Electromagnetic Compatibility Tests on a Transmitter, Part No. UR1H

For	:	Shure Inc. 5800 West Touhy Avenue Niles, IL 60714
P.O. No.	:	4500170097
Date Received	:	February 5, 2010
Dates Tested	:	February 8, 2010 through February 10, 2010
Test Personnel	:	Mark E. Longinotti
Specification	:	FCC "Code of Federal Regulations" Title 47 Part 74 Industry Canada RSS-123

Test Report By : Mark E. Longinotti

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TABLE OF CONTENTS

REPORT REVISION HISTORY

Revision	Date	Description
--	February 11, 2010	Initial release

Electromagnetic Compatibility Tests on a Transmitter, Part No. UR1H

1. INTRODUCTION

1.1 Scope of Tests

This document presents the results of a series of electromagnetic compatibility (EMC) tests performed on a Transmitter, Model No. UR1H, Serial No. 2 (hereinafter referred to as the test item). The test item was manufactured and submitted for testing by Shure Inc. located in Niles, IL.

The test item is designed to transmit in the 470MHz to 530MHz frequency band using an external ducky antenna.

1.2 Purpose

The test series was performed to determine if the test item would meet selected requirements of the FCC Part 74 for low power auxiliary station bands and Industry Canada RSS-123 Low Power Licensed Radio communication Devices.

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

The electromagnetic compatibility tests were performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois.

1.5 Laboratory Conditions

The temperature at the time of the test was 21°C and the relative humidity was 17%.

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 74, dated 1 October 2009
- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 2, dated 1 October 2009
- RSS-123, "Radio Standards Specification Low Power Licensed Radio communication Devices" Issue 1, Rev. 2 November 6, 1999
- TIA-603-C-2004, "Land Mobile FM or PM Communications Equipment Measurement and Performance Standard"

3. TEST ITEM SET-UP AND OPERATION

3.1 General Description

The test item is a Transmitter, Model No. UR1H. A block diagram of the test item set-up is shown as Figure 1.

3.1.1 Power Input

The test item could be powered by 3 VDC from 2 "AA" batteries (DC powered) or the test item could be powered by 9VDC to 20VDC from an external AC adapter (AC powered). For AC powered mode, the test item was powered with 12VDC from a Shure AC adapter, Model No. PS22US. The AC adapter was

connected to the test item via a 1.8 meter long 2 wire power cord. The AC adapter was powered with 115V, 60Hz via a 1.8 meter long 2 wire power cord.

3.1.2 Signal Input/Output Leads

The audio input port of the test item was connected to a Shure 183 microphone via a 2 wire 1.2 meter long cable.

3.1.3 Grounding

The test item was not grounded during testing.

3.1.4 Frequency of Test Item

Per CFR Title 47, Section 2, part 1057, for spurious emissions measurements at the antenna terminal and for spurious radiated emissions measurements, the frequency spectrum shall be investigated up to at least the tenth harmonic of the highest fundamental frequency.

3.2 Operational Mode

All emissions tests were performed separately in the following modes:

Tx @ 500MHz, 250mW, AC Powered
Tx @ 500MHz, 250mW, DC Powered

3.3 Test Item 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 C63.4-2003 for site attenuation.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in **Table 10-1**.

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 Emission Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

Radiated Emission Measurements		
Combined Standard Uncertainty	2.26	-2.18
Expanded Uncertainty (95% confidence)	4.5	-4.4

5. TEST PROCEDURES

5.1 RF POWER OUTPUT MEASUREMENTS

5.1.1 Requirements

In accordance with paragraph 74.861(e)(1)(ii), for low power auxiliary stations operating in the bands allocated for TV broadcasting, the power of the measured unmodulated carrier power at the output of the transmitter power amplifier (antenna input power) may not exceed 250 milliwatts in the 470-608 band.

For certification to paragraph 6.2 of the Industry Canada's RSS-123 requirement, the RF power output must not exceed 1 watt average power as listed in Table 1.

5.1.2 Procedures

The output from the antenna port of the test item was connected to a power meter. The output power of the each test item was then measured.

5.1.3 Results

The output power measurements are presented on page 17. As can be seen from the data, the power output of each transmitter is within the requirements of Part 74.861 and RSS-123.

5.2 MODULATION CHARACTERISTICS

5.2.1 Requirements

In accordance with paragraph 74.861(e)(3) and paragraph 5.5 of RSS-123, for low power auxiliary stations operating in the bands allocated for TV broadcasting, any form of modulation may be used. A maximum deviation of ±75kHz is permitted when frequency modulation is employed.

5.2.2 Procedures

The output of the antenna port of the test item was connected to a modulation analyzer. An audio signal generator was connected to the audio input port of the test item.

a) The test item was modulated with a 1000 Hz modulating signal at 60% of the test items rated frequency deviation.

b) With input level held constant the audio signal generator was varied from 20 Hz to 20 kHz.

c) The positive and negative peak deviations were recorded and plotted.

The output of the antenna port of the test item was connected to a modulation analyzer. An audio signal generator was connected to the audio input port of the test item.

a) The modulation response was measured separately for each of five frequencies (100Hz, 500Hz, 2500Hz, 10000Hz and 15000Hz).

b) The input voltage of the audio signal generator was varied and frequency deviation was observed on the modulation analyzer.

c) The frequency deviations were recorded and plotted.

5.2.3 Results

The plots of the modulation characteristics are presented on page 18.

5.3 FREQUENCY STABILITY

5.3.1 Requirements

In accordance with paragraph 74.861(e)(4) and paragraph 7 of RSS-123 Table 1, for low power auxiliary stations operating in the bands allocated for TV broadcasting, the frequency tolerance of the transmitter shall be 0.005 percent.

5.3.2 Procedures

The test item was connected to a frequency counter through the antenna output of each transmitter. The test item was then placed in a humidity temperature chamber. The test item was AC powered.

a) The nominal frequency of the transmitter was measured and recorded.

b) The temperature chamber was then set to -30ºC.

c) Once the temperature had reached -30ºC the test item was allowed to soak for 30 minutes.

d) After soaking at -30ºC for thirty minutes the test item was turned on and the transmit frequency was measured and recorded.

e) Steps (b) through (d) were repeated for each temperature in 10ºC steps from -20ºC to +50ºC.

f) Steps (a) through (e) were repeated with the test item DC powered.

g) The test item was then removed from the temperature chamber and allowed to adjust to nominal room temperature (22ºC).

h) The test item was AC powered.

i) The input voltage was checked and adjusted to the nominal level. The frequency was measured and recorded.

j) The input voltage was then varied to 85% of its nominal level. The frequency was measured and recorded.

k) The input voltage was then varied to 115% of its nominal level. The frequency was measured and recorded.

l) The test item was DC powered.

m) The frequency was measured and recorded.

n) The input voltage was reduced to the battery operating end point and the frequency was measured and recorded.

5.3.3 Results

The frequency stability measurements are presented on pages 19 through 22. As can be seen from the data the test frequency deviation was within the 0.005 percent limit. A photograph of the test set-up is shown in Figure 2.

5.4 OCCUPIED BANDWIDTH MEASUREMENTS

5.4.1 Requirements

In accordance with paragraph 74.861(e)(5) and (6), for low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

a) The operating bandwidth shall not exceed 200 kHz.

b) The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

i. On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;

ii. On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;

iii. On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43+10log10 (mean output power in watts) dB.

For certification to the RSS-123 paragraph 6.3.1, the power of unwanted emissions shall be attenuated below the mean transmitter power in accordance with the following schedule:

a) On any frequency removed from the carrier frequency by more than 50% up to and including 100% of the authorized bandwidth: at least 25 dB.

b) On any frequency removed from the carrier frequency by more than 100% up to and including 250% of the authorized bandwidth: at least 35 dB.

c) On any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth: at least 55 + 10 Log (P) dB.

5.4.2 Procedures

a) The test item was AC powered. The test item was connected to a spectrum analyzer through 40 dB of attenuation. The unmodulated carrier signal level was measured and recorded.

b) The test item was modulated with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of the rated system deviation.

c) Fore Industry Canada, the test item was modulated with a signal representative of that encountered in a real system operation (2500Hz at 80% rated deviation).

d) The test item was modulated with a 15 kHz sine wave at an input level necessary to produce 85% of the rated system deviation.

e) Steps (a) through (d) were repeated separately with the test item DC Powered. The bandwidth of the spectrum analyzer was set to 2kHz (1% of Authorized BW).

5.4.3 Results

The plots of the occupied bandwidth measured are presented on pages 23 through 30. The limits, shown on the plots, are referenced to the power measured from the un-modulated carrier, the power when modulated with a 2500 Hz sine wave at an input 16dB greater than that necessary to produce 50% of the rated deviation, the power when modulated with a 2500Hz sine wave at 80% of rated deviation, and a 15 kHz sine wave at 85% of the maximum deviation.

The operating bandwidth was determined using Carson's rule:
Bn = 2M + 2DK where Bn = bandwidth, M= Maximum modulating frequency and D = Peak Deviation. With K = 1, M = 12.5kHz and D = 45kHz resulting in an operating bandwidth of 115kHz.

The maximum Industry Canada 99% bandwidth measurement was 150kHz.

As can be seen from the data, the test items met all occupied bandwidth requirements. . A photograph of the test set-up is shown in Figure 2.

5.5 SPURIOUS EMISSIONS AT ANTENNA TERMINAL

5.5.1 Requirements

This test determines whether the test item produces excessive spurious emissions.

In accordance with paragraph 74.861(e)(6)(iii), on any frequency remove from the operating frequency by more than 250 percent of the authorized bandwidth shall attenuated by at least 43 + 10 log (P) dB which is equivalent to -13 dBm. The emissions shall be measured from 30MHz up to the 10th harmonic of the fundamental frequency.

In accordance with RSS–123 paragraph 6.3.1(3) on any frequency remove from the operating frequency by more than 250 percent of the authorized bandwidth: at least 55 + 10 log (P) dB which is equivalent to -25 dBm. The emissions shall be measured from the fundamental minus 500 kHz up to the 5th harmonic of the fundamental frequency.

5.5.2 Procedures

A spectrum analyzer was connected to the output of the test item through 40 dB of external attenuation. The out of band emissions were measured.

The spectrum analyzer was adjusted accordingly.

For the FCC measurements - the resolution bandwidth was set to 100kHz for spurious emissions below 1GHz and 1MHz for spurious emissions above 1GHz.

For the RSS-123 measurements - the resolution bandwidth was set to 30 kHz.

For the FCC measurements - the test item was modulated with a 2500 Hz sine wave at an input level 16dB greater than that necessary to produce 50% of rated system deviation

For the RSS-123 measurements – the test item was modulated with signals representative of those encountered in a real system operation (2500Hz at 80% rated deviation)

The plots of the spectrum analyzer screens were recorded.

5.5.3 Results

The plots of the antenna conducted output measurements for FCC part 74 are presented on pages 31 and 32. As can be seen from the data, the test item did not produce spurious emissions in excess of the limit.

The plots of the antenna conducted output measurements for Industry Canada RSS-123 are presented on pages 33 through 36. As can be seen from the data, the test item did not produce spurious emissions in excess of the limit.

5.6 FIELD STRENGTH OF SPURIOUS EMISSIONS

5.6.1 Requirements

In accordance with paragraph 74.861 of CFR 47, the power of any emission on any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth shall be attenuated by at least 43 + 10 log (P) dB.

In accordance with RSS-123 paragraph 6.3.1, the power of any emission on any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth shall be attenuated by at least 55 + 10 log (P) dB.

5.6.2 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 2003for 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.

1. Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. With the test item 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 broadband measuring antenna was positioned at a 3 meter distance from the test item. This data was then automatically plotted. All preliminary tests were performed separately with the test item operating in the modes listed in Para. 3.2.
2. All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a bilog antenna over the frequency range of 30MHz to 1GHz, and a double ridged waveguide antenna was used for frequencies above 1GHz.
3. To ensure that maximum emission levels were measured, the following steps were taken:
    a. The test item was rotated so that all of its sides were exposed to the receiving antenna.
    b. Since the measuring antennas are linearly polarized, both horizontal and vertical field components were measured.
    c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
    d. For hand-held or body-worn devices, the test item was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

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

5.6.3 Results

The preliminary plots peak levels are presented on pages 37 through 44. Factors for the antennas and cables were added to the data before it was plotted. This data is only presented for a reference, and is not used as official data. All significant radiated emissions were subsequently measured using the substitution method.

The final radiated levels are presented on pages 45 and 47. The radiated emissions were measured through the 10th harmonic. All emissions measured from the test item were within the specification limits. Photographs of the test set-up are shown in Figure 3.

6. OTHER TEST CONDITIONS

6.1 Test Personnel and Witnesses

All EMC tests were performed by qualified personnel from Elite Electronic Engineering Incorporated.

6.2 Disposition of the Test Item

The test item and all associated equipment were returned to Shure Inc. upon completion of the tests.

7. CONCLUSION

It was found that the Shure Inc., model UR1H Transmitter, did comply with the RF power output, the occupied bandwidth, the frequency stability, the spurious emissions at antenna terminal, and the field strength of spurious emissions requirements of FCC Part 74 for low power auxiliary station bands and Industry Canada RSS-123 Low Power Licensed Radio communication Devices.

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

9. ENDORSEMENT DISCLAIMER

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

10. EQUIPMENT LIST

Table 10-1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
ETD0	ENV Chambers	Thermotron	S-8	15461	-70 to 150 degrees C	Note 1	
ETDA	HONEYWELL CHART RECORDER	HONEYWELL	DR45AT-1100	0825Y878133300009	PROGRAMMABLE	12/7/2009	12/7/2010
ETDC	Temperature Controller	Thermotron	2800	753726	Programmable	Note 1	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	1/12/2010	2/12/2011
GWH2	DDS FUNCTION GENERATOR	WAVETEK	29	079190	0.0001HZ-10MHZ	9/8/2009	9/8/2010
MDB8	MULTIMETER (M. LONGINOTTI)	FLUKE CORPORATION	177	81240019	I,VAC,VDC,R	8/19/2009	8/19/2010
MFC0	MICROWAVE FREQ. COUNTER	HEWLETT PACKARD	5343A	2133A00591	10HZ-26GHZ	7/13/2009	7/13/2010
MPCA	POWER SENSOR (DCC-TEM)	HEWLETT PACKARD	8482A	US37291018	0.1-4200MHZ	2/24/2009	2/24/2010
MPE1	DUAL POWER METER (DCC-TEM)	HEWLETT PACKARD	E4419A	US38260885	0.1MHZ-50GHZ	2/11/2009	2/11/2010
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL6112	2054	0.03-2GHZ	9/10/2009	9/10/2010
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	12/5/2009	12/5/2010
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/11/2009	8/11/2010
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/11/2009	3/11/2010
RYE0	MODULATION ANALYZER	HEWLETT PACKARD	8901B	3104A03410	0.15-1300MHZ	5/23/2009	5/23/2010
SAA1	AC POWER SOURCE/ANALYZER	HEWLETT PACKARD	6813A	3524A-00446	0-300VRMS, 1750VA	NOTE 1	
SEK0	DC POWER SUPPLY	LABORNETZGERAT	L3205	94081001	0-32VDC;0-5A	NOTE 1	
T1N7	10DB 20W ATTENUATOR	NARDA	766-10	---	DC-4GHZ	8/24/2009	8/24/2010
T2D7	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AY9246	DC-18GHZ	8/24/2009	8/24/2010
T2S3	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BV3544	DC-18GHZ	1/5/2010	1/5/2011
XPU2	HIGH PASS FILTER (600MHz)	MINI-CIRCUITS	MNH-1000+	749	DC-3GHz	NOTE 1	

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.

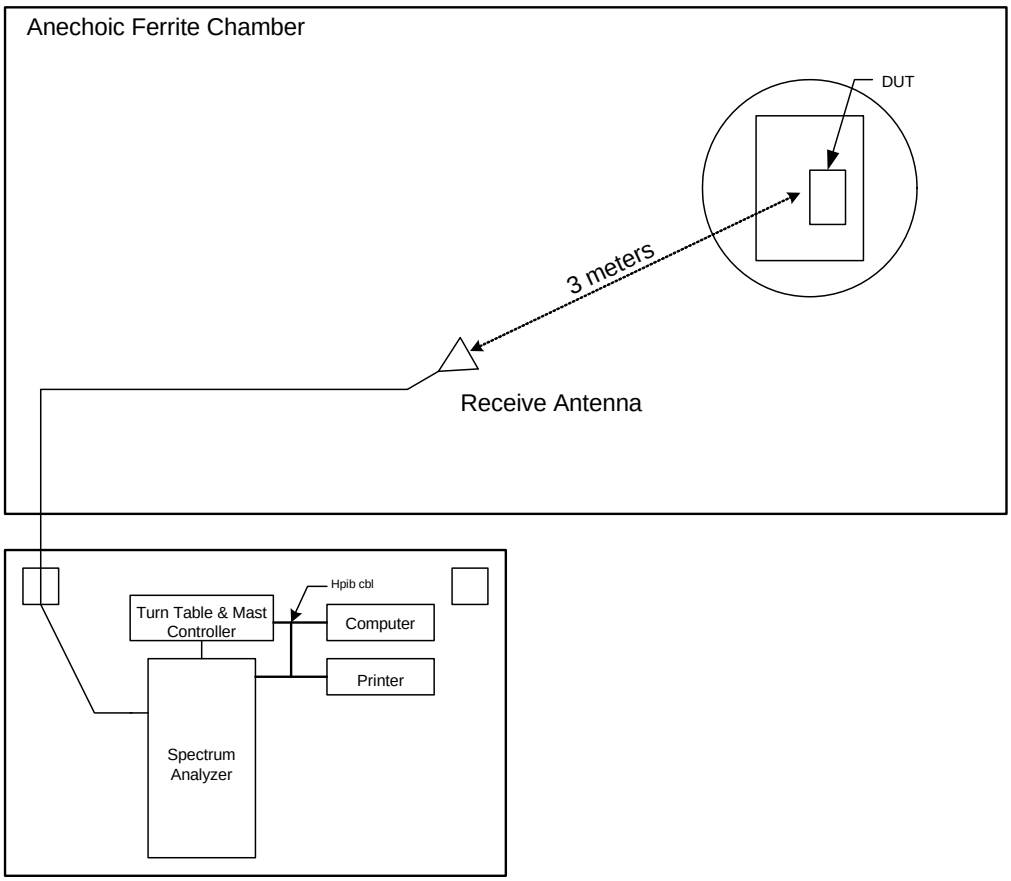
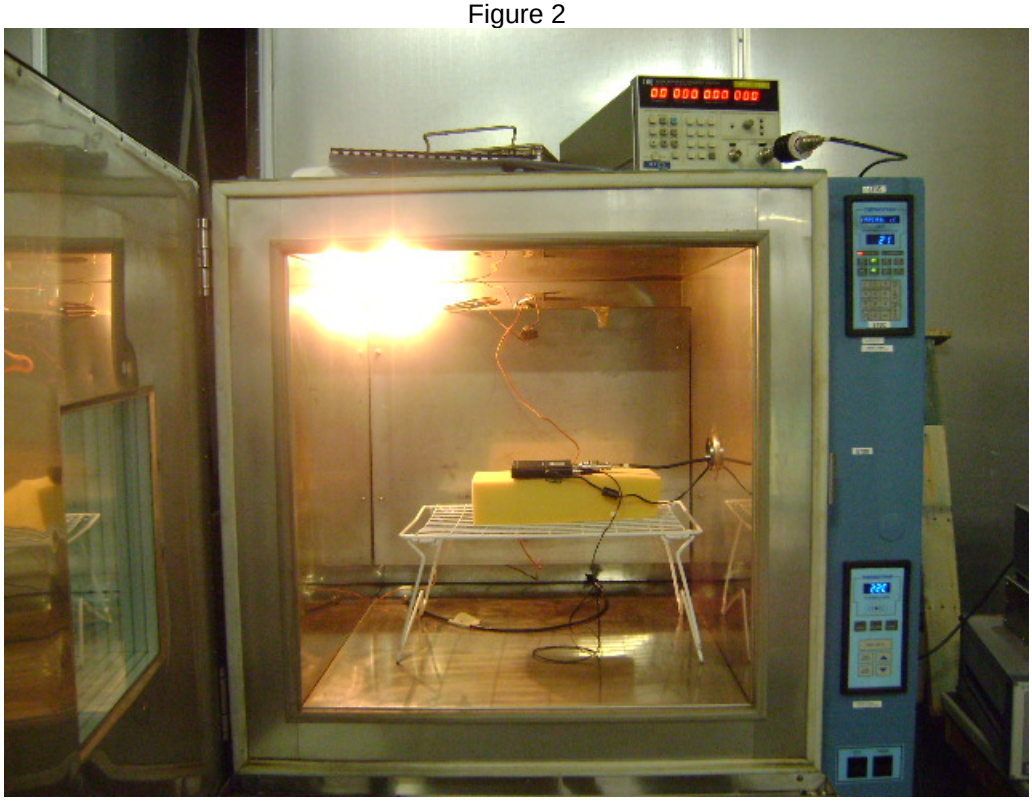
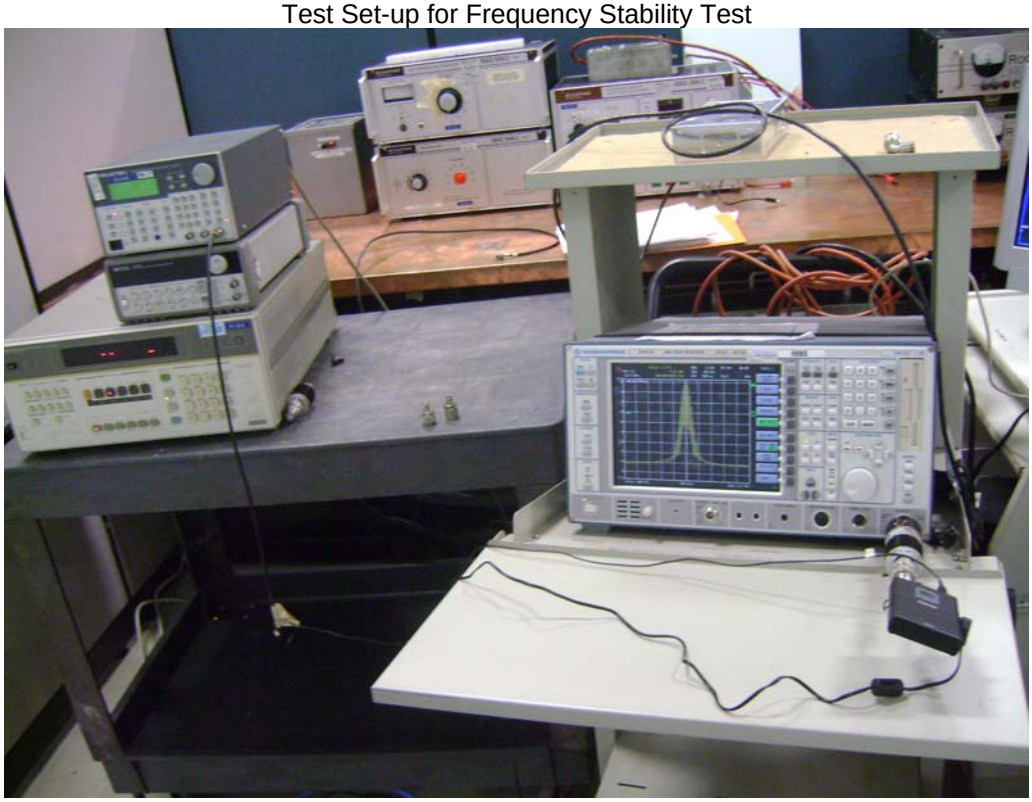


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

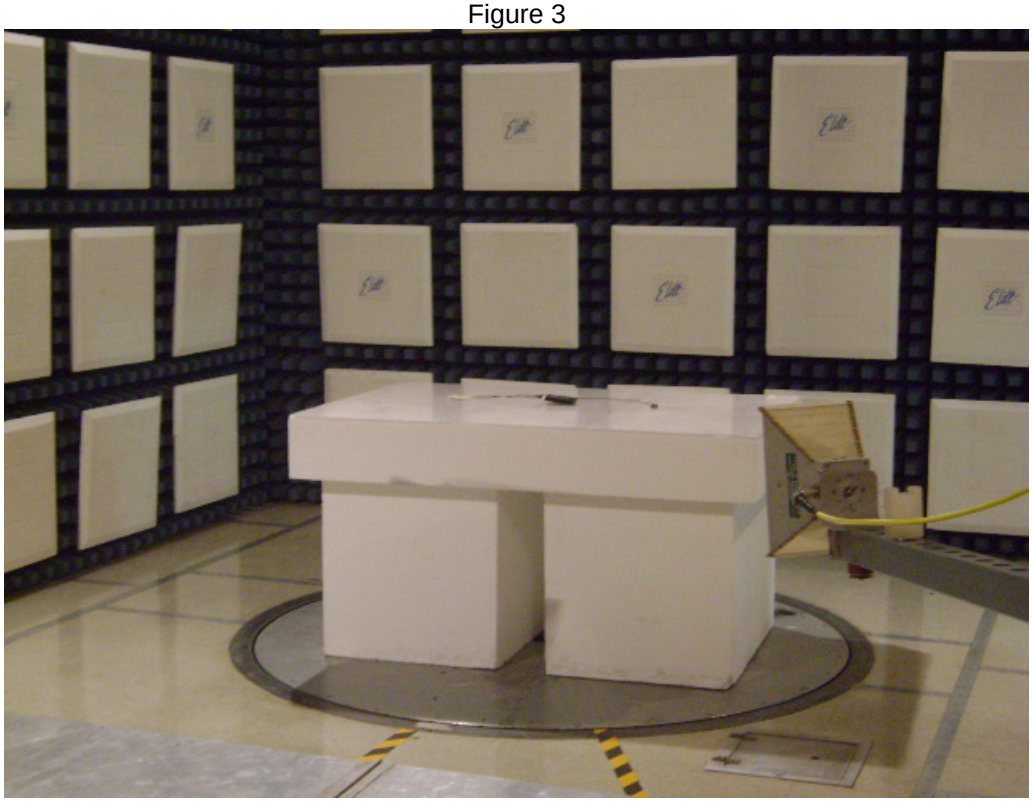


Test Set-up for Frequency Stability Test

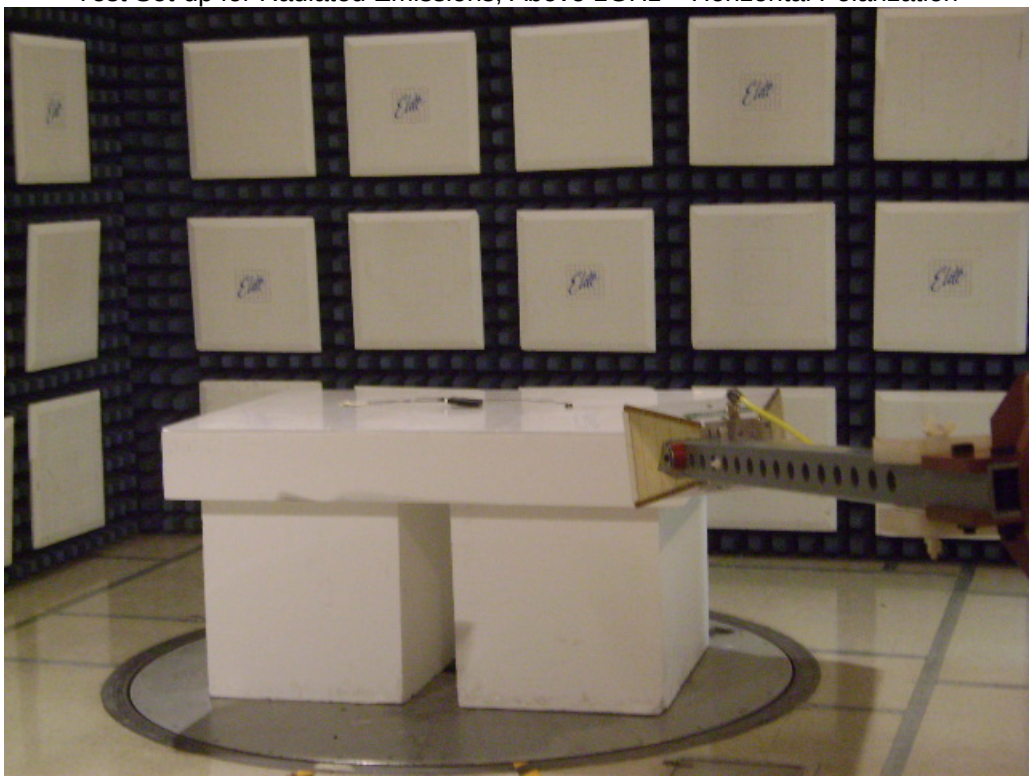


Test Set-up for Occupied Bandwidth Test

Figure 3



Test Set-up for Radiated Emissions, Above 1GHz – Horizontal Polarization



Test Set-up for Radiated Emissions, Above 1GHz – Vertical Polarization

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 RF Power Output
DATE : February 8, 2010
MODE : Transmit at 500MHz
EQUIPMENT USED : MPCA, MPE1, T1N7

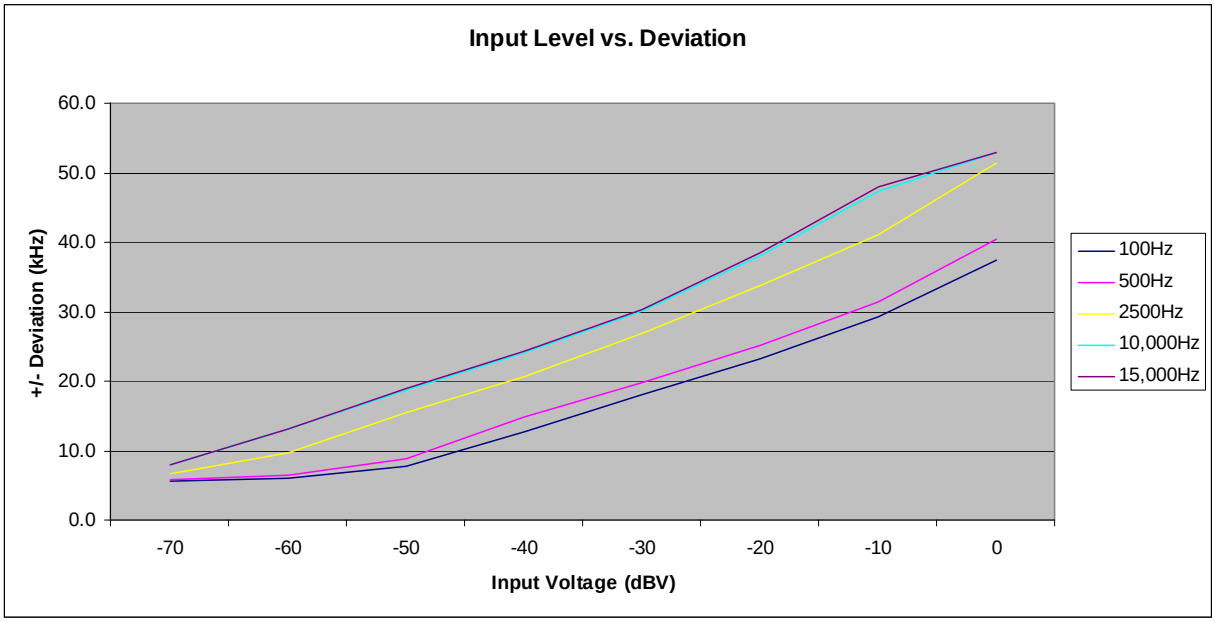
Frequency MHz	Nominal Power mW	Power Meter Reading dBm	External Attenuation dB	Total Measured Power dBm	Total Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
DC Powered							
500	250	12.61	10.2	22.81	191	250	1000
AC Powered							
500	250	12.59	10.2	22.79	190	250	1000

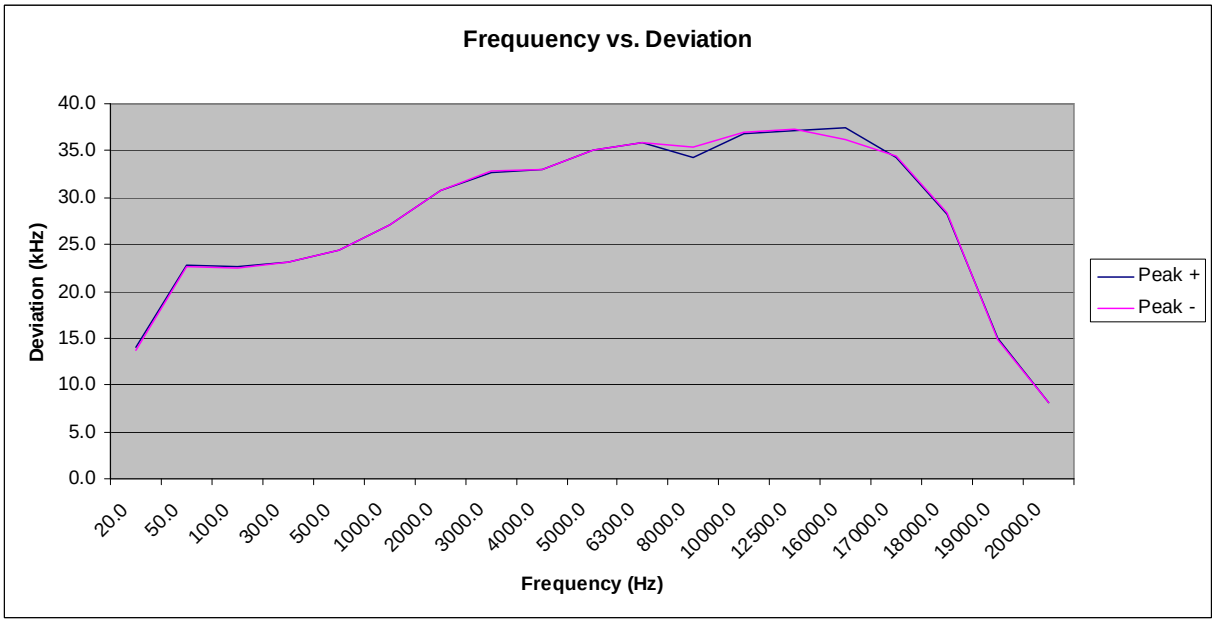
Total Measured Power (dBm) = Power Meter Reading (dBm) + External Attenuation (dB)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Modulation Characteristics
DATE : February 9, 2010
MODE : Transmit at 500MHz, 250mW
NOTE : AC Powered
EQUIPMENT USED : RYE0, GWH2





MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Frequency Stability vs. Temperature
DATE : February 10, 2010
MODE : Transmit at 500MHz, 250mW
NOTES : AC Powered
EQUIPMENT USED : ETD0, ETDC, ETDA, MFC0, T2D7,MDB8, SAA1

Temperature °C	Nominal Frequency MHz	Measured Frequency MHz	Deviation %	Deviation Limit %	Deviation Hz	Limit Hz
-30	499.999724	499.997233	-0.0004982	0.005	-2491.0	24999.9862
-20	499.999724	499.998713	-0.0002022	0.005	-1011.0	24999.9862
-10	499.999724	500.000269	0.0001090	0.005	545.0	24999.9862
0	499.999724	500.000885	0.0002322	0.005	1161.0	24999.9862
10	499.999724	500.000739	0.0002030	0.005	1015.0	24999.9862
20	499.999724	499.999956	0.0000464	0.005	232.0	24999.9862
30	499.999724	500.000732	0.0002016	0.005	1008.0	24999.9862
40	499.999724	500.000787	0.0002126	0.005	1063.0	24999.9862
50	499.999724	500.000743	0.0002038	0.005	1019.0	24999.9862

Checked By: Mark E. Longinotti
For Brandon Lugo

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Frequency Stability vs. Voltage
DATE : February 20, 3020
MODE : Transmit at 500MHz, 250mW
NOTES : AC Powered
EQUIPMENT USED : ETD0, ETDC, ETDA, MFC0, T2D7,MDB8, SAA1

Input Voltage VAC	Nominal Frequency MHz	Measured Frequency MHz	Deviation %	Deviation Limit %	Deviation Hz	Limit Hz
115VAC (100%)	499.999724	499.999724	0.0000000	0.005	0.0	24999.9862
97.75 VAC (85%)	499.999724	500.000220	0.0000992	0.005	496.0	24999.9862
132.25 VAC (115%)	499.999724	500.000211	0.0000974	0.005	487.0	24999.9862

Checked By: MARK E. LONGINOTTI
For Brandon Lugo

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Frequency Stability vs. Temperature
DATE : February 10, 2010
MODE : Transmit at 500MHz, 250mW
NOTES : DC Powered
EQUIPMENT USED : ETD0, ETDC, ETDA, MFC0, T2D7,MDB8, SEK0

Temperature °C	Nominal Frequency MHz	Measured Frequency MHz	Deviation %	Deviation Limit %	Deviation Hz	Limit Hz
-30	499.999771	499.997233	-0.0005076	0.005	-2,538.0	24999.98855
-20	499.999771	499.999000	-0.0001542	0.005	-771.0	24999.98855
-10	499.999771	500.000368	0.0001194	0.005	597.0	24999.98855
0	499.999771	500.000893	0.0002244	0.005	1,122.0	24999.98855
10	499.999771	500.000727	0.0001912	0.005	956.0	24999.98855
20	499.999771	500.000005	0.0000468	0.005	234.0	24999.98855
30	499.999771	499.999393	-0.0000756	0.005	-378.0	24999.98855
40	499.999771	500.000807	0.0002072	0.005	1,036.0	24999.98855
50	499.999771	500.000732	0.0001922	0.005	961.0	24999.98855

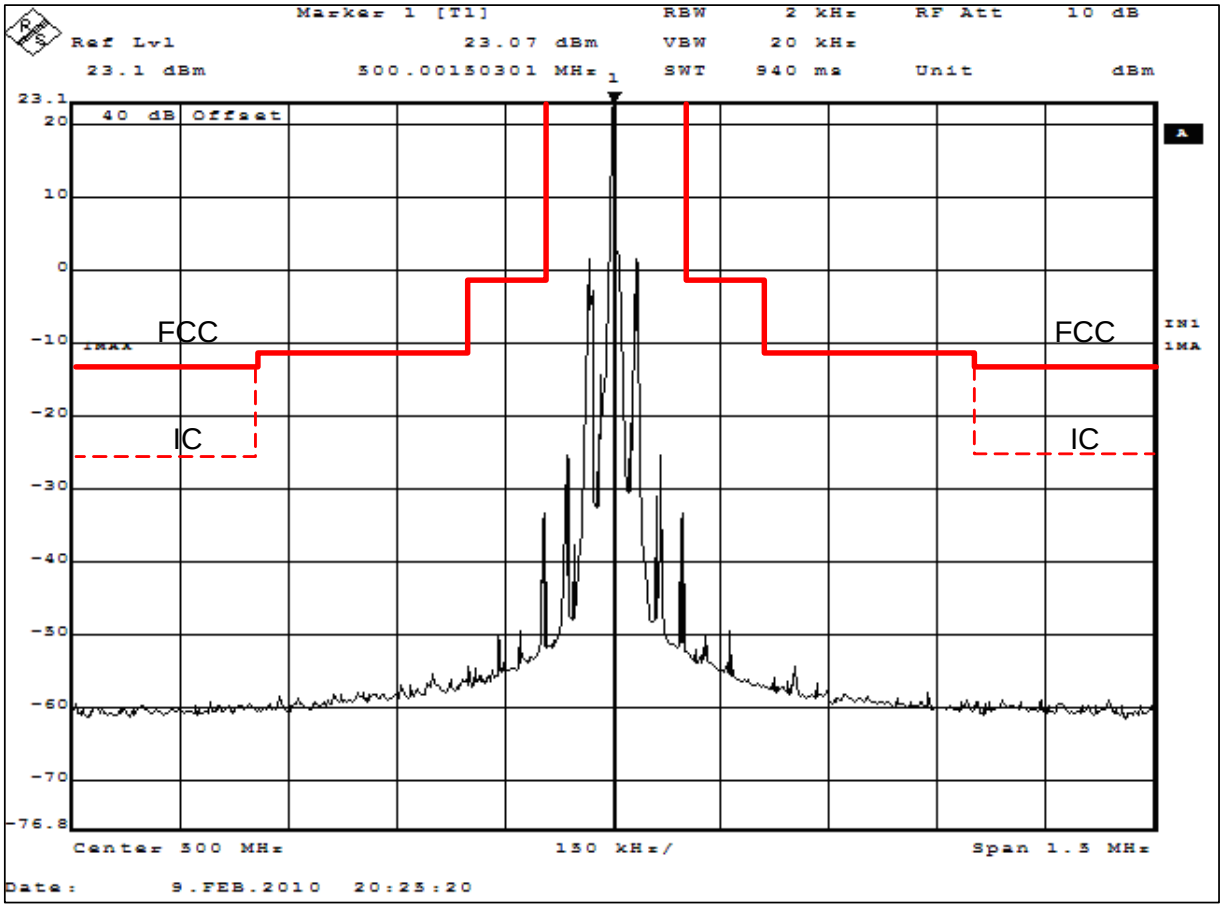
Checked By: MARK E. LONGINOTTI
For Brandon Lugo

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Frequency Stability vs. Voltage
DATE : February 20, 3020
MODE : Transmit at 500MHz, 250mW
NOTES : DC Powered
EQUIPMENT USED : ETD0, ETDC, ETDA, MFC0, T2D7,MDB8, SEK0

Input Voltage VDC	Nominal Frequency MHz	Measured Frequency MHz	Deviation %	Deviation Limit %	Deviation Hz	Limit Hz
3	499.999771	499.999771	0.0000000	0.005	0.0	24999.9862
1.8*	499.999771	500.000016	0.0000490	0.005	245.0	24999.98855

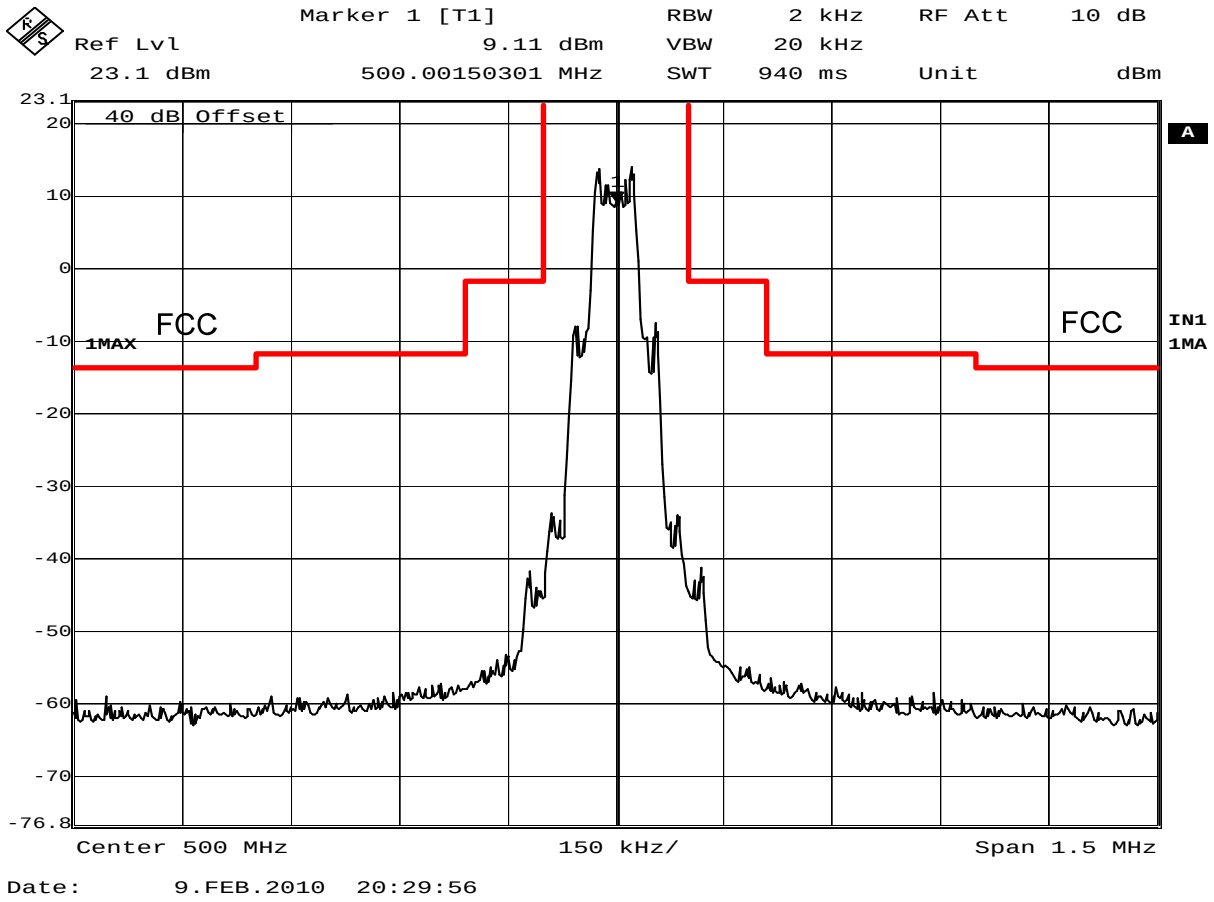
* - Per Shure, Inc. personnel, the the battery operating end point is 1.8VDC.

Checked By: MARK E. LONGINOTTI
For Brandon Lugo



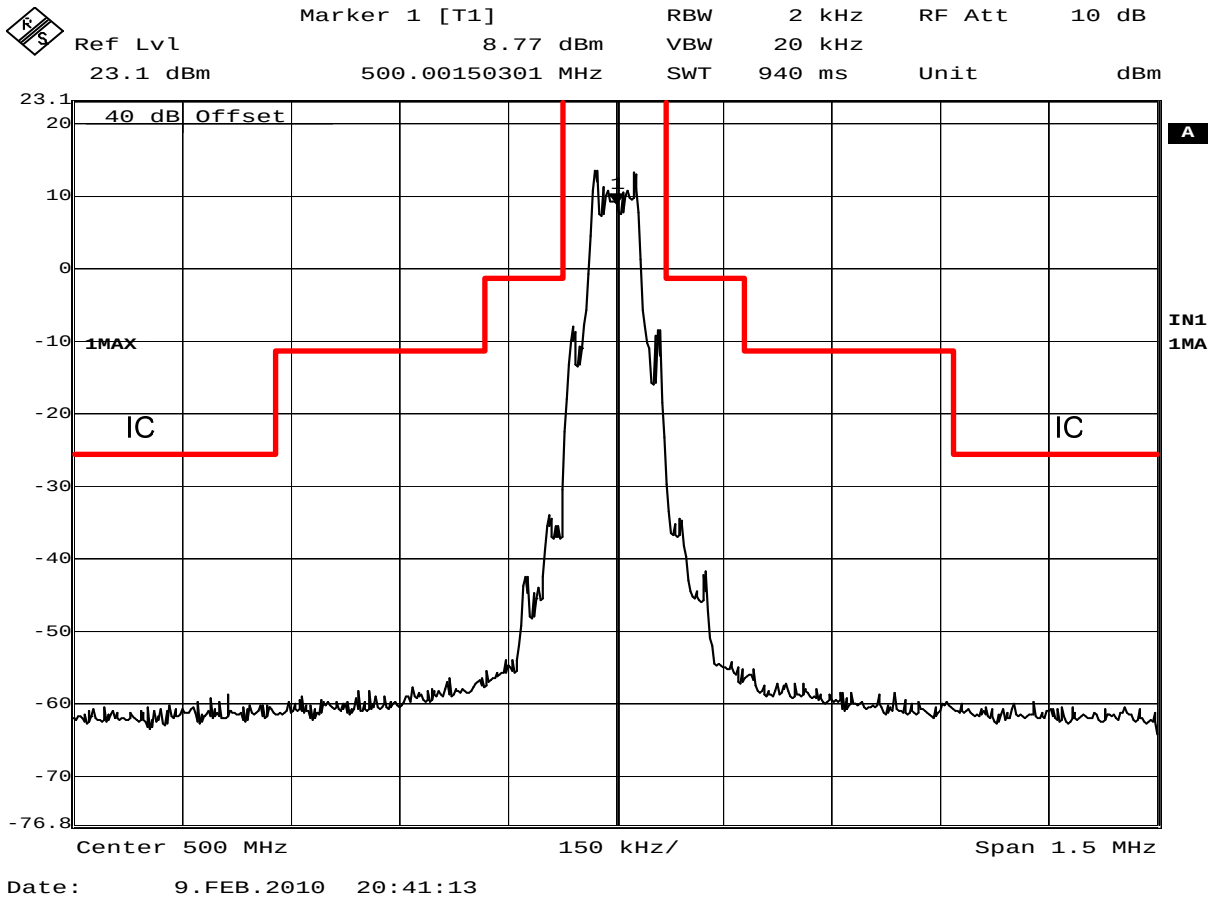
FCC/IC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, AC POWERED
NOTES	: CW
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,



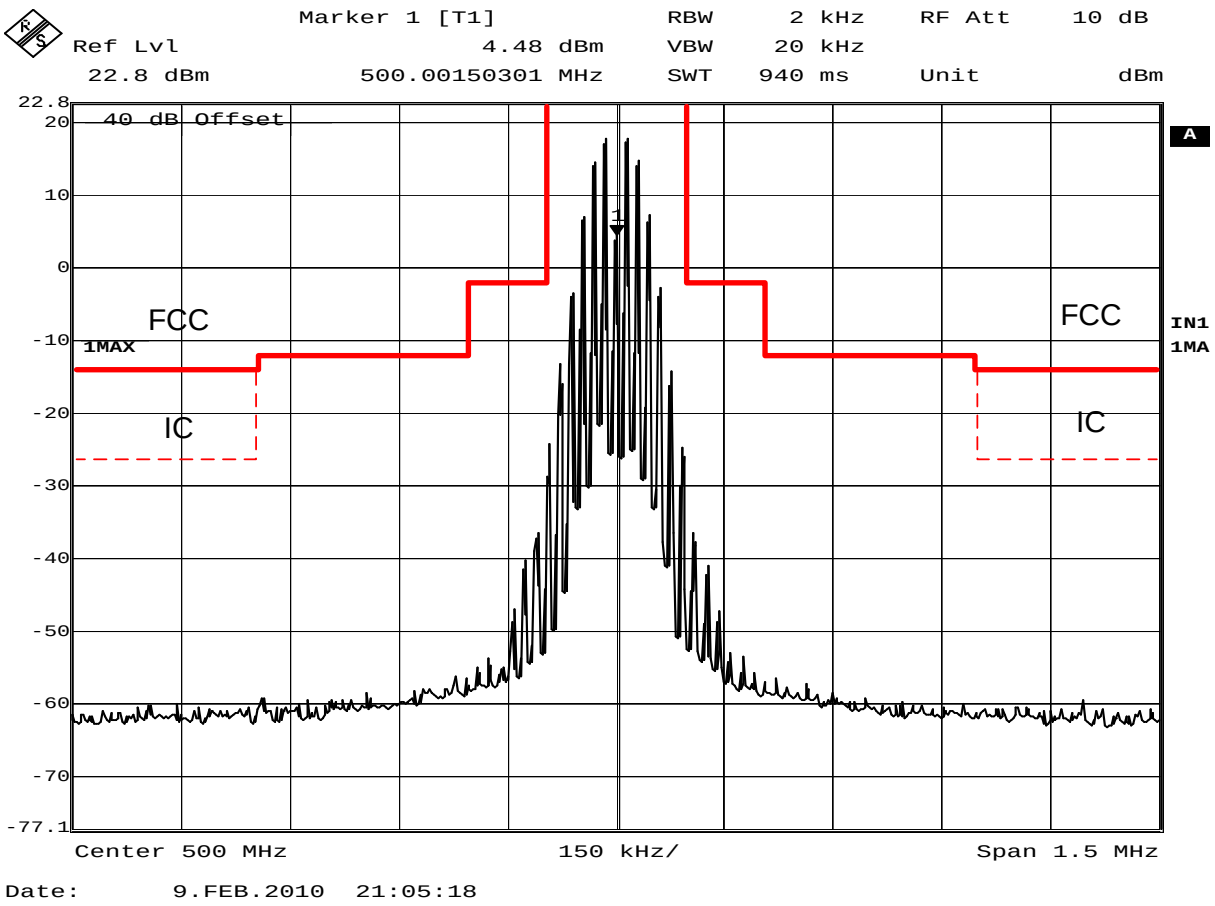
FCC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, AC POWERED
NOTES	: 2500Hz AT 16dB over 50%
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,



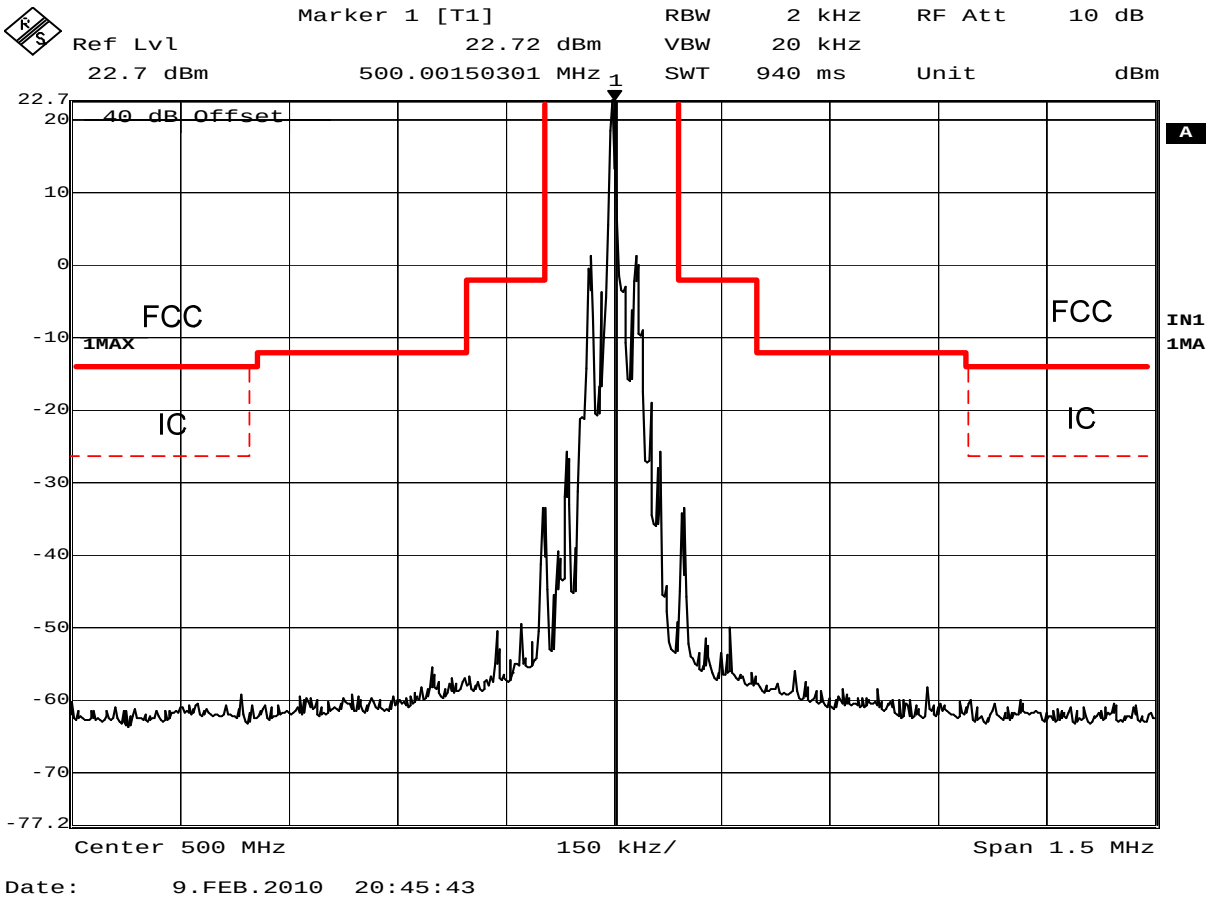
IC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, AC POWERED
NOTES	: Modulated with signals representative of those
	: encountered in a real system operation
	: (2500Hz at 80% rated deviation)
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,



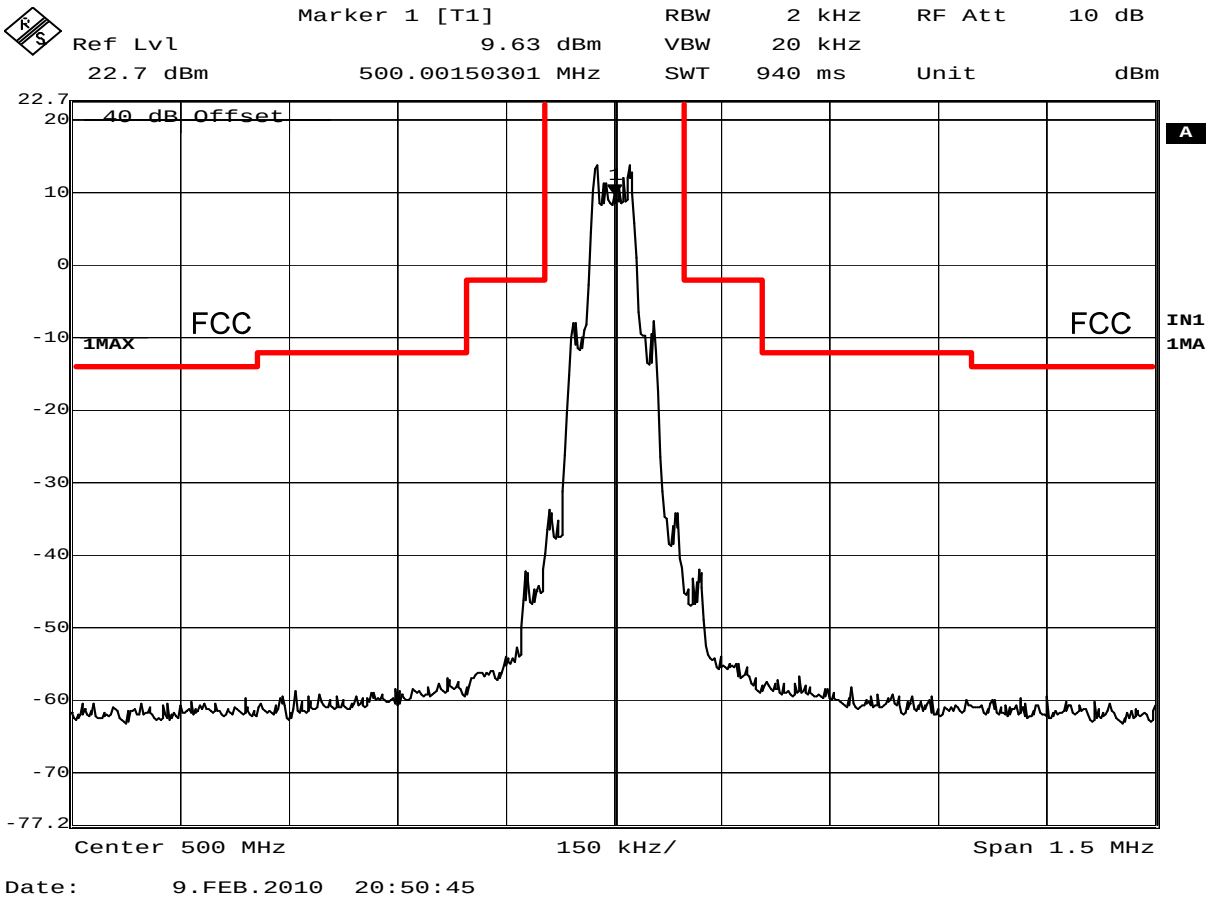
FCC/IC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, AC POWERED
NOTES	: 15kHz @ 85% modulation
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,



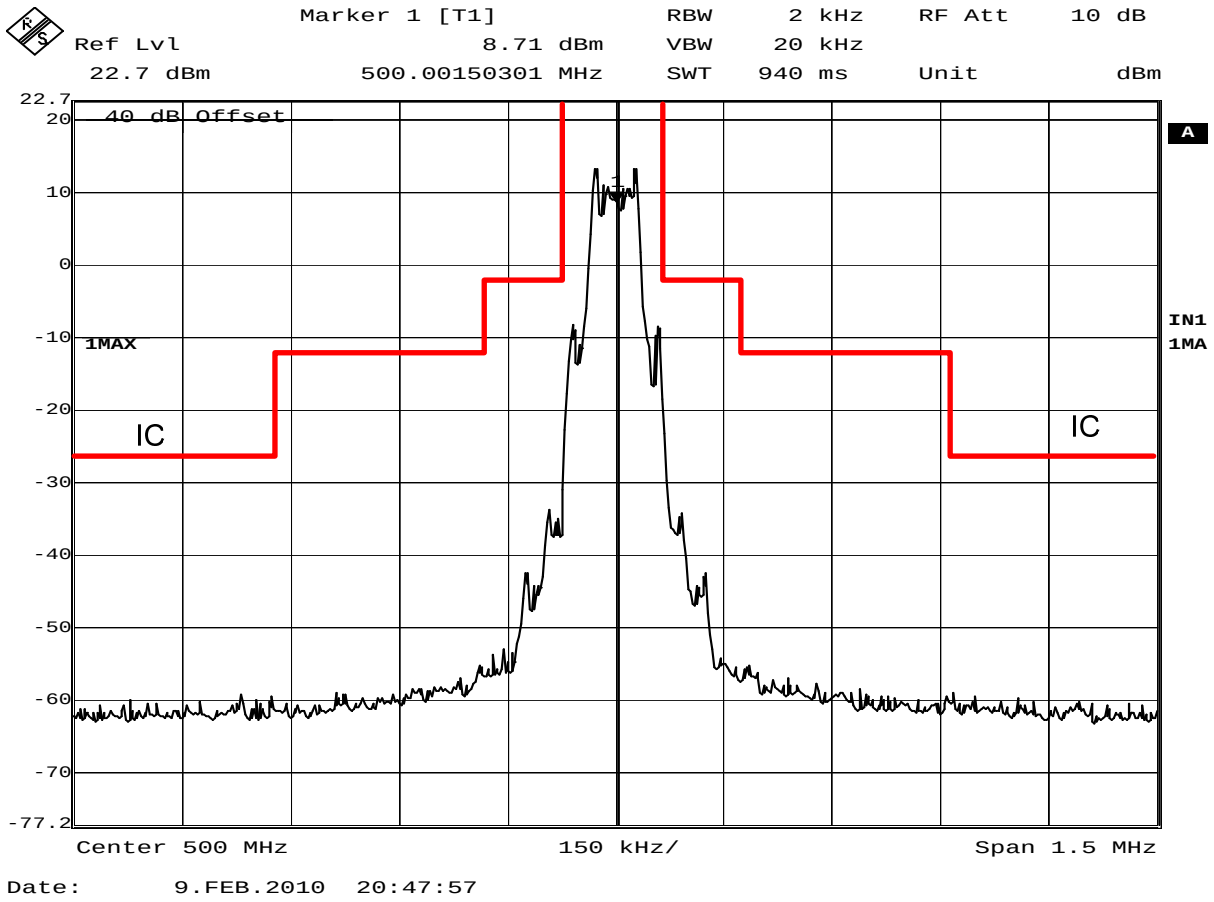
FCC/IC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, DC POWERED
NOTES	: CW
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,



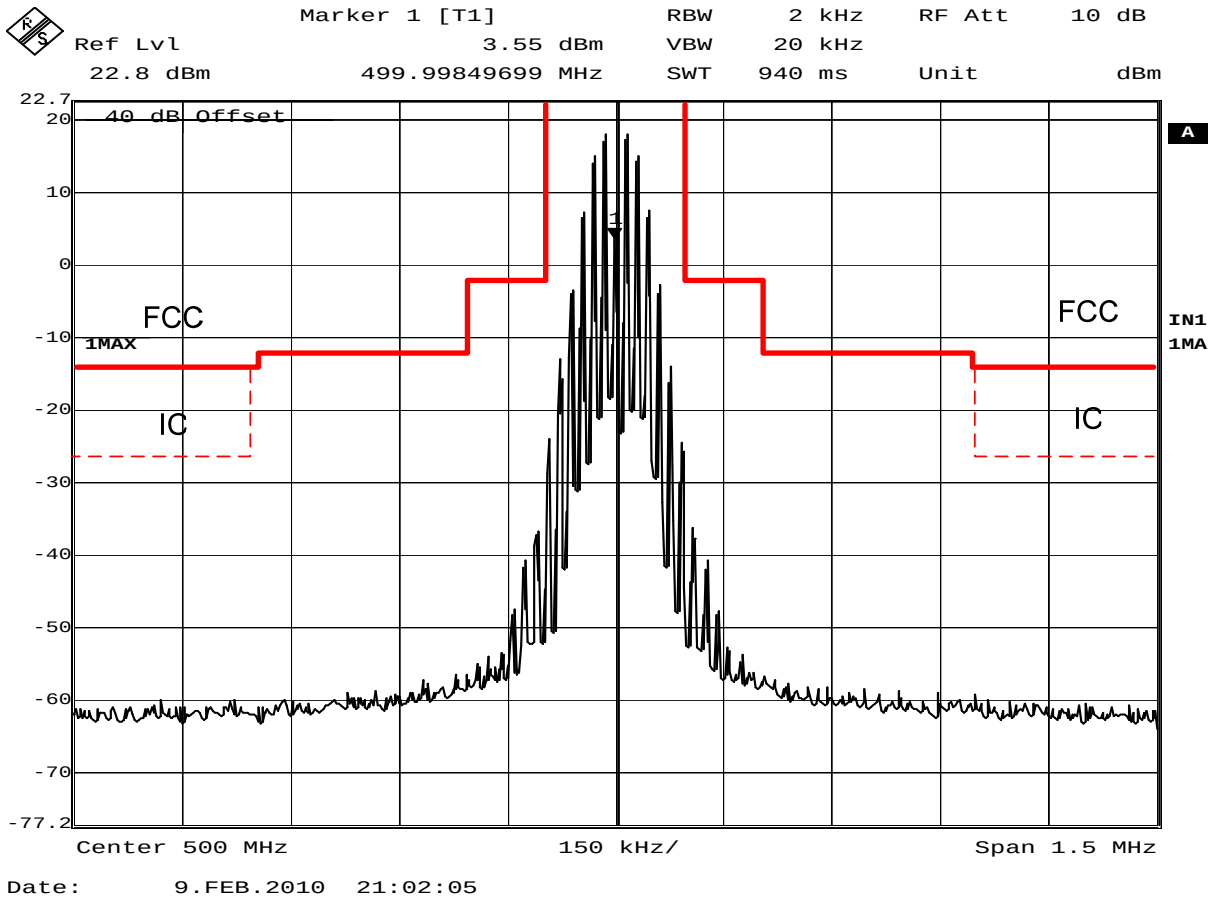
FCC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, DC POWERED
NOTES	: 2500 at 16dB over 50%
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,



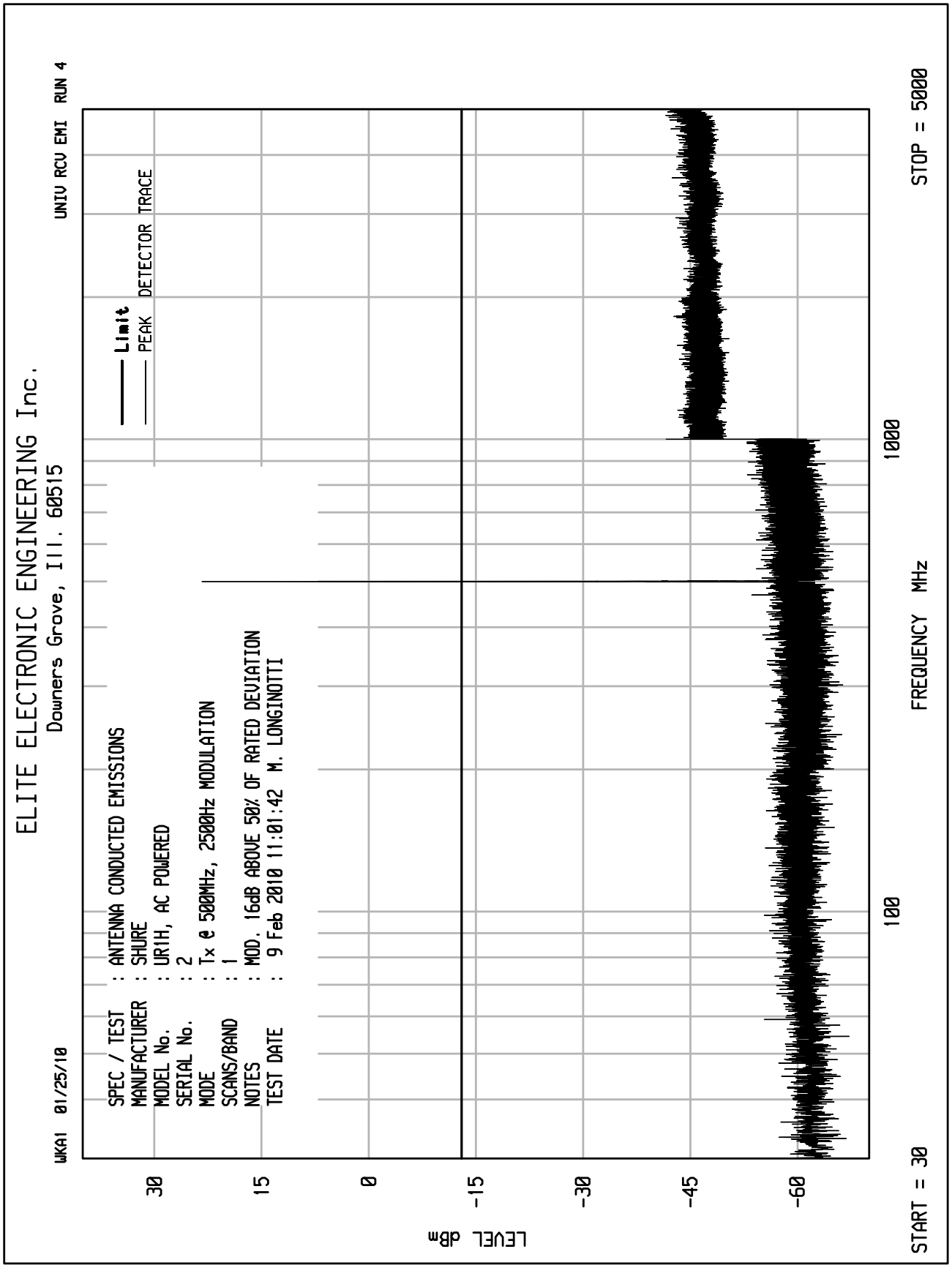
IC Occupied Bandwidth

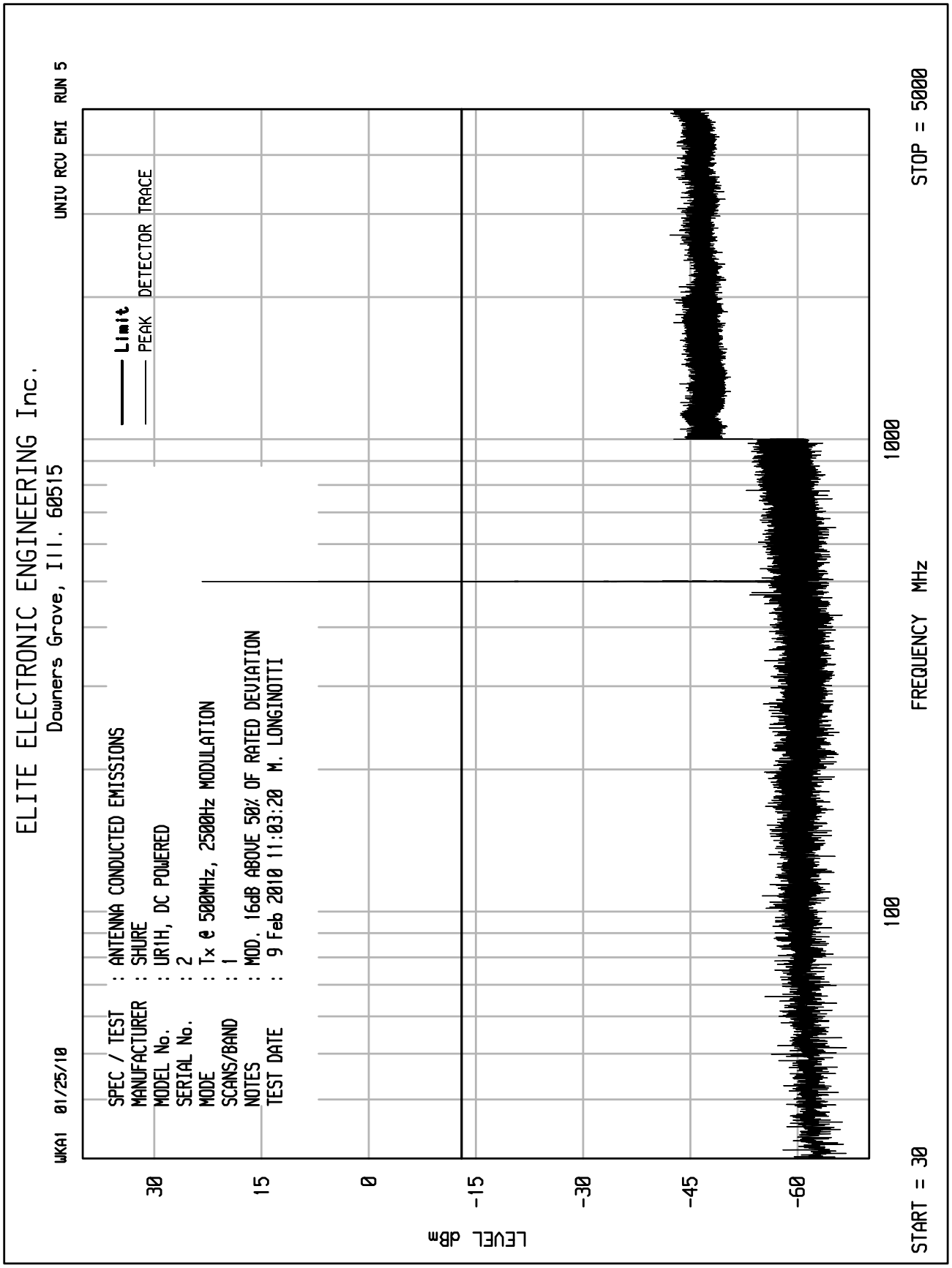
MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, DC POWERED
NOTES	: Modulated with signals representative of those
	: encountered in a real system operation
	: (2500Hz at 80% rated deviation)
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,

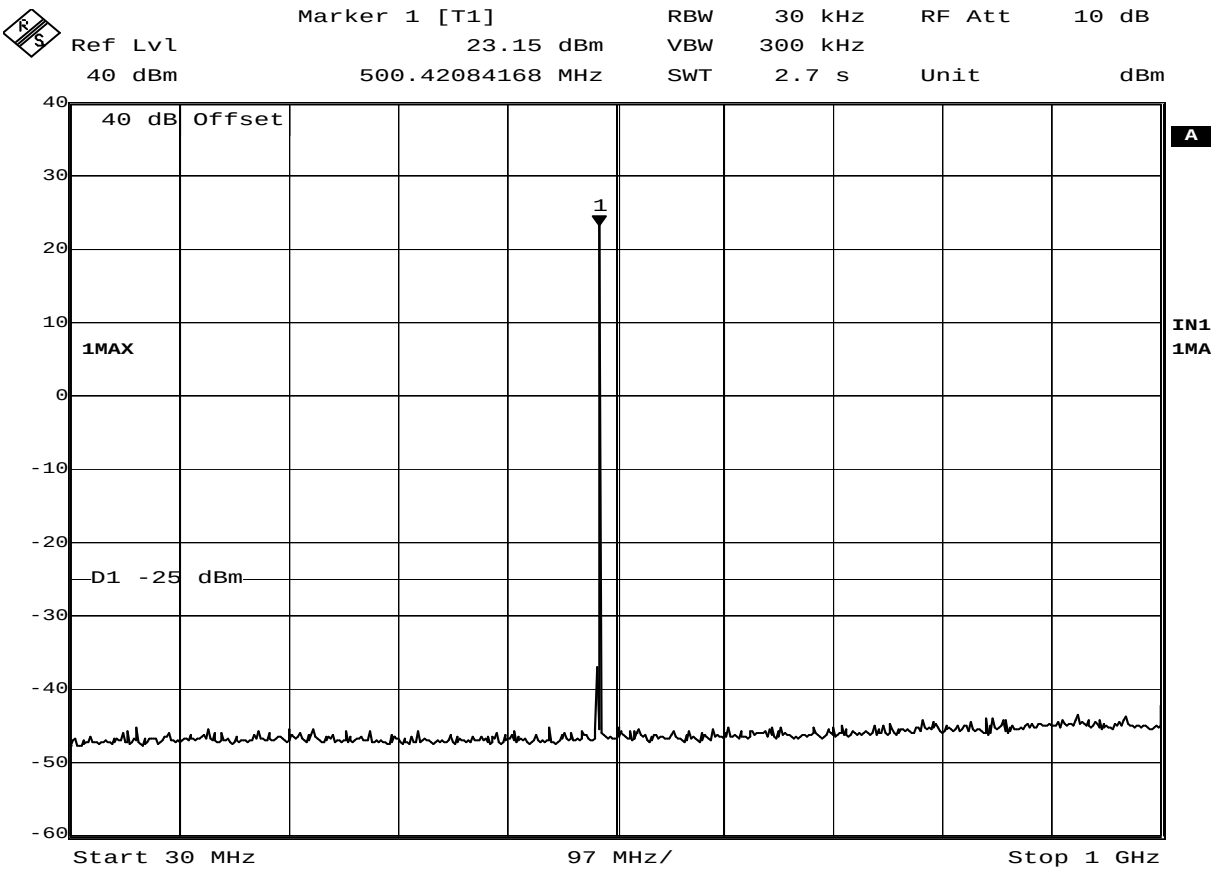


IC Occupied Bandwidth

MANUFACTURER	: Shure, Inc.
MODEL NUMBER	: UR1H
SERIAL NUMBER	: 2
TEST MODE	: Tx at 500MHz, DC POWERED
NOTES	: 15kHz @ 85% modulation
EQUIPMENT USED	: RBB0, GWH2, T2S3, T2D7, RYE0,


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKAI 01/25/10
SPEC / TEST : ANTENNA CONDUCTED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H, AC POWERED
SERIAL No. : 2
MODE : Tx @ 500MHz, 2500Hz MODULATION
SCANS/BAND : 1
NOTES : MOD. 16dB ABOVE 50% OF RATED DEVIATION
TEST DATE : 9 Feb 2010 11:01:42 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
START = 30
100
1000
STOP = 5000
FREQUENCY MHz

