



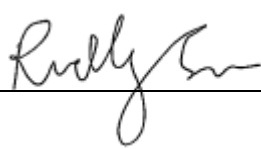
FCC PART 74 SUBPART H TEST AND MEASUREMENT REPORT

For

Lectrosonics, Inc.

581 Laser Road NE Rio Rancho, NM 87124, USA

FCC ID: DBZSSMB2

Report Type: Original Report	Product Type: Digital Hybrid Wireless Micro Transmitter
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Report Number: R1702023-74	
Report Date: 2017-07-19	
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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 "*" (Rev.3)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1702023-74	Original Report	2017-06-19
1	R1702023-74	Updated comment	2017-06-28
2	R1702023-74	Updated comment	2017-07-19

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *Lectrosonics, Inc.* and their product model: *SSM-B2, FCC ID: DBZSSMB2* which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a Digital Hybrid Wireless Micro Transmitter. The EUT operates in the frequency range: 563.2-607.9 MHz and 614.1-639.975 MHz.

1.2 Mechanical Description of EUT

The EUT measures approximately 6.6 cm (L) x 3.2 cm (W) x 2.1 cm (H) and weighs approximately 0.211 kg.

The data gathered are from a typical production sample provided by the manufacturer with serial number: 2062

1.3 Objective

The following type approved report is prepared on behalf of *Lectrosonics, Inc.* in accordance with Part 74, Subparts H of the Federal Communications Commission rules.

The objective is to determine compliance with Part 74 of the FCC Rules, limits for RF output power, Modulation characteristics, Emission bandwidth, Field strength of spurious radiation and Frequency stability for license-exempt, low-power radio apparatus operating in the television bands.

1.4 Related Submittal(s)/Grant(s)

NA

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with TIA 603-D Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

All tests were performed at Bay Area Compliance Laboratories Corp.

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 Registrations

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

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

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

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

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02), 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

- - For the USA (Federal Communications Commission):

- 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
- 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
- 3- All Telephone Terminal Equipment within FCC Scope C.

- For the Canada (Industry Canada):

- 1- All Scope 1-Licence-Exempt Radio Frequency Devices;
- 2- All Scope 2-Licensed Personal Mobile Radio Services;
- 3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
- 4- All Scope 4-Licensed Maritime & Aviation Radio Services;
- 5- All Scope 5-Licensed Fixed Microwave Radio Services
- 6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

For Singapore (Info-Communications Development Authority (IDA)):

- 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:

- 1 All Radio Equipment, per KHCA 10XX-series Specifications;
- 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
- 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.

- For Japan:

- 1 MIC Telecommunication Business Law (Terminal Equipment):
 - All Scope A1 - Terminal Equipment for the Purpose of Calls;
 - All Scope A2 - Other Terminal Equipment
- 2 Radio Law (Radio Equipment):
 - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
 - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
 - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01) to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

- 1 Electronics and Office Equipment:
 - for Telephony (ver. 3.0)
 - for Audio/Video (ver. 3.0)
 - for Battery Charging Systems (ver. 1.1)
 - for Set-top Boxes & Cable Boxes (ver. 4.1)
 - for Televisions (ver. 6.1)
 - for Computers (ver. 6.0)
 - for Displays (ver. 6.0)
 - for Imaging Equipment (ver. 2.0)
 - for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
 - for Commercial Dishwashers (ver. 2.0)
 - for Commercial Ice Machines (ver. 2.0)
 - for Commercial Ovens (ver. 2.1)
 - for Commercial Refrigerators and Freezers
- 3 Lighting Products
 - For Decorative Light Strings (ver. 1.5)
 - For Luminaires (including sub-components) and Lamps (ver. 1.2)
 - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
 - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products

- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)
- 5 Other
 - For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - 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/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
 - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter
- USA:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o Telecommunications Certification Body (TCB) – US FCC;
 - o Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 EUT Test Configuration

2.1 Justification

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

2.2 EUT Exercise Software

N/A

2.3 Special Equipment

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

The device is equipped with integrated antenna. However, the test sample provided by client was modified to make SMA antenna port available for testing purpose.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Lenovo	Laptop	0679	CB08585694

2.6 Interface Ports and Cables

Cable Description	Length(m)	To	From
RF Cable	<1.0	PSA	EUT
Dynamic mic level adapter	<1.0	EUT	Mini Microphone

3 Summary of Test Results

FCC Rules	Descriptions of Test	Result (s)
FCC §2.1093	RF Exposure	Compliant ¹
FCC §74.861(e)(1)	RF output power	Compliant
FCC §74.861(e)(3)	Modulation characteristics	Compliant
FCC §74.861(e)(5)(6)	Emission bandwidth & Emission Mask	Compliant
FCC §74.861(e)(6)	Spurious radiation at the antenna port	Compliant
FCC §74.861(e)(6)	Field strength of spurious radiation	Compliant
FCC §74.861(e)(4)	Frequency stability	Compliant

Note¹: RF exposure analysis is covered in a separate report. Please refers to R1702023-SAR

4 FCC §2.1093 - RF Exposure

4.1 Applicable Standards

FCC §2.1093

4.2 Test Results

Please refer to the SAR Report: R1702023-SAR.

5 FCC §74.861 - RF Output Power

5.1 Applicable Standards

According to FCC §74.861 (e) (1): the power of the measured unmodulated carrier power at the output of the transmitter power amplifier (antenna input power) may not exceed the following:

- (i) 54-72, 76-88, and 174-216 MHz bands—50 mW
- (ii) 470-608 and 614-698 MHz bands—250 mW

5.2 Test Procedure

Connect the EUT to spectrum analyzer and set the spectrum analyzer as following:

- Center frequency: channel frequency under test
- RBW: 2 MHz
- VBW: 6 MHz
- Detector mode: peak
- Span: 5 MHz

Max hold the trace and record the peak value once the trace stabilized.

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2016-06-10	1 year
Mini Circuits	Precision Fixed Attenuator, 20 dB	BW-S20W5+	-	-	N/A
UTiFLEX	SMA Cable	64639	218625006	2016-06-09	1 year

Cable and attenuator included in the test set-up were checked each time before testing.

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 09 June 2016) “A2LA Policy on Metrological Traceability”.*

5.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	43 %
ATM Pressure:	101.2 kPa

The testing was performed by Rudy Sun on 2017-02-17 at RF site.

5.5 Test Results

Conducted output power:

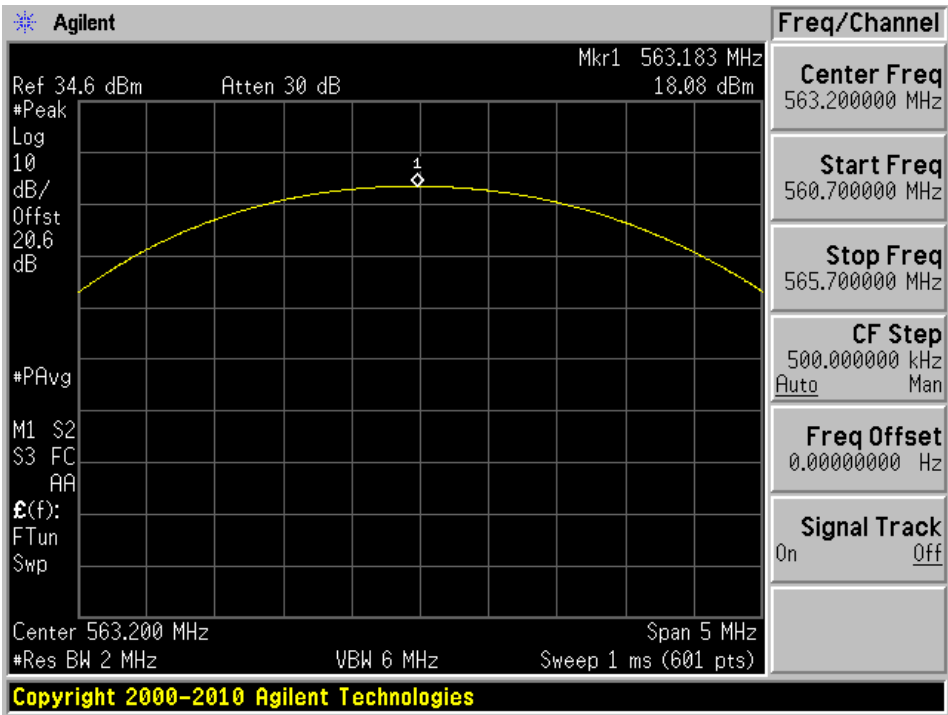
563.2 – 607.9 MHz band

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limits (dBm)	Margin (dB)	Rated Power (mW/dBm)
Low	563.2	18.08	24	-5.92	50/17
		15.14	24	-8.86	25/14
Middle	585.6	17.89	24	-6.11	50/17
		15.18	24	-8.82	25/14
High	607.9	17.95	24	-6.05	50/17
		14.8	24	-9.2	25/14

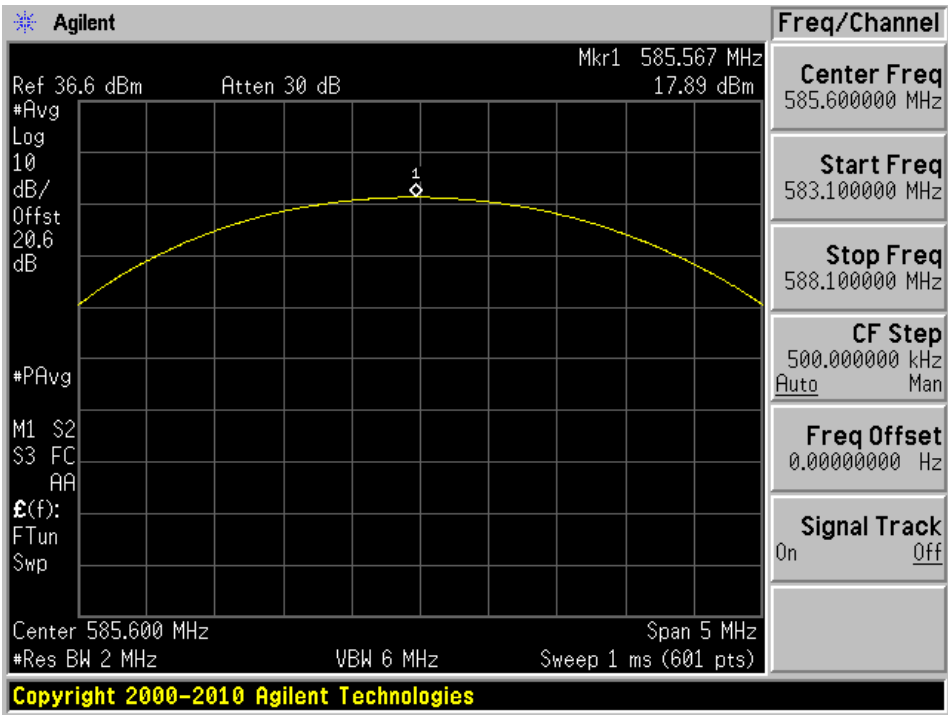
Please refer to the following plots for detailed test results

50 mW Power Setting:

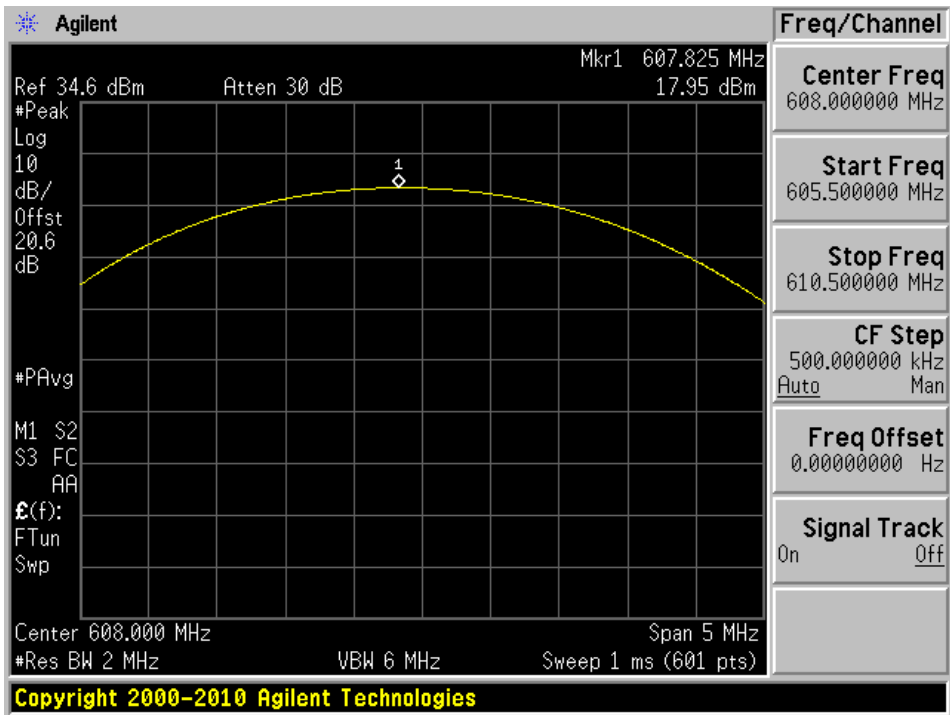
Low Channel



Middle Channel

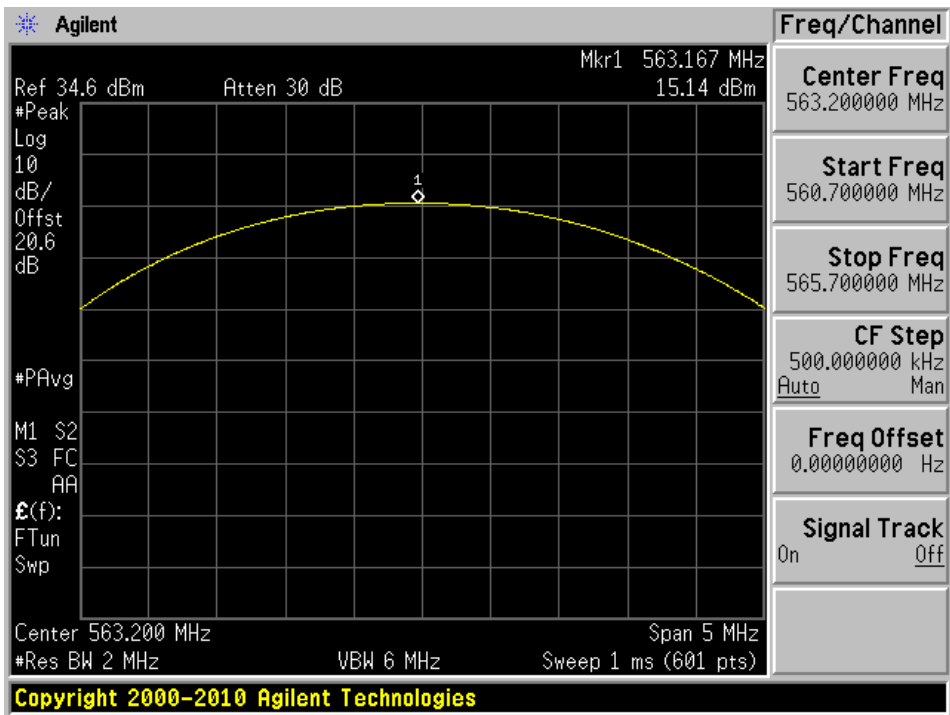


High Channel

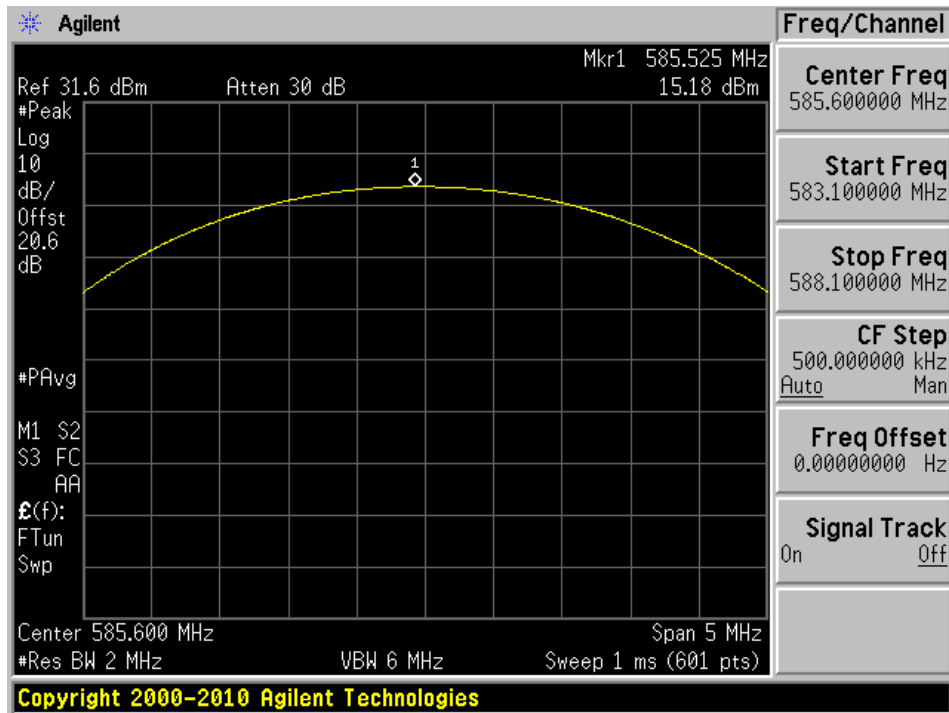


25 mW Power Setting:

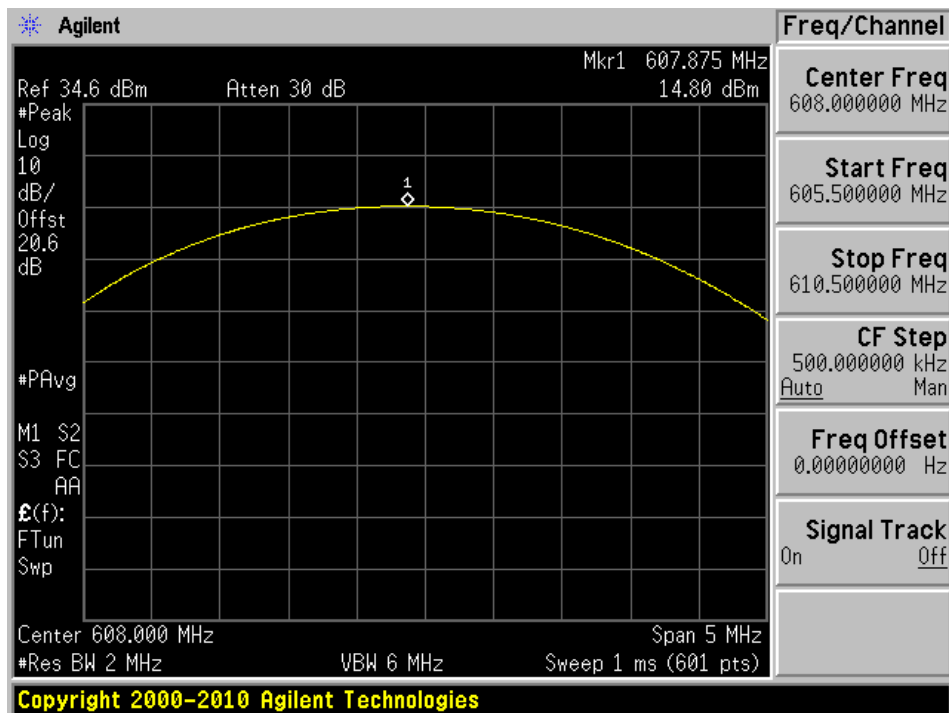
Low Channel



Middle Channel



High Channel



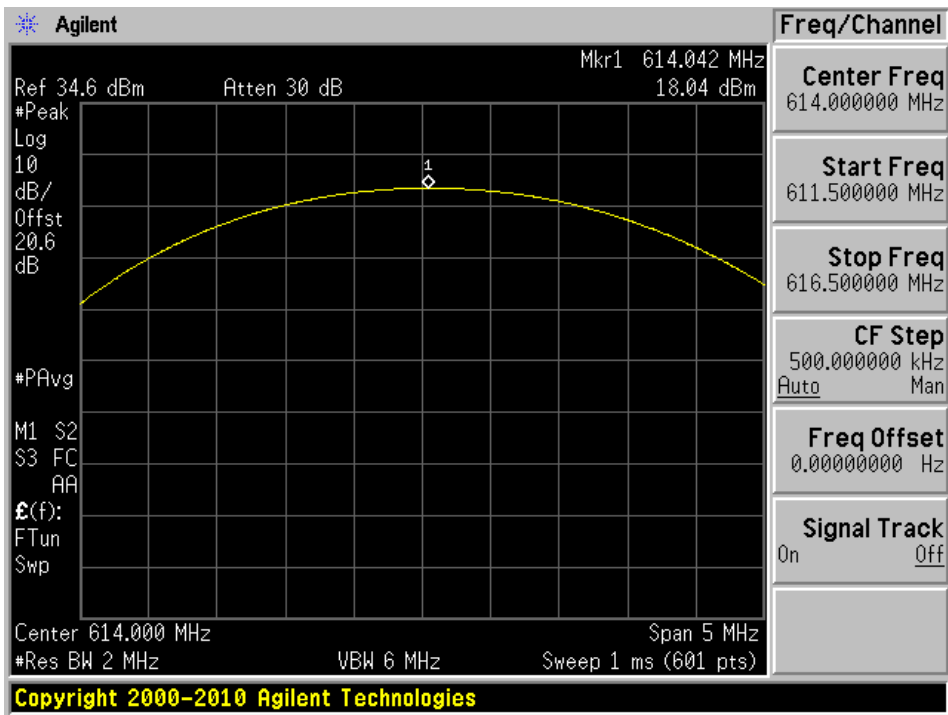
614.1- 639.975 MHz band

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limits (dBm)	Margin (dB)	Rated Power (mW/dBm)
Low	614.1	18.04	24	-5.96	50/17
		14.94	24	-9.06	25/14
Middle	626.95	17.88	24	-6.12	50/17
		14.75	24	-9.25	25/14
High	639.975	16.76	24	-7.24	50/17
		14.08	24	-9.92	25/14

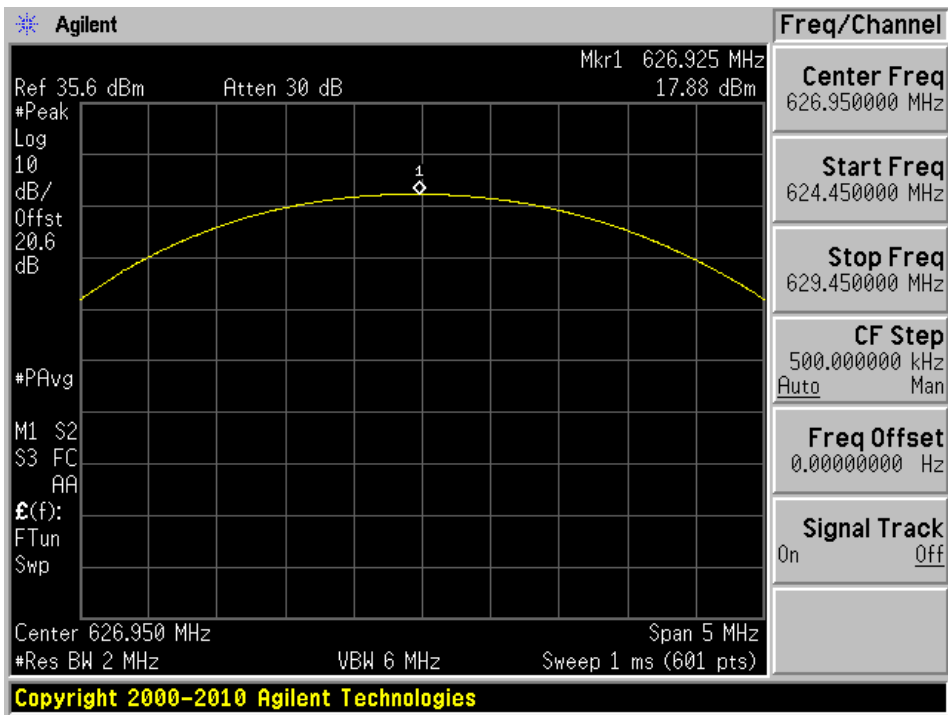
Please refer to the following plots for detailed test results

