



FCC PART 74 SUBPART H TEST AND MEASUREMENT REPORT

For

Lectrosonics, Inc.

581 Laser Road NE
Rio Rancho, NM 87124, USA

FCC ID: DBZSMV9

Report Type: Original Report	Product Type: Wireless Microphone Transmitters
Prepared By: Frank Wang Test Engineer	<i>Frank Wang</i>
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Reviewed By: Simon Ma RF Engineer Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732 9164	<i>Simon Ma</i>

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1710024-74	Original Report	2017-11-21

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 models: *SMV-941 and SMQV-941, FCC ID:DBZSMV9* which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a Wireless Microphone Transmitters. The EUT operates in the frequency range: 941.525-944 MHz, 944-951.975 MHz, 952.875-956.225 MHz and 956.475-959.825 MHz.

1.2 Mechanical Description of EUT

The EUT measures approximately:

SMQV-941: 5.8 cm (W) x 6 cm (L) x 1.6 cm (H) and weighs approximately 0.105 kg with lithium batteries.

SMV-941: 5.8 cm (W) x 4.6 cm (L) x 1.6 cm (H) and weighs approximately 0.0759 kg with lithium batteries.

The data gathered is from the production samples provided by the manufacturer, serial number: 19990 for SMQV-941 and 7450 for SMV-941 assigned by client.

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)

None

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

None

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

None

2.5 Local Support Equipment

None

2.6 Interface Ports and Cables

Cable Description	Length(m)	To	From
RF Cable	< 1.0	PSA	EUT
MC35 XLR/F to TA5F Cable	< 1.0	EUT	Audio Signal Generator

3 Summary of Test Results

FCC Rules	Descriptions of Test	Result (s)
FCC §2.1093	RF Exposure	Compliant ¹
FCC §74.861(d)(1)	RF output power	Compliant
FCC §2.1047	Modulation characteristics	Compliant
FCC §2.1049	Occupied Bandwidth	Compliant
FCC §74.861(d)(1)(i)	Emission Mask	Compliant
FCC §74.861(d)(3)	Band Edge	Compliant
FCC §74.861(d)(4)(i)	Spurious radiation at the antenna port	Compliant
FCC §74.861(d)(4)(i)	Radiated Spurious Emission	Compliant
FCC §2.1055	Frequency stability	Compliant

Note¹: RF exposure analysis is covered in a separate report. Please refers to R1710024-SAR

4 FCC §2.1093 - RF Exposure

4.1 Applicable Standards

FCC §2.1093

4.2 Test Results

Please refer to the SAR Report: R1710024-SAR.

5 FCC §74.861(d)(1) - RF Output Power

5.1 Applicable Standards

According to FCC §74.861 (d) (1): For all bands except the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 1 watt. In the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 100 milliwatts. Licensees may accept the manufacturer's power rating; however, it is the licensee's responsibility to observe specified power limits.

5.2 Test Procedure

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

- Center frequency: channel frequency under test
- RBW: 1 MHz
- VBW: 3 MHz
- Detector mode: peak
- Span: 2 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	2017-02-24	1 year
Mini Circuits	Precision Fixed Attenuator, 10dB	BW-S10W5+	-	-	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".

5.4 Test Environmental Conditions

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

The testing was performed by Frank Wang on 2017-10-06 at RF site.

5.5 Test Results

Conducted output power:

SMV-941

Channel	Frequency (MHz)	Device Power Setting (mW)	Conducted Output Power (dBm)	Limits (dBm)	Margin (dB)
Low	941.525	50 mW	17.37	30	-12.63
		100 mW	20.34	30	-9.66
Middle	952.875	50 mW	17.38	30	-12.62
		100 mW	20.42	30	-9.58
High	959.825	50 mW	17.37	30	-12.63
		100 mW	20.38	30	-9.62

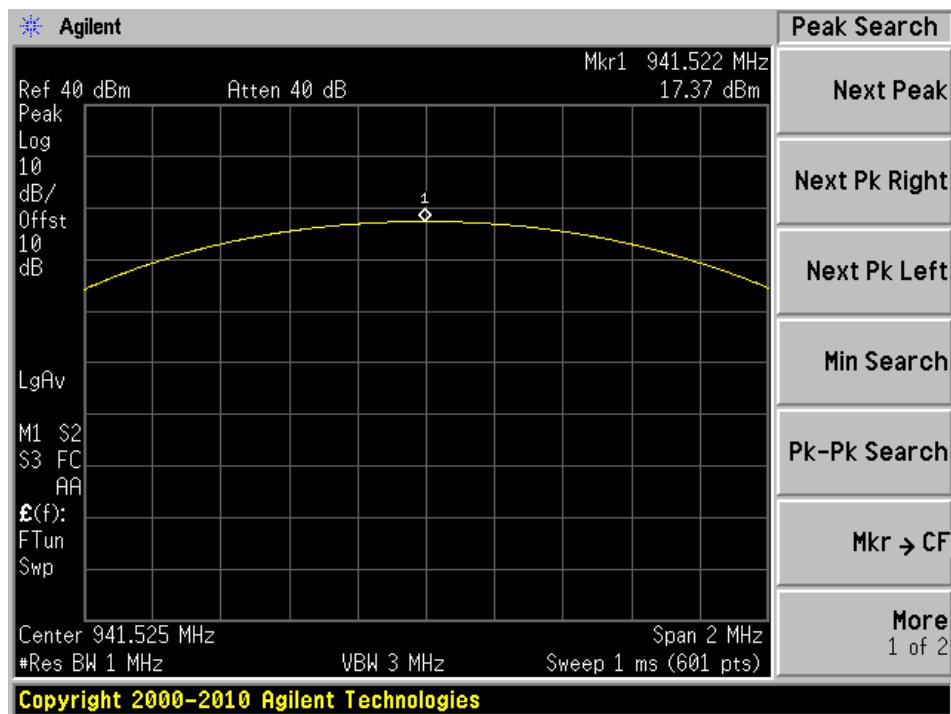
SMQV-941

Channel	Frequency (MHz)	Device Power Setting (mW)	Conducted Output Power (dBm)	Limits (dBm)	Margin (dB)
Low	941.525	50 mW	17.41	30	-12.59
		100 mW	20.42	30	-9.58
Middle	952.875	50 mW	17.47	30	-12.53
		100 mW	20.46	30	-9.54
High	959.825	50 mW	17.43	30	-12.57
		100 mW	20.4	30	-9.6

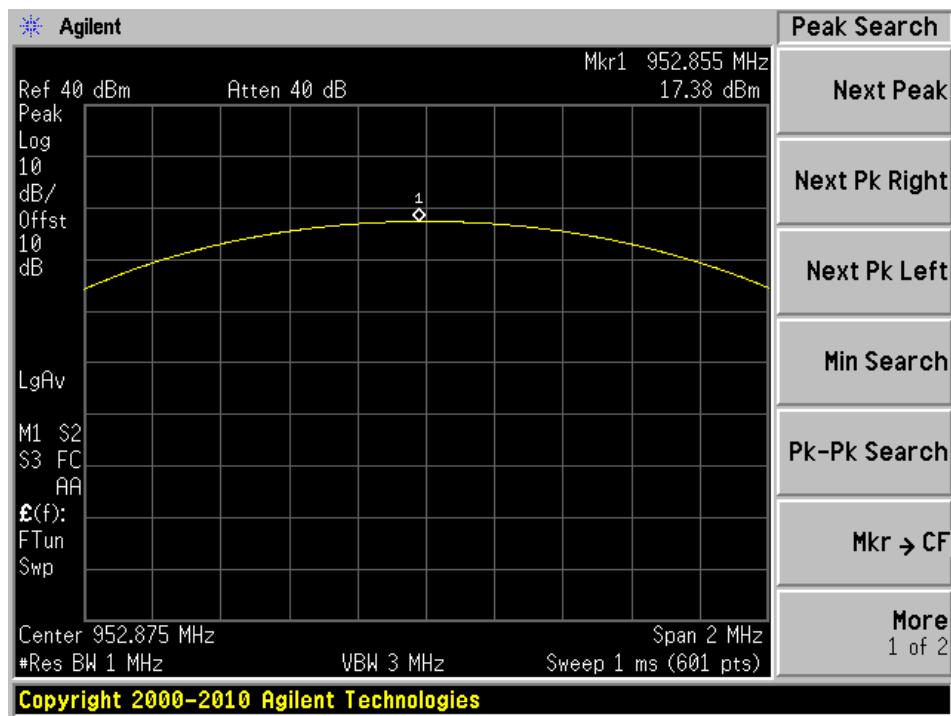
Please refer to the following plots for detailed test results

