



FCC PART 74 SUBPART H TEST AND MEASUREMENT REPORT

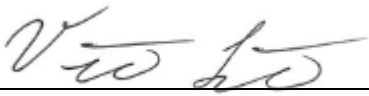

For

Lectrosonics, Inc.

581 Laser Road NE Rio Rancho,

NM 87124, USA

FCC ID: DBZHMA9

Report Type: Original Report	Product Type: UHF Plug-on Transmitter
Prepared By: Vincent Licata Test Engineer	
Report Number: R1710022-74	
Report Date: 2017-11-30	
Reviewed By: Frank Wang RF Engineer	
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1710022-74	Original Report	2017-11-13
1	R1710022-74	Updated Page 13, 15, 20, 34, and 36	2017-11-30

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: *HMA-941*, FCC ID: DBZHMA9, which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a Wireless UHF Plug-on Transmitter. The EUT operates in the frequency ranges: 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 4.25 inches (L) x 1.62 inches (W) x 1.38 inches (H) and weighs 6.7 oz with no batteries.

The data gathered is from the production samples provided by the manufacturer, serial number: 5 provided by the Lectrosonics, Inc.

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, License-Exempt, Low-Power Radio Apparatus Operating in the Television Bands.

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, Frequency stability, and Band Edge for license-exempt, low-power radio apparatus.

1.4 Related Submittal(s)/Grant(s)

N/A

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. ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9kHz to 40GHz.

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, ANSI C63.10-2013, and ETSI EN 300 422-1 v1.4.2 (2011-08) Standards.

2.2 EUT Exercise Software

None

2.3 Special Equipment

Manufacturer	Description	Model
SENNHEISER	Microphone	E 835

2.4 Equipment Modifications

For the conducted sample there was a hole drilled into the side of the EUT with an RF port installed for conducted measurements.

2.5 Local Support Equipment

None

2.6 Interface Ports and Cables

Cable Description	Length (m)	To	From
Microphone cable	1.6 m	Microphone	EUT

3 Summary of Test Results

FCC Rules	Descriptions of Test	Result (s)
FCC §2.1093	RF Exposure	Compliant
FCC §74.861(d)(1)	RF output power	Compliant
FCC §2.1047	Modulation characteristics	Compliant
FCC §74.861(d)(4)(1), FCC §74.861(c)	Emission bandwidth & Emission Mask	Compliant
FCC §74.861(d)(4)(1)	Spurious radiation at the antenna port	Compliant
FCC §74.861(d)(4)(1)	Field strength of spurious radiation	Compliant
FCC §2.1055	Frequency stability	Compliant
FCC §74.861(d)(3)	Band Edge	Compliant

4 FCC §2.1093 - RF Exposure

4.1 Applicable Standards

FCC §2.1093

4.2 Test Results

Please refer to the SAR Report: R1710022-20.

5 FCC §74.861(d) (1) - RF Output Power

5.1 Applicable Standards

According to FCC §74.861 (d) (1): the power may not exceed the following values:

(d) For low power auxiliary stations operating in the bands other than those allocated for TV broadcasting, the following technical requirements are imposed.

(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 250 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

According to TIA-603-D Section 2.2.1

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2017-02-24	1 year
Mini Circuits	Precision Fixed Attenuator, 20 dB	FW-20+	-	-	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".

5.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2017-10-03 at RF site.

5.5 Test Results

Conducted output power:

Channel	Frequency (MHz)	Device Power Setting (mW)	Conducted Output Power (dBm)	Limits (dBm)
Low	941.525	50	17.76	30
		100	20.68	30
Middle	952.875	50	17.61	30
		100	20.37	30
High	959.825	50	17.50	30
		100	20.35	30

6 FCC §2.1047- Modulation Characteristics

6.1 Applicable Standards

According to FCC §2.1047

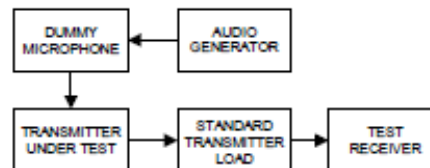
(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) *Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.* A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.

(d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

6.2 Test Procedure



- Connect the equipment as illustrated.
- Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
- Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 0.25 Hz to $\geq 15,000$ Hz. Turn the de-emphasis function off.
- 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.
- Increase the level from the audio frequency generator by 20 dB in one step (rise time between the 10% and 90% points shall be 0.1 second maximum).
- Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.

- g) With the level from the audio frequency generator held constant at the level obtained in step e), slowly vary the audio frequency from 300 Hz to 3000 Hz and observe the steady-state deviation. Record the maximum deviation.
- h) Set the test receiver to measure peak negative deviation and repeat steps d) through g).
- i) The values recorded in steps g) and h) are the modulation limiting.

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	Modulation Analyzer	8901A	2026A00847	2015-09-24	26 months
-	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

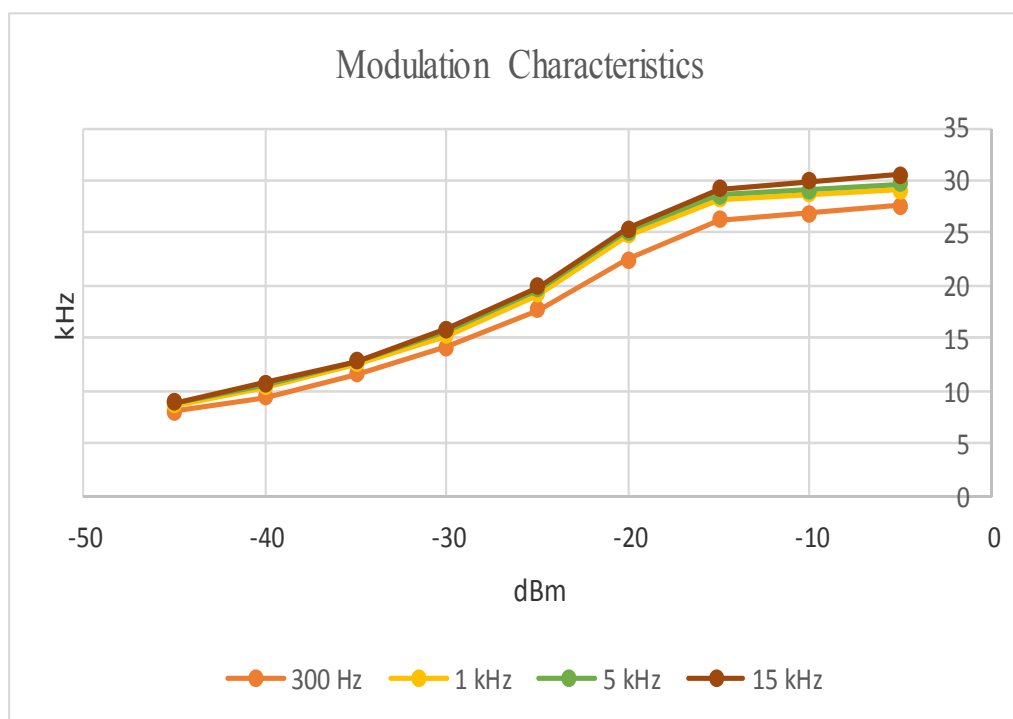
Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2017-10-10 at RF site.

6.5 Test Results

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

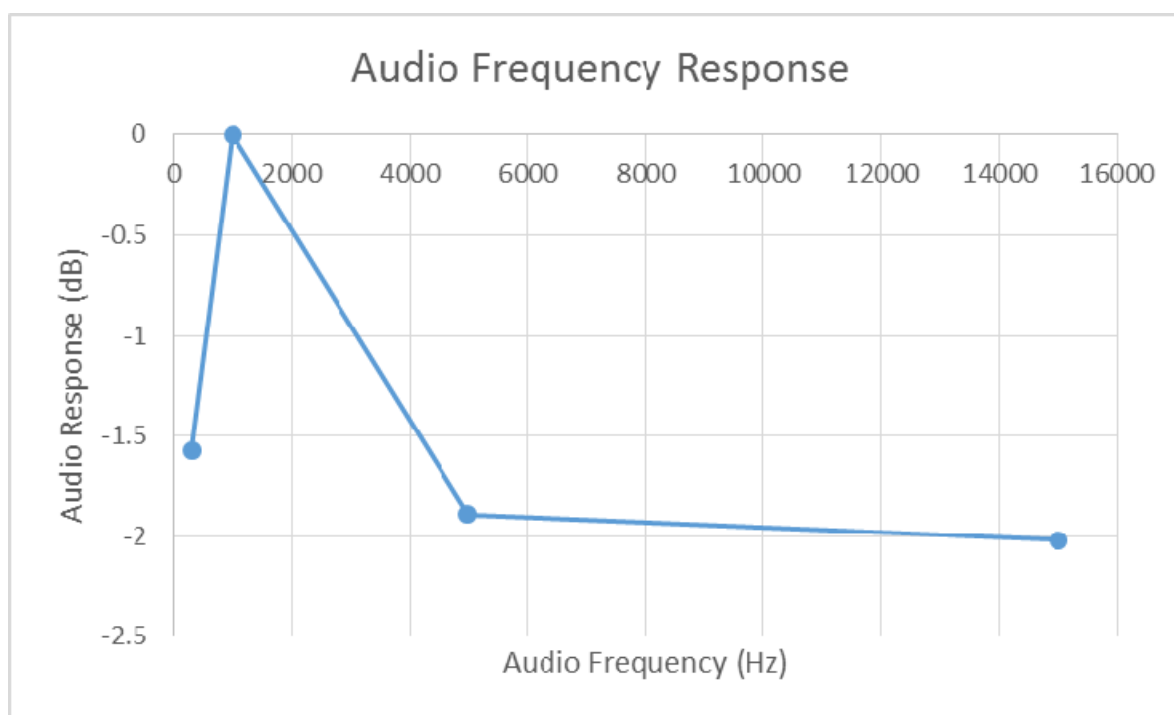
AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
-5	27.58	29.08	29.7	30.56	±45
-10	26.95	28.69	29.05	29.96	±45
-15	26.24	28.23	28.66	29.22	±45
-20	22.51	24.8	25.17	25.48	±45
-25	17.72	19.20	19.64	19.98	±45
-30	14.17	15.32	15.81	15.88	±45
-35	11.6	12.61	12.82	12.86	±45
-40	9.45	10.39	10.59	10.77	±45
-45	8.08	8.69	8.87	8.91	±45



Audio Frequency Response, Middle Channel

AF Frequency (Hz)	AF Level (kHz)	AF Response (dB)
300	27.58	-1.57
1000	19.20	0.00
5000	29.70	-1.89
15000	30.56	-2.02

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



7 FCC §74.861(c) and §74.861(d) (4) (1) - Occupied Bandwidth & Emission Mask

7.1 Applicable Standards

According to FCC §74.861 (c)

Low power auxiliary transmitters not required to operate on specific carrier frequencies shall operate sufficiently within the authorized frequency band edges to insure the emission bandwidth falls entirely within the authorized band.

