FCC PART 22H

TEST AND MEASUREMENT REPORT

For

Whoop Wireless, Inc.

5913 NW 31st Ave., Fort Lauderdale,
Germantown, FL 33309, USA

FCC ID: 2AEQJ-HE4-001

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

Prepared By:	Todd Moy Test Engineer
Report Number:	R1509101-22
Report Date:	2015-11-03
Reviewed By:	Simon Ma RF Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1509101-22	Initial	2015-11-03

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Whoop Wireless, Inc.* and their product model: HE4-001, FCC ID: 2AEQJ-HE4-001 which will henceforth be referred to as the EUT (Equipment under Test). The EUT was a dual-directional industrial amplifier. The EUT operated in the frequency band of 800 MHz for GSM, CDMA, WCDMA and LTE for uplink and downlink.

1.2 Mechanical Description

The EUT measured approximately 25.4 cm (L) x 21 cm (W) x 5.1 cm (H) and weighs 1.25 kg.

The test data gathered are from typical production sample, serial number: R1509101-1, assigned by BACL.

1.3 Objective

This type approval report was prepared on behalf of *Whoop Wireless, Inc.* in accordance with Part 2, Subpart J, Part 20.21, Part 22 Subpart H, of the Federal Communication Commission's rules.

The objective was to determine compliance with FCC rules for RF output power, occupied bandwidth, spurious emissions at antenna terminal, field strength of spurious radiation and band edge.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals

1.5 Test Methodology

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

Part 20.21 – Signal Boosters
Part 22 Subpart H - Public Mobile 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.

Based on CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from ±2.0 dB for Conducted Emissions tests and ±4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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

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

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

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

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

2 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
Zore Access Tech	-	HE4-001 REV A	-

2.5 Local Support Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers
Dell	Laptop	Latitude D600	CN-0X2034-48643-3A6-8307

2.6 Power Supply and Line Filters

Manufacturers	Descriptions	Models	Serial Numbers
-	AC/DC Adapter	KWT-0605000	-

2.7 Interface Ports and Cabling

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

3 Summary of Test Results

FCC Rules	Description of Tests	Results
§2.1091	RF Exposure	Compliant
§2.1046, §22.913(a)	Output Power	Compliant
§2.1049	Occupied Bandwidth	Compliant
§2.1053, §22.917(a)	Spurious Radiated Emissions	Compliant
§2.1053, §22.917(a)	Spurious Emissions at Antenna Terminals	Compliant
§2.1053, §22.917(b)	Band Edge & Intermodulation	Compliant
§2.1055, §22.355	Frequency Stability	N/A[1]
§20.21	Out of Band Rejection	Compliant

[1] The EUT was a signal booster.

4 FCC §2.1091 - RF Exposure

4.1 Applicable Standards

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

Limits for General Population/Uncontrolled Exposure

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

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

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

Downlink

Maximum peak output power at antenna input terminal (dBm):	15.61
Maximum peak output power at antenna input terminal (mW):	36.39
Prediction distance (cm):	30
Prediction frequency (MHz):	881.92
Antenna Gain, typical (dBi):	8.5
Maximum Antenna Gain (numeric):	7.0795
Power density at predication frequency and distance (mW/cm^2):	0.0228
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.5880

Uplink

Maximum peak output power at antenna input terminal (dBm):	25.51
Maximum peak output power at antenna input terminal (mW):	355.63
Prediction distance (cm):	30
Prediction frequency (MHz):	832.85
Antenna Gain, typical (dBi):	8.5
Maximum Antenna Gain (numeric):	7.0795
Power density at predication frequency and distance (mW/cm^2):	0.2226
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.5552

Results

For uplink and downlink, the highest power density levels at 30 cm are below the MPE uncontrolled exposure limit.

5 FCC §2.1046 & §22.913(a) – Output Power

5.1 Applicable Standards

According to FCC §22.913 (a), the maximum effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.

5.2 Test Procedure

Conducted:

The EUT was connected to the spectrum analyzer and Signal Generator followed by 50Ω-75Ω matching pad.

5.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2014-10-24	1 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2014-09-18	2 years
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2014-07-15	2 years

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

5.4 Test Environmental Conditions

Temperature:	21-23° C
Relative Humidity:	42-48 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Todd Moy 2015-10-12 in the RF Site.

5.5 Test Results

Downlink

Signal Type	AGC	Input Power (dBm)	Output Power (dBm)	Gain (dB)	ERP
Broadband	Off	-52.9	14.84	67.74	21.19
	On	-49.71	15.61	65.32	21.96
Narrowband	Off	-55.19	13.15	68.34	19.5
	On	-51.84	12.43	64.27	18.78

Uplink

Signal Type	AGC	Input Power (dBm)	Output Power (dBm)	Gain (dB)	ERP
Broadband	Off	-45.67	22.53	68.2	28.88
	On	-42.55	21.72	64.27	28.07
Narrowband	Off	-43.66	25.51	69.17	31.86
	On	-40.48	23.49	63.97	29.84

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

6 FCC §2.1049 - Occupied Bandwidth

6.1 Applicable Standards

Requirements: FCC §2.1049

6.2 Test Procedure

The EUT was connected to the spectrum analyzer and Signal Generator followed by 50Ω-75Ω matching pad.

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	E4446A	US44300386	2014-10-24	1 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2014-09-18	2 years
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2014-07-15	2 years

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

6.4 Test Environmental Conditions

Temperature:	21-23 °C
Relative Humidity:	42-48 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Todd Moy 2015-10-9 in the RF Site.

6.5 Test Results

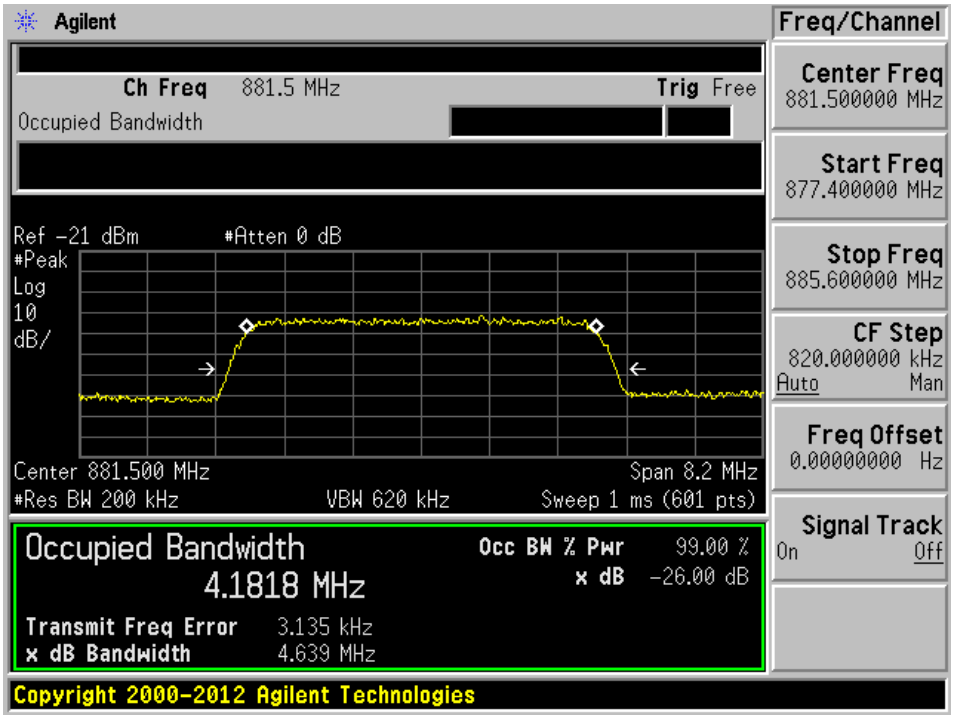
Please refer to the following table and plots.

DL/UP	Signal Type	AGC	Input		Output	
			99 % OBW (kHz)	26 dB OBW (kHz)	99 % OBW (kHz)	26 dB OBW (kHz)
Downlink	Broadband	off	4181.8	4639	4145	4629
		on	4181.8	4639	4151.9	4616
	Narrowband	off	242.71	320.41	242.77	316.67
		on	242.71	320.41	245.93	320.2
Uplink	Broadband	off	4185.9	4642	4179.5	4733
		on	4185.9	4642	4169.8	4634
	Narrowband	off	240.56	317.51	241.31	321.56
		on	240.56	317.51	243.07	314.11

Downlink: Broadband Signal

AGC off

Input



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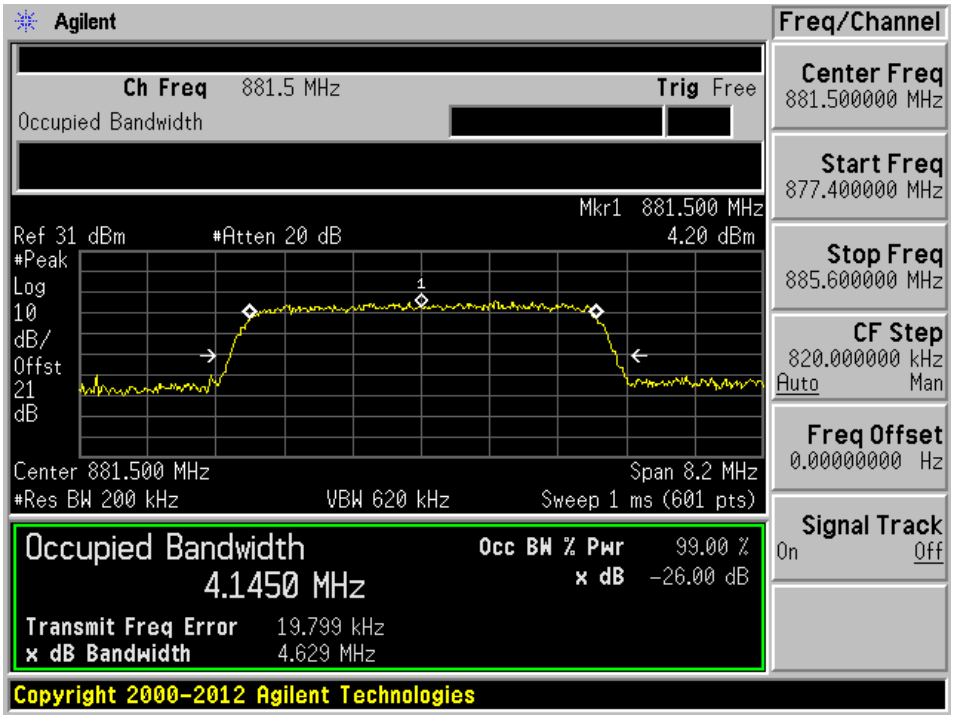
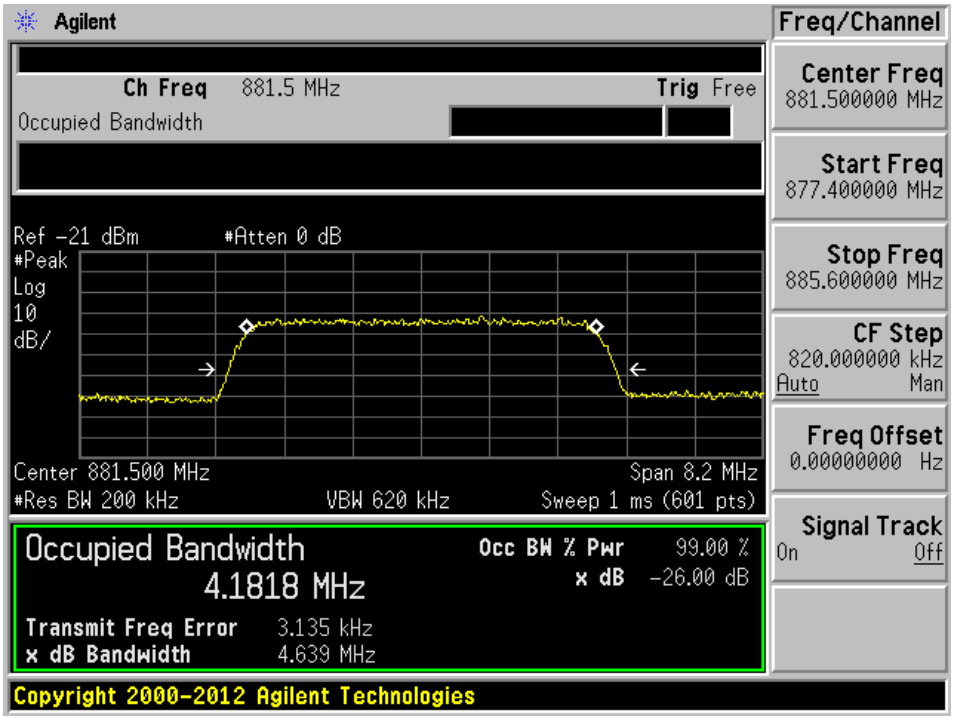


AGC on

Input



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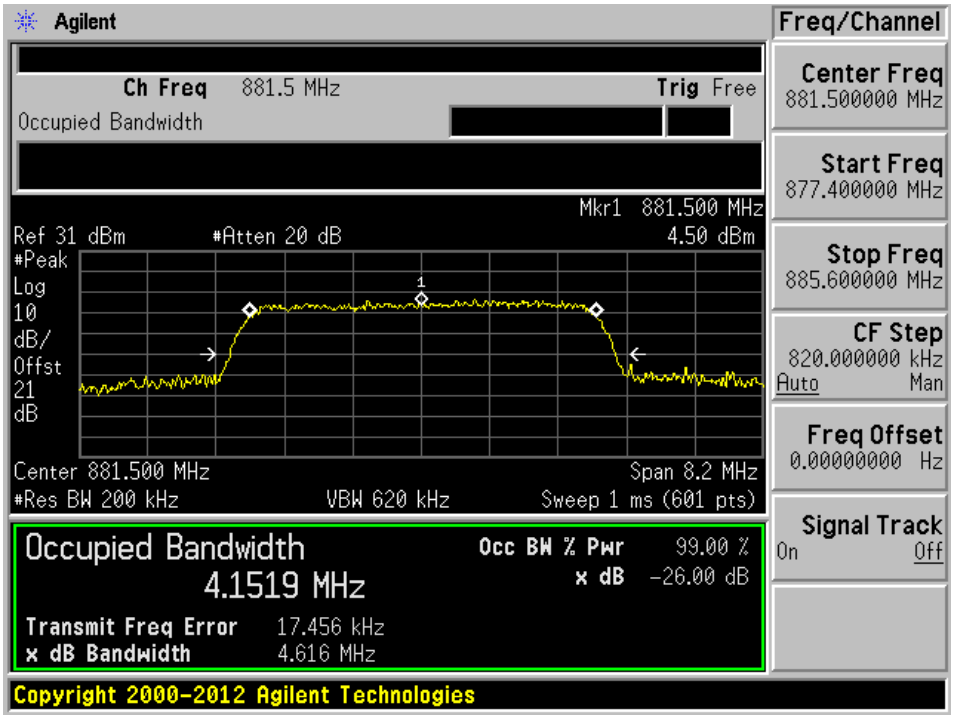
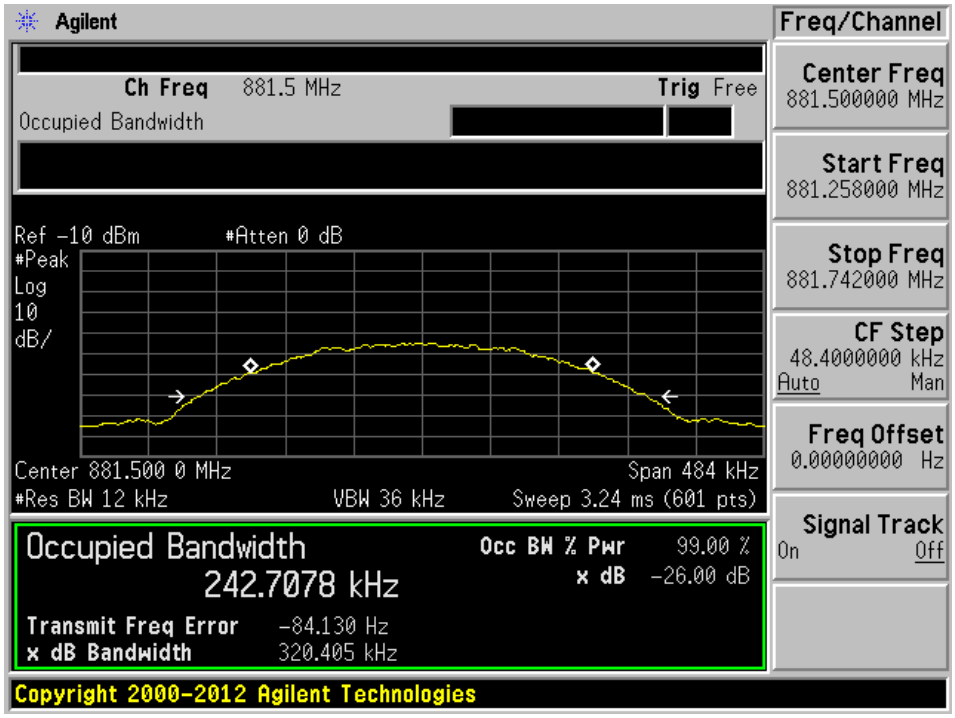


Downlink: Narrowband Signal

AGC off

Input



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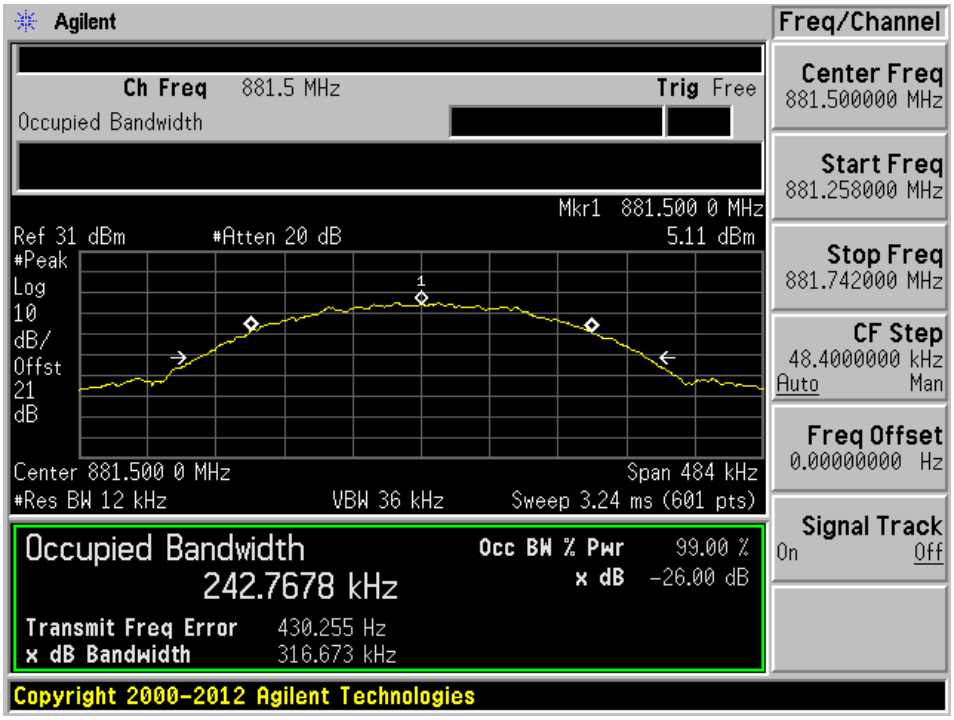
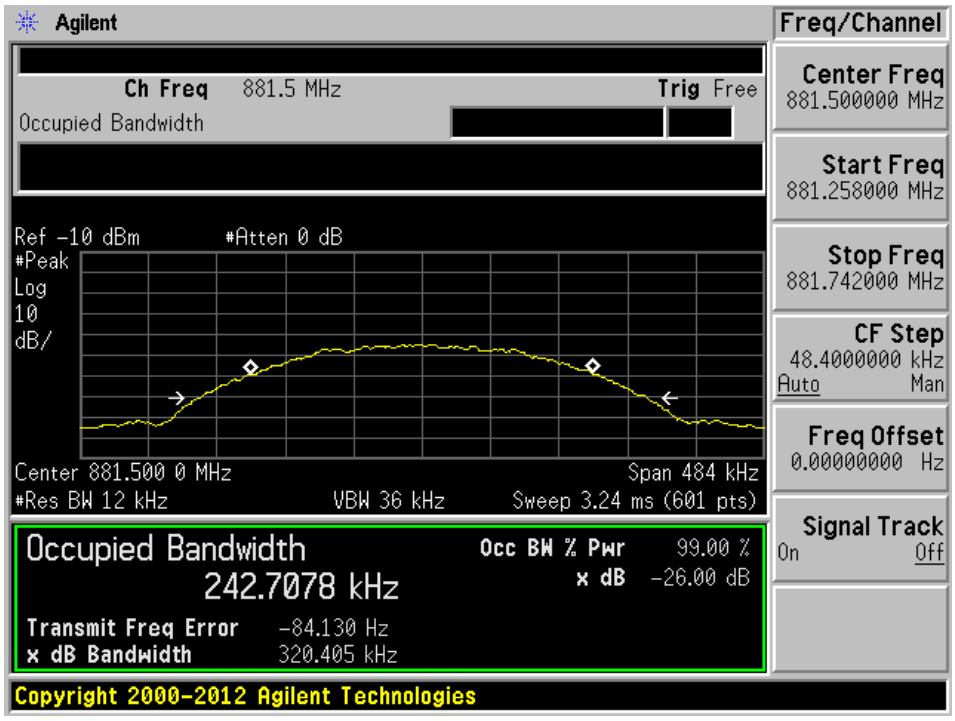


