Measurement of RF Interference from a Model ECM984 Digicall Spectrum System Console Transceiver

For : Fleetwood Group, Inc.
Holland, MI

P.O. No. : P53152-00
Date Received : August 17, 2006
Date Tested : August 17, 2006 and August 18, 2006
Test Personnel : Mark E. Longinotti, NARTE® Certified EMC Test Engineer, ATL-0154-E
Specification : FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and Subpart C, Section 15.249 for Intentional Radiators Operating within the 902MHz to 928MHz band

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

TABLE I - EQUIPMENT LIST 13

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

REVISION HISTORY

Revision	Date	Description
—	September 7, 2006	Initial release

Measurement of RF Emissions from a Transceiver,
Model No. ECM984 Digicall Spectrum System Console

1.0 INTRODUCTION:

1.1 Description of Test Item - This document presents the results of the series of radio interference measurements performed on a Transceiver, Model No.ECM984 Digicall Spectrum System Console, Serial No. Proto 1 (hereinafter referred to as the test item). The test item was designed to transmit in the frequency range of 921.25MHz to 927.45MHz using an internal antenna. The test item was designed to receive in the frequency range of 902.55MHz to 908.75MHz using a second internal antenna. The LO of the receiver was two times the tuned frequency. The test item was 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, and Subpart C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 902MHz -928MHz band. 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, dated 1 October 2005

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 23°C and the relative humidity was 47%.

2.0 TEST ITEM SET-UP AND OPERATION:

The test item is a Transceiver, Model No. ECM984 Digicall Spectrum System Console. A block diagram of the test item set-up is shown as Figure 1.

2.1 Power Input - The test item was powered with 115V, 60Hz via a 3 wire, 2.25m long unshielded power cable. For conducted emissions tests, each AC power lead to the test item was connected through a line impedance stabilization network (LISN) which was located on the ground plane. The network complies with the requirements of Paragraph 4.1.2 of ANSI C63.4-2003.

2.2 Grounding - The test item was grounded only through the third wire of its input power cord.

2.3 Peripheral Equipment - The test item was submitted for testing with headphones with built in microphone.

2.4 Interconnect Cables - The test item was connected to the headphones with built in microphone via a 1.55 meter long cable.

2.5 Operational Mode - For all tests, the test item was placed on an 80cm high non-conductive stand. The test item was energized. The test item was programmed separately so that it would receive continuously at 904.545MHz and 908.75MHz. The test item was programmed separately so that it would transmit continuously at 921.25MHz and 927.45MHz.

2.6 Test Item Modifications - No modifications were required for compliance to the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109, and Subpart C, Sections 15.207 and 15.249 requirements.

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).

3.3 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 budgets were based on guidelines in "ISO Guide to the Expression of Uncertainty in Measurements" and NAMAS NIS81 "The Treatment of Uncertainty in EMC Measurements".

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

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 Powerline Conducted Emissions

4.1.1 Receiver

4.1.1.1 Requirements - Per 15.107(a), all radio frequency voltages on the power lines of a receiver shall be below the values shown below when using a quasi-peak detector:

CONDUCTED LIMITS FOR CLASS B DEVICE

Frequency MHz	RFI Voltage dBuV(QP)	RFI Voltage dBuV(Average)
0.15-0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5-5	56	46
5-30	60	50

Note 1: The lower limit shall apply at the transition frequencies.
Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the test item is considered to have met both requirements and measurements do not need to be performed using the Average detector.

4.1.1.2 Procedures - The interference on each power lead was measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. The meter terminal of the LISN not under test was terminated with 50 ohm. Measurements were first made over the entire frequency range from 150kHz through 30MHz with a peak detector and the results were automatically plotted. The data thus obtained was then searched by the computer for the highest levels. Quasi-peak

measurements were automatically performed at the frequencies selected from the highest peak measurements, and the results printed.

4.1.1.3 Results - The plots of the peak preliminary conducted voltage levels on each power line with the test item operated in the continuous receive at 908.75MHz mode are presented on pages 18 and 19. The conducted limit for receivers is shown as a reference. The final quasi-peak results are presented on pages 20 and 21. As can be seen from the data, all conducted emission levels met the requirements for receivers. The emissions level closest to the limit (worst case) occurred at 1.961MHz. The emissions level at this frequency was 4.1dB within the limit. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 2.

4.1.2 Transmitter

4.1.2.1 Requirements - Per 15.207(a), all radio frequency voltages on the power lines of a transmitter shall be below the values shown below when using a quasi-peak detector:

CONDUCTED LIMITS FOR CLASS B DEVICE

Frequency MHz	RFI Voltage dBuV(QP)	RFI Voltage dBuV(Average)
0.15-0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5-5	56	46
5-30	60	50

Note 1: The lower limit shall apply at the transition frequencies.
Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the test item is considered to have met both requirements and measurements do not need to be performed using the Average detector.

4.1.2.2 Procedures - The interference on each power lead was measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. The meter terminal of the LISN not under test was terminated with 50 ohm. Measurements were first made over the entire frequency range from 150kHz through 30MHz with a peak detector and the results were automatically plotted. The data thus obtained was then searched by the computer for the highest levels. Quasi-peak measurements were automatically performed at the frequencies selected from the highest peak measurements, and the results printed.

4.1.2.3 Results - The plots of the peak preliminary conducted voltage levels on each power line with the test item operated in the continuous transmit at 927.45MHz mode are presented

on pages 22 and 23. The conducted limit for receivers is shown as a reference. The final quasi-peak results are presented on pages 24 and 25. As can be seen from the data, all conducted emission levels met the requirements for transmitters. The emissions level closest to the limit (worst case) occurred at 2.283MHz. The emissions level at this frequency was 5.0dB 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 Radiated Measurements

4.2.1 Receiver

4.2.1.1 Requirements - - All emanations from a receiver shall be below the levels shown on the following table:

RADIATION LIMITS FOR CLASS B DEVICE

Frequency MHz	Distance between Test Item And Antenna in Meters	Field Strength uV/m	Field Strength dBuV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
Above 960	3	500	54

Note: The tighter limit shall apply at the edge between the two frequency bands.

4.2.1.2 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 2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Since quasi-peak and average measurements require long integration times, it is not practical to automatically sweep through the quasi-peak or average levels. Therefore, radiated emissions from the test item were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak or average detector.

For preliminary radiated emissions sweeps from 30MHz to 10GHz, the broadband measuring antenna was positioned at a 3 meter distance from the test item. The frequency range from 30MHz to

10GHz was investigated using a peak detector function with the bilog antenna below 1GHz and the double-ridged waveguide antenna above 1GHz. The maximum levels were plotted.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) Measurements below 1GHz were made using a quasi-peak detector and a tuned dipole antenna. Measurements above 1GHz were made using an average detector and a double ridged waveguide antenna.

2) To ensure that maximum or worst case, 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 antenna is 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.

4.2.1.3 Results - The preliminary plots with the test item programmed to receive continuously at 904.545MHz are presented on pages 26 and 27. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on page 28. As can be seen from the data, all emissions measured from the test item were within the specification limits for receivers. The emissions level closet to the limit (worst case) occurred at 9045.5MHz. The emissions level at this frequency was 11.7dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 3a and 3b.

The preliminary plots with the test item programmed to receive continuously at 908.75MHz are presented on pages 29 and 30. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on page 31. As can be seen from the data, all emissions measured from the test item were within the specification limits for receivers. The emissions level closet to the limit (worst case) occurred at 9087.5MHz. The emissions level at this frequency was 11.0dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 3a and 3b.

4.2.2 Transmitters -

4.2.2.1 Requirements - The test item must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.205 et seq.

Paragraph 15.249(a) has the following radiated emission limits:

Fundamental Frequency MHz	Field Intensity mV/m @ 3 meters	Field Strength Harmonics and Spurious uV/m @ 3 meters
902 to 928	50	500

4.2.2.2 Procedures - All measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. 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. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

A preliminary radiated emissions test was performed to determine the emission characteristics of the test item. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the test item. The entire frequency range from 30MHz to 10GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final emission tests were then manually performed over the frequency range of 30MHz to 9.1GHz. Between 30MHz and 1000MHz, a tuned dipole antenna was used as the pick-up device. A broadband double ridged waveguide antenna was used as the pick-up device for all frequencies above 1GHz. All significant broadband and narrowband signals were measured and recorded.

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

(1) The test item was rotated so that all of its sides were exposed to the receiving antenna.
(2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
(3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

4.2.2.3 Results - The preliminary plots, with the test item transmitting at 921.25MHz, are presented on data pages 32 and 33. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels, with the test item transmitting at

921.25MHz, are presented on data page 34. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closet to the limit (worst case) occurred at 921.25MHz. The emissions level at this frequency was 3.0dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 3a and 3b.

The preliminary plots, with the test item transmitting at 927.45MHz, are presented on data pages 35 and 36. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels, with the test item transmitting at 927.45MHz, are presented on data page 37. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closet to the limit (worst case) occurred at 927.45MHz. The emissions level at this frequency was 1.3dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 3a and 3b.

4.3 Occupied Bandwidth Measurements

4.3.1 Requirement - In accordance with paragraph 15.249(d), all emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuate by at least 50dB below the level of the fundamental or to the general radiated emissions limits in 15.209, which ever is the lesser attenuation.

4.3.2 Procedures - The test item was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously at 927.45MHz. With an antenna positioned nearby, occupied bandwidth emissions were displayed on the spectrum analyzer. The resolution bandwidth was set to 30 kHz and span was set to 2MHz. The frequency spectrum near the fundamental was plotted.

4.3.3 Results - The plot of the emissions near the fundamental frequency is presented on data page 38. As can be seen from this data page, the transmitter met the occupied bandwidth requirements.

5.0 CONCLUSIONS:

It was determined that the Fleetwood Group, Inc. Transceiver, Model No. ECM984 Digicall Spectrum System Console, Serial No. Proto 1 did fully meet the conducted and radiated 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, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 902MHz -928MHz band, when tested per ANSI C63.4-2003.

