



# SHURE

## ELECTROMAGNETIC COMPATIBILITY LABORATORY

### TEST REPORT

**TEST REPORT TITLE:** Electromagnetic Compatibility Tests of the Shure ULXD2 Digital Wireless Transmitter in the J50A Band (572MHz to 608MHz, and 614MHz to 616MHz)

**TEST ITEM DESCRIPTION:**

The Shure ULXD1 is a digital wireless microphone transmitter.

**For:** Shure Incorporated  
5800 West Touhy Avenue  
Niles, IL 60714

**Project ID Number:** SEL-043/ULXD2 J50A FCC74H

**Date Tested:** February 26 thru March 8, 2019

**Test Personnel:** Jamal Qureshi, Juan Castrejon, and Craig Kozokar

**Test Specification:**

FCC Part 74, Subpart H – Low Power Auxiliary Stations

FCC Title 47, Part 2.1051

IC RSS-GEN – General Requirements and Information for the Certification of Radio Apparatus

IC RSS-210 - License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

TEST REPORT BY:	<u>Craig Kozokar</u>	<u>Global Compliance Engineer</u>	<u>3-15-2019</u>
APPROVED BY:	<u>[Signature]</u>	<u>Engineer Project Managing, G.C.</u>	<u>3-15-2019</u>
	Signature	Position	Date



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**LIST OF APPENDICIES**

<b>APPENDIX</b>	<b>TEST DESCRIPTION</b>
A	Operating Bandwidth
B	Spurious Emissions
C	Maximum Rated Power
D	Frequency Tolerance



**REPORT REVISION HISTORY**

Revision	Date	Description
0	March 15, 2019	Initial release

**1. INTRODUCTION**

**1.1. Scope of Tests**

This report presents the results of testing per FCC Part 74H, Section 74.861(e)(1)(ii), Section 74.861(e)(4), Section 74.861(e)(5), Section 74.861(e)(7), FCC OET Basic Certification Requirements for Wireless Microphones, FCC Part 2.1051, RSS-Gen, and RSS-210. The following data was taken following the measurement method as described in the document section(s) listed on page 1 of this document. Provided is the data for the test sample. Also included is a summary of the measurements made and a description of the measurement setup. The test samples meet the requirements of the above standards. The equipment under test (EUT) contained a transmitter that was designed to transmit in the UHF TV frequency bands shown in Table 1.

Model	Band	Frequency (MHz)	Output Power (mW)
ULXD2	J50A	572 to 608	1, 10, 20
ULXD2	J50A	614 to 616	1, 10

**Table 1. EUT Frequencies and Power Levels**

**1.2. Purpose**

This series of testing was performed to determine if the test item would meet the requirements of FCC Part 74H, Section 74.861(e)(1)(ii), Section 74.861(e)(4), Section 74.861(e)(5), Section 74.861(e)(7), the FCC OET Basic Certification Requirements for Wireless Microphones, FCC Part 2.1051, RSS-Gen, and RSS-210.

**1.3 Deviations, Additions and Exclusions**

None

**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 Industry 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 (Table 2) were performed on the test item in accordance with ETSI specifications.

**Table 2. Summary of tests performed**

FCC Part 74H Test Spec	Description	EUT Firmware	Tested Frequency in MHz	Appendix	Test Results
74.861(e)(5)	Operation Bandwidth	2.2.24	572.000, 589.925, 607.875, 614.125, 615.875	A	Pass
74.861(e)(7)	Spurious Emissions	2.2.24	572.000, 589.925, 607.875, 614.125, 615.875	B	Pass
74.861(e)(1)(ii)	Maximum Rated Power	2.2.24	572.000, 589.925, 607.875, 614.125, 615.875	C	Pass
74.861(e)(4)	Frequency Tolerance	2.2.24	572.000, 589.925, 607.875, 614.125, 615.875	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 74H, Section 74.861(e)(1)(ii)

FCC Part 74H, Section 74.861(e)(4)

FCC Part 74H, Section 74.861(e)(5)

FCC Part 74H, Section 15.236(e)(7)

FCC Title 47, Chapter I, Subchapter A, Part 2 – Frequency Allocations and Radio Treaty Matters, General Rules and Regulations, Subpart J – Equipment Authorization Procedures

EN 300 422-1 V1.4.2 (2011-08), “Electromagnetic compatibility and Radio spectrum Matters (ERMM); Wireless Microphones in the 25 MHz to 3 GHz frequency range; Part 1: technical characteristics and methods of measurement”

ANSI C63.4 (2014), "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

“Federal Communications Commission  
Office of Engineering and Technology, Laboratory Division  
BASIC CERTIFICATION REQUIREMENTS FOR WIRELESS MICROPHONES”  
Dated December 13, 2017

RSS-Gen Issue 5, “General Requirements for Compliance of Radio Apparatus”

RSS-210 Issue 9, “Licence-Exempt Radio Apparatus: Category I Equipment”



### 3 EUT SET-UP AND OPERATION

#### 3.1. General Description

The test sample used was Shure ULXD1 digital wireless microphone transmitter. The EUT was arranged and tested per individual Appendices.

#### 3.2 Test Sample

The following product sample was tested:

**Table 3: Shure ULXD1 Digital Wireless Transmitter Sample**

Band	Serial Numbers
J50A	J5x PPR GC SAMPLE finalClips

#### 3.3 Operational Mode

The transmit frequency and output power modes shown in the individual appendices.

### 4. Test Instrumentation

A list of the test equipment used can be found in Table 10-1. All equipment used was within calibration during and throughout the duration of the tests. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

### 5. Procedure

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 of Tests:

The results are presented in Appendices. It was found that the EUT meets the requirements of FCC Part 74H, Section 74.861(e)(1)(ii), Section 74.861(e)(4), Section 74.861(e)(5), Section 74.861(e)(7), the FCC OET Basic Certification Requirements for Wireless Microphones, FCC 2,1051, RSS-Gen, and RSS-210.



**8. Conclusions:**

It was determined that the Shure ULXD2 Digital Wireless Microphone Transmitter did fully comply with the requirements of FCC Part 74H, Section 74.861(e)(1)(ii), Section 74.861(e)(4), Section 74.861(e)(5), Section 74.861(e)(7), the FCC OET Basic Certification Requirements for Wireless Microphones, FCC 2.1051, RSS-Gen, and RSS-210.

**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
L23-011-01	3 meter RF Chamber	ETS Lindgren	FACT-3	AJ640	25MHz - 18GHz	8/8/2016	8/8/2019
L23-011-02	Electric Powered Turntable	ETS Lindgren	2088	N/A	N/A	N/A	N/A
L23-011-08	Controller	EMCO	2090	29799	N/A	N/A	N/A
L23-011-09	Antenna Positioner	ETS Lindgren	2071-2	35500	N/A	N/A	N/A
L23-011-15	BiConiLog Antenna	ETS Lindgren	3142C	34790	25MHz-1GHz	6/22/2017	6/22/2019
L23-011-54	EMI Test Receiver	Rohde & Schwarz	ESR26	100220	9kHz-26GHz	11/28/2017	11/28/2019
L23-011-31	EMI/EMS Test Software	Rohde & Schwarz	EMC32	V 9.21.00	N/A	N/A	N/A
L23-011-53	Horn antenna with pre-amplifier	ETS Lindgren	3117-PA	200363	1GHz to 18 GHz	10/16/2017	4/27/2019
L23-011-41	Horn Antenna	ETS Lindgren	3117	123511	1GHz to 18 GHz	5/7/2017	5/7/2019
L23-011-56	High Pass Filter	K&L	11SH10-940/X10000-0/0	2	940MHz – 10GHz	10/18/2017	3/31/2019
L23-022-02	Spectrum Analyzer	Rohde & Schwarz	FSW26	103788	9kHz-26GHz	4-24-2018	4-24-2020
L23-022-01	Spectrum Analyzer	Rohde & Schwarz	FSU26	201043	9kHz-26GHz	8/23/2017	8/23/2019
L23-034-02	Temperature Hygrometer	Extech	445703	48254-65	N/A	5/2/2018	5/2/2019
L23-034-04	Temperature Hygrometer	Extech	445703	48254-13	N/A	5/2/2018	5/2/2019
L23-040-03	20dB Attenuator	MCL	BW-N20W5+	N/A	20MHz to 18GHz	5/31/2018	5/31/2020
L23-045-36	RF Power Sensor	ETS-Lindgren	7002-006	151071	10MHz to 6GHz	1-31-2018	1-31-2020
L23-024-01	Frequency Counter	Agilent	53220A	MY50006485	DC to 6GHz	11-27-2018	11-27-2020
L23-034-08	Thermometer	Extech	TM100	13018733	N/A	4-25-2018	04-25-2020
L19-006-01	Temperature Chamber	ESPEC	SU-240	910004211	N/A	4-5-2018	4-5-2019
L23-023-01	RF Signal Generator	Rohde & Schwarz	SMF100A	101553	20Hz to 26.5GHz	8/23/2017	8/23/2019

## OPERATING BANDWIDTH

### PURPOSE

This test was performed to determine if the EUT meets the operating bandwidth requirements of FCC Part 74 Section 74.861(e)(5) and EN 300 422-1, section 8.3.2., with the EUT operating at 572.000MHz, 589.875MHz, 607.875, 614.125, and 615.875MHz.

The testing results show the EUT meets FCC 74H Section 74.861(e)(5) and RSS-210, operating bandwidth does not exceed 200kHz.

### REQUIREMENTS

As stated in FCC 74H Section 74.861(e)(5), operating bandwidth shall not exceed 200kHz, and EN 300 422-1, section 8.3.2, the emission mask given in section 8.3.2.2 shall not be exceeded.

### TEST SETUP AND INSTRUMENTATION

A photograph of the test setup is shown in Figure A-1. The test instrumentation can be determined from Table 10-1.

### 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	$U_{LAB}$
Operating Bandwidth	$\pm 0.130 \%$

$U_{lab}$  = Determined for Shure EMC Laboratory

Since  $U_{LAB}$  is less than or equal to  $U_{ETSI}$ :

- 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.

### EUT OPERATION

The EUT was powered up and the transmit frequency and power output of the EUT were selected. The EUT was checked for proper operation after it was setup for the test. Testing was conducted with the EUT set to transmit at 572.000MHz, 589.925MHz, 607.875, at an output power level of 1mW and 20mW, except 614.125 and 615.875 which will have the power level of 1mW and 10mW. The transmitter was modulated per EN300422-1 V1.4.2 (2011-08), clause 7.1.2.

**Appendix A**

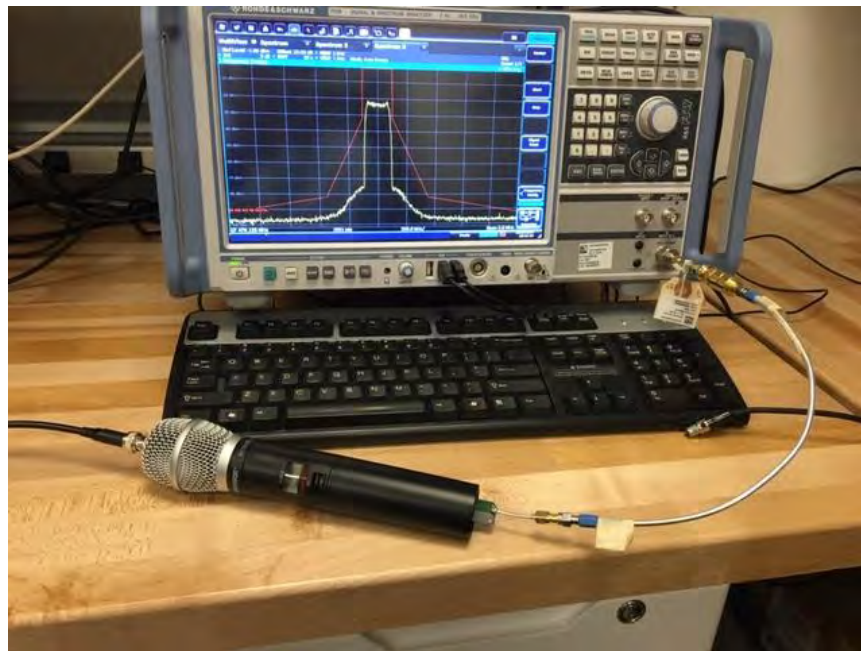
**TEST PROCEDURE**

The test procedure followed is shown in EN300422-1 V1.4.2 (2011-08), section 8.3.2.

**RESULTS**

The necessary bandwidth data is presented on pages 12 and 26. Data is shown on the figures for each transmitter. The figure shows the maximum relative level within the emission mask with modulation. As shown by the test data, the necessary bandwidth of the EUT meets the requirements of EN 300 422-1, section 8.3.2. The RSS-Gen maximum ISED Canada 99% bandwidth measurement was 163 kHz.

The temperature during the testing was 74 degrees F, with relative humidity of 17%.