SMV-941**50 mW Power Setting:**

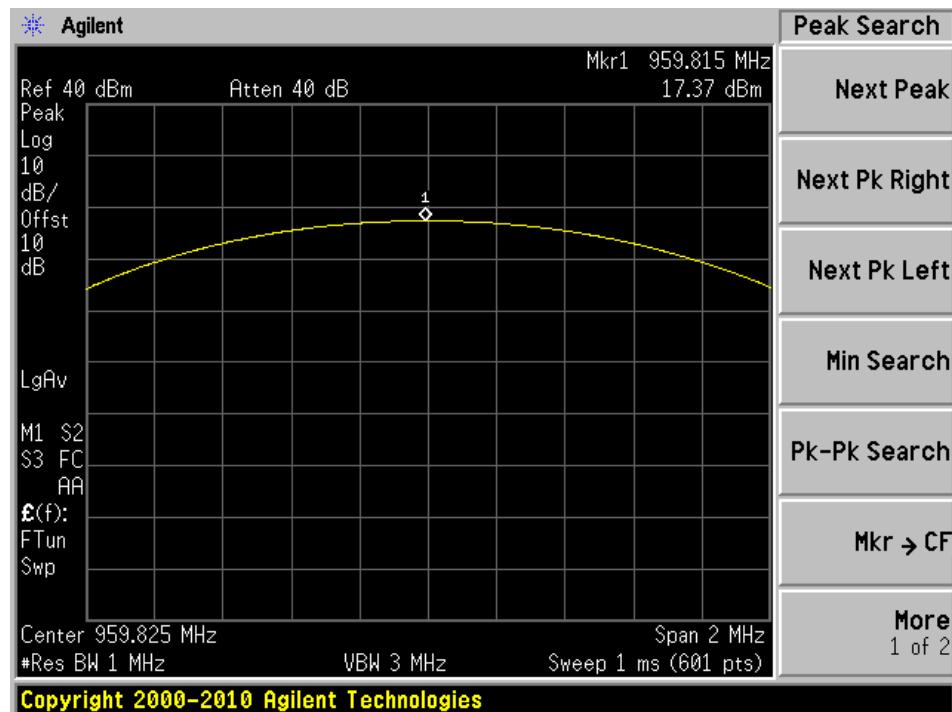
Low Channel



Middle Channel

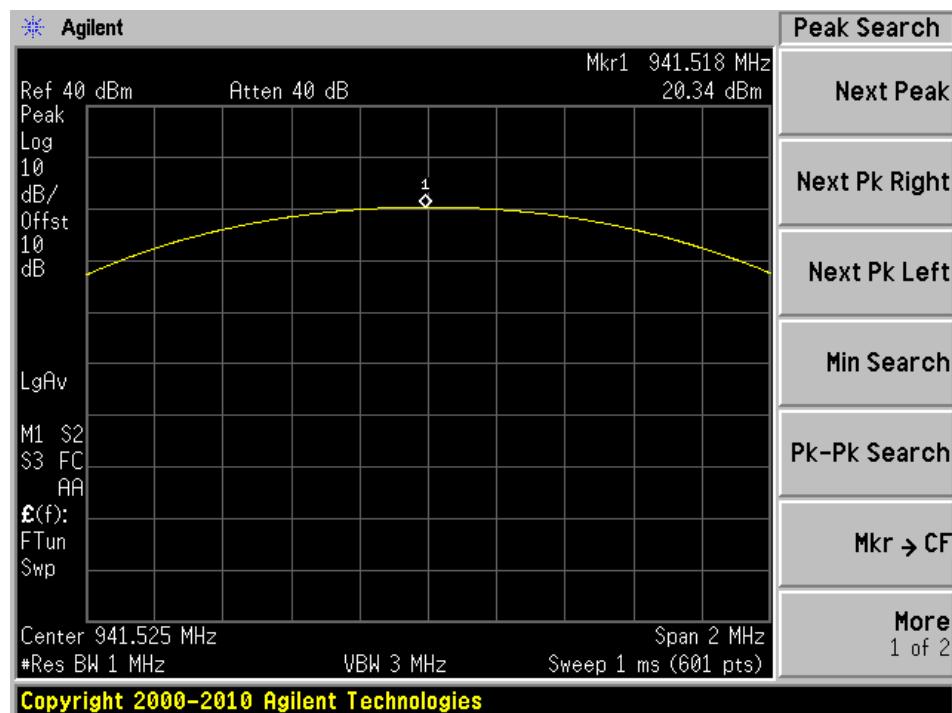


High Channel

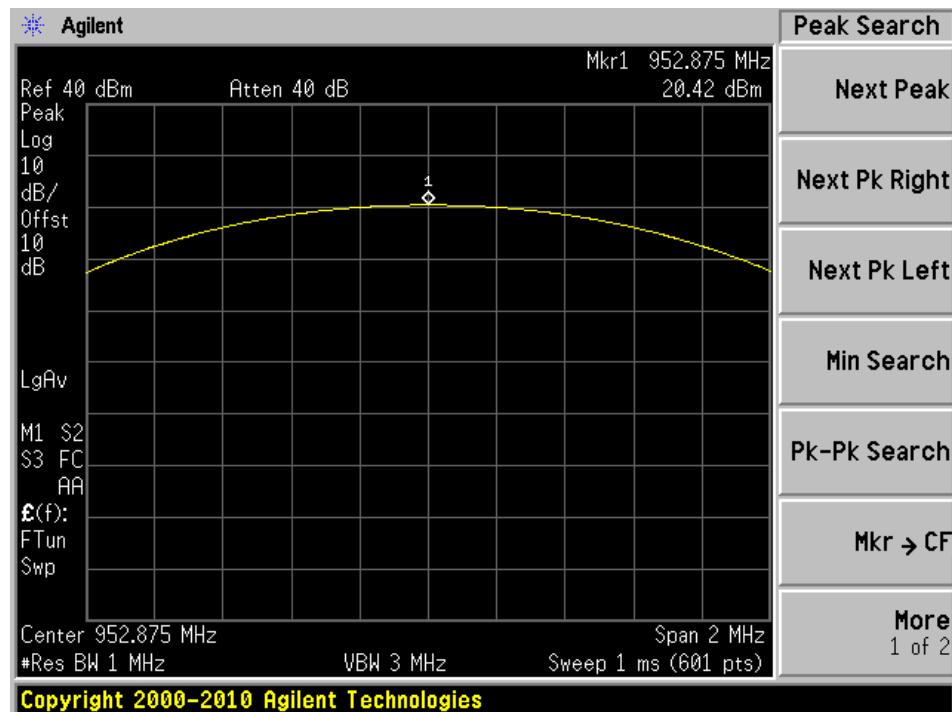


100 mW Power Setting:

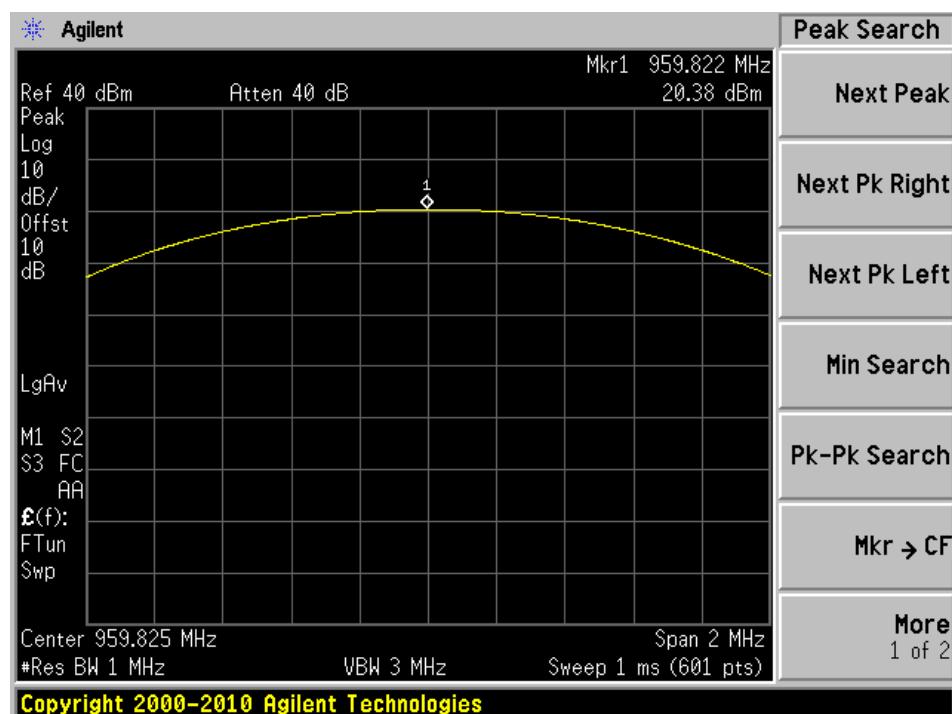
Low Channel



Middle Channel

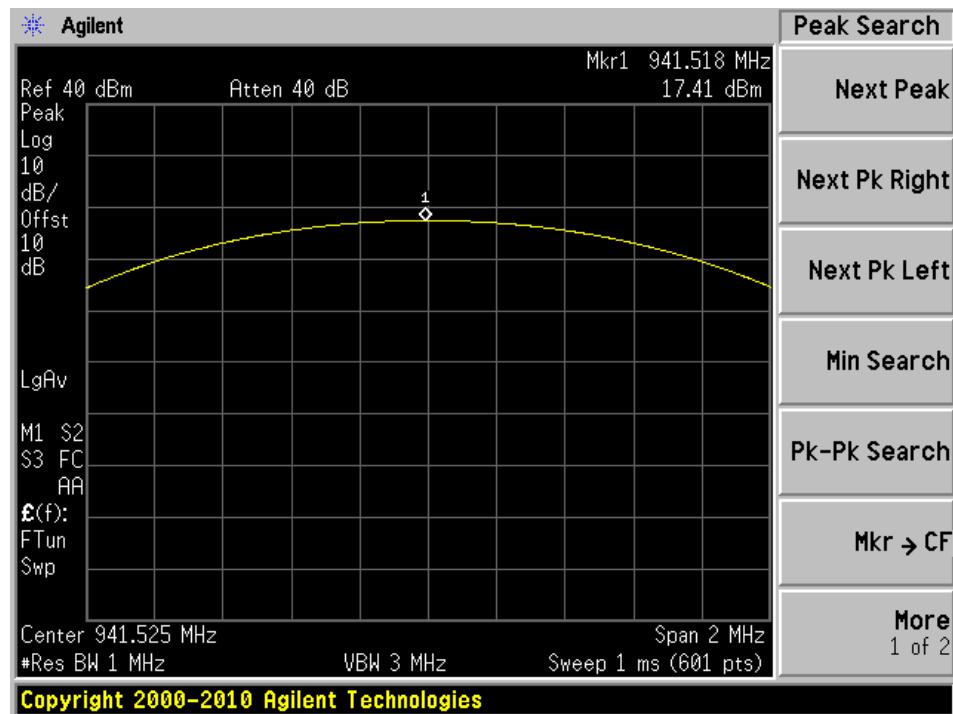


High Channel

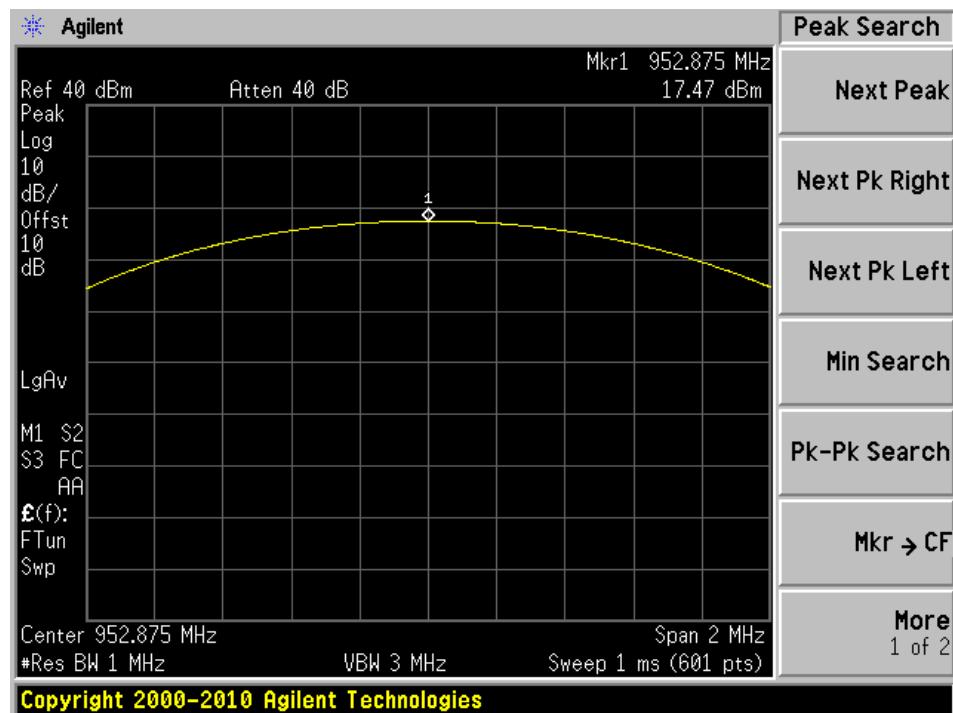


SMQV-941**50 mW Power Setting:**

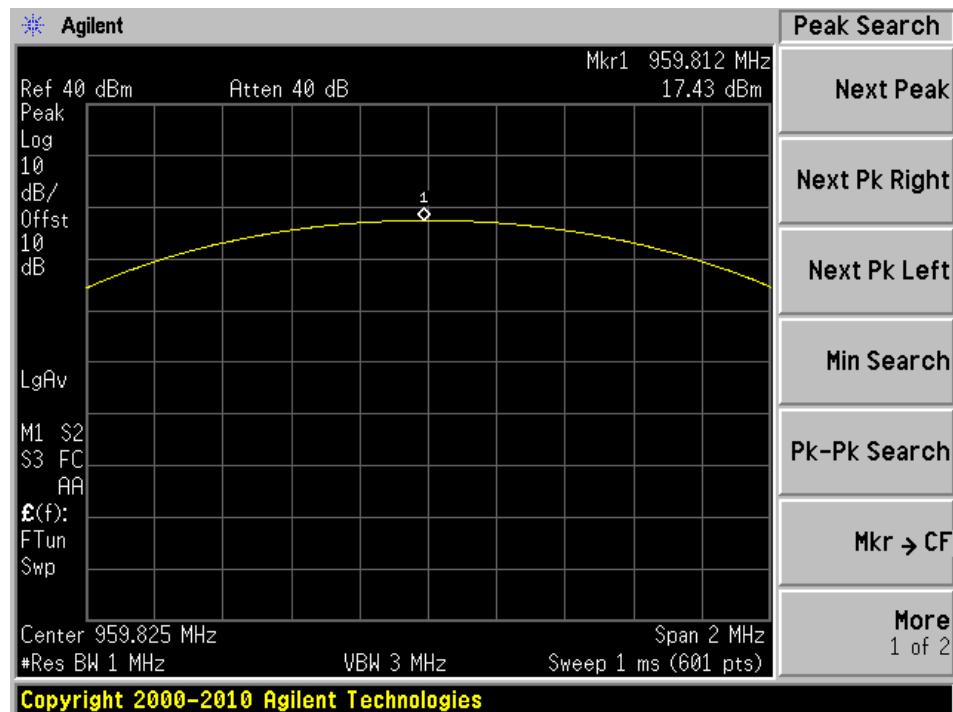
Low Channel



Middle Channel

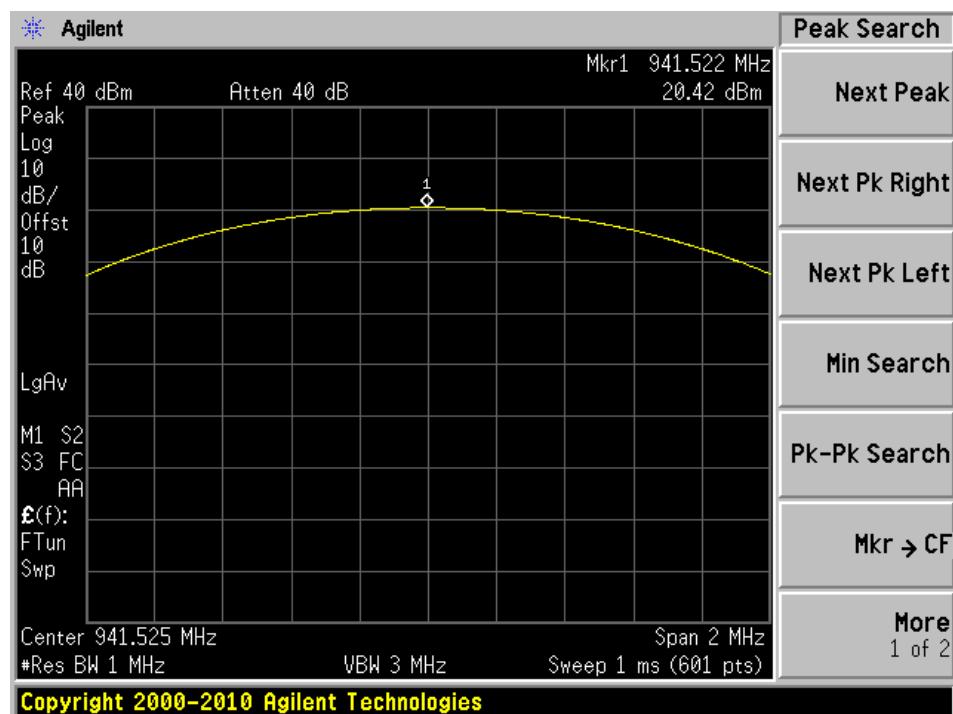


High Channel

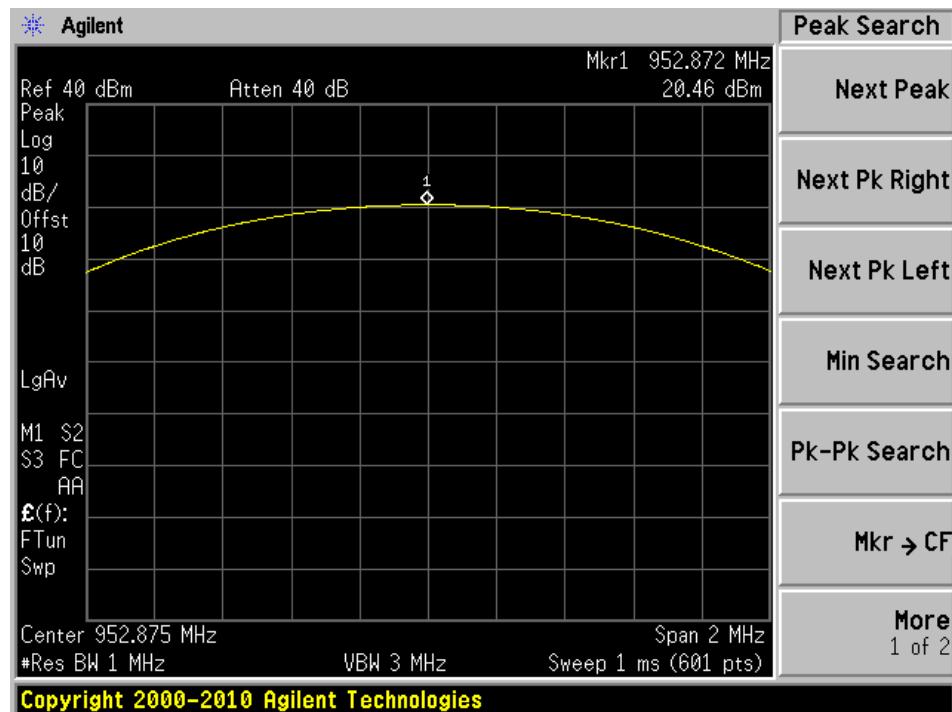


100 mW Power Setting:

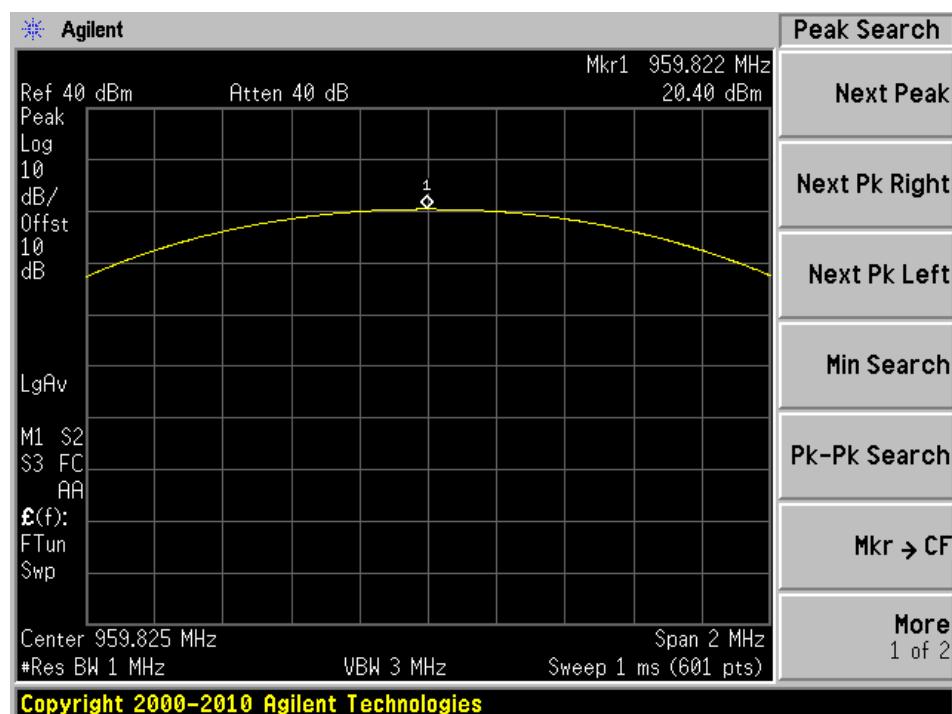
Low Channel



Middle Channel



High Channel



6 FCC §2.1047 - Modulation Characteristics

6.1 Applicable Standards

FCC §2.1047

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	27 months
HP	Analyzer, Modulation	8901A	2026A00847	2015-09-24	26 months
Mini Circuits	Precision Fixed Attenuator, 10 dB	BW-S10W5+	-	-	N/A
-	RF Cable	-	-	-	Each time

*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 Frank Wang on 2017-10-11 at RF site.