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								
XZG4	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2223A01683	---		N/A	
Equipment Type: AMPLIFIERS								
APK4	PREAMPLIFIER OPT H02	HEWLETT PACKARD	8449B	3008A00329	1-26.5GHZ	01/31/06	12	01/31/07
Equipment Type: ANTENNAS								
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	03/10/06	12	03/10/07
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2054	0.03-2GHZ	05/23/06	12	05/23/07
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	10/01/05	12	10/01/06
Equipment Type: ATTENUATORS								
T1N1	10DB 20W ATTENUATOR	NARDA	766-10		DC-4GHZ	09/07/05	12	09/07/06
Equipment Type: CONTROLLERS								
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ	0028483108	1.8GHZ		N/A	
Equipment Type: PROBES; CLAMP-ON & LISNS								
PLL9	50UH LISN 462D	ELITE	462D/70A	010	0.01-400MHZ	03/06/06	12	03/06/07
PLLA	50UH LISN 462D	ELITE	462D/70A	011	0.01-400MHZ	03/06/06	12	03/06/07
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A	
Equipment Type: RECEIVERS								
RACA	RF PRESELECTOR	HEWLETT PACKARD	85685A	2926A00980	20HZ-2GHZ	02/11/06	12	02/11/07
RAEC	SPECTRUM ANALYZER	HEWLETT PACKARD	8566B	3014A06690	100HZ-22GHZ	02/10/06	12	02/10/07
RAF5	QUASIPEAK ADAPTOR W/ RECEI	HEWLETT PACKARD	85650A	2043A00151	0.01-1000MHZ	02/11/06	12	02/11/07
Equipment Type: SIGNAL GENERATORS								
GWH2	DDS FUNCTION GENERATOR	WAVETEK	29	079190	0.0001HZ-10MHZ	08/11/06	12	08/11/07

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.

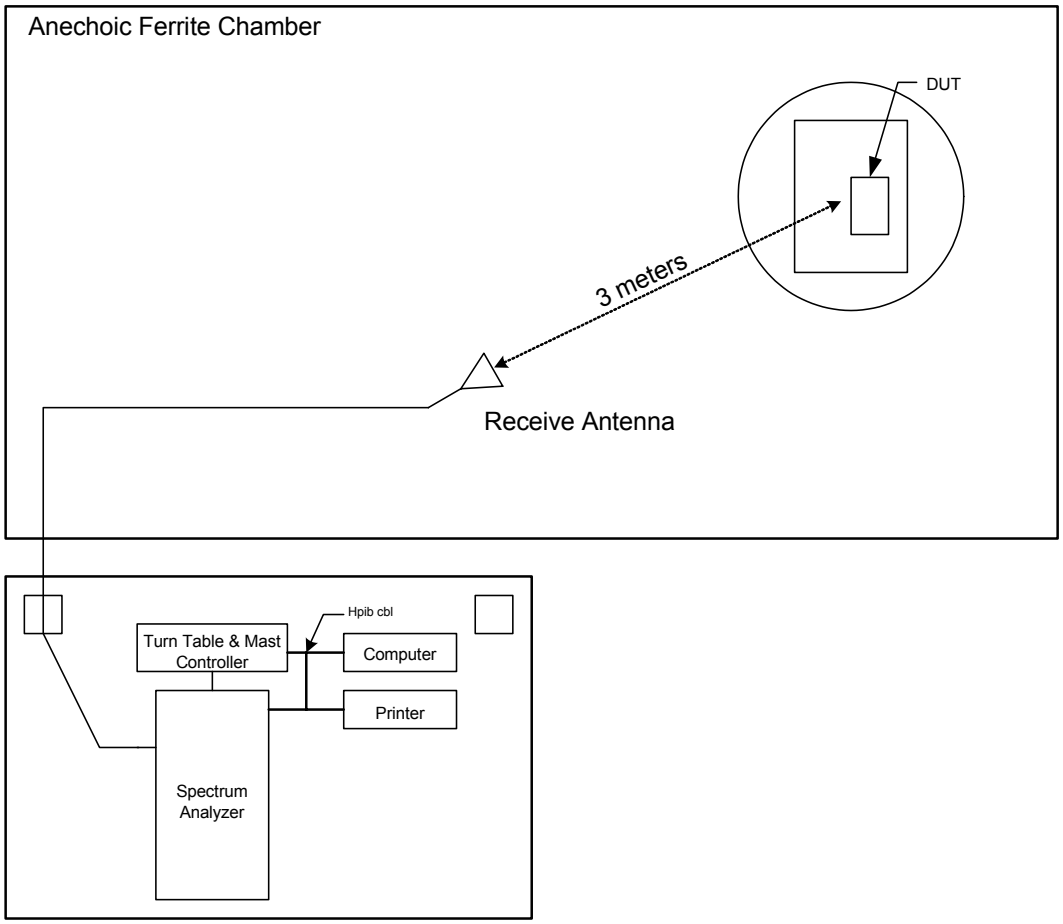


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

Test Setup for Conducted Emissions

Figure 3a

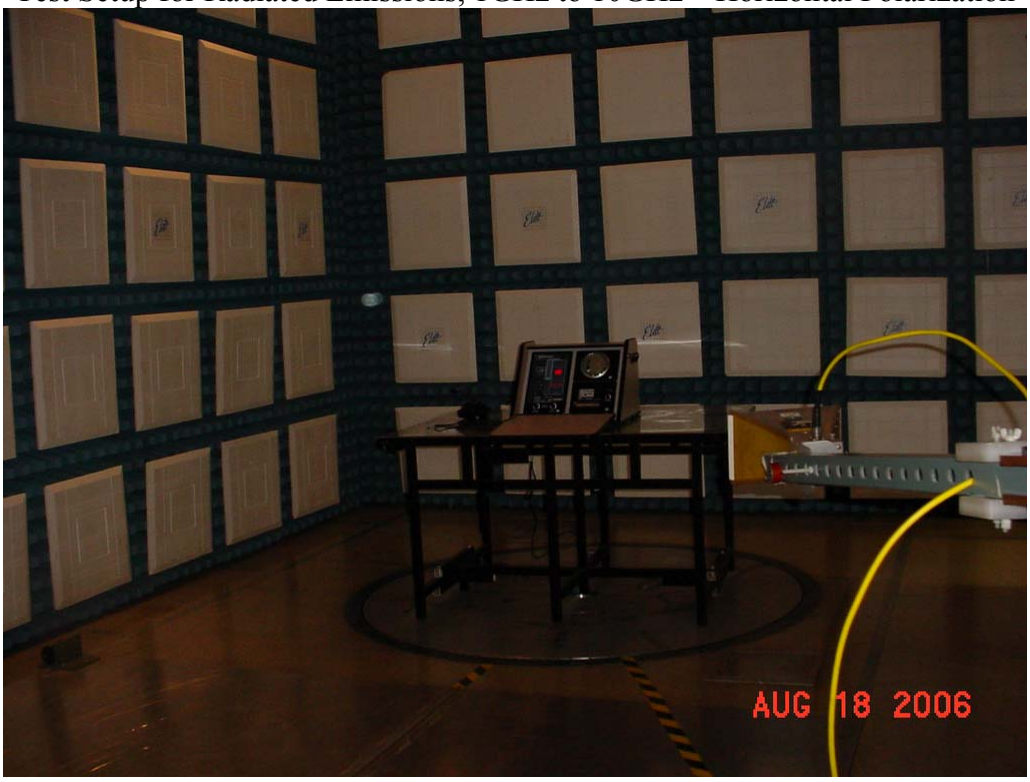
Test Setup for Radiated Emissions, 904MHz to 927MHz– Horizontal Polarization