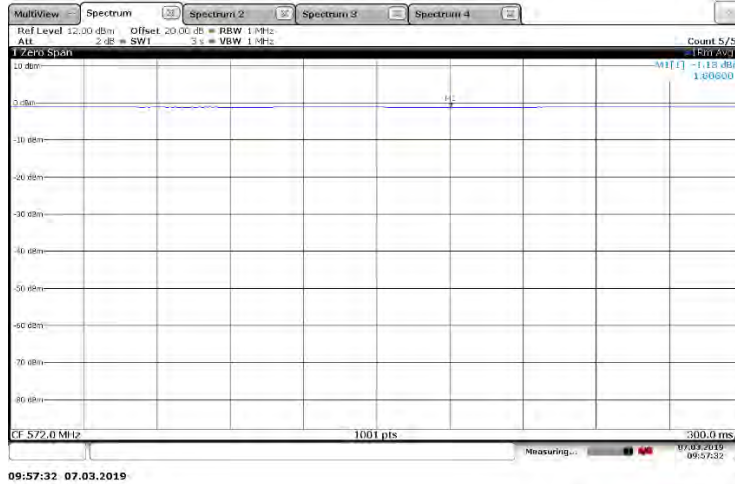


**Figure A-1 - Test Setup for Necessary Bandwidth**

Appendix A

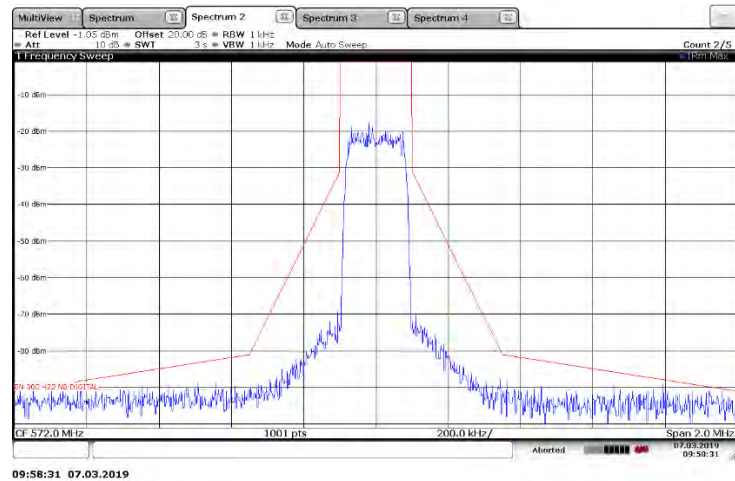
**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: Low Band, Low Frequency, 572.000MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
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 Comment: 8.3.2.1: Step 2;Maximum Relative Level  
 Date Tested: Test on March 7, 2019

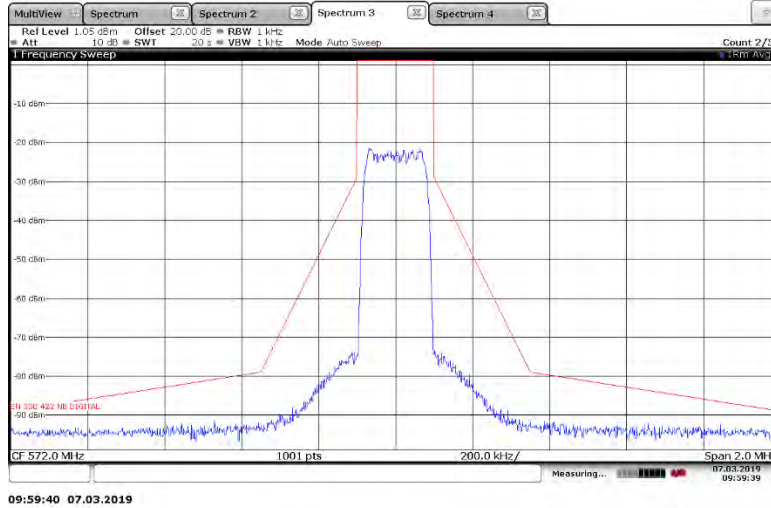




Appendix A

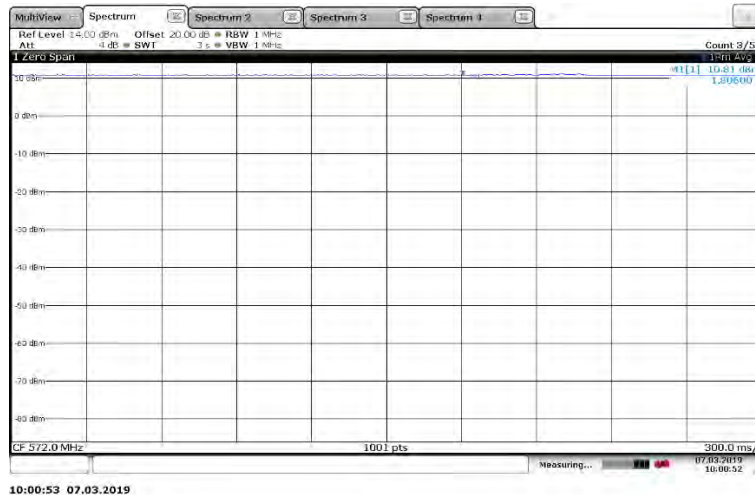
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 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: Low Band, Low Frequency, 572.000MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 3; Lower and upper frequency transmitter band  
 Wide band noise floor  
 Date Tested: Test on March 7, 2019



Test Information

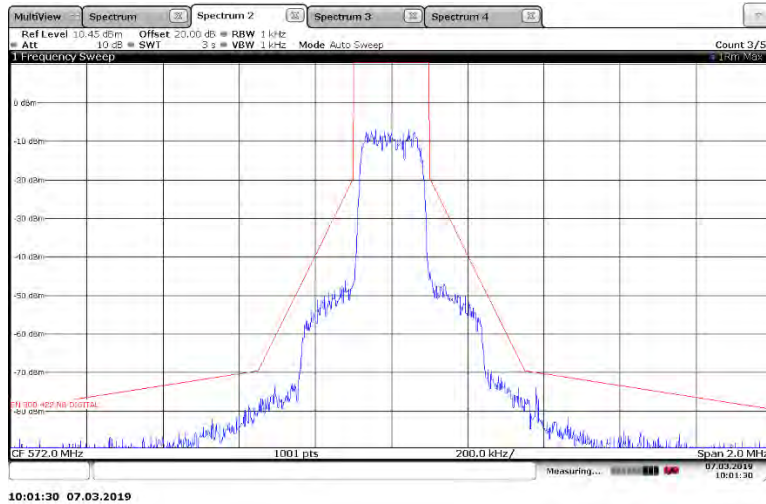
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 Operating Conditions: Low Band, Low Frequency, 572.000MHz, 20mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



Appendix A

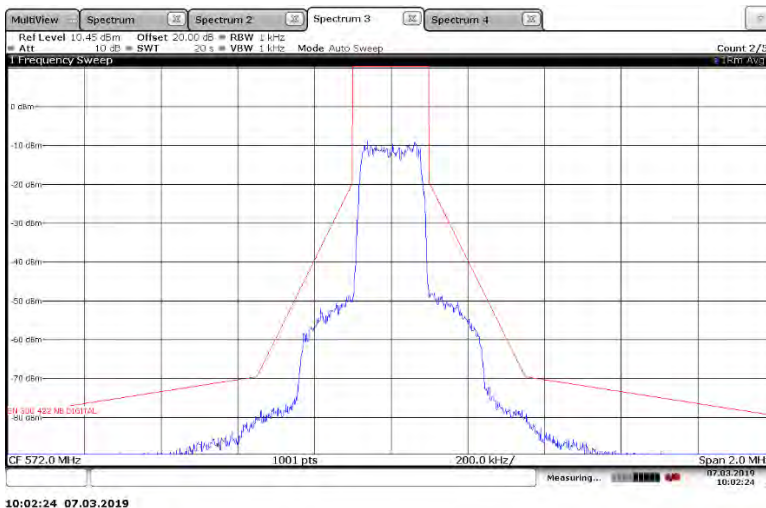
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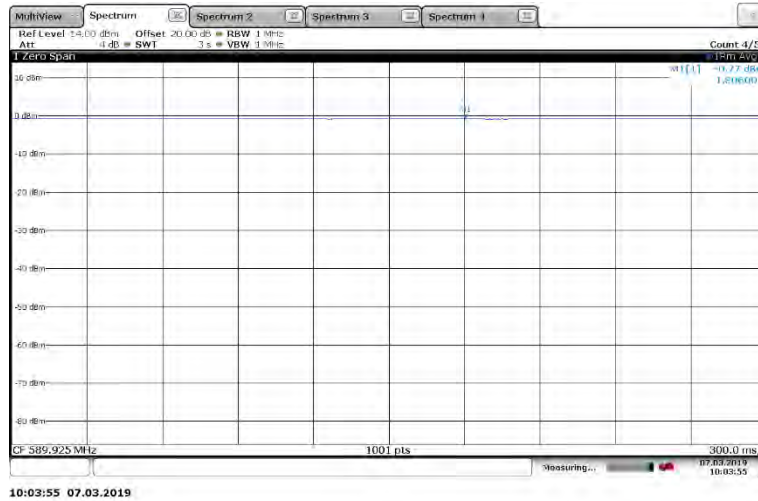
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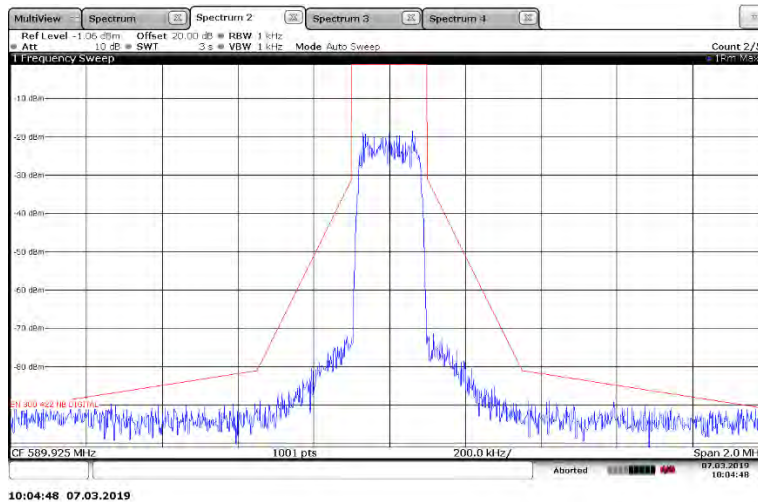
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 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: Low Band, Middle Frequency, 589.925MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: Low Band, Middle Frequency, 589.925MHz, 1mW  
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 Date Tested: Test on March 7, 2019

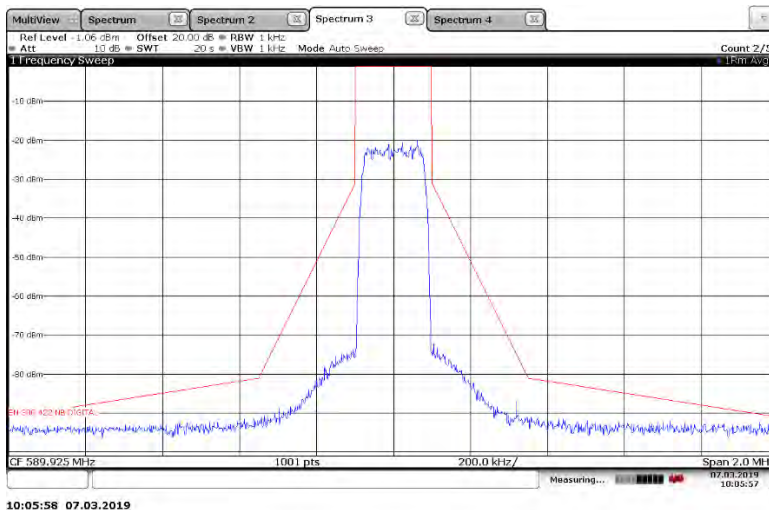




Appendix A

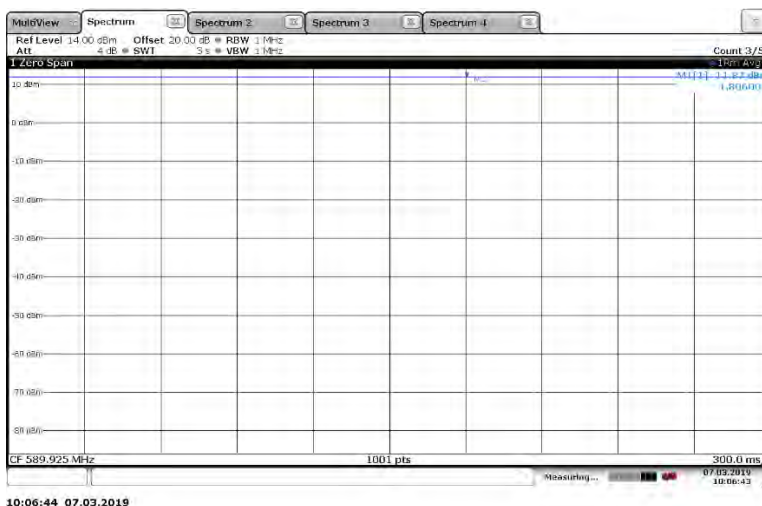
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 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: Low Band, Middle Frequency, 589.925MHz, 1mW  
 Operator Name: Craig Kozokar  
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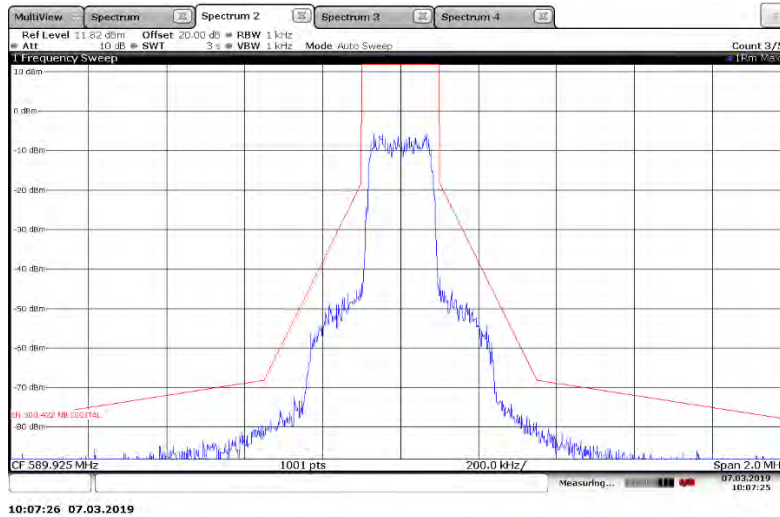




Appendix A

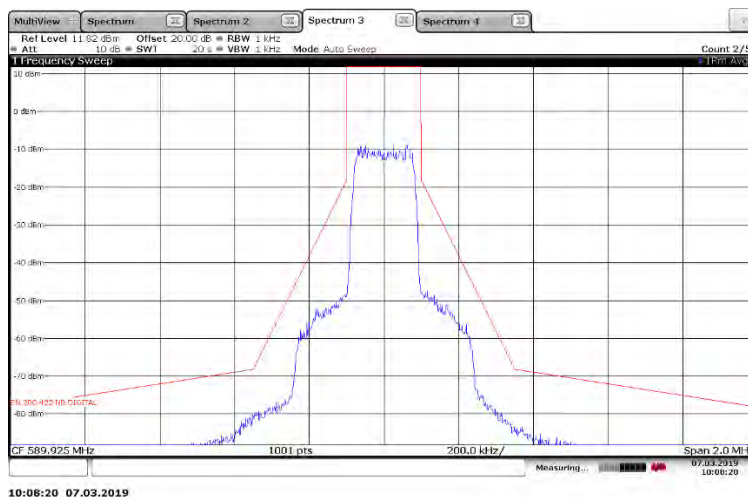
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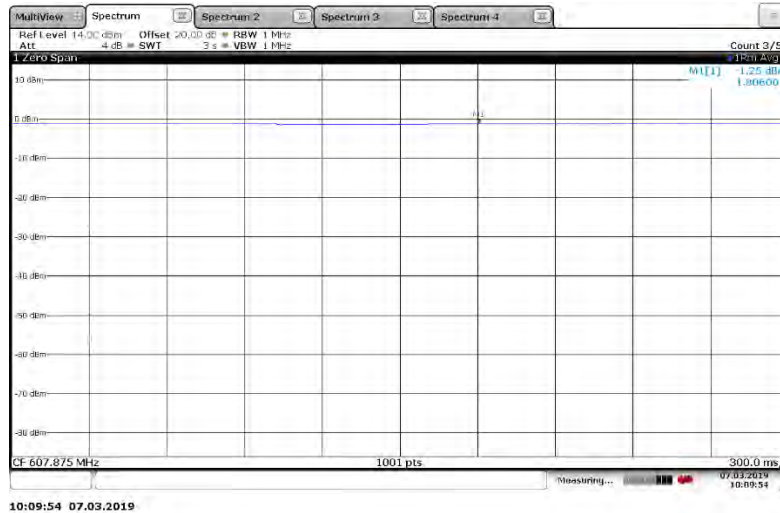
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 Comment: 8.3.2.1: Step 3;Lower and upper frequency transmitter band Wide band noise floor  
 Date Tested: Test on March 7, 2019



Appendix A

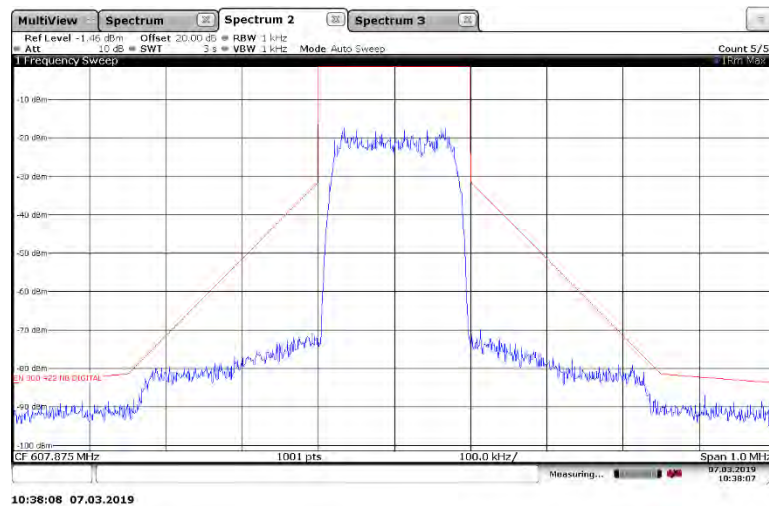
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 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: Low Band, High Frequency, 607.875MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



Test Information

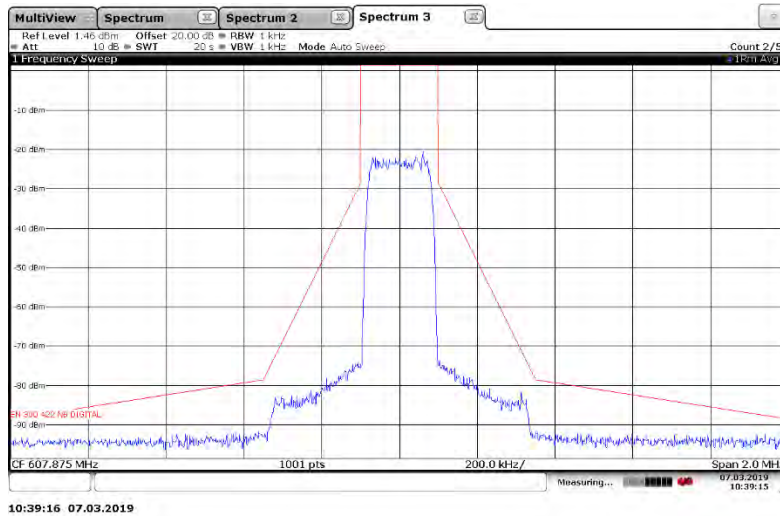
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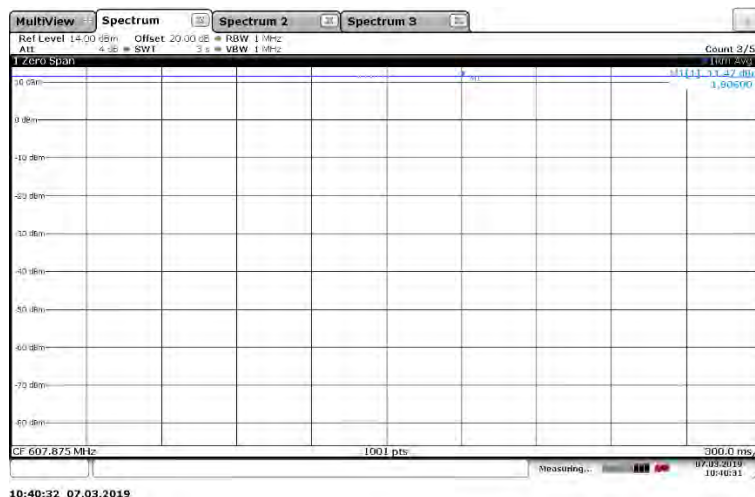
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 Operator Name: Craig Kozokar  
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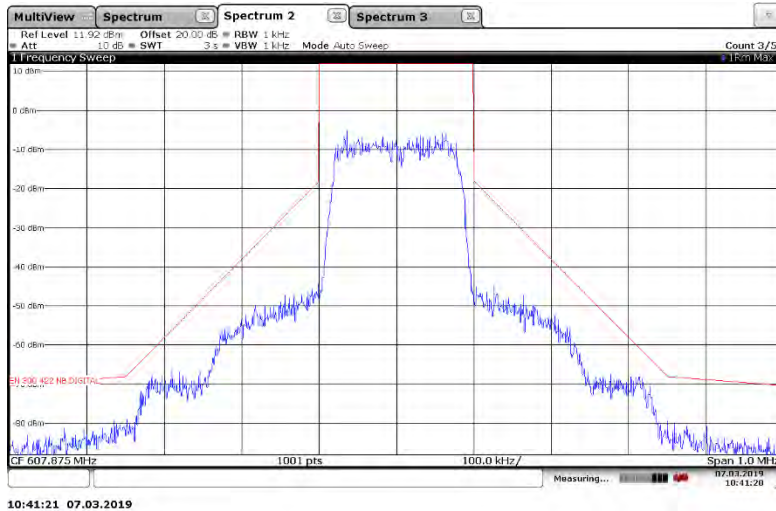
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 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
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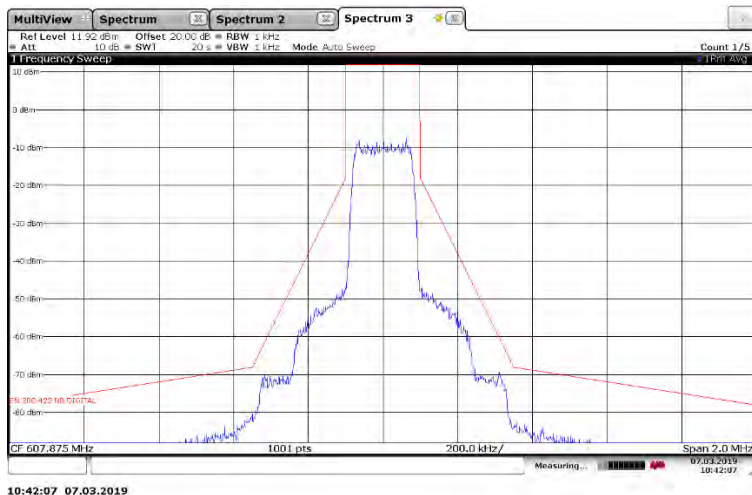
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 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 2;Maximum Relative Level  
 Date Tested: Test on March 7, 2019



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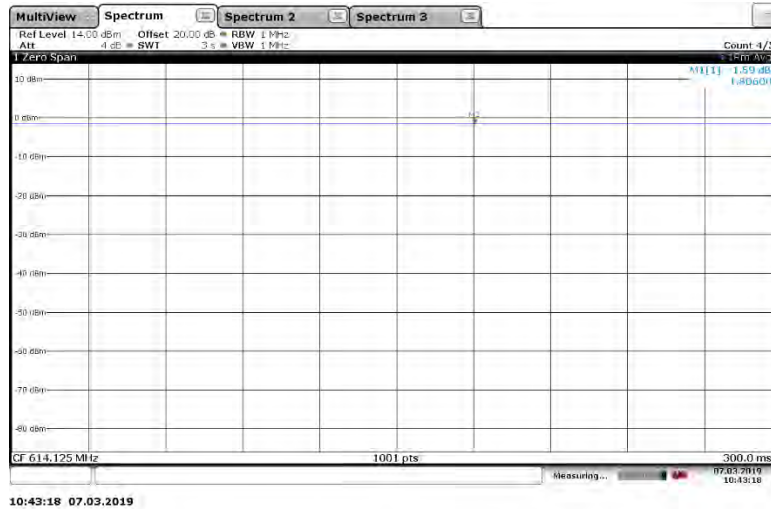
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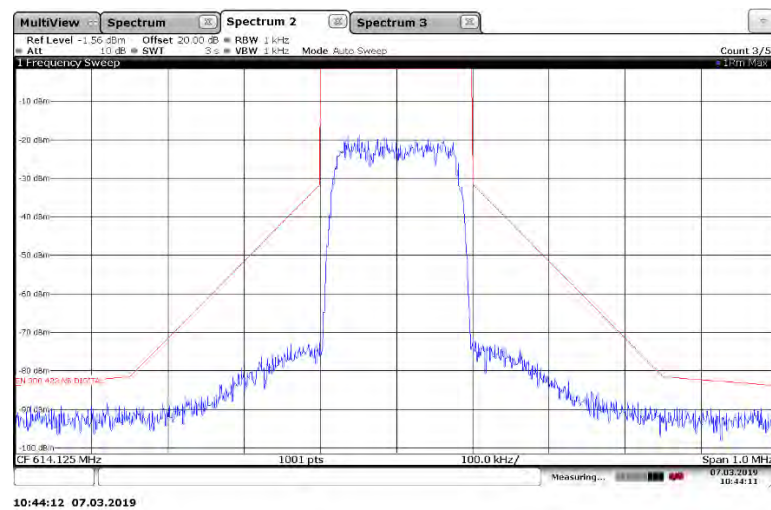
Test Information

