FCC PART 90S

TEST AND MEASUREMENT REPORT

For

G-Way Mircowave

38 Leuning Street,

South Hackensack, NJ 07606, USA

FCC ID: Q8KPS82070M

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

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Report Number:	R1705094-90S
Report Date:	2017-10-18
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1705094-90S	Original Report	2017-10-18

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *G-Way Microwave* and their product model: BDA-PS9-20/20-70-M, FCC ID: Q8KPS82070M, which will henceforth be referred to as the EUT (Equipment under Test). The EUT is a Class B Industrial Signal Booster. The operating frequency range is shown below,

Model Number	Downlink	Uplink	Equipment Class
BDA-PS7W-20/20-70-M	758-775 MHz	788-805 MHz	B9B*
BDA-PS8NEPS-20/20-70-M	851-861 MHz	806-816 MHz	B9B*
BDA-PS9-20/20-70-M	935-940 MHz	896-901 MHz	B9B* & B2I
	940-941 MHz	901-902 MHz	B2I*

**measurements for these operating frequencies were reported in separate Test Reports. Please refer to Section 1.4 of this Test Report for details.*

1.2 Mechanical Description

The EUT measured approximately 25.4 cm (L) x 15.75 cm (W) x 7.62 cm (H) and weighs 2.08 kg.

The test data gathered are from production sample. Serial number: 17051003 provided 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 90 of the Federal Communication Commissions rules.

The objective was to determine compliance with FCC rules for Effective Radiated Power (e.r.p), Occupied Bandwidth, Band edge & Intermodulation, Spurious Emissions at Antenna Terminals, Field Strength of Spurious Radiation, Out of Band Rejection and RF Exposure.

1.4 Related Submittal(s)/Grant(s)

FCC Part 90 Report: R1705094-90 for Equipment Class B9B.
FCC Part 24D Report: R1705094-24D for Equipment Class B2I.

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 Indus Booster Basic Meas 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 ° C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.7 Test Facility

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 3279.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Clause 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***

- - 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 3279.01)*** 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/EU US-EU EMC & Telecom MRA CAB (NB)
    - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
    - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
    - Low Voltage Directive (LVD) 2014/35/EU
- 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;
    - Nationally Recognized Test Laboratory (NRTL) – US OSHA

Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to KDB 935210 D05 V01r01. The final qualification test was performed with the EUT operating at normal mode.

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 Local Support Equipment

None

2.5 Power Supply and Line Filters

Manufacturers	Descriptions	Models	Serial Numbers
-	-	TRH25150-A-12E03 VI	-

2.6 External I/O Cabling List and Details

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

3 Summary of Test Results

FCC Rules	Description of Tests	Results
FCC §2.1091	RF Exposure	Compliant
§90.219(e)(1)	Effective Radiated Power (e.r.p)	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
§90.219	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

Downlink 935-940 MHz

Maximum peak output power at antenna input terminal (dBm):	20.85
Maximum peak output power at antenna input terminal (mW):	121.62
Prediction distance (cm):	20
Prediction frequency (MHz):	937.5
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.58
Power density of prediction frequency and distance (mW/cm^2):	0.0383
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.625

Uplink 896-901 MHz

Maximum peak output power at antenna input terminal (dBm):	21.02
Maximum peak output power at antenna input terminal (mW):	126.47
Prediction distance (cm):	20
Prediction frequency (MHz):	898.5
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.58
Power density at prediction frequency and distance (mW/cm^2):	0.0399
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.599

4.3 Conclusion

The device complies with the MPE requirements by providing a safe separation distance of at least 20 cm between the antenna with maximum gain, including any radiating structure, and any persons when normally operated.

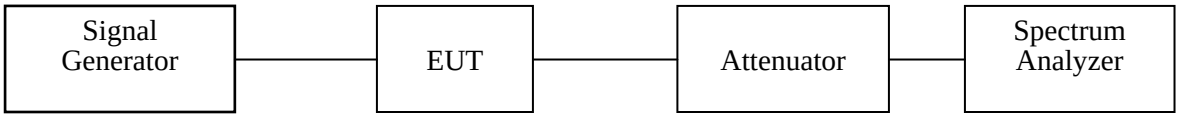
5 FCC §2.1046 & §90.219(e) - RF Output Power

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 output was connected to the EUT input. 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	US45303156	2017-02-24	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C04	Each Time[1]	Each Time[1]
-	SMA cable	-	C09	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 2017-06-07 in the RF Site.

5.5 Test Results

Downlink 935-940 MHz

Signal Type	AGC	Input Power (dBm)	Conducted Output Power (dBm)	Booster Gain (dB)	Antenna Gain (dBi)	Output ERP (dBm)	Limit (dBm)	Results
Broadband	Off	-52.56	19.90	72.46	2	19.75	37	Compliant
	On	-49.45	20.85	70.3	2	20.7	37	Compliant
Narrowband	Off	-52.57	19.83	72.4	2	19.68	37	Compliant
	On	-49.56	20.50	70.06	2	20.35	37	Compliant

Uplink 896-901 MHz

Signal Type	AGC	Input Power (dBm)	Conducted Output Power (dBm)	Booster Gain (dB)	Antenna Gain (dBi)	Output ERP (dBm)	Limit (dBm)	Results
Broadband	Off	-52.39	19.71	72.10	2	19.56	37	Compliant
	On	-49.36	21.02	70.38	2	20.87	37	Compliant
Narrowband	Off	-52.15	19.70	71.85	2	19.55	37	Compliant
	On	-49.54	20.51	70.05	2	20.36	37	Compliant

Note 1: ERP = Measured Conducted Output Power (dBm) + Antenna Gain (dBi) -2.15 (dB)
Note 2: 5 Watts = 37 dBm

6 FCC §2.1049 - Occupied Bandwidth

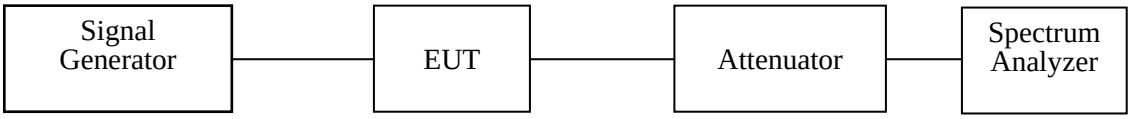
6.1 Applicable Standard

Requirements: FCC §2.1049

6.2 Test Procedure

The signal generator output was connected to the EUT input. 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	US45303156	2017-02-24	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
-	10 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C04	Each Time[1]	Each Time[1]
-	SMA cable	-	C09	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 2017-06-07 in the RF Site.

6.5 Test Results

Please refer to the following tables and plots.

Downlink 935-940 MHz

Signal Type	AGC	Input	Output
		99 % OBW (kHz)	99 % OBW (kHz)
Broadband	off	4134.5	4119.0
	on	4122.2	4121.5
Narrowband	off	243.19	241.32
	on	243.72	242.11

Uplink 896-901 MHz

Signal Type	AGC	Input	Output
		99 % OBW (kHz)	99 % OBW (kHz)
Broadband	off	4127.5	4112.9
	on	4125.9	4121.0
Narrowband	off	242.36	242.45
	on	241.66	242.72

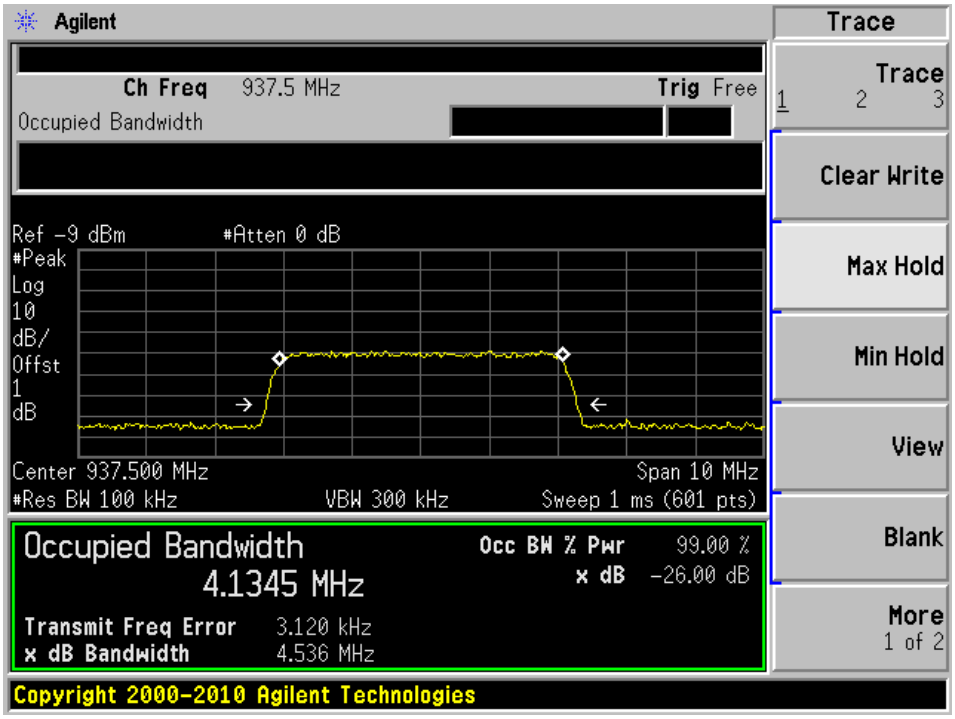
Note: The 99 % occupied bandwidth was used to compare the input and output signal.

Please refer to the following plots.

