FCC PART 90S

TEST AND MEASUREMENT REPORT

For

Intelibs, Inc.

1500 Stony Brook Road,

Stony Brook, NY 11794, USA

FCC ID: Z69D01T4JX5

Report Type: Original Report	**Product Type:** Radio Hub Unit (RHU)

Prepared By:	Jose Martinez Test Engineer
Report Number:	R1608091-90S
Report Date:	2016-12-19
Reviewed By:	Todd Moy RF Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1608091-90S	Original	2016-12-19

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Intelibs, Inc.* and their product model: RHU, FCC ID: Z69D01T4JX5, which will henceforth be referred to as the EUT (Equipment under Test). The EUT is a Radio Hub Unit (RHU) with global positioning system (GPS) service. The EUT operates in the uplink ESMR, Cellular, 700 MHz, Broadband PCS, and the AWS-1 bands.

1.2 Mechanical Description

The EUT measured approximately 35 cm (L) x 44.5 cm (W) x 25.4 cm (H) and weighs 32 kg.

The test data gathered are from production sample. Serial number: R1608091-1 provided by BACL.

1.3 Objective

This type approval report is prepared on behalf of *Intelibs, Inc.* in accordance with Part 90 of the Federal Communication Commissions rules.

The objective was to determine compliance with FCC rules for RF output power; Occupied Bandwidth, Spurious Emissions at Antenna Terminal, Field Strength of Spurious Radiation, and Band Edge.

1.4 Related Submittal(s)/Grant(s)

FCC Part 22, Subpart H, Equipment B2I with FCC ID: Z69D01T4JX5
FCC Part 24, Subpart E, Equipment B2I with FCC ID: Z69D01T4JX5
FCC Part 27, Subpart C, Equipment B2I with FCC ID: Z69D01T4JX5

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 individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: FCC KDB 935210 D05 v01r01

All emissions measurement was performed by Bay Area Compliance Laboratories 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.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.7 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)

- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D. A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EC US-EU EMC & Telecom MRA CAB
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
    US -EU EMC & Telecom MRA CAB

  Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA)
  APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA - Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

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

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

There was no exercise software with the EUT; signal was sent through EUT using a signal generator.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Internal Configuration

Manufacturer	Description	Model	Serial Number
Intelibs	700MHz RHM Unit	-	-
Intelibs	850MHz RHM Unit	-	-
Intelibs	1900MHz RHM Unit	-	-
Intelibs	2100 RHM Unit	-	-
Intelibs	GPS FEM	-	-
Intelibs	RHOM	-	-
Intelibs	RF Controller	-	-
Intelibs	GPS Controller	-	-

2.5 Local Support Equipment

N/A

2.6 Power Supply and Line Filters

Manufacturers	Descriptions	Models	Serial Numbers
TDK-Lambda	SMPS	-	-

2.7 External I/O Cabling List and Details

Cable Description	Length (m)	From	To
RF cable	< 1	Signal Generator	Support Equipment
RF cable	< 1	EUT Output	Spectrum Analyzer
Fiber Optic Cable	1	Support Equipment	EUT Input

3 Summary of Test Results

FCC Rules	Description of Tests	Results
FCC §2.1091	FCC §2.1091 RF Exposure Information	Compliant
§2.1046, §90.219(e)(1)	RF Output Power	Compliant
§2.1051, §90.219(e)(3)	Intermodulation	Compliant
§2.1049	Occupied Bandwidth	Compliant
§2.1051, §90.219(e)(3)	Spurious Emissions at Antenna Terminals	Compliant
§90.219(e)(3)	Band Edge & Intermodulation	Compliant
§2.1053, §90.219(e)(3)	Field Strength of Spurious Radiation	Compliant
§20.21	Out of Band Rejection	Compliant

4 FCC §2.1091 - RF Exposure Information

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 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

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

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	20.37
Maximum peak output power at antenna input terminal (mW):	108.89
Prediction distance (cm):	40
Prediction frequency (MHz):	820.5
Maximum Antenna Gain, typical (dBi):	18
Maximum Antenna Gain (numeric):	63.10
Power density of prediction frequency at 40 cm (mW/cm^2):	0.3417
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.547

4.3 Conclusion

The device complies with the MPE requirements by providing a safe separation distance of at least 40 cm between the antenna with maximum 18 dBi gain, including any radiating structure, and any persons when normally operated.

5 FCC §2.1046 & §90.219(e) – RF Output Power

5.1 Applicable Standard

According to FCC §90.219(e), the output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

5.2 Test Procedure

The signal generator was connected to the support equipment and the support equipment was connected to the EUT through a fiber cable. The output of the EUT was connected to a spectrum analyzer through appropriate attenuation.

5.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C0003	Each Time[1]	Each Time[1]
-	SMA cable	-	C0006	Each Time[1]	Each Time[1]

[1]*Note: This equipment was calibrated for each test.*

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

5.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.6 kPa

The testing was performed by Jose Martinez 2016-08-29 in the RF Site.

5.5 Test Results

Signal Type	AGC	Input Power (dBm)	Output Power (dBm)	Gain (dB)	Output ERP (dBm)
Broadband	Off	-66.01	16.95	82.96	32.8
	On	-62.53	19.96	82.49	35.81
Narrowband	Off	-64.11	19.16	83.27	35.01
	On	-60.56	20.37	80.93	36.22

The maximum antenna gain used with the EUT is 18 dBi.
EIRP = Measured Conducted Output Power (dBm) + Antenna Gain (dBi) -2.15 (dB)

Note: Calculation results of the amplifier gain listed in the table above contains two parts: gain of RHU (the EUT) and gain of MRU. The typical gain of the EUT was 40 dB, while the typical gain of MRU was 45 dB. Please refer to FCC ID: Z69D01T4JX6 for the MRU.

6 FCC §2.1049– Occupied Bandwidth

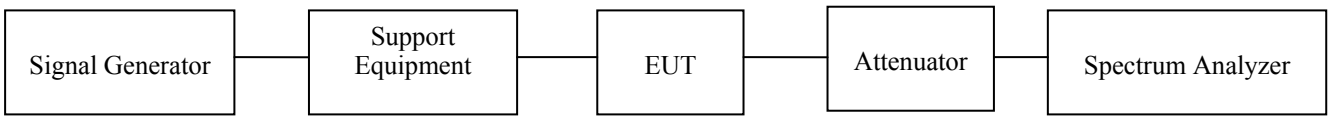
6.1 Applicable Standard

Requirements: FCC §2.1049

6.2 Test Procedure

The signal generator was connected to the support equipment and the support equipment was connected to the EUT through a fiber cable. The output of the EUT was connected to a spectrum analyzer through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set to at least 1 to 5% of the OBW and the 26 dB & 99% bandwidth was recorded.



6.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C0003	Each Time[1]	Each Time[1]
-	SMA cable	-	C0006	Each Time[1]	Each Time[1]

[1]*Note: This equipment was calibrated for each test.*

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

6.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	32 %
ATM Pressure:	101.3 kPa

The testing was performed by Jose Martinez 2016-08-26 in the RF Site.

6.5 Test Results

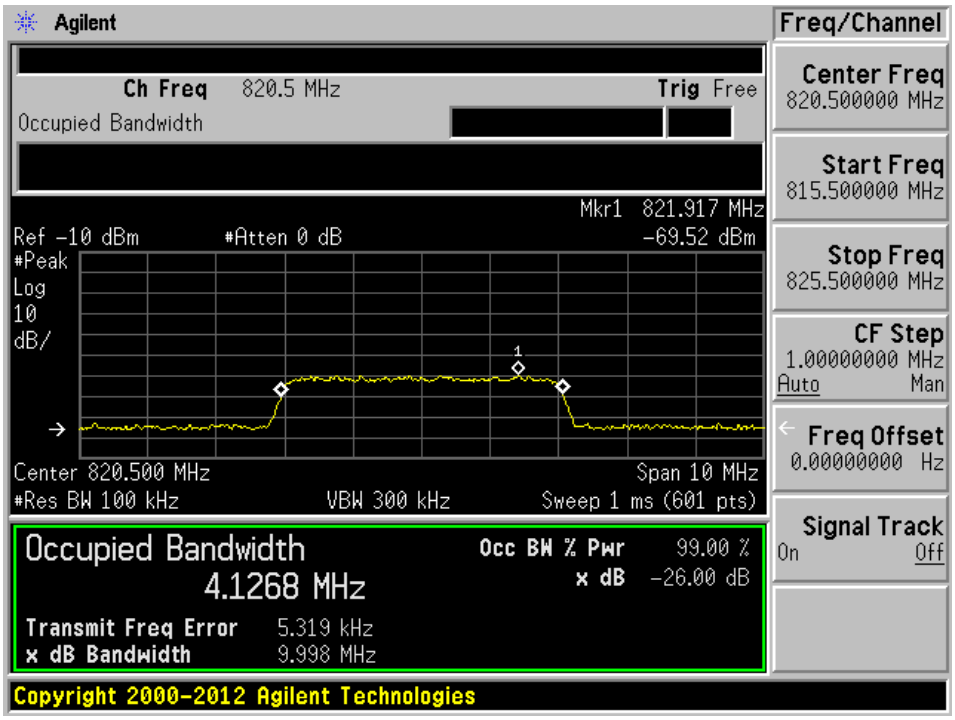
Please refer to the following tables and plots.

Signal Type	AGC	Input	Output
		99 % OBW (kHz)	99 % OBW (kHz)
Broadband	off	4126.8	4005.2
	on	4126.8	4010.6
Narrowband	off	243.74	243.02
	on	243.74	243.41

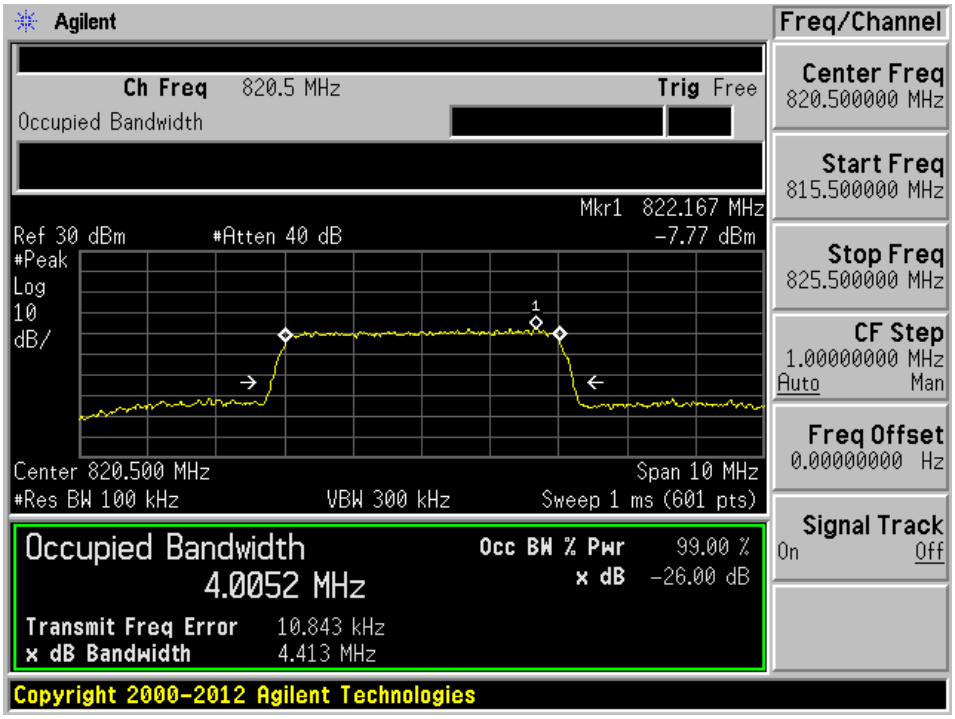
Note: The 99 % occupied bandwidth was used to compare the input and output signal.

Broadband

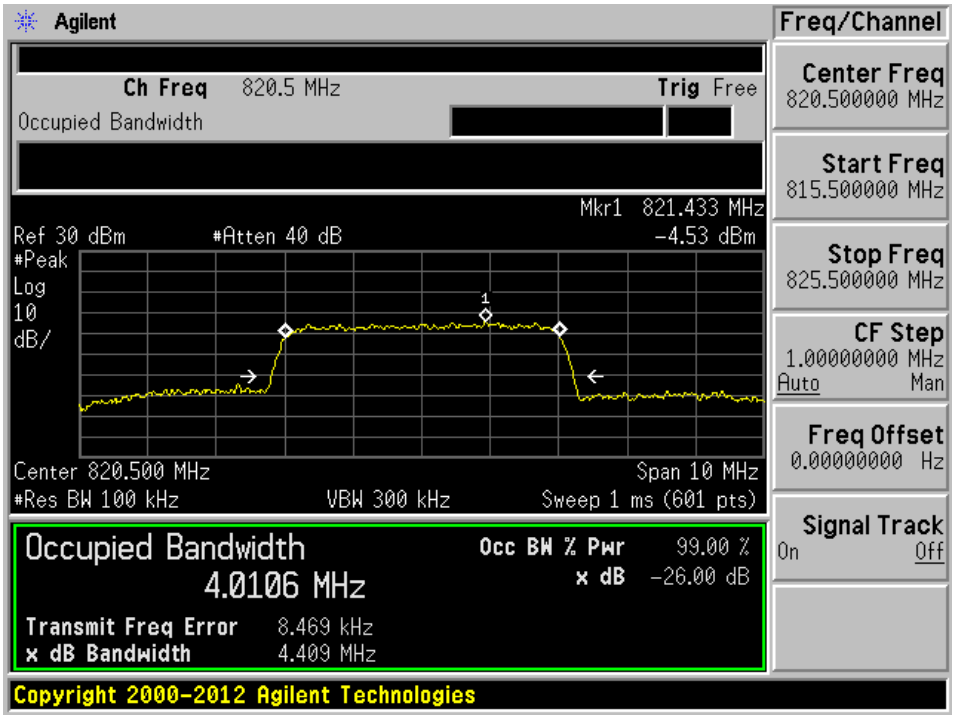
Input



Output, AGC Off

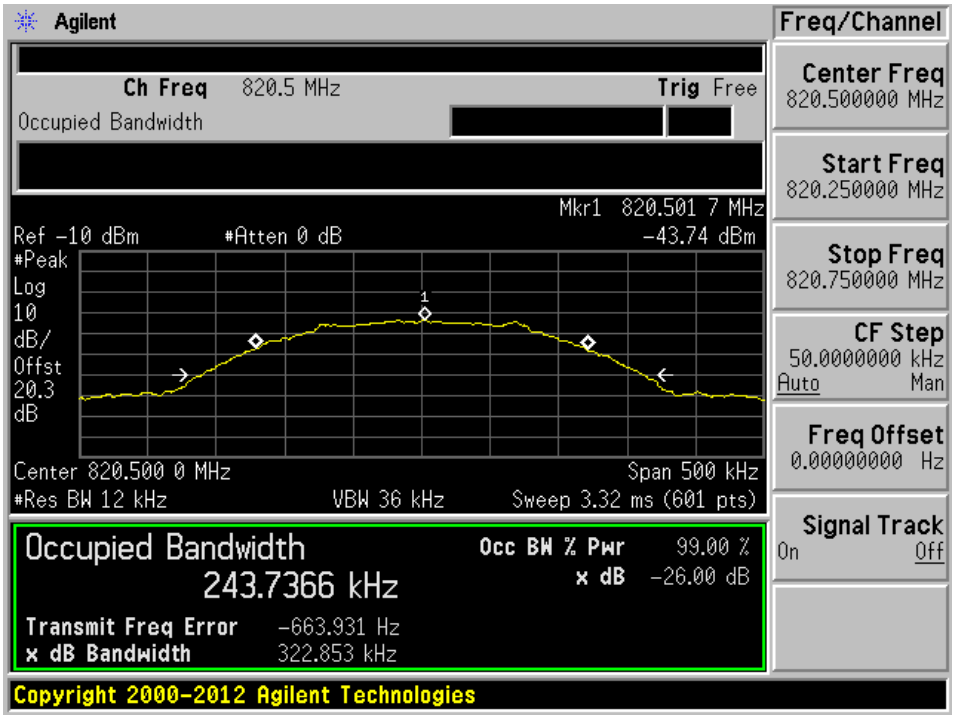


Output, AGC On

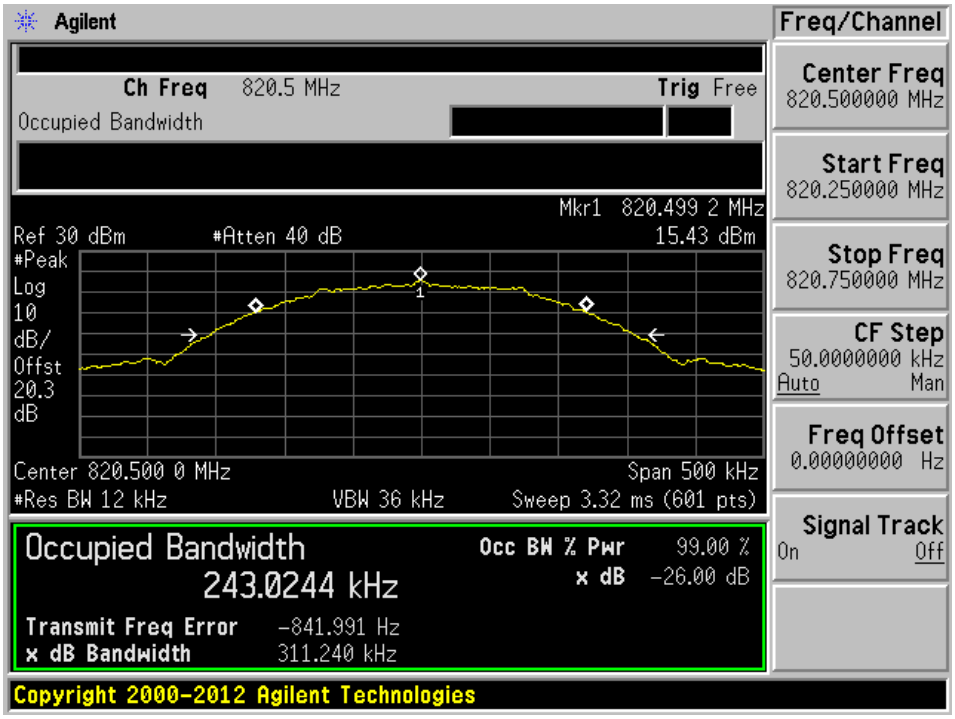


Narrowband

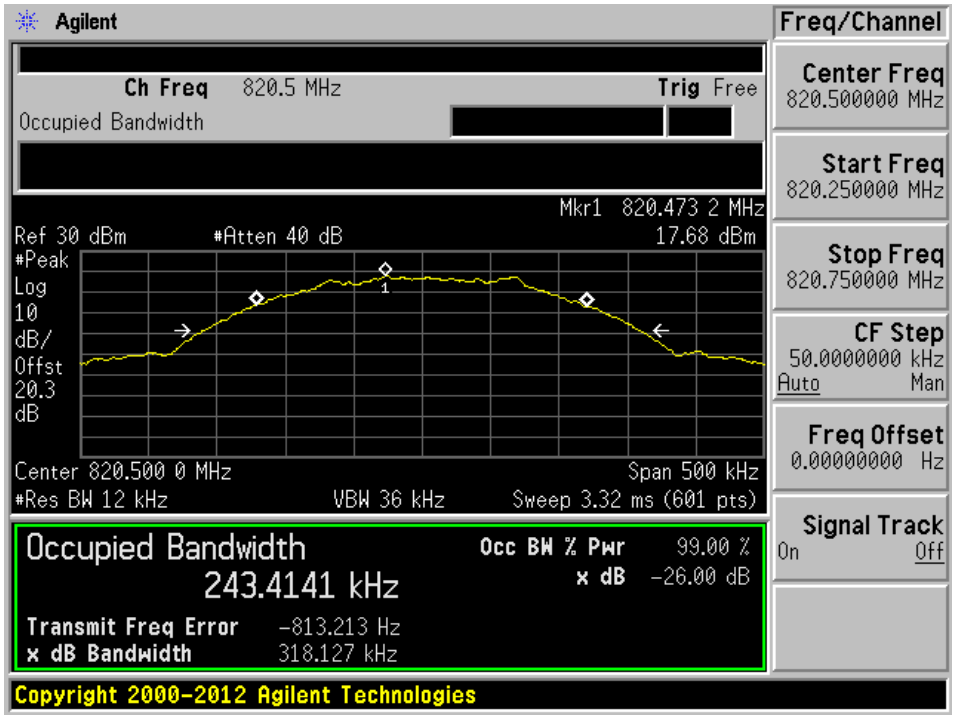
Input



Output, AGC Off



Output, AGC On



7 FCC §2.1051 & §90.219(e) - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

According to FCC §90.219 (e), spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

7.2 Test Procedure

The signal generator was connected to the support equipment and the support equipment was connected to the EUT through a fiber cable. The output of the EUT was connected to a spectrum analyser through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C0003	Each Time[1]	Each Time[1]
-	SMA cable	-	C0006	Each Time[1]	Each Time[1]

[1]*Note: This equipment was calibrated for each test.*

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

7.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	32 %
ATM Pressure:	101.3 kPa

The testing was performed by Jose Martinez on 2016-09-13 in the RF Site.

