Lab Code: 200167-0

FCC PART 22H

TEST AND MEASUREMENT REPORT

For

Public Wireless, Inc.

1325A McCandless Dr. Bldg. A,

Milpitas, CA 95035, USA

FCC ID: V7DCM150D01

Report Type:	**Product Type:**
Original Report	Fiber Fed Repeater

Test Engineer: Jack Liu

Report Number: R0912151-22

Report Date: 2009-12-23

Reviewed By: Boni Baniqued, Senior RF Engineer

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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0912151-22	Original Report	2009-12-23

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The Public Wireless, Inc. product, CM150D-01 RU, FCC ID: V7DCM150D01or the "EUT" as referred to in this report, is a solution allows much faster time to service turn up and reduced operating costs when compared to competing DAS offerings. It does this through an innovative design that allows leveraging existing aerial cable utility infrastructure and rights of way. This reduces the permitting and construction overheads and schedules, allowing deployments to start in as little as 90 days from customer authorization to proceed.
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General Specifications:

• Operating Frequency:
GSM/EDGE
Downlink: 869-894 MHz; Uplink: 824-849 MHz
WCDMA
Downlink: 870-890 MHz; Uplink: 825-845 MHz
• Emission Designator: GXW, F9W
• Modulation: GSM, EDGE, WCDMA

Item		CM150D-01 RU
Enclosure Type		Strand Mount Outdoor Enclosure
Dimension (mm)	W x H x D	25in x 12in x 11in
	Weight	65 lbs
Power Supply		65 – 90VAC QSW
Power Connector		F Connector
RF In/Out Port		N Type Female
Optic Connector Type		Corning Opti-Fit Adapter
Optic Wavelength		FWD: 1310nm / RVS: 1550nm
Operating Temperature		0℃ ~ 50℃

1.2 Mechanical Description

The EUT dimension is approximately 63.5cm (L) x 30.48cm (W) x 27.94cm (H) and weighs approximately 29.45 kg.

** The test data gathered are from typical production sample, serial number: R0912151-2, provided by BACL.*

1.3 EUT Photo

Please see additional photos in Exhibit C

1.4 Objective

This type approval report is prepared on behalf of Public Wireless, Inc. in accordance with Part 2, Subpart J, Part 22 Subpart H, 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.

1.5 Related Submittal(s)/Grant(s)

No Related Submittals

1.6 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 22 Subpart H - Public Mobile Services

Applicable Standards: TIA/EIA 98-C, TIA/EIA603-C and 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.

1.7 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 +2.0 dB for Conducted Emissions tests and +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.

1.8 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 EUT Exercise Software

NA, signal was sent through EUT using a signal generator, device was set to normal operating mode.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Power Supply and Line Filters

Manufacturer	Description	Model Number	Serial Number
Power Tronics	OMEGA Broadband Power Supply	OM-115/60-15	-

2.5 Local Support Equipment List and Details

Manufacture	Description	Model Number	Serial Number
Public Wireless	Central hub units	CM150D -01 DU	N/A
IBM	Laptop	T40	99-PCNYB

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Fiber cable	>3m	EUT CM150D-01RU	EUT CM150D-01DU
Coax Cable	>3m	Power supply	EUT CM150D-01RU
USB to Com cable	<3m	Laptop	EUT CM150D-01DU
RF cable	< 3m	Signal Generator	Input/ EUT CM150D-01DU CM150D-01RU
RF cable	< 3m	Output/ EUT CM150D-01DU CM150D-01RU	Spectrum analyzer

3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Tests	Results
§ 2.1046 § 22.913 (a)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	N/A*
§ 2.1049 § 22.905; § 22.917	Occupied Bandwidth /Out of Band Emissions	Compliant
§ 2.1053 § 22.917	Spurious Radiated Emissions	Compliant
§ 2.1051 § 22.917	Spurious Emissions at Antenna Terminals	Compliant
§ 22.917	Band Edge	Compliant
§ 2.1055 § 22.355	Frequency Stability	N/A
§2.1091	RF Exposure	Compliant

Note: *According to FCC § 2.1047(d) and part 22H, there is no specific requirement for digital modulation and no oscillator circuit, therefore modulation characteristic is not presented.

4 FCC §2.1046 & §22.913(a) – RF OUTPUT POWER

4.1 Applicable Standard

According to §22.913 (a), the maximum effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.

4.2 Test Procedure

Conducted:

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

4.3 Test Environmental Conditions

Temperature:	12~16 °C
Relative Humidity:	35~42 %
ATM Pressure:	101.9~102.7 kPa

** The testing was performed by Jack Liu on 2009-12-17 ~ 2009-12-19*

4.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2008-10-14
Agilent	Analyzer, Spectrum	E4440A	US45303156	2009-07-23

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

4.5 Summary of Test Results

Mode		Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Limit (Watt)
GSM	850 MHz Downlink	Low	869.2	36.16	4.13	500
		Middle	881.6	37.74	5.94	500
		High	891.4	36.05	4.03	500
EDGE	850 MHz Downlink	Low	869.2	36.21	4.18	500
		Middle	881.6	37.90	6.17	500
		High	891.4	36.03	4.01	500
WCDMA	850 MHz Downlink	Low	871.5	37.38	5.47	500
		Middle	881.4	37.64	5.81	500
		High	887.5	37.46	5.57	500

5 FCC §2.1047 - MODULATION CHARACTERISTIC

5.1 Applicable Standard

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

5.2 Test Result

N/A

6 FCC §2.1049 & §22.917 - OCCUPIED BANDWIDTH

6.1 Applicable Standard

Requirements: CFR 47, Section 2.1049, Section 22.917.

6.2 Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at least 1% of emission bandwidth (Standard GSM, EDGE, and WCDMA) and the 26 dB & 99% bandwidth was recorded.

6.3 Test Environmental Conditions

Temperature:	12~16 °C
Relative Humidity:	35~42 %
ATM Pressure:	101.9~102.7 kPa

** The testing was performed by Jack Liu on 2009-12-17 ~ 2009-12-19*

6.4 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27
HP	Signal Generator	8648C	3426A00417	2009-07-23
R & S	Signal Generator	SMIQ03	849192/0085	2008-10-14

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

6.5 Summary of Test Results

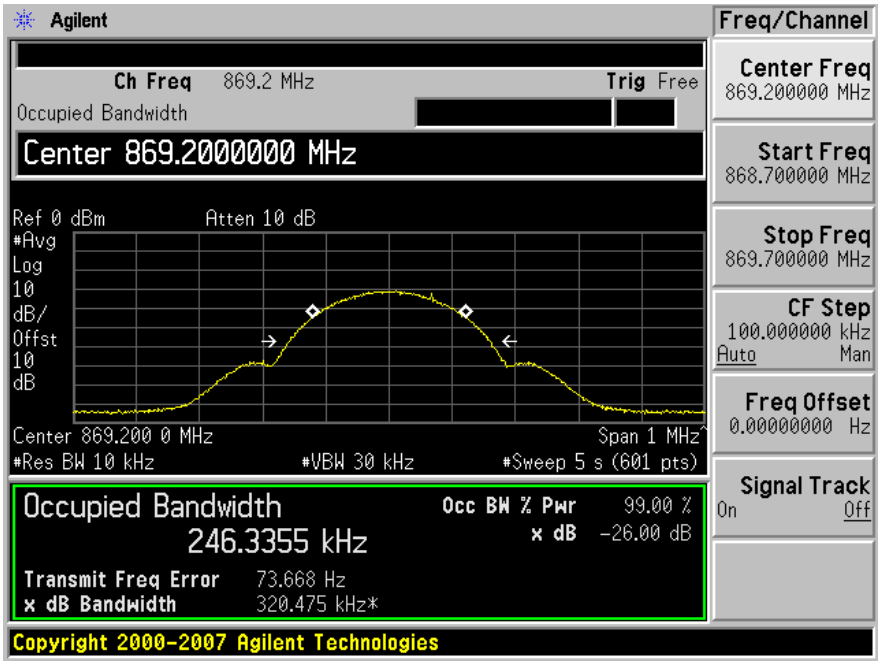
Mode		Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM	850 MHz Downlink	Low	869.2	247.2117	319.363
		Middle	881.6	247.3538	321.574
		High	891.4	246.4358	317.492
EDGE	850 MHz Downlink	Low	869.2	248.8284	308.738
		Middle	881.6	250.2434	308.016
		High	891.4	250.5882	309.157
WCDMA	850 MHz Downlink	Low	871.5	4.3171	4.929
		Middle	881.4	4.3358	4.948
		High	887.5	4.3352	4.946

Please refer to the following plots.

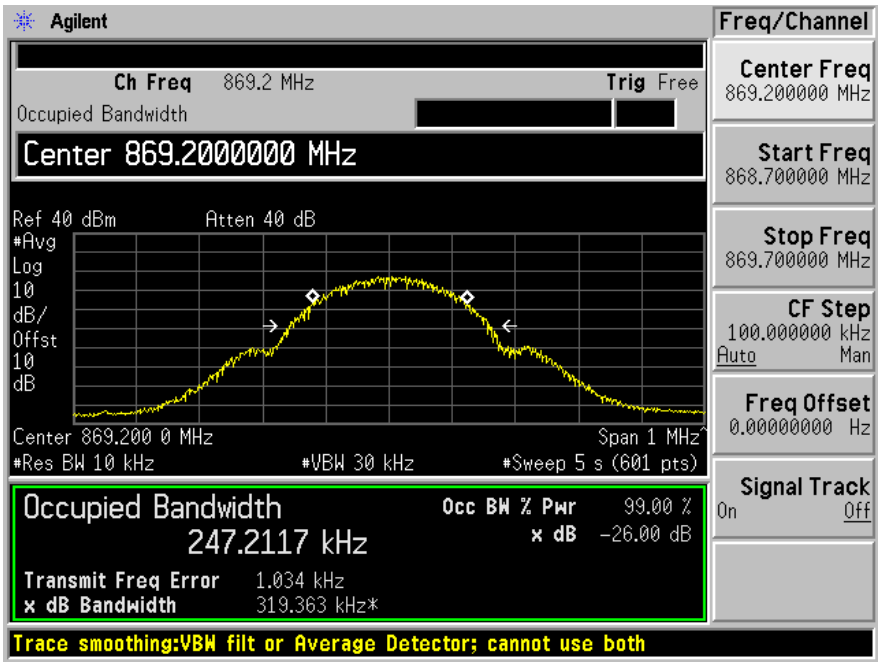
GSM 850 MHz Band (Downlink)

Low Channel (869.2 MHz)

Input

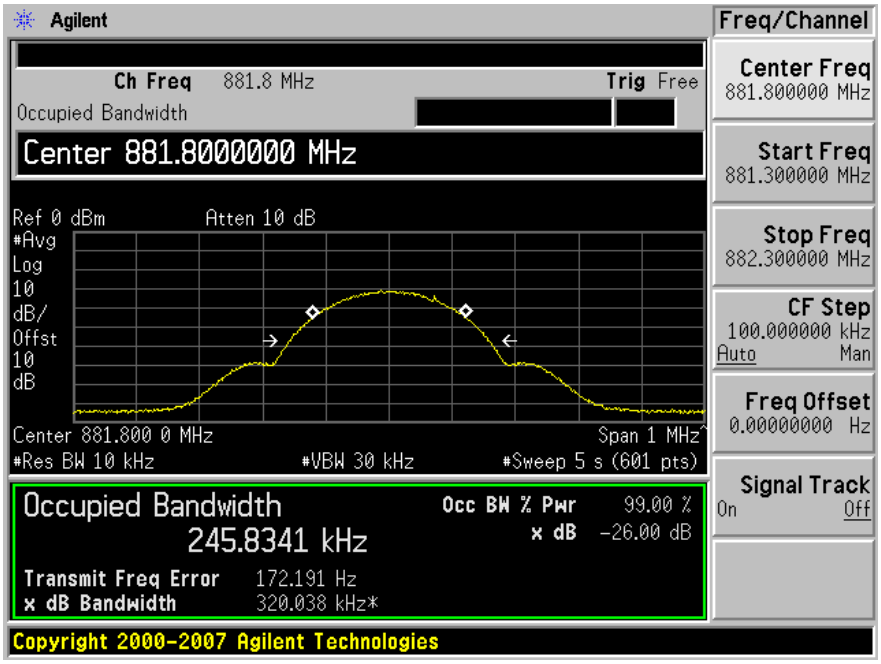


Output



Middle Channel (881.6 MHz)