Test Setup for Radiated Emissions, 904MHz to 927MHz – Vertical

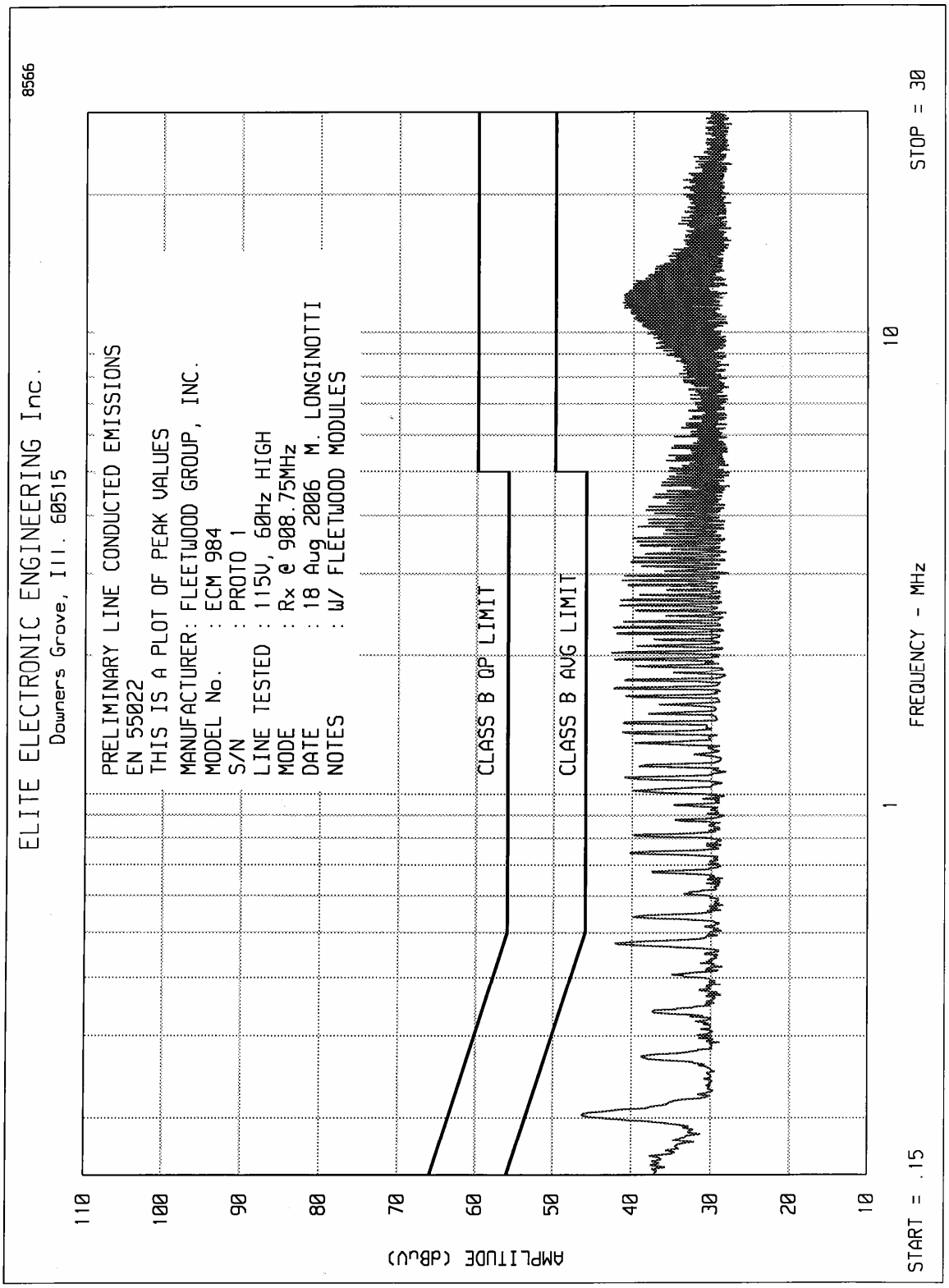
Polarization

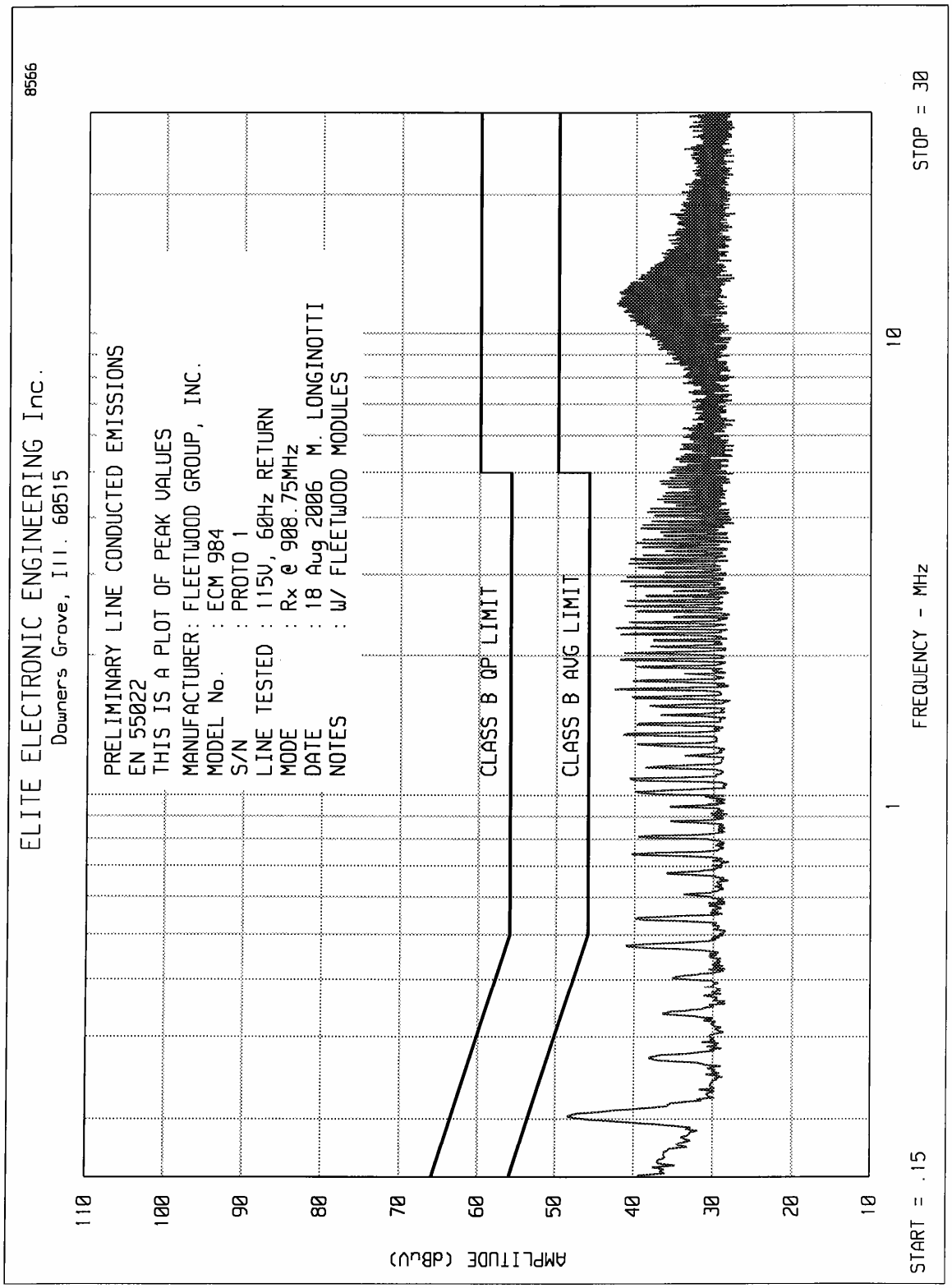
Figure 3b

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



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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8566
PRELIMINARY LINE CONDUCTED EMISSIONS
EN 55022
THIS IS A PLOT OF PEAK VALUES
MANUFACTURER: FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
LINE TESTED : 115V, 60Hz HIGH
MODE : Rx @ 908.75MHz
DATE : 18 Aug 2006 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
CLASS B QP LIMIT
CLASS B AVG LIMIT
AMPLITUDE (dBuV)
110
100
90
80
70
60
50
40
30
20
10
START = .15
1
10
STOP = 30
FREQUENCY - MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8566
PRELIMINARY LINE CONDUCTED EMISSIONS
EN 55022
THIS IS A PLOT OF PEAK VALUES
MANUFACTURER: FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
LINE TESTED : 115V, 60Hz RETURN
MODE : Rx @ 908.75MHz
DATE : 18 Aug 2006 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
CLASS B QP LIMIT
CLASS B AVG LIMIT
AMPLITUDE (dBuV)
110
100
90
80
70
60
50
40
30
20
10
START = .15
1
10
STOP = 30
FREQUENCY - MHz

ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL : ECM 984
S/N : PROTO 1
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz HIGH
MODE : Rx @ 908.75MHz
DATE : 18 Aug 2006
NOTES : W/ FLEETWOOD MODULES
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.205	44.6	63.4		53.4	
.272	35.7	61.0		51.0	
.341	34.6	59.2		49.2	
.408	31.5	57.7		47.7	
.476	40.6	56.4		46.4	
.746	38.9	56.0		46.0	
.814	37.9	56.0		46.0	
1.355	40.1	56.0		46.0	
1.693	40.9	56.0		46.0	
2.031	40.9	56.0		46.0	
2.301	41.4	56.0		46.0	
2.572	40.7	56.0		46.0	
3.180	39.9	56.0		46.0	
3.248	39.2	56.0		46.0	
4.127	37.0	56.0		46.0	
6.223	31.7	60.0		50.0	
9.943	36.5	60.0		50.0	
11.363	40.3	60.0		50.0	
11.567	40.6	60.0		50.0	
11.770	40.7	60.0		50.0	
12.581	39.4	60.0		50.0	
13.461	36.6	60.0		50.0	
15.016	32.9	60.0		50.0	
19.007	31.1	60.0		50.0	
20.630	31.1	60.0		50.0	
24.013	28.8	60.0		50.0	
26.989	27.8	60.0		50.0	

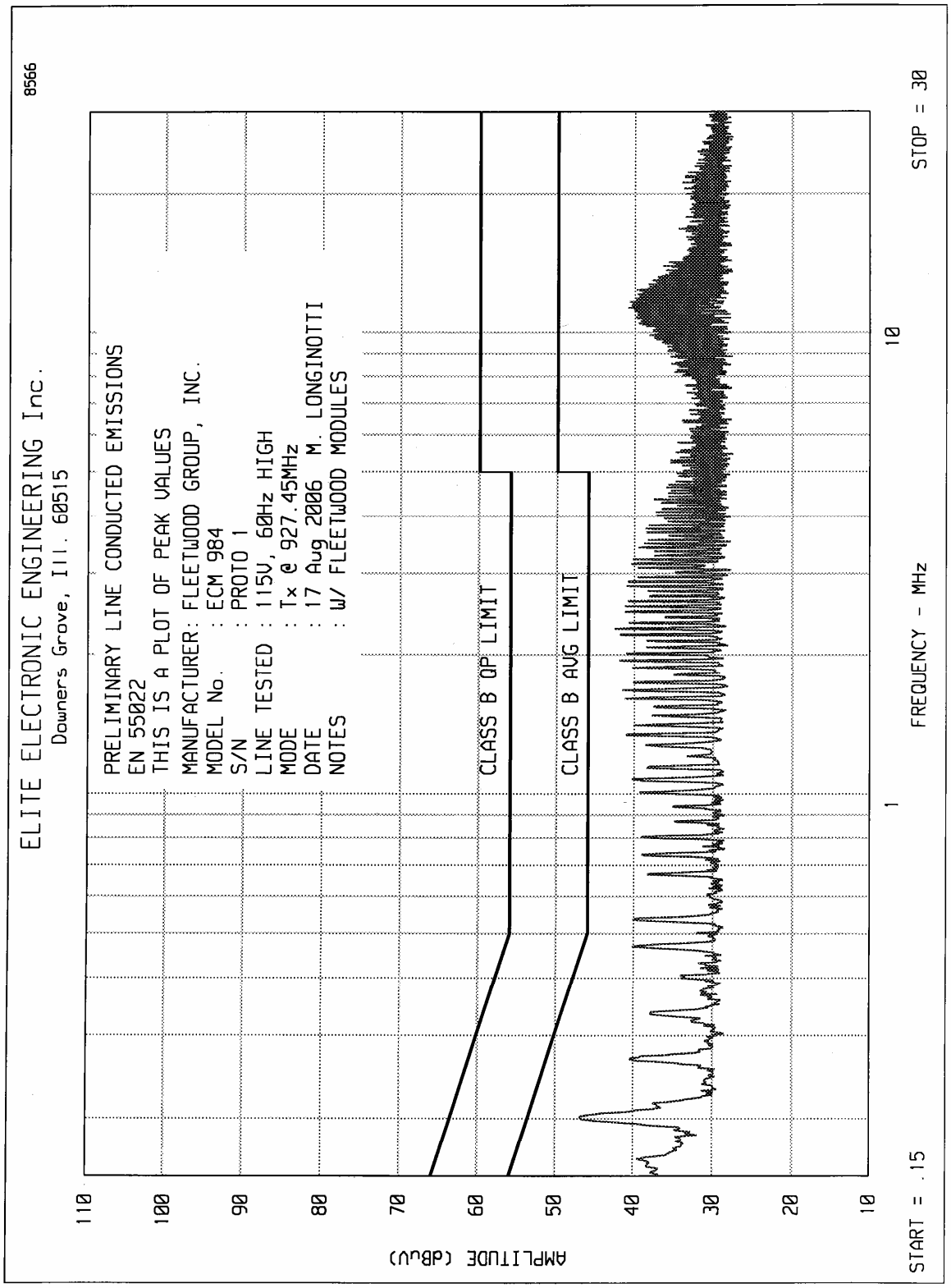
CHECKED BY: Mark E. Longinotti
M. LONGINOTTI

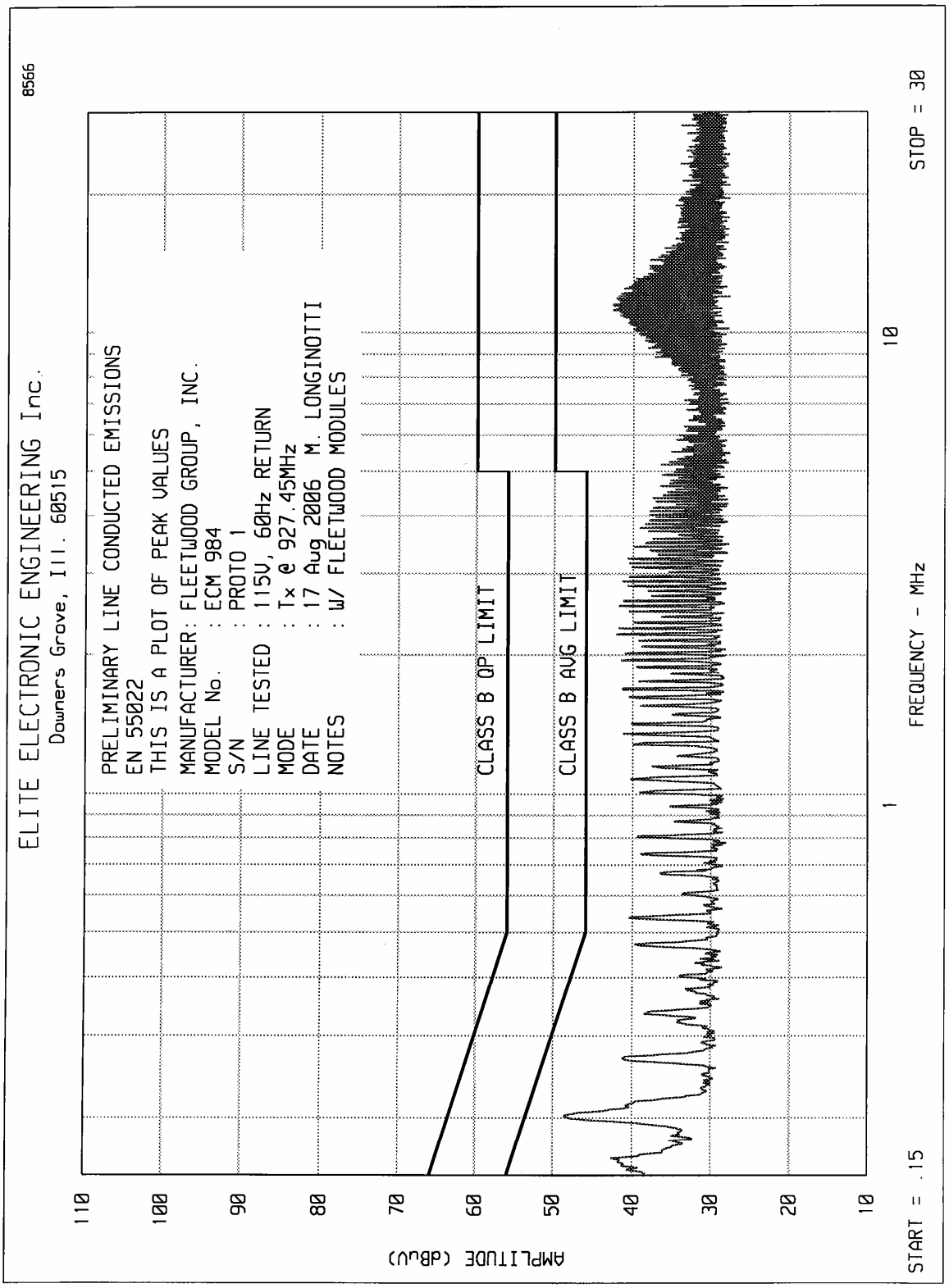
ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL : ECM 984
S/N : PROTO 1
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz RETURN
MODE : Rx @ 908.75MHz
DATE : 18 Aug 2006
NOTES : W/ FLEETWOOD MODULES
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.205	46.9	63.4		53.4	
.340	33.3	59.2		49.2	
.408	32.8	57.7		47.7	
.475	40.1	56.4		46.4	
.746	38.8	56.0		46.0	
.880	32.7	56.0		46.0	
1.353	40.1	56.0		46.0	
1.691	40.2	56.0		46.0	
1.961	41.9	56.0		46.0	
2.907	41.0	56.0		46.0	
3.177	40.4	56.0		46.0	
4.123	37.3	56.0		46.0	
4.731	35.6	56.0		46.0	
5.001	34.6	60.0		50.0	
9.663	36.6	60.0		50.0	
9.934	37.5	60.0		50.0	
11.556	41.7	60.0		50.0	
11.624	41.9	60.0		50.0	
11.691	41.9	60.0		50.0	
12.637	40.7	60.0		50.0	
13.381	38.4	60.0		50.0	
18.043	33.0	60.0		50.0	
20.409	31.6	60.0		50.0	
24.328	30.5	60.0		50.0	
27.978	30.0	60.0		50.0	

CHECKED BY: Mark E Longinotti
M. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8566
PRELIMINARY LINE CONDUCTED EMISSIONS
EN 55022
THIS IS A PLOT OF PEAK VALUES
MANUFACTURER: FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
LINE TESTED : 115V, 60Hz HIGH
MODE : Tx @ 927.45MHz
DATE : 17 Aug 2006 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
CLASS B QP LIMIT
CLASS B AVG LIMIT
AMPLITUDE (dBuV)
110
100
90
80
70
60
50
40
30
20
10
START = .15
1
10
STOP = 30
FREQUENCY - MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8566
PRELIMINARY LINE CONDUCTED EMISSIONS
EN 55022
THIS IS A PLOT OF PEAK VALUES
MANUFACTURER: FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
LINE TESTED : 115V, 60Hz RETURN
MODE : Tx @ 927.45MHz
DATE : 17 Aug 2006 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
CLASS B QP LIMIT
CLASS B AVG LIMIT
AMPLITUDE (dBuV)
110
100
90
80
70
60
50
40
30
20
10
START = .15
1
10
STOP = 30
FREQUENCY - MHz

ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL : ECM 984
S/N : PROTO 1
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz HIGH
MODE : Tx @ 927.45MHz
DATE : 17 Aug 2006
NOTES : W/ FLEETWOOD MODULES
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.203	45.5	63.5		53.5	
.270	37.3	61.1		51.1	
.338	35.9	59.3		49.3	
.472	38.1	56.5		46.5	
.539	38.4	56.0		46.0	
.740	37.5	56.0		46.0	
.807	37.7	56.0		46.0	
.941	32.9	56.0		46.0	
1.612	39.8	56.0		46.0	
1.947	40.5	56.0		46.0	
2.283	41.0	56.0		46.0	
2.484	39.8	56.0		46.0	
2.551	40.3	56.0		46.0	
3.155	39.3	56.0		46.0	
4.362	35.8	56.0		46.0	
4.631	34.8	56.0		46.0	
5.235	33.3	60.0		50.0	
8.523	32.6	60.0		50.0	
9.865	36.8	60.0		50.0	
11.342	39.9	60.0		50.0	
11.477	40.0	60.0		50.0	
11.746	39.9	60.0		50.0	
12.687	37.5	60.0		50.0	
13.895	33.8	60.0		50.0	
16.782	30.8	60.0		50.0	
21.079	30.7	60.0		50.0	
23.094	29.6	60.0		50.0	
25.781	28.2	60.0		50.0	

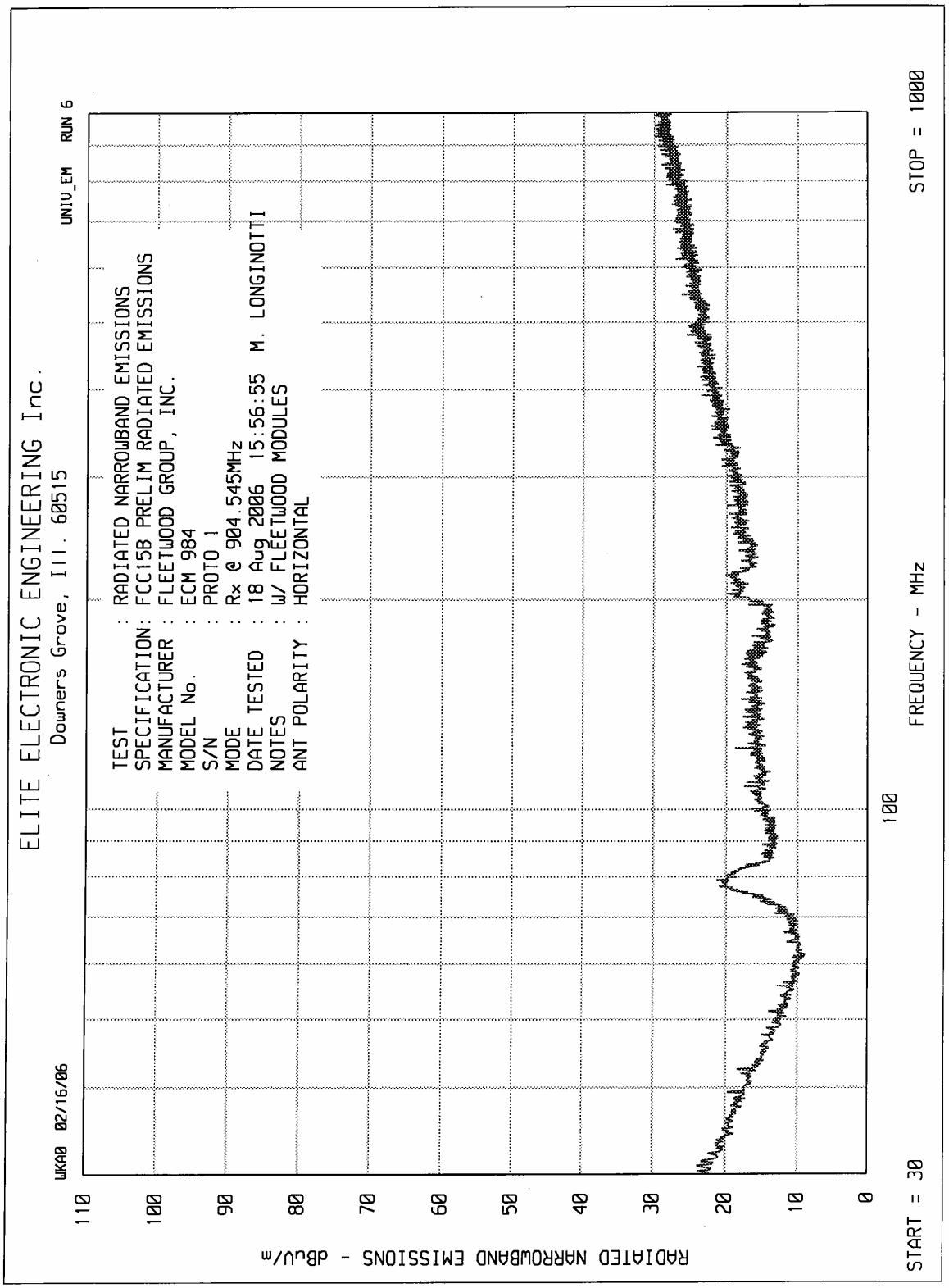
CHECKED BY: Mark E. Longinotti
M. LONGINOTTI

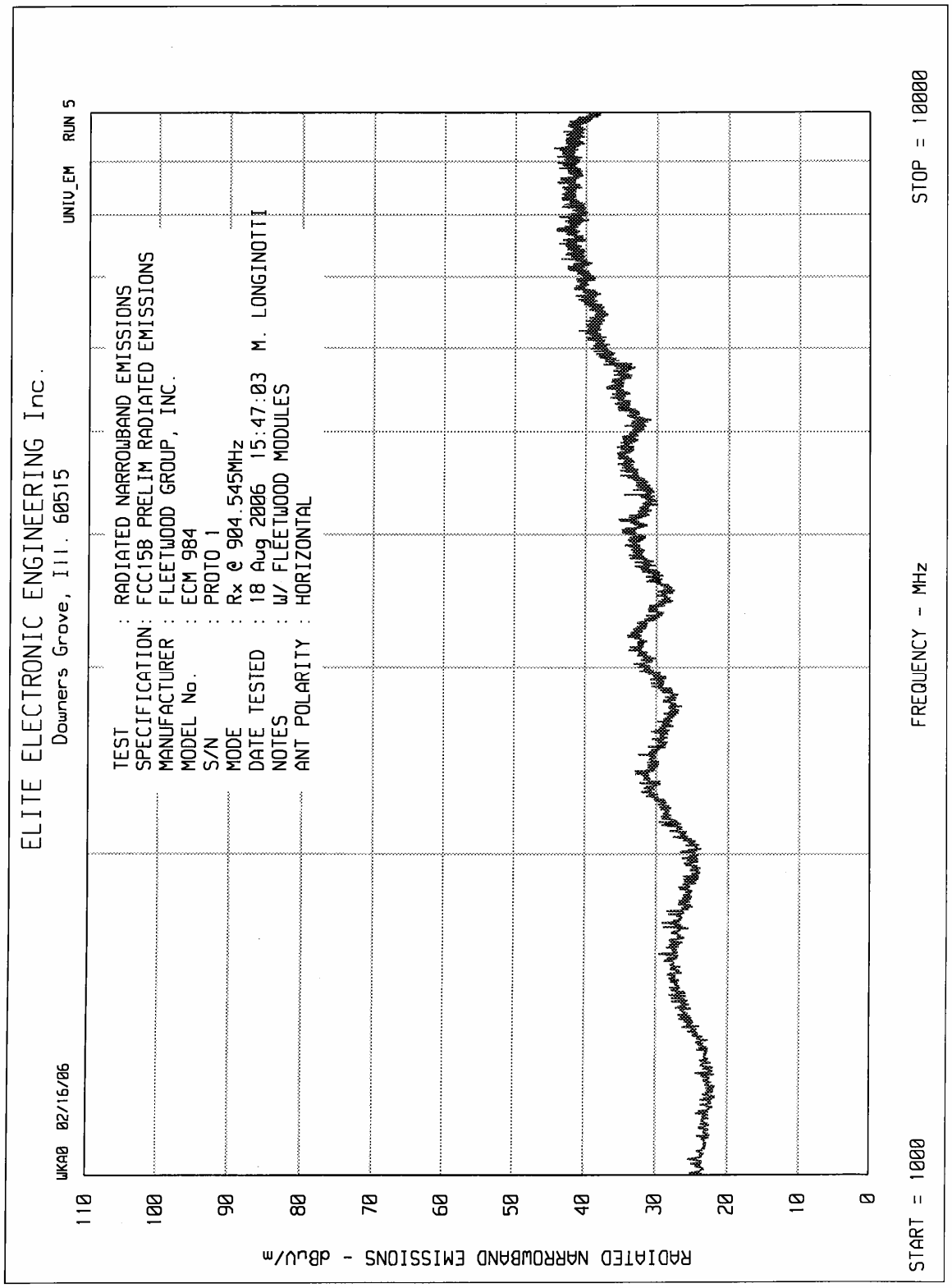
ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL : ECM 984
S/N : PROTO 1
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz RETURN
MODE : Tx @ 927.45MHz
DATE : 17 Aug 2006
NOTES : W/ FLEETWOOD MODULES
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.204	47.3	63.4		53.4	
.271	37.7	61.1		51.1	
.339	35.5	59.2		49.2	
.540	38.6	56.0		46.0	
.809	38.2	56.0		46.0	
.944	33.3	56.0		46.0	
1.347	40.1	56.0		46.0	
1.952	40.5	56.0		46.0	
2.221	41.0	56.0		46.0	
2.289	40.8	56.0		46.0	
2.557	40.2	56.0		46.0	
3.230	39.1	56.0		46.0	
4.037	37.1	56.0		46.0	
4.710	34.8	56.0		46.0	
7.064	31.1	60.0		50.0	
9.956	38.0	60.0		50.0	
11.168	41.9	60.0		50.0	
11.303	41.6	60.0		50.0	
11.841	41.5	60.0		50.0	
12.918	38.3	60.0		50.0	
13.390	37.5	60.0		50.0	
15.207	33.6	60.0		50.0	
17.629	32.4	60.0		50.0	
21.397	30.5	60.0		50.0	
24.830	30.5	60.0		50.0	
28.128	30.1	60.0		50.0	

CHECKED BY: Mark E. Longinotti
M. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 6
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15B PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Rx @ 904.545MHz
DATE TESTED : 18 Aug 2006 15:56:55 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 5
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15B PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Rx @ 904.545MHz
DATE TESTED : 18 Aug 2006 15:47:03 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

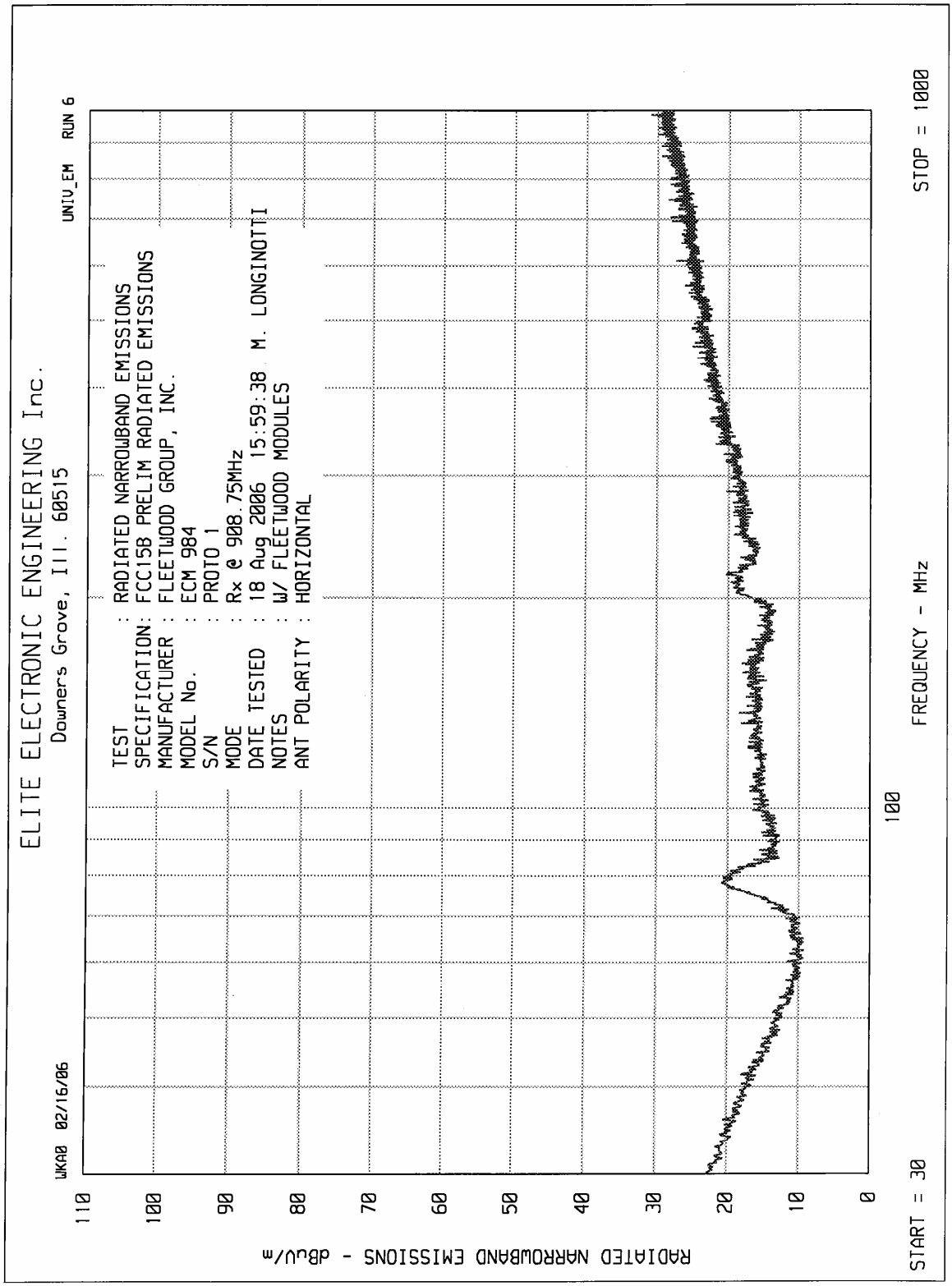
MANUFACTURER : Fleetwood Group, Inc.
TEST ITEM : Transceiver
MODEL NO. : ECM984 Digicall Spectrum System Console
SERIAL NO. : Proto 1
TEST SPECIFICATION : FCC 15.109(a), Radiated Emissions
MODE : Receive @ 904.545MHz
TEST DATE : August 17 and 18, 2006
TEST DISTANCE : 3 meters