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 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, Low Frequency, 614.125MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



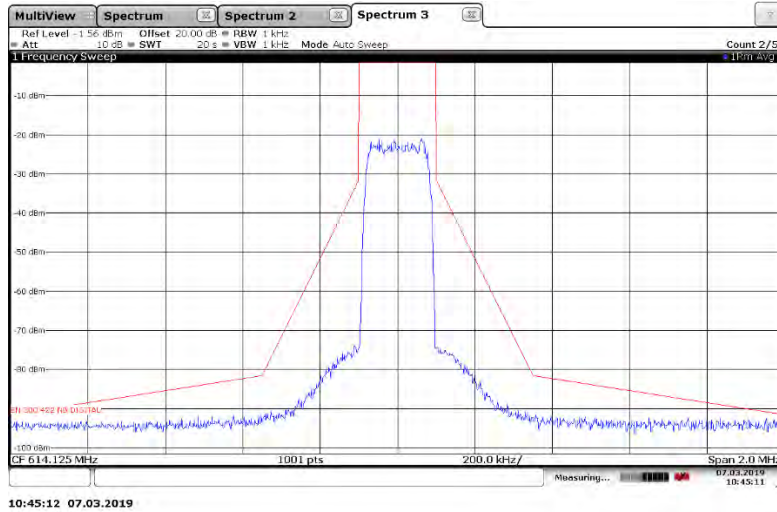
Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, Low Frequency, 614.125MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 2;Maximum Relative Level  
 Date Tested: Test on March 7, 2019



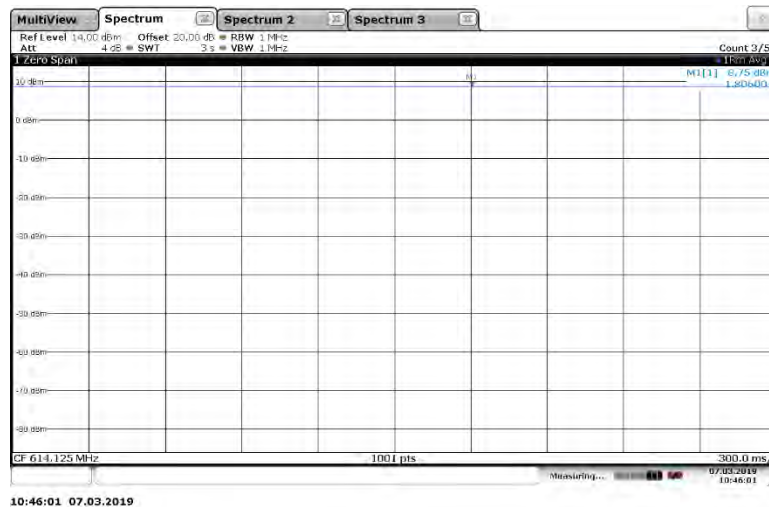
**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, Low Frequency, 614.875MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 3; Lower and upper frequency transmitter band  
 Wide band noise floor  
 Date Tested: Test on March 7, 2019



**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, Low Frequency, 614.125MHz, 10mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019

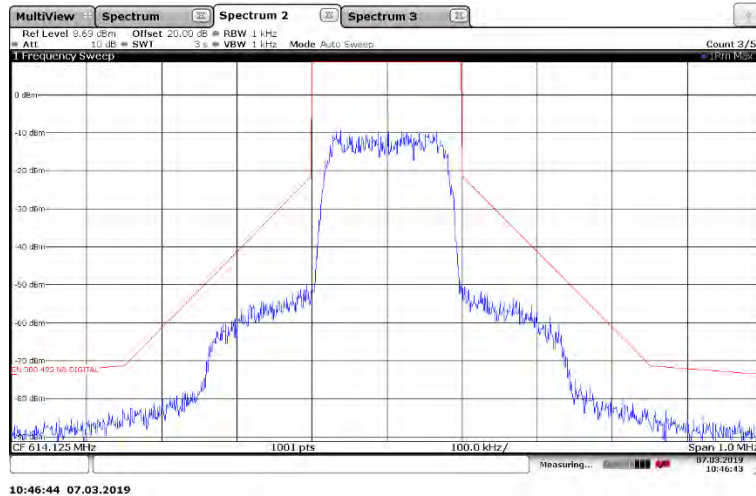




Appendix A

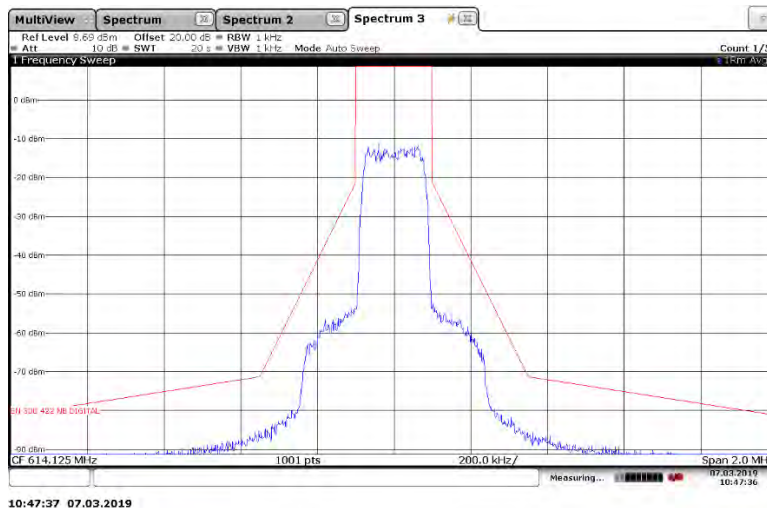
**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, Low Frequency, 614.125MHz, 10mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 2;Maximum Relative Level  
 Date Tested: Test on March 7, 2019



**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, Low Frequency, 614.125MHz, 10mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 3;Lower and upper frequency transmitter band  
 Wide band noise floor  
 Date Tested: Test on March 7, 2019

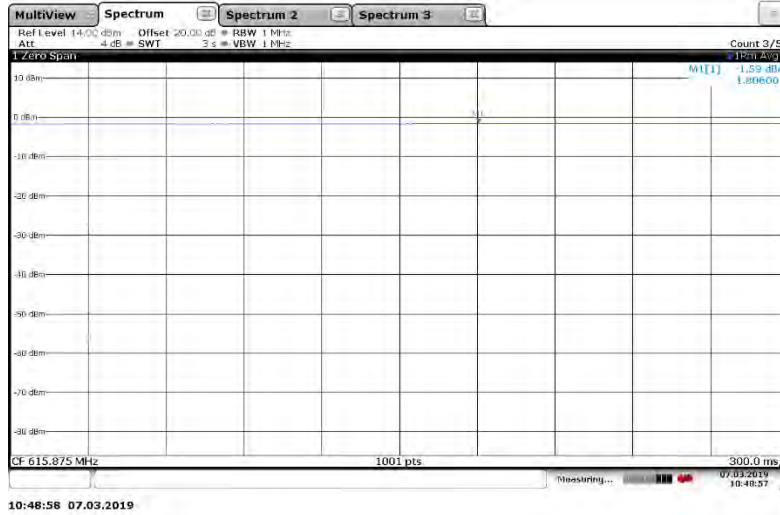




Appendix A

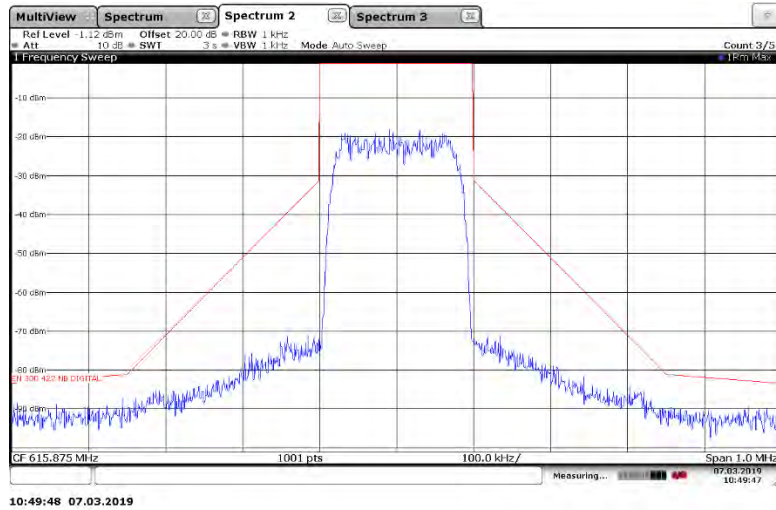
Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, High Frequency, 615.875MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



Test Information

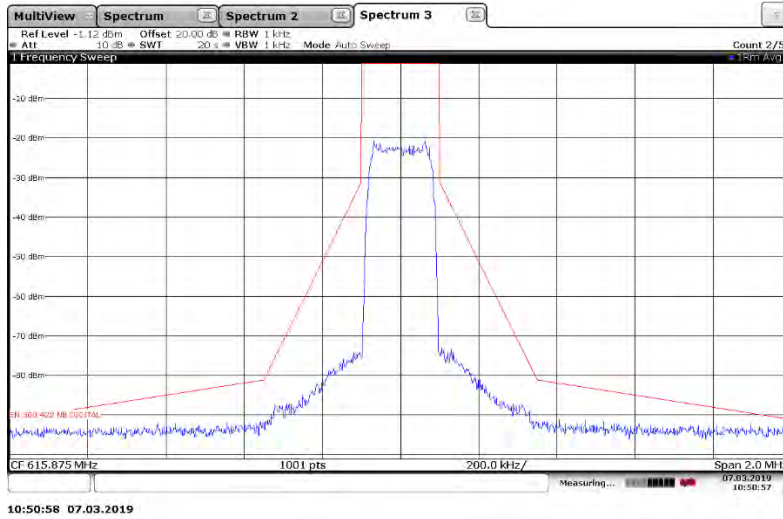
EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, High Frequency, 615.875MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 2;Maximum Relative Level  
 Date Tested: Test on March 7, 2019





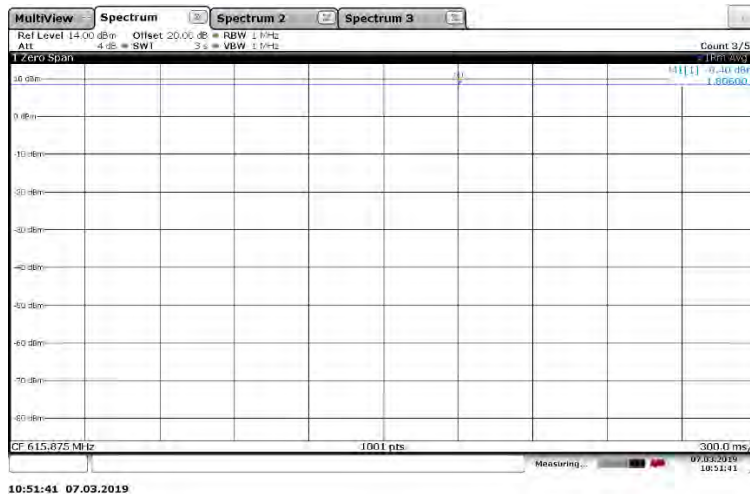
**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, High Frequency, 615.875MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 3; Lower and upper frequency transmitter band  
 Wide band noise floor  
 Date Tested: Test on March 7, 2019



**Test Information**

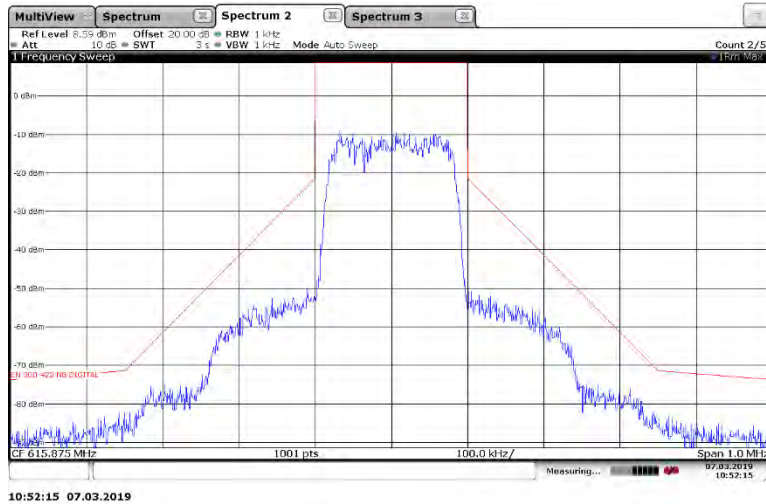
EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, High Frequency, 615.875MHz, 10mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 1; Carrier Power  
 Date Tested: Tested on March 7, 2019



