SHURE

ELECTROMAGNETIC COMPATIBILITY LABORATORY
TEST REPORT

TEST REPORT TITLE: Electromagnetic Compatibility Tests of the Shure QLXD1 Digital Wireless Transmitter in the X52 Band (902MHz to 928MHz)

TEST ITEM DESCRIPTION:

The Shure QLXD1 is a digital wireless microphone transmitter.

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

Project ID Number: SEL-041/QLXD1 X52 FCC15C

Date Tested: July 27 to August 19, 2020 and November 9, 2020

Test Personnel: Sharjeel Sohail and Juan Castrejon

Test Specification:

IC RSS-GEN – General Requirements and Information for the Certification of Radio Apparatus
RSS-247 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
FCC Title 47, Part 2.1051
FCC Part 15C, Section 15.247(a)(2)
FCC Part 15C, Section 15.247(b)(3)
FCC Part 15C, Section 15.247(b)(4)
FCC Part 15C, Section 15.247(d)
FCC Part 15C, Section 15.247(e)

TEST REPORT BY:	Craig Kogahara	Global Compliance Engineer	November 17, 2020
APPROVED BY:	Richard Perez	Manager, Quality Labs	November 17, 2020
	Signature	Position	Date

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REPORT REVISION HISTORY

Revision	Date	Description
0	September 9, 2020	Initial release
1	November 17, 2020	Removed FCC 15.249 from report along with test data. Updated Appendix B using conducted measurements. Added 1mW measurements to all appendixes.

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of testing per FCC Part 15C, Section 15.247(a)(2), Section 15.247(b)(3), Section 15.247(b)(4), Section 15.247(d), Section 15.247(e), FCC Part 2.1051, RSS-Gen, and RSS-247. 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 frequency bands shown in Table 1.

Model	Band	Frequency (MHz)	Output Power (mW)
QLXD1	X52	902 to 928	1 and 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 15C, Section 15.247(a)(2), Section 15.247(b)(3), Section 15.247(b)(4), Section 15.247(d), Section 15.247(e), FCC Part 2.1051 RSS-Gen, and RSS-247.

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 15C and IC Test Spec	Description	EUT Firmware	Tested Frequency in MHz	Appendix	Test Results
15.247(a)(2), RSS-247 5.2(a)	6dB Bandwidth	2.3.22	902.400, 915.000, 927.600	A	Pass
15.247(b)(3) RSS-247 5.4(d)	Maximum Peak Conducted Output Power	2.3.22	902.400, 915.000, 927.600	B	Pass
RSS-247 5.4(d)	Maximum E.I.R.P.	2.3.22	902.400, 915.000, 927.600	B	Pass
15.247(d), RSS-247 5.5	Unwanted Emissions	2.3.22	902.400, 915.000, 927.600	C	Pass
15.247(e) RSS-247 5.2(b)	Power Spectral Density	2.3.22	902.400, 915.000, 927.600	D	Pass
2.1051	Spurious Emissions on Antenna Port	2.3.22	902.400, 915.000, 927.600	E	Pass

2 APPLICABLE DOCUMENTS

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

FCC Part 15C, Section 15.247(a)(2)

FCC Part 15C, Section 15.247(b)(3)

FCC Part 15C, Section 15.247(b)(4)

FCC Part 15C, Section 15.247(d)

FCC Part 15C, Section 15.247(e)

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

RSS-247 Issue 2, February 2017 “digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices”

ANSI C63.10 (2013), "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"

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

3 EUT SET-UP AND OPERATION

3.1. General Description

The test sample used was Shure QLXD1 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 QLXD1 Digital Wireless Transmitter Sample

Band	Serial Numbers
X52	1

3.3 Operational Mode

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

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 15C, Section 247(a)(2), Section 15.247(b)(3), Section 15.247(b)(4), Section 15.247(d), Section 15.247(e), FCC 2.1051, RSS-Gen, and.RSS-247.

8. Conclusions:

It was determined that the Shure QLXD1 Digital Wireless Microphone Transmitter did fully comply with the requirements of FCC Part 15C, Section 247(a)(2), Section 15.247(b)(3), Section 15.247(b)(4), Section 15.247(d), Section 15.247(e), and FCC 2.1051, RSS-Gen, RSS-247.

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	5/23/2019	5/23/2021
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	7/16/2019	7/16/2021
L23-011-54	EMI Test Receiver	Rohde & Schwarz	ESR26	100220	9kHz-26GHz	11/18/2019	11/18/2021
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	9/17/2019	9/17/2021
L23-011-41	Horn Antenna	ETS Lindgren	3117	123511	1GHz to 18 GHz	1/23/2019	1/23/2021
L23-011-56	High Pass Filter	K&L	11SH10-940/X10000-0/0	2	940MHz – 10GHz	3/3/2020	3/3/2022
L23-022-02	Spectrum Analyzer	Rohde & Schwarz	FSW26	103788	9kHz-26GHz	3/4/2020	3/4/2022
L23-022-01	Spectrum Analyzer	Rohde & Schwarz	FSU26	201043	9kHz-26GHz	8/23/2017	8/14/2021
L23-034-02	Temperature Hygrometer	Extech	445703	48254-65	N/A	5/1/2020	5/1/2022
L23-034-04	Temperature Hygrometer	Extech	445703	48254-13	N/A	5/1/2020	5/1/2022
L23-040-03	20dB Attenuator	MCL	BW-N20W5+	N/A	20MHz to 18GHz	3/2/2020	3/2/2022
L23-045-36	RF Power Sensor	ETS-Lindgren	7002-006	151071	10MHz to 6GHz	1/10/2020	1/10/2022
L23-023-01	RF Signal Generator	Rohde & Schwarz	SMF100A	101553	20Hz to 26.5GHz	8/14/2019	8/14/2021

Appendix A

6dB BANDWIDTH

PURPOSE

This test was performed to determine if the EUT meets the minimum bandwidth requirements of FCC 15C, section 15.247(a)(2), and RSS-247 5.2(a), with the EUT operating at 902.400MHz, 915.000MHz, and 927.600MHz.

This testing results show the EUT meets FCC 15C 15.247(a)(2) and RSS-247 5.2(a), a minimum 6dB bandwidth of at least 500kHz.

REQUIREMENTS

As stated in 15.247(a)(2) and RSS-247 5.2(a), the minimum 6dB bandwidth shall be at least 500kHz.

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}
Necessary Bandwidth	**±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

A Shure microphone was plugged into the EUT. 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 902.400MHz, 915.000MHz, and 927.600MHz, at an output power level of 1mW and 10mW.

Appendix A

TEST PROCEDURE

The EUT antenna output connector was connected thru an attenuator to a spectrum analyzer.

RESULTS

The measurements show the EUT met the minimum bandwidth of 500 kHz.

At 902.400 MHz, bandwidth measured 555.9 kHz at 1mW.
At 902.400 MHz, bandwidth measured 563.4 kHz at 10mW.
At 915.000 MHz, bandwidth measured 554.4 kHz at 1mW.
At 915.000 MHz, bandwidth measured 563.4 kHz at 10mW.
At 927.600 MHz, bandwidth measured 552.9 kHz at 1mW.
At 927.600 MHz, bandwidth measured 563.4 kHz at 10mW.

The temperature during the testing was 72 degrees F, with relative humidity of 22%.

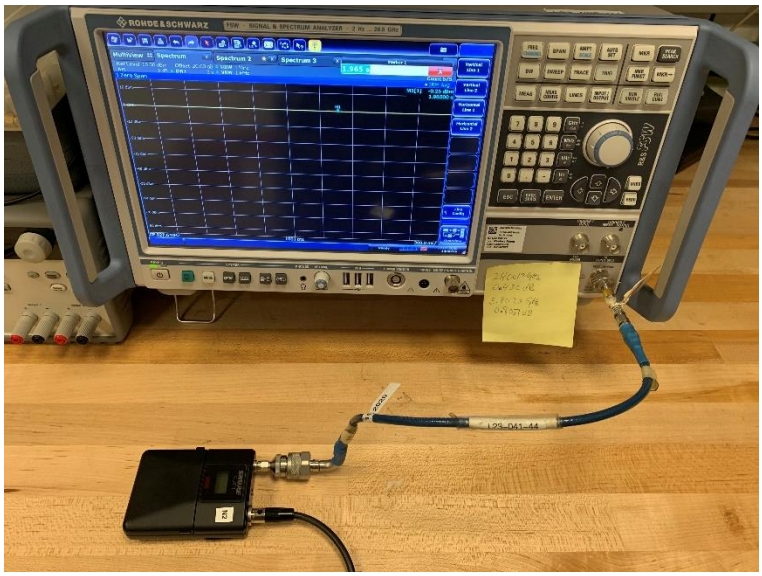
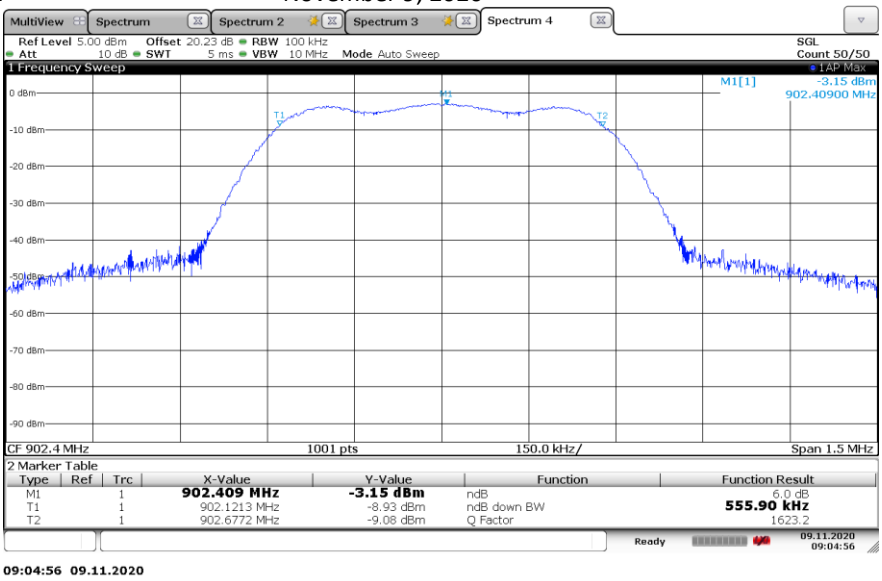


Figure A-1 - Test Setup for Minimum Bandwidth

Appendix A

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: FCC 15C, Section 15.247(a)(2) 6dB Bandwidth
Operating Conditions: Low Frequency, 902.400MHz, 1mW
Operator Name: Juan Castrejon
Date Tested: November 9, 2020



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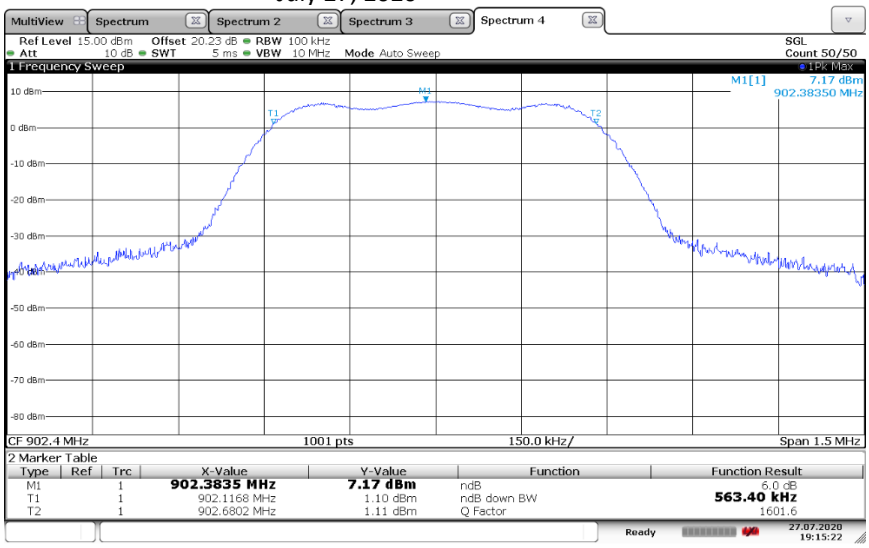
Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: FCC 15C, Section 15.247(a)(2) 6dB Bandwidth
Operating Conditions: Low Frequency, 902.400MHz, 10mW
Operator Name: Juan Castrejon
Date Tested: July 27, 2020



