Measurement of RF Interference from a Model Meridia Keypad Spread Spectrum Transceiver

For : Fleetwood Group, Inc.
11832 James Street
Holland, MI 49424

Date Received : May 24, 2006
Date Tested : May 25, 2006 through June 5, 2006
Test Personnel : Mark E. Longinotti
Specification : FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, for receivers and
Subpart C, Section 15.247 for Frequency Hopping Spread Spectrum Intentional Radiators Operating within the 2400-2483.5MHz band

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TABLE OF CONTENTS

PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.

1.0 INTRODUCTION 5
1.1 Description of Test Item 5
1.2 Purpose 5
1.3 Deviations, Additions and Exclusions 5
1.4 Applicable Documents 5
1.5 Subcontractor Identification 5
1.6 Laboratory Conditions 5
2.0 TEST ITEM SETUP AND OPERATION 5
2.1 Power Input 6
2.2 Grounding 6
2.3 Peripheral Equipment 6
2.4 Interconnect Cables 6
2.5 Operational Mode 6
3.0 TEST EQUIPMENT 7
3.1 Test Equipment List 7
3.2 Calibration Traceability 7
4.0 REQUIREMENTS, PROCEDURES AND RESULTS 7
4.1 Transmitter 7
4.1.1 Powerline Conducted Emissions 7
4.1.1.1 Requirements 7
4.1.2 20dB Bandwidth 7
4.1.2.1 Requirements 7
4.1.2.2 Procedures 7
4.1.2.3 Results 7
4.1.3 Carrier Frequency Separation 7
4.1.3.1 Requirements 7
4.1.3.2 Procedures 8
4.1.3.3 Results 8
4.1.4 Number of Hopping Frequencies 8
4.1.4.1 Requirements 8
4.1.4.2 Procedures 8
4.1.4.3 Results 8
4.1.5 Time of Occupancy 8
4.1.5.1 Requirements 8
4.1.5.2 Procedures 8
4.1.5.3 Results 9

4.1.6 Peak Output Power - Internal Antenna 9
4.1.6.1 Requirements 9
4.1.6.2 Procedures 9
4.1.6.3 Results 9
4.1.7 Bandedge Compliance 9
4.1.7.1 Requirements 9
4.1.7.2 Procedures 10
4.1.7.3 Results 10
4.1.8 Radiated Spurious Emissions 10
4.1.8.1 Requirements 10
4.1.8.2 Procedures 10
4.1.8.3 Results 11
4.2 Receiver 11
4.2.1 Requirements 12
5.0 CONCLUSIONS 12
6.0 CERTIFICATION 12
7.0 ENDORSEMENT DISCLAIMER 12
TABLE I - EQUIPMENT LIST 13

REVISION HISTORY

Revision	Date	Description
—	June 7, 2006	Initial release

Measurement of RF Interference from a

Meridia Keypad Spread Spectrum Transceiver

1.0 INTRODUCTION:

1.1 Description of Test Item - This document represents the results of the series of radio interference measurements performed on a Meridia Keypad, Serial No. 2, (hereinafter referred to as the test item). The test item is a frequency hopping spread spectrum transceiver. It transmits and receives in the 2400.0MHz to 2483.5MHz band using an internal antenna. The test item was manufactured and submitted for testing by Fleetwood Group, Inc. located in Holland, MI.

1.2 Purpose - The test series was performed to determine if the test item meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and Subpart C, Section 15.247 for Intentional Radiators. 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 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 2005

- 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"

1.5 Subcontractor 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.

1.6 Laboratory Conditions - The temperature at the time of the test was 21^{o}C and the relative humidity was 43%.

2.0 TEST ITEM SET-UP AND OPERATION:

The test item is a Meridia Keypad spread spectrum transceiver. A block diagram of the test item set-up is shown as Figure 1.

2.1 Power Input - The test item obtained 3VDC power via 2 "AA" internal batteries.

2.2 Grounding - The test item was ungrounded during the tests.

2.3 Support Equipment - In order to enable the hopping function of the test item, the Meridia Base Unit must be running and polling the test item. The Meridia Base Unit was powered with 5VDC power over Ethernet (PoE). An ITE Power Supply, Model Number PW130, was powered with 115V, 60Hz via a 0.5 meter long 3-wire unshielded power cable. The ITE Power Supply output 48VDC over the J1 data and power port. (J2 port of the ITE Power Supply was unterminated.) A 3 meter long CAT 5 cable was used to connect the J1 port of the ITE Power Supply to the P + Data In port of the D-Link Power Over Ethernet Adapter, Model Number DWL-P50, Serial Number BH4A163000076. The DC Out port of the Power Over Ethernet Adapter output 5VDC over the DC out port. The DC out port was connected to the power in port of the test item via a 60 cm long 2 wire cable. The LAN OUT port of the Power Over Ethernet Adapter was connected to the test item via a 60 cm long CAT 5 Cable.

In order to enable the hopping function of the test item, the test item was placed on an 80cm high non-conductive table, 3 meters away from the receive antenna. The Meridia Base Unit was placed in the corner of the test chamber – as far away from the receive antenna as possible - so that radiated emissions from the Meridia Base Unit were significantly lower than the radiated emissions from the test item. The Meridia Base Unit was powered up and the frequency hopping function of the Meridia Base Unit was enabled. The test item was then powered up and the frequency hopping function of the test item was enabled by the Meridia Base Unit hopping and polling the test item.

2.4 Interconnect Cables - No interconnect cables were supplied with the test item.

2.5 Operational Mode - The normal mode of operation for the test item is to act as a frequency hopping spread spectrum transceiver. No testing was performed on the receiver function of the test item. (See 4.2 for more information.)

In order to enable the hopping function of the test item, the test item was placed on an 80cm high non-conductive table, 3 meters away from the receive antenna. The Meridia Base Unit was placed in the corner of the test chamber – as far away from the receive antenna as possible - so that radiated emissions from the Meridia Base Unit were significantly lower than the radiated emissions from the test item. The Meridia Base Unit was powered up and the frequency hopping function of the Meridia Base Unit was

enabled. The test item was then powered up and the frequency hopping function of the test item was enabled by the Meridia Base Unit hopping and polling the test item.

For some tests, the frequency hopping function was disabled. With the hopping disabled, the test item was set to transmit at frequencies of 2401MHz, 2435MHz or 2475MHz. The Meridia Base Unit was removed from the test chamber when the frequency hopping function of test item was disabled.

3.0 TEST EQUIPMENT:

3.1 Test Equipment List - A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

3.2 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).

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 Transmitter

4.1.1 Powerline Conducted Emissions

4.1.1.1 Requirements – Since the test item was powered by internal batteries, no powerline conducted emissions tests were required.

4.1.2 20dB Bandwidth

4.1.2.1 Requirements - Per section 15.247(a)(1), for frequency hopping systems operating in the 2400-2483.5MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits.

4.1.2.2 Procedures - The test item was setup inside the chamber. With the hopping function disabled, the test item was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to $\geq$ to 1% of the 20 dB BW.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

4.1.2.3 Results - The plots on pages 16 through 19 show that the maximum 20 dB bandwidth was 490.98 kHz.

4.1.3 Carrier Frequency Separation

4.1.3.1 Requirements - Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

4.1.3.2 Procedures - The test item was set up inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to ≥ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels.

When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

4.1.3.3 Results - Page 19 shows the carrier frequency separation. As can be seen from this plot, the separation is 1.00MHz which is greater than the 20dB bandwidth (490.98 kHz).

4.1.4 Number of Hopping Frequencies

4.1.4.1 Requirements - Per section 15.247(a)(1)(iii), for frequency hopping systems operating in the 2400-2483.5MHz band, the frequency hopping systems shall use at least 15 non-overlapping channels.

4.1.4.2 Procedures - The test item was set up inside the chamber. The output of the test item was connected to the spectrum analyzer. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to ≥ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.

The test item’s signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted. The analyzer's display was plotted using a 'screen dump' utility.

4.1.4.3 Results - Page 20 and 21 show the number of hopping frequencies. As can be seen from the plots, the number of hopping frequencies is 75, which is greater than the minimum required.

4.1.5 Time of Occupancy

4.1.5.1 Requirements - Per section 15.247(a)(1)(iii), for frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy shall not be greater than 0.4 seconds within a 0.4 second period multiplied by the number of hopping channels employed.

4.1.5.2 Procedures - The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to 1 MHz. The peak detector and 'Max-Hold' function were engaged. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. Then, the sweep time was increased to a 0.4 second period multiplied by the number of hopping channels. The number of hops was counted. The analyzer's display was plotted using a 'screen dump' utility.

The dwell time was then calculated from dwell time per hop multiplied by the number of hops.

4.1.5.3 Results - Pages 22 and 23 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by a 1.032msec pulse multiplied by 7 hops. This calculated value is equal to 0.0072 seconds which is less than the 0.4 seconds maximum allowed.

4.1.6 Peak Output Power - Internal Antenna

4.1.6.1 Requirements - Per section 15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5MHz band and employing at least 75 hopping channels, the peak output power shall not be greater than 1 watt.

4.1.6.2 Procedures - The test item was placed on the non-conductive stand and set to transmit using the internal antenna. A broadband measuring antenna was placed at a test distance of 3 meters from the test item. The test item was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high hopping frequencies.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, another double ridged waveguide antenna was then set in place of test item and connected to a calibrated signal generator. 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 then corrected to compensate for cable loss, as required. The peak power output was calculated for the low, middle and high hopping frequencies.

4.1.6.3 Results - The results are presented on page 24. The maximum EIRP measured from the transmitter was 6.0dBm which meets the 36dBm de facto limit.

4.1.7 Bandedge Compliance

4.1.7.1 Requirements - Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required. In addition, the radiated emissions which fall in the

restricted band beginning at 2483.5 MHz, must meet the general limits of 15.209(a).

4.1.7.2 Procedures - The test item was setup inside the chamber. With the hopping function disabled, the test item was allowed to transmit continuously. The transmit frequency was set separately to low and high channels. The resolution bandwidth (RBW) was set to 100 kHz.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility. The measurement was repeated with the frequency hopping function enabled.

For the emissions which fall in the restricted band the "marker-delta" method described in Public Notice DA 00-705 was used. Initially radiated measurements were performed at the fundamentals of the highest hopping frequencies using 1 MHz bandwidth. For the measurements the "delta" required to meet the general limit was calculated.

Next, the band-edge emissions were plotted using peak detector and 100 kHz bandwidth. The "delta" limit was applied to this plot to determine compliance at the band-edge.

The test item was placed on the non-conductive stand and set to transmit. A broadband measuring antenna was placed at a test distance of 3 meters from the test item. The test item was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded.

4.1.7.3 Results - Pages 25 through 28 show the radiated band-edge compliance results using the 20dB down method at the 2.4GHz band edge and the marker-delta method at the 2.4835GHz band edge. As can be seen from these plots, the emissions at the 2.4GHz band edge are within the 20dB down limits and the emissions at the 2.4835GHz restricted band edge are within the general limits.

4.1.8 Radiated Spurious Emissions

4.1.8.1 Requirements – Per section 15.247(c), in any 100 kHz bandwidth outside the frequency band in which the test item is operating, the spurious emissions shall be at least 20dB down from the highest level of power but attenuation below the general limits listed in 15.209(a) is not required. In addition, the radiated emissions which fall in the restricted bands must meet the general limits of 15.209(a).

4.1.8.2 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 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 18 GHz. The frequency range from 18 to 25 GHz was checked manually but not plotted.

Next, the harmonic or spurious emissions falling in the restricted bands were measured up through the 10th harmonic. For the measurements above 1GHz, the measurement bandwidth was set to 1 MHz RBW and 3MHz VBW and a peak reading was taken. Then analyzer was set to **linear mode** with 10 Hz VBW in order to simulate an average detector and an average reading was taken. A pre-amplifier was used to increase the receiver sensitivity.

For harmonics or spurious emissions that fell in the restricted bands, a duty cycle correction factor (D.C. Corr. Fac.) was applied to the average reading per the procedures of Public Notice DA 00-705. Per Public Notice DA 00-705, if the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10Hz VBW may be further adjusted by a duty cycle correction factor derived from 20*log((dwell time)/100msec). Based on a dwell time of 7.224msec, the duty cycle correction factor was 20*log(7.224/100) = -22.8dB.

For harmonics or spurious emissions readings above 18GHz, measurements were made at a 1 meter distance. For these readings, a distance correction factor of -9.5dB was applied to the readings using linear extrapolation: -9.5dB (-9.5dB = 20 * Log (1m/3m)).

4.1.8.3 Results - The preliminary emissions plots up to 18GHz (taken with 100 kHz BW) are shown on pages 29 through 37. The plots indicated that the radiated spurious emissions were below the 20dBc. A highpass filter with 2.4 GHz cutoff frequency was used when measuring above 2GHz to prevent overloading the preamplifier.

Radiated emissions measurements on all harmonics and any other emissions from the test item that fell in the restricted frequency bands are shown on pages 38 through 40. All emissions were within the general limit. The emissions level closest to the limit (worst case) occurred at 7.305GHz. The emissions level at this frequency was 0.3dB within the limit. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 2.

4.2 Receiver

4.2.1 Requirements - Per section 15.101(b), receivers operating above 960MHz or below 30MHz are exempt from complying with the technical provisions of CFR Title 47, Part 15, Subpart B. Therefore no testing was performed on the receiver portion of the test item.

5.0 CONCLUSIONS:

It was determined that the Fleetwood Group, Inc. Meridia Keypad spread spectrum transceiver, Serial No. 2, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.107 and 15.109 for receivers and Subpart C, Section 15.247 for spread spectrum transmitters.

6.0 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. 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.

7.0 ENDORSEMENT DISCLAIMER:

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

TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC. Page: 1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/	001	4.8-20GHZ	07/27/05	12	07/27/06
XZG0	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A02724	---		N/A	
Equipment Type: AMPLIFIERS								
APK0	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	3008A00662	1-26.5GHZ	03/06/06	12	03/06/07
Equipment Type: ANTENNAS								
NWI0	RIDGED WAVE GUIDE	AEL	H1498	153	2-18GHZ	10/01/05	12	10/01/06
NWI1	RIDGED WAVE GUIDE	AEL	H1498	154	2-18GHZ	10/01/05	12	10/01/06
Equipment Type: ATTENUATORS								
T1E8	10DB, 25W ATTENUATOR	WEINSCHEL CORP.	46-10-34	BH7996	DC-18GHZ	12/05/05	12	12/05/06
T2D9	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BH5445	DC-18HGZ	12/05/05	12	12/05/06
Equipment Type: RECEIVERS								
RAC1	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3407A08369	100HZ-22GHZ	02/13/06	12	02/13/07
RACB	RF PRESELECTOR	HEWLETT PACKARD	85685A	3506A01491	20HZ-2GHZ	02/13/06	12	02/13/07
RAF3	QUASIPEAK ADAPTER	HEWLETT PACKARD	85650A	3303A01775	0.01-1000MHZ	02/13/06	12	02/13/07
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	03/25/06	12	03/25/07
Equipment Type: SIGNAL GENERATORS								
GBR2	SIGNAL GENERATOR	HEWLETT PACKARD	8648D	3847U00488	0.009-4000MHZ	02/15/06	12	02/15/07
GBX1	SYNTHESIZED SWEEPER	HEWLETT PACKARD	83630A	3420A00857	10MHZ-26.5GHZ	02/15/06	12	02/15/07

Cal. Interval: Listed in Months 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.

ELITE ELECTRONIC ENGINEERING INC.

Radiated Emissions Test Setup Anechoic Ferrite Chamber

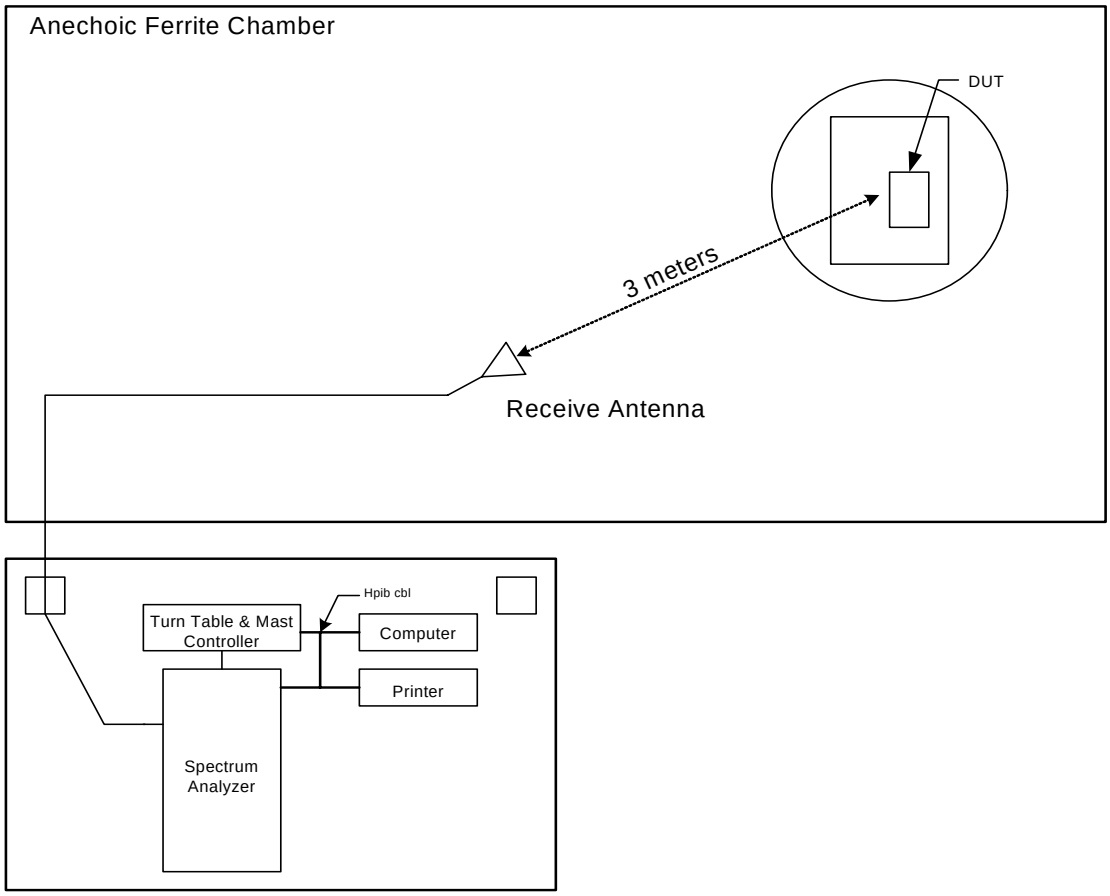
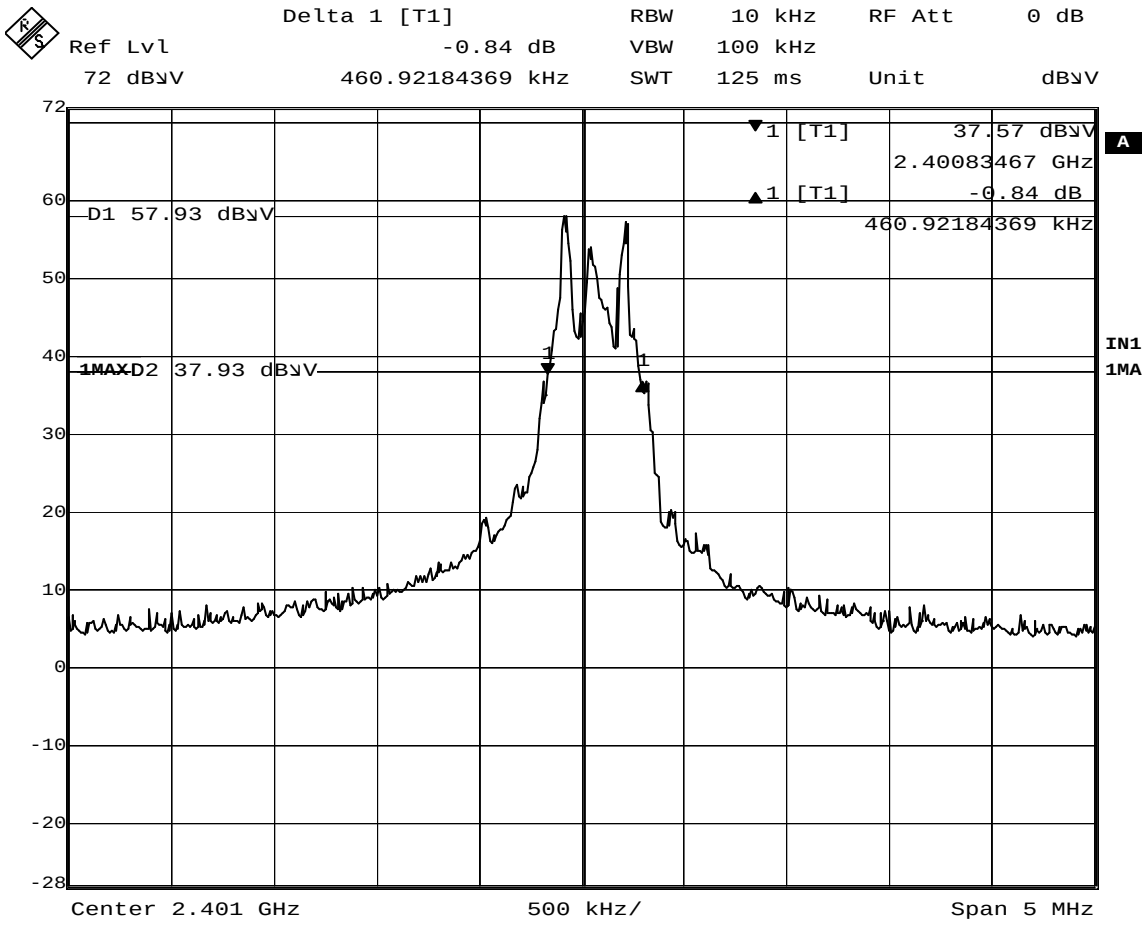


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

Test Setup for Radiated Emissions – Horizontal Polarization

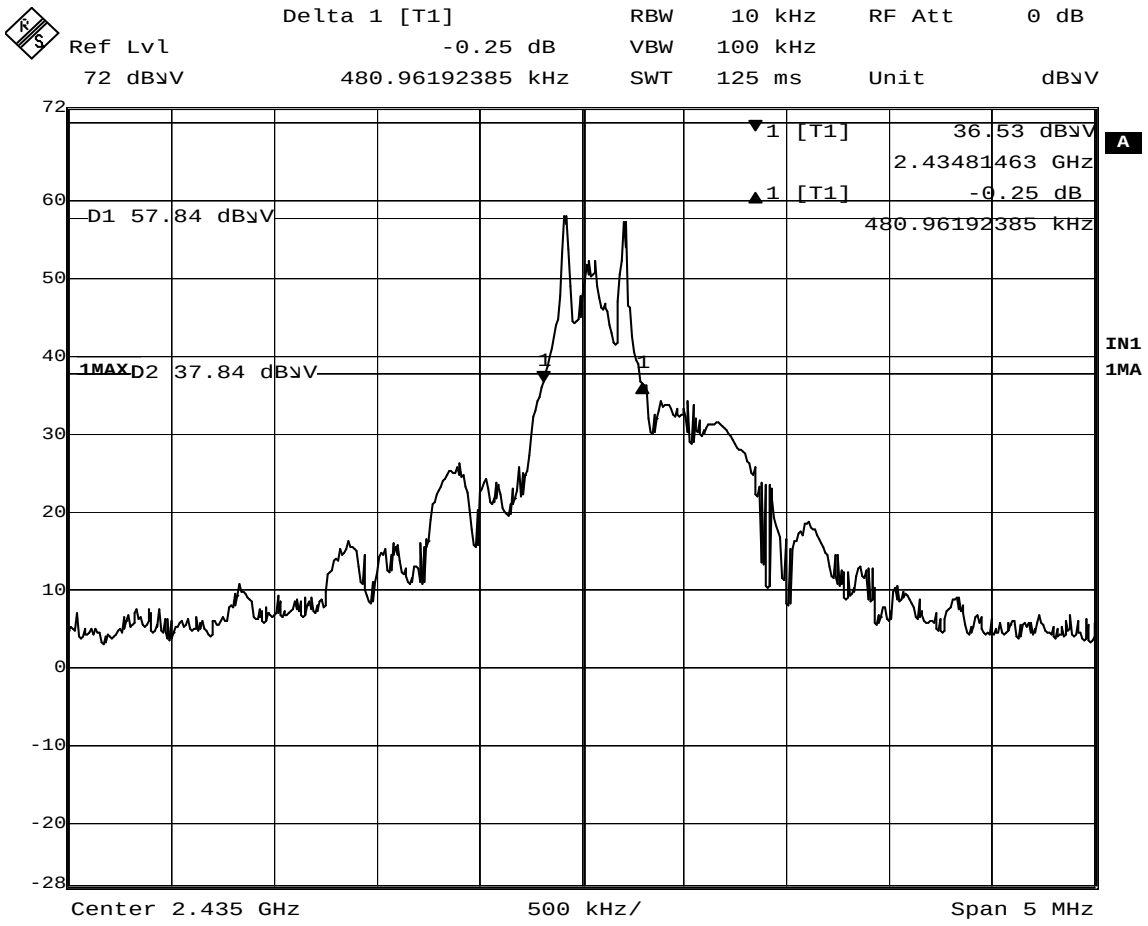
Test Setup for Radiated Emissions – Vertical Polarization



Date: 1.JUN.2006 09:43:50

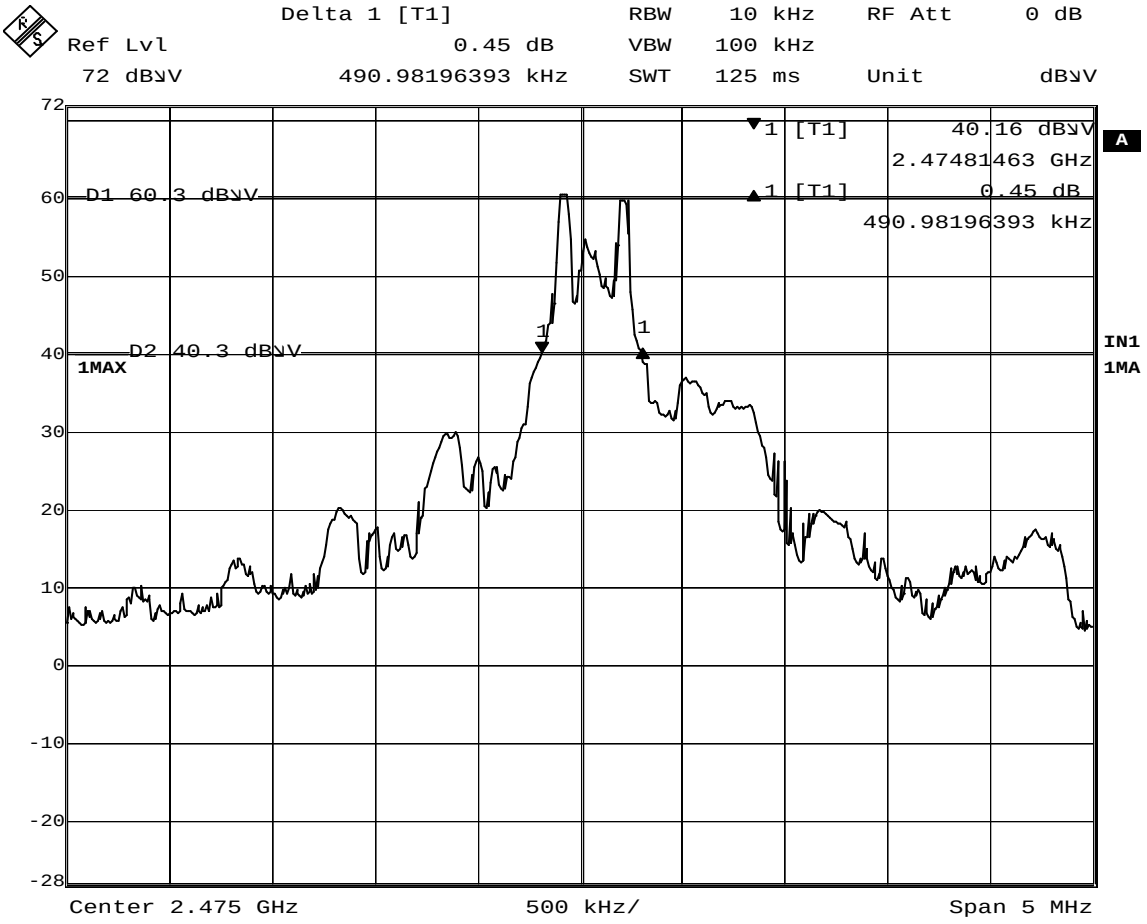
MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : 20dB Bandwidth
TEST PARAMETERS : Tx @ 2.401GHz
NOTES :
EQUIPMENT USED : RBA0

