



## FCC PART 24E



# TEST AND MEASUREMENT REPORT

For

## MS Magnet Solutions Ltd.

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Limassol, Cyprus

**FCC ID: 2AKJA-S1500W2**

<b>Report Type:</b> Original Report	<b>Product Type:</b> PiXcell Smallcell Wi-Fi Router
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<b>Report Number:</b>	R16121417-24 (WCDMA band 2)
<b>Report Date:</b>	2017-02-20
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\* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk

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**DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision
0	R16121417-24 (WCDMA band 2)	Original Report	-

## 1 General Information

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### 1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *MS Magnet Solutions Ltd.* and their product model: S1500 W2, FCC ID:2AKJA-S1500W2 which will henceforth be referred to as the EUT (Equipment under Test). The EUT operated in the frequency band of 1932.4 – 1987.6 MHz for WCDMA.

### 1.2 Mechanical Description

The EUT measures approximately 217 mm (L) x 135 mm (W) x 36 mm (H).

*The test data gathered are from typical production sample, serial number: S03-15080662 assigned by MS Magnet Solutions Ltd.*

### 1.3 Objective

This type approval report was prepared on behalf of *MS Magnet Solutions Ltd.* in accordance with Part 2, Subpart J, Part 24 Subpart E, of the Federal Communication Commission's rules.

The objective was to determine compliance with FCC rules for RF radiated output power, peak to average power ratio, occupied bandwidth, spurious emissions at antenna terminal, radiated spurious emission, band edge and frequency stability.

### 1.4 Related Submittal(s)/Grant(s)

R16121417-247 DTS (Wi-Fi)

### 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 24 Subpart E

Applicable Standards: TIA/EIA603-D, FCC KDB 971168 D01 v02r02.

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  $\pm 2.0$  dB for Conducted Emissions tests and  $\pm 4.0$  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 Luminaires 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 and FCC KDB 971168 D01 v02r02. The final qualification test was performed with the EUT operating at normal mode.

### 2.2 EUT Exercise Software

The test firmware used was SecureCRTPortable.exe, RT3050QA.exe and firmware files provided by MS Magnet Solutions Ltd., the software is comply with the standard requirements being tested against.

### 2.3 Equipment Modifications

No modifications were made to the EUT.

### 2.4 Local Support Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers
Dell	Windows Laptop	E6410	-

### 2.5 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RJ45	< 1 m	Windows Laptop	EUT
RF Cable	< 1 m	PSA	EUT



### 3 Summary of Test Results

FCC Rules	Description of Tests	Results
§2.1091, §1.1307	RF Exposure	Compliant
§24.232(c)	Radiated Output Power & PAPR	Compliant
§2.1049, §24.238	Occupied Bandwidth	Compliant
§2.1053, §24.238(a)	Spurious Radiated Emissions	Compliant
§2.1051, §24.238(a)	Spurious Emissions at Antenna Terminals	Compliant
§24.238(a)	Band Edge	Compliant
§2.1055, §24.235	Frequency Stability	Compliant

## 4 FCC §2.1091 - RF Exposure

### 4.1 Applicable Standards

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

#### 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

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>26.71</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>468.813</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>1932.4</u>
<u>Antenna Gain, typical (dBi):</u>	<u>3</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.995</u>
<u>Power density at predication frequency and distance (mW/cm<sup>2</sup>):</u>	<u>0.186</u>
<u>MPE limit for uncontrolled exposure at predication frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.186 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>. The percentage is 0.186/1= 18.6%. The total percentage is 18.6% (WWAN) + 4.55% (WLAN) = 23.15%.

## 5 FCC §24.232(c) – RF Output Power

### 5.1 Applicable Standards

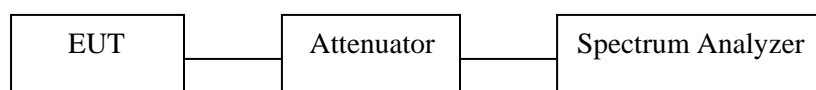
According to FCC §24.232(c), Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

The Peak to average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

### 5.2 Test Procedure

*Conducted method:*

The EUT was connected to the spectrum analyzer through sufficient attenuator.



*Radiated Method:*

TIA 603-D Section 2.2.17

### 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
-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	20dB attenuator	-	-	Each time <sup>1</sup>	N/A
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2015-07-11	2 year
Sunol	Horn antenna	DRH-118	A052704	2015-03-09	2 year
A. H. Systems	Antenna, Horn	SAS-200/571	261	2015-03-19	2 year
HP	Signal Generator	83650B	18485-91	2016-09-09	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1,721033DB2,721033DB3,721033DB4,	2015-01-16	2 year

Note<sup>1</sup>: cable and attenuator included in the test set-up will be checked each time before testing.

**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

<b>Temperature:</b>	20-22° C
<b>Relative Humidity:</b>	39-42 %
<b>ATM Pressure:</b>	101.6-102 kPa

*The testing was performed by Rudy Sun 2017-01-31 in the RF Site.*

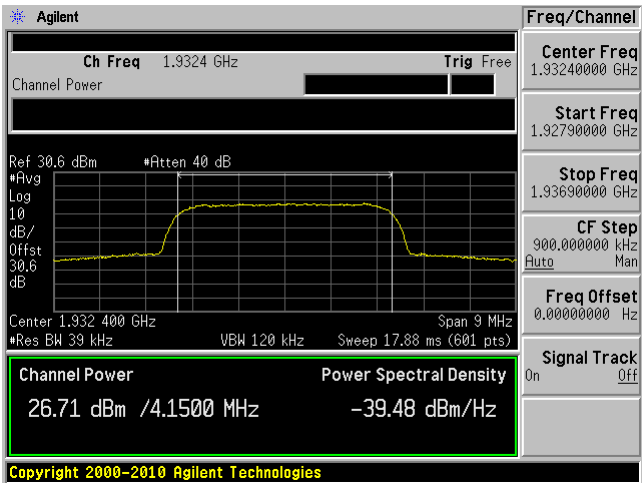
## 5.5 Test Results

### Conducted Power

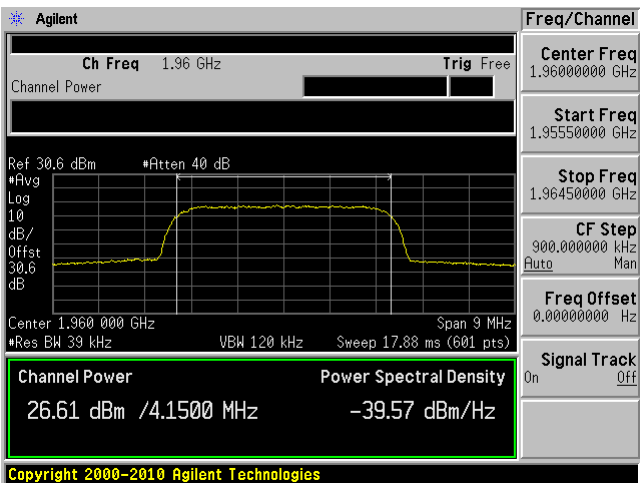
Channel	Frequency (MHz)	Ave Power (dBm)	Limit (dBm)
<b>WCDMA Band 2</b>			
Low	1932.4	26.71	33
Middle	1960	26.61	33
High	1987.6	26.28	33

Please refer to the following plots for detailed test results.

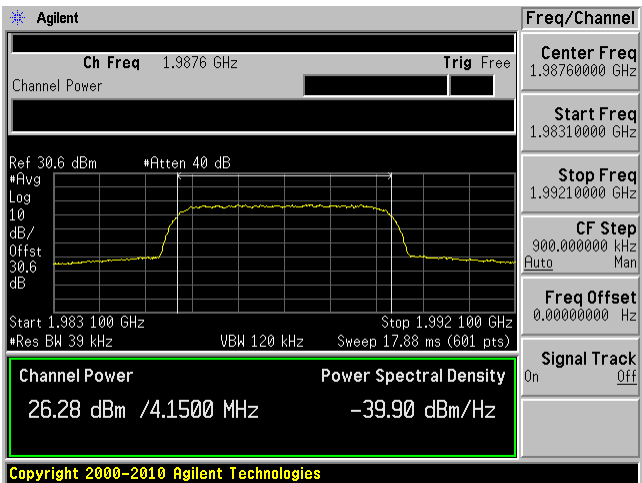
Low channel



Middle channel



High channel

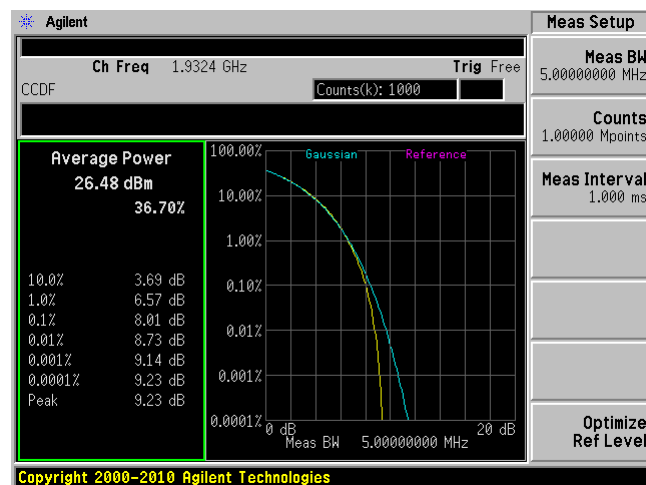


**Peak to Average Power Ratio (PAPR)**

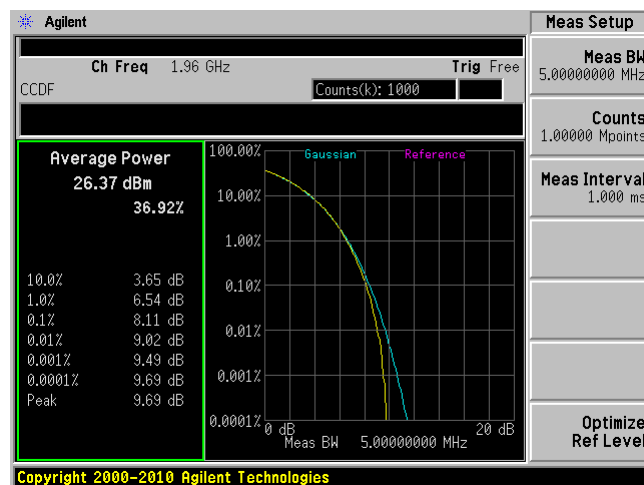
Channel	Frequency (MHz)	PAPR (dB)	Limit (dB)
<b>WCDMA Band 2</b>			
Low	1932.4	8.01	13
Middle	1960	8.11	13
High	1987.6	8.00	13

Please refer to the following plots for detailed test results.