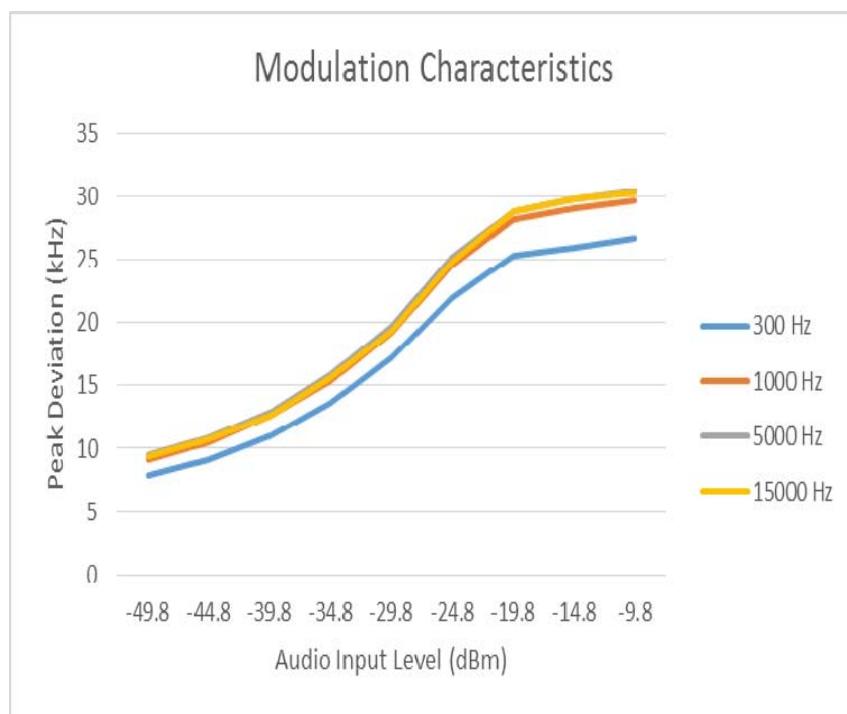
6.5 Test Results

Note: SMQV-941 unit is selected for testing which is the worst case

Middle Channel 952.875 MHz

Deviation versus Audio input level and Audio Frequency in 100 mV power setting

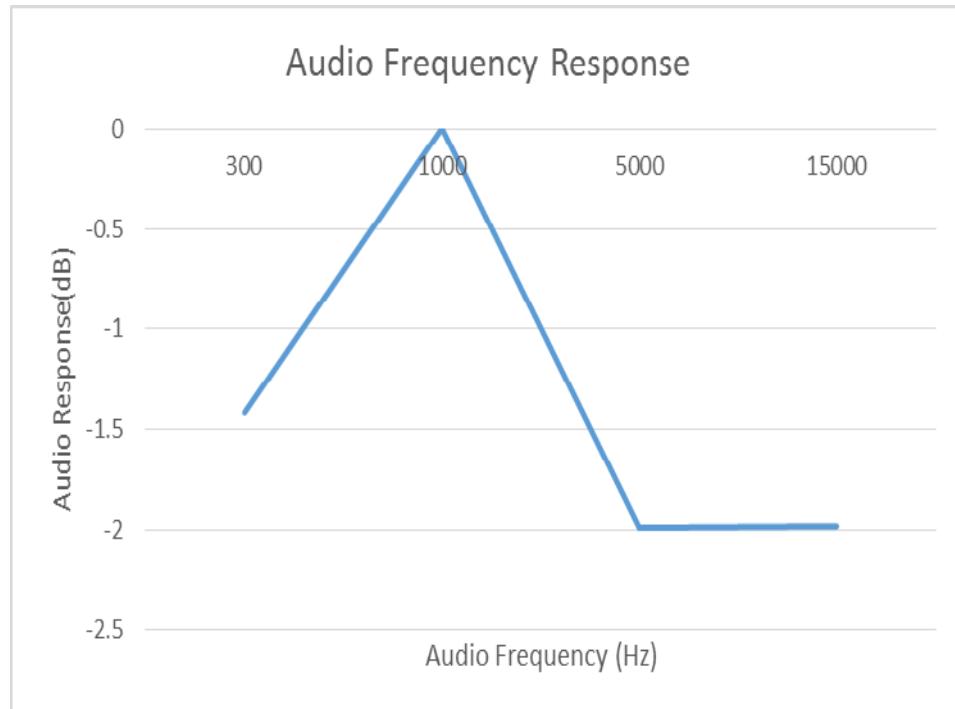
AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
-9.8	26.64	29.67	30.38	30.28	±45
-14.8	25.98	29.05	29.80	29.80	±45
-19.8	25.28	28.18	28.86	28.81	±45
-24.8	21.98	24.53	25.23	24.86	±45
-29.8	17.23	19.20	19.76	19.35	±45
-34.8	13.56	15.34	15.90	15.64	±45
-39.8	10.98	12.59	12.80	12.56	±45
-44.8	9.12	10.53	10.87	10.76	±45
-49.8	7.86	9.18	9.53	9.34	±45



Audio Frequency Response, Middle Channel

AF Frequency (Hz)	AF Level (kHz)	AF Response (dB)
300	26.64	-1.42
1000	19.2	0.00
5000	30.38	-1.99
15000	30.28	-1.98

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



7 FCC §2.1049- Occupied Bandwidth

7.1 Applicable Standards

FCC §2.1049

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	27 months
HP	Analyzer, Modulation	8901A	2026A00847	2015-09-24	26 months
Mini Circuits	Precision Fixed Attenuator, 10 dB	BW-S10W5+	-	-	N/A
-	RF Cable	-	-	-	Each time
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:	23 °C
Relative Humidity:	45 %
ATM Pressure:	101.2 kPa

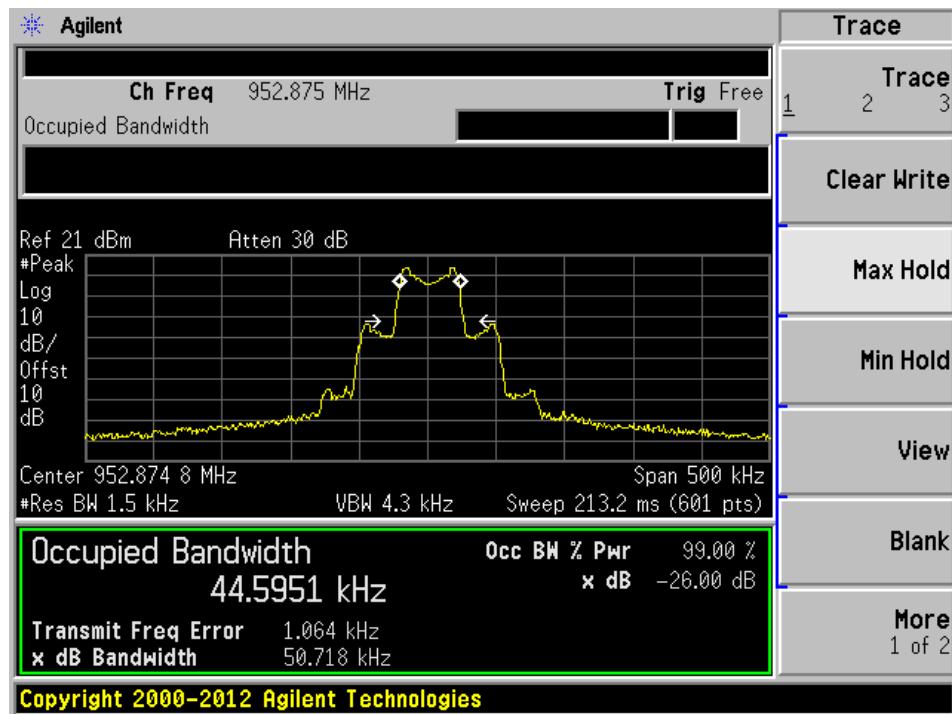
The testing was performed by Frank Wang on 2017-11-14 at RF site.

7.5 Test Results

Note: SMQV-941 unit is selected for testing which is the worst case

Center Frequency (MHz)	99% Bandwidth (kHz)	Power Setting
952.875	44.5951	High (100 mW)

Please refer to the following table plots for detailed test results



8 FCC §74.861 (d) (4) (i) - Emission Mask

8.1 Applicable Standards

According to FCC §74.861 (d) (4) (i)

For the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

8.2 Test Procedure

The arrangement of test equipment as shown in figure B.1 shall be used. Note that the noise meter conforms to (quasi peak) without weighting filter (flat).

With the Low Frequency (LF) audio signal generator set to 500 Hz, the audio input level to the EUT shall be adjusted to 8 dB below the limiting threshold (-8 dB (lim)) as declared by the manufacturer.

The corresponding audio output level from the demodulator shall be measured and recorded.

The input impedance of the noise meter shall be sufficiently high to avoid more than 0,1 dB change in input level when the meter is switched between input and output.

The audio input level shall be increased by 20 dB, i.e. to +12 dB (lim), and the corresponding change in output level shall be measured. It shall be checked that the audio output level has increased by ≤ 10 dB.

If this condition is not met, the initial audio input level shall be increased from -8 dB (lim) in 1 dB steps until the above condition is fulfilled, and the input level recorded in the test report. This level replaces the value derived from the manufacturer's declaration and is defined as -8 dB (lim).

Measure the input level at the transmitter required to give +12 dB (lim).

The LF generator shall be replaced with the weighted noise source to ITU-R Recommendation BS.559-2 [1], band-limited to 15 kHz as described in IEC 60244-13 [2], and the level shall be adjusted such that the measured input to the transmitter corresponds to +12 dB (lim). ETSI 24 ETSI EN 300 422-1 V1.4.2 (2011-08)

If the transmitter incorporates any ancillary coding or signaling channels (e.g. pilot-tones), these shall be enabled prior to any spectral measurements.

If the transmitter incorporates more than one audio input, e.g. stereo systems, the second and subsequent channels shall be simultaneously driven from the same noise source, attenuated to a level of -6 dB (lim). The transmitter RF output spectrum shall be measured, using a spectrum analyser with the following settings:

- Centre frequency: fc: Transmitter (Tx) nominal frequency;
- Dispersion (Span): fc - 1 MHz to fc + 1 MHz;
- Resolution BandWidth (RBW): 1 kHz;
- Video BandWidth (VBW): 1 kHz;

- Detector: Peak hold.

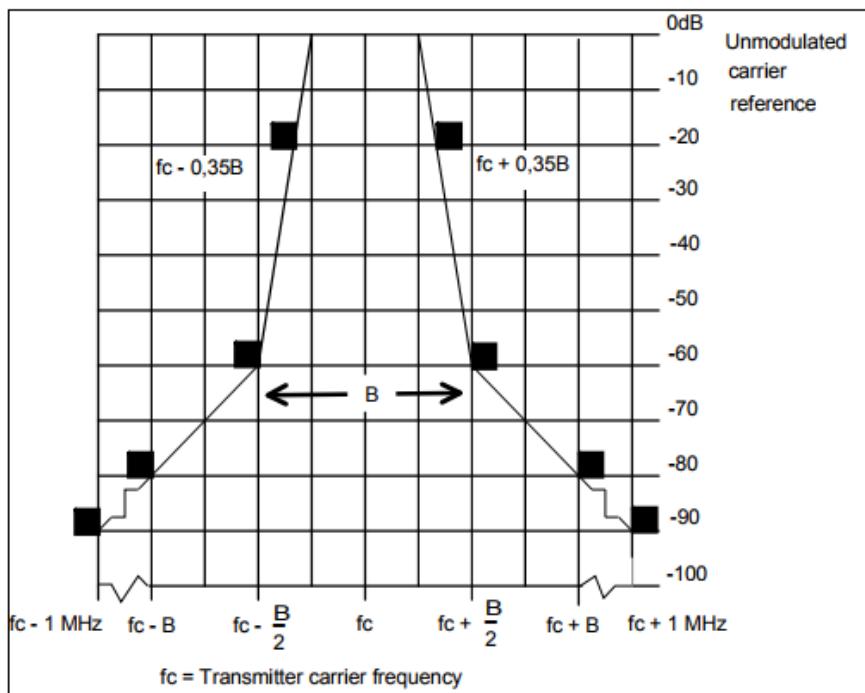


Figure 3: Spectrum mask for analogue systems in all bands

8.3 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	27 months
Rohde and Schwarz	Spectrum Analyzer	FSQ26	200749	2017-06-08	24 months
Agilent	Function Generator	33220A	MY43004878	2016-08-24	15 months
HP	Modulation Analyzer	8901A	2026A00847	2015-09-24	26 months
Krohn-Hite	Filter, 4 Pole LP/HP/Butterworth/ Bessel	3362	KN1586	2017-05-17	1 year
HP	TIMS	4934A	3737U15141	2016-08-03	16 months
Mini Circuits	Precision Fixed Attenuator, 10 dB	BW-S10W5+	-	-	N/A
-	RF Cable	-	-	-	Each time

