Lab Code: 200167-0

FCC PART 27

TEST AND MEASUREMENT REPORT

For

Wilson Electronics, Inc.

3301 East Deseret Drive,

St. George, Utah 84790, USA

FCC ID: PWO271865
Model: 271865

Report Type:	**Product Type:**
Original Report	LTE Signal Booster

Test Engineer: Quinn Jiang

Report Number: R1106171-27

Report Date: 2011-08-16

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1106171-27	Original Report	2011-08-16

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Wilson Electronics, Inc.,* and their product, *FCC ID: PWO271865*, model: *271865*, which will henceforth be referred to as the EUT "Equipment Under Test". The EUT is a LTE Signal Booster. 50 Ω N-type connectors are used for connecting to both the inside and outside antenna connections of the amplifier. The downlink frequency range is 746 MHz to 757 MHz. The uplink frequency range is 776 MHz to 787 MHz. The amplifier contains a microcontroller which controls the gain. The self-generated clock frequency of the microcontroller is 16 MHz. The modulation type is OFDMA.

Technical Specification

Modulation	Frequency (MHz)	
	Downlink	Uplink
LTE	746-757	776-787

1.2 Mechanical Description

The EUT Approximate measurement is: 155 mm (L) x 100 mm (W) x 30 mm (H). Weight: 586 g.

The test data gathered are from production sample, serial number: 801865999910590, provided by the manufacturer.

1.3 Objective

This type approval report is prepared on behalf of *Wilson Electronics, Inc*. in accordance with Part 2, Subpart J, 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, band edge, and conducted and radiated margin.

1.4 Related Submittal(s)/Grant(s)

N/A

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 27 - Miscellaneous Wireless Communications Services
Applicable Standards: TIA/EIA-603-C, ANSI C63.4-2003.

All radiated and conducted emission 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, signal was sent through EUT using a signal generator, device was set to normal operating mode.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment and Software List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Signal Generator	SMIQ03	DE23746
Dell	Laptop	Latitude D600	CN-0X2034-48643-3A6-8307
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309
Agilent	Signal Studio for 3GPP LTE	N7624B	-

2.5 Internal Configurations of EUT

Manufacturer	Description	Model	Serial Number
Wilson Electronics, Inc.	Main PCB Board	PCB-801865 REV C	-

1.8 EUT Power Supply Information

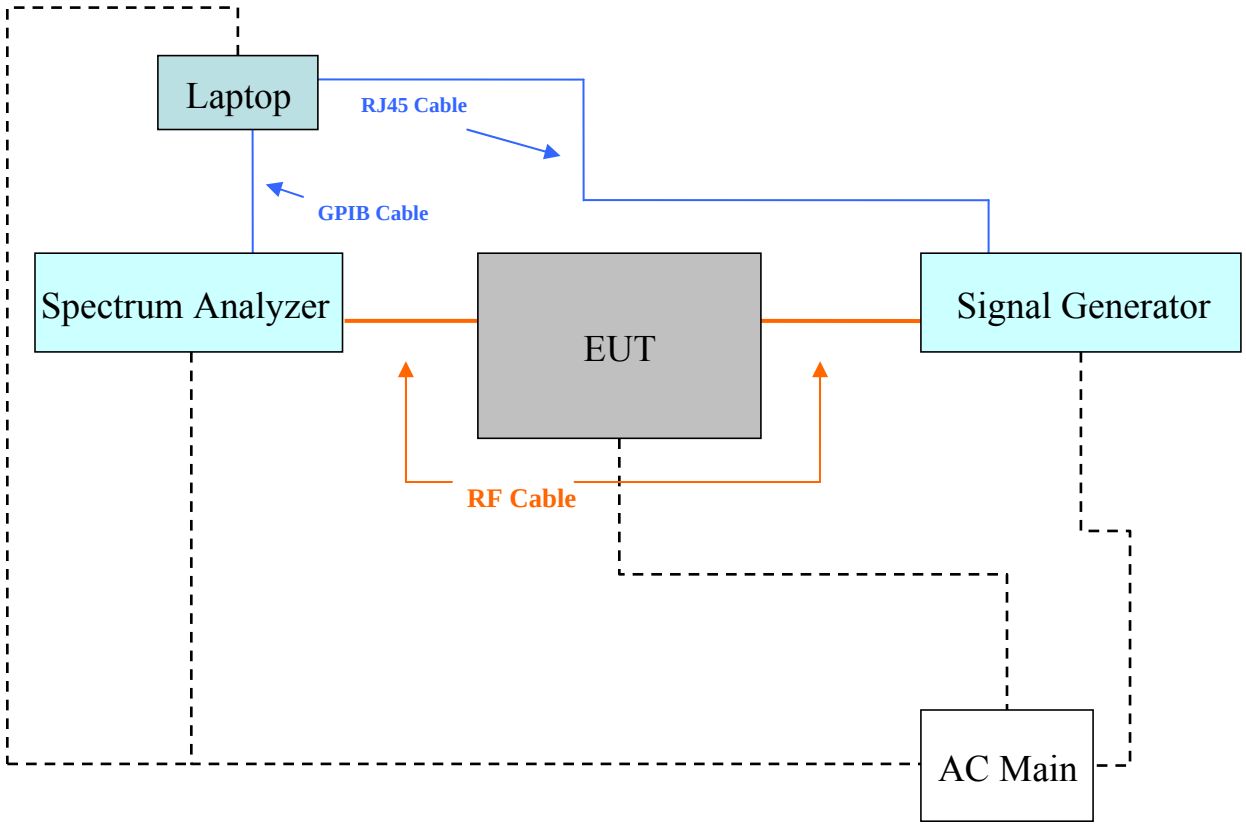
Manufacturer	Description	Model	Serial Number
Jentec Technology Co., Ltd.	AC/DC Power Adapter	AF1806-B	32LCP9

2.6 Interface Ports and Cables

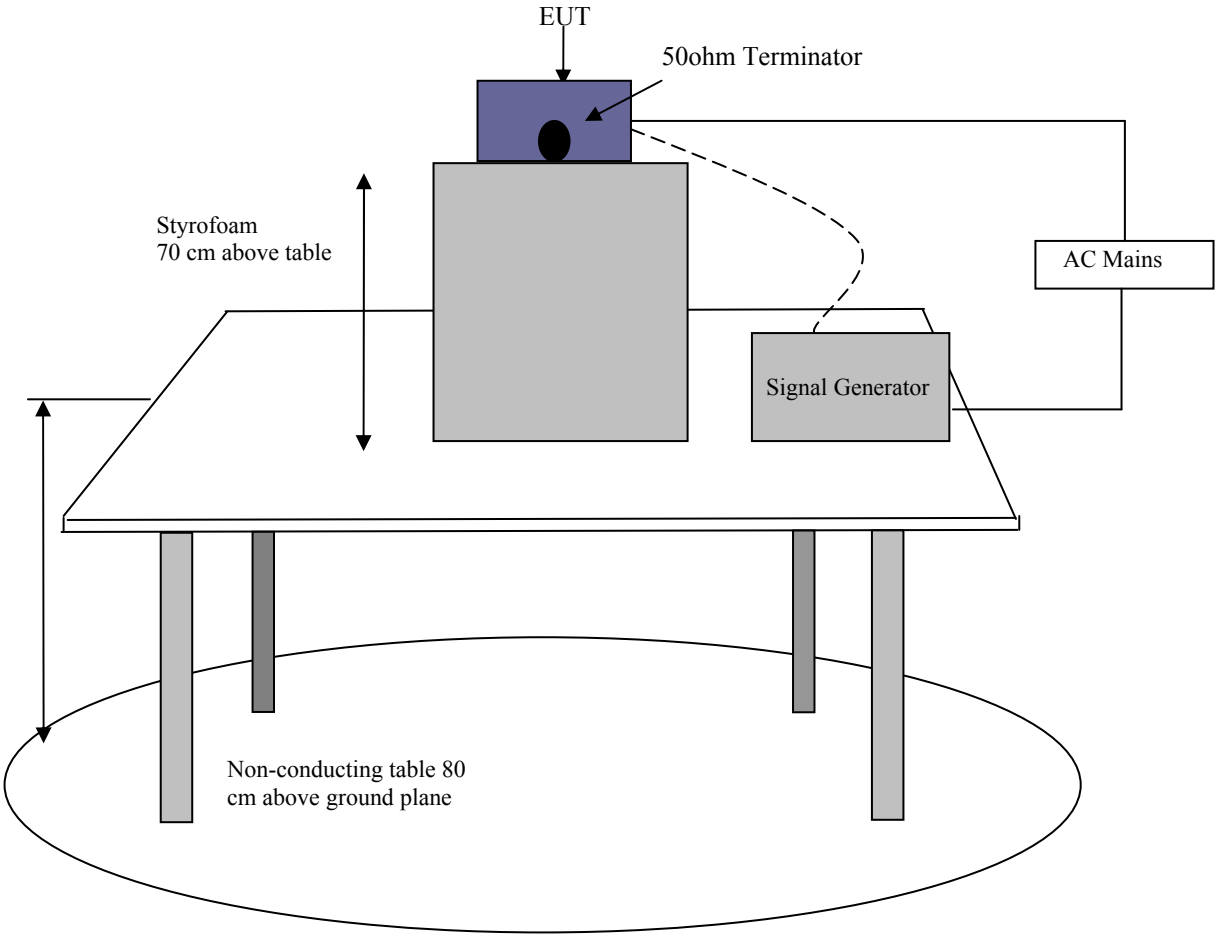
Cable Description	Length (m)	To	From
RF Cable	< 1	EUT	Spectrum Analyzer
RF Cable	< 1	EUT	Signal Generator

2.7 Test Setup Block Diagram

Antenna Port Conducted Testing



Radiated Emissions Testing



3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Tests	Results
§2.1046, §27.50(d)(i)	RF Output Power	Compliant
§2.1047	Modulation Characteristics	N/A[1]
§2.1049, §27.53 (c)	Occupied Bandwidth	Compliant
§2.1053, §27.53 (c)(g)	Spurious Radiated Emissions	Compliant
§2.1051, §27.53 (c)(g)	Spurious Emissions at Antenna Terminals	Compliant
§27.53 (c)(g)	Band Edge	Compliant
§2.1055, §27.54	Frequency Stability	Note[1]
§2.1091, §27.52	RF Exposure Information	Compliant

1) Note: EUT is an amplifier.

4 FCC §2.1046 & §27.50 – RF OUTPUT POWER

4.1 Applicable Standard

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 Environmental Conditions

Temperature:	20-25°C
Relative Humidity:	40-48 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang from 2011-06-22 to 2011-06-24 at RF Site.

4.4 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Spectrum Analyzer	E4446A	US44300386	2010-08-18

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

4.5 Test Results

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
LTE Downlink 746-757 MHz	QPSK (1.4 MHz)	747	-48.4	24.20
	QPSK (1.4 MHz)	752	-48.4	21.60
	QPSK (1.4 MHz)	756	-45.4	21.43
	16QAM (1.4 MHz)	747	-48.4	24.08
	16QAM (1.4 MHz)	752	-48.4	21.82
	16QAM (1.4 MHz)	756	-45.4	21.56
	64QAM (1.4 MHz)	747	-48.4	24.06
	64QAM (1.4 MHz)	752	-48.4	21.83
	64QAM (1.4 MHz)	756	-45.4	21.58
	QPSK (3 MHz)	748	-47.4	25.30
	QPSK (3 MHz)	752	-47.4	23.22
	QPSK (3 MHz)	755	-45	22.60
	16QAM (3 MHz)	748	-47.4	25.41
	16QAM (3 MHz)	752	-47.4	23.20
	16QAM (3 MHz)	755	-45	22.65
	64QAM (3 MHz)	748	-47.2	25.40
	64QAM (3 MHz)	752	-47.6	23.14
	64QAM (3 MHz)	755	-45	22.55
	QPSK (5 MHz)	749	-46.8	25.38
	QPSK (5 MHz)	754	-46.6	22.88
	16QAM (5 MHz)	749	-46.8	25.40
	16QAM (5 MHz)	754	-46.6	22.9
	64QAM (5 MHz)	749	-46.8	25.51
	64QAM (5 MHz)	754	-46.8	22.97
	QPSK (10 MHz)	752	-46	24.94
	16QAM (10 MHz)	752	-46	25.02
	64QAM (10 MHz)	752	-46	24.93

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
LTE Uplink 776-787 MHz	QPSK (1.4 MHz)	777	-44	25.87
	QPSK (1.4 MHz)	782	-41.8	27.78
	QPSK (1.4 MHz)	786	-42.8	27.87
	16QAM (1.4 MHz)	777	-44.2	25.75
	16QAM (1.4 MHz)	782	-42	27.50
	16QAM (1.4 MHz)	786	-43.2	27.55
	64QAM (1.4 MHz)	777	-44.4	25.50
	64QAM (1.4 MHz)	782	-42.2	27.22
	64QAM (1.4 MHz)	786	-43.2	27.34
	QPSK (3 MHz)	778	-43.6	26.63
	QPSK (3 MHz)	782	-41.4	28.24
	QPSK (3 MHz)	785	-41.6	28.65
	16QAM (3 MHz)	778	-44	26.24
	16QAM (3 MHz)	782	-41.8	27.64
	16QAM (3 MHz)	785	-42	28.27
	64QAM (3 MHz)	778	-44	26.14
	64QAM (3 MHz)	782	-42	27.55
	64QAM (3 MHz)	785	-42	28.18
	QPSK (5 MHz)	779	-42.8	26.98
	QPSK (5 MHz)	784	-41.2	28.67
	16QAM (5 MHz)	779	-43.2	26.50
	16QAM (5 MHz)	784	-41.6	28.22
	64QAM (5 MHz)	779	-43.4	26.32
	64QAM (5 MHz)	784	-41.6	28.19
	QPSK (10 MHz)	782	-41.6	28.10
	16QAM (10 MHz)	782	-41.6	28.01
	64QAM (10 MHz)	782	-41.6	27.97

5 FCC §2.1047 - MODULATION CHARACTERISTIC

5.1 Applicable Standard

According to FCC §2.1047(d) and Part 27, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

5.2 Test Result

N/A

6 FCC §2.1049 & §27.53 - OCCUPIED BANDWIDTH

6.1 Applicable Standard

Requirements: FCC §2.1049 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 100 kHz and the 26 dB & 99% bandwidth was recorded.

6.3 Test Environmental Conditions

Temperature:	20-25°C
Relative Humidity:	40-48 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang from 2011-06-22 to 2011-06-24 at RF Site.

6.4 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Spectrum Analyzer	E4446A	US44300386	2010-08-18

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

6.5 Test Results

Occupied Bandwidth – Downlink

Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Downlink 746-757 MHz	QPSK (1.4 MHz)	752	1.1630	1.1623
	16QAM (1.4 MHz)	752	1.1631	1.1657
	64QAM (1.4 MHz)	752	1.1625	1.1618
	QPSK (3 MHz)	752	2.7299	2.7364
	16QAM (3 MHz)	752	2.7314	2.7326
	64QAM (3 MHz)	752	2.7301	2.7353
	QPSK (5 MHz)	754	4.4994	4.4829
	16QAM (5 MHz)	754	4.5015	4.4841
	64QAM (5 MHz)	754	4.5019	4.4821
	QPSK (10 MHz)	752	8.9350	8.9008
	16QAM (10 MHz)	752	8.9329	8.8908
	64QAM (10 MHz)	752	8.9333	8.8983

Occupied Bandwidth – Uplink

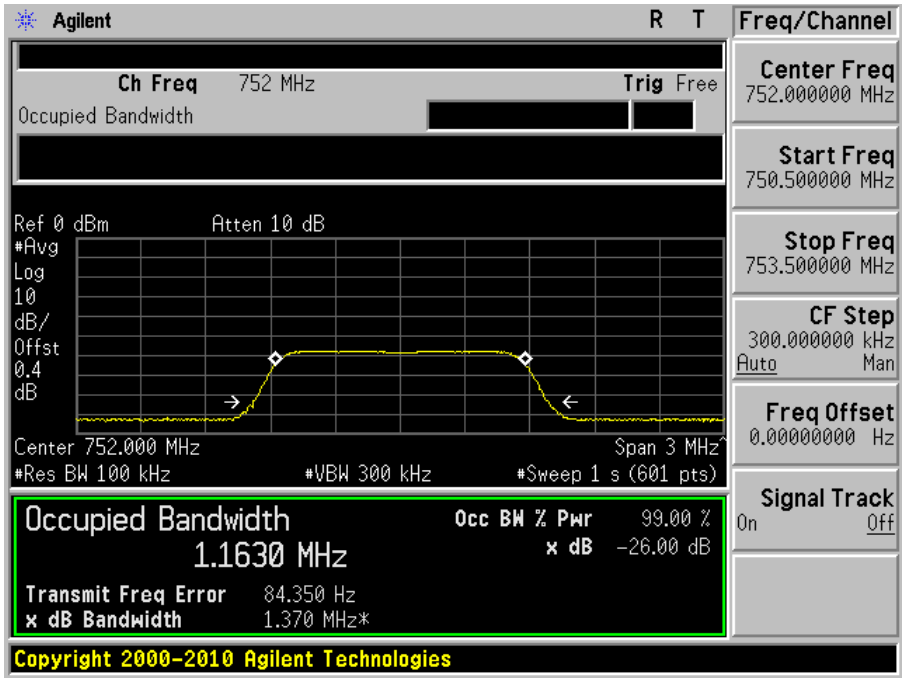
Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Uplink 776-787 MHz	QPSK (1.4 MHz)	782	1.1483	1.1591
	16QAM (1.4 MHz)	782	1.1464	1.1584
	64QAM (1.4 MHz)	782	1.1466	1.1604
	QPSK (3 MHz)	782	2.7165	2.7197
	16QAM (3 MHz)	782	2.7176	2.7203
	64QAM (3 MHz)	782	2.7119	2.7189
	QPSK (5 MHz)	784	4.4754	4.4849
	16QAM (5 MHz)	784	4.4808	4.4922
	64QAM (5 MHz)	784	4.4792	4.4909
	QPSK (10 MHz)	782	8.9082	8.9271
	16QAM (10 MHz)	782	8.9110	8.9357
	64QAM (10 MHz)	782	8.9152	8.9327

Please refer to the following plots.

DL: 746 - 757 MHz

LTE-QPSK (1.4 MHz), Frequency: 752 MHz

Input



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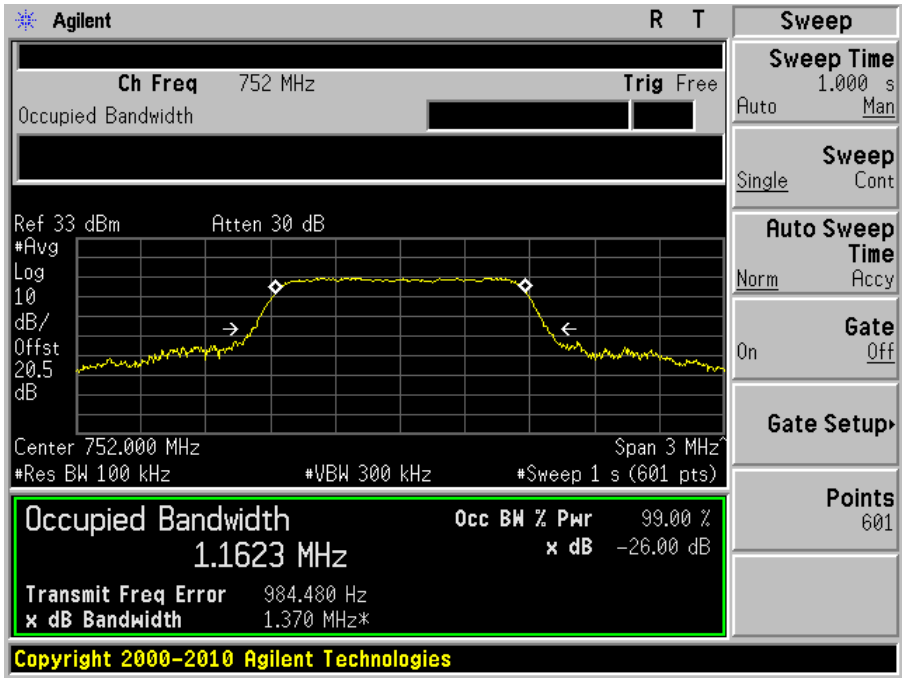
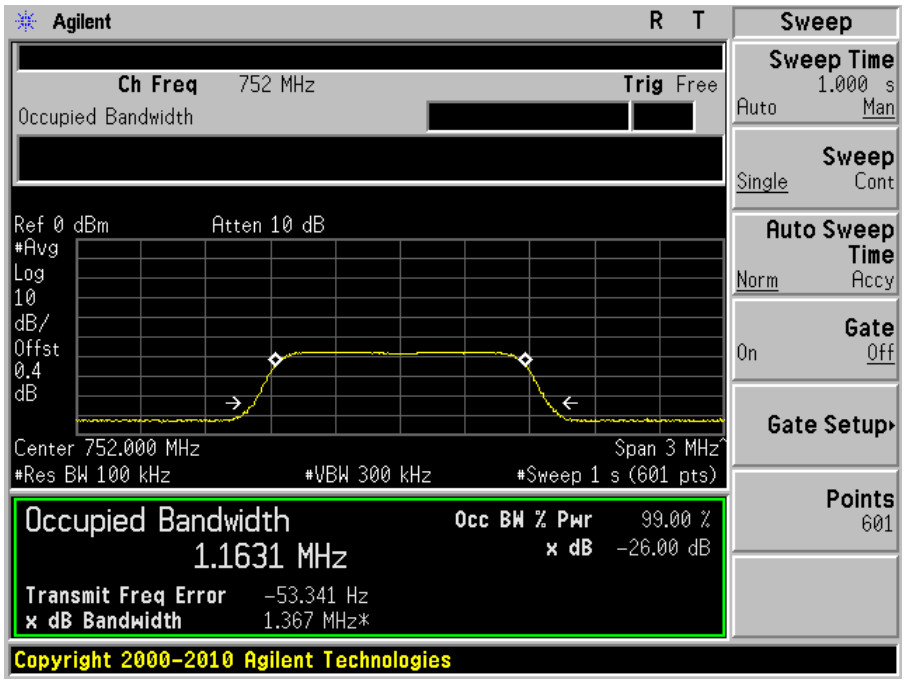
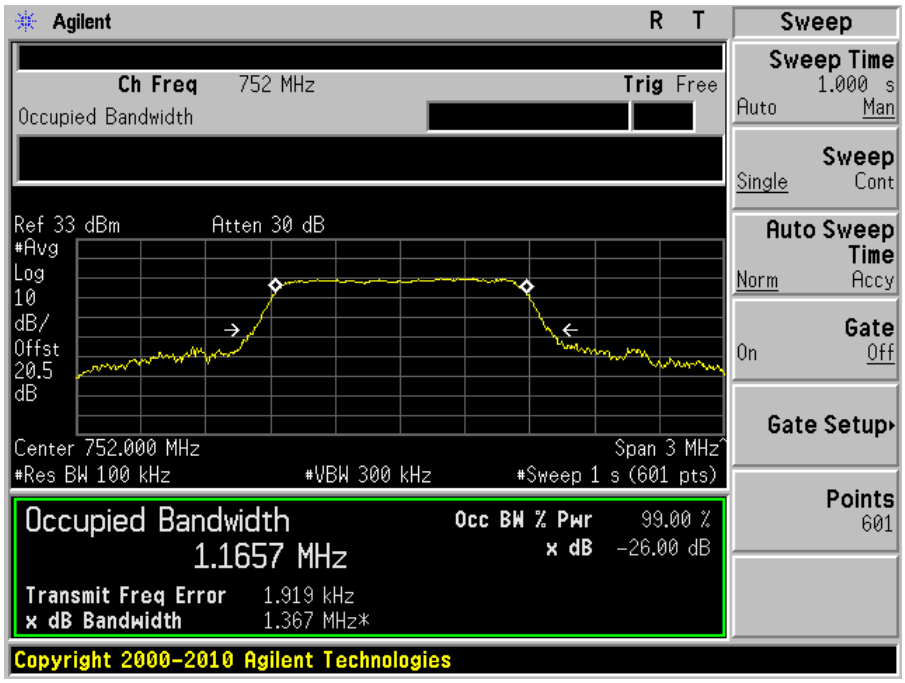