AGC on

Input



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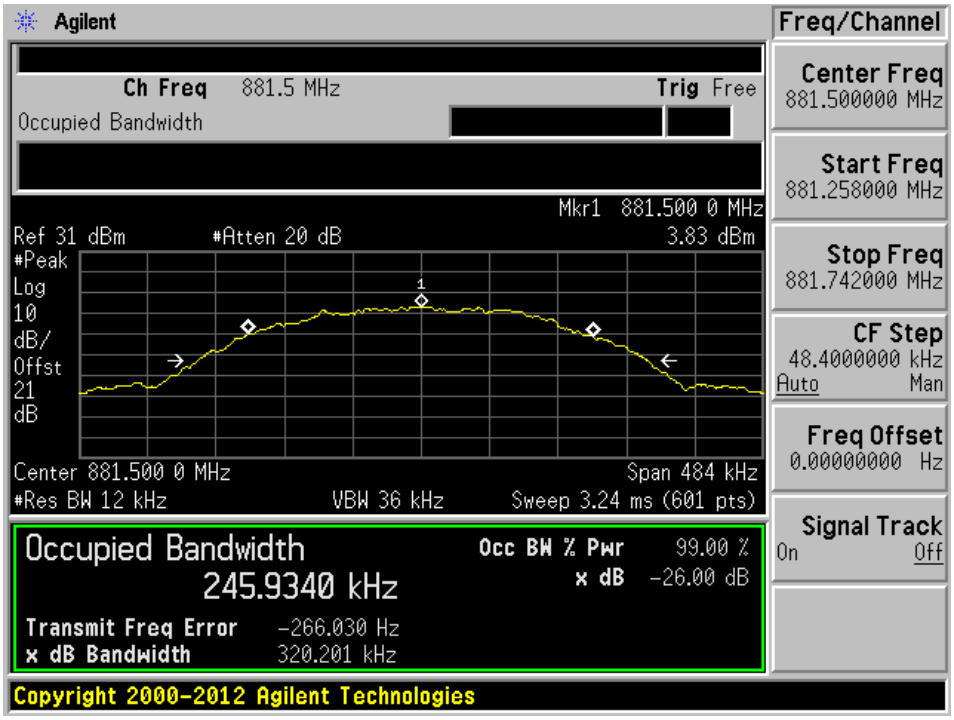
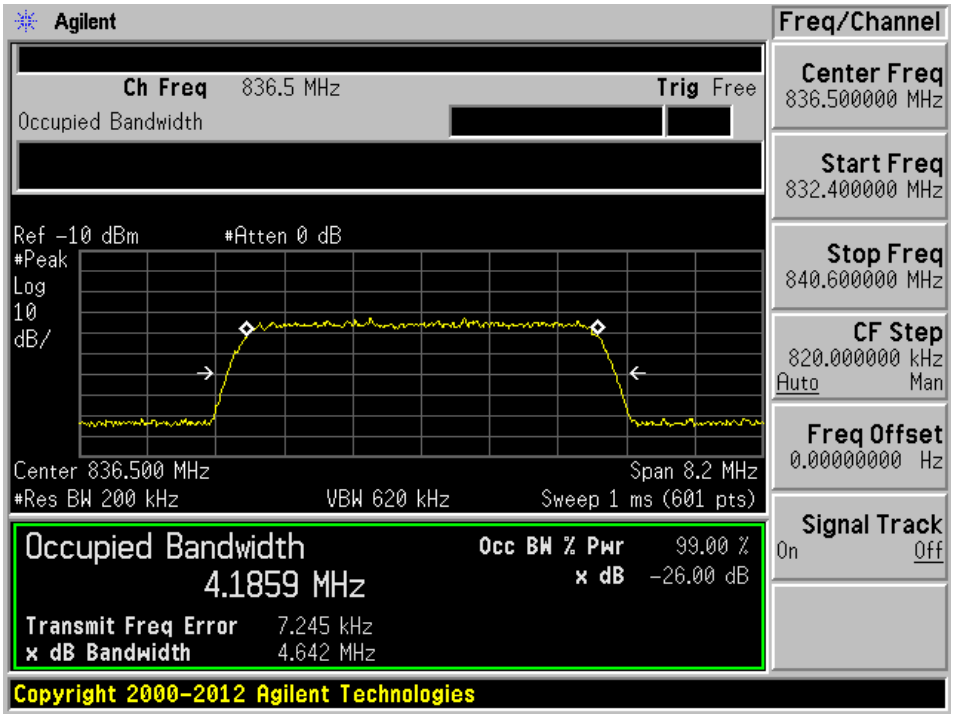


Uplink: Broadband Signal

AGC off

Input



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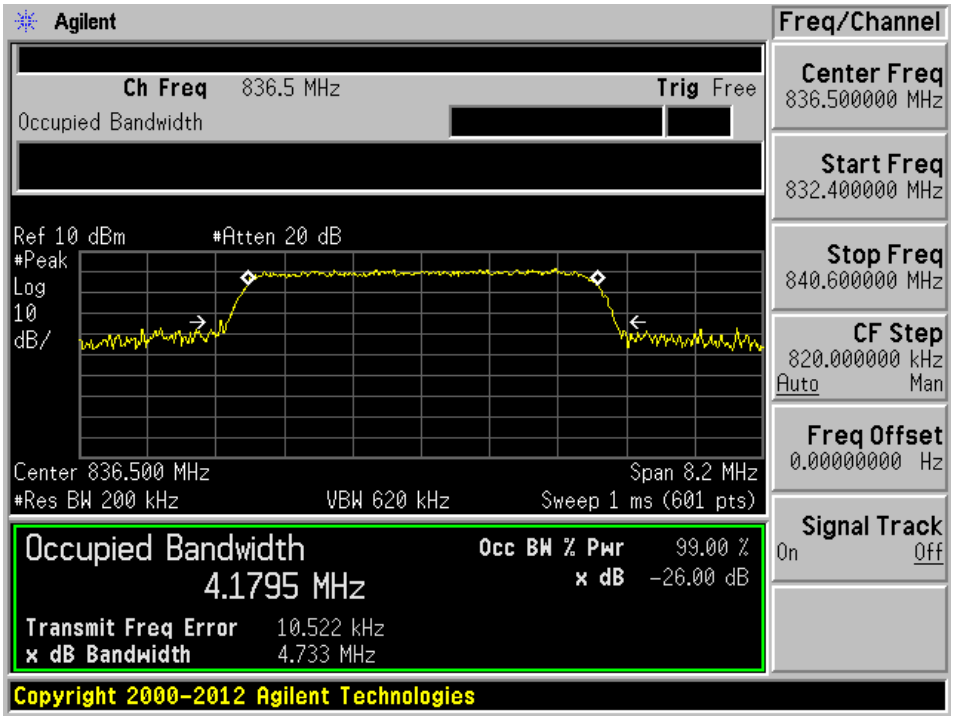
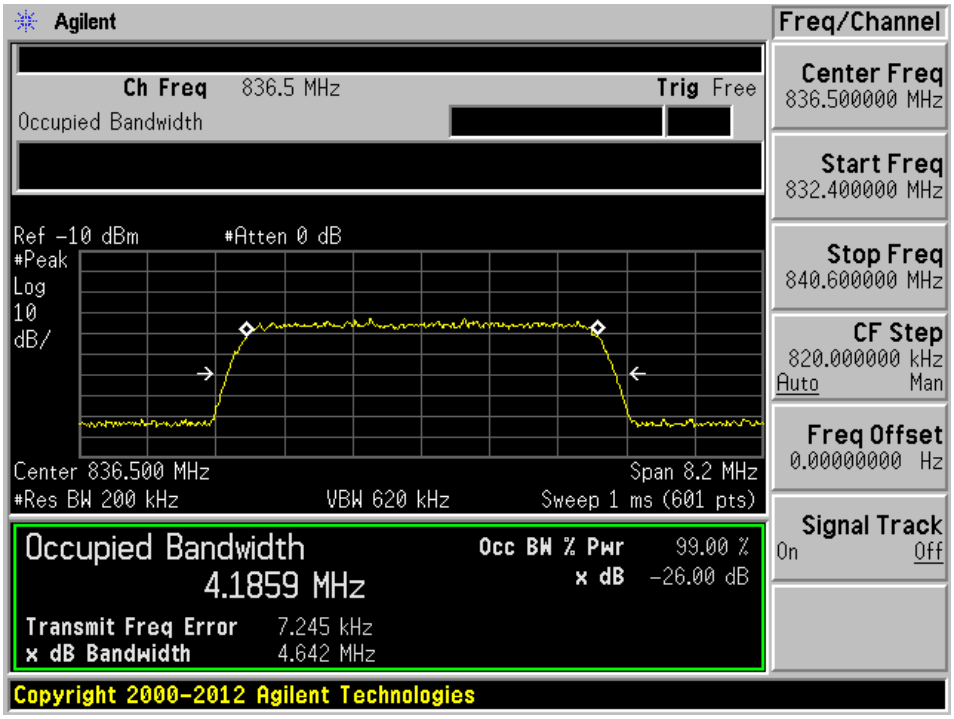


AGC on

Input



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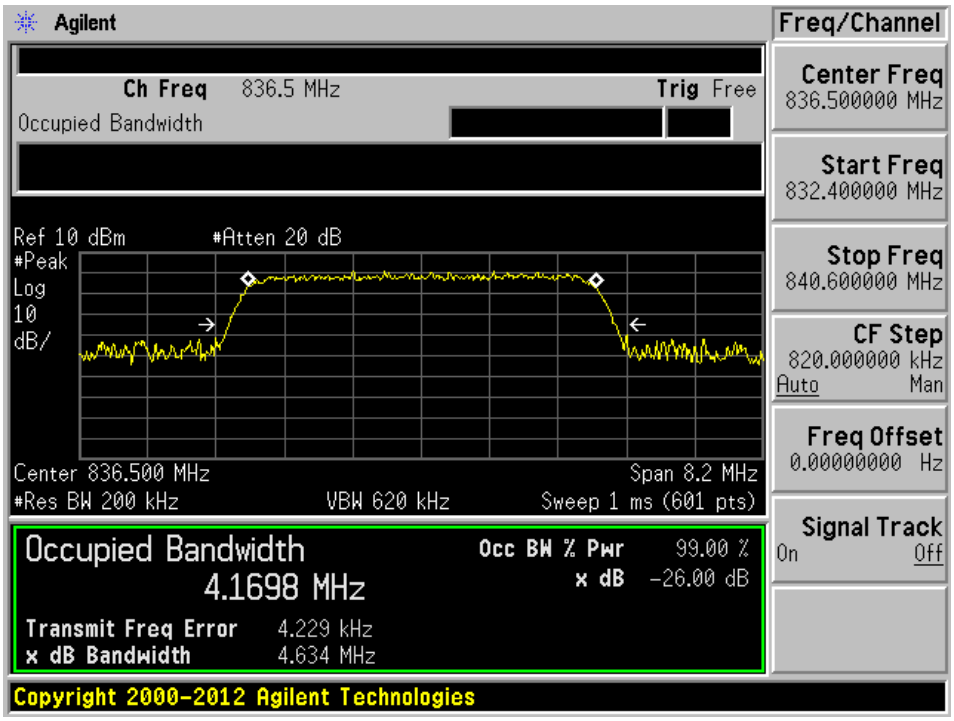
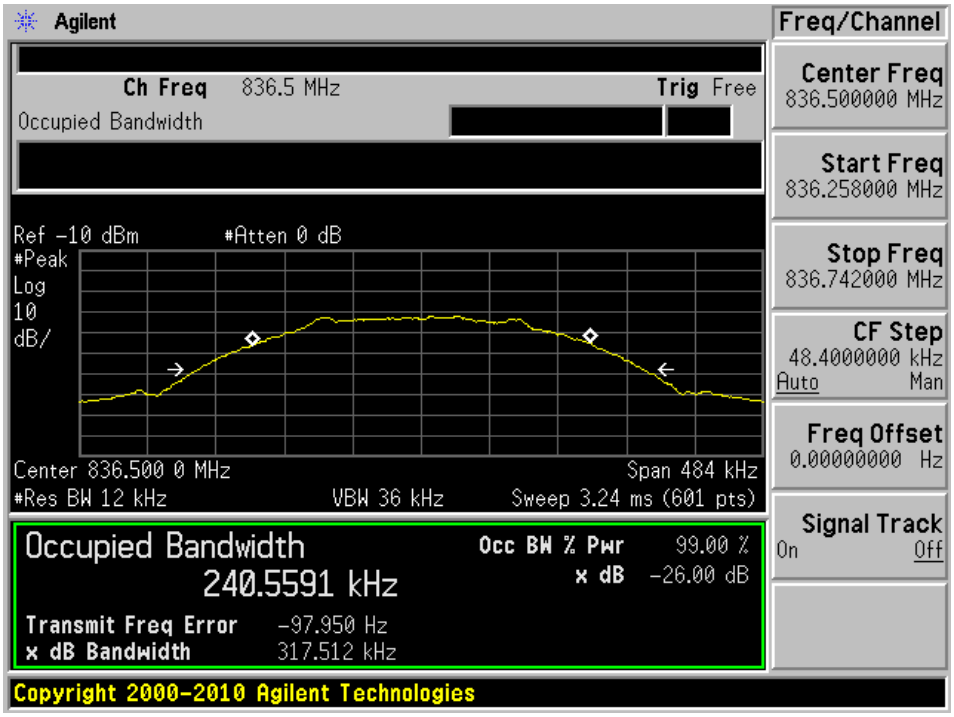


Uplink: Narrowband Signal

AGC off

Input



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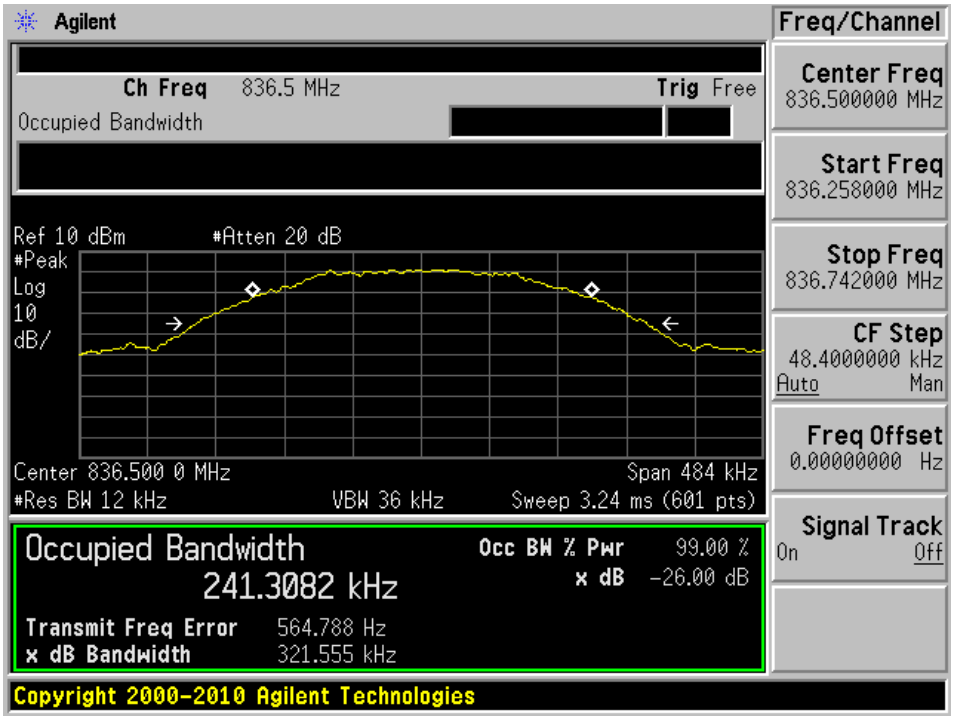

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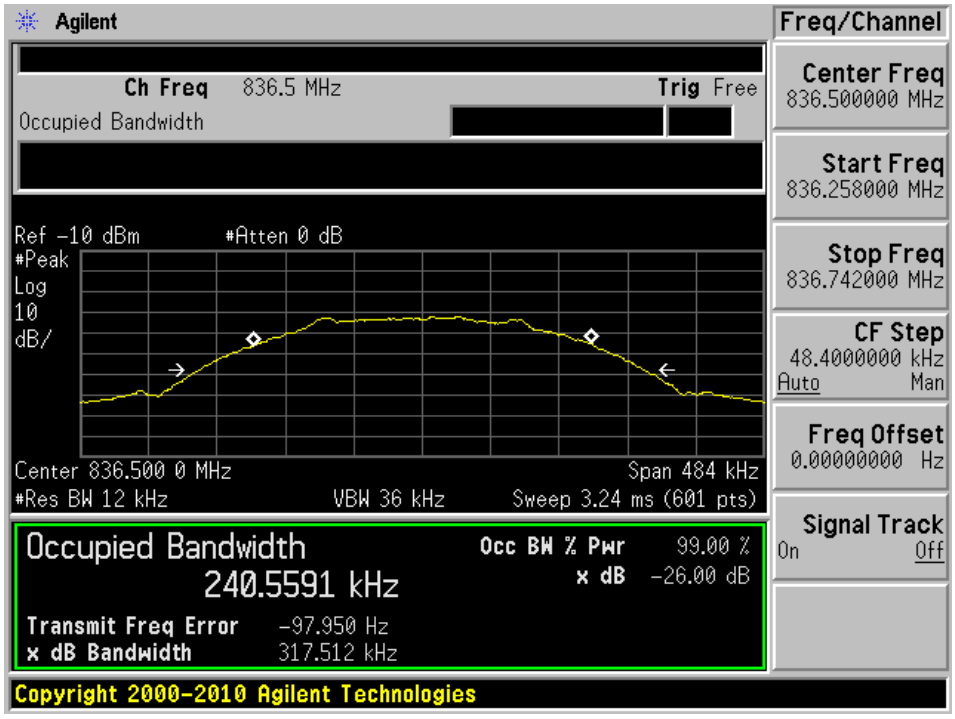
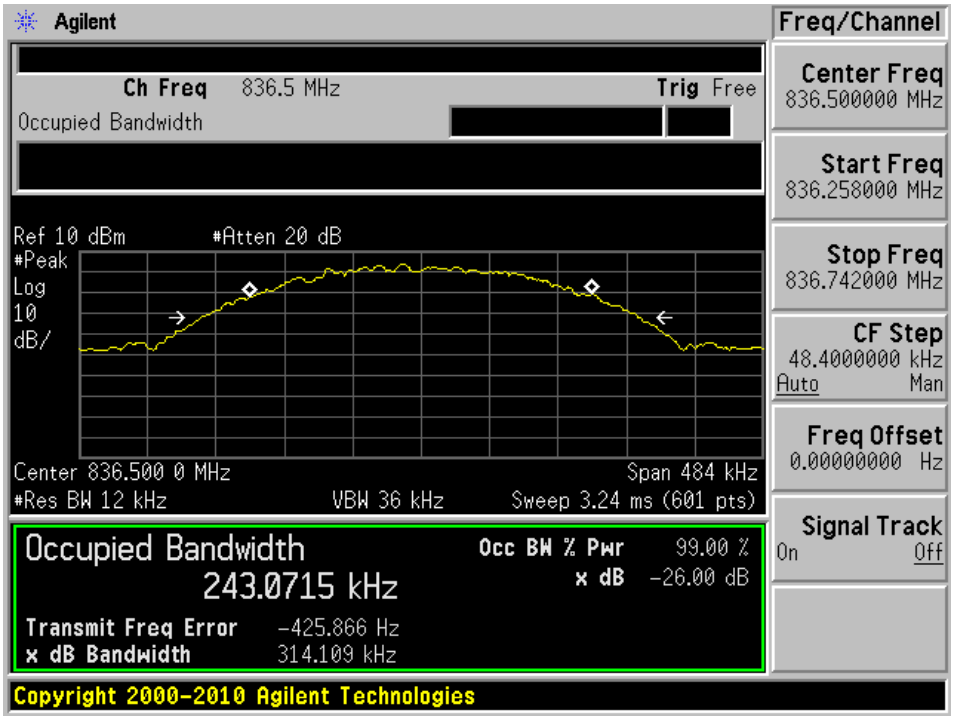


Output



7 FCC §2.1053 & §22.917- Spurious Radiated Emissions

7.1 Applicable Standards

According to FCC §22.917 the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

7.2 Test Procedure

The transmitter was placed on the turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 log (TX Power in Watts/0.001) – the absolute level
Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

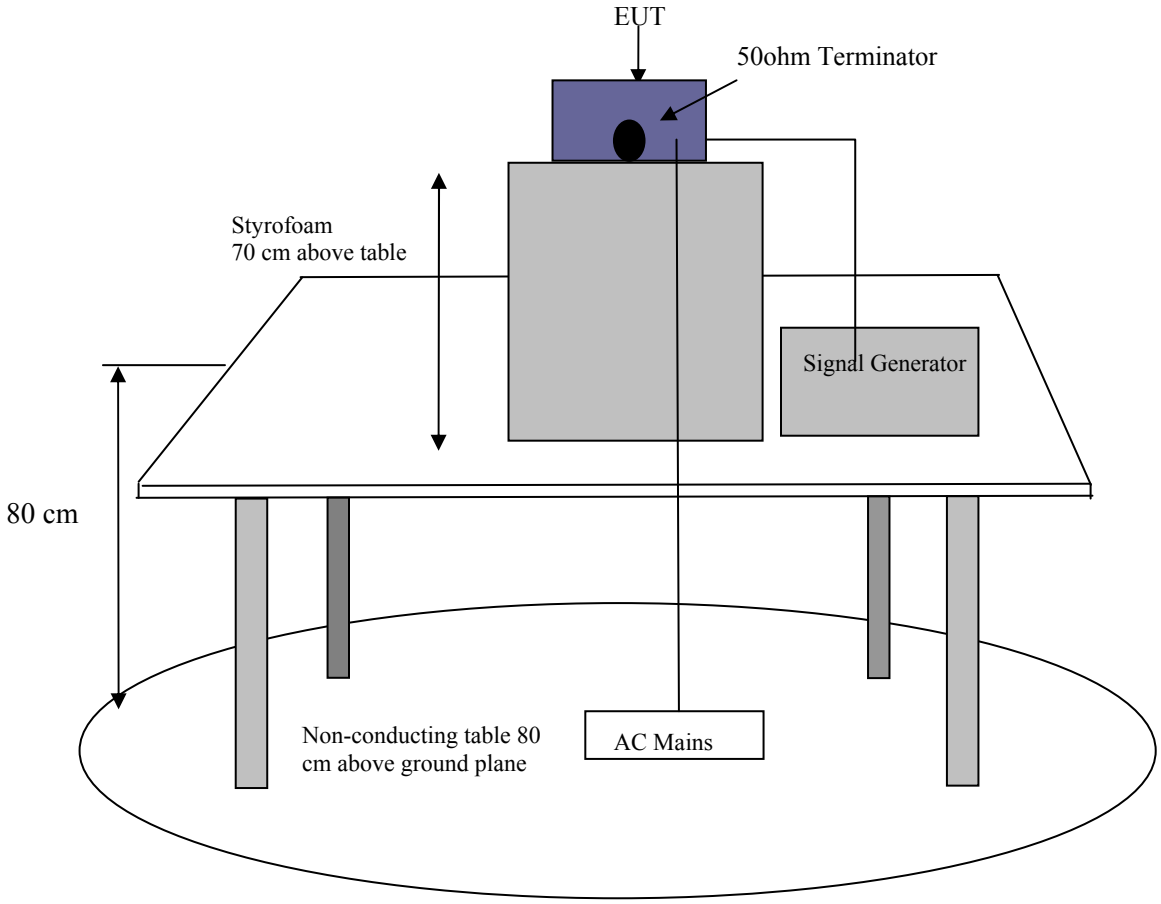
7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	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
Hewlett Packard	Pre-amplifier	8447D	2944A10187	3/20/2015	1 year
HP/ Agilant	Pre Amplifier	8449B OPT HO2	3008A0113	3/11/2015	1year
EMCO	Antenna, Horn	3115	9511-4627	2015-01-15	1 year
A.R.A.	Antenna, Horn	DRG-118/A	1132	2015-09-21	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2014-09-18	2 years
COM-POWER	Antenna, Dipole	AD-100	721033DB1, 2, 3, 4	2014-11-03	2 years
Agilent	Analyzer, Communications	E5515C	GB44051221	2015-09-10	1 year

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

7.4 Test Setup Block Diagram

Radiated Emissions Testing



7.5 Test Environmental Conditions

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

The testing was performed by Todd Moy on 2015- 10-23 in 5 Meter Chamber 3.

