SHURE

ELECTROMAGNETIC COMPATIBILITY LABORATORY
TEST REPORT

TEST REPORT TITLE: Electromagnetic Compatibility Tests for Shure BLX1 H11 and J11 Bodypack Transmitter

TEST ITEM DESCRIPTION: BLX1 is a digital wireless bodypack transmitter intended for use in mid-tier presentation, installed, and performance markets. The system operates in the UHF TV bands. Regionally dependent 2mW, 10mW and 35mW output power modes are available. The BLX1 transmitter is capable of operating with AA alkaline batteries.

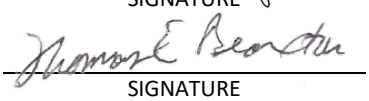
Shure Incorporated
5800 West Touhy Avenue
Niles, IL 60714

PROJECT ID NUMBER: SEL-038A

DATE TESTED: 10/11/2018 TO 01/28/2019

TEST PERSONNEL: Juan Castrejon, Hannah Hart, Alex Mishinger, Jamal Qureshi

TEST SPECIFICATION (STANDARDS APPLIED): FCC Part 74: Experimental Radio, Auxiliary, Special Broadcast And Other Program Distributional Services
RSS 210 Issue 9, Annex G: Low-Power Radio Apparatus Operating in the Television Bands

TEST REPORT BY:	 SIGNATURE	Global Compliance Engineer POSITION	1/29/2019 DATE
APPROVED BY:	 SIGNATURE	GC Project Engineer POSITION	1/29/2019 DATE

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A	Frequency Stability
B	Necessary Bandwidth
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Report Revision History

Revision	Date	Description
0	1/29/2019	Released for use
1	4/19/2019	Revised to divide FCC part 74 and 15 data into separate reports, to include EIRP values for RF Power Output data, and to make minor edits throughout.
2	4/23/2019	Corrected a mathematical error in EIRP data.
3	5/10/2019	Reformatted cover page, added details about EIRP calculation, replaced radiated emissions graphs (uncalibrated) with substitution data, and made minor edits throughout.
4	6/11/2019	Corrected substitution data
5	7/8/2019	Added additional substitution data

Report Summary

1. Introduction

1.1. Scope of Tests

This document presents the results of a series of electromagnetic compatibility (EMC) tests performed on the BLX1 H11 and BLX1 J11. The test items were manufactured and submitted for testing by Shure Incorporated located in Niles, IL. The data was taken following the measurement methods as described in the test specifications listed on page 1 of this document. Provided is the data for the test samples which also includes a summary of the measurements made and a description of the measurement setup.

1.2. Purpose

This series of tests was performed to determine if the test item would meet the selected requirements of the following specifications:

FCC Part 74.861

RSS 210 Issue 9, Annex G

1.3. Deviations, Additions, and Exclusions

1.4. EMC Laboratory Identification

The electromagnetic compatibility tests were performed at the Shure Electromagnetic Laboratory, Shure Incorporated, 5800 West Touhy Ave, Niles, Illinois 60714-4608. This laboratory is registered with ISED Canada as Site # 616A-1. The Shure Electromagnetic Laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). The NVLAP Lab Code is: 200946-0.

1.5. Summary of Tests Performed

The following electromagnetic compatibility tests were performed on the test item in accordance with the specifications as stated in the following:

FCC Part 2

ETSI EN 300 422-1

RSS 210 Issue 9, Annex G

Table 1-1: Summary of tests performed

Test Specifications	Description	Tested Range	Described in Appendix	Test Results
FCC 74.861 RSS 210.9 Annex G	Frequency Stability	572.150MHz – 595.850MHz 596.125MHz – 615.875MHz	A	PASS
FCC 74.861 RSS 210.9 Annex G	Necessary Bandwidth	572.150MHz – 595.850MHz 596.125MHz – 615.875MHz	B	PASS
FCC 74.861 RSS 210.9 Annex G	Field Strength Spurious Emissions	25MHz – 18GHz	C	PASS

FCC 74.861 RSS 210.9 Annex G	RF Output Power	572.150MHz – 595.850MHz 596.125MHz – 615.875MHz	D	PASS

2. Applicable Documents

The following documents of the exact issue designated form part of this document to the extent specified herein:

FCC Part 15

RSS 210 Issue 9

3. EUT Set-Up and Operation

3.1. General Description

The Shure BLX1 Bodypack Transmitter is a digital wireless bodypack transmitter intended for use in mid-tier presentation, installed, and performance markets. The system operates in the UHF TV bands and is frequency modulated. Regionally dependent 2mW, 10mW and 35mW output power modes are available. Wireless signals are modulated using frequency modulation. The BLX1 transmitter is capable of operating with AA alkaline batteries.

3.2. Test Samples

The following BLX1 H11 and BLX1 J11 samples were tested:

Table 3-1: Transmitter Samples

Frequency Band	RF Power Output In mW	EUT Serial Number	Frequency Range
H11	10	TS1R & TS1C	572MHz-596MHz
J11	10	TS1R & TS1C	596MHz-616MHz

3.3. Test Setup

3.3.1. Power Input

The EUT obtained power through internal alkaline batteries.

3.3.2. Signal Input /Output Leads

3.3.3. Grounding Considerations

3.3.4. Operational Mode

4. Test Instrumentation

A list of the test equipment used can be found in Table 10-1. All equipment is calibrated on an annual basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

5. Test Procedures

The specific test procedures are presented in the individual appendices.

6. Other Test Conditions

6.1. Test Personnel

All EMC tests were performed by qualified personnel from the Shure EMC Laboratory.

6.2. Disposition of the EUT

The EUTs and all associated equipment were returned to Shure Incorporated upon completion of the tests.

7. Results

The results are presented in the individual test appendices. It was found that the EUT met the requirements of the following:

FCC Part 74

RSS 210, Issue 9

8. Conclusions

It was determined that the BLX1 H11 and BLX1 J11 did fully comply with the requirements of the following:

FCC Part 74

RSS 210, Issue 9

9. Certification

Shure EMC Laboratory certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUTs at the test date. Any electrical or mechanical modification made to the EUTs subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

10. Equipment List

Table 10-1: Test Equipment

L# or ID	Description	Manufacturer	Model #	Serial #	Frequency Range	Cal Date	Due Date
L05-068-02	Modulation Analyzer	Boonton	8200	46410-1223	100KHz-2GHz	5/30/2018	5/30/2020
L23-011-15	BiConiLog Antenna	ETS Lindgren	3142C	34790	25MHz-3GHz	6/22/2017	6/22/2019
L23-011-44	BiConiLog Antenna	ETS Lindgren	3142C	79899	26MHz-3GHz	8/10/2018	8/10/2020
L23-011-53	Horn Antenna	ETS Lindgren	3117	200363	1GHz-18GHz	10/16/2017	10/16/2019
L23-011-55	Horn Antenna	ETS Lindgren	3117	206583	1GHz-18GHz	4/10/2018	4/10/2020
L19-006-01	Temperature Chamber	Espec	SU-240	91004211	N/A	4/5/2018	4/5/2019
L23-021-01	Audio Signal Generator/Analyzer	Audio Precision	SYS-2722	48254-1041	N/A	4/26/2018	4/26/2020

L23-022-01	Spectrum Analyzer	Rhode & Schwarz	FSU26	201043	2Hz-26.5GHz	8/23/2017	8/23/2019
L23-022-02	Spectrum Analyzer	Rhode & Schwarz	FSW26	103788	2Hz-26.5GHz	4/24/2018	4/24/2020
L23-023-01	Signal Generator	Rhode & Schwarz	SMF 100A	48254-151	100kHz-22GHz	8/23/2017	8/23/2019
L23-024-01	Frequency Counter	Agilent	53220A	MY50006485	100MHz-6GHz	7/24/2018	7/24/2020
L23-040-03	20dB Signal Attenuator	Mini-Circuits	BW-N20W5+	0952	18GHz	5/31/2018	5/30/2020
L23-040-22	ETSI Noise Filter	Shure	N/A	N/A	N/A	5/24/2017	5/24/2019
L23-041-13	Coax Cable	Micro-Coax	W27.16	CP1/X3	N/A	8/29/2018	8/29/2019
L23-041-38	Coax Cable	Utiflex	UFB311A-1-3188-50U50U	229546-002	25MHz-18GHz	5/31/2018	5/31/2019
L23-041-56	SMA-N-type Coaxial Cable	Florida RF Labs	N/A	46410-1080	100kHz-22GHz	5/30/2018	5/30/2019
L23-045-36	RF Power Meter	EMPower	7002-006	00151071	18GHz	1/31/2018	1/31/2020

Appendix A: Frequency Stability

A.1. Purpose

This test was performed to determine if the EUT meets the frequency stability requirements of FCC Part 74.861 and RSS 210 Issue 9, Annex G.