Appendix A

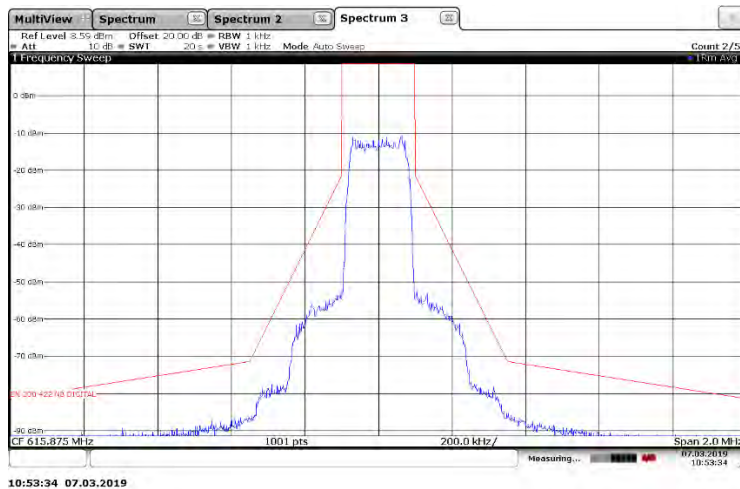
Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, High Frequency, 615.875MHz, 10mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 2;Maximum Relative Level  
 Date Tested: Test on March 7, 2019



Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: EN 300 422 Digital Necessary Bandwidth  
 Operating Conditions: High Band, High Frequency, 615.875MHz, 10mW  
 Operator Name: Craig Kozokar  
 Comment: 8.3.2.1: Step 3;Lower and upper frequency transmitter band  
 Wide band noise floor  
 Date Tested: Test on March 7, 2019





## Spurious Emissions

### Purpose:

This test performed to determine if the EUT meets the radiated RF emission requirements of the FCC Part 74H Section 74.861(e)(7) and FCC OET Basic Certification Requirements for Wireless Microphones over the frequency range from 30MHz to 7GHz. An Average detector was used for the measurements.

### Requirements:

As stated in FCC 74H section 74.861(e)(7), the FCC OET Basic Certification Requirements For Wireless Microphones, and RSS-210 Annex G, Compliance for spurious emission requirements shall be demonstrated using the applicable measurement procedures of ETSI EN 300 422-1. Compliance with the emission limits shall be demonstrated using a RMS Average detector. Both the FCC Part 74H and RSS-210 require Emissions shall be investigated up to the 10<sup>th</sup> harmonic of the fundamental.

### 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 <sub>lab</sub>	U <sub>ETSI</sub>
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.24 dB	6.00 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 13 GHz)	4.56 dB	6.00 dB

U<sub>lab</sub> = Determined for Shure EMC Laboratory

U<sub>ETSI</sub> = From ETSI EN 300 422-1 Table 10

Since U<sub>lab</sub> is less than or equal to U<sub>ETSI</sub>:

- 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.

### Test Setup and Instrumentation:

A Shure model KSM8 microphone head was connected to the EUT. Photographs of the test setup are shown in Figure B 1 and Figure B 2. The test instrumentation can be determined from Table 10-1.

### EUT Operation:

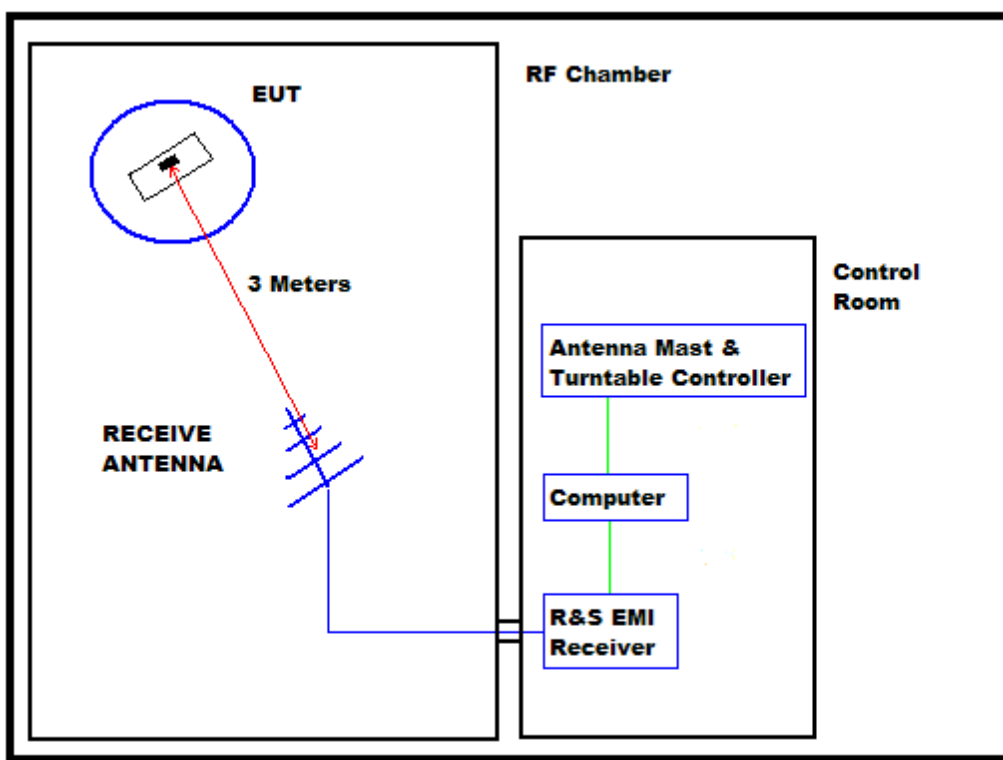
The EUT was powered up and the frequency of the transmitter was selected using the front panel controls. The EUT was checked for proper operation after it was setup on the test table. For radiated spurious emissions the testing was performed with the EUT set to the Low Band, 572.000, 589.925, 607.875, with RF power output of 1mW and 20mW, and the High Band, 614.125 and 615.875, with RF power output of 1mW and 10mW.

**Appendix B**

**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. With the EUT at one set position and the measurement antenna at a set height (i.e. without maximizing), the radiated emissions were measured using a peak detector and automatically plotted. The BiConiLog measuring antenna was positioned at a 3 meter distance from the EUT for below 1GHz testing, and a double ridged waveguide antenna above 1GHz testing.

## Appendix B

All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a BiConiLog antenna over the frequency range of 30 MHz to 1 GHz, and a double ridged waveguide antenna over the frequency range of 1 GHz to 7 GHz.

To ensure that maximum 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 antennas are linearly polarized, both horizontal and vertical field components were measured.
- iii. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, another antenna was set in place of the EUT and connected to a calibrated signal generator. (A tuned dipole was used for all measurements below 1GHz and a double ridged waveguide antenna was used for all measurements above 1GHz.) The output of the signal generator was adjusted to match the received level at the EMI receiver. The signal level was recorded. The reading was corrected to compensate for cable loss and antenna gain.

### Results:

The plots of the peak preliminary radiated voltage levels in the graphs on page 30 thru page 39. The ERP measurements are shown on pages 40 thru page 44. All emissions measured from the EUT were within the ETSI EN 300 422-1 specification limits.

The temperature during the testing in the RF Chamber was 73 degrees F, with relative humidity of 17%.



Figure B 1: ULXD2 Transmitter Test Setup

Figure B 2: ULXD2 Transmitter Test Setup

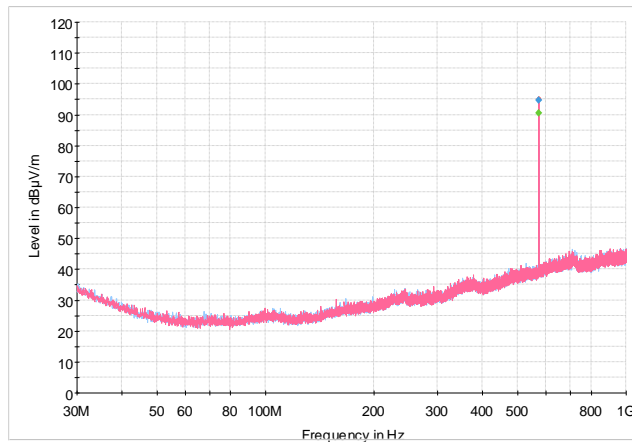


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, Low Frequency, 572.000MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 27, 2019

Full Spectrum

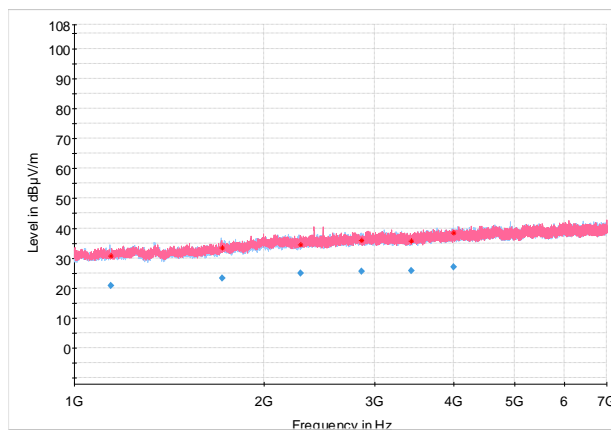


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, Low Frequency, 572.000MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 26, 2019

Full Spectrum



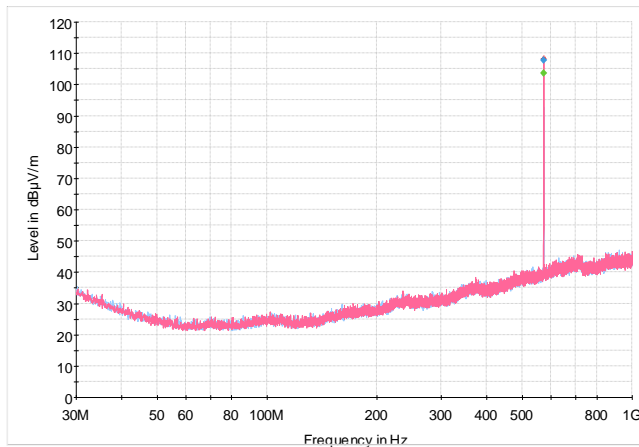


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description: FCC 74H Radiated Emissions 30MHz - 1GHz  
EUT: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Operating Frequency: Low Band, Low Frequency, 572.000MHz  
RF Power Level: 20mW  
Tester Name: Jamal Qureshi  
Date Tested: Tested on February 27, 2019

Full Spectrum

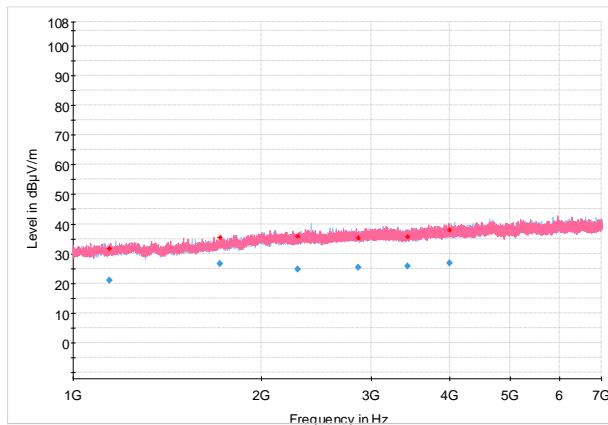


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description: FCC 74H Radiated Emissions 1GHz - 7GHz  
EUT: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Operating Frequency: Low Band, Low Frequency, 572.000MHz  
RF Power Level: 20mW  
Tester Name: Jamal Qureshi  
Date Tested: Tested on February 26, 2019

Full Spectrum

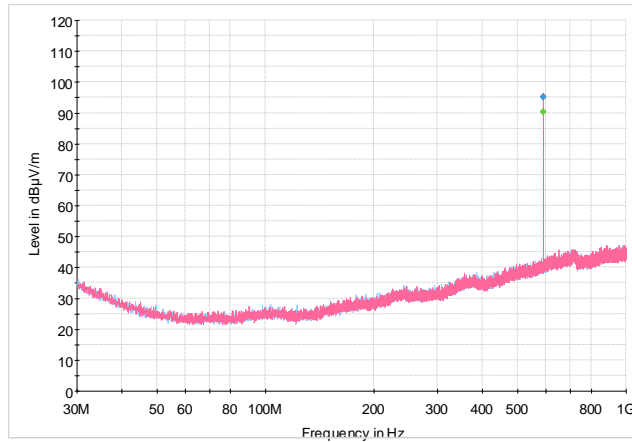


**SHURE Radiated RF Emissions Test Report**

**Common Information**

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, Middle Frequency, 589.925MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 28, 2019