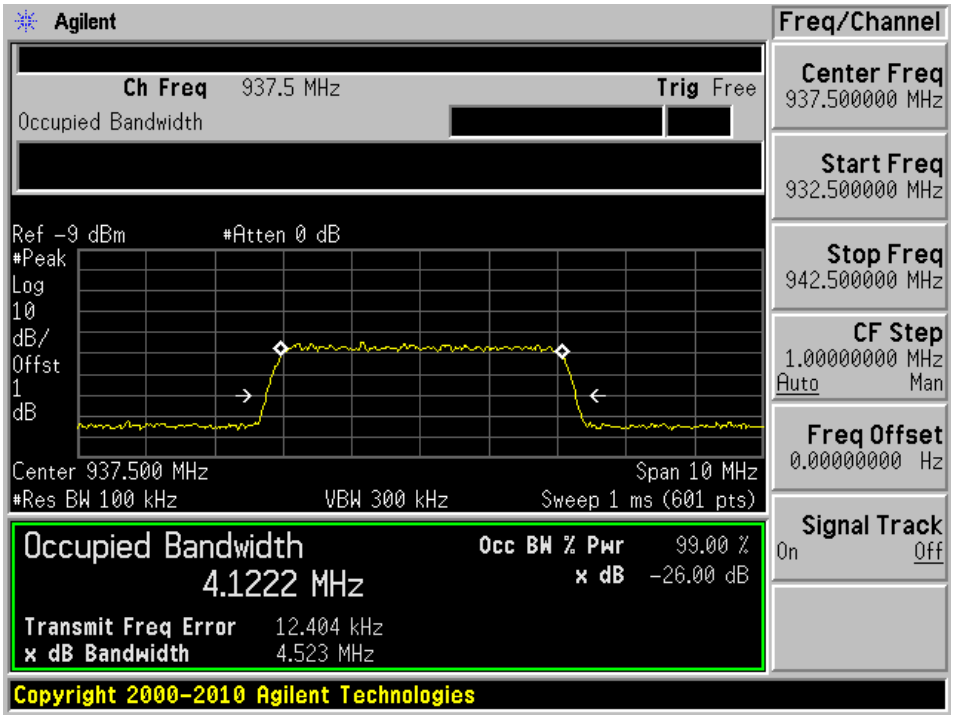
Downlink

Broadband

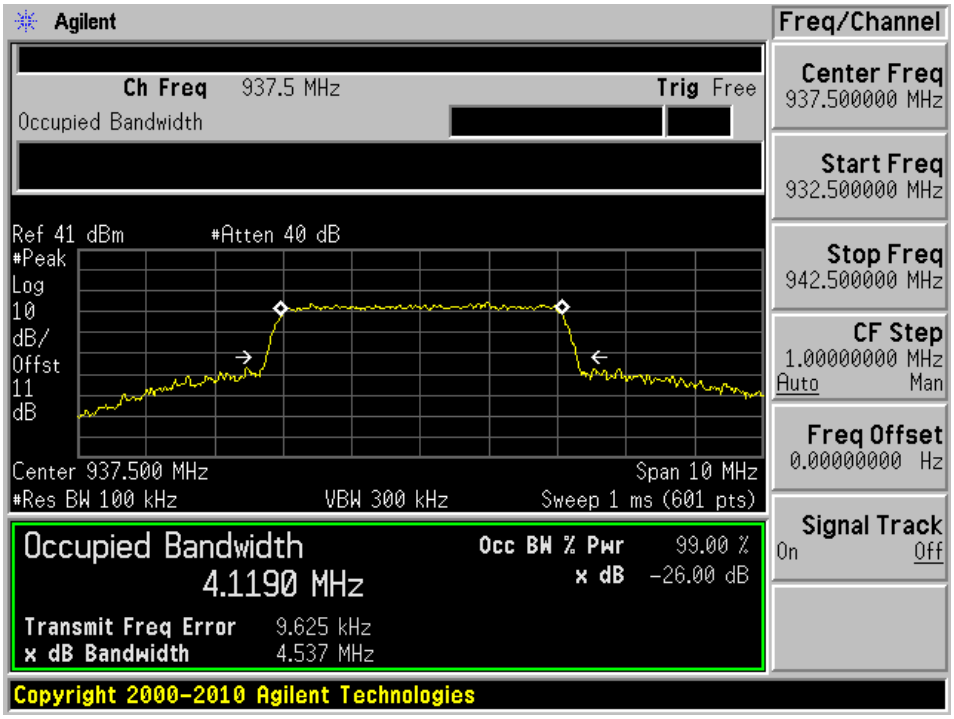
Input, AGC Off



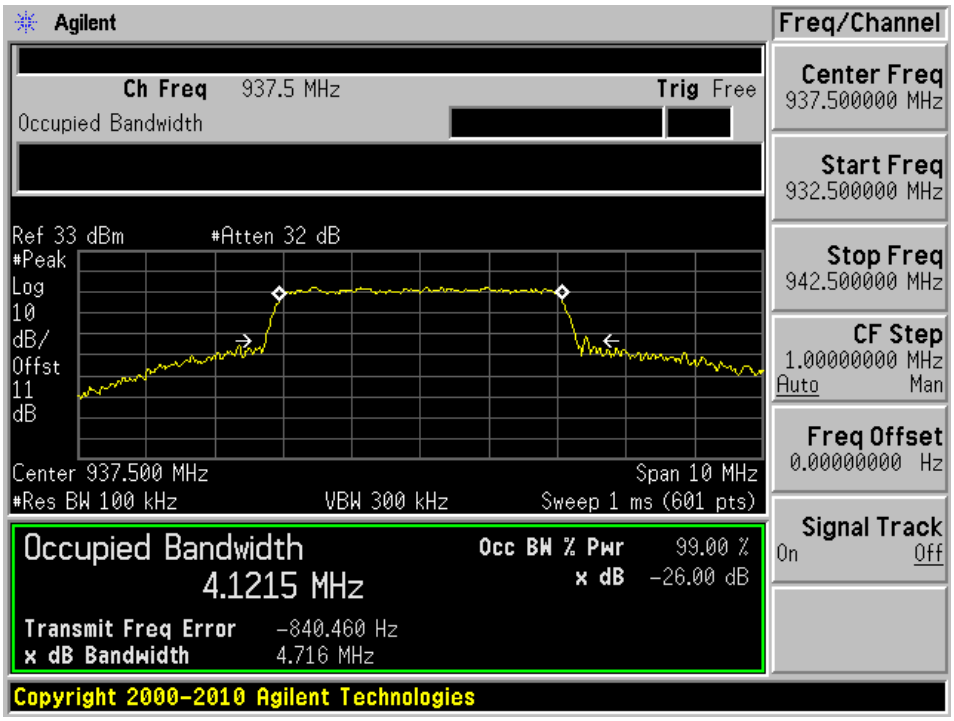
Input, AGC On



Output, AGC Off

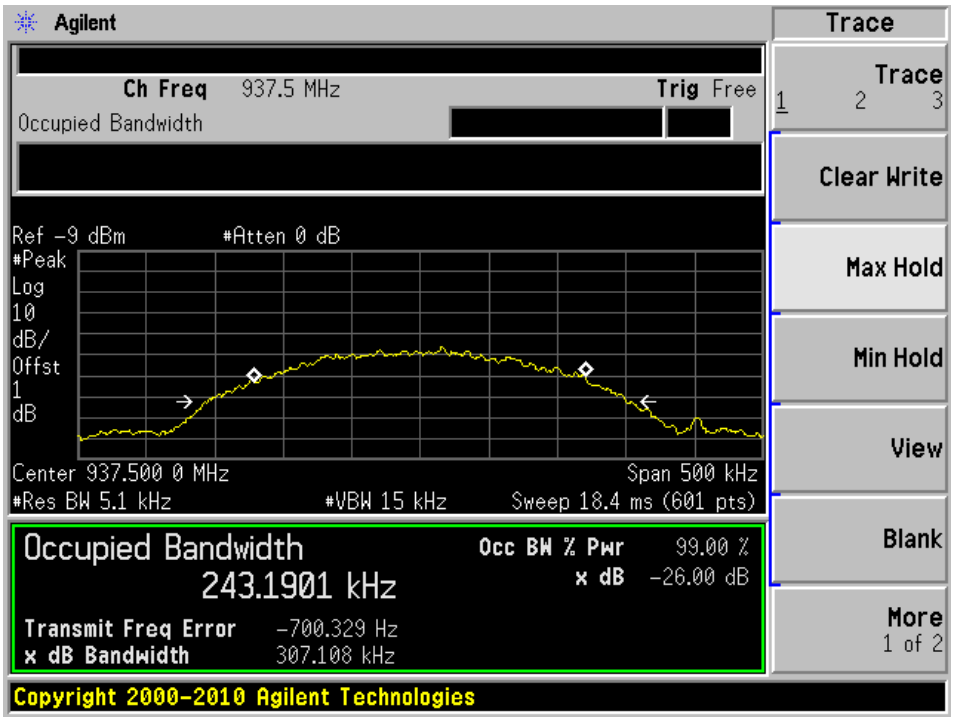


Output, AGC On

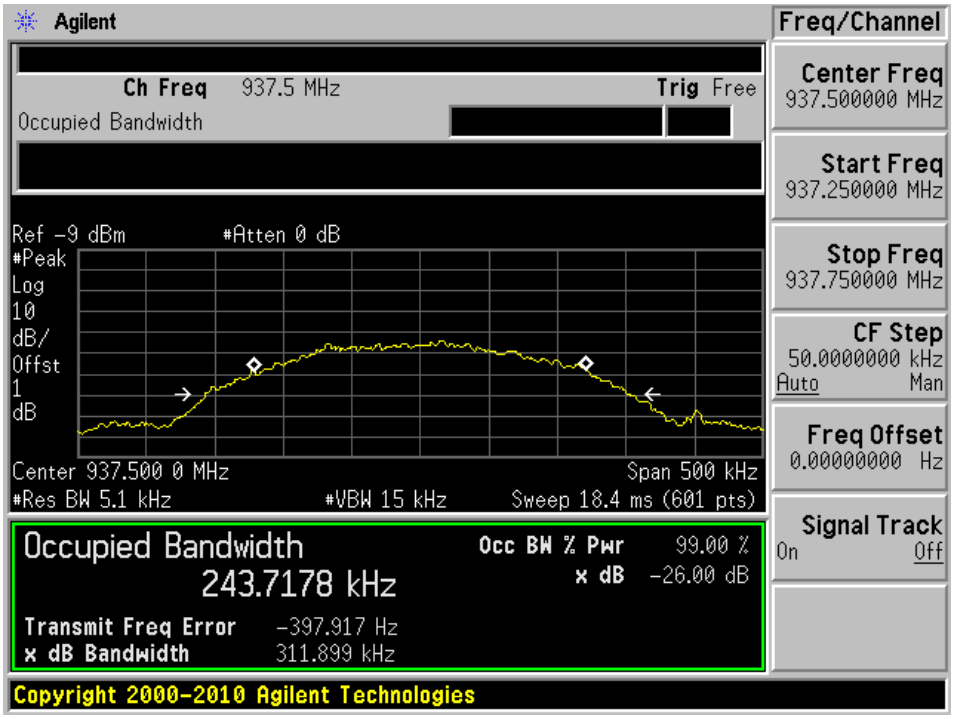


Narrowband

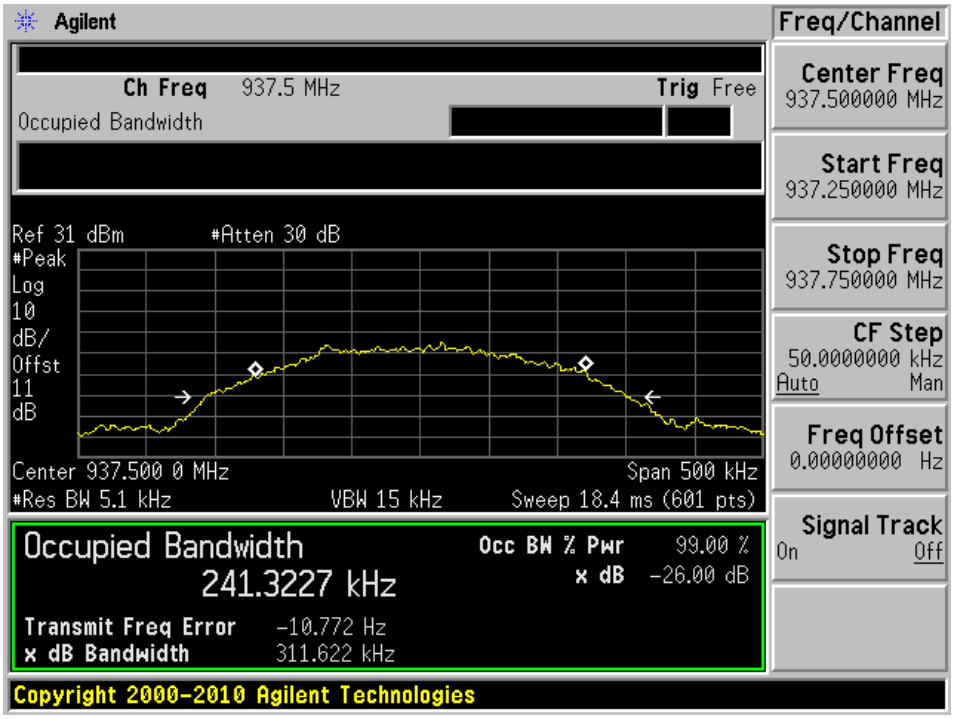
Input, AGC Off



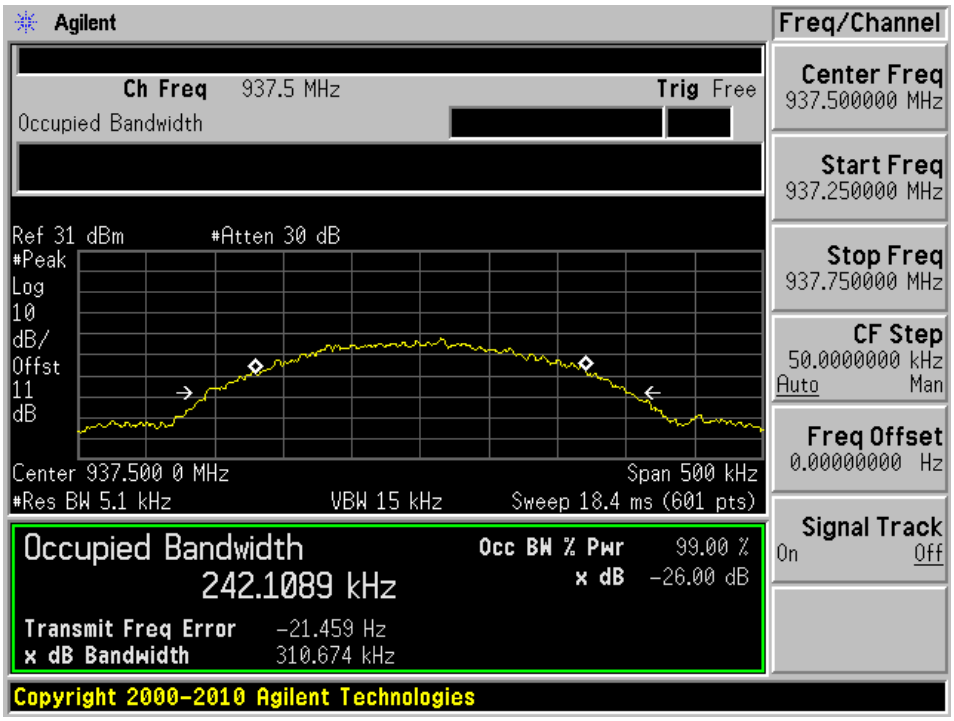
Input, AGC On



Output, AGC Off



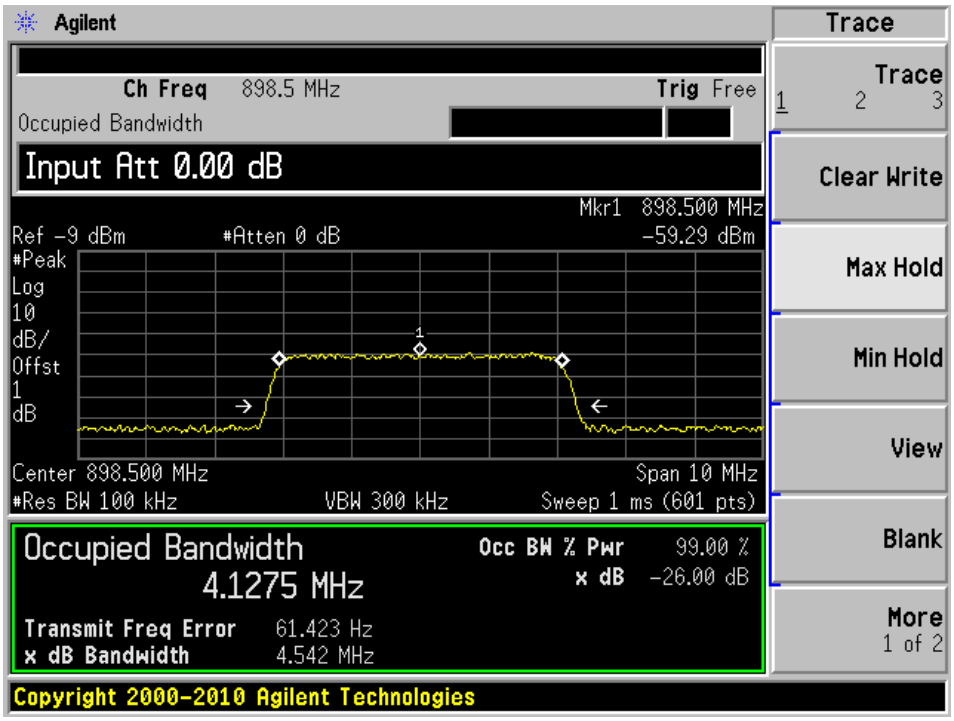
Output, AGC On



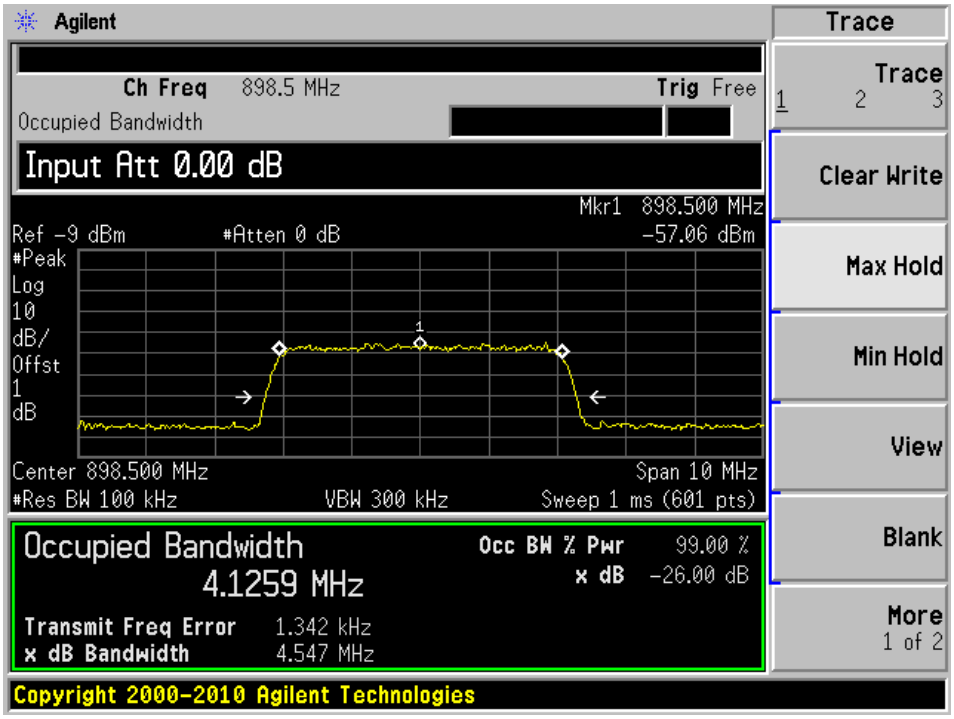
Uplink

Broadband

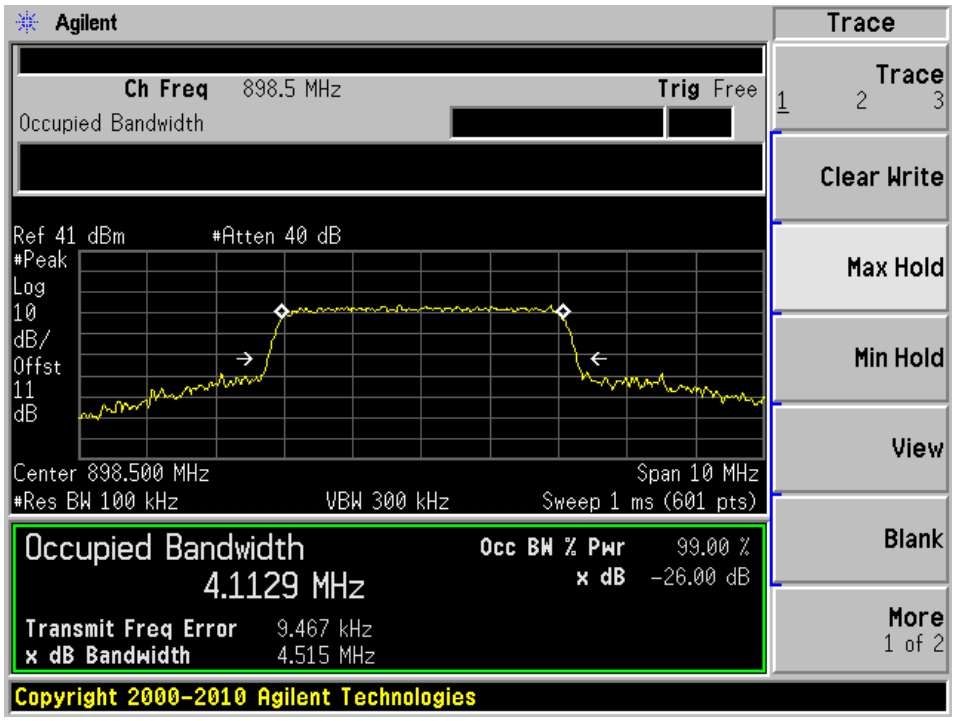
Input, AGC Off



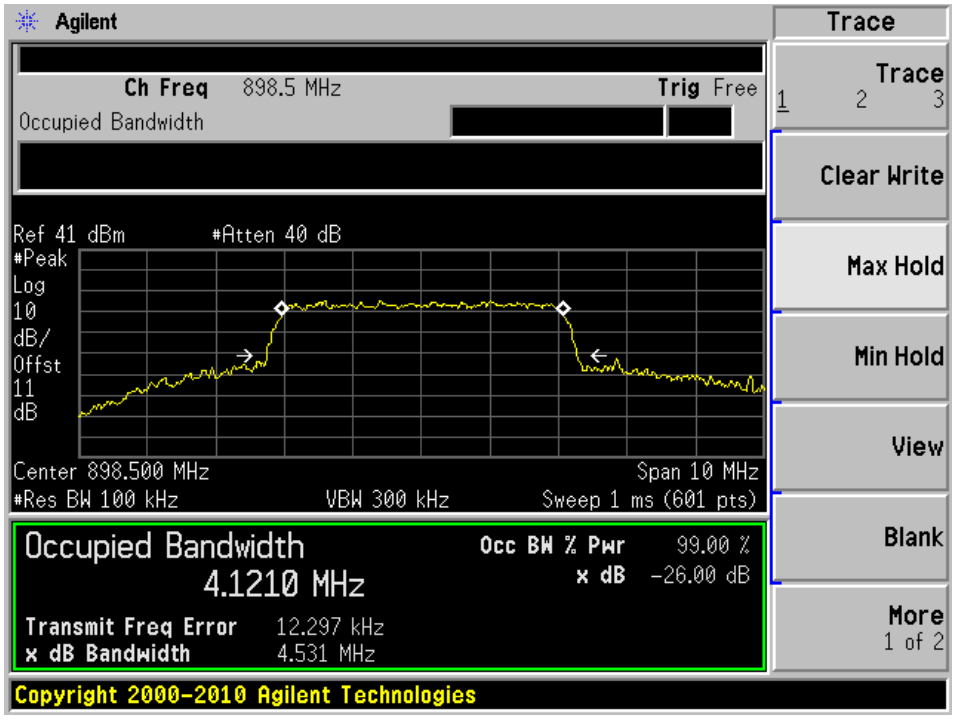
Input, AGC On



Output, AGC Off

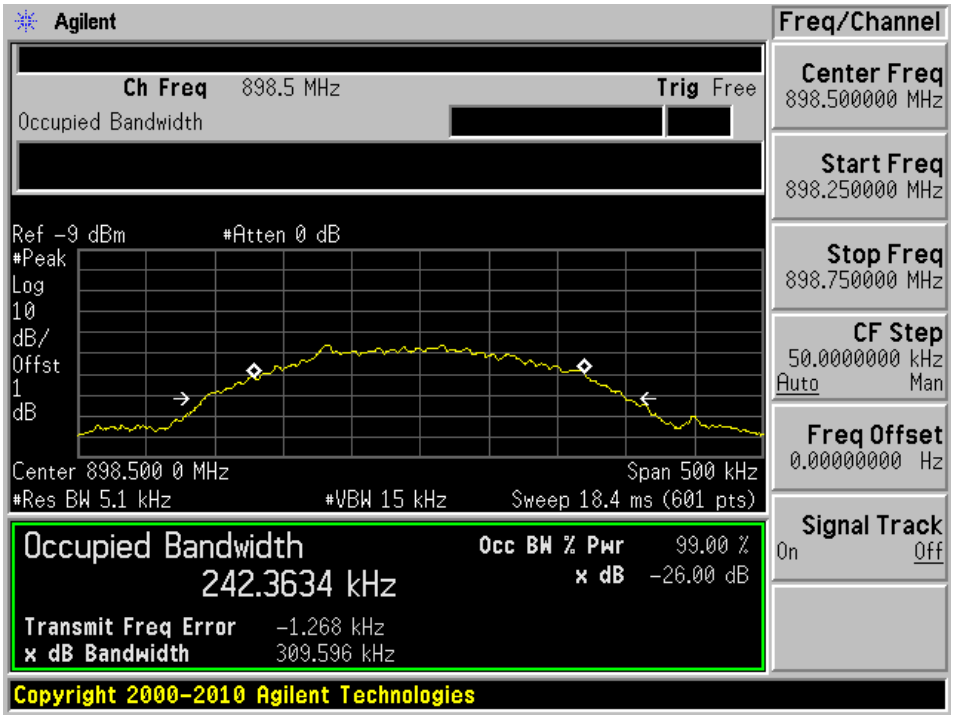


Output, AGC On

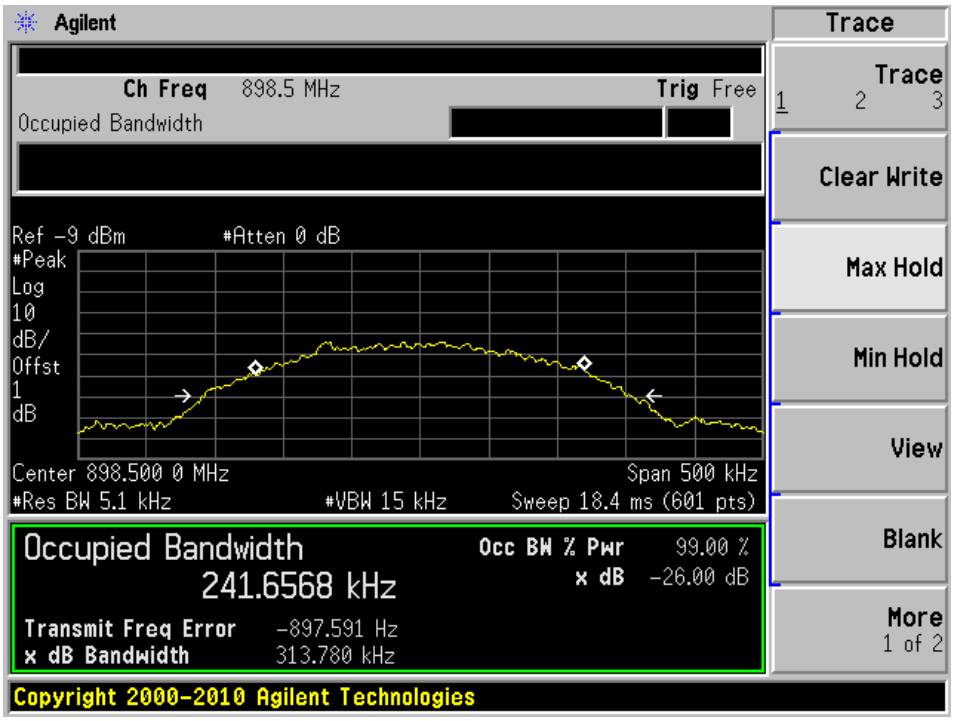


Narrowband

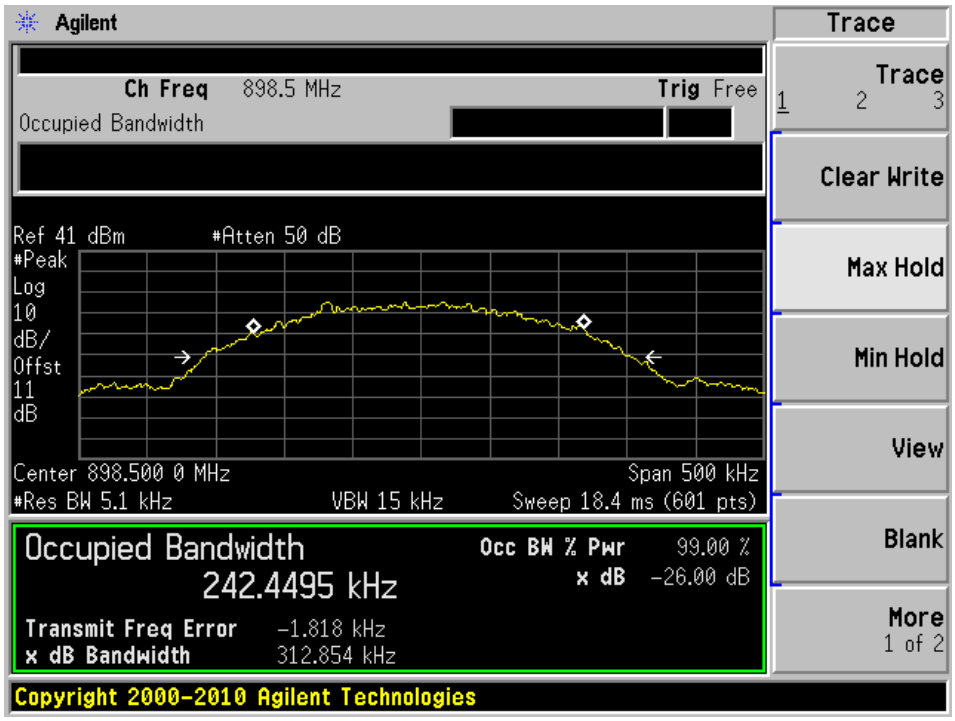
Input, AGC Off



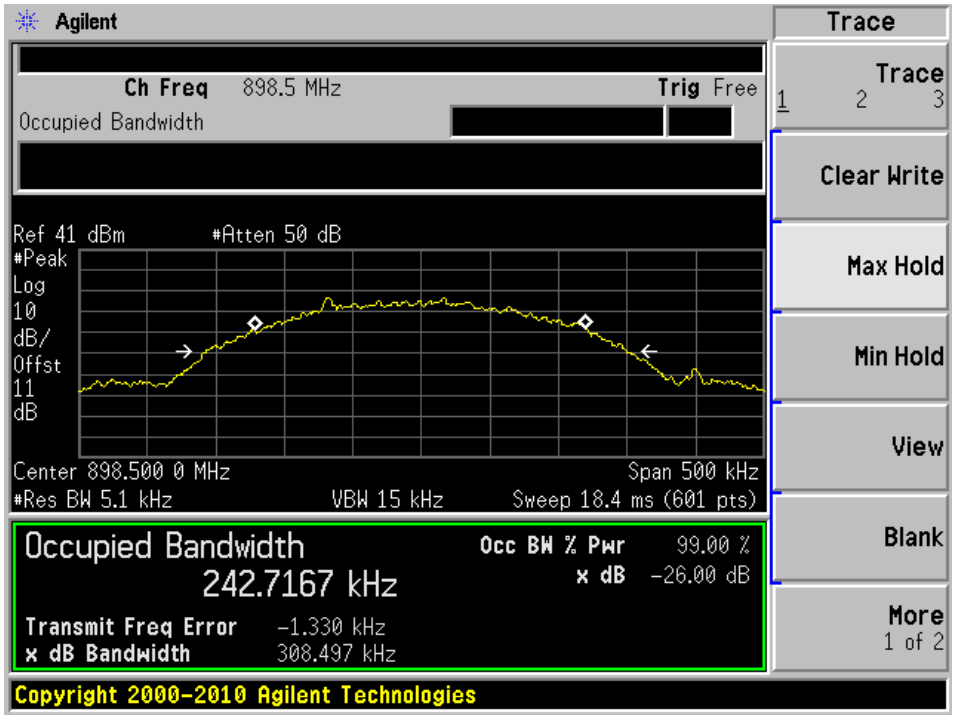
Input, AGC On



Output, AGC Off



Output, AGC On



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

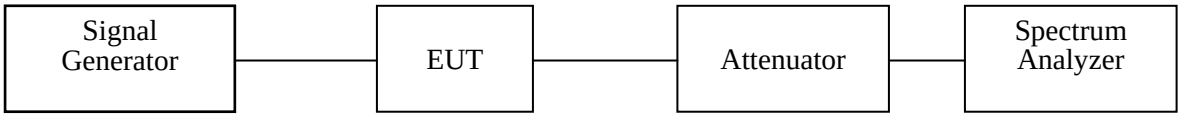
7.1 Applicable Standard

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 output was connected to the EUT input. The output of the EUT was connected to a spectrum analyzer 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	US45303156	2017-02-24	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
-	10 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C04	Each Time[1]	Each Time[1]
-	SMA cable	-	C09	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

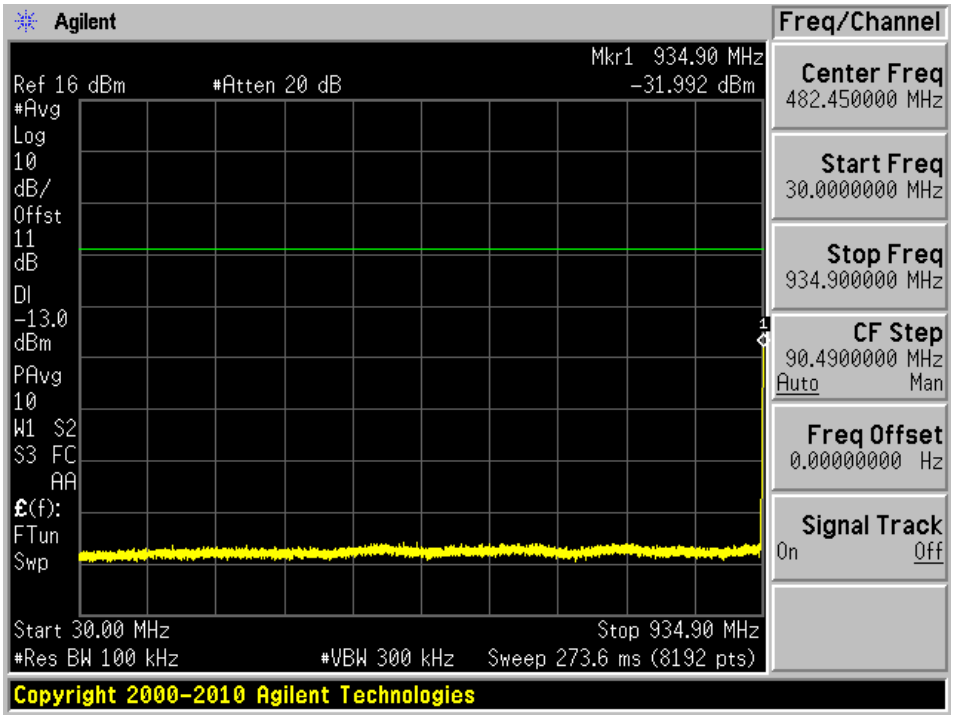
The testing was performed by Jose Martinez on 2017-07-08 in the RF Site.