A.2. Requirements

FCC Part 74.861(e)(4) states:

"The frequency tolerance of the transmitter shall be 0.005 percent."

The requirements for RSS 210 Issue 9, Annex G can be found in the table below.

Table G1 — Specification for Low-Power Radio Apparatus

Frequency Bands (MHz)	Transmit e.i.r.p. (mW)	Authorized Bandwidth (kHz)	Frequency Stability (ppm)
54-72 76-88 174-216	50	200	± 50
470-608 614-698[Note]	250	200	± 50

A.3. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

	Std uncertainty ±u(error)
Expanded Uncertainty (U_{95}):	**5.83E-08**

These values can be found in the document titled 'Frequency Error_Stability – 2018_09_24.xlsx' located at *\\shure.com\organization\Quality\Product Conformance-Lab Services\Global Compliance\Shure EMC Lab\Controlled Documents\Measurement Uncertainties.*

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

A.4. Test Setup and Instrumentation

The EUT was heated and cooled in an Espec temperature chamber over a temperature range of -30°C to +50°C. The temperature around the EUT was measured and monitored by the built-in thermometer. The EUT's frequency was measured with a spectrum analyzer set to measure signal count at 0.1Hz resolution. The center frequency of the spectrum analyzer was set to the selected transmit frequency of the EUT (Low, Mid or High). Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.

A.5. EUT Operation

The device was powered on and transmitting. The three frequencies were set using the buttons on the device inside the battery door.

A.6. Specific Test Procedures

The temperature chamber was set to -30°C with the EUT inside and powered on.

The EUT was allowed to soak for ~20 minutes after the temperature chamber reached the set temperature.

The measured frequency of the transmitter was then recorded in the spreadsheet in section D.7.

The temperature chamber was incremented +10°C with the EUT inside and powered on.

Steps c. through e. were repeated until the device reached +50°C.

Steps a. through e. were repeated for representative low, mid and high frequencies within the EUT's operational bands.

A.7. Results

The test results can be viewed in the table below.

	Temp (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation (%)	FCC Limit (%)	Deviation (ppm)	RSS Limit (ppm)	Pass/Fail
572.150MHz								
	-30	572.150	572.1499	0.000016	0.005	0.157	±50	PASS
	-20	572.150	572.1498	0.000028	0.005	0.283	±50	PASS
	-10	572.150	572.1495	0.000087	0.005	0.874	±50	PASS
	0	572.150	572.1500	0.000000	0.005	0.002	±50	PASS
	10	572.150	572.1501	0.000015	0.005	0.150	±50	PASS
	20	572.150	572.1502	0.000028	0.005	0.280	±50	PASS
	30	572.150	572.1501	0.000015	0.005	0.150	±50	PASS
	40	572.150	572.1500	0.000007	0.005	0.073	±50	PASS
	50	572.150	572.1499	0.000026	0.005	0.255	±50	PASS
Room Temp	24.5	572.150	572.1501	0.000021	0.005	0.206	±50	PASS
584.125MHz								
	-30	584.125	584.12498	0.000003	0.005	0.034	±50	PASS
	-20	584.125	584.124844	0.000027	0.005	0.267	±50	PASS
	-10	584.125	584.12488	0.000021	0.005	0.205	±50	PASS
	0	584.125	584.124989	0.000002	0.005	0.019	±50	PASS
	10	584.125	584.125093	0.000016	0.005	0.159	±50	PASS
	20	584.125	584.12516	0.000027	0.005	0.274	±50	PASS
	30	584.125	584.125093	0.000016	0.005	0.159	±50	PASS
	40	584.125	584.124955	0.000008	0.005	0.077	±50	PASS
	50	584.125	584.124853	0.000025	0.005	0.252	±50	PASS
Room Temp	24.5	584.125	584.125112	0.000019	0.005	0.192	±50	PASS
595.850MHz								
	-30	595.850	595.8499	0.000017	0.005	0.168	±50	PASS
	-20	595.850	595.84983	0.000029	0.005	0.285	±50	PASS
	-10	595.850	595.84989	0.000018	0.005	0.185	±50	PASS
	0	595.850	595.849971	0.000005	0.005	0.049	±50	PASS
	10	595.850	595.850099	0.000017	0.005	0.166	±50	PASS
	20	595.850	595.850168	0.000028	0.005	0.282	±50	PASS
	30	595.850	595.850097	0.000016	0.005	0.163	±50	PASS
	40	595.850	595.849954	0.000008	0.005	0.077	±50	PASS
	50	595.850	595.84985	0.000025	0.005	0.252	±50	PASS
Room Temp	24.5	595.850	595.85012	0.000020	0.005	0.201	±50	PASS

Figure 1: BLX1 H11 Frequency Stability Measurements

		Nominal	Measured		FCC		RSS	
	Temp	Frequency	Frequency	Deviation	Limit	Deviation	Limit	Pass/Fail
	(°C)	(MHz)	(MHz)	(%)	(%)	(ppm)	(ppm)	
F1								
	-30	596.125	596.125129	0.000022	0.005	0.216	±50	PASS
	-20	596.125	596.125201	0.000034	0.005	0.337	±50	PASS
	-10	596.125	596.125194	0.000033	0.005	0.325	±50	PASS
	0	596.125	596.125176	0.000030	0.005	0.295	±50	PASS
	10	596.125	596.125200	0.000034	0.005	0.336	±50	PASS
	20	596.125	596.125165	0.000028	0.005	0.277	±50	PASS
	30	596.125	596.125100	0.000017	0.005	0.168	±50	PASS
	40	596.125	596.125050	0.000008	0.005	0.084	±50	PASS
	50	596.125	596.125009	0.000002	0.005	0.015	±50	PASS
Room Temp	24.5	596.125	596.125148	0.000025	0.005	0.248	±50	PASS
D6								
	-30	606.150	606.150198	0.000033	0.005	0.327	±50	PASS
	-20	606.150	606.150204	0.000034	0.005	0.337	±50	PASS
	-10	606.150	606.150188	0.000031	0.005	0.310	±50	PASS
	0	606.150	606.150189	0.000031	0.005	0.312	±50	PASS
	10	606.150	606.150208	0.000034	0.005	0.343	±50	PASS
	20	606.150	606.150161	0.000027	0.005	0.266	±50	PASS
	30	606.150	606.150106	0.000017	0.005	0.175	±50	PASS
	40	606.150	606.150060	0.000010	0.005	0.099	±50	PASS
	50	606.150	606.150009	0.000001	0.005	0.015	±50	PASS
Room Temp	24.5	606.150	606.150142	0.000023	0.005	0.234	±50	PASS
A8								
	-30	615.875	615.875170	0.000028	0.005	0.276	±50	PASS
	-20	615.875	615.875210	0.000034	0.005	0.341	±50	PASS
	-10	615.875	615.875194	0.000031	0.005	0.315	±50	PASS
	0	615.875	615.875188	0.000031	0.005	0.305	±50	PASS
	10	615.875	615.875212	0.000034	0.005	0.344	±50	PASS
	20	615.875	615.875165	0.000027	0.005	0.268	±50	PASS
	30	615.875	615.875103	0.000017	0.005	0.167	±50	PASS
	40	615.875	615.875052	0.000008	0.005	0.084	±50	PASS
	50	615.875	615.875008	0.000001	0.005	0.013	±50	PASS
Room Temp	24.5	615.875	615.875149	0.000024	0.005	0.242	±50	PASS

Figure 2: BLX1 J11 Frequency Stability Measurements

A.8. Conclusion

It was found that the BLX1 H11 and J11 bodypack transmitters passed the requirements of FCC part 74.861 and RSS 210.9 Annex G.

Appendix B: Necessary Bandwidth

B.1. Purpose

This test was performed to determine if the Shure BLX1 H11 complies with the requirements stated in FCC part 74.861 and RSS210 Issue 9, Annex G.

B.2. Requirements

As stated in paragraph 74.861(7), for low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

"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."

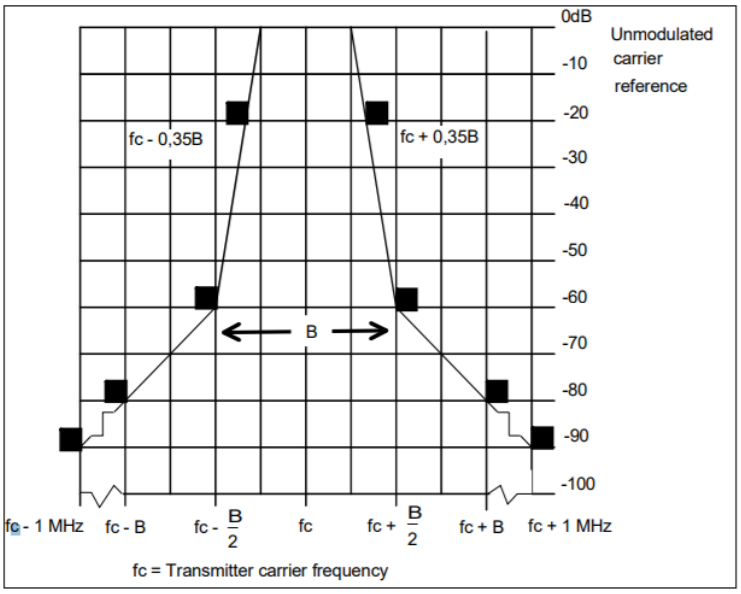


Figure 3: Spectrum mask for analogue systems in all bands - ETSI EN 300 422-1

The limits for RSS 210 Issue 9, Annex G.3.1 are shown in table G1 below:

Table G1 — Specification for Low-Power Radio Apparatus

Frequency Bands (MHz)	Transmit e.i.r.p. (mW)	Authorized Bandwidth (kHz)	Frequency Stability (ppm)
54-72 76-88 174-216	50	200	± 50
470-608 614-698[Note]	250	200	± 50

B.3. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

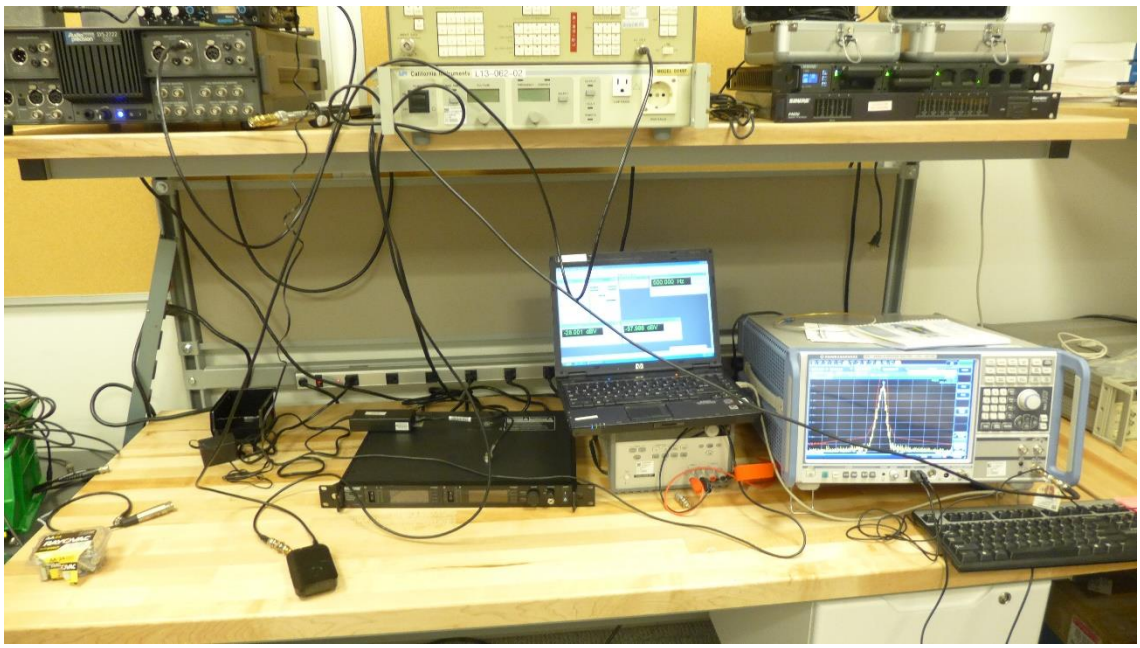
Values of Expanded Measurement Uncertainty (95% Confidence):

	Std uncertainty	
	+u(%)	-u(%)
Expanded Uncertainty (U_{95}):	**0.130**	**0.130**

These values can be found in the document titled 'Occupied Bandwidth Max Input Freq Above 3kHz.xlsx' located at *\\shure.com\organization\Quality\Product Conformance-Lab Services\Global Compliance\Shure EMC Lab\Controlled Documents\Measurement Uncertainties.*

B.4. Test Setup and Instrumentation

Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.



B.5. EUT Operation

The device was powered on and set to three frequencies using the buttons on the front of the device: 572.125MHz, 584.125MHz, and 595.850MHz.

B.6. Specific Test Procedures

The device was tested using procedures outlined in EN 300 422-1 part 8.3.2.1 as listed below.

> “The arrangement of test equipment as shown in figure B.1 shall be used. Note that the noise meter conforms to (quasi peak) without weighting filter (flat).
>
> With the Low Frequency (LF) audio signal generator set to 500 Hz, the audio input level to the DUT shall be adjusted to 8 dB below the limiting threshold (-8 dB (lim)) as declared by the manufacturer.

The corresponding audio output level from the demodulator shall be measured and recorded.

The input impedance of the noise meter shall be sufficiently high to avoid more than 0,1 dB change in input level when the meter is switched between input and output.

The audio input level shall be increased by 20 dB, i.e. to +12 dB (lim), and the corresponding change in output level shall be measured.

It shall be checked that the audio output level has increased by ≤ 10 dB.

If this condition is not met, the initial audio input level shall be increased from -8 dB (lim) in 1 dB steps until the above condition is fulfilled, and the input level recorded in the test report. This level replaces the value derived from the manufacturer's declaration and is defined as -8 dB (lim).

Measure the input level at the transmitter required to give +12 dB (lim).

The LF generator shall be replaced with the weighted noise source to Recommendation ITU-R BS.559-2 [i.3], band-limited to 15 kHz as described in IEC 60244-13 [2], and the level shall be adjusted such that the measured input to the transmitter corresponds to +12 dB (lim).

If the transmitter incorporates any ancillary coding or signalling channels (e.g. pilot-tones), these shall be enabled prior to any spectral measurements.

If the transmitter incorporates more than one audio input, e.g. stereo systems, the second and subsequent channels shall be simultaneously driven from the same noise source, attenuated to a level of -6 dB (lim).

The transmitter RF output spectrum shall be measured, using a spectrum analyser with the following settings:

- centre frequency: fc: Transmitter (Tx) nominal frequency;
- dispersion (Span): fc - 1 MHz to fc + 1 MHz;
- Resolution BandWidth (RBW): 1 kHz;
- Video BandWidth (VBW): 1 kHz;
- detector: Peak hold.

Figure 8 shows the spectrum mask for all analogue systems in the band. The -90 dBc point shall be ±1 MHz from fc measured with an average detector. To comply, a measured value shall fall below the mask limit."

A +12dB level of -28dBV and a -8dB level of -48dBV were chosen using the first set of instructions, and the output RF power was measured with inputs of -28dBV for the +12dB level and -46dBV for the -6dB level.

B.7. Results

The necessary bandwidth data are presented on the following pages. Data are shown as the maximum relative level of the output level within the emission mask.

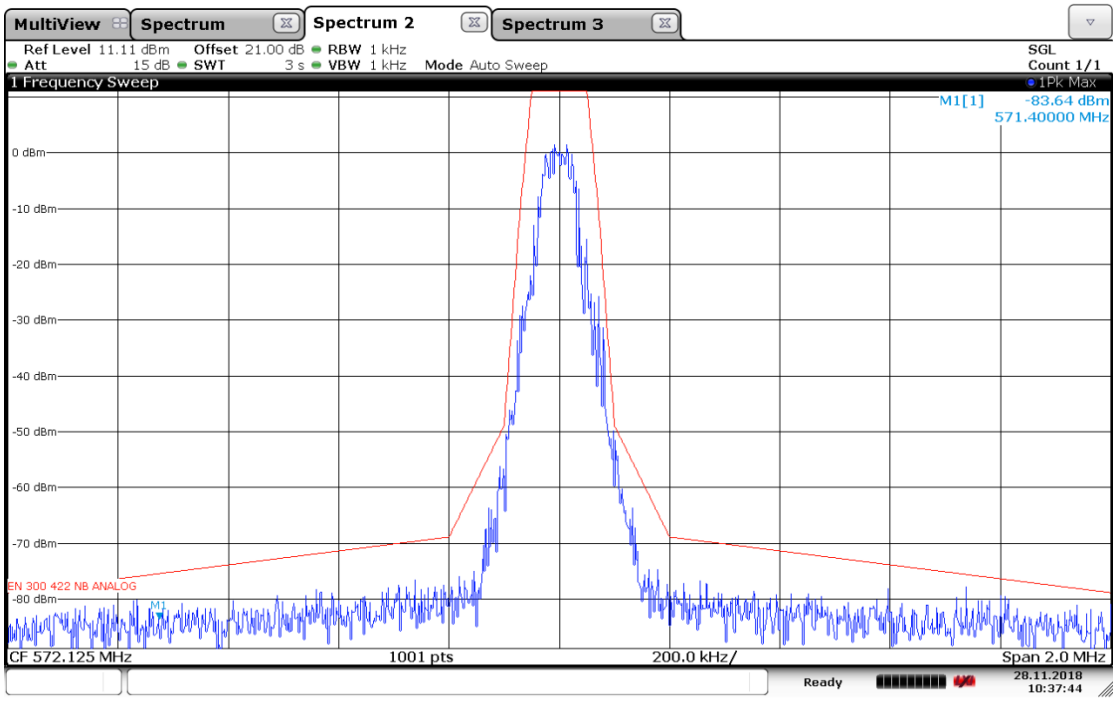


Figure 4: H11 Necessary Bandwidth results at 572.125MHz

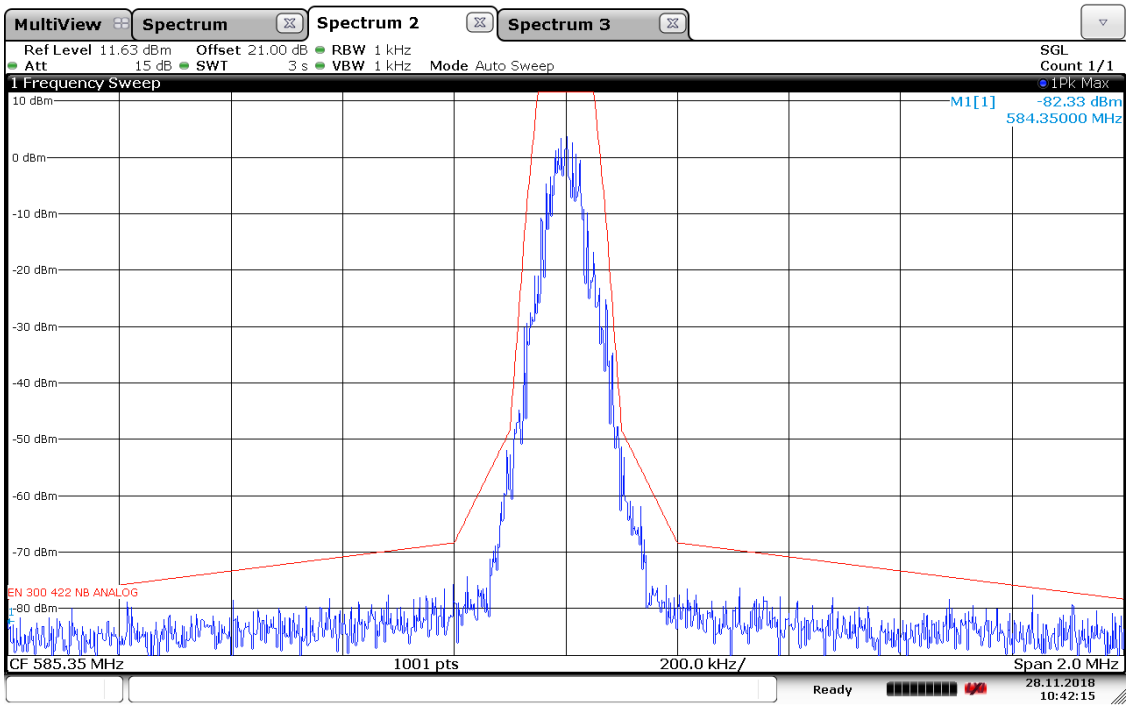


Figure 5: H11 Necessary Bandwidth results at 584.125MHz

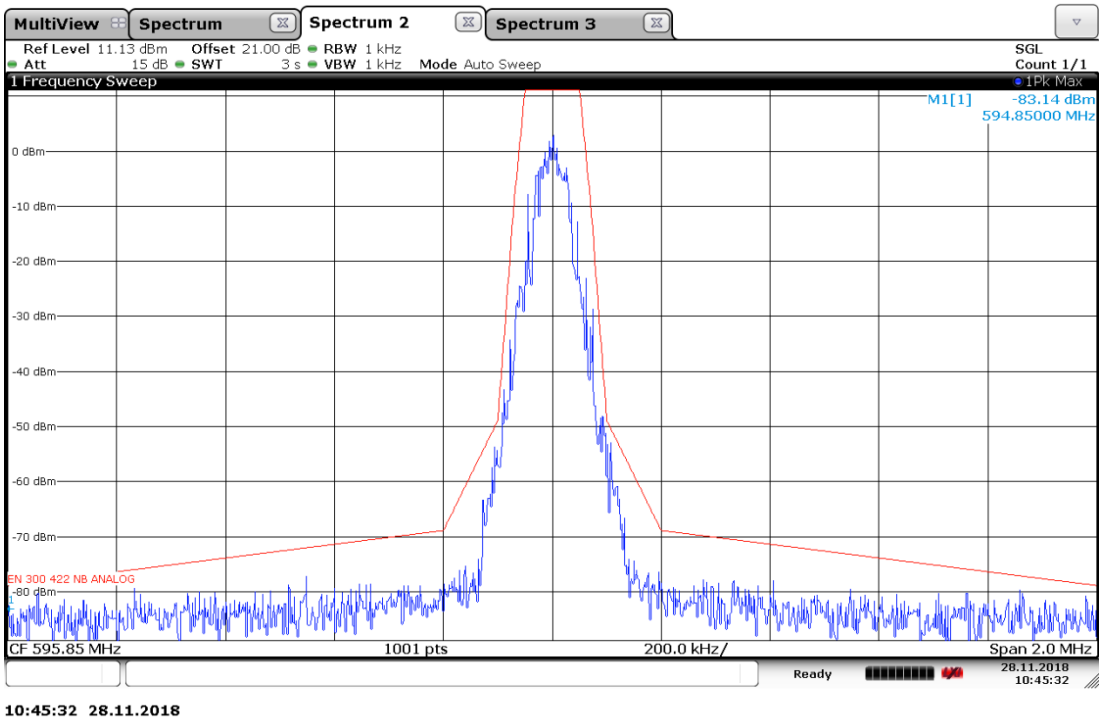


Figure 6: H11 Necessary Bandwidth results at 595.850MHz

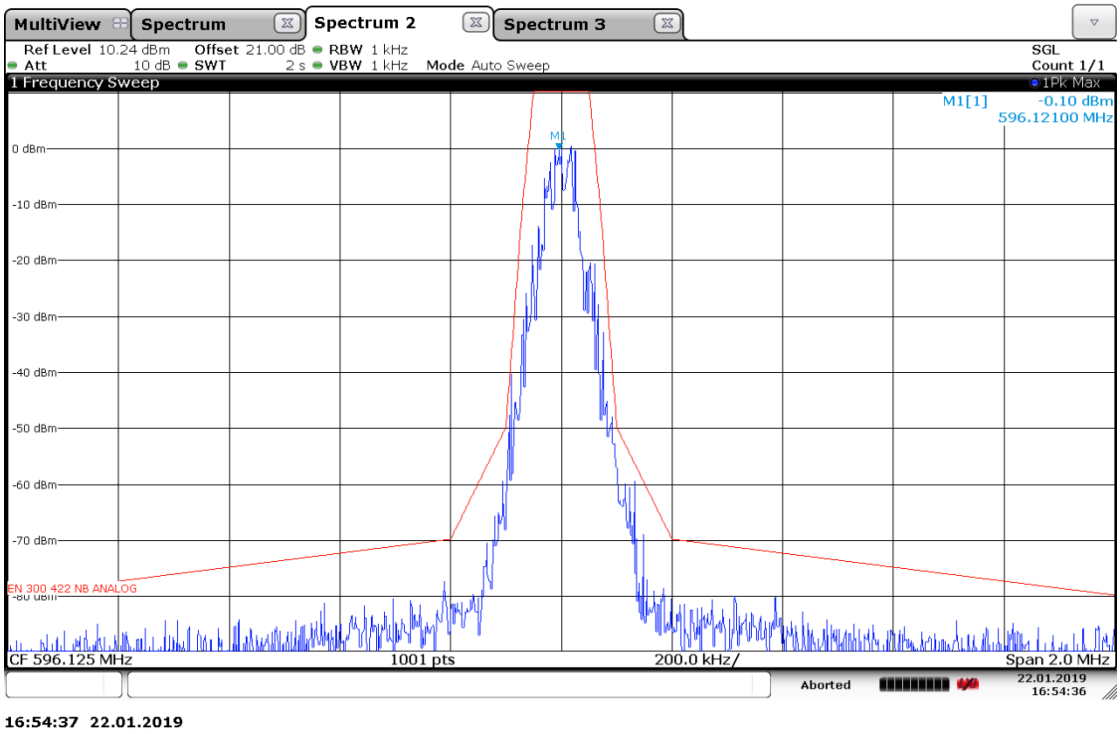


Figure 7: J11 Necessary Bandwidth results at 596.125MHz

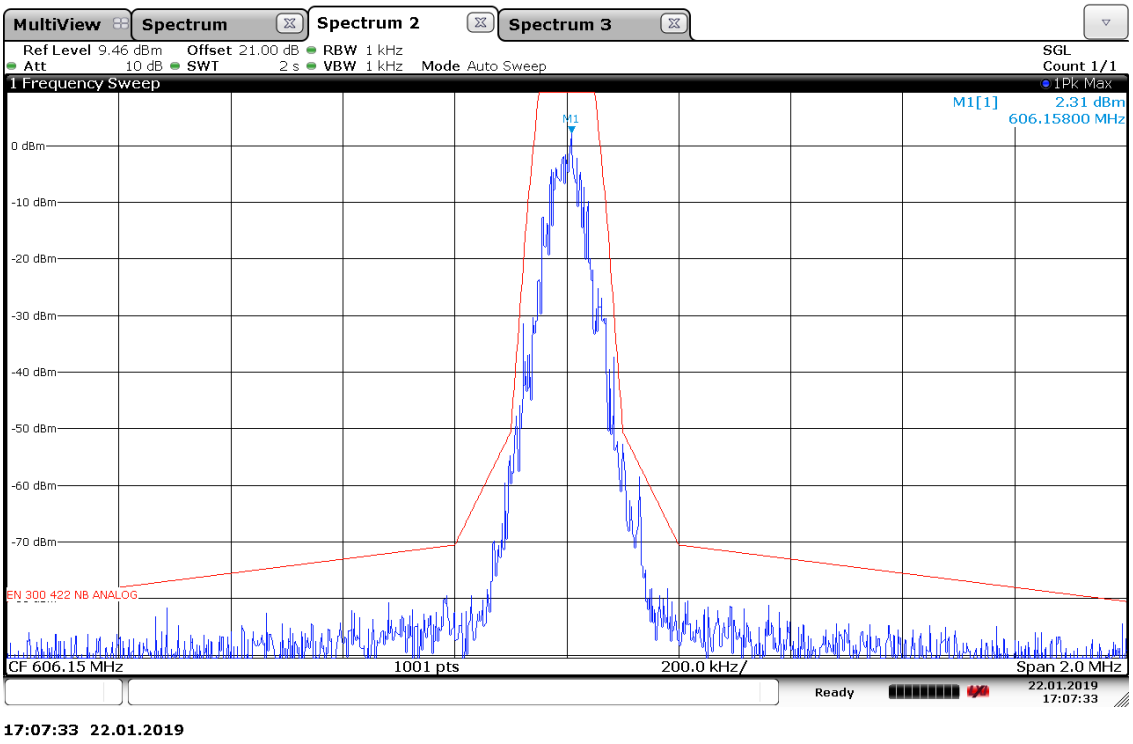


Figure 8: J11 Necessary Bandwidth results at 606.15MHz

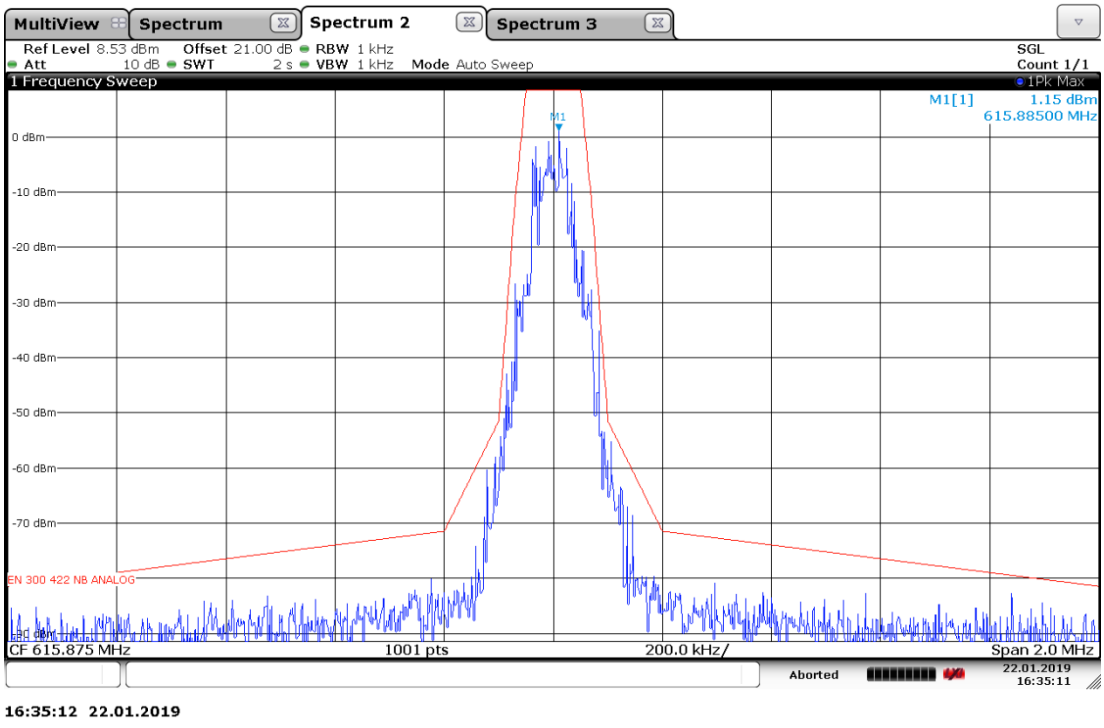


Figure 9: J11 Necessary Bandwidth results at 615.875MHz

B.8. Conclusion

It was found that the BLX1 H11 bodypack transmitter passed the requirements of FCC part 74.861, FCC part 15.236 and RSS210 Issue 9, Annex G.

Appendix C: Field Strength Spurious Emissions

C.1. Purpose

This test was performed to determine if the BLX1 H11 and J11 meet the spurious emissions requirements of FCC Part 74.861 and RSS 210 Issue 9, Annex G.

C.2. Requirements

FCC Part 74.861 (e)(7) states:

“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).”

RSS 210.9 Annex G.3.4 states:

“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.”

The limits for spurious emissions from a transmitter as stated by EN 300 422-1 v1.4.2 section 8.4 are shown below.

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

Figure 10: Table - Limits for Spurious Emissions

C.3. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

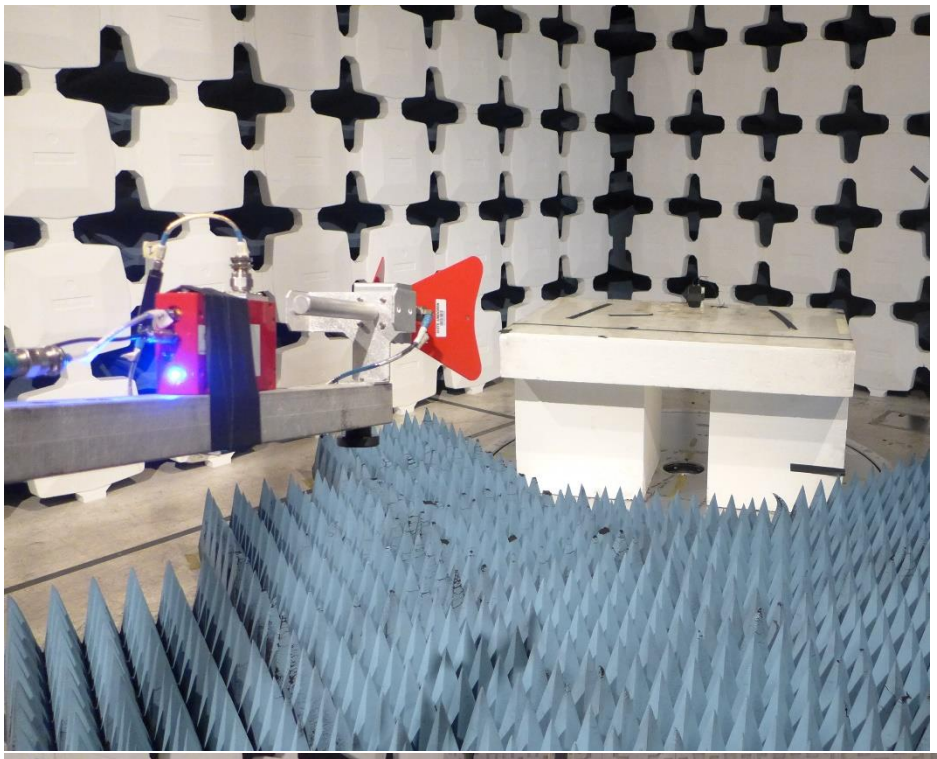
Measurement Type	U_{LAB}	U_{FCC}
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.12dB	6dB
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 12.75 GHz)	4.56dB	6dB