Low Channel



Middle Channel



High channel



**Radiated Power**

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC §24.232(c)	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
Low channel										
1932.4	87.55	325	100	H	16.73	0.9	8.381	24.21	33.00	-8.79
1932.4	94.65	190	105	V	23.65	0.9	8.381	31.13	33.00	-1.87
Middle Channel										
1960	85.47	325	100	H	15.98	0.91	8.138	23.21	33.00	-9.79
1960	94.6	190	105	V	25.14	0.91	8.138	32.37	33.00	-0.63
High Channel										
1987.6	86.27	325	100	H	17.32	0.92	7.894	24.29	33.00	-8.71
1987.6	93.62	190	105	V	24.31	0.92	7.894	31.28	33.00	-1.72

Note: the above data was tested without Pre-amp

Absolute Level = SG Level – Cable Loss + Antenna Gain

Margin = Absolute Level - Limit

## 6 FCC §2.1049, §24.238 - Occupied Bandwidth

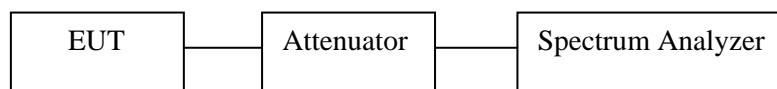
### 6.1 Applicable Standards

Requirements: FCC §2.1049, §24.238

### 6.2 Test Procedure

The EUT was connected to the spectrum analyzer through sufficient attenuator.

The resolution bandwidth of the spectrum analyzer was set to 51 kHz 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
-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	20dB attenuator	-	-	Each time <sup>1</sup>	N/A

**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

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

The testing was performed by Rudy Sun 2017-01-31 in the RF Site.

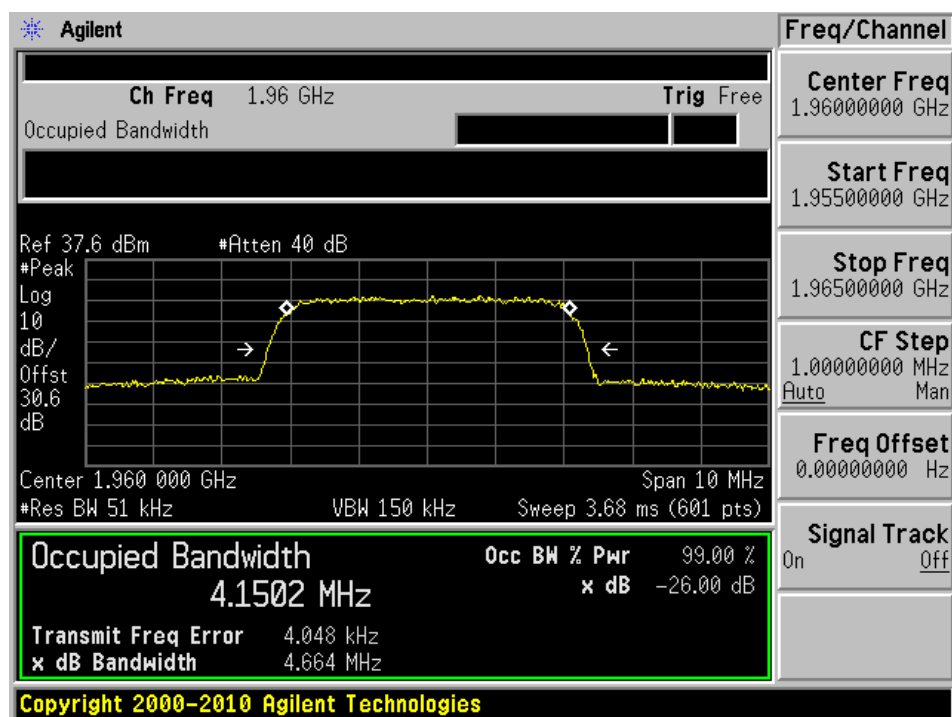


## 6.5 Test Results

Please refer to the following table and plots.

Channel	Frequency (MHz)	99% OBW (MHz)	26 dB BW (MHz)
Middle	1960	4.15	4.664

Middle Channel



## 7 FCC §2.1051 & §24.238 (a) - Spurious Radiated Emissions

### 7.1 Applicable Standards

According to FCC §24.238(a) 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 =  $10 \log(\text{TX Power in Watts}/0.001)$  – the absolute level

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

### 7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2015-07-11	2 year
Sunol	Horn antenna	DRH-118	A052704	2015-03-09	2 year
A. H. Systems	Antenna, Horn	SAS-200/571	261	2015-03-19	2 year
HP	Signal Generator	83650B	18485-91	2016-09-09	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1,721033DB2,721033DB3,721033DB4,	2015-01-16	2 year
Wisewave	Amplifier, Low Noise	ALN-22093530-01	12263-01	2016-05-16	1 year
AH Systems	18 - 40 GHz Preamplifier	PAM-1840VH	153	2016-12-01	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 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 Rudy Sun on 2017- 01-30 in 5 Meter Chamber 3

## 7.5 Test Results

30MHz – 20GHz

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC §24.238(a)	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
Low Channel										
101.37	50.88	239	200	H	-57.35	0.37	0	-57.72	-13	-44.72
51.53	55.28	194	103	V	-52.28	0.37	0	-52.65	-13	-39.65
3973.4	78.83	340	117	V	-25.59	1.5	10.53	-16.56	-13	-3.56
3973.4	71.77	337	141	H	-33.22	1.5	10.53	-24.19	-13	-11.19
Middle Channel										
101.37	50.62	239	200	H	-57.61	0.37	0	-57.98	-13	-44.98
51.53	54.69	194	103	V	-52.87	0.37	0	-53.24	-13	-40.24
4225.1	55.23	156	342	H	-54.39	1.53	10.795	-45.125	-13	-32.125
4225.1	56.12	149	114	V	-52.11	1.53	10.795	-42.845	-13	-29.845
High Channel										
101.37	50.11	239	200	H	-58.12	0.37	0	-58.49	-13	-45.49
51.53	55.03	194	103	V	-52.53	0.37	0	-52.9	-13	-39.9
4225.1	56.32	156	342	H	-53.3	1.53	10.795	-44.035	-13	-31.035
4225.1	56.18	149	114	V	-52.05	1.53	10.795	-42.785	-13	-29.785

## 8 FCC §2.1051 & §24.238 - Spurious Emissions at Antenna Terminals

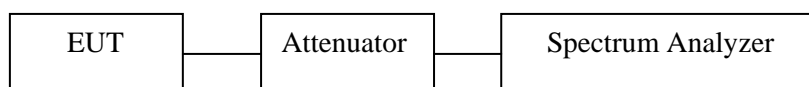
### 8.1 Applicable Standards

According to FCC §24.238 (a) 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 through sufficient attenuator.