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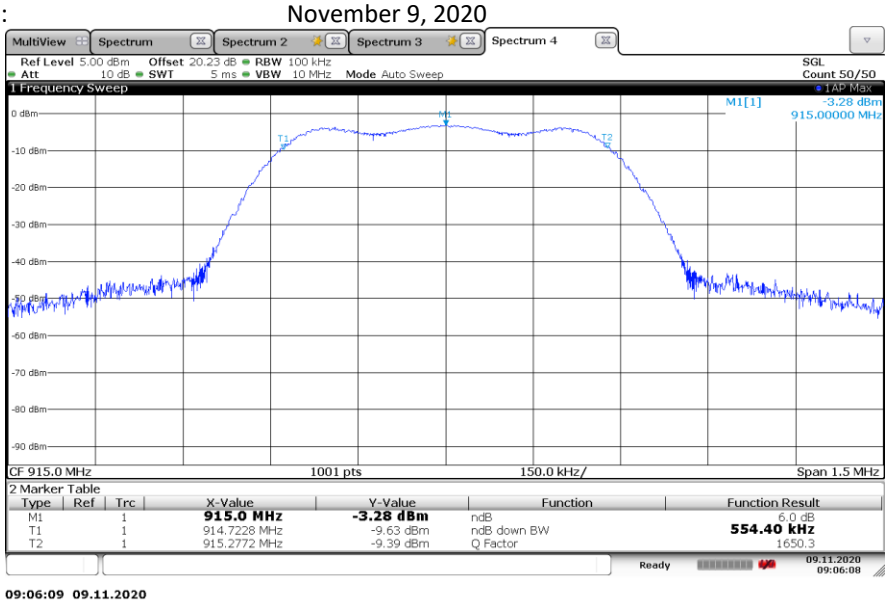
Appendix A

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: FCC 15C, Section 15.247(a)(2) 6dB Bandwidth
Operating Conditions: Middle Frequency, 915.000MHz, 1mW
Operator Name: Juan Castrejon
Date Tested: November 9, 2020



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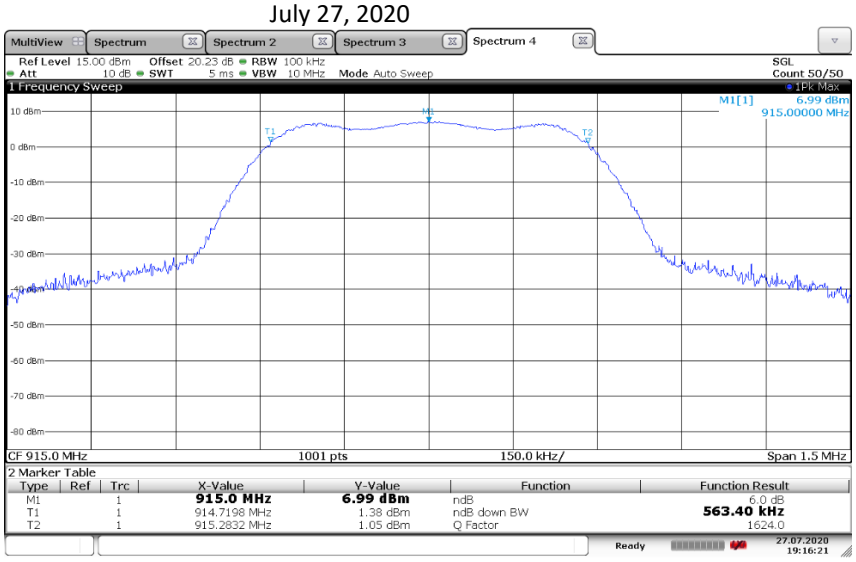
Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: FCC 15C, Section 15.247(a)(2) 6dB Bandwidth
Operating Conditions: Middle Frequency, 915.000MHz, 10mW
Operator Name: Juan Castrejon
Date Tested: July 27, 2020



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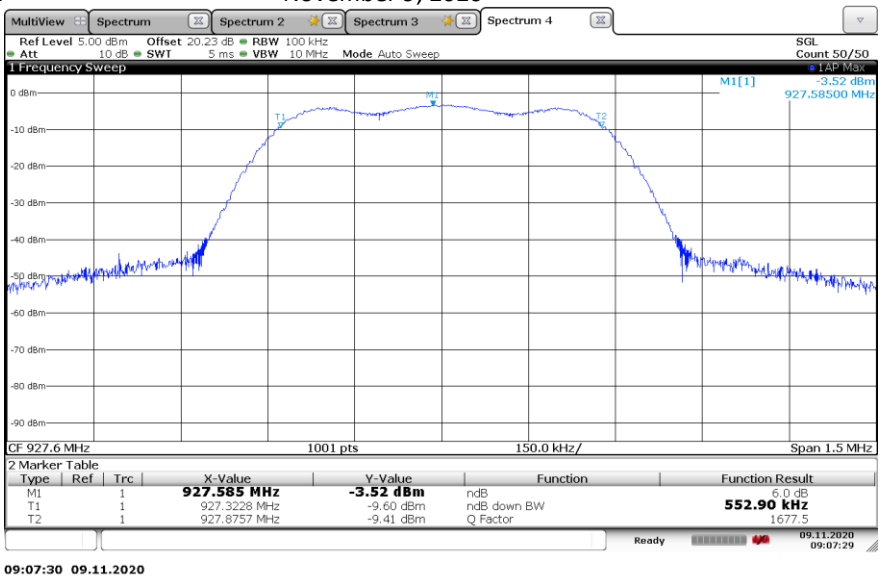
Appendix A

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: FCC 15C, Section 15.247(a)(2) 6dB Bandwidth
Operating Conditions: High Frequency, 927.600MHz, 1mW
Operator Name: Juan Castrejon
Date Tested: November 9, 2020



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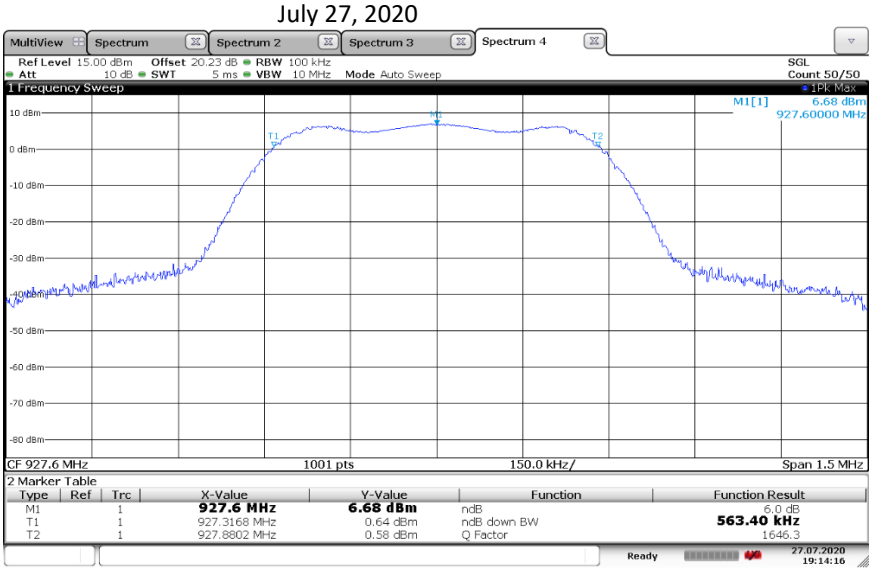
Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: FCC 15C, Section 15.247(a)(2) 6dB Bandwidth
Operating Conditions: High Frequency, 927.600MHz, 10mW
Operator Name: Juan Castrejon
Date Tested: July 27, 2020



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Appendix B

MAXIMUM PEAK CONDUCTED OUTPUT POWER
MAXIMUM E.I.R.P.

Purpose:
This test performed to determine if the EUT meets the maximum peak conducted output FCC Part15C, Section 15.247(b)(3), and RSS-247 Section 5.4(d).

Requirements:
As stated in FCC 15C Section 15.247(b)(3). For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one-Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

FCC 15C Section 15.247(b)(4) deals with antennas with gain greater the 6dBi. The Shure QLXD1 antenna gain is not directional and has gain less than 6dBi.

As stated in RSS-247 Section 5.4(d), for DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

Appendix B

Measurement Uncertainty, Conducted:

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.

Measurement Uncertainty, Radiated:

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_{ETSI}
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

U_{lab} = Determined for Shure EMC Laboratory

U_{ETSI} = From ETSI EN 300 422-1 Table 10

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 B 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. A Shure TL47 microphone was plugged into the EUT microphone socket. For rated output power, the testing was performed with the EUT set to the low, middle, and high frequency within the operating frequency range, and at 1mW and 10mW RF output.

Appendix B

Maximum Peak Conducted Output Power Specific Test Procedures:

The Maximum Rated Power test was performed with the RF output port connected to a 20dB attenuator, which was connected to the EMPower RF Power Sensor.

The EUT was set to transmit on the low, middle, and high frequencies, and power levels of 1mW and 10mW. EUT serial number was N2.

Results:

The maximum peak conducted output for all frequencies measured meets the FCC15C 15.247(b)(3) requirements, and RSS-247 5.4(d). The e.i.r.p. measurement did not exceed 1 W.

The temperature during the test was 69 degrees F, with relative humidity of 20%.

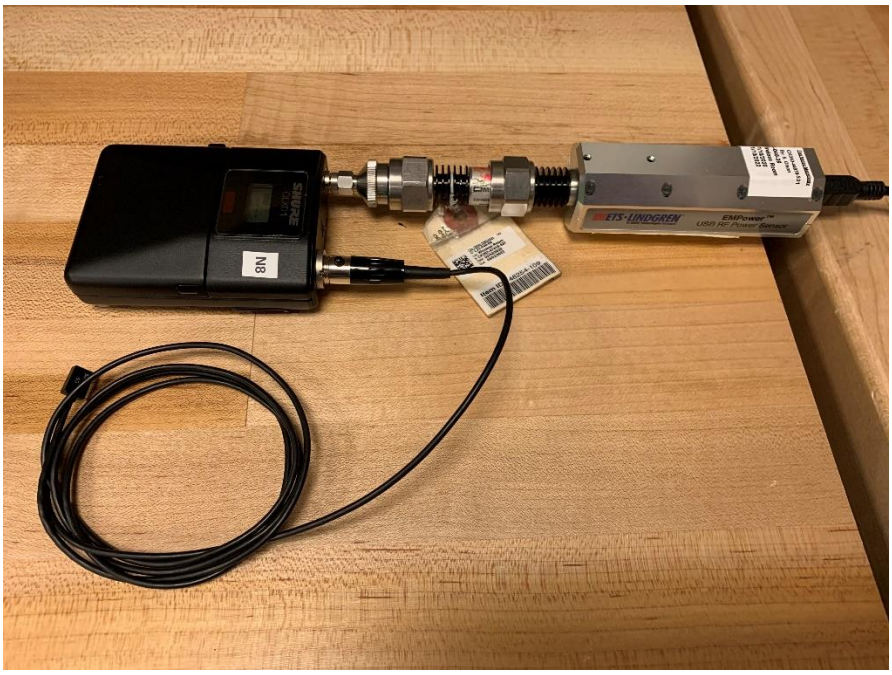


Figure B 1: Test setup for maximum peak conducted output

Appendix B

Conducted RF Output Measurements Test Information

Frequency in MHz	Nominal Power in mW	Measured Power in dBm	Measured Power in mW	FCC 15.247 Limit in mW	RSS-247 Limit in mW
902.400	1	-1.26	0.75	1000	1000
915.000	1	-1.42	0.72	1000	1000
927.600	1	-1.66	0.68	1000	1000

Frequency in MHz	Nominal Power in mW	Measured Power in dBm	Measured Power in mW	FCC 15.247 Limit in mW	RSS-247 Limit in mW
902.400	10	8.80	7.59	1000	1000
915.000	10	8.64	7.31	1000	1000
927.600	10	8.49	7.06	1000	1000

Test performed on November 9, 2020 by Juan Castrejon.

