DNB ENGINEERING, INC.
"One World, One EMC Solution"

# VERIFICATION REPORT
# OF
# ELECTROMAGNETIC INTERFERENCE

Per

**CFR 47 Part 15 Subpart B**
**Conducted Emissions Per EN 55022**

## EUT:

PREPARED FOR APPLICANT:
**Visionary Product Inc.**
11814 South Election Road Ste 200
Draper, UT. 84020

REPORT # 56015
TEST COMPLETION DATE: December 20, 2004

NVLAP Lab Code 200634-0

Prepared By:
DNB ENGINEERING, INC.
1100 East Chalk Creek Rd.
Coalville, Utah 84017
Phone (435) 336-4433

# 1. CONDUCTED EMISSIONS EN 55022 CLASS A

## 1.1 Test Setup and Procedure

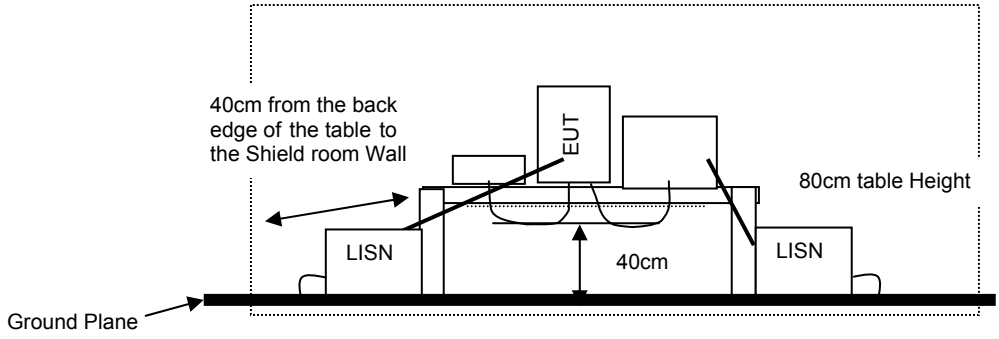
The EUT was placed on a wooden table 1 meter wide and 1.5 meters long .The top of the table is 80 cm above the ground plane and 40 cm from the vertical coupling plane. The EUT was put into the mode of operation as stated in 1.4. The conducted tests are performed by inserting a 50-ohm, 50 uH LISN in series with the power line of the EUT. The tests are either performed on each unit individually or on several units at a time for each test configuration.

The spectrum analyzer is setup to store the peak emissions over the range stated in the applicable standard. Cables are then adjusted to maximize emissions. The peak spectrum analyzer trace and limits are plotted onto graph paper. A receiver (with CISPR quasi peak and average capability) is used to identify the highest frequencies with respect to the limit. Ambients are noted on the graph along with emissions from the EUT. EUT emissions with more than 10 dB margin may only have peak spectrum analyzer measurements taken. The highest levels are listed in the Conducted Emissions Summary Test Data.

**Example of Typical Calculation**

| | | |
|---|---|---|
| Rohde and Schwarz reading @ 20 MHz | 49.0 | dBµV |
| LISN Factor | +7.5 | dB |
| Cable Loss | +2.0 | dB |
| Total Factors | 9.5 | dB |
| Voltage dBµV at LISN = | 58.5 | dBµv |

## 1.2 Diagram of test setup




## 1.3 Deviations

The EUT was tested at 2402 MHz and 2441 MHz using the wire Dipole Antenna and at 2480 MHz with the Chip Antenna, and there seemed to be little difference in the results. Therefore the reaming Antenna and Transmit Frequencies was not tested due to time restraints.