*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

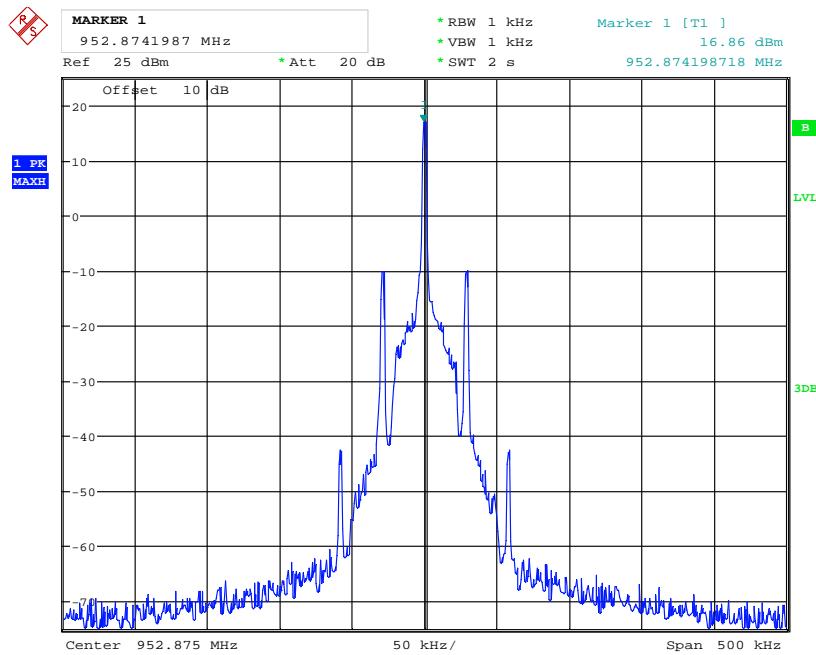
Temperature:	23 °C
Relative Humidity:	45 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2017-11-15 at RF site.

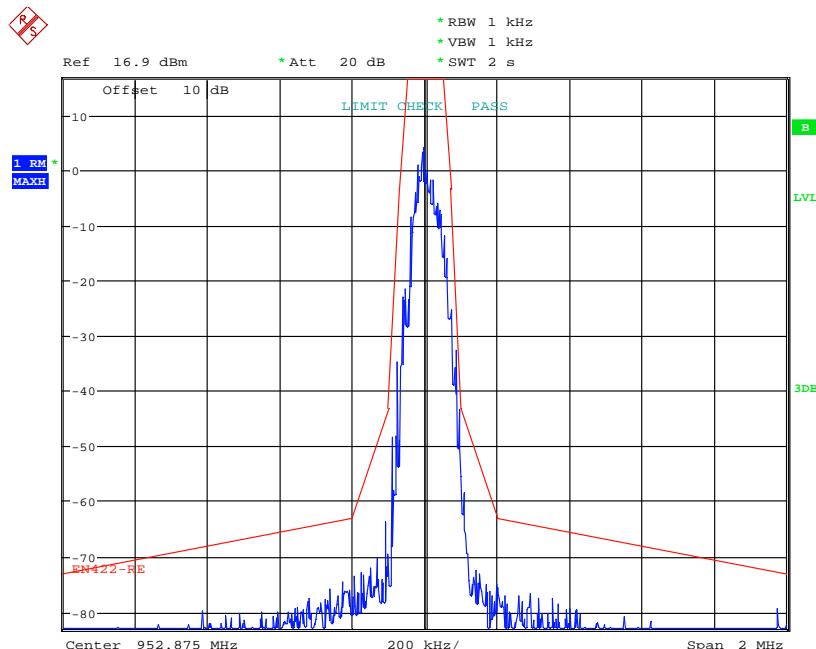
8.5 Test Results

Note: SMQV-941 unit was selected for testing which is the worst case

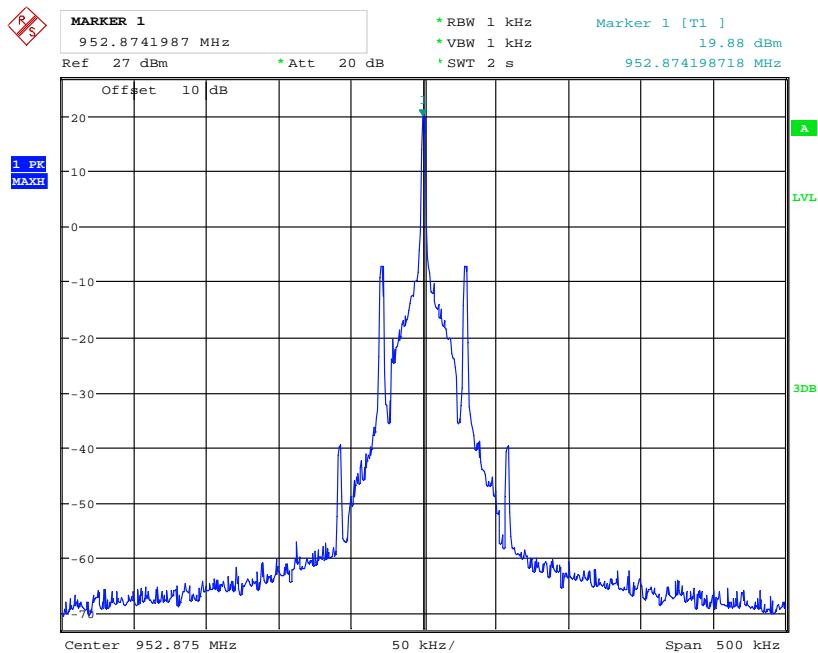
Please refer to the following plots,

50 mW Power Setting:**Reference level**

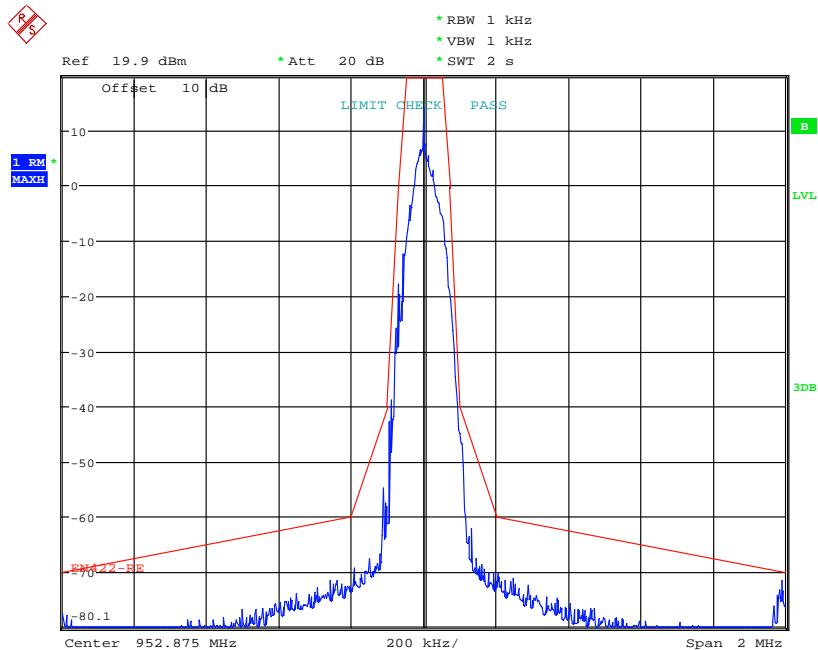
Date: 15.NOV.2017 16:08:43

Mask

Date: 15.NOV.2017 16:13:27

100 mW Power Setting:**Reference level**

Date: 15.NOV.2017 15:45:25

Mask

Date: 15.NOV.2017 16:15:24

9 FCC §74.861(d) (3) – Band Edge

9.1 Applicable Standards

According to FCC §74.861 (d) (3) :

For the 26.1-26.480 MHz, 161.625-161.775 MHz, 450-451 MHz, and 455-456 MHz bands, the occupied bandwidth shall not be greater than that necessary for satisfactory transmission and, in any event, an emission appearing on any discrete frequency outside the authorized band shall be attenuated, at least, $43 + 10 \log_{10}$ (mean output power, in watts) dB below the mean output power of the transmitting unit. The requirements of this paragraph shall also apply to the applications for certification of equipment for the 944-952 MHz band until January 13, 2018.