Input



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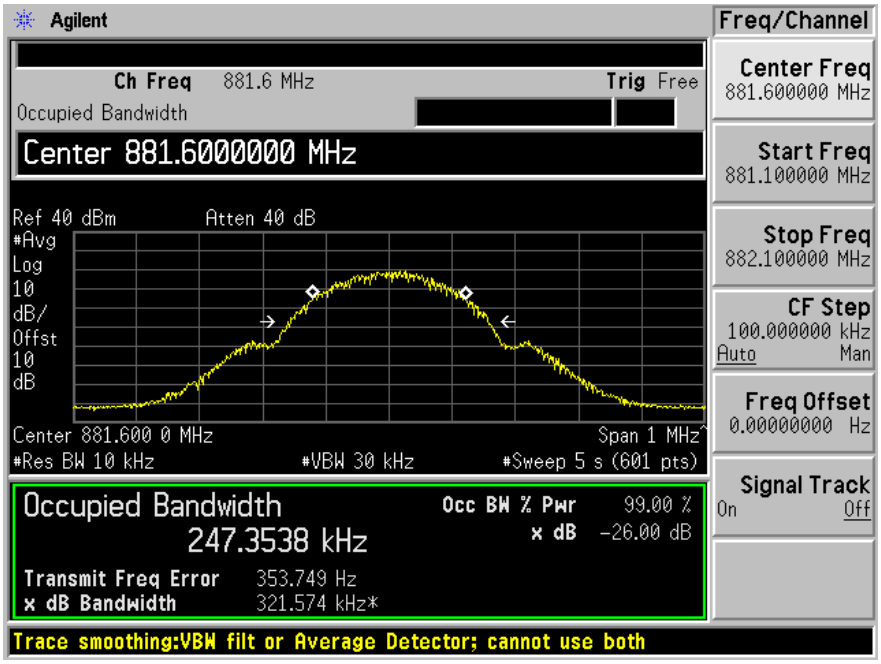
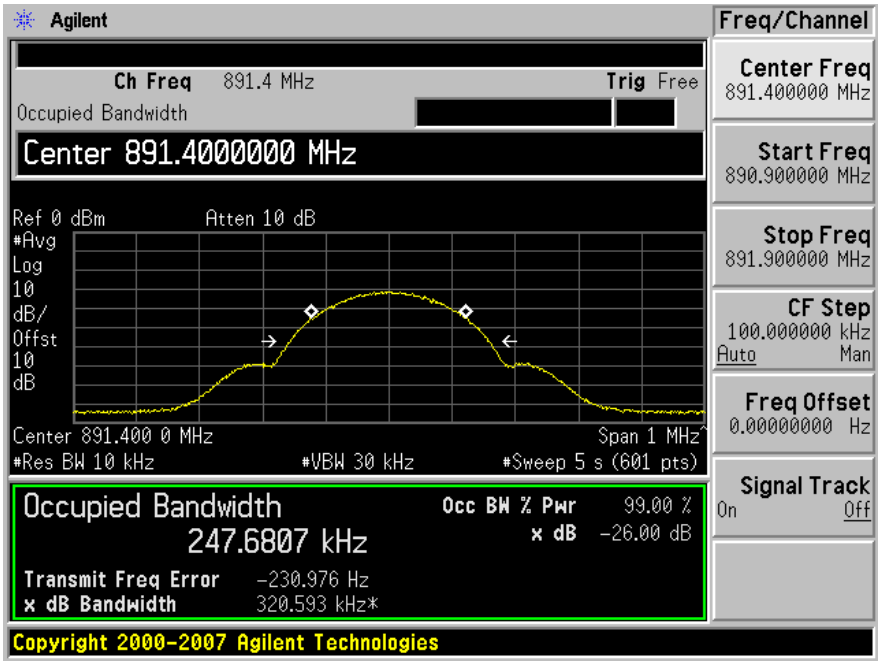
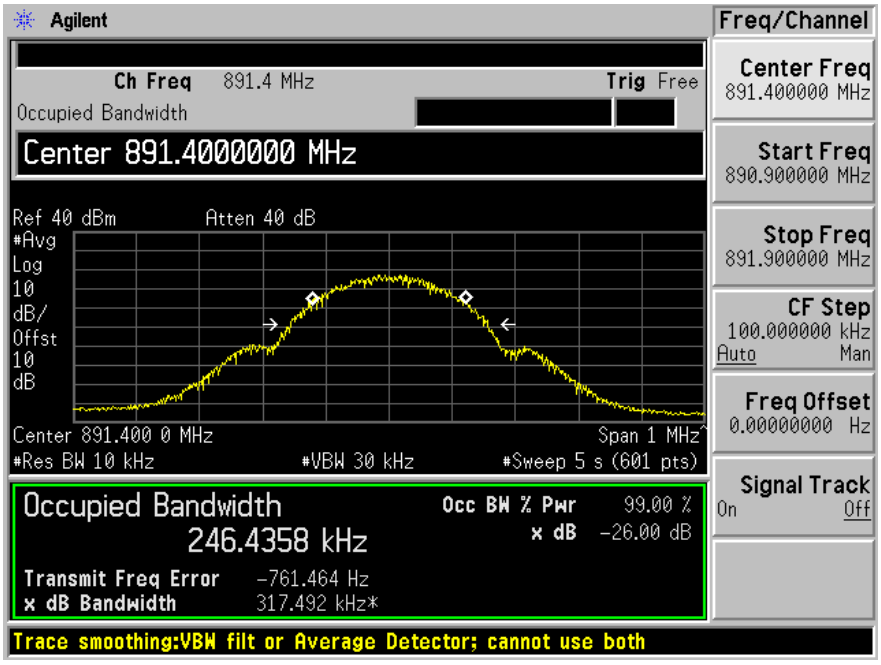


High Channel (891.4 MHz)

Input



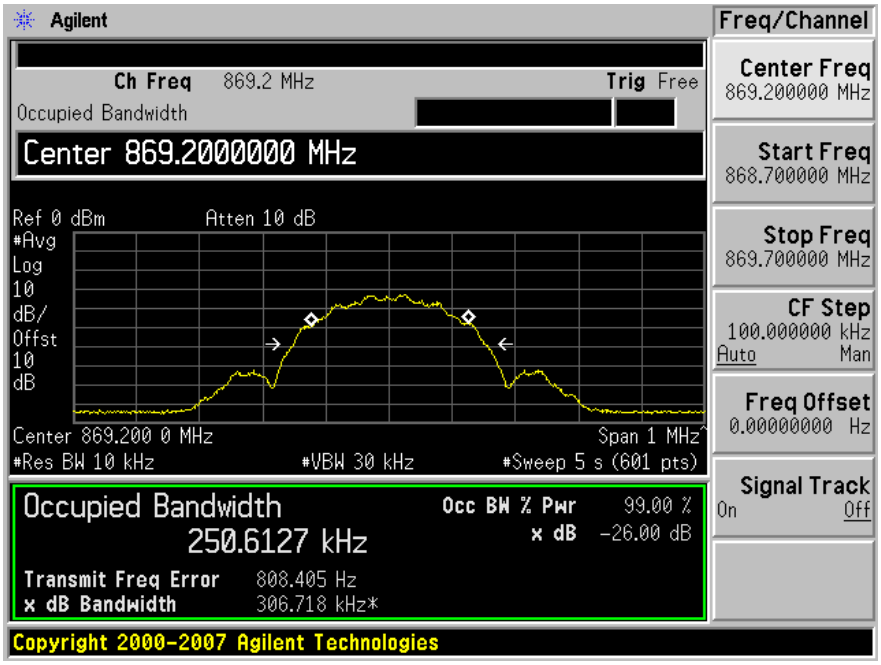
Output



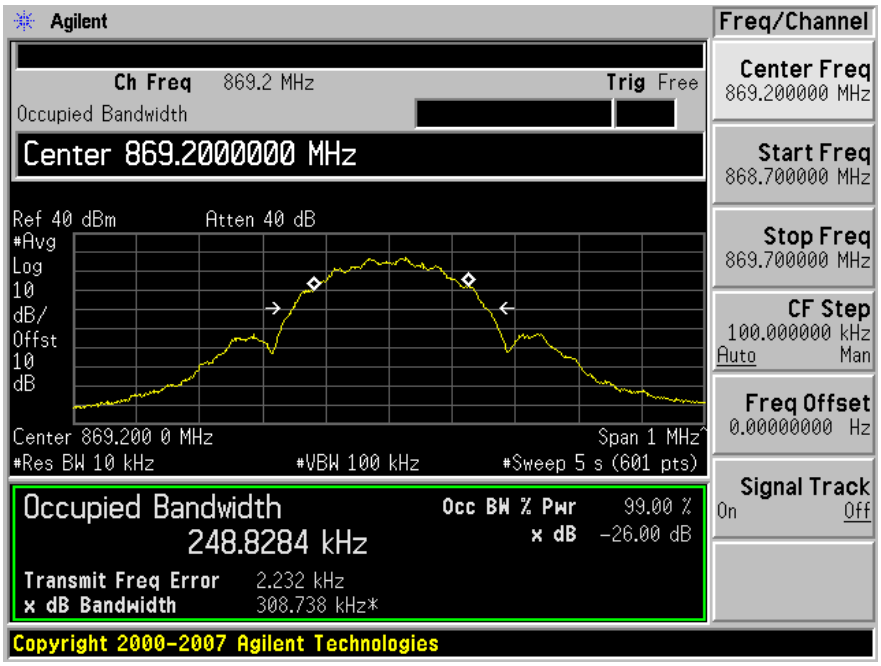
EDGE 850 MHz Band (Downlink)

Low Channel (869.2 MHz)

Input

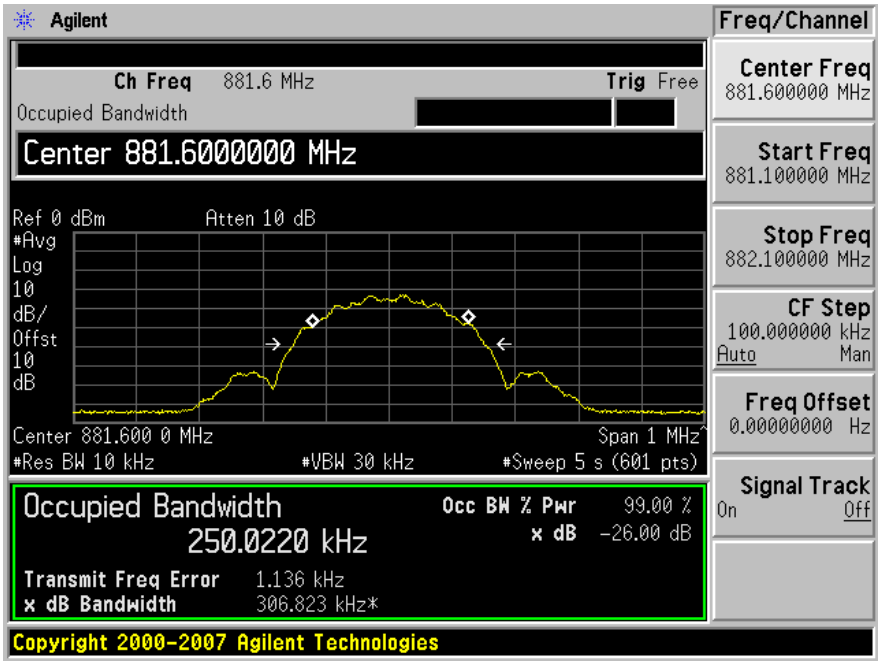


Output

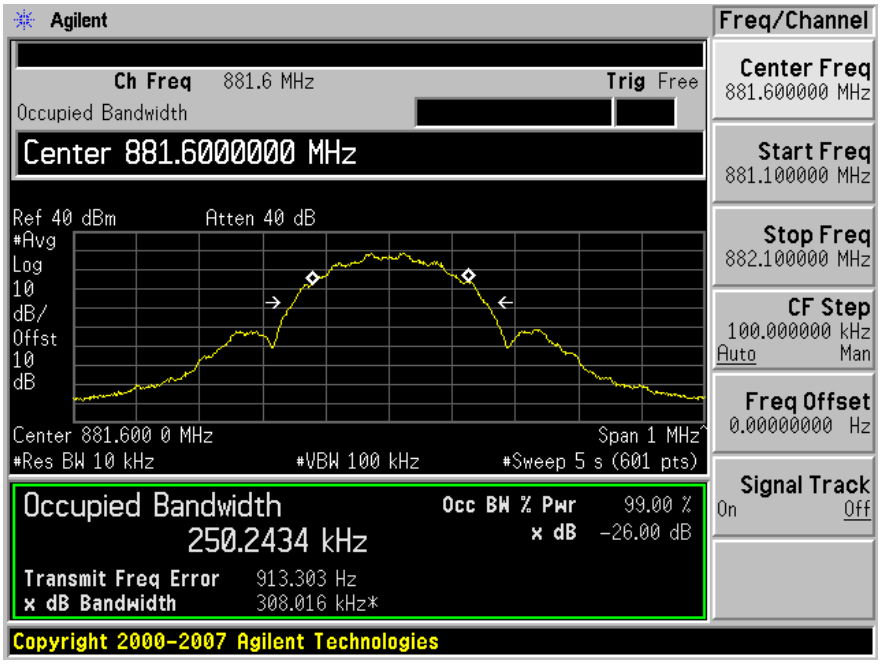


Middle Channel (881.6 MHz)

Input

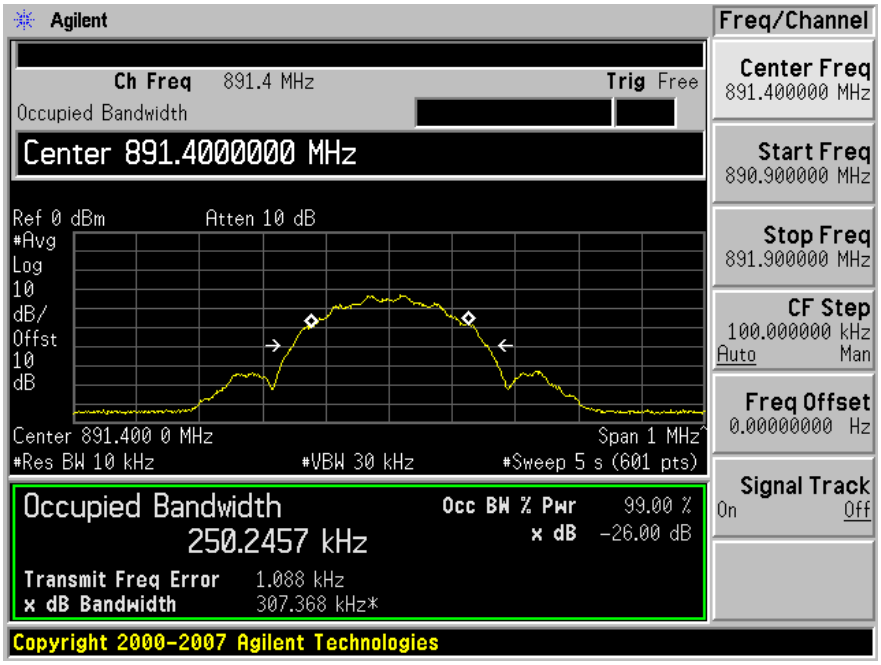


Output

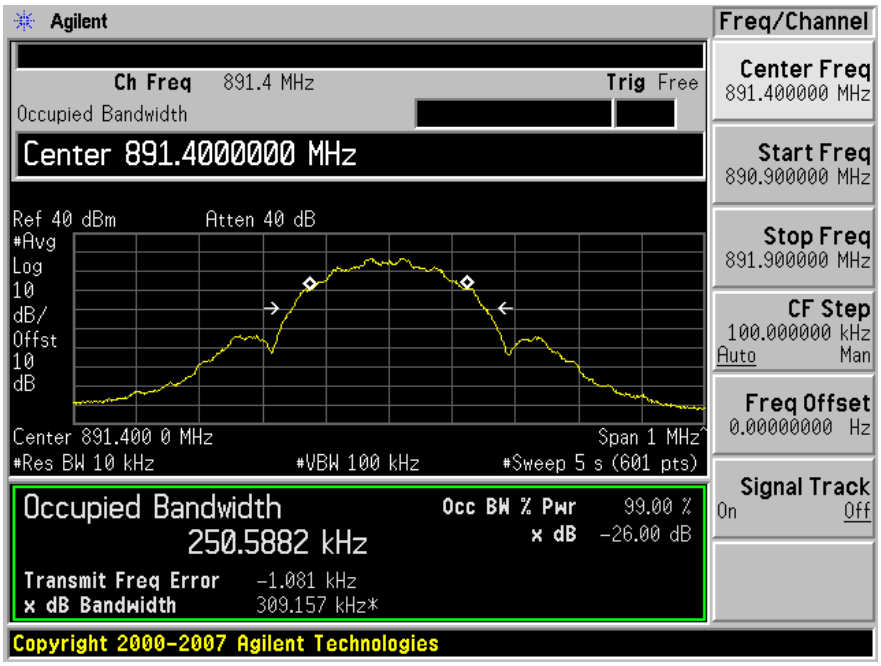


High Channel (891.4 MHz)

Input



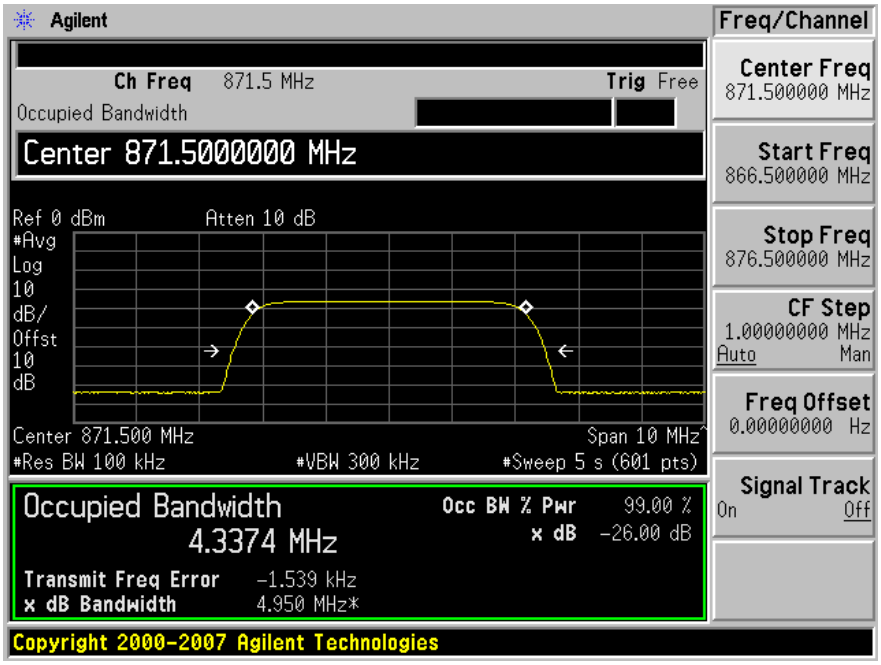
Output



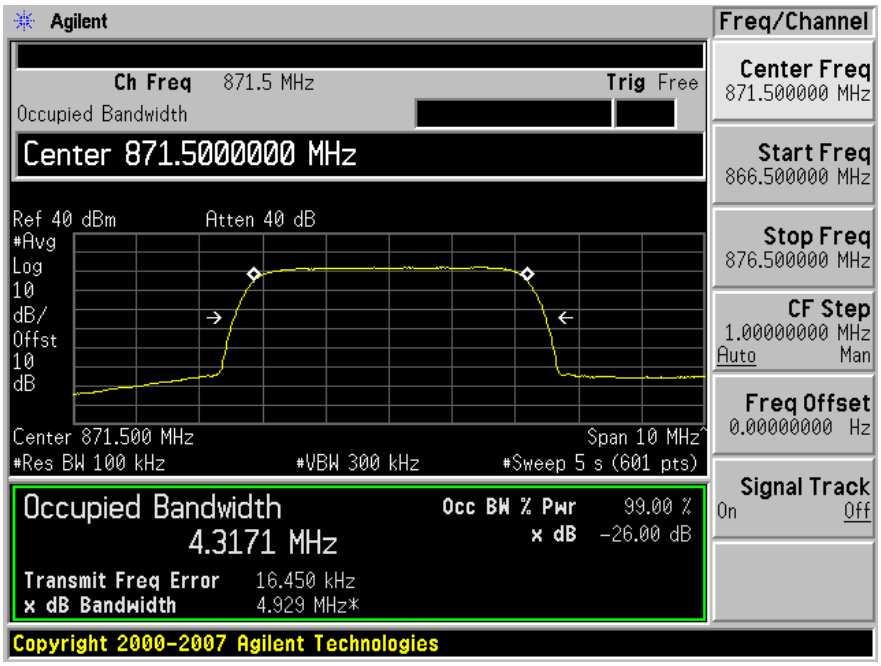
WCDMA 850 MHz Band (Downlink)

Low Channel (871.5 MHz)

Input

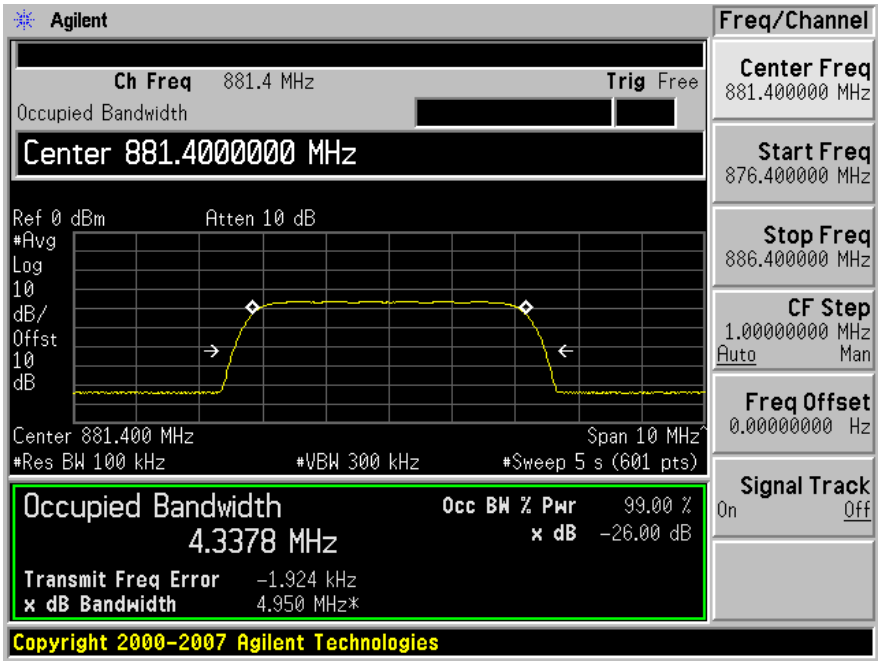


Output

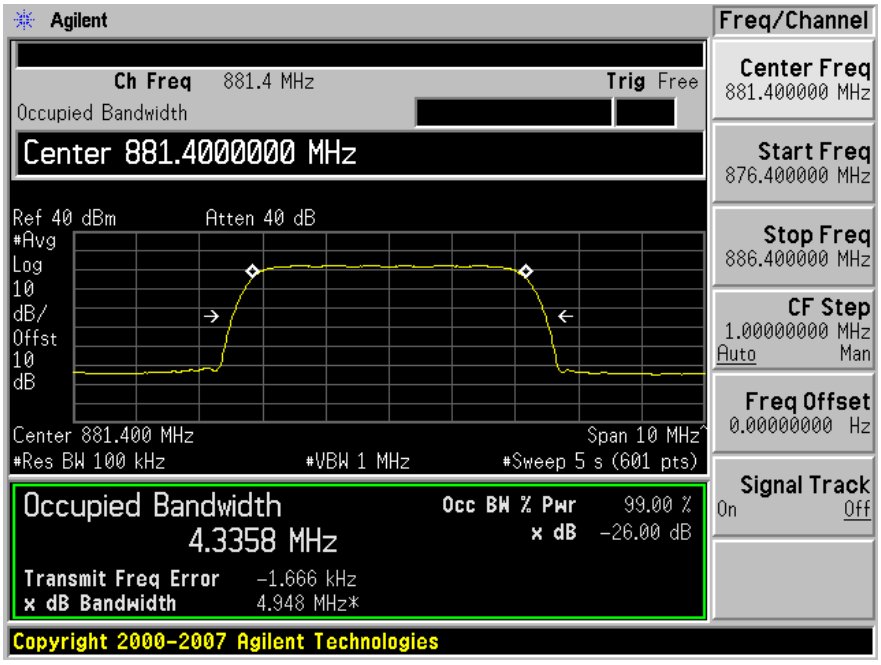


Middle Channel (881.4 MHz)

Input

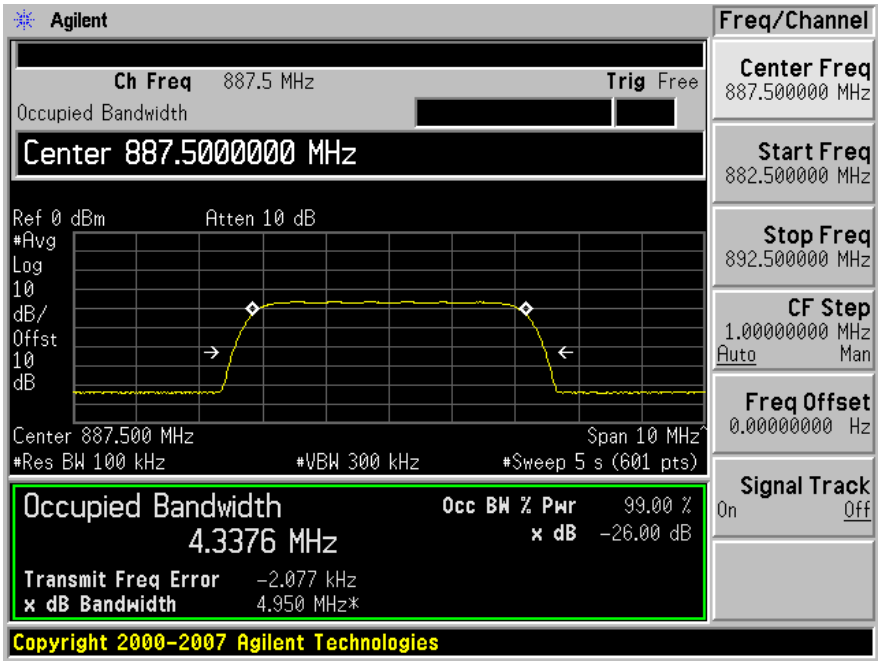


Output

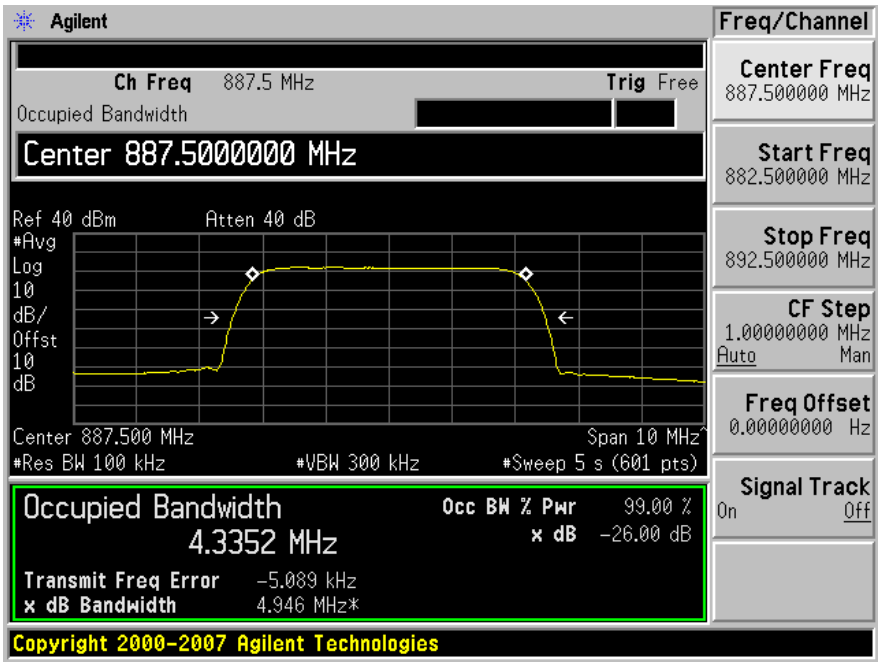


High Channel (887.5 MHz)

Input



Output



7 FCC §2.1053 & §22.917 - SPURIOUS RADIATED EMISSIONS

7.1 Applicable Standard

Requirements: CFR 47, § 2.1053, § 22.917. § 24.238

7.2 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 log (TX Power in Watts/0.001) – the absolute level
Spurious attenuation limit in dB = 43 + 10 Log10 (power out in Watts)

7.3 Test Environmental Conditions

Temperature:	12~16 °C
Relative Humidity:	35~42 %
ATM Pressure:	101.9~102.7 kPa

** The testing was performed by Jack Liu on 2009-12-17 ~ 2009-12-19*

7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US44303352	2009-04-27
Sunol Sciences	Antenna	JB1	A020106-1	2009-04-17
A.R.A	Horn Antenna	DRG-118/A	1132	2009-10-27
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2009-09-23
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2008-10-14
Ducommun	Pre-Amplifier	ALN-09173030-01	988251-03R	2009-03-04
HP	Pre-Amplifier	8447D	2944A06639	2009-06-05

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

7.5 Summary of Test Results

Worst case reading as follows:

Mode: GSM 850 MHz Downlink			
Margin (dB)	**Frequency (MHz)**	**Antenna Polarization (Horizontal/Vertical)**	**Input Frequency**
-30.61	1000	Horizontal	881.6
Mode: EDGE 850 MHz Downlink			
-29.8	1000	Horizontal	881.6
Mode: WCDMA 850 MHz Downlink			
-30.45	1000	Horizontal	881.4

7.6 Test Results

GSM 850 MHz band Downlink

Input frequency = 881.6 MHz

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1000	57.64	288	100	H	1000	-50.36	6.5	0.25	-43.61	-13	-30.61
1000	60.27	237	149	V	1000	-49.89	6.5	0.25	-43.14	-13	-30.14

EDGE 850 MHz band Downlink

Input frequency = 881.6 MHz

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1000	58.45	288	100	H	1000	-49.55	6.5	0.25	-42.8	-13	-29.8
1000	59.53	232	148	V	1000	-50.63	6.5	0.25	-43.88	-13	-30.88

WCDMA 850 MHz band Downlink

Input frequency = 881.6 MHz

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1000	57.8	288	100	H	1000	-50.2	6.5	0.25	-43.45	-13	-30.45
1000	59.93	236	148	V	1000	-50.23	6.5	0.25	-43.48	-13	-30.48

8 FCC §2.1051 & §22.917- SPURIOUS EMISSIONS AT ANTENNA TERMINALS

8.1 Applicable Standard

Requirements: CFR 47, § 2.1051. § 22.917.

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

§ 22.917**:** The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB

8.2 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.

8.3 Test Environmental Conditions

Temperature:	12~16 °C
Relative Humidity:	35~42 %
ATM Pressure:	101.9~102.7 kPa

** The testing was performed by Jack Liu on 2009-12-17 ~ 2009-12-19*

8.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2008-10-14
Agilent	Analyzer, Spectrum	E4440A	US45303156	2008-07-23
HP	Generator, Signal	83650B	3614A00276	2008-05-28

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

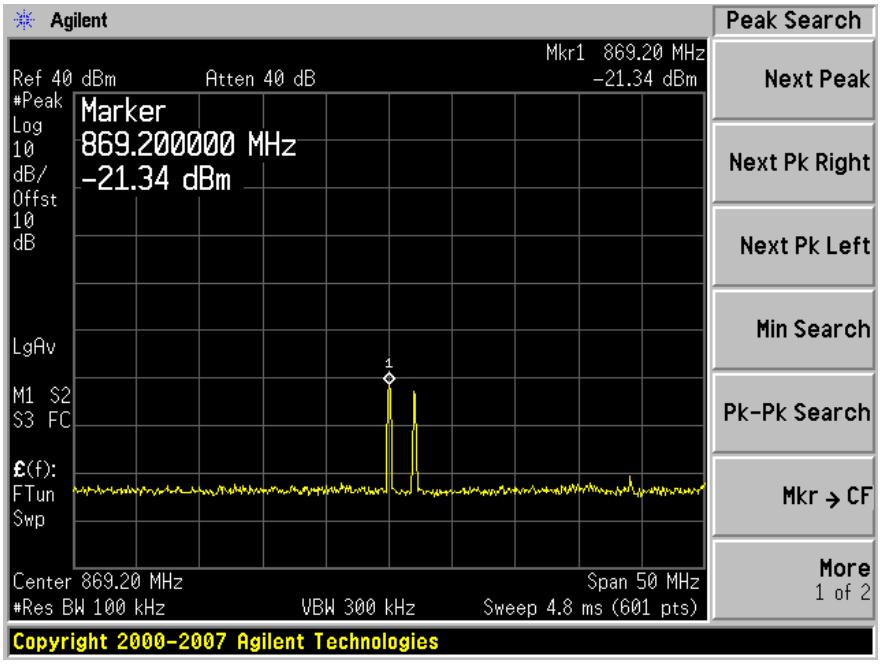
8.5 Test Results

Please refer to the hereinafter plots.

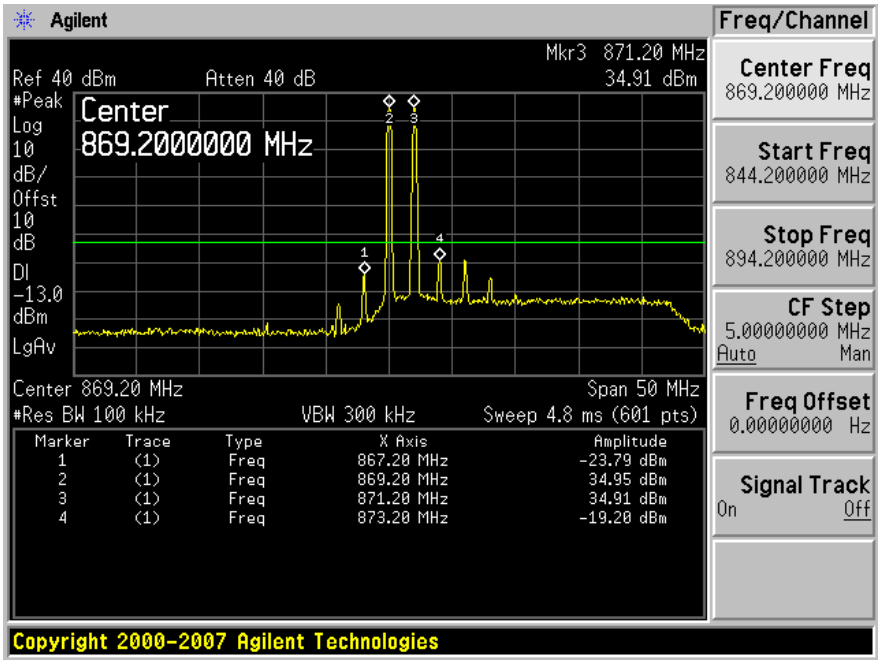
Inter-modulations:

GSM/EDGE 850 MHz Band Low Channel Downlink:

Input

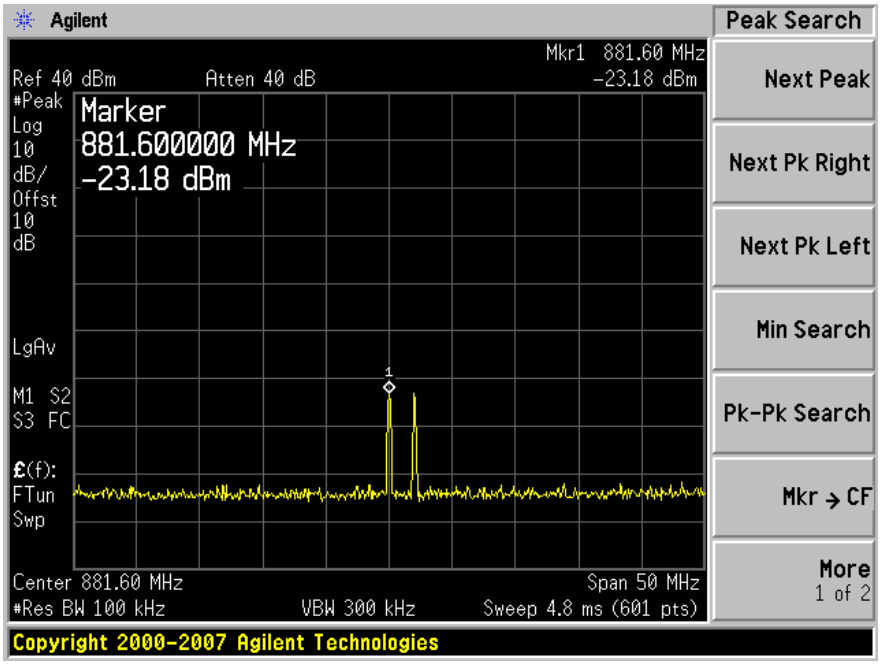


Output

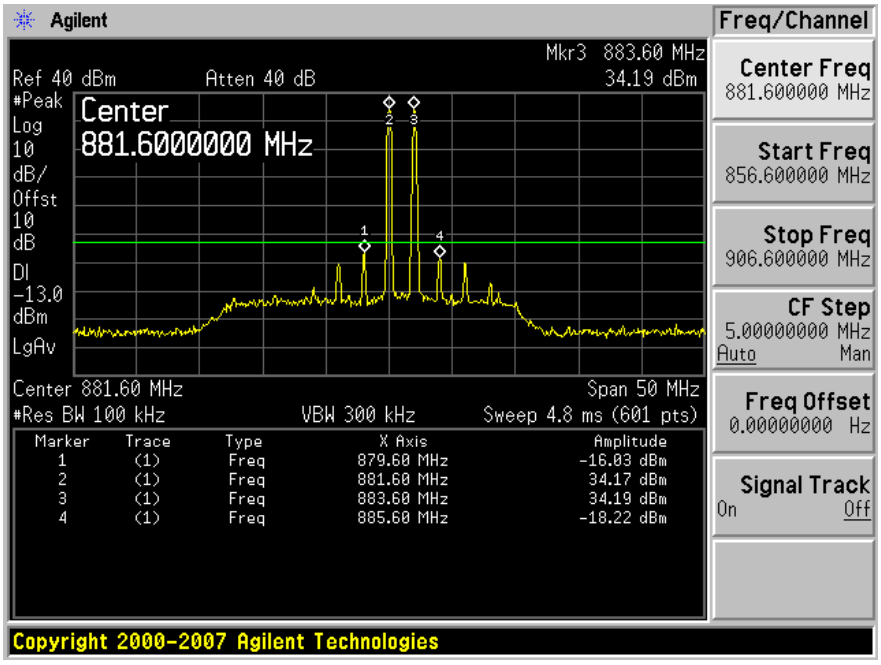


GSM/EDGE 850 MHz Band Middle Channel Downlink:

Input

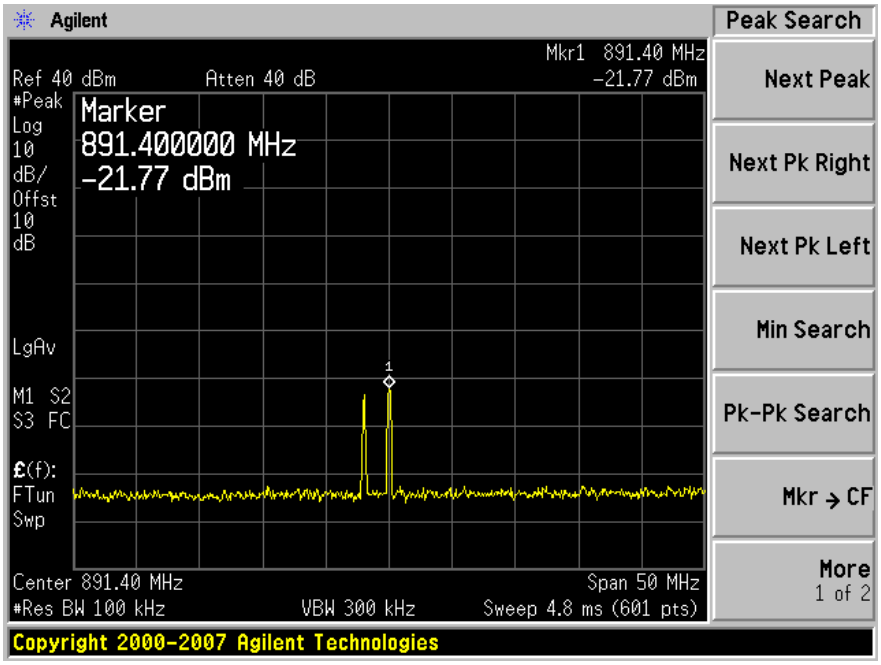


Output

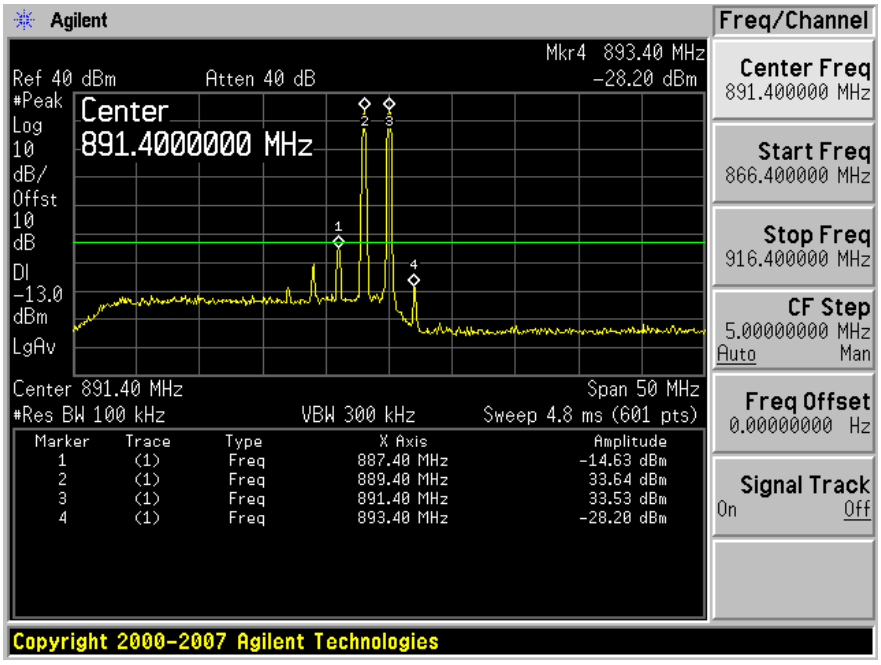


GSM/EDGE 850 MHz Band High Channel Downlink:

Input

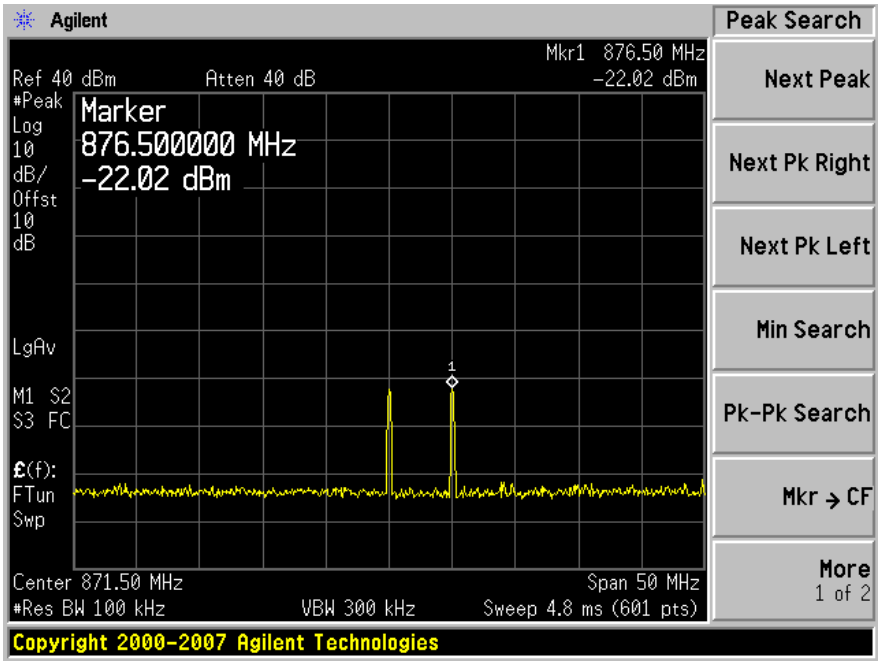


Output

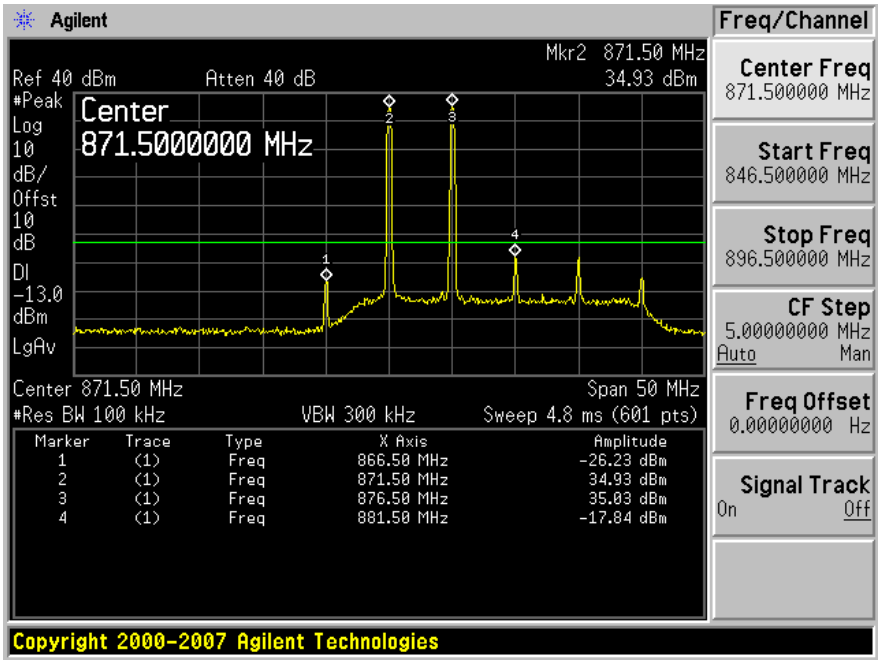


WCDMA 850 MHz Band Low Channel Downlink:

Input

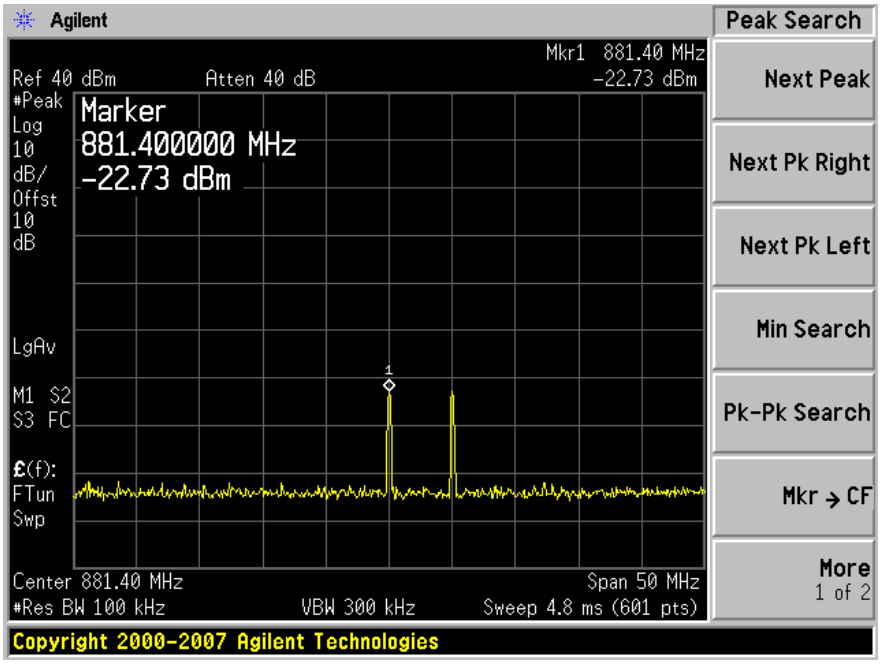


Output

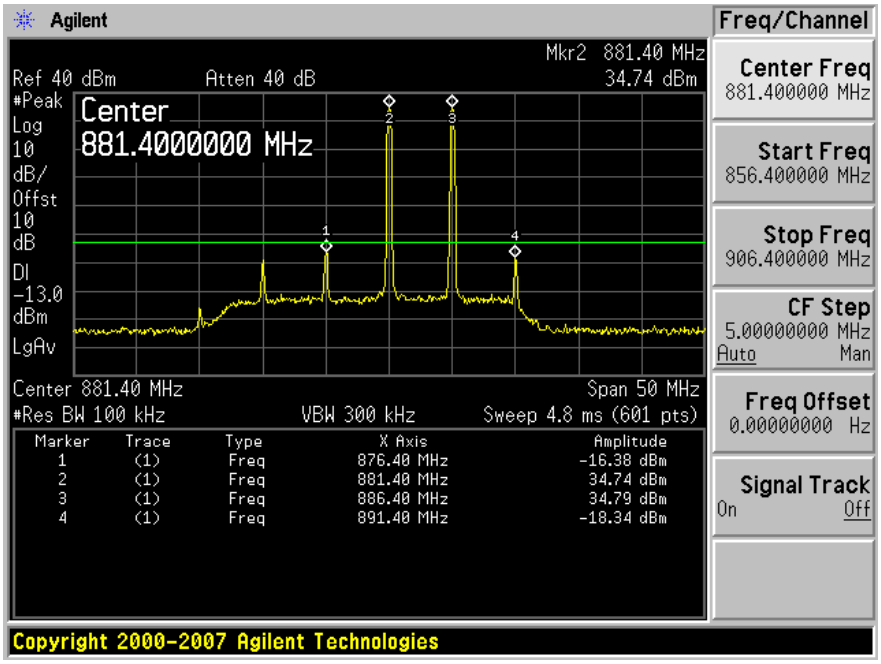


WCDMA 850 MHz Band Middle Channel Downlink:

Input

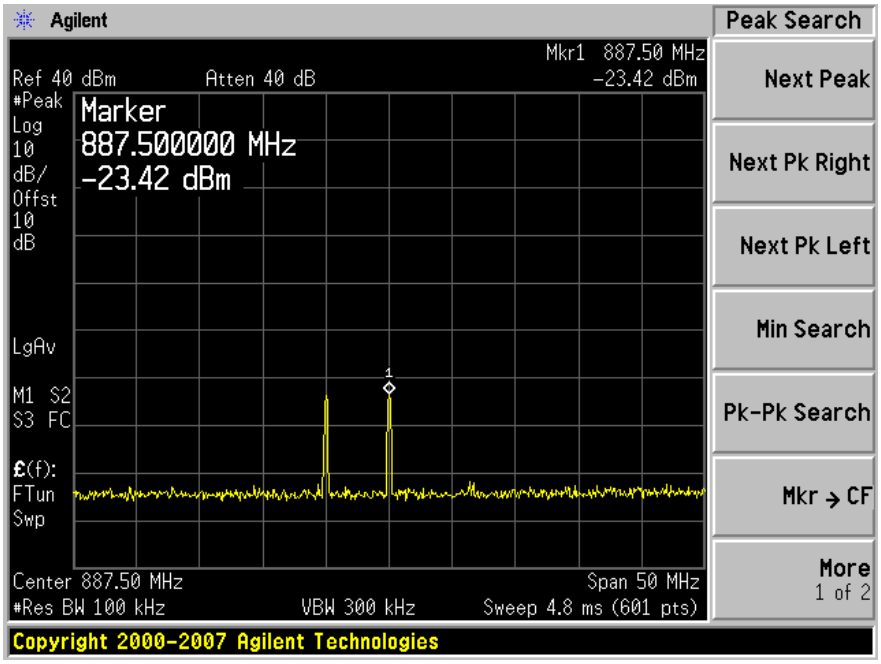


Output

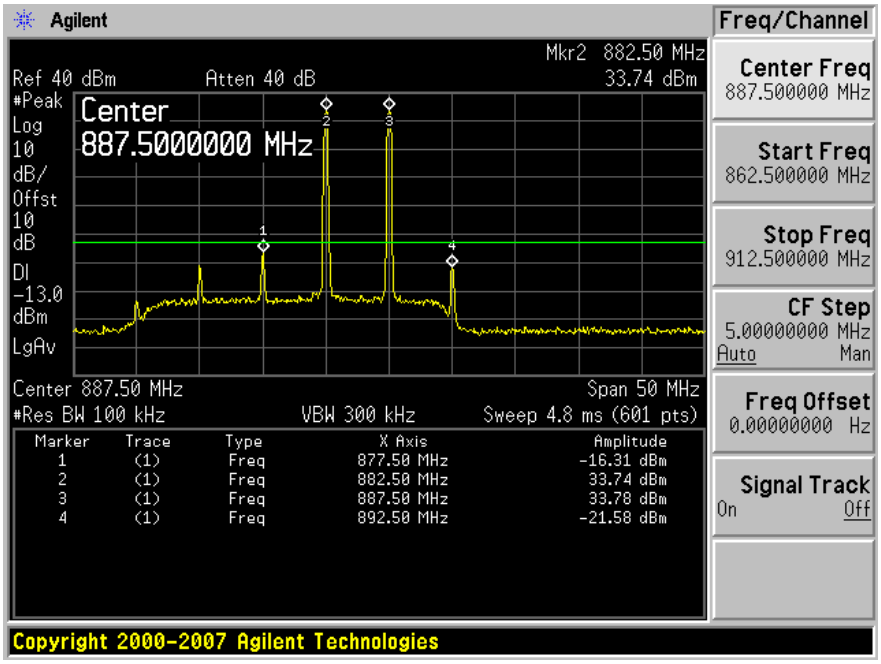


WCDMA 850 MHz Band High Channel Downlink:

Input

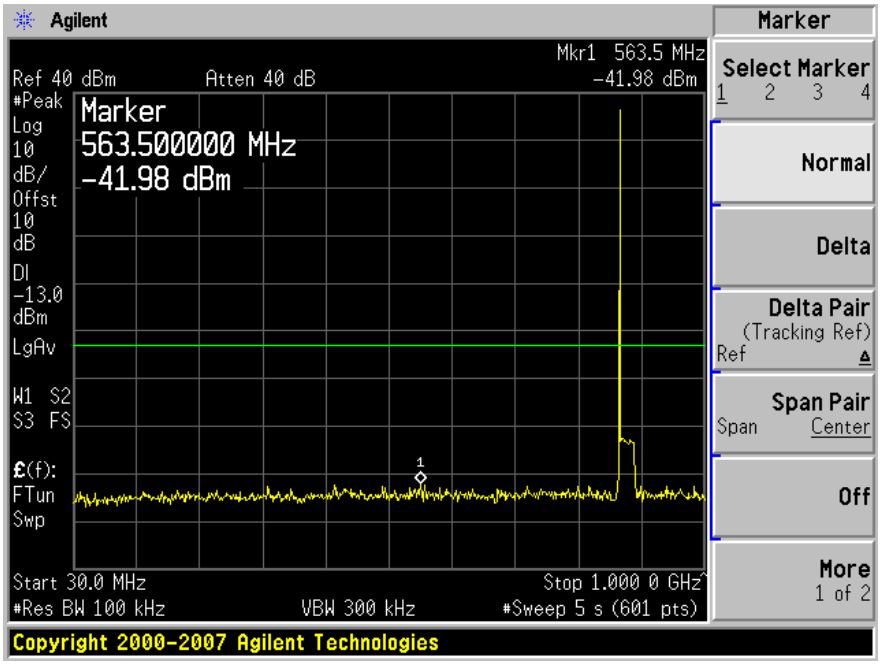


Output

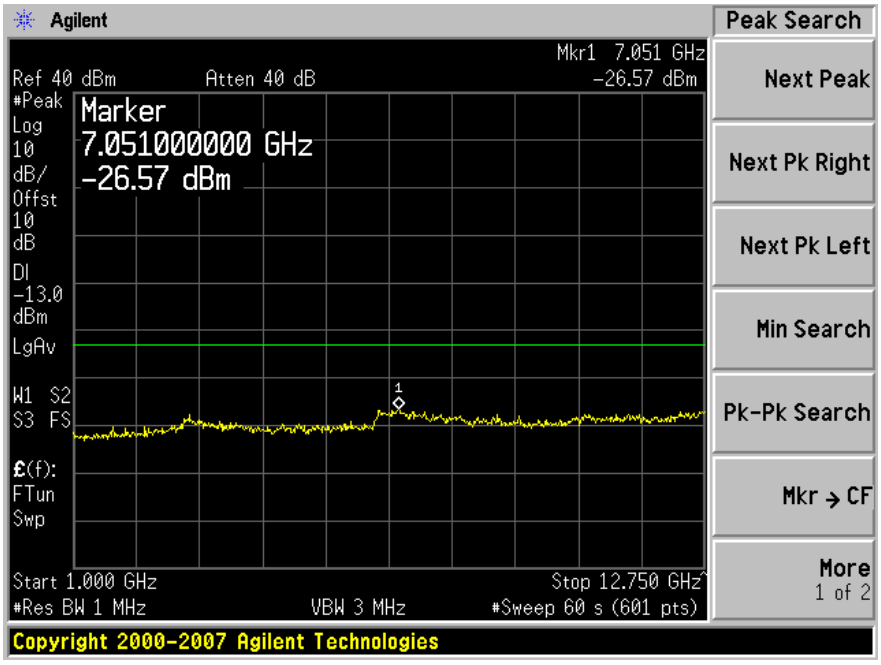


Antenna Port Conducted Spurious Emissions:

GSM 850 MHz Band Downlink: Low Channel (869.2 MHz)

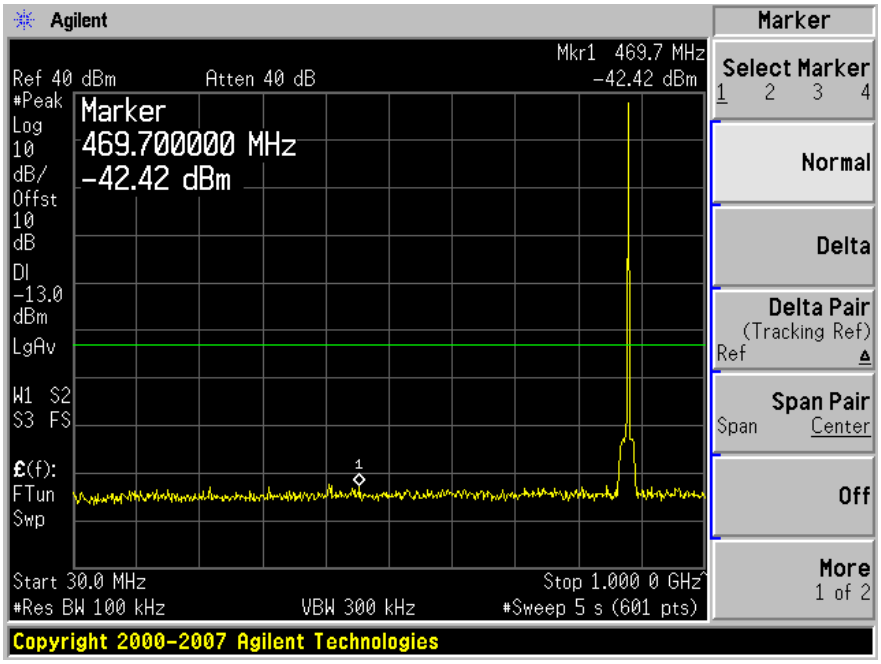


30 MHz to 1 GHz

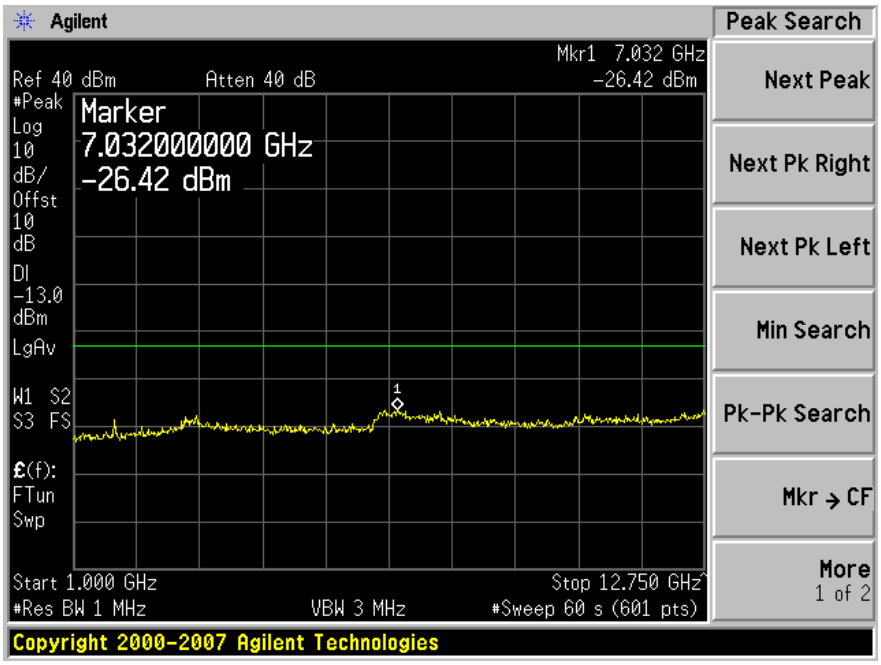


1 GHz to 12.75 GHz

GSM 850 MHz Band Downlink: Middle Channel (881.6 MHz)

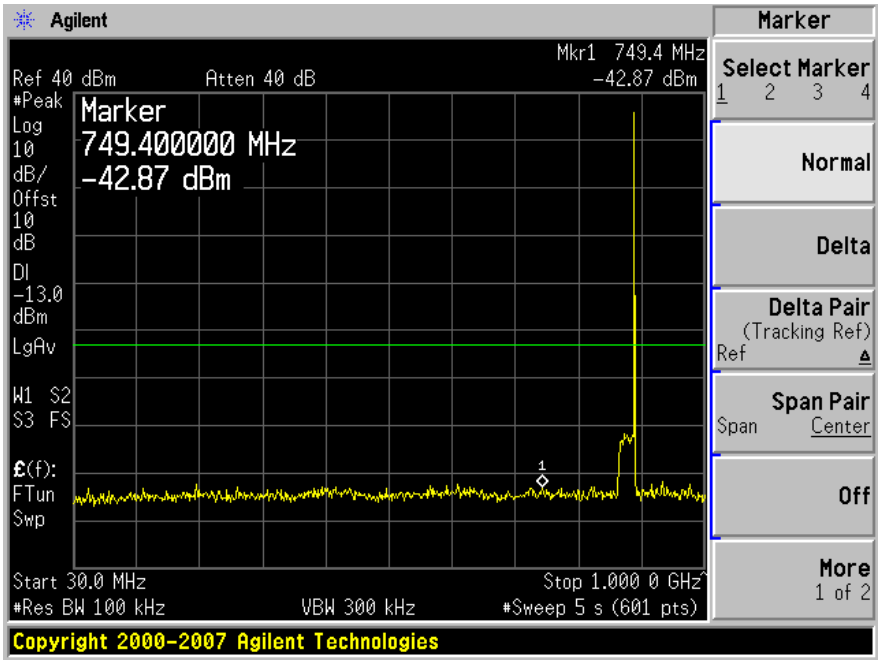


30 MHz to 1 GHz

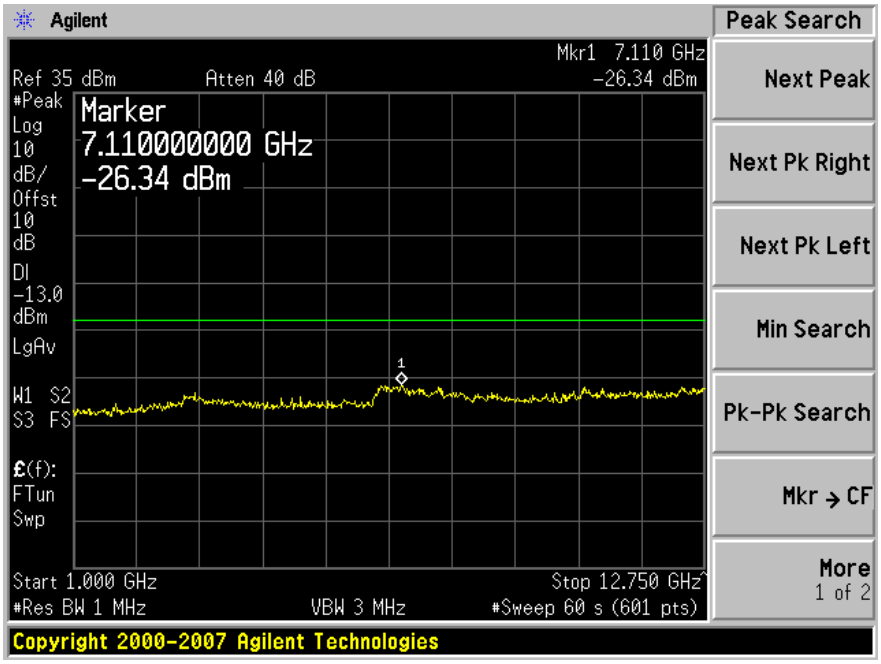


1 GHz to 12.75 GHz

GSM 850 MHz Band Downlink: High Channel (891.4 MHz)

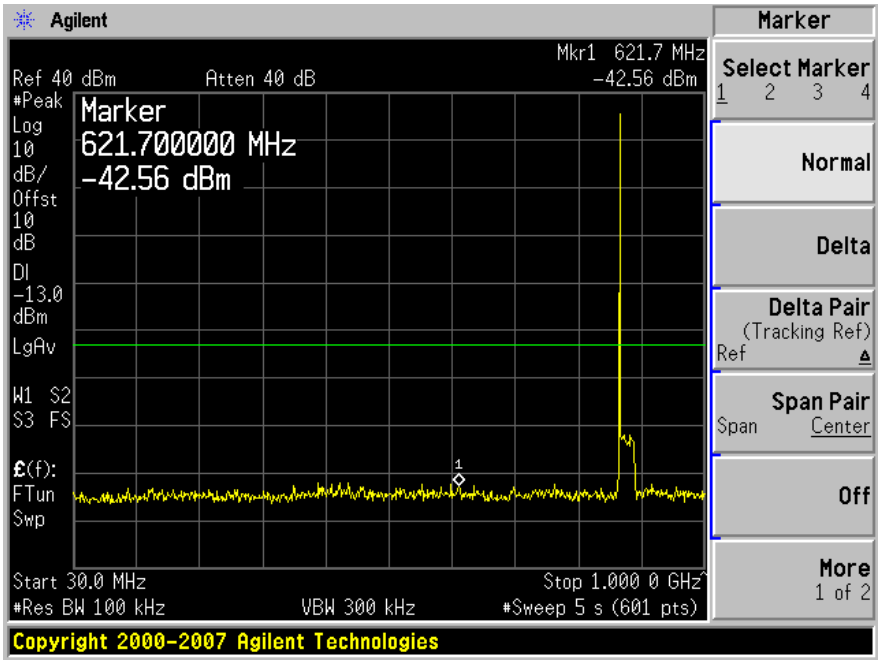


30 MHz to 1 GHz

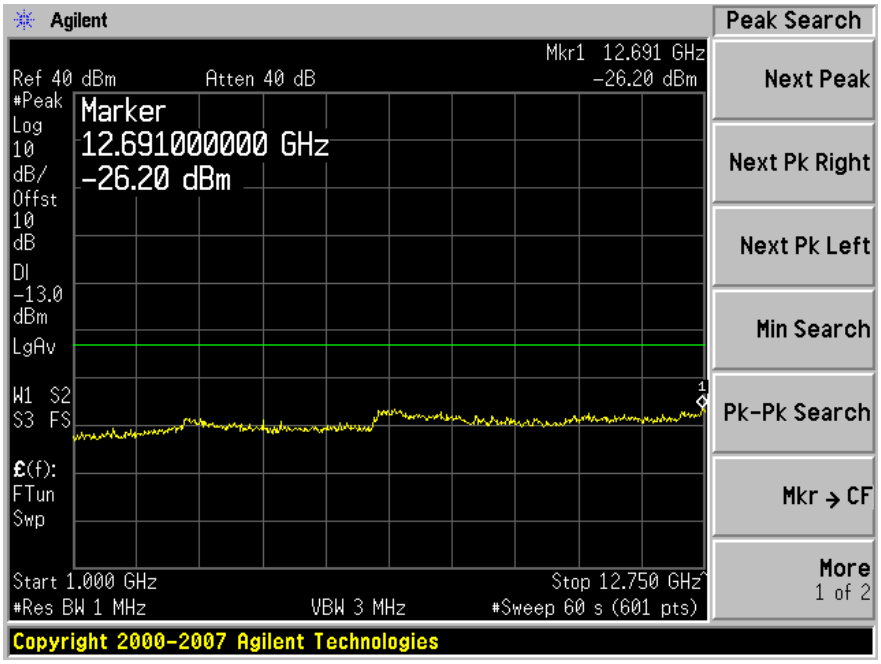


1 GHz to 12.75 GHz

EDGE 850 MHz Band Downlink: Low Channel (869.2 MHz)

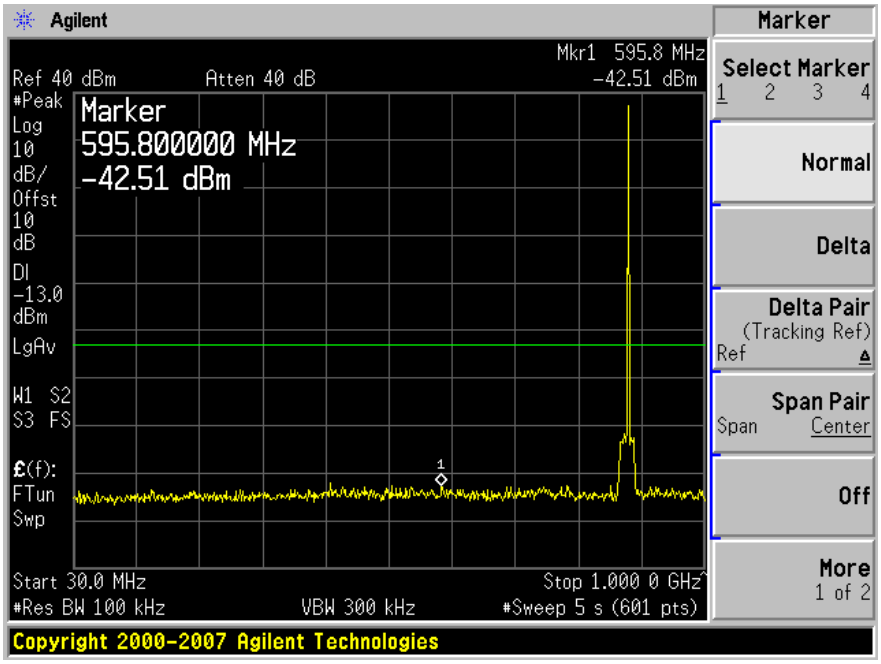


30 MHz to 1 GHz

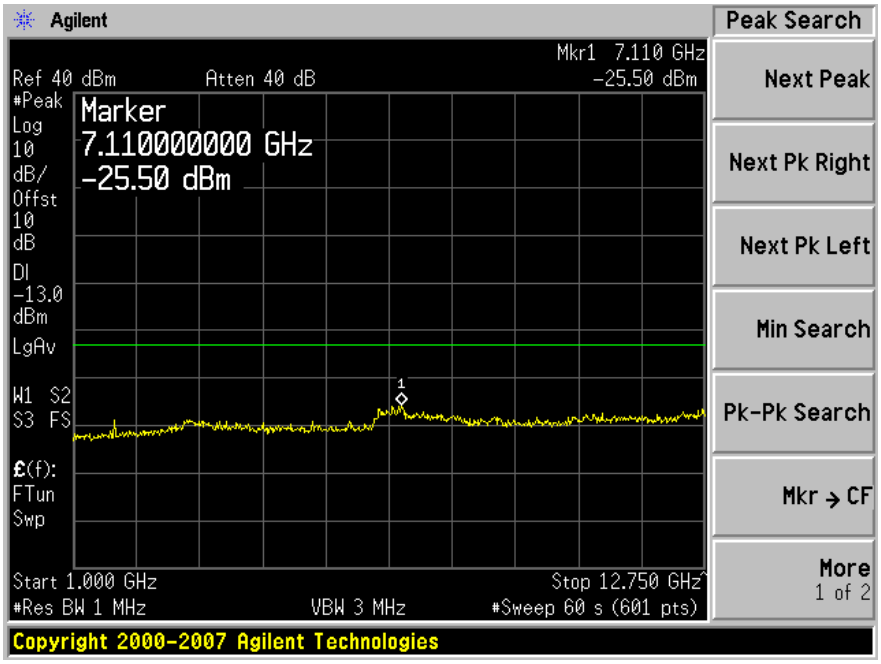


1 GHz to 12.75 GHz

EDGE 850 MHz Band Downlink: Middle Channel (881.6 MHz)

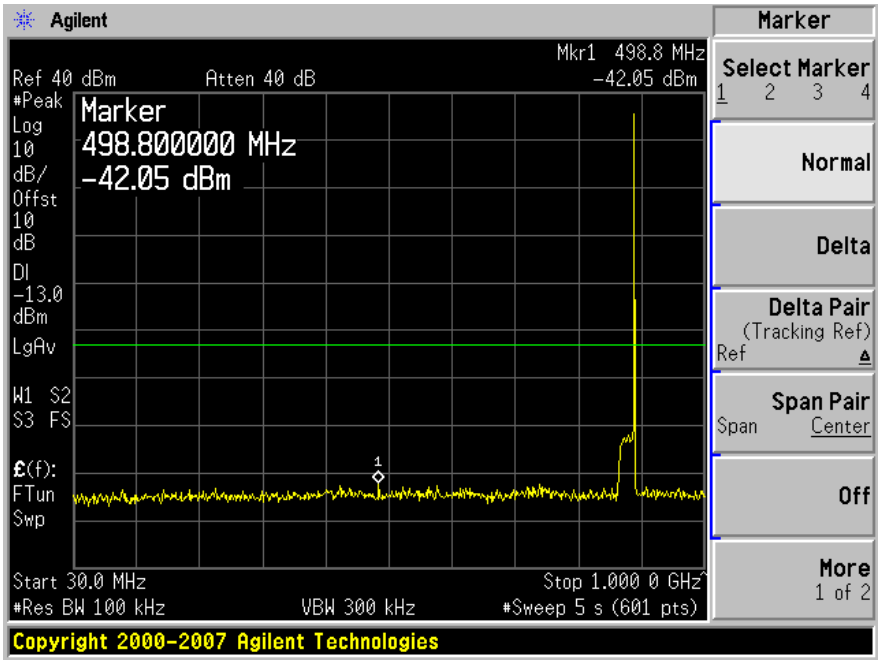


30 MHz to 1 GHz

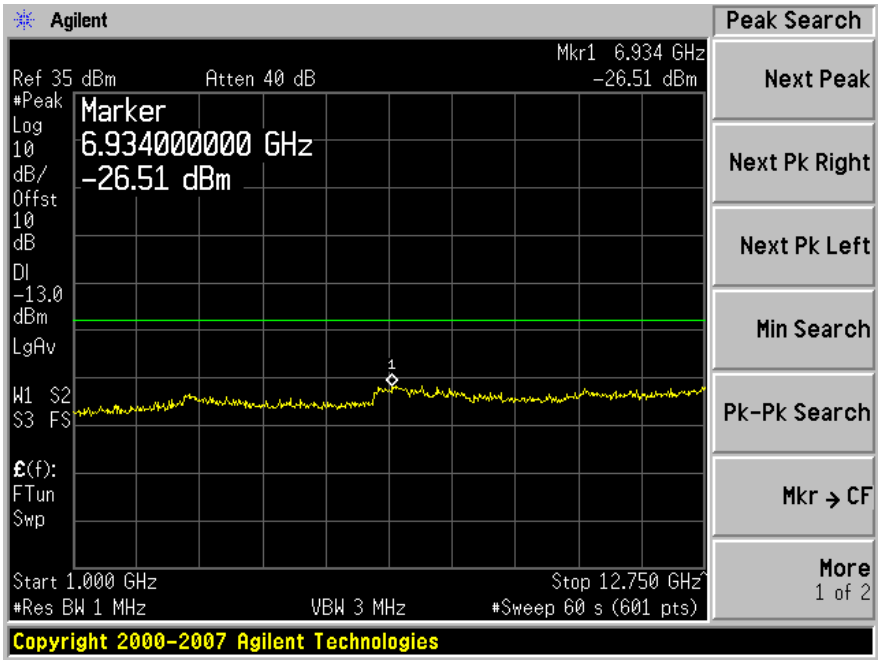


1 GHz to 12.75 GHz

EDGE 850 MHz Band Downlink: High Channel (891.4 MHz)

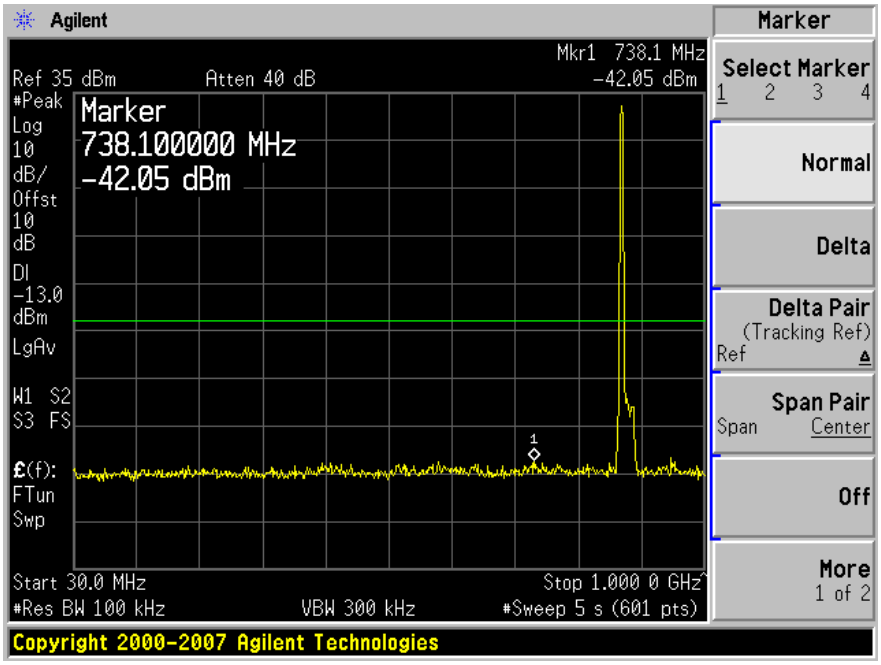


30 MHz to 1 GHz

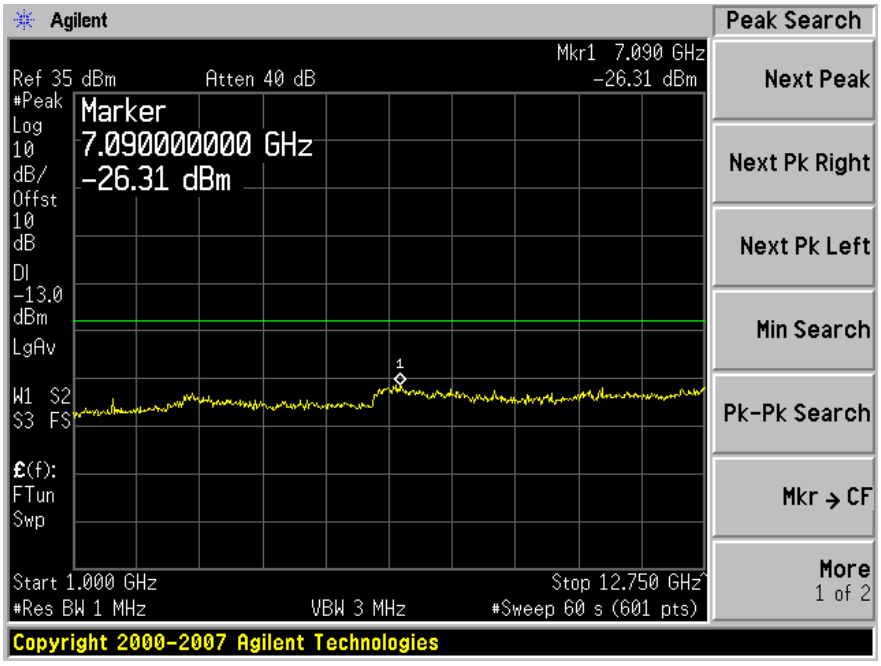


1 GHz to 12.75 GHz

WCDMA 850 MHz Band Downlink: Low Channel (871.5 MHz)

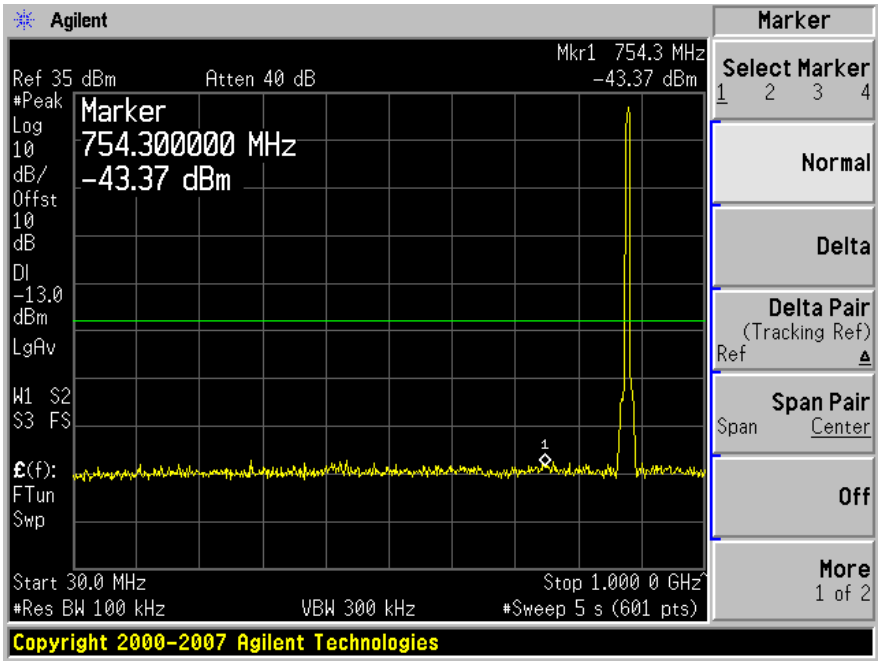


30 MHz to 1 GHz

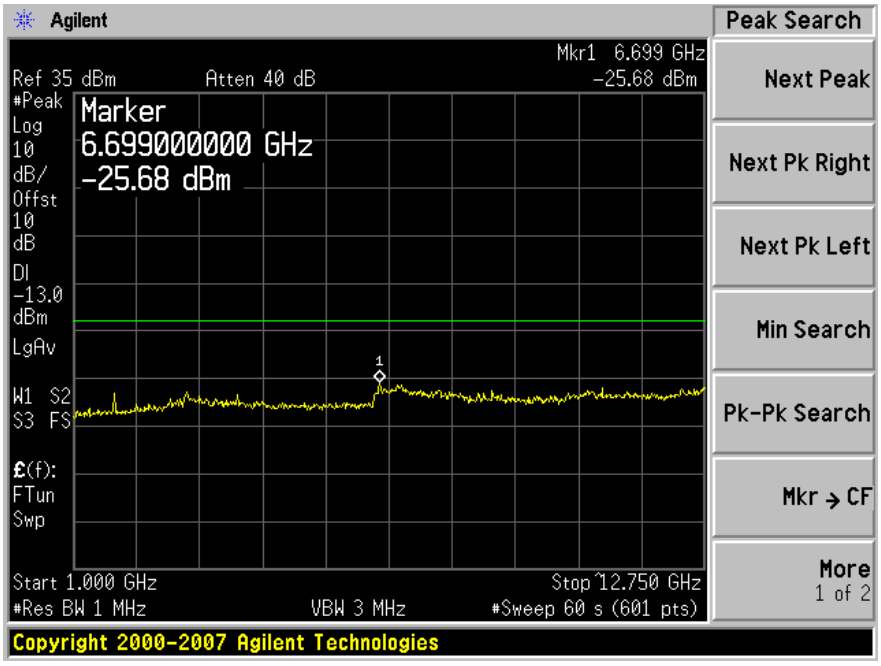


1 GHz to 12.75 GHz

WCDMA 850 MHz Band Downlink: Middle Channel (881.4 MHz)

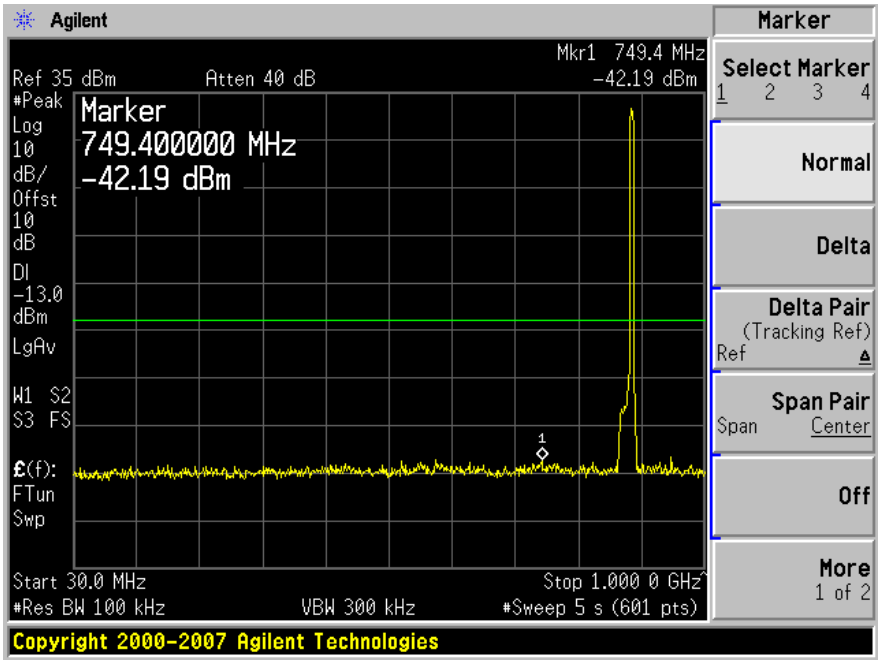


30 MHz to 1 GHz

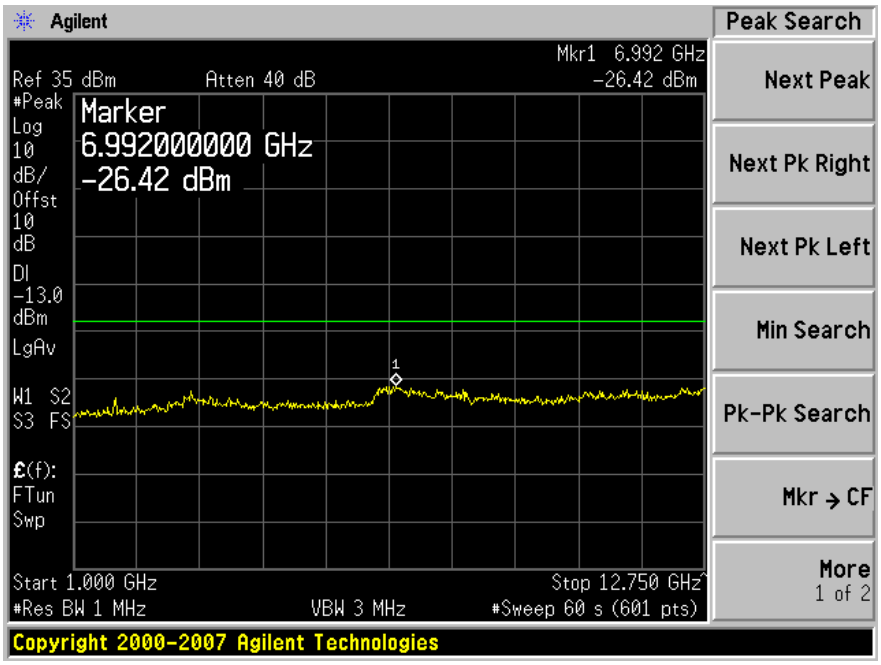


1 GHz to 12.75 GHz

WCDMA 850 MHz Band Downlink: High Channel (887.5 MHz)



30 MHz to 1 GHz



1 GHz to 12.75 GHz

9 FCC §22.917– BAND EDGE

9.1 Applicable Standard

According to § 22.917, the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §24.238, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

9.2 Test Procedure

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

The center of the spectrum analyzer was set to block edge frequency.