According to FCC §74.861 (d) (4) (1)

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).

7.2 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 signalling 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: f_c : Transmitter (Tx) nominal frequency;
- Dispersion (Span): $f_c - 1\text{ MHz}$ to $f_c + 1\text{ MHz}$;
- Resolution BandWidth (RBW): 1 kHz;
- Video BandWidth (VBW): 1 kHz;
- Detector: Peak hold.

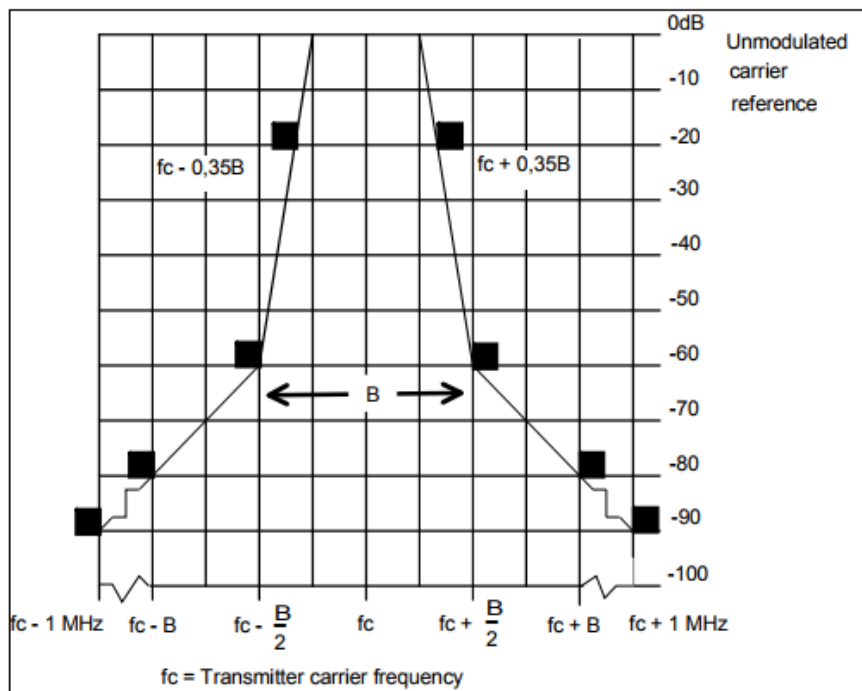


Figure 3: Spectrum mask for analogue systems in all bands

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
Rohde and Schwarz	Spectrum Analyzer	FSQ26	200749	2017-06-08	26 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	15 months
Mini Circuits	Precision Fixed Attenuator, 20 dB	FW-20+	-	-	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".

7.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2017-10-10 at RF site.

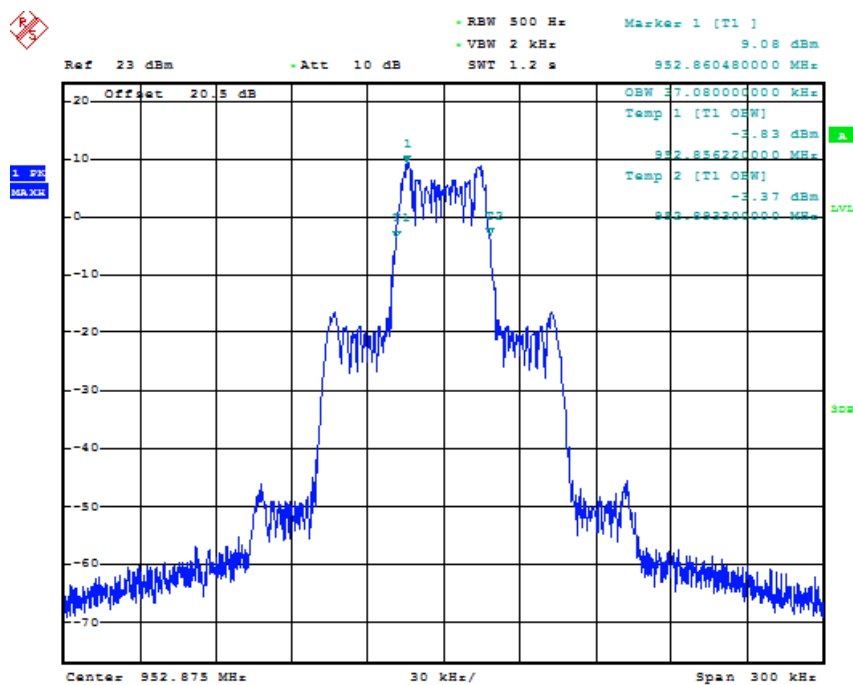
7.5 Test Results

Center Frequency (MHz)	99% Bandwidth (kHz)	Result	Power Setting
952.875	37.08	Pass	High (100 mW)
952.875	37.08	Pass	Low (50 mW)