7.6 Test Results

Carrier Wave Signal

Downlink

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)		
47.8	43.64	0	100	V	47.8	-41.92	0	0.05	-41.97	-13	-28.97
300	30.58	150	136	H	300	-71.44	0	0.07	-71.51	-13	-58.51
300	31.07	136	100	V	300	-70.95	0	0.07	-71.02	-13	-58.02
374.4	25.62	32	100	H	374.4	-73.31	0	0.08	-73.39	-13	-60.39
374.4	27.25	240	100	V	374.4	-71.68	0	0.08	-71.76	-13	-58.76
1039	47.96	0	100	H	1039	-62.15	6.122	0.49	-56.518	-13	-43.518
1039	48.09	0	100	V	1039	-63.63	6.279	0.49	-57.841	-13	-44.841
2253	47.17	0	100	H	2253	-60.36	9.205	0.69	-51.845	-13	-38.845
2253	46.02	0	100	V	2253	-61.95	9.506	0.69	-53.134	-13	-40.134

Uplink

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)		
47.8	43.01	0	100	V	47.8	-42.55	0	0.05	-42.6	-13	-29.6
300	28.65	120	100	H	300	-73.37	0	0.07	-73.44	-13	-60.44
300	29.04	279	100	V	300	-72.98	0	0.07	-73.05	-13	-60.05
374.4	26.54	85	100	H	374.4	-72.39	0	0.08	-72.47	-13	-59.47
374.4	30.3	309	100	V	374.4	-68.63	0	0.08	-68.71	-13	-55.71
1039	48.39	0	100	H	1039	-61.72	6.122	0.49	-56.088	-13	-43.088
1039	48.49	0	100	V	1039	-63.23	6.279	0.49	-57.441	-13	-44.441
2253	46.95	0	100	H	2253	-60.58	9.205	0.69	-52.065	-13	-39.065
2253	48.74	0	100	V	2253	-59.23	9.506	0.69	-50.414	-13	-37.414

Co-location with CDMA Modem in 850 MHz cellular band

Downlink

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)		
47.8	48.6	0	100	V	47.8	-36.96	0	0.05	-37.01	-13	-24.01
92.33	31.75	0	100	H	92.33	-52.65	0	0.06	-52.71	-13	-39.71
92.33	32.54	0	100	V	92.33	-51.86	0	0.06	-51.92	-13	-38.92
500	37.57	312	115	H	500	-59.52	0	0.09	-59.61	-13	-46.61
500	29.37	165	100	V	500	-67.72	0	0.09	-67.81	-13	-54.81
1039	49.86	0	100	H	1039	-60.25	6.122	0.49	-54.618	-13	-41.618
1039	49.16	0	100	V	1039	-62.56	6.279	0.49	-56.771	-13	-43.771
2253	45.26	0	100	H	2253	-62.27	9.205	0.69	-53.755	-13	-40.755
2253	45.39	0	100	V	2253	-62.58	9.506	0.69	-53.764	-13	-40.764

Uplink

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)		
47.8	26.08	0	100	V	47.8	-24.12	0	0.05	-24.17	-13	-11.17
300	14.65	0	100	H	300	-64.63	0	0.07	-64.7	-13	-51.7
300	15.35	0	100	V	300	-63.93	0	0.07	-64	-13	-51
374.4	14.22	0	100	H	374.4	-60.9	0	0.08	-60.98	-13	-47.98
374.4	13.93	0	100	V	374.4	-61.19	0	0.08	-61.27	-13	-48.27
1039	40.12	0	100	H	1039	-69.99	6.122	0.49	-64.358	-13	-51.358
1039	39.95	0	100	V	1039	-71.77	6.279	0.49	-65.981	-13	-52.981
2253	36.44	0	100	H	2253	-71.09	9.205	0.69	-62.575	-13	-49.575
2253	35.92	0	100	V	2253	-72.05	9.506	0.69	-63.234	-13	-50.234

Co-location with CDMA Modem in 1900 MHz PCS band

Downlink

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)		
47.8	45.43	0	100	V	47.8	-40.13	0	0.05	-40.18	-13	-27.18
92.33	31.86	0	100	H	92.33	-52.54	0	0.06	-52.6	-13	-39.6
92.33	32.46	0	100	V	92.33	-51.94	0	0.06	-52	-13	-39
500	38.51	329	136	H	500	-58.58	0	0.09	-58.67	-13	-45.67
500	30.17	168	100	V	500	-66.92	0	0.09	-67.01	-13	-54.01
1039	25.27	0	100	H	1039	-51.23	6.122	0.49	-45.598	-13	-32.598
1039	25.88	0	100	V	1039	-50.62	6.279	0.49	-44.831	-13	-31.831
2253	25.99	0	100	H	2253	-46.88	9.205	0.69	-38.365	-13	-25.365
2253	26.02	0	100	V	2253	-46.85	9.506	0.69	-38.034	-13	-25.034

Uplink

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)		
47.8	46.51	0	100	V	47.8	-39.05	0	0.05	-39.1	-13	-26.1
92.33	31.83	0	100	H	92.33	-52.57	0	0.06	-52.63	-13	-39.63
92.33	34.21	0	100	V	92.33	-50.19	0	0.06	-50.25	-13	-37.25
500	39.65	332	127	H	500	-57.44	0	0.09	-57.53	-13	-44.53
500	31.01	240	104	V	500	-66.08	0	0.09	-66.17	-13	-53.17
1039	26.03	0	100	H	1039	-50.47	6.122	0.49	-44.838	-13	-31.838
1039	25.08	0	100	V	1039	-51.42	6.279	0.49	-45.631	-13	-32.631
2253	26.27	0	100	H	2253	-46.6	9.205	0.69	-38.085	-13	-25.085
2253	26.8	0	100	V	2253	-46.07	9.506	0.69	-37.254	-13	-24.254

8 FCC §2.1051 & §22.917- Spurious Emissions at Antenna Terminals

8.1 Applicable Standards

According to FCC §22.917 the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

8.2 Test Procedure

The EUT was connected to the spectrum analyzer and Signal Generator followed by 50Ω-75Ω matching pad

The resolution bandwidth of the spectrum analyzer was set 100 KHz for frequency band of 800. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2014-10-24	1 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2014-09-18	2 years
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2014-07-15	2 years

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

8.4 Test Environmental Conditions

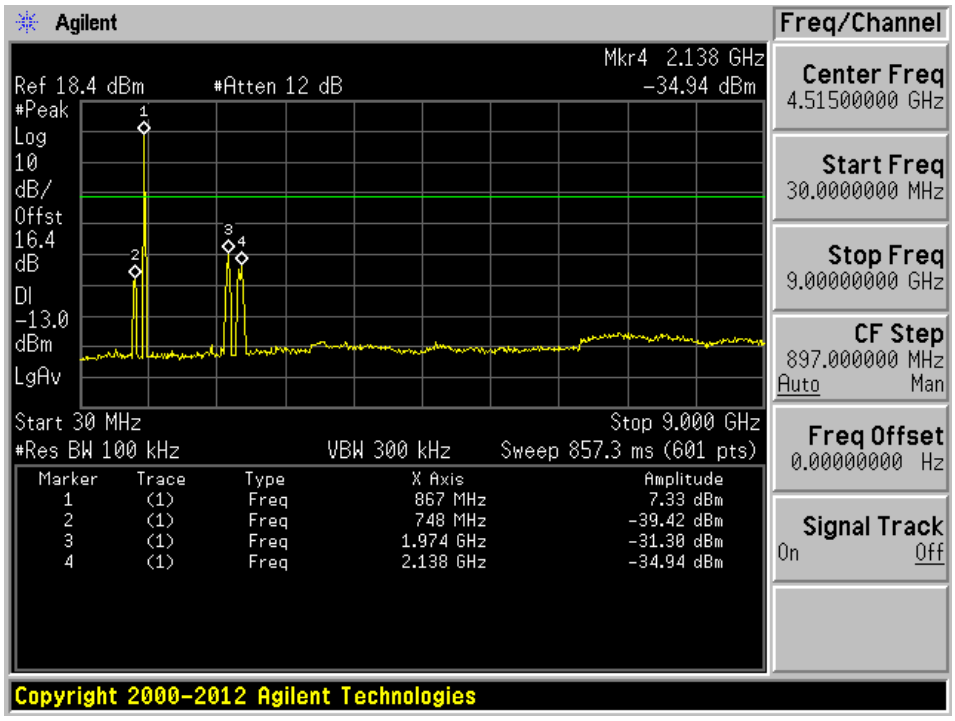
Temperature:	21-23° C
Relative Humidity:	42-48 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Todd Moy 2015-10-08 in the RF Site.

