Measurement of RF Emissions from a Handheld Transmitter Model No. ULXD2

For	Shure Incorporated 5800 West Touhy Avenue Niles, IL 60714
P.O. Number	4500275203
Date Tested	September 2, 2014 through September 12, 2014
Test Personnel	Mark Longinotti
Test Specification	FCC "Code of Federal Regulations" Title 47 Part15, Subpart C, Section 15.249 Industry Canada RSS-GEN Industry Canada RSS-210

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EMC Engineer

Requested By: Alex Stelmaszczyk
Shure Incorporated

Approved By: Raymond J. Klouda
Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894

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REVISION HISTORY

Revision	Date	Description
—	1 October 2014	Initial release

Measurement of RF Emissions from a Handheld Transmitter, Model No. ULXD2

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Shure Incorporated Handheld Transmitter, Model No. ULXD2, Serial No. None Assigned, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was designed to transmit in the 902-928MHz band using an internal, non-removable whip antenna. The EUT was manufactured and submitted for testing by Shure Incorporated located in Niles, IL.

1.2. Purpose

The test series was performed to determine if the EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.249 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2009.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 2, section A2.9 for transmitters. Testing was performed in accordance with ANSI C63.4-2009.

1.3. Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4. EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by The American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5. Laboratory Conditions

The temperature at the time of the test was 21^{o}C and the relative humidity was 35%.

2. APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2013
- ANSI C63.4-2009, "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"
- Industry Canada Radio Standards Specification, RSS-Gen, “General Requirements and Information for the Certification of Radiocommunication Equipment”, Issue 3, December 2010
- Industry Canada Radio Standards Specification, RSS-210, “Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”, Issue 8, December 2010

3. EUT Setup and Operation

3.1. General Description

The EUT is a Shure Incorporated, Handheld Transmitter, Model No. ULXD2. A block diagram of the EUT setup is shown as Figure 1.

3.1.1. Power Input

The EUT was powered with 3VDC from 2 each internal “AA” batteries.

3.1.2. Peripheral Equipment

The EUT was tested with a Shure SM58 microphone cartridge attached.

3.1.3. Signal Input/Output Leads

The EUT was submitted for testing with no signal leads.

3.1.4. Grounding

The EUT was not grounded during testing.

3.2. Software

For all tests the EUT had Firmware Version X52 1.5.14 loaded onto the device to provide correct load characteristics.

3.3. Operational Mode

All emissions tests were performed separately in the following modes:

- Transmit at 902.4MHz, High Density (HD) Mode
- Transmit at 915MHz, High Density (HD) Mode
- Transmit at 927.6MHz, High Density (HD) Mode

3.4. EUT Modifications

No modifications were required for compliance.

4. Test Facility and Test Instrumentation

4.1. Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. 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 C63.4-2009 for site attenuation.

4.2. Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

Conducted and radiated emission measurements were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths and detector functions specified by the FCC.

4.3. Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4. 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 measurement uncertainty for these tests is presented below:

Conducted Emissions Measurements		
Combined Standard Uncertainty	1.06	-1.06
Expanded Uncertainty (95% confidence)	2.12	-2.12

Radiated Emissions Measurements		
Combined Standard Uncertainty	2.09	-2.09
Expanded Uncertainty (95% confidence)	4.19	-4.19

5. TEST PROCEDURES

5.1. Powerline Conducted Emissions

5.1.1. Requirements

Since the EUT was powered by internal batteries and has no connections for AC power, no conducted emissions tests are required.

5.2. Radiated Measurements

5.2.1. Requirements

The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249(a) and Industry Canada Radio Standards Specification RSS-210 Annex 2, section A2.9 for transmitters:

Fundamental Frequency MHz	Field Intensity mV/m @ 3 meter	Field Strength of Harmonics uV/m @ 3 meter
902 - 928	50	500

Note: The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector. In addition, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20 dB under any condition of modulation. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits, whichever is the lesser attenuation.

5.2.2. Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined 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 C63.4-2009 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering

with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 10.0GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final emission tests were then manually performed over the frequency range of 30MHz to 10GHz. Between 30MHz and 1000MHz, a bilog antenna was used as the pick-up device. A broadband double ridged waveguide antenna was used as the pick-up device for all frequencies above 1GHz. All significant broadband and narrowband signals were measured and recorded.

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

1) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
4) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.2.3.Results

The preliminary plots, with the EUT transmitting at 902.4MHz, 915MHz, and 927.6MHz, are presented on data pages 13 through 24. The plots are presented for a reference only, and are not used to determine compliance.

Final radiated emissions levels are presented on data pages 25 through 30. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 915MHz. The emissions level at this frequency was 4.2dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 2 and Figures 3.

5.3. Occupied Bandwidth Measurements

5.3.1.Requirement

In accordance with paragraph of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249(d) and Industry Canada Radio Standards Specification RSS-210 Annex 2, section A2.9(b), emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits, whichever is less stringent.

5.3.2.Procedures

The EUT was placed on an 80cm high non-conductive stand. A bilog antenna was placed at a test distance of 3 meters from the EUT. The unit was set to transmit continuously at the channel closest to the low band-edge. The EUT was maximized for worst case emissions at the low band-edge. The maximum meter reading was recorded using a quasi-peak (QP) detector with a 120kHz resolution bandwidth.

The unit was then set to transmit continuously at the channel closest to the high band-edge. The EUT was maximized for worst case emissions at the high band-edge. The maximum meter reading was recorded using a quasi-peak (QP) detector with a 120kHz resolution bandwidth.

5.3.3.Results

The occupied bandwidth data are shown on data pages 31 and 32. As can be seen from this data page, the transmitter met the occupied bandwidth requirements. The 99% bandwidth was measured to be 204.4kHz.

6. OTHER TEST CONDITIONS

6.1. Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was partially witnessed by Shure Incorporated personnel.

6.2. Disposition of the EUT

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

7. CONCLUSIONS

It was determined that the Shure Incorporated Handheld Transmitter, Model No. ULXD2, Serial No. None Assigned, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-2009.

It was also determined that the Shure Incorporated Handheld Transmitter, Model No. ULXD2, Serial No. None Assigned, did fully meet the conducted and radiated emission requirements of the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 2, section A2.9 for transmitters, when tested per ANSI C63.4-2009.

8. CERTIFICATION

Elite Electronic Engineering Incorporated 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 EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

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

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	3/11/2014	3/11/2015
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
NTA3	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	2/19/2014	2/19/2015
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/11/2014	3/11/2015
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/7/2014	3/7/2015
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	11/25/2013	11/25/2014

I/O: Initial Only
N/A: Not Applicable
Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

