FCC PART 74 SUBPART H
TEST AND MEASUREMENT REPORT

For

Lectrosonics, Inc.

581 Laser Road NE Rio Rancho, NM 87124, USA

FCC ID: DBZHHA9

Report Type:	**Product Type:**
Original Report	Wireless Microphone Transmitter

Prepared By:	ChinMing Lui Test Engineer
Report Number:	R1710023-74
Report Date:	2017-11-20
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1710023-74	Original Report	2017-11-07
1	R1710023-74	Updated comments	2017-11-20

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: *HHa-941, FCC ID: DBZHH9* which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a Wireless Microphone Transmitter. 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 24.1 cm (L) x 5 cm (W) x 5 cm (H) and weights 0.323 kg.

The data gathered are from a typical production sample provided by the Lectrosonics, Inc with serial number: 5 provided by customer.

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, Experimental Radio, Auxiliary, Special Broadcast And Other Program Distributional Services.

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. 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

BACLs 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):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - 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:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - 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

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

2.4 Equipment Modifications

For the conducted sample there was a hole drilled into the microphone tip with a connector installed and a SMA connector for RF port provided.

2.5 Local Support Equipment

None

2.6 Interface Ports and Cables

None

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 (Conducted)	Compliant
FCC §2.1047	Modulation characteristics	Compliant
FCC §74.861(d)(4)(i)	Occupied bandwidth & Emission Mask	Compliant
FCC §74.861(d)(3)	Band-edge	Compliant
FCC §74.861(d)(4)(i)	Conducted Spurious Emissions at Antenna Port	Compliant
FCC §74.861(d)(4)(i)	Field strength of spurious radiation	Compliant
FCC §2.1055	Frequency stability	Compliant

4 FCC §2.1093 - RF Exposure

According to FCC KDB 447498 D01 General RF Exposure Guidance v06 Section 4.3.1, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
   [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

   • f(GHz) is the RF channel transmit frequency in GHz
   • Power and distance are rounded to the nearest mW and mm before calculation
   • The result is rounded to one decimal place for comparison
   • 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

   The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:

   a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

3) At frequencies below 100 MHz, the following may be considered for SAR test exclusion, and as illustrated in Appendix C:

   a) The power threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by [1 + log(100/f(MHz))] for test separation distances > 50 mm and < 200 mm
   b) The power threshold determined by the equation in a) for 50 mm and 100 MHz is multiplied by ½ for test separation distances ≤ 50 mm

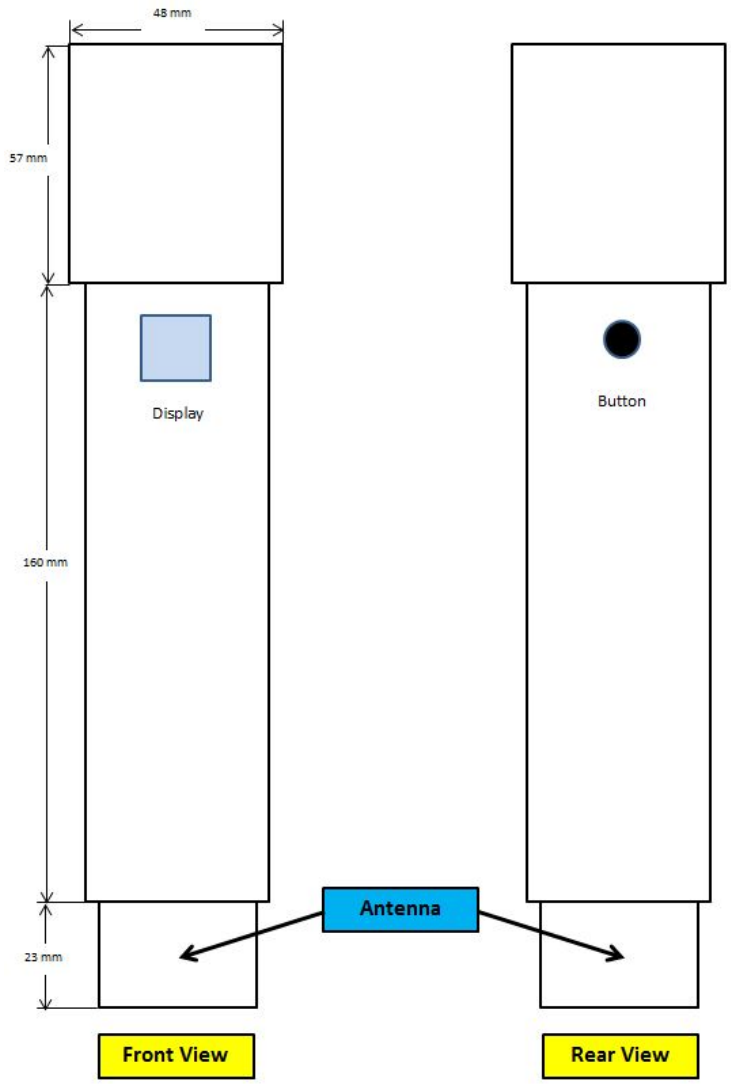
c) SAR measurement procedures are not established below 100 MHz. When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any test results to be acceptable.

4.1 EUT Dimension and Antenna Location

The EUT is a hand held wireless microphone, the physical dimension and the antenna location is shown in the diagram below.

There will be no accessories sold together with this product and the normal usage will be hand held only.

The distance between antenna and human hand should be 20 mm or more.



4.2 Test Results

Channel	Frequency (MHz)	Target Conducted Output Power Including Tune-up Tolerance		Distance (mm)	Calculated Value	FCC 10-g Extreme SAR Threshold	SAR Exclusion (Yes/No)
		dBm	mW				
Low	941.525	20	100	20	4.85	7.5	Yes
Middle	952.875	20	100	20	4.88	7.5	Yes
High	959.825	20	100	20	4.90	7.5	Yes

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 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	BW-S20W5+	-	-	Each time
HARBOUR INDUSTRIES	Coaxial Cable	MIL-C-17	SN42	-	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 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Chin Ming Lui on 2017-10-10 at RF site.

5.5 Test Results

Conducted output power:

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limits (dBm)	Rated Power (mW/dBm)
Low	941.525	19.49	30	100/20
		16.35	30	50/17
Middle	952.875	19.51	30	100/20
		16.07	30	50/17
High	959.825	19.70	30	100/20
		16.39	30	50/17

6 FCC §2.1047 – Modulation Characteristics

6.1 Applicable Standards

According to FCC §2.1047:

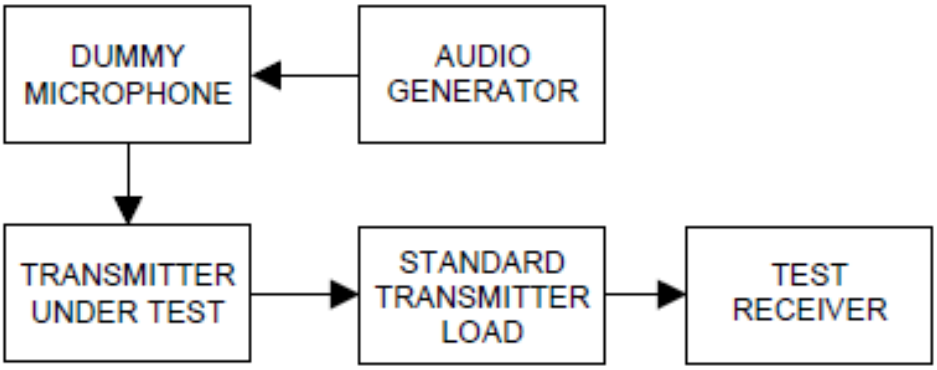
(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or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



a) Connect the equipment as illustrated.

b) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

c) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤0.25 Hz to ≥15,000 Hz. Turn the de-emphasis function off.

d) 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.

e) 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).

f) 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	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".*

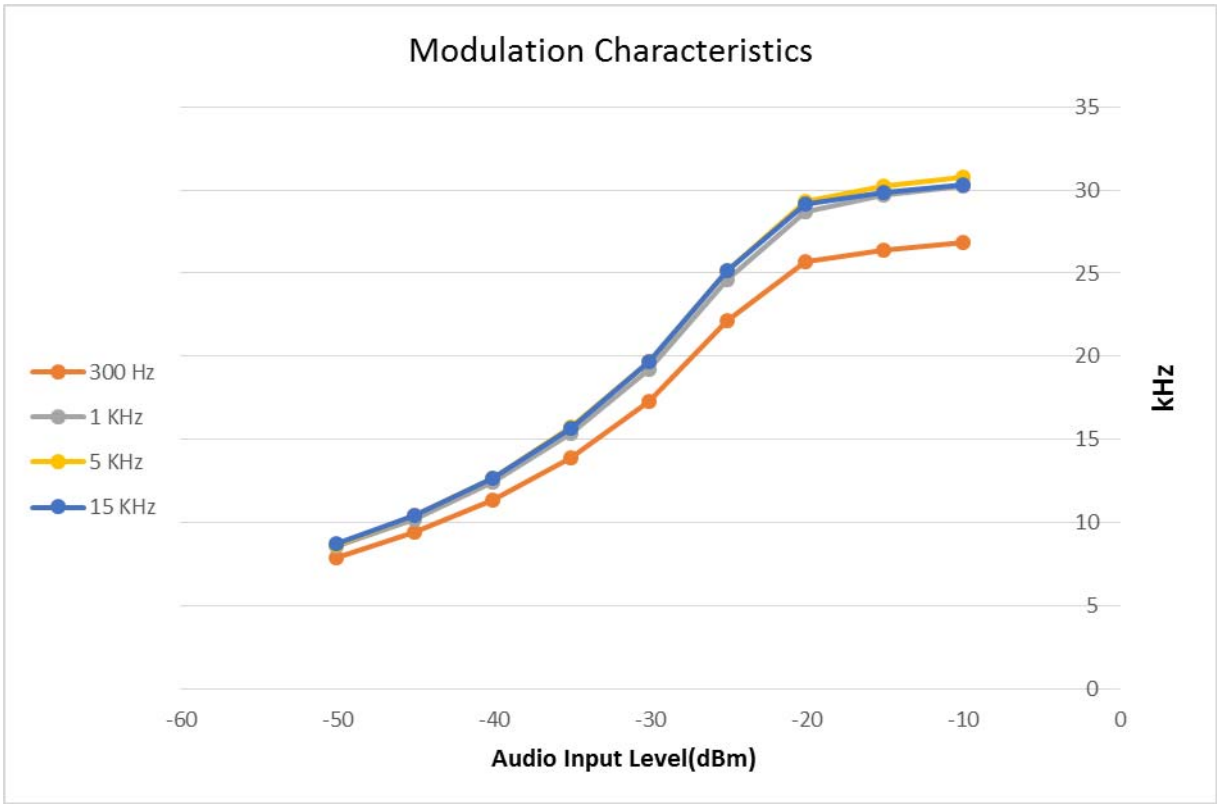
6.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Chin Ming Lui on 2017-10-10 at RF site.

6.5 Test Results

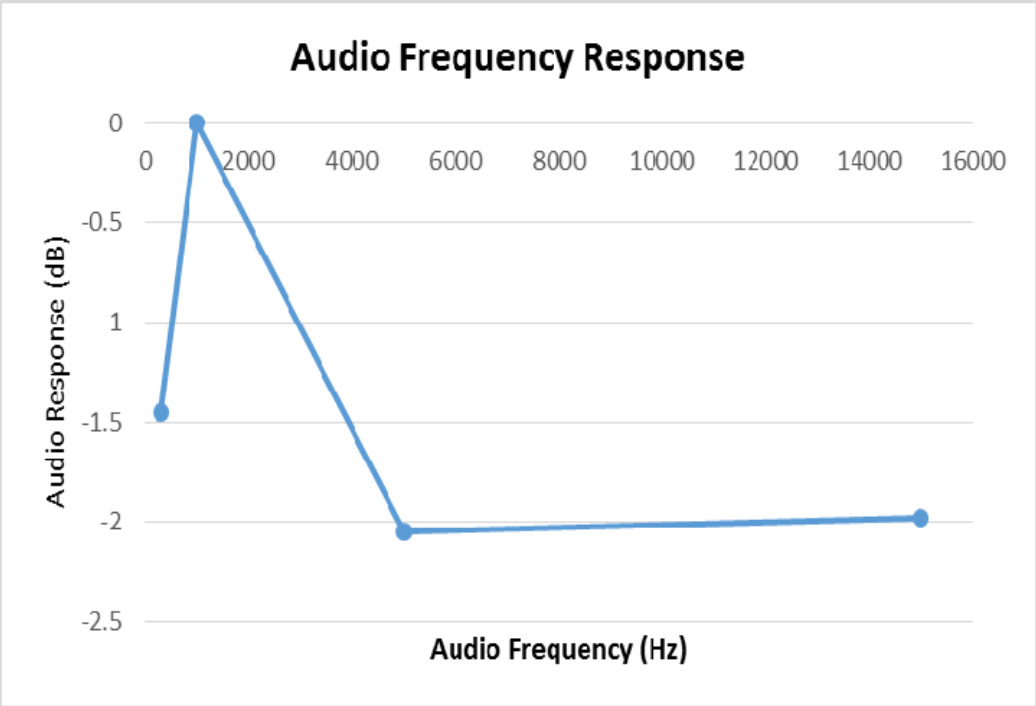
AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
-10.1	26.84	30.28	30.75	30.31	±45
-15.1	26.39	29.67	30.23	29.89	±45
-20.1	25.66	28.72	29.32	29.14	±45
-25.1	22.11	24.60	25.15	25.15	±45
-30.1	17.25	19.20	19.67	19.68	±45
-35.1	13.91	15.38	15.72	15.67	±45
-40.1	11.37	12.43	12.62	12.65	±45
-45.1	9.39	10.15	10.44	10.44	±45
-50.1	7.88	8.57	8.62	8.75	±45



Audio Frequency Response, Middle Channel

Audio Frequency (Hz)	AF Level (kHz)	AF Response (dB)
300	26.84	-1.45
1000	19.20	0.00
5000	30.75	-2.05
15000	30.31	-1.98

Note: AF Response = 10*log (AF Level of 1 kHz/AF Level)



7 FCC §74.861(d)(4)(i) - 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)(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).

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).

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: 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.