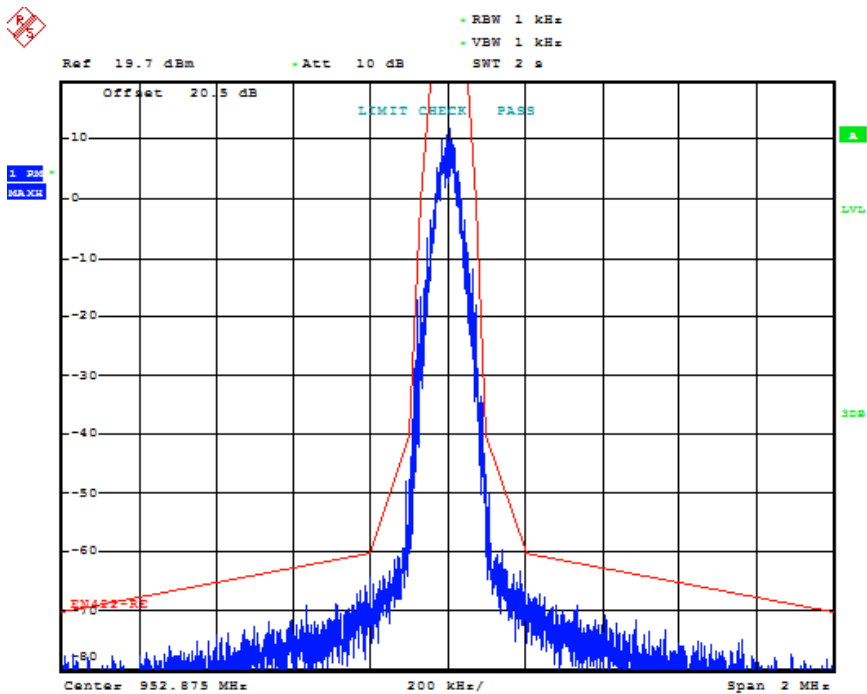
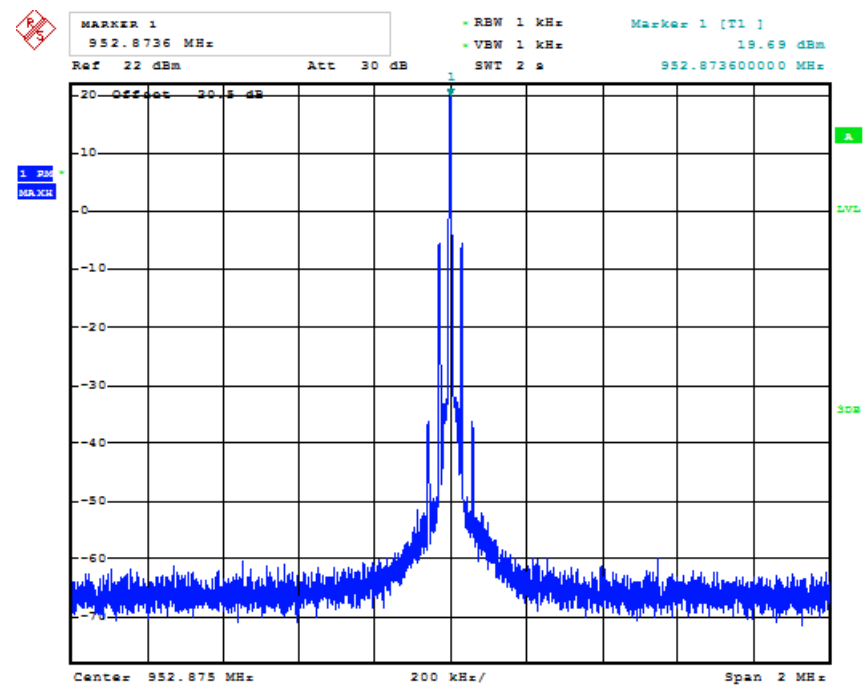
Please refer to the following table plots for detailed test results