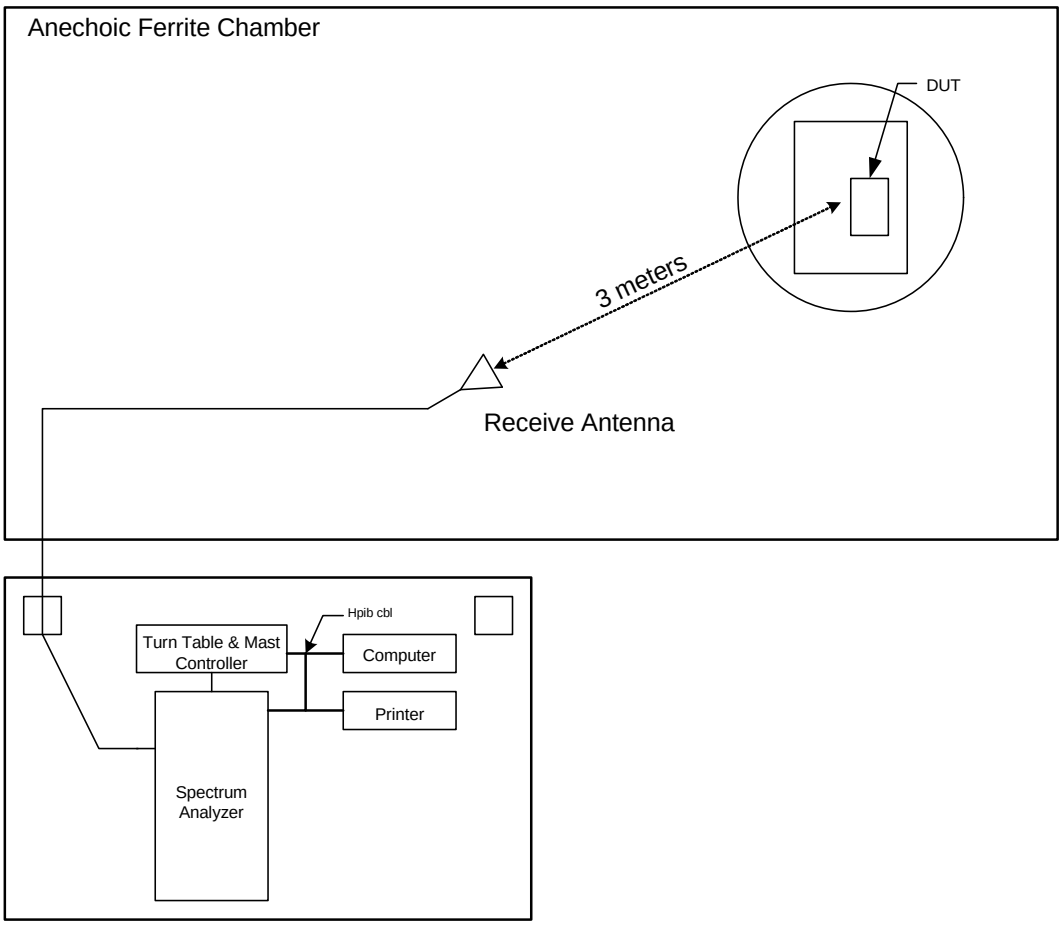
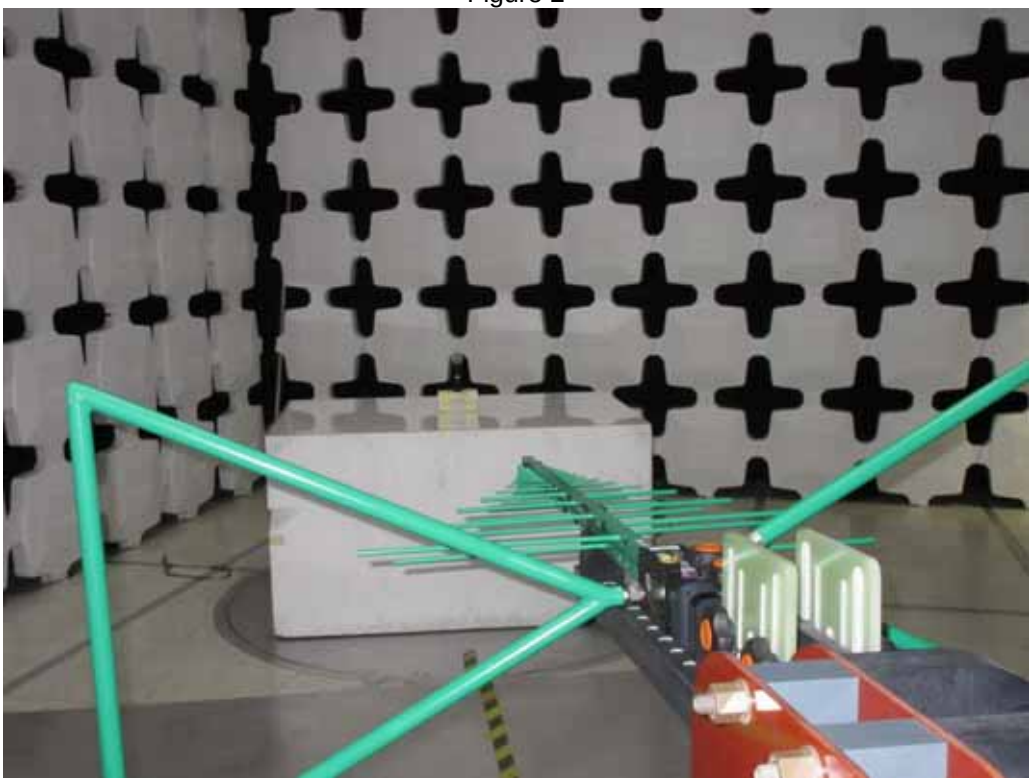
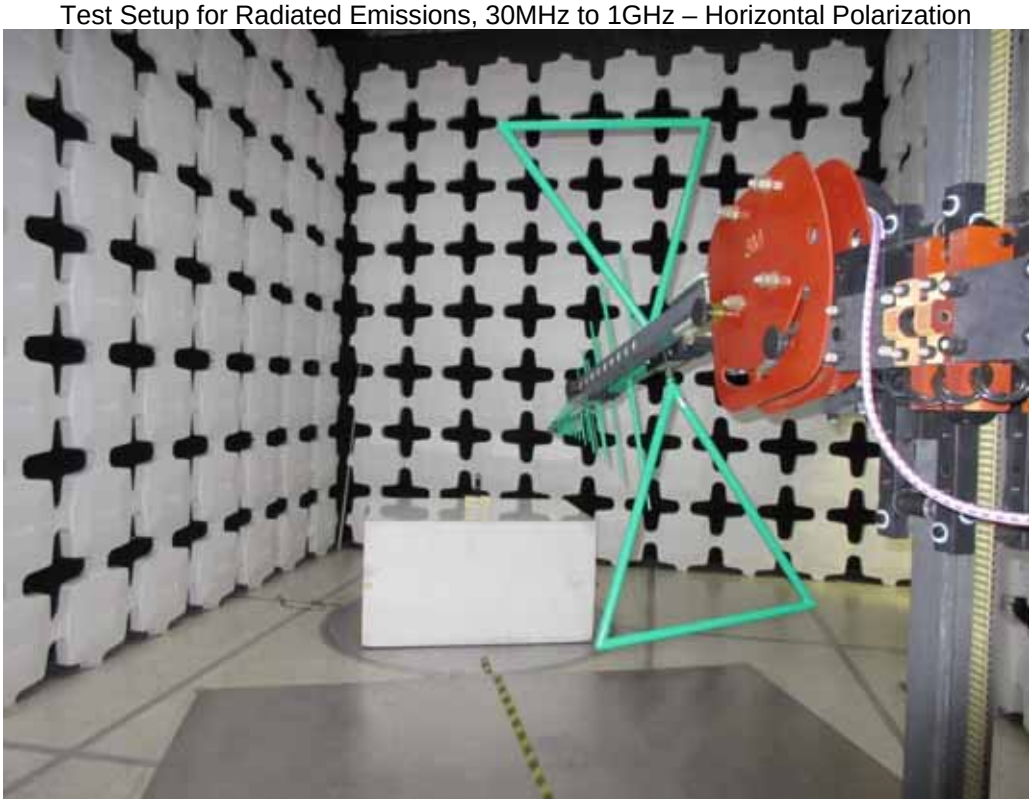


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

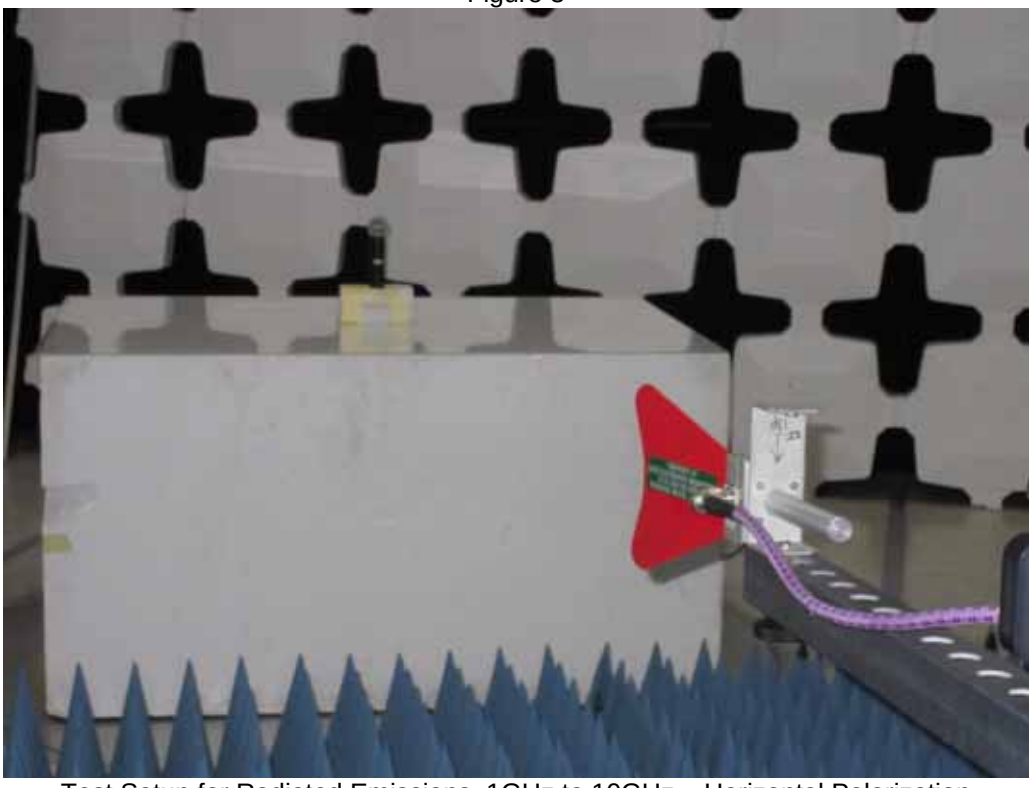


Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization



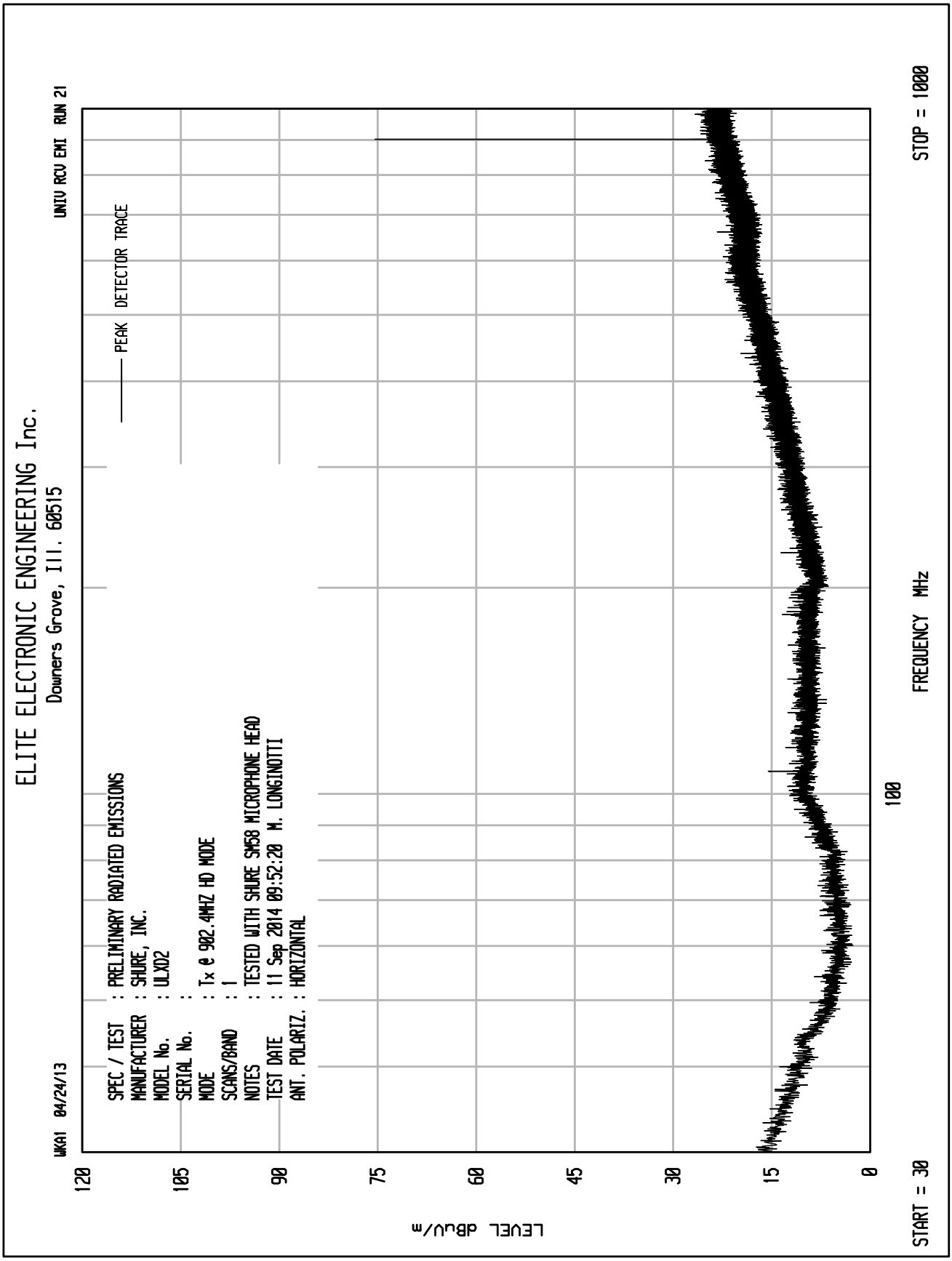
Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