## 1.4 Conducted Compliance Test Data

### EN 55022 Class B at 120 Volts 60Hz

### Run 1 Wire Dipole Antenna Transmitting at 2402 MHz

| Customer: Visionary Products Inc. | | | | | | | | EUT: VMX-100 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipment on LISN | **Freq. MHz** | Meas'd (dBuV) | Filter Factors (dB) | AMP Factors (dB) | LISN Factors | Cable Factors | Total Factors | **Total (dBuV)** | Limit (dBuV) | **Delta (dB)** | Limit Type AVE, QP | **Line** | Meas. Mode |
| **VMX-100** | **0.198** | 48.40 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **48.70** | 55.0 | **-6.30** | AVE | L2 | QP |
| **VMX-100** | **0.198** | 48.20 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **48.50** | 55.0 | **-6.50** | AVE | L1 | QP |
| **VMX-100** | **1.389** | 38.10 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **38.40** | 46.0 | **-7.60** | AVE | L2 | QP |
| **VMX-100** | **1.456** | 37.60 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **37.90** | 46.0 | **-8.10** | AVE | L2 | QP |
| **VMX-100** | **0.158** | 47.00 | 0.00 | 0.00 | 0.30 | 0.10 | 0.40 | **47.40** | 56.0 | **-8.60** | AVE | L2 | QP |
| **VMX-100** | **0.158** | 46.80 | 0.00 | 0.00 | 0.30 | 0.10 | 0.40 | **47.20** | 56.0 | **-8.80** | AVE | L1 | QP |

- 6 Highest frequencies relative to the Limit.

### Run 1.1 Dipole Wire Antenna Transmitting at 2441 MHz

| Customer: Visionary Products Inc. | | | | | | | | EUT: VMX-100 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipment on LISN | **Freq. MHz** | Meas'd (dBuV) | Filter Factors (dB) | AMP Factors (dB) | LISN Factors | Cable Factors | Total Factors | **Total (dBuV)** | Limit (dBuV) | **Delta (dB)** | Limit Type AVE, QP | **Line** | Meas. Mode |
| **VMX-100** | **0.198** | 48.20 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **48.50** | 55.0 | **-6.50** | AVE | L2 | QP |
| **VMX-100** | **0.198** | 48.20 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **48.50** | 55.0 | **-6.50** | AVE | L1 | QP |
| **VMX-100** | **1.389** | 38.10 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **38.40** | 46.0 | **-7.60** | AVE | L2 | QP |
| **VMX-100** | **0.158** | 47.40 | 0.00 | 0.00 | 0.30 | 0.10 | 0.40 | **47.80** | 56.0 | **-8.20** | AVE | L1 | QP |
| **VMX-100** | **0.158** | 46.70 | 0.00 | 0.00 | 0.30 | 0.10 | 0.40 | **47.10** | 56.0 | **-8.90** | AVE | L2 | QP |
| **VMX-100** | **1.456** | 36.40 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **36.70** | 46.0 | **-9.30** | AVE | L2 | QP |

- 6 Highest frequencies relative to the Limit.

### Run 1.2 Chip Antenna Transmitting at 2480 MHz

| Customer: Visionary Products Inc. | | | | | | | | EUT: VMX-100 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipment on LISN | **Freq. MHz** | Meas'd (dBuV) | Filter Factors (dB) | AMP Factors (dB) | LISN Factors | Cable Factors | Total Factors | **Total (dBuV)** | Limit (dBuV) | **Delta (dB)** | Limit Type AVE, QP | **Line** | Meas. Mode |
| **VMX-100** | **0.198** | 48.40 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **48.70** | 55.0 | **-6.30** | AVE | L2 | QP |
| **VMX-100** | **0.198** | 48.10 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **48.40** | 55.0 | **-6.60** | AVE | L1 | QP |
| **VMX-100** | **1.456** | 37.80 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **38.10** | 46.0 | **-7.90** | AVE | L2 | QP |
| **VMX-100** | **1.390** | 37.50 | 0.00 | 0.00 | 0.10 | 0.20 | 0.30 | **37.80** | 46.0 | **-8.20** | AVE | L2 | QP |
| **VMX-100** | **0.159** | 46.50 | 0.00 | 0.00 | 0.30 | 0.10 | 0.40 | **46.90** | 56.0 | **-9.10** | AVE | L2 | QP |
| **VMX-100** | **0.158** | 46.30 | 0.00 | 0.00 | 0.30 | 0.10 | 0.40 | **46.70** | 56.0 | **-9.30** | AVE | L1 | QP |

- 6 Highest frequencies relative to the Limit.

## 1.5 Compliant Statement

**The EUT was compliant with EN 55022**

| YES | NO |
|---|---|
| CA | |

**CA Test Engineer's Initials**

## 1.6 Test Data for Conducted Emissions

### 1.6.1 Run 1 Wire Dipole Antenna Transmitting at 2402 MHz Spread Sheet

56015 DMX-100b

**DNB Engineering Inc.**

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**CONDUCTED EMISSIONS**

International .01- 30MHz [Based on CISPR 22, CISPR 11, ANSI C63.4, GR-1089-CORE(O3-7)]

| File #: | 56015 | Engr.: | ClaY Allred | Date : | Dec 20, 2004 | Standard: | EN 55022 |
|---|---|---|---|---|---|---|---|
| Site : | 1 | Temp: | 16 | Humidity: | 33 | Receiver: | U-082 |
| LISN : | 286 | Filter | NA | Cable: | 1.2 | Class: | B |

Amp: NA

| Freq. (MHz) | Meas'd (dBuV) | Filter Factors (dB) | Amp Factors (dB) | LISN Factors (dB) | Cable Factors (dB) | Total Factors (dB) | Total (dBuV) | Limit (dBuV) | Delta (dB) | Limit Type AVE,QP | Line L1 L2 L3 L4 | HP/ R&S | Meas. Type AVE, QP, Peak | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.198 | 48.40 | | | 0.1 | 0.2 | 0.3 | 48.70 | 55.0 | -6.30 | AVE | L2 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 0.198 | 48.20 | | | 0.1 | 0.2 | 0.3 | 48.50 | 55.0 | -6.50 | AVE | L1 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 1.389 | 38.10 | | | 0.1 | 0.2 | 0.3 | 38.40 | 46.0 | -7.60 | AVE | L2 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 1.456 | 37.60 | | | 0.1 | 0.2 | 0.3 | 37.90 | 46.0 | -8.10 | AVE | L2 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 0.158 | 47.00 | | | 0.3 | 0.1 | 0.4 | 47.40 | 56.0 | -8.60 | AVE | L2 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 0.158 | 46.80 | | | 0.3 | 0.1 | 0.4 | 47.20 | 56.0 | -8.80 | AVE | L1 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 1.389 | 36.20 | | | | 0.2 | 0.2 | 36.40 | 46.0 | -9.60 | AVE | L1 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 1.456 | 35.50 | | | | 0.2 | 0.2 | 35.70 | 46.0 | -10.30 | AVE | L1 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 1.323 | 34.10 | | | 0.1 | 0.2 | 0.3 | 34.40 | 46.0 | -11.60 | AVE | L2 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 1.323 | 32.90 | | | | 0.2 | 0.2 | 33.10 | 46.0 | -12.90 | AVE | L1 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 0.264 | 36.30 | | | 0.1 | 0.2 | 0.3 | 36.60 | 53.0 | -16.40 | AVE | L1 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |
| 0.264 | 35.80 | | | 0.1 | 0.2 | 0.3 | 36.10 | 53.0 | -16.90 | AVE | L2 | R&S | QP | Run 1 Wire Dipole Antenna @2402MHz |

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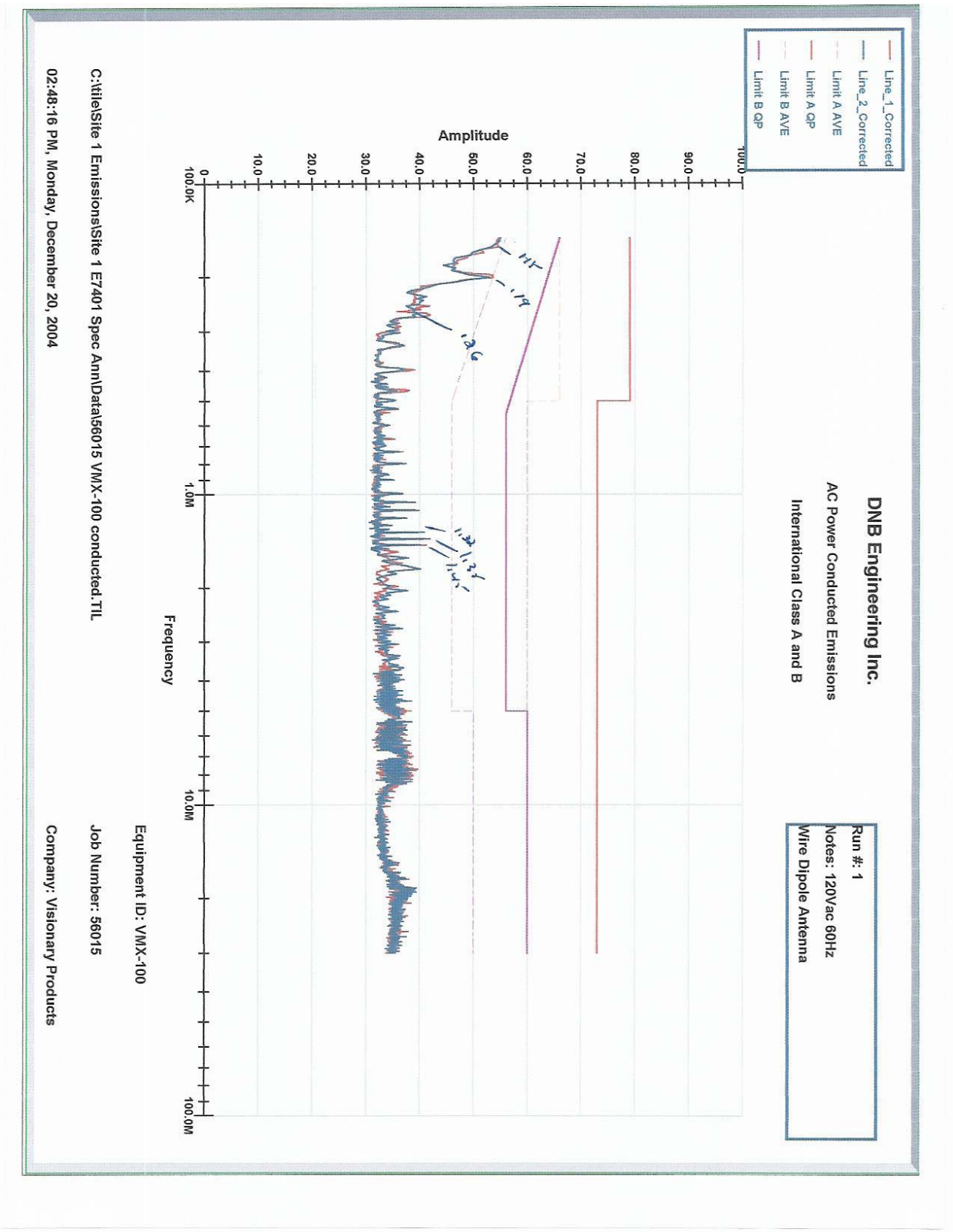
## 1.6.2 Run 1 Wire Dipole Antenna Transmitting at 2402 MHz Plot



## 1.6.3 Run 1.1 Wire Dipole Antenna Transmitting at 2441 MHz Spread Sheet

56015 DMX-100b

**DNB Engineering Inc.**

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**CONDUCTED EMISSIONS**

International .01- 30MHz [Based on CISPR 22, CISPR 11, ANSI C63.4, GR-1089-CORE(O3-7)]

| File #: | 56015 | Engr.: | ClaY Allred | Date : | Dec 20, 2004 | Standard: | EN 55022 |
|---|---|---|---|---|---|---|---|
| Site : | 1 | Temp: | 16 | Humidity: | 33 | Receiver: | U-082 |
| LISN : | 286 | Filter | NA | Cable: | 1.2 | Class: | B |

Amp: NA

| Freq. (MHz) | Meas'd (dBuV) | Filter Factors (dB) | Amp Factors (dB) | LISN Factors (dB) | Cable Factors (dB) | Total Factors (dB) | Total (dBuV) | Limit (dBuV) | Delta (dB) | Limit Type AVE,QP | Line L1 L2 L3 L4 | HP/ R&S | Meas. Type AVE, QP, Peak | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.198 | 48.20 | | | 0.1 | 0.2 | 0.3 | 48.50 | 55.0 | -6.50 | AVE | L2 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 0.198 | 48.20 | | | 0.1 | 0.2 | 0.3 | 48.50 | 55.0 | -6.50 | AVE | L1 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 1.389 | 38.10 | | | 0.1 | 0.2 | 0.3 | 38.40 | 46.0 | -7.60 | AVE | L2 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 0.158 | 47.40 | | | 0.3 | 0.1 | 0.4 | 47.80 | 56.0 | -8.20 | AVE | L1 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 0.158 | 46.70 | | | 0.3 | 0.1 | 0.4 | 47.10 | 56.0 | -8.90 | AVE | L2 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 1.456 | 36.40 | | | 0.1 | 0.2 | 0.3 | 36.70 | 46.0 | -9.30 | AVE | L2 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 1.456 | 35.90 | | | | 0.2 | 0.2 | 36.10 | 46.0 | -9.90 | AVE | L1 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 1.389 | 35.60 | | | | 0.2 | 0.2 | 35.80 | 46.0 | -10.20 | AVE | L1 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 1.323 | 35.50 | | | 0.1 | 0.2 | 0.3 | 35.80 | 46.0 | -10.20 | AVE | L2 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 1.323 | 30.40 | | | | 0.2 | 0.2 | 30.60 | 46.0 | -15.40 | AVE | L1 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 0.264 | 36.50 | | | 0.1 | 0.2 | 0.3 | 36.80 | 53.0 | -16.20 | AVE | L1 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |
| 0.264 | 35.50 | | | 0.1 | 0.2 | 0.3 | 35.80 | 53.0 | -17.20 | AVE | L2 | R&S | QP | Run 1.1 Wire Dipole @ 2441MHz |

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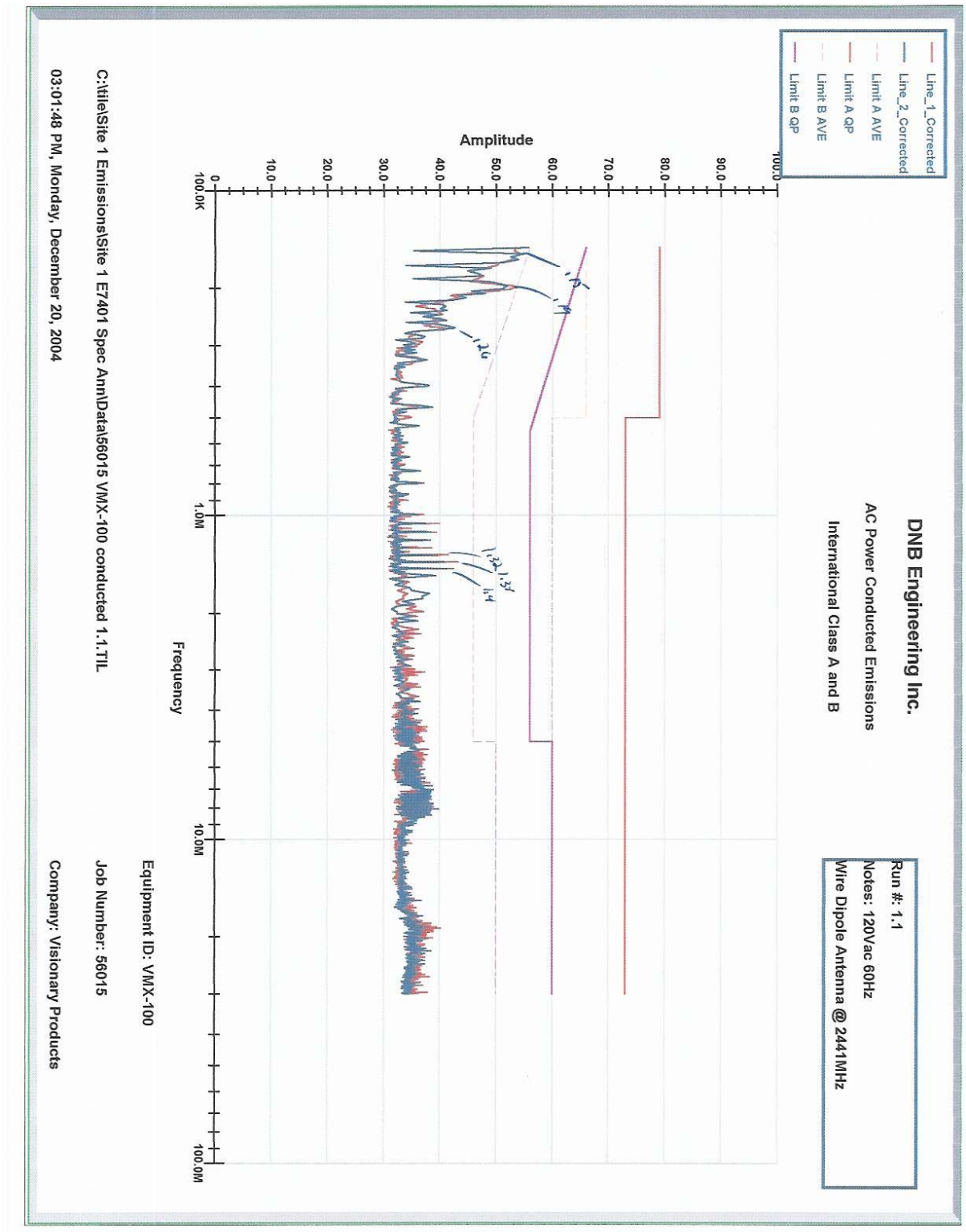
## 1.6.4 Run 1.1 Wire Dipole Antenna Transmitting at 2441 MHz Plot



## 1.6.5 Run 1.2 Chip Antenna Transmitting at 2480 MHz Spread Sheet



### CONDUCTED EMISSIONS

International .01- 30MHz [Based on CISPR 22, CISPR 11, ANSI C63.4, GR-1089-CORE(O3-7)]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| File #: | 56015 | Engr.: | ClaY Allred | Date : | Dec 20, 2004 | Standard: | EN 55022 |
| Site : | 1 | Temp: | 16 | Humidity: | 33 | Receiver: | U-082 |
| LISN : | 286 | Filter | NA | Cable: | 1.2 | Class: | B |

Amp: NA

| Freq. (MHz) | Meas'd (dBuV) | Filter Factors (dB) | Amp Factors (dB) | LISN Factors (dB) | Cable Factors (dB) | Total Factors (dB) | Total (dBuV) | Limit (dBuV) | Delta (dB) | Limit Type AVE,QP | Line L1 L2 L3 L4 | HP/ R&S | Meas. Type AVE, QP, Peak | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.198 | 48.40 | | | 0.1 | 0.2 | 0.3 | 48.70 | 55.0 | -6.30 | AVE | L2 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 0.198 | 48.10 | | | 0.1 | 0.2 | 0.3 | 48.40 | 55.0 | -6.60 | AVE | L1 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 1.456 | 37.80 | | | 0.1 | 0.2 | 0.3 | 38.10 | 46.0 | -7.90 | AVE | L2 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 1.390 | 37.50 | | | 0.1 | 0.2 | 0.3 | 37.80 | 46.0 | -8.20 | AVE | L2 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 0.159 | 46.50 | | | 0.3 | 0.1 | 0.4 | 46.90 | 56.0 | -9.10 | AVE | L2 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 0.158 | 46.30 | | | 0.3 | 0.1 | 0.4 | 46.70 | 56.0 | -9.30 | AVE | L1 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 1.389 | 35.90 | | | | 0.2 | 0.2 | 36.10 | 46.0 | -9.90 | AVE | L1 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 1.456 | 35.70 | | | | 0.2 | 0.2 | 35.90 | 46.0 | -10.10 | AVE | L1 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 1.323 | 31.90 | | | 0.1 | 0.2 | 0.3 | 32.20 | 46.0 | -13.80 | AVE | L2 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 1.323 | 31.50 | | | | 0.2 | 0.2 | 31.70 | 46.0 | -14.30 | AVE | L1 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 0.264 | 36.60 | | | 0.1 | 0.2 | 0.3 | 36.90 | 53.0 | -16.10 | AVE | L1 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |
| 0.264 | 36.50 | | | 0.1 | 0.2 | 0.3 | 36.80 | 53.0 | -16.20 | AVE | L2 | R&S | QP | Run 1.2 Chip Antenna @ 2480 MHz |

