



FCC PART 22H, 24E  
TEST AND MEASUREMENT REPORT

For

**ADC Telecommunications, Inc.**

P.O. Box 1101, Minneapolis, Minnesota 55440, USA

**FCC ID: NOO-F0695-011**

<b>Report Type:</b> CIIPC Report	<b>Product Type:</b> InterReach Fusion System, RAU
<b>Test Engineer:</b> <u>Quinn Jiang</u> 	
<b>Report Number:</b> <u>R1105124-2224</u>	
<b>Report Date:</b> <u>2011-06-01</u>	
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\* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "\*" and

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**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R1105124-2224	Original Report	2011-06-01

# 1 GENERAL INFORMATION

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## 1.1 Product Description for Equipment under Test (EUT)

The *ADC Telecommunications, Inc.*'s product, FCC ID: NOO-F0695-011, model number: FSN-2-758519-1 is the remote access unit of InterReach Fusion system, the system consists three modular components, the Main Hub (model number: FSN-2-MH-1), Expansion Hub (model: FSN-EH-2) and RAU (model: FSN-2-758519-1).

## 1.2 Mechanical Description

Dimension of Remote Access Unit: 28.1 cm (L) x 28.6 cm (W) x 5.4 cm (H). Weigh: 2724g

*The test data gathered are from typical production sample, serial number: R1105124-1, provided by BAACL.*

## 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, 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.

The purpose of this Class II Permissive Change report is to add a LTE modulation to the Cellular 850 and PCS 1900 bands in the system. The original application (FCC ID: NOO-F0695-011, certified on 2011-03-16) included Cellular band with GSM, EDGE, CDMA and WCDMA modulation, PCS band with GSM, EDGE, CDMA and WCDMA modulation and 700MHz band with LTE modulation.

## 1.4 Related Submittal(s)/Grant(s)

Original FCC ID: NOO-F0695-011, report number: RSZ11011101.on 2011-03-16 did by BAACL Shenzhen.

## 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 - Public Mobile Services  
Part 24 Subpart E - PCS

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

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

## 1.6 Measurement Uncertainty

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

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from +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.

## 1.7 Test Facility

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

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and

December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

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

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

## 2 SYSTEM TEST CONFIGURATION

### 2.1 Justification

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

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

### 2.2 EUT Exercise Software

N/A

### 2.3 Equipment Modifications

No modifications were made to the EUT.

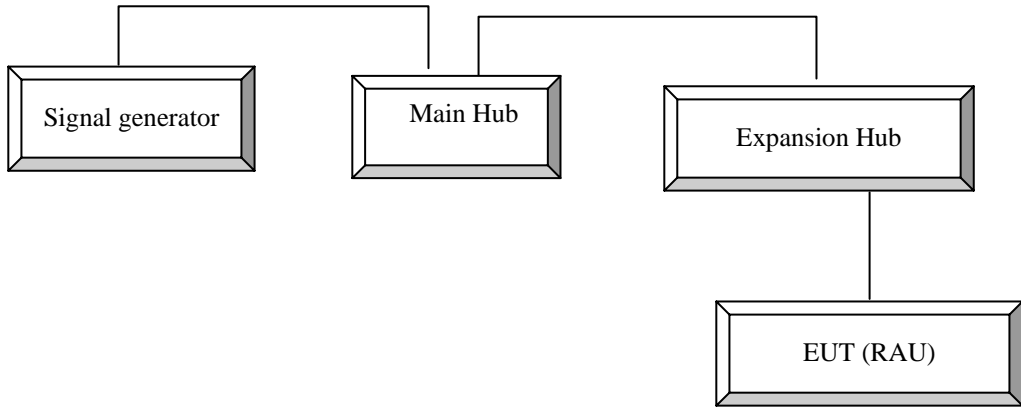
### 2.4 Local Support Equipment List and Details

Manufacturer	Device Name	Model	Serial Number
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309
Rohde & Schwarz	Signal Generator	SMIQ03	849192/0085
ADC	Main Hub	-	-
ADC	Expansion Hub	-	-

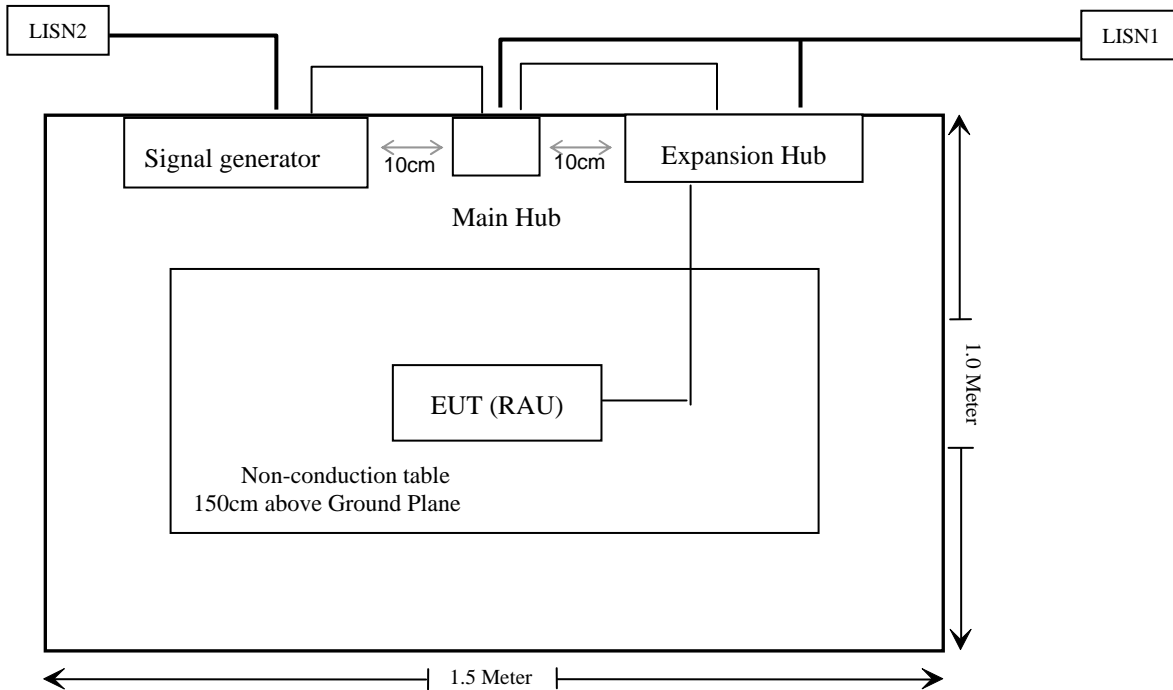
### 2.5 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Shielded Detachable K/B Cable	150	Expansion Hub	RAU (EUT)
Fiber Cable	2.0	Main Hub	Expansion Hub
RF cable	< 3m	Signal Generator	Input/ EUT
RF cable	< 3m	Output/ EUT	Spectrum analyzer

### 2.6 Configuration of Test Setup



### 2.7 Block Diagram of Test Setup





### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Tests	Results
§2.1046 §22.913 (a), §24.232	RF Output Power	Compliant <sup>2</sup>
§2.1047	Modulation Characteristics	N/A <sup>1</sup>
§2.1049, §22.905 §22.917, §24.238	Occupied Bandwidth / Out of Band Emissions	Compliant <sup>2</sup>
§2.1053 §22.917, §24.238	Spurious Radiated Emissions	Compliant <sup>2</sup>
§2.1051 §22.917, §24.238	Spurious Emissions at Antenna Terminals	Compliant <sup>2</sup>
§22.917, §24.238	Band Edge	Compliant <sup>2</sup>
§2.1055 §22.355, §24.235	Frequency Stability	Note <sup>2</sup>
§2.1091	RF Exposure	Compliant <sup>2</sup>

N/A <sup>1</sup>: According to FCC § 2.1047(d) and Part 22H, Part 24E, there is no specific requirement for digital modulation; therefore, No Modulation Characteristics measurement required

Note <sup>2</sup>: For Cellular band with GSM, EDGE, CDMA and WCDMA modulation, PCS band with GSM, EDGE, CDMA and WCDMA modulation and 700 MHz band with LTE modulation please Refer to original FCC ID: NOO-F0695-011, report number: RSZ11011101 did by BACL Shenzhen.

## 4 §2.1046, §22.913(a) & §24.232 – 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.

### 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	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Analyzer, Spectrum	E4440A	US45303156	2010-08-09

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

### 4.4 Test Environmental Conditions

<b>Temperature:</b>	20~24 °C
<b>Relative Humidity:</b>	35~42 %
<b>ATM Pressure:</b>	101.1~101.7 kPa

\* *The testing was performed by Quinn Jiang on 2011-05-18 ~ 2011-5-20*

## 4.5 Test Results

### Maximum Output Power – Modulated Signal

Mode		Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)
LTE QPSK (1.4 MHz)	850 MHz Downlink	Low	869.7	15.30	0.0339
		Middle	881.5	15.38	0.0345
		High	893.3	15.20	0.0331
	1900 MHz Downlink	Low	1930.7	15.23	0.0333
		Middle	1960	15.26	0.0336
		High	1989.3	15.21	0.0332
LTE 16QAM (1.4 MHz)	850 MHz Downlink	Low	869.7	15.30	0.0339
		Middle	881.5	15.31	0.034
		High	893.3	15.20	0.0331
	1900 MHz Downlink	Low	1930.7	15.24	0.0334
		Middle	1960	15.27	0.0337
		High	1989.3	15.26	0.0336
LTE 64QAM (1.4 MHz)	850 MHz Downlink	Low	869.7	15.25	0.0335
		Middle	881.5	15.32	0.0340
		High	893.3	15.22	0.0333
	1900 MHz Downlink	Low	1930.7	15.24	0.0334
		Middle	1960	15.28	0.0337
		High	1989.3	15.19	0.0330

Mode		Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)
LTE QPSK (10 MHz)	850 MHz Downlink	Low	874	15.21	0.0332
		Middle	881.5	15.32	0.0340
		High	889	15.31	0.0340
	1900 MHz Downlink	Low	1935	15.28	0.0337
		Middle	1960	15.35	0.0343
		High	1985	15.24	0.0334
LTE 16QAM (10 MHz)	850 MHz Downlink	Low	874	15.24	0.0334
		Middle	881.5	15.35	0.0343
		High	889	15.26	0.0336
	1900 MHz Downlink	Low	1935	15.23	0.0333
		Middle	1960	15.37	0.0344
		High	1985	15.23	0.0333
LTE 64QAM (10 MHz)	850 MHz Downlink	Low	874	15.27	0.0337
		Middle	881.5	15.35	0.0343
		High	889	15.28	0.0337
	1900 MHz Downlink	Low	1935	15.27	0.0337
		Middle	1960	15.34	0.0342
		High	1985	15.29	0.0338

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## **5 §2.1047 - MODULATION CHARACTERISTIC**

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### **5.1 Applicable Standard**

According to FCC §2.1047(d) and Part 22H, Part 24 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 §2.1049, §22.917 & §24.238 - OCCUPIED BANDWIDTH

### 6.1 Applicable Standard

Requirements: CFR 47, Section 2.1049, Section 22.917 and Section 24.238.

### 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	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Analyzer, Spectrum	E4440A	US45303156	2010-08-09

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

### 6.4 Test Environmental Conditions

<b>Temperature:</b>	20~24 °C
<b>Relative Humidity:</b>	35~42 %
<b>ATM Pressure:</b>	101.1~101.7 kPa

\* *The testing was performed by Quinn Jiang on 2011-05-18 ~ 2011-5-20*

## 6.5 Test Results

Mode		Channel	Frequency (MHz)	Emission Bandwidth 26 dB (MHz)	Emission Bandwidth 99% (MHz)
LTE QPSK (1.4 MHz)	850 MHz Downlink	Low	869.7	1.388	1.0934
		Middle	881.5	1.388	1.0945
		High	893.3	1.386	1.0937
	1900 MHz Downlink	Low	1930.7	1.388	1.0934
		Middle	1960	1.386	1.0933
		High	1989.3	1.388	1.0933
LTE 16QAM (1.4 MHz)	850 MHz Downlink	Low	869.7	1.391	1.0931
		Middle	881.5	1.393	1.0939
		High	893.3	1.386	1.0932
	1900 MHz Downlink	Low	1930.7	1.389	1.0929
		Middle	1960	1.389	1.0929
		High	1989.3	1.390	1.0929
LTE 64QAM (1.4 MHz)	850 MHz Downlink	Low	869.7	1.387	1.0934
		Middle	881.5	1.390	1.0943
		High	893.3	1.388	1.0935
	1900 MHz Downlink	Low	1930.7	1.387	1.0933
		Middle	1960	1.386	1.0933
		High	1989.3	1.385	1.0933

Mode		Channel	Frequency (MHz)	Emission Bandwidth 26 dB (MHz)	Emission Bandwidth 99% (MHz)
LTE QPSK (10 MHz)	850 MHz Downlink	Low	874	9.481	8.9184
		Middle	881.5	9.484	8.9246
		High	889	9.498	8.9233
	1900 MHz Downlink	Low	1935	9.482	8.9211
		Middle	1960	9.496	8.9216
		High	1985	9.472	8.9225
LTE 16QAM (10 MHz)	850 MHz Downlink	Low	874	9.525	8.9198
		Middle	881.5	9.537	8.9251
		High	889	9.536	8.9243
	1900 MHz Downlink	Low	1935	9.528	8.9224
		Middle	1960	9.566	8.9231
		High	1985	9.512	8.9242
LTE 64QAM (10 MHz)	850 MHz Downlink	Low	874	9.500	8.9202
		Middle	881.5	9.497	8.9266
		High	889	9.524	8.9250
	1900 MHz Downlink	Low	1935	9.511	8.9220
		Middle	1960	9.542	8.9234
		High	1985	9.493	8.9241

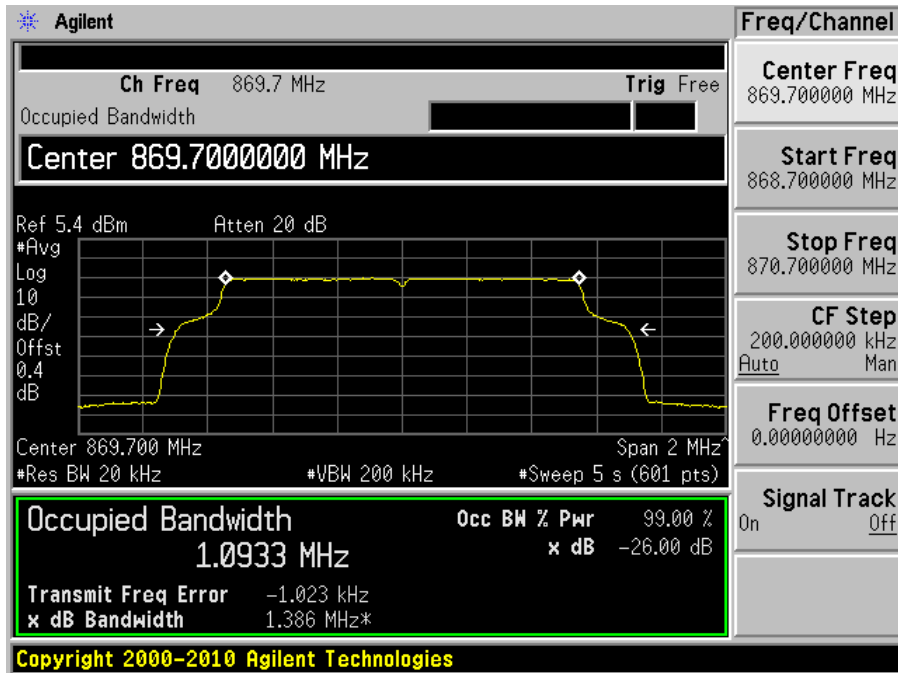
Please refer to the following plots.



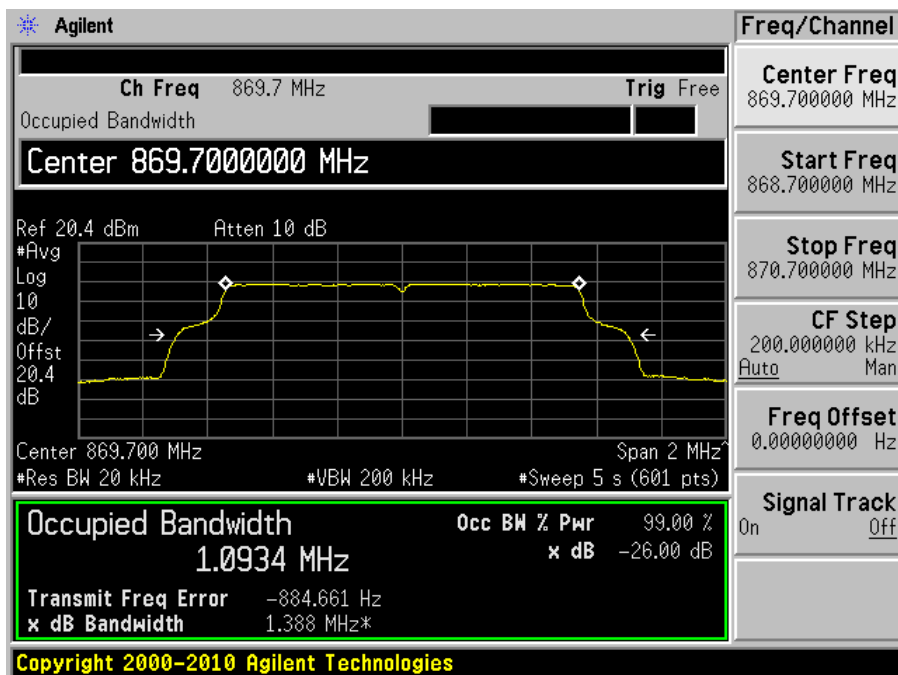
**LTE 850 MHz Band (downlink), Modulation: QPSK (1.4 MHz bandwidth)**

Low Channel (869.7 MHz)

Input

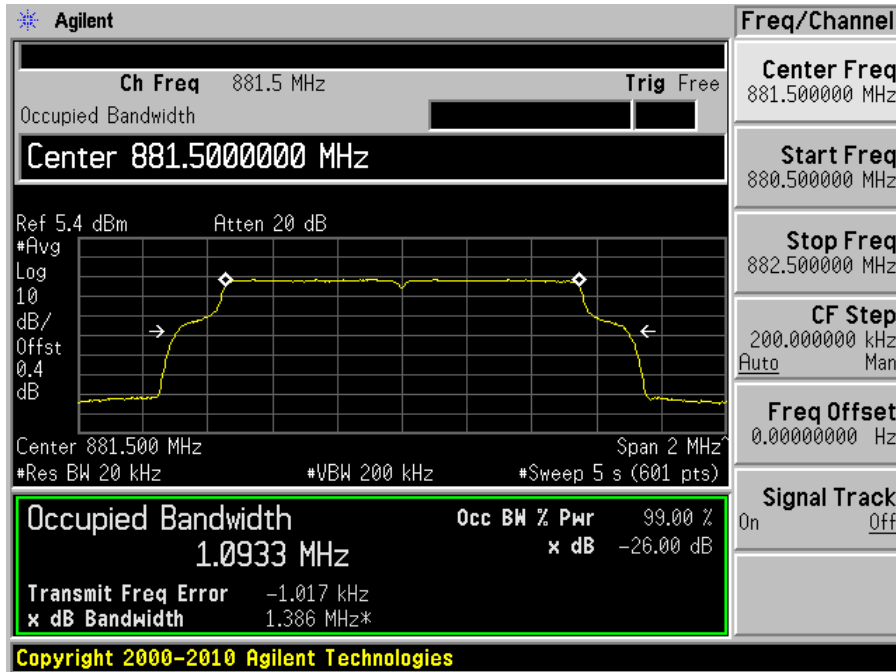


Output

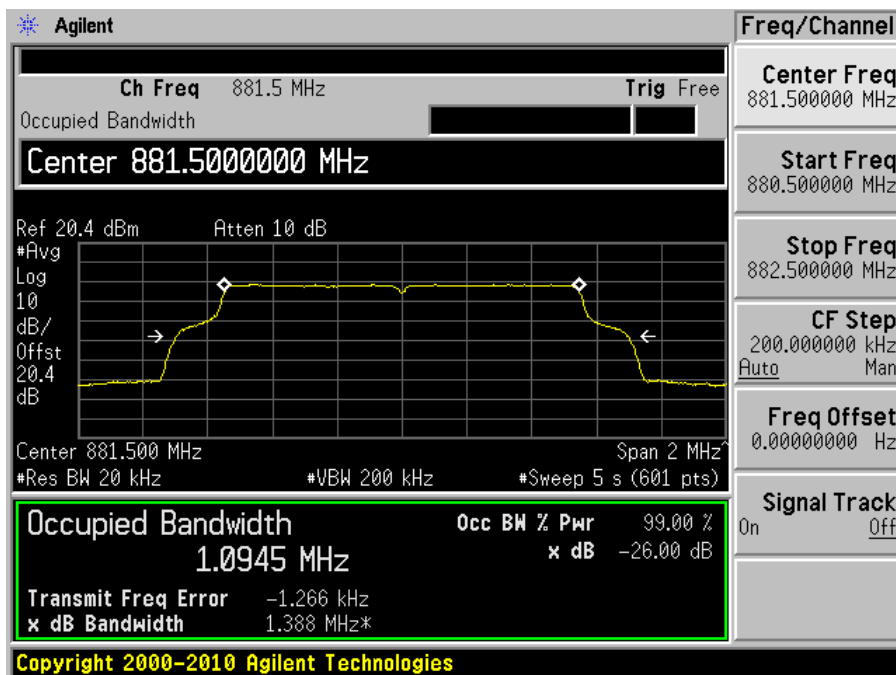


Middle Channel (881.5 MHz)

Input

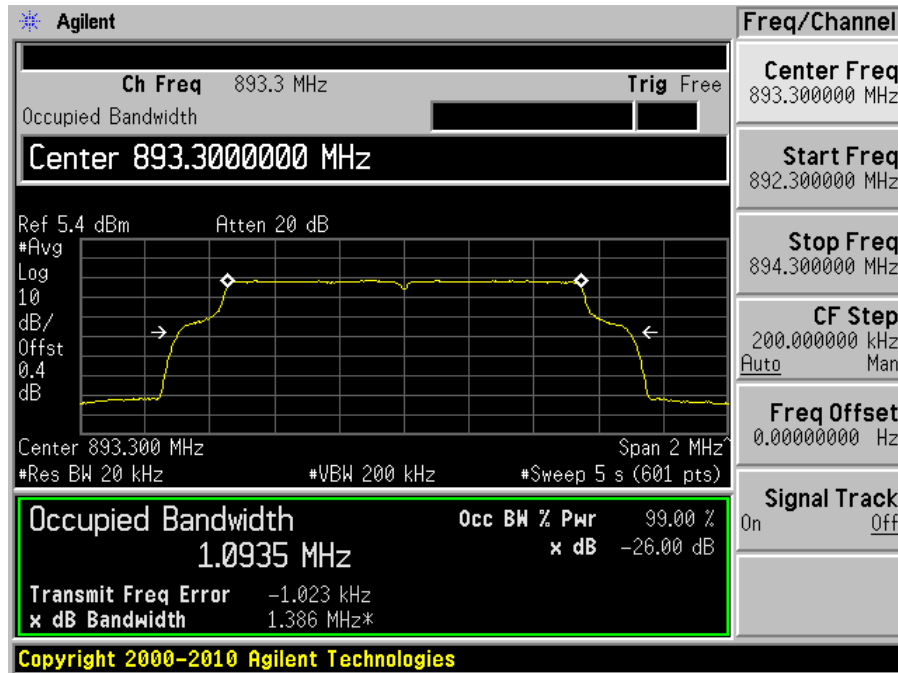


Output

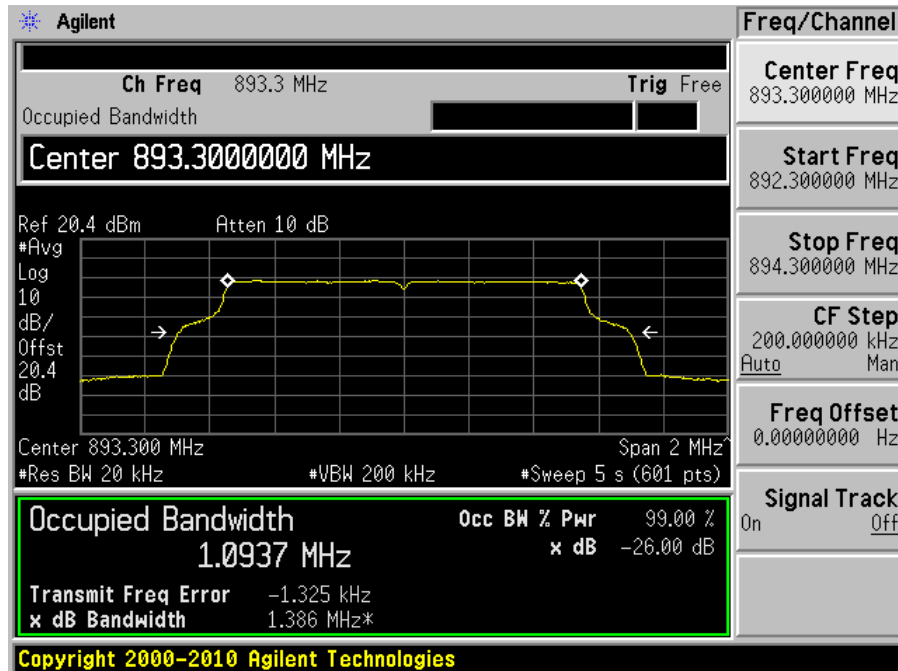


High Channel (893.3 MHz)

Input



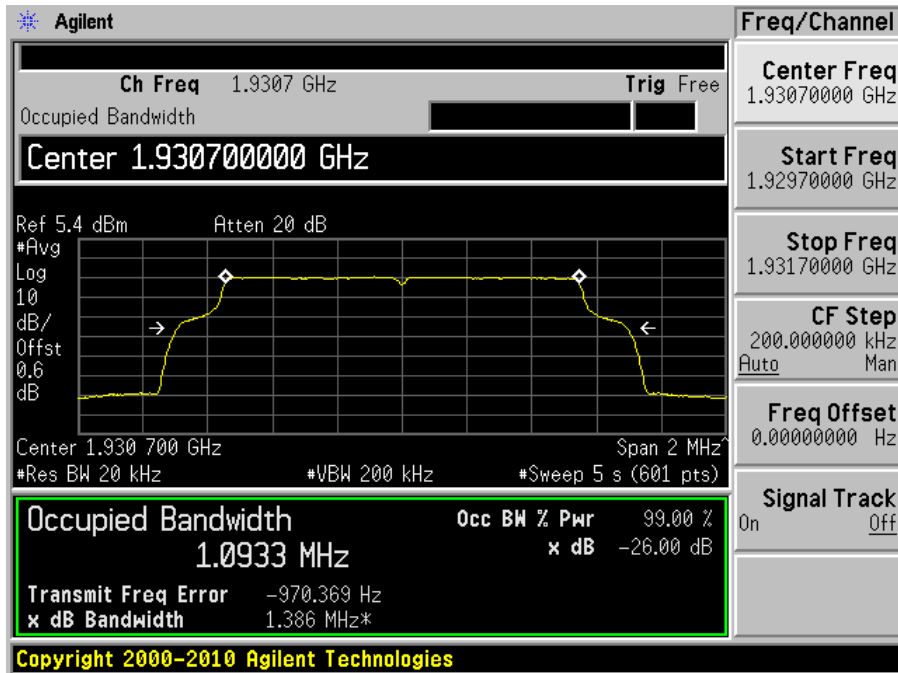
Output



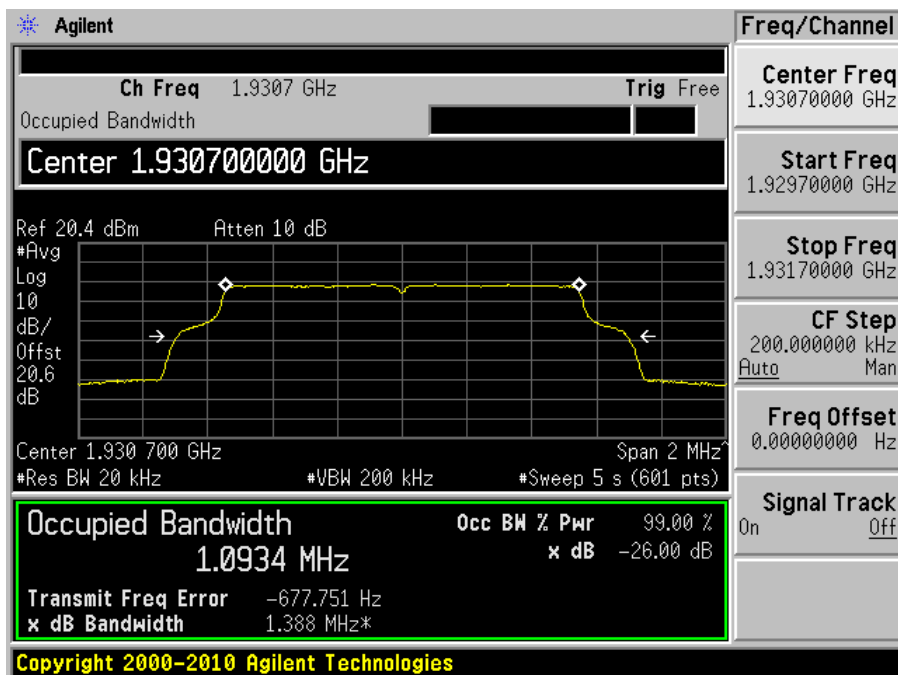
**LTE 1900 MHz Band (downlink), Modulation: QPSK (1.4 MHz bandwidth)**

Low Channel (1930.7 MHz)

Input

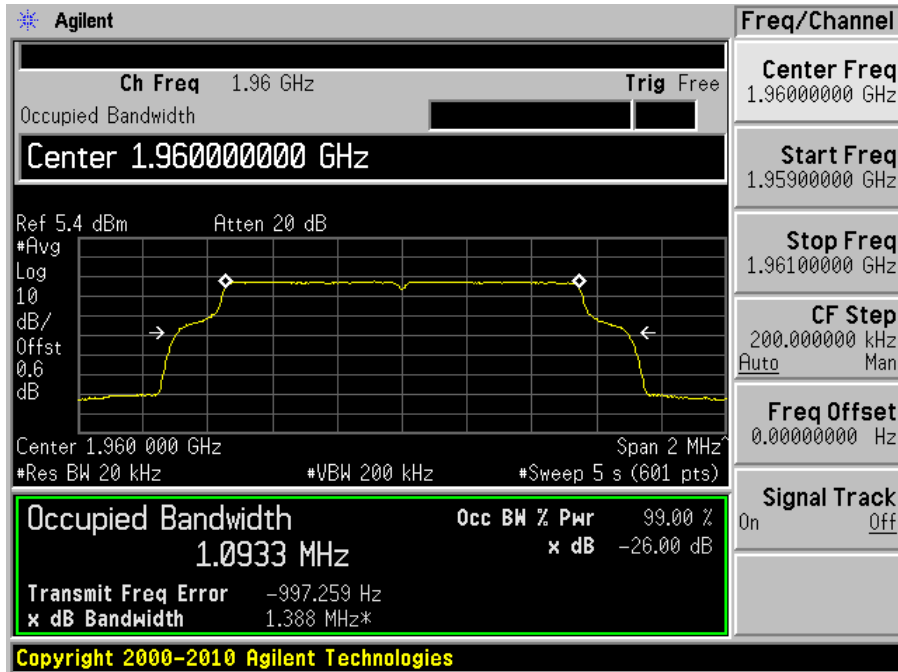


Output

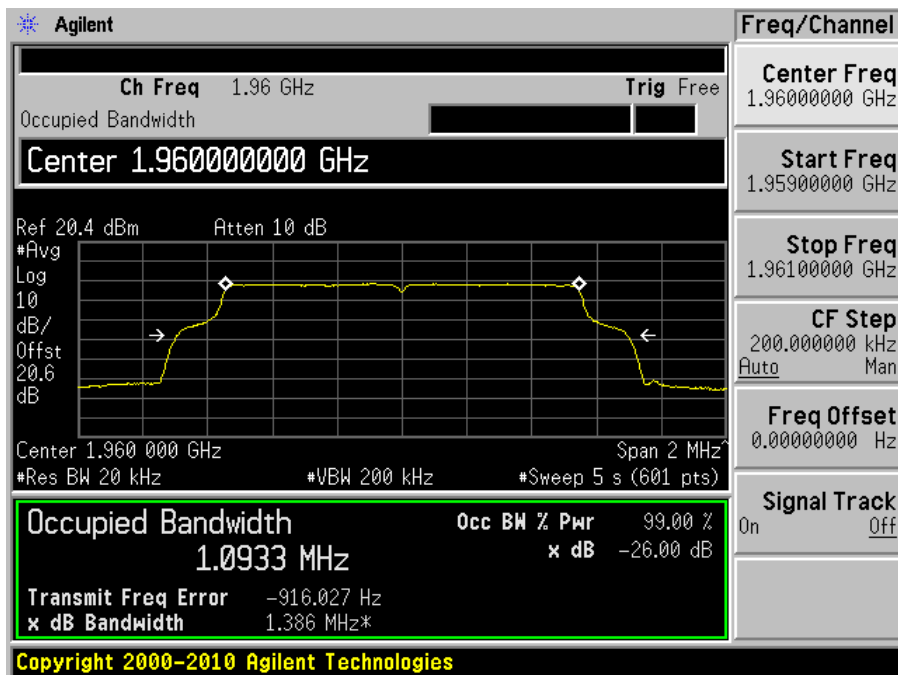


Middle Channel (1960 MHz)

Input

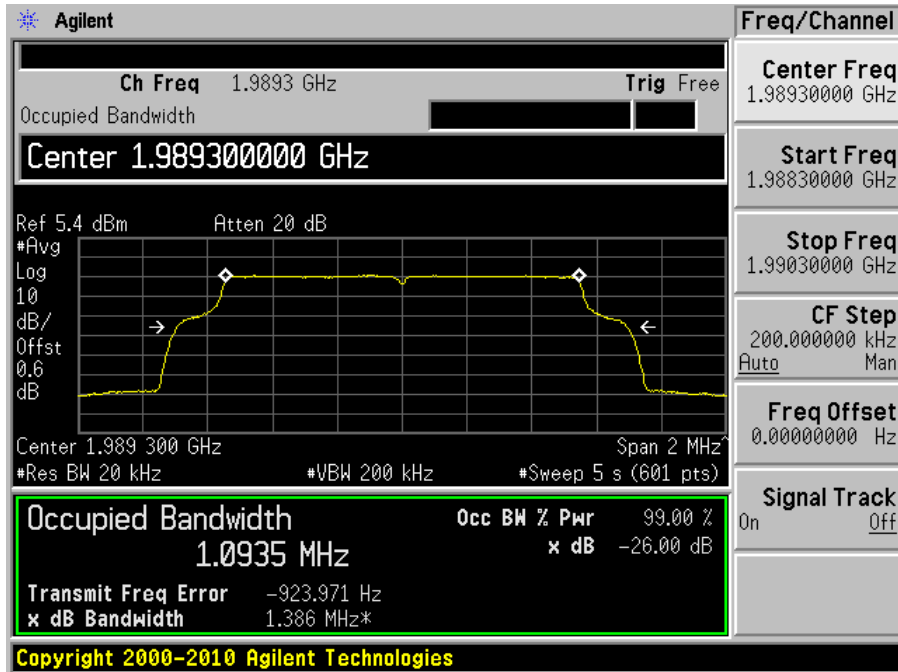


Output

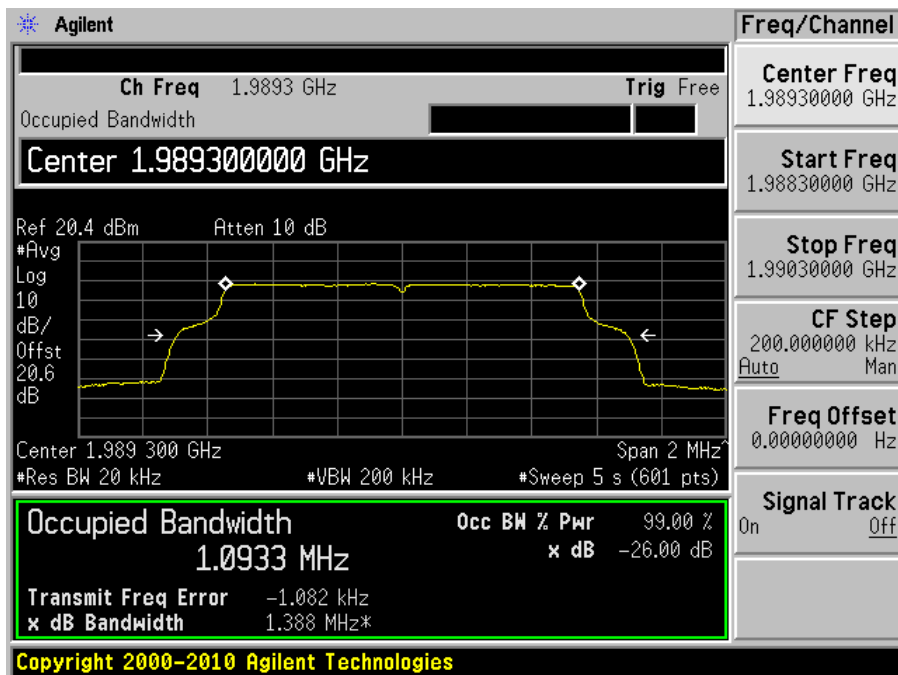


High Channel (1989.3 MHz)

Input



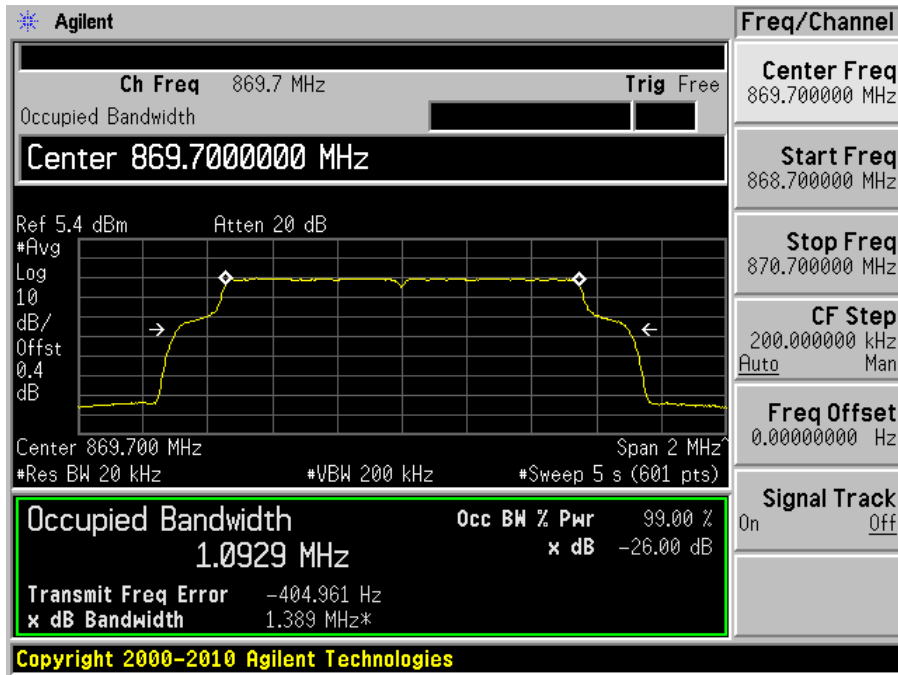
Output



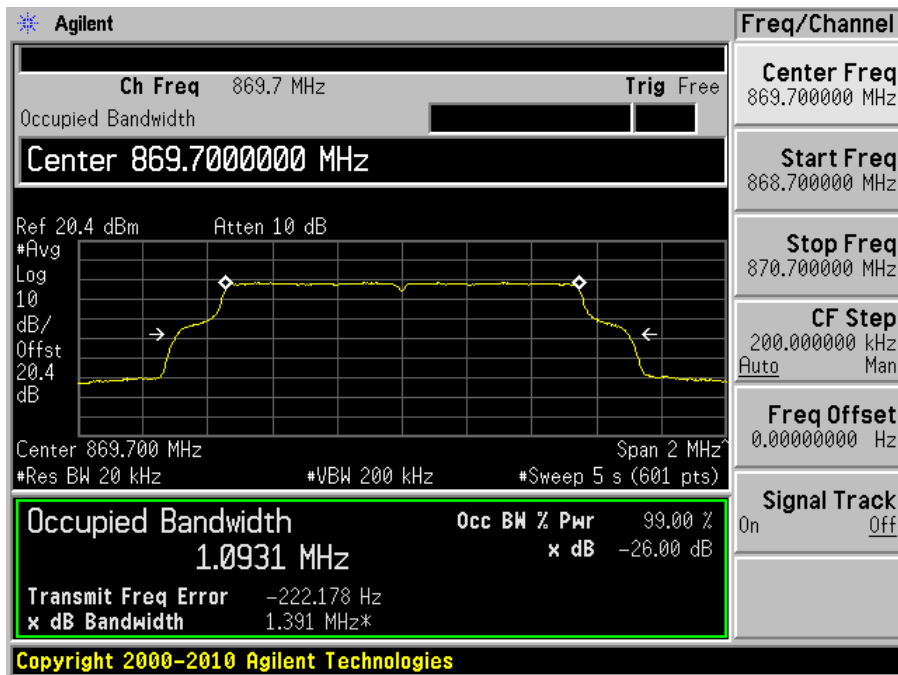
**LTE 850 MHz Band (downlink), Modulation: 16QAM (1.4 MHz bandwidth)**

Low Channel (869.7 MHz)

Input

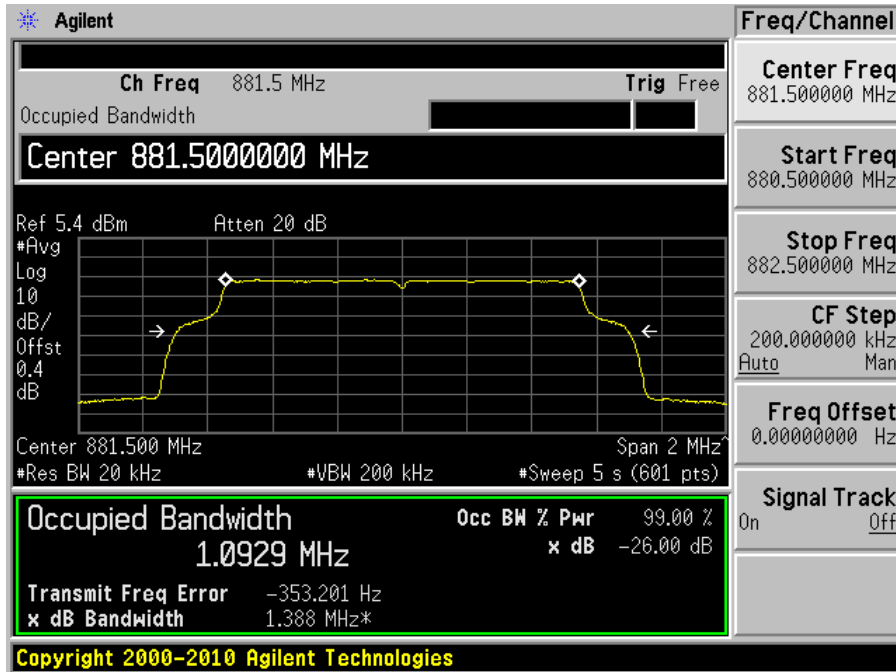


Output

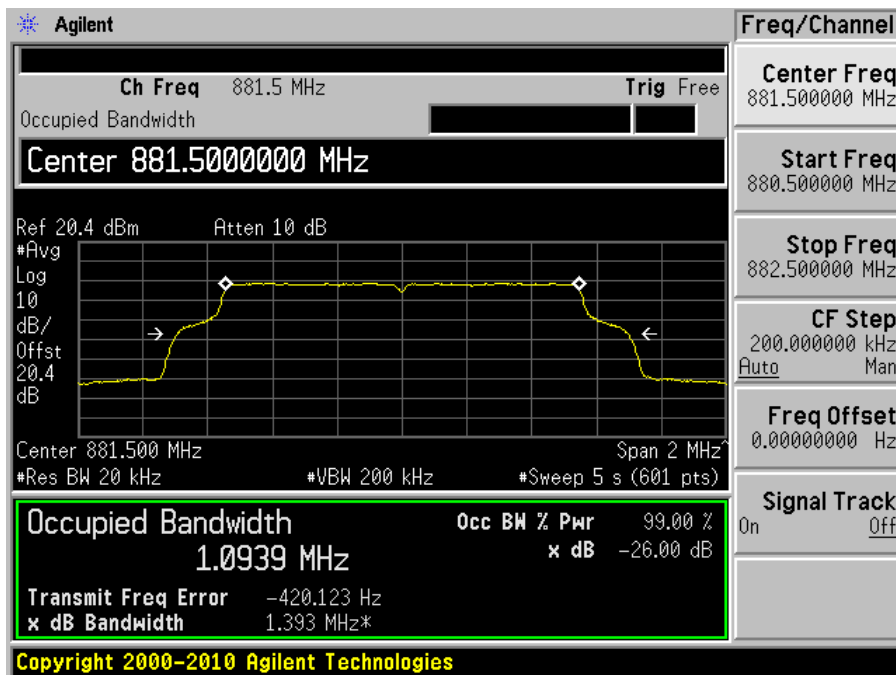


Middle Channel (881.5 MHz)

Input



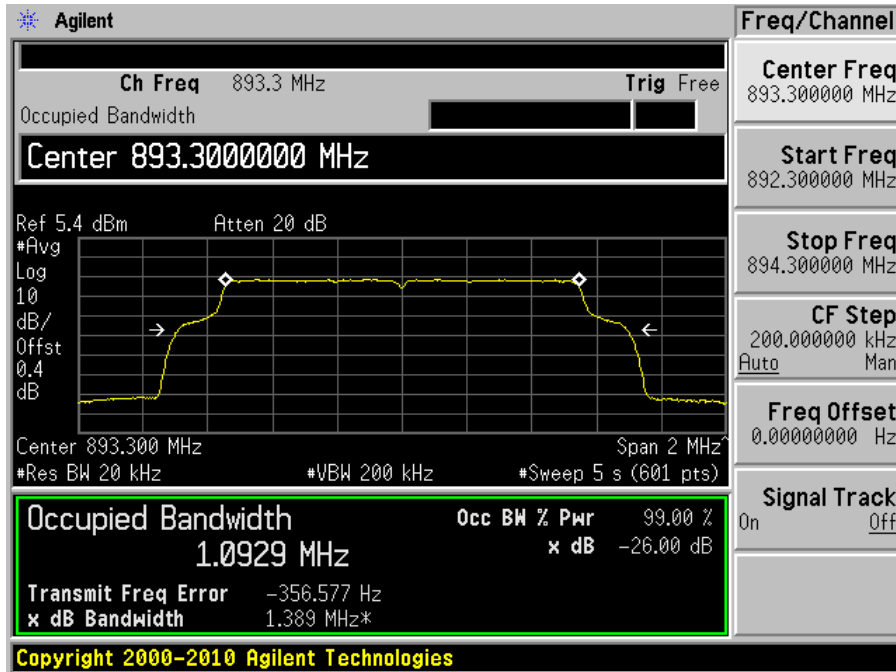
Output



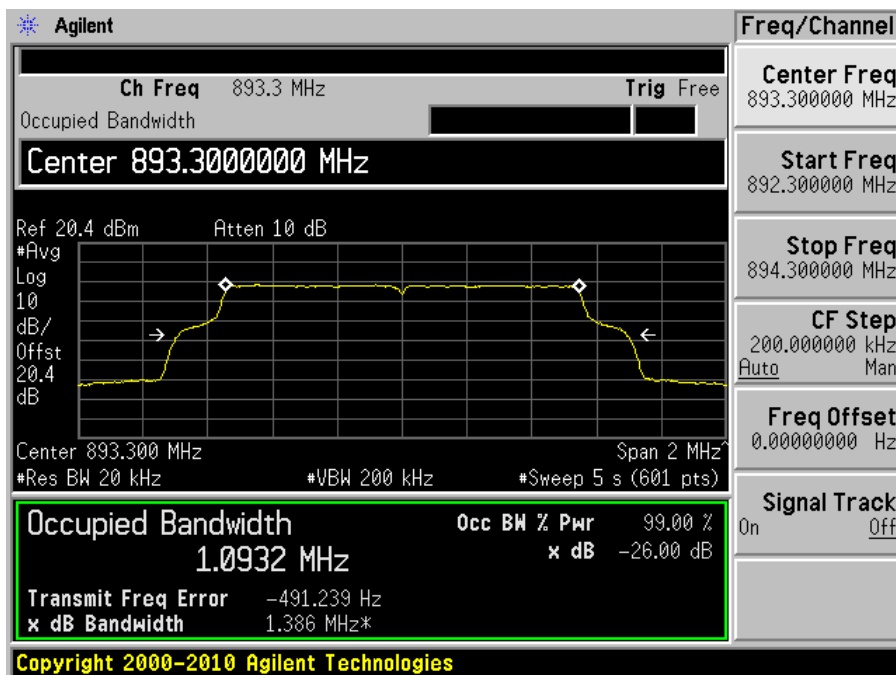


High Channel (893.3 MHz)

Input



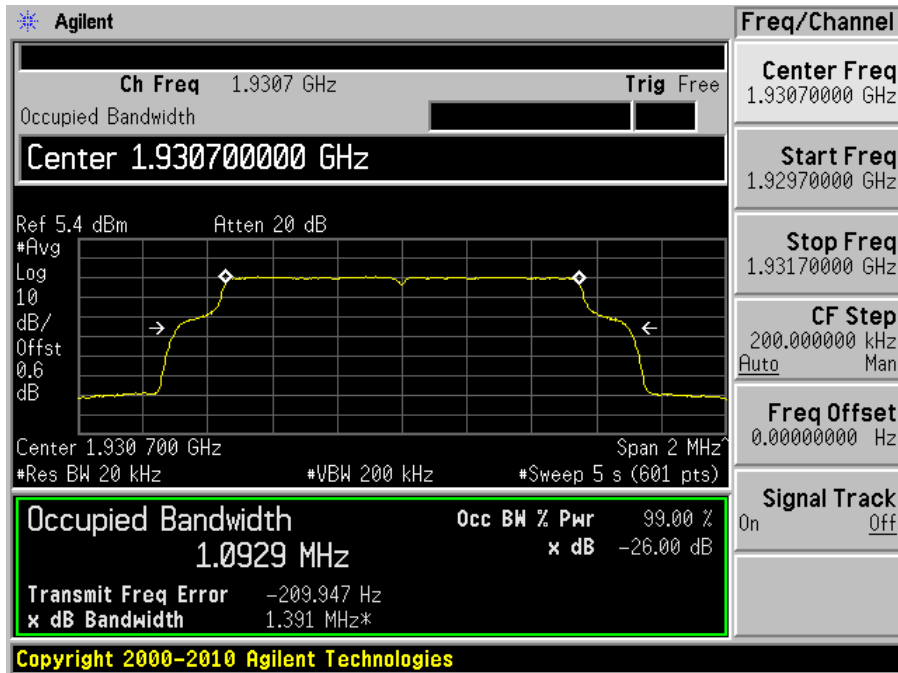
Output



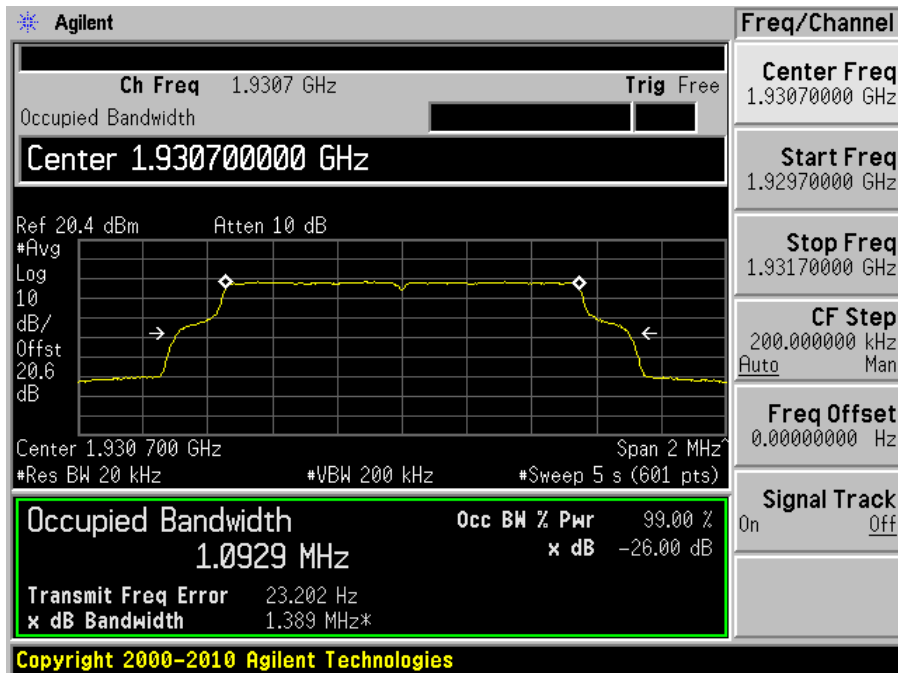
**LTE 1900 MHz Band (downlink), Modulation: 16QAM (1.4 MHz bandwidth)**

Low Channel (1930.7 MHz)

Input

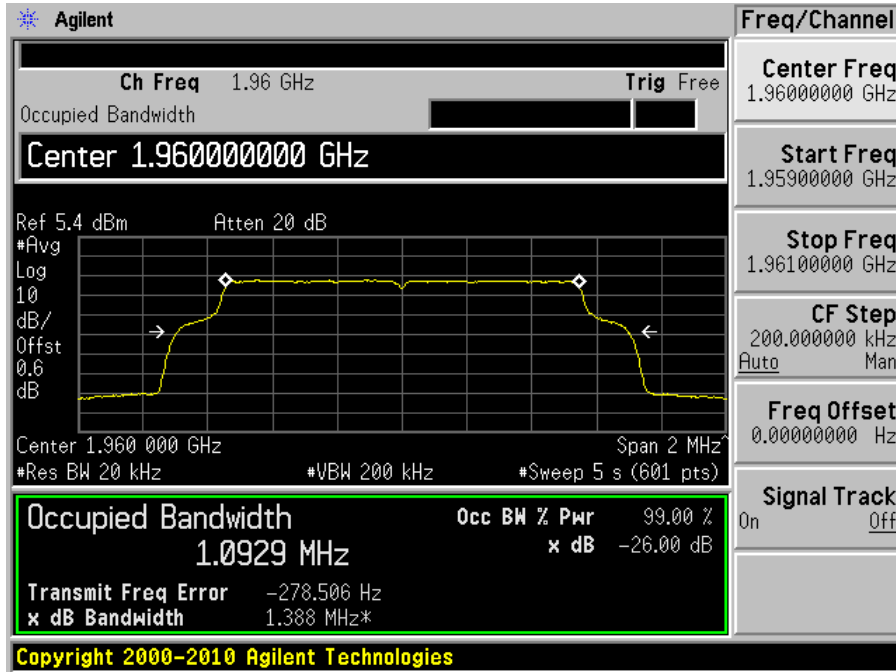


Output

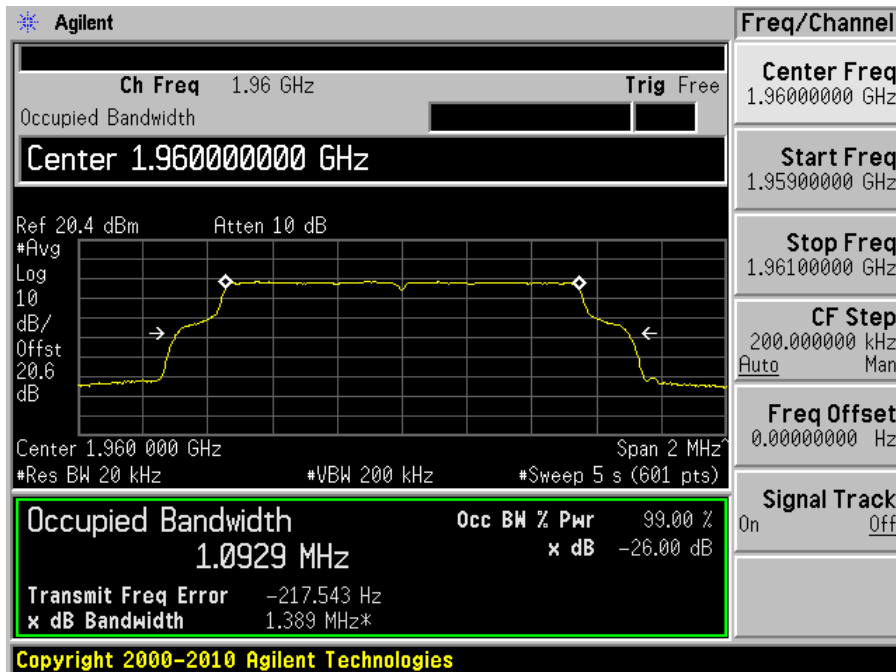


Middle Channel (1960 MHz)

Input

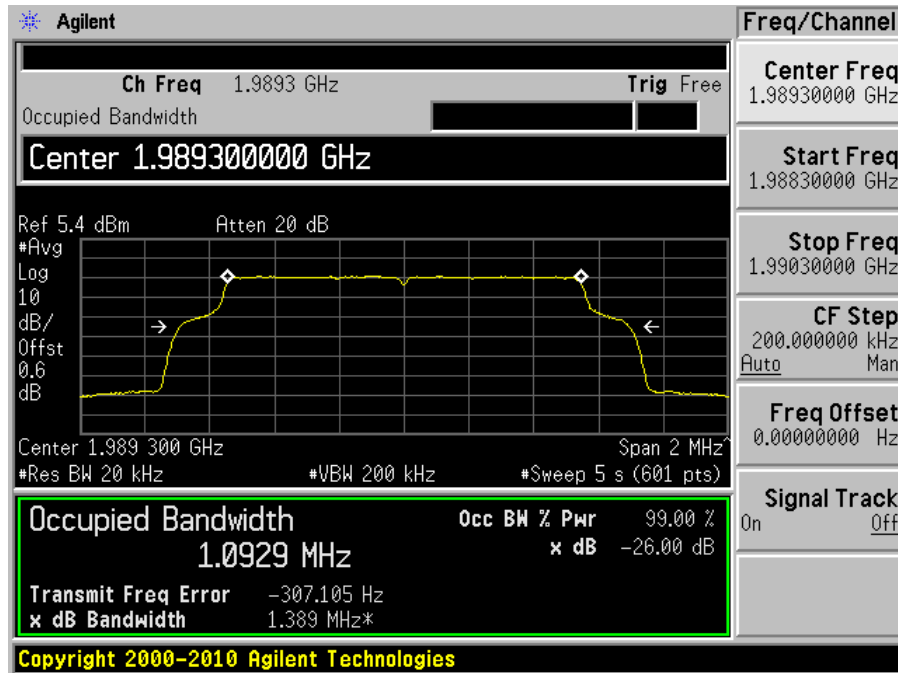


Output

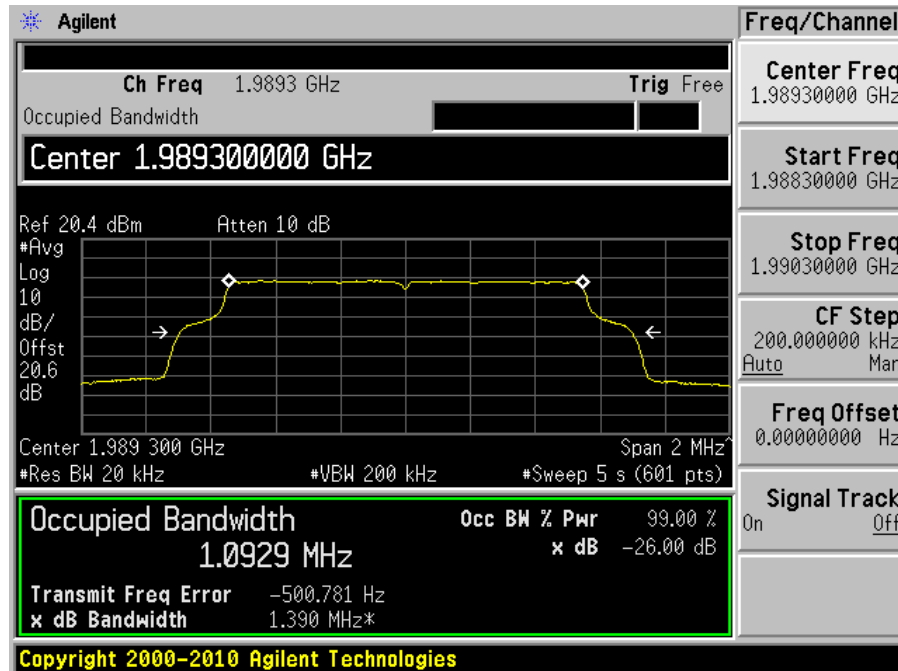


High Channel (1989.3 MHz)

Input



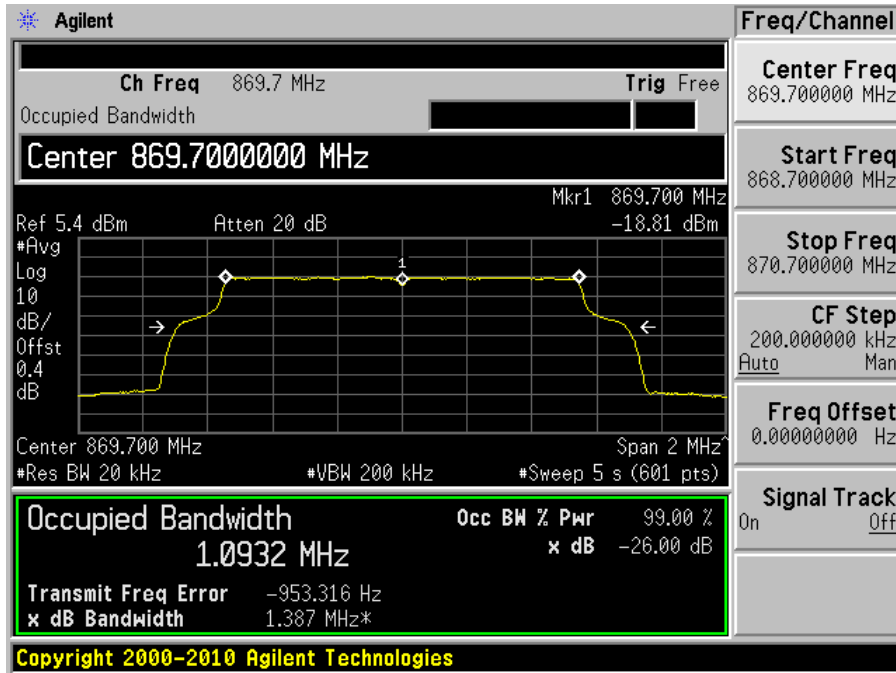
Output



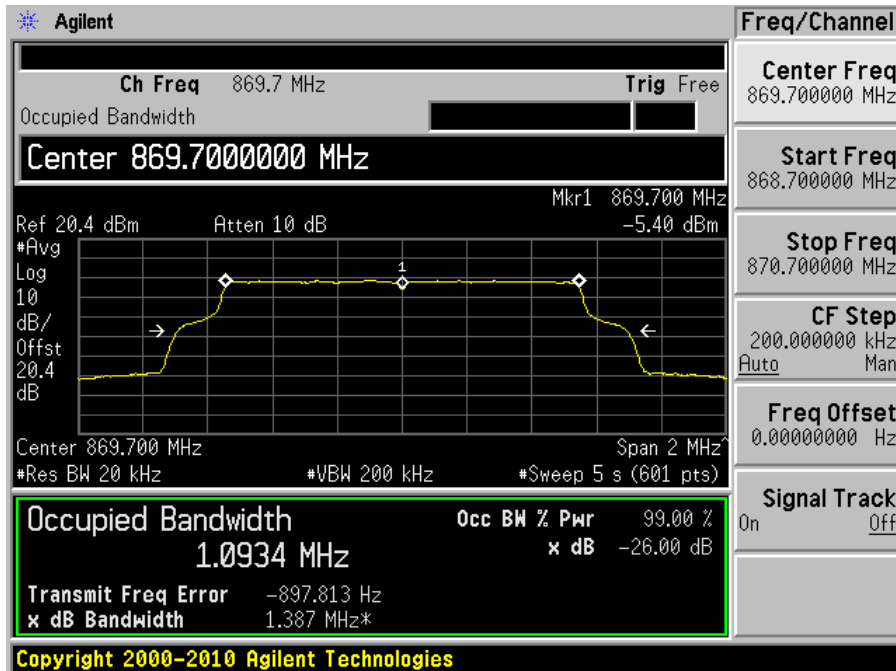
**LTE 850 MHz Band (downlink), Modulation: 64QAM (1.4 MHz bandwidth)**

Low Channel (869.7 MHz)

Input

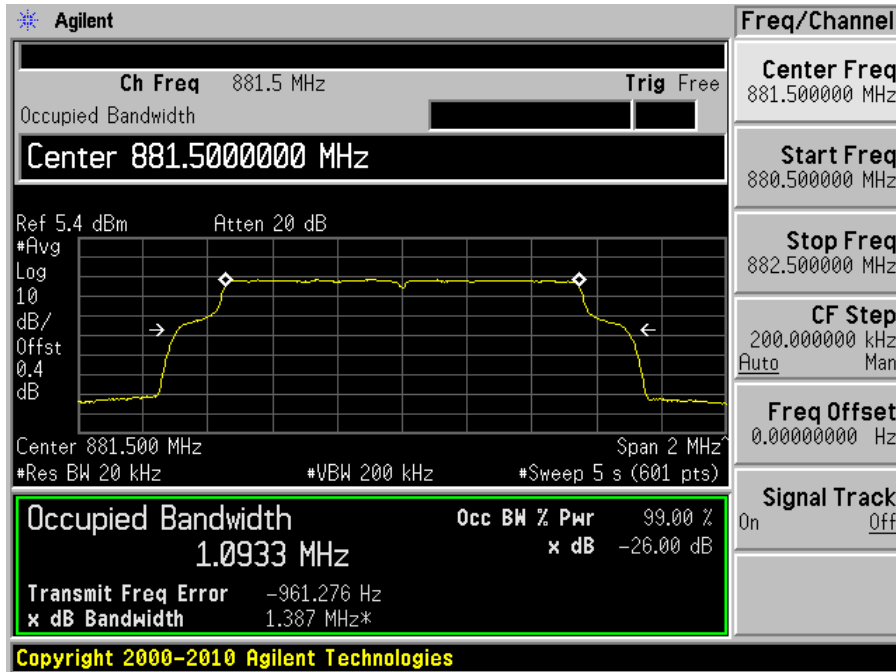


Output

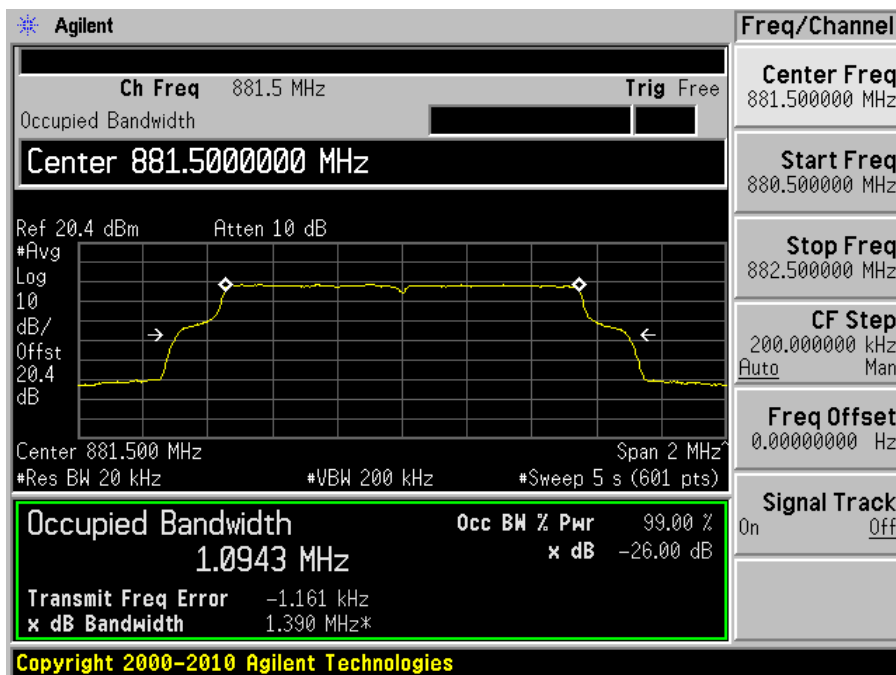


Middle Channel (881.5 MHz)

Input

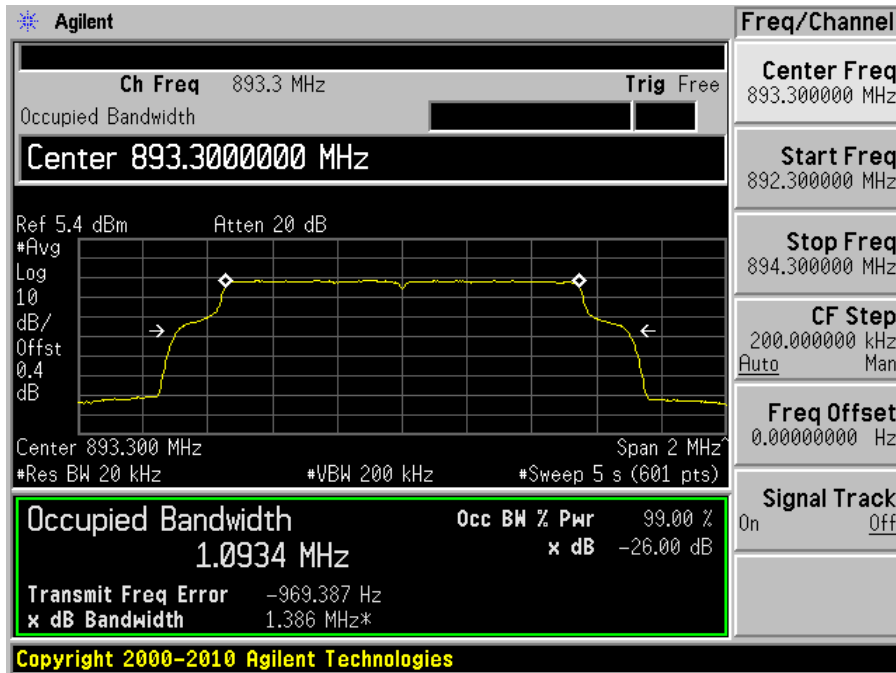


Output

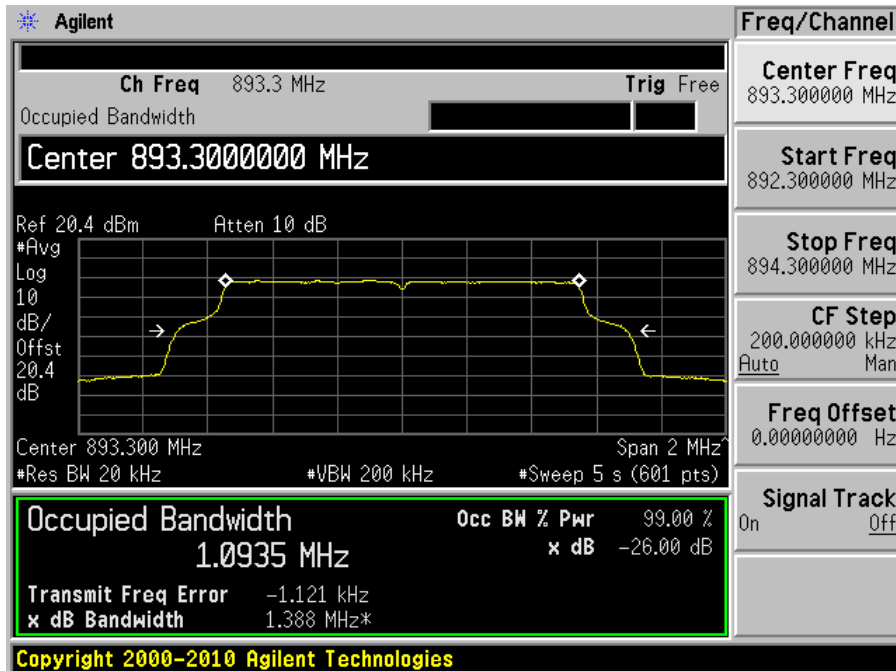


High Channel (893.3 MHz)

Input



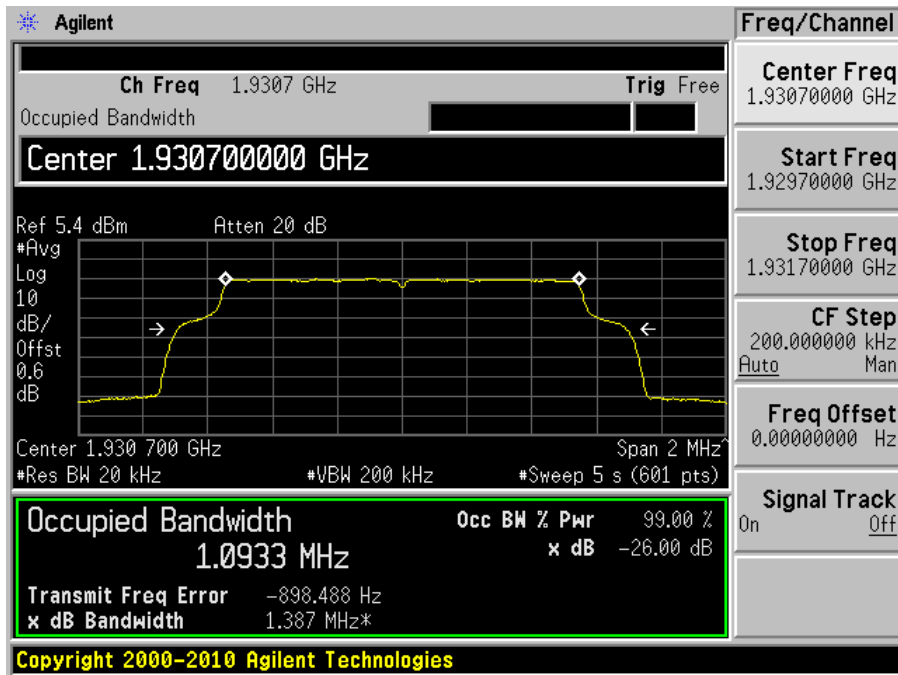
Output



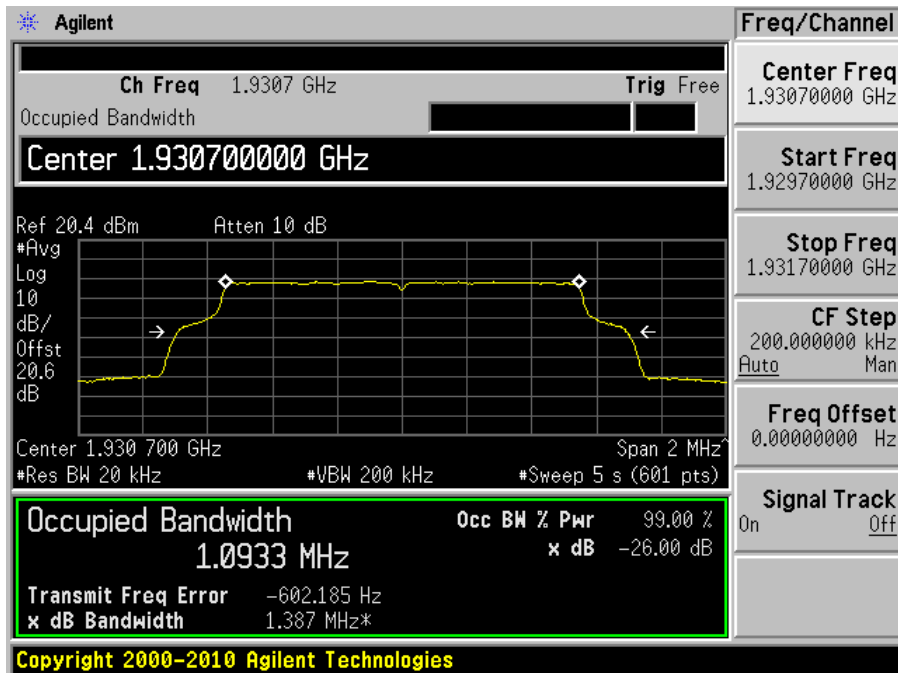
**LTE 1900 MHz Band (downlink), Modulation: 64QAM (1.4 MHz bandwidth)**

Low Channel (1930.7 MHz)

Input



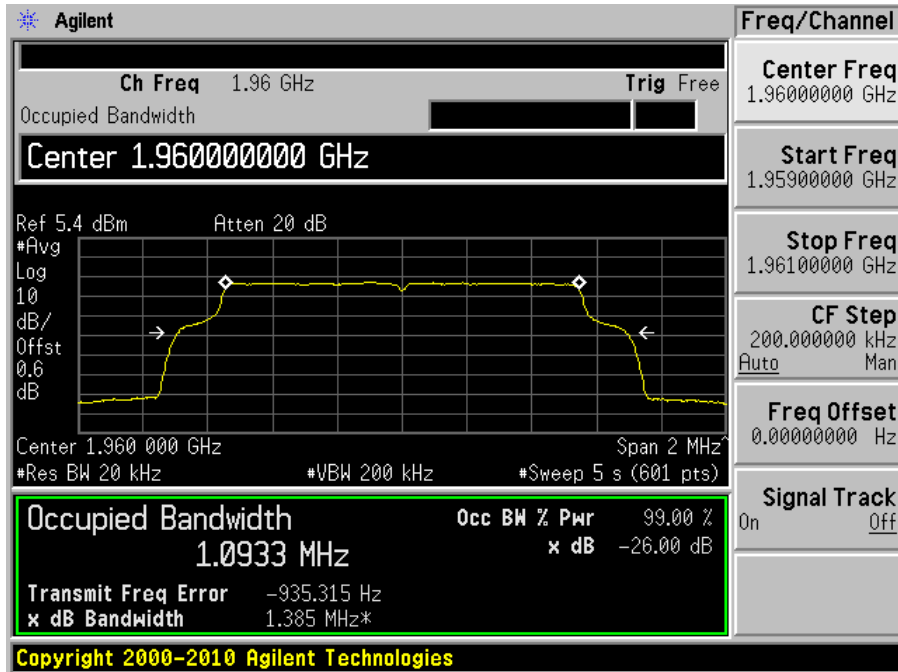
Output



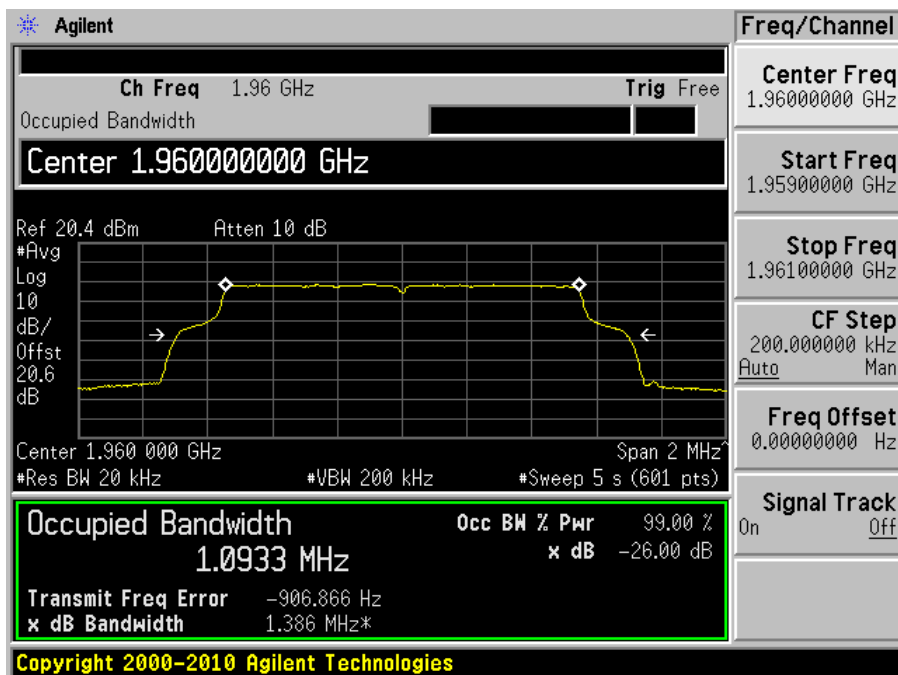


Middle Channel (1960 MHz)

Input

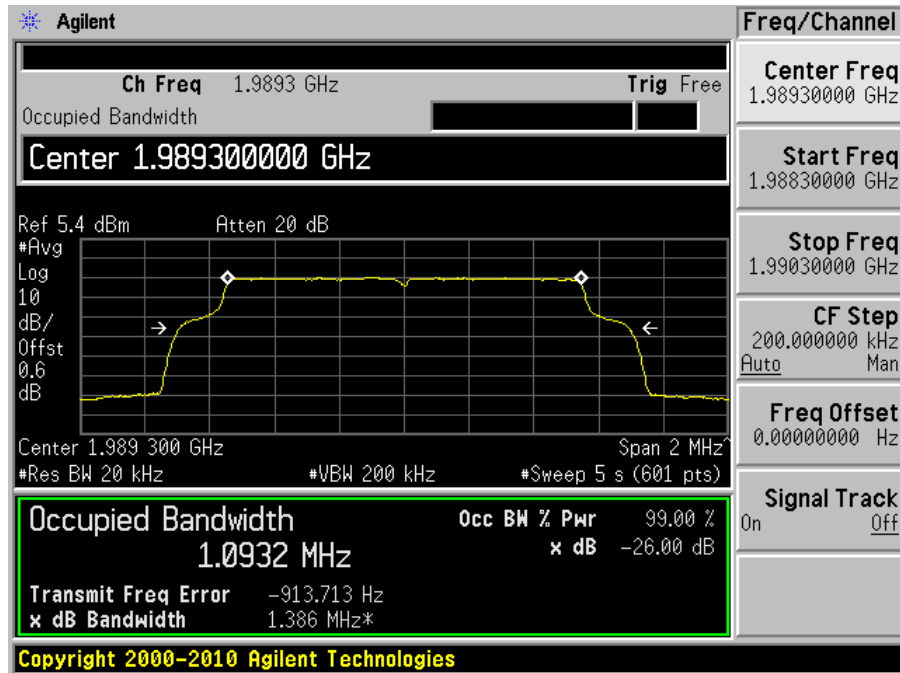


Output

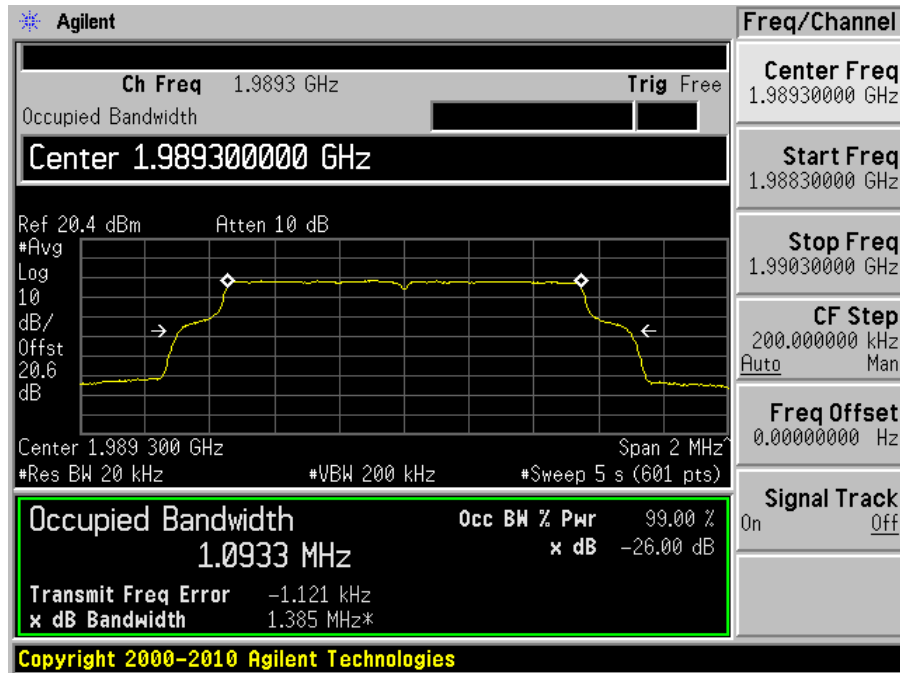


High Channel (1989.3 MHz)

Input



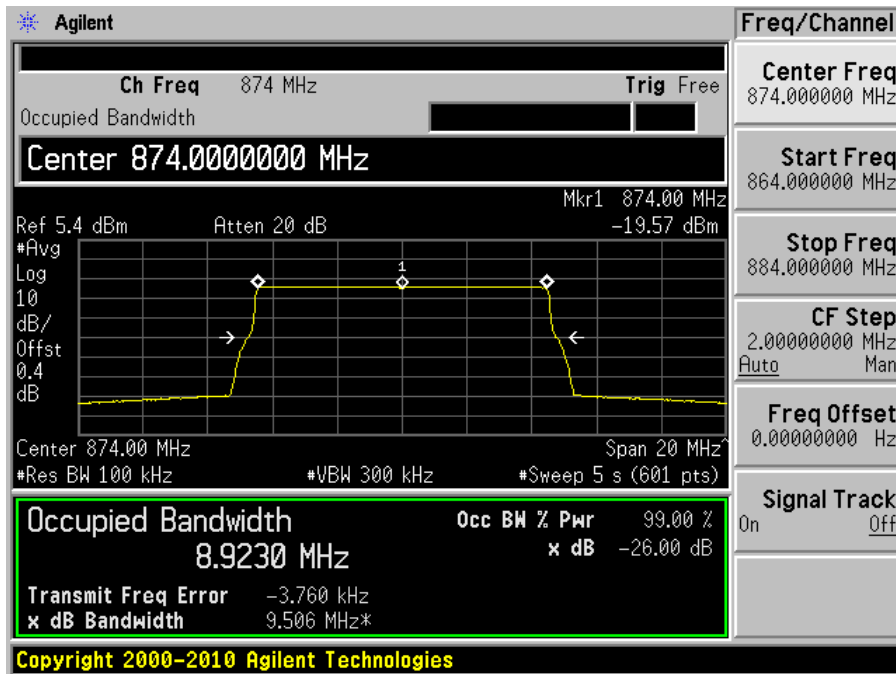
Output



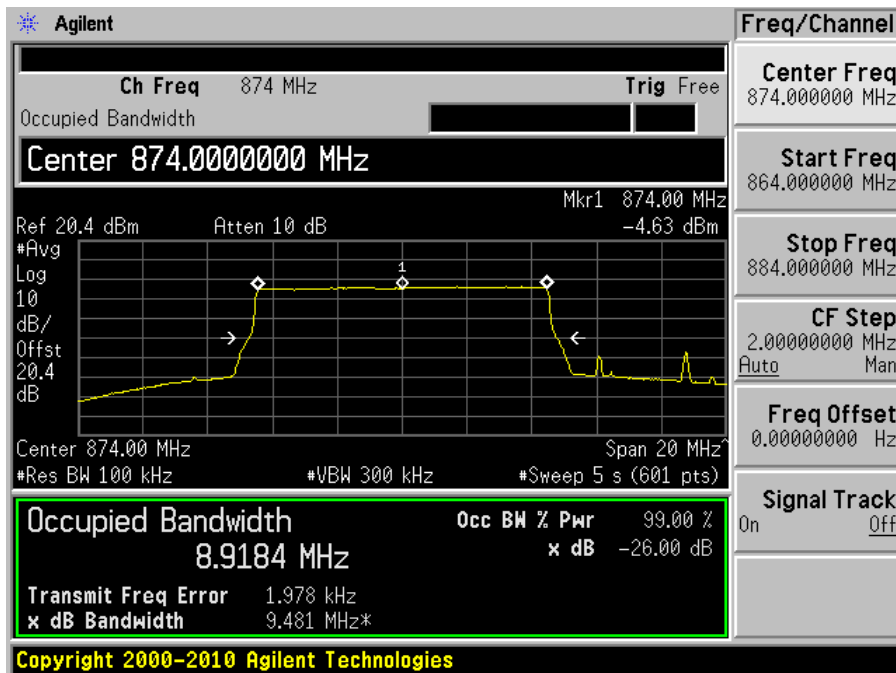
**LTE 850 MHz Band (downlink), Modulation: QPSK (10 MHz bandwidth)**

Low Channel (874 MHz)

Input

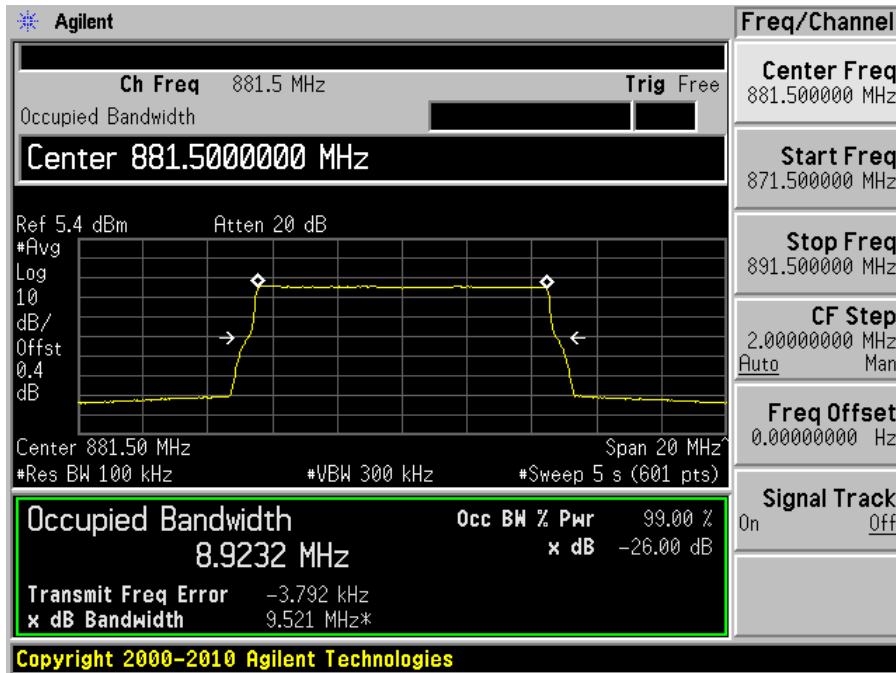


Output

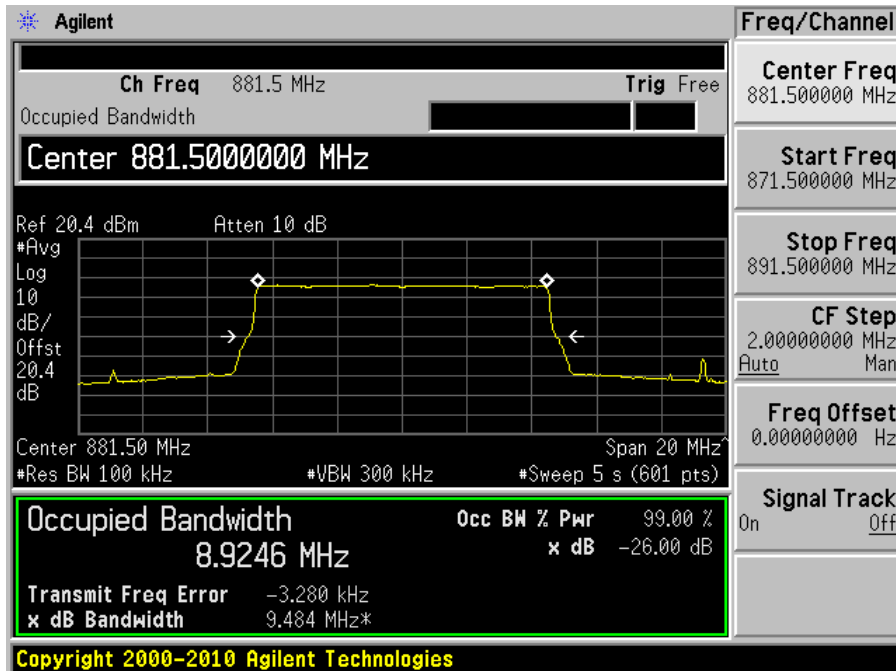


Middle Channel (881.5 MHz)

Input

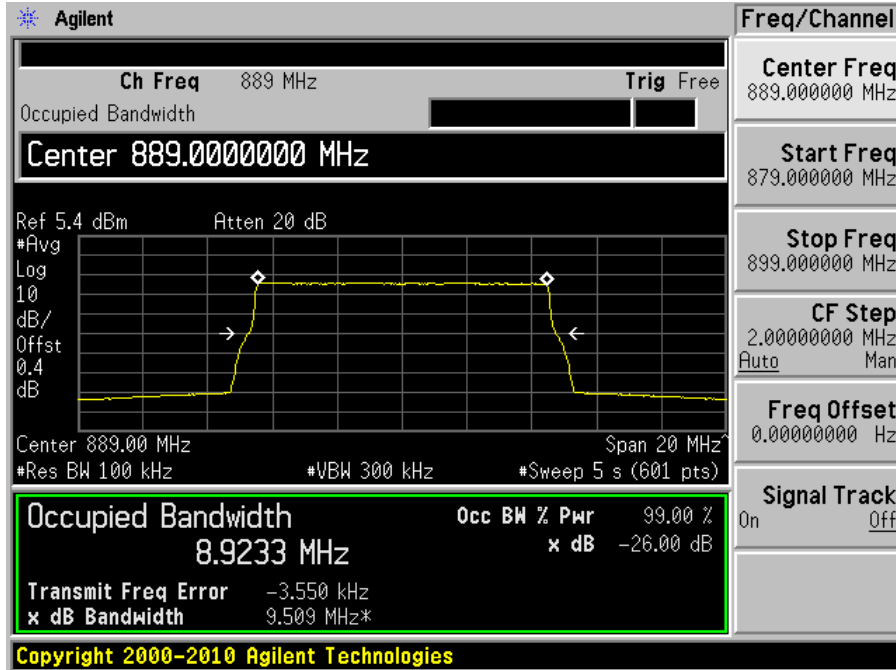


Output

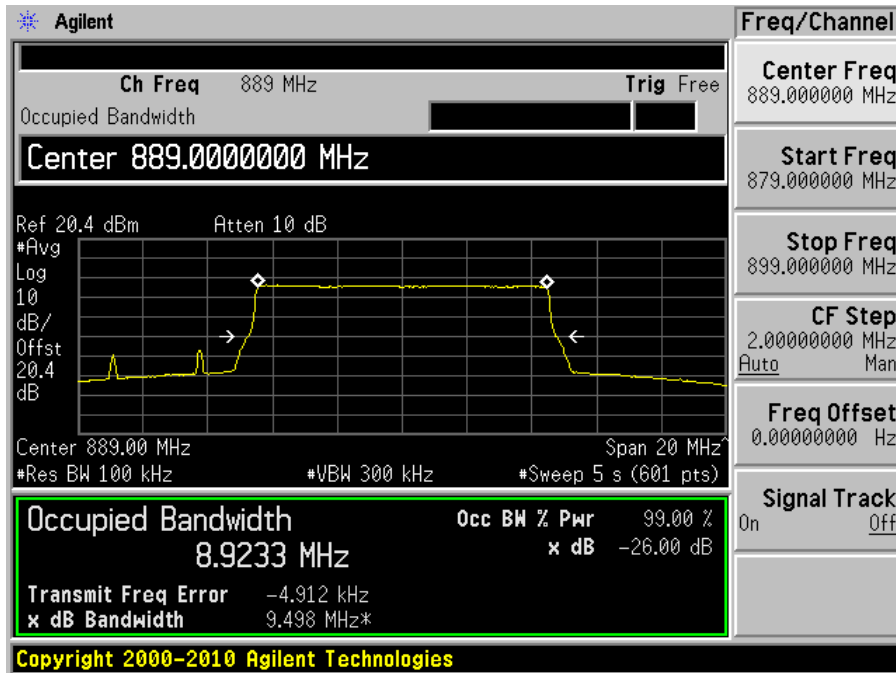


High Channel (889 MHz)

Input



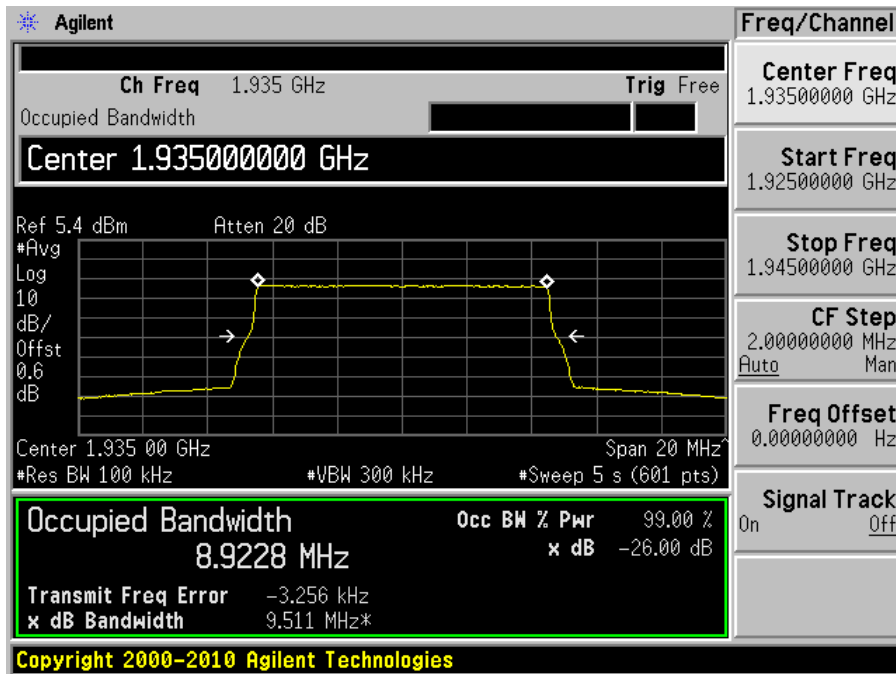
Output



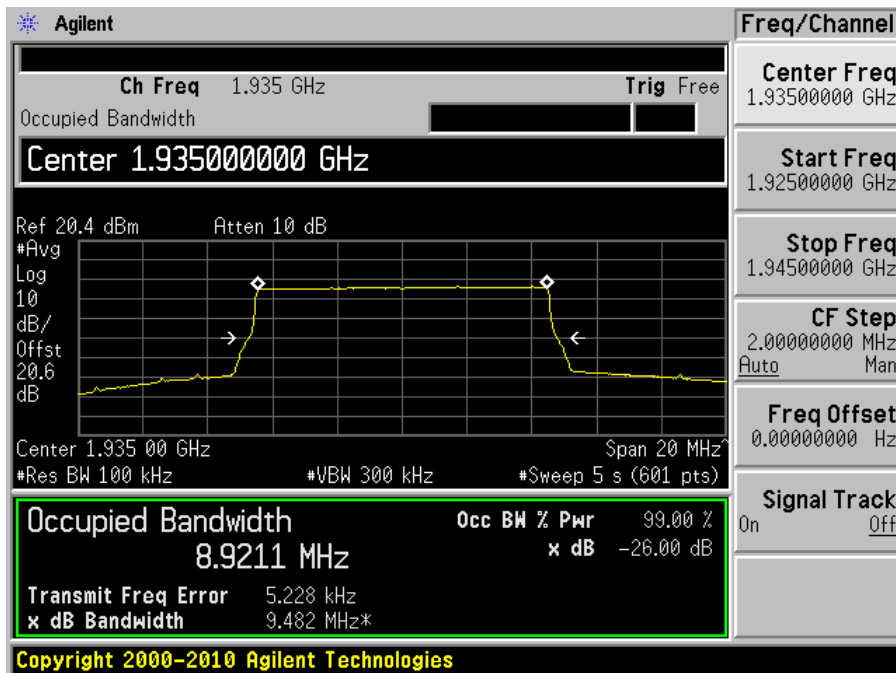
**LTE 1900 MHz Band (downlink), Modulation: QPSK (10 MHz bandwidth)**

Low Channel (1935 MHz)

Input

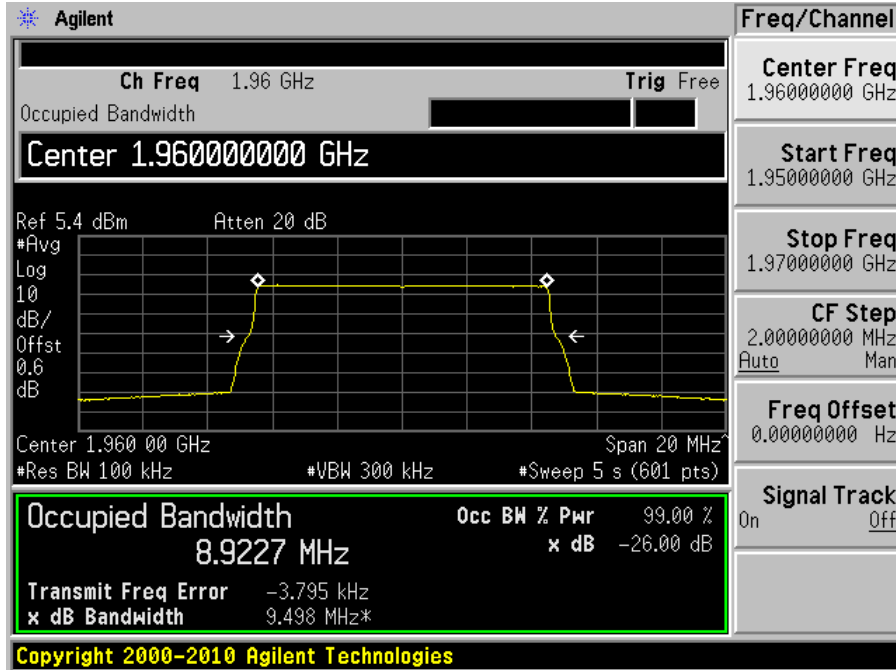


Output

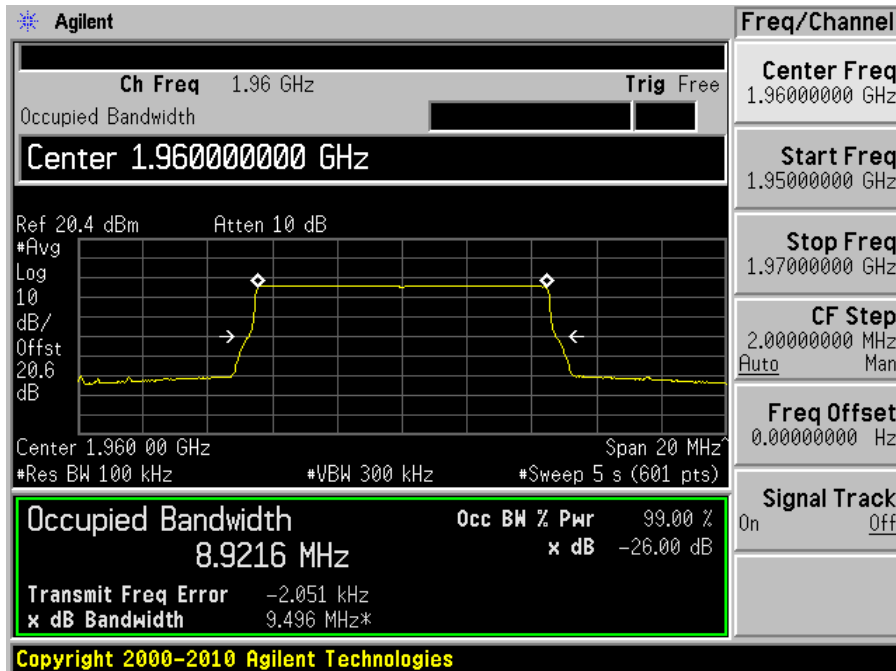


Middle Channel (1960 MHz)

Input

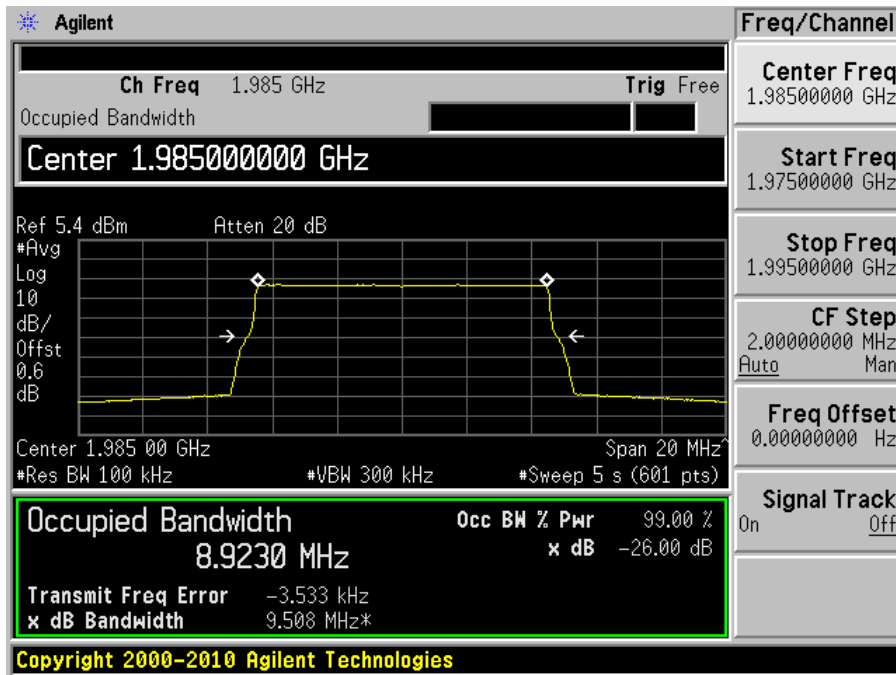


Output

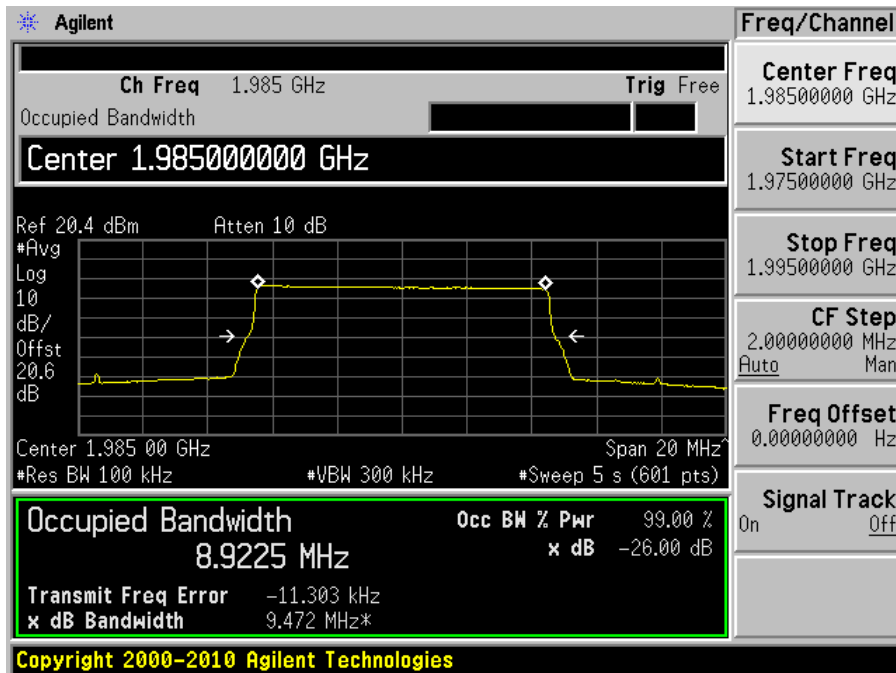


High Channel (1985 MHz)

Input



Output

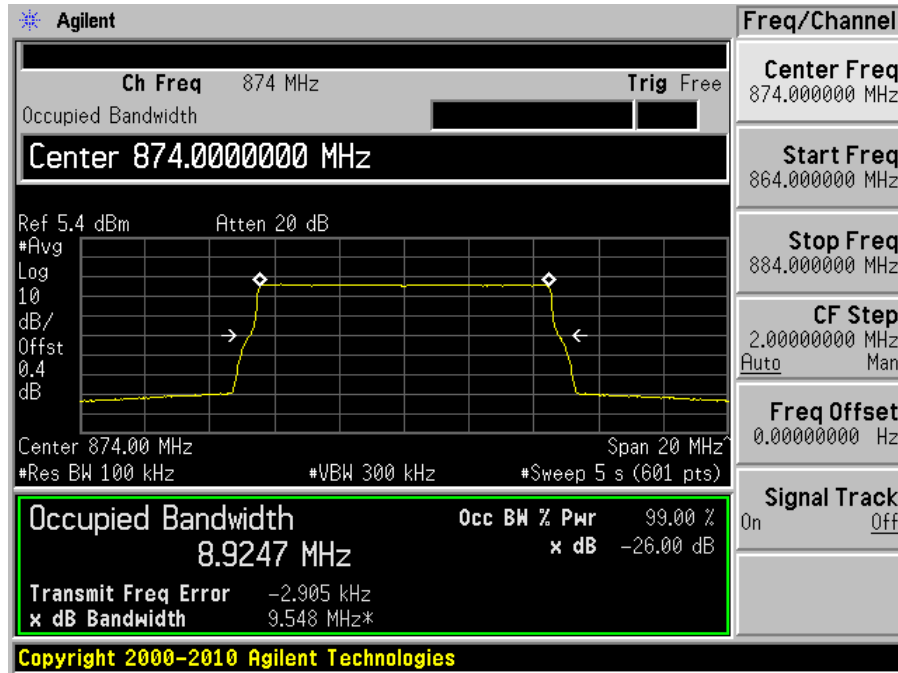




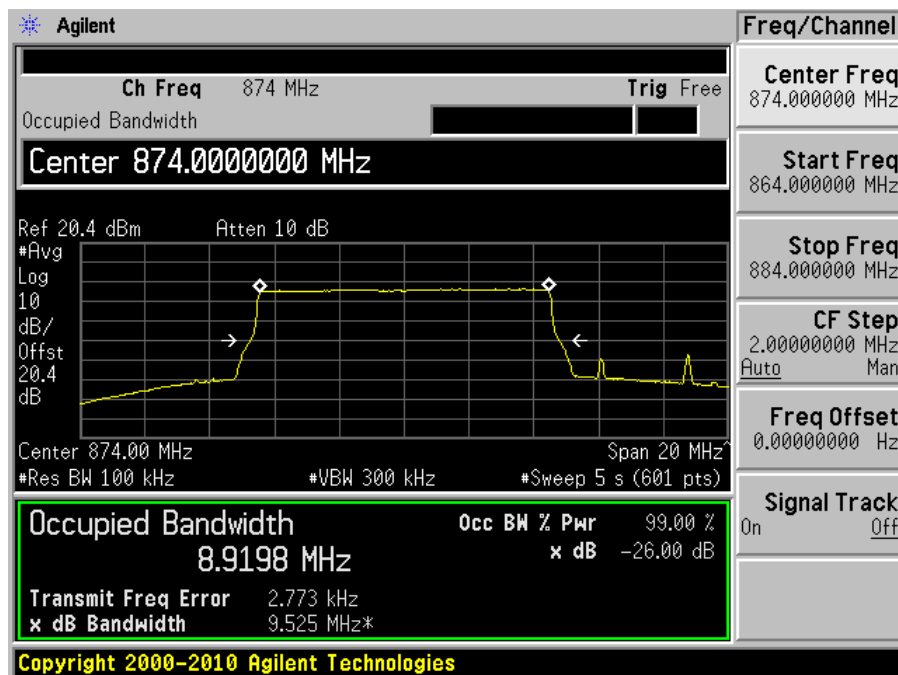
**LTE 850 MHz Band (downlink), Modulation: 16QAM (10 MHz bandwidth)**

Low Channel (874 MHz)

Input

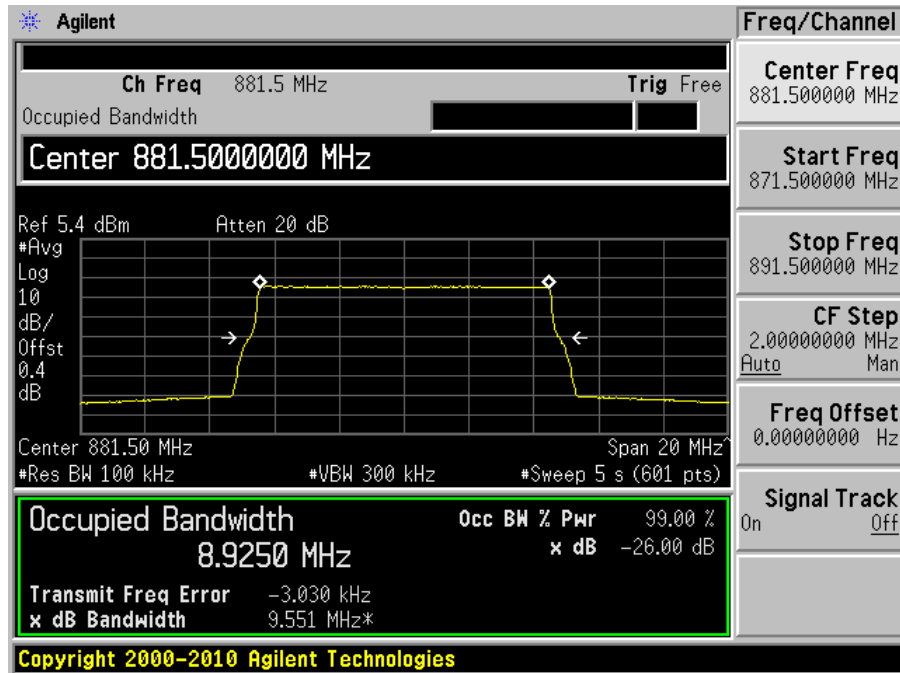


Output

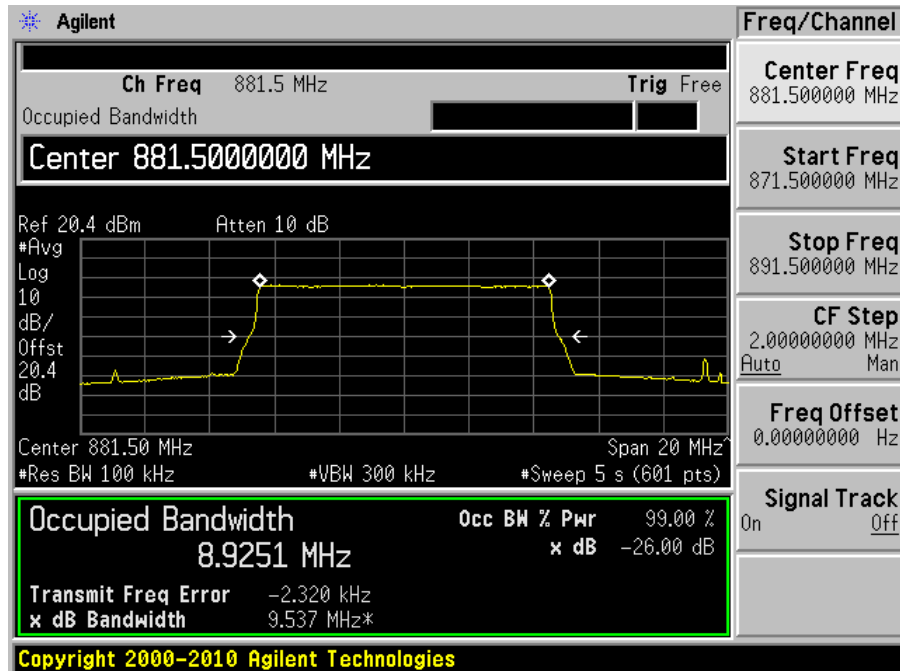


Middle Channel (881.5 MHz)

Input

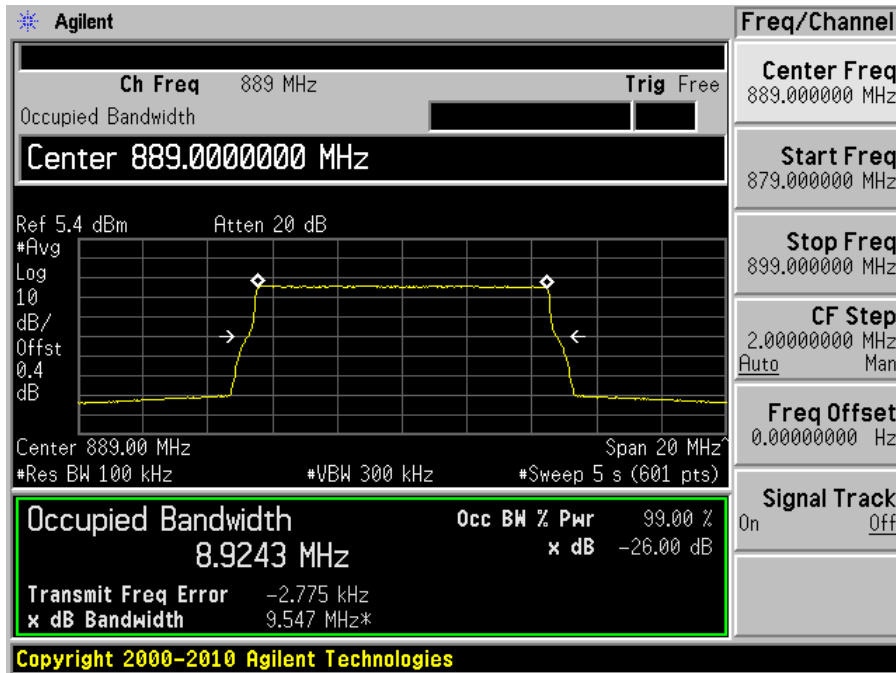


Output

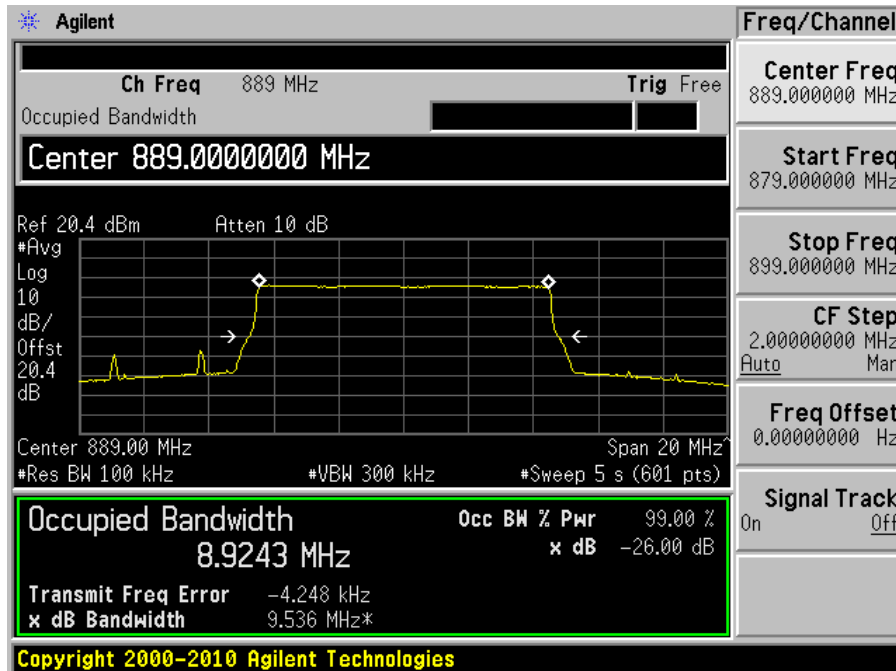


High Channel (889 MHz)

Input



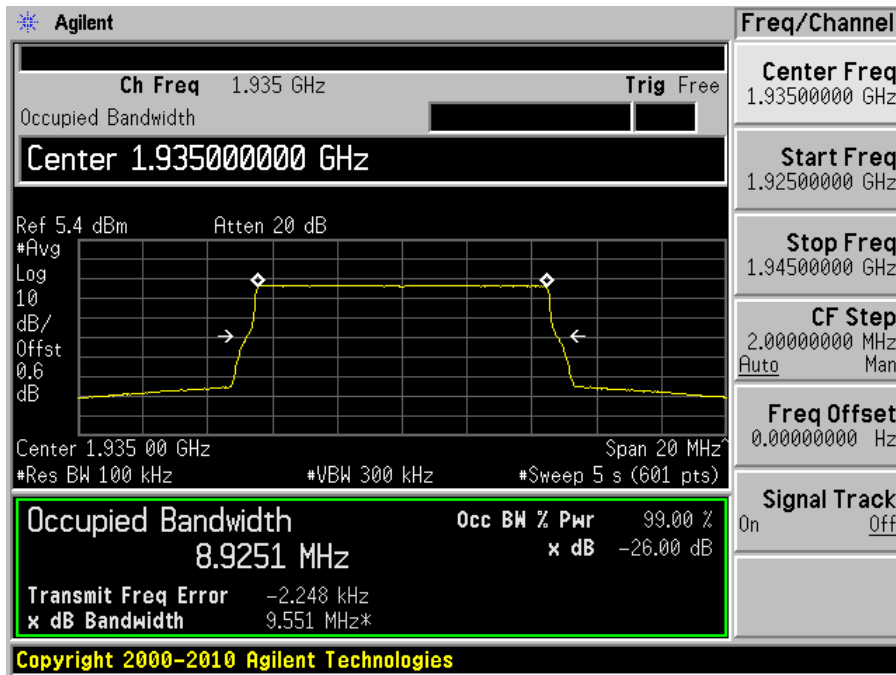
Output



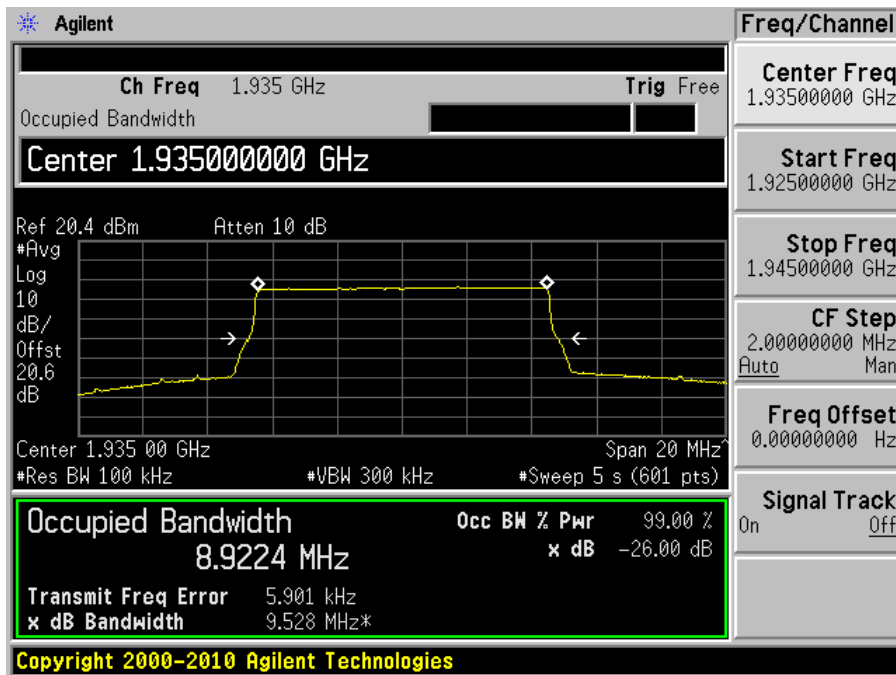
**LTE 1900 MHz Band (downlink), Modulation: 16QAM (10 MHz bandwidth)**

Low Channel (1935 MHz)

Input

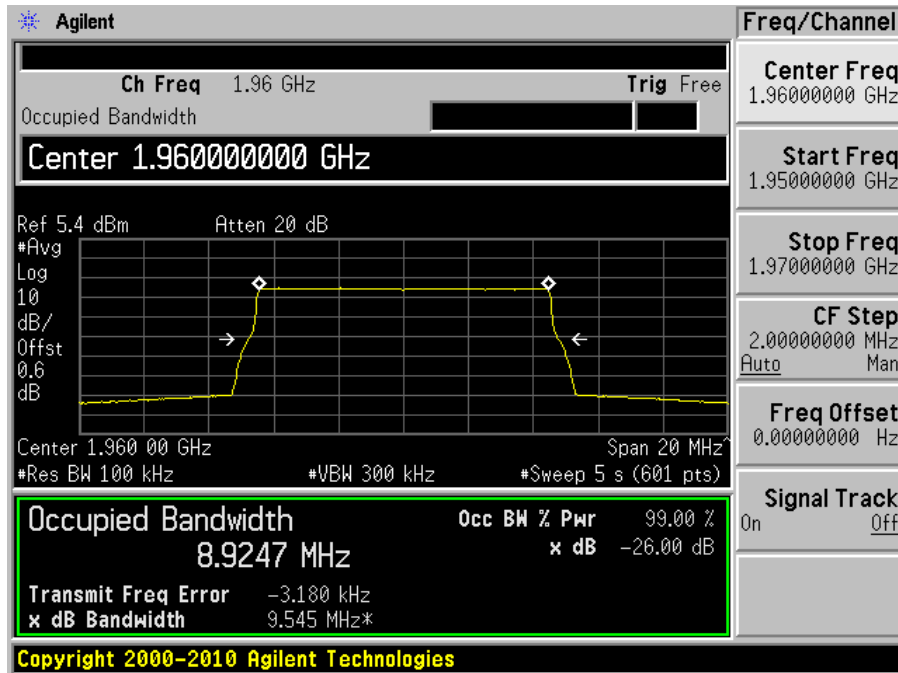


Output

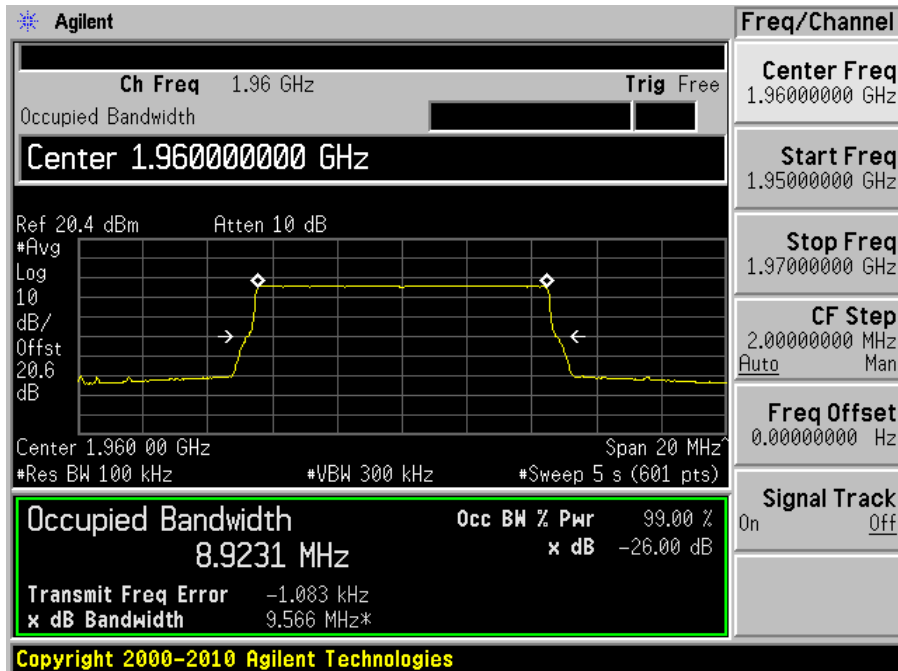


Middle Channel (1960 MHz)

Input

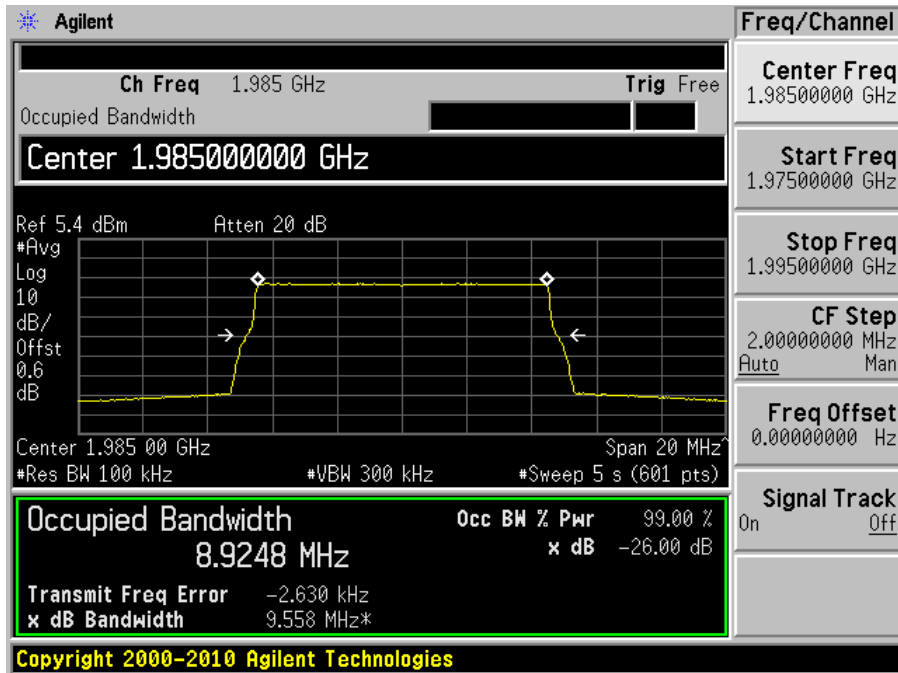


Output

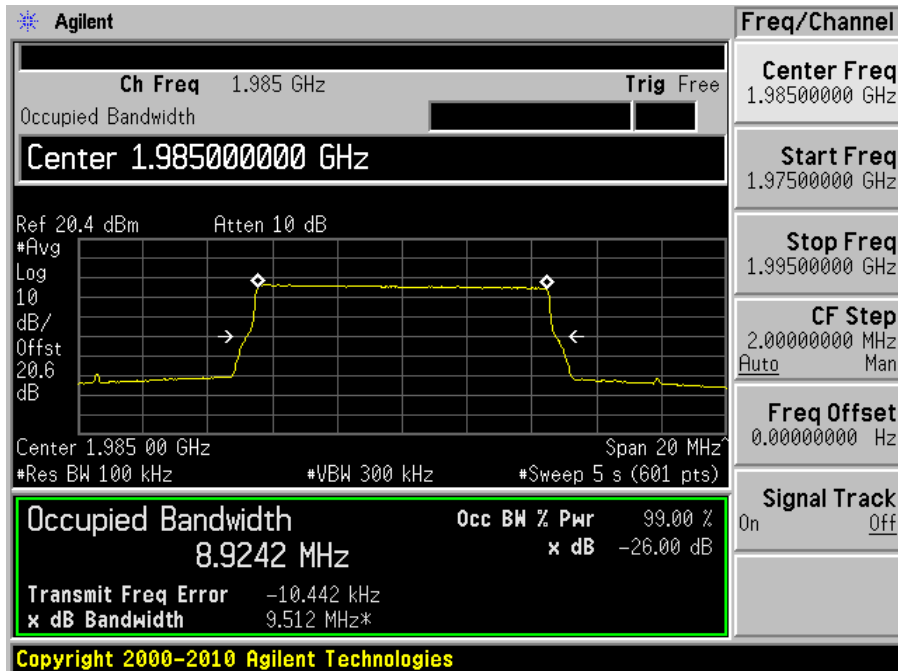


High Channel (1985 MHz)

Input



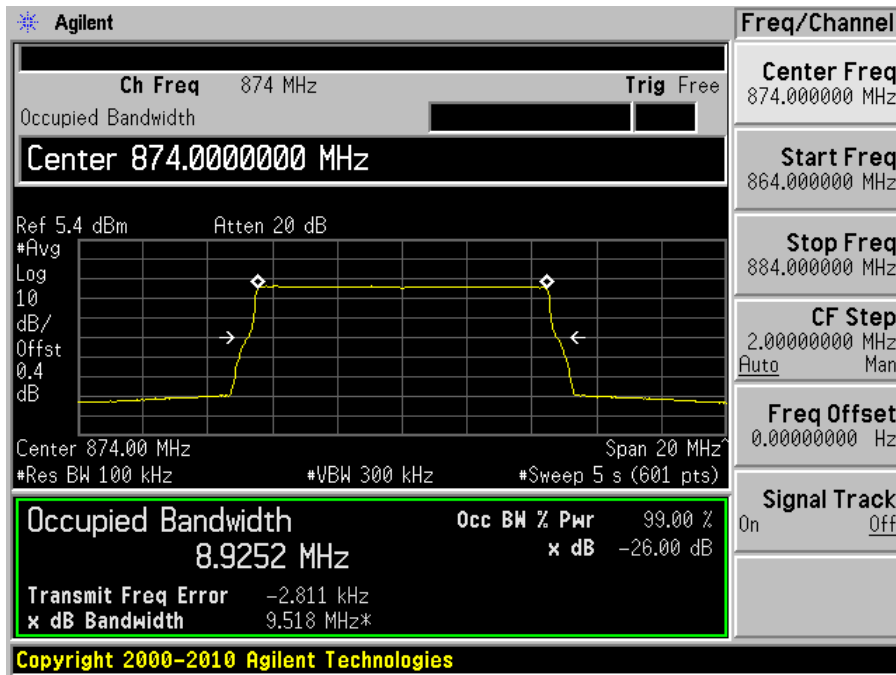
Output



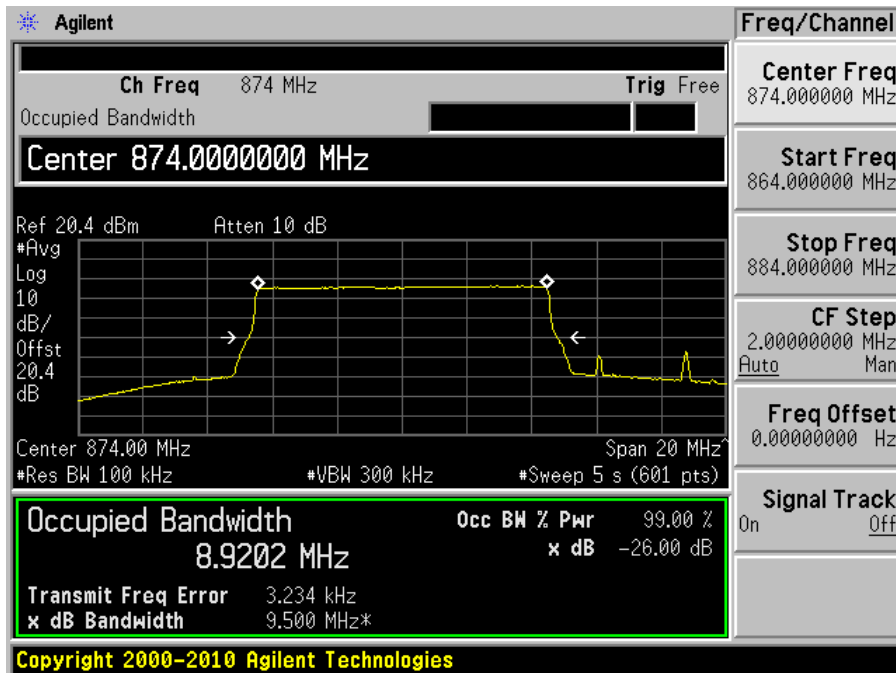
**LTE 850 MHz Band (downlink), Modulation: 64QAM (10 MHz bandwidth)**

Low Channel (874 MHz)

Input

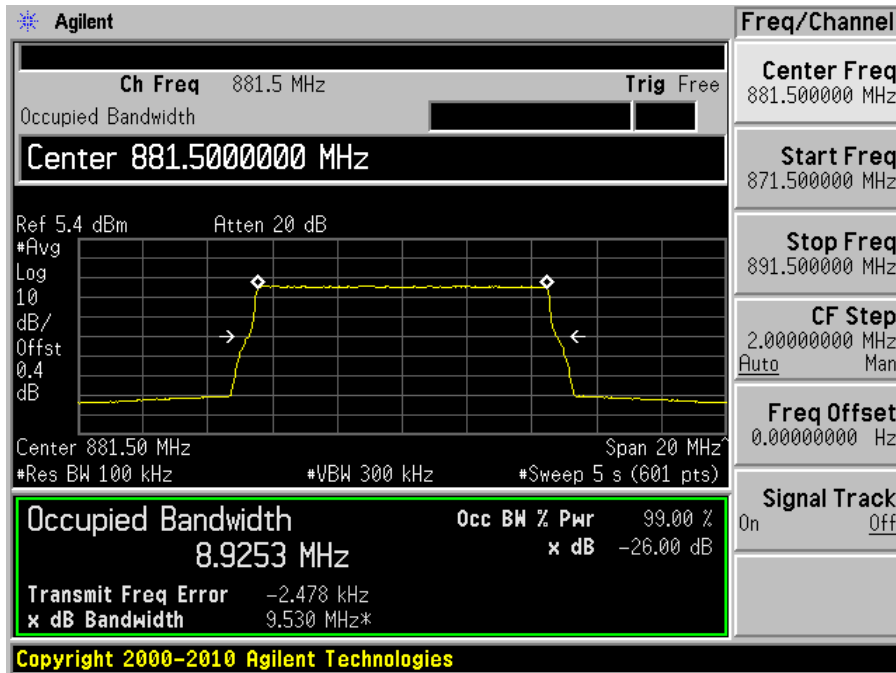


Output

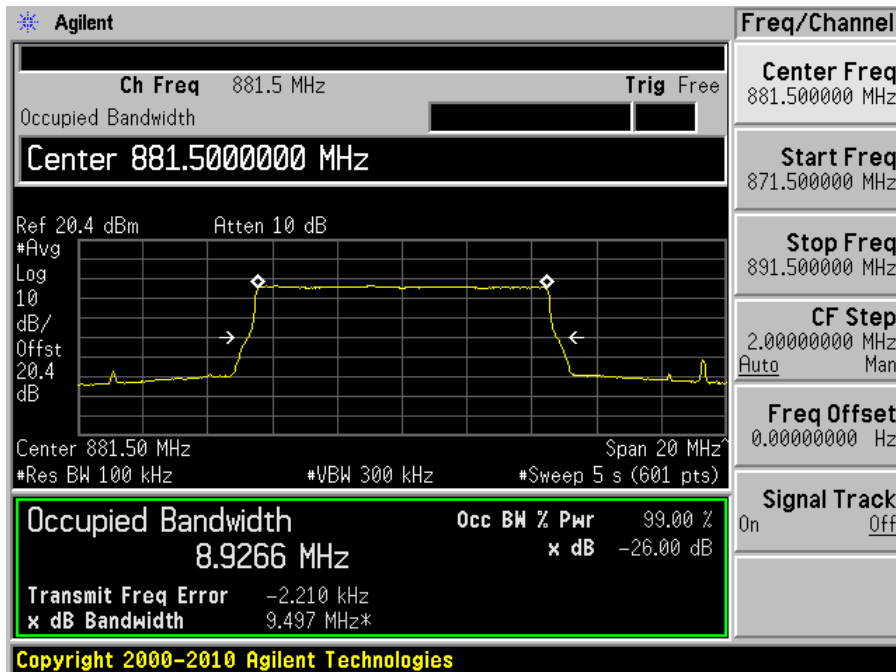


Middle Channel (881.5 MHz)

Input



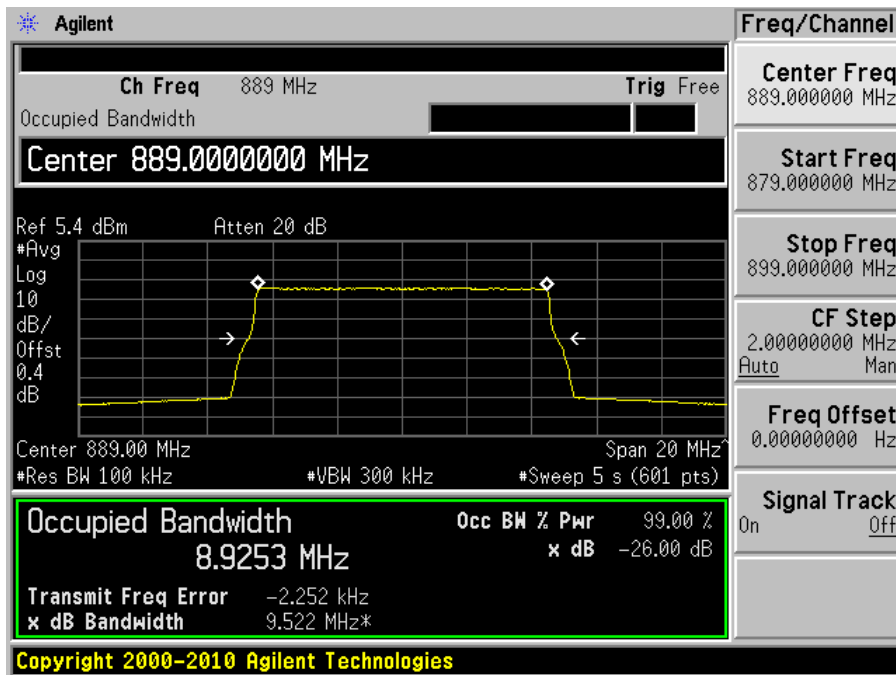
Output



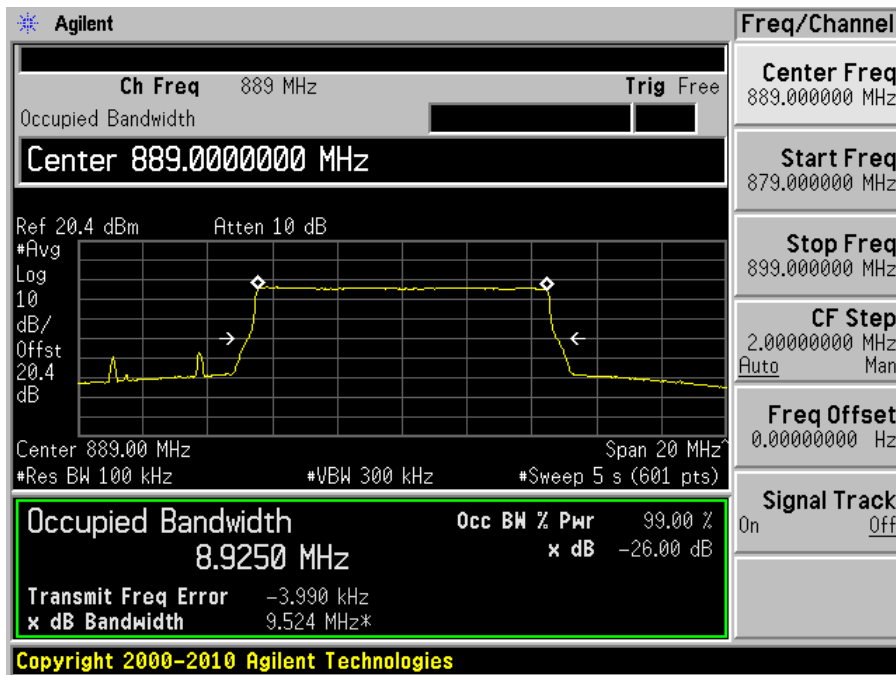


High Channel (889 MHz)

Input



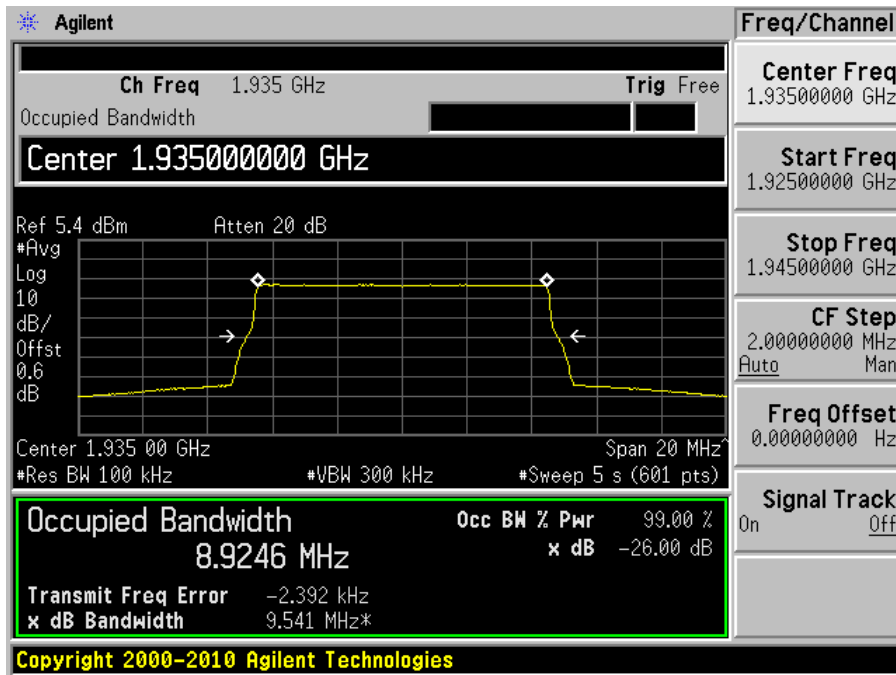
Output



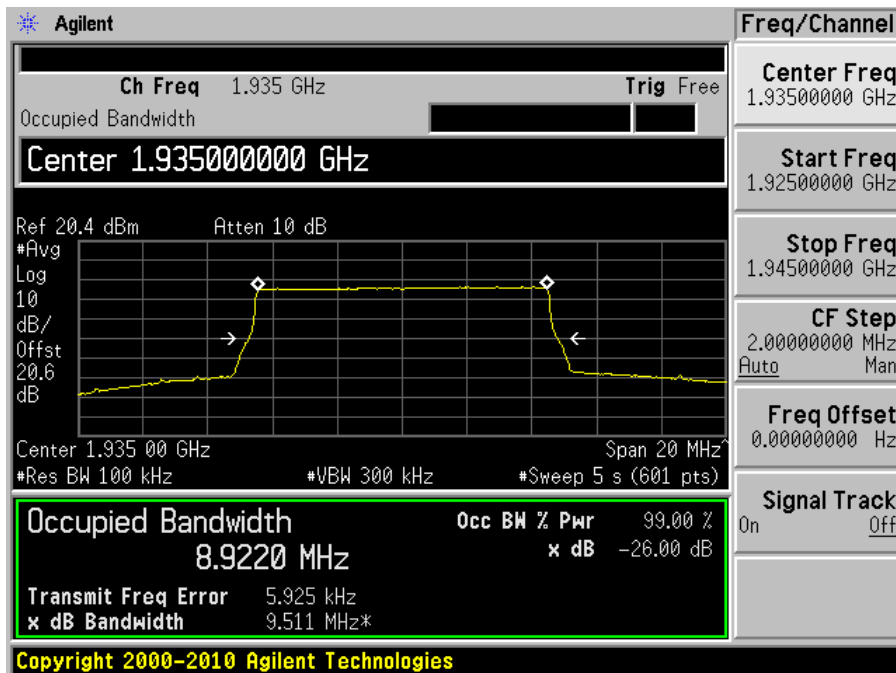
**LTE 1900 MHz Band (downlink), Modulation: 64QAM (10 MHz bandwidth)**

Low Channel (1935 MHz)

Input

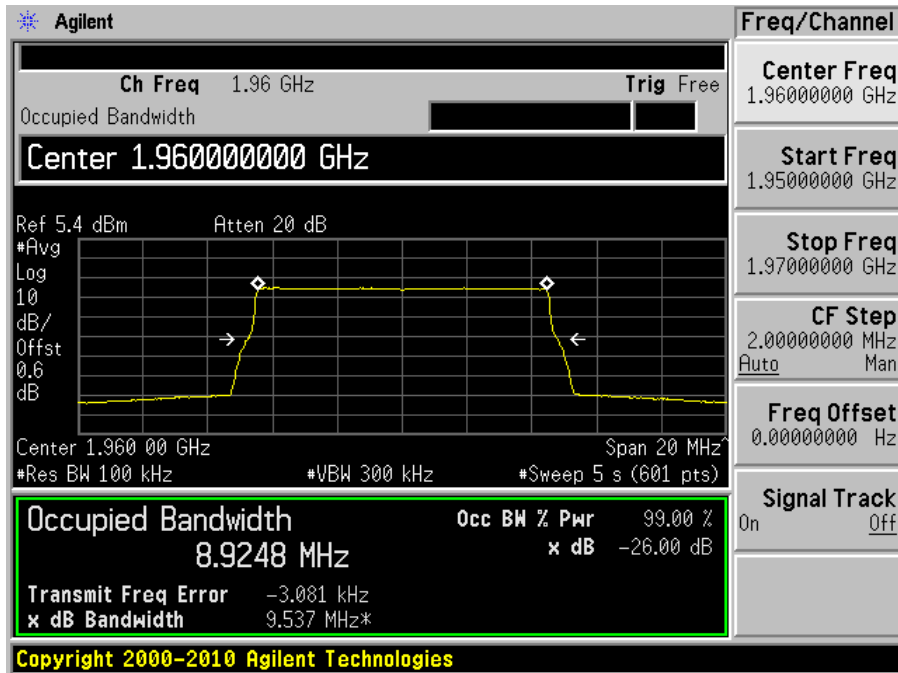


Output

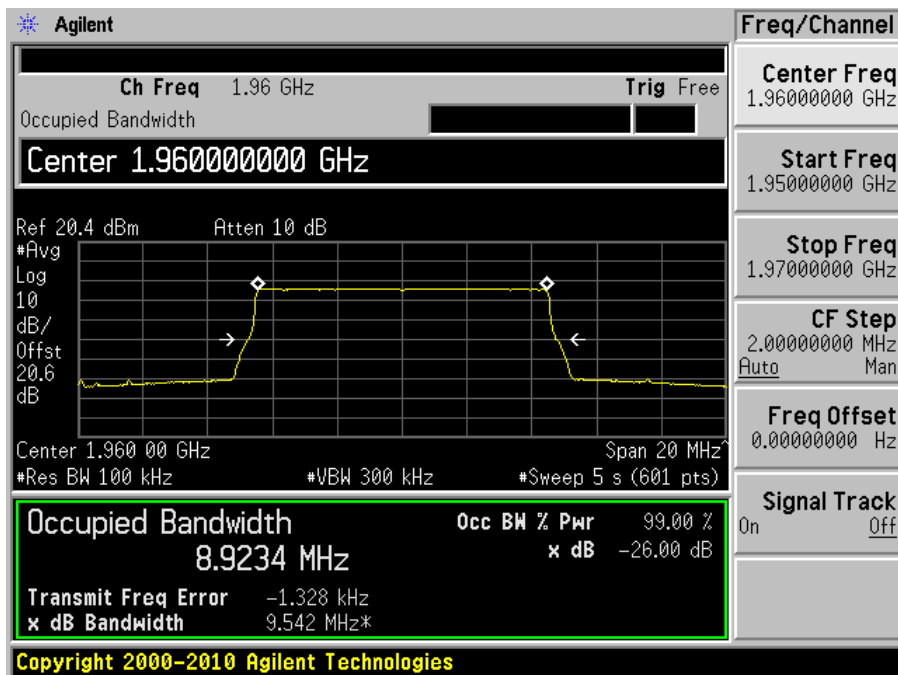


Middle Channel (1960 MHz)

Input

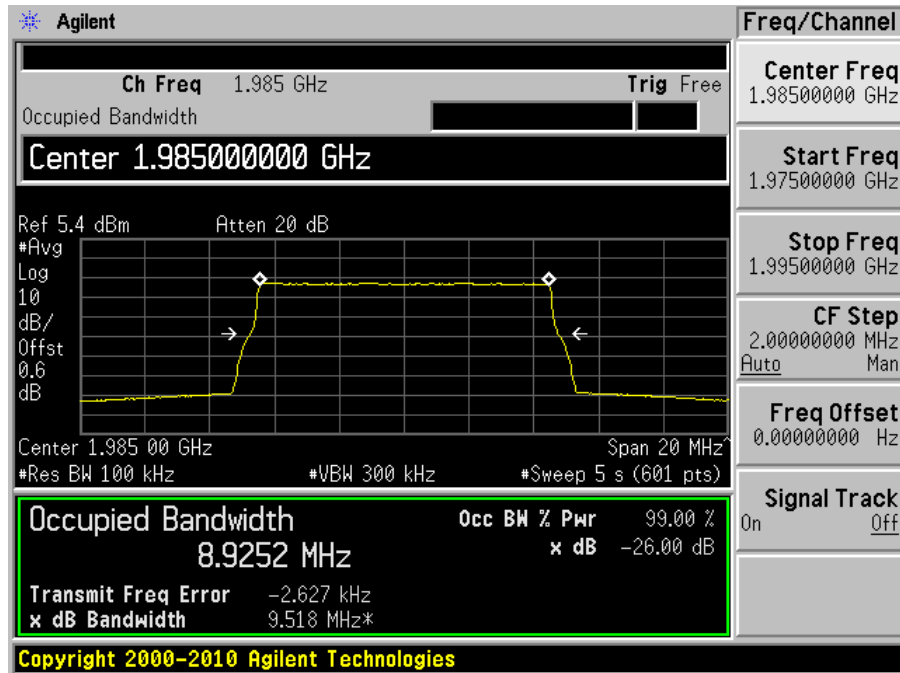


Output

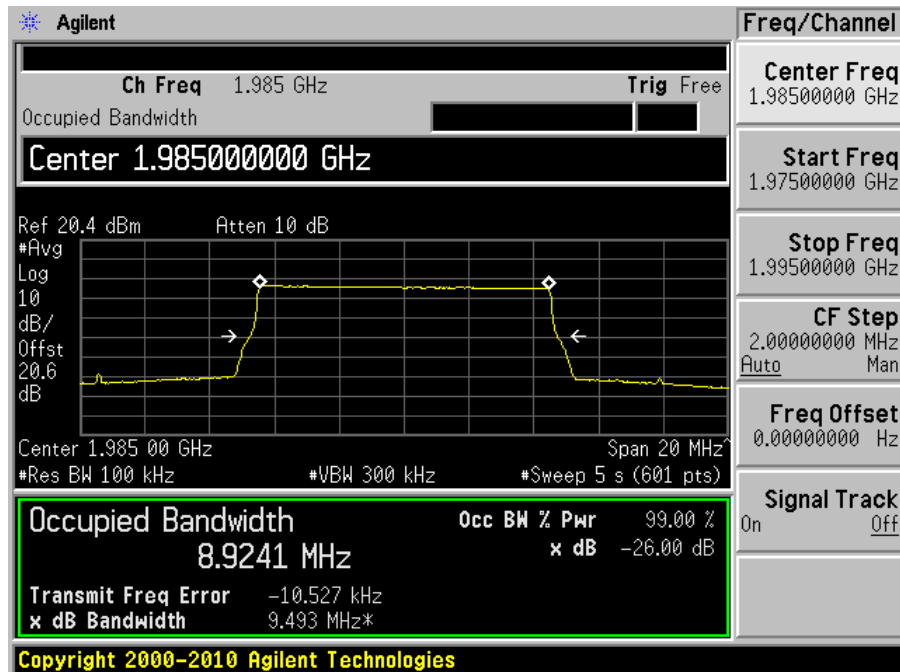


High Channel (1985 MHz)

Input



Output



## 7 §2.1053, §22.917 & §24.238 - 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA Series Spectrum Analyzer	E4440A	US45303156	2010-08-09
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2010-06-16
Hewlett Packard	Pre amplifier	8447D	2944A06639	2010-06-18
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2011-05-09

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

## 7.4 Test Environmental Conditions

Temperature:	20~24 °C
Relative Humidity:	35~42 %
ATM Pressure:	101.1~101.7 kPa

\* The testing was performed by Quinn Jiang on 2011-05-18 ~ 2011-5-20

## 7.5 Summary of Test Results

850 MHz Downlink			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Input Frequency
-7.74	1723	Horizontal	881.5
1900 MHz Downlink			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Input Frequency
-8.59	1722	Horizontal	1960

## 7.6 Test Results

### 850 MHz band Downlink

Input frequency = 881.5 MHz, Worst Modulation: QPSK with 1.4MHz bandwidth

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1723	74.45	137	1.48	H	1723	-28.64	8.9	1	-20.74	-13	-7.74
1723	68.8	153	1.75	V	1723	-34.17	8.9	1	-26.27	-13	-13.27
266.07	66.64	343	1.0	H	266.07	-38.34	0	1	-39.34	-13	-26.34
266.07	63.47	86	1.5	V	266.07	-41.51	0	1	-42.51	-13	-29.51

### 1900 MHz band Downlink

Input frequency = 1960 MHz, Worst Modulation: QPSK with 1.4MHz bandwidth

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1722	73.6	135	1.45	H	1722	-29.49	8.9	1	-21.59	-13	-8.59
1722	68.25	155	1.68	V	1722	-34.72	8.9	1	-26.82	-13	-13.82
384.42	57.07	1.13	3.26	H	384.42	-45.68	0	1	-46.68	-13	-33.68
384.42	56.18	1.1	2.69	V	384.42	-46.57	0	1	-47.57	-13	-34.57

## 8 §2.1051, §22.917& §24.238 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### 8.1 Applicable Standard

Requirements: CFR 47, § 2.1051, § 22.917, § 24.238.

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 10<sup>th</sup> harmonic.

### 8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2010-03-31
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Analyzer, Spectrum	E4440A	US45303156	2010-08-09

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

### 8.4 Test Environmental Conditions

<b>Temperature:</b>	20~24 °C
<b>Relative Humidity:</b>	35~42 %
<b>ATM Pressure:</b>	101.1~101.7 kPa

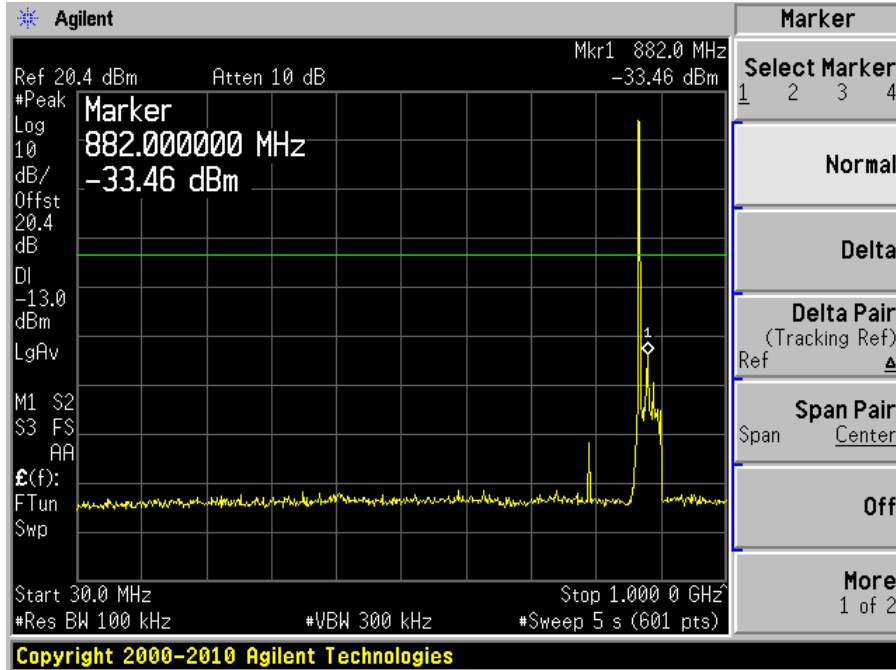
\* The testing was performed by Quinn Jiang on 2011-05-18 ~ 2011-5-20

### 8.5 Test Results

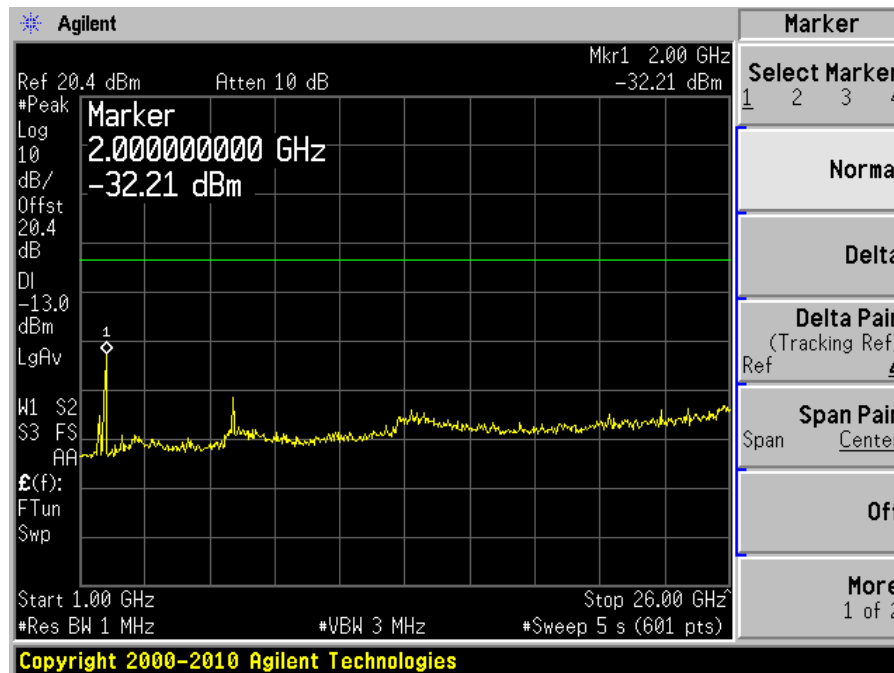
Please refer to the hereinafter plots.

**LTE 850 MHz Band (downlink), Modulation: QPSK (1.4 MHz bandwidth)**

**Low Channel (869.7 MHz)**



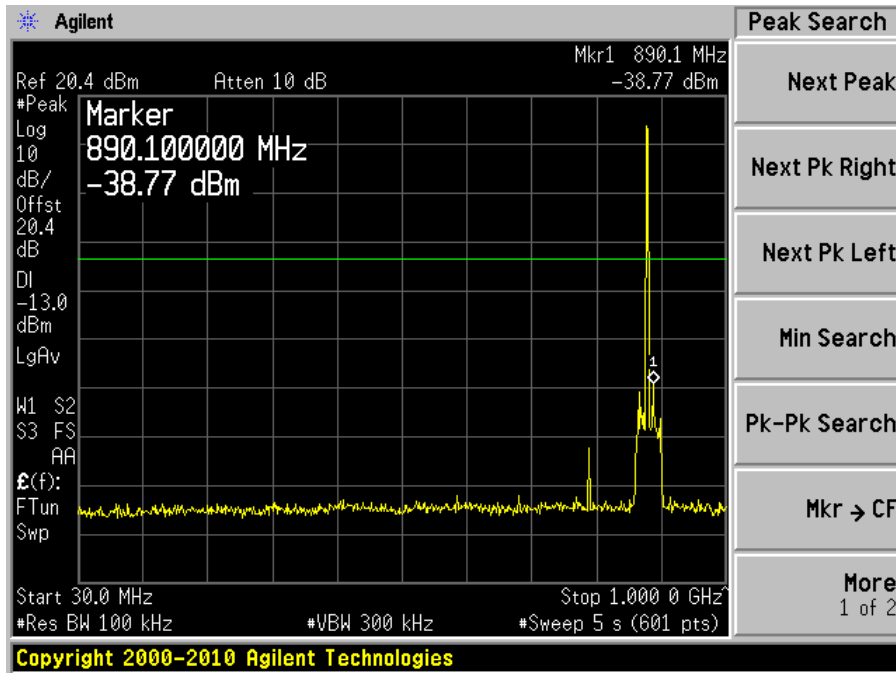
30 MHz to 1 GHz



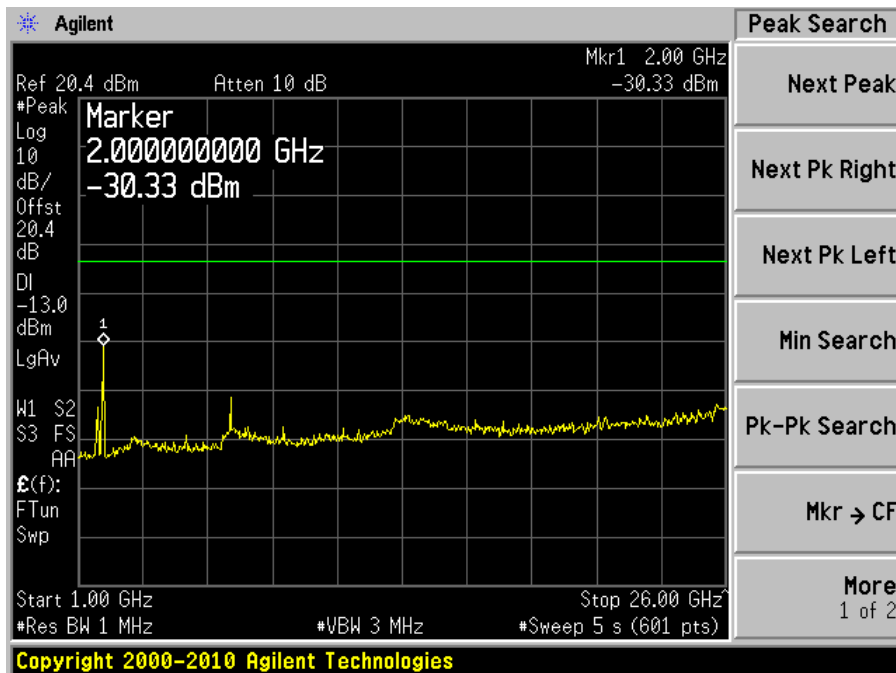
1 GHz to 26GHz



### Middle Channel (881.5 MHz)

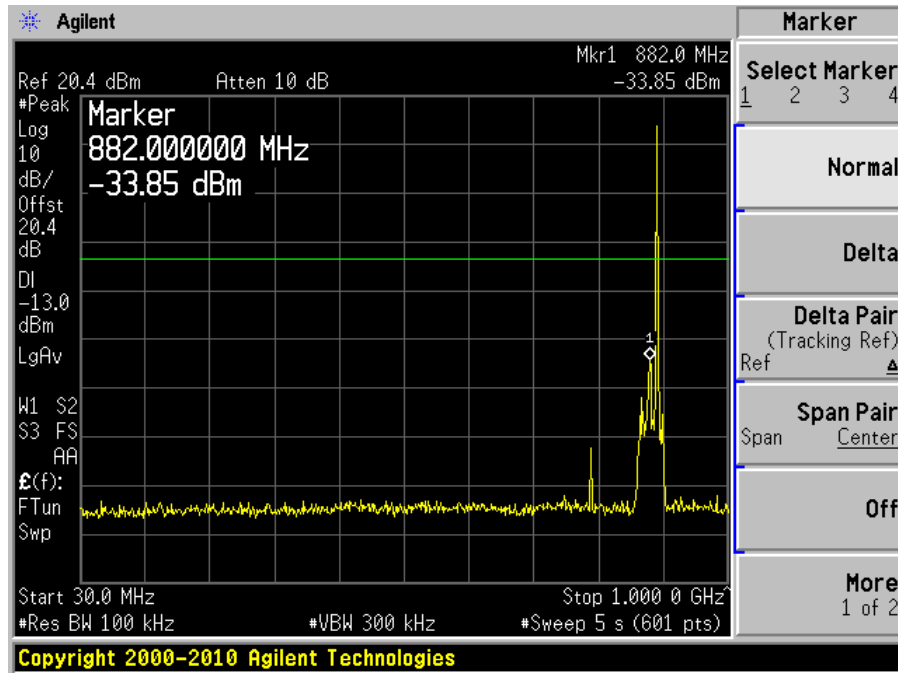


30 MHz to 1 GHz

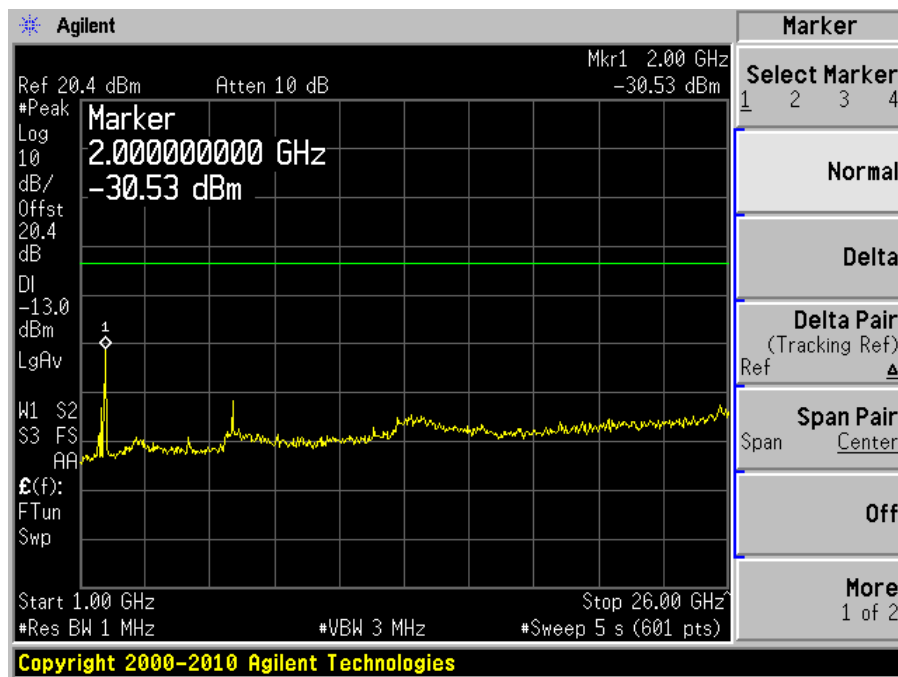


1 GHz to 26GHz

### High Channel (893.3 MHz)



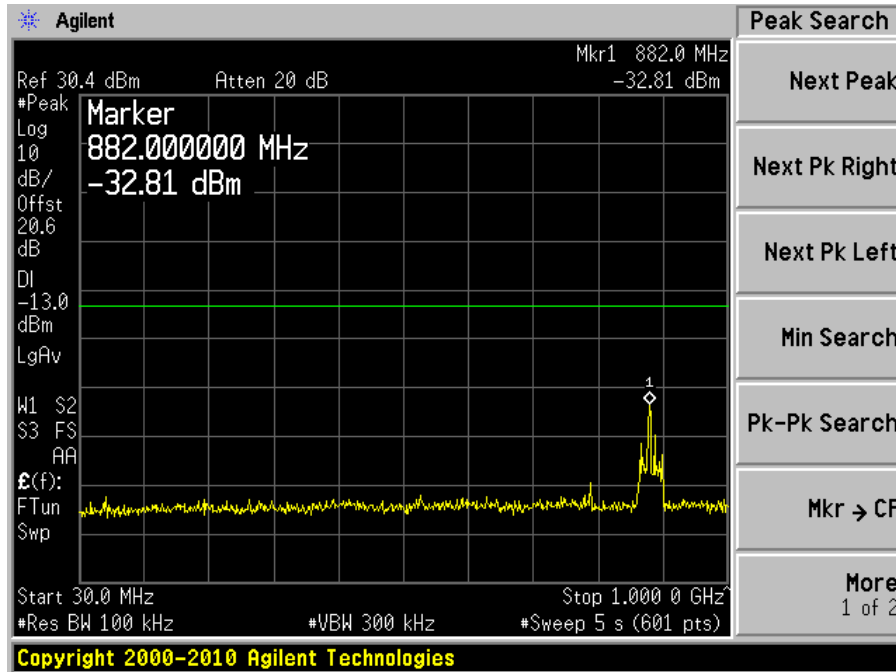
30 MHz to 1 GHz



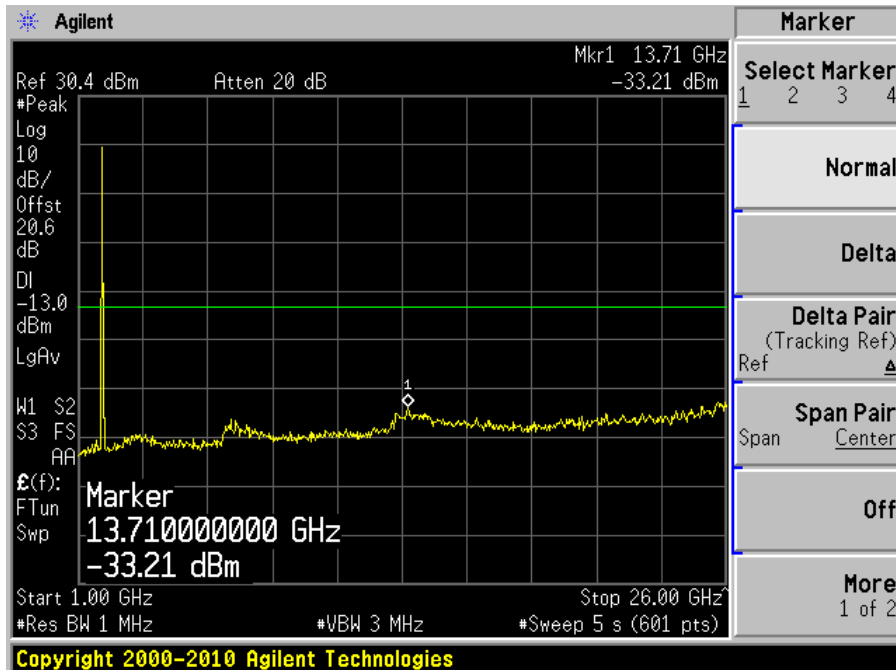
1 GHz to 26GHz

**LTE 1900 MHz Band (downlink), Modulation: QPSK (1.4 MHz bandwidth)**

**Low Channel (1930.7 MHz)**

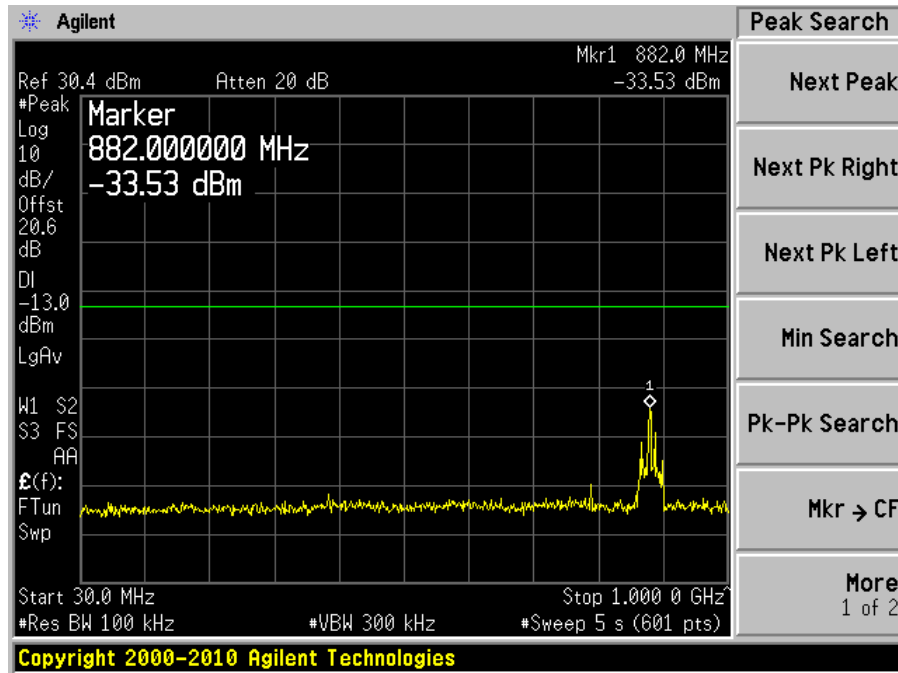


30 MHz to 1 GHz

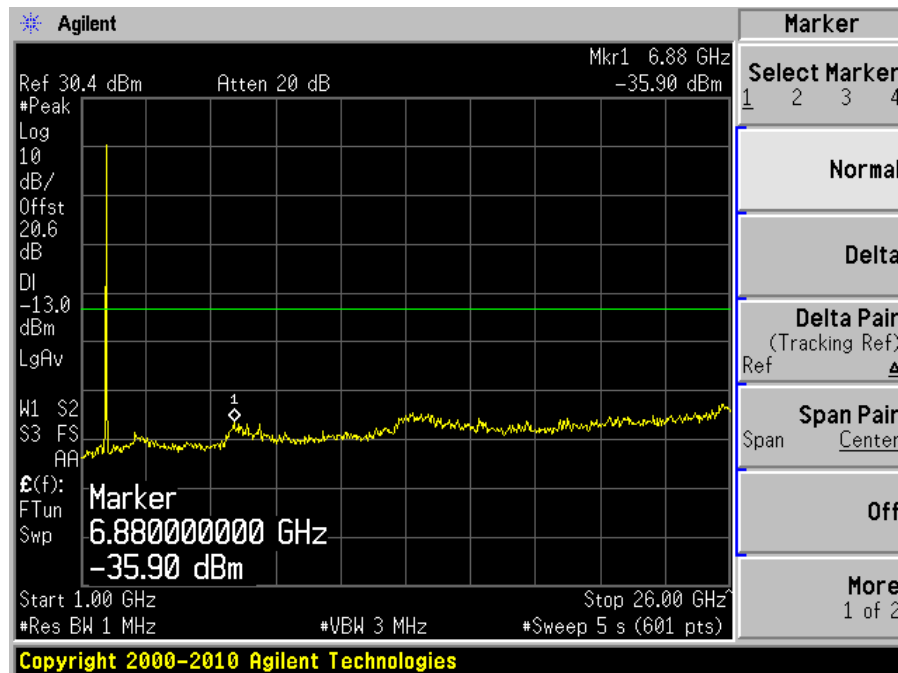


1 GHz to 26GHz

### Middle Channel (1960 MHz)

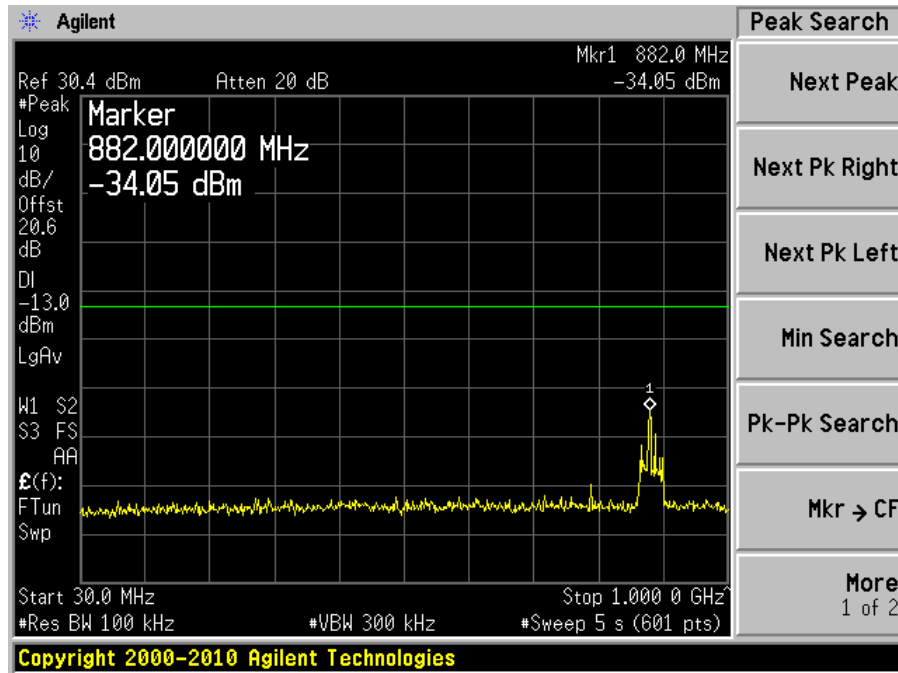


30 MHz to 1 GHz

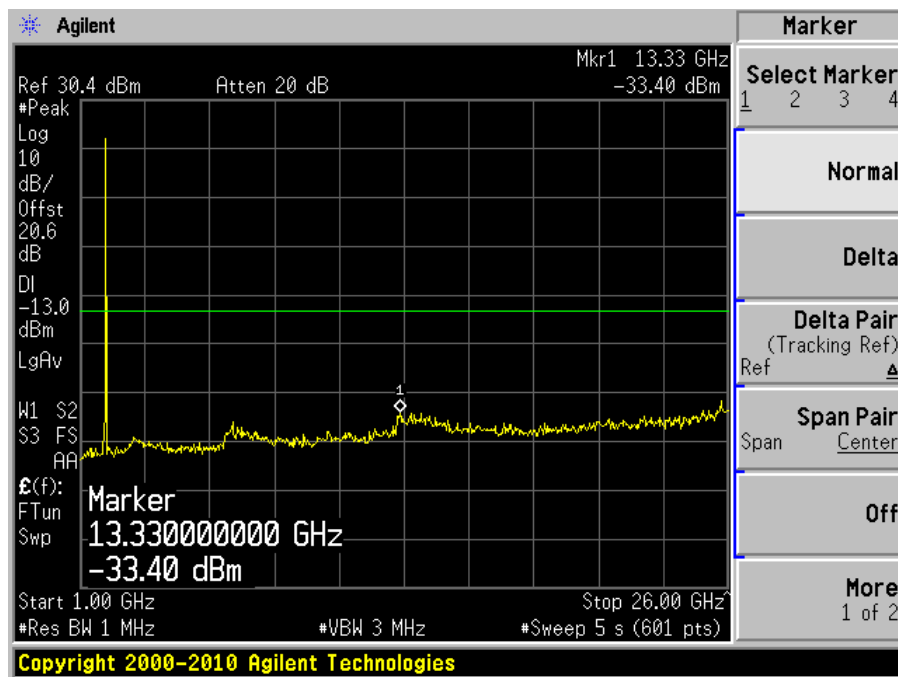


1 GHz to 26GHz

### High Channel (1989.3 MHz)



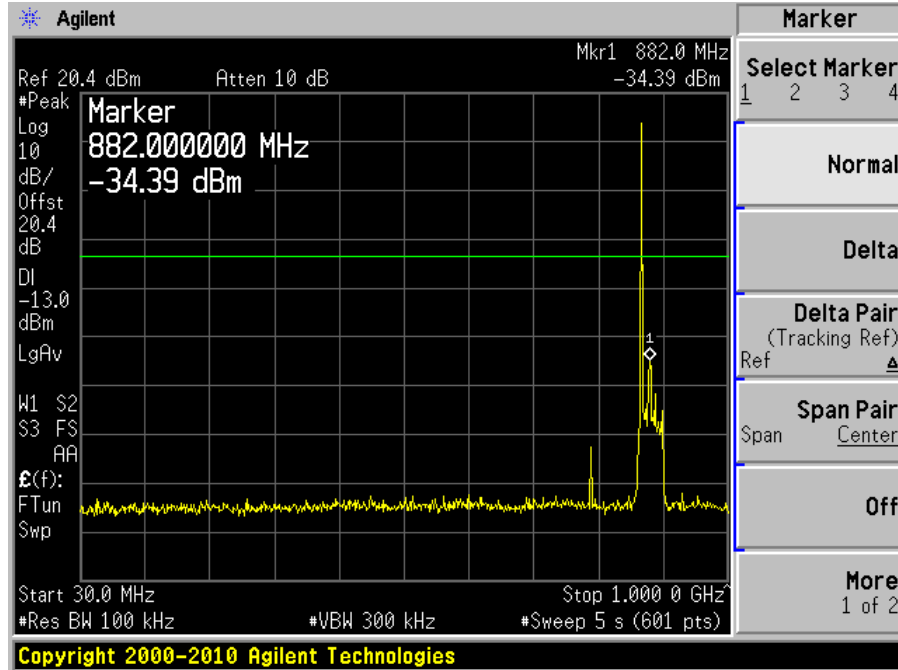
30 MHz to 1 GHz



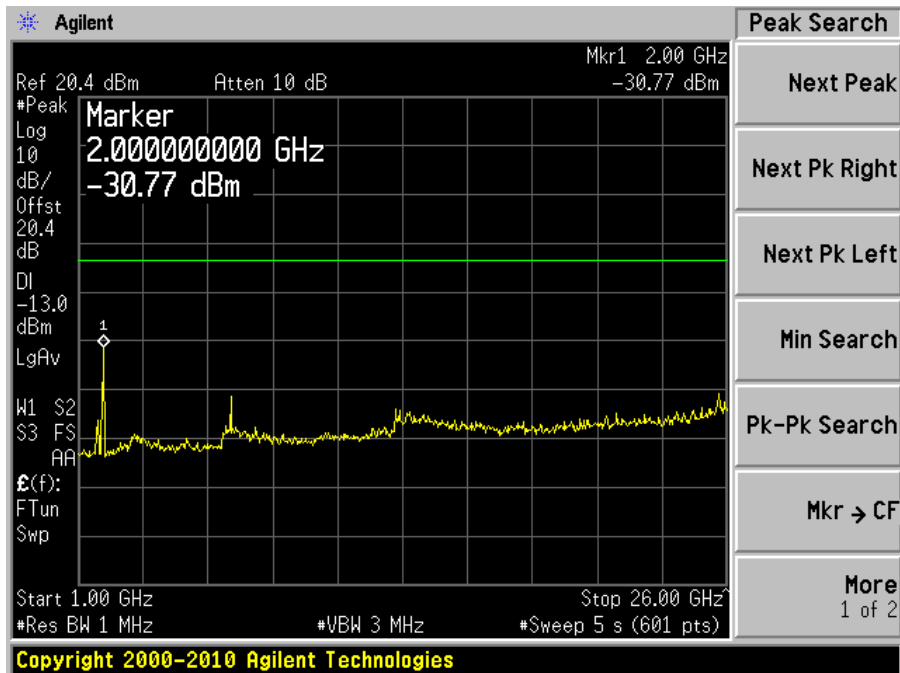
1 GHz to 26GHz

**LTE 850 MHz Band (downlink), Modulation: 16QAM (1.4 MHz bandwidth)**

**Low Channel (869.7 MHz)**

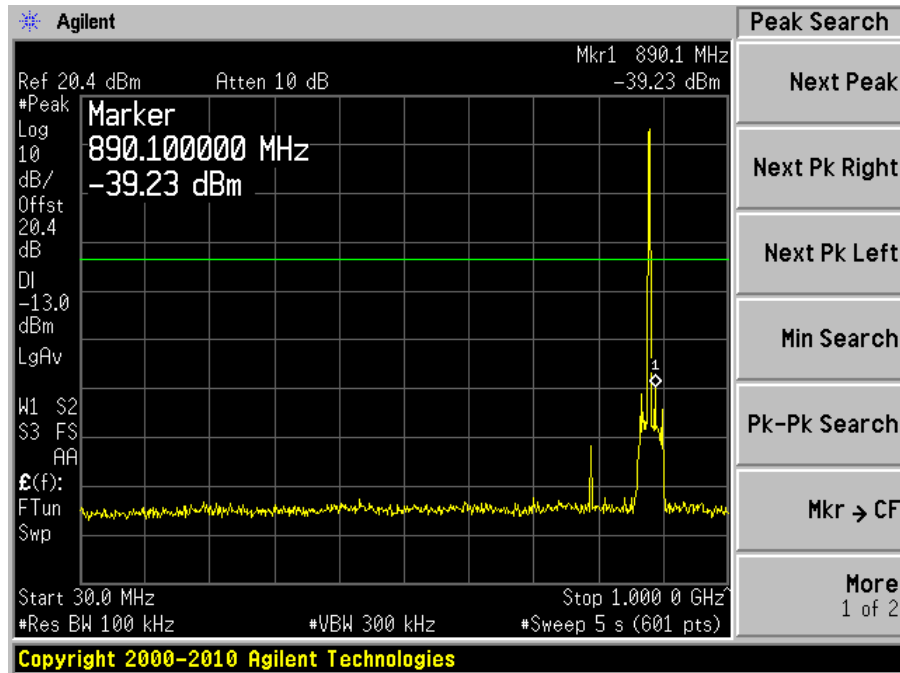


30 MHz to 1 GHz

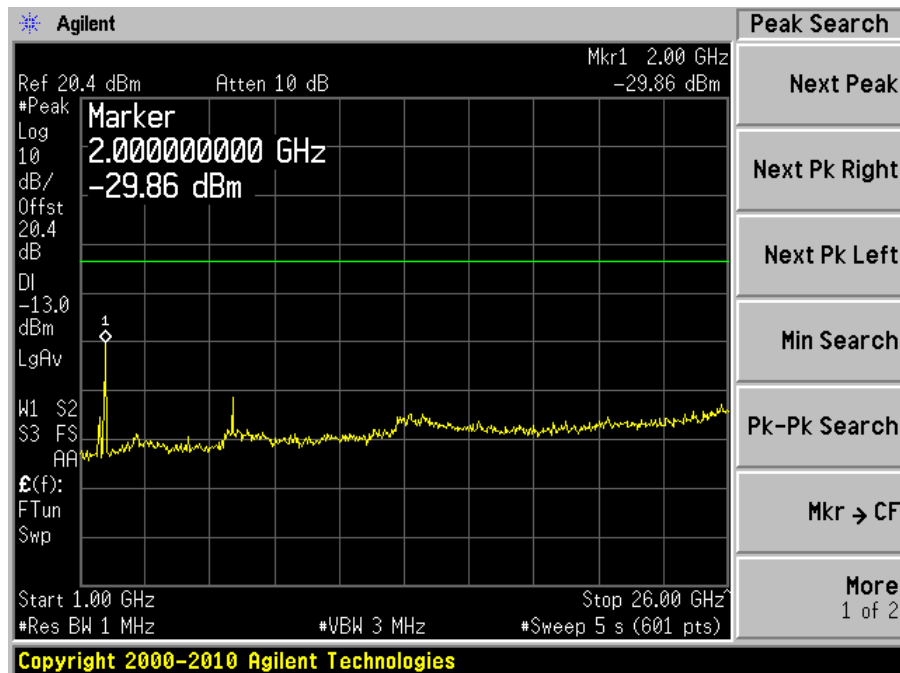


1 GHz to 26GHz

### Middle Channel (881.5 MHz)

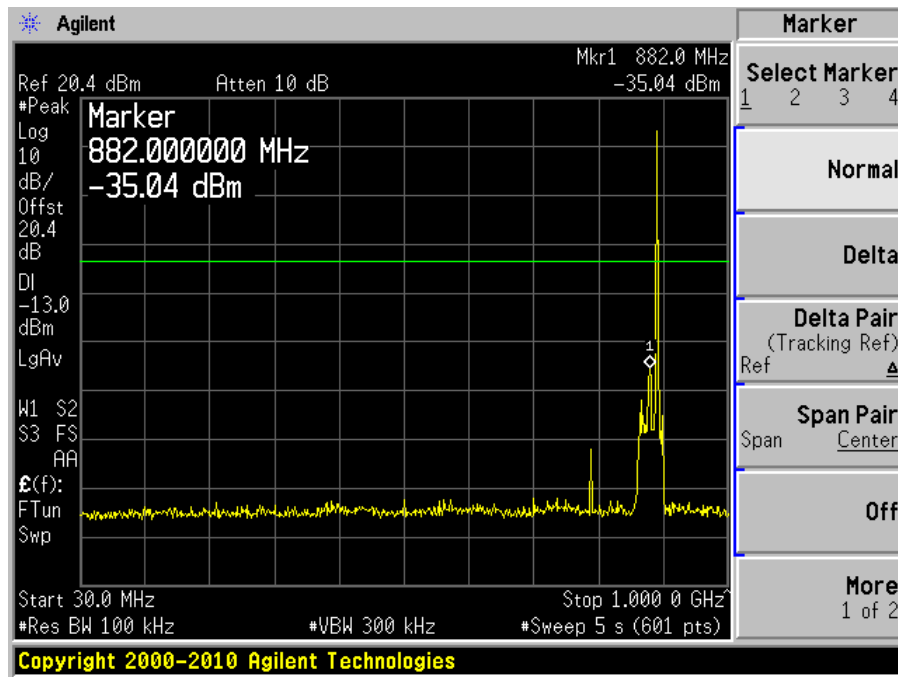


30 MHz to 1 GHz

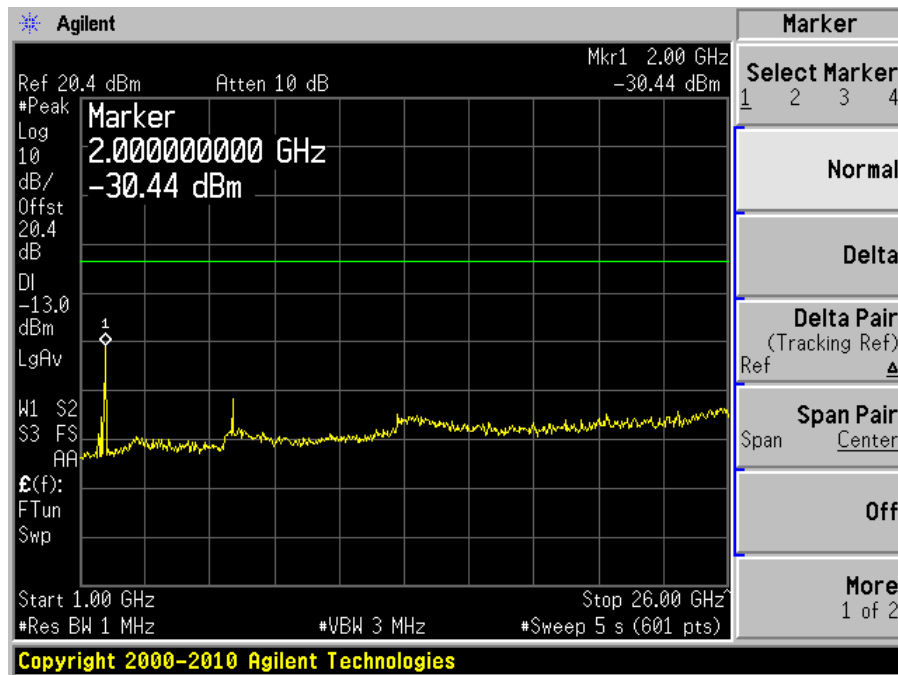


1 GHz to 26GHz

### High Channel (893.3 MHz)



30 MHz to 1 GHz

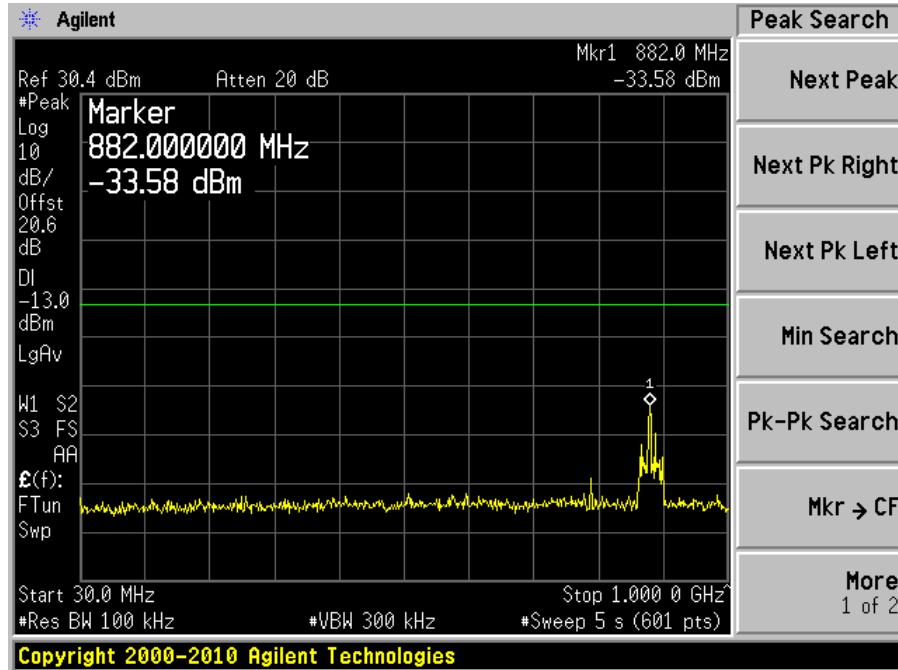


1 GHz to 26GHz

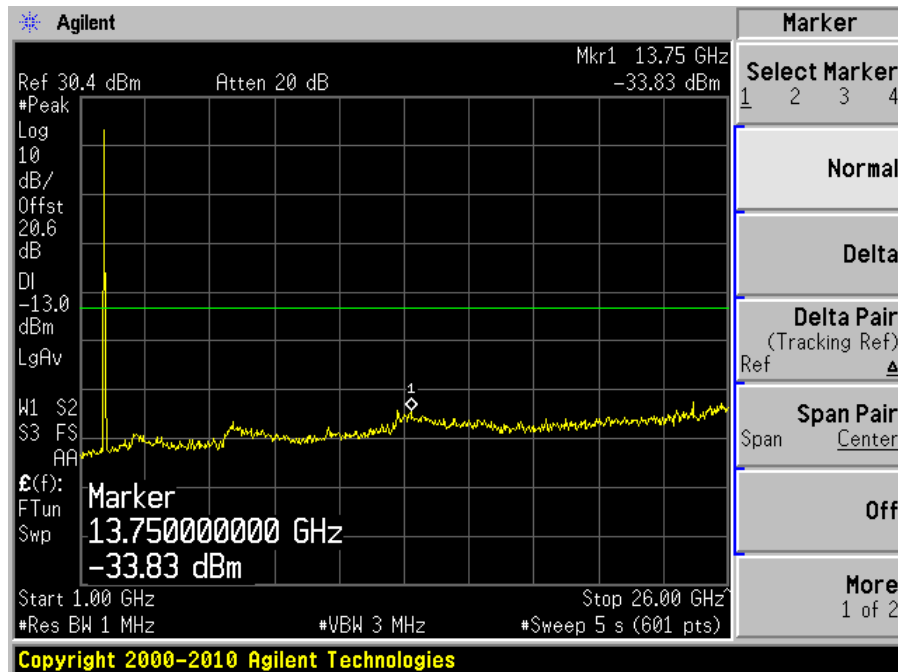


**LTE 1900 MHz Band (downlink), Modulation: 16QAM (1.4 MHz bandwidth)**

**Low Channel (1930.7 MHz)**

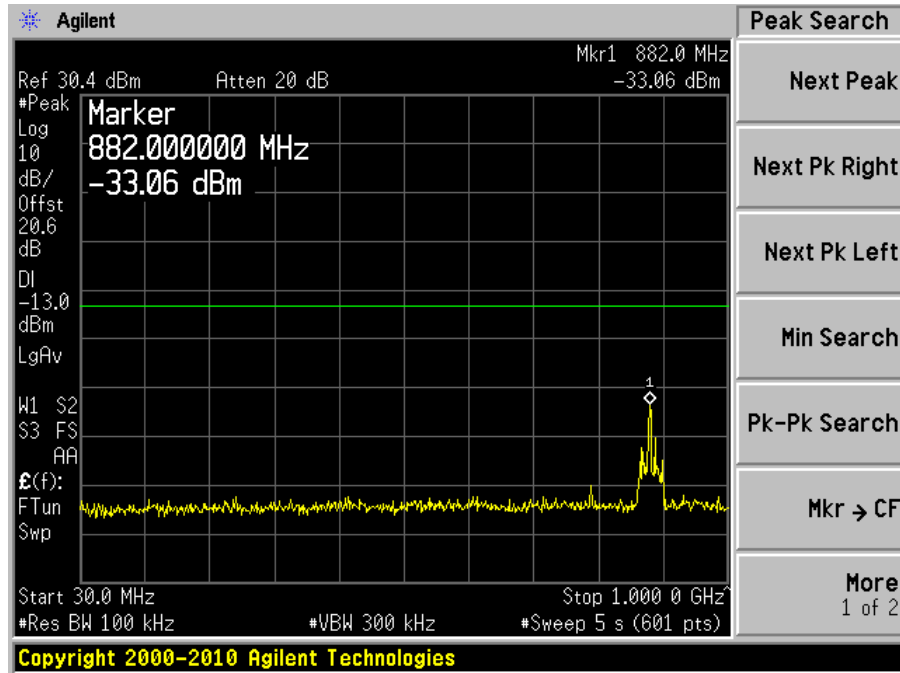


30 MHz to 1 GHz

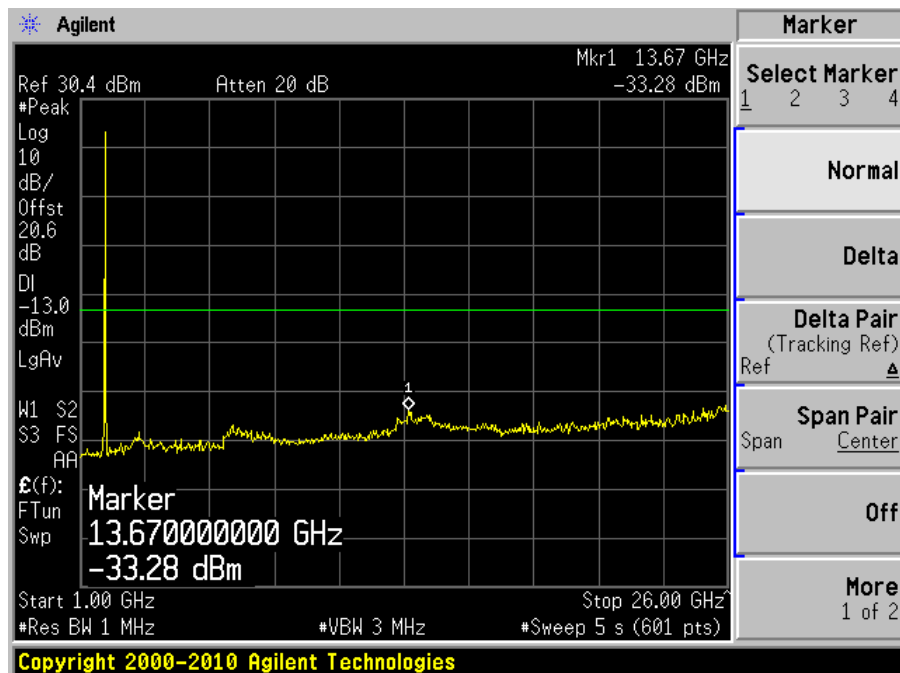


1 GHz to 20 GHz

Middle Channel (1960 MHz)

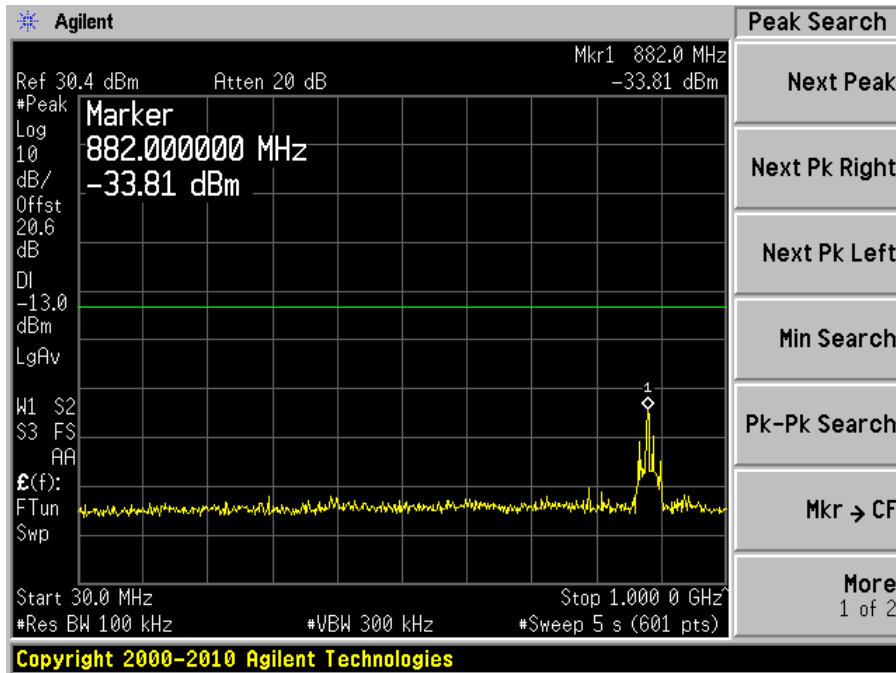


30 MHz to 1 GHz

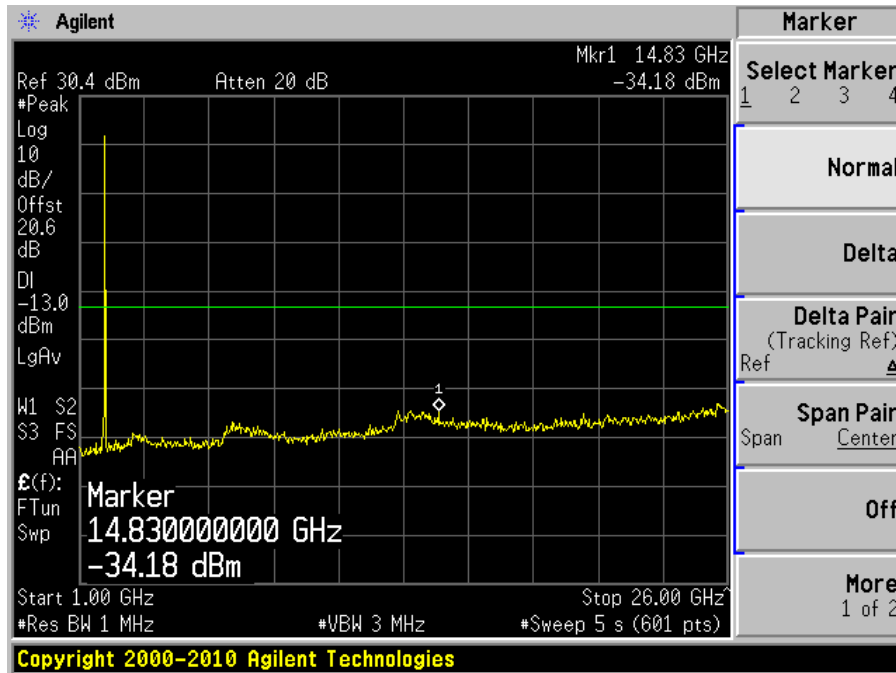


1 GHz to 20 GHz

**High Channel (1989.3 MHz)**



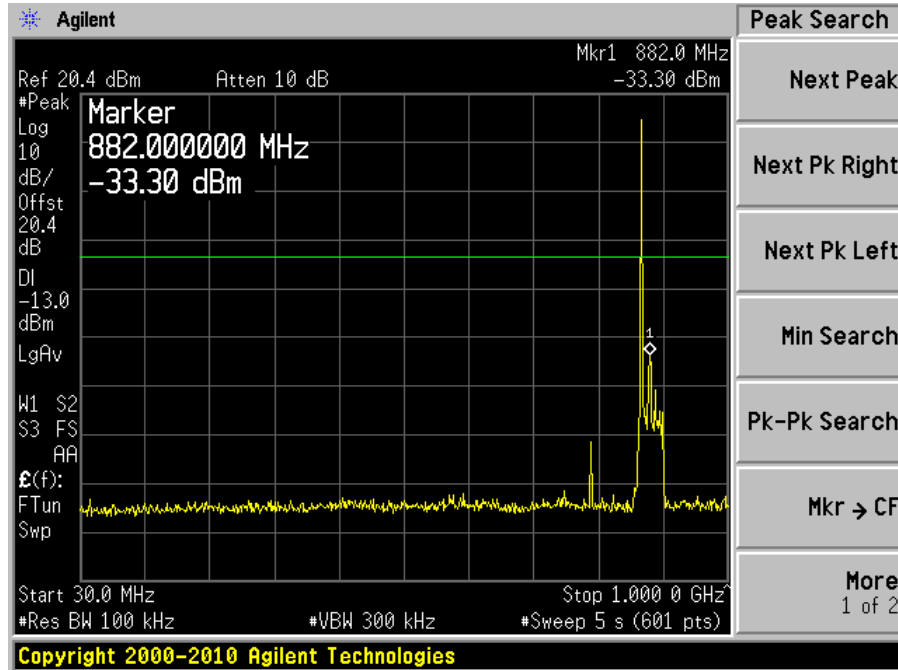
30 MHz to 1 GHz



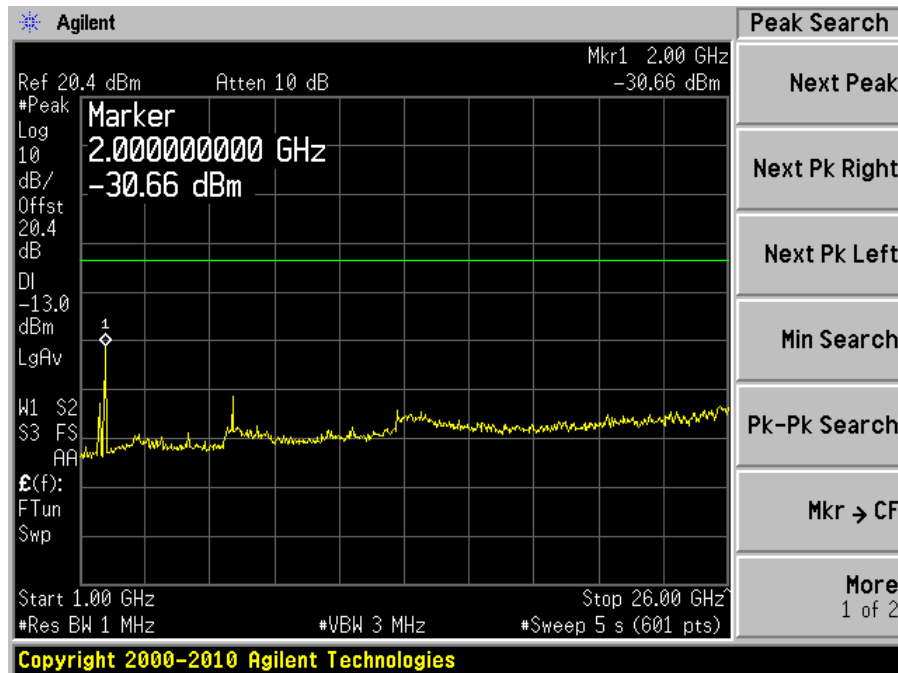
1 GHz to 20 GHz

**LTE 850 MHz Band (downlink), Modulation: 64QAM (1.4 MHz bandwidth)**

**Low Channel (869.7 MHz)**

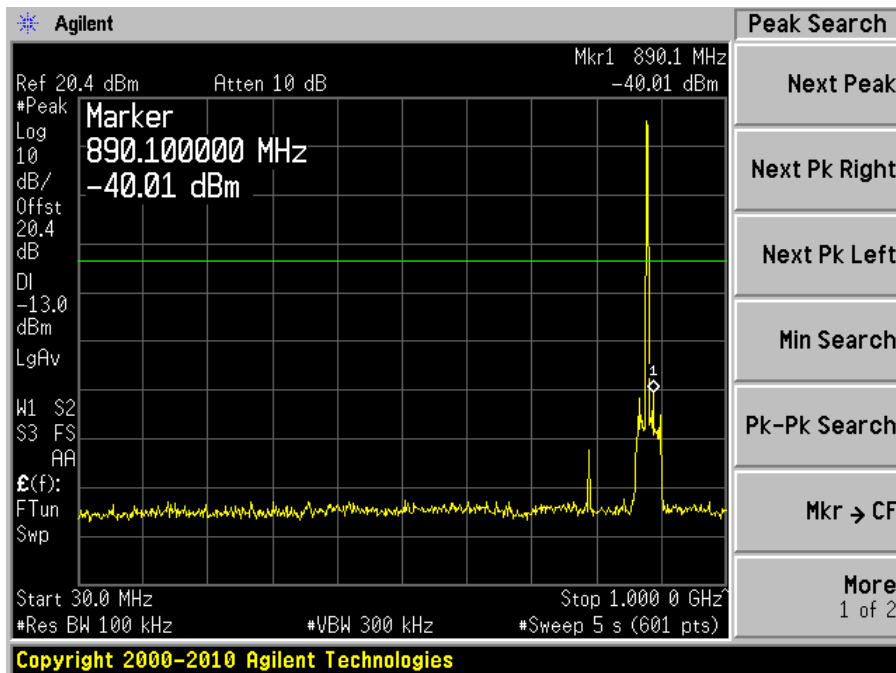


30 MHz to 1 GHz

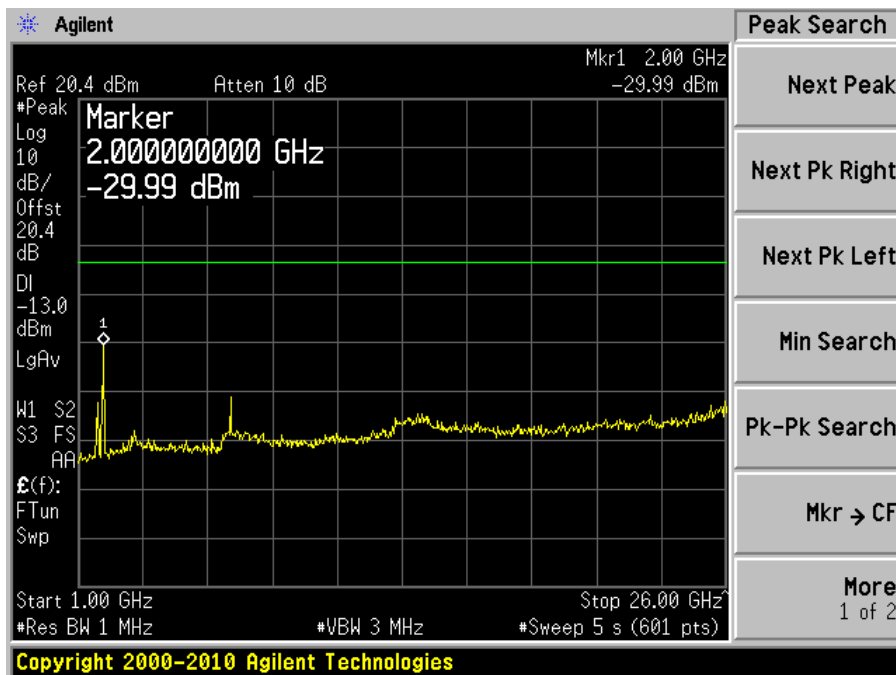


1 GHz to 20 GHz

### Middle Channel (881.5 MHz)

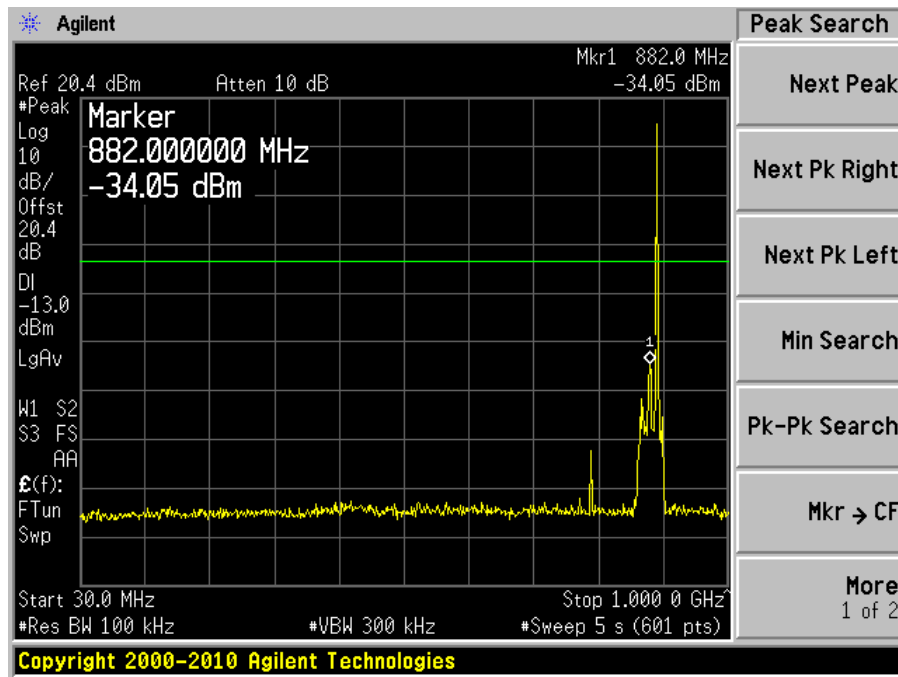


30 MHz to 1 GHz

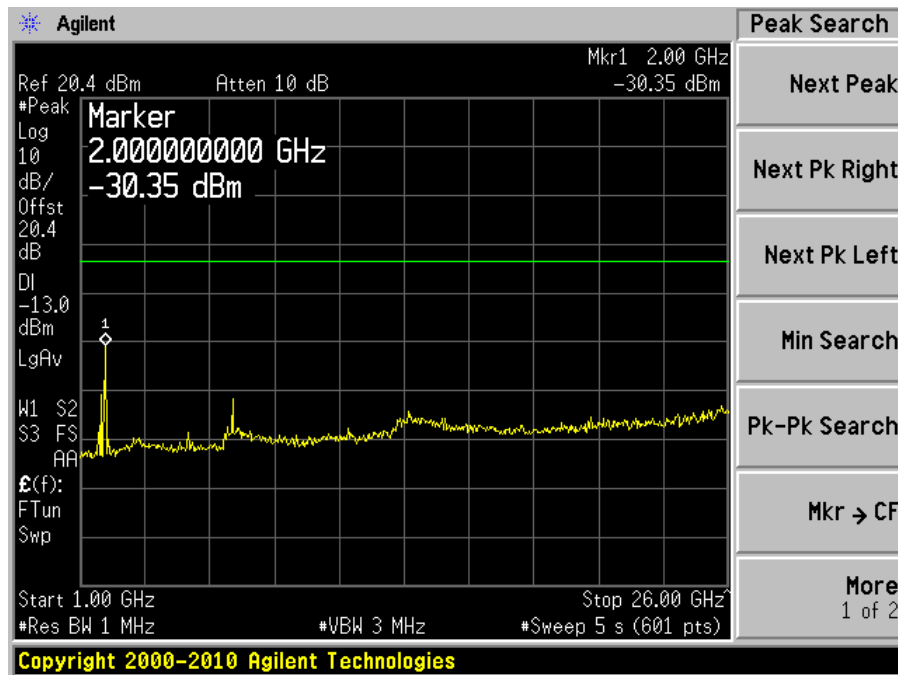


1 GHz to 20 GHz

### High Channel (893.3 MHz)



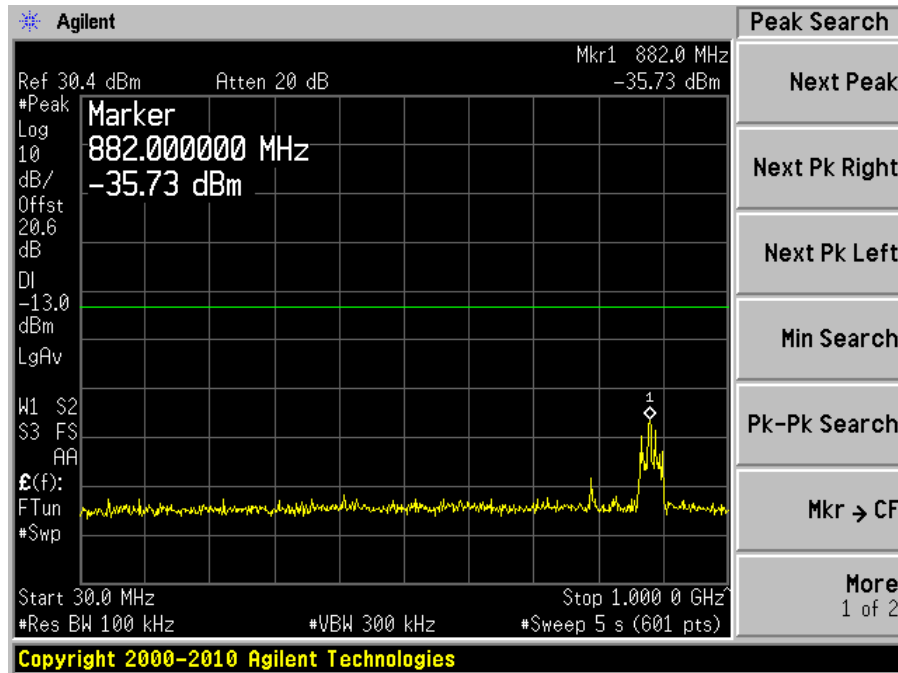
30 MHz to 1 GHz



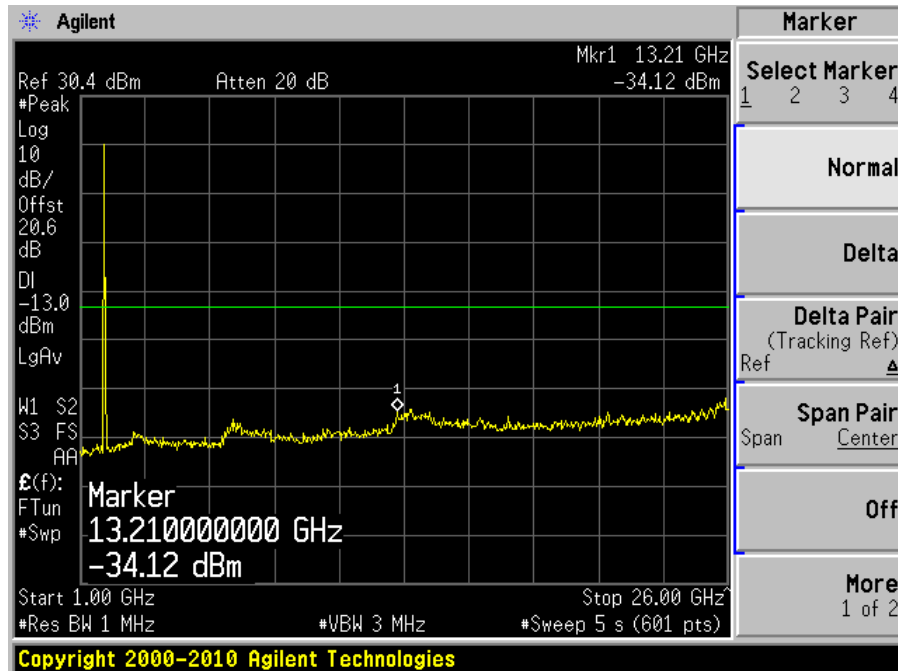
1 GHz to 20 GHz

**LTE 1900 MHz Band (downlink), Modulation: 64QAM (1.4 MHz bandwidth)**

**Low Channel (1930.7 MHz)**

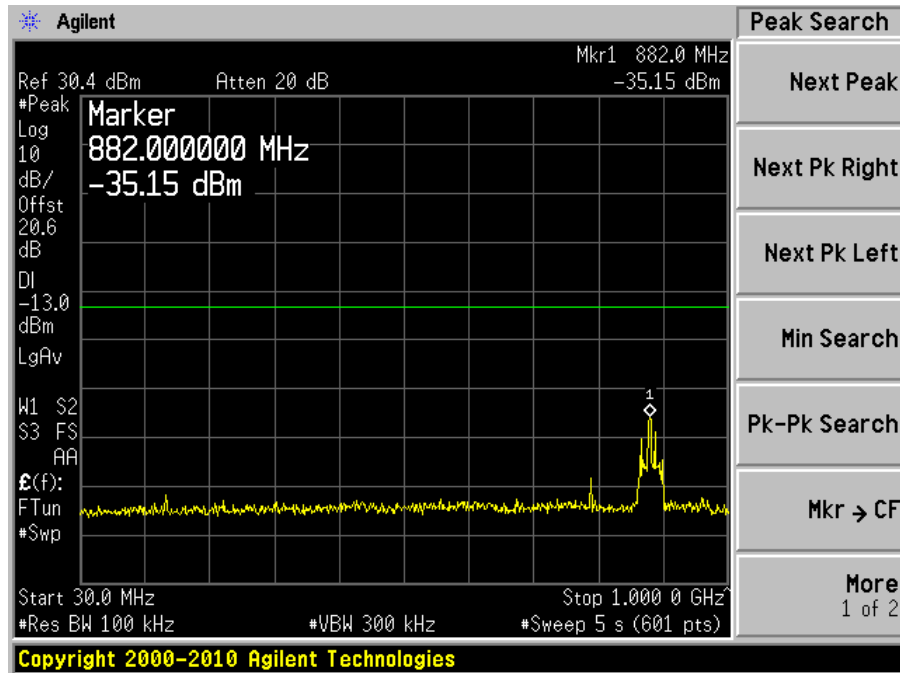


30 MHz to 1 GHz

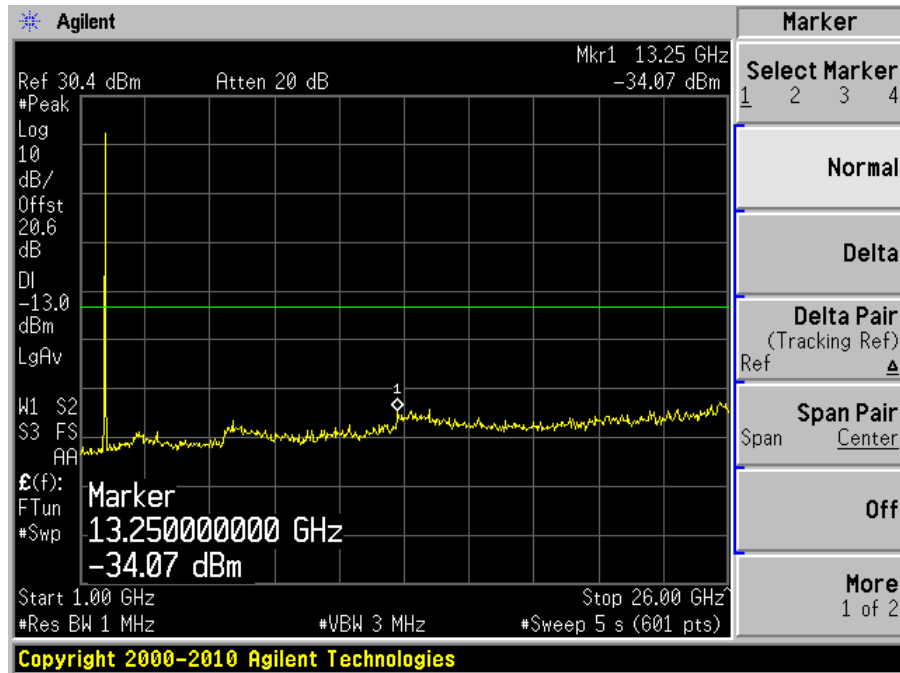


1 GHz to 20 GHz

### Middle Channel (1960 MHz)



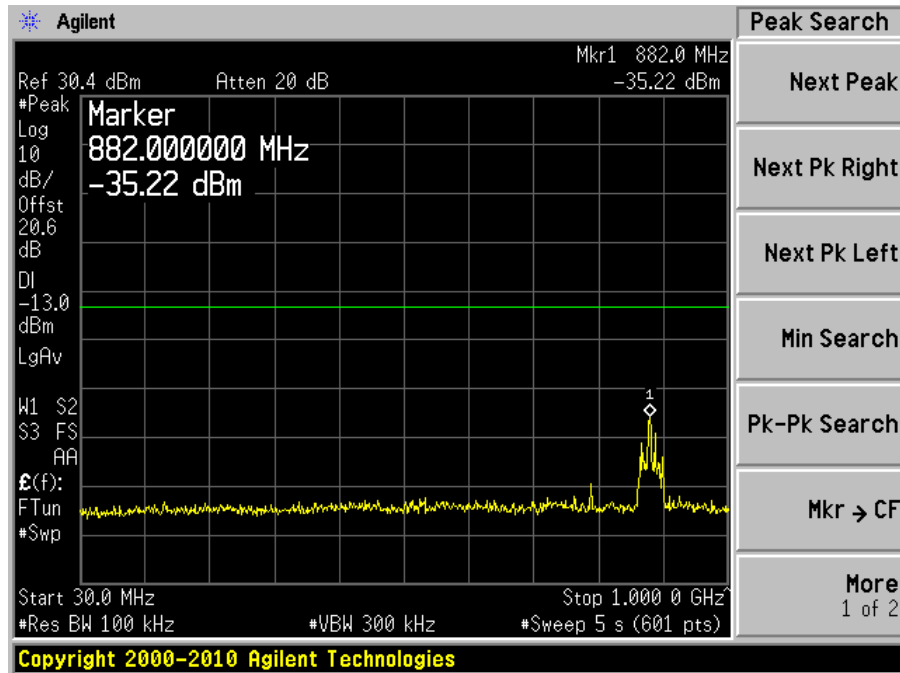
30 MHz to 1 GHz



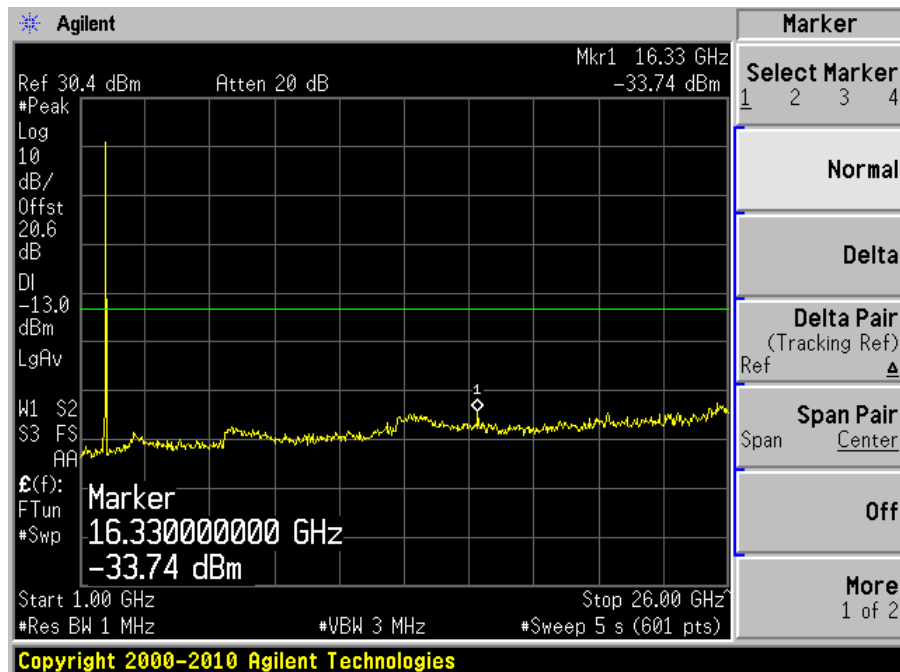
1 GHz to 20 GHz



### High Channel (1989.3 MHz)



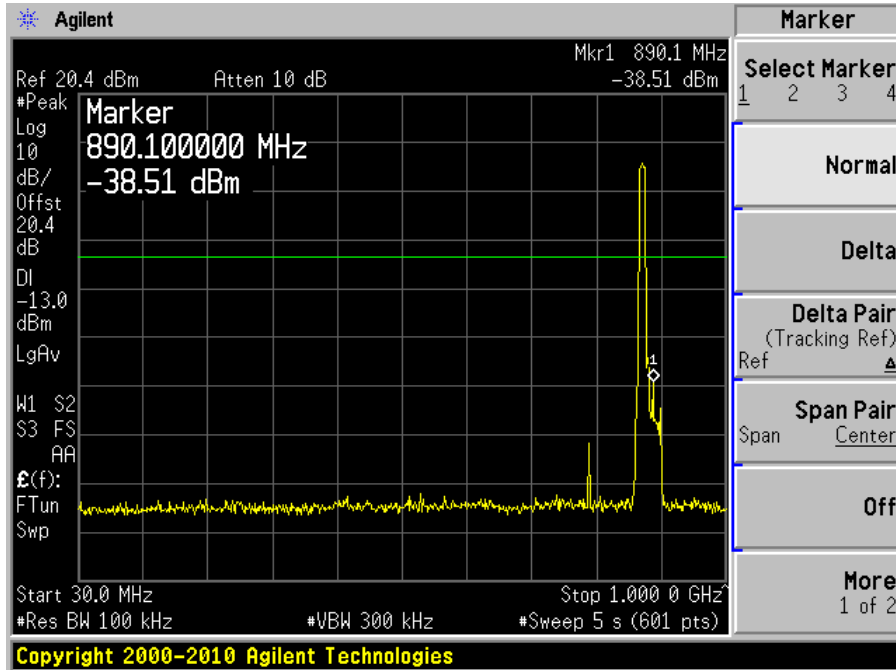
30 MHz to 1 GHz



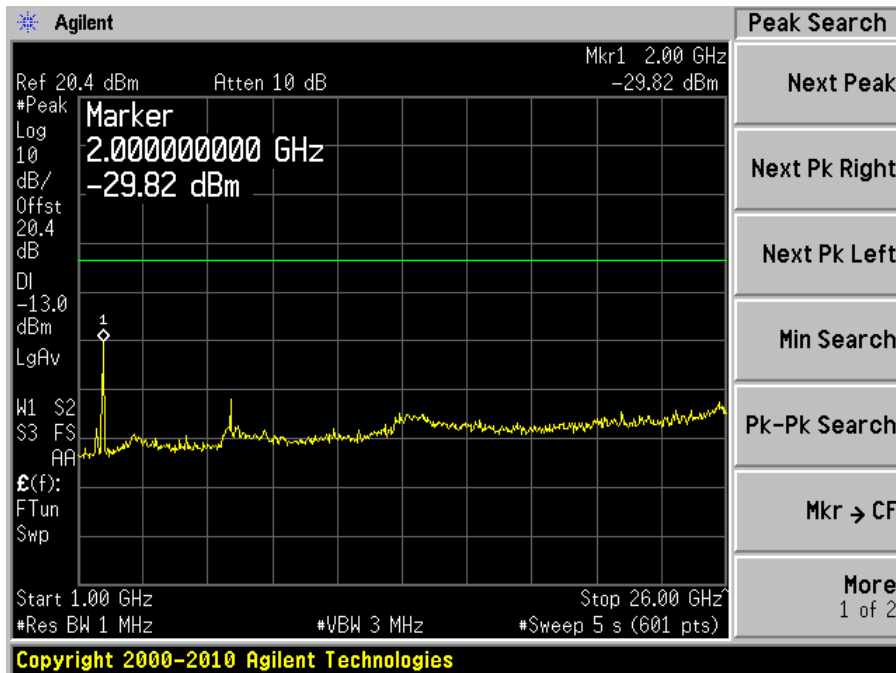
1 GHz to 20 GHz

**LTE 850 MHz Band (downlink), Modulation: QPSK (10 MHz bandwidth)**

**Low Channel (874 MHz)**

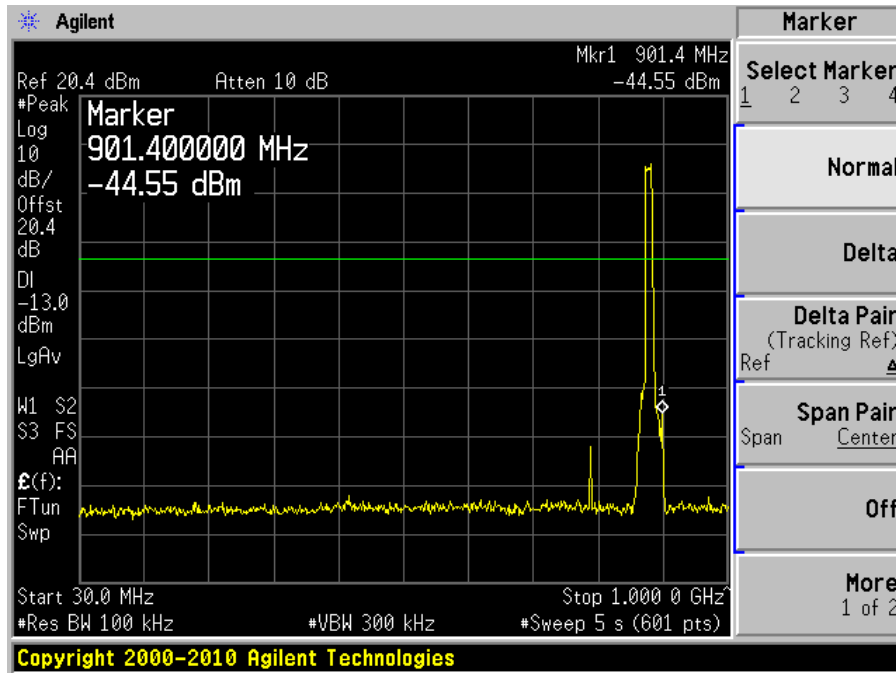


30 MHz to 1 GHz

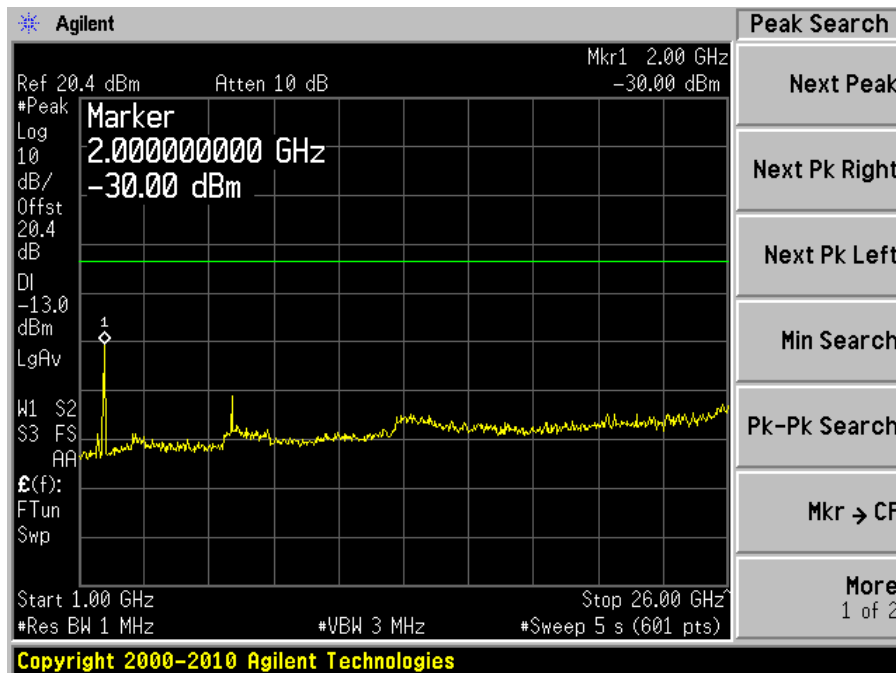


1 GHz to 20 GHz

### Middle Channel (881.5 MHz)

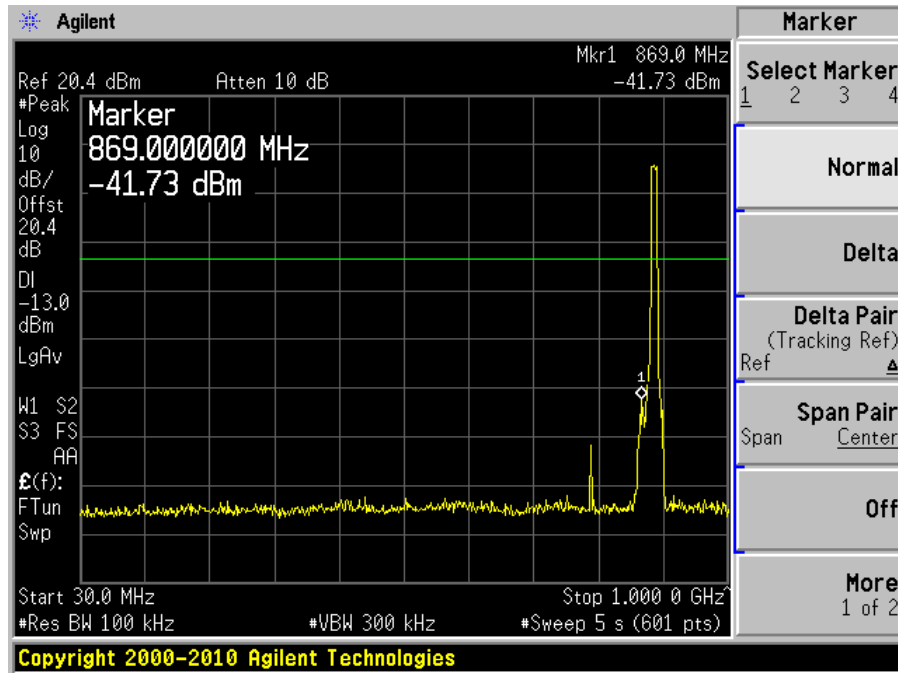


30 MHz to 1 GHz

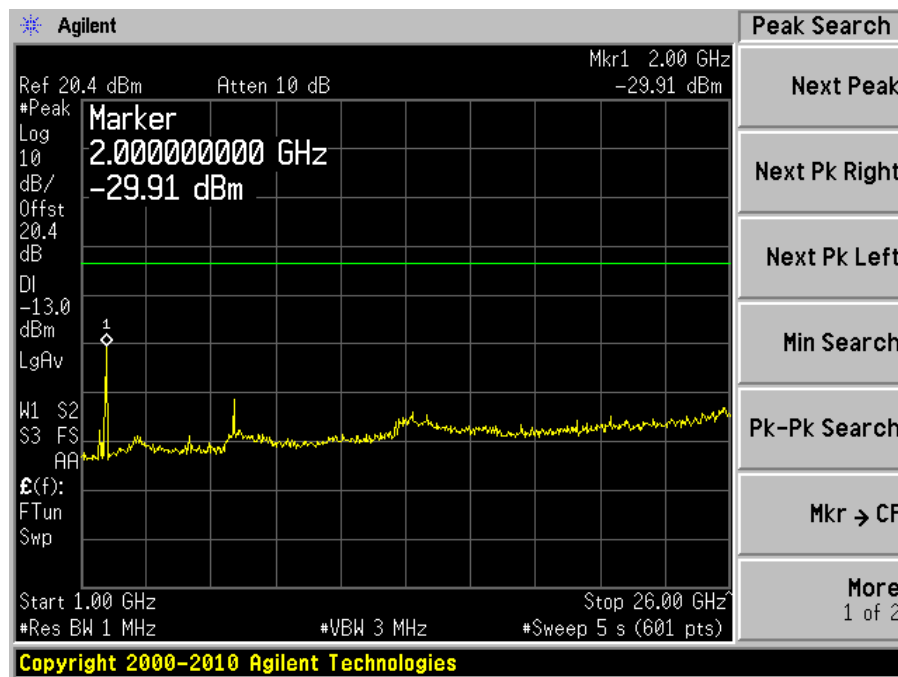


1 GHz to 20 GHz

### High Channel (889 MHz)



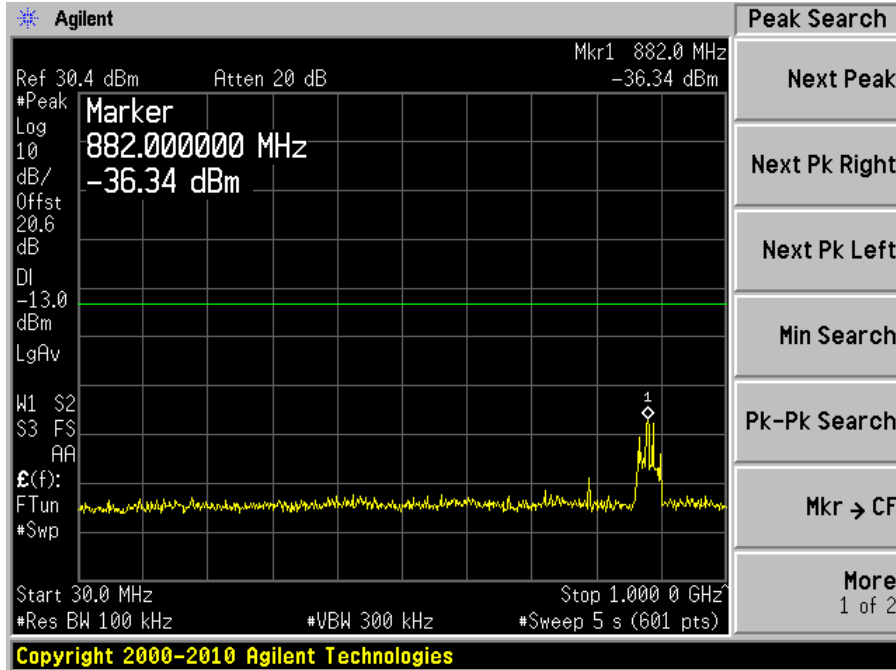
30 MHz to 1 GHz



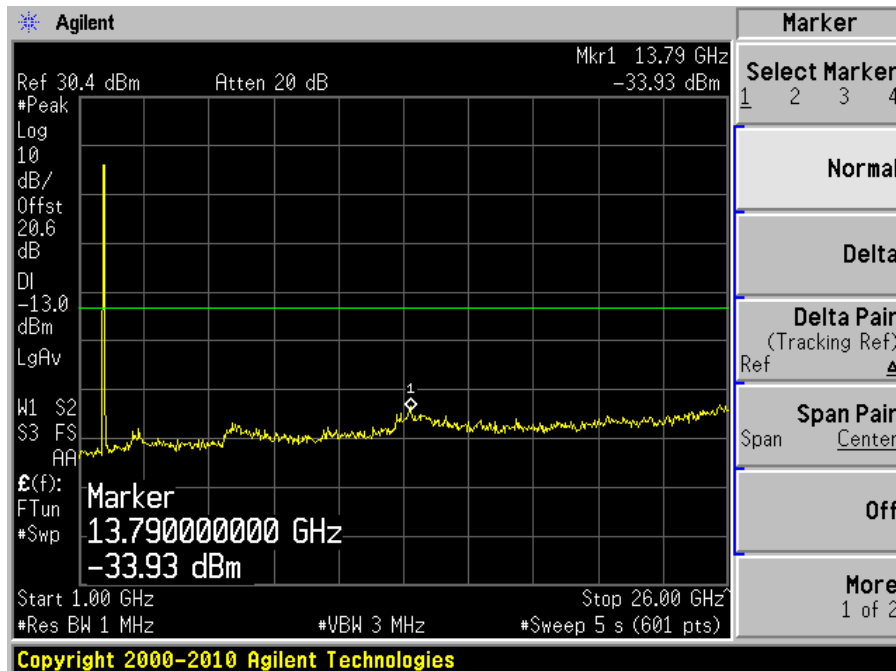
1 GHz to 20 GHz

**LTE 1900 MHz Band (downlink), Modulation: QPSK (10 MHz bandwidth)**

**Low Channel (1935 MHz)**

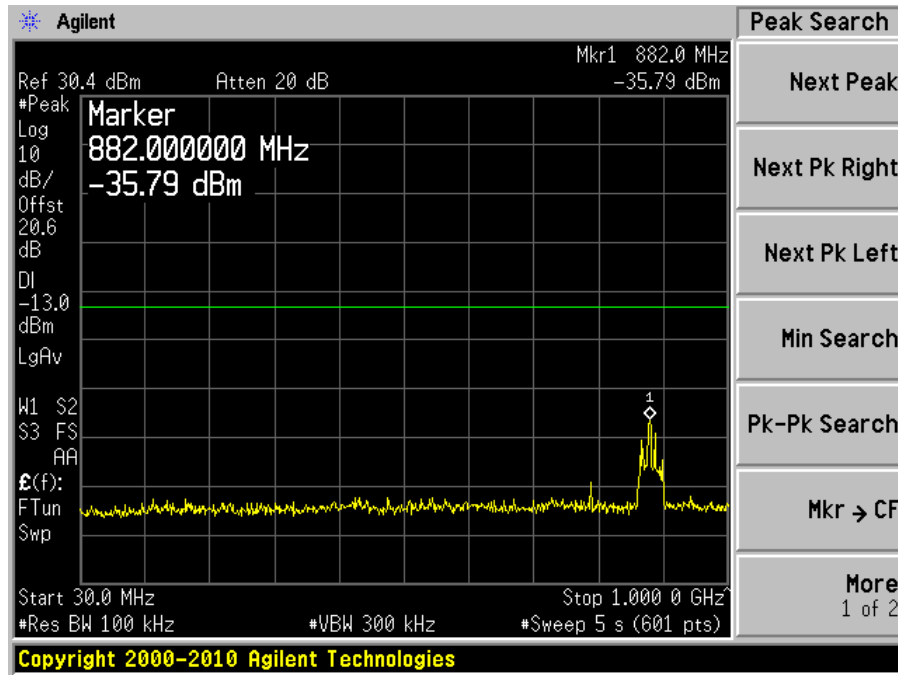


30 MHz to 1 GHz

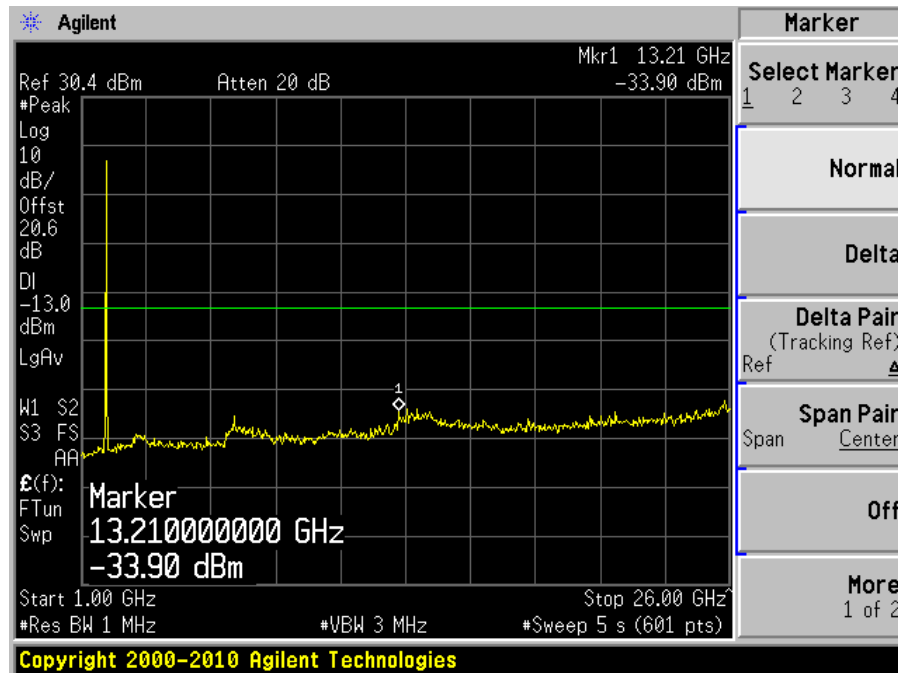


1 GHz to 20 GHz

Middle Channel (1960 MHz)

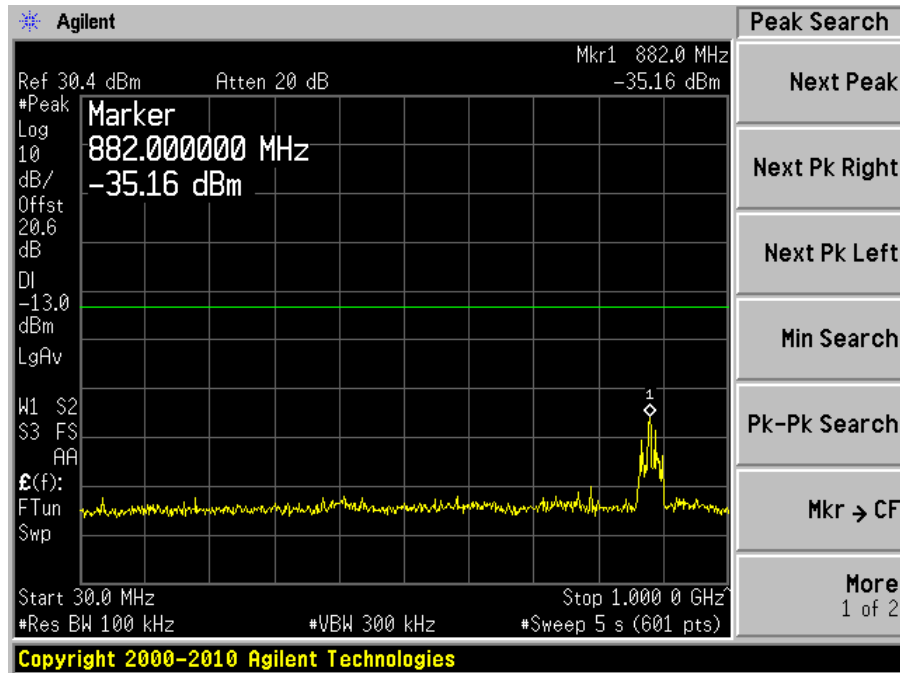


30 MHz to 1 GHz

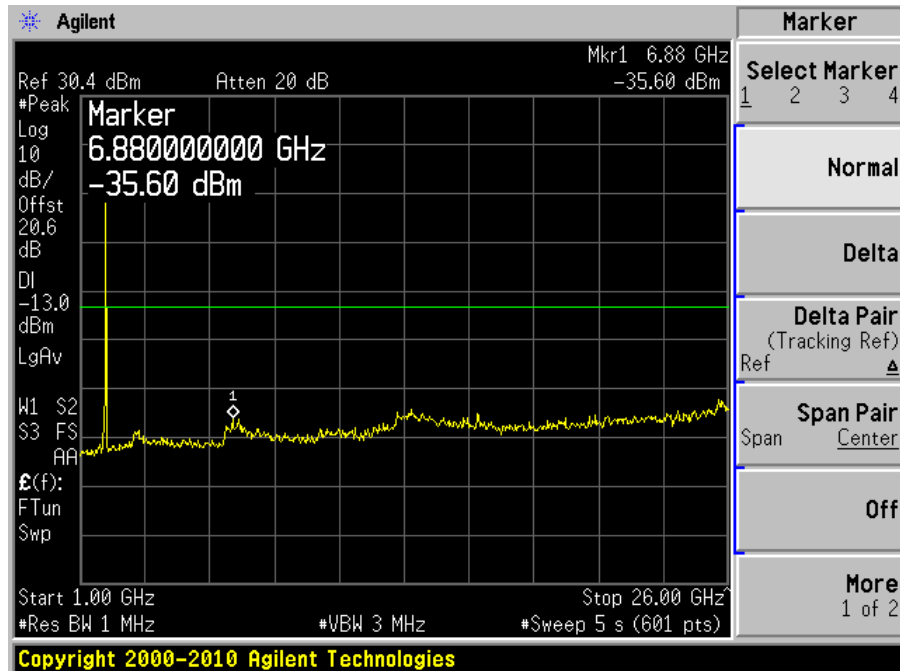


1 GHz to 20 GHz

### High Chanel (1985 MHz)



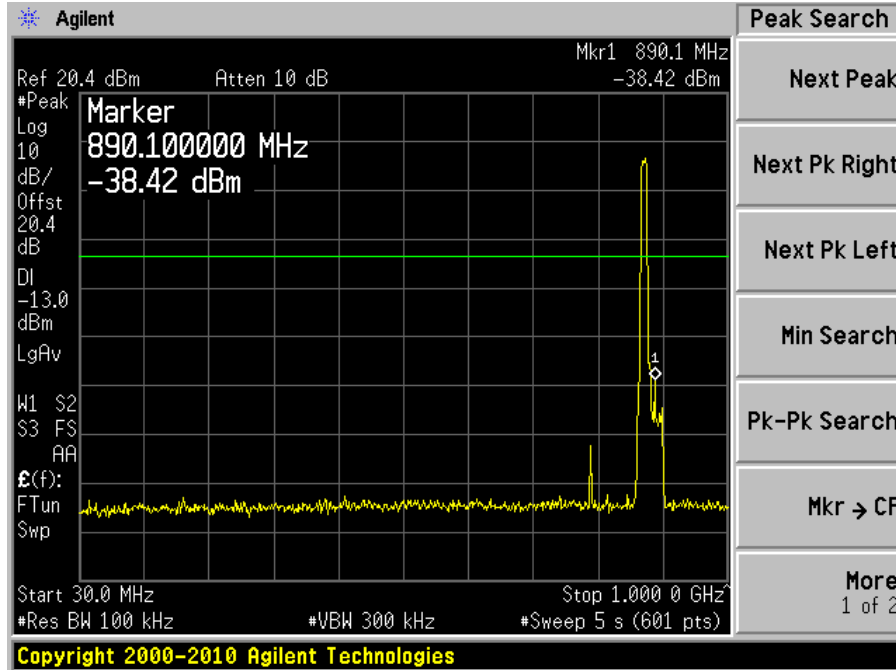
30 MHz to 1 GHz



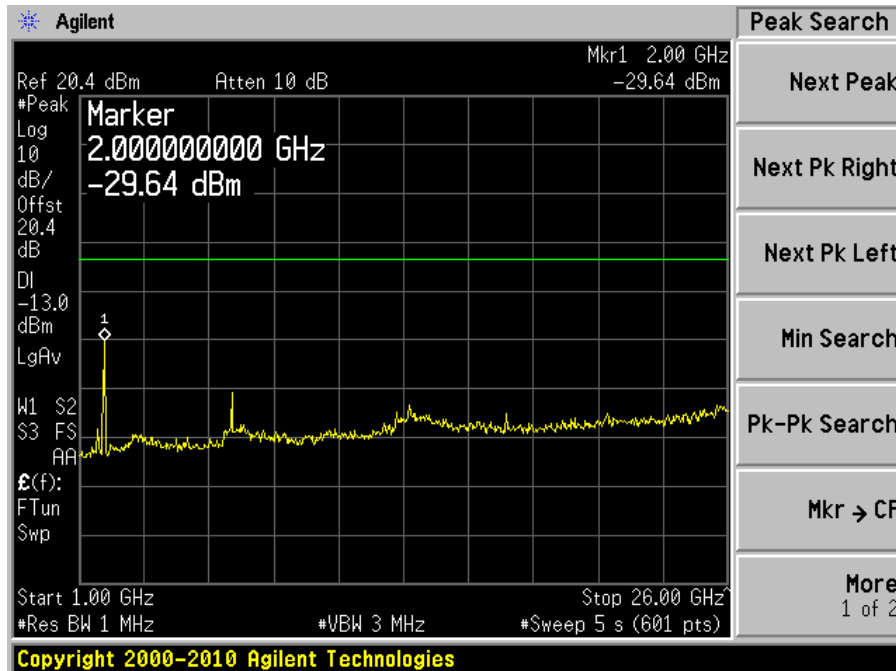
1 GHz to 20 GHz

**LTE 850 MHz Band (downlink), Modulation: 16QAM (10 MHz bandwidth)**

**Low Channel (874 MHz)**



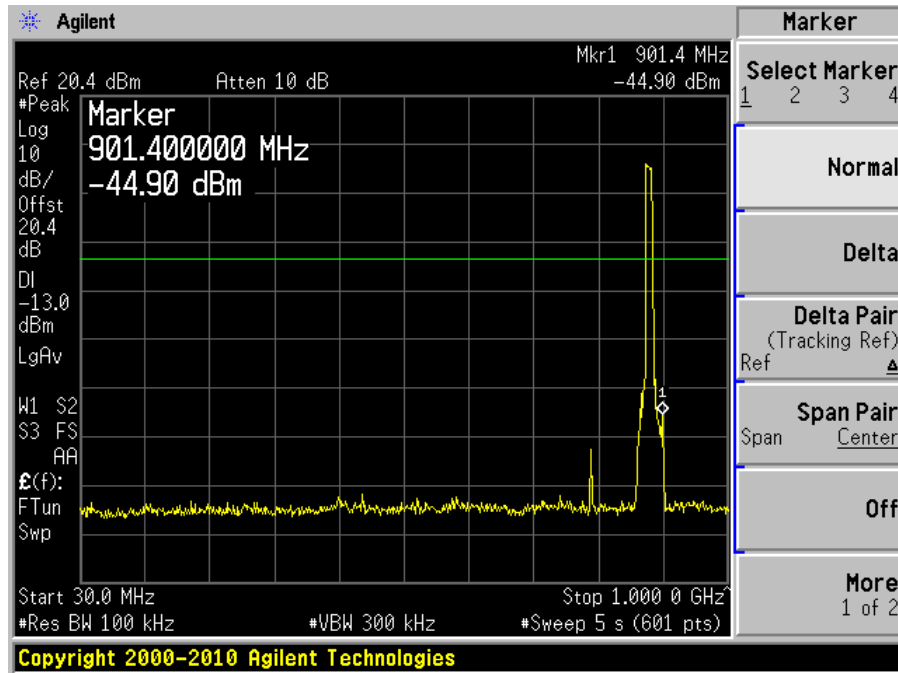
30 MHz to 1 GHz



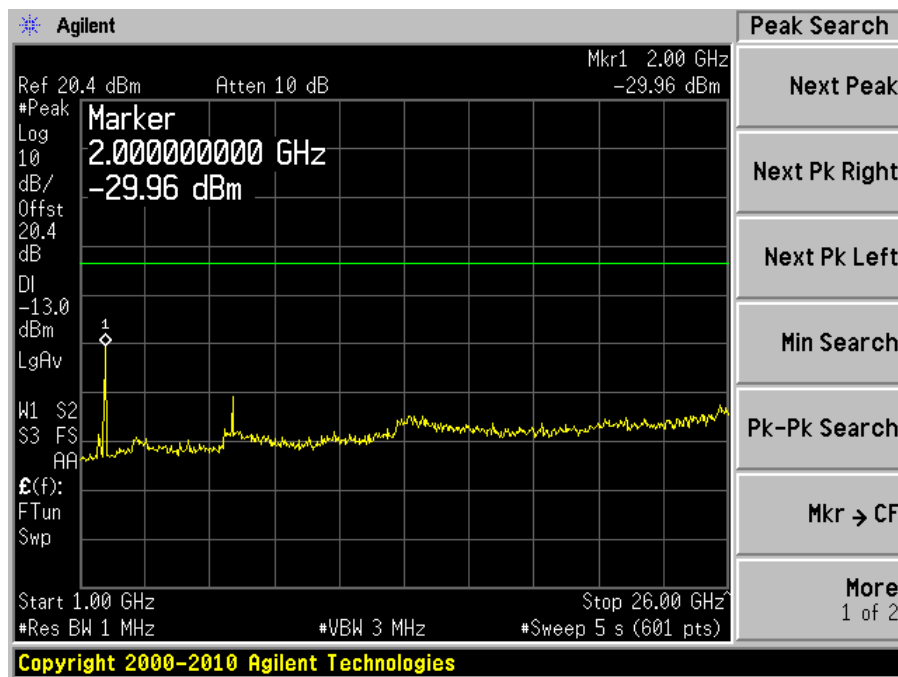
1 GHz to 20 GHz



### Middle Channel (881.5 MHz)

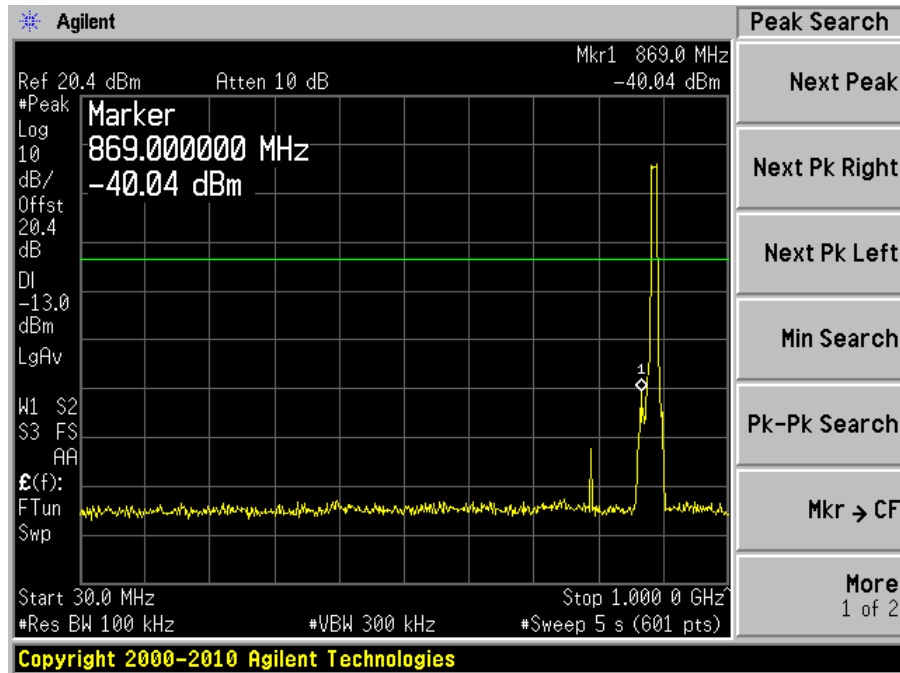


30 MHz to 1 GHz

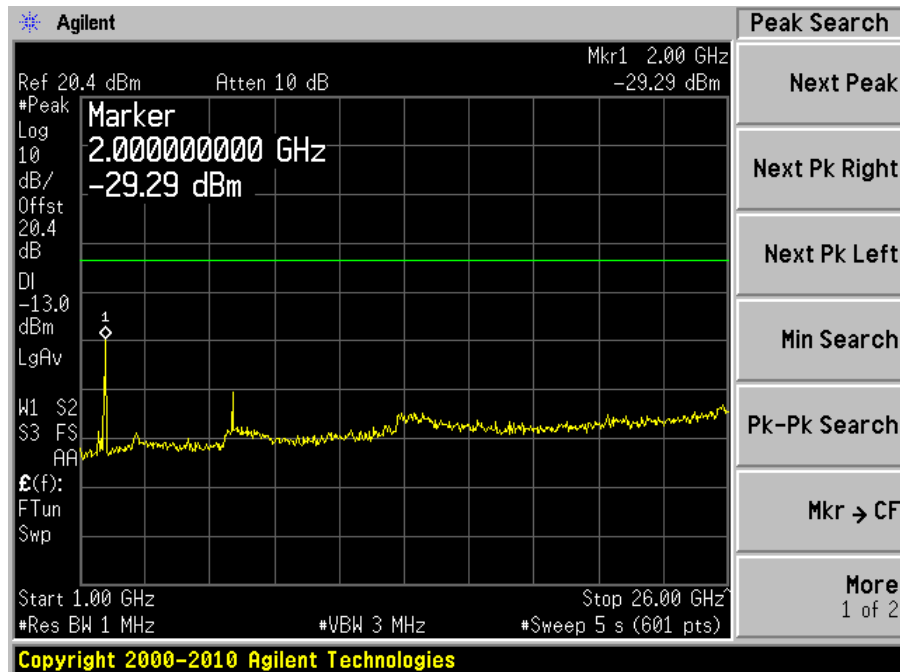


1 GHz to 20 GHz

### High Channel (889 MHz)



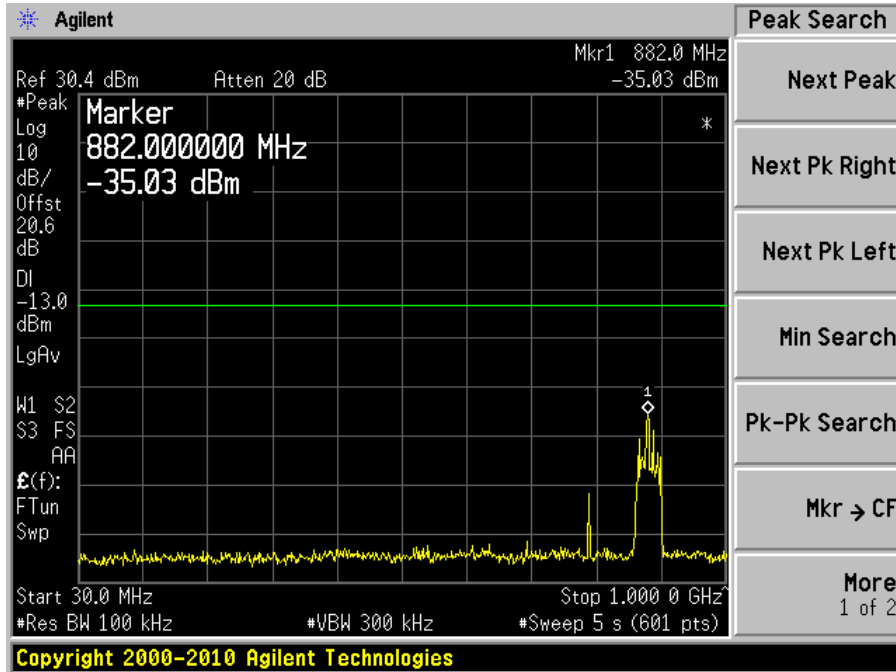
30 MHz to 1 GHz



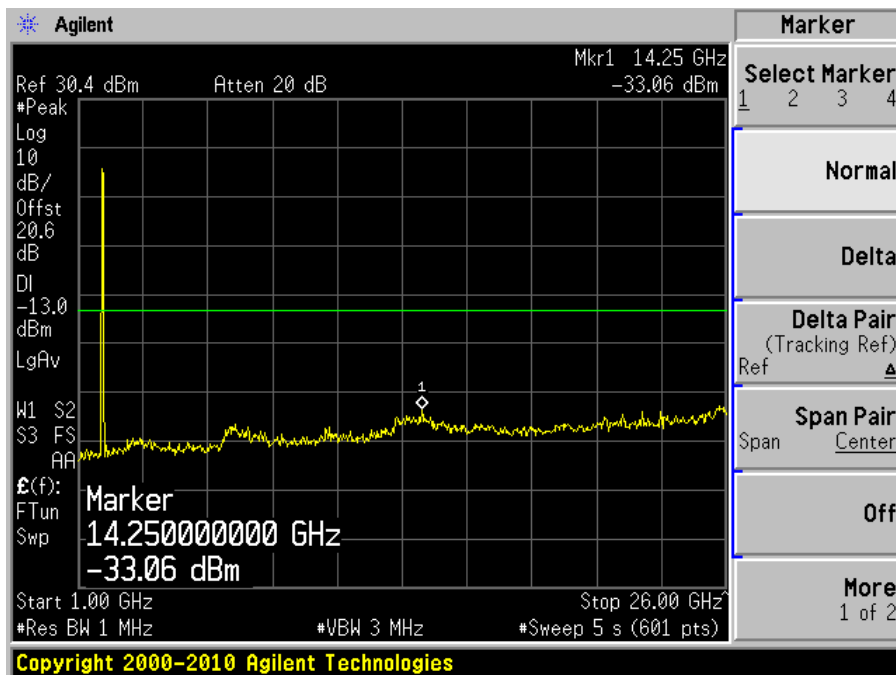
1 GHz to 20 GHz

**LTE 1900 MHz Band (downlink), Modulation: 16QAM (10 MHz bandwidth)**

**Low Channel (1935 MHz)**

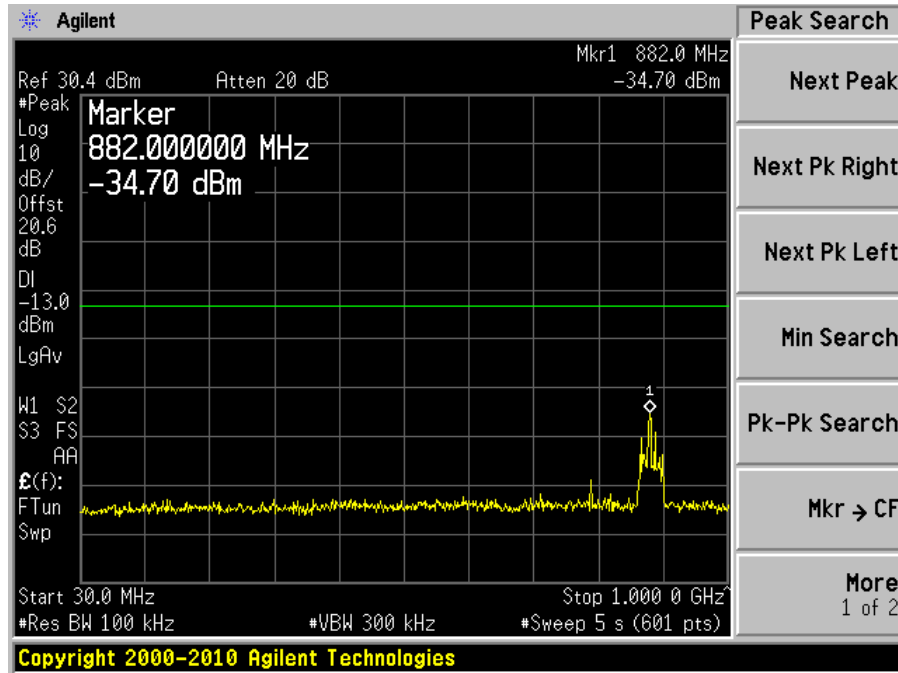


30 MHz to 1 GHz

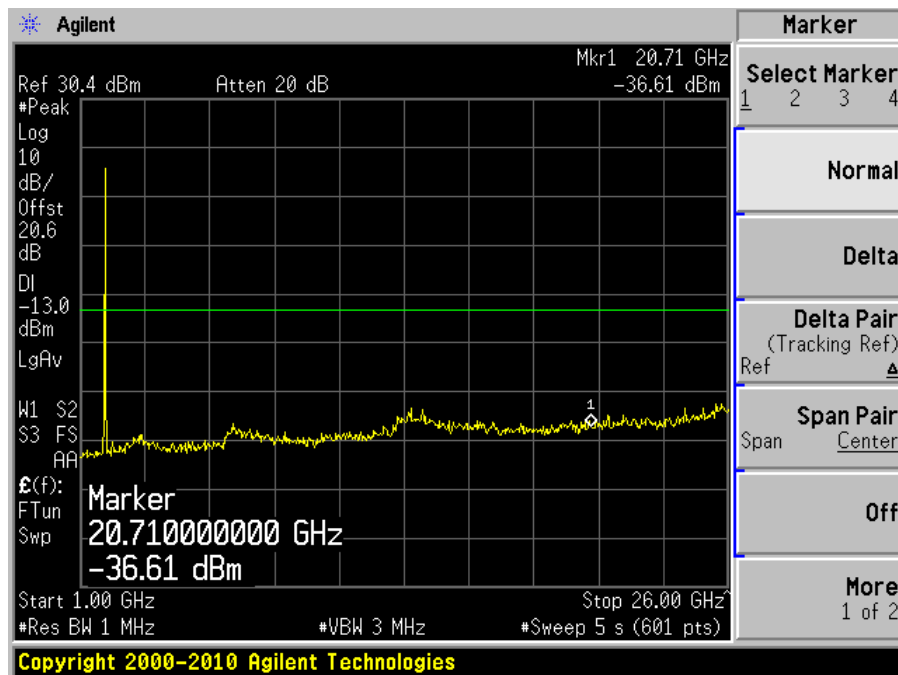


1 GHz to 20 GHz

### Middle Channel (1960 MHz)

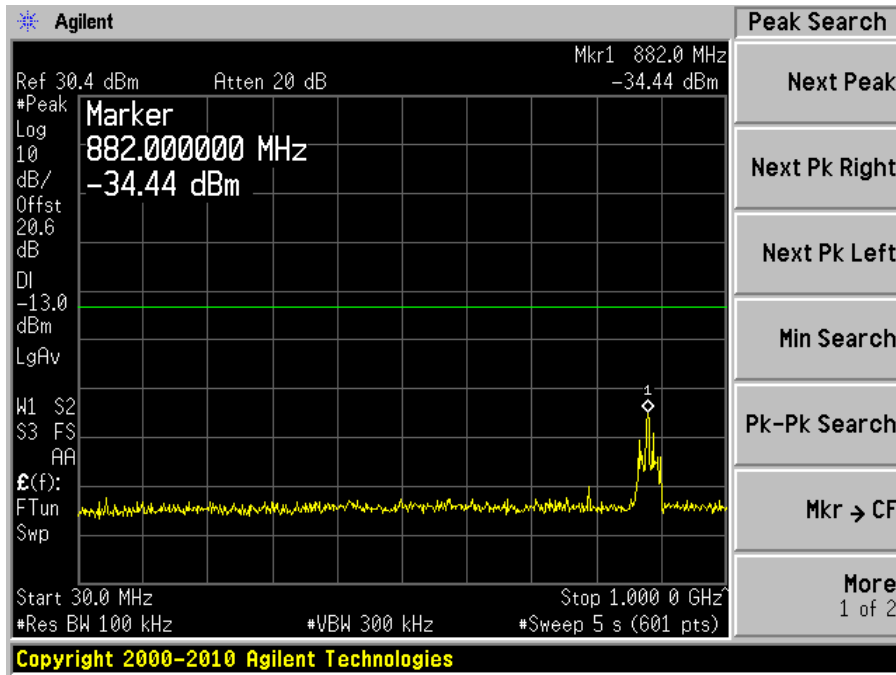


30 MHz to 1 GHz

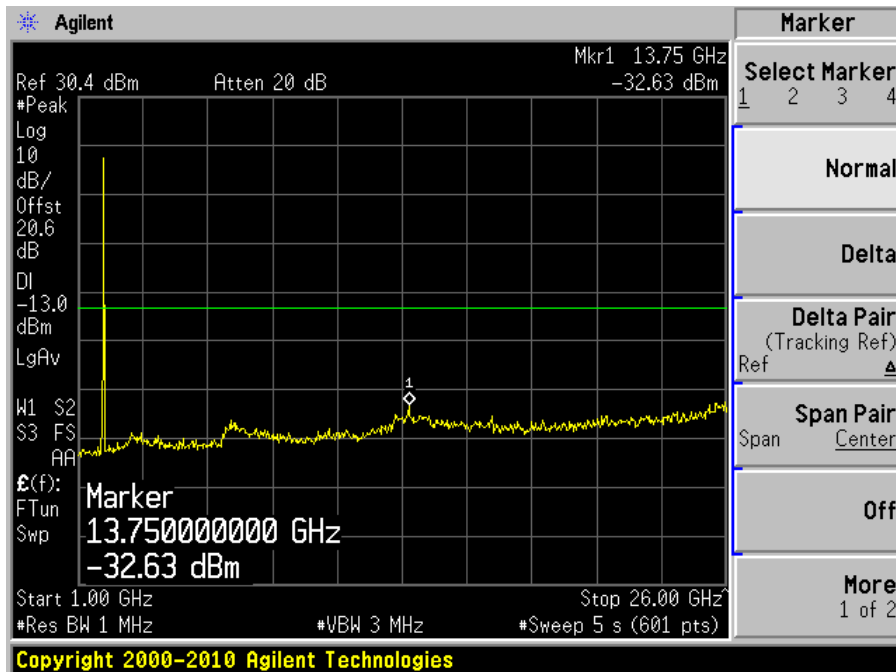


1 GHz to 20 GHz

### High Channel (1985 MHz)



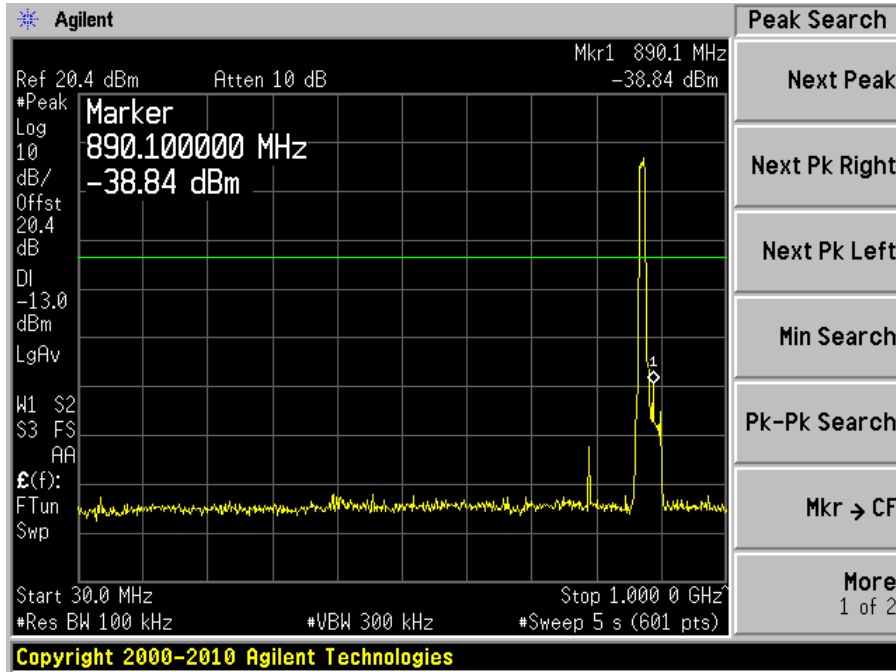
30 MHz to 1 GHz



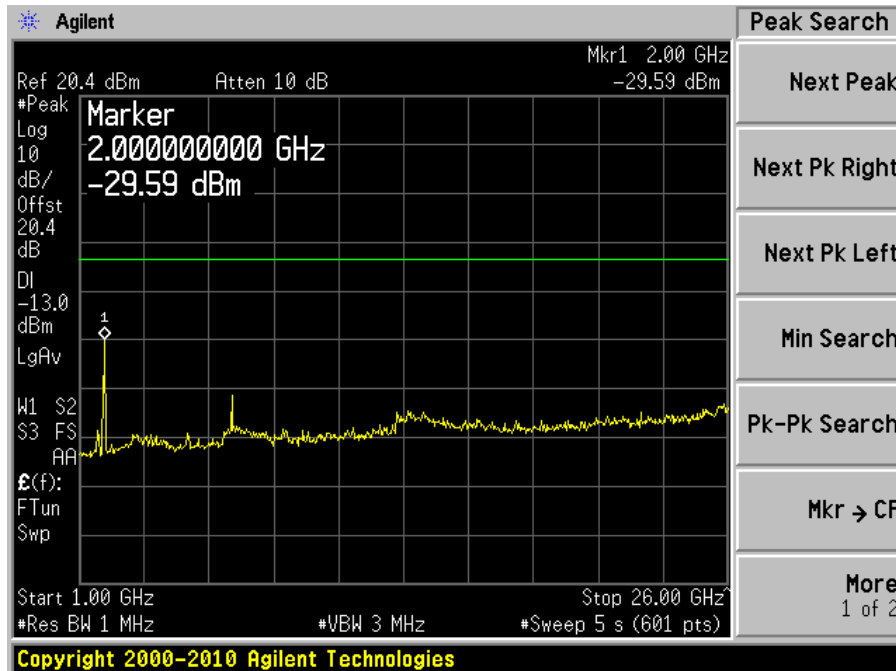
1 GHz to 20 GHz

**LTE 850 MHz Band (downlink), Modulation: 64QAM (10 MHz bandwidth)**

**Low Channel (874 MHz)**

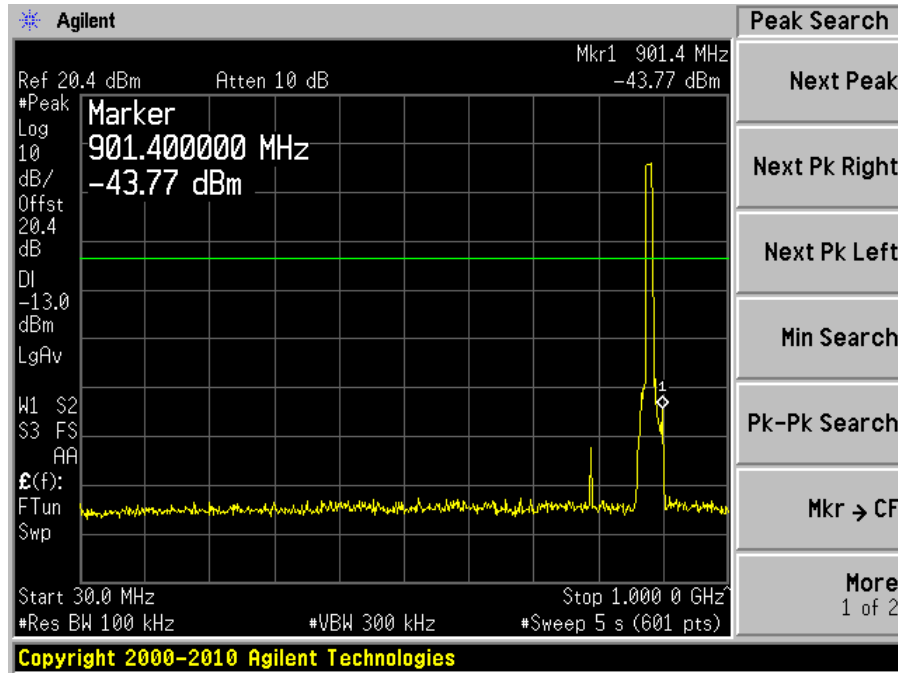


30 MHz to 1 GHz

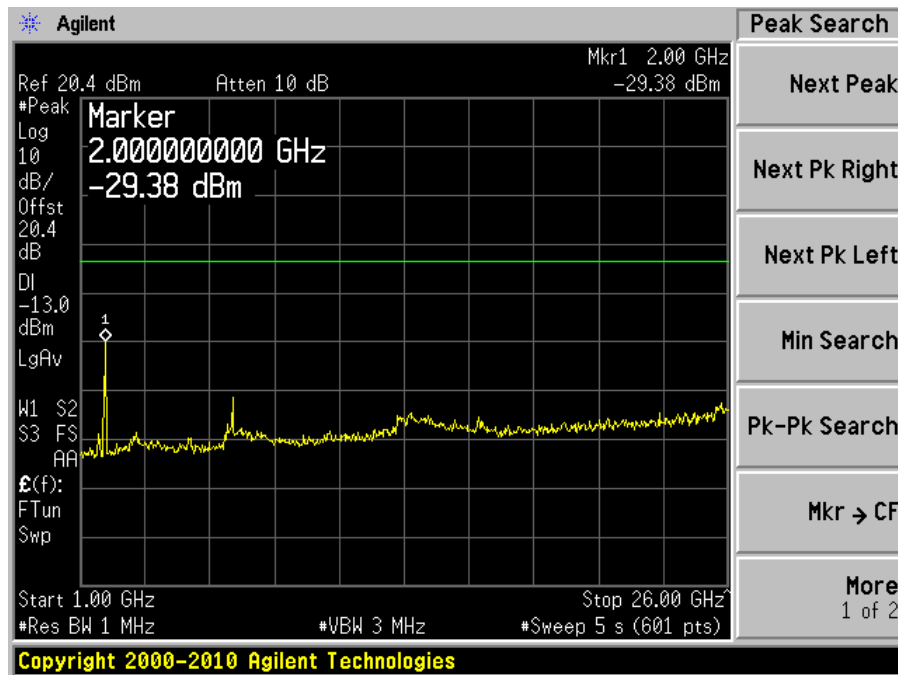


1 GHz to 20 GHz

### Middle Channel (881.5 MHz)

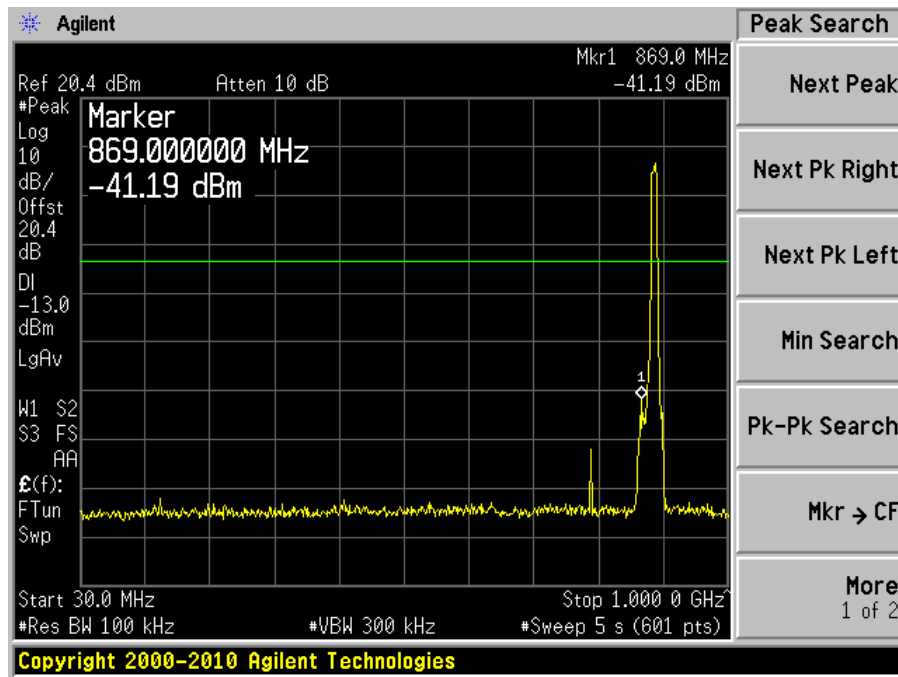


30 MHz to 1 GHz

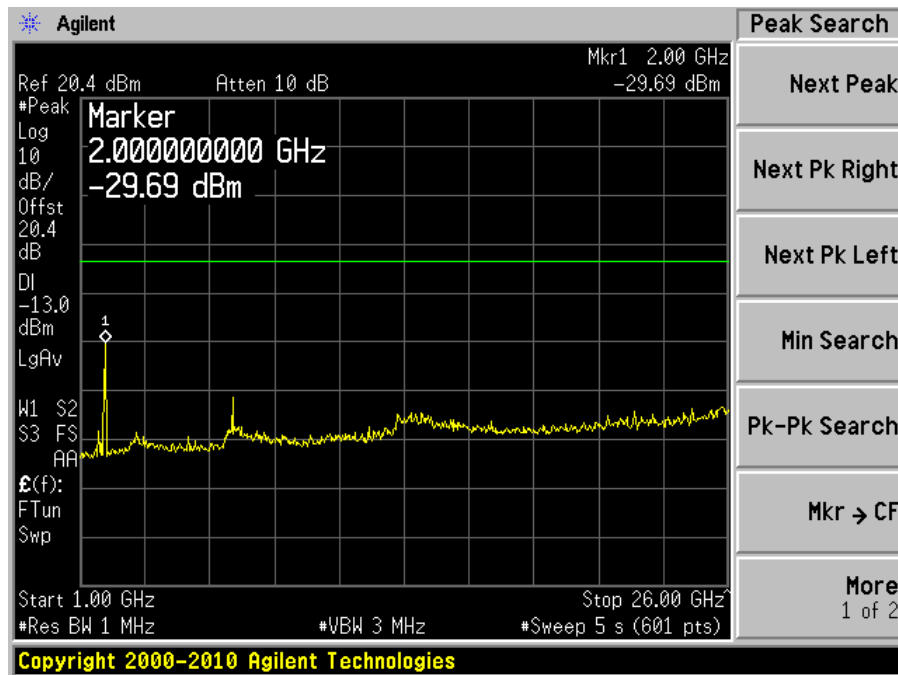


1 GHz to 20 GHz

### High Channel (889 MHz)



30 MHz to 1 GHz

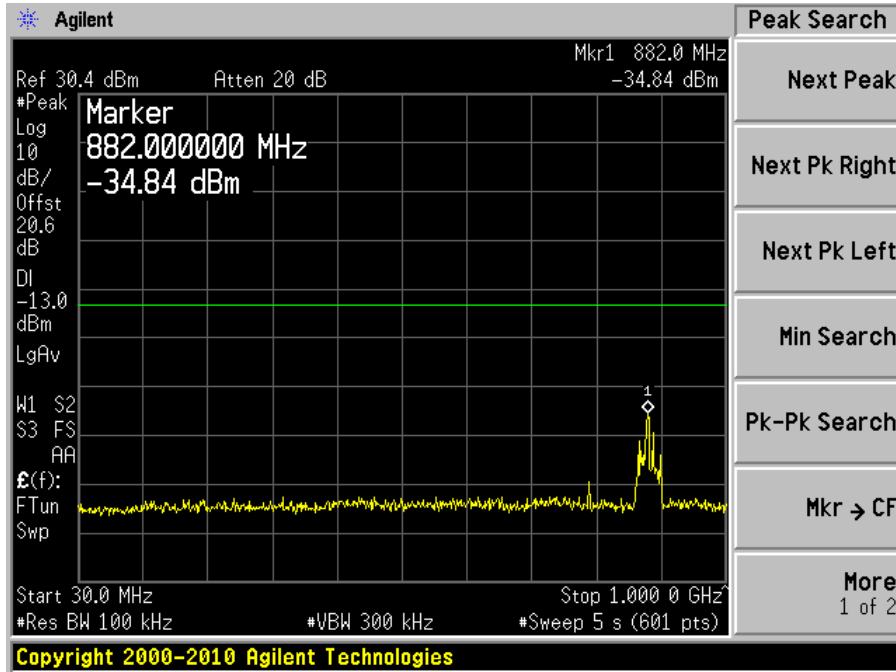


1 GHz to 20 GHz

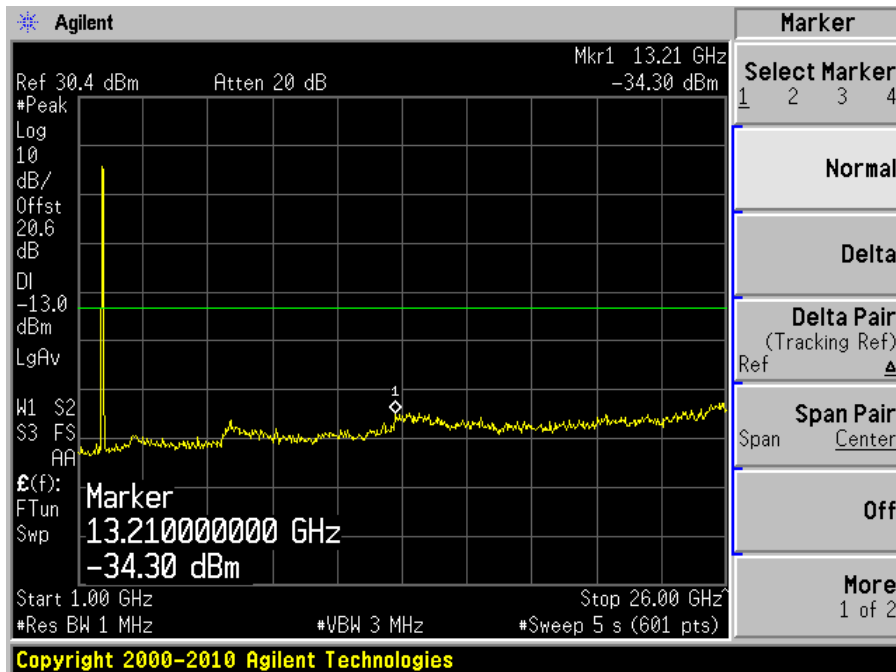


**LTE 1900 MHz Band (downlink), Modulation: 64QAM (10 MHz bandwidth)**

**Low Channel (1935 MHz)**

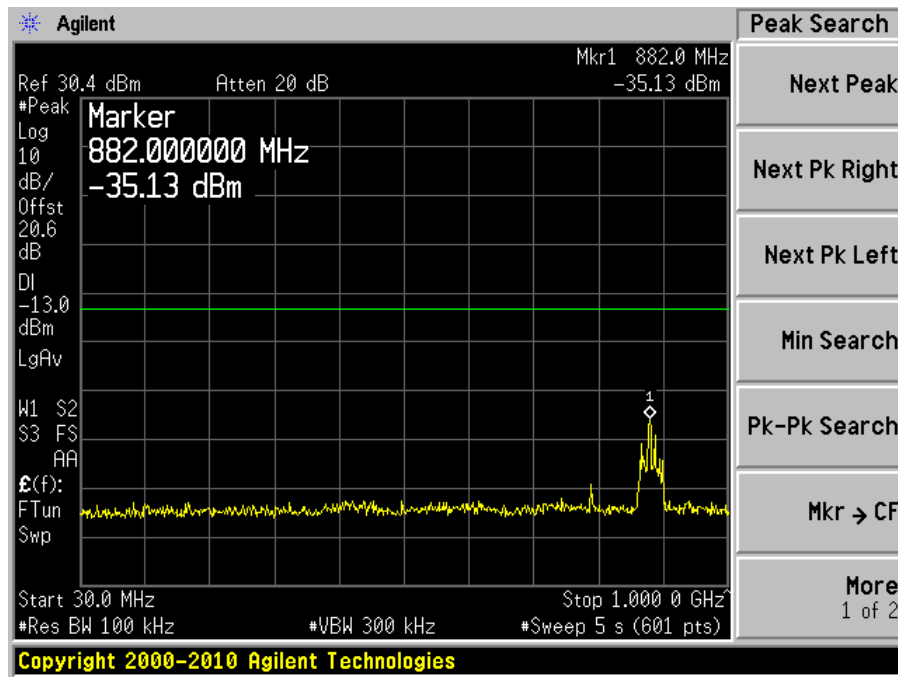


30 MHz to 1 GHz

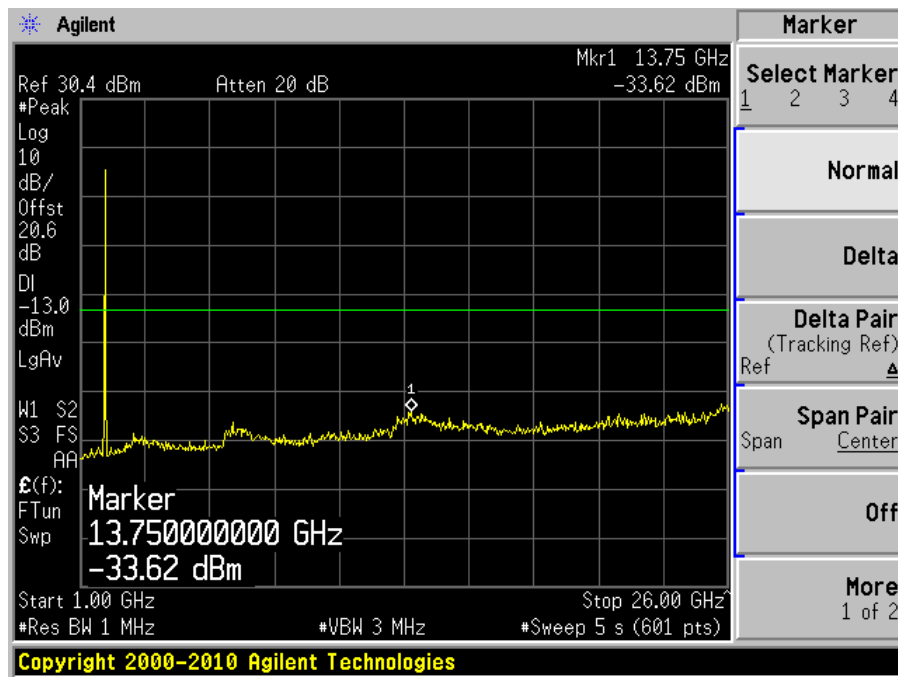


1 GHz to 20 GHz

Middle Channel (1960 MHz)

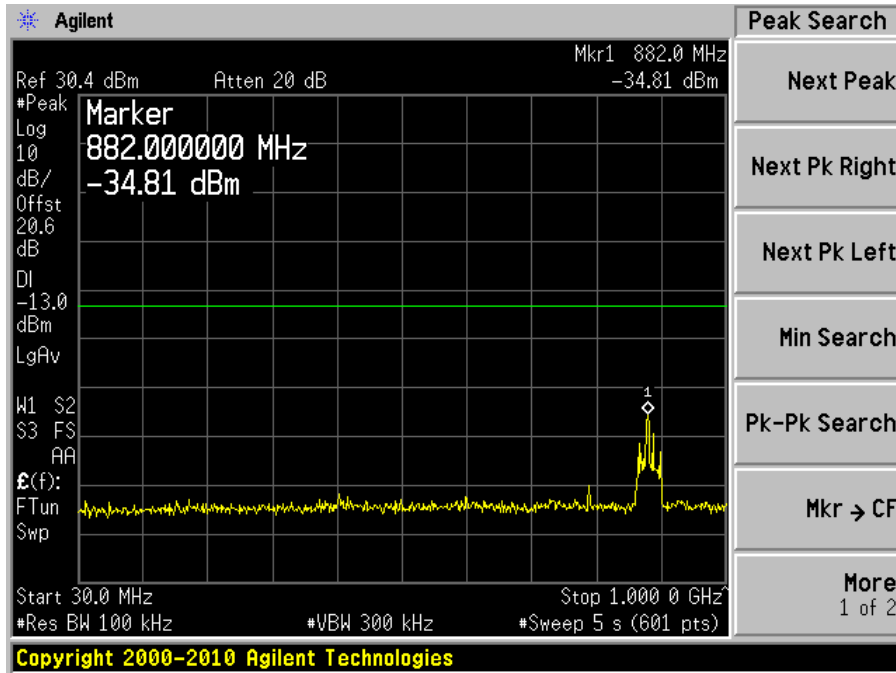


30 MHz to 1 GHz

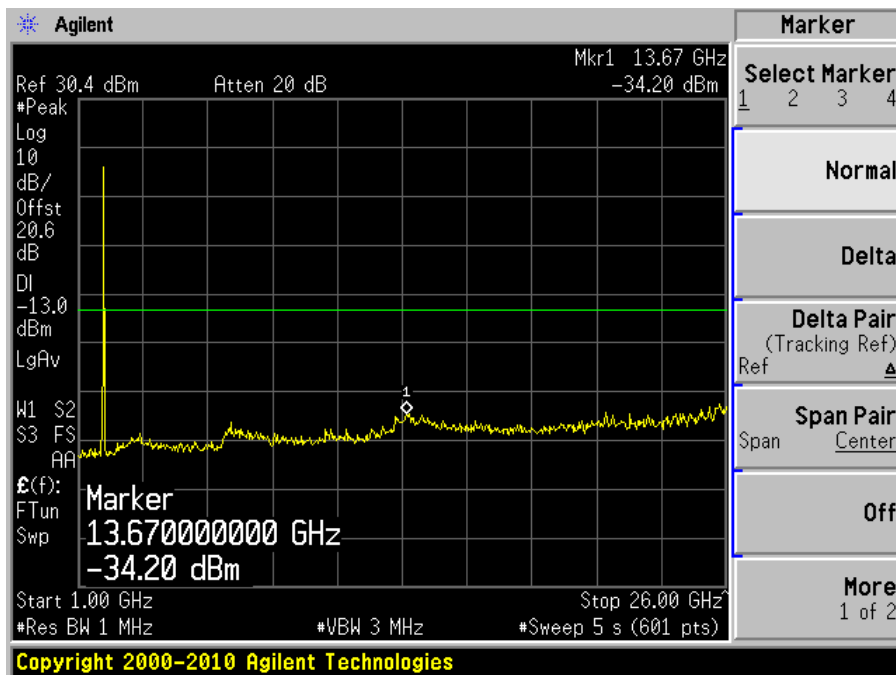


1 GHz to 20 GHz

### High Channel (1985 MHz)



30 MHz to 1 GHz

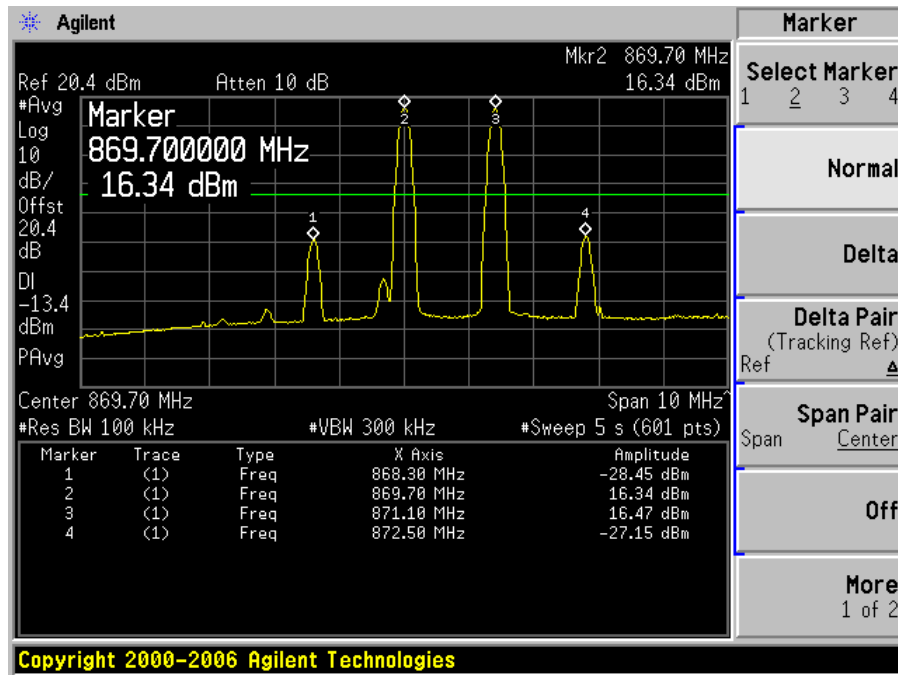


1 GHz to 20 GHz

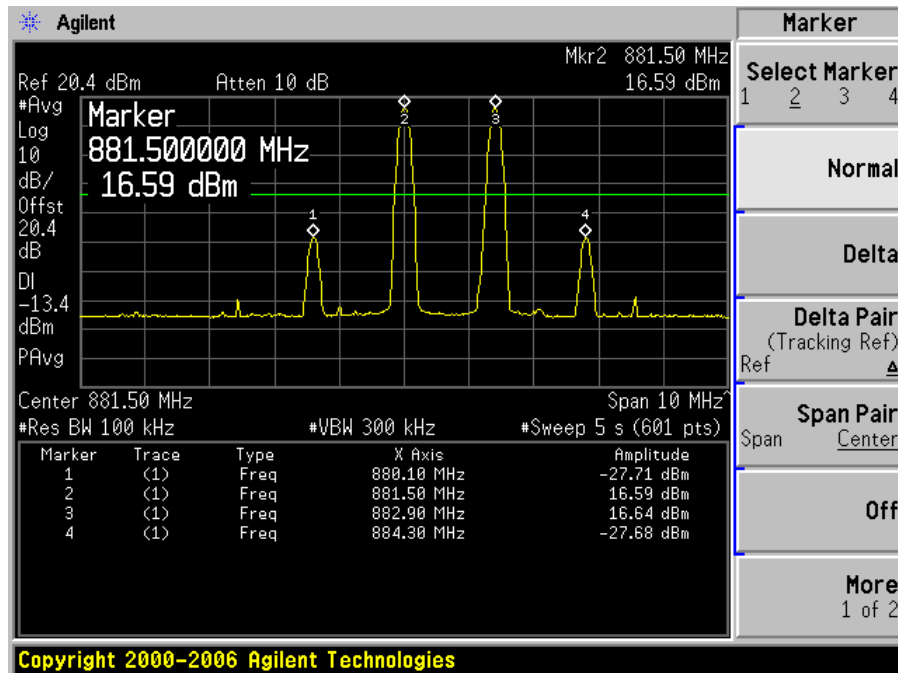
**Inter-modulation:**

**850 MHz Band, Downlink:**

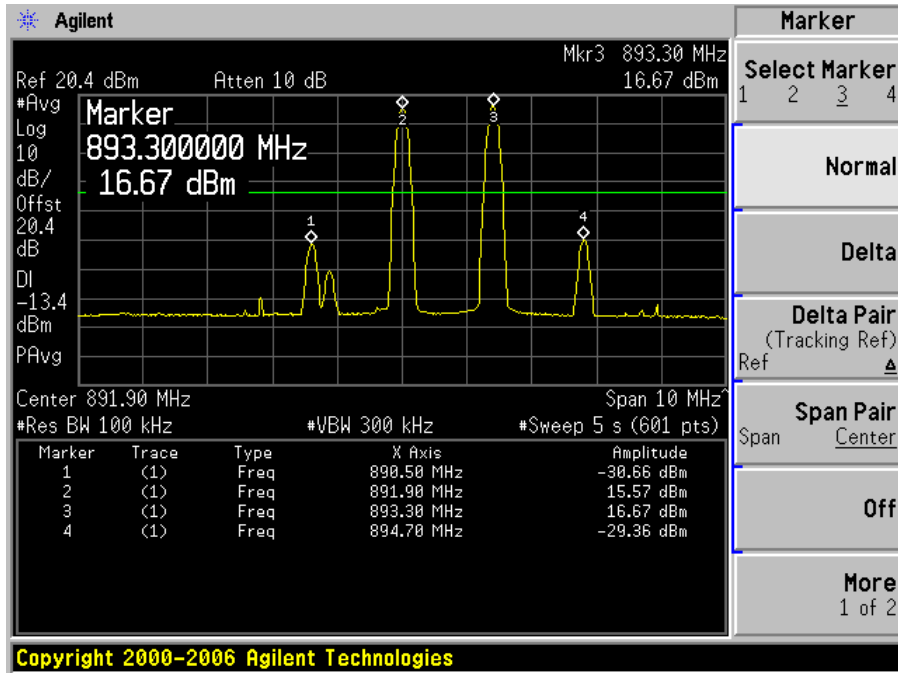
Low channel



Middle Channel

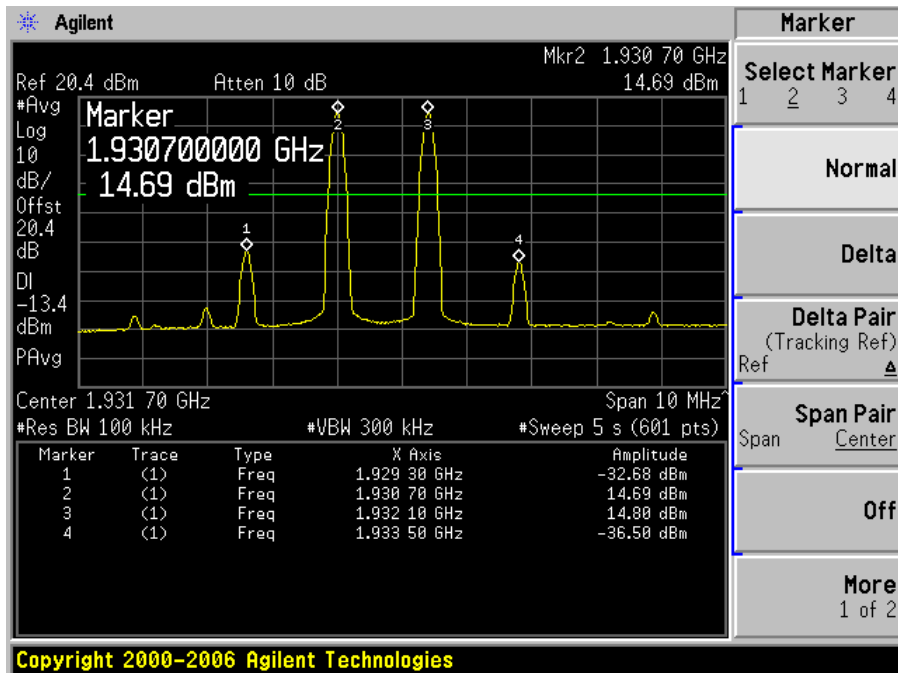


### High Channel

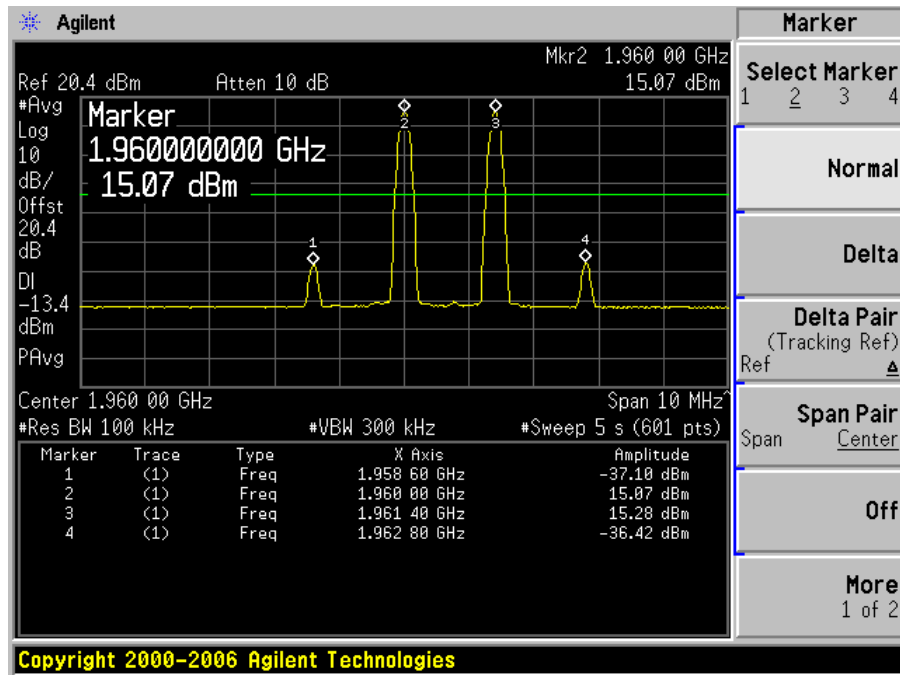


### 1900 MHz Band, Downlink:

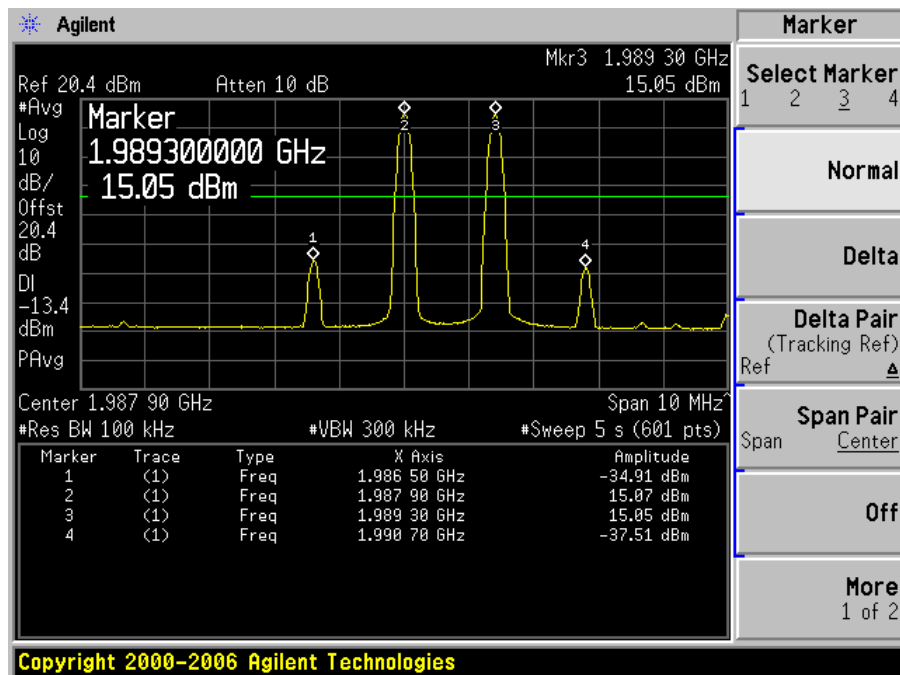
### Low Channel



Middle Channel



High Channel



## 9 §22.917 & §24.238 – 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.

### 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	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Analyzer, Spectrum	E4440A	US45303156	2010-08-09

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

### 9.4 Test Environmental Conditions

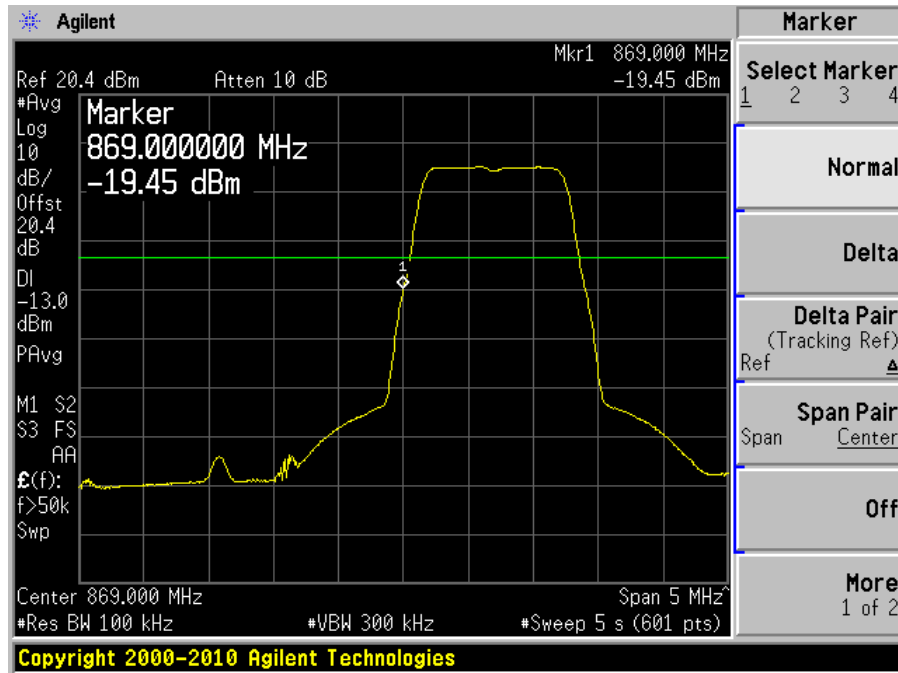
<b>Temperature:</b>	20~24 °C
<b>Relative Humidity:</b>	35~42 %
<b>ATM Pressure:</b>	101.1~101.7 kPa

\* *The testing was performed by Quinn Jiang on 2011-05-18 ~ 2011-5-20*

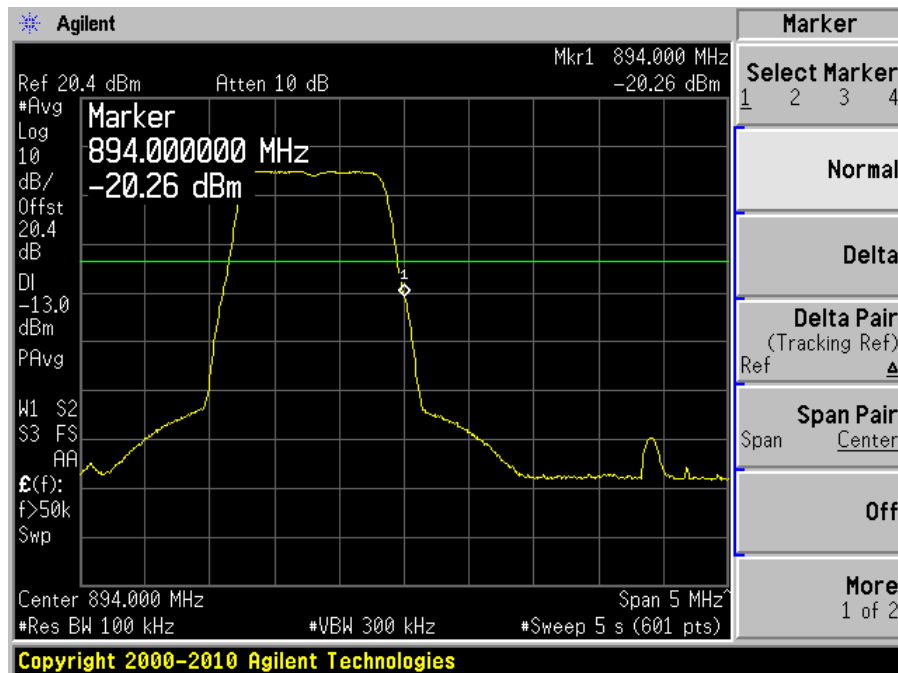
### 9.5 Test Results

Please refer to the following plots.