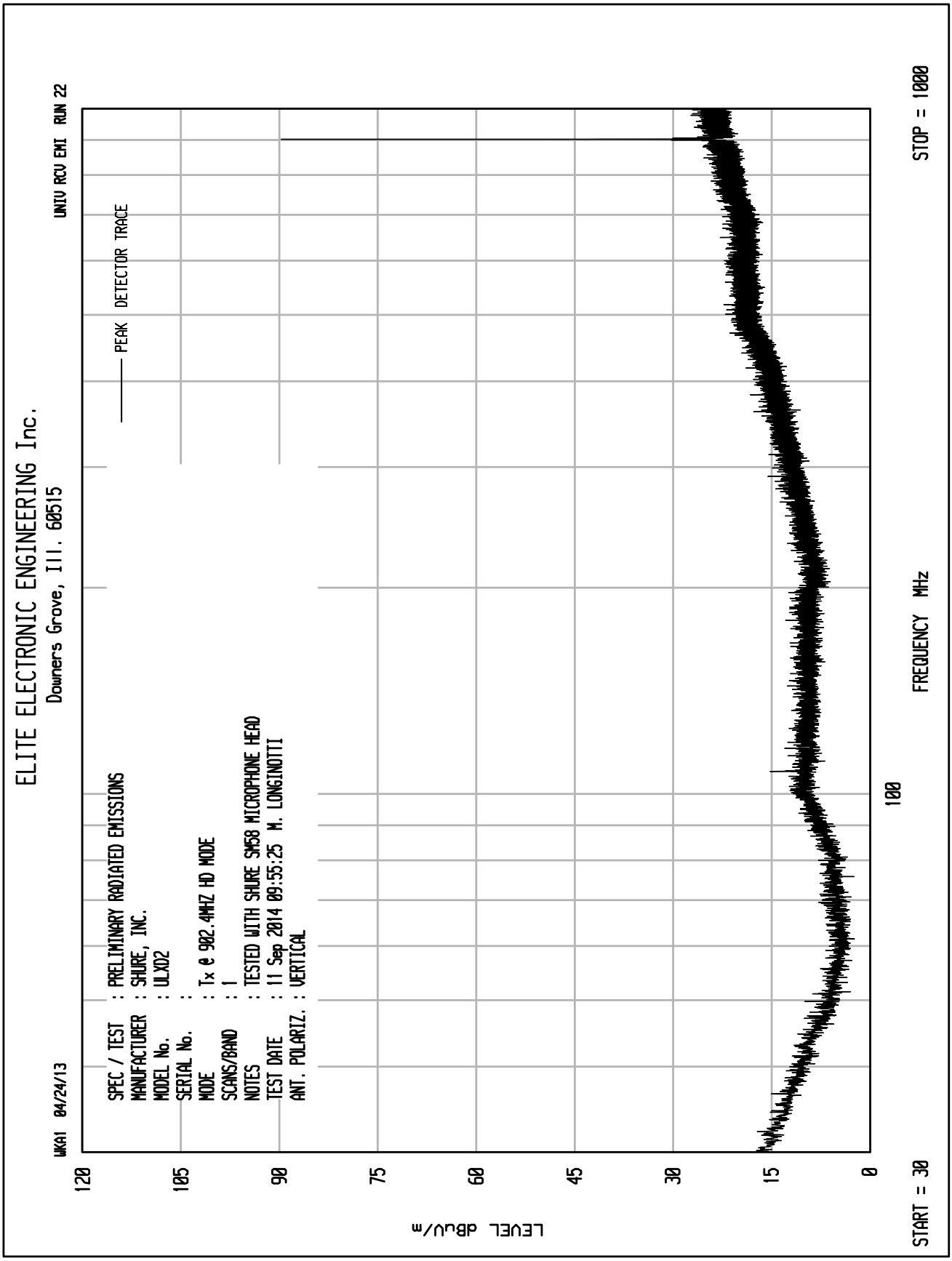
Figure 3



Test Setup for Radiated Emissions, 1GHz to 10GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 1GHz to 10GHz – Vertical Polarization


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 21
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 902.4MHZ HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 09:52:20 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 22
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 902.4MHZ HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 09:55:25 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
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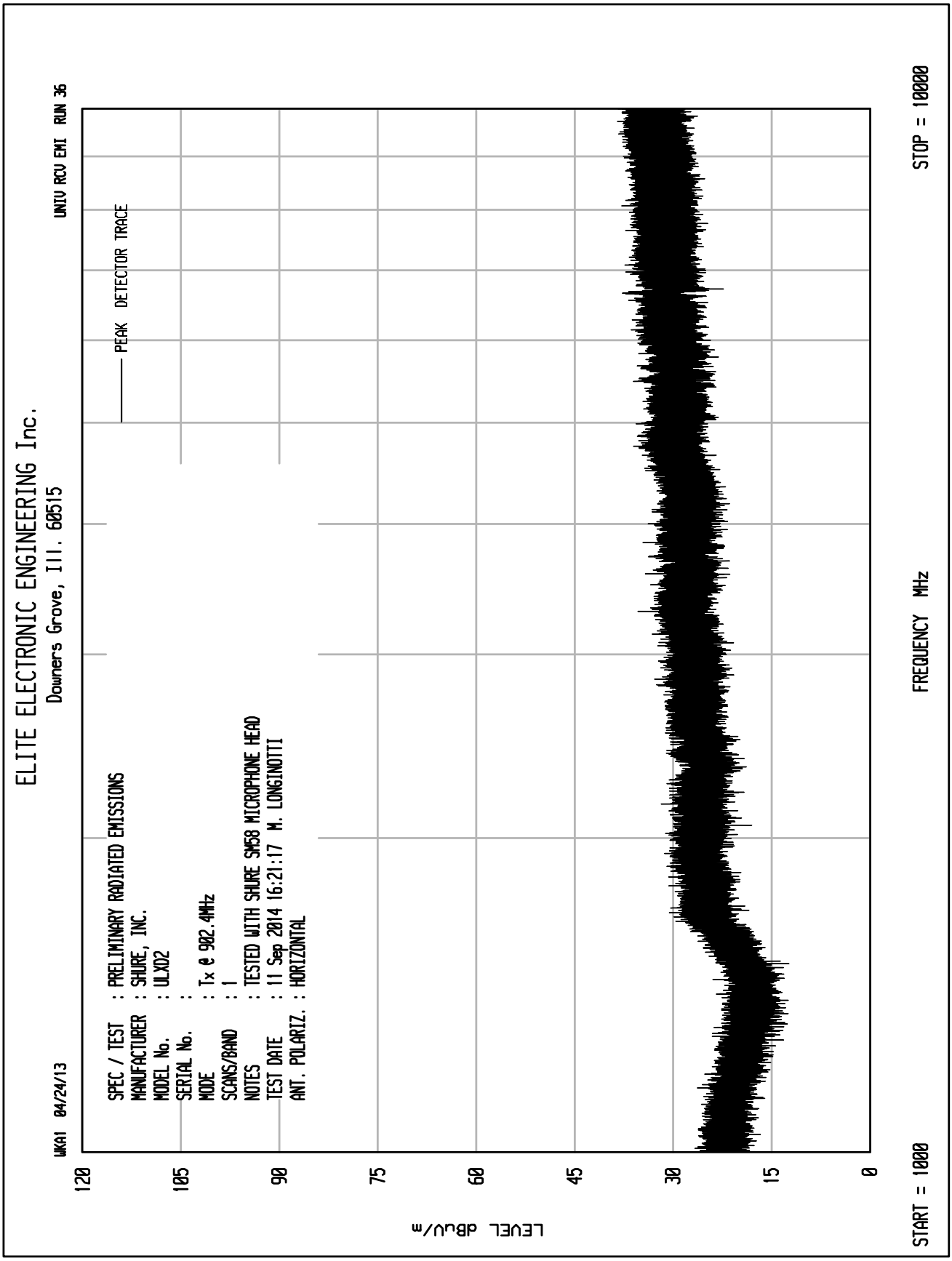
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 36
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 902.4MHz
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 16:21:17 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
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90
75
60
45
30
15
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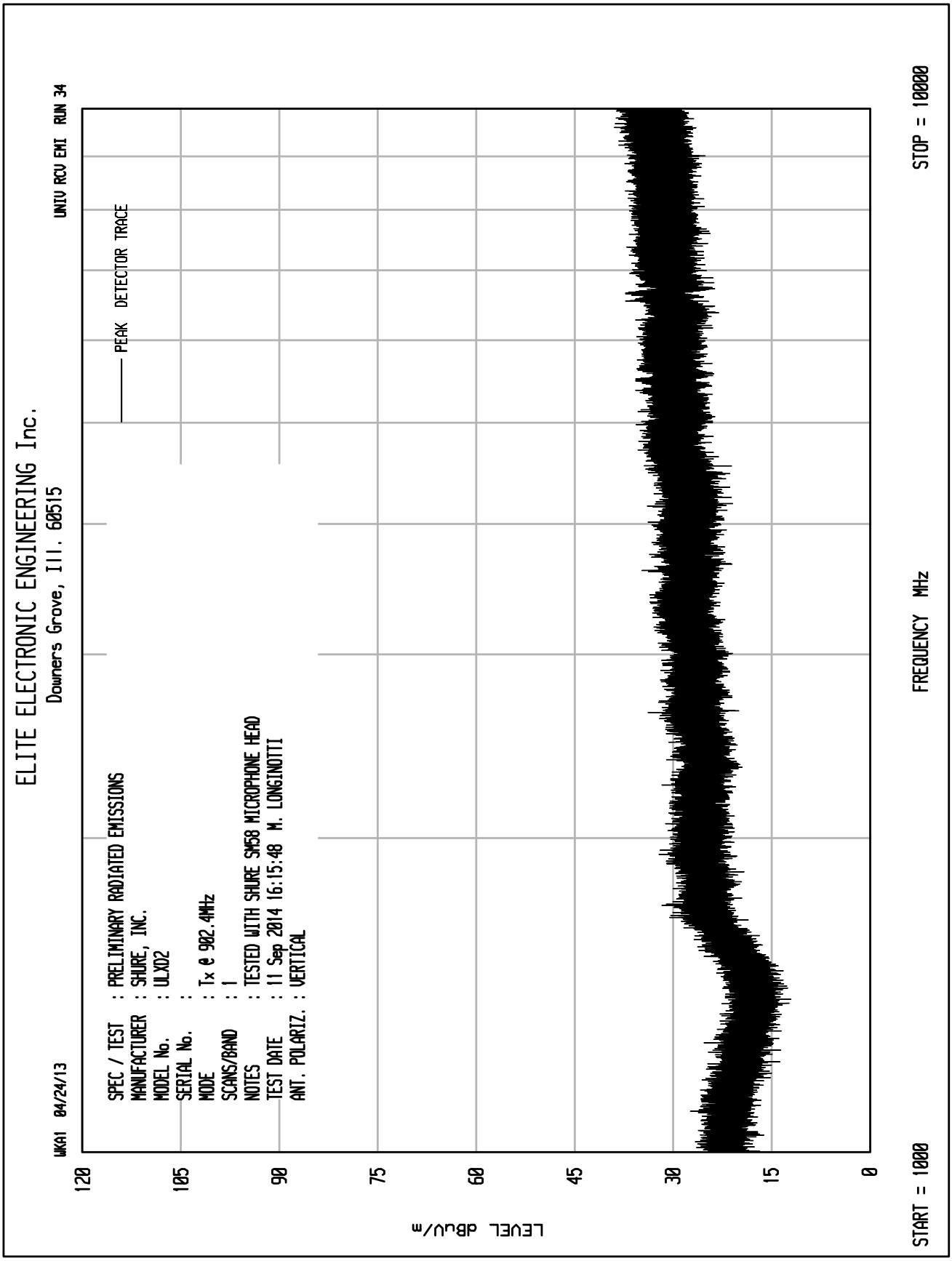
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 34
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. : :
MODE : Tx @ 902.4MHz
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 16:15:48 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
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90
75
60
45
30
15
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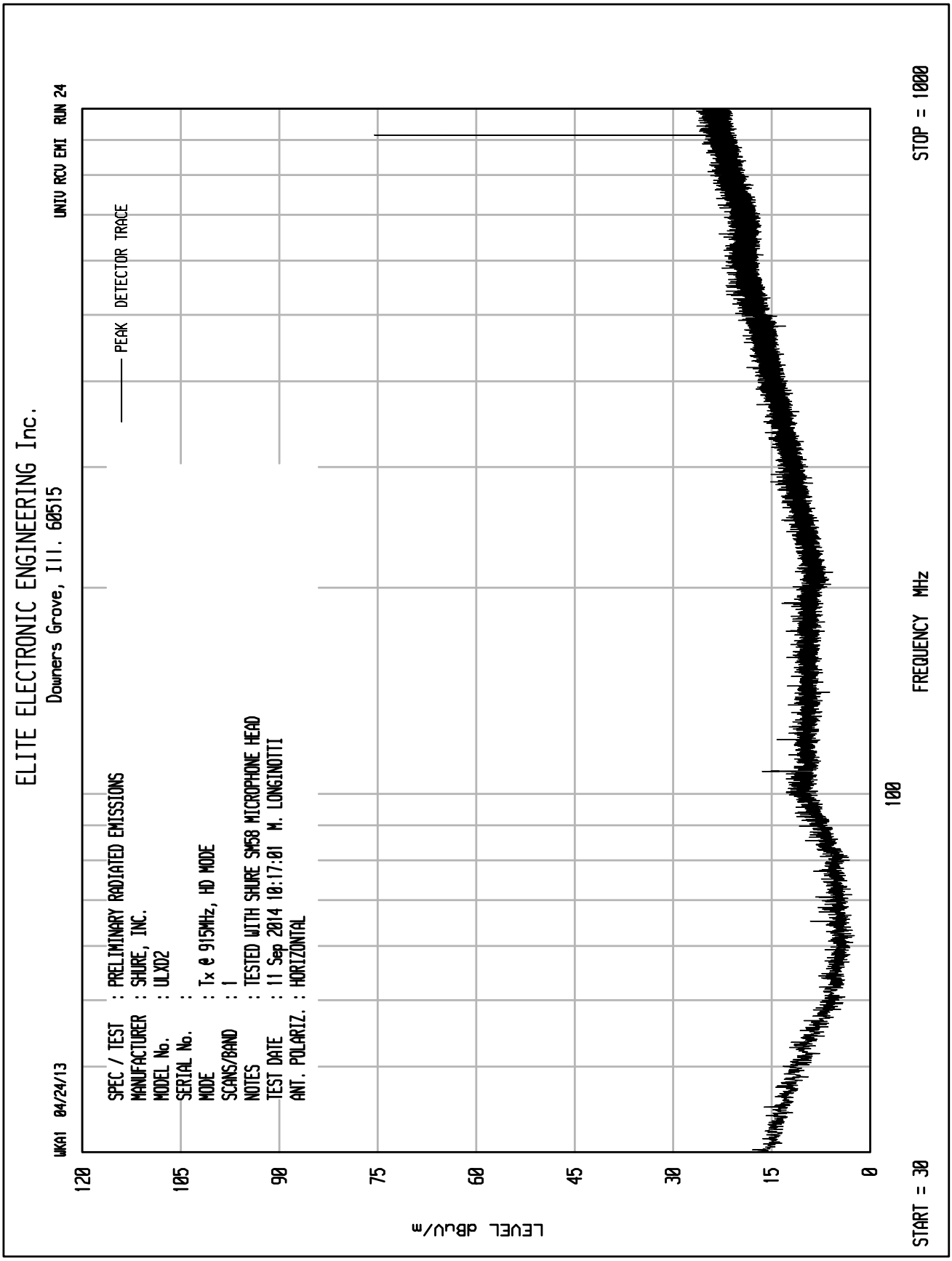
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 24
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 915MHz, HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 10:17:01 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
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105
90
75
60
45
30
15
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START = 30
100
FREQUENCY MHz
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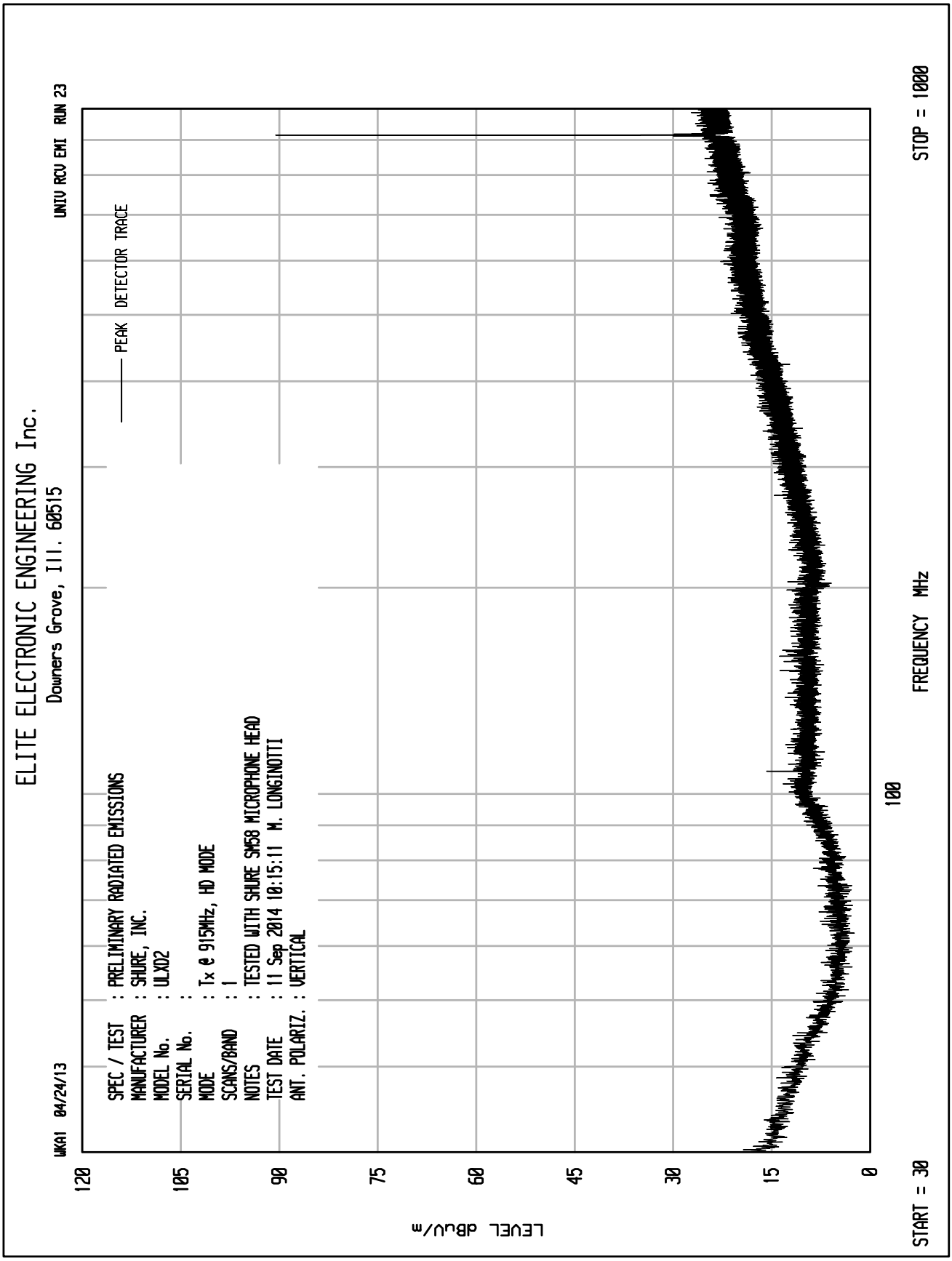
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 23
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 915MHz, HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 10:15:11 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
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105
90
75
60
45
30
15
0
START = 30