Appendix B

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Maximum EIRP
Operating: Low Frequency, 902.400MHz, 1mW
Operator Name: Juan Castrejon
Comment: RSS-247 5.4(d)
Date Tested: November 9, 2020

Conducted Measurement in dBm	Isotropic Antenna Gain in dBi	EIRP In dBm	EIRP In Watts	EIRP Limit in Watts	Margin In Watts
-1.26	0.1	-1.16	0.00077	4.0	3.99

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

Antenna Gain is 0.1dBi

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Maximum EIRP
Operating: Low Frequency, 902.400MHz, 10mW
Operator Name: Juan Castrejon
Comment: RSS-247 5.4(d)
Date Tested: November 9, 2020

Conducted Measurement in dBm	Isotropic Antenna Gain in dBi	EIRP In dBm	EIRP In Watts	EIRP Limit in Watts	Margin In Watts
8.80	0.1	8.90	0.0078	4.0	3.99

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

Antenna Gain is 0.1dBi

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Maximum EIRP
Operating: Middle Frequency, 915.000MHz, 1mW
Operator Name: Juan Castrejon
Comment: RSS-247 5.4(d)
Date Tested: November 9, 2020

Conducted Measurement in dBm	Isotropic Antenna Gain in dBi	EIRP In dBm	EIRP In Watts	EIRP Limit in Watts	Margin In Watts
-1.42	0.1	-1.32	0.00074	4.0	3.99

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

Antenna Gain is 0.1dBi

Appendix B

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Maximum EIRP
Operating: Middle Frequency, 915.000MHz, 10mW
Operator Name: Juan Castrejon
Comment: RSS-247 5.4(d)
Date Tested: November 9, 2020

Conducted Measurement in dBm	Isotropic Antenna Gain in dBi	EIRP In dBm	EIRP In Watts	EIRP Limit in Watts	Margin In Watts
8.64	0.1	8.74	0.0075	4.0	3.99

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

Antenna Gain is 0.1dBi

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Maximum EIRP
Operating: High Frequency, 927.600MHz, 1mW
Operator Name: Juan Castrejon
Comment: RSS-247 5.4(d)
Date Tested: November 9, 2020

Measurement 1n dBm	Isotropic Antenna Gain in dBi	EIRP In dBm	EIRP In Watts	EIRP Limit in Watts	Margin In Watts
-1.66	0.1	-1.56	0.0007	4.0	3.99

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

Antenna Gain is 0.1dBi

Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Maximum EIRP
Operating: High Frequency, 927.600MHz, 10mW
Operator Name: Juan Castrejon
Comment: RSS-247 5.4(d)
Date Tested: November 9, 2020

Measurement 1n dBm	Isotropic Antenna Gain in dBi	EIRP In dBm	EIRP In Watts	EIRP Limit in Watts	Margin In Watts
8.49	0.1	8.59	0.0072	4.0	3.99

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

Antenna Gain is 0.1dBi

Appendix C

Unwanted Emissions

Purpose:

This test performed to determine if the EUT meets the radiated RF emission requirements of the FCC Part 15C Section 15.247(d), and RSS-247 Section 5.5 over the frequency range from 30MHz to 10GHz. A Quasi-Peak and Average detectors were used for the measurements. Both FCC Part 15C and IC RSS-Gen require measurements to the 10th harmonic of the carrier.

Requirements:

As stated in FCC 15C section 247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

As stated in RSS-247 Section 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Appendix C

Measurement Uncertainty, Radiated:

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_{ETSI}
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_{lab} = Determined for Shure EMC Laboratory

U_{ETSI} = From ETSI EN 300 422-1 Table 10

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.

Measurement Uncertainty, Conducted:

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:

A Shure microphone was plugged into the EUT microphone socket. 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:

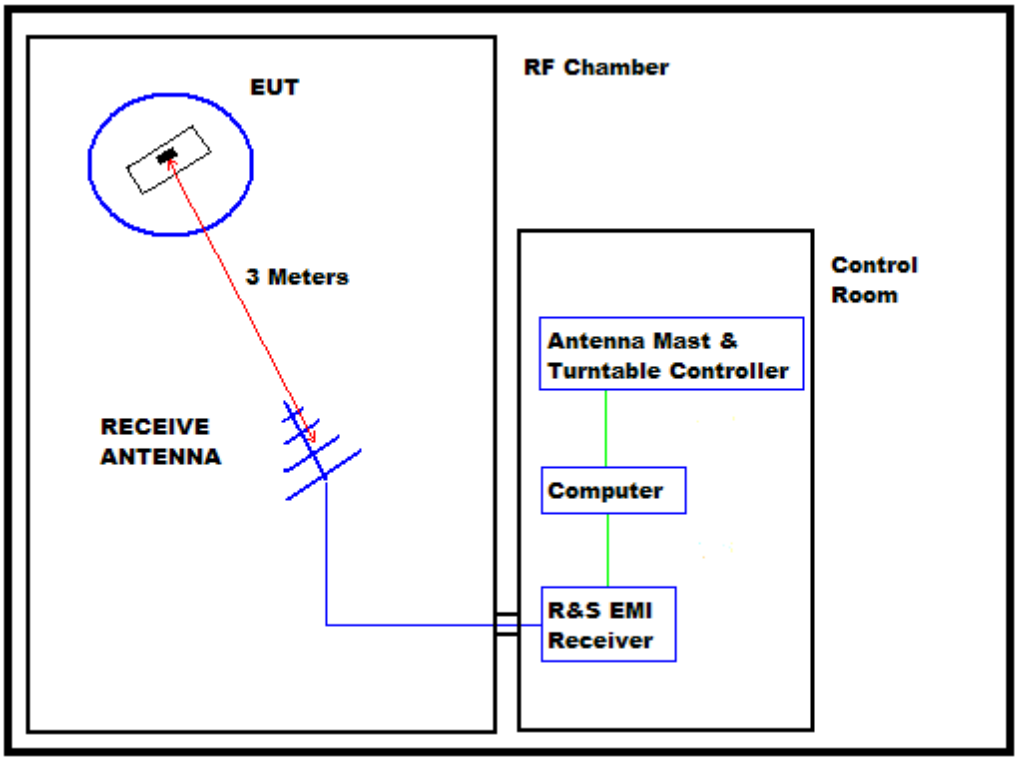
The EUT was powered up and the frequency of the transmitter was selected using the front panel controls. The EUT was checked for proper operation after it was setup on the test table. For radiated spurious emissions the testing was performed with the EUT set to the low, middle, and high frequencies with RF power output of 1mW and 10mW.

Appendix C

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 C

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.

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.

Results:

The plots of the peak preliminary radiated voltage levels in the graphs on page 25 thru page 36. All emissions measured from the EUT were within the FCC 15C Section 15.247(d), and RSS-247 Section 5.5 specification limits.

Figure B 1: QLXD1 Transmitter Test Setup

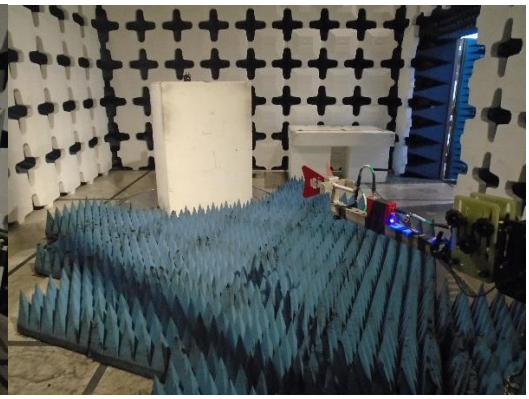
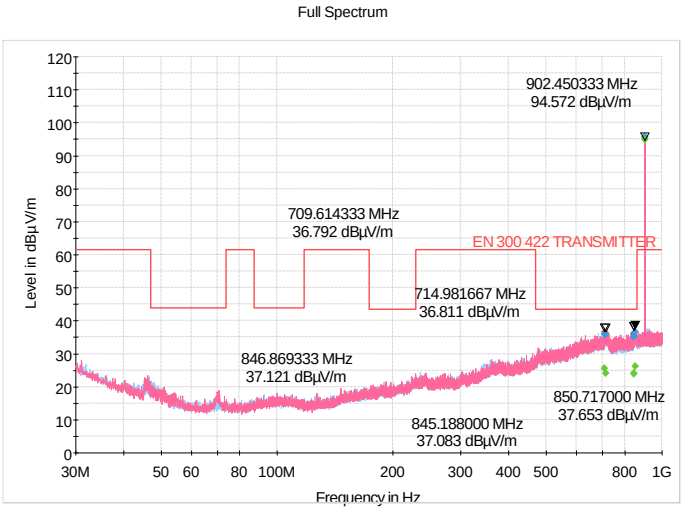


Figure B 2: QLXD1 Transmitter Test Setup

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 30MHz - 1GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Low Frequency 902.400MHz
RF Power Level	1mW
Tester Name:	Sharjeel Sohail
Date Tested	July 30, 2020, 74F 43% RH



Critical Frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
709.614333	36.68	---	---	187.0	V	340.0	23.1	10:52:22 AM - 7/30/2020
714.981667	36.44	---	---	125.0	V	0.0	23.1	10:54:25 AM - 7/30/2020
845.188000	36.10	---	---	251.0	H	60.0	24.2	10:55:32 AM - 7/30/2020
846.869333	35.83	---	---	121.0	H	0.0	24.2	10:58:00 AM - 7/30/2020
850.717000	36.80	---	---	125.0	V	57.0	24.2	10:59:31 AM - 7/30/2020
902.450333	95.59	---	---	112.0	V	273.0	25.0	11:01:08 AM - 7/30/2020

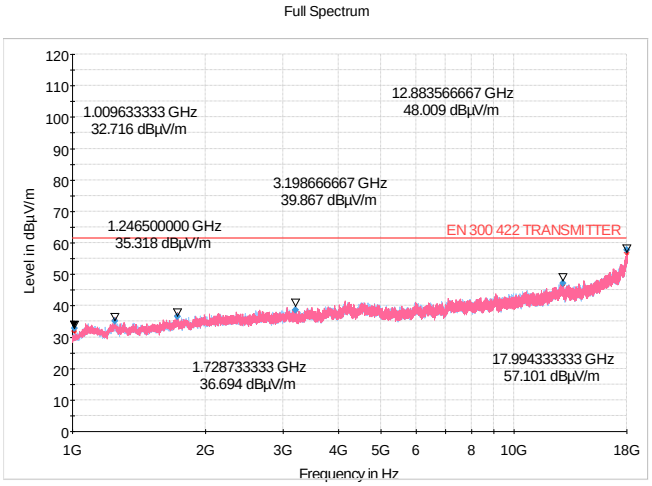
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
709.614333	---	25.47	1000.0	120.000	187.0	V	340.0	23.1	10:52:35 AM - 7/30/2020
709.614333	35.98	---	1000.0	120.000	187.0	V	340.0	23.1	10:52:35 AM - 7/30/2020
714.981667	---	24.09	1000.0	120.000	125.0	V	0.0	23.1	10:54:30 AM - 7/30/2020
714.981667	35.89	---	1000.0	120.000	125.0	V	0.0	23.1	10:54:30 AM - 7/30/2020
845.188000	---	23.91	1000.0	120.000	251.0	H	61.0	24.2	10:55:43 AM - 7/30/2020
845.188000	35.06	---	1000.0	120.000	251.0	H	61.0	24.2	10:55:43 AM - 7/30/2020
846.869333	---	24.16	1000.0	120.000	121.0	H	0.0	24.2	10:58:08 AM - 7/30/2020
846.869333	35.31	---	1000.0	120.000	121.0	H	0.0	24.2	10:58:08 AM - 7/30/2020
850.717000	---	26.22	1000.0	120.000	125.0	V	57.0	24.2	10:59:45 AM - 7/30/2020
850.717000	36.58	---	1000.0	120.000	125.0	V	57.0	24.2	10:59:45 AM - 7/30/2020
902.450333	---	94.81	1000.0	120.000	112.0	V	273.0	25.0	11:01:20 AM - 7/30/2020
902.450333	95.61	---	1000.0	120.000	112.0	V	273.0	25.0	11:01:20 AM - 7/30/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 1GHz - 10GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Low Frequency 902.400MHz
RF Power Level	1mW
Tester Name:	Sharjeel Sohail
Date Tested	August 19, 2020, 74F 38% RH