LTE-16QAM (1.4 MHz), Frequency: 752 MHz

Input

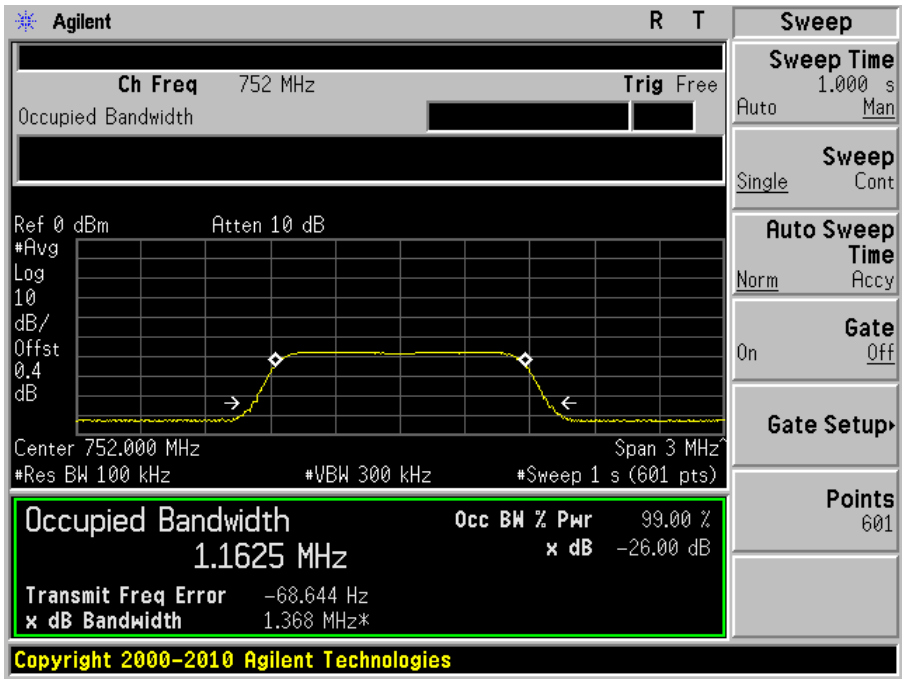


Output

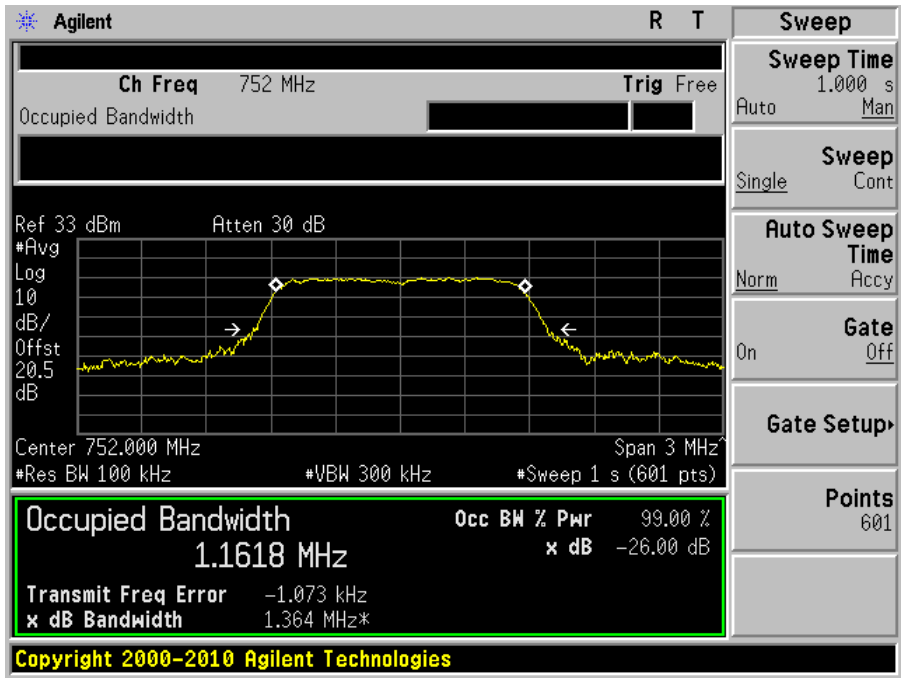


LTE-64QAM (1.4 MHz), Frequency: 752 MHz

Input

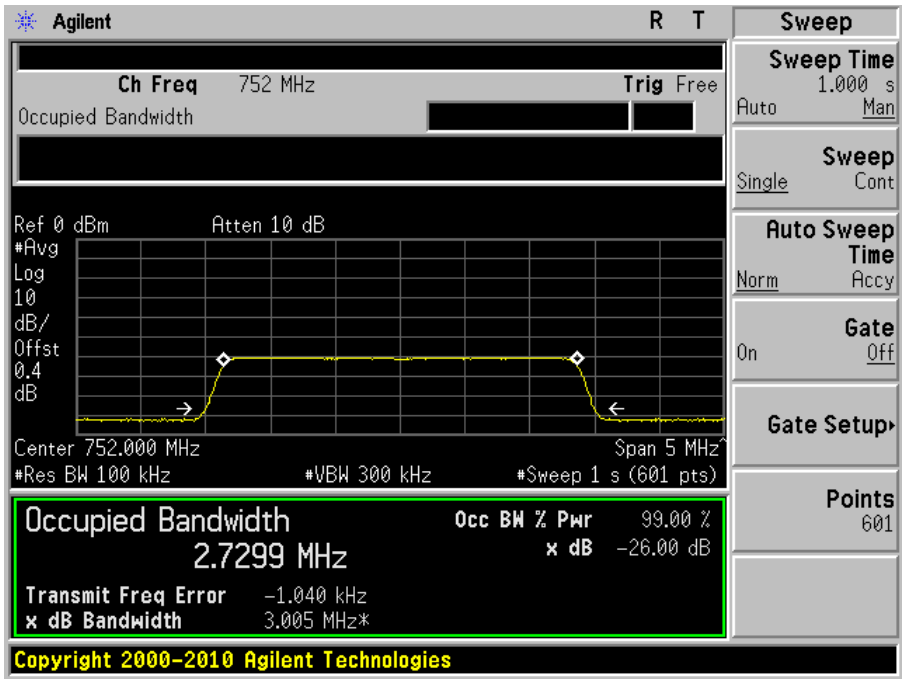


Output

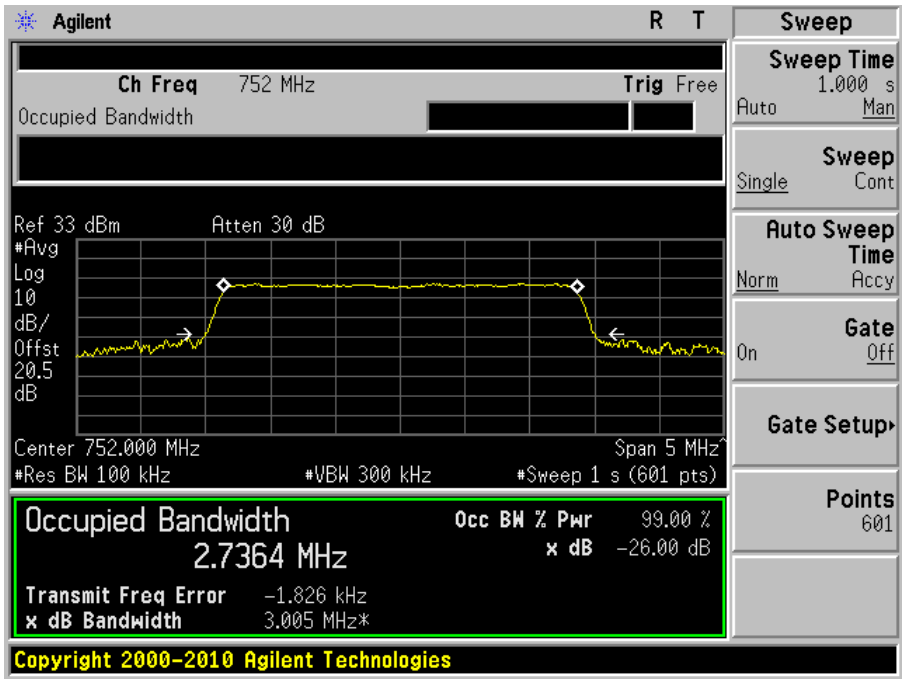


LTE-QPSK (3 MHz), Frequency: 752 MHz

Input

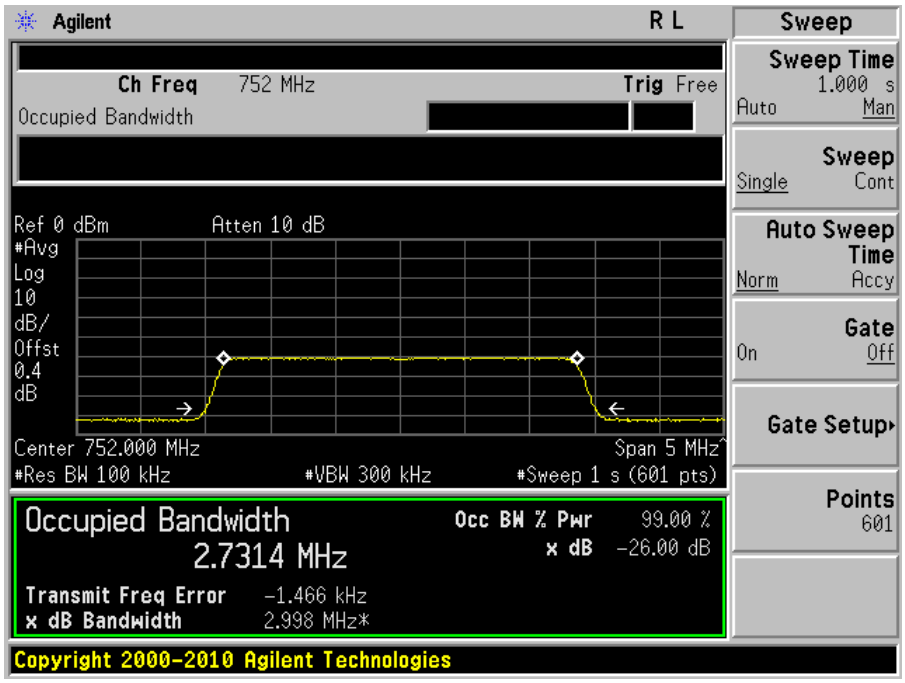


Output

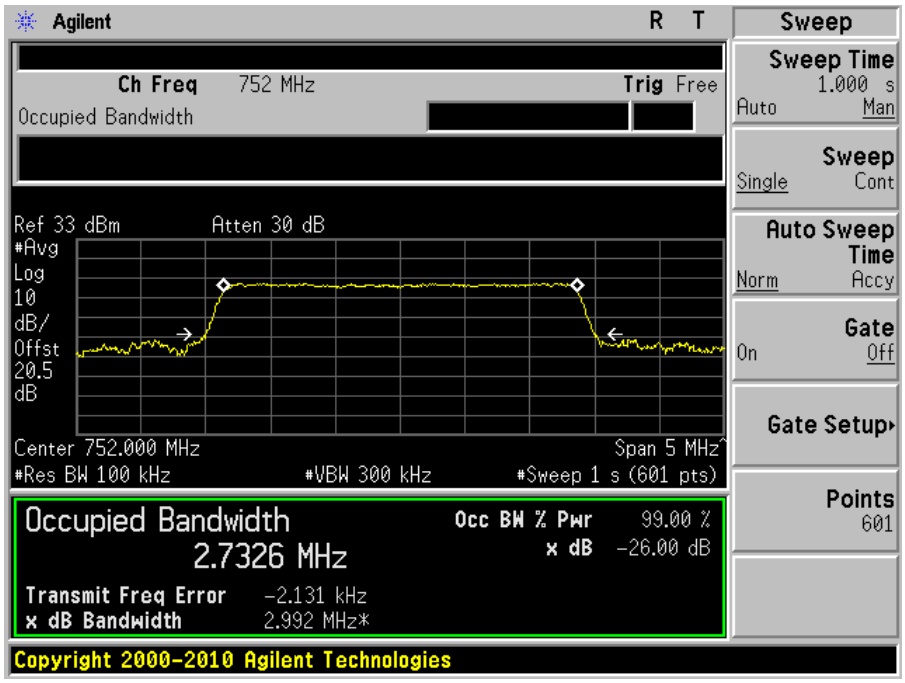


LTE-16QAM (3 MHz), Frequency: 752 MHz

Input

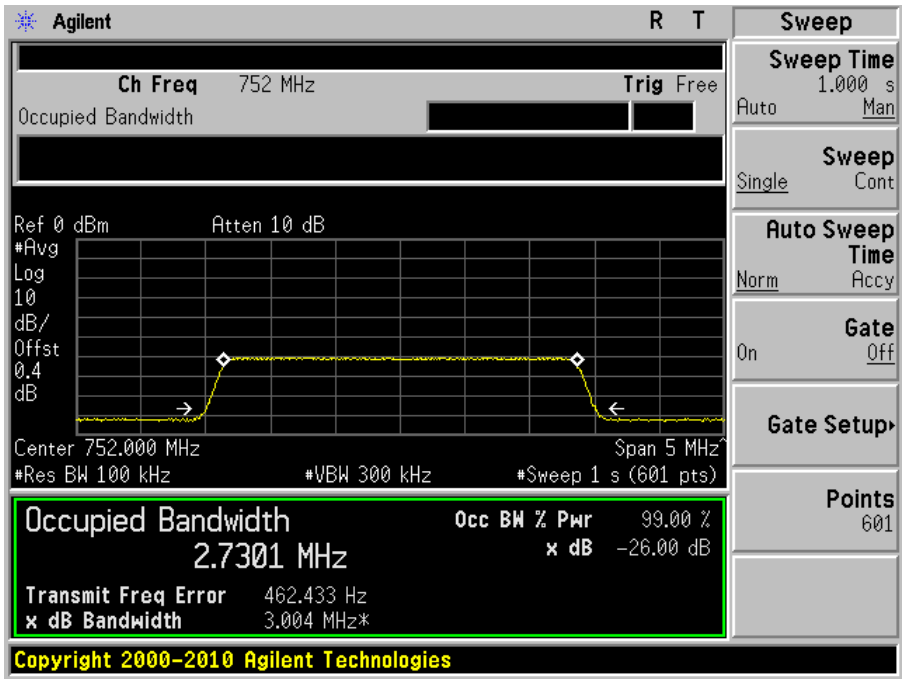


Output



LTE-64QAM (3 MHz), Frequency: 752 MHz

Input



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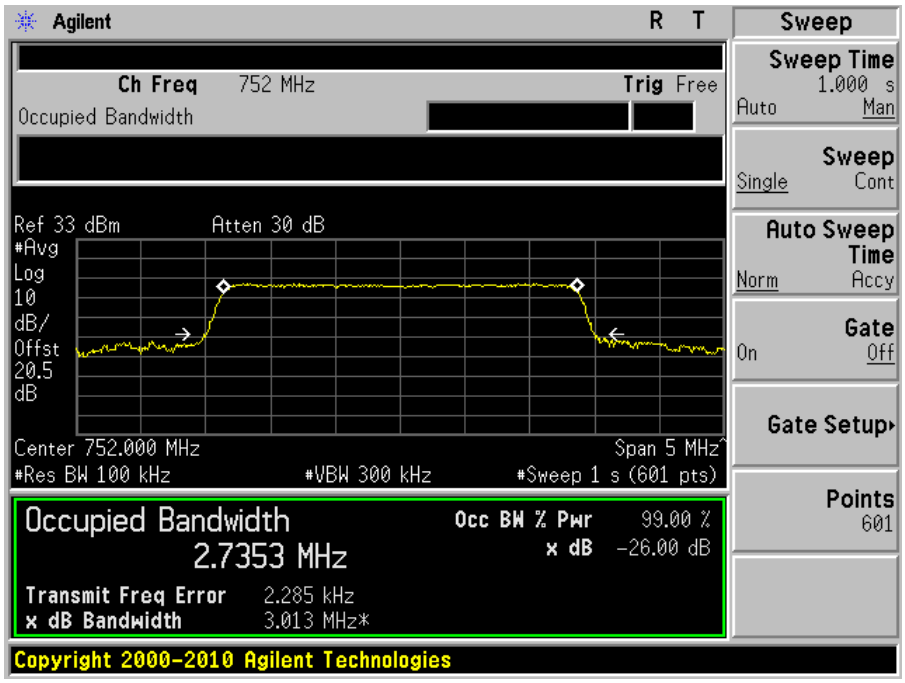
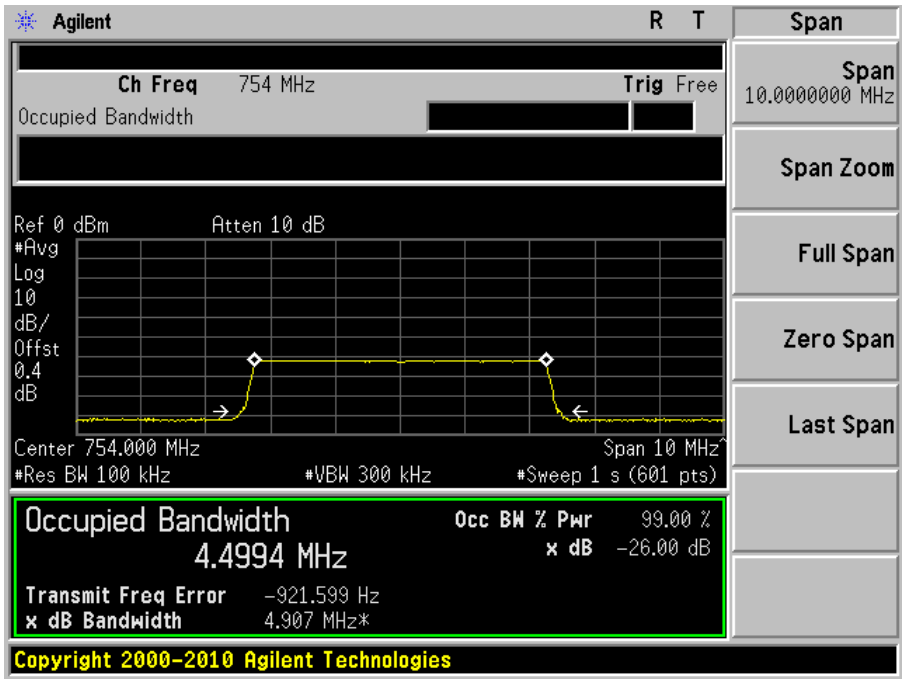
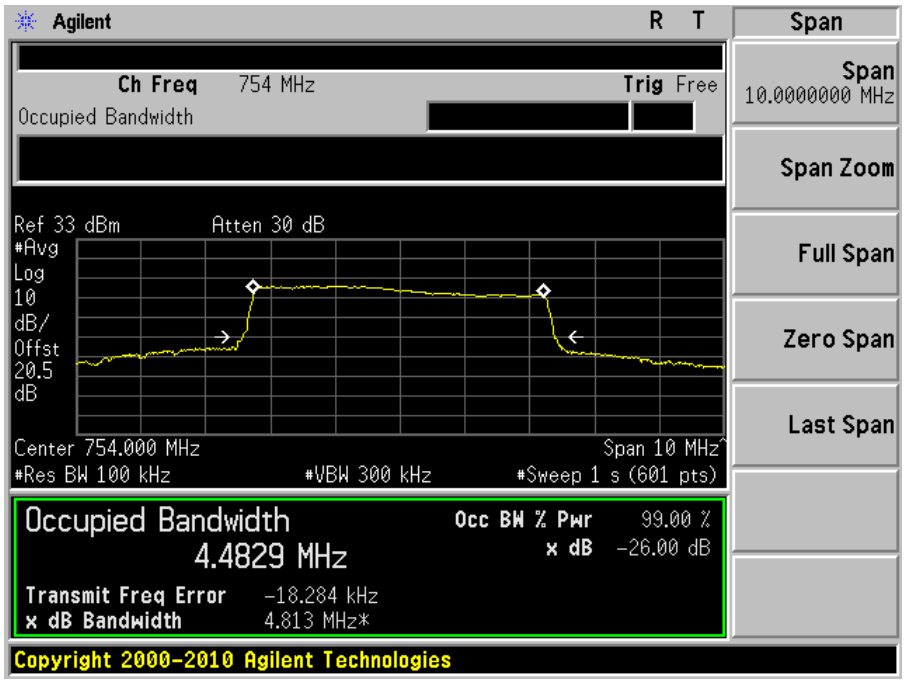


LTE-QPSK (5 MHz), Frequency: 754 MHz

Input

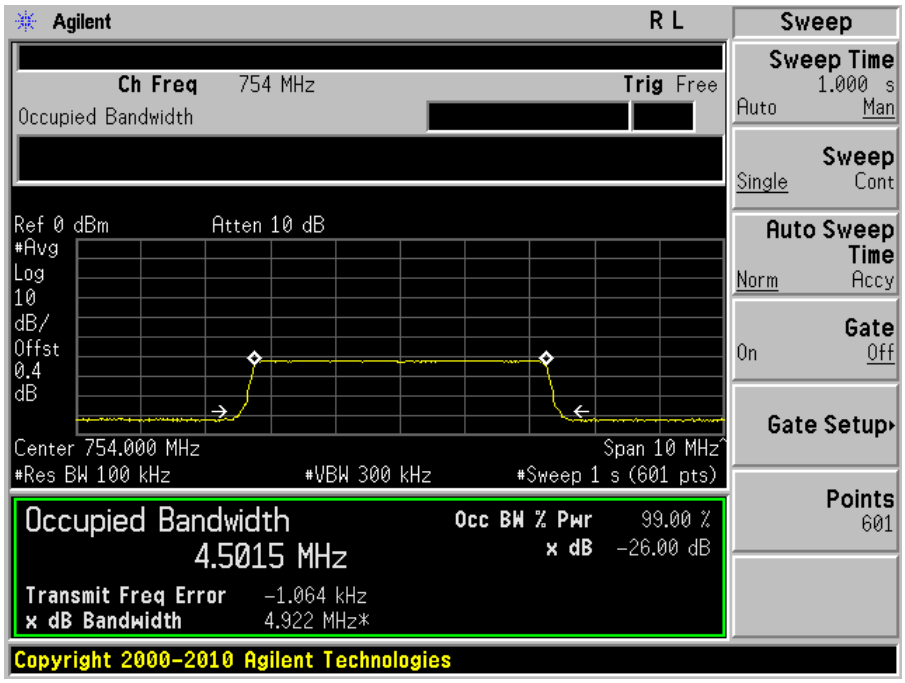


Output

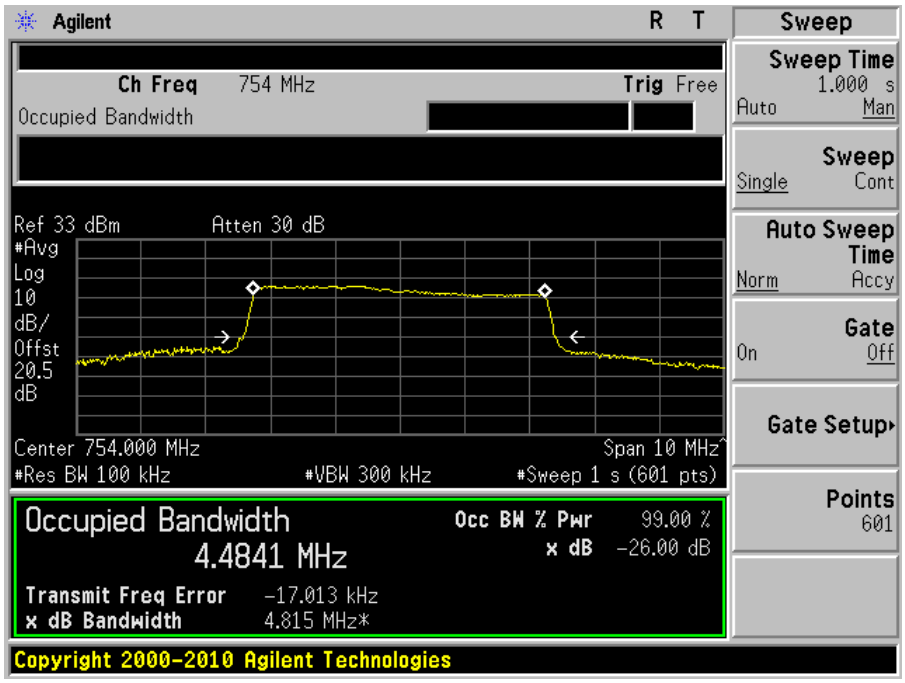


LTE-16QAM (5 MHz), Frequency: 754 MHz

Input

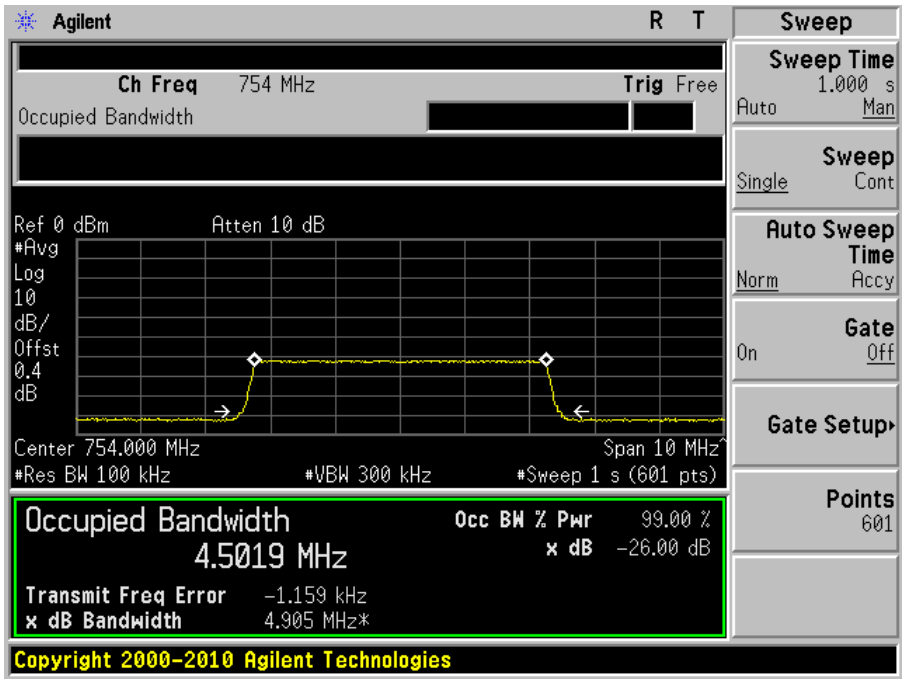


Output

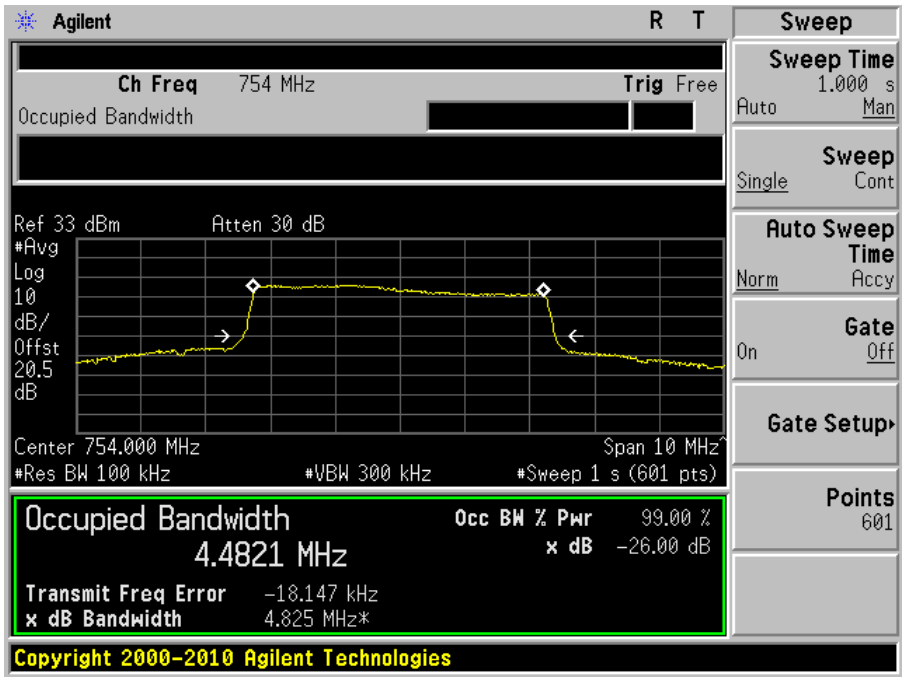


LTE-64QAM (5 MHz), Frequency: 754 MHz

Input

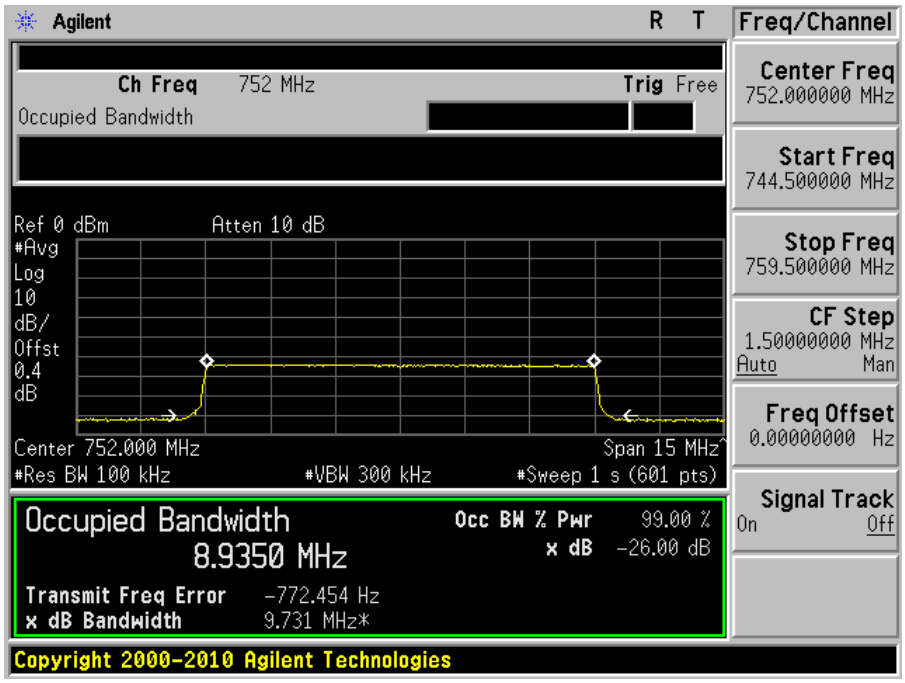


Output

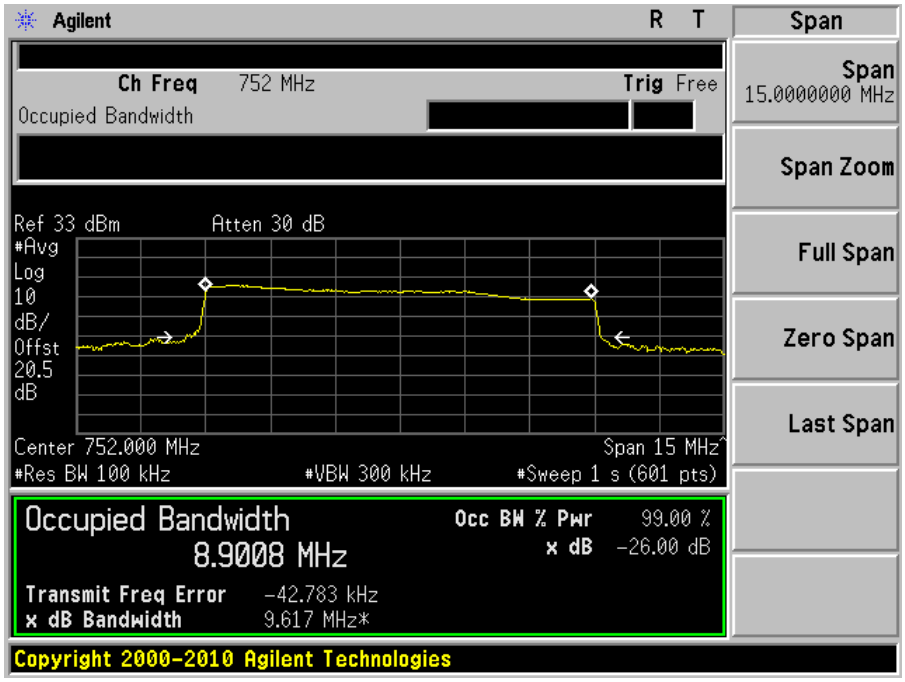


LTE-QPSK (10 MHz), Frequency: 752 MHz

Input

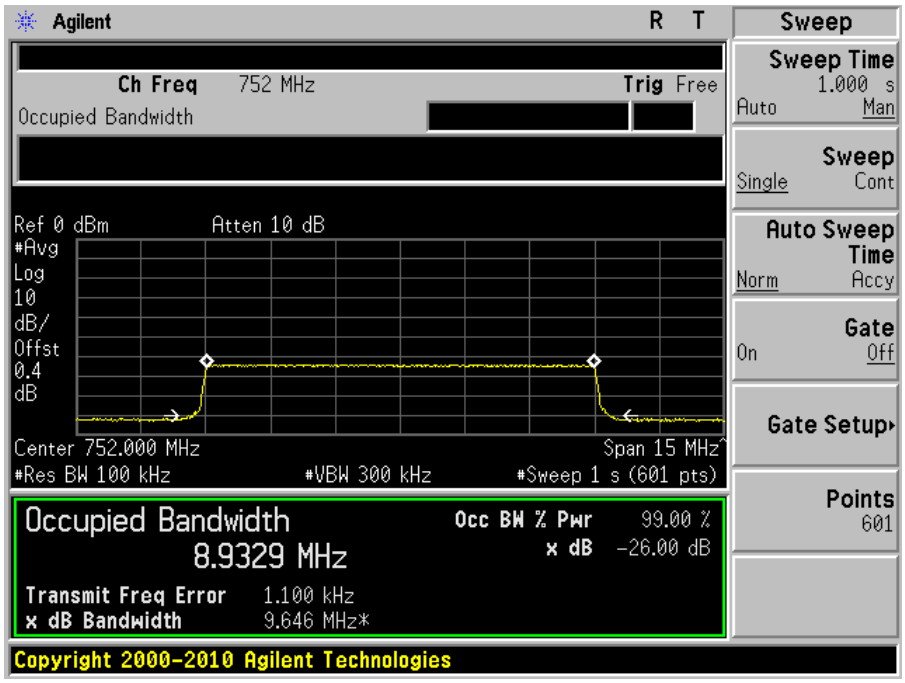


Output

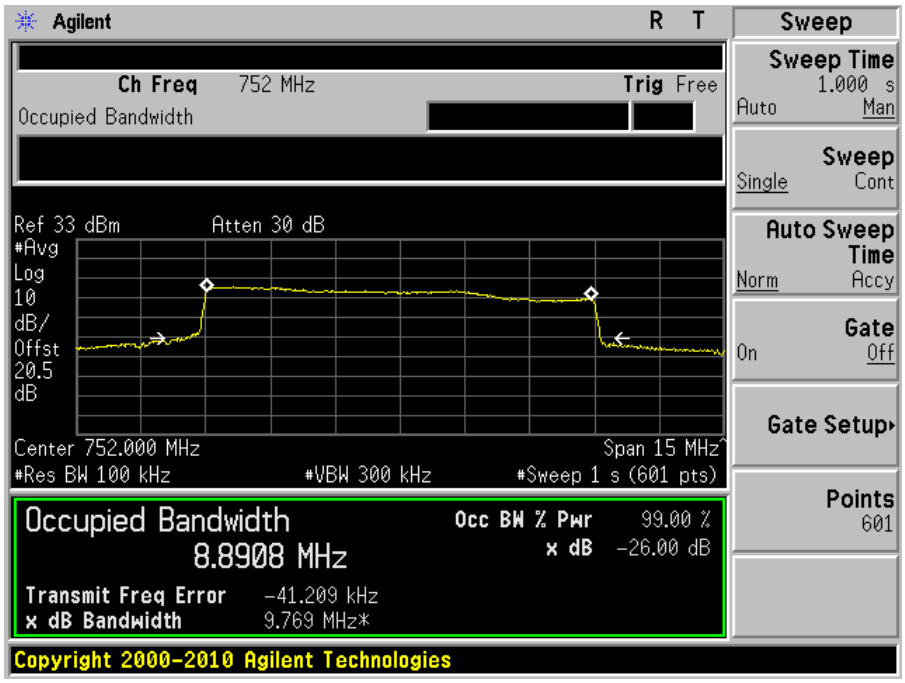


LTE-16QAM (10 MHz), Frequency: 752 MHz

Input

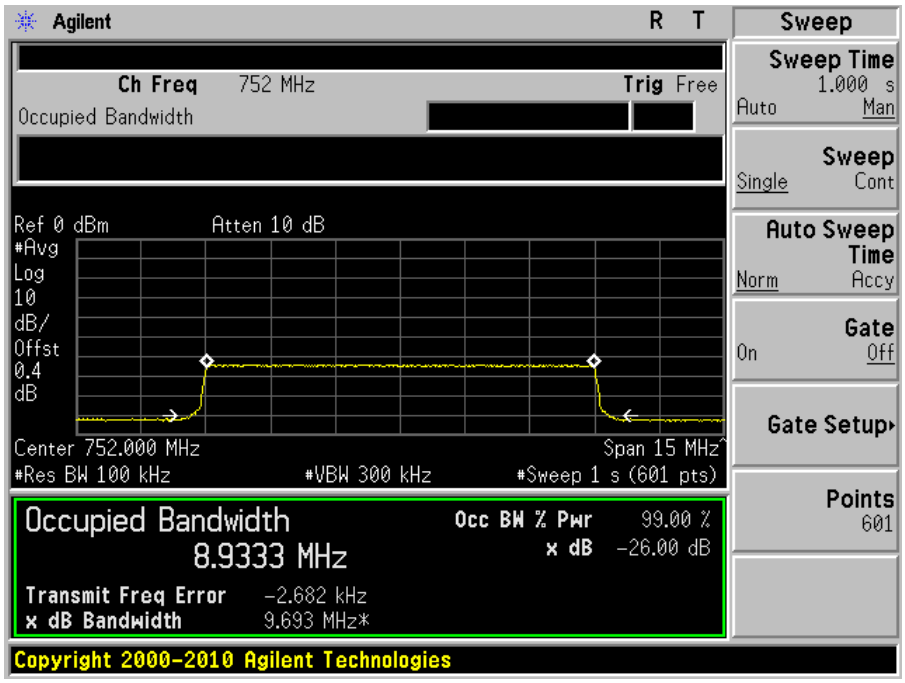


Output

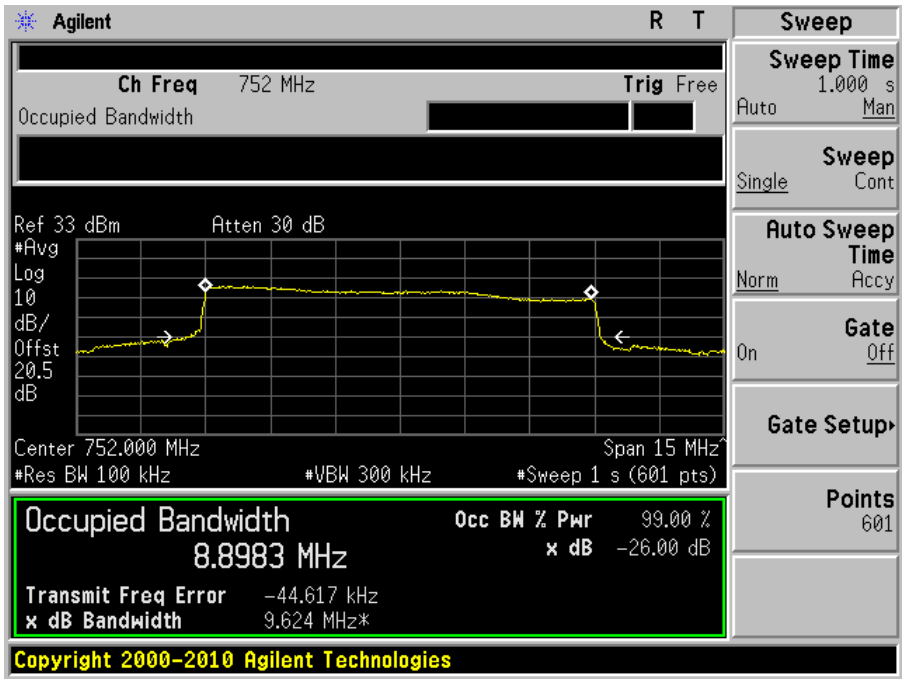


LTE-64QAM (10 MHz), Frequency: 752 MHz

Input



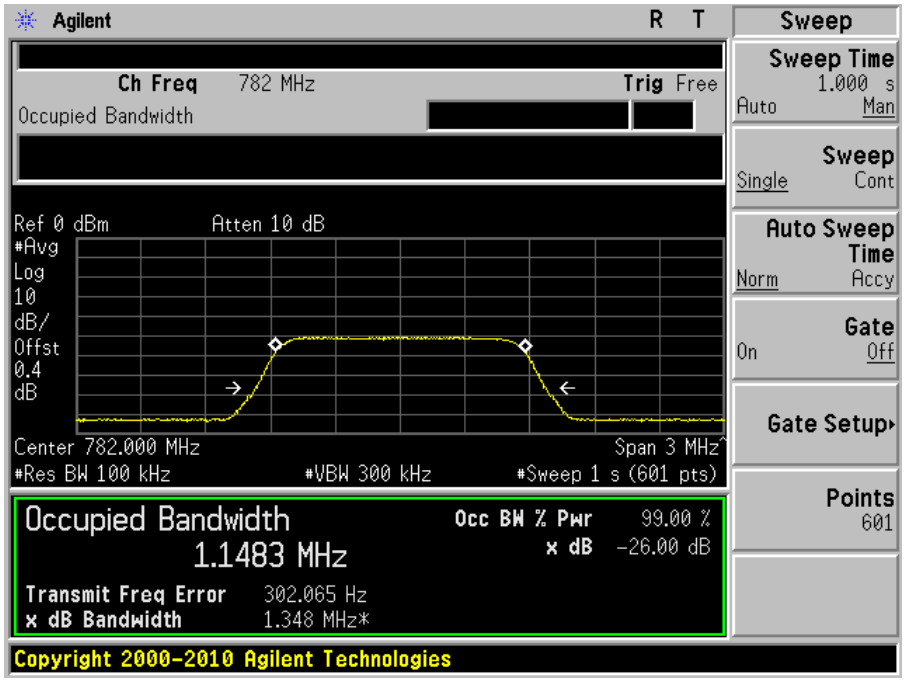
Output



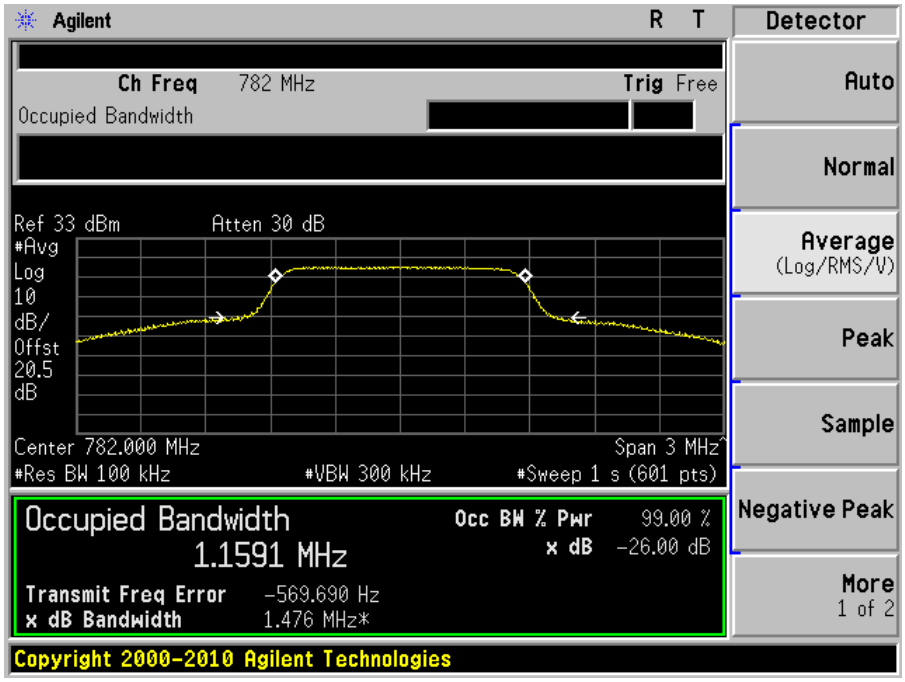
UL: 776 - 787 MHz

LTE-QPSK (1.4 MHz), Frequency: 782 MHz

Input

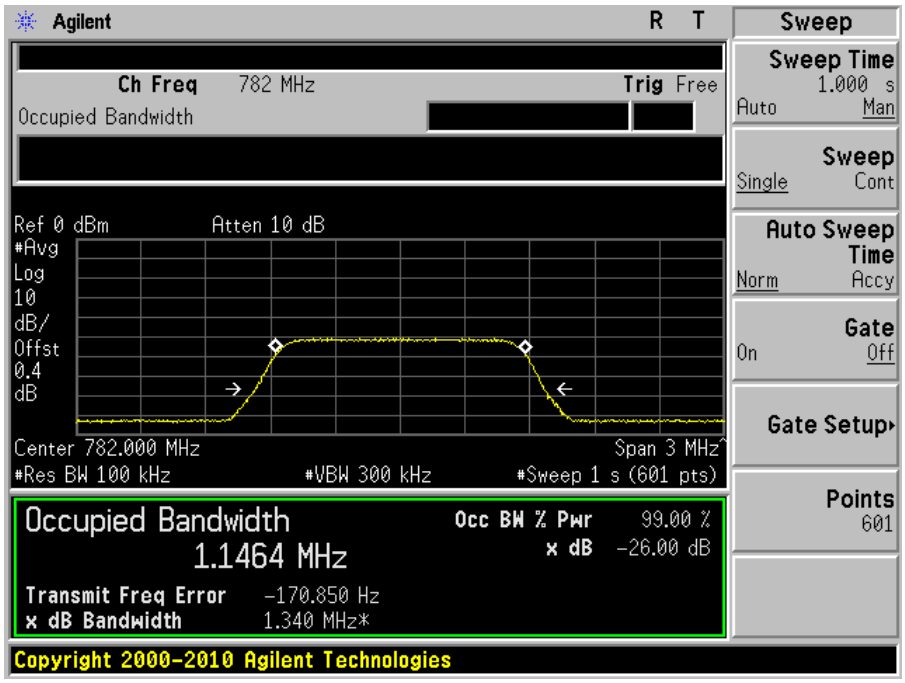


Output

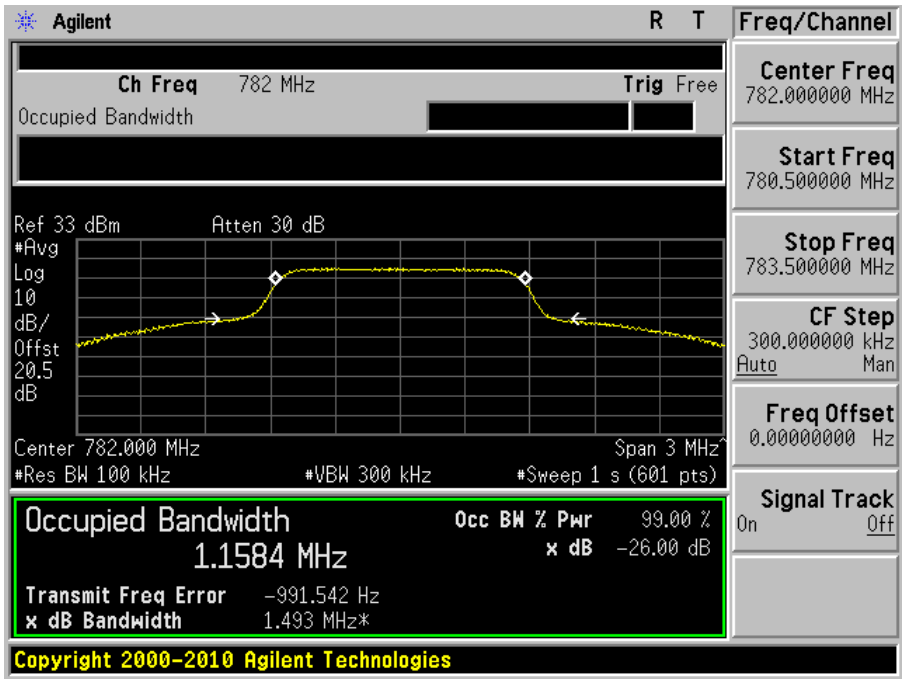


LTE-16QAM (1.4 MHz), Frequency: 782 MHz

Input

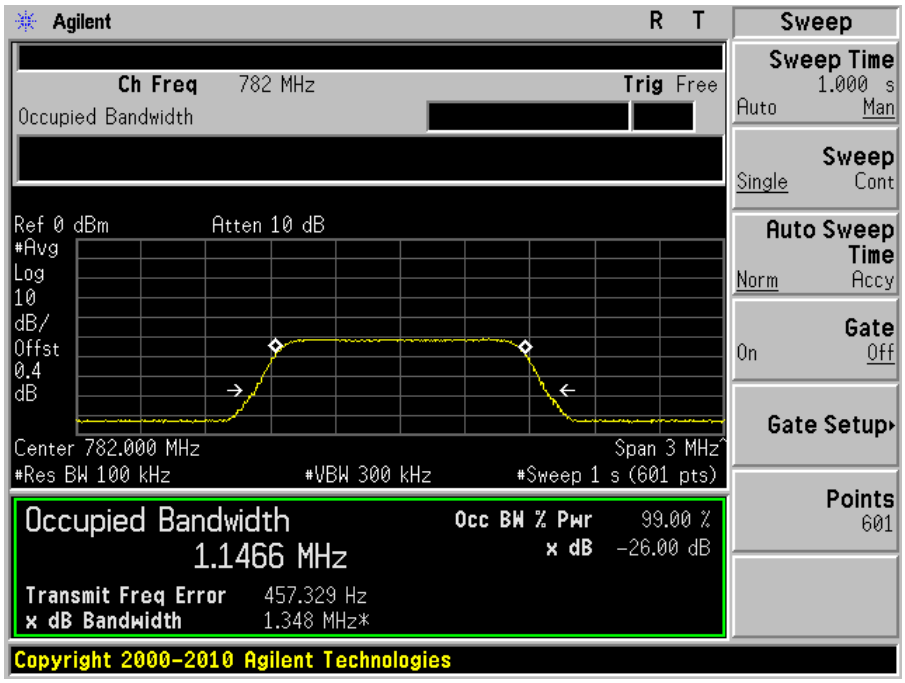


Output

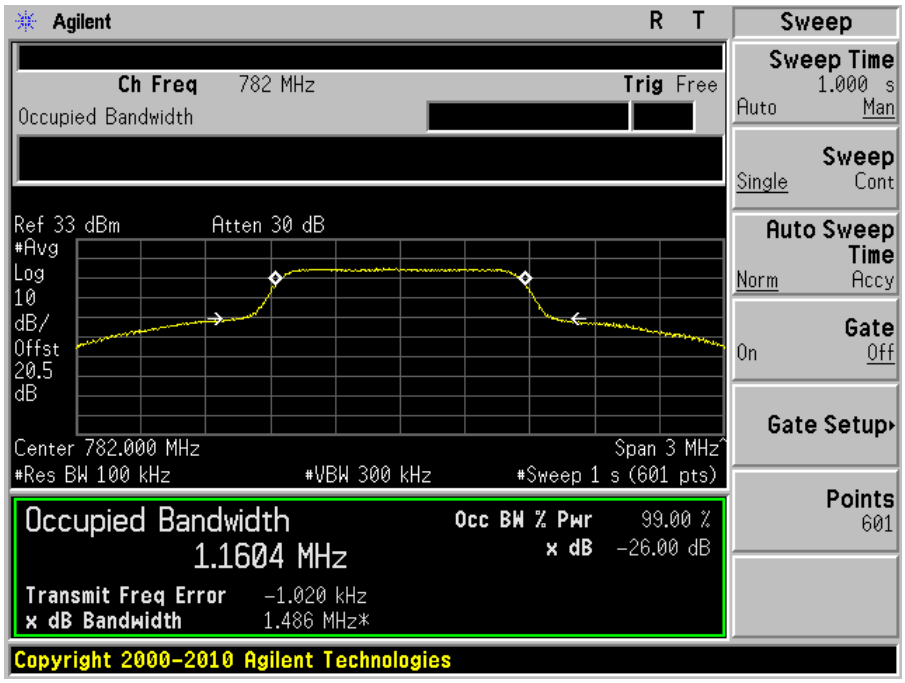


LTE-64QAM (1.4 MHz), Frequency: 782 MHz

Input

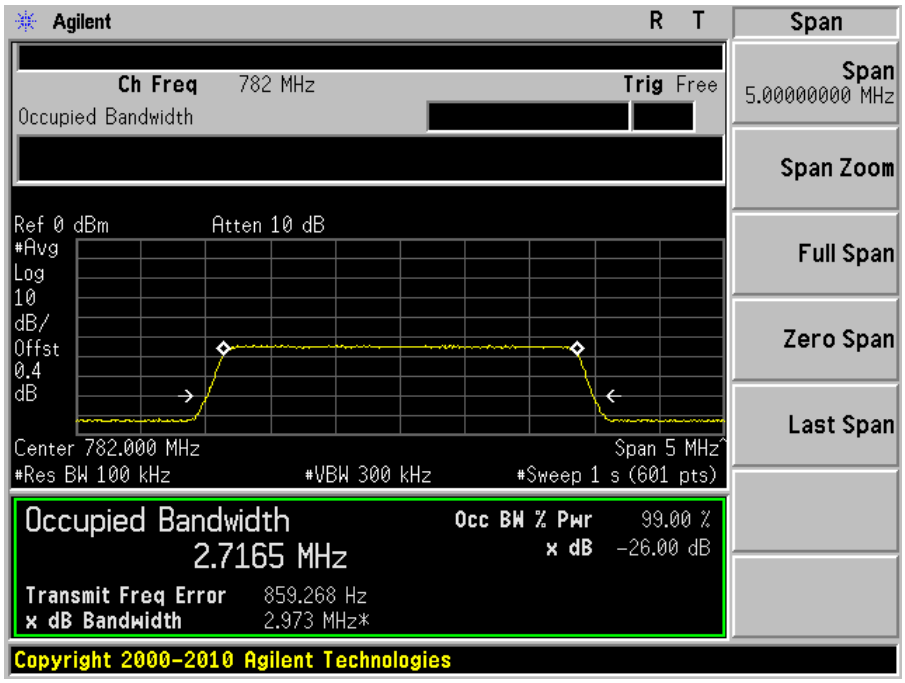


Output

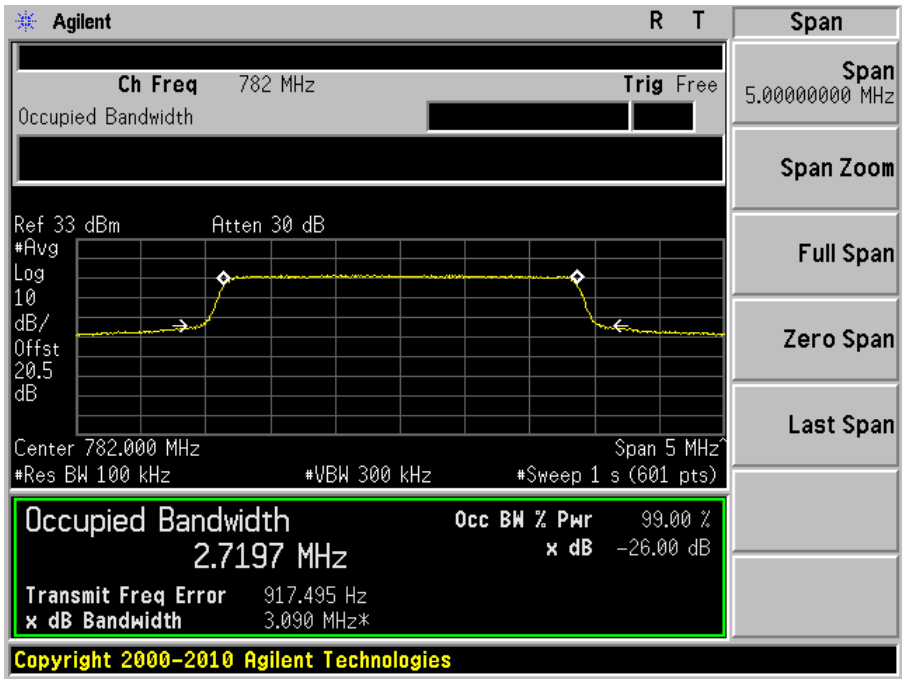


LTE-QPSK (3 MHz), Frequency: 782 MHz

Input

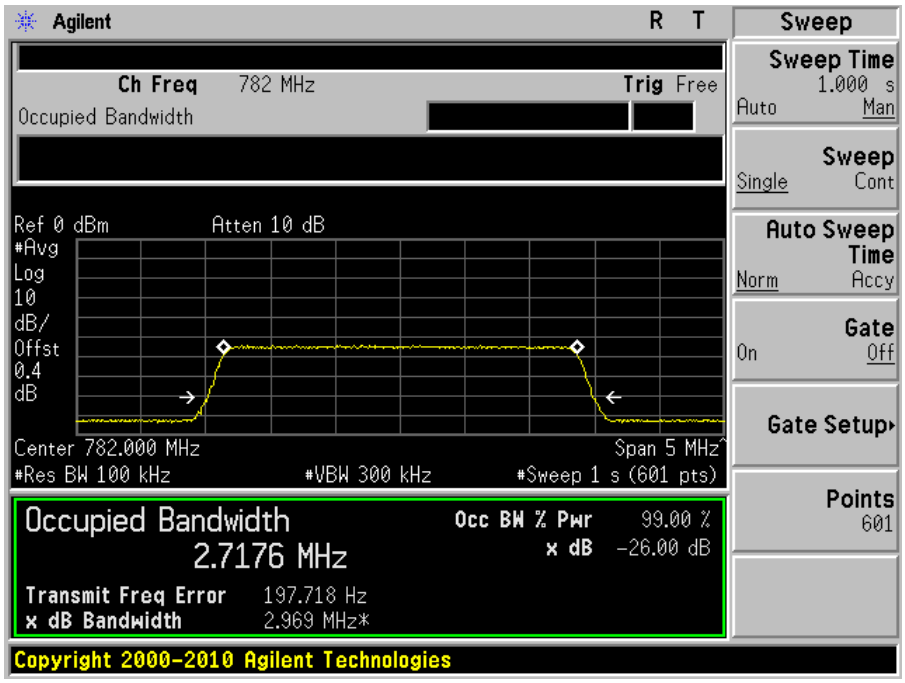


Output

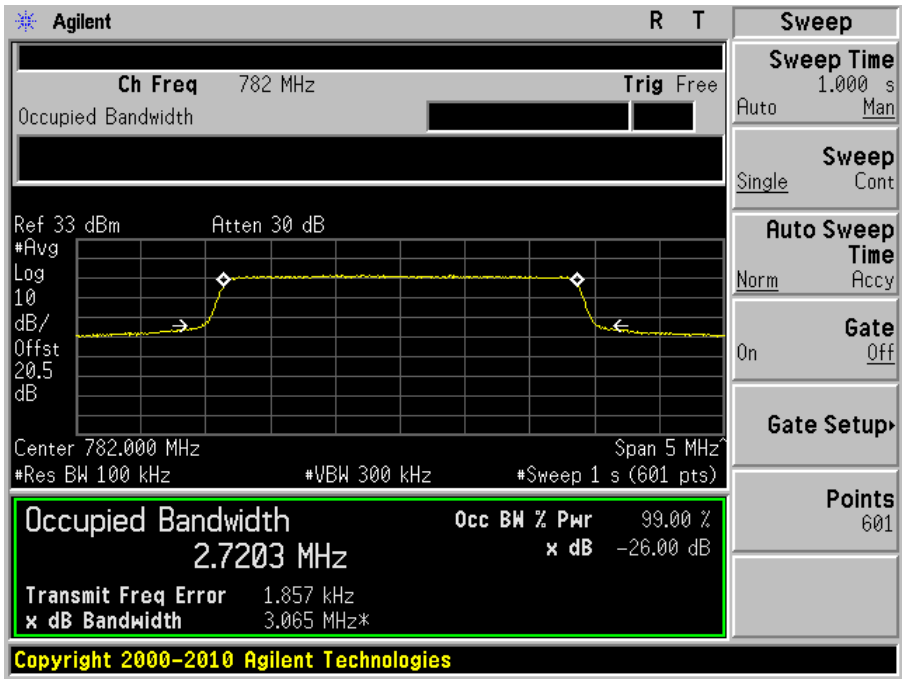


LTE-16QAM (3 MHz), Frequency: 782 MHz

Input

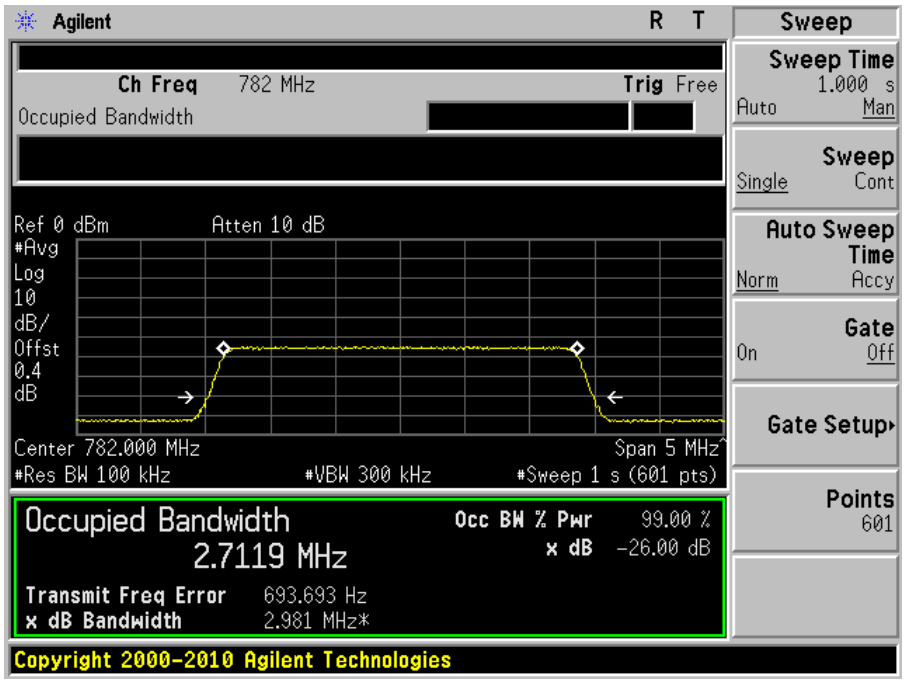


Output

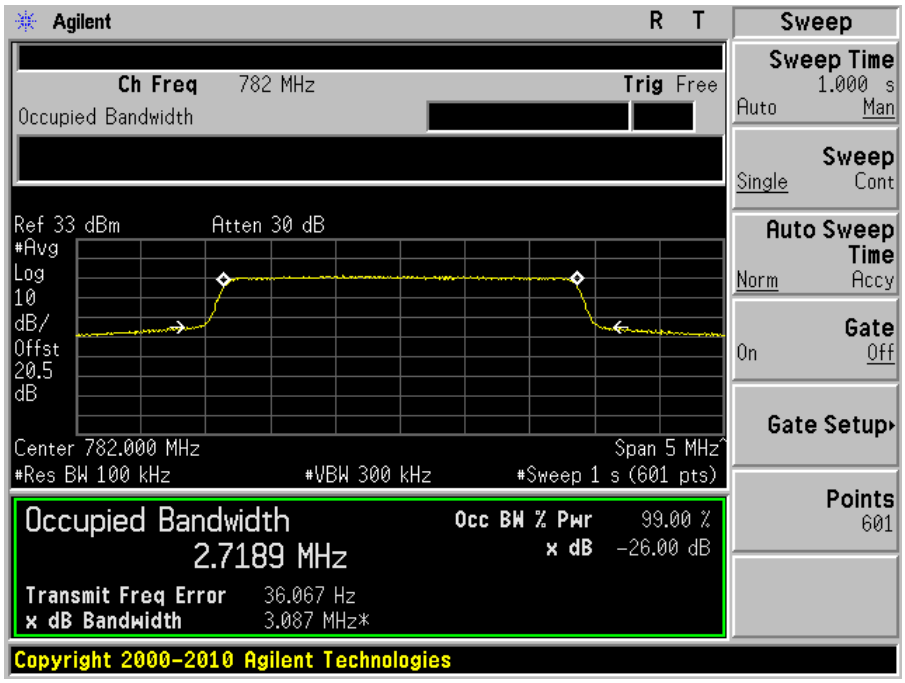


LTE-64QAM (3 MHz), Frequency: 782 MHz

Input

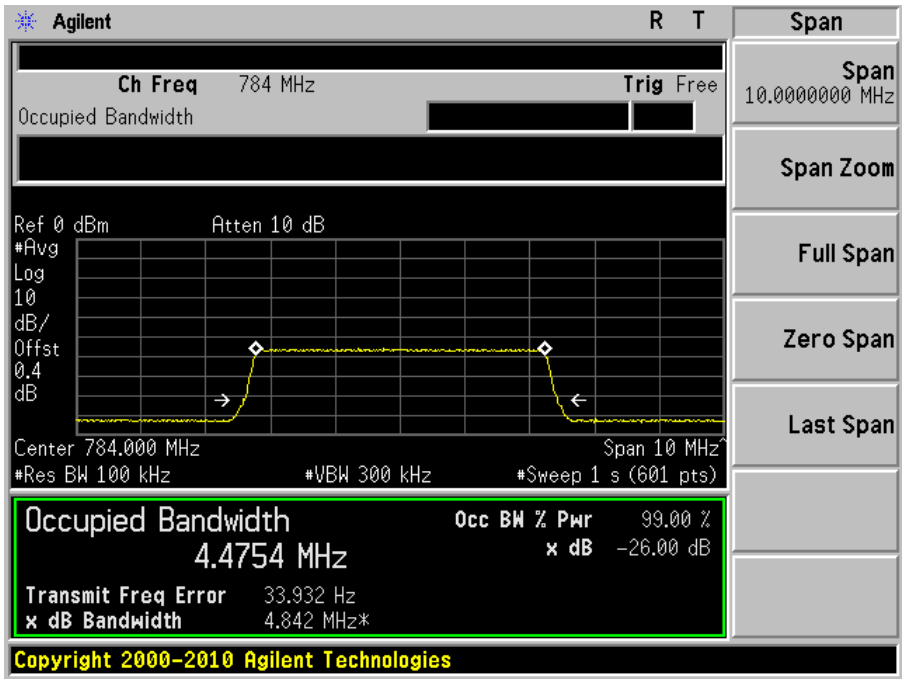


Output

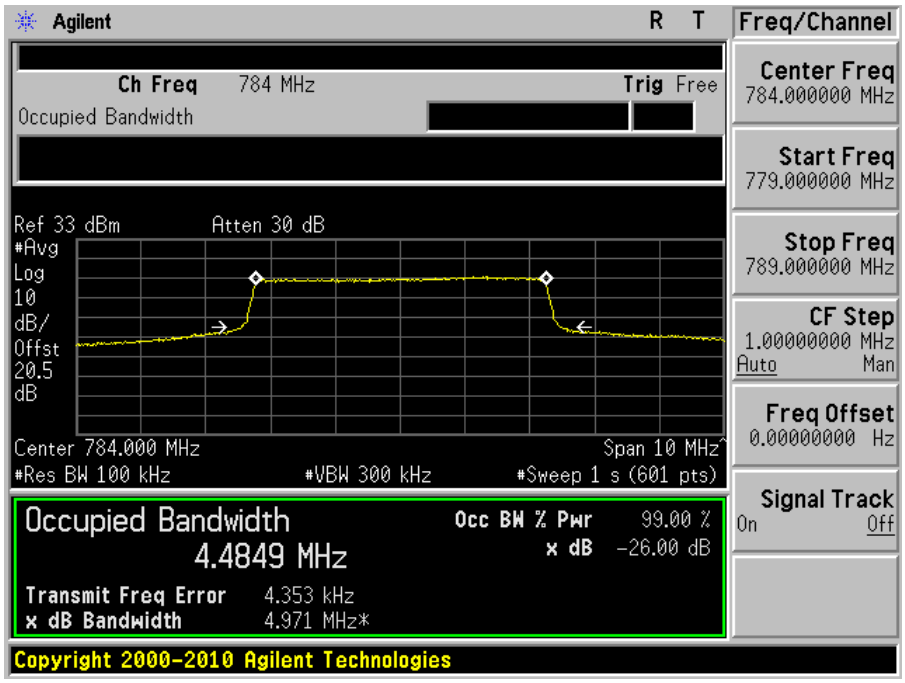


LTE-QPSK (5 MHz), Frequency: 784 MHz

Input

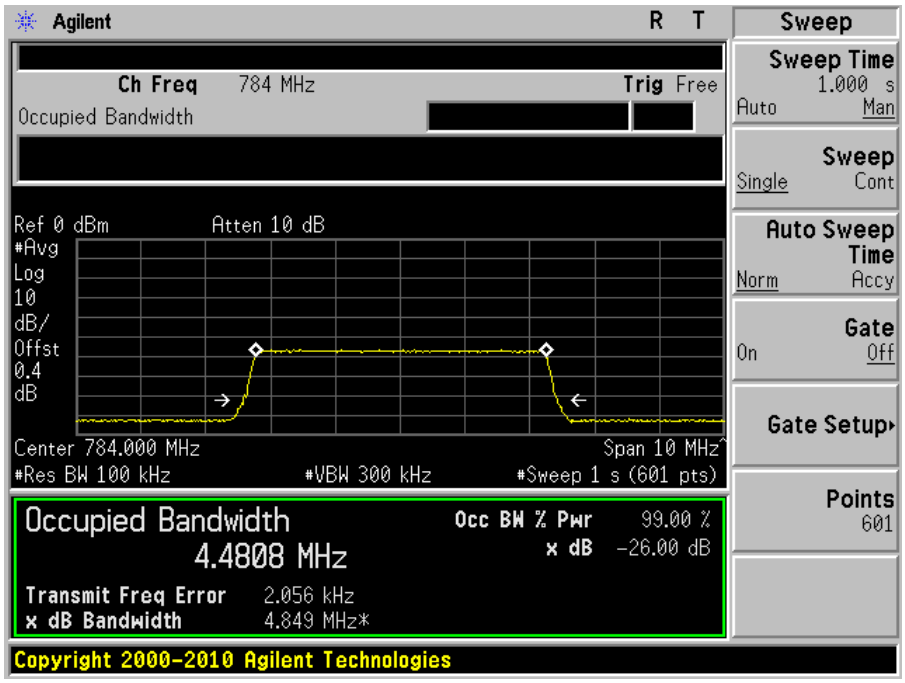


Output

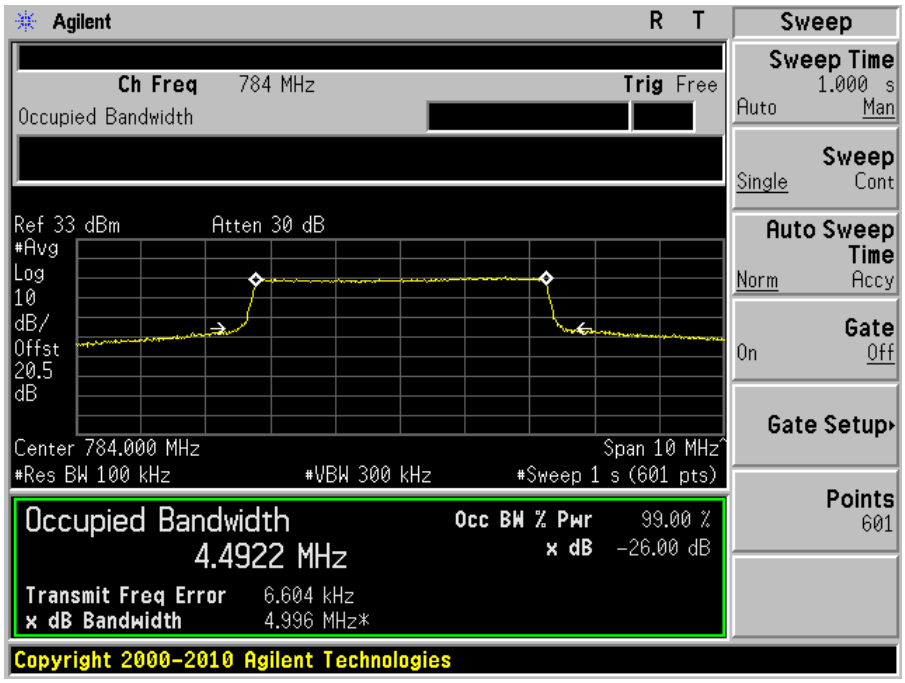


LTE-16QAM (5 MHz), Frequency: 784 MHz

Input

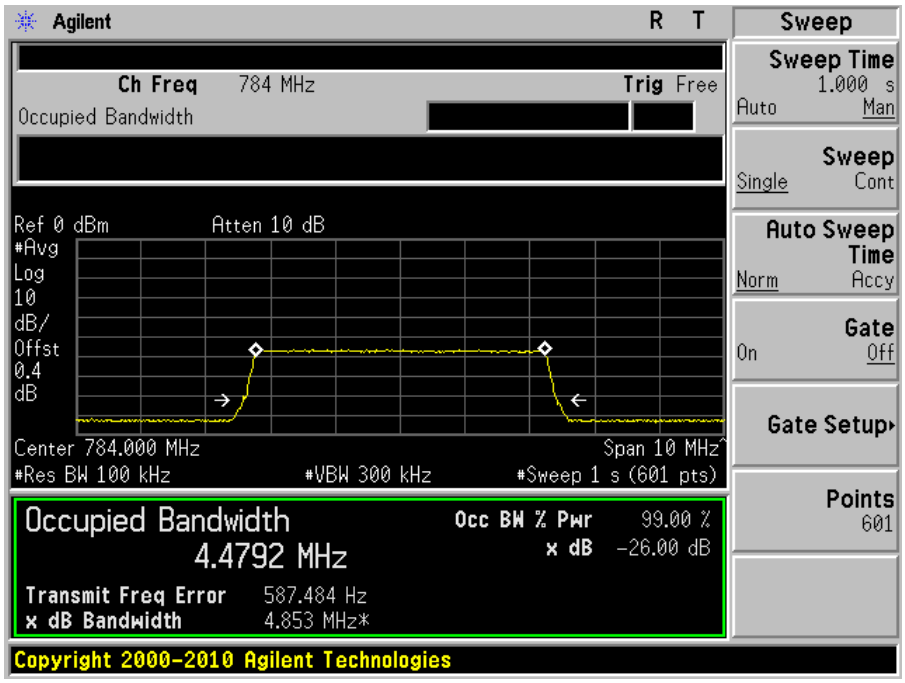


Output

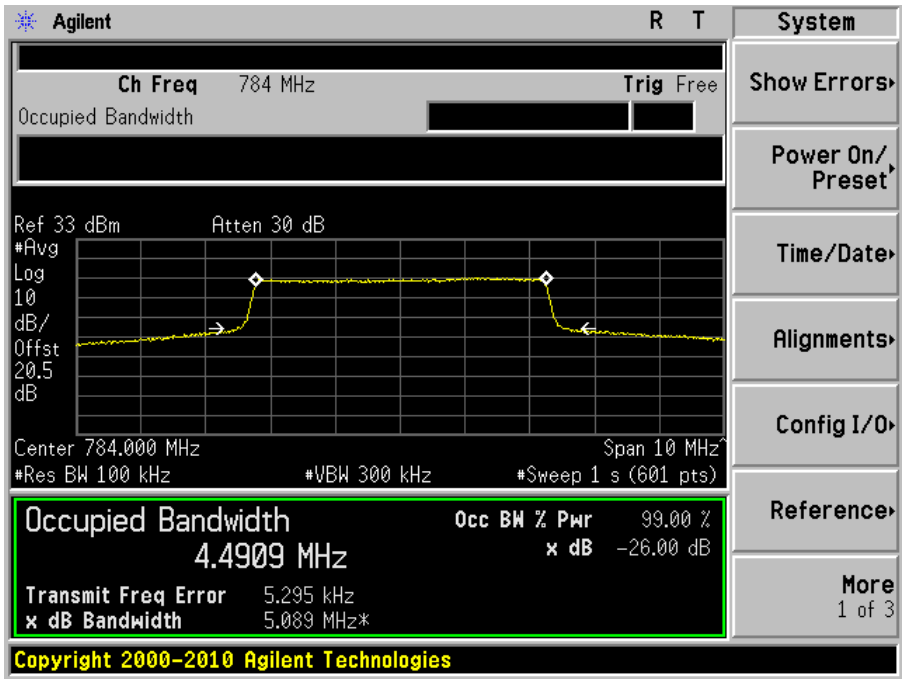


LTE-64QAM (5 MHz), Frequency: 784 MHz

Input

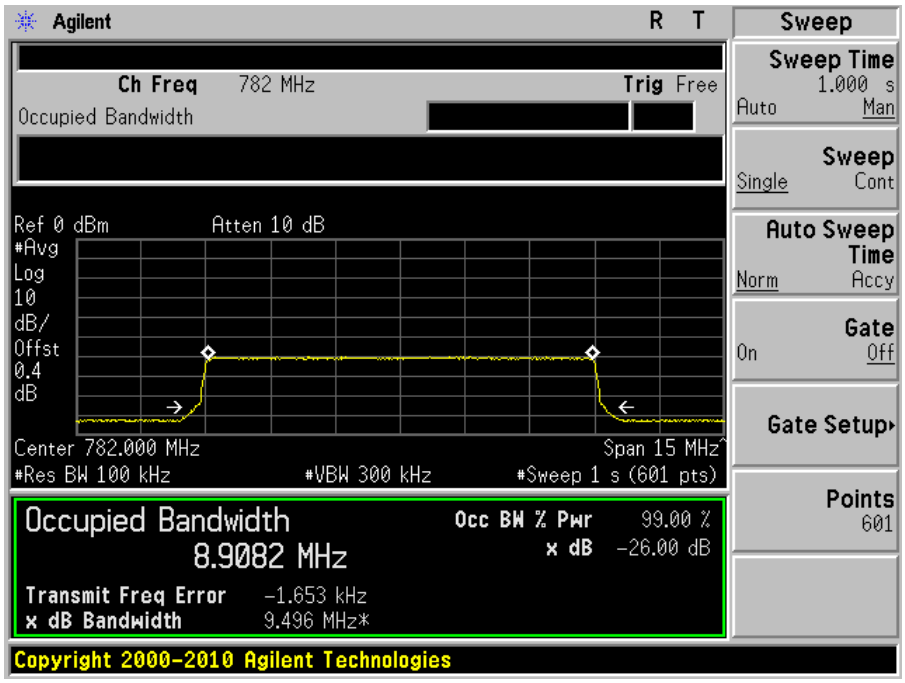


Output

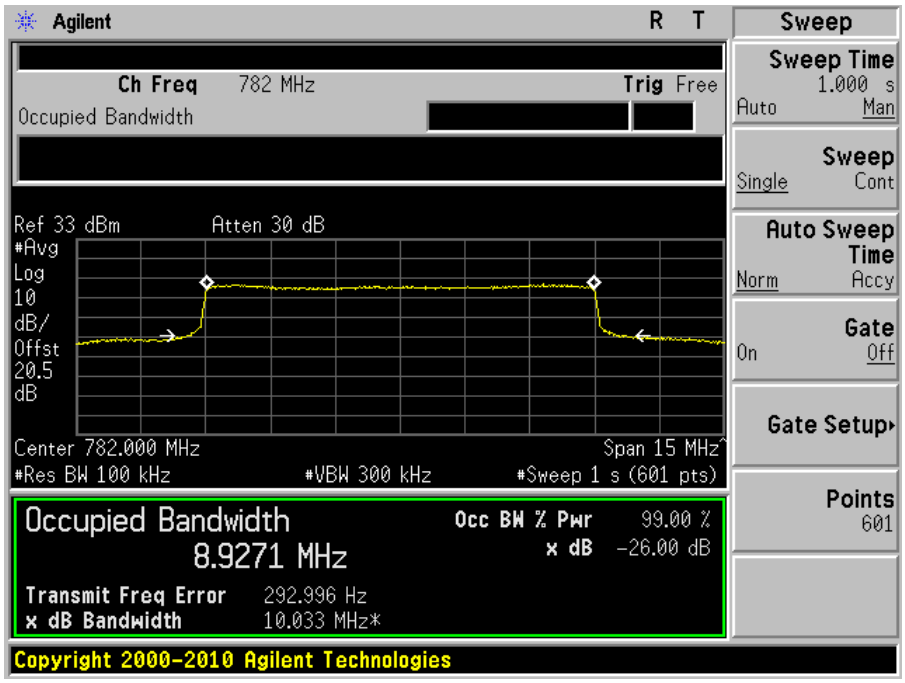


LTE-QPSK (10 MHz), Frequency: 782 MHz

Input

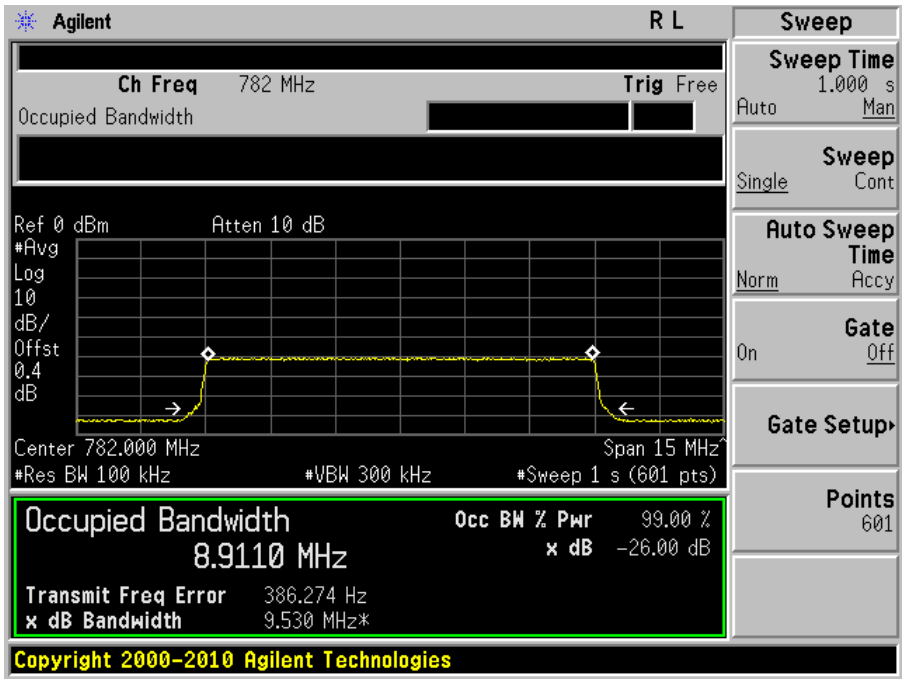


Output

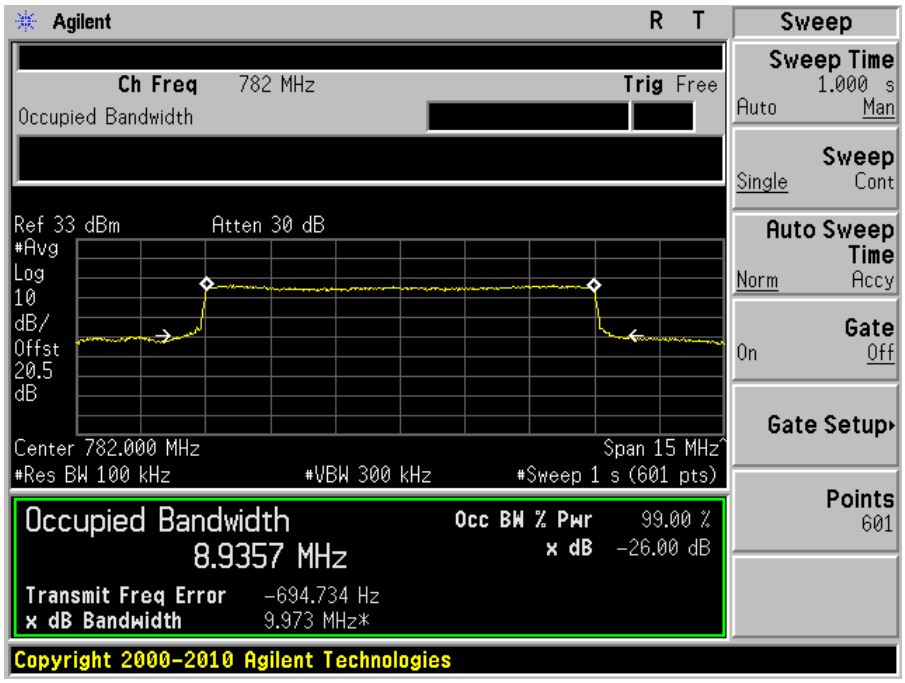


LTE-16QAM (10 MHz), Frequency: 782 MHz

Input

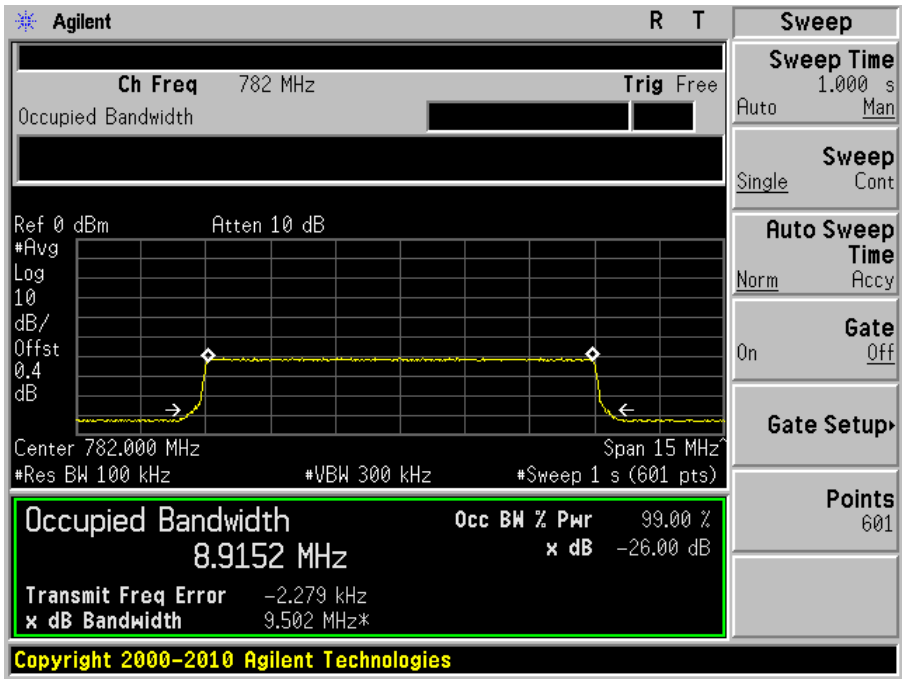


Output

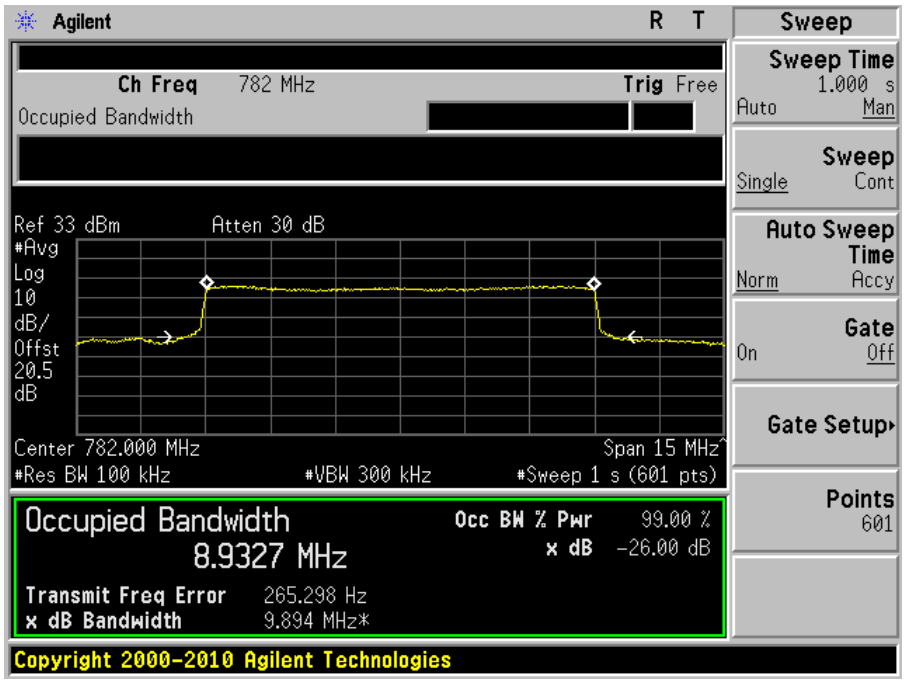


LTE-64QAM (10 MHz), Frequency: 782 MHz

Input



Output



7 FCC §2.1053 & §27.53 - SPURIOUS RADIATED EMISSIONS

7.1 Applicable Standard

Requirements: FCC §2.1053, §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 Log_{10} (power out in Watts)

7.3 Test Environmental Conditions

Temperature:	20-25°C
