



## FCC PART 27

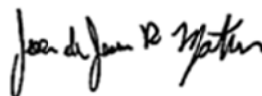
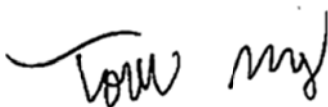
# TEST AND MEASUREMENT REPORT

For

**Intelibs, Inc.**

1500 Stony Brookroad,  
Stony Brook, NY 11794, USA

**FCC ID: Z69D01T4JX5**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Radio Hub Unit (RHU)
<b>Prepared By:</b> Jose Martinez Associate Test Engineer 	
<b>Report Number:</b> R1608091-27	
<b>Report Date:</b> 2016-12-01	
<b>Reviewed By:</b> Todd Moy RF Lead 	
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732 9164	

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA\* or any agency of the Federal Government.

\* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk

## TABLE OF CONTENTS

<b>1</b>	<b>GENERAL INFORMATION .....</b>	<b>5</b>
1.1	PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	5
1.2	MECHANICAL DESCRIPTION .....	5
1.3	OBJECTIVE .....	5
1.4	RELATED SUBMITTAL(S)/GRANT(S).....	5
1.5	TEST METHODOLOGY .....	5
1.6	MEASUREMENT UNCERTAINTY.....	6
1.7	TEST FACILITY REGISTRATIONS .....	6
<b>2</b>	<b>SYSTEM TEST CONFIGURATION .....</b>	<b>9</b>
2.1	JUSTIFICATION.....	9
2.2	EUT EXERCISE SOFTWARE.....	9
2.3	EQUIPMENT MODIFICATIONS .....	9
2.4	EUT INTERNAL CONFIGURATION .....	9
2.5	LOCAL SUPPORT EQUIPMENT LIST AND DETAILS .....	9
2.6	POWER SUPPLY AND LINE FILTERS.....	9
2.7	INTERFACE PORTS AND CABLING .....	10
<b>3</b>	<b>SUMMARY OF TEST RESULTS.....</b>	<b>11</b>
<b>4</b>	<b>FCC §2.1091 - RF EXPOSURE .....</b>	<b>12</b>
4.1	APPLICABLE STANDARDS .....	12
4.2	MPE PREDICTION .....	12
4.3	TEST RESULTS .....	13
<b>5</b>	<b>FCC §2.1046 &amp; §27.50- RF OUTPUT POWER .....</b>	<b>14</b>
5.1	APPLICABLE STANDARDS .....	14
5.2	TEST PROCEDURE .....	14
5.3	TEST EQUIPMENT LIST AND DETAILS .....	15
5.4	TEST ENVIRONMENTAL CONDITIONS.....	15
5.5	TEST RESULTS .....	15
<b>6</b>	<b>FCC §2.1049 – OCCUPIED BANDWIDTH.....</b>	<b>17</b>
6.1	APPLICABLE STANDARDS .....	17
6.2	TEST PROCEDURE .....	17
6.3	TEST EQUIPMENT LIST AND DETAILS .....	17
6.4	TEST ENVIRONMENTAL CONDITIONS.....	18
6.5	TEST RESULTS .....	18
<b>7</b>	<b>FCC §2.1053 &amp; §27.53 - SPURIOUS RADIATED EMISSIONS.....</b>	<b>31</b>
7.1	APPLICABLE STANDARDS .....	31
7.2	TEST PROCEDURE .....	32
7.3	TEST EQUIPMENT LIST AND DETAILS .....	33
7.4	TEST SETUP BLOCK DIAGRAM.....	34
7.5	TEST ENVIRONMENTAL CONDITIONS.....	34
7.6	TEST RESULTS .....	35
<b>8</b>	<b>FCC §2.1051 &amp; §27.53- SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....</b>	<b>37</b>
8.1	APPLICABLE STANDARDS .....	37
8.2	TEST PROCEDURE .....	38
8.3	TEST EQUIPMENT LIST AND DETAILS .....	38
8.4	TEST ENVIRONMENTAL CONDITIONS.....	38
8.5	TEST RESULTS .....	39
<b>9</b>	<b>FCC §27.53 - BAND EDGE &amp; INTERMODULATION.....</b>	<b>69</b>

9.1 APPLICABLE STANDARDS .....69

9.2 TEST PROCEDURE .....70

9.3 TEST EQUIPMENT LIST AND DETAILS .....70

9.4 TEST ENVIRONMENTAL CONDITIONS .....70

9.5 TEST RESULTS .....70

**10 FCC §20.21 - OUT OF BAND REJECTION.....95**

10.1 APPLICABLE STANDARD .....95

10.2 TEST PROCEDURE .....95

10.3 TEST EQUIPMENT LIST AND DETAILS .....95

10.4 TEST ENVIRONMENTAL CONDITIONS .....95

10.5 TEST RESULTS .....96

**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R1608091-27	Original	2016-12-01

## 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 35.5 cm (L) x 44.5 cm (W) x 25.4 cm (H) and weighs 32 kg.

*The test data gathered are from typical production sample, serial number: R1608091-1, assigned by BACL.*

### 1.3 Objective

This type approval report was prepared on behalf of *Intelibs, Inc.* in accordance with Part 2, Subpart J, Part 20.21, and Part 27 of the Federal Communication Commission's rules.

The objective is 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 90, Subpart S, 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, Subpart J as well as the following parts:

Part 20.21 – Signal Boosters

Part 27 - Miscellaneous Wireless Communication Services

Applicable Standards: TIA/EIA603-D, FCC KDB 935210.

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

## 1.6 Measurement Uncertainty

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

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 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, 3<sup>rd</sup>-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):
  - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - o EMC Directive 2014/30/EC US-EU EMC & Telecom MRA CAB
  - o 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:
  - o ENERGY STAR Recognized Test Laboratory – US EPA
  - o 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 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 EUT 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 List and Details

N/A

### 2.6 Power Supply and Line Filters

Manufacturers	Descriptions	Models	Serial Numbers
TDK-Lambda	SMPS	-	-

## 2.7 Interface Ports and Cabling

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
§2.1091	RF Exposure	Compliant
§2.1046, §27.50	RF Output Power	Compliant
§2.1049	26 dB Occupied Bandwidth	Compliant
§2.1053, §27.53	Spurious Radiated Emissions	Compliant
§2.1053, §27.53	Spurious Emissions at Antenna Terminals	Compliant
§2.1053, §27.53	Band Edge & Intermodulation	Compliant
§2.1055, §27.54	Frequency Stability	N/A <sup>1</sup>
§20.21	Out of Band Rejection	Compliant

<sup>1</sup> The EUT was a signal booster.

## 4 FCC §2.1091 - RF Exposure

### 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 <sup>2</sup> )	Averaging Time (minute)
<b>Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Note: f = frequency in MHz

\* = Plane-wave equivalent power density

### 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

## 4.3 Test Results

### 698–716 MHz

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>20.70</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>117.49</u>
<u>Prediction distance (cm):</u>	<u>40</u>
<u>Prediction frequency (MHz):</u>	<u>707</u>
<u>Antenna Gain, typical (dBi):</u>	<u>18</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>63.10</u>
<u>Power density at predication frequency and distance (mW/cm<sup>2</sup>):</u>	<u>0.3687</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm<sup>2</sup>):</u>	<u>0.47</u>

### 776–787 MHz

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>20.24</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>105.68</u>
<u>Prediction distance (cm):</u>	<u>40</u>
<u>Prediction frequency (MHz):</u>	<u>781.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>18</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>63.10</u>
<u>Power density at predication frequency and distance (mW/cm<sup>2</sup>):</u>	<u>0.3316</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm<sup>2</sup>):</u>	<u>0.521</u>

### 1710–1755 MHz

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>21.53</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>142.23</u>
<u>Prediction distance (cm):</u>	<u>40</u>
<u>Prediction frequency (MHz):</u>	<u>1732.5</u>
<u>Antenna Gain, typical (dBi):</u>	<u>8.45</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>7.00</u>
<u>Power density at predication frequency and distance (mW/cm<sup>2</sup>):</u>	<u>0.0495</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>

## Results

The highest power density levels at 40 cm are below the MPE uncontrolled exposure limit.

## 5 FCC §2.1046 & §27.50- RF Output Power

### 5.1 Applicable Standards

According to FCC §27.50 (b) (1), fixed and base stations transmitting a signal in the 757-758 and 775-776 MHz bands must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT), except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

According to FCC §27.50 (b) (4), fixed and base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

According to FCC §27.50 (c), the following power and antenna height requirements apply to stations transmitting in the 600 MHz band and the 698-746 MHz band:

(1) fixed and base stations transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT), except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

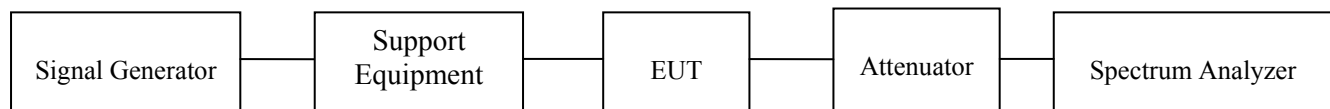
(3) fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

According to FCC §27.50 (d) (4), fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground.

### 5.2 Test Procedure

Conducted:

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 <sup>1</sup>	Each Time <sup>1</sup>
-	20 dB attenuator	-	-	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0003	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0006	Each Time <sup>1</sup>	Each Time <sup>1</sup>

<sup>1</sup>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

<b>Temperature:</b>	23° C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4-102 kPa

The testing was performed by Jose Martinez 2016-09-28 in the RF Site.

### 5.5 Test Results

#### 698–716 MHz

Signal Type	AGC	Input Power (dBm)	Output Power (dBm)	Gain (dB)	ERP (dBm)
Broadband	Off	-64.97	18.73	83.7	34.58
	On	-61.53	20.49	82.02	36.34
Narrowband	Off	-65.34	17.55	82.89	33.4
	On	-62.48	20.70	83.18	36.55

**776–787 MHz**

Signal Type	AGC	Input Power (dBm)	Output Power (dBm)	Gain (dB)	ERP (dBm)
Broadband	Off	-66.02	17.5	83.52	33.35
	On	-62.52	20.24	82.76	36.09
Narrowband	Off	-67.14	16.26	83.4	32.11
	On	-63.78	20.04	83.82	35.89

**1710–1755 MHz**

Signal Type	AGC	Input Power (dBm)	Output Power (dBm)	Gain (dB)	EIRP (dBm)
Broadband	Off	-70.12	20.69	90.81	29.14
	On	-66.63	21.53	88.16	29.98
Narrowband	Off	-62.77	19.88	82.65	28.33
	On	-59.04	20.73	79.77	29.18

Note 1: The maximum recommended antenna gain used with the 700MHz band is 18 dBi.

Note 2: The maximum recommended antenna gain used with the 1700MHz band is 8.45 dBi.

ERP=Conducted Output Power (dBm) + Antenna Gain (dBi) -2.15 dB

EIRP=Conducted Output Power (dBm) + Antenna Gain (dBi)

Note 2: 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 RHU is around 40 dB. Thus, the typical gain of MRU is around 45 dB, please refer to FCC ID: Z69D01T4JX6.



## 6 FCC §2.1049 – Occupied Bandwidth

### 6.1 Applicable Standards

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 anticipated 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 <sup>1</sup>	Each Time <sup>1</sup>
-	20 dB attenuator	-	-	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0003	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0006	Each Time <sup>1</sup>	Each Time <sup>1</sup>

<sup>1</sup>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

<b>Temperature:</b>	23° C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4-102 kPa

The testing was performed by Jose Martinez 2016-09-28 in the RF Site.

## 6.5 Test Results

Please refer to the following table and plots.

### 698–716 MHz

Signal Type	AGC	Input	Output
		99 % OBW (kHz)	99 % OBW (kHz)
Broadband	off	4089.6	4020.5
	on	4089.6	4044.2
Narrowband	off	244.38	241.28
	on	244.38	241.28

### 776–787 MHz

Signal Type	AGC	Input	Output
		99 % OBW (kHz)	99 % OBW (kHz)
Broadband	off	4128.0	4012.6
	on	4128.0	40143
Narrowband	off	243.81	242.45
	on	243.81	245.24

### 1710–1755 MHz

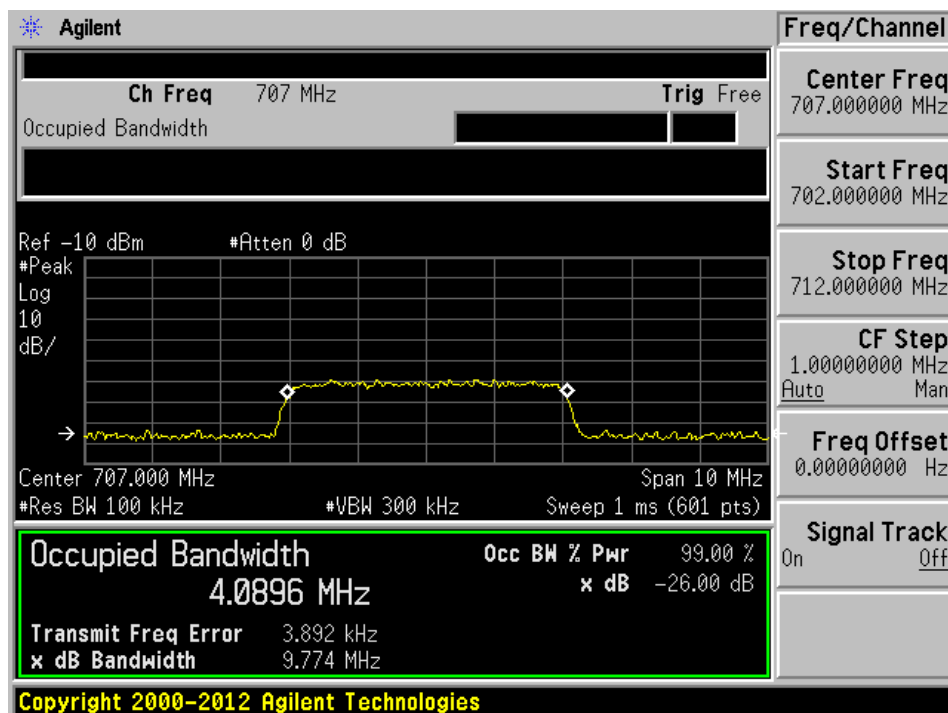
Signal Type	AGC	Input	Output
		99 % OBW (kHz)	99 % OBW (kHz)
Broadband	off	4111.0	4114.8
	on	4111.0	4134.6
Narrowband	off	243.58	241.76
	on	243.58	241.41