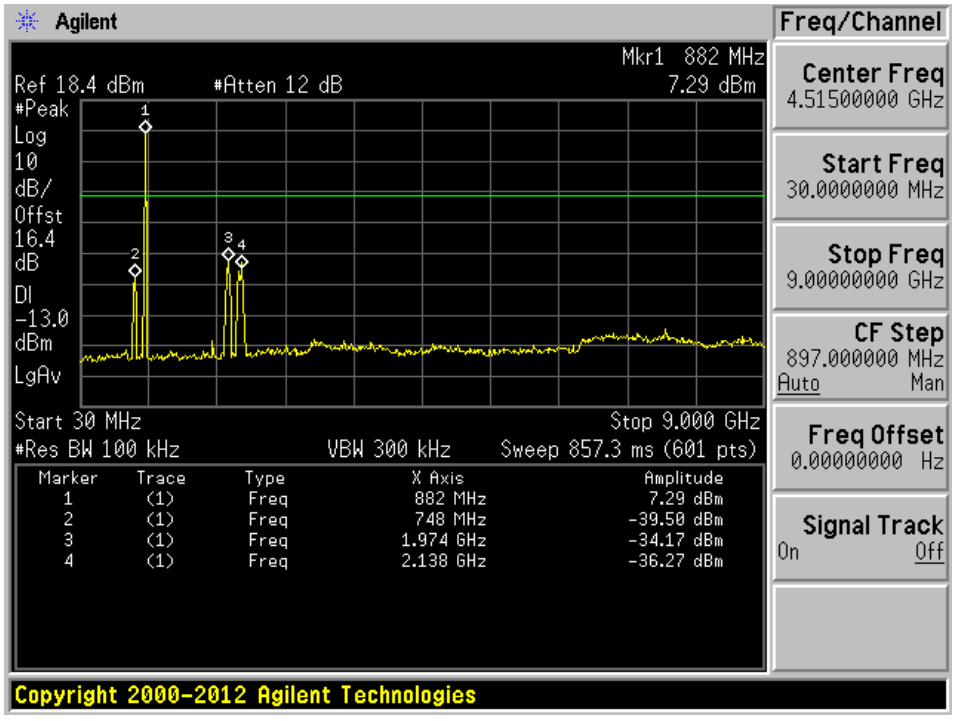
Downlink: Broadband Signal

AGC Off

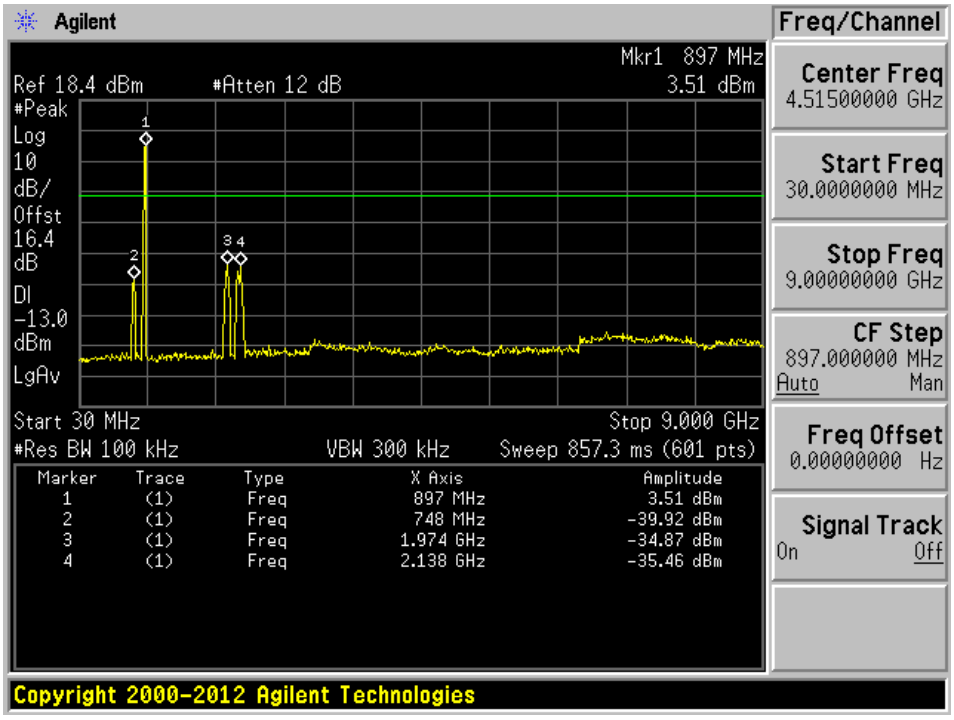
Low Channel: 871.5 MHz



Middle Channel: 881.5 MHz

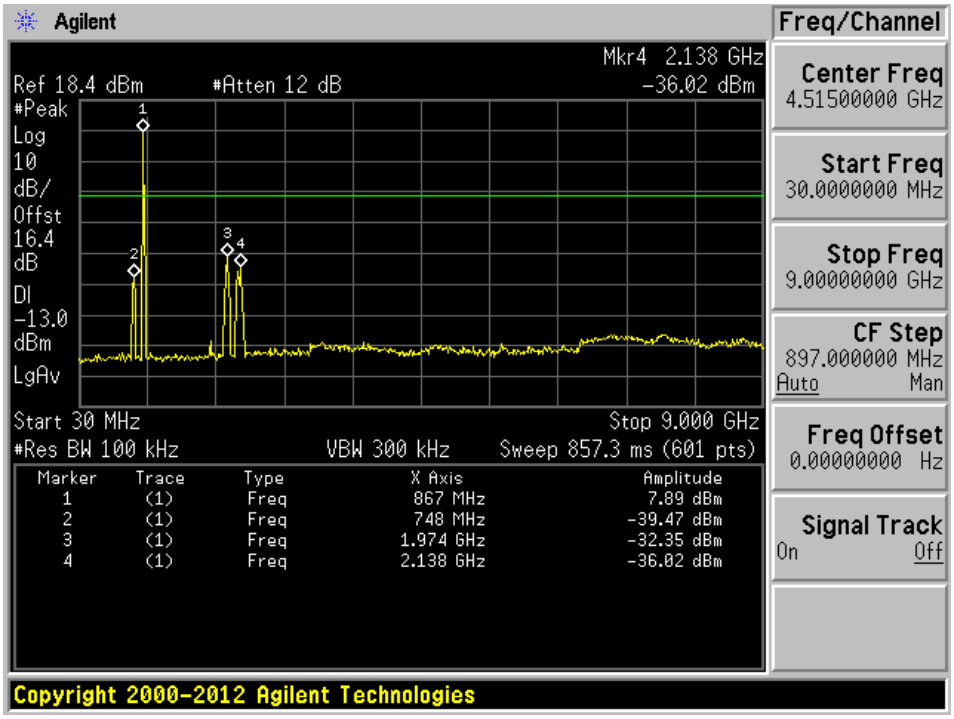


High Channel: 891.5 MHz

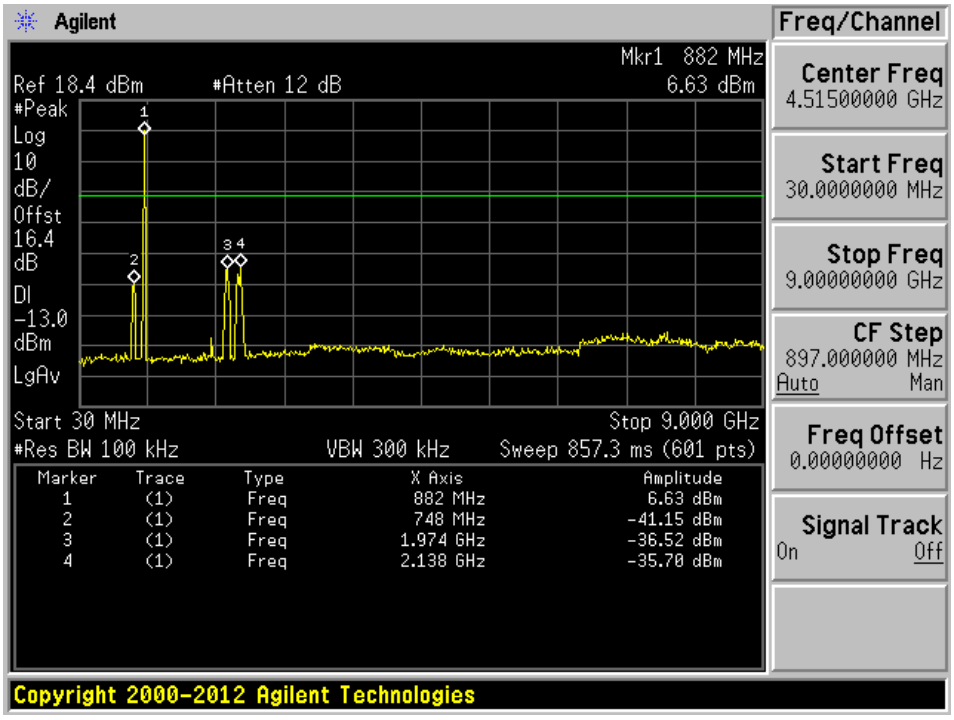


AGC On

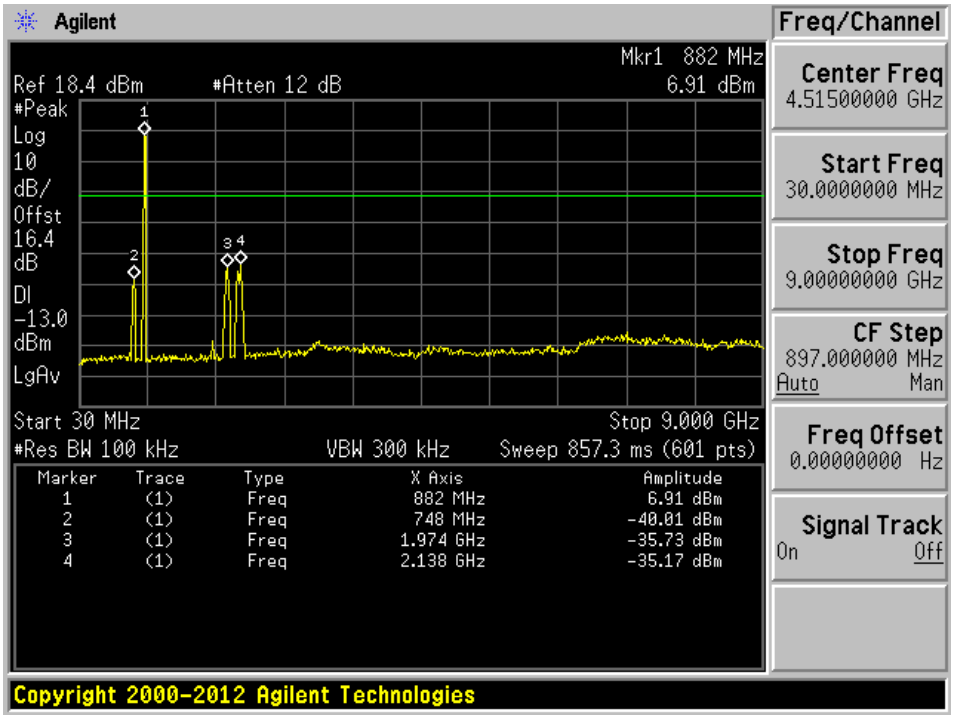
Low Channel: 871.5 MHz



Middle Channel: 881.5 MHz



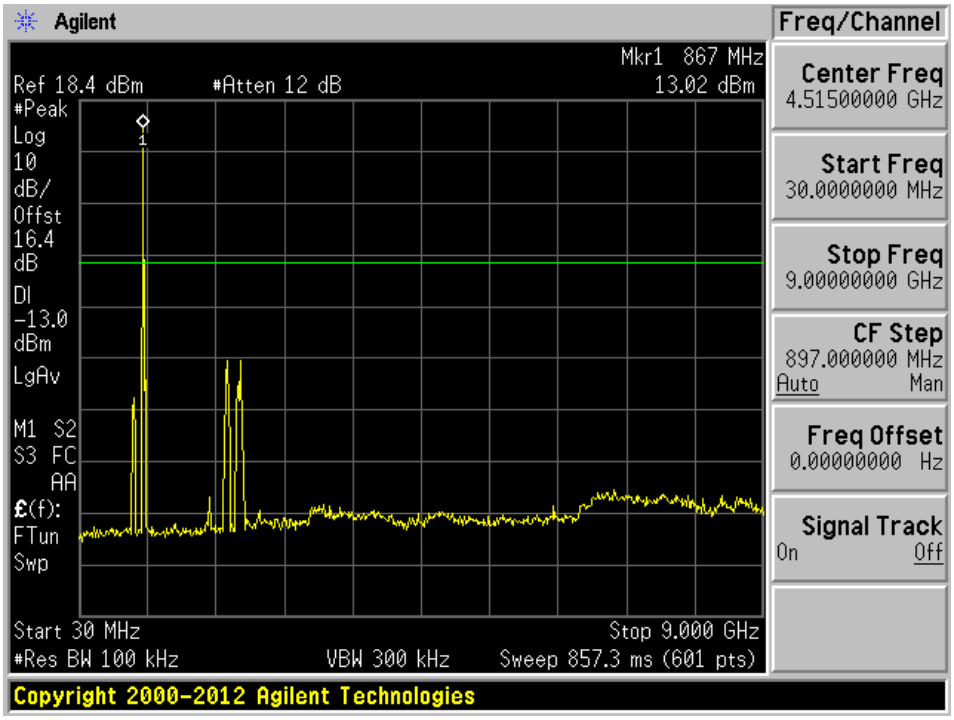
High Channel: 891.5 MHz



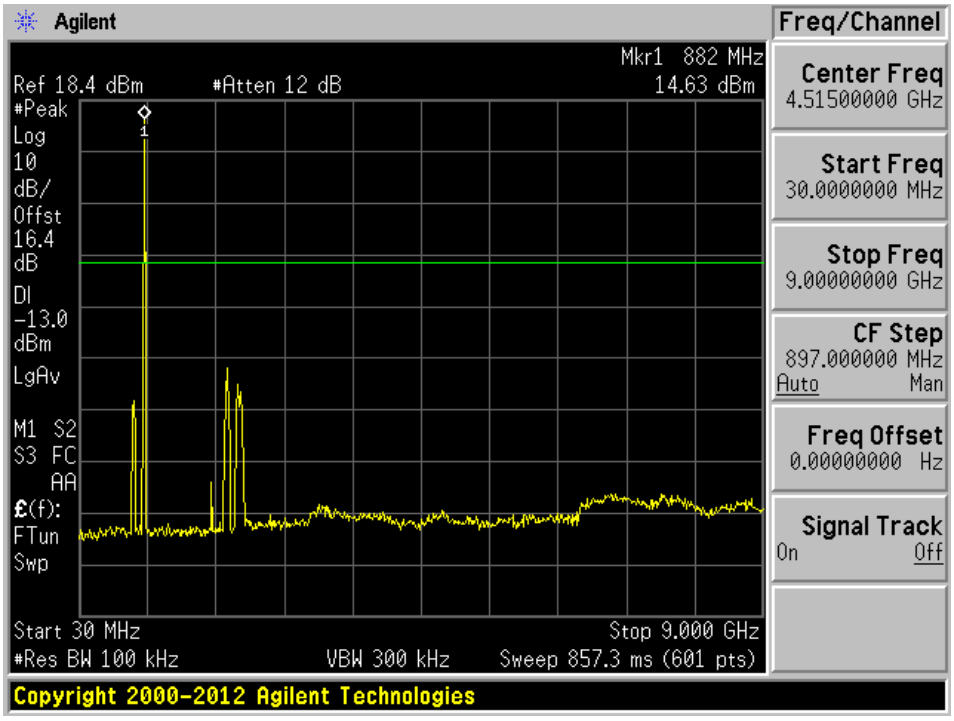
Downlink: Narrowband signal

AGC Off

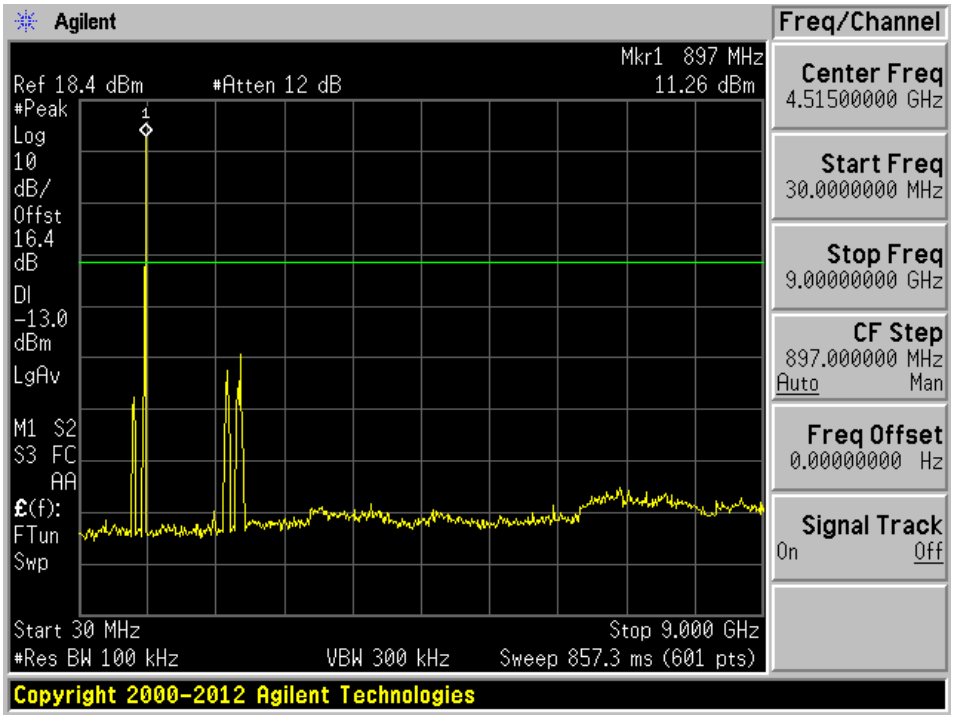
Low Channel: 869.2 MHz



Middle Channel: 881.5 MHz

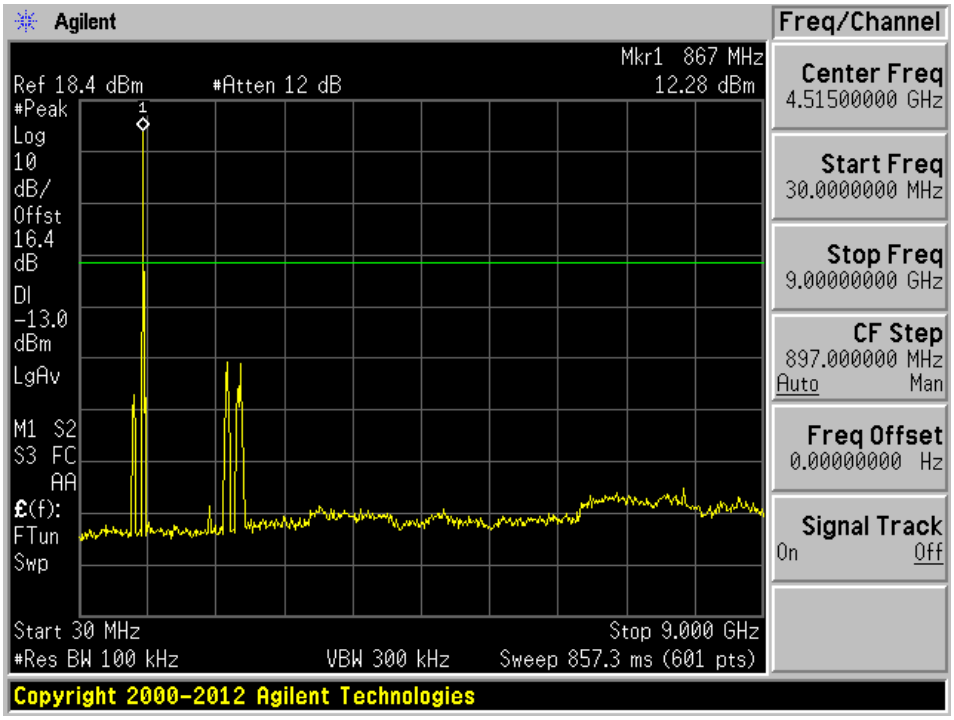


High Channel: 893.8 MHz

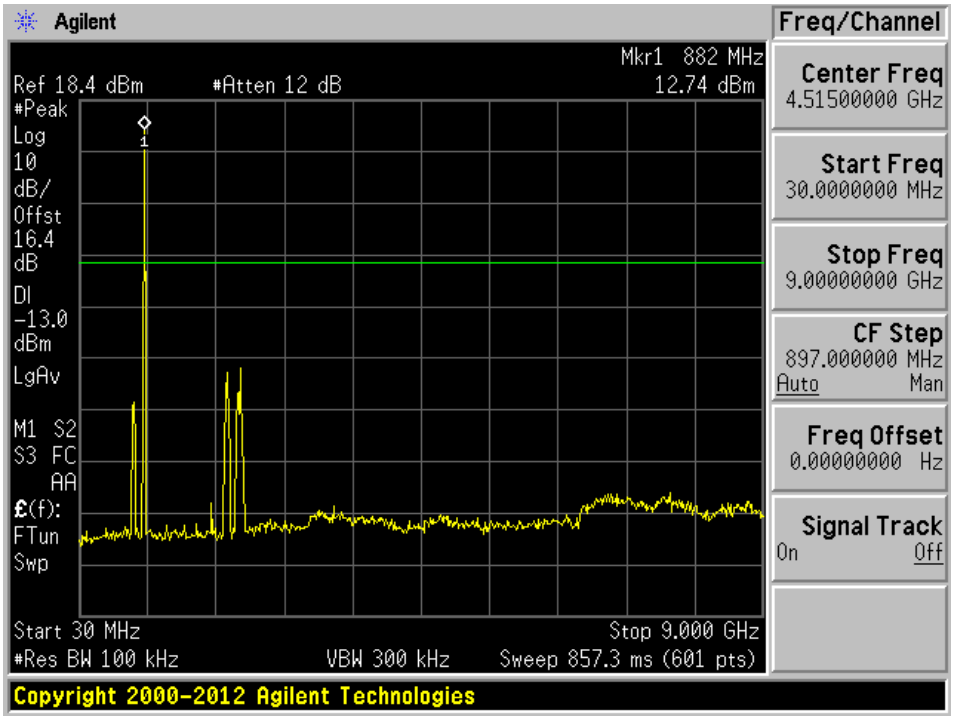


AGC On

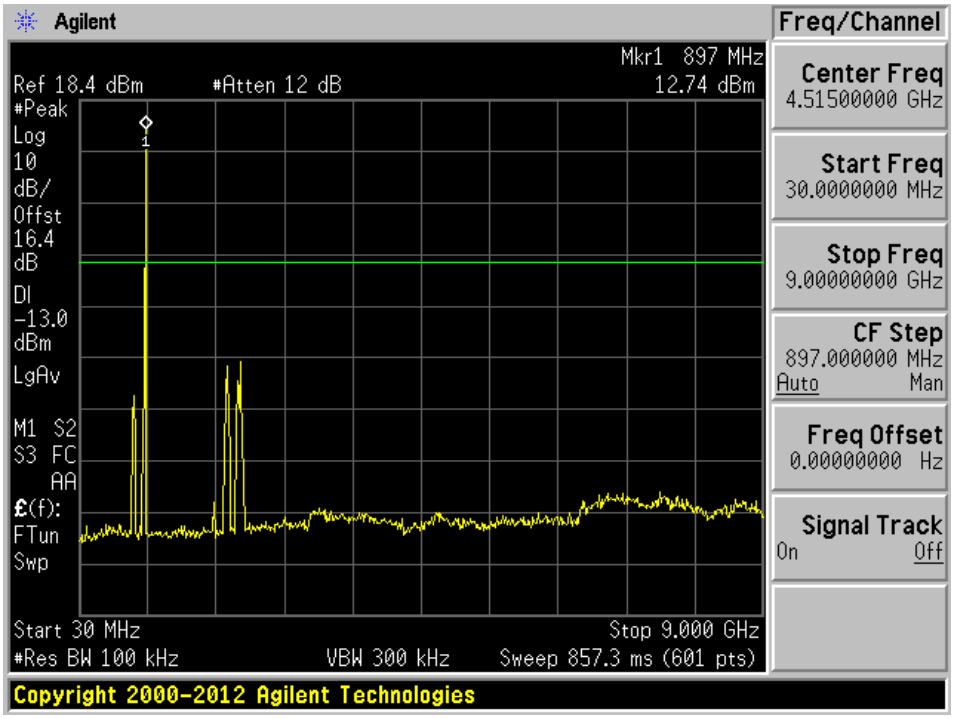
Low Channel: 869.2 MHz



Middle Channel: 881.5 MHz



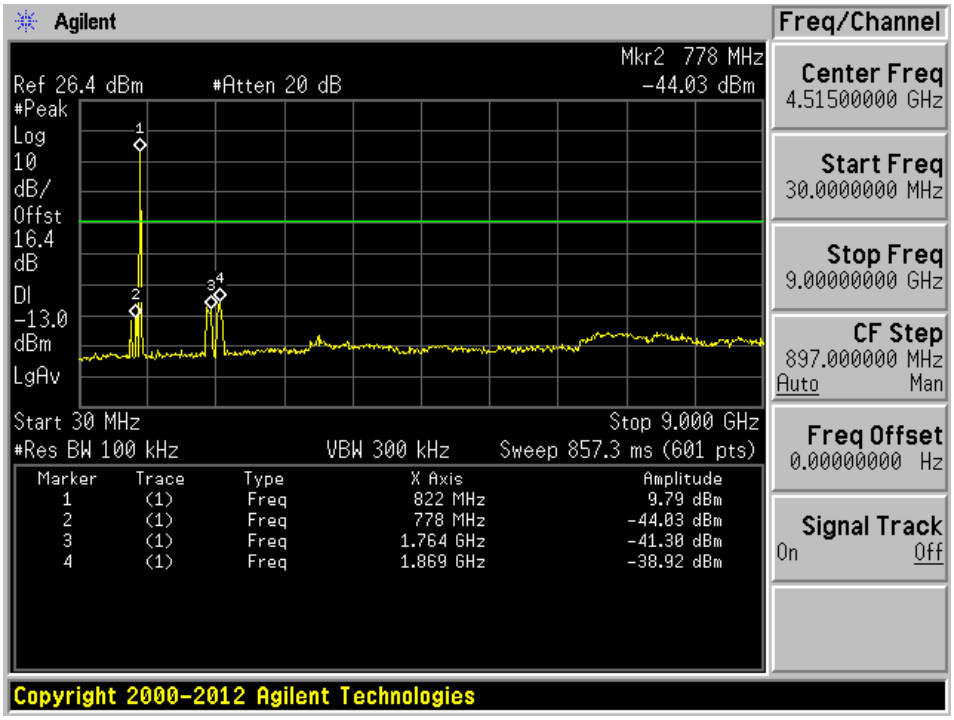
High Channel: 893.8 MHz



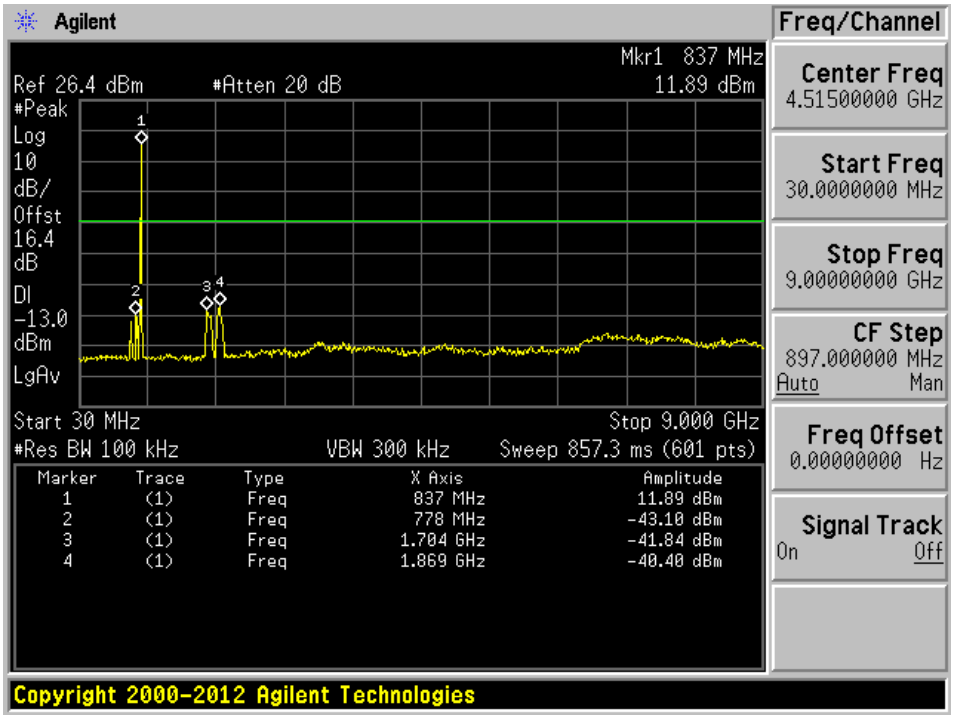
Uplink: Broadband Signal

AGC Off

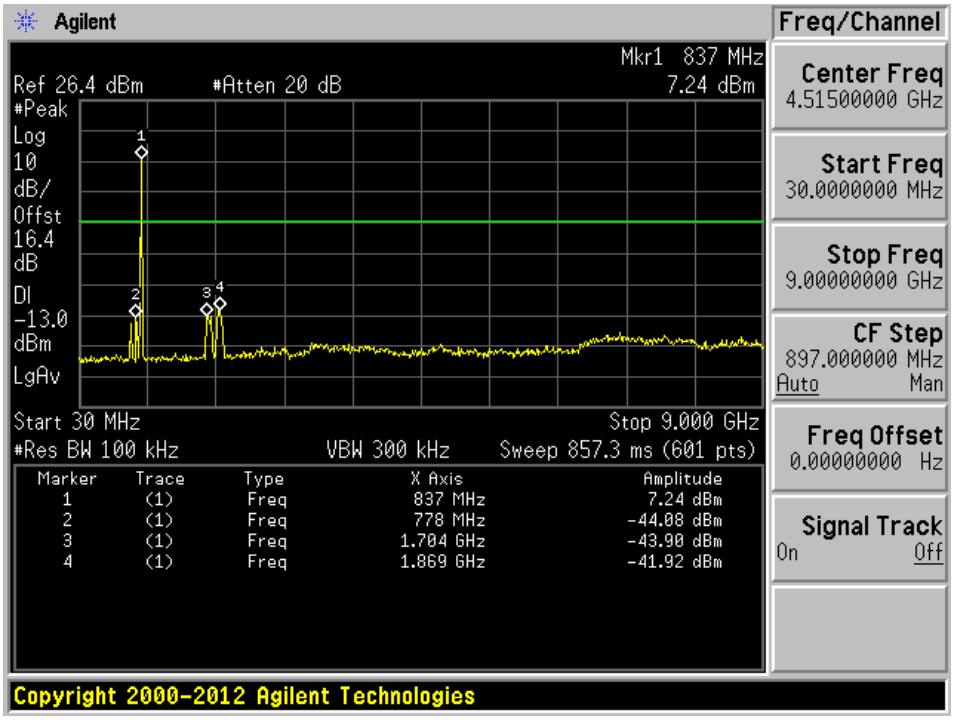
Low Channel: 826.5 MHz



Middle Channel: 836.5 MHz

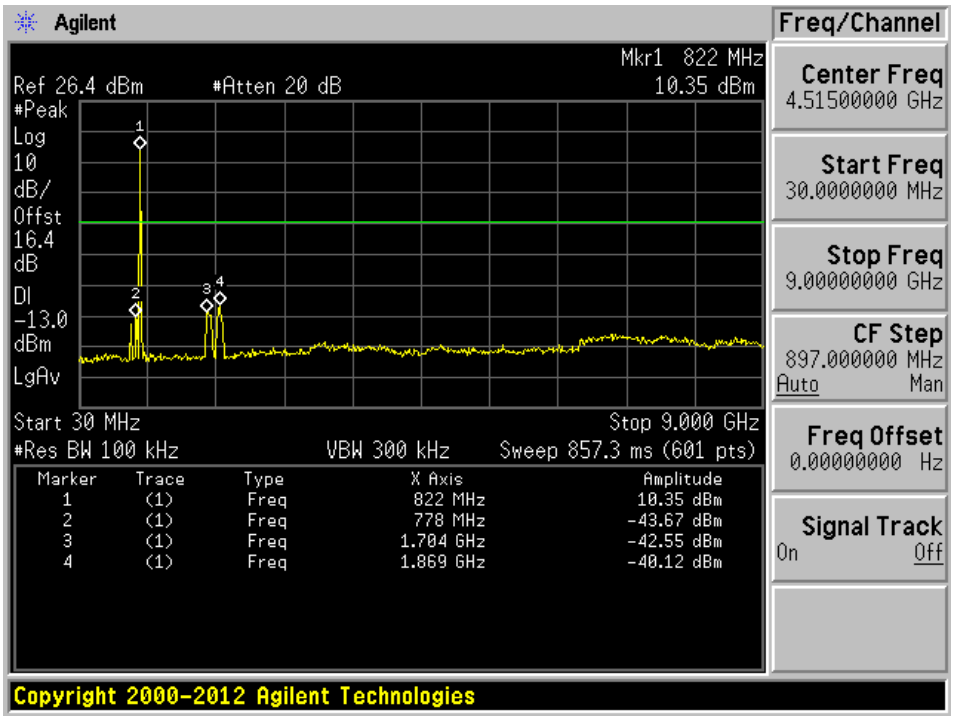


High Channel: 846.5 MHz

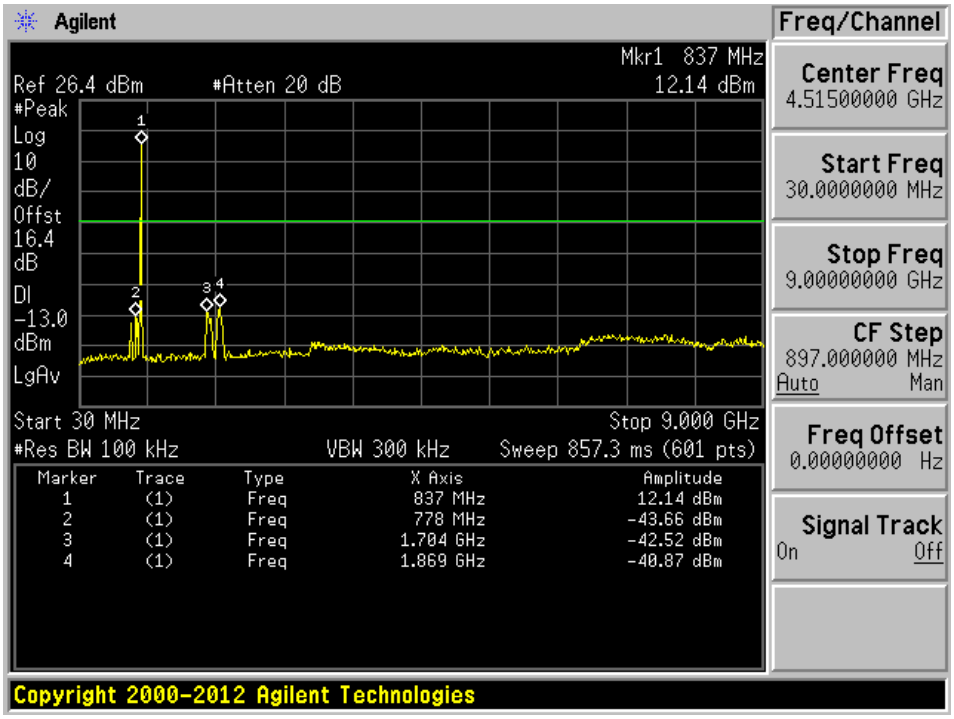


AGC On

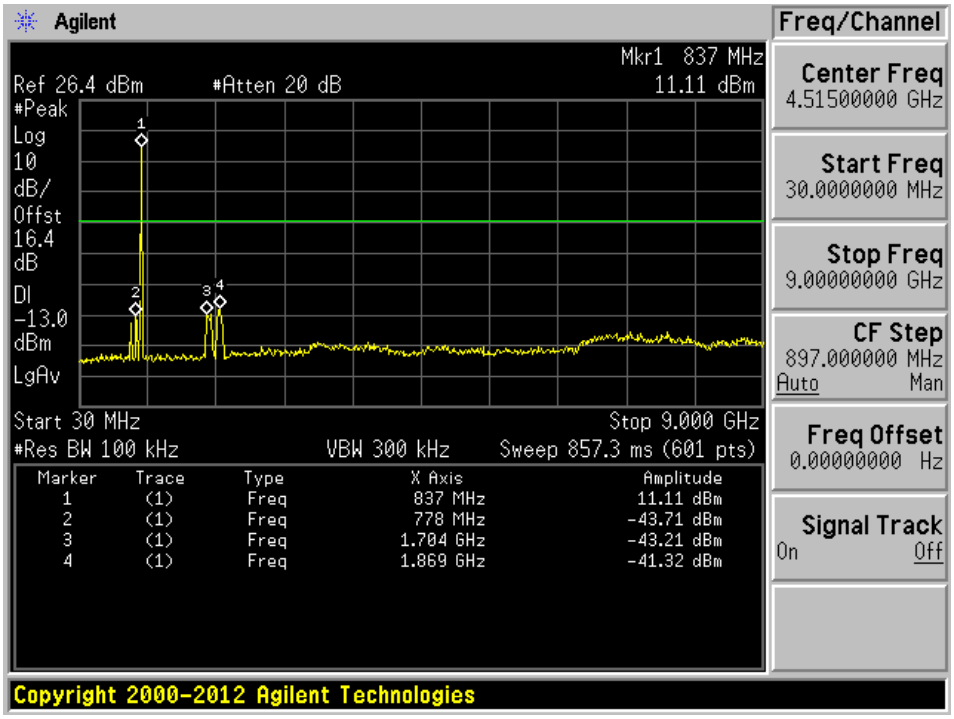
Low Channel: 826.5 MHz



Middle Channel: 836.5 MHz



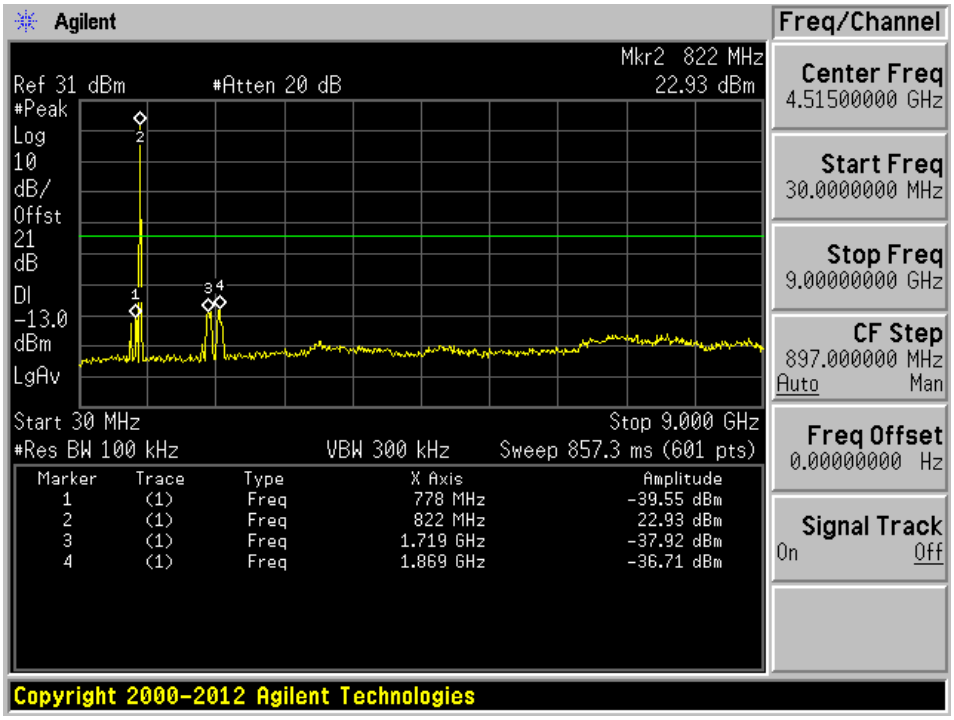
High Channel: 846.5 MHz



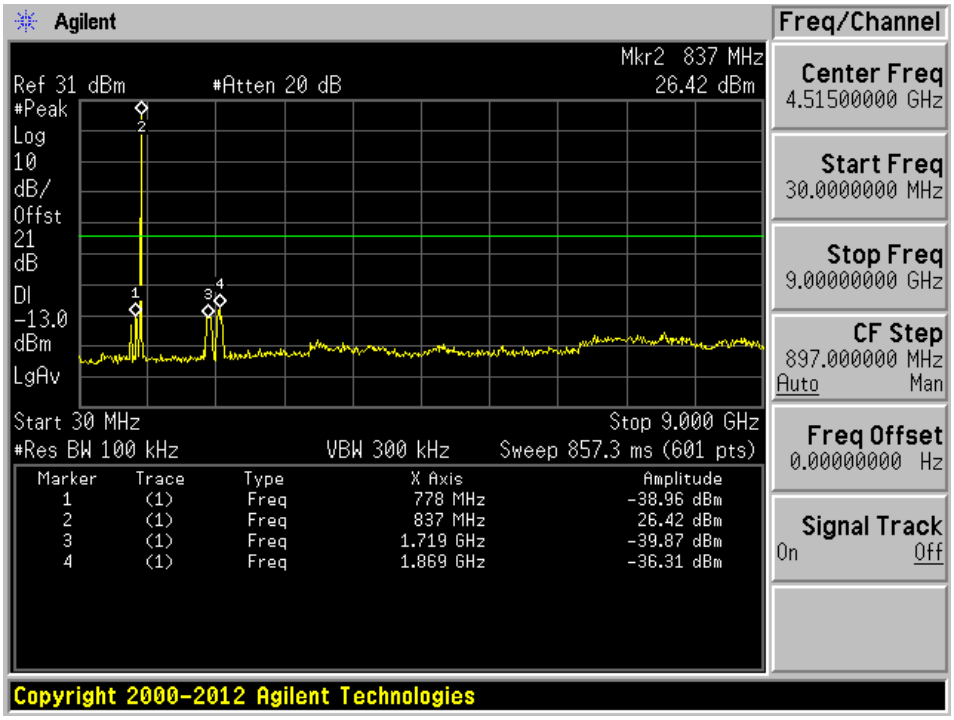
Uplink: Narrowband signal

AGC Off

