FCC PART 27

TEST AND MEASUREMENT REPORT

For

G-Way Microwave

38 Leuning Street,

South Hackensack, NJ 07606, USA

FCC ID: Q8KBDALTEUC3390C

Report Type:	Product Type:
Original	Bi Directional Amplifier

Test Engineer: Glenn Escano

Report Number: R13100115-27

Report Date: 2014-01-03

Reviewed By: Ning Ma, EMC Lead

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

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R13100115-27	Original Report	2014-01-03

1 General Description

1.1 Product Description for Equipment under Test (EUT)

The *G-Way Microwave* product, model: *BDA-LTE/UC-33/33-90-C*, FCC ID: Q8KBDALTEUC3390C or the "EUT" as referred to in this report, is an Upper C LTE Bi Directional Amplifier that enhances the coverage area of radio communications in buildings and RF shielded environments. The BDA is a device that automatically receives, amplifies, and retransmits signals on a bi directional basis, the BDA has dual RF paths to improve coverage in two distinct frequency bands, Uplink and Downlink referenced to LTE technology operators with the signals received from base stations, fixed or COW (Cell On Wheels), with no change in frequency or authorized bandwidth.

1.2 Mechanical Description

The EUT dimension is approximately "17"cm (L) x "35.6"cm (W) x "45.9"cm (H) and weighs approximately "16" kilograms.

The test data gathered are from production sample. Serial number: 13101002, assigned by "G-Way Microwave".

1.3 Objective

This type approval report is prepared on behalf of *G-Way Microwave* in accordance with Part 2, Subpart J, and part 27 Subpart C of the Federal Communication Commission rules.

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

1.4 Related Submittal(s)/Grant(s)

No Related Submittals

1.5 Test Methodology

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

Part 20.21 – Signal boosters
Part 27 Subpart C – Miscellaneous Wireless Communications Services

Applicable Standards: TIA EIA 98-C, TIA/EIA 603-C, ANSI C63.4-2009.

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

1.6 Measurement Uncertainty

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

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from ±2.0 dB for Conducted Emissions tests and ±4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

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

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-3729, C-4176, G-469, and T-1206. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-C.
The final qualification test was performed with the EUT operating at normal mode.

2.2 EUT Exercise Software

N/A, "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 Special Equipment

No special equipment used during testing.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Agilent	Generator, Signal	E4438C	MY45091309
Dell	Laptop	D650	-

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
G-Way Microwave	Main PCB	-	CD8550
G-Way Microwave	PCB 2	XML-2	E315391
COSEL	Power Supply Board	LEP240F	-
G-Way Microwave	Front L.E.D. Board	GWY-1000-00046-A-2	E315391
G-Way Microwave	Band Pass Filter LTE DL	CB782/10SK-B2	13091028
G-Way Microwave	Band Pass Filter LTE UL	CB751/10SK-B2	13091027
G-Way Microwave	Gain Adjuster	-	-
G-Way Microwave	LTE Diplexer Upper C	CD765.5/10Sk-B-1	13091094 13091095
G-Way Microwave	DL Amplifier	MP740/25/5MK-A1-LTE	13091146
G-Way Microwave	UL Amplifier	MP740/25/5MK-A1-LTE	13091147

2.7 External I/O Cabling List and Details

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

3 Summary of Test Results

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

Note: *N/A, the device is a signal booster.*

4 FCC §2.1046, §27.50(b) & §27.50(i) – RF Output Power

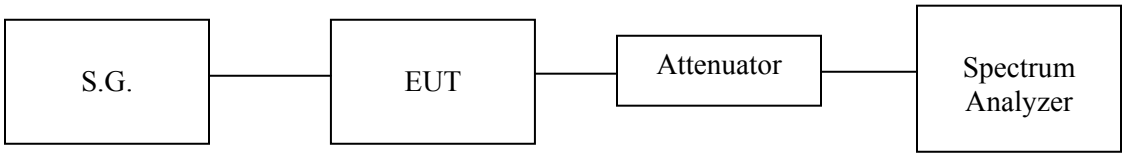
4.1 Applicable Standard

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA, Series Spectrum Analyzer	E4440A	US42221851	2013-03-05
Agilent	Generator, Signal	E4438C	MY45091309	2013-05-30

***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

Temperature:	21 ºC
Relative Humidity:	40 %
ATM Pressure:	101.89 kPa

The testing was performed by Glenn Escano from 2013-10-23 at RF Site.

4.5 Test Results

Maximum Output Power – Modulated Signal

700 MHz Upper C LTE Band – Downlink

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
Downlink 746-757 MHz	QPSK (1.4 MHz)	747	-59.6	32.92
	QPSK (1.4 MHz)	752	-60.2	32.96
	QPSK (1.4 MHz)	756	-58.5	32.99
	16QAM (1.4 MHz)	747	-59.4	32.94
	16QAM (1.4 MHz)	752	-60.3	32.91
	16QAM (1.4 MHz)	756	-58.5	32.93
	64QAM (1.4 MHz)	747	-59.4	32.92
	64QAM (1.4 MHz)	752	-60	32.97
	64QAM (1.4 MHz)	756	-58.3	32.97
	QPSK (3 MHz)	748	-59.6	32.99
	QPSK (3 MHz)	752	-60.1	32.97
	QPSK (3 MHz)	755	-59.1	32.92
	16QAM (3 MHz)	748	-59.6	32.95
	16QAM (3 MHz)	752	-60.1	32.91
	16QAM (3 MHz)	755	-59	32.96
	64QAM (3 MHz)	748	-59.6	32.99
	64QAM (3 MHz)	752	-60	32.99
	64QAM (3 MHz)	755	-59	32.94
	QPSK (5 MHz)	749	-59.9	32.91
	QPSK (5 MHz)	754	-59.5	32.92
	16QAM (5 MHz)	749	-59.9	32.95
	16QAM (5 MHz)	754	-59.5	32.92
	64QAM (5 MHz)	749	-59.7	32.92
	64QAM (5 MHz)	754	-59.3	32.93
	QPSK (10 MHz)	752	-59.6	32.93
	16QAM (10 MHz)	752	-59.6	32.91
	64QAM (10 MHz)	752	-59.6	32.91

700 MHz Upper C LTE Band – Uplink

Mode	Modulation	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)
Uplink 776-787 MHz	QPSK (1.4 MHz)	777	-55.8	32.91
	QPSK (1.4 MHz)	782	-57.8	32.92
	QPSK (1.4 MHz)	786	-56.8	32.94
	16QAM (1.4 MHz)	777	-55.8	32.92
	16QAM (1.4 MHz)	782	-57.8	32.92
	16QAM (1.4 MHz)	786	-56.8	32.95
	64QAM (1.4 MHz)	777	-55.8	32.93
	64QAM (1.4 MHz)	782	-57.8	32.98
	64QAM (1.4 MHz)	786	-56.9	32.91
	QPSK (3 MHz)	778	-56.6	32.91
	QPSK (3 MHz)	782	-57.4	32.99
	QPSK (3 MHz)	785	-56.8	32.91
	16QAM (3 MHz)	778	-56.6	32.93
	16QAM (3 MHz)	782	-57.5	32.90
	16QAM (3 MHz)	785	-56.9	32.96
	64QAM (3 MHz)	778	-56.6	32.94
	64QAM (3 MHz)	782	-57.5	32.99
	64QAM (3 MHz)	785	-56.9	32.94
	QPSK (5 MHz)	779	-56.7	32.94
	QPSK (5 MHz)	784	-57.1	32.94
	16QAM (5 MHz)	779	-56.7	32.97
	16QAM (5 MHz)	784	-57.2	32.97
	64QAM (5 MHz)	779	-56.7	32.98
	64QAM (5 MHz)	784	-57.2	32.97
	QPSK (10 MHz)	782	-57.2	32.98
	16QAM (10 MHz)	782	-57.1	32.99
	64QAM (10 MHz)	782	-57.2	32.92

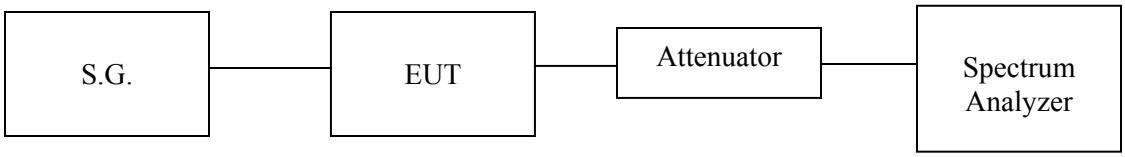
5 FCC §2.1049 – Occupied Bandwidth

5.1 Applicable Standard

Requirements: FCC §2.1049.
The spectral shape of the output should look similar to input for all modulations

5.2 Test Procedure

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



5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA, Series Spectrum Analyzer	E4440A	US42221851	2013-03-05
Agilent	Generator, Signal	E4438C	MY45091309	2013-05-30

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

5.4 Test Environmental Conditions

Temperature:	21 ºC
Relative Humidity:	36 %
ATM Pressure:	101.69 kPa

The testing was performed by Glenn Escano from 2013-10-24 at RF Site.

5.5 Test Results

Please refer to the following tables and plots.

700 MHz Upper C LTE Band – Downlink

Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Downlink 746-757 MHz	QPSK (1.4 MHz)	752	1.0911	1.0913
	16QAM (1.4 MHz)	752	1.0947	1.0938
	64QAM (1.4 MHz)	752	1.1030	1.0927
	QPSK (3 MHz)	752	2.6940	2.6879
	16QAM (3 MHz)	752	2.7009	2.6888
	64QAM (3 MHz)	752	2.6978	2.6967
	QPSK (5 MHz)	754	4.4859	4.4766
	16QAM (5 MHz)	754	4.4940	4.4827
	64QAM (5 MHz)	754	4.4960	4.4841
	QPSK (10 MHz)	752	8.9638	8.9006
	16QAM (10 MHz)	752	8.9552	8.9223
	64QAM (10 MHz)	752	8.9604	8.9097

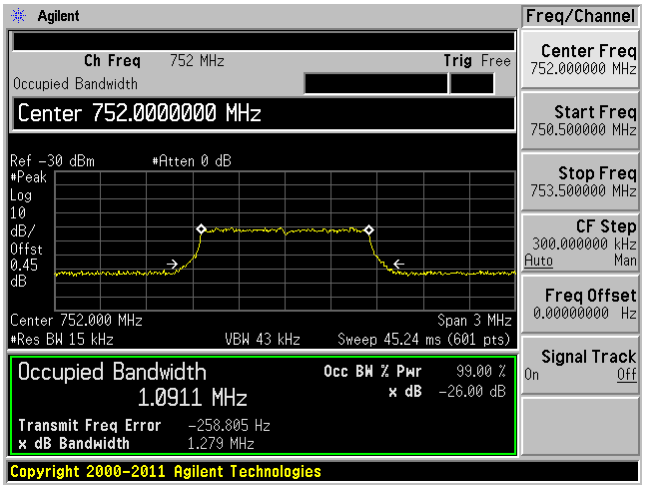
700 MHz Upper C LTE Band – Uplink

Mode	Modulation	Frequency (MHz)	Emission Bandwidth Input (MHz)	Emission Bandwidth Output (MHz)
Uplink 776-787 MHz	QPSK (1.4 MHz)	782	1.0991	1.0973
	16QAM (1.4 MHz)	782	1.1090	1.1079
	64QAM (1.4 MHz)	782	1.1016	1.0977
	QPSK (3 MHz)	782	2.7021	2.6956
	16QAM (3 MHz)	782	2.7099	2.6992
	64QAM (3 MHz)	782	2.7102	2.6963
	QPSK (5 MHz)	779	4.4979	4.4769
	16QAM (5 MHz)	779	4.4981	4.4863
	64QAM (5 MHz)	779	4.4969	4.4861
	QPSK (10 MHz)	782	8.9563	8.9373
	16QAM (10 MHz)	782	8.9341	8.9274
	64QAM (10 MHz)	782	8.9824	8.9252

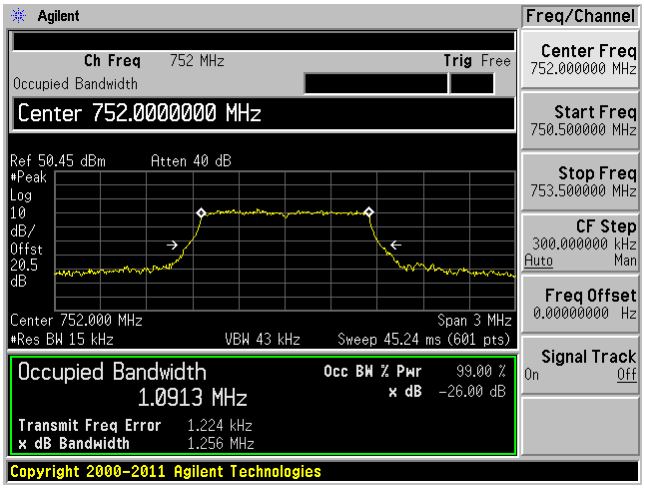
Downlink, 746-757 MHz

QPSK (1.4 MHz), (Middle Channel)

Input

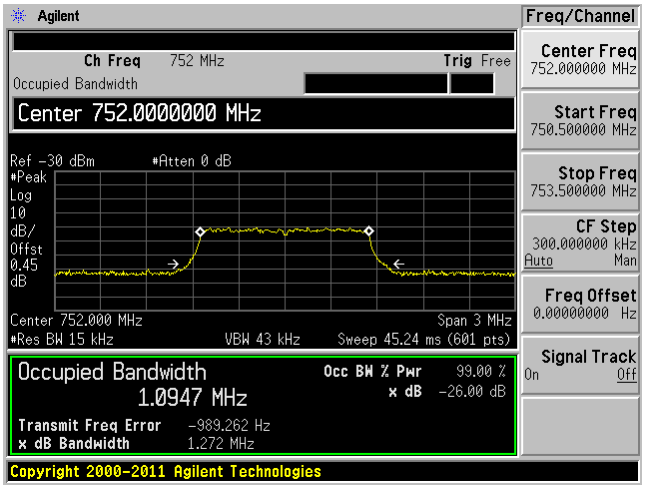


Output

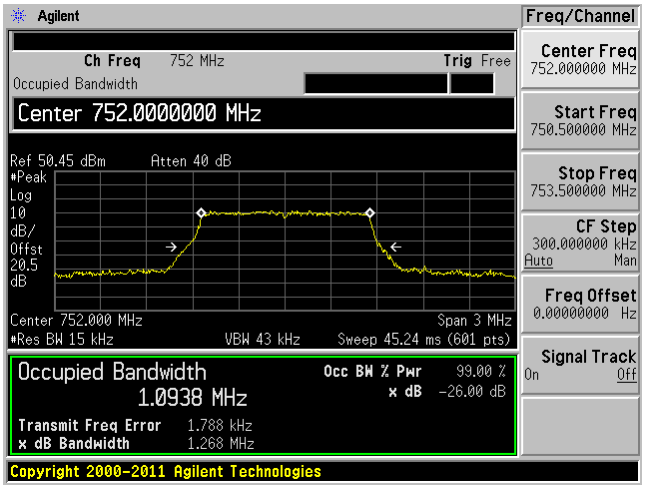


16QAM (1.4 MHz), (Middle Channel)

Input

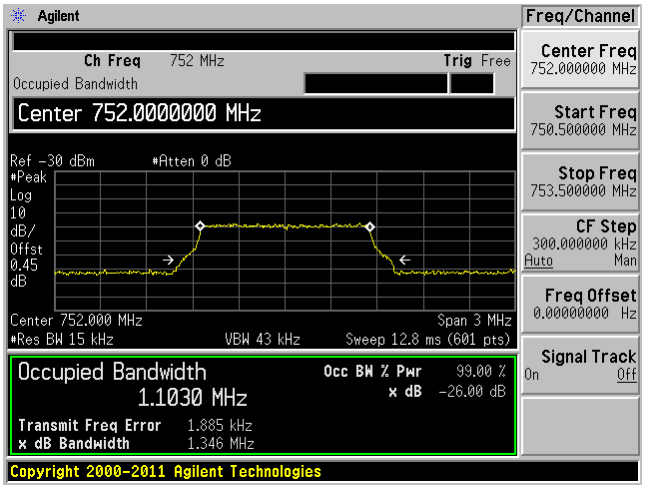


Output

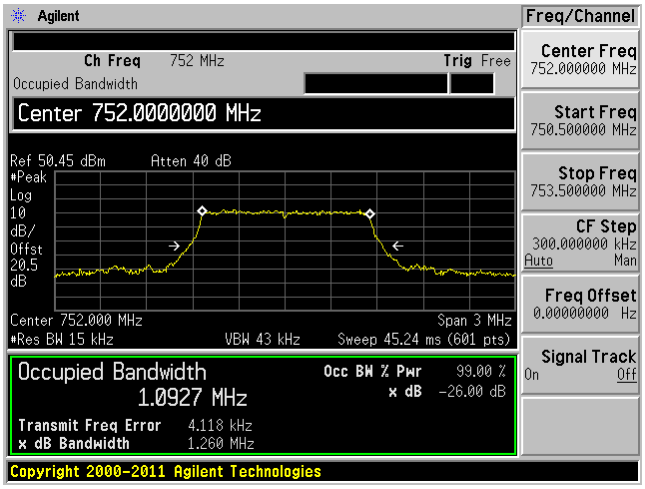


64QAM (1.4 MHz), (Middle Channel)

Input

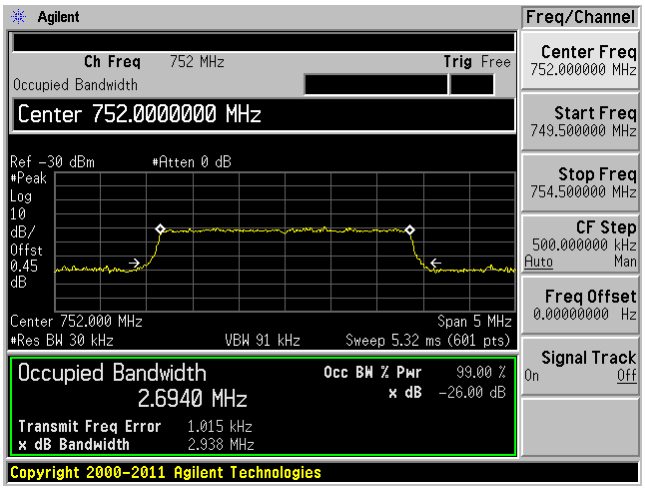


Output

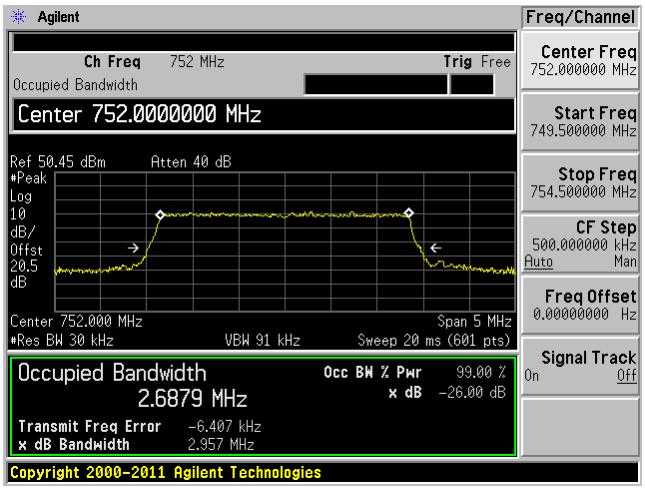


QPSK (3 MHz), (Middle Channel)

Input

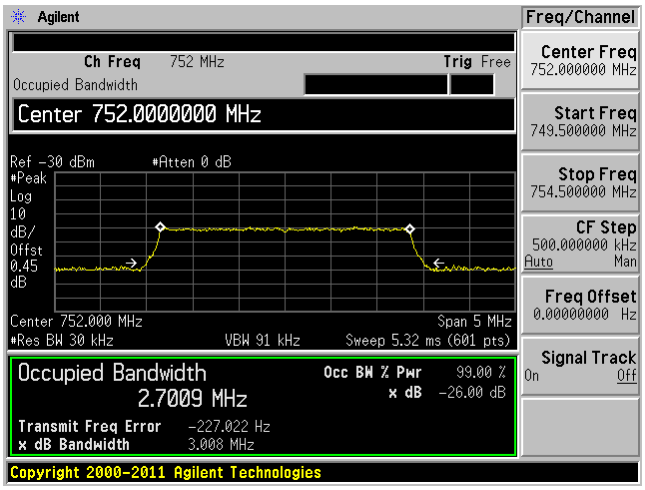


Output

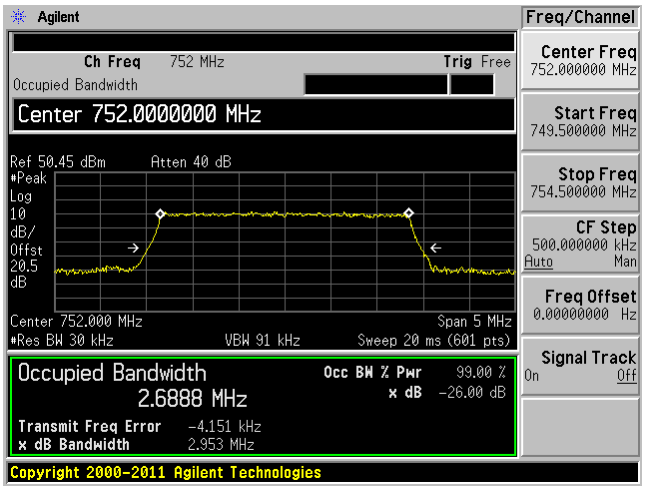


16QAM (3 MHz), (Middle Channel)

Input

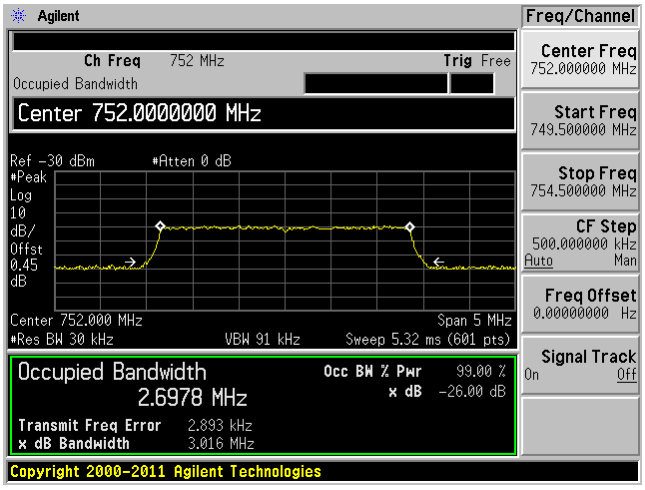


Output

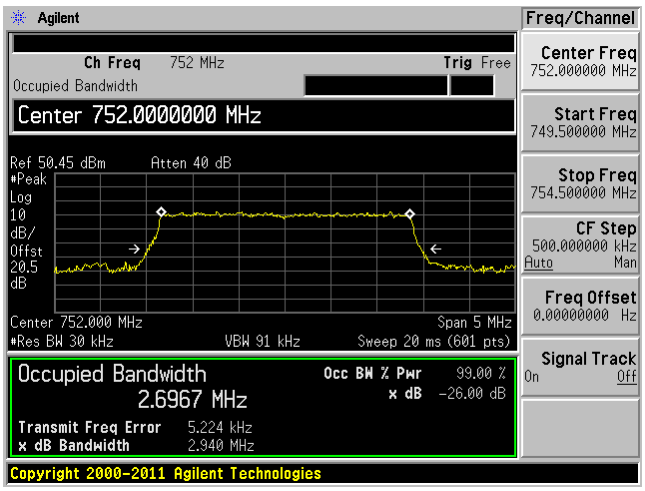


64QAM (3 MHz), (Middle Channel)

Input

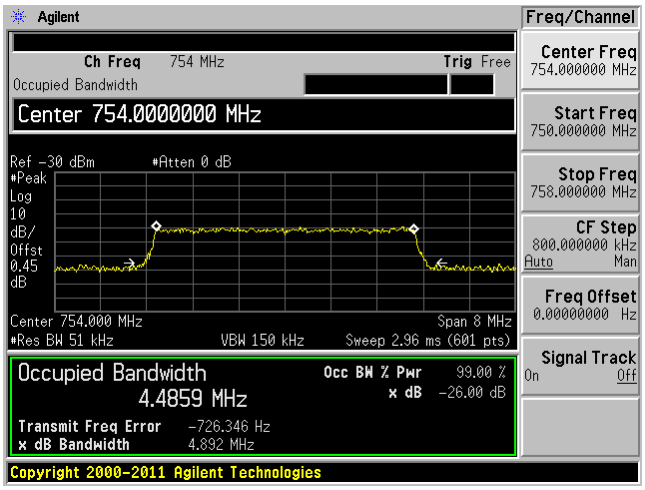


Output

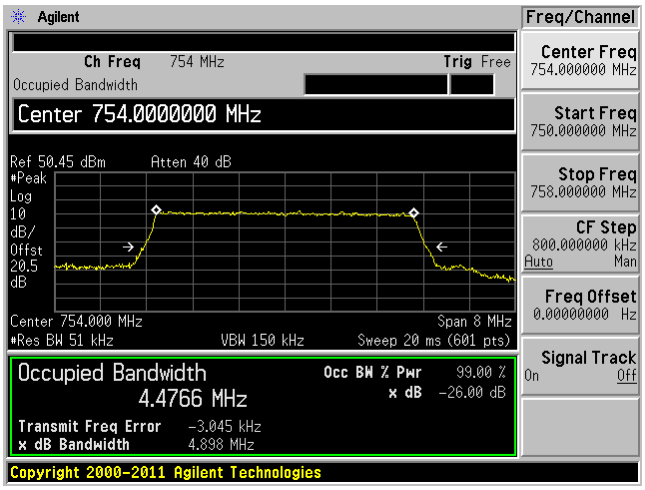


QPSK (5 MHz), (High Channel)

Input

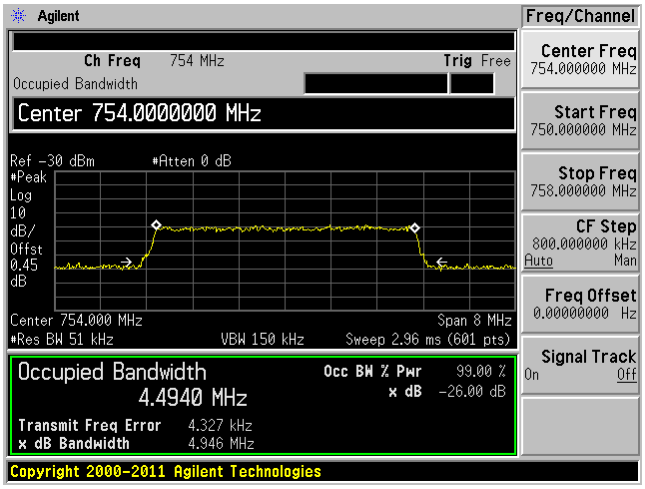


Output

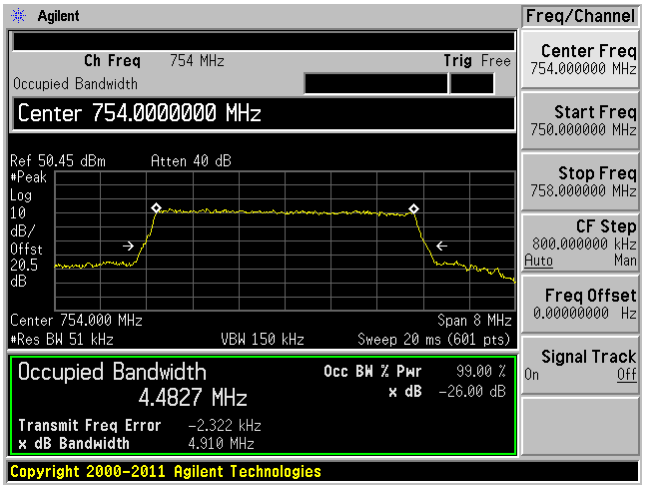


16QAM (5 MHz), (High Channel)

Input

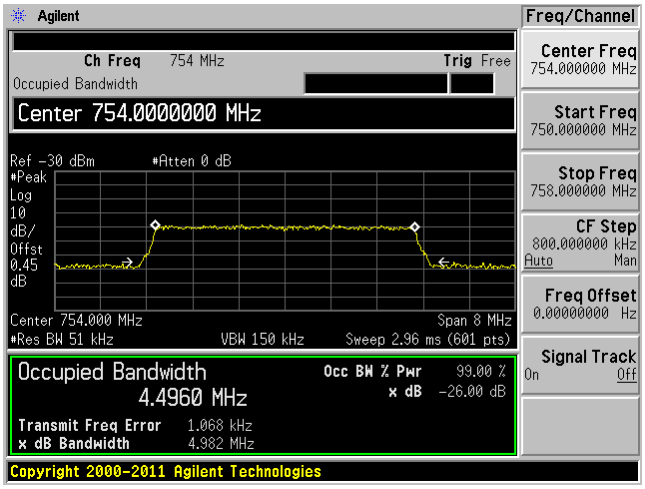


Output

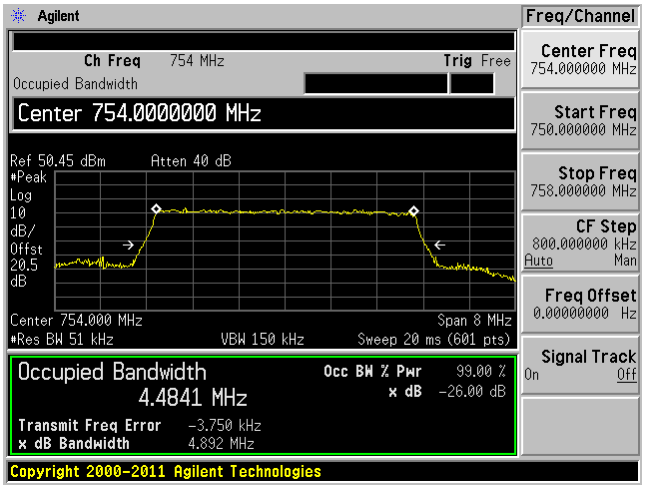


64QAM (5 MHz), (High Channel)

