ELITE ELECTRONIC ENGINEERING INCORPORATED
1516 CENTRE CIRCLE
DOWNERS GROVE, ILLINOIS 60515-1082

ELITE PROJECT: 30521 DATES TESTED: December 31, 2001

TEST PERSONNEL: Mark Longinotti

TEST SPECIFICATION: FCC "Code of Federal Regulations" Title 47
Part 15, Subpart C, Section 15.205

ENGINEERING TEST REPORT NO. 24359

MEASUREMENT OF RF INTERFERENCE FROM

A MODEL DS6MA DIGICALL SPECTRUM SYSTEM STUDENT UNIT TRANSMITTER

FOR: Fleetwood Group
Holland, MI

PURCHASE ORDER NO.: 5649

Report By: Richard E. King
Richard E. King

Witnessed By:
Dave Raymond, Mike Hall
Harry Derks
Fleetwood Group

Approved By: Craig W. Fanning
Craig Fanning
EMC Department Supervisor
Narte Certified: EMC-0029-NT
ATL-0188-E

ENGINEERING TEST REPORT NO. 24359

ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: DIGICALL SPECTRUM SYSTEM STUDENT UNIT

MODEL NO: DS6MA **SERIAL NO:** 4

MANUFACTURER: Fleetwood Group

APPLICABLE SPECIFICATIONS: FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C

QUANTITY OF ITEMS TESTED: One (1)

TEST PERFORMED BY: ELITE ELECTRONIC ENGINEERING INCORPORATED
Radio Interference Consultants
Downers Grove, Illinois 60515

DATE RECEIVED: December 31, 2001

DATES TESTED: December 31, 2001

PERSONNEL (OPERATORS, OBSERVERS, AND CO-ORDINATORS):
CUSTOMER: Dave Raymond, Mike Hall and Harry Derks of Fleetwood Group were present.
ELITE ELECTRONIC: Mark Longinotti

ELITE JOB NO.: 30521

ABSTRACT: The model DS6MA Digicall Spectrum System Student Unit, does meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-1992.

The radiated emissions level closest to the limit (worst case) occurred at 2724.45 MHz. The emissions level at this frequency was 1.4 dB within the limit. See data page 23 for more details.

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A MODEL DS6MA Digicall SPECTRUM SYSTEM STUDENT UNIT TRANSMITTER

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: This document presents the results of a series of radio interference measurements performed on a model DS6MA Digicall Spectrum System Student Unit Transmitter, serial number 4,(hereinafter referred to as the test item). The test item was designed to transmit at approximately 902-908MHz using an internal antenna, 3.5 inches long. The tests were performed for Fleetwood Group of 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 C, Sections for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-1992.

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 1999

- ANSI C63.4-1992, "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°C and the relative humidity was 17%.

2.0 TEST ITEM SETUP AND OPERATION:

A block diagram of the test item setup is included as Figure 3.

2.1 POWER INPUT: The test item obtained 3VDC power via 2 "C" batteries.

2.2 GROUNDING: Since the test item was battery operated. The test item was ungrounded during testing.

2.3 PERIPHERAL EQUIPMENT: No peripheral equipment was submitted with the test item.

2.4 INTERCONNECT CABLES: No interconnect cables were submitted with the test item.

2.5 OPERATIONAL MODE: For all tests, the test item was set to transmit continuously. The tests were performed with the test item operating between 902-908MHz.

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.

The fundamental, harmonics and spurious emissions were measured with a spectrum analyzer. All measurements were taken with the resolution and video bandwidth of the measuring instrument adjusted to 100kHz below 1GHz and 1MHz above 1GHz.

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 REQUIREMENTS: All radio frequency voltages on the power lines of an intentional radiator shall be below 250uV (quasi-peak) over the frequency range from 0.45MHz to 30MHz. It is also to be noted that if emitted levels in the peak detector function do not exceed the above limits, the test item does meet the intent of these requirements. Since the test item was battery operated, no conducted emissions were measured.

4.2 RADIATED MEASUREMENTS:

4.2.1 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	Fundamental Field Intensity uV/m @ 3 meters	Field Strength Harmonics and Spurious @ 3 meters
Above 470	50000	500

For 902.55 MHz and 908.1 MHz, the limit at the fundamental is 50000uV/m @ 3m and the limit on the harmonics is 500uV/m @ 3m.

In addition, emissions appearing in the Restricted Bands of Operation listed in paragraph 15.205(a) shall not exceed the general requirements shown in paragraph 15.209.

4.2.2 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 1992 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.

Preliminary radiated emissions measurements were first performed using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then re-measured.

With the broadband measuring antennas positioned at a 3 meter distance from the test item, the frequency range from 30MHz to 1GHz was investigated using a peak detector function.

With the broadband measuring antennas positioned at a 3 meter distance from the test item, the frequency range from 1GHz to 10GHz was

investigated using a peak detector function.

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

1) Measurements were made using a peak detector and a broadband bi-log antenna for the frequency range of 30MHz to 1000MHz. For measurements made in the 1GHz to 10GHz range a double ridged waveguide was used.

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.

   (d) The fundamental through the 10th harmonic of the transmit frequency were measured.

4.2.3 RESULTS: The preliminary plots, with the test item transmitting at 902.55 and 908.15 MHz, are presented on data pages 14 through 21. The plots of data from 30MHz to 1000MHz represent composite maximum peak readings of multiple antenna heights and multiple orientations of the test item. 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 902.55 and 908.15 MHz, are presented on data pages 22 and 23. 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 908.15 MHz. The emissions level at these frequencies were 1.4 dB within the limