



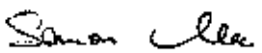
FCC PART 74, SUBPART H
ISED C RSS-123, ISSUE 4, AUGUST 2019
TEST AND MEASUREMENT REPORT

For

Lectrosonics, Inc.

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

FCC ID: DBZHMA79
IC: 8024A-HMA79

Report Type: Original Report	Product Type: Wireless Microphone Transmitter
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Report Number R1911182-74	
Report Issue Date: 2020-01-22	
Reviewed By: Simon Ma RF Supervisor	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA*, NIST, or any agency of the Federal Government.

* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*”

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1911182-74	Original Report	2020-01-22

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/E07-941*, *FCC ID: DBZHMA79*; *IC: 8024A-HMA79*, which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a plug on wireless microphone transmitter. The EUT operates in the frequency range: 941.525 to 959.825 MHz.

1.2 Mechanical Description of EUT

The HMA/E07-941 (EUT) measures approximately 10.8 cm (L) x 4.4 cm (W) x 3.5 cm (H) and weighs approximately 0.190 kg.

The data gathered are from the typical production sample provided by the Lectrosonics, Inc. with serial number: 1 and 2.

1.3 Objective

The following test report is prepared on behalf of *Lectrosonics, Inc.* in accordance with Part 74, Subparts H of the Federal Communications Commission rules and ISED RSS-123, Issue 4, August 2019.

The objective is to determine compliance with Part 74 of the FCC Rules, and ISED RSS-123 Issue 4, limits for RF output power, Modulation characteristics, Emission bandwidth, Field strength of spurious radiation and Frequency stability for low power auxiliary stations operating in the bands other than those allocated for TV broadcasting.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI/TIA-603-E-2016, FCC KDB 971168 D01 Power Meas License Digital Systems v03r01, and EN 300 422-1 v1.4.2 Electromagnetic compatibility and Radio Spectrum Matters; Wireless microphones in the 25MHz to 3GHz frequency range.

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.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 0.57 \text{ dB}$
Power Spectral Density, conducted	$\pm 1.48 \text{ dB}$
Unwanted Emissions, conducted	$\pm 1.57 \text{ dB}$
All emissions, radiated	$\pm 4.0 \text{ dB}$
AC power line Conducted Emission	$\pm 2.0 \text{ dB}$
Temperature	$\pm 2 \text{ }^{\circ} \text{C}$
Humidity	$\pm 5 \%$
DC and low frequency voltages	$\pm 1.0 \%$
Time	$\pm 2 \%$
Duty Cycle	$\pm 3 \%$

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 Innovation, Science and Economic development 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 3297.02), 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 (Innovation, Science and Economic development Canada - ISED):

- 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 (Infocomm Media Development Authority - IMDA):

- 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IMDA MRA Recognition Scheme: 2011, Annex 2
2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IMDA 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 3297.01) 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: (Innovation, Science and Economic development Canada - ISED) 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 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 Media Development Authority - IMDA) 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 ANSI/TIA-603-E-2016, ANSI C63.26-2015, and KDB 971168 D01 v03r01.

2.2 EUT Exercise Software

None

2.3 Special Equipment

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

2.4 Equipment Modifications

An SMA port was modified by the manufacturer for conducted tests.

2.5 Local Support Equipment

None

2.6 Interface Ports and Cables

None

3 Summary of Test Results

FCC & ISEDC Rules	Descriptions of Test	Result (s)
FCC §2.1093 ISEDC RSS-102	RF exposure	Compliant ¹
FCC §74.861(d)(1) ISEDC RSS-123 §8.2	RF output power	Compliant
FCC §2.1047 ISEDC RSS-123 §8.1	Modulation characteristics	Compliant
FCC §2.1049 FCC §74.861(d)(4)(i) ISEDC RSS-123 §8.2 & § 8.3	Operating bandwidth & Emission mask	Compliant
FCC §2.1051 FCC §74.861(d)(4)(i) ISEDC RSS-123 §8.3	Spurious emissions at the antenna port	Compliant
FCC §2.1053 FCC §74.861(d)(4)(i) ISEDC RSS-123 §8.3	Field strength of spurious emissions	Compliant
FCC §2.1055 ISEDC RSS-123 §8.2	Frequency Stability	Compliant

Note¹: Please refer to report R1911182-20

4 FCC §2.1093 & ISEDC RSS-102 - RF Exposure

Please refer to R1911182-20 for details.

5 FCC §74.861(d)(1) & ISEDC RSS-123 §8.2 - RF Output Power

5.1 Applicable Standards

According to FCC §74.861 (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.

According to ISEDC RSS-123 §8.2 the device shall meet the transmit power/e.r.p., authorized bandwidth and frequency stability limits for its operating bands as specified in table 1.

Table 1 — Frequency bands, transmit power/e.r.p., authorized bandwidths and frequency stability limits

Frequency band (MHz)	Transmit power (W)	e.r.p. (W)	Authorized bandwidth (kHz)	Frequency stability ($\pm$ ppm)
26.10-26.48	--	1	200	50
88-107.5	--	1	200	50
150-174	0.05	--	54	50
450-451	--	1	200	50
455-456	--	1	200	50
941.5-952	1	--	200	20
953-959.85	1	--	200	20
6930-6955	1	--	600	10
7100-7125	1	--	600	10

5.2 Test Procedure

KDB 971168 D01 v03r01

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
ETS-LINDGREN	Power Sensor	7002-006	160097	2018-12-31	2 years
-	20dB attenuator	-	-	Each time ¹	N/A
-	RF Cable	-	-	Each time ¹	N/A

Note¹: attenuator and cable included in the test set-up will be 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 02 October 2018) "A2LA Policy on Metrological Traceability".

5.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	45 %
ATM Pressure:	101.2 kPa

The testing was performed by Christopher Casteel on 2019-12-19 at RF site.

5.5 Test Results

HMA/E07-941:

Channel	Frequency (MHz)	Conducted Output Power (dBm)		Limits (dBm)	Rated Power (dBm)
		50 mW	100 mW		
Low	941.525	18.17	20.87	30	17/20
Middle	954.625	18.00	20.92	30	17/20
High	959.825	18.22	21.02	30	17/20

6 FCC §2.1049, §74.861(d)(4)(i) & ISEDC RSS-123 §8.2, §8.3 - Occupied Bandwidth & Emission Mask

6.1 Applicable Standards

FCC §2.1049

According to FCC §74.861 (d) (4) (i):

(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).

According to ISEDC RSS123 §8.2:

Table 1 — Frequency bands, transmit power/e.r.p., authorized bandwidths and frequency stability limits

Frequency band (MHz)	Transmit power (W)	e.r.p. (W)	Authorized bandwidth (kHz)	Frequency stability (± ppm)
26.10-26.48	--	1	200	50
88-107.5	--	1	200	50
150-174	0.05	--	54	50
450-451	--	1	200	50
455-456	--	1	200	50
941.5-952	1	--	200	20
953-959.85	1	--	200	20
6930-6955	1	--	600	10
7100-7125	1	--	600	10

According to ISEDC RSS123 §8.3 Clause c. devices operating in frequency bands 941.5-952 MHz, 953-959.85 MHz, 6930-6955 MHz and 7100-7125 MHz shall have the transmitter's unwanted emissions meet the requirements in sections 8.3 and 8.4 of ETSI EN 300 422-1.

6.2 Test Procedure

The OBW is according to KDB 971168 D01 v03r01

The Emission mask is 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
Rohde & Schwarz	Spectrum Analyzer	FSQ26	200749	2019-11-07	2 years
HP	RF Communications Test Set	8920A	3438A05338	2018-01-09	2 years
HP	Modulation Analyzer	8901A	2026A00847	2019-01-24	2 years
Krohn-Hite	Active Dual Channel Filter	3940	3212	2019-10-24	1 year
Agilent	Function Generator	33220A	MY43004878	2019-01-09	1 year
HP	TIMS	4934A	3737U15141	2019-01-18	1 year
-	20dB attenuator	-	-	Each time ¹	N/A
-	RF Cable	-	-	Each time ¹	N/A

Note¹: attenuator and cable included in the test set-up will be 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 02 October 2018) "A2LA Policy on Metrological Traceability".

6.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	45 %
ATM Pressure:	101.2 kPa

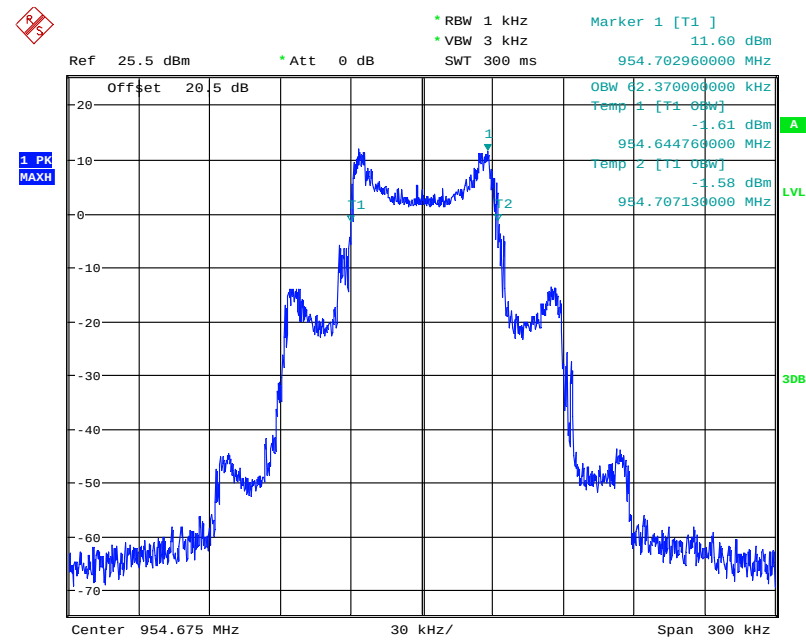
The testing was performed by Zhao Zhao on 2020-01-03 at RF site.

6.5 Test Results

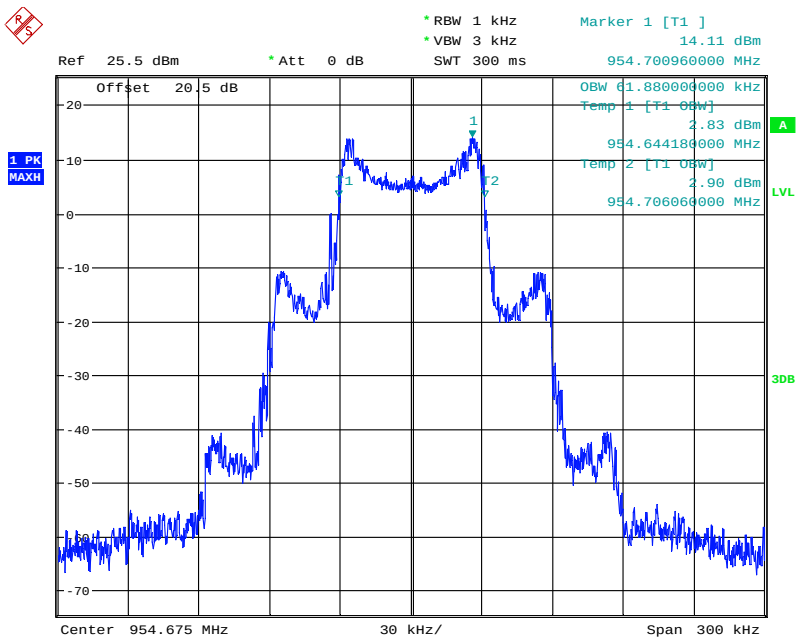
Center Frequency (MHz)	Power Setting (mW)	99% Bandwidth (kHz)	Limit (kHz)	Result
950.675	50	62.37	200	Pass
950.675	100	61.88	200	Pass

Please refer to the following plots for detailed test results

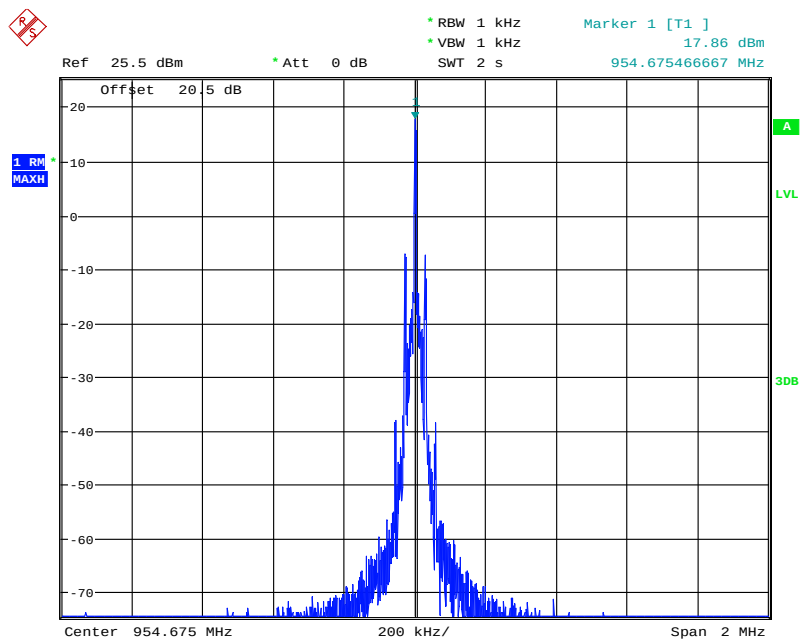
99% OBW @ 50 mW



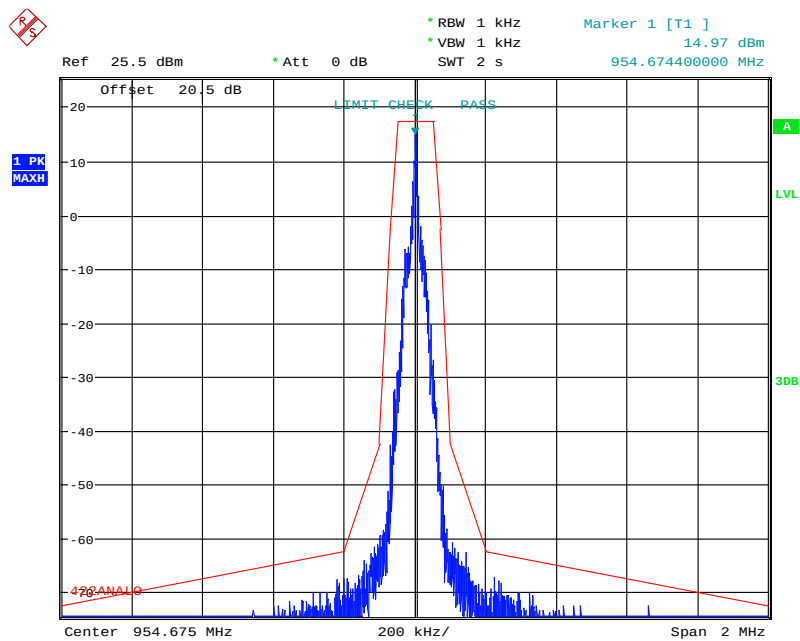
99% OBW @ 100 mW



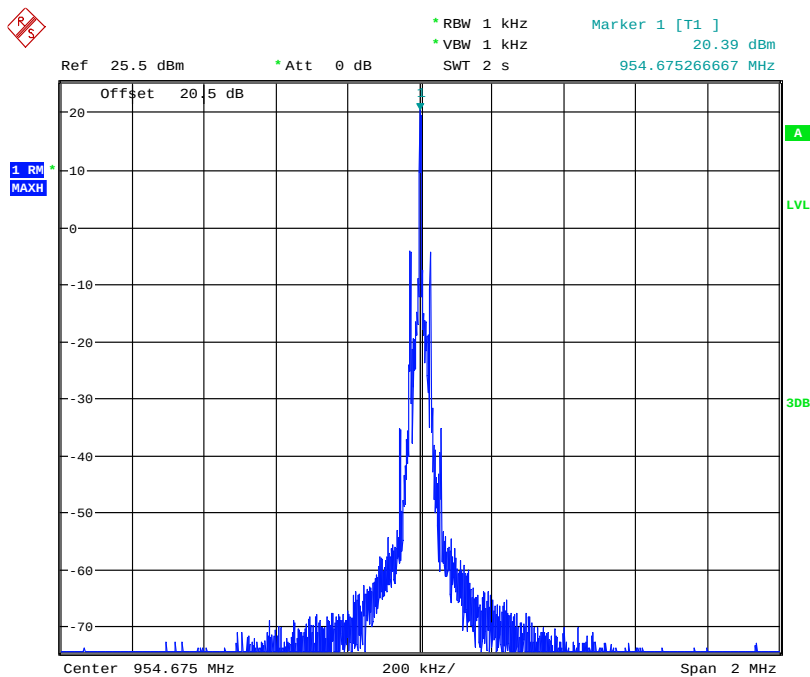
Emission Mask Reference Level (50 mW)



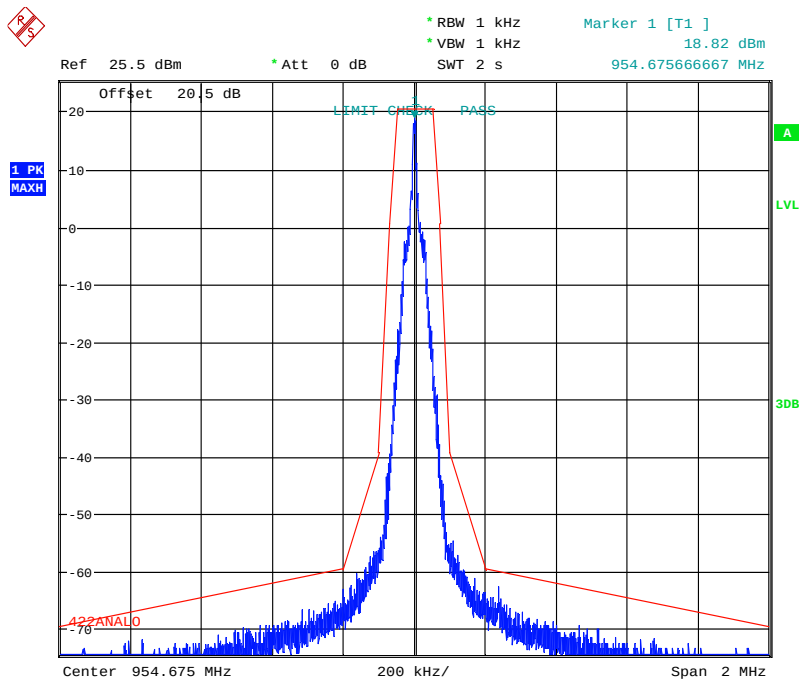
Emission Mask (50 mW)



Emission Mask Reference Level (100 mW)



Emission Mask (100 mW)



7 FCC §74.861(d)(4)(i) & ISEDC RSS-123 §8.3 - Conducted Spurious Emissions at Antenna Port

7.1 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).

According to RSS-123 §8.3 Clause c. devices operating in frequency bands 941.5-952 MHz, 953-959.85 MHz, 6930-6955 MHz and 7100-7125 MHz shall have the transmitter's unwanted emissions meet the requirements in sections 8.3 and 8.4 of ETSI EN 300 422-1

7.2 Test Procedure

KDB 971168 D01 v03r01 and ETSI EN 300 422-1 V1.4.2 (2011-08).

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	EXA Signal Analyzer	N9010A	MY48030852	2018-10-22	2 years
-	20dB attenuator	-	-	Each time ¹	N/A
-	RF Cable	-	-	Each time ¹	N/A

Note¹: attenuator and cable included in the test set-up will be 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 02 October 2018) "A2LA Policy on Metrological Traceability".