Input

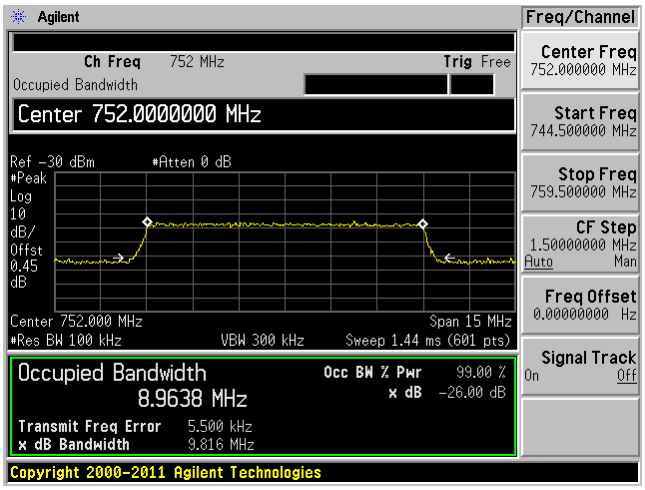


Output

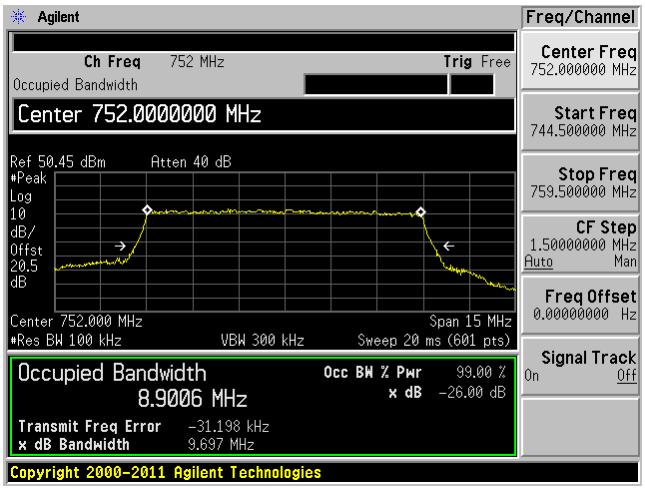


QPSK (10 MHz), (Middle Channel)

Input

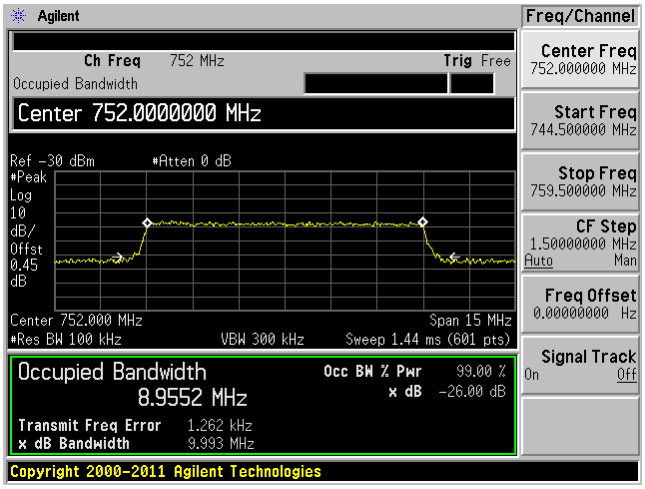


Output

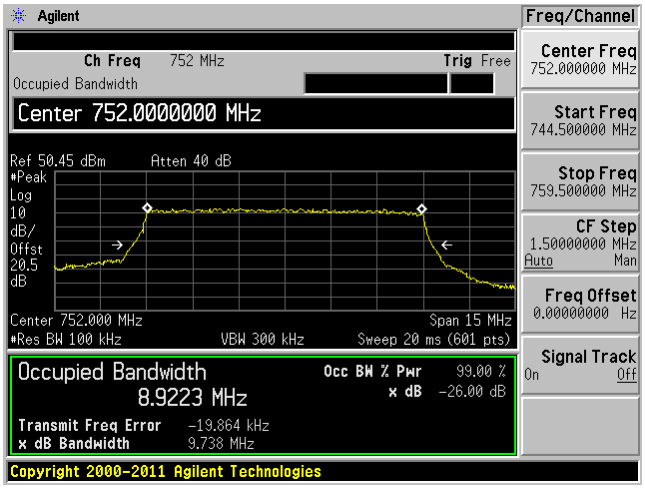


16QAM (10 MHz), (Middle Channel)

Input

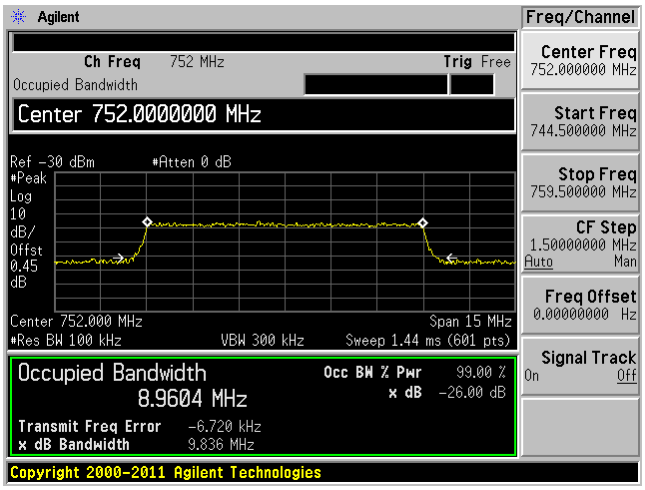


Output

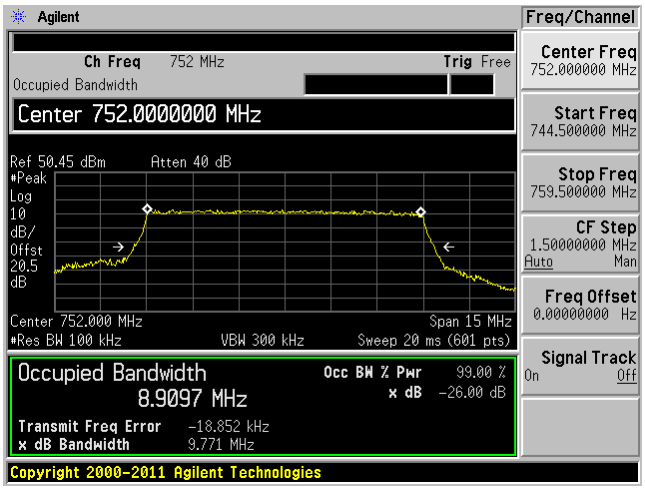


64QAM (10 MHz), (Middle Channel)

Input



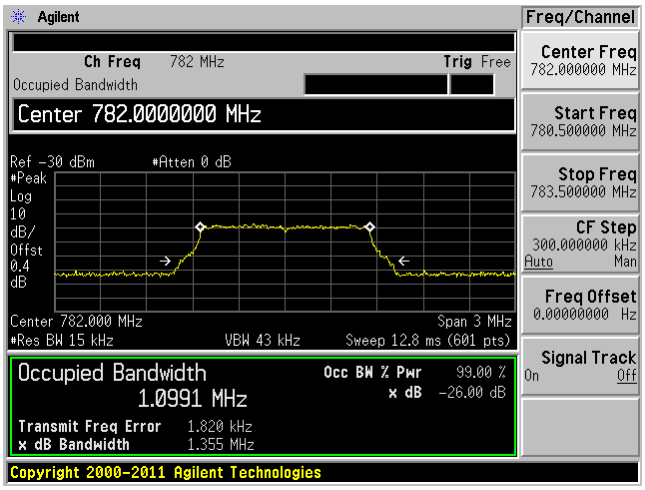
Output



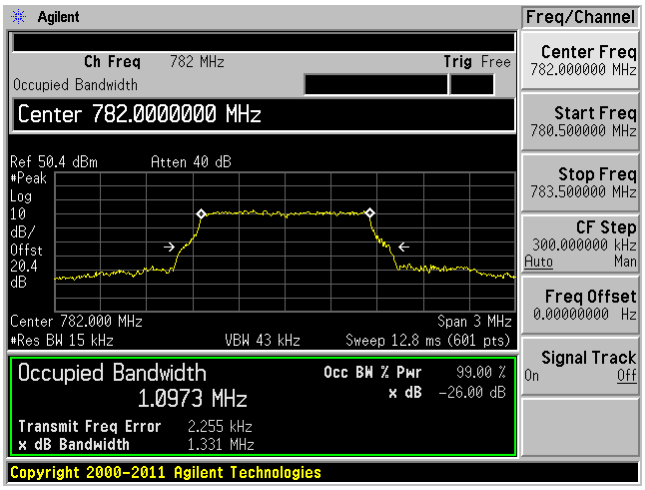
Uplink, 776-787 MHz

QPSK (1.4 MHz), (Middle Channel)

Input

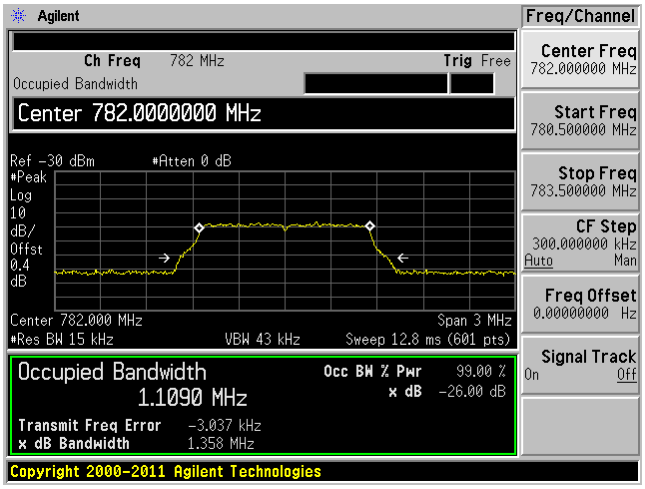


Output

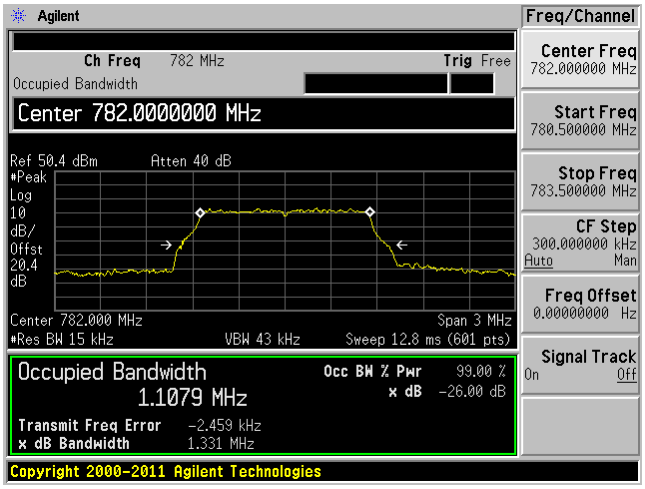


16QAM (1.4 MHz), (Middle Channel)

Input

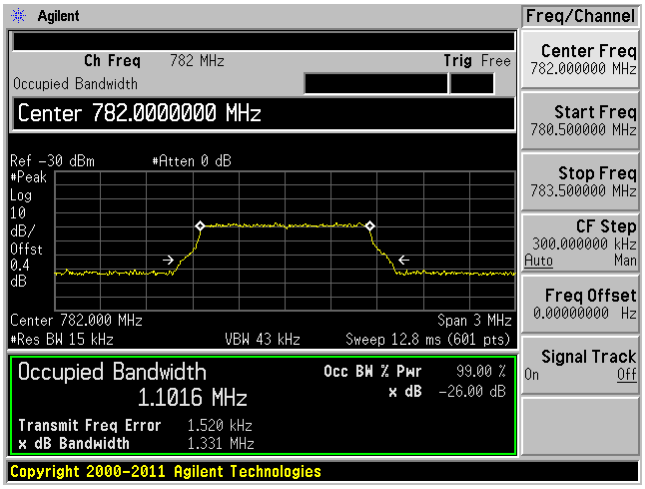


Output

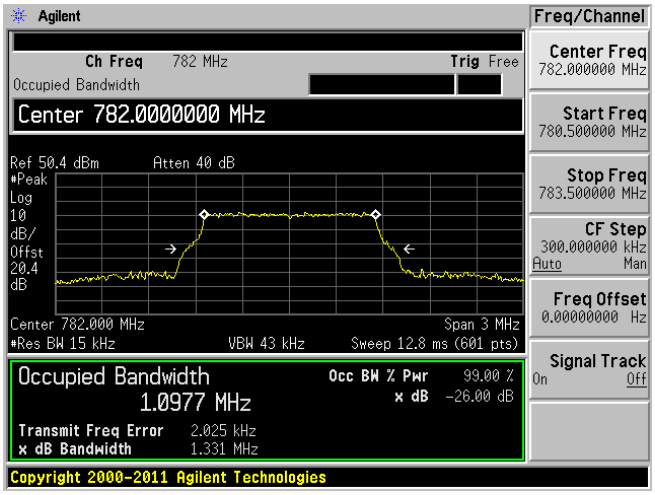


64QAM (1.4 MHz), (Middle Channel)

Input

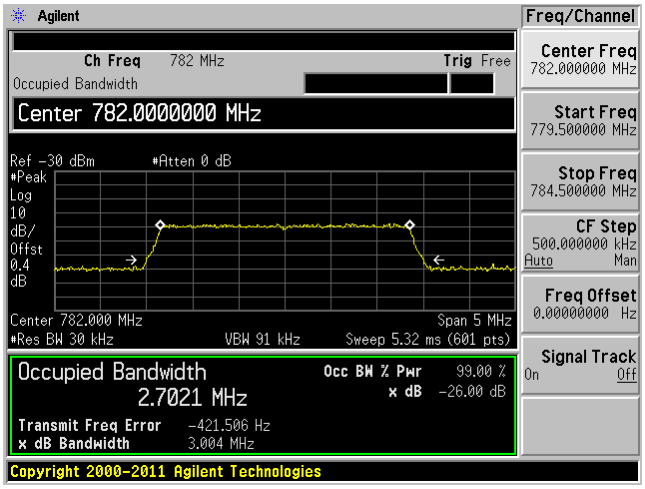


Output

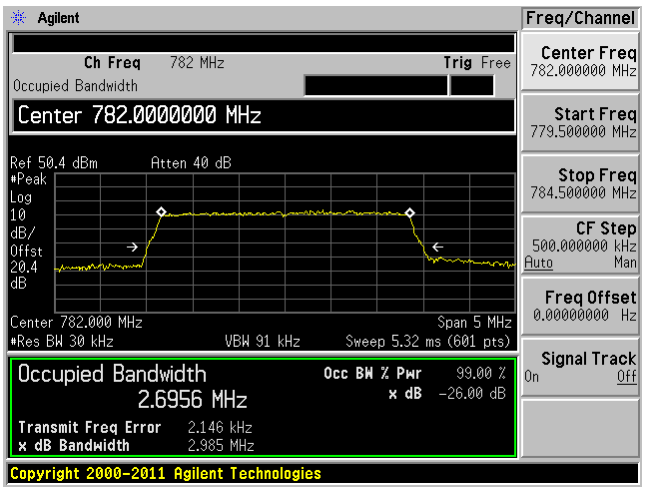


QPSK (3 MHz), (Middle Channel)

Input

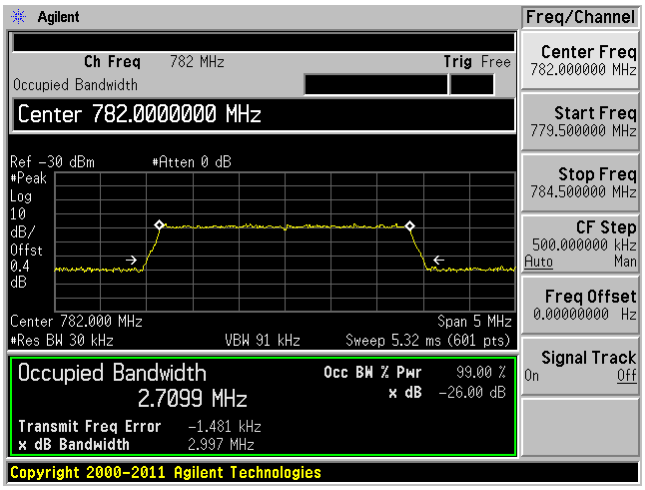


Output

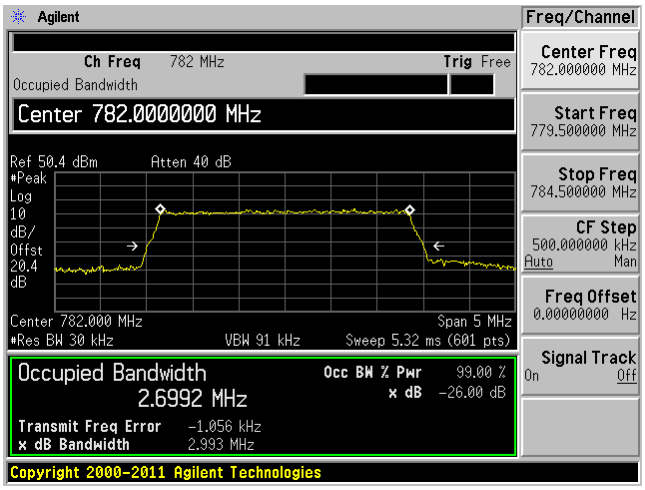


16QAM (3 MHz), (Middle Channel)

Input

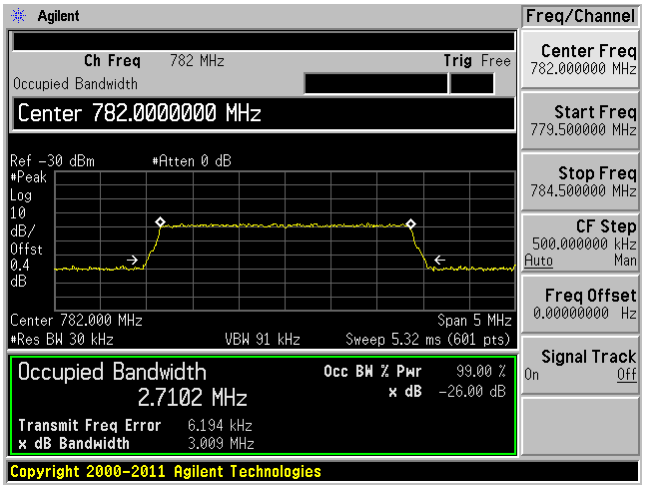


Output

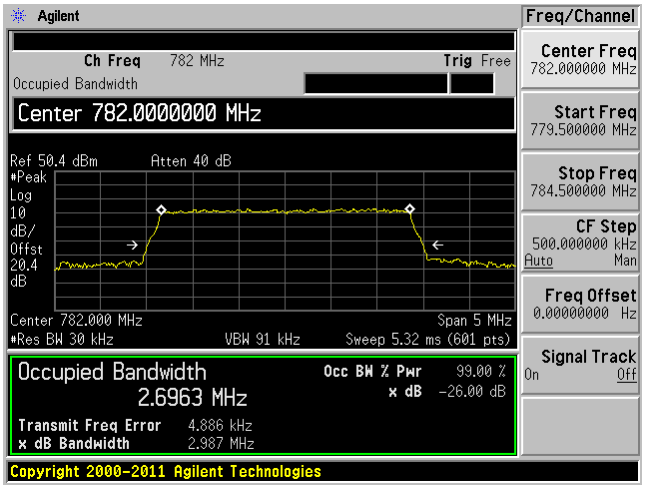


64QAM (3 MHz), (Middle Channel)

Input

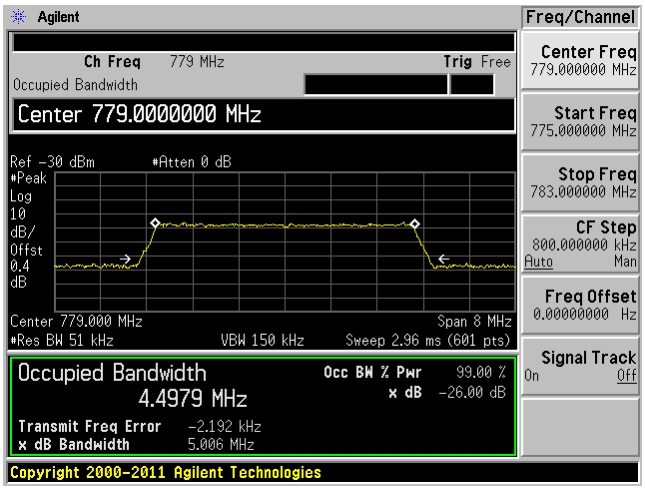


Output

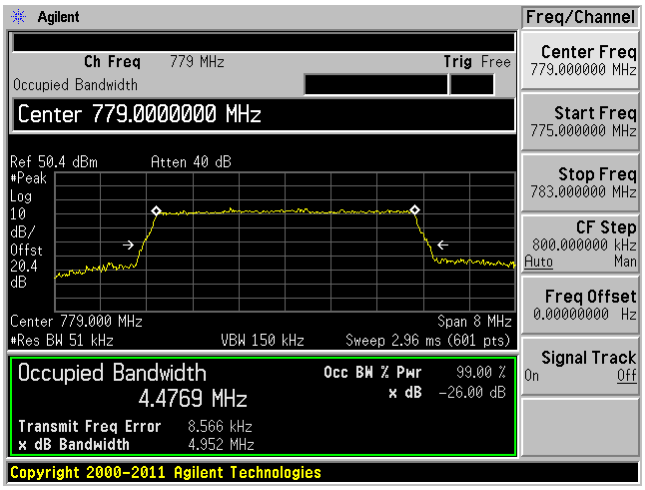


QPSK (5 MHz), (Low Channel)

Input

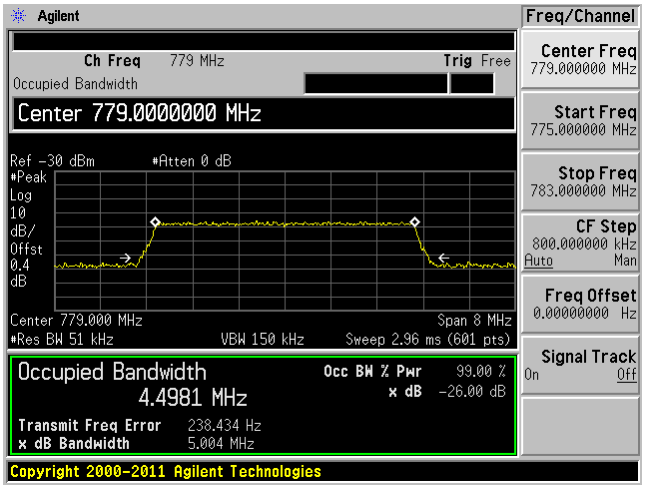


Output

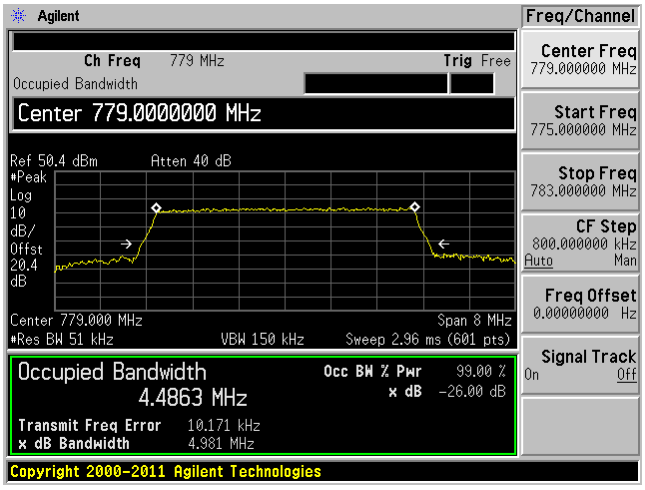


16QAM (5 MHz), (Low Channel)

Input

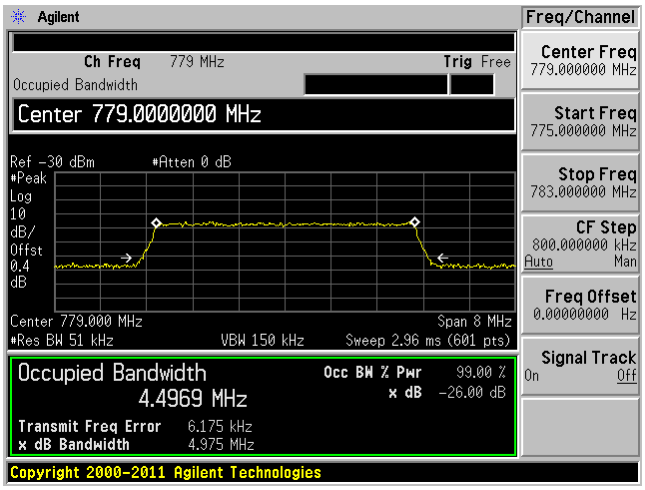


Output

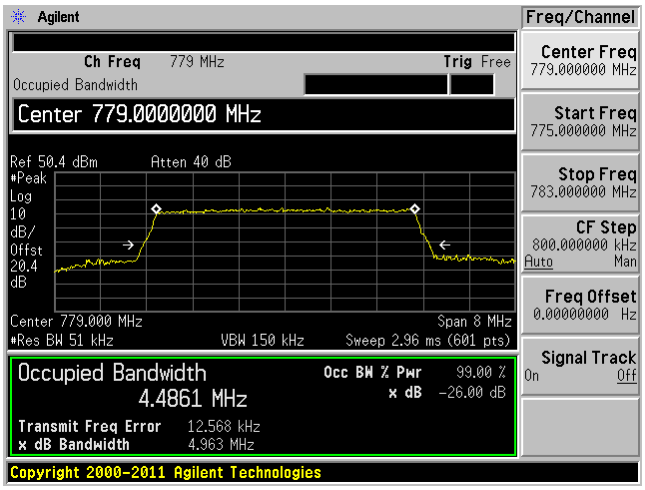


64QAM (5 MHz), (Low Channel)

Input

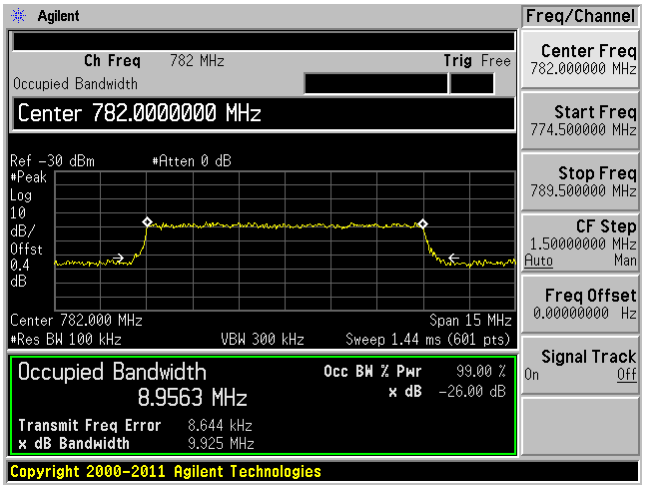


Output

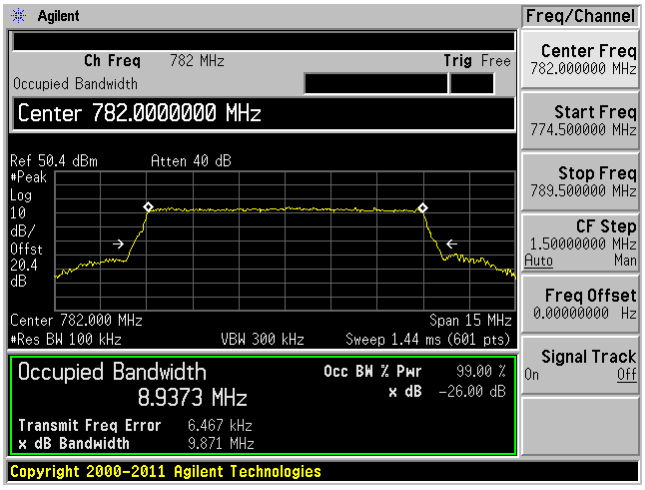


QPSK (10 MHz), (Middle Channel)

Input

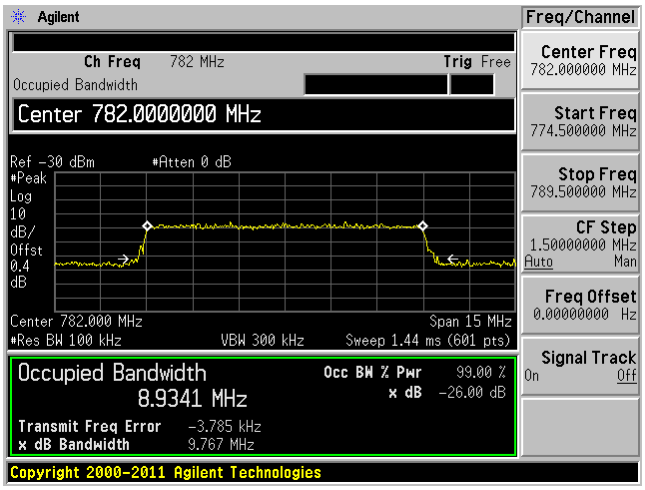


Output

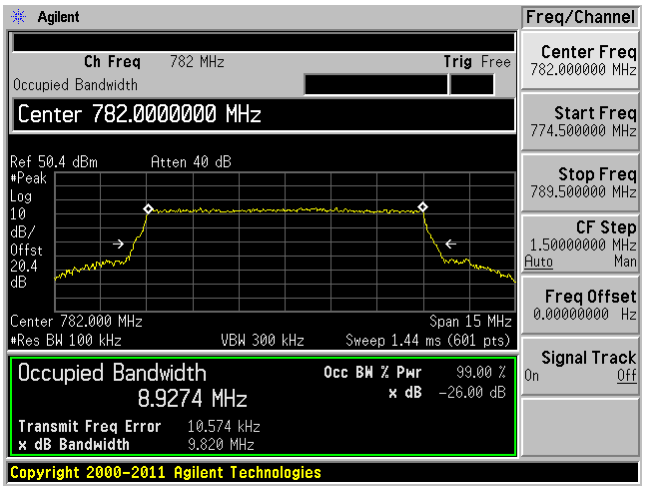


16QAM (10 MHz), (Middle Channel)

Input

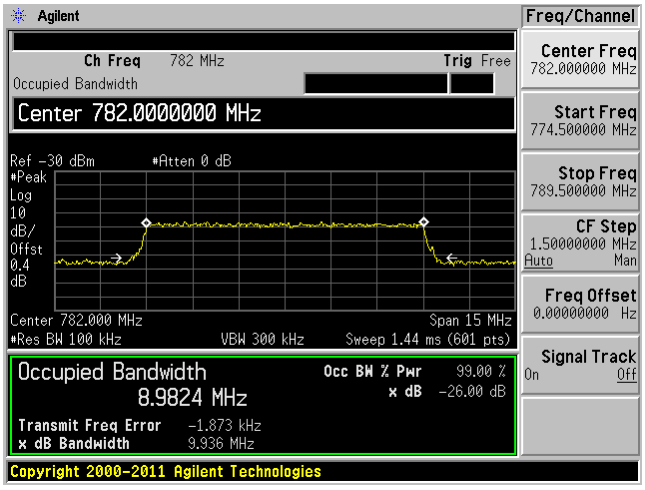


Output

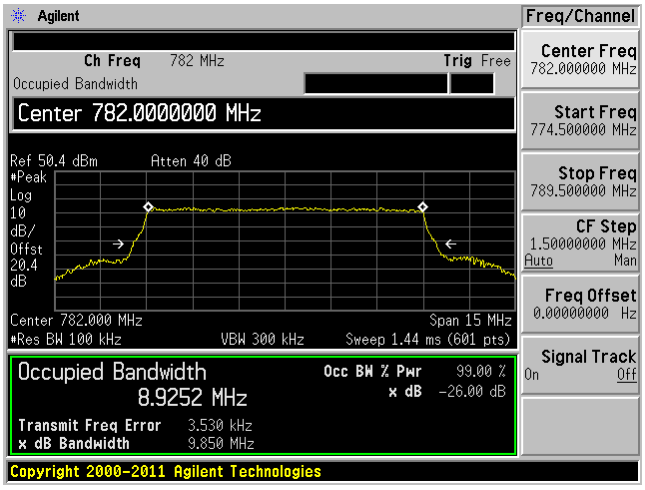


64QAM (10 MHz), (Middle Channel)

Input



Output



6 FCC §2.1053 & §27.53 - Spurious Radiated Emissions

6.1 Applicable Standard

Requirements: FCC §2.1053 and §27.53.

