



FCC PART 74 SUBPART H
ISED RSS-210, ISSUE 9, ANNEX G
TEST AND MEASUREMENT REPORT

For

Lectrosonics, Inc.

581 Laser Road NE, Rio Rancho, NM 87124, USA

FCC ID: DBZDHU
IC: 8024A-DHU

Report Type: Original Report	Product Type: Digital Wireless Microphone Transmitter
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1708095-74	Original Report	2017-10-18

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: *DHu*, FCC ID: *DBZDHU*, IC: *8024A-DHU* which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a Digital Wireless Microphone Transmitter. The EUT operates in the frequency range: 470.1-607.975 MHz.

1.2 Mechanical Description of EUT

The EUT measures approximately 4.8 cm (L) x 4.8 cm (W) x 24 cm (H).

The data gathered are from a typical production sample provided by the Lectrosonics, Inc with serial number: 2 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, Issue 4 of the Industry Canada RSS-Gen General Requirements and Information for the Certification of Radio Apparatus and Issue 9 of Industry Canada RSS-210, License-Exempt, Low-Power Radio Apparatus Operating in the Television Bands.

The objective is to determine compliance with Part 74 of the FCC Rules, Industry Canada RSS-Gen and Industry Canada RSS-210 Standard, limits for RF output power, Modulation characteristics, Emission bandwidth, Field strength of spurious radiation and Frequency stability for license-exempt, low-power radio apparatus operating in the television bands.

1.4 Related Submittal(s)/Grant(s)

NA

1.5 Test Methodology

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

Bay area compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to **ISO 17025:2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminaires and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC (Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:

1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.

2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.

3. Radio Communication Equipment for Singapore.

4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.

5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).

6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s), Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

<http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b>

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA 603-D and ANSI C63.10-2013 Standards.

2.2 EUT Exercise Software

N/A

2.3 Special Equipment

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

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

N/A

2.6 Interface Ports and Cables

N/A

3 Summary of Test Results

FCC & IC Rules	Descriptions of Test	Result (s)
FCC §2.1093, ISED RSS-102	RF Exposure	Compliant
FCC §74.861(e)(1), ISED RSS-210 G.3.1	RF output power	Compliant
FCC §74.861(e)(3), ISED RSS-210 G.3.5	Modulation characteristics	Not applicable*
FCC §74.861(e)(5)(7), ISED RSS-210 G.3.2 & G.3.4	Emission bandwidth & Emission Mask	Compliant
FCC §74.861(e)(7) ISED RSS-210 G.3.4	Spurious radiation at the antenna port	Compliant
FCC §74.861(e)(7), ISED RSS-210 G.3.4	Field strength of spurious radiation	Compliant
FCC §74.861(e)(4), ISED RSS-210 G.3.3	Frequency stability	Compliant

* Not applicable: The EUT only supports digital modulation.

4 FCC §2.1093 & ISED RSS-102 - 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:

$$\left[\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \right] \cdot \sqrt{f(\text{GHz})} \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

- $f(\text{GHz})$ 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) · ($f(\text{MHz})/150$)] 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 $[1 + \log(100/f(\text{MHz}))]$ 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 $\frac{1}{2}$ 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.

According to ISSED RSS-102 Issue 5 §2.5.1,

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71	101	132	162	193
450	52	70	88	106	123
835	17	30	42	55	67
1900	7	10	18	34	60
2450	4	7	15	30	52
3500	2	6	16	32	55
5800	1	6	15	27	41

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥ 50 mm
≤ 300	223	254	284	315	345
450	141	159	177	195	213
835	80	92	105	117	130
1900	99	153	225	316	431
2450	83	123	173	235	309
3500	86	124	170	225	290
5800	56	71	85	97	106

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW.

The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

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.

