Test Report

Prepared for: Radio Active Designs

Model: UV-1G Basestation

Description: Wireless Intercom System

FCC ID: 2AA6F-UV-1GBS

To

Part 74H

Date of Issue: November 16, 2020

On the behalf of the applicant: **Radio Active Designs**
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Project No: p2070003BS

Greg Corbin
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	November 16, 2020	Greg Corbin	Original Document
2.0	December 1, 2020	Greg Corbin	Added EIRP to output power table on page 8
3.0	January 13, 2021	Greg Corbin	Added Frequency Stability test data and updated emission mask using avg detector
4.0	January 25, 2021	Greg Corbin	Added final stage voltage / current to page 6
5.0	January 29, 2021	Greg Corbin	Removed any reference to C2PC and updated output power table on page 8
6.0	February 26, 2021	Greg Corbin	added CW output power table to page 9

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ANAB

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The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

FCC Site Reg. #349717

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Non-accredited tests contained in this report:

N/A

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Part 2, Subpart J Part 74H, and ANSI C63.26-2015.

Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI/C63.4-2014, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F), unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
26.4 – 28.6	16.1 – 38.2	960.8 – 966.4

Measurement results, unless otherwise noted, are worst-case measurements.

EUT Description
Model: UV-1G Basestation
Description: Wireless Intercom System
Software:3.1.4
Firmware: BASE201027A
Serial Number: 101504

Additional Information:

The Radio Active Designs® UV-1G is a two-channel full-duplex UHF/VHF wireless intercom system that utilizes up to six wireless Belt Pack units per Base Station.
The system uses double sideband AM modulation.
The channel spacing for the basestation is 100 – 200 kHz.

This test report provides the technical data to show that the basestation meets the new wireless microphone requirements per FCC's Report and Order FCC 17-95. The main changes are that the equipment must meet the ETSI 300 442-01 emission mask and spurious requirements per Part 74.861(e)(7), that the power is reduced to 20 mW in the Duplex Gap, the operating bandwidth is limited to 200 kHz and frequency tolerance is 0.005 percent

Per the manufacturer, the changes to the equipment were firmware or software based with no changes to the hardware.

The Part 74 frequency range of the basestation are listed below.

Frequency Range (MHz)		Power limits
TX	470 - 608	250 mW
TX (duplex gap)	653 - 657	20 mW
RX	174 - 216	N/A

EUT Operation during Tests
The basestation has 2 TX output ports, TX1 and TX2. The basestation output power is adjustable from 20 – 250 mw.
All transmitter tests were performed using TX1 set to 250 mw.
The manufacturer installed a temporary switch to put the transmitter into CW mode to set the reference level for the emission mask test.

The basestation is powered by a AC to DC power supply operating with the following parameters:
Input: 100 – 240 VAC, 50 – 60 Hz
Output: + 18 vdc

The basestation antenna gain is 0 dB.

Per the manufacturer, the voltage and current for the final amplifier stage is 28 vdc @ 160 mA.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Headset	Telex	300534	N/A
1	AC Adapter	N/A	AT 5090T-P180	N/A
1	Beltpack	Radio Active Designs	UV-1G Belt Pack	10790 (Conducted sample) 10789 (Radiated sample)
1	TX Antenna (Basestation)	SHURE Inc	UA8-500-560	N/A
1	RX Antenna (Basestation)	SHURE Inc	UA8-174-216	N/A

Cables: None

Modifications: None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
74.861 (e)(1)(ii)(iii)	RF Output Power	Pass	
74.861 (e)(7)	Emission Mask	Pass	
74.861 (e)(7)	Spurious emissions transmitter	Pass	
74.861 (e)(4)	Frequency Tolerance	Pass	

Statements of conformity

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

RF Output Power

Engineer: Greg Corbin

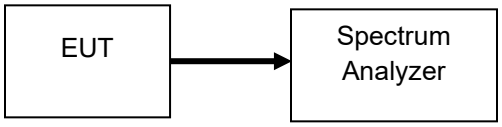
Test Date: 1/29/2021

Test Procedure

The EUT was connected to a spectrum analyzer for the output power test.
The output power was set to 20 mw for test frequencies in the Duplex Gap and 250 mw for test frequencies outside of the Duplex Gap.
The output power was measured using the procedure in ANSI C63.26-2015 section 5.2.4.3.
The output power was measured at the low, middle, and high frequencies of the passband.
The cable loss from the EUT output to the spectrum analyzer input were input to the spectrum analyzer as correction factor before recording the output power.

RBW = 100 kHz
VBW = 3 x RBW
Detector = Avg

Test Setup



Test Results

Frequency	Conducted Output Power	Antenna Gain	EIRP Output Power		Limit	Result
(MHz)	(dBm)	(dB)	(dBm)	(mW)	(mW)	(Pass/Fail)
470.025	19.5	0	19.5	89.13	50	Pass
539.025	19.2	0	19.2	83.18	50	Pass
607.975	19.79	0	19.79	95.28	50	Pass
653.025	8.37	0	8.37	6.87	20	Pass
656.975	8.37	0	8.37	6.87	20	Pass

CW output Power
provided as reference only.

Frequency	Conducted Output Power		Limit
(MHz)	(dBm)	(mW)	(mW)
470.025	23.61	229.61	250
539.025	23.58	228.03	250
607.975	23.71	234.96	250
653.025	12.65	18.41	20
656.975	12.43	17.50	20

Emission Mask

Engineer: Greg Corbin

Test Date:11/13/2020

Test Procedure

This test references a necessary bandwidth test in the following document per FCC Part 74.861(e)(7).

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.

The EUT was connected to a spectrum analyzer with the ETSI 300 422-01 emission mask limits programmed into it to verify the EUT meets the emission mask requirements per FCC Part 74H section 74.861(e)(7).

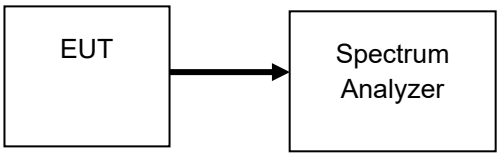
The CW output power was measured using a peak detector set to max hold.
This measurement is required to set the reference level for the emission mask test.
The channel spacing that meets the emission mask test is 100 – 200 kHz.
The emission mask was measured at 100 kHz and 200 kHz channel spacing.
The maximum allowed channel spacing is 200 kHz.

The EUT channel spacing is used in calculating the necessary bandwidth limits for the spectrum mask for analog systems per Figure 3 in the ETSI EN 300 422-1 standard.

The spectrum analyzer settings were as follows:

Center Frequency	fc: Transmitter (Tx) nominal frequency;
Span	fc - 1 MHz to fc + 1 MHz
Resolution BandWidth (RBW)	1 kHz
Detector	Peak, max hold

Test Setup



CW Output Power to set reference level.

Frequency	Measured Output Power CW mode
(MHz)	(dBm)
470.025	23.6
539.025	23.6
607.975	23.6
653.025 (duplex gap)	12.6
656.975 (duplex gap)	12.6

The EUT met the emission mask requirements for 100 and 200 kHz channel spacing.
Refer to Annex A for the Emission Mask test results.

Spurious Emissions Transmitter
Engineer: Greg Corbin
Test Date: 11/16/2020

Test Procedure

This test references a necessary bandwidth test limit in the following document per FCC Part 74.861(e)(7).

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.

The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for transmitter spurious emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer before recording the level of the spurious emissions.

The EUT is required to meet the ETSI 300 422-01 radiated spurious limits (Table 3) per FCC Part 74H section 74.861(e)(7).

Table 3: Limits for spurious emissions

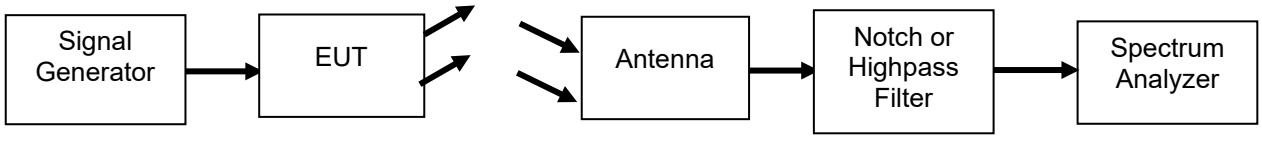
State	Frequency Range		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operating	4 nW	250 nW	1 uW
Standby	2 nW	2 nW	20 nW

The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz. The VBW was set to 3 times the RBW.

For 30 – 1000 MHz, A notch filter was used for the transmit frequency at the receive antenna output.

For 1 – 7 GHz a 1 GHz Highpass filter was used at the receive antenna output

Test Setup



Radiated Spurious Test Results

Frequency Range	Tuned Frequency	Measured Spurious – Specific bands per table 3		Limit	Results
(MHz)	(MHz)	Frequency (MHz)	Level (nW)	(nW)	(Pass / Fail)
30 – 1000	470.025	522.3	0.454	4	Pass
30 – 1000	539.025	592.6	0.424	4	Pass
30 – 1000	607.975	556.2	0.544	4	Pass
30 – 1000	653.025	862.0	0.320	4	Pass
30 – 1000	656.975	862.0	0.303	4	Pass
Frequency Range	**Tuned Frequency**	**Other Spurious below 1000 MHz**		**Limit**	**Results**
(MHz)	(MHz)	Frequency (MHz)	Level (nW)	(nW)	(Pass / Fail)
30 – 1000	470.025	940.055	172.1	250	Pass
30 – 1000	539.025	992.7	0.466	250	Pass
30 – 1000	607.975	990.3	0.481	250	Pass
30 – 1000	653.025	990.3	0.541	250	Pass
30 – 1000	656.975	990.3	0.425	250	Pass
Frequency Range	**Tuned Frequency**	**Measured Spurious 1 – 7 GHz**		**Limit**	**Results**
(GHz)	(MHz)	Frequency (MHz)	Level (uW)	(uW)	(Pass / Fail)
1 - 7	470.025	6955	0.000900	1	Pass
1 - 7	539.025	6865	0.000909	1	Pass
1 - 7	607.975	6850	0.000825	1	Pass
1 - 7	653.025	1960	0.000869	1	Pass
1 - 7	656.975	6955	0.000707	1	Pass
Frequency Range	**Standby**	**Measured Spurious Standby Mode**		**Limit**	**Results**
(GHz)		Frequency (MHz)	Level (nW)	(nW)	(Pass / Fail)
0.03 - 1	Standby	997.6	0.485	2	Pass
1 - 7	Standby	6865	0.827	20	Pass

All spurious emissions were below the limit.

Refer to Annex B for Radiated Spurious Emission test results.