50 mW Power Setting:

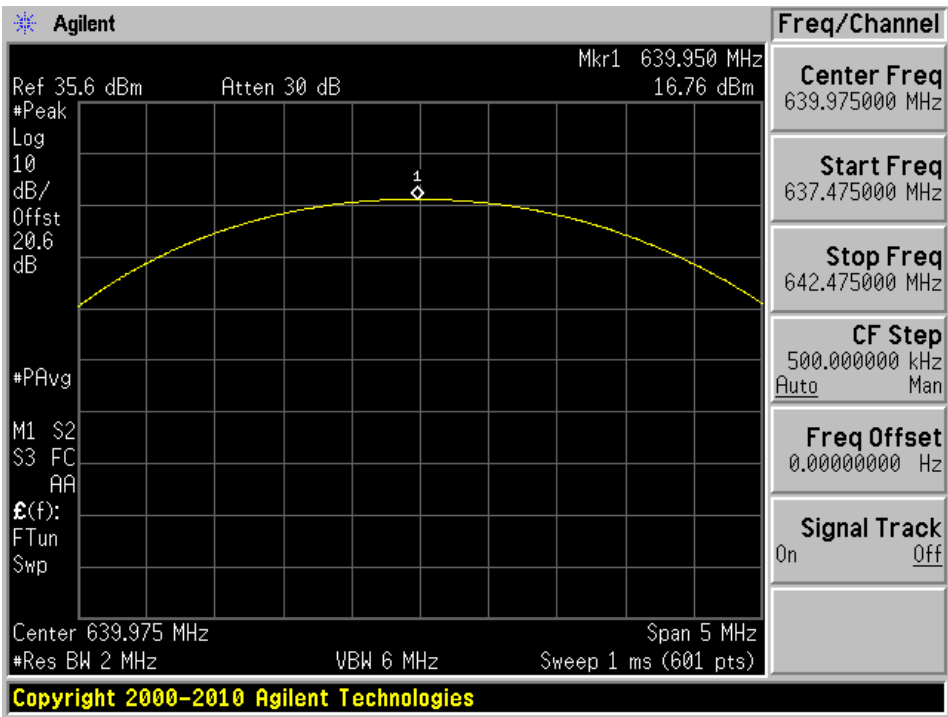
Low Channel



Middle Channel

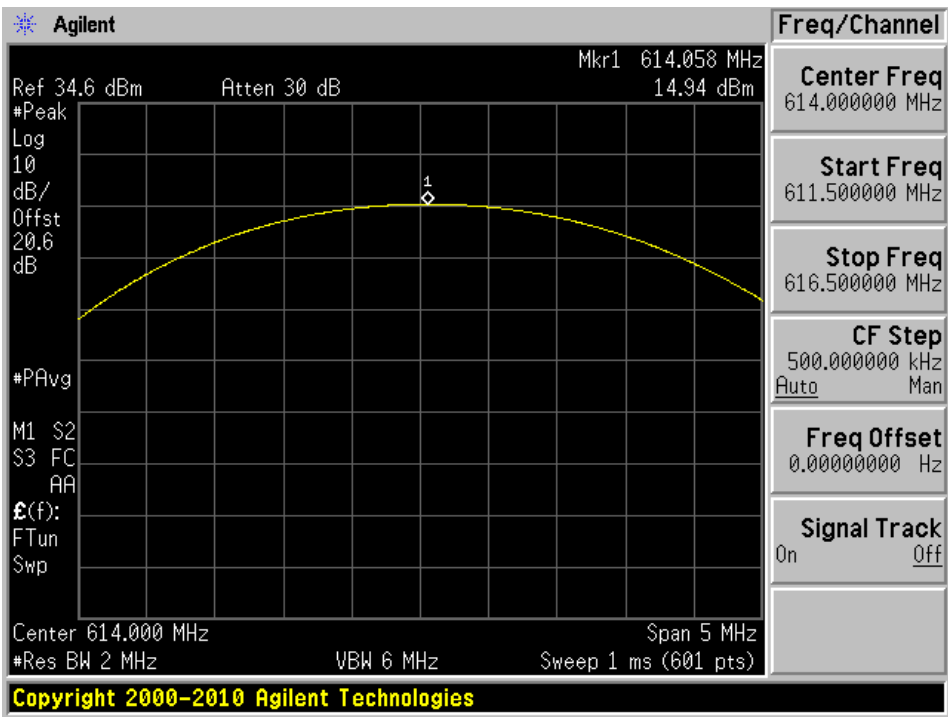


High Channel

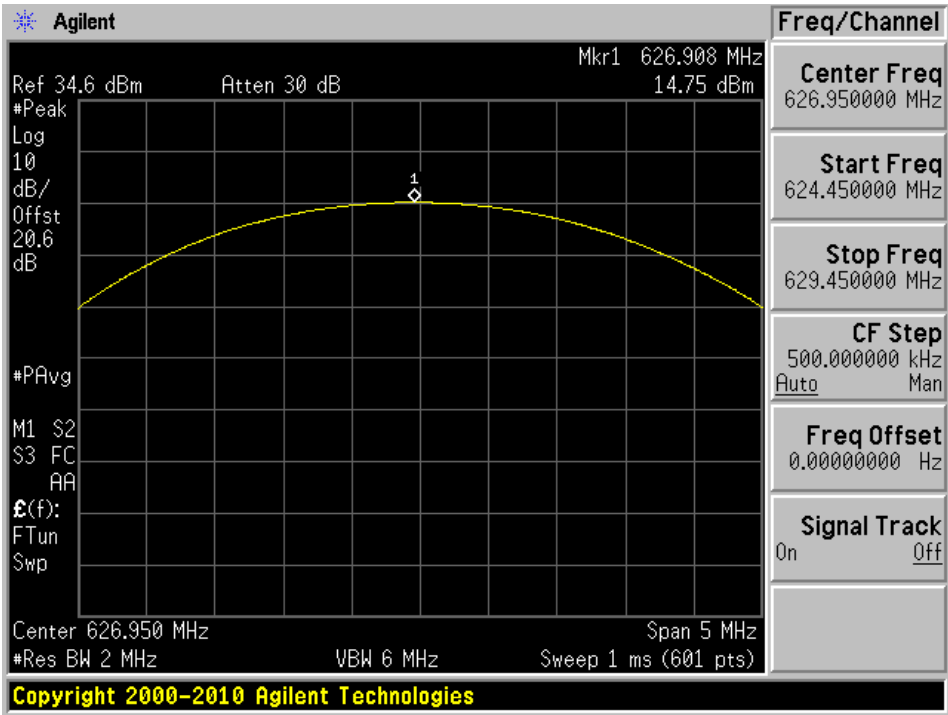


25 mW Power Setting:

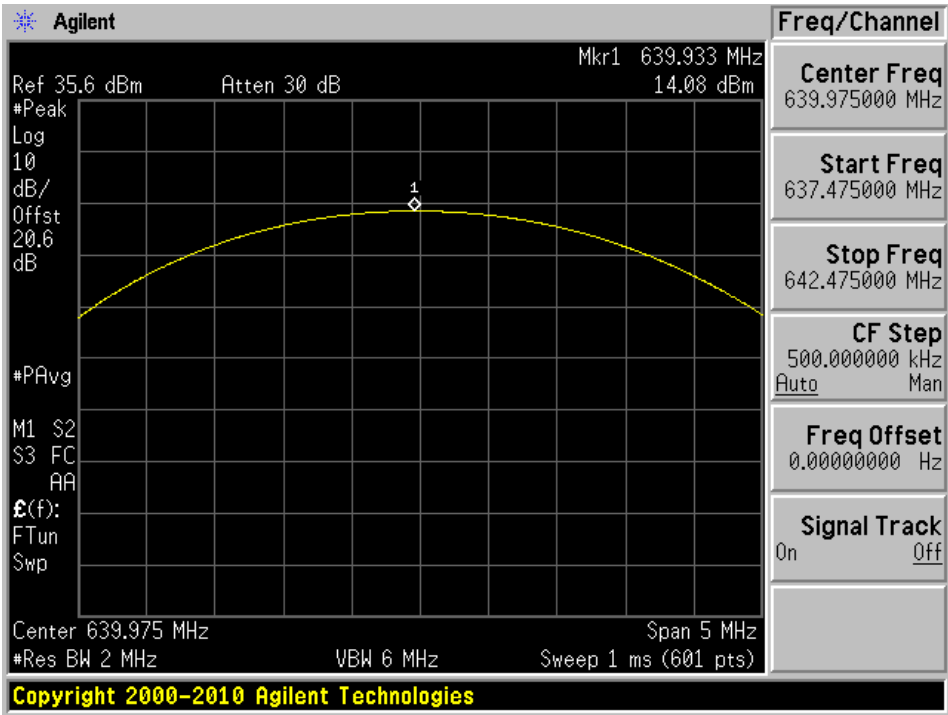
Low Channel



Middle Channel



High Channel



6 FCC §74.861(e)(3) - Modulation Characteristics

6.1 Applicable Standards

According to FCC §74.861 (e) (3):

Any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

6.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.3, modulation limiting is the transmitter circuit's ability to limit the transmitter from producing deviation in excess of a rated system deviation.

Connect the modulation analyzer to EUT and EUT to test receiver. Apply a 1000 Hz modulating signal to the transmitter from the modulation analyzer, and adjust the level to obtain 60% of full rated system deviation. Increase the level from the modulation analyzer by 5dB in one step, record the deviation obtained from the receiver.

Decrease the level from the modulation analyzer by 5dB in one step, record the deviation obtained from the receiver.

With the level from the modulation analyzer held constant at each level, vary frequency from 300 Hz to 15000 Hz. Record the deviation.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2015-09-09	2 year
HP	Analyzer, Modulation	8901A	2026A00847	2015-09-24	2 year
Mini Circuits	Precision Fixed Attenuator, 20 dB	BW-S20W5+	-	-	N/A
UTiFLEX	SMA Cable	64639	218625006	2016-06-09	1 year

Cable and attenuator included in the test set-up were checked each time before testing.

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 09 June 2016) "A2LA Policy on Metrological Traceability".*

6.4 Test Environmental Conditions

Temperature:	20 °C
Relative Humidity:	39 %
ATM Pressure:	101.24 kPa

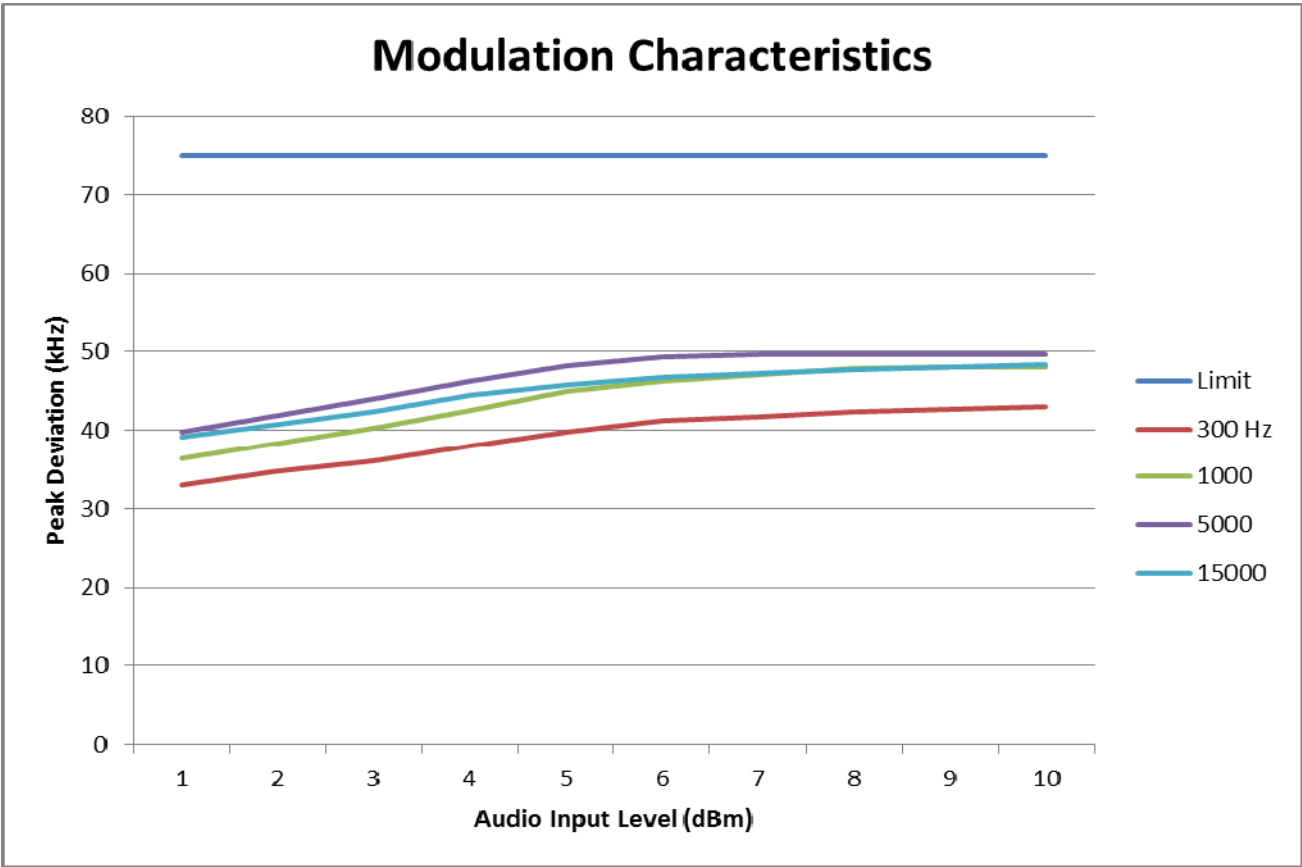
The testing was performed by Rudy Sun on 2017-02-22 at RF site.

6.5 Test Results

563.2-607.9MHz band

Deviation versus Audio input level and Audio Frequency, Middle Channel

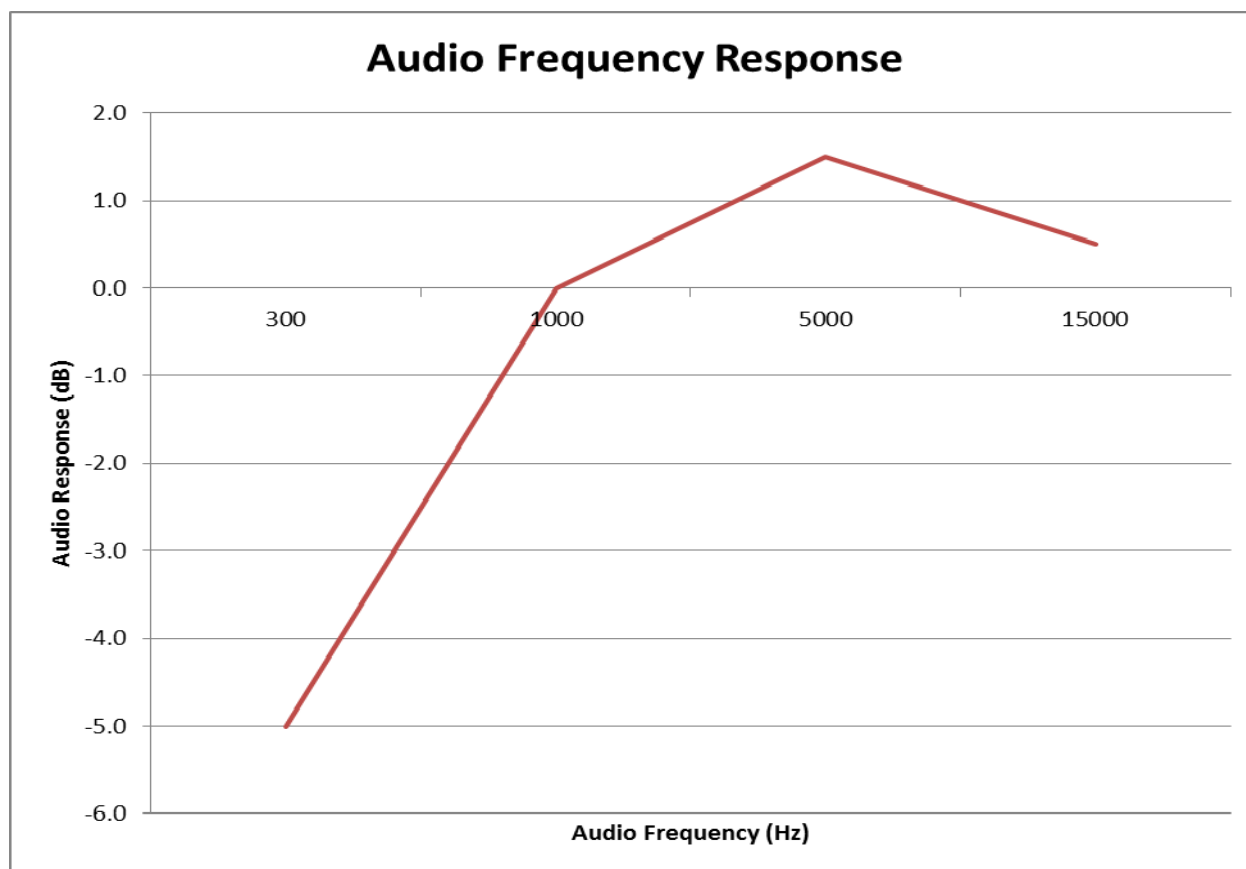
AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
1	33	36.4	39.8	39.2	±75
2	34.7	38.3	41.9	40.8	±75
3	36.1	40.2	44	42.3	±75
4	38	42.6	46.3	44.4	±75
5	39.8	45	48.2	45.8	±75
6	41.2	46.3	49.3	46.7	±75
7	41.8	47.1	49.6	47.3	±75
8	42.3	47.8	49.6	47.7	±75
9	42.7	48.1	49.7	48	±75
10	43	48.1	49.7	48.4	±75



Audio Frequency Response, Middle Channel

AF Frequency (Hz)	AF Level (mW)	AF Response (dB)
300	10.00	-5.0
1000	3.16	0.0
5000	2.24	1.5
15000	2.82	0.5

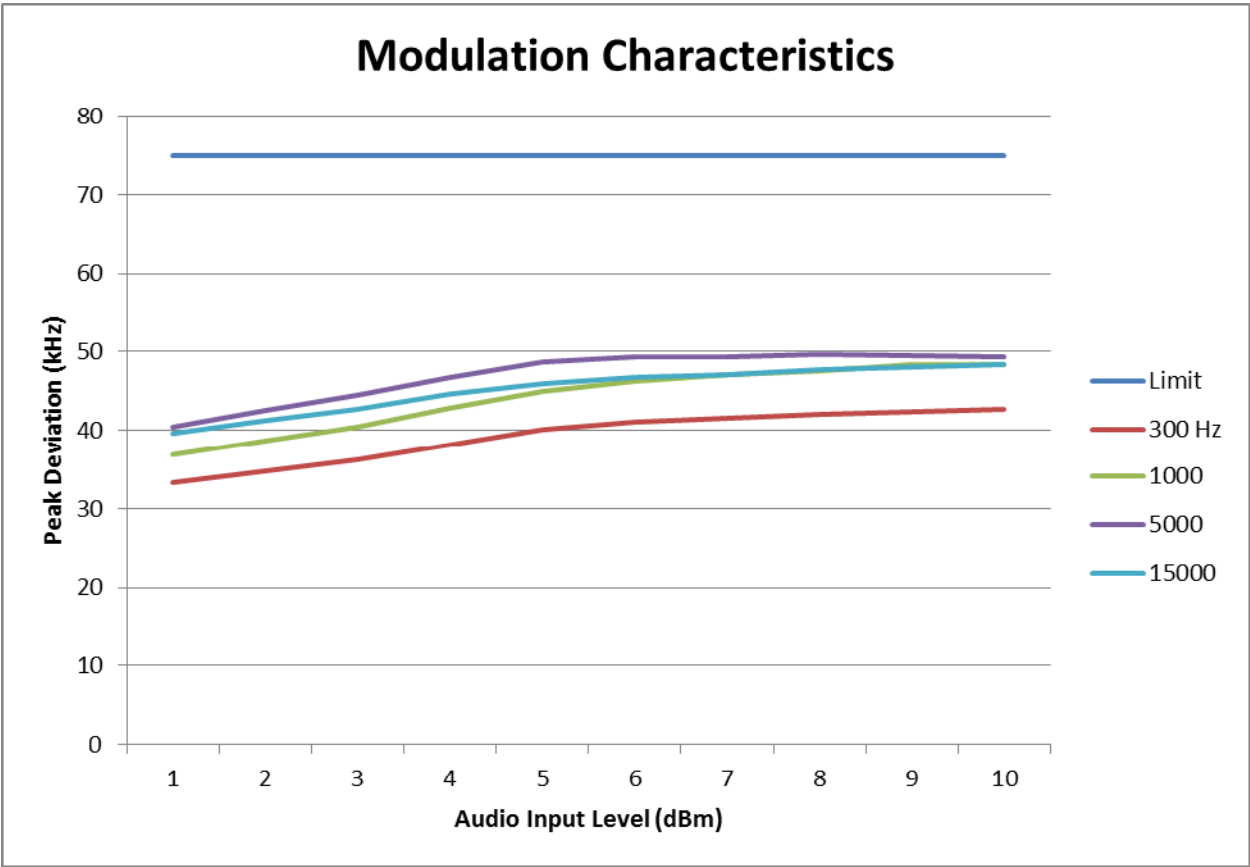
Note: AF Response = $10 \cdot \log (\text{AF Level of 1 kHz} / \text{AF Level})$



614.1-639.975MHz band

Deviation versus Audio input level and Audio Frequency, Middle Channel

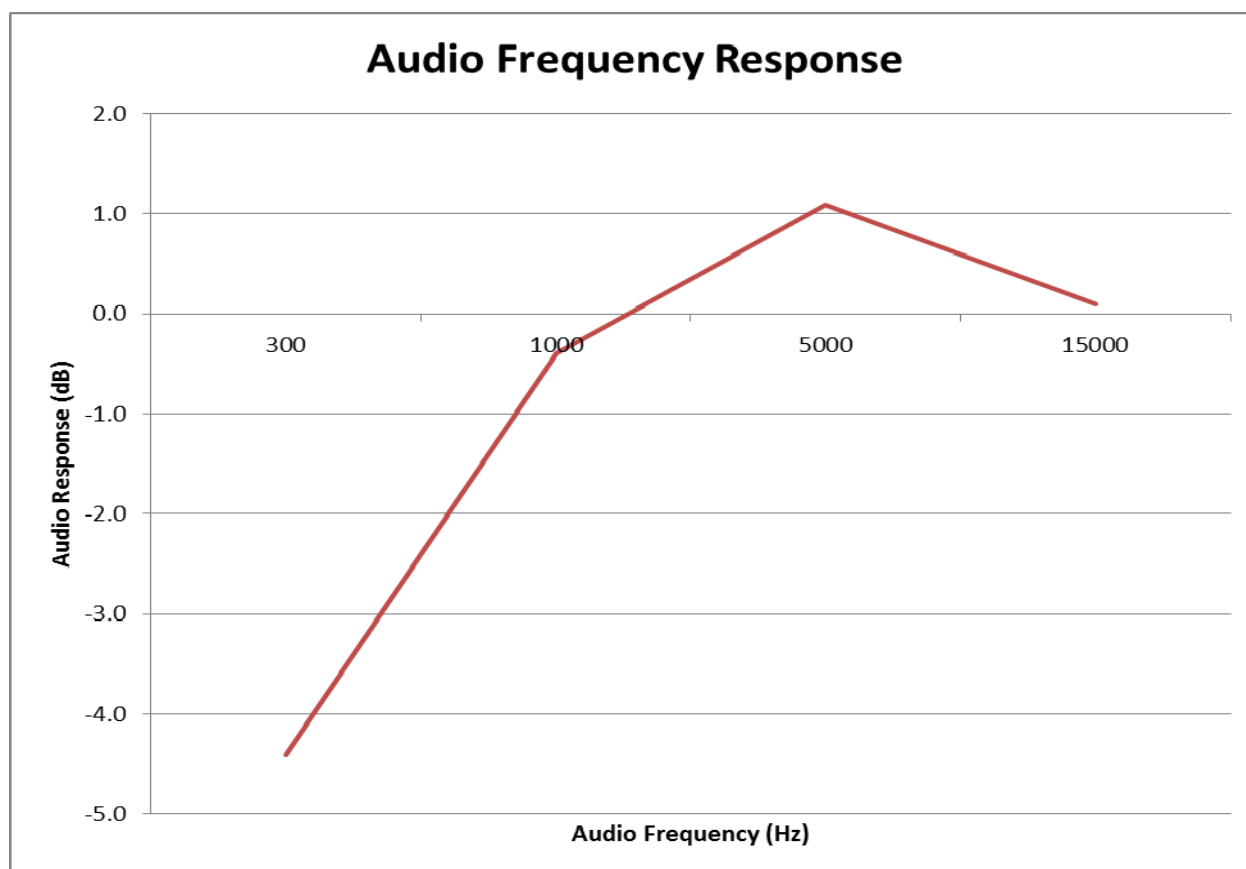
AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
1.4	33.3	36.9	40.4	39.6	±75
2.4	34.8	38.7	42.5	41.2	±75
3.4	36.3	40.5	44.5	42.7	±75
4.4	38.1	42.8	46.7	44.6	±75
5.4	40.1	45	48.7	46	±75
6.4	41	46.3	49.3	46.8	±75
7.4	41.6	47	49.4	47.1	±75
8.4	42	47.6	49.7	47.7	±75
9.4	42.3	48.3	49.5	48.1	±75



Audio Frequency Response, Middle Channel

AF Frequency (Hz)	AF Level (mW)	AF Response (dB)
300	8.71	-4.4
1000	3.47	-0.4
5000	2.45	1.1
15000	3.09	0.1

Note: AF Response = $10 \cdot \log(\text{AF Level of 1 kHz} / \text{AF Level})$



7 FCC §74.861(e) (5) (6) - Occupied Bandwidth & Emission Mask

7.1 Applicable Standards

According to FCC §74.861 (e) (5) (6):

The operating bandwidth shall not exceed 200 kHz.