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FREQUENCY MHz
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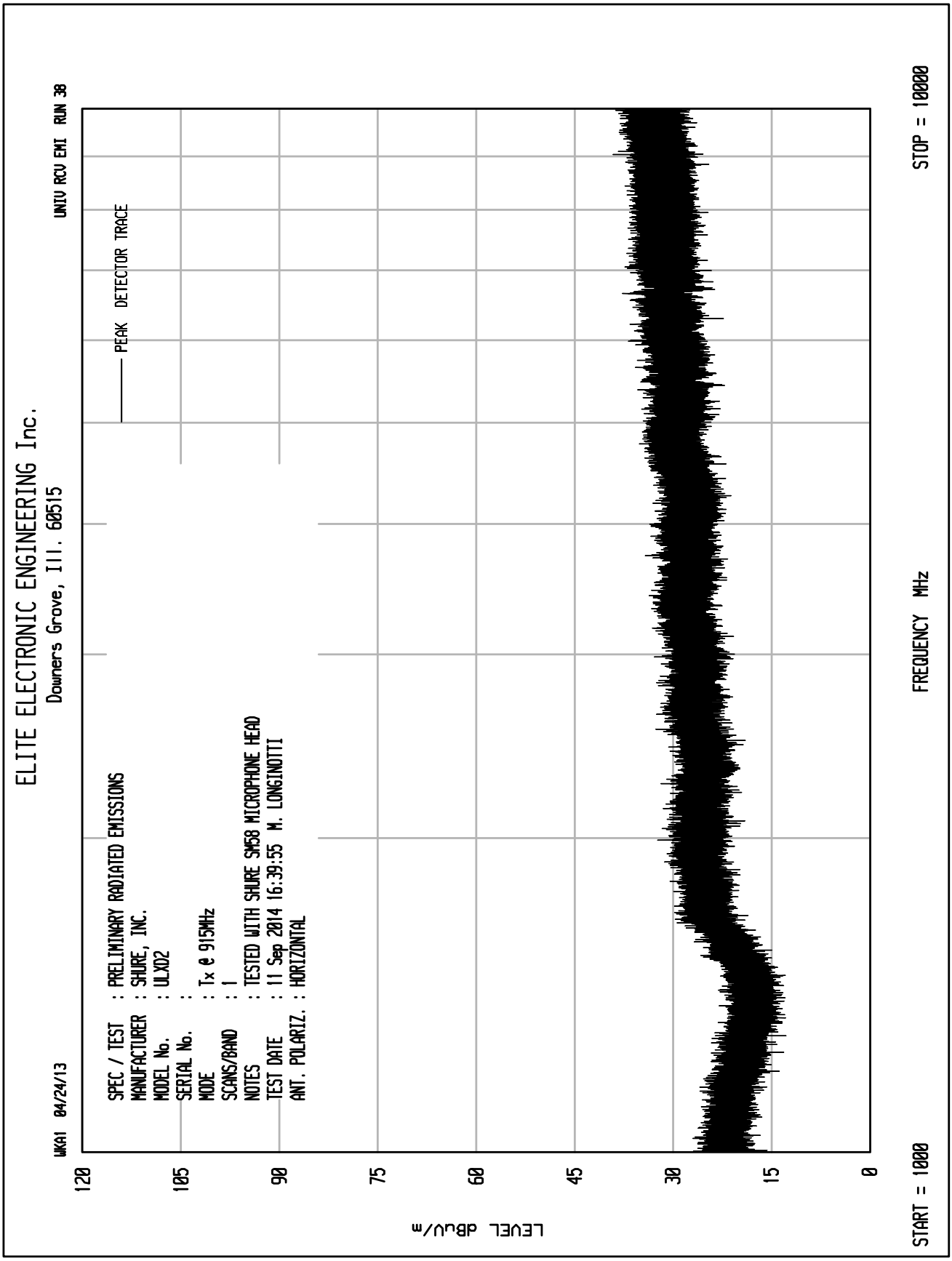
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 38
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 16:39:55 M. LONGINOTTI
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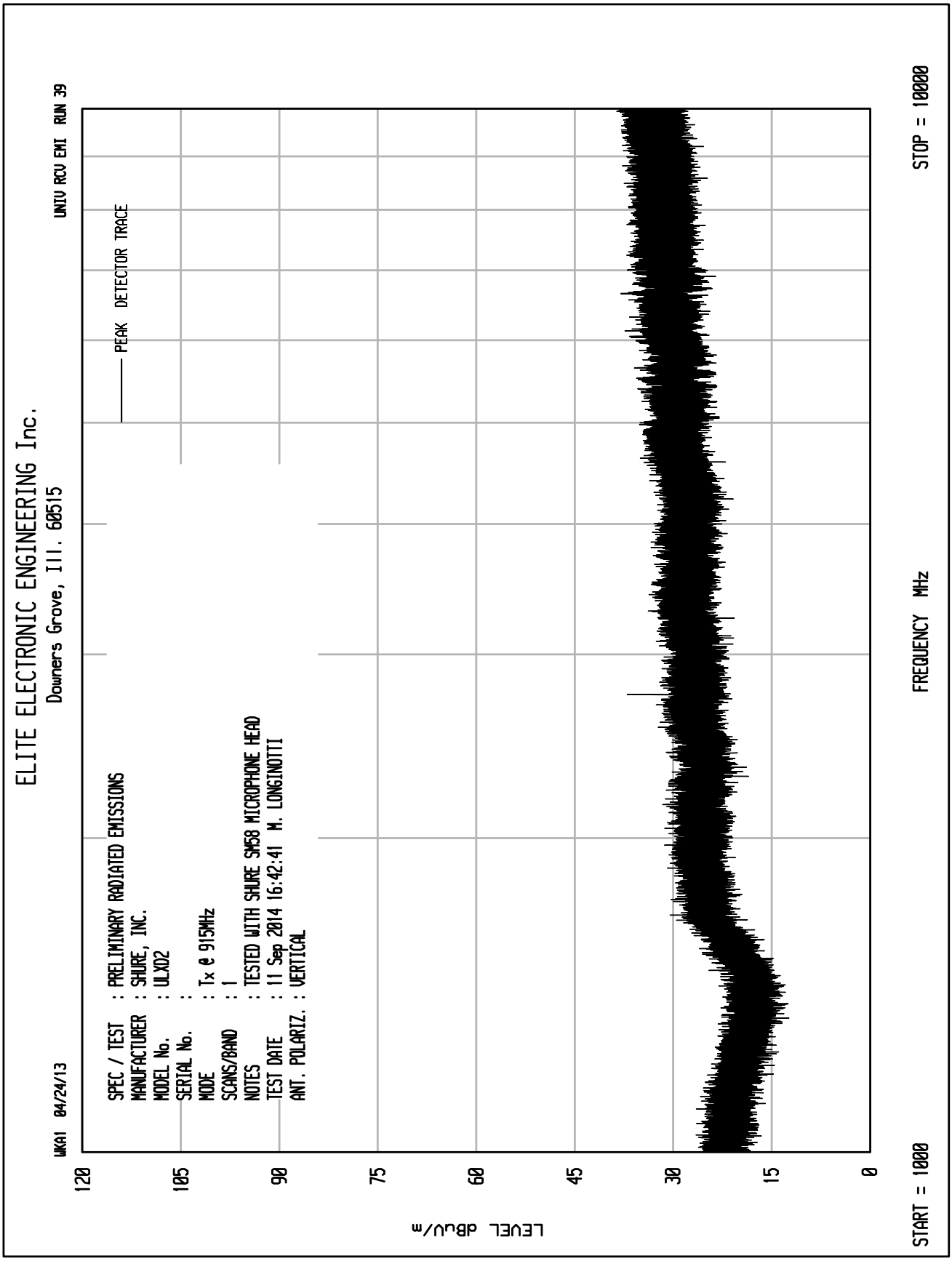
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 39
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. : :
MODE : Tx @ 915MHz
SCANS/BAND : 1
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ANT. POLARIZ. : VERTICAL
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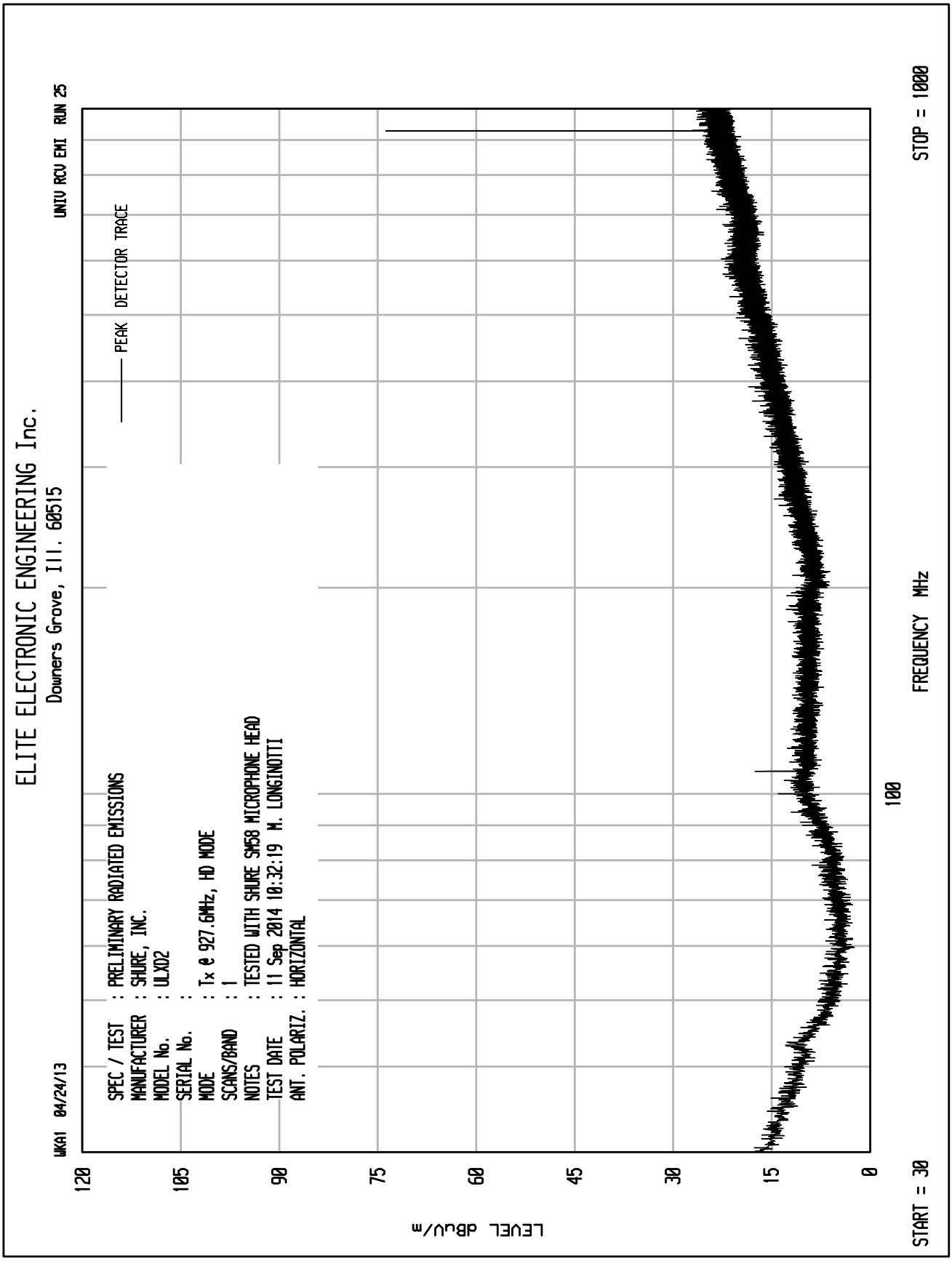
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 25
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 927.6MHz, HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 11 Sep 2014 10:32:19 M. LONGINOTTI
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PEAK DETECTOR TRACE
LEVEL dBuV/m
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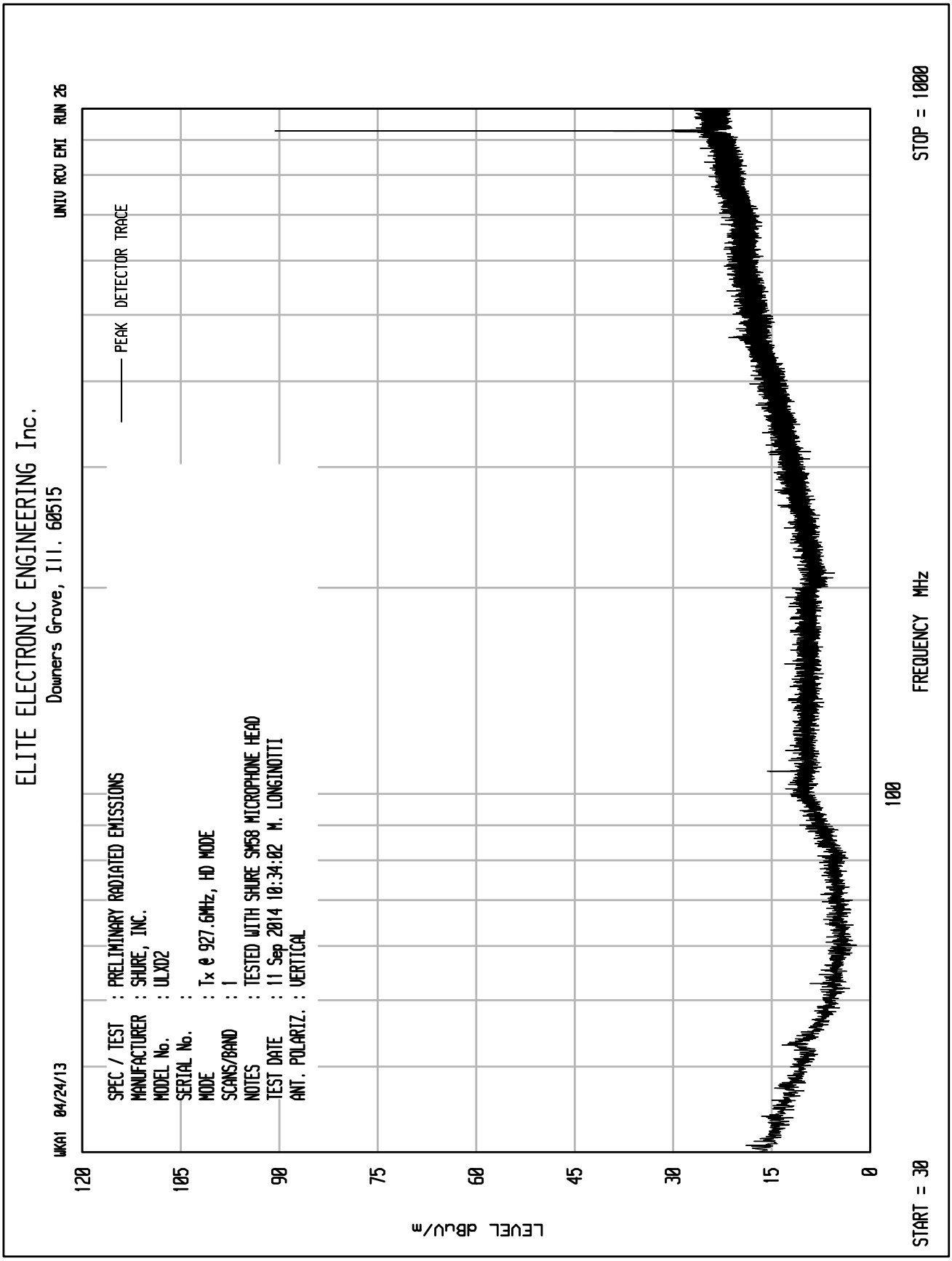
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 26
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 927.6MHz, HD MODE
SCANS/BAND : 1
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PEAK DETECTOR TRACE
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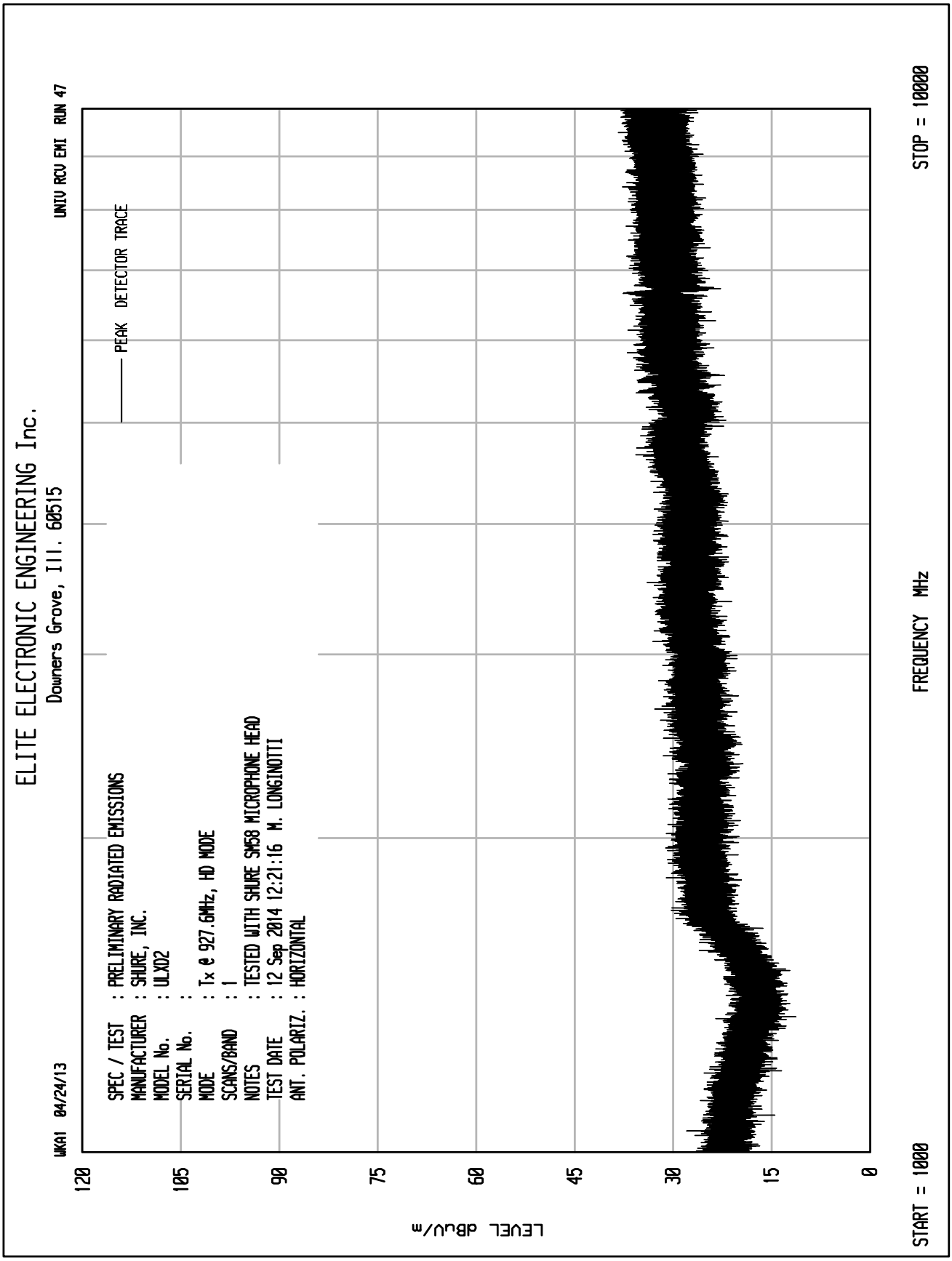
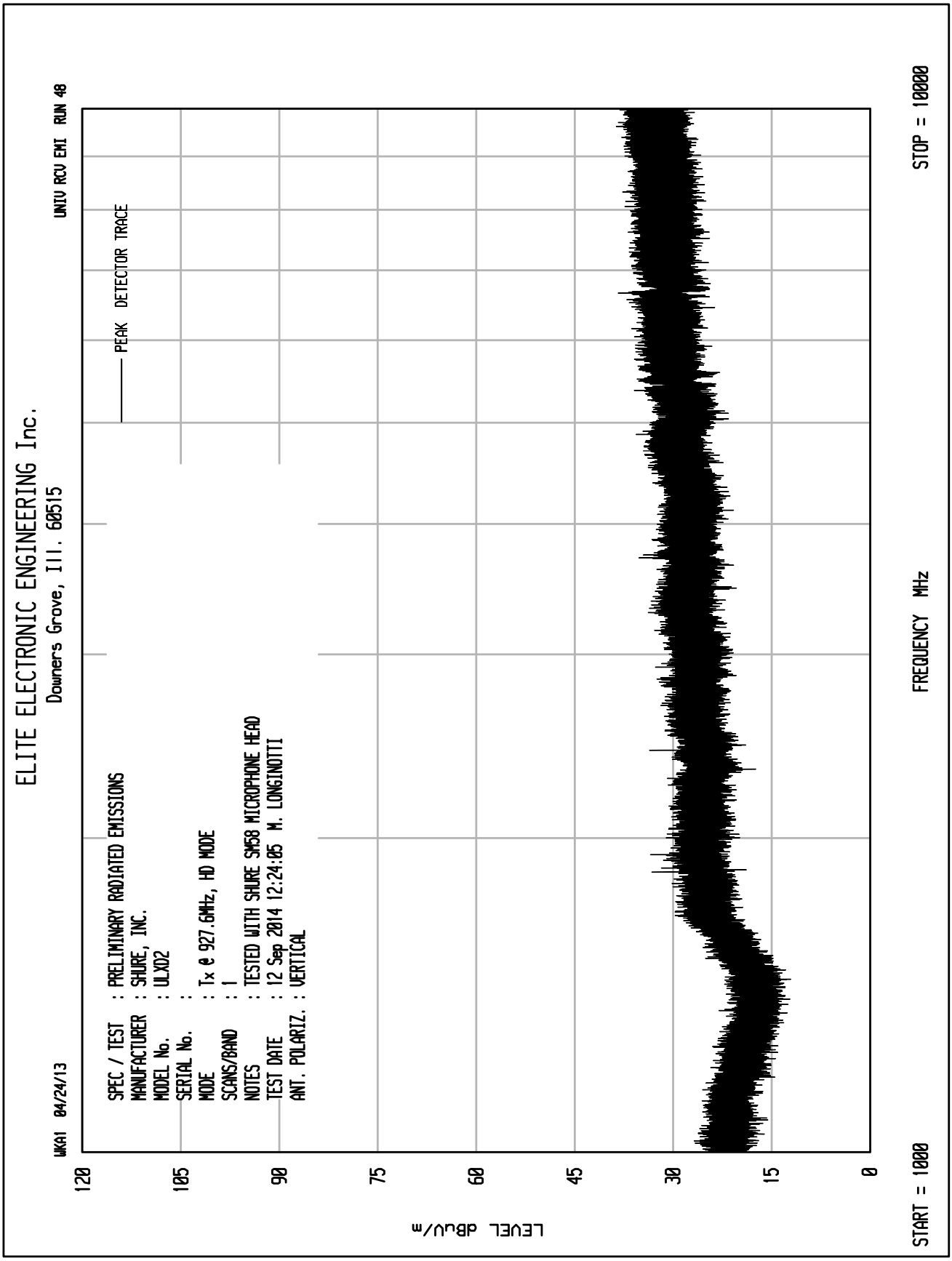
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 47
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. : :
MODE : Tx @ 927.6MHz, HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 12 Sep 2014 12:21:16 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 48
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE, INC.
MODEL No. : ULX02
SERIAL No. :
MODE : Tx @ 927.6MHz, HD MODE
SCANS/BAND : 1
NOTES : TESTED WITH SHURE SM58 MICROPHONE HEAD
TEST DATE : 12 Sep 2014 12:24:05 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Radiated Emissions
Mode : Transmit at 902.4MHz, HD Mode
Test Distance : 3 meters
Notes : QP detector with 120kHz RBW used below 1GHz
: Peak detector with 1MHz RBW used above 1GHz

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP/Peak Total dBuV/m at 3m	QP/Peak Total uV/m at 3 m	QP/Peak Limit uV/m at 3 m	Margin (dB)
902.400	H	51.6		1.5	20.5	0.0	73.7	4840.5	50000.0	-20.3
902.400	V	67.5		1.5	20.5	0.0	89.6	30191.9	50000.0	-4.4
1804.800	H	49.7	Ambient	2.2	30.7	-39.8	42.9	138.9	5000.0	-31.1
1804.800	V	49.6	Ambient	2.2	30.7	-39.8	42.8	137.3	5000.0	-31.2
2707.200	H	49.1	Ambient	2.8	32.7	-39.5	45.1	179.3	5000.0	-28.9
2707.200	V	50.2	Ambient	2.8	32.7	-39.5	46.2	203.5	5000.0	-27.8
3609.600	H	49.0	Ambient	3.2	33.4	-38.9	46.8	219.5	5000.0	-27.2
3609.600	V	49.3	Ambient	3.2	33.4	-38.9	47.1	227.2	5000.0	-26.9
4512.000	H	48.4	Ambient	3.6	34.5	-38.9	47.6	240.3	5000.0	-26.4
4512.000	V	47.7	Ambient	3.6	34.5	-38.9	46.9	221.7	5000.0	-27.1
5414.400	H	46.8	Ambient	3.9	34.9	-39.0	46.6	213.9	5000.0	-27.4
5414.400	V	46.7	Ambient	3.9	34.9	-39.0	46.5	211.4	5000.0	-27.5
6316.800	H	45.4	Ambient	4.3	35.8	-39.0	46.4	209.3	5000.0	-27.6
6316.800	V	45.8	Ambient	4.3	35.8	-39.0	46.8	219.2	5000.0	-27.2
7219.200	H	48.1	Ambient	4.6	35.6	-39.0	49.3	293.3	5000.0	-24.6
7219.200	V	48.6	Ambient	4.6	35.6	-39.0	49.8	310.6	5000.0	-24.1
8121.600	H	47.3	Ambient	4.9	35.9	-39.0	49.2	286.8	5000.0	-24.8
8121.600	V	47.6	Ambient	4.9	35.9	-39.0	49.5	296.9	5000.0	-24.5
9024.000	H	47.4	Ambient	4.9	36.2	-38.9	49.6	303.4	5000.0	-24.3
9024.000	V	46.7	Ambient	4.9	36.2	-38.9	48.9	279.9	5000.0	-25.0

Peak Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Peak Total (uV/m) = 10^(Peak Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Radiated Emissions
Mode : Transmit at 902.4MHz, HD Mode
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW, 10Hz VBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
1804.80	H	37.7	Ambient	2.2	30.7	-39.8	30.9	34.9	500.0	-23.1
1804.80	V	37.7	Ambient	2.2	30.7	-39.8	30.9	34.9	500.0	-23.1
2707.20	H	38	Ambient	2.8	32.7	-39.5	34.0	50.0	500.0	-20.0
2707.20	V	40.9	Ambient	2.8	32.7	-39.5	36.9	69.8	500.0	-17.1
3609.60	H	37.3	Ambient	3.2	33.4	-38.9	35.1	57.1	500.0	-18.9
3609.60	V	39.4	Ambient	3.2	33.4	-38.9	37.2	72.7	500.0	-16.8
4512.00	H	36.3	Ambient	3.6	34.5	-38.9	35.5	59.7	500.0	-18.5
4512.00	V	36.2	Ambient	3.6	34.5	-38.9	35.4	59.0	500.0	-18.6
5414.40	H	34.4	Ambient	3.9	34.9	-39.0	34.2	51.3	500.0	-19.8
5414.40	V	34.4	Ambient	3.9	34.9	-39.0	34.2	51.3	500.0	-19.8
6316.80	H	33.5	Ambient	4.3	35.8	-39.0	34.5	53.2	500.0	-19.5
6316.80	V	33.5	Ambient	4.3	35.8	-39.0	34.5	53.2	500.0	-19.5
7219.20	H	36.4	Ambient	4.6	35.6	-39.0	37.6	76.3	500.0	-16.3
7219.20	V	36.3	Ambient	4.6	35.6	-39.0	37.5	75.4	500.0	-16.4
8121.60	H	35.6	Ambient	4.9	35.9	-39.0	37.5	74.6	500.0	-16.5
8121.60	V	35.6	Ambient	4.9	35.9	-39.0	37.5	74.6	500.0	-16.5
9024.00	H	35.3	Ambient	4.9	36.2	-38.9	37.5	75.3	500.0	-16.4
9024.00	V	35.1	Ambient	4.9	36.2	-38.9	37.3	73.6	500.0	-16.6