Frequency Stability

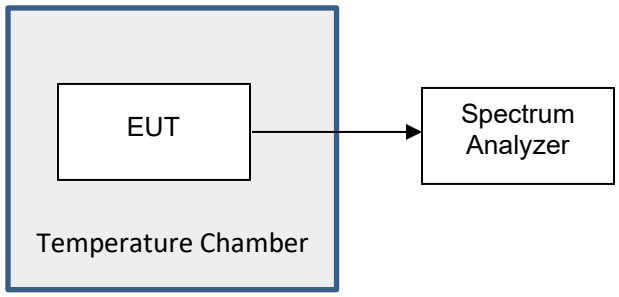
Engineer: Greg Corbin

Test Date: 1/23/2021

Measurement Procedure

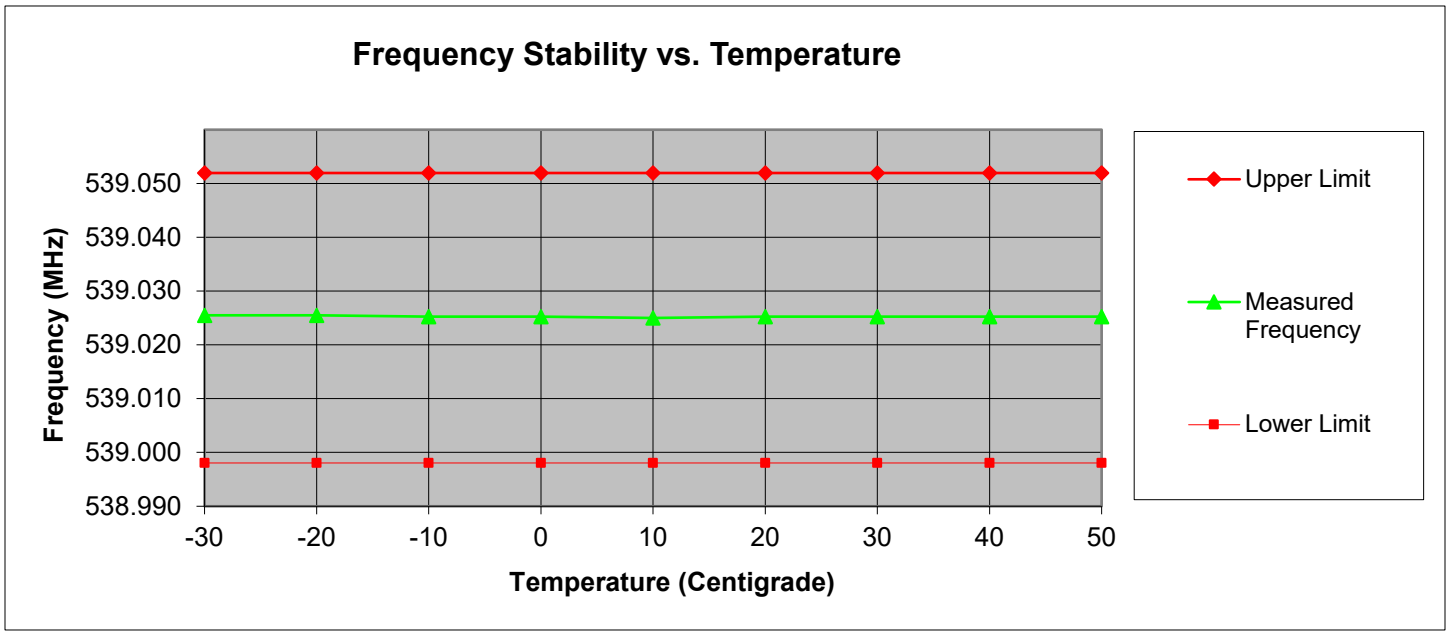
The EUT was placed in an environmental test chamber and the RF output was connected to a spectrum analyzer.
The temperature was varied from -30°C to 50°C in 10°C increments. After a sufficient time for temperature stabilization the RF output frequency was measured.
At 20°C the power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured.
The nominal input voltage is 120 vac for the basestation.

Test Setup



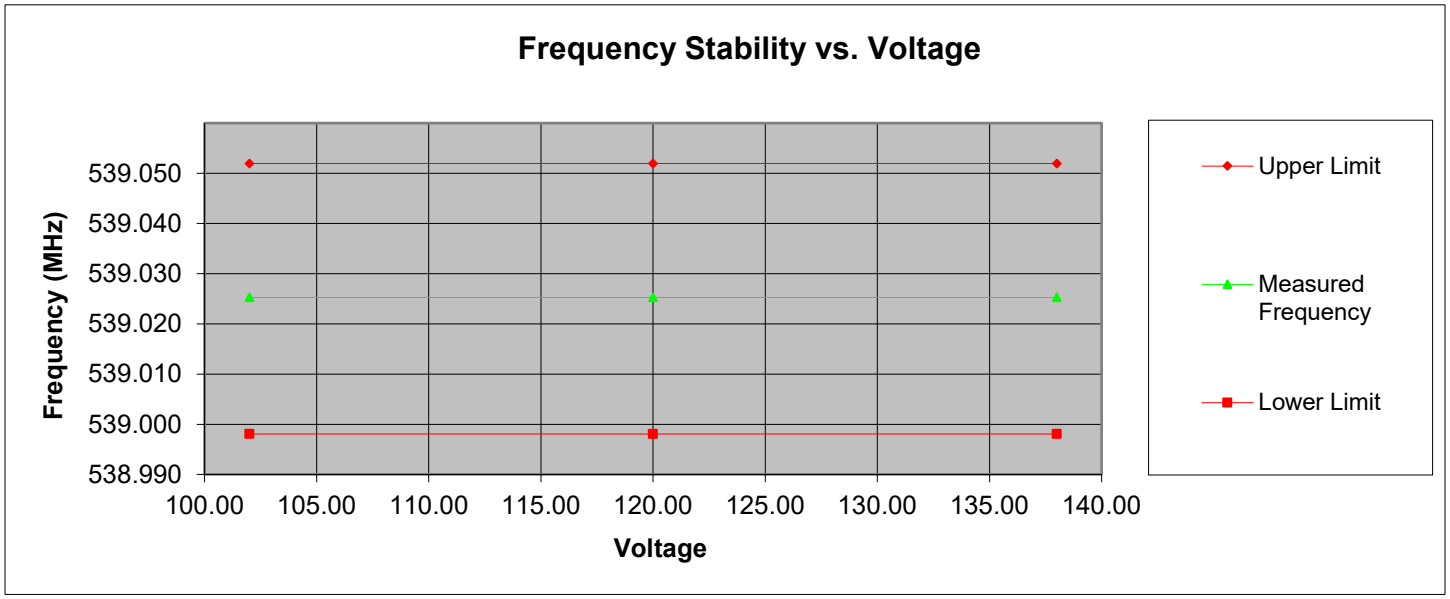
Frequency Stability Temperature Variation Measurement Results

Tuned Frequency	Temperature	Tolerance	Measured Frequency	Upper Limit	Lower Limit	Upper Margin	Lower Margin
(MHz)	(deg C)	(%)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
539.025	-20	0.005	539.0255000	539.0519513	538.9980488	0.0264513	0.0274513
539.025	-10	0.005	539.0255000	539.0519513	538.9980488	0.0264513	0.0274513
539.025	0	0.005	539.0252500	539.0519513	538.9980488	0.0267012	0.0272013
539.025	10	0.005	539.0252500	539.0519513	538.9980488	0.0267012	0.0272013
539.025	20	0.005	539.0250000	539.0519513	538.9980488	0.0269513	0.0269513
539.025	30	0.005	539.0252500	539.0519513	538.9980488	0.0267012	0.0272013
539.025	40	0.005	539.0252500	539.0519513	538.9980488	0.0267012	0.0272013
539.025	50	0.005	539.0252500	539.0519513	538.9980488	0.0267012	0.0272013



Frequency Stability Voltage Variation Measurement Results

Tuned Frequency	Tolerance	Voltage	Measured Frequency	Upper Limit	Lower Limit	Upper Margin	Lower Margin
(MHz)	(%)	(vac)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
539.025	0.005	102.00	539.0252500	539.0519513	538.9980488	-0.0267012	0.0272013
539.025	0.005	120.00	539.0252500	539.0519513	538.9980488	-0.0267012	0.0272013
539.025	0.005	138.00	539.0252500	539.0519513	538.9980488	-0.0267012	0.0272013



Measurement Uncertainty

Measurement Uncertainty for Compliance Testing is listed in the table below.

The reported expanded uncertainty has been estimated at a 95% confidence level (k=2)

Measurement Type	Expanded Uncertainty
Conducted Emissions, AC Powerline	± 3.28 dB
Radiated Emissions_30 – 1000 MHz	± 4.82 dB
Radiated Emissions_1 – 18 GHz	± 5.73 dB
Frequency Error	± 22 Hz
Conducted RF Power	± 0.98 dB
Conducted Spurious Emission	± 2.49 dB
AC Voltage	± 2.3 %
DC Voltage	± 0.12 %
Temperature	± 1.0 deg C
Humidity	± 4.32 %

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	8/3/20	8/3/21
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	8/28/20	8/28/21
Bi-Log Antenna	Schaffner	CBL 6111D	i00267	8/28/20	8/28/22
EMI Analyzer	Agilent	E7405A	i00379	1/21/20	1/21/21
Spectrum Analyzer	Textronix	RSA5126A	i00424	8/3/20	8/3/21
Band Reject Filter	Eagle	TNF-1	i00124	N/A	
1 GHz High Pass Filter	K&L	7IH40-980/6000-0/0	i00432	N/A	
Voltmeter	Fluke	179	i00488	5/18/20	5/18/21

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation

END OF TEST REPORT