6.2 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)

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
HP	Pre-Amplifier	8447D	2944A10187	2013-03-08	1year
Sunol Sciences Corp	Biconical Log Antenna	JB1	A013105-3	2012-07-24	2 years
Sunol Sciences Corp	System Controller	SC99V	122303-1	N/R	N/R
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year
A.H. Systems	Horn Antenna	SAS-200/571	261	2013-01-29	1 year
A.R.A.	Horn Antenna	DRG-118/A	1132	2013-01-29	1 year
Mini-Circuits	Pre-Amplifier	ZVA-183-S	570400946	2013-05-09	1 year
Agilent	Generator, Signal	E4438C	MY45091309	2013-05-30	1 year

***Statement of Traceability**: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.4 Test Environmental Conditions

Temperature:	21 ºC
Relative Humidity:	36 %
ATM Pressure:	101.96 kPa

The testing was performed by "Glenn Escano" from 2013-11-01 at Chamber"3".

6.5 Summary of Test Results

Downlink, 746-757 MHz, Input frequency = 752 MHz, CW

Indicated		Turntable 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)		
431	38.58	334	100	V	431	-70.86	0	0.68	-71.54	-13	-58.54
431	33.62	72	150	H	431	-71.49	0	0.68	-72.17	-13	-59.17
510	30.87	0	150	V	510	-75.58	0	0.75	-76.33	-13	-63.33
510	31.41	0	154	H	510	-77.75	0	0.75	-78.5	-13	-65.5
737	32.07	205	150	V	737	-62.57	0	0.89	-63.46	-13	-50.46
737	31.05	131	100	H	737	-65.77	0	0.89	-66.66	-13	-53.66
1363	52.79	193	115	V	1363	-59.78	6.15	2.15	-55.78	-13	-42.78
1363	50.44	167	146	H	1363	-62.01	6.27	2.15	-57.89	-13	-44.89
1593	52.55	44	130	V	1593	-60.06	7.25	2.31	-55.12	-13	-42.12
1593	45.42	114	140	H	1593	-67.36	7.22	2.31	-62.45	-13	-49.45
2494	43.36	109	124	V	2494	-65.85	7.62	3.01	-61.24	-13	-48.24
2494	45.85	140	134	H	2494	-63.93	7.67	3.01	-59.27	-13	-46.27

Note: - All spurious emissions are on the noise floor level

Uplink, 776-787 MHz, Input frequency = 782 MHz, CW

Indicated		Turntable 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)		
430	38.91	0	134	V	430	-70.53	0	0.68	-71.21	-13	-58.21
430	37.05	117	196	H	430	-68.06	0	0.68	-68.74	-13	-55.74
614	29.02	122	150	V	614	-75.77	0	0.83	-76.6	-13	-63.6
614	29.31	343	125	H	614	-79.09	0	0.83	-79.92	-13	-66.92
737	30.95	205	154	V	737	-74.17	0	0.89	-75.06	-13	-62.06
737	30.99	128	164	H	737	-76.03	0	0.89	-76.92	-13	-63.92
1360	52.31	190	123	V	1360	-60.55	6.15	2.15	-56.55	-13	-43.55
1360	51.38	170	131	H	1360	-61.14	6.27	2.15	-57.02	-13	-44.02
1703	42.4	149	159	V	1703	-69.13	6.67	2.4	-64.86	-13	-51.86
1703	41.69	95	150	H	1703	-69.8	6.65	2.4	-65.55	-13	-52.55
2496	43.27	169	113	V	2496	-66.37	7.62	3.01	-61.76	-13	-48.76
2496	43.65	141	137	H	2496	-66.25	7.67	3.01	-61.59	-13	-48.59

Note: - All spurious emissions are on the noise floor level.

7 FCC §2.1051 & §27.53 - Spurious Emissions at Antenna Terminals

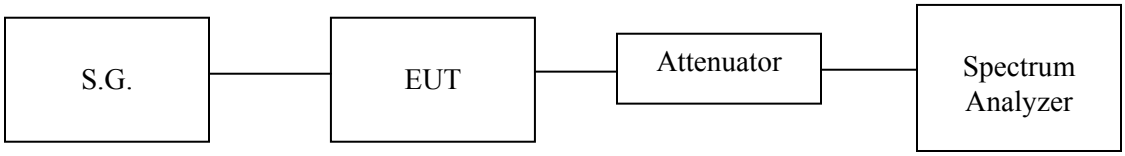
7.1 Applicable Standard

Requirements: FCC §2.1051 and §27.53.

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

7.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation.



7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA, Series Spectrum Analyzer	E4440A	US42221851	2013-03-05
Agilent	Generator, Signal	E4438C	MY45091309	2013-05-30

***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:	24 ºC
Relative Humidity:	38 %
ATM Pressure:	101.75 kPa

The testing was performed by Glenn Escano from 2013-10-25 at RF Site.

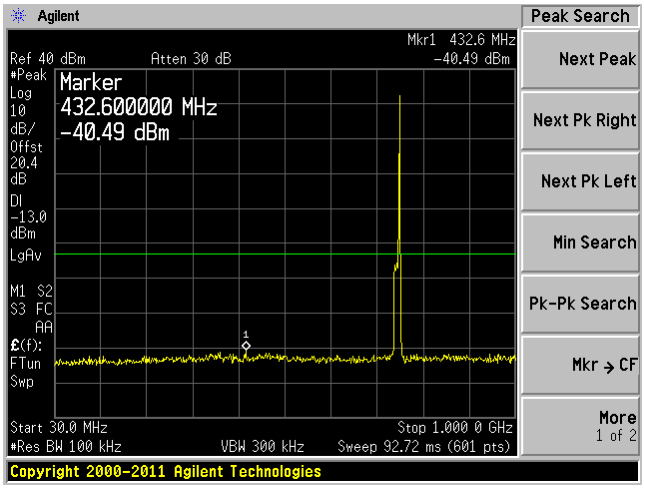
7.5 Test Results

Please refer to the following plots.

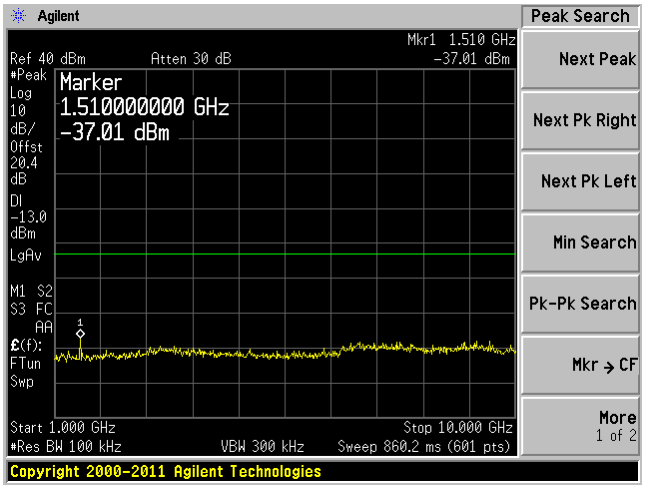
Spurious Emissions at Antenna Port

Downlink, High Channel: 756 MHz:

Plot 1: 30 MHz to 1 GHz

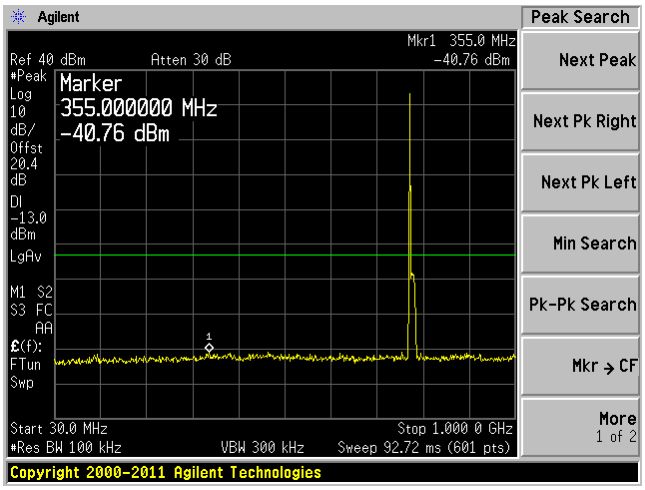


Plot 2: Above 1 GHz

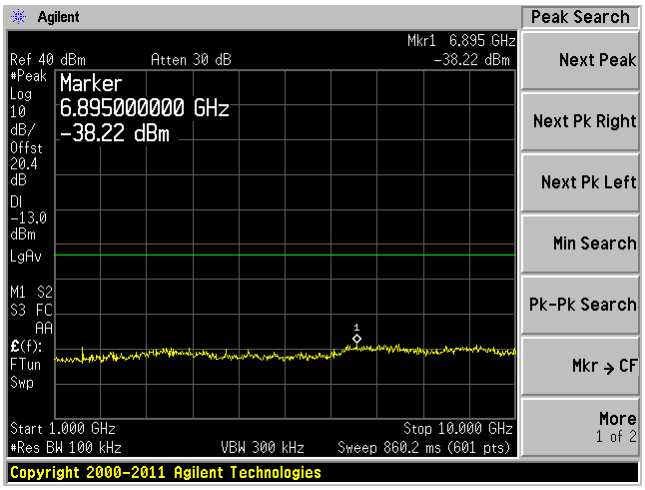


Uplink, Low Channel: 777 MHz:

Plot 1: 30 MHz to 1 GHz



Plot 2: Above 1 GHz

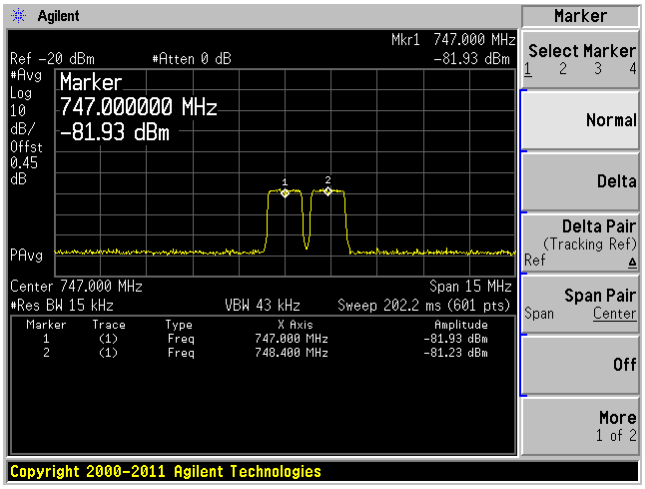


Inter-modulation

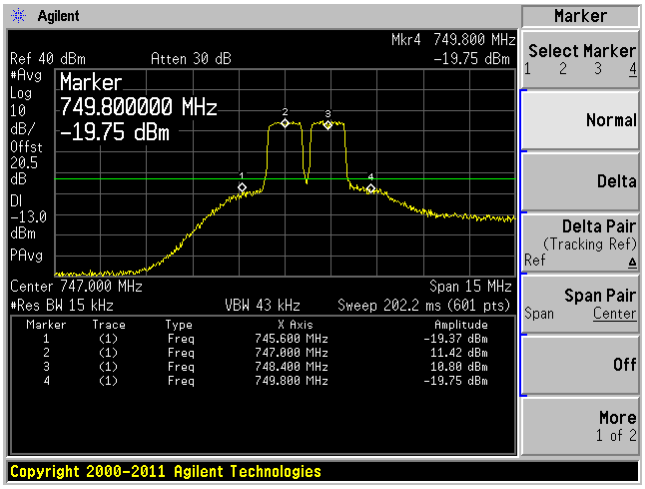
Downlink, 746-757 MHz

QPSK (1.4 MHz), (Low Channel)

Input

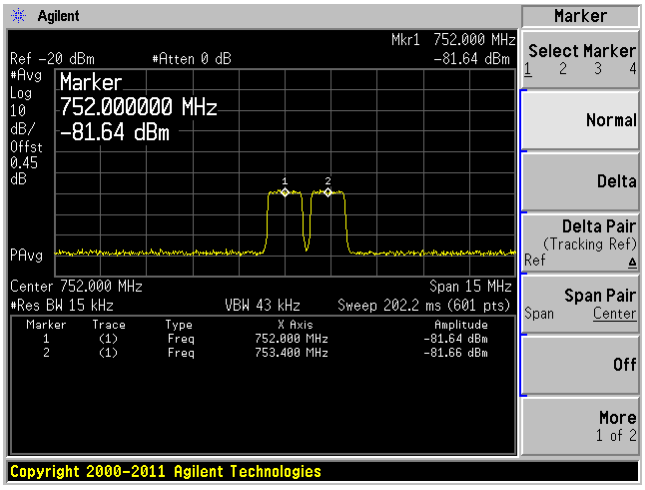


Output

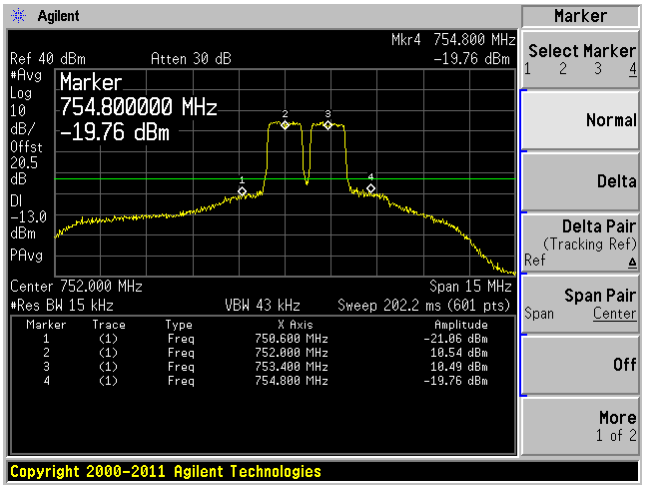


QPSK (1.4 MHz), (Middle Channel)

Input

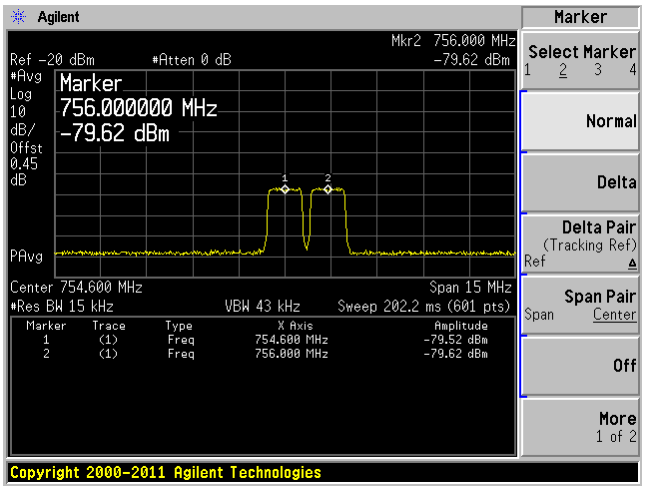


Output

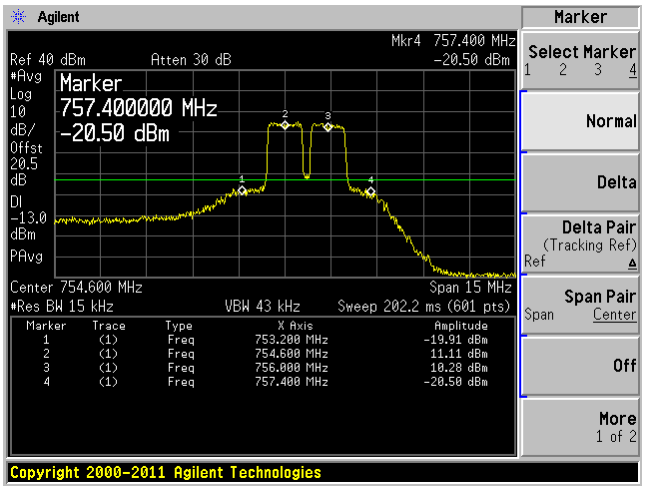


QPSK (1.4 MHz), (High Channel)

Input

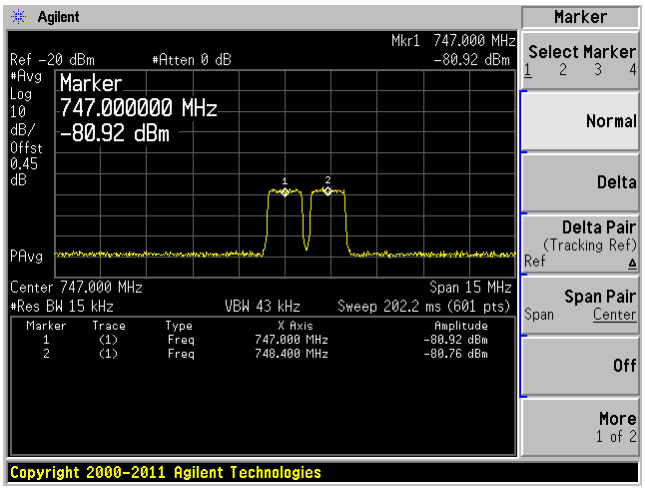


Output

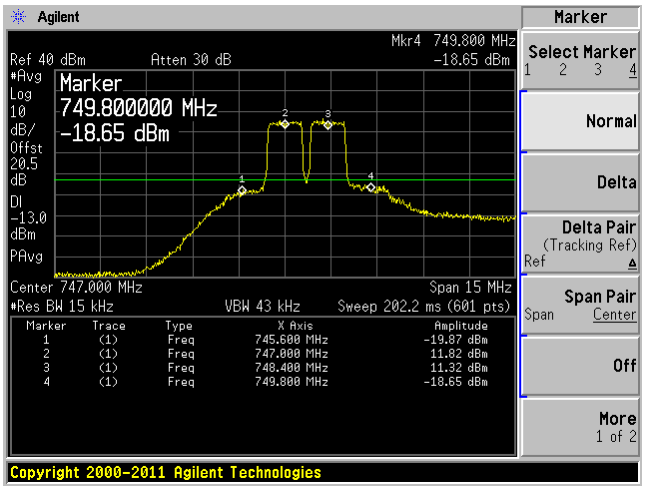


16QAM (1.4 MHz), (Low Channel)

Input

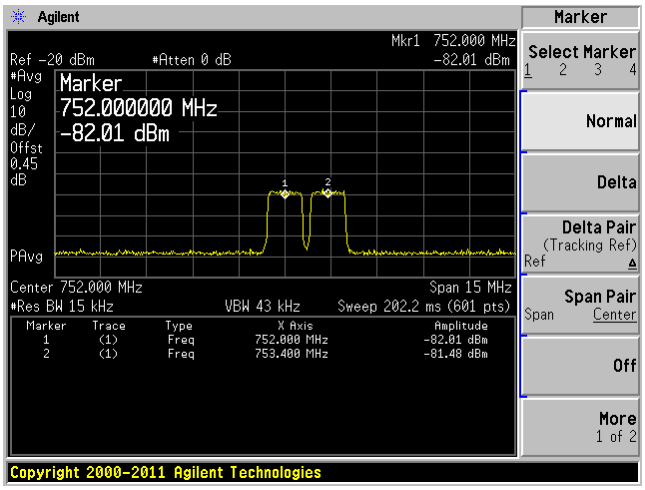


Output

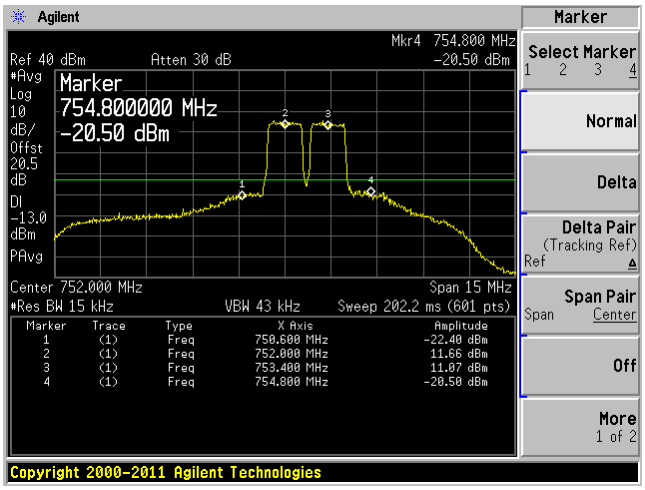


16QAM (1.4 MHz), (Middle Channel)

Input

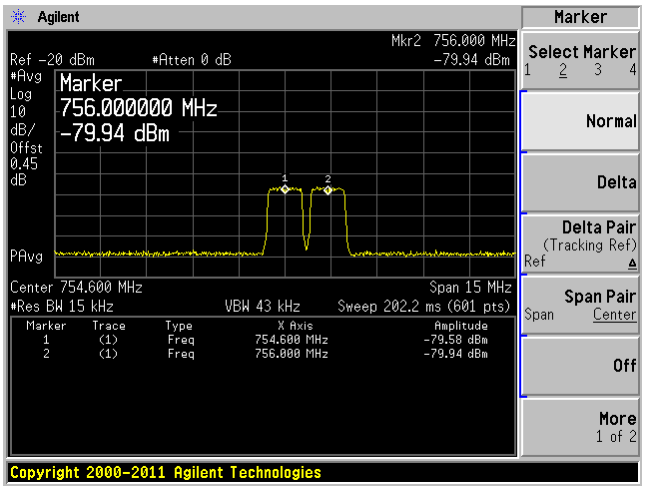


Output

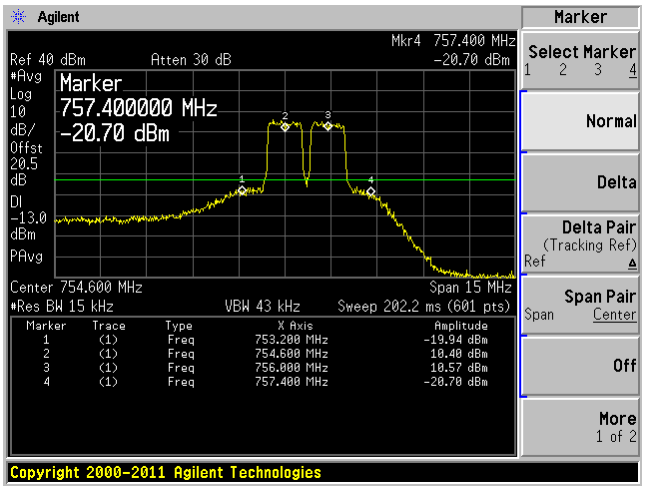


16QAM (1.4 MHz), (High Channel)

Input

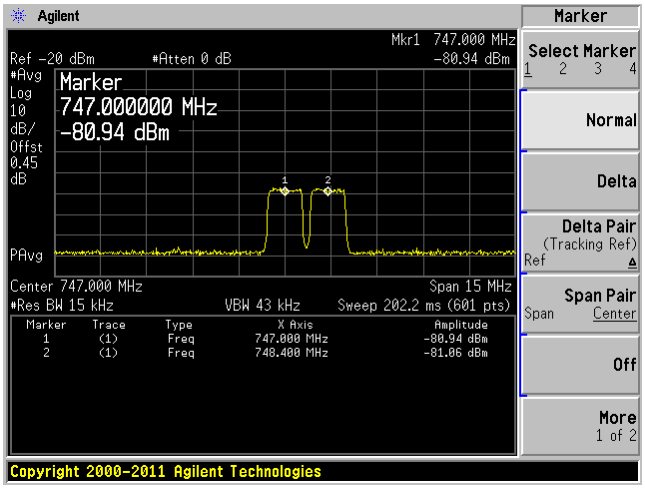


Output

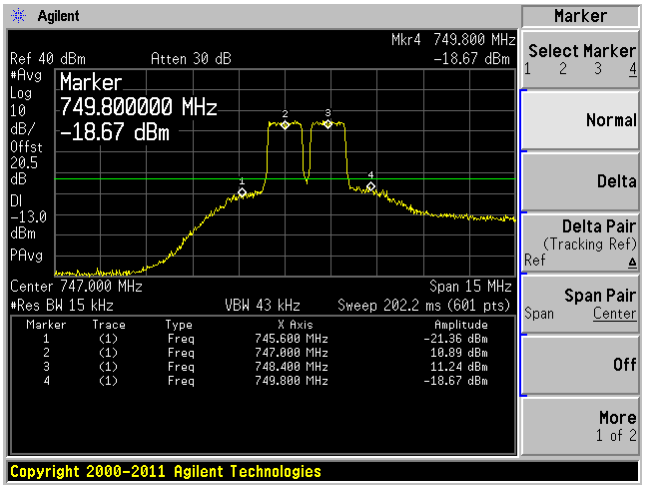


64QAM (1.4 MHz), (Low Channel)

Input

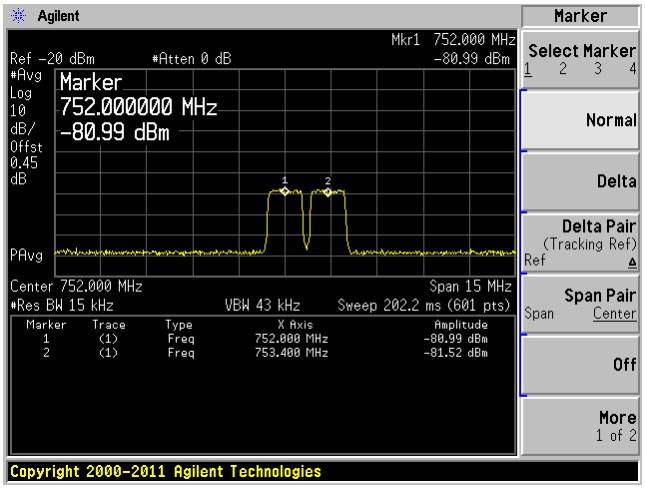


Output

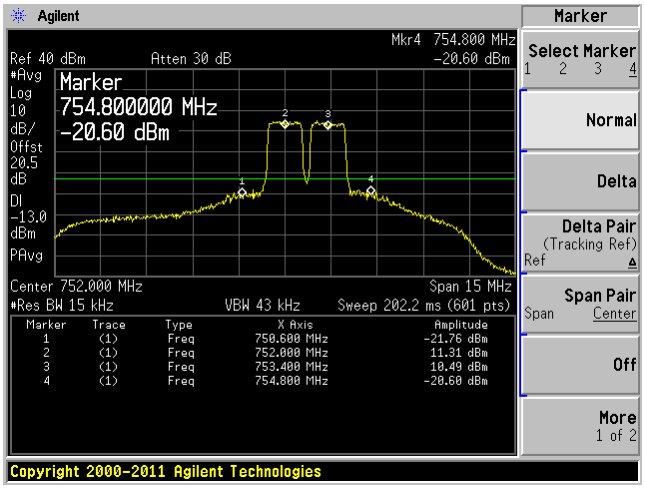


64QAM (1.4 MHz), (Middle Channel)