Critical Frequencies

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1009.633333	31.8	---	---	397.0	H	290.0	-16.0	9:22:24 AM - 8/19/2020
1246.500000	35.5	---	---	275.0	V	306.0	-15.2	9:23:39 AM - 8/19/2020
1728.733333	37.0	---	---	178.0	H	356.0	-14.6	9:24:49 AM - 8/19/2020
3198.666667	38.5	---	---	360.0	V	308.0	-11.4	9:26:25 AM - 8/19/2020

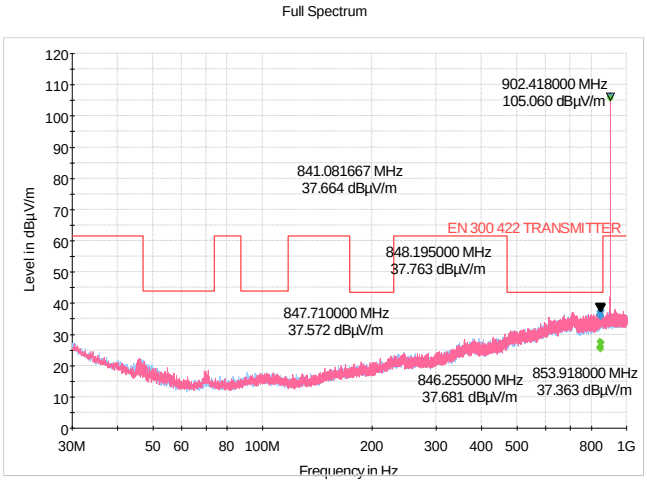
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1009.633333	32.84	1000.0	1000.000	400.0	H	290.0	-16.0	9:22:30 AM - 8/19/2020
1246.500000	35.19	1000.0	1000.000	275.0	V	306.0	-15.2	9:23:54 AM - 8/19/2020
1728.733333	36.52	1000.0	1000.000	178.0	H	0.0	-14.6	9:25:03 AM - 8/19/2020
3198.666667	38.71	1000.0	1000.000	360.0	V	315.0	-11.4	9:26:35 AM - 8/19/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 30MHz - 1GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Low Frequency 902.400MHz
RF Power Level	10mW
Tester Name:	Sharjeel Sohail
Date Tested	July 30, 2020, 74F 43% RH



Critical Frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
841.081667	36.40	---	---	125.0	V	184.0	24.2	10:05:52 AM - 7/30/2020
846.255000	37.57	---	---	125.0	V	94.0	24.2	10:07:29 AM - 7/30/2020
847.710000	37.03	---	---	125.0	V	269.0	24.2	10:09:17 AM - 7/30/2020
848.195000	37.29	---	---	227.0	V	0.0	24.2	10:11:28 AM - 7/30/2020
853.918000	37.52	---	---	127.0	V	80.0	24.2	10:12:43 AM - 7/30/2020
902.418000	106.32	---	---	113.0	V	278.0	25.0	10:14:16 AM - 7/30/2020

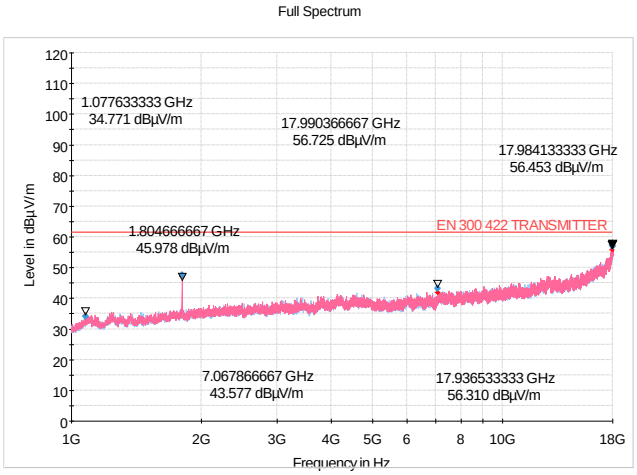
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
841.081667	---	25.67	1000.0	120.000	125.0	V	184.0	24.2	10:06:06 AM - 7/30/2020
841.081667	36.40	---	1000.0	120.000	125.0	V	184.0	24.2	10:06:06 AM - 7/30/2020
846.255000	---	27.58	1000.0	120.000	125.0	V	94.0	24.2	10:07:43 AM - 7/30/2020
846.255000	37.38	---	1000.0	120.000	125.0	V	94.0	24.2	10:07:43 AM - 7/30/2020
847.710000	---	26.22	1000.0	120.000	125.0	V	269.0	24.2	10:09:33 AM - 7/30/2020
847.710000	36.36	---	1000.0	120.000	125.0	V	269.0	24.2	10:09:32 AM - 7/30/2020
848.195000	---	25.27	1000.0	120.000	227.0	V	0.0	24.2	10:11:41 AM - 7/30/2020
848.195000	35.68	---	1000.0	120.000	227.0	V	0.0	24.2	10:11:41 AM - 7/30/2020
853.918000	---	27.33	1000.0	120.000	127.0	V	80.0	24.2	10:12:57 AM - 7/30/2020
853.918000	37.56	---	1000.0	120.000	127.0	V	80.0	24.2	10:12:57 AM - 7/30/2020
902.418000	---	105.69	1000.0	120.000	113.0	V	278.0	25.0	10:14:26 AM - 7/30/2020
902.418000	106.35	---	1000.0	120.000	113.0	V	278.0	25.0	10:14:26 AM - 7/30/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 1GHz - 11GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Low Frequency 902.400MHz
RF Power Level	10mW
Tester Name:	Sharjeel Sohail
Date Tested	August 19, 2020, 74F 39% RH



Critical Frequencies

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1077.633333	34.3	---	---	239.0	V	0.0	-15.5	8:32:48 AM - 8/19/2020
1804.666667	47.0	---	---	356.0	V	323.0	-14.3	8:34:35 AM - 8/19/2020
7067.866667	42.0	---	---	201.0	H	26.0	-4.5	8:36:39 AM - 8/19/2020

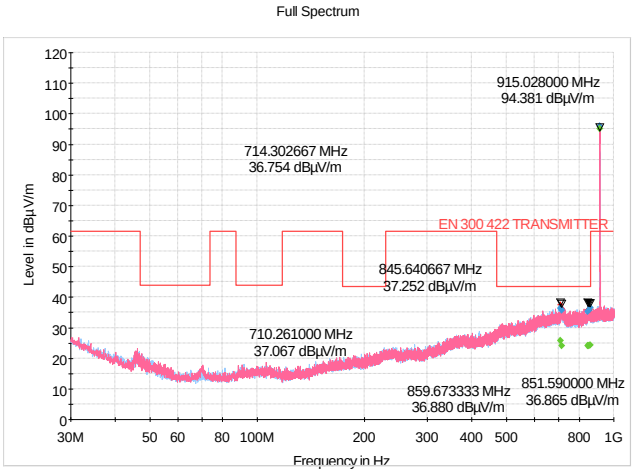
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1077.633333	33.98	1000.0	1000.000	239.0	V	0.0	-15.5	8:33:01 AM - 8/19/2020
1804.666667	47.58	1000.0	1000.000	356.0	V	323.0	-14.3	8:34:46 AM - 8/19/2020
7067.866667	43.23	1000.0	1000.000	201.0	H	26.0	-4.5	8:36:51 AM - 8/19/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 30MHz - 1GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Middle Frequency 915.000MHz
RF Power Level	1mW
Tester Name:	Sharjeel Sohail
Date Tested	July 30, 2020, 74F 42% RH



Critical Frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
710.261000	37.59	---	---	175.0	V	354.0	23.1	12:23:54 PM - 7/30/2020
714.302667	36.27	---	---	390.0	H	259.0	23.1	12:25:43 PM - 7/30/2020
845.640667	35.96	---	---	200.0	H	0.0	24.2	12:27:54 PM - 7/30/2020
851.590000	35.61	---	---	213.0	H	109.0	24.2	12:28:56 PM - 7/30/2020
859.673333	36.21	---	---	213.0	H	21.0	24.2	12:30:12 PM - 7/30/2020
915.028000	95.86	---	---	112.0	V	274.0	25.0	12:31:57 PM - 7/30/2020

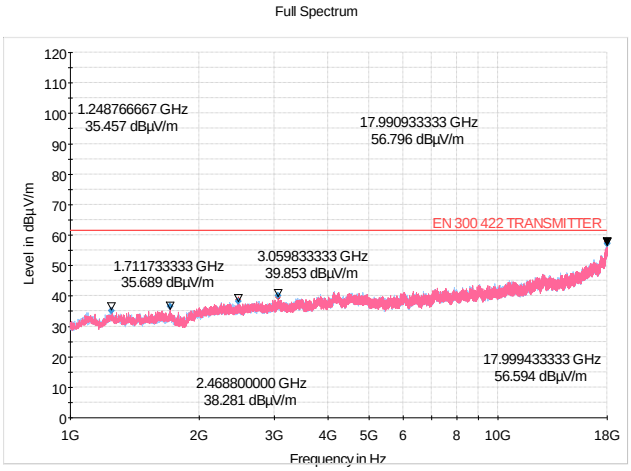
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
710.261000	---	25.74	1000.0	120.000	175.0	V	0.0	23.1	12:24:00 PM - 7/30/2020
710.261000	36.33	---	1000.0	120.000	175.0	V	0.0	23.1	12:23:59 PM - 7/30/2020
714.302667	---	24.03	1000.0	120.000	390.0	H	259.0	23.1	12:25:53 PM - 7/30/2020
714.302667	35.63	---	1000.0	120.000	390.0	H	259.0	23.1	12:25:53 PM - 7/30/2020
845.640667	---	24.12	1000.0	120.000	200.0	H	0.0	24.2	12:28:06 PM - 7/30/2020
845.640667	35.37	---	1000.0	120.000	200.0	H	0.0	24.2	12:28:05 PM - 7/30/2020
851.590000	---	23.99	1000.0	120.000	213.0	H	109.0	24.2	12:29:06 PM - 7/30/2020
851.590000	35.80	---	1000.0	120.000	213.0	H	109.0	24.2	12:29:06 PM - 7/30/2020
859.673333	---	24.22	1000.0	120.000	213.0	H	21.0	24.2	12:30:22 PM - 7/30/2020
859.673333	36.50	---	1000.0	120.000	213.0	H	21.0	24.2	12:30:22 PM - 7/30/2020
915.028000	---	95.12	1000.0	120.000	112.0	V	274.0	25.0	12:32:08 PM - 7/30/2020
915.028000	95.87	---	1000.0	120.000	112.0	V	274.0	25.0	12:32:08 PM - 7/30/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 1GHz - 11GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Middle Frequency 915.000MHz
RF Power Level	1mW
Tester Name:	Sharjeel Sohail
Date Tested	August 19, 2020, 74F 38% RH



Critical Frequencies

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1248.766667	35.1	---	---	285.0	H	195.0	-15.2	10:10:47 AM - 8/19/2020
1711.733333	36.4	---	---	121.0	V	41.0	-14.5	10:12:14 AM - 8/19/2020
2468.800000	38.8	---	---	162.0	V	354.0	-12.8	10:13:39 AM - 8/19/2020
3059.833333	39.6	---	---	224.0	V	128.0	-11.1	10:15:21 AM - 8/19/2020

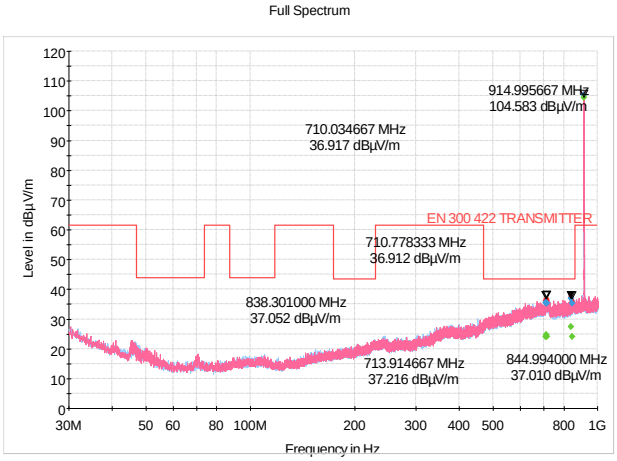
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1248.766667	35.04	1000.0	1000.000	285.0	H	195.0	-15.2	10:10:59 AM - 8/19/2020
1711.733333	36.62	1000.0	1000.000	121.0	V	45.0	-14.5	10:12:22 AM - 8/19/2020
2468.800000	38.22	1000.0	1000.000	162.0	V	354.0	-12.8	10:13:49 AM - 8/19/2020
3059.833333	40.11	1000.0	1000.000	225.0	V	128.0	-11.1	10:15:27 AM - 8/19/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 30MHz - 1GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Middle Frequency 915.000MHz
RF Power Level	10mW
Tester Name:	Sharjeel Sohail
Date Tested	July 30, 2020, 75F 42% RH



Critical Frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
710.034667	36.33	---	---	289.0	H	134.0	23.1	1:11:53 PM - 7/30/2020
710.778333	36.72	---	---	353.0	V	232.0	23.1	1:13:05 PM - 7/30/2020
713.914667	36.82	---	---	250.0	H	0.0	23.1	1:15:16 PM - 7/30/2020
838.301000	37.76	---	---	125.0	V	50.0	24.2	1:16:21 PM - 7/30/2020
844.994000	36.20	---	---	175.0	H	45.0	24.2	1:17:26 PM - 7/30/2020
914.995667	105.73	---	---	102.0	V	317.0	25.0	1:18:50 PM - 7/30/2020

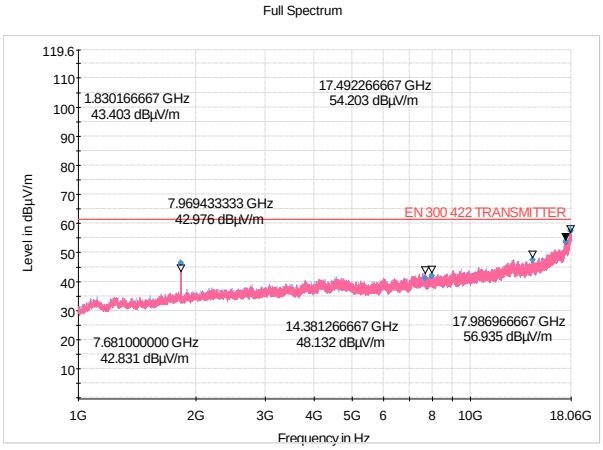
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
710.034667	---	24.07	1000.0	120.000	289.0	H	134.0	23.1	1:12:06 PM - 7/30/2020
710.034667	35.51	---	1000.0	120.000	289.0	H	134.0	23.1	1:12:06 PM - 7/30/2020
710.778333	---	24.78	1000.0	120.000	353.0	V	233.0	23.1	1:13:17 PM - 7/30/2020
710.778333	35.56	---	1000.0	120.000	353.0	V	233.0	23.1	1:13:16 PM - 7/30/2020
713.914667	---	24.18	1000.0	120.000	250.0	H	0.0	23.1	1:15:28 PM - 7/30/2020
713.914667	35.37	---	1000.0	120.000	250.0	H	0.0	23.1	1:15:27 PM - 7/30/2020
838.301000	---	27.34	1000.0	120.000	125.0	V	59.0	24.2	1:16:27 PM - 7/30/2020
838.301000	37.05	---	1000.0	120.000	125.0	V	59.0	24.2	1:16:26 PM - 7/30/2020
844.994000	---	24.11	1000.0	120.000	175.0	H	45.0	24.2	1:17:32 PM - 7/30/2020
844.994000	35.22	---	1000.0	120.000	175.0	H	45.0	24.2	1:17:32 PM - 7/30/2020
914.995667	---	104.52	1000.0	120.000	102.0	V	322.0	25.0	1:19:01 PM - 7/30/2020
914.995667	105.19	---	1000.0	120.000	102.0	V	322.0	25.0	1:19:01 PM - 7/30/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 1GHz - 11GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	Middle Frequency 915.000MHz
RF Power Level	10mW
Tester Name:	Sharjeel Sohail
Date Tested	August 19, 2020, 75F 37% RH



Critical Frequencies

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1830.166667	46.3	---	---	293.0	V	313.0	-14.5	12:03:58 PM - 8/19/2020
7681.000000	41.3	---	---	272.0	V	118.0	-4.3	12:05:35 PM - 8/19/2020
7969.433333	41.8	---	---	124.0	V	344.0	-3.8	12:06:58 PM - 8/19/2020

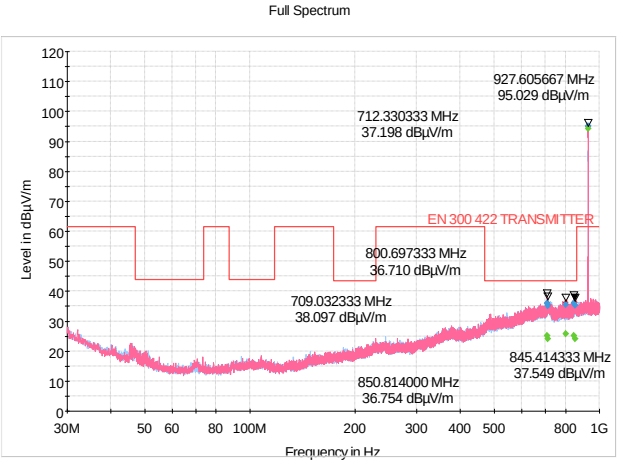
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1830.166667	46.31	1000.0	1000.000	293.0	V	313.0	-14.5	12:04:10 PM - 8/19/2020
7681.000000	41.09	1000.0	1000.000	275.0	V	118.0	-4.3	12:05:41 PM - 8/19/2020
7969.433333	42.05	1000.0	1000.000	125.0	V	344.0	-3.8	12:07:04 PM - 8/19/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 30MHz - 1GHz
EUT	QLXD1 X52
Serial Number	1
Operating Frequency:	High Frequency 927.600MHz
RF Power Level	1mW
Tester Name	Sharjeel Sohail
Date Tested	July 30, 2020, 75F 41% RH



Critical Frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
709.032333	36.12	---	---	175.0	V	232.0	23.1	2:24:23 PM - 7/30/2020
712.330333	35.80	---	---	121.0	H	312.0	23.1	2:25:38 PM - 7/30/2020
800.697333	36.36	---	---	127.0	V	327.0	23.5	2:26:56 PM - 7/30/2020
845.414333	36.39	---	---	120.0	V	184.0	24.2	2:28:31 PM - 7/30/2020
850.814000	36.24	---	---	390.0	H	225.0	24.2	2:30:10 PM - 7/30/2020
927.605667	95.10	---	---	200.0	V	315.0	24.9	2:31:47 PM - 7/30/2020

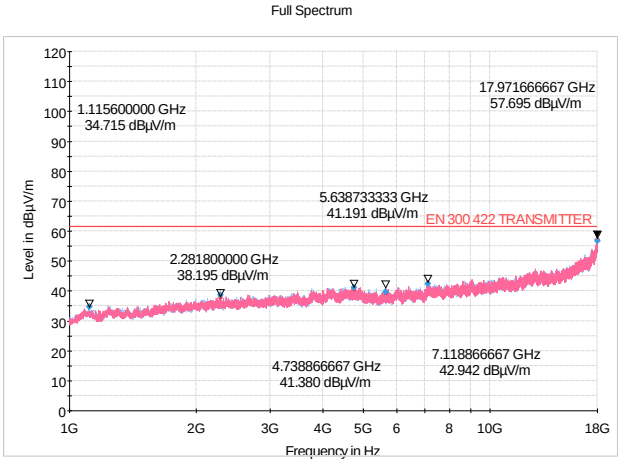
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
709.032333	---	25.04	1000.0	120.000	175.0	V	232.0	23.1	2:24:28 PM - 7/30/2020
709.032333	35.99	---	1000.0	120.000	175.0	V	232.0	23.1	2:24:28 PM - 7/30/2020
712.330333	---	24.03	1000.0	120.000	121.0	H	312.0	23.1	2:25:46 PM - 7/30/2020
712.330333	35.00	---	1000.0	120.000	121.0	H	312.0	23.1	2:25:46 PM - 7/30/2020
800.697333	---	25.76	1000.0	120.000	127.0	V	329.0	23.5	2:27:10 PM - 7/30/2020
800.697333	35.41	---	1000.0	120.000	127.0	V	329.0	23.5	2:27:10 PM - 7/30/2020
845.414333	---	25.04	1000.0	120.000	120.0	V	184.0	24.2	2:28:40 PM - 7/30/2020
845.414333	35.85	---	1000.0	120.000	120.0	V	184.0	24.2	2:28:40 PM - 7/30/2020
850.814000	---	24.10	1000.0	120.000	390.0	H	225.0	24.2	2:30:19 PM - 7/30/2020
850.814000	35.33	---	1000.0	120.000	390.0	H	225.0	24.2	2:30:19 PM - 7/30/2020
927.605667	---	94.34	1000.0	120.000	200.0	V	315.0	24.9	2:31:59 PM - 7/30/2020
927.605667	95.12	---	1000.0	120.000	200.0	V	315.0	24.9	2:31:59 PM - 7/30/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 1GHz - 11GHz
EUT	QLXD1 X52
Serial Number	1
Operating Frequency:	High Frequency 927.600MHz
RF Power Level	1mW
Tester Name	Sharjeel Sohail
Date Tested	August 19, 2020, 75F 38% RH



Critical Frequencies

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1115.600000	34.8	---	---	175.0	H	14.0	-15.3	1:36:12 PM - 8/19/2020
2281.800000	38.0	---	---	110.0	V	4.0	-13.0	1:37:18 PM - 8/19/2020
4738.866667	40.6	---	---	102.0	V	158.0	-7.5	1:38:13 PM - 8/19/2020
5638.733333	39.4	---	---	374.0	V	278.0	-8.2	1:39:36 PM - 8/19/2020
7118.866667	42.4	---	---	231.0	H	294.0	-3.7	1:40:50 PM - 8/19/2020
	1							

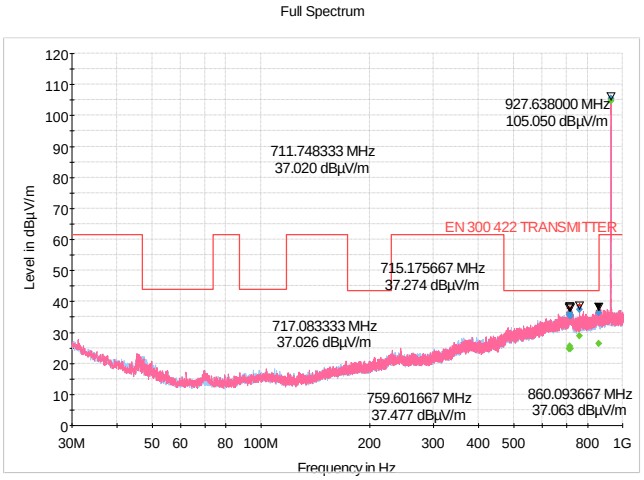
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1115.600000	34.74	1000.0	1000.000	175.0	H	14.0	-15.3	1:36:18 PM - 8/19/2020
2281.800000	38.54	1000.0	1000.000	110.0	V	4.0	-13.0	1:37:29 PM - 8/19/2020
4738.866667	41.08	1000.0	1000.000	102.0	V	159.0	-7.5	1:38:25 PM - 8/19/2020
5638.733333	39.56	1000.0	1000.000	375.0	V	278.0	-8.2	1:39:42 PM - 8/19/2020
7118.866667	42.36	1000.0	1000.000	231.0	H	297.0	-3.7	1:41:05 PM - 8/19/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 30MHz - 1GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	High Frequency 927.600MHz
RF Power Level	10mW
Tester Name:	Sharjeel Sohail
Date Tested	July 30, 2020, 75F 42% RH