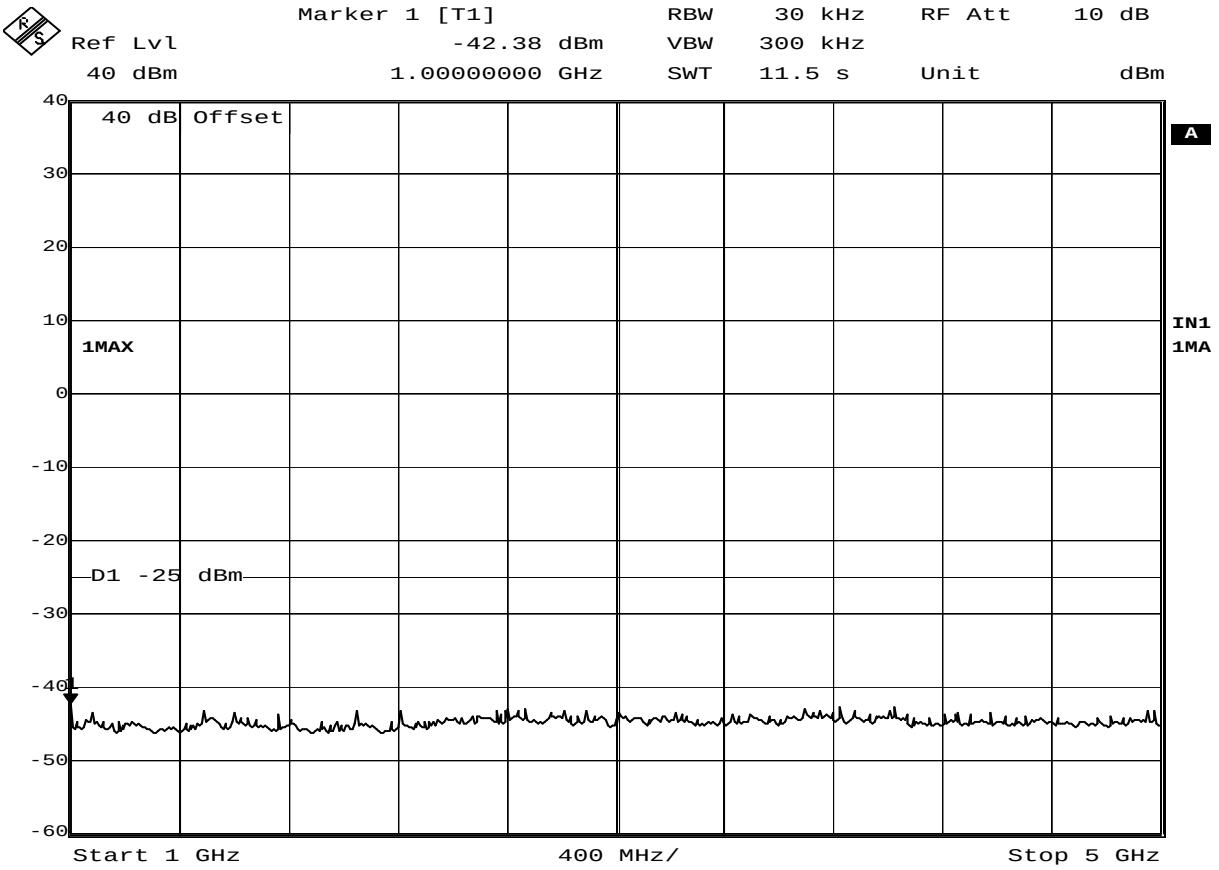

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKAI 01/25/10
SPEC / TEST : ANTENNA CONDUCTED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H, DC POWERED
SERIAL No. : 2
MODE : Tx @ 500MHz, 2500Hz MODULATION
SCANS/BAND : 1
NOTES : MOD. 16dB ABOVE 50% OF RATED DEVIATION
TEST DATE : 9 Feb 2010 11:03:20 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
START = 30
100
1000
STOP = 5000
FREQUENCY MHz



RSS-123 Antenna Conducted Emissions

MANUFACTURER : Shure
MODEL NUMBER : UR1H
SERIAL NUMBER : 2
TEST MODE :Tx @ 500MHz, AC Powered
TEST PARAMETERS : Modulated with signals representative of those encountered in a real system operation (2500Hz at 80% rated deviation)
EQUIPMENT USED : RBB0, T2S3, T2D7

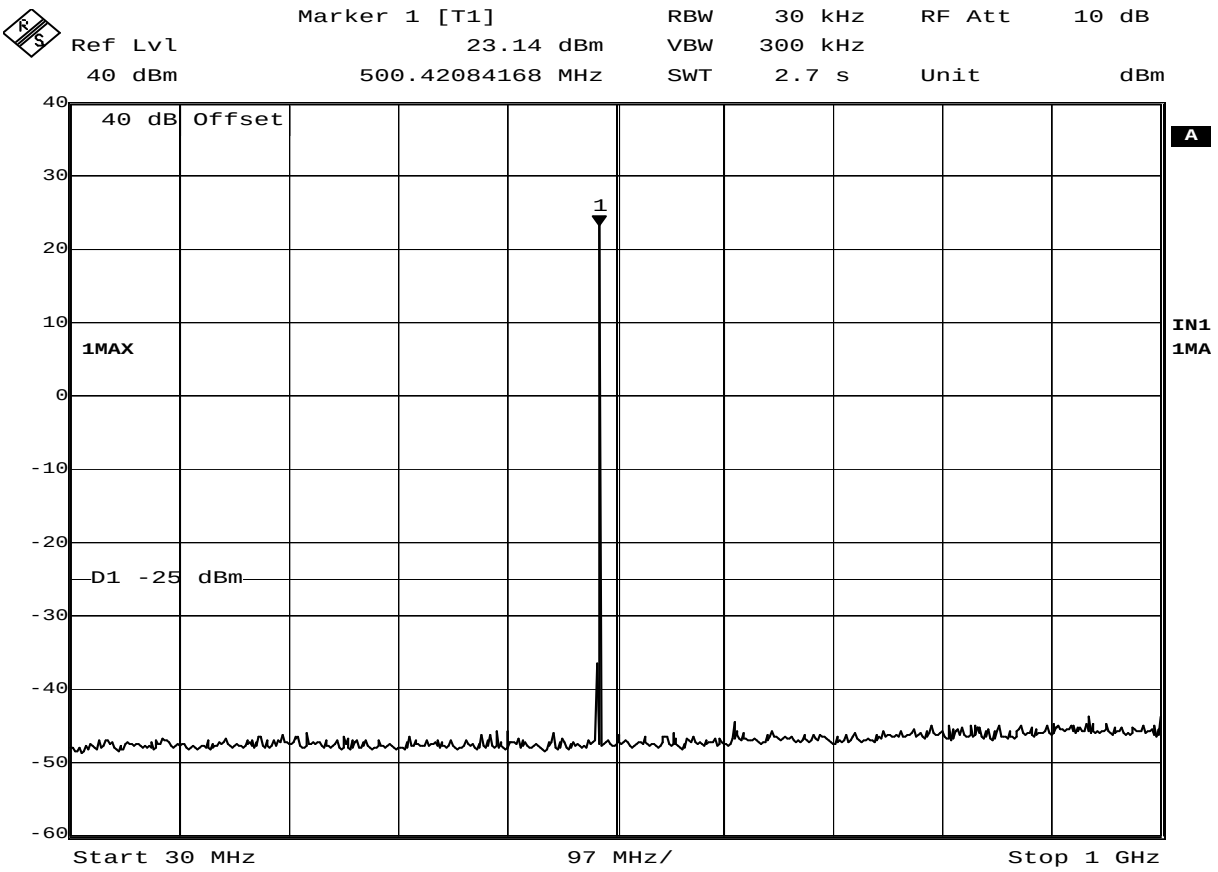
NOTES



RSS-123 Antenna Conducted Emissions

MANUFACTURER : Shure
MODEL NUMBER : UR1H
SERIAL NUMBER : 2
TEST MODE : Tx @ 500MHz, AC Powered
TEST PARAMETERS : Modulated with signals representative of those encountered in a real system operation (2500Hz at 80% rated deviation)
EQUIPMENT USED : RBB0, T2S3, T2D7

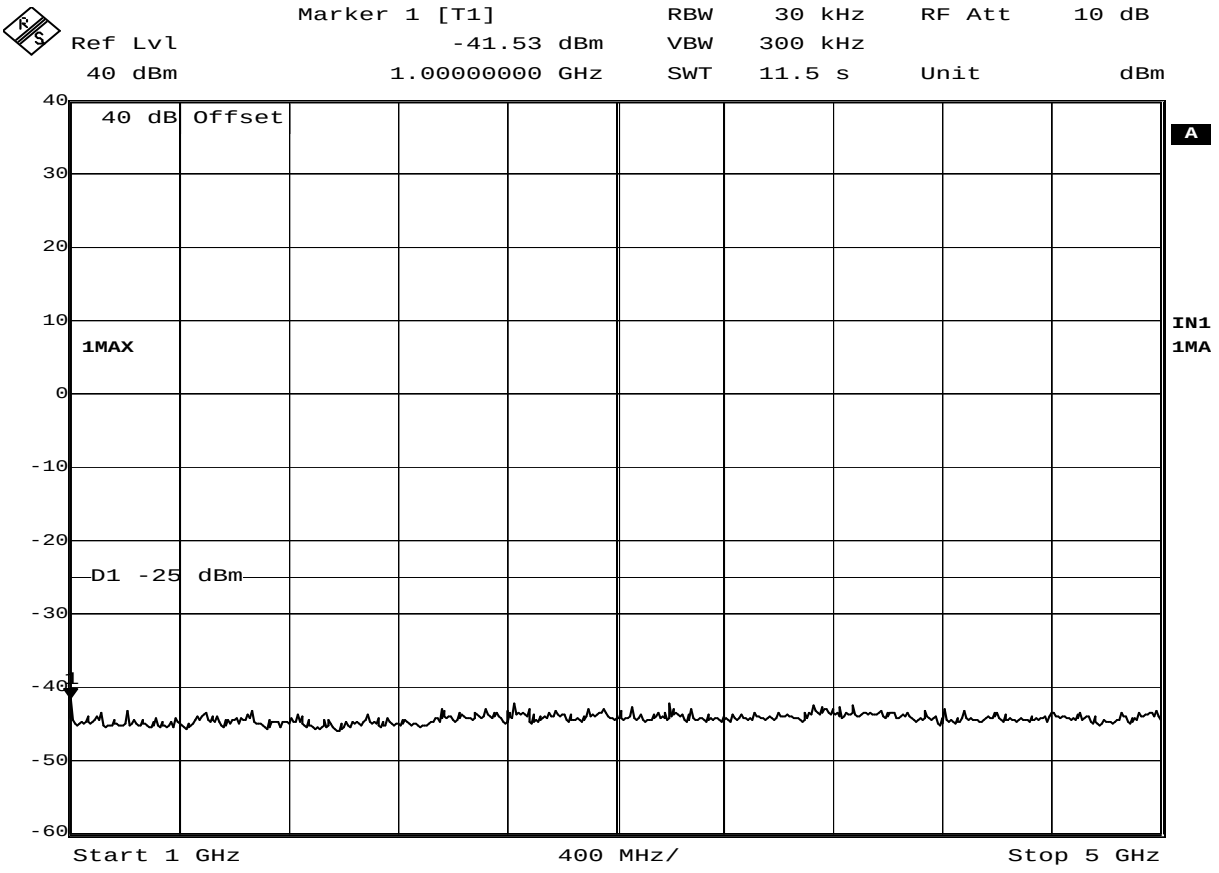
NOTES



RSS-123 Antenna Conducted Emissions

MANUFACTURER : Shure
MODEL NUMBER : UR1H
SERIAL NUMBER : 2
TEST MODE : Tx @ 500MHz, DC Powered
TEST PARAMETERS : Modulated with signals representative of those encountered in a real system operation (2500Hz at 80% rated deviation)
EQUIPMENT USED : RBB0, T2S3, T2D7

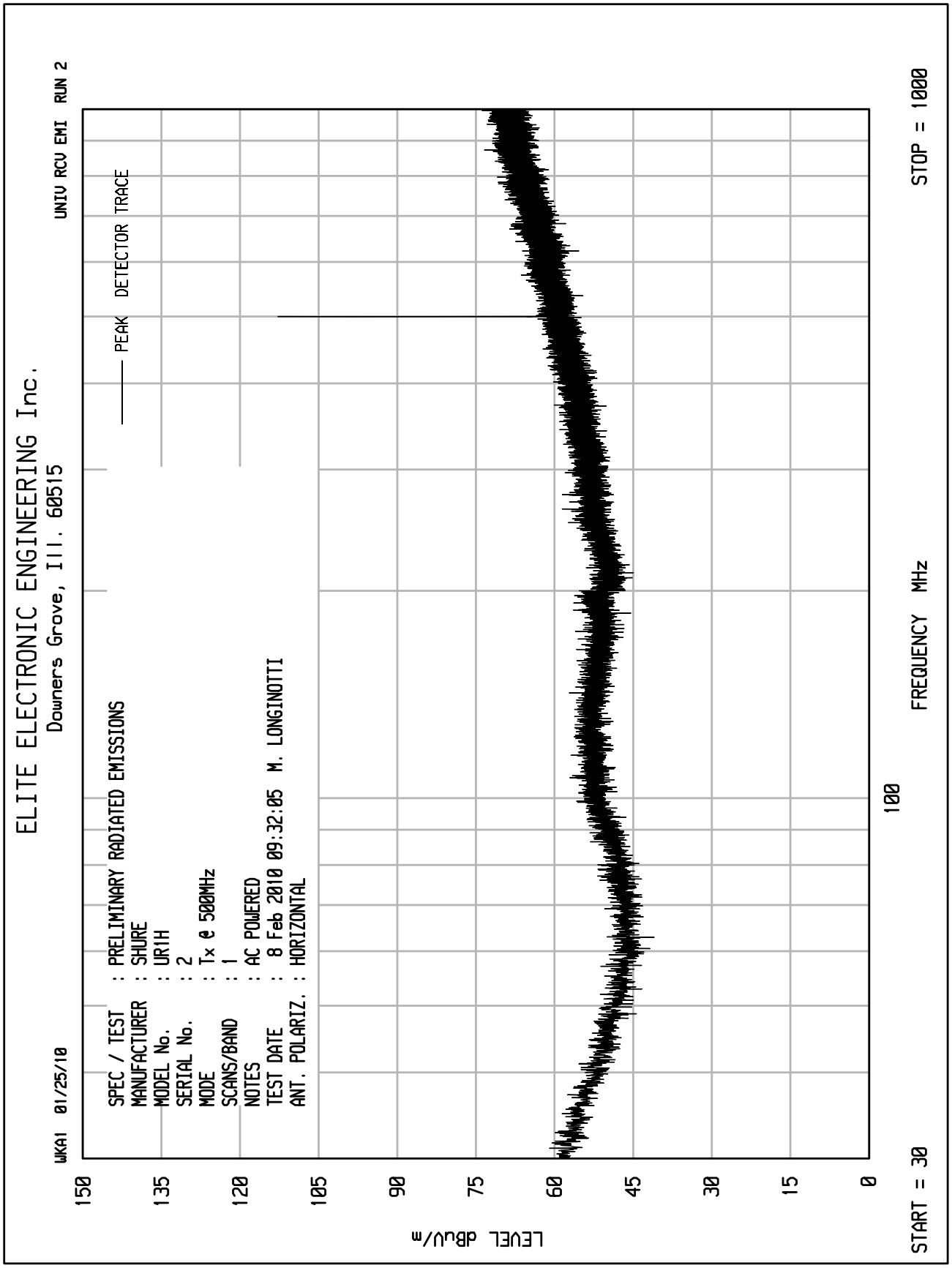
NOTES

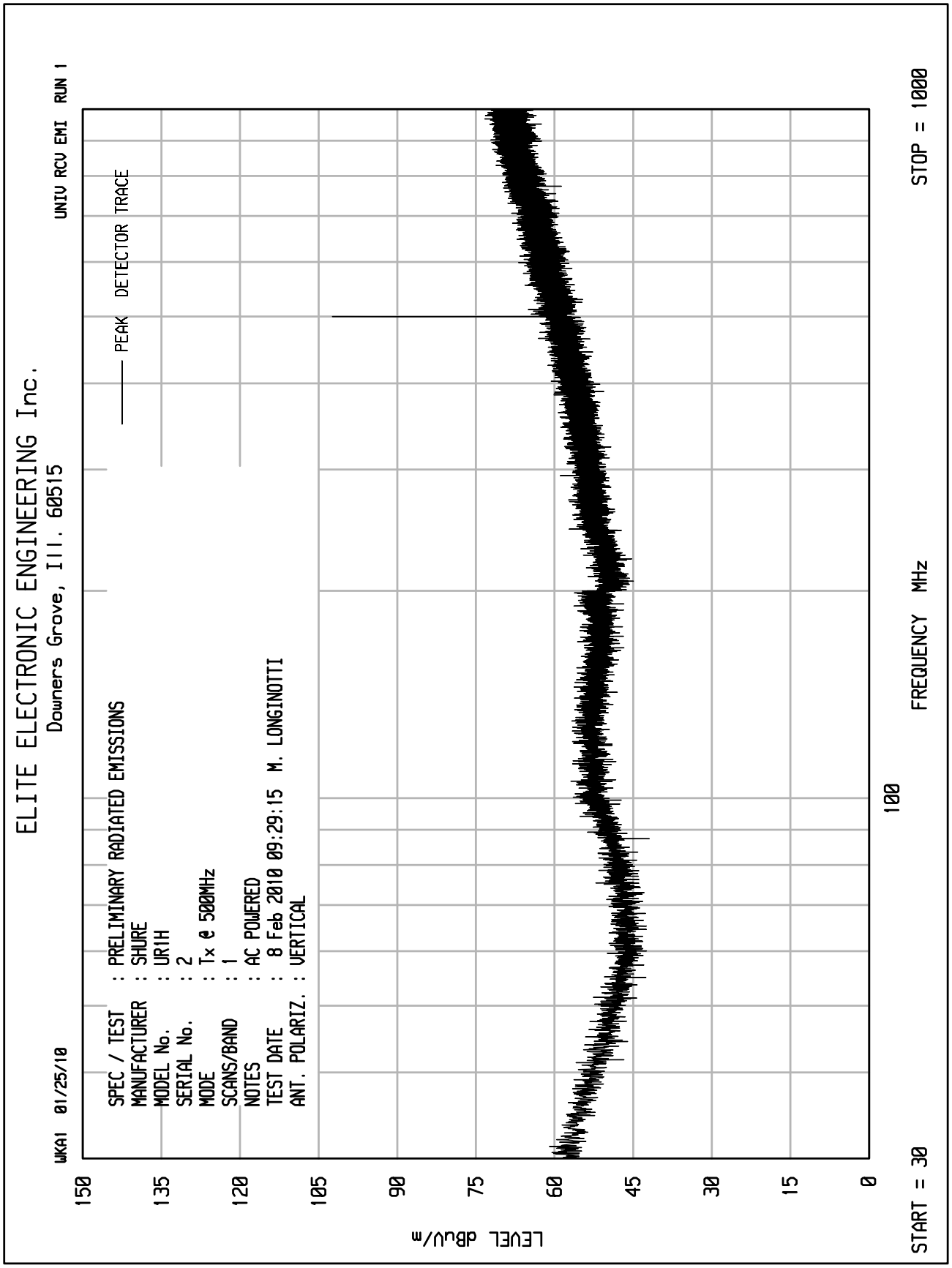


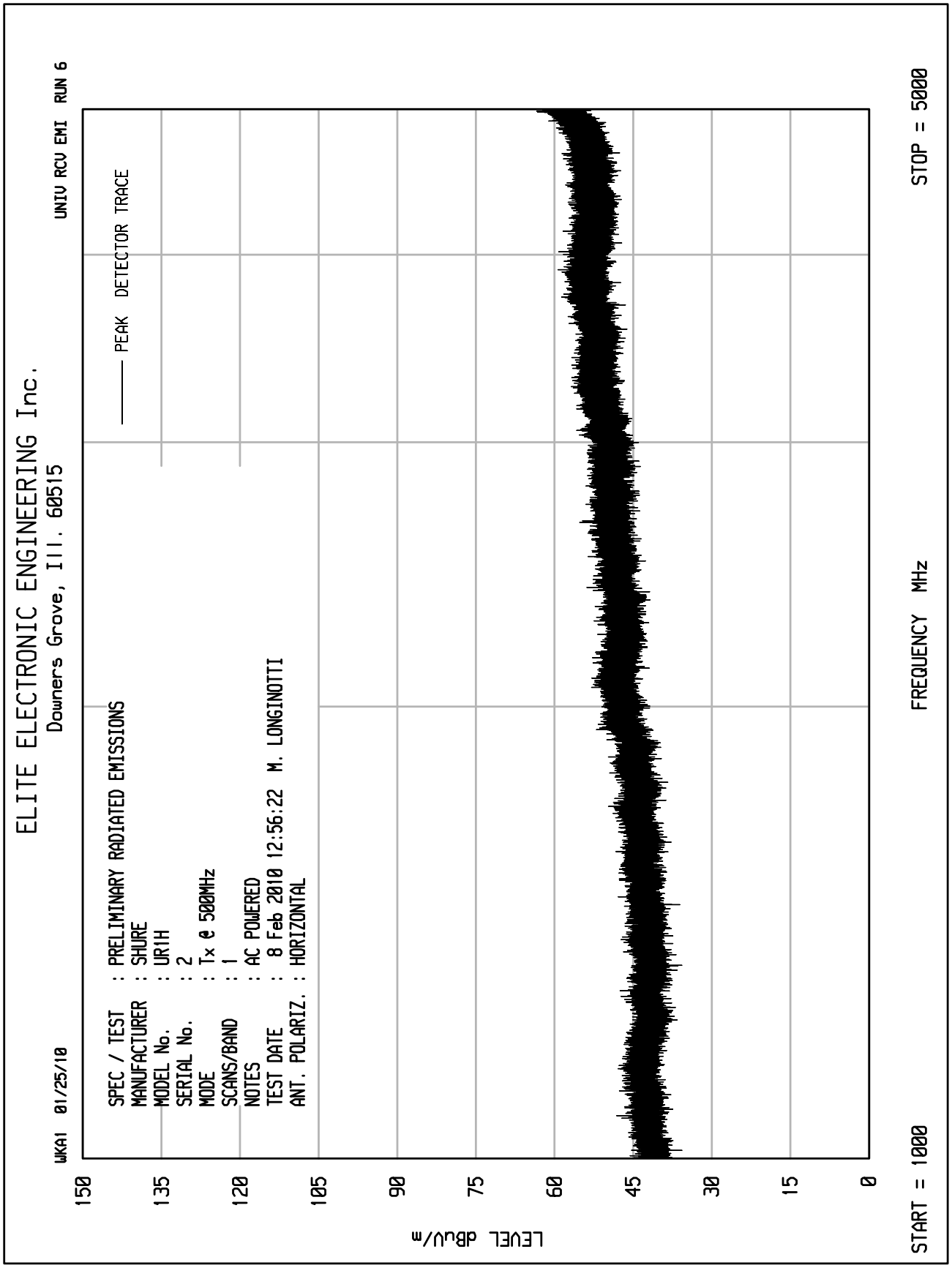
RSS-123 Antenna Conducted Emissions

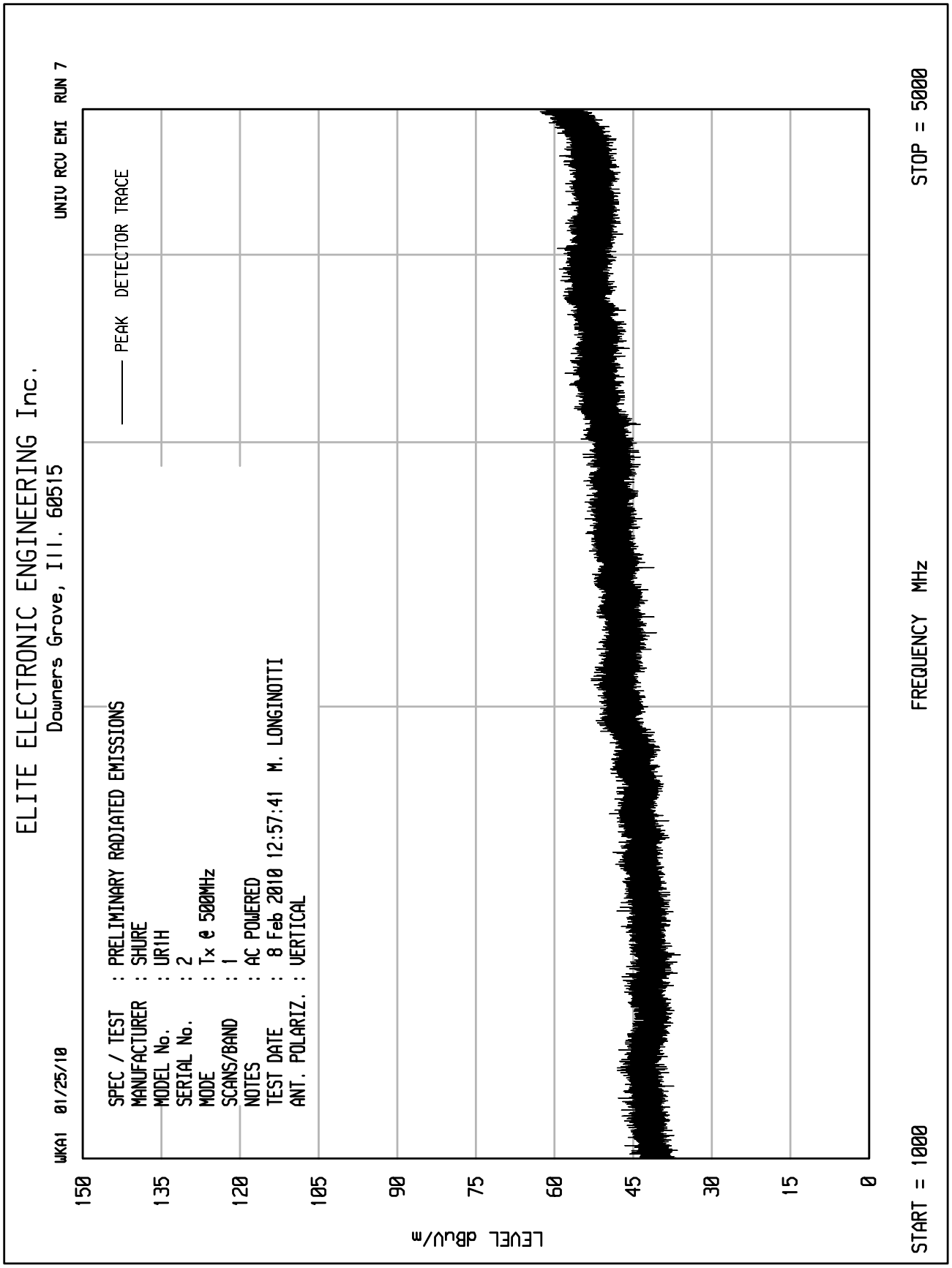
MANUFACTURER : Shure
MODEL NUMBER : UR1H
SERIAL NUMBER : 2
TEST MODE : Tx @ 500MHz, DC Powered
TEST PARAMETERS : Modulated with signals representative of those encountered in a real system operation (2500Hz at 80% rated deviation)
EQUIPMENT USED : RBB0, T2S3, T2D7

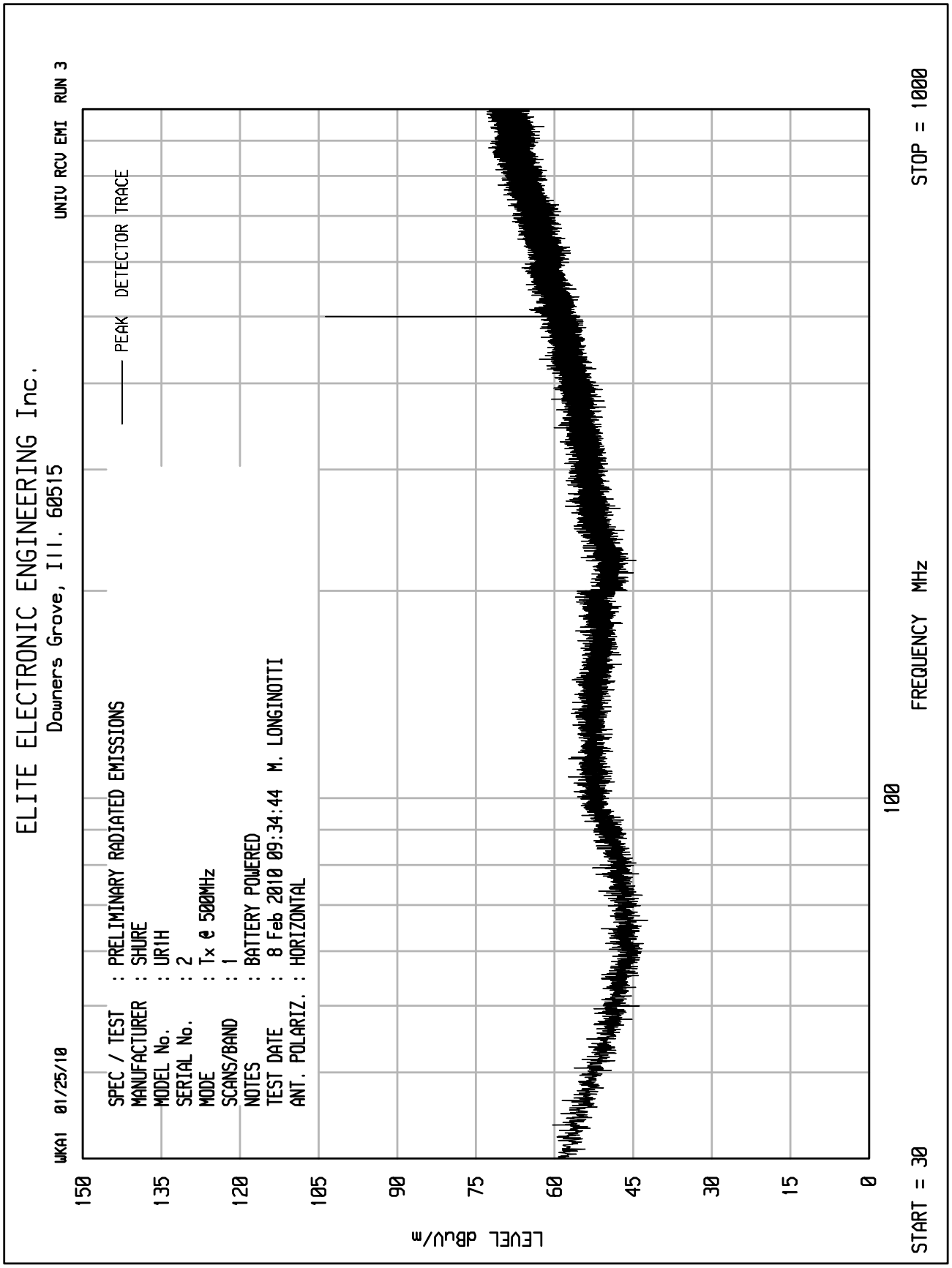
NOTES

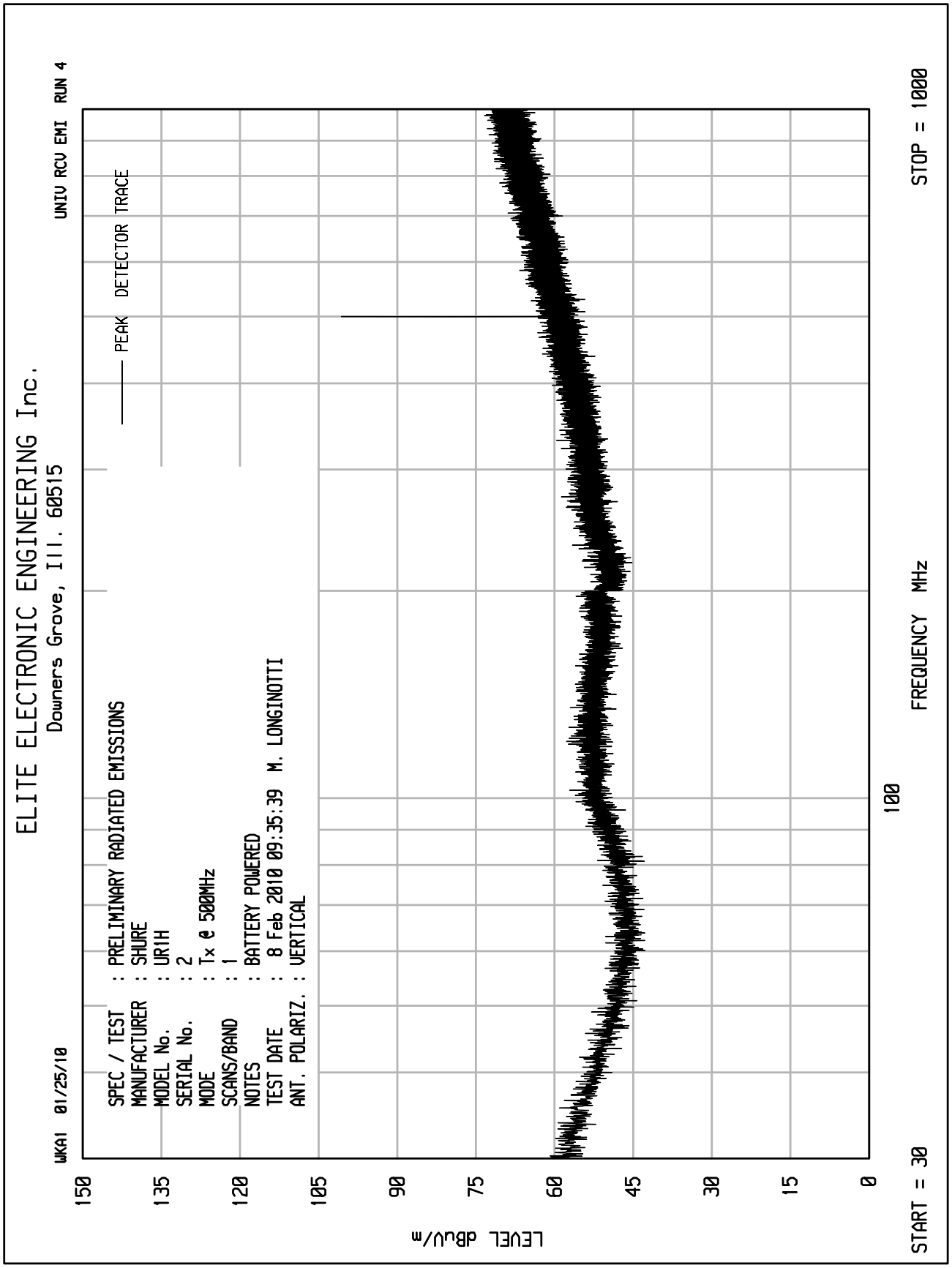

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : AC POWERED
TEST DATE : 8 Feb 2010 09:32:05 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