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

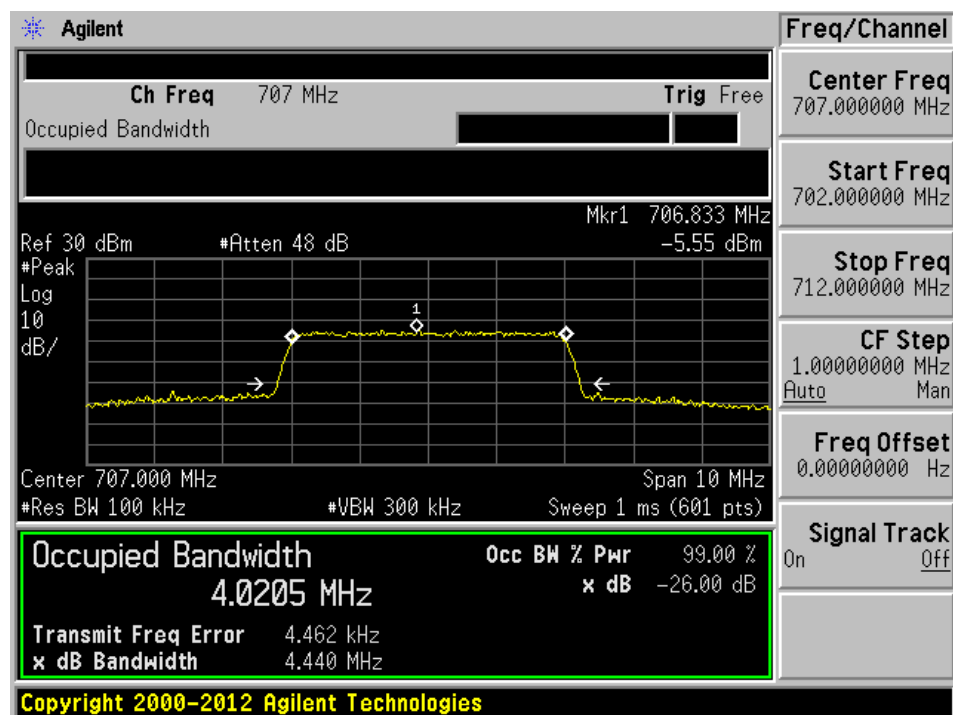
## 698–716 MHz: Broadband Signal

AGC off

Input

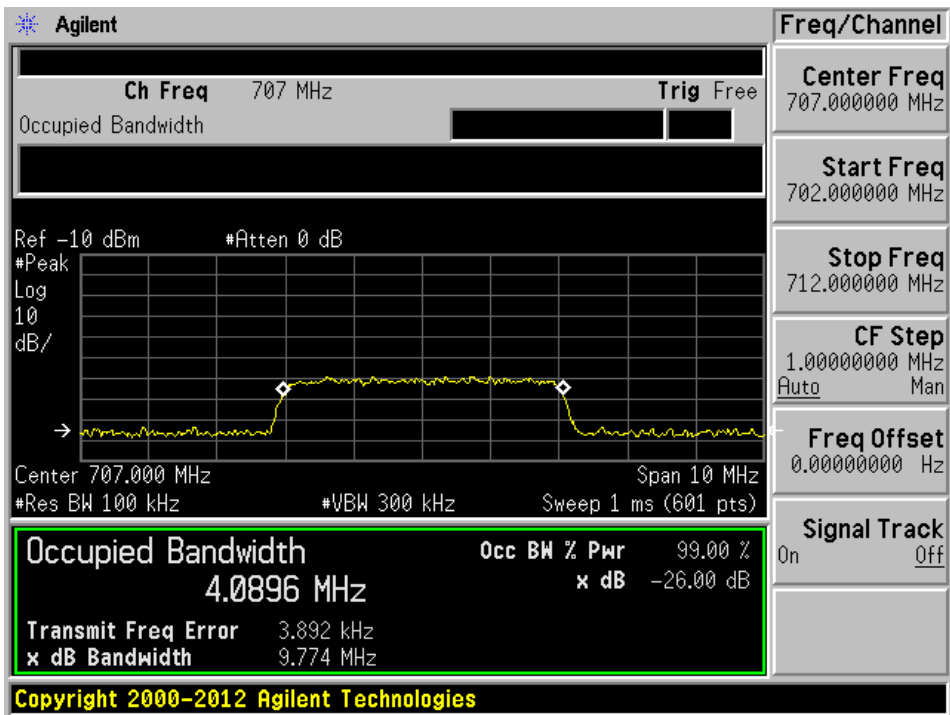


Output

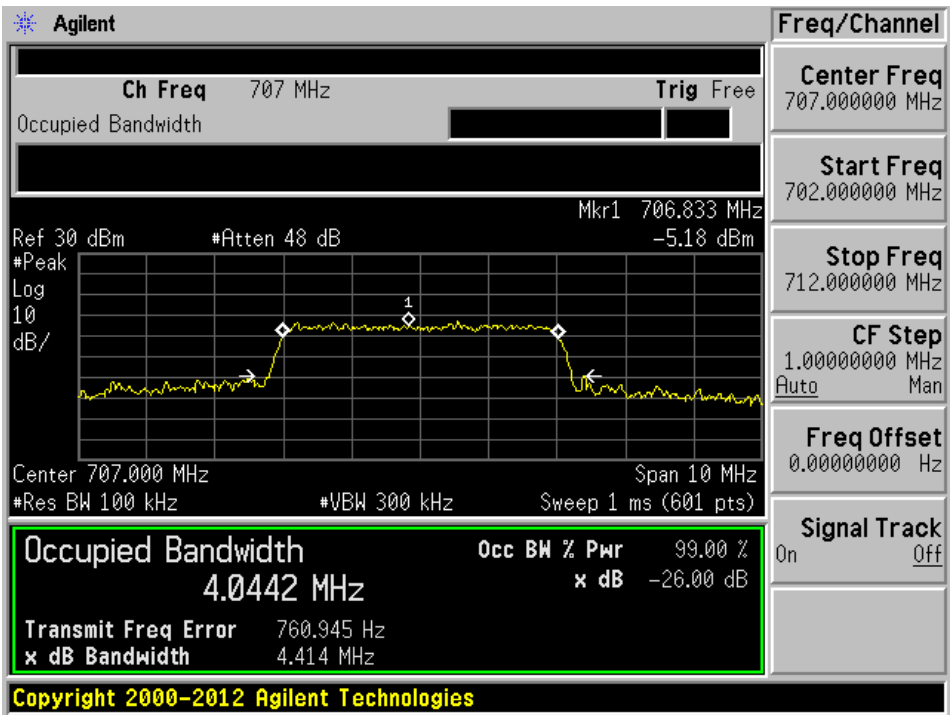


AGC on

Input



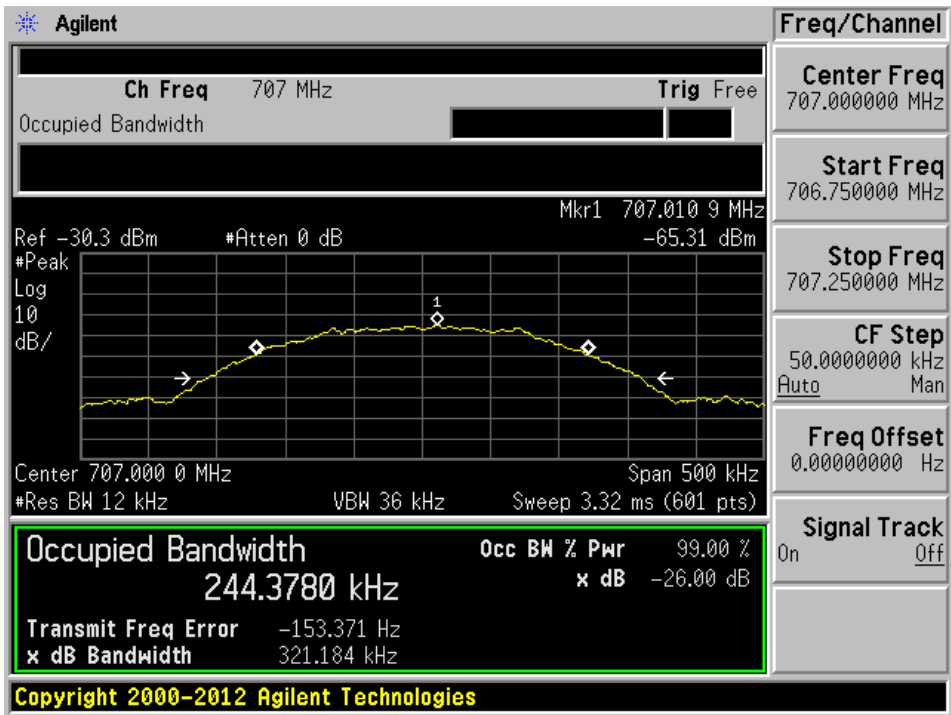
Output



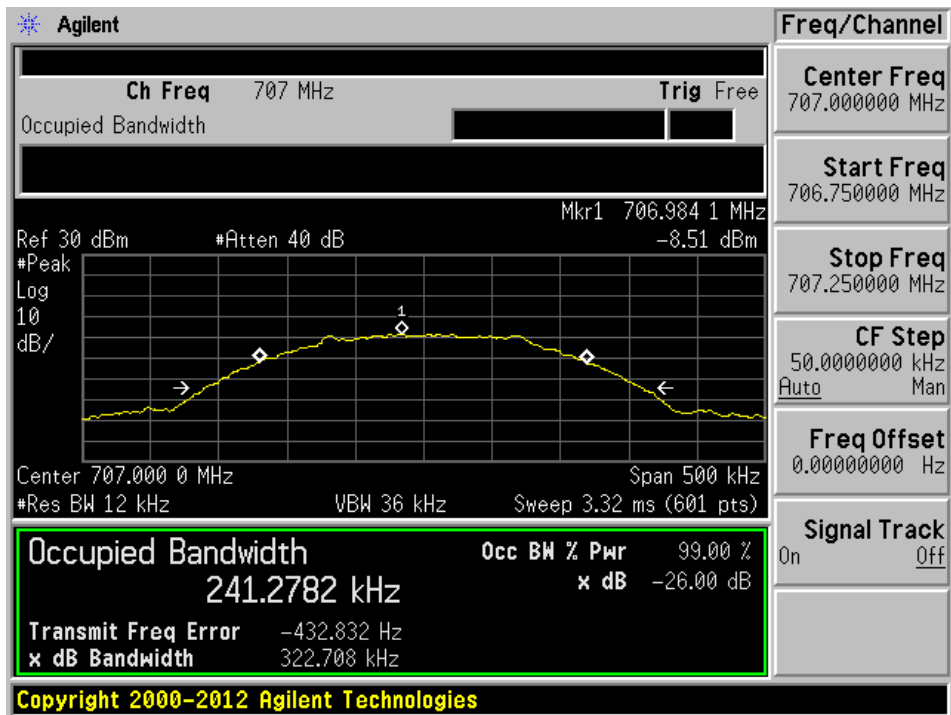
698–716 MHz: Narrowband Signal

AGC off

Input

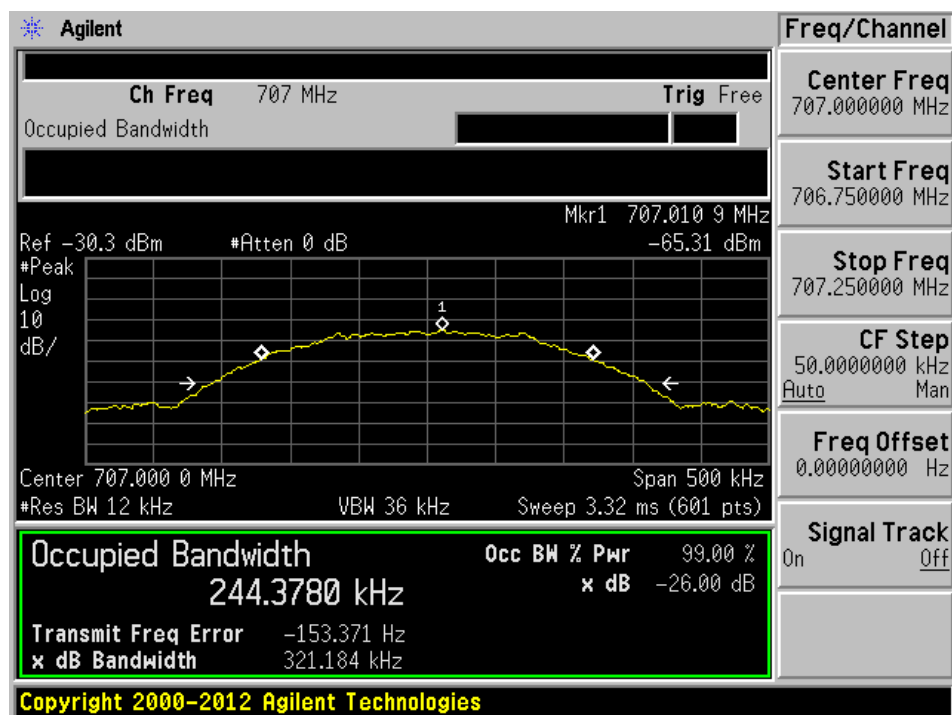


Output

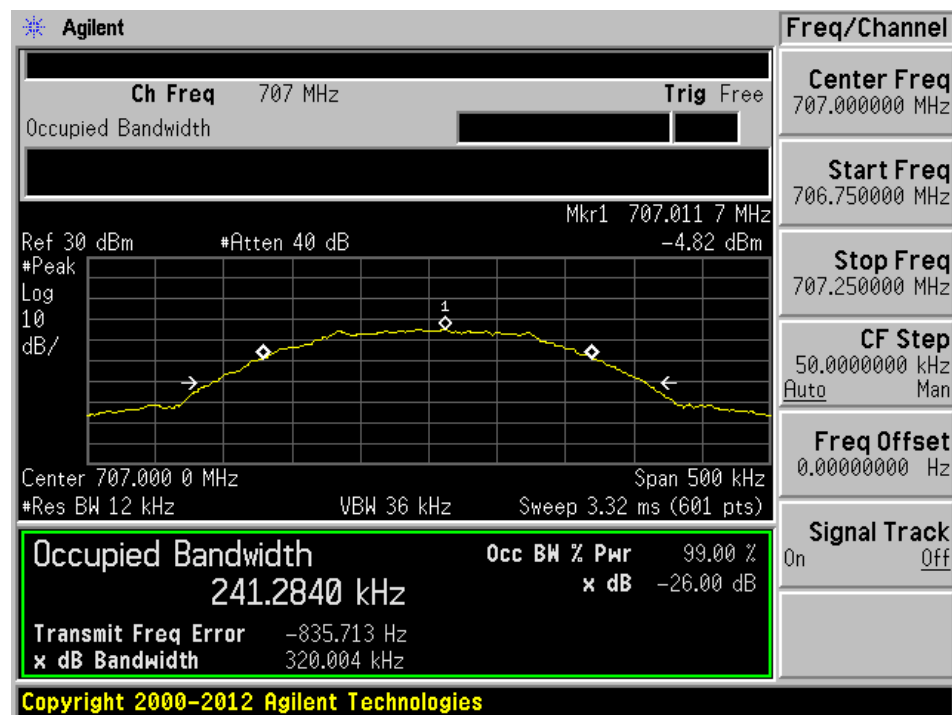


AGC on

Input



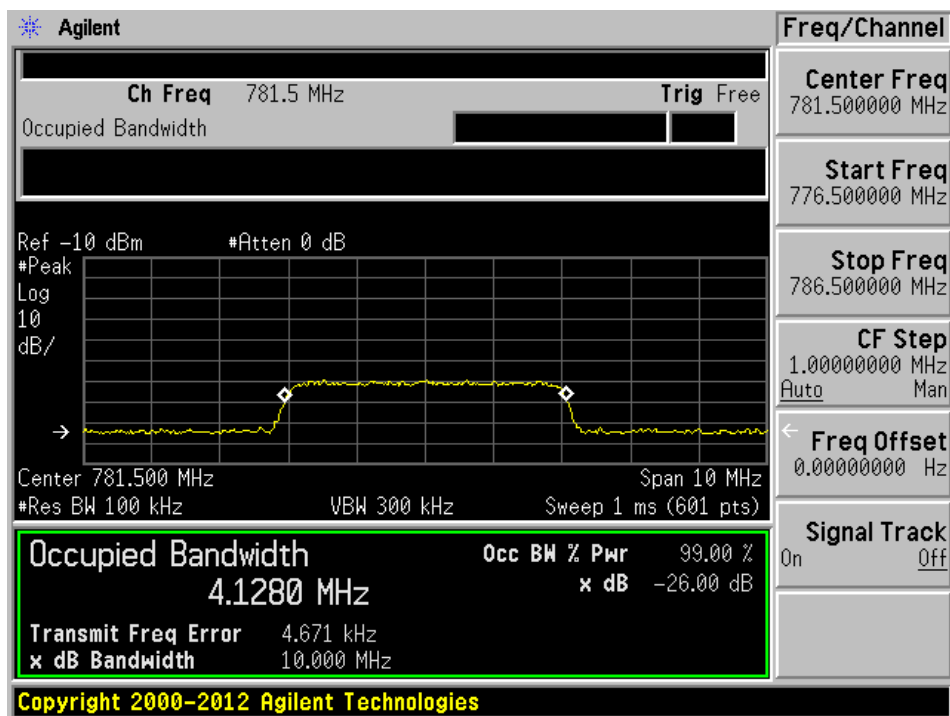
Output



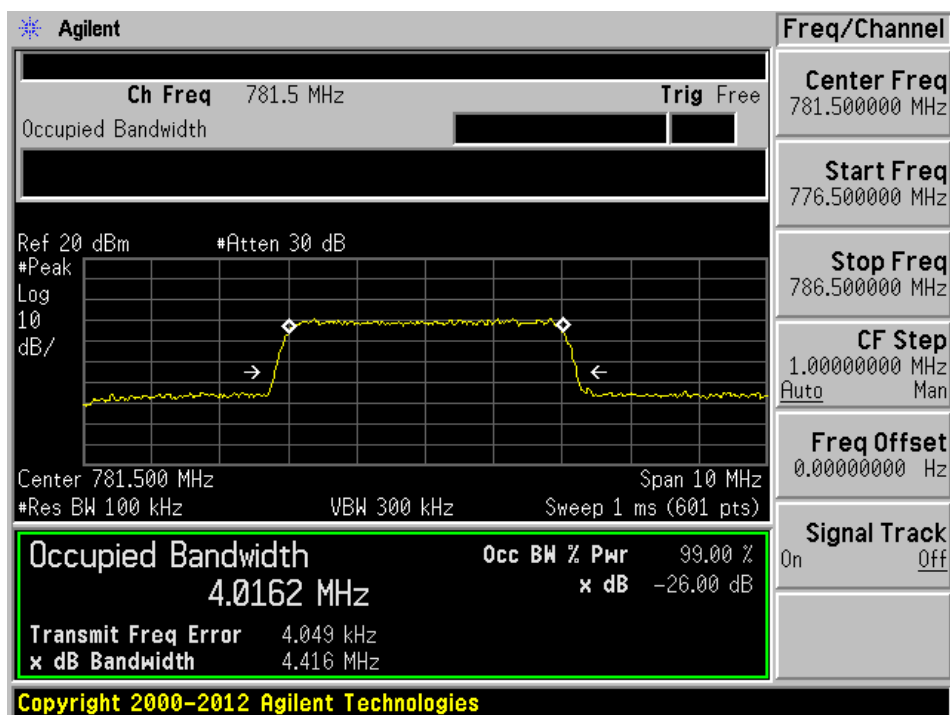
## 776–787 MHz: Broadband Signal

AGC off

Input

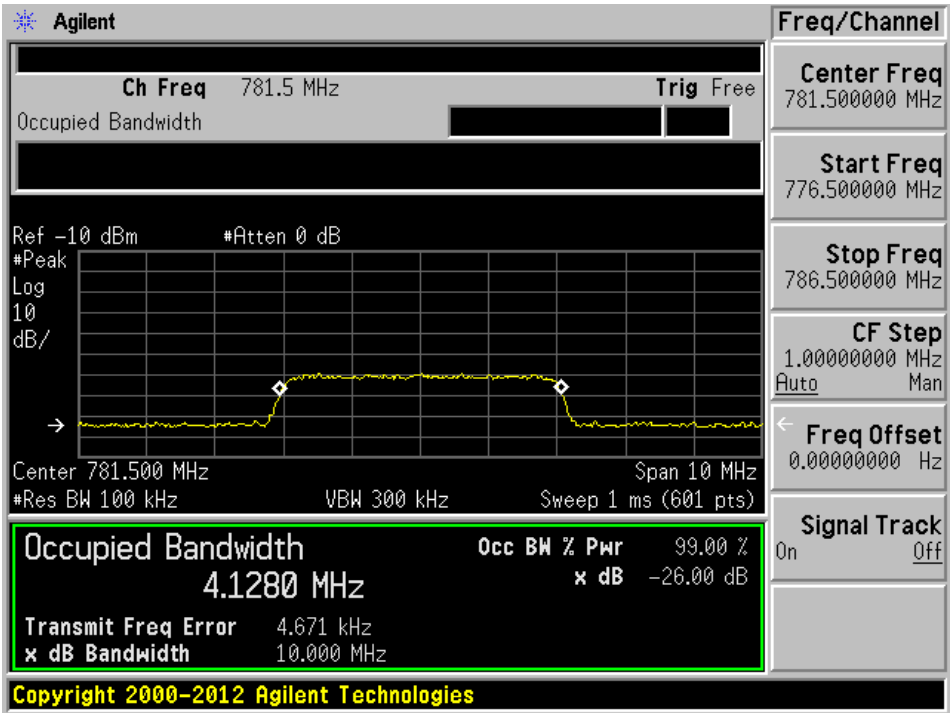


Output

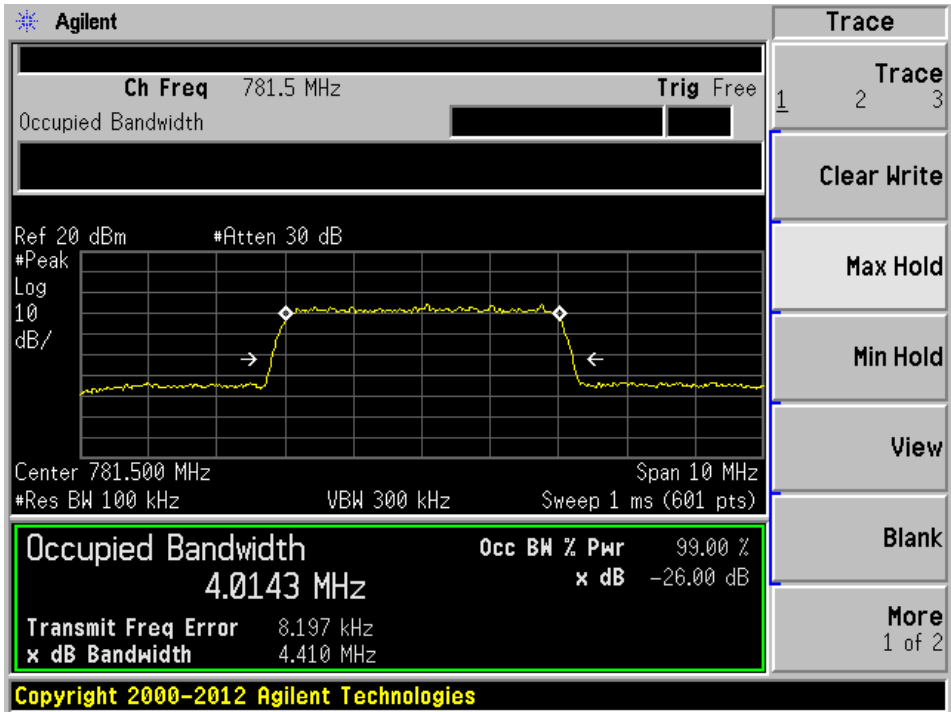


AGC on

Input



Output

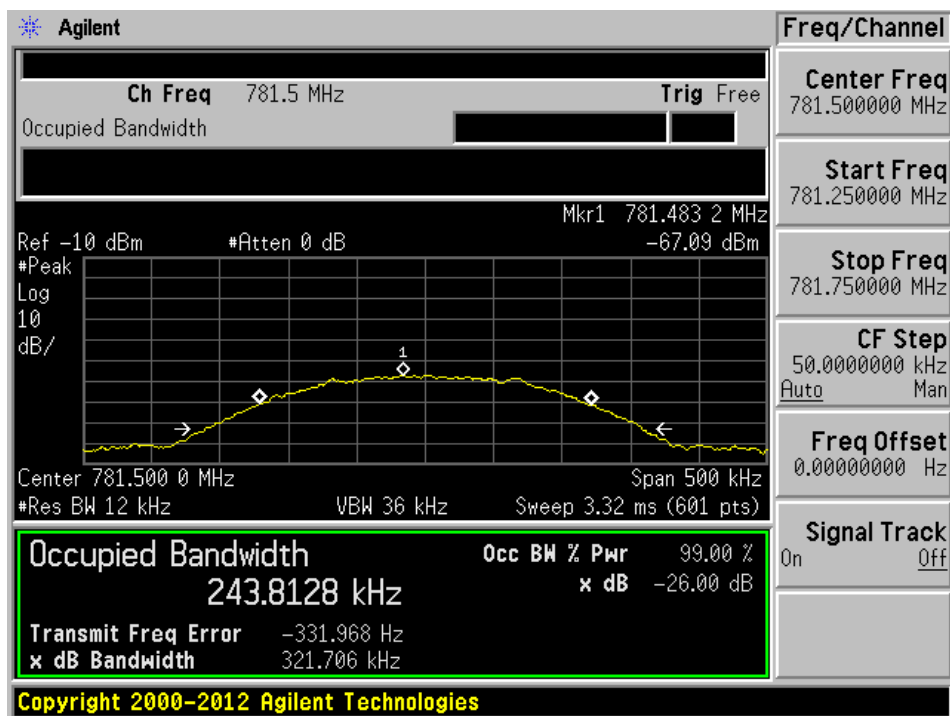




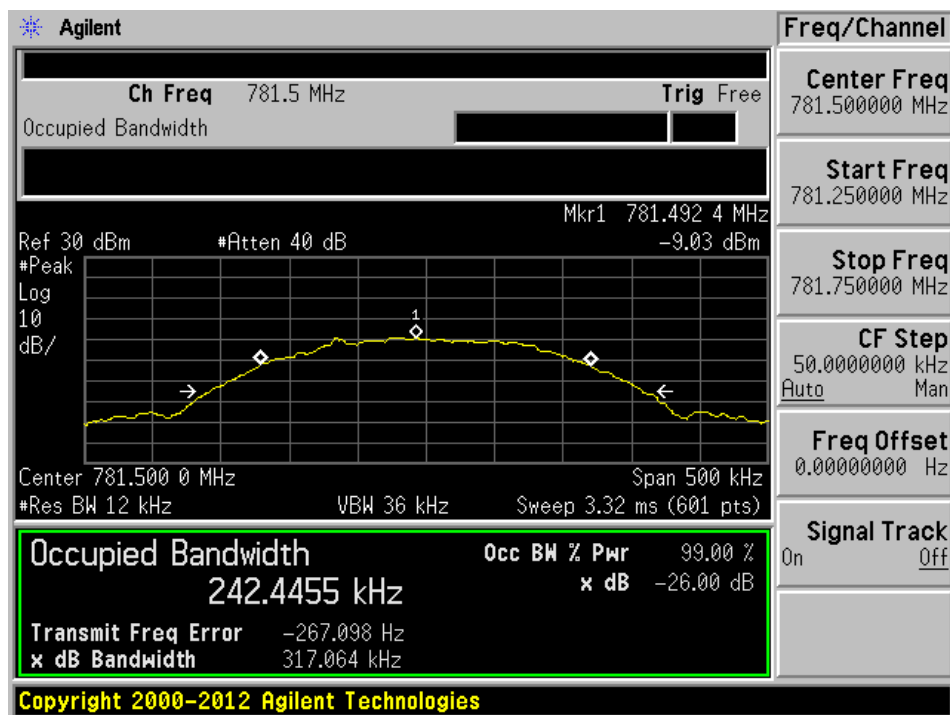
## 776–787 MHz: Narrowband Signal

AGC off

Input

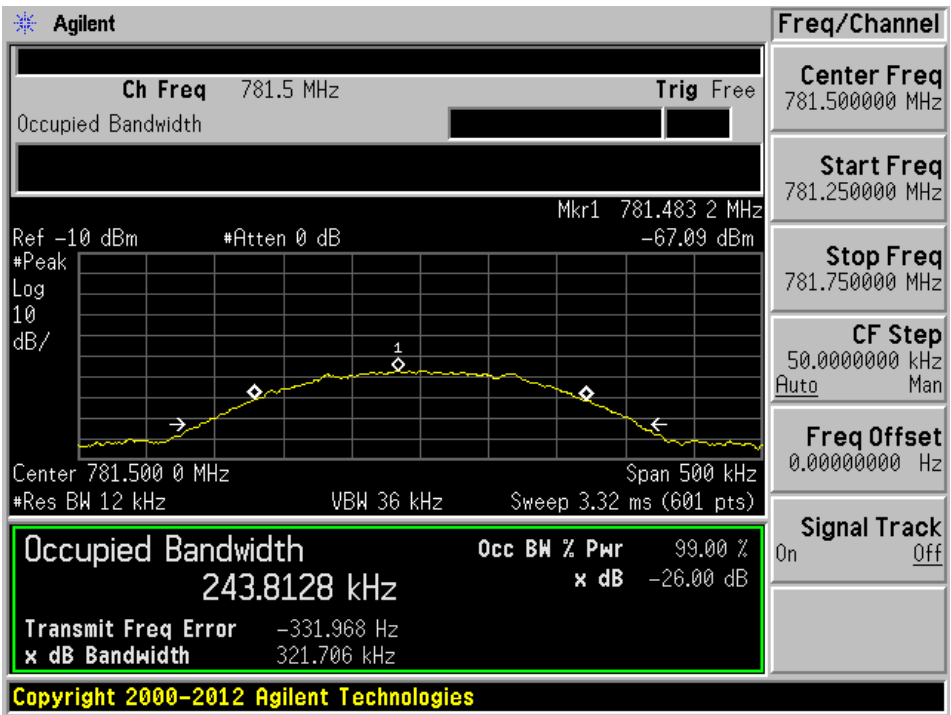


Output

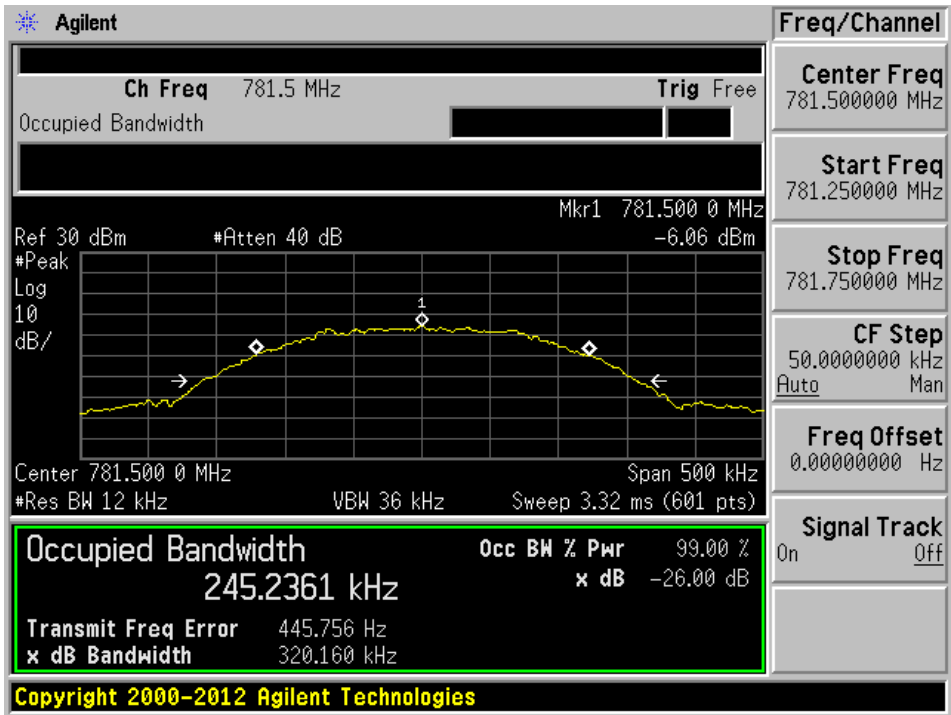


AGC on

Input



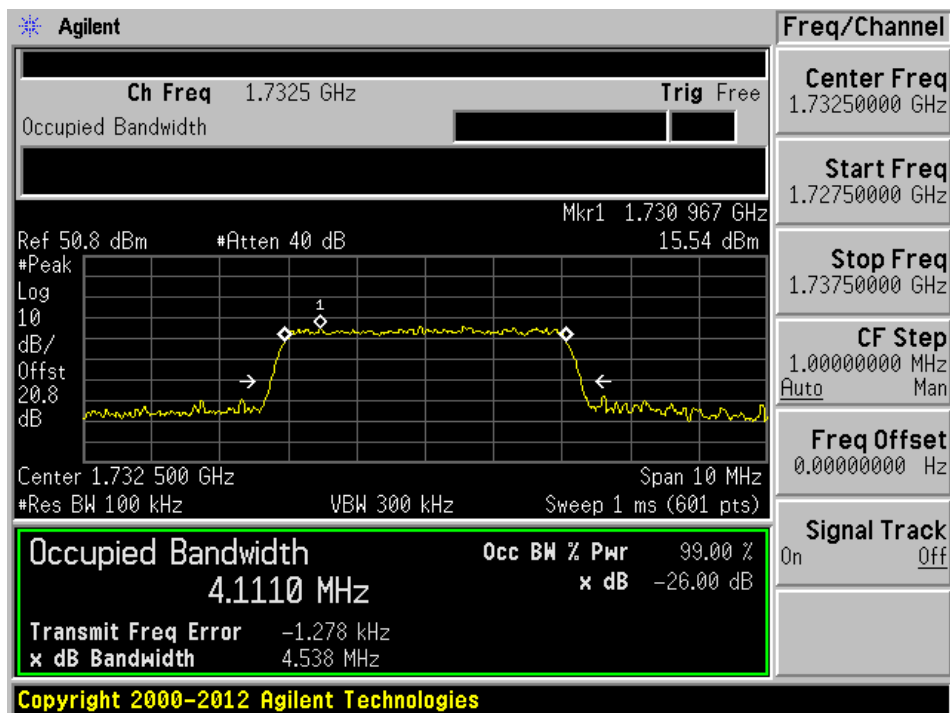
Output



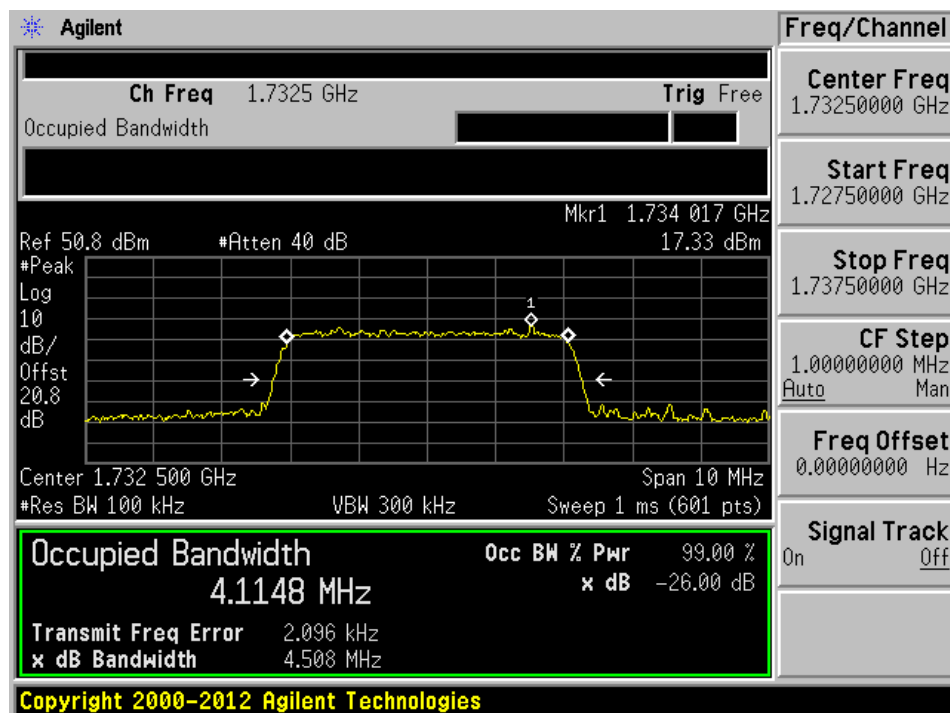
## 1710–1755 MHz: Broadband Signal

AGC off

Input

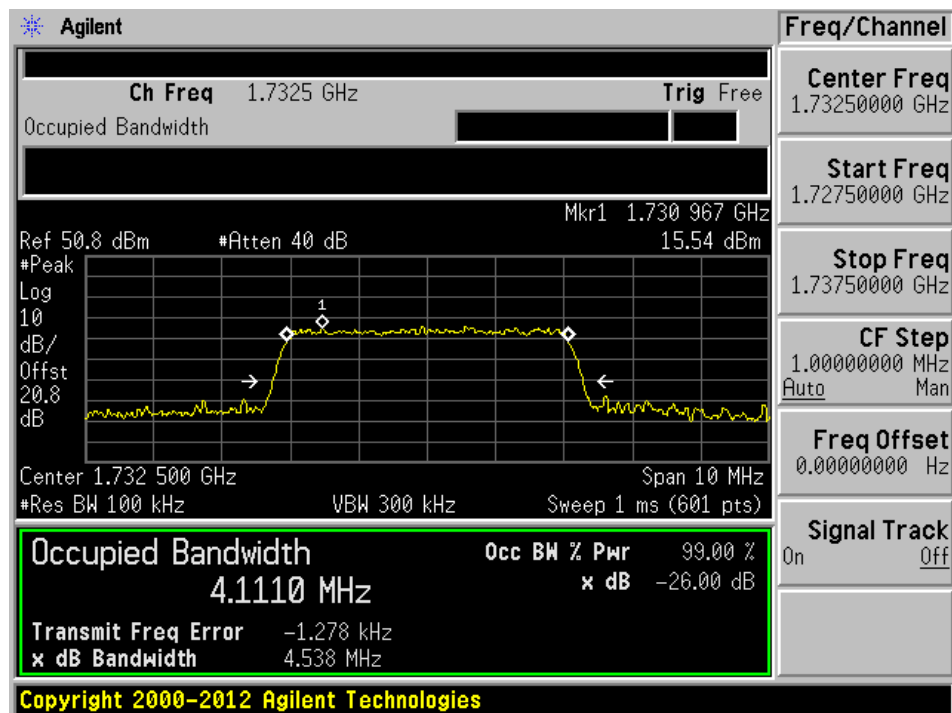


Output

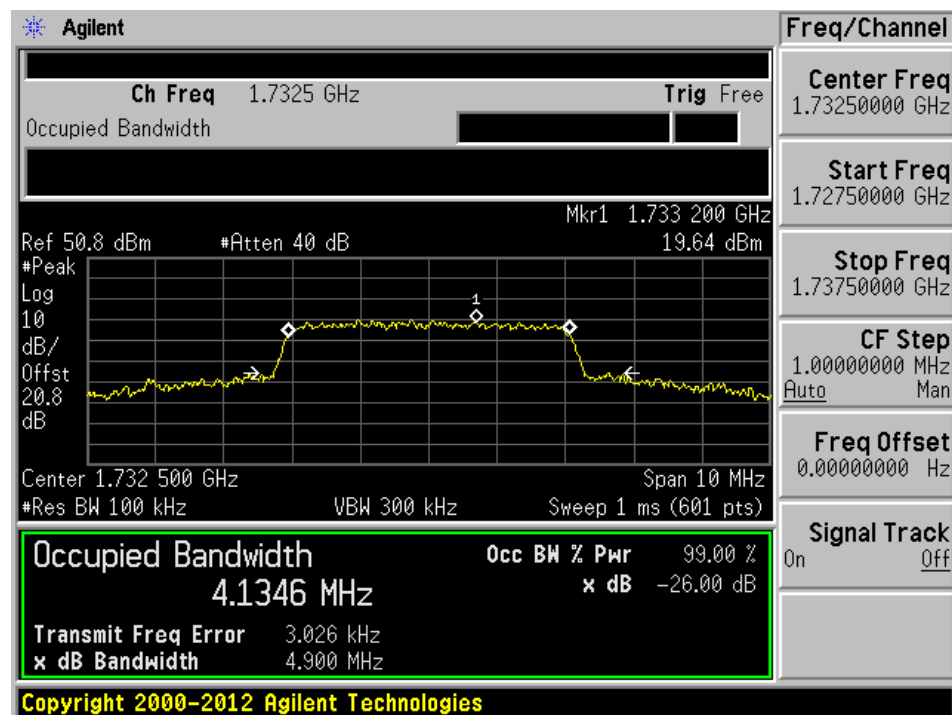


AGC on

Input



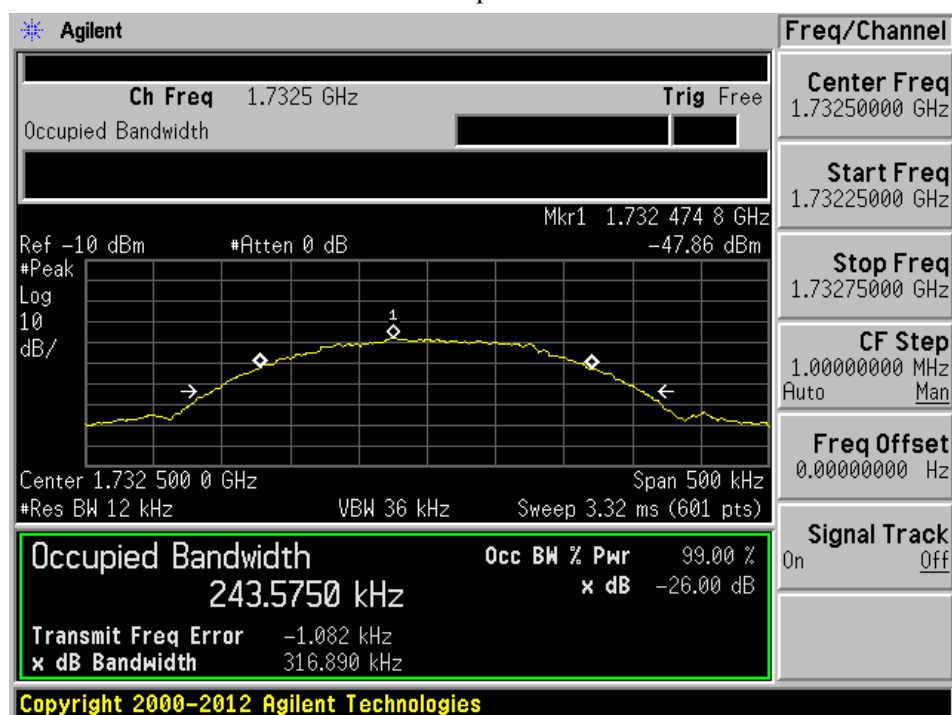
Output



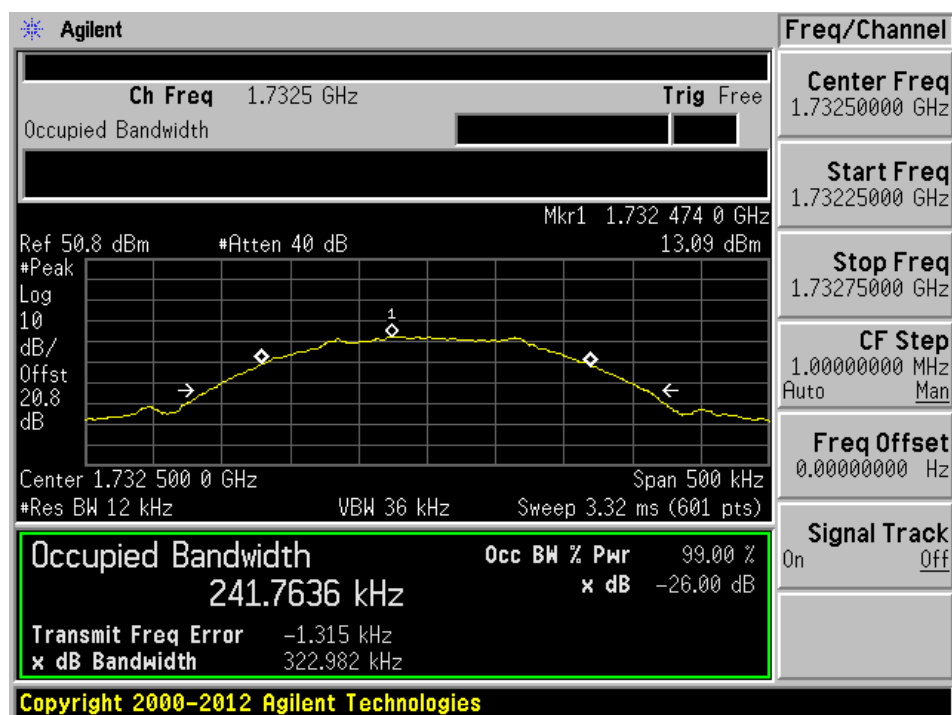
## 1710–1755 MHz: Narrowband Signal

AGC off

Input

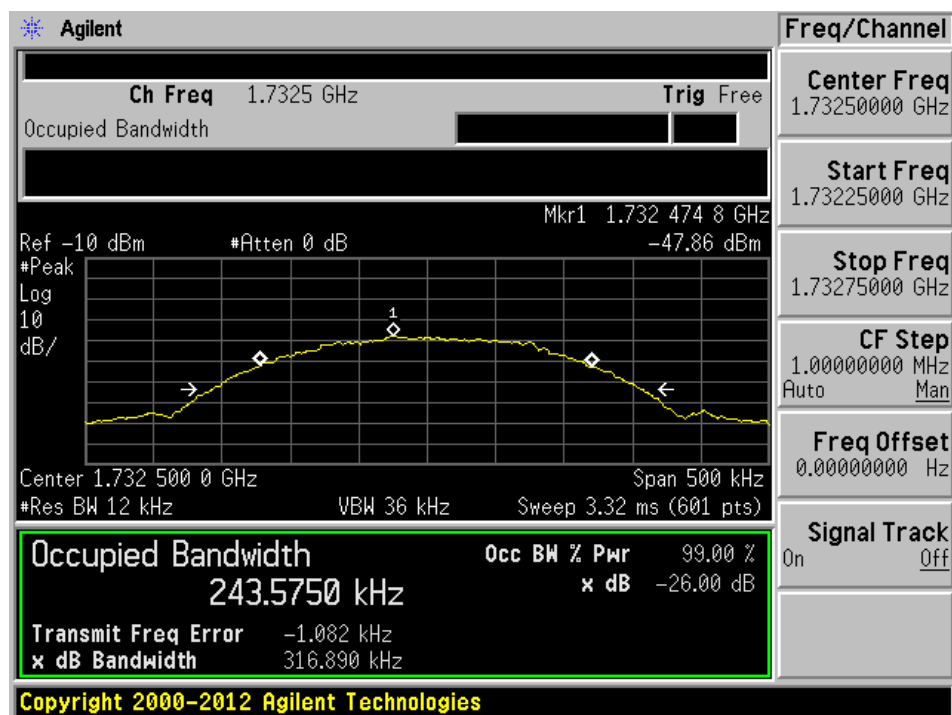


Output

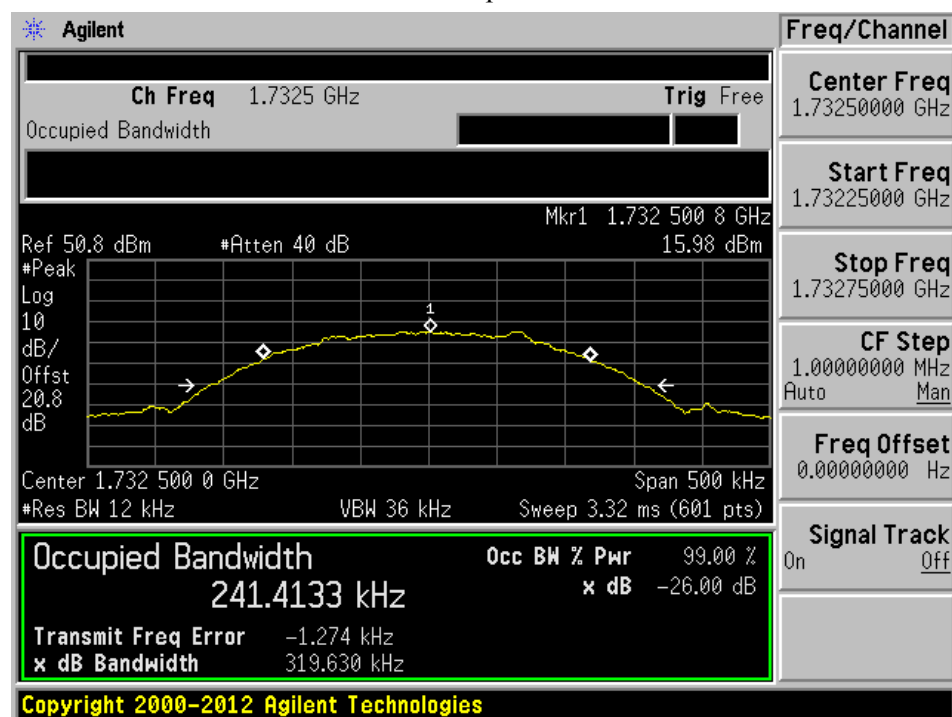


AGC on

Input



Output



## 7 FCC §2.1053 & §27.53 - Spurious Radiated Emissions

### 7.1 Applicable Standards

According to FCC §27.53,

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(5) Compliance with the provisions of paragraphs (c) (1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.

(h)(3) *Measurement procedure.* (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

## 7.2 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 =  $10 \lg (\text{TXpwr in Watts}/0.001)$  – the absolute level

Spurious attenuation limit in dB =  $43 + 10 \text{Log}_{10} (\text{power out in Watts})$



### 7.3 Test Equipment List and Details

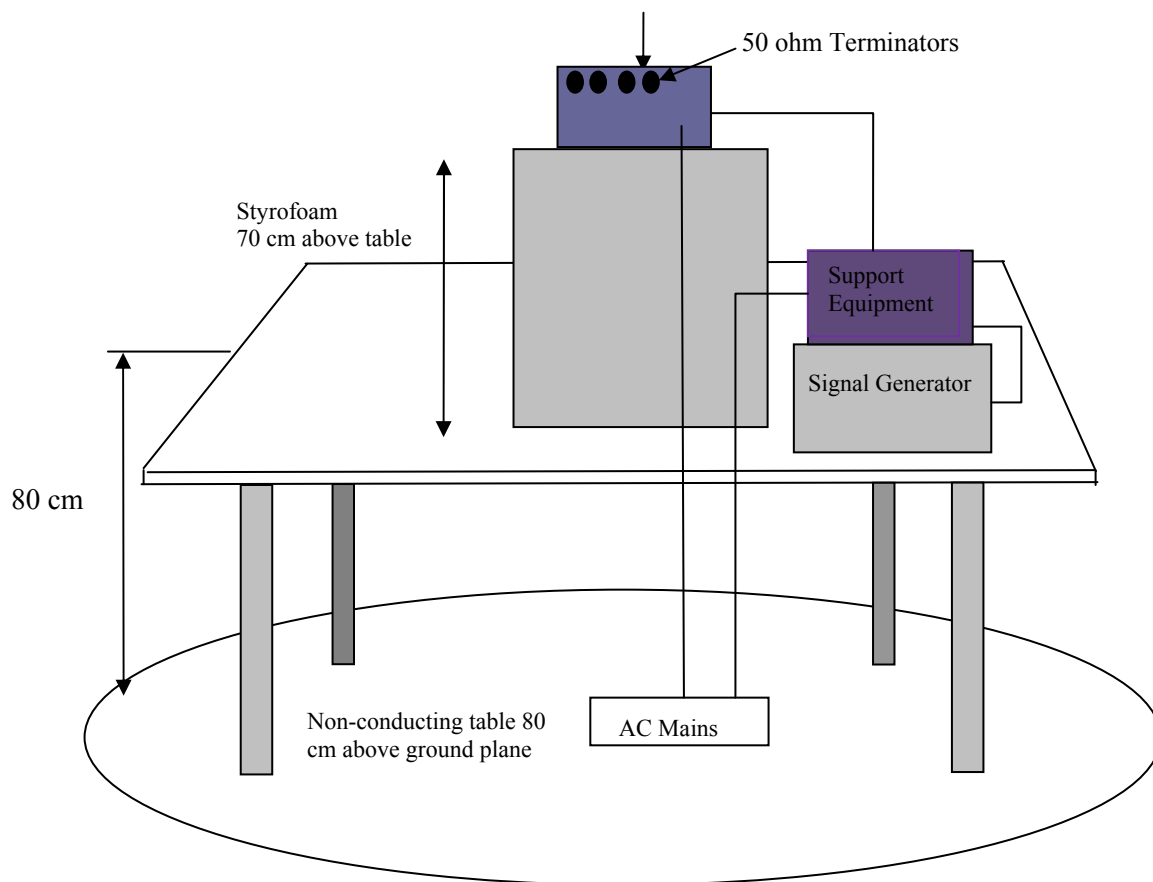
Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2015-10-22	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2016-03-23	1 year
HP/ Agilent	Pre Amplifier	8449B OPT HO2	3008A0113	2016-05-23	1 year
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 years
A.R.A.	Antenna, Horn	DRG-118/A	1132	2015-09-21	2 year
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 <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0006	Each Time <sup>1</sup>	Each Time <sup>1</sup>

<sup>1</sup>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 Setup Block Diagram

### Radiated Emissions Testing



## 7.5 Test Environmental Conditions

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

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

## 7.6 Test Results

Carrier Wave Signal

### 698-716 MHz

Middle Channel

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)		
60	61.31	0	300	H	60	-28.53	0.000	0.38	-28.91	-13	-15.91
60	64.83	55	277	V	60	-20.84	0.000	0.38	-21.22	-13	-8.22
80	55.32	325	210	H	80	-34.52	0.000	0.33	-34.85	-13	-21.85
80	56.45	120	100	V	80	-29.22	0.000	0.33	-29.55	-13	-16.55
1414	32.83	0	100	H	1414	-42.05	7.638	0.50	-34.912	-13	-21.91
1414	32.72	0	100	V	1414	-42.24	7.557	0.50	-35.183	-13	-22.18
2121	32.74	0	100	H	2121	-37.97	8.066	0.57	-30.474	-13	-17.47
2121	33.04	0	100	V	2121	-37.35	8.042	0.57	-29.878	-13	-16.88

### 776-787 MHz

Middle Channel

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)		
60	61.64	0	300	H	60	-28.2	0.000	0.38	-28.58	-13	-15.58
60	65.07	55	241	V	60	-20.6	0.000	0.38	-20.98	-13	-7.98
80	56.06	325	210	H	80	-33.78	0.000	0.33	-34.11	-13	-21.11
80	56.7	120	100	V	80	-28.97	0.000	0.33	-29.3	-13	-16.3
1563	32.19	0	100	H	1563	-42.69	8.479	0.49	-34.701	-13	-21.701
1563	32.39	0	100	V	1563	-42.37	8.45	0.49	-34.41	-13	-21.41
2344.5	33.93	0	100	H	2344.5	-37.31	9.382	0.58	-28.508	-13	-15.508
2344.5	34.18	0	100	V	2344.5	-36.94	9.37	0.58	-28.15	-13	-15.15

**1710-1755 MHz**

## Middle Channel

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)		
60	54.18	180	300	H	60	-35.66	0.000	0.38	-36.04	-13	-23.04
60	59.37	0	140	V	60	-26.3	0.000	0.38	-26.68	-13	-13.68
80	62.35	55	235	H	80	-27.49	0.000	0.33	-27.82	-13	-14.82
80	58.41	120	300	V	80	-27.26	0.000	0.33	-27.59	-13	-14.59
3465	35.32	0	100	H	3465	-32.07	9.494	0.52	-23.096	-13	-10.10
3465	33.22	0	100	V	3465	-34.53	9.461	0.52	-25.589	-13	-12.59
5197.5	33.2	0	100	H	5197.5	-31.22	9.774	0.65	-22.096	-13	-9.10
5197.5	32.66	0	100	V	5197.5	-32.23	9.763	0.65	-23.117	-13	-10.12

## 8 FCC §2.1051 & §27.53- Spurious Emissions at Antenna Terminals

### 8.1 Applicable Standards

According to FCC §27.53,

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(5) Compliance with the provisions of paragraphs (c) (1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

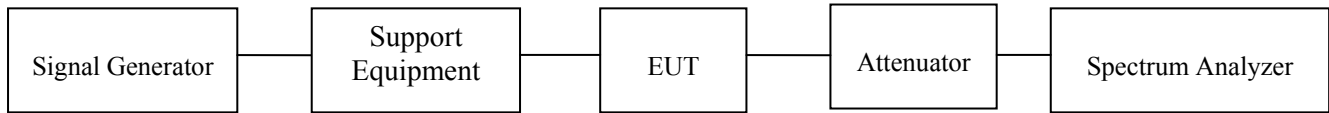
(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.

(h)(3) *Measurement procedure.* (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

## 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 analyzer through appropriate attenuation.



## 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 <sup>1</sup>	Each Time <sup>1</sup>
-	20 dB attenuator	-	-	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0003	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0006	Each Time <sup>1</sup>	Each Time <sup>1</sup>

<sup>1</sup>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:	101.4-102 kPa

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

8.5 Test Results

Please refer to the following plots.

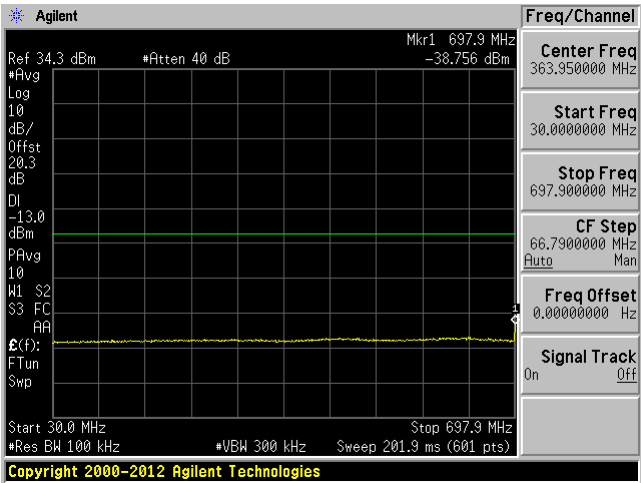
Note: For the 1710-1755 MHz band, a 1 MHz RBW was to be used, but compliance was ensured using a 100 kHz RBW.