9.3 Test Environmental Conditions

Temperature:	12~16 °C
Relative Humidity:	35~42 %
ATM Pressure:	101.9~102.7 kPa

** The testing was performed by Jack Liu on 2009-12-17 ~ 2009-12-19*

9.4 Test Equipment List and Details

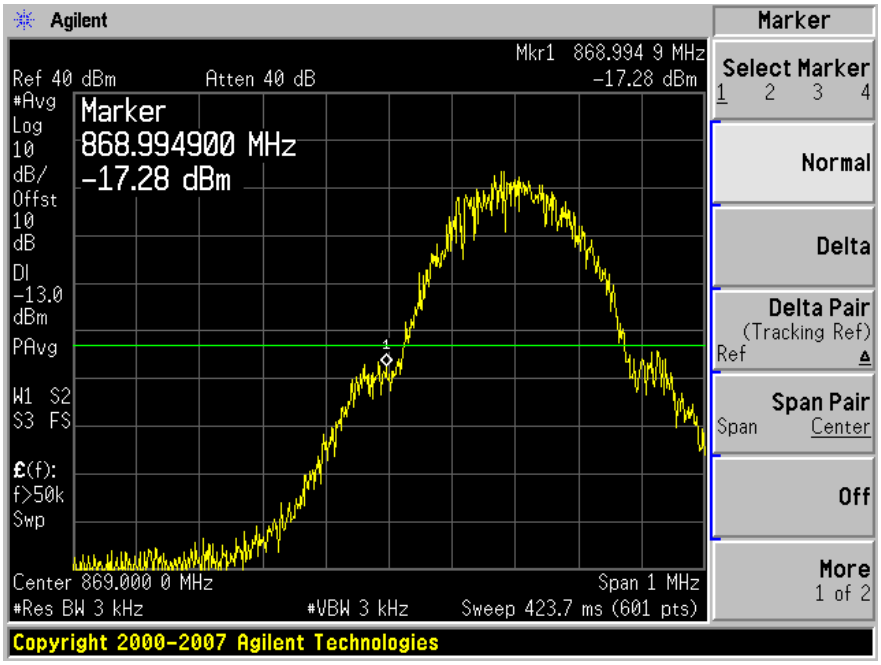
Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2008-10-14
Agilent	Analyzer, Spectrum	E4440A	US45303156	2008-07-23

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

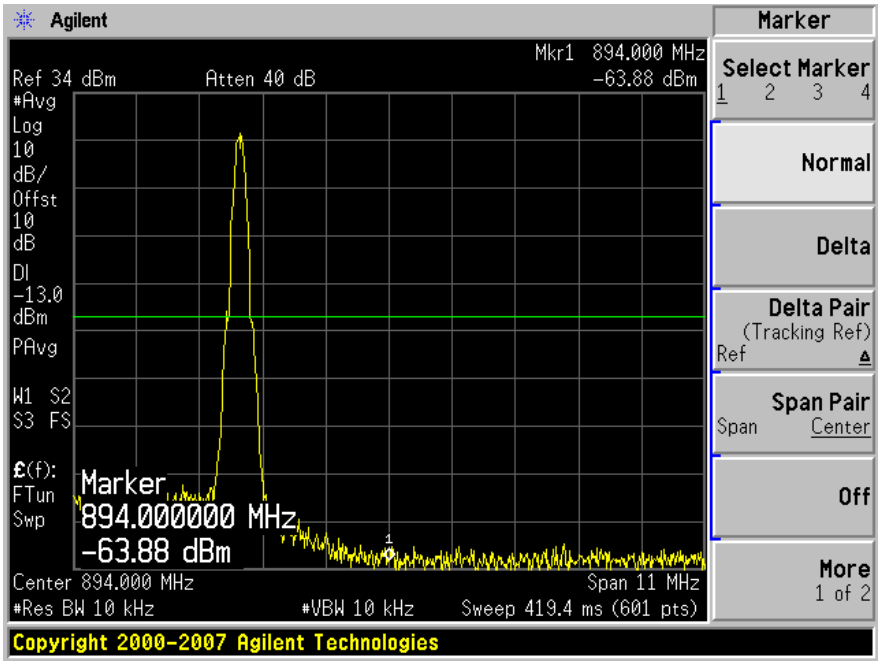
9.5 Test Results

Please refer to the following plots.

GSM 850 MHz Band Downlink Band Edge

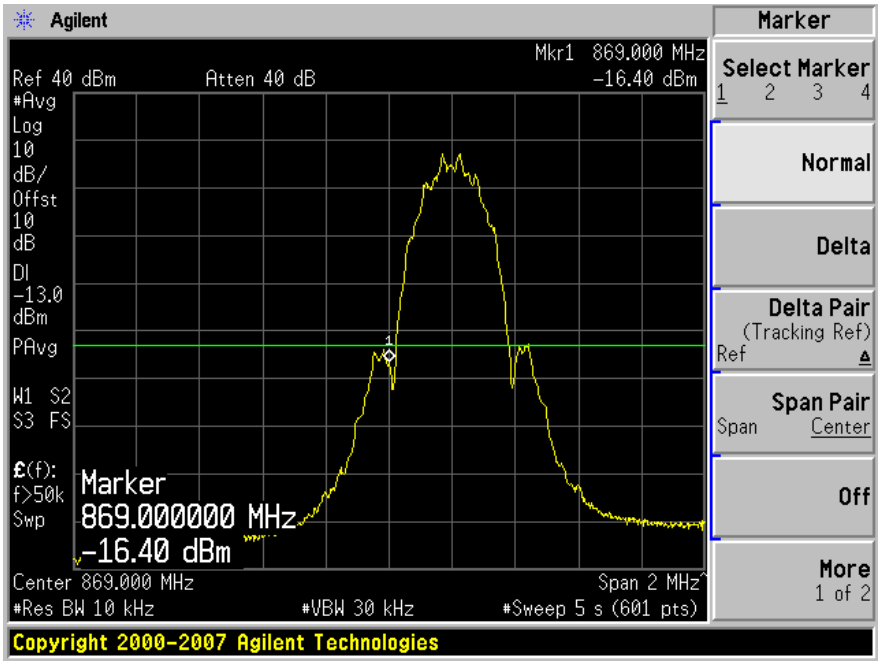


Low Channel

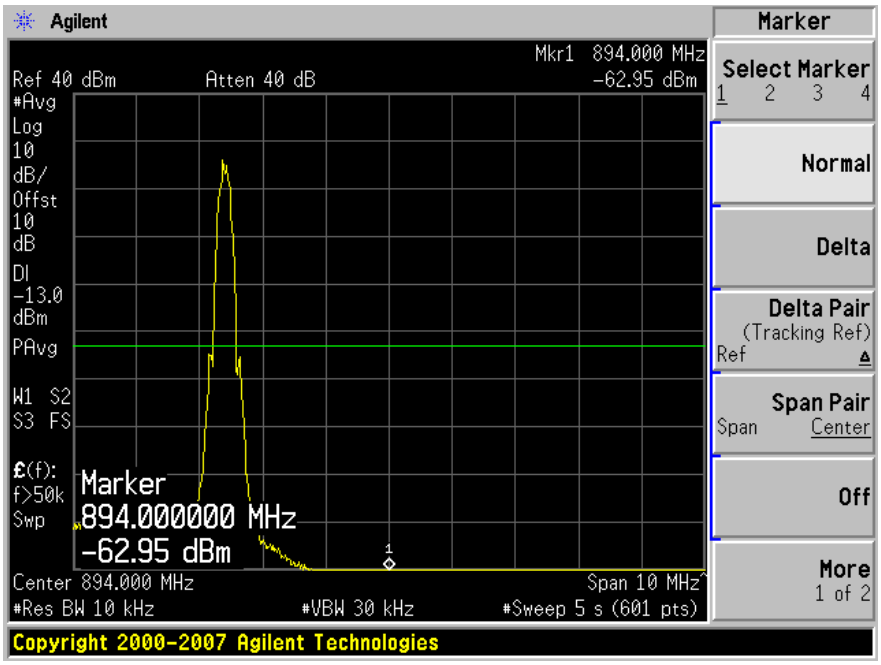


High Channel

EDGE 850 MHz Band Downlink Band Edge

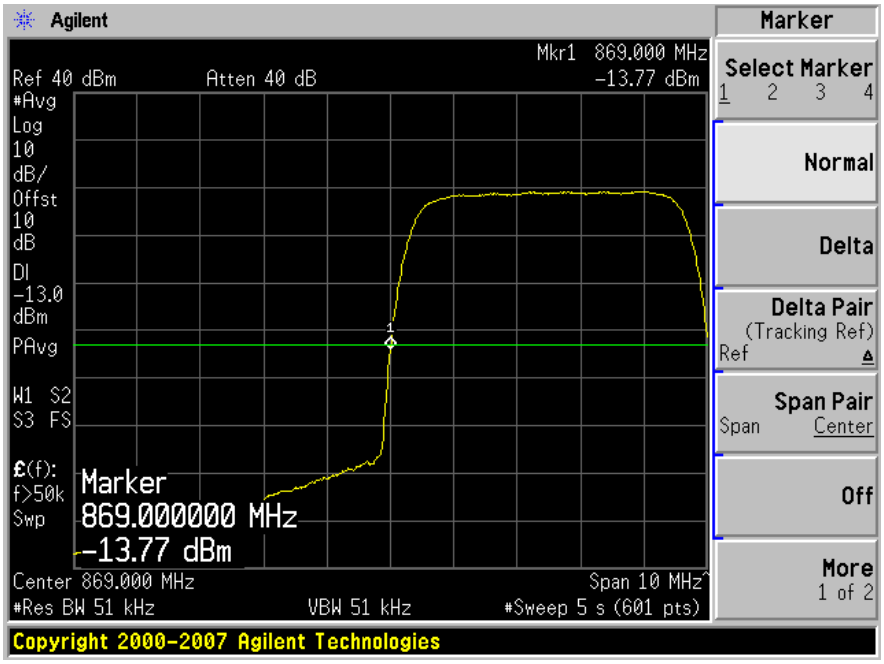


Low Channel

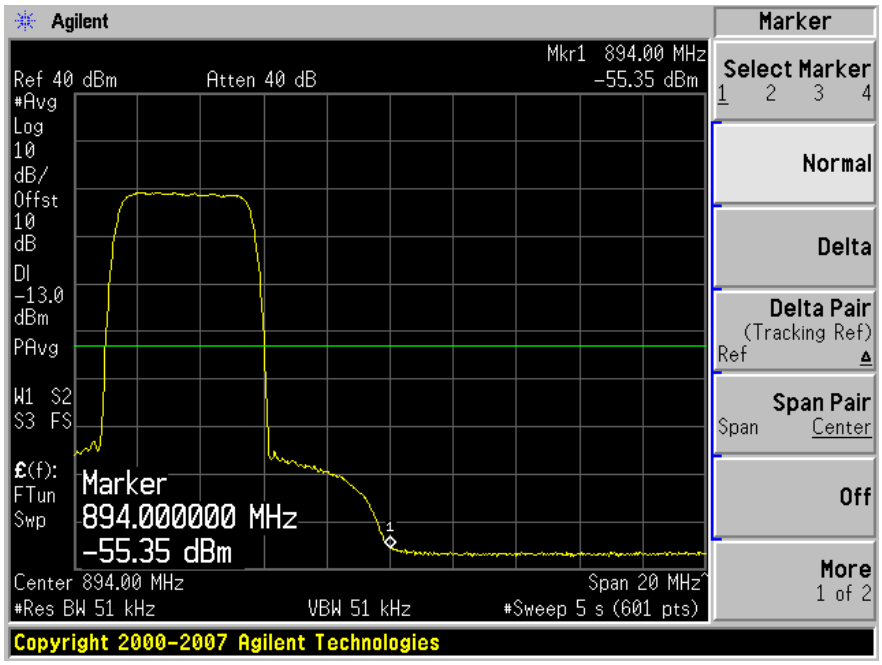


High Channel

WCDMA 850 MHz Band Downlink Band Edge



Low Channel



High Channel

10 FCC §2.1055 – Frequency Stability

This EUT is an amplifier, not a transmitter. There is no oscillator circuit in the EUT, therefore there is no frequency stability measurement required.

10.1 Test Result

N/A

11 FCC §1.1307(b)(1) & §2.1091 - RF EXPOSURE

11.1 Applicable Standard

According to §1.1310 and §2.1091 (Mobile Devices) RF exposure is calculated.

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 (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

11.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from 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):	37.90
Maximum peak output power at antenna input terminal (mW):	6165.95
Prediction distance (cm):	40.0
Prediction frequency (MHz):	881.6
Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.585
Power density at predication frequency and distance (mW/cm^2):	0.486
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.5877

Test Result

For Downlink, the highest power density level at 40 cm is 0.486 W/cm^2, which is below the uncontrolled exposure limit of 0.5877mW/cm^2 at 881.6 MHz.