The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
- On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
- On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43+10\log_{10}$ (mean output power in watts) dB.

7.2 Test Procedure

Section 4.2 of KDB 971168 D01 v02r02

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2015-09-09	2 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2016-06-10	1 year
Mini Circuits	Precision Fixed Attenuator, 20 dB	BW-S20W5+	-	-	N/A
UTiFLEX	SMA Cable	64639	218625006	2016-06-09	1 year
Agilent	Spectrum Analyzer	E4446A	MY48250238	2016-12-16	1 year

Cable and attenuator included in the test set-up were checked each time before testing.

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 09 June 2016) "A2LA Policy on Metrological Traceability".

7.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	39 %
ATM Pressure:	101.2 kPa

The testing was performed by Rudy Sun on 2017-02-22 at RF site.

7.5 Test Results

563.2 – 607.9 MHz band

Center Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Result	Power Setting
585.6	93.37	200	Pass	High (50 mW)
585.6	92.82	200	Pass	Low (25 mW)

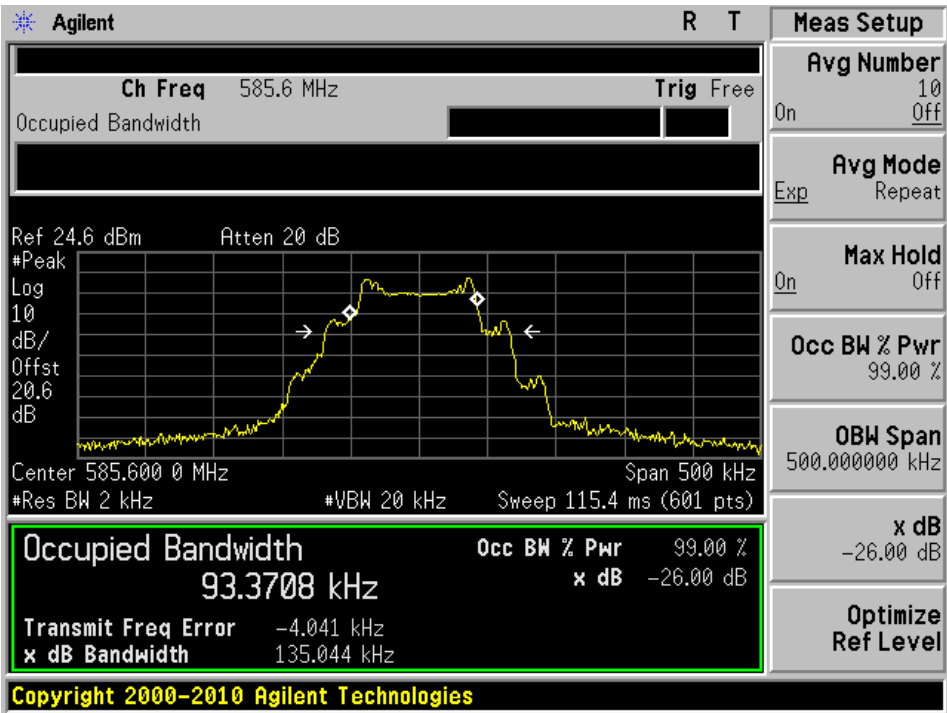
614.1- 639.975 MHz band

Center Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Result	Power Setting
626.95	92.00	200	Pass	High (50 mW)
626.95	91.02	200	Pass	Low (25 mW)

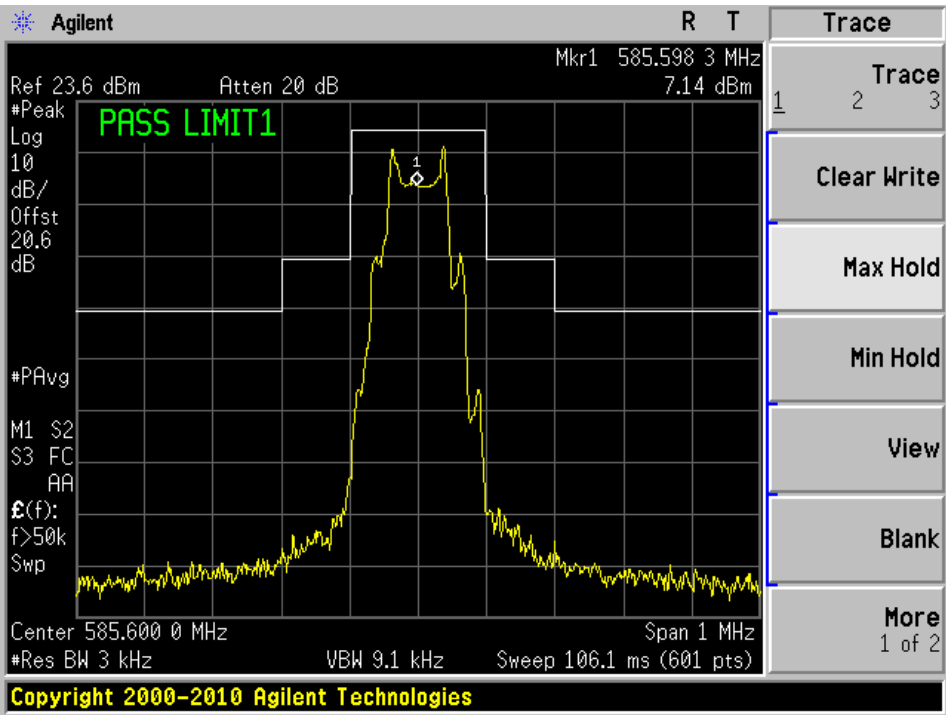
Please refer to the following table plots for detailed test results

563.2 – 607.9 MHz Band-50 mW power level

Occupied Bandwidth

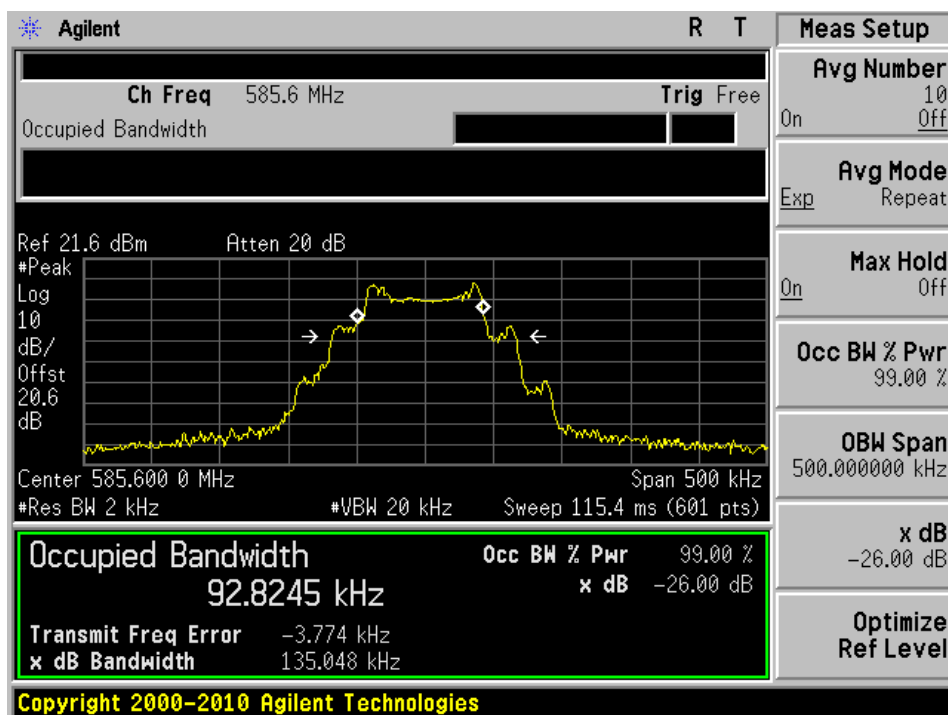


Emission Mask

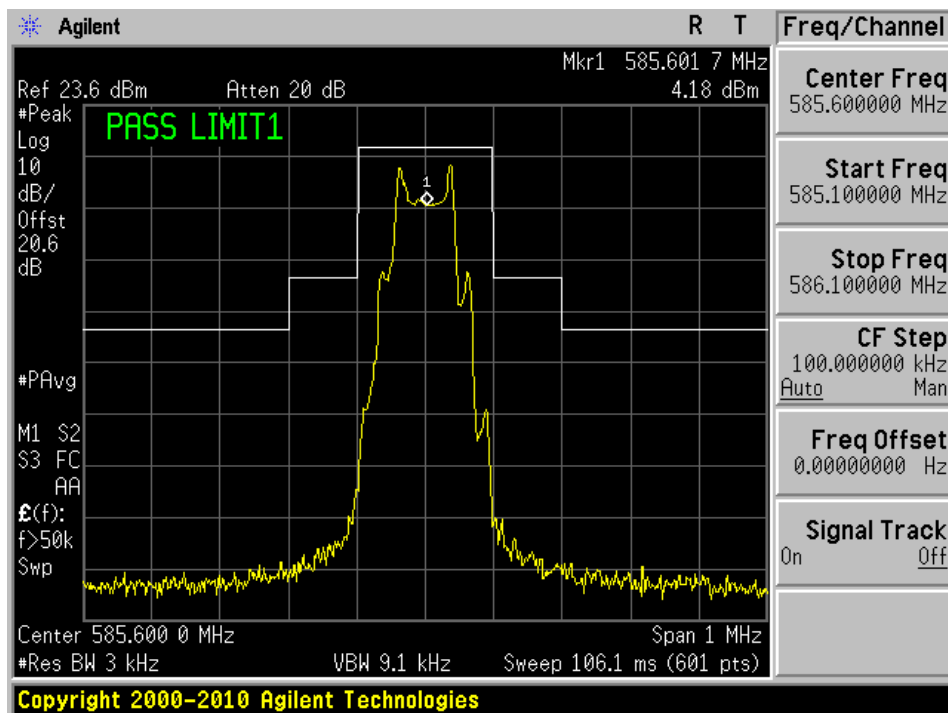


563.2 – 607.9 MHz Band-25 mW power level

Occupied Bandwidth

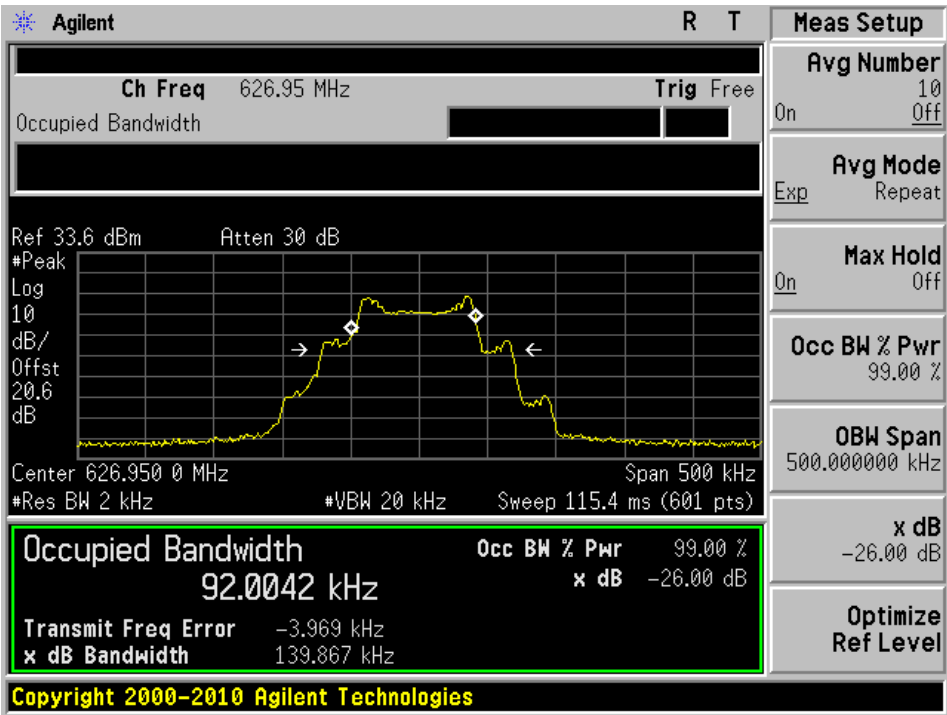


Emission Mask

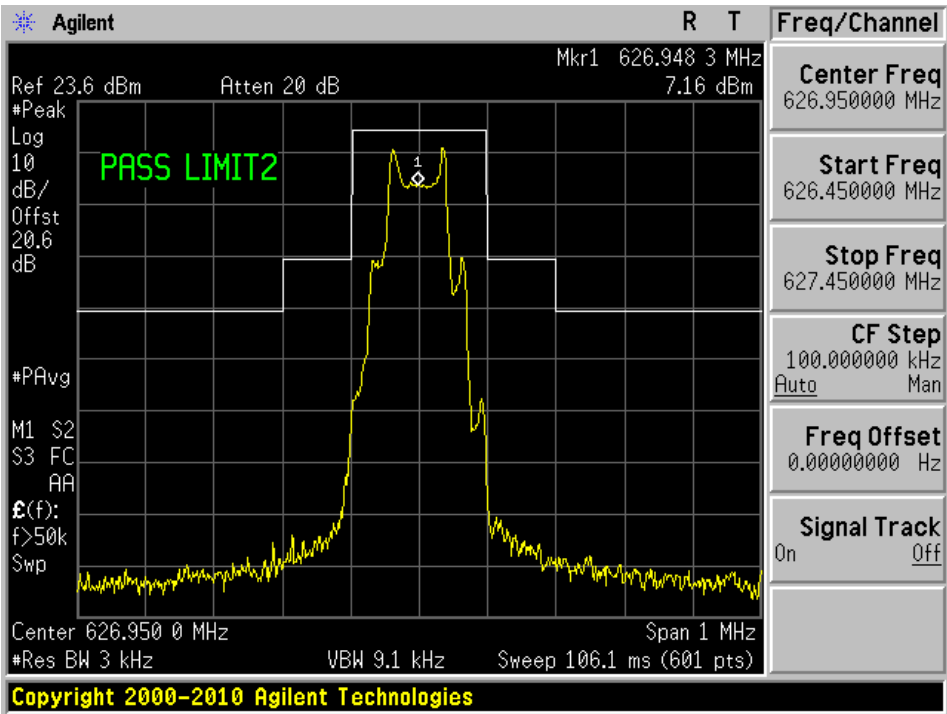


614.1- 639.975 MHz Band-50 mW power level

Occupied Bandwidth

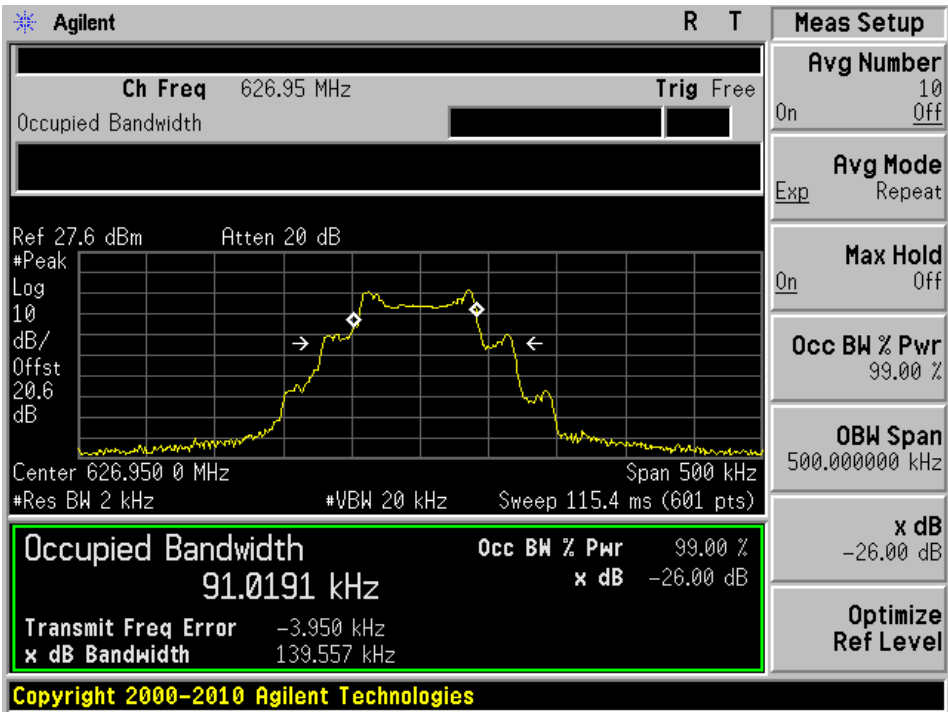


Emission Mask

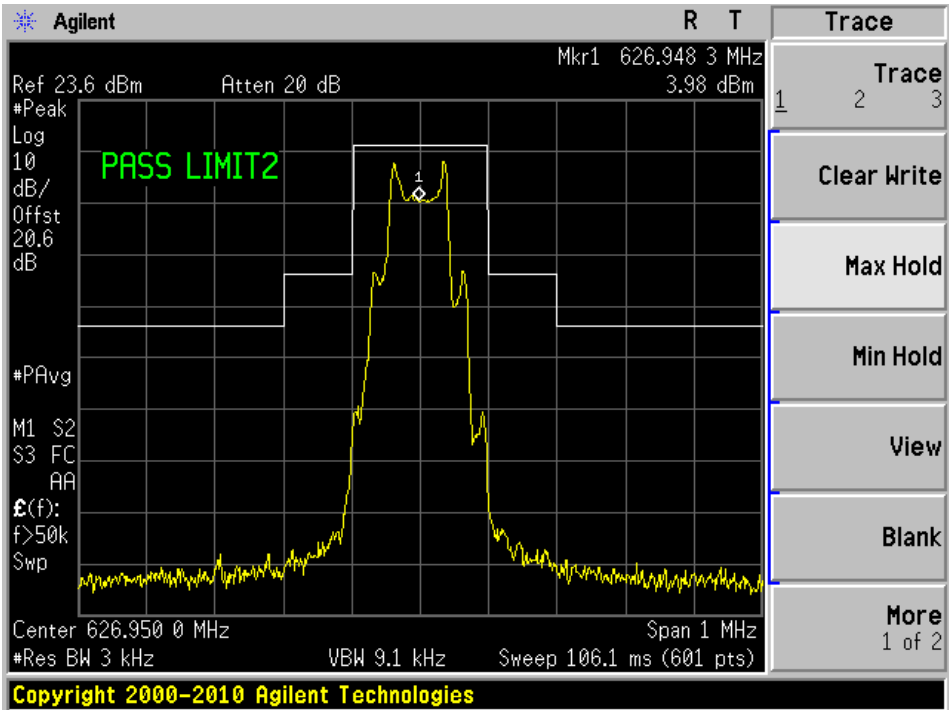


614.1- 639.975 MHz Band-25 mW power level

Occupied Bandwidth



Emission Mask



8 FCC §74.861(e) (6) (iii) - Conducted Spurious Emissions at Antenna Port

8.1 Applicable Standards

According to FCC §74.861 (e) (6) (iii):

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10\log$ (mean output power in watts) dB.

8.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.13, conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired. The method of measurement is as following:

- Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
- Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.
- Adjust the spectrum analyzer for the following setting:
 1. Resolution bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
 2. Video bandwidth ≥ 3 times the resolution bandwidth.
 3. Sweep speed ≤ 2000 Hz per second
 4. Detector mode = mean or average power.
- Record the frequencies and level of spurious emissions.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2016-06-10	1 year
Mini Circuits	Precision Fixed Attenuator, 20dB	BW-S20W5+	-	-	N/A
UTiFLEX	SMA Cable	64639	218625006	2016-06-09	1 year

Cable and attenuator included in the test set-up were checked each time before testing.

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 09 June 2016) “A2LA Policy on Metrological Traceability”.

8.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	41 %
ATM Pressure:	101.2 kPa

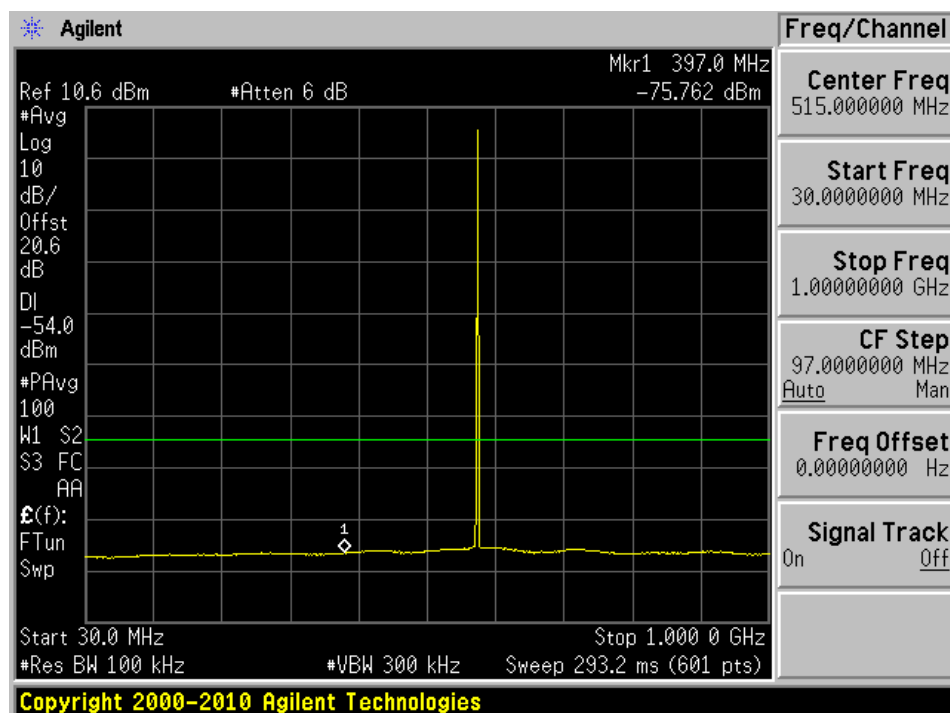
The testing was performed by Rudy Sun on 2017-02-22 at RF site.