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



### 8.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	20dB attenuator	-	-	Each time <sup>1</sup>	N/A

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

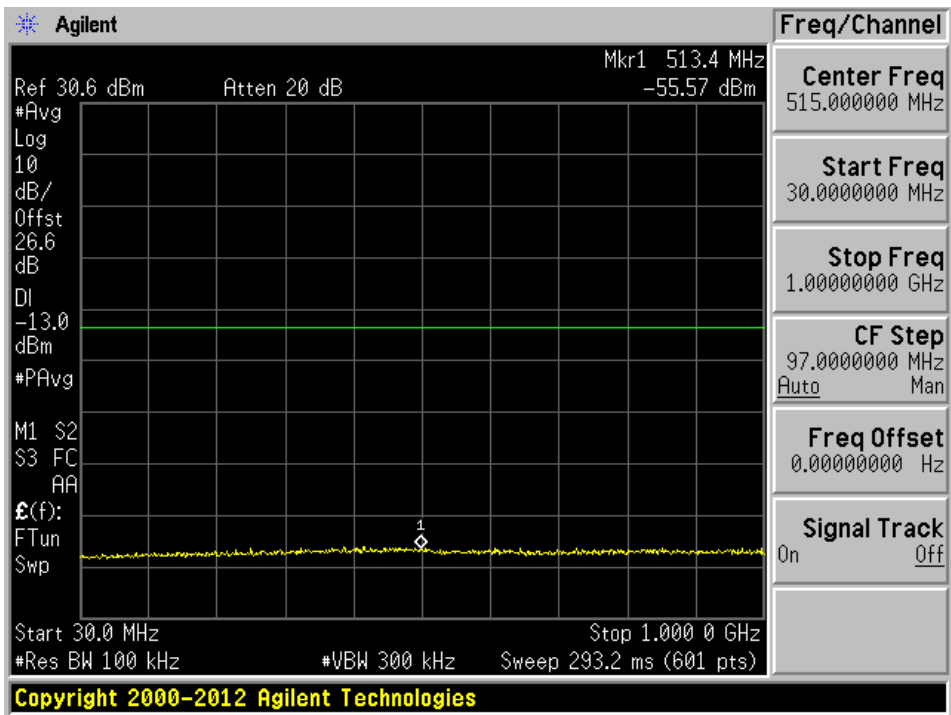
### 8.4 Test Environmental Conditions

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

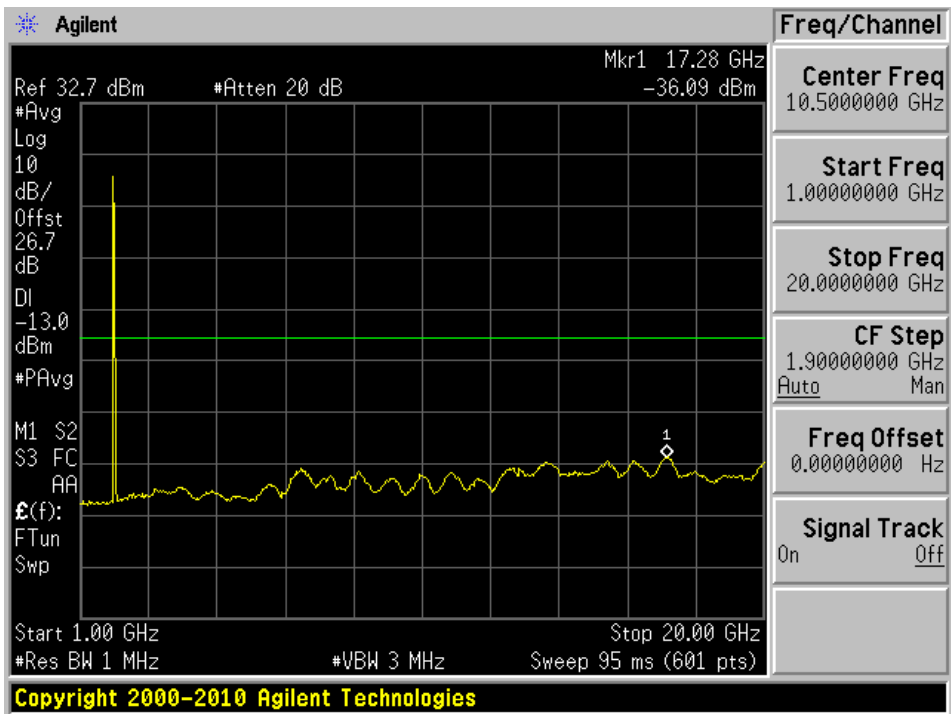
The testing was performed by Rudy Sun 2017-01-30 in the RF Site.