7.5 Test Results

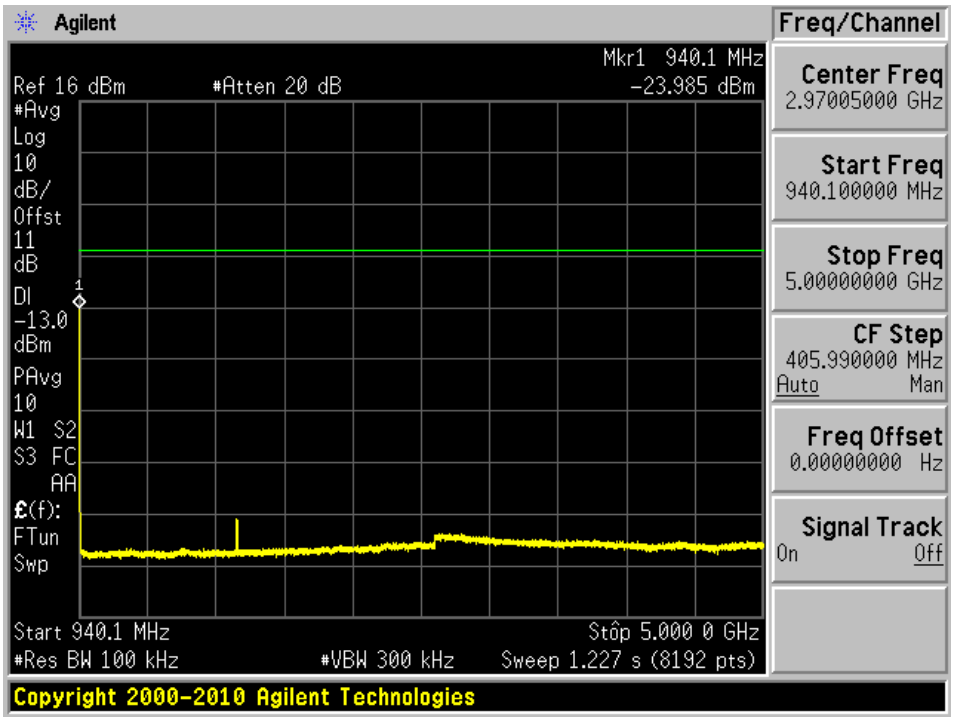
Please refer to the following plots.

Downlink: Broadband Signal

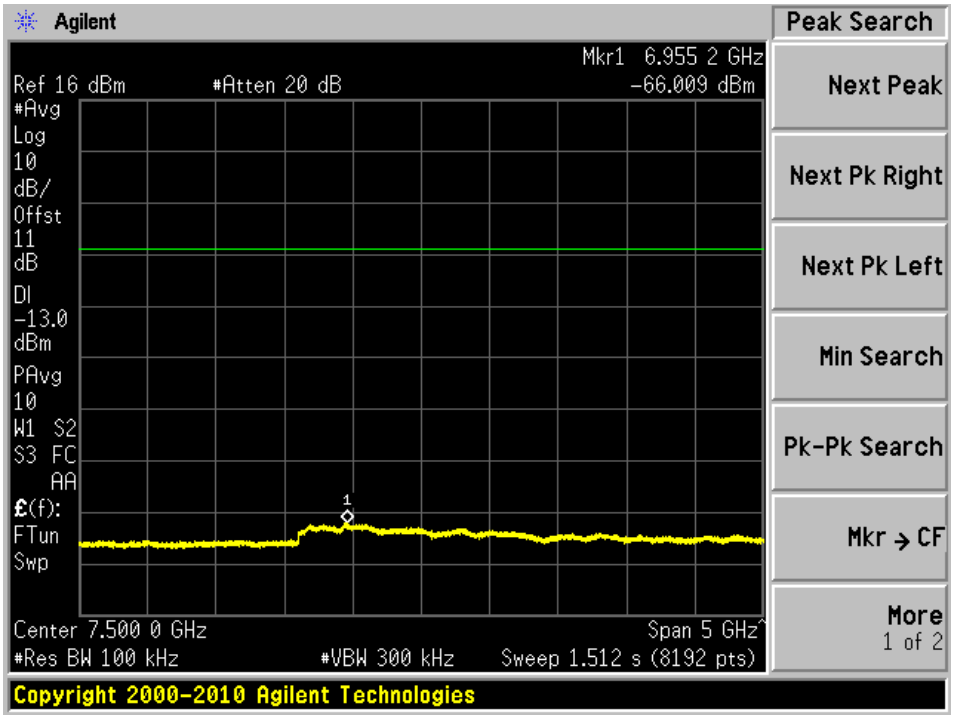
30 MHz - 934.9 MHz



940.1 MHz - 5 GHz

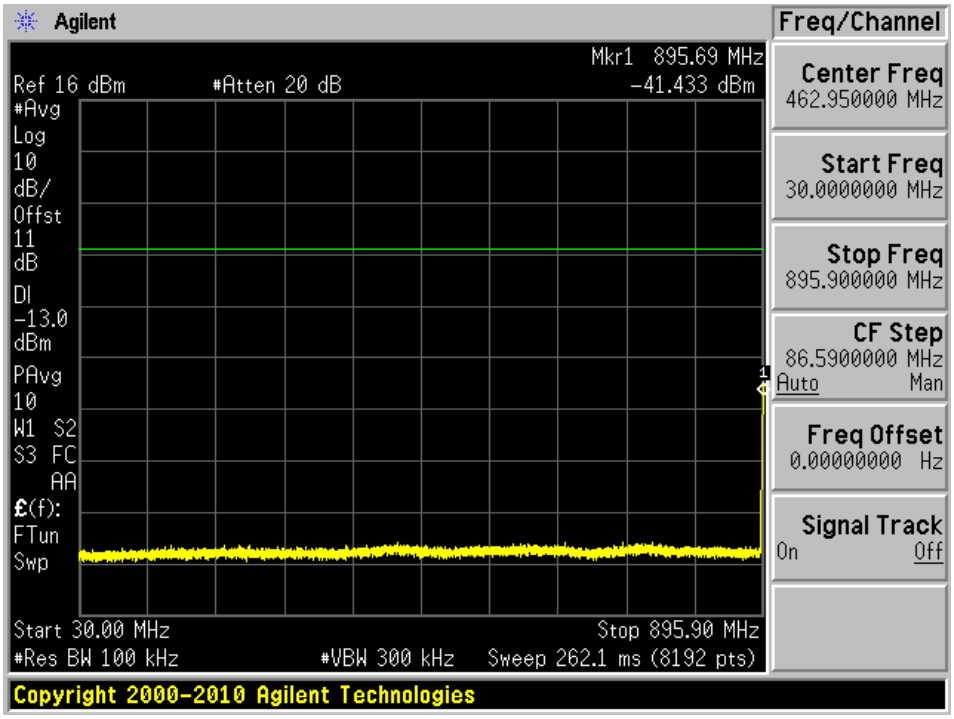


5 GHz –10 GHz

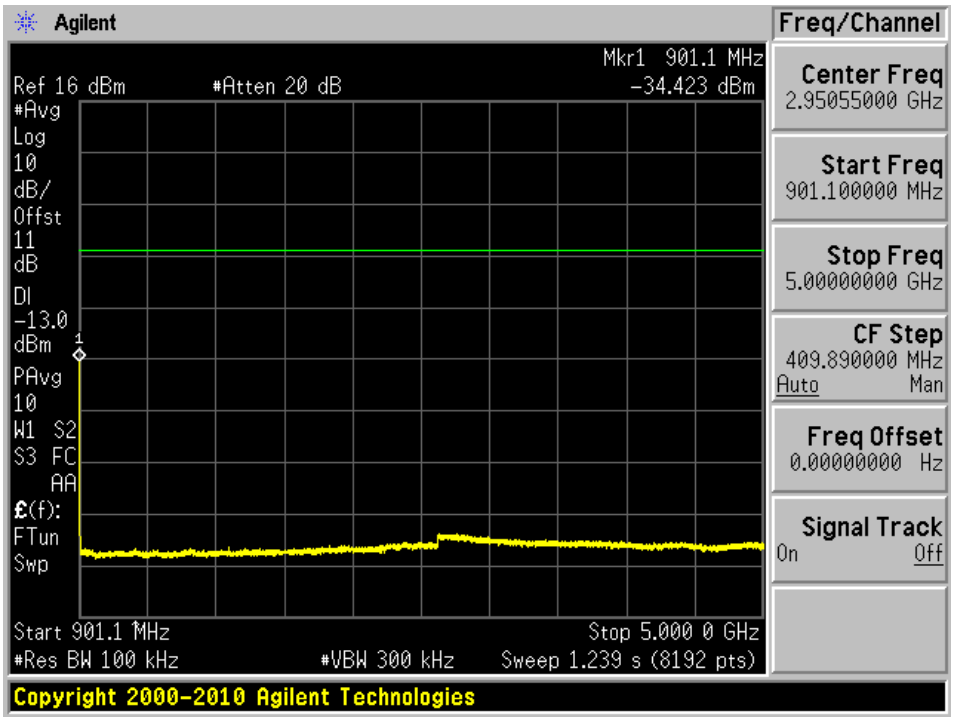


Uplink: Broadband Signal

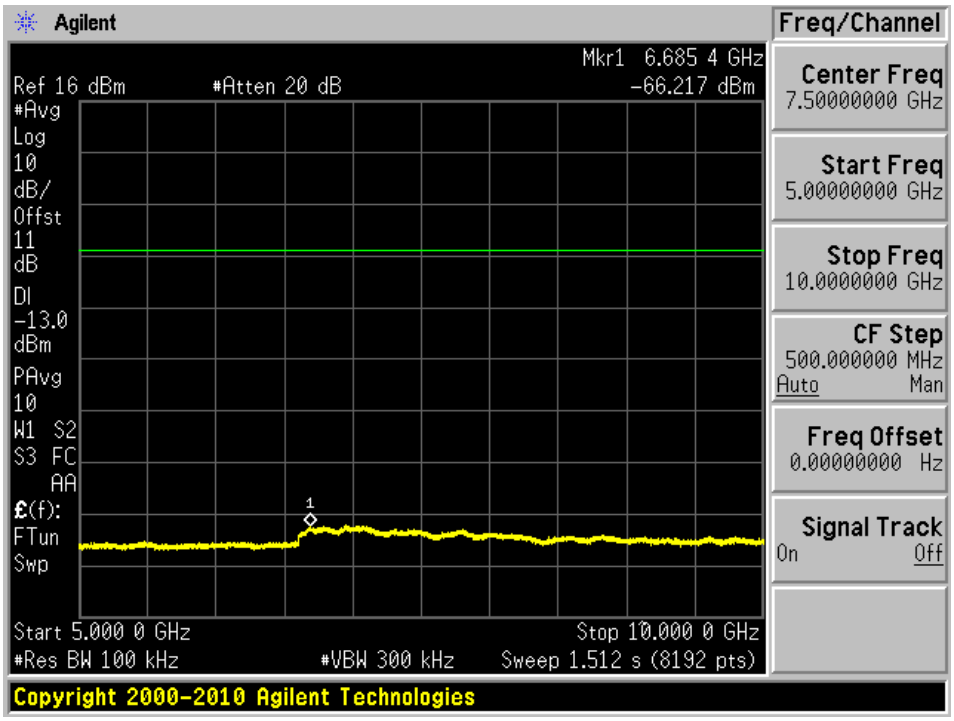
30 MHZ - 895.9 MHz



901.1 MHZ - 5 GHz



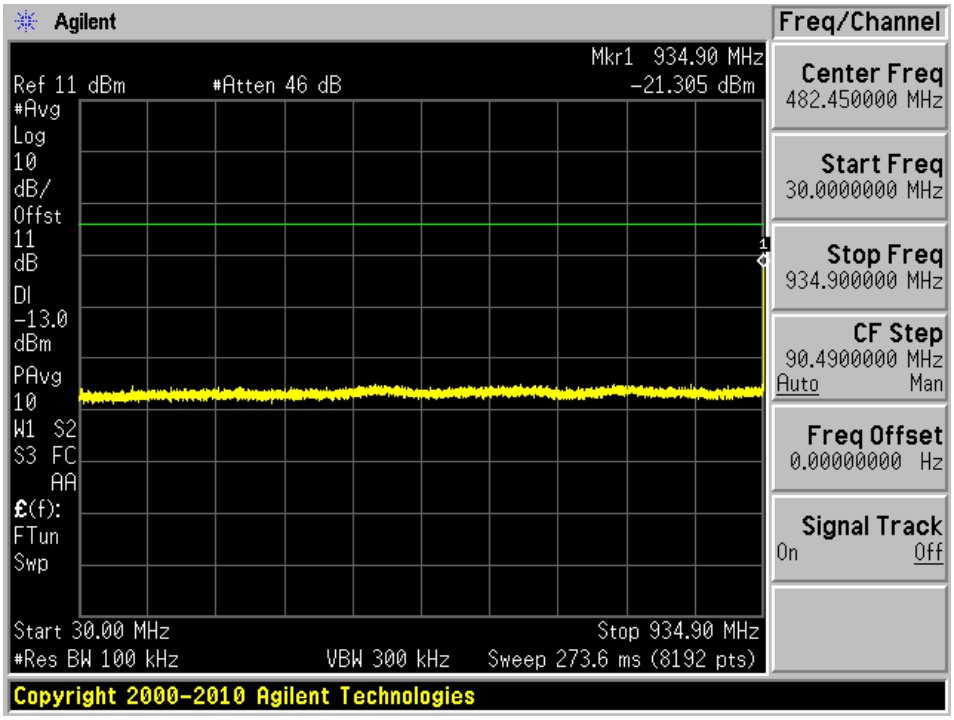
5 GHz – 10 GHz


Agilent
Freq/Channel
Mkr1 6.685 4 GHz
Ref 16 dBm
#Atten 20 dB
-66.217 dBm
#Avg
Log
10
dB/
Offst
11
dB
Dl
-13.0
dBm
PAvg
10
W1 S2
S3 FC
AA
£(f):
FTun
Swp
Center Freq
7.50000000 GHz
Start Freq
5.00000000 GHz
Stop Freq
10.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 5.000 0 GHz
Stop 10.000 0 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 1.512 s (8192 pts)
Copyright 2000-2010 Agilent Technologies

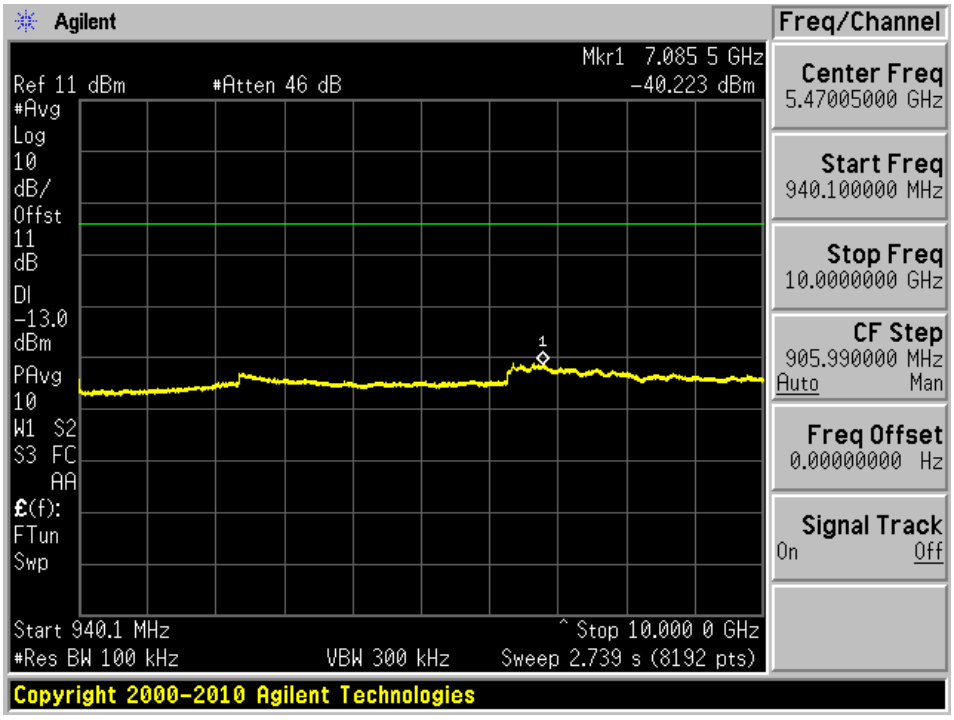
Downlink: Narrowband signal

Low Channel

30 MHz - 934.9 MHz

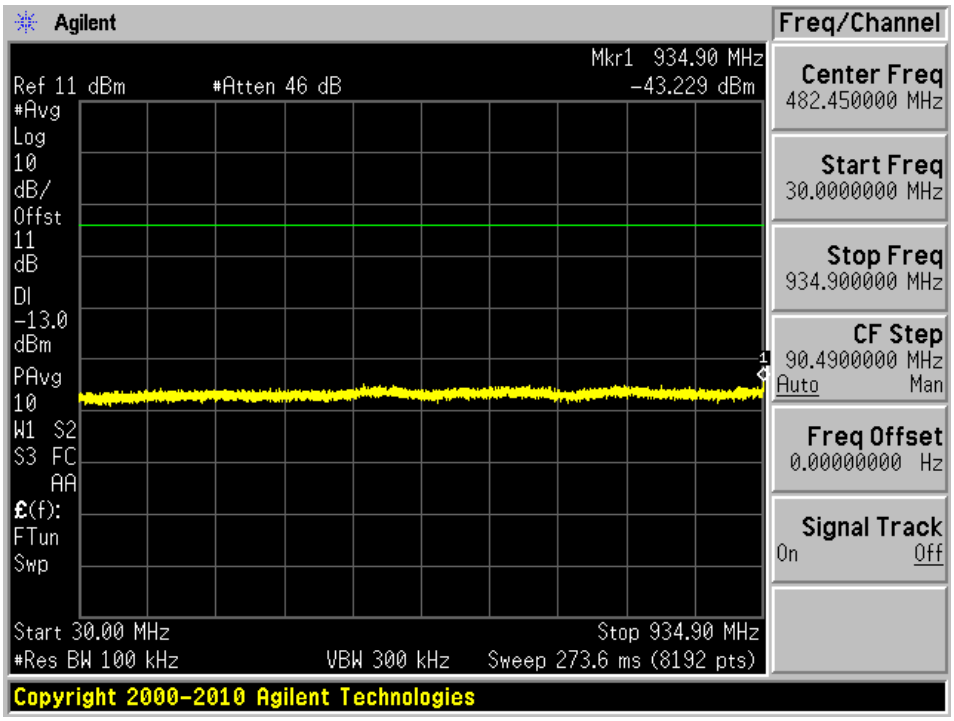


940.1 MHz- 10 GHz

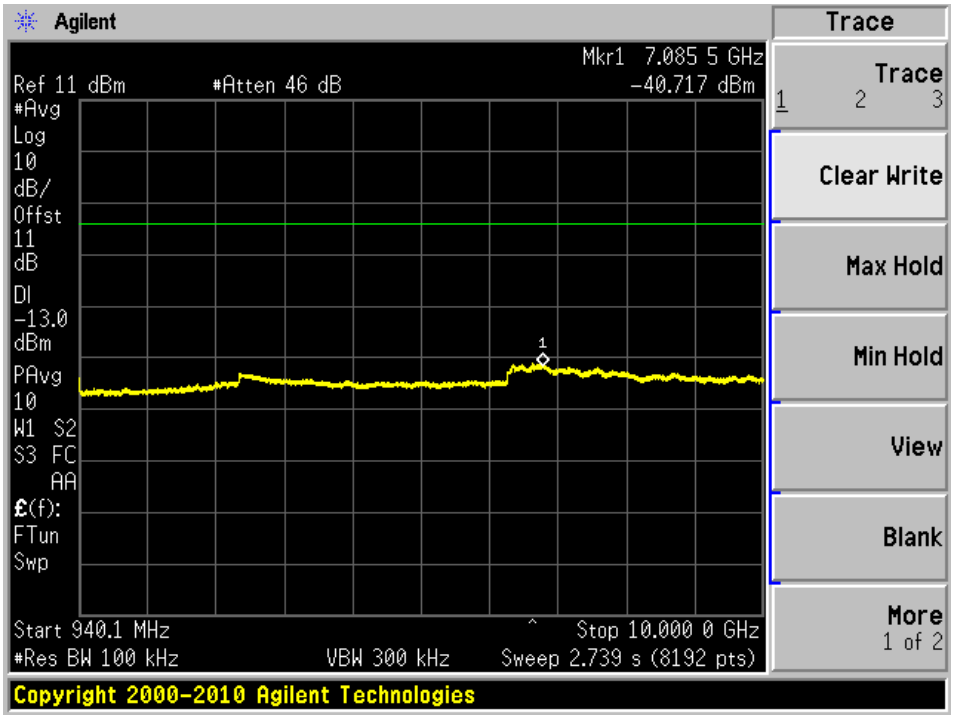


Middle Channel

30 MHz - 934.9 MHz

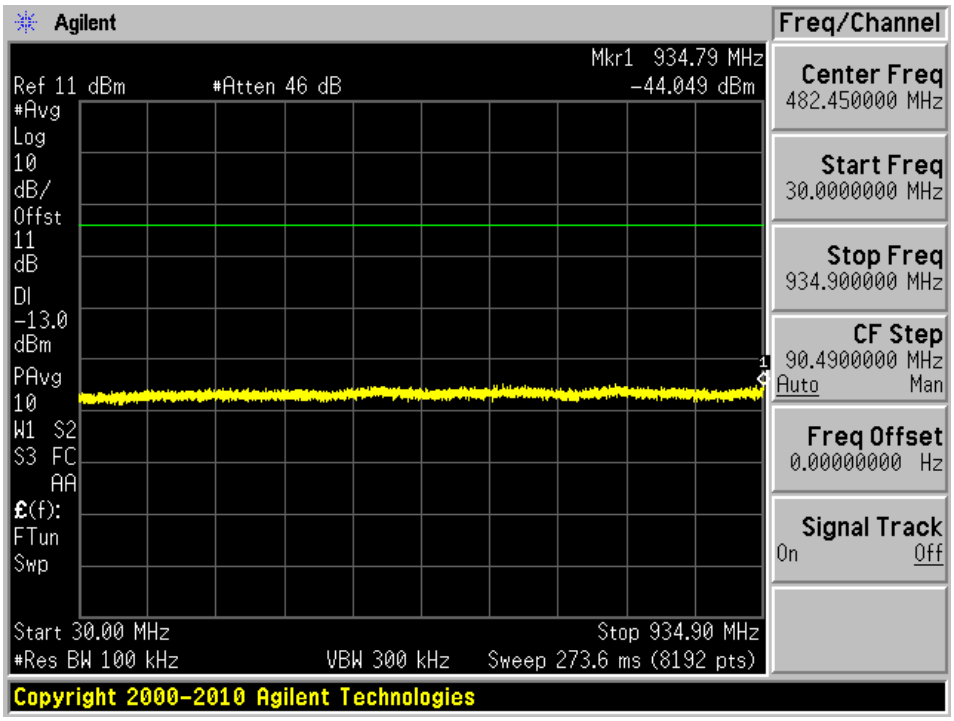


940.1 MHz – 10 GHz

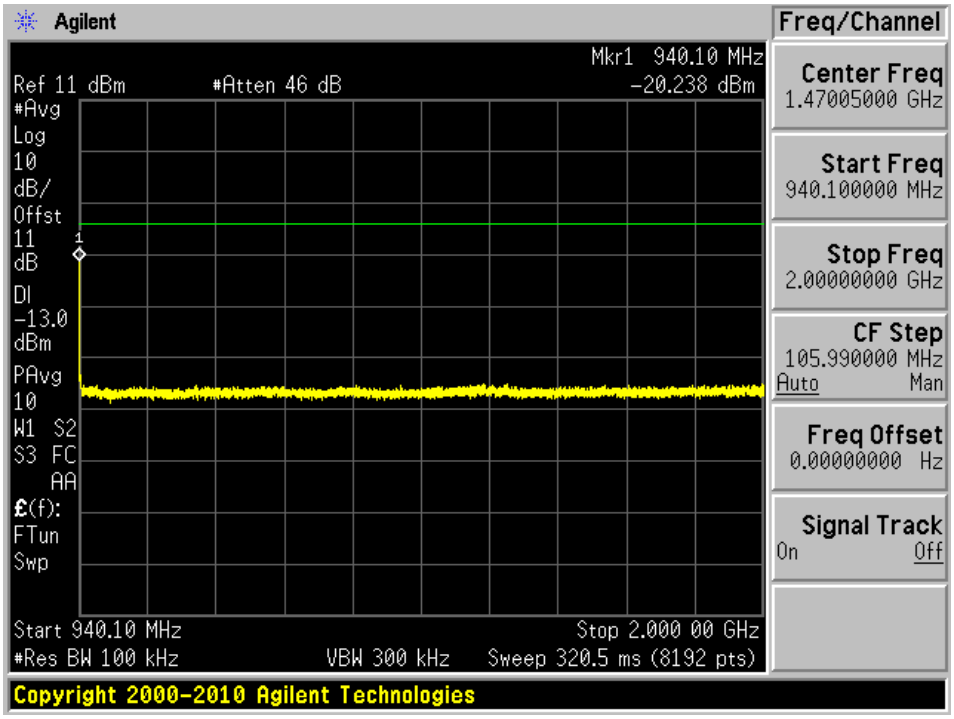


High Channel

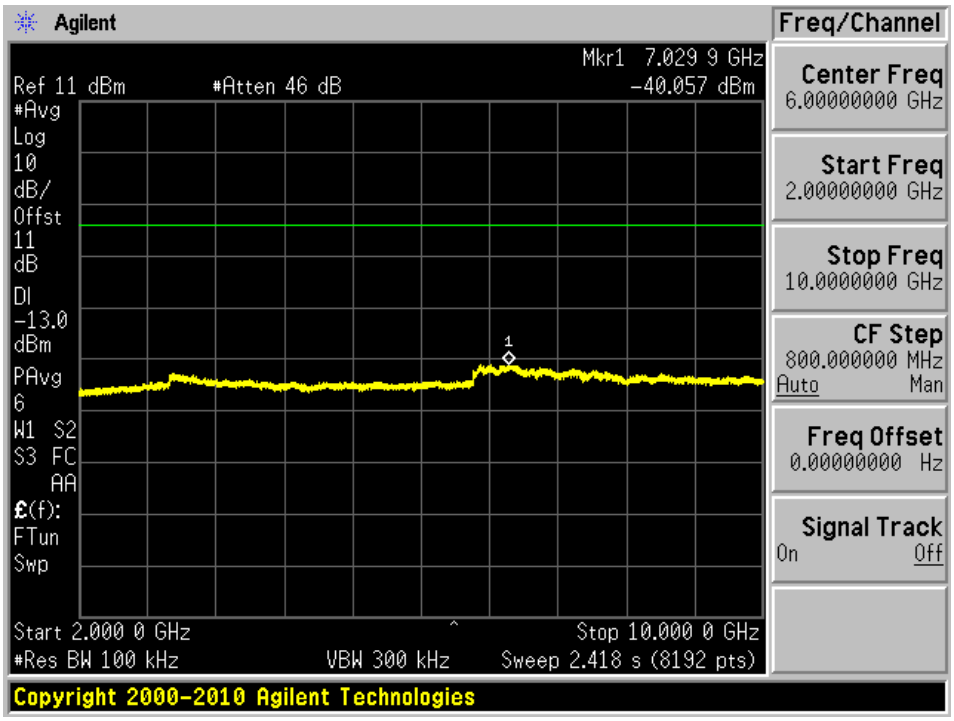
30 MHz- 934.9 MHz



940.1 MHz-2 GHz



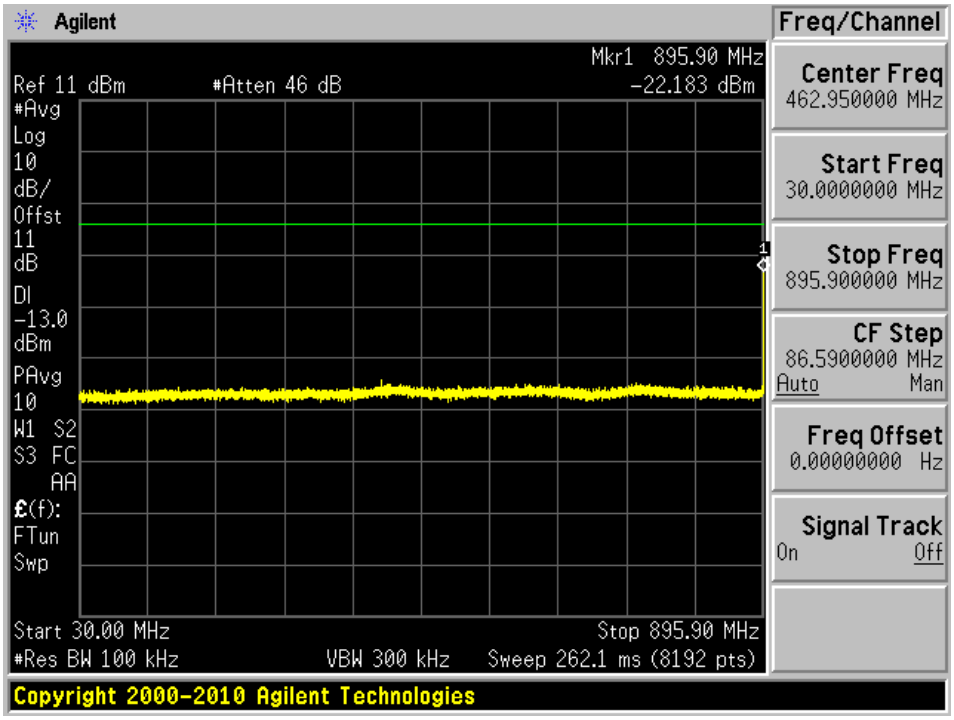
2 GHz - 10 GHz


Agilent
Freq/Channel
Mkr1 7.029 9 GHz
Ref 11 dBm
#Atten 46 dB
-40.057 dBm
#Avg
Log
10
dB/
Offst
11
dB
Dl
-13.0
dBm
PAvg
6
W1 S2
S3 FC
AA
£(f):
FTun
Swp
Center Freq
6.00000000 GHz
Start Freq
2.00000000 GHz
Stop Freq
10.0000000 GHz
CF Step
800.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 2.000 0 GHz
Stop 10.000 0 GHz
#Res BW 100 kHz
VBW 300 kHz
Sweep 2.418 s (8192 pts)
Copyright 2000-2010 Agilent Technologies

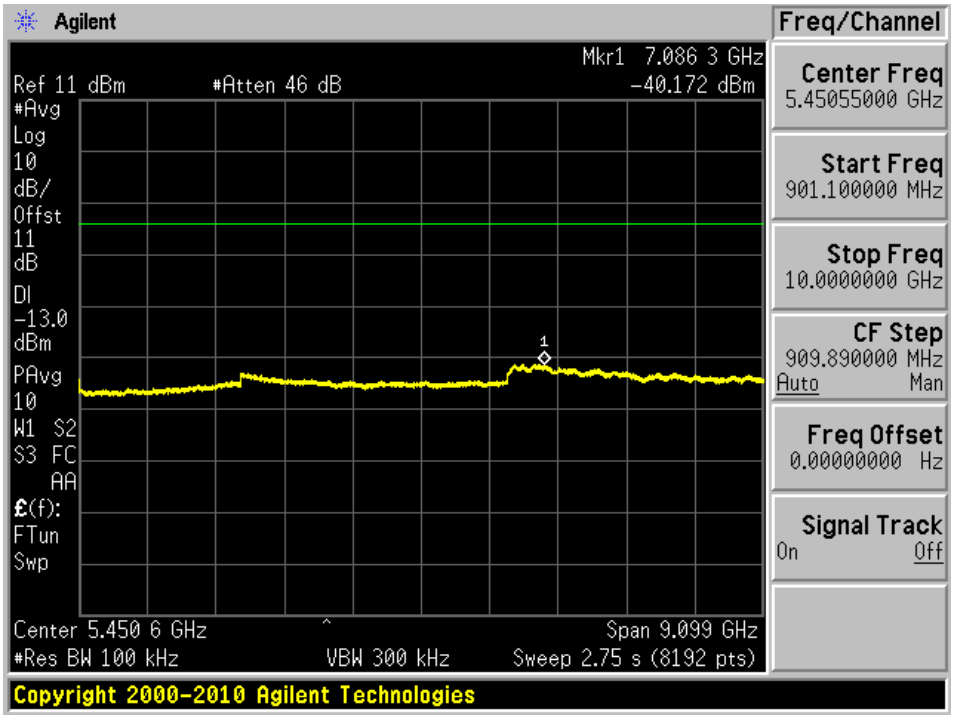
Uplink: Narrowband signal

Low Channel

30 MHz - 895.9 MHz

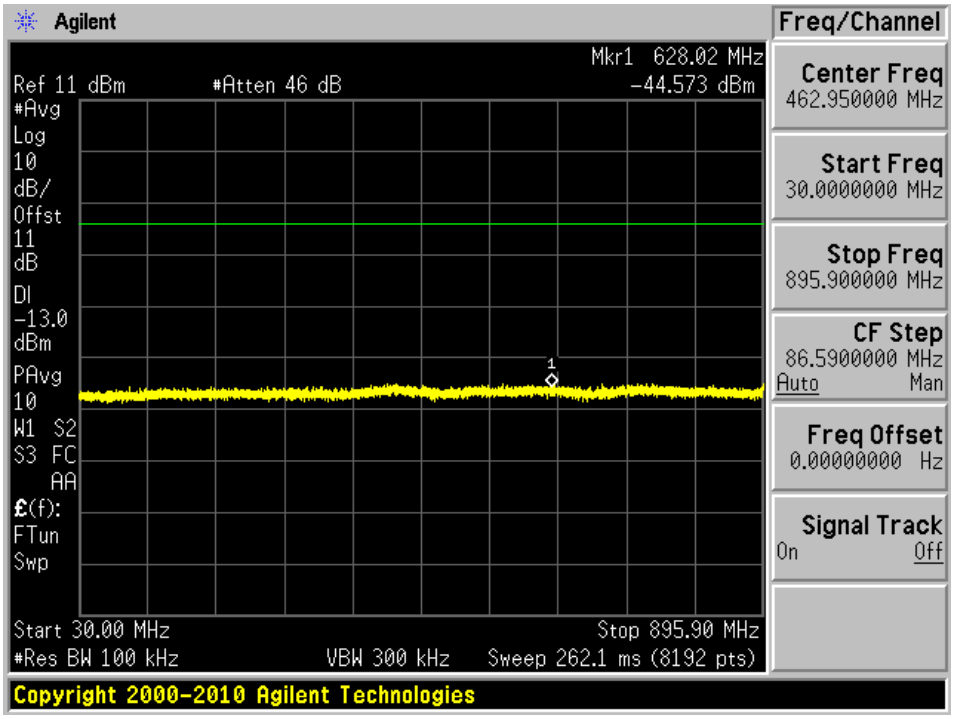


901.1 MHz - 10 GHz

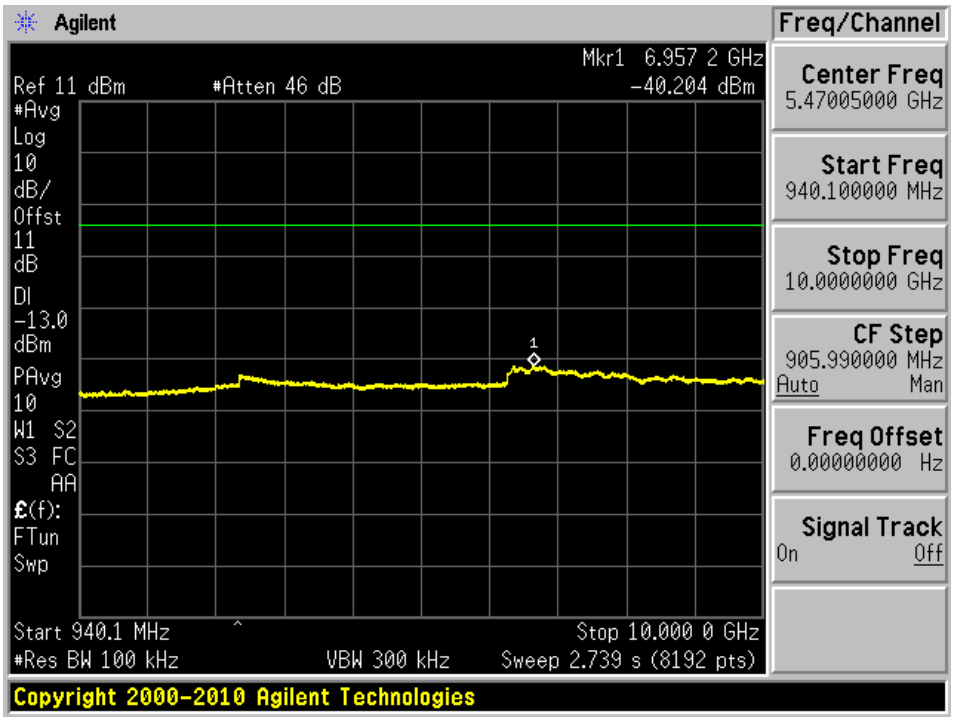


Middle Channel

30 MHz – 895.9 MHz

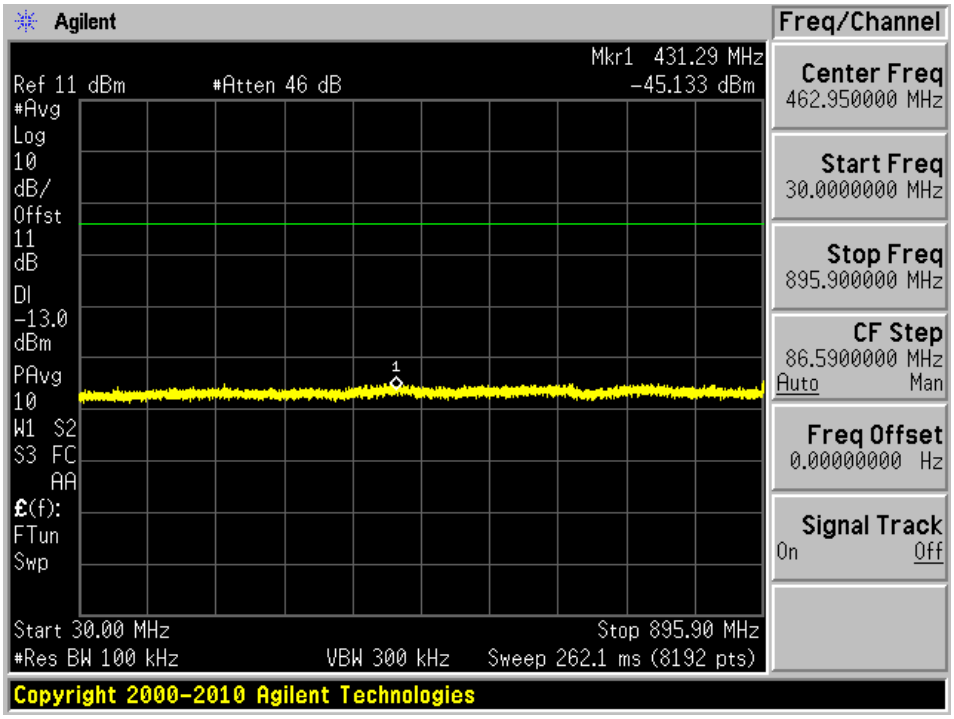


940.1 MHz – 10 GHz

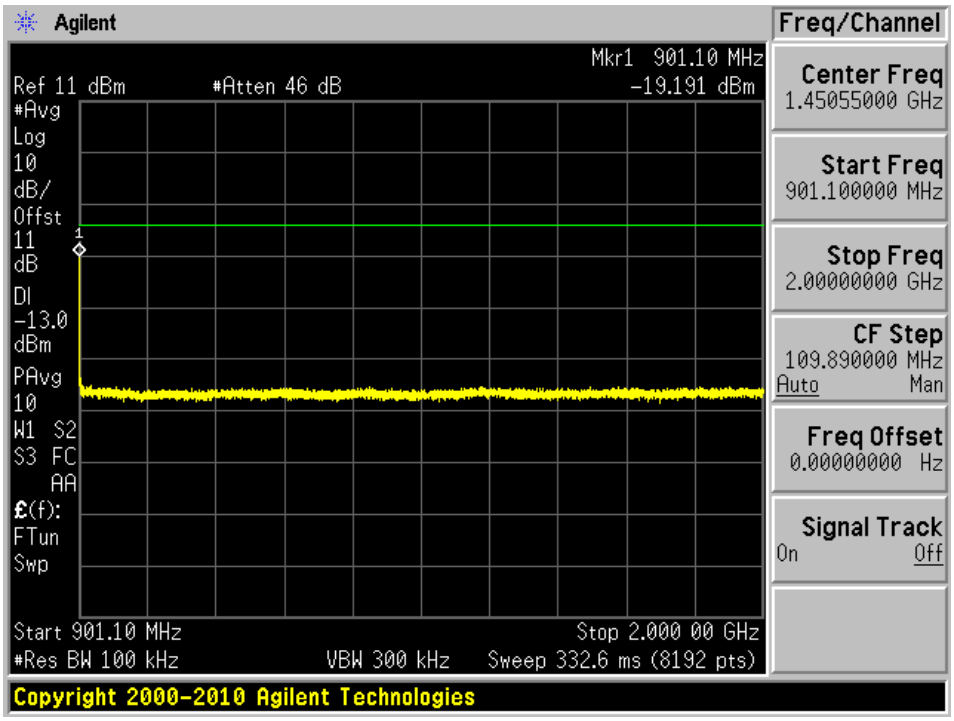


High Channel

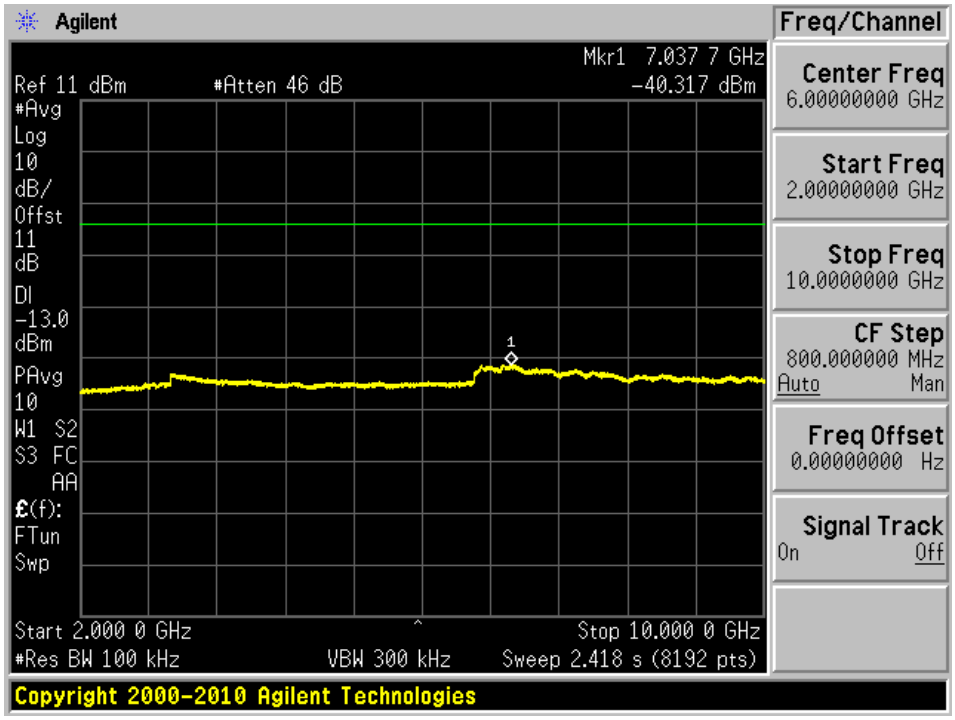
30 MHz - 895.9 MHz



901.1 MHz - 2 GHz



2 GHz - 10 GHz


Agilent
Freq/Channel
Mkr1 7.037 7 GHz
Ref 11 dBm
#Atten 46 dB
-40.317 dBm
#Avg
Log
10
dB/
Offst
11
dB
Dl
-13.0
dBm
PAvg
10
W1 S2
S3 FC
AA
£(f):
FTun
Swp
Center Freq
6.00000000 GHz
Start Freq
2.00000000 GHz
Stop Freq
10.0000000 GHz
CF Step
800.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 2.000 0 GHz
Stop 10.000 0 GHz
#Res BW 100 kHz
VBW 300 kHz
Sweep 2.418 s (8192 pts)
Copyright 2000-2010 Agilent Technologies