7.5 Test Results

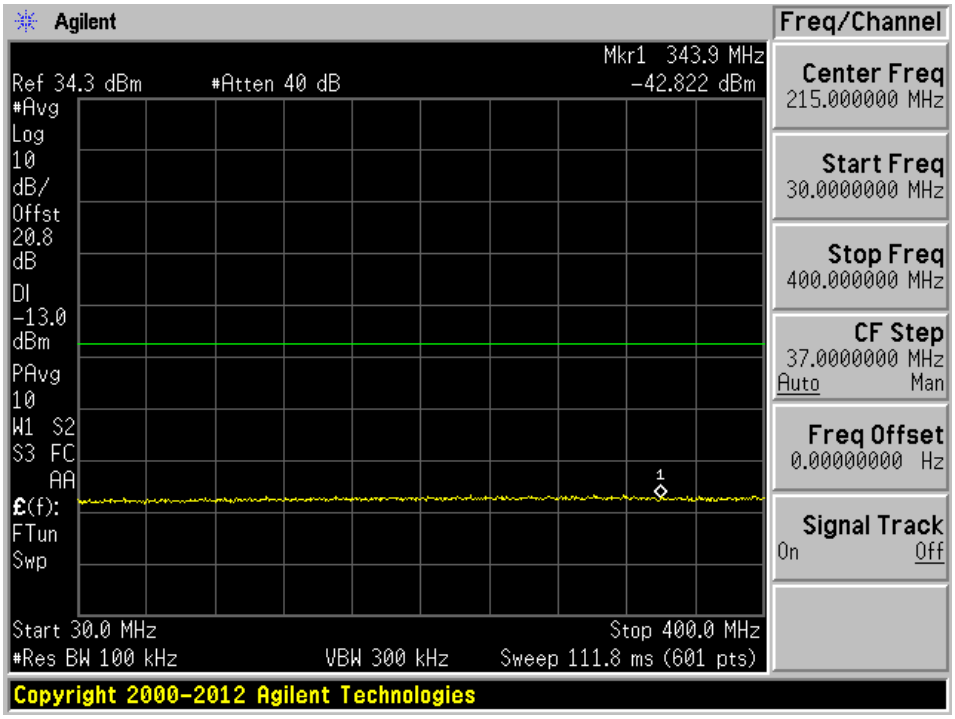
Please refer to the following plots.