Critical Frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
711.748333	36.45	---	---	100.0	H	40.0	23.1	1:47:20 PM - 7/30/2020
715.175667	37.74	---	---	200.0	V	323.0	23.1	1:49:05 PM - 7/30/2020
717.083333	36.56	---	---	378.0	V	1.0	23.1	1:51:19 PM - 7/30/2020
759.601667	38.60	---	---	138.0	V	356.0	23.4	1:53:21 PM - 7/30/2020
860.093667	37.22	---	---	112.0	V	278.0	24.2	1:54:42 PM - 7/30/2020
927.638000	105.38	---	---	112.0	V	269.0	24.9	1:55:52 PM - 7/30/2020

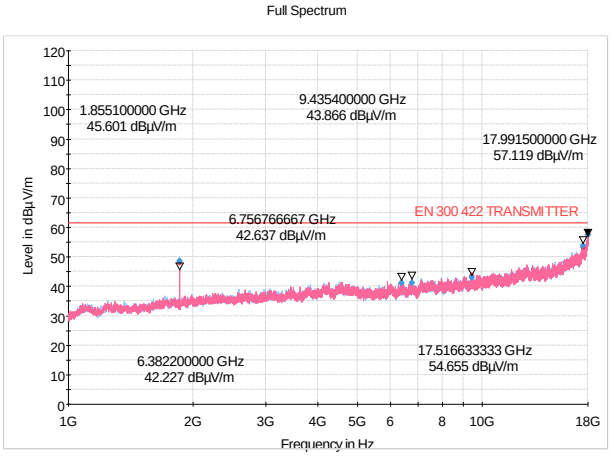
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
711.748333	---	24.65	1000.0	120.000	100.0	H	40.0	23.1	1:47:33 PM - 7/30/2020
711.748333	35.61	---	1000.0	120.000	100.0	H	40.0	23.1	1:47:32 PM - 7/30/2020
715.175667	---	25.61	1000.0	120.000	200.0	V	323.0	23.1	1:49:17 PM - 7/30/2020
715.175667	36.20	---	1000.0	120.000	200.0	V	323.0	23.1	1:49:16 PM - 7/30/2020
717.083333	---	24.68	1000.0	120.000	378.0	V	1.0	23.1	1:51:31 PM - 7/30/2020
717.083333	35.23	---	1000.0	120.000	378.0	V	1.0	23.1	1:51:30 PM - 7/30/2020
759.601667	---	28.86	1000.0	120.000	138.0	V	0.0	23.4	1:53:33 PM - 7/30/2020
759.601667	37.31	---	1000.0	120.000	138.0	V	0.0	23.4	1:53:33 PM - 7/30/2020
860.093667	---	26.44	1000.0	120.000	112.0	V	278.0	24.2	1:54:53 PM - 7/30/2020
860.093667	36.25	---	1000.0	120.000	112.0	V	278.0	24.2	1:54:53 PM - 7/30/2020
927.638000	---	104.65	1000.0	120.000	112.0	V	269.0	24.9	1:56:02 PM - 7/30/2020
927.638000	105.37	---	1000.0	120.000	112.0	V	269.0	24.9	1:56:02 PM - 7/30/2020

Appendix C

Common Information

Test Description:	FCC 15C Radiated Emissions 1GHz - 11GHz
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	High Frequency 927.600MHz
RF Power Level	10mW
Tester Name:	Sharjeel Sohail
Date Tested	August 19, 2020, 75F 37% RH



Critical Frequencies

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1855.100000	47.9	---	---	355.0	V	108.0	-14.5	12:49:47 PM - 8/19/2020
6382.200000	41.1	---	---	125.0	H	1.0	-5.5	12:51:18 PM - 8/19/2020
6756.766667	41.2	---	---	186.0	H	342.0	-5.0	12:52:56 PM - 8/19/2020
9435.400000	43.8	---	---	393.0	V	197.0	-2.5	12:54:51 PM - 8/19/2020

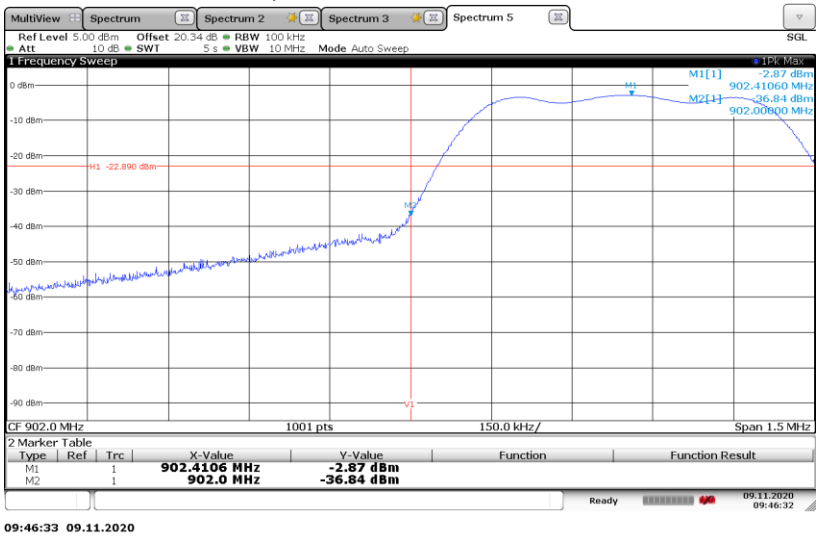
Final Results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1855.100000	48.53	1000.0	1000.000	355.0	V	108.0	-14.5	12:49:58 PM - 8/19/2020
6382.200000	41.21	1000.0	1000.000	125.0	H	1.0	-5.5	12:51:24 PM - 8/19/2020
6756.766667	41.13	1000.0	1000.000	186.0	H	342.0	-5.0	12:53:11 PM - 8/19/2020
9435.400000	43.07	1000.0	1000.000	393.0	V	197.0	-2.5	12:55:01 PM - 8/19/2020

Appendix C

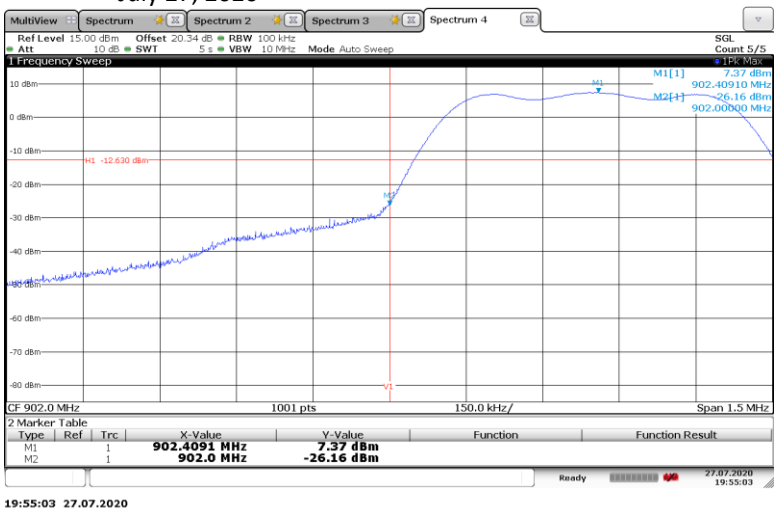
Common Information

Test Description: FCC 15C 15.247(a)(2)
EUT: QLXD1 X52
Serial Number: 1
Operating Frequency: Low Frequency 902.400MHz
RF Power Level 1mW
Tester Name: Juan Castrejon
Date Tested November 9, 2020



Common Information

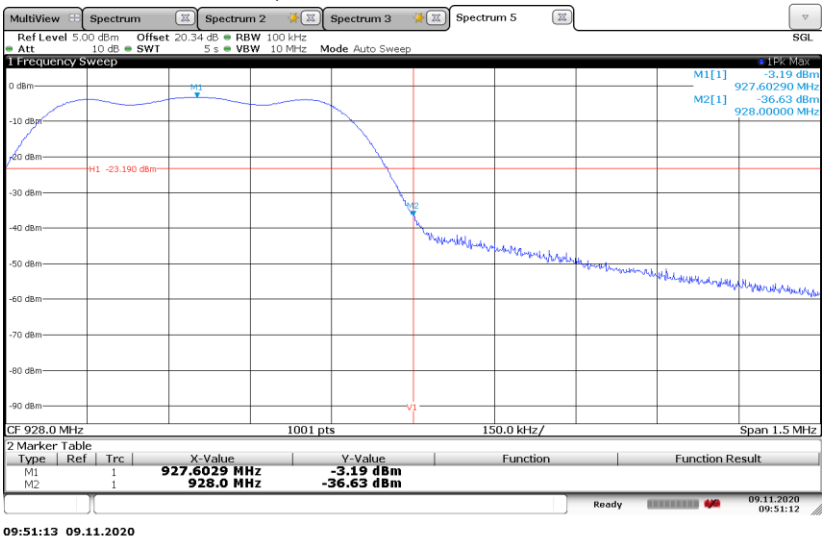
Test Description: FCC 15C 15.247(a)(2)
EUT: QLXD1 X52
Serial Number: 1
Operating Frequency: Low Frequency 902.400MHz
RF Power Level 10mW
Tester Name: Juan Castrejon
Date Tested July 27, 2020



Appendix C

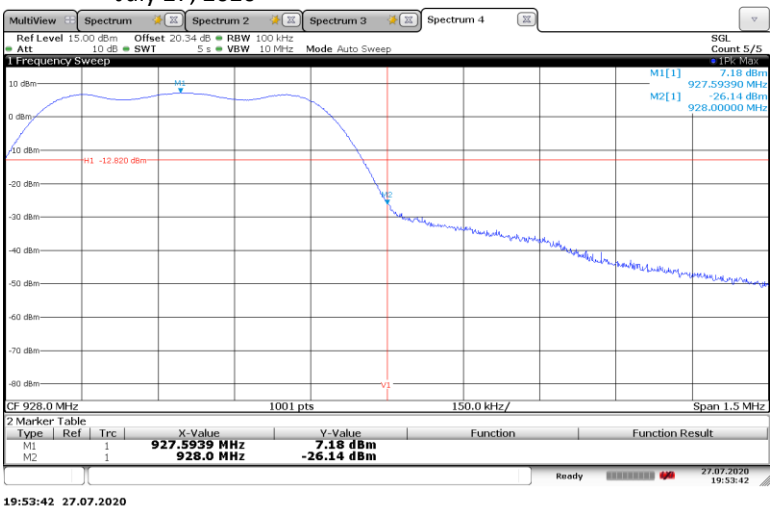
Common Information

Test Description:	FCC 15C 15.247(a)(2)
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	High Frequency 927.600MHz
RF Power Level	1mW
Tester Name:	Juan Castrejon
Date Tested	November 9, 2020



Common Information

Test Description:	FCC 15C 15.247(a)(2)
EUT:	QLXD1 X52
Serial Number:	1
Operating Frequency:	High Frequency 927.600MHz
RF Power Level	10mW
Tester Name:	Juan Castrejon
Date Tested	July 27, 2020



Appendix C

Date: July 30 and August 19, 2020
EUT: QLXD1
Band: X52
Serial Number: 1
Specification: FCC 15C, Section 15.247(d)
Comments: Limit is 30dB below carrier level
Mode: EUT set to Low Frequency 902.400 MHz at 1mW
Tested By: Sharjeel Sohail

Frequency in MHz	Carrier level in dBm	Limit In dBm	Margin In dB
902.400	-1.77		
850.717	-60.80	-31.77	29.03
3198.667	-58.67	-31.77	26.90

Date: July 30 and August 19, 2020
EUT: QLXD1
Band: X52
Serial Number: 1
Specification: FCC 15C, Section 15.247(d)
Comments: Limit is 30dB below carrier level
Mode: EUT set to Low Frequency 902.400 MHz at 10mW
Tested By: Sharjeel Sohail

Frequency in MHz	Carrier level in dBm	Limit In dBm	Margin In dB
902.400	13.57		
853.918	-59.82	-16.43	43.39
1804.667	-49.80	-16.43	33.37