Relative Humidity:	40-48 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang from 2011-06-22 to 2011-06-24 at Chamber2.

7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09
Rohde & Schwarz	Signal Generator	SMIQ03	DE23746	2010-03-31[1]
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	JB1	A020106-1	2011-05-17
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-18
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Hewlett Packard	Pre-amplifier	8449B	3147A00400	2011-02-03

1) Note: two year calibration cycle.

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

7.5 Summary of Test Results

The worst case reading as follows:

Frequency Bands	Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Frequency Range
DL: 746-757 MHz	-24.41	3757.4	Horizontal	30 MHz – 22 GHz
UL: 776-787 MHz	-22.1	3126.1	Horizontal	30 MHz – 22 GHz

7.6 Test Results

DL: 746 - 757 MHz

Modulation: CW Signal – 751.5 MHz (Scan from 30 MHz to 22 GHz @ 3 Meter Distance)

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)		
97.08	53.81	117	191	H	97.08	-64.67	0	0.3	-64.97	-13	-51.97
97.08	57.41	149	149	V	97.08	-61.07	0	0.3	-61.37	-13	-48.37
3757.4	55.26	152	100	H	3757.4	-45.11	9.2	1.5	-37.41	-13	-24.41
3757.4	51.81	132	100	V	3757.4	-48.56	9.2	1.5	-40.86	-13	-27.86

UL: 776 - 787 MHz

Modulation: CW Signal – 781.5 MHz (Scan from 30 MHz to 22 GHz @ 3 Meter Distance)

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)		
65.15	46.06	222	380	H	65.15	-71.47	0	0.3	-71.77	-13	-58.77
65.15	57.68	239	147	V	65.15	-59.85	0	0.3	-60.15	-13	-47.15
3126.1	60.96	220	127	H	3126.1	-42.7	9.1	1.5	-35.1	-13	-22.1
3126.1	55.37	228	293	V	3126.1	-48.29	9.1	1.5	-40.69	-13	-27.69

8 FCC §2.1051 & §27.53 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

8.1 Applicable Standard

Requirements: FCC §2.1051 & §27.53.

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

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^{th} harmonic.

8.3 Test Environmental Conditions

Temperature:	20-25°C
Relative Humidity:	40-48 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang from 2011-06-22 to 2011-06-24 at RF Site.

8.4 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Rohde & Schwarz	Signal Generator	SMIQ03	DE23746	2010-03-31[1]
Agilent	Spectrum Analyzer	E4446A	US44300386	2010-08-18

1) Note: two year calibration cycle.

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

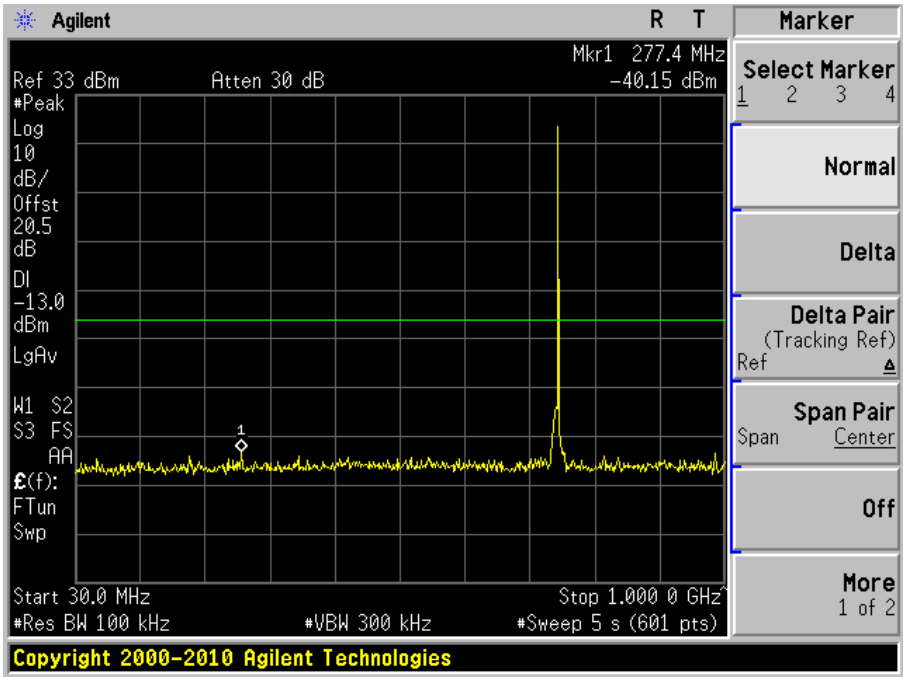
8.5 Test Results

Please refer to the following plots.

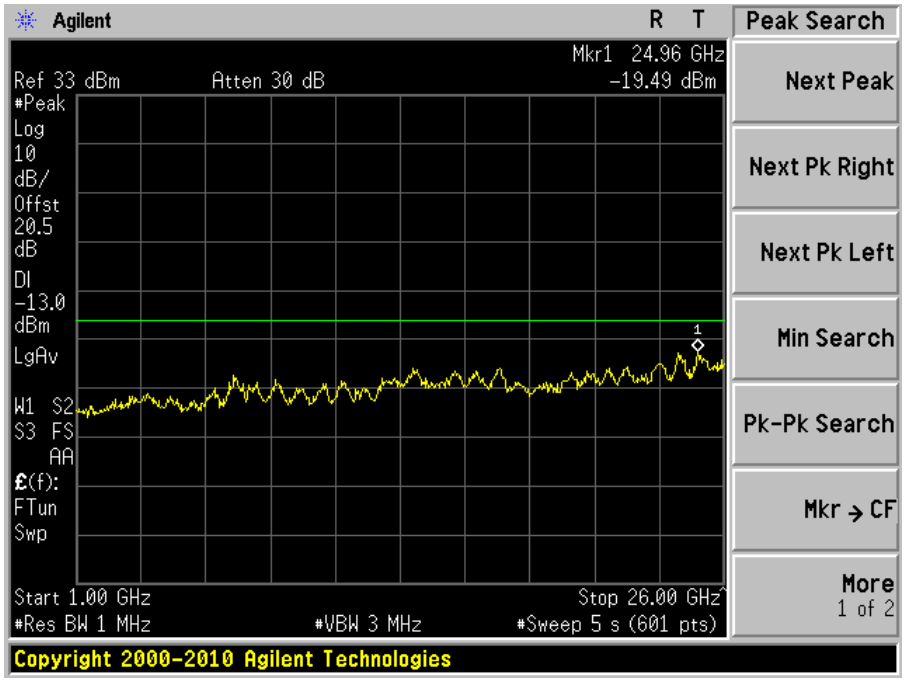
DL: 746-757 MHz

Modulation: CW Signal, Frequency: 751.5 MHz

Plot 1: 30 MHz to 1 GHz



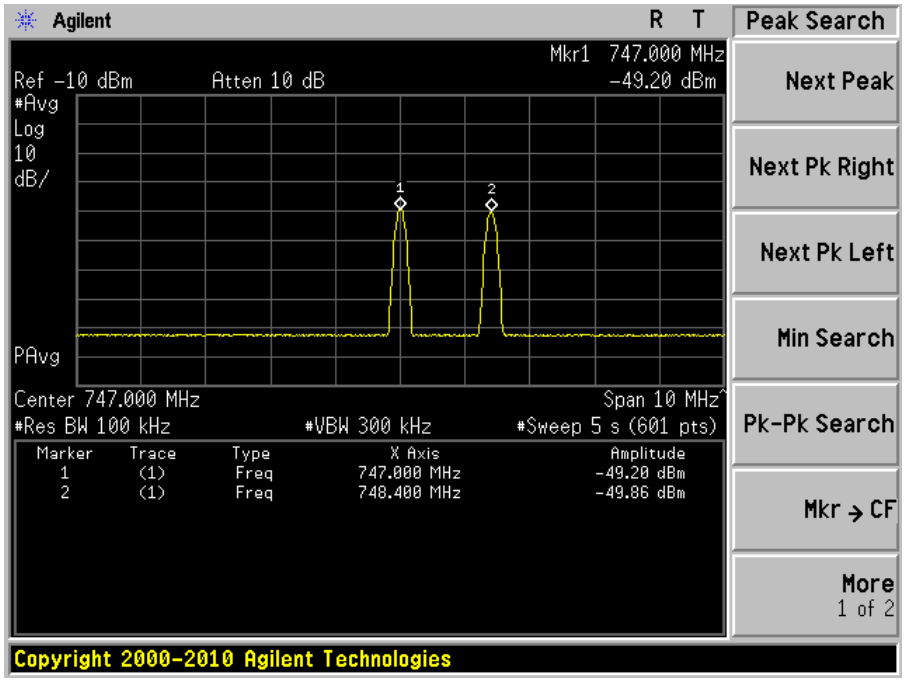
Plot 2: Above 1 GHz



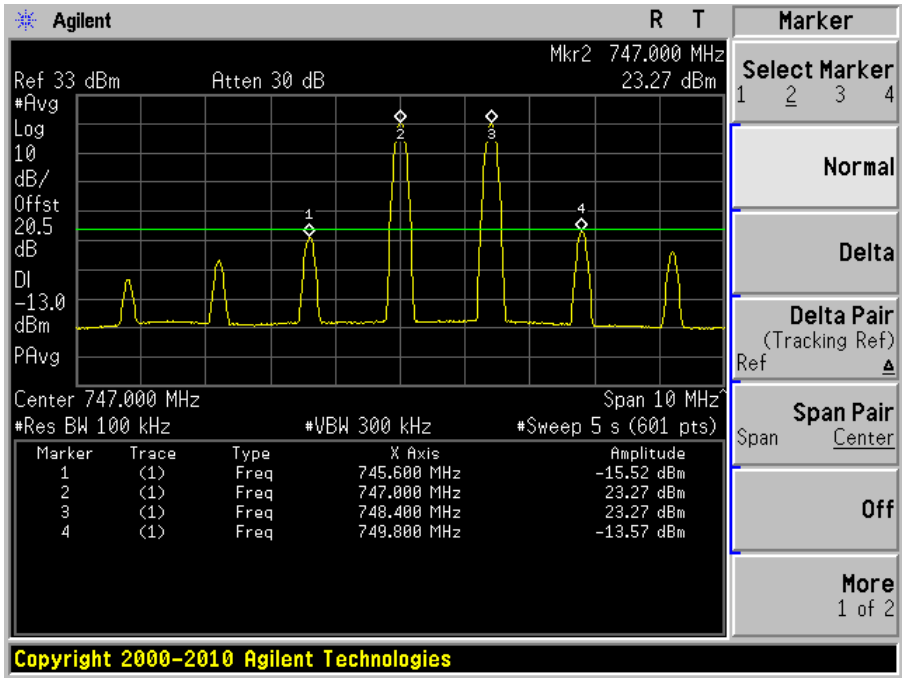
Inter-Modulation:

Lowest Frequency

Input

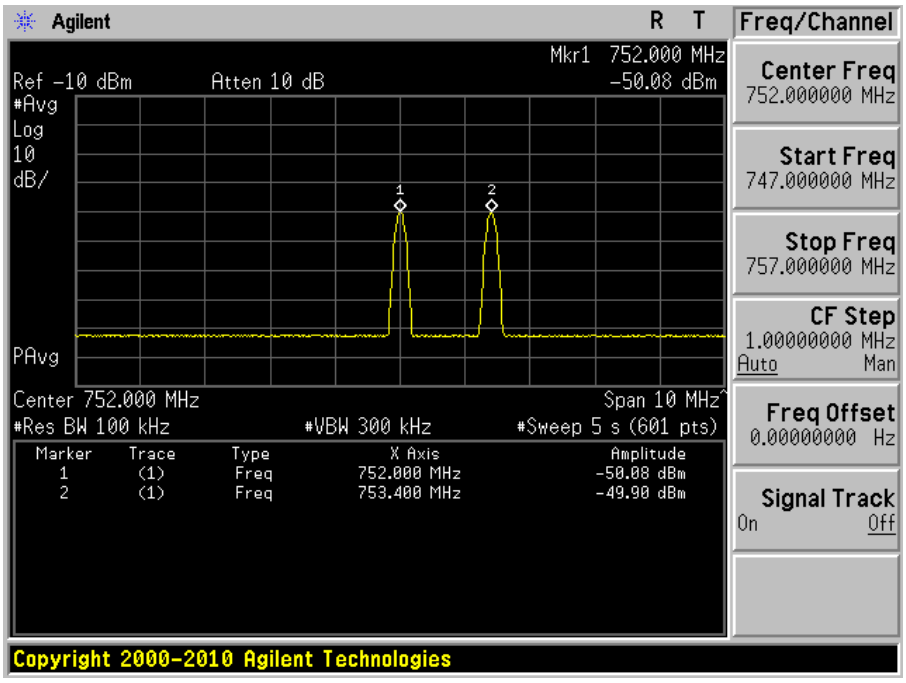


Output

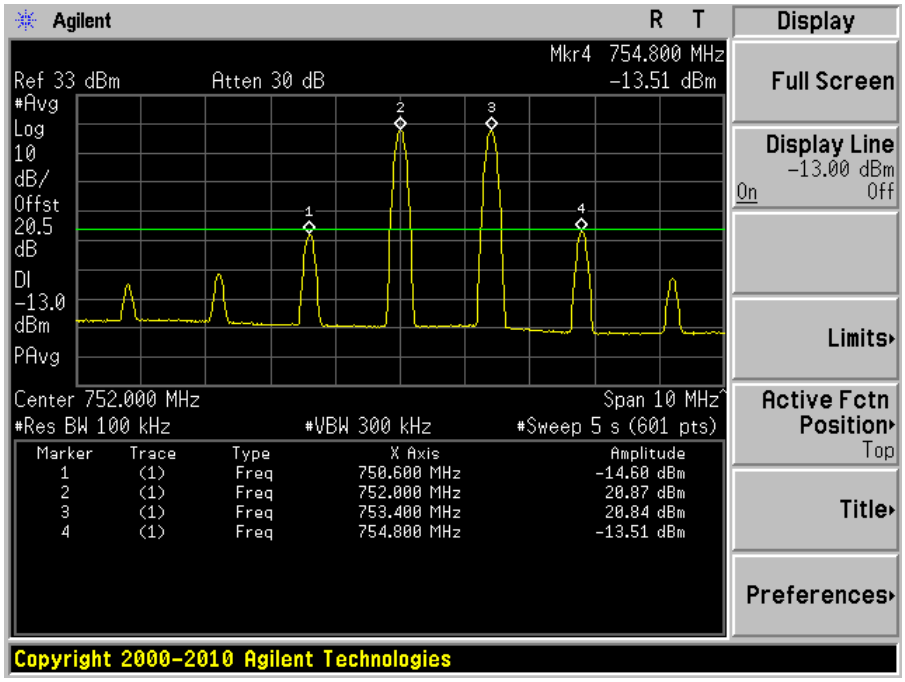


Middle Frequency

Input

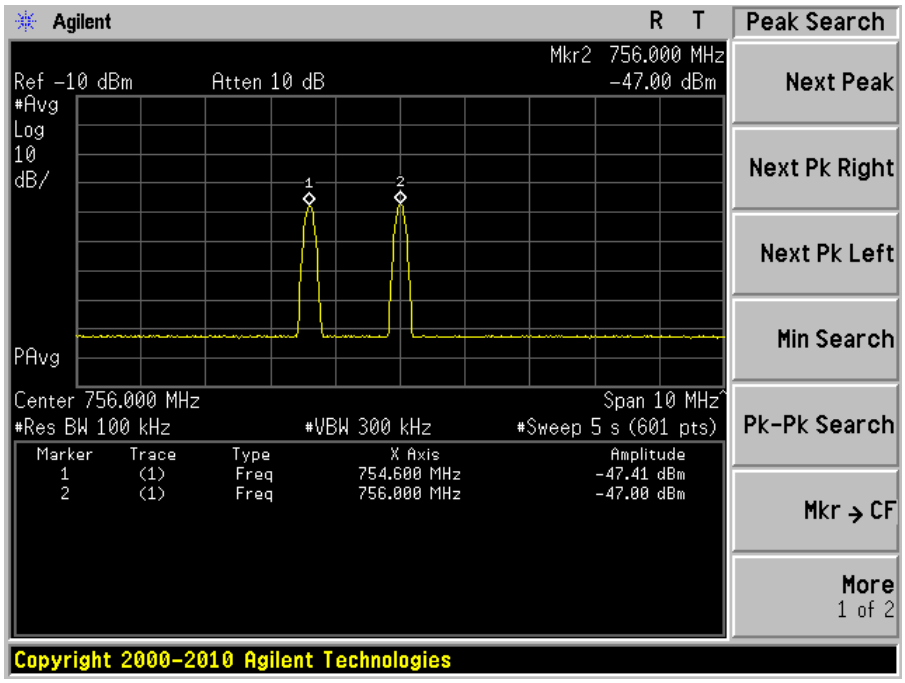


Output



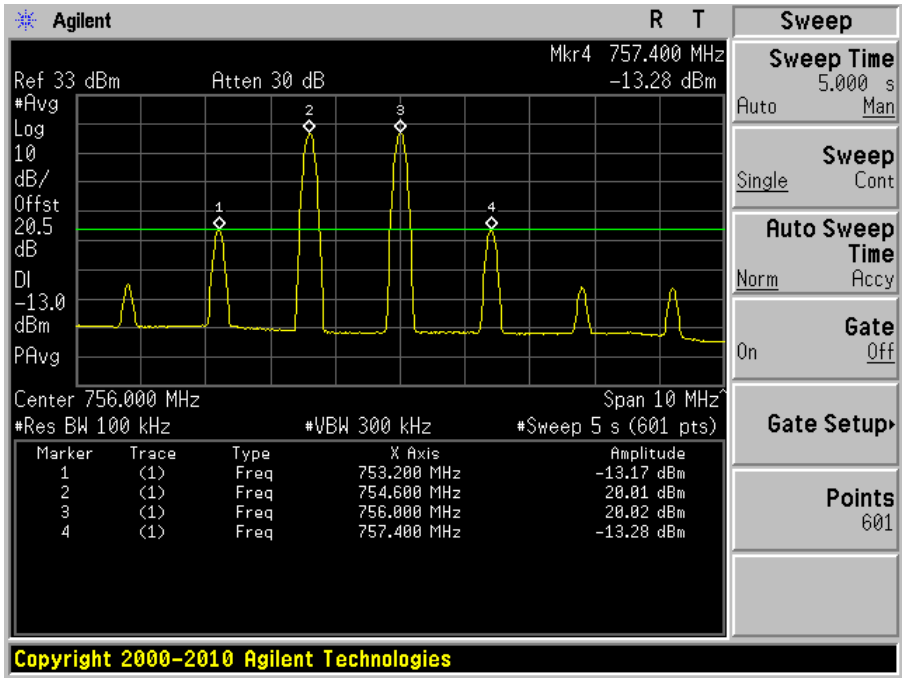
Highest Frequency

Input



.

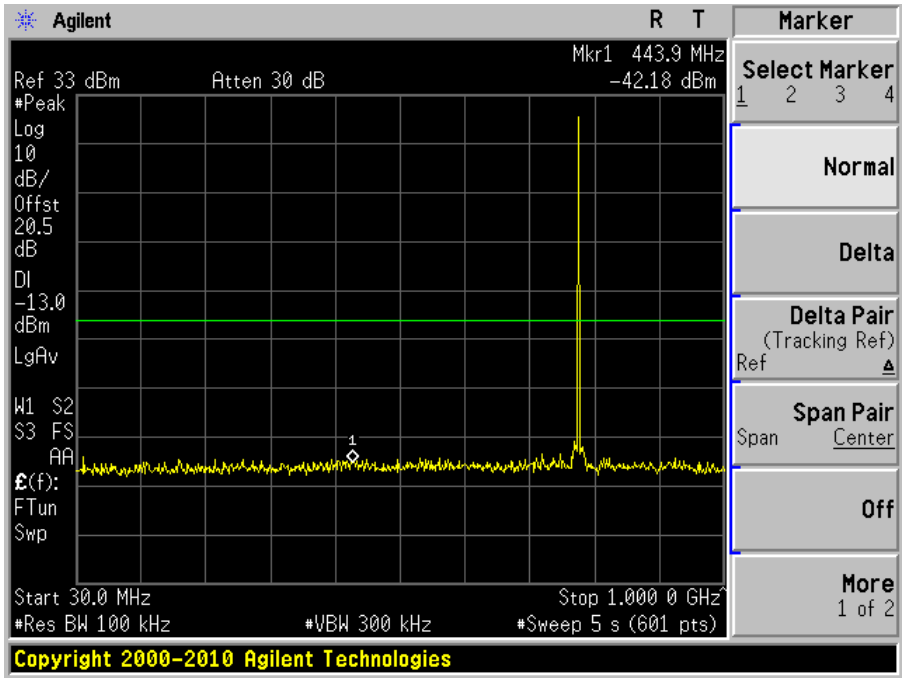
Output



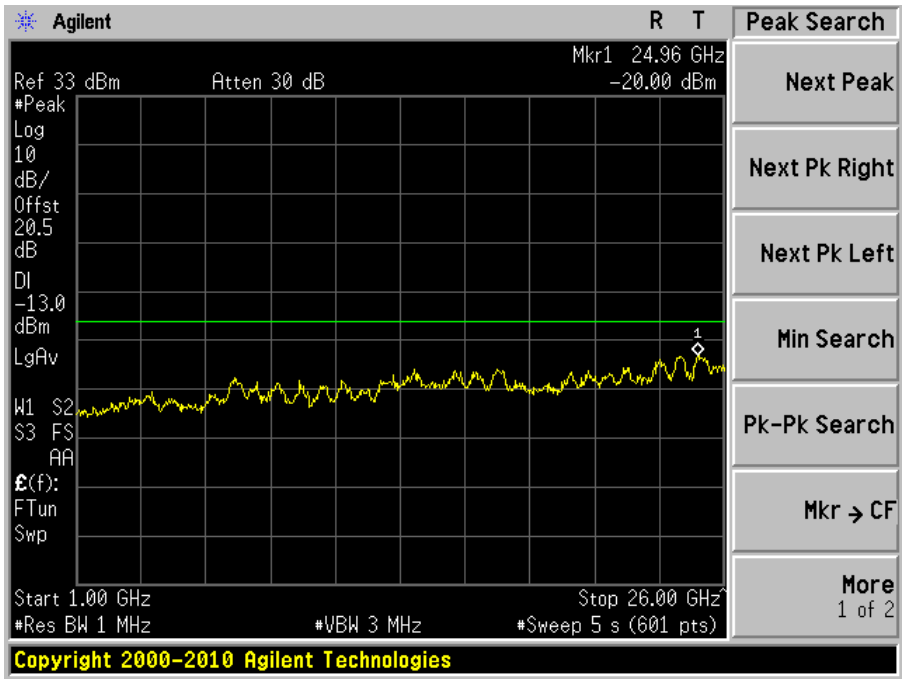
UL: 776-787 MHz

Modulation: CW Signal, Frequency: 781.5 MHz

Plot 1: 30 MHz to 1 GHz



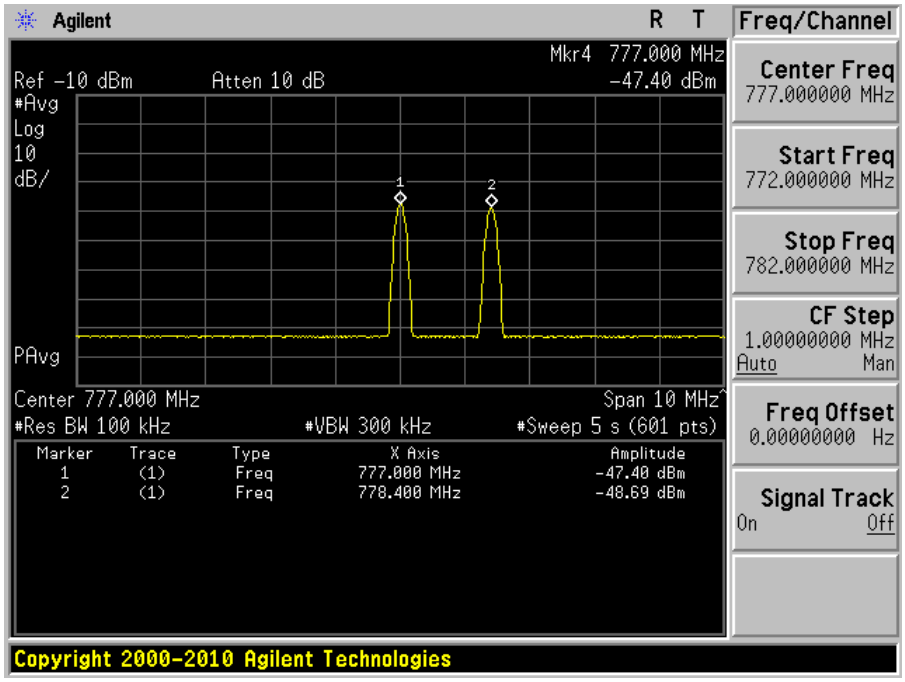
Plot 2: Above 1 GHz



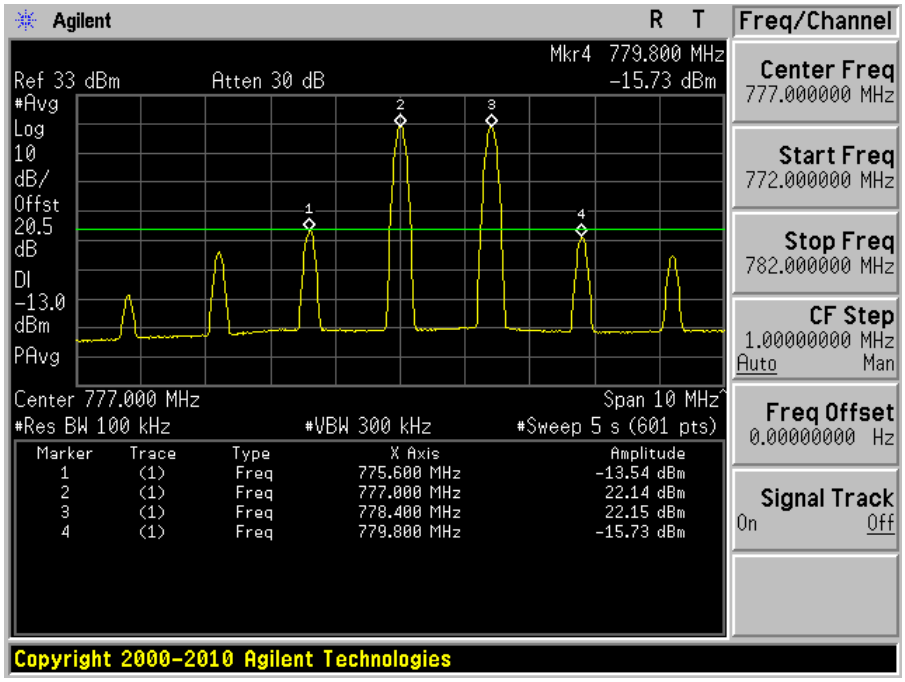
Inter-modulation:

Lowest Frequency

Input

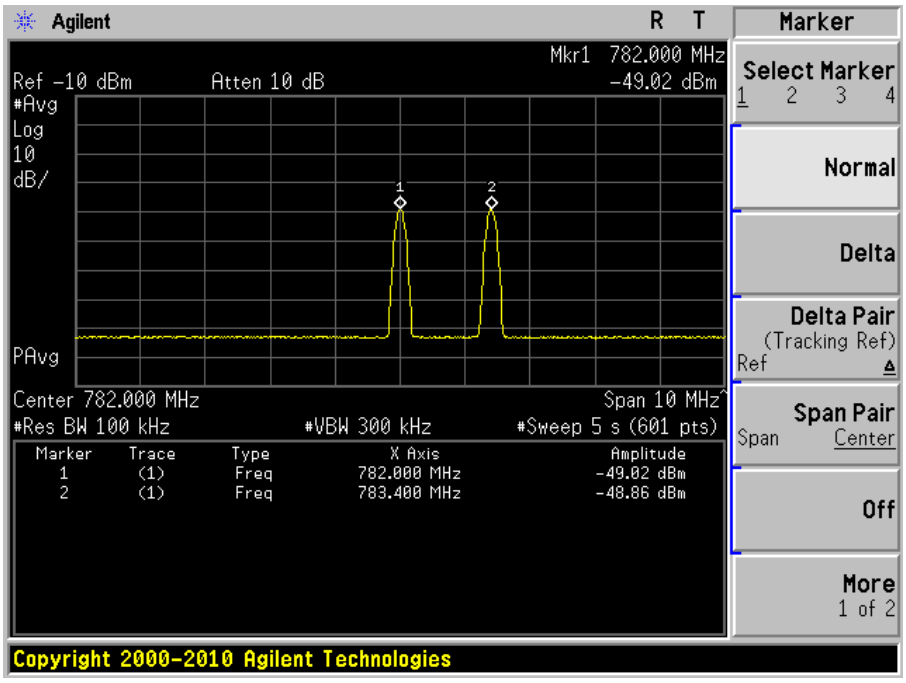


Output

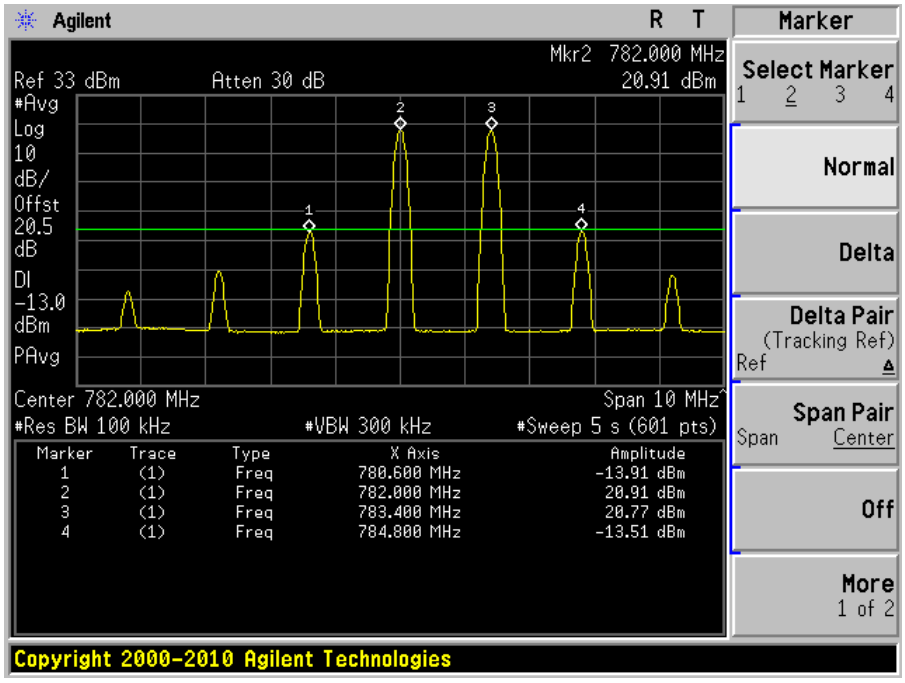


Middle Frequency

Input

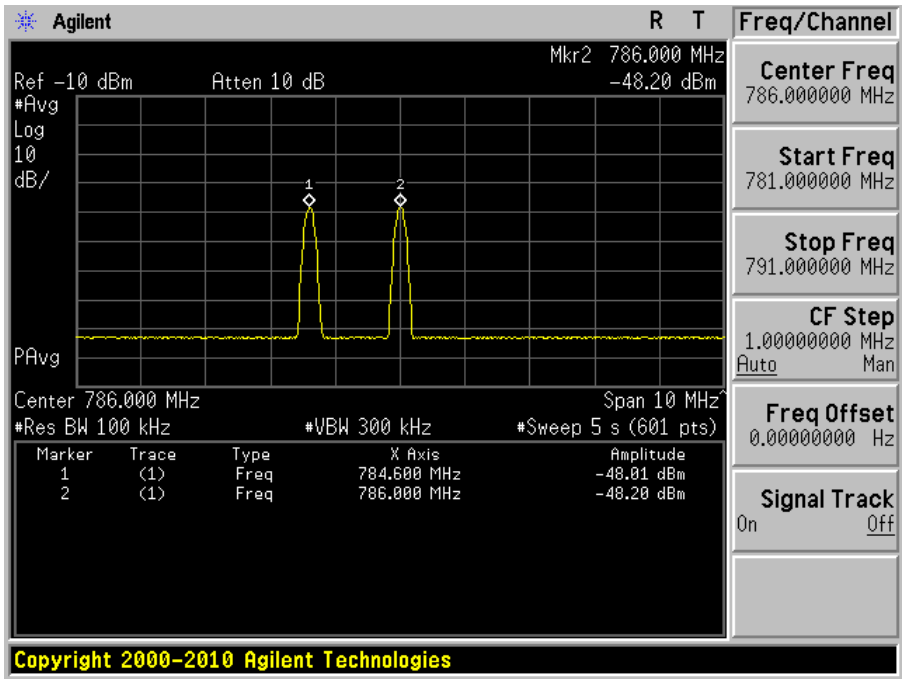


Output

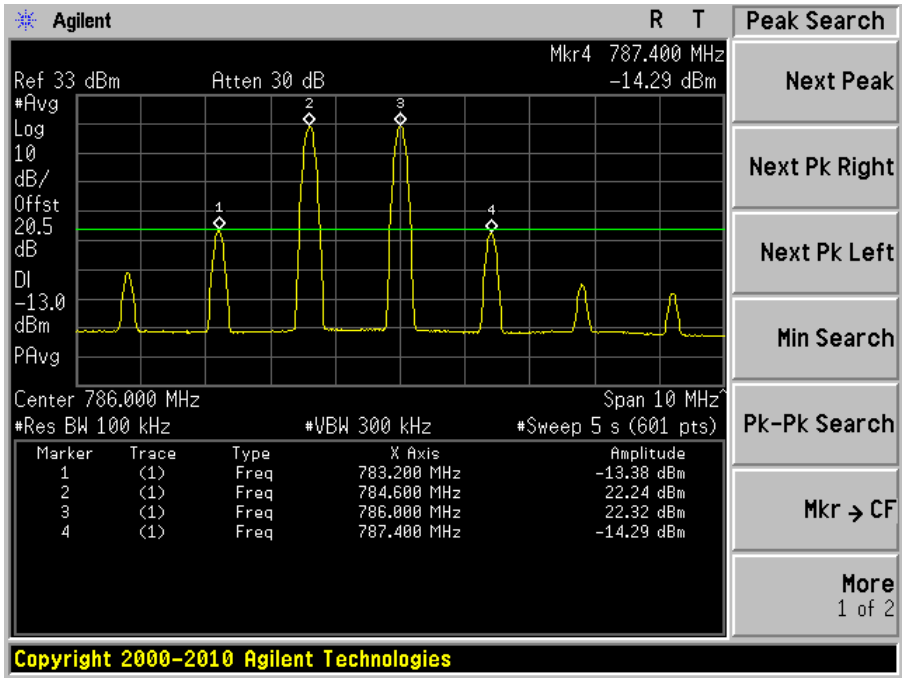


Highest Frequency

Input



Output



9 FCC §27.53 – BAND EDGE

9.1 Applicable Standard

According to FCC §27.53, 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.

9.2 Test Procedure

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

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

9.3 Test Environmental Conditions

Temperature:	20-25°C
Relative Humidity:	40-48 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang from 2011-06-22 to 2011-06-24 at RF Site.

9.4 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates
Agilent	ESG-D Series Signal Generator	E4438C	MY45091309	2011-04-28
Agilent	Spectrum Analyzer	E4446A	US44300386	2010-08-18

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

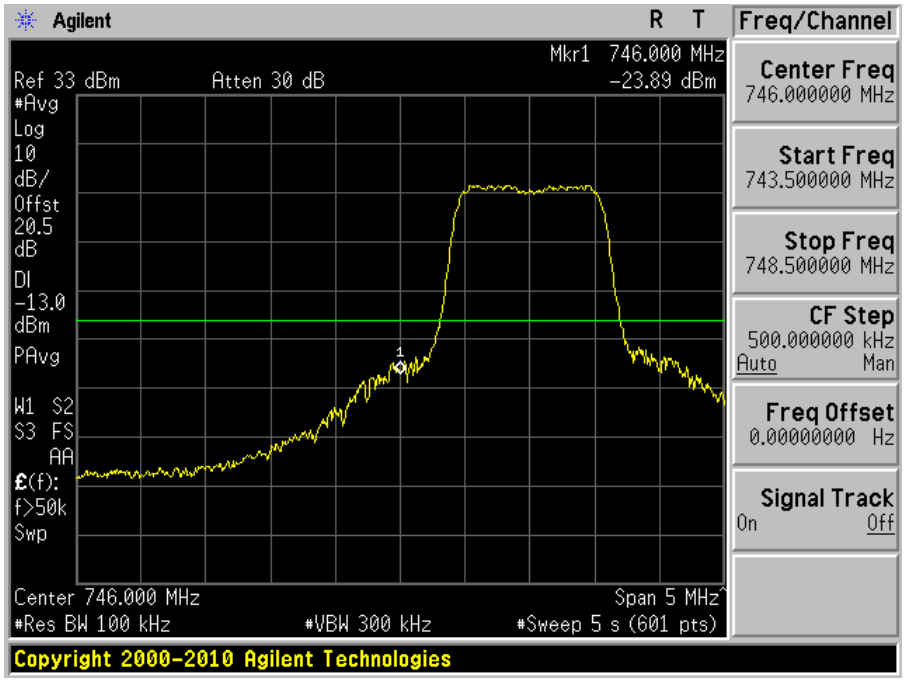
9.5 Test Results

Please refer to the following plots.

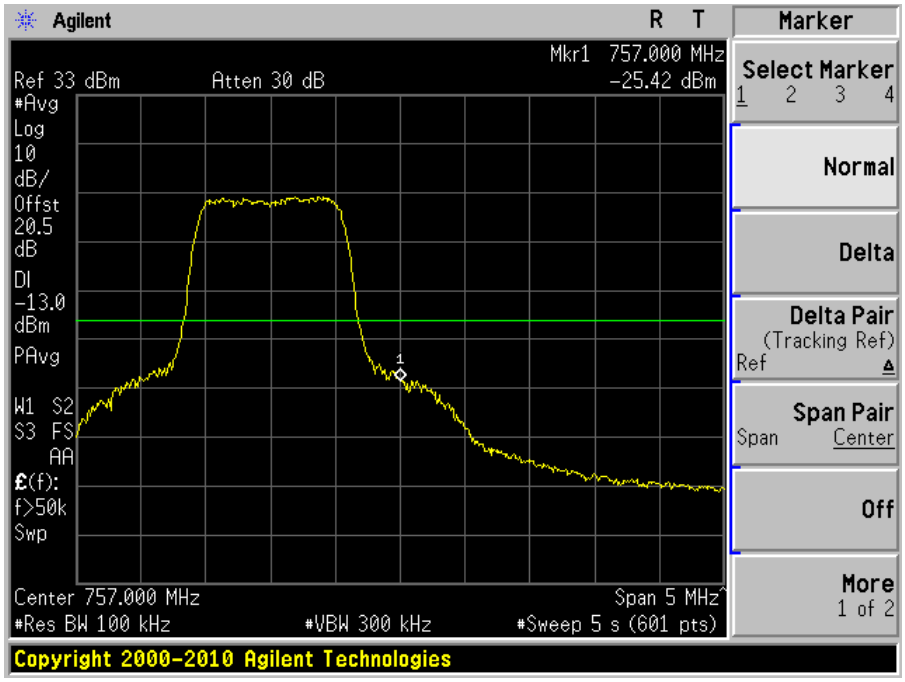
DL: 746-757 MHz

Modulation: LTE-QPSK (1.4 MHz):

Plot 1: Lowest Edge

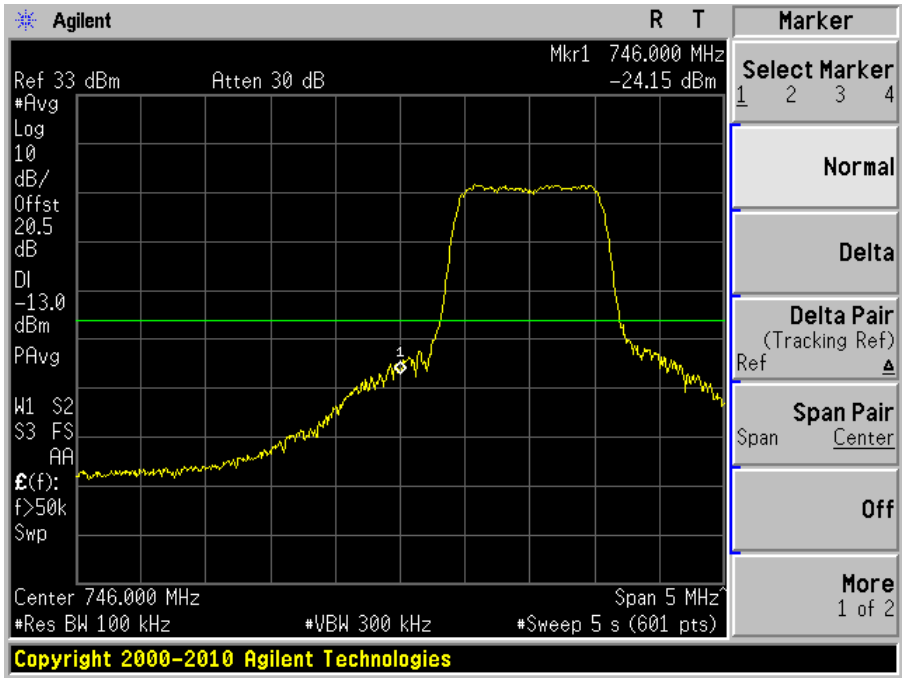


Plot 2: Highest Edge

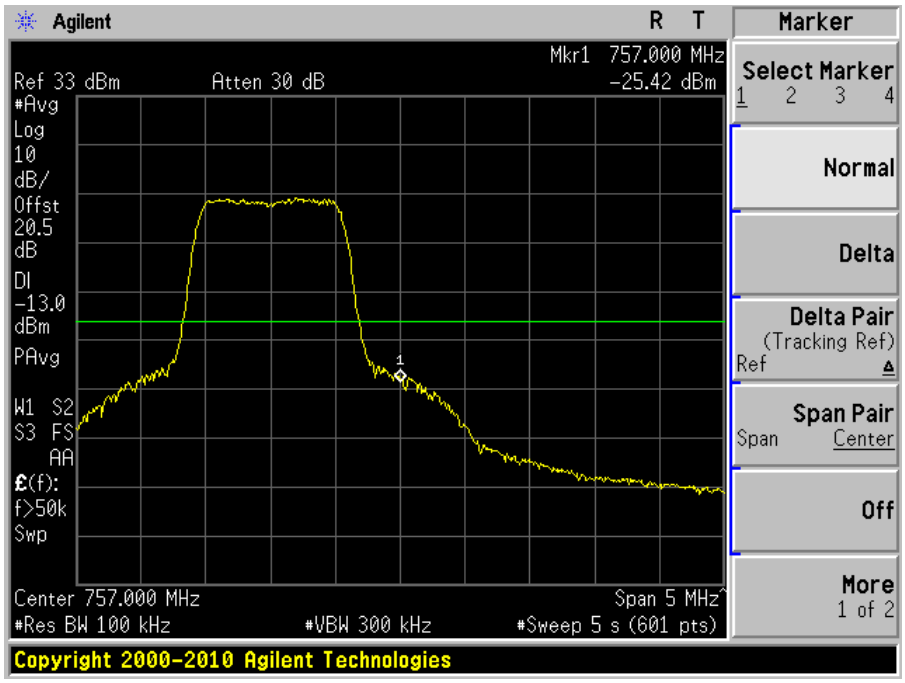


Modulation: LTE-16QAM (1.4 MHz):

Plot 1: Lowest Edge

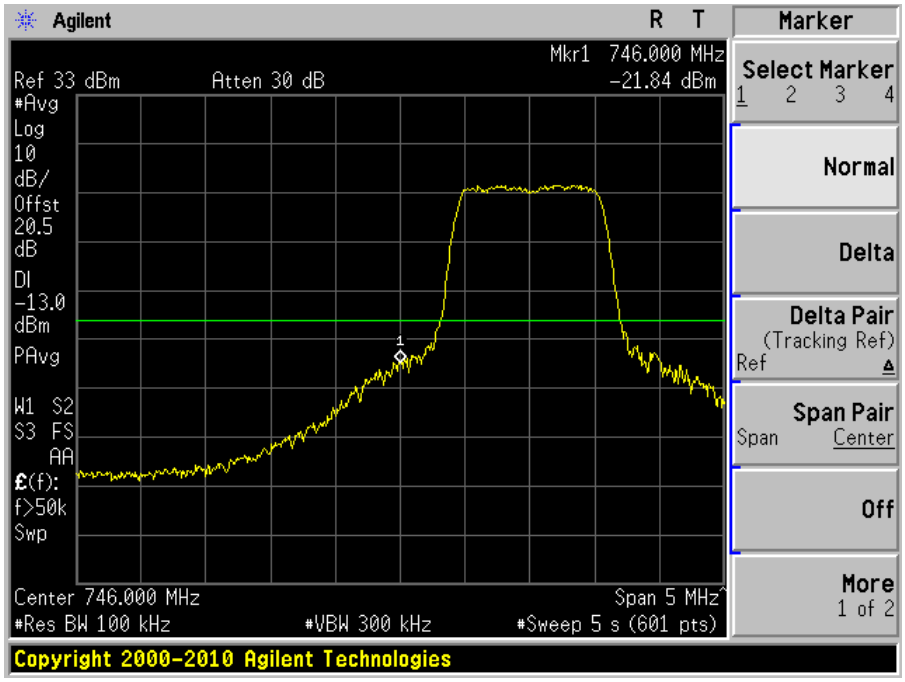


Plot 2: Highest Edge

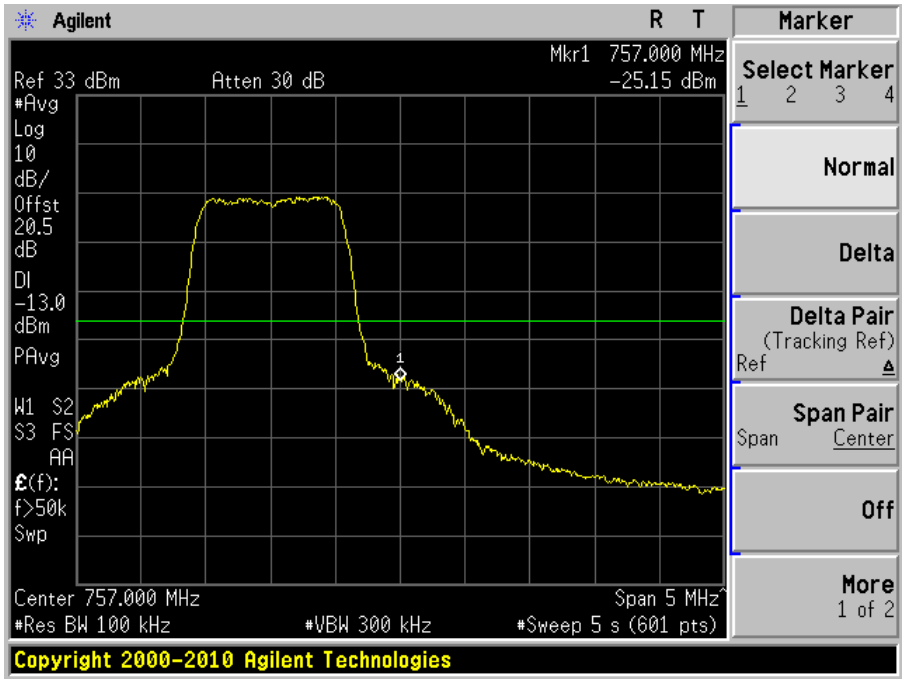


Modulation: LTE-64QAM (1.4 MHz):

Plot 1: Lowest Edge

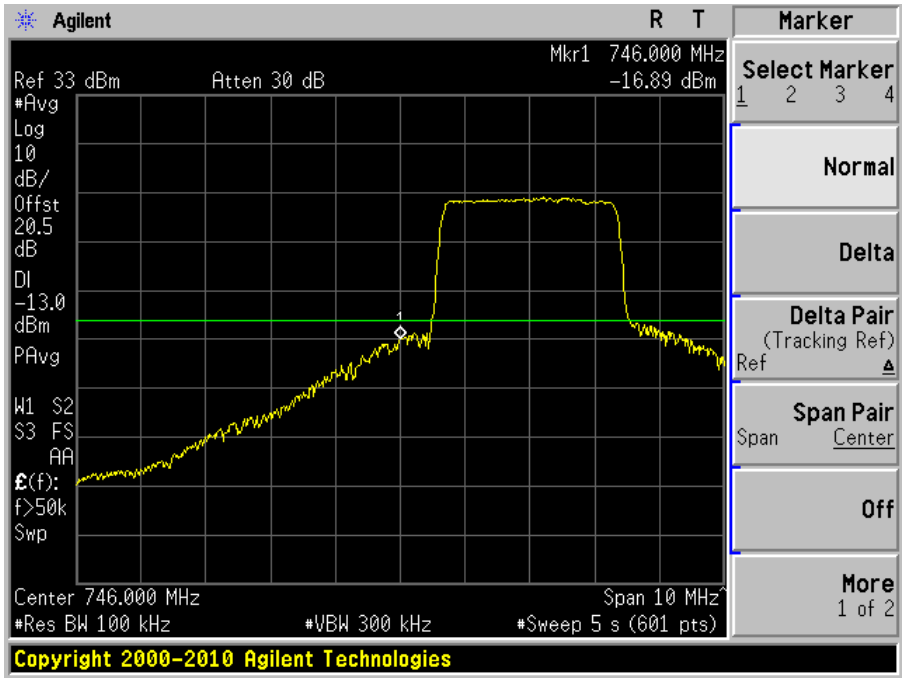


Plot 2: Highest Edge

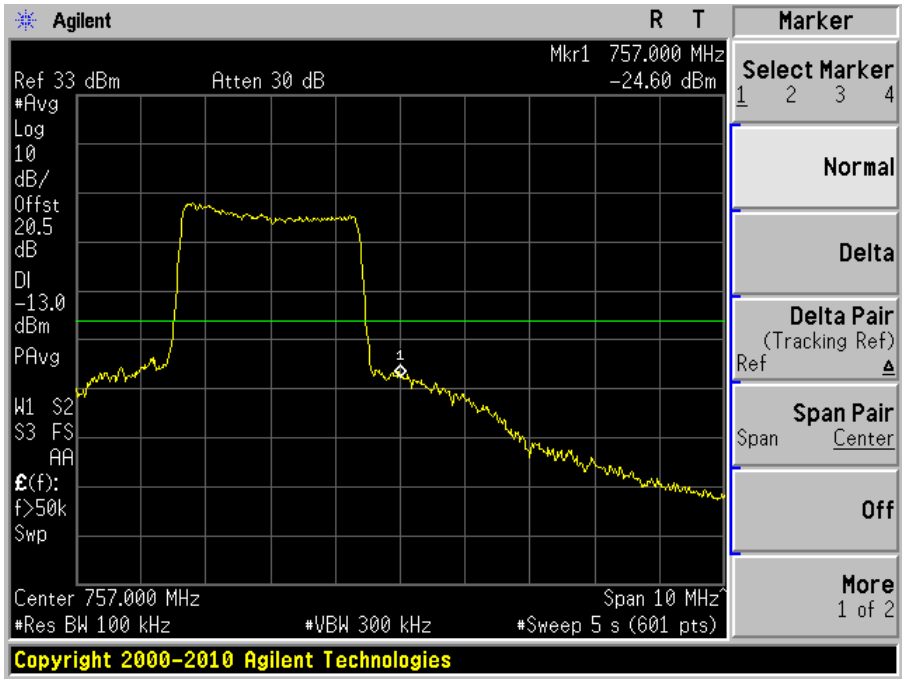


Modulation: LTE-QPSK (3 MHz):

Plot 1: Lowest Edge

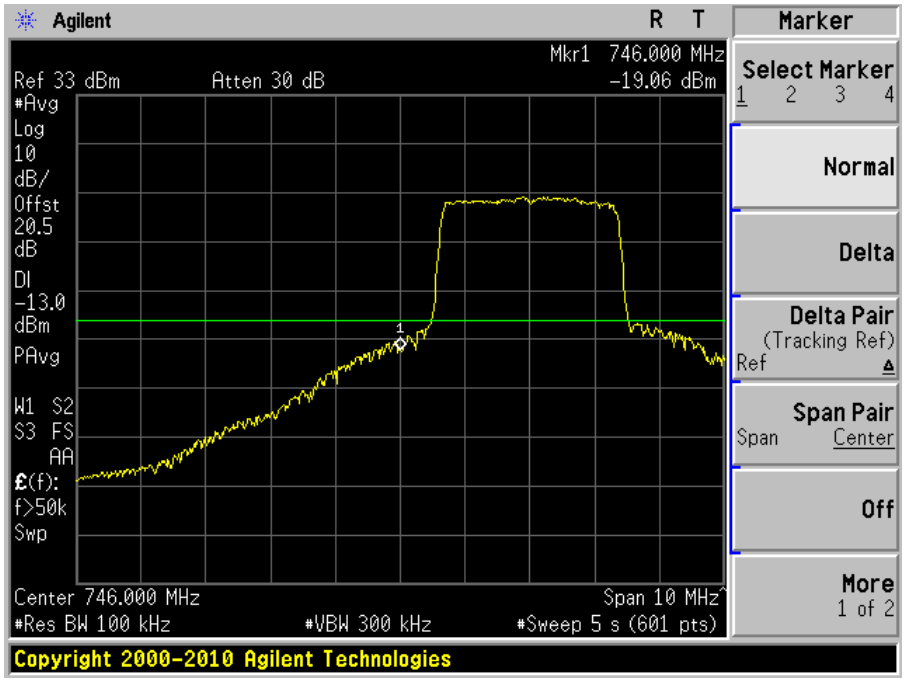


Plot 2: Highest Edge

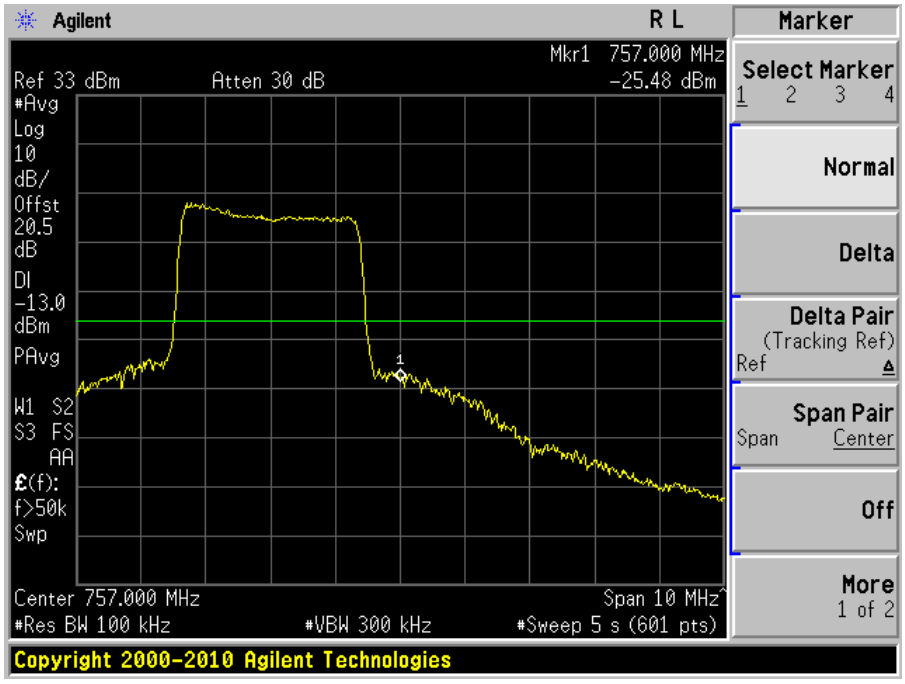


Modulation: LTE-16QAM (3 MHz):

Plot 1: Lowest Edge

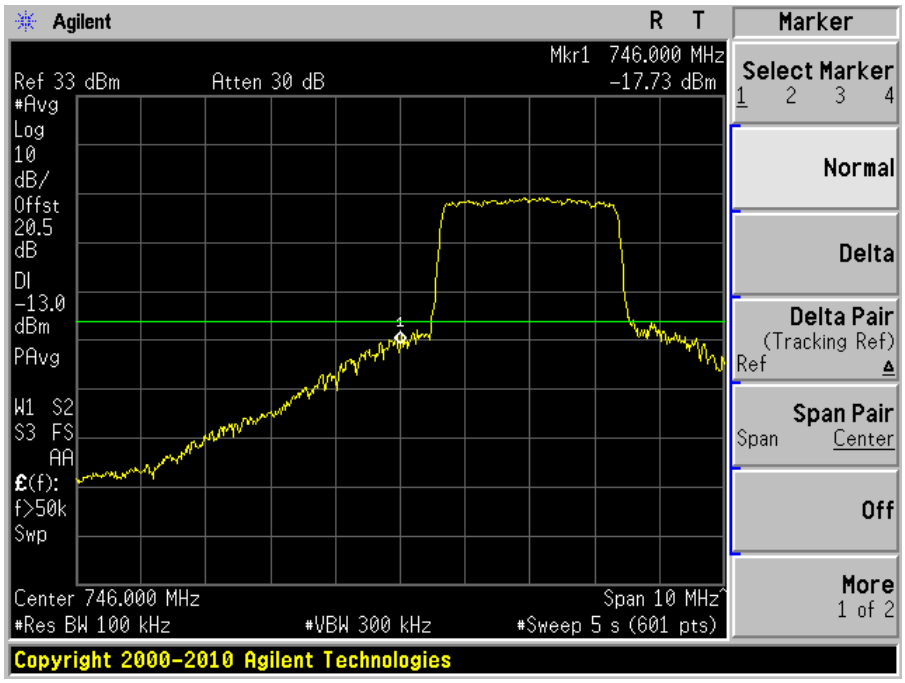


Plot 2: Highest Edge

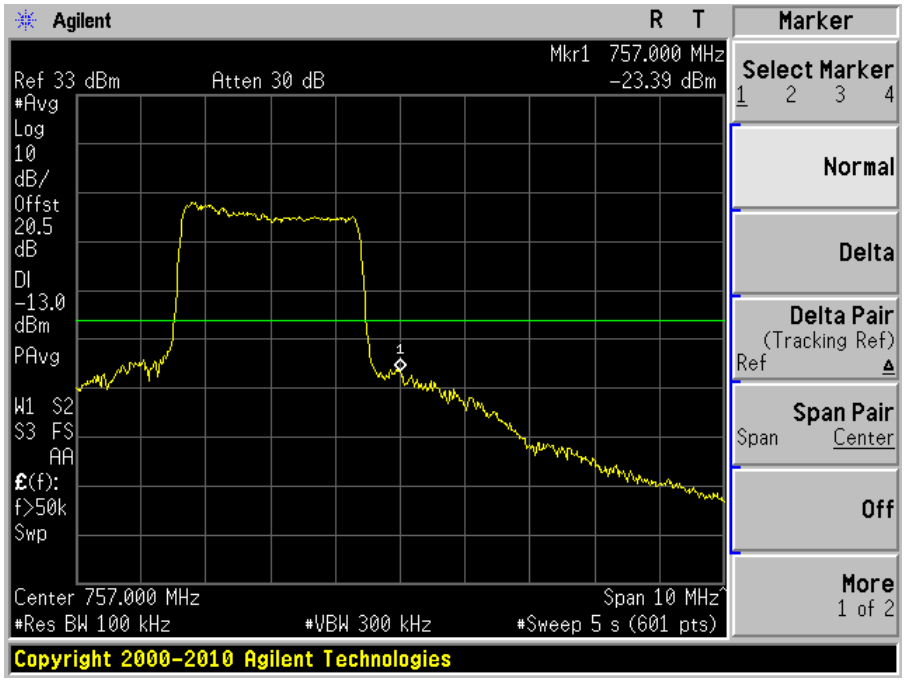


Modulation: LTE-64QAM (3 MHz):

Plot 1: Lowest Edge

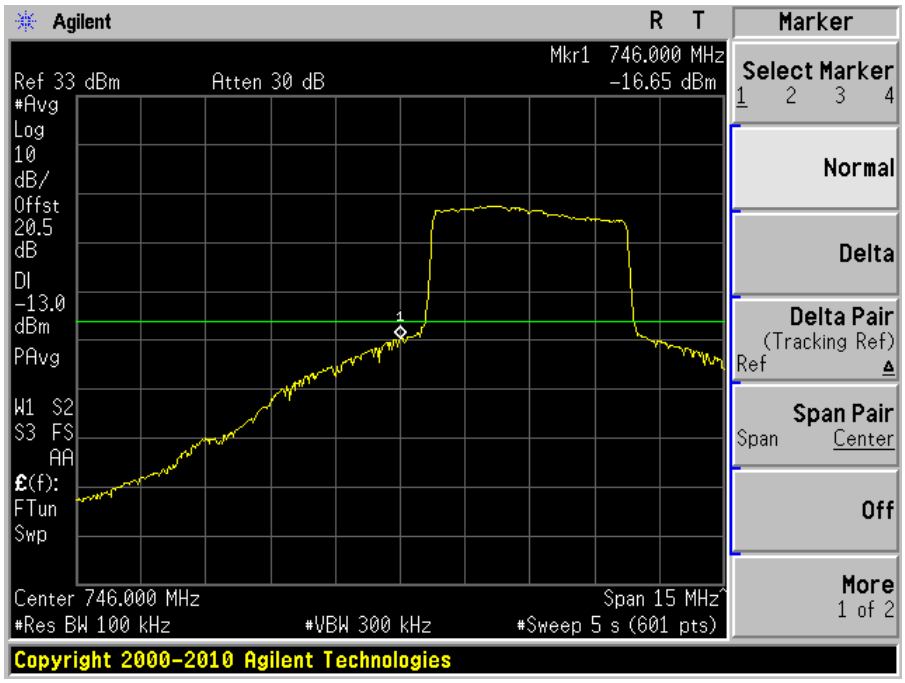


Plot 2: Highest Edge

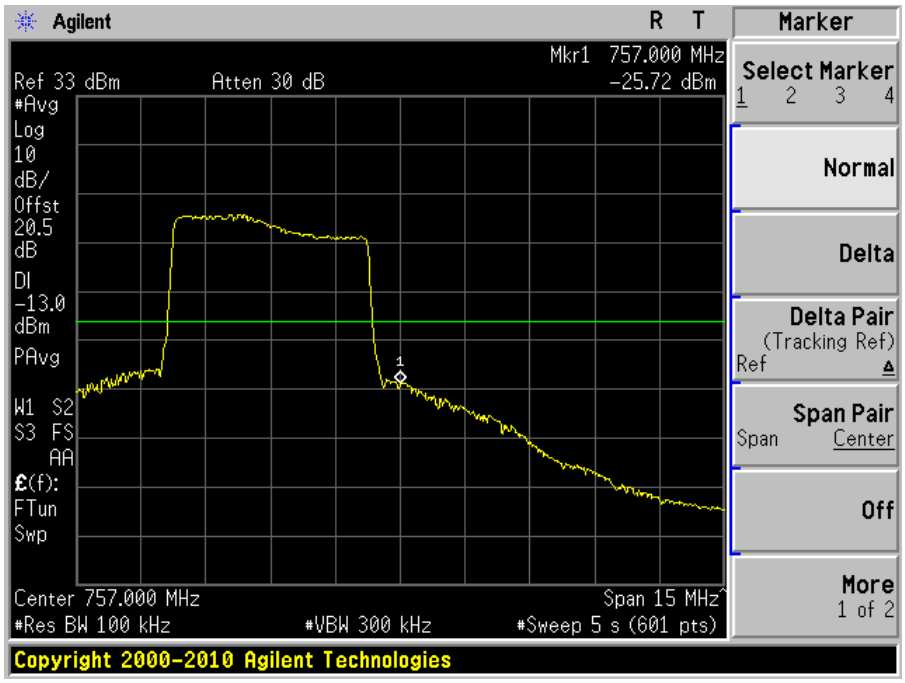


Modulation: LTE-QPSK (5 MHz):

Plot 1: Lowest Edge

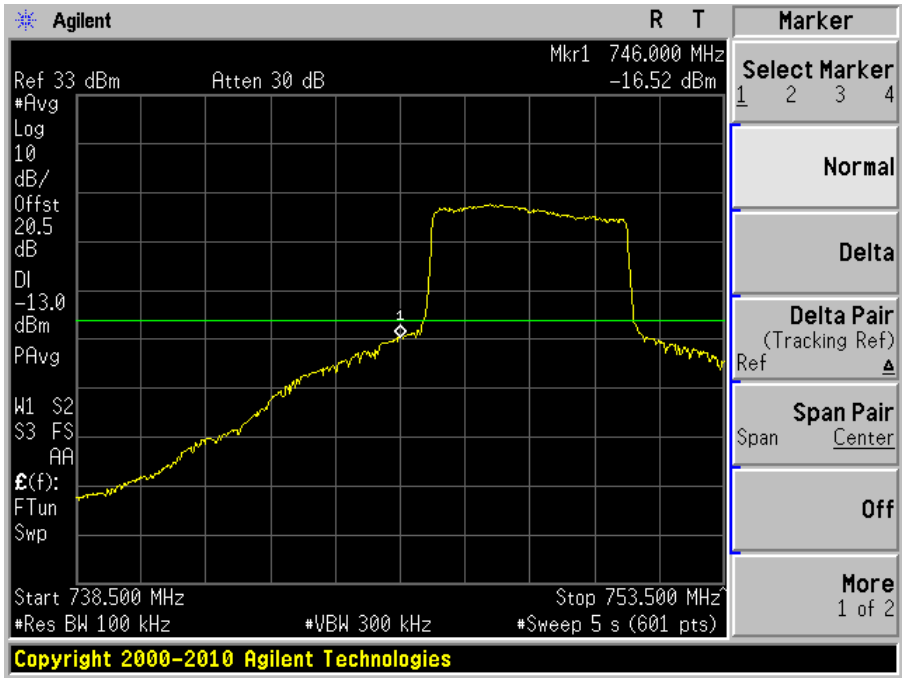


Plot 2: Highest Edge

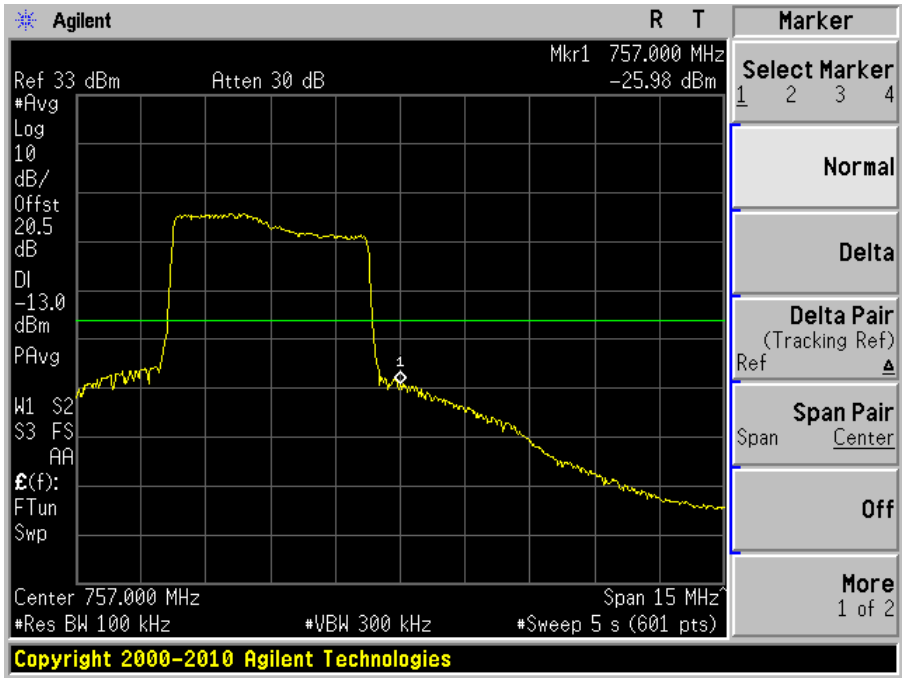


Modulation: LTE-16QAM (5 MHz):

Plot 1: Lowest Edge

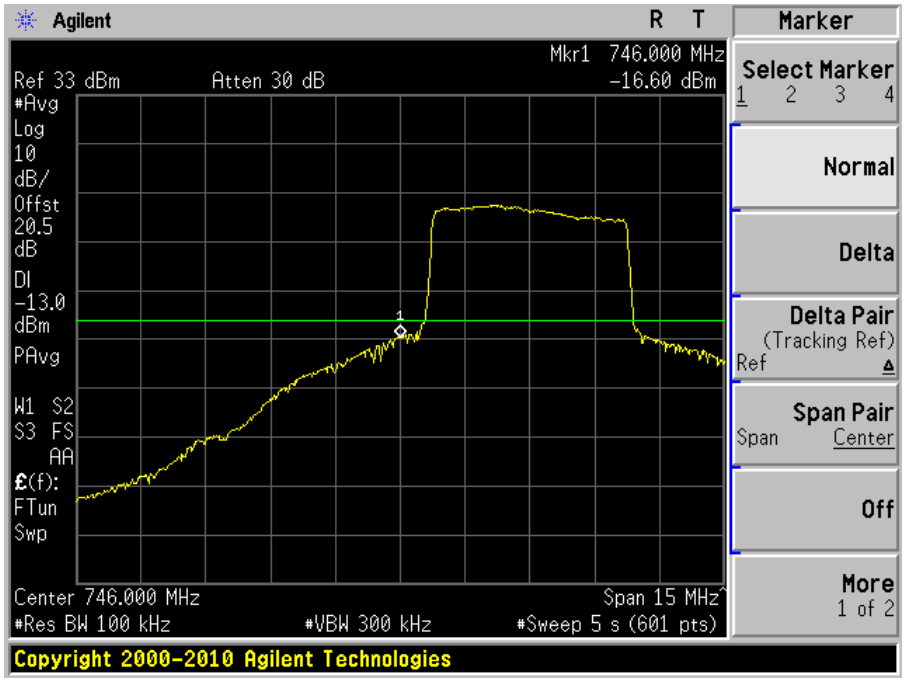


Plot 2: Highest Edge

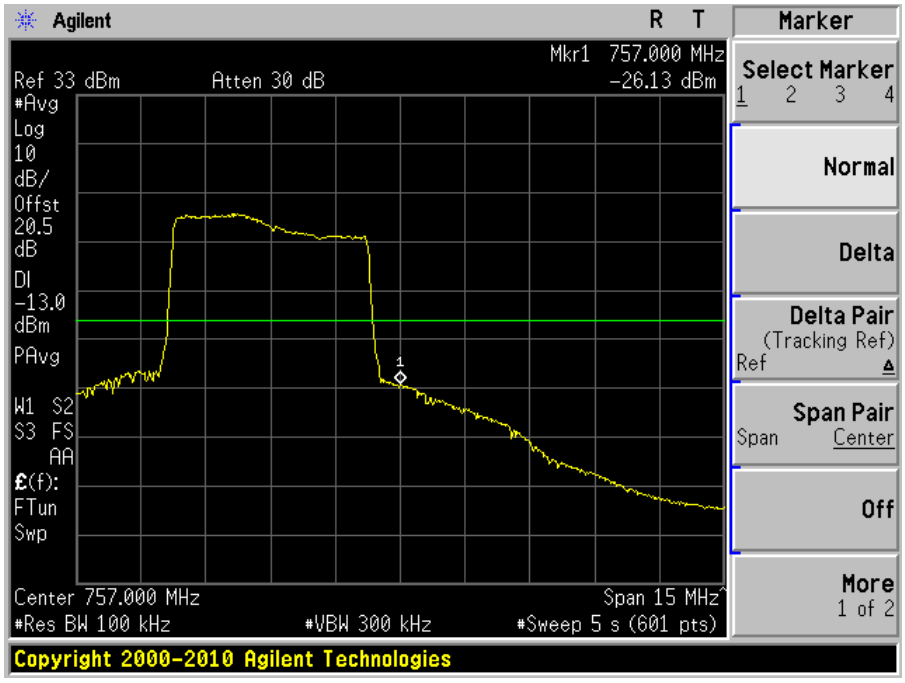


Modulation: LTE-64QAM (5 MHz):

Plot 1: Lowest Edge

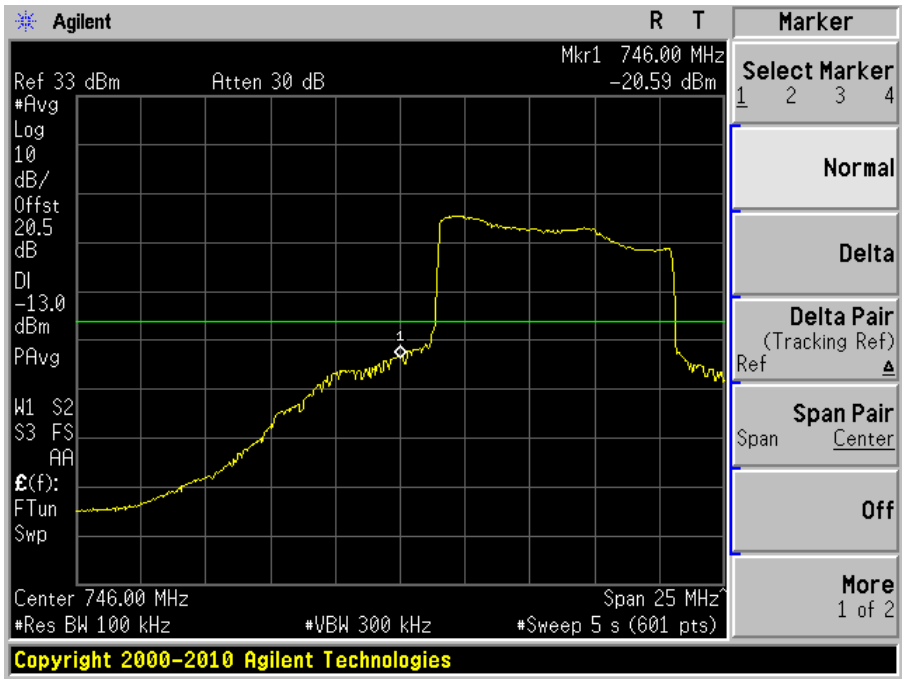


Plot 2: Highest Edge

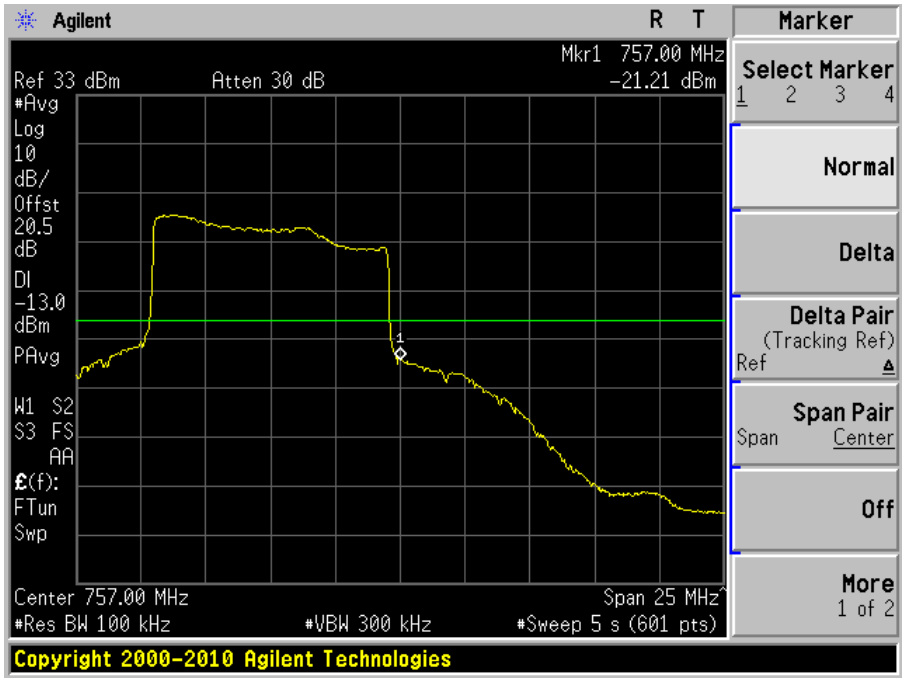


Modulation: LTE-QPSK (10 MHz):

