



Measurement of RF Interference from a 900-AP Cyclone Access Point with Til-Tek TA- 926H-8-60 Antenna

For : Cascade Networks, Inc.
1111 - 11th Ave
Longview, IL 98632

P.O. No. :
Date Tested : February 20, 2009
Test Personnel : Mark E. Longinotti
Specification : FCC "Code of Federal Regulations" Title 47
Part 15, Subpart C, Section 15.247 for Frequency
Hopping Intentional Radiators Operating within
The 902-928MHz

: RSS-210, Annex 8, for Frequency Hopping
: Systems Operating in the Bands 902 – 928MHz

: RSS-Gen

Test Report By : *MARK E. LONGINOTTI*
Mark E. Longinotti

Witnessed by :
Brian Magnuson
Cascade Networks, Inc.

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

**TABLE OF CONTENTS**

PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.
1	INTRODUCTION.....	3
1.1	Scope of Tests.....	3
1.2	Purpose	3
1.3	Deviations, Additions and Exclusions.....	3
1.4	EMC Laboratory Identification	3
1.5	Laboratory Conditions	3
2	APPLICABLE DOCUMENTS	3
3	TEST ITEM SETUP AND OPERATION.....	3
3.1	General Description.....	3
3.1.1	Power Input	3
3.1.2	Grounding.....	3
3.1.3	Support Equipment.....	3
3.1.4	Interconnect Cables	3
3.2	Operational Mode	3
3.3	Test Item Modifications.....	3
4	TEST EQUIPMENT	3
4.1	Test Equipment List.....	3
4.2	Calibration Traceability	3
5	REQUIREMENTS, PROCEDURES AND RESULTS	3
5.1	Powerline Conducted Emissions.....	3
5.1.1	Requirements	3
5.2	Peak Output Power	3
5.2.1	Requirement.....	3
5.2.2	Procedures	3
5.2.3	Results	3
5.3	Spurious Radiated Emissions	3
5.3.1	Requirement.....	3
5.3.2	Procedures	3
5.3.3	Results	3
6	CONCLUSIONS	3
7	CERTIFICATION.....	3
8	EQUIPMENT LIST.....	3

THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE
WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.



REVISION HISTORY

Revision	Date	Description
—	February 23, 2009	Initial release

Measurement of RF Emissions from a 900-AP Cyclone Access Point with Til-Tek TA-926H-8-60 Antenna

1 INTRODUCTION

1.1 Scope of Tests

This document presents the results of tests performed to determine if the Cascade Networks, Inc. Model No. 900-AP Cyclone Access Point would meet the FCC and Industry Canada requirements when using a Til-Tek TA-926H-8-60 Antenna. The test item is a Cascade Networks, Inc. Model No. 900-AP, Cyclone Access Point with Til-Tek TA-926H-8-60 Antenna, Serial No. 020911712. It is designed to transmit in the 902MHz to 924MHz band. The test was performed for Cascade Networks, Inc. located in Longview, WA.

1.2 Purpose

The test series was performed to determine if the test item meets the peak output power and radiated RF emission requirements in the restricted bands per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Intentional Radiators and per the Industry Canada RSS-210 and RSS-GEN. Testing was performed in accordance with ANSI C63.4-2003..

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 National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.5 Laboratory Conditions

The temperature at the time of the test was 21°C and the relative humidity was 18%.

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 2008
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- ANSI C63.4-2003, "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 2, June 2007
- Industry Canada Radio Standards Specification, RSS-210, "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment", Issue 7, June 2007

3 TEST ITEM SETUP AND OPERATION

3.1 General Description

The test item is a Cascade Networks, Inc., 900-AP Cyclone Access Point with Til-Tek TA-926H-8-60 Antenna. A block diagram of the test item setup is shown as Figure 1.

3.1.1 Power Input

The test item was powered with 24VDC from a Motorola model ACPSSW-13A transformer via the 45 feet of Ethernet cable.

3.1.2 Grounding

The test item was grounded via the 45 feet of Ethernet cable to the transformer.

3.1.3 Support Equipment

The test item was submitted with a Panasonic ToughBook laptop that was used to power and communicate with the test item via one 45 foot long Ethernet cable.

3.1.4 Interconnect Cables

The test item was connected to the laptop via a 45 foot long Ethernet cable.

3.2 Operational Mode

For all tests the test item was placed on an 80cm high non-conductive stand. The test item and all peripheral equipment were energized. The test item was controlled and powered by the laptop computer. Through the computer the test item was set to transmit continuously in a continuous wave mode. The tests were performed with the test item transmitting at 902MHz, 915MHz and 928MHz.

3.3 Test Item Modifications

No modifications were required for compliance to the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Intentional Radiators and to the Industry Canada RSS-210 and RSS-GEN specifications.

4 TEST EQUIPMENT

4.1 Test Equipment List

A list of the test equipment used can be found on Table 8-1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

4.2 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).

5 REQUIREMENTS, PROCEDURES AND RESULTS

5.1 Powerline Conducted Emissions

5.1.1 Requirements

The conducted emissions were not addressed in the test sequence since the antenna does not affect the conducted emission levels.



5.2 Peak Output Power

5.2.1 Requirement

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band, the peak output power shall not be greater than 1 watt for systems employing at least 50 hopping channels. For systems employing less than 50 hopping channels the peak output power shall not be greater than 0.25 watts

5.2.2 Procedures

The output of the test item was connected to the spectrum analyzer. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high hopping frequencies.

5.2.3 Results

The results are presented on page 3. The maximum antenna conducted output power measured from the transmitter was 12.8dBm which meets the 30 dBm limit. Per Cascade Networks, Inc. personnel, the gain of the Til-Tek TA-926H-8-60 Antenna is 15.5dB. Therefore the maximum EIRP for the transmitter and antenna combination would be 28.3dBm (12.8dBm + 15.5dBm) which meets the De Facto 36 dBm limit.

5.3 Spurious Radiated Emissions

5.3.1 Requirement

Per section 15.247(c), the radiated emissions which fall in the restricted bands must meet the general limits of 15.209.

5.3.2 Procedures

The radiated tests were performed in a 32ft. x 20ft. x 18ft. hybrid absorber lined semi-anechoic 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. The floor of the chamber is used as the ground plane. The chamber complies with ANSI 63.4 and CISPR 16 requirements for site attenuation.

Preliminary radiated measurements are 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 peak detection with 100 kHz BW. This data was then automatically plotted up through 10 GHz.

Next, the harmonic or spurious emissions falling in the restricted bands were measured up through the 10th harmonic. For these measurements, the measurement bandwidths were set to 1 MHz RBW. The analyzer was set to linear mode with 10 Hz VBW in order to simulate an average detector. A pre-amplifier was used to increase the receiver sensitivity.

5.3.3 Results

The preliminary emissions levels were plotted. These plots are presented on pages 3 through 3. These plots show that the radiated spurious emissions were at least 20 dB below the level of the fundamental.

The harmonics and any other emissions that fall in the restricted frequency bands were then re-measured manually. This data is shown in the tables on pages 3 through 3. The field intensities levels for the harmonics in the restricted band were within the limit.

6 CONCLUSIONS

It was determined that the Cascade Networks, Inc. 900-AP Cyclone Access Point, Serial No. 020911712, when tested with a Til-Tek TA-926H-8-60 Antenna, did fully meet the peak output power and radiated emissions in the



restricted bands requirements of the FCC "Code of Federal Regulations" Title 47, Subpart C, Part 15.247 for Intentional Radiators when tested per ANSI C63.4-2003.

It was also determined that the Cascade Networks, Inc. 900-AP Cyclone Access Point, Serial No. 020911712, when tested with a Til-Tek TA-926H-8-60 Antenna,, did fully meet the peak output power and radiated emissions in the restricted bands requirements of the Industry Canada RSS-210, Annex 8 for Intentional Radiators when tested per ANSI C63.4-2003.

7 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 test item at the test date as operated by Cascade Networks personnel. 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.

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



8 EQUIPMENT LIST

Table 8-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	12/16/2008	12/16/2009
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL6112	2054	0.03-2GHZ	9/2/2008	9/2/2009
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	10/25/2008	10/25/2009
RBA1	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100146	20HZ-26.5GHZ	9/10/2008	9/10/2009
T2D1	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AV5814	DC-18GHZ	2/20/2009	2/20/2010
T2D7	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AY9246	DC-18GHZ	8/29/2008	8/29/2009

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.

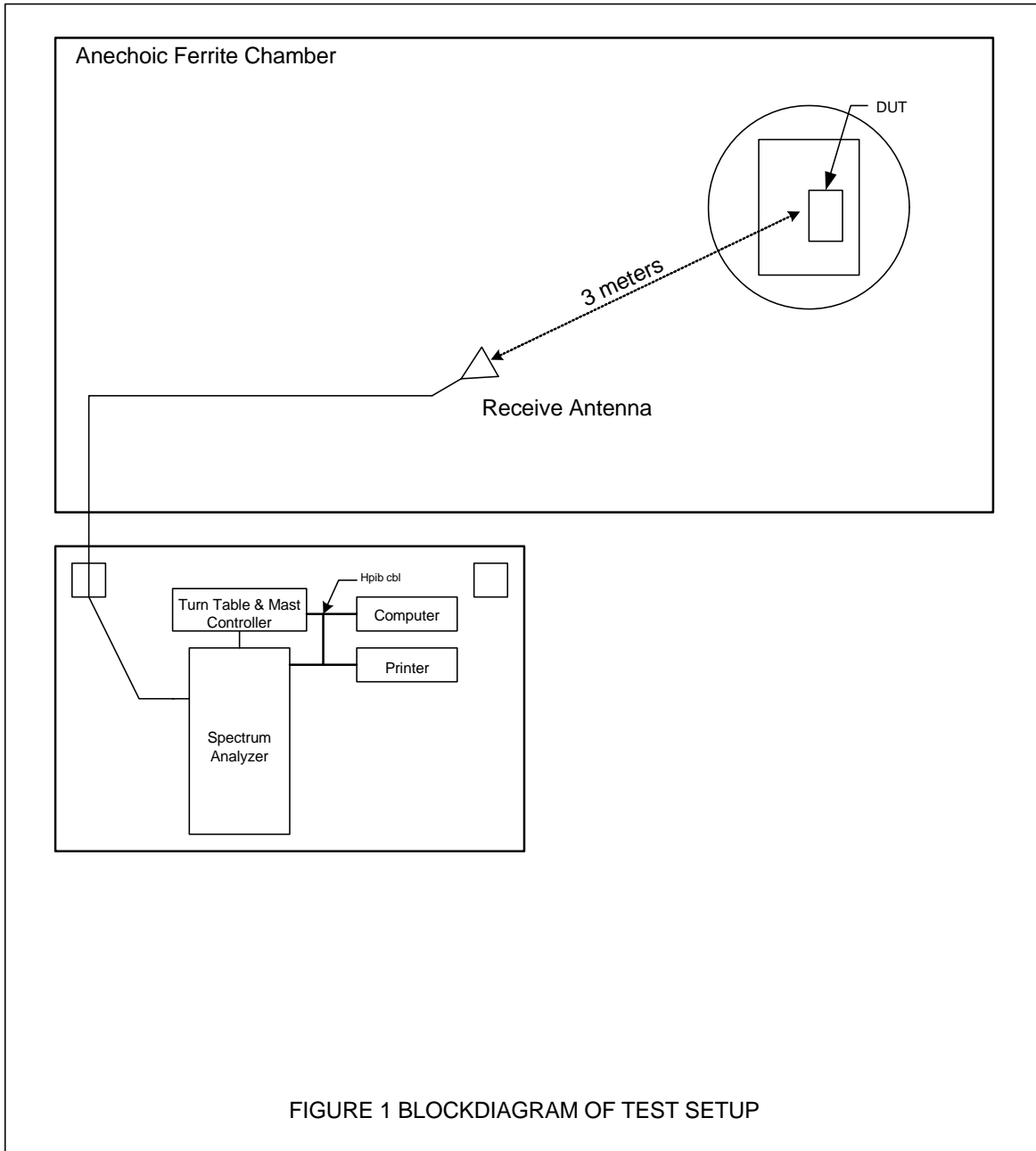
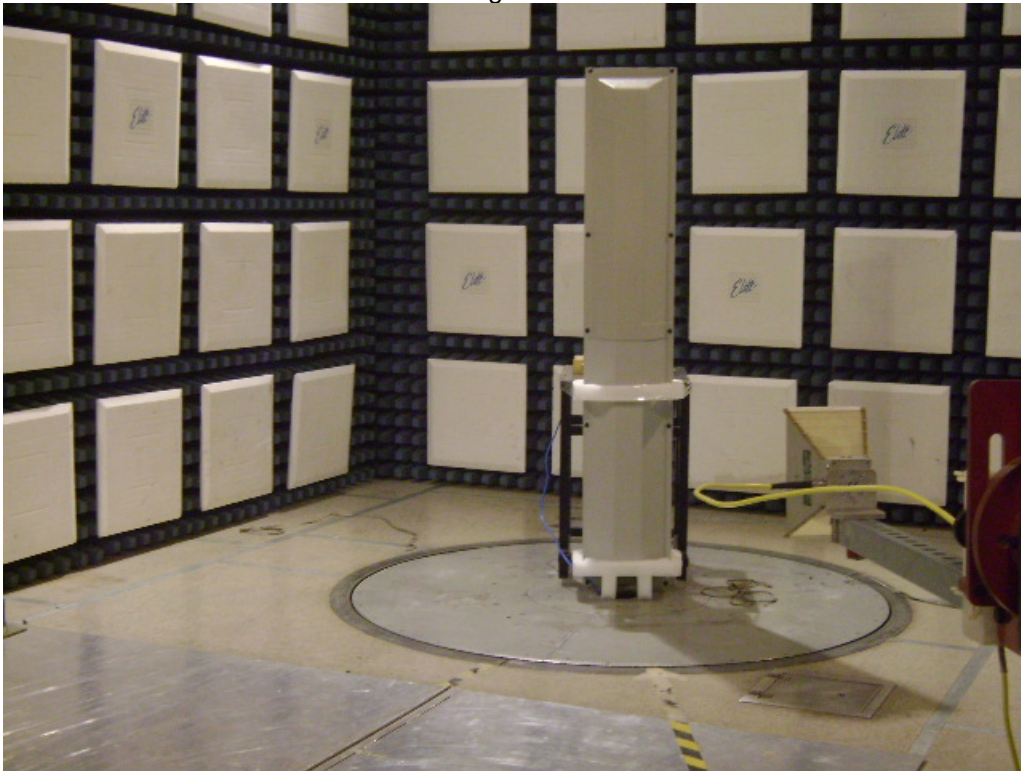
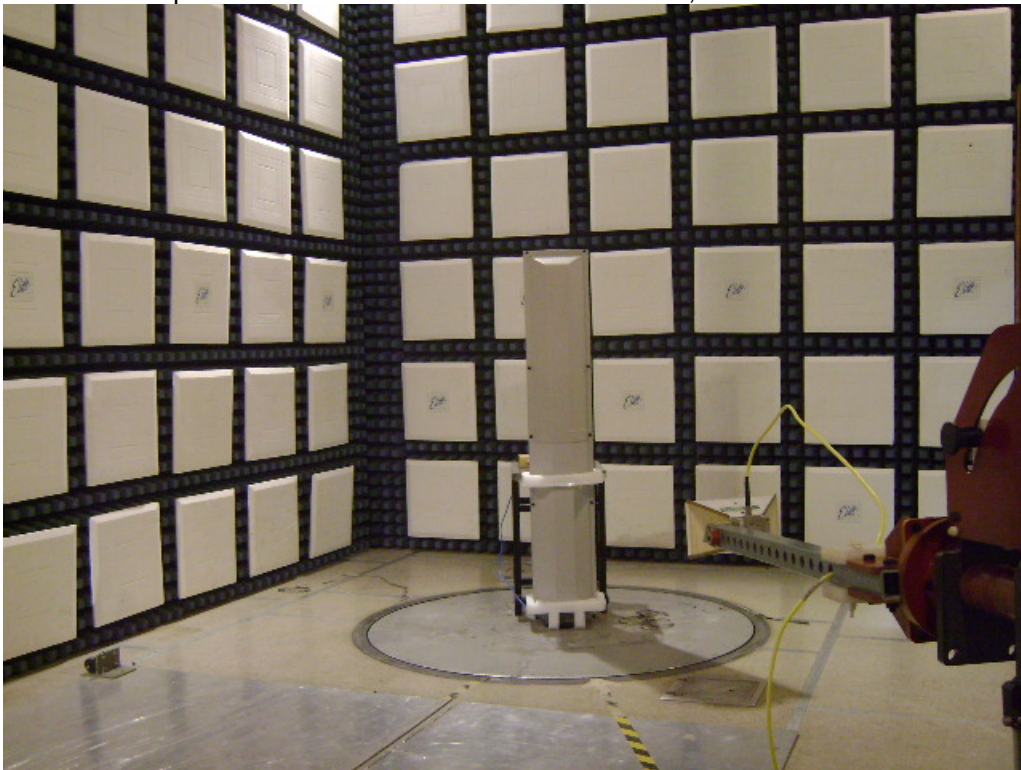


Figure 2



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



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



MANUFACTURER : Cascade Networks, Inc.
MODEL : 900-AP Cyclone Access Point
S/N : 020911712
SPECIFICATION : FCC-15.247 and RSS-210 Annex 8, Peak Output Power
MODE : See Below
DATE : February 20, 2009
NOTES :

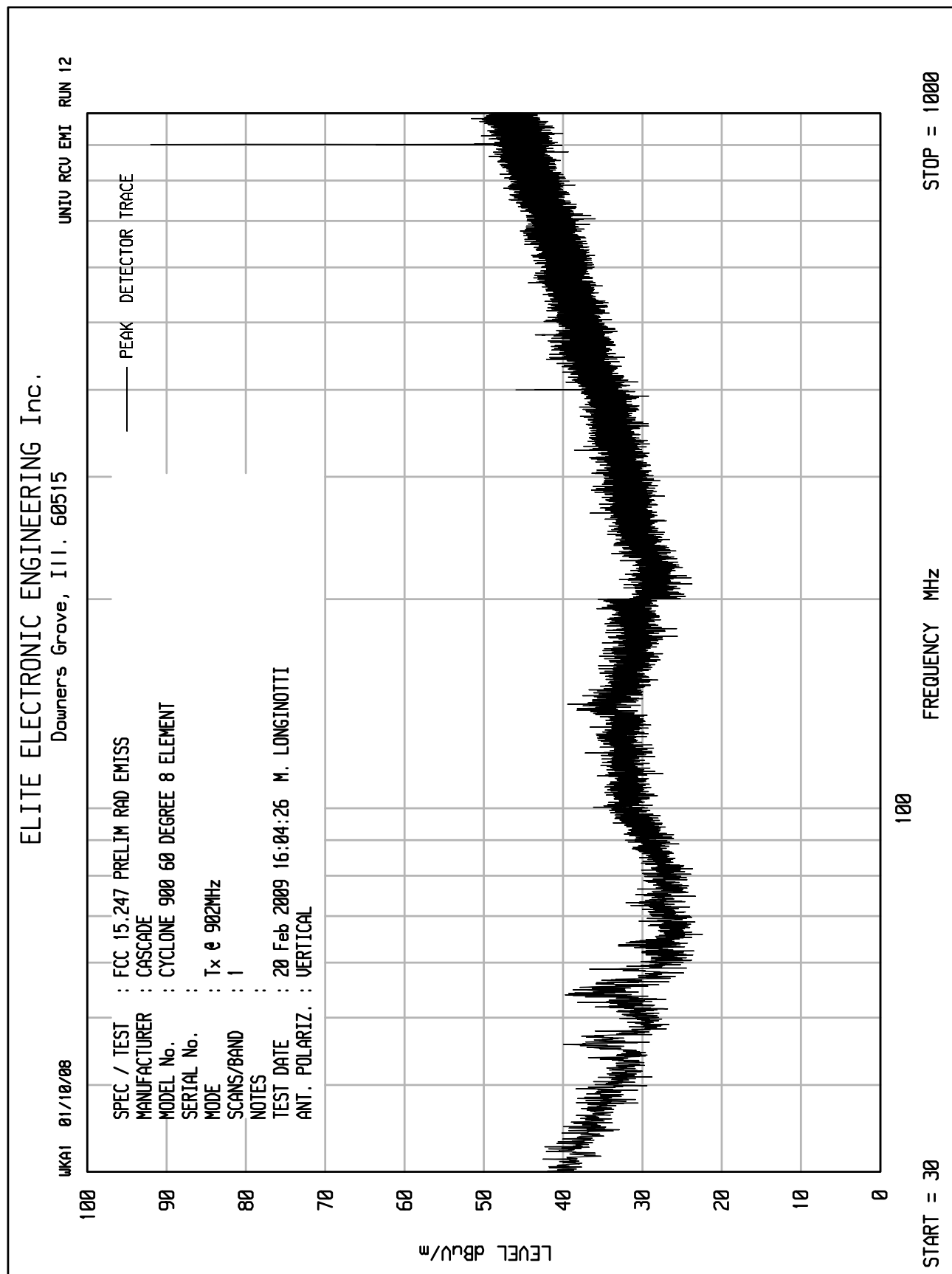
Frequency MHz	Meter Reading dBm	Attenuation dB	Peak Power dBm
902	-27.2	40.0	12.8
915	-27.4	40.0	12.6
928	-27.4	40.0	12.6

Peak Power (dBm) = Meter Reading (dBm) + Attenuation (dB)

Checked By:

MARK E. LONGINOTTI

Mark E. Longinotti

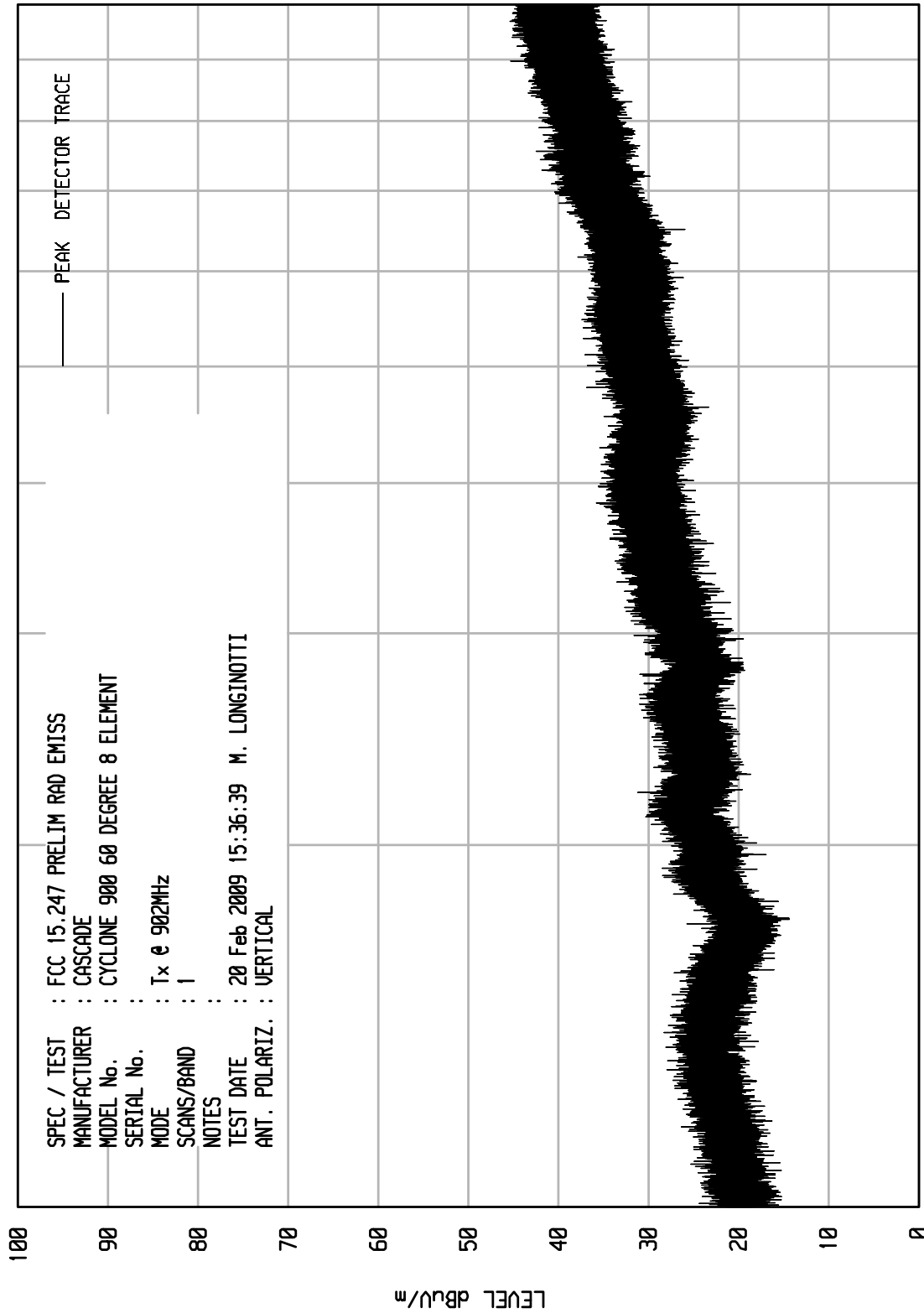




ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 5

WKA1 01/10/08



START = 1000

STOP = 10000

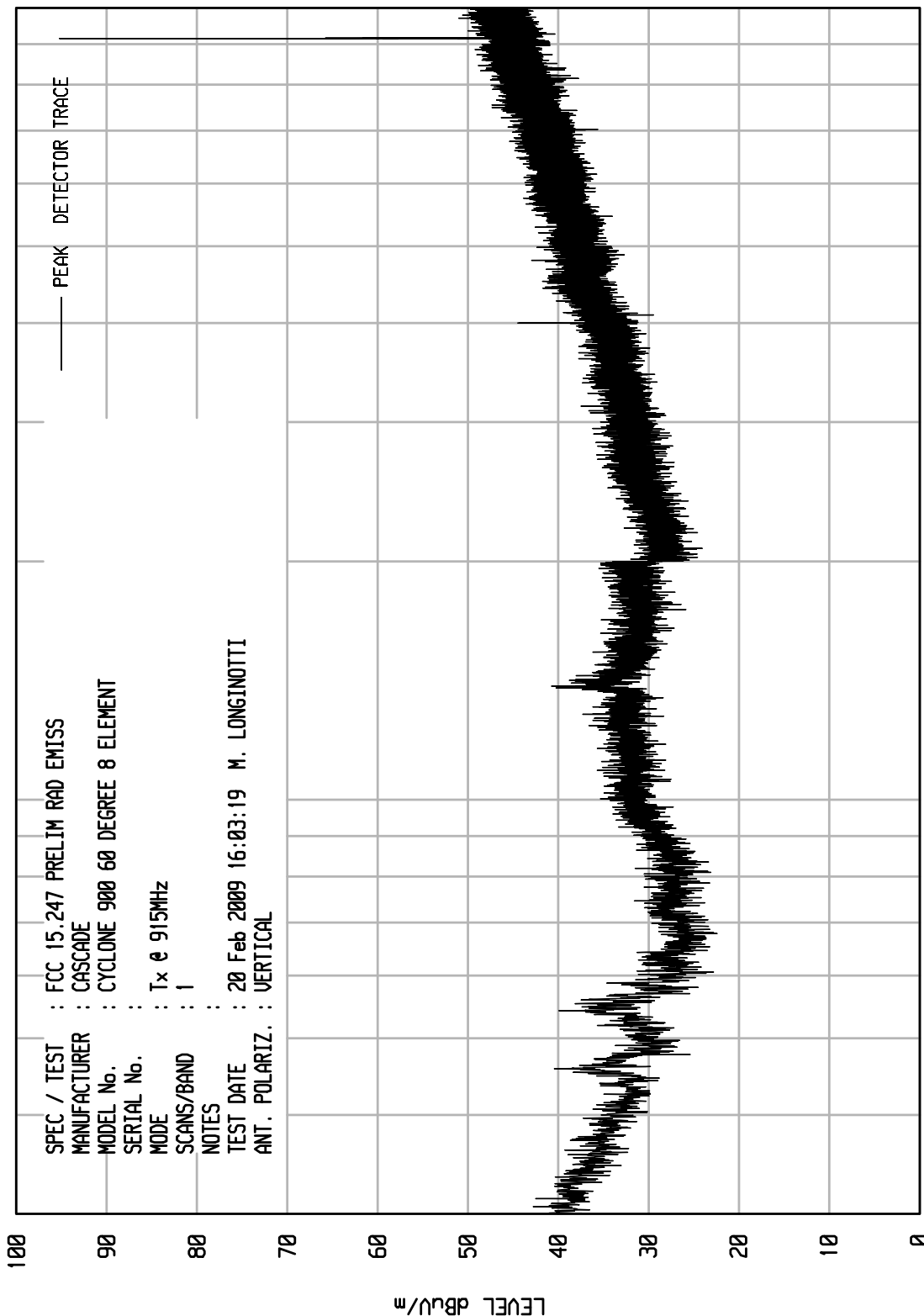


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 11

WKA1 01/10/08

SPEC / TEST : FCC 15.247 PRELIM RAD EMISS
MANUFACTURER : CASCADE
MODEL No. : CYCLONE 900 60 DEGREE 8 ELEMENT
SERIAL No. :
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 20 Feb 2009 16:03:19 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL



START = 30

100

FREQUENCY MHz

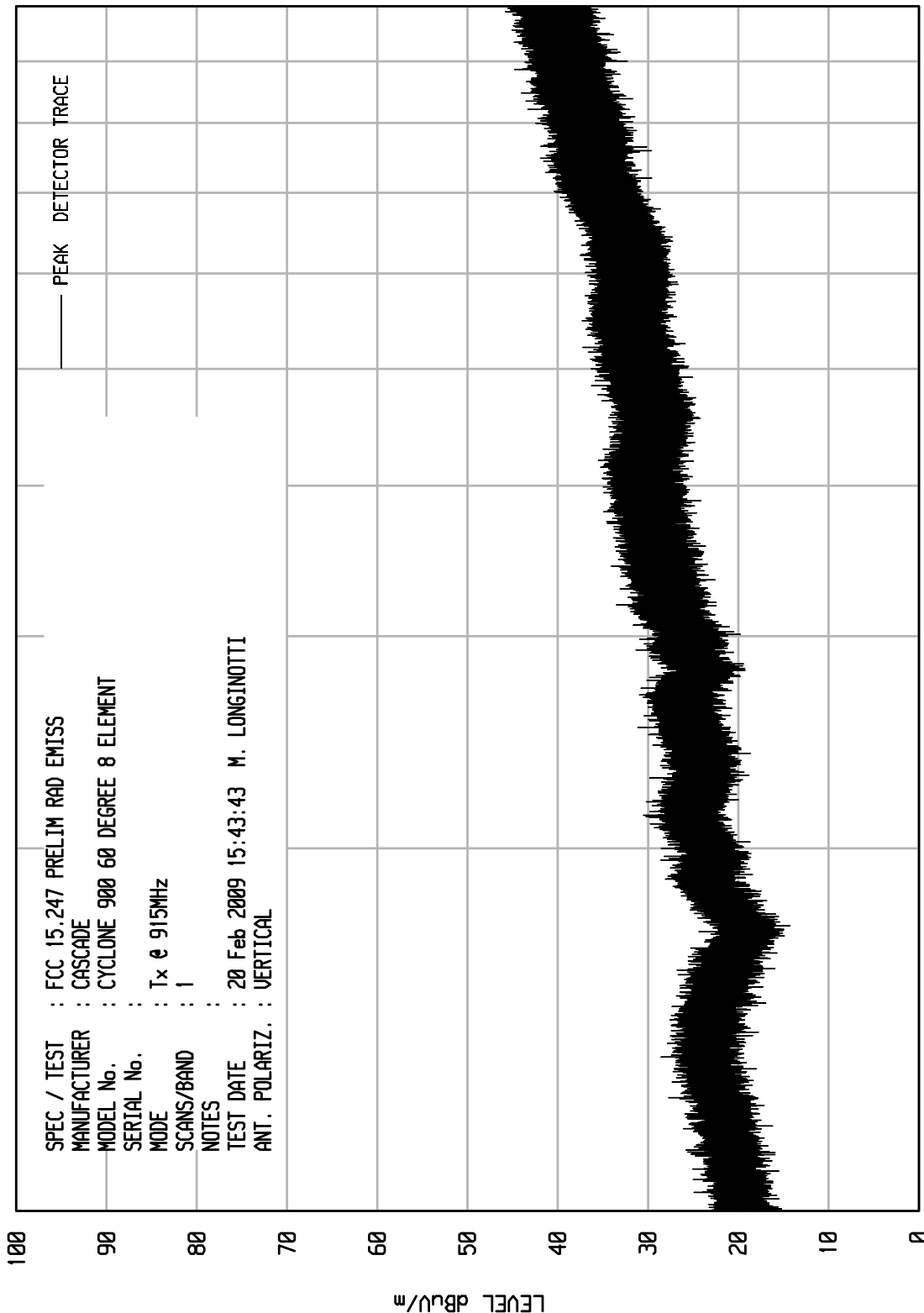
STOP = 1000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

WKA1 01/10/08

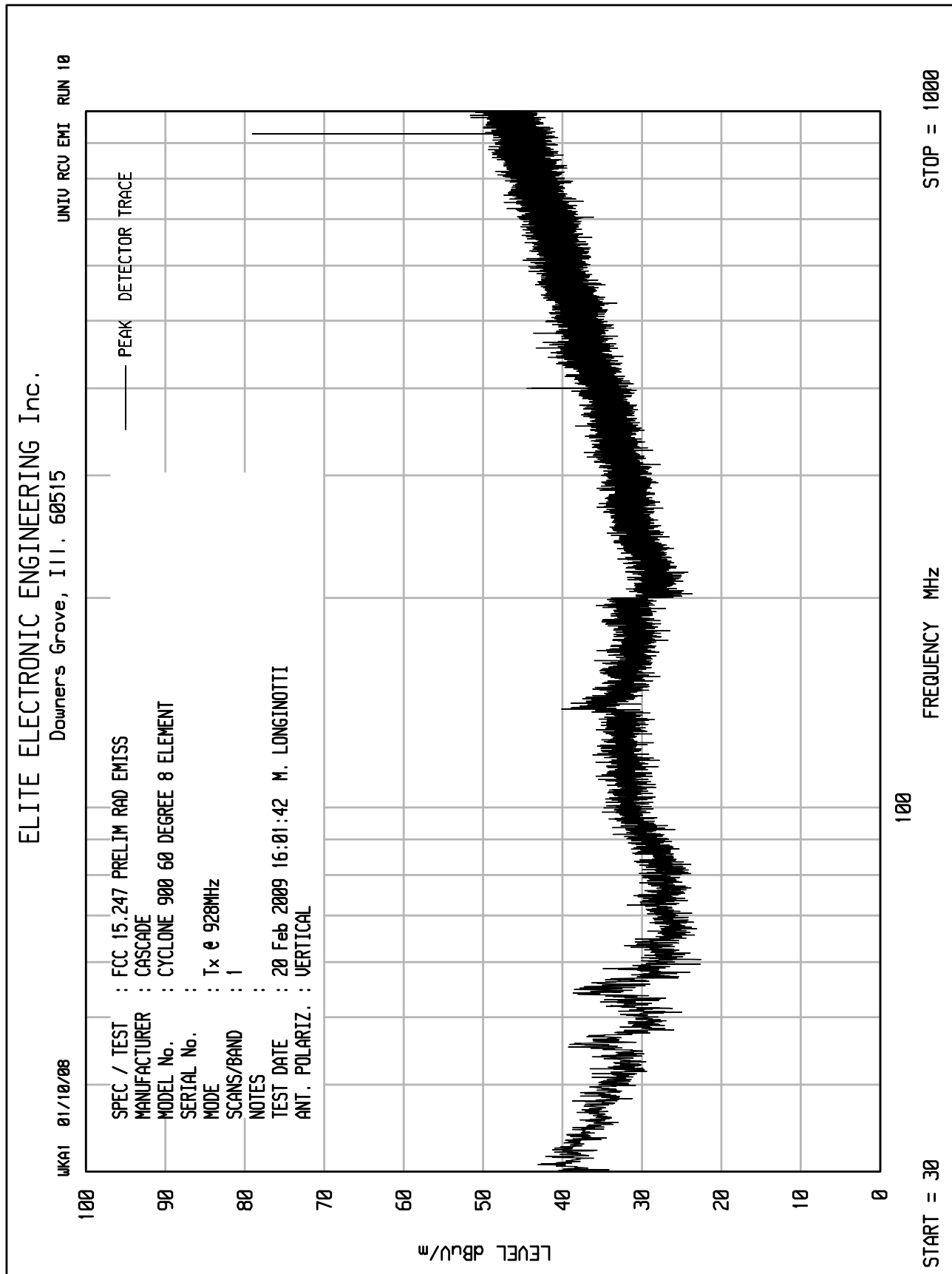
UNITV RCU EMI RUN 8



START = 1000

FREQUENCY MHz

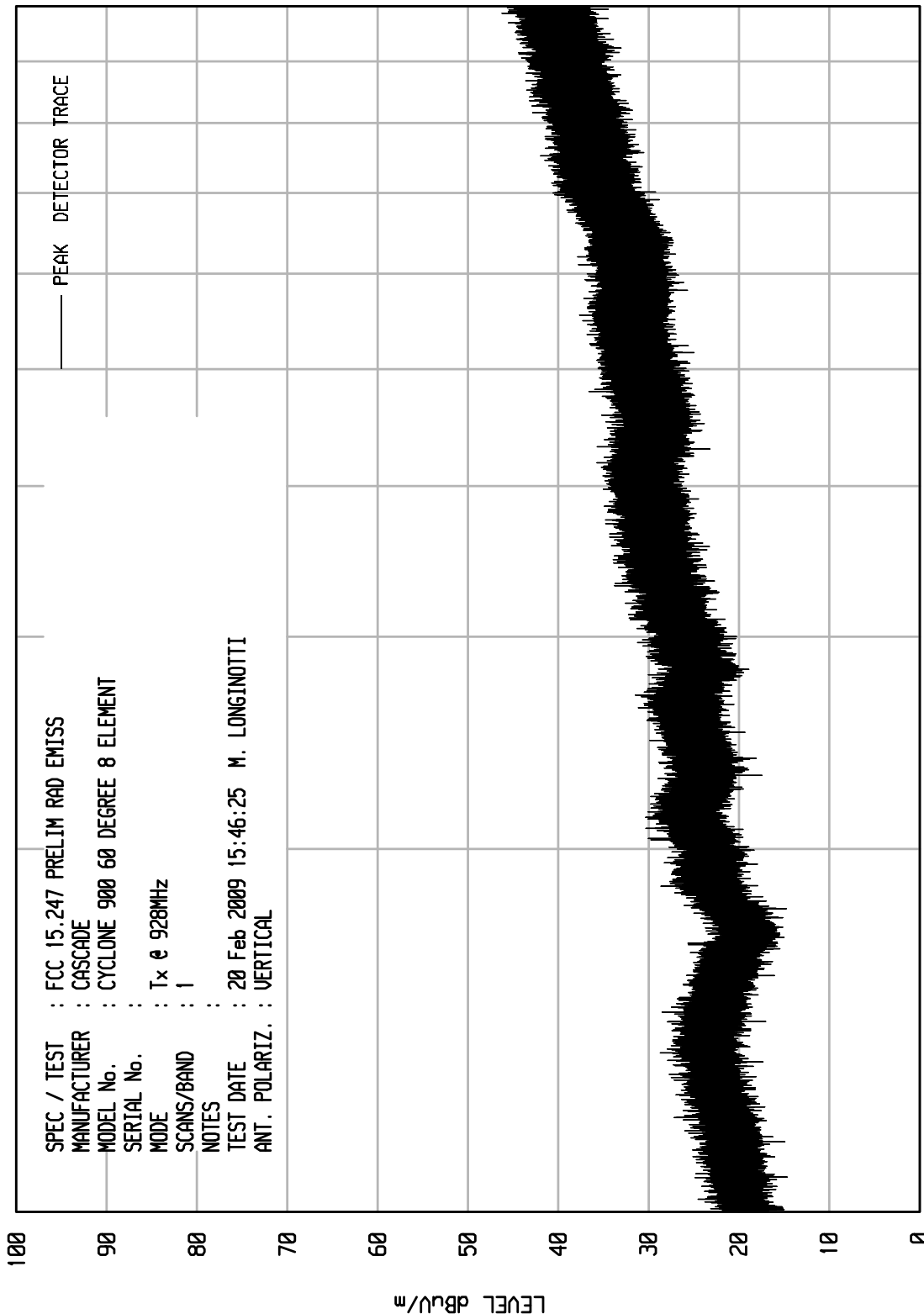
STOP = 10000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 9

WKA1 01/10/08





MANUFACTURER : Cascade Networks, Inc.
MODEL : 900-AP Cyclone Access Point
S/N : 6069JS13C7
SPECIFICATION : FCC-15C, Spurious Radiated Emissions in Restricted Bands
MODE : Transmit at 902MHz
DATE : February 20, 2009
NOTES : Tested with a Til-Tek TA-926H-8-60 Antenna

FREQ MHz	ANT POL	MTR RDG dBuV	BW	ANT FAC	CABLE LOSS	PRE AMP	TOTAL dBuV/m	TOTAL uV/m	LIMIT uV/m
2706.0	H	35.9	1M/10	30.2	3.9	-40.3	29.7	30.5	500.0
	V	35.9	1M/10	30.2	3.9	-40.3	29.7	30.5	500.0
3608.0	H	35.1	1M/10	33.9	4.7	-40.1	33.5	47.4	500.0
	V	34.9	1M/10	33.9	4.7	-40.1	33.3	46.3	500.0
4510.0	H	33.7	1M/10	33.9	5.5	-40.0	33.2	45.4	500.0
	V	33.7	1M/10	33.9	5.5	-40.0	33.2	45.4	500.0
5412.0	H	34.3	1M/10	36.3	6.2	-40.1	36.7	68.1	500.0
	V	34.1	1M/10	36.3	6.2	-40.1	36.5	66.6	500.0
8118.0	H	34.3	1M/10	38.0	8.0	-39.6	40.7	108.1	500.0
	V	34.3	1M/10	38.0	8.0	-39.6	40.7	108.1	500.0
9020.0	H	34.1	1M/10	38.5	8.8	-39.1	42.3	129.9	500.0
	V	34.0	1M/10	38.5	8.8	-39.1	42.2	128.4	500.0

Total (dBuV/m) = MTR RDG (dBuV) + ANT FAC (dB) + CABLE LOSS (dB) + PRE AMP (dB)

Checked By:

MARK E. LONGINOTTI

Mark E. Longinotti



MANUFACTURER : Cascade Networks, Inc.
MODEL : 900-AP Cyclone Access Point
S/N : 6069JS13C7
SPECIFICATION : FCC-15C, Spurious Radiated Emissions in Restricted Bands
MODE : Transmit at 915MHz
DATE : February 20, 2009
NOTES : Tested with a Til-Tek TA-926H-8-60 Antenna

FREQ MHz	ANT POL	MTR RDG dBuV	BW	ANT FAC	CABLE LOSS	PRE AMP	TOTAL dBuV/m	TOTAL uV/m	LIMIT uV/m
2745.0	H	35.1	1M/10	30.3	3.9	-40.3	29.0	28.2	500.0
	V	35.1	1M/10	30.3	3.9	-40.3	29.0	28.2	500.0
3660.0	H	35.2	1M/10	33.9	4.7	-40.1	33.8	48.9	500.0
	V	36.6	1M/10	33.9	4.7	-40.1	35.2	57.5	500.0
4575.0	H	33.3	1M/10	34.1	5.5	-40.0	33.0	44.5	500.0
	V	33.4	1M/10	34.1	5.5	-40.0	33.1	45.0	500.0
7320.0	H	34.0	1M/10	38.2	7.7	-39.8	40.2	101.9	500.0
	V	34.0	1M/10	38.2	7.7	-39.8	40.2	101.9	500.0
8235.0	H	34.2	1M/10	37.9	8.1	-39.5	40.7	107.8	500.0
	V	34.2	1M/10	37.9	8.1	-39.5	40.7	107.8	500.0
9150.0	H	34.2	1M/10	38.5	8.7	-39.0	42.4	132.5	500.0
	V	34.4	1M/10	38.5	8.7	-39.0	42.6	135.6	500.0

Total (dBuV/m) = MTR RDG (dBuV) + ANT FAC (dB) + CABLE LOSS (dB) + PRE AMP (dB)

Checked By:

MARK E. LONGINOTTI

Mark E. Longinotti



MANUFACTURER : Cascade Networks, Inc.
MODEL : 900-AP Cyclone Access Point
S/N : 6069JS13C7
SPECIFICATION : FCC-15C, Spurious Radiated Emissions in Restricted Bands
MODE : Transmit at 928MHz
DATE : February 20, 2009
NOTES : Tested with a Til-Tek TA-926H-8-60 Antenna

FREQ MHz	ANT POL	MTR RDG dBuV	BW	ANT FAC	CABLE LOSS	PRE AMP	TOTAL dBuV/m	TOTAL uV/m	LIMIT uV/m
2784.0	H	33.9	1M/10	30.4	4.0	-40.4	27.9	24.9	500.0
	V	33.8	1M/10	30.4	4.0	-40.4	27.8	24.6	500.0
3712.0	H	34.9	1M/10	34.0	4.8	-40.1	33.7	48.2	500.0
	V	34.9	1M/10	34.0	4.8	-40.1	33.7	48.2	500.0
4640.0	H	33.8	1M/10	34.3	5.6	-40.0	33.7	48.3	500.0
	V	33.7	1M/10	34.3	5.6	-40.0	33.6	47.7	500.0
7424.0	H	33.9	1M/10	38.5	7.7	-39.7	40.3	103.8	500.0
	V	33.9	1M/10	38.5	7.7	-39.7	40.3	103.8	500.0
8352.0	H	34.5	1M/10	37.8	8.2	-39.4	41.0	112.5	500.0
	V	34.4	1M/10	37.8	8.2	-39.4	40.9	111.2	500.0

Total (dBuV/m) = MTR RDG (dBuV) + ANT FAC (dB) + CABLE LOSS (dB) + PRE AMP (dB)

Checked By:

MARK E. LONGINOTTI

Mark E. Longinotti