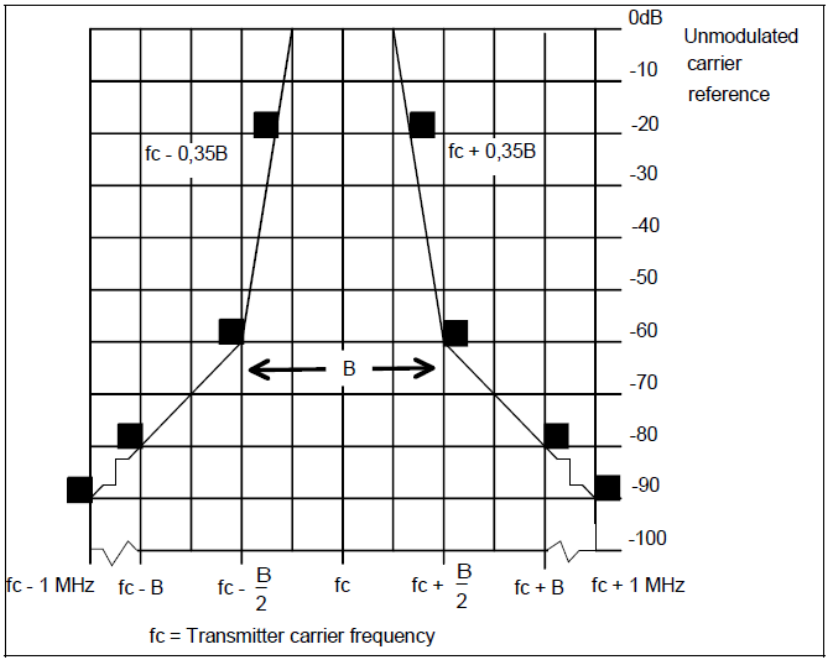


Figure 3: Spectrum mask for analogue systems in all bands

Figure 3 shows the spectrum mask for all analogue systems in the band. The -90 dBc point shall be ±1 MHz from fc measured with an average detector. To comply, a measured value must fall below the mask limit as shown in figure 3.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2017-06-08	2 years
HP	RF Communications Test Set	8920A	3438A05338	2015-09-09	27 months
Agilent	Function Generator	33220A	MY43004878	2016-08-24	15 months
HP	Modulation Analyzer	8901A	2026A00847	2015-09-24	26 months
Krohn-Hite	4 Pole LP/HP/Butterworth/Bessel Filter	3362	KN1586	2017-05-17	1 year
HP	TIMS	4934A	3737U15141	2016-08-03	15 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".*

7.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Chin Ming Lui on 2017-10-17 at RF site.

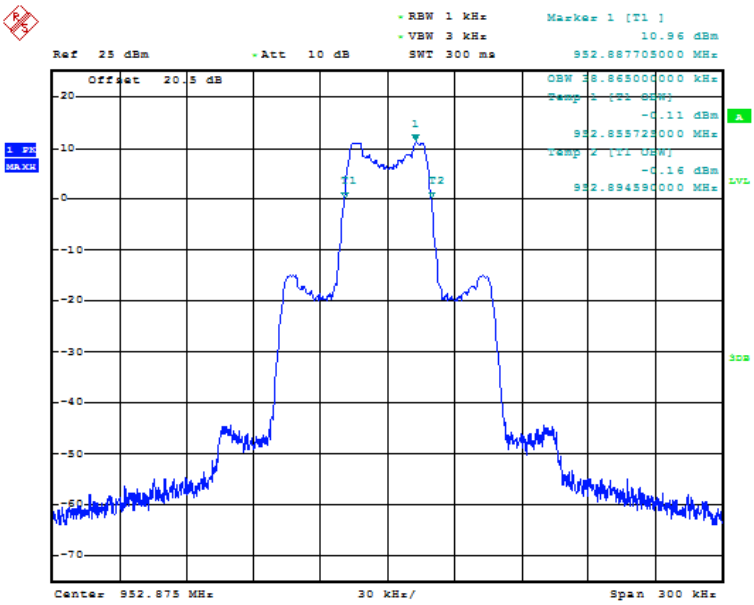
7.5 Test Results

Center Frequency (MHz)	99% Bandwidth (kHz)	Result	Power Setting
952.875	38.865	Pass	High (100 mW)
952.875	38.985	Pass	Low (50 mW)

Please refer to the following table plots for detailed test results

100mW power setting

Occupied Bandwidth



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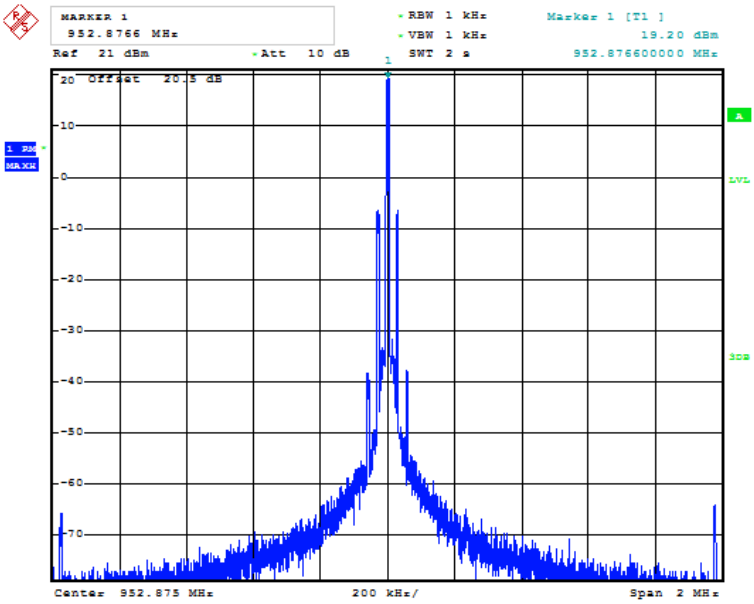
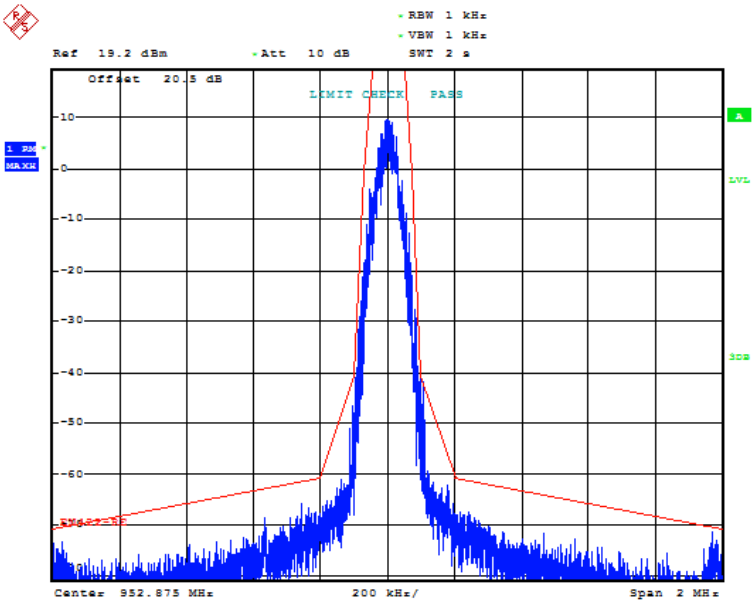
Emission Mask