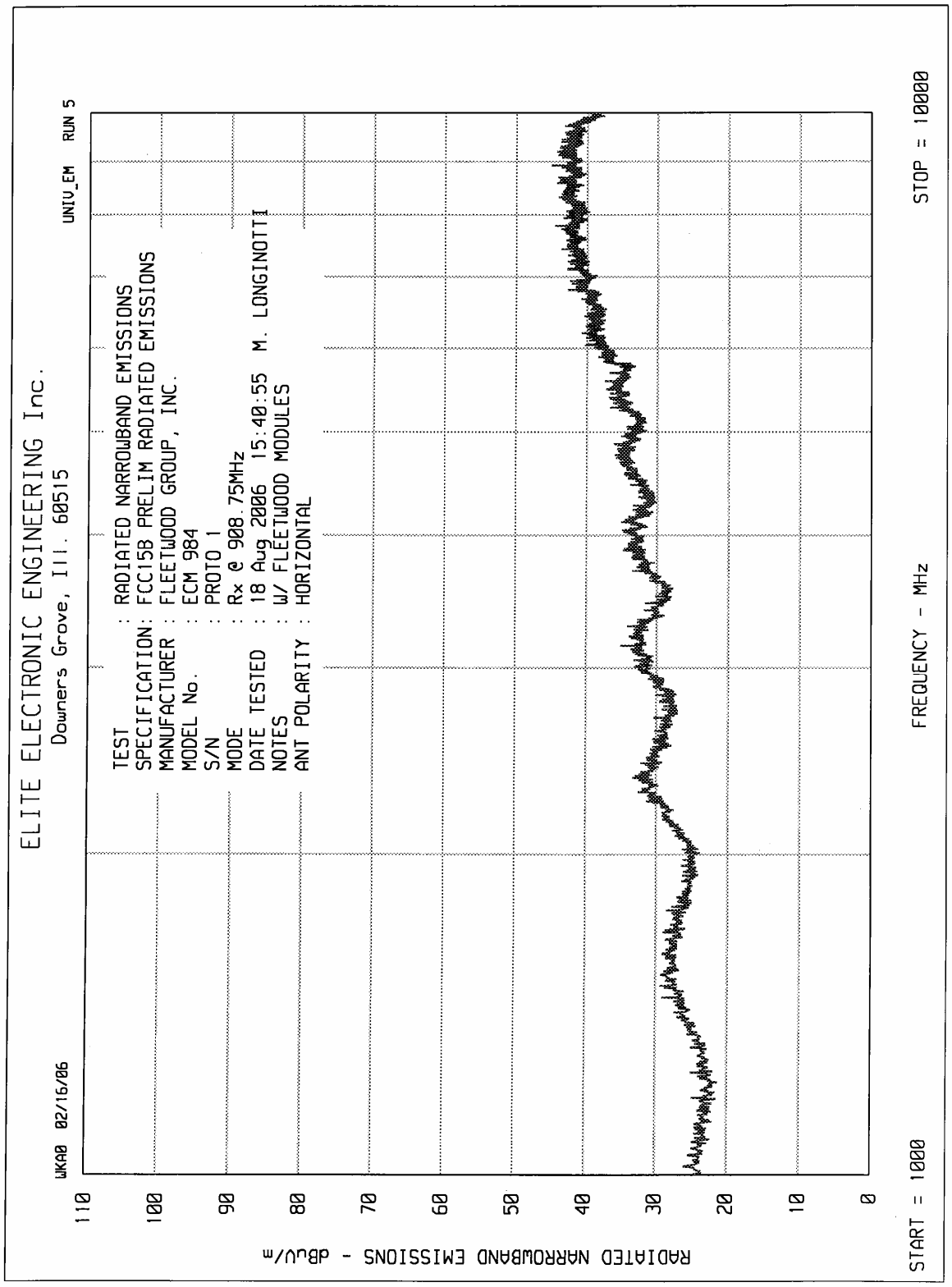
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Preamp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
1809.1	H	29.2	Ambient	2.9	28.0	-33.8	26.3	20.7	500.0
1809.1	V	29.2	Ambient	2.9	28.0	-33.8	26.3	20.7	500.0
3618.2	H	26.6	Ambient	4.4	32.5	-33.6	29.9	31.1	500.0
3618.2	V	26.5	Ambient	4.4	32.5	-33.6	29.8	30.8	500.0
5427.3	H	25.7	Ambient	5.2	35.3	-31.9	34.3	52.0	500.0
5427.3	V	25.4	Ambient	5.2	35.3	-31.9	34.0	50.3	500.0
7236.4	H	28.6	Ambient	6.6	37.6	-31.4	41.4	117.1	500.0
7236.4	V	28.6	Ambient	6.6	37.6	-31.4	41.4	117.1	500.0
9045.5	H	28.7	Ambient	7.5	37.9	-31.8	42.3	130.7	500.0
9045.5	V	28.7	Ambient	7.5	37.9	-31.8	42.3	130.7	500.0

H – Horizontal
V = Vertical

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By : MARK E. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 6
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15B PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Rx @ 908.75MHz
DATE TESTED : 18 Aug 2006 15:59:38 M. LONGINOTTI
NOTES : w/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 5
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15B PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Rx @ 908.75MHz
DATE TESTED : 18 Aug 2006 15:40:55 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

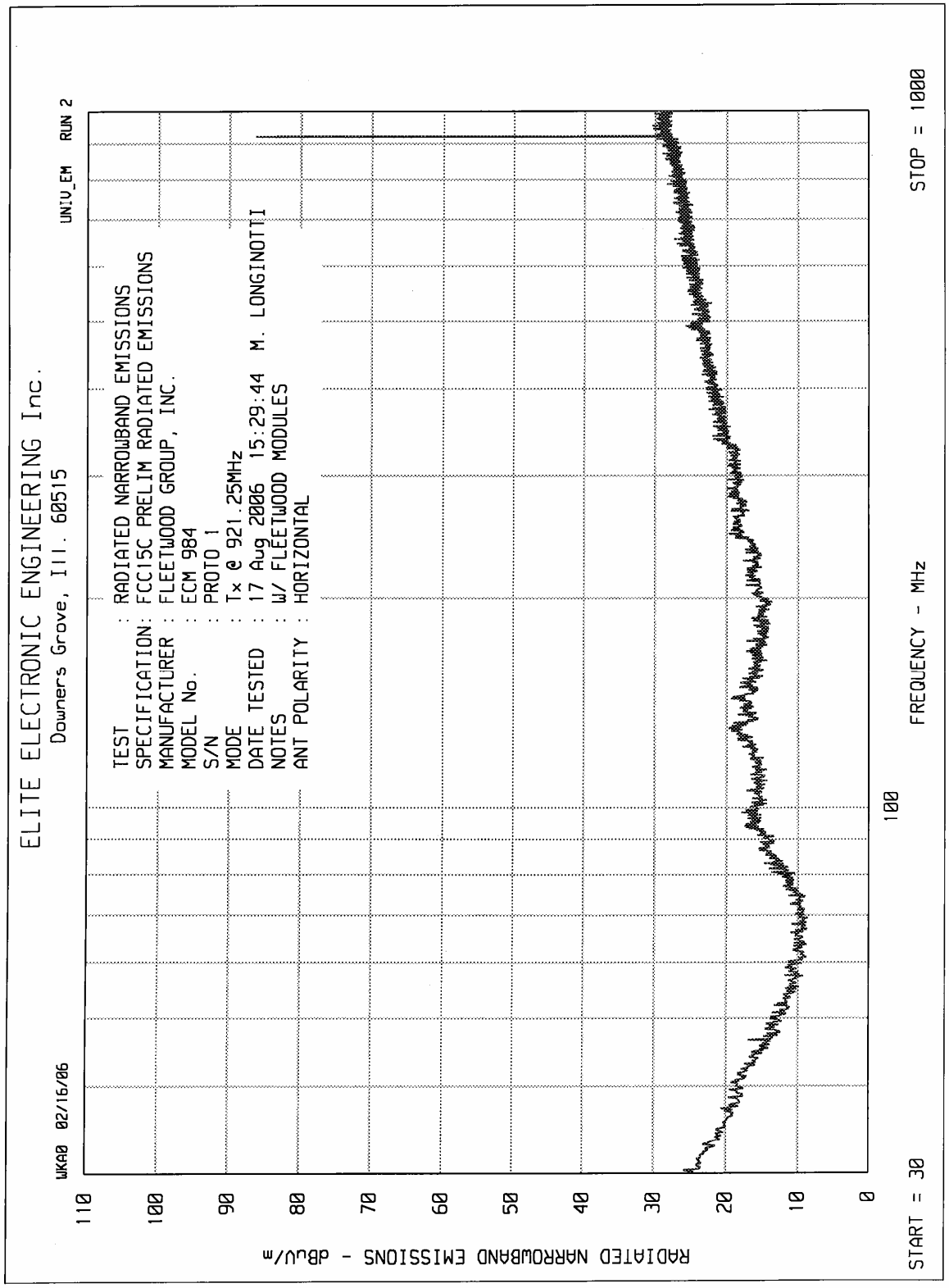
MANUFACTURER : Fleetwood Group, Inc.
TEST ITEM : Transceiver
MODEL NO. : ECM984 Digicall Spectrum System Console
SERIAL NO. : Proto 1
TEST SPECIFICATION : FCC 15.109(a), Radiated Emissions
MODE : Receive @ 908.75MHz
TEST DATE : August 17 and 18, 2006
TEST DISTANCE : 3 meters