NOTES:



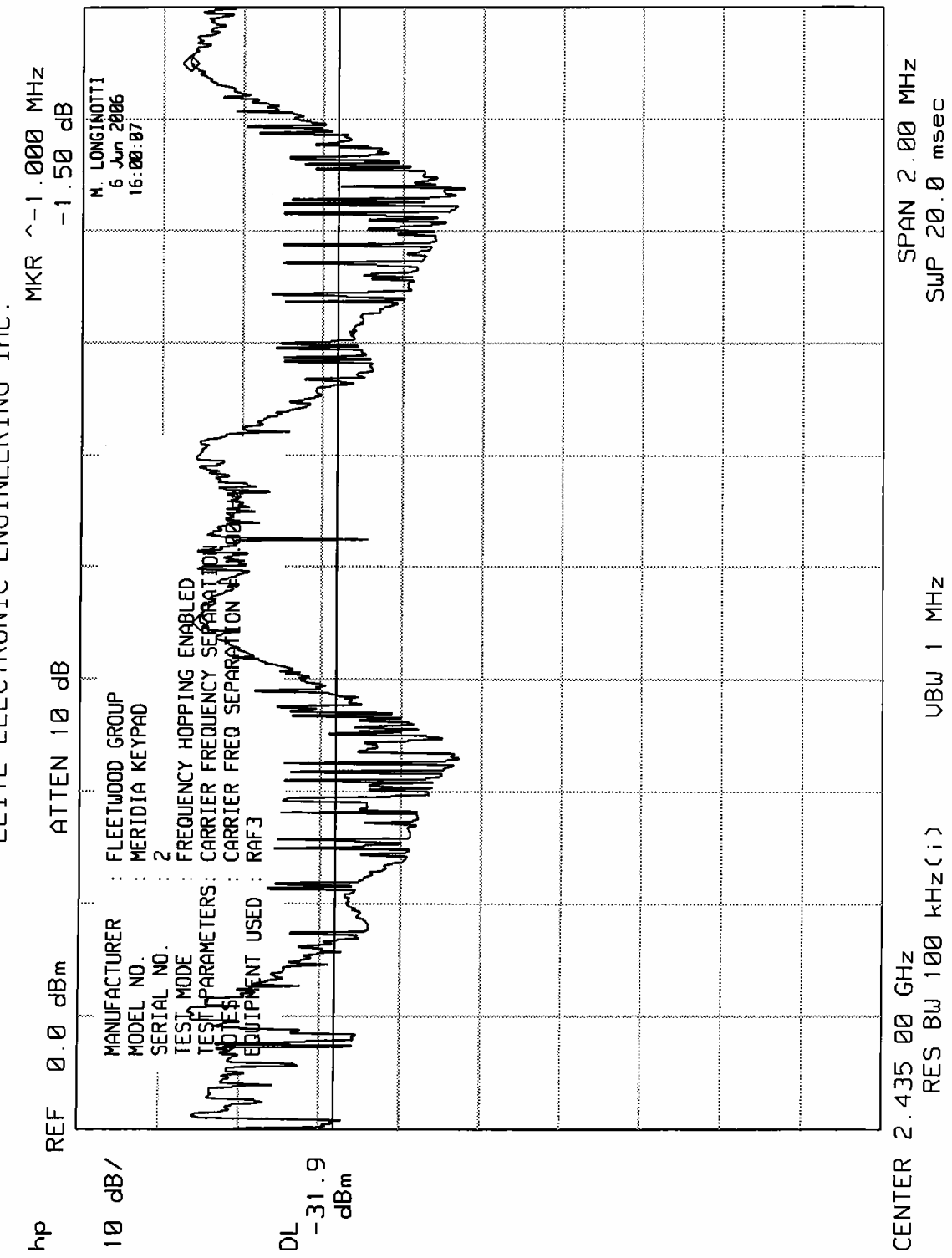
Date: 1.JUN.2006 09:41:29

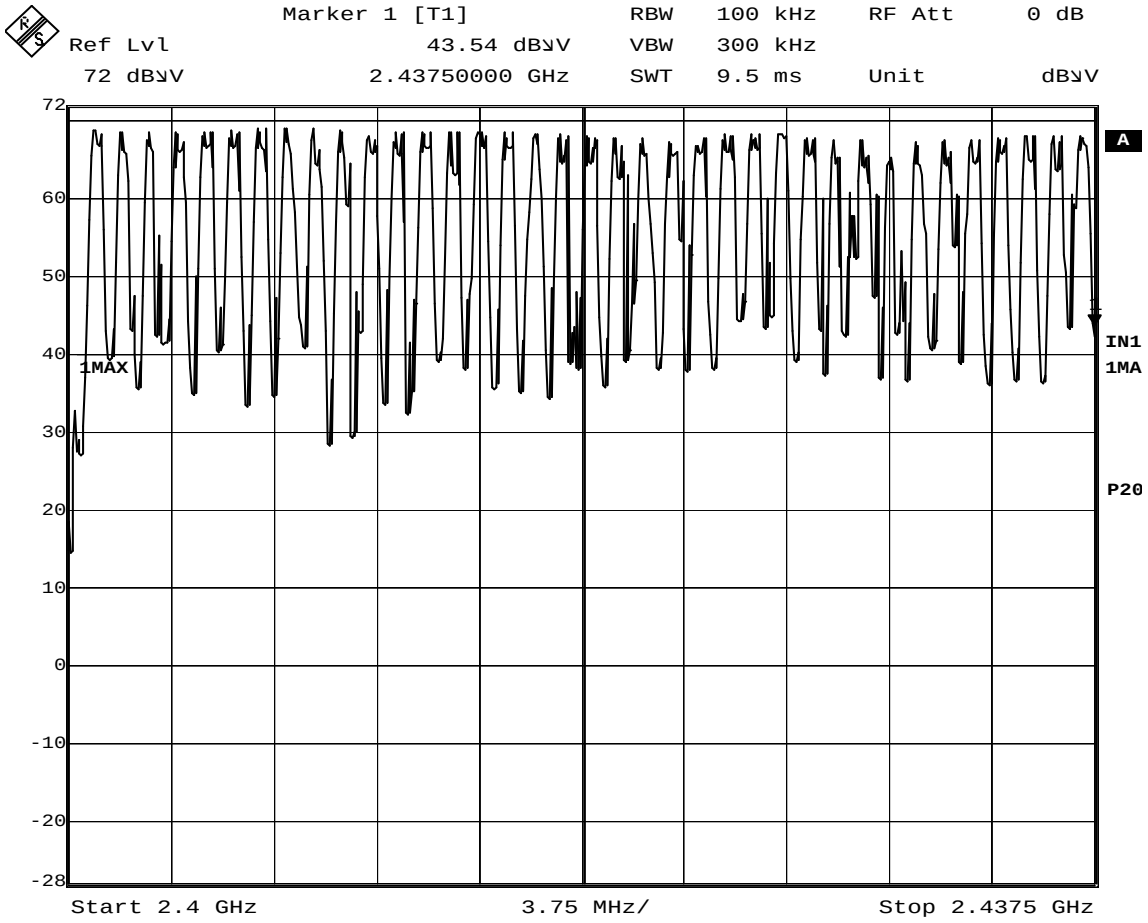
MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : 20dB Bandwidth
TEST PARAMETERS : Tx @ 2.435GHz
NOTES :
EQUIPMENT USED : RBA0



NOTES: Date: 1.JUN.2006 09:38:48
MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : 20dB Bandwidth
TEST PARAMETERS : Tx @ 2.475GHz
NOTES :
EQUIPMENT USED : RBA0

NOTES:


ELITE ELECTRONIC ENGINEERING Inc.
hp
REF 0.0 dBm
ATTEN 10 dB
MKR ^-1.000 MHz
-1.50 dB
10 dB/
DL
-31.9
dBm
M. LONGINOTTI
6 Jun 2006
16:00:07
MANUFACTURER : FLEETWOOD GROUP
MODEL NO. : MERIDIA KEYPAD
SERIAL NO. : 2
TEST MODE : FREQUENCY HOPPING ENABLED
TEST PARAMETERS: CARRIER FREQUENCY SEPARATION
: CARRIER FREQ SEPARATION
EQUIPMENT USED : RAF3
CENTER 2.435 00 GHz
RES BW 100 kHz(i)
VBW 1 MHz
SPAN 2.00 MHz
SWP 20.0 msec

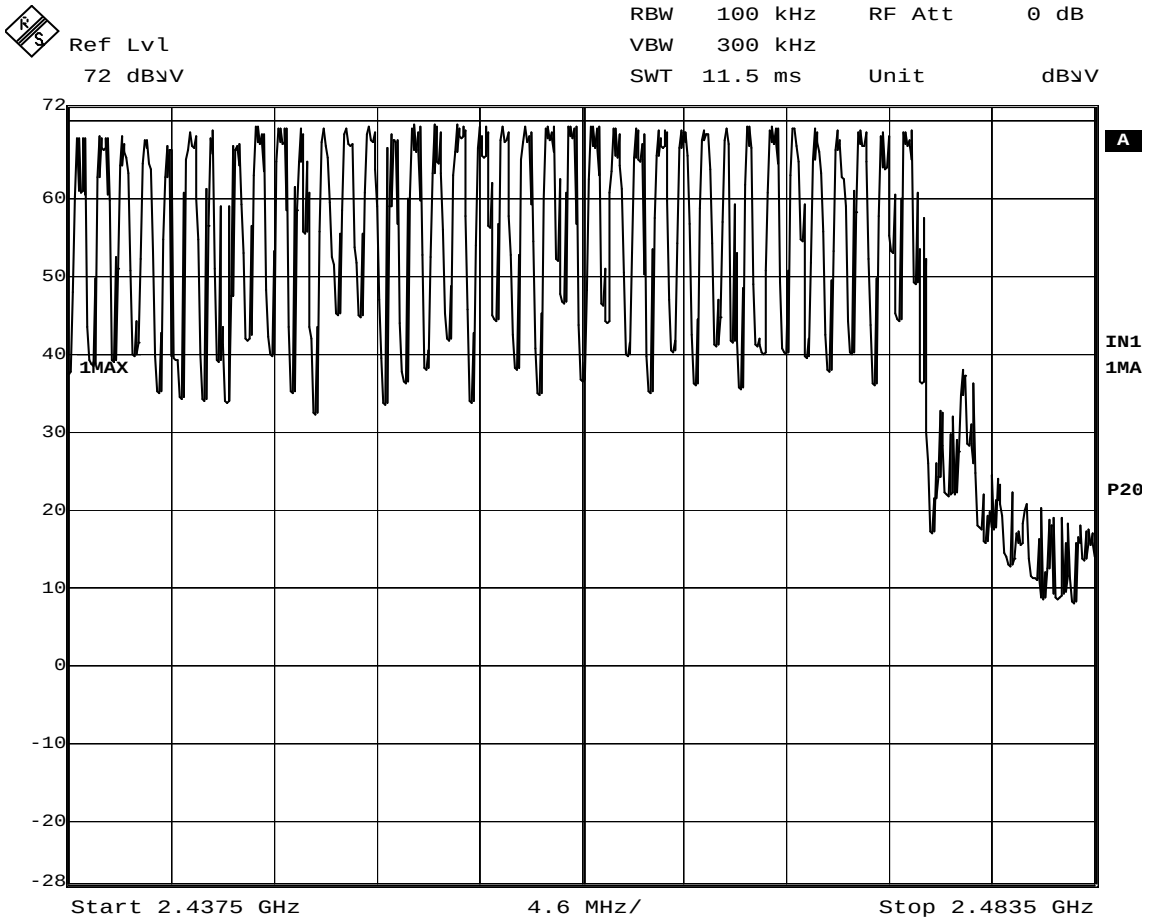


Date: 5.JUN.2006 13:33:54

Number of Hopping Frequencies from 2.4GHz to 2.4375GHz = 37

MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Frequency Hopping Enabled
TEST PARAMETERS : Number of Hopping Frequencies
NOTES :
EQUIPMENT USED : RBA0

NOTES:



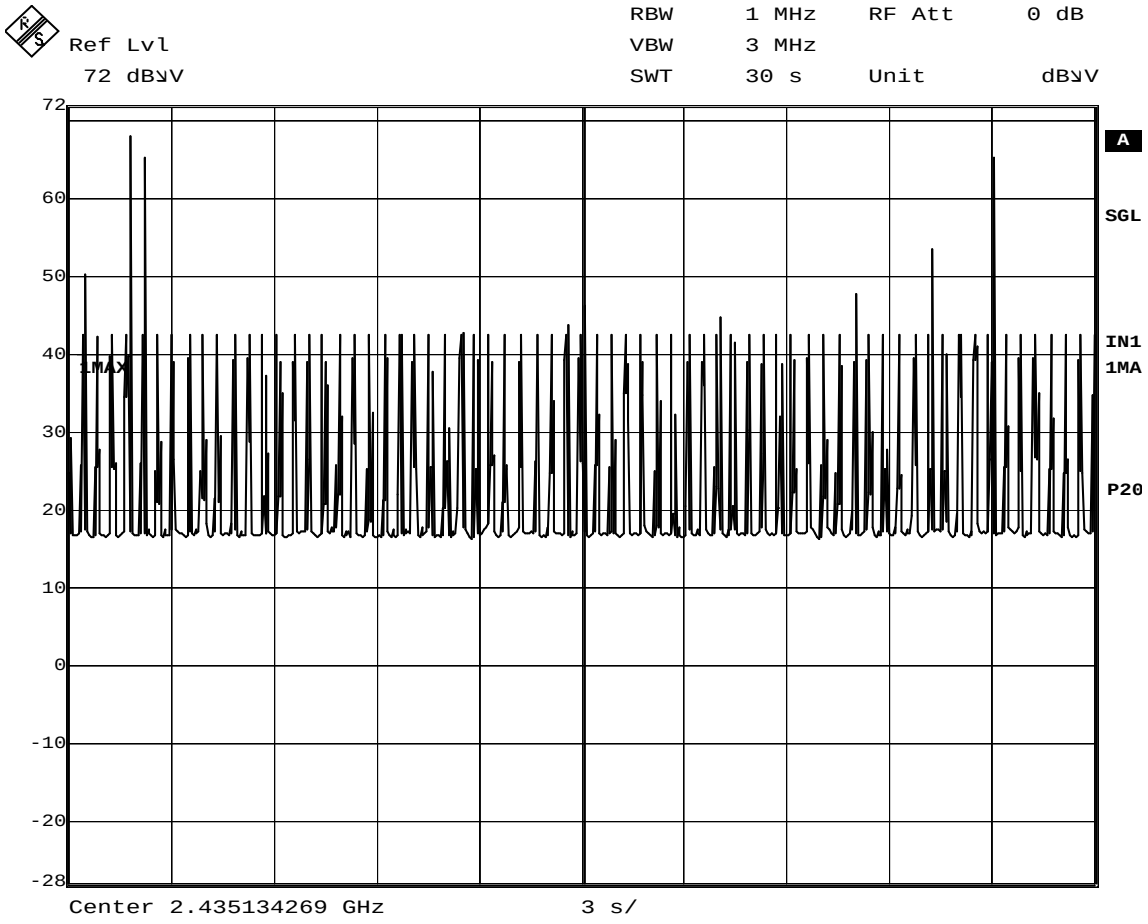
Date: 5.JUN.2006 15:52:46

Number of Hopping Frequencies from 2.4375GHz to 2.475GHz = 38

Total Number of Hopping Frequencies = 75
=(No. of Hopping frequencies from 2.401GHz to 2.4375GHz) + (No. of Hopping frequencies form 2.4375GHz to 2.475GHz) = 37 + 38 = 75

MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Frequency Hopping Enabled
TEST PARAMETERS : Number of Hopping Frequencies
NOTES :
EQUIPMENT USED : RBA0

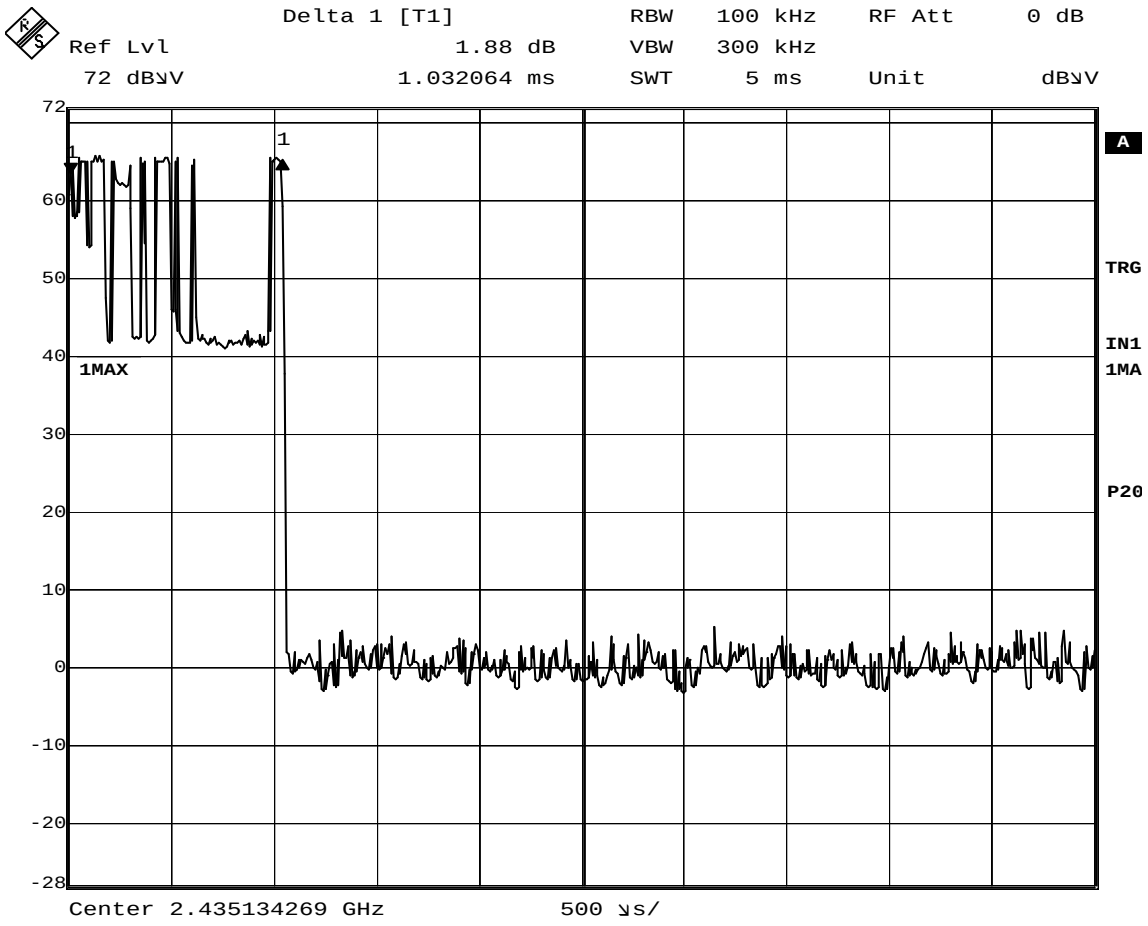
NOTES:



Number of Pulses in a 30 second window = 7

MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Frequency Hopping Enabled
TEST PARAMETERS : Dwell Time
NOTES :
EQUIPMENT USED : RBA0

NOTES:



Dwell Time = (# of Pulses) * (Pulse Width) =
7 * 1.032msec = 7.224msec = 0.0072sec

MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Frequency Hopping Enabled
TEST PARAMETERS : Dwell Time
NOTES :
EQUIPMENT USED : RBA0

NOTES:

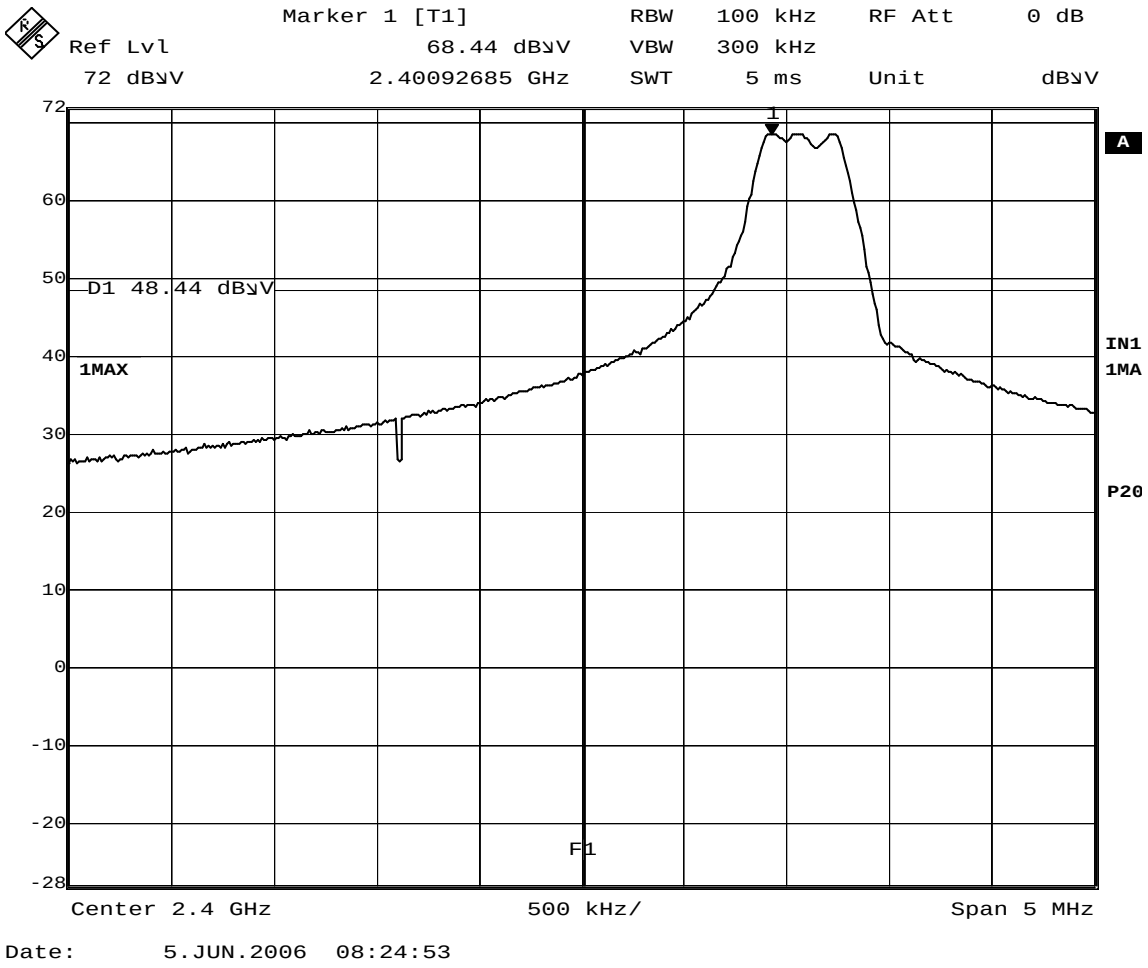
DATA SHEET

MANUFACTURER : Fleetwood Group, Inc.
MODEL : Meridia Keypad
S/N : 2
SPECIFICATION : FCC Part 15, Subpart C, Section 15.247
Peak Output Power – Radiated Measurement
DATE : May 29, 2006
NOTES : TEST DISTANCE IS 3 METERS

FREQ. (MHz)	ANT POL	SPECTRUM ANALYZER RDG(dBuV)	MATCHED SIGNAL GENERATOR RDG (dBm)	CABLE LOSS (dB)	ANTENNA GAIN (dB)	EIRP TOTAL (dBm)	DeFacto EIRP Limit (dBm)
2401	V	101.8	0.1	2.8	6.5	3.8	36
2401	H	103.5	2.3	2.8	6.5	6.0	36
2435	V	101.3	-0.7	2.8	6.6	3.1	36
2435	H	103.4	1.8	2.8	6.6	5.6	36
2475	V	101.7	-0.3	2.9	6.7	3.5	36
2475	H	102.6	1.8	2.9	6.7	5.6	36

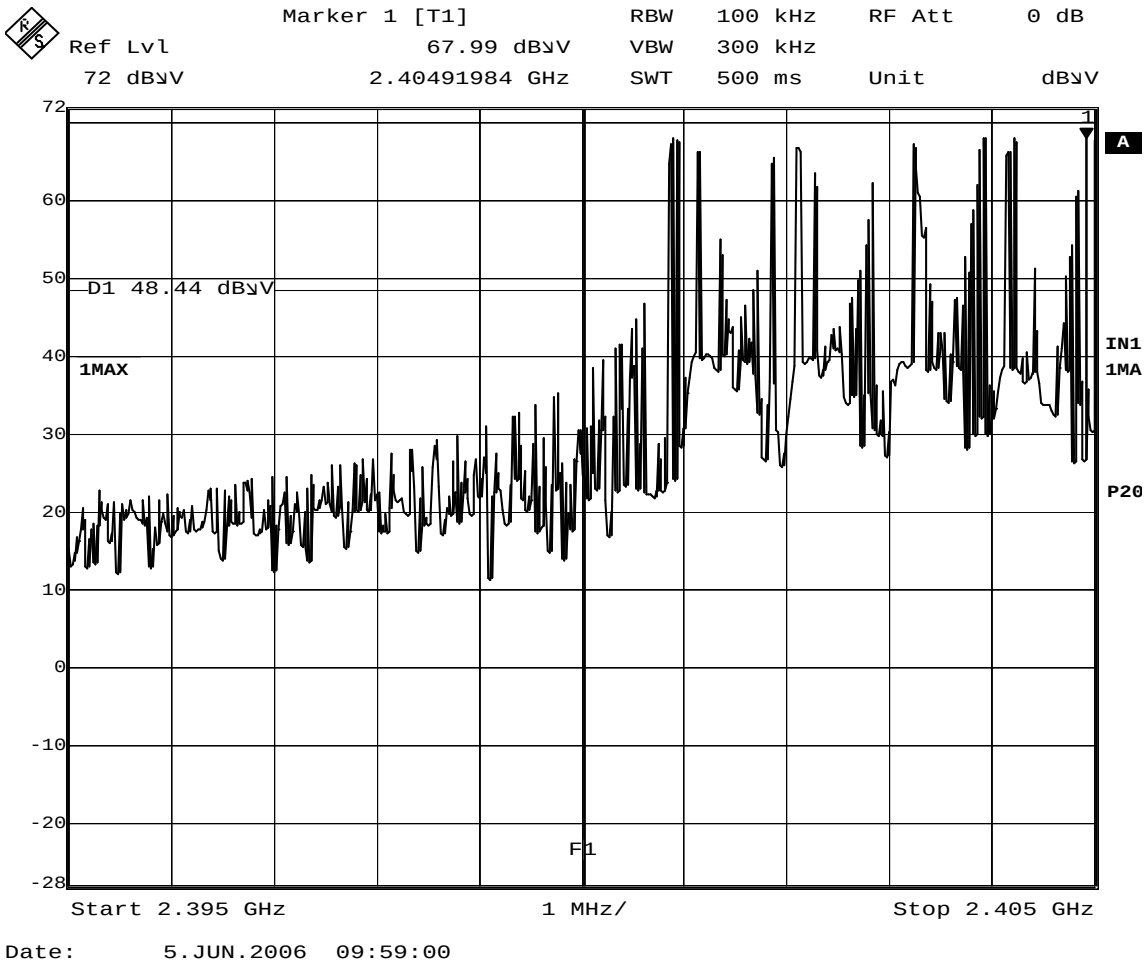
EIRP = S.G. RDG - Cable Loss + Antenna Gain

Checked By: MARK E. LONGINOTTI



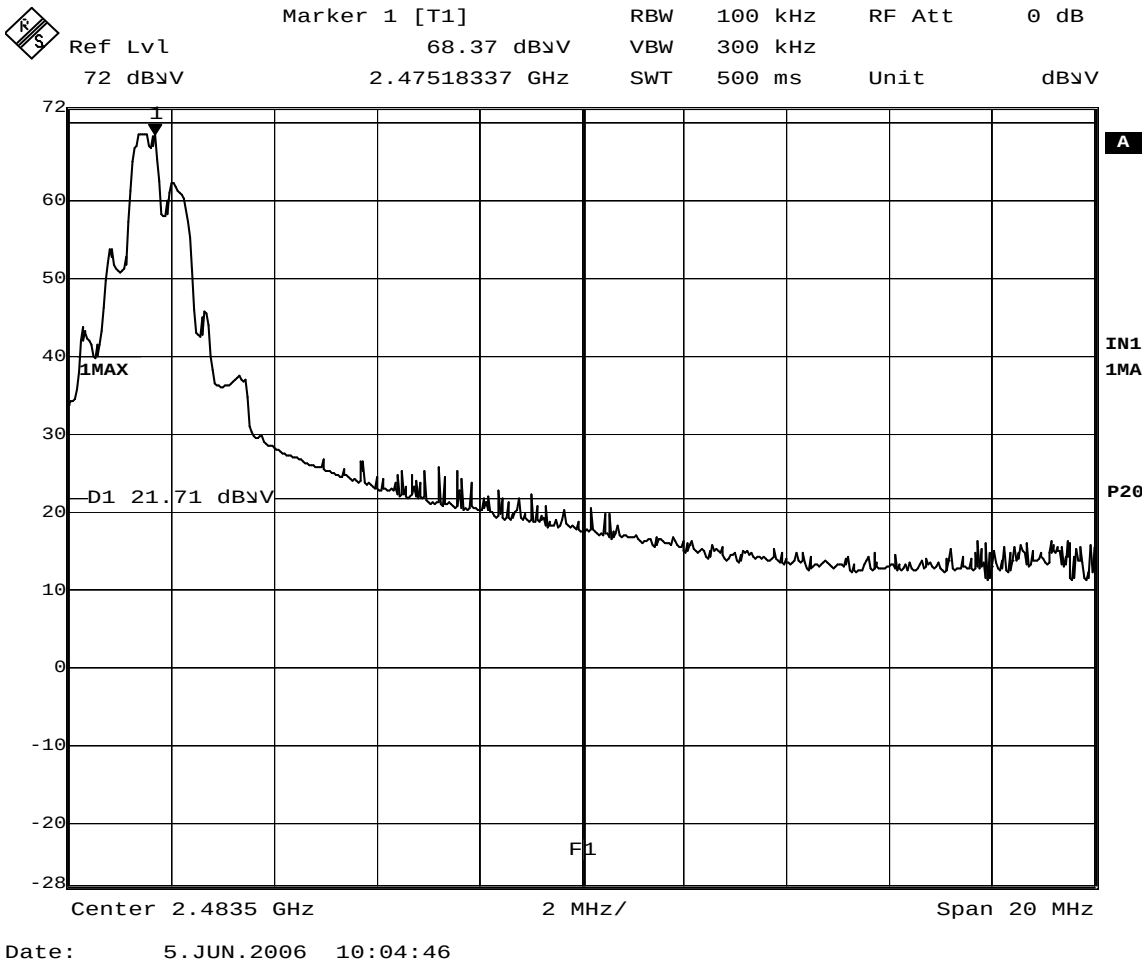
MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Tx @ 2.401GHz
TEST PARAMETERS : Bandedge compliance
NOTES :
EQUIPMENT USED : RBA0

NOTES:



MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Frequency Hopping Enabled
TEST PARAMETERS : Bandedge compliance
NOTES :
EQUIPMENT USED : RBA0

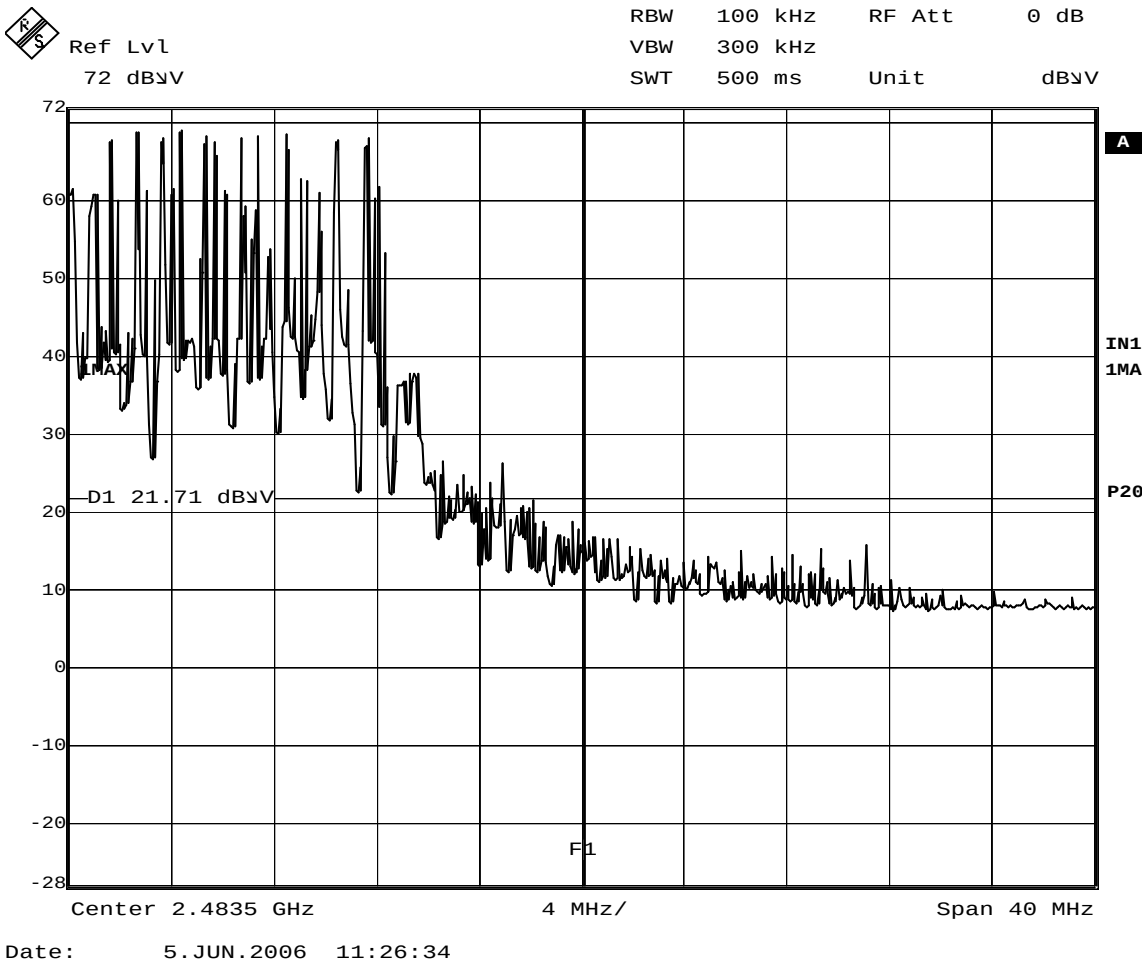
NOTES:



Marker Delta Method: 100.7dBuV/m – 54 dBuV/m = 46.7 dB down

MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Tx @ 2.475GHz
TEST PARAMETERS : Bandedge compliance
NOTES :
EQUIPMENT USED : RBA0

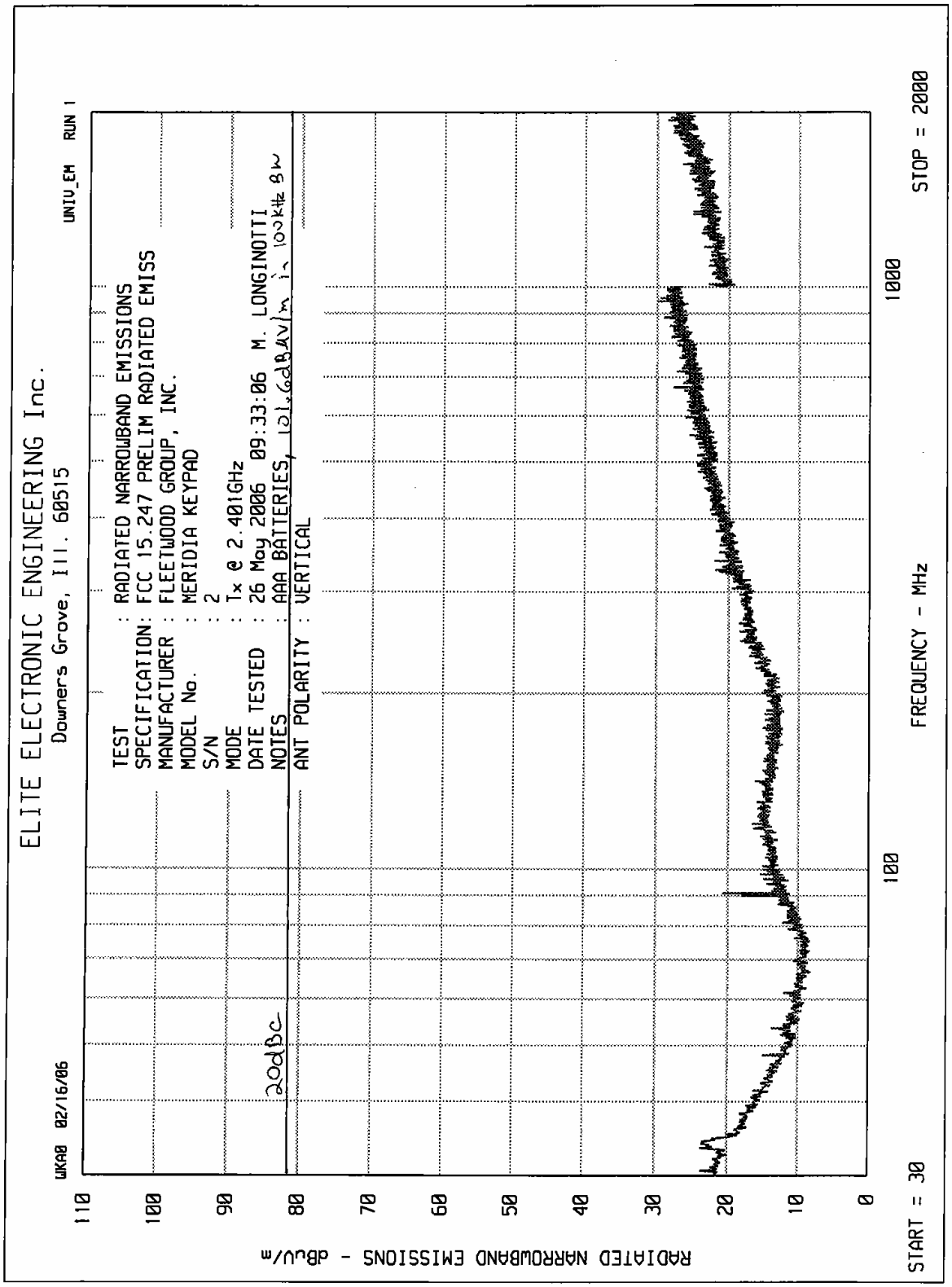
NOTES:

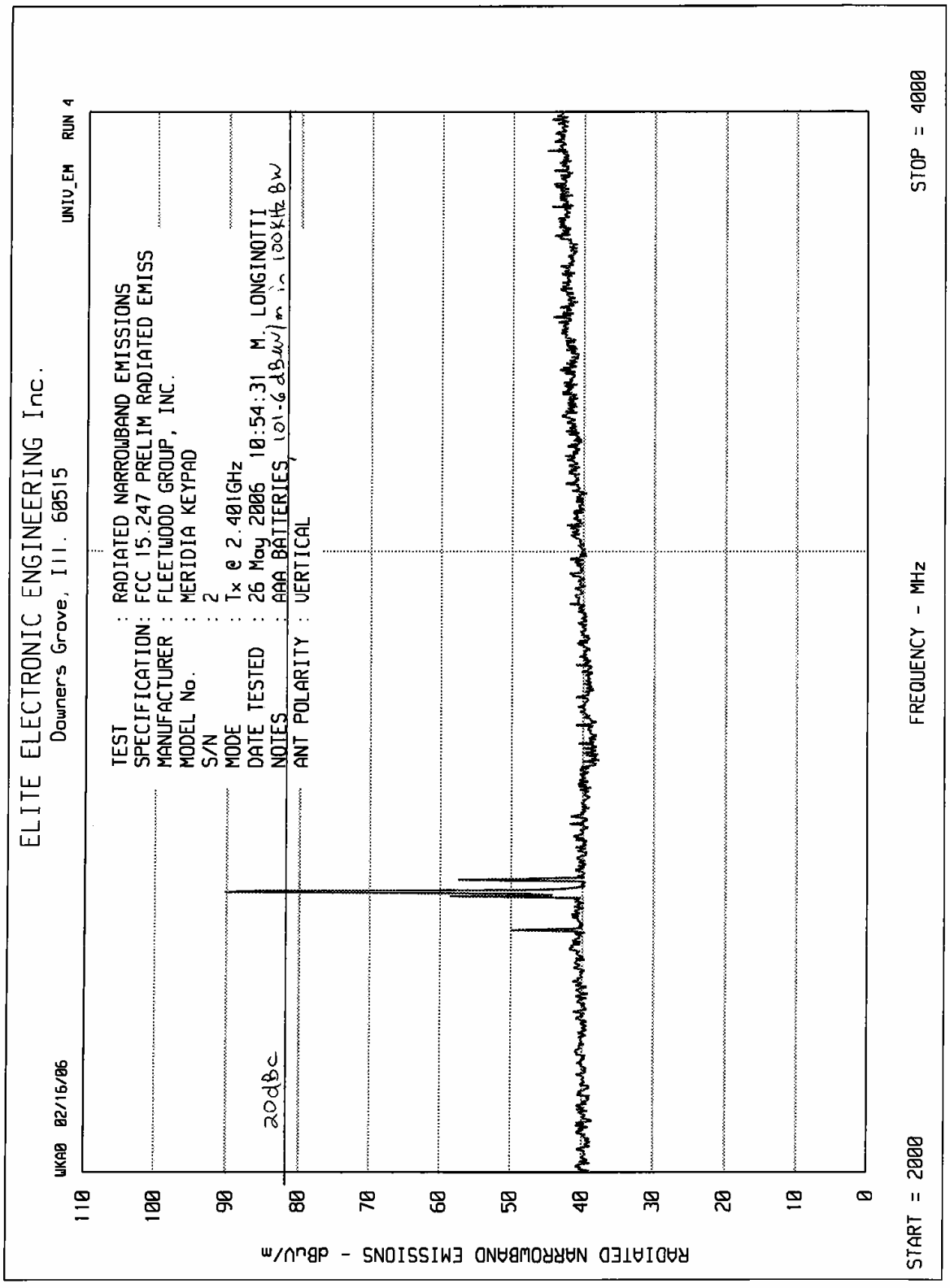


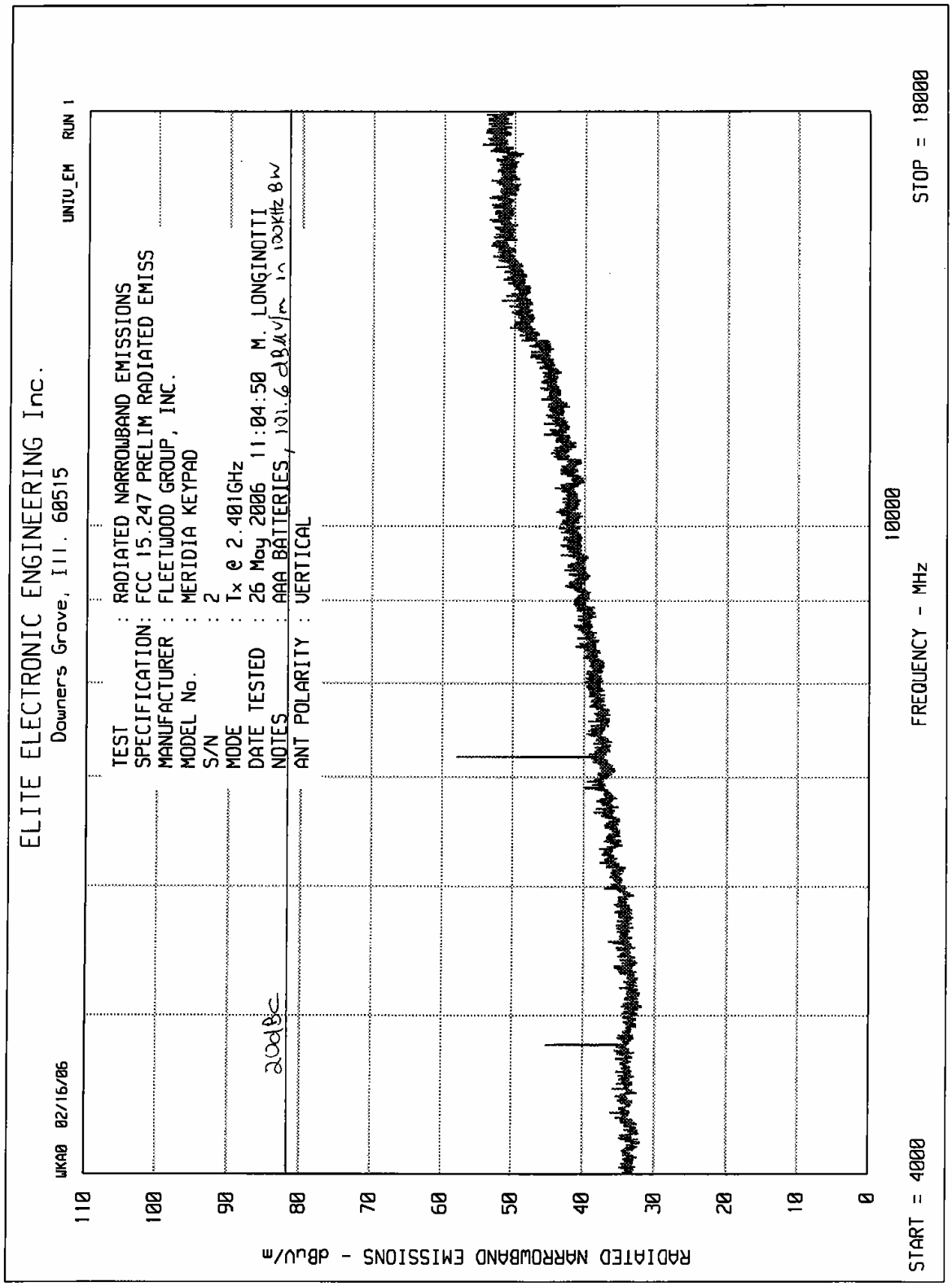
Marker Delta Method: 100.7dBuV/m – 54 dBuV/m = 46.7 dB down

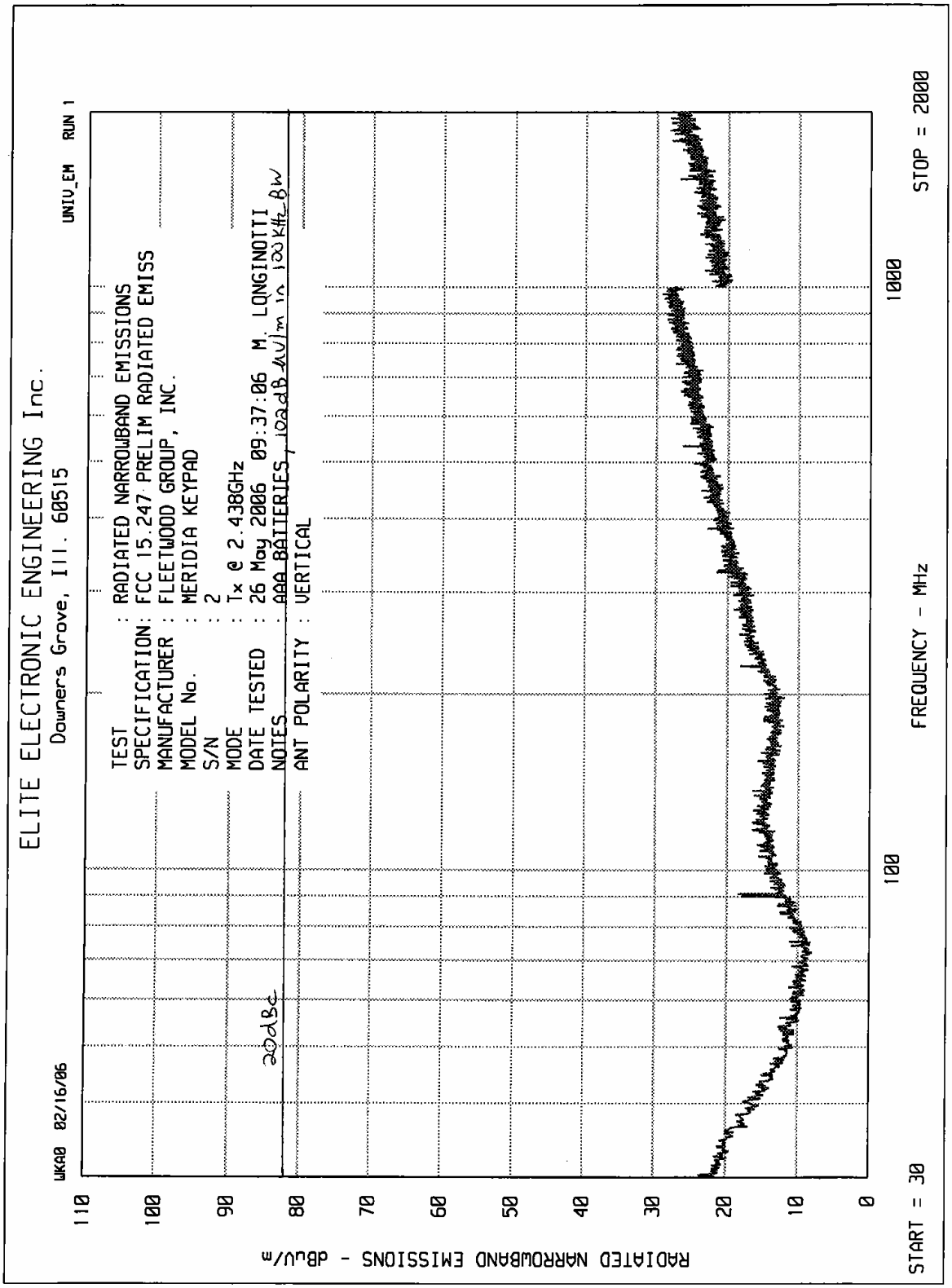
MANUFACTURER : Fleetwood Group, Inc.
MODEL NUMBER : Meridia Keypad
SERIAL NUMBER : 2
TEST MODE : Frequency Hopping Enabled
TEST PARAMETERS : Bandedge compliance
NOTES :
EQUIPMENT USED : RBA0

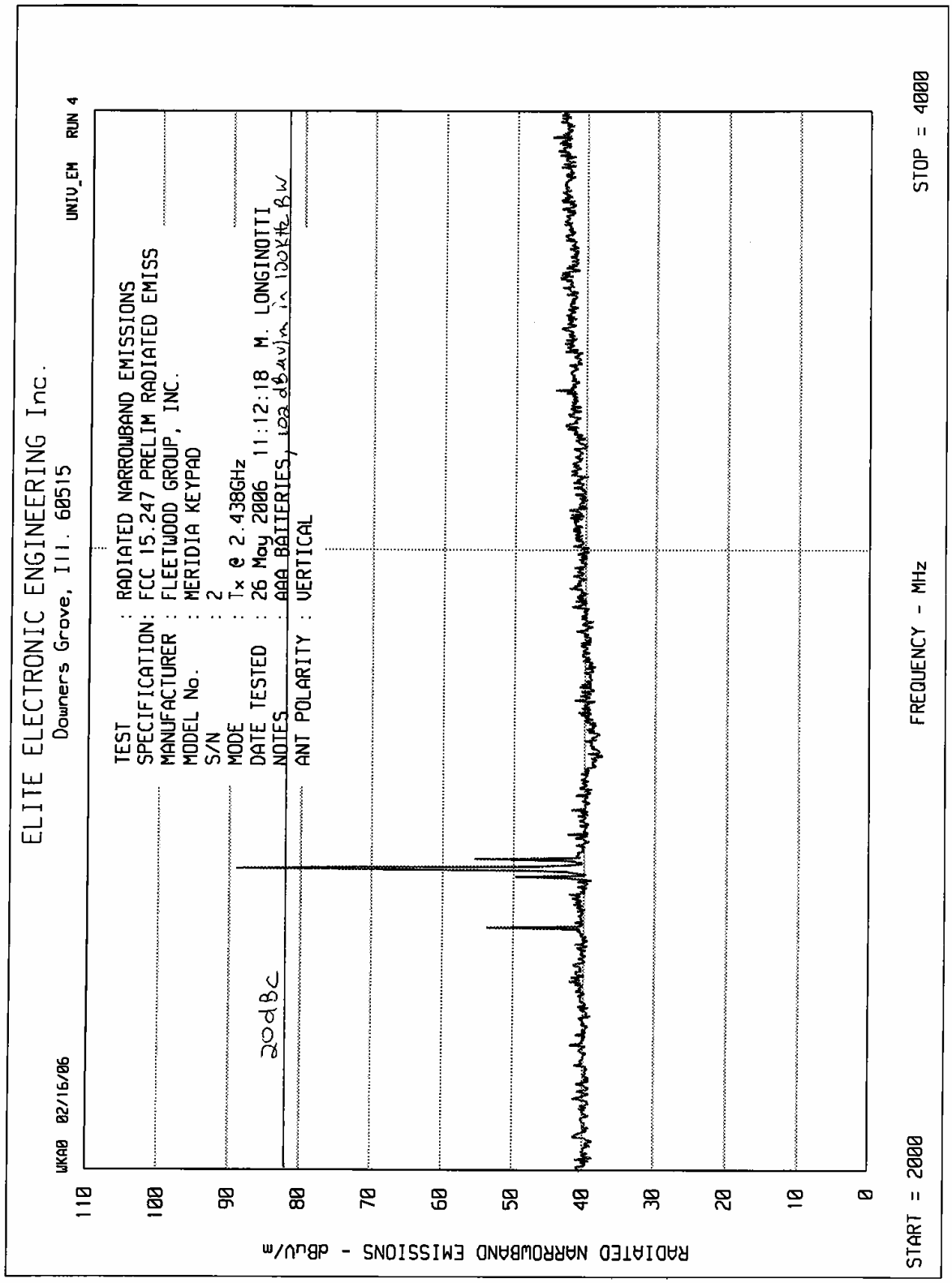
NOTES:

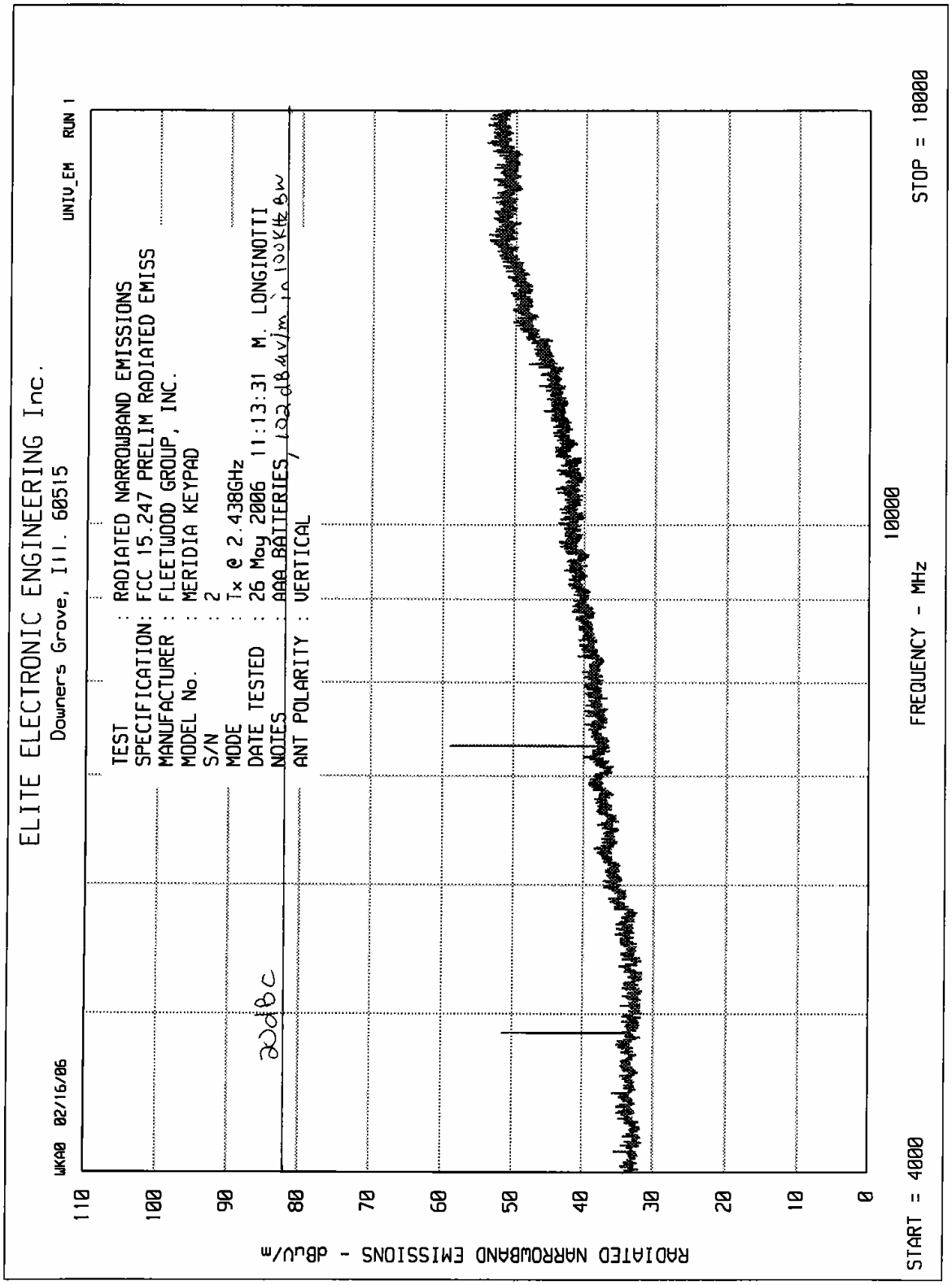

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : 1x @ 2.401GHz
DATE TESTED : 26 May 2006 09:33:06 M. LONGINOTTI
NOTES : AAA BATTERIES, 120kHz BW
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
1000
STOP = 2000
FREQUENCY - MHz

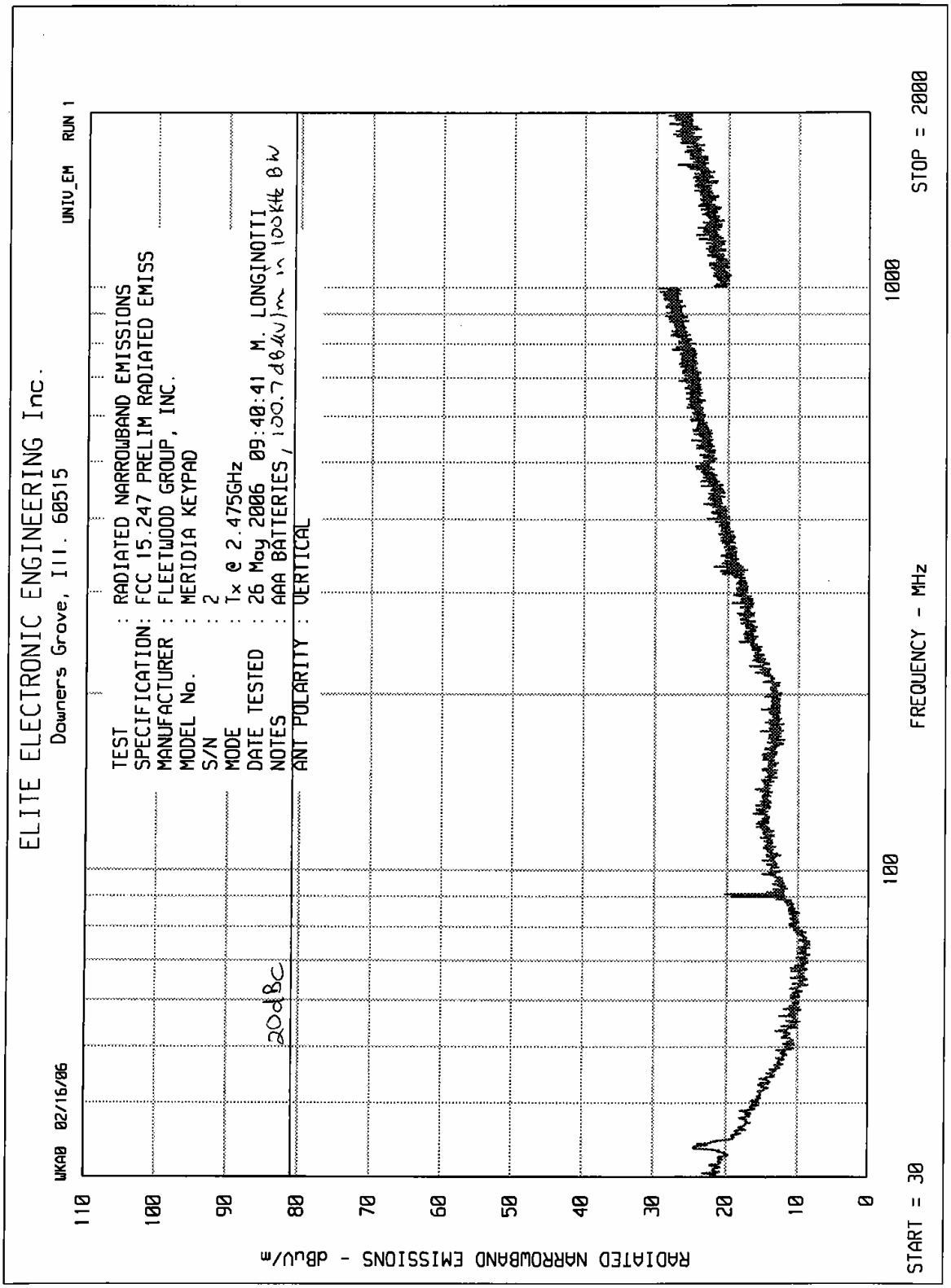

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 4
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : Tx @ 2.401GHz
DATE TESTED : 26 May 2006 10:54:31 M. LONGINOTTI
NOTES : AAA BATTERIES, 101-6 dBuV/m in 100kHz BW
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 2000
FREQUENCY - MHz
STOP = 4000

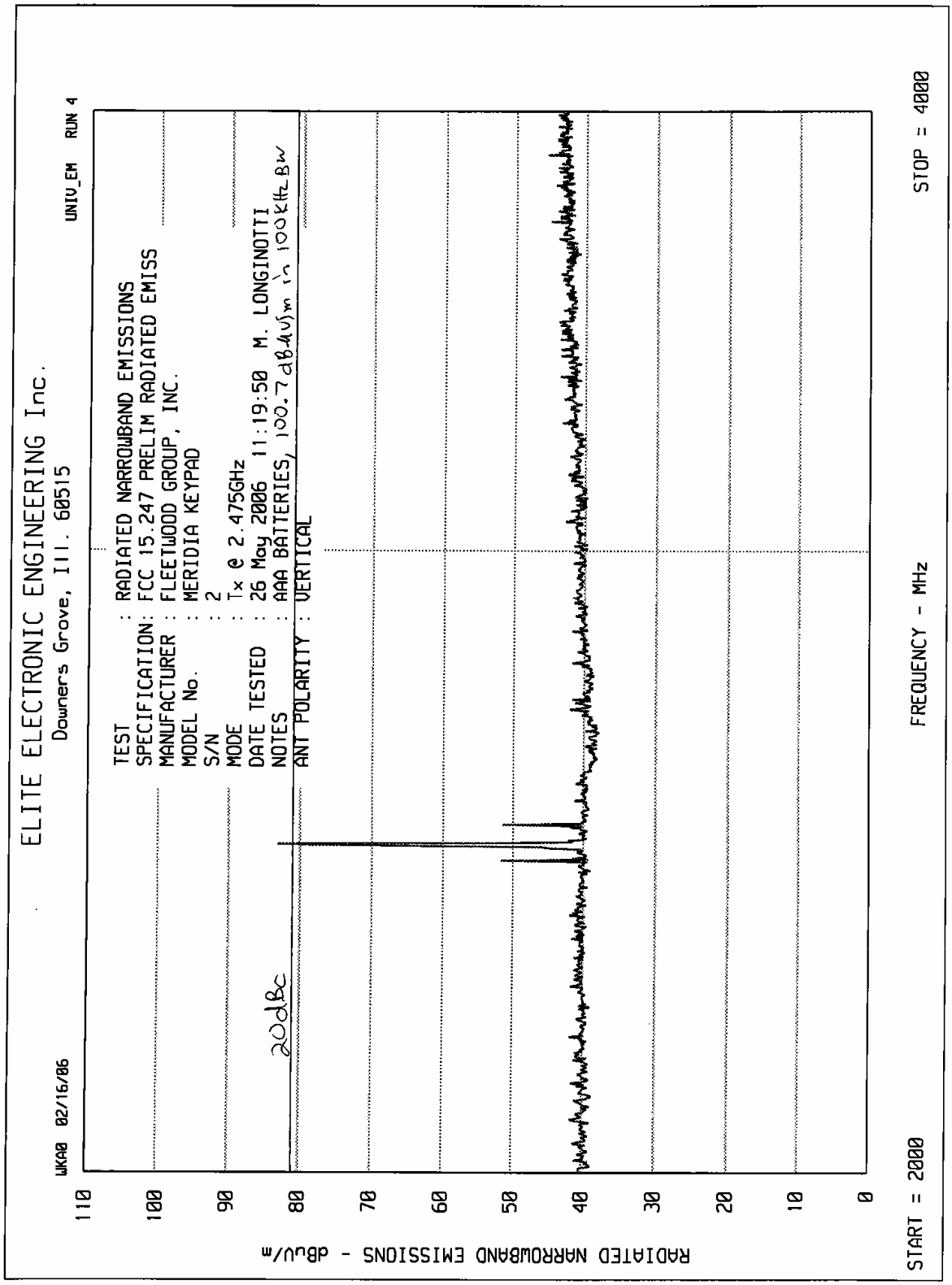

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : Tx @ 2.401GHz
DATE TESTED : 26 May 2006 11:04:50 M. LONGINOTTI
NOTES : AAA BATTERIES, 101.6 dBuV/m in 100kHz BW
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 4000
10000
FREQUENCY - MHz
STOP = 18000