8.5 Test Results

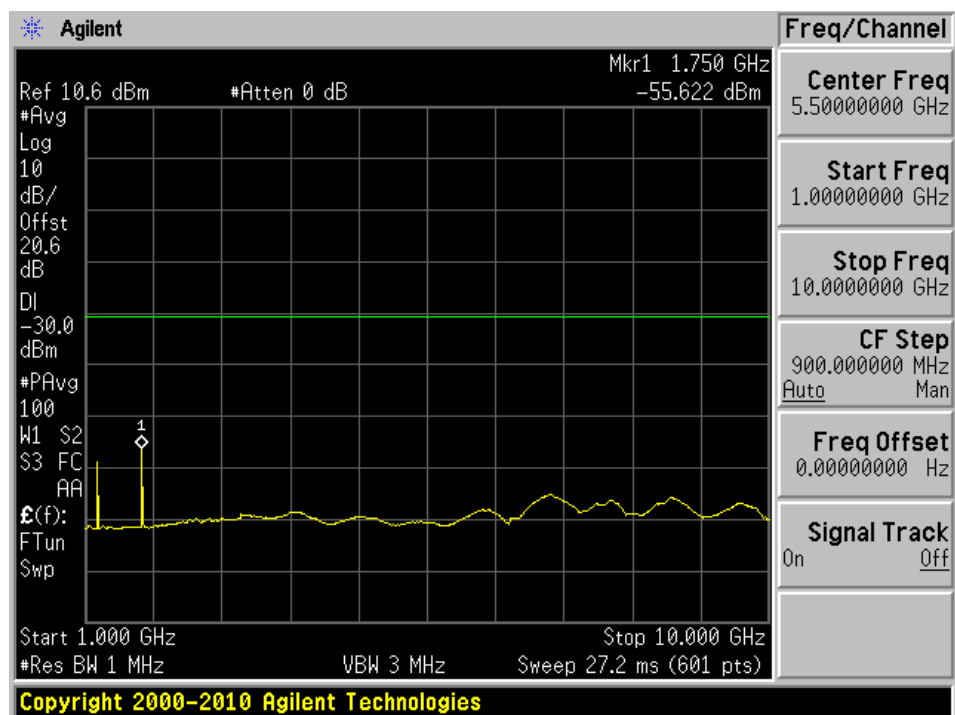
Please refer to the following table plots for detailed test results

563.2 – 607.9 MHz Band-50 mW power level

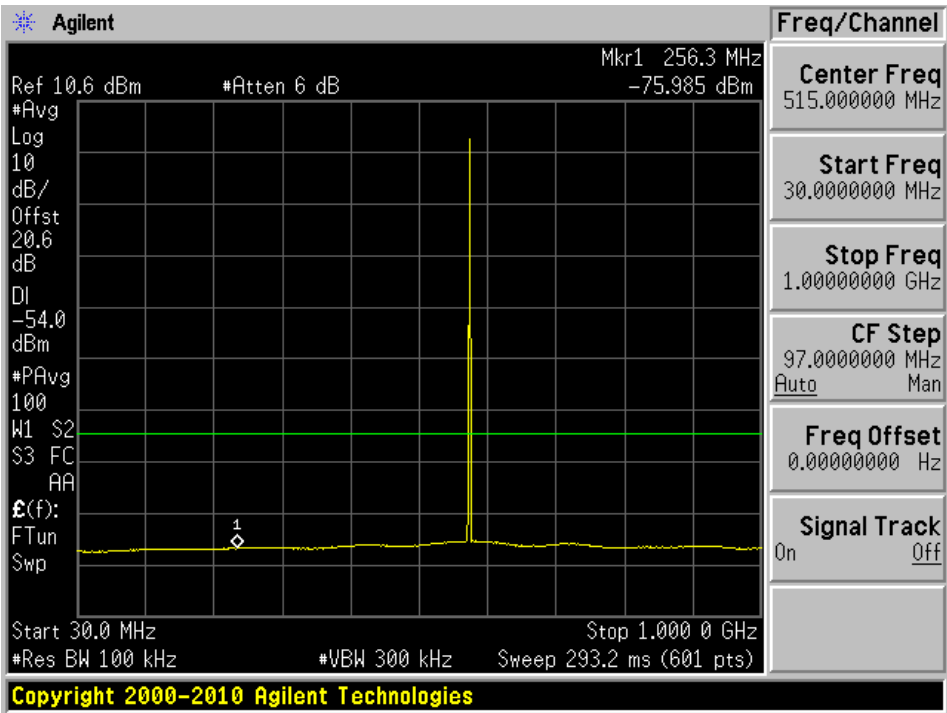
30 MHz to 1 GHz



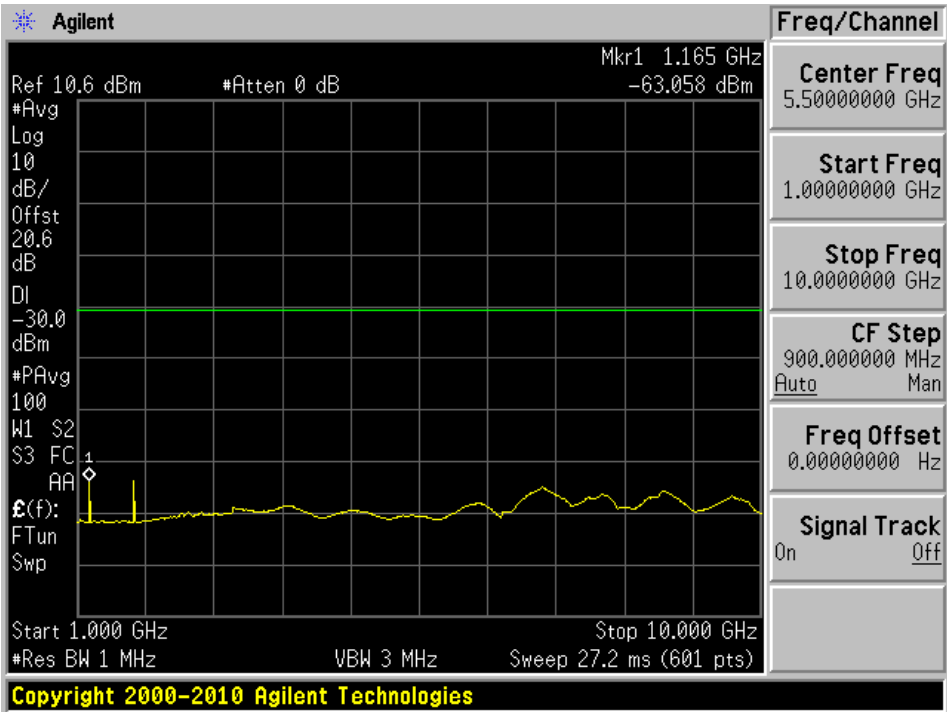
1 GHz to 10 GHz



563.2 – 607.9 MHz Band-25 mW power level
30 MHz to 1 GHz

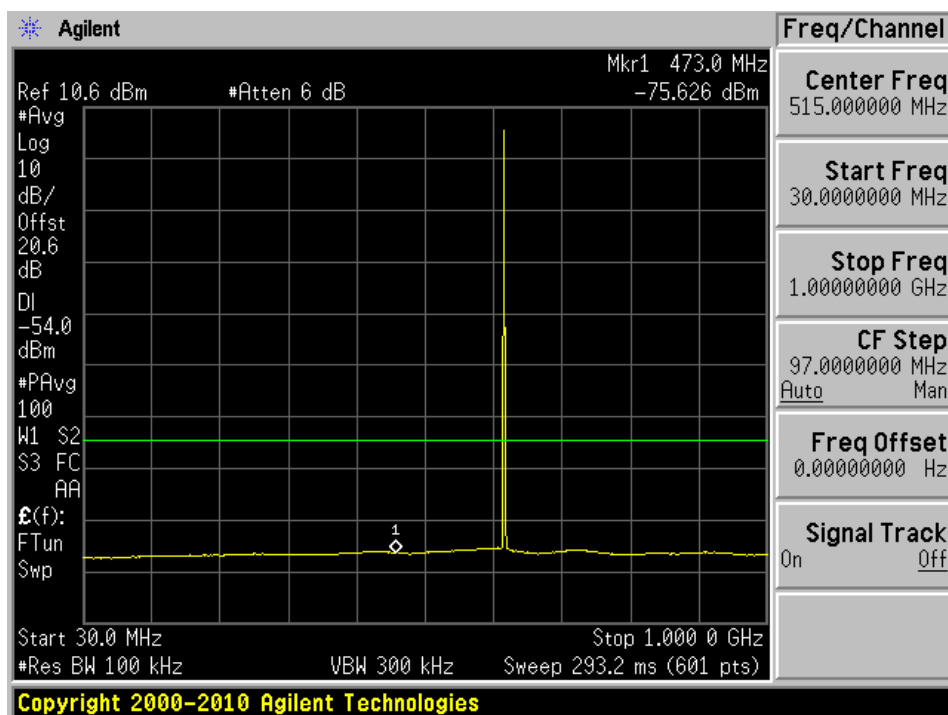


1 GHz to 10 GHz

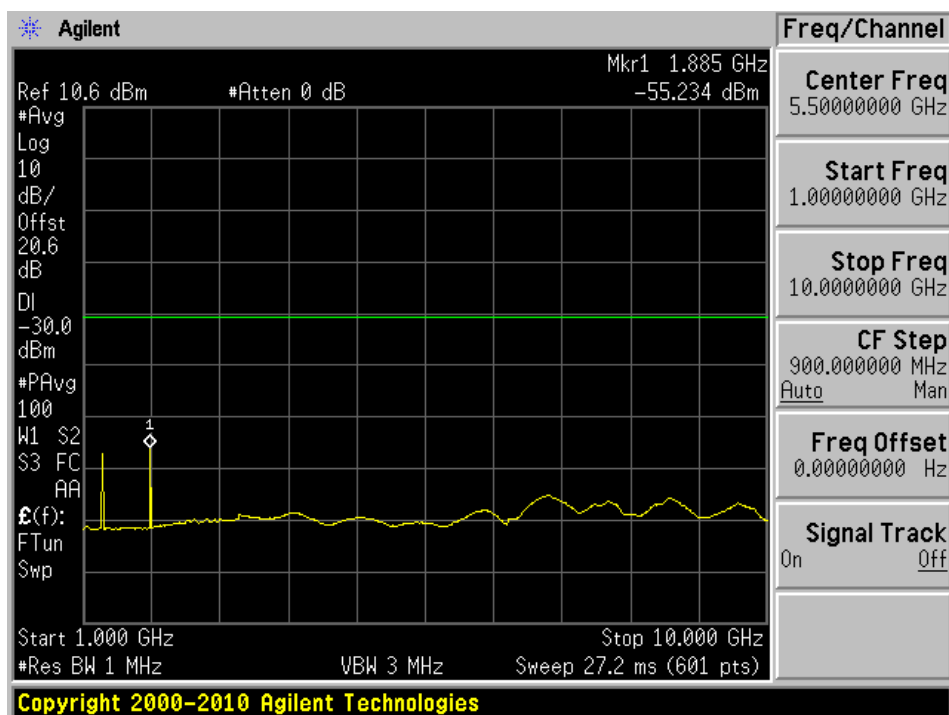


614.1 – 639.975 MHz Band-50 mW power level

30 MHz to 1 GHz

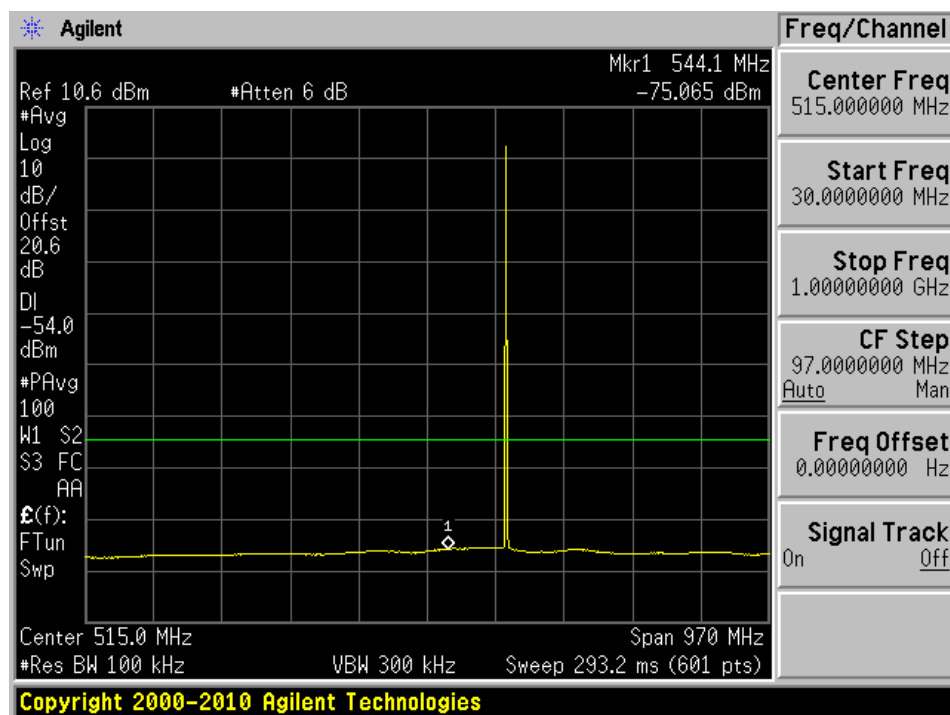


1 GHz to 10 GHz

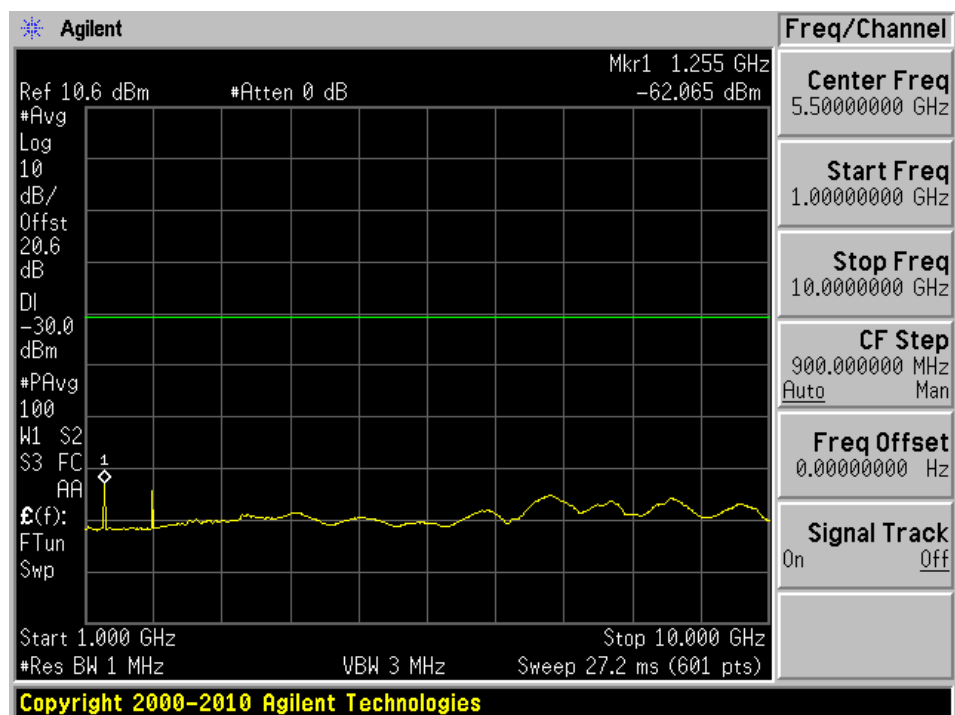


614.1 – 639.975 MHz Band-25 mW power level

30 MHz to 1 GHz



1 GHz to 10 GHz



9 FCC §74.861(e) (6) (iii) - Field Strength of Spurious Radiation

9.1 Applicable Standards

According to FCC §74.861 (e) (6) (iii):

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10\log$ (mean output power in watts) dB.

9.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.13, conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired. The method of measurement is as following:

- Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
- Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.
- Adjust the spectrum analyzer for the following setting:
 5. Resolution bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
 6. Video bandwidth ≥ 3 times the resolution bandwidth.
 7. Sweep speed ≤ 2000 Hz per second
 8. Detector mode = mean or average power.
- Record the frequencies and level of spurious emissions.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2016-06-10	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
HP/Agilent	Pre-Amplifier	8449BOPHO2	3008A0113	2016-05-23	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2 year
HP	Pre-Amplifier	8447D	2944A06639	2016-06-28	1 year
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1, 2, 3, 4	2017-02-12	2 years
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
-	SMA Cable	-	C0003	-	N/A
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	2 year
IW Microwave	High Frequency Cable	DC-1438	SPS-2303- 3840-SPS	2017-01-23	1 year

Cable and attenuator included in the test set-up were checked each time before testing.

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 09 June 2016) "A2LA Policy on Metrological Traceability".

9.4 Test Environmental Conditions

Temperature:	20 °C
Relative Humidity:	39 %
ATM Pressure:	101.2 kPa

The testing was performed by Rudy Sun on 2017-02-22 at 5m3.

9.5 Test Results

EUT was configured to high power setting

563.2 – 607.9 MHz band

Freq. (MHz)	S.A. Amp. (dBmV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dB)	Cable Loss (dB)			
88.5	36.8	102	150	V	88.5	-68.31	0	0.25	-68.56	-13	-55.56
88.5	36.16	62	130	H	88.5	-73.64	0	0.25	-73.89	-13	-60.89
1014.7	48.32	0	100	H	1014.7	-67.32	6.756	0.466	-61.03	-13	-48.03
1014.7	47.63	0	100	V	1014.7	-68.5	6.756	0.466	-62.21	-13	-49.21

614.1 – 639.975 MHz band

Freq. (MHz)	S.A. Amp. (dBmV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dB)	Cable Loss (dB)			
88.5	38.17	42	104	V	88.5	-66.94	0	0.25	-67.19	-13	-54.19
88.5	36.14	254	119	H	88.5	-73.66	0	0.25	-73.91	-13	-60.91
1004	45.91	0	100	H	1004	-69.44	8.453	0.466	-61.453	-13	-48.45
1004	48.38	0	100	V	1004	-68.02	8.453	0.466	-60.033	-13	-47.03

10 FCC §74.861(e) (4) - Frequency Stability

10.1 Applicable Standards

According to FCC §74.861 (e) (4):

The frequency tolerance of the transmitter shall be 0.005 percent

10.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.2, the carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The measurement method is as following:

- Operate the equipment in standby conditions for 15 minutes before proceeding.
- Record the carrier frequency of the transmitter as MCF MHz.
- Calculate the ppm frequency error by the following:

$$\text{Ppm error} = (\text{MCF}/\text{ACF} - 1) * 10^6$$

Where

MCF is the Measured Carrier Frequency in MHz

ACF is the Assigned Carrier Frequency in MHz

- The value recorded above is the carrier frequency stability.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2016-06-10	1 year
Tenney	Chamber, Environmental	TUJR	27445-06	2016-09-20	2 Years
KEPCO	Source, DC	25-10M	H1334526	Cal. Not Required	N/A
Fluke	Digital Multi-meter	189	89920092	2016-03-31	1 year
Mini Circuits	Precision Fixed Attenuator, 20dB	BW-S20W5+	-	-	N/A
-	SMA Cable	-	C0003	-	N/A

Cable and attenuator included in the test set-up were checked each time before testing.

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 09 June 2016) "A2LA Policy on Metrological Traceability".

10.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.68 kPa

The testing was performed by Rudy Sun on 2017-02-20 at RF site.