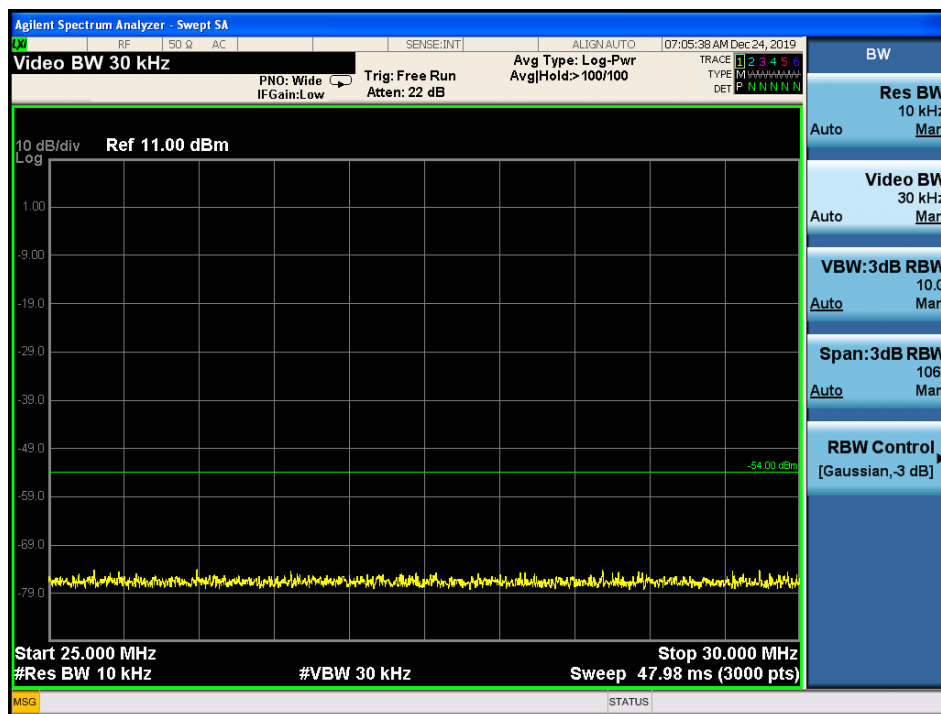
7.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	45 %
ATM Pressure:	101.2 kPa

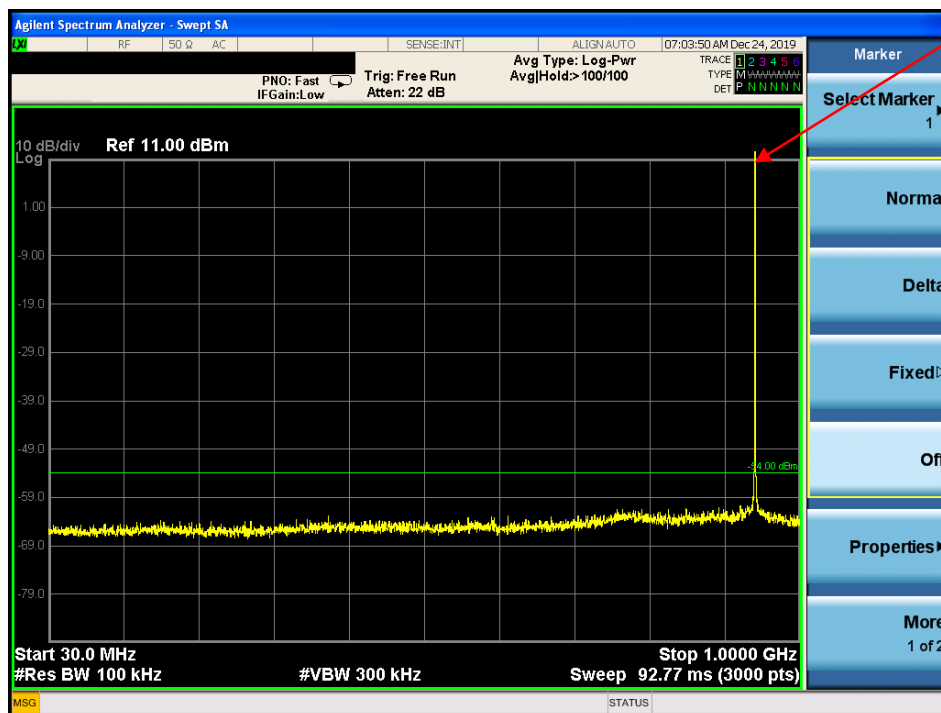
The testing was performed by Christopher Casteel on 2019-12-24 at RF site.