Broadband Signal

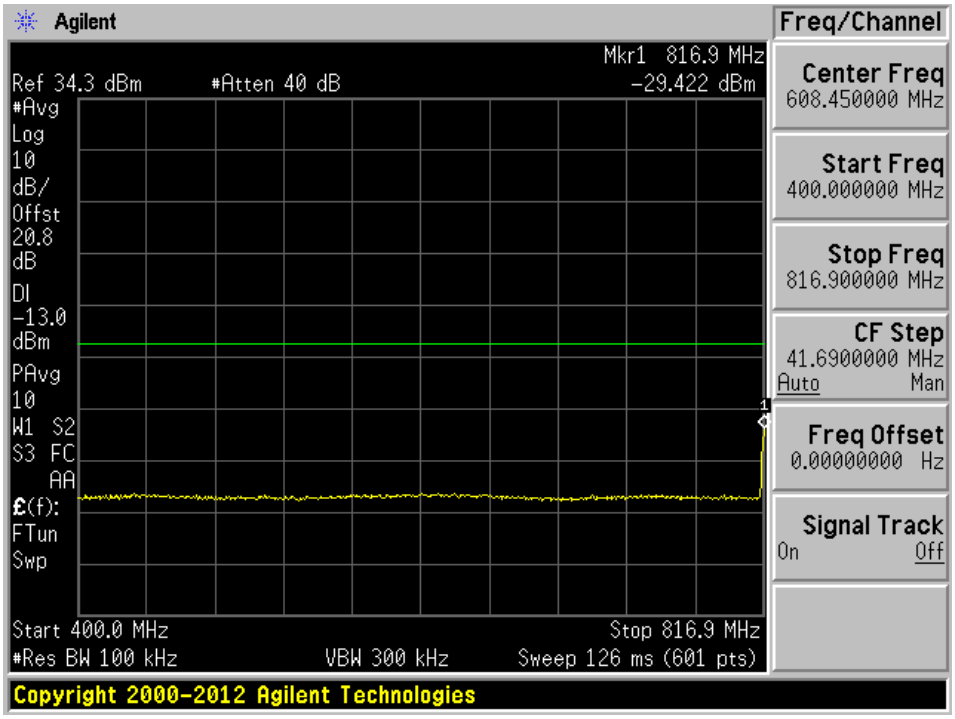
AGC Off

Low Channel

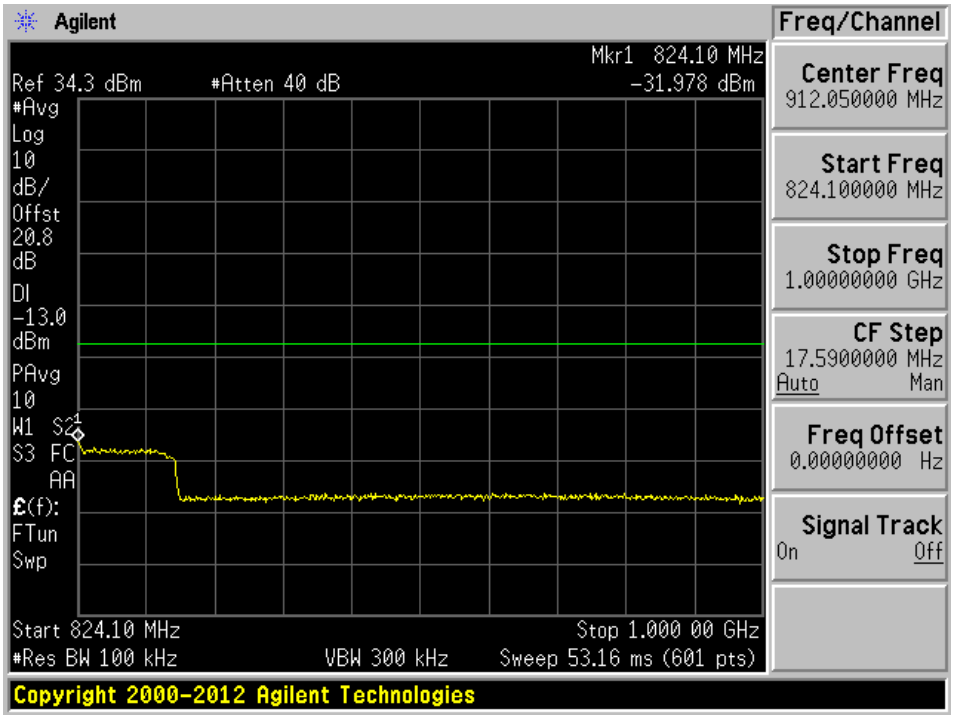
30 MHz-400 MHz



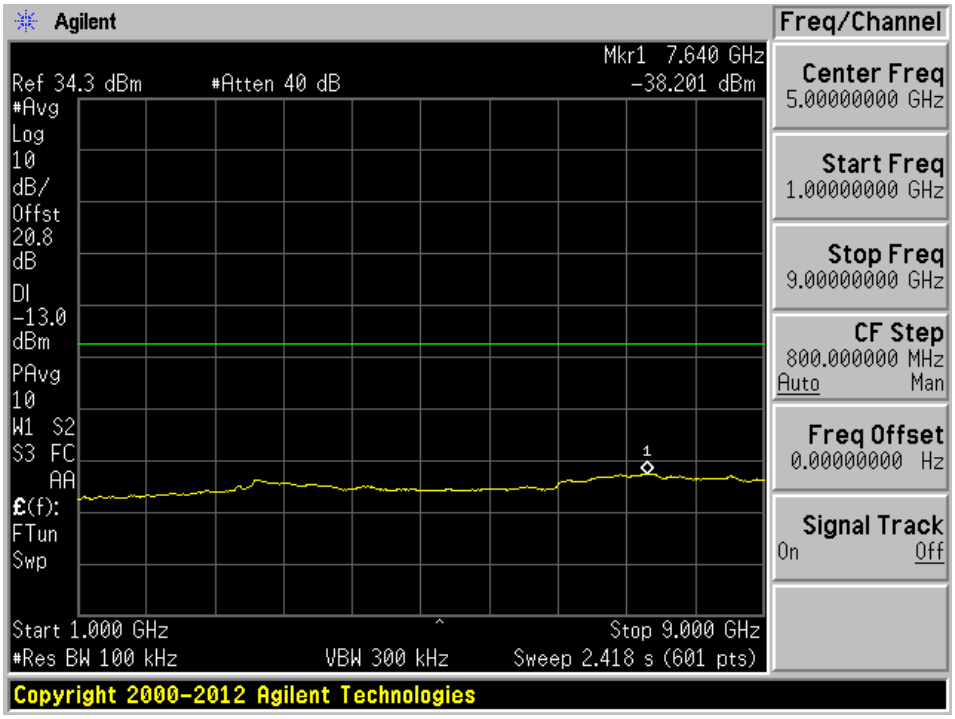
400 MHz-816.9 MHz



824.1 MHz –1 GHz

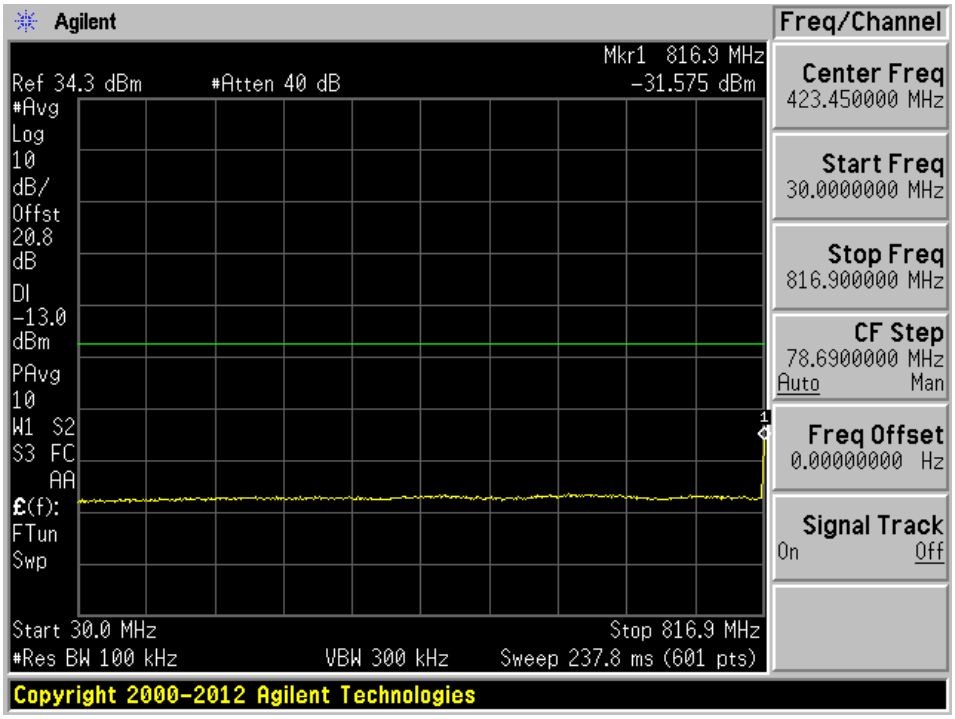


1 GHz – 9 GHz

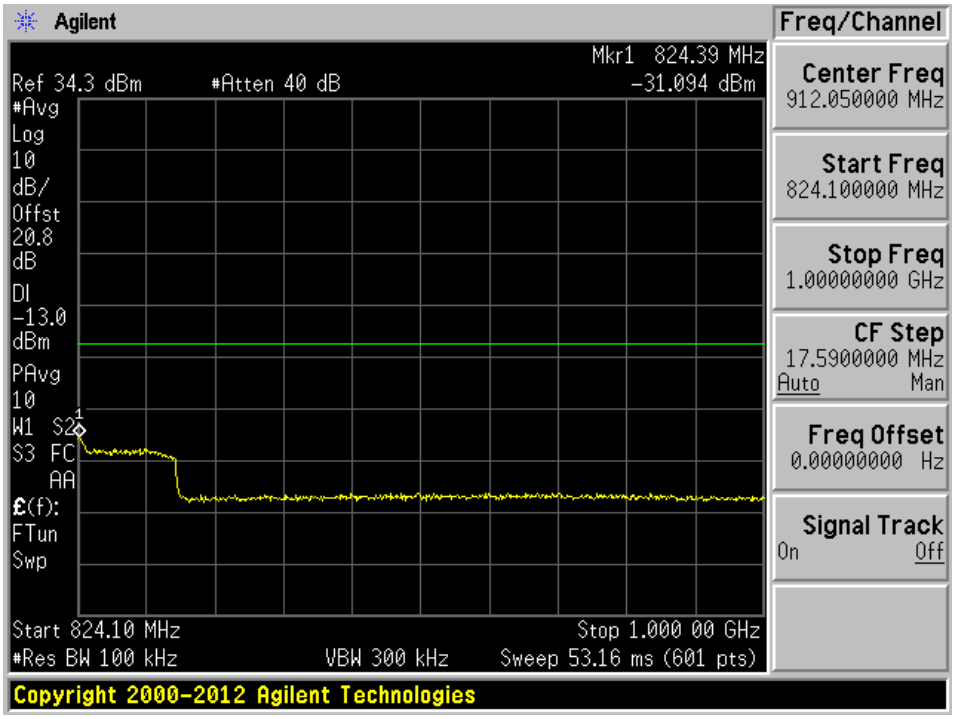


Middle Channel

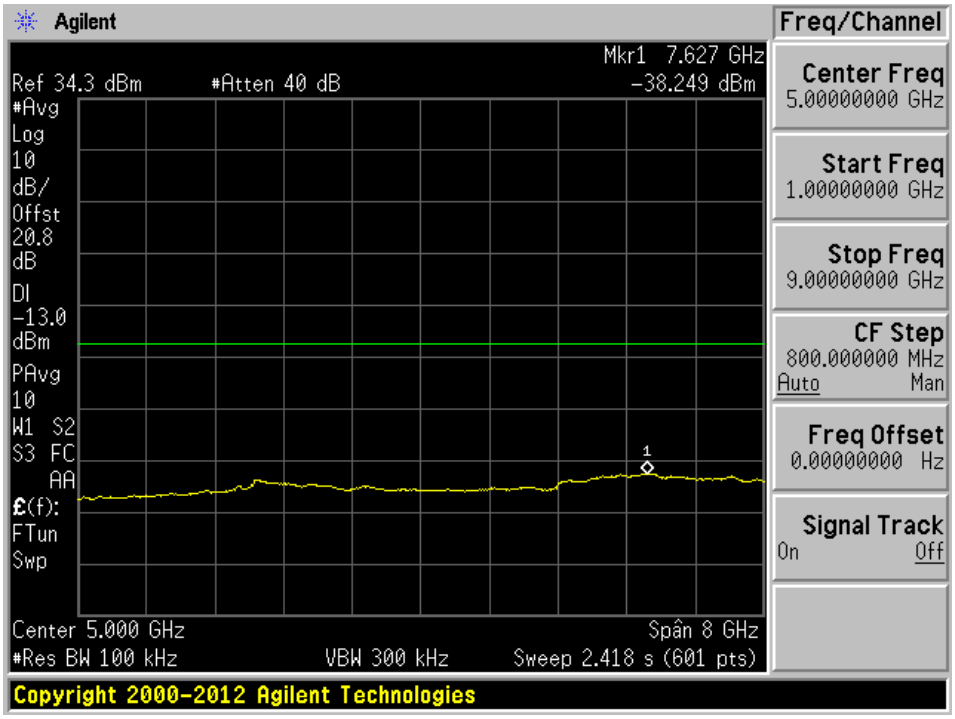
30 MHz- 816.9 MHz



824.1 MHz-1 GHz

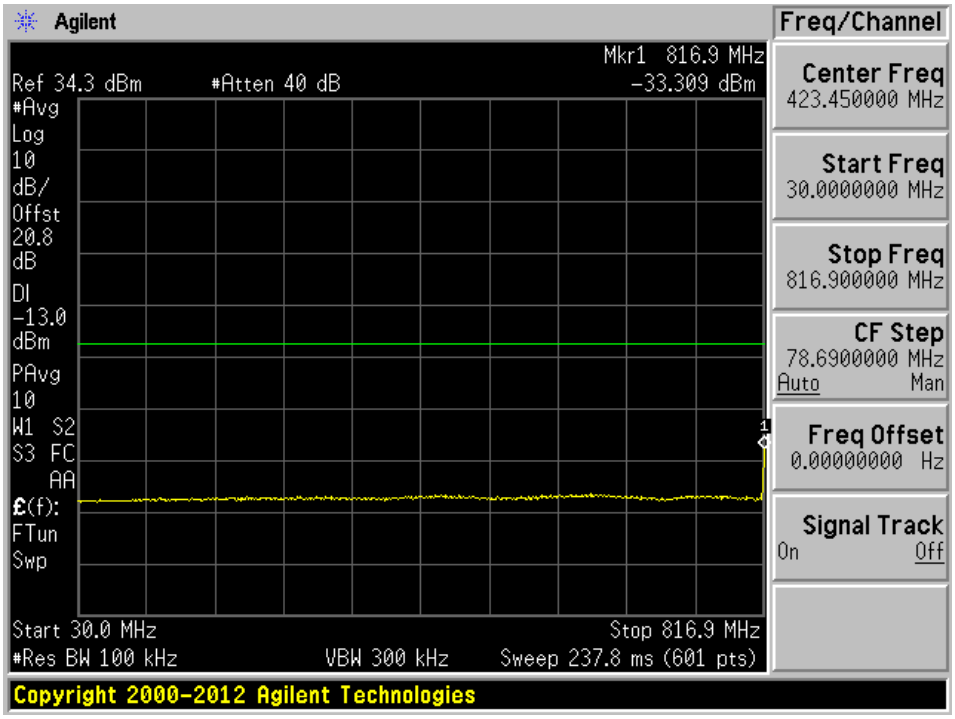


1 GHz-9 GHz

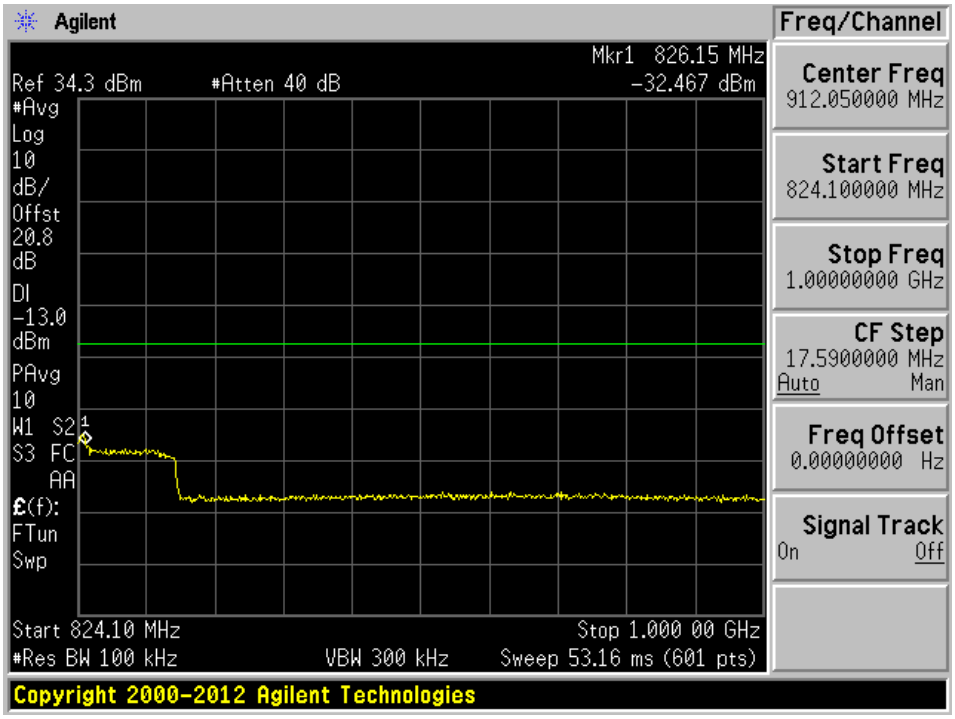


High Channel

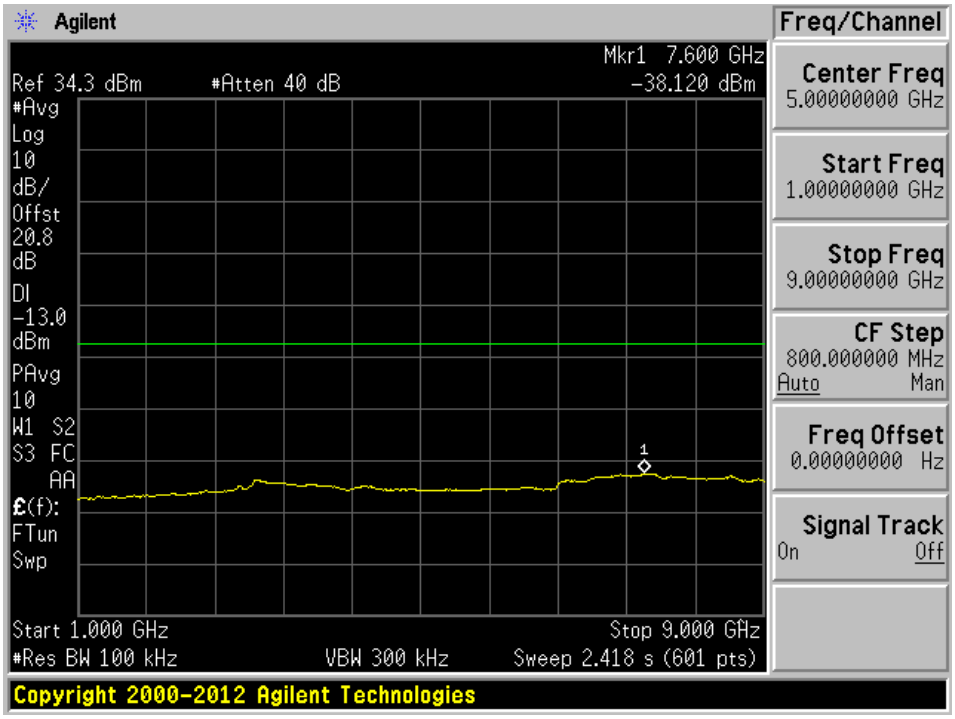
30 MHz- 816.9 MHz



824.1 MHz-1 GHz



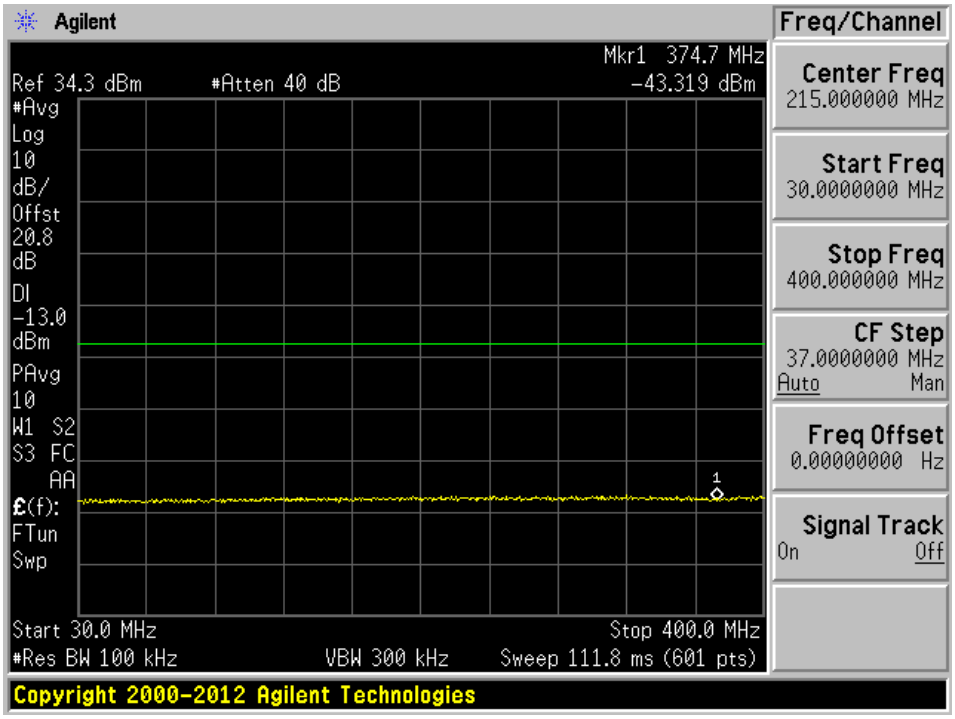
1 GHz-9 GHz


Agilent
Freq/Channel
Mkr1 7.600 GHz
Ref 34.3 dBm
#Atten 40 dB
-38.120 dBm
#Avg
Log
10
dB/
Offst
20.8
dB
Dl
-13.0
dBm
PAvg
10
W1 S2
S3 FC
AA
£(f):
FTun
Swp
1
Center Freq
5.00000000 GHz
Start Freq
1.00000000 GHz
Stop Freq
9.00000000 GHz
CF Step
800.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 1.000 GHz
Stop 9.000 GHz
#Res BW 100 kHz
VBW 300 kHz
Sweep 2.418 s (601 pts)
Copyright 2000-2012 Agilent Technologies

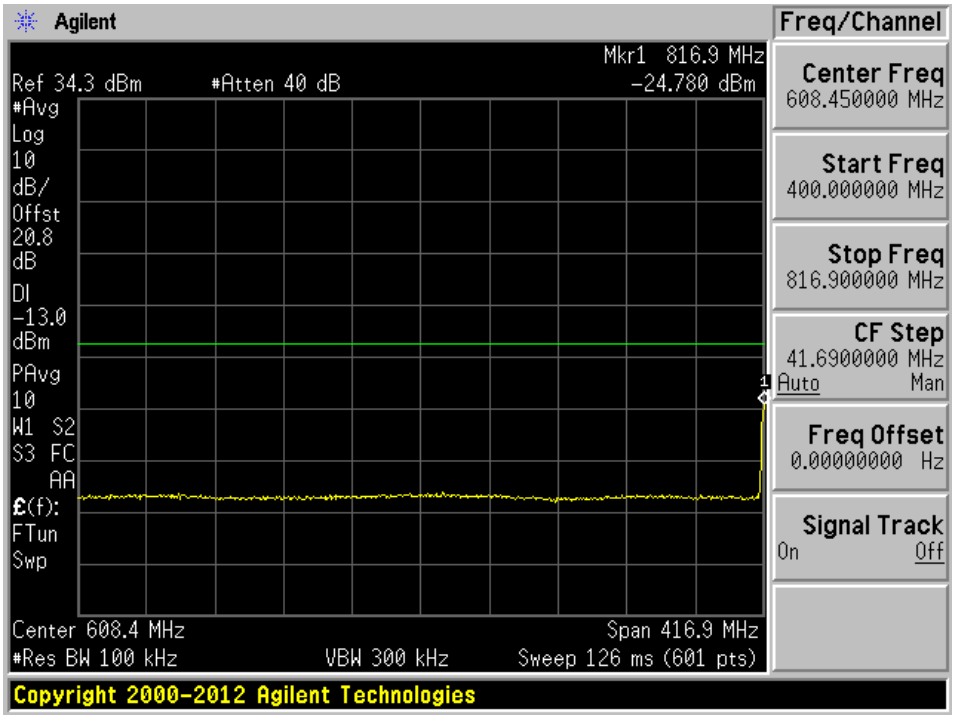
AGC On

Low Channel

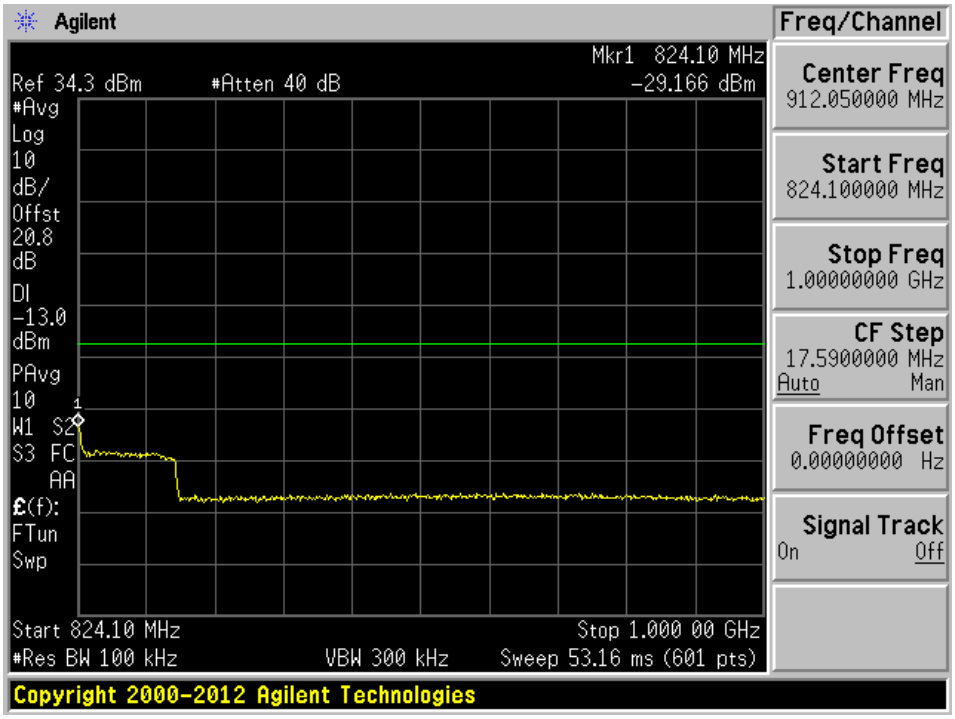
30 MHZ-400 MHz



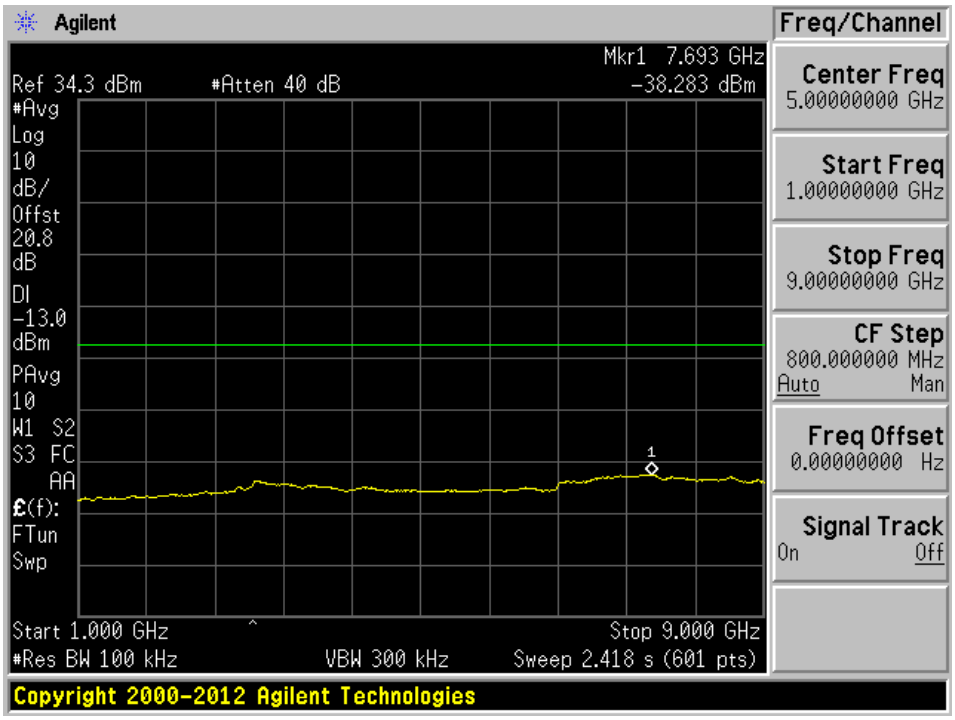
400 MHZ-816.9 MHz



824.1 MHz –1 GHz

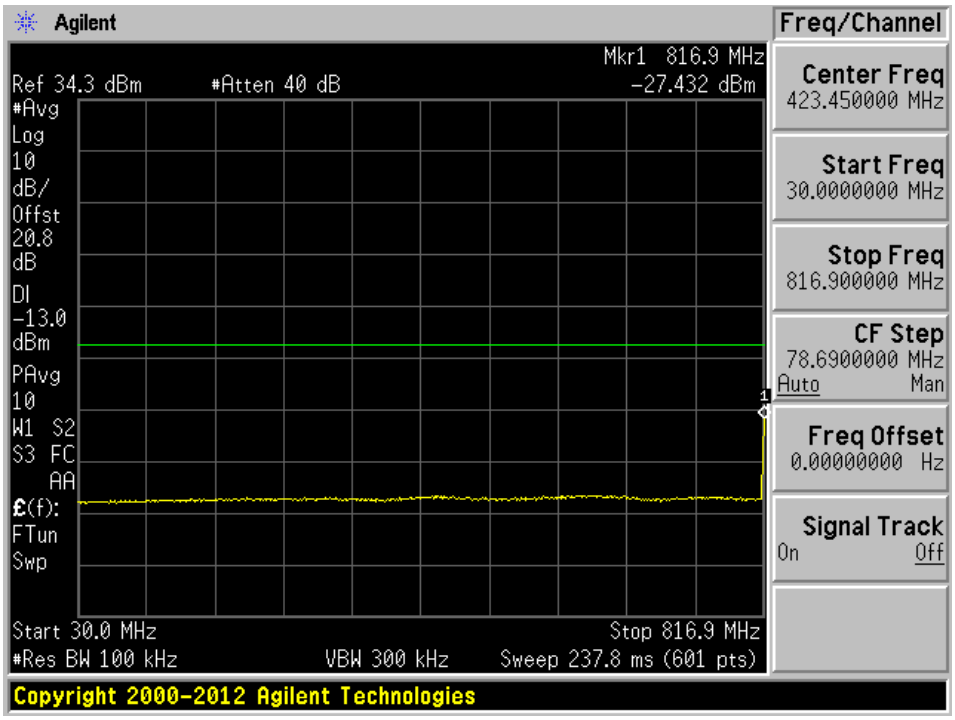


1 GHz – 9 GHz

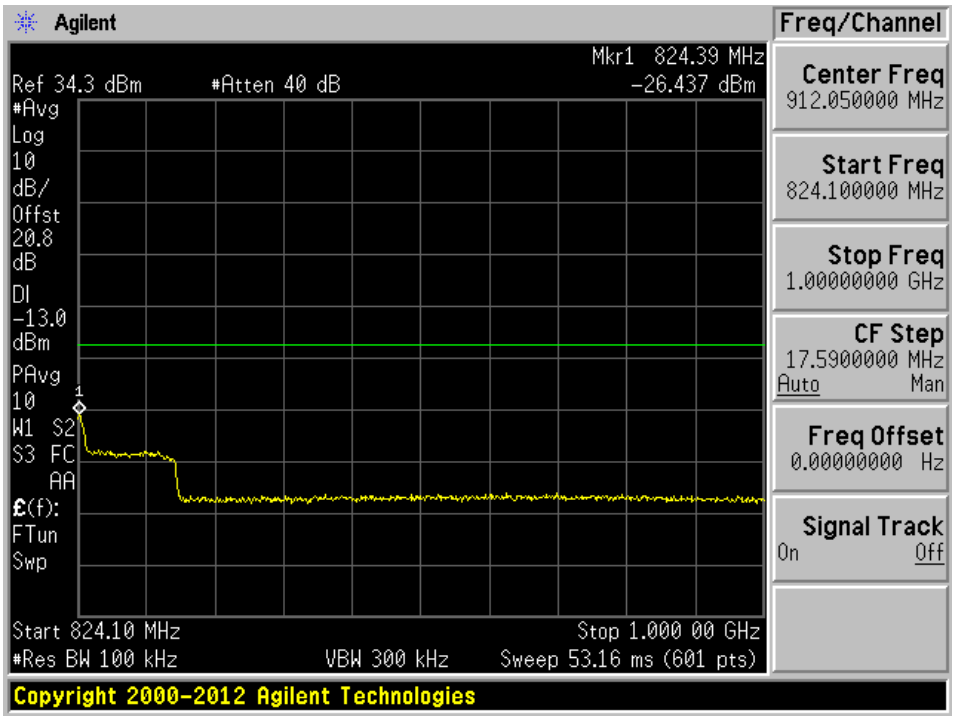


Middle Channel

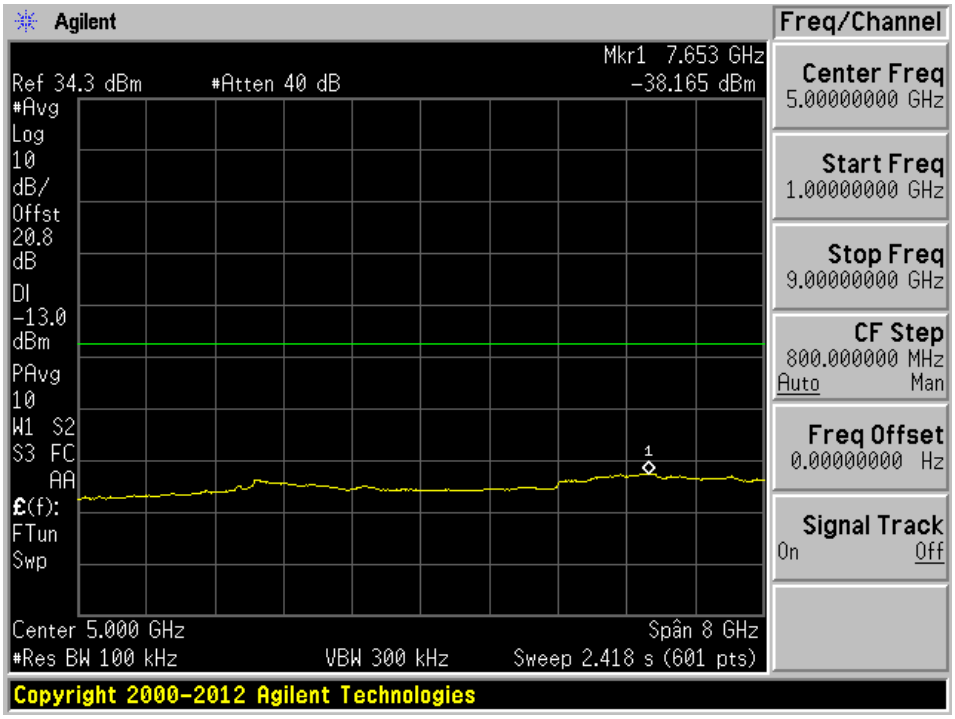
30 MHz- 816.9 MHz



824.1 MHz-1 GHz

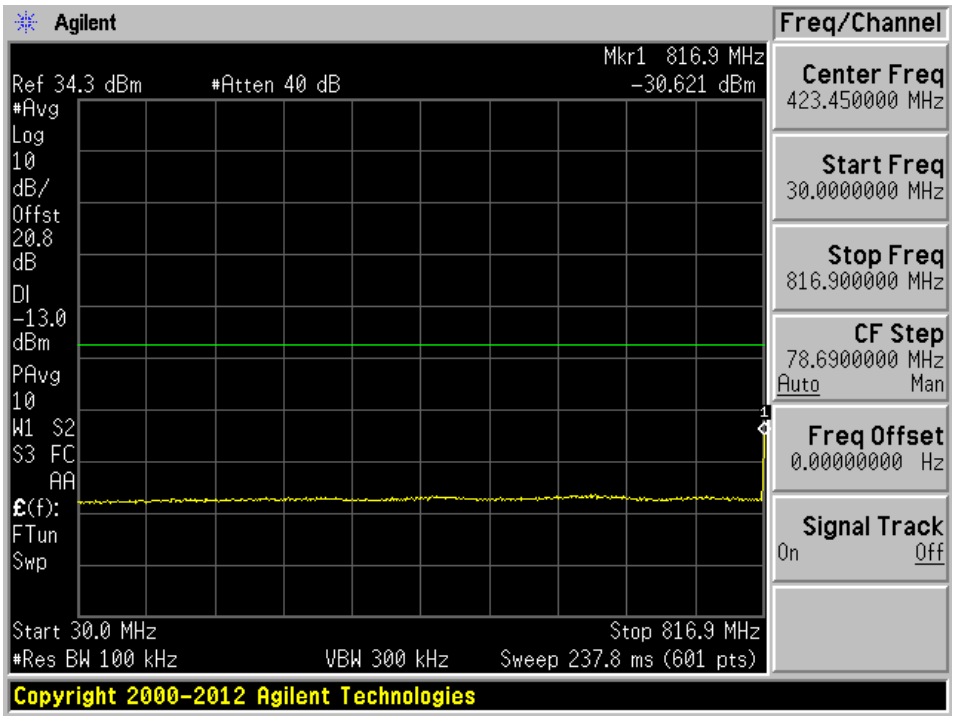


1 GHz-9 GHz

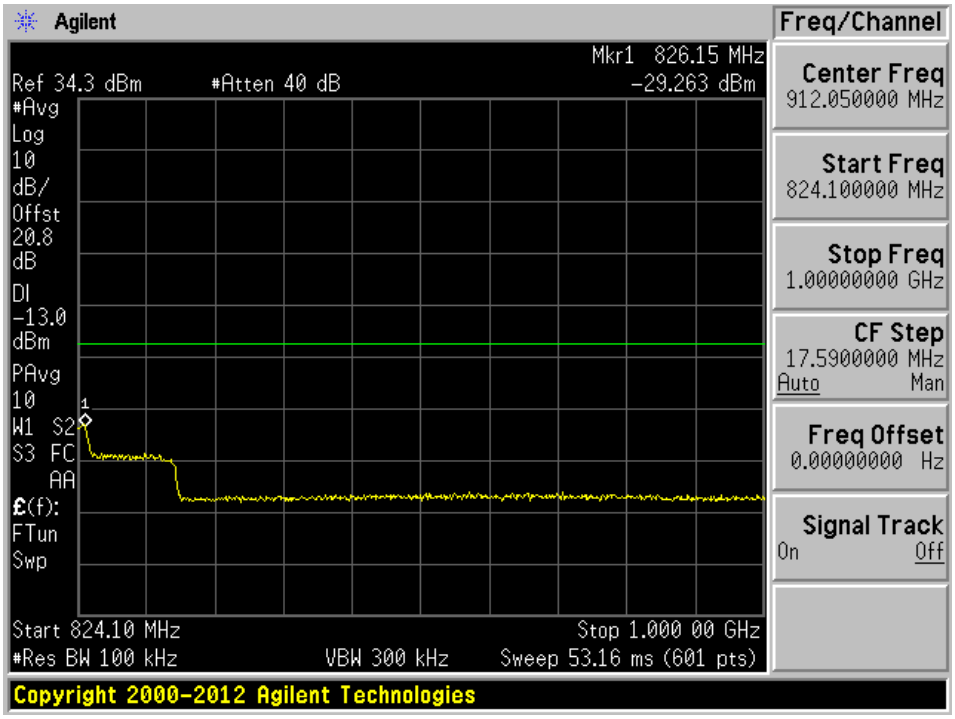


High Channel

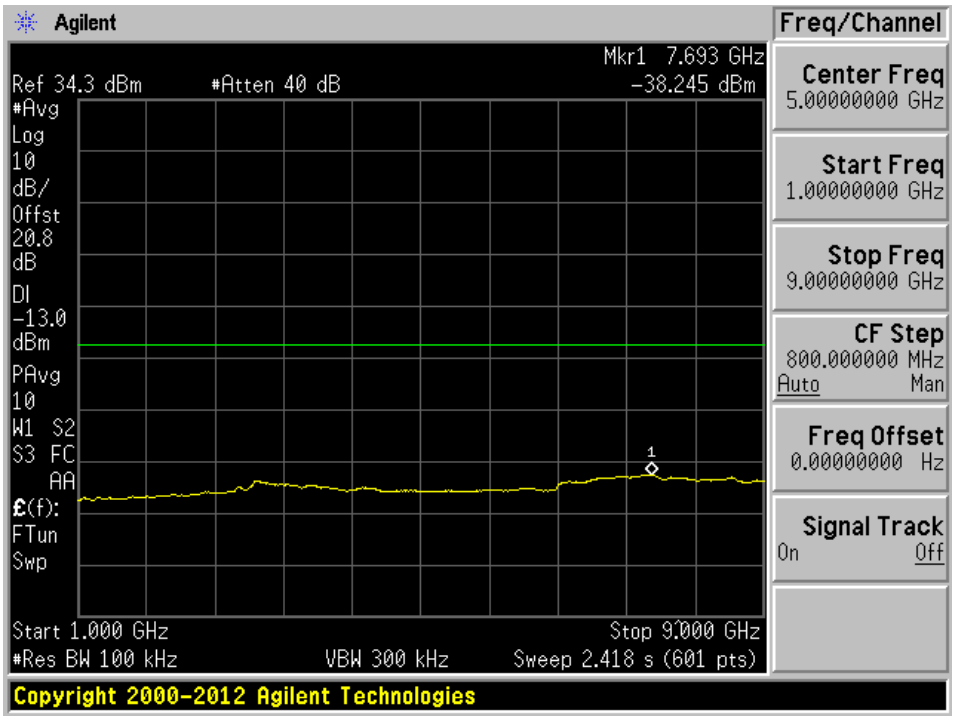
30 MHz- 816.9 MHz



824.1 MHz-1 GHz



1 GHz-9 GHz

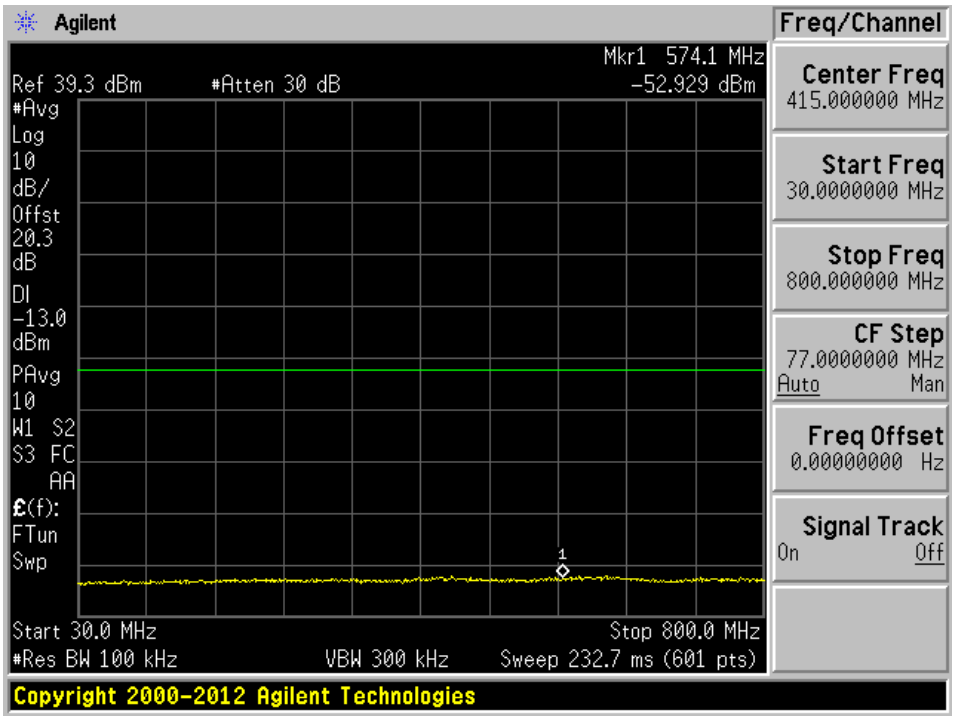


Narrowband signal

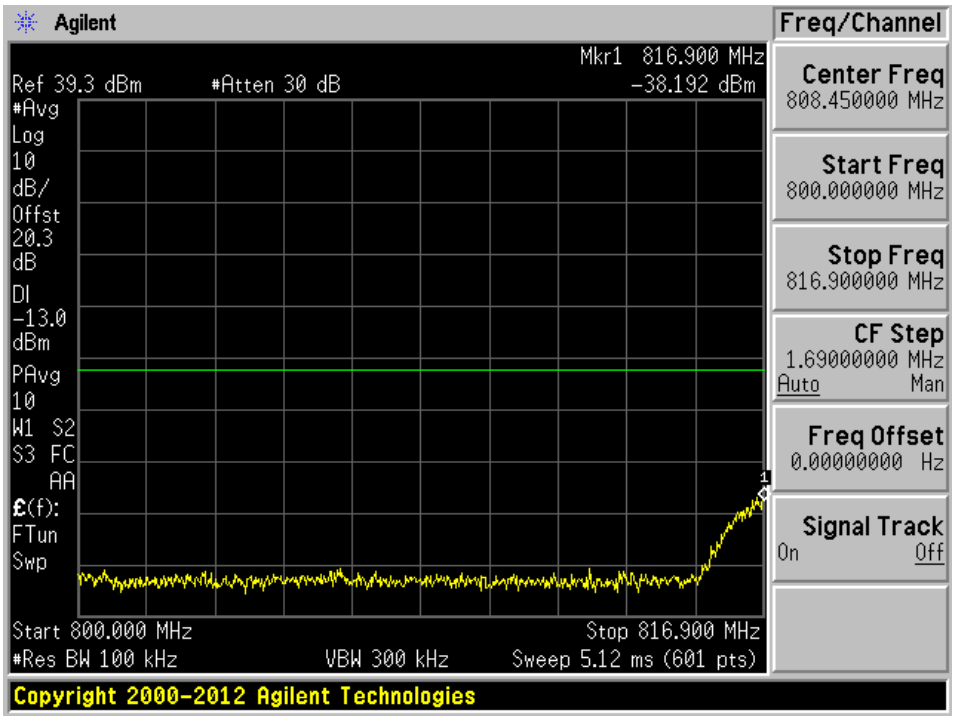
AGC Off

Low Channel

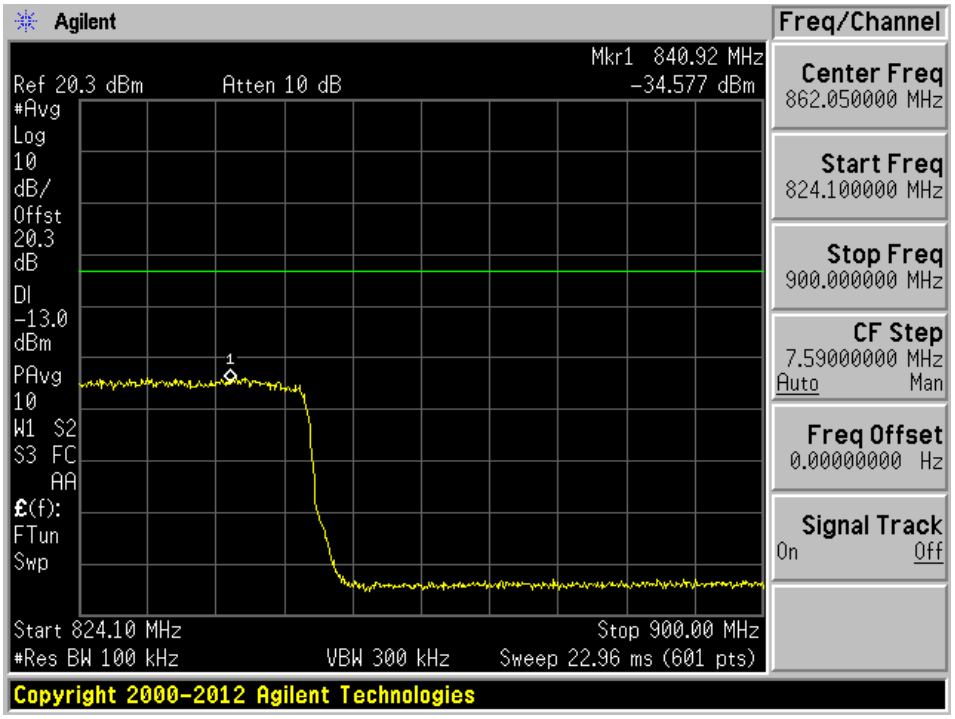
30 MHz-800 MHz



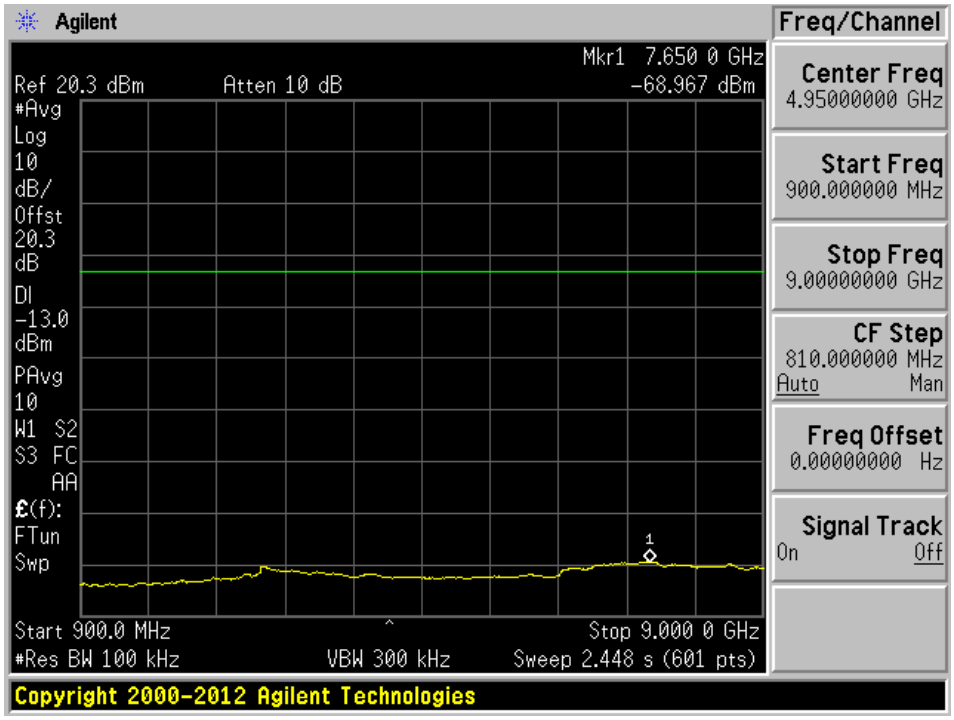
800 MHz-816.9 MHz



824.1 MHz-900 MHz

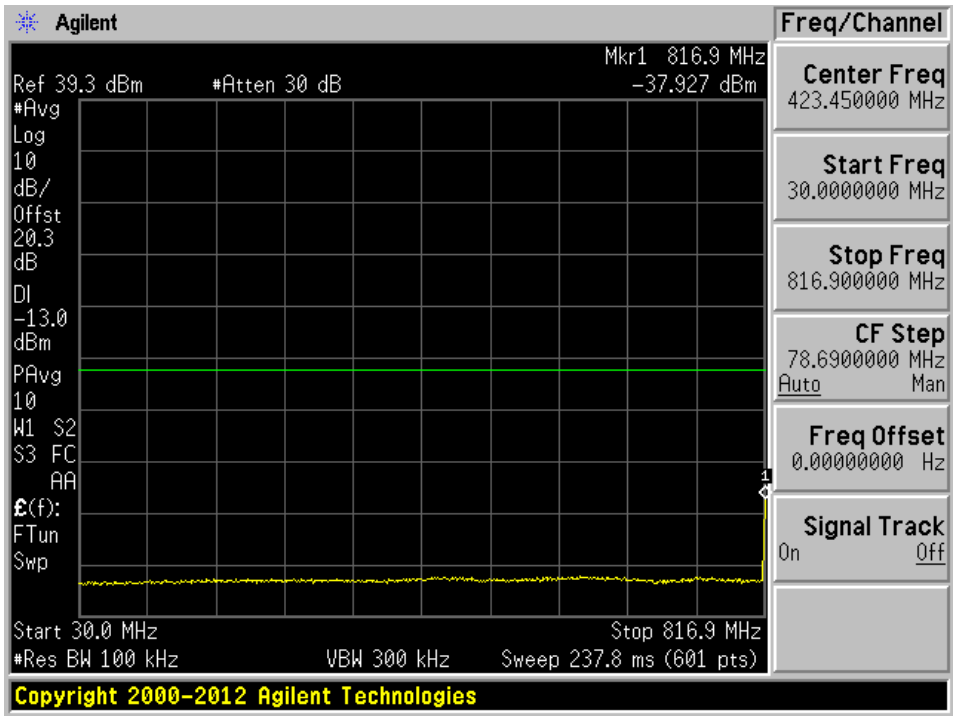


900 MHz – 9 GHz

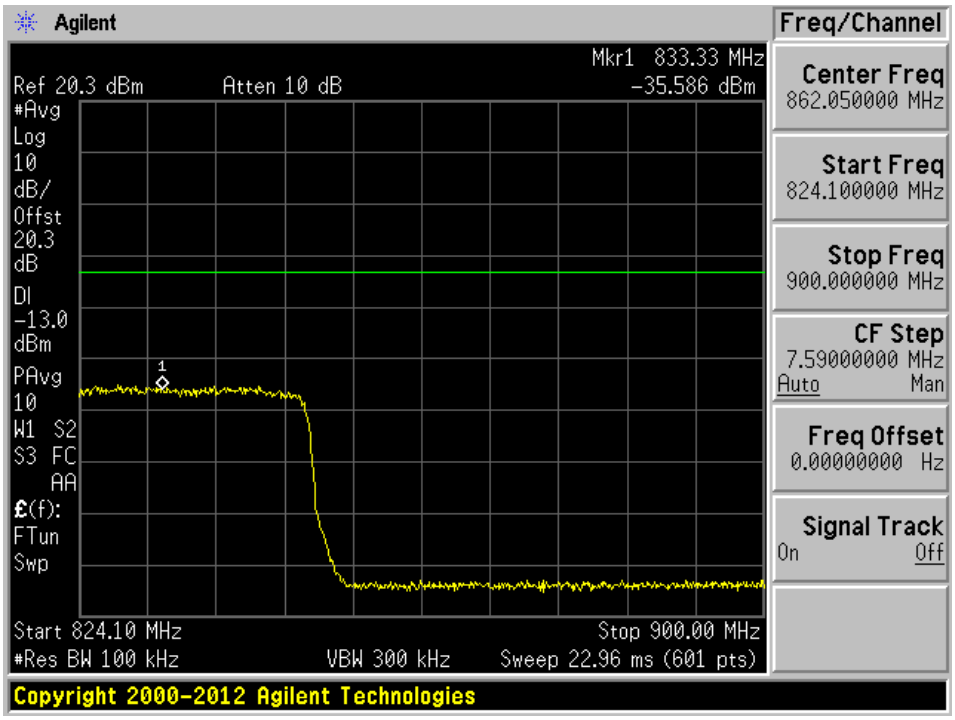


Middle Channel

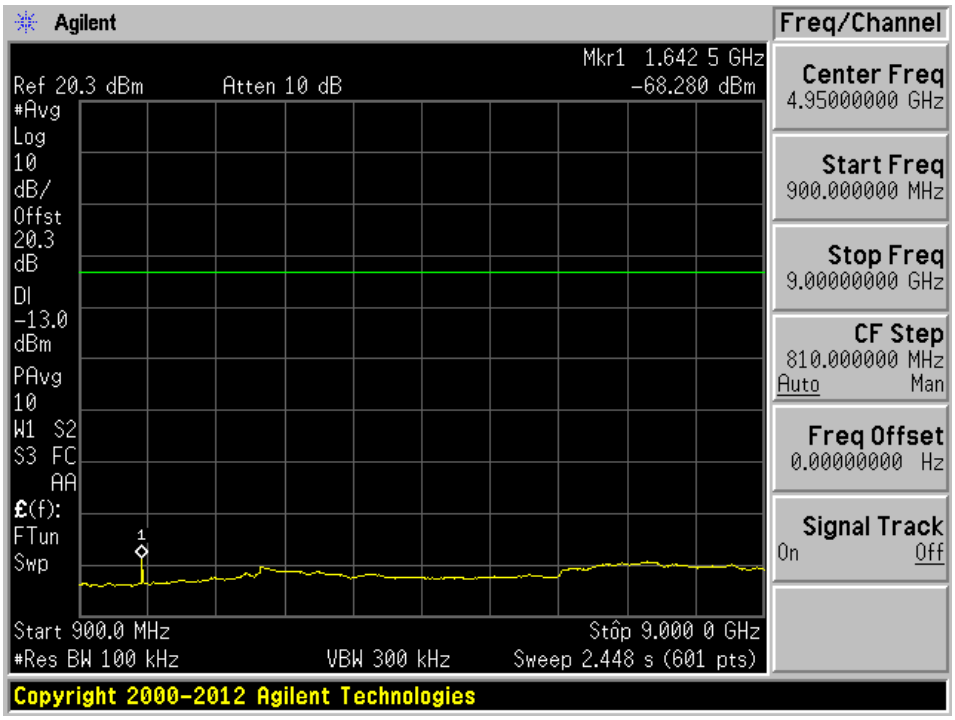
30 MHz- 816.9 MHz



824.1 MHz-900 MHz

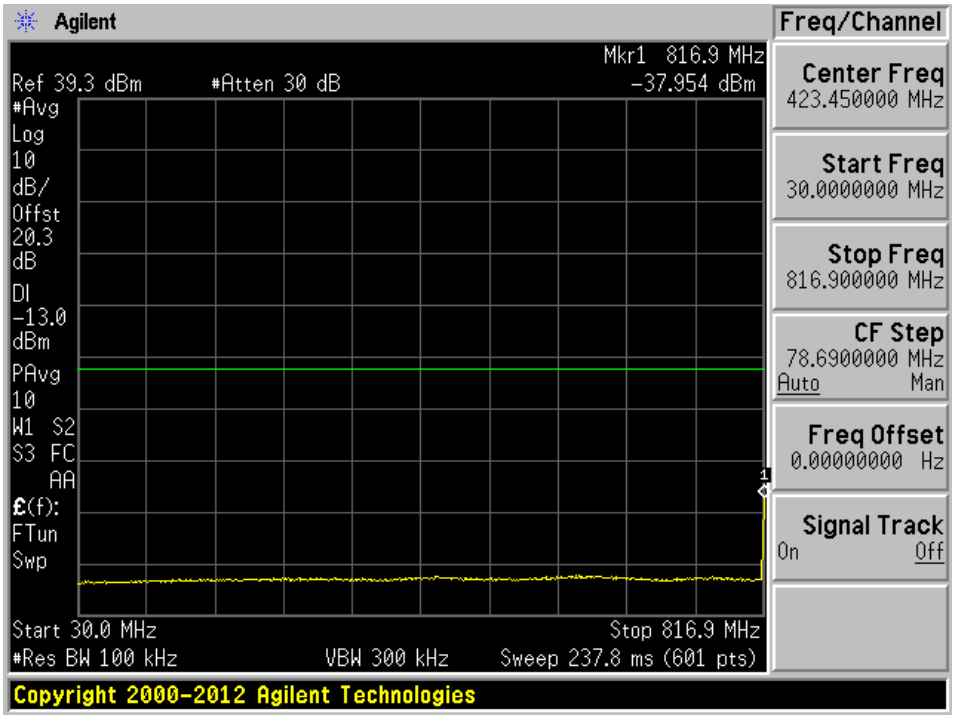


900 MHz-9 GHz

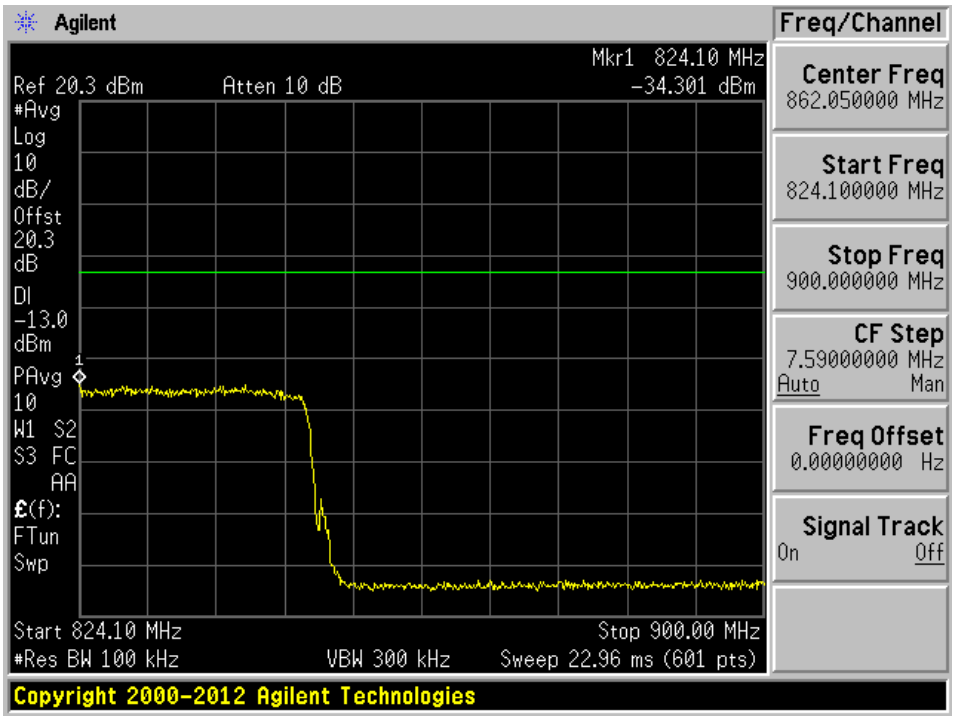


High Channel

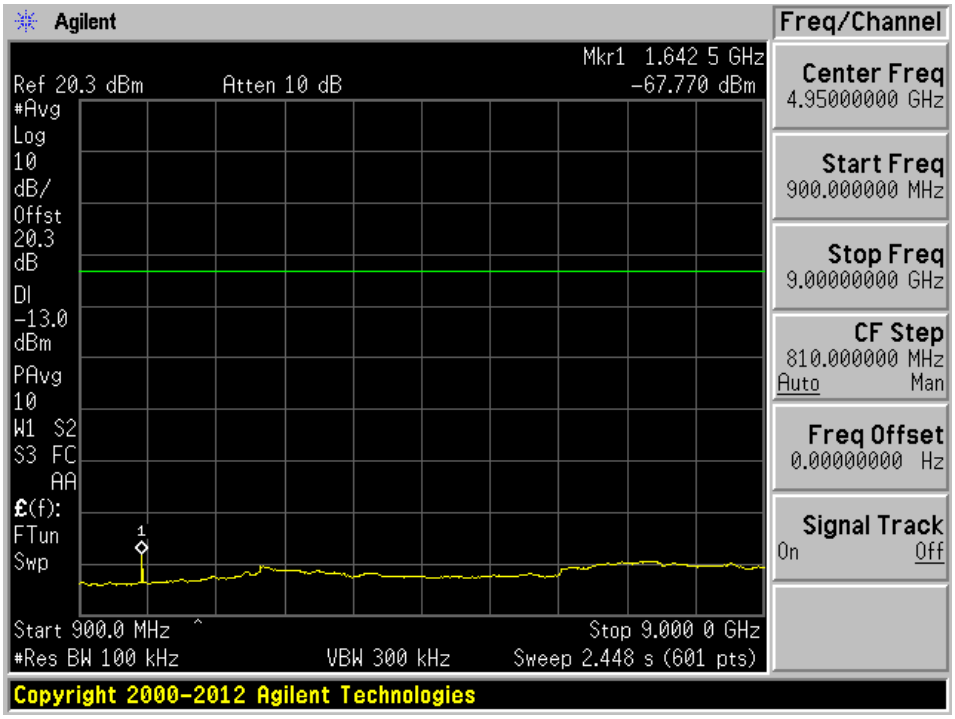
30 MHz- 816.9 MHz



824.1 MHz-900 MHz



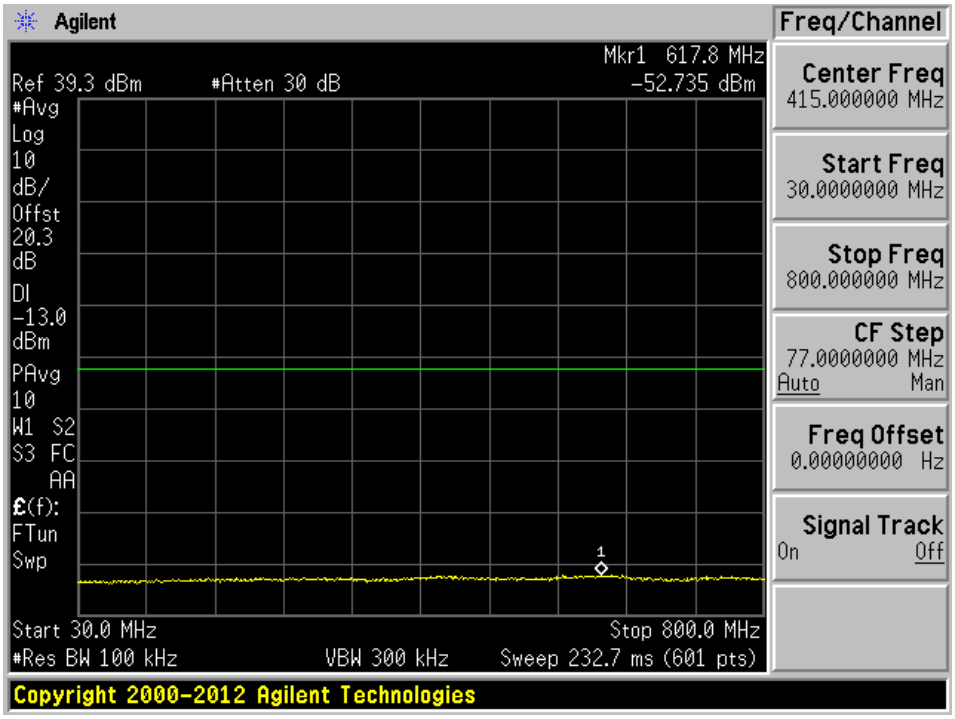
900 MHz-9 GHz


Agilent
Freq/Channel
Mkr1 1.642 5 GHz
Ref 20.3 dBm
Atten 10 dB
-67.770 dBm
#Avg
Log
10
dB/
Offst
20.3
dB
Dl
-13.0
dBm
PAvg
10
W1 S2
S3 FC
AA
£(f):
FTun
Swp
Center Freq
4.95000000 GHz
Start Freq
900.000000 MHz
Stop Freq
9.00000000 GHz
CF Step
810.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 900.0 MHz
Stop 9.000 0 GHz
#Res BW 100 kHz
VBW 300 kHz
Sweep 2.448 s (601 pts)
Copyright 2000-2012 Agilent Technologies

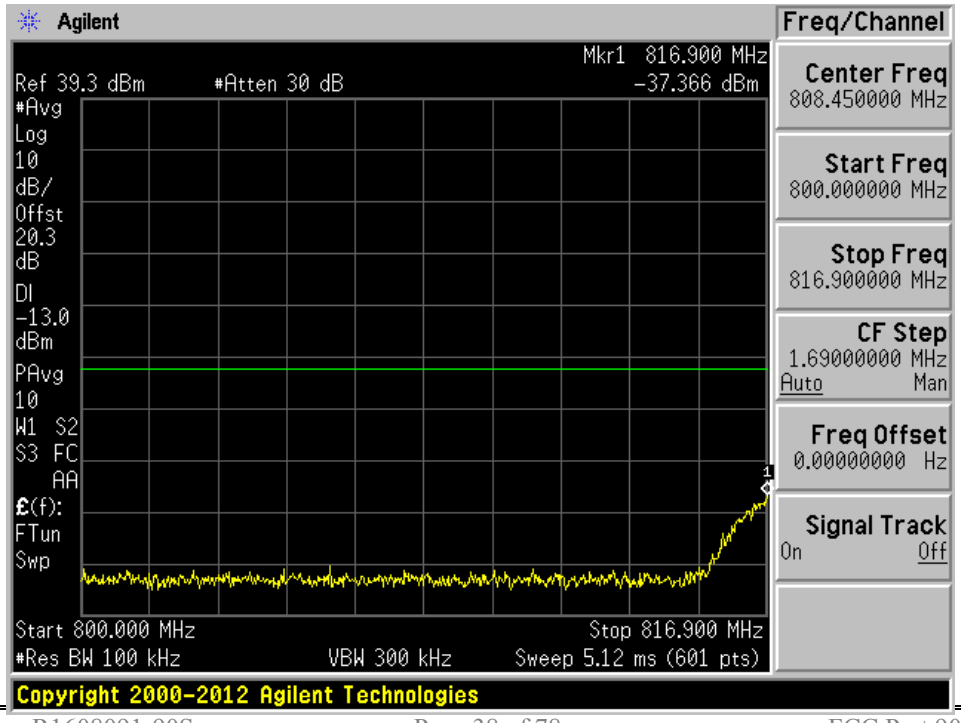
AGC On

Low Channel

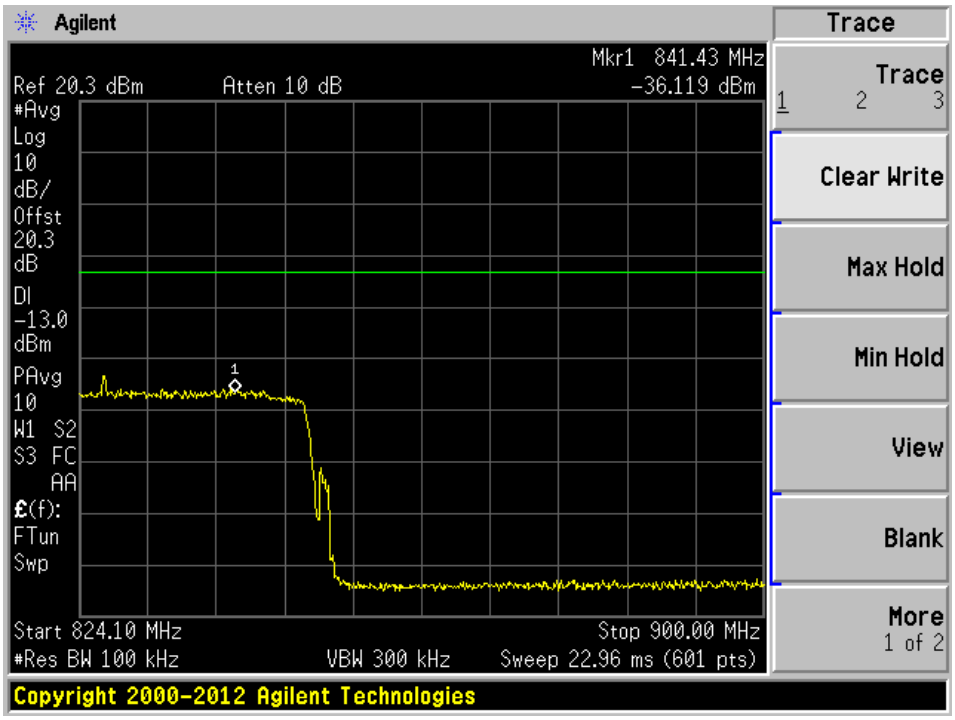
30 MHZ-800 MHz



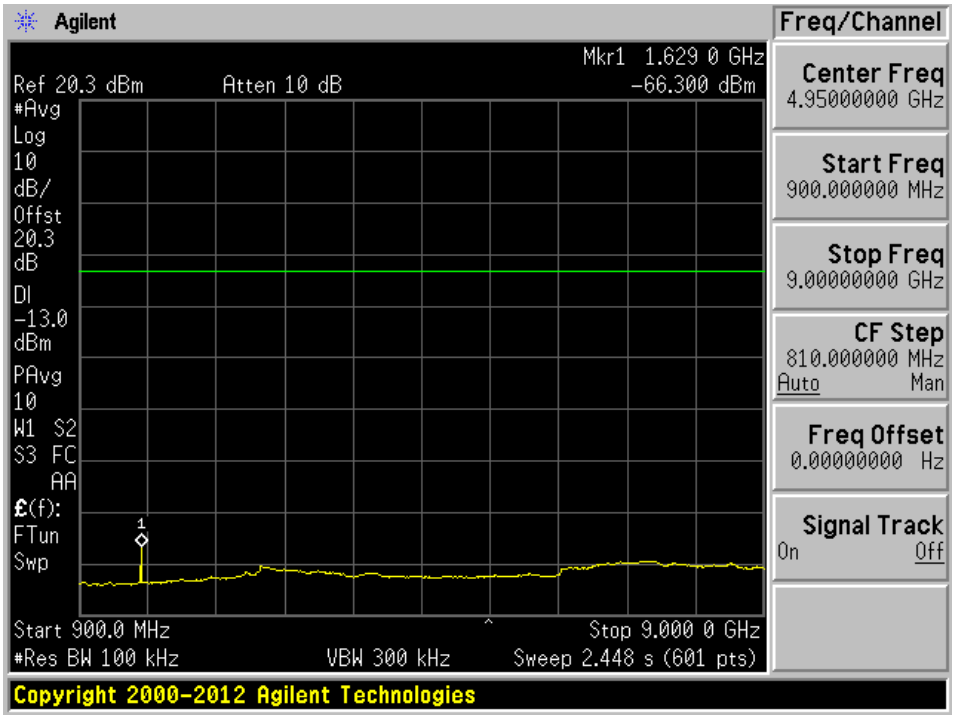
800 MHz-816.9 MHz



824.1 MHz-900 MHz

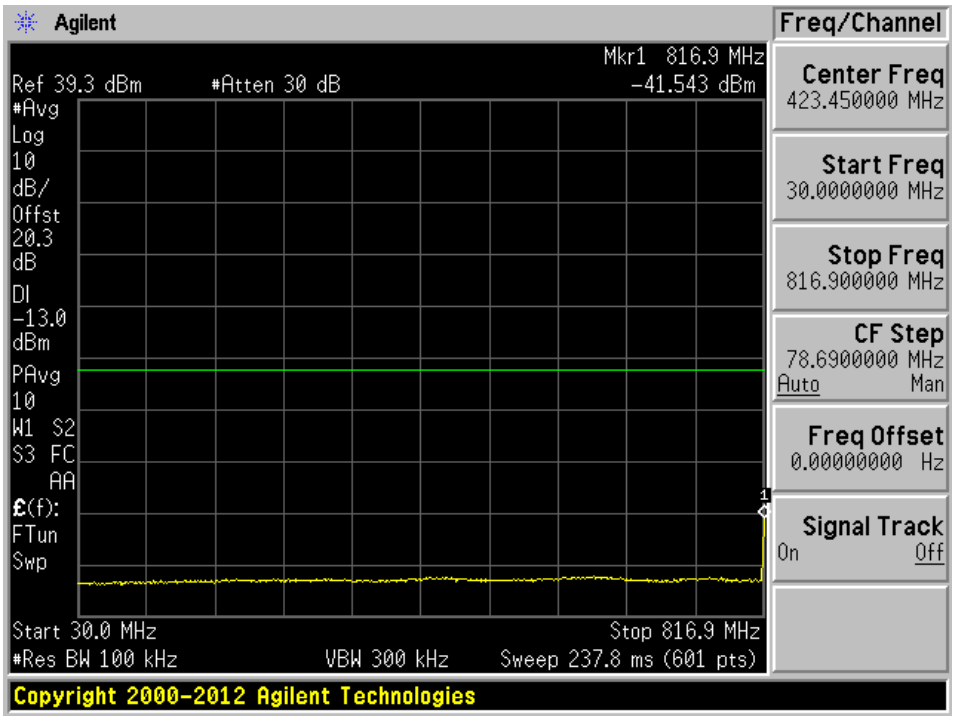


900 MHz – 9 GHz

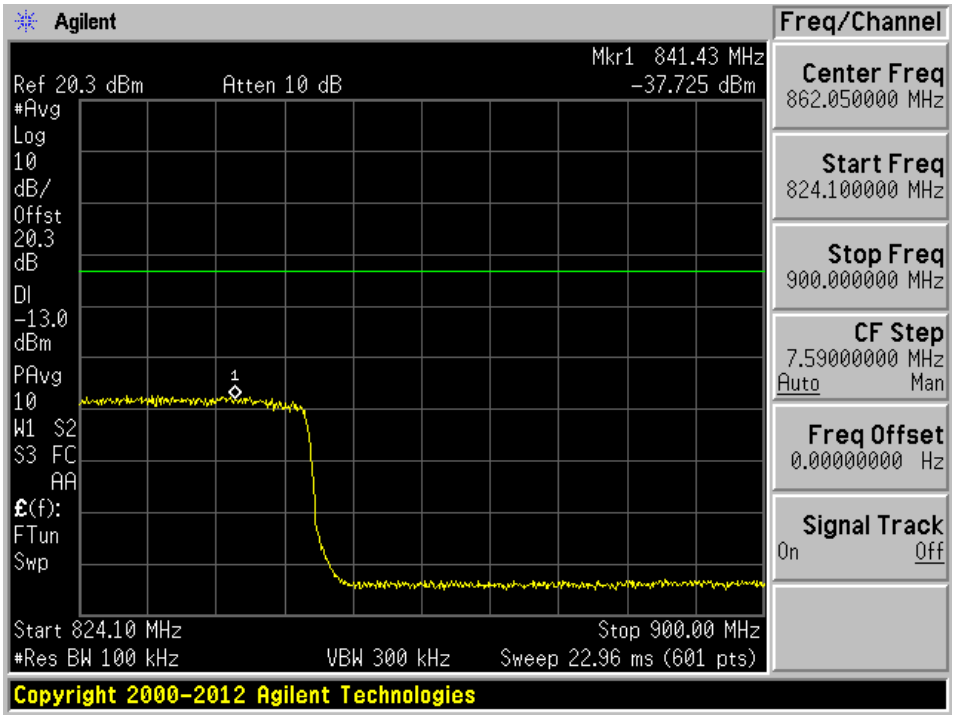


Middle Channel

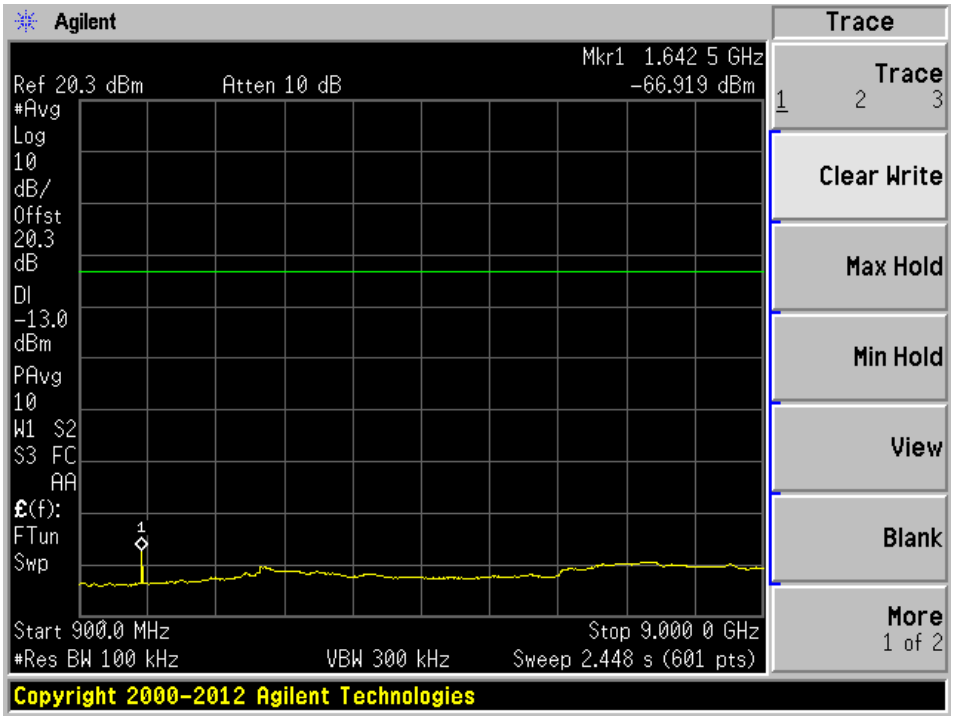
30 MHz- 816.9 MHz



824.1 MHz-900 MHz

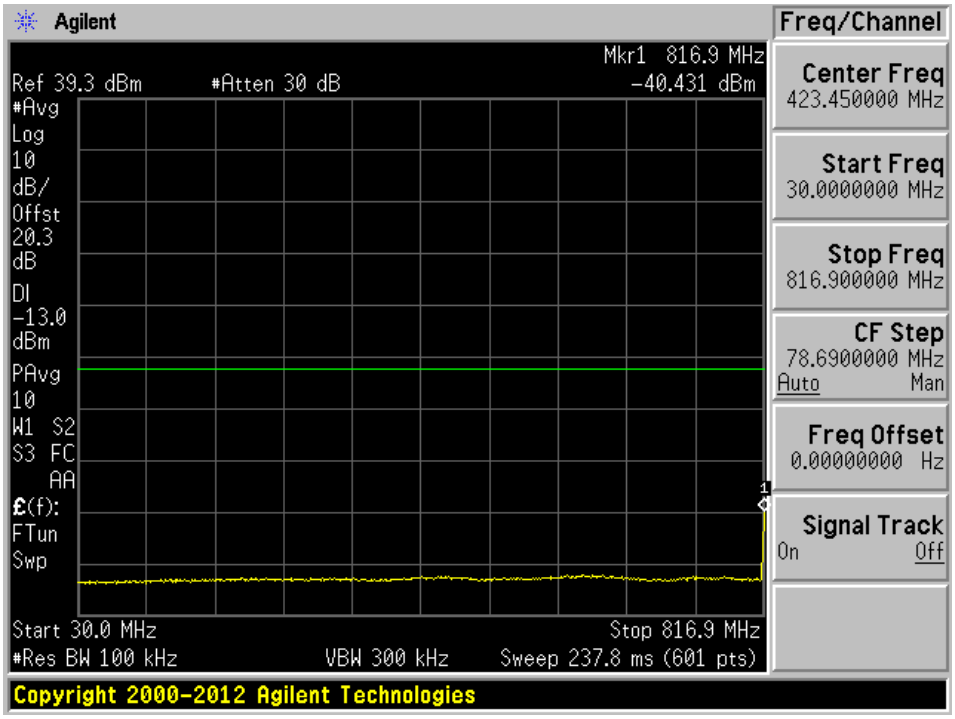


900 MHz-9 GHz

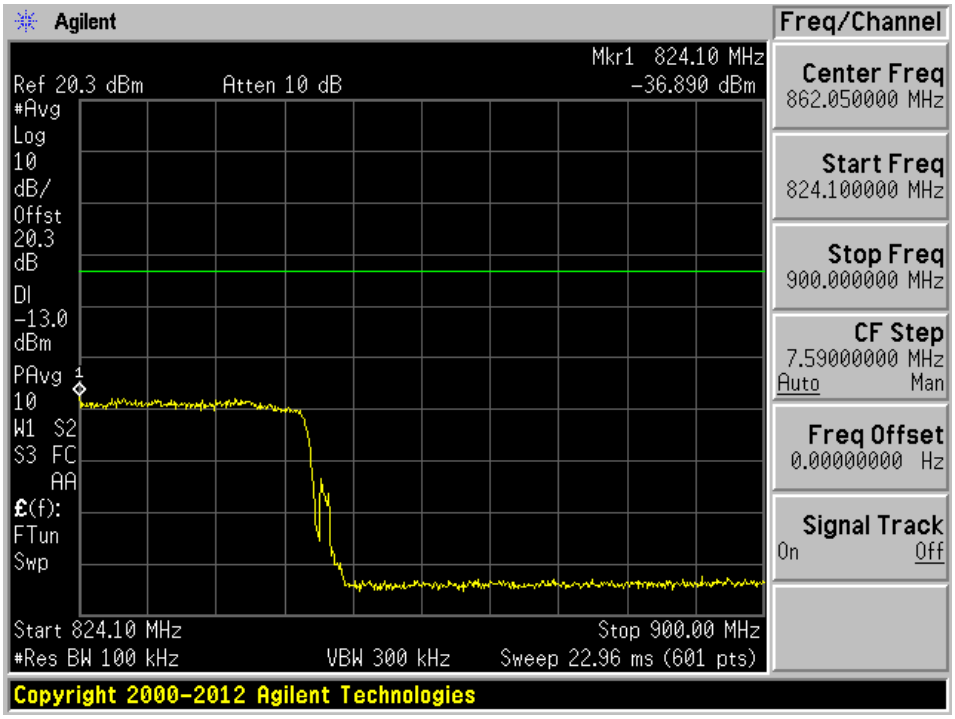


High Channel

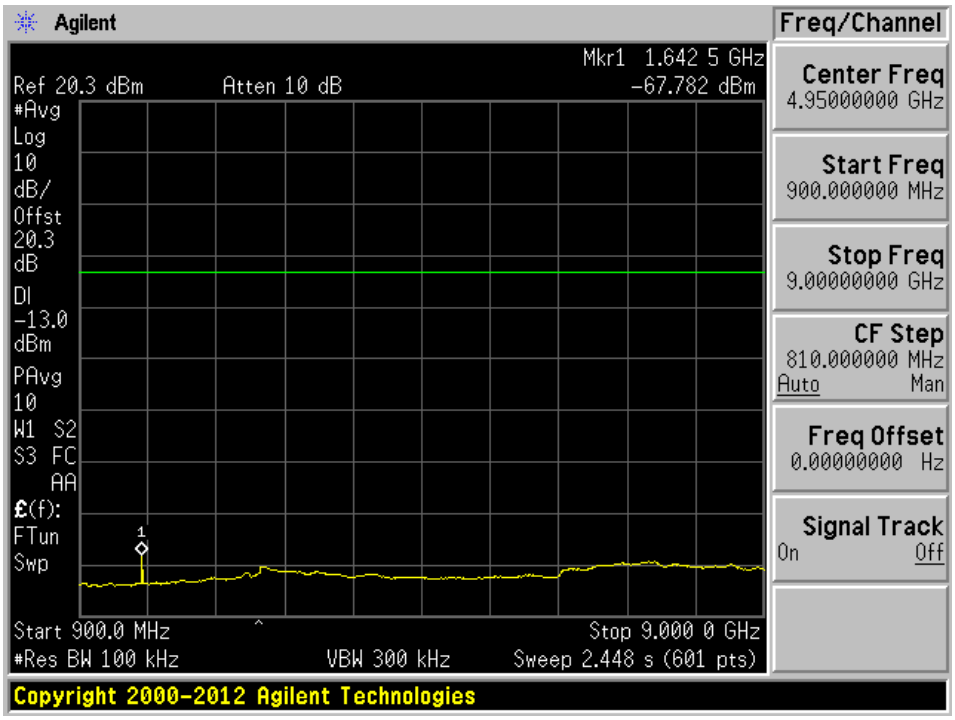
30 MHz- 816.9 MHz



824.1 MHz-900 MHz



900 MHz-9 GHz



8 FCC §2.1051 & §90.219(e) – Band Edge & Intermodulation

8.1 Applicable Standard

According to FCC §90.219 (e), spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

8.2 Test Procedure

The signal generator was connected to the support equipment and the support equipment was connected to the EUT through a fiber cable. The output of the EUT was connected to a spectrum analyser through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C0003	Each Time[1]	Each Time[1]
-	SMA cable	-	C0006	Each Time[1]	Each Time[1]

[1]*Note: This equipment was calibrated for each test.*

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

8.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	32 %
ATM Pressure:	101.3 kPa

The testing was performed by Jose Martinez on 2016-09-13 in the RF Site.

8.5 Test Results

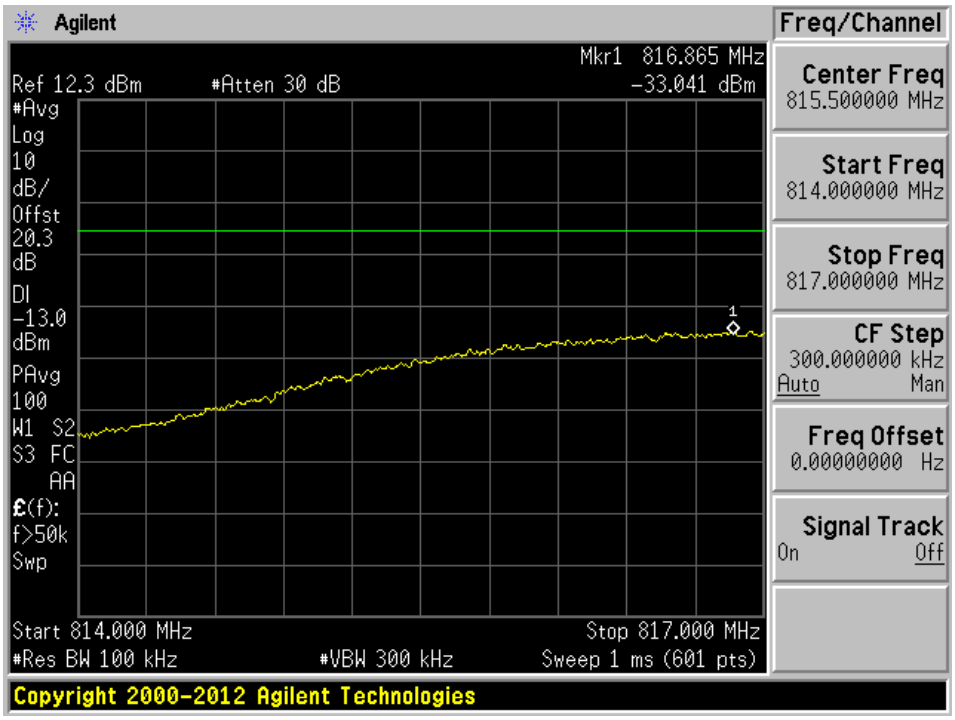
Please refer to the following plots.

Band Edge

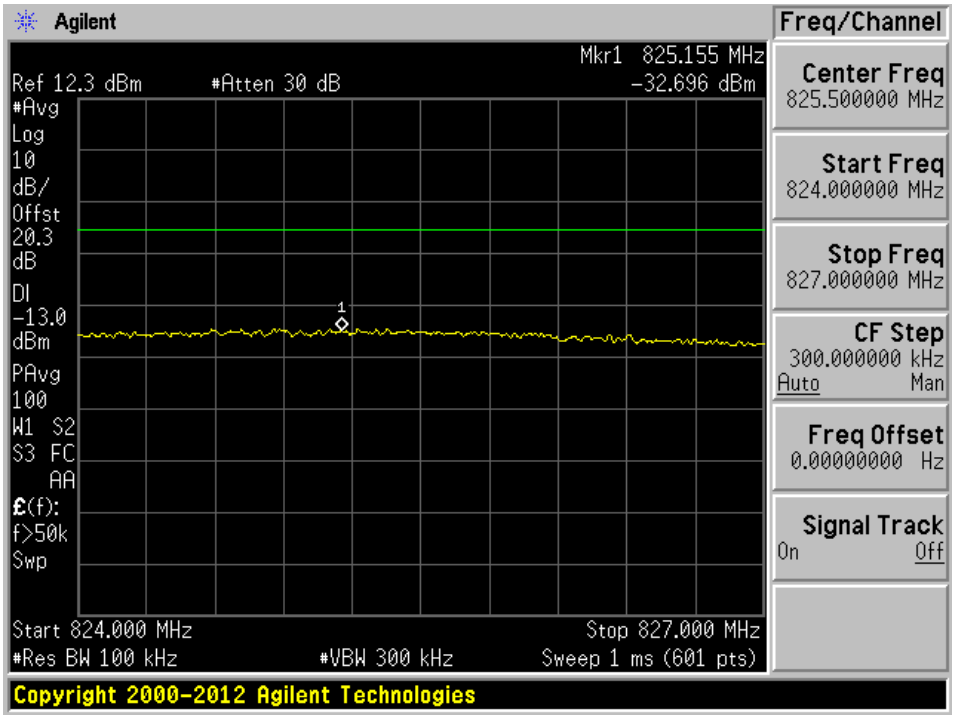
Broadband Signal

AGC Off

Lower Band Edge

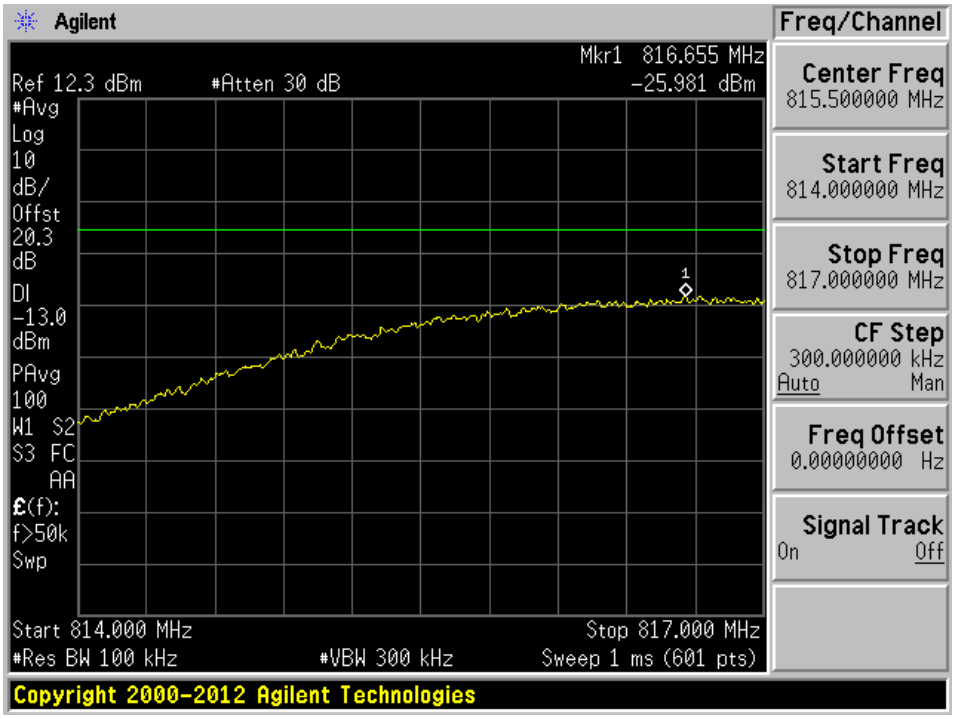


Upper Band Edge

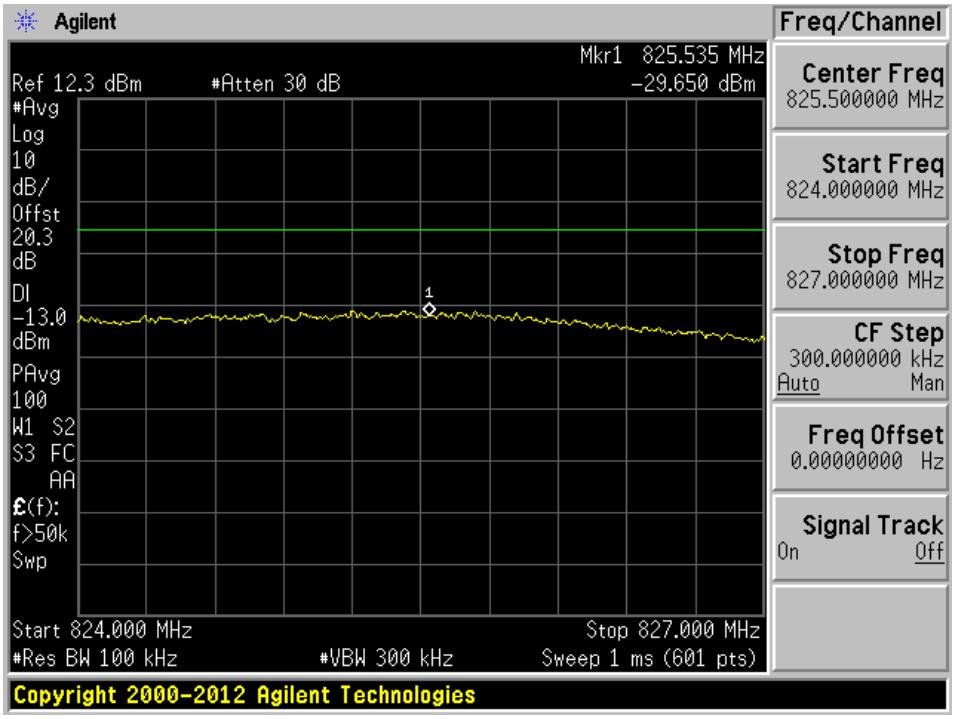


AGC On

Lower Band Edge



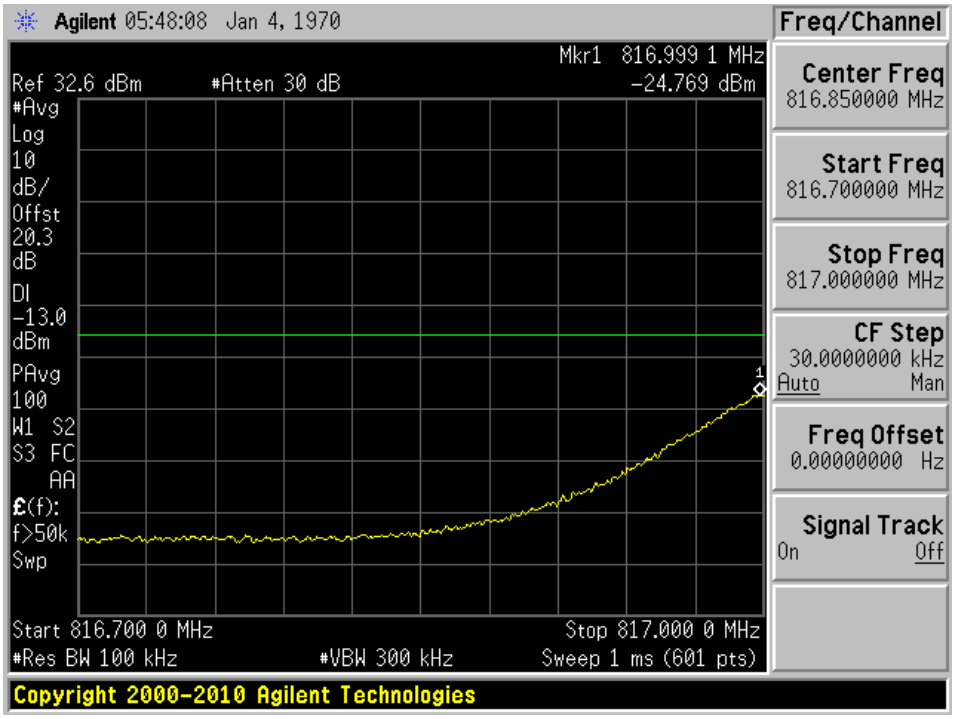
Upper Band Edge



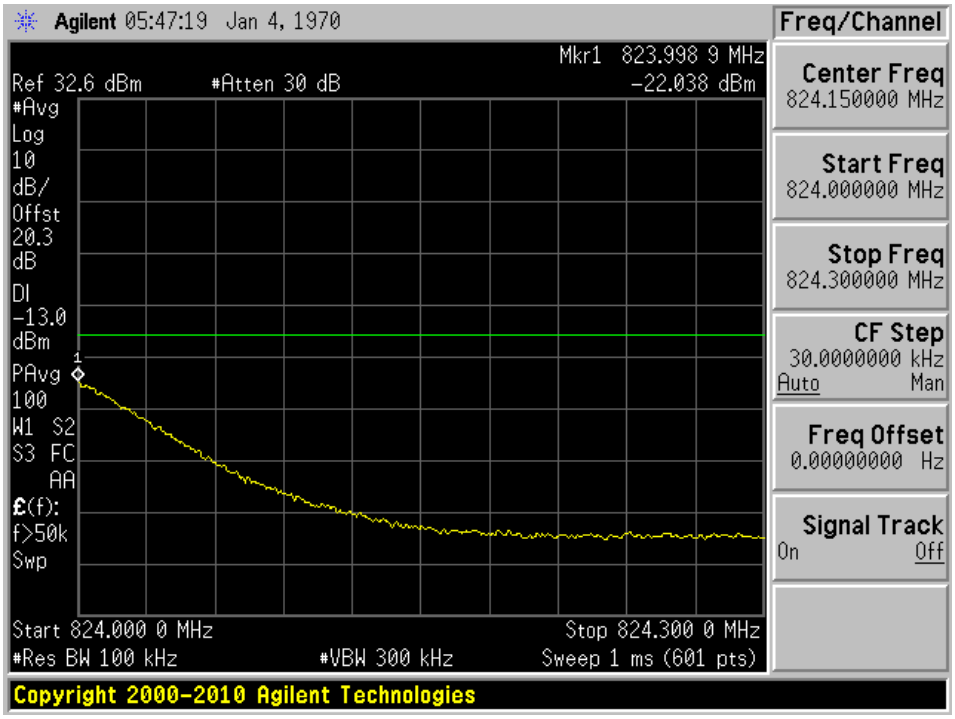
Narrowband Signal

AGC Off

Lower Band Edge

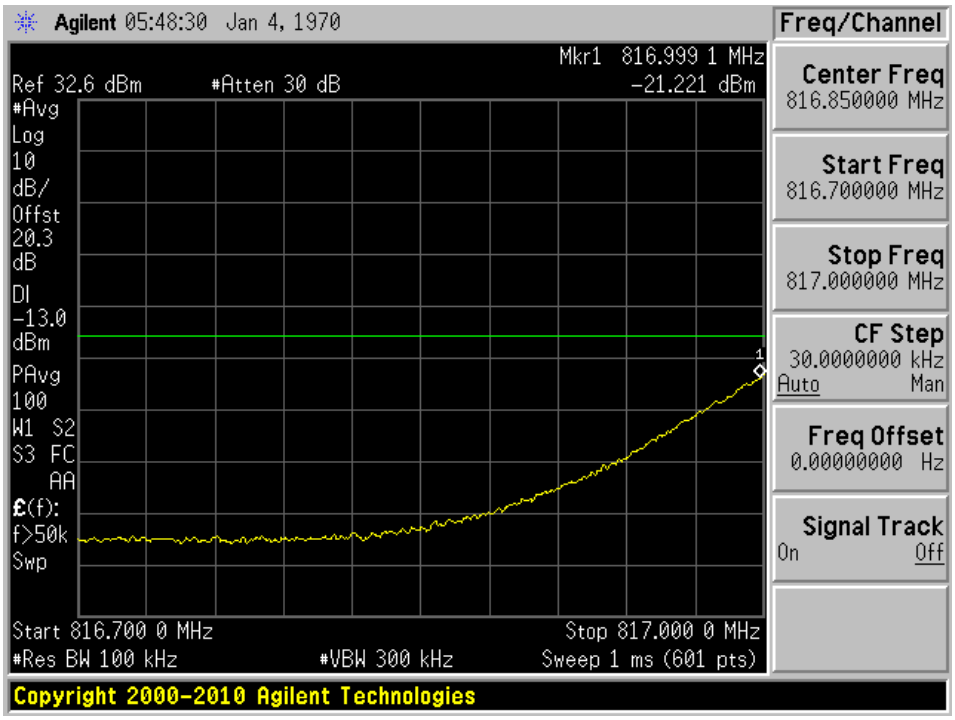


Upper Band Edge

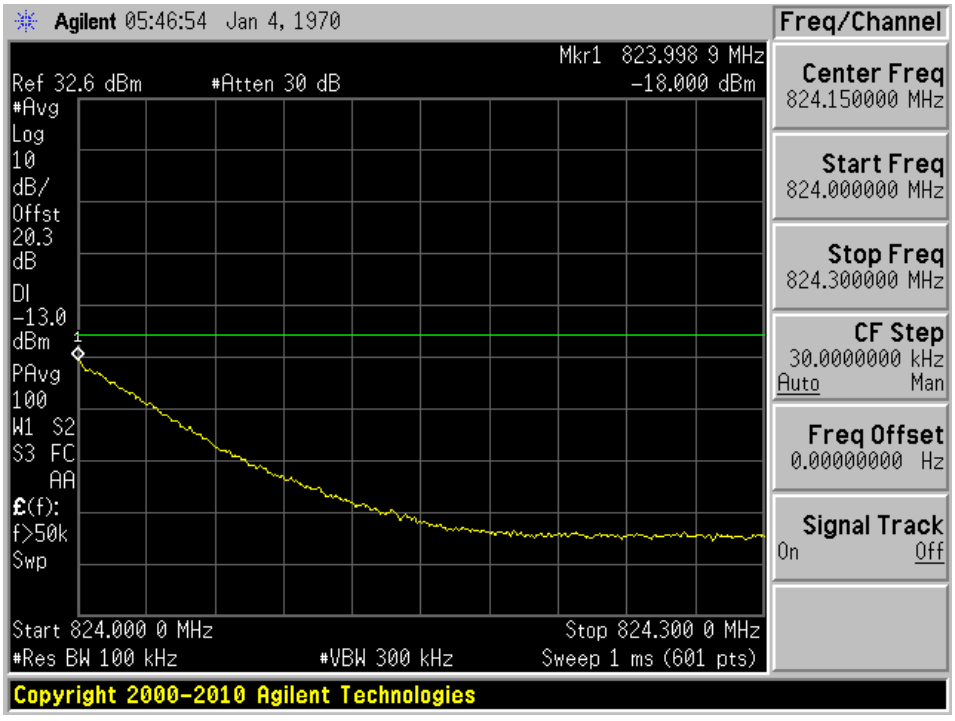


AGC On

Lower Band Edge



Upper Band Edge

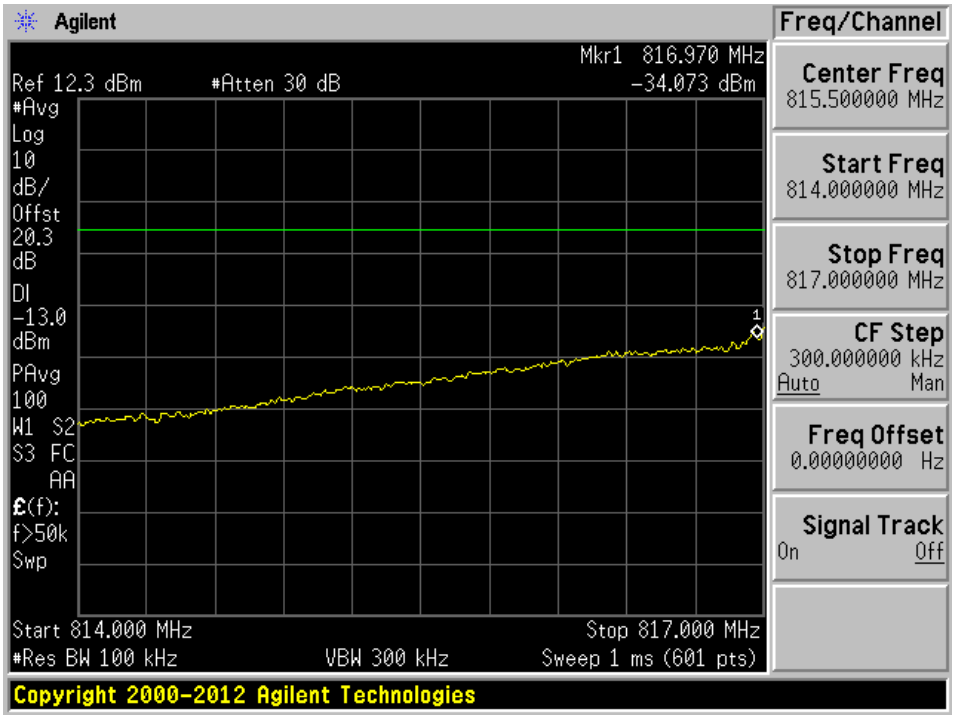


Intermodulation

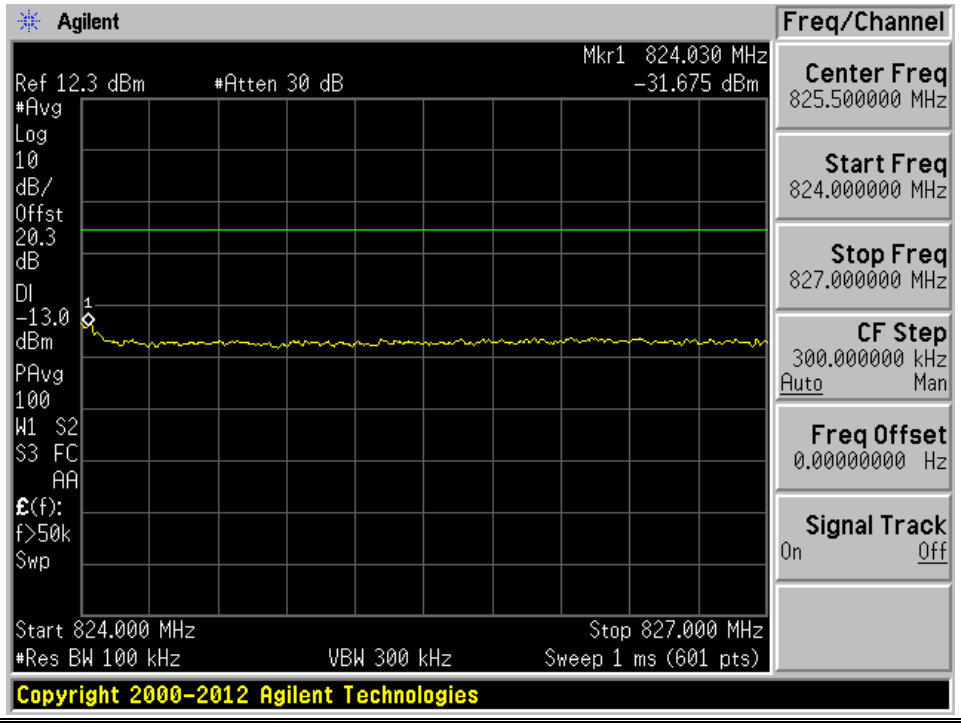
Broadband Signal

AGC Off

Lower Band Edge

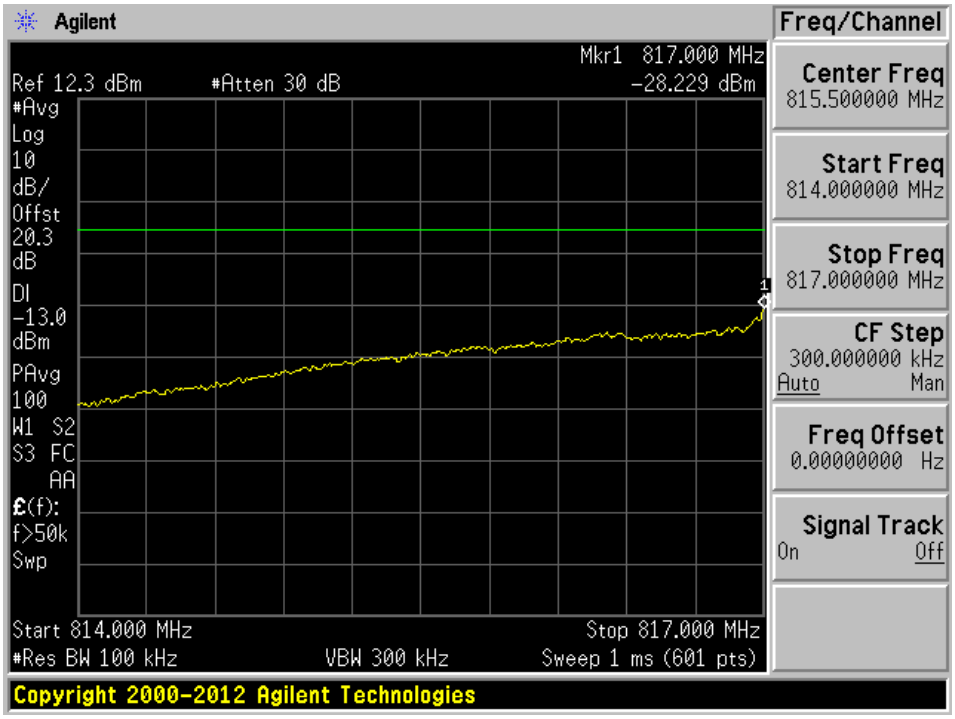


Upper Band Edge

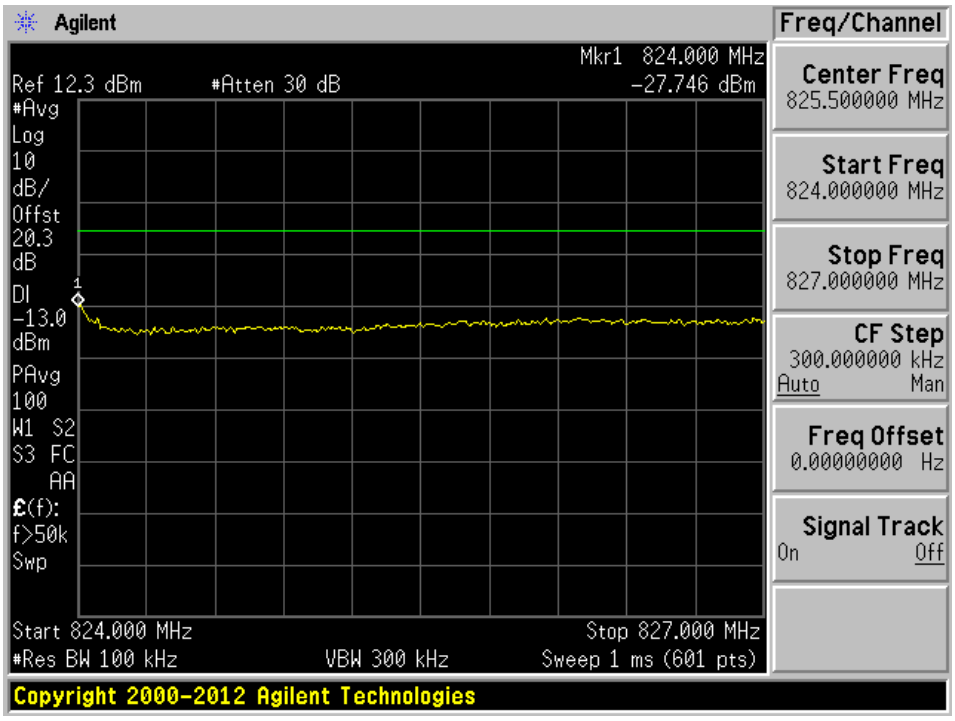


AGC On

Lower Band Edge



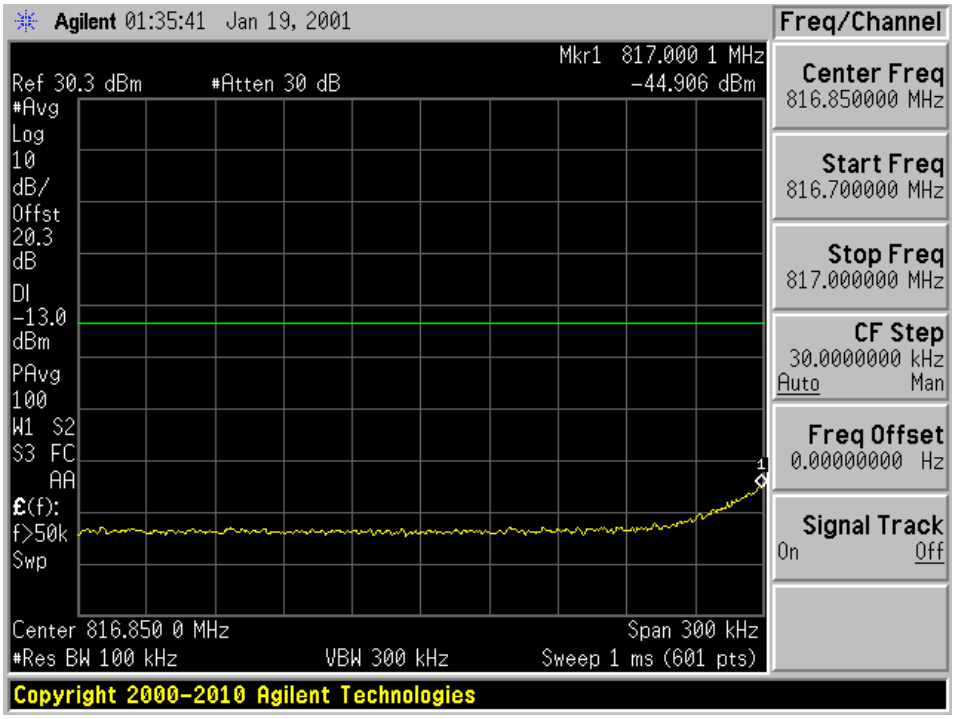
Upper Band Edge



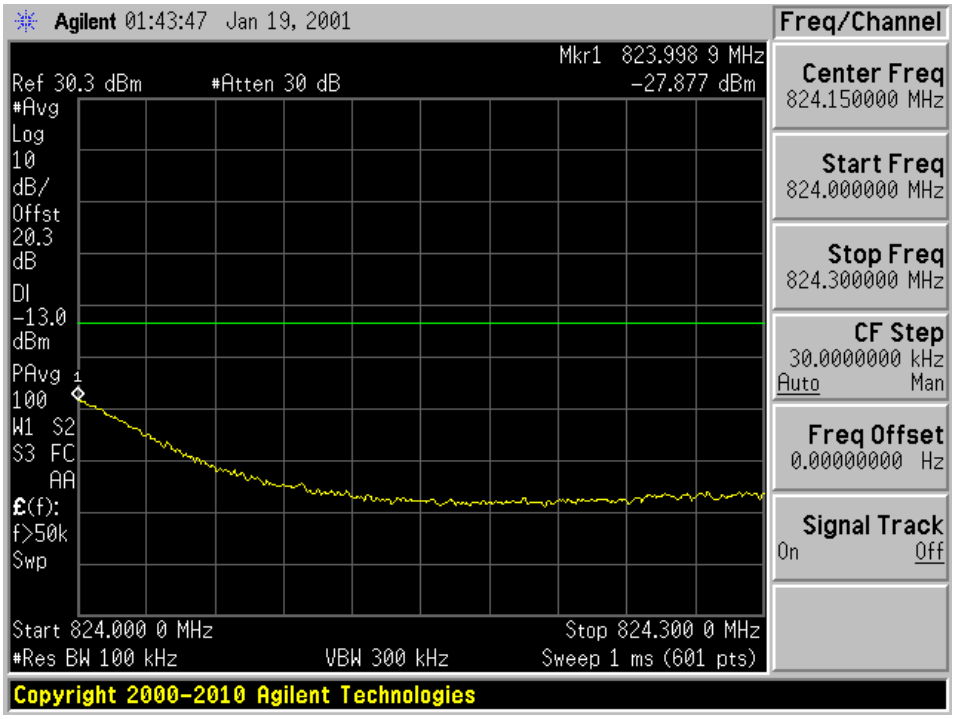
Narrowband Signal

AGC Off

Lower Band Edge

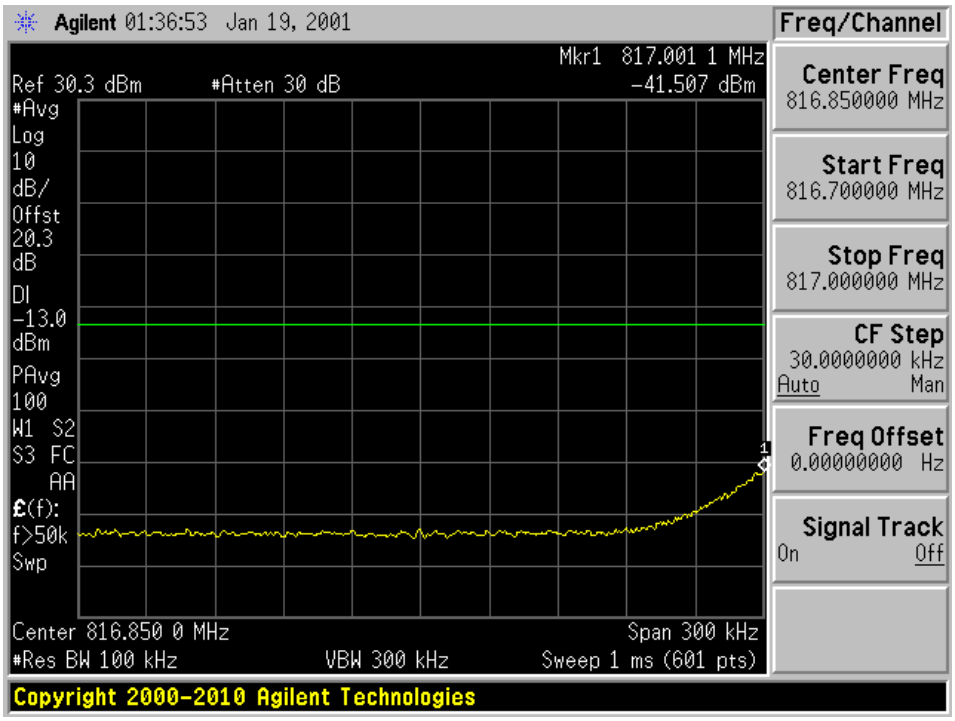


Upper Band Edge

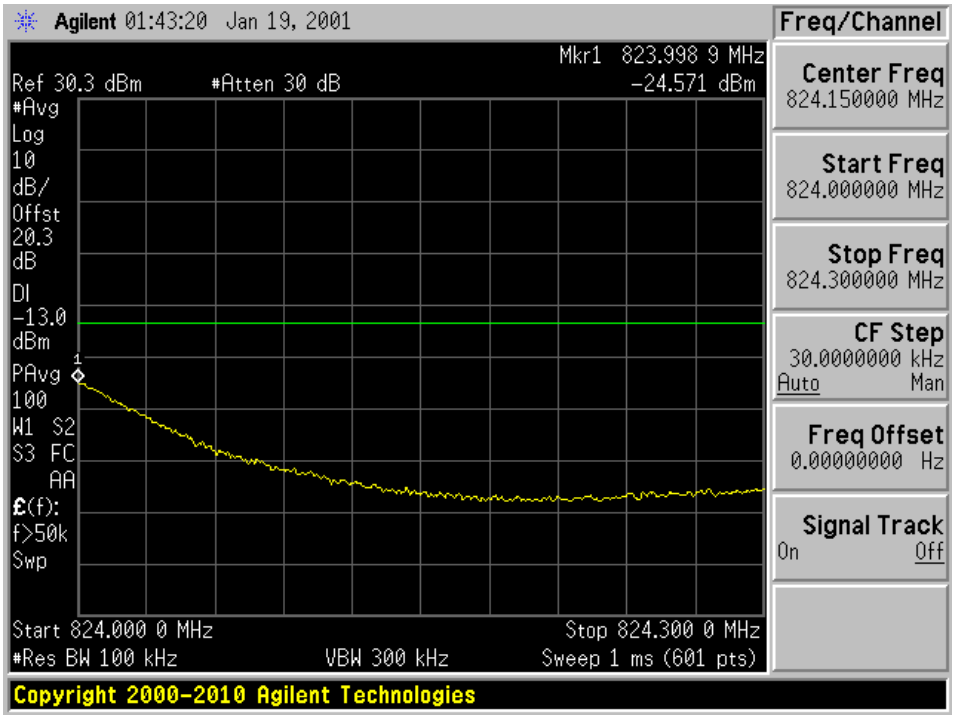


AGC On

Lower Band Edge



Upper Band Edge



9 FCC §2.1053 & §90.219(e) – Field Strength of Spurious Radiation

9.1 Applicable Standard

According to FCC §90.219 (e), spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

9.2 Test Procedure

The transmitter was place onto a Styrofoam block. The unit was normally transmitting with a 50 ohm terminator connected to the antenna terminal.

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.

Emissions were investigated up to the tenth harmonic of the fundamental frequency.

After the emissions were found, the EUT was removed and replaced by a substituting antenna. A signal generator was connected to the substituting antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2016-03-23	1 year
HP/ Agilant	Pre Amplifier	8449B OPT HO2	3008A0113	2016-05-23	1year
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 years
A.R.A.	Antenna, Horn	DRG-118/A	1132	2015-09-21	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1/2/3/4	2014-11-03	2 years
-	N-Type Cable	-	C00013	2016-04-28	1 year
-	N-Type Cable	-	C00014	2016-05-28	1 year
-	SMA cable	-	C0003	Each Time[1]	Each Time[1]
-	SMA cable	-	C0006	Each Time[1]	Each Time[1]

[1]*Note: This equipment was calibrated for each test.*