Low Channel: 1932.4 MHz

30 MHz – 1GHz

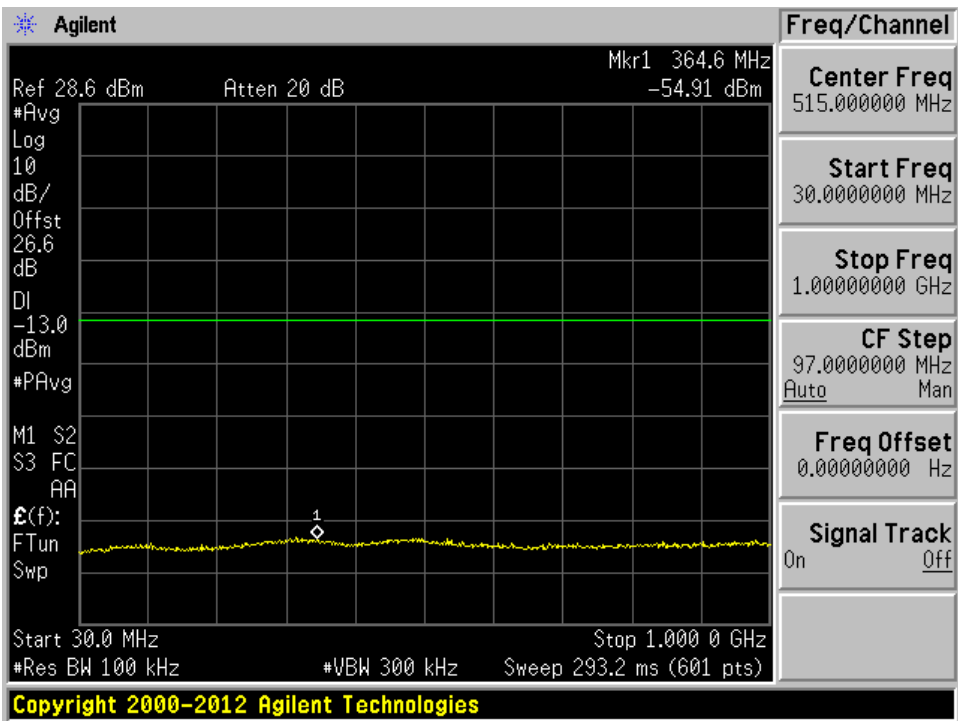


1 GHz – 20 GHz

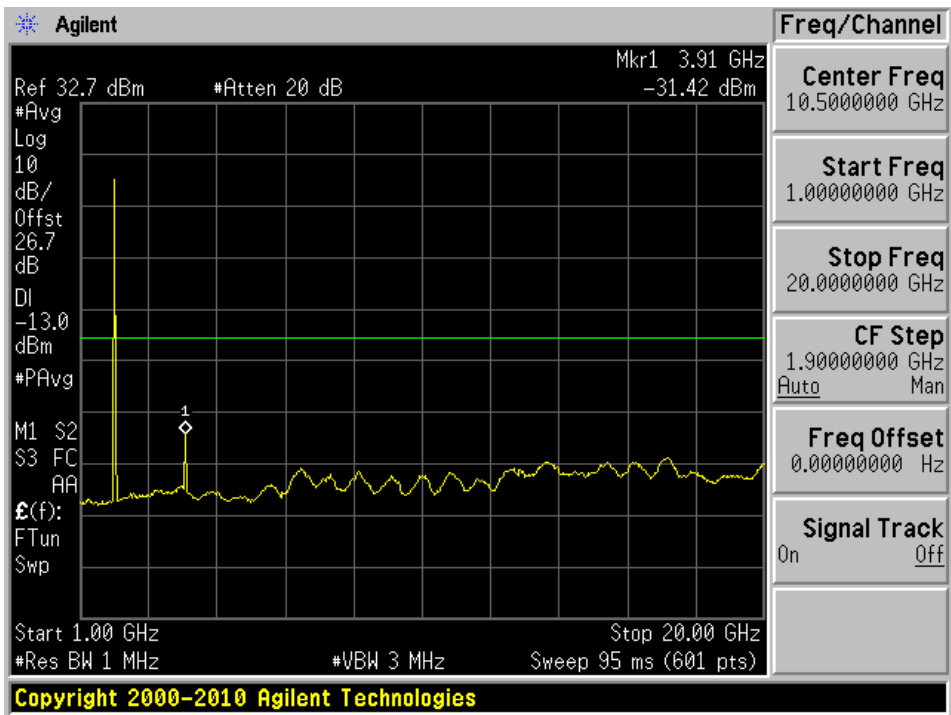


Middle Channel: 1960 MHz

30 MHz – 1 GHz

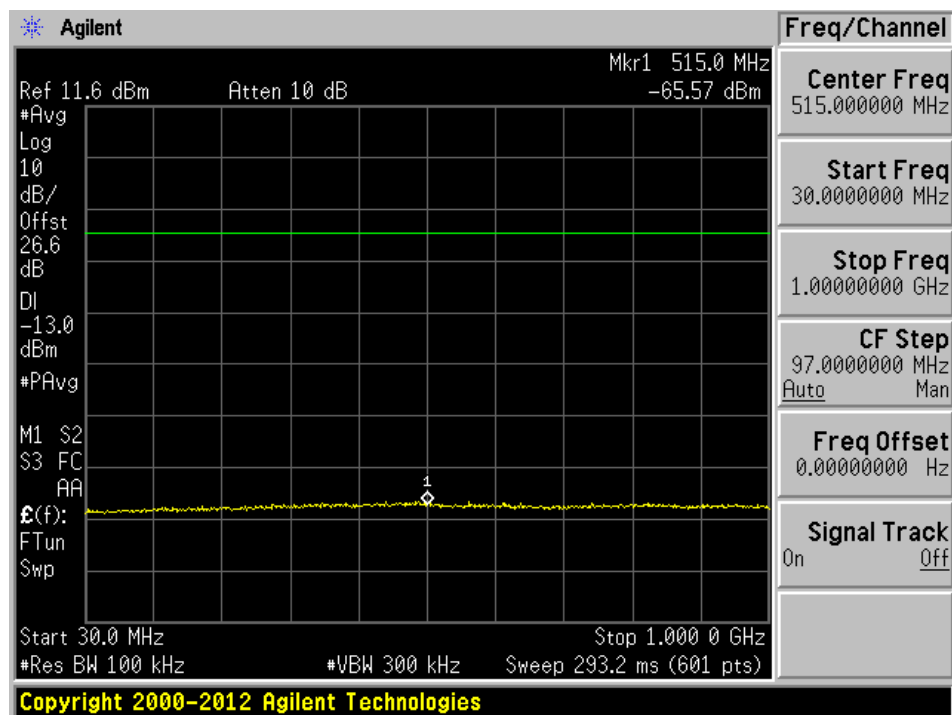


1 GHz – 20 GHz

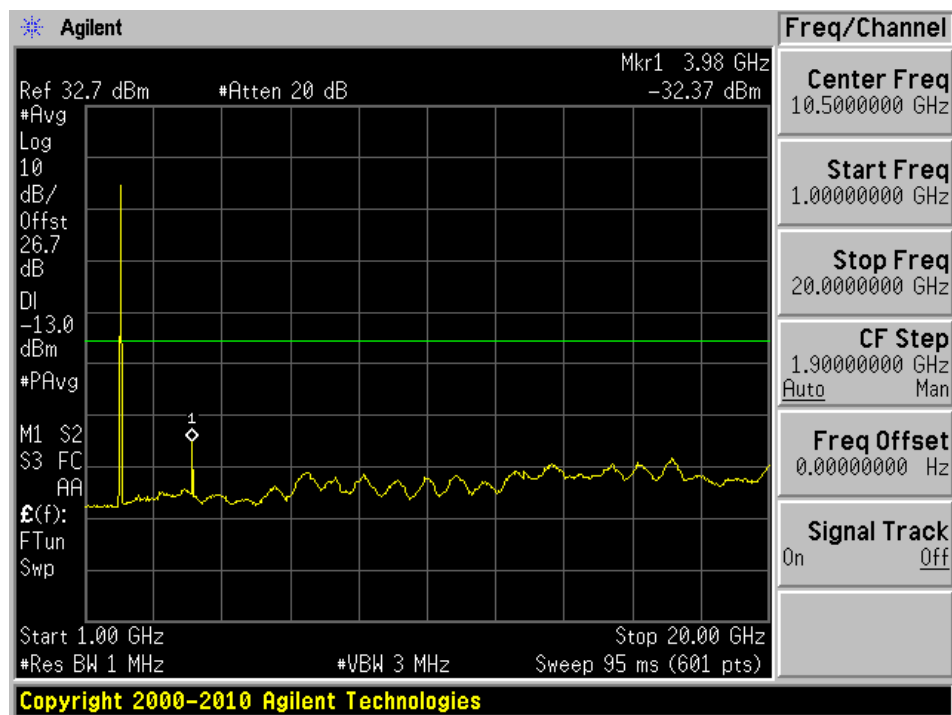


High Channel: 1987.6 MHz

30 MHz – 1 GHz



1 GHz – 20 GHz



## 9 FCC §24.238 - Band Edge

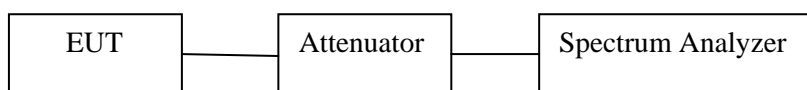
### 9.1 Applicable Standards

According to FCC §24.238 (a) 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 through sufficient attenuation.

The center frequency of the spectrum analyzer was set to block edge frequency.



### 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
-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	26dB attenuator	-	-	Each time <sup>1</sup>	N/A

*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

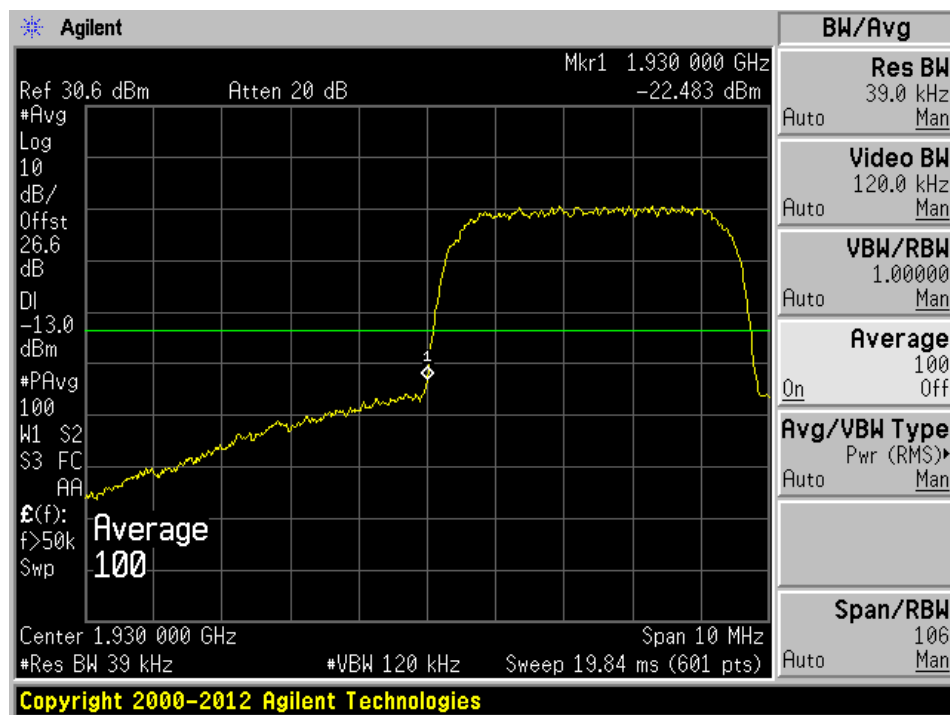
*The testing was performed by Rudy Sun 2017-01-30 in the RF Site.*



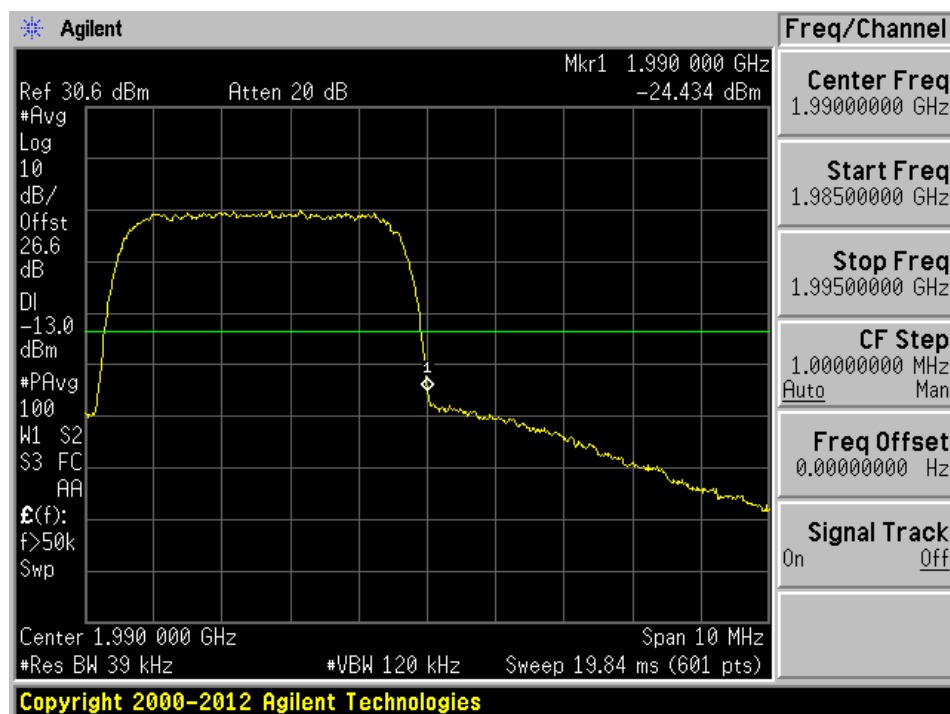
## 9.5 Test Results

Please refer to the following plots.

Lower Band Edge



Upper Band Edge



## 10 FCC §2.1055 & §24.235– Frequency Stability

### 10.1 Applicable Standard

According to FCC §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### 10.2 Test Procedure

Frequency Stability vs. Temperature: the equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency stability vs. voltage: for hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by manufacturer.

### 10.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	20dB attenuator	-	-	Each time <sup>1</sup>	N/A
Espec	Chamber, Humidity	ESL-4CA	18010	2016-02-24	1 year
KEPCO	Source, DC	25-10M	H1334526	N/A	N/A
Fluke	Multimeter	287	11820006	2016-04-05	1 year

**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

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

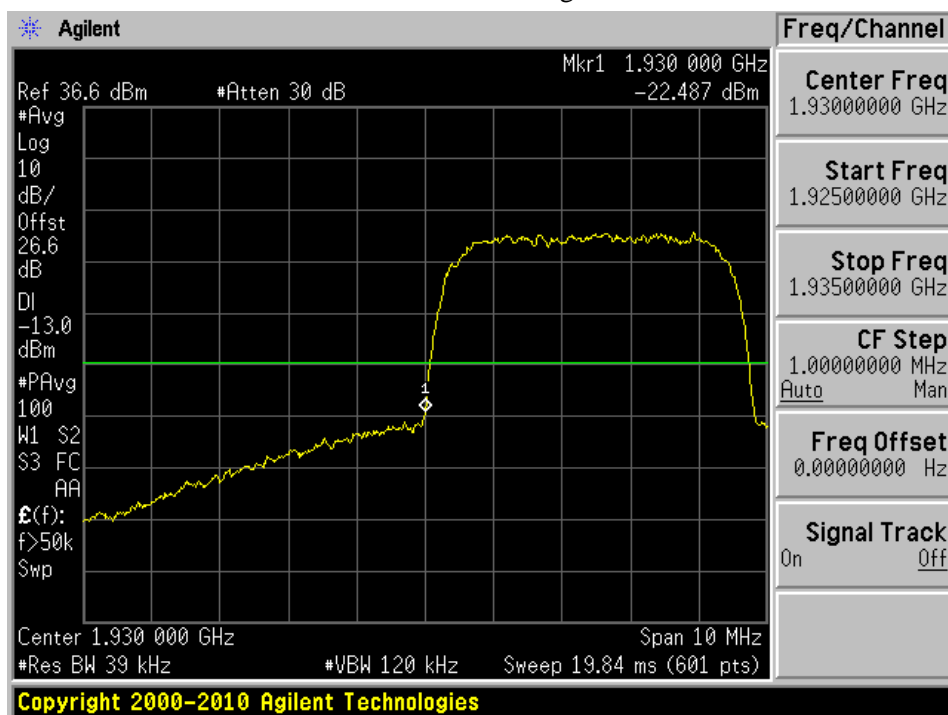
*The testing was performed by Rudy Sun on 2017-01-30 in the RF Site.*