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

a) Connect a signal generator to the input of the EUT. If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW).

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block under test.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168 [R8], but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168 [R8].

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the EBW or 100 kHz or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the spectrum analyzer start frequency to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (rms) mode.

l) Use the marker function to find the maximum power level.

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the frequencies of the input signals to the lower edge of the frequency block or band under test.

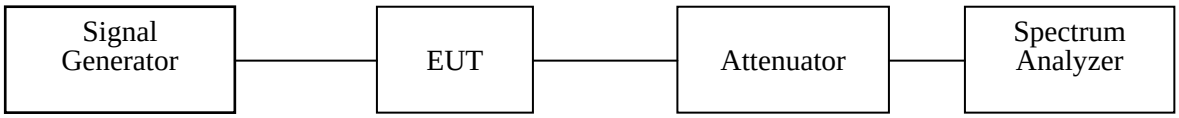
p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.



8.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2017-02-24	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
-	10 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C04	Each Time[1]	Each Time[1]
-	SMA cable	-	C09	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 2017-06-21 in the RF Site.

8.5 Test Results

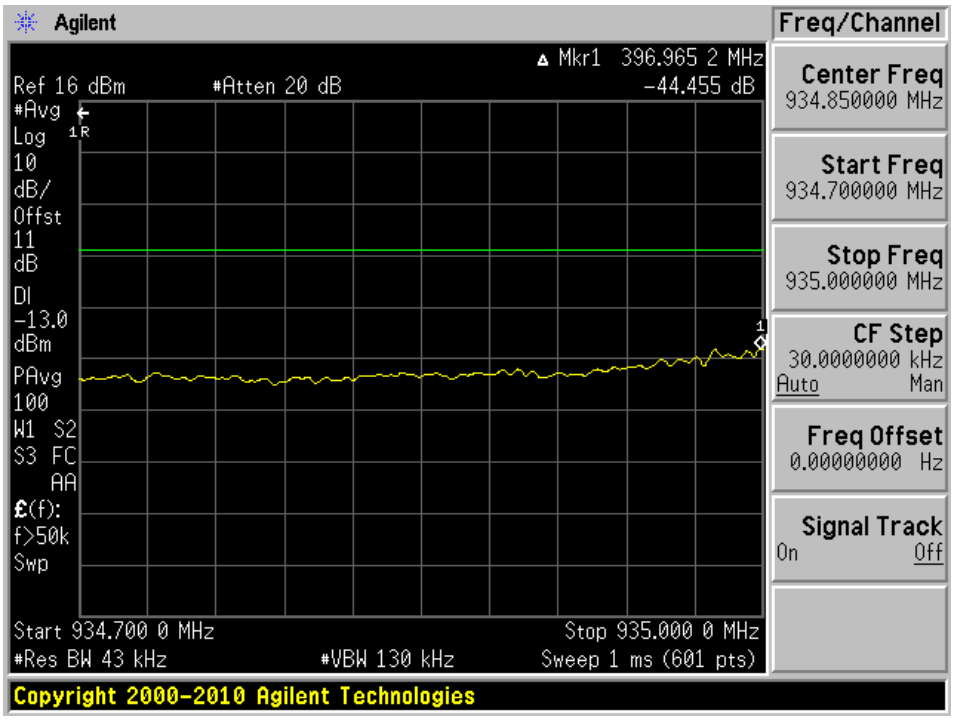
Please refer to the following plots.