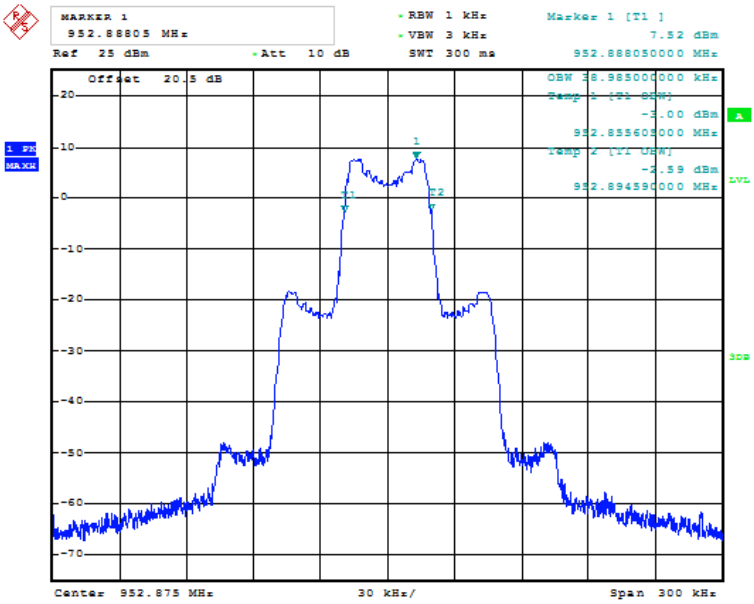
Date: 17.OCT.2017 11:33:07



Date: 17.OCT.2017 11:47:24

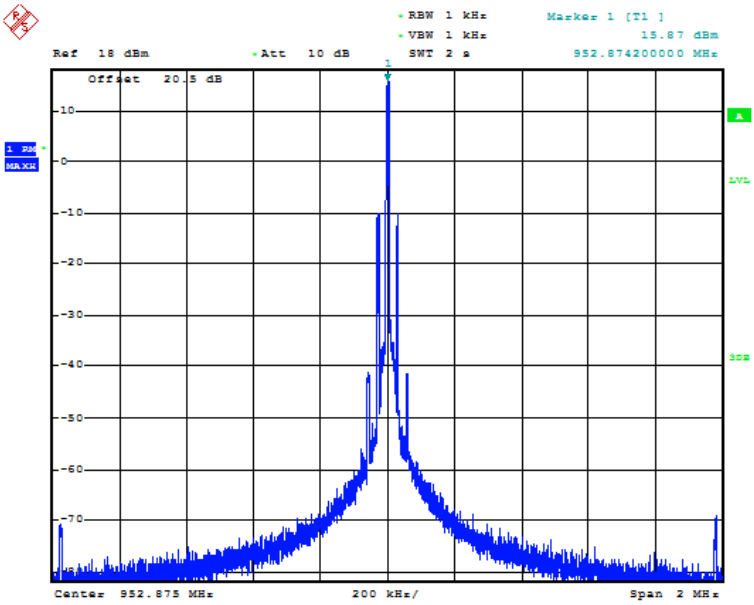
50mW power setting

Occupied Bandwidth

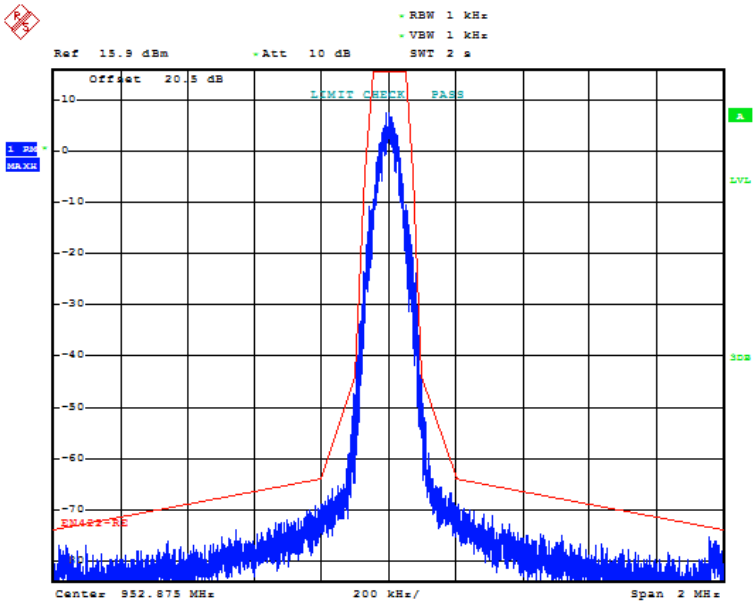


Date: 17.OCT.2017 11:07:11

Emission Mask



Date: 17.OCT.2017 13:15:16



Date: 17.OCT.2017 13:37:32

8 FCC §74.861(d)(3) – Band-edge

8.1 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.

8.2 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.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde and Schwarz	Spectrum Analyzer	FSQ26	200749	2017-06-08	2 years
HP	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+	-	-	Each time
-	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 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Chin Ming Lui on 2017-10-16 at RF site.

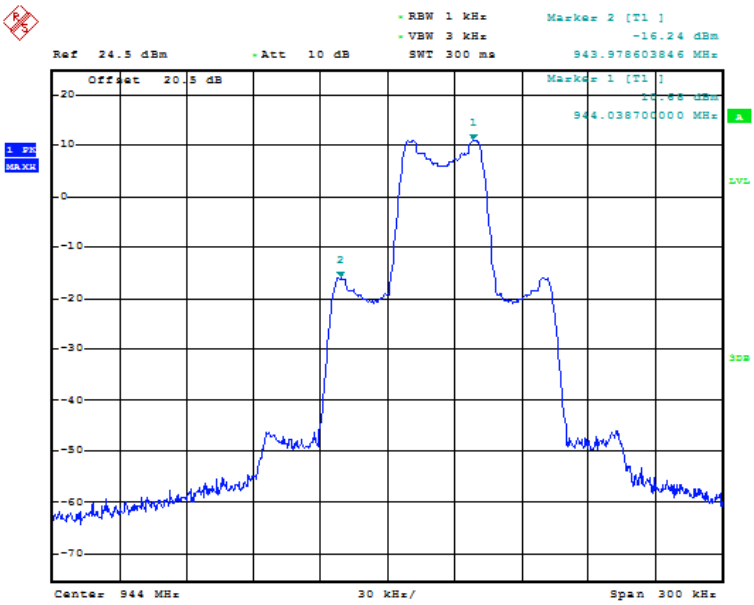
8.5 Test Results

Refer to following table and plots

Power Setting	Frequency (MHz)	Emission at Band Edge (dBm)	Limits (dBm)
100 mW	944.025	-16.24	-13
	951.975	-15.13	-13
50 mW	944.025	-19.41	-13
	951.975	-18.6	-13