## 10.5 Test Results

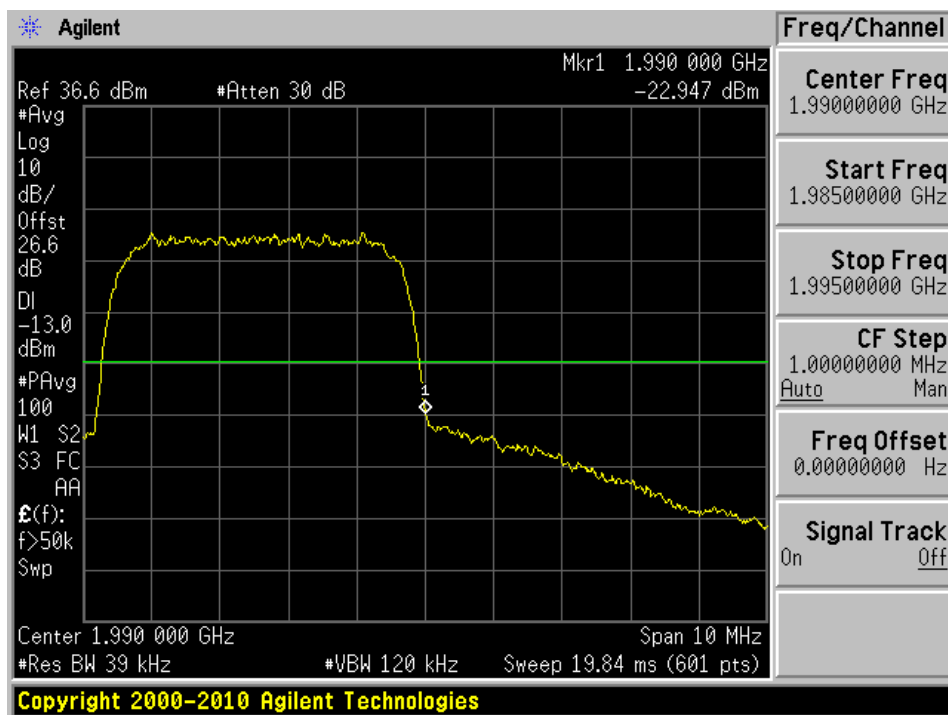
Please refer the following plots:

**-15 ° C and 12 VDC**

Lower Band Edge

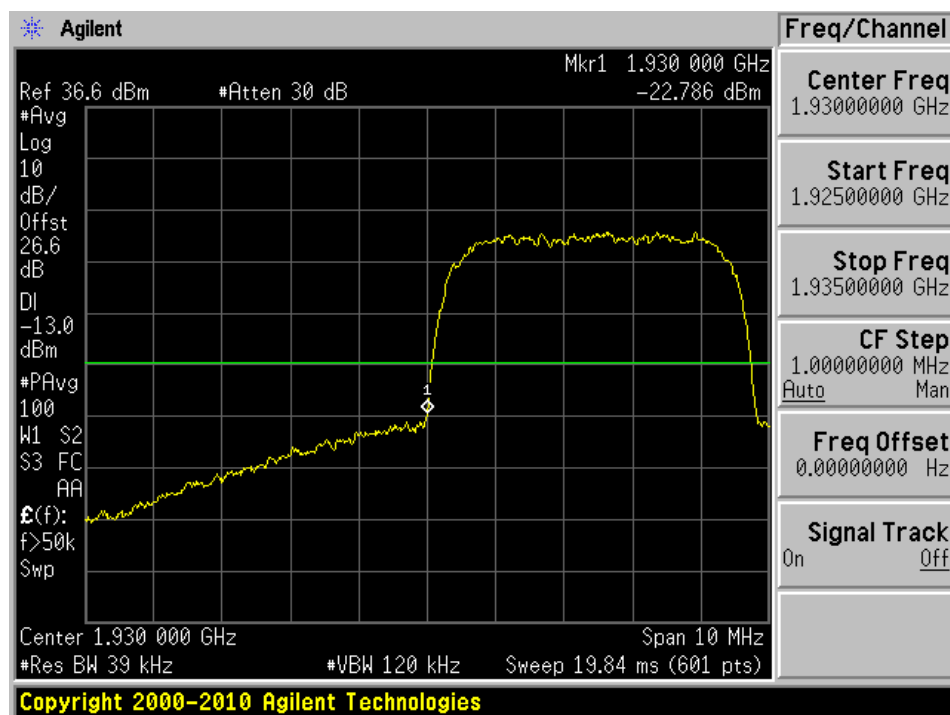


Upper Band Edge

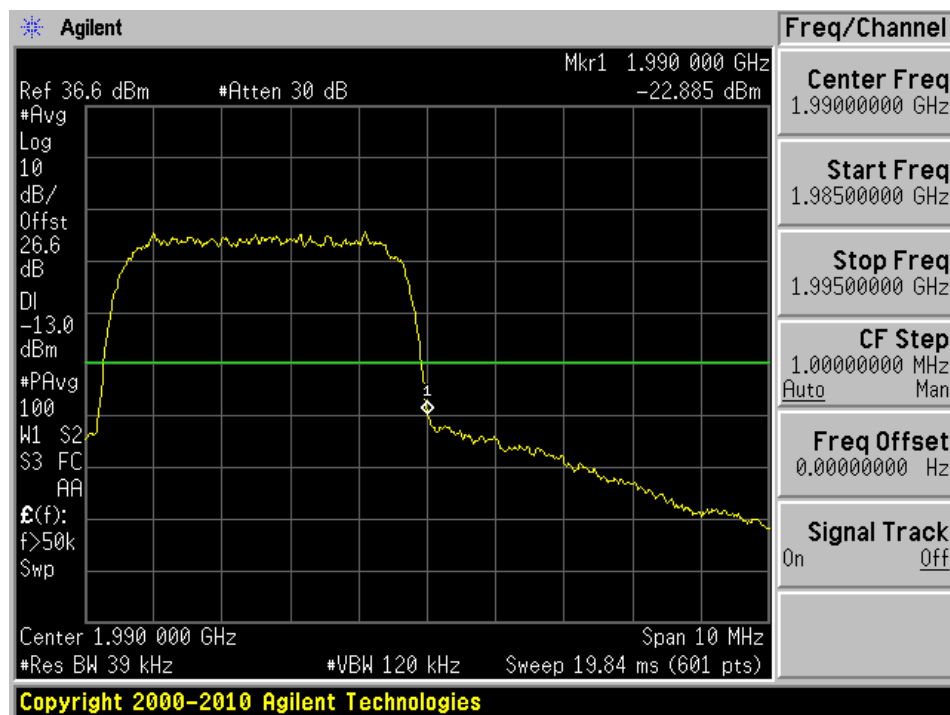


**-10 ° C and 12 VDC**

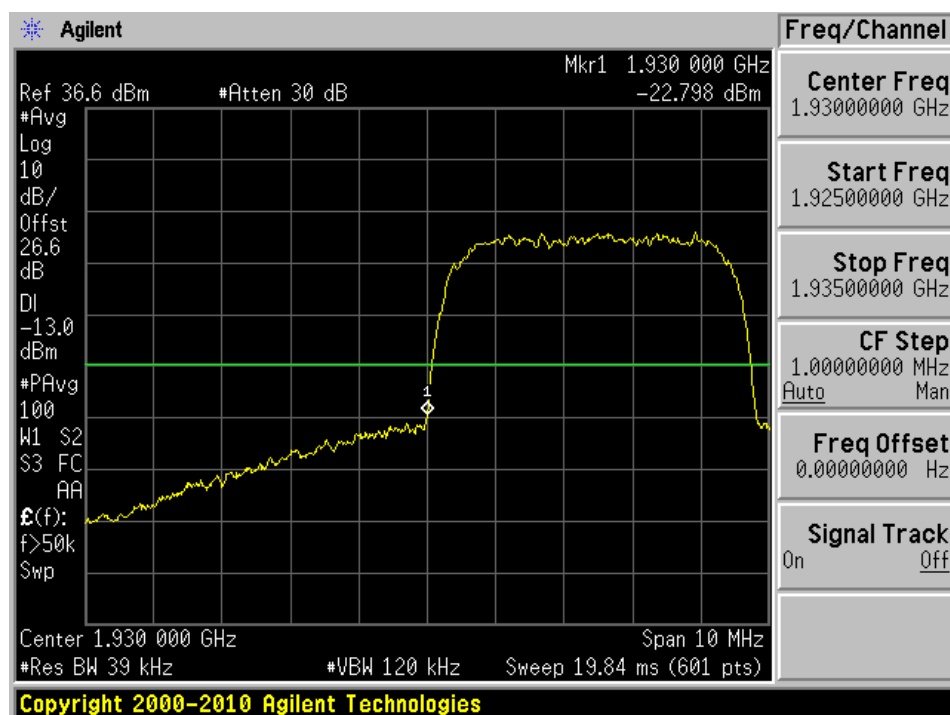
Lower Band Edge



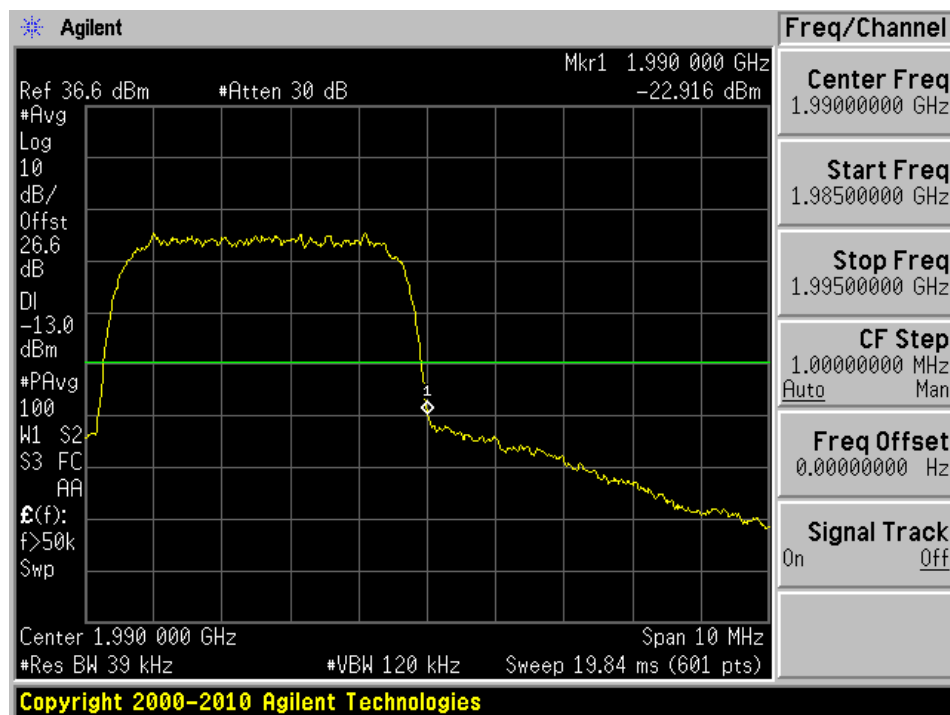
Upper Band Edge



0 ° C and 12 VDC  
Lower Band Edge

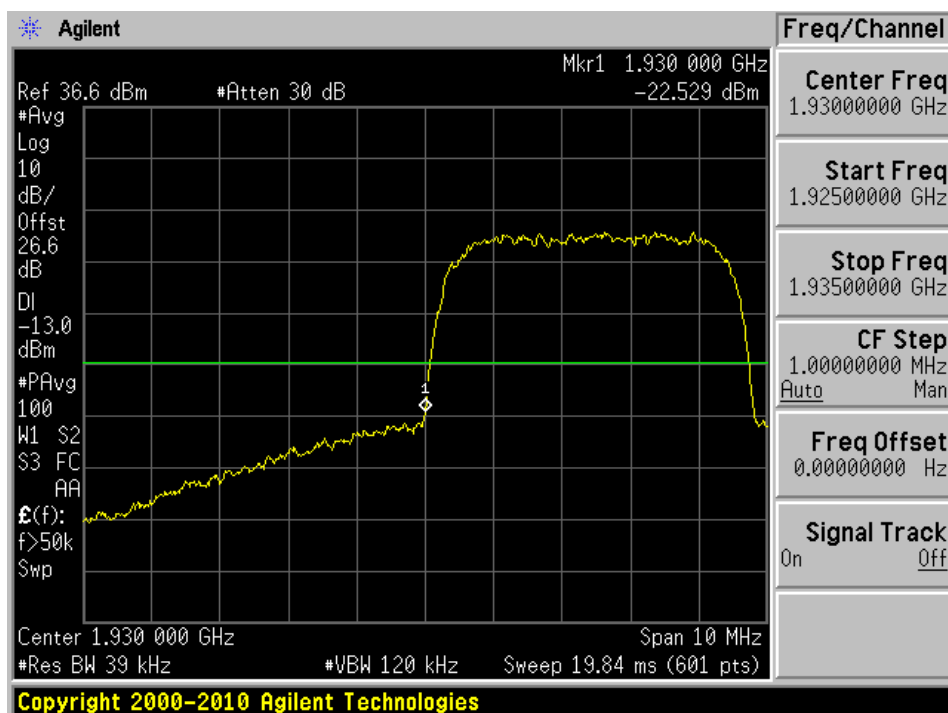


Upper Band Edge

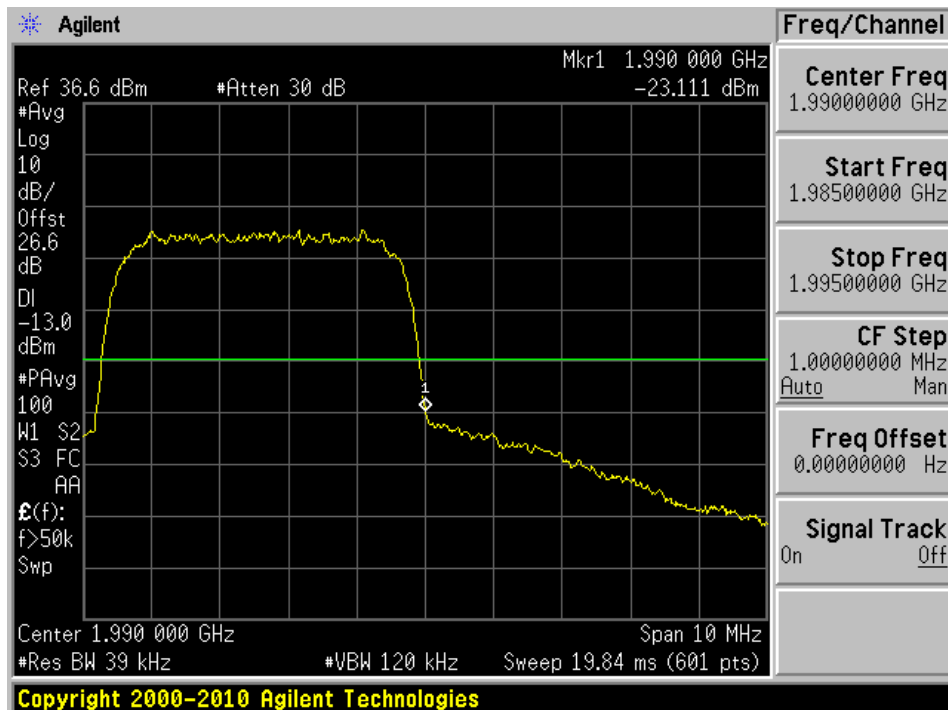