Average Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Average Total (uV/m) = 10^(Average Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Radiated Emissions
Mode : Transmit at 915MHz, HD Mode
Test Distance : 3 meters
Notes : QP detector with 120kHz RBW used below 1GHz
: Peak detector with 1MHz RBW used above 1GHz

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP/Peak Total dBuV/m at 3m	QP/Peak Total uV/m at 3 m	QP/Peak Limit uV/m at 3 m	Margin (dB)
915.000	H	51.8		1.6	20.6	0.0	74.0	4989.2	50000.0	-20.0
915.000	V	67.6		1.6	20.6	0.0	89.8	30763.1	50000.0	-4.2
1830.000	H	50.3	Ambient	2.2	30.8	-39.7	43.6	150.9	5000.0	-30.4
1830.000	V	50.4	Ambient	2.2	30.8	-39.7	43.7	152.7	5000.0	-30.3
2745.000	H	48.8	Ambient	2.8	32.8	-39.5	44.9	175.6	5000.0	-29.1
2745.000	V	50.4	Ambient	2.8	32.8	-39.5	46.5	211.1	5000.0	-27.5
3660.000	H	48.0	Ambient	3.3	33.5	-38.9	45.9	197.3	5000.0	-28.1
3660.000	V	48.8	Ambient	3.3	33.5	-38.9	46.7	216.3	5000.0	-27.3
4575.000	H	48.9	Ambient	3.6	34.5	-38.9	48.1	254.8	5000.0	-25.9
4575.000	V	48.2	Ambient	3.6	34.5	-38.9	47.4	235.1	5000.0	-26.6
5490.000	H	49.1	Ambient	3.9	34.9	-39.0	48.9	277.3	5000.0	-25.1
5490.000	V	50.7	Ambient	3.9	34.9	-39.0	50.5	333.4	5000.0	-23.5
6405.000	H	47.7	Ambient	4.3	35.9	-39.0	48.9	279.7	5000.0	-25.0
6405.000	V	47.9	Ambient	4.3	35.9	-39.0	49.1	286.2	5000.0	-24.8
7320.000	H	47.7	Ambient	4.7	35.6	-39.0	49.0	282.5	5000.0	-25.0
7320.000	V	47.8	Ambient	4.7	35.6	-39.0	49.1	285.8	5000.0	-24.9
8235.000	H	47.5	Ambient	4.9	35.9	-39.0	49.4	295.6	5000.0	-24.6
8235.000	V	47.3	Ambient	4.9	35.9	-39.0	49.2	288.9	5000.0	-24.8
9150.000	H	46.9	Ambient	5.0	36.2	-38.9	49.2	288.5	5000.0	-24.8
9150.000	V	47.0	Ambient	5.0	36.2	-38.9	49.3	291.8	5000.0	-24.7

Peak Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Peak Total (uV/m) = 10^(Peak Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Radiated Emissions
Mode : Transmit at 915MHz, HD Mode
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW, 10Hz VBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
1830.00	H	38.2	Ambient	2.2	30.8	-39.7	31.5	37.5	500.0	-22.5
1830.00	V	39	Ambient	2.2	30.8	-39.7	32.3	41.1	500.0	-21.7
2745.00	H	37.8	Ambient	2.8	32.8	-39.5	33.9	49.5	500.0	-20.1
2745.00	V	41.5	Ambient	2.8	32.8	-39.5	37.6	75.8	500.0	-16.4
3660.00	H	37.6	Ambient	3.3	33.5	-38.9	35.5	59.6	500.0	-18.5
3660.00	V	40.2	Ambient	3.3	33.5	-38.9	38.1	80.4	500.0	-15.9
4575.00	H	36.3	Ambient	3.6	34.5	-38.9	35.5	59.7	500.0	-18.5
4575.00	V	36.3	Ambient	3.6	34.5	-38.9	35.5	59.7	500.0	-18.5
5490.00	H	37	Ambient	3.9	34.9	-39.0	36.8	68.9	500.0	-17.2
5490.00	V	37	Ambient	3.9	34.9	-39.0	36.8	68.9	500.0	-17.2
6405.00	H	34.4	Ambient	4.3	35.9	-39.0	35.6	60.5	500.0	-18.3
6405.00	V	35.4	Ambient	4.3	35.9	-39.0	36.6	67.9	500.0	-17.3
7320.00	H	36	Ambient	4.7	35.6	-39.0	37.3	73.5	500.0	-16.7
7320.00	V	36.1	Ambient	4.7	35.6	-39.0	37.4	74.3	500.0	-16.6
8235.00	H	35.7	Ambient	4.9	35.9	-39.0	37.6	76.0	500.0	-16.4
8235.00	V	35.7	Ambient	4.9	35.9	-39.0	37.6	76.0	500.0	-16.4
9150.00	H	35.7	Ambient	5.0	36.2	-38.9	38.0	79.5	500.0	-16.0
9150.00	V	35.6	Ambient	5.0	36.2	-38.9	37.9	78.6	500.0	-16.1

Average Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Average Total (uV/m) = 10^(Average Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Radiated Emissions
Mode : Transmit at 927.6MHz, HD Mode
Test Distance : 3 meters
Notes : QP detector with 120kHz RBW used below 1GHz
: Peak detector with 1MHz RBW used above 1GHz

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP/Peak Total dBuV/m at 3m	QP/Peak Total uV/m at 3 m	QP/Peak Limit uV/m at 3 m	Margin (dB)
927.600	H	49.6		1.6	19.8	0.0	71.0	3556.0	50000.0	-23.0
927.600	V	67.4		1.6	19.8	0.0	88.8	27603.4	50000.0	-5.2
1855.200	H	49.9	Ambient	2.3	30.9	-39.7	43.3	146.1	5000.0	-30.7
1855.200	V	50.5	Ambient	2.3	30.9	-39.7	43.9	156.6	5000.0	-30.1
2782.800	H	48.7	Ambient	2.8	32.8	-39.5	44.9	175.9	5000.0	-29.1
2782.800	V	50.4	Ambient	2.8	32.8	-39.5	46.6	214.0	5000.0	-27.4
3710.400	H	49.9	Ambient	3.3	33.5	-38.9	47.9	246.9	5000.0	-26.1
3710.400	V	50.8	Ambient	3.3	33.5	-38.9	48.8	273.9	5000.0	-25.2
4638.000	H	48.0	Ambient	3.6	34.6	-38.9	47.3	232.0	5000.0	-26.7
4638.000	V	48.3	Ambient	3.6	34.6	-38.9	47.6	240.2	5000.0	-26.4
5565.600	H	46.9	Ambient	4.0	34.8	-39.0	46.7	215.3	5000.0	-27.3
5565.600	V	46.5	Ambient	4.0	34.8	-39.0	46.3	205.6	5000.0	-27.7
6493.200	H	47.5	Ambient	4.4	36.0	-39.0	48.8	276.6	5000.0	-25.1
6493.200	V	47.9	Ambient	4.4	36.0	-39.0	49.2	289.6	5000.0	-24.7
7420.800	H	48.1	Ambient	4.7	35.7	-39.0	49.5	297.7	5000.0	-24.5
7420.800	V	47.6	Ambient	4.7	35.7	-39.0	49.0	281.1	5000.0	-25.0
8348.400	H	48.8	Ambient	4.9	35.9	-39.0	50.7	341.4	5000.0	-23.3
8348.400	V	48.1	Ambient	4.9	35.9	-39.0	50.0	315.0	5000.0	-24.0
9276.000	H	48.1	Ambient	5.0	36.1	-38.9	50.4	332.5	5000.0	-23.5
9276.000	V	47.9	Ambient	5.0	36.1	-38.9	50.2	324.9	5000.0	-23.7

Peak Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Peak Total (uV/m) = 10^(Peak Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Radiated Emissions
Mode : Transmit at 927.6MHz, HD Mode
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW, 10Hz VBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
1855.20	H	37.7	Ambient	2.3	30.9	-39.7	31.1	35.9	500.0	-22.9
1855.20	V	39.3	Ambient	2.3	30.9	-39.7	32.7	43.1	500.0	-21.3
2782.80	H	37.9	Ambient	2.8	32.8	-39.5	34.1	50.7	500.0	-19.9
2782.80	V	41.2		2.8	32.8	-39.5	37.4	74.2	500.0	-16.6
3710.40	H	38.1	Ambient	3.3	33.5	-38.9	36.1	63.5	500.0	-17.9
3710.40	V	42		3.3	33.5	-38.9	40.0	99.4	500.0	-14.0
4638.00	H	35.9	Ambient	3.6	34.6	-38.9	35.2	57.6	500.0	-18.8
4638.00	V	35.9	Ambient	3.6	34.6	-38.9	35.2	57.6	500.0	-18.8
5565.60	H	34.1	Ambient	4.0	34.8	-39.0	33.9	49.3	500.0	-20.1
5565.60	V	34.1	Ambient	4.0	34.8	-39.0	33.9	49.3	500.0	-20.1
6493.20	H	34.9	Ambient	4.4	36.0	-39.0	36.2	64.8	500.0	-17.7
6493.20	V	34.9	Ambient	4.4	36.0	-39.0	36.2	64.8	500.0	-17.7
7420.80	H	34.4	Ambient	4.7	35.7	-39.0	35.8	61.5	500.0	-18.2
7420.80	V	35.5	Ambient	4.7	35.7	-39.0	36.9	69.8	500.0	-17.1
8348.40	H	35.8	Ambient	4.9	35.9	-39.0	37.7	76.4	500.0	-16.3
8348.40	V	35.7	Ambient	4.9	35.9	-39.0	37.6	75.6	500.0	-16.4
9276.00	H	35.9	Ambient	5.0	36.1	-38.9	38.2	81.6	500.0	-15.7
9276.00	V	35.9	Ambient	5.0	36.1	-38.9	38.2	81.6	500.0	-15.7

Average Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Average Total (uV/m) = 10^(Average Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Occupied Bandwidth (band-edge)
Mode : Transmit at 902.4MHz, HD Mode
Test Distance : 3 meters
Notes : QP detector with 120kHz RBW used below 1GHz

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP Total dBuV/m at 3m	QP Total uV/m at 3 m	QP Limit uV/m at 3 m	Margin (dB)
902.000	H	10.4	qp	1.5	20.5	0.0	32.5	42.1	200.0	-13.5
902.000	V	22.8	qp	1.5	20.5	0.0	44.9	175.6	200.0	-1.1

QP Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

QP Total (uV/m) = 10^(Peak Total (dBuV/m)/20)

Manufacturer : Shure Incorporated
Model No. : ULXD2
Serial No. : None Assigned
Date Tested : September 10 and 11, 2014
Test Performed : Occupied Bandwidth (band-edge)
Mode : Transmit at 927.6MHz, HD Mode
Test Distance : 3 meters
Notes : QP detector with 120kHz RBW used below 1GHz

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP Total dBuV/m at 3m	QP Total uV/m at 3 m	QP Limit uV/m at 3 m	Margin (dB)
928.000	H	10.0		1.6	19.8	0.0	31.4	37.2	200.0	-14.6
928.000	V	18.9		1.6	19.8	0.0	40.3	103.7	200.0	-5.7

QP Total (dBuV/m) = Meter Reading (dBuV) + CBL Fac (dB) + Ant Fac (dB) + Pre Amp (dB)

Peak Total (uV/m) = 10^(Peak Total (dBuV/m)/20)