Appendix C

Date: July 30 and August 19, 2020
EUT: QLXD1
Band: X52
Serial Number: 1
Specification: FCC 15C, Section 15.247(d)
Comments: Limit is 30dB below carrier level
Mode: EUT set to Middle Frequency 915.000 MHz at 1mW
Tested By: Sharjeel Sohail

Frequency in MHz	Carrier Level in dBm	Limit In dBm	Margin In dB
915.000	-1.51		
859.673	-60.88	-31.51	29.37
3059.833	-57.27	-31.51	25.76

Date: July 30 and August 19, 2020
EUT: QLXD1
Band: X52
Serial Number: 1
Specification: FCC 15C, Section 15.247(d)
Comments: Limit is 30dB below carrier level
Mode: EUT set to Middle Frequency 915.000 MHz at 10mW
Tested By: Sharjeel Sohail

Frequency in MHz	Carrier Level in dBm	Limit In dBm	Margin In dB
915.000	13.46		
838.301	-60.33	-16.54	43.79
7969.433	-55.34	-16.54	38.80

Appendix C

Date: July 30 and August 19, 2020
EUT: QLXD1
Band: X52
Serial Number: 1
Specification: FCC 15C, Section 15.247(d)
Comments: Limit is 30dB below carrier level
Mode: EUT set to High Frequency 927.600 MHz at 1mW
Tested By: Sharjeel Sohail

Frequency in MHz	Carrier Level in dBm	Limit In dBm	Margin In dB
927.600	-2.26		
709.032	-61.39	-32.26	29.13
7118.867	-55.02	-32.26	22.76

Date: July 30 and August 19, 2020
EUT: QLXD1
Band: X52
Serial Number: 1
Specification: FCC 15C, Section 15.247(d)
Comments: Limit is 30dB below carrier level
Mode: EUT set to High Frequency 927.600 MHz at 10mW
Tested By: Sharjeel Sohail

Frequency in MHz	Carrier Level in dBm	Limit In dBm	Margin In dB
927.600	13.27		
759.602	-60.07	-16.73	43.34
1855.100	-48.85	-16.73	32.12

Appendix D

Power Spectral Density

Purpose:

This test performed to determine if the EUT meets the Power Spectral Density requirements of the FCC Part15C, Section 15.247(e), and RSS-247 Section 5.2(b).

Requirements:

As stated in FCC 15C Section 15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

As stated in RSS-247 Section 5.2(b), the transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d),(i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power)

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 D 1. The test instrumentation can be determined from Table 10-1.

Appendix D

EUT Operation:

A Shure microphone was plugged into the EUT. 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, middle, and high frequency within the operating frequency range, and at 1mW and 10mW RF output.

Specific Test Procedures:

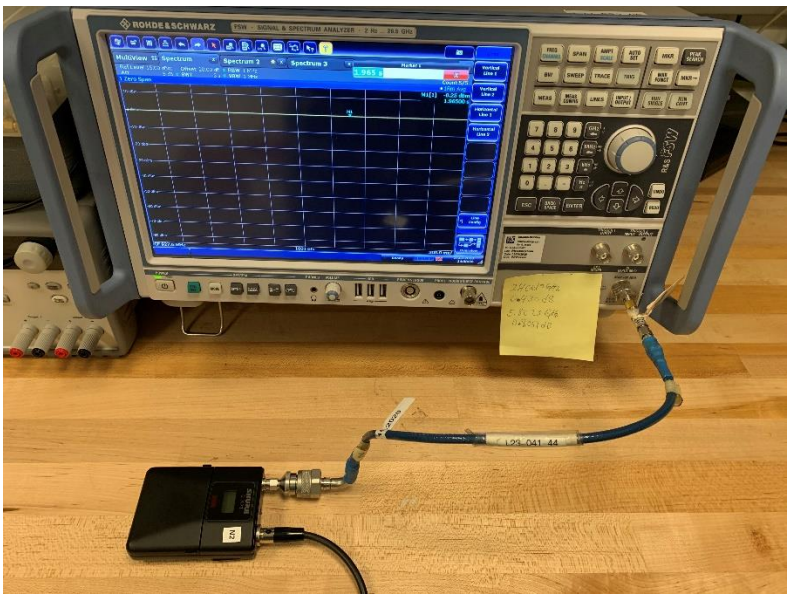
The Power Spectral Density test was setup as follows;

Center Frequency = Operating Frequency of EUT
Reference Level = 20 dB
Internal Attenuator = 10 dB
Offset = 20.36 dB (External attenuator)
RBW = 3 kHz
VBW = 10 MHz
Span = 1 MHz

The EUT was set to transmit on the low, middle, and high frequencies, and power level of 1mW and 10mW.

Results:

The power spectral density at low, middle and high frequencies were below 8dBm.

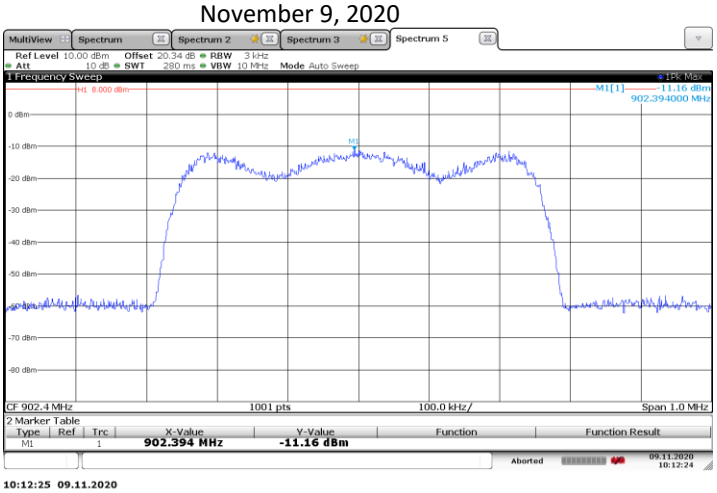


Figures D-1 - Test Setup for Power Spectral Density

Appendix D

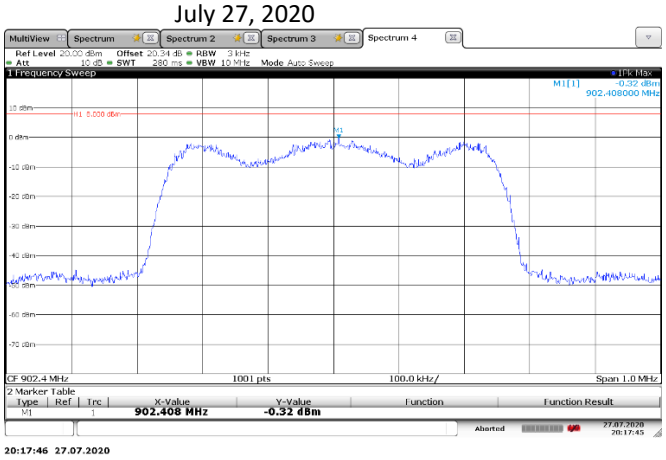
Test Information

EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Power Spectral Density
Operating Conditions: Low Frequency, 902.400MHz, 1mW
Operator Name: Juan Castrejon
Comment: FCC Part15C, Section 15.247(e), RSS-247 Section 2.5(b)
Date Tested: November 9, 2020



Test Information

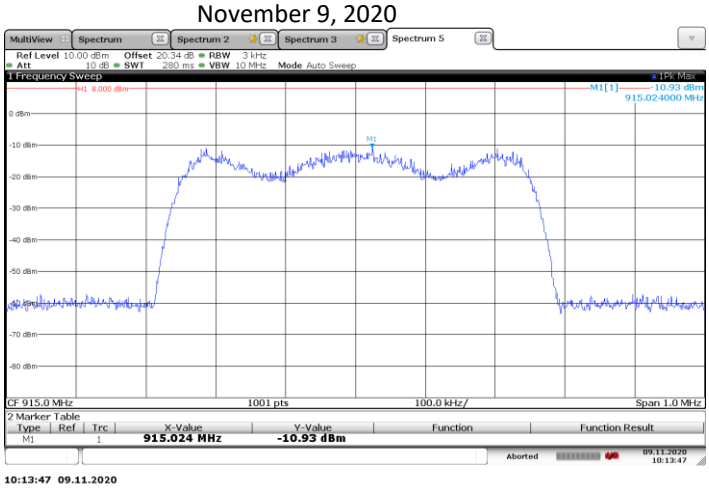
EUT Name: QLXD1 X52
Serial Number: 1
Test Description: Power Spectral Density
Operating Conditions: Low Frequency, 902.400MHz, 10mW
Operator Name: Juan Castrejon
Comment: FCC Part15C, Section 15.247(e), RSS-247 Section 2.5(b)
Date Tested: July 27, 2020



Appendix D

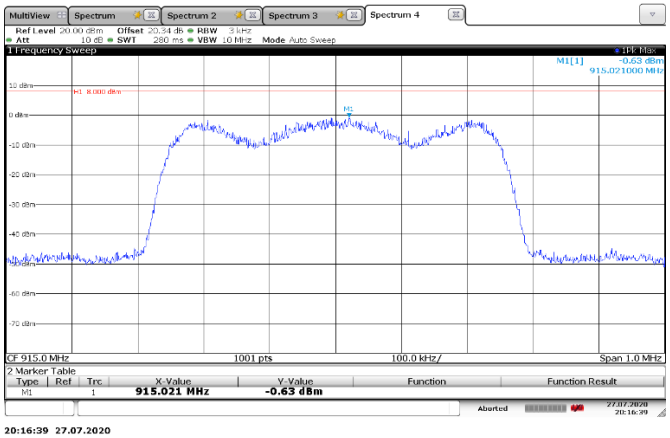
Test Information

EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	Power Spectral Density
Operating Conditions:	Middle Frequency, 915.000MHz, 1mW
Operator Name:	Juan Castrejon
Comment:	FCC Part15C, Section 15.247(e), RSS-247 Section 2.5(b)
Date Tested:	November 9, 2020



Test Information

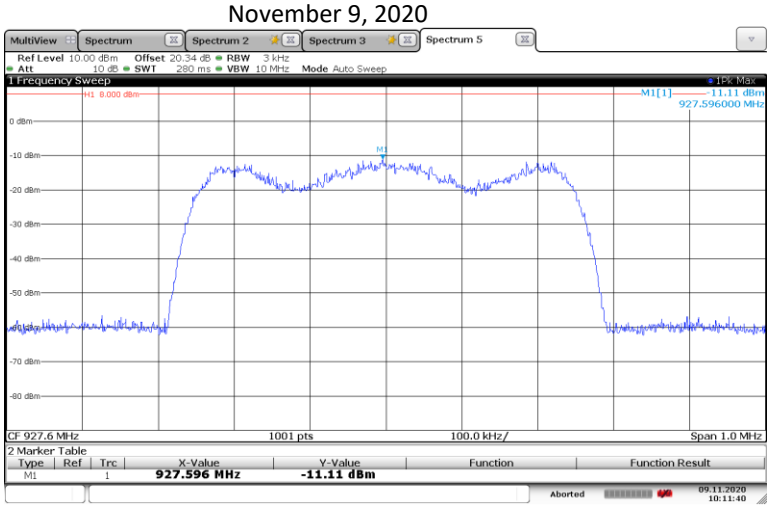
EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	Power Spectral Density
Operating Conditions:	Middle Frequency, 915.000MHz, 10mW
Operator Name:	Juan Castrejon
Comment:	FCC Part15C, Section 15.247(e), RSS-247 Section 2.5(b)
Date Tested:	July 27, 2020