**LTE 850 MHz Band (downlink), Modulation: QPSK (1.4 MHz bandwidth)**



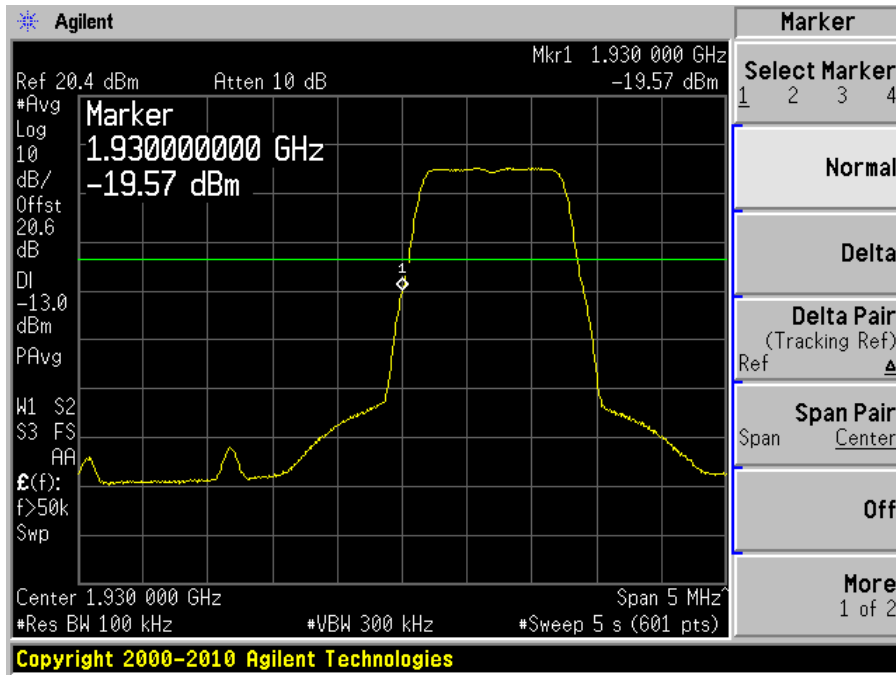
Low Channel



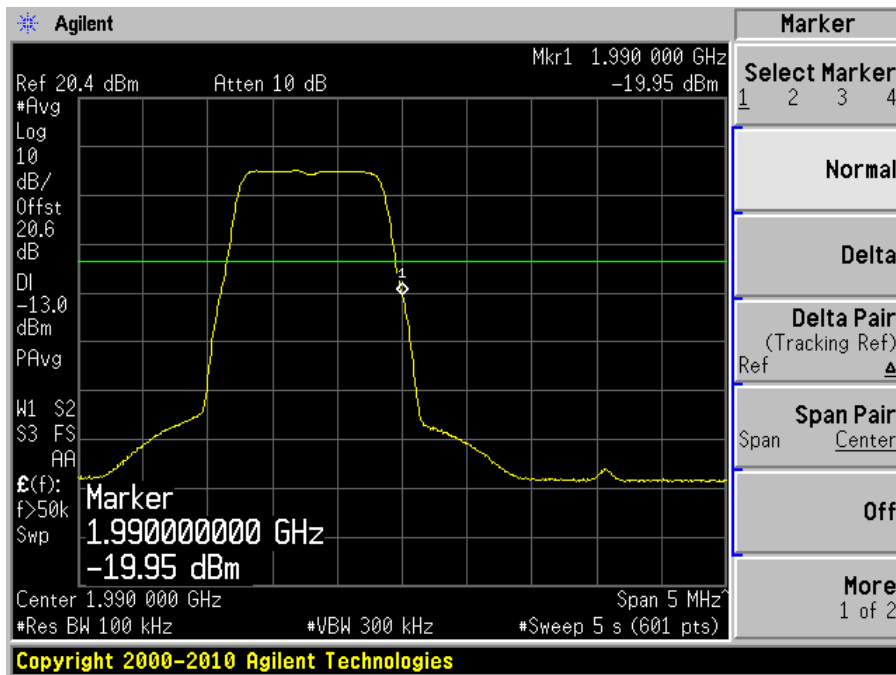
High Channel



**LTE 1900 MHz Band (downlink), Modulation: QPSK (1.4 MHz bandwidth)**

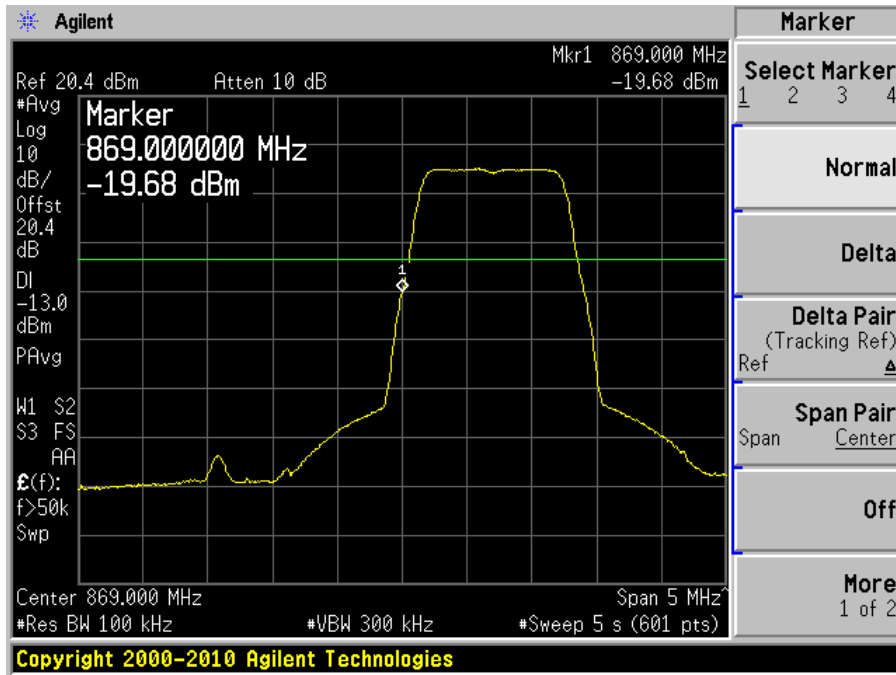


Low Channel

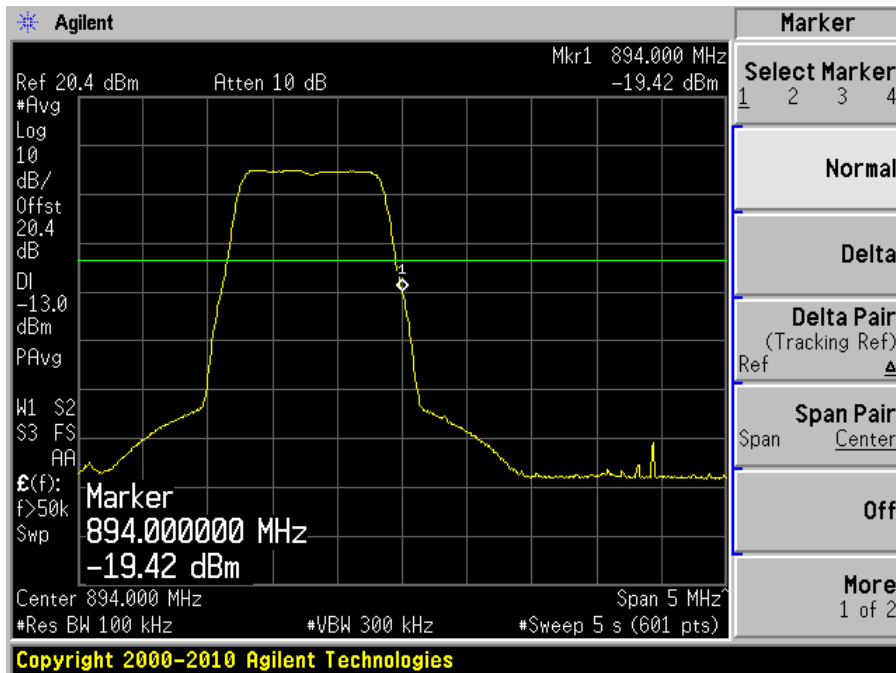


High Channel

**LTE 850 MHz Band (downlink), Modulation: 16QAM (1.4 MHz bandwidth)**

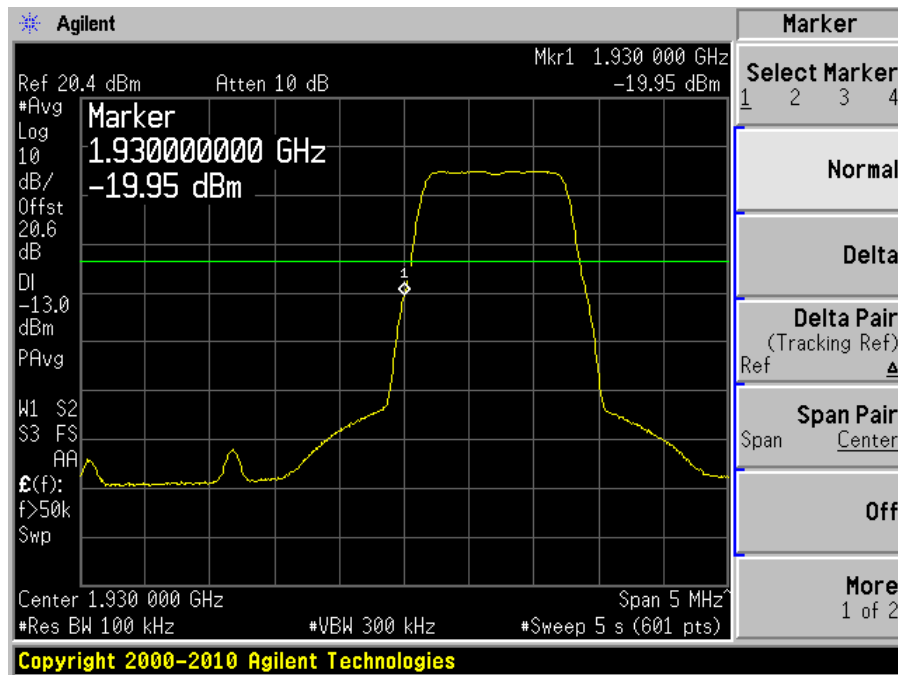


Low Channel

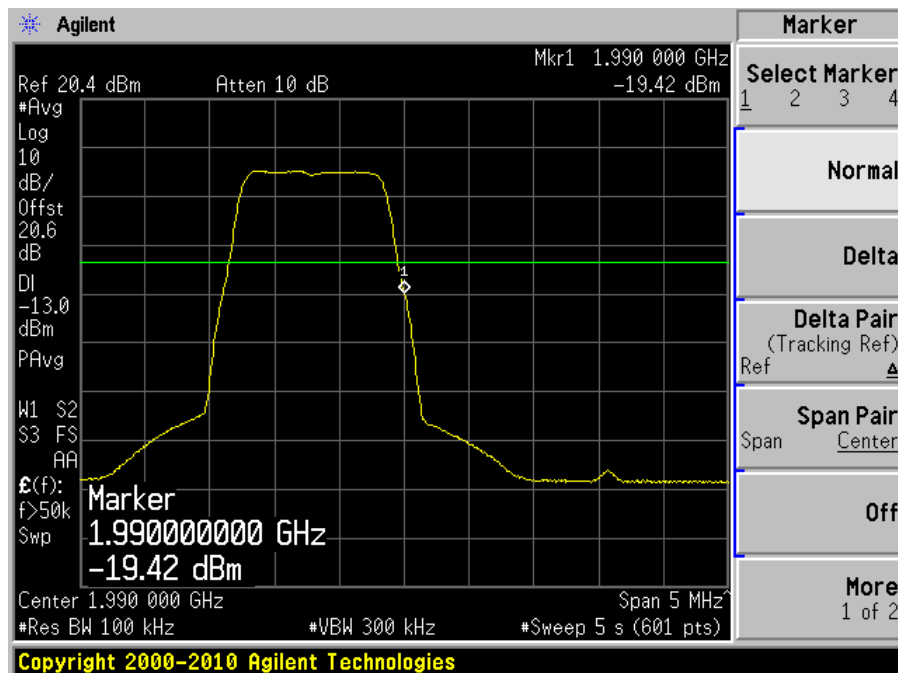


High Channel

**LTE 1900 MHz Band (downlink), Modulation: 16QAM (1.4 MHz bandwidth)**

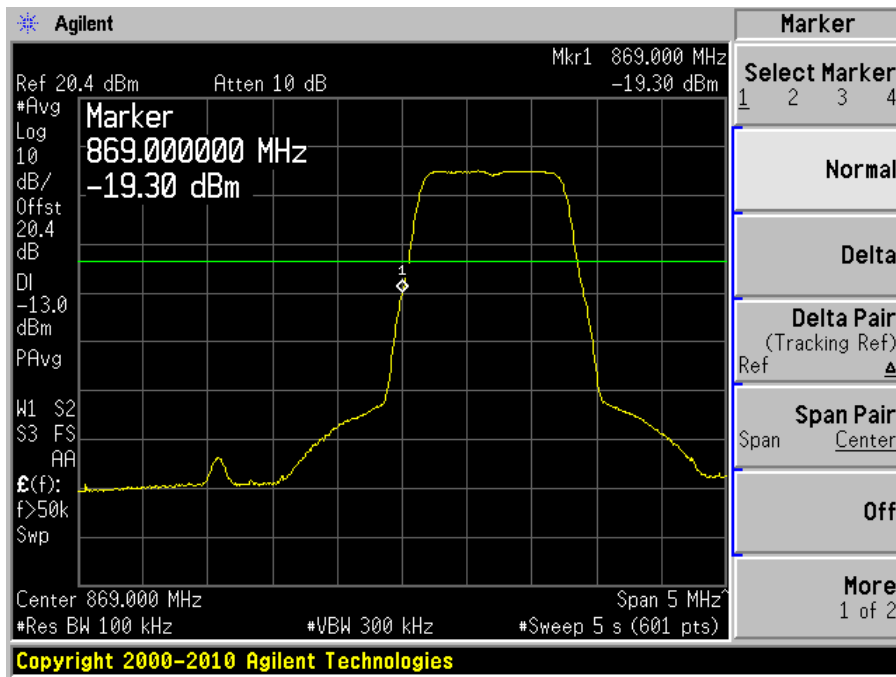


Low Channel

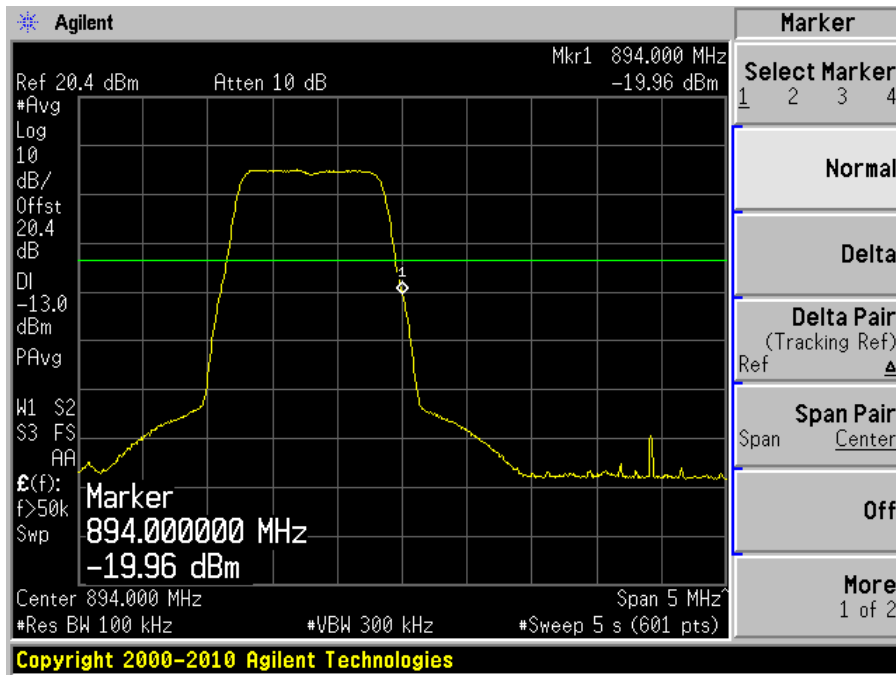


High Channel

**LTE 850 MHz Band (downlink), Modulation: 64QAM (1.4 MHz bandwidth)**

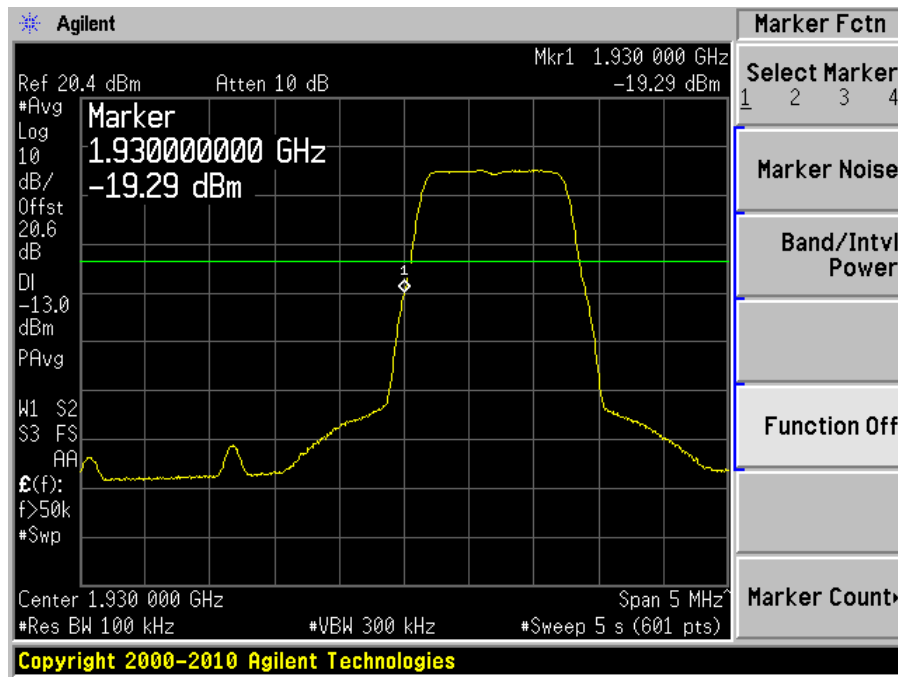


Low Channel

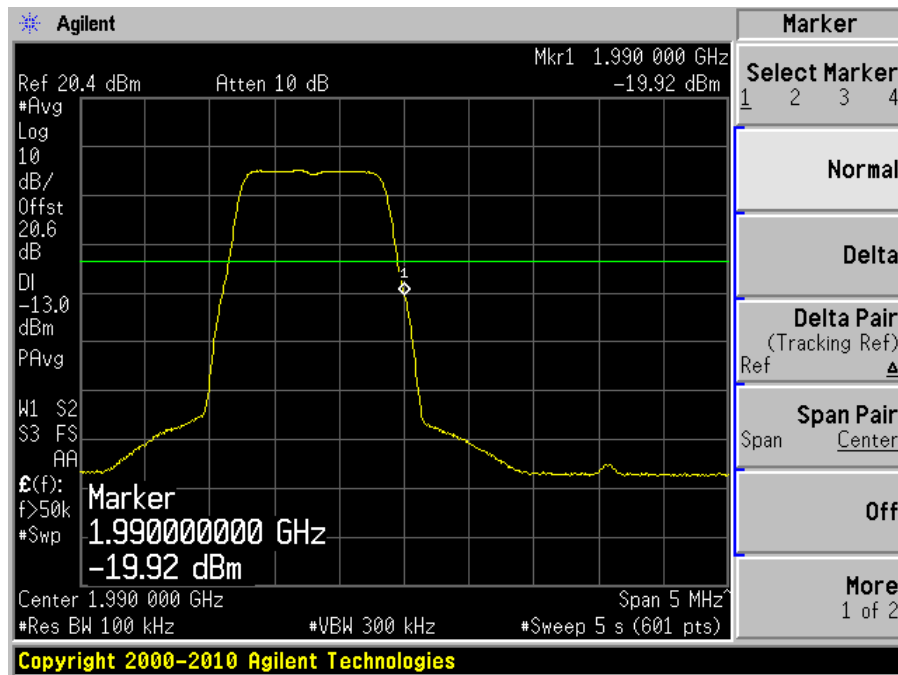


High Channel

**LTE 1900 MHz Band (downlink), Modulation: 64QAM (1.4 MHz bandwidth)**

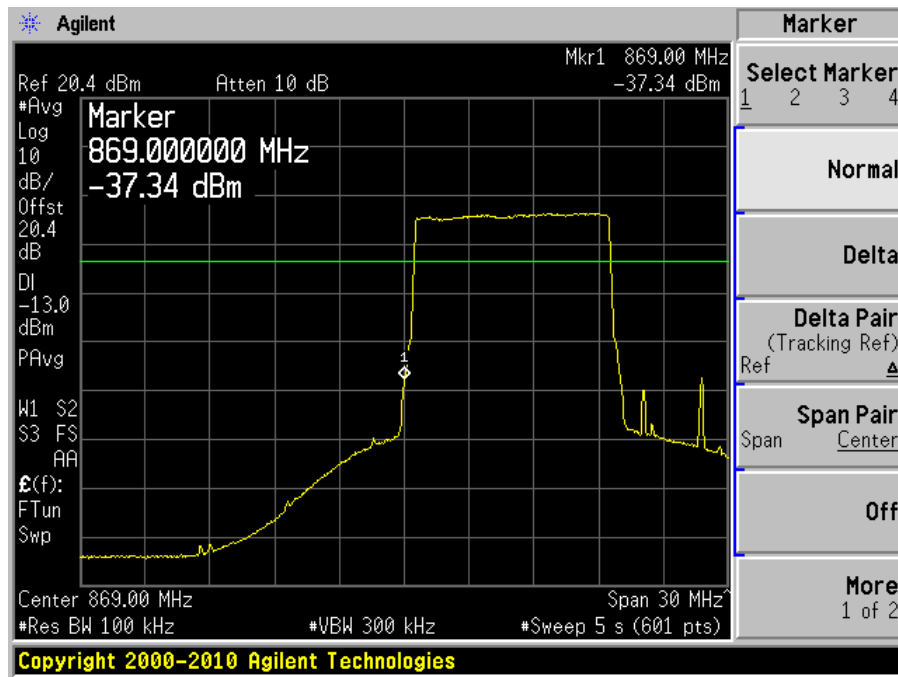


Low Channel

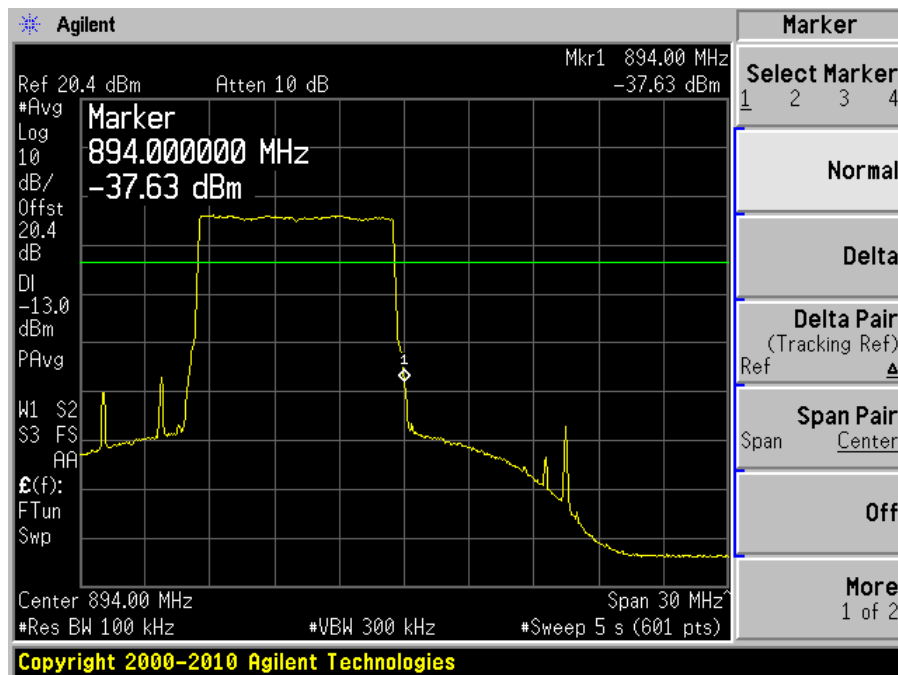


High Channel

**LTE 850 MHz Band (downlink), Modulation: QPSK (10 MHz bandwidth)**

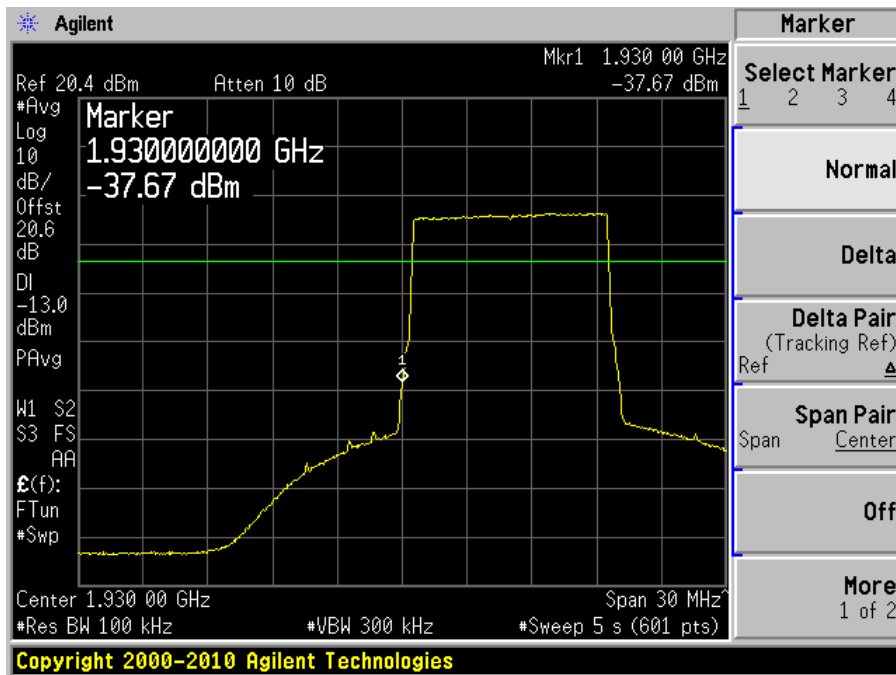


Low Channel

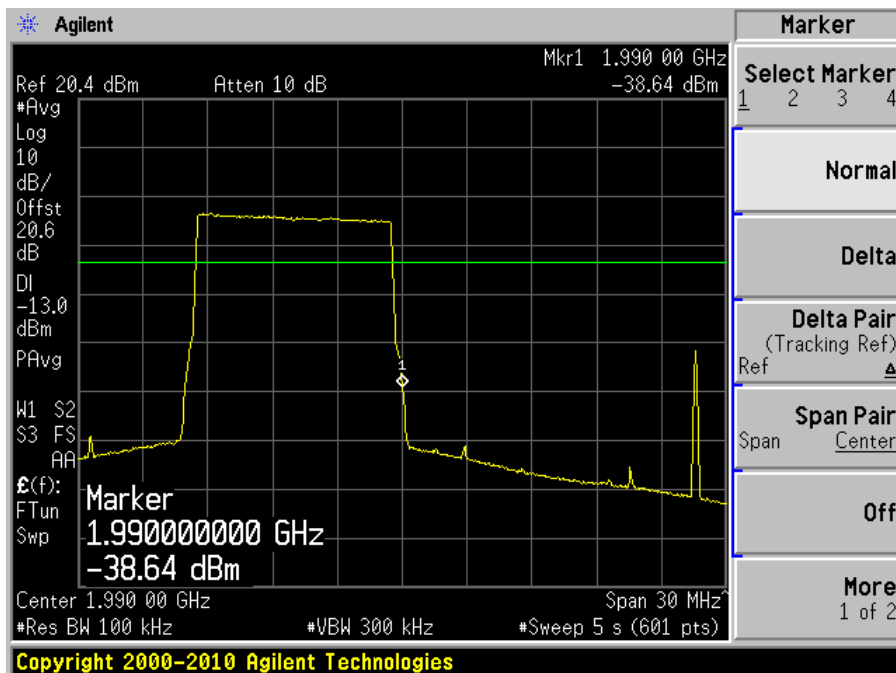


High Channel

**LTE 1900 MHz Band (downlink), Modulation: QPSK (10 MHz bandwidth)**

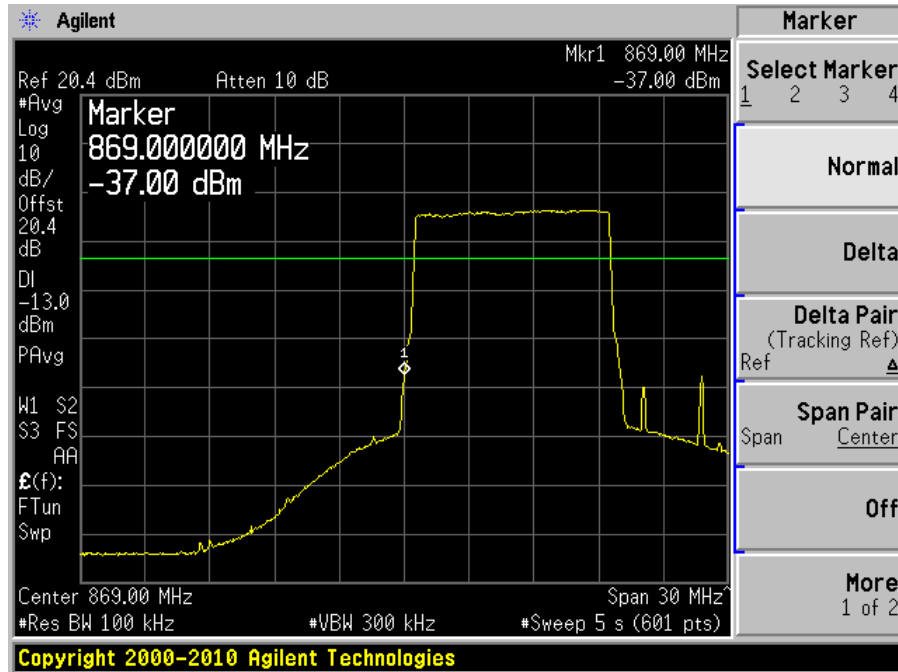


Low Channel

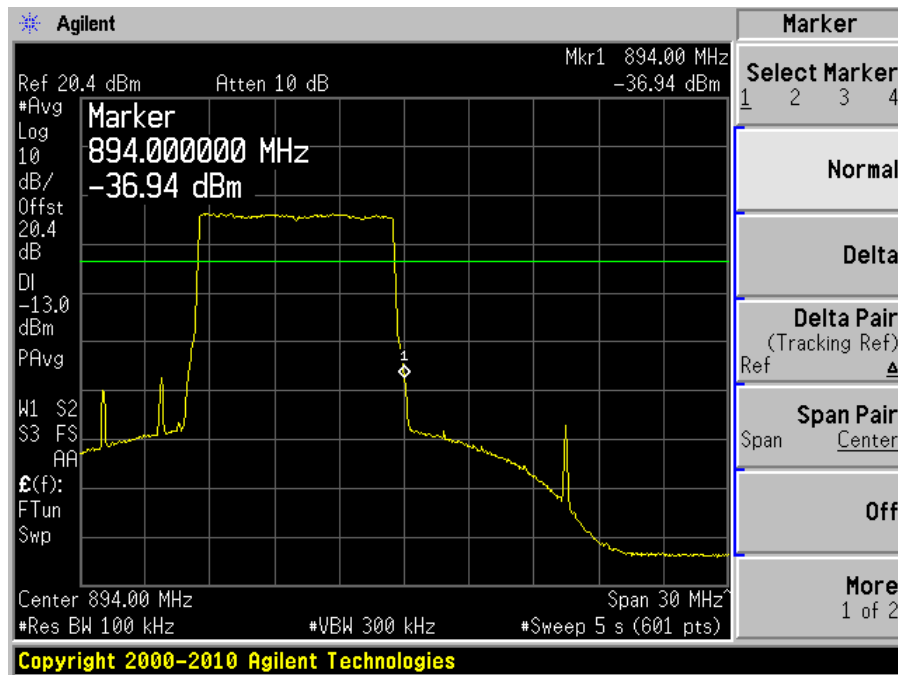


High Channel

**LTE 850 MHz Band (downlink), Modulation: 16QAM (10 MHz bandwidth)**



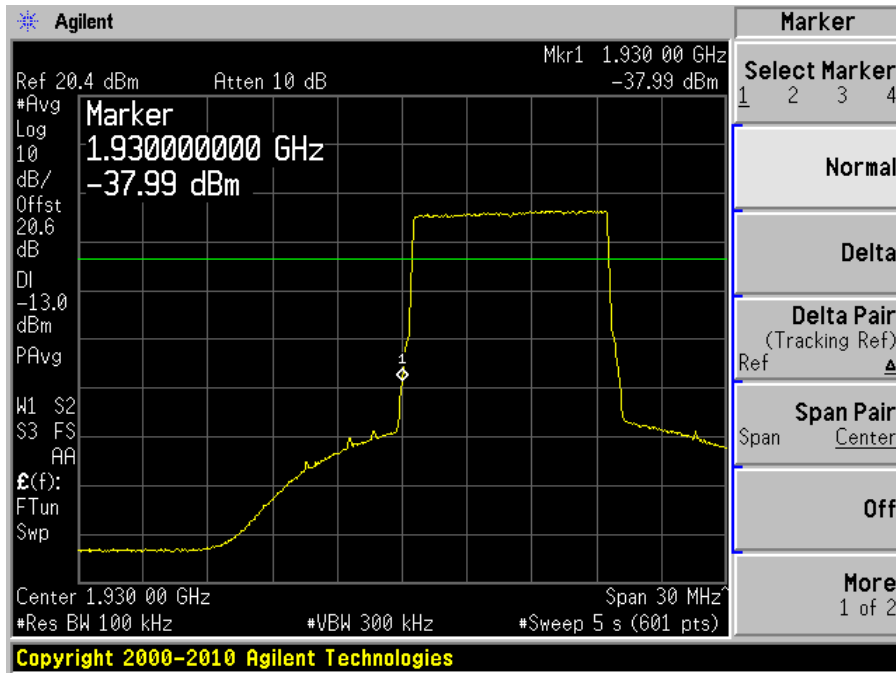
Low Channel



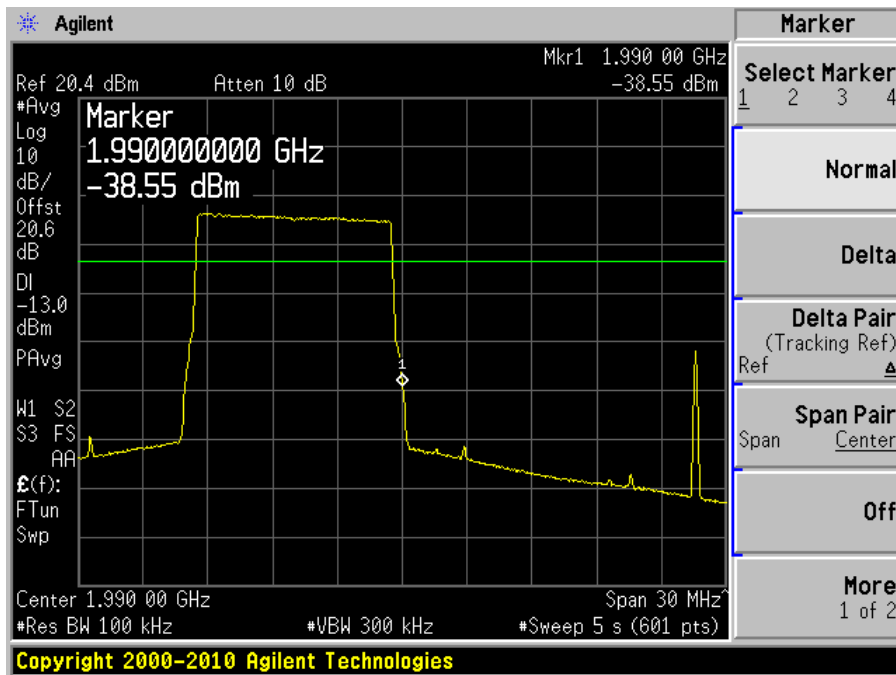
High Channel



**LTE 1900 MHz Band (downlink), Modulation: 16QAM (10 MHz bandwidth)**

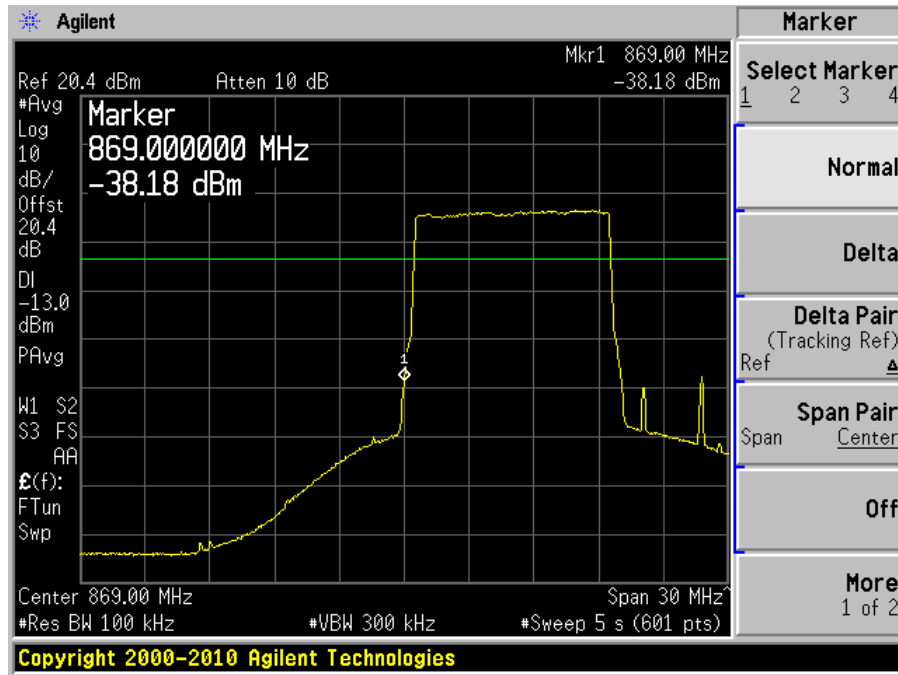


Low Channel

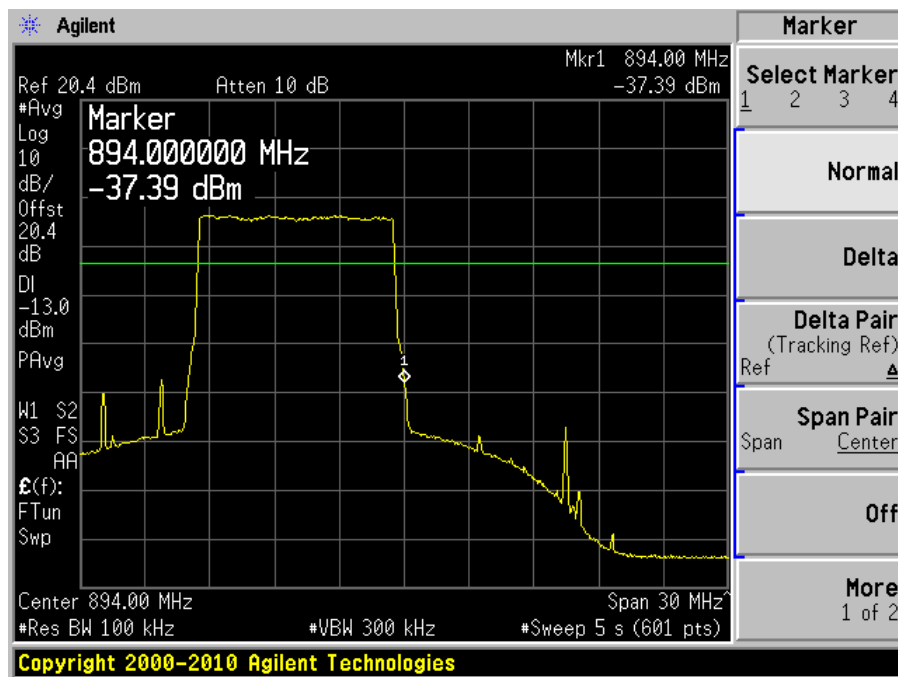


High Channel

**LTE 850 MHz Band (downlink), Modulation: 64QAM (10 MHz bandwidth)**

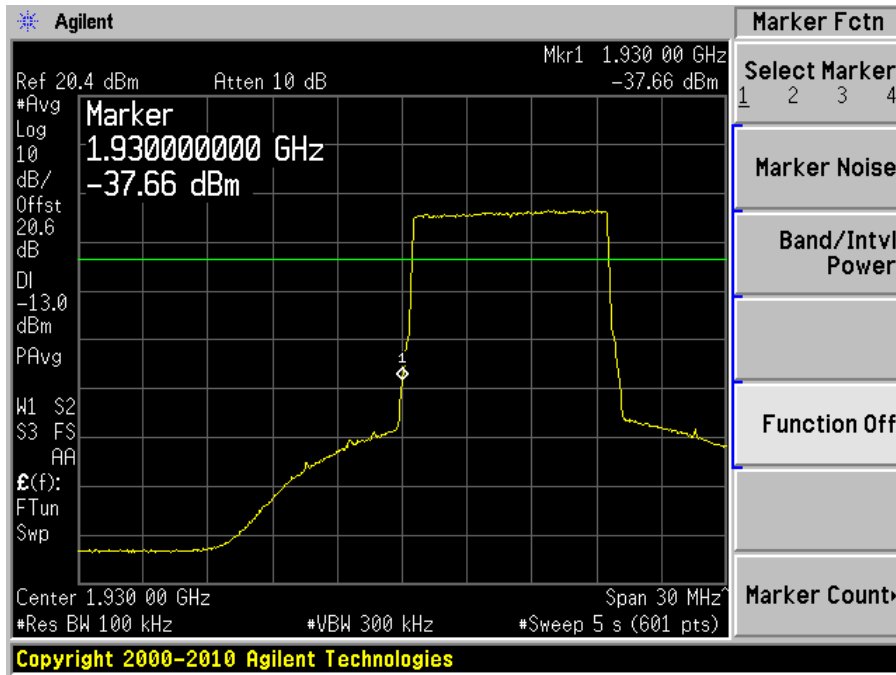


Low Channel

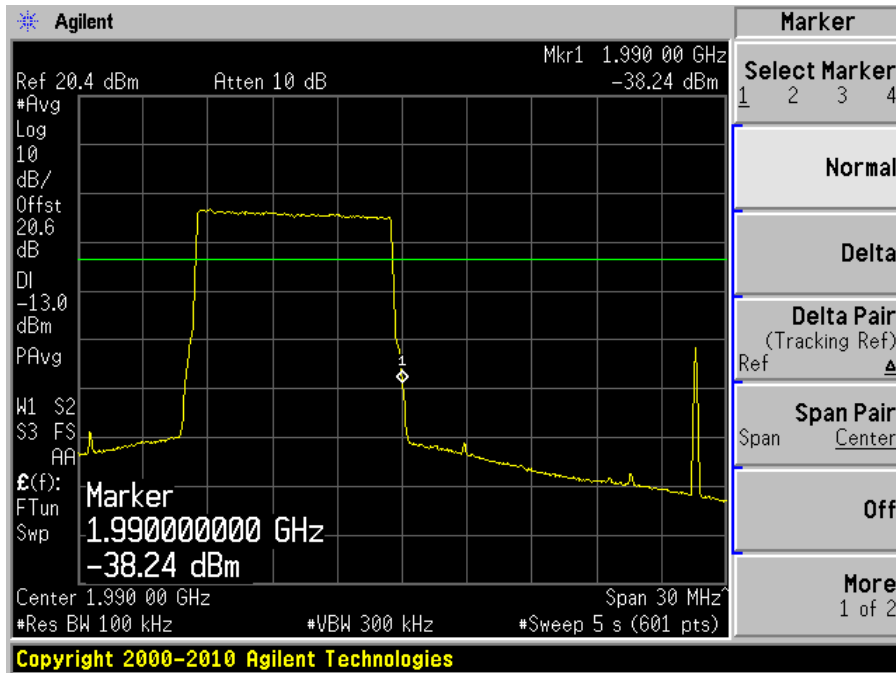


High Channel

**LTE 1900 MHz Band (downlink), Modulation: 64QAM (10 MHz bandwidth)**



Low Channel



High Channel

## 10 §1.1307(b) (1) & §2.1091 - RF EXPOSURE INFORMATION

### 10.1 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 <sup>2</sup> )	Averaging Time (minute)
<b>Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	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

### 10.2 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

#### 850 MHz Cellular Band Downlink (LTE):

Maximum peak output power at antenna input terminal (dBm): 15.38

Maximum peak output power at antenna input terminal (mW): 34.51

Prediction distance (cm): 20

Prediction frequency (MHz): 881.5

Antenna Gain, typical (dBi): 3

Maximum Antenna Gain (numeric): 2

Power density at predication frequency and distance (mW/cm<sup>2</sup>): 0.01374

MPE limit for uncontrolled exposure at predication frequency (mW/cm<sup>2</sup>): 0.588

**PCS 1900 MHz Band Downlink (LTE):**

Maximum peak output power at antenna input terminal (dBm):	<u>15.37</u>
Maximum peak output power at antenna input terminal (mW):	<u>34.43</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>1960</u>
Antenna Gain, typical (dBi):	<u>3</u>
Maximum Antenna Gain (numeric):	<u>2</u>
Power density at predication frequency and distance (mW/cm <sup>2</sup> ):	<u>0.01371</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm <sup>2</sup> ):	<u>1.00</u>

**Test Result**

For Downlink, the highest power density level at 20 cm is 0.01374 mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 0.588 mW/cm<sup>2</sup> at 881.5 MHz.

So the indoor antenna prediction distance should be greater than 20 cm, and outdoor antenna prediction distance should be greater than 20 cm.