Plot 1: Lowest Edge

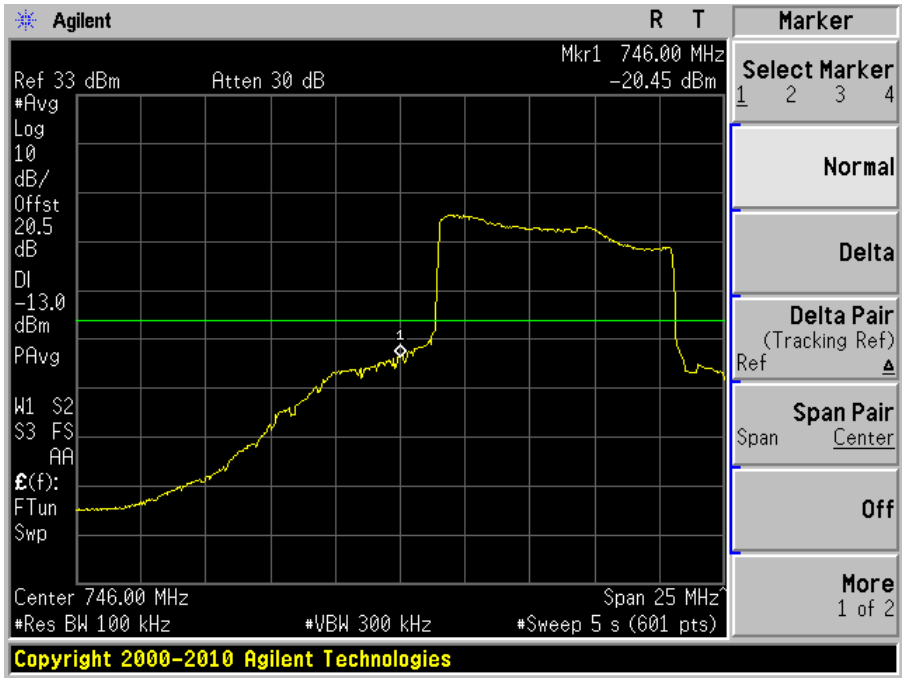


Plot 2: Highest Edge

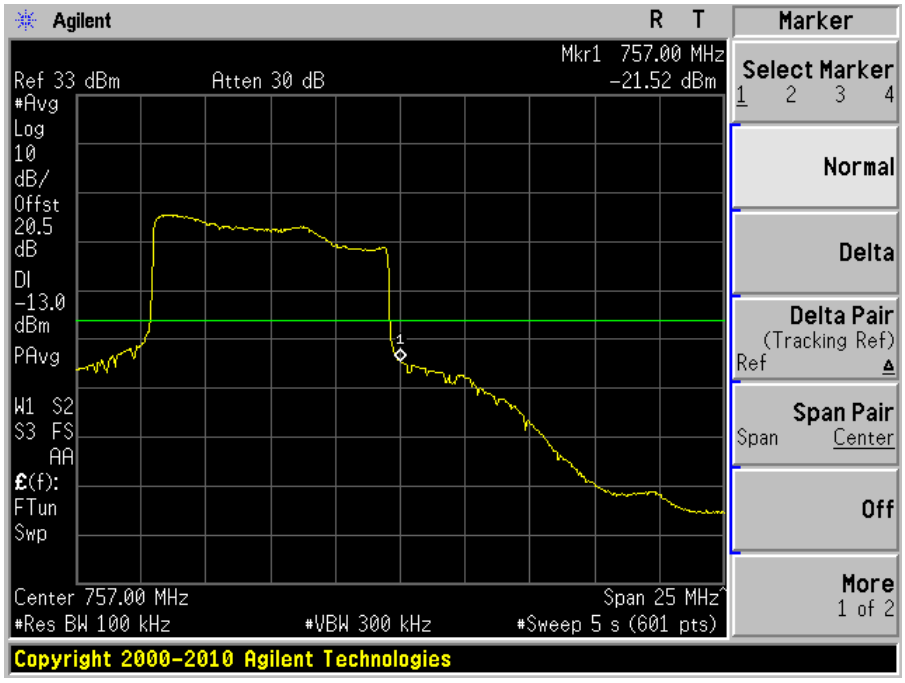


Modulation: LTE-16QAM (10 MHz):

Plot 1: Lowest Edge

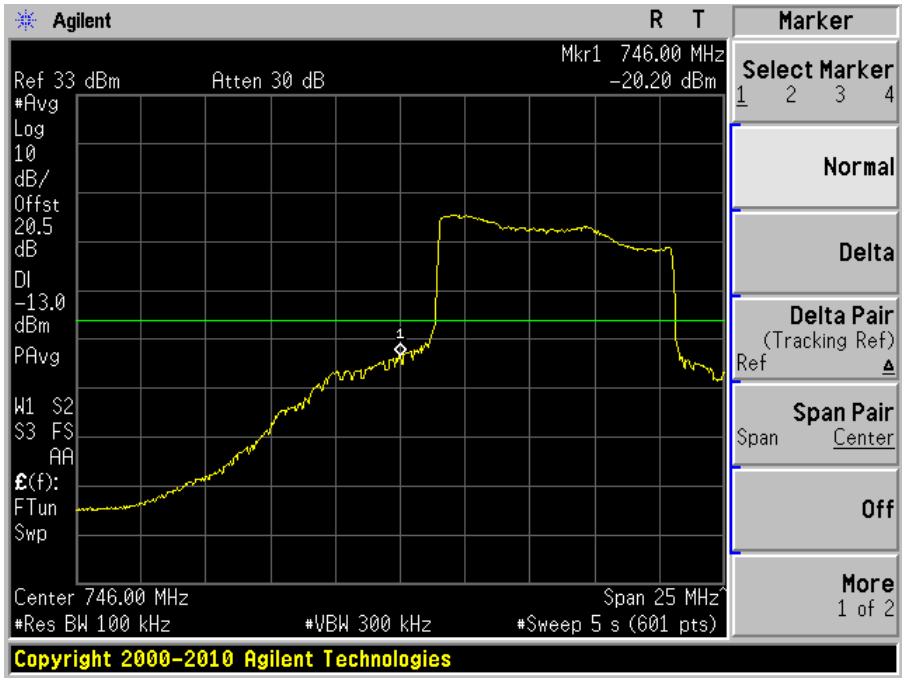


Plot 2: Highest Edge

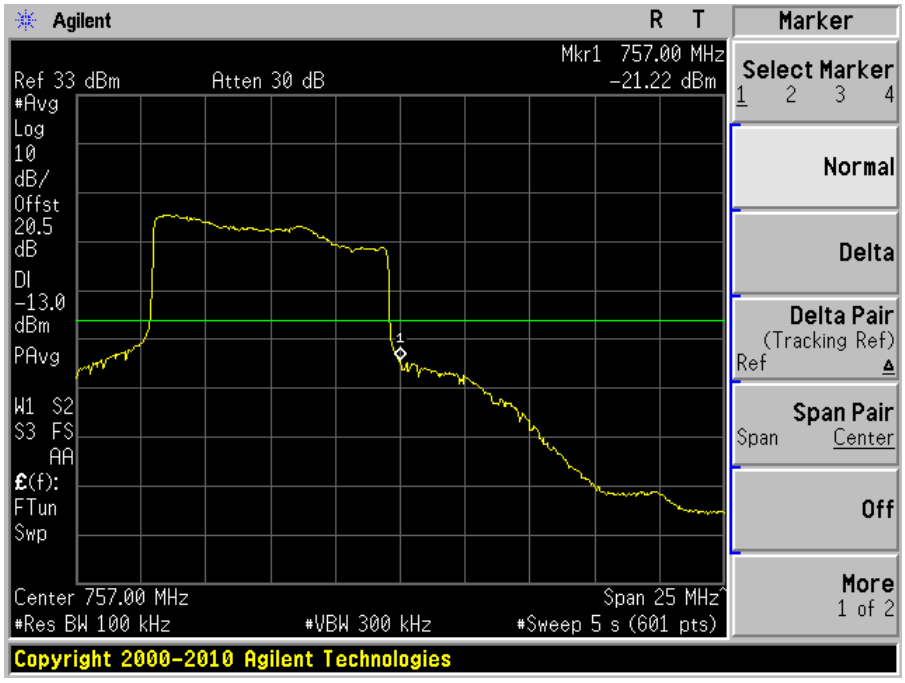


Modulation: LTE-64QAM (10 MHz):

Plot 1: Lowest Edge



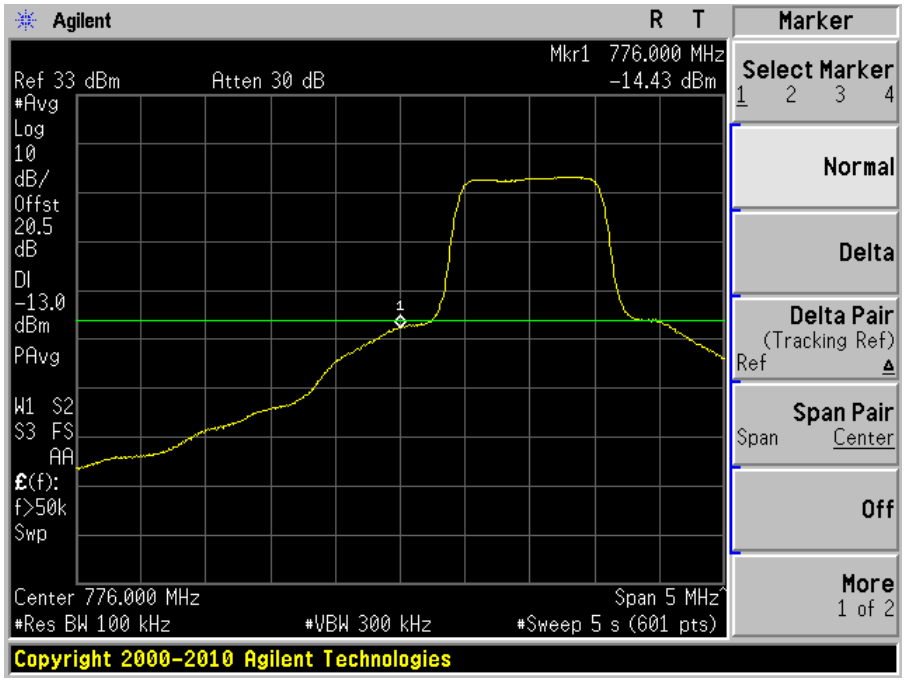
Plot 2: Highest Edge



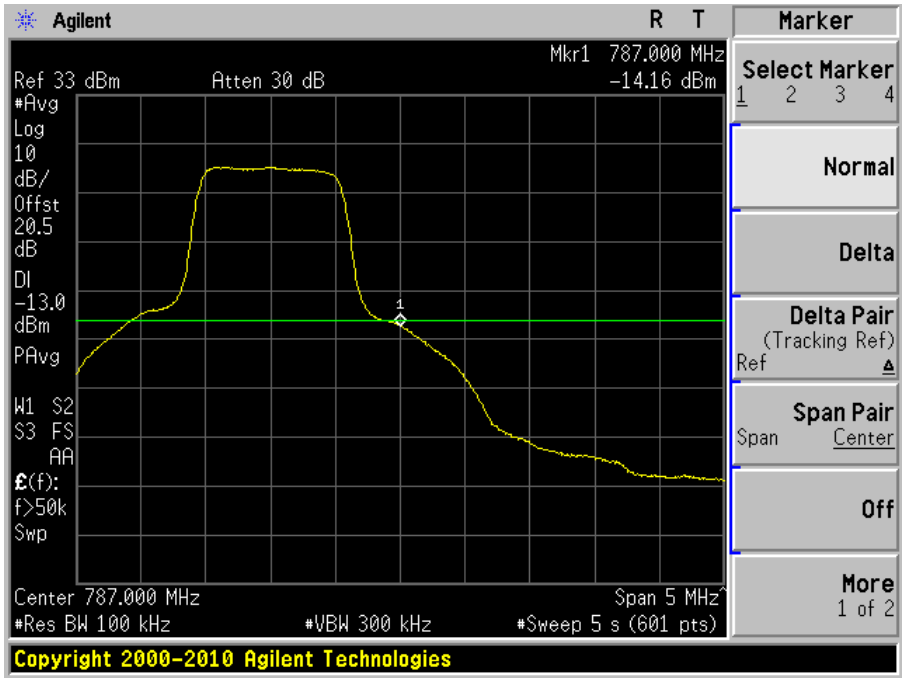
UL: 776-787 MHz

Modulation: LTE-QPSK (1.4 MHz):

Plot 1: Lowest Edge

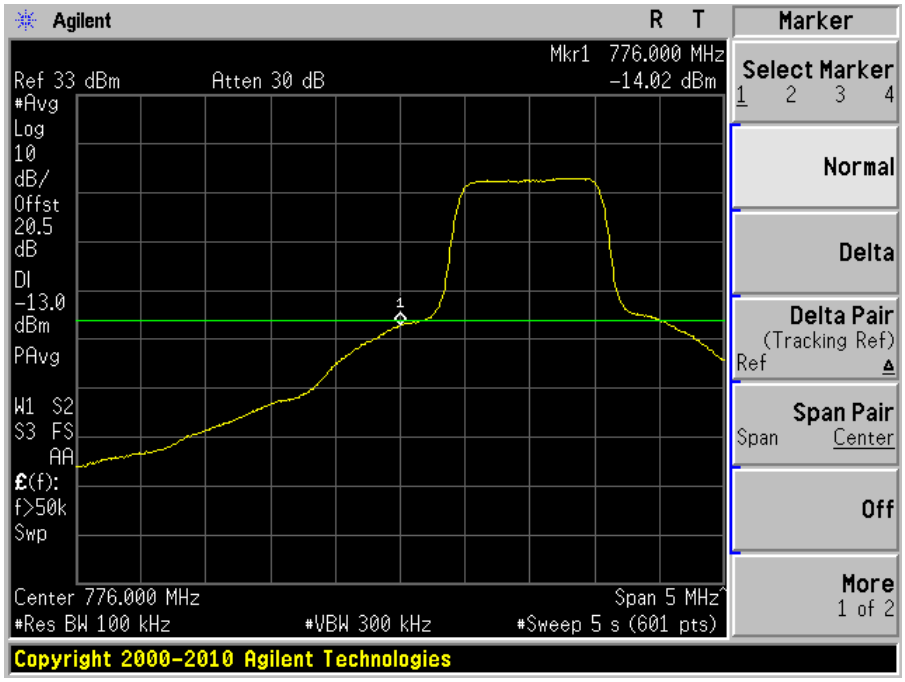


Plot 2: Highest Edge

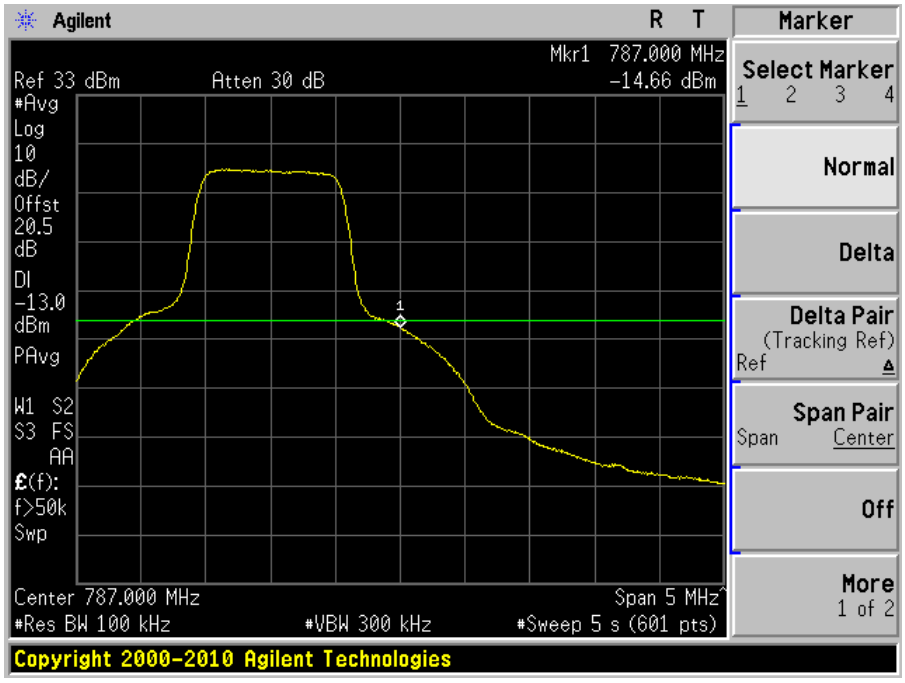


Modulation: LTE-16QAM (1.4 MHz):

Plot 1: Lowest Edge

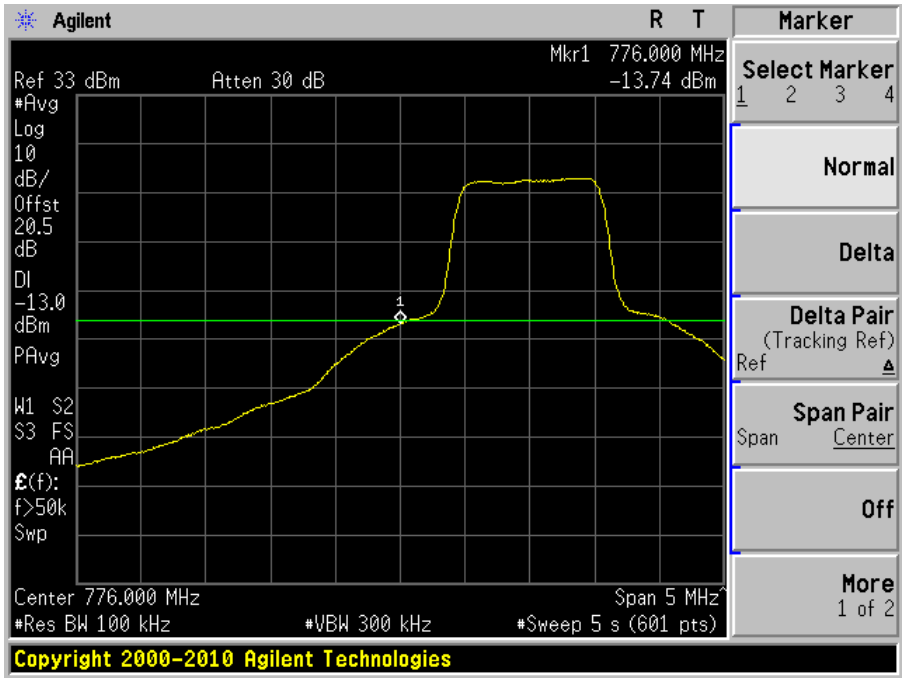


Plot 2: Highest Edge

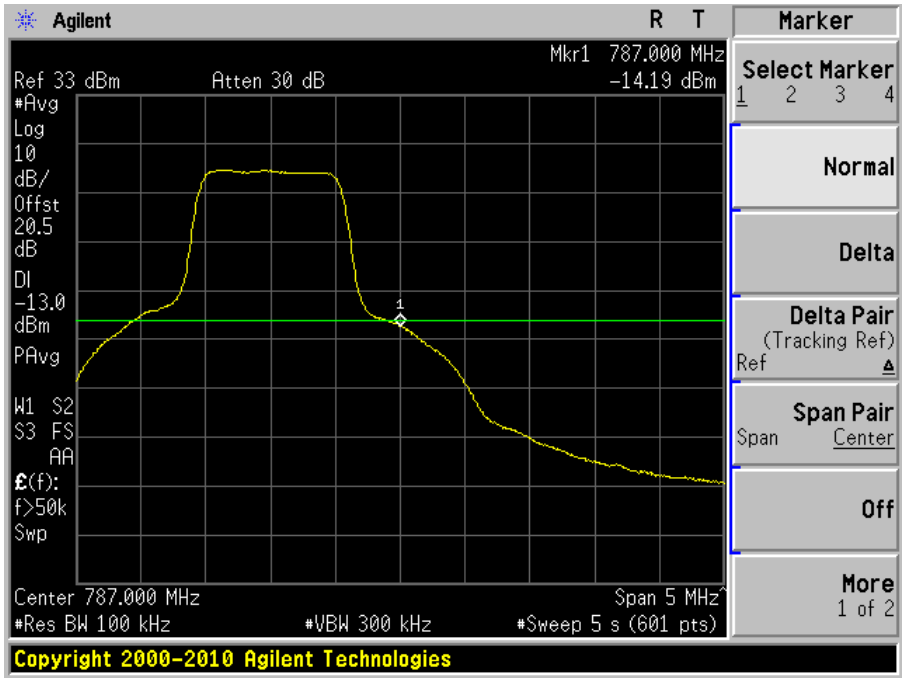


Modulation: LTE-64QAM (1.4 MHz):

Plot 1: Lowest Edge

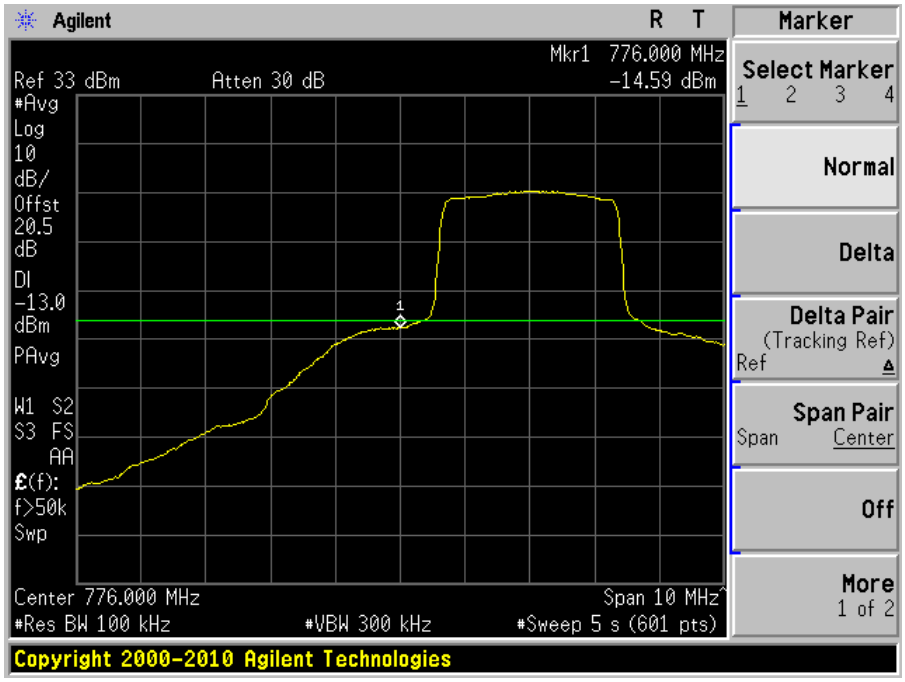


Plot 2: Highest Edge

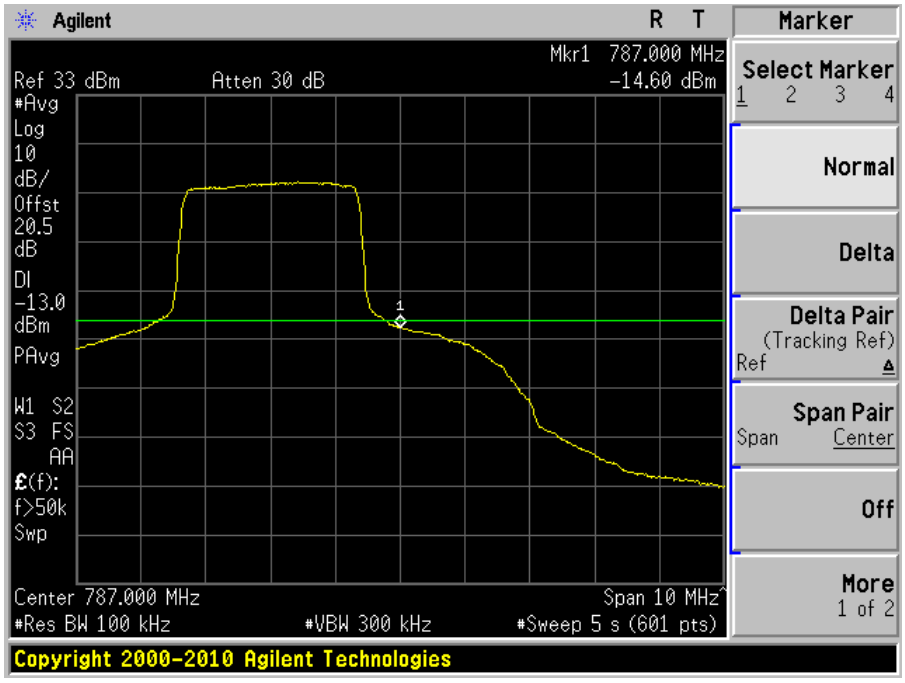


Modulation: LTE-QPSK (3 MHz):

Plot 1: Lowest Edge

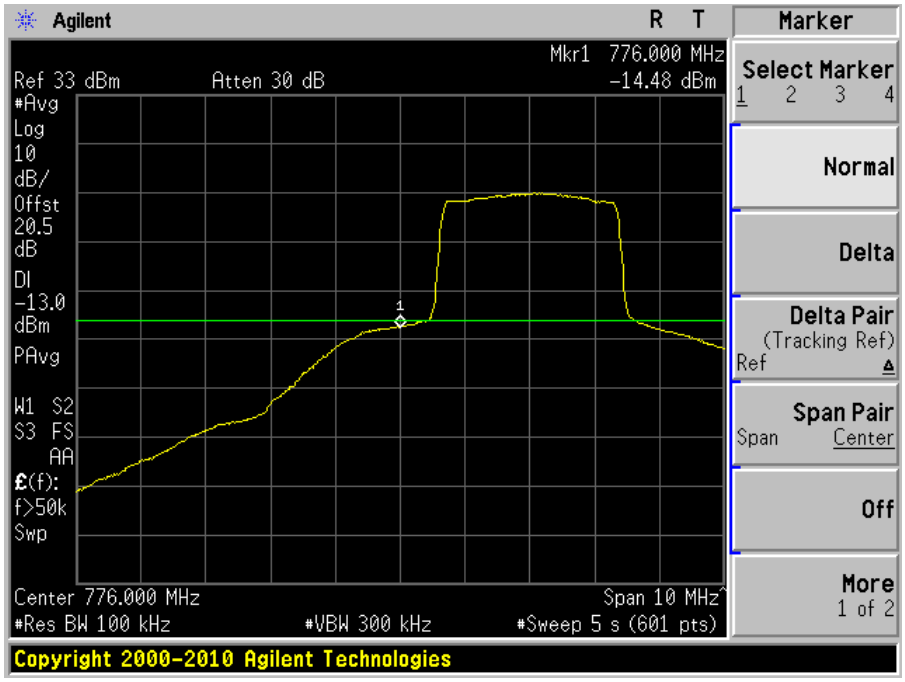


Plot 2: Highest Edge

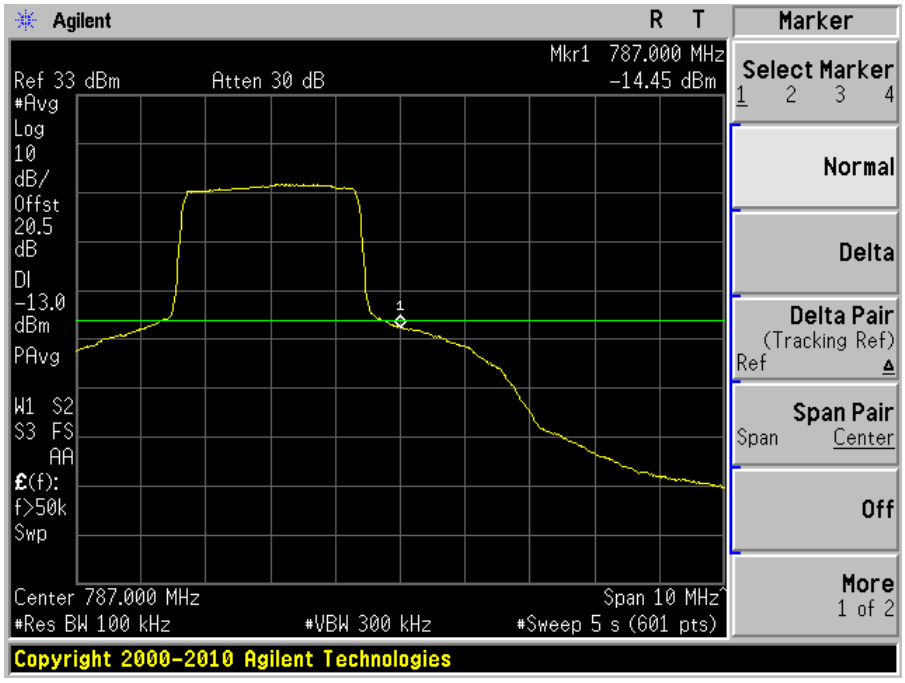


Modulation: LTE-16QAM (3 MHz):