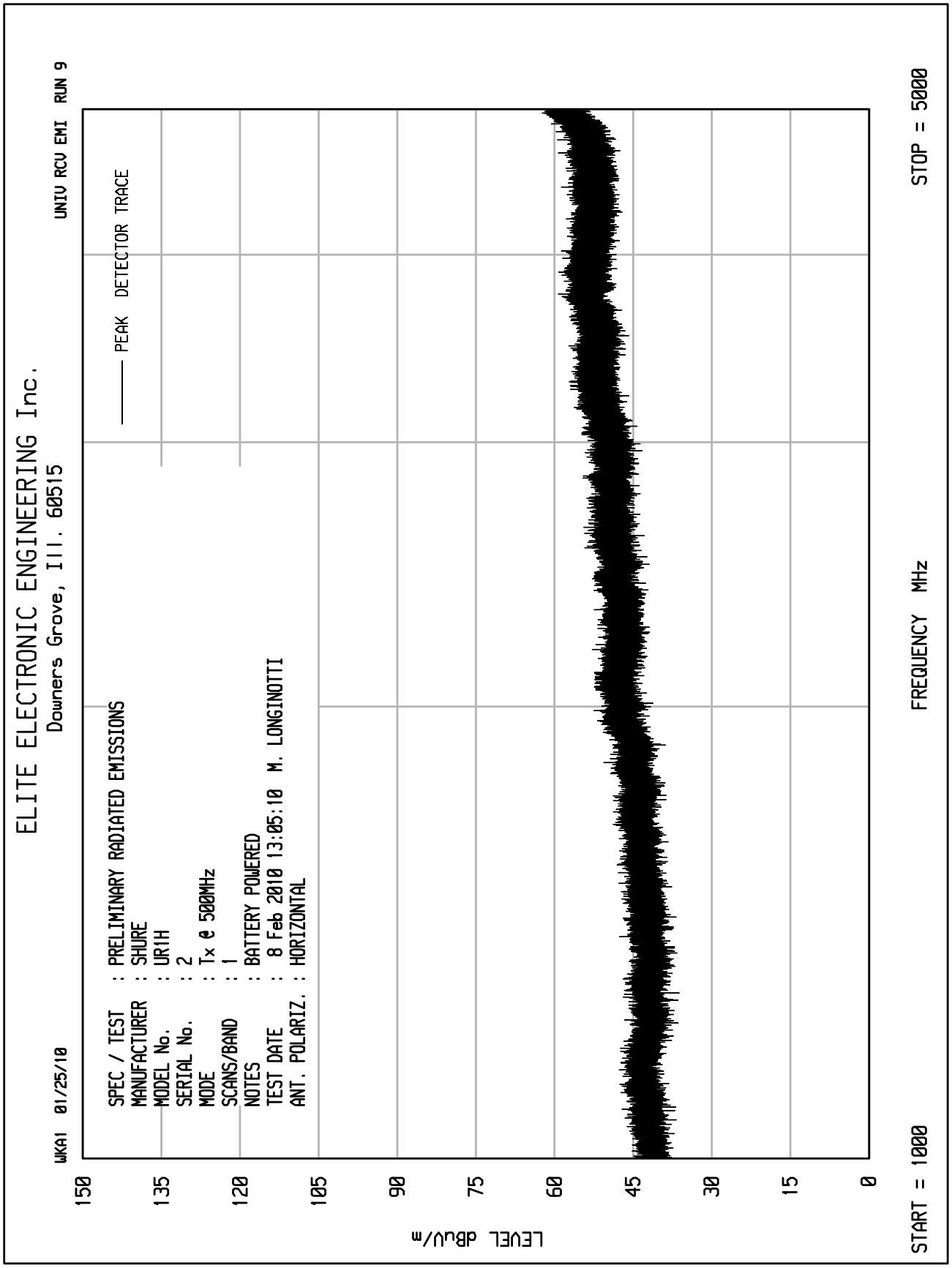

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : AC POWERED
TEST DATE : 8 Feb 2010 09:29:15 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

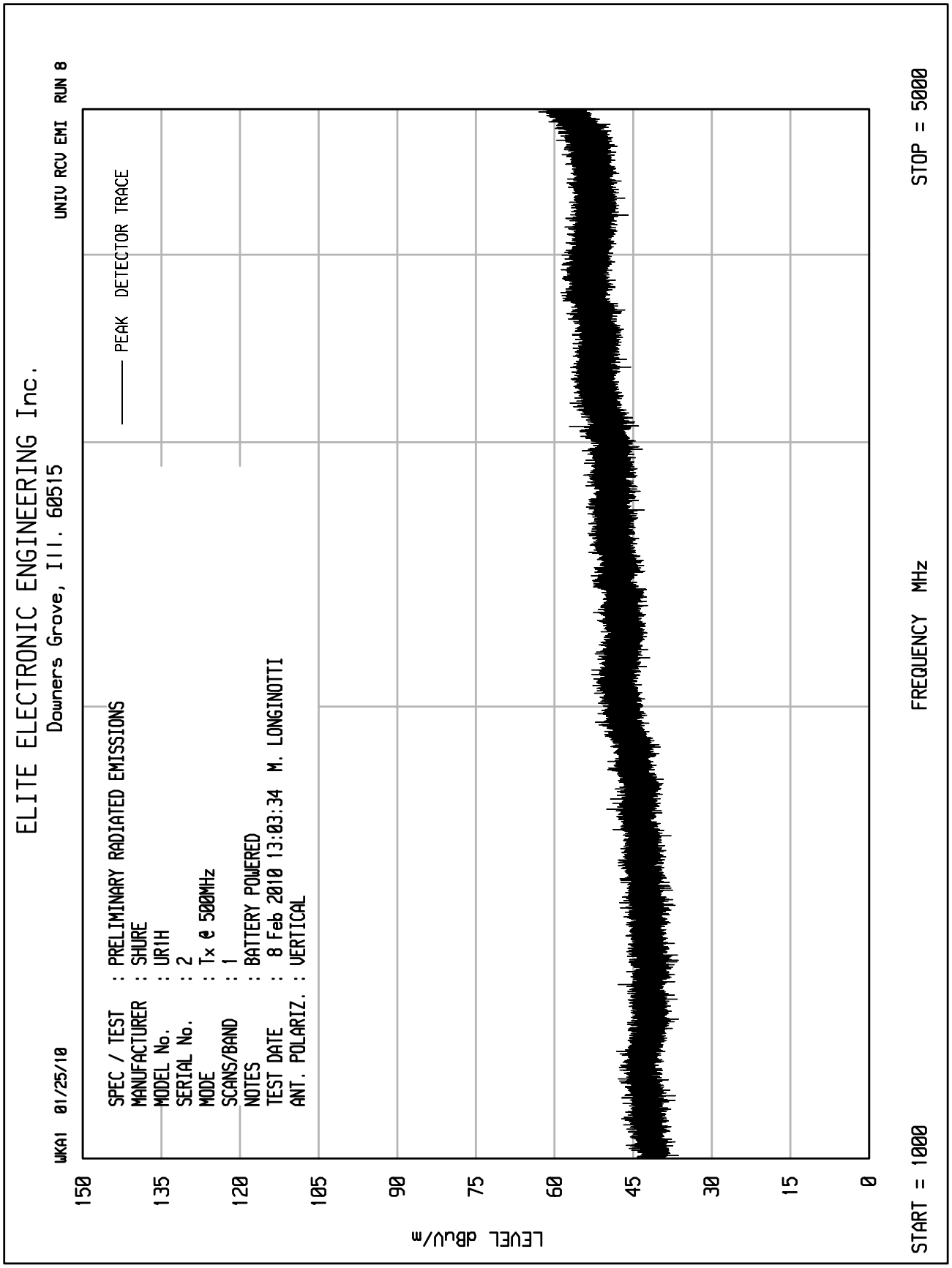

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : AC POWERED
TEST DATE : 8 Feb 2010 12:56:22 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : AC POWERED
TEST DATE : 8 Feb 2010 12:57:41 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 3
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : BATTERY POWERED
TEST DATE : 8 Feb 2010 09:34:44 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
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 4
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : BATTERY POWERED
TEST DATE : 8 Feb 2010 09:35:39 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
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 9
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : BATTERY POWERED
TEST DATE : 8 Feb 2010 13:05:10 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 8
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SHURE
MODEL No. : UR1H
SERIAL No. : 2
MODE : Tx @ 500MHz
SCANS/BAND : 1
NOTES : BATTERY POWERED
TEST DATE : 8 Feb 2010 13:03:34 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
150
135
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Spurious Radiated Emissions
DATE : February 8, 2010
MODE : Transmit at 500MHz, 250mW (24dBm)
NOTES : AC Powered
EQUIPMENT USED : RBB0, XPU2, NTA1, NWH0, NWF0, GRE0

Freq. MHz	Ant Pol	Meter Reading dBuV	Amb	Matched Sig Gen dBm	Antenna Gain dB	Cable Factor dB	ERP Total dBm	Atten. dB	Part 74 Min. Attn. dB	RSS-123 Min. Attn. dB
1000.0	H	27.9		-46.2	1.8	2.8	-47.2	71.2	37.0	49.0
1000.0	V	26.4	Amb	-49.3	1.8	2.8	-50.3	74.3	37.0	49.0
1500.0	H	26.1	Amb	-49.0	2.3	3.3	-50.0	74.0	37.0	49.0
1500.0	V	26.8	Amb	-48.8	2.3	3.3	-49.8	73.8	37.0	49.0
2000.0	H	27.8	Amb	-44.2	2.0	3.6	-45.8	69.8	37.0	49.0
2000.0	V	27.3	Amb	-44.3	2.0	3.6	-45.9	69.9	37.0	49.0
2500.0	H	26.1	Amb	-43.6	2.0	4.1	-45.7	69.7	37.0	49.0
2500.0	V	26.5	Amb	-40.8	2.0	4.1	-42.9	66.9	37.0	49.0
3000.0	H	24.8	Amb	-42.3	3.4	4.4	-43.3	67.3	37.0	49.0
3000.0	V	24.8	Amb	-40.4	3.4	4.4	-41.4	65.4	37.0	49.0
3500.0	H	25.9	Amb	-41.4	3.2	4.5	-42.7	66.7	37.0	49.0
3500.0	V	26.4	Amb	-39.8	3.2	4.5	-41.1	65.1	37.0	49.0
4000.0	H	26.2	Amb	-38.7	4.4	5.6	-39.9	63.9	37.0	49.0
4000.0	V	26.6	Amb	-37.3	4.4	5.6	-38.5	62.5	37.0	49.0
4500.0	H	25.9	Amb	-39.1	3.7	6.0	-41.4	65.4	37.0	49.0
4500.0	V	25.5	Amb	-40.0	3.7	6.0	-42.3	66.3	37.0	49.0
5000.0	H	30.2	Amb	-31.3	4.4	6.0	-32.9	56.9	37.0	49.0
5000.0	V	29.7	Amb	-32.7	4.4	6.0	-34.3	58.3	37.0	49.0

Amb - Ambient

ERP Total (dBm) = Matched Sig Gen (dBm) + Antenna Gain (dB) – Cable Factor (dB)

Atten. (dB) = Output Power (dBm) – ERP (dBm)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

MANUFACTURER : Shure Inc.
MODEL : UR1H Transmitter
SERIAL NO. : 2
SPECIFICATION : FCC-74 and RSS-123 Spurious Radiated Emissions
DATE : February 8, 2010
MODE : Transmit at 500MHz, 250mW (24dBm)
NOTES : DC Powered
EQUIPMENT USED : RBB0, XPU2, NTA1, NWH0, NWF0, GRE0

Freq. MHz	Ant Pol	Meter Reading dBuV	Amb	Matched Sig Gen dBm	Antenna Gain dB	Cable Factor dB	ERP Total dBm	Atten. dB	Part 74 Min. Attn. dB	RSS-123 Min. Attn. dB
1000.0	H	29.2		-44.8	2.5	2.0	-44.3	68.3	37.0	49.0
1000.0	V	26.6		-48.8	2.5	2.0	-48.3	72.3	37.0	49.0
1500.0	H	25.9	Amb	-49.2	4.8	2.5	-46.9	70.9	37.0	49.0
1500.0	V	27.4	Amb	-47.9	4.8	2.5	-45.6	69.6	37.0	49.0
2000.0	H	27.4	Amb	-44.5	5.0	2.9	-42.4	66.4	37.0	49.0
2000.0	V	27.2	Amb	-44.4	5.0	2.9	-42.3	66.3	37.0	49.0
2500.0	H	26.5	Amb	-43.1	5.9	3.1	-40.3	64.3	37.0	49.0
2500.0	V	26.5	Amb	-40.8	5.9	3.1	-38.0	62.0	37.0	49.0
3000.0	H	25.3	Amb	-41.7	6.0	3.2	-39.0	63.0	37.0	49.0
3000.0	V	25.3	Amb	-39.8	6.0	3.2	-37.1	61.1	37.0	49.0
3500.0	H	26.1	Amb	-41.2	6.8	3.7	-38.1	62.1	37.0	49.0
3500.0	V	26.5	Amb	-39.7	6.8	3.7	-36.6	60.6	37.0	49.0
4000.0	H	26.1	Amb	-38.8	6.9	4.0	-36.0	60.0	37.0	49.0
4000.0	V	26.7	Amb	-37.2	6.9	4.0	-34.4	58.4	37.0	49.0
4500.0	H	25.8	Amb	-39.2	8.3	4.4	-35.3	59.3	37.0	49.0
4500.0	V	26.1	Amb	-39.2	8.3	4.4	-35.3	59.3	37.0	49.0
5000.0	H	29.5	Amb	-31.9	7.9	4.7	-28.7	52.7	37.0	49.0
5000.0	V	29.5	Amb	-32.9	7.9	4.7	-29.7	53.7	37.0	49.0

Amb - Ambient

ERP Total (dBm) = Matched Sig Gen (dBm) + Antenna Gain (dB) – Cable Factor (dB)

Atten. (dB) = Output Power (dBm) – ERP (dBm)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti