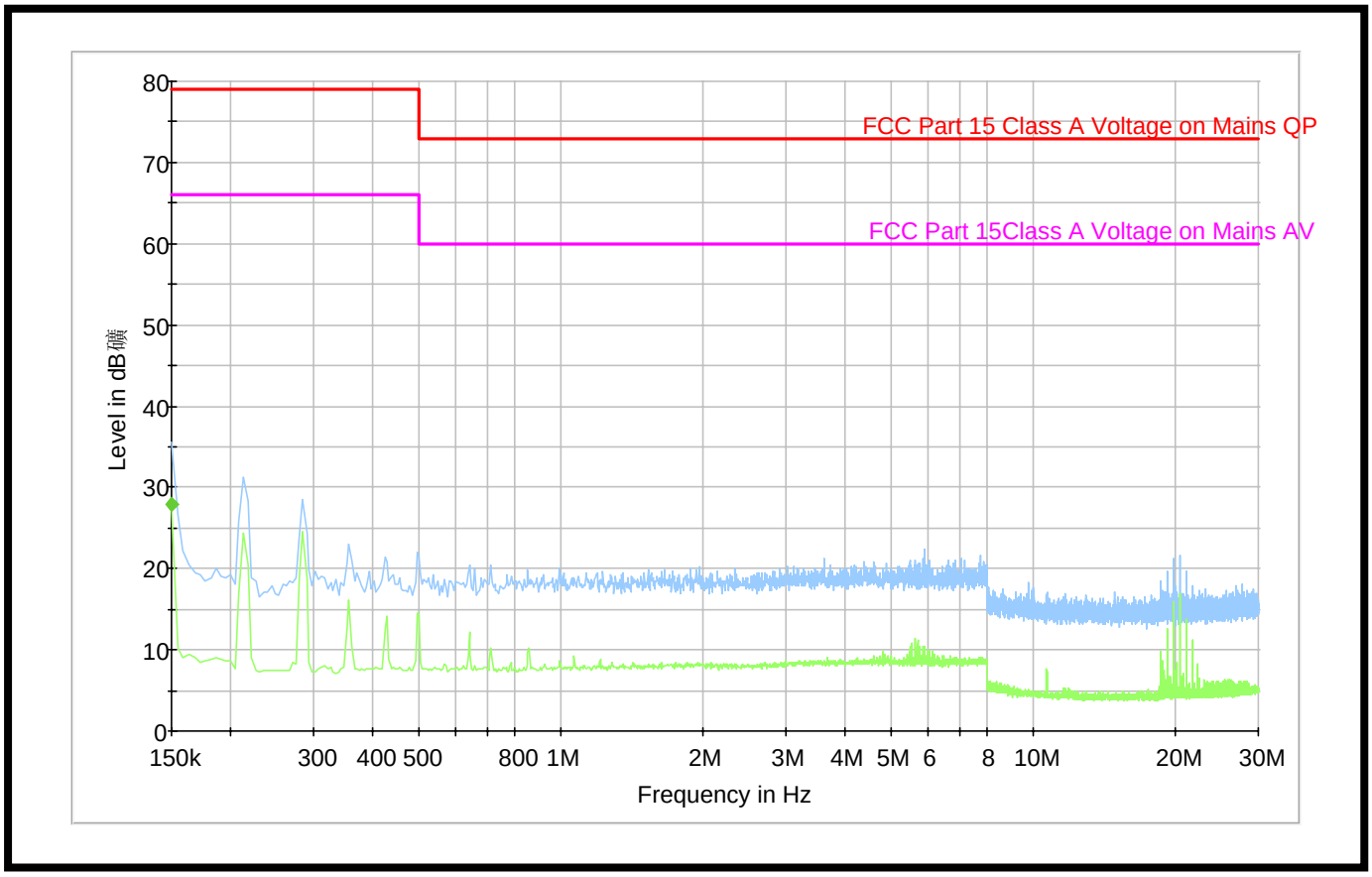
12.7.1 120 V, 60 Hz - Hot (Main Hub)



Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (H/N)	Limit (dBµV)	Margin (dB)
0.213000	32.8	H	66.0	-33.2
0.285000	33.8	H	66.0	-32.2

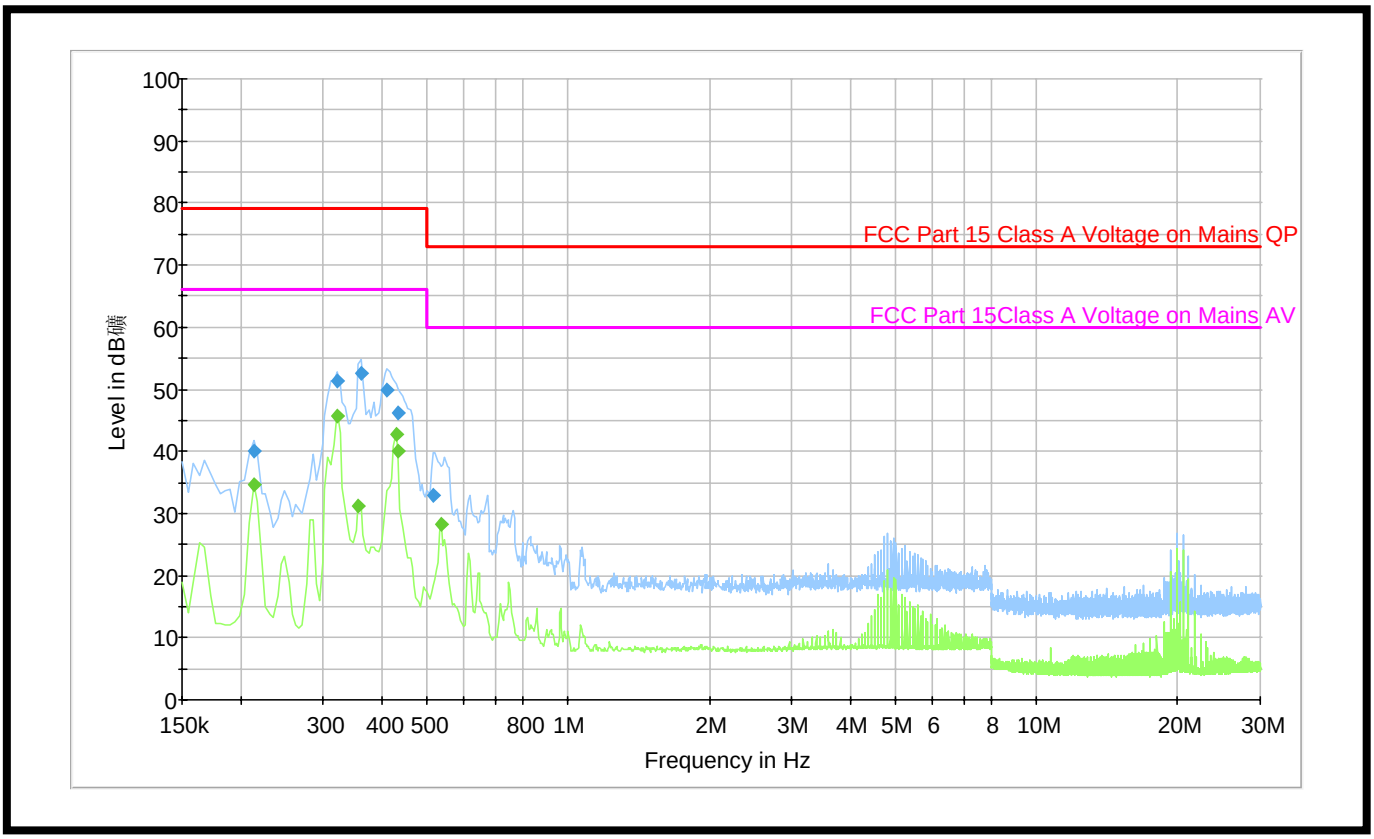
12.7.2 120 V, 60 Hz - Neutral (Main Hub)



Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (H/N)	Limit (dBµV)	Margin (dB)
0.150000	27.8	N	66.0	-38.2

12.7.3 120 V, 60 Hz - Hot (Expansion Hub)



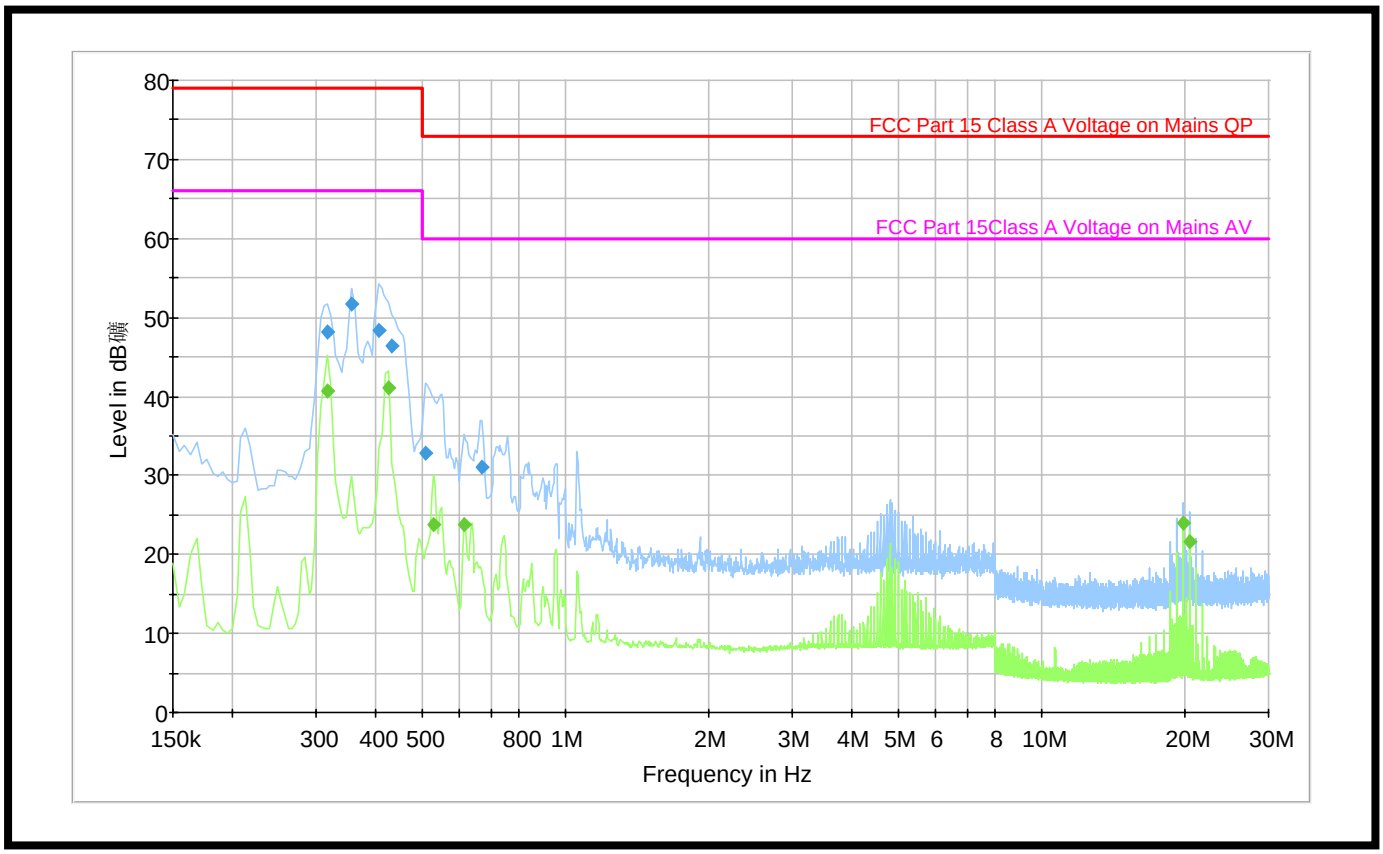
QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Line (H/N)	Limit (dBµV)	Margin (dB)
0.213000	40.1	H	79.0	-38.9
0.321000	51.5	H	79.0	-27.5
0.361500	52.7	H	79.0	-26.3
0.411000	49.9	H	79.0	-29.1
0.433500	46.2	H	79.0	-32.8
0.514500	32.9	H	73.0	-40.2

Average Measurements

Frequency (MHz)	Average (dBµV)	Line (H/N)	Limit (dBµV)	Margin (dB)
0.213000	34.6	H	66.0	-31.4
0.321000	45.7	H	66.0	-20.3
0.357000	31.3	H	66.0	-34.7
0.429000	42.7	H	66.0	-23.4
0.433500	39.9	H	66.0	-26.1
0.537000	28.3	H	60.0	-31.7

12.7.4 120 V, 60 Hz – Neutral (Expansion Hub)



QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Line (H/N)	Limit (dBµV)	Margin (dB)
0.316500	48.2	N	79.0	-30.8
0.357000	51.6	N	79.0	-27.4
0.406500	48.4	N	79.0	-30.6
0.433500	46.4	N	79.0	-32.6
0.510000	32.8	N	73.0	-40.2
0.667500	31.0	N	73.0	-42.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line (H/N)	Limit (dBµV)	Margin (dB)
0.316500	40.6	N	66.0	-25.4
0.424500	41.0	N	66.0	-25.0
0.528000	23.7	N	60.0	-36.3
0.613500	23.9	N	60.0	-36.1
19.900500	23.9	N	60.0	-36.1
20.517000	21.5	N	60.0	-38.5

13 FCC §15.109 – RADIATED EMISSIONS

13.1 Applicable Standard

As per FCC §15.109: Radiated Emission Limits

(a) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission (MHz)	Field Strength (µV/m)
30-88	90
88-216	150
216-960	210
Above 960	300

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement."

Note: The CISPR 22 §6 Standard, Class A limits are applied to the test data hereinafter.

13.2 Test Setup

The radiated emissions tests were performed in the 10-meter test chamber, using the setup in accordance with CISPR 22 Ed. 5.2 b: 2006 measurement procedures. The specifications used were in accordance with CISPR 22 Ed. 5.2 b: 2006 Standard, Class A limits for measurements up to 1 GHz and FCC Part 15 Rules, Class A limits for frequencies above 1 GHz.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to a -48V DC Power Source.

13.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonama Instrument	Pre- Amplifier	317	260407	N/R
Sunol Science	Broadband Antenna	JB3 Antenna	A020106-2	2007-04-05
Rohde & Schwarz	EMI Test Receiver	ESCI 3	100337	2007-03-08
Sunol Science	System Controller	SC99V	011003-1	N/R

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

13.4 Test Procedure

Maximization procedure was performed on the six (6) highest emissions readings to ensure the EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings were performed only when an emission was found to be marginal (within -4 dB of specification limits).

13.5 Environmental Conditions

Temperature:	22.3 º C
Relative Humidity:	35.3 %
ATM Pressure:	102.5 kPa

**Testing was performed by Choon Sian Ooi on 2007-10-08.*

13.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor, and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class A. The equation for margin calculation is as follows:

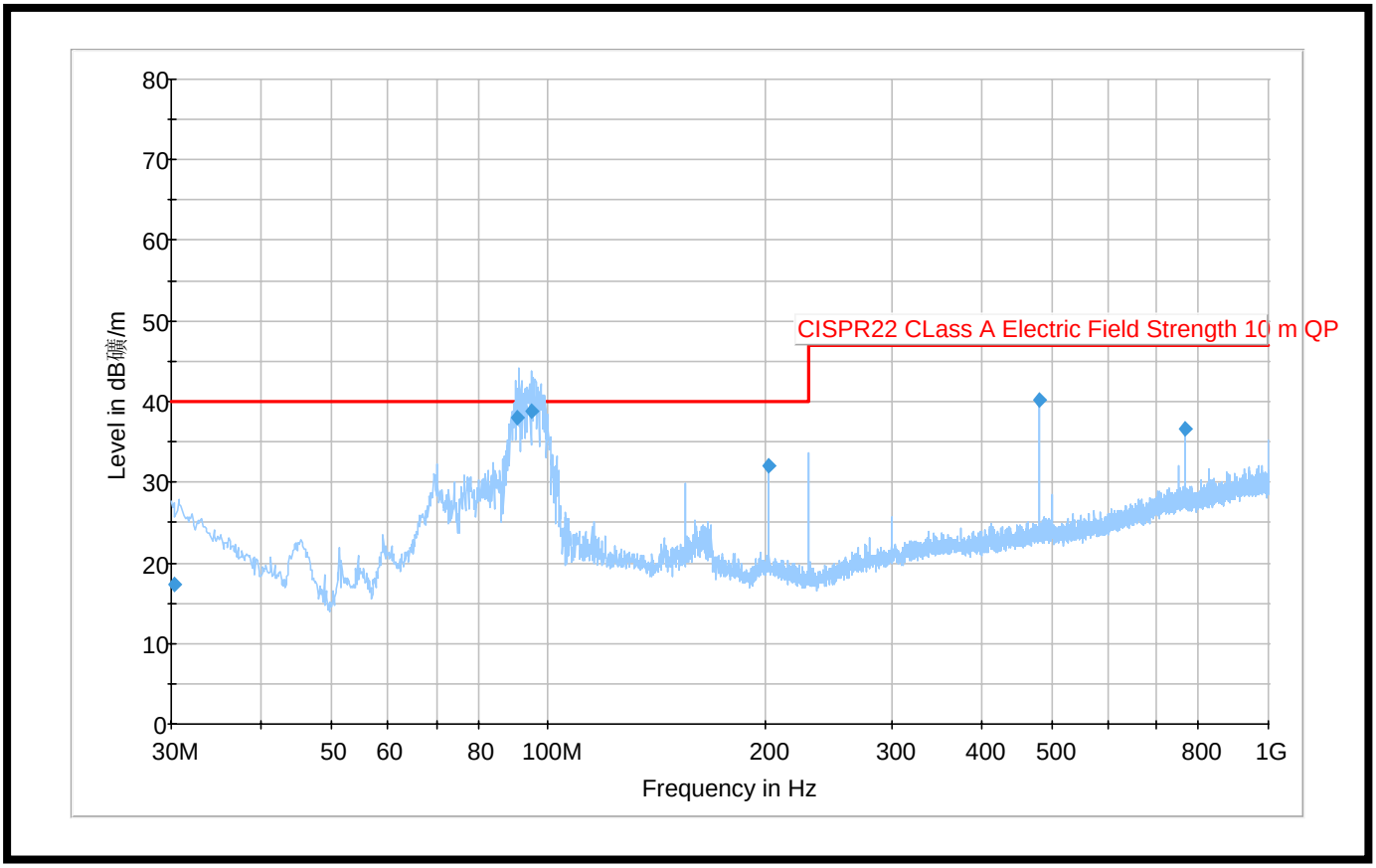
Margin = Corrected Amplitude - Class A Limit

13.7 Summary of Test Results

According to the recorded data, the EUT complied with CISPR 22 Standard, Class A limits, and had the worst margin readings (when calculated using CISPR 22 Standard, Class A limits) of:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-1.2	94.868750	Horizontal	30 to 1000 MHz

Test Data



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Limit (dBµV/m)	Margin (dB)
94.868750	38.8	215.8	H	124.0	40	-1.2
90.631250	38.1	213.6	H	124.0	40	-1.9
481.475000	40.2	184.7	H	11.0	47	-6.8
765.078750	36.6	111.8	V	45.0	47	-10.4
201.998750	32.1	184.8	V	194.0	40	-7.9
30.307500	17.3	220.9	V	332.0	40	-22.7