FCC PART 22H, 24E, 27

TEST AND MEASUREMENT REPORT

For

ADC Telecommunications Inc.

P.O.Box 1101, Minneapolis, MN 55440-1101, USA

FCC ID: NOO-F0695-012

Report Type:	**Product Type:**
Original Report	Remote Access Unit for InterReach Fusion System

Test Engineer: Ning Ma

Report Number: R1205181-222427

Report Date: 2012-06-20

Victor Zhang

Reviewed By: EMC/RF Lead

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732 9164

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1205181-222427	Original Report	2012-06-20

1 General Description

1.1 Product Description for Equipment under Test (EUT)

The ADC Telecommunications Inc. product, model: Inter Reach Fusion, FCC ID: NOO-F0695-012, model: FSN-2-758519-1, or the "EUT" as referred to in this report, is a RAU for Indoor Booster. that is Indoor Wireless Repeater System. the system consists three modular components, the Main Hub (model number: FSN-2-MH-1), Expansion Hub (model: FSN-EH-2) and RAU-EUT (model: FSN-2-758519-1). For RAU the downlink frequency bands are 869-894 MHz, 1930-1995 MHz, and 746-757 MHz. Modulation types are CDMA/EVDO, GSM, EDGE, WCDMA/HSPA, QPSK, 16QAM and 64QAM.

1.2 Mechanical Description

The EUT dimension is approximately 28.1cm (L) x 28.6cm (W) x 5.4cm (H) and weighs approximately 14.06 kg.

The test data gathered are from production sample. Serial number: MR225EFN, assigned by ADC Telecommunications Inc.

1.3 Objective

This type approval report is prepared on behalf of ADC Telecommunications Inc. in accordance with Part 2, Subpart J, Part 22 Subpart H, and Part 24 Subpart E, and Part 27 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)

NA

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 22 Subpart H - Cellular Radiotelephone Service
Part 24 Subpart E - Broadband PCS
Part 27 - Miscellaneous Wireless Communications Services

Applicable Standards: TIA/EIA 603-C

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 CISPR16-4-2:2003, 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.

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 site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 EUT 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

N/A.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Equipment

No special equipment used during testing.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
ADC Telecommunications Inc.	Main Hub	MR223HLE	-
ADC Telecommunications Inc.	Expansion Hub	MR225UVN	-

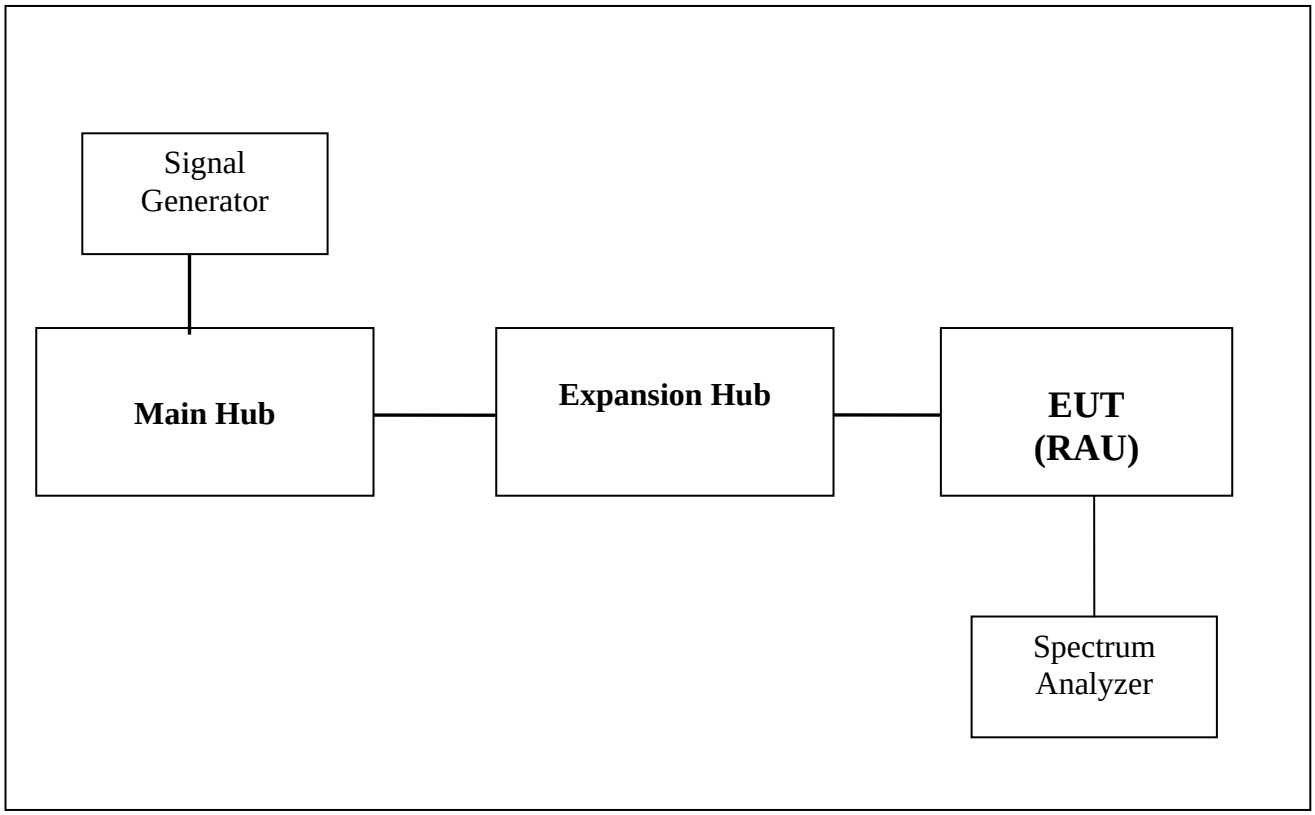
2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
ADC Telecommunications Inc.	PCB Board	740695-0	-

2.7 External I/O Cabling List and Details

Cable Description	Length (m)	From	To
Shielded Detachable K/B Cable	15	Expansion Hub	RAU (EUT)
Fiber Cable	2.0	Main Hub	Expansion Hub

2.8 Test Setup Block Diagram



3 Summary of Test Results

FCC Rules	Description of Tests	Results
§2.1046 §22.913(a), §24.232, §27.50	RF Output Power	Compliant
§2.1047	Modulation Characteristics	N/A
§2.1049 §22.917, §24.238, §27.53	Occupied Bandwidth / Out of Band Emissions	Compliant
§2.1053 §22.917, §24.238, §27.53	Spurious Radiated Emissions	Compliant
§2.1051 §22.917, §24.238, §27.53	Spurious Emissions at Antenna Terminals	Compliant
§22.917, §24.238, §27.53	Band Edge	Compliant
§2.1055 §22.355, §24.235,§27.54	Frequency Stability	Compliant
§2.1091	RF Exposure Information	Compliant

4 FCC §2.1046, §22.913(a), §24.232 & §27.50 – RF Output Power

4.1 Applicable Standard

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

According to FCC §24.232 , Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

According to FCC §27.50, the maximum effective radiated power (ERP) of fixed and base station must not exceed 1000 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09[1]
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03

Note 1: Based on a two year calibration cycle.
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

4.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	57 %
ATM Pressure:	101.4kPa

The testing was performed by Ning Ma from 2012-05-27 at RF Site.

4.5 Test Results

Maximum Output Power – Modulated Signal

Mode		Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
GSM/GPRS	850 MHz Downlink	Low	869.2	12	25.93
		Middle	881.6	12	26.01
		High	893.8	12	26.12
	1900 MHz Downlink	Low	1930.2	12	25.17
		Middle	1960.0	12	25.68
		High	1994.8	12	26.01

Mode		Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
EDGE	850 MHz Downlink	Low	869.2	10	25.79
		Middle	881.6	10	26.41
		High	893.8	10	26.61
	1900 MHz Downlink	Low	1930.2	10	24.11
		Middle	1960.0	10	26.45
		High	1994.8	10	24.30

Mode		Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
CDMA/EVDO	850 MHz Downlink	Low	869.80	7	19.73
		Middle	881.52	7	19.54
		High	893.20	7	19.72
	1900 MHz Downlink	Low	1930.8	8	18.87
		Middle	1960.0	8	19.88
		High	1994.2	8	18.79

Mode		Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
WCDMA/HSPA	850 MHz Downlink	Low	871.4	5	19.51
		Middle	881.4	5	20.08
		High	891.6	5	20.22
	1900 MHz Downlink	Low	1932.4	6	19.66
		Middle	1960.0	6	20.68
		High	1992.6	6	19.28

LTE 700UC Band – Downlink

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
Downlink 746-757 MHz	QPSK (1.4 MHz)	747	4	19.13
	QPSK (1.4 MHz)	752	4	19.56
	QPSK (1.4 MHz)	756	4	19.14
	16QAM (1.4 MHz)	747	4	19.14
	16QAM (1.4 MHz)	752	4	19.55
	16QAM (1.4 MHz)	756	4	19.71
	64QAM (1.4 MHz)	747	4	19.02
	64QAM (1.4 MHz)	752	4	19.52
	64QAM (1.4 MHz)	756	4	18.66
	QPSK (3 MHz)	748	5	19.48
	QPSK (3 MHz)	752	5	19.78
	QPSK (3 MHz)	755	5	19.16
	16QAM (3 MHz)	748	5	19.45
	16QAM (3 MHz)	752	5	19.76
	16QAM (3 MHz)	755	5	19.16
	64QAM (3 MHz)	748	5	19.02
	64QAM (3 MHz)	752	5	19.35
	64QAM (3 MHz)	755	5	19.48
	QPSK (5 MHz)	749	5	19.35
	QPSK (5 MHz)	754	5	19.96
	16QAM (5 MHz)	749	5	19.33
	16QAM (5 MHz)	754	5	19.96
	64QAM (5 MHz)	749	5	19.32
	64QAM (5 MHz)	754	5	19.93
	QPSK (10 MHz)	752	5	19.31
	16QAM (10 MHz)	752	5	19.30
	64QAM (10 MHz)	752	5	19.28

LTE Cellular 850 Band – Downlink

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
Downlink 869-894 MHz	QPSK (1.4 MHz)	870	5	19.13
	QPSK (1.4 MHz)	881.5	5	19.56
	QPSK (1.4 MHz)	893	5	19.14
	16QAM (1.4 MHz)	870	5	19.15
	16QAM (1.4 MHz)	881.5	5	19.55
	16QAM (1.4 MHz)	893	5	19.11
	64QAM (1.4 MHz)	870	5	19.15
	64QAM (1.4 MHz)	881.5	5	19.62
	64QAM (1.4 MHz)	893	5	19.12
	QPSK (3 MHz)	871	5	19.17
	QPSK (3 MHz)	881.5	5	19.73
	QPSK (3 MHz)	892	5	19.19
	16QAM (3 MHz)	871	5	19.17
	16QAM (3 MHz)	881.5	5	19.10
	16QAM (3 MHz)	892	5	19.26
	64QAM (3 MHz)	871	5	19.69
	64QAM (3 MHz)	881.5	5	19.15
	64QAM (3 MHz)	892	5	19.35
	QPSK (5 MHz)	872	5	19.65
	QPSK (5 MHz)	881.5	5	19.05
	QPSK (5 MHz)	891	5	19.21
	16QAM (5 MHz)	872	5	19.63
	16QAM (5 MHz)	881.5	5	19.05
	16QAM (5 MHz)	891	5	19.31
	64QAM (5 MHz)	872	5	19.65
	64QAM (5 MHz)	881.5	5	19.21
	64QAM (5 MHz)	891	5	19.26
	QPSK (10 MHz)	874	5	19.07
	QPSK (10 MHz)	881.5	5	19.13
	QPSK (10 MHz)	889	5	19.48
	16QAM (10 MHz)	874	5	18.08
	16QAM (10 MHz)	881.5	5	18.15
	16QAM (10 MHz)	889	5	19.01
	64QAM (10 MHz)	874	5	18.09
	64QAM (10 MHz)	881.5	5	19.18
	64QAM (10 MHz)	889	5	19.47

LTE PCS 1900 Band – Downlink

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
Downlink 1930-1990 MHz	QPSK (1.4 MHz)	1931	4	18.27
	QPSK (1.4 MHz)	1960	4	18.38
	QPSK (1.4 MHz)	1994	4	19.15
	16QAM (1.4 MHz)	1931	4	18.25
	16QAM (1.4 MHz)	1960	4	18.37
	16QAM (1.4 MHz)	1994	4	19.15
	64QAM (1.4 MHz)	1931	4	19.58
	64QAM (1.4 MHz)	1960	4	19.82
	64QAM (1.4 MHz)	1994	4	19.42
	QPSK (3 MHz)	1932	4	19.05
	QPSK (3 MHz)	1960	4	19.41
	QPSK (3 MHz)	1993	4	18.82
	16QAM (3 MHz)	1932	4	19.05
	16QAM (3 MHz)	1960	4	19.51
	16QAM (3 MHz)	1993	4	18.82
	64QAM (3 MHz)	1932	4	18.55
	64QAM (3 MHz)	1960	4	19.29
	64QAM (3 MHz)	1993	4	19.81
	QPSK (5 MHz)	1933	4	18.67
	QPSK (5 MHz)	1960	4	19.01
	QPSK (5 MHz)	1992	4	18.42
	16QAM (5 MHz)	1933	4	18.65
	16QAM (5 MHz)	1960	4	19.36
	16QAM (5 MHz)	1992	4	18.46
	64QAM (5 MHz)	1933	4	19.64
	64QAM (5 MHz)	1960	4	19.56
	64QAM (5 MHz)	1992	4	18.88
	QPSK (10 MHz)	1935	4	18.96
	QPSK (10 MHz)	1960	4	19.65
	QPSK (10 MHz)	1990	4	18.89
	16QAM (10 MHz)	1935	4	18.39
	16QAM (10 MHz)	1960	4	19.31
	16QAM (10 MHz)	1990	4	18.79
	64QAM (10 MHz)	1935	4	19.16
	64QAM (10 MHz)	1960	4	18.98
	64QAM (10 MHz)	1990	4	18.69

5 FCC §2.1047 - Modulation Characteristic

5.1 Applicable Standard

According to FCC §2.1047(d), Part 22H and Part 24E, 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, §24.238 & §27.53 – Occupied Bandwidth

6.1 Applicable Standard

Requirements: FCC §2.1049, §22.917, §24.238 and §27.53.

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 30 kHz (Cellular/PCS) and the 26 dB & 99% bandwidth was recorded.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09[1]
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03

Note 1: Based on a two year calibration cycle.
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

6.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	57 %
ATM Pressure:	101.4kPa

The testing was performed by Ning Ma from 2012-05-27 at RF Site.

6.5 Test Results

Mode		Channel	Frequency (MHz)	Emission Bandwidth Input (kHz)	Emission Bandwidth Output (kHz)
GSM	850 MHz Downlink	Middle	881.6	245.1640	244.9104
	1900 MHz Downlink	Middle	1960.0	245.8515	242.6393

Mode		Channel	Frequency (MHz)	Emission Bandwidth Input (kHz)	Emission Bandwidth Output (kHz)
EDGE	850 MHz Downlink	Middle	881.6	244.6436	243.7371
	1900 MHz Downlink	Middle	1960.0	243.8317	246.8012

Mode		Channel	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
CDMA/EVDO	850 MHz Downlink	Middle	881.52	1.2601	1.2586
	1900 MHz Downlink	Middle	1960.0	1.2627	1.2657

Mode		Channel	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
WCDMA/HSPA	850 MHz Downlink	Middle	881.4	4.1504	4.1758
	1900 MHz Downlink	Middle	1960.0	4.1690	4.1669

LTE 700UC Band – Downlink

Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Downlink 746-757 MHz	QPSK (1.4 MHz)	752	1.0916	1.0936
	16QAM (1.4 MHz)	752	1.0990	1.1003
	64QAM (1.4 MHz)	752	1.0971	1.0948
	QPSK (3 MHz)	752	2.6940	2.6906
	16QAM (3 MHz)	752	2.6955	2.6934
	64QAM (3 MHz)	752	2.6981	2.6962
	QPSK (5 MHz)	752	4.4835	4.4828
	16QAM (5 MHz)	752	4.4848	4.4838
	64QAM (5 MHz)	752	4.4814	4.4858
	QPSK (10 MHz)	752	8.9428	8.9381
	16QAM (10 MHz)	752	8.9450	8.9242
	64QAM (10 MHz)	752	8.9391	8.9256

LTE Cellular 850 Band – Downlink

Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Downlink 869-894 MHz	QPSK (1.4 MHz)	881.5	1.0957	1.0989
	16QAM (1.4 MHz)	881.5	1.0973	1.1061
	64QAM (1.4 MHz)	881.5	1.0951	1.0998
	QPSK (3 MHz)	881.5	2.6944	2.7020
	16QAM (3 MHz)	881.5	2.6926	2.7034
	64QAM (3 MHz)	881.5	2.6964	2.6977
	QPSK (5 MHz)	881.5	4.4818	4.4788
	16QAM (5 MHz)	881.5	4.4898	4.4902
	64QAM (5 MHz)	881.5	4.4856	4.4868
	QPSK (10 MHz)	881.5	8.9522	8.9628
	16QAM (10 MHz)	881.5	8.9528	8.9617
	64QAM (10 MHz)	881.5	8.9402	8.9516

LTE PCS 1900 Band – Downlink

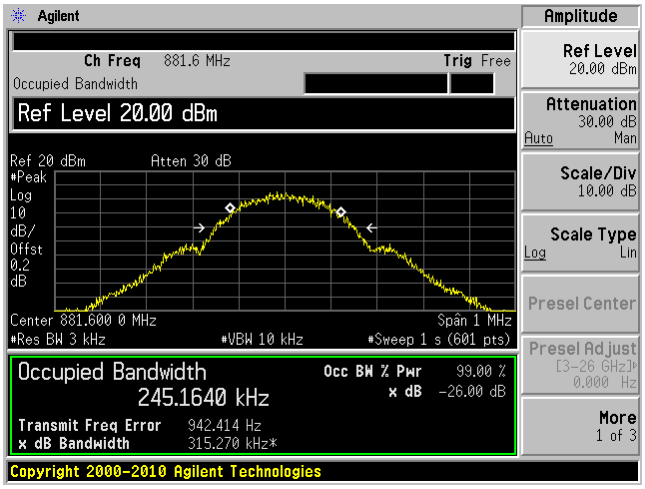
Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Downlink 1930-1990 MHz	QPSK (1.4 MHz)	1960	1.0950	1.0968
	16QAM (1.4 MHz)	1960	1.0967	1.0962
	64QAM (1.4 MHz)	1960	1.0957	1.0966
	QPSK (3 MHz)	1960	2.6915	2.6902
	16QAM (3 MHz)	1960	2.7033	2.6950
	64QAM (3 MHz)	1960	2.6966	2.6984
	QPSK (5 MHz)	1960	4.4711	4.4859
	16QAM (5 MHz)	1960	4.4889	4.4804
	64QAM (5 MHz)	1960	4.4834	4.4876
	QPSK (10 MHz)	1960	8.9420	8.9386
	16QAM (10 MHz)	1960	8.9470	8.9499
	64QAM (10 MHz)	1960	8.9423	8.9482

Please refer to the following plots.

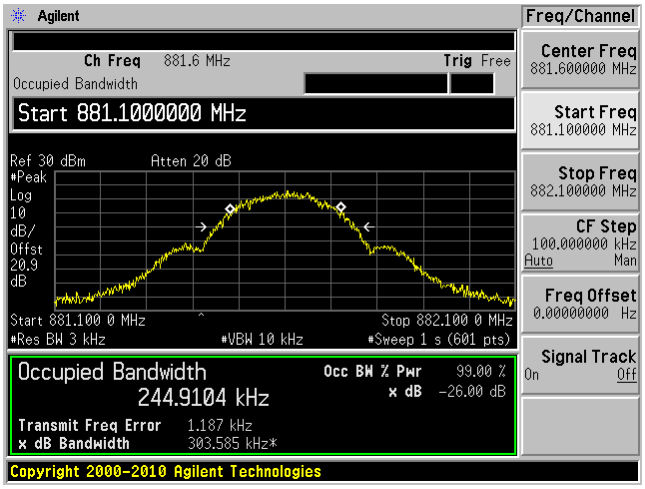
Cell Band, Downlink

GSM/GPRS (Middle Channel)

Input

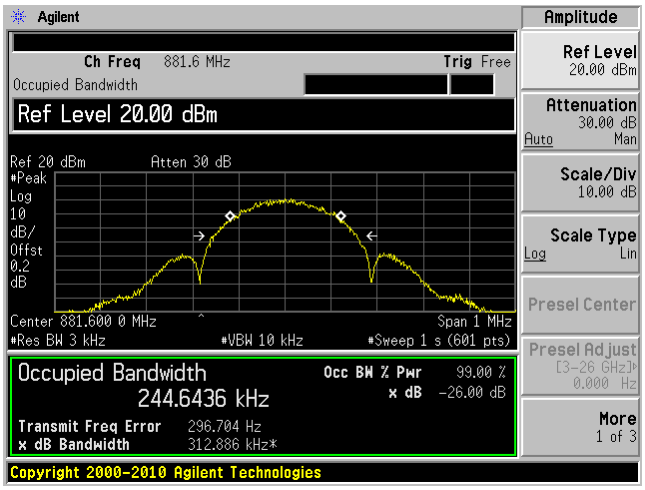


Output

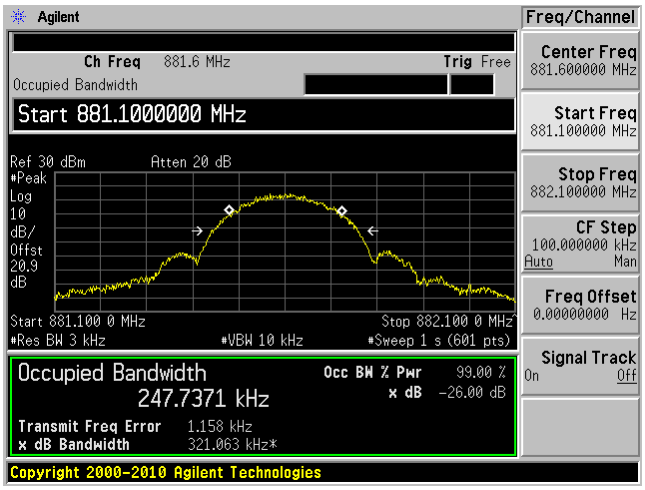


EDGE (Middle Channel)

Input

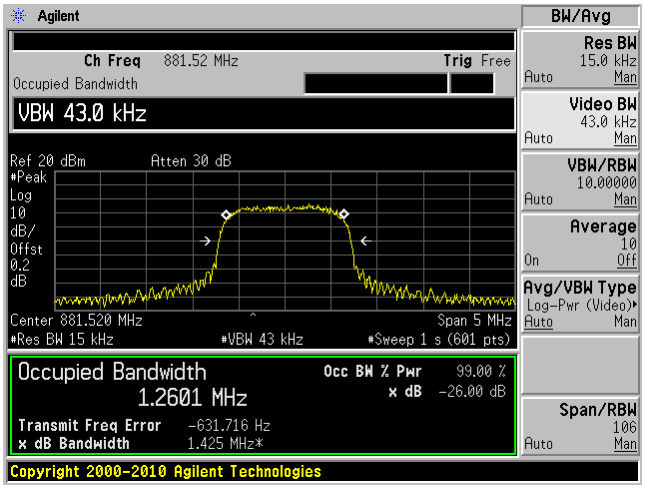


Output

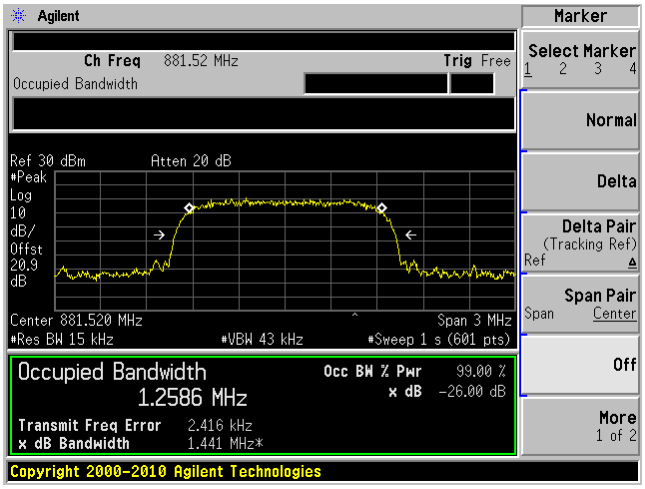


CDMA/EVDO (Middle Channel)

Input

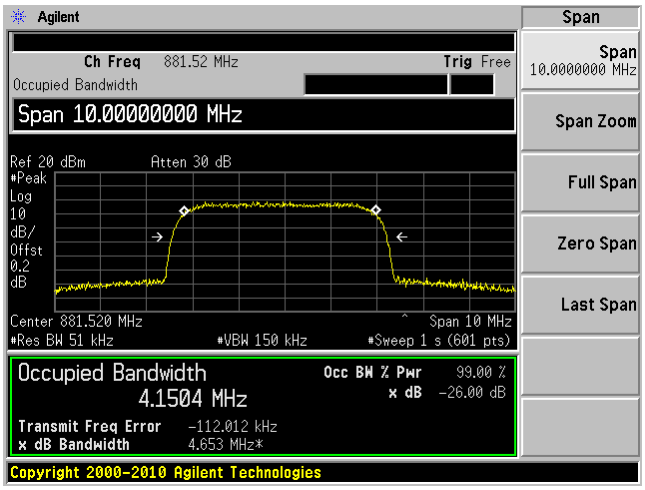


Output

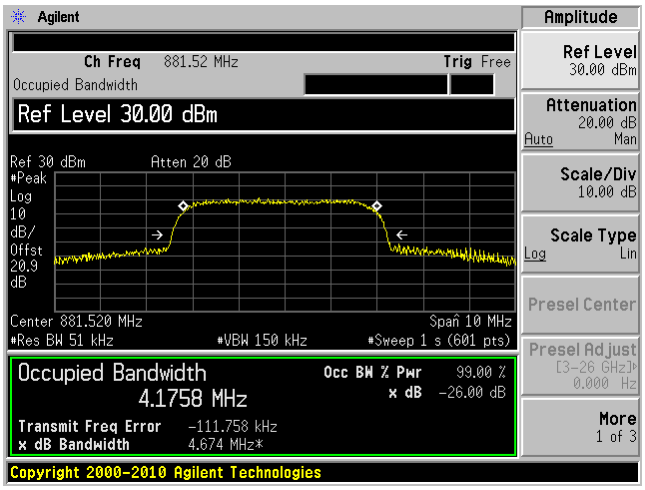


WCDMA/HSPA (Middle Channel)

Input



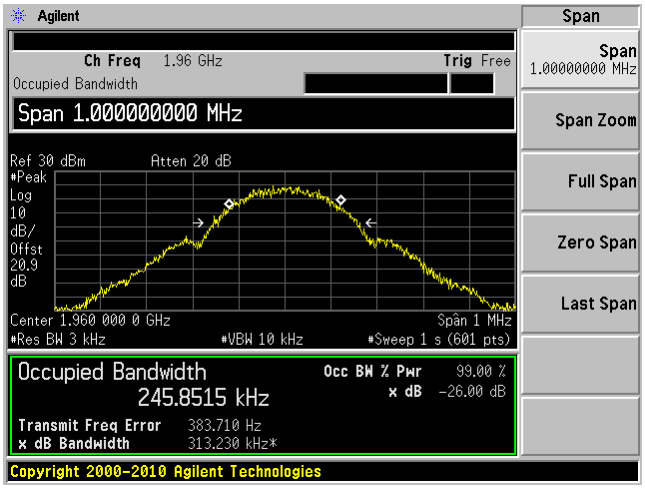
Output



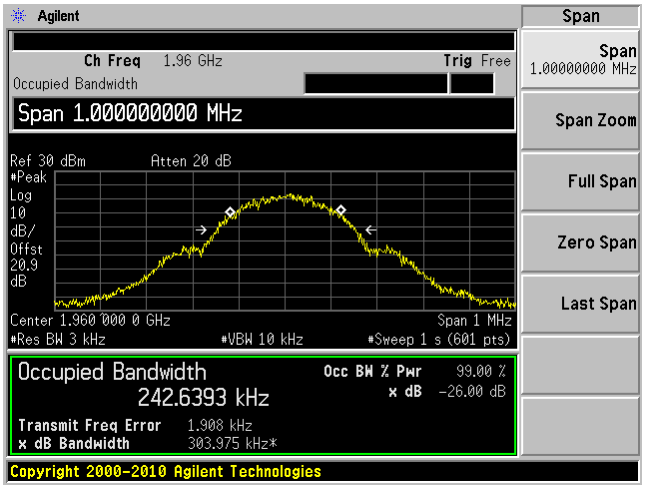
PCS Band, Downlink

GSM/GPRS (Middle Channel)

Input

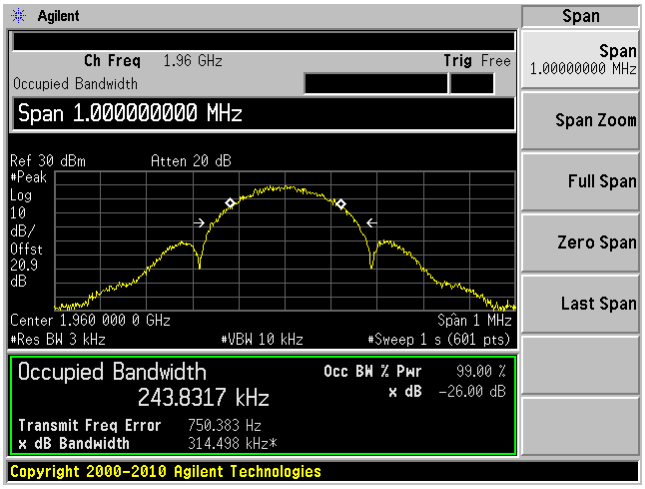


Output

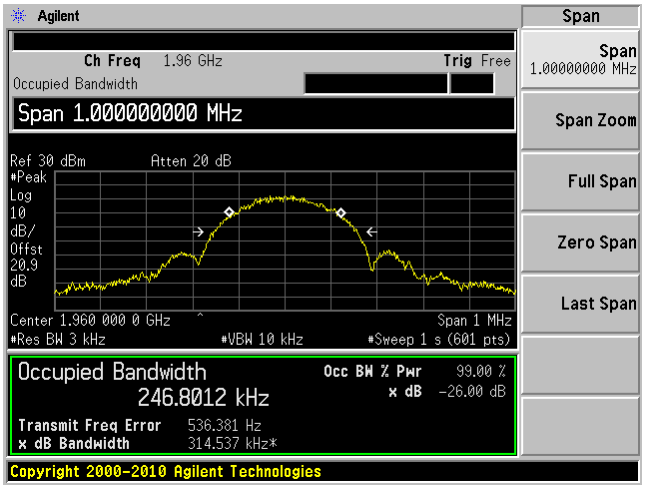


EDGE (Middle Channel)

Input

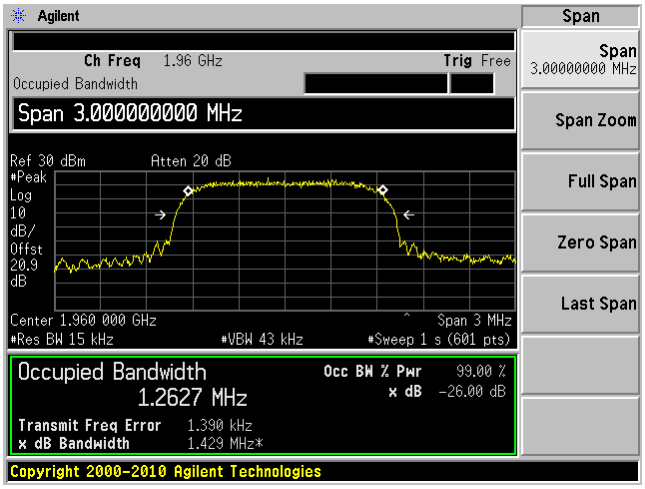


Output

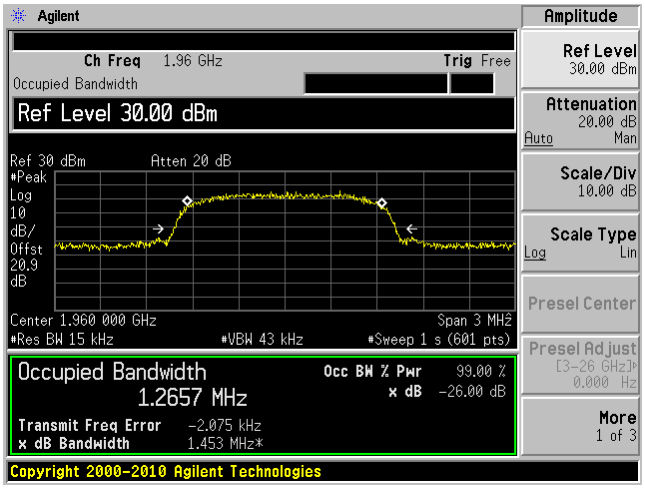


CDMA/EVDO (Middle Channel)

Input

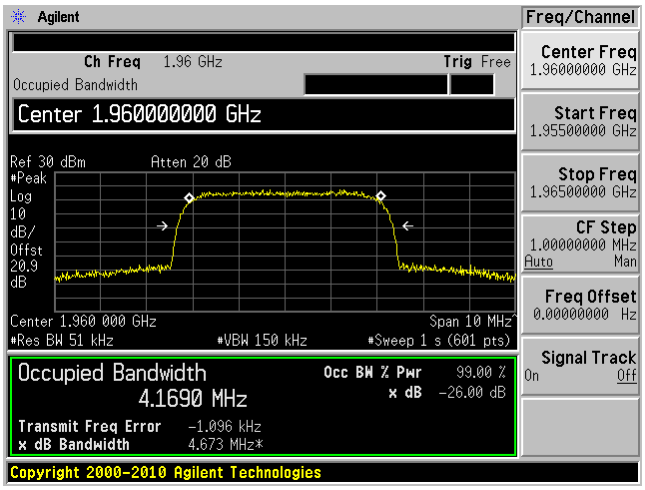


Output

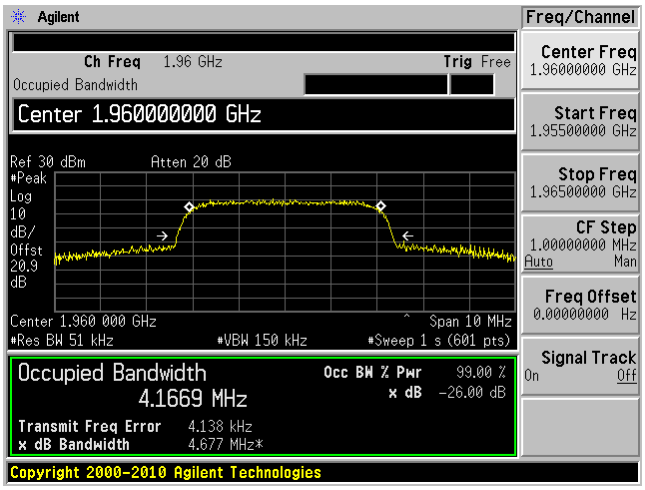


WCDMA/HSPA (Middle Channel)

Input



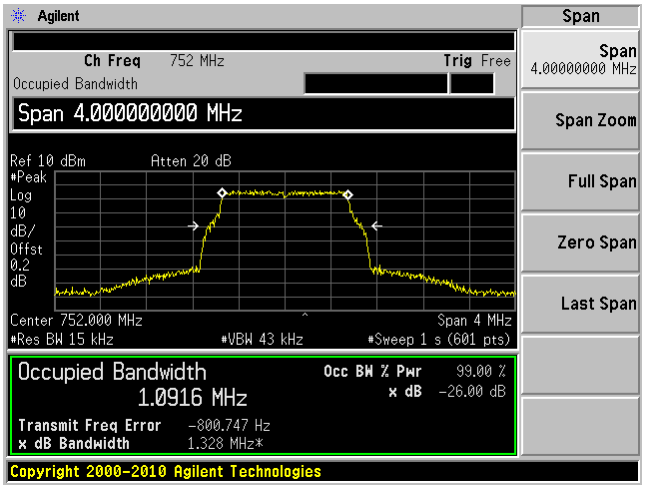
Output



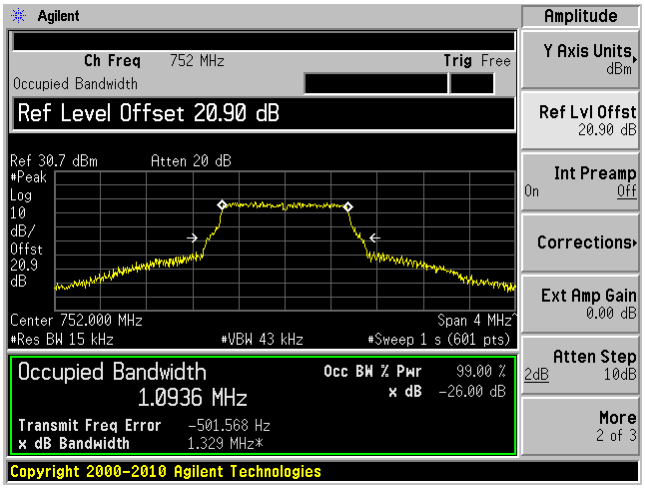
LTE 700UC Band; Downlink (746-757 MHz)

QPSK (1.4 MHz), (Middle Channel)

Input

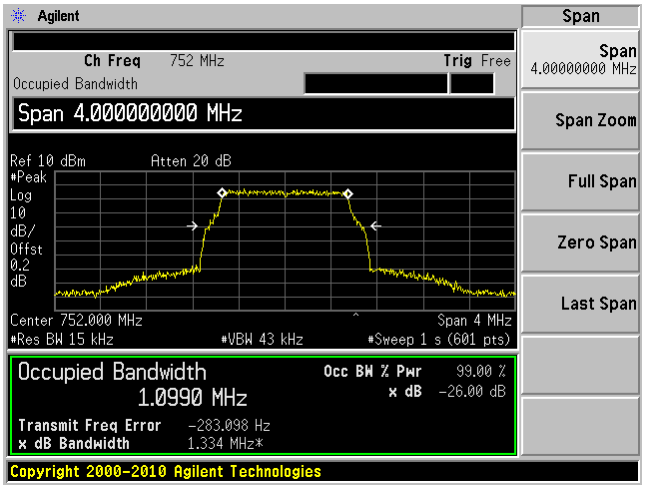


Output

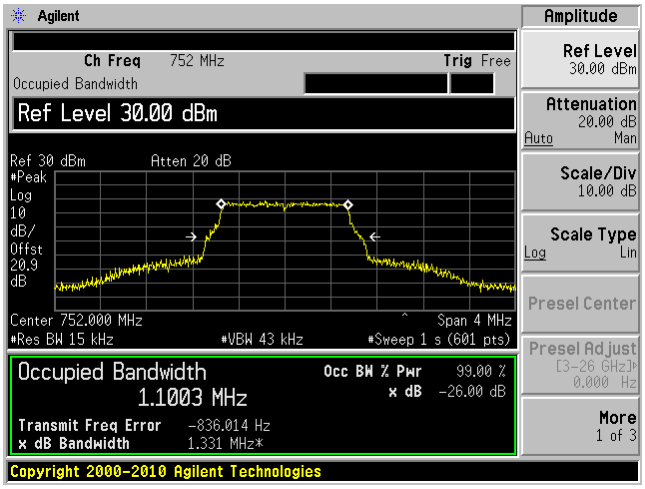


16QAM (1.4 MHz), (Middle Channel)

Input

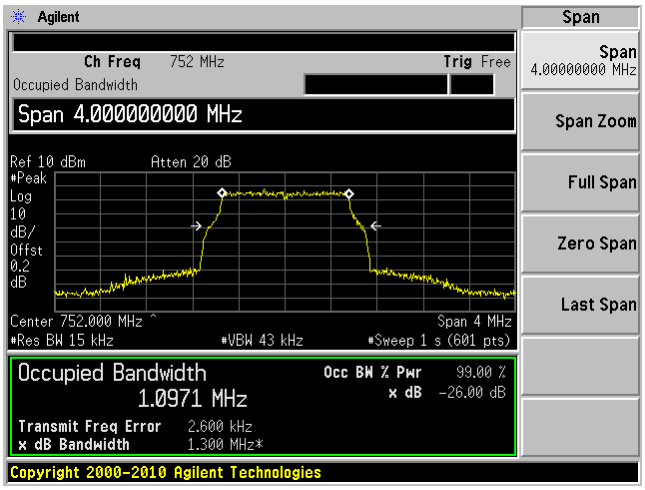


Output

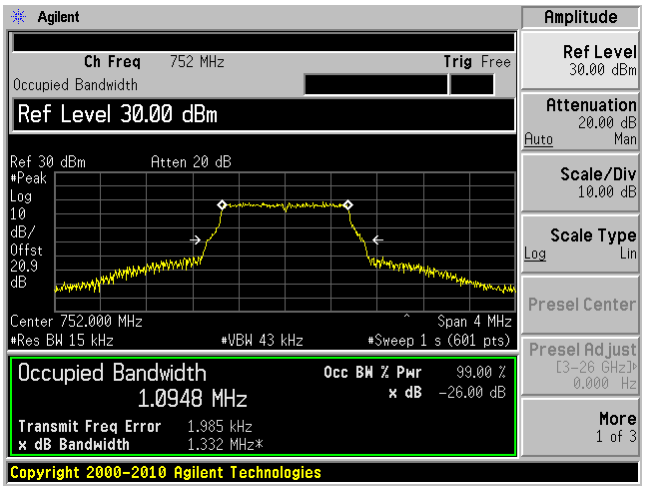


64QAM (1.4 MHz), (Middle Channel)

Input

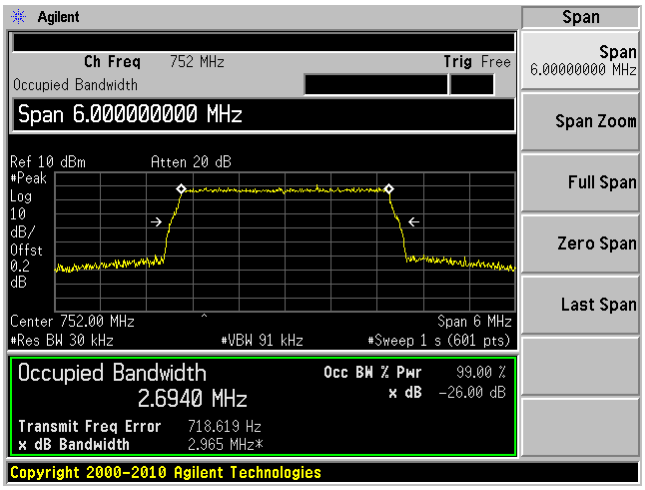


Output

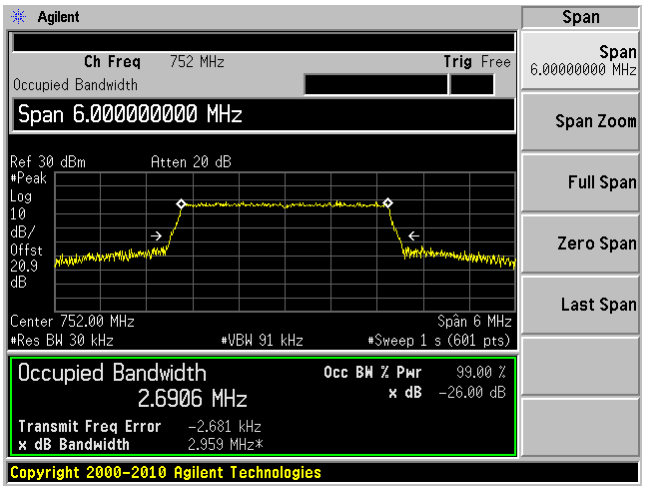


QPSK (3 MHz), (Middle Channel)

Input

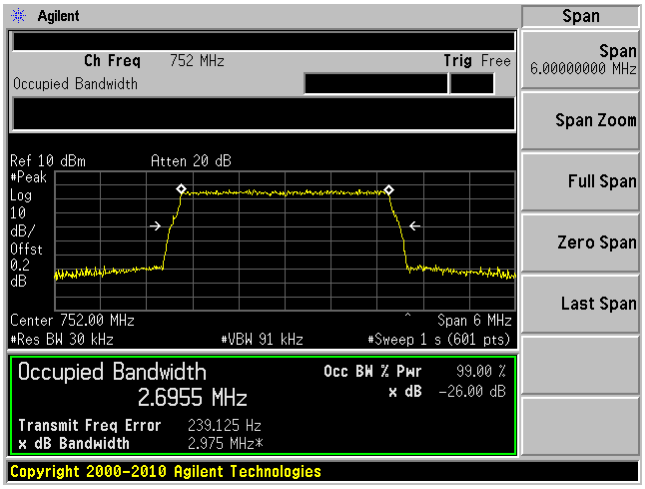


Output

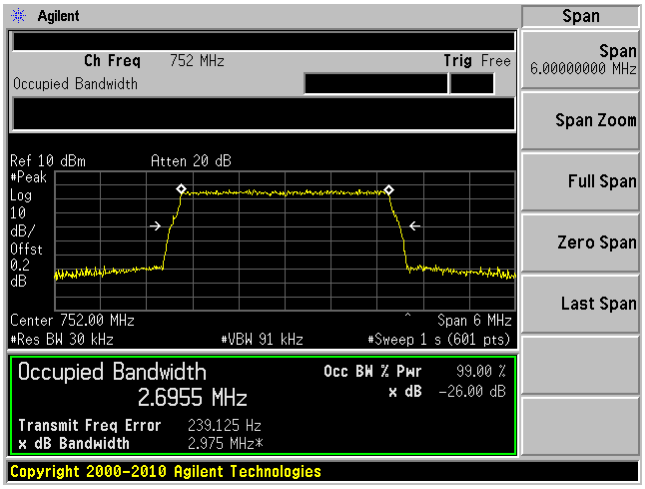


16QAM (3 MHz), (Middle Channel)

Input

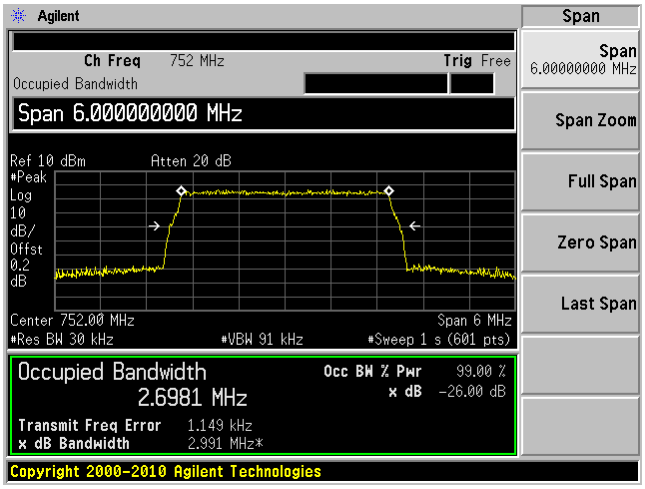


Output

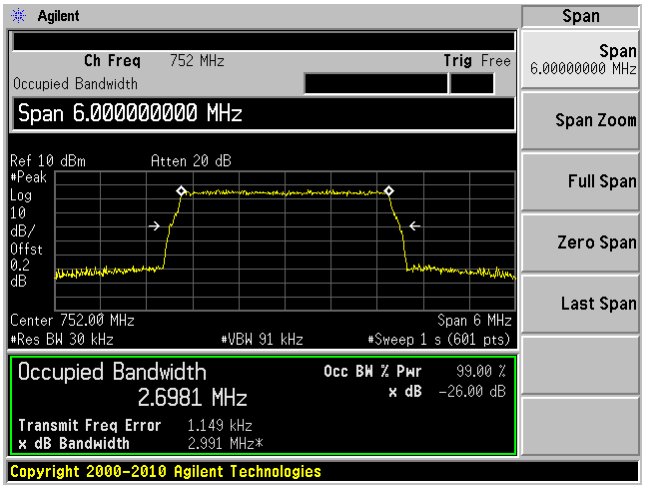


64QAM (3 MHz), (Middle Channel)

Input

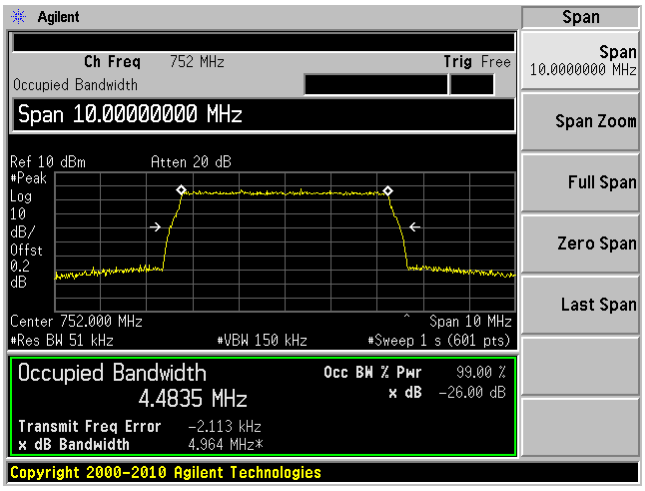


Output

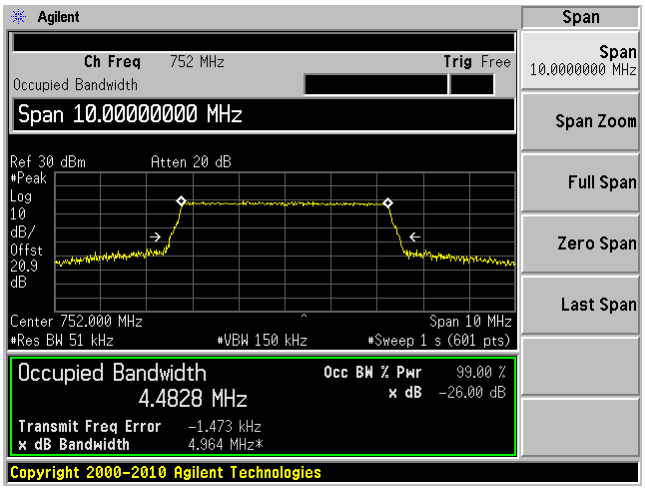


QPSK (5 MHz), (Middle Channel)

Input

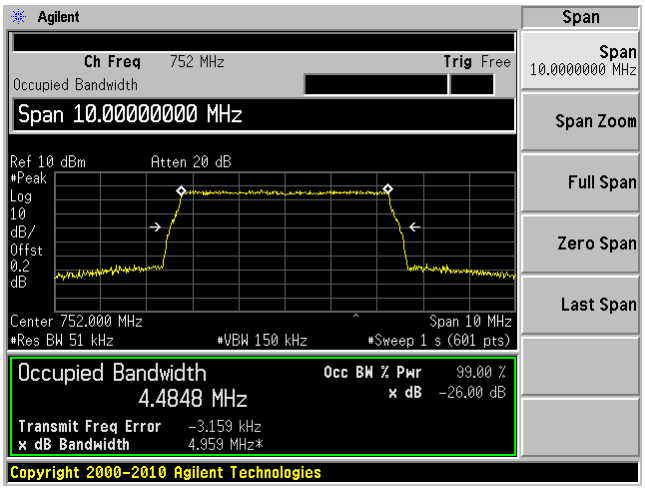


Output

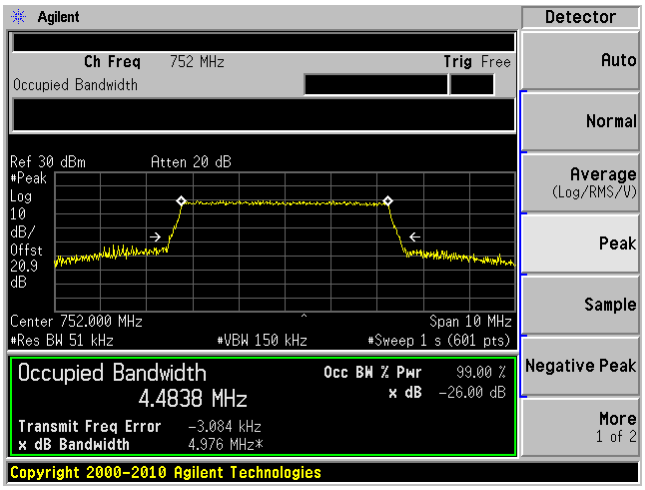


16QAM (5 MHz), (Middle Channel)

Input

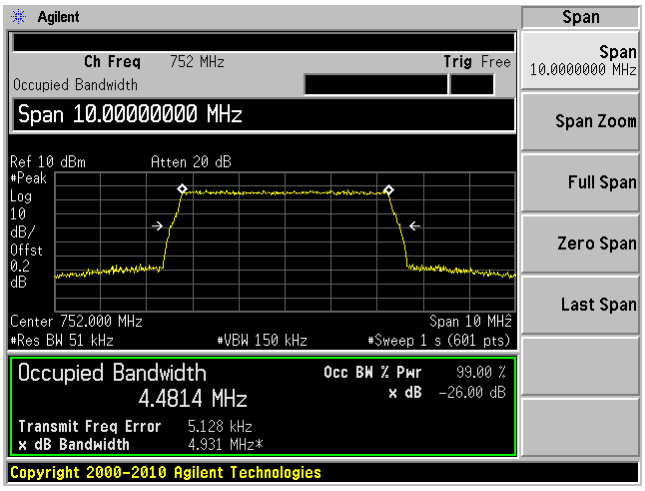


Output

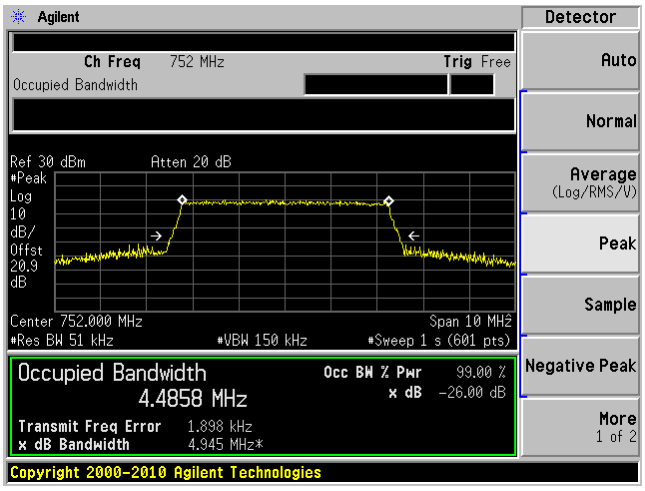


64QAM (5 MHz), (Middle Channel)

Input

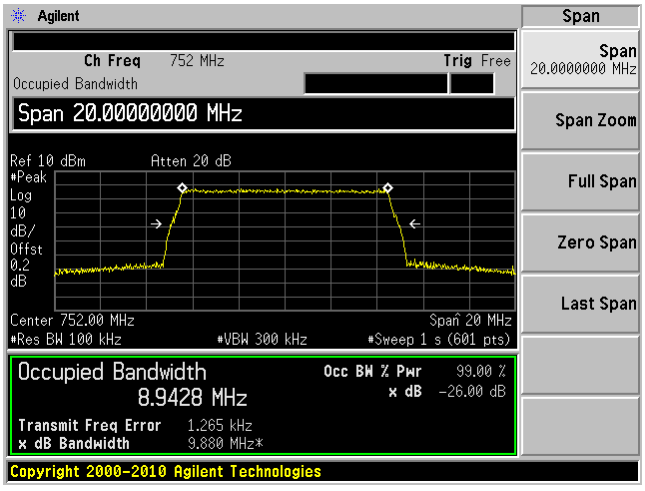


Output

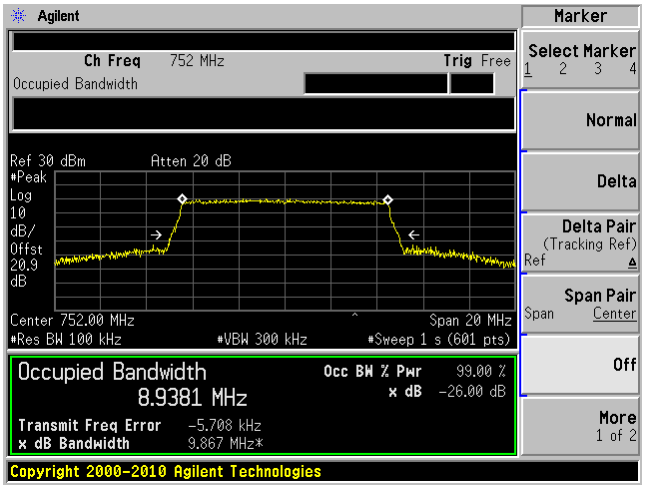


QPSK (10 MHz), (Low Channel)

Input

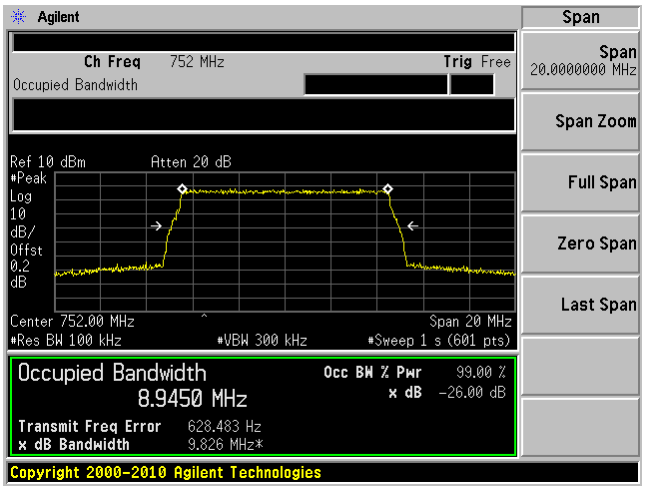


Output

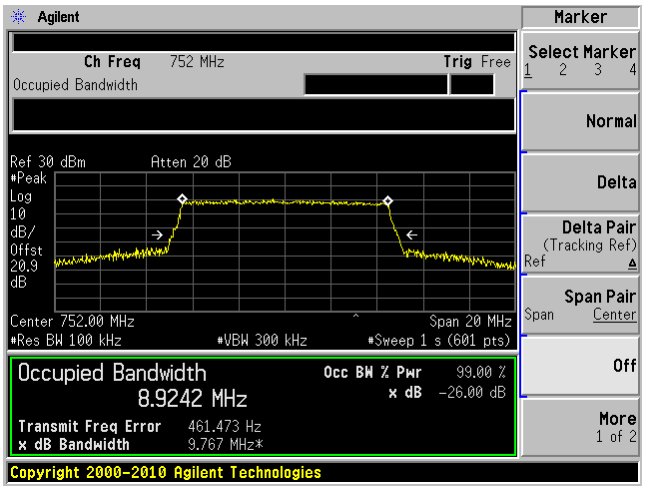


16QAM (10 MHz), (Low Channel)

Input

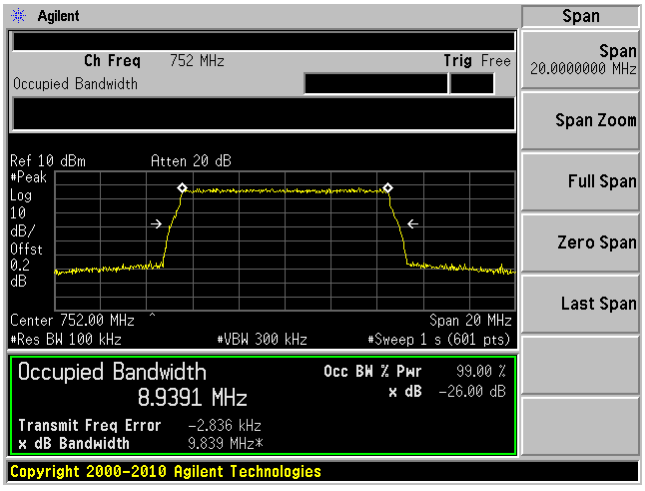


Output

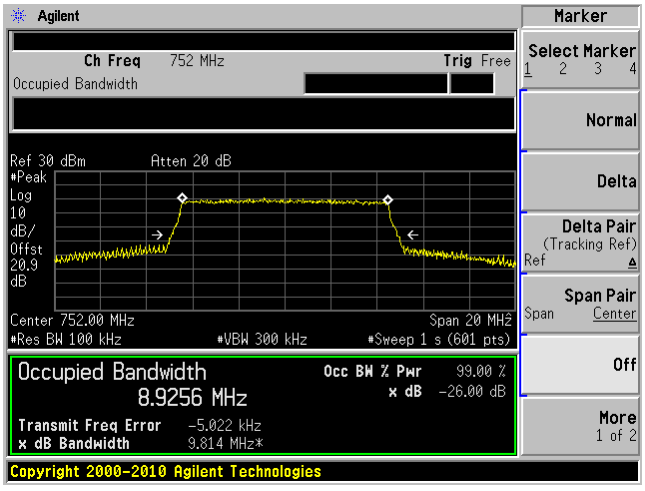


64QAM (10 MHz), (Low Channel)

Input



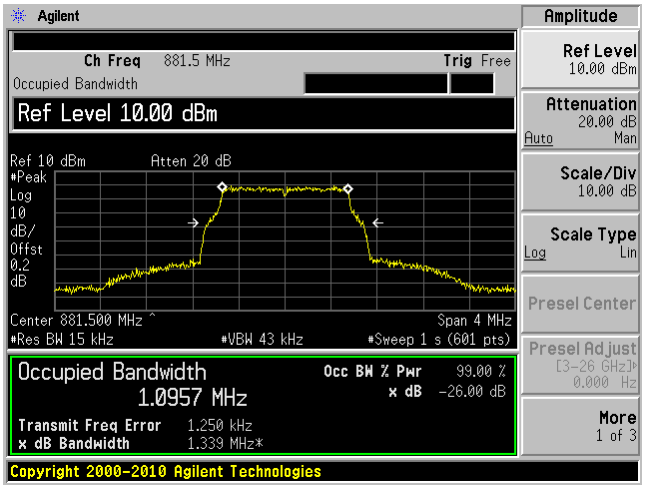
Output



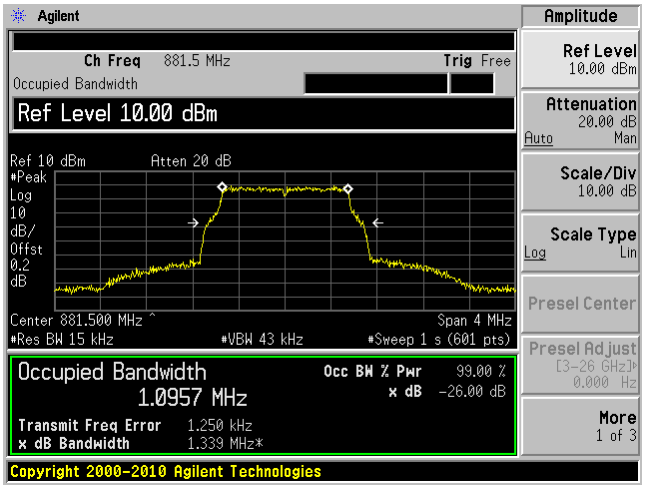
LTE Cellular 850 Band; Downlink (869-894 MHz)

QPSK (1.4 MHz), (Middle Channel)

Input

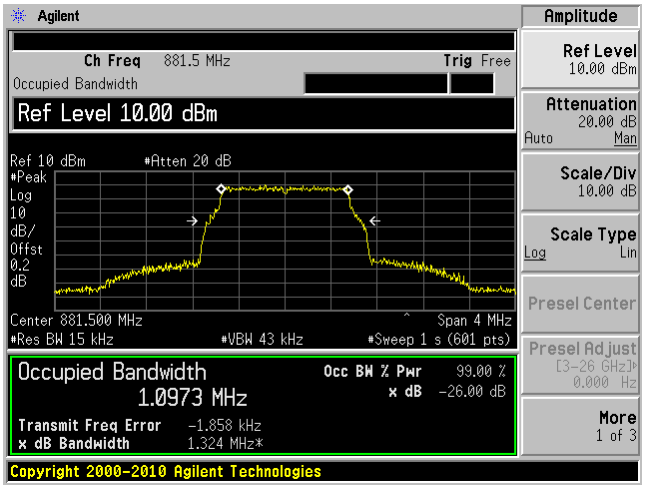


Output

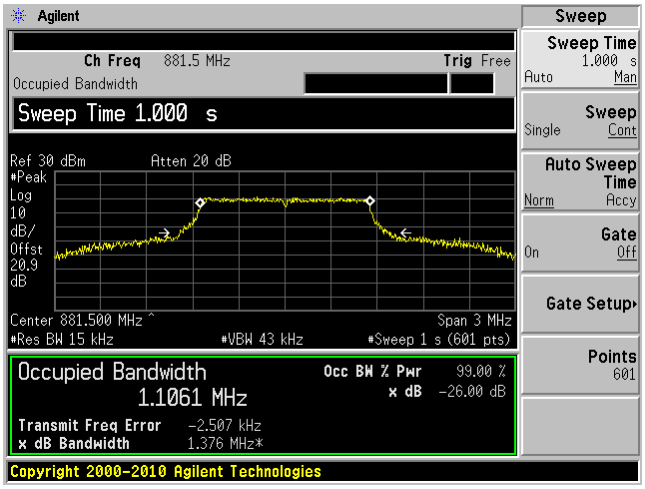


16QAM (1.4 MHz), (Middle Channel)

Input

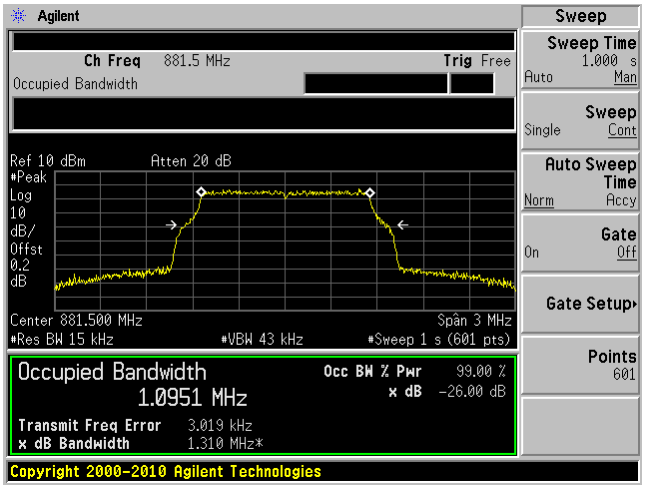


Output

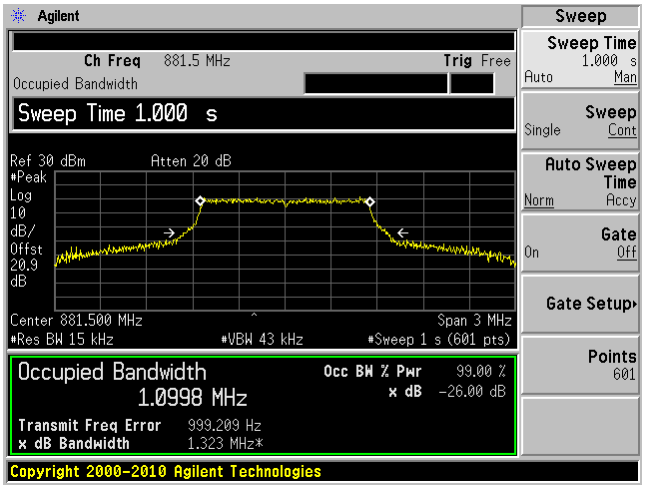


64QAM (1.4 MHz), (Middle Channel)

Input

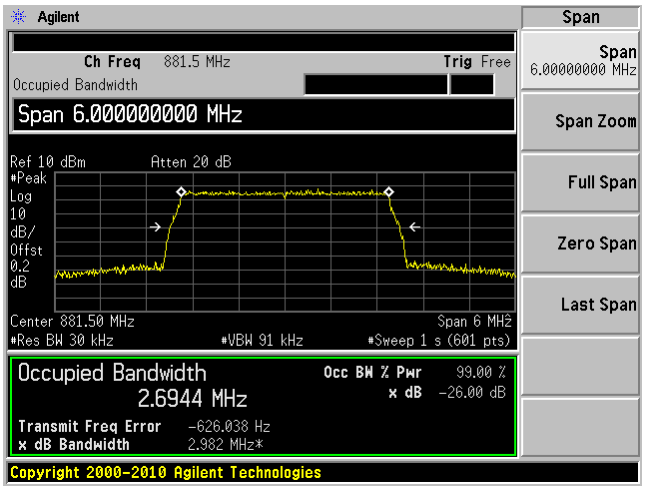


Output

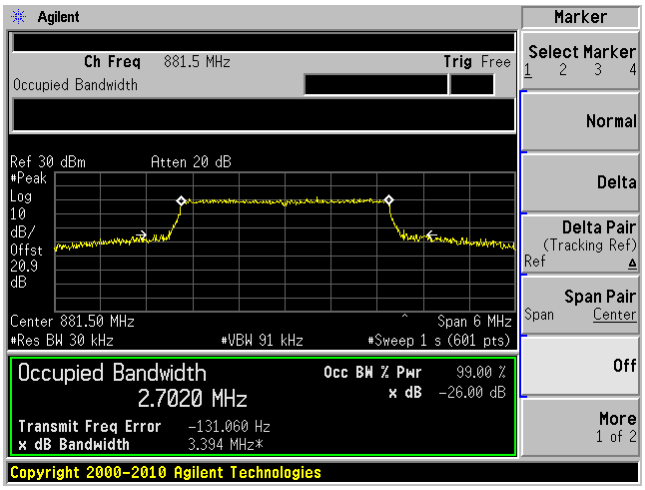


QPSK (3 MHz), (Middle Channel)

Input

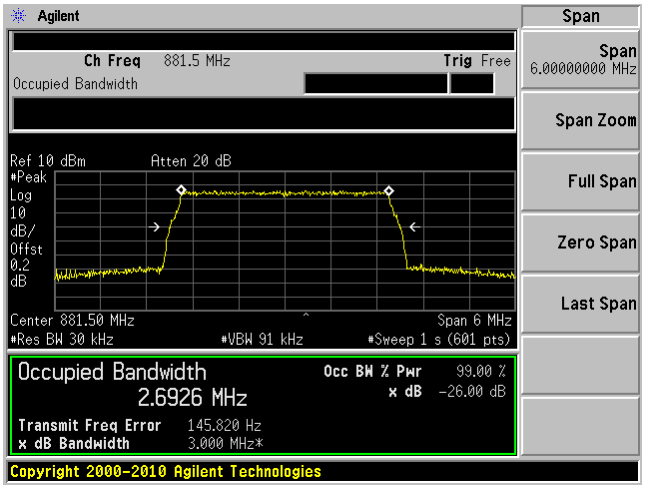


Output

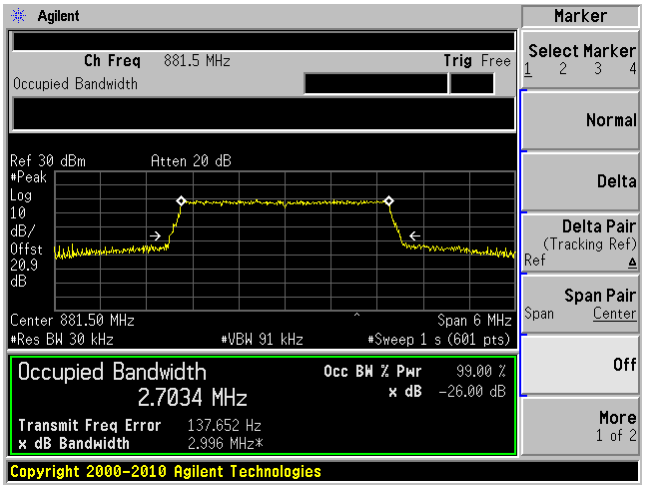


16QAM (3 MHz), (Middle Channel)

Input

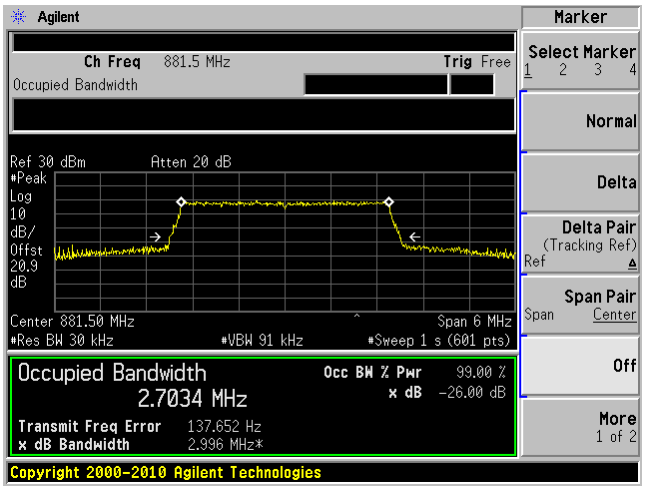


Output

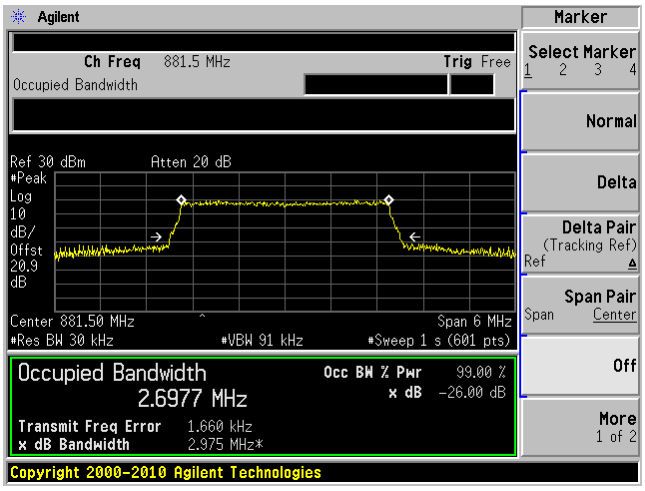


64QAM (3 MHz), (Middle Channel)

Input

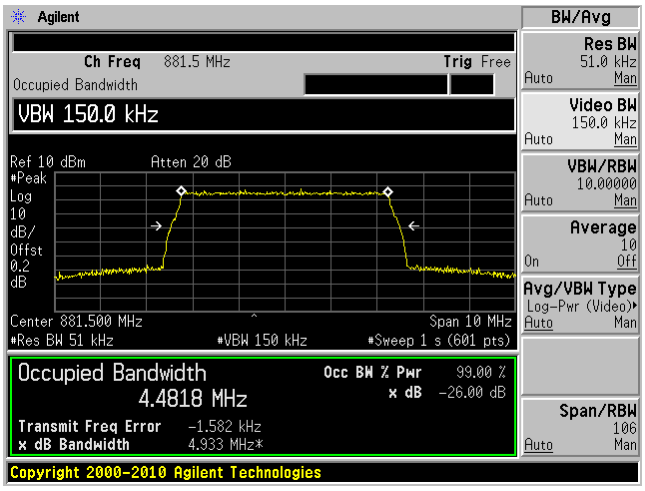


Output

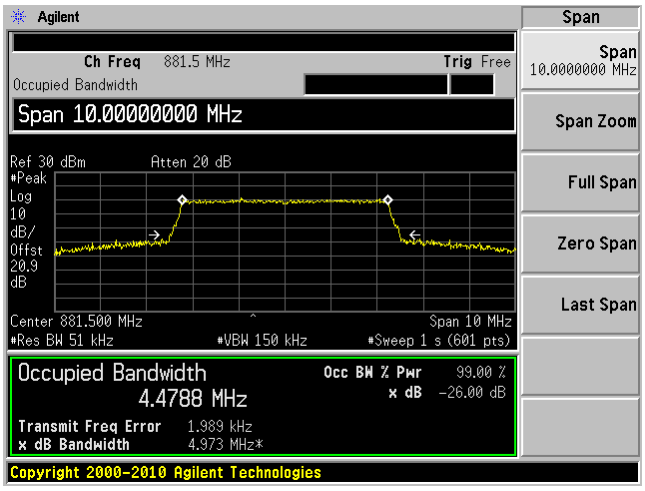


QPSK (5 MHz), (Middle Channel)

Input

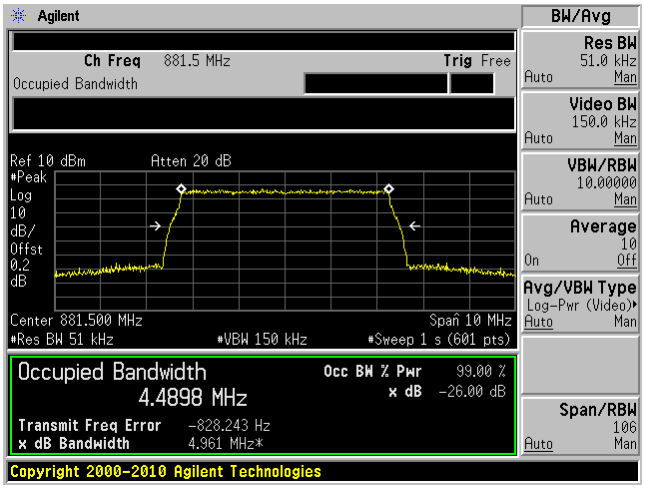


Output

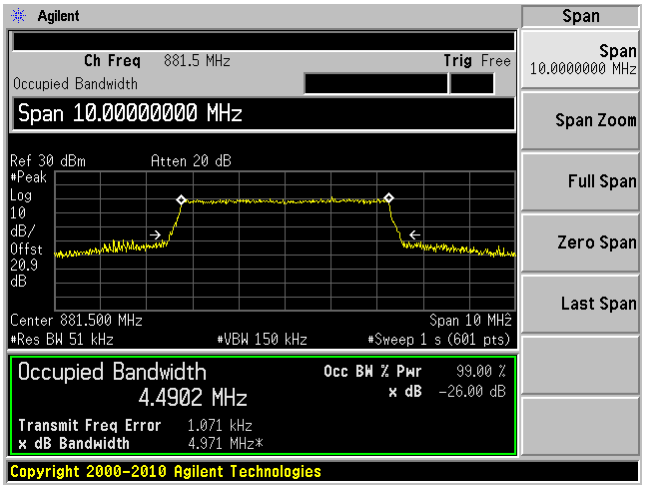


16QAM (5 MHz), (Middle Channel)

Input

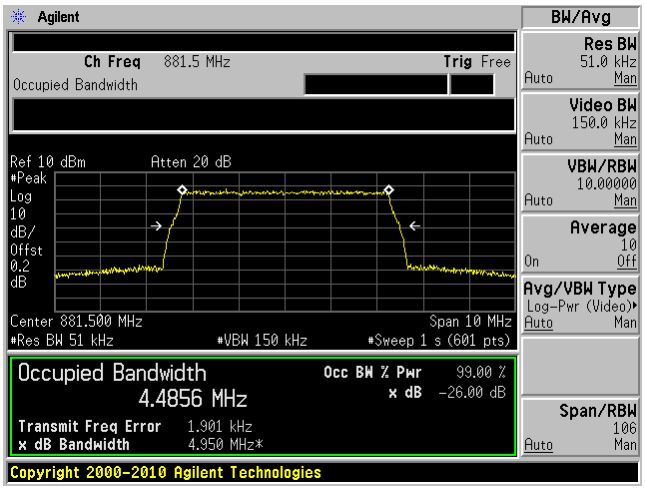


Output

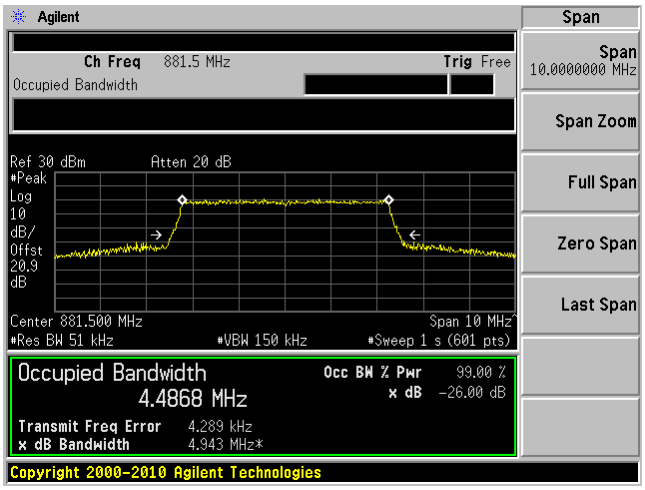


64QAM (5 MHz), (Middle Channel)

Input

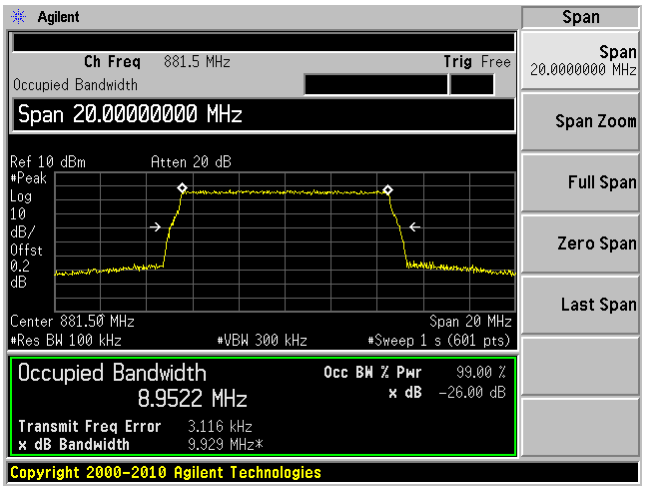


Output

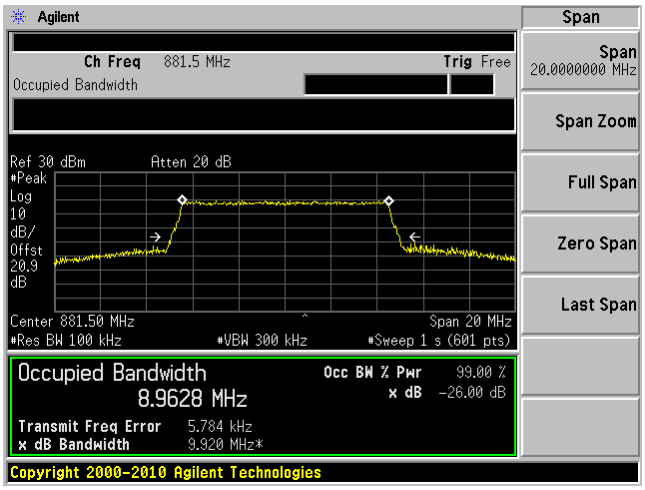


QPSK (10 MHz), (Low Channel)

Input

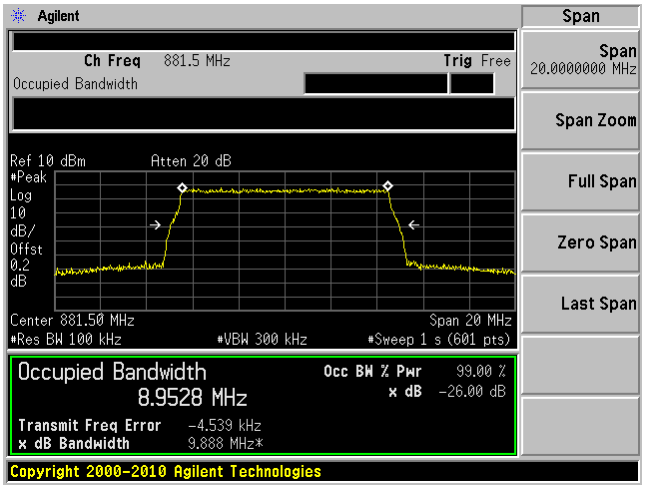


Output

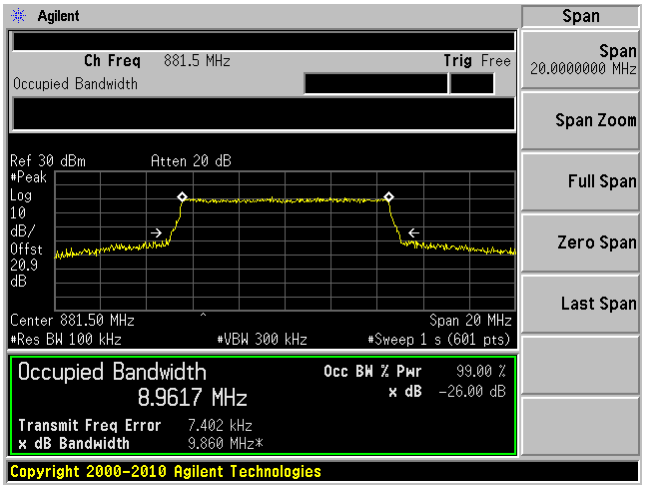


16QAM (10 MHz), (Low Channel)

Input

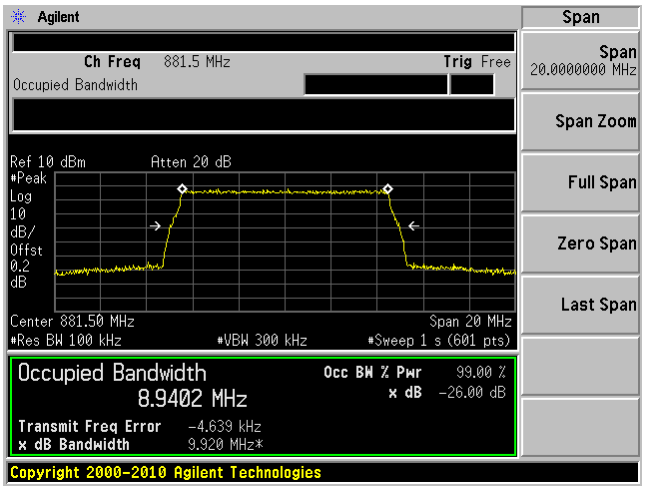


Output

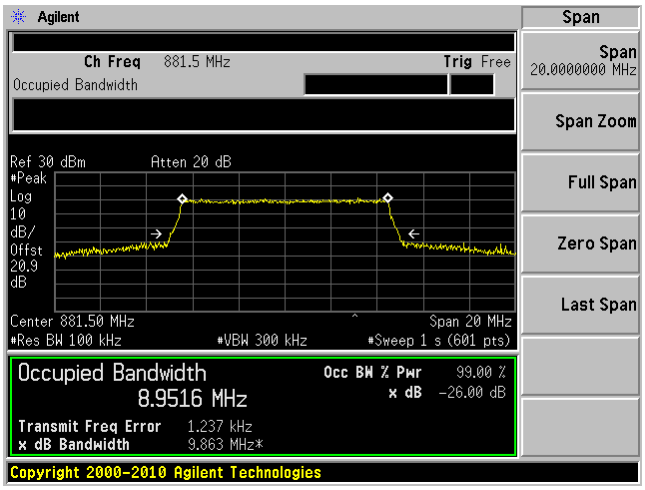


64QAM (10 MHz), (Low Channel)

Input



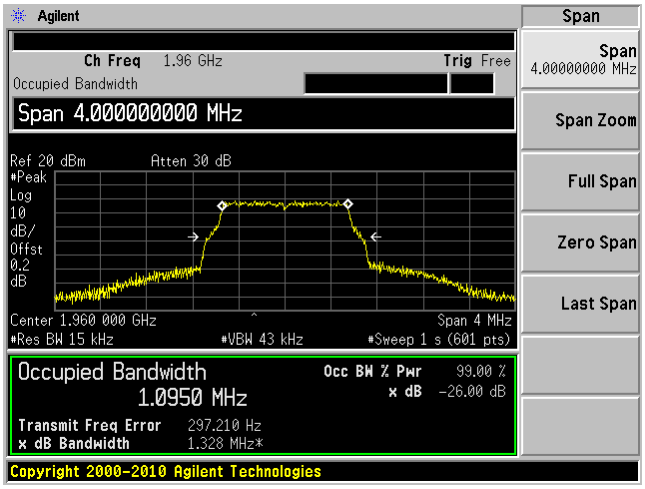
Output



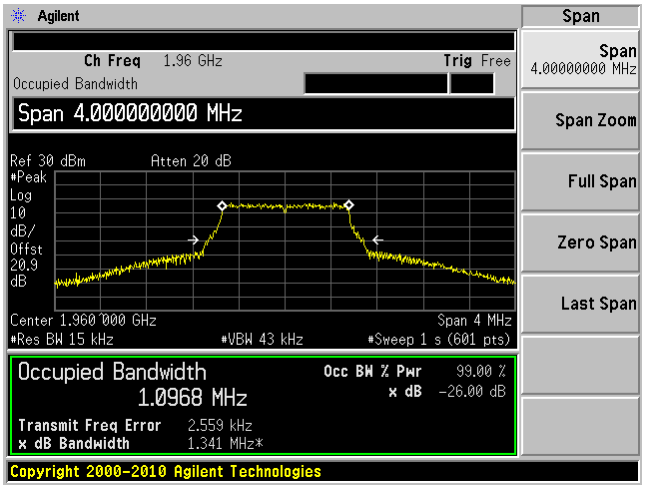
LTE PCS 1900 Band; Downlink (1930-1995 MHz)

QPSK (1.4 MHz), (Middle Channel)

Input

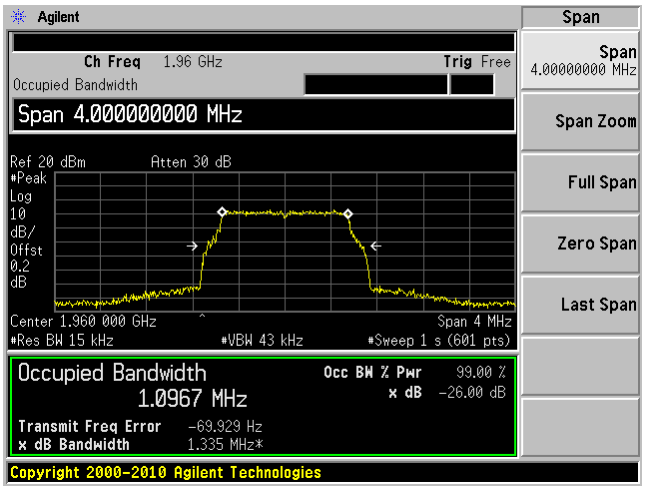


Output

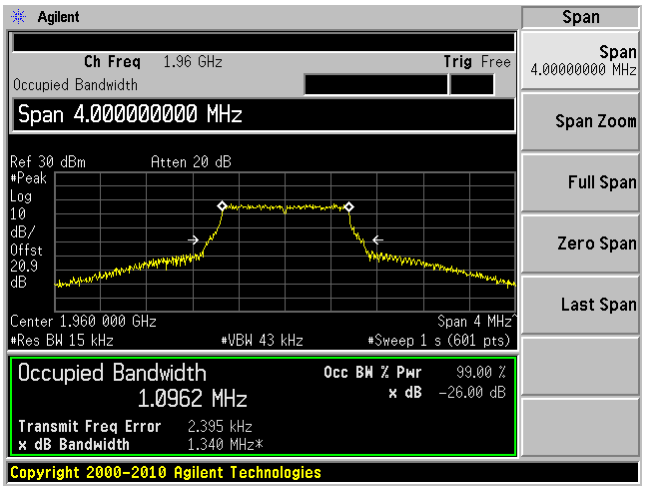


16QAM (1.4 MHz), (Middle Channel)

Input

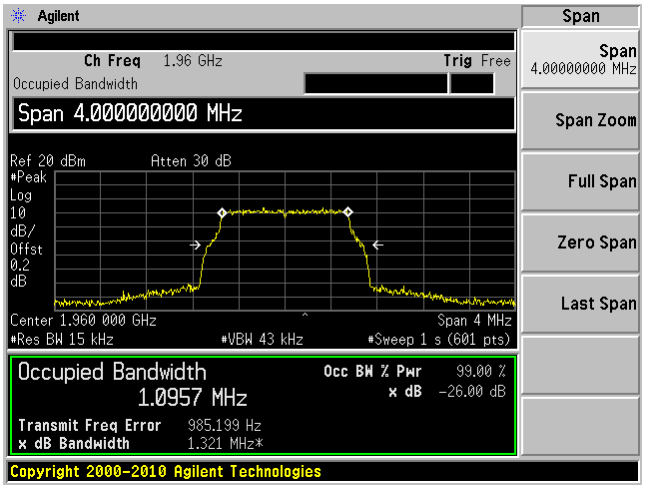


Output

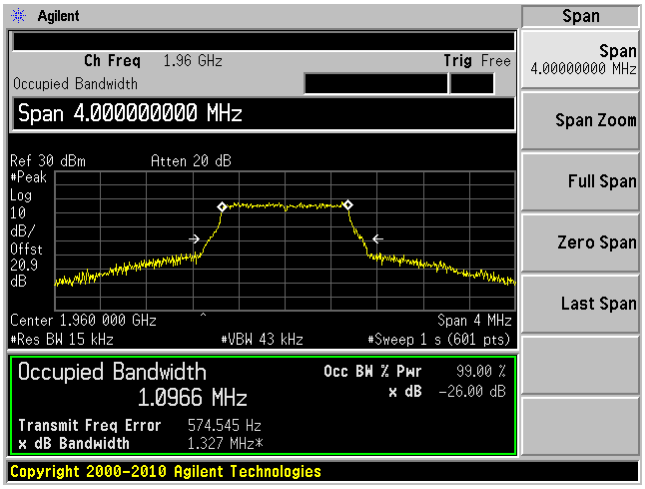


64QAM (1.4 MHz), (Middle Channel)

Input

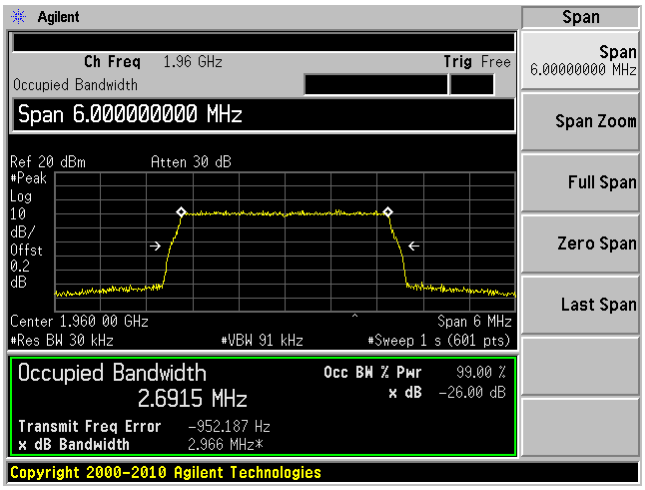


Output

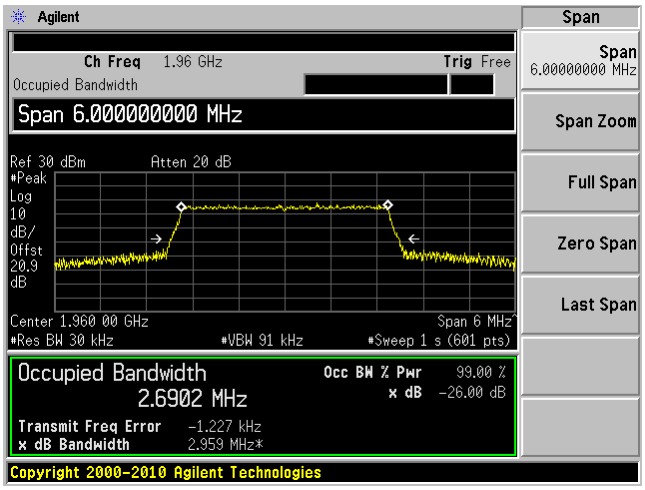


QPSK (3 MHz), (Middle Channel)

Input

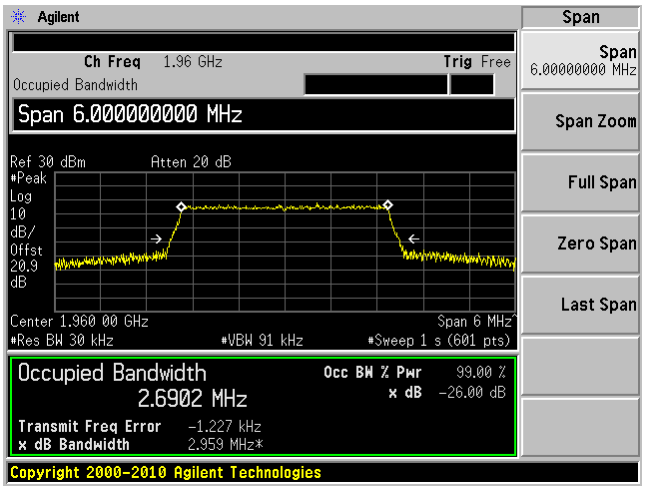


Output

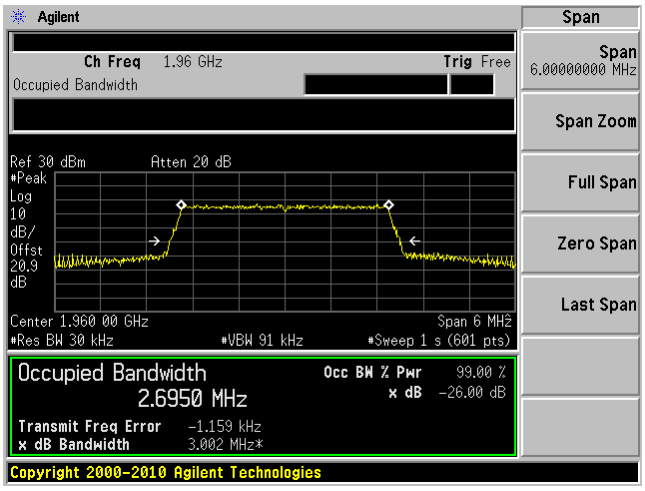


16QAM (3 MHz), (Middle Channel)

Input

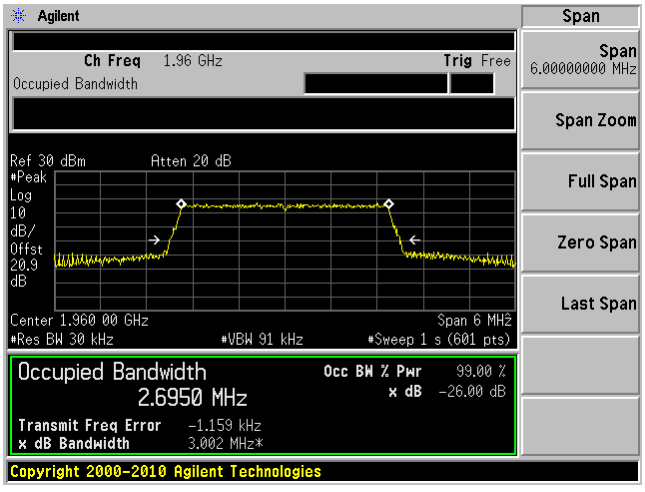


Output

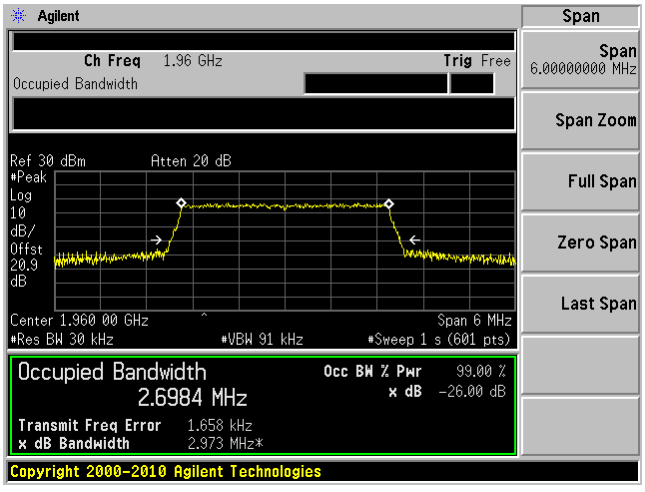


64QAM (3 MHz), (Middle Channel)

Input

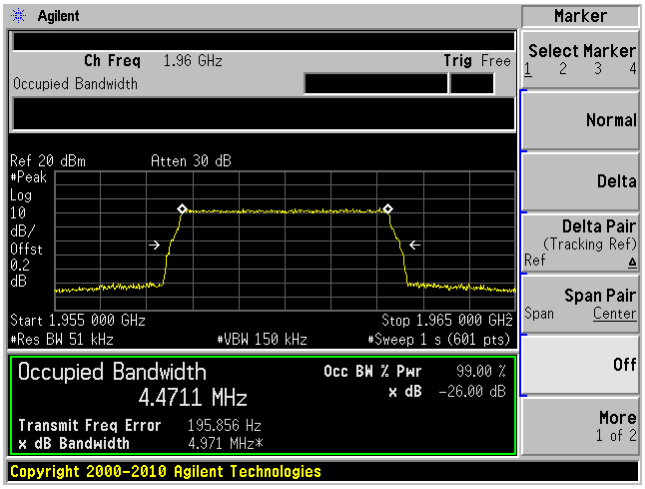


Output

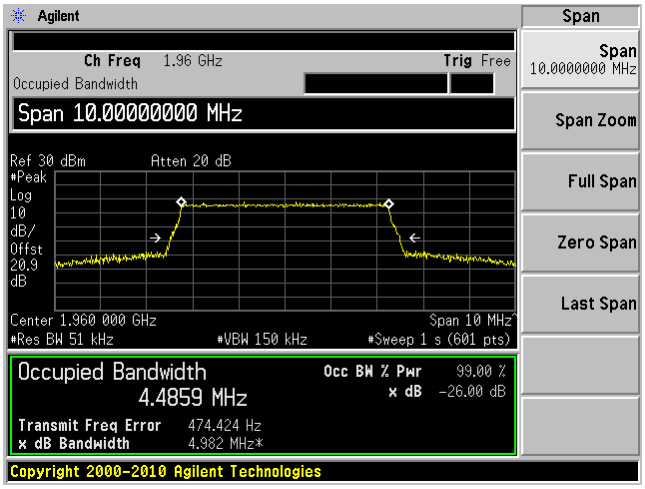


QPSK (5 MHz), (Middle Channel)

Input

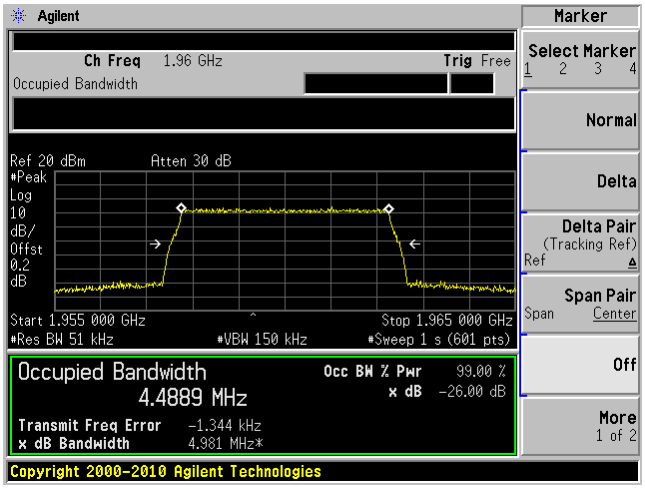


Output

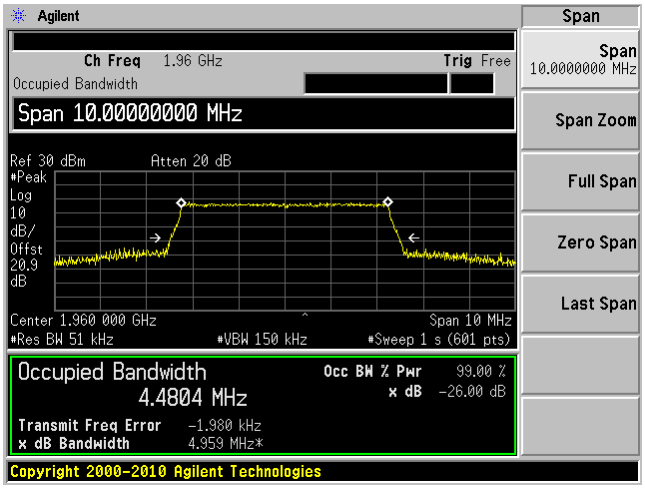


16QAM (5 MHz), (Middle Channel)

Input

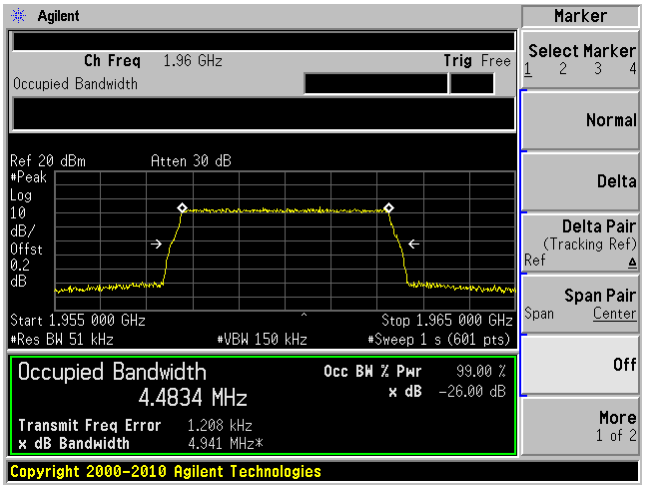


Output

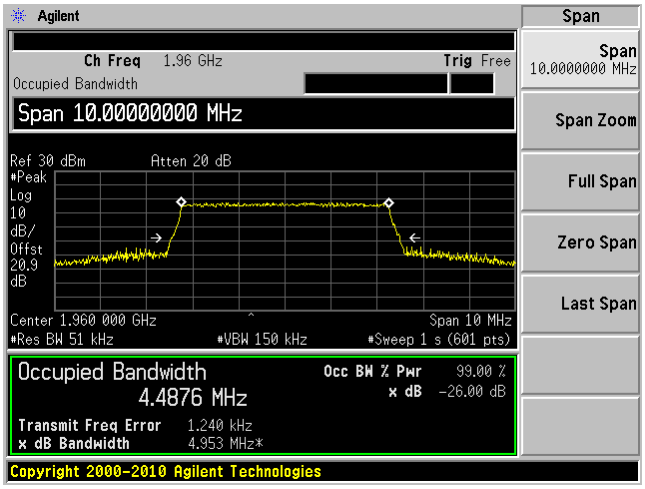


64QAM (5 MHz), (Middle Channel)

Input

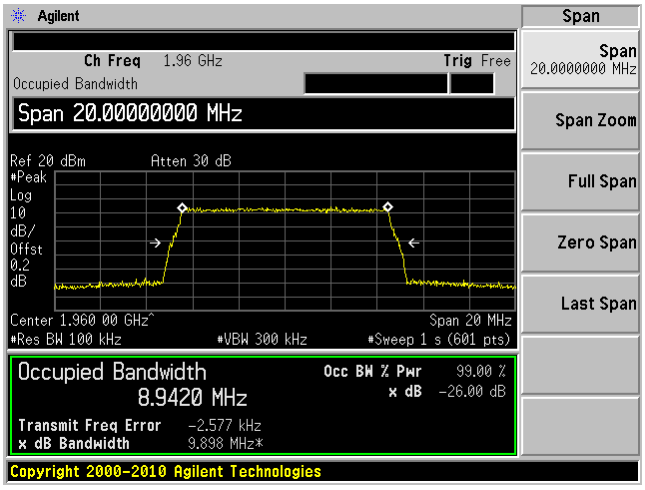


Output

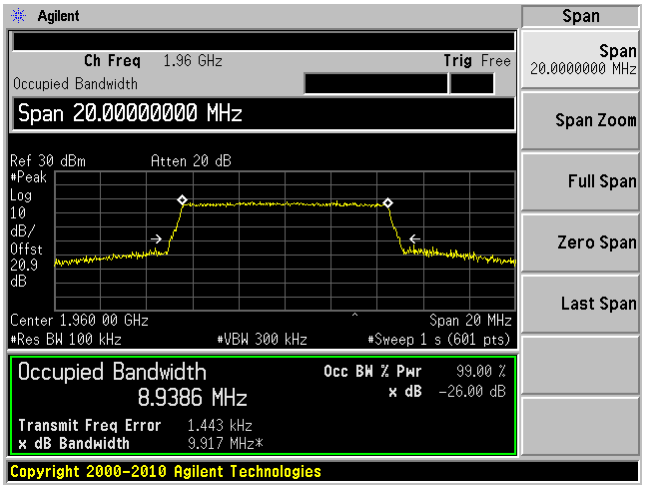


QPSK (10 MHz), (Middle Channel)

Input

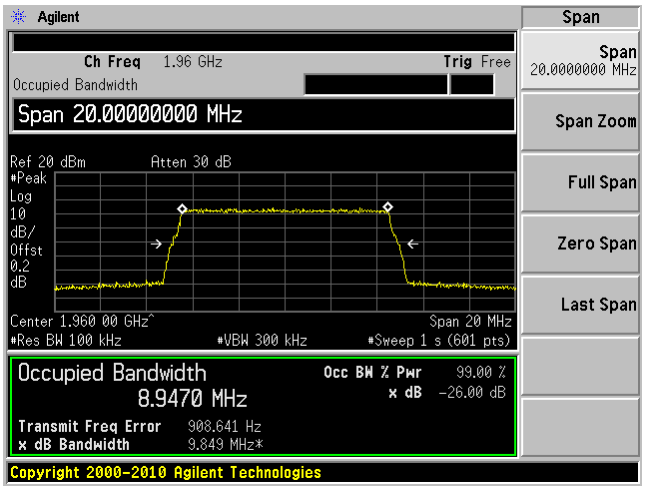


Output

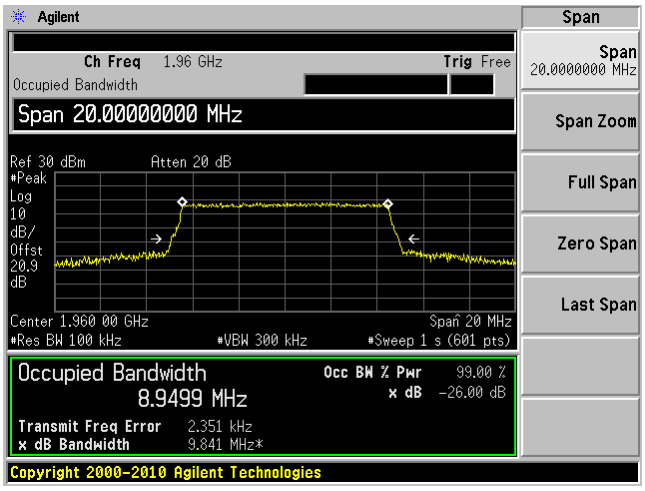


16QAM (10 MHz), (Middle Channel)

Input

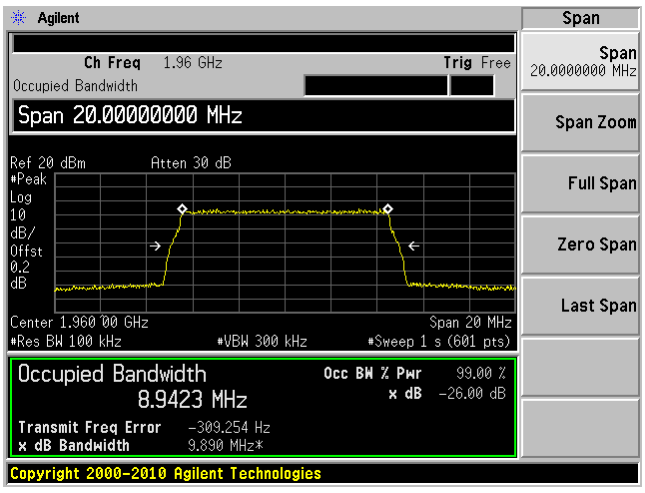


Output

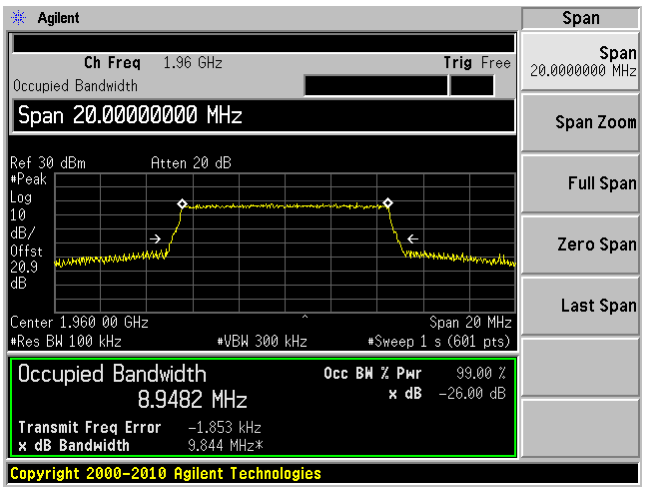


64QAM (10 MHz), (Middle Channel)

Input



Output



7 FCC §2.1053, §22.917, §24.238 & §27.53 - Spurious Radiated Emissions

7.1 Applicable Standard

Requirements: FCC §2.1053, §22.917, §24.238 and §27.53.

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09[1]
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-09
Eaton	Horn antenna	96001	Mar-07	2011-10-03
A.H. Systems	Horn antenna	SAS-200/571	261	2012-01-18
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2012-05-08
HP	Signal Generator	8648C	3426A00417	2011-08-18

Note 1: Based on a two year calibration cycle.
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	42 %
ATM Pressure:	101.79kPa

The testing was performed by Wei sun from 2012-06-03 at Chamber 3.

7.5 Test Results

Cellular 850 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. Gain Correction (dB)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

PCS 1900 Band:

Downlink (Input frequency = 1960 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. Gain Correction (dB)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

LTE 700UC Band:

Downlink (Input frequency = 752 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. Gain Correction (dB)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: - All spurious emissions are 20 dB below the limit or are on the noise floor level

8 FCC §2.1051, §22.917, §24.238 & §27.53 - Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

Requirements: FCC §2.1051, §22.917, §24.238 and §27.53.

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

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 10^{th} harmonic.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09[1]
HP	Signal Generator	E4438C	MY45091309	2012-05-03

Note 1: Based on a two year calibration cycle.
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

8.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	57 %
ATM Pressure:	101.4kPa

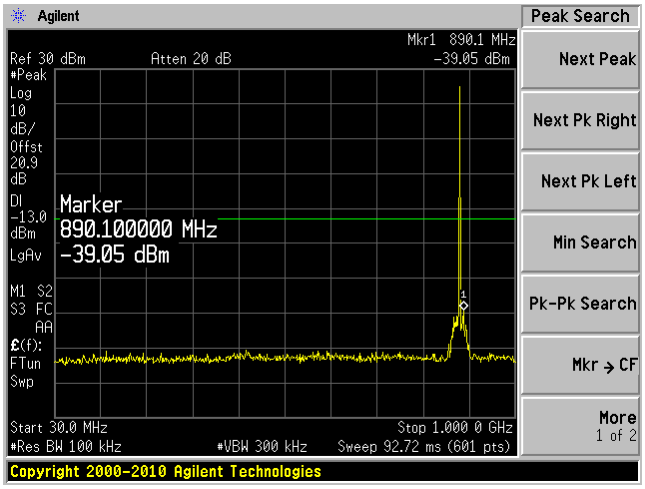
The testing was performed by Ning Ma from 2012-05-27 at RF Site.

8.5 Test Results

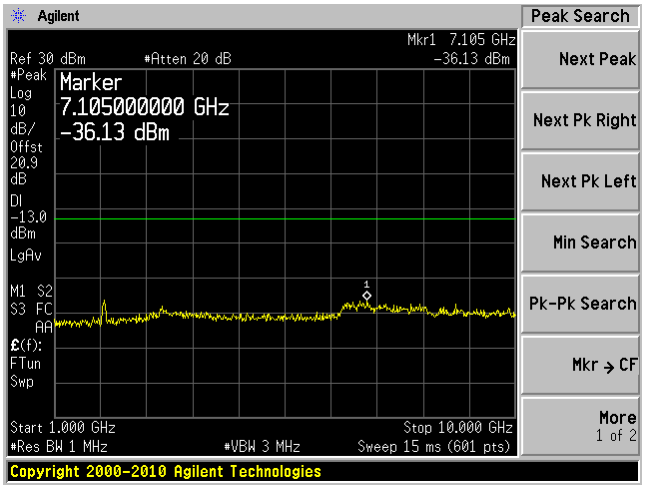
Please refer to the following plots.

Cellular Band Downlink, Middle Channel: 881.6 MHz

Plot 1: 30 MHz to 1 GHz

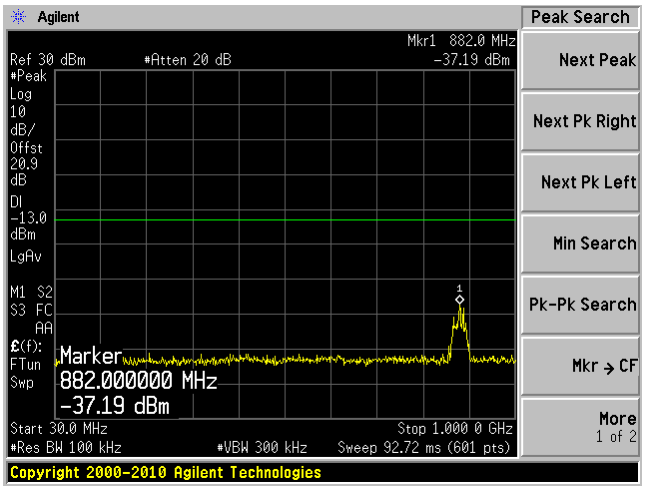


Plot 2: Above 1 GHz

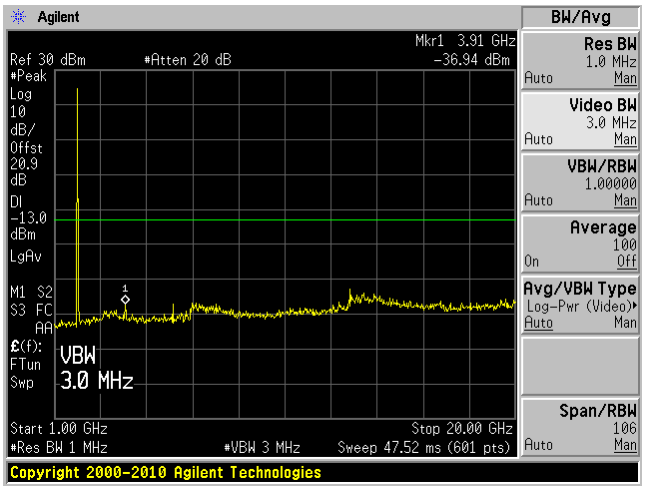


PCS Band Downlink, Middle Channel: 1960 MHz

Plot 1: 30 MHz to 1 GHz

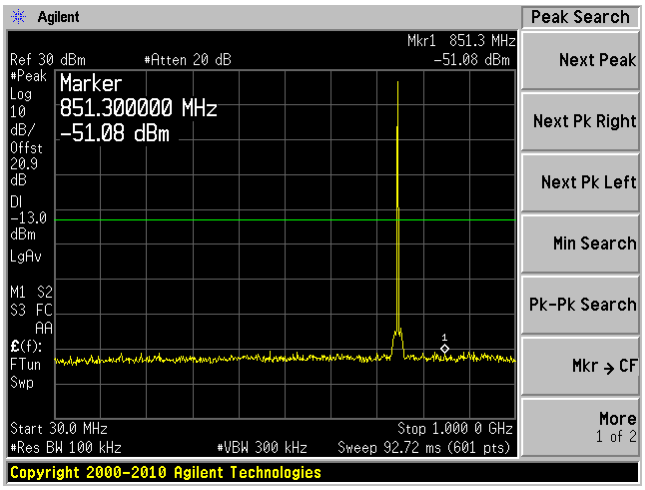


Plot 2: Above 1 GHz

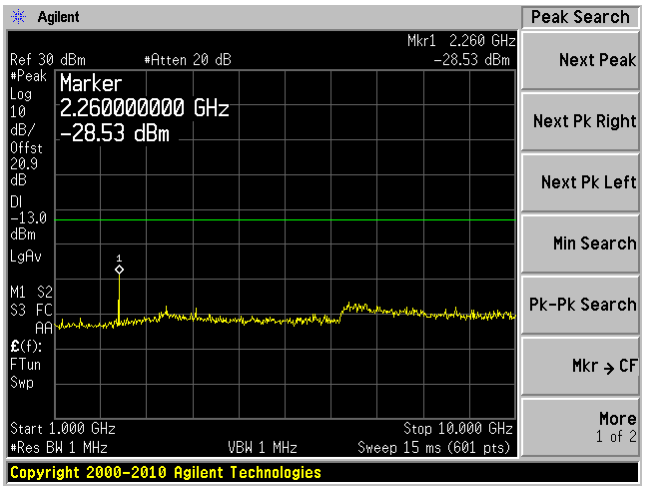


700UC Band Downlink, Middle Channel: 752 MHz

Plot 1: 30 MHz to 1 GHz



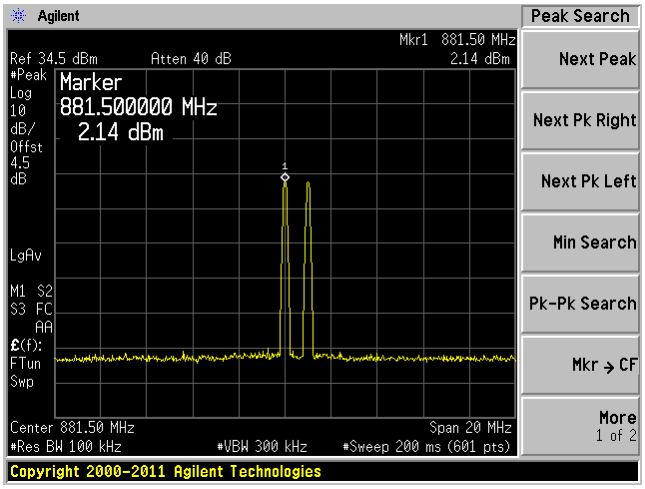
Plot 2: Above 1 GHz



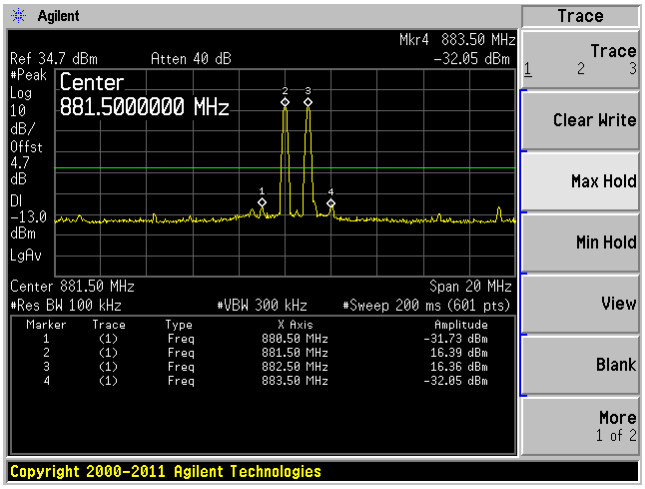
Inter-modulation

Cellular 850 Band Downlink

Middle Channel, Input

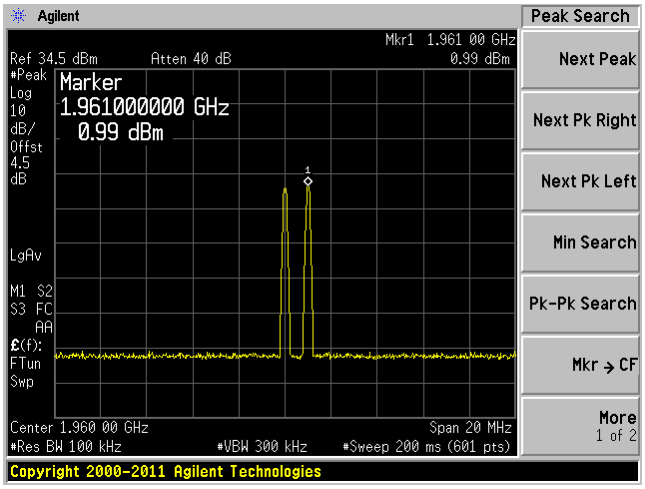


Middle Channel, Output:

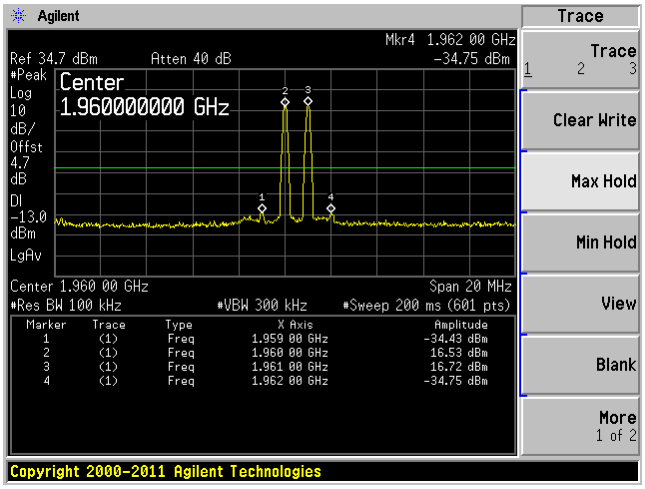


PCS 1900 Band Downlink

Middle Channel, Input

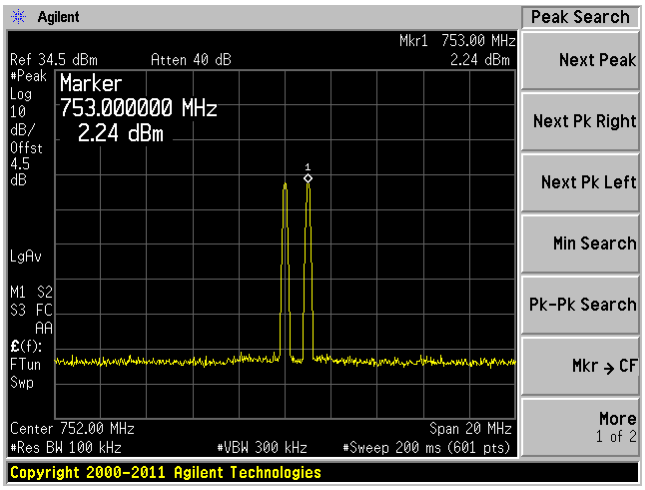


Middle Channel, Output

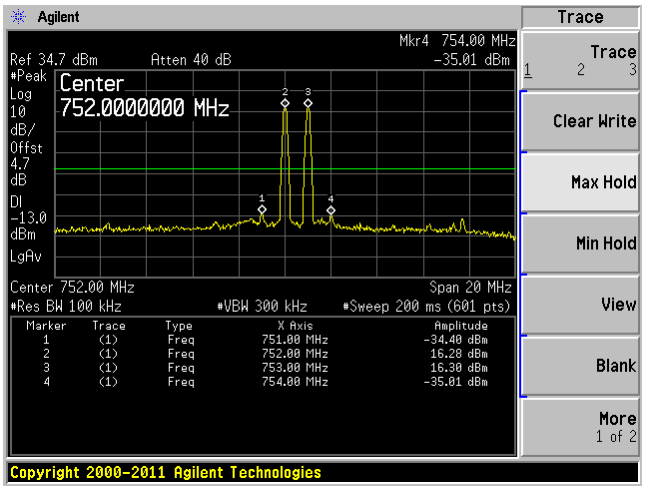


700UC Band Downlink

Middle Channel, Input



Middle Channel, Output



9 FCC §22.917, §24.238 & §27.53 – Band Edge

9.1 Applicable Standard

According to FCC §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 FCC §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.

According to FCC §27.53, 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09[1]
HP	Signal Generator	E4438C	MY45091309	2012-05-03

Note 1: Based on a two year calibration cycle.
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

9.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	57 %
ATM Pressure:	101.4kPa

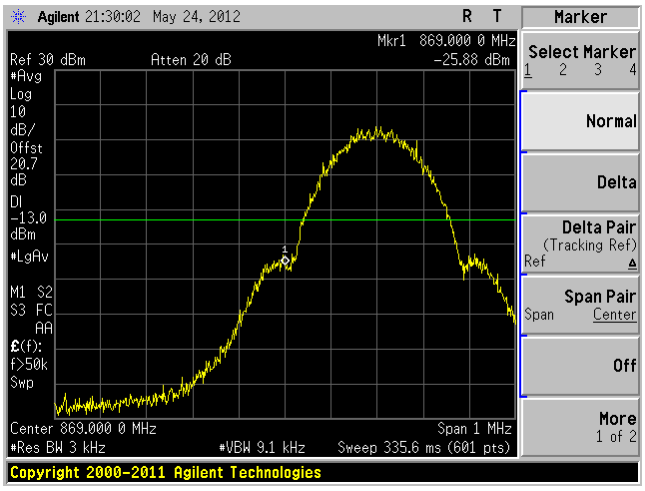
The testing was performed by Ning Ma from 2012-05-27 at RF Site.

9.5 Test Results

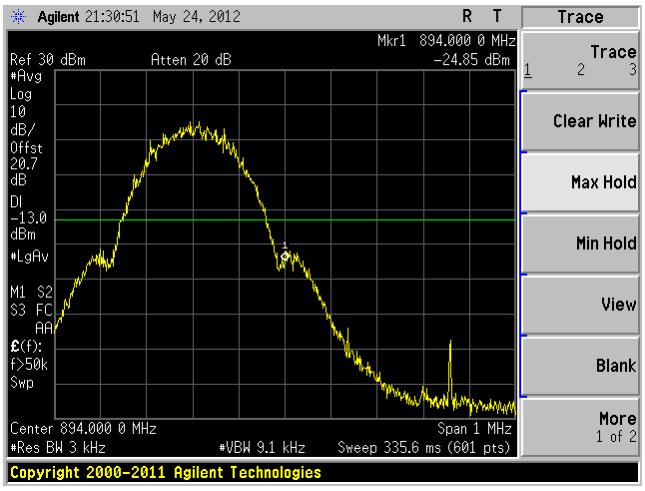
Please refer to the following plots.

Cell 850 Band Downlink

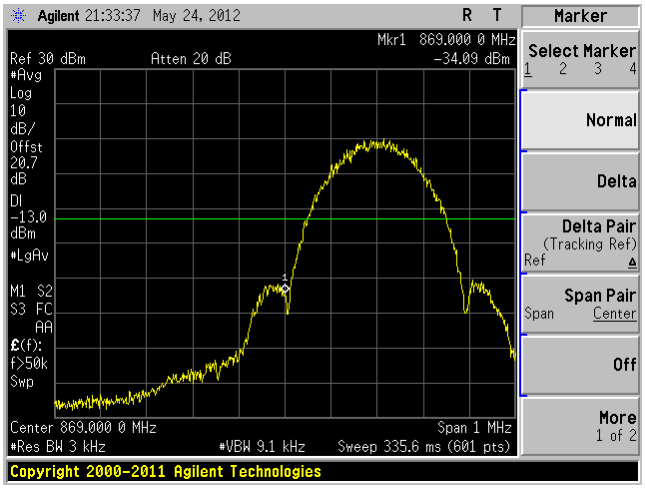
GSM - Low Channel



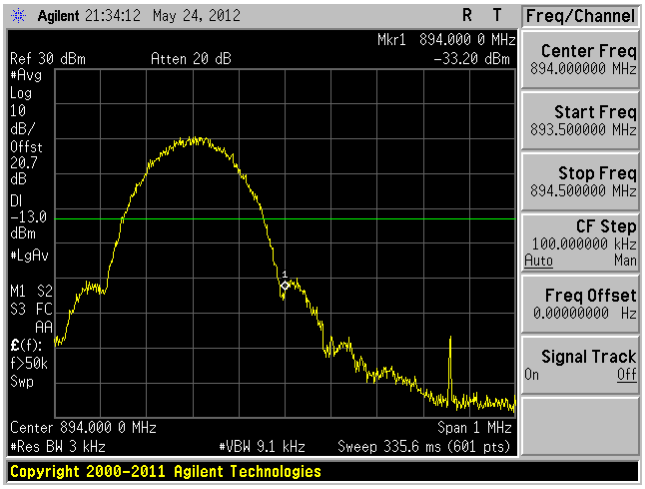
GSM - High Channel



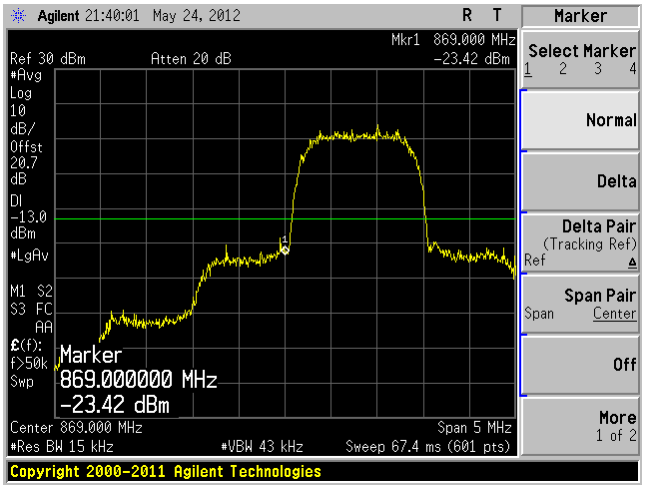
EDGE - Low Channel



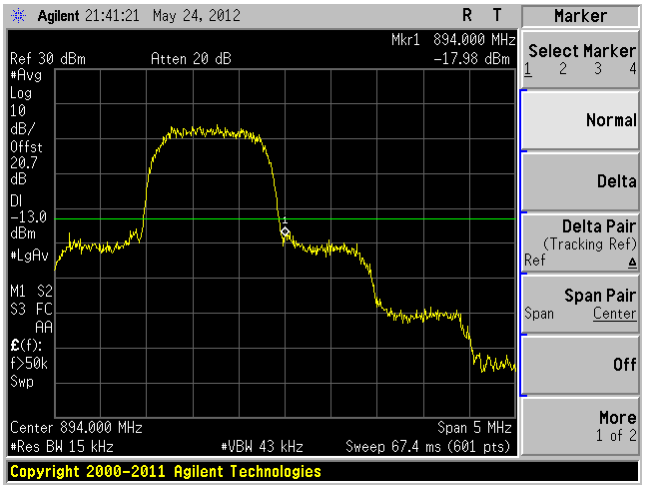
EDGE - High Channel



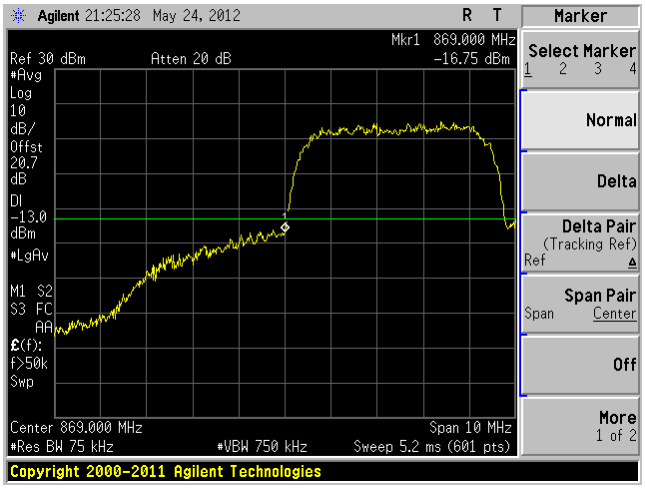
CDMA - Low Channel



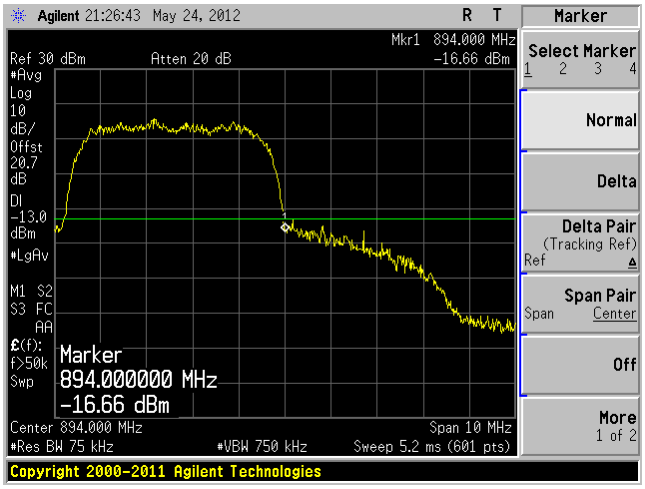
CDMA - High Channel



WCDMA - Low Channel

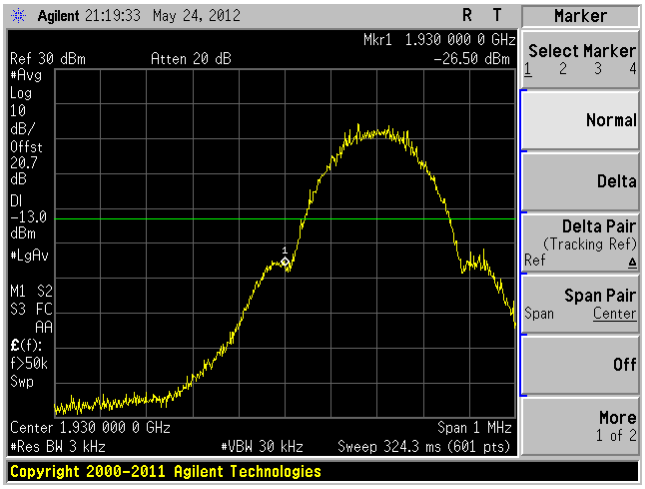


WCDMA - High Channel

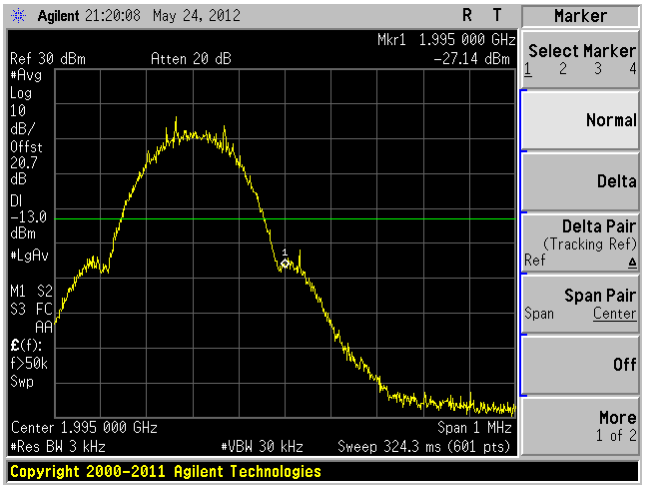


PCS 1900 Band Downlink

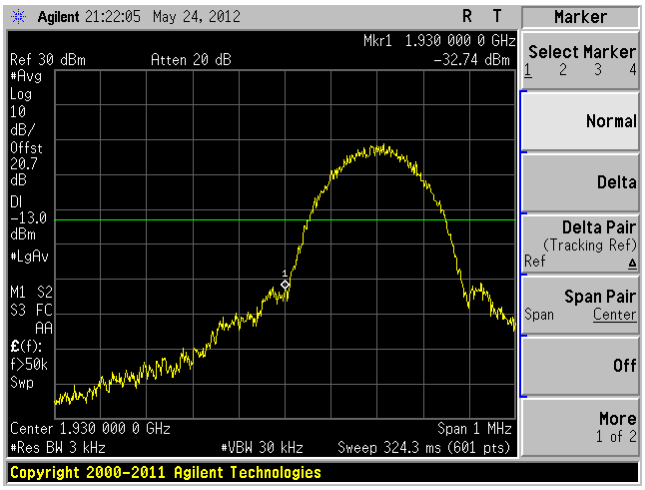
GSM - Low Channel



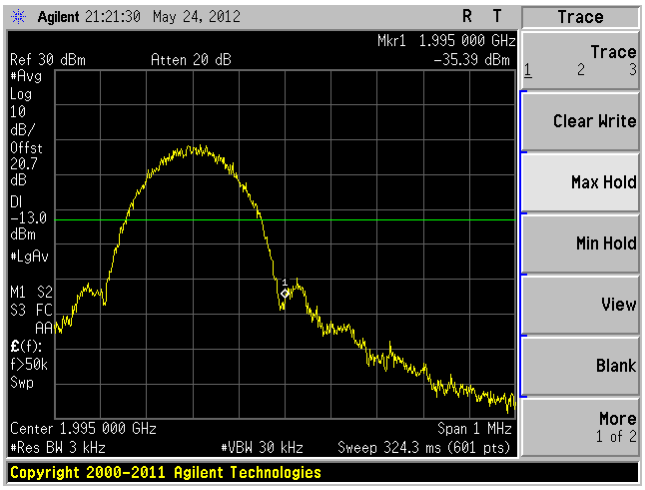
GSM - High Channel



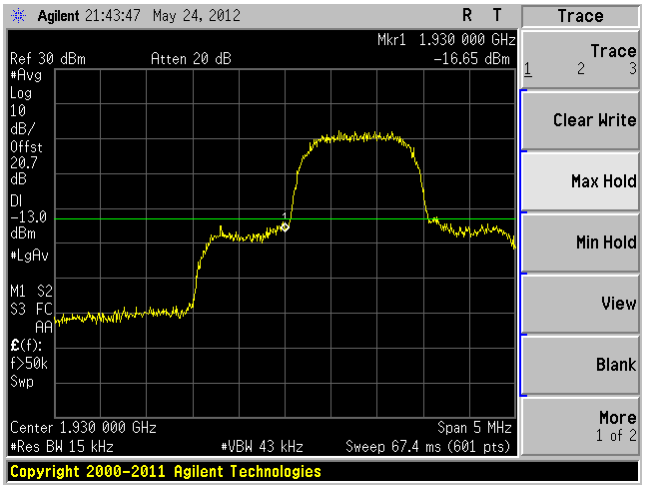
EDGE - Low Channel



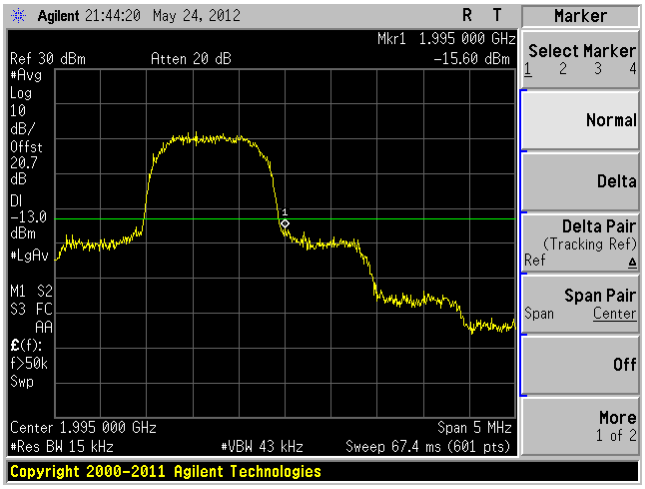
EDGE - High Channel



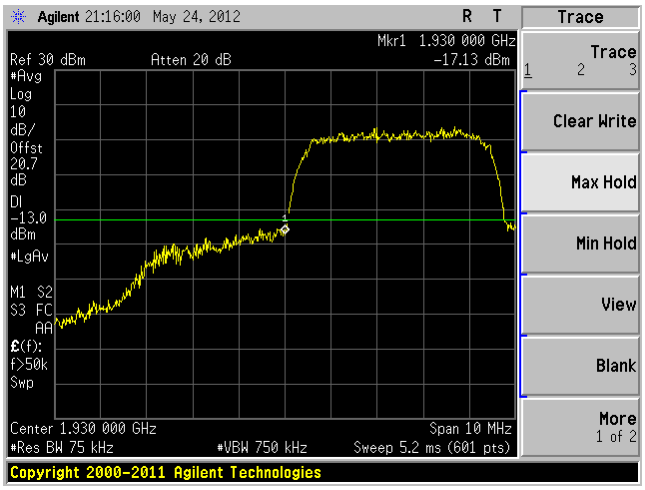
CDMA - Low Channel



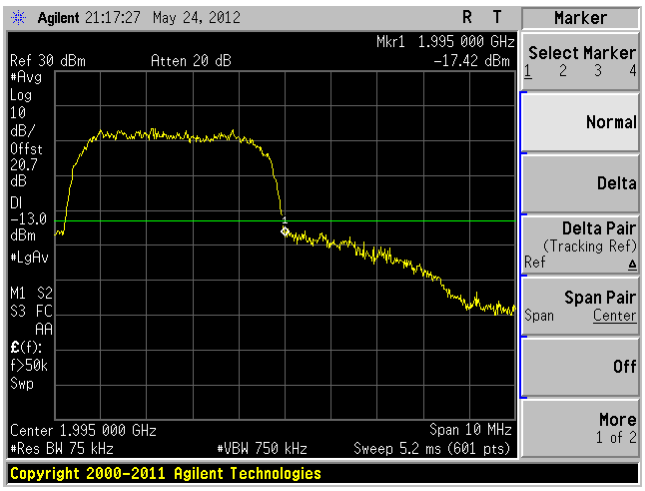
CDMA - High Channel



WCDMA - Low Channel

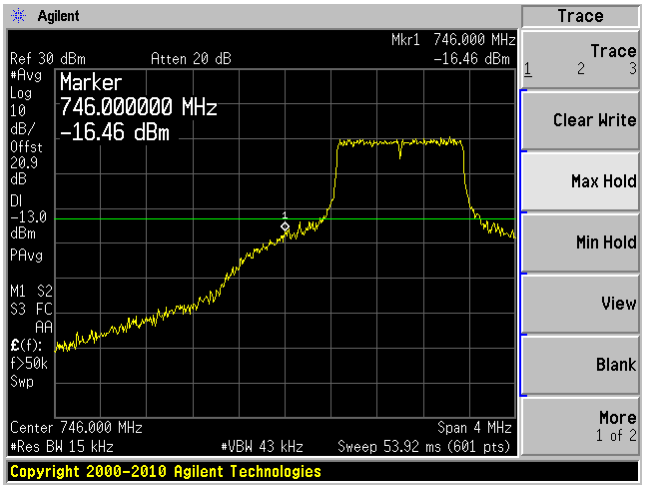


WCDMA - High Channel

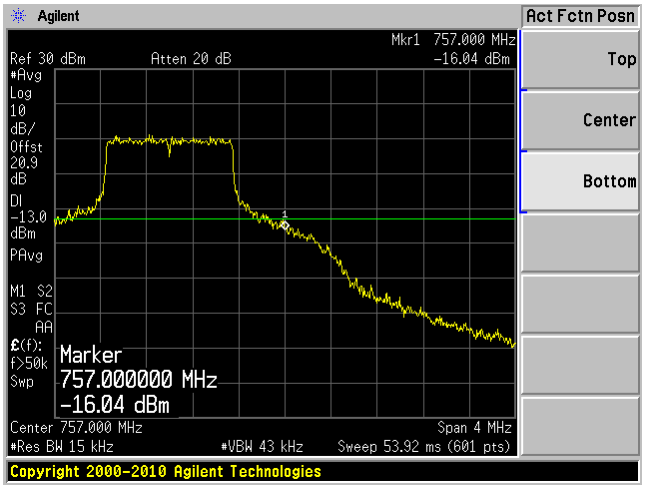


700UC LTE Band Downlink

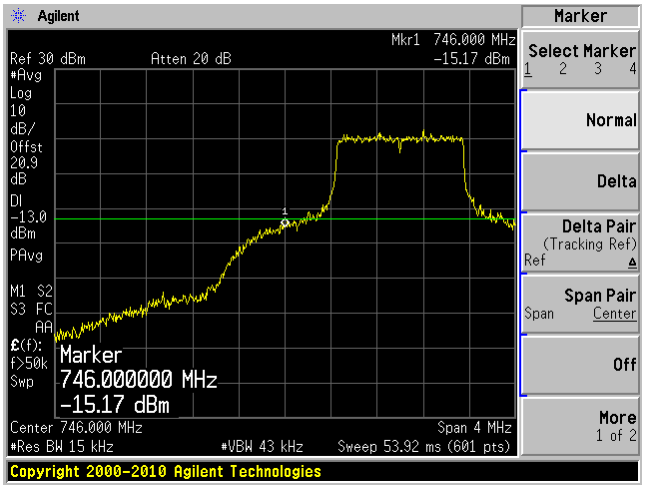
QPSK (1.4 MHz) - Low Channel



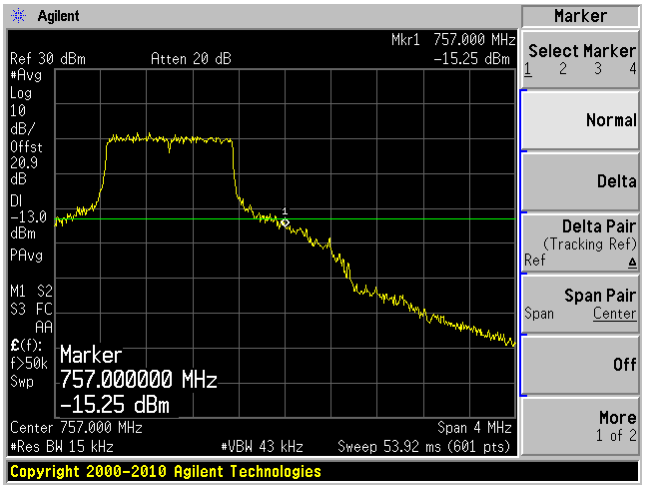
QPSK (1.4 MHz) - High Channel



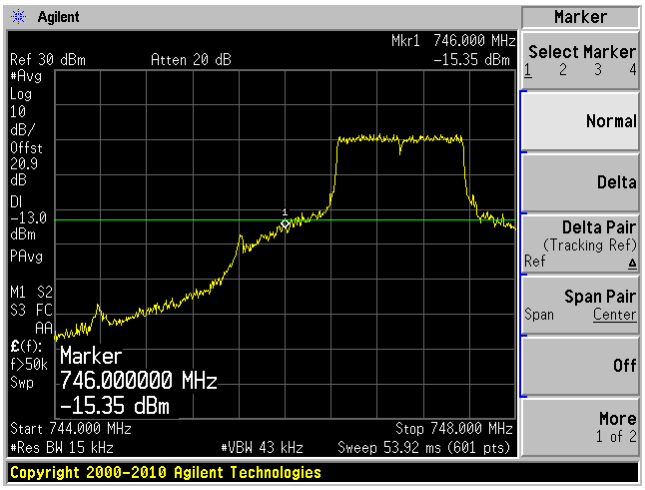
16QAM (1.4 MHz) - Low Channel



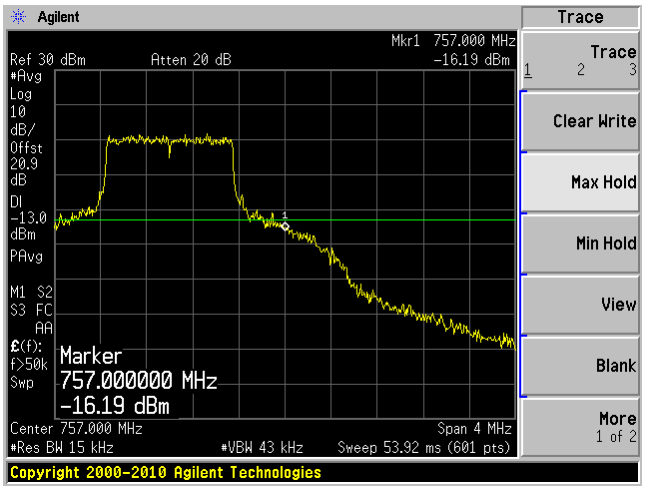
16QAM (1.4 MHz) - High Channel



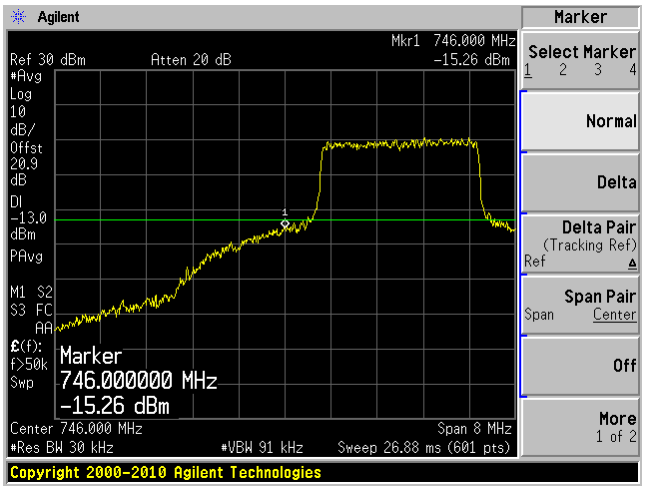
64QAM (1.4 MHz) - Low Channel



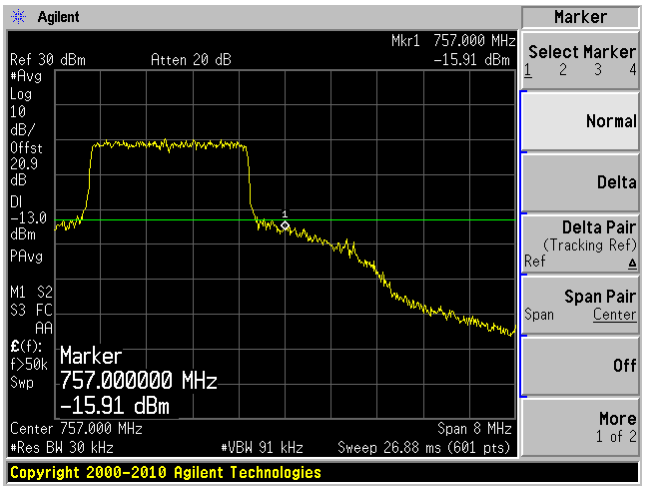
64QAM (1.4 MHz) - High Channel



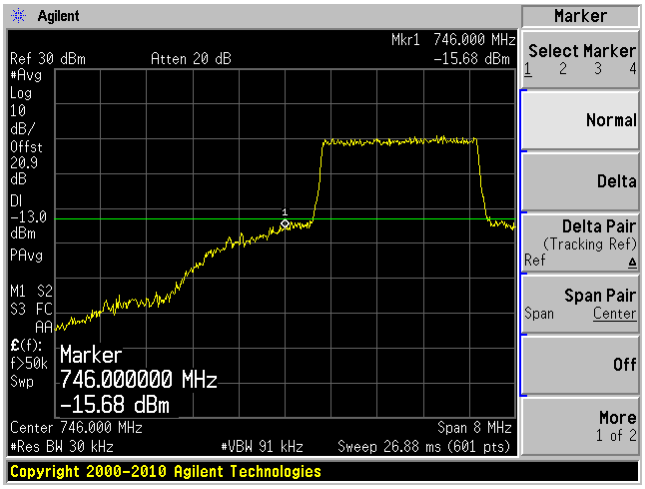
QPSK (3 MHz) - Low Channel



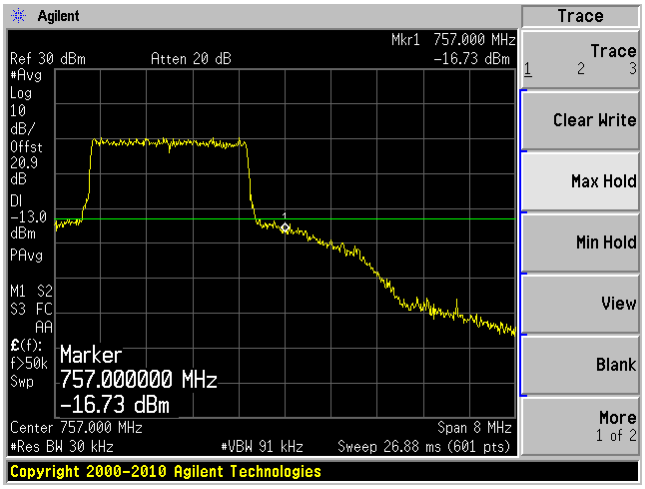
QPSK (3 MHz) - High Channel



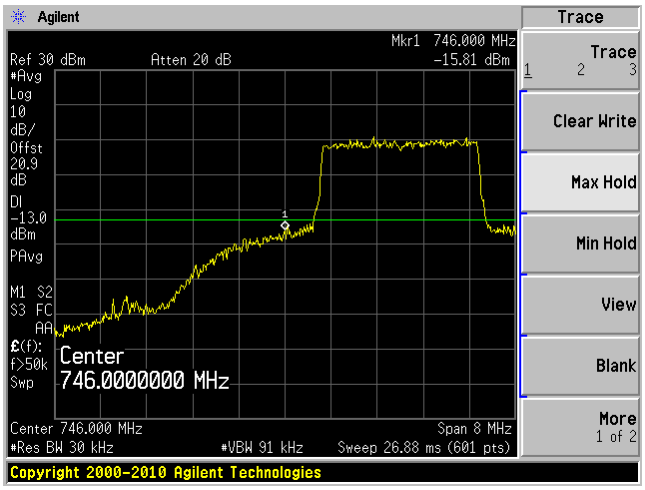
16QAM (3 MHz) - Low Channel



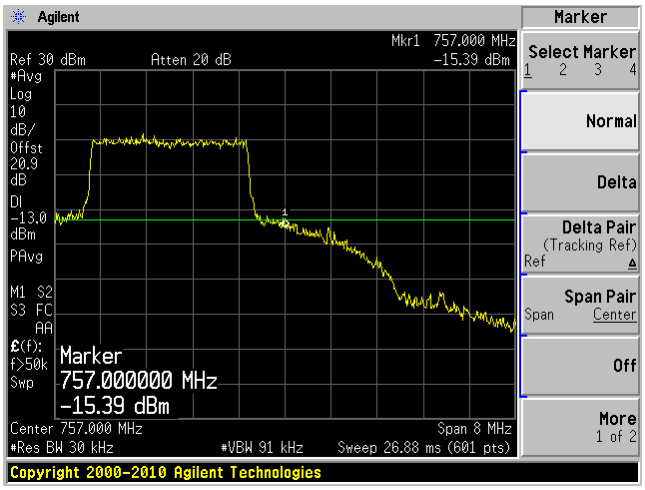
16QAM (3 MHz) - High Channel



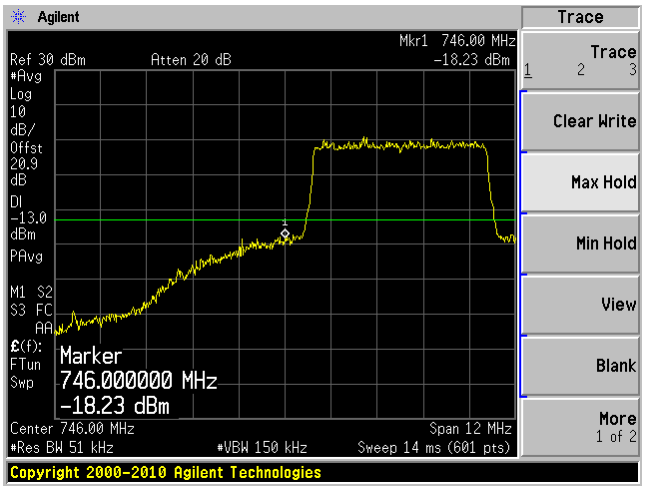
64QAM (3 MHz) - Low Channel



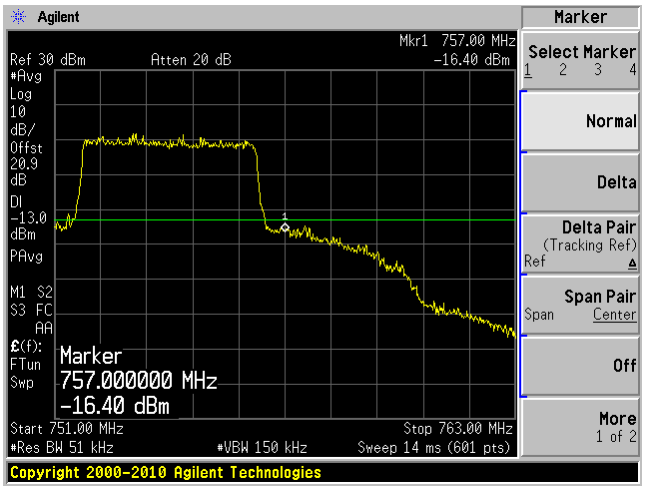
64QAM (3 MHz) - High Channel



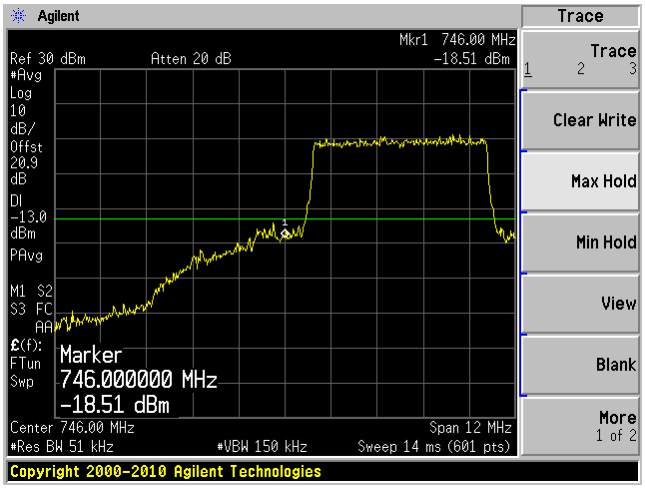
QPSK (5 MHz) - Low Channel



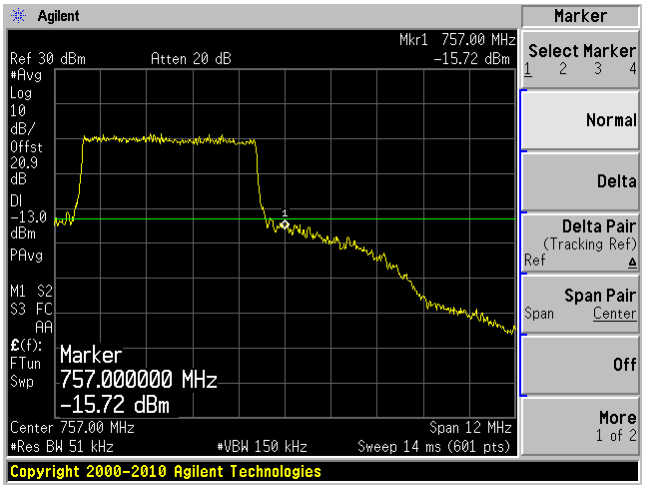
QPSK (5 MHz) - High Channel



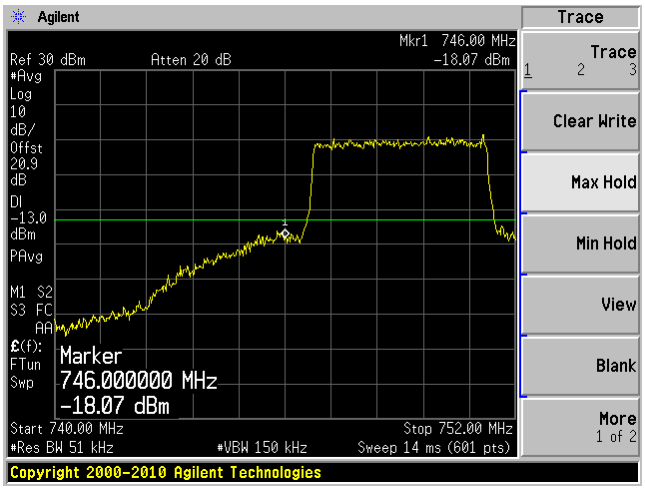
16QAM (5 MHz) - Low Channel



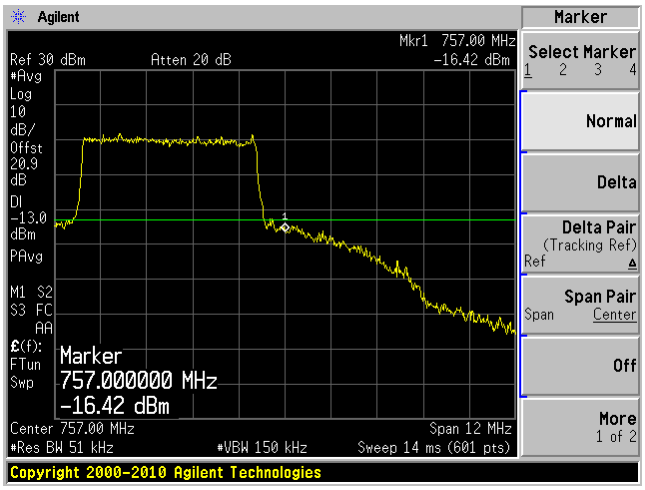
16QAM (5 MHz) - High Channel



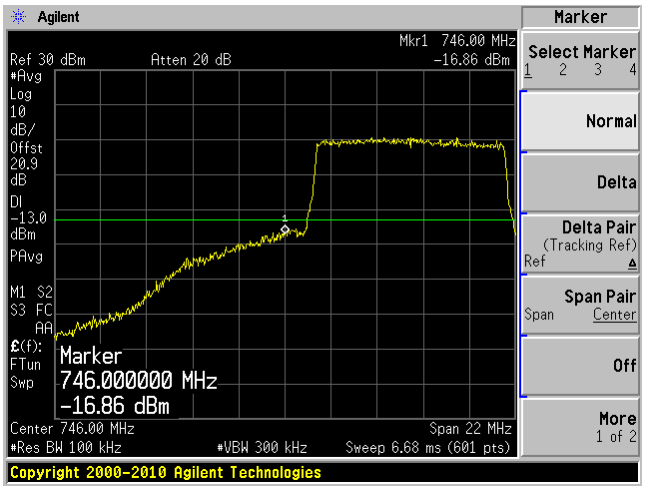
64QAM (5 MHz) - Low Channel



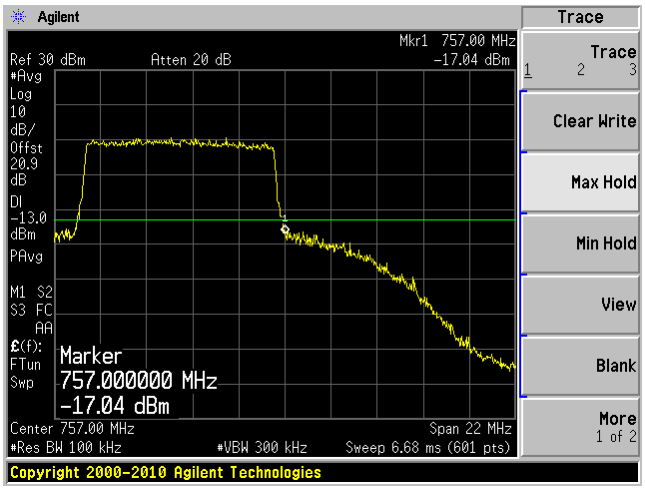
64QAM (5 MHz) - High Channel



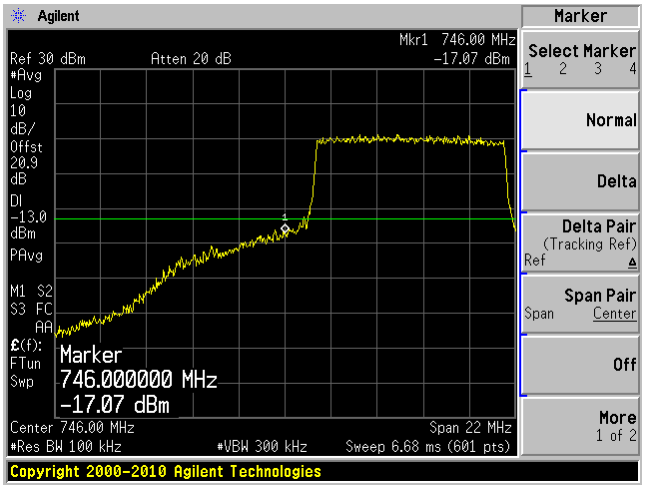
QPSK (10 MHz) - Low Channel



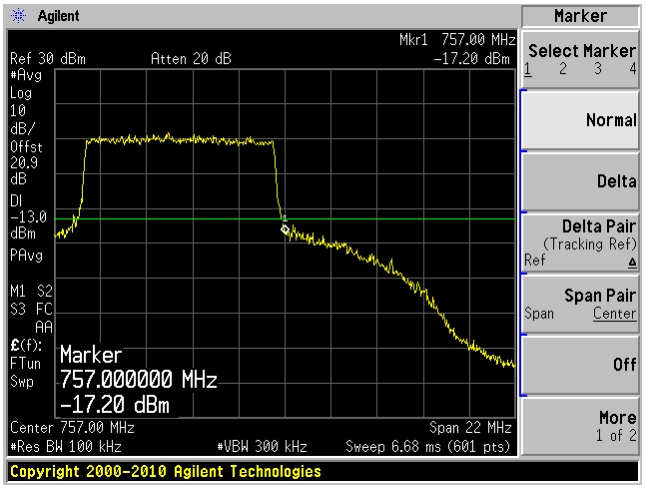
QPSK (10 MHz) - High Channel



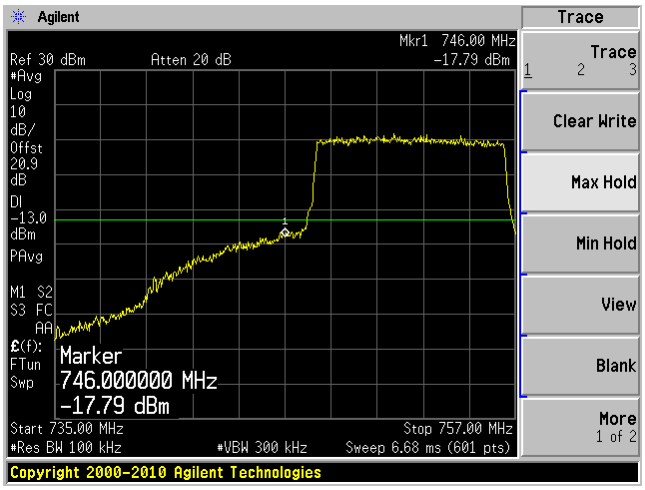
16QAM (10 MHz) - Low Channel



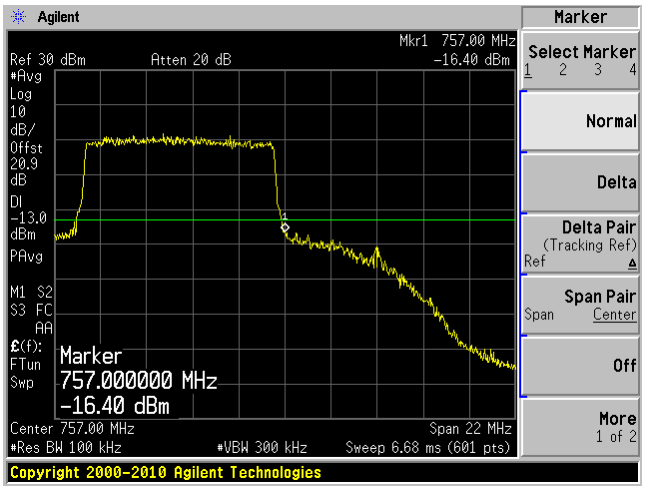
16QAM (10 MHz) - High Channel



64QAM (10 MHz) - Low Channel

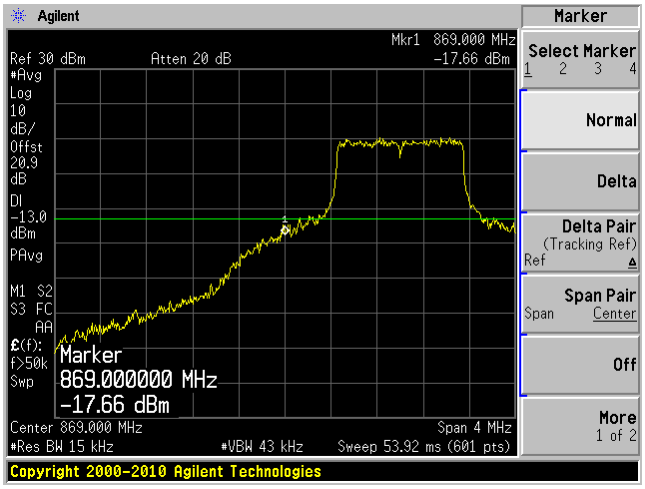


64QAM (10 MHz) - High Channel

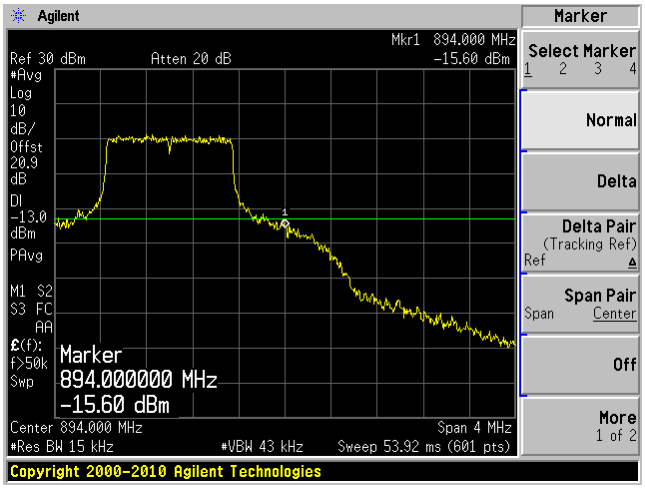


LTE Cellular 850 Band, Downlink

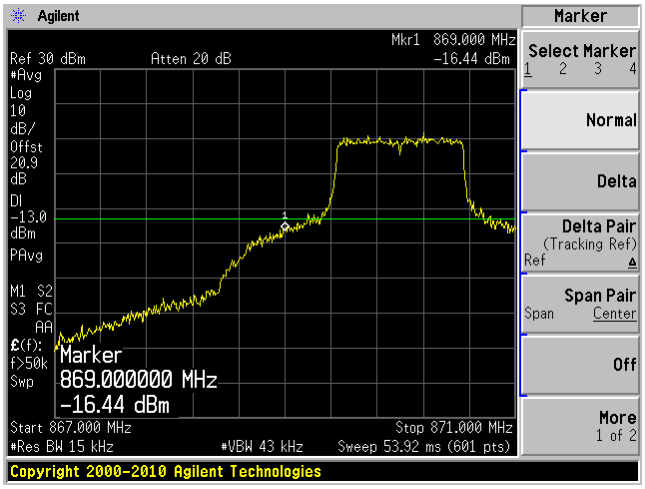
QPSK (1.4 MHz) - Low Channel



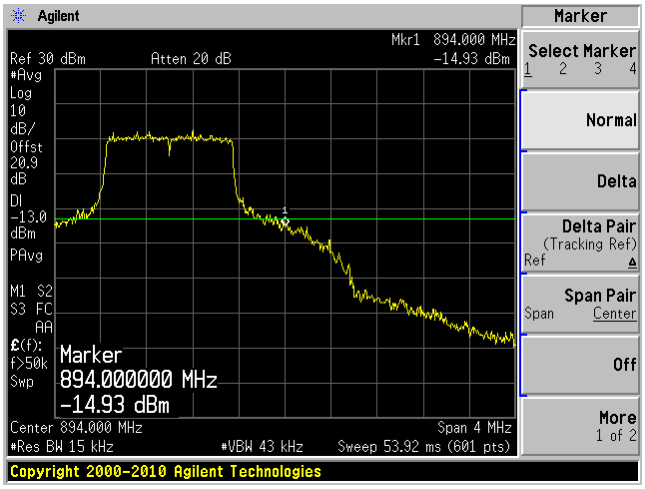
QPSK (1.4 MHz) - High Channel



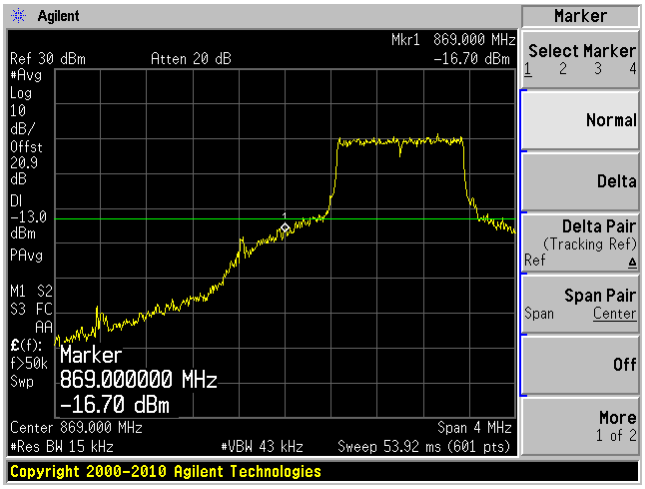
16QAM (1.4 MHz) - Low Channel



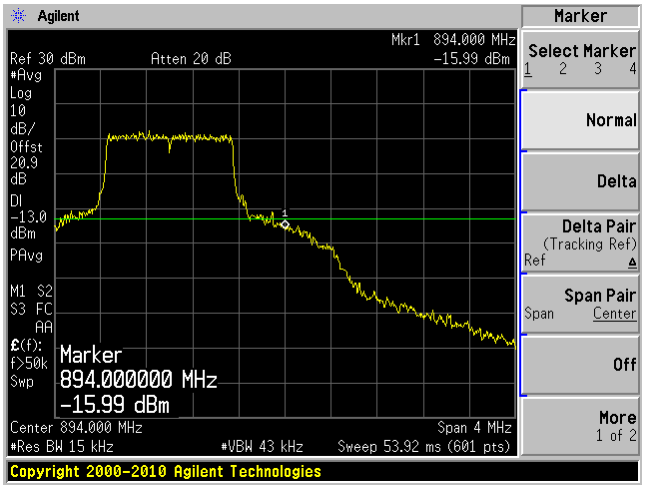
16QAM (1.4 MHz) - High Channel



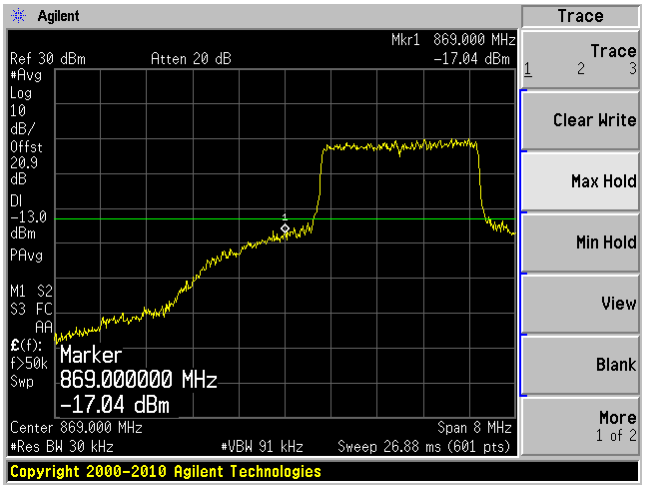
64QAM (1.4 MHz) - Low Channel



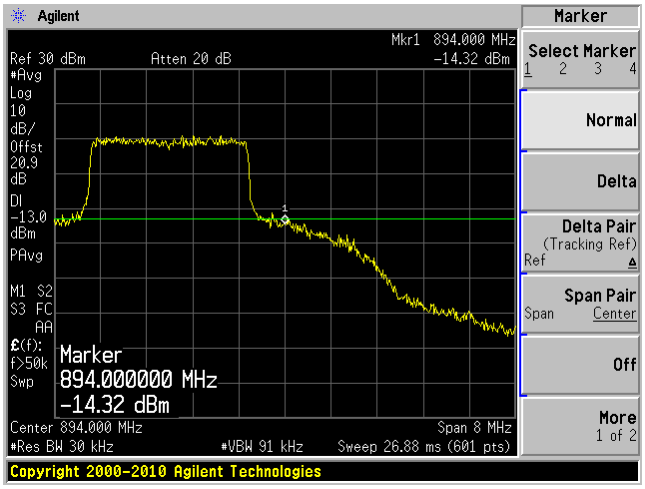
64QAM (1.4 MHz) - High Channel



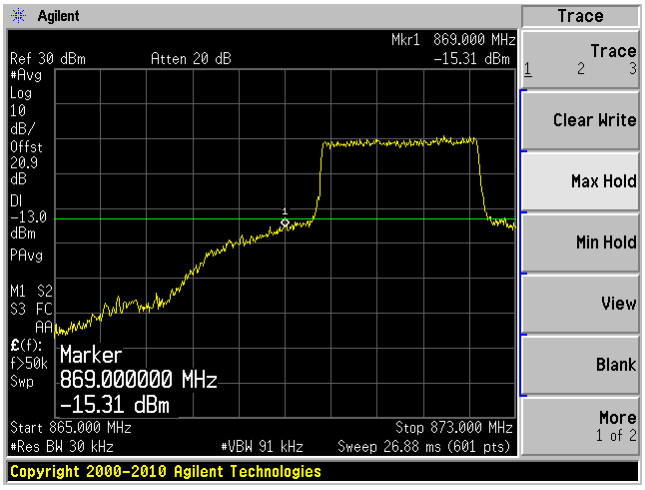
QPSK (3 MHz) - Low Channel



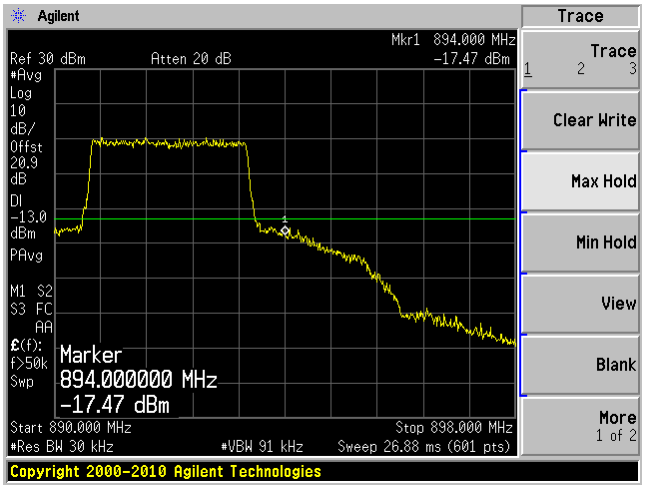
QPSK (3 MHz) - High Channel



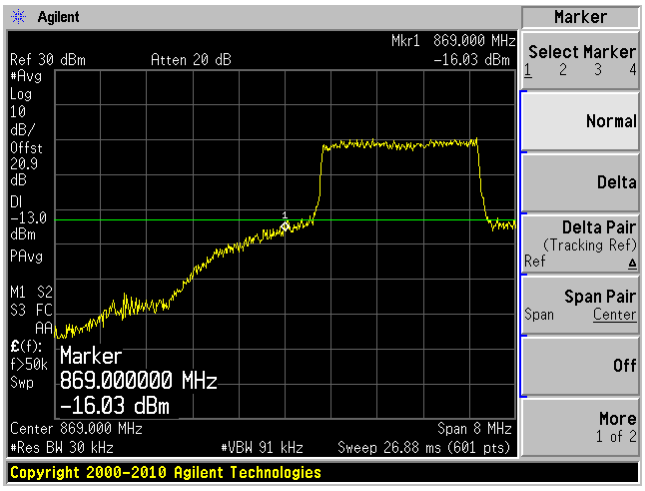
16QAM (3 MHz) - Low Channel



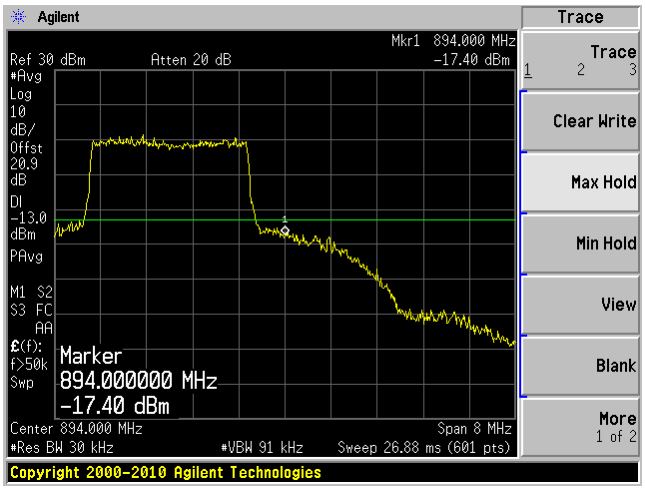
16QAM (3 MHz) - High Channel



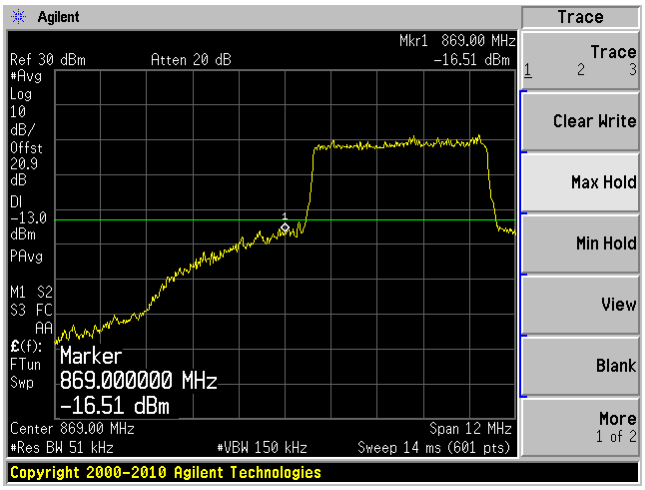
64QAM (3 MHz) - Low Channel



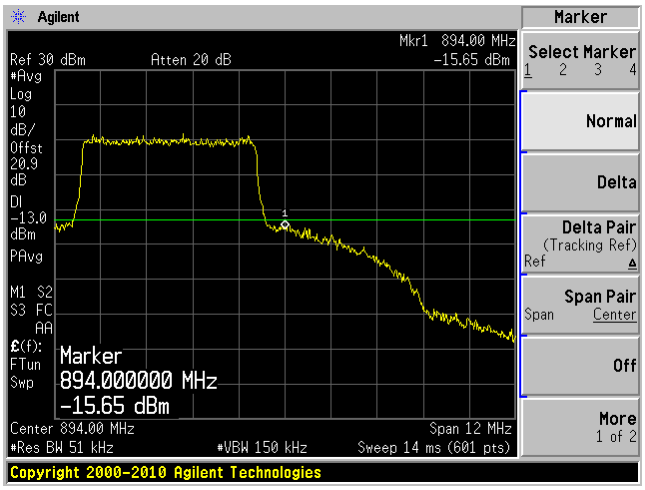
64QAM (3 MHz) - High Channel



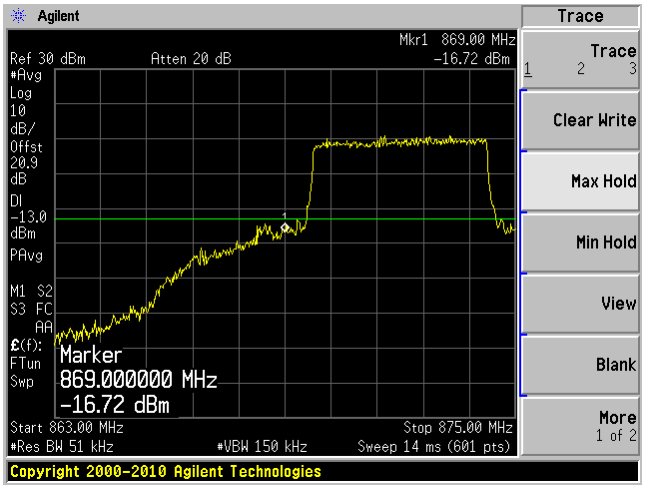
QPSK (5 MHz) - Low Channel



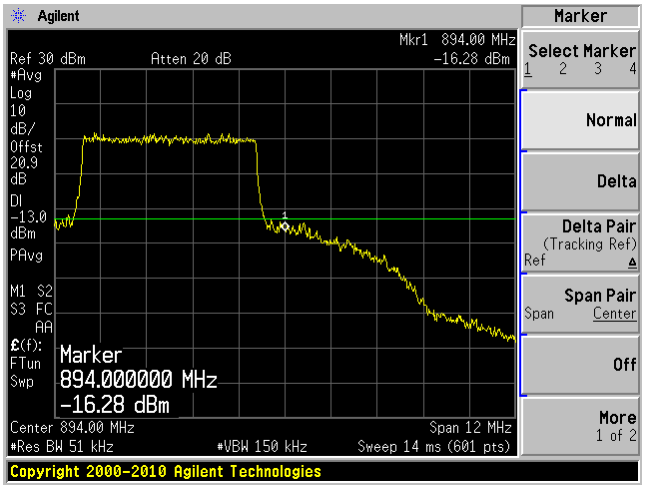
QPSK (5 MHz) - High Channel



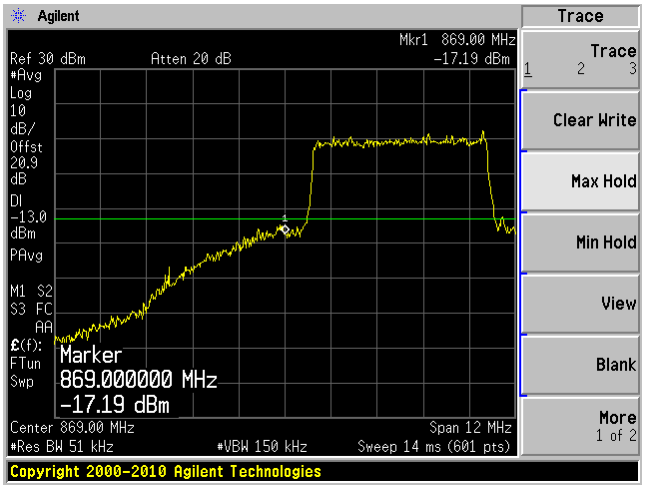
16QAM (5 MHz) - Low Channel



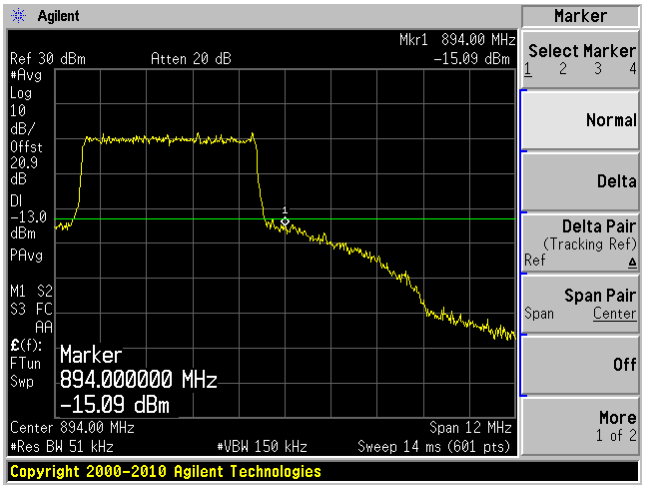
16QAM (5 MHz) - High Channel



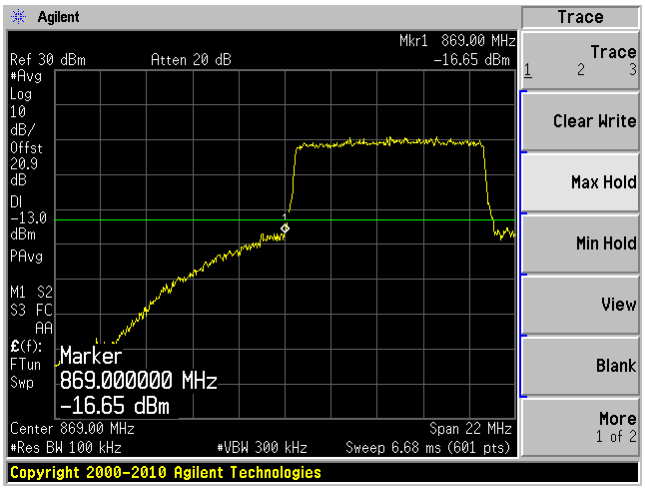
64QAM (5 MHz) - Low Channel



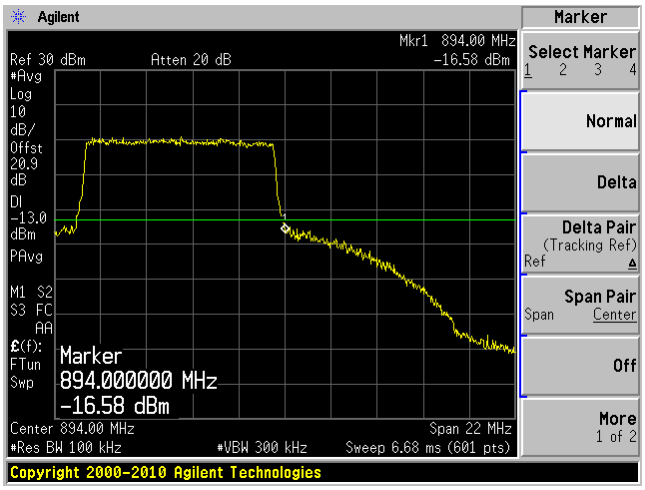
64QAM (5 MHz) - High Channel



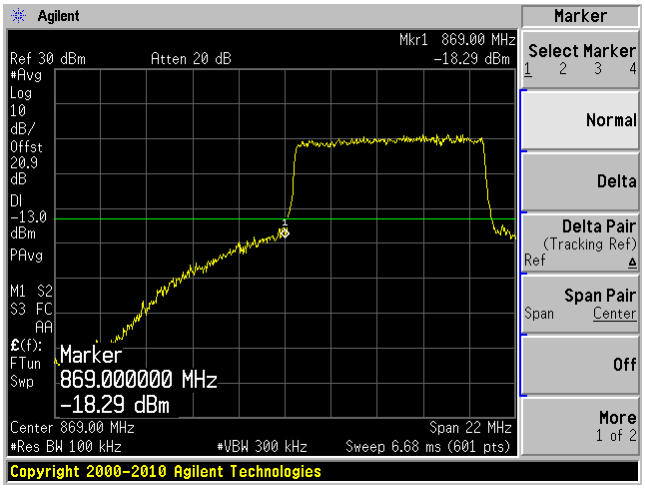
QPSK (10 MHz) - Low Channel



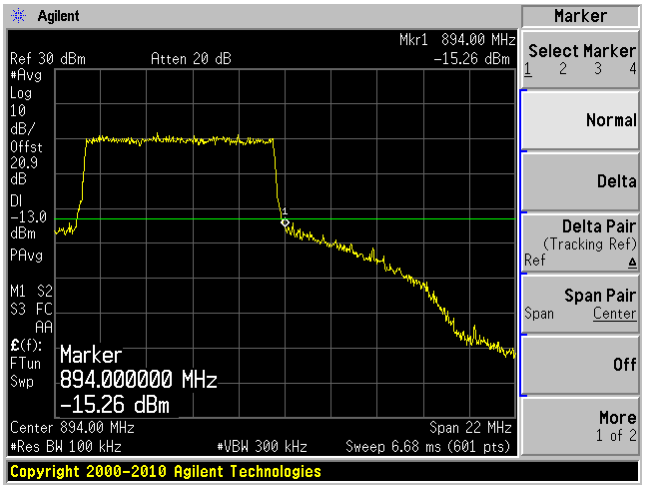
QPSK (10 MHz) - High Channel



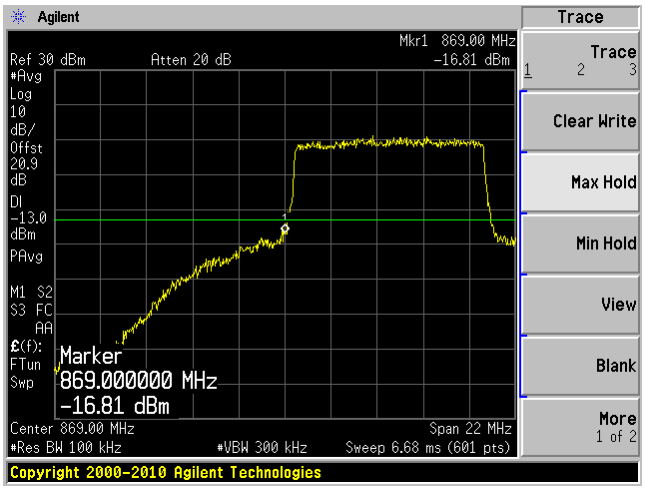
16QAM (10 MHz) - Low Channel



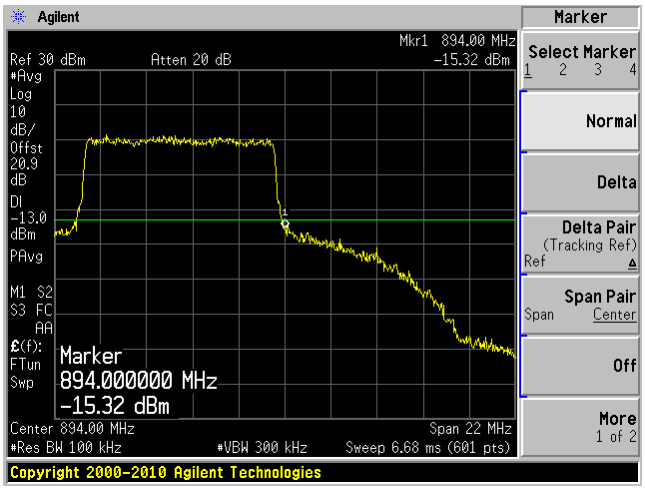
16QAM (10 MHz) - High Channel



64QAM (10 MHz) - Low Channel

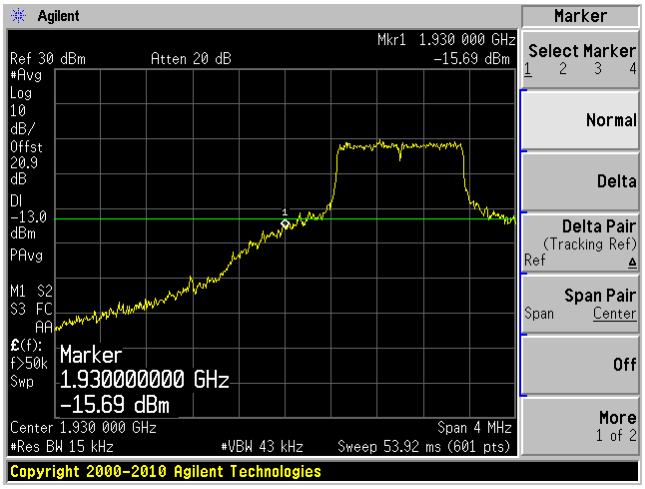


64QAM (10 MHz) - High Channel

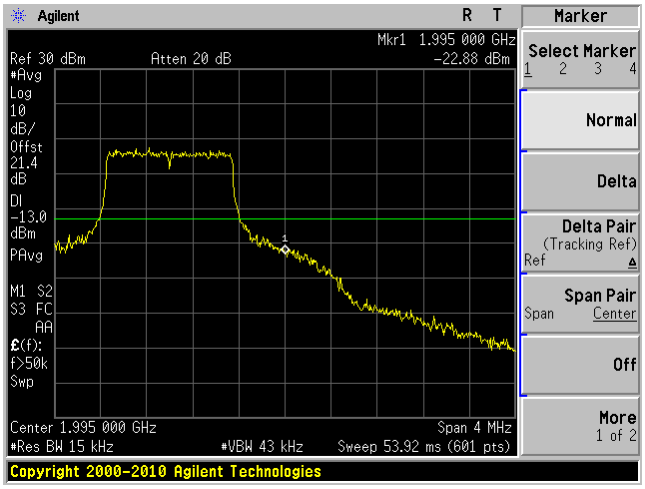


LTE PCS 1900 Band Downlink

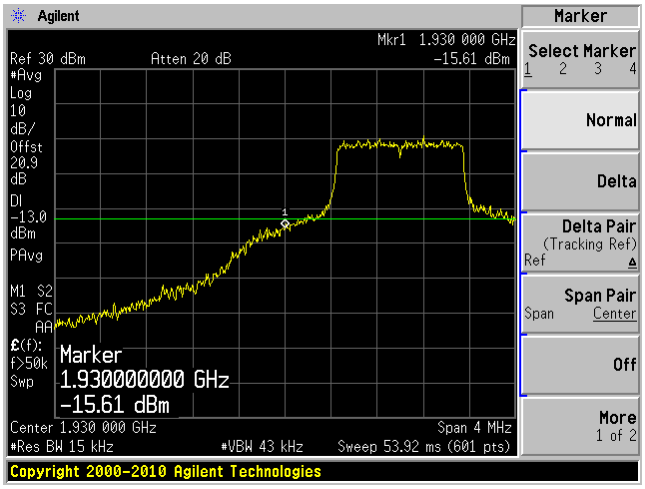
QPSK (1.4 MHz) - Low Channel



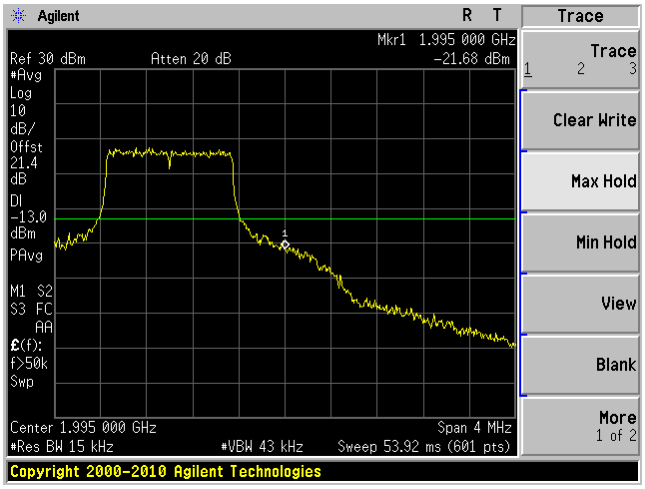
QPSK (1.4 MHz) - High Channel



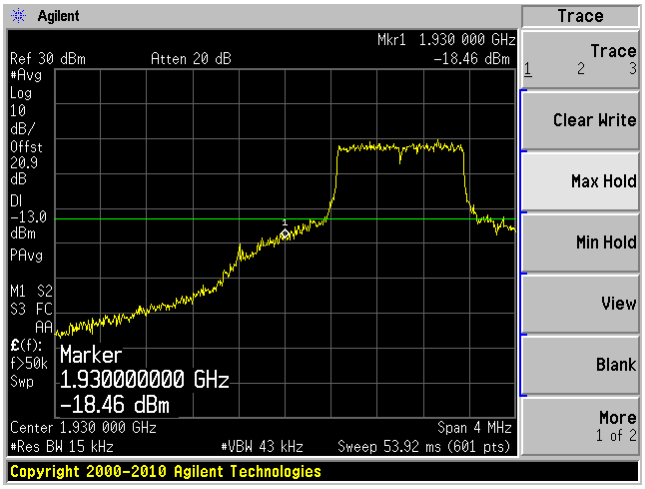
16QAM (1.4 MHz) - Low Channel



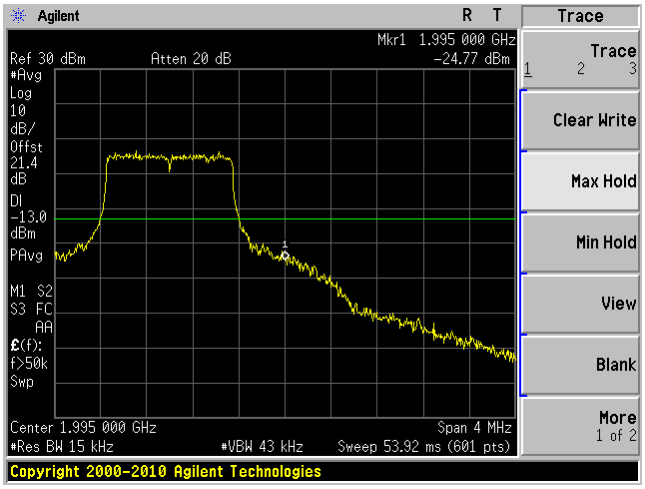
16QAM (1.4 MHz) - High Channel



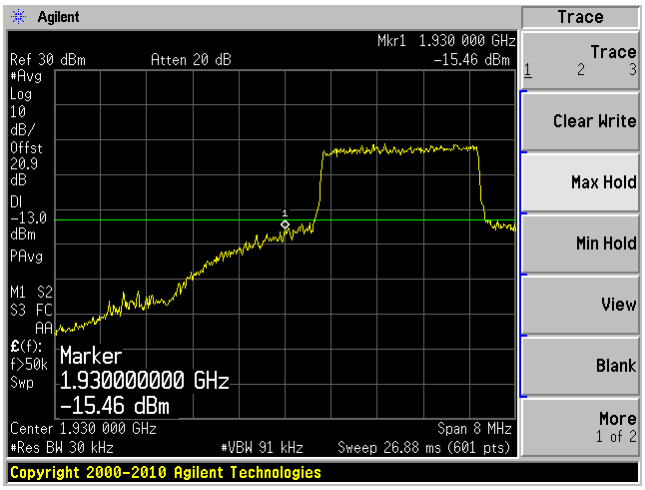
64QAM (1.4 MHz) - Low Channel



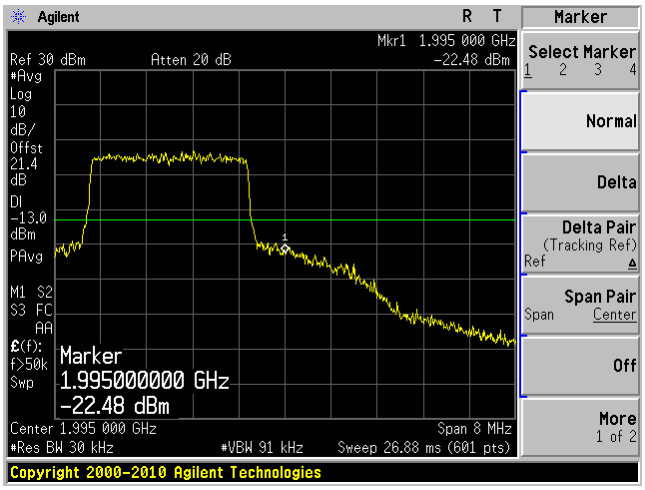
64QAM (1.4 MHz) - High Channel



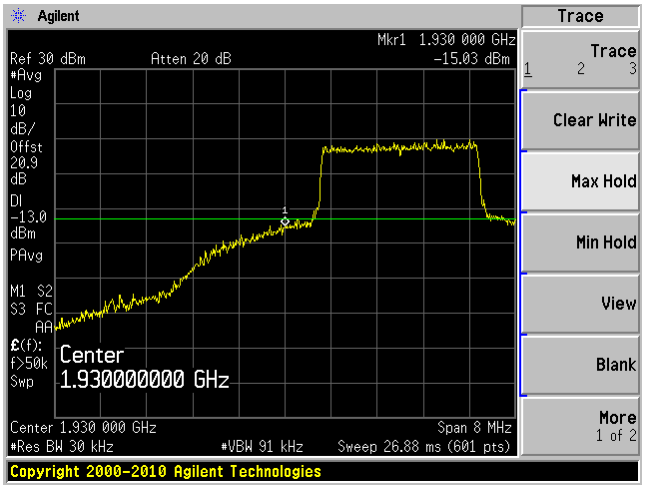
QPSK (3 MHz) - Low Channel



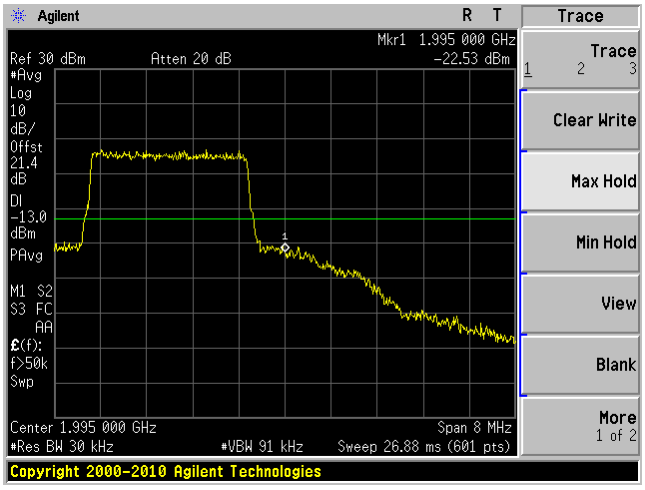
QPSK (3 MHz) - High Channel



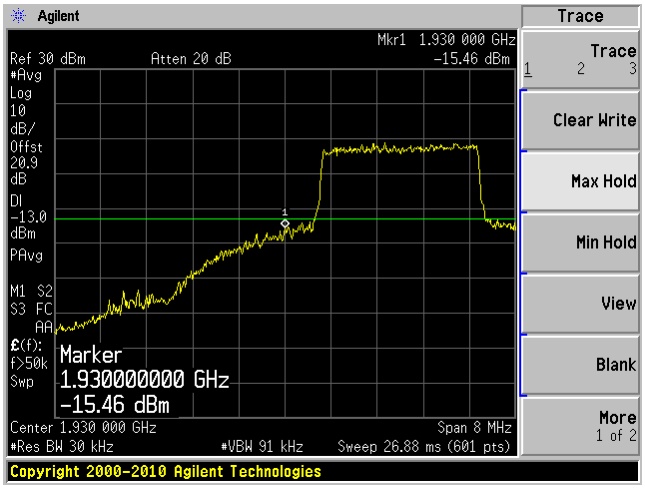
16QAM (3 MHz) - Low Channel



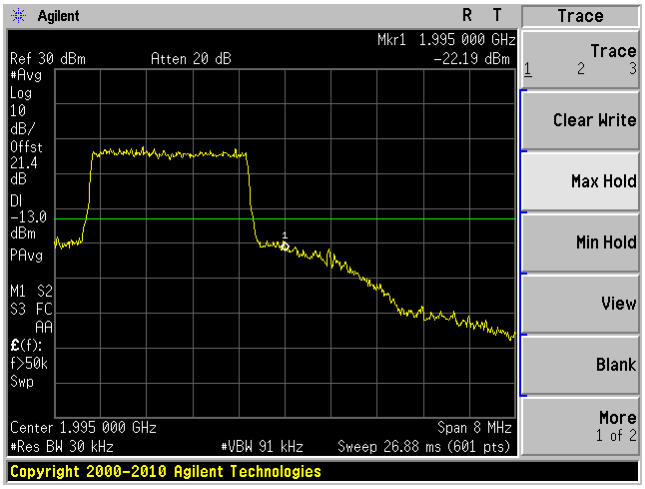
16QAM (3 MHz) - High Channel



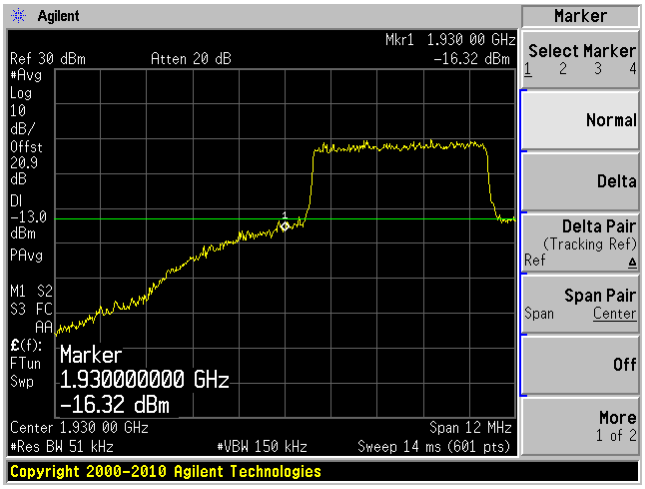
64QAM (3 MHz) - Low Channel



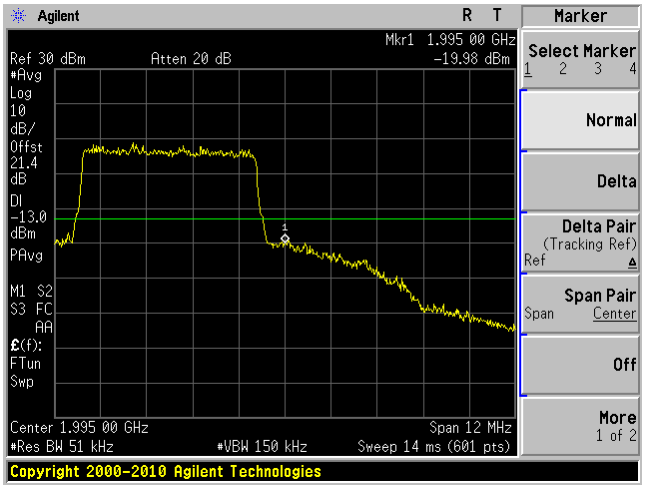
64QAM (3 MHz) - High Channel



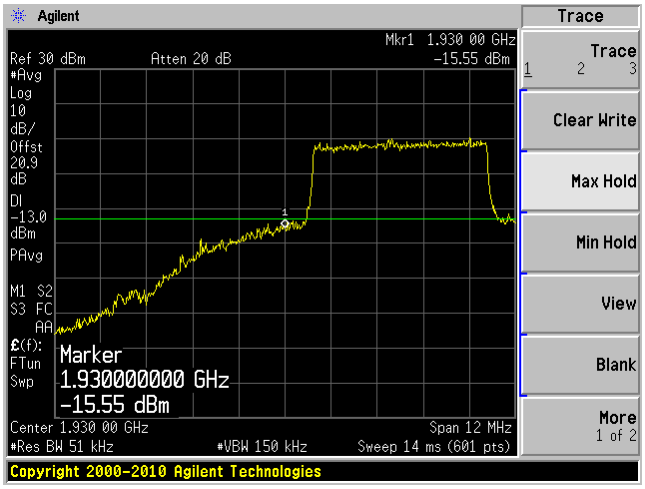
QPSK (5 MHz) - Low Channel



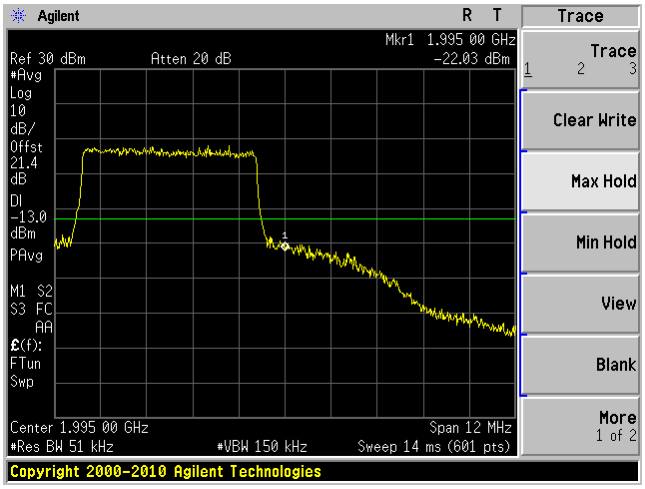
QPSK (5 MHz) - High Channel



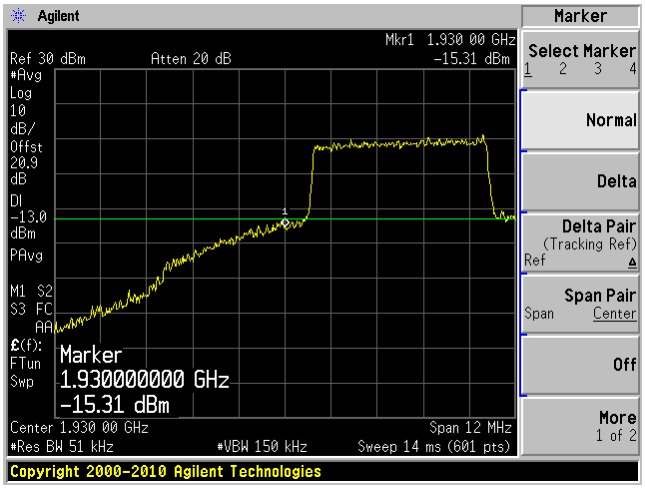
16QAM (5 MHz) - Low Channel



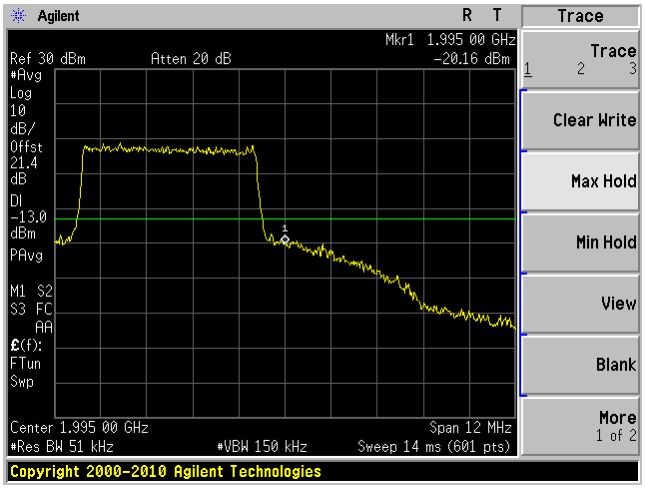
16QAM (5 MHz) - High Channel



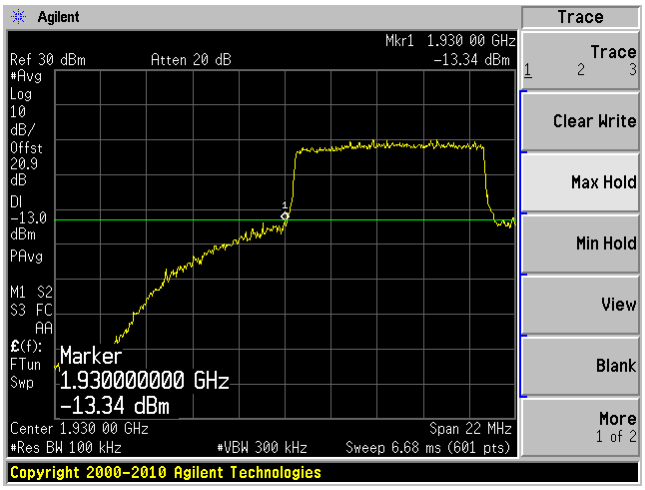
64QAM (5 MHz) - Low Channel



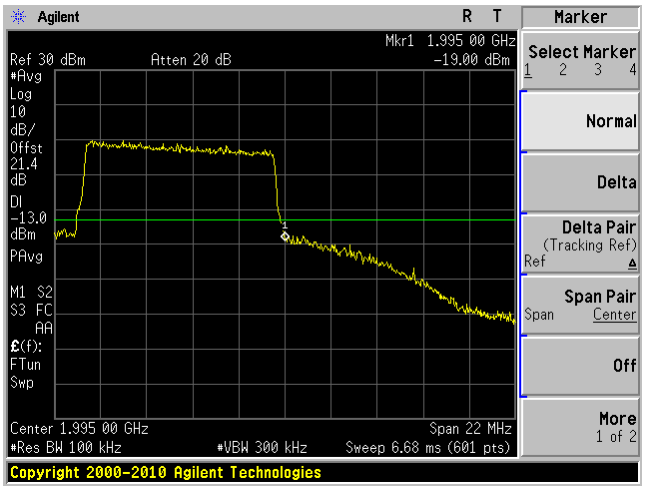
64QAM (5 MHz) - High Channel



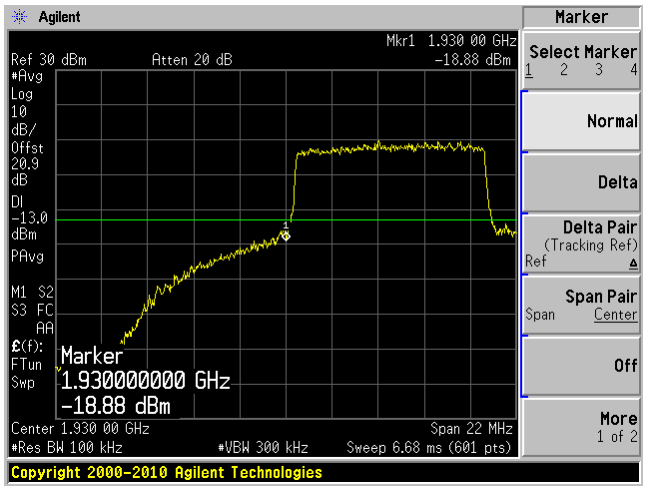
QPSK (10 MHz) - Low Channel



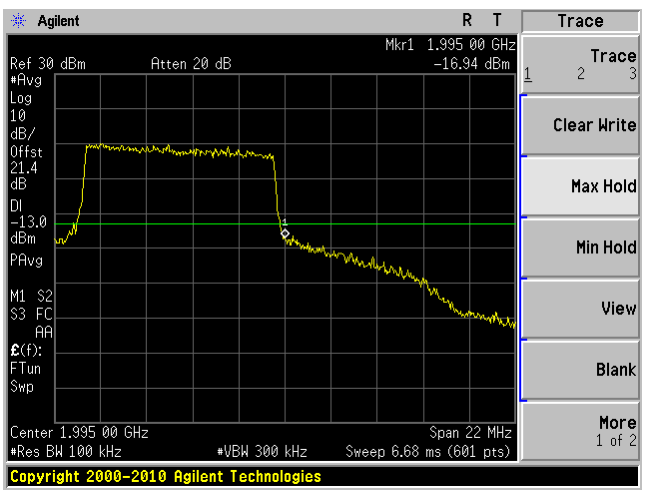
QPSK (10 MHz) - High Channel



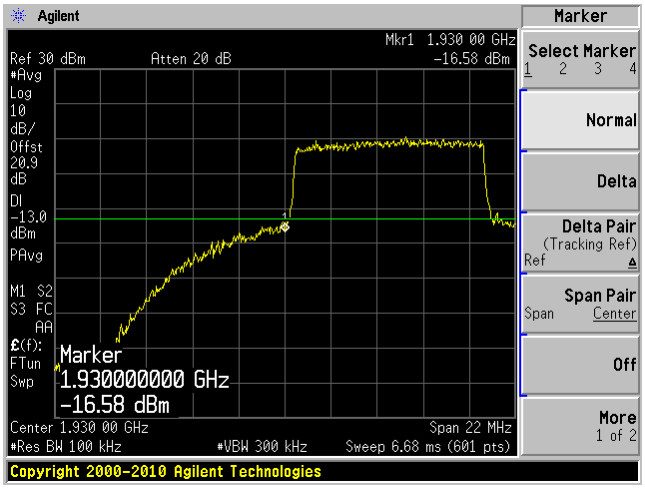
16QAM (10 MHz) - Low Channel



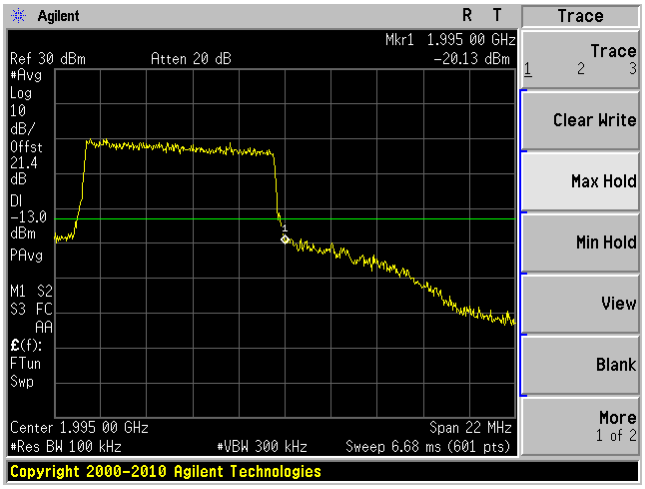
16QAM (10 MHz) - High Channel



64QAM (10 MHz) - Low Channel



64QAM (10 MHz) - High Channel



10 FCC §2.1055, §22.355, §24.235 & §27.54 – Frequency Stability

10.1 Applicable Standard

According to FCC §2.1055, §2.2.355, §24.235 and §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

10.2 Test Procedure

The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.
b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification **—** the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 0.000 25 %(± 2.5 ppm) of the center frequency.

CW was tested as worst case.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09[1]
HP	Signal Generator	E4438C	MY45091309	2012-05-03

Note 1: Based on a two year calibration cycle.
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

10.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	57 %
ATM Pressure:	101.4kPa

The testing was performed by Ning Ma from 2012-05-27 at RF Site.

10.5 Test Results

700 UC Band (746-757 MHz)

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Result
Voltage (Vac)	Temperature (^{o}C)				
Frequency vs. Temperature					
120	45	752	752.000000	0.23	Compliant
120	35	752	752.000170	0.23	Compliant
120	25	752	752.000170	0.23	Compliant
120	15	752	752.000170	0.23	Compliant
120	5	752	752.000170	0.23	Compliant
120	-5	752	752.000170	0.23	Compliant
120	-15	752	752.000170	0.23	Compliant
120	-25	752	752.000000	0	Compliant
Frequency vs. Voltage					
108	25	752	752.000170	0.23	Compliant
132	25	752	752.000170	0.23	Compliant

Cellular 850 Band (869-894 MHz)

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (Vac)	Temperature (^{o}C)				
Frequency vs. Temperature					
120	45	881.5	881.500170	0.20	± 1.5
120	35	881.5	881.500170	0.20	± 1.5
120	25	881.5	881.500170	0.20	± 1.5
120	15	881.5	881.500170	0.20	± 1.5
120	5	881.5	881.500170	0.20	± 1.5
120	-5	881.5	881.500000	0.20	± 1.5
120	-15	881.5	881.500170	0.20	± 1.5
120	-25	881.5	881.500170	0.20	± 1.5
Frequency vs. Voltage					
108	25	881.5	881.500170	0.20	Compliant
132	25	881.5	881.500170	0.20	Compliant

PCS 1900 Band (1930-1995 MHz)

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Result
Voltage (Vac)	Temperature (^{o}C)				
Frequency vs. Temperature					
120	45	1960	1960.000170	0.09	Compliant
120	35	1960	1960.000170	0.09	Compliant
120	25	1960	1960.000170	0.09	Compliant
120	15	1960	1960.000330	0.15	Compliant
120	5	1960	1960.000170	0.09	Compliant
120	-5	1960	1960.000330	0.15	Compliant
120	-15	1960	1960.000300	0.15	Compliant
120	-25	1960	1960.000500	0.26	Compliant
Frequency vs. Voltage					
108	25	1960	1960.000330	0.15	Compliant
132	25	1960	1960.000330	0.15	Compliant

11 FCC §1.1307(b)(1) & §2.1091 – RF Exposure Information

11.1 Applicable Standard

According to FCC §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

Cellular 850 Band Downlink

Maximum peak output power at antenna input terminal (dBm):	26.61
Maximum peak output power at antenna input terminal (mW):	458.14
Prediction distance (cm):	20
Prediction frequency (MHz):	893.8
Antenna Gain, typical (dBi):	15
Cable Loss (dB)	8.0
Maximum Antenna Net Gain (numeric):	5.01
Power density at predication frequency and distance (mW/cm^2):	0.457
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.5576

PCS 1900 Band Downlink

Maximum peak output power at antenna input terminal (dBm):	26.45
Maximum peak output power at antenna input terminal (mW):	441.57
Prediction distance (cm):	20
Prediction frequency (MHz):	1960
Antenna Gain, typical (dBi):	15
Cable Loss (dB)	8.0
Maximum Antenna Net Gain (numeric):	5.01
Power density at predication frequency and distance (mW/cm^2):	0.440
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	1.0

700UC LTE Band Downlink

Maximum peak output power at antenna input terminal (dBm):	19.96
Maximum peak output power at antenna input terminal (mW):	99.08
Prediction distance (cm):	20
Prediction frequency (MHz):	754
Antenna Gain, typical (dBi):	15
Cable Loss (dB)	8.0
Maximum Antenna Net Gain (numeric):	5.01
Power density at predication frequency and distance (mW/cm^2):	0.099
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.503

Results

For Downlink; the highest power density level at 20 cm is below the MPE uncontrolled exposure limit.