Plot 1: Lowest Edge

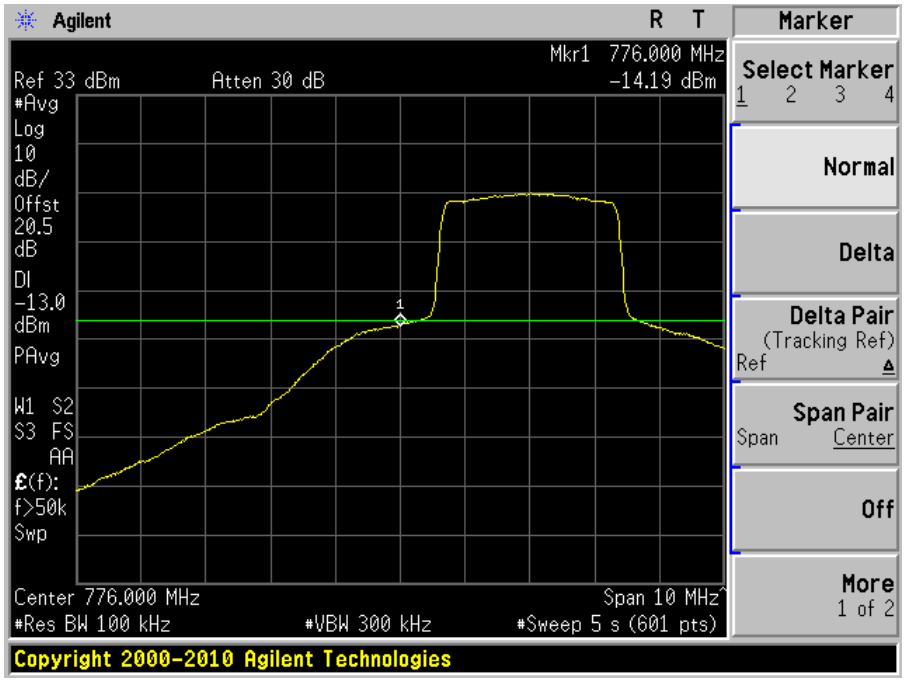


Plot 2: Highest Edge

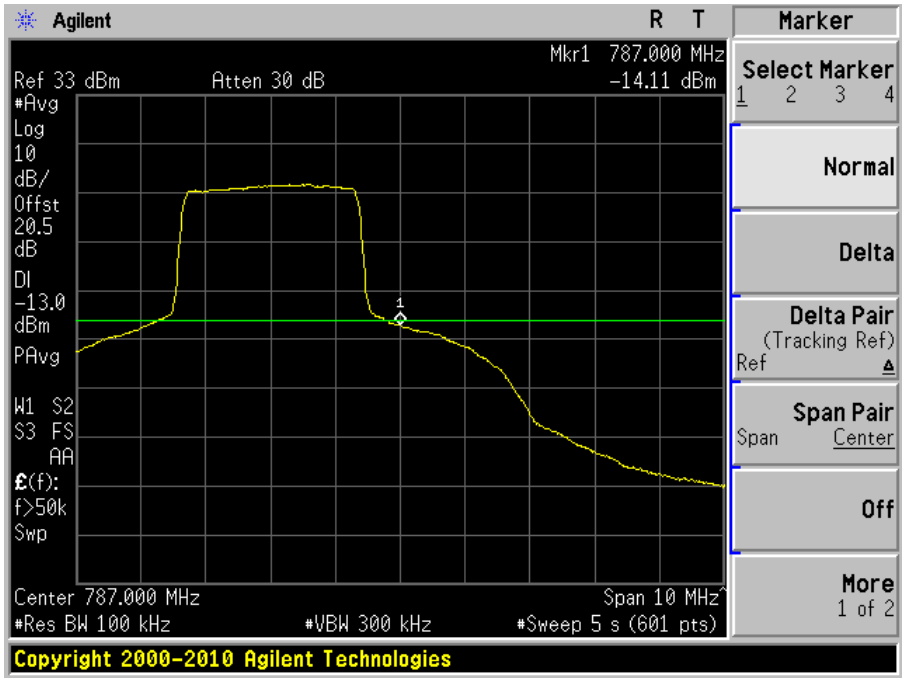


Modulation: LTE-64QAM (3 MHz):

Plot 1: Lowest Edge

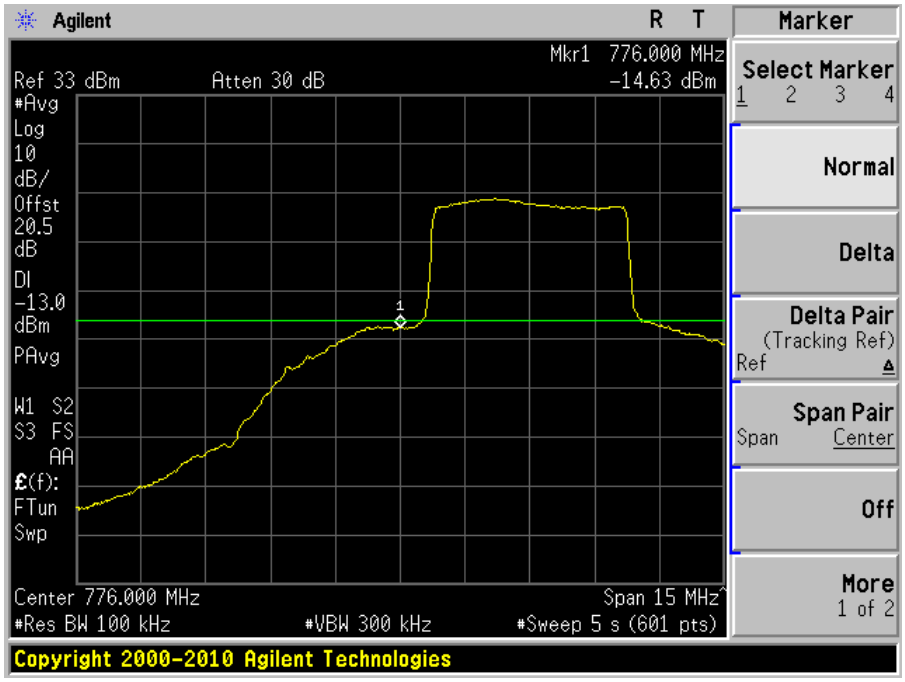


Plot 2: Highest Edge

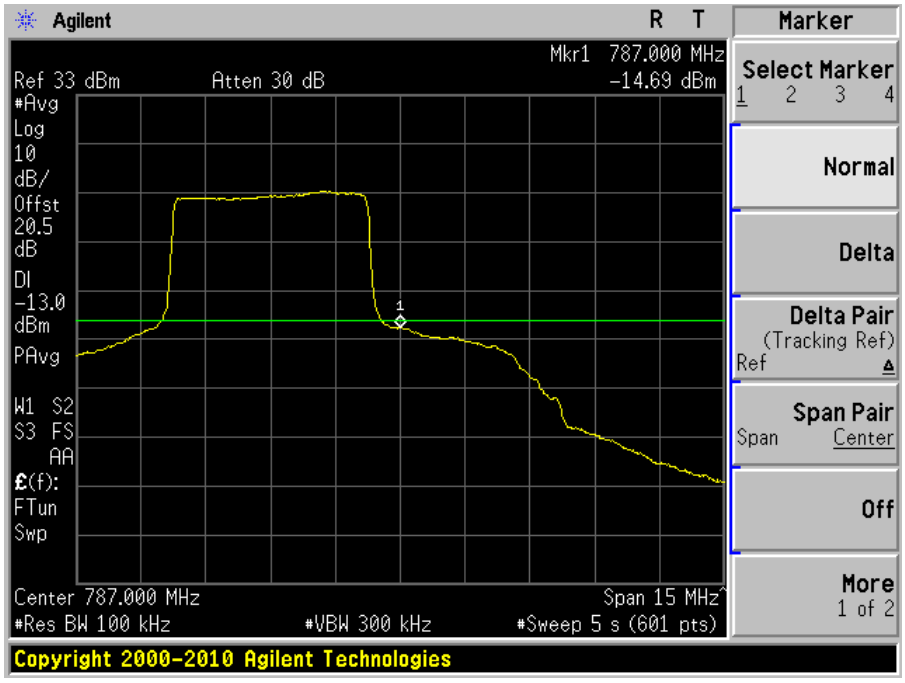


Modulation: LTE-QPSK (5 MHz):

Plot 1: Lowest Edge

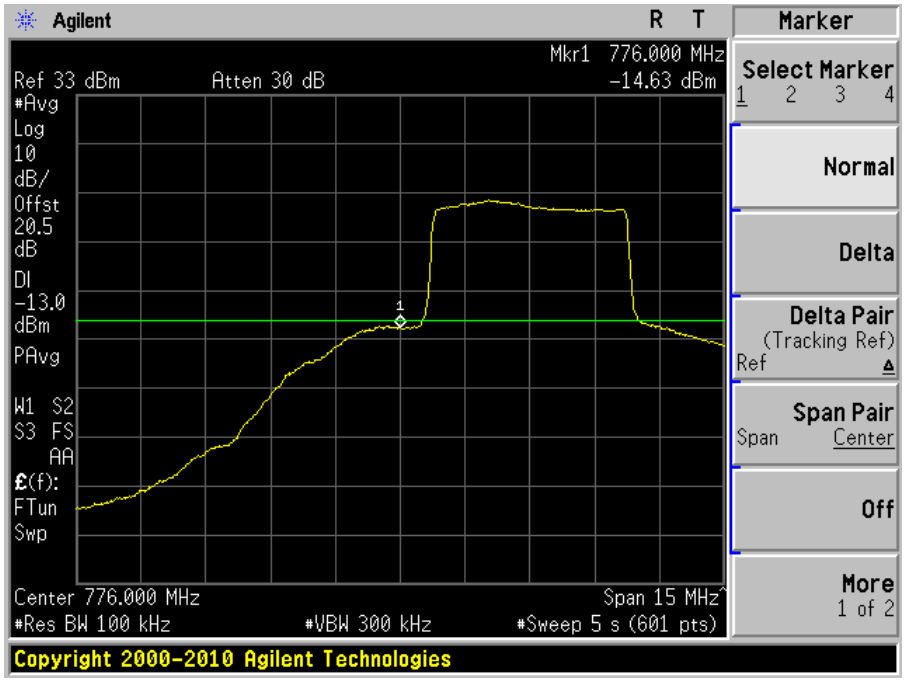


Plot 2: Highest Edge

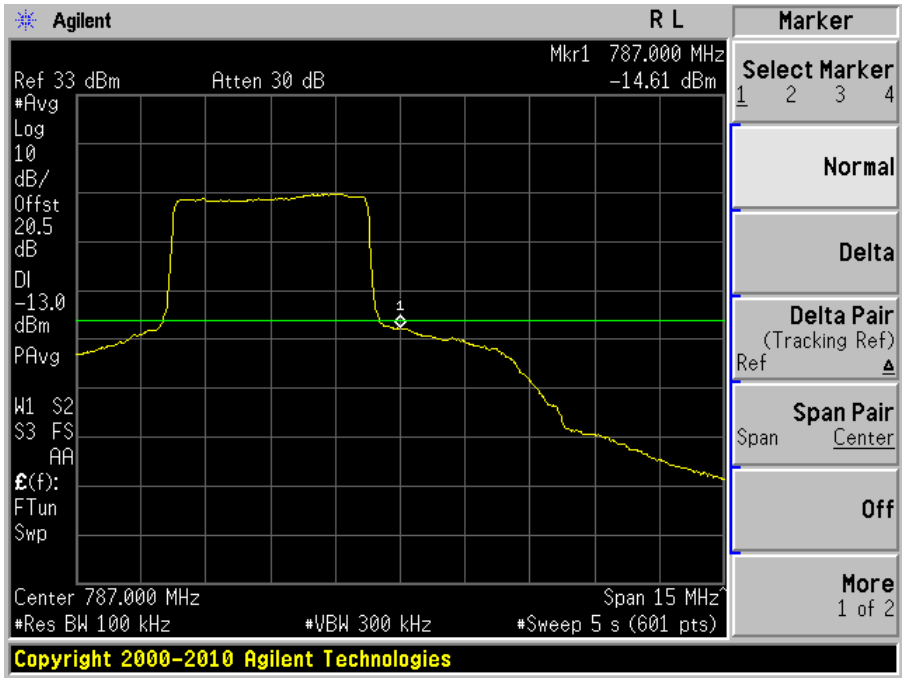


Modulation: LTE-16QAM (5 MHz):

Plot 1: Lowest Edge

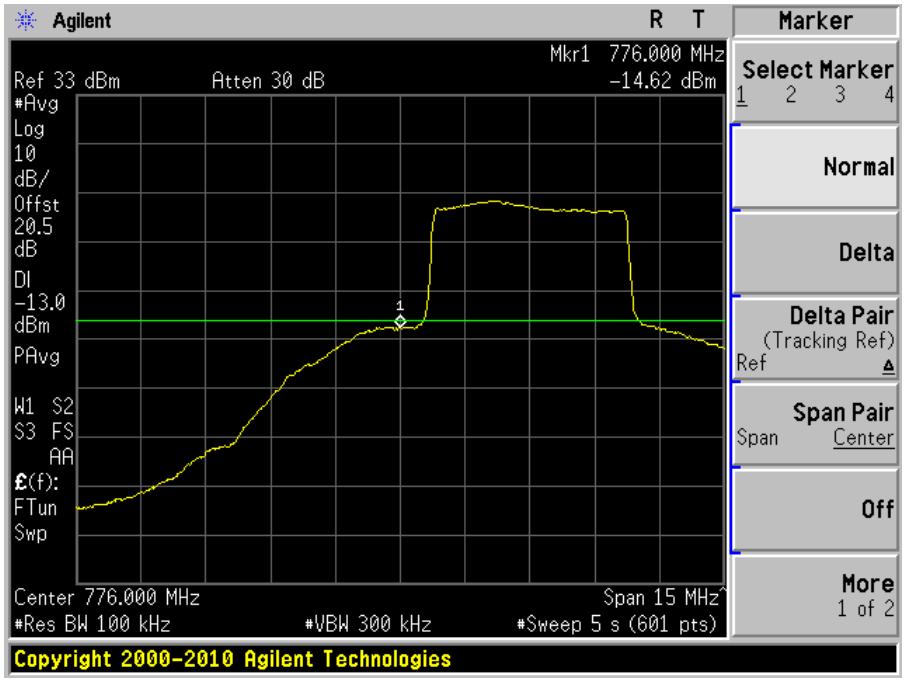


Plot 2: Highest Edge

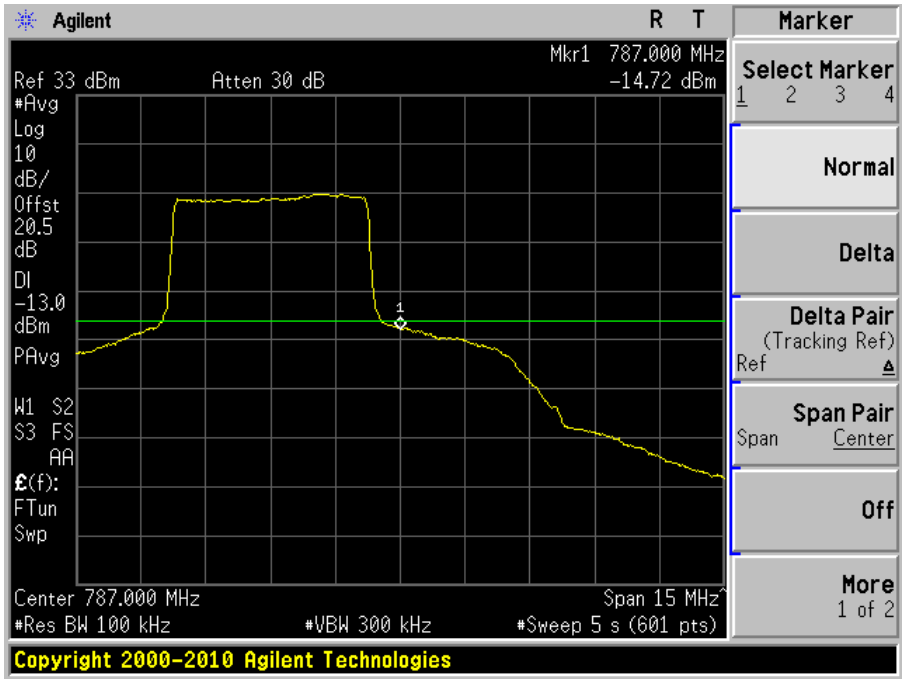


Modulation: LTE-64QAM (5 MHz):

Plot 1: Lowest Edge

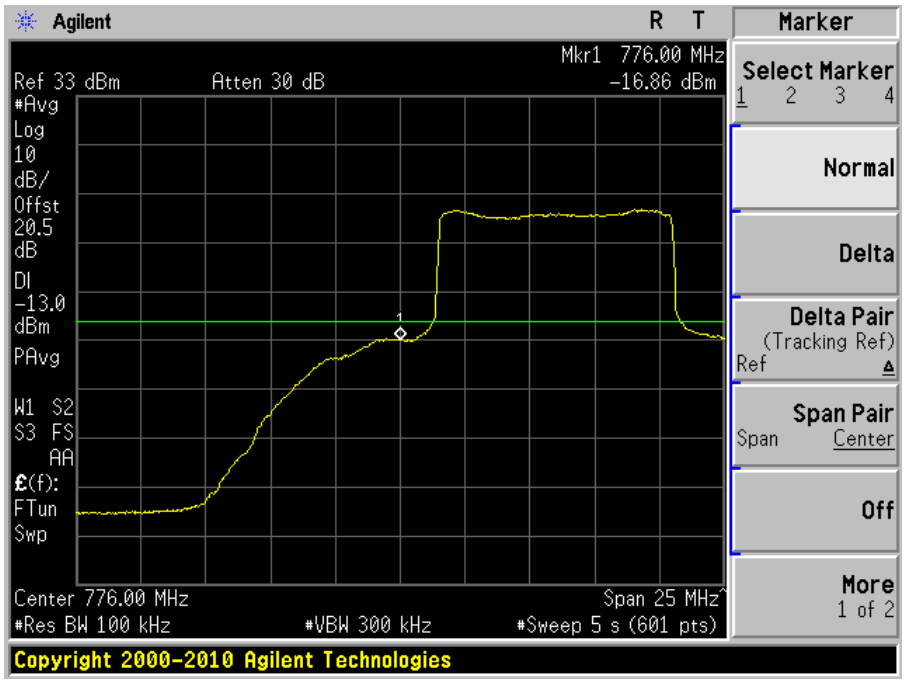


Plot 2: Highest Edge

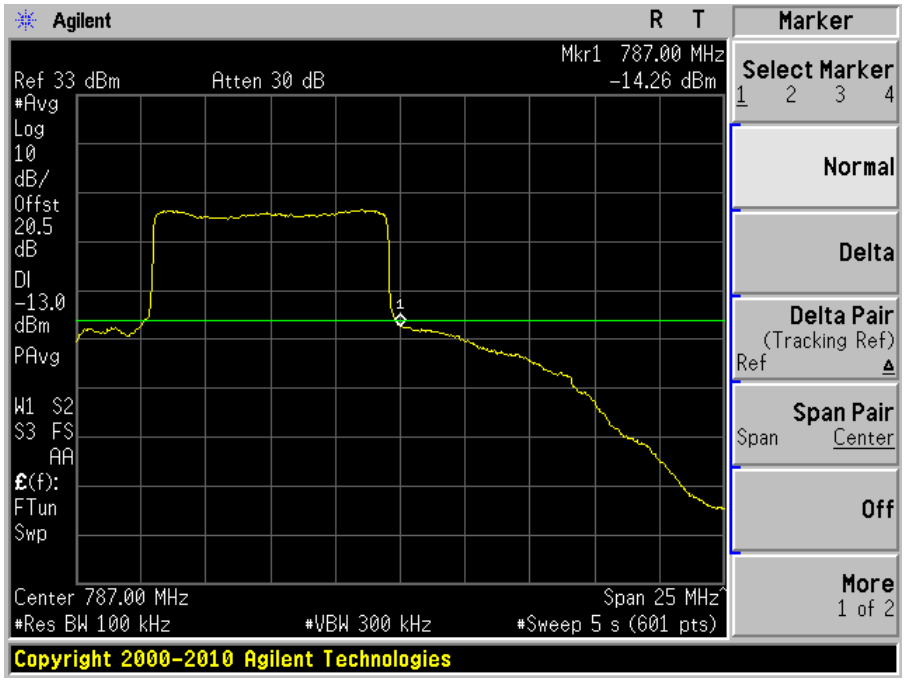


Modulation: LTE-QPSK (10 MHz):

Plot 1: Lowest Edge

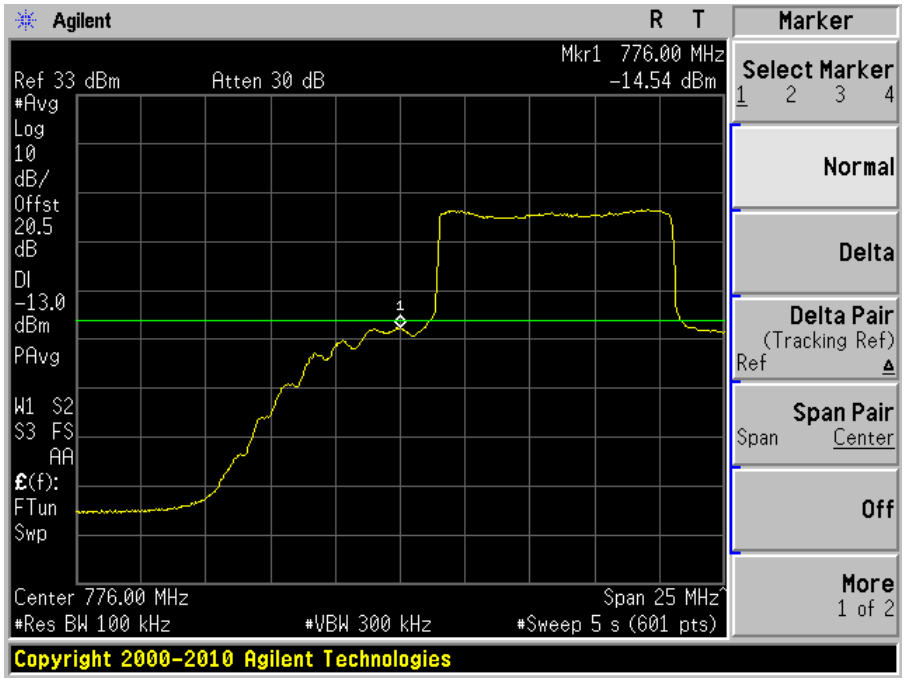


Plot 2: Highest Edge

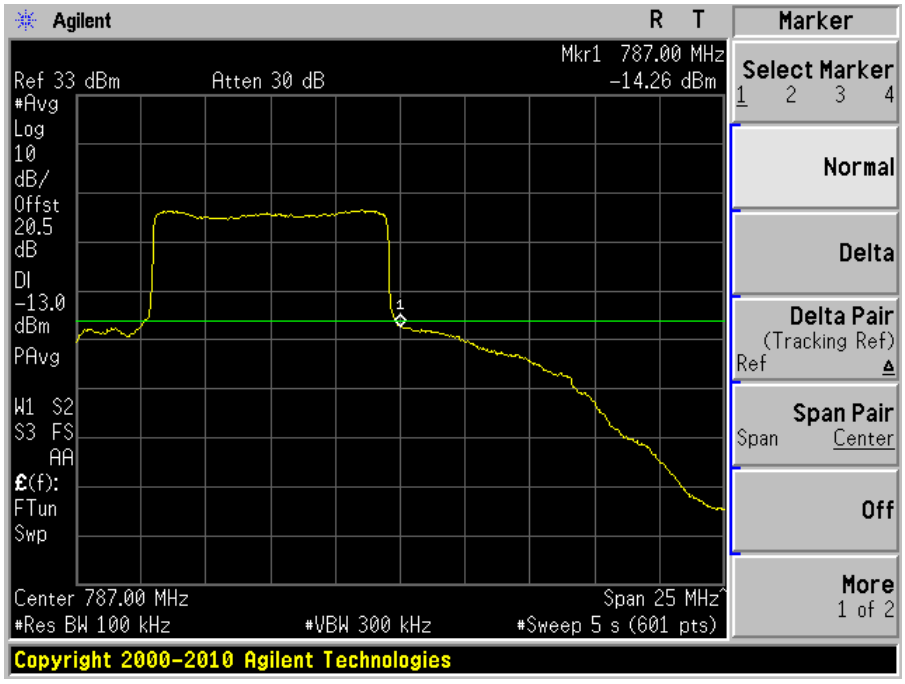


Modulation: LTE-16QAM (10 MHz):

Plot 1: Lowest Edge

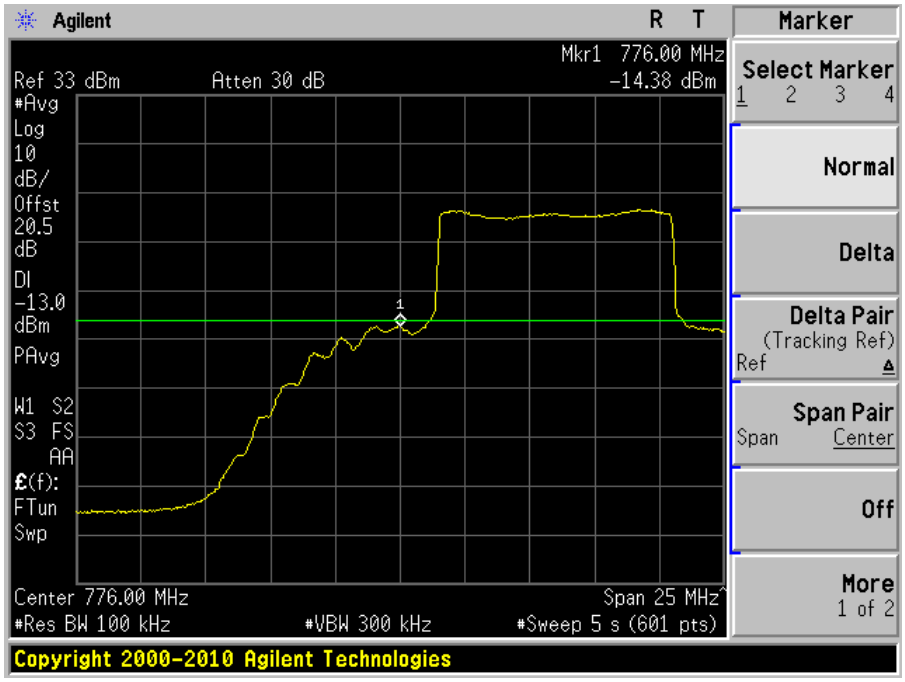


Plot 2: Highest Edge

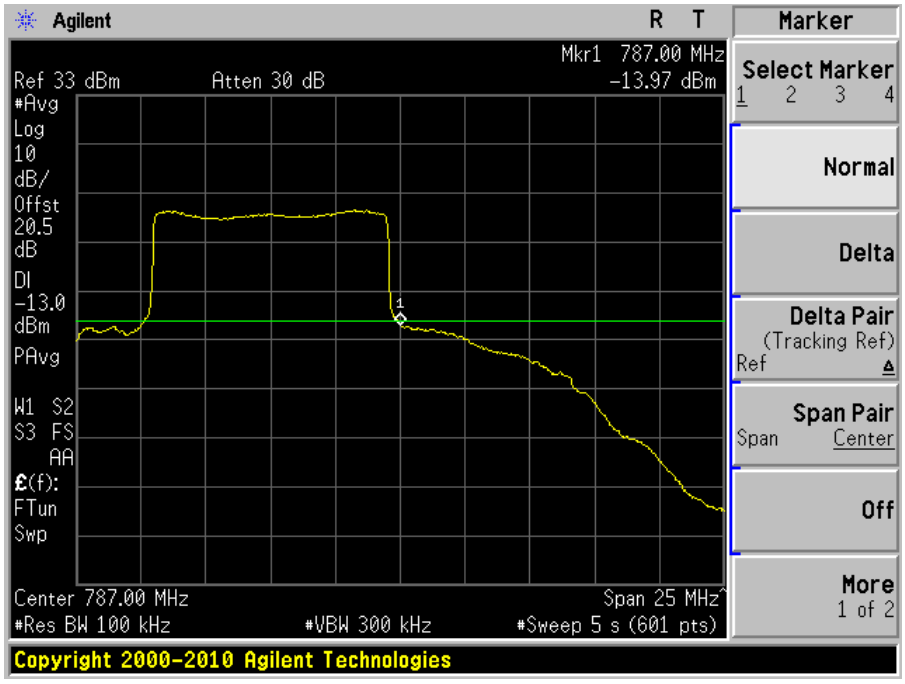


Modulation: LTE-64QAM (10 MHz):

Plot 1: Lowest Edge



Plot 2: Highest Edge



10 FCC §2.1055 & §27.54 – FREQUENCY STABILITY

10.1 Applicable Standard

According to FCC §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.

10.3 Test Results

Not applicable, *EUT is an amplifier; the signal source is from the signal generator, no frequency stability applied.*

11 FCC §1.1307(b) & §27.52 & §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	[1] (100)	30
1.34-30	824/f	2.19/f	[1] ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
[1] = 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

Test Results:

Please refer to the following MPE calculation for the details.

Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	746
Pout Watts	0.42400
Duty Cycle Percent	100.0%
Ant. Gain dBi	7.60
Coax Loss dB	0.00

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	7.60
Min. Distance Inches	7.78
Min. Distance Centimeters	19.76
ERP (Watts)	1.4877
EIRP (Watts)	2.4399

REFERENCE DATA

Pout dBm	26.27
Antenna Gain (non-log)	5.75
Coax loss (non-log)	1.00
FCC Limit (mw/cm^2)	f/1500
Calculated limit (mw/cm^2)	0.50

NOTES:

(1) Valid only between 300 MHz - 100,000 MHz.

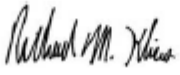
(2) Calculations are sufficient for determining antenna safe distance for mobile antennas and fixed inside antennas provided that calculated ERP < 1.5 watts for frequencies equal to or below 1.5 GHz, and calculated ERP < 3 watts for frequencies above 1.5 GHz.

(3) Mobile antenna distances and fixed indoor antenna distances shall be no less than 8 inches.

(4) There are no predefined ERP and distance limitations for fixed outside (building) antennas.

(5) Mobile/portable stations are limited to 2 watts EIRP peak power in the 1900 MHz band (FCC rules §24.232[c]).

SUMMARY FOR PUBLICATION

For Amplifier Model Number:	271865
Frequency Band (MHz)	746 - 757 MHz (downlink)
Mobile or Fixed?	Fixed
Outside or Inside Antenna?	Inside
Antenna Type:	Any antenna whose gain less cable loss does not exceed 7.6 dBi
Safe Distance (inches):	8 inches
Signature:	
Date:	July 12, 2011

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Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	776
Pout Watts	0.73700
Duty Cycle Percent	100.0%
Ant. Gain dBi	10.00
Coax Loss dB	0.00

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	10.00
Min. Distance Inches	13.26
Min. Distance Centimeters	33.67
ERP (Watts)	4.4939
EIRP (Watts)	7.3700

REFERENCE DATA

Pout dBm	28.67
Antenna Gain (non-log)	10.00
Coax loss (non-log)	1.00
FCC Limit (mw/cm^2)	f/1500
Calculated limit (mw/cm^2)	0.52

NOTES:

(1) Valid only between 300 MHz - 100,000 MHz.

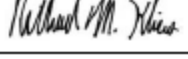
(2) Calculations are sufficient for determining antenna safe distance for mobile antennas and fixed inside antennas provided that calculated ERP < 1.5 watts for frequencies equal to or below 1.5 GHz, and calculated ERP < 3 watts for frequencies above 1.5 GHz.

(3) Mobile antenna distances and fixed indoor antenna distances shall be no less than 8 inches.

(4) There are no predefined ERP and distance limitations for fixed outside (building) antennas.

(5) Mobile/portable stations are limited to 2 watts EIRP peak power in the 1900 MHz band (FCC rules §24.232[c]).

SUMMARY FOR PUBLICATION

For Amplifier Model Number:	271865
Frequency Band (MHz)	776 - 787 MHz (uplink)
Mobile or Fixed?	Fixed
Outside or Inside Antenna?	Outside
Antenna Type:	Any antenna whose gain less cable loss does not exceed 10 dBi
Safe Distance (inches):	14 inches
Signature:	
Date:	July 12, 2011

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