Full Spectrum

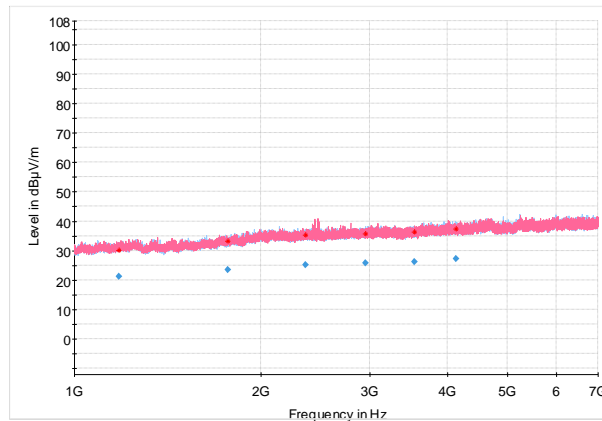


**SHURE Radiated RF Emissions Test Report**

**Common Information**

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, Middle Frequency, 589.925MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 26, 2019

Full Spectrum





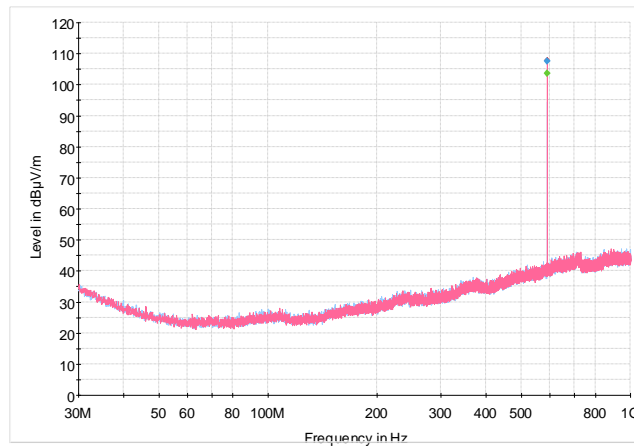


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, Middle Frequency, 589.925MHz
RF Power Level	20mW
Tester Name	Jamal Qureshi
Date Tested	Tested on February 28, 2019

Full Spectrum

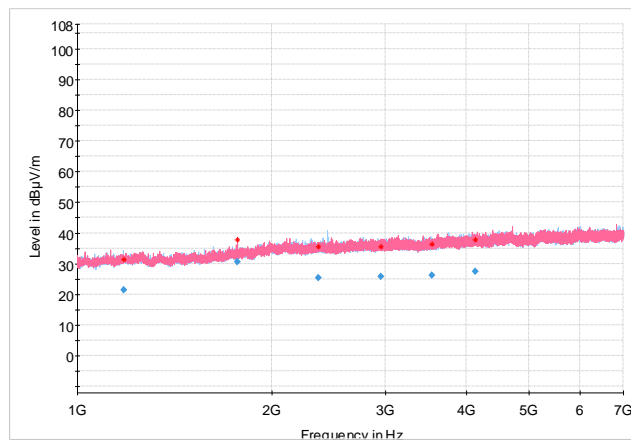


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, Middle Frequency, 589.925MHz
RF Power Level	20mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 26, 2019

Full Spectrum

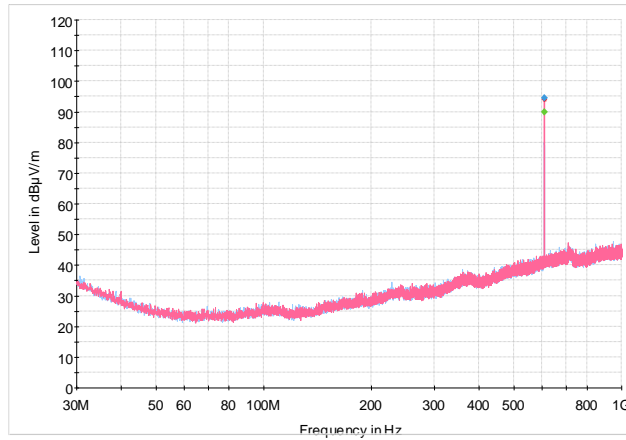


**SHURE Radiated RF Emissions Test Report**

**Common Information**

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, High Frequency, 607.875MHz
RF Power Level	1mW
Tester Name	Jamal Qureshi
Date Tested	Tested on February 28, 2019

Full Spectrum

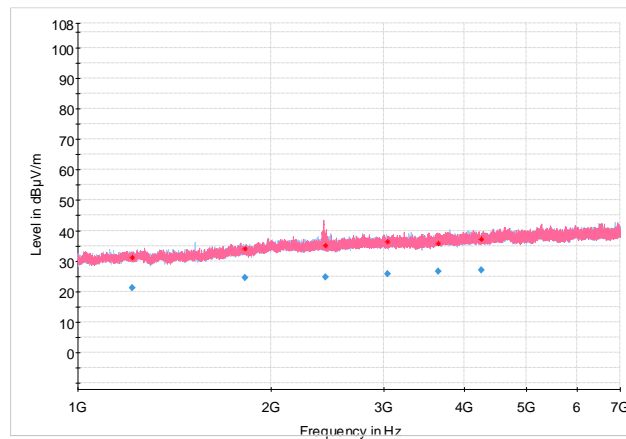


**SHURE Radiated RF Emissions Test Report**

**Common Information**

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, High Frequency, 607.875MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 26, 2019

Full Spectrum



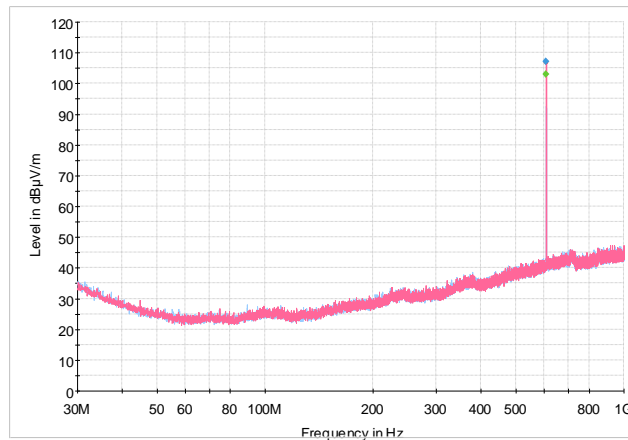


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, High Frequency, 607.875MHz
RF Power Level	20mW
Tester Name	Jamal Qureshi
Date Tested	Tested on February 28, 2019

Full Spectrum

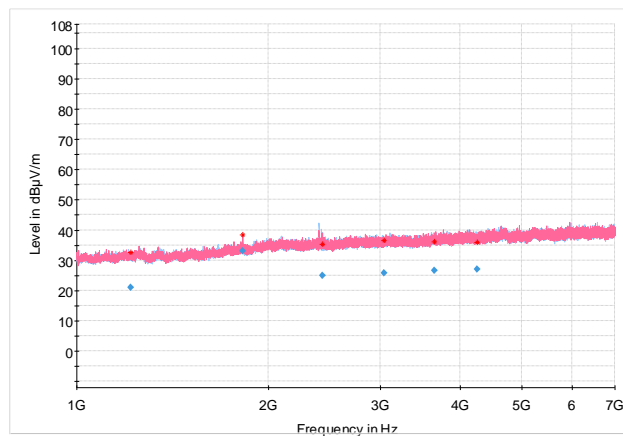


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	Low Band, High Frequency, 607.875MHz
RF Power Level	20mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 26, 2019

Full Spectrum



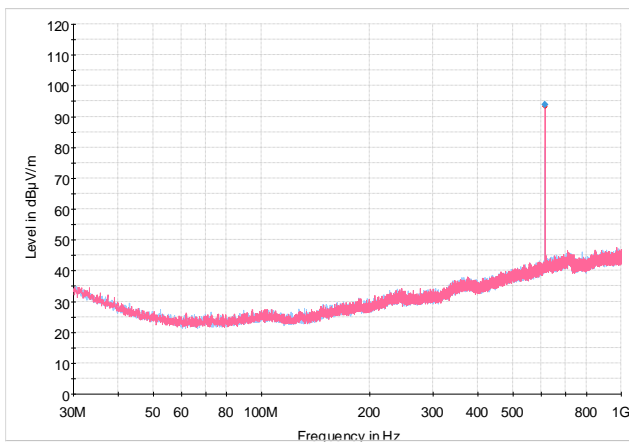


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, Low Frequency, 614.125MHz
RF Power Level	1mW
Tester Name	Jamal Qureshi
Date Tested	Tested on February 28, 2019

Full Spectrum

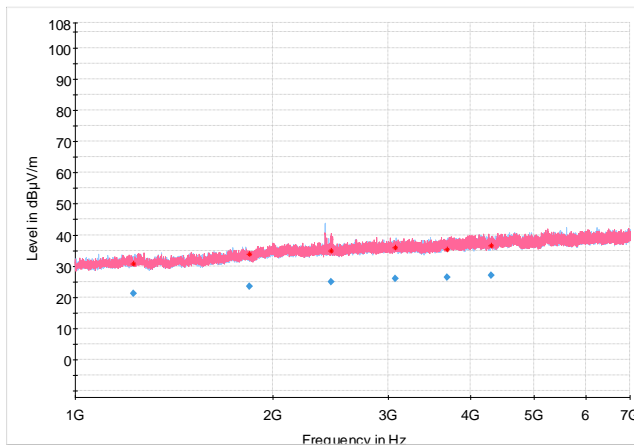


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, Low Frequency, 614.125MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on February 26, 2019

Full Spectrum



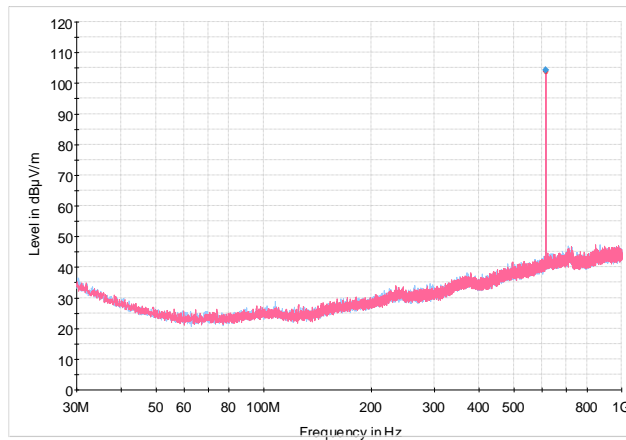


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, Low Frequency, 614.125MHz
RF Power Level	10mW
Tester Name	Jamal Qureshi
Date Tested	Tested on March 7, 2019

Full Spectrum

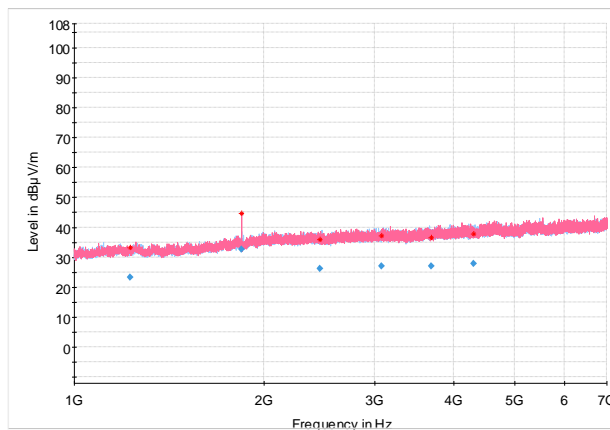


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, Low Frequency, 614.125MHz
RF Power Level	10mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on March 7, 2019

Full Spectrum

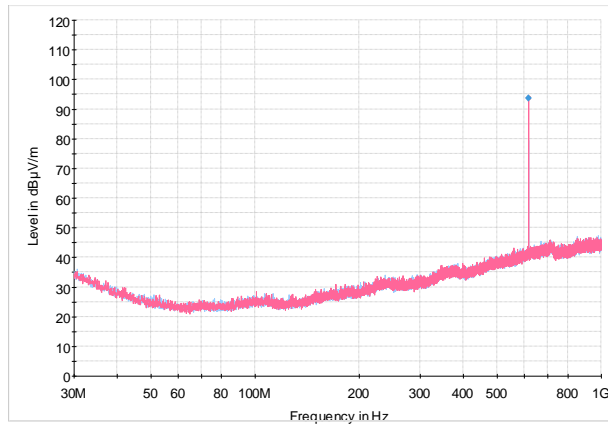


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, High Frequency, 615.875MHz
RF Power Level	1mW
Tester Name	Jamal Qureshi
Date Tested	Tested on February 28, 2019

Full Spectrum

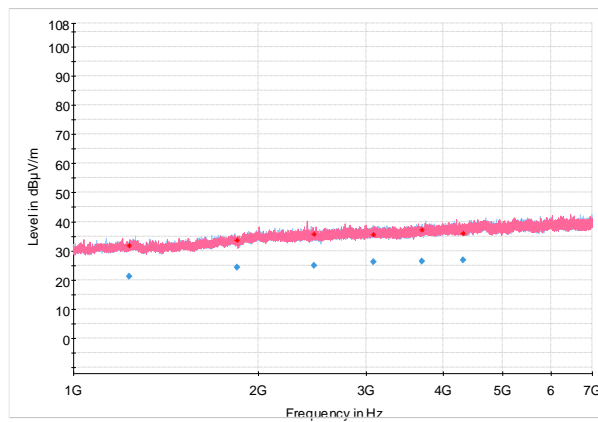


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, High Frequency, 615.875MHz
RF Power Level	1mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on March 4, 2019