100mW power setting

Occupied Bandwidth

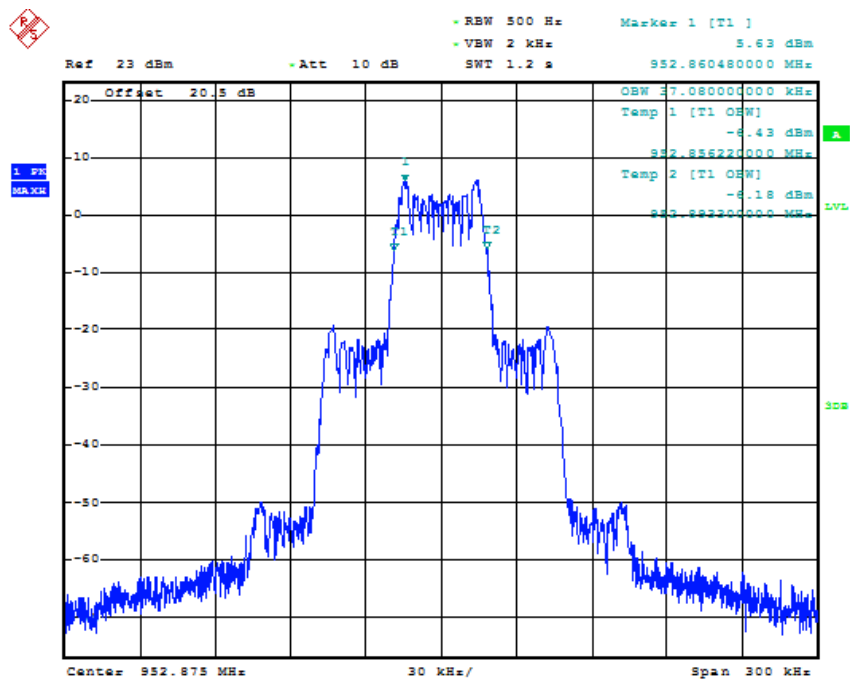


Emission Mask

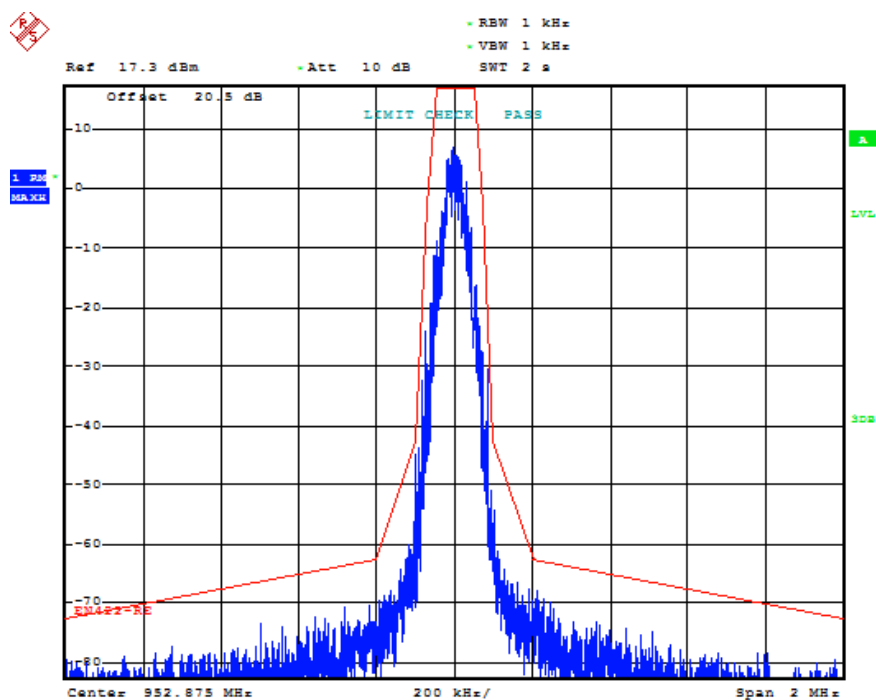
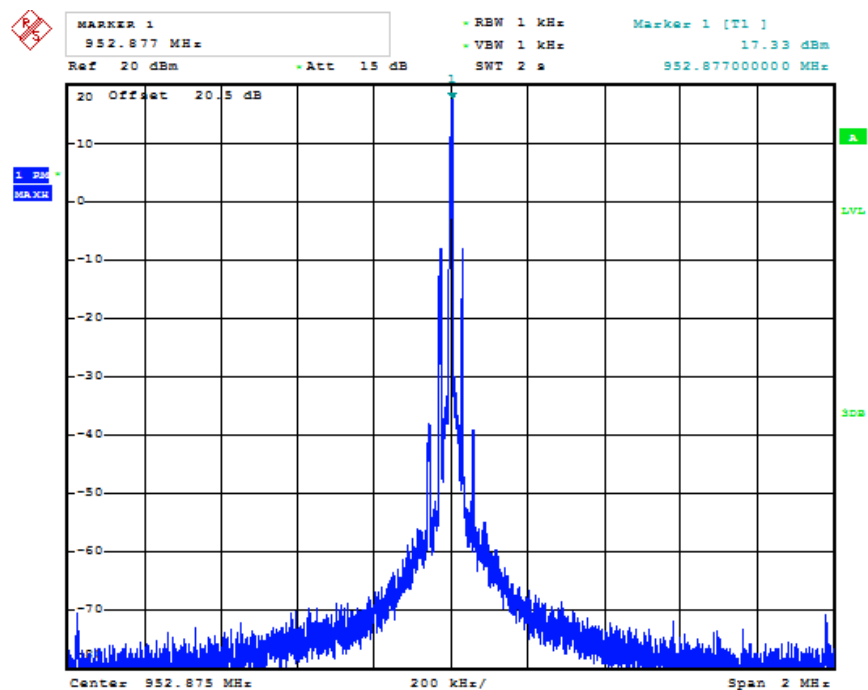


50 mW power setting

Occupied Bandwidth



Emission Mask



8 FCC §74.861(d) (4) (1) - Conducted Spurious Emissions at Antenna Port

8.1 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).

8.2 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.
- 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 = 100 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 = peak.
- 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	US45303156	2017-02-24	1 year
Mini Circuits	Precision Fixed Attenuator, 20 dB	FW-20+	-	-	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 PI02 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

8.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

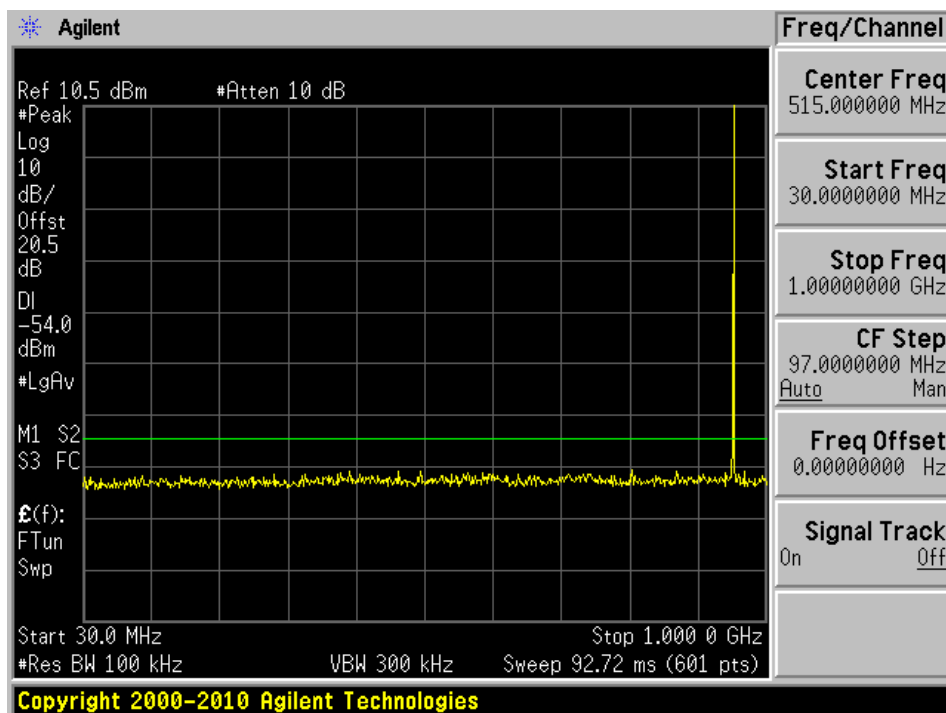
The testing was performed by Vincent Licata on 2017-10-03 at RF site.

8.5 Test Results

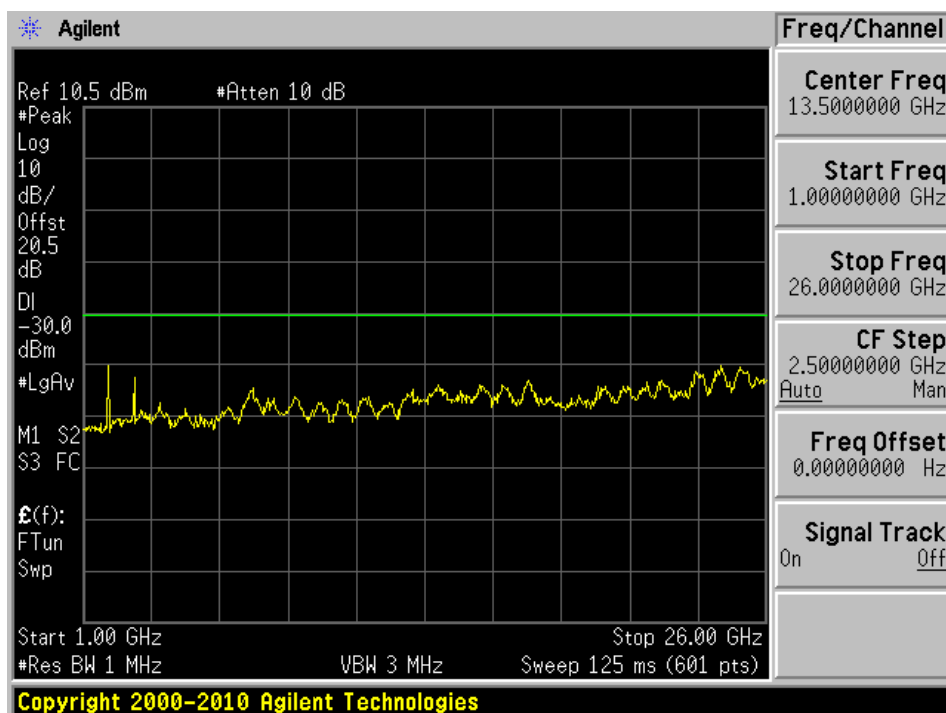
Please refer to the following plots for detailed test results

Highest Power Setting:

30 MHz to 1 GHz



1 GHz to 26 GHz



9 FCC §74.861(d) (4) (1) - Field Strength of Spurious Radiation

9.1 Applicable Standards

According to FCC §74.861 (d) (4) (1)

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).

9.2 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.

If the transmitter allows for standby operation, the tests shall be repeated with the transmitter in standby mode.

9.3 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	8449BOPHO2	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".

9.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	43 %
ATM Pressure:	101.2 kPa

The testing was performed by Vincent Licata on 2017-10-09 at RF site.

9.5 Test Results

Test mode: Transmitting

EUT was configured to highest power setting

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)			
952.875 MHz											
55	47.84	155	100	H	55	-61.27	0	0.49	-61.76	-54	-7.76
55	39.4	40	100	V	55	-71.85	0	0.49	-72.34	-54	-18.34
193	32.34	0	120	H	193	-78.87	0	0.5	-79.37	-54	-25.37
193	29.45	0	100	V	193	-78	0	0.5	-78.5	-54	-24.5
1905.75	46.43	0	100	H	1905.75	-66.51	8.163	0.24	-58.587	-30	-28.587
1905.75	46.38	0	100	V	1905.75	-67.01	8.163	0.24	-59.087	-30	-29.087
2858.62	54.02	284	100	H	2858.62	-56.74	10.114	0.46	-47.086	-30	-17.086
2858.62	53.15	267	190	V	2858.62	-57.88	10.114	0.46	-48.226	-30	-18.226

10 FCC §2.1055 - Frequency Stability

10.1 Applicable Standards

According to FCC §2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From -20° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, and portable equipment having less than 3 watts mean output power.

(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0° centigrade and $+30^{\circ}$ centigrade with no primary power applied.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

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:

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

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.
- At temperature of -30°C, +20°C and +50°C, and at the manufacturer's rated supply voltage; and
- At a temperature of +20°C and at ±15 percent of the manufacturer's rated supply voltage

10.3 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
KEPCO	Source, DC	25-10M	H1334526	Cal. Not Required	N/A
Fluke	Digital Multi-meter	189	89920092	2017-03-22	1 year
Mini Circuits	Precision Fixed Attenuator, 20 dB	FW-20+	-	-	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:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.1 kPa

The testing was performed by Vincent Licata on 2017-10-11 at RF site.

10.5 Test Results

Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
-30	952.8784	952.875	3.57	50
-20	952.8716	952.875	-3.57	50
-10	952.8767	952.875	1.78	50
0	952.8767	952.875	1.78	50
10	952.8784	952.875	3.57	50
20	952.8750	952.875	0.00	50
30	952.8750	952.875	0.00	50
40	952.8750	952.875	0.00	50
50	952.8767	952.875	1.78	50

Varying supply voltage:

Voltage (V _{DC})	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
2.55	952.875	952.875	0.00	50
3.0	952.875	952.875	0.00	50

11 FCC §74.861(d) (3) – Band Edge

11.1 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.

11.2 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) Measure highest point outside of the designated band 944-952 MHz.
- g) This point should not be higher than -13 dBm.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde and Schwarz	Spectrum Analyzer	FSQ26	200749	2017-06-08	26 months
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2015-09-09	27 months
HP	Modulation Analyzer	8901A	2026A00847	2015-09-24	26 months
Mini Circuits	Precision Fixed Attenuator, 20 dB	FW-20+	-	-	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".

11.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

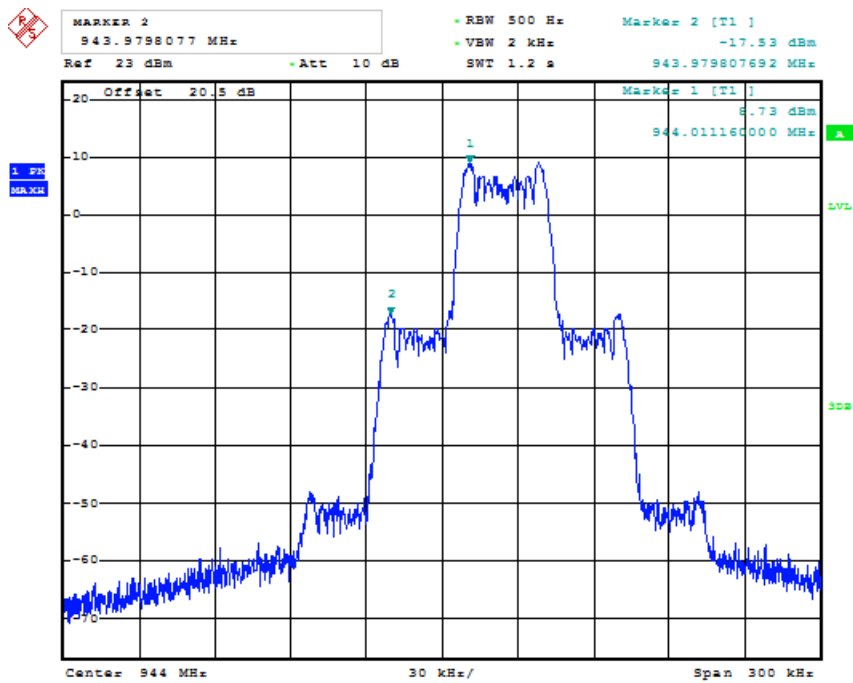
The testing was performed by Vincent Licata on 2017-10-11 at RF site.

11.5 Test Results

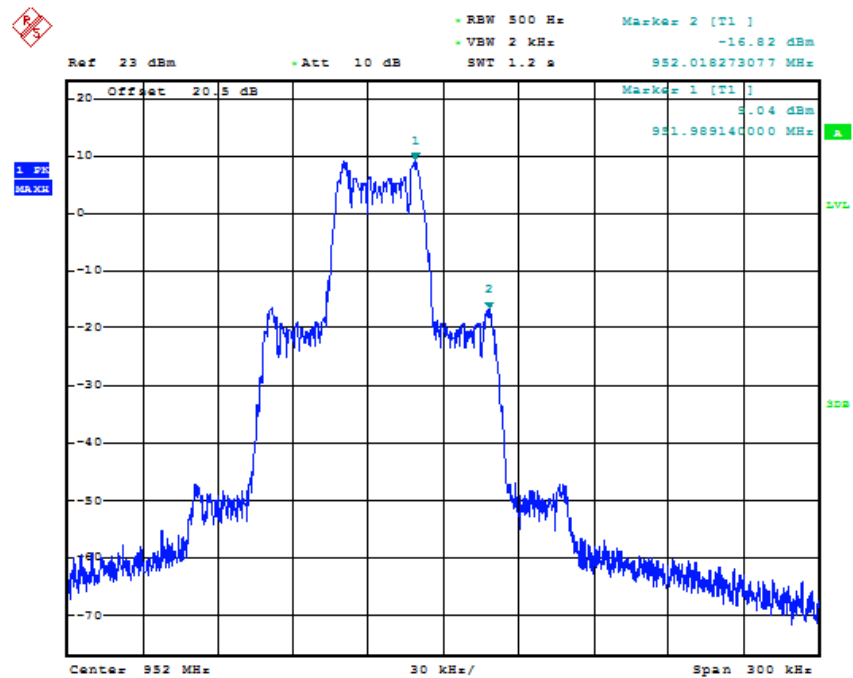
Refer to following plots

100 mw

Low Channel

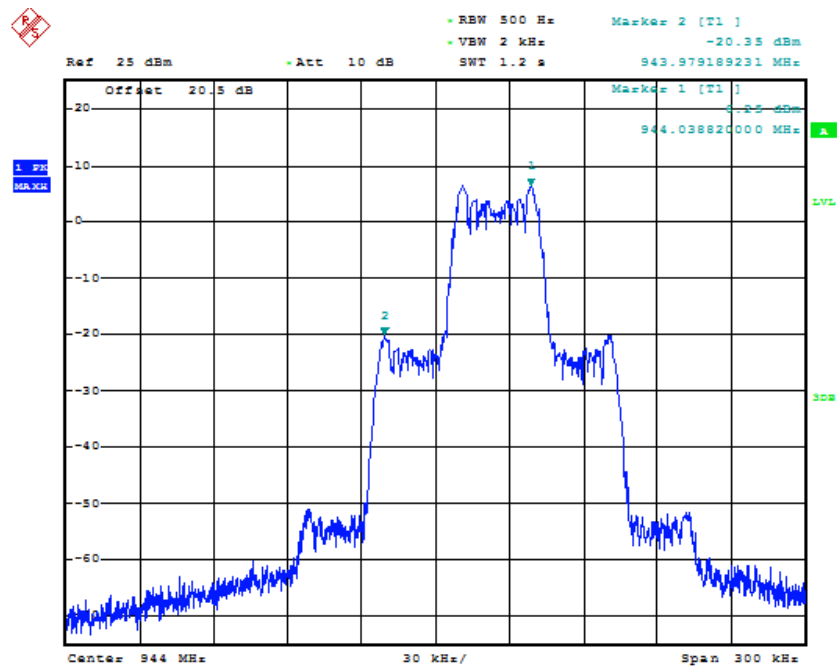


High Channel

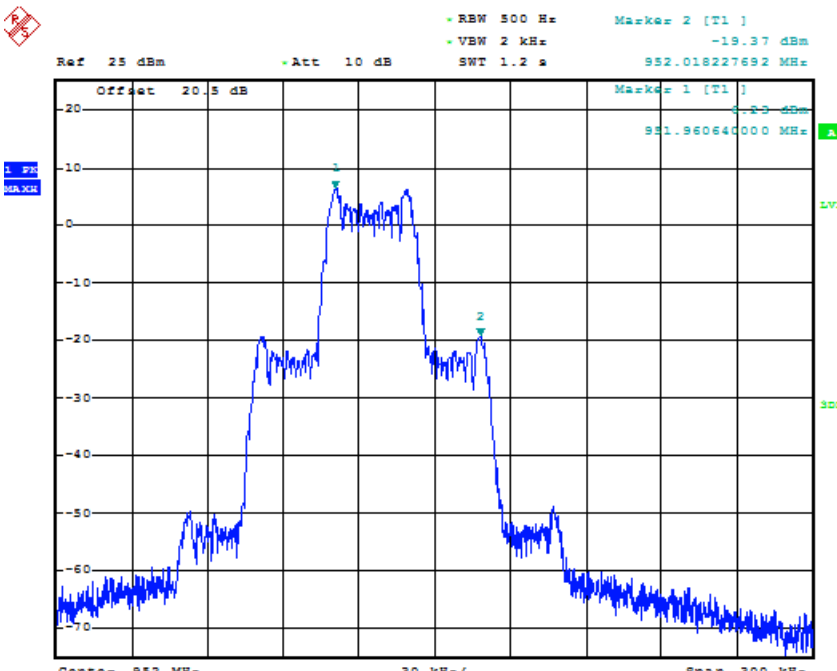


50 mw

Low Channel



High Channel



12 Annex A (Informative) - A2LA Electrical Testing Certificate



Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of A2LA R222 - *Specific Requirements - EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 30th day of August 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.



13 Annex B (Normative)- Test Setup Photographs

Please refer to the attachment

14 Annex C (Normative) – External Photographs

Please refer to the attachment

15 Annex D (Normative) – Internal Photographs

Please refer to the attachment

--- END OF REPORT ---