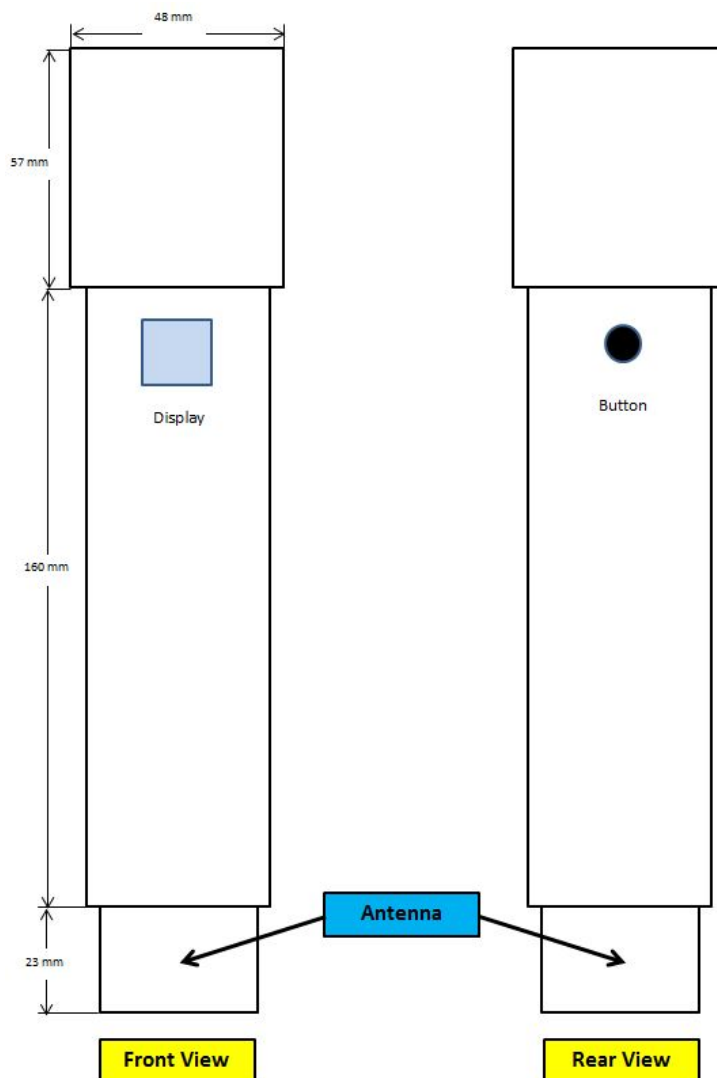
The distance between antenna and human hand should be 20 mm or more.

4.2 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.



4.3 FCC and IC SAR Exclusion Consideration

Channel	Frequency (MHz)	Target Conducted Output Power Including Tune-up Tolerance		Max. Antenna Gain (dBi)	Max. e.i.r.p (mW)	Distance (mm)	Calculated Value	FCC 10-g Extreme SAR Threshold	SAR Exclusion (Yes/No)
		dBm	mW						
Low	470.1	17.5	56.23	2.15	92.26	20	3.16	7.5	Yes
Middle	539	17.5	56.23	2.15	92.26	20	3.39	7.5	Yes
High	607.975	17.5	56.23	2.15	92.26	20	3.60	7.5	Yes

Channel	Frequency (MHz)	Target Conducted Output Power Including Tune-up Tolerance		Max. Antenna Gain (dBi)	Max. e.i.r.p (mW)	Distance (mm)	IC 10-g SAR Exemption Limit * (mW)	SAR Exclusion (Yes/No)
		dBm	mW					
Low	470.1	17.5	56.23	2.15	92.26	20	258.34	Yes
Middle	539	17.5	56.23	2.15	92.26	20	235.53	Yes
High	607.975	17.5	56.23	2.15	92.26	20	212.68	Yes

* Linear interpolation was applied for finding the exemption limit for the 19.65e channel frequencies list above. The following equation was used to determine the exemption power level p_c at channel frequency f_c .

$$(f_1 - f_2) / (f_c - f_2) = (p_1 - p_2) / (p_c - p_2)$$

5 FCC §74.861(e) (1) & ISED RSS-210 G.3.1 - RF Output Power

5.1 Applicable Standards

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

- (i) 54-72, 76-88, and 174-216 MHz bands-50 mW EIRP
- (ii) 470-608 and 614-698 MHz bands-250 mW Conducted power
- (iii) 600 MHz duplex gap: 20 mW EIRP

As per ISED RSS-210 Issue 9, G.3.1:

470-608 MHz and 614-698 MHz bands 250 mW e.i.r.p

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

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

5.4 Test Environmental Conditions

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

The testing was performed by Dean Liu on 2017-09-08 at RF site.

5.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	e.i.r.p. Limits (dBm)	Rated Power (mW/dBm)
Low	470.1	17.11	2.15	19.26	24	50/17
		14.19	2.15	16.34	24	25/14
Middle	539	17.02	2.15	19.17	24	50/17
		14.10	2.15	16.25	24	25/14
High	607.975	17.11	2.15	19.26	24	50/17
		13.82	2.15	15.97	24	25/14

Note FCC is compliant with limit for conducted power.

6 FCC §74.861(e) (5) (7) & ISED RSS-210 G.3.2, G.3.4 - Occupied Bandwidth & Emission Mask

6.1 Applicable Standards

According to FCC §74.861 (e) (5)

The operating bandwidth shall not exceed 200 kHz.

According to FCC §74.861 (e) (7)

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. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.2.2 (Figure 4) 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). The requirements of this section (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter.

As per ISED RSS-210 Issue 9, G.3.2:

The occupied bandwidth for low-power radio apparatus shall not exceed the authorized bandwidth specified in Table G1, which is 200 kHz for 470-608MHz and 614-698MHz.