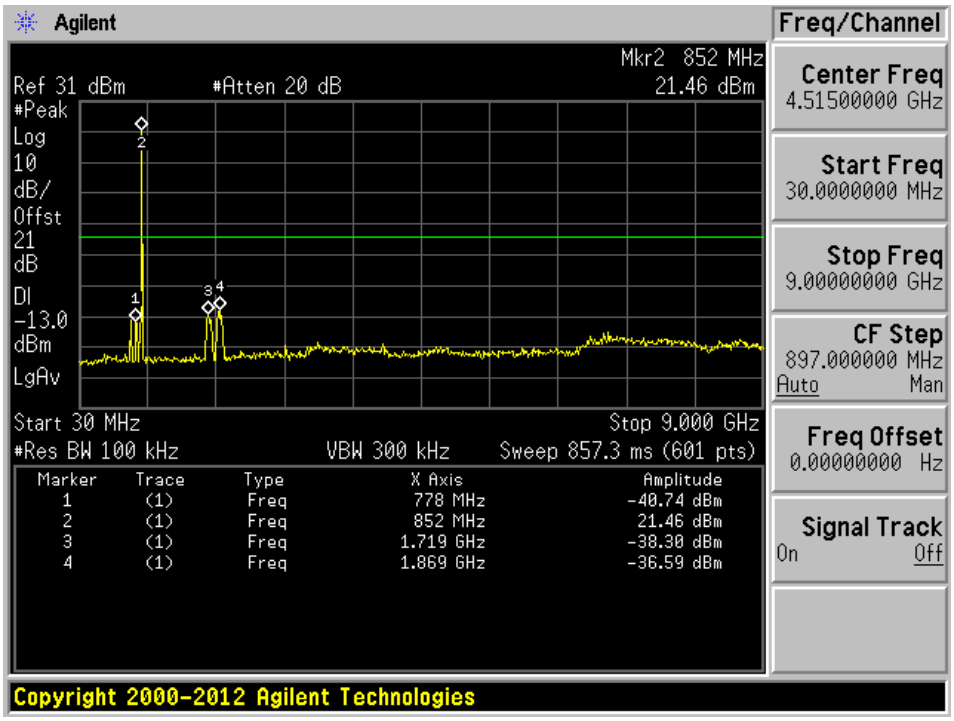
Low Channel: 824.2 MHz



Middle Channel: 836.5 MHz

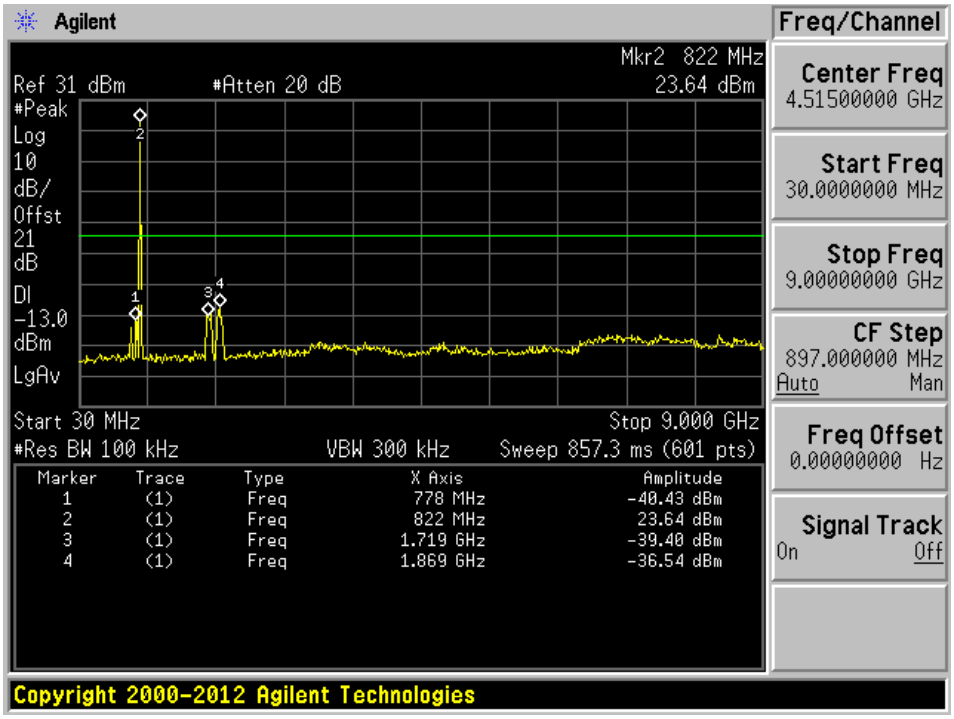


High Channel: 848.8 MHz

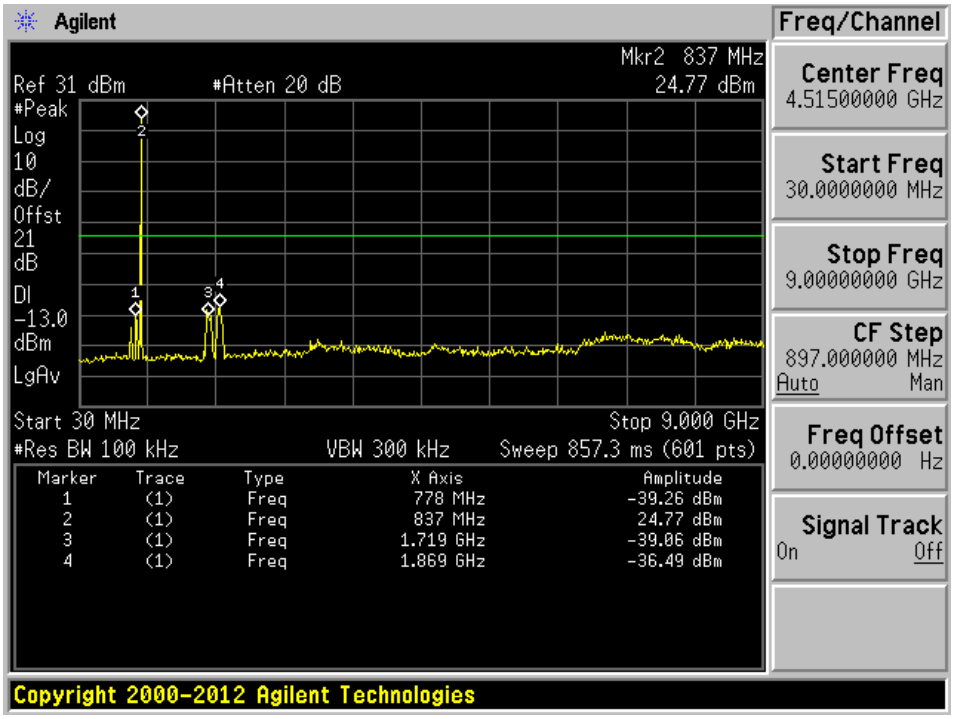


AGC On

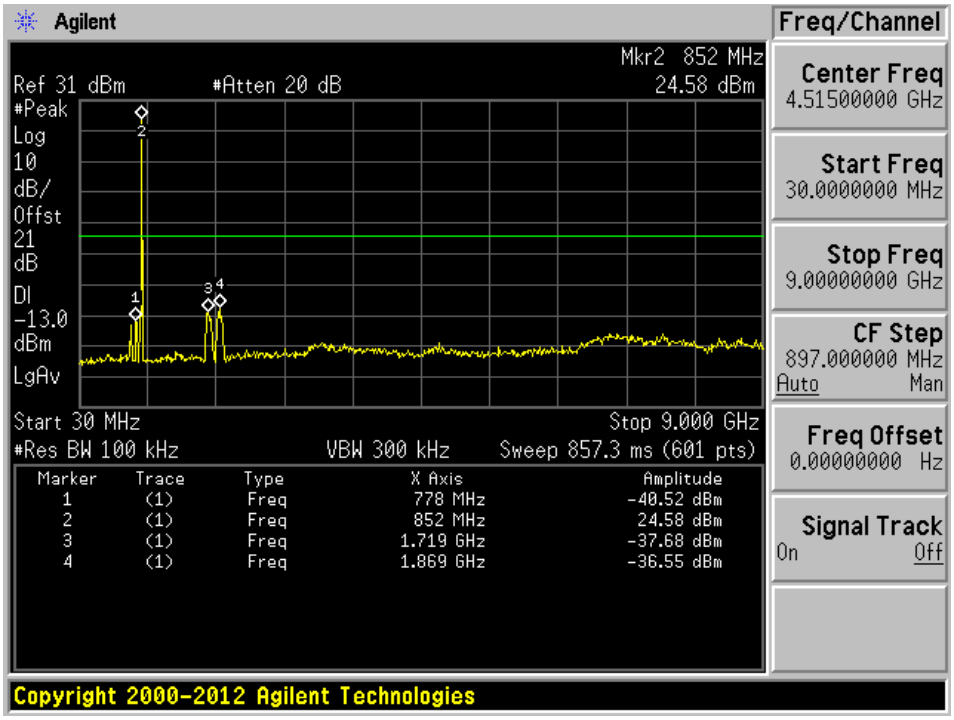
Low Channel: 824.2 MHz



Middle Channel: 836.5 MHz



High Channel: 849.8 MHz



9 FCC §22.917 - Band Edge & Intermodulation

9.1 Applicable Standards

According to FCC §22.917 the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

9.2 Test Procedure

The EUT was connected to the spectrum analyzer and Signal Generator followed by 50Ω-75Ω matching pad.

The center frequency of the spectrum analyzer was set according to center frequency of the EUT to be transmitted. The RBW was set to greater than 1% of emission bandwidth for all uplink and downlink frequencies.

9.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2014-10-24	1 year
Agilent	Generator, Signal	E4438C	MY45091309	2015-08-21	1 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2014-09-18	2 years
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2014-07-15	2 years

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

9.4 Test Environmental Conditions

Temperature:	21-23° C
Relative Humidity:	42-48 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Todd Moy 2015-10-10 in the RF Site.

9.5 Test Results

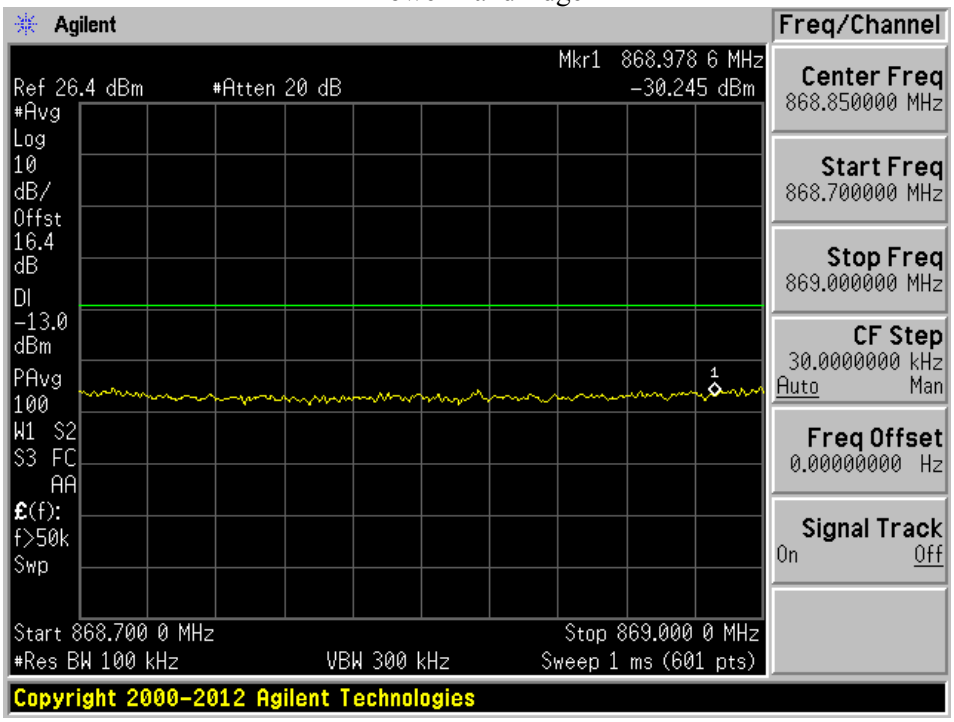
Please refer to the following plots.

Band Edge:

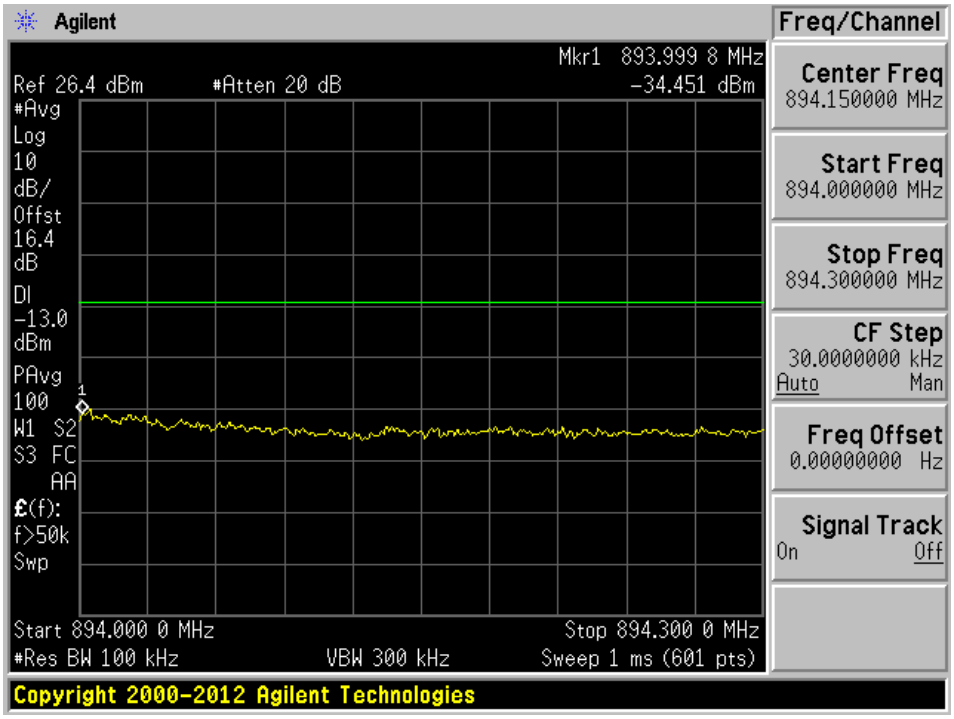
Downlink: Broadband Signal

AGC Off

Lower Band Edge

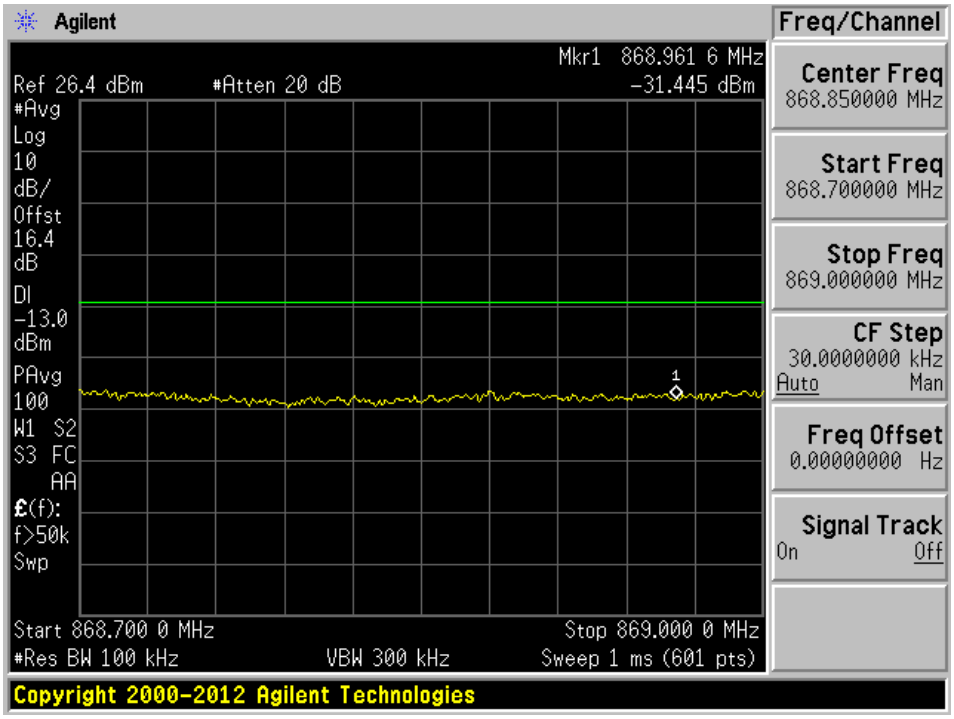


Upper Band Edge

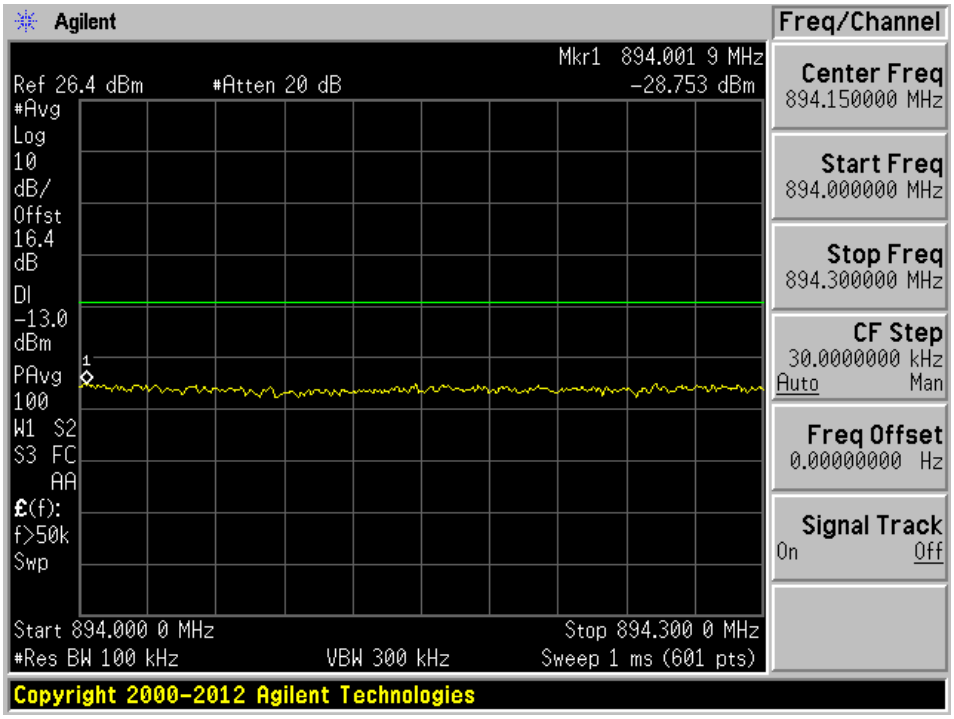


AGC On

Lower Band Edge



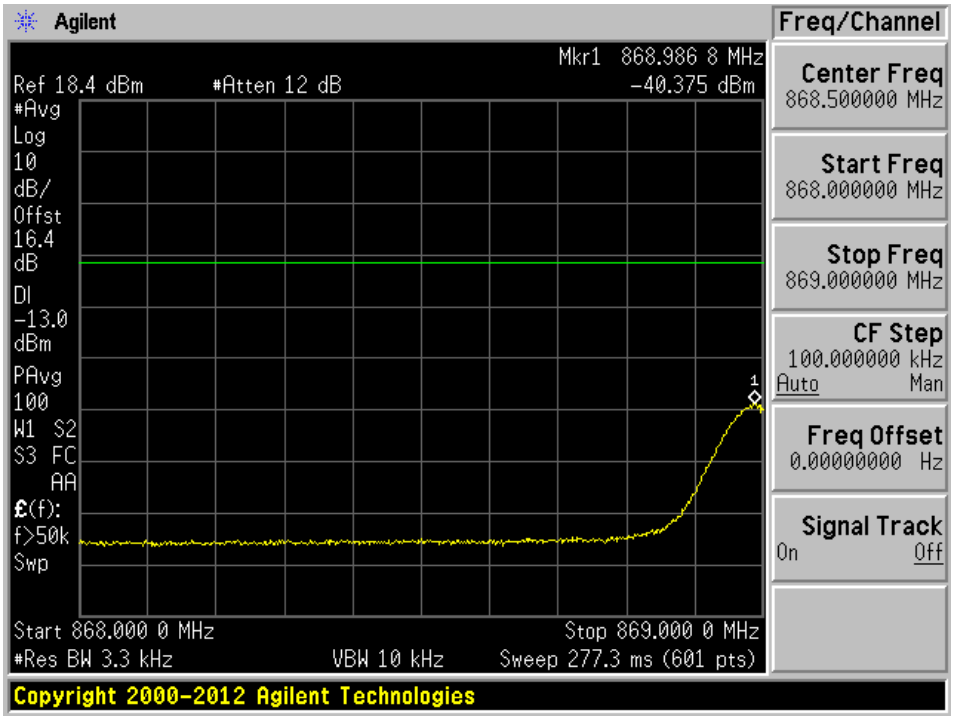
Upper Band Edge



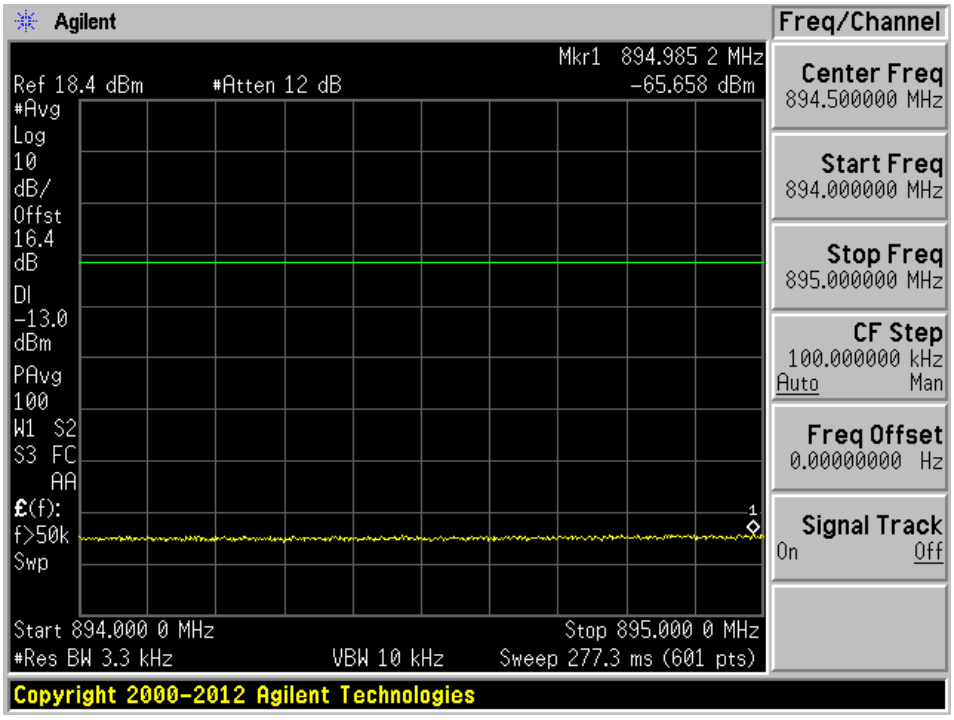
Downlink: Narrowband Signal

AGC Off

Lower Band Edge

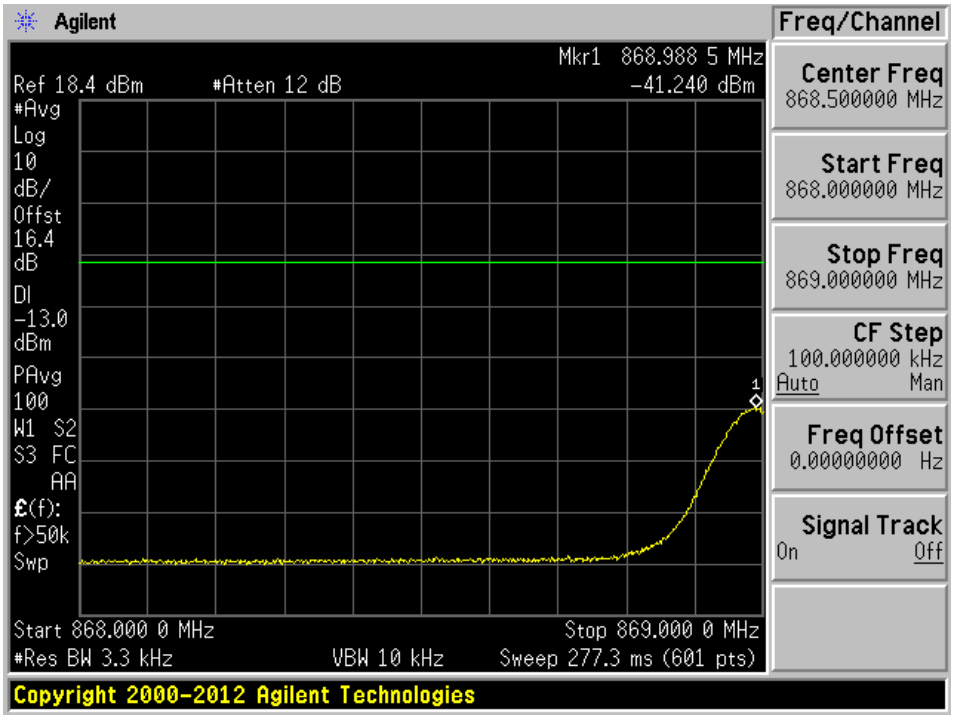


Upper Band Edge

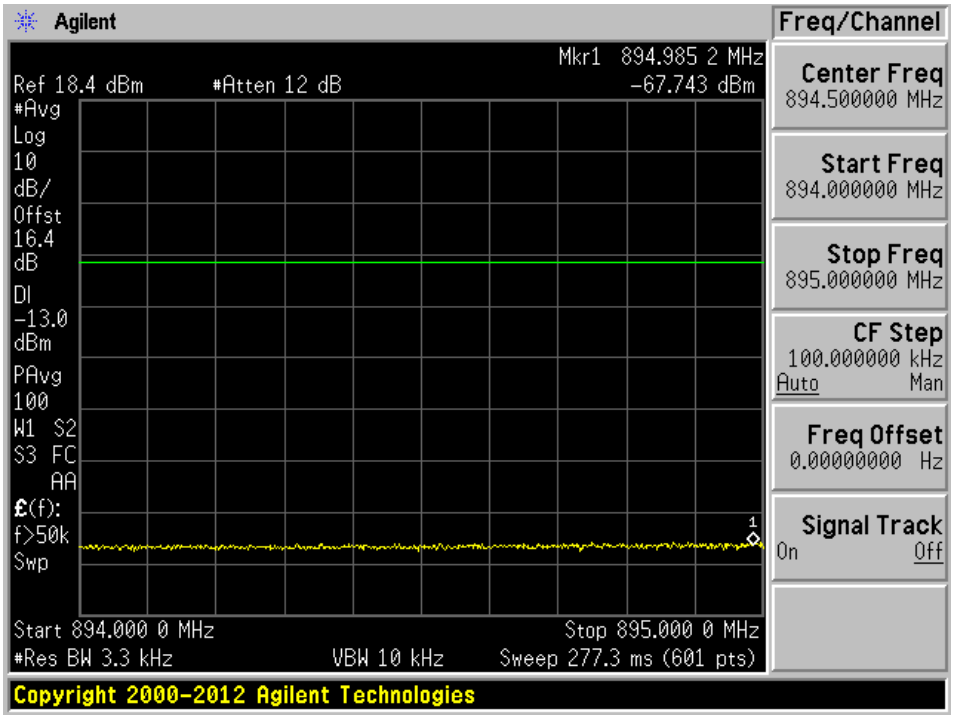


AGC On

Lower Band Edge



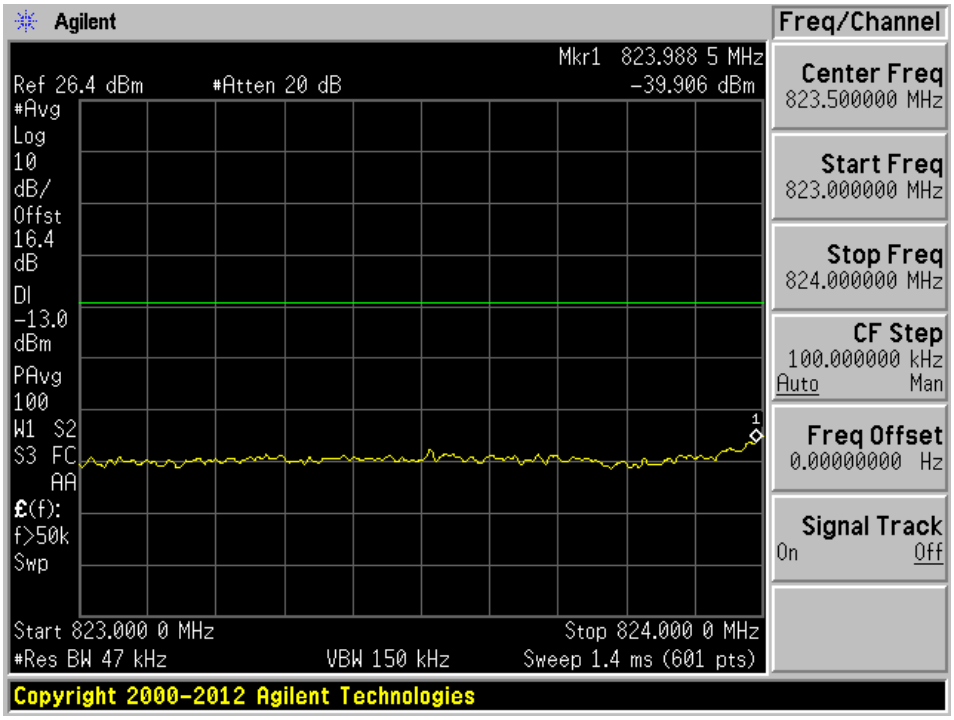
Upper Band Edge



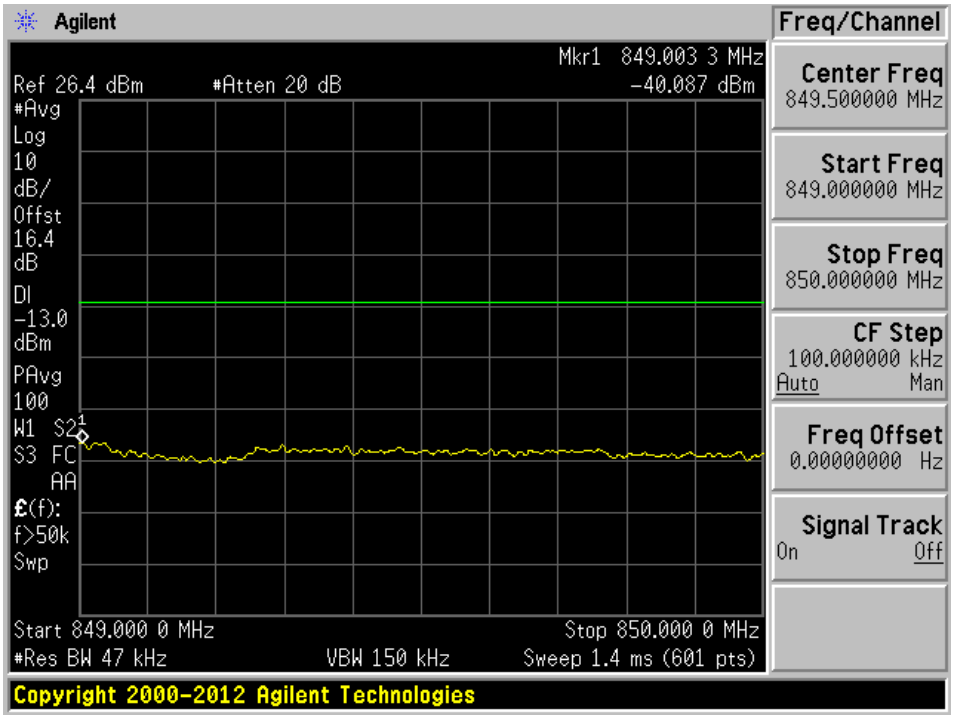
Uplink: Broadband Signal

AGC Off

Lower Band Edge

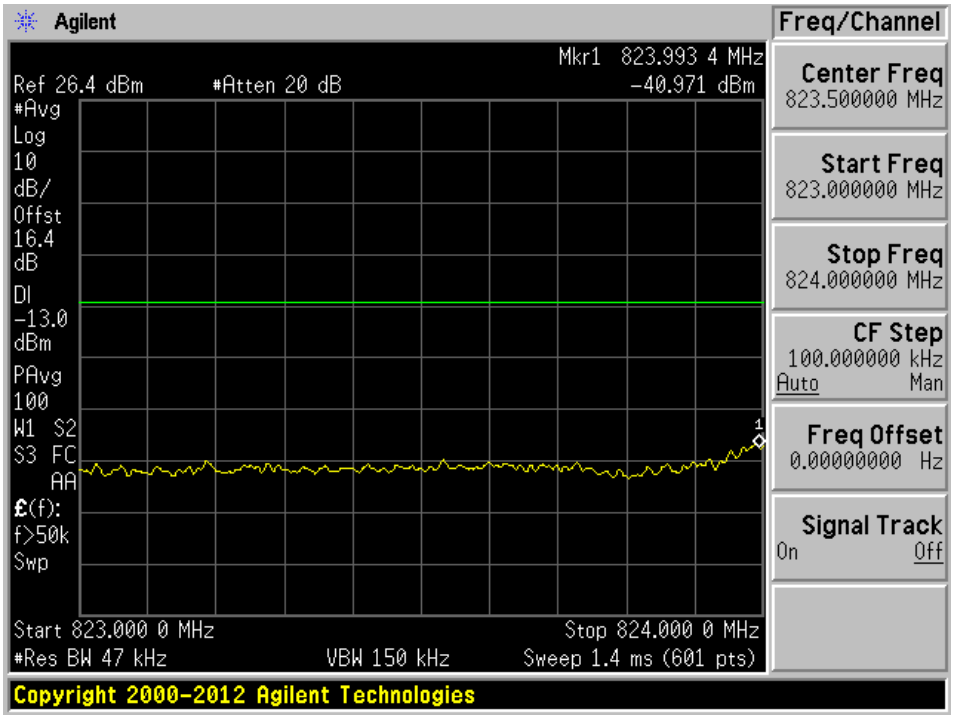


Upper Band Edge

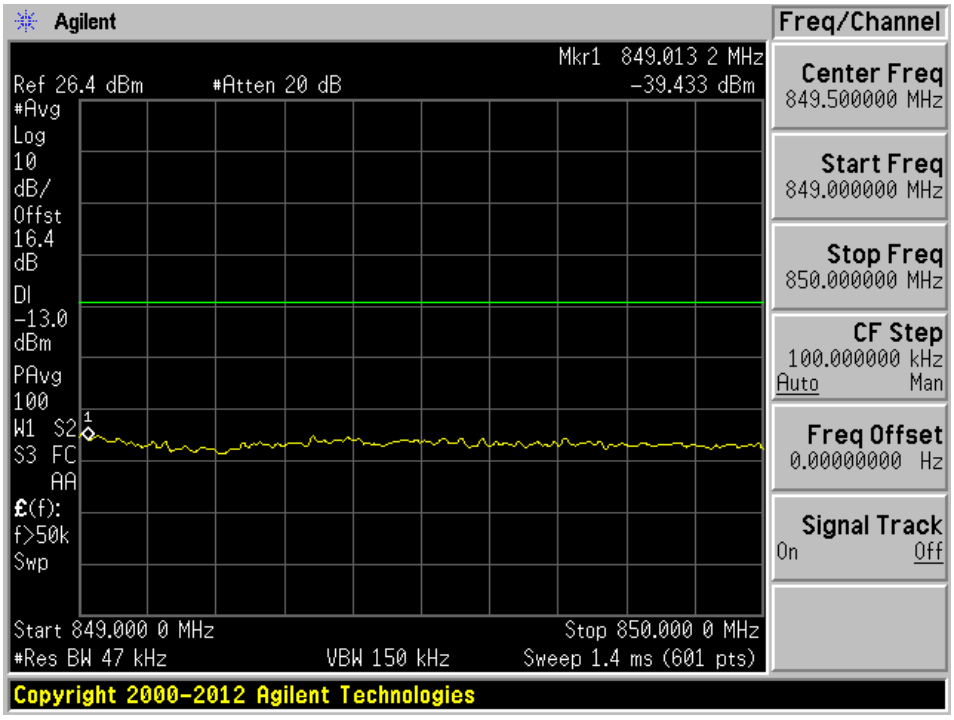


AGC On

Lower Band Edge



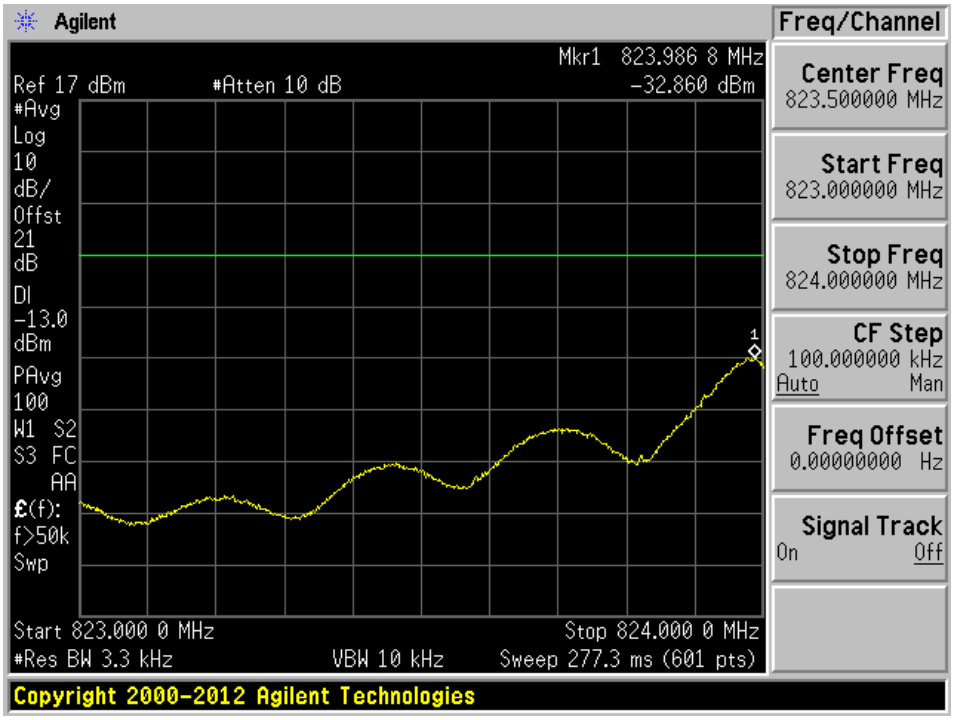
Upper Band Edge



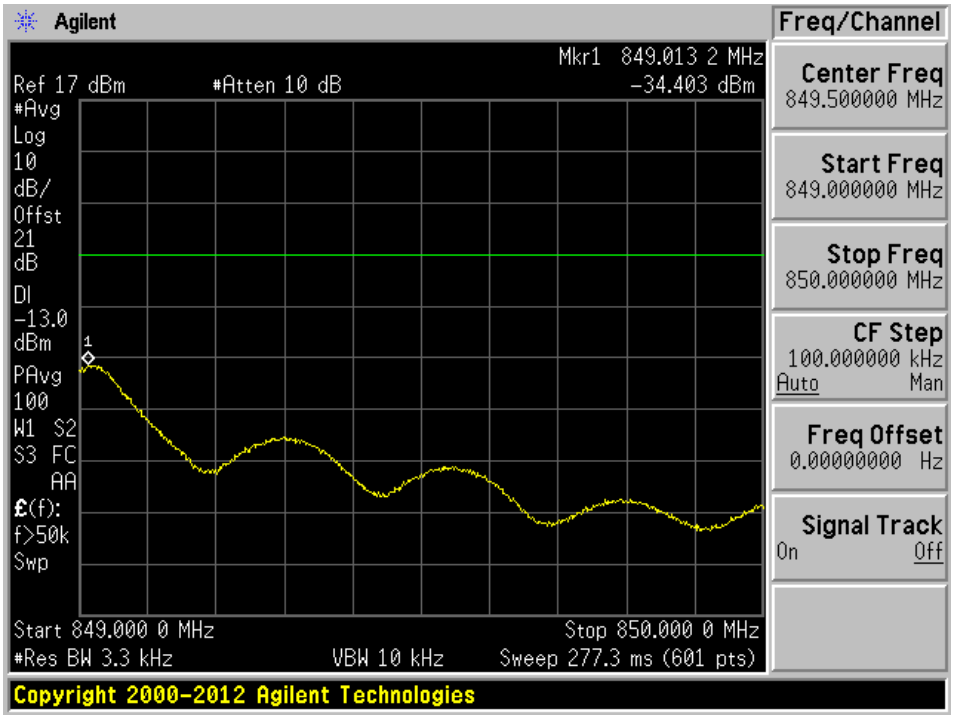
Uplink: Narrowband Signal

AGC Off

Lower Band Edge

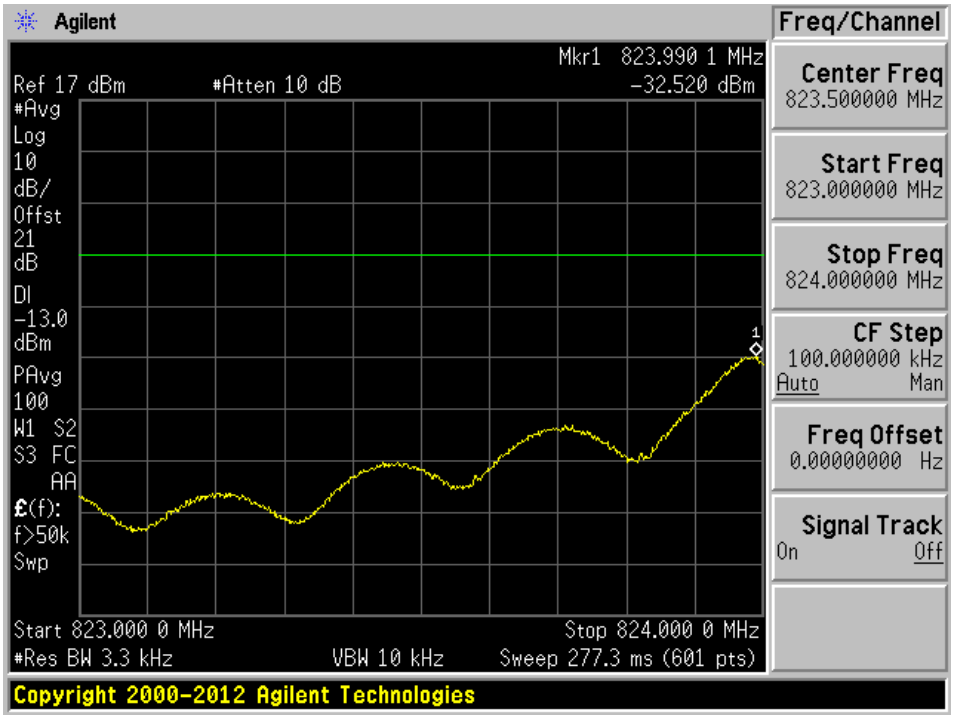


Upper Band Edge

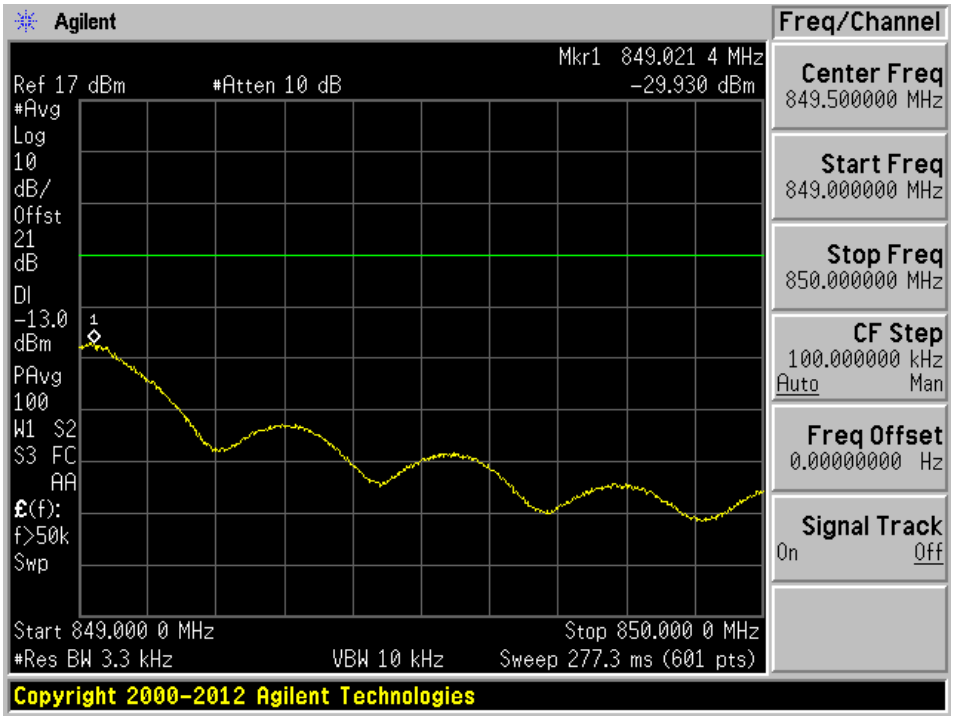


AGC On

Lower Band Edge



Upper Band Edge

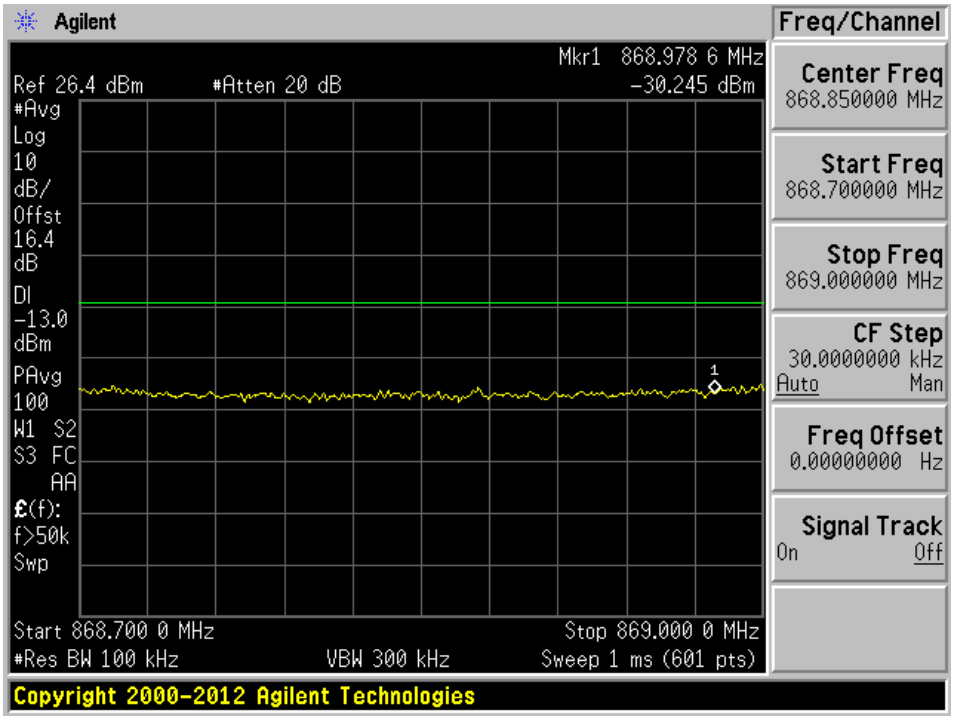


Intermodulation:

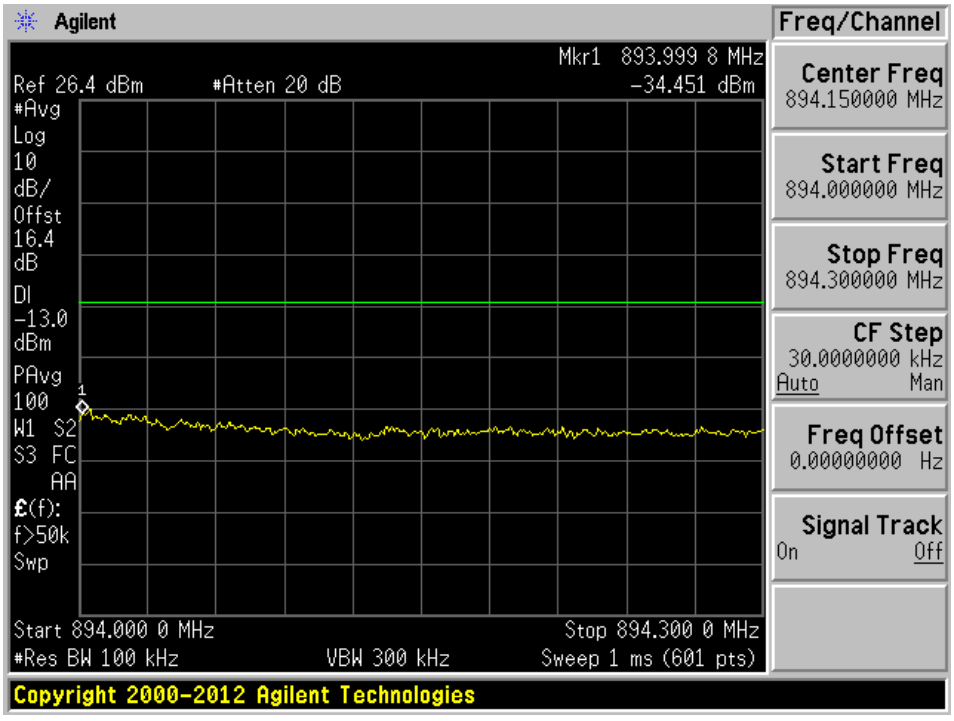
Downlink: Broadband Signal

AGC Off

Low Channel

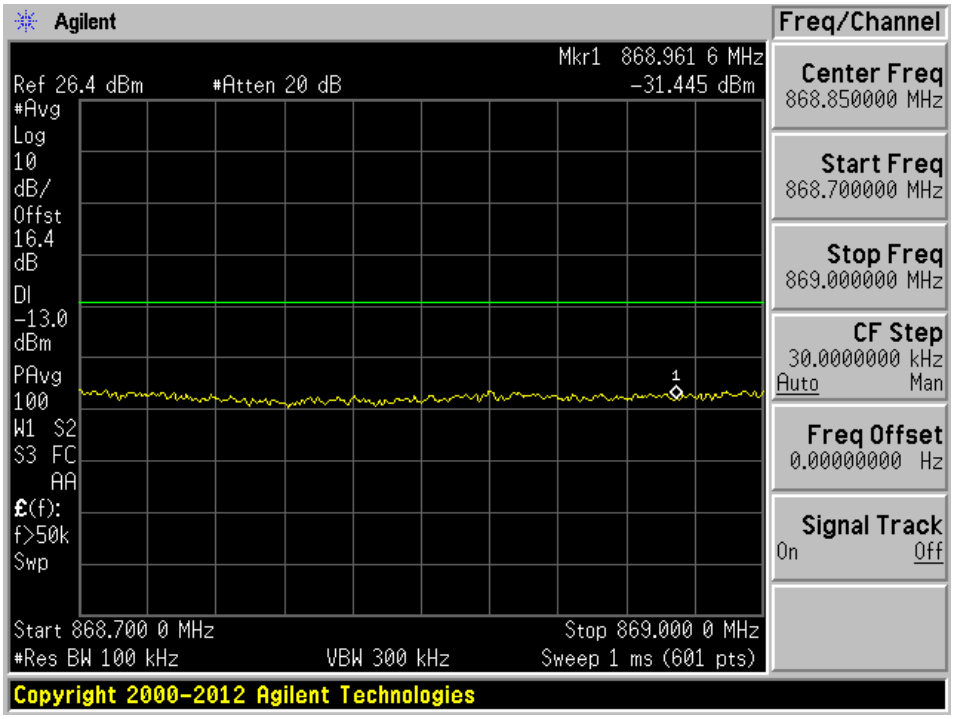


High Channel

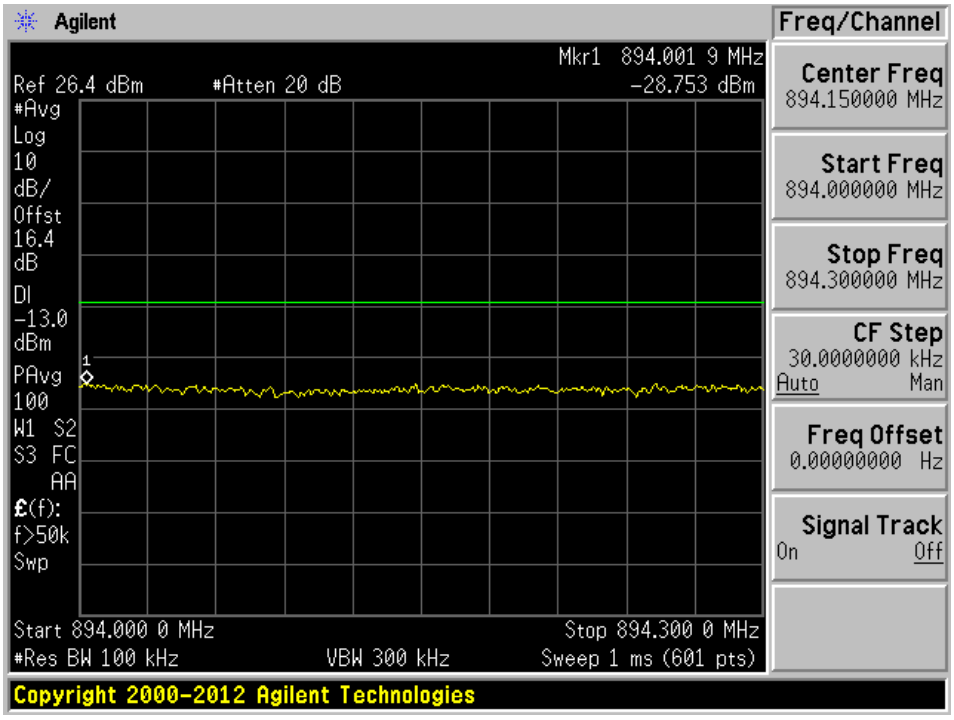


AGC On

Low Channel



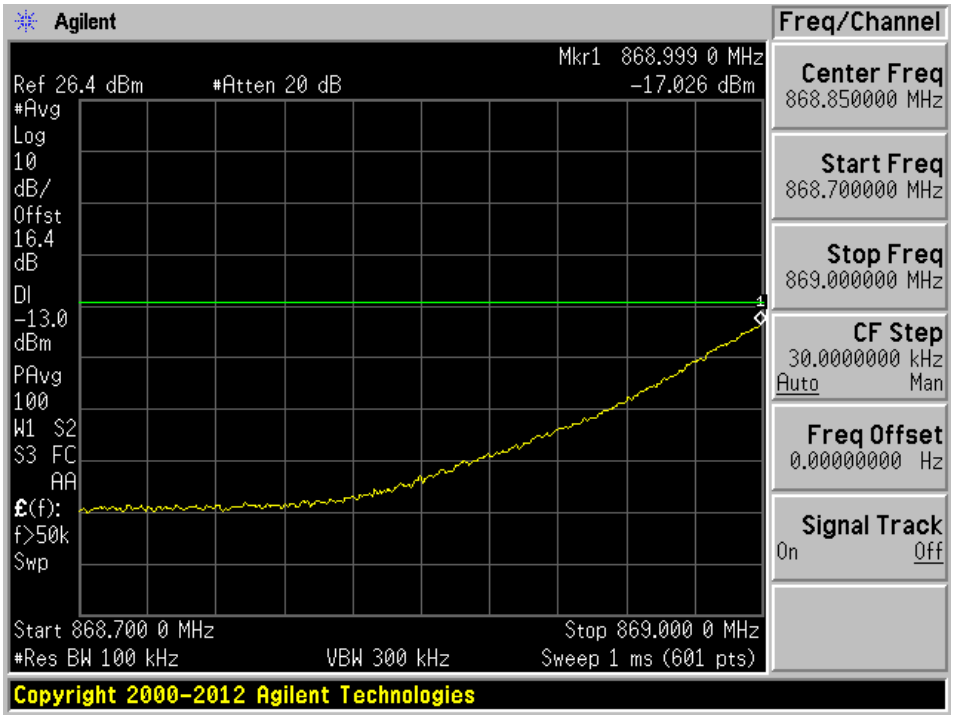
High Channel



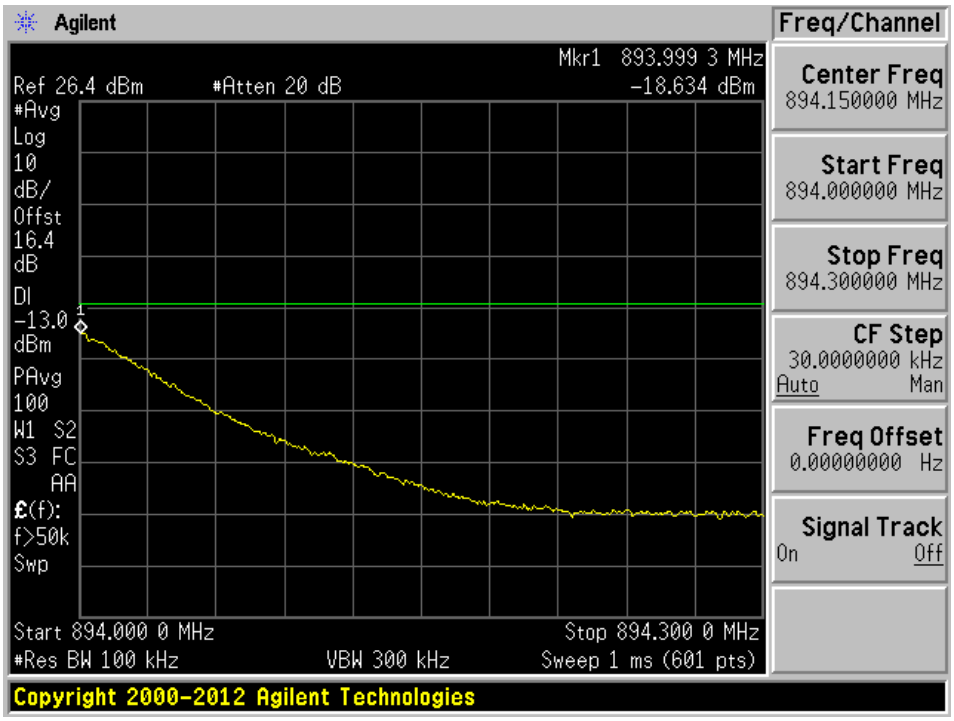
Downlink: Narrowband Signal

AGC Off

Low Channel

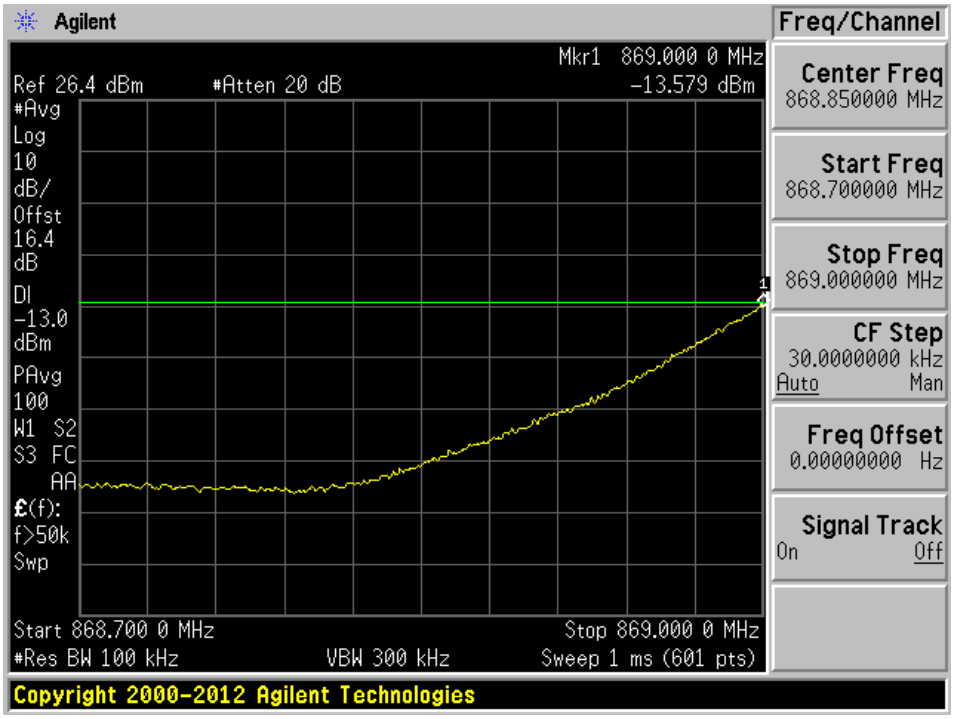


High Channel

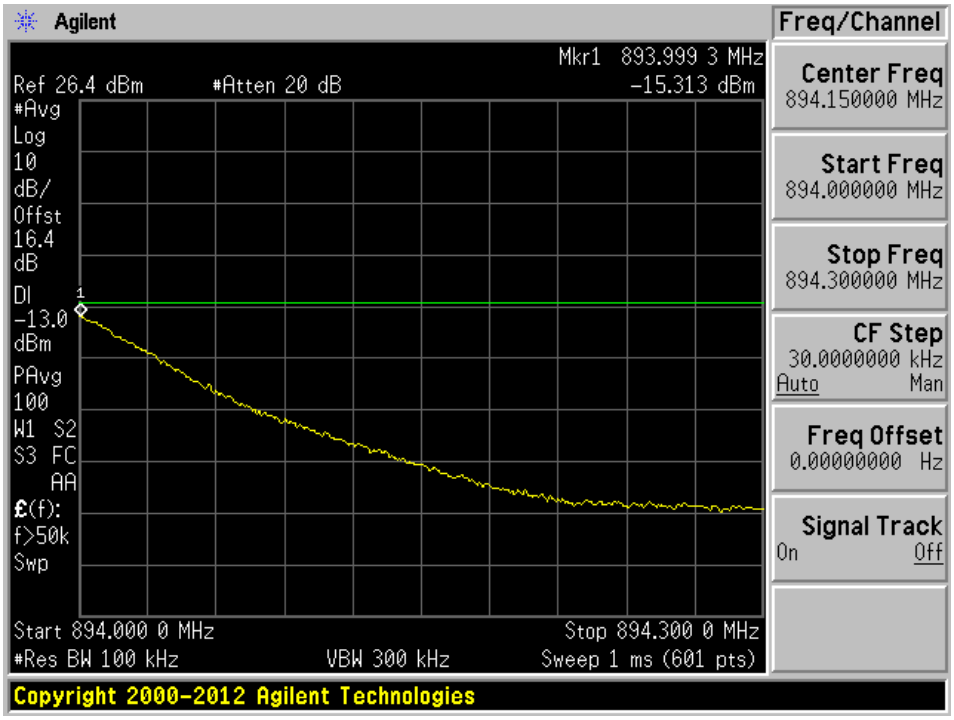


AGC On

Low Channel



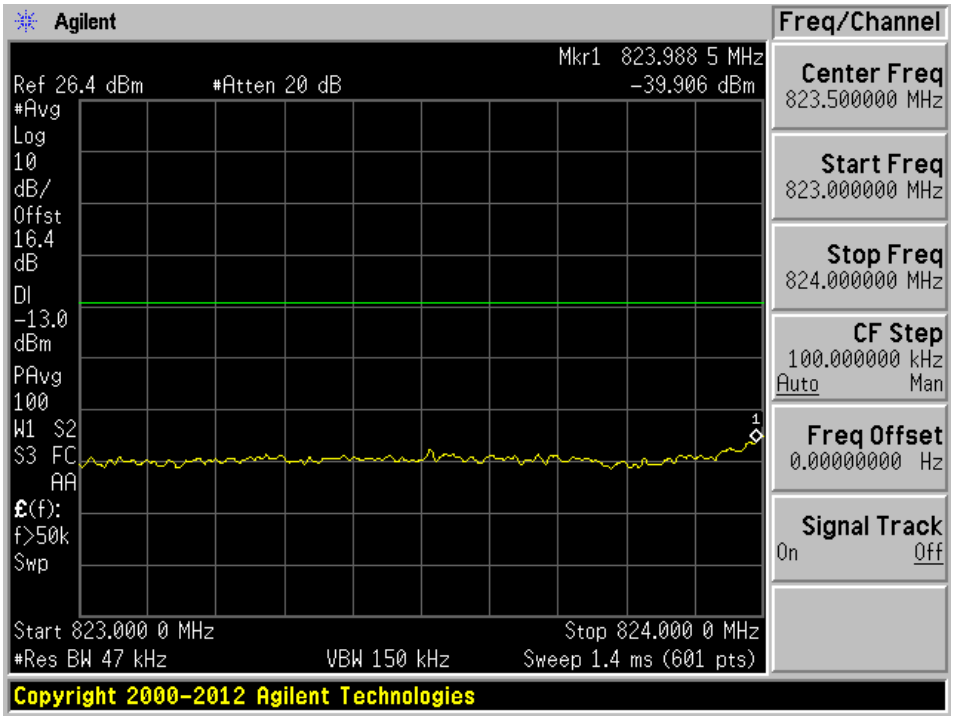
High Channel



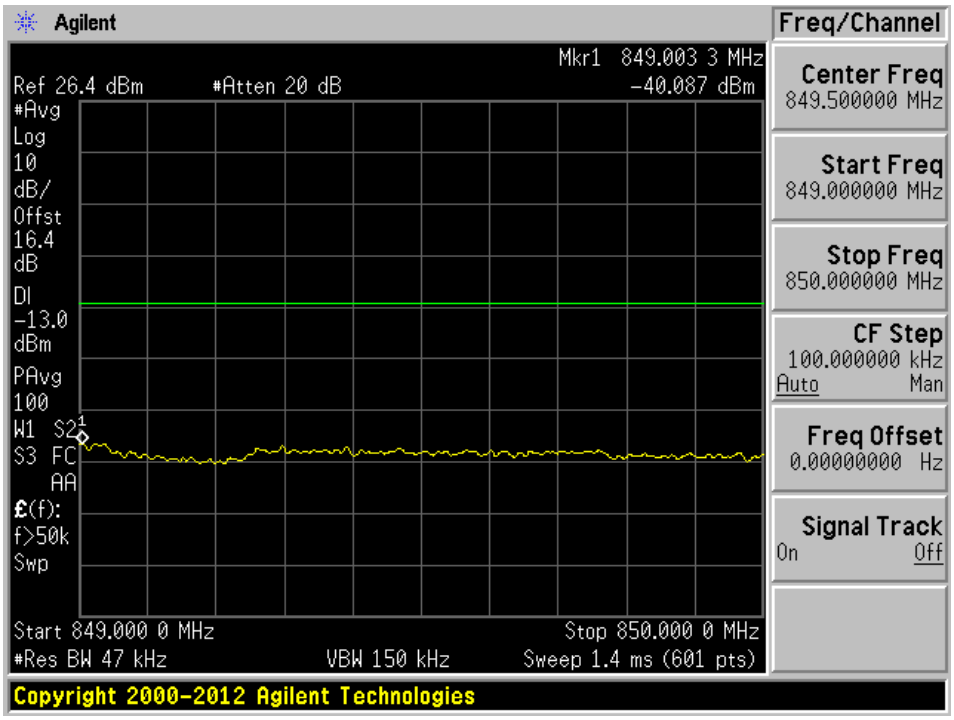
Uplink: Broadband Signal

AGC Off

Low Channel

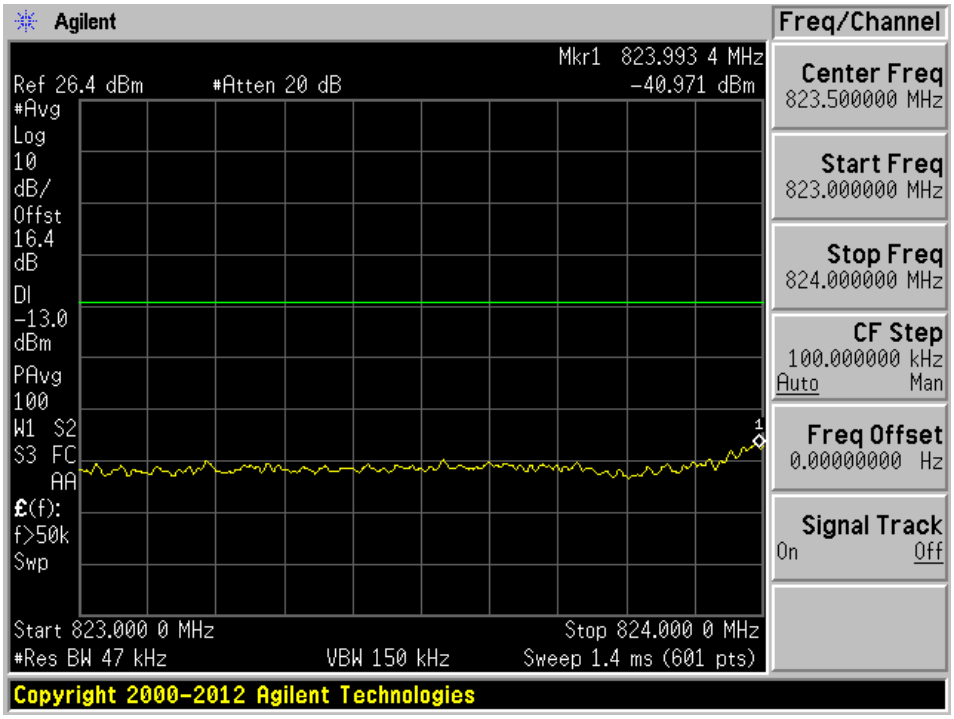


High Channel

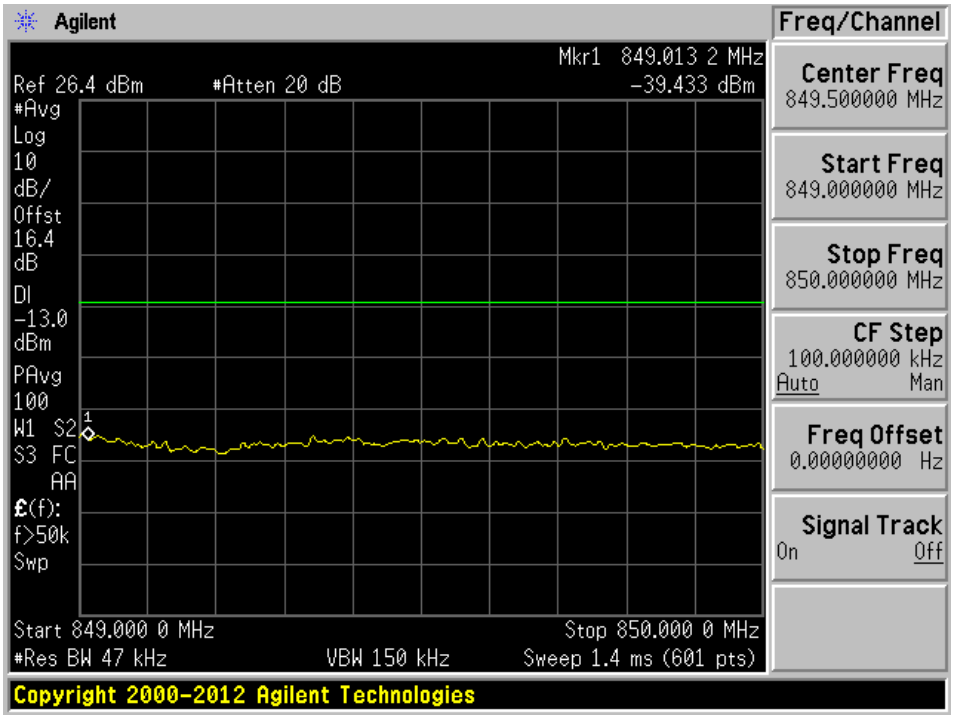


AGC On

Low Channel



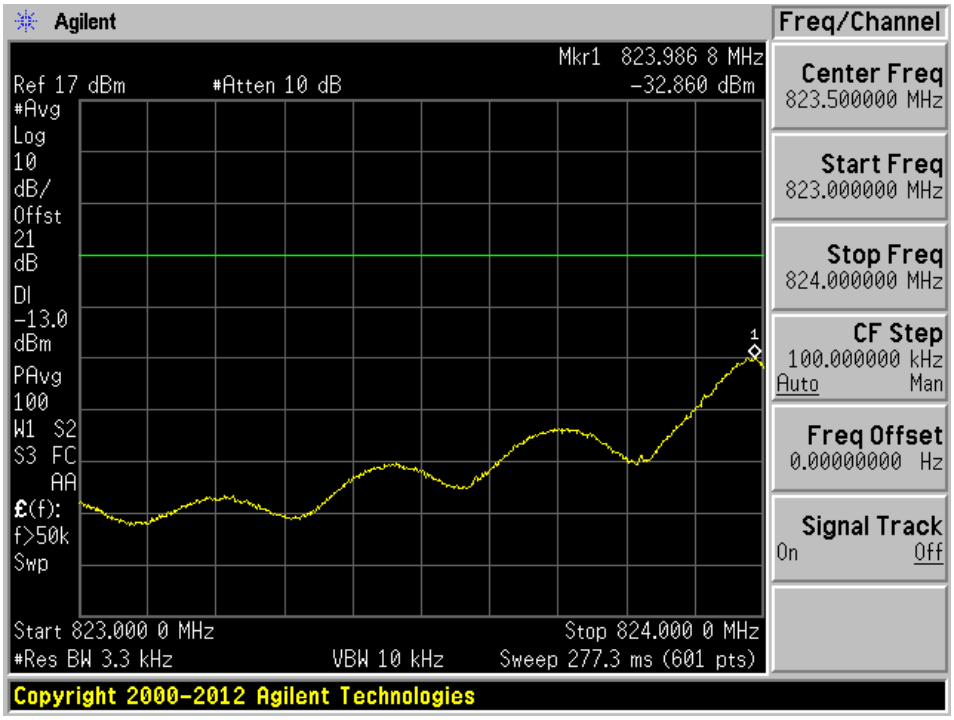
High Channel