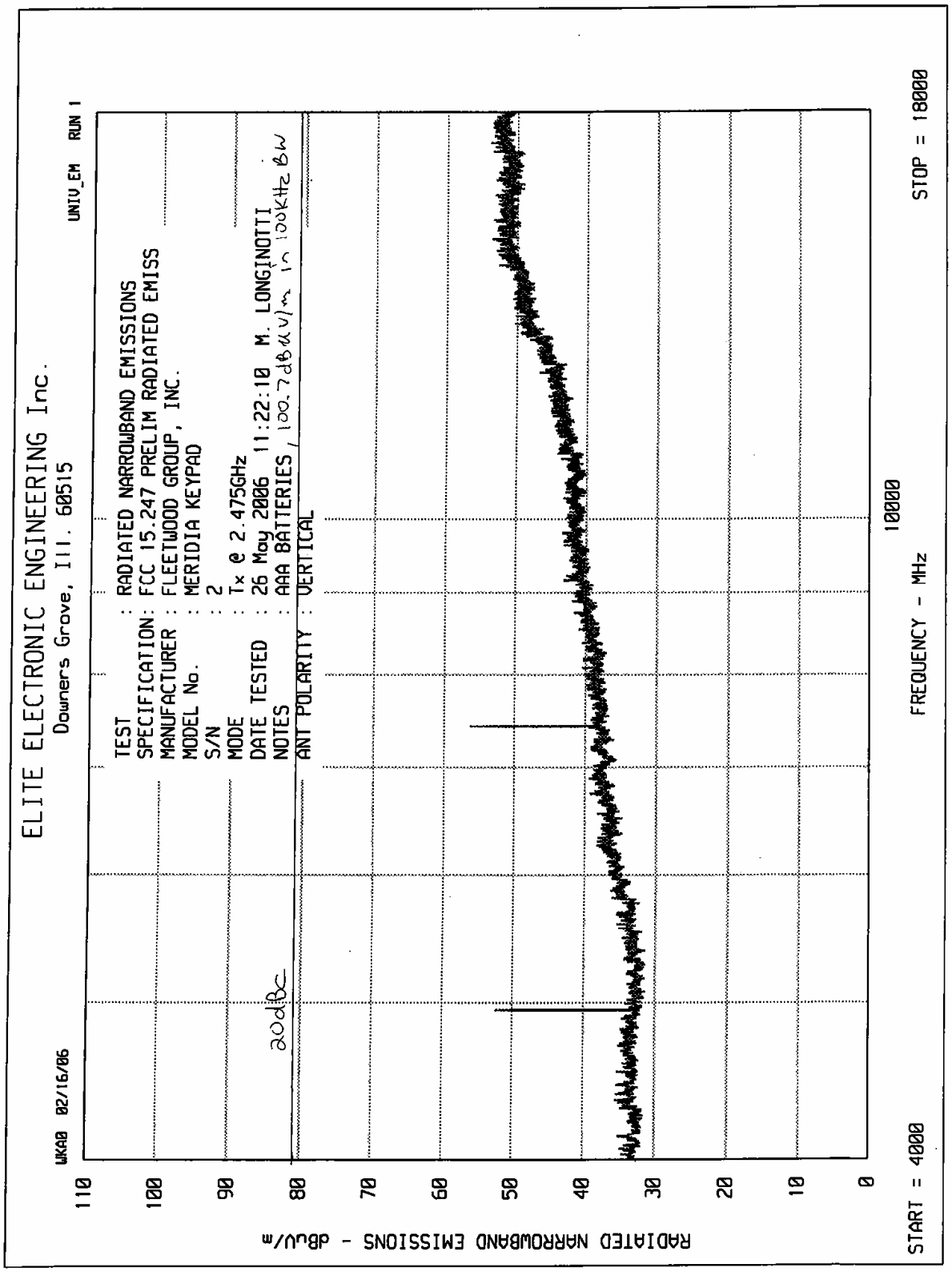

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : 1x @ 2.438GHz
DATE TESTED : 26 May 2006 09:37:06 M. LONGINOTTI
NOTES : 20dBc
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
1000
STOP = 2000
FREQUENCY - MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 4
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : Tx @ 2.438GHz
DATE TESTED : 26 May 2006 11:12:18 M. LONGINOTTI
NOTES : AAA BATTERIES, 120dBuV/m in 120kHz BW
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 2000
FREQUENCY - MHz
STOP = 4000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : Tx @ 2.438GHz
DATE TESTED : 26 May 2006 11:13:31 M. LONGINOTTI
NOTES : AAA BATTERIES, 192dB uV/m in 100KHz BW
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 4000
10000
FREQUENCY - MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : 1x @ 2.475GHz
DATE TESTED : 26 May 2006 09:40:41 M. LONGINOTTI
NOTES : AAA BATTERIES, 100.7dBuV/m in 100KHz BW
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
1000
STOP = 2000
FREQUENCY - MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 4
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : Tx @ 2.475GHz
DATE TESTED : 26 May 2006 11:19:50 M. LONGINOTTI
NOTES : AAA BATTERIES, 100.7dBuV/m in 100kHz Bw
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 2000
FREQUENCY - MHz
STOP = 4000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RADIATED EMISS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : MERIDIA KEYPAD
S/N : 2
MODE : Tx @ 2.475GHz
DATE TESTED : 26 May 2006 11:22:10 M. LONGINOTTI
NOTES : AAA BATTERIES / 100.7dBuV in 100kHz BW
ANT POLARITY : VERTICAL
20dBc
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 4000
10000
FREQUENCY - MHz
STOP = 18000

Data Sheet

MANUFACTURER : Fleetwood Group, Inc.
MODEL : Meridia Keypad
S/N : 2
SPECIFICATION : FCC Part 15, Subpart C, Section 15.247
Radiated Spurious Emissions Measurement
DATE : May 30, 2006 through June 1, 2006
NOTES : Transmitting at 2.401GHz

Freq MHz	Ant Pol	Meter Rdg dBuV	Amb	BW RBW/VBW Hz	Ant Fac dB	Cable Loss dB	Pre Amp Gain dB	D.C. Corr. Factor dB	Distance Corr. Factor dB	Total dBuV/m	15.247 Limit dBuV/m
2401	V	100.8		100k/300k	31.4	3.5	35.9			99.8	
2401	H	102.6		100k/300k	31.4	3.5	35.9			101.6	
4802	V	57.4		1M/3M	34.5	4.9	35.2			61.6	74
4802	V	44		1M/10	34.5	4.9	35.2	22.8		25.4	54
4802	H	63.4		1M/3M	34.5	4.9	35.2			67.6	74
4802	H	49.9		1M/10	34.5	4.9	35.2	22.8		31.3	54
7203	V	60.8		100k/300k	38	6.6	35.5			69.9	81.6
7203	H	65.2		100k/300k	38	6.6	35.5			74.3	81.6
12005	V	41.8	Amb	1M/3M	41.4	1	34.8			49.4	74
12005	V	29.1	Amb	1M/10	41.4	1	34.8			36.7	54
12005	H	43.3	Amb	1M/3M	41.4	1	34.8			50.9	74
12005	H	29.6	Amb	1M/10	41.4	1	34.8			37.2	54
19208	V	41.4	Amb	1M/3M	45.6	2.2	26.2		9.5	53.5	74
19208	V	28.9	Amb	1M/10	45.6	2.2	26.2		9.5	41	54
19208	H	42.3	Amb	1M/3M	45.6	2.2	26.2		9.5	54.4	74
19208	H	29	Amb	1M/10	45.6	2.2	26.2		9.5	41.1	54

Amb = Ambient

D.C. = Duty Cycle Correction Factor = 20*log((dwell time)/100msec)= 20*log(7.224/100) = -22.8dB

Distance Correction Factor = 20*log(1m/3m) = -9.5dB

Total = Meter reading + antenna factor + cable loss – pre amp gain – D.C. correction factor – distance correction factor

Checked By: MARK E. LONGINOTTI

Data Sheet

MANUFACTURER : Fleetwood Group, Inc.
MODEL : Meridia Keypad
S/N : 2
SPECIFICATION : FCC Part 15, Subpart C, Section 15.247
Radiated Spurious Emissions Measurement
DATE : May 30, 2006 through June 1, 2006
NOTES : Transmitting at 2.435 GHz

Freq MHz	Ant Pol	Meter Rdg dBuV	Amb	BW RBW/VBW Hz	Ant Fac dB	Cable Loss dB	Pre Amp Gain dB	D.C. Corr. Factor dB	Distance Corr. Factor dB	Total dBuV/m	15.247 Limit dBuV/m
2435	V	100.4		100k/300k	31.4	3.5	35.9			99.4	
2435	H	103		100k/300k	31.4	3.5	35.9			102	
4870	V	55.3		1M/3M	34.5	4.9	35.2			59.5	74
4870	V	42.2		1M/10	34.5	4.9	35.2	22.8		23.6	54
4870	H	55.5		1M/3M	34.5	4.9	35.2			59.7	74
4870	H	42.2		1M/10	34.5	4.9	35.2	22.8		23.6	54
7305	V	61.3		1M/3M	38.1	6.7	35.6			70.5	74
7305	V	47.3		1M/10	38.1	6.7	35.6	22.8		33.7	54
7305	H	64.5		1M/3M	38.1	6.7	35.6			73.7	74
7305	H	50.2		1M/10	38.1	6.7	35.6	22.8		36.6	54
12175	V	44.1	Amb	1M/3M	41.4	1	34.6			51.9	74
12175	V	30.5	Amb	1M/10	41.4	1	34.6			38.3	54
12175	H	44.5	Amb	1M/3M	41.4	1	34.6			52.3	74
12175	H	30.2	Amb	1M/10	41.4	1	34.6			38	54
19480	V	40.2	Amb	1M/3M	45.8	1.6	27		9.5	51.1	74
19480	V	28.3	Amb	1M/10	45.8	1.6	27		9.5	39.2	54
19480	H	41.1	Amb	1M/3M	45.8	1.6	27		9.5	52	74
19480	H	28.6	Amb	1M/10	45.8	1.6	27		9.5	39.5	54

Amb = Ambient

D.C. = Duty Cycle Correction Factor = 20*log((dwell time)/100msec)= 20*log(7.224/100) = -22.8dB

Distance Correction Factor = 20*log(1m/3m) = -9.5dB

Total = Meter reading + antenna factor + cable loss – pre amp gain – D.C. correction factor – distance correction factor

Checked By: MARK E. LONGINOTTI

Data Sheet

MANUFACTURER : Fleetwood Group, Inc.
MODEL : Meridia Keypad
S/N : 2
SPECIFICATION : FCC Part 15, Subpart C, Section 15.247
Radiated Spurious Emissions Measurement
DATE : May 30, 2006 through June 1, 2006
NOTES : Transmitting at 2.475 GHz

Freq MHz	Ant Pol	Meter Rdg dBuV	Amb	BW RBW/VBW Hz	Ant Fac dB	Cable Loss dB	Pre Amp Gain dB	D.C. Corr. Factor dB	Distance Corr. Factor dB	Total dBuV/m	15.247 Limit dBuV/m
2475	V	100.9		100k/300k	31.4	3.5	35.9			99.9	
2475	H	101.7		100k/300k	31.4	3.5	35.9			100.7	
4950	V	58.3		1M/3M	34.5	5	35.2			62.6	74
4950	V	44.5		1M/10	34.5	5	35.2	22.8		26	54
4950	H	54.1		1M/3M	34.5	5	35.2			58.4	74
4950	H	40.7		1M/10	34.5	5	35.2	22.8		22.2	54
7425	V	57.2		1M/3M	38.1	6.7	35.6			66.4	74
7425	V	43		1M/10	38.1	6.7	35.6	22.8		29.4	54
7425	H	61.5		1M/3M	38.1	6.7	35.6			70.7	74
7425	H	47.5		1M/10	38.1	6.7	35.6	22.8		33.9	54
12375	V	45	Amb	1M/3M	41.3	1.1	34.3			53.1	74
12375	V	31.2	Amb	1M/10	41.3	1.1	34.3			39.3	54
12375	H	44.3	Amb	1M/3M	41.3	1.1	34.3			52.4	74
12375	H	30.4	Amb	1M/10	41.3	1.1	34.3			38.5	54
19800	V	40.7	Amb	1M/3M	45.9	2.6	27.1		9.5	52.6	74
19800	V	28.6	Amb	1M/10	45.9	2.6	27.1		9.5	40.5	54
19800	H	41	Amb	1M/10	45.9	2.6	27.1		9.5	52.9	74
19800	H	28.2	Amb	1M/10	45.9	2.6	27.1		9.5	40.1	54
22275	V	42	Amb	1M/3M	46.5	5	25.3		9.5	58.7	74
22275	V	29.3	Amb	1M/10	46.5	5	25.3		9.5	46	54
22275	H	40.5	Amb	1M/3M	46.5	5	25.3		9.5	57.2	74
22275	H	28.7	Amb	1M/10	46.7	5	25.3		9.5	45.6	54

Amb = Ambient

D.C. = Duty Cycle Correction Factor = 20*log((dwell time)/100msec)= 20*log(7.224/100) = -22.8dB

Distance Correction Factor = 20*log(1m/3m) = -9.5dB

Total = Meter reading + antenna factor + cable loss – pre amp gain – D.C. correction factor – distance correction factor

Checked By: MARK E. LONGINOTTI