As per ISED RSS-210 Issue 9, G.3.4:

The transmitter unwanted emissions shall meet the requirements in sections 8.3 and 8.4 of 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*.

6.2 Test Procedure

According to RSS-Gen Issue 4 Section 6.6, When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3×RBW

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

The Emission mask for IC according to sections 8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08).

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2015-09-09	2 year
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

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

6.4 Test Environmental Conditions

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

The testing was performed by Dean Liu on 2017-09-08 at RF site.

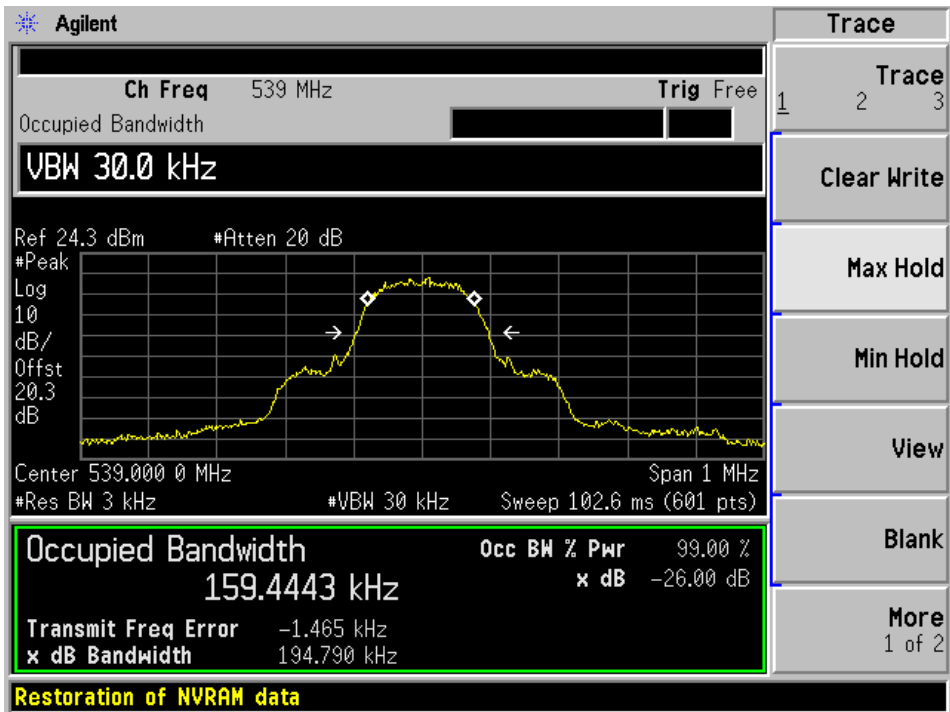
6.5 Test Results

Center Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Result	Power Setting
539	159.44	200	Pass	High (50 mW)
539	158.12	200	Pass	Low (25 mW)

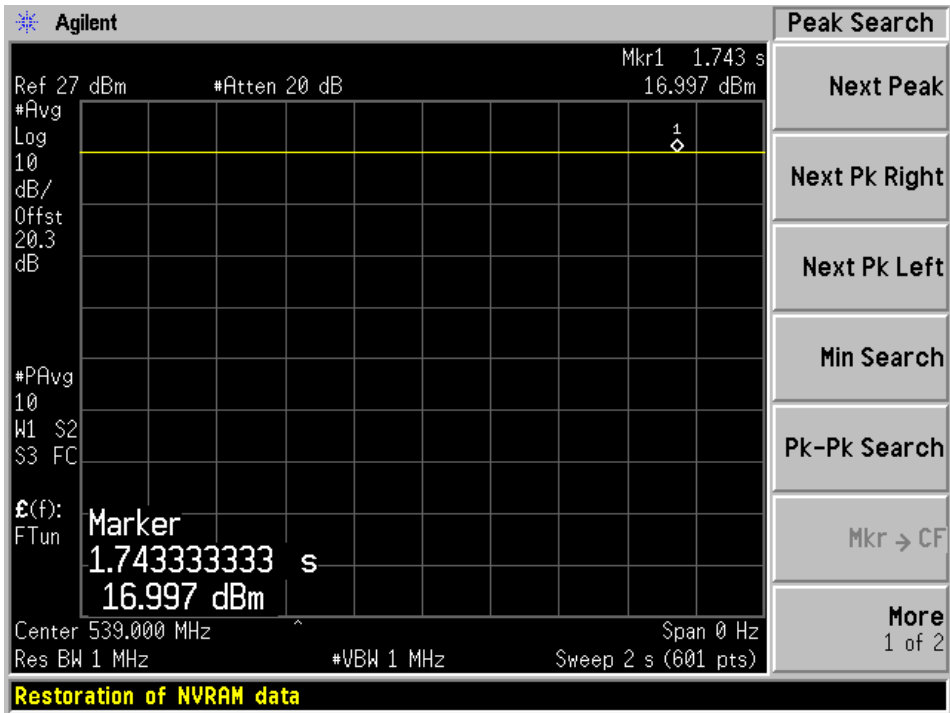
Please refer to the following table plots for detailed test results