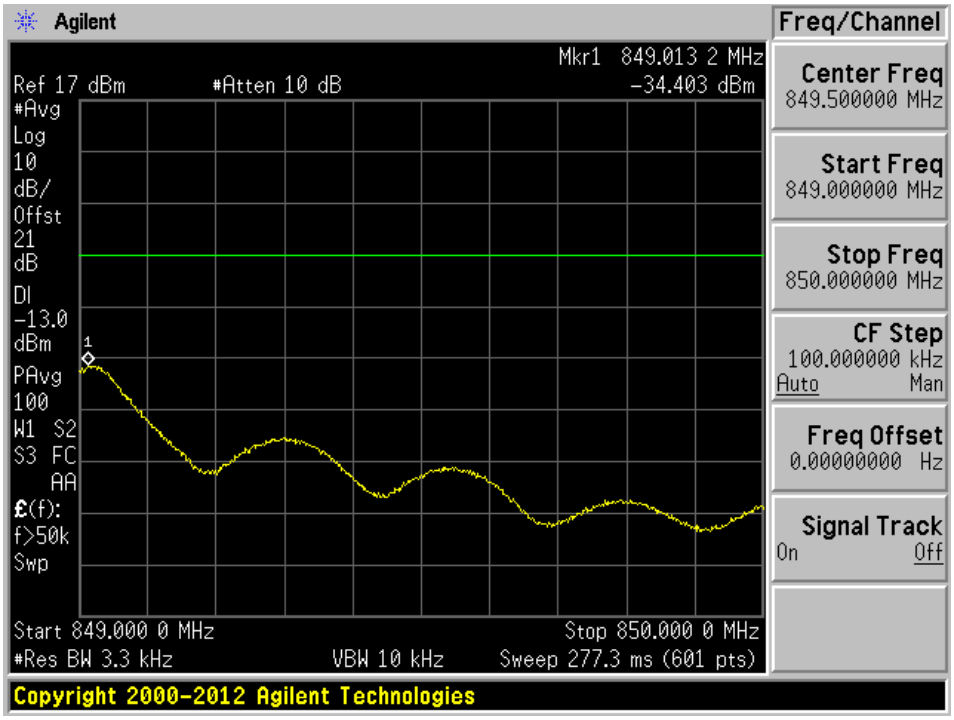
Uplink: Narrowband Signal

AGC Off

Low Channel

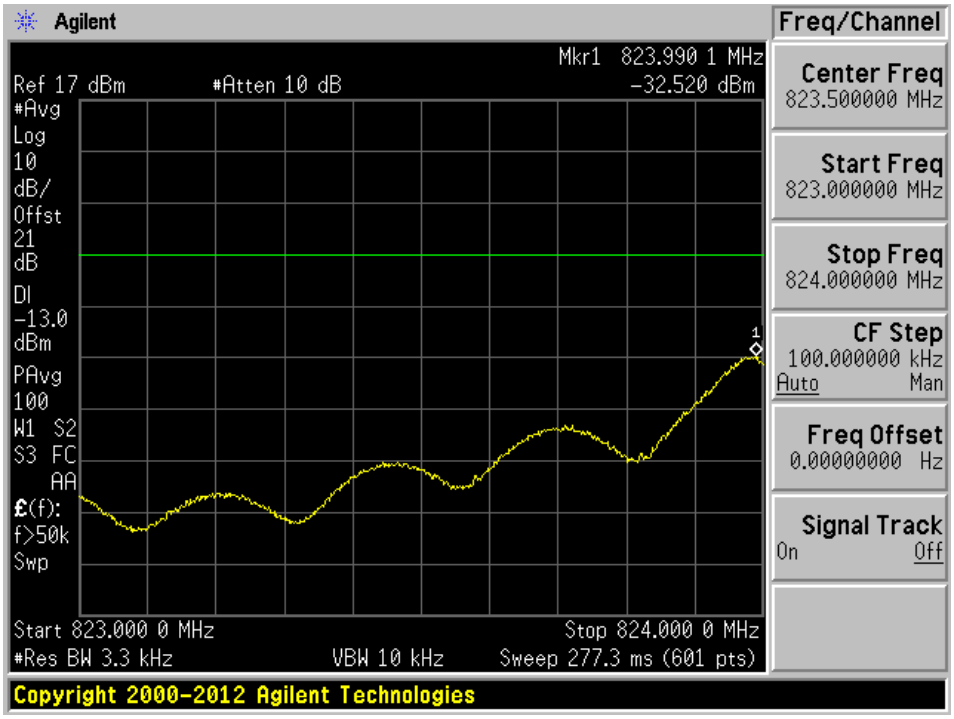


High Channel

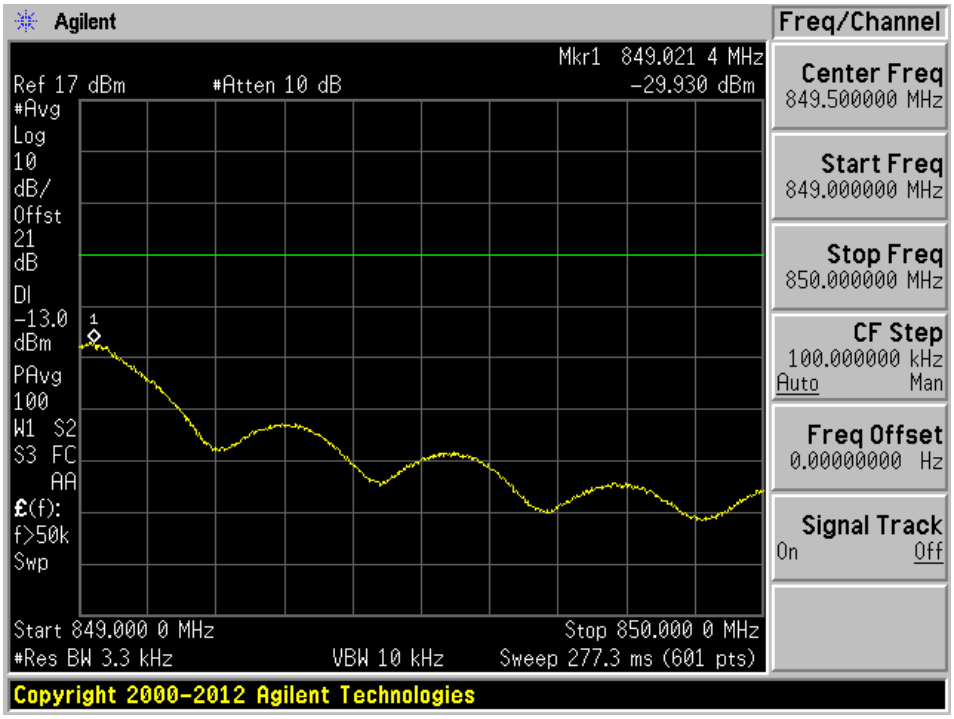


AGC On

Low Channel



High Channel



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

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2014-10-24	1 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2014-09-18	2 years

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

10.4 Test Environmental Conditions

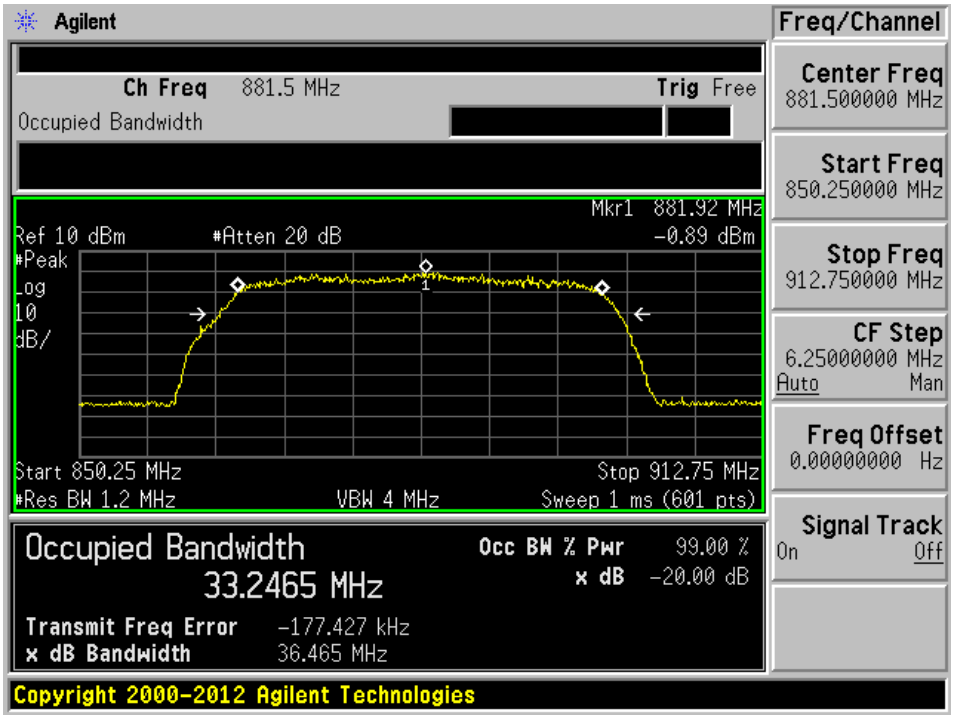
Temperature:	21-23° C
Relative Humidity:	42-48 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Todd Moy on 2015-09-21 in the RF Site.

10.5 Test Results

Please refer to the following plot,

Downlink, 869 – 894 MHz



Uplink, 824 – 849 MHz