Full Spectrum



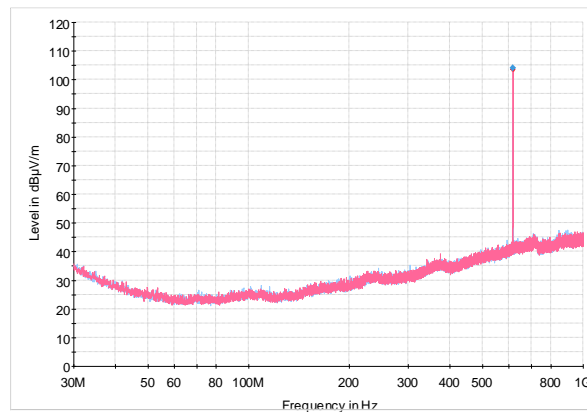


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 30MHz - 1GHz
EUT	ULXD2 J50A
Serial Number	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, High Frequency, 615.875MHz
RF Power Level	10mW
Tester Name	Jamal Qureshi
Date Tested	Tested on March 7, 2019

Full Spectrum

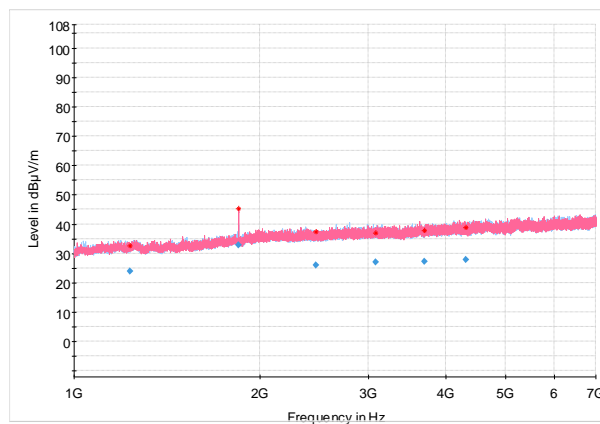


### SHURE Radiated RF Emissions Test Report

#### Common Information

Test Description:	FCC 74H Radiated Emissions 1GHz - 7GHz
EUT:	ULXD2 J50A
Serial Number:	J5x PPR GC SAMPLE finalClips
Operating Frequency:	High Band, High Frequency, 615.875MHz
RF Power Level	10mW
Tester Name:	Jamal Qureshi
Date Tested	Tested on March 7, 2019

Full Spectrum





**Appendix B**

Date: March 4, 2019  
 EUT: ULXD2  
 Band: J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Specification: EN 300 422-1, Spurious Radiated Emissions  
 Comments: Test Distance is 3 meters  
 Mode: EUT set to Low Band, Low Frequency, 572.000MHz, 1mW  
 Tested By: Jamal Qureshi

T

Frequency in MHz	Detector Used	Antenna Polarity	Measured Level in dBuV	Matched Sig. Gen. Reading in dBm	Antenna Gain in dB	Cable Loss in dB	ERP Total in dBm	ETSI Limit in dBm
572.000	QP	V	94.57	-1.33	0.00	2.75		
1144.000	Average	V	21.49	-90.0	3.43	3.57	-90.14	-30
1716.000	Average	V	24.02	-90.0	5.55	4.20	-88.65	-30
2288.000	Average	V	25.61	-90.0	5.61	4.72	-89.11	-30
2860.000	Average	V	26.43	-90.0	6.89	5.07	-88.18	-30
3432.000	Average	V	26.59	-90.0	8.15	5.47	-87.32	-30
4004.000	Average	V	27.81	-90.0	8.86	6.29	-87.43	-30

otal (dBm) = Matched Signal. Generator Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

Date: March 4, 2019  
 EUT: ULXD2  
 Band: J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Specification: EN 300 422-1, Spurious Radiated Emissions  
 Comments: Test Distance is 3 meters  
 Mode: EUT set to Low Band, Low Frequency, 572.000MHz, 20mW  
 Tested By: Jamal Qureshi

Frequency in MHz	Detector Used	Antenna Polarity	Measured Level in dBuV	Matched Sig. Gen. Reading in dBm	Antenna Gain in dB	Cable Loss in dB	ERP Total in dBm	ETSI Limit in dBm
572.000	QP	V	107.66	11.7	0.00	2.75		
1144.000	Average	V	21.48	-90.0	3.43	3.57	-90.14	-30
1716.000	Average	V	26.55	-72.0	5.55	4.20	-70.61	-30
2288.000	Average	V	25.61	-90.0	5.61	4.72	-89.11	-30
2860.000	Average	V	26.43	-90.0	6.89	5.07	-88.18	-30
3432.000	Average	V	26.59	-90.0	8.15	5.47	-87.32	-30
4004.000	Average	V	27.81	-90.0	8.86	6.29	-87.43	-30

Total (dBm) = Matched Signal. Generator Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)





**Appendix B**

Date: March 4, 2019  
 EUT: ULXD2  
 Band: J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Specification: EN 300 422-1, Spurious Radiated Emissions  
 Comments: Test Distance is 3 meters  
 Mode: EUT set to Low Band, Middle Frequency, 589.925MHz, 1mW  
 Tested By: Jamal Qureshi

Frequency in MHz	Detector Used	Antenna Polarity	Measured Level in dBuV	Matched Sig. Gen. Reading in dBm	Antenna Gain in dB	Cable Loss in dB	ERP Total in dBm	ETSI Limit in dBm
589.925	QP	V	95.01	-1.30	0.00	2.76		
1179.850	Average	V	22.19	-90.0	3.56	3.66	-90.10	-30
1769.775	Average	V	23.64	-90.0	5.26	4.24	-88.98	-30
2359.700	Average	V	26.08	-88.8	5.70	4.75	-87.89	-30
2949.625	Average	V	26.66	-90.0	6.97	5.20	-88.23	-30
3539.550	Average	V	27.00	-90.0	8.23	5.56	-87.33	-30
4129.475	Average	V	28.21	-90.0	9.19	6.16	-86.97	-30

Total (dBm) = Matched Signal. Generator Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

Date: March 4, 2019  
 EUT: ULXD2  
 Band: J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Specification: EN 300 422-1, Spurious Radiated Emissions  
 Comments: Test Distance is 3 meters  
 Mode: EUT set to Low Band, Middle Frequency, 589.925MHz, 20mW  
 Tested By: Jamal Qureshi

Frequency in MHz	Detector Used	Antenna Polarity	Measured Level in dBuV	Matched Sig. Gen. Reading in dBm	Antenna Gain in dB	Cable Loss in dB	ERP Total in dBm	ETSI Limit in dBm
589.925	QP	V	107.64	11.35	0.00	2.76		
1179.850	Average	V	22.18	-90.0	3.56	3.66	-90.10	-30
1769.775	Average	V	30.56	-65.4	5.26	4.24	-64.39	-30
2359.700	Average	V	26.07	-90.0	5.70	4.75	-89.05	-30
2949.625	Average	V	26.66	-90.0	6.97	5.20	-88.23	-30
3539.550	Average	V	27.00	-90.0	8.23	5.56	-87.33	-30
4129.475	Average	V	28.20	-90.0	9.19	6.16	-86.97	-30

Total (dBm) = Matched Signal. Generator Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)







**Appendix B**

Date: March 4, 2019  
 EUT: ULXD2  
 Band: J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Specification: EN 300 422-1, Spurious Radiated Emissions  
 Comments: Test Distance is 3 meters  
 Mode: EUT set to High Band, High Frequency, 615.875MHz, 1mW  
 Tested By: Jamal Qureshi

Frequency in MHz	Detector Used	Antenna Polarity	Measured Level in dBuV	Matched Sig. Gen. Reading in dBm	Antenna Gain in dB	Cable Loss in dB	ERP Total in dBm	ETSI Limit in dBm
615.875	QP	V	93.62	-3.42	0.00	2.84		
1231.750	Average	V	22.33	-90.0	3.54	3.66	-90.12	-30
1847.625	Average	V	24.33	-62.4	5.13	4.29	-61.59	-30
2463.500	Average	V	25.91	-90.0	5.90	4.85	-88.95	-30
3079.375	Average	V	27.12	-90.0	7.13	5.24	-88.11	-30
3695.250	Average	V	27.31	-90.0	8.33	5.90	-87.57	-30
4311.125	Average	V	27.92	-90.0	9.48	6.65	-87.17	-30

Total (dBm) = Matched Signal. Generator Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

Date: March 7, 2019  
 EUT: ULXD2  
 Band: J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Specification: EN 300 422-1, Spurious Radiated Emissions  
 Comments: Test Distance is 3 meters  
 Mode: EUT set to High Band, High Frequency, 615.875MHz, 10mW  
 Tested By: Jamal Qureshi

Frequency in MHz	Detector Used	Antenna Polarity	Measured Level in dBuV	Matched Sig. Gen. Reading in dBm	Antenna Gain in dB	Cable Loss in dB	ERP Total in dBm	ETSI Limit in dBm
615.875	QP	V	103.98	6.50	0.00	2.84		
1231.750	Average	V	23.90	-70.7	3.54	3.66	-70.78	-30
1847.625	Average	V	32.92	-56.7	5.13	4.29	-55.85	-30
2463.500	Average	V	26.01	-70.6	5.90	4.85	-69.58	-30
3079.375	Average	V	26.94	-69.8	7.13	5.24	-67.86	-30
3695.250	Average	V	27.15	-68.2	8.33	5.90	-65.75	-30
4311.125	Average	V	27.80	-67.8	9.48	6.65	-65.00	-30



## Appendix C

**Maximum Conducted Power****Purpose:**

This test performed to determine if the EUT meets the Maximum Conducted Power requirements of the FCC Part 74H, Section 74.861(e)(1)(ii), the FCC OET Basic Certification Requirements For Wireless Microphones, and RSS-210.

**Requirements:**

As stated in FCC Part 74H, Section 74.861(e)(1)(ii). In the FCC OET Basic Certification Requirements For Wireless Microphones, it states in Part III(e)(1)(ii) that this measurement is conducted. RSS-210 requirement is for EIRP.

**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	$U_{lab}$
Conducted measurements (30 MHz – 1000 MHz)	1.24 dB

$U_{lab}$  = Determined for Shure EMC Laboratory

Since  $U_{lab}$  is less than or equal to  $U_{ETSI}$ :

- 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.

**Test Setup and Instrumentation:**

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

**EUT Operation:**

The EUT was powered up and the frequency of the transmitter was selected using the front panel controls. For rated output power, the testing was performed with the EUT set to the Low Band, 572.000, 589.925, 607.875, with RF power output of 1mW and 20mW, and the High Band, 614.125 and 615.875, with RF power output of 1mW and 10mW.

## Appendix C

### Specific Test Procedures:

The output of the EUT was connected to the input of a 20dB attenuator. The output of the attenuator was connected to the input of an ETS-Lindgren EMPower USB RF Power Sensor.

The EMPower software was set to:

Trigger Level = -40dBm

Measure Time = 500mS

Sample Rate (S/s) = 5MS/s

Gap Time = 2.5mS

Threshold Level = -30dBc

Assembly Gain = 0dBi

Beamforming Gain = 0dB

The EUT was set to transmit on the low, middle, and high frequencies, and power levels of 1mW and 20mW.

### Results:

The conducted RF power output for all frequencies measured meets the FCC 74H Section 74.861(e)(1)(ii) and the FCC OET "Basic Certification Requirements For Wireless Microphones, Part III(e)(1)(ii).

The results are shown on page 47 thru page 56.

The temperature during the test was 75 degrees F, with relative humidity of 18%.



Figure C 1: Test setup for Maximum Power Output



**Appendix C**

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Power Output  
Operating Conditions: EUT set to Low Band, Low Frequency, 572.000MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measured in mW	Limit in dBm	Limit in mW	Margin In mW
-1.00	0.79	23.98	250.00	249.21

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to Low Band, Low Frequency, 572.000MHz, 20mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measured in mW	Limit in dBm	Limit in mW	Margin In mW
+11.94	15.63	23.98	250.00	234.37



Appendix C

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to Low Band, Middle Frequency, 589.925MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measured in mW	Limit in dBm	Limit in mW	Margin In mW
-1.09	1.29	23.98	250.00	248.71

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to Low Band, Middle Frequency, 589.925MHz, 20mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measured in mW	Limit in dBm	Limit in mW	Margin In mW
+11.97	15.74	23.98	250.00	234.26





Appendix C

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to Low Band, High Frequency, 607.875MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	Limit in dBm	Limit in mW	Margin In mW
-1.28	0.75	23.98	250.00	249.25

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to Low Band, High Frequency, 607.875MHz, 20mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	Limit in dBm	Limit in mW	Margin In mW
+11.86	15.35	23.98	250.00	234.65



Appendix C

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, Low Frequency, 614.125MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	Limit in dBm	Limit in mW	Margin In mW
-1.34	0.74	23.98	250.00	249.26

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, Low Frequency, 614.125MHz, 10mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	Limit in dBm	Limit in mW	Margin In mW
+8.44	6.98	23.98	250.00	243.02



**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, High Frequency, 615.875MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	Limit in dBm	Limit in mW	Margin In mW
-1.37	0.73	23.98	250.00	249.27

**Test Information**

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, High Frequency, 615.875MHz, 10mW  
Operator Name: Craig Kozokar  
Comment: FCC Part 74H, Section 74.861(e)(1)(ii)  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	Limit in dBm	Limit in mW	Margin In mW
+8.42	6.95	23.98	250.00	243.05



Appendix C

Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: Maximum Rated Output  
 Operating Conditions: EUT set to Low Band, Low Frequency, 572.000MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: RSS-210  
 Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
-1.00	0.79	0.3	2.15	1.40	1.38	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB

Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: Maximum Rated Output  
 Operating Conditions: EUT set to Low Band, Low Frequency, 572.000MHz, 20mW  
 Operator Name: Craig Kozokar  
 Comment: RSS-210  
 Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
+11.94	15.63	0.3	2.15	14.39	27.48	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB



Appendix C

Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: Maximum Rated Output  
 Operating Conditions: EUT set to Low Band, Middle Frequency, 589.925MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: RSS-210  
 Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
-1.09	0.78	0.3	2.15	1.36	1.37	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB

Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: Maximum Rated Output  
 Operating Conditions: EUT set to Low Band, Middle Frequency, 589.925MHz, 20mW  
 Operator Name: Craig Kozokar  
 Comment: RSS-210  
 Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
+11.97	15.74	0.3	2.15	14.42	27.67	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB



Appendix C

Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: Maximum Rated Output  
 Operating Conditions: EUT set to Low Band, High Frequency, 607.875MHz, 1mW  
 Operator Name: Craig Kozokar  
 Comment: RSS-210  
 Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
-1.28	0.75	0.3	2.15	1.17	1.31	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB

Test Information

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: Maximum Rated Output  
 Operating Conditions: EUT set to Low Band, High Frequency, 607.875MHz, 20mW  
 Operator Name: Craig Kozokar  
 Comment: RSS-210  
 Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
+11.86	15.35	0.3	2.15	14.31	26.98	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB



## Appendix C

## Test Information

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, Low Frequency, 614.125MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: RSS-210  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
-1.34	0.74	0.3	2.15	1.11	1.29	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB

## Test Information

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, Low Frequency, 614.125MHz, 10mW  
Operator Name: Craig Kozokar  
Comment: RSS-210  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
+8.44	6.98	0.3	2.15	10.89	12.27	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB



## Appendix C

## Test Information

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, High Frequency, 615.875MHz, 1mW  
Operator Name: Craig Kozokar  
Comment: RSS-210  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
-1.37	0.73	0.3	2.15	1.08	1.28	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB

## Test Information

EUT Name: ULXD2 J50A  
Serial Number: J5x PPR GC SAMPLE finalClips  
Test Description: Maximum Rated Output  
Operating Conditions: EUT set to High Band, High Frequency, 615.875MHz, 10mW  
Operator Name: Craig Kozokar  
Comment: RSS-210  
Date Tested: Tested on March 7, 2019

Power Meter Measurement in dBm	Power Meter Measurement in mW	RSS-210: Measured Antenna Gain in dB	RSS-210: Equivalent Antenna Gain in dB	RSS-210: EIRP in dBm	RSS-210: EIRP in mW	RSS-210: EIRP LIMIT in mW
+8.42	6.95	0.3	2.15	10.87	12.22	250

EIRP = (dBm) = Measurement (dBm) + Antenna Gain + Equivalent Antenna Gain (dB)

G50 Measured antenna gain = 0.3dB





## FREQUENCY TOLERANCE

### PURPOSE:

This test was performed to determine if the EUT meets the frequency stability requirements of the FCC Part 74H, Section 74.861(e)(4) and the RSS-210 paragraph 6, table 1 specifications over the EUT operating frequency range of 534MHz to 598MHz.

### REQUIREMENTS:

As stated in paragraph 74.861(e)(4) and paragraph 6 of RSS-210 Table 1, for low power auxiliary stations operating in the bands allocated for TV broadcasting, the frequency tolerance of the transmitter shall be 0.005 percent.

### 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	$U_{lab}$
Frequency Error (Stability)	.0000000583 ppm

$U_{lab}$  = Determined for Shure EMC Laboratory

- 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.

### TEST SETUP AND INSTRUMENTATION:

The EUT firmware was temporarily changed to transmit a CW signal just for this test. The EUT was heated and cooled in an ESPEC temperature chamber over a temperature range of -30C to +50C. The temperature around the EUT was measured and monitored by a J-Type thermocouple connected to an Extech thermometer. The EUTs frequency was measured with a frequency counter set to measure signal count at 0.1Hz resolution. The EUT was measured at low, middle, and high frequencies in the low band, and low and high frequencies in the high band. Photographs of the test setup are shown as Figure B-1. The test instrumentation can be determined from Table 10-1.

### EUT OPERATION:

The antenna port of the EUT was connected to the 50 Ohm input of a frequency counter. The EUT was operated at 10mW.

**Appendix D**

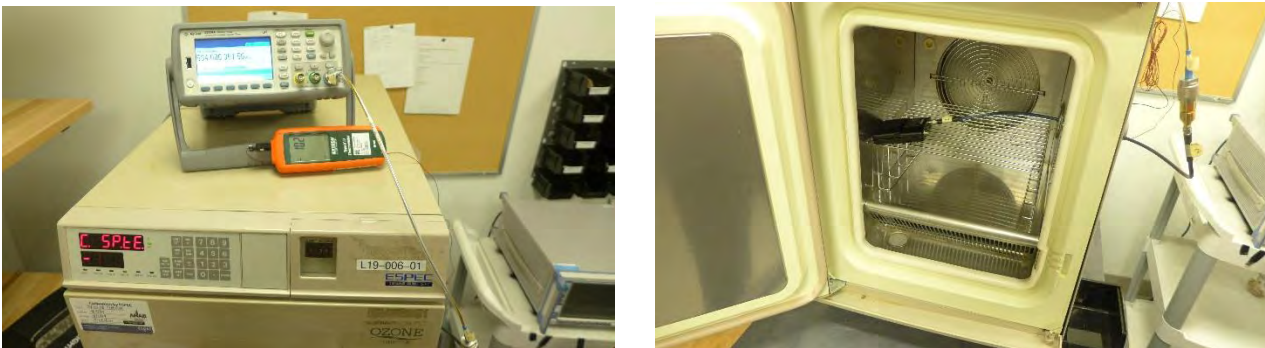
**TEST PROCEDURES:**

- a. The temperature chamber was set to 20C, ambient temperature, with the EUT inside and powered on.
- b. The EUT was allowed to soak for at least 15 minutes after the temperature chamber reached the set temperature.
- c. The measured frequency of the transmitter was measured on the frequency counter.
- d. Steps a. through c. were repeated at -30C through +50C in ten degree increments for representative low, mid and high frequencies within the EUTs operational band.

**RESULTS:**

The frequency stability measurements are presented on pages 59 and 60. As shown by the test data, the test frequency deviation was within the 0.005 percent limit set out in the FCC Part 74.861(e)(4) and the RSS-210 specifications.

The temperature in the test room during the test was 75 degrees F, with relative humidity of 18%.



**Figure D-1 - Test Setup for Frequency Stability**



Appendix D

**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: FCC Part 15C Section 15.236(f)(3), RSS-210 Frequency Tolerance  
 Operating Conditions: Low Band: Low, Middle, and High frequency at 10mW, -30C to +50C  
 Operator Name: Juan Castrejon  
 Comment: Agilent Frequency Counter and ESPEC Temp Chamber  
 Test Date: March 8, 2019

Temp °C	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation (%)	FCC Frequency Stability Limit in %	Deviation in Hz	Deviation in PPM	RSS Limit in ppm	FCC Pass/Fail	RSS Pass/Fail
-30	572.000	572.000038	0.000007	0.005	38.34	0.067028	±50	PASS	PASS
-20	572.000	572.000148	0.000026	0.005	147.67	0.258164	±50	PASS	PASS
-10	572.000	572.000244	0.000043	0.005	244.47	0.427395	±50	PASS	PASS
0	572.000	572.000315	0.000055	0.005	315.11	0.550892	±50	PASS	PASS
10	572.000	572.000332	0.000058	0.005	331.88	0.580210	±50	PASS	PASS
20	572.000	572.000377	0.000066	0.005	376.71	0.658584	±50	PASS	PASS
30	572.000	572.000361	0.000063	0.005	361.24	0.631538	±50	PASS	PASS
40	572.000	572.000389	0.000068	0.005	388.60	0.679371	±50	PASS	PASS
50	572.000	572.000407	0.000071	0.005	407.3	0.712063	±50	PASS	PASS
-30	589.925	589.925048	0.000008	0.005	47.60	0.080688	±50	PASS	PASS
-20	589.925	589.925152	0.000026	0.005	151.51	0.256829	±50	PASS	PASS
-10	589.925	589.925253	0.000043	0.005	252.51	0.428037	±50	PASS	PASS
0	589.925	589.925325	0.000055	0.005	324.70	0.550409	±50	PASS	PASS
10	589.925	589.925342	0.000058	0.005	341.81	0.579413	±50	PASS	PASS
20	589.925	589.925388	0.000066	0.005	388.07	0.657829	±50	PASS	PASS
30	589.925	589.925371	0.000063	0.005	371.33	0.629453	±50	PASS	PASS
40	589.925	589.925400	0.000068	0.005	400.31	0.678578	±50	PASS	PASS
50	589.925	589.925418	0.000071	0.005	417.54	0.707785	±50	PASS	PASS
-30	607.875	607.875057	0.000009	0.005	57.38	0.094394	±50	PASS	PASS
-20	607.875	607.875156	0.000026	0.005	156.11	0.256813	±50	PASS	PASS
-10	607.875	607.875863	0.000142	0.005	863.44	1.420424	±50	PASS	PASS
0	607.875	607.875336	0.000055	0.005	336.12	0.552943	±50	PASS	PASS
10	607.875	607.875354	0.000058	0.005	353.66	0.581797	±50	PASS	PASS
20	607.875	607.875401	0.000066	0.005	401.03	0.659724	±50	PASS	PASS
30	607.875	607.875383	0.000063	0.005	382.88	0.629724	±50	PASS	PASS
40	607.875	607.875414	0.000068	0.005	413.73	0.680617	±50	PASS	PASS
50	607.875	607.875429	0.000071	0.005	429.14	0.705968	±50	PASS	PASS



Appendix D

**Test Information**

EUT Name: ULXD2 J50A  
 Serial Number: J5x PPR GC SAMPLE finalClips  
 Test Description: FCC Part 15C Section 15.236(f)(3), RSS-210 Frequency Tolerance  
 Operating Conditions: High Band: Low and High frequency at 10mW, -30C to +50C  
 Operator Name: Juan Castrejon  
 Comment: Agilent Frequency Counter and ESPEC Temp Chamber  
 Test Date: March 8, 2019

Temp °C	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation (%)	FCC Frequency Stability Limit in %	Deviation in Hz	Deviation in PPM	RSS Limit in ppm	FCC Pass/Fail	RSS Pass/Fail
-30	614.125	614.125064	0.000010	0.005	63.95	0.104132	±50	PASS	PASS
-20	614.125	614.125157	0.000026	0.005	157.22	0.256007	±50	PASS	PASS
-10	614.125	614.125268	0.000044	0.005	268.46	0.437142	±50	PASS	PASS
0	614.125	614.125340	0.000055	0.005	339.77	0.553259	±50	PASS	PASS
10	614.125	614.125358	0.000058	0.005	357.55	0.582210	±50	PASS	PASS
20	614.125	614.125405	0.000066	0.005	405.23	0.659849	±50	PASS	PASS
30	614.125	614.125386	0.000063	0.005	386.40	0.629188	±50	PASS	PASS
40	614.125	614.125418	0.000068	0.005	418.37	0.681246	±50	PASS	PASS
50	614.125	614.125432	0.000070	0.005	431.55	0.702707	±50	PASS	PASS
-30	615.875	615.875069	0.000011	0.005	69.47	0.112799	±50	PASS	PASS
-20	615.875	615.875157	0.000025	0.005	156.70	0.254435	±50	PASS	PASS
-10	615.875	615.875271	0.000044	0.005	271.44	0.440739	±50	PASS	PASS
0	615.875	615.875340	0.000055	0.005	340.33	0.552596	±50	PASS	PASS
10	615.875	615.875359	0.000058	0.005	359.02	0.582943	±50	PASS	PASS
20	615.875	615.875406	0.000066	0.005	406.21	0.659566	±50	PASS	PASS
30	615.875	615.875387	0.000063	0.005	387.07	0.628488	±50	PASS	PASS
40	615.875	615.875420	0.000068	0.005	419.60	0.681307	±50	PASS	PASS
50	615.875	615.875431	0.000070	0.005	431.36	0.700402	±50	PASS	PASS