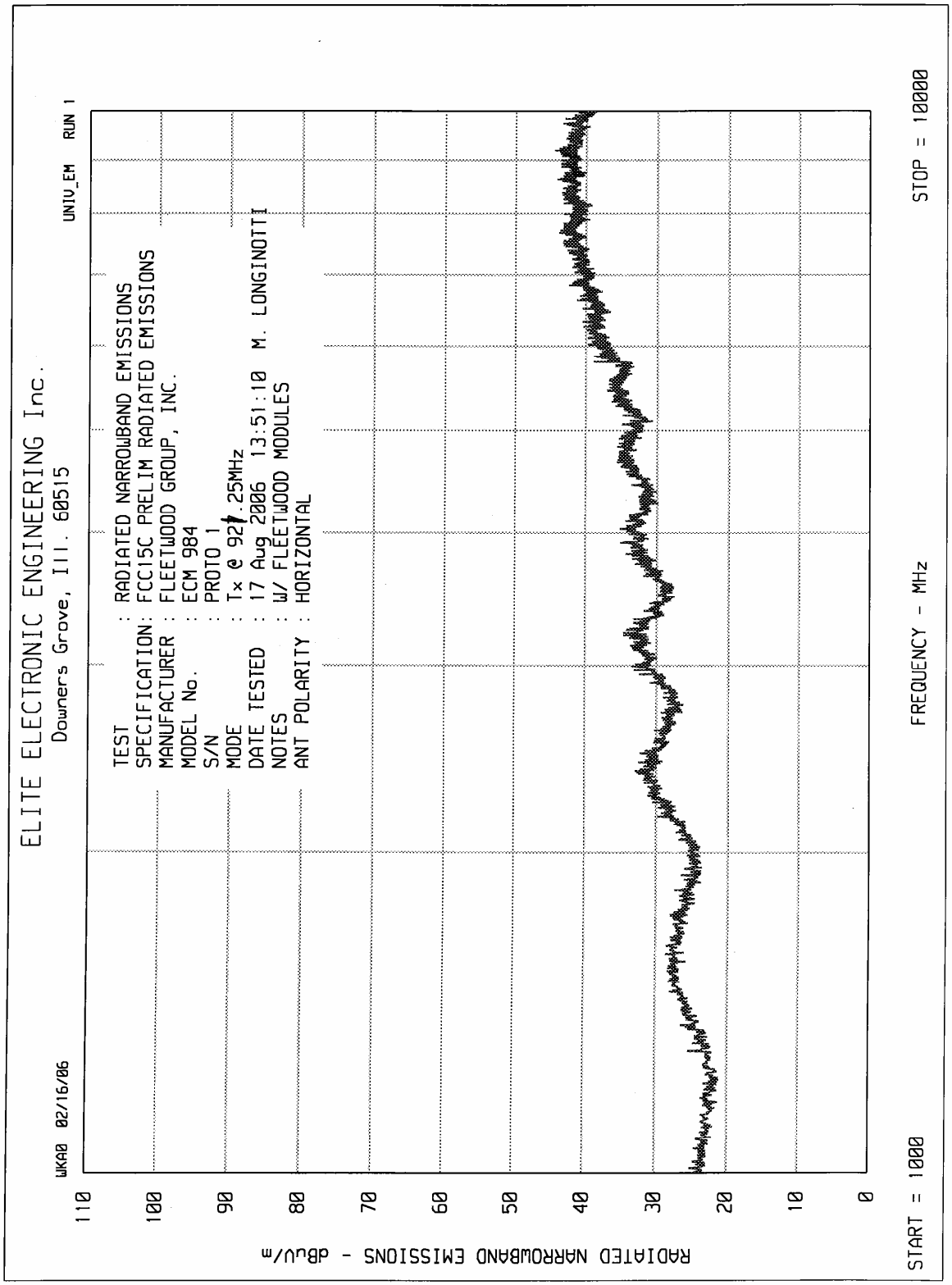
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Preamp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
1817.5	H	29.1	Ambient	2.9	28.1	-33.8	26.3	20.6	500.0
1817.5	V	29.1	Ambient	2.9	28.1	-33.8	26.3	20.6	500.0
3635.0	H	26.7	Ambient	4.4	32.5	-33.6	30.0	31.8	500.0
3635.0	V	26.8	Ambient	4.4	32.5	-33.6	30.1	32.2	500.0
5452.5	H	26.0	Ambient	5.2	35.3	-31.9	34.7	54.4	500.0
5452.5	V	26.2	Ambient	5.2	35.3	-31.9	34.9	55.7	500.0
7270.0	H	28.8	Ambient	6.6	37.7	-31.4	41.7	121.1	500.0
7270.0	V	28.8	Ambient	6.6	37.7	-31.4	41.7	121.1	500.0
9087.5	H	29.3	Ambient	7.5	38.0	-31.8	43.0	140.6	500.0
9087.5	V	29.3	Ambient	7.5	38.0	-31.8	43.0	140.6	500.0

H – Horizontal
V = Vertical

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By : MARK E. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15C PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Tx @ 921.25MHz
DATE TESTED : 17 Aug 2006 15:29:44 M. LONGINOTTI
NOTES : W/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15C PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Tx @ 927.25MHz
DATE TESTED : 17 Aug 2006 13:51:10 M. LONGINOTTI
NOTES : w/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

MANUFACTURER : Fleetwood Group, Inc.
TEST ITEM : Transceiver
MODEL NO. : ECM984 Digicall Spectrum System Console
SERIAL NO. : Proto 1
TEST SPECIFICATION : FCC 15.249(a), Radiated Emissions
MODE : Transmit @ 921.25MHz
TEST DATE : August 17 and 18, 2006
TEST DISTANCE : 3 meters

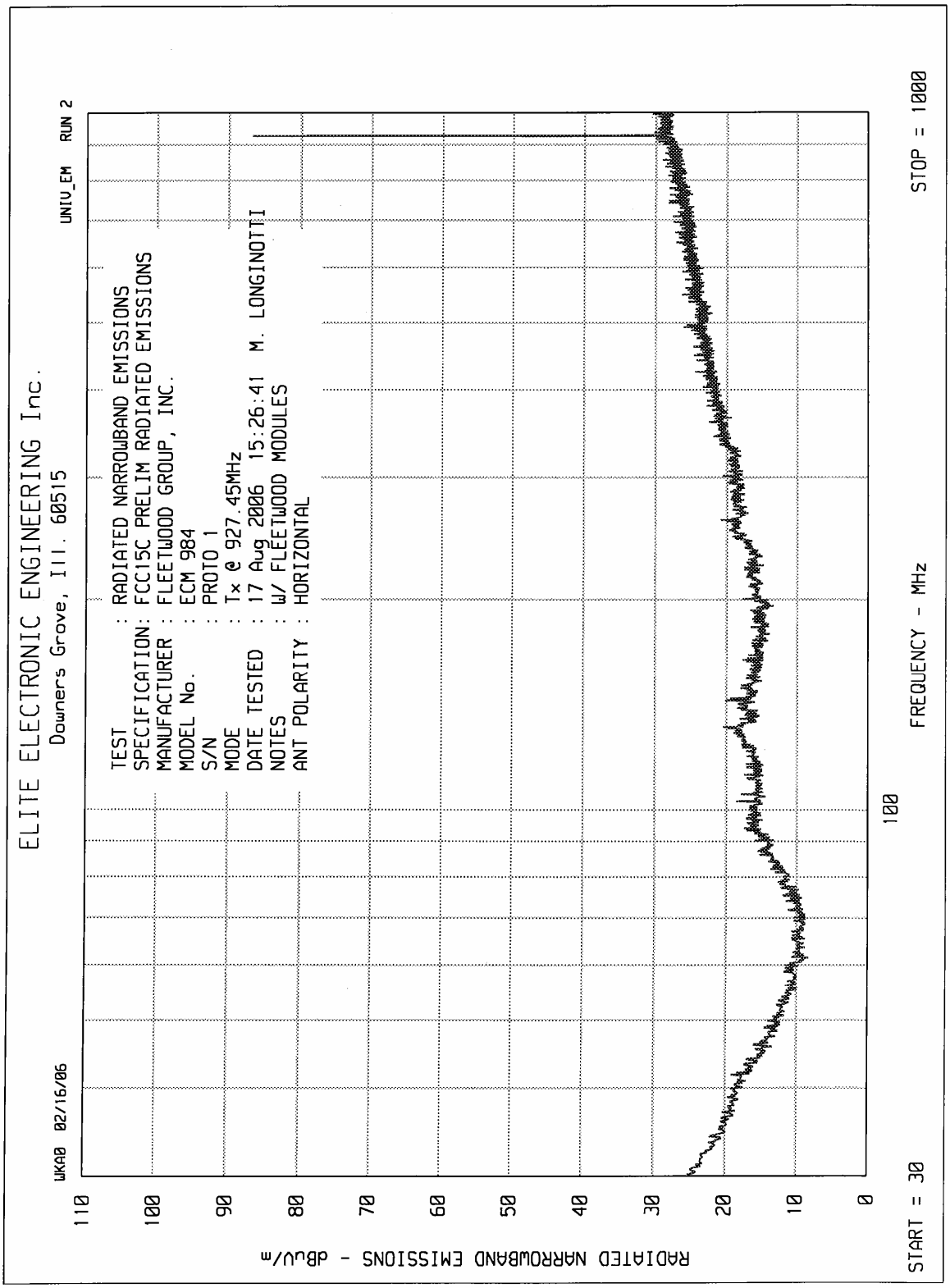
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Preamp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
921.3	H	61.1		2.0	27.9	0.0	91.0	35343.9	50000.0
921.3	V	55.8		2.0	27.9	0.0	85.7	19200.6	50000.0
1842.5	H	29.0	Ambient	2.9	28.2	-33.8	26.3	20.6	500.0
1842.5	V	29.0	Ambient	2.9	28.2	-33.8	26.3	20.6	500.0
2763.8	H	26.2	Ambient	3.8	31.5	-33.4	28.1	25.5	500.0
2763.8	V	25.8	Ambient	3.8	31.5	-33.4	27.7	24.3	500.0
3685.0	H	27.1	Ambient	4.4	32.6	-33.4	30.7	34.2	500.0
3685.0	V	26.8	Ambient	4.4	32.6	-33.4	30.4	33.1	500.0
4606.3	H	27.8	Ambient	4.8	33.1	-32.2	33.5	47.6	500.0
4606.3	V	27.6	Ambient	4.8	33.1	-32.2	33.3	46.5	500.0
5527.5	H	26.7	Ambient	5.3	35.5	-31.8	35.6	60.4	500.0
5527.5	V	25.5	Ambient	5.3	35.5	-31.8	34.4	52.6	500.0
6448.8	H	28.4	Ambient	6.0	36.2	-31.5	39.0	89.2	500.0
6448.8	V	28.5	Ambient	6.0	36.2	-31.5	39.1	90.2	500.0
7370.0	H	28.8	Ambient	6.7	37.9	-31.5	41.9	124.8	500.0
7370.0	V	28.8	Ambient	6.7	37.9	-31.5	41.9	124.8	500.0
8291.3	H	29.8	Ambient	7.2	37.7	-31.7	43.0	140.8	500.0
8291.3	V	29.8	Ambient	7.2	37.7	-31.7	43.0	140.8	500.0
9212.5	H	29.4	Ambient	7.5	38.1	-31.8	43.2	143.9	500.0
9212.5	V	29.3	Ambient	7.5	38.1	-31.8	43.1	142.3	500.0