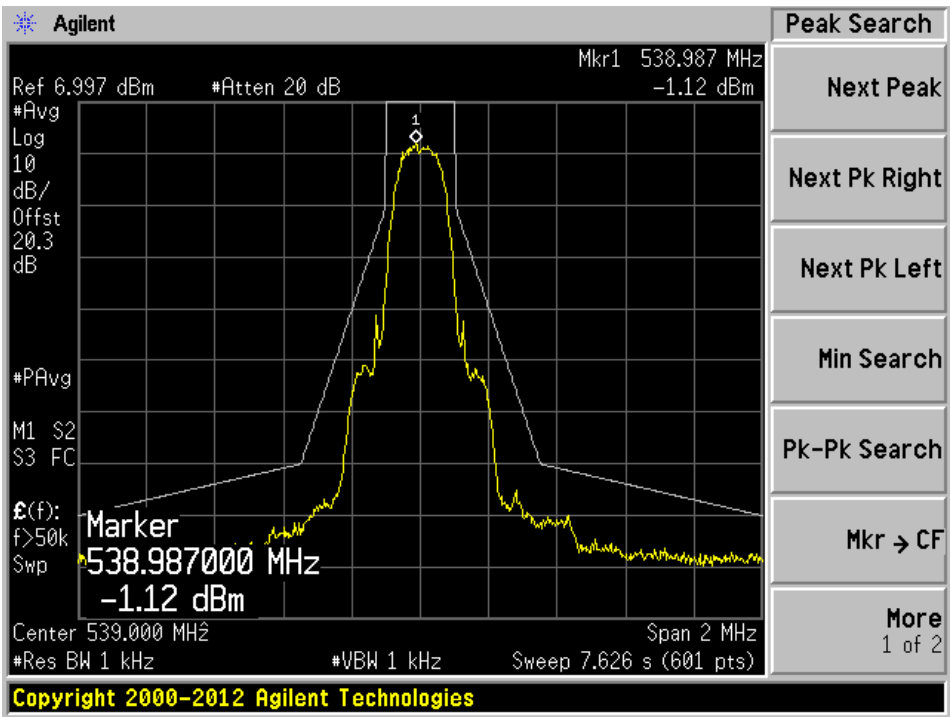
50 mW power setting

Occupied Bandwidth



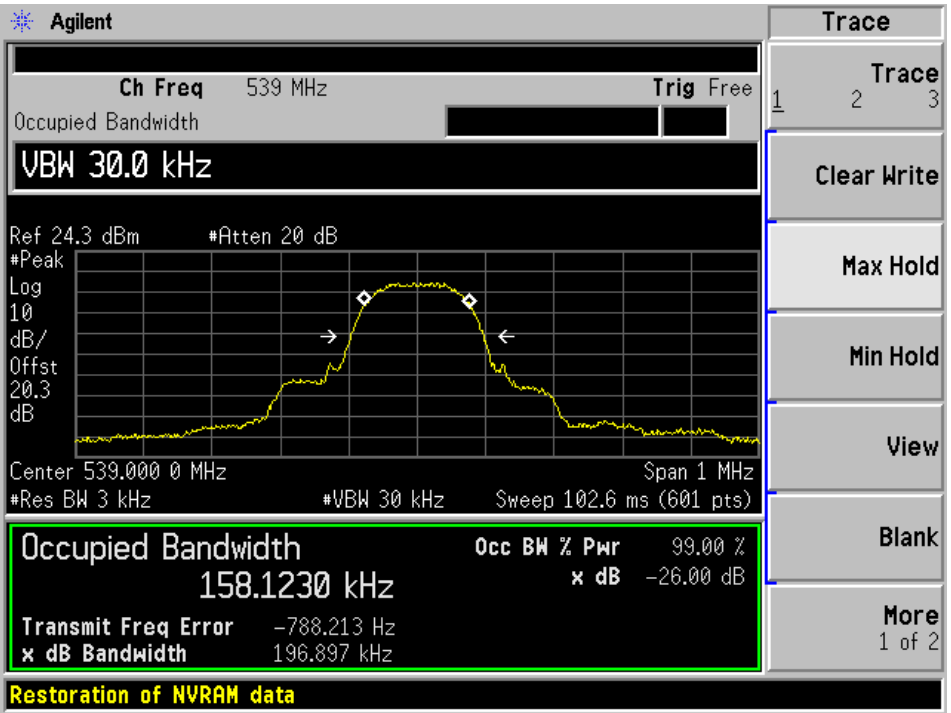
Emission Mask



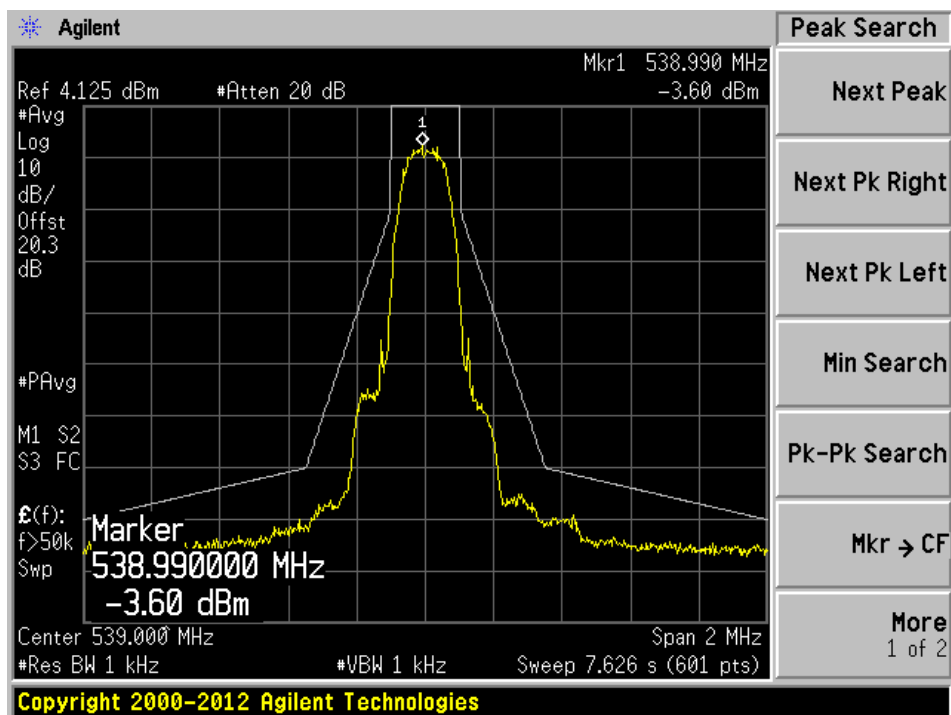
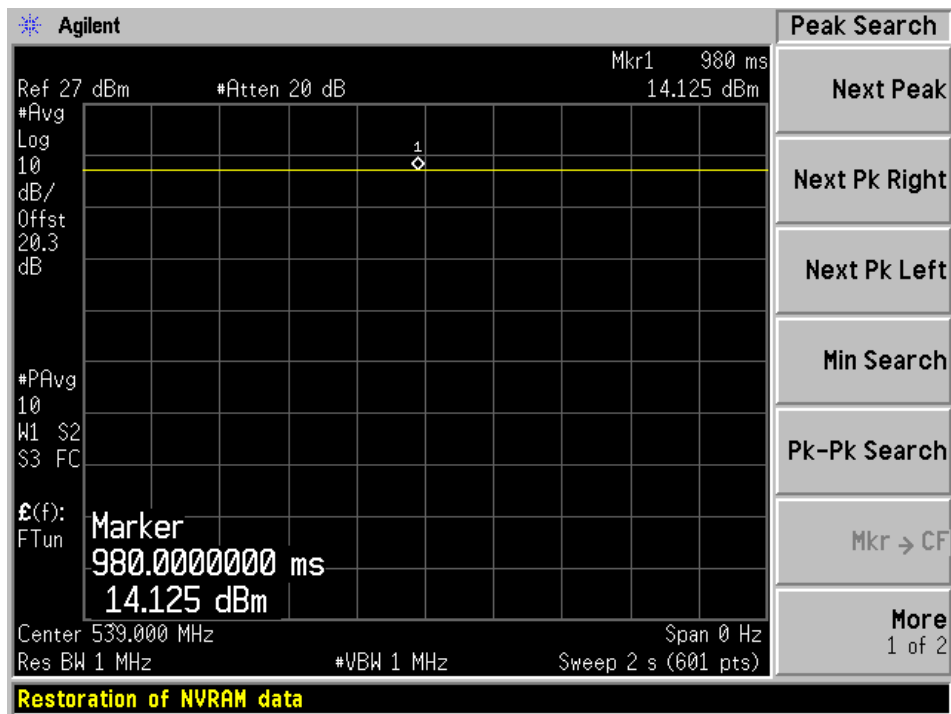


25 mW power setting

Occupied Bandwidth



Emission Mask



7 FCC §74.861(e) (7) & ISED RSS-210 G.3.4 - Conducted Spurious Emissions at Antenna Port

7.1 Applicable Standards

According to FCC §74.861 (e) (7)

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. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.2.2 (Figure 4) 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). The requirements of this section (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter.