7.5 Test Results

941.525 MHz Spurious Emission 25MHz to 30MHz

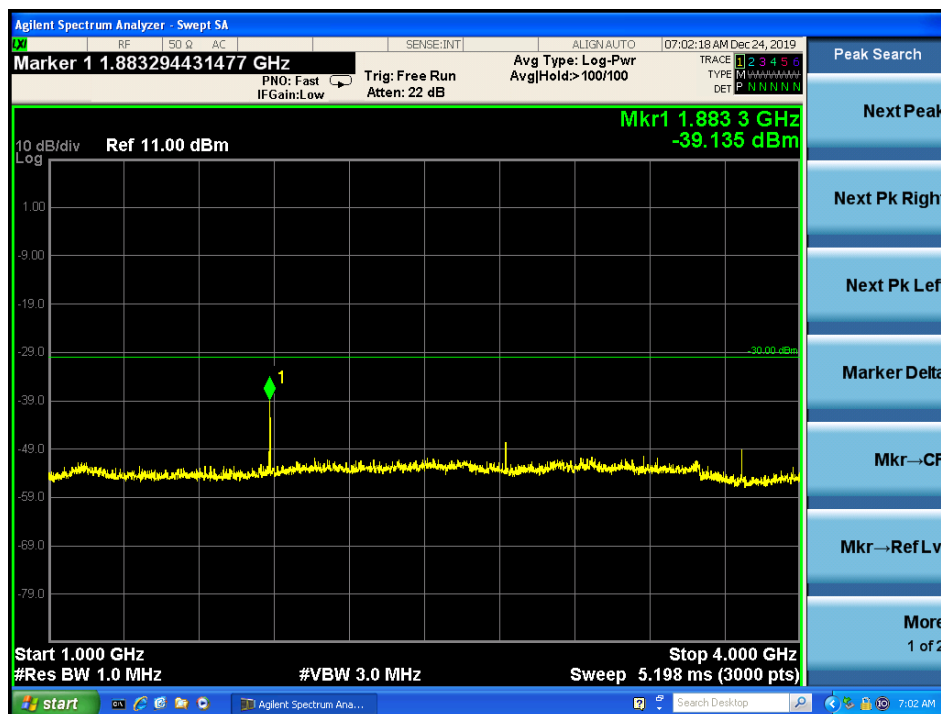


941.525 MHz Spurious Emission 30MHz to 1GHz

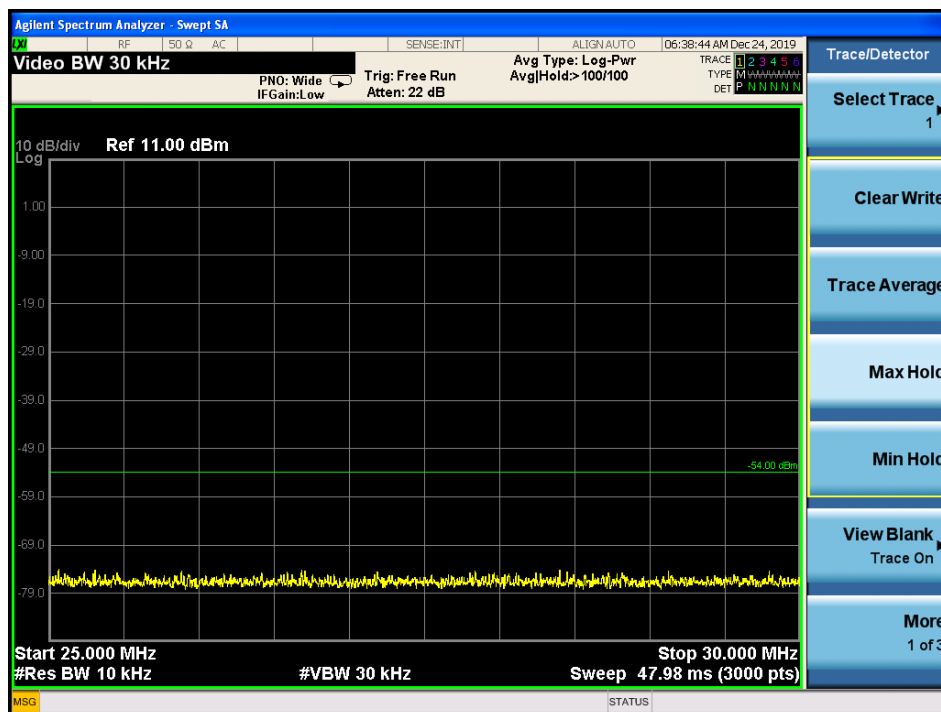


Fundamental

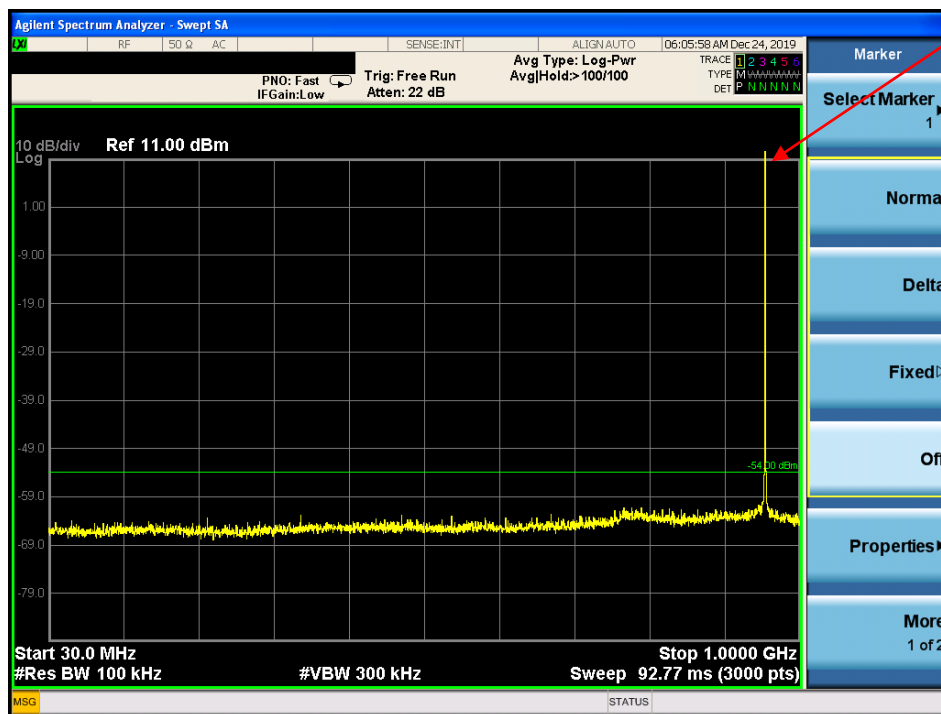
941.525 MHz Spurious Emission above 1 GHz



954.625 MHz Spurious Emission 25MHz to 30MHz

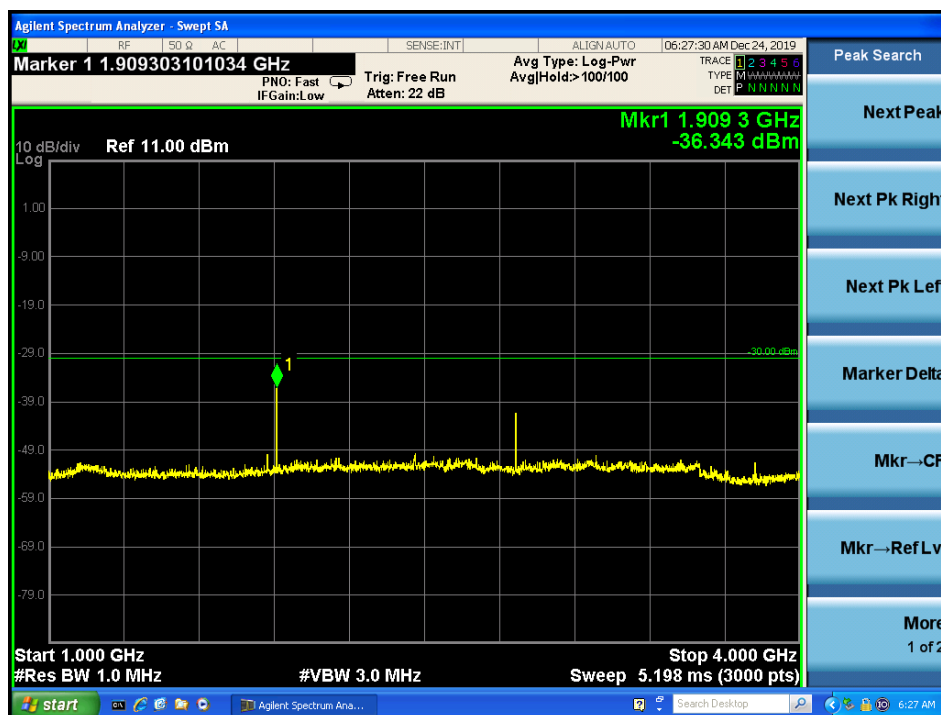


954.625 MHz Spurious Emission 30MHz to 1GHz

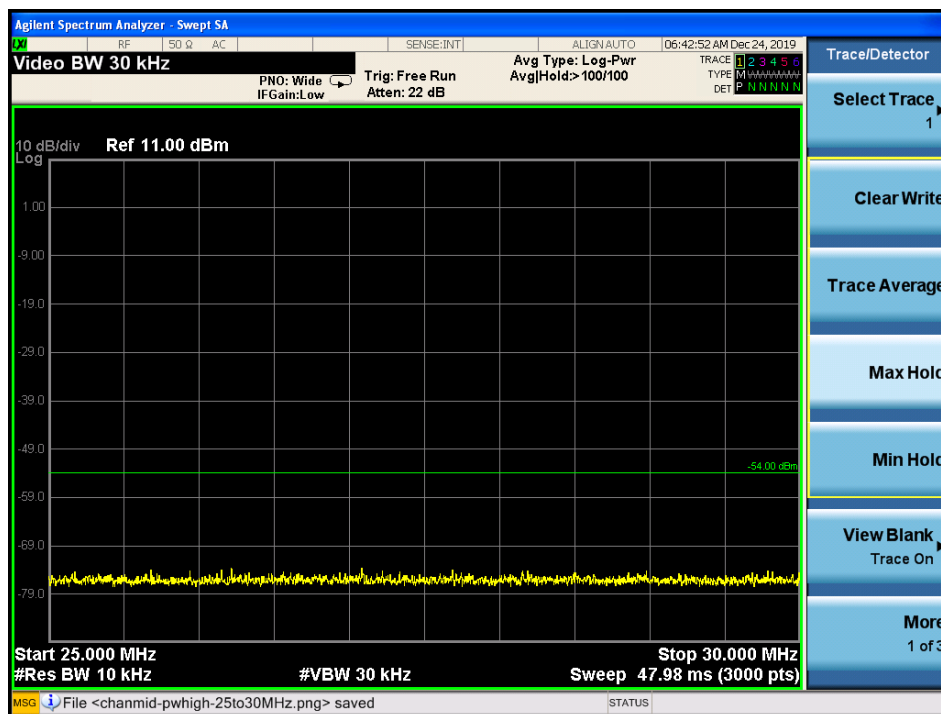


Fundamental

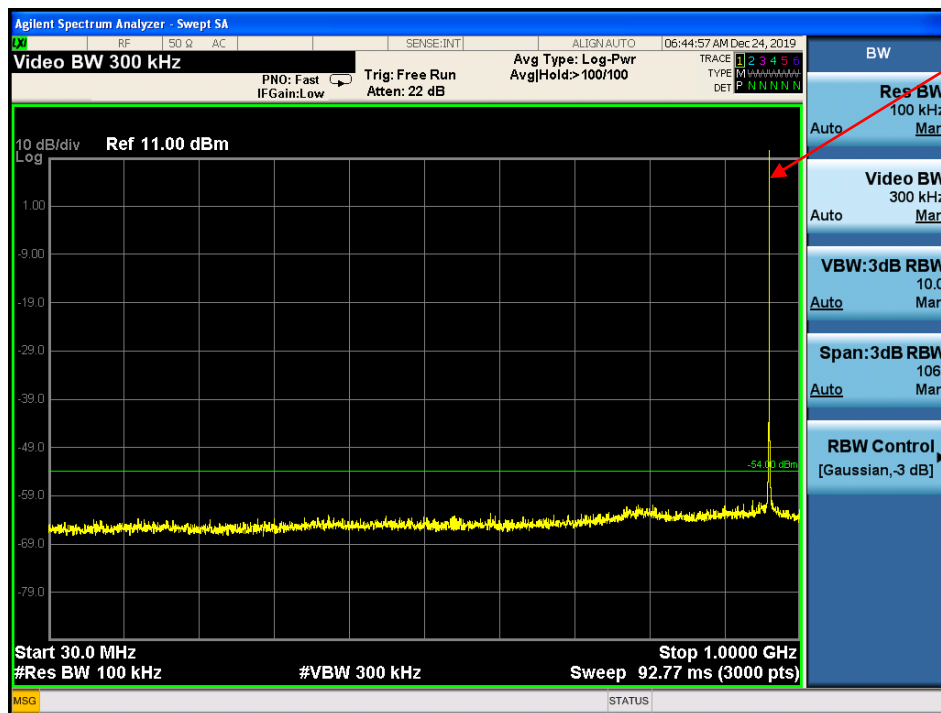
954.625 MHz Spurious Emission above 1 GHz



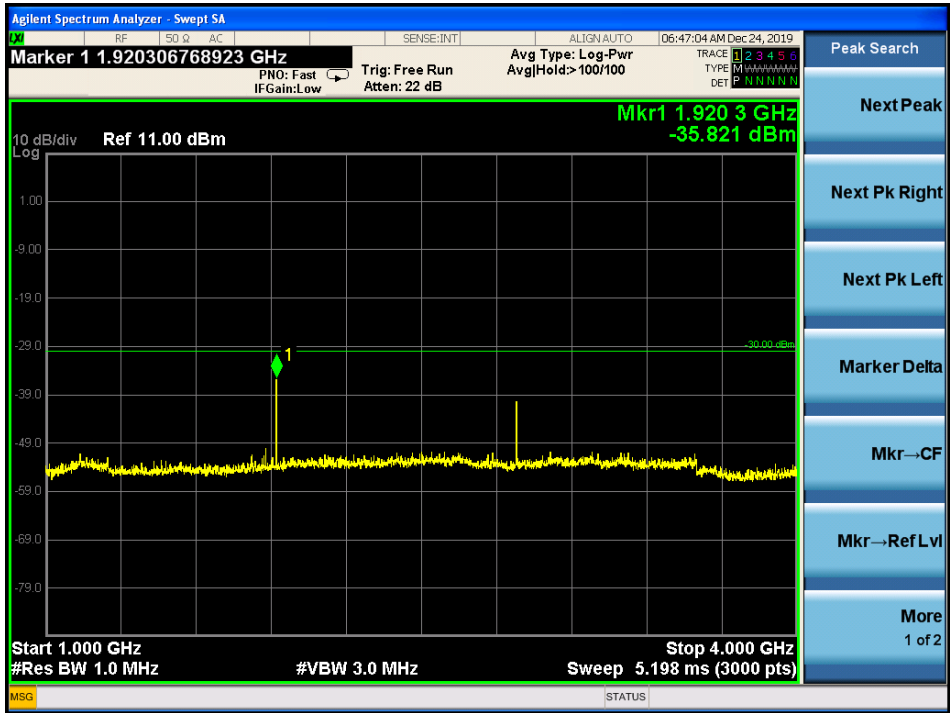
959.825 MHz Spurious Emission 25MHz to 30MHz



959.825 MHz Spurious Emission 30MHz to 1GHz



959.825 MHz Spurious Emission above 1GHz



8 FCC §74.861(d)(4)(i) & ISEDC RSS-123 §8.3 - Field Strength of Spurious Radiation

8.1 Applicable Standards

According to FCC §74.861 (d) (4) (i):

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

According to RSS-123 §8.3 Clause c. devices operating in frequency bands 941.5-952 MHz, 953-959.85 MHz, 6930-6955 MHz and 7100-7125 MHz shall have the transmitter's unwanted emissions meet the requirements in sections 8.3 and 8.4 of ETSI EN 300 422-1

8.2 Test Procedure

KDB 971168 D01 v03r01 and ETSI EN 300 422-1 V1.4.2 (2011-08).

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39-101203-UW	2019-08-06	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Biconi-Log Antenna	JB1	A013105-3	2018-02-26	2 years
Agilent	Pre Amplifier	8447D	2944A10187	2019-04-11	1 year
HP/ Agilent	Pre-Amplifier	8449B OPT HO2	3008A0113	2019-09-30	1 year
MDP Digital	Times Microwave LMR 400 UltraFex Coaxial Cable 35'	LMR400UF	BACL1904161	2019-04-16	1 year
Sunol Sciences	Horn Antenna	DRH-118	A052704	2019-04-02	2 years
A.R.A.	Horn Antenna	DRG-118/A	1132	2018-02-13	2 years
HP	Signal Generator	83650B	3614A00276	2019-04-12	1 year
IW Microwave	150 Series 2.92mm Cable	KPS1501AN-3780-KPS	DC 1925	2019-09-11	1 year
-	RF Cable	-	-	Each time ¹	N/A
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2019-01-29	1 year
COM-POWER	Dipole Antenna	AD-100	721033DB1, 2, 3, 4	2019-03-06	2 years

Note¹: cable included in the test set-up will be 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 02 October 2018) "A2LA Policy on Metrological Traceability".

8.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	40 %
ATM Pressure:	101.0 kPa

The testing was performed by Matthew Riego de Dios on 2020-01-14 at 5 meter chamber 3.

8.5 Test Results

TX Low channel (941.525 MHz) at the maximum output power:

Freq. (MHz)	S.A. Amp. (dBμV)	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 (dBi/dBd)	Cable Loss (dB)			
410	19.92	0	100	H	410	-43.96	1.8	0.54	-42.7	-36	-6.7
410	19.11	0	100	V	410	-47.27	1.1	0.54	-46.71	-36	-10.71
1883.05	64.16	90	210	H	1883.05	-45.92	9.041	1.8	-38.679	-30	-8.679
1883.05	67.26	355	125	V	1883.05	-42.58	9.041	1.8	-35.339	-30	-5.339
2824.58	61.49	144	140	H	2824.58	-41.88	9.558	2.46	-34.782	-30	-4.782
2824.58	62.63	106	165	V	2824.58	-40.43	9.558	2.46	-33.332	-30	-3.332
3766.1	54.88	140	100	H	3766.1	-43.48	10.718	2.93	-35.692	-30	-5.692
3766.1	53.05	244	206	V	3766.1	-45.27	10.718	2.93	-37.482	-30	-7.482

TX Middle channel (954.625 MHz) at the maximum output power:

Freq. (MHz)	S.A. Amp. (dBμV)	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 (dBi/dBd)	Cable Loss (dB)			
410	18.9	0	100	H	410	-44.98	1.8	0.54	-43.72	-36	-7.72
410	19.02	0	100	V	410	-47.36	1.8	0.54	-46.1	-36	-10.1
1909.25	62.54	165	100	H	1909.25	-46.91	8.92	1.85	-39.84	-30	-9.84
1909.25	69.91	355	100	V	1909.25	-39.5	8.92	1.85	-32.43	-30	-2.43
2863.88	63.55	165	140	H	2863.88	-39.56	9.51	2.47	-32.52	-30	-2.52
2863.88	61.52	267	220	V	2863.88	-41.37	9.51	2.47	-34.33	-30	-4.33
3818.5	54.03	176	100	H	3818.5	-43.54	10.868	2.97	-35.642	-30	-5.642
3818.5	51.48	145	280	V	3818.5	-45.73	10.868	2.97	-37.832	-30	-7.832

TX High channel (959.825 MHz) at the maximum output power:

Freq. (MHz)	S.A. Amp. (dBμV)	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 (dBi/dBd)	Cable Loss (dB)			
410	18.71	0	100	H	410	-45.17	1.8	0.54	-43.91	-36	-7.91
410	19.27	0	100	V	410	-47.11	1.8	0.54	-45.85	-36	-9.85
1919.65	68.3	92	202	H	1919.65	-41.07	8.876	1.84	-34.034	-30	-4.034
1919.65	72.02	350	140	V	1919.65	-37.25	8.876	1.84	-30.214	-30	-0.214
2879.48	64.64	175	145	H	2879.48	-39.06	9.496	2.52	-32.084	-30	-2.084
2879.48	64.1	260	100	V	2879.48	-39.32	9.496	2.52	-32.344	-30	-2.344
3839.3	54.44	140	105	H	3839.3	-43.39	10.905	2.94	-35.425	-30	-5.425
3839.3	51.18	90	235	V	3839.3	-46.38	10.905	2.94	-38.415	-30	-8.415

9 FCC §2.1055 & ISEDC RSS-123 §8.2 - Frequency Stability

9.1 Applicable Standards

According to §2.1055 and RSS-123 §8.2 the device shall meet the transmit power/e.r.p., authorized bandwidth and frequency stability limits for its operating bands as specified in table 1.

Table 1 — Frequency bands, transmit power/e.r.p., authorized bandwidths and frequency stability limits

Frequency band (MHz)	Transmit power (W)	e.r.p. (W)	Authorized bandwidth (kHz)	Frequency stability ($\pm$ ppm)
26.10-26.48	--	1	200	50
88-107.5	--	1	200	50
150-174	0.05	--	54	50
450-451	--	1	200	50
455-456	--	1	200	50
941.5-952	1	--	200	20
953-959.85	1	--	200	20
6930-6955	1	--	600	10
7100-7125	1	--	600	10

9.2 Test Procedure

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 Radio beacons (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.

(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.
- (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.

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	EXA Signal Analyzer	N9010A	MY48030852	2018-10-22	2 years
Tenney	Environmental Chamber	TUJR	2744-06	2019-03-06	1 year
KEPCO	DC Source	25-10M	H1334526	Cal. Not Required	N/A
-	20dB attenuator	-	-	Each time ¹	N/A
-	RF Cable	-	-	Each time ¹	N/A

Note¹: cable and attenuator included in the test set-up will be 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 02 October 2018) "A2LA Policy on Metrological Traceability".

9.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	43 %
ATM Pressure:	101.1 kPa

The testing was performed by Christopher Casteel on 2019-12-21 and 2019-12-24 at RF site.

9.5 Test Results

Fc=954.625 MHz:

Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limit (± ppm)
-20	-	954.625	-	20
-10	954.628	954.625	3.179	20
0	954.6291	954.625	4.295	20
10	954.6291	954.625	4.263	20
20	954.628	954.625	3.143	20
30	954.6251	954.625	0.136	20
40	954.6226	954.625	-2.551	20
50	954.6191	954.625	-6.144	20

Note: The sample shut down at -20 °C.

Varying supply voltage:

Voltage	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)	Limit (± ppm)
Low (2.55 V)	954.62630	954.625	1.362	20
High (3.45 V)	954.62653	954.625	1.603	20

10 FCC §2.1047 & ISEDC RSS-123 §8.1 – Modulation Characteristic

10.1 Applicable Standards

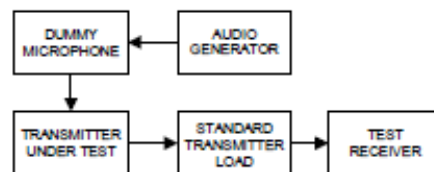
According to FCC §2.1047(a):

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.

According to ISEDC RSS-123 §8.1 Equipment employing frequency modulation (FM) shall have the frequency deviation not exceed ± 75 kHz.

10.2 Test Procedure

Modulation Characteristic:



- 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.
- 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.
- Set the test receiver to measure peak negative deviation and repeat steps d) through g).
- The values recorded in steps g) and h) are the modulation limiting.