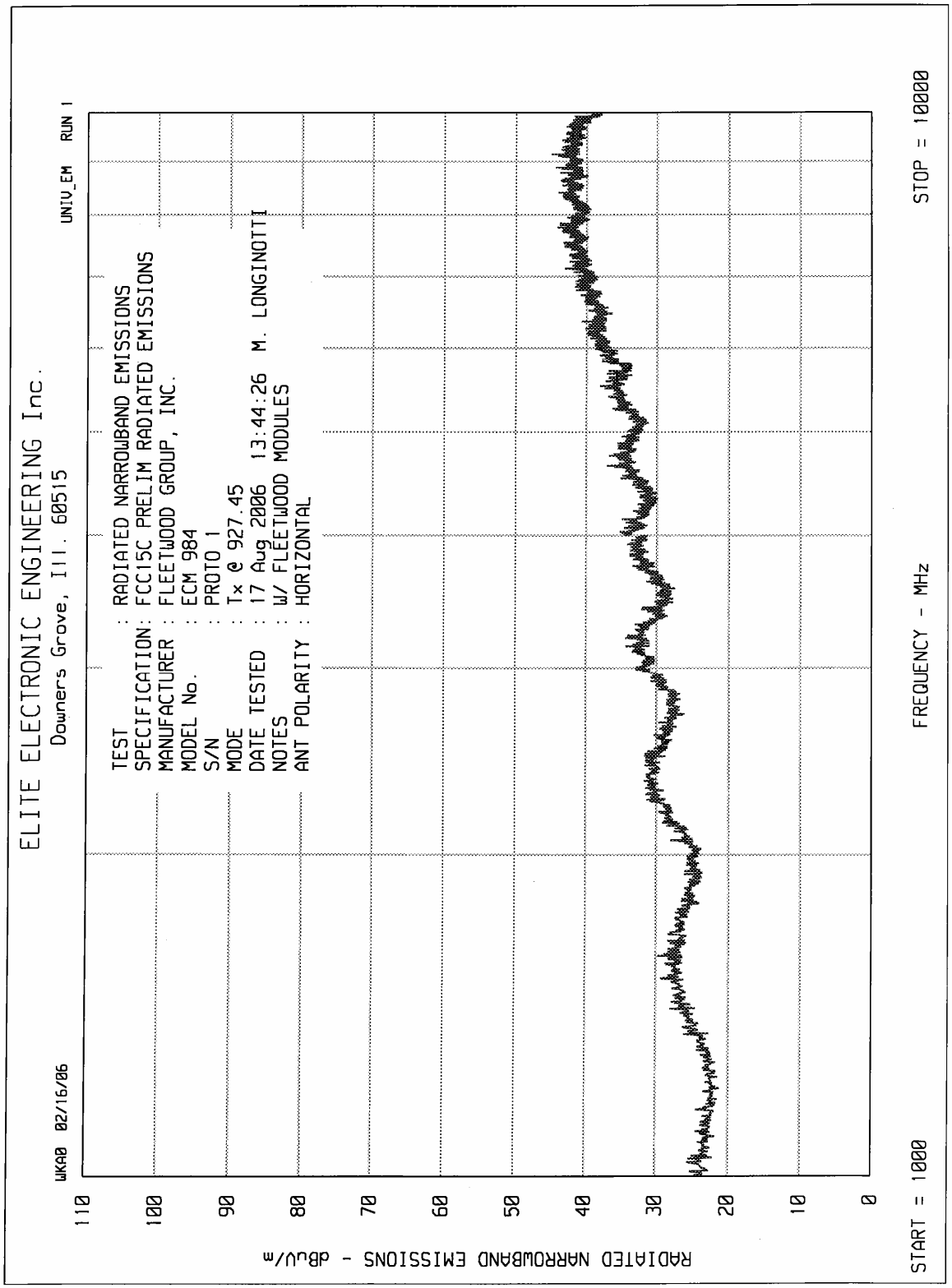
H – Horizontal

V = Vertical

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By : MARK E. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15C PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Tx @ 927.45MHz
DATE TESTED : 17 Aug 2006 15:26:41 M. LONGINOTTI
NOTES : w/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 02/16/06
UNIV_EM RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC15C PRELIM RADIATED EMISSIONS
MANUFACTURER : FLEETWOOD GROUP, INC.
MODEL No. : ECM 984
S/N : PROTO 1
MODE : Tx @ 927.45
DATE TESTED : 17 Aug 2006 13:44:26 M. LONGINOTTI
NOTES : w/ FLEETWOOD MODULES
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

MANUFACTURER : Fleetwood Group, Inc.
TEST ITEM : Transceiver
MODEL NO. : ECM984 Digicall Spectrum System Console
SERIAL NO. : Proto 1
TEST SPECIFICATION : FCC 15.249(a), Radiated Emissions
MODE : Transmit @ 927.45MHz
TEST DATE : August 17 and 18, 2006
TEST DISTANCE : 3 meters

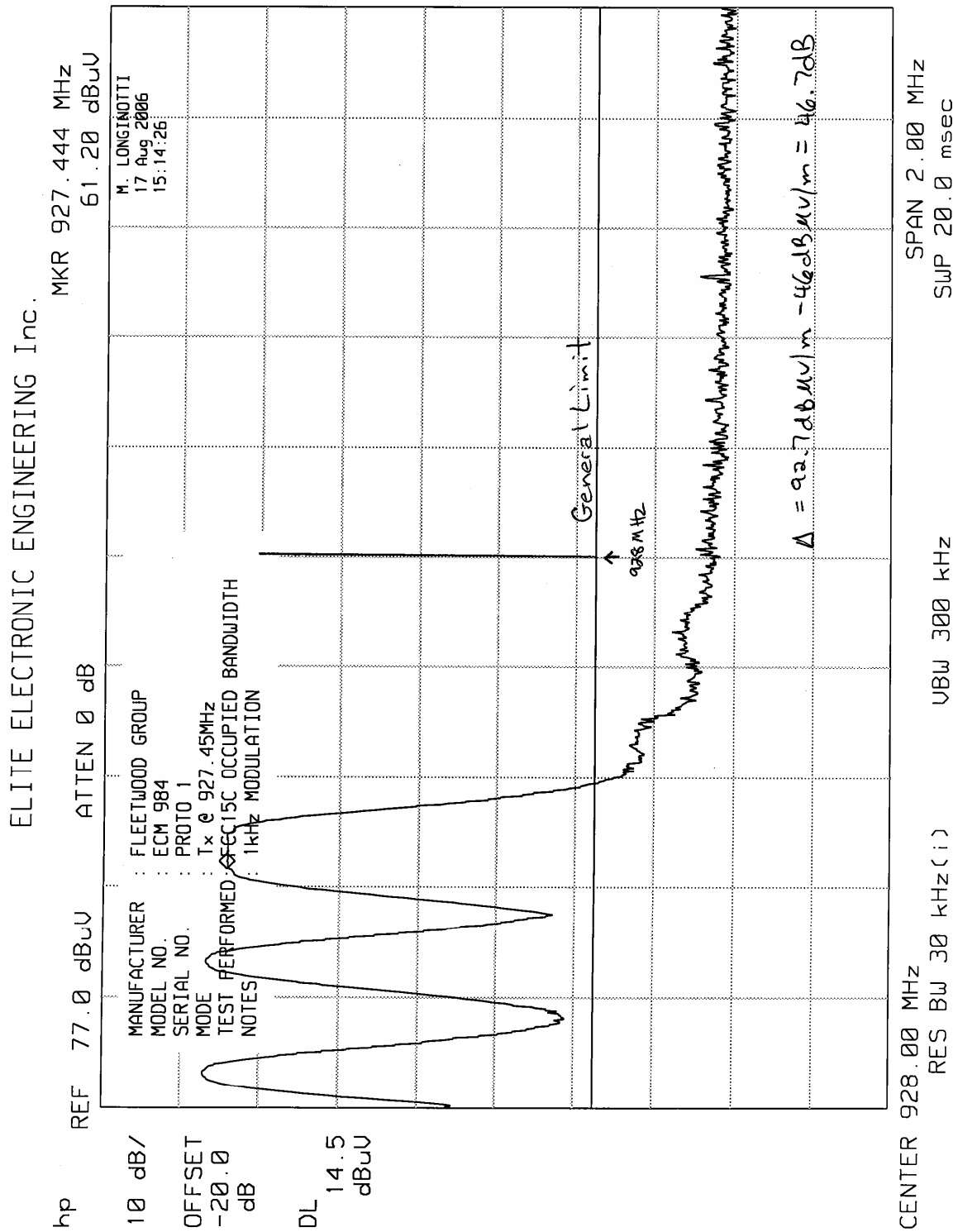
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Preamp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
927.45	H	62.7		2.0	28.1	0.0	92.7	43243.5	50000.0
927.45	V	57.9		2.0	28.1	0.0	87.9	24884.0	50000.0
1854.9	H	28.7	Ambient	2.9	28.2	-33.8	26.0	20.0	500.0
1854.9	V	28.8	Ambient	2.9	28.2	-33.8	26.1	20.3	500.0
2782.4	H	26.4	Ambient	3.8	31.6	-33.4	28.4	26.3	500.0
2782.4	V	26.2	Ambient	3.8	31.6	-33.4	28.2	25.8	500.0
3709.8	H	28.0	Ambient	4.4	32.6	-33.3	31.7	38.5	500.0
3709.8	V	27.9	Ambient	4.4	32.6	-33.3	31.6	38.1	500.0
4637.3	H	28.3	Ambient	4.9	33.2	-32.2	34.2	51.1	500.0
4637.3	V	28.2	Ambient	4.9	33.2	-32.2	34.1	50.5	500.0
5564.7	H	25.9	Ambient	5.3	35.5	-31.8	34.9	55.5	500.0
5564.7	V	26.5	Ambient	5.3	35.5	-31.8	35.5	59.5	500.0
6492.2	H	28.2	Ambient	6.0	36.2	-31.5	38.9	87.9	500.0
6492.2	V	28.3	Ambient	6.0	36.2	-31.5	39.0	88.9	500.0
7419.6	H	28.3	Ambient	6.7	38.0	-31.5	41.6	119.6	500.0
7419.6	V	28.5	Ambient	6.7	38.0	-31.5	41.8	122.3	500.0
8347.1	H	29.7	Ambient	7.2	37.8	-31.7	42.9	140.0	500.0
8347.1	V	29.8	Ambient	7.2	37.8	-31.7	43.0	141.6	500.0
9274.5	H	29.1	Ambient	7.5	38.2	-31.9	42.9	139.9	500.0
9274.5	V	29.1	Ambient	7.5	38.2	-31.9	42.9	139.9	500.0

H – Horizontal

V = Vertical

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By : MARK E. LONGINOTTI


hp
ELITE ELECTRONIC ENGINEERING Inc.
REF 77.0 dBuV
ATTEN 0 dB
MKR 927.444 MHz
61.20 dBuV
10 dB/
OFFSET
-20.0
dB
DL
14.5
dBuV
MANUFACTURER : FLEETWOOD GROUP
MODEL NO. : ECM 984
SERIAL NO. : PROTO 1
MODE : Tx @ 927.45MHz
TEST PERFORMED : FCC15C OCCUPIED BANDWIDTH
NOTES : 1kHz MODULATION
M. LONGINOTTI
17 Aug 2006
15:14:26
General Limit
928 MHz
Δ = 92.7dBμV/m -46dBμV/m = 46.7dB
CENTER 928.00 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 msec