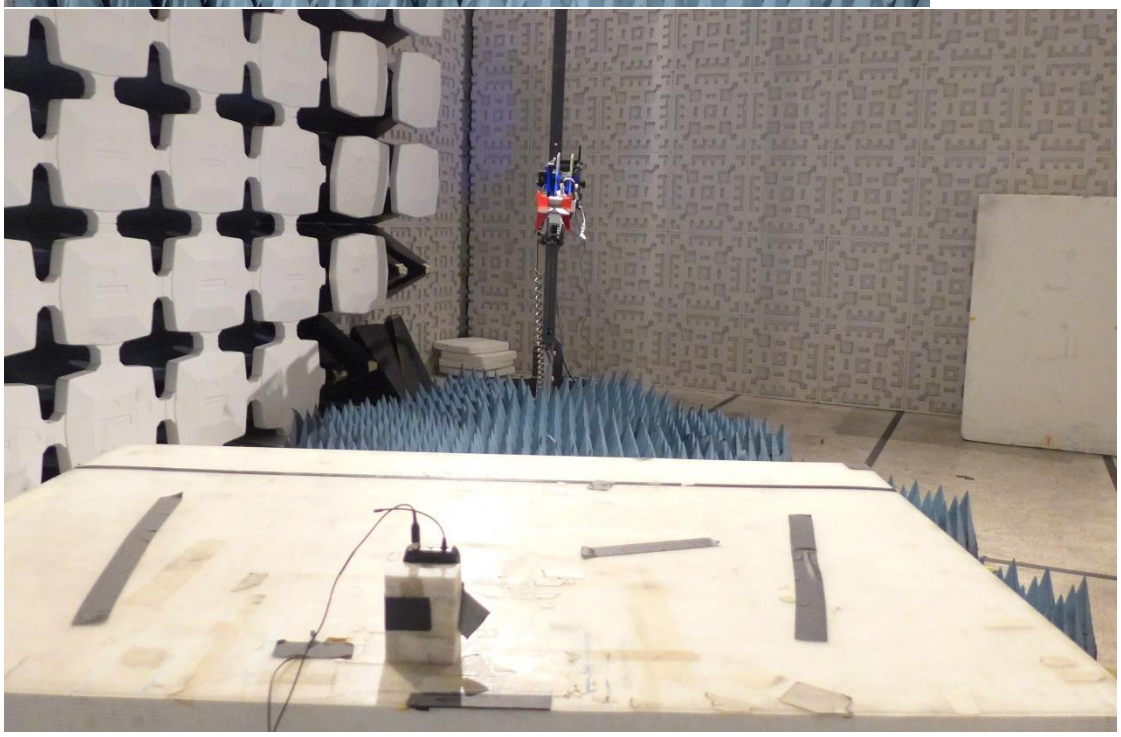
U_{LAB} = Determined for Shure EMC Laboratory
U_{FCC} = From FCC EN 300 422-1 Table 10: Measurement uncertainty
Since U_{LAB} is less than or equal to U_{FCC}:

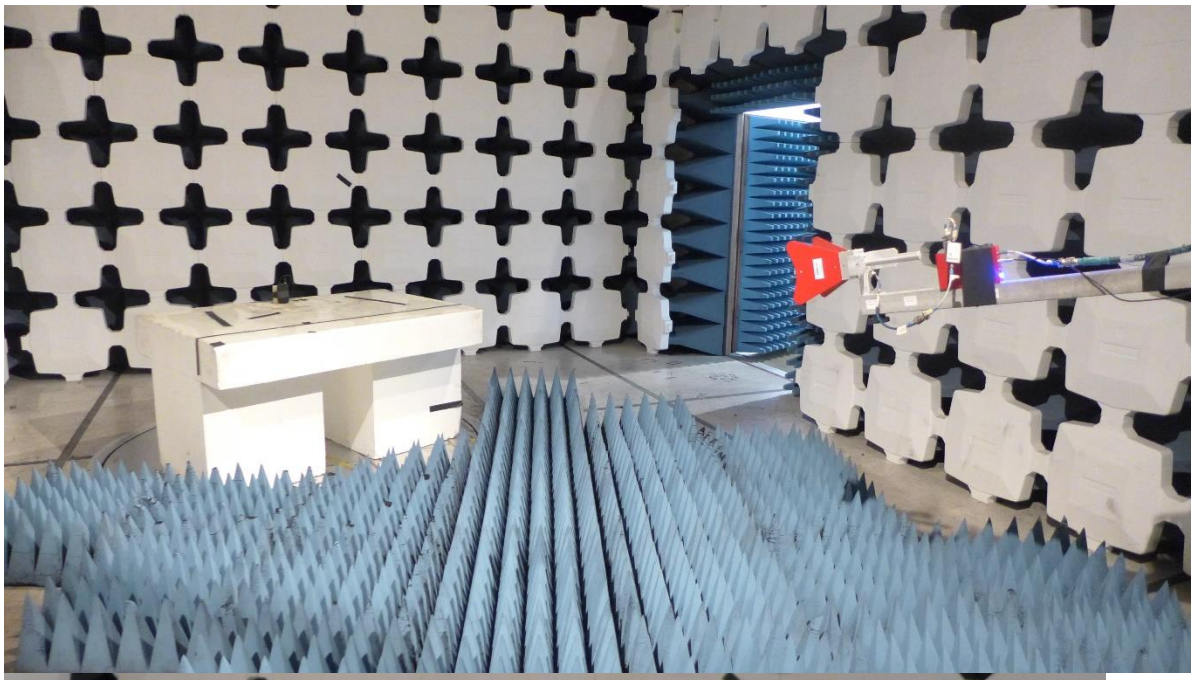
- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