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

9.4 Test Environmental Conditions

Temperature:	20-21°C
Relative Humidity:	47-49 %
ATM Pressure:	101.4-101.6 kPa

The testing was performed by Jose Martinez 2016-10-04 in 5 Meter Chamber 3.

9.5 Test Results

Worst Margin: **-8.13 dB** at **60 MHz** in the **Vertical** polarization.

Please see following table for detailed results.

Uplink: 817-824 MHz

Carrier Wave Signal

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)		
Middle Channel											
60	62.27	0	300	H	60	-27.57	0.000	0.38	-27.95	-13	-14.95
60	64.92	55	277	V	60	-20.75	0.000	0.38	-21.13	-13	-8.13
80	55.77	325	210	H	80	-34.07	0.000	0.33	-34.4	-13	-21.40
80	56.76	120	100	V	80	-28.91	0.000	0.33	-29.24	-13	-16.24
1641	32.65	0	100	H	1641	-41.92	8.895	0.49	-33.515	-13	-20.52
1641	32.8	0	100	V	1641	-41.89	8.913	0.49	-33.467	-13	-20.47
2461.5	33.6	0	100	H	2461.5	-36.61	9.144	0.60	-28.066	-13	-15.07
2461.5	33.97	0	100	V	2461.5	-36.1	9.113	0.60	-27.587	-13	-14.59

10 FCC §20.21 – Out of Band Rejection

10.1 Applicable Standard

According to FCC Part 20.21, a frequency selective booster shall have −20 dB at the band edge referenced to the gain in the center of the pass band of the booster, where band edge is the end of the licensee's allocated spectrum.

10.2 Test Procedure

The signal generator was connected to the support equipment and the support equipment was connected to the EUT through a fiber cable. The output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The span of the spectrum analyzer was set to be wide enough in order to capture the spectrum of entire operating band.

10.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C0003	Each Time[1]	Each Time[1]
-	SMA cable	-	C0006	Each Time[1]	Each Time[1]

[1]*Note: This equipment was calibrated for each test.*

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

10.4 Test Environmental Conditions

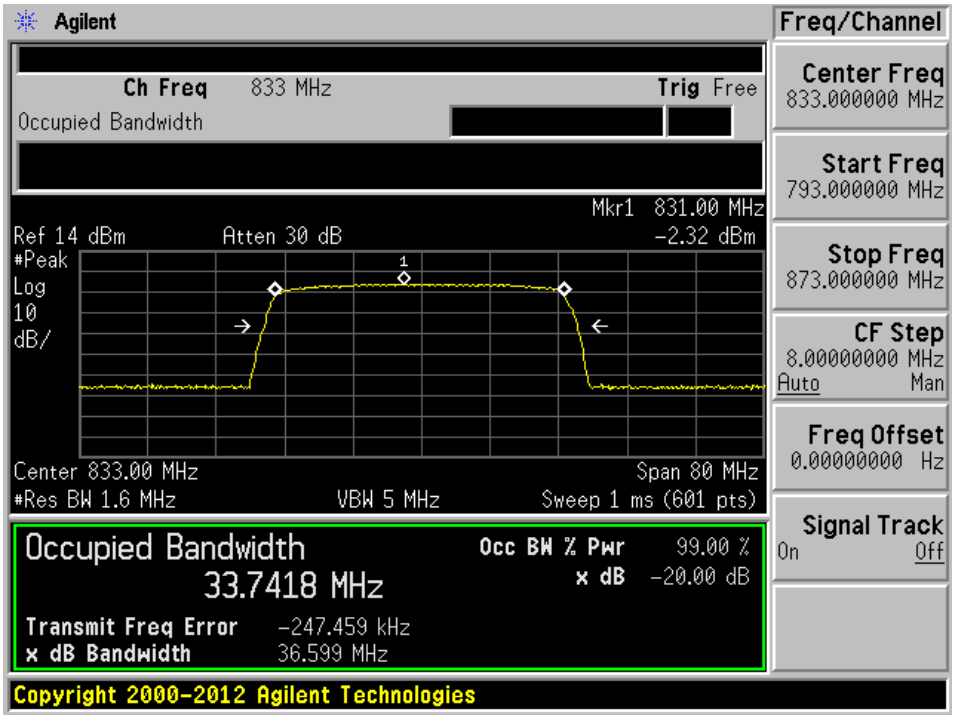
Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.3 kPa

The testing was performed by Jose Martinez on 2016-09-08 in the RF Site.

10.5 Test Results

Please refer to the following plots.

Uplink: 817-849 MHz



Note: A single filter was used for the 817-824 MHz and the 824-849 MHz band.