Band Edge

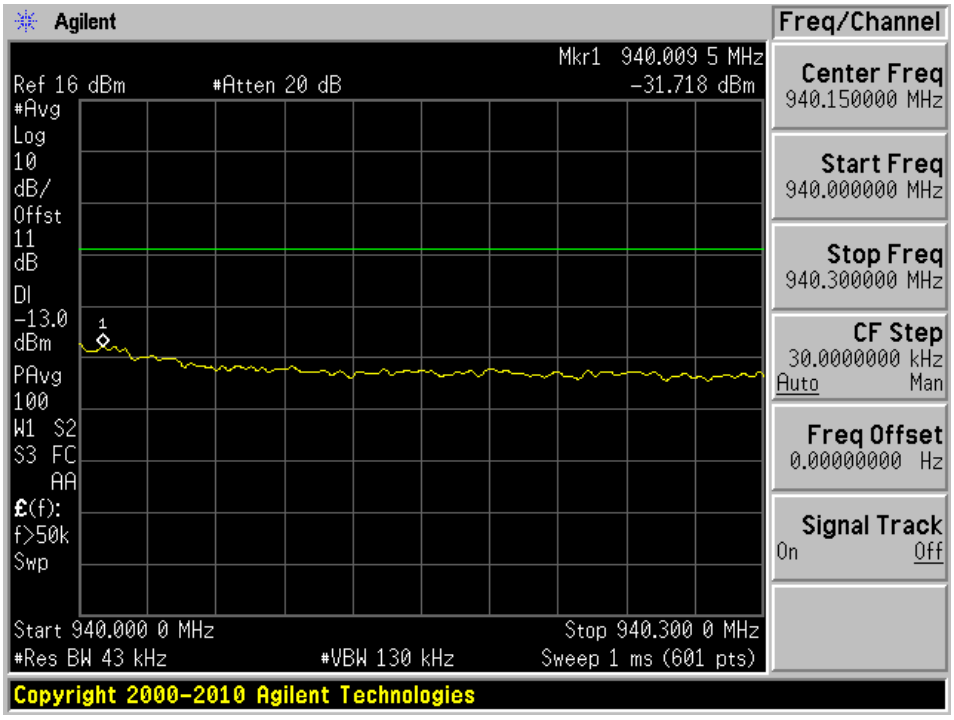
Downlink: Broadband Signal

AGC Off

Lower Band Edge

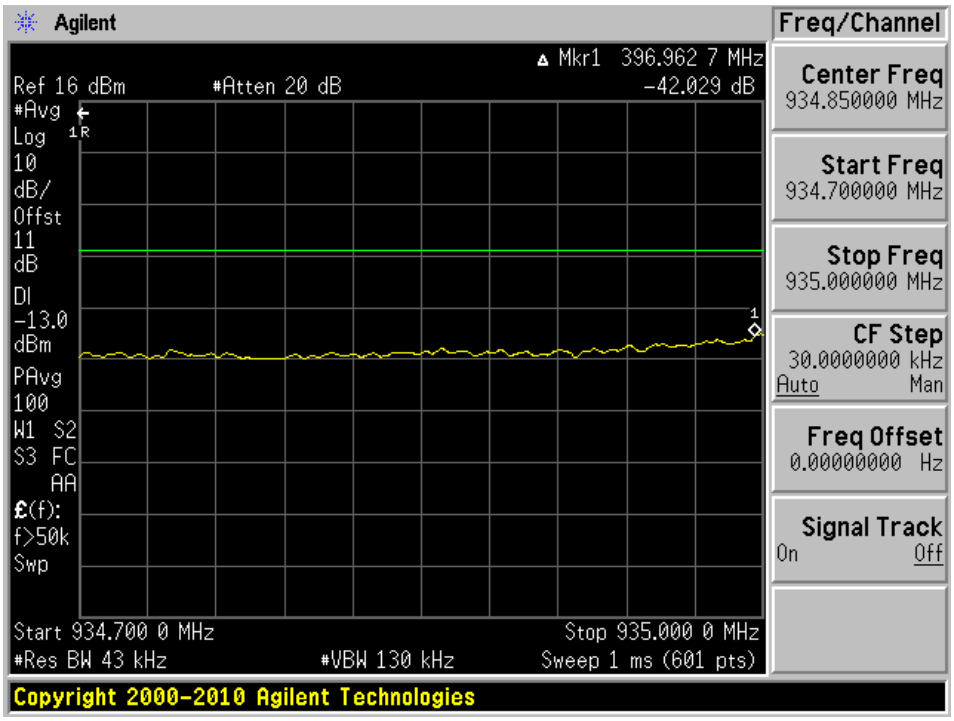


Upper Band Edge

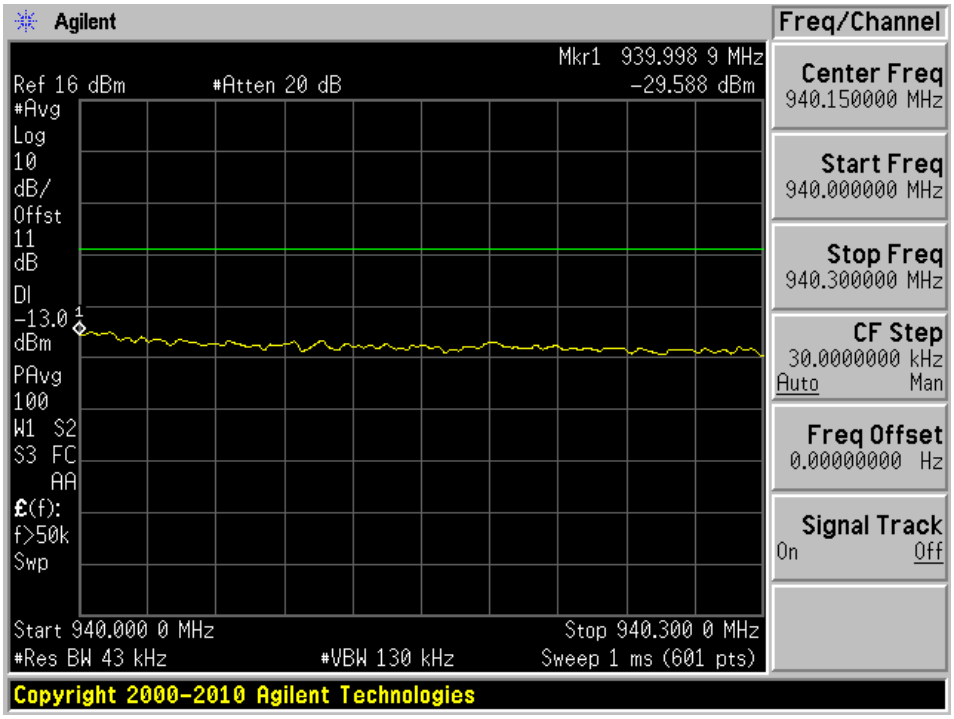


AGC On

Lower Band Edge



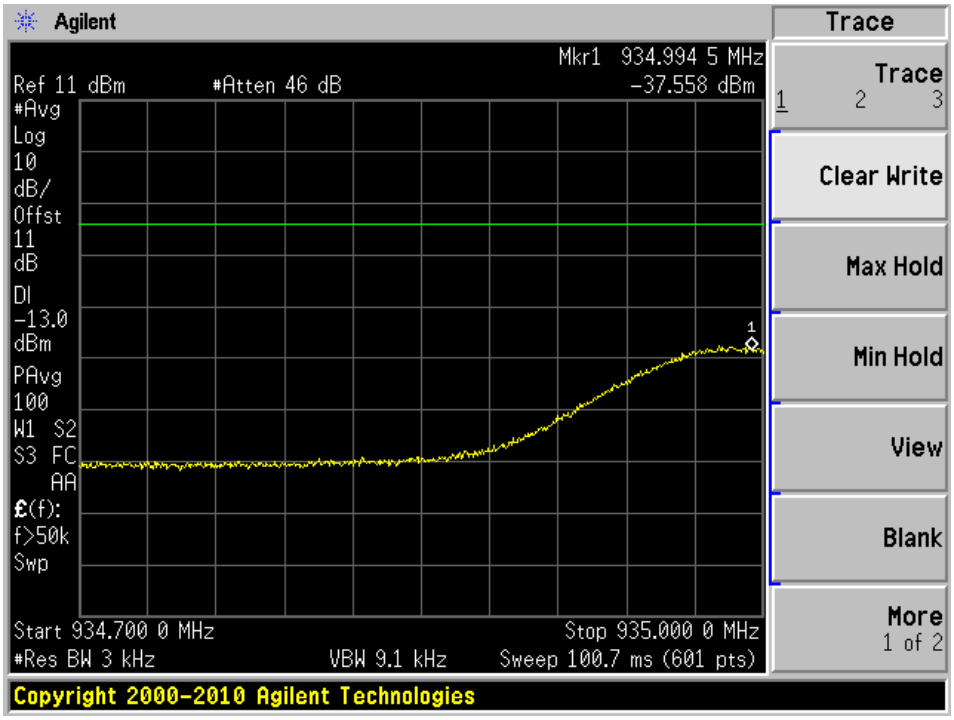
Upper Band Edge



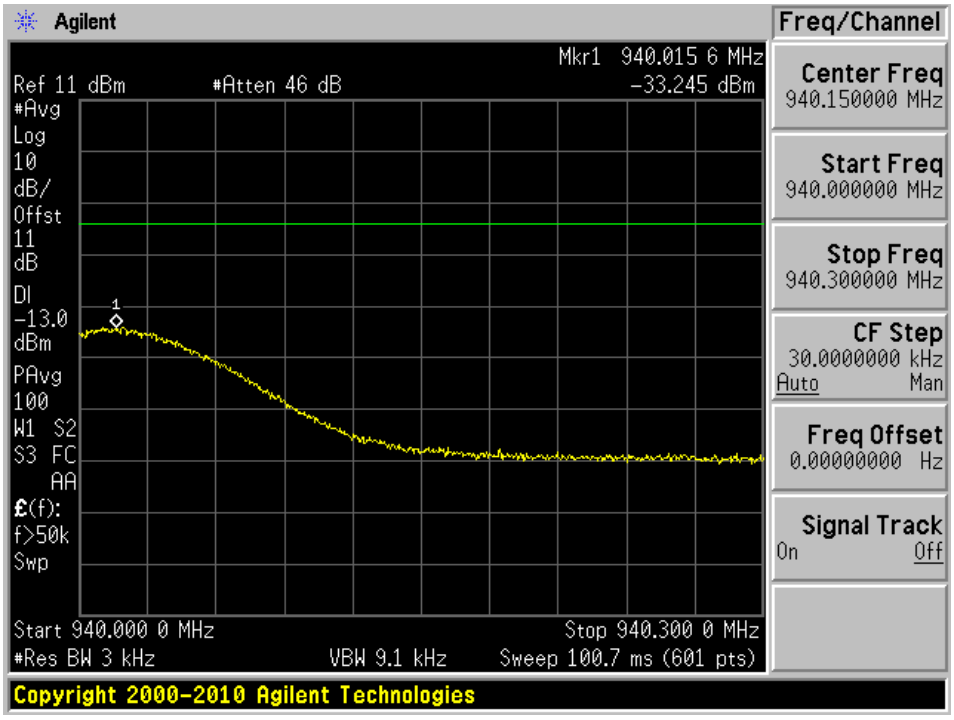
Downlink: Narrowband Signal

AGC Off

Lower Band Edge

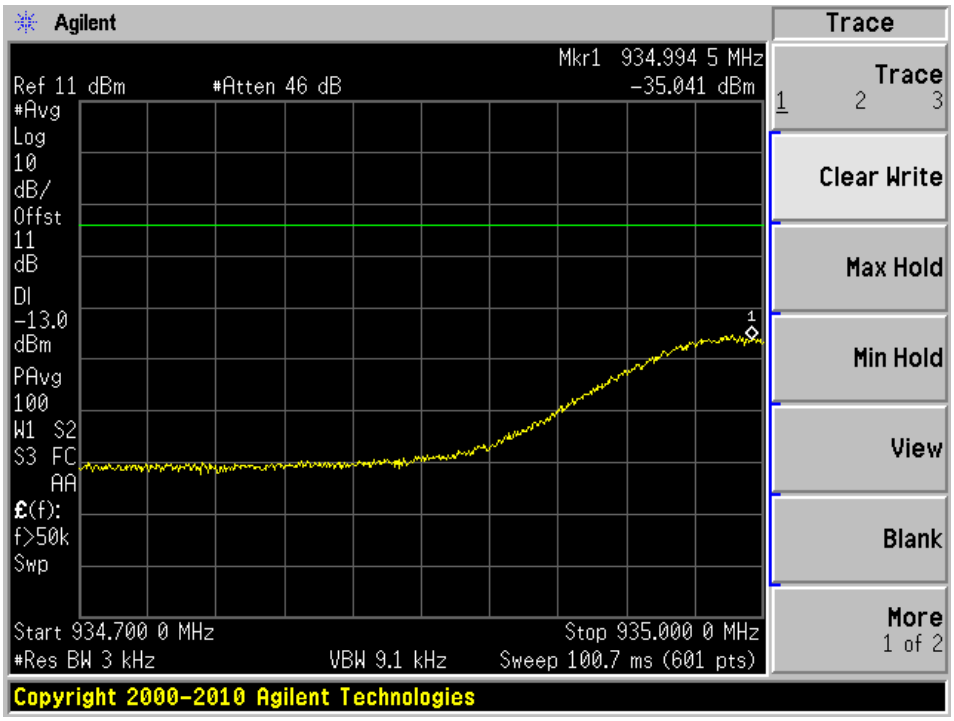


Upper Band Edge

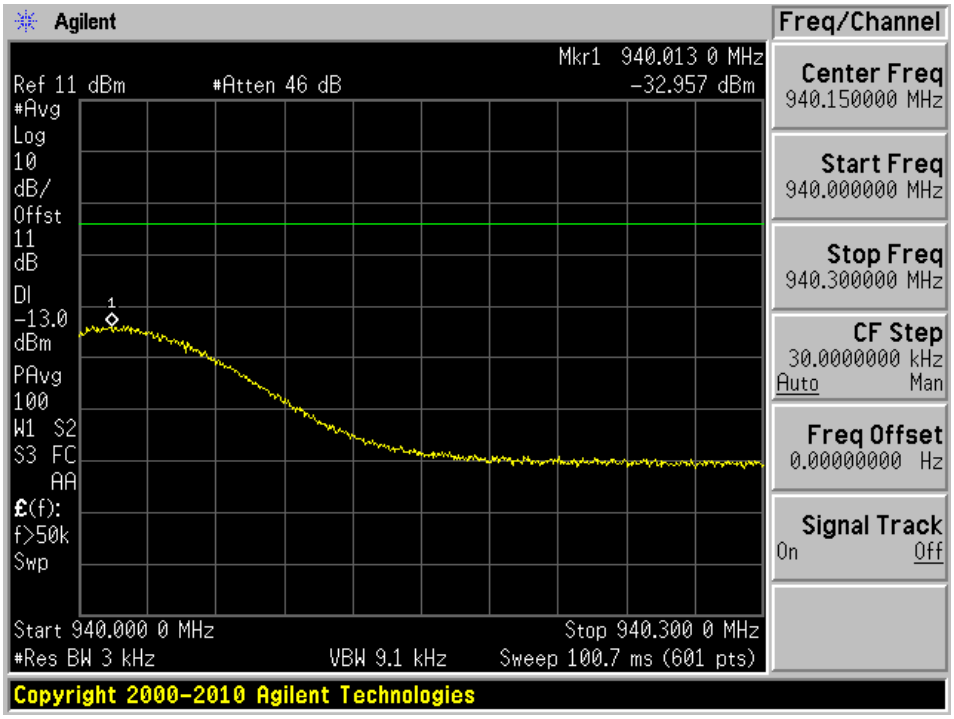


AGC On

Lower Band Edge



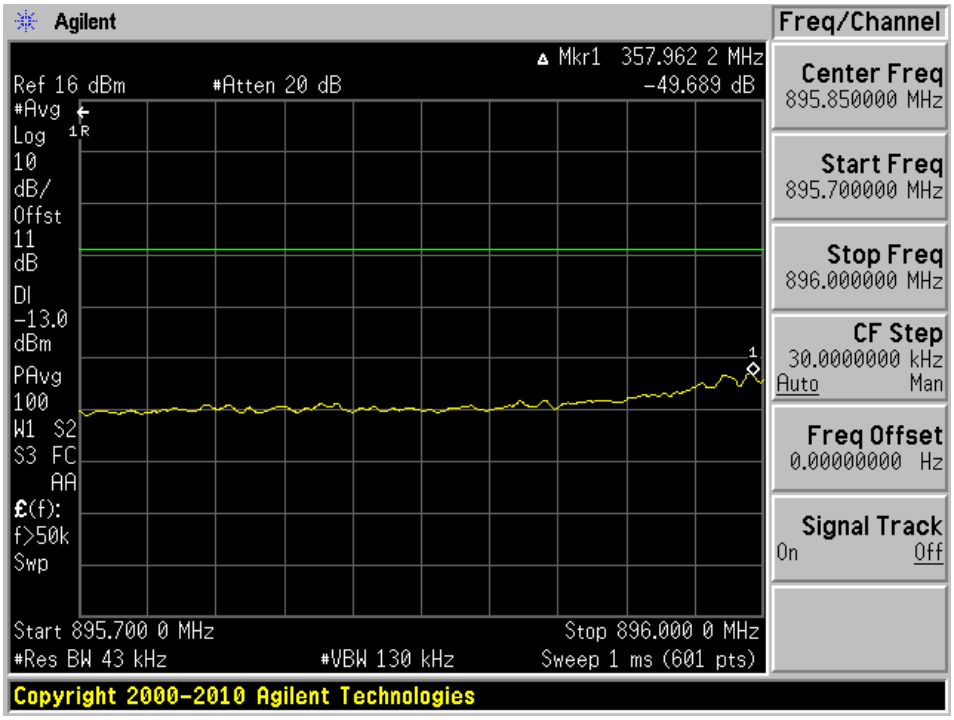
Upper Band Edge



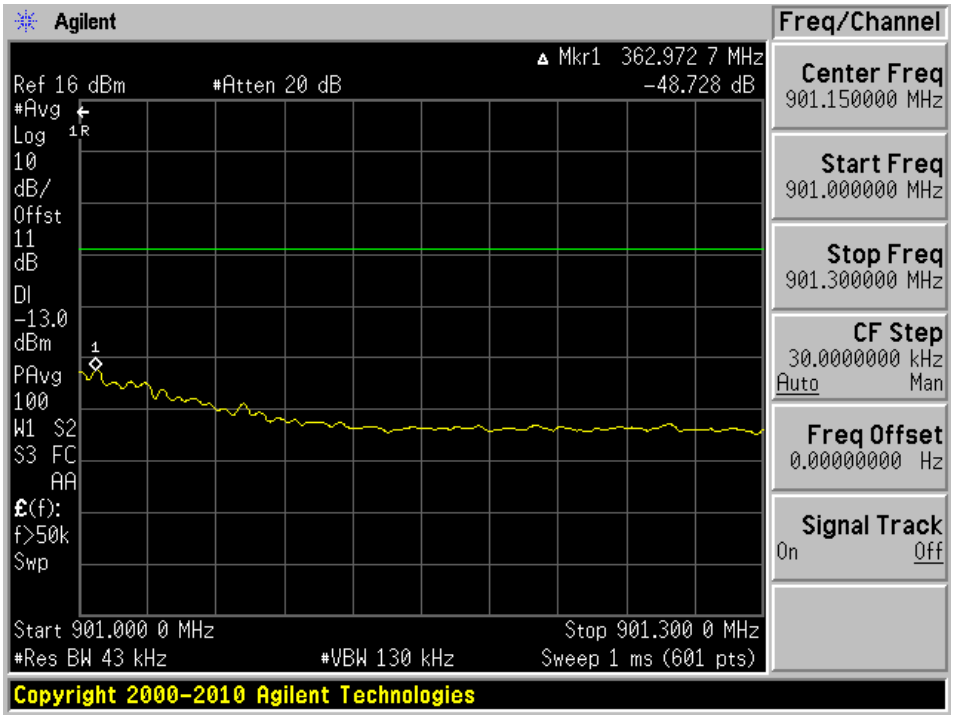
Uplink: Broadband Signal

AGC Off

Lower Band Edge

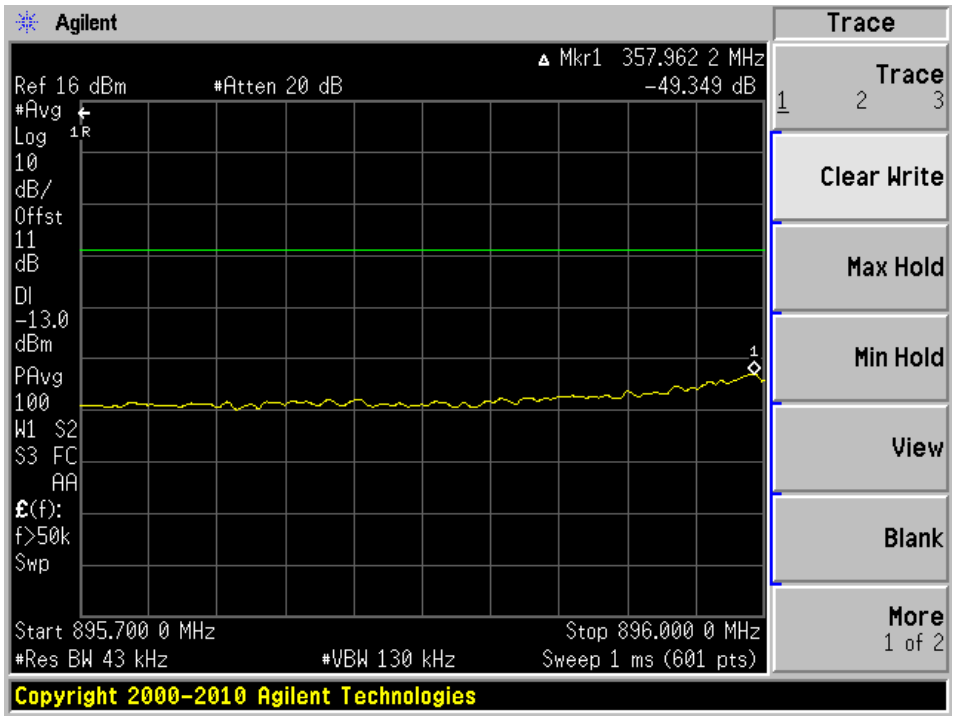


Upper Band Edge

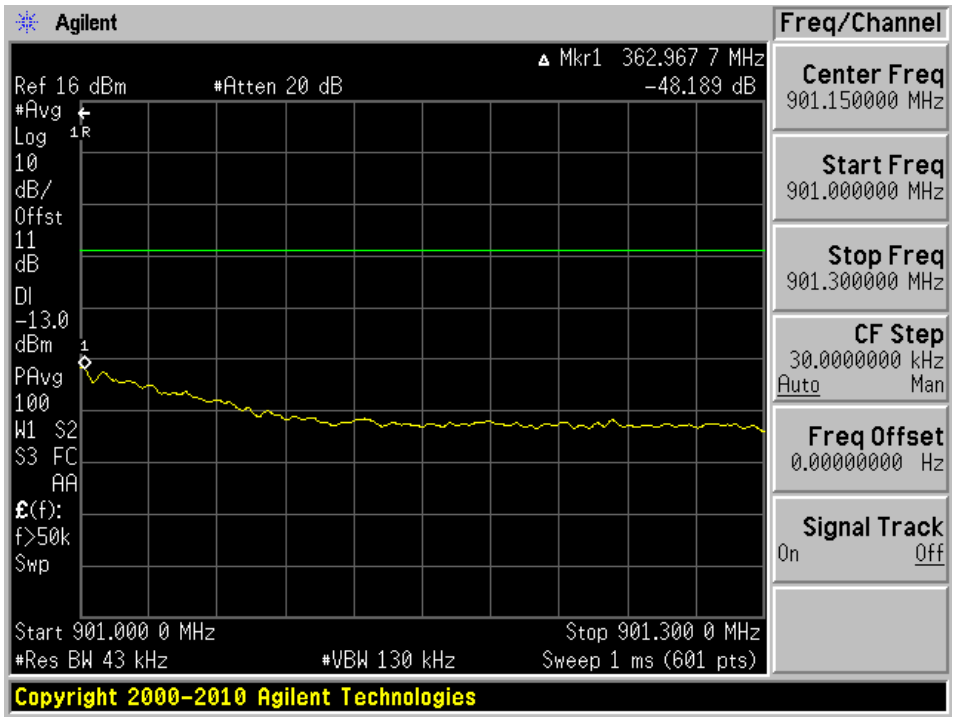


AGC On

Lower Band Edge



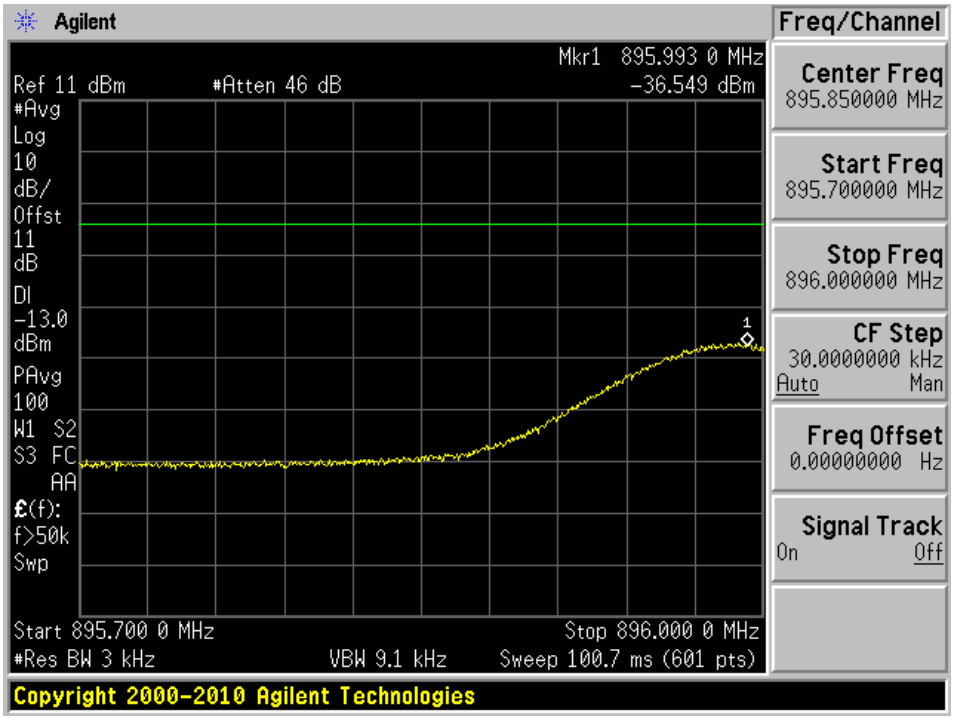
Upper Band Edge



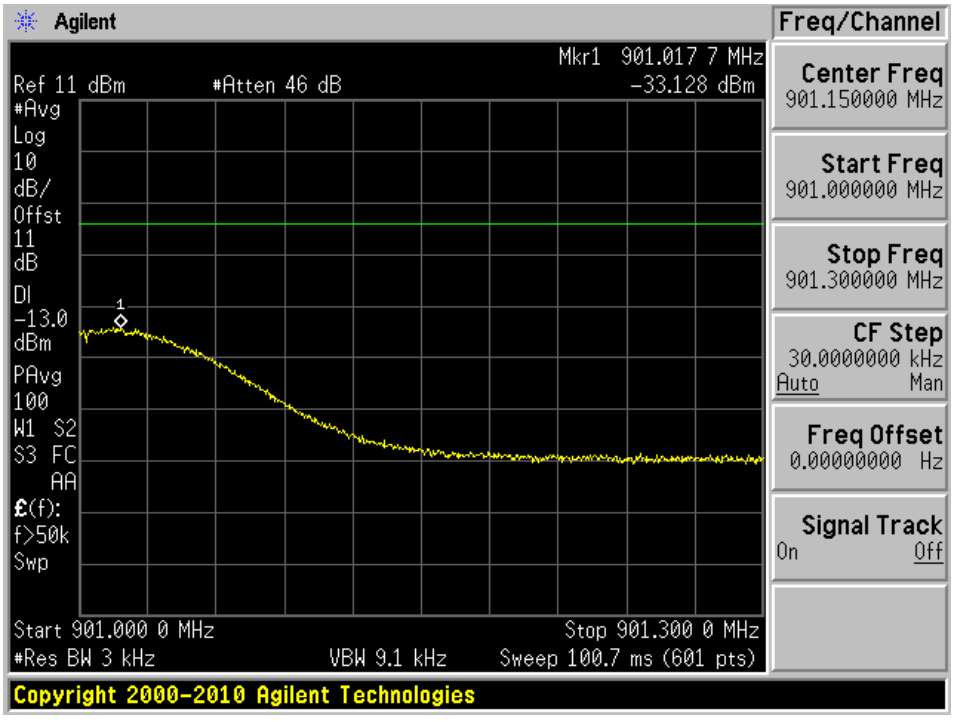
Uplink: Narrowband Signal

AGC Off

Lower Band Edge

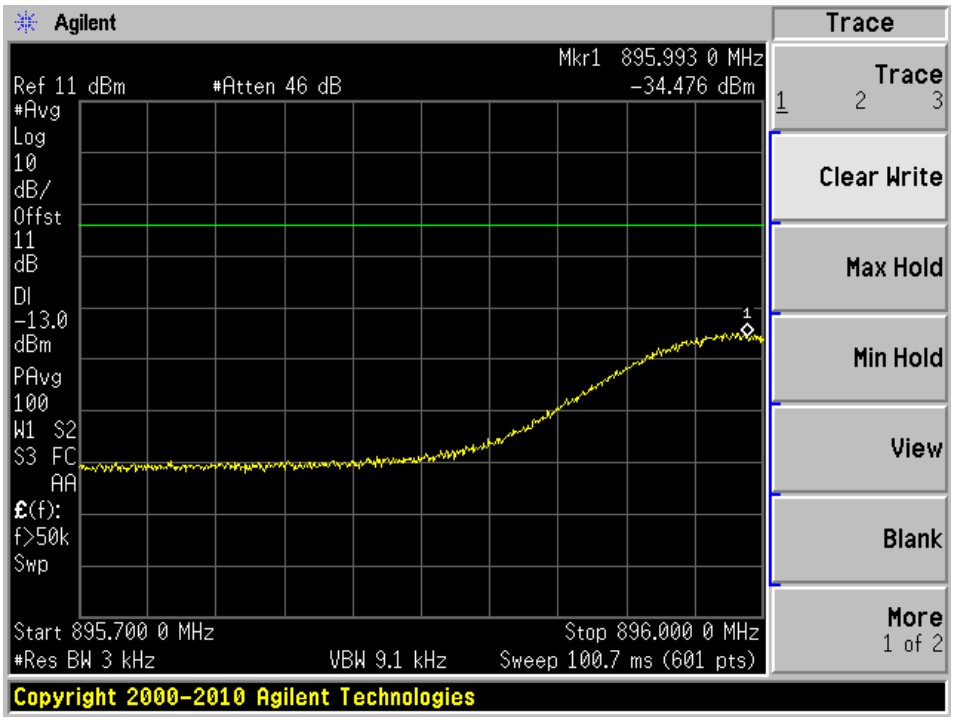


Upper Band Edge

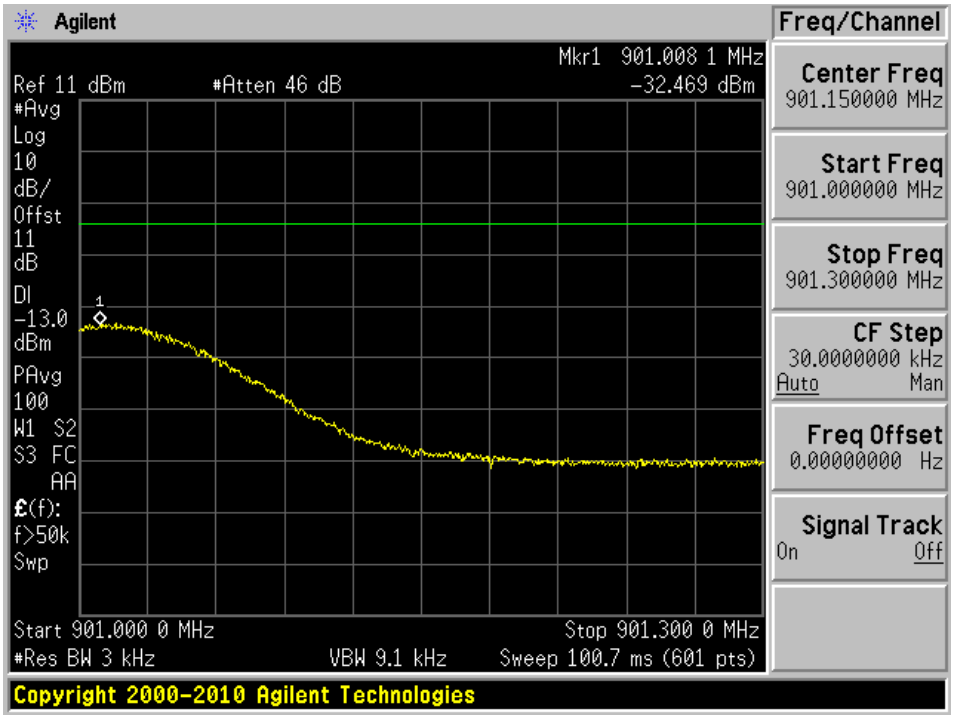


AGC On

Lower Band Edge



Upper Band Edge

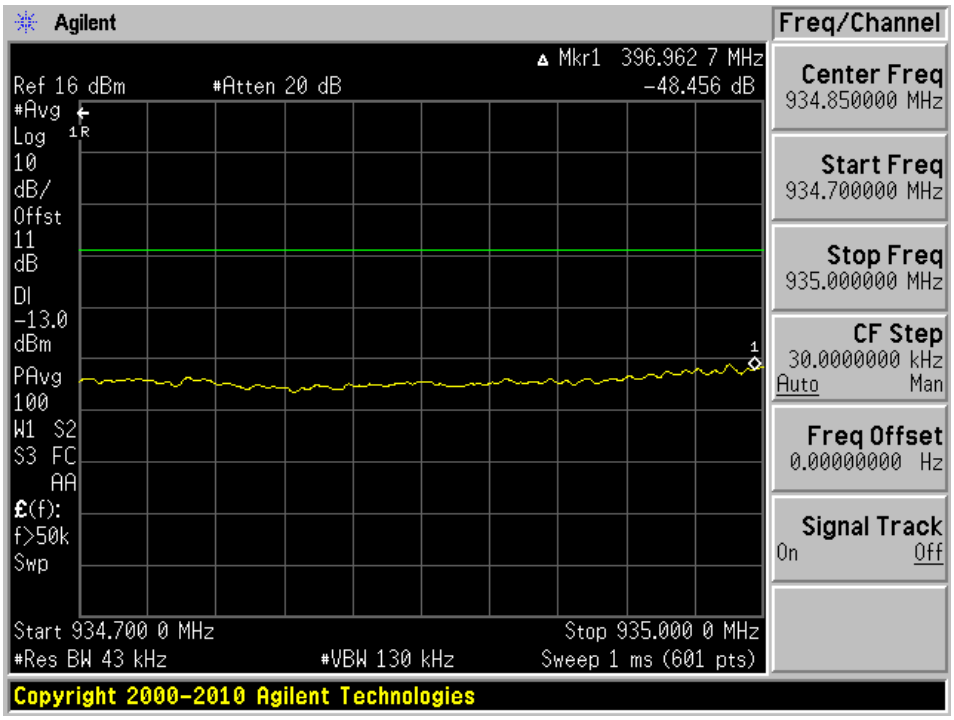


Intermodulation

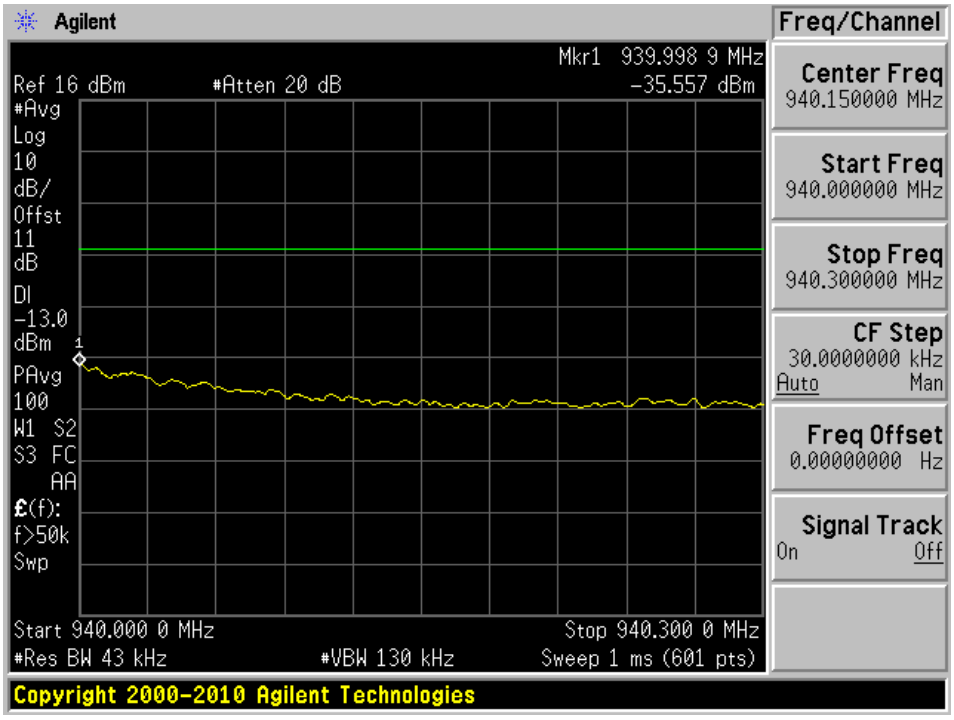
Downlink: Broadband Signal

AGC Off

Lower Band Edge

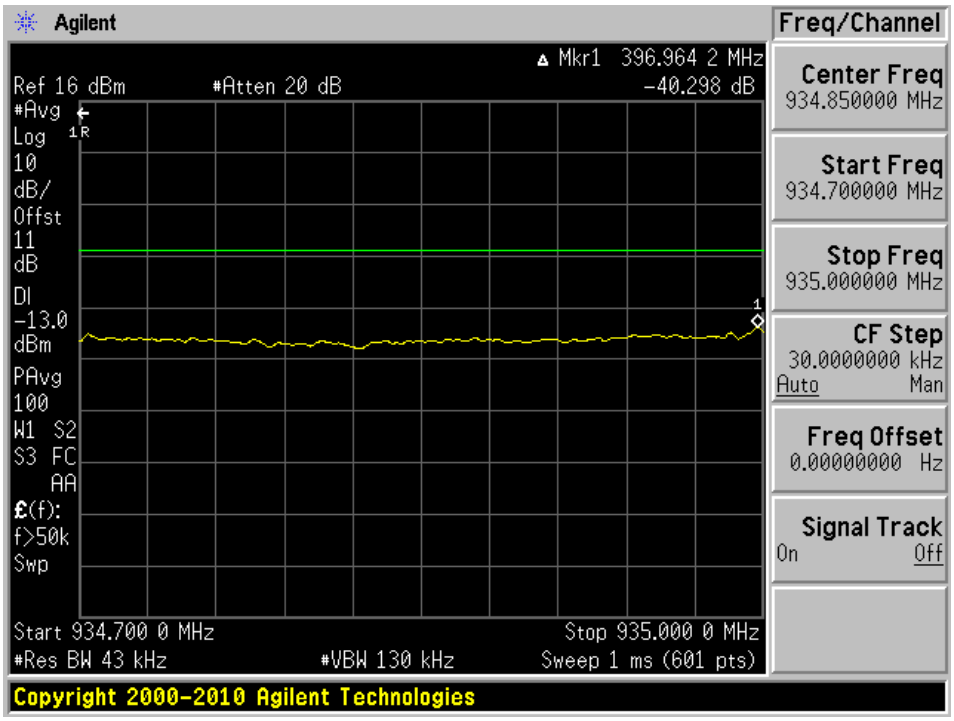


Upper Band Edge

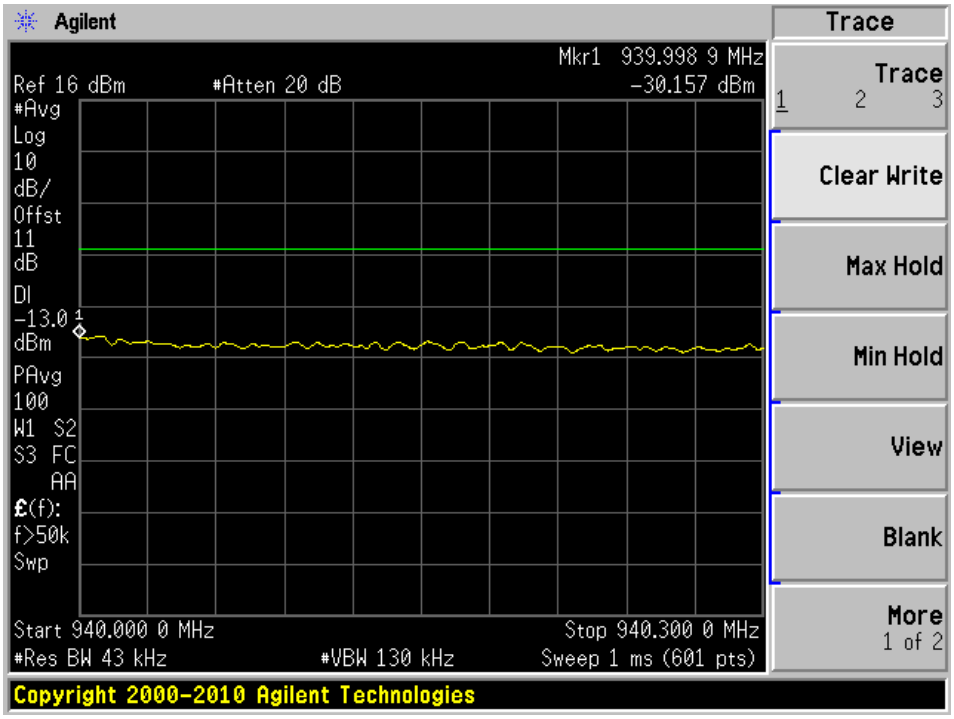


AGC On

Lower Band Edge



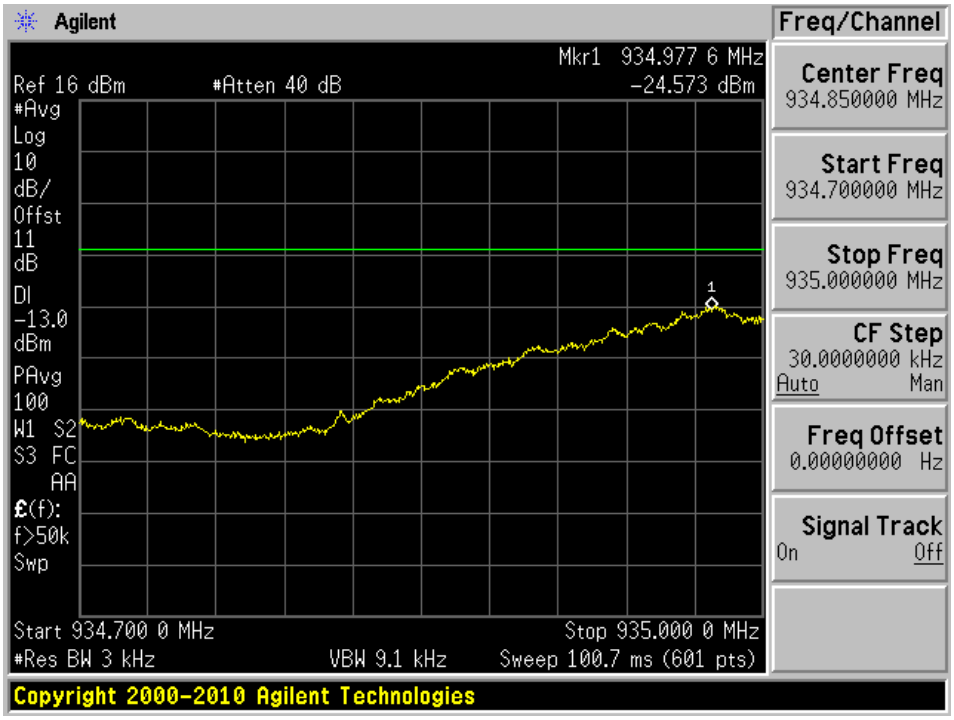
Upper Band Edge



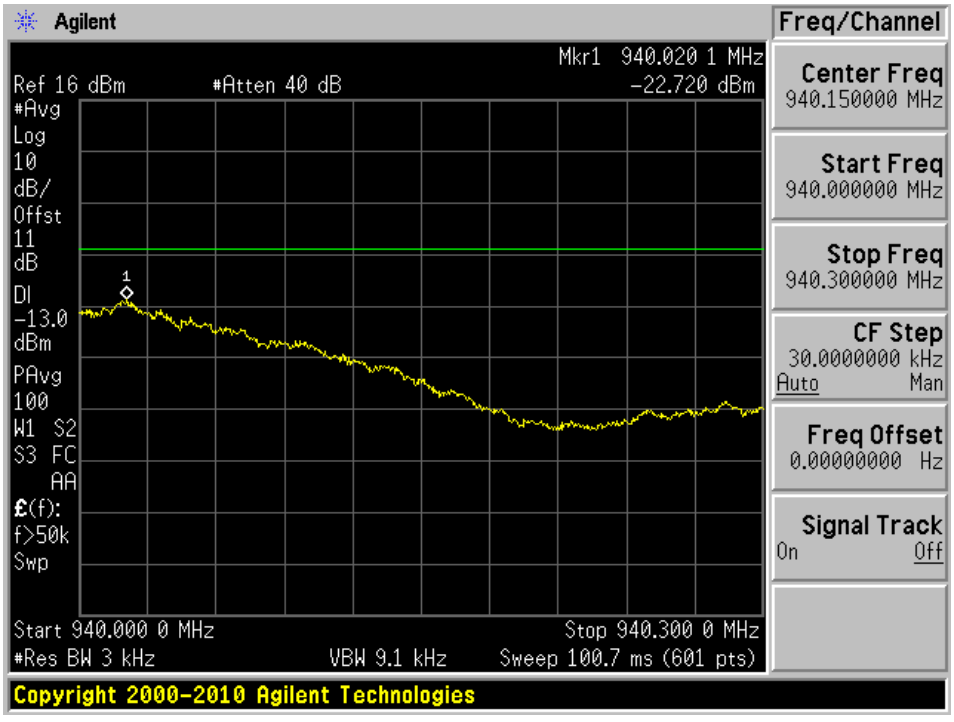
Downlink: Narrowband Signal

AGC Off

Lower Band Edge

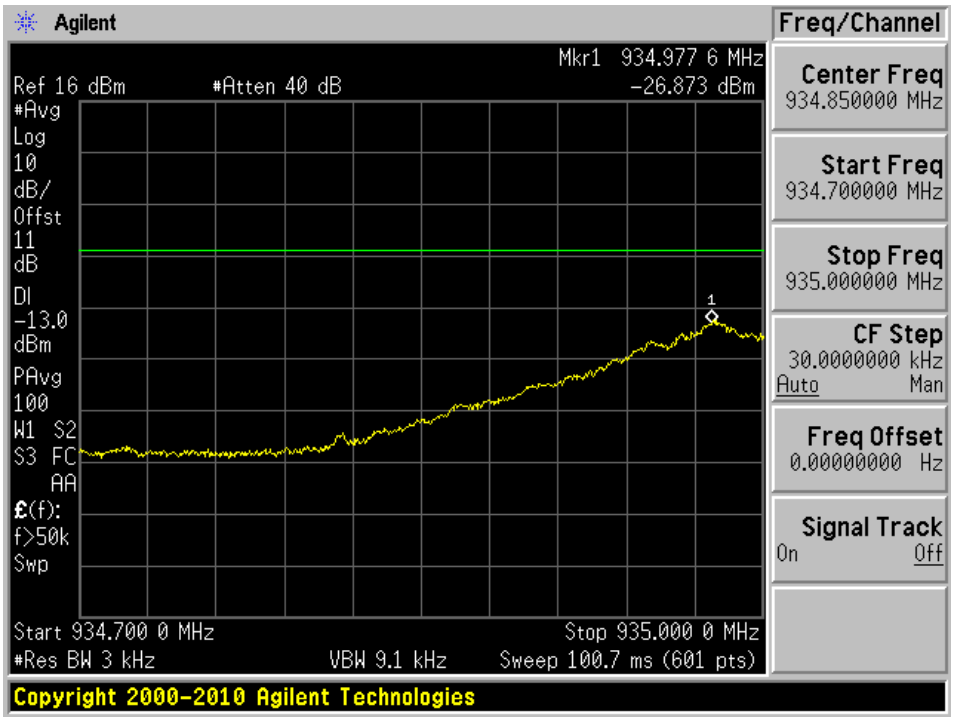


Upper Band Edge

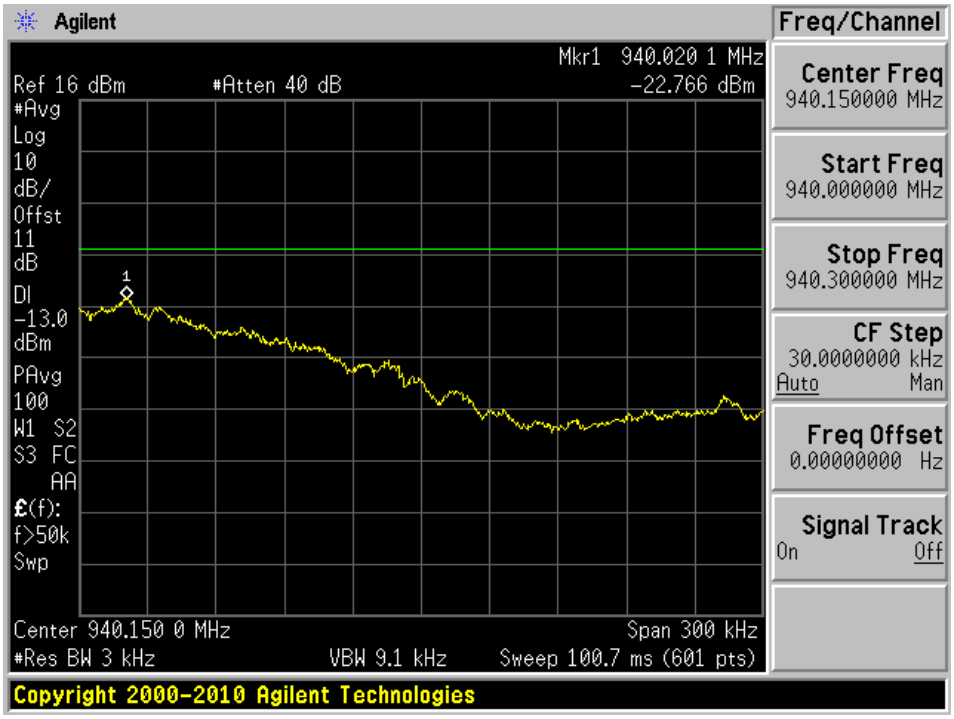


AGC On

Lower Band Edge



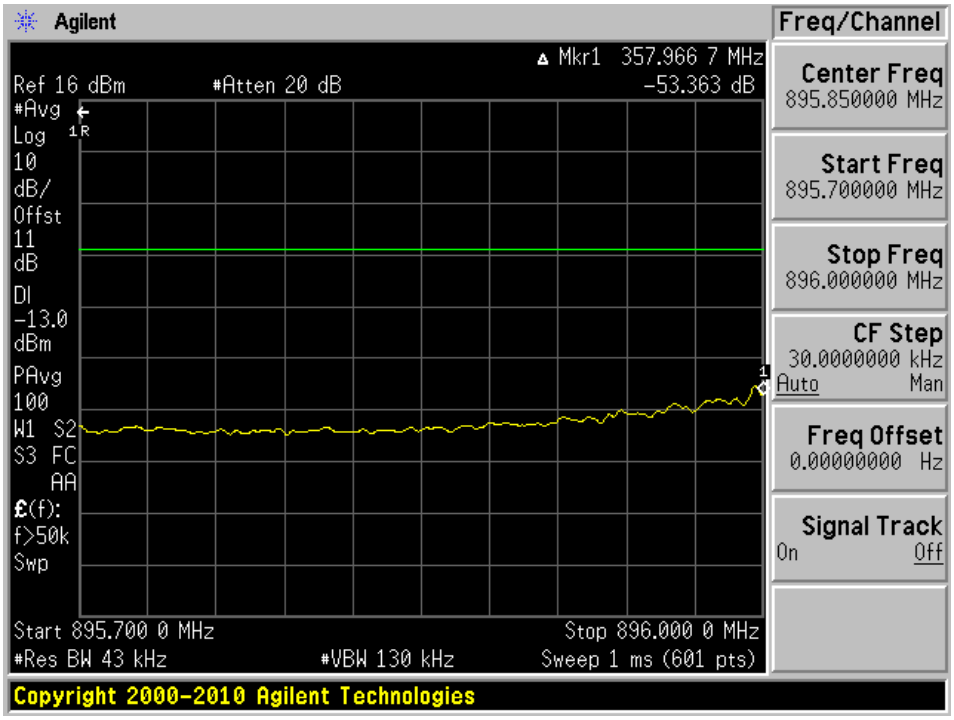
Upper Band Edge



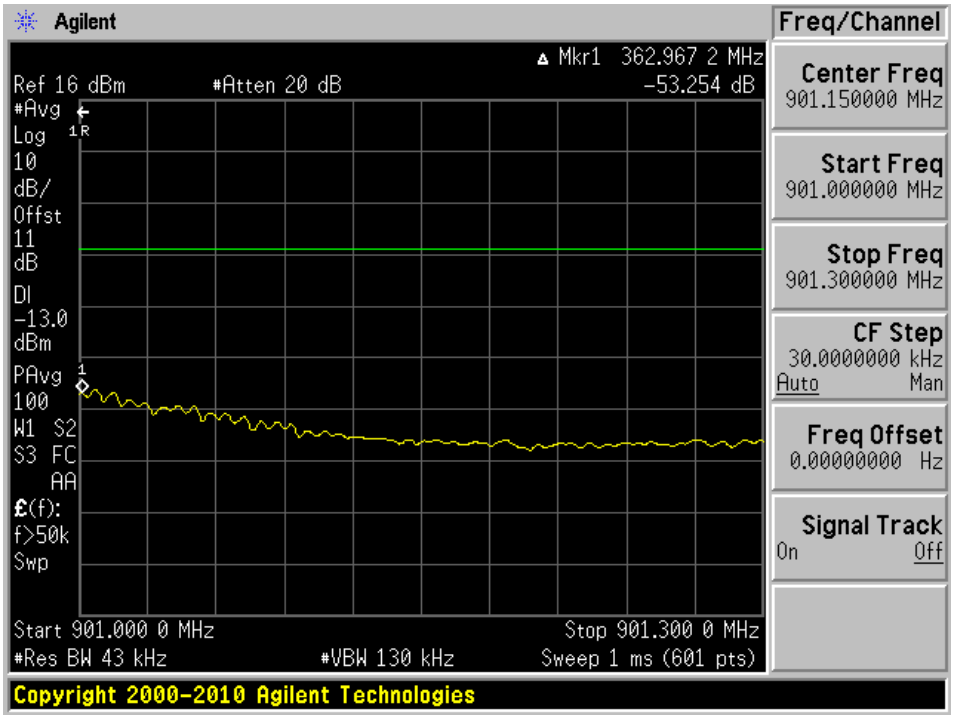
Uplink: Broadband Signal

AGC Off

Lower Band Edge

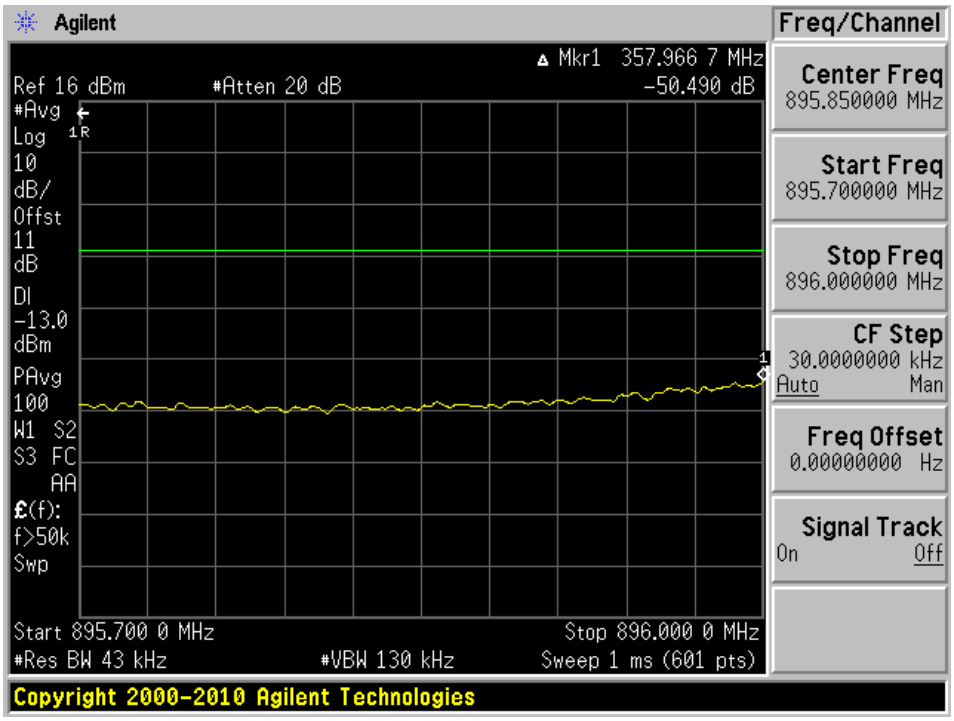


Upper Band Edge

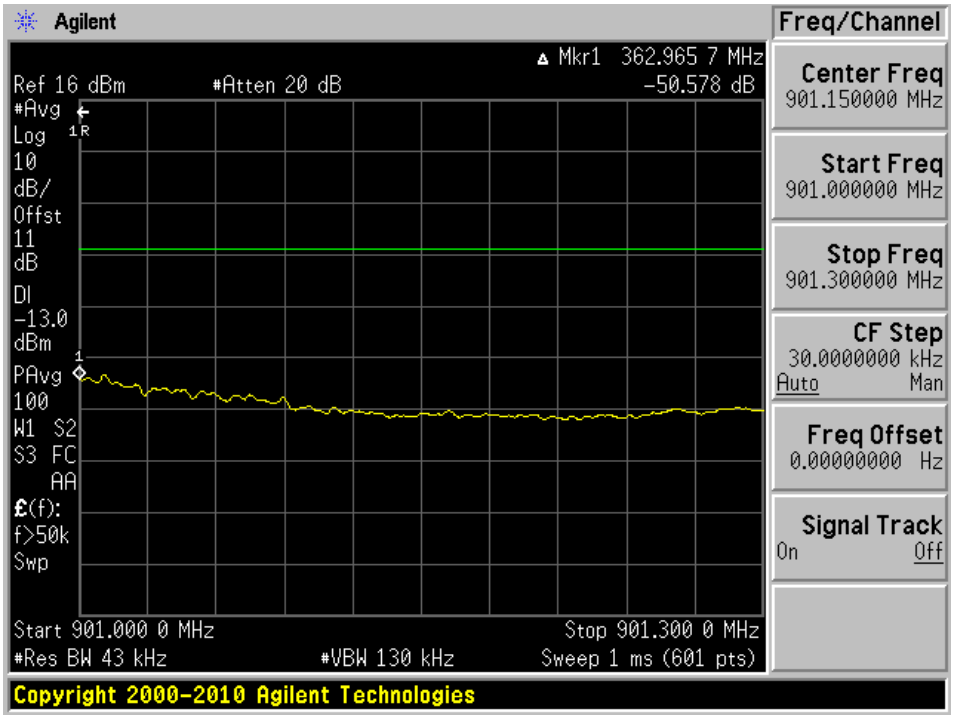


AGC On

Lower Band Edge



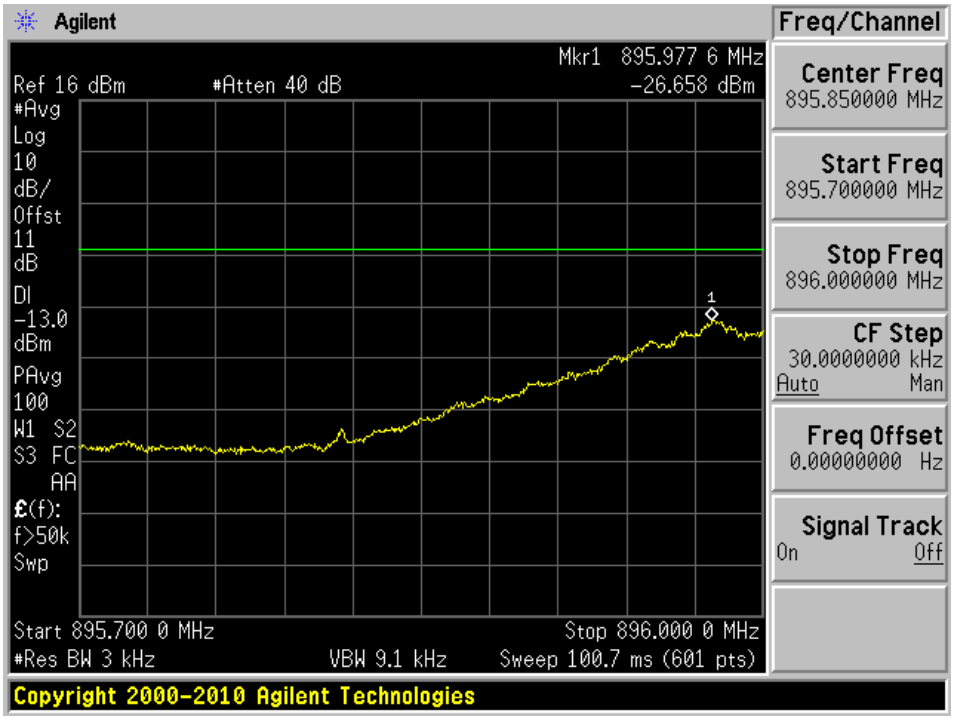
Upper Band Edge



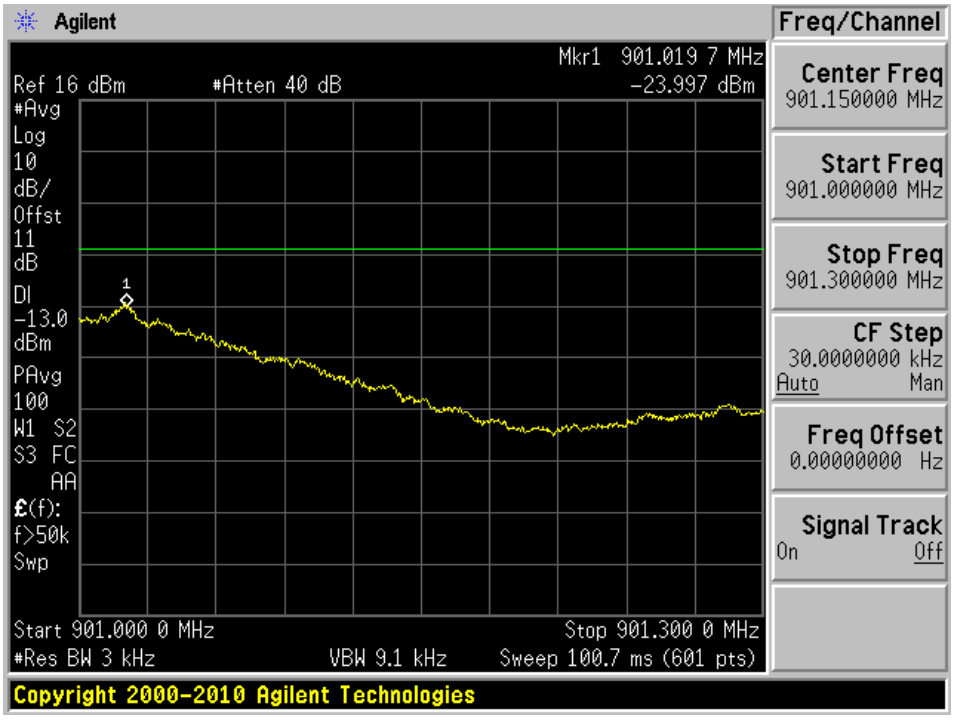
Uplink: Narrowband Signal

AGC Off

Lower Band Edge

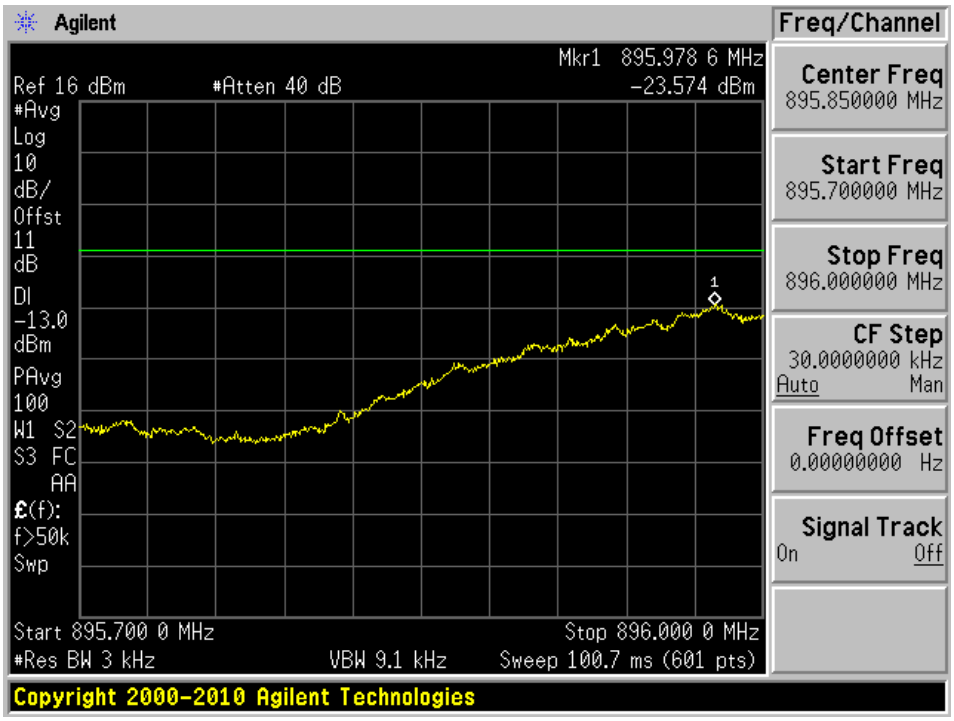


Upper Band Edge

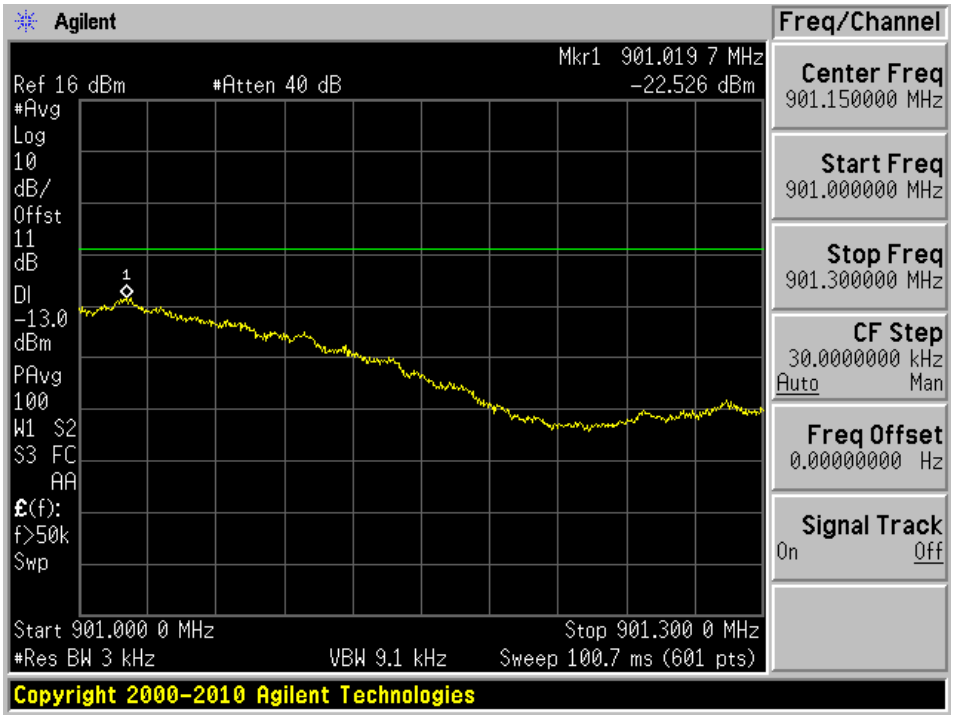


AGC On

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 placed 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	US45303156	2017-02-24	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	2016-07-05	1 year
Agilent	Pre-Amplifier	8449B	3008A01978	2016-10-06	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	2017-01-06	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1/2/3/4	2017-02-13	2 years