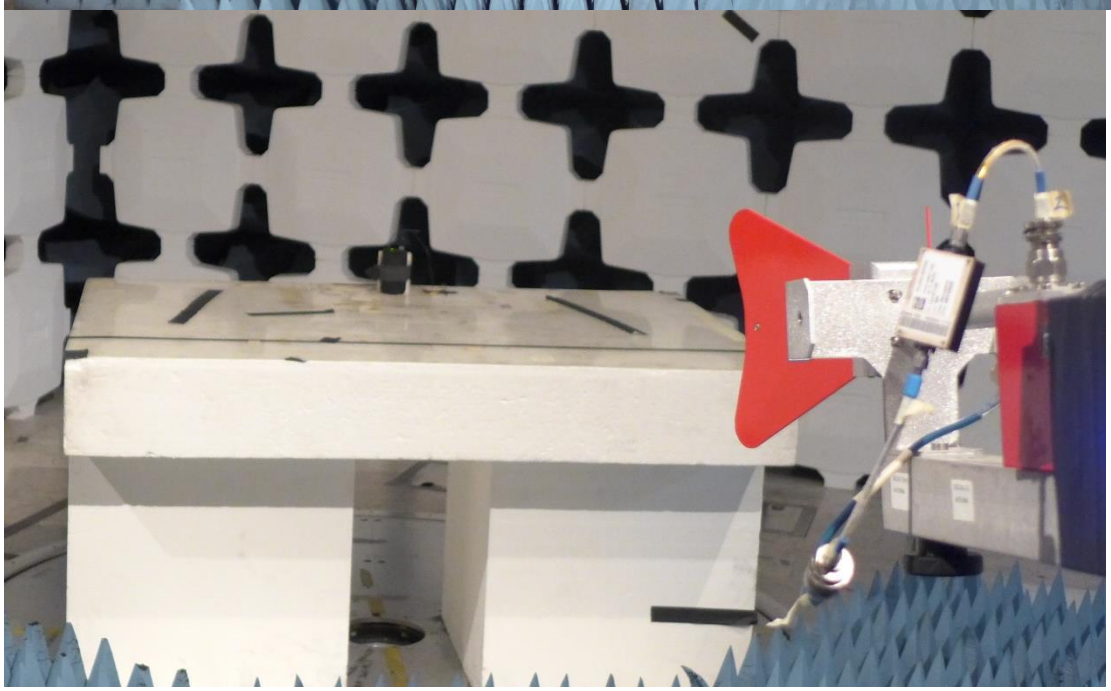
C.4. Test Setup and Instrumentation

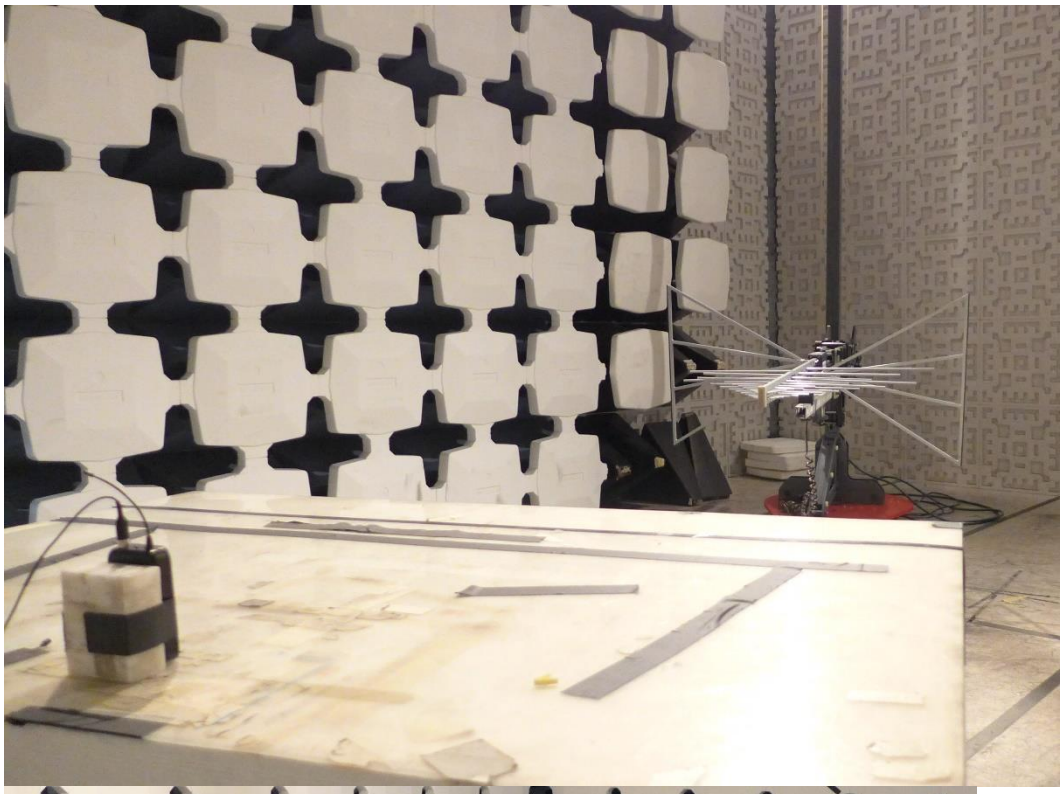
Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.

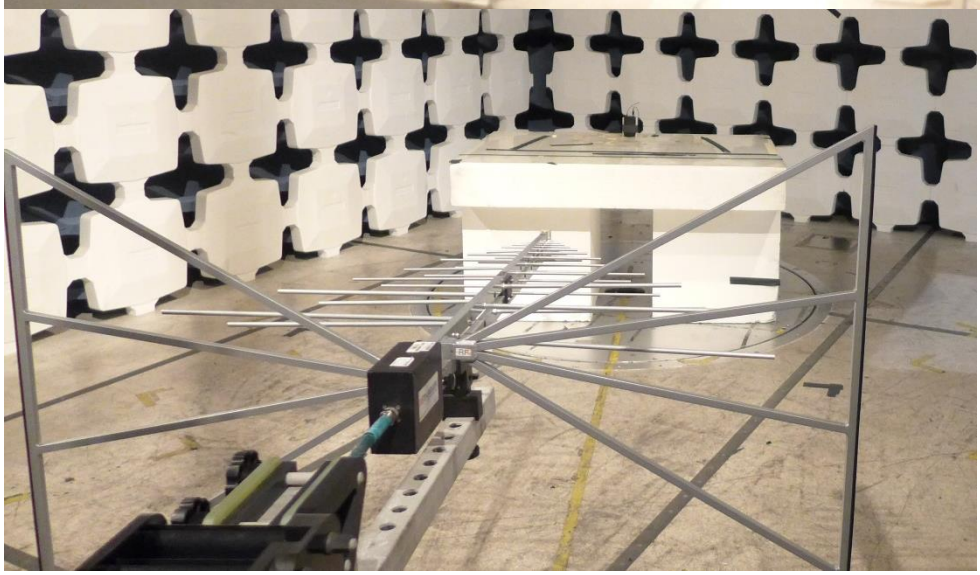












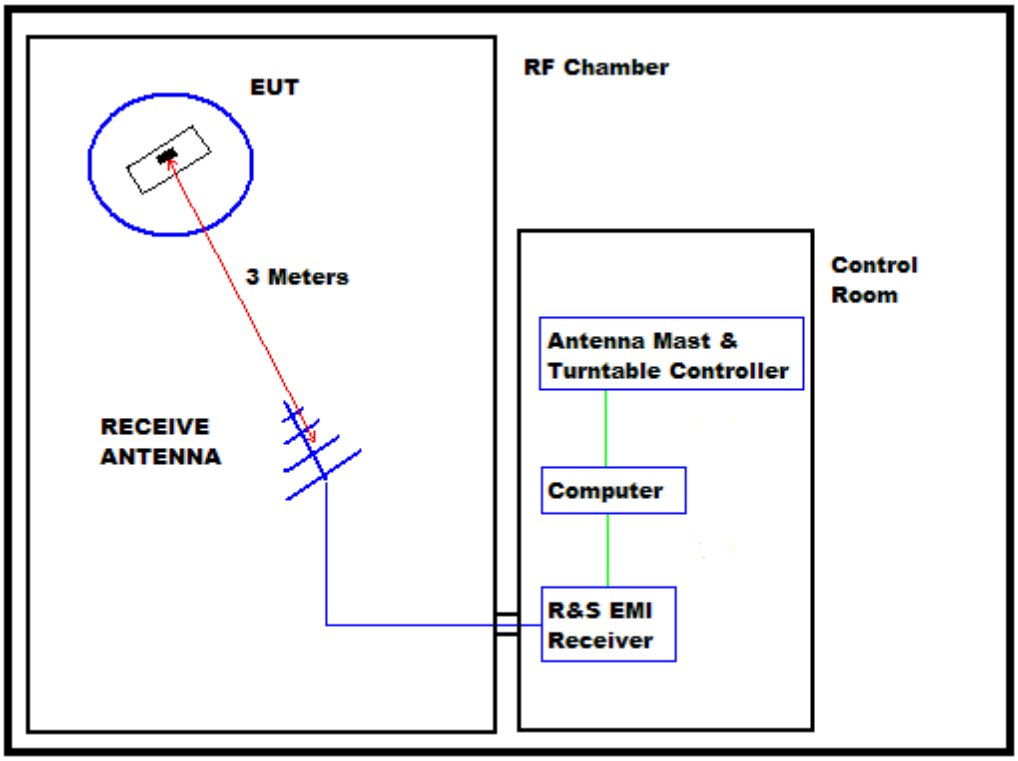
C.5. EUT Operation

. The device was powered up and the frequency was set using the buttons on the device, with the audio gain set to 0. Testing was conducted with the EUT set to the three frequencies chosen within the operating frequency range of H11: 572.125MHz, 584.125MHz, and 595.850MHz and J11: 596.125MHz, 606.150MHz, and 615.875MHz. The device was powered by two AA batteries.

C.6. Specific Test Procedures

All tests were performed in a 28ft. x 20ft. x 18.5ft. 3m semi-anechoic test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All power lines and signal lines entering the enclosure pass through filters on the enclosure wall. The power line filters prevent extraneous signals from entering the enclosure on these leads.



BLOCK DIAGRAM OF SHIELDED ENCLOSURE

Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 25MHz to 1GHz was investigated using a peak detector function with the BiConiLog antenna at horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels measured for each antenna polarization were then automatically plotted. The resultant field strength (FS) is a summation in decibels (dB) of the EMI receiver measurement (ERM), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA).

Formula 1: FS (dBµV/m) = MTR (dBµV) + AF (dB/m) + CF (dB) + (- PA (dB))

To convert the Field Strength dBµV/m term to µV/m, the dBµV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in µV/m terms.

Formula 2: FS (µV/m) = AntiLog [(FS (dBµV/m))/20]

Final radiated RF emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) Measurements of all significant broadband and narrowband signals from 25MHz to 1GHz were made using a quasi-peak detector and a BiConiLog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.