Broadband Signal 698-716 MHz

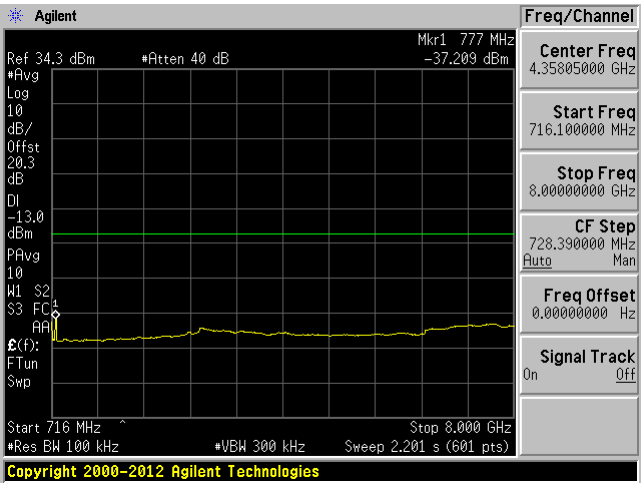
AGC Off

Low Channel

Low Channel: 30 MHz-697.9 MHz

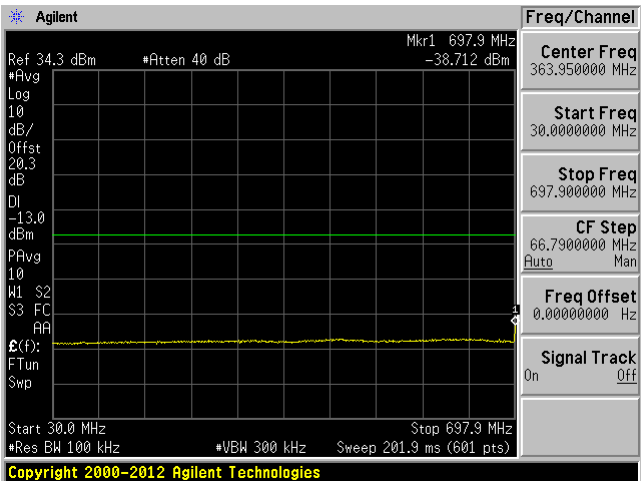


Low Channel: 716.1 MHz-8 GHz

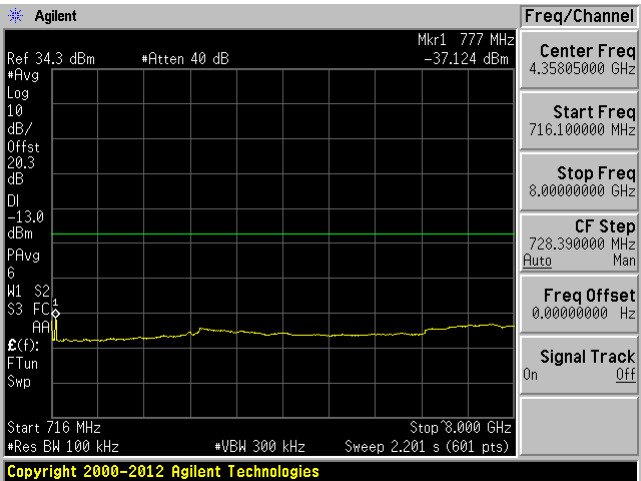


Middle Channel

Middle Channel: 30 MHz-697.9 MHz

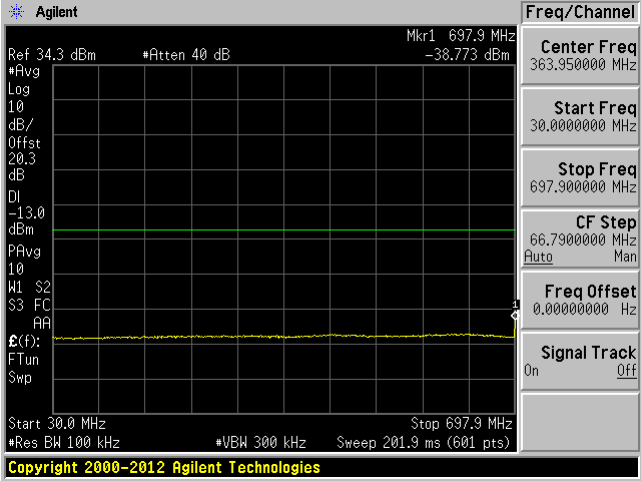


Middle Channel: 716.1 MHz-8 GHz

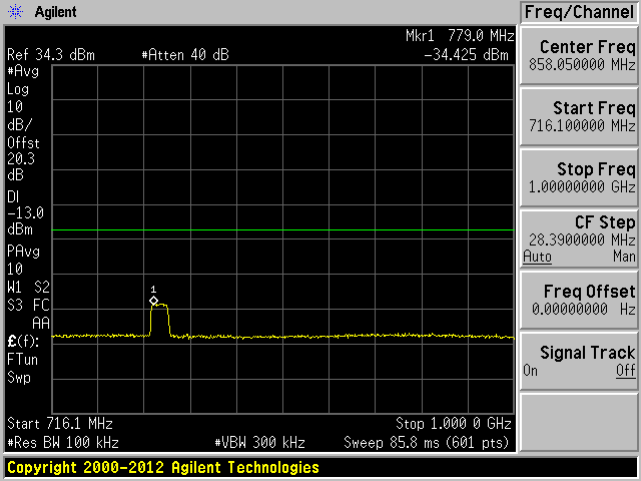


High Channel

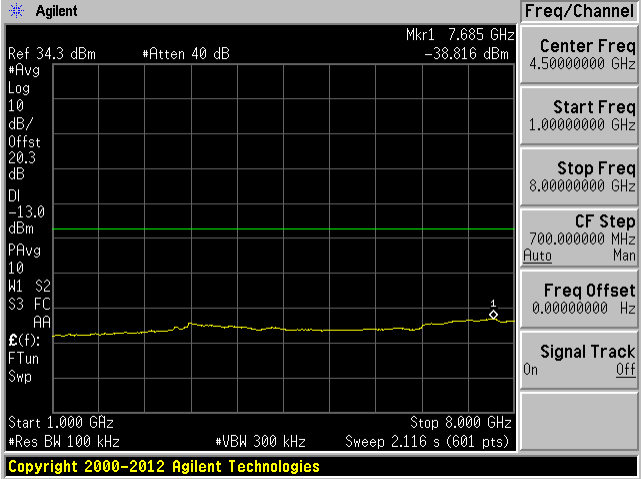
High Channel: 30 MHz-697.9 MHz



High Channel: 716.1 MHz-1 GHz



High Channel: 1 GHz- 8 GHz

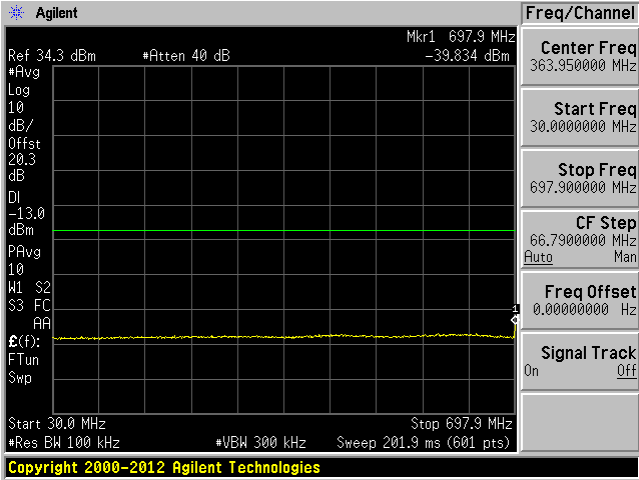




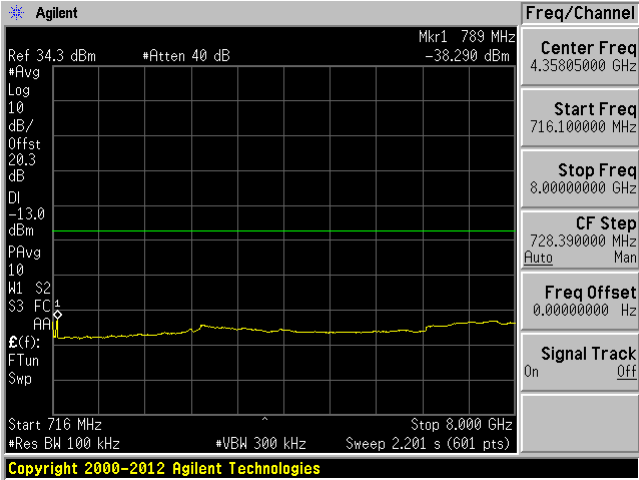
AGC On

Low Channel

Low Channel: 30 MHz-697.9 MHz

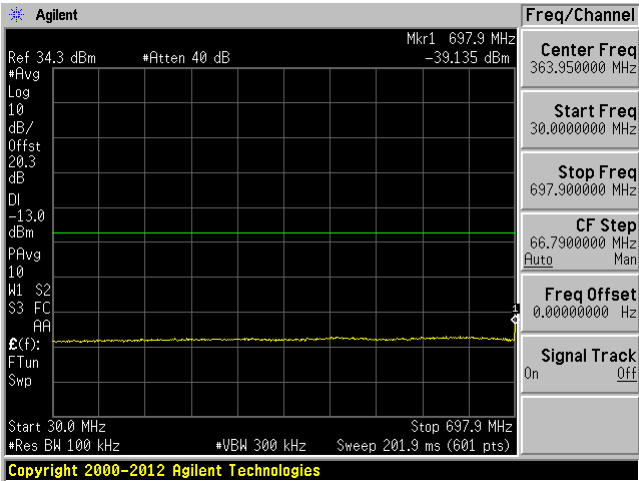


Low Channel: 716.1 MHz-8 GHz

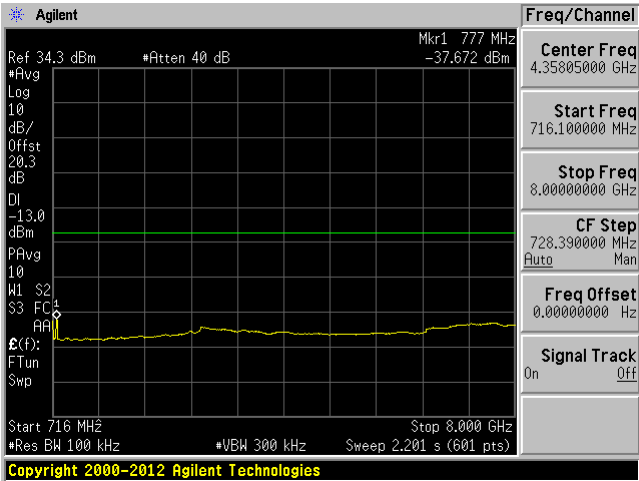


Middle Channel

Middle Channel: 30 MHz-697.9 MHz

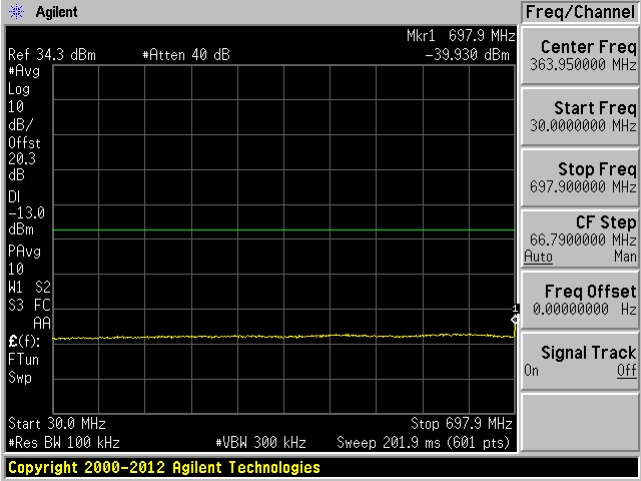


Middle Channel: 716.1 MHz-8 GHz

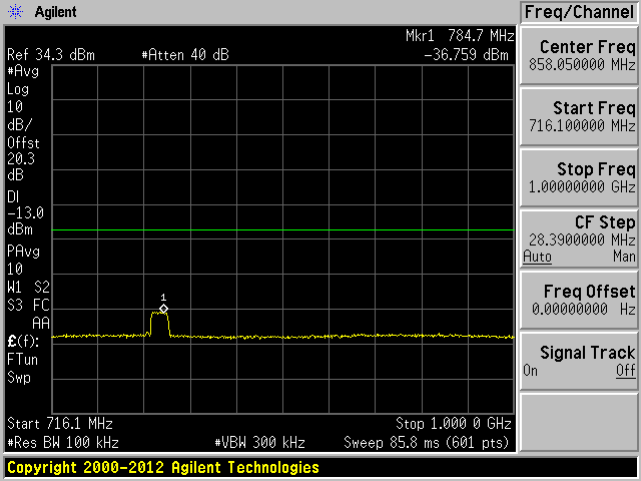


High Channel

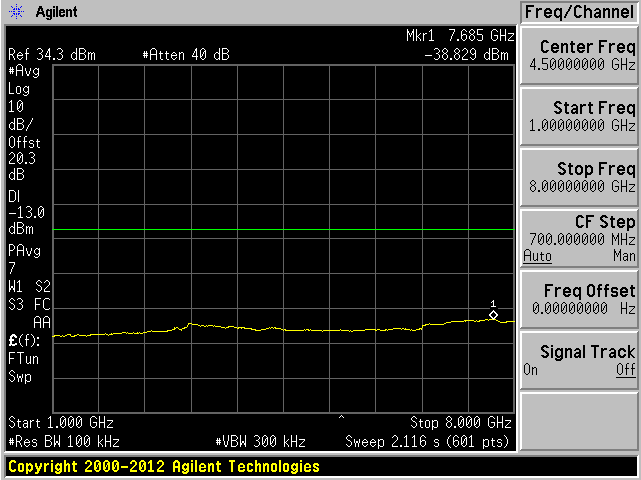
High Channel: 30 MHz-697.9 MHz



High Channel: 716.1 MHz-1 GHz



High Channel: 1 GHz- 8 GHz

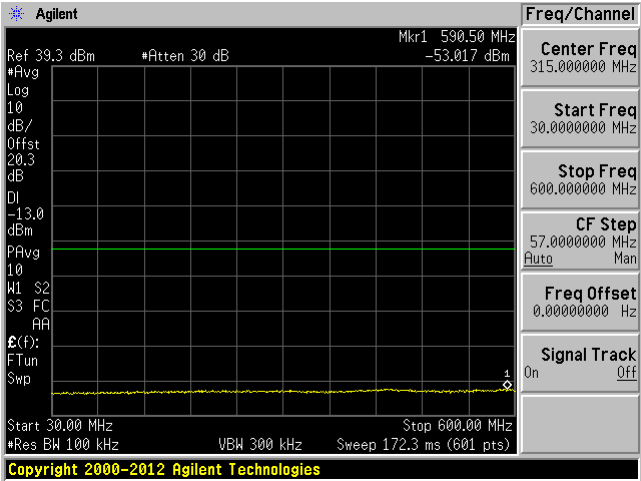


Narrowband signal 698-716 MHz

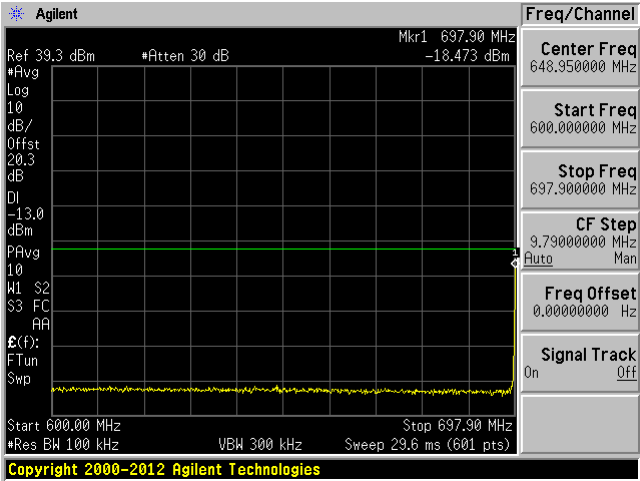
AGC Off

Low Channel

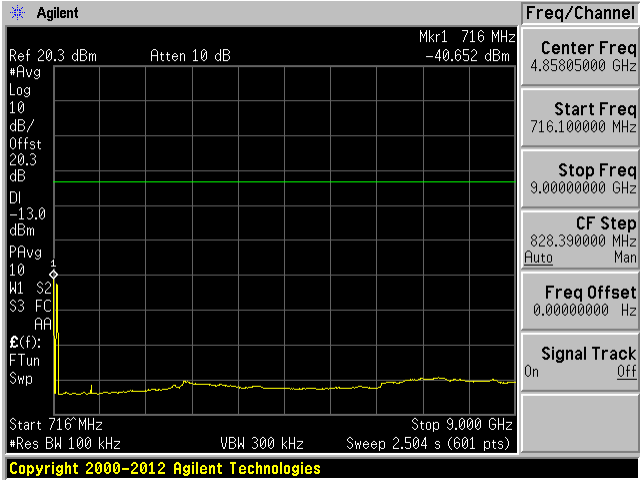
Low Channel: 30 MHz-600 MHz



Low Channel: 600 MHz-697.9 MHz

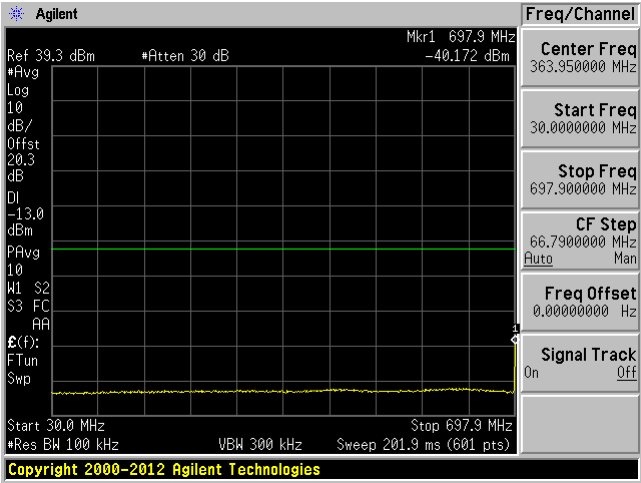


Low Channel: 716.1 MHz- 9 GHz

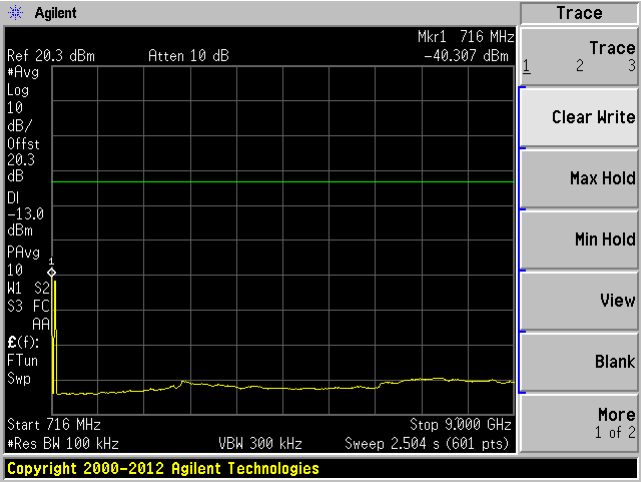


Middle Channel

Middle Channel: 30 MHz-697.9 MHz

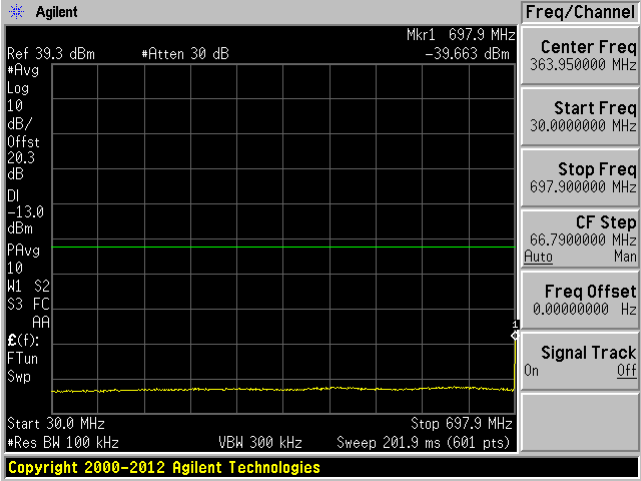


Middle Channel: 716.1 MHz-9 GHz

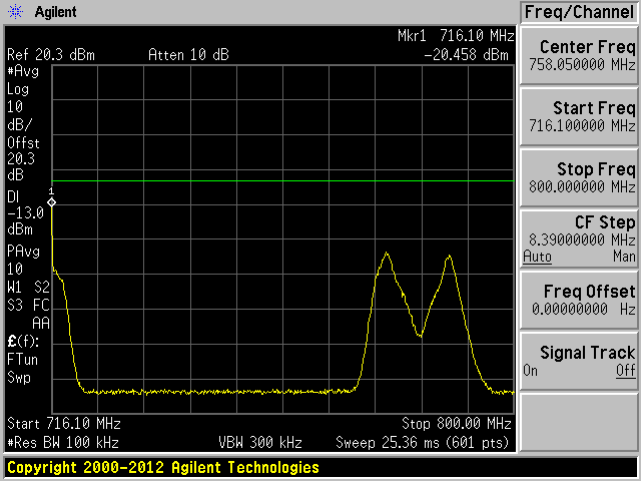


High Channel

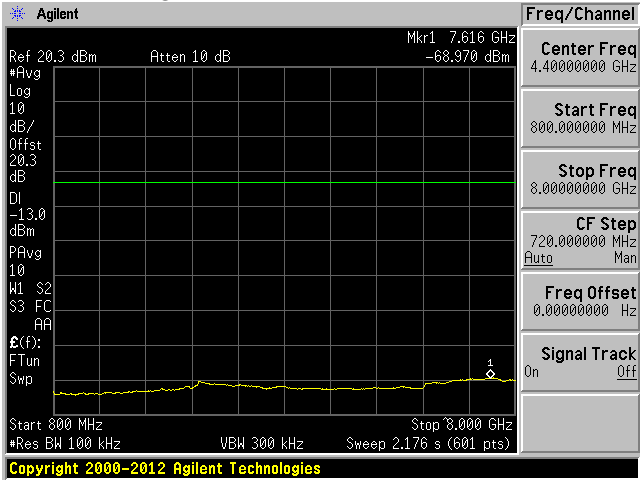
High Channel: 30 MHz-697.9 MHz



High Channel: 716.1 MHz-800 MHz



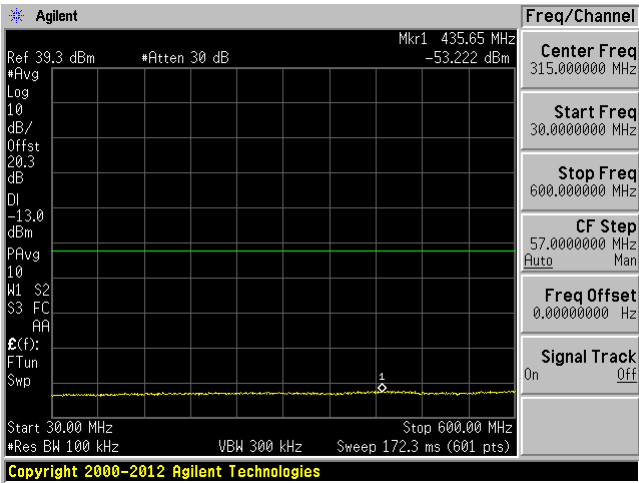
High Channel: 800 MHz- 8 GHz



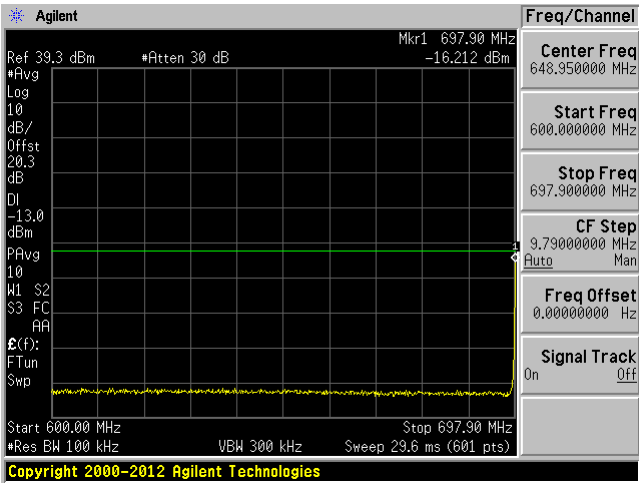
AGC On

Low Channel

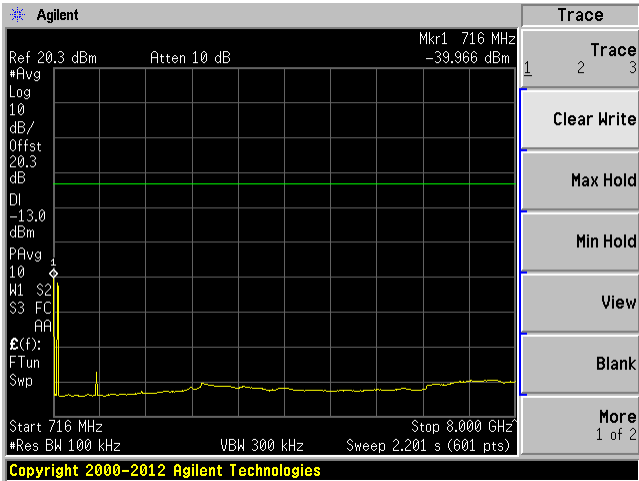
Low Channel: 30 MHz-600 MHz



Low Channel: 600 MHz-697.9 MHz

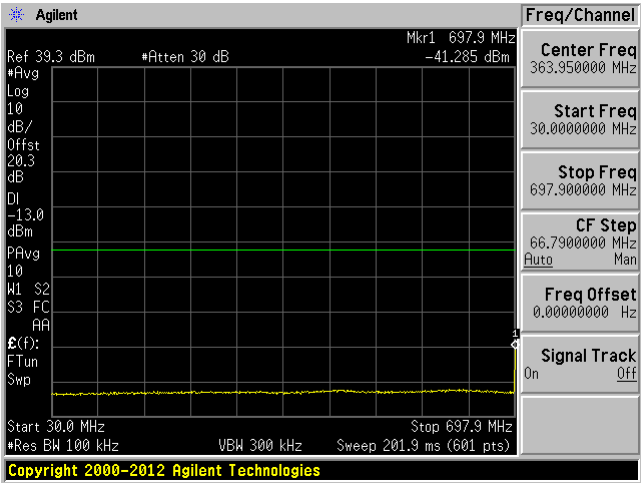


Low Channel: 716.1 MHz- 8 GHz

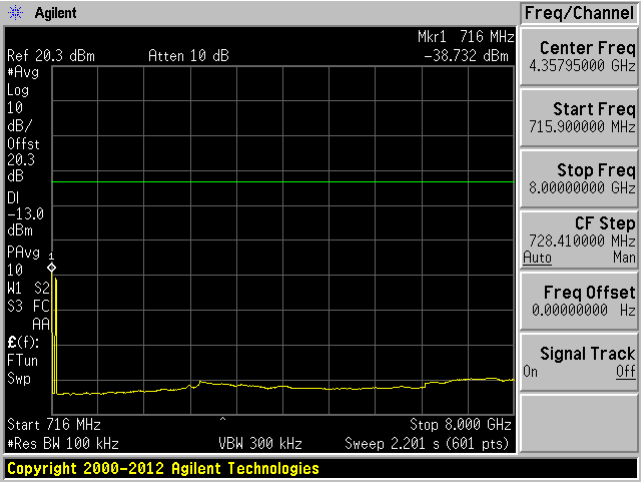


Middle Channel

Middle Channel: 30 MHz-697.9 MHz

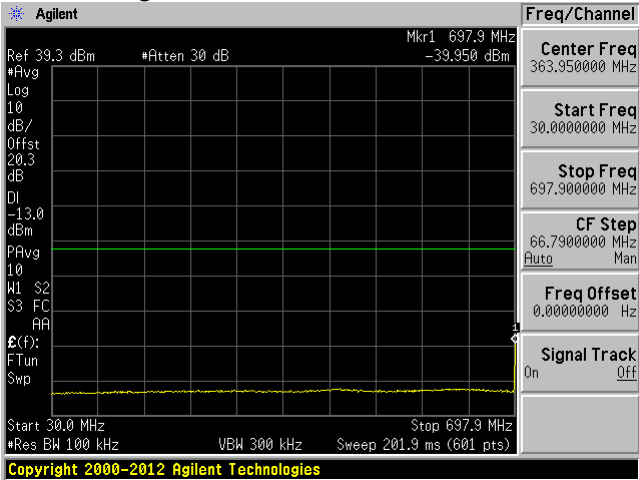


Middle Channel: 715.9 MHz-8 GHz

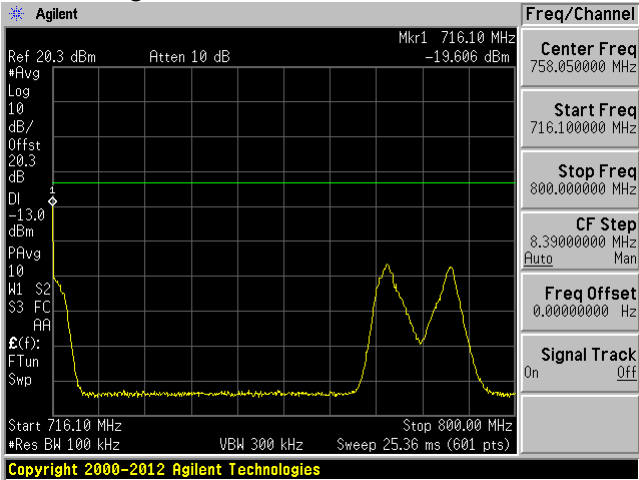


High Channel

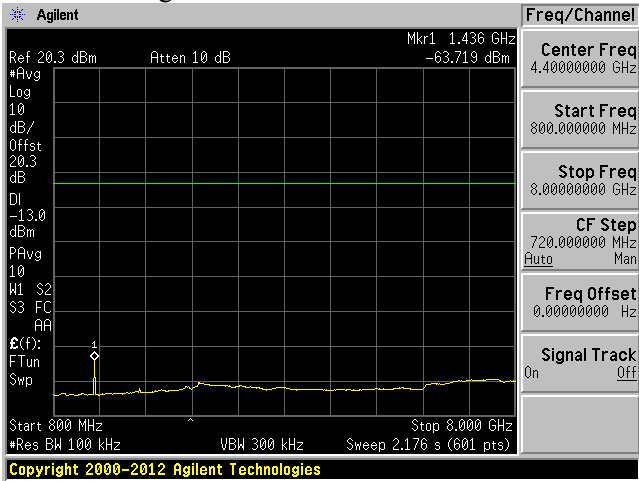
High Channel: 30 MHz-697.9 MHz



High Channel: 716.1 MHz-800 MHz



High Channel: 800 MHz- 8 GHz



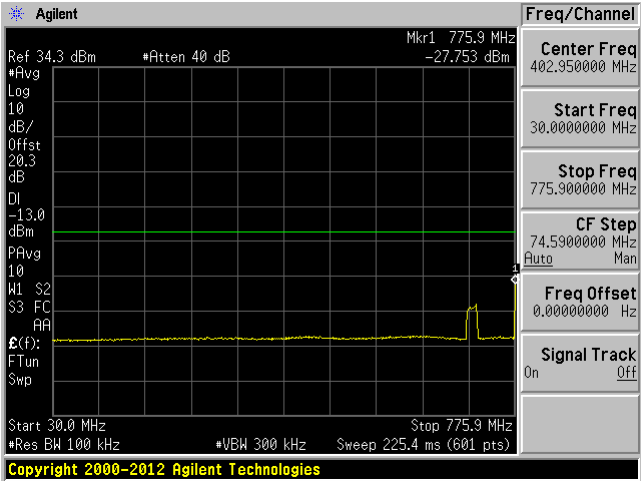


Broadband Signal 776-787 MHz

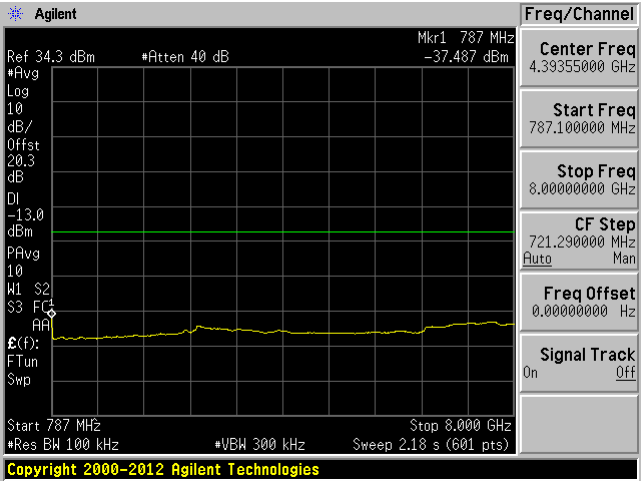
AGC Off

Low Channel

Low Channel: 30 MHz-775.9 MHz

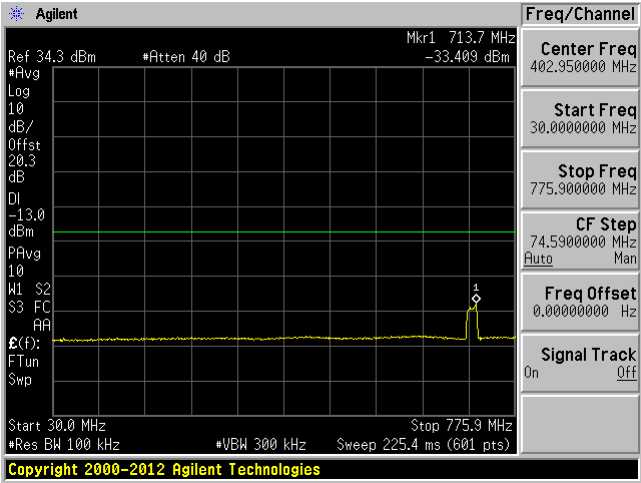


Low Channel: 787.1 MHz-8 GHz