Input

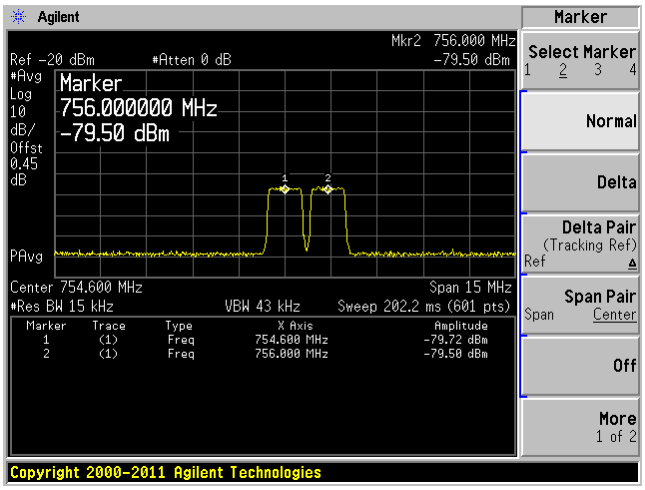


Output

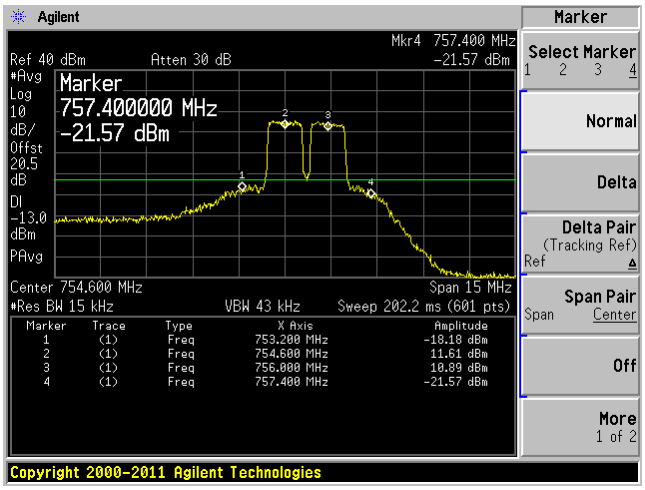


64QAM (1.4 MHz), (High Channel)

Input

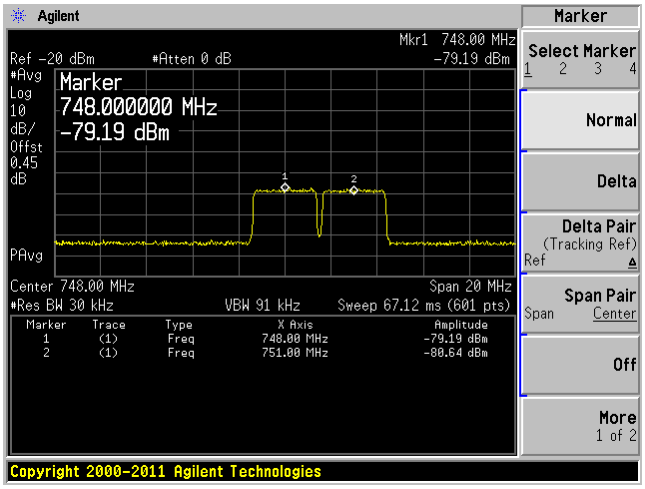


Output

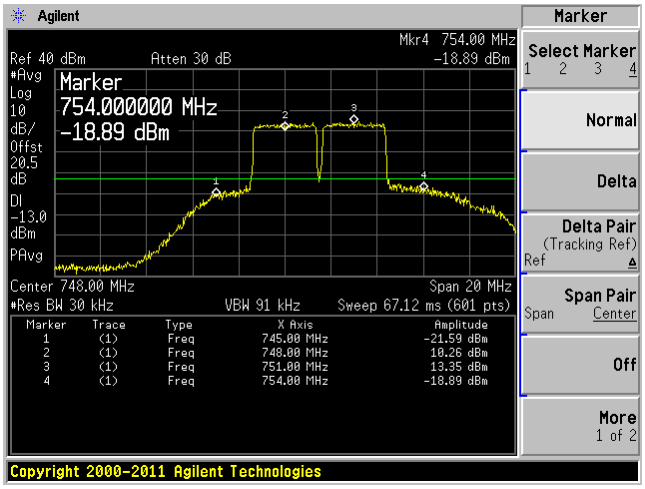


QPSK (3 MHz), (Low Channel)

Input

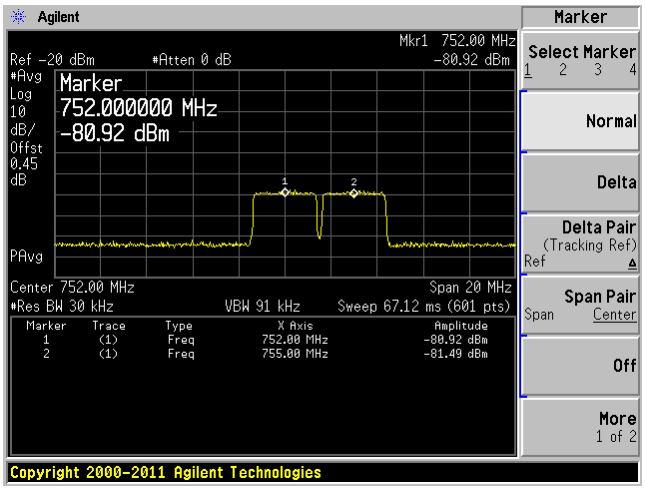


Output

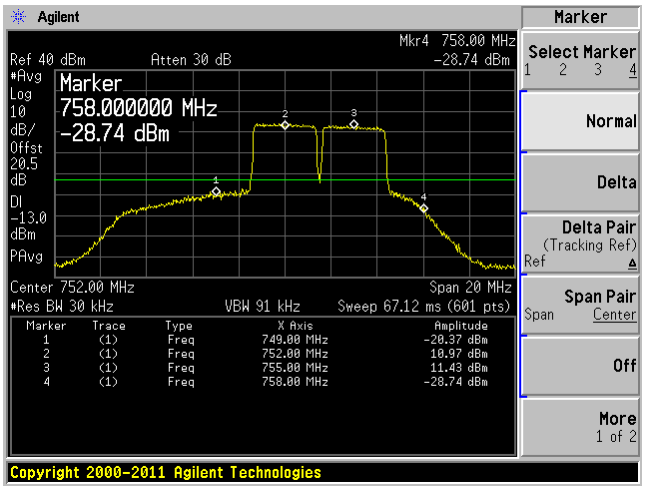


QPSK (3 MHz), (Middle Channel)

Input

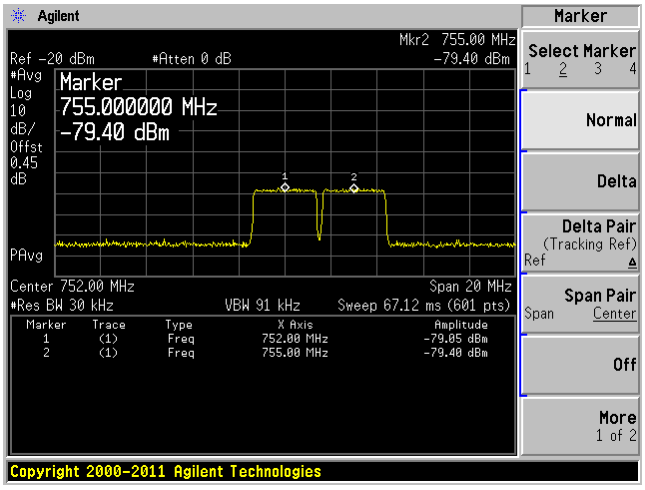


Output

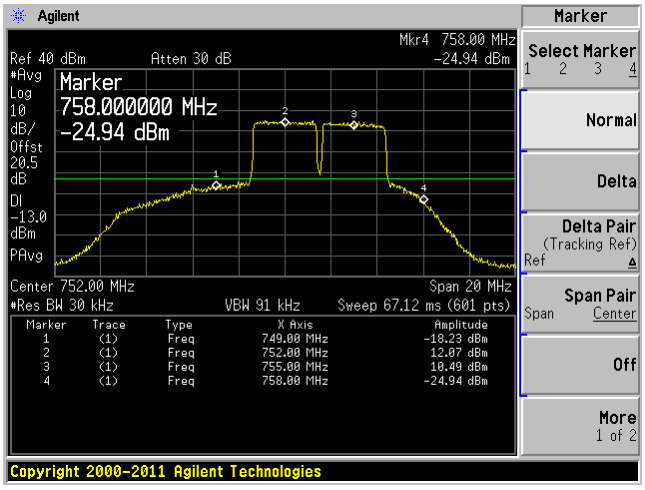


QPSK (3 MHz), (High Channel)

Input

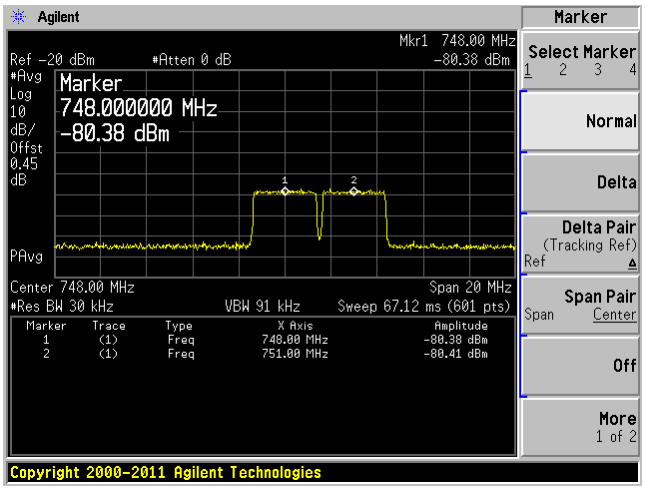


Output

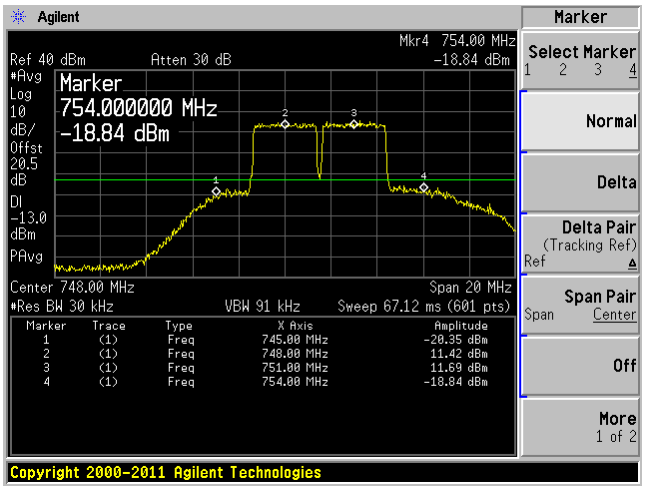


16QAM (3 MHz), (Low Channel)

Input

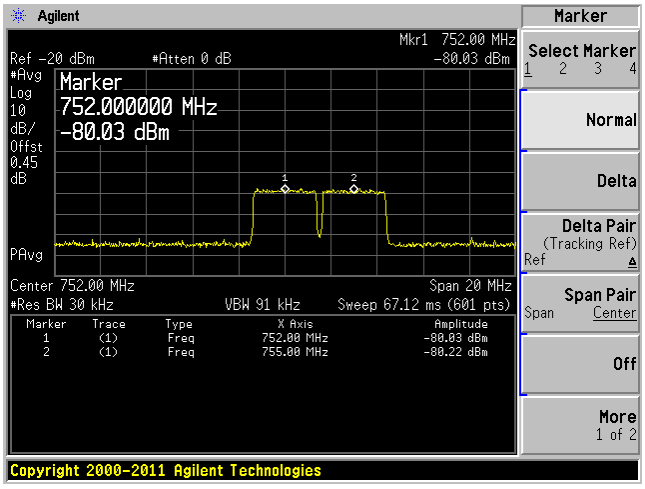


Output

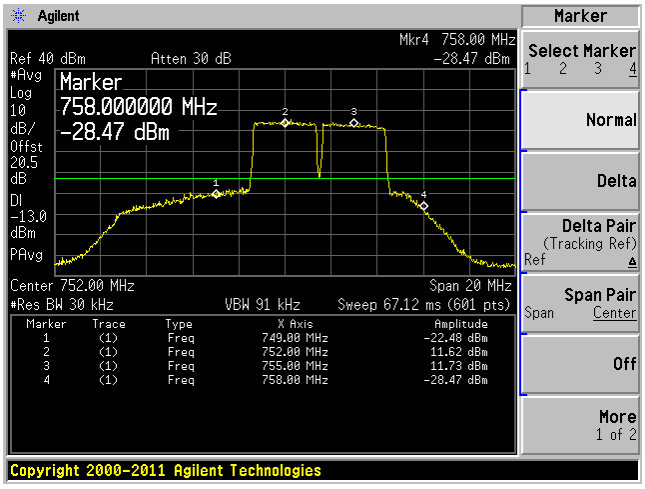


16QAM (3 MHz), (Middle Channel)

Input

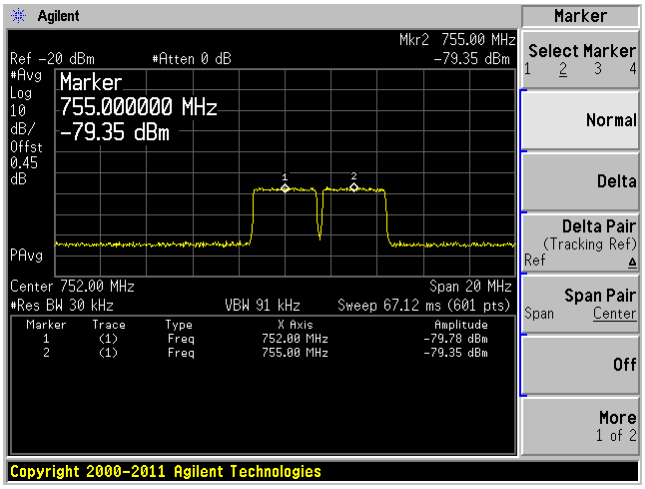


Output

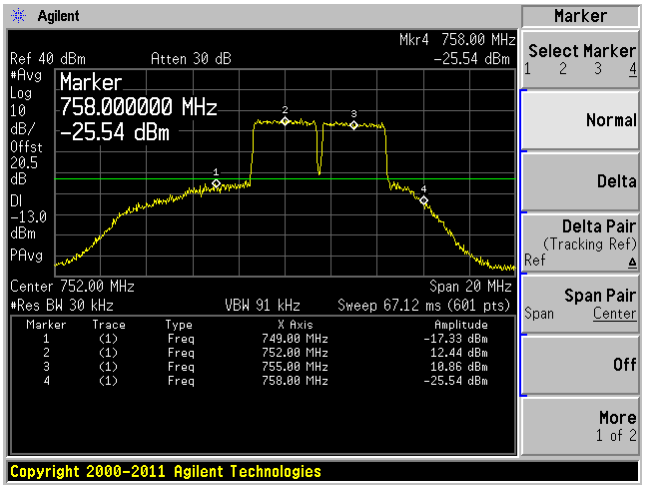


16QAM (3 MHz), (High Channel)

Input

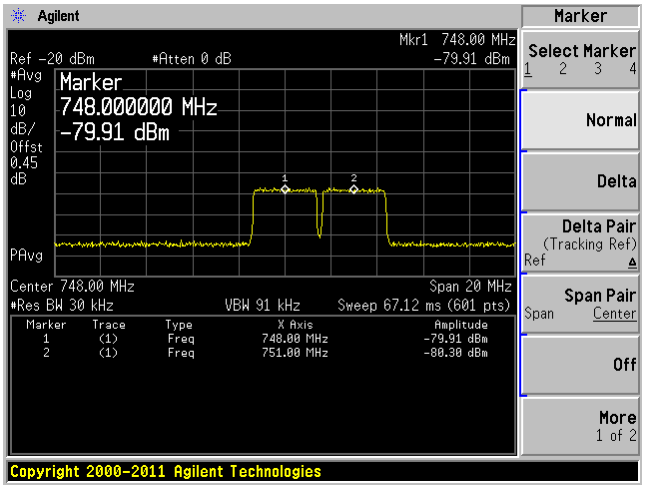


Output

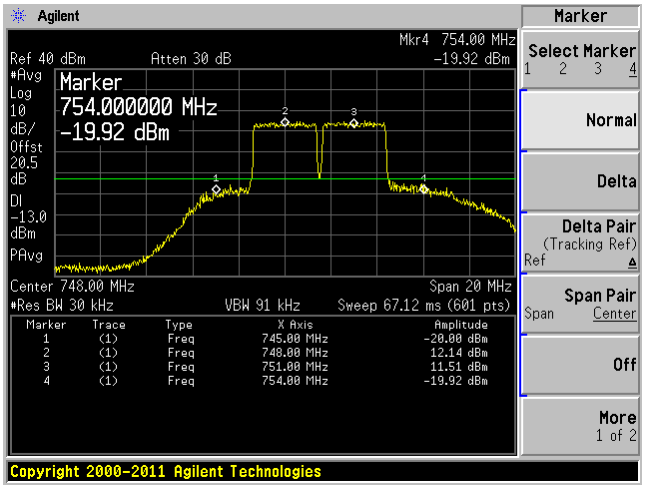


64QAM (3 MHz), (Low Channel)

Input

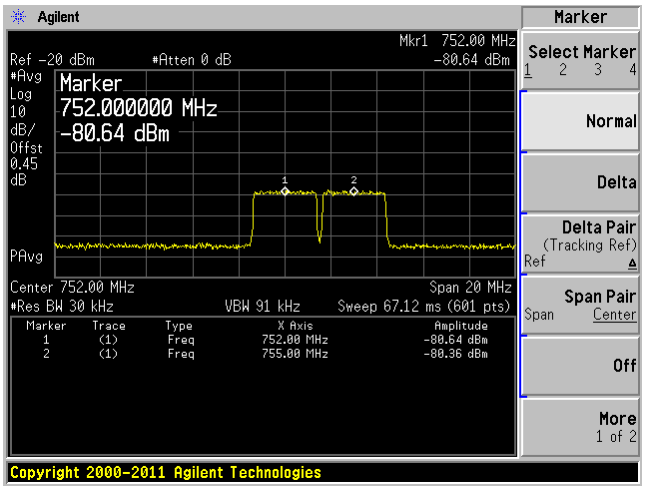


Output

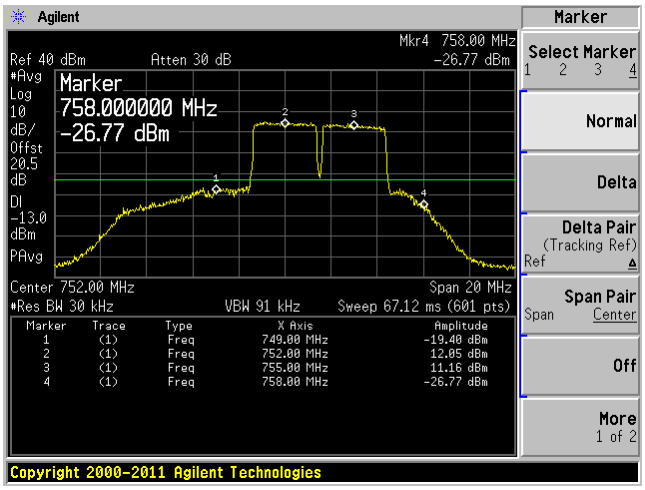


64QAM (3 MHz), (Middle Channel)

Input

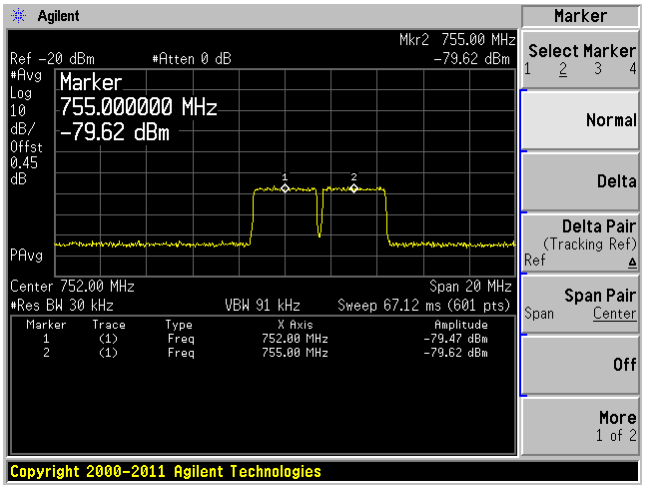


Output

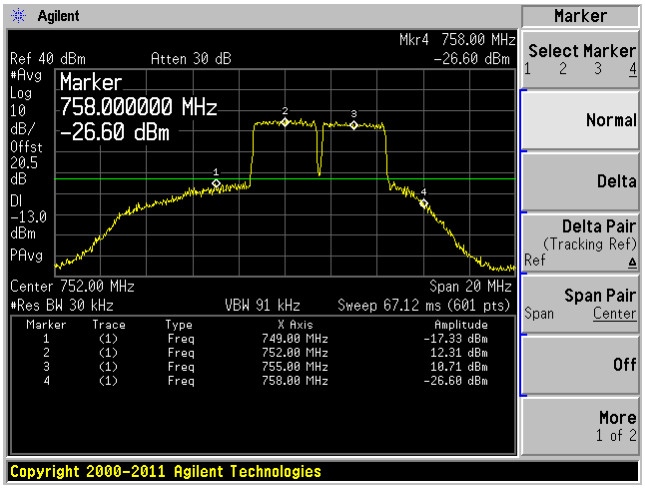


64QAM (3 MHz), (High Channel)

Input

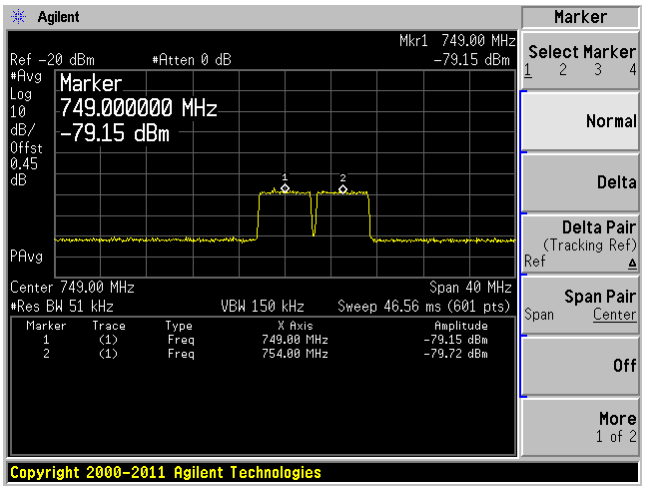


Output

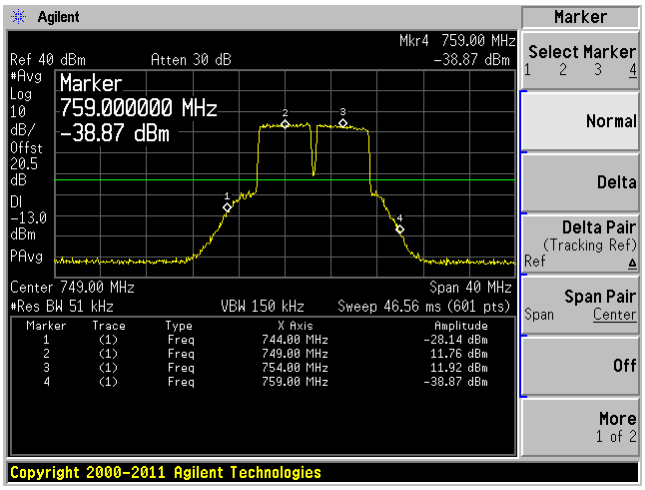


QPSK (5 MHz), (Low Channel)

Input

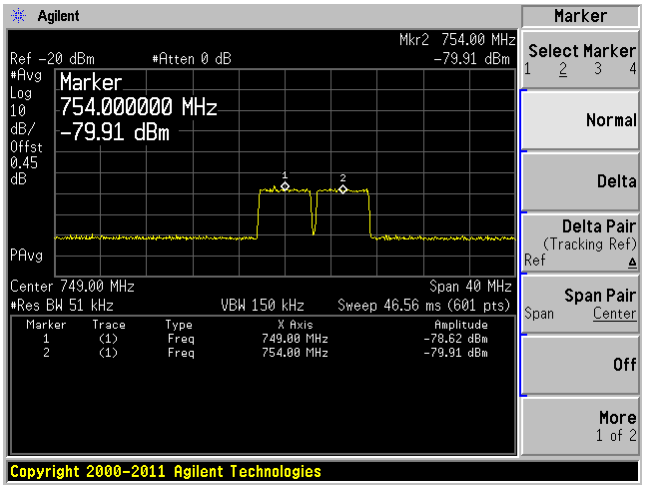


Output

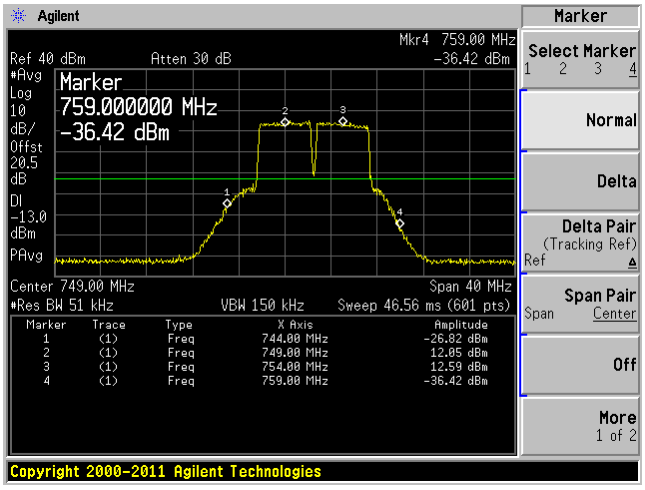


QPSK (5 MHz), (High Channel)

Input

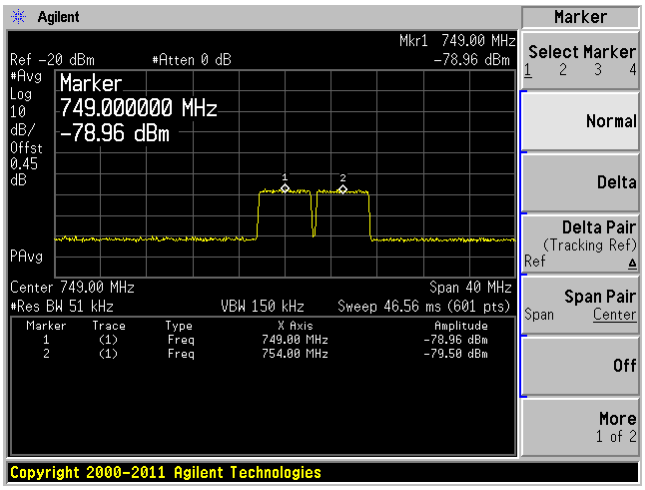


Output

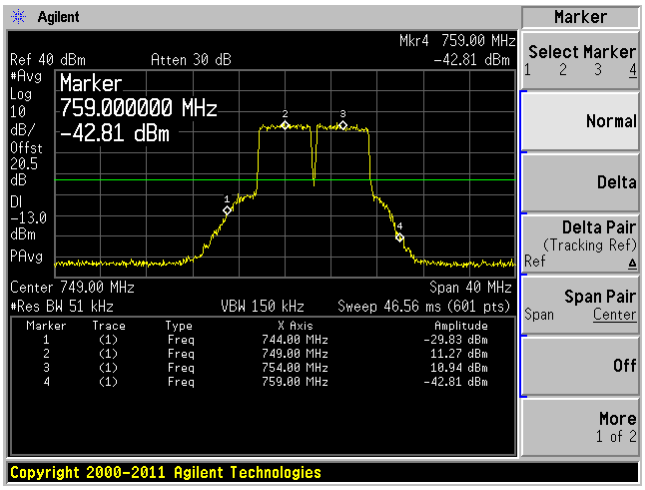


16QAM (5 MHz), (Low Channel)