2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

i. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
ii. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

C.7. Results

The substitution data from the radiated emissions tests are presented below.

Substitution Data BLX1 H11					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
572.125	112.41	16.87	0.00	2.95	13.92
584.125	112.51	16.40	0.00	3.06	13.34
595.850	111.61	14.95	0.00	2.89	12.06
Substitution Data BLX1 H11 (P1) 572.125 Mhz Above 1Ghz					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
1444.200	55.47	-43.41	5.20	1.62	-39.83
1716.400	38.70	-69.10	5.60	1.63	-65.13
2288.400	41.11	-62.79	5.70	1.96	-59.05
2860.600	41.84	-64.96	6.90	2.35	-60.41
3432.800	46.66	-69.08	8.1	2.24	-63.22
4005.000	37.70	-72.00	8.90	2.54	-65.64
Substitution Data BLX1 H11 (H5) 584.125 Mhz Above 1Ghz					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
1168.200	50.55	-47.98	3.40	1.34	-45.92
1752.000	35.45	-70.00	5.50	1.63	-66.13
2336.600	43.5	-58.39	5.60	1.80	-54.59
2920.600	47.19	-54.30	7.00	2.15	-49.45
3504.800	43.97	-62	8.2	2.71	-56.51
4089.000	38.18	-64.00	9.00	2.54	-57.54
Substitution Data BLX1 H11 (J9) 595.850 Mhz Above 1Ghz					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
1191.800	44.88	-54.93	3.40	1.43	-52.96
1788.000	37.44	-70.00	5.50	1.63	-66.13
2383.400	46.38	-54.90	5.70	2.35	-51.55
2979.600	46.96	-54.60	7.00	2.15	-49.75

3575.200	40.95	-66	8.2	2.71	-60.51
4171.000	38.86	-66.00	9.20	2.61	-59.41

Substitution Data BLX1 J11					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
596.125	110.74	13.95	0.00	2.95	11.00
606.150	108.38	10.69	0.00	3.06	7.63
615.875	106.18	8.68	0.00	2.89	5.79
Substitution Data BLX1 J11 596 Mhz Above 1Ghz					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
1192.400	45.57	-50.71	3.40	1.43	-48.74
1788.200	40.28	-57.70	5.50	1.63	-53.83
2384.600	46.92	-49.37	5.70	1.85	-45.52
2980.800	48.93	-48.16	7.00	2.15	-43.31
3576.800	44.84	-52.49	8.20	2.71	-47.00
4173.000	41.04	-57.14	9.20	2.61	-50.55
Substitution Data BLX1 J11 606MHz Above 1Ghz					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
1212.600	38.58	-57.08	3.70	1.41	-54.79
1818.600	38.82	-57.80	4.90	1.91	-54.81
2424.600	42.81	-51.32	5.80	2.11	-47.63
3030.800	45.27	-51.96	7.10	2.21	-47.07
3637.000	45.17	-52.17	8.30	2.41	-46.28
4243.000	39.43	-59.07	9.40	2.81	-52.48
Substitution Data BLX1 J11 615 Mhz Above 1Ghz					
Frequency (MHz)	Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)
1231.800	38.81	-57.42	4.10	1.41	-54.73
1847.800	40.64	-56.85	4.90	1.91	-53.86
2463.600	47	-49.28	5.80	2.11	-45.59
3079.400	52.74	-45.35	7.10	2.21	-40.46
3695.200	42.29	-56.2	8.30	2.41	-50.31
4311.200	40.84	-57.13	9.50	2.83	-50.46

C.8. Conclusion

It was found that the BLX1 H11 and J11 bodypack transmitters passed the requirements of FCC part 74 and RSS 210 Issue 9, Annex G.

Appendix D: RF Output Power

D.1. Purpose

This test was performed to determine if the EUT meets the RF power output requirements of FCC Part 74.861 and RSS 210.9.

D.2. Requirements

As stated in FCC 74.861(e)(1)(ii), For low power auxiliary stations operating in the 600 MHz duplex gap and the bands allocated for TV broadcasting, the following technical requirements apply: The power may not exceed the following values. (ii) 470-608 and 614-698: 250 mW conducted power

As stated in RSS 210.9 Annex G, transmitter EIRP shall be limited to the values listed in Table G1 below, or 250 mW.

Table G1 — Specification for Low-Power Radio Apparatus

Frequency Bands (MHz)	Transmit e.i.r.p. (mW)	Authorized Bandwidth (kHz)	Frequency Stability (ppm)
54-72 76-88 174-216	50	200	± 50
470-608 614-698[Note]	250	200	± 50

Note: Effective May 25, 2018, the Department will no longer accept applications for the certification of new low-power apparatus that operate in the bands 617-652 MHz and 663-698 MHz. Furthermore, as of November 15, 2018, no low-power apparatus in the bands 617-652 MHz and 663-698 MHz may be sold, offered for sale, manufactured, imported, distributed or leased on the Canadian market.

D.3. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

	Std uncertainty +u(dB)	-u(dB)
Expanded Uncertainty (U_{95}):	**0.461**	**0.461**

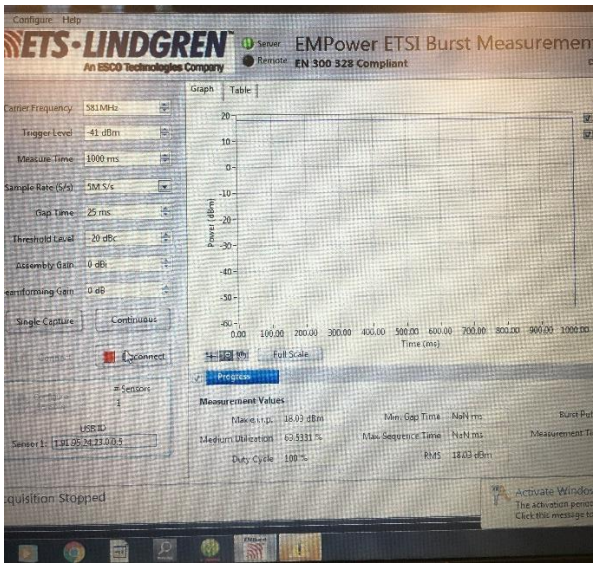
These values can be found in the document titled 'Carrier Power w ETS Power Meter (L23-045-36).xlsx' located at *\\shure.com\organization\Quality\Product Conformance-Lab Services\Global Compliance\Shure EMC Lab\Controlled Documents\Measurement Uncertainties.*

D.4. Test Setup and Instrumentation

Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.


Fox Valley Metrology
CH151-55272-435
By: A. Smith
ID: L23-040-03
Loc: N/A
Date: 05/31/2018
Due: 05/31/2020
Item ID: 46410-1059


L23-045-36



D.5. EUT Operation

The EUT was powered up and the transmit frequencies (572.125MHz, 584.125MHz, and 595.850MHz and J11: 596.125MHz, 606.150MHz, and 615.875MHz) were selected using the front panel controls.

D.6. Specific Test Procedures

a. The EUT's RF output was connected to an artificial antenna at ambient temperature.
b. The EUT's frequency was set at the first test frequency.
c. The power level was measured and recorded.
d. Steps b and c were repeated at the other test frequencies.
e. The cable loss and antenna gain were recorded and factored into the measured power data using the equation below:

$$EIRP = P_T - L_C + G_a$$

Where,

$EIRP$ (Effective Isotropic Radiated Power) = Output power of a signal when it is concentrated into a smaller area by the antenna

P_T = Output power of the transmitter (dBm)

L_C = Cable Loss (dB)

G_a = Antenna Gain (dBi)

D.7. Results

The results of the power output test can be seen below.

Unit#	Frequency (MHz)	Nominal Power (mW)	Measured Power (dBm)	Measured Power (mW)	Measured Power (mW EIRP)	FCC Limit (mW)	RSS Limit (mW EIRP)
RF Out1 **H11**	572.150	10	11.14	13.00	13.48	250	250
	584.125	10	10.79	11.99	12.35	250	250
	595.850	10	10.21	10.50	10.86	250	250

Unit#	Frequency (MHz)	Nominal Power (mW)	Measured Power (dBm)	Measured Power (mW)	Measured Power (mW EIRP)	FCC Limit (mW)	RSS Limit (mW EIRP)
RF Out1 **J11**	596.125	10	10.69	11.72	12.51	250	250
	606.150	10	10.00	10.00	10.79	250	250
	615.875	10	9.11	8.15	8.94	250	250

D.8. Conclusion

It was found that the BLX1 H11 and J11 bodypack transmitters passed the requirements of RSS 210.9 and FCC 74.861(e)(1)(ii).