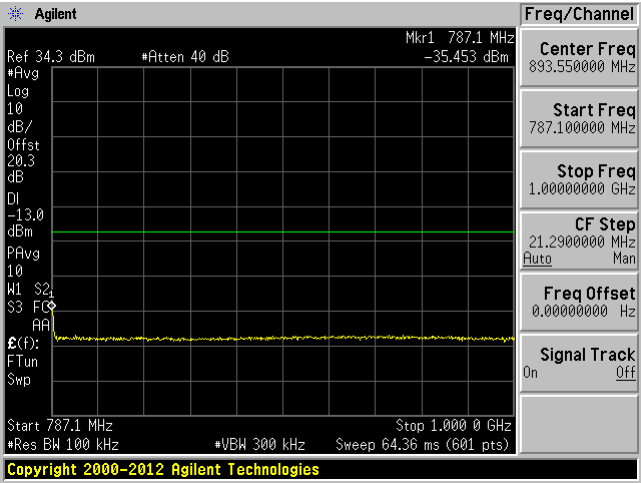


Middle Channel

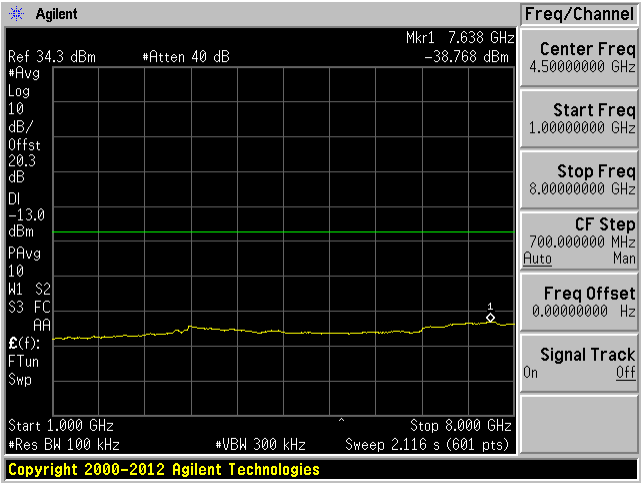
Middle Channel: 30 MHz-775.9 MHz



Middle Channel: 787.1 MHz-1 GHz

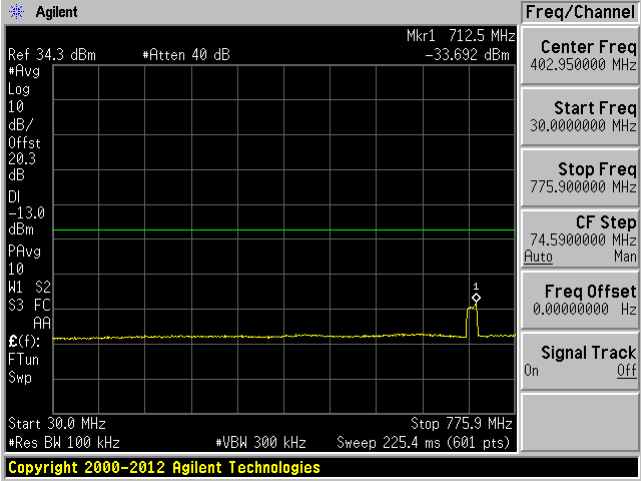


Middle Channel: 1 GHz- 8 GHz

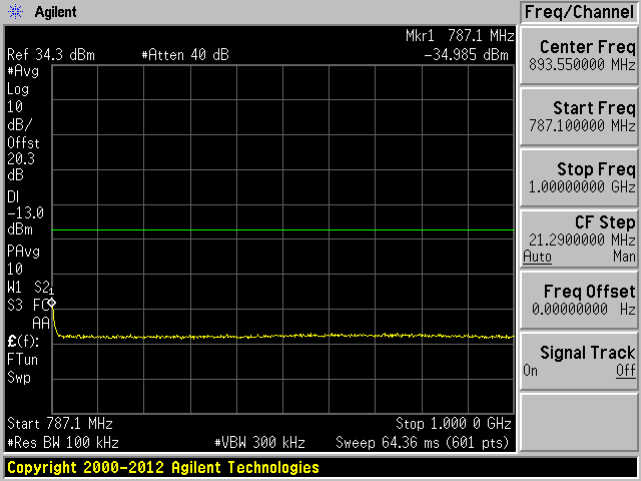


High Channel

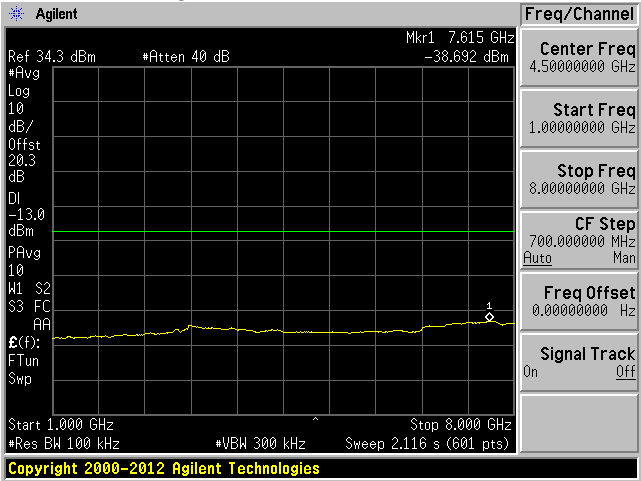
High Channel: 30 MHz-775.9 MHz



High Channel: 787.1 MHz-1 GHz



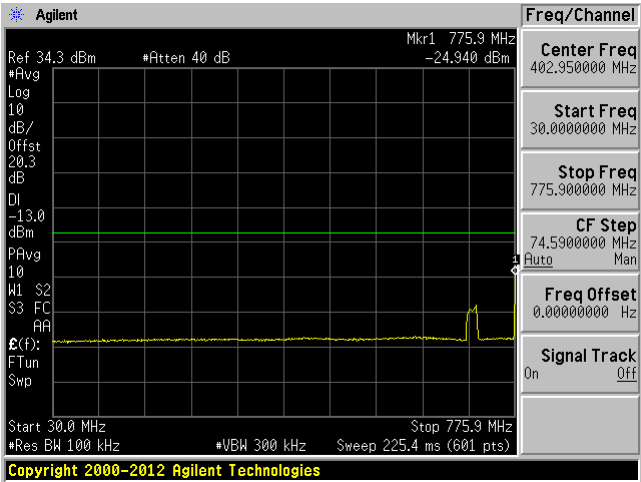
High Channel: 1 GHz- 8 GHz



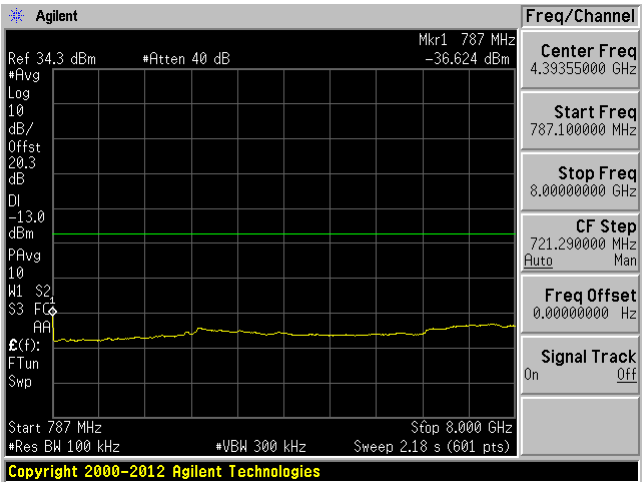
AGC On

Low Channel

Low Channel: 30 MHz-775.9 MHz

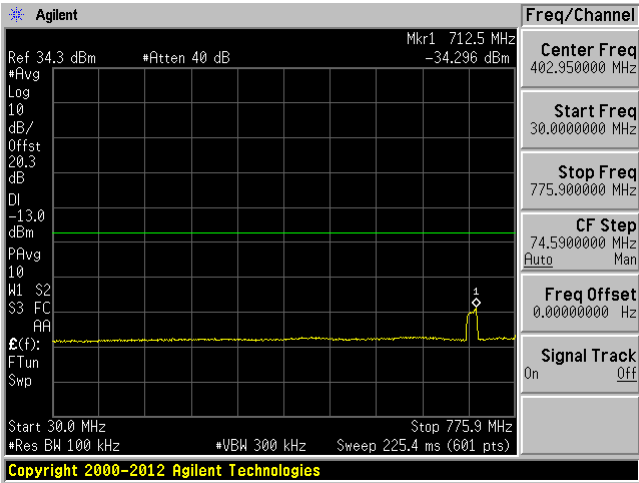


Low Channel: 787.1 MHz-8 GHz

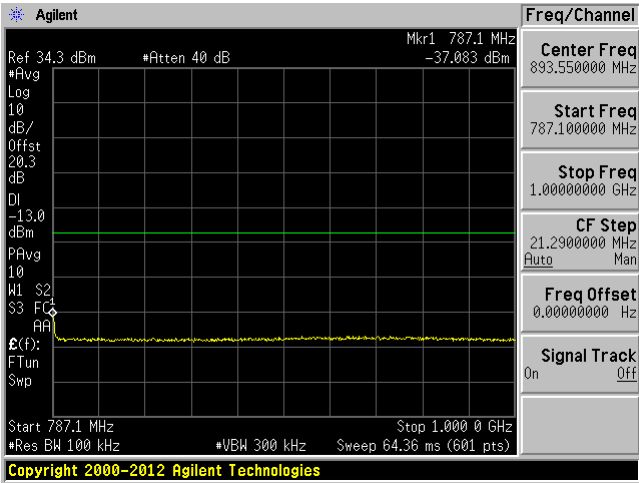


Middle Channel

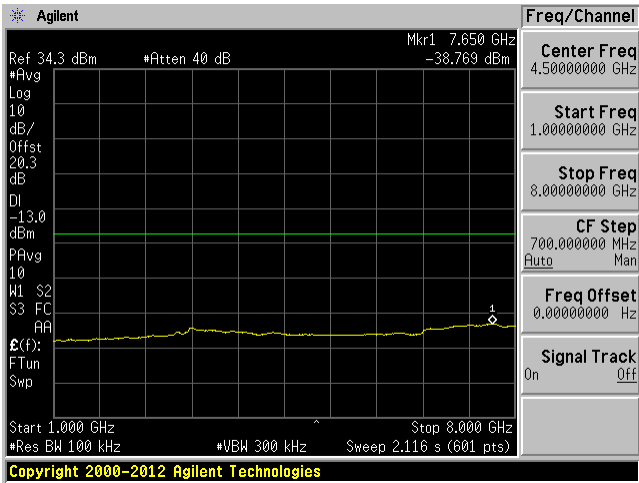
Middle Channel: 30 MHz-775.9 MHz



Middle Channel: 787.1 MHz-1 GHz

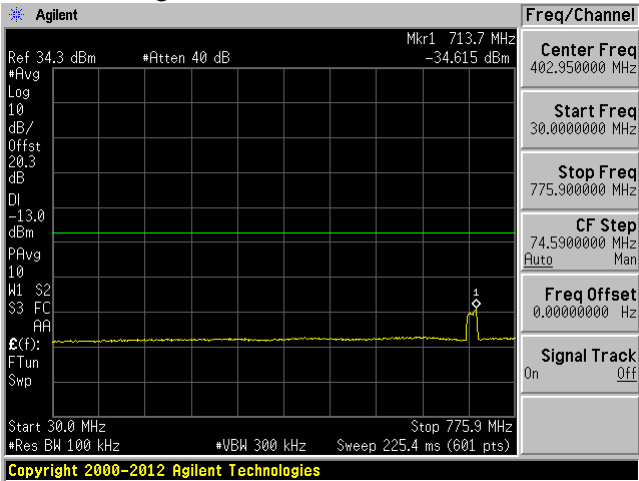


Middle Channel: 1 GHz- 8 GHz

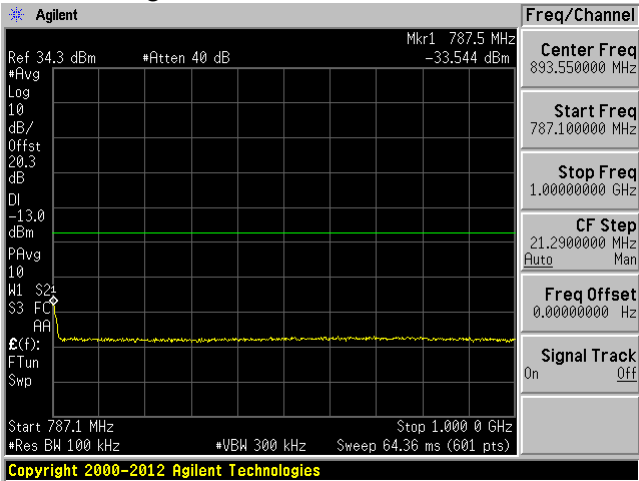


High Channel

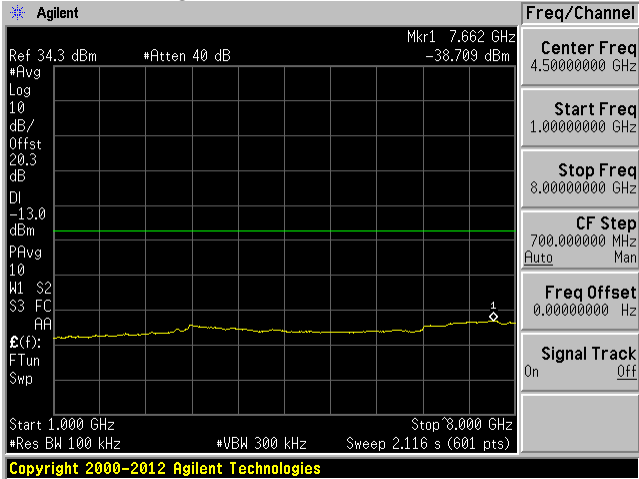
High Channel: 30 MHz-775.9 MHz



High Channel: 787.1 MHz-1 GHz



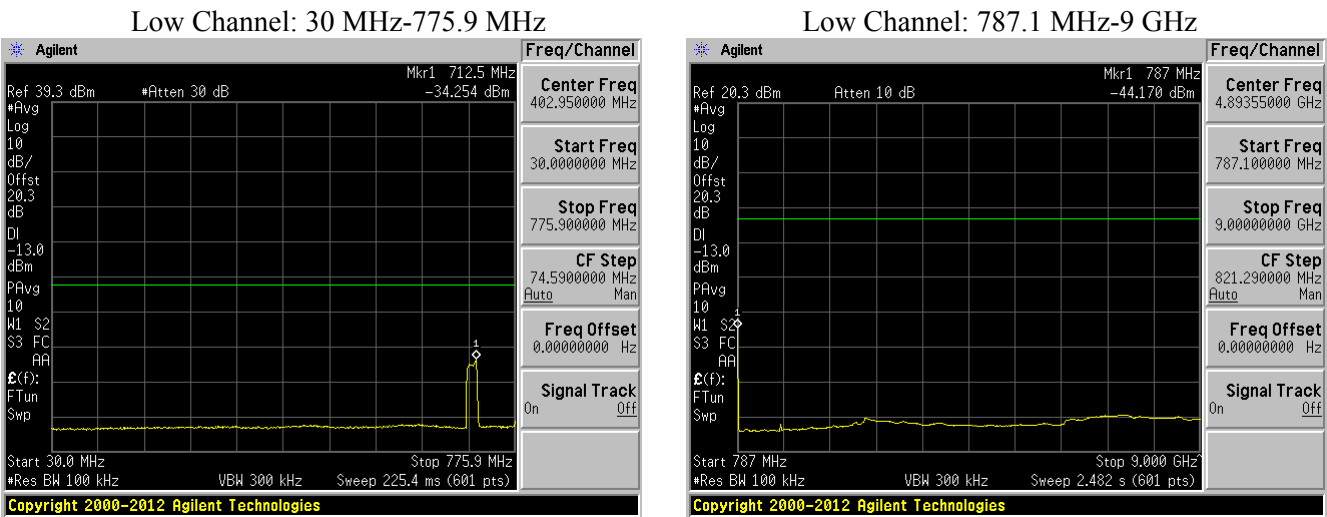
High Channel: 1 GHz- 8 GHz



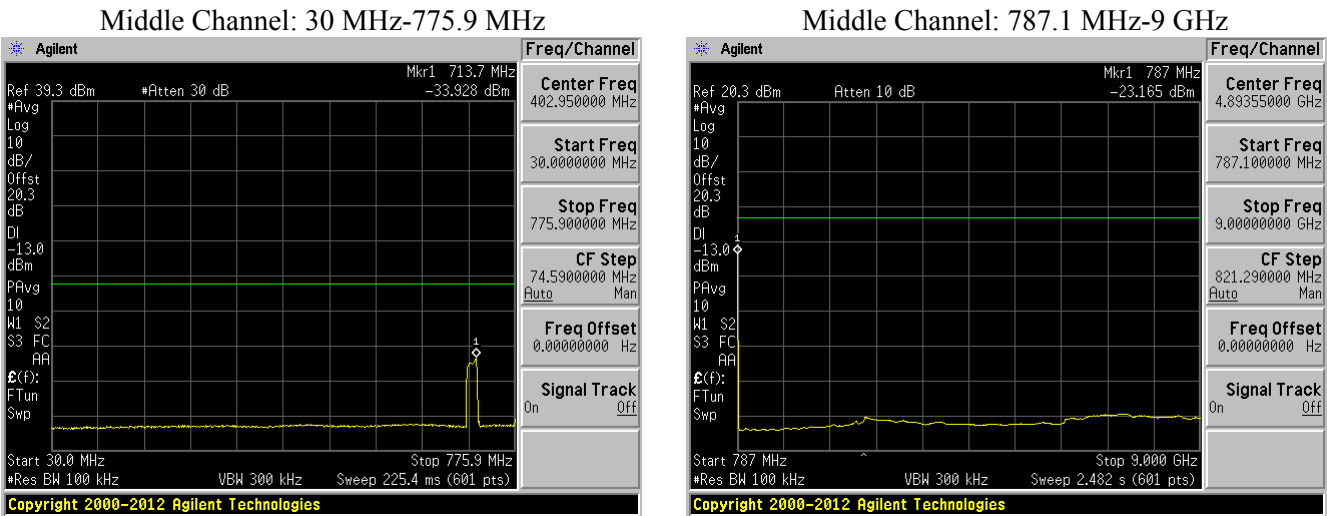
Narrowband Signal 776-787 MHz

AGC Off

Low Channel

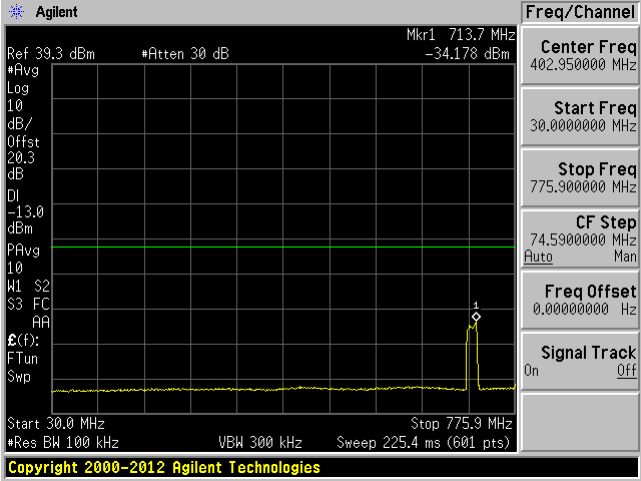


Middle Channel

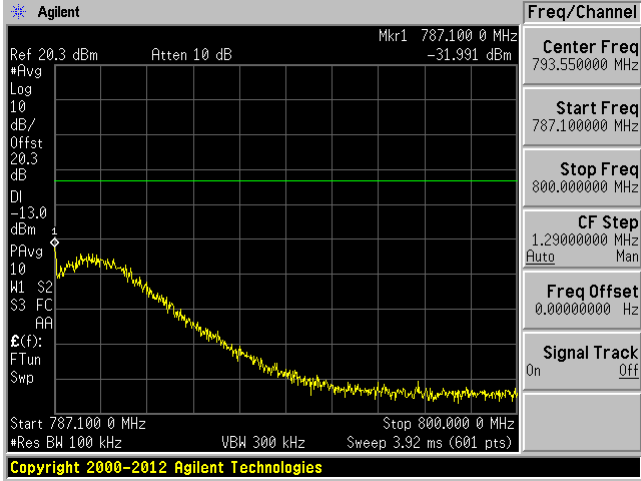


High Channel

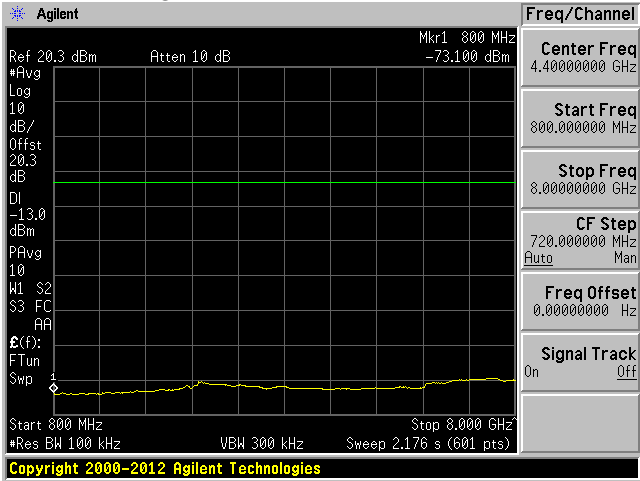
High Channel: 30 MHz-775.9 MHz



High Channel: 787.1 MHz-800 MHz



High Channel: 800 MHz- 8 GHz

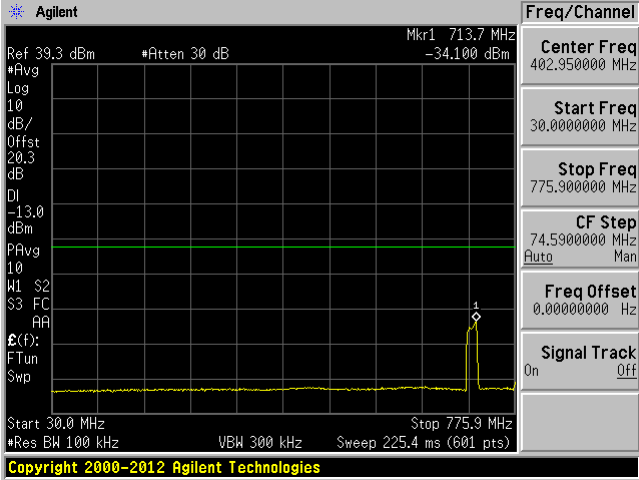




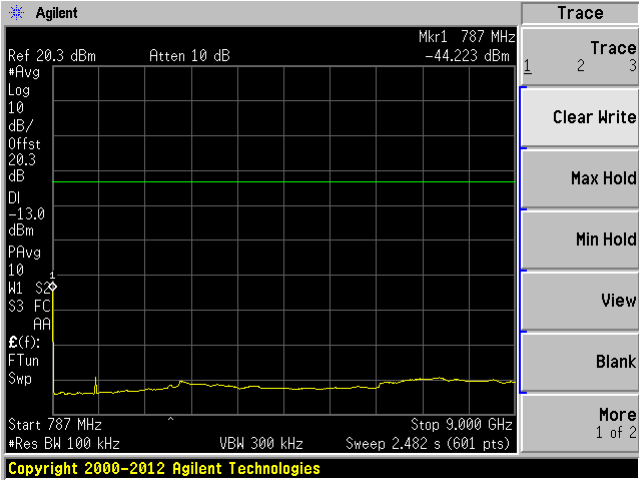
AGC On

Low Channel

Low Channel: 30 MHz-775.9 MHz

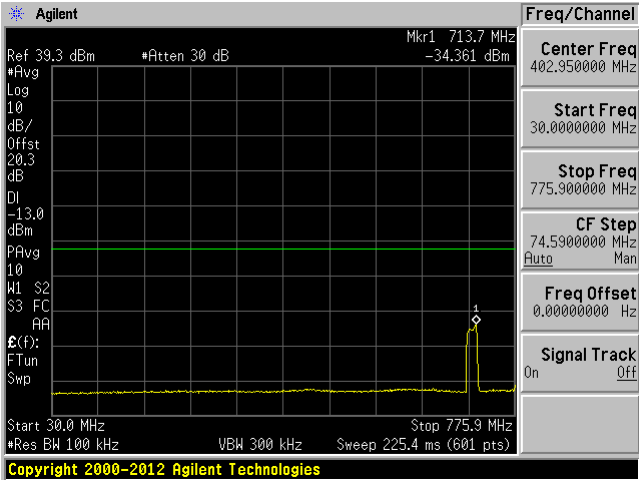


Low Channel: 787.1 MHz-9 GHz

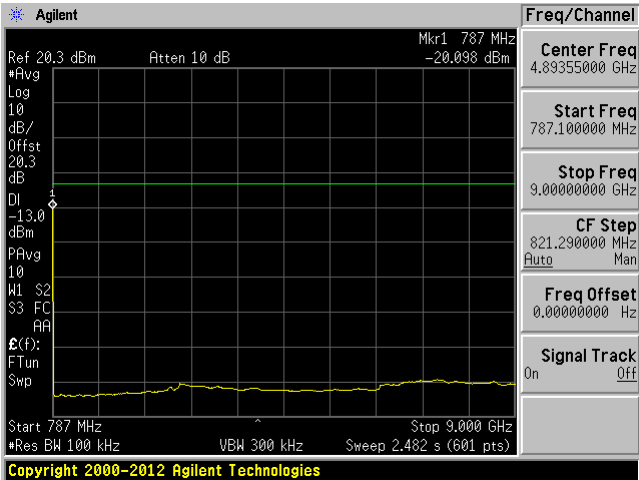


Middle Channel

Middle Channel: 30 MHz-775.9 MHz

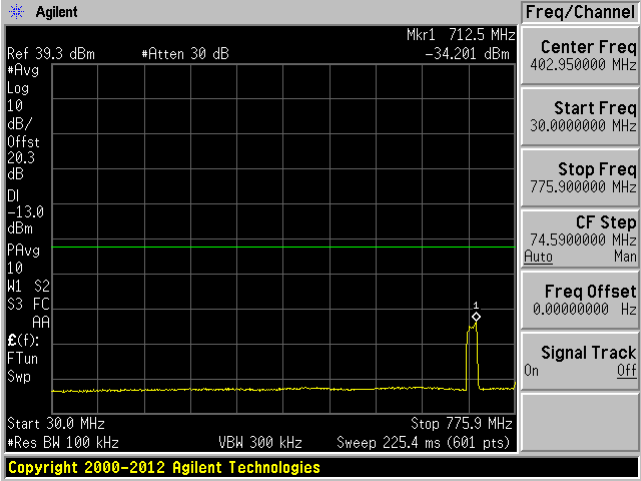


Middle Channel: 787.1 MHz-9 GHz

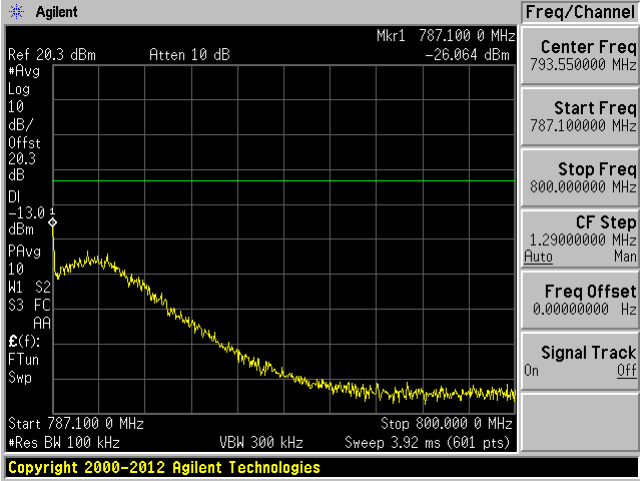


High Channel

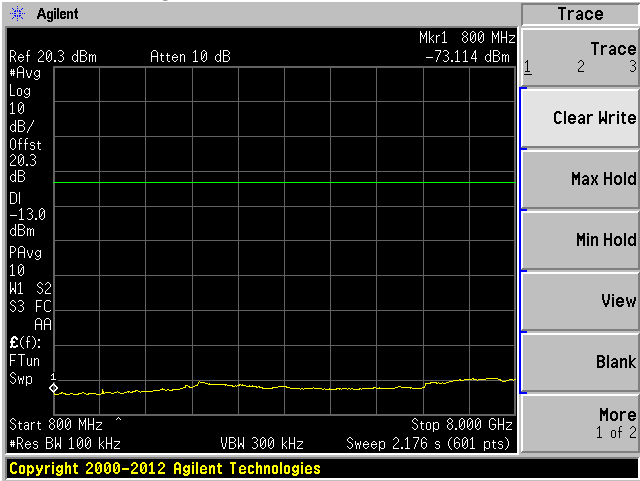
High Channel: 30 MHz-775.9 MHz



High Channel: 787.1 MHz-800 MHz



High Channel: 800 MHz- 8 GHz

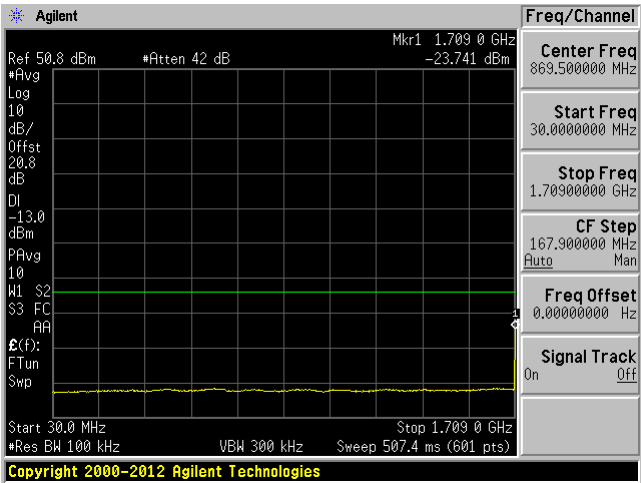


Broadband signal 1710-1755 MHz

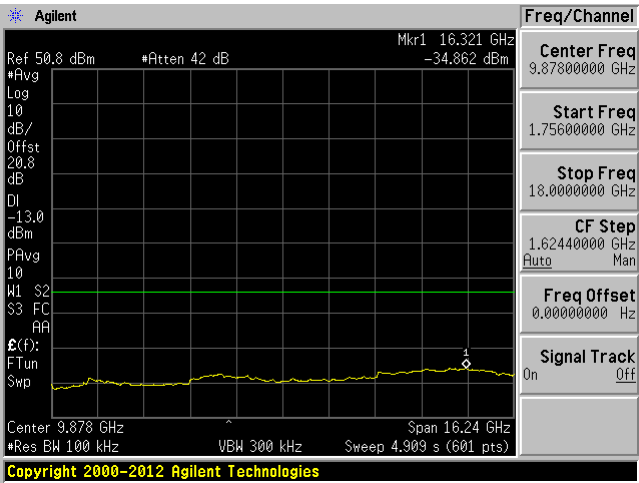
AGC Off

Low Channel

Low Channel: 30 MHz-1.709 GHz

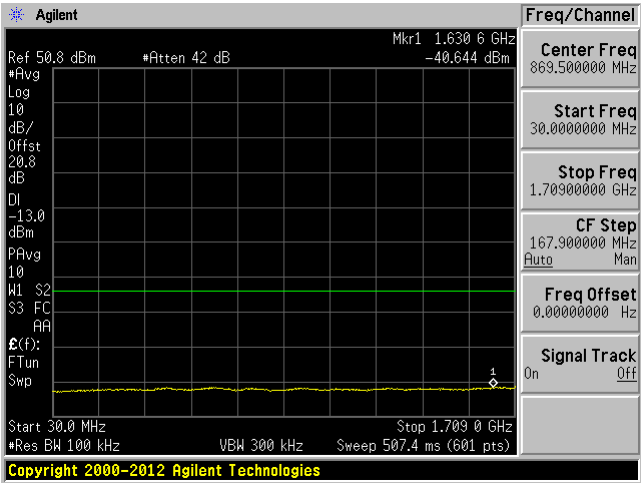


Low Channel: 1.756 GHz-18 GHz

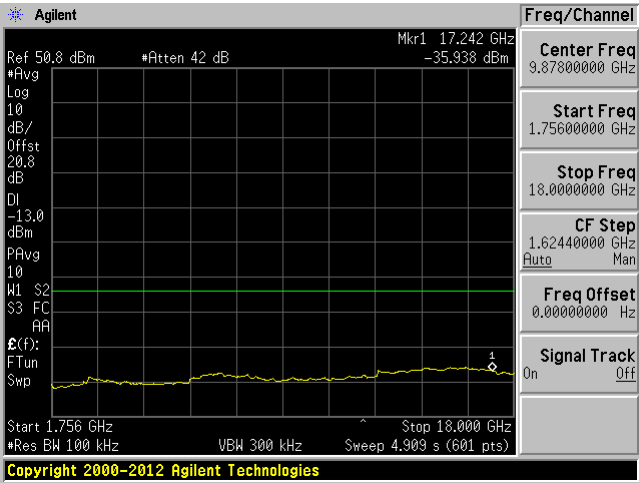


Middle Channel

Middle Channel: 30 MHz-1.709 GHz

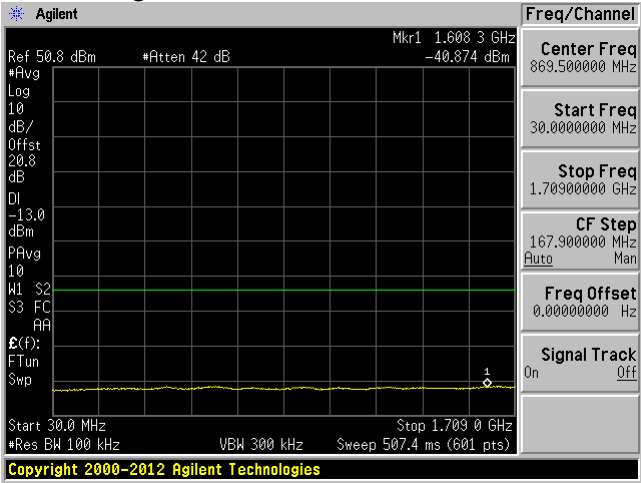


Middle Channel: 1.756 GHz-18 GHz

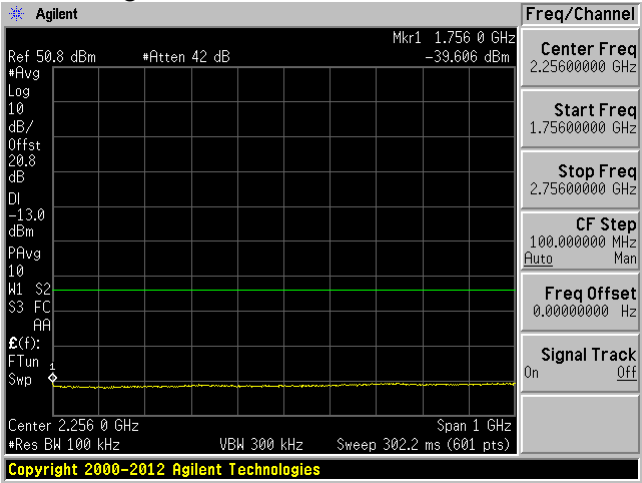


High Channel

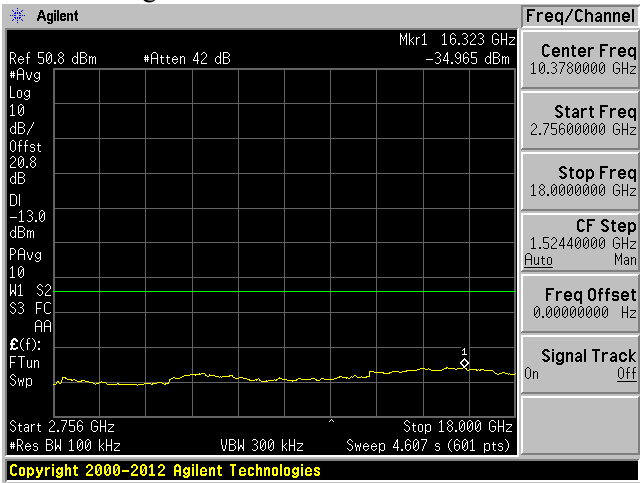
High Channel: 30 MHz-1.709 MHz



High Channel: 1.756 GHz-2.756 GHz

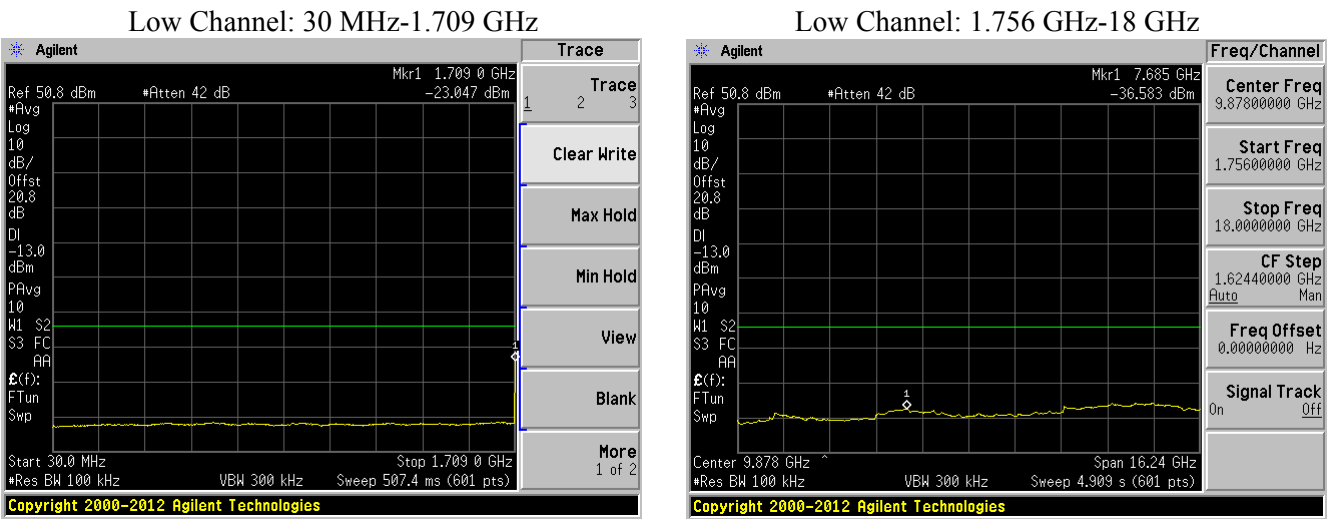


High Channel: 2.756 GHz- 18 GHz