10.5 Test Results

563.2- 607.9MHz Band-50 mW power level

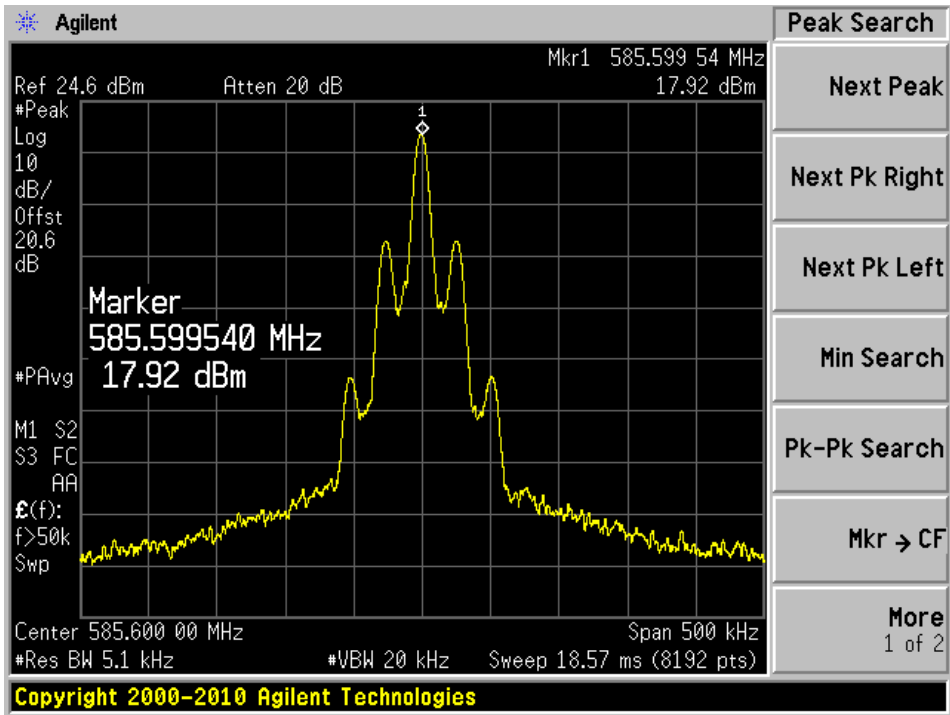
Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
-20	585.59954	585.6	-0.79	50
-10	585.59929	585.6	-1.21	50
0	585.59868	585.6	-2.25	50
10	585.59942	585.6	-0.99	50
20	585.59917	585.6	-1.42	50
30	585.5988	585.6	-2.05	50
40	585.59862	585.6	-2.36	50
50	585.59886	585.6	-1.95	50

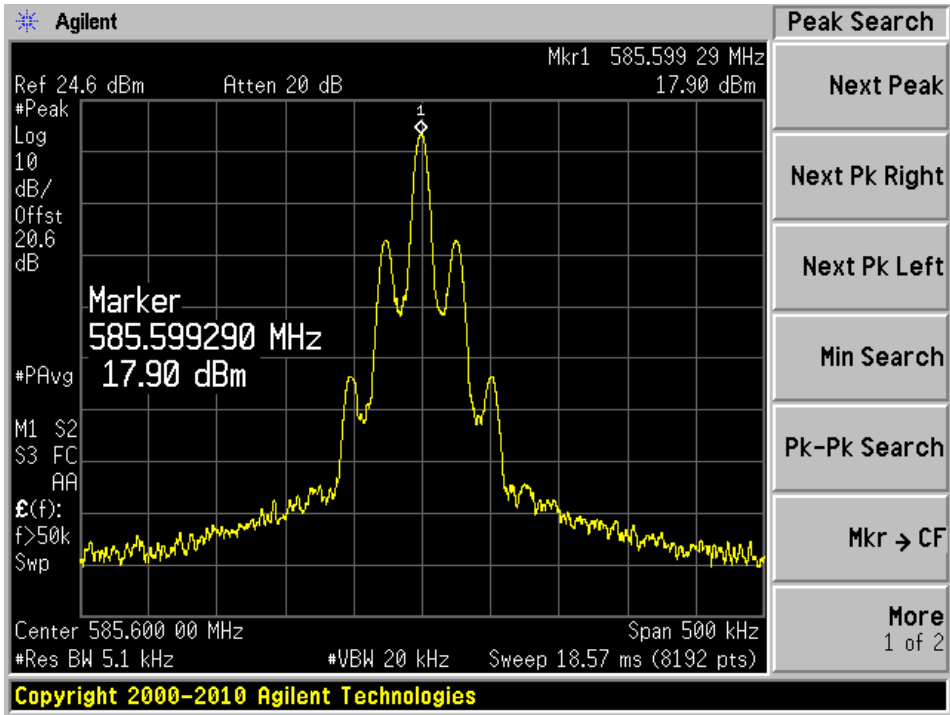
Varying supply voltage:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
3.06V at 20°C	585.59868	585.6	-2.25	50
3.6V at 20°C	585.59856	585.6	-2.46	50
4.14V 20°C	585.59929	585.6	-1.21	50

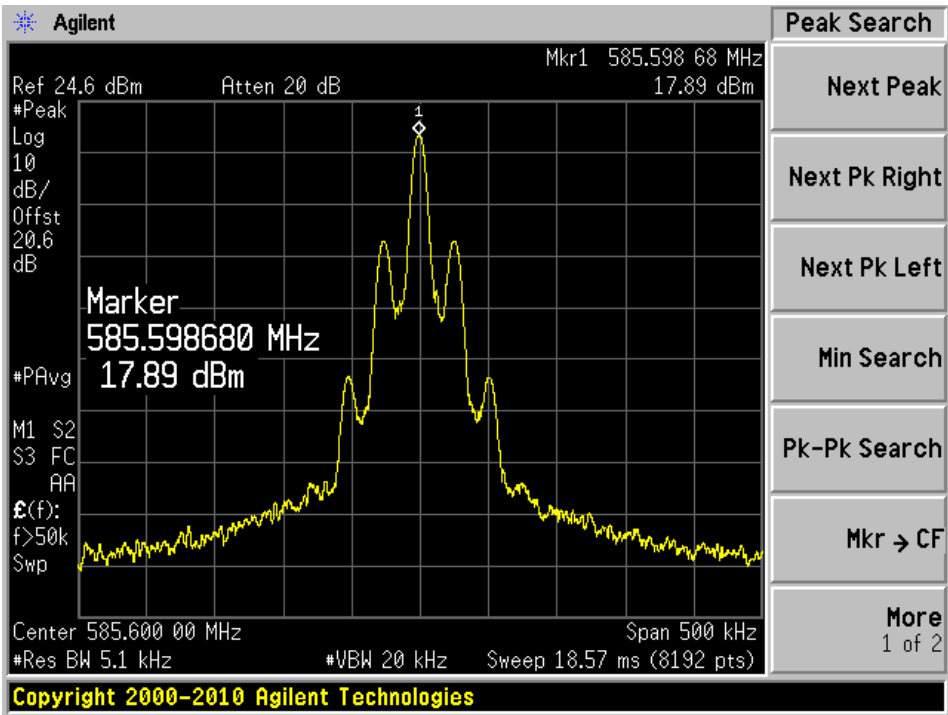
Temperature -20°C:



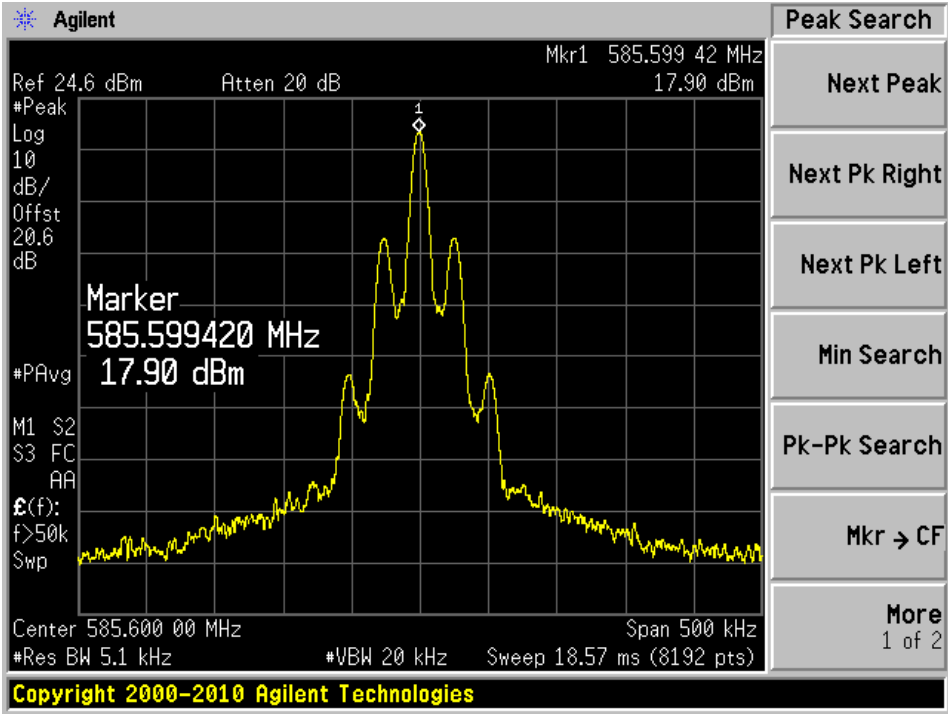
Temperature -10°C:



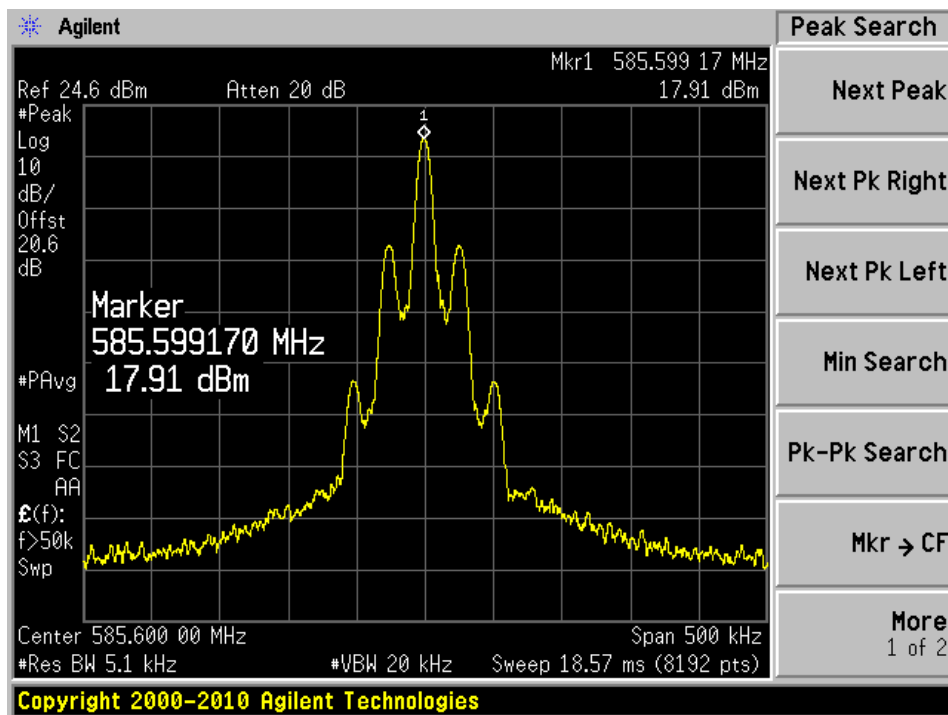
Temperature 0°C:



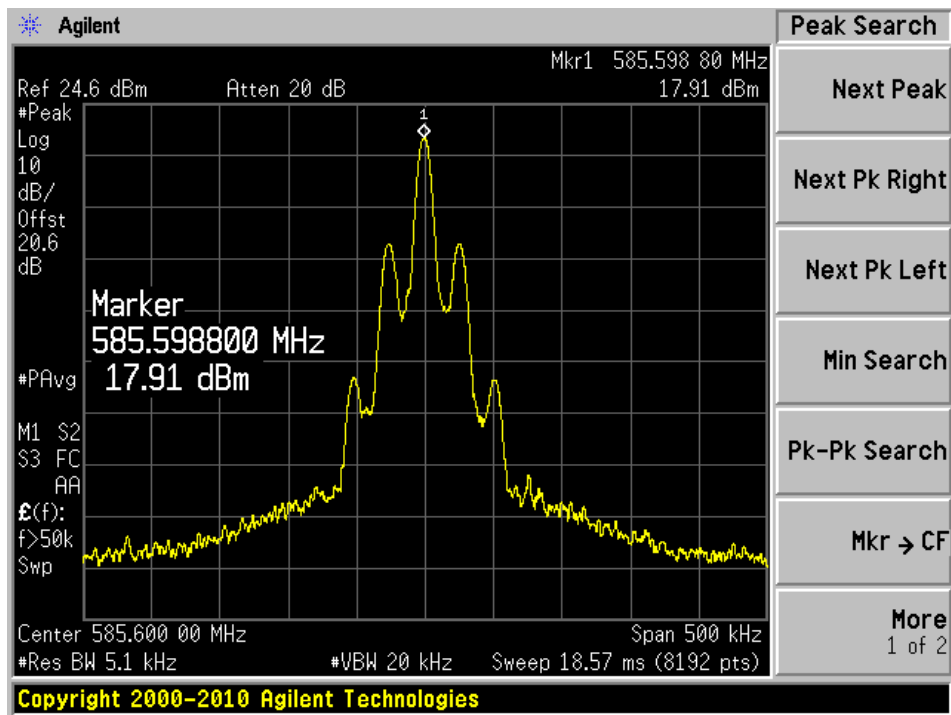
Temperature 10°C:



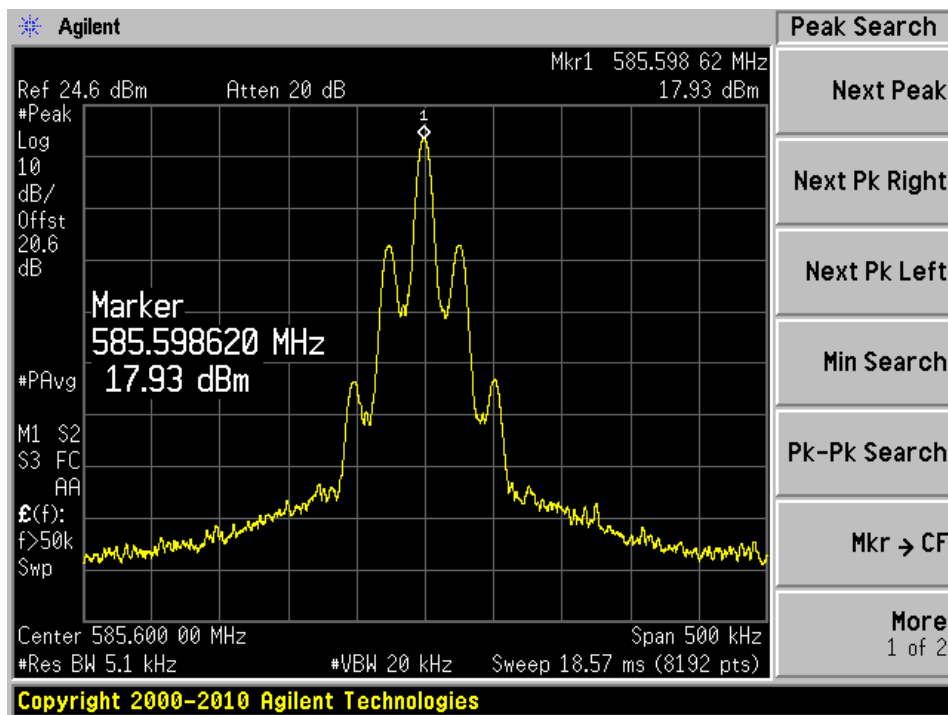
Temperature 20°C:



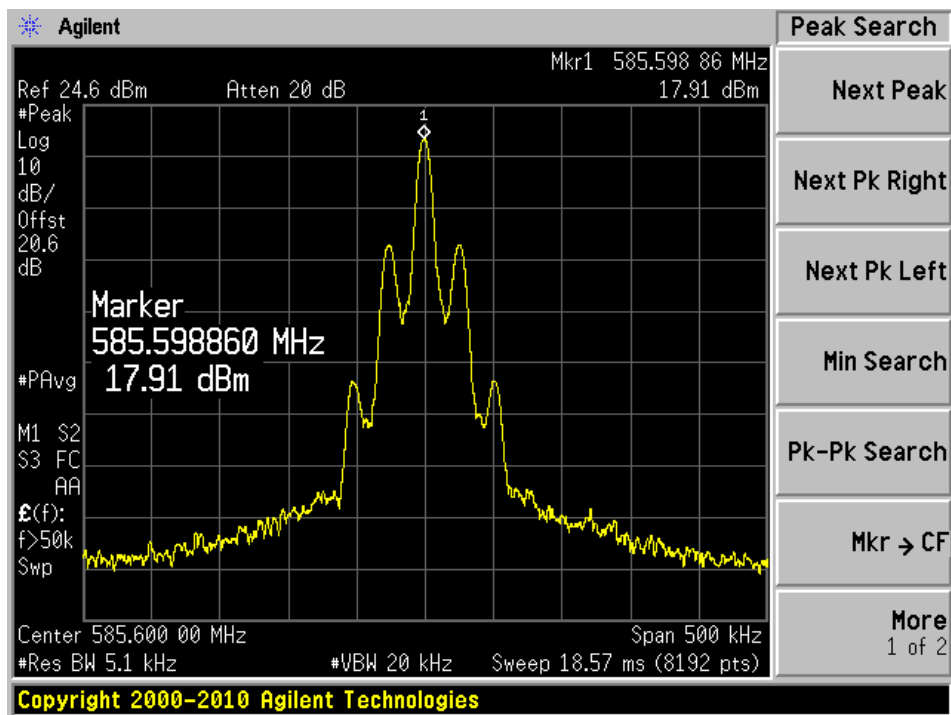
Temperature 30°C:



Temperature 40°C:

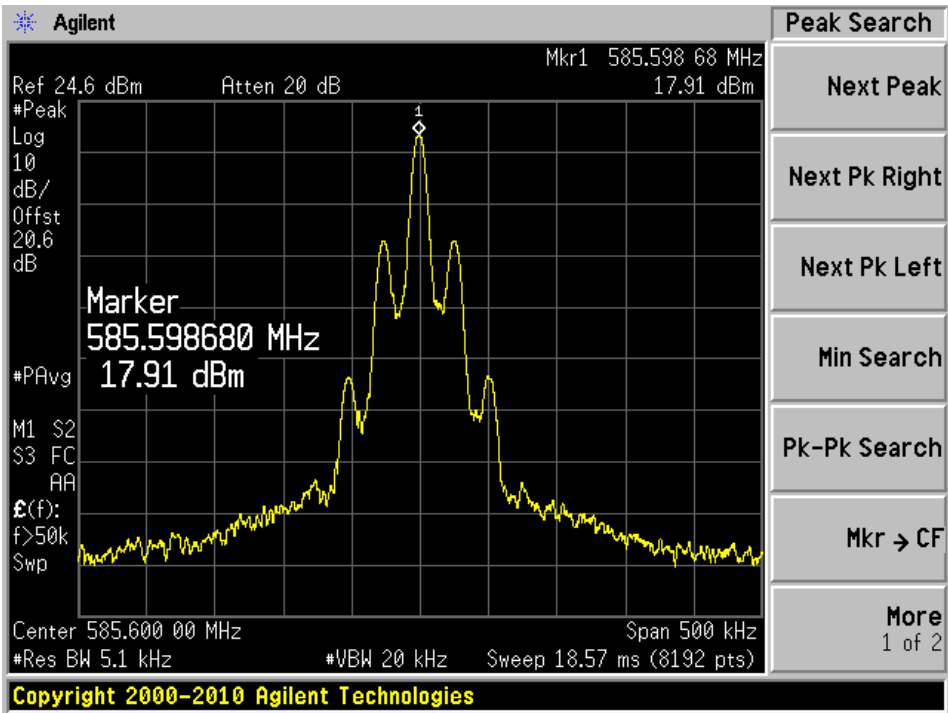


Temperature 50°C:

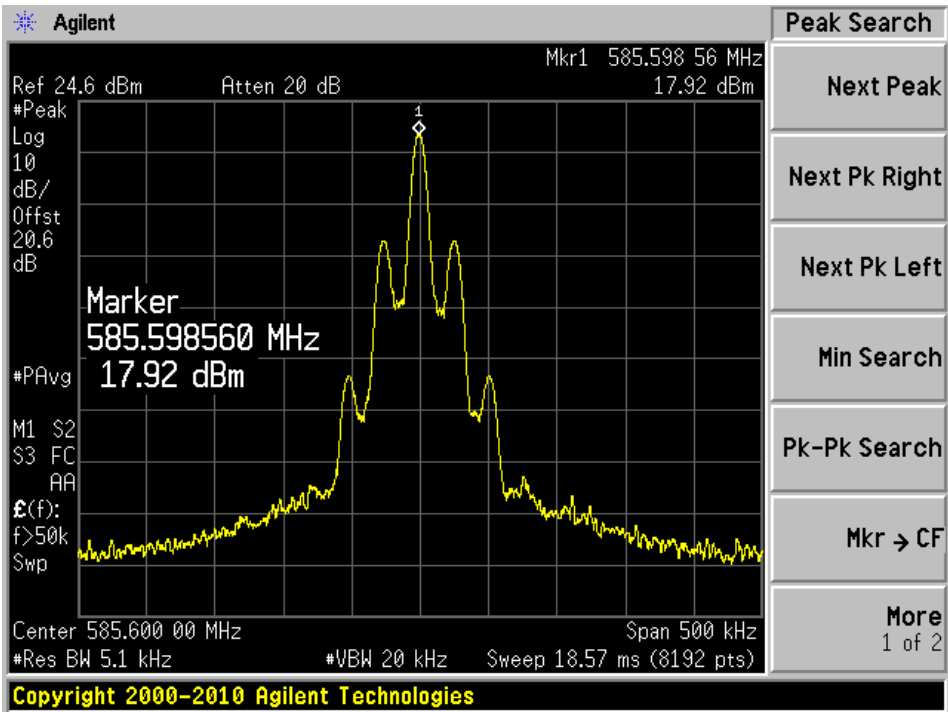


Varying Voltage:

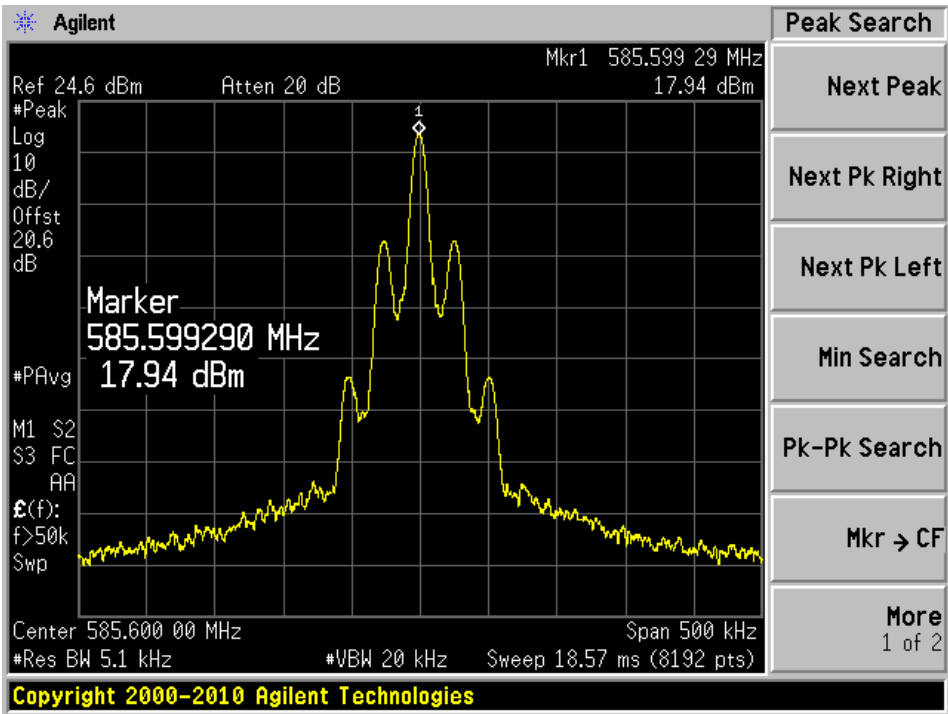
3.06 V at 20°C:



3.6 V at 20°C:



4.14 V at 20°C:



563.2- 607.9MHz Band-25 mW power level

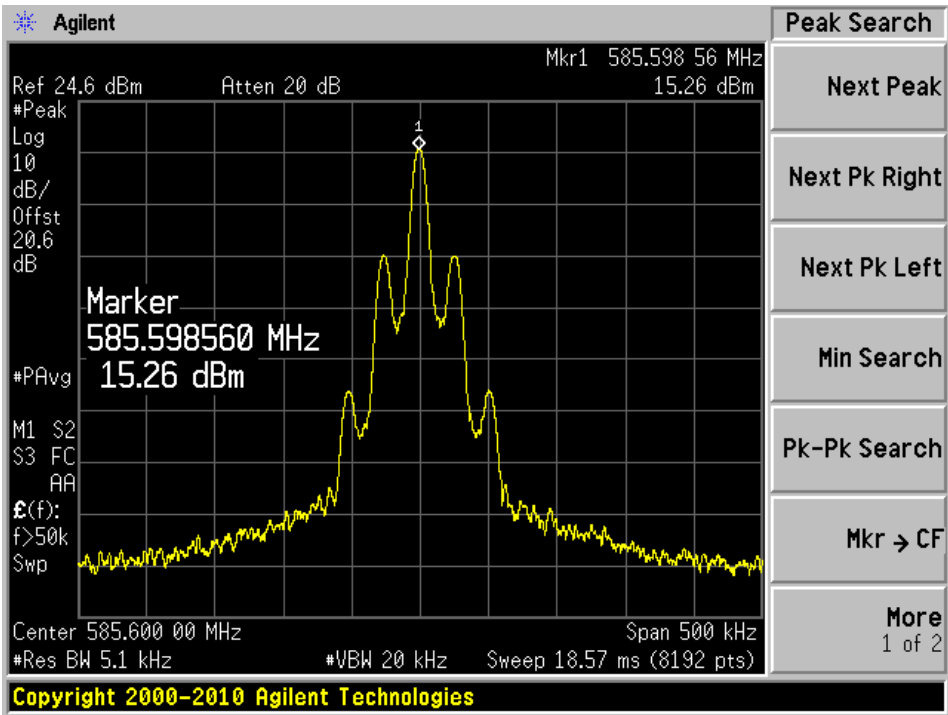
Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
-20	585.59856	585.6	-2.46	50
-10	585.59868	585.6	-2.25	50
0	585.59936	585.6	-1.09	50
10	585.59868	585.6	-2.25	50
20	585.59874	585.6	-2.15	50
30	585.59923	585.6	-1.31	50
40	585.59923	585.6	-1.31	50
50	585.59856	585.6	-2.46	50

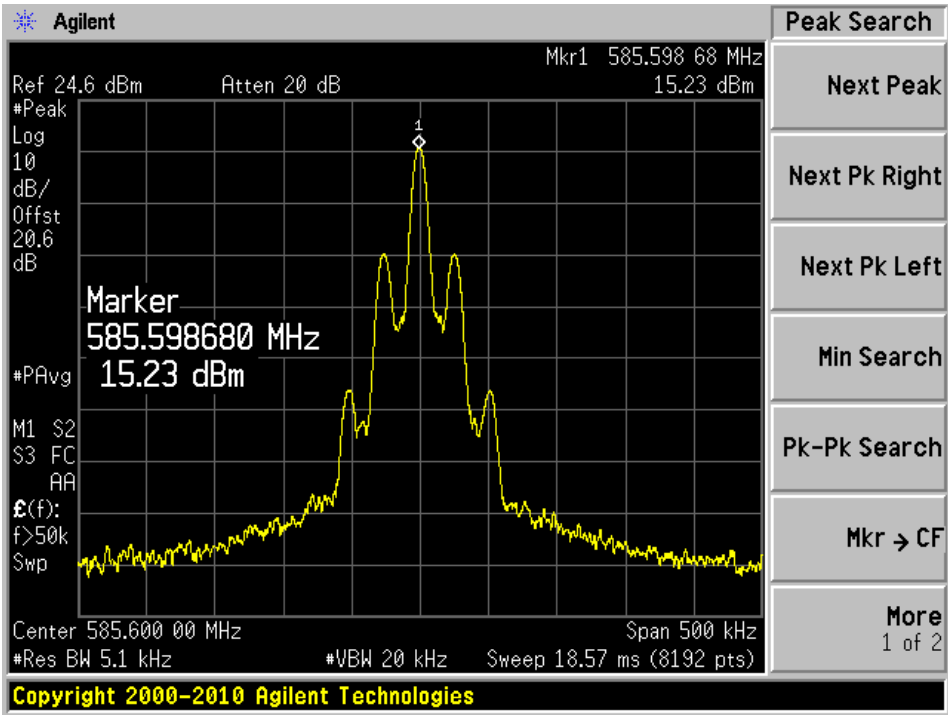
Varying supply voltage:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
3.06 V at 20°C	585.5988	585.6	-2.05	50
3.6 V at 20°C	585.59862	585.6	-2.36	50
4.14 V 20°C	585.59936	585.6	-1.09	50

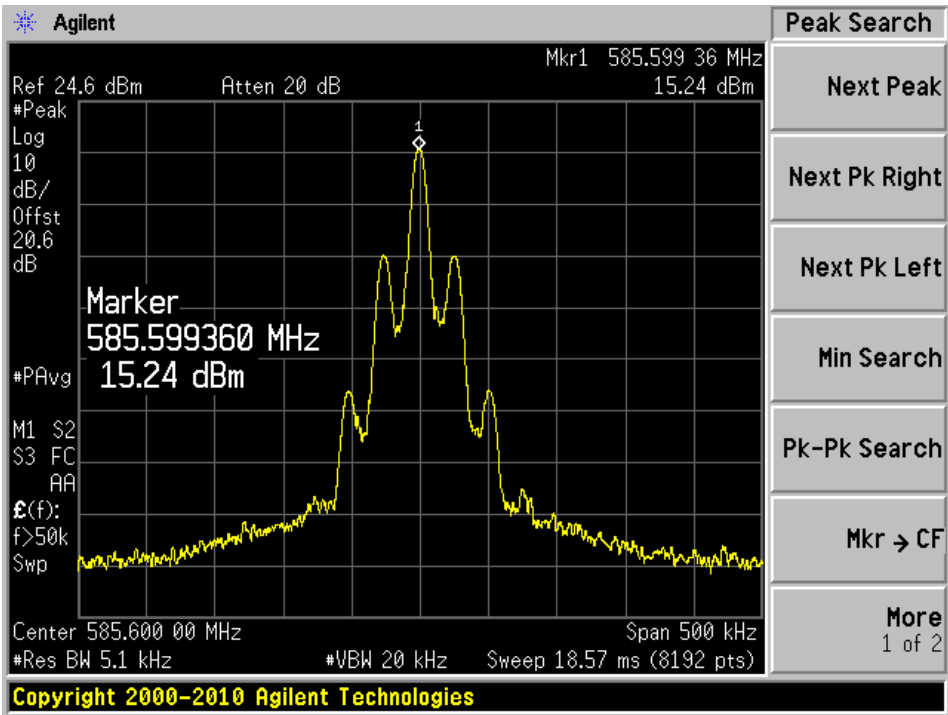
Temperature -20°C:



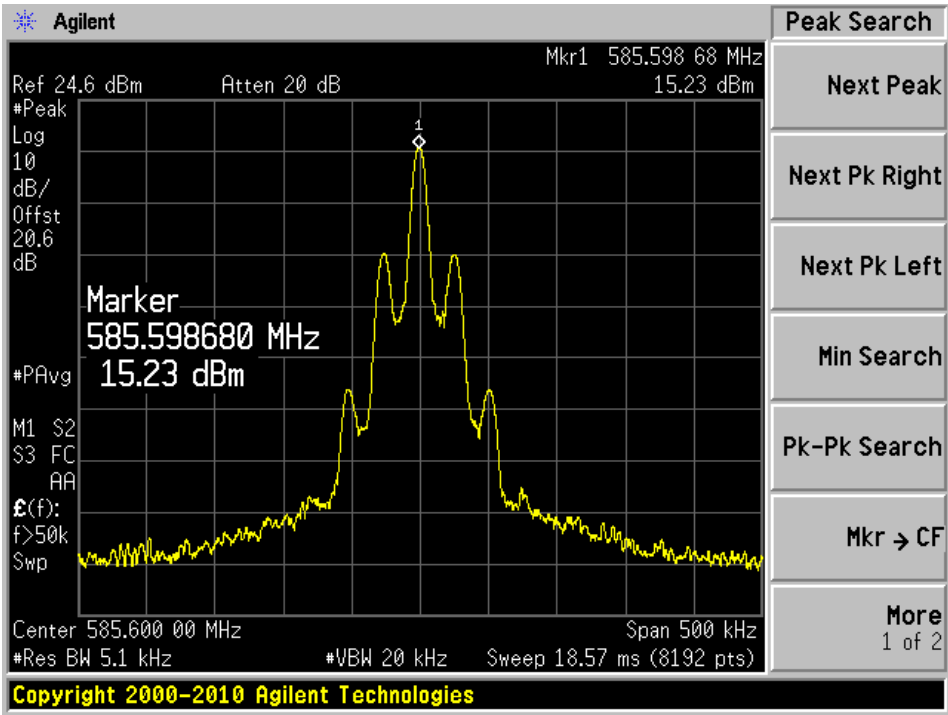
Temperature -10°C:



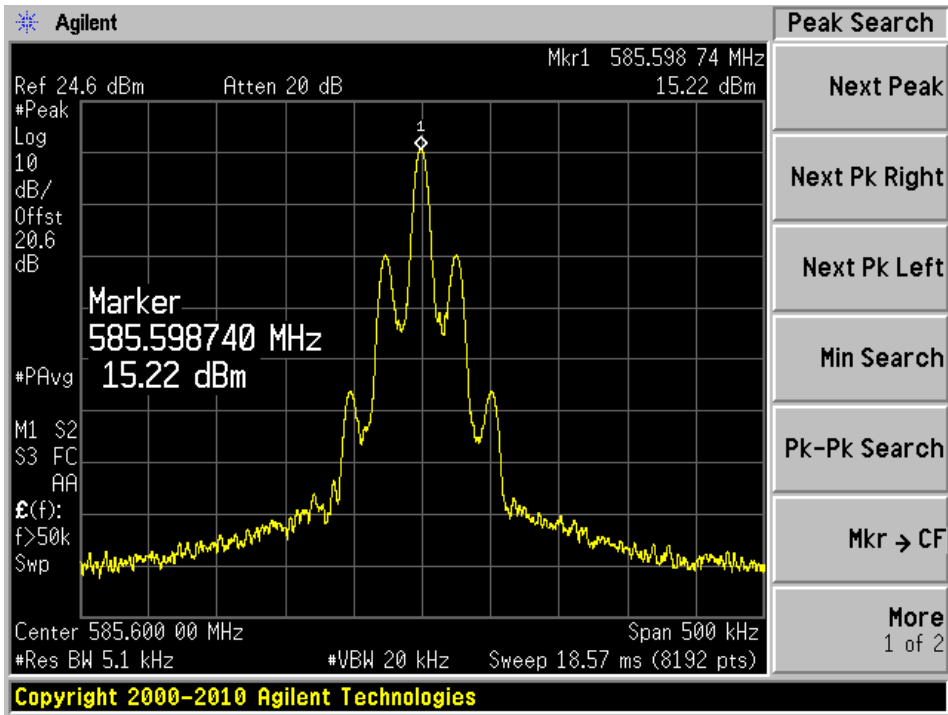
Temperature 0°C:



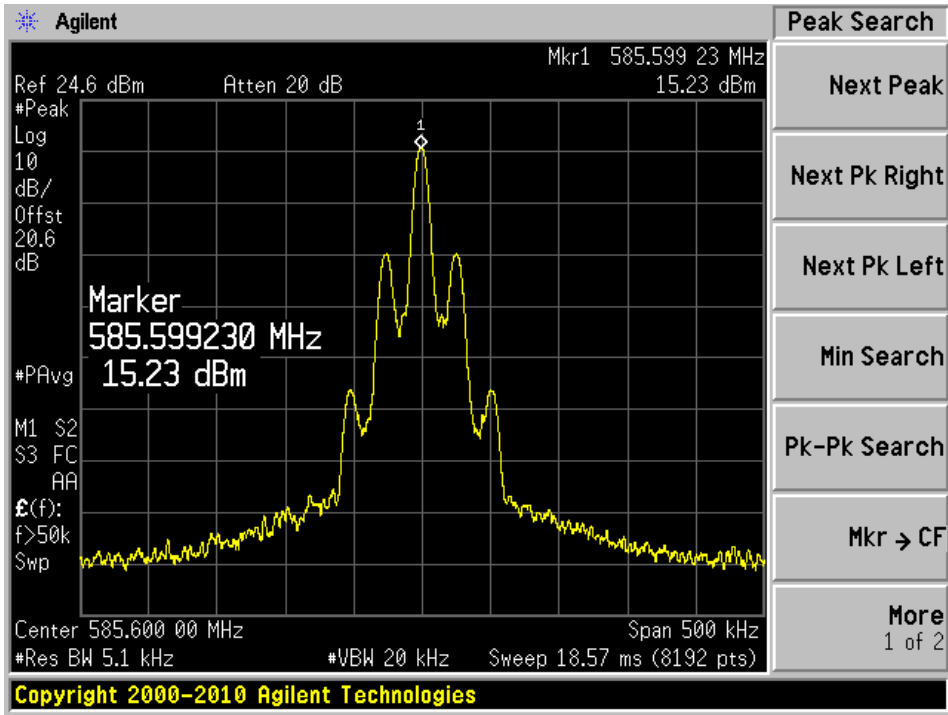
Temperature 10°C:



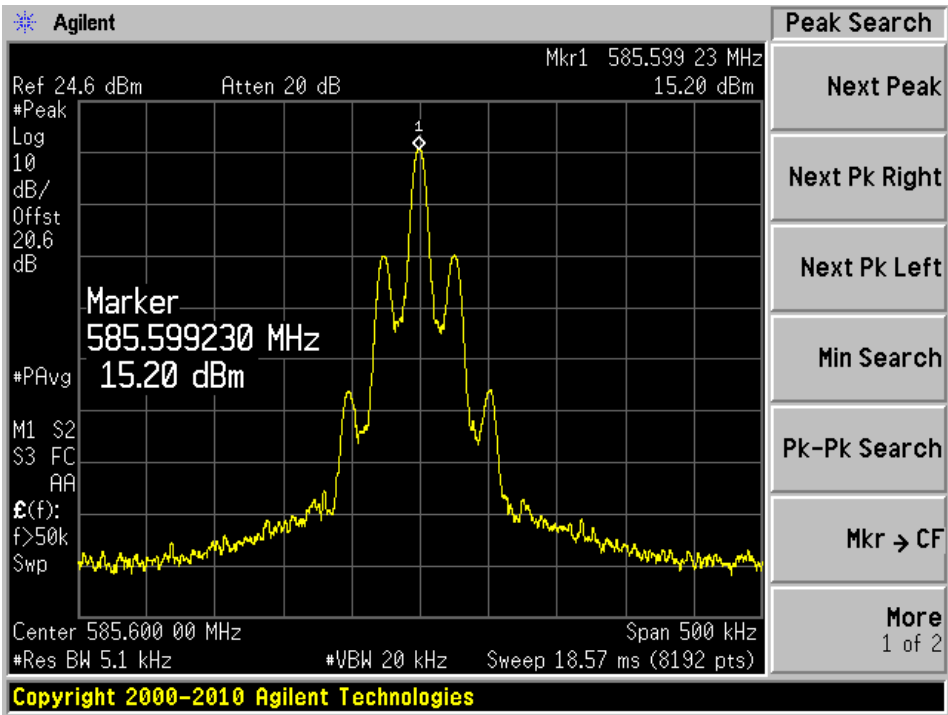
Temperature 20°C:



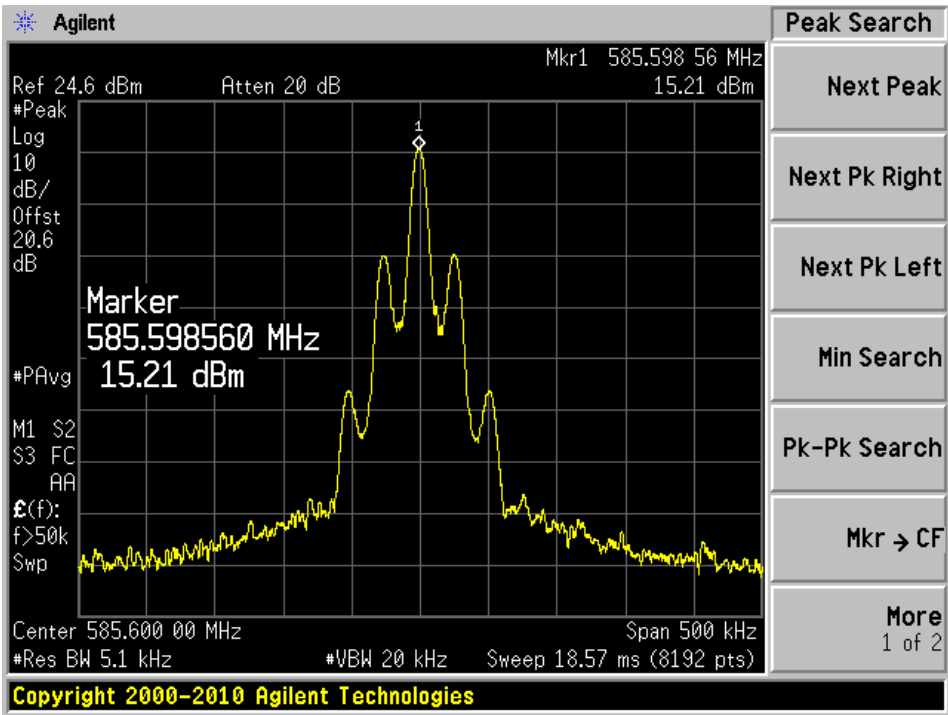
Temperature 30°C:



Temperature 40°C:

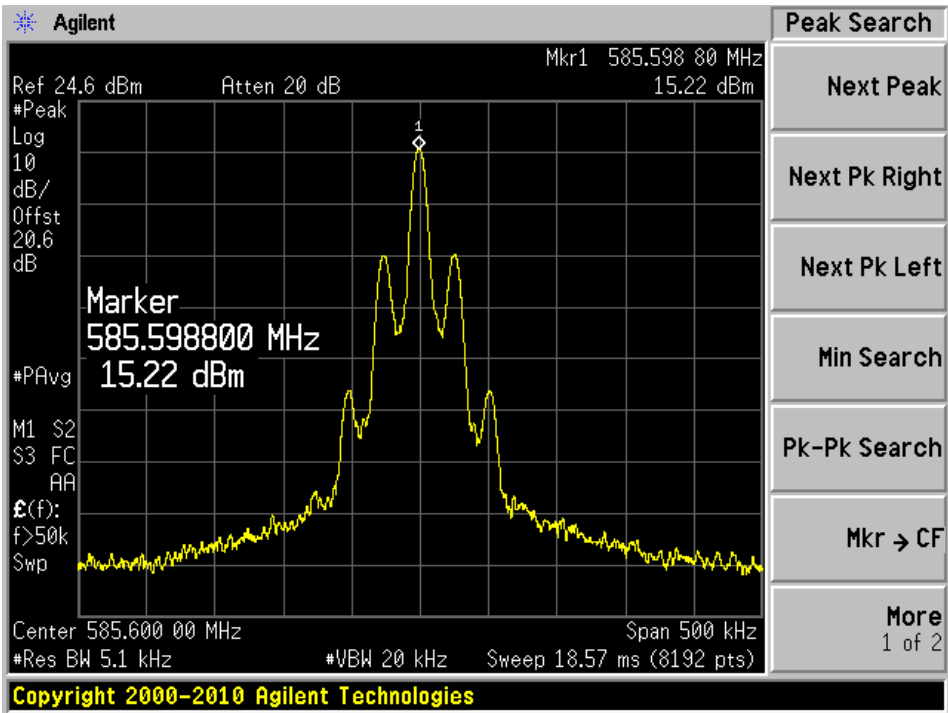


Temperature 50°C:

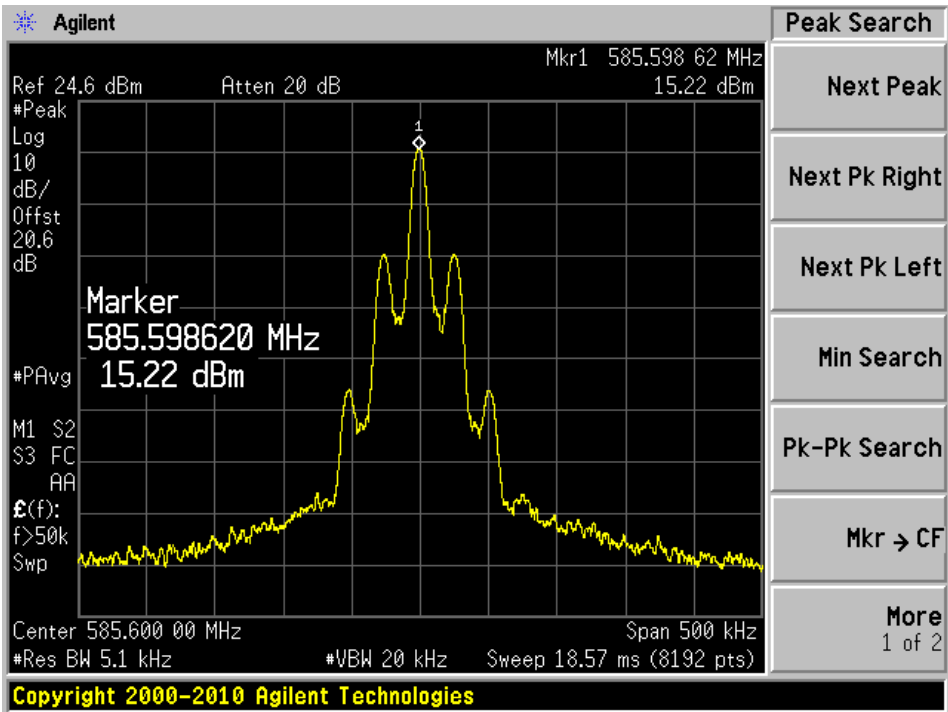


Varying Voltage:

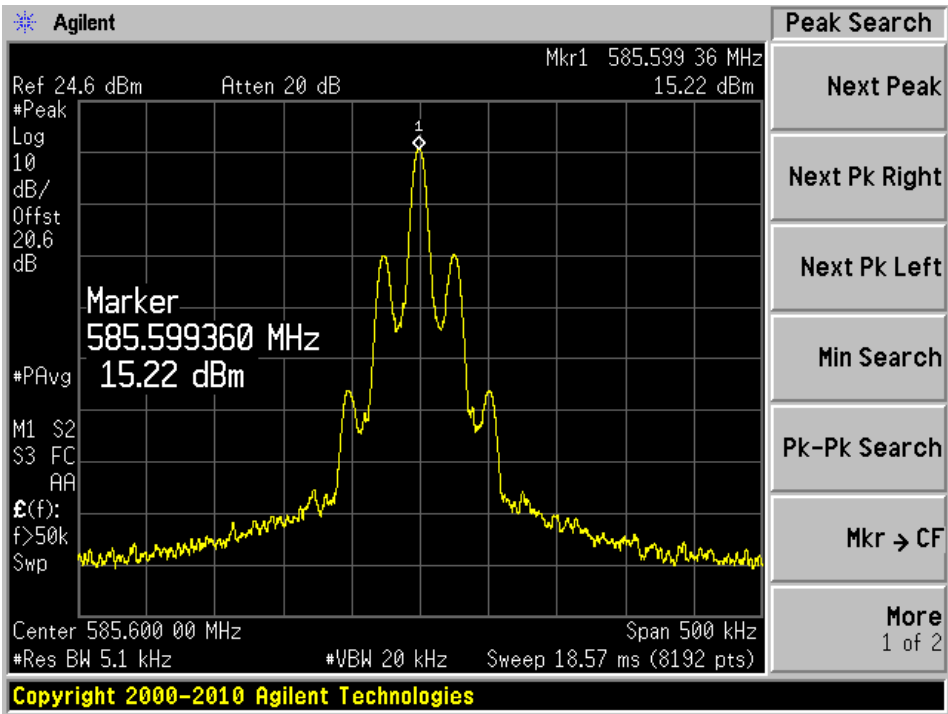
3.06 V at 20°C:



3.6 V at 20°C:



4.14 V at 20°C:



614.1- 639.975 MHz Band-50 mW power level

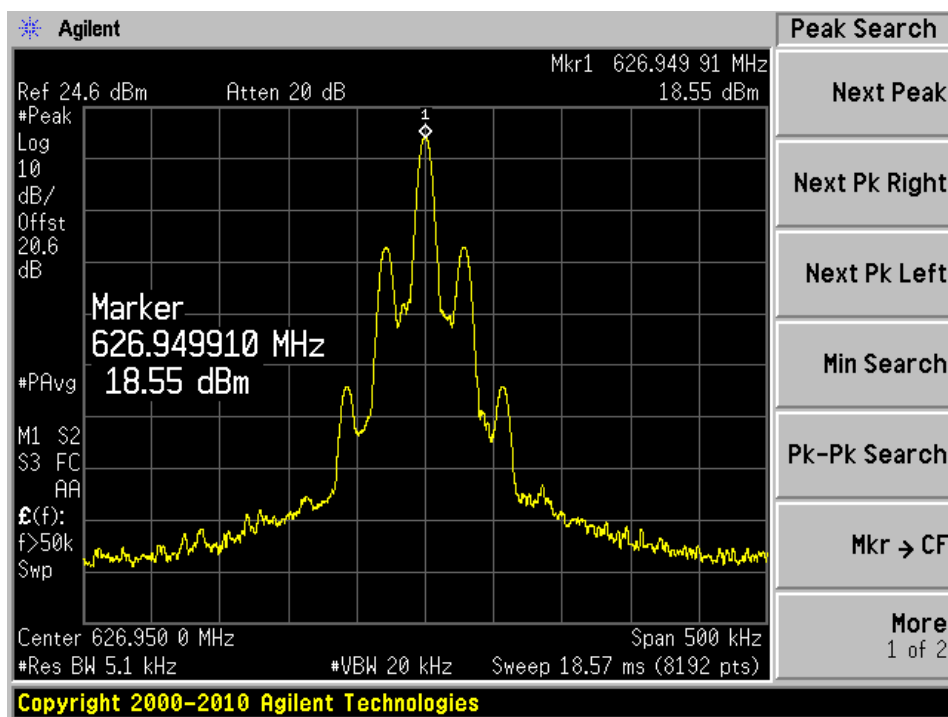
Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
-20	626.94991	626.95	-0.14	50
-10	626.95046	626.95	0.73	50
0	626.94948	626.95	-0.83	50
10	626.94929	626.95	-1.13	50
20	626.94972	626.95	-0.45	50
30	626.95021	626.95	0.33	50
40	626.94979	626.95	-0.33	50
50	626.95028	626.95	0.45	50

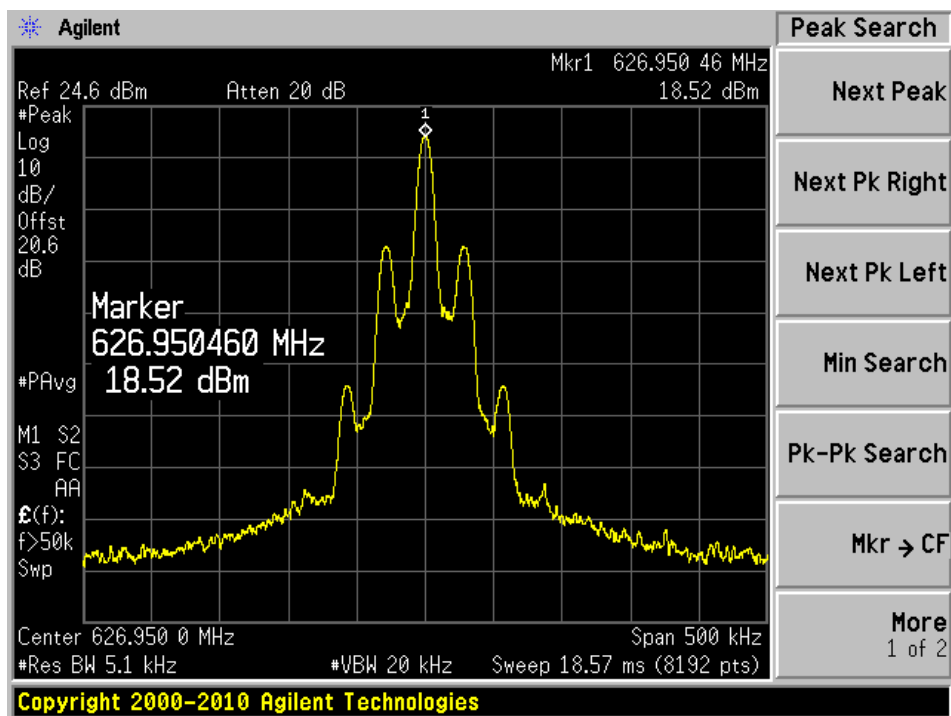
Varying supply voltage:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
3.06 V at 20°C	626.94856	626.95	-2.30	50
3.6 V at 20°C	626.94843	626.95	-2.50	50
4.14 V 20°C	626.94831	626.95	-2.70	50

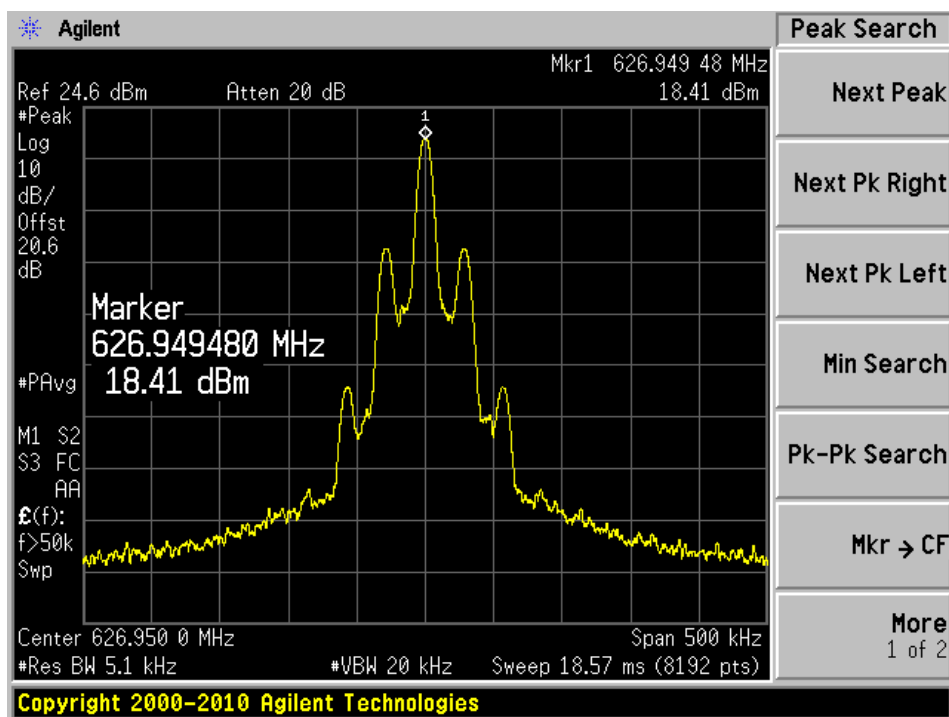
Temperature -20°C:



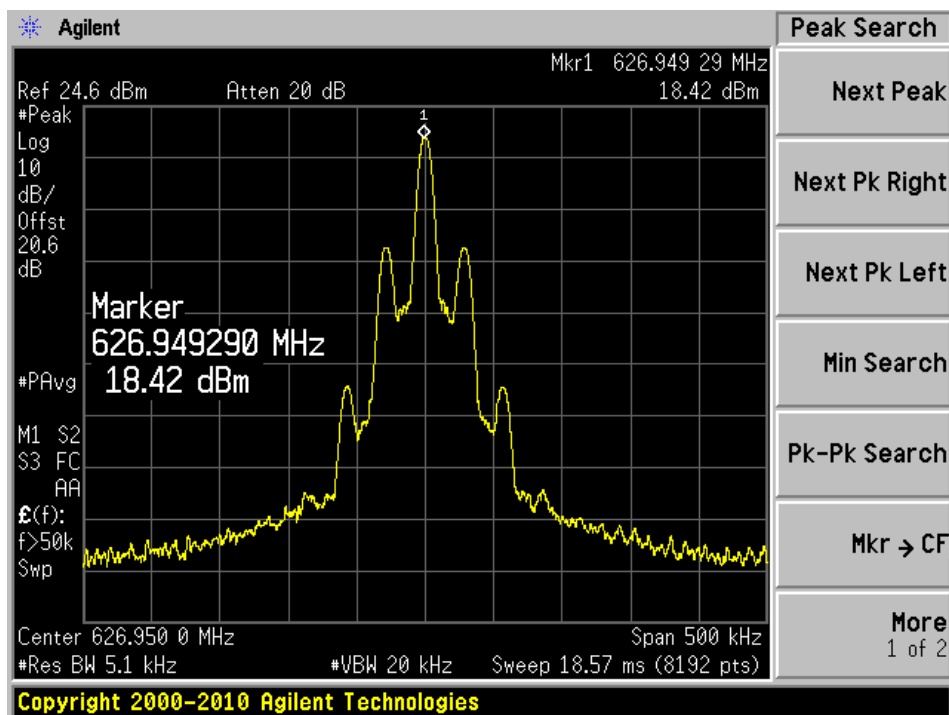
Temperature -10°C:



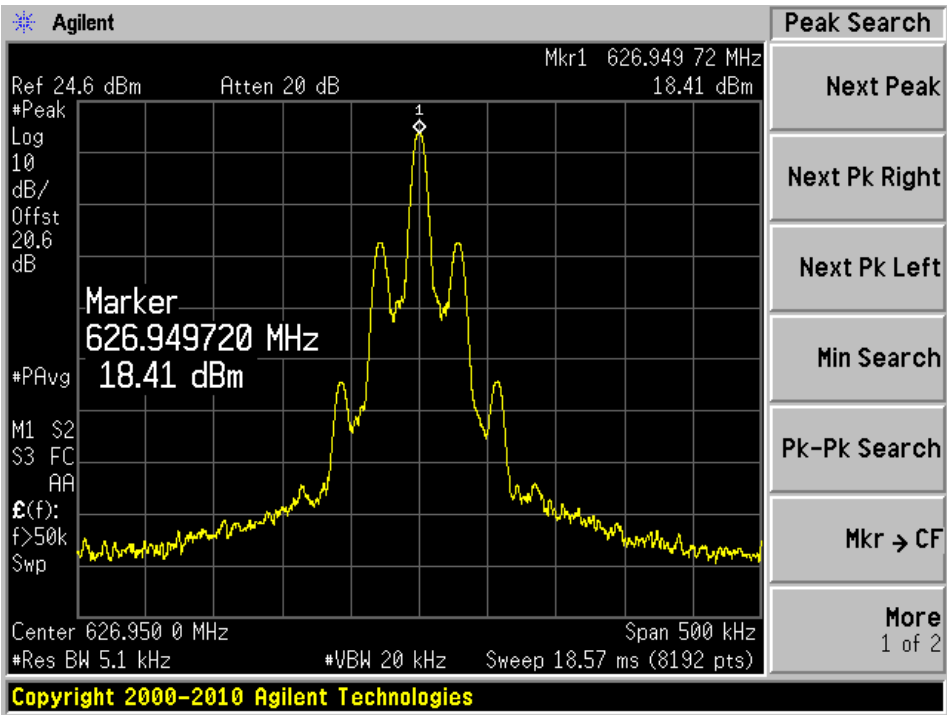
Temperature 0°C:



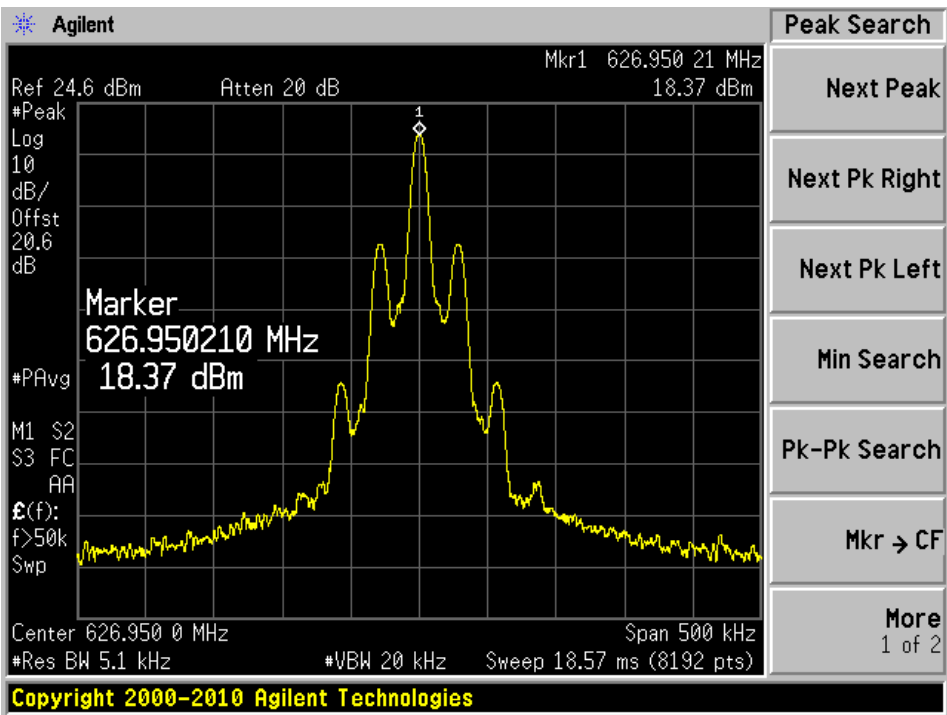
Temperature 10°C:



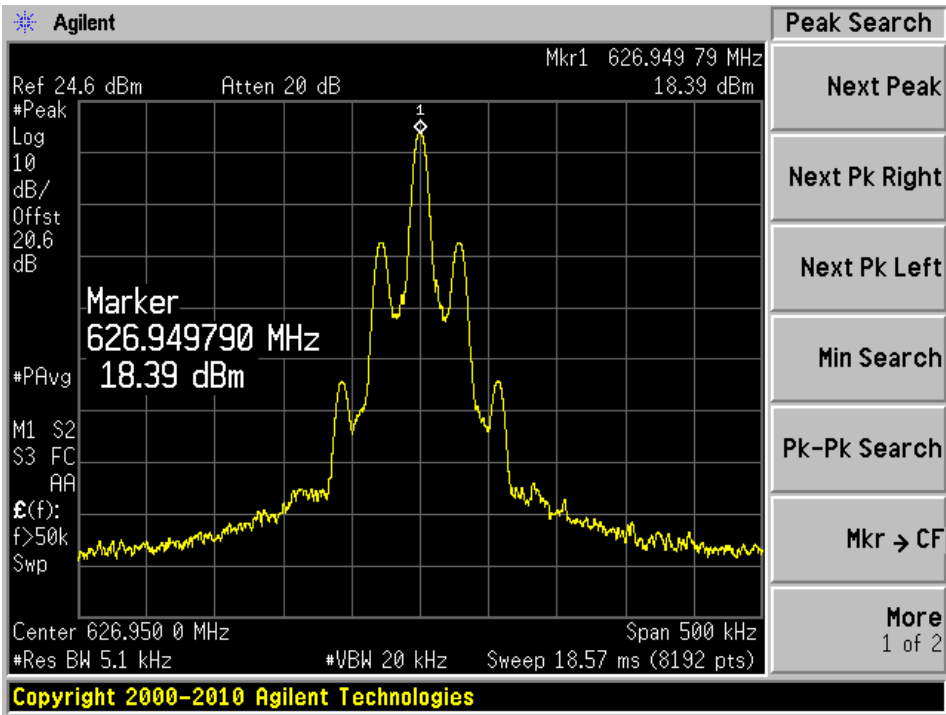
Temperature 20°C:



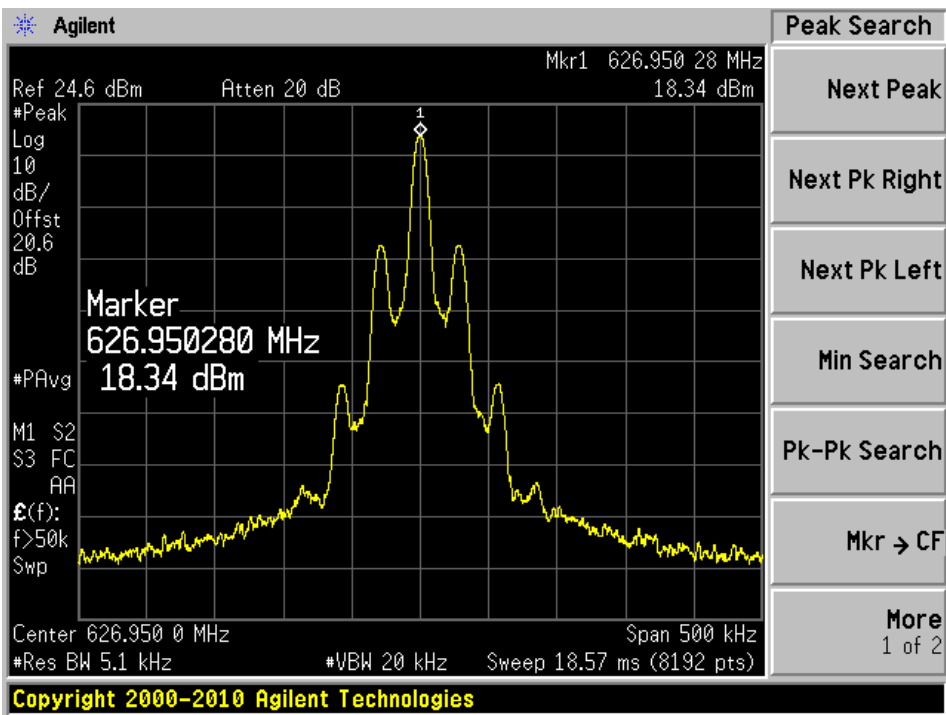
Temperature 30°C:



Temperature 40°C:

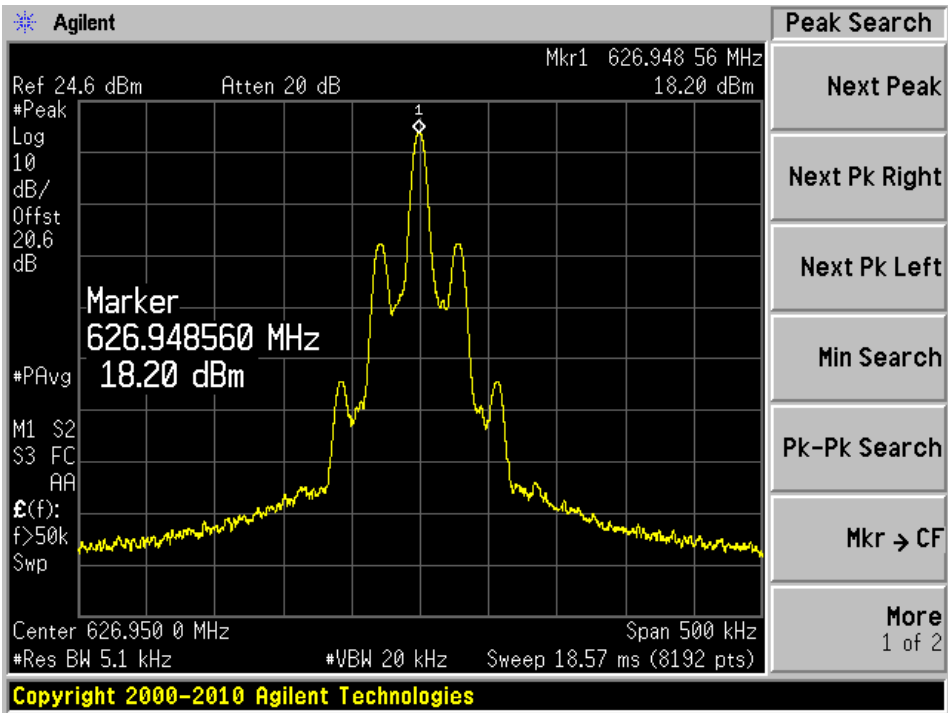


Temperature 50°C:

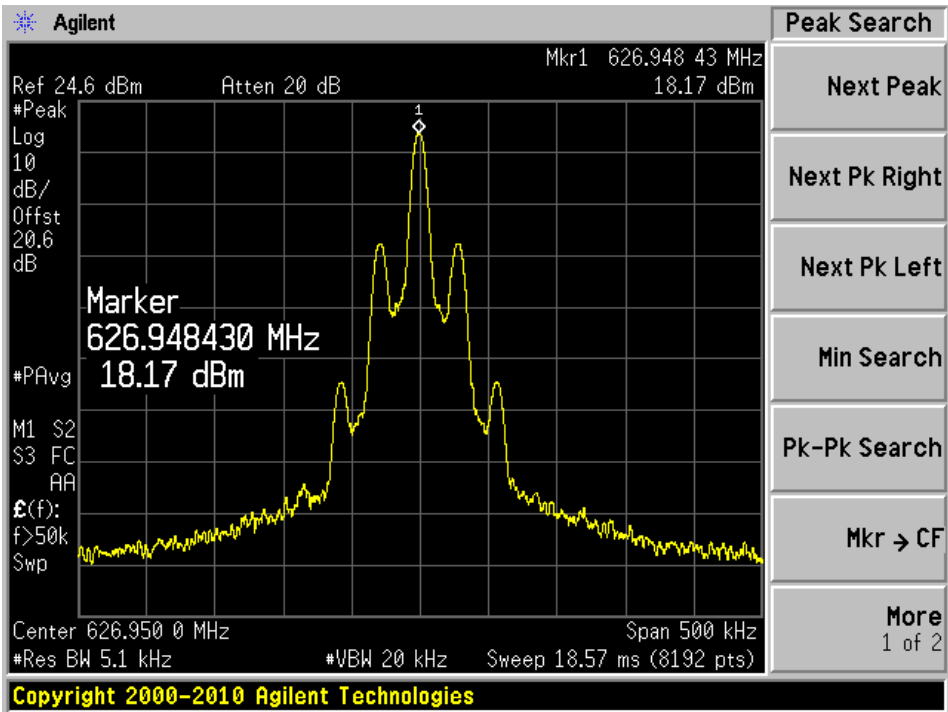


Varying Voltage:

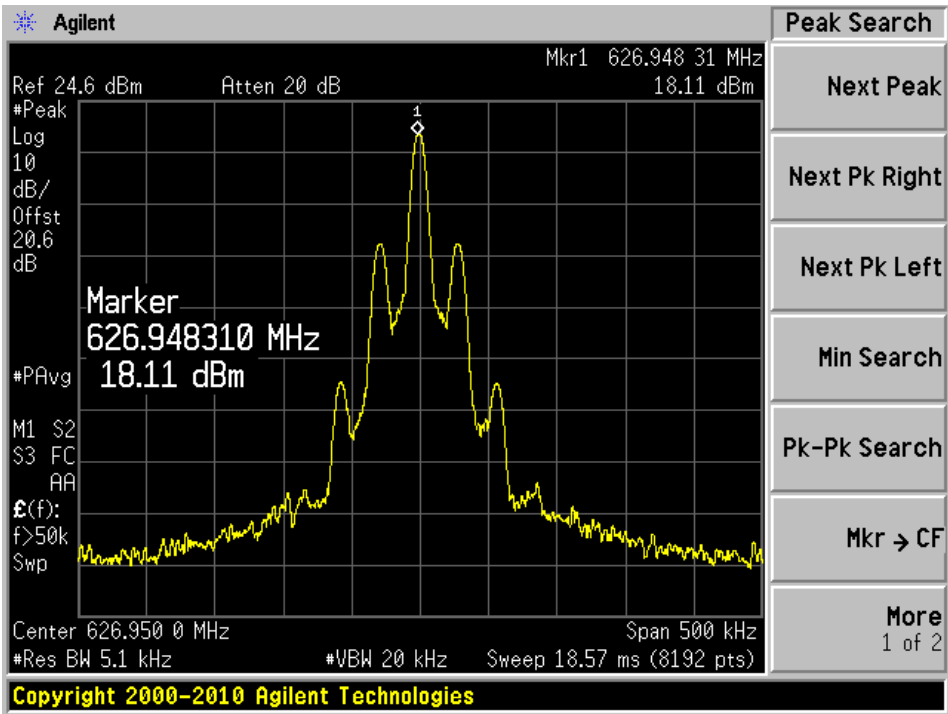
3.06 V at 20°C:



3.6 V at 20°C:



4.14 V at 20°C:



614.1- 639.975 MHz Band-25 mW power level

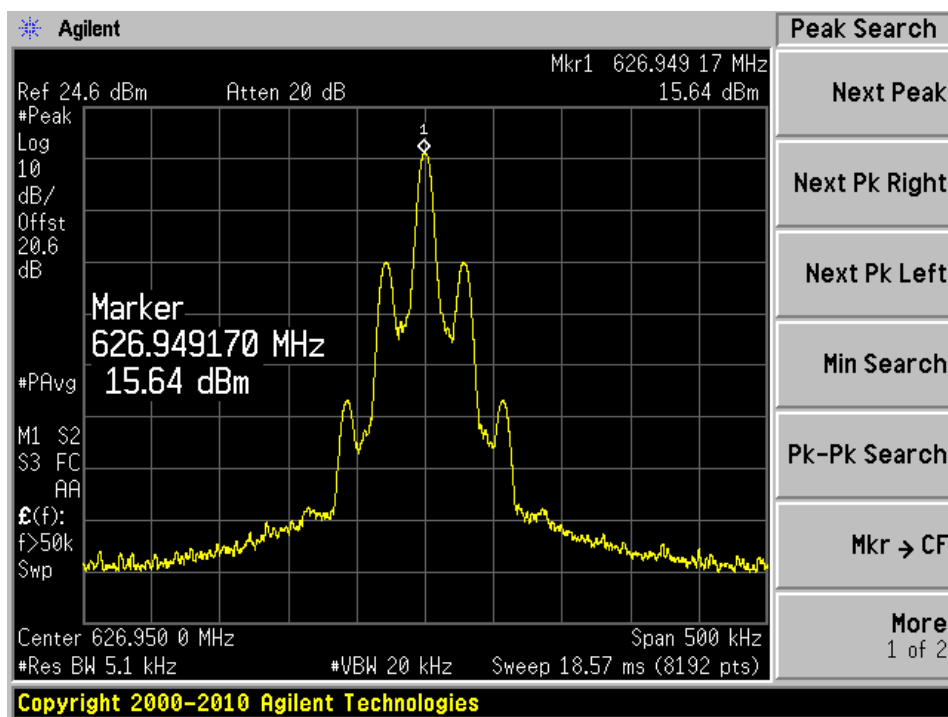
Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
-20	626.94917	626.95	-1.32	50
-10	626.9504	626.95	0.64	50
0	626.94917	626.95	-1.32	50
10	626.94837	626.95	-2.60	50
20	626.94825	626.95	-2.79	50
30	626.94886	626.95	-1.82	50
40	626.94886	626.95	-1.82	50
50	626.94807	626.95	-3.08	50

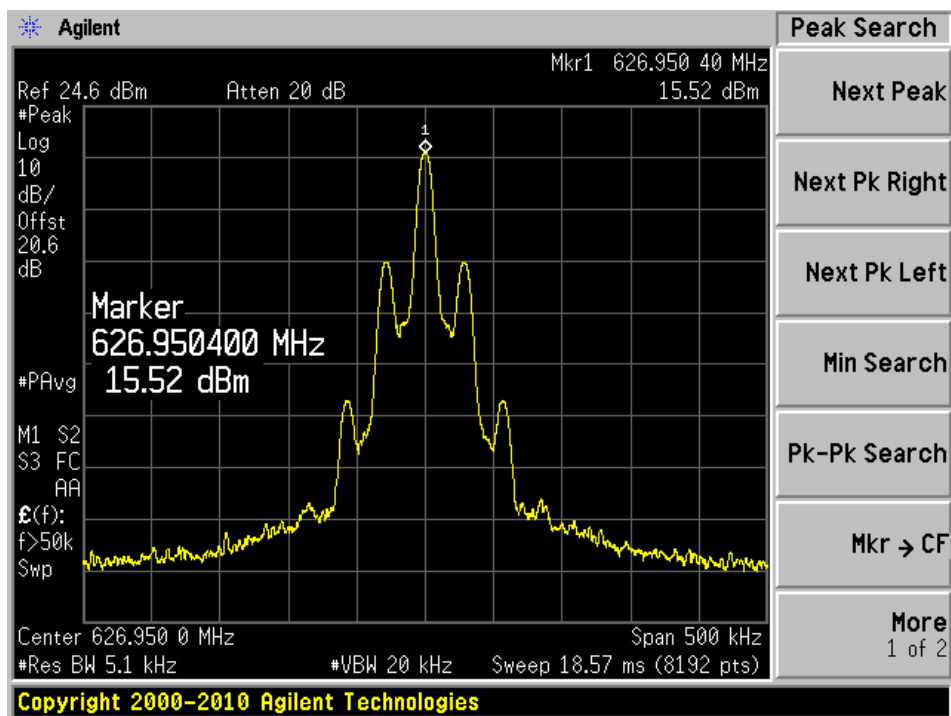
Varying supply voltage:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
3.06 V at 20°C	626.94886	626.95	-1.82	50
3.6 V at 20°C	626.94807	626.95	-3.08	50
4.14 V 20°C	626.9488	626.95	-1.91	50

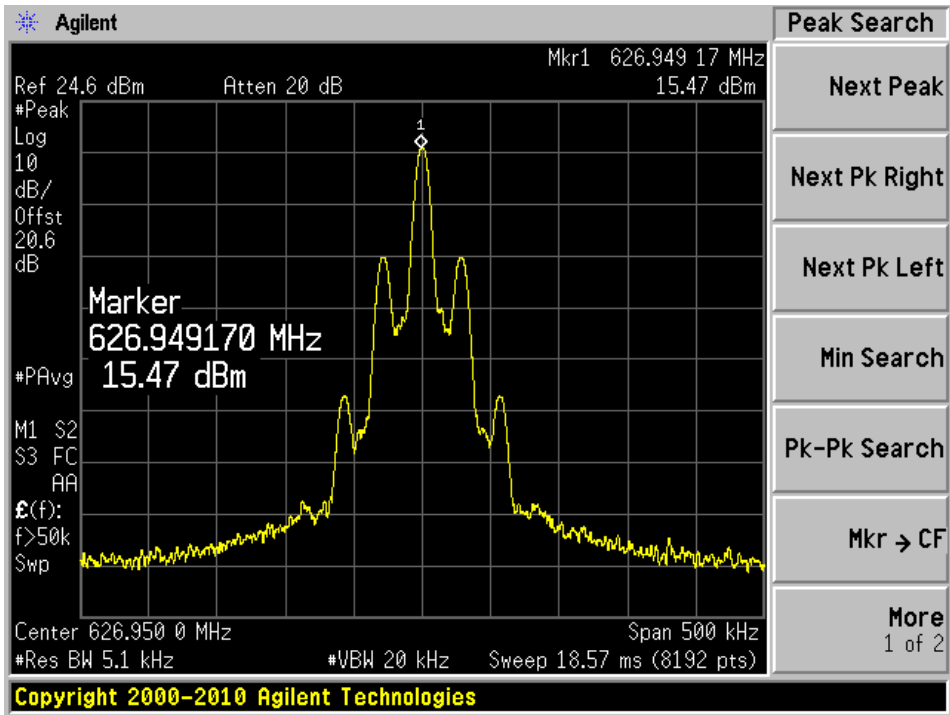
Temperature -20°C:



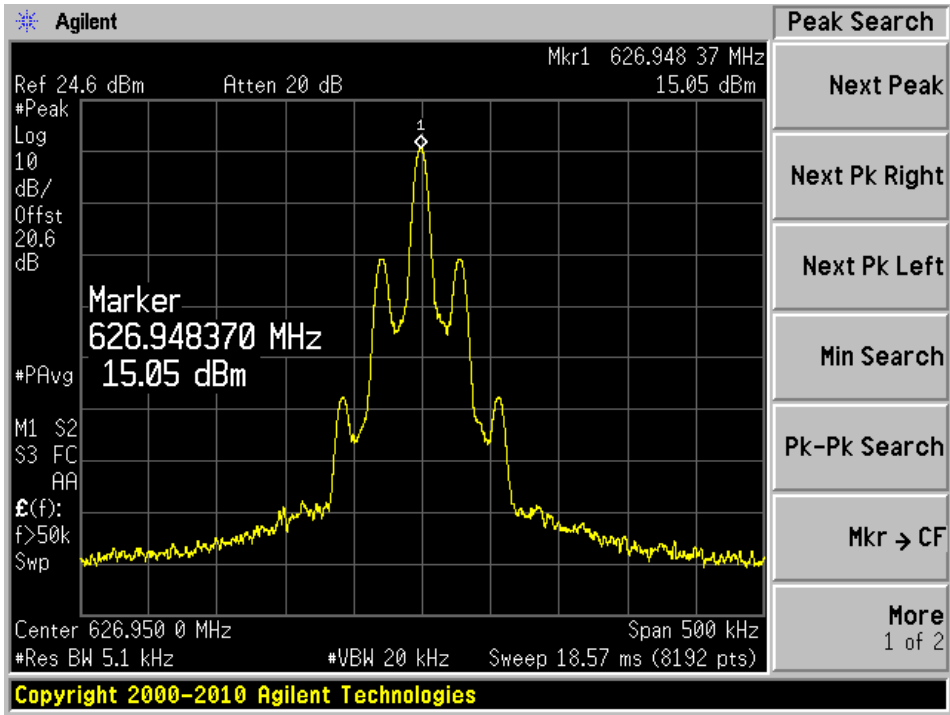
Temperature -10°C:



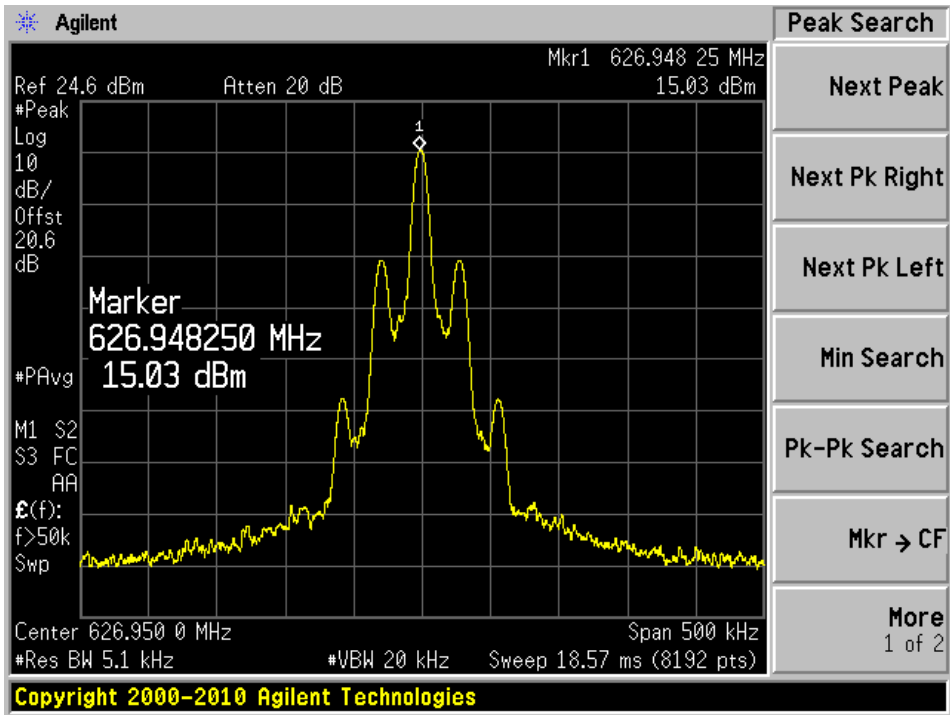
Temperature 0°C:



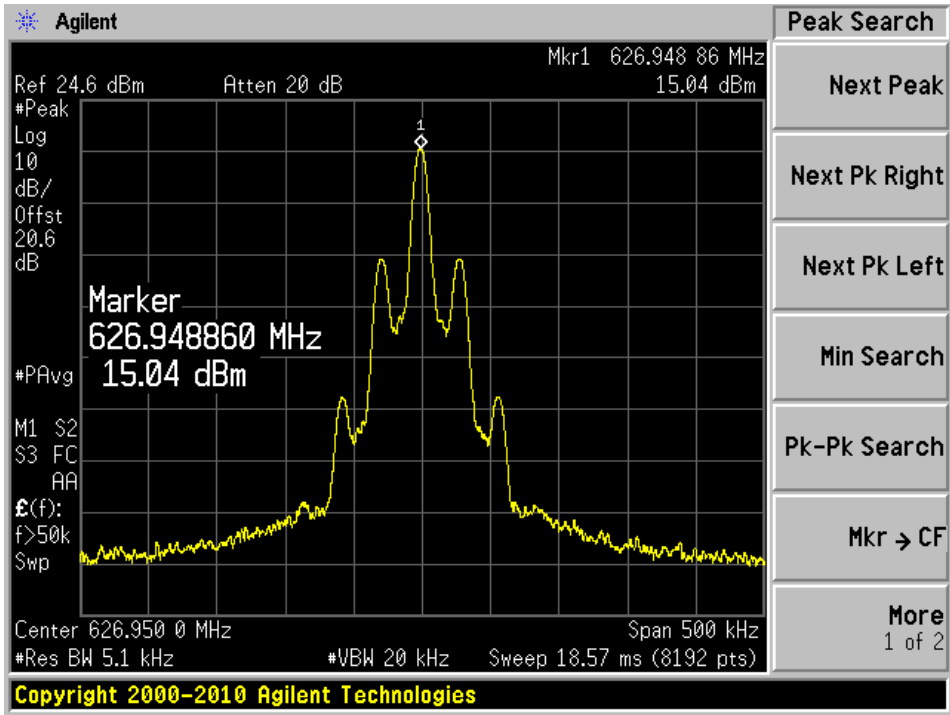
Temperature 10°C:



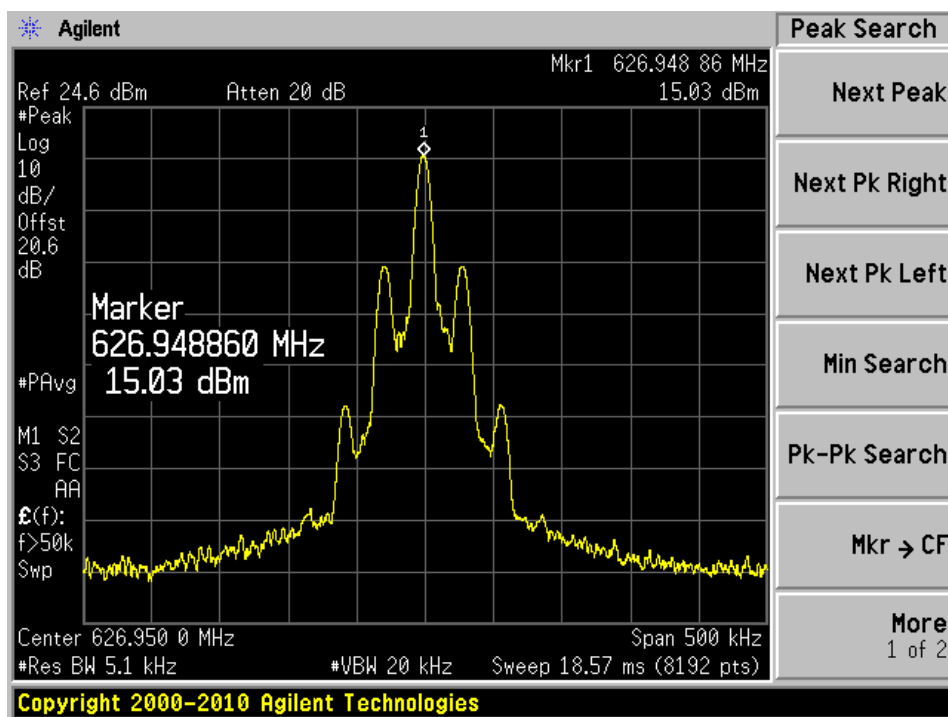
Temperature 20°C:



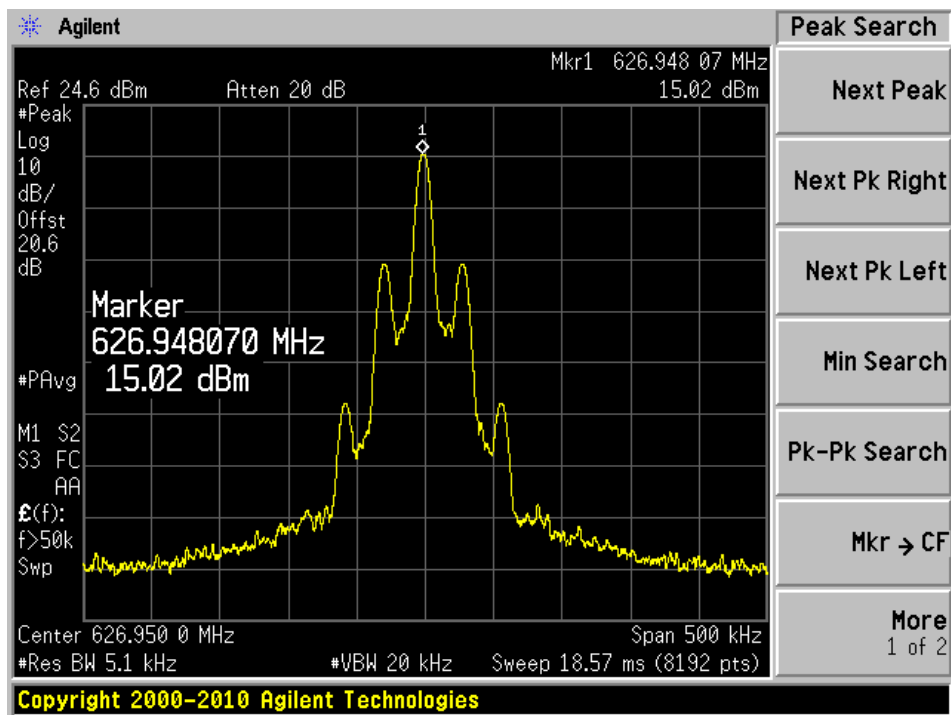
Temperature 30°C:



Temperature 40°C:

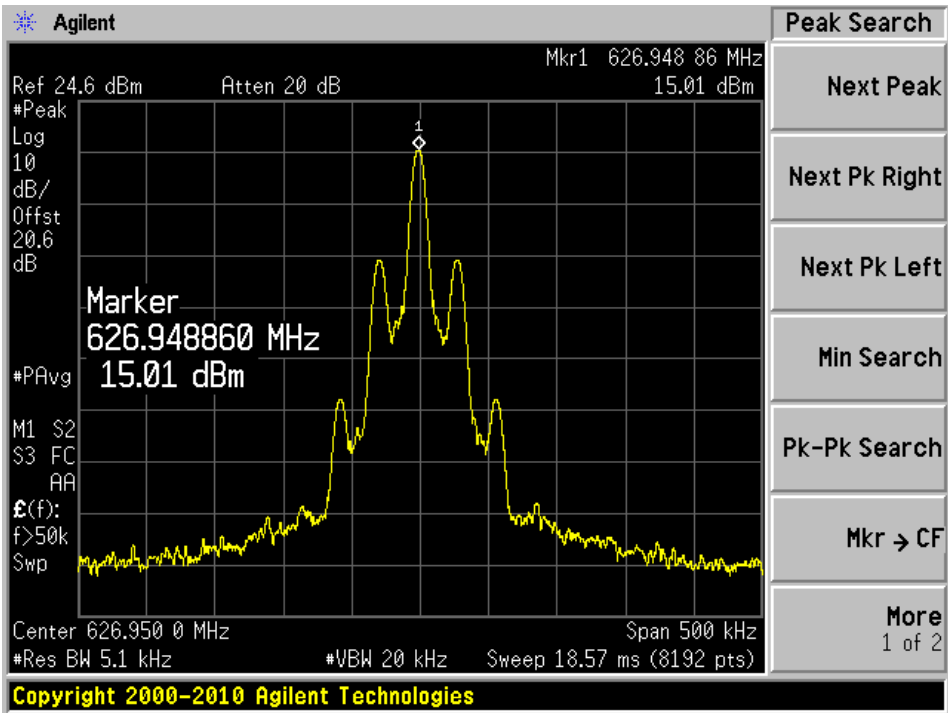


Temperature 50°C:

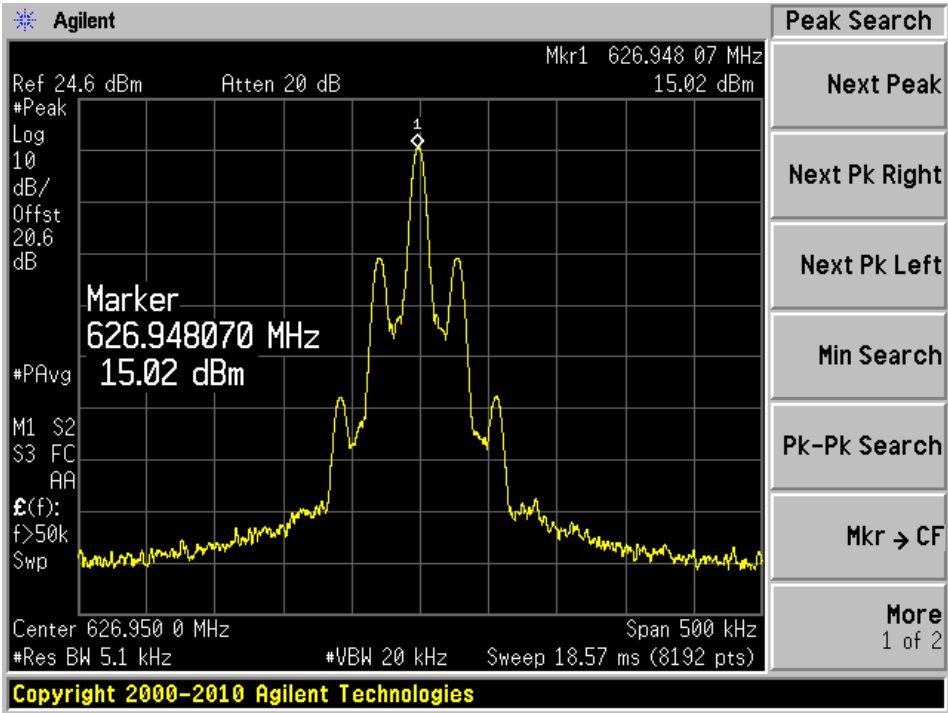


Varying Voltage:

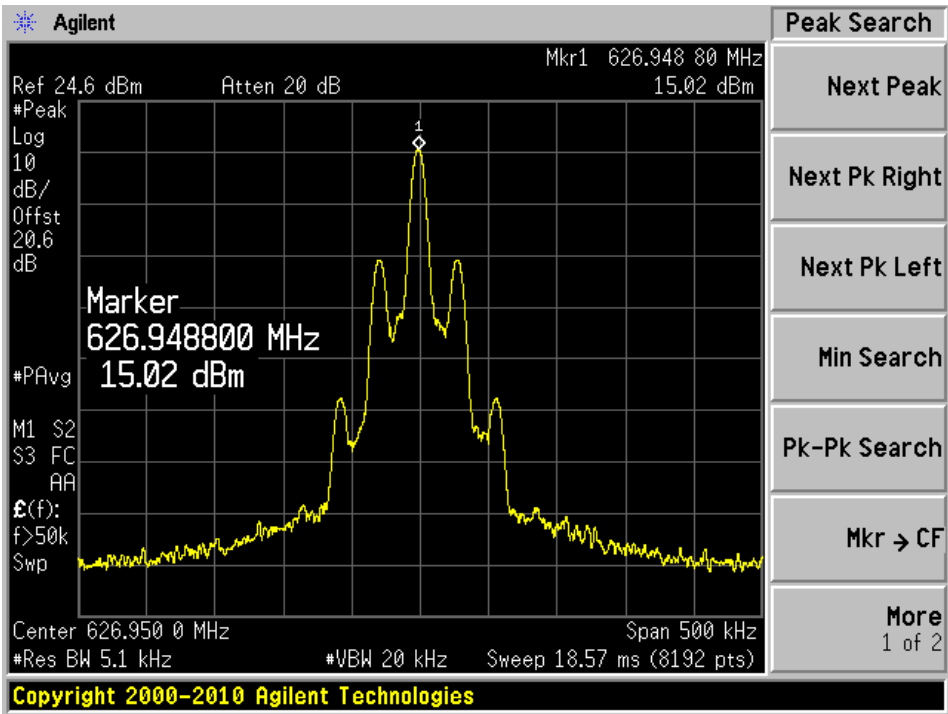
3.06 V at 20°C:



3.6 V at 20°C:



4.14 V at 20°C:



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