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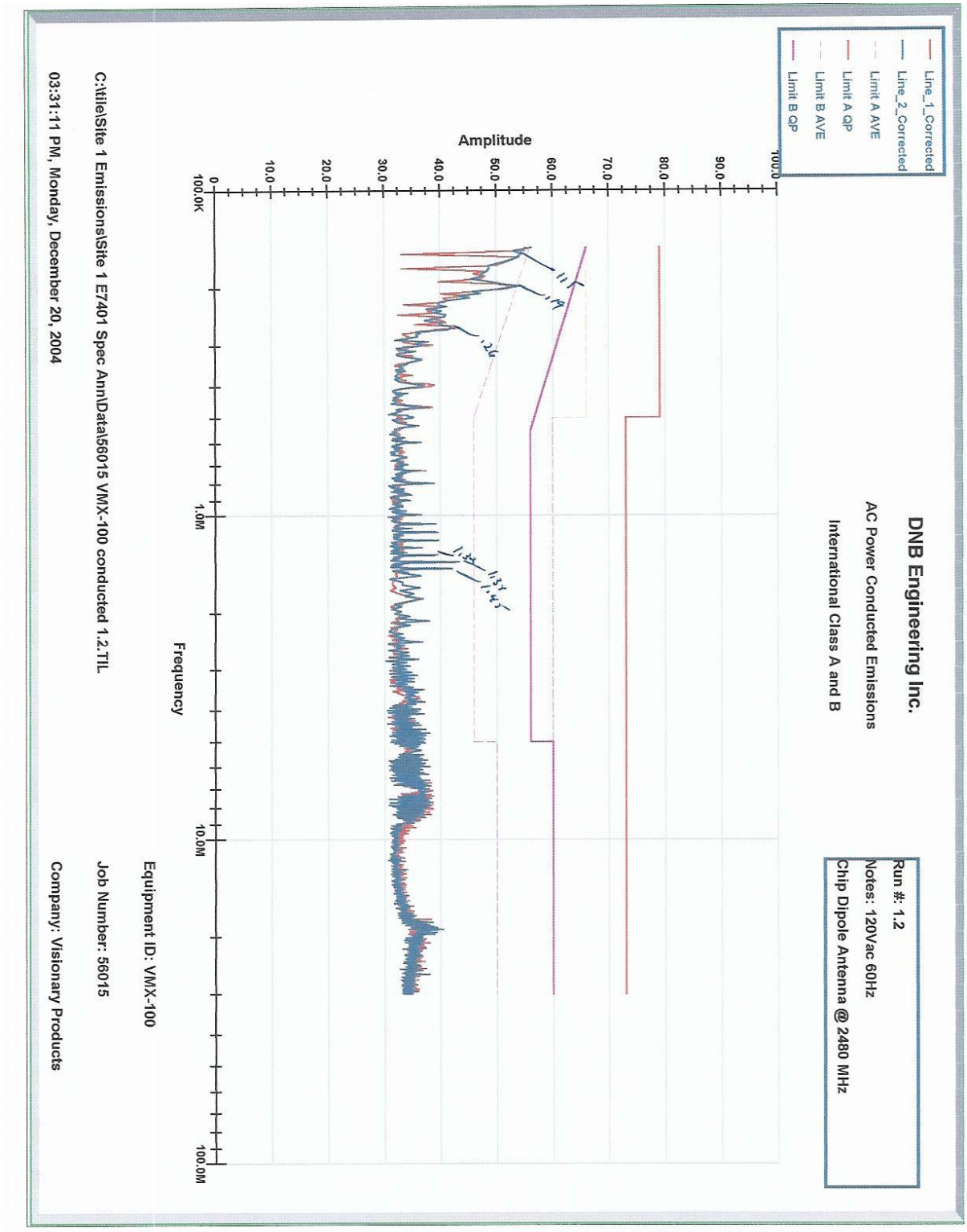
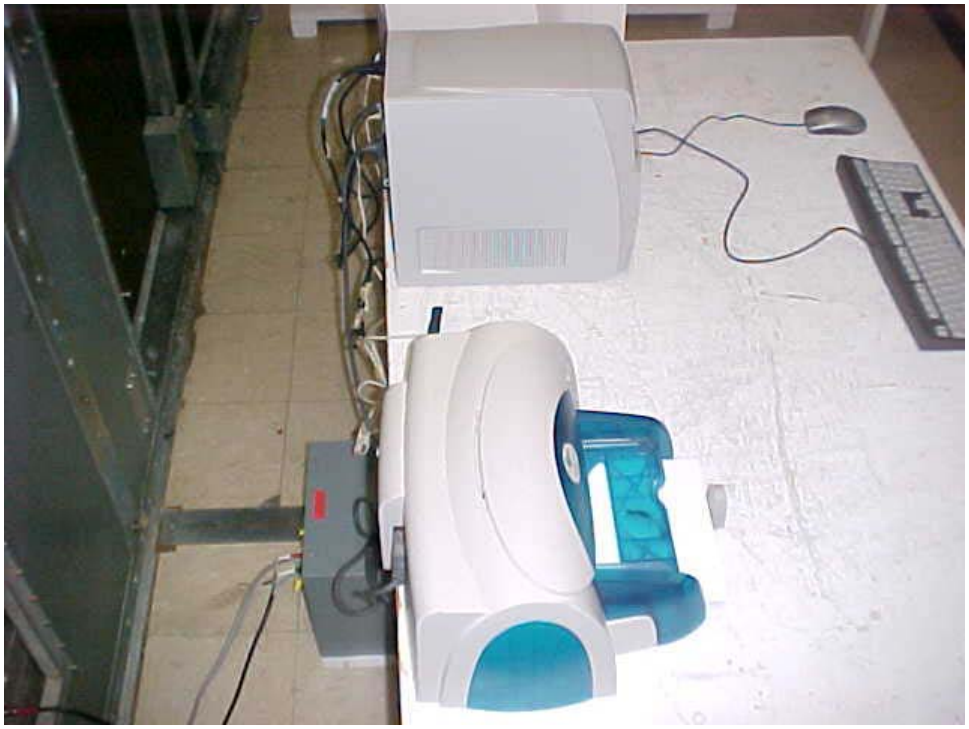
## 1.6.6 Run 1.2 Chip Antenna Transmitting at 2480 MHz Plot



## 1.7 Photographs of Test Setup Conducted Emissions

**EUT: VMX-100**
**View: Test Setup**



## 1.8 APPENDIX: EMC INSTRUMENTATION AND MEASUREMENT EQUIPMENT

Calibration of test and measurement equipment is performed by an approved commercial facility, whose standards are traceable to the National Institute of Science and Technology.

**Conducted Emissions Equipment**

| Description | Manufacturer/MN | Asset # | Serial # | Cal Due |
|---|---|---|---|---|
| LISN | Fisher LISN-50-32-4-01 | U-286 | 02020 | 18MAR05 |
| QP Adapter | HP/85650 A | U-001 | 2043A00277 | 05JAN04 |
| Receiver | R&S/ESH3 | U-081 | 872742/045 | 20SEP05 |
| Receiver | R&S/ESH3 | U-082 | 882399/025 | 23MAR05 |
| Spectrum Analyzer | Agilent | U-257 | MY 42000103 | 19JAN04 |
| Spectrum Analyzer | HP/8566B | U-138 | 2421A00516 | 06MAR05 |
| 75 Ohm CDN | FCC/FCC-801-C1-8 | U-339 | 9940 | 14AUG05 |
| 50 Ohm CDN | FCC/FCC-801-C1-B | U-338 | 9908 | 27AUG05 |
| Current Probe | Solar 6741-1 | U-267 | 966727 | 13JAN05 |
| Telecom Impedance Stabilization | Fischer FCC-T-LISN-T4 | U-023 | 40020 | 15AUG05 |