Test Report

Prepared for: Radio Active Designs

Model: UV-1G Beltpack

Description: Wireless Intercom System

FCC ID: 2AA6F-UV-1GBP
ISED ID:11482A-UV1GBP

Part 15.236
RSS-210 Issue 10 (Dec 2019)

Date of Issue: November 16, 2020

On the behalf of the applicant:
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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 RSS-210 to test report for ISED
3.0	January 13, 2021	Greg Corbin	Added Frequency Stability test data, updated emission mask using avg detector and removed references to C2PC
4.0	January 25, 2021	Greg Corbin	Added final stage voltage / current to page 6
5.0	January 29, 2021	Greg Corbin	Updated output power table on page 8
6.0	February 23, 2021	Greg Corbin	Updated EIRP in the output power table with new antenna gain on page 8, added CW output power table to page 8

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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

IC Site Reg. #2044A-2

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 15.236, and ANSI C63.10-2015 and ISED regulations; RSS-210 and RSS-GEN.

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 Beltpack
Description: Wireless Intercom System
Software:3.1.4
Firmware: BELT200910A
Serial Number: 10790 (conducted sample)
10789 (radiated sample)

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 is to support adding FCC Part 15.236 rule section to the existing FCC ID: 2AA6F-UV-1GBP per FCC's Report and Order FCC 17-95.

This test report also supports adding RSS-210 to the existing ISED ID: 11482A-UV1GBP per SAB-003-17 to support the transition to the revised frequency allocation in the 600 MHz band.

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

The frequency ranges of the beltpack are listed below.

Frequency Range (MHz)		Power limits
TX	174 - 216	50 mW
RX	470 - 608	N/A

EUT Operation during Tests
The beltpack is powered by a Li-ion rechargeable battery pack with a 10.8 vdc nominal output.

The beltpack has an internal antenna and no RF port connector.
The manufacturer modified a beltpack to provide a temporary RF output connector for both TX and RX for conducted measurements.
The manufacturer installed a temporary switch to put the transmitter into CW mode to set the reference level for the emission mask test.

The beltpack output power is adjustable from 10 -50 mW.
All transmitter tests were performed with the output power set to 50 mw.

The beltpack antenna gain is 0 dB.

Per the manufacturer, the voltage and current for the final amplifier stage is 5 vdc @ 220 mA.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Headset	Telex	300534	N/A
1	ITE Power Supply	N/A	CENB1100A1800F04	N/A
1	Basestation	Radio Active Designs	UV-1G Basestation	101504
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
FCC	ISED			
15.236 (d)(1)(2)	RSS-210, Annex G.1	RF Output Power	Pass	
15.236(g)	RSS-210, Annex G.4	Emission Mask	Pass	
15.236(g)	RSS-210, Annex G.4	Spurious emissions transmitter	Pass	
N/A	RSS-210, Annex G.2	Occupied Bandwidth	Pass	
15.236(f)(3)	RSS-210, Annex G.3	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

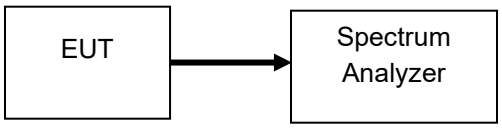
Test Date: 1/29/2021

Test Procedure

The EUT was connected to a spectrum analyzer for the output power test.
The output power was set to 50 mw.
The modulated output power was measured using a QP detector per ANSI C63.10-2013 section 4.1.4.2.1.
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 = 120 kHz
VBW = 3 x RBW
Detector = QP

Test Setup



Test Results

Frequency	Output Power Conducted	Antenna Gain	Output Power EIRP		Limit	Result
(MHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW)	(Pass/Fail)
174.255	14.27	-2	12.27	16.87	50	Pass
195.025	14.27	-2	12.27	16.87	50	Pass
215.745	14.36	-2	12.36	17.22	50	Pass

CW output Power
provided as reference only.

Frequency	Conducted Output Power		Limit
(MHz)	(dBm)	(mW)	(mW)
174.255	15.41	34.75	50
195.025	15.54	35.81	50
215.745	15.55	35.89	50

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 15.236(g).

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 15.236 section (g).

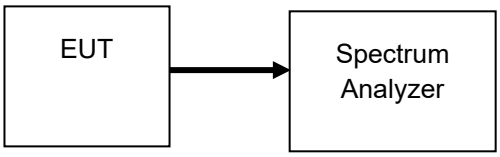
The CW output power was measured using a peak detector set to max hold.
This measurement is required to set the reference level for the emission mask test.
The channel spacing that meets the emission mask test is 100 – 200 kHz.
The worst case is the narrow channel spacing so the emission mask was measured at 100 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)
174.255	15.8
195.025	16
215.745	15.8

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 15.236(g).

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 15.236 section (g).

Table 3: Limits for spurious emissions

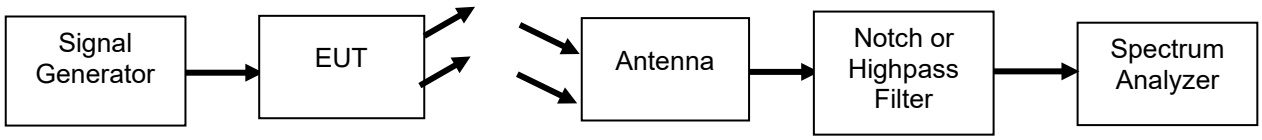
State	Frequency Range		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operating	4 nW	250 nW	1 uW
Standby	2 nW	2 nW	20 nW

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	174.255	745.6	1.17	4	Pass
30 – 1000	195.025	745.6	1.33	4	Pass
30 – 1000	215.745	745.6	1.25	4	Pass
Frequency Range	**Tuned Frequency**	**Other Spurious below 1000 MHz**		**Limit**	**Results**
(MHz)	**(MHz)**	**Frequency (MHz)**	**Level (nW)**	**(nW)**	**(Pass / Fail)**
30 – 1000	174.255	745.6	1.17	250	Pass
30 – 1000	195.025	745.6	1.33	250	Pass
30 – 1000	215.745	745.6	1.25	250	Pass
Frequency Range	**Tuned Frequency**	**Measured Spurious 1 – 4 GHz**		**Limit**	**Results**
(GHz)	**(MHz)**	**Frequency (MHz)**	**Level (uW)**	**(uW)**	**(Pass / Fail)**
1 - 4	174.255	3760	0.00295	1	Pass
1 - 4	195.025	3760	0.00264	1	Pass
1 - 4	215.745	3760	0.00355	1	Pass
Frequency Range	**Standby**	**Measured Spurious Standby Mode**		**Limit**	**Results**
(GHz)		**Frequency (MHz)**	**Level (nW)**	**(nW)**	**(Pass / Fail)**
0.03 - 1	Standby	553.8	0.679	2	Pass
1 - 4	Standby	1877.5	2.06	20	Pass

All spurious emissions were below the limit.

Refer to Annex B for Radiated Spurious Emission test results.

Occupied Bandwidth

Engineer: Greg Corbin

Test Date: 12/1/2020

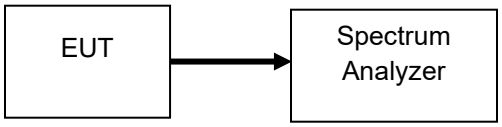
Test Procedure

The EUT was connected to a spectrum analyzer for the occupied bandwidth test.
The output power was set to the maximum allowed for the frequency being testing.

The 99% occupied bandwidth was measured using the occupied bandwidth tool on the spectrum analyzer.
The RBW was set between 1 – 5% of the occupied bandwidth.

The occupied bandwidth was measured at the low, middle, and high frequencies of the passband as required.

Test Setup



Occupied Bandwidth Test Summary Table

Tuned Frequency	Occupied Bandwidth
MHz	kHz
174.255	21.2
195.025	23.7
215.745	23.3

Refer to Annex C for Occupied Bandwidth test results

Frequency Stability

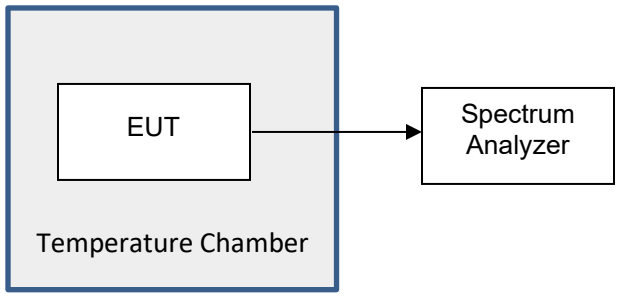
Engineer: Greg Corbin

Test Date: 1/23/2021

Measurement Procedure

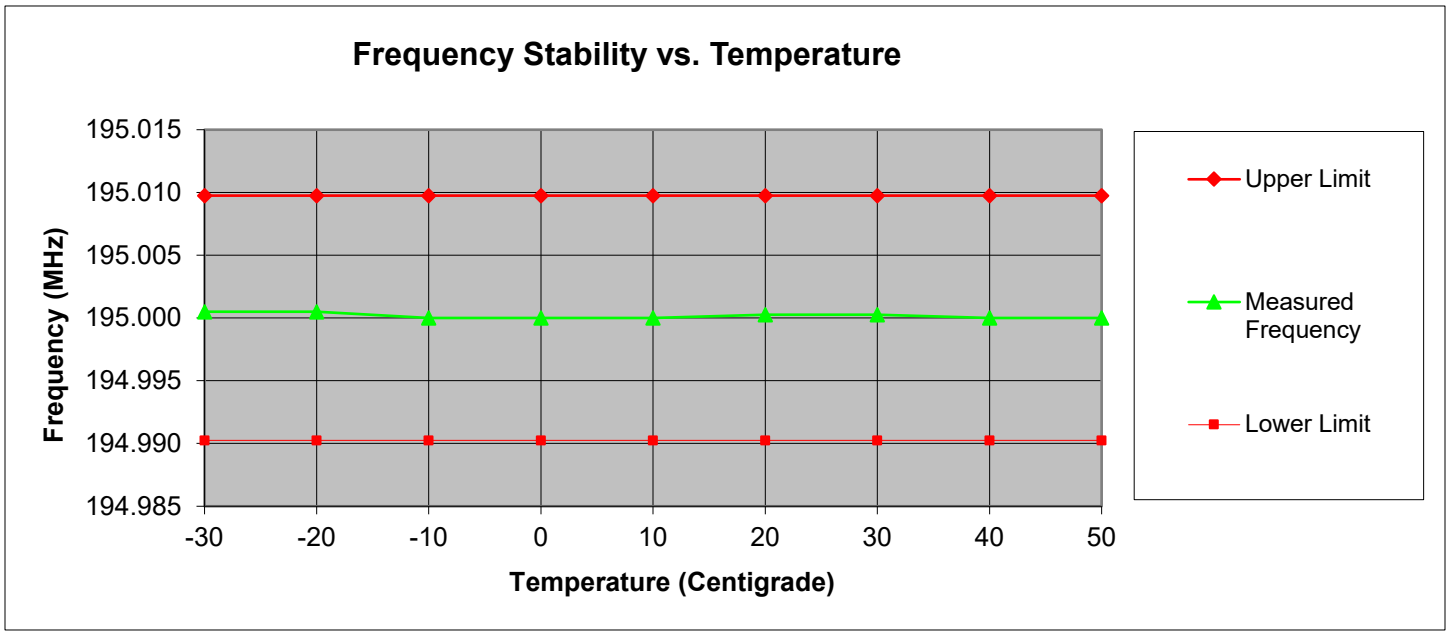
The EUT was placed in an environmental test chamber and the RF output was connected to a spectrum analyzer.
The temperature was varied from -30°C to 50°C in 10°C increments. After a sufficient time for temperature stabilization the RF output frequency was measured.
At 20°C the power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured.
The nominal input voltage declared by the manufacturer is 10.8 vdc for the beltpack.