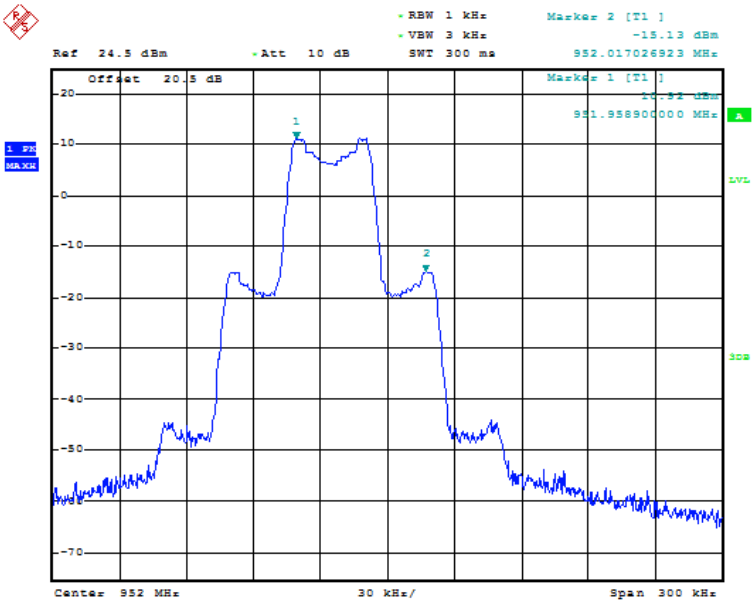
100 mw power setting

Low Channel: 944.025 MHz



Date: 16.OCT.2017 17:07:41

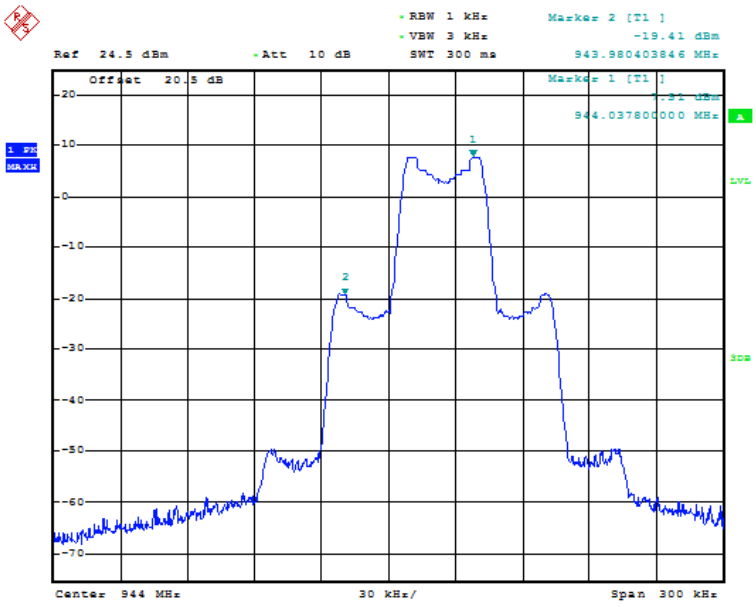
High Channel: 951.975 MHz



Date: 16.OCT.2017 17:19:20

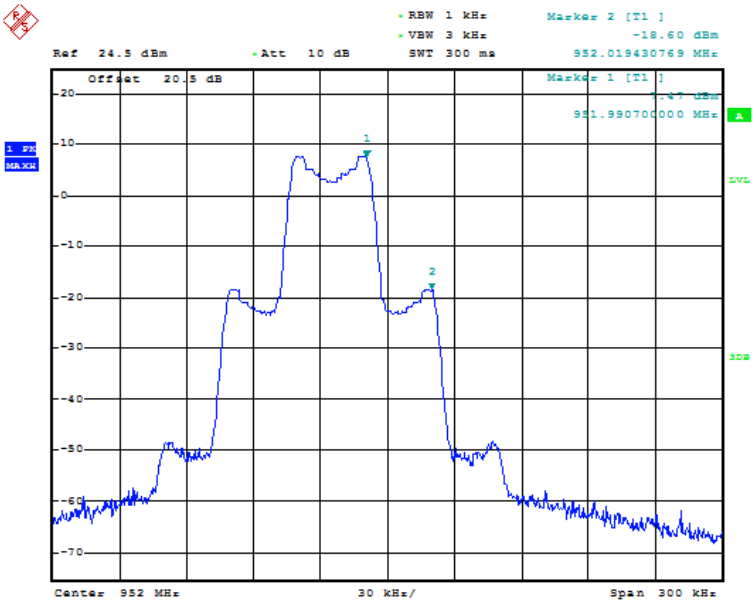
50 mw power setting

Low Channel: 944.025 MHz



Date: 16.OCT.2017 17:13:08

High Channel: 951.975 MHz



Date: 16.OCT.2017 17:17:17

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

9.1 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).

ETSI EN 300 422-1 v1.4.2 (2011-08) Section 8.4:

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 µW
Standby	2 nW	2 nW	20 nW

Measured values for equipment in each frequency band must fall below the values given in table 3.

9.2 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.

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
Mini Circuits	Precision Fixed Attenuator, 20 dB	FW-20+	-	-	Each time
-	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".*

9.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

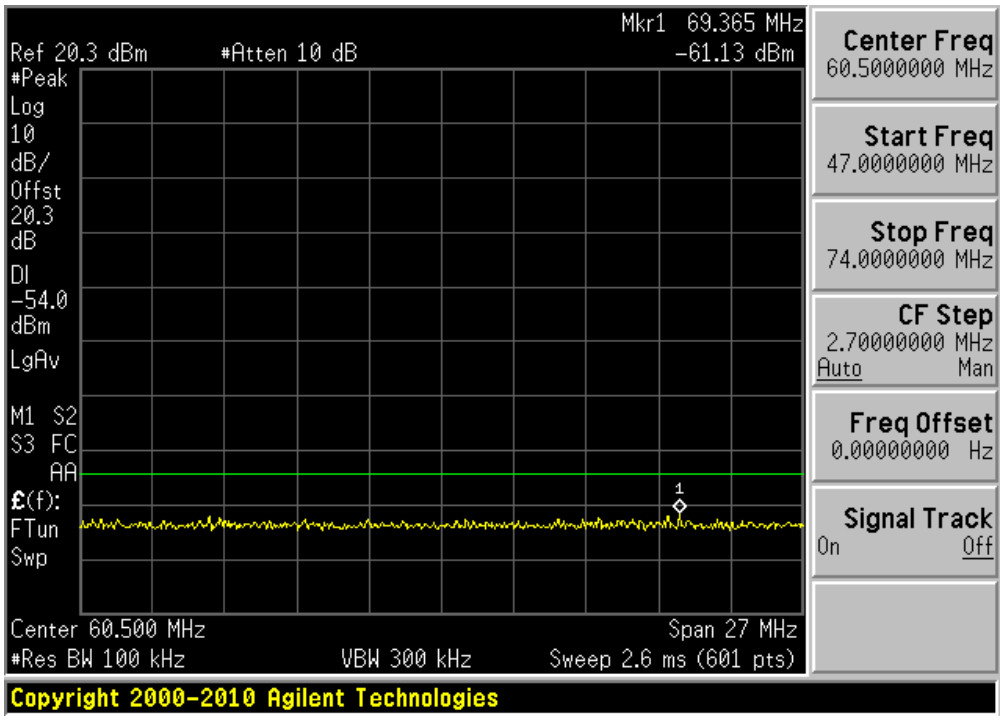
The testing was performed by Chin Ming Lui on 2017-10-10 at RF site.

9.5 Test Results

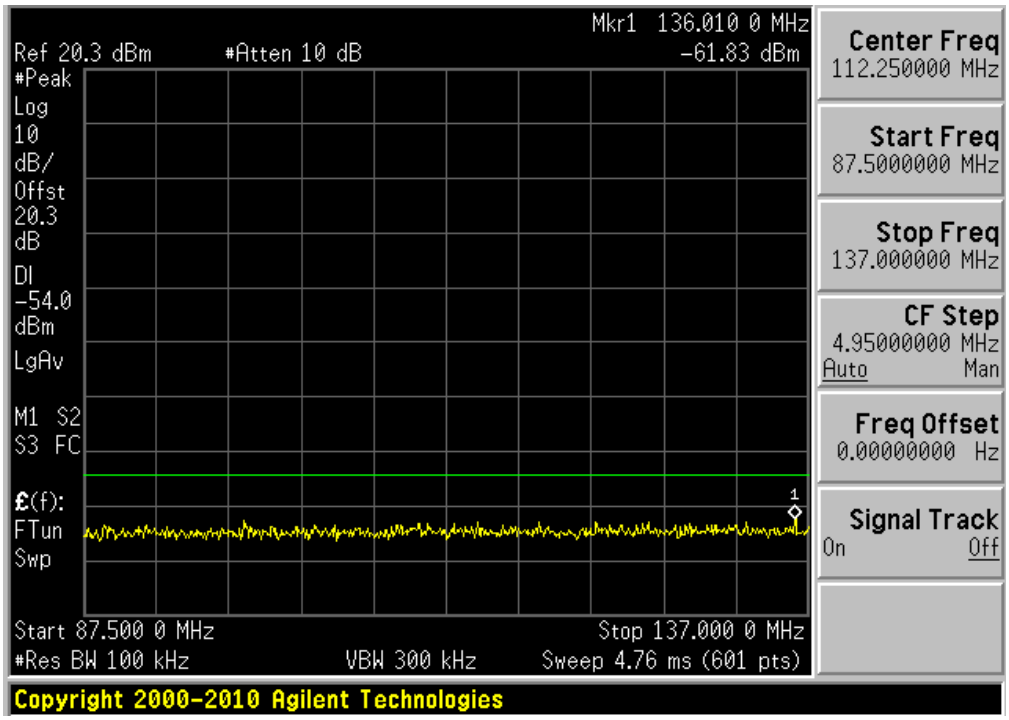
Please refer to the following table plots for detailed test results

Highest Power Setting:

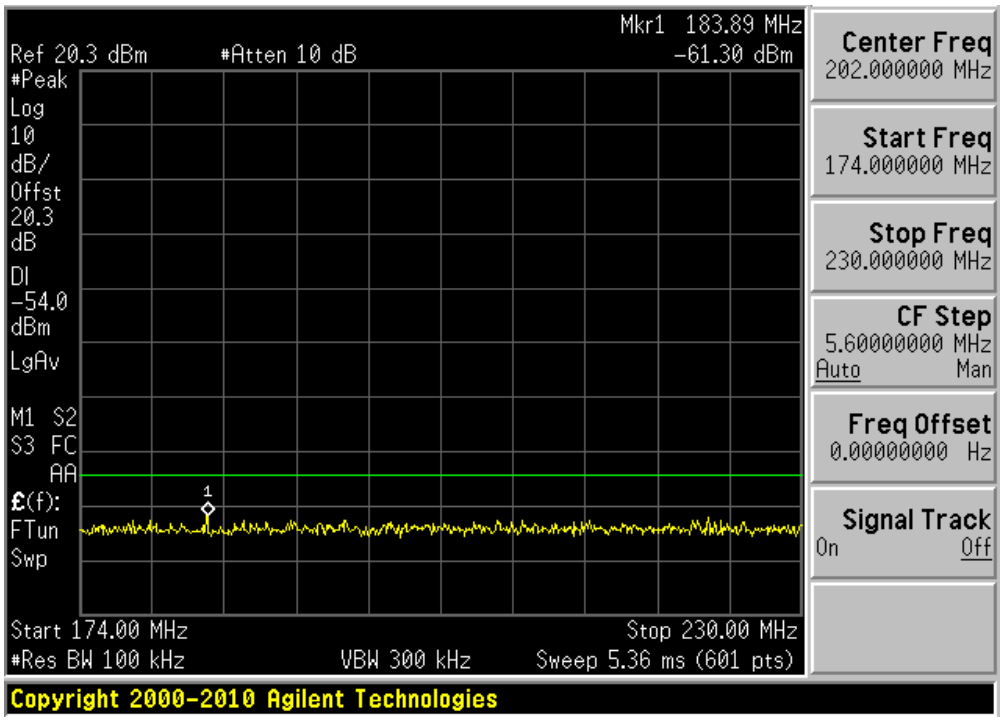
47 MHz to 74 MHz



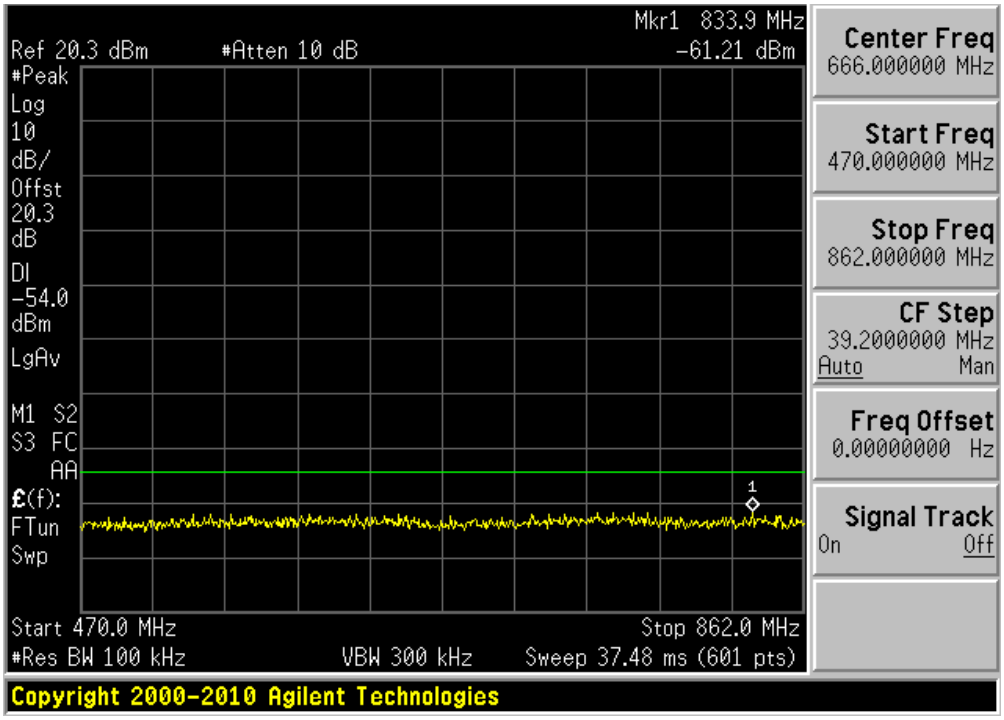
87.5 MHz to 137 MHz



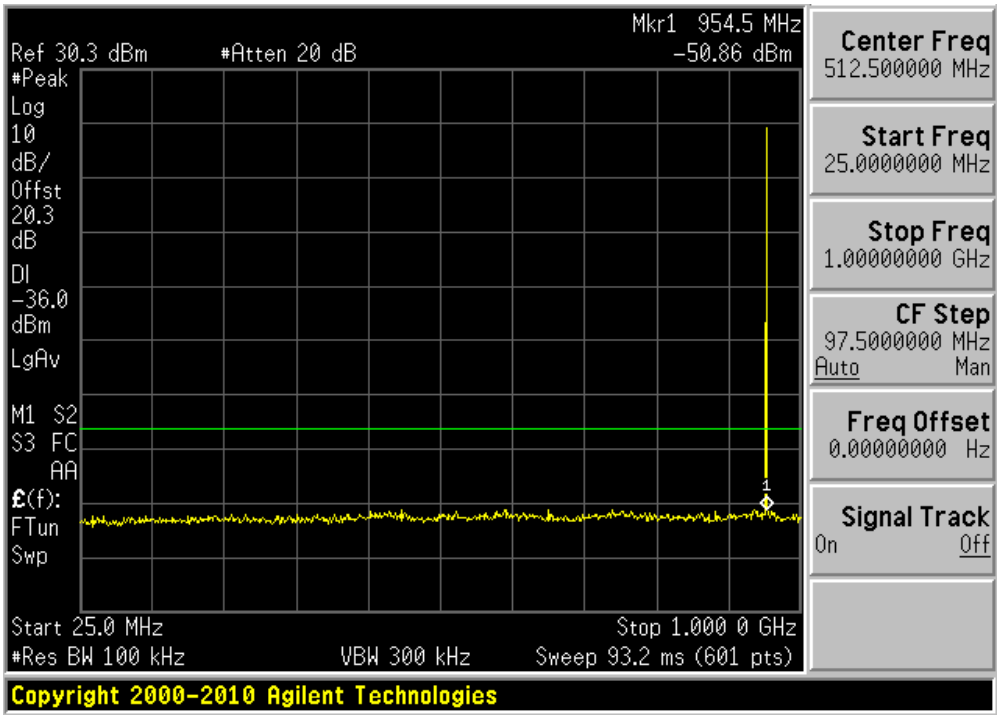
174 MHz to 230 MHz



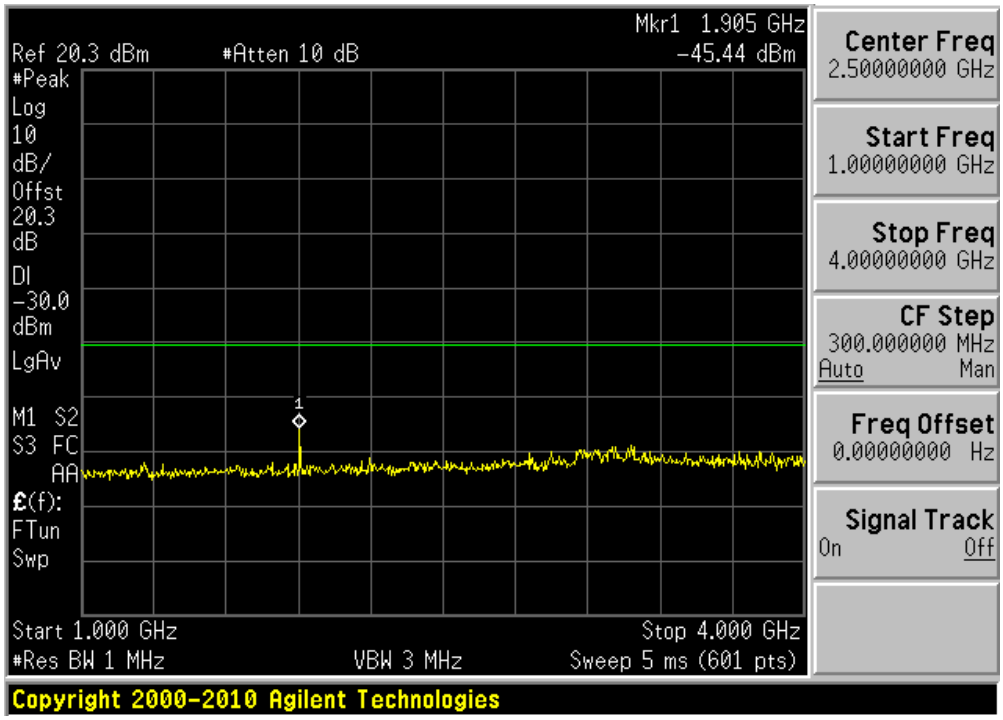
470 MHz to 862 MHz



25 MHz to 1 GHz

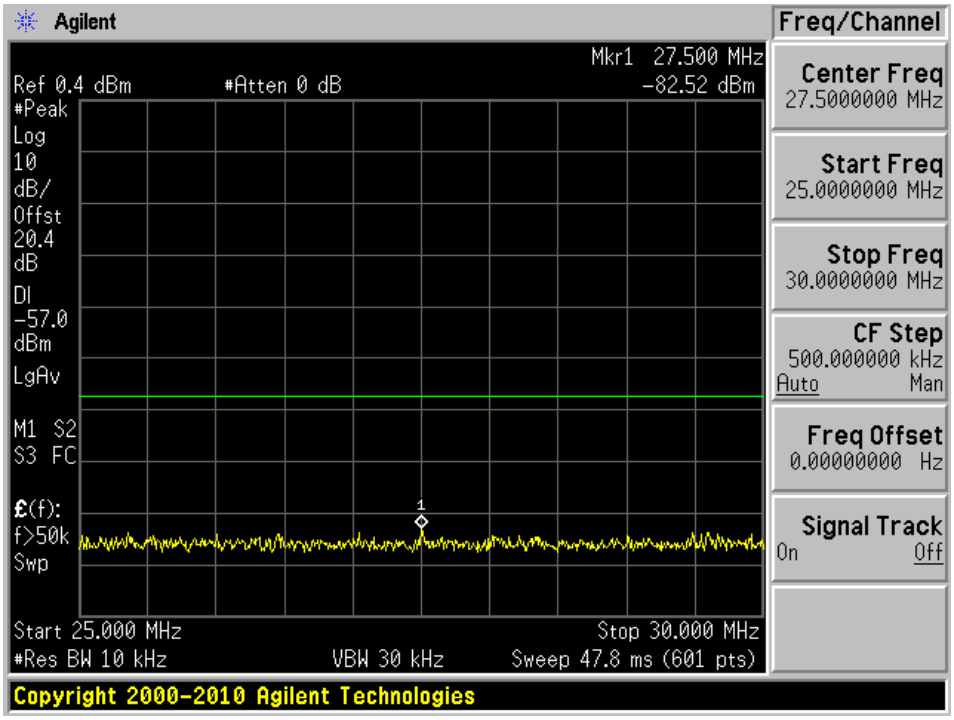


1 GHz to 4 GHz

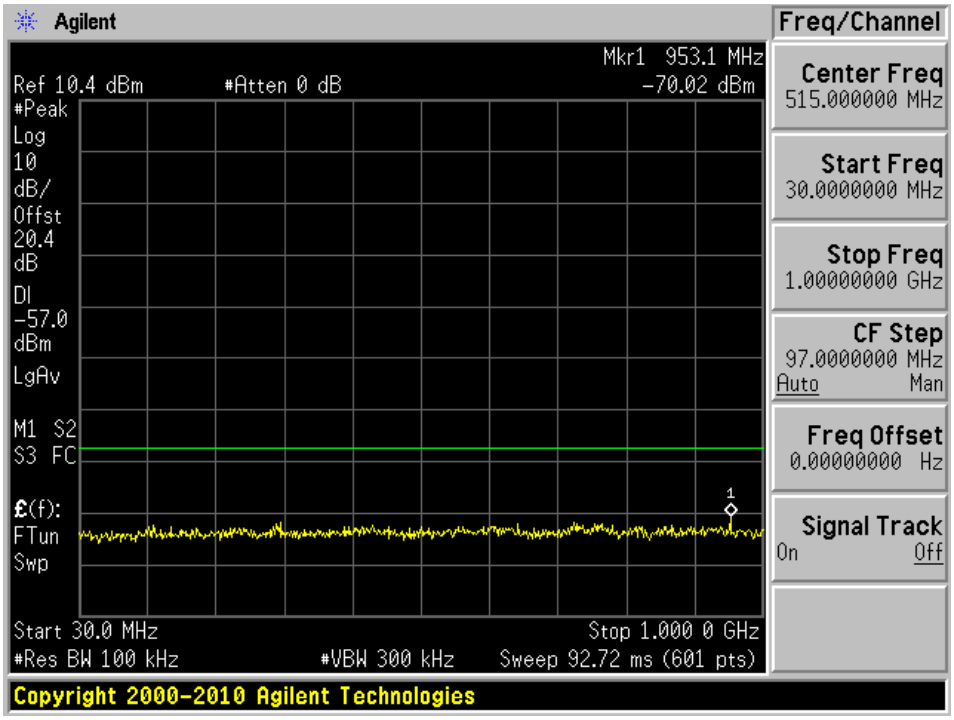


Standby:

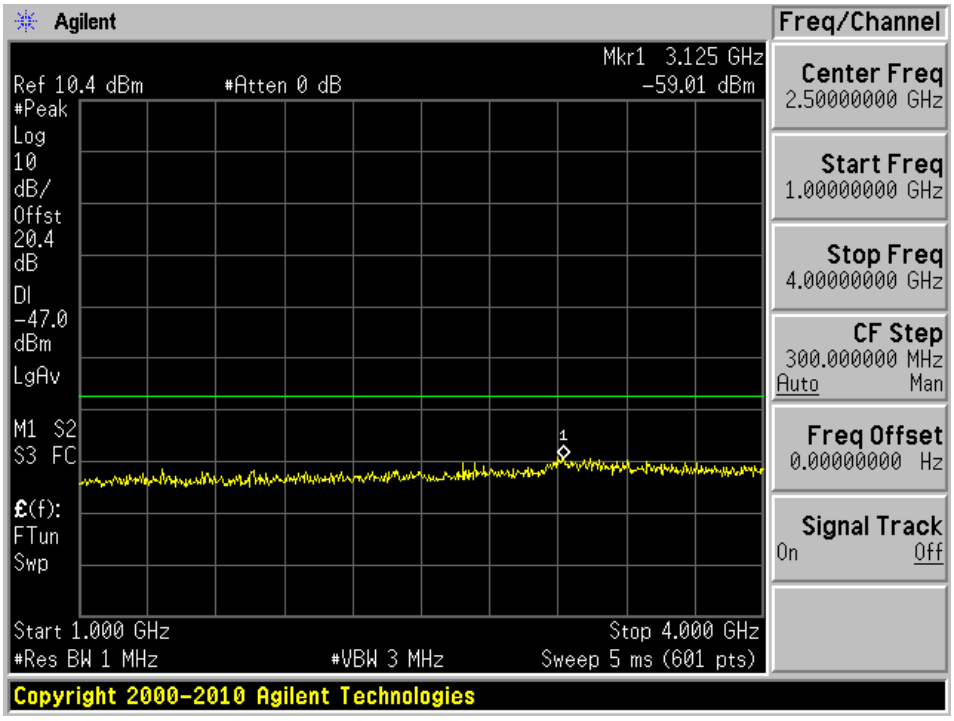
25 MHz to 30 MHz



30 MHz to 1 GHz



1 GHz to 4 GHz


Agilent
Freq/Channel
Mkr1 3.125 GHz
Ref 10.4 dBm
#Atten 0 dB
-59.01 dBm
#Peak
Log
10
dB/
Offst
20.4
dB
Dl
-47.0
dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Center Freq
2.50000000 GHz
Start Freq
1.00000000 GHz
Stop Freq
4.00000000 GHz
CF Step
300.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 1.000 GHz
Stop 4.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 5 ms (601 pts)
Copyright 2000-2010 Agilent Technologies

10 FCC §74.861(d)(4)(i) - Field Strength of Spurious Radiation

10.1 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).

10.2 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.

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
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
HP/Agilant	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".*

10.4 Test Environmental Conditions

Temperature:	24 ºC
Relative Humidity:	43 %
ATM Pressure:	101.2 kPa

The testing was performed by Chin Ming Lui on 2017-10-09 in Chamber 5m3.

10.5 Test Results

Test mode: Transmitting

EUT was configured to highest power setting (100mW)

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)			
CW signal, 952.875 MHz											
99.63	28.9	0	100	H	99.63	-84.06	0	0.04	-84.1	-54	-30.1
99.63	28.85	190	290	V	99.63	-80.78	0	0.04	-80.82	-54	-26.82
179.92	28.63	110	100	H	179.92	-82.58	0	0.07	-82.65	-54	-28.65
179.92	28.27	0	100	V	179.92	-80.56	0	0.07	-80.63	-54	-26.63
1905.75	47.75	296	100	H	1905.75	-59.39	8.163	0.83	-52.057	-30	-22.057
1905.75	46.4	123	100	V	1905.75	-60.54	8.163	0.83	-53.207	-30	-23.207
2858.625	47.91	32	100	H	2858.625	-55.44	10.114	1.31	-46.636	-30	-16.636
2858.625	45.5	0	100	V	2858.625	-58.01	10.114	1.31	-49.206	-30	-19.206

Test mode: Standby

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)			
50.89	30.21	280	100	H	50.89	-80.95	0	0.03	-80.98	-57	-23.98
138	28.53	0	100	V	138	-73.9	0	0.11	-74.01	-57	-17.01
102.95	29.24	138	100	H	102.95	-83.92	0	0.06	-83.98	-57	-26.98
172.58	28.6	205	100	V	172.58	-80.2	0	0.1	-80.3	-57	-23.3
1905.75	46.72	0	100	H	1905.75	-60.42	8.163	0.83	-53.087	-47	-6.087
1905.75	46.45	0	100	V	1905.75	-60.49	8.163	0.83	-53.157	-47	-6.157
2858.625	45.87	0	100	H	2858.625	-57.48	10.114	1.31	-48.676	-47	-1.676
2858.625	45.03	0	100	V	2858.625	-58.48	10.114	1.31	-49.676	-47	-2.676

11 FCC §2.1055 - Frequency Stability

11.1 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° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From −20° to + 50° 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° 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, 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° 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.)

11.2 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:

  Ppm error = (MCF/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.

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
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+	-	-	Each time
-	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 ºC
Relative Humidity:	52 %
ATM Pressure:	101.1 kPa

The testing was performed by Chin Ming Lui on 2017-10-11 at RF site.

11.5 Test Results

Varying temperature:

Temperature (℃)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
-30	952.8801	952.875	5.35
-20	952.8784	952.875	3.57
-10	952.8767	952.875	1.78
0	952.8784	952.875	3.57
10	952.8784	952.875	3.57
20	952.8767	952.875	1.78
30	952.875	952.875	0
40	952.8733	952.875	-1.78
50	952.8733	952.875	-1.78

Varying supply voltage:

Voltage (V_{DC})	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
2.7	952.8733	952.875	-1.78
3.3	952.8767	952.875	1.78

12 Appendix A- Test Setup Photographs

Please refer to the attachment

13 Appendix B- EUT External Photographs

Please refer to the attachment

14 Appendix C- EUT Internal Photographs

Please refer to the attachment

15 Annex D (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.

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