9.2 Test Procedure

- a) Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation.
- b) Connect RF cable from EUT to the Spectrum analyzer.
- c) RBW: 1~5% of OBW
- d) VBW > RBW
- e) Center Frequency: High or Low band edge (Whichever is being tested)
- f) All the points outside of the designated band 944-952 MHz should not be higher than -13 dBm.

9.3 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	27 months
HP	Analyzer, Modulation	8901A	2026A00847	2015-09-24	26 months
Mini Circuits	Precision Fixed Attenuator, 10 dB	BW-S10W5+	-	-	N/A
-	RF Cable	-	-	-	Each time
Rohde and Schwarz	Spectrum Analyzer	FSQ26	200749	2017-06-08	26 months

*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:	23 °C
Relative Humidity:	45 %
ATM Pressure:	101.2 kPa

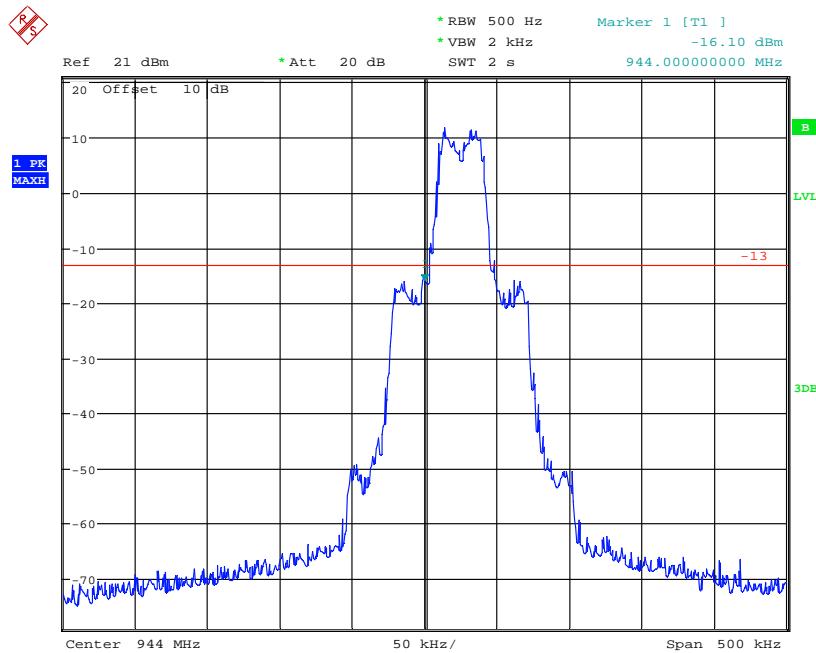
The testing was performed by Frank Wang on 2017-11-14 at RF site.

9.5 Test Results

Note: SMQV-941 unit was selected for testing which is the worst case

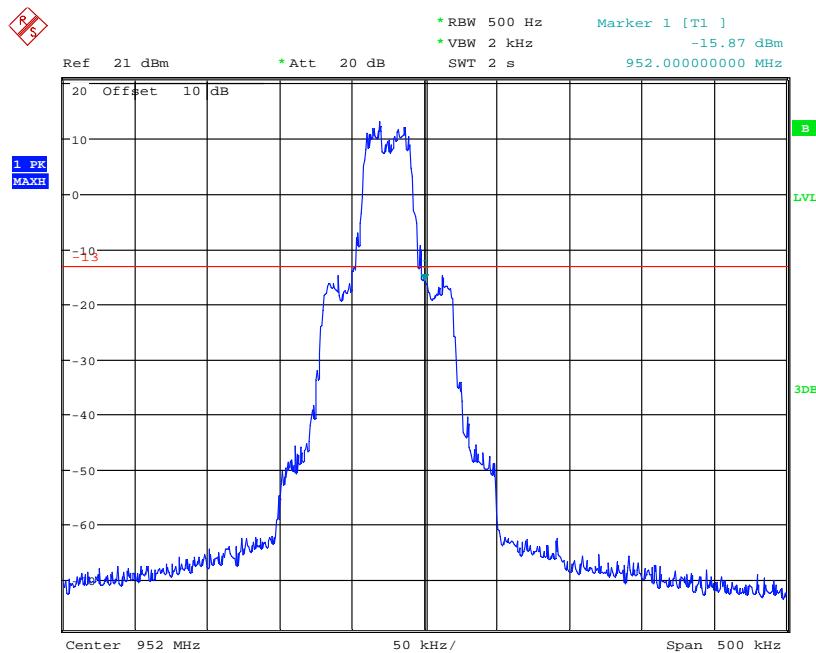
Please refer to the following plots,

Low Channel 944.025 MHz



Date: 15.NOV.2017 16:50:36

High Channel 951.975 MHz



Date: 15.NOV.2017 16:54:46

10 FCC §74.861(d) (4) (i) - Conducted Spurious Emissions at Antenna Port

10.1 Applicable Standards

For the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

Table 3: Limits for spurious emissions

State	Frequency		
	47 MHz to 74 MHz 87.5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 μ W

10.2 Test Procedure

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.
- Adjust the spectrum analyzer for the following setting:
 1. Resolution bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
 2. Video bandwidth \geq 3 times the resolution bandwidth.
 3. Sweep speed \leq 2000 Hz per second
 4. Detector mode = peak.
- Record the frequencies and level of spurious emissions.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2017-02-24	1 year
Mini Circuits	Precision Fixed Attenuator, 10dB	BW-S10W5+	-	-	N/A
-	RF Cable	-	-	-	Each time

*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

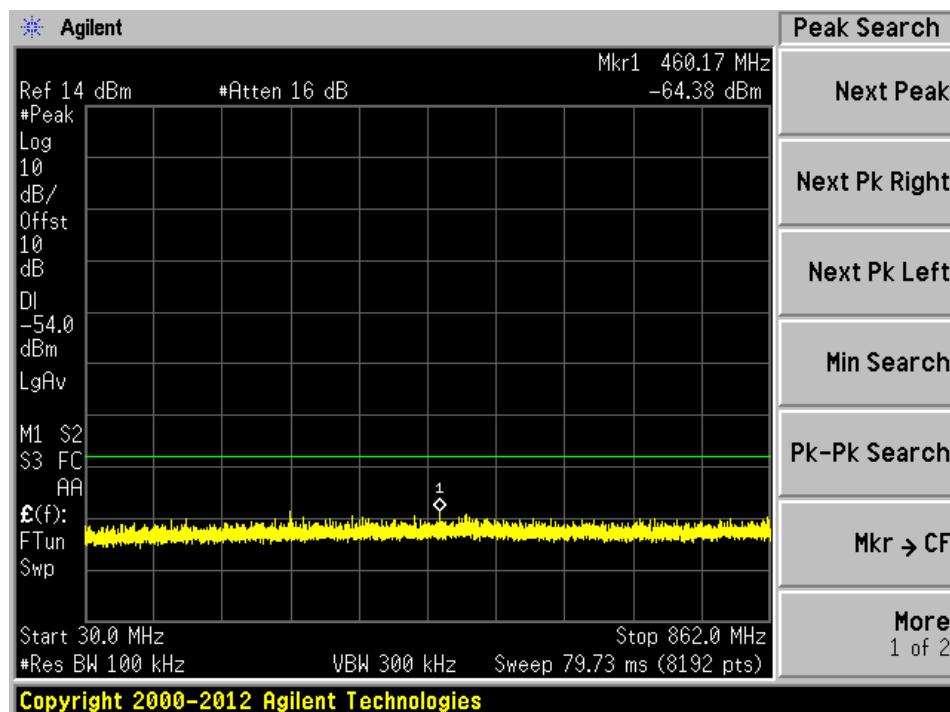
Temperature:	22 °C
Relative Humidity:	41 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2017-10-06 at RF site.

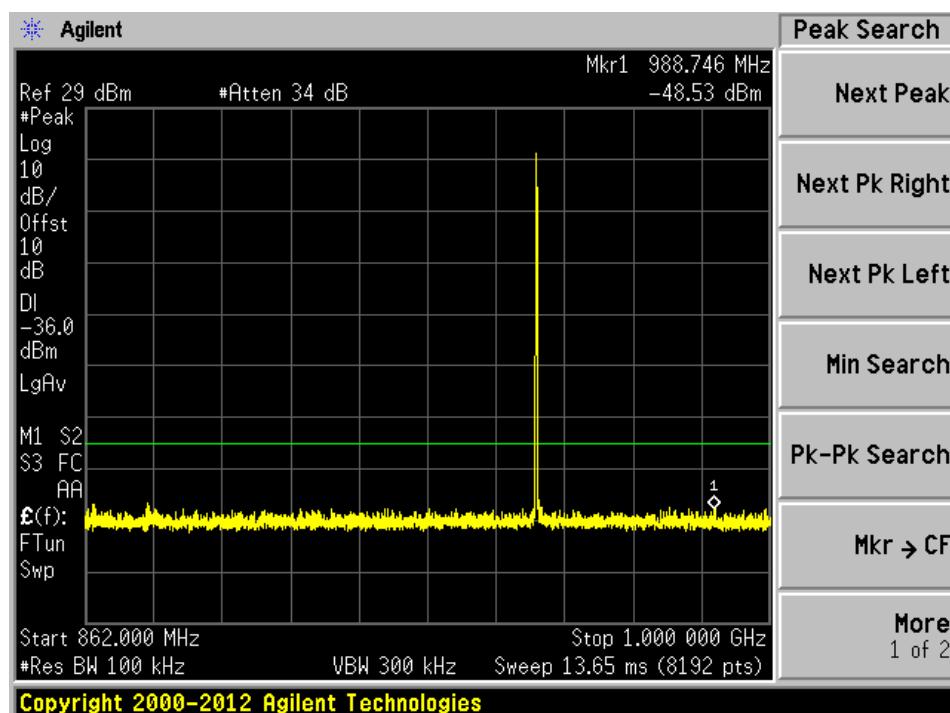
10.5 Test Results

Note: SMQV-941 unit 100 mW power setting is selected for testing which is the worst case

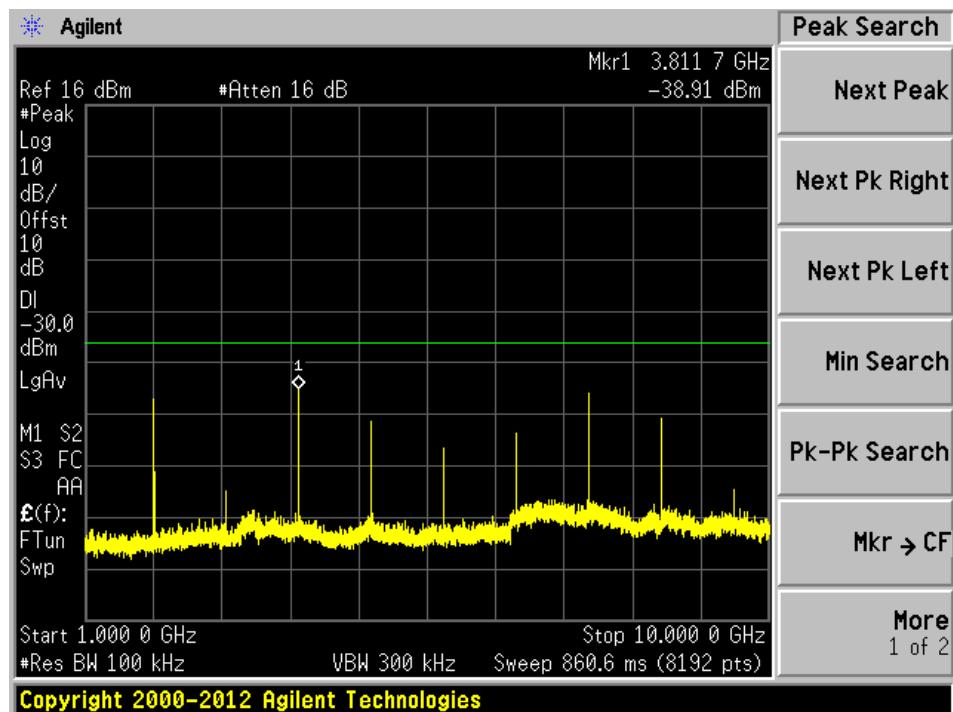
30 MHz to 862 MHz



862 MHz to 1 GHz



1 GHz to 10 GHz



11 FCC §74.861(d) (4) (i) – Radiated Spurious Emission

11.1 Applicable Standards

For the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

Table 3: Limits for spurious emissions

State	Frequency		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 μ W

11.2 Test Procedure

On a test site, the sample shall be placed at the specified height on a non-conducting support. The transmitter shall be operated at the power as specified under clause 8.2, delivered to the antenna (see clause 5.1.1).

Radiation of any spurious components shall be detected by the test antenna and receiver, over the frequency range specified below, excluding the 250 % (out of band region) band of frequencies centred on the channel on which the transmitter is intended to operate.

NOTE: The 250 % (out of band region) exclusion is covered by measurements carried out in clauses 8.3.1 and 8.3.2.

The measuring receiver, as defined in table 4, shall be tuned over the frequency range 25 MHz to 4 GHz for equipment operating on frequencies below 1 GHz or in the frequency range of 25 MHz to 12,75 GHz for equipment operating on frequencies above 1 GHz.

At each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement.

The measurement shall be repeated with the test antenna in the orthogonal polarization plane.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2017-02-24	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
HP/Agilent	Pre-Amplifier	8449BOPTHO2	3008A0113	2017-05-23	1 year
A.R.A.	Antenna, Horn	DRG-118/A	1132	2015-09-21	26 months
HP	Pre-Amplifier	8447D	2944A06639	2017-03-28	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	-	Each time
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	27 months
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".

11.4 Test Environmental Conditions

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

The testing was performed by Troy Pandhumsoporn on 2017-10-09 at 5m3.

11.5 Test Results

EUT was configured to high power setting and transmitted at middle channel. Please refer to the following tables for measurement results.

Above 1 GHz**SMV-941**

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)			
1905.75	53.06	307	160	H	1905.75	-52.9	8.163	0.591	-45.328	-30	-15.328
1905.75	56.11	240	189	V	1905.75	-49.64	8.163	0.591	-42.068	-30	-12.068
3811.6	54.96	286	180	H	3811.6	-44.18	9.454	0.87	-35.596	-30	-5.596
3811.5	60.43	57	147	V	3811.5	-40.83	9.454	0.87	-32.246	-30	-2.246

SMQV-941

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)			
1905.75	53.81	0	167	H	1905.75	-52.15	8.163	0.591	-44.578	-30	-14.578
1905.75	55.56	246	224	V	1905.75	-50.19	8.163	0.591	-42.618	-30	-12.618
3811.5	56.97	105	167	H	3811.5	-42.17	9.454	0.87	-33.586	-30	-3.586
3811.5	62.22	56	148	V	3811.5	-39.04	9.454	0.87	-30.456	-30	-0.456

Below 1 GHz**SMV-941**

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)			
200	29.04	0	100	H	200	-79.22	0	0.149	-79.369	-54	-25.369
198.2	31.75	0	100	V	198.2	-73.74	0	0.149	-73.889	-54	-19.889
604.45	29.87	0	100	H	604.45	-71.2	0	0.227	-71.427	-54	-17.427
600	29.96	0	100	V	600	-67.8	0	0.227	-68.027	-54	-14.027

SMQV-941

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)			
200	29.23	0	100	H	200	-79.03	0	0.149	-79.179	-54	-25.179
200	29.29	178	100	V	200	-76.2	0	0.149	-76.349	-54	-22.349
600	29.56	222	100	H	600	-71.51	0	0.227	-71.737	-54	-17.737
600	29.83	14	100	V	600	-67.93	0	0.227	-68.157	-54	-14.157

12 FCC §2.1055 - Frequency Stability

12.1 Applicable Standards

FCC §2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows: (1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows: (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

12.2 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.

12.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2017-02-24	1 year
Tenney	Chamber, Environmental	TUJR	27445-06	2016-09-20	2 Years
Fluke	Digital Multi-meter	189	89920092	2017-03-22	1 year
Mini Circuits	Precision Fixed Attenuator, 10dB	BW-S10W5+	-	-	N/A
-	SMA Cable	-	C#12	-	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".

12.4 Test Environmental Conditions

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

The testing was performed by Troy Pandhumsoporn 2017-10-10 at RF site.

12.5 Test Results

Note: SMQV-941 unit is selected for testing which is the worst case

952.875 MHz - 100 mW power level

Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
-30	952.8784	952.875	3.568
-20	952.8767	952.875	1.784
-10	952.8801	952.875	5.352
0	952.8784	952.875	3.568
10	952.8784	952.875	3.568
20	952.875	952.875	0
30	952.8733	952.875	-1.784
40	952.8733	952.875	-1.784
50	952.875	952.875	0

Varying supply voltage:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
1 V at 20°C	952.8767	952.875	1.784

13 Exhibit A - Test Setup Photographs

Please refer to the attachment

14 Exhibit B – External Photographs

Please refer to the attachment

15 Exhibit C - Internal Photographs

Please refer to the attachment

--- END OF REPORT ---