Test Setup



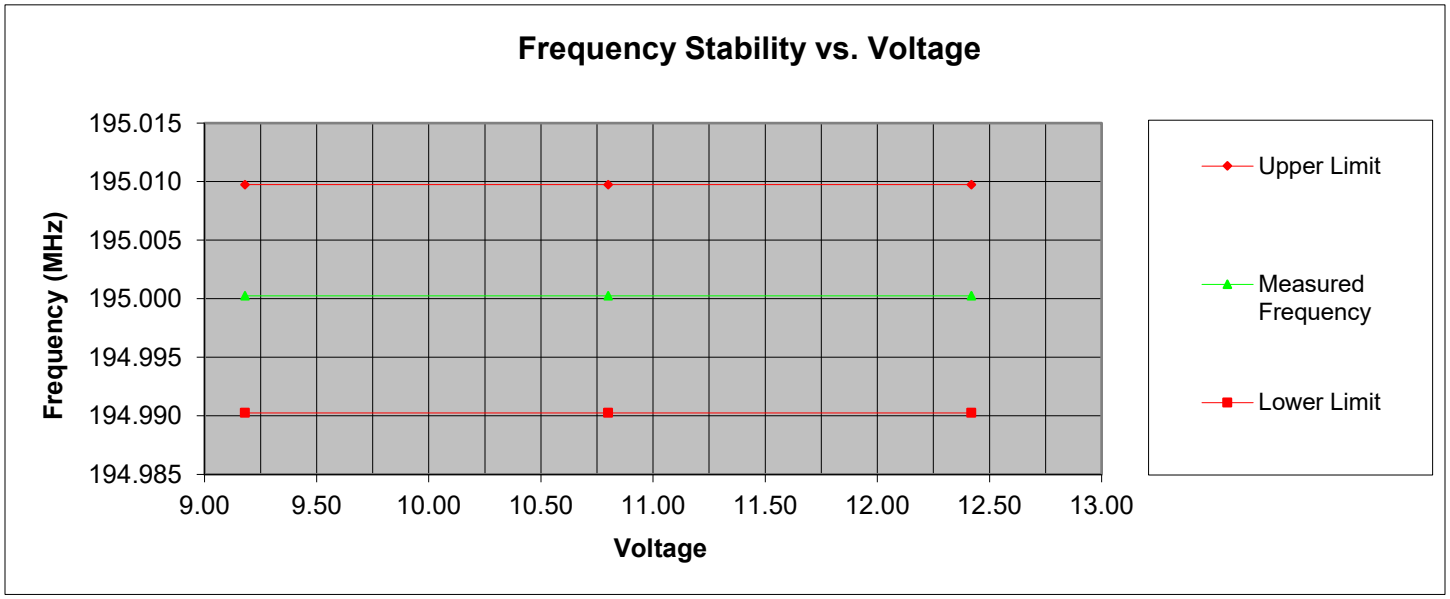
Frequency Stability Temperature Variation Measurement Results

Tuned Frequency	Temperature	Tolerance	Measured Frequency	Upper Limit	Lower Limit	Upper Margin	Lower Margin
(MHz)	(deg C)	(%)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
195.000	-20	0.005	195.0005000	195.0097500	194.9902500	0.0092500	0.0102500
195.000	-10	0.005	195.0005000	195.0097500	194.9902500	0.0092500	0.0102500
195.000	0	0.005	195.0000000	195.0097500	194.9902500	0.0097500	0.0097500
195.000	10	0.005	195.0000000	195.0097500	194.9902500	0.0097500	0.0097500
195.000	20	0.005	195.0000000	195.0097500	194.9902500	0.0097500	0.0097500
195.000	30	0.005	195.0002500	195.0097500	194.9902500	0.0095000	0.0100000
195.000	40	0.005	195.0002500	195.0097500	194.9902500	0.0095000	0.0100000
195.000	50	0.005	195.0000000	195.0097500	194.9902500	0.0097500	0.0097500



Frequency Stability Voltage Variation Measurement Results
DC Voltage

Tuned Frequency	Tolerance	DC Voltage	Measured Frequency	Upper Limit	Lower Limit	Upper Margin	Lower Margin
(MHz)	(%)	(vdc)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
195.000	0.005	9.18	195.0002500	195.0097500	194.9902500	-0.0095000	0.0100000
195.000	0.005	10.80	195.0002500	195.0097500	194.9902500	-0.0095000	0.0100000
195.000	0.005	12.42	195.0002500	195.0097500	194.9902500	-0.0095000	0.0100000



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