Appendix D

Test Information

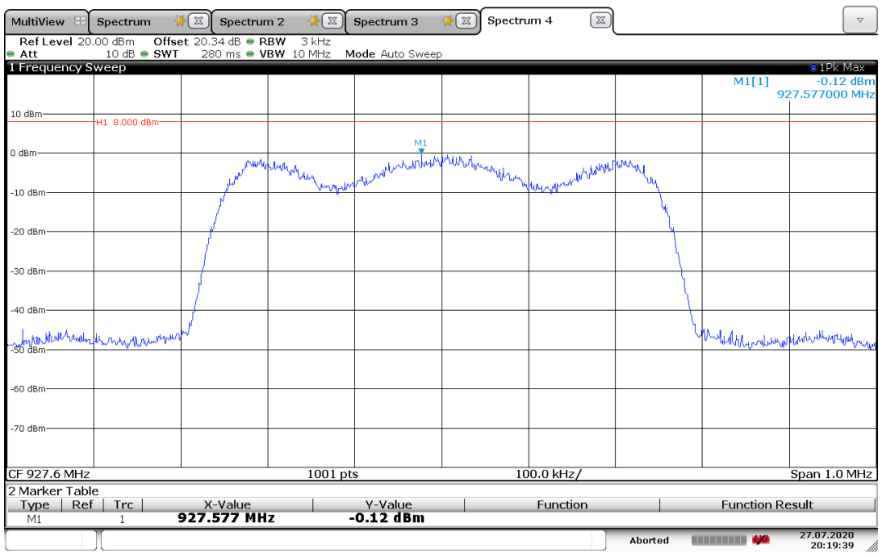
EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	Power Spectral Density
Operating Conditions:	High Frequency, 927.600MHz, 1mW
Operator Name:	Juan Castrejon
Comment:	FCC Part15C, Section 15.247(e), RSS-247 Section 2.5(b)
Date Tested:	November 9, 2020



10:11:40 09.11.2020

Test Information

EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	Power Spectral Density
Operating Conditions:	High Frequency, 927.600MHz, 10mW
Operator Name:	Juan Castrejon
Comment:	FCC Part15C, Section 15.247(e), RSS-247 Section 2.5(b)
Date Tested:	July 27, 2020



20:19:40 27.07.2020

Appendix E

Spurious Emissions on Antenna Port

PURPOSE:
This test was performed to determine if the EUT meets the Spurious Emissions on Antenna Port requirements of the FCC Title 47, Section 2.1051 specifications over the EUT operating frequency range of 902MHz to 928MHz.

REQUIREMENTS:

As stated in paragraph Section 2.1051, the radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

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. The expanded measurement uncertainty (95% confidence) has been determined to be ± 1.28 dB.

TEST SETUP AND INSTRUMENTATION:

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

EUT OPERATION:

A Shure microphone was plugged into the EUT. The EUT was powered up and the frequency of the transmitter was selected using the front panel controls. For conducted spurious emissions the testing was performed with the EUT set to the low, middle, and high frequencies with RF power output of 1mW and 10mW.

Appendix E

TEST PROCEDURES:

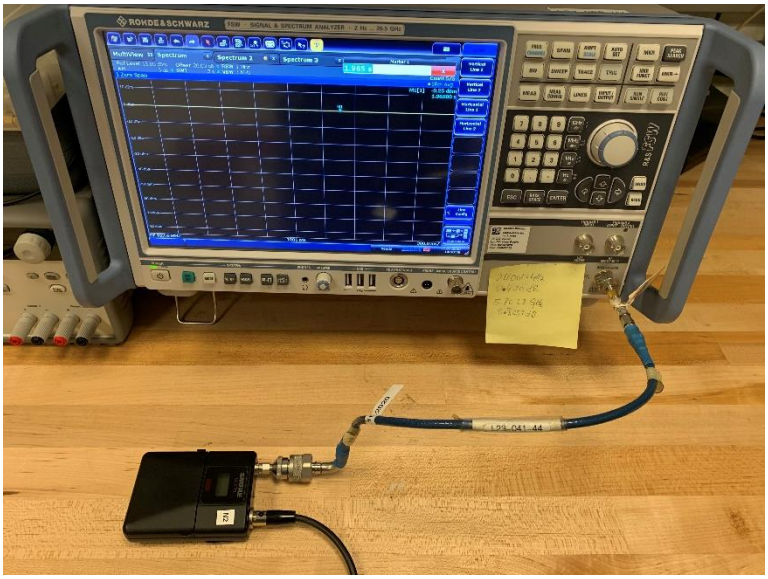
The testing was performed as states in FCC Part 2.1051.

RESULTS:

The plots of the antenna port spurious emissions are shown on page 42 thru page 43. All emissions measured from the EUT were within the FCC 15C Section 15.247(d) specification limits. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

All spurious emissions were at least 20 dB below the highest measured power of the EUT.

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

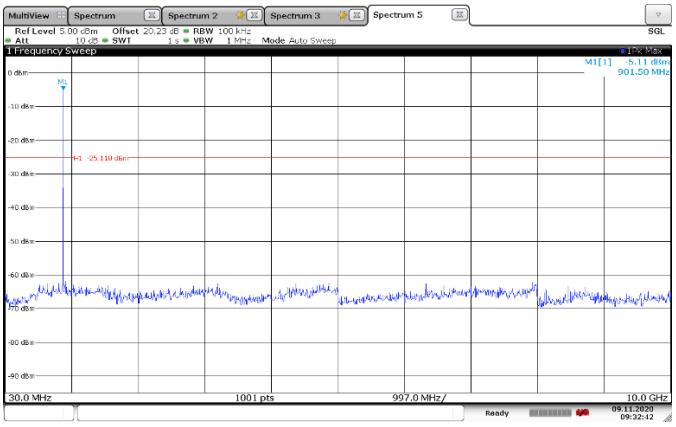


Figures E-1 - Test Setup for Spurious Emissions on Antenna Port

Appendix E

Test Information

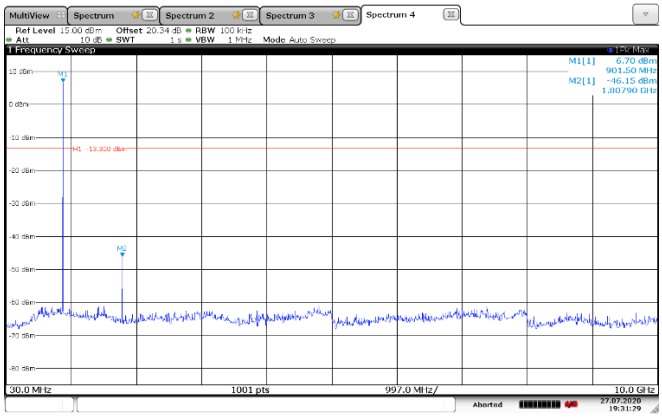
EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	FCC Section 2.1051 Spurious Emissions on Antenna Port
Operating Conditions:	Low frequency 902.400MHz at 1mW
Operator Name:	Juan Castrejon
Comment:	R & S FSU Spectrum Analyzer
Test Date	November 9, 2020



09:32:42 09.11.2020

Test Information

EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	FCC Section 2.1051 Spurious Emissions on Antenna Port
Operating Conditions:	Low frequency 902.400MHz at 10mW
Operator Name:	Juan Castrejon
Comment:	R & S FSU Spectrum Analyzer
Test Date	July 27, 2020

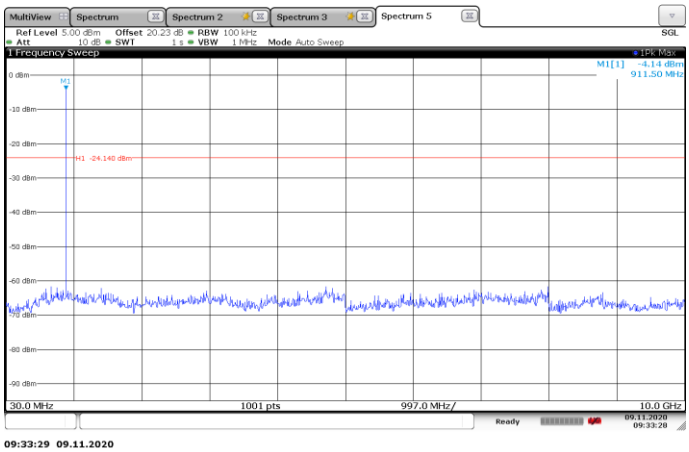


19:31:30 27.07.2020

Appendix E

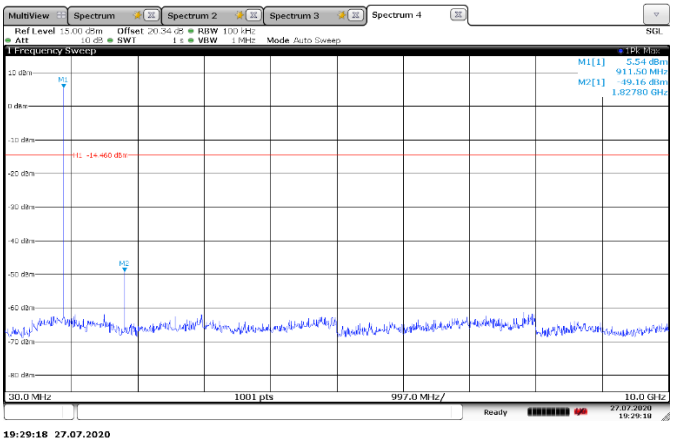
Test Information

EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	FCC Section 2.1051 Spurious Emissions on Antenna Port
Operating Conditions:	Middle frequency 915.000MHz at 1mW
Operator Name:	Juan Castrejon
Comment:	R & S FSU Spectrum Analyzer
Test Date	November 9, 2020



Test Information

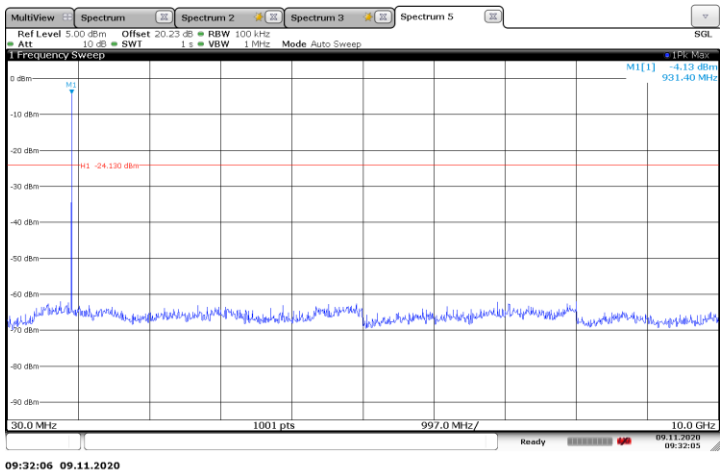
EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	FCC Section 2.1051 Spurious Emissions on Antenna Port
Operating Conditions:	Middle frequency 915.000MHz at 10mW
Operator Name:	Juan Castrejon
Comment:	R & S FSU Spectrum Analyzer
Test Date	July 27, 2020



Appendix E

Test Information

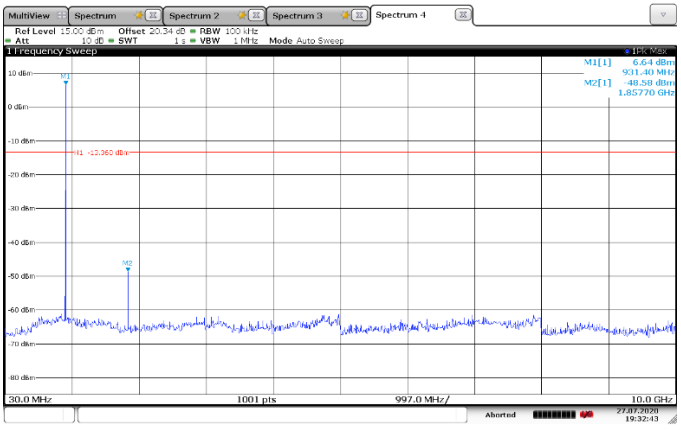
EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	FCC Section 2.1051 Spurious Emissions on Antenna Port
Operating Conditions:	High Frequency 927.600MHz at 1mW
Operator Name:	Juan Castrejon
Comment:	R & S FSU Spectrum Analyzer
Test Date	November 9, 2020



09:32:06 09.11.2020

Test Information

EUT Name:	QLXD1 X52
Serial Number:	1
Test Description:	FCC Section 2.1051 Spurious Emissions on Antenna Port
Operating Conditions:	High Frequency 927.600MHz at 10mW
Operator Name:	Juan Castrejon
Comment:	R & S FSU Spectrum Analyzer
Test Date	July 27, 2020



19:32:44 27.07.2020