## 10 ° C and 12 VDC

## Lower Band Edge

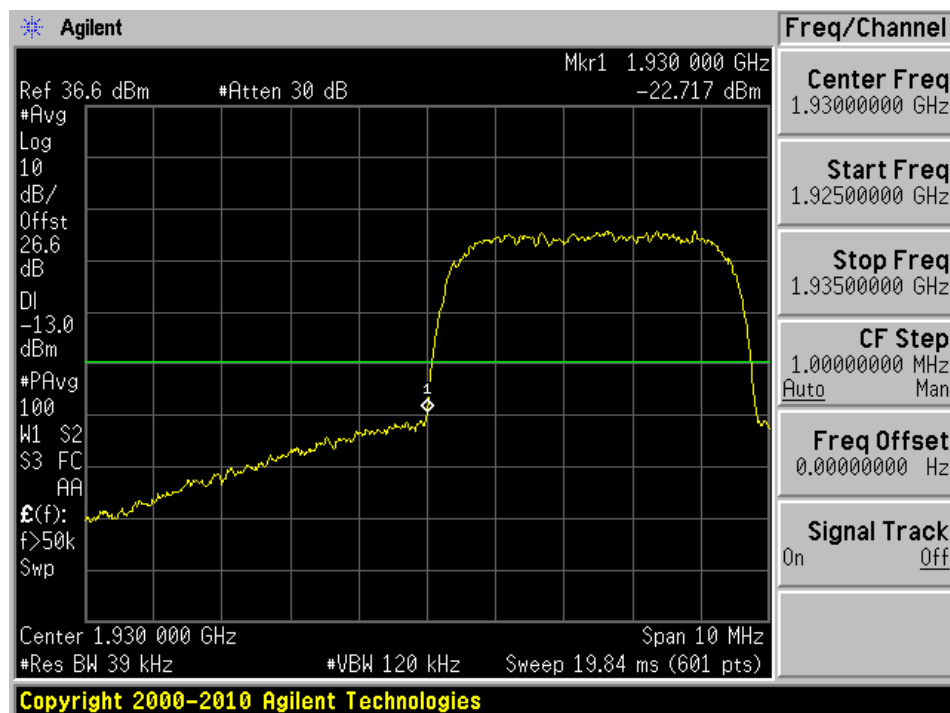


## Upper Band Edge

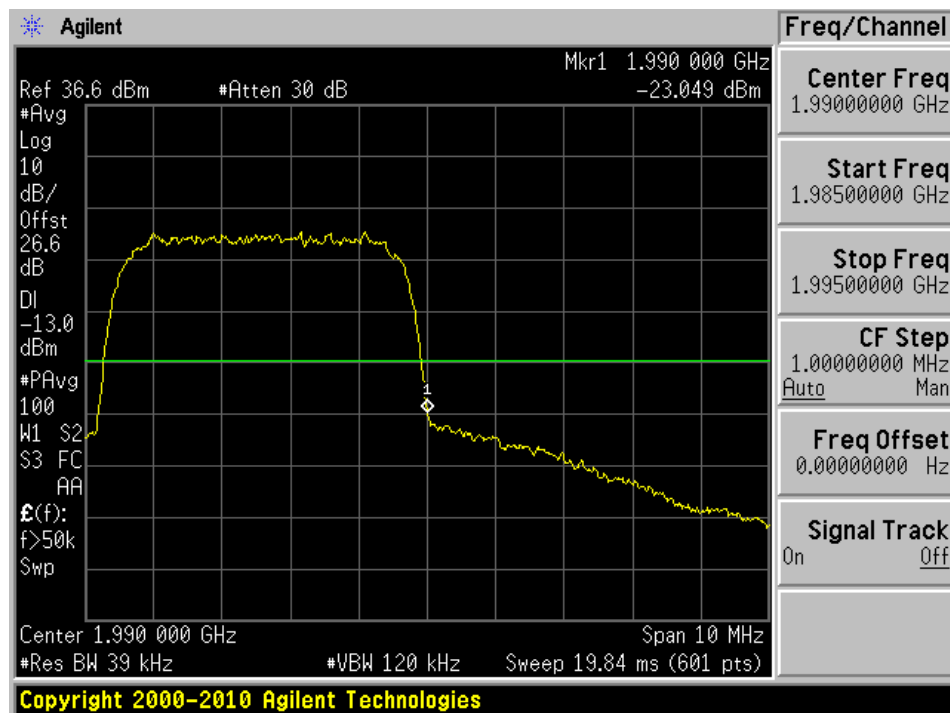


20 ° C and 12 VDC

Lower Band Edge

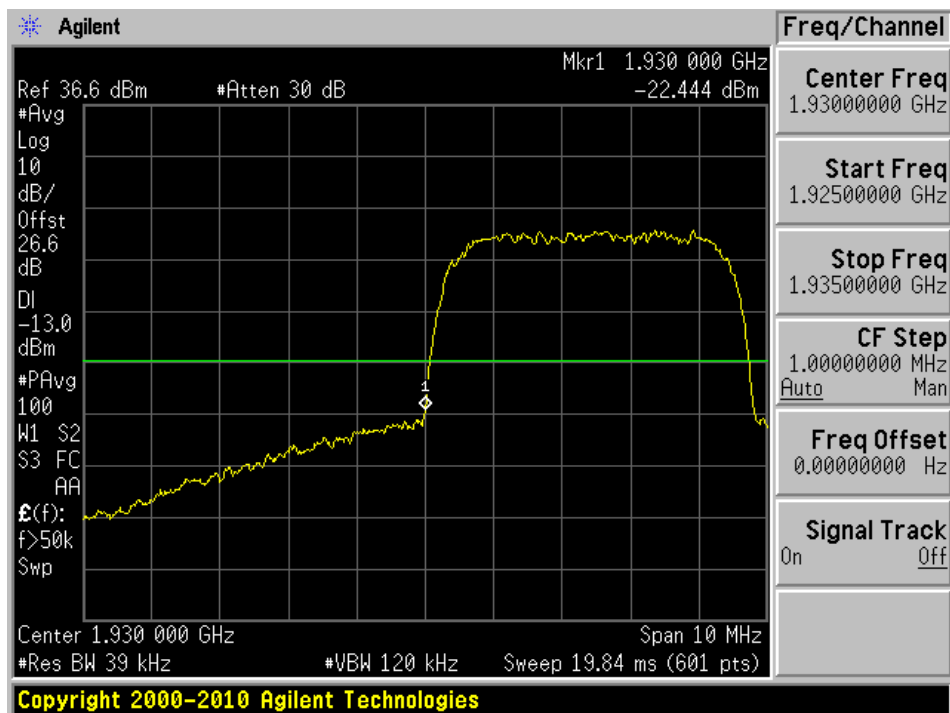


Upper Band Edge

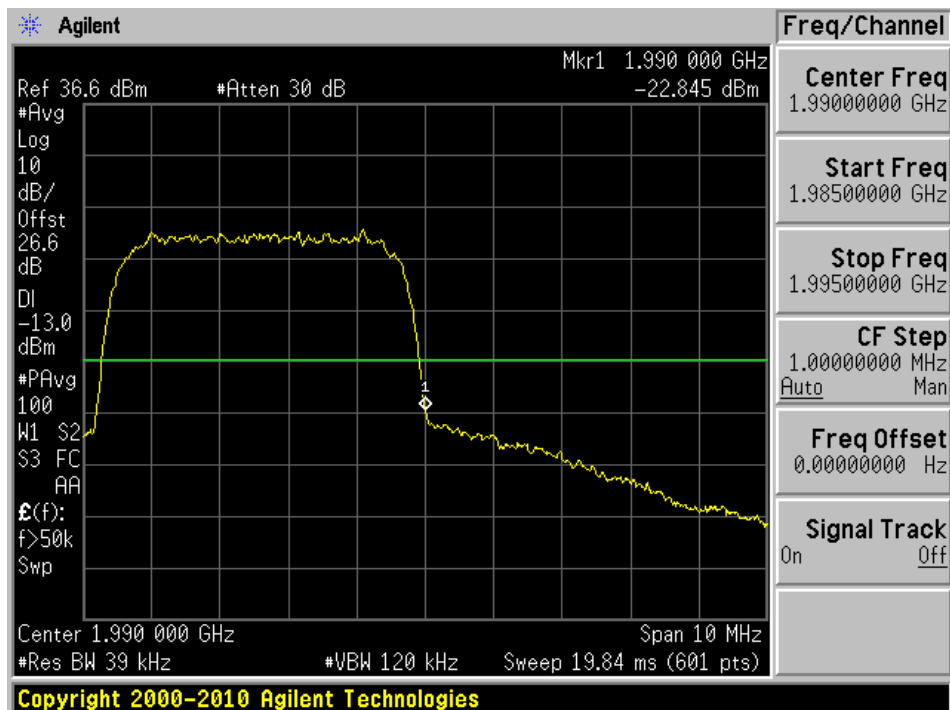


## 30 ° C and 12 VDC

## Lower Band Edge



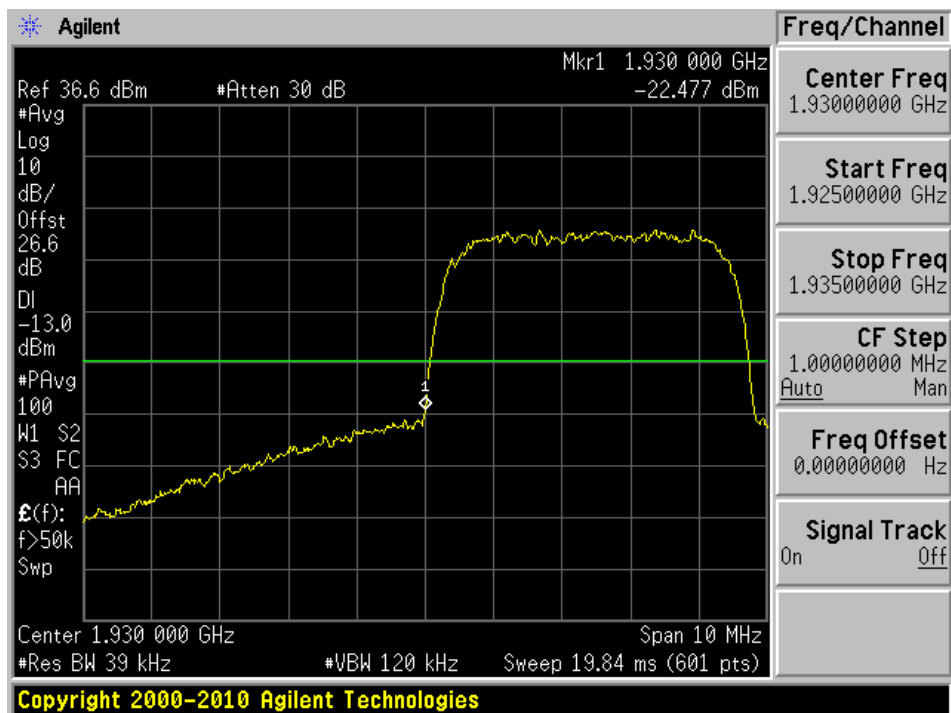
## Upper Band Edge



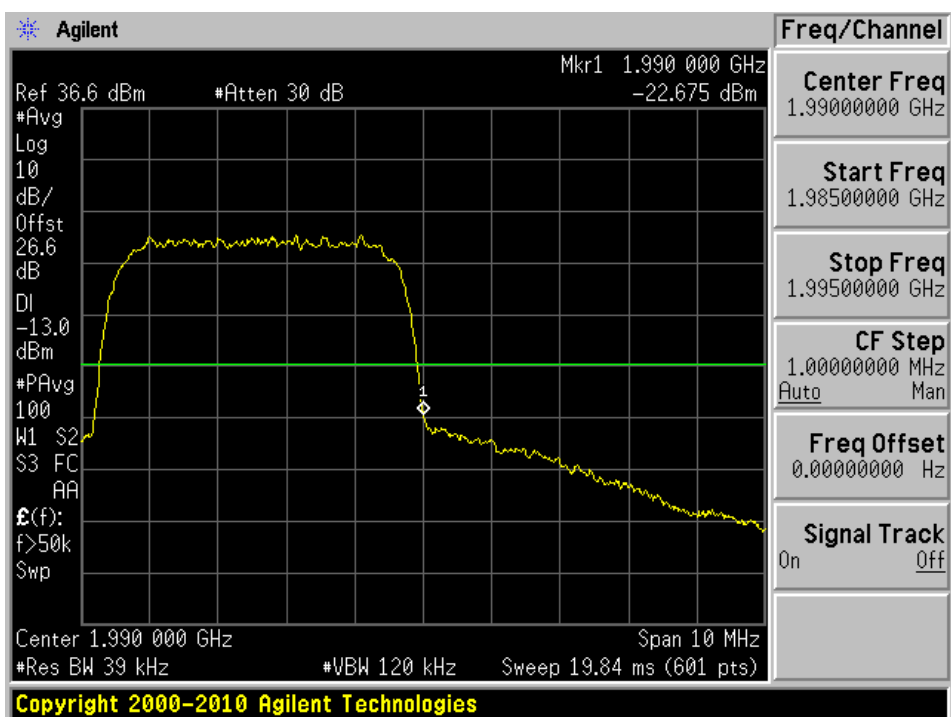


## 40 ° C and 12 VDC

## Lower Band Edge

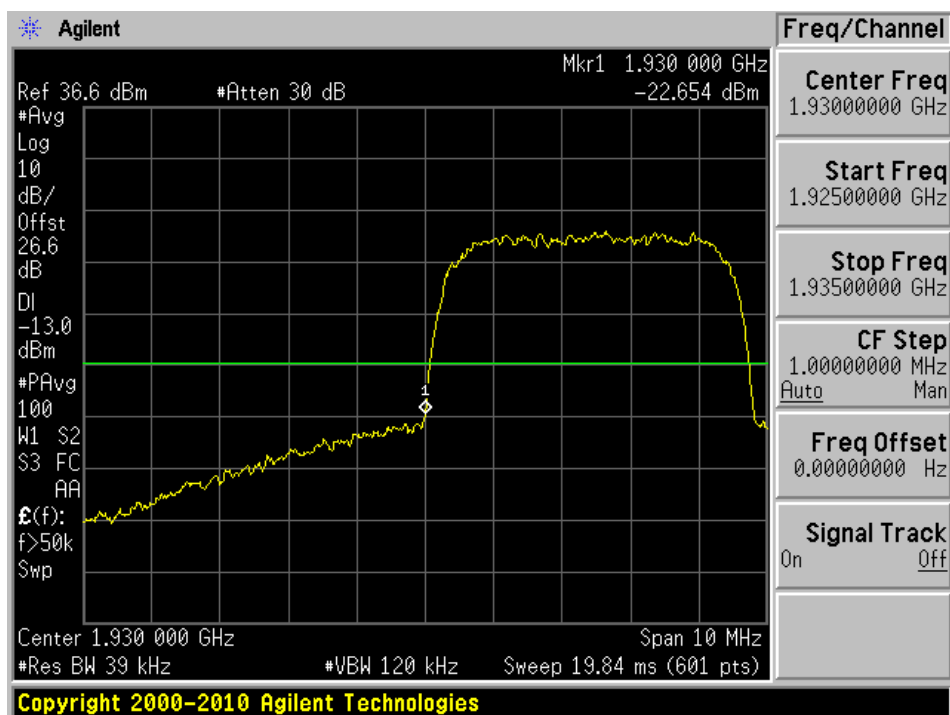


## Upper Band Edge

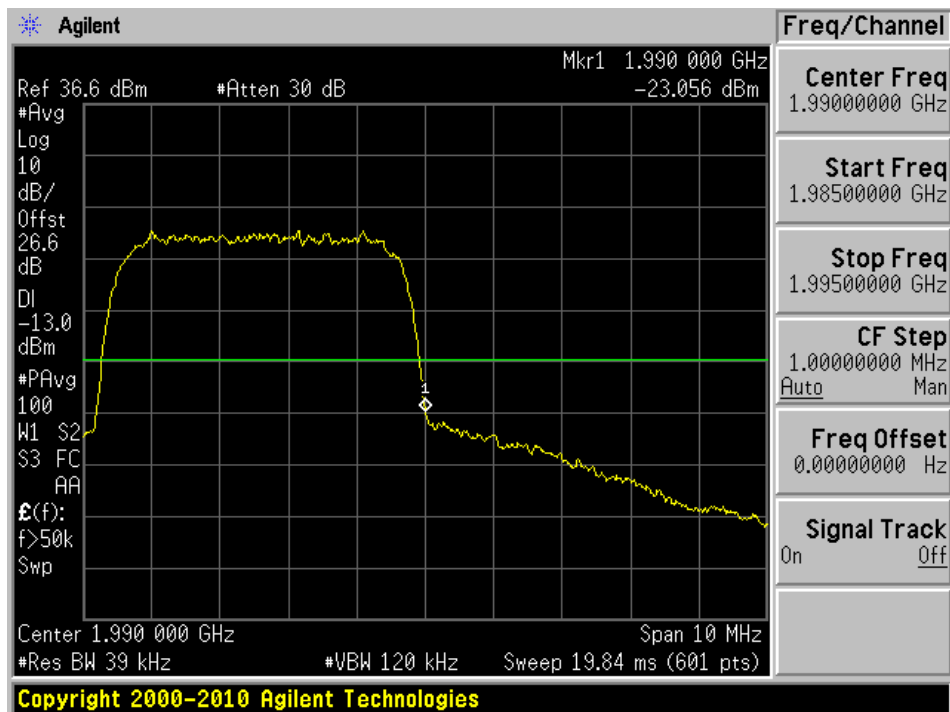


20 ° C and 10.2 VDC

Lower Band Edge

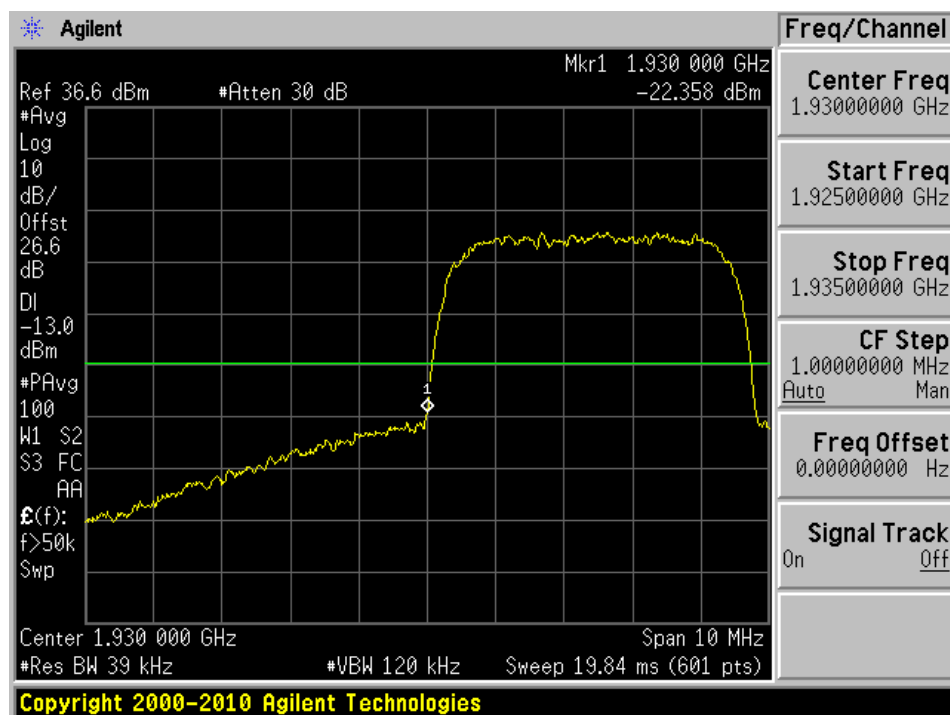


Upper Band Edge

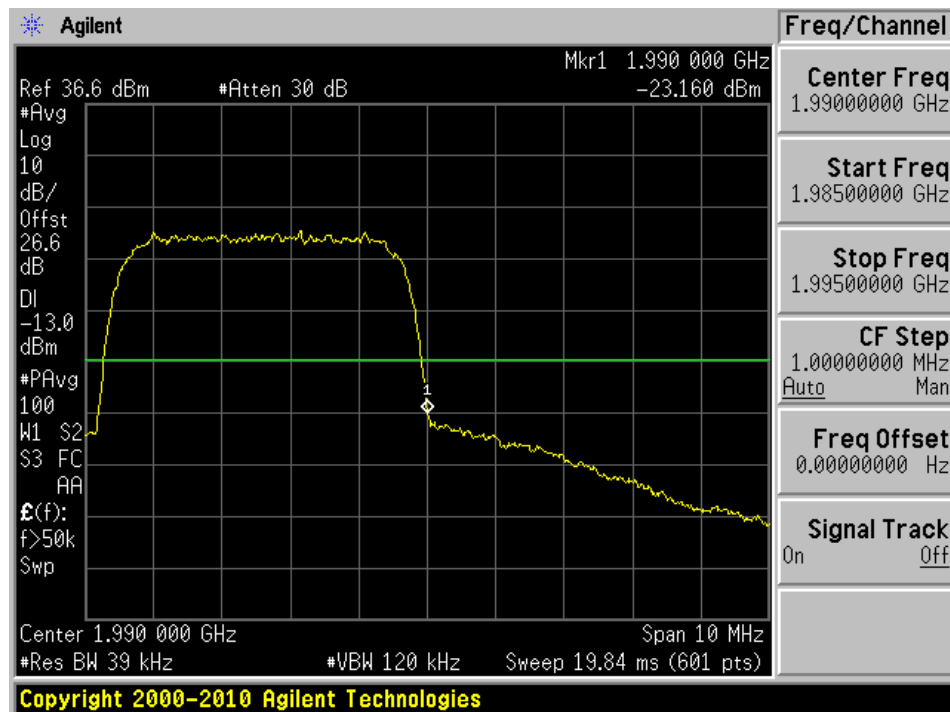


20 ° C and 13.8 VDC

Lower Band Edge



Upper Band Edge



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