As per ISED RSS-210 Issue 9, G.3.4:

The transmitter unwanted emissions shall meet the requirements in sections 8.3 and 8.4 of 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.*

7.2 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.

7.3 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

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

7.4 Test Environmental Conditions

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

The testing was performed by Dean Liu on 2017-09-08 at RF site.

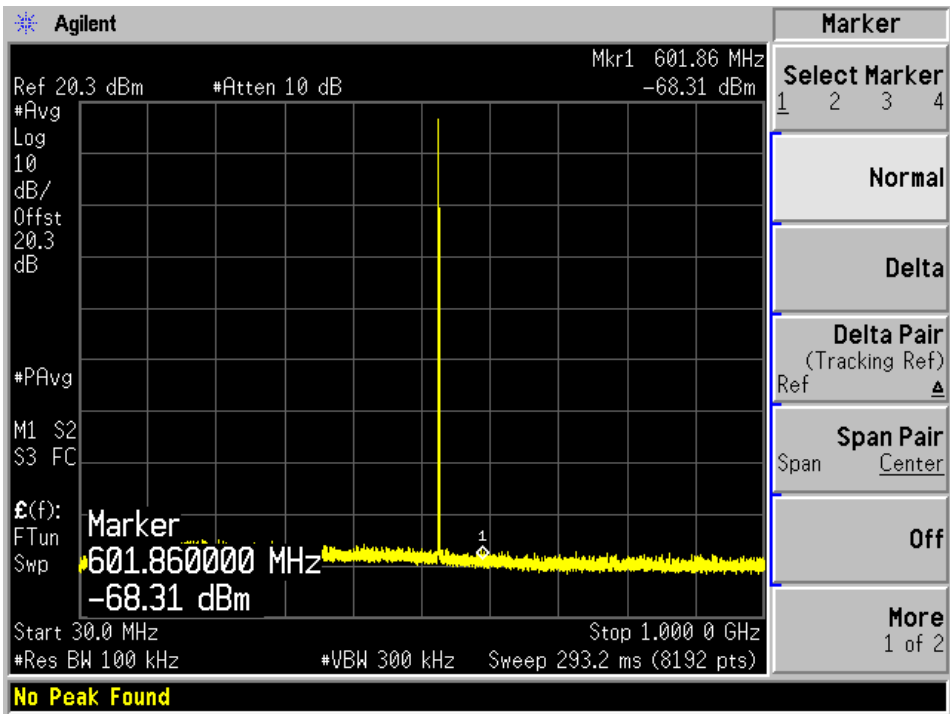
7.5 Test Results

Please refer to the following table plots for detailed test results

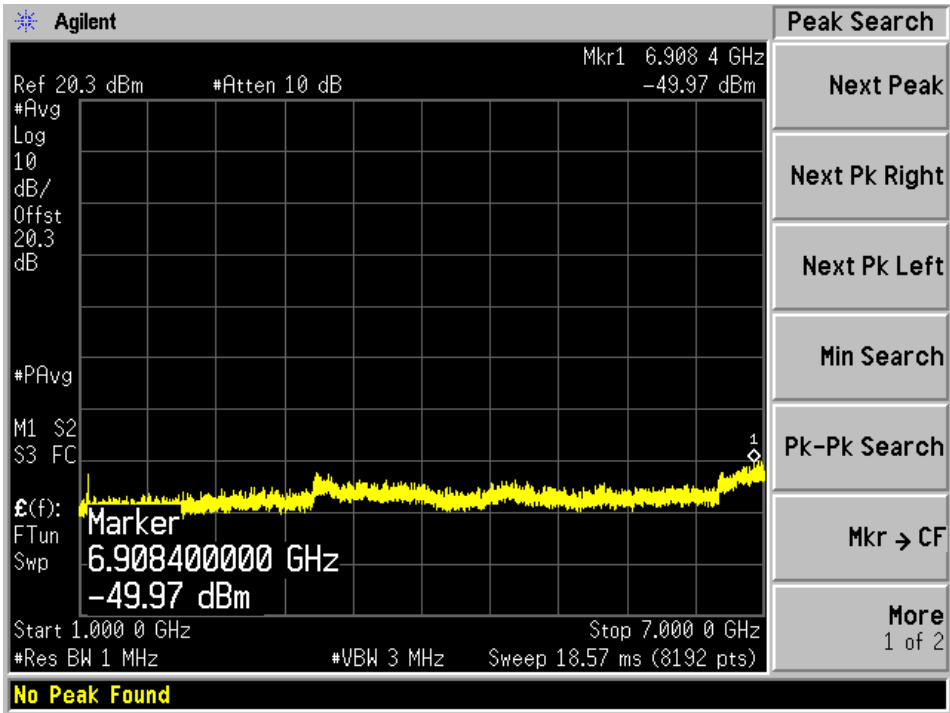
EUT Configuration	Frequency Range (GHz)	Emission Freq. (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
Transmitting	0.03-1	601.86	-68.31	-36	-32.31
	1-7	6908.4	-49.97	-30	-19.97
Stand-by	0.03-1	36.87	-84.70	-57	-27.70
	1-7	6770.1	-70.35	-47	-23.35