Input

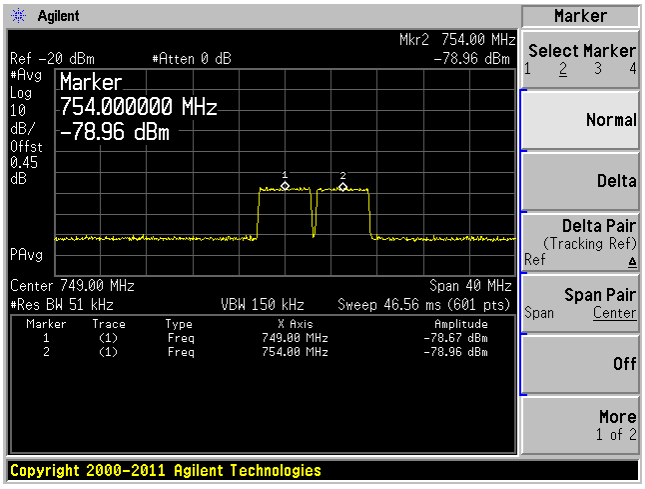


Output

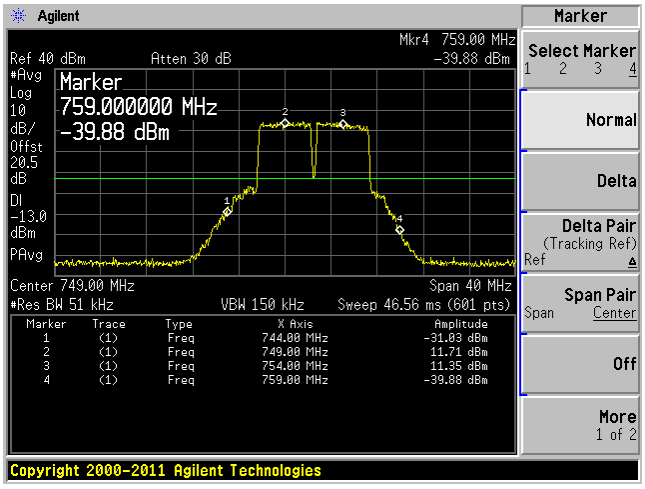


16QAM (5 MHz), (High Channel)

Input

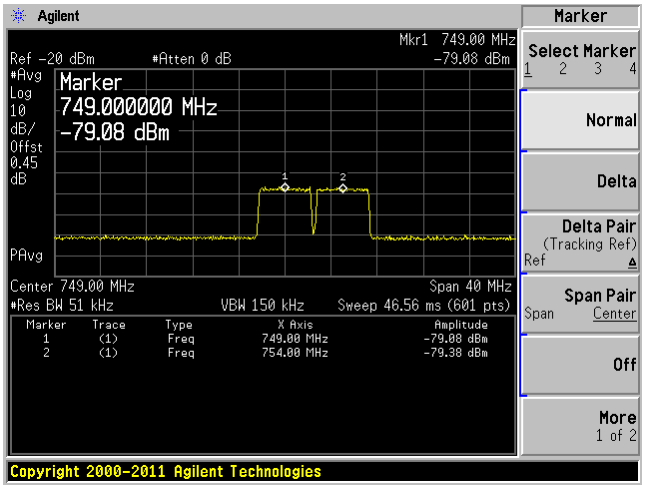


Output

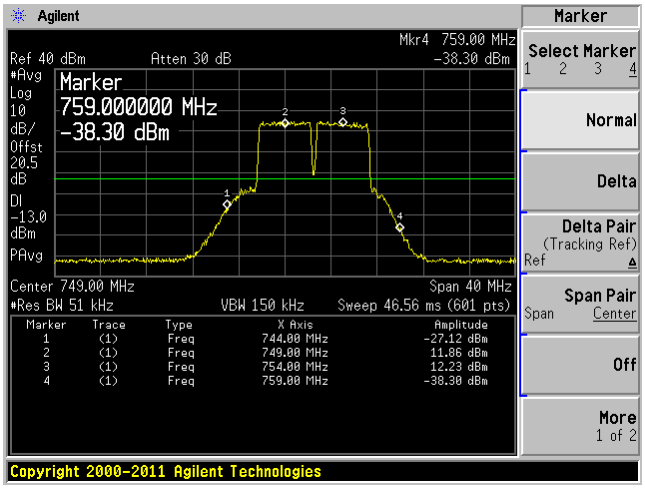


64QAM (5 MHz), (Low Channel)

Input

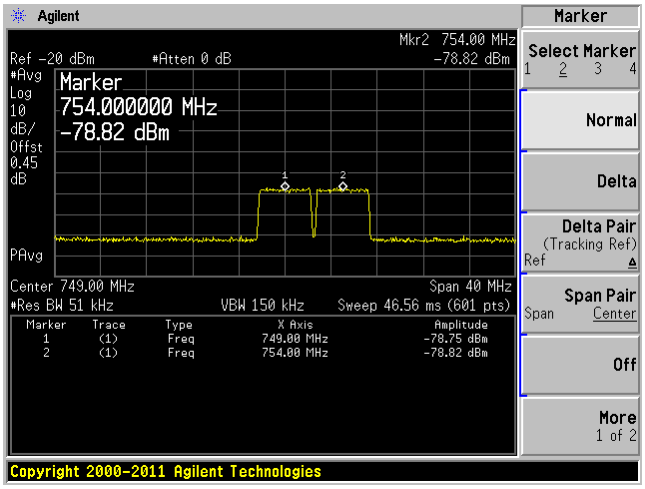


Output

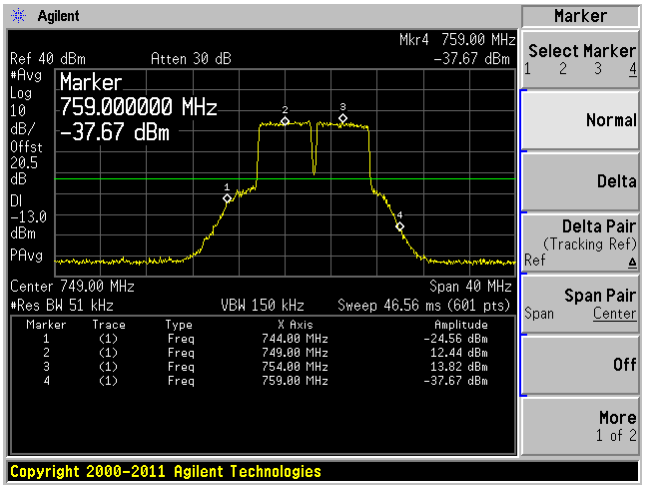


64QAM (5 MHz), (High Channel)

Input



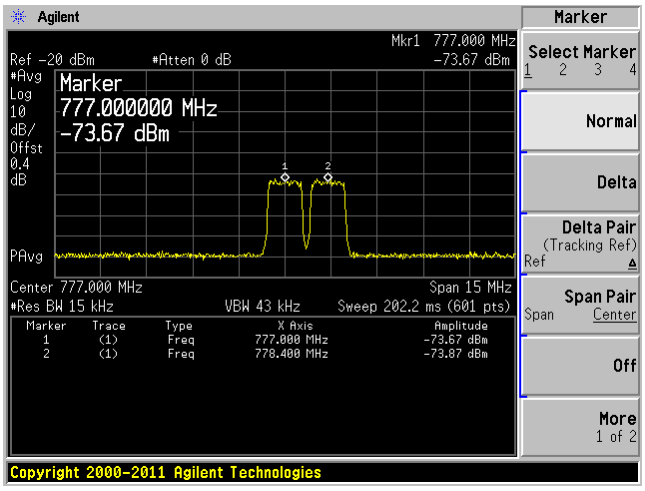
Output



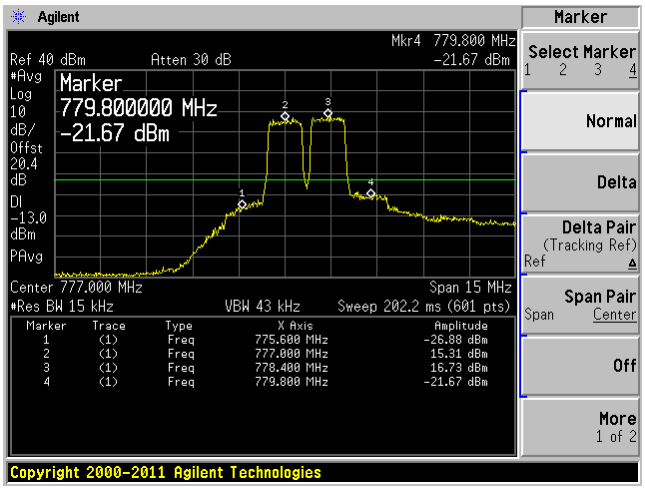
Uplink, 776-787 MHz

QPSK (1.4 MHz), (Low Channel)

Input

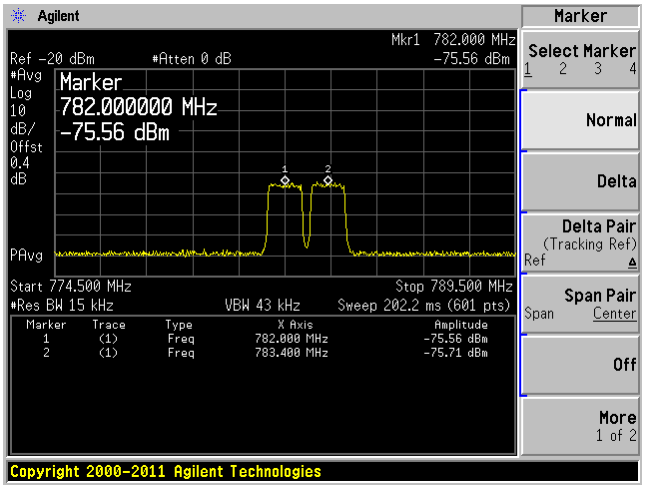


Output

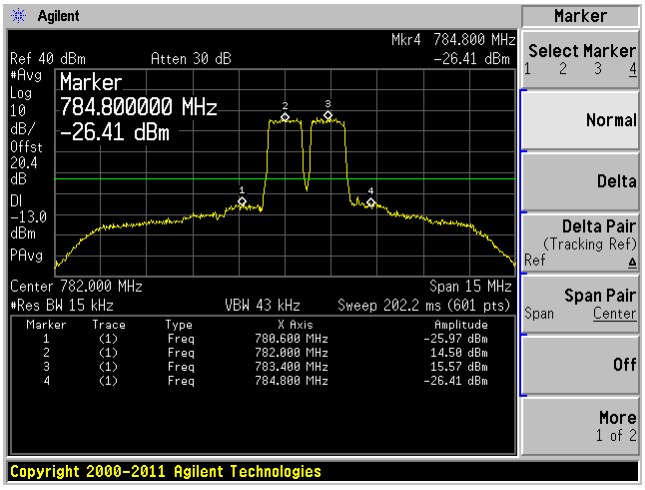


QPSK (1.4 MHz), (Middle Channel)

Input

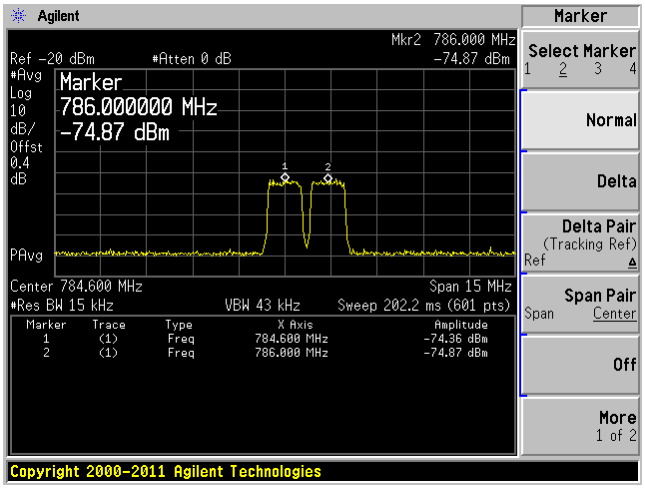


Output

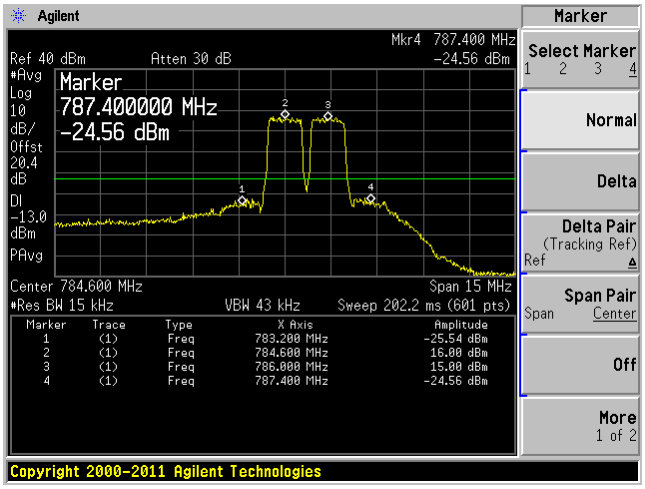


QPSK (1.4 MHz), (High Channel)

Input

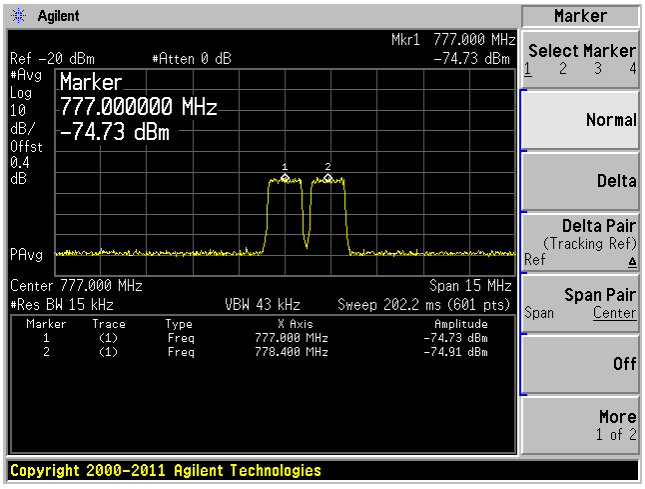


Output

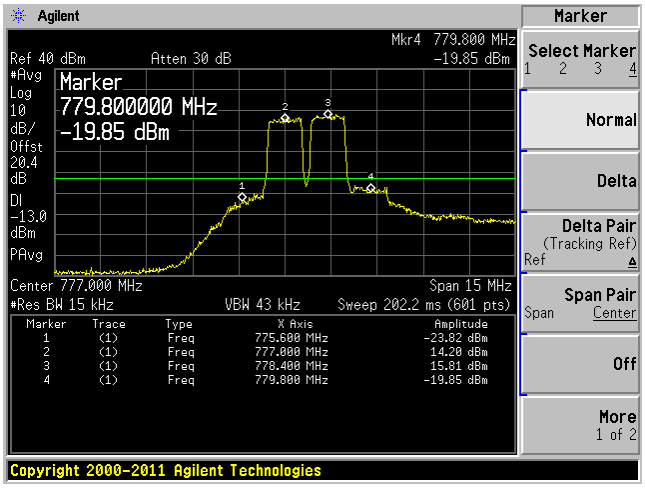


16QAM (1.4 MHz), (Low Channel)

Input

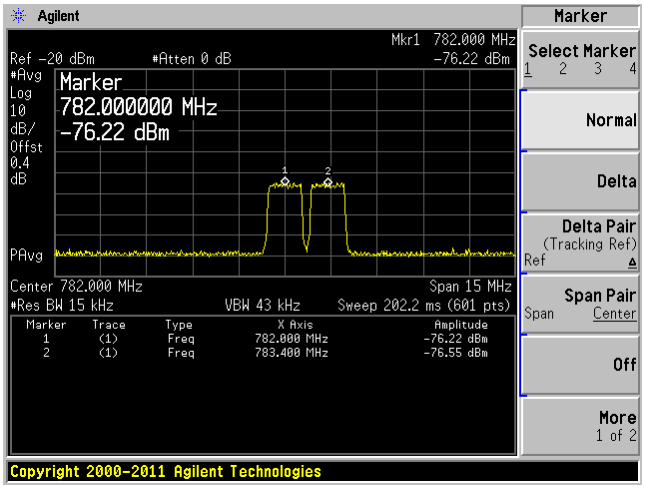


Output

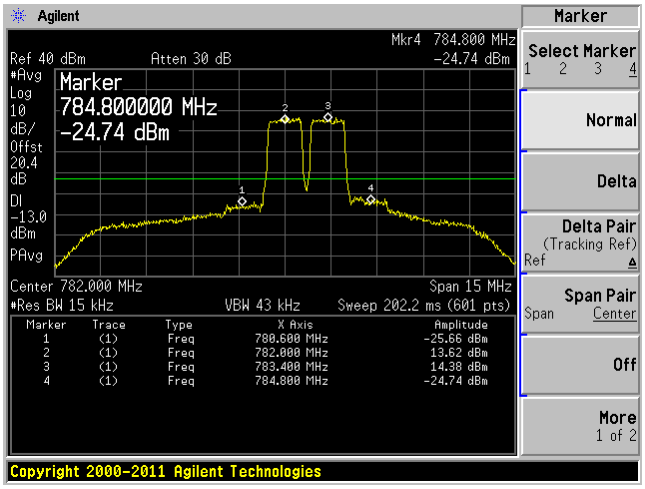


16QAM (1.4 MHz), (Middle Channel)

Input

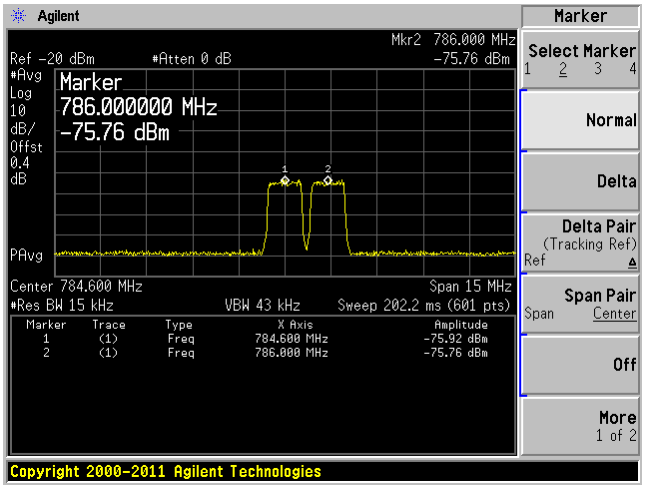


Output

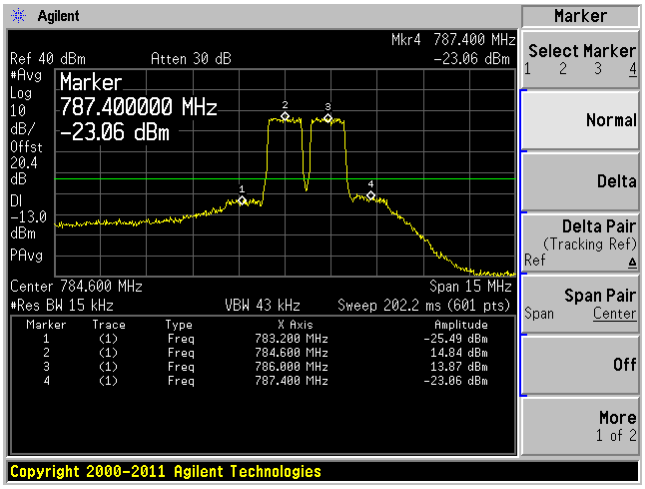


16QAM (1.4 MHz), (High Channel)

Input

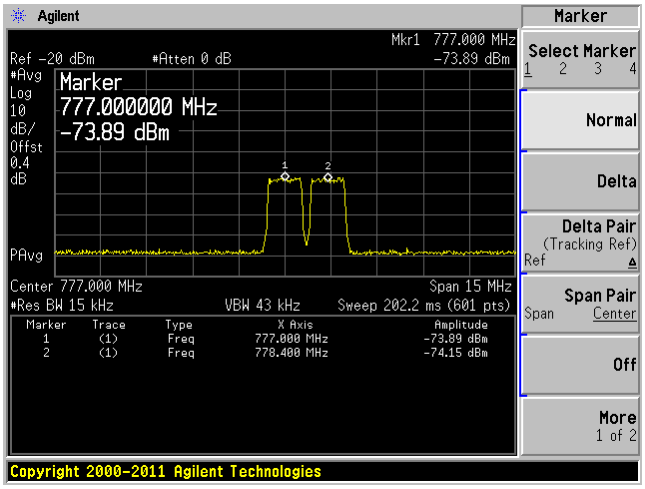


Output

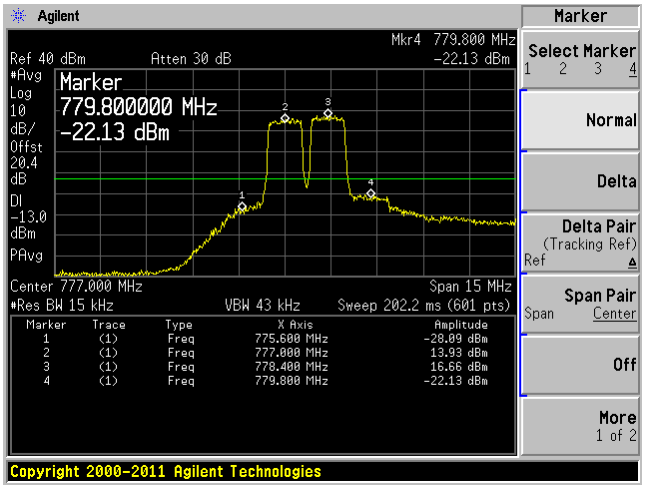


64QAM (1.4 MHz), (Low Channel)

Input

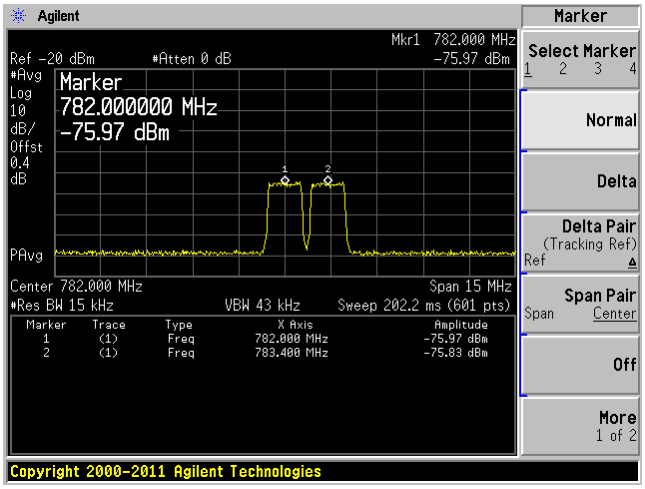


Output

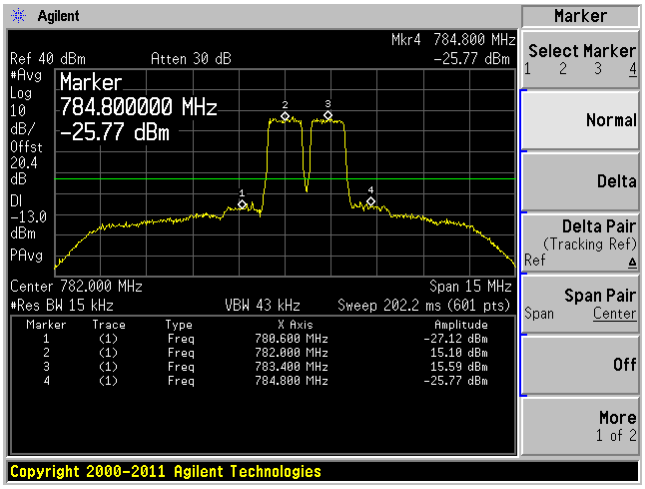


64QAM (1.4 MHz), (Middle Channel)

Input

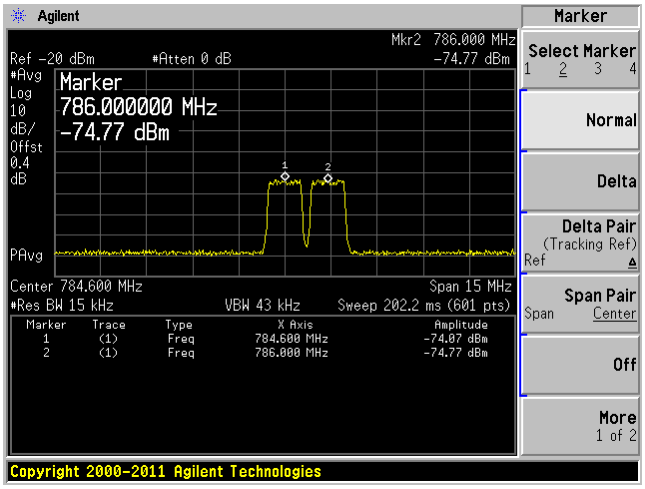


Output

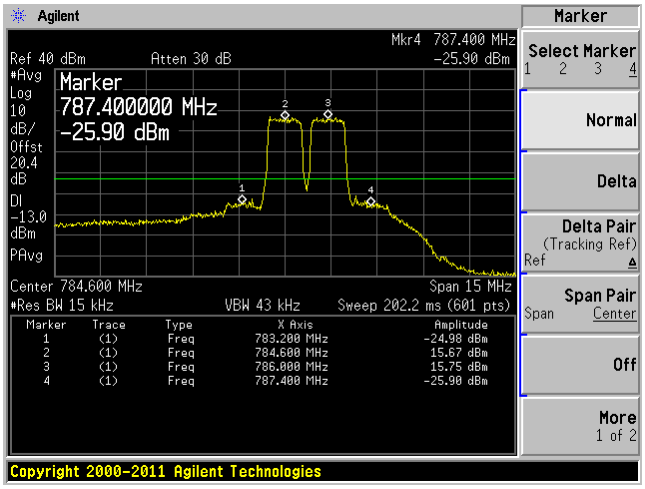


64QAM (1.4 MHz), (High Channel)

Input

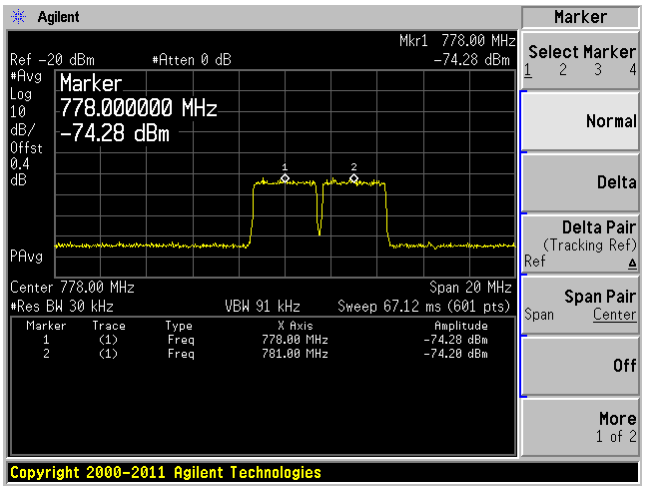


Output

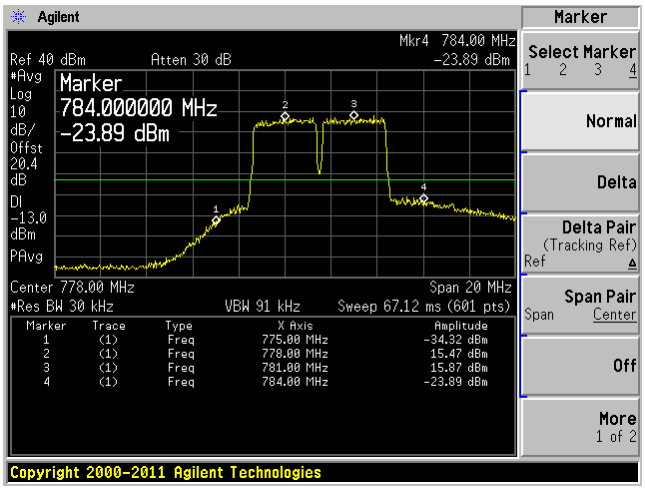


QPSK (3 MHz), (Low Channel)

Input

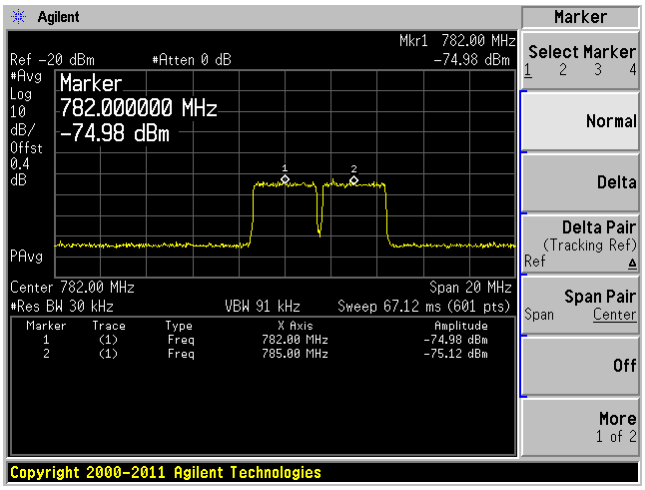


Output

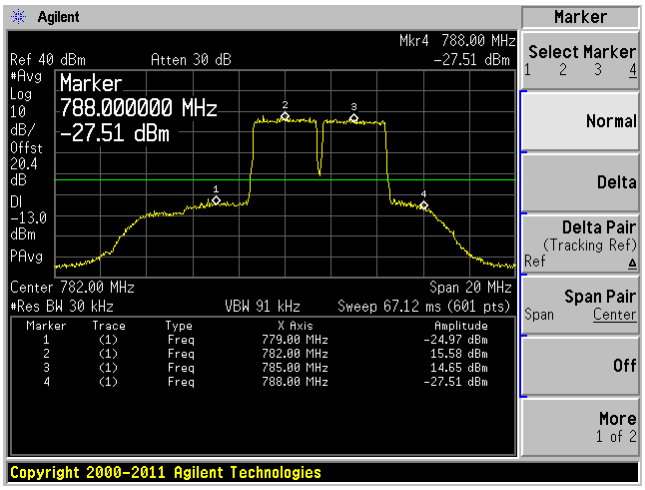


QPSK (3 MHz), (Middle Channel)

Input

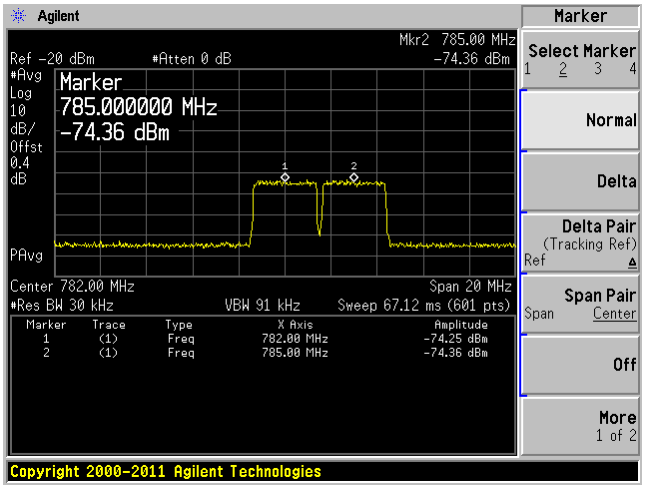


Output

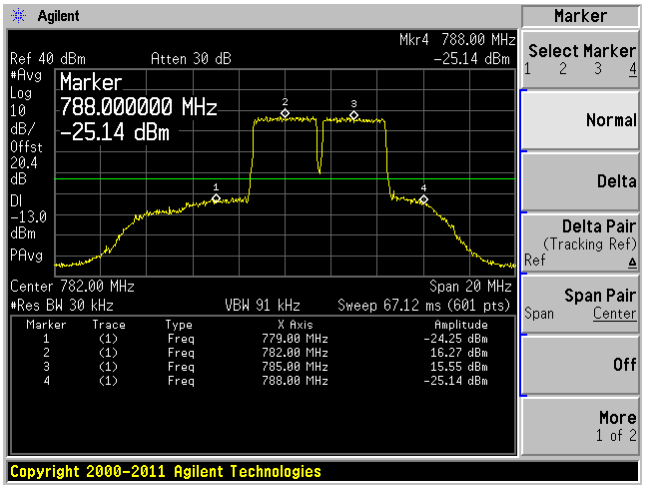


QPSK (3 MHz), (High Channel)

Input

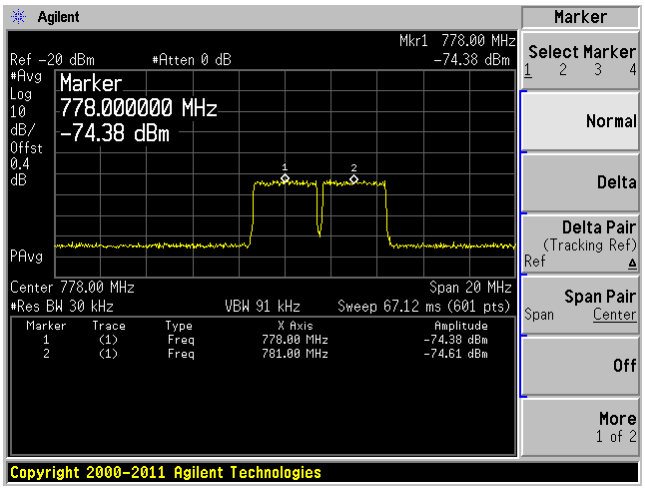


Output

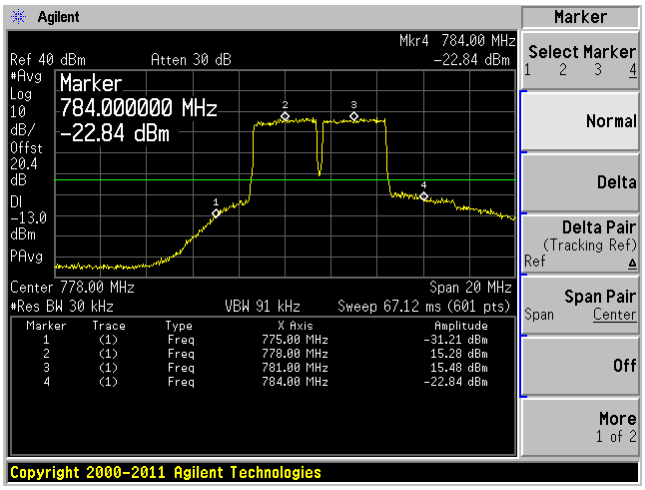


16QAM (3 MHz), (Low Channel)

Input

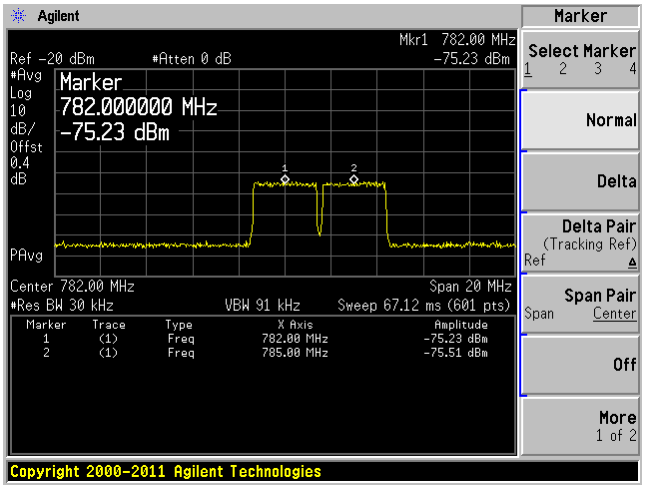


Output

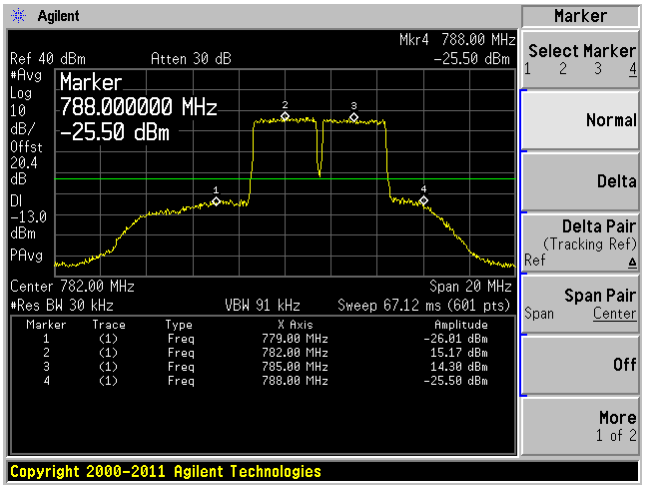


16QAM (3 MHz), (Middle Channel)

Input

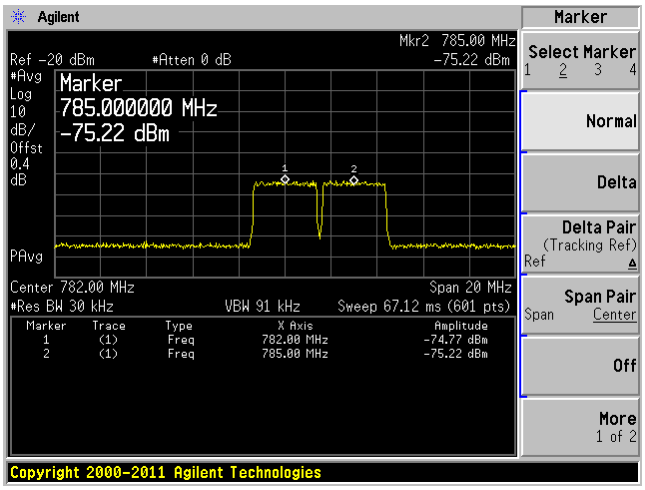


Output

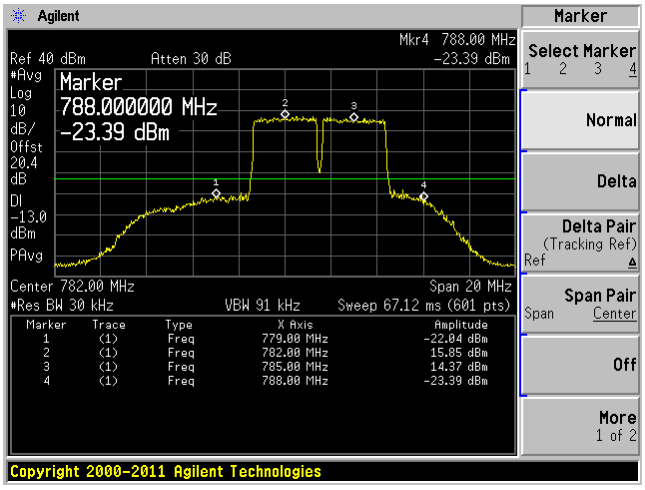


16QAM (3 MHz), (High Channel)

Input

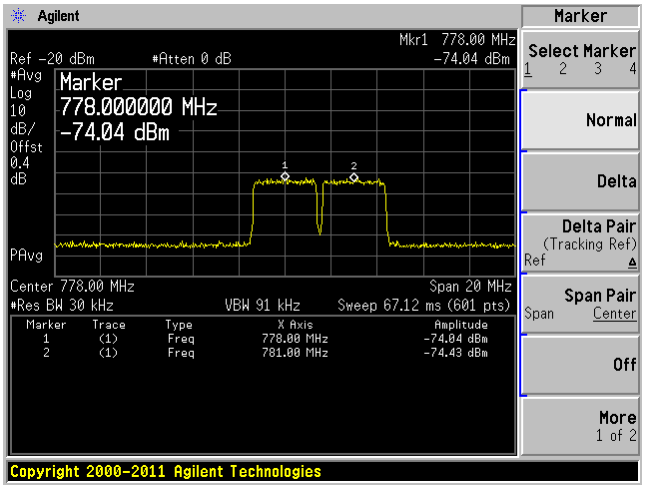


Output

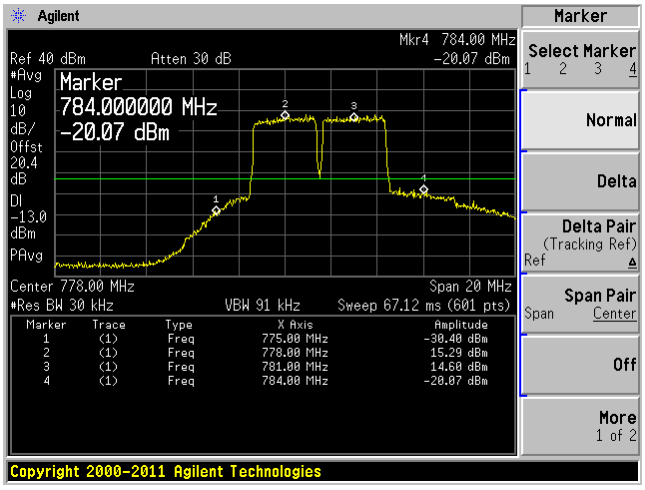


64QAM (3 MHz), (Low Channel)

Input

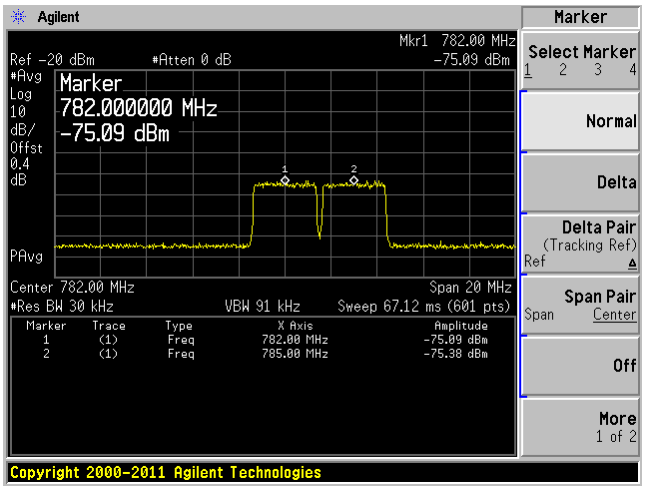


Output

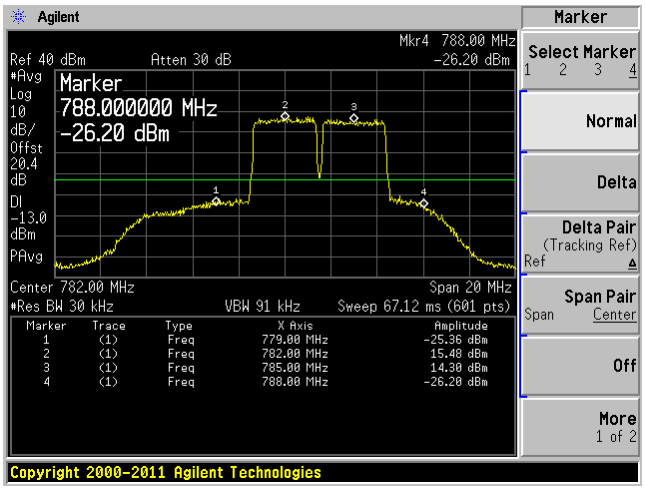


64QAM (3 MHz), (Middle Channel)

Input

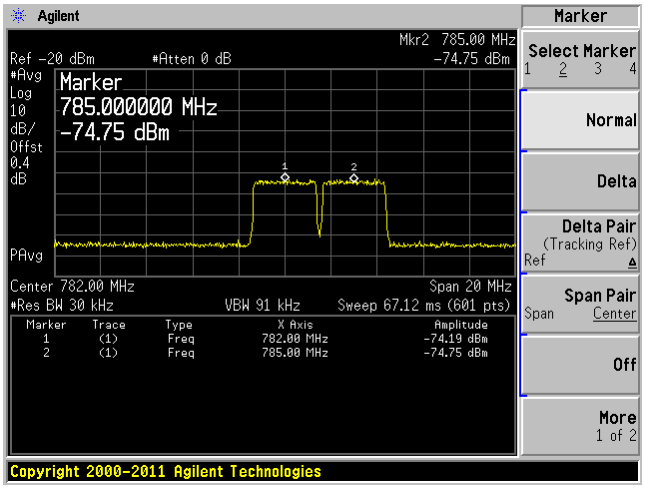


Output

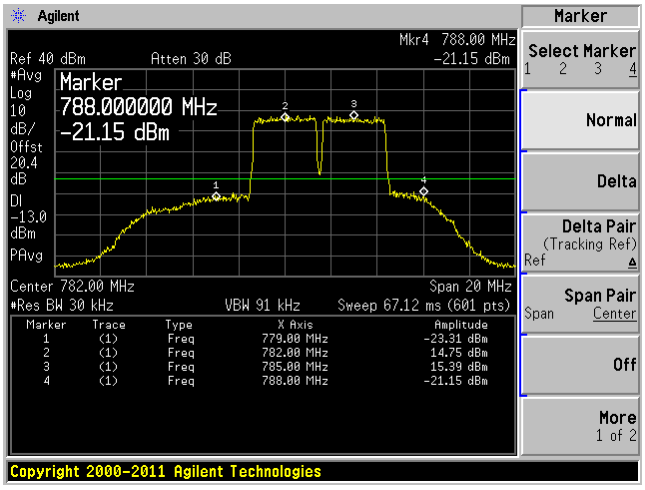


64QAM (3 MHz), (High Channel)

Input

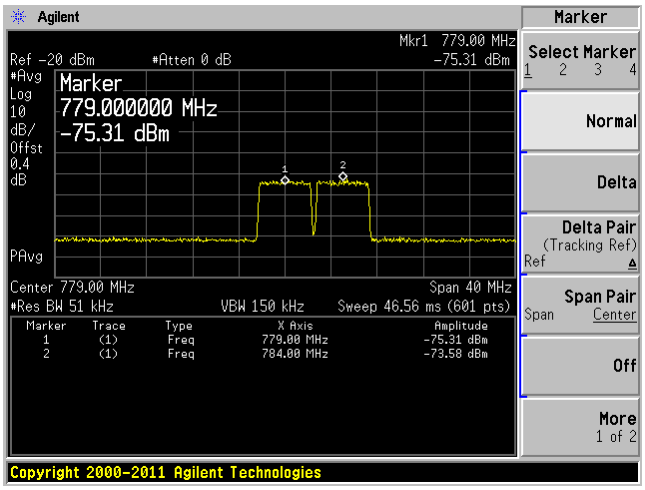


Output

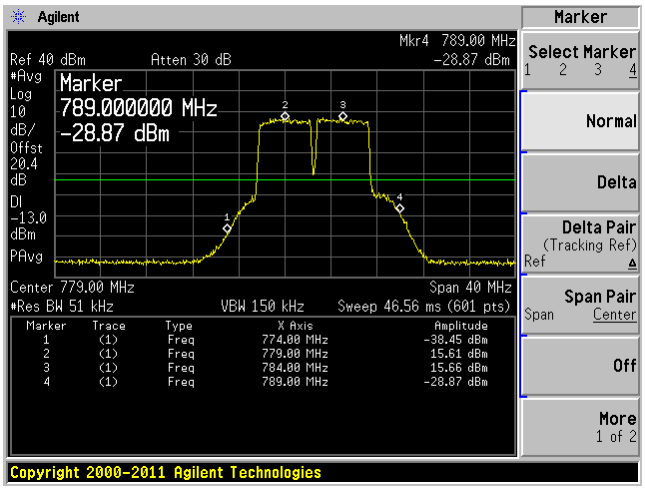


QPSK (5 MHz), (Low Channel)

Input

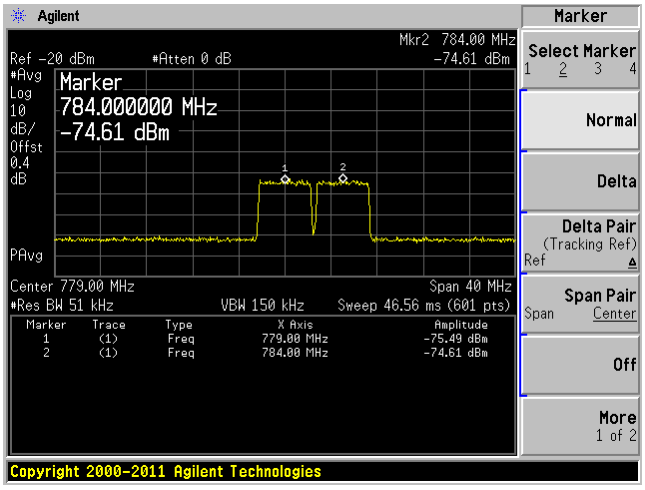


Output

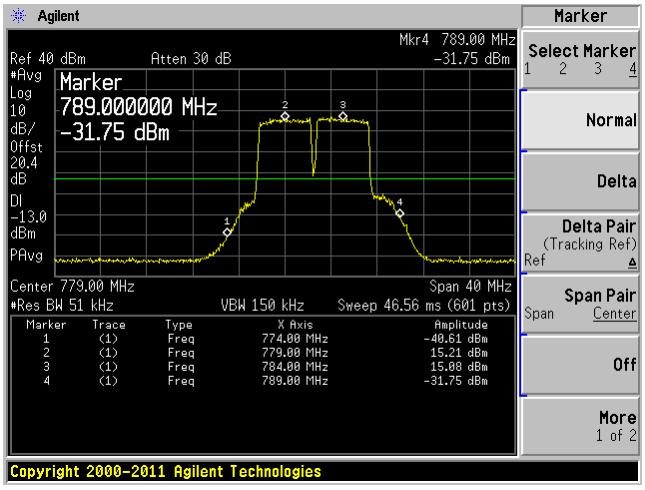


QPSK (5 MHz), (High Channel)

Input

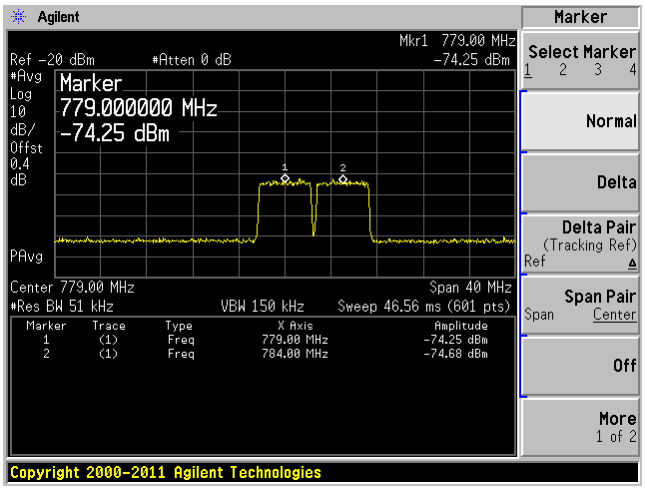


Output

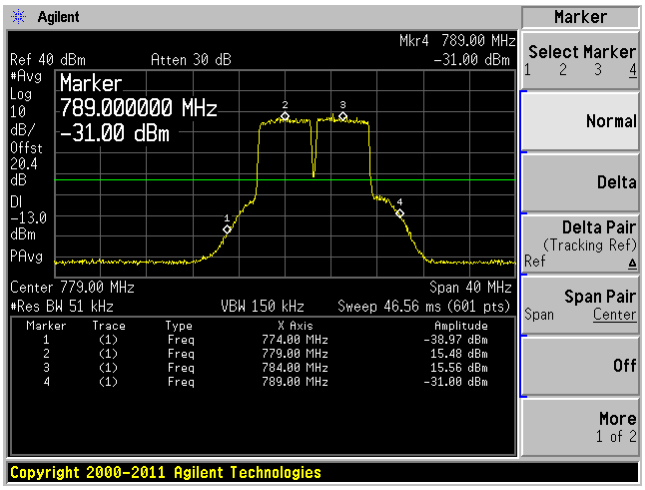


16QAM (5 MHz), (Low Channel)

Input

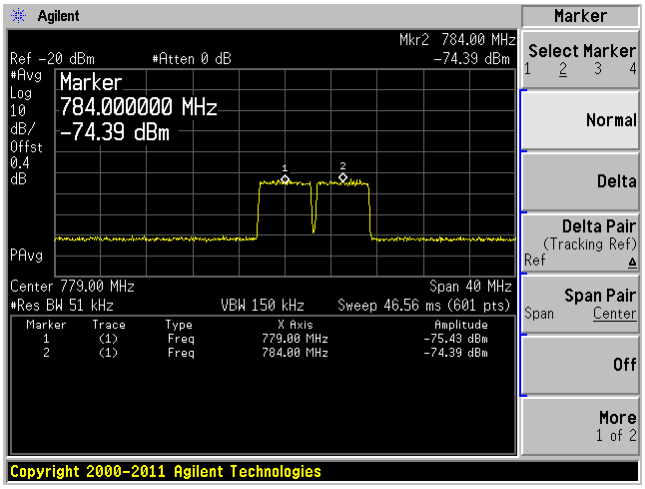


Output

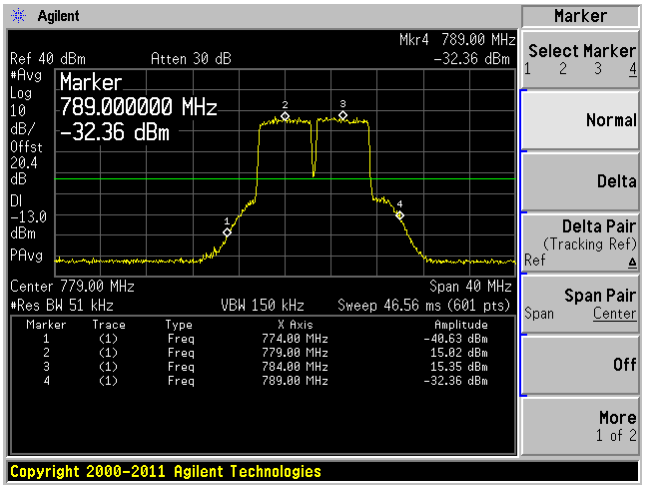


16QAM (5 MHz), (High Channel)

Input

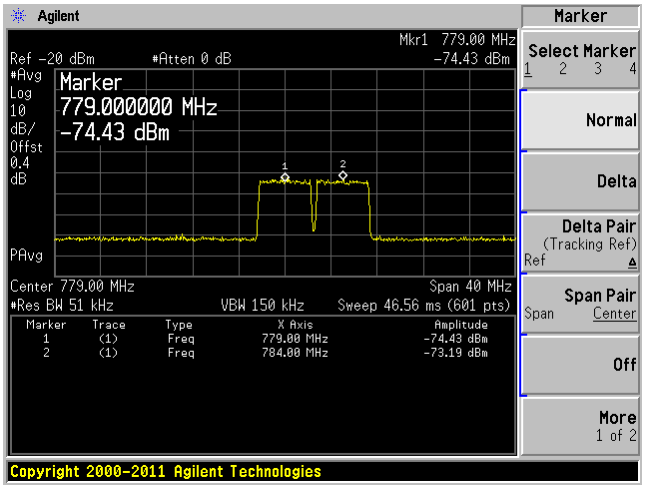


Output

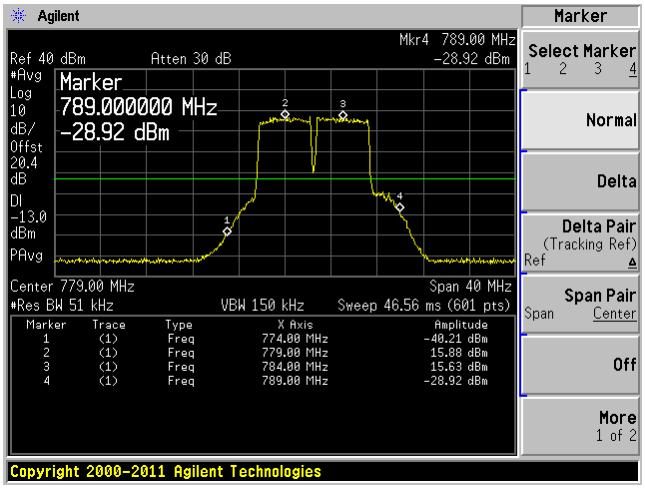


64QAM (5 MHz), (Low Channel)

Input

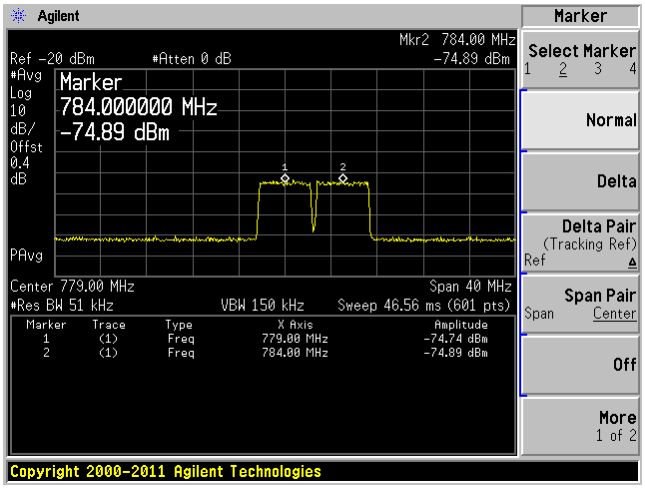


Output

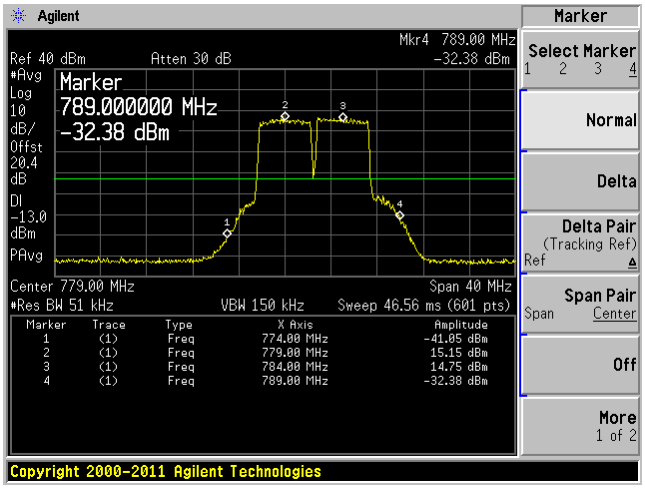


64QAM (5 MHz), (High Channel)

Input

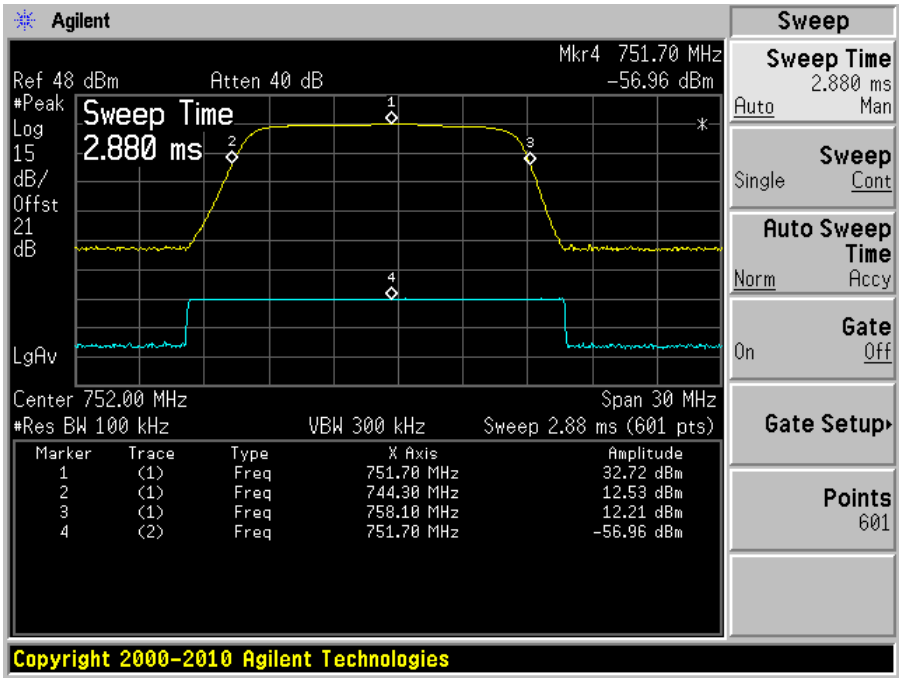


Output

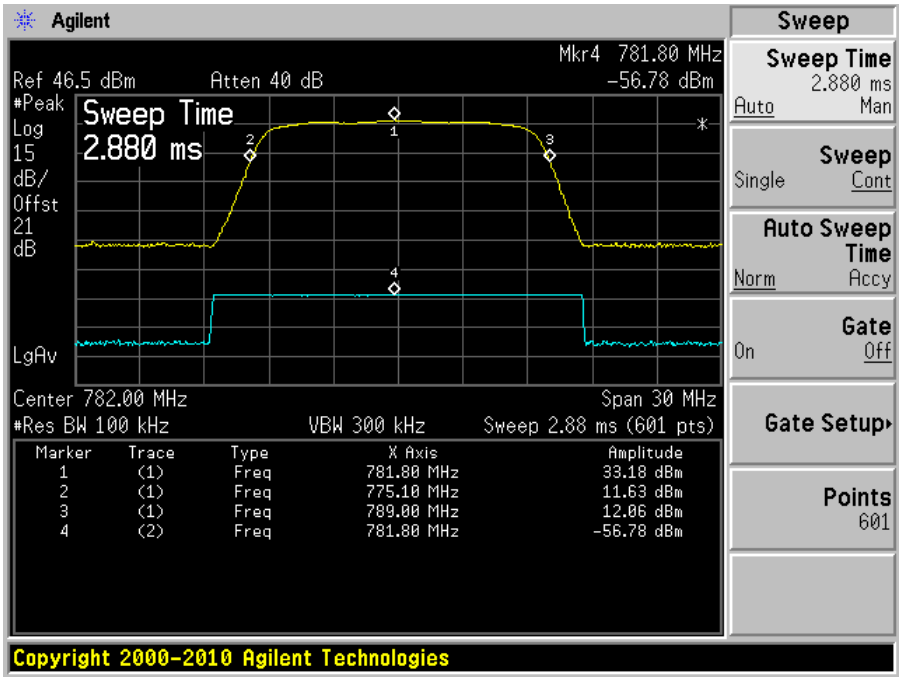


Out of Band Rejection

Downlink, 746-757 MHz



Uplink, 776-787 MHz



8 FCC §27.53 – Band Edge

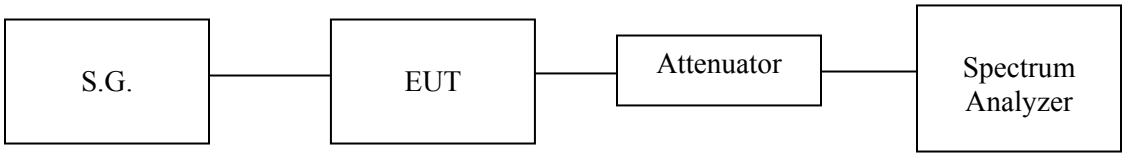
8.1 Applicable Standard

According to FCC §27.53, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

8.2 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.



8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA, Series Spectrum Analyzer	E4440A	US42221851	2013-03-05
Agilent	Generator, Signal	E4438C	MY45091309	2013-05-30

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

Temperature:	23 ºC
Relative Humidity:	36 %
ATM Pressure:	101.75 kPa

The testing was performed by Glenn Escano from 2013-10-25 at RF Site.

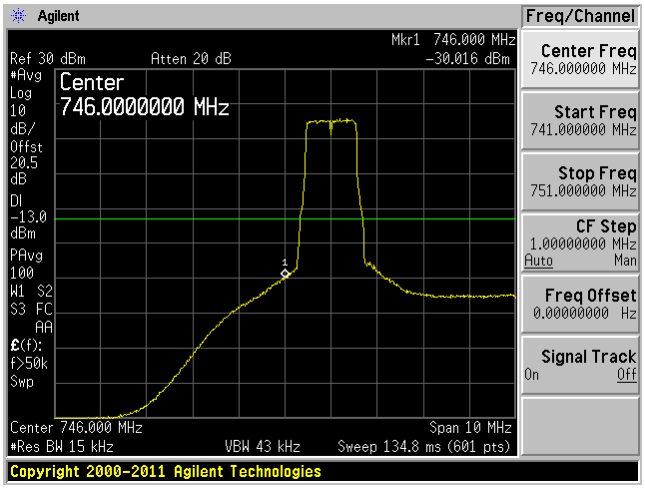
8.5 Test Results

Please refer to the following plots.

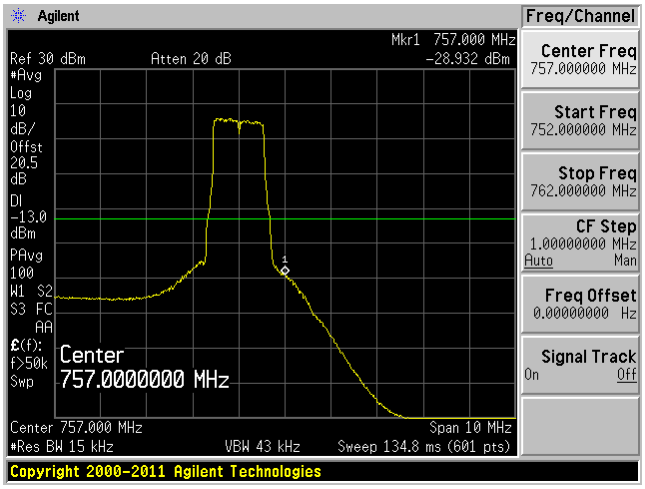
Downlink, 746-757 MHz

QPSK (1.4 MHz)

Low Channel

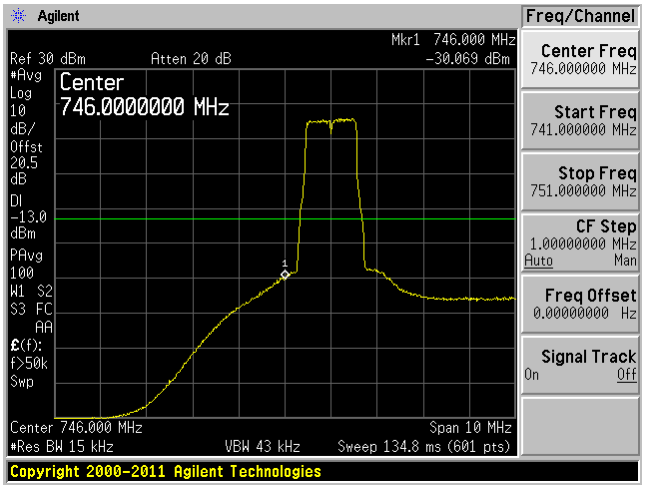


High Channel

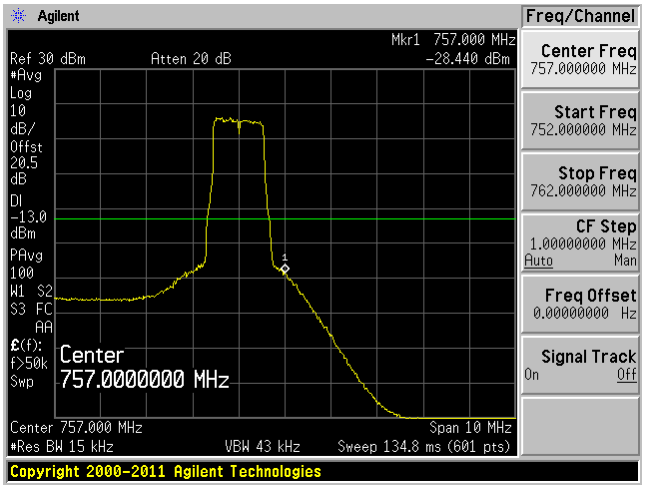


16QAM (1.4 MHz)

Low Channel

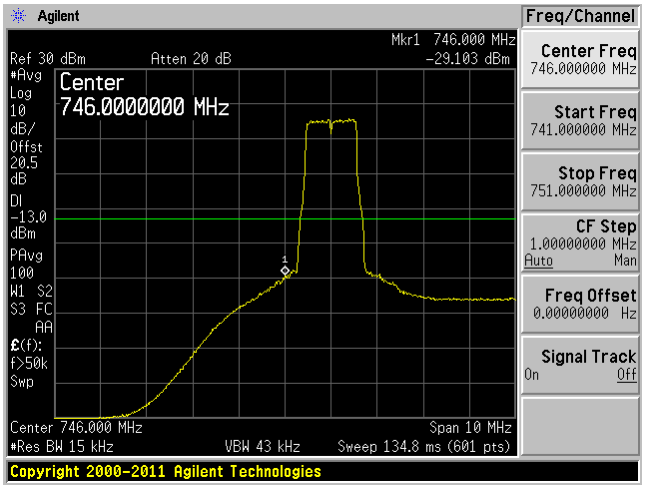


High Channel

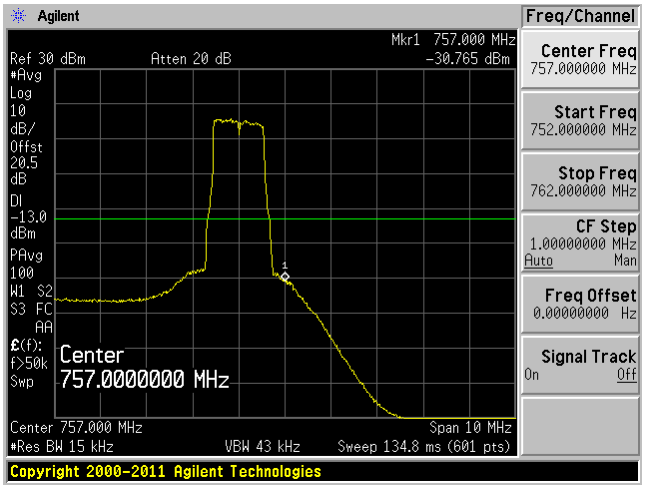


64QAM (1.4 MHz)

Low Channel

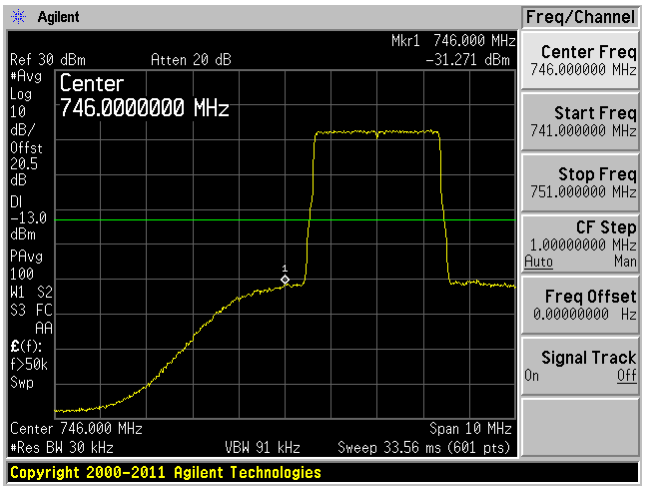


High Channel

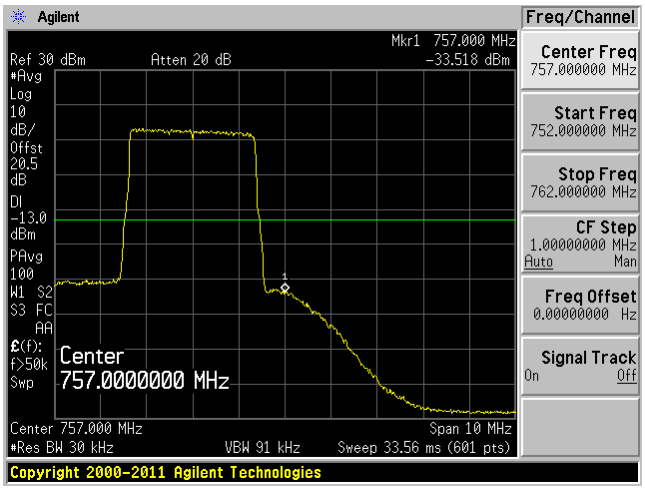


QPSK (3 MHz)

Low Channel

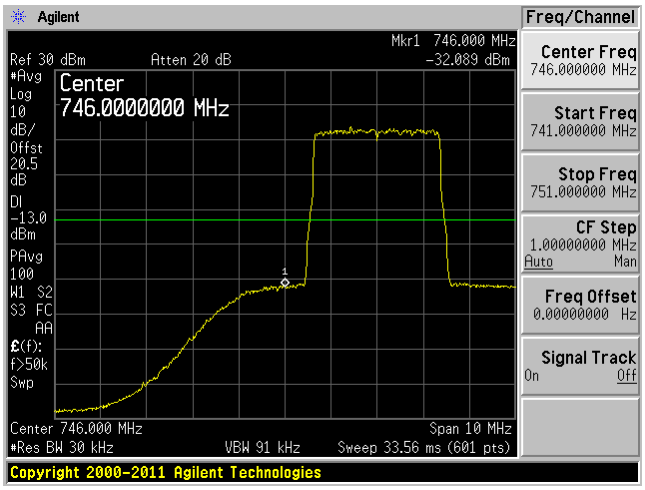


High Channel

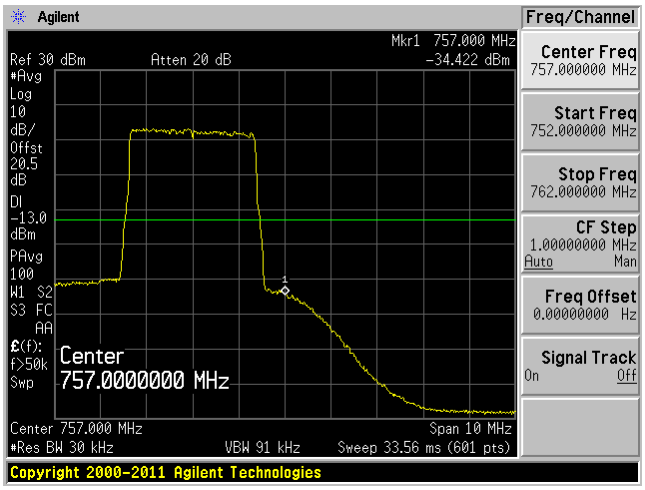


16QAM (3 MHz)

Low Channel

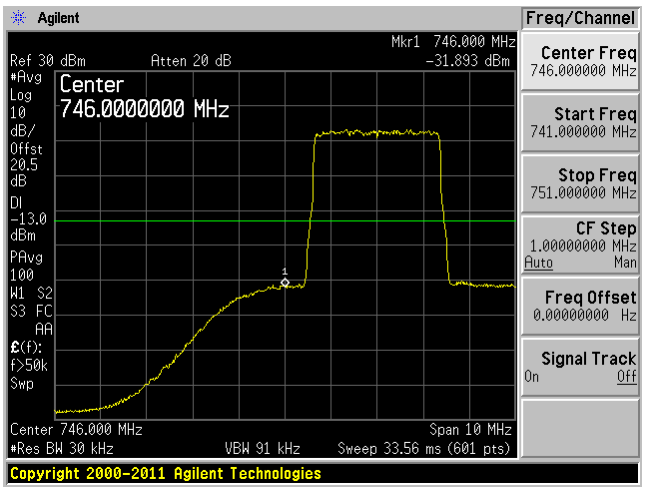


High Channel

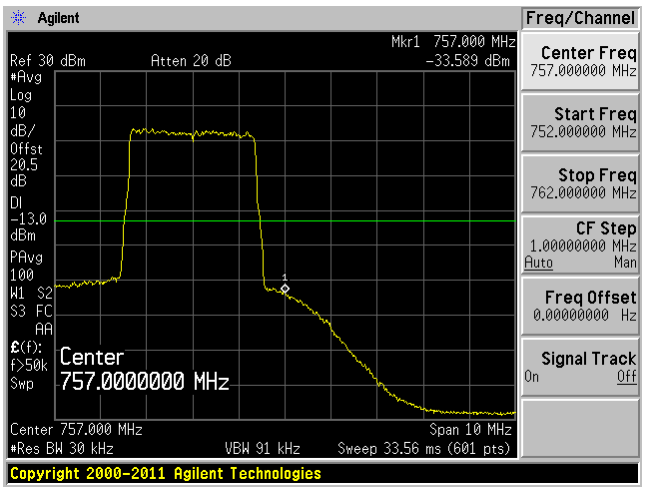


64QAM (3 MHz)

Low Channel

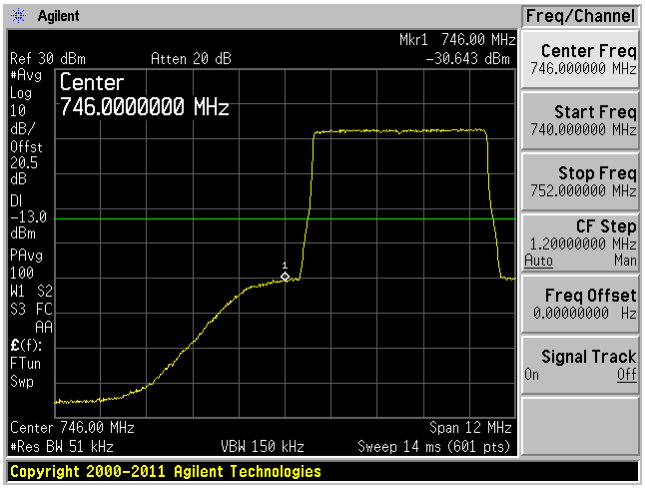


High Channel

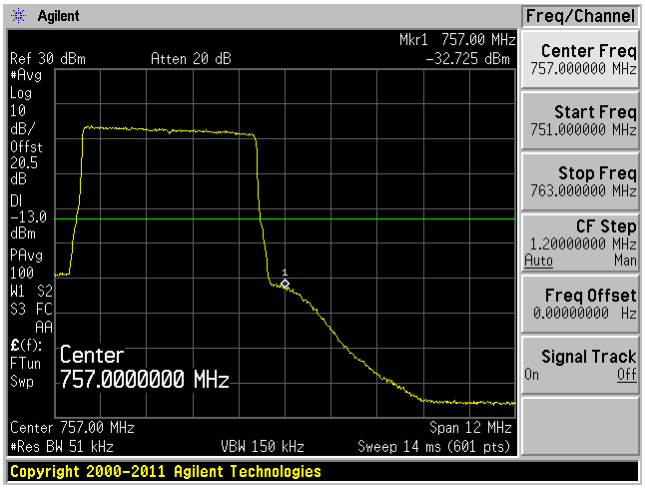


QPSK (5 MHz)

Low Channel

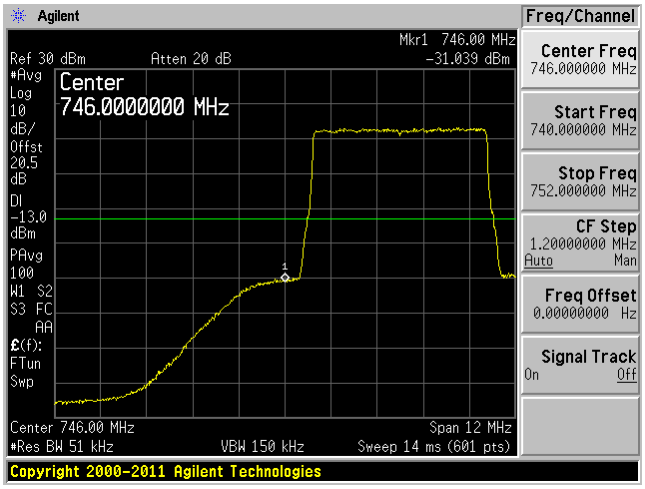


High Channel

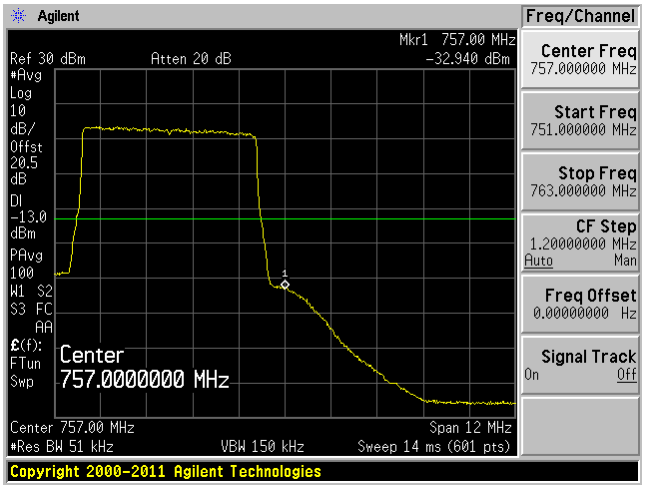


16QAM (5 MHz)

Low Channel

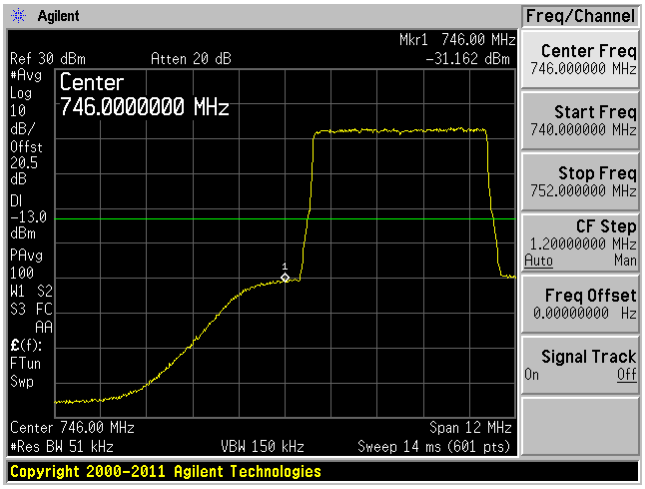


High Channel

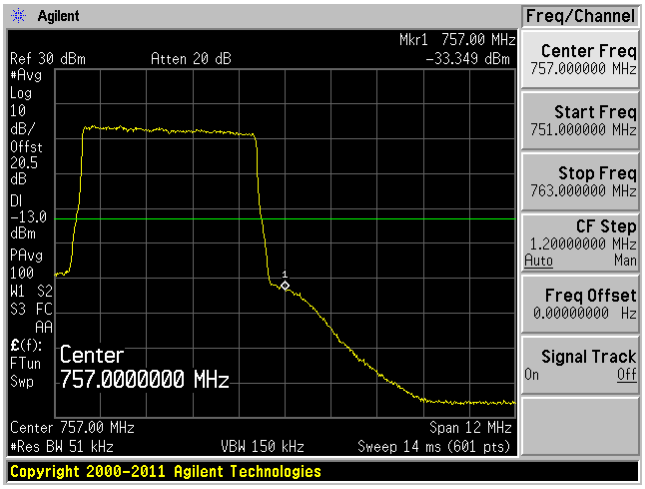


64QAM (5 MHz)

Low Channel

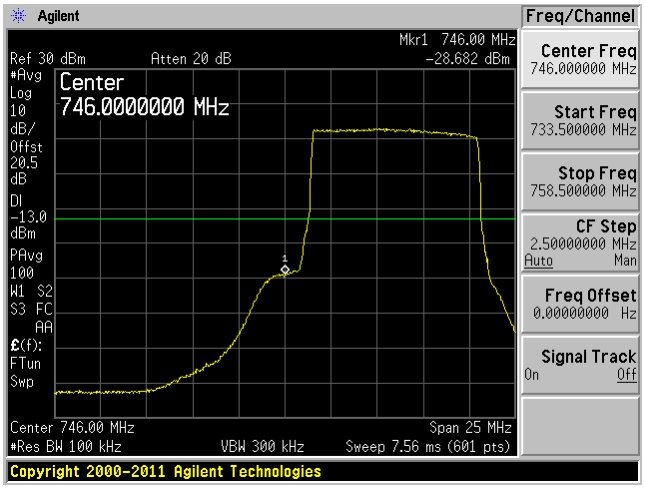


High Channel

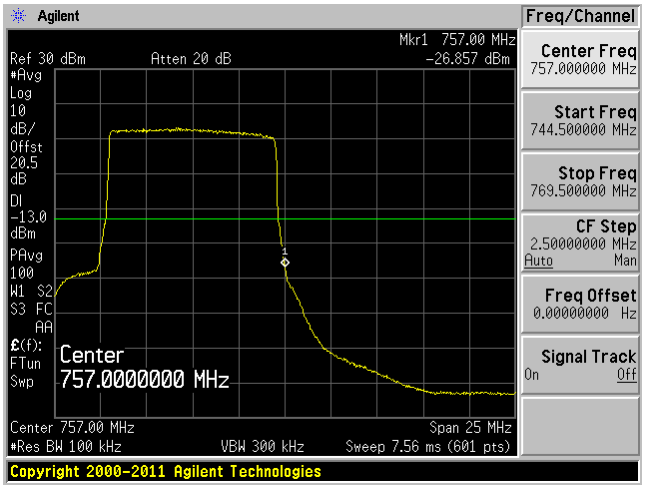


QPSK (10 MHz)

Low Channel

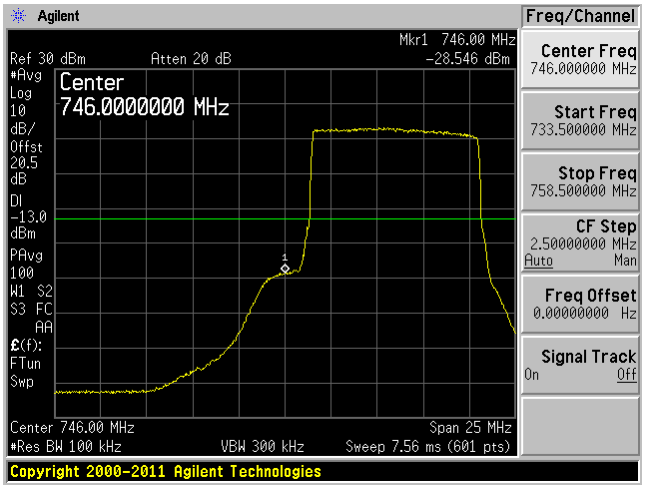


High Channel

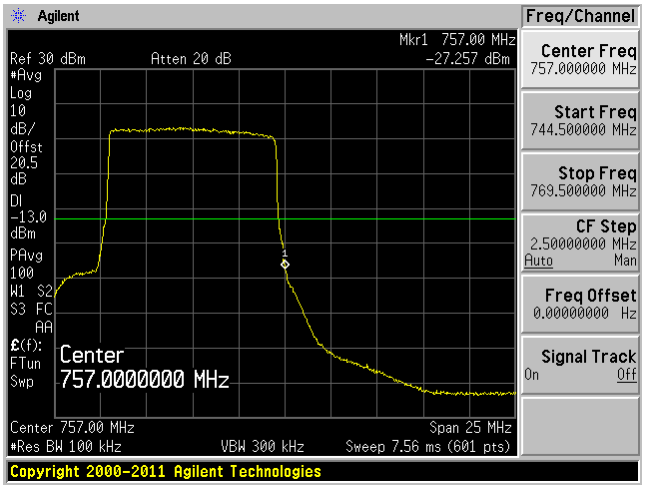


16QAM (10 MHz)

Low Channel

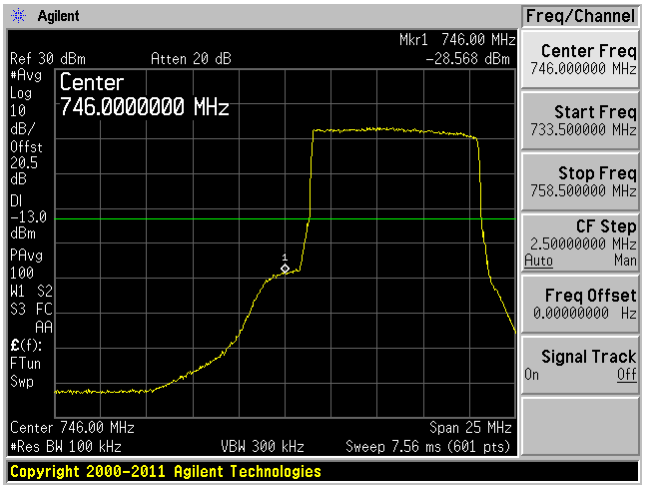


High Channel

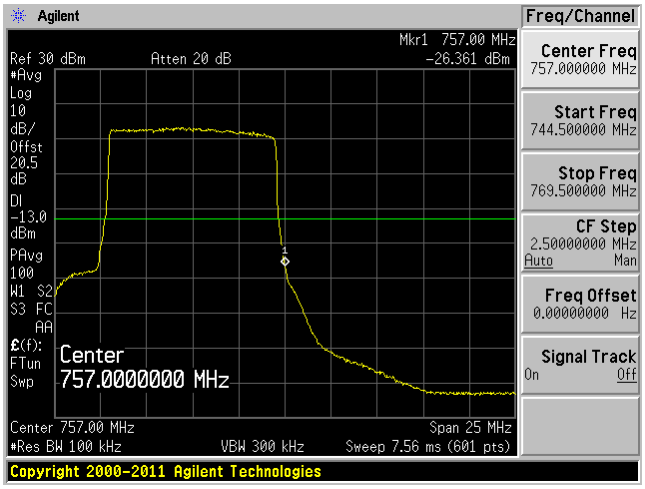


64QAM (10 MHz)

Low Channel



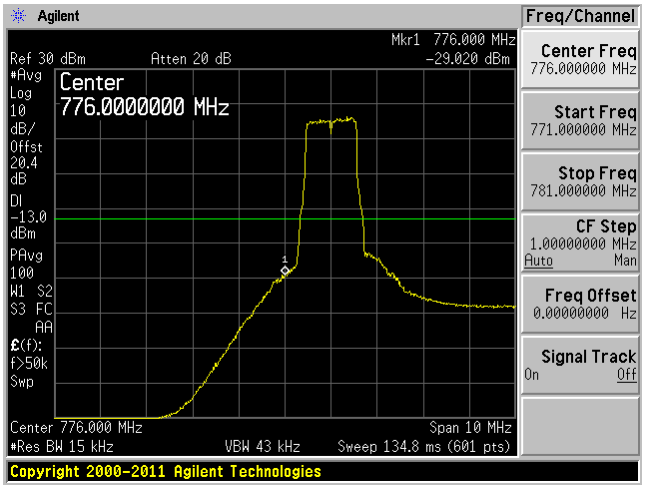
High Channel



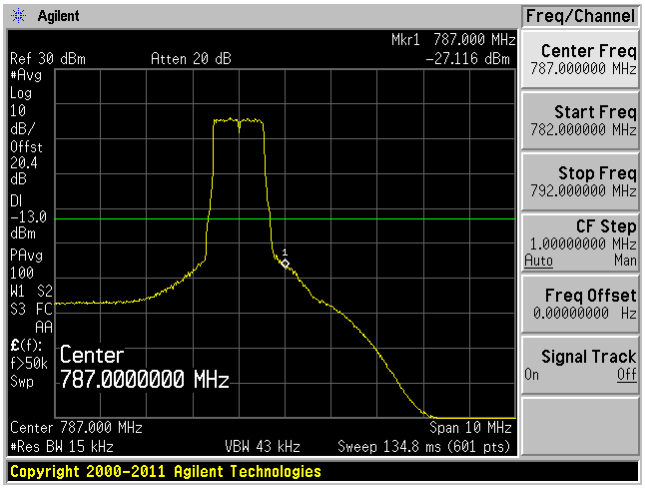
Uplink, 776-787 MHz

QPSK (1.4 MHz)

Low Channel

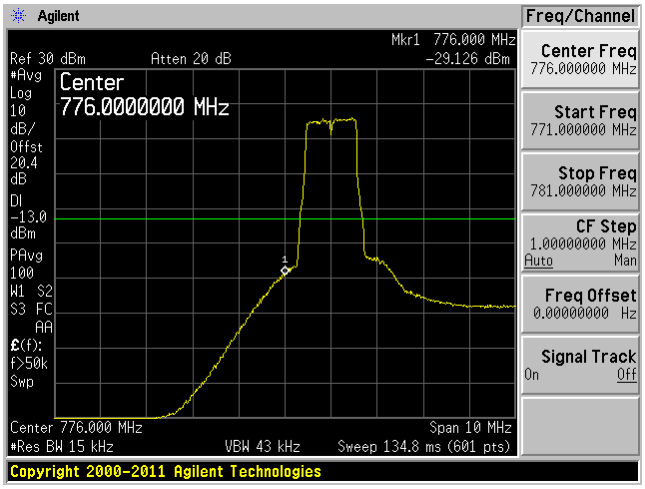


High Channel

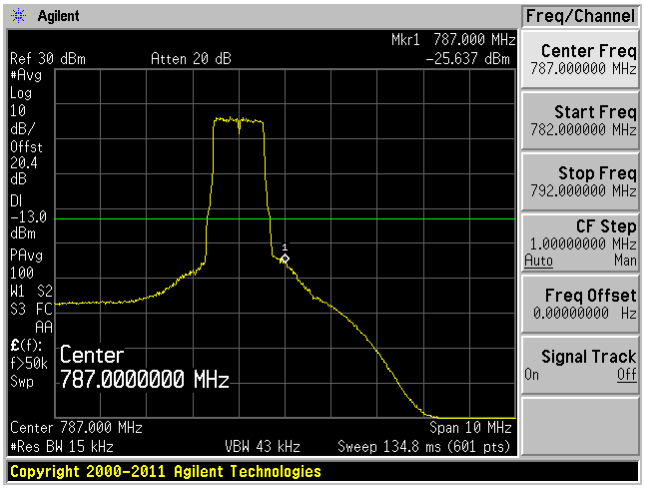


16QAM (1.4 MHz)

Low Channel

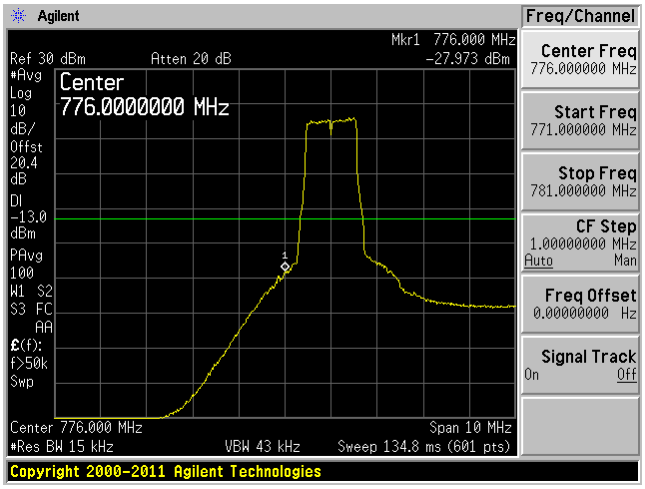


High Channel

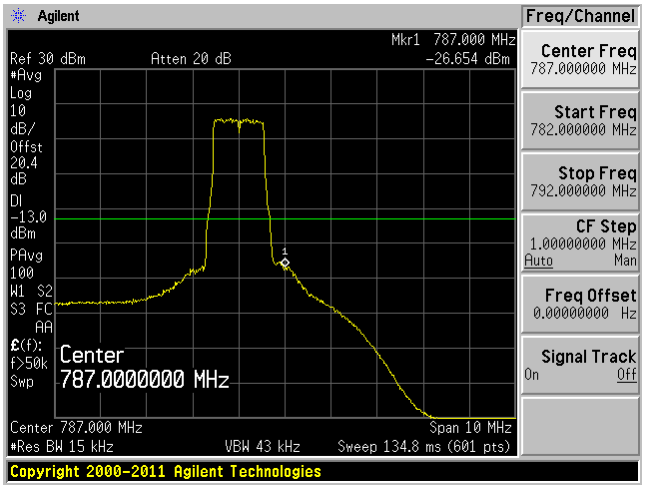


64QAM (1.4 MHz)

Low Channel

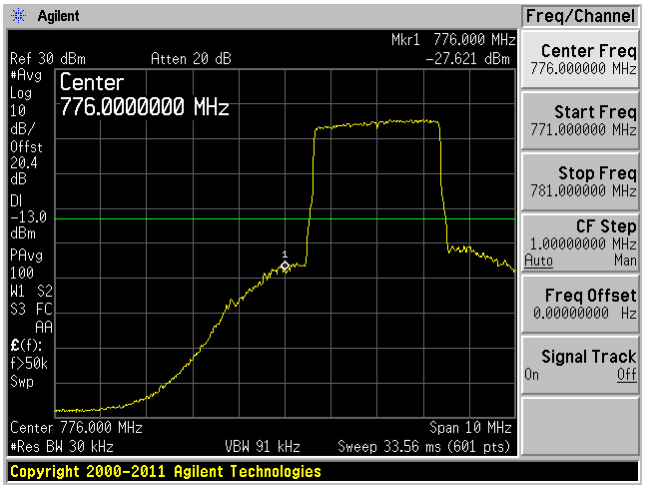


High Channel

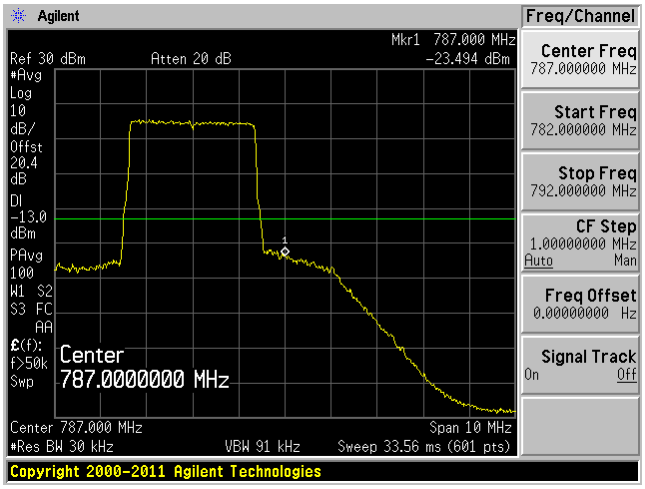


QPSK (3 MHz)

Low Channel

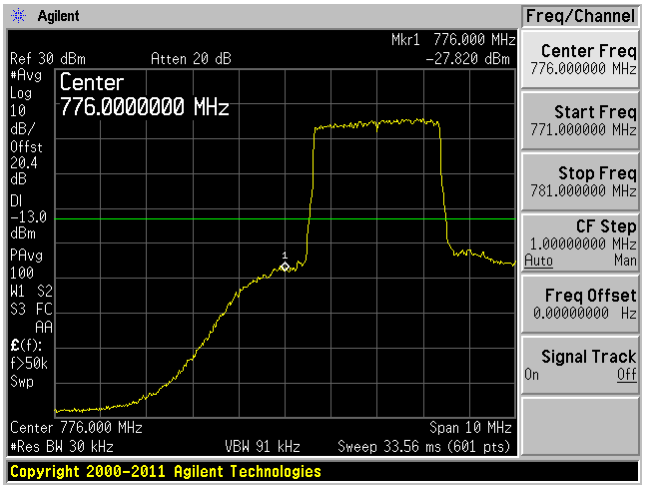


High Channel



16QAM (3 MHz)

Low Channel



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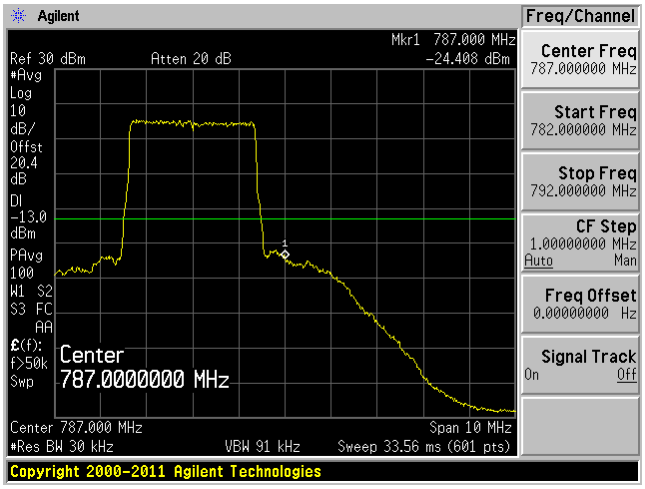
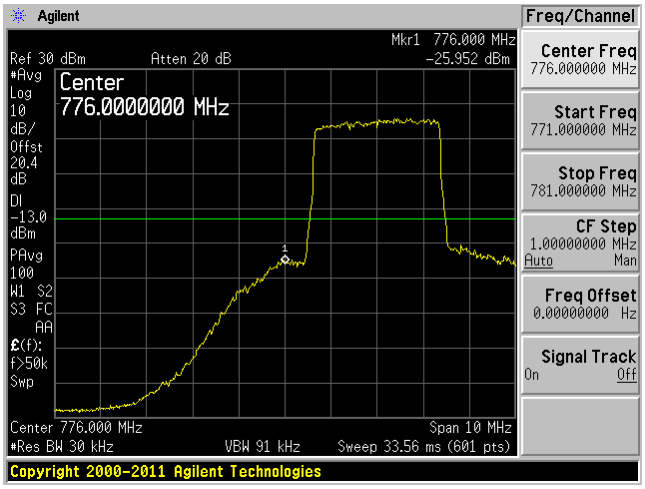
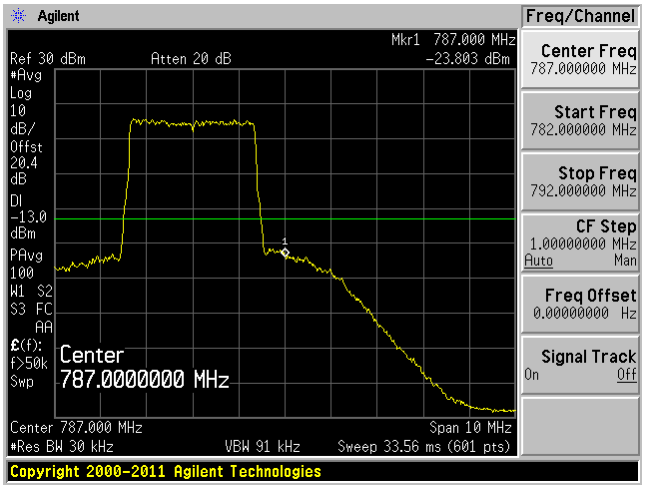


64QAM (3 MHz)

Low Channel

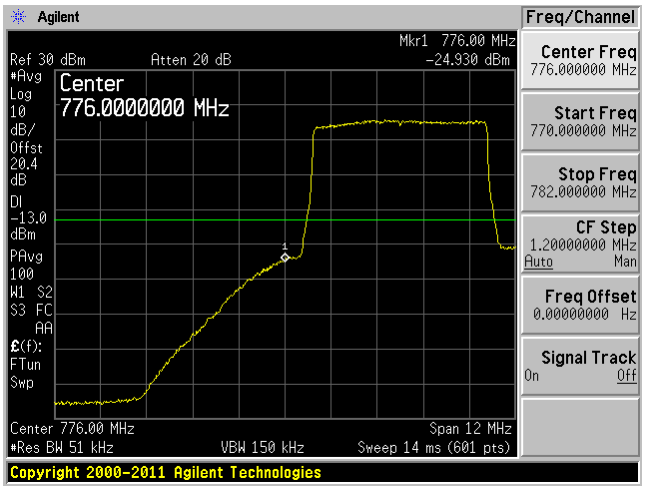


High Channel

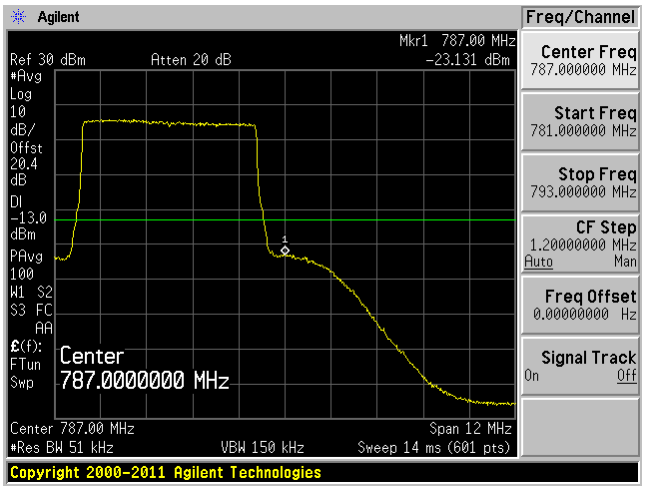


QPSK (5 MHz)

Low Channel

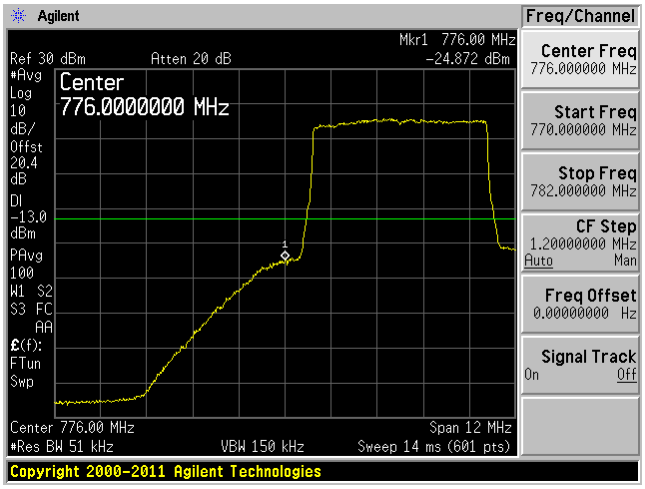


High Channel

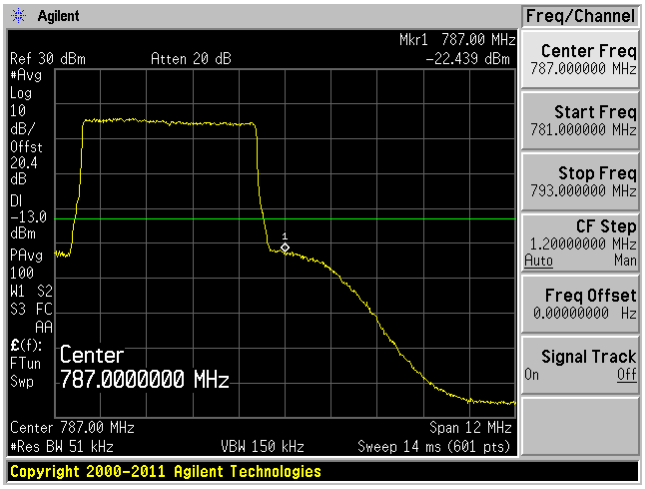


16QAM (5 MHz)

Low Channel

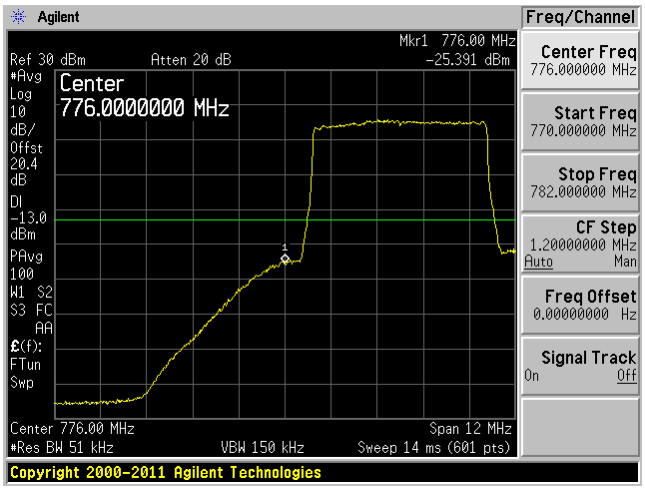


High Channel

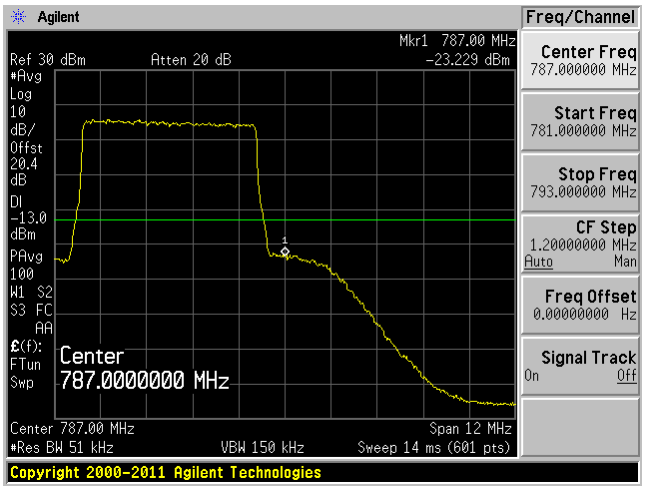


64QAM (5 MHz)

Low Channel

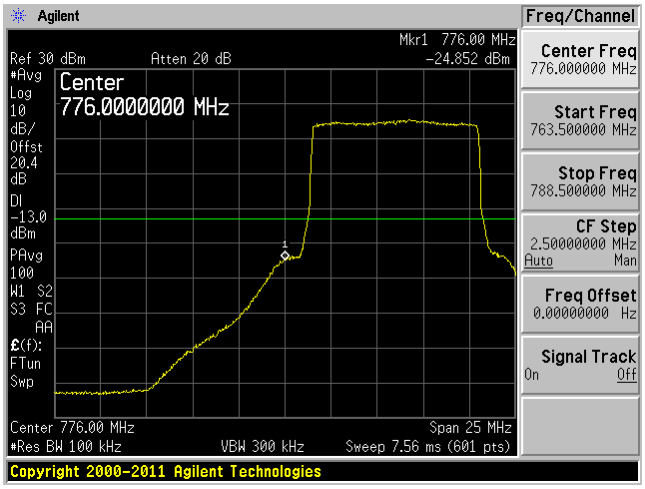


High Channel

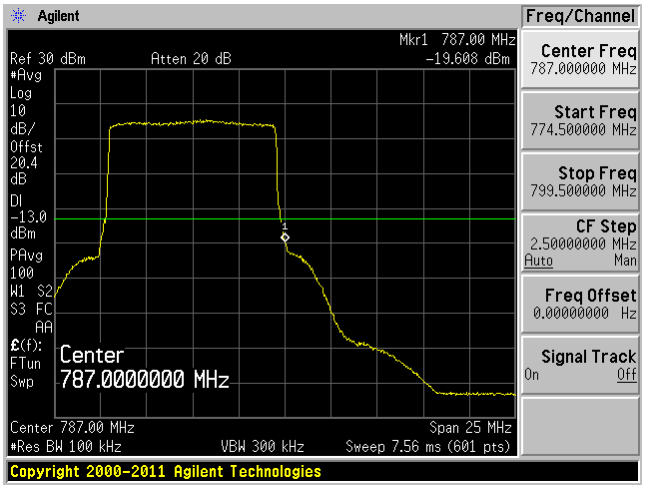


QPSK (10 MHz)

Low Channel

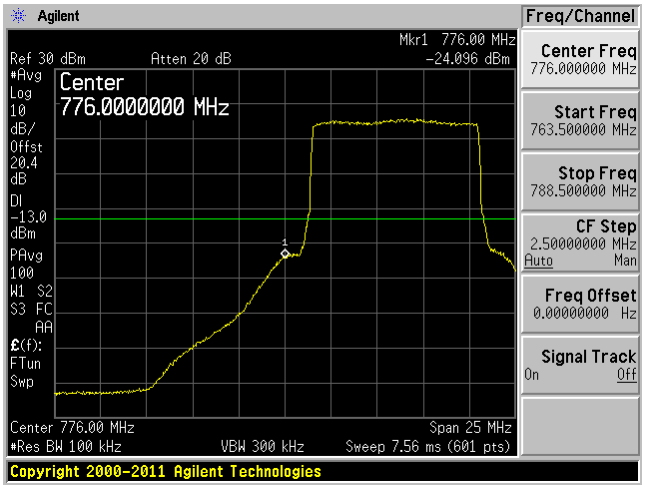


High Channel



16QAM (10 MHz)

Low Channel



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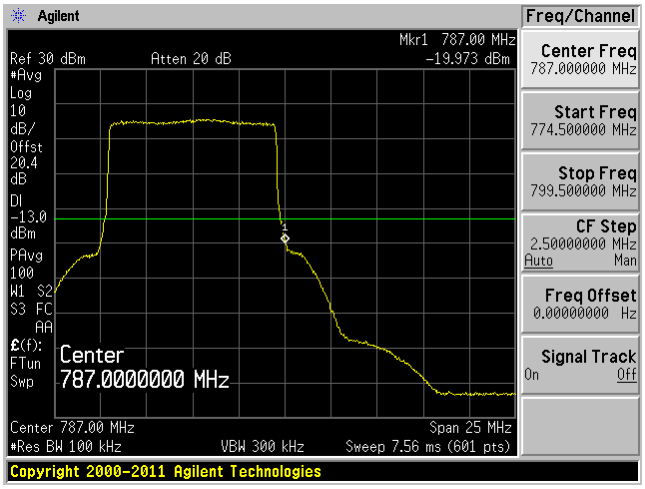
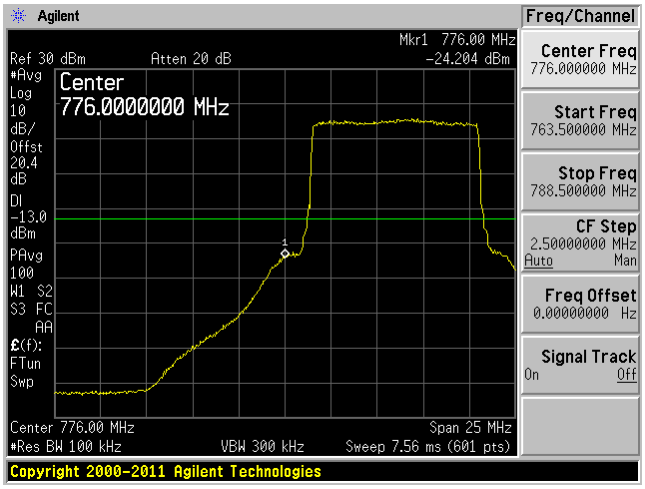
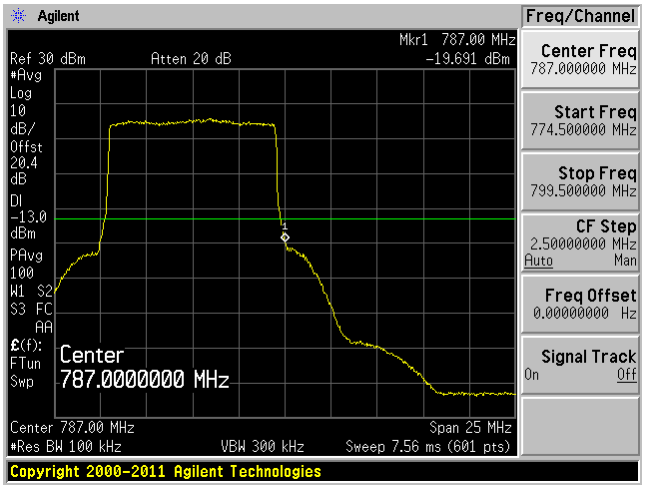


64QAM (10 MHz)

Low Channel



High Channel



9 FCC §2.1055 & §27.54 – Frequency Stability

9.1 Applicable Standard

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

9.2 Test Procedure

The frequency stability of the transmitter is measured by:

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

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

CW was tested as worst case.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA, Series Spectrum Analyzer	E4440A	US42221851	2013-03-05
Agilent	Generator, Signal	E4438C	MY45091309	2013-05-30

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

9.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	44 %
ATM Pressure:	101.89kPa

The testing was performed by Glenn Escano from 2013-11-04 at RF Site.

9.5 Test Result

700MHz Upper C Band Downlink (746-757 MHz)

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Result
Voltage (Vac)	Temperature (^{o}C)				
Frequency vs. Temperature					
120	50	752	751.995	-6.6489362	Compliant
120	40	752	751.995	-6.6489362	Compliant
120	30	752	752	0	Compliant
120	20	752	752	0	Compliant
120	10	752	752	0	Compliant
120	0	752	751.995	-6.6489362	Compliant
120	-10	752	752	0	Compliant
120	-20	752	752	0	Compliant
Frequency vs. Voltage					
108	50	752	752	0	Compliant
132	50	752	751.995	-6.6489362	Compliant

700MHz Upper C Band Uplink (776-787 MHz)

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Result
Voltage (Vac)	Temperature (^{o}C)				
Frequency vs. Temperature					
120	50	782	781.995	-6.3938619	Compliant
120	40	782	782	0	Compliant
120	30	782	781.995	-6.3938619	Compliant
120	20	782	781.995	-6.3938619	Compliant
120	10	782	781.995	-6.3938619	Compliant
120	0	782	781.995	-6.3938619	Compliant
120	-10	782	781.995	-6.3938619	Compliant
120	-20	782	781.995	-6.3938619	Compliant
Frequency vs. Voltage					
108	50	782	781.995	-6.3938619	Compliant
132	50	782	781.995	-6.3938619	Compliant

Note: Limit is stay in the authorized band.

10 FCC §2.1091 – RF Exposure Information

10.1 Applicable Standard

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

Limits for General Population/Uncontrolled Exposure

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

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

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

700 MHz Upper C Band, Downlink:

Maximum peak output power at antenna input terminal (dBm):	32.99
Maximum peak output power at antenna input terminal (mW):	1990.67
Prediction distance (cm):	20
Prediction frequency (MHz):	756
Antenna Gain, typical (dBi):	2.0
Cable Loss (dB):	1.0
Power density at predication frequency and distance (mW/cm^2):	0.499
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.504

700 MHz Upper C Band, Uplink:

Maximum peak output power at antenna input terminal (dBm):	32.99
Maximum peak output power at antenna input terminal (mW):	1990.67
Prediction distance (cm):	60
Prediction frequency (MHz):	782
Antenna Gain, typical (dBi):	10
Cable Loss (dB):	1.0
Power density at predication frequency and distance (mW/cm^2):	0.35
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.521

Note: Based on the manufacturer's declaration, the outdoor antenna (Yagi type or similar directional antenna if off air donor signal used) must be installed so as to provide a minimum separation distance of 0.3 meters (60 cm) between the antenna and persons within the area. (This assumes a typical antenna with gain of [10.1 dBi, VSWR ≤ 1.5:1, Zo= 50 ohms, and a cable attenuation between 1-10 dB). The indoor antenna (Omni directional or leaky cable) must be installed so as to provide a minimum separation distance of at least 8 inches (20 cm) between the indoor antenna connected to the RF booster and the human user's body within the area. (This assumes a typical wide-beam type antenna with gain of 0-2 dBi, VSWR ≤ 2:1, Zo= 50 ohms, and a cable attenuation of between 1-10 dB).

Results

For Uplink, the highest power density level at 60 cm is below the MPE uncontrolled exposure limit. For Downlink; the highest power density level at 20 cm is below the MPE uncontrolled exposure limit.