Audio Frequency Response

- a) Connect the equipment as illustrated.
- b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 50 Hz to $\geq 15,000$ Hz. Turn the de-emphasis function off.
- c) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
- d) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.
- e) Set the test receiver to measure rms deviation and record the deviation reading as DEV_{FREQ} .
- f) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.
- g) Record the test receiver deviation reading as DEV_{FREQ} .
- h) Calculate the audio frequency response at the present frequency as:

$$audio\ frequency\ response = 20 \log_{10} \left(\frac{DEV_{FREQ}}{DEV_{REF}} \right)$$

- i) Repeat steps f) through h) for all the desired test frequencies.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
HP	RF Communications Test Set	8920A	3438A05338	2018-01-09	25 months
HP	Modulation Analyzer	8901A	2026A00847	2019-01-24	2 years
-	RF Cable	-	-	-	Each time ¹

Note¹: cable included in the test set-up will be 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 02 October 2018) "A2LA Policy on Metrological Traceability".

10.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	36 %
ATM Pressure:	101.4 kPa

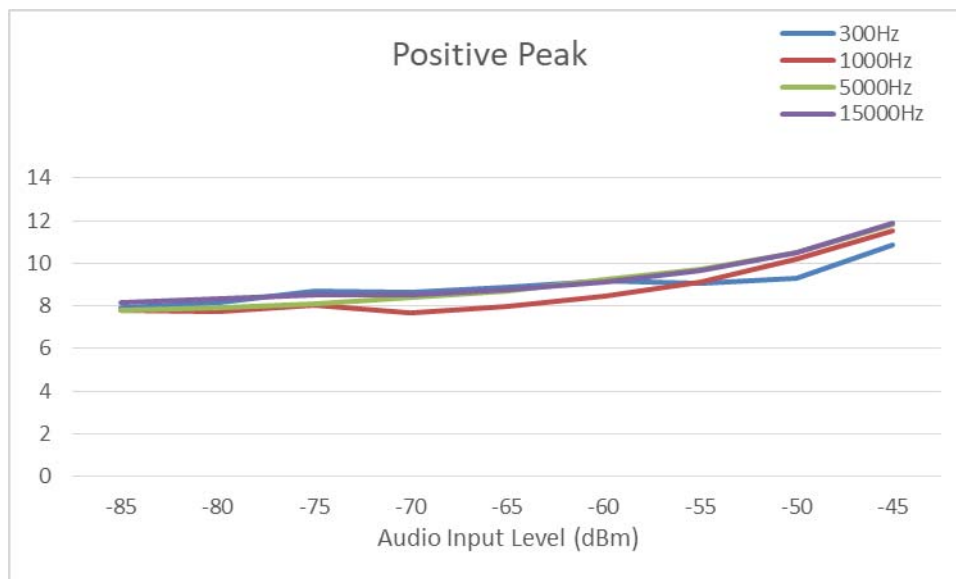
The testing was performed by Christopher Casteel on 2019-12-26 at RF site.

10.5 Test Results

MODULATION LIMITING

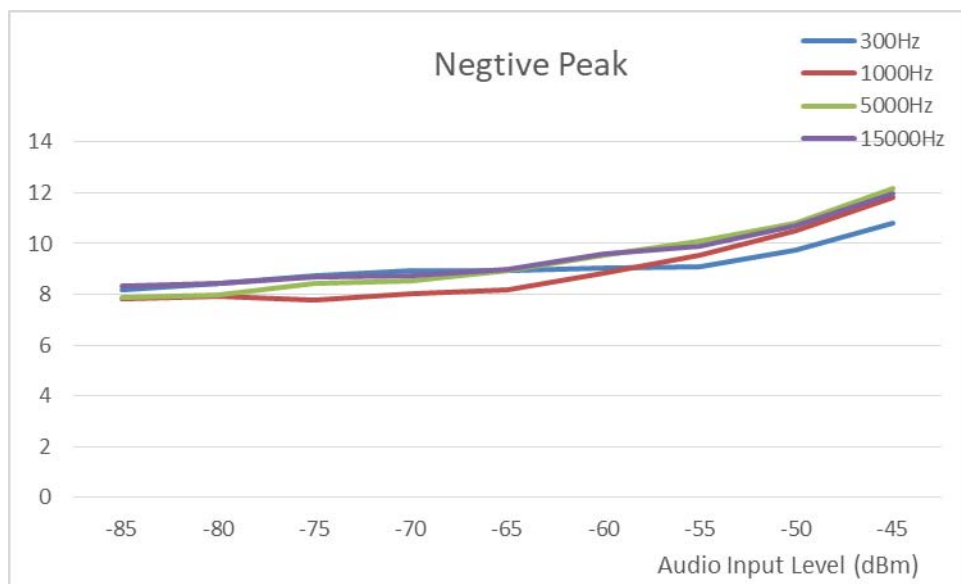
Carrier Frequency: 954.625 MHz, Peak Positive

AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
-85	7.93	7.82	7.82	8.16	±75
-80	8.18	7.71	7.89	8.35	±75
-75	8.67	8.01	8.12	8.5	±75
-70	8.66	7.7	8.38	8.5	±75
-65	8.88	7.95	8.67	8.73	±75
-60	9.19	8.45	9.25	9.15	±75
-55	9.07	9.14	9.71	9.66	±75
-50	9.3	10.18	10.53	10.51	±75
-45	10.89	11.55	11.82	11.87	±75



Carrier Frequency: 954.625 MHz, Peak Negative

AF Level (dBm)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	5000 Hz	15000 Hz	
-85	8.16	7.84	7.85	8.32	±75
-80	8.42	7.92	7.98	8.44	±75
-75	8.71	7.77	8.45	8.67	±75
-70	8.94	8.01	8.55	8.75	±75
-65	8.95	8.16	8.94	8.98	±75
-60	9.02	8.85	9.52	9.57	±75
-55	9.07	9.52	10.1	9.92	±75
-50	9.73	10.49	10.81	10.72	±75
-45	10.79	11.84	12.16	11.97	±75



Audio Frequency Response, Middle Channel

AF Frequency (Hz)	Frequency Deviation (kHz)	AF Response (dB)
300	2.49	-0.342
400	2.52	-0.238
500	2.55	-0.135
600	2.57	-0.067
700	2.57	-0.067
800	2.57	-0.067
900	2.58	-0.034
1000	2.59	0.000
1500	2.60	0.033
2000	2.60	0.033
2500	2.60	0.033
3000	2.58	-0.034

Note: AF Response = $20 \cdot \log(\text{Frequency Deviation} / \text{Frequency Deviation of 1 kHz})$

11 Annex A - EUT Test Setup Photographs

Please refer to the attachment

12 Annex B - EUT External Photographs

Please refer to the attachment

13 Annex C - EUT Internal Photographs

Please refer to the attachment

14 Annex D (Normative) - A2LA Electrical Testing Certificate



Please follow the web link below for a full ISO 17025 scope

<https://www.a2la.org/scopepdf/3297-02.pdf>

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