-	SMA cable	-	C04	Each Time[1]	Each Time[1]
-	SMA cable	-	C09	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 2017-06-15 in 5 Meter Chamber 3.

9.5 Test Results

Downlink Worst Margin: **-21.3 dB** at **1240 MHz** in the **Horizontal** polarization.
Uplink Worst Margin: **-29.52 dB** at **141.6 MHz** in the **Vertical** polarization.

Downlink: 935-940 MHz

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain Correction (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
Low Channel											
80	49.29	100	190	H	80	-52.82	0	0.28	-53.1	-13	-40.1
80	49.95	100	180	V	80	-49.93	0	0.28	-50.21	-13	-37.21
144.8	52	75	190	H	144.8	-47	0	0.37	-47.37	-13	-34.37
144.8	48.05	160	160	V	144.8	-46.48	0	0.37	-46.85	-13	-33.85
1135	51.58	100	100	H	1135	-60.91	6.14	0.2	-54.97	-13	-41.97
1135	52.21	230	100	V	1135	-61.57	6.14	0.2	-55.63	-13	-42.63
1540	50.85	0	100	H	1540	-60.75	6.87	0.25	-54.13	-13	-41.13
1540	50.63	0	100	V	1540	-62.02	6.87	0.25	-55.4	-13	-42.4

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 (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
Middle Channel											
80	35.28	150	200	H	80	-66.83	0	0.28	-67.11	-13	-54.11
80	49.98	273	100	V	80	-49.9	0	0.28	-50.18	-13	-37.18
144.8	52.13	130	120	H	144.8	-46.87	0	0.37	-47.24	-13	-34.24
144.8	48.23	147	100	V	144.8	-46.3	0	0.37	-46.67	-13	-33.67
1000	54.98	145	211	H	1000	-57.93	6.14	0.2	-51.99	-13	-38.99
1000	56.49	230	120	V	1000	-57.12	6.14	0.2	-51.18	-13	-38.18
1240	72.41	280	100	H	1240	-40.92	6.87	0.25	-34.3	-13	-21.3
1240	66.75	310	100	V	1240	-46.87	6.87	0.25	-40.25	-13	-27.25

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 (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
High Channel											
80	49.51	150	190	H	80	-52.6	0	0.28	-52.88	-13	-39.88
80	46.82	100	100	V	80	-53.06	0	0.28	-53.34	-13	-40.34
144.8	52.13	90	180	H	144.8	-46.87	0	0.37	-47.24	-13	-34.24
144.8	46.47	140	300	V	144.8	-48.06	0	0.37	-48.43	-13	-35.43
1015	52.21	0	300	H	1015	-58.84	6.14	0.2	-52.90	-13	-39.90
1015	52.52	0	255	V	1015	-61.89	6.14	0.2	-55.95	-13	-42.95
1360	50.95	45	100	H	1360	-61.77	6.87	0.25	-55.15	-13	-42.15
1360	51.15	150	241	V	1360	-61.9	6.87	0.25	-55.28	-13	-42.28

Uplink: 896- 901 MHz

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain Correction (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
Low Channel											
80	38	90	190	H	80	-64.11	0	0.28	-64.39	-13	-51.39
80	37.35	100	100	V	80	-62.53	0	0.28	-62.81	-13	-49.81
141.6	48.53	80	180	H	141.6	-50.47	0	0.45	-50.92	-13	-37.92
141.6	52.46	0	150	V	141.6	-42.07	0	0.45	-42.52	-13	-29.52
1000	52.36	0	100	H	1000	-59.85	6.14	0.2	-53.91	-13	-40.91
1000	52.34	240	100	V	1000	-61.25	6.14	0.2	-55.31	-13	-42.31
1270	52.96	20	100	H	1270	-58.6	6.87	0.25	-51.98	-13	-38.98
1270	51.88	200	100	V	1270	-60.35	6.87	0.25	-53.73	-13	-40.73

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 (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
Middle Channel											
80	34.86	135	180	H	80	-67.25	0	0.28	-67.53	-13	-54.53
80	49.01	210	100	V	80	-50.87	0	0.28	-51.15	-13	-38.15
141.6	48.4	86	100	H	141.6	-50.6	0	0.45	-51.05	-13	-38.05
141.6	52.16	115	160	V	141.6	-42.37	0	0.45	-42.82	-13	-29.82
1000	55.64	135	100	H	1000	-57.27	6.14	0.2	-51.33	-13	-38.33
1000	54.38	240	100	V	1000	-59.23	6.14	0.2	-53.29	-13	-40.29
1165	51.41	190	100	H	1165	-61.92	6.87	0.25	-55.3	-13	-42.3
1165	51.96	175	100	V	1165	-61.66	6.87	0.25	-55.04	-13	-42.04

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 (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
High Channel											
80	33.52	84	200	H	80	-68.59	0	0.28	-68.87	-13	-55.87
80	25.55	100	200	V	80	-74.33	0	0.28	-74.61	-13	-61.61
141.6	48.35	85	180	H	141.6	-50.65	0	0.45	-51.1	-13	-38.1
141.6	52.25	161	100	V	141.6	-42.28	0	0.45	-42.73	-13	-29.73
1030	53.25	35	100	H	1030	-60.06	6.14	0.2	-54.12	-13	-41.12
1030	52.46	250	100	V	1030	-62.51	6.14	0.2	-56.57	-13	-43.57
1270	51.73	0	100	H	1270	-59.86	6.87	0.25	-53.24	-13	-40.24
1270	51.94	345	100	V	1270	-60.42	6.87	0.25	-53.8	-13	-40.8

10 FCC §90.219 - Out of Band Rejection

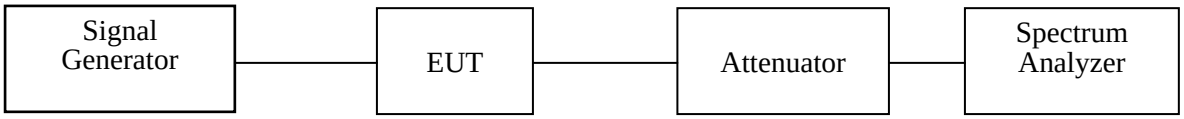
10.1 Applicable Standard

KDB 935210 D05, Section 3.3.

10.2 Test Procedure

KDB 935210 D05, Section 3.3.

The signal generator output was connected to the EUT input. The output of the EUT was connected to a spectrum analyzer through appropriate attenuation.



10.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2017-02-24	1 year
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2016-07-29	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
-	20 dB attenuator	-	-	Each Time[1]	Each Time[1]
-	SMA cable	-	C04	Each Time[1]	Each Time[1]
-	SMA cable	-	C09	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

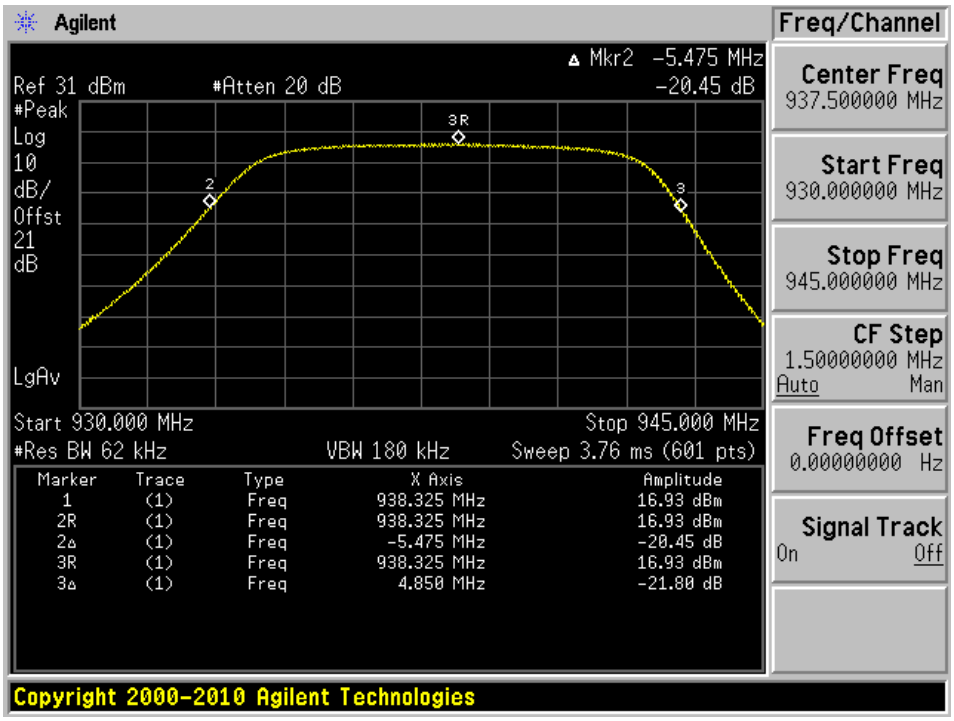
Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.3 kPa

The testing was performed by Jose Martinez on 2017-05-29 in the RF Site.

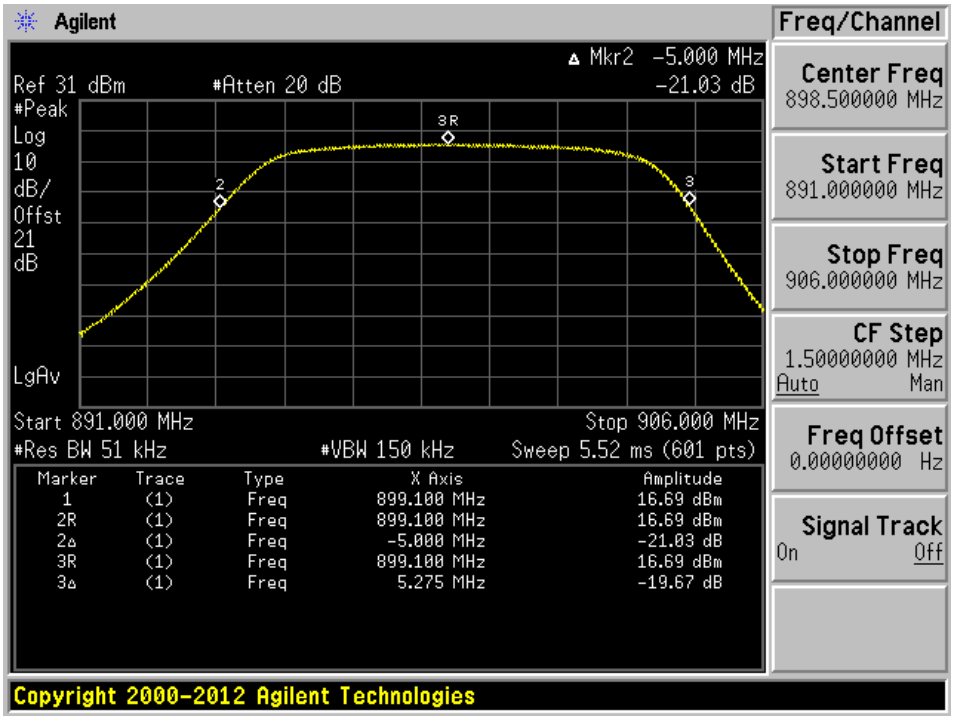
10.5 Test Results

Please refer to the following plots.

Downlink: 935-940 MHz



Uplink: 896-901 MHz



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