Highest Power Setting:

30 MHz to 1 GHz

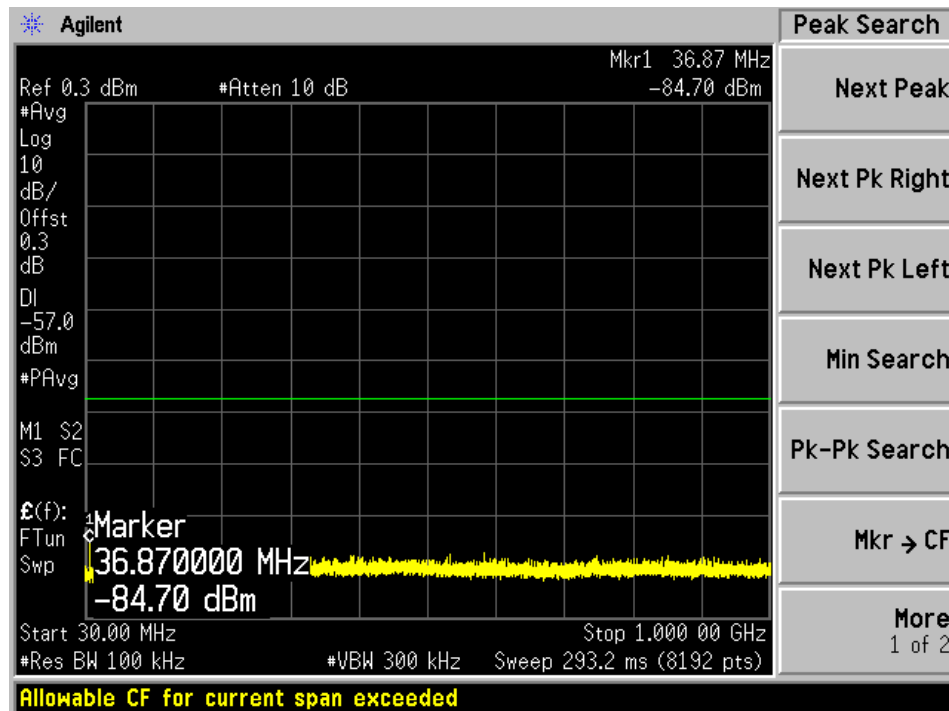


1 GHz to 7 GHz

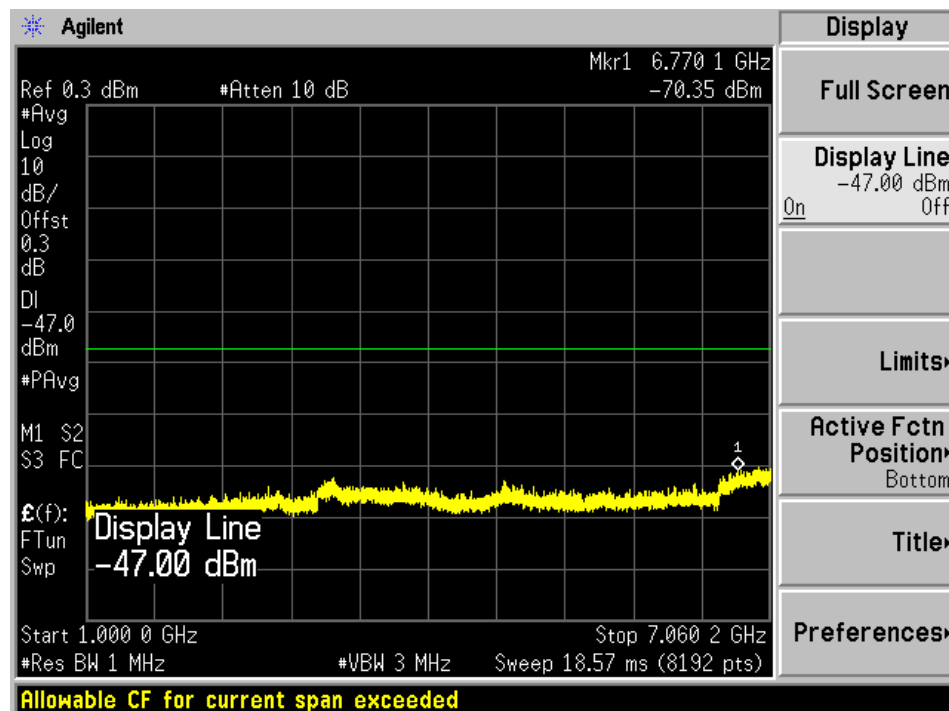


Standby:

30 MHz to 1 GHz



1 GHz to 7 GHz



8 FCC §74.861(e) (7) & ISED RSS-210 G.3.4 - Field Strength of Spurious Radiation

8.1 Applicable Standards

According to FCC §74.861 (e) (7)

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*. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.2.2 (Figure 4) 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). The requirements of this section (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter.

As per ISED RSS-210 Issue 9, G.3.4:

The transmitter unwanted emissions shall meet the requirements in sections 8.3 and 8.4 of 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*.

8.2 Test Procedure

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

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

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
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	2 years
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

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

8.4 Test Environmental Conditions

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

The testing was performed by Dean Liu on 2017-09-07 at RF site.

8.5 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)			
539 MHz											
604.5	30.37	0	100	H	604.5	-70.7	0	0.41	-71.11	-54	-17.11
599.78	29.57	0	100	V	599.78	-68.19	0	0.36	-68.55	-54	-14.55
1075	48.8	130	100	H	1075	-60.02	6.866	0.72	-53.874	-30	-23.874
1076	48.95	118	100	V	1076	-59.73	6.866	0.72	-53.584	-30	-23.584

Note: FCC limit is -13 dBm, which is higher than the RSS limit.

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)			
497.65	31.15	0	200	H	497.65	-67.62	0	0.34	-67.96	-57	-10.96
497.65	41.18	0	100	V	497.65	-57.61	0	0.34	-58.95	-57	-1.95
1298	47.78	0	100	H	1298	-61.47	7.308	0.79	-54.952	-47	-7.952
1296	48.74	0	100	V	1296	-60.61	7.308	0.79	-54.092	-47	-7.092

9 FCC §74.861(e) (4) & ISED RSS-210 G.3.3 - Frequency Stability

9.1 Applicable Standards

According to FCC §74.861 (e) (4):

The frequency tolerance of the transmitter shall be 0.005 percent

As per ISED RSS-210 Issue 9, G.3.3:

The frequency stability of equipment shall comply with the limits specified in Table G1, which is ± 50 ppm.

9.2 Test Procedure

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

The measurement method is as following:

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

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

Where

MCF is the Measured Carrier Frequency in MHz

ACF is the Assigned Carrier Frequency in MHz

- The value recorded above is the carrier frequency stability.

According to RSS- Gen issue 4 Section 6.11, frequency stability is a measure of frequency drift due to temperature and supply voltage variations with reference to the frequency measurement at an appropriate reference temperature and the rated supply voltage.

Unless specified otherwise in the RSS that is applicable to the device, the reference temperature for transmitters is $+20^{\circ}\text{C}$.

A hand-held device that is only capable of operating using internal batteries shall be tested using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the batter nominal voltage, and again at the battery operating end point voltage which must be specified by the equipment manufacturer.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement. The following temperatures and supply voltage ranges apply, unless specified otherwise in the applicable RSS.

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

If the frequency stability limits are only met at a different temperature range than specified in (a), the frequency stability requirement will be deemed met if the transmitter is automatically inhibited from operating outside this different temperature range and the published equipment operating characteristics are revised to reflect this different temperature range.

If an unmodulated carrier is not available, the measurement method shall be described in the test report.

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
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	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 attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

9.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.1 kPa

The testing was performed by Dean Liu on 2017-09-12 at RF site.

9.5 Test Results

Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
-30	539.00101	539	1.87	50
-20	539.00115	539	2.13	50
-10	538.99931	539	-1.28	50
0	538.99865	539	-2.50	50
10	539.00063	539	1.17	50
20	538.99914	539	-1.60	50
30	538.99883	539	-2.17	50
40	539.00236	539	4.38	50
50	539.00162	539	3.01	50

Varying supply voltage:

Voltage (V _{DC})	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limits (+/-ppm)
2.7	538.99815	539	-3.43	50
3.3	538.99803	539	-3.65	50

10 Exhibit A – Test Setup Photographs

Please refer to the attachment

11 Exhibit B - EUT External Photographs

Please refer to the attachment

12 Exhibit C - EUT Internal Photographs

Please refer to attachment

--- END OF REPORT ---