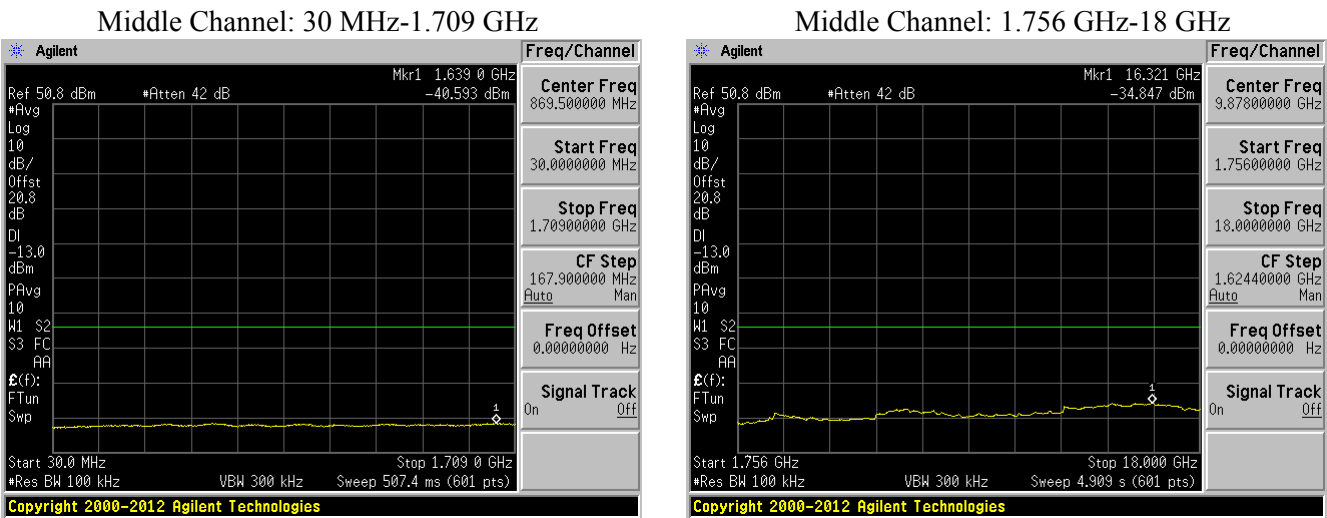


AGC On

Low Channel

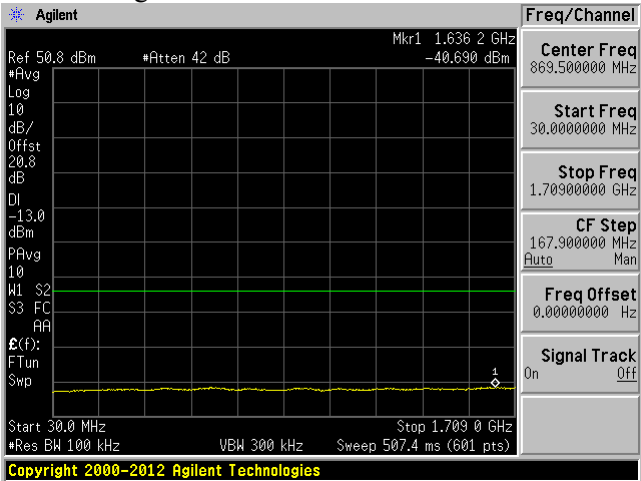


Middle Channel

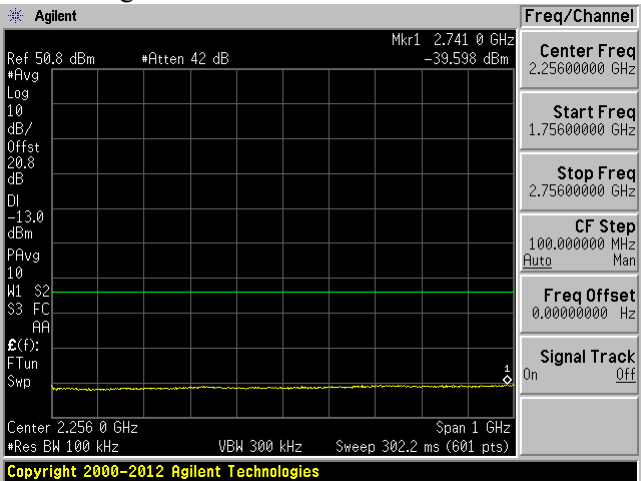


High Channel

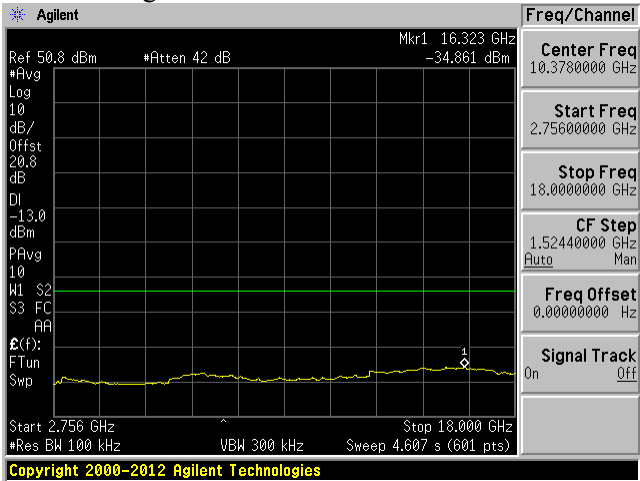
High Channel: 30 MHz-1.709 GHz



High Channel: 1.756 GHz-2.756 GHz



High Channel: 2.756 GHz- 18 GHz

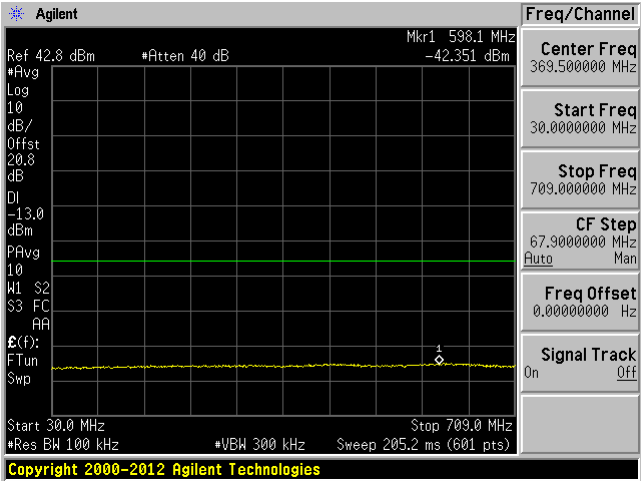


Narrowband Signal 1710-1755 MHz

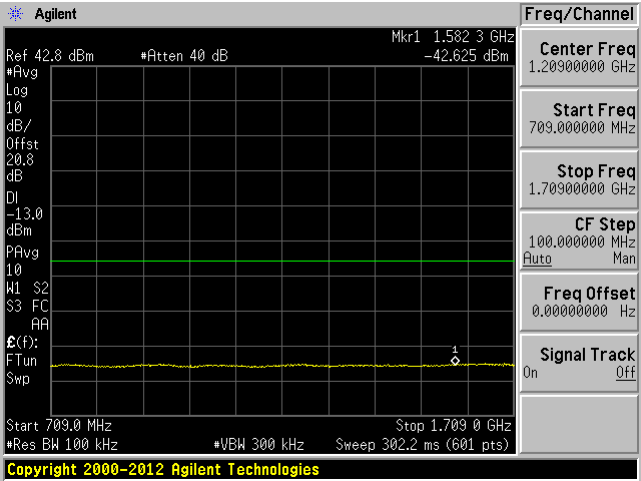
AGC Off

Low Channel

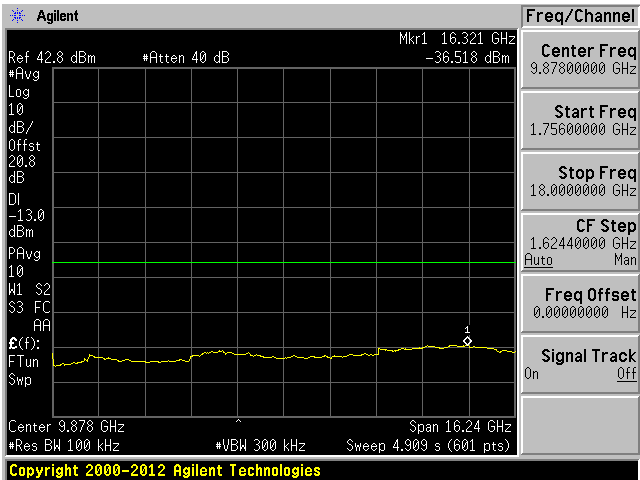
Low Channel: 30 MHz-709 MHz



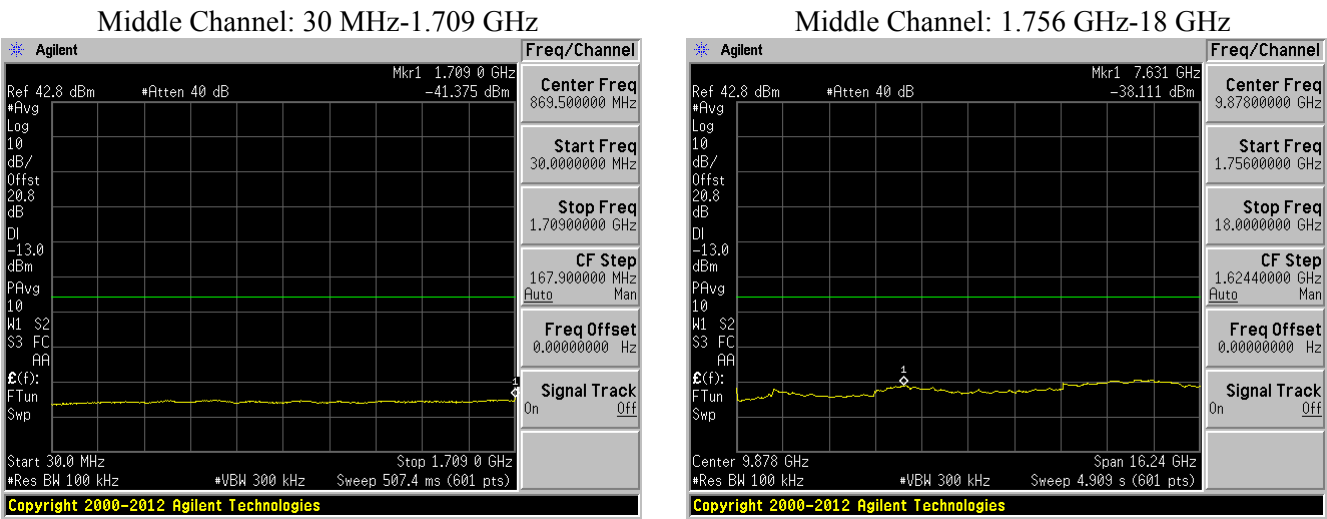
Low Channel: 709 GHz-1.709 GHz



Low Channel: 1.756 GHz- 18 GHz



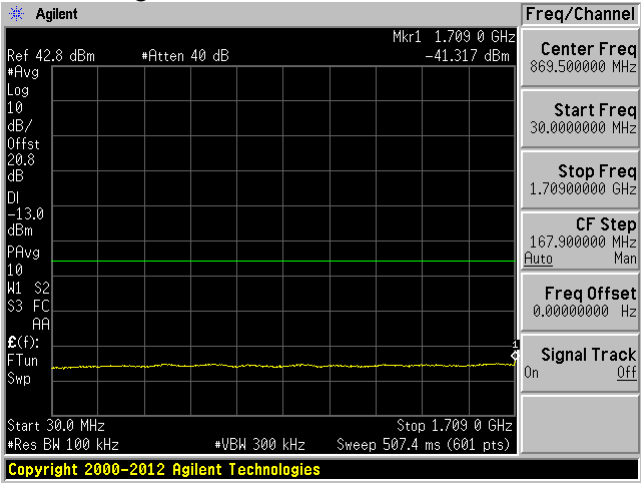
Middle Channel



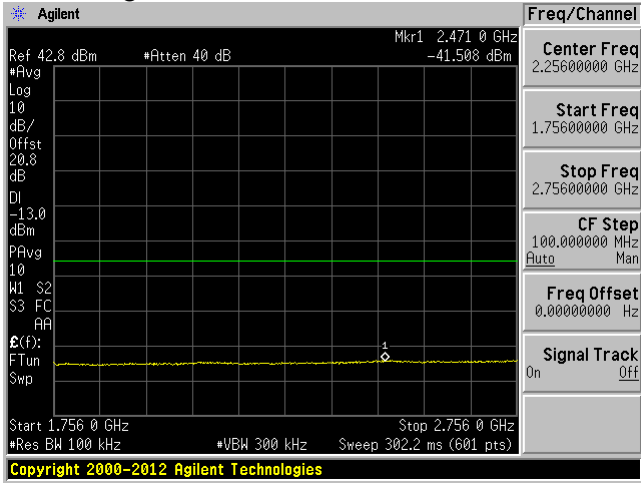


High Channel

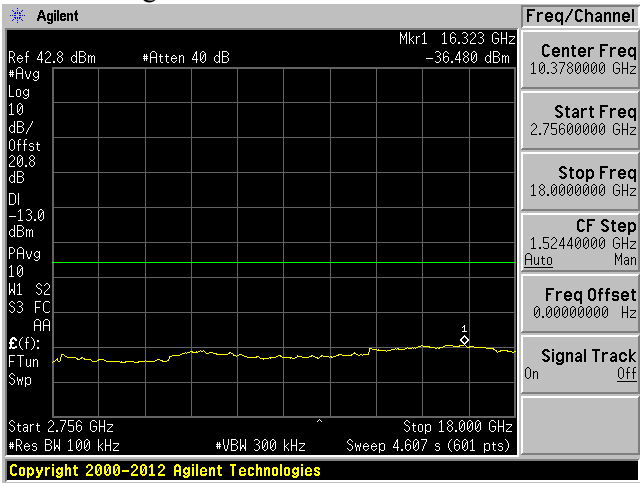
High Channel: 30 MHz-1.709 GHz



High Channel: 1.756 GHz-2.756 GHz



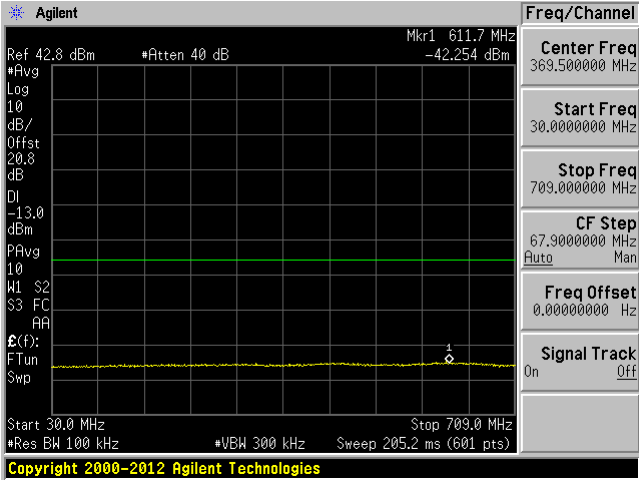
High Channel: 2.756 GHz- 18 GHz



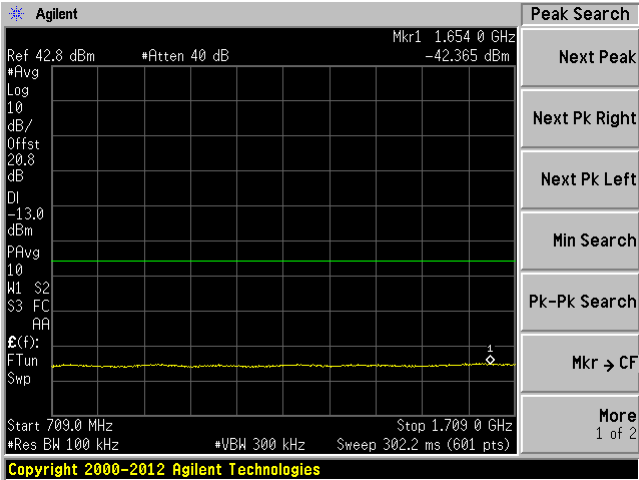
AGC On

Low Channel

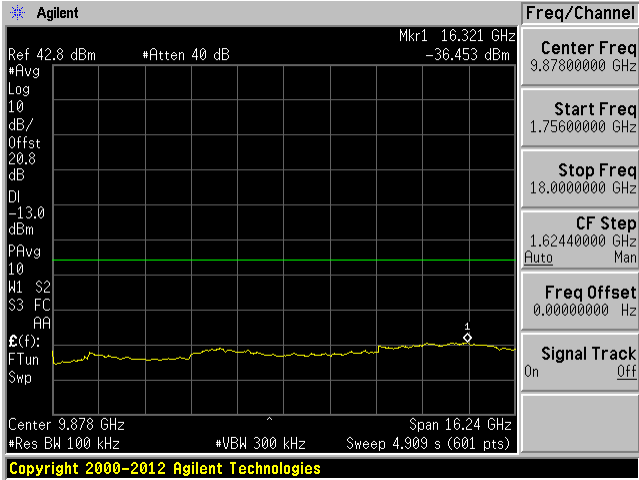
Low Channel: 30 MHz-709 MHz



Low Channel: 709 GHz-1.709 GHz

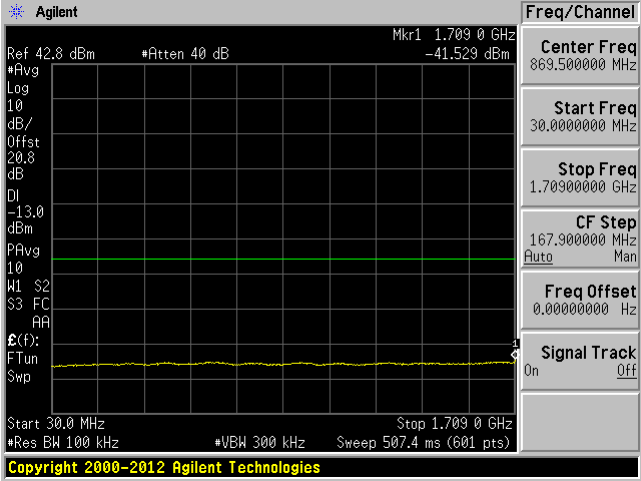


Low Channel: 1.756 GHz- 18 GHz

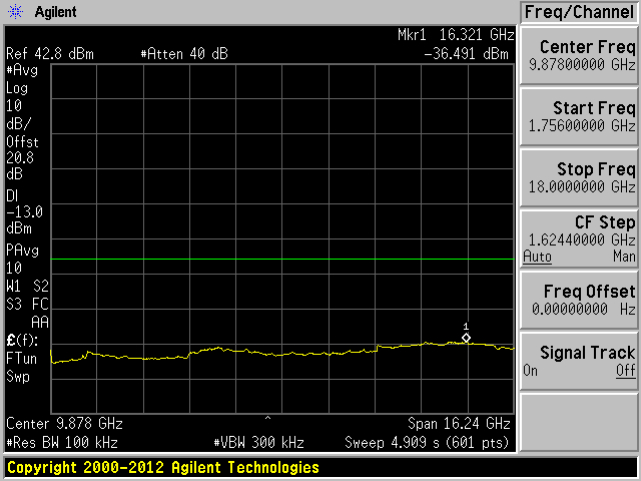


Middle Channel

Middle Channel: 30 MHz-1.709 GHz

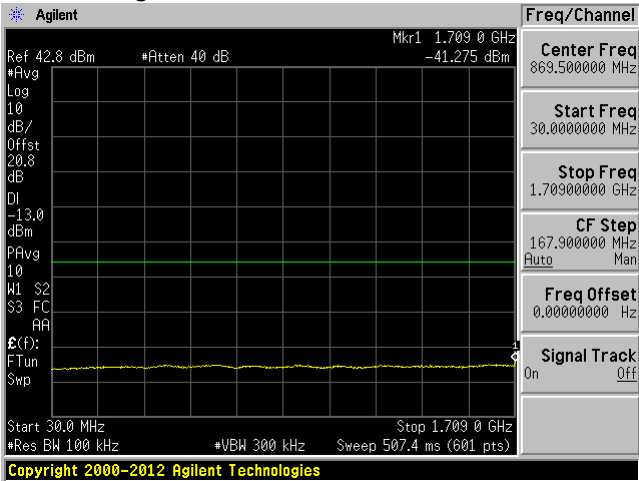


Middle Channel : 1.756 GHz-18 GHz

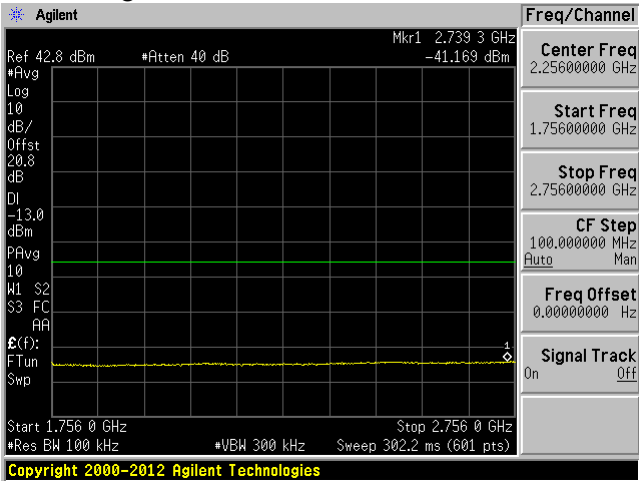


High Channel

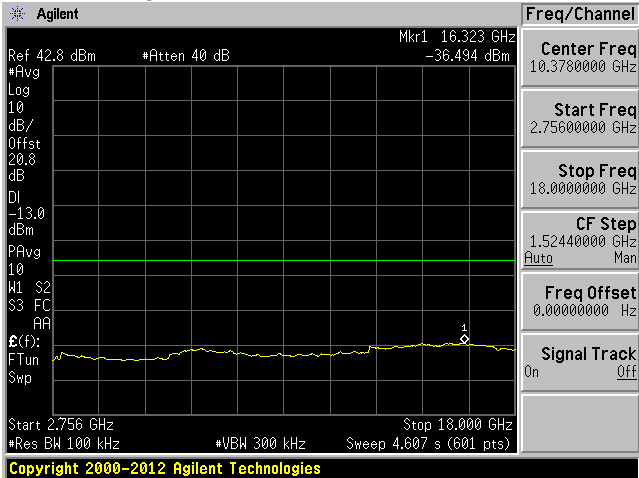
High Channel: 30 MHz-1.709 GHz



High Channel: 1.756 GHz-2.756 GHz



High Channel: 2.756 GHz- 18 GHz



## 9 FCC §27.53 - Band Edge & Intermodulation

---

### 9.1 Applicable Standards

According to FCC §27.53,

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(5) Compliance with the provisions of paragraphs (c) (1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

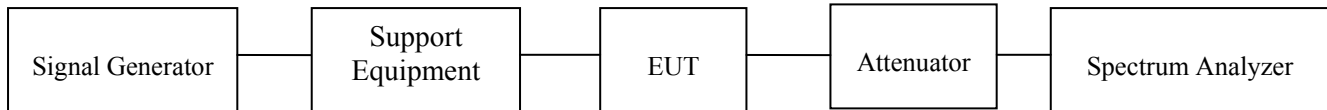
(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.

(h)(3) *Measurement procedure.* (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

## 9.2 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.



## 9.3 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 <sup>1</sup>	Each Time <sup>1</sup>
-	20 dB attenuator	-	-	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0003	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0006	Each Time <sup>1</sup>	Each Time <sup>1</sup>

<sup>1</sup>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

<b>Temperature:</b>	23° C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4-102 kPa

The testing was performed by Jose Martinez 2016-10-07 in the RF Site.

## 9.5 Test Results

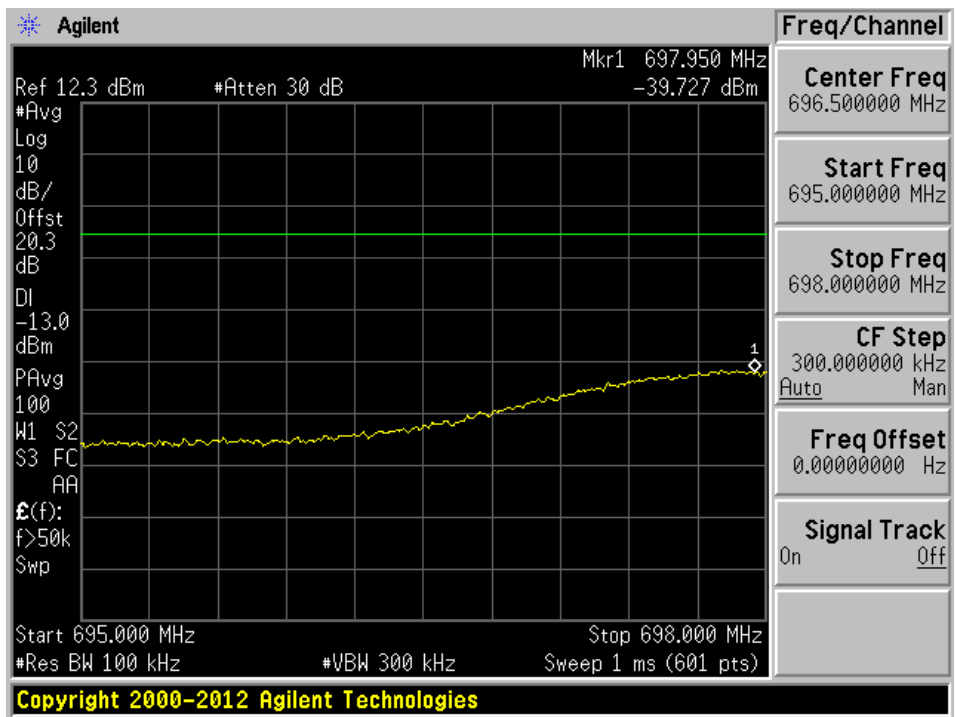
Please refer to the following plots.

Band Edge:

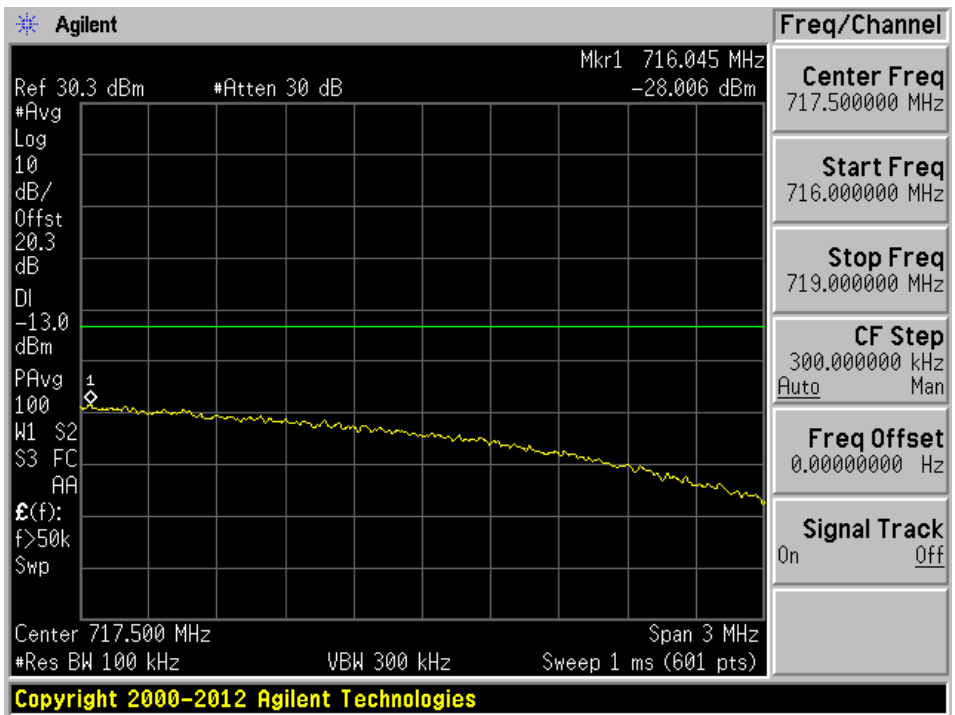
Broadband Signal 698-716 MHz

AGC Off

Lower Band Edge

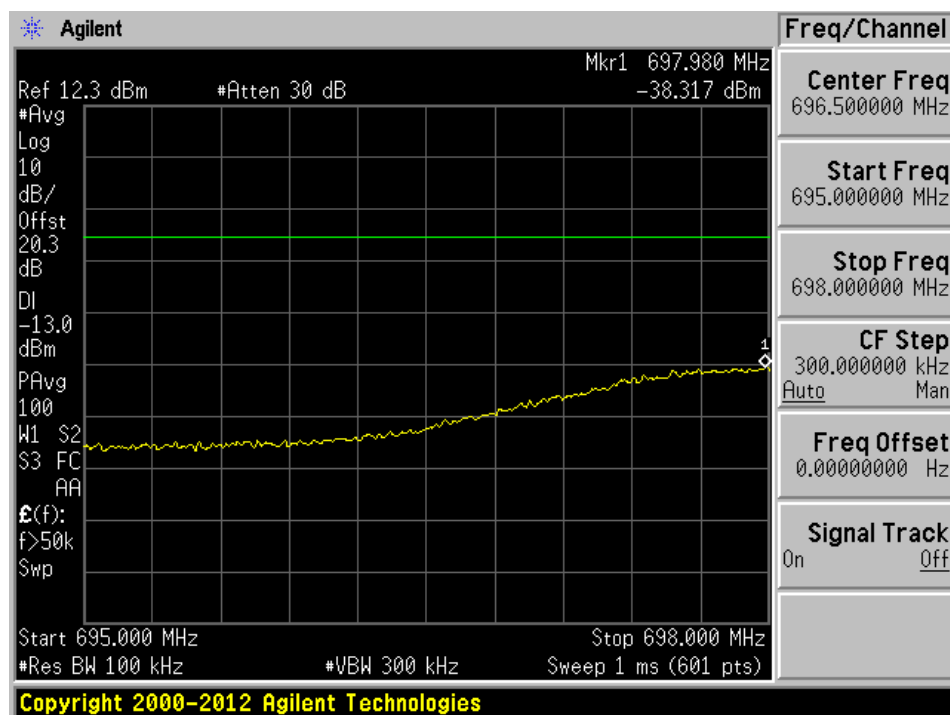


Upper Band Edge

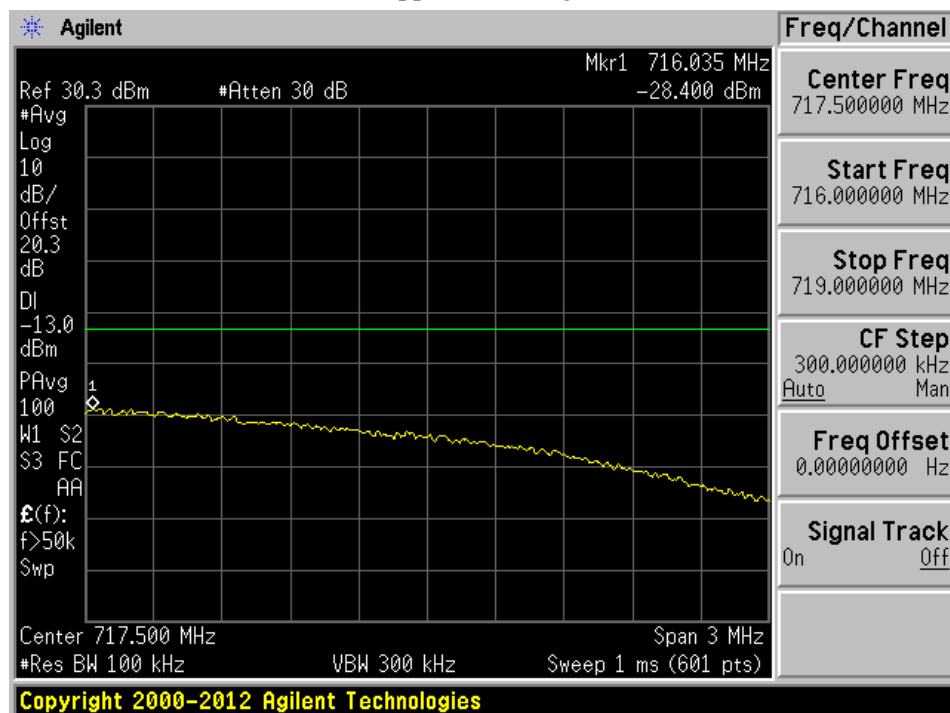


AGC On

Lower Band Edge



Upper Band Edge

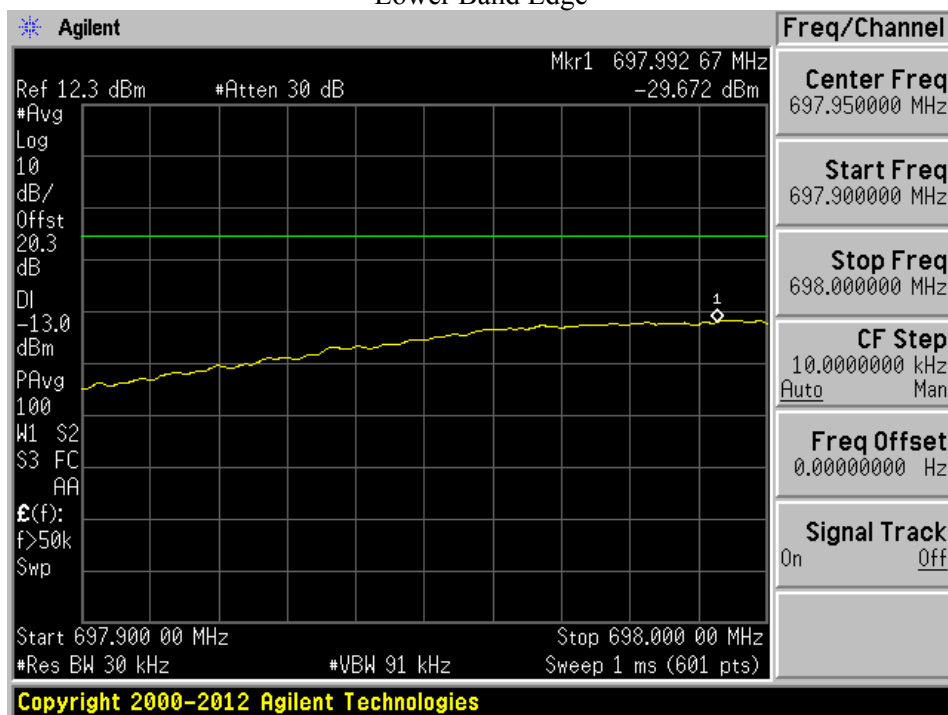




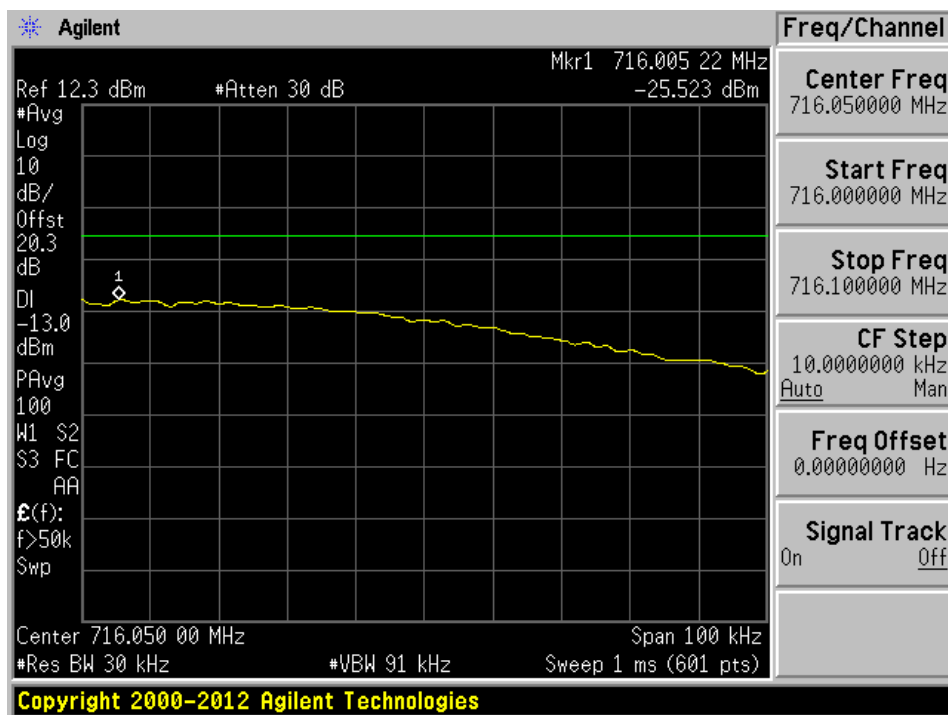
## Narrowband Signal 698-716 MHz

AGC Off

Lower Band Edge

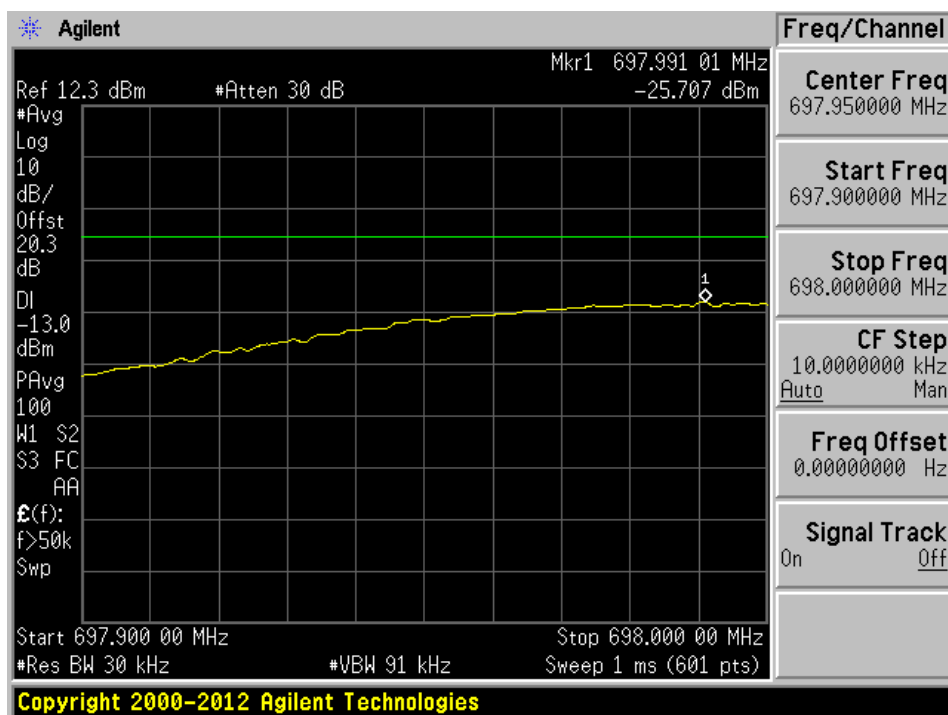


Upper Band Edge

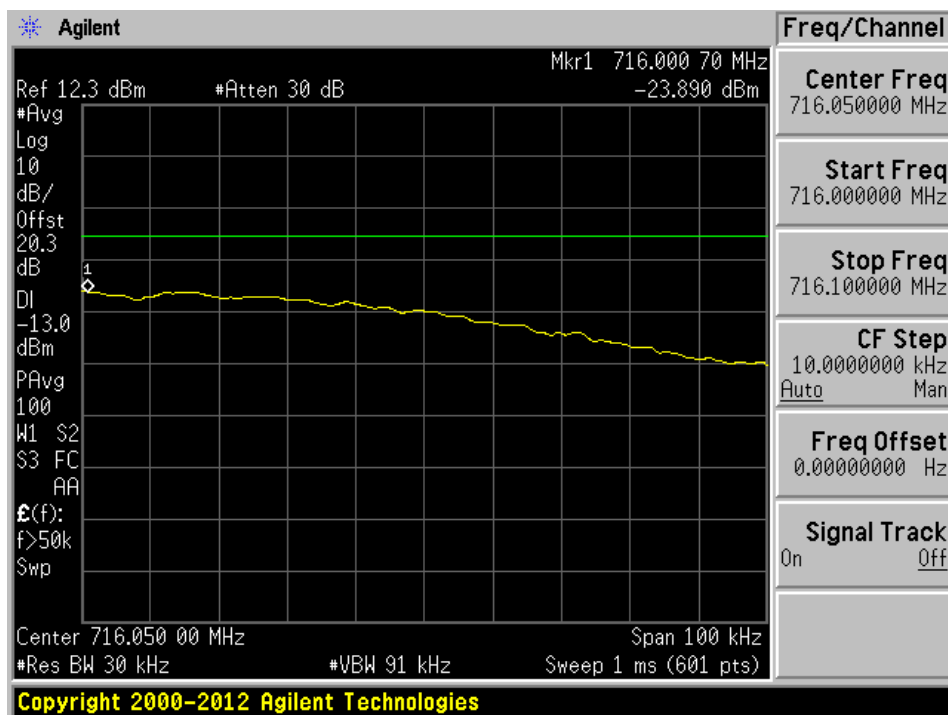


AGC On

Lower Band Edge



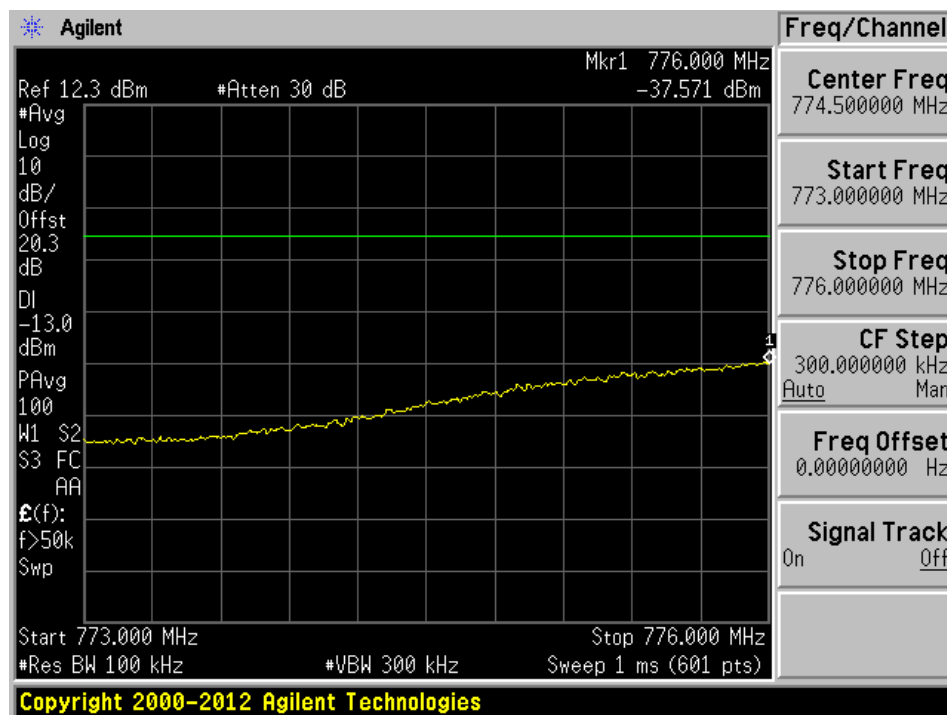
Upper Band Edge



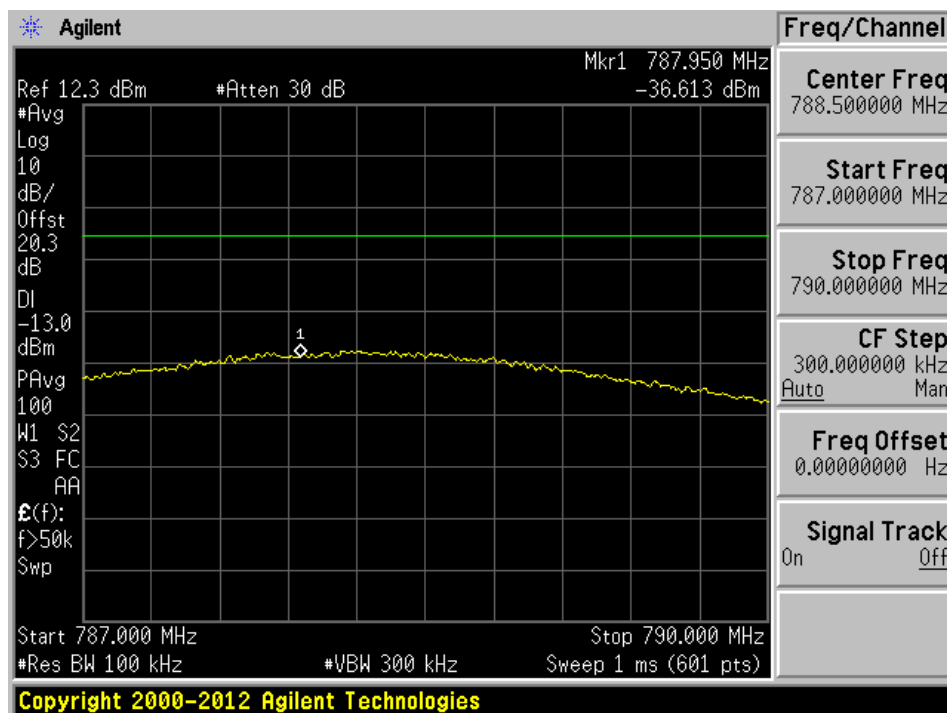
**Broadband Signal 776-787 MHz**

AGC Off

Lower Band Edge

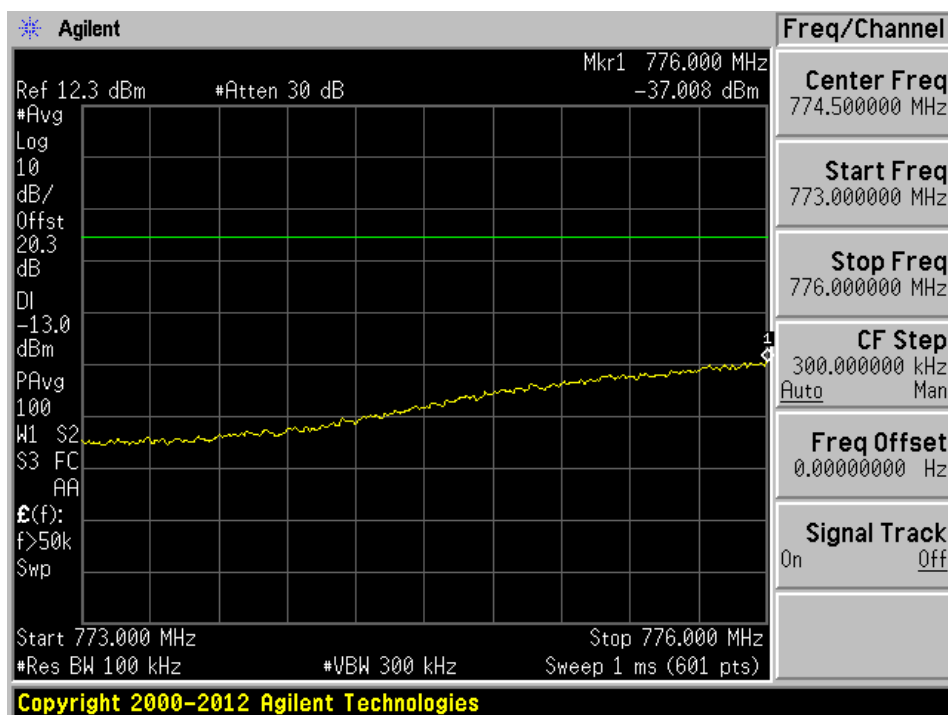


Upper Band Edge

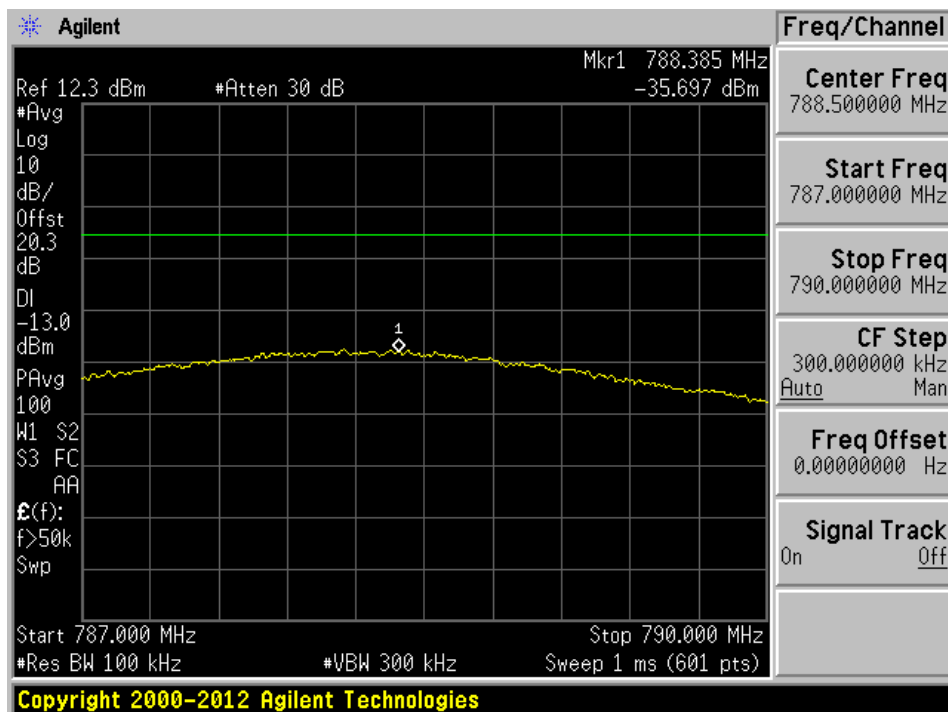


AGC On

Lower Band Edge



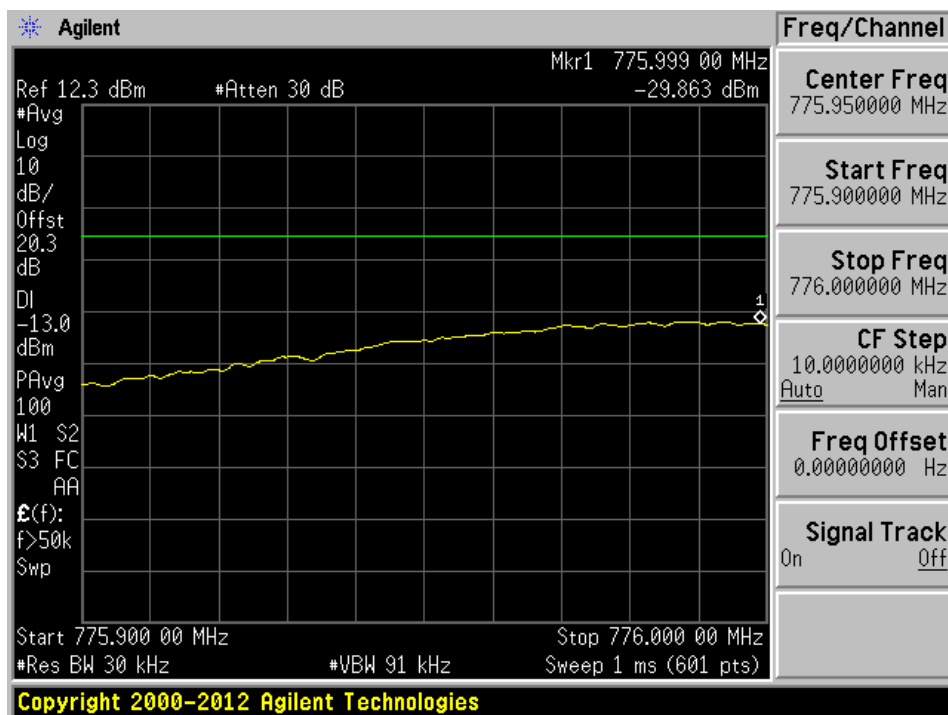
Upper Band Edge



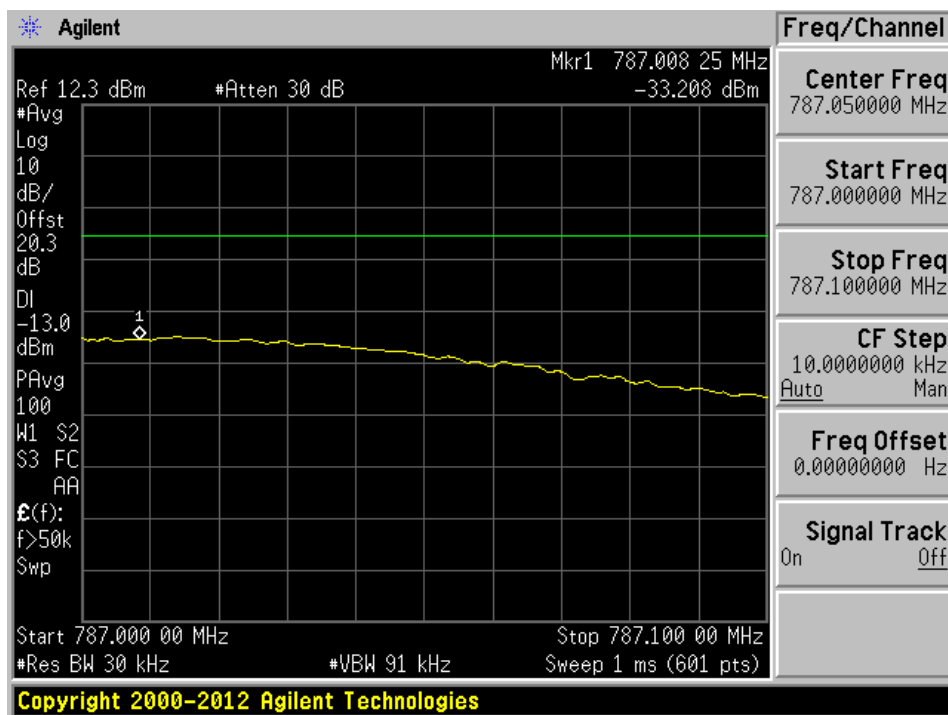
## Narrowband signal 776-787 MHz

AGC Off

Lower Band Edge

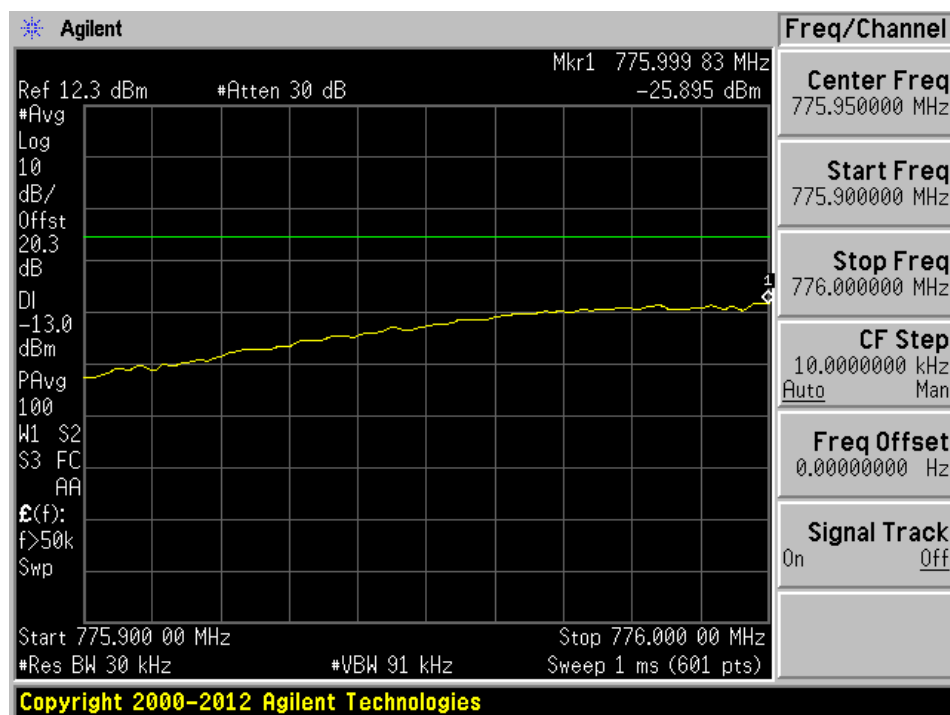


Upper Band Edge

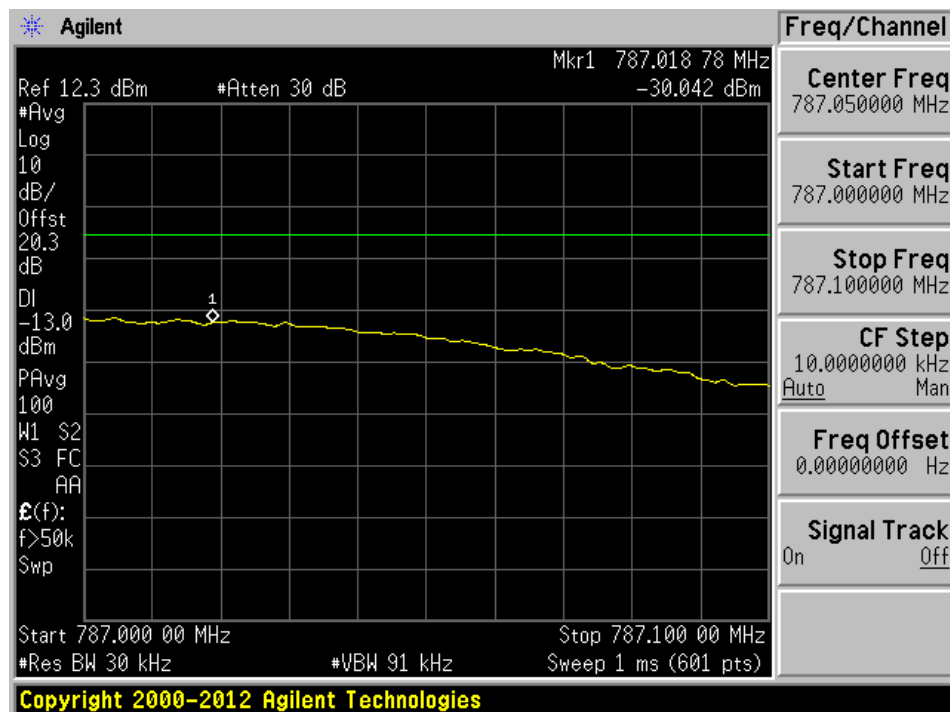


AGC On

Lower Band Edge



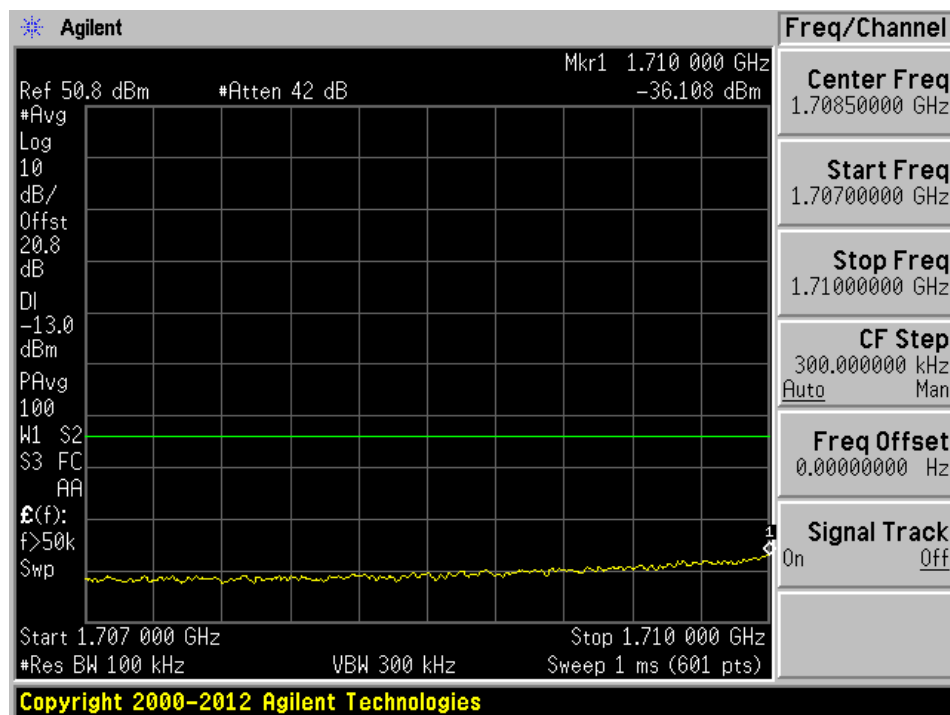
Upper Band Edge



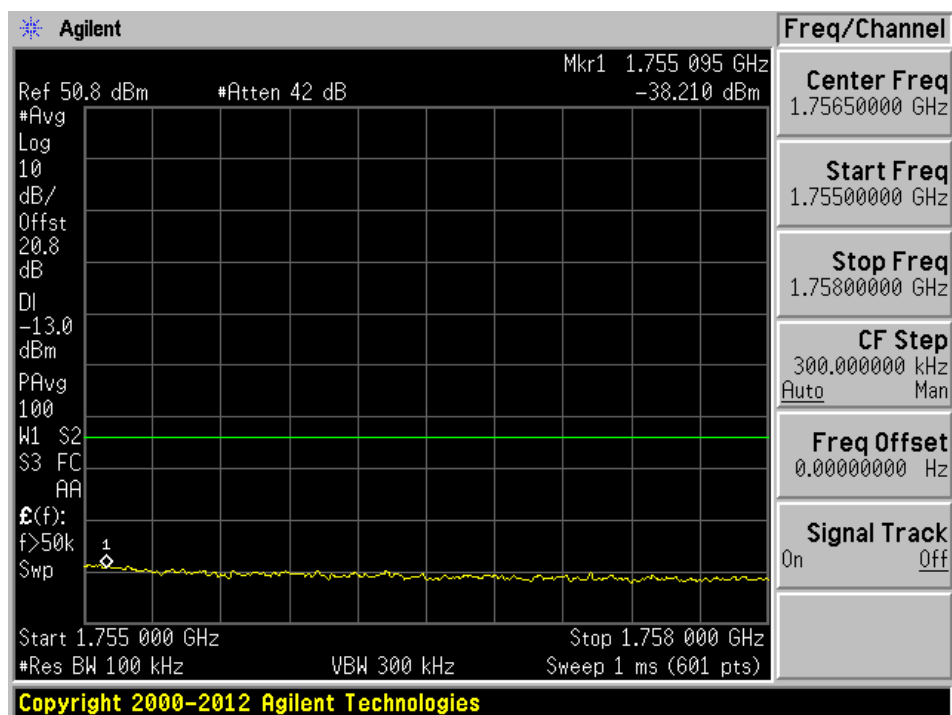
**Broadband Signal 1710-1755 MHz**

AGC Off

Lower Band Edge

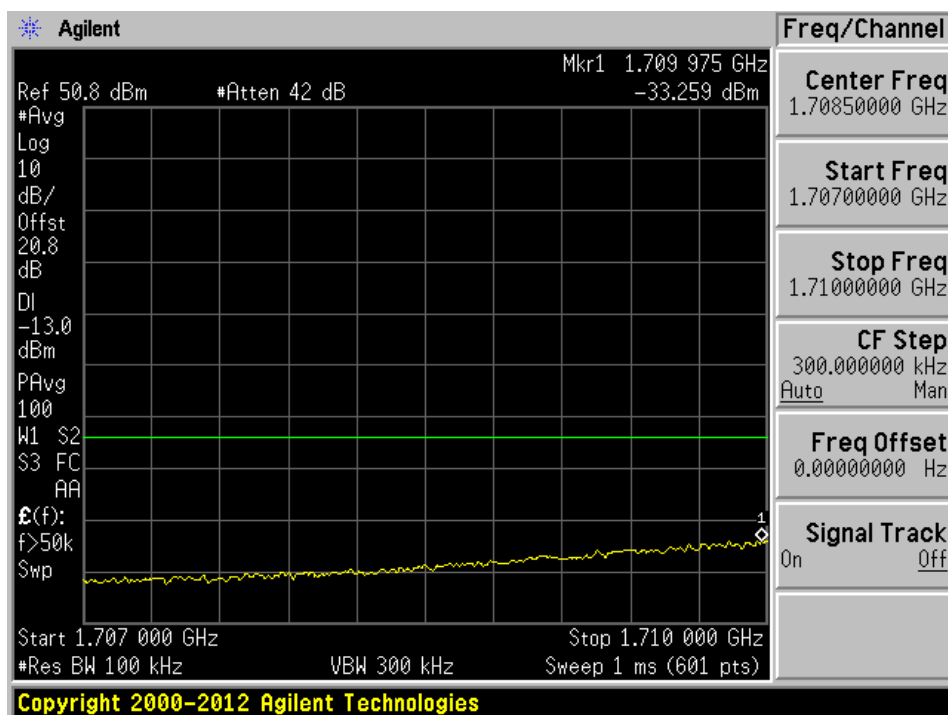


Upper Band Edge

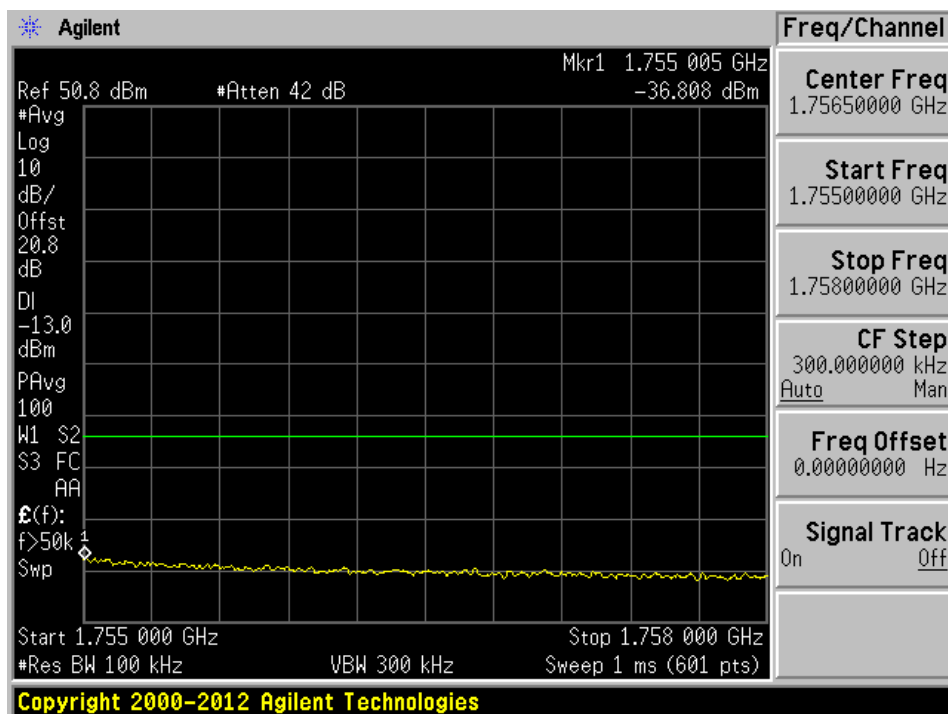


AGC On

Lower Band Edge



Upper Band Edge

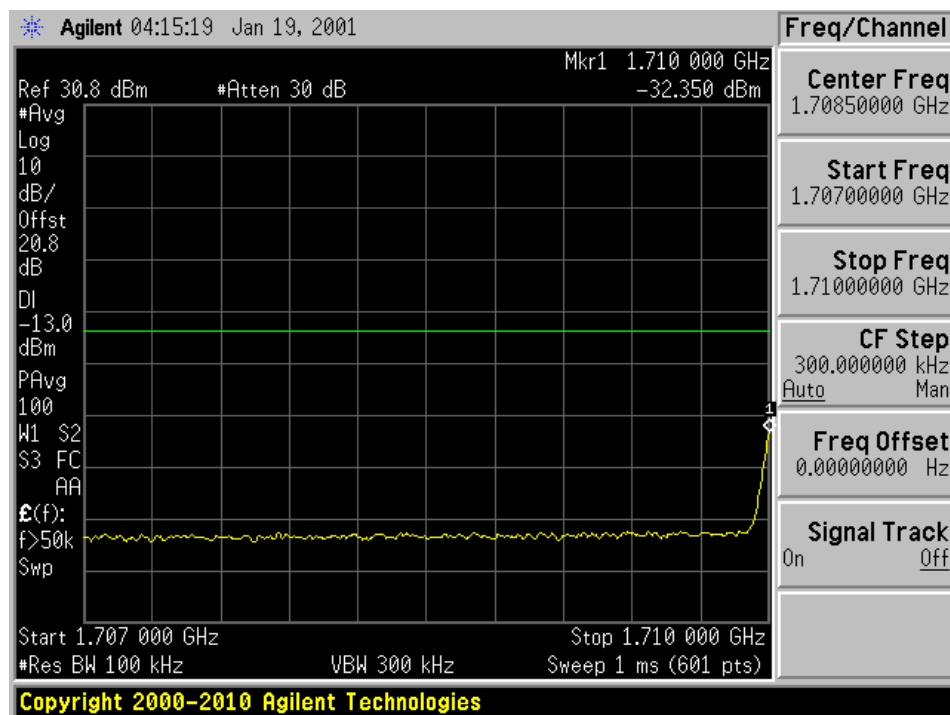




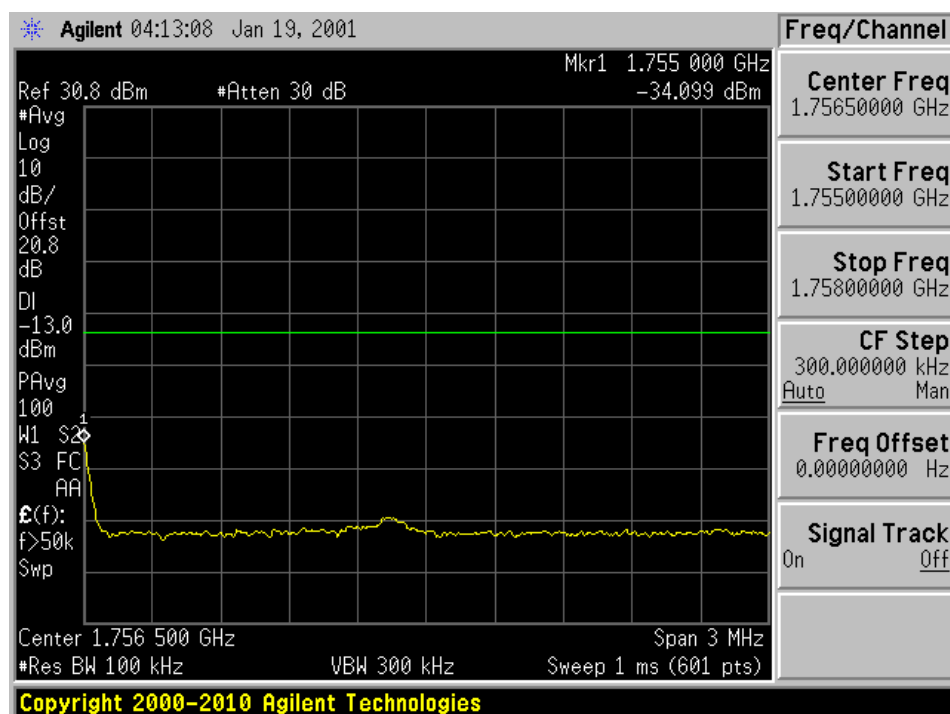
## Narrowband signal 1710-1755 MHz

AGC Off

Lower Band Edge

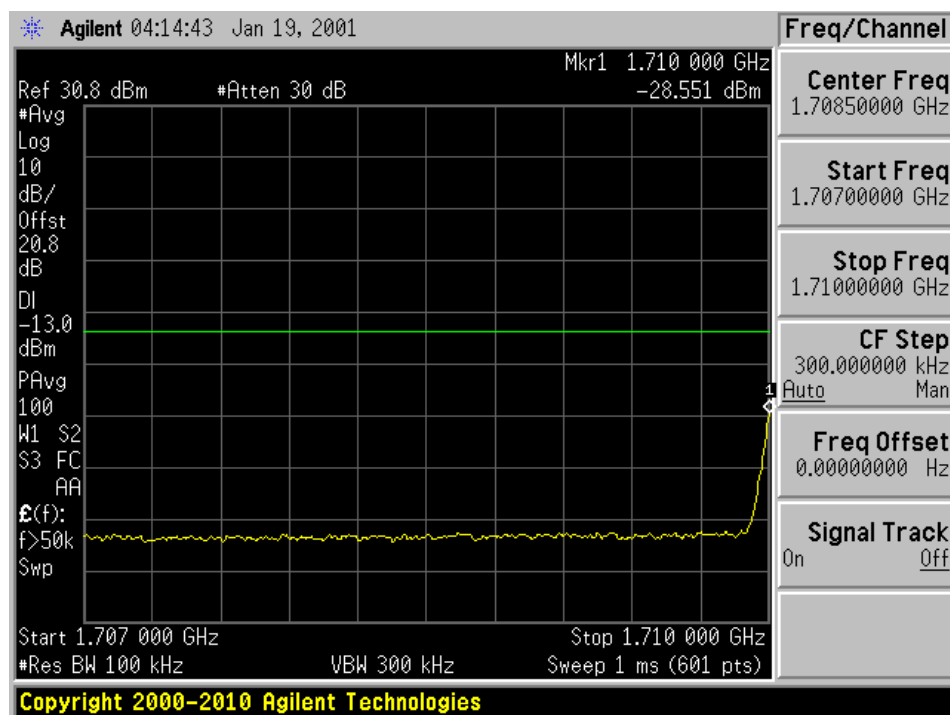


Upper Band Edge

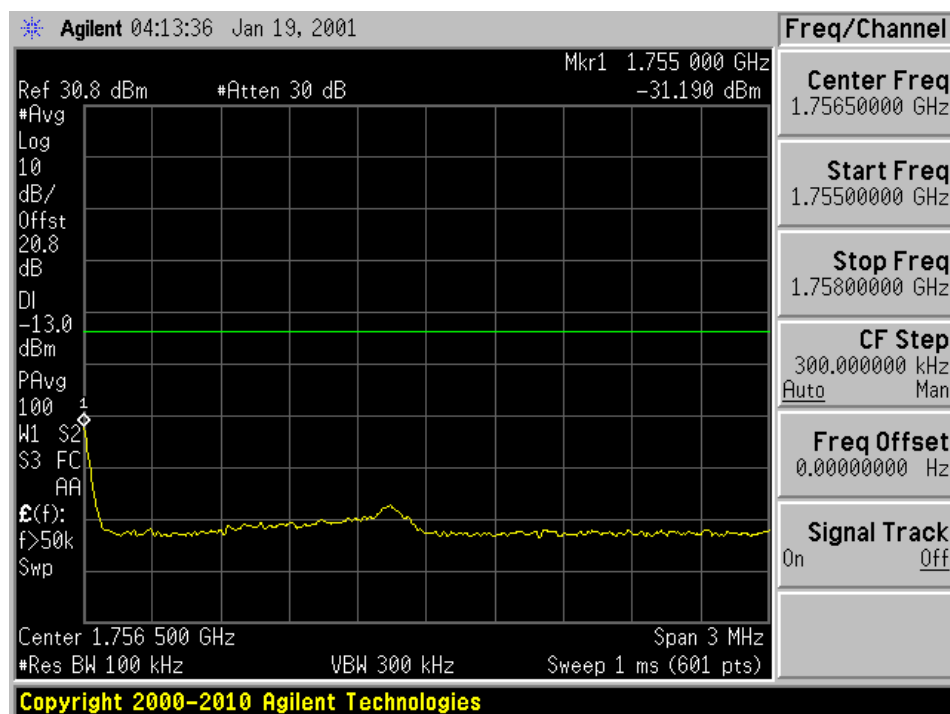


AGC On

Lower Band Edge



Upper Band Edge

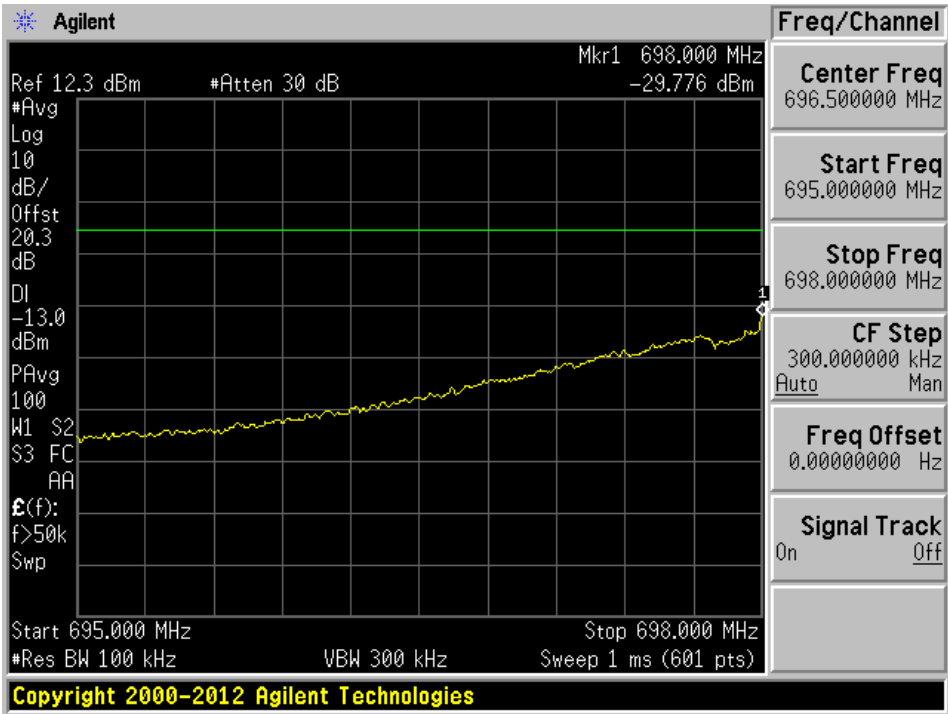


Intermodulation:

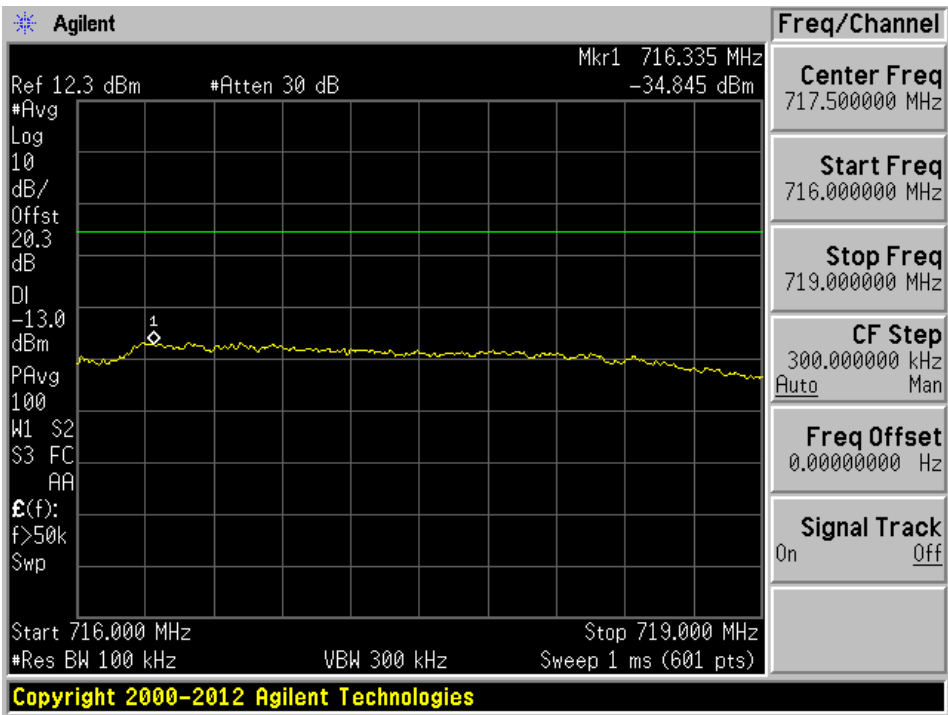
Broadband signal 698-716 MHz

AGC Off

Low Channel

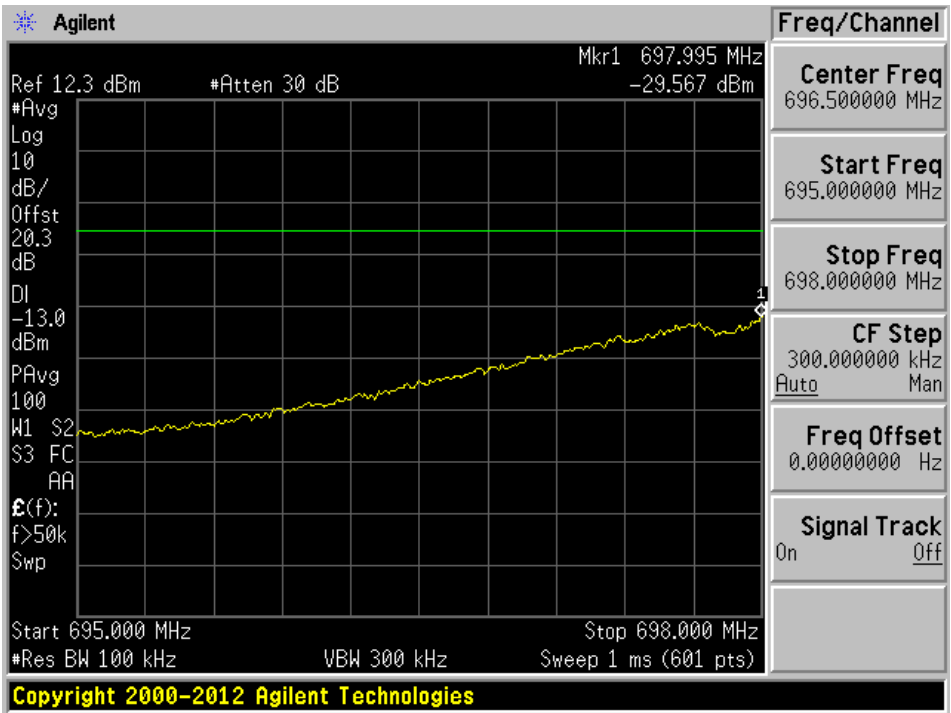


High Channel

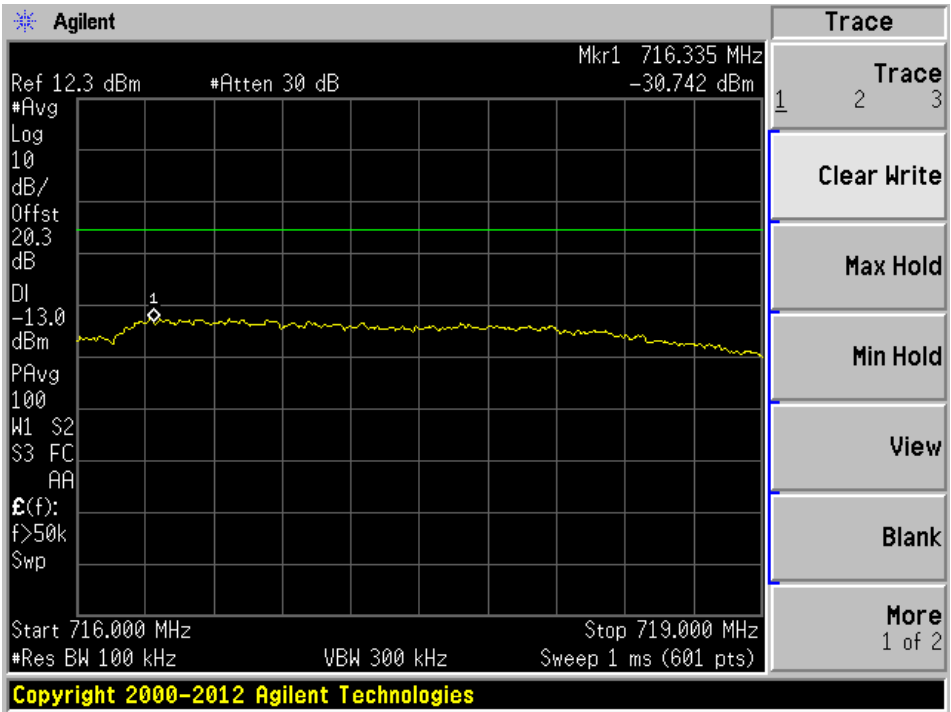


AGC On

Low Channel



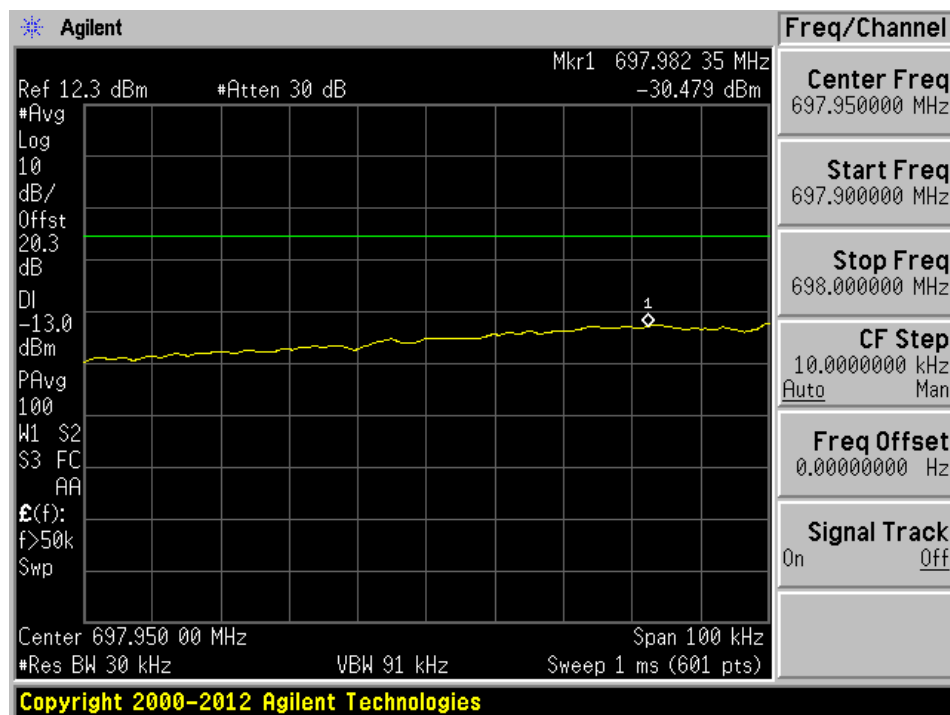
High Channel



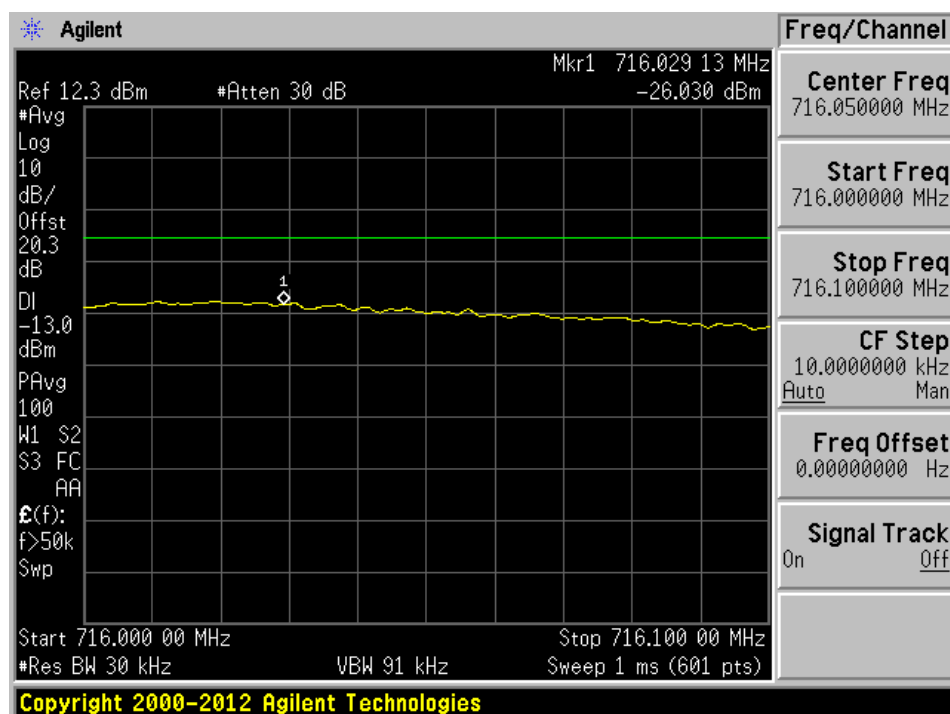
## Narrowband Signal 698-716 MHz

AGC Off

Low Channel

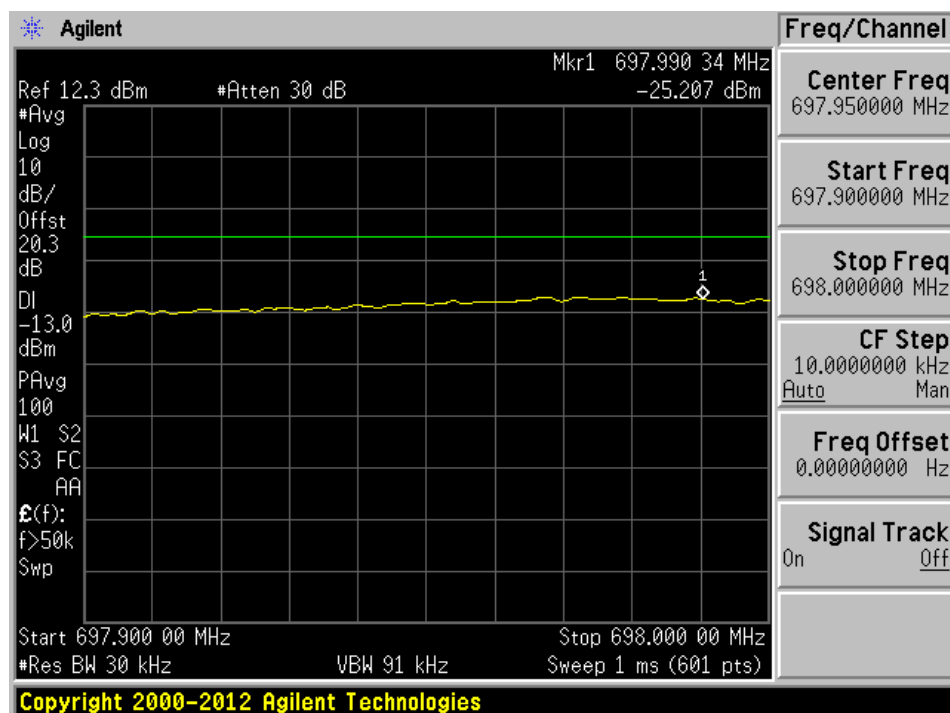


High Channel

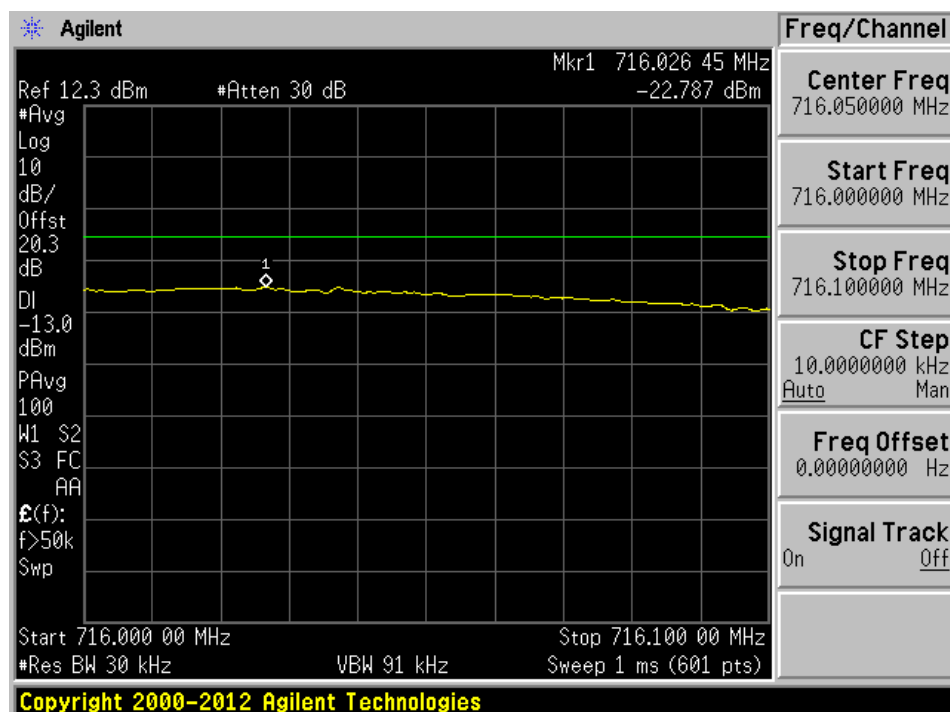


AGC On

Low Channel



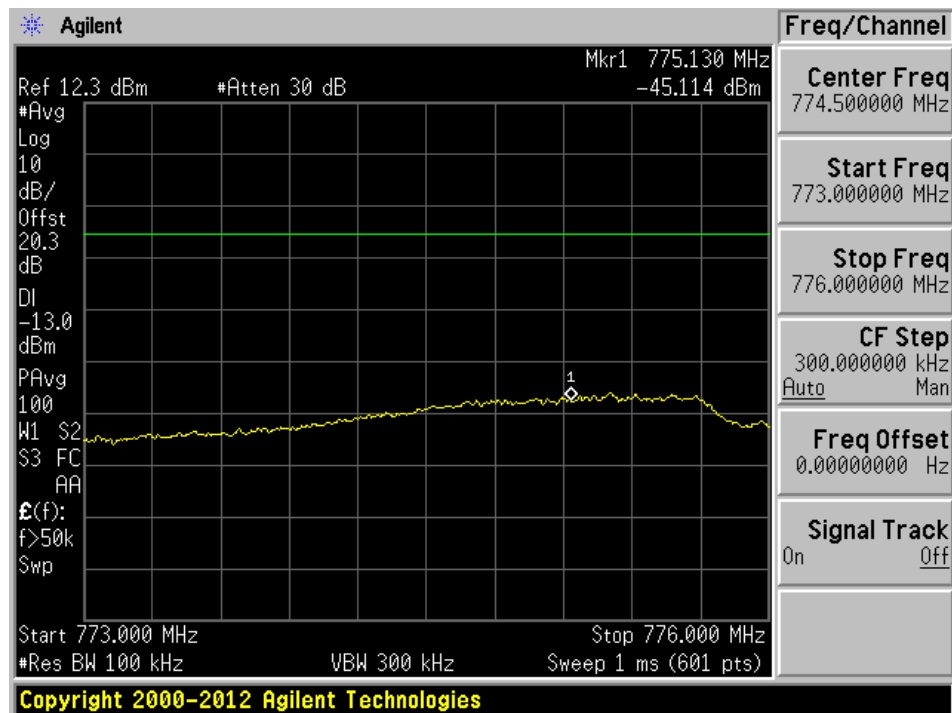
High Channel



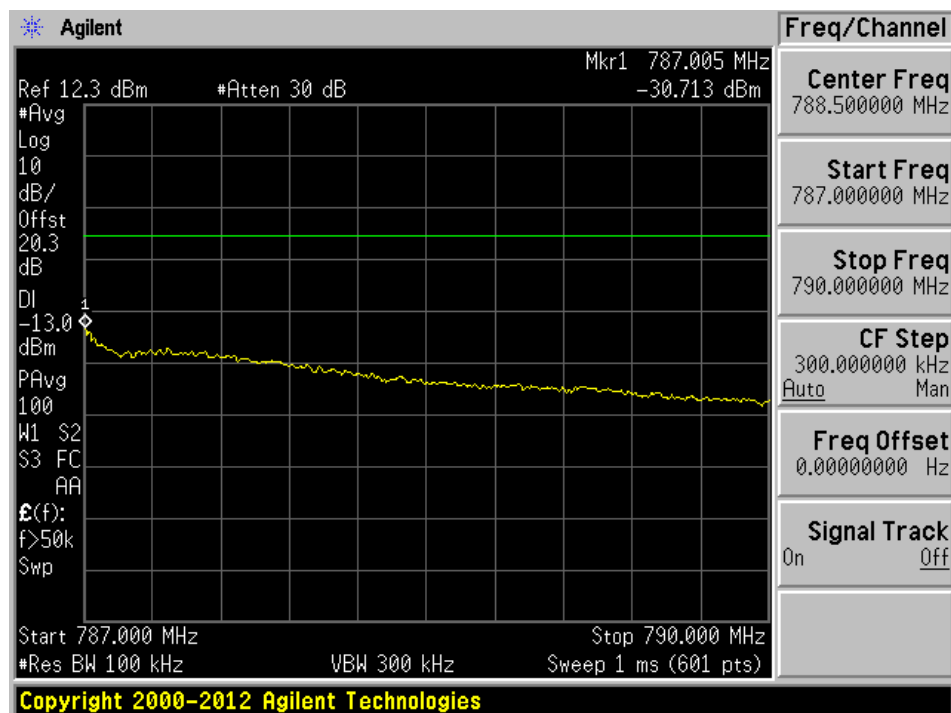
**Broadband Signal 776-787 MHz**

AGC Off

Low Channel

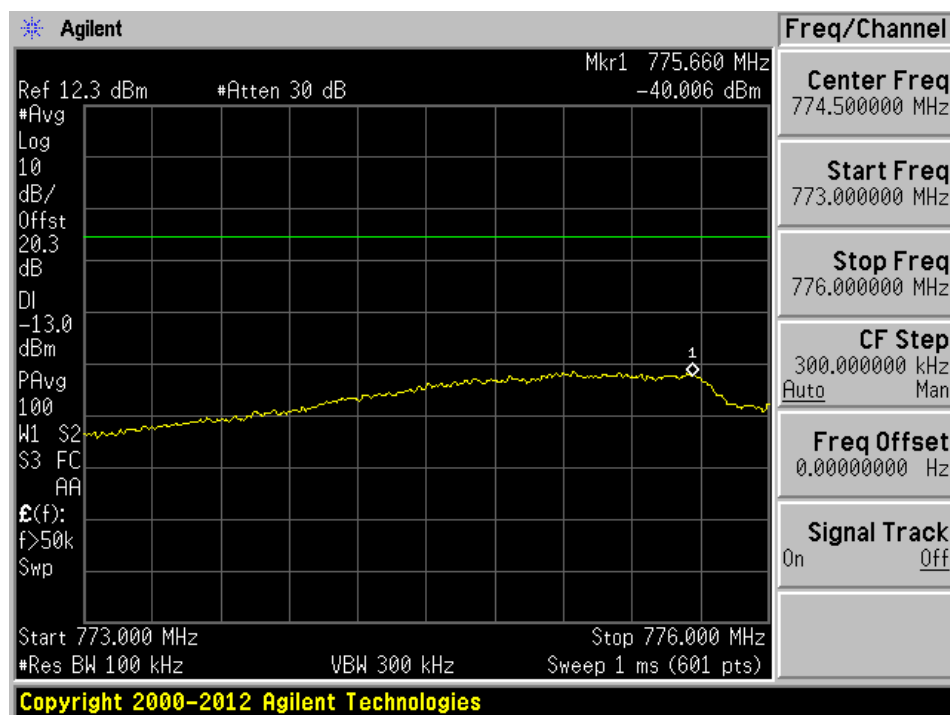


High Channel

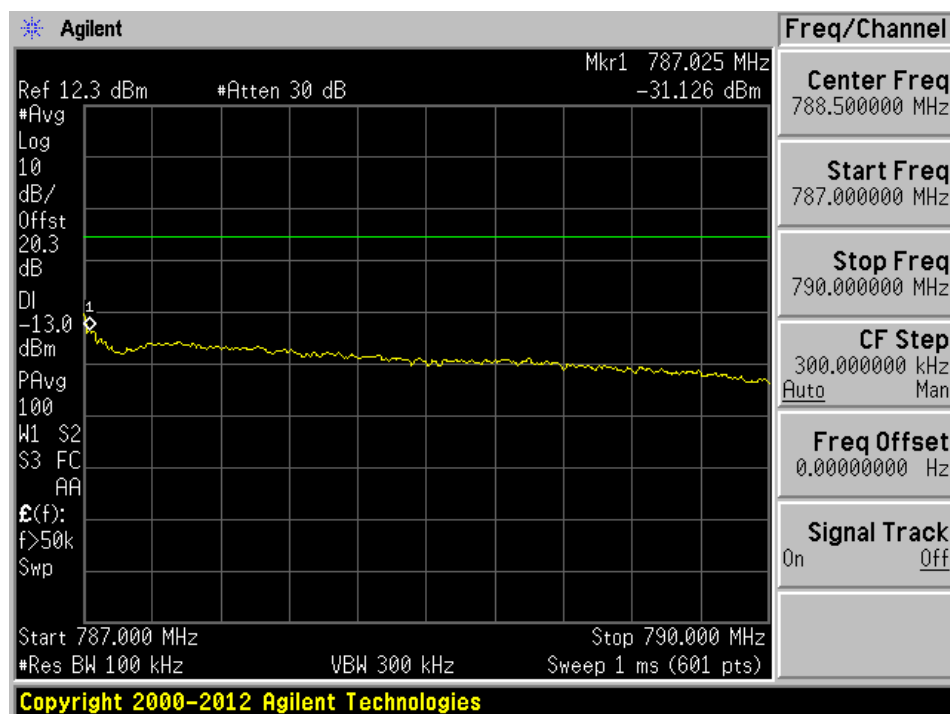


AGC On

Low Channel



High Channel

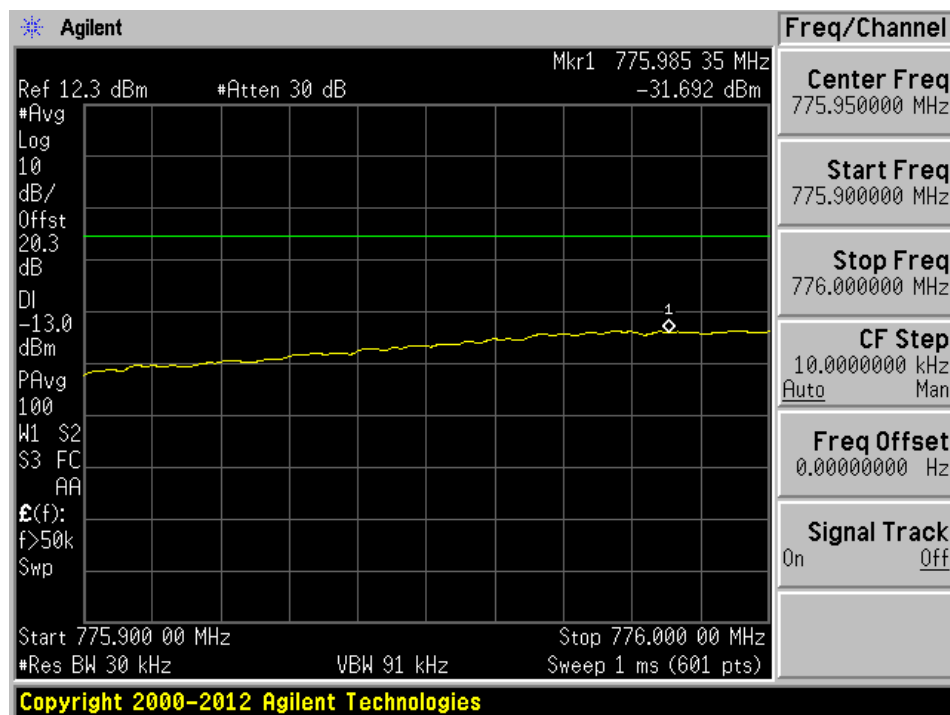




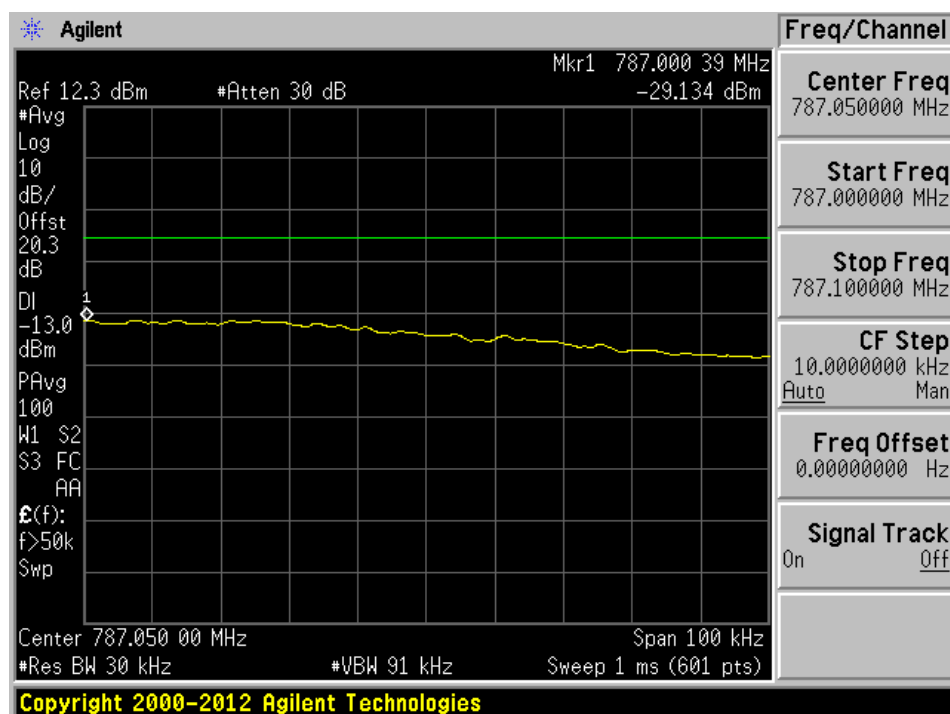
## Narrowband Signal 776-787 MHz

AGC Off

Low Channel

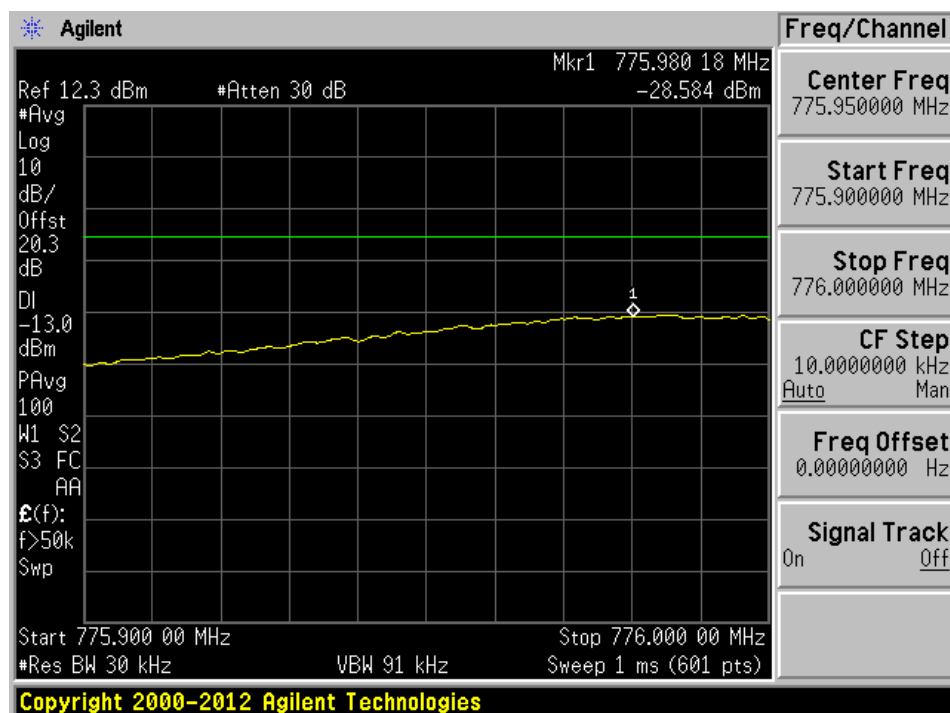


High Channel

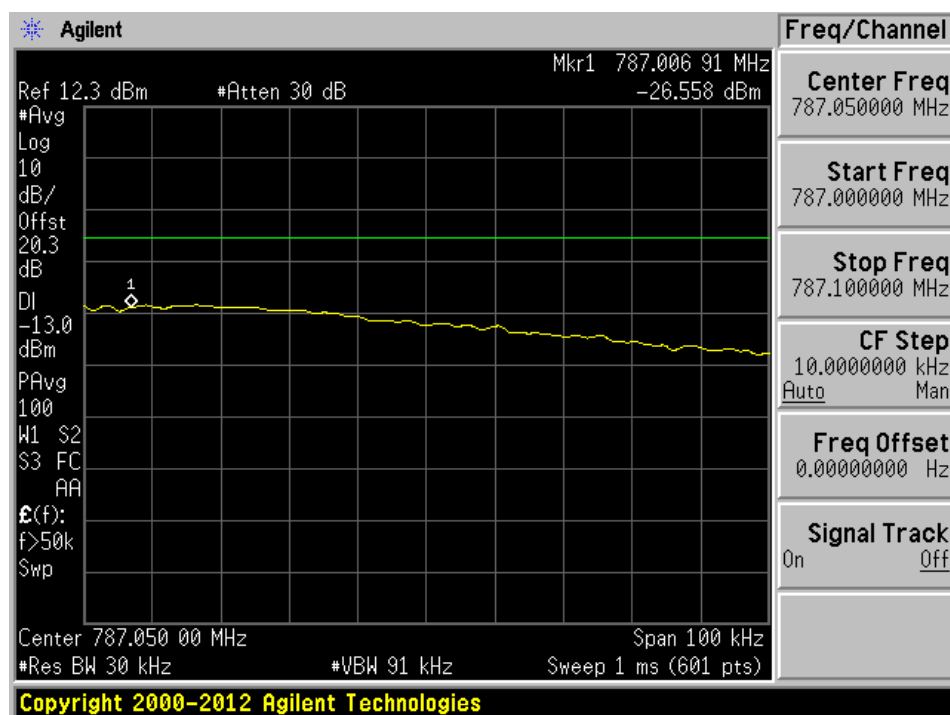


AGC On

Low Channel



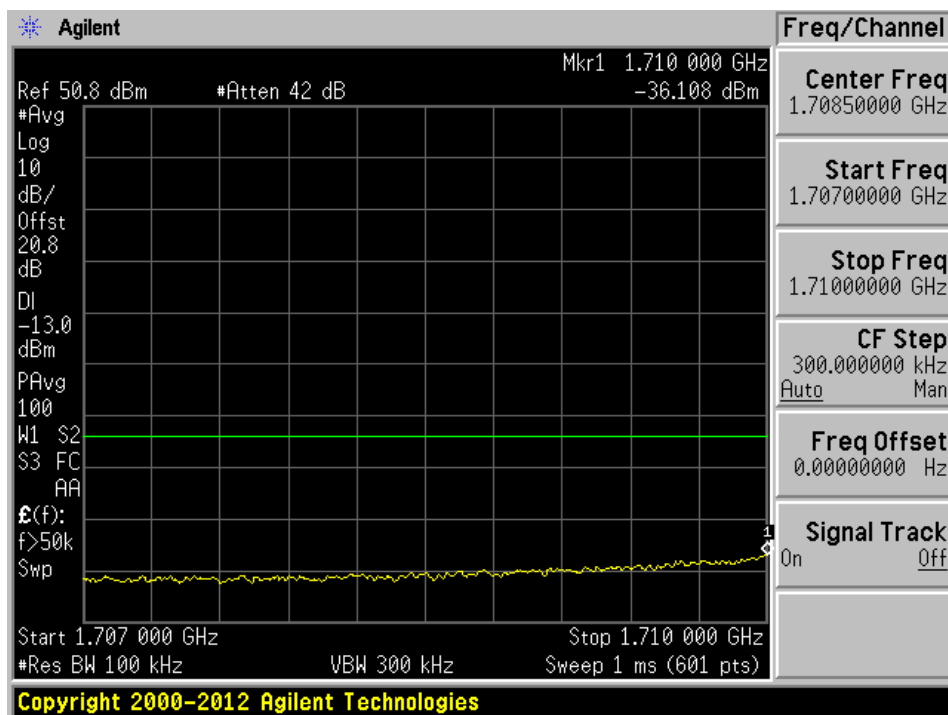
High Channel



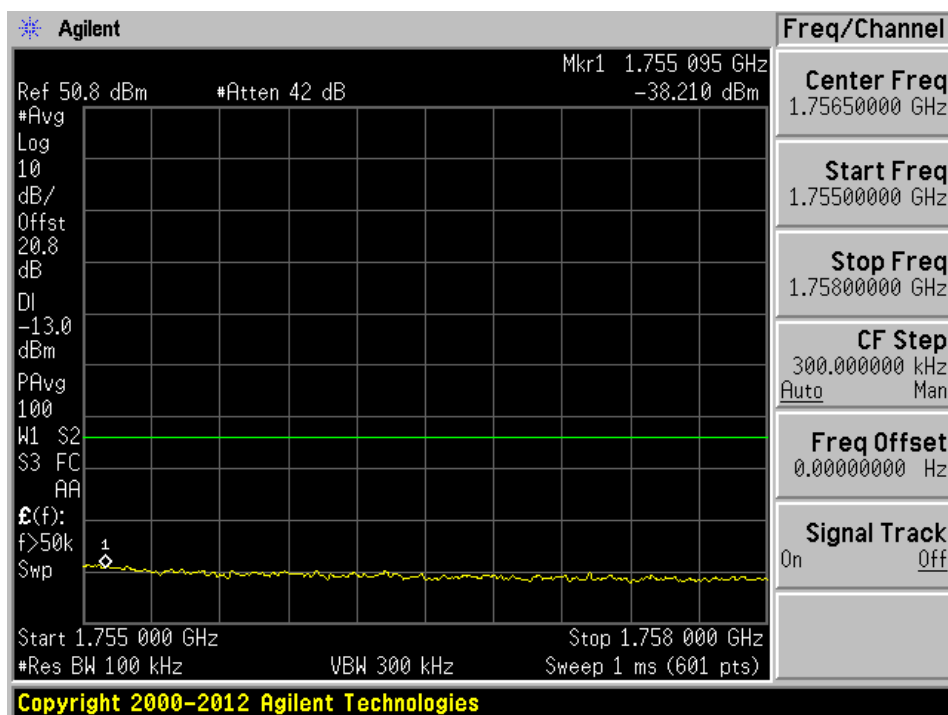
## Broadband signal 1710-1755 MHz

AGC Off

Lower Band Edge

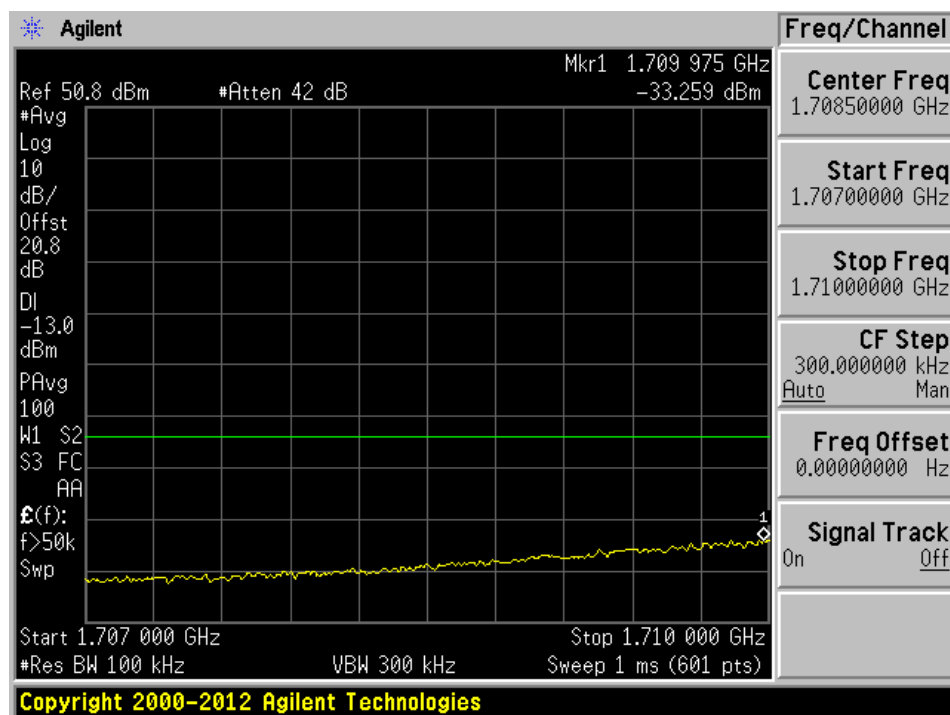


Upper Band Edge

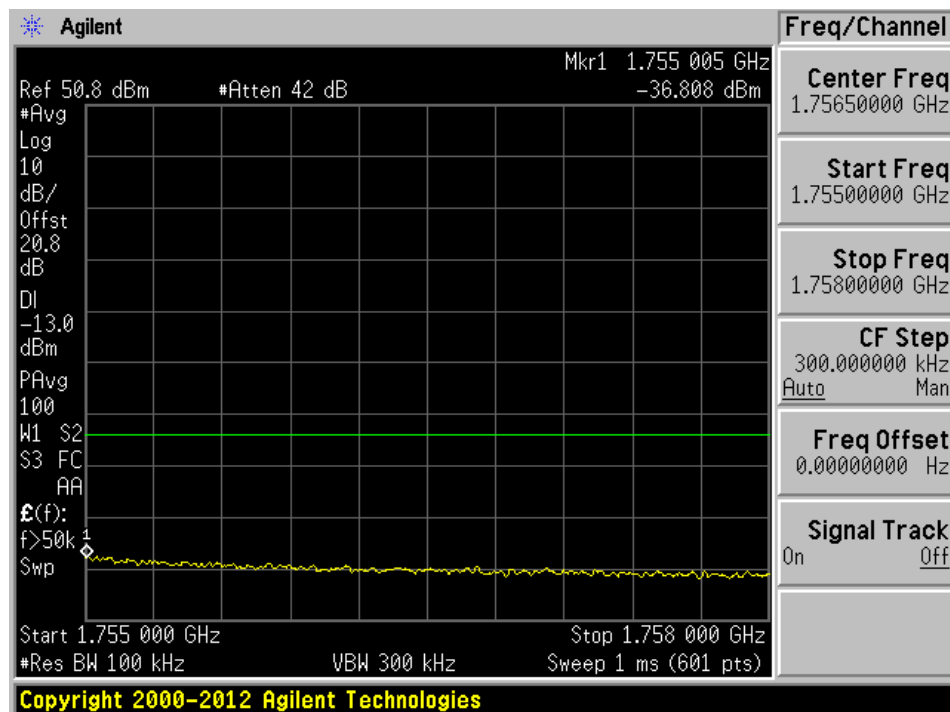


AGC On

Lower Band Edge



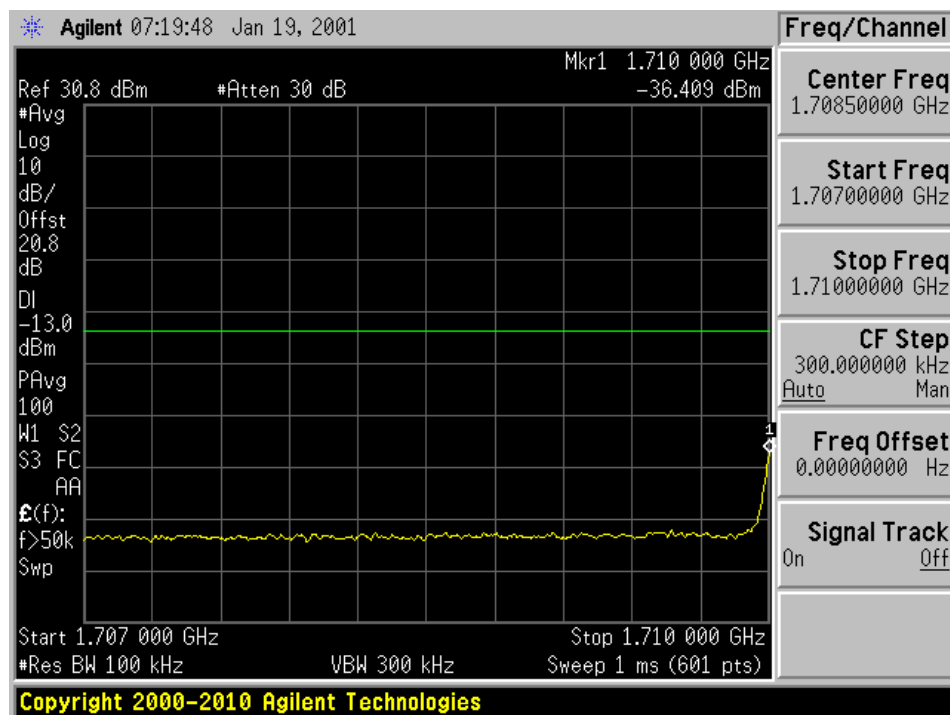
Upper Band Edge



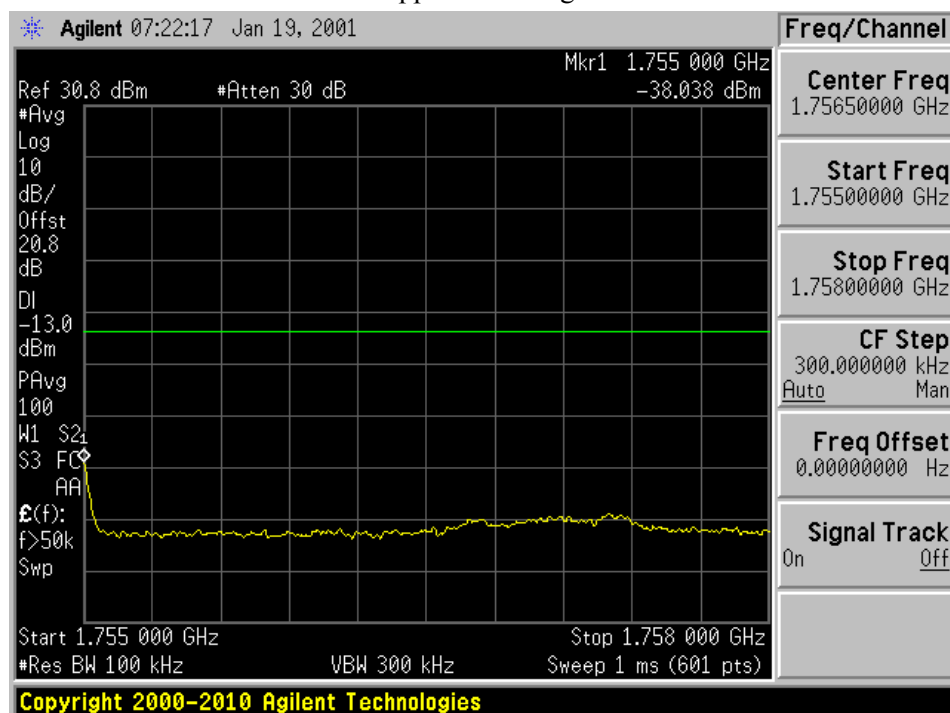
**Narrowband Signal 1710-1755 MHz**

AGC Off

Lower Band Edge

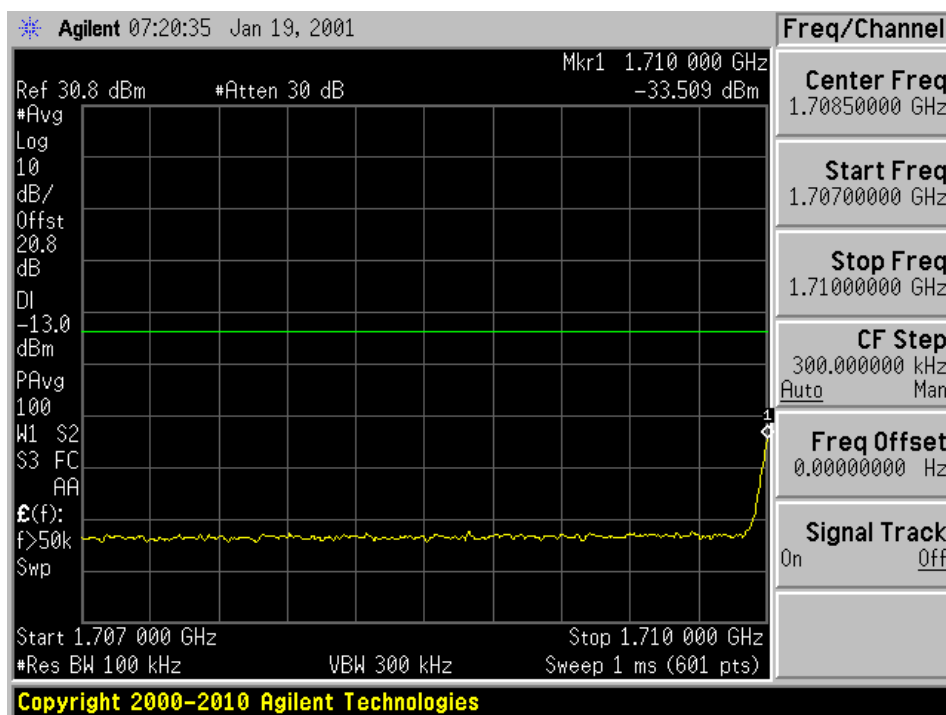


Upper Band Edge

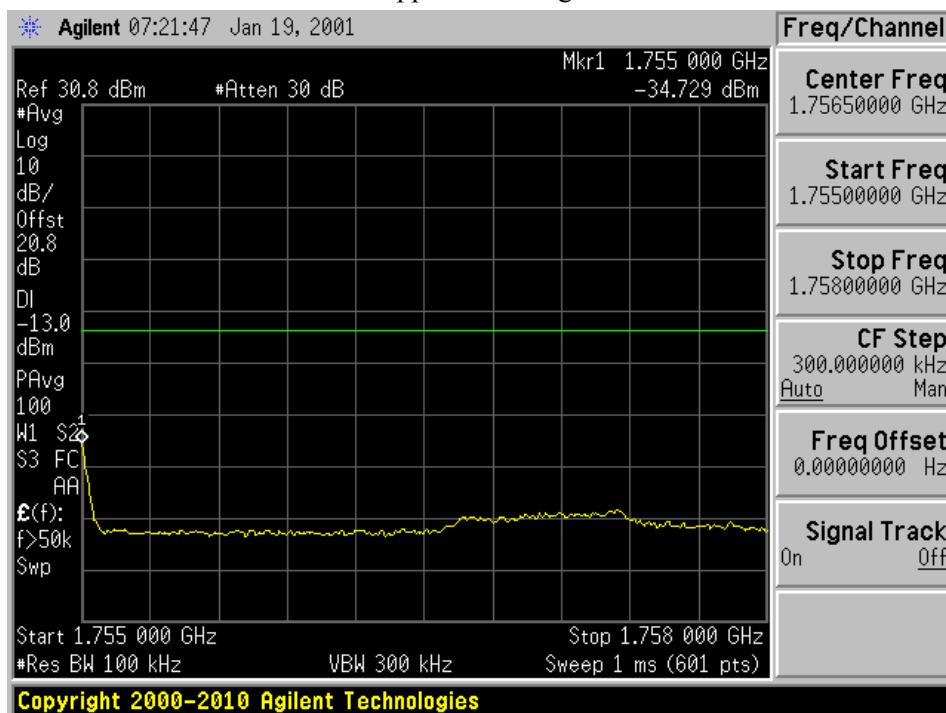


AGC On

Lower Band Edge



Upper Band Edge



## 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

KDB 935210 D05, Section 3.3.

The RF output of the transceiver 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

Manufacturer	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Rohde & Schwarz	Generator, Signal	SMI03	849192/0085	2016-07-29	2 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2015-11-18	1 year
-	20 dB attenuator	-	-	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	20 dB attenuator	-	-	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0003	Each Time <sup>1</sup>	Each Time <sup>1</sup>
-	SMA cable	-	C0006	Each Time <sup>1</sup>	Each Time <sup>1</sup>

<sup>1</sup>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

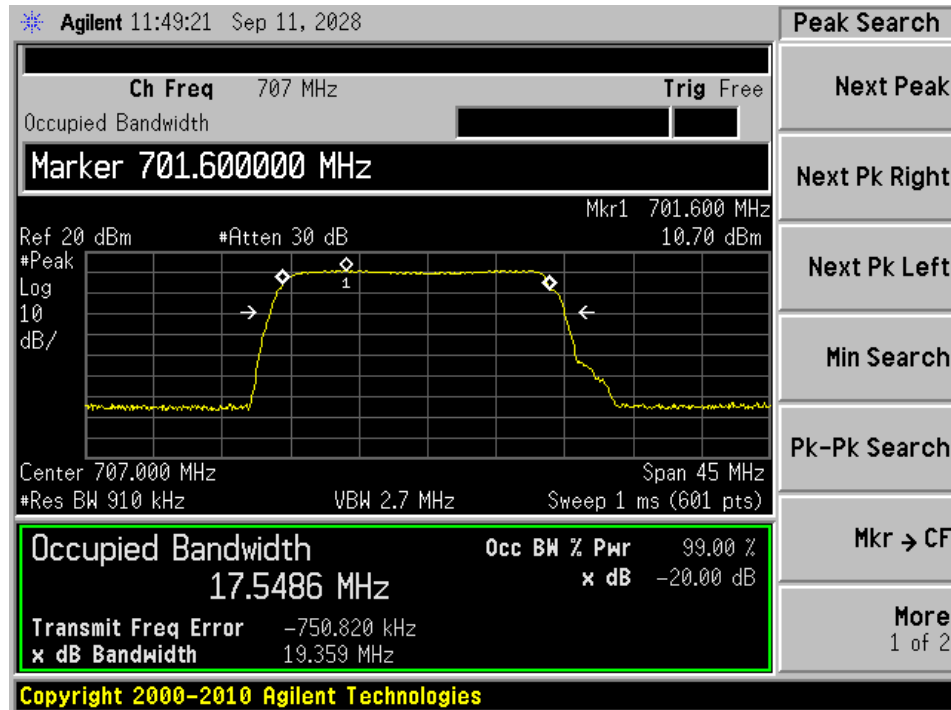
Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.4-102 kPa

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

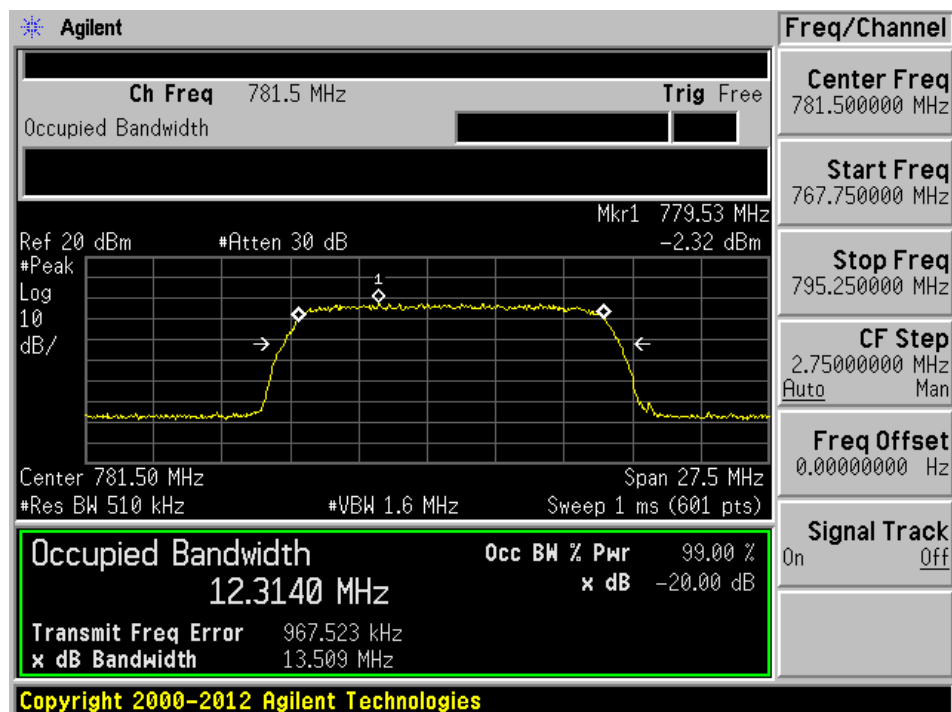
## 10.5 Test Results

Please refer to the following plot.

698-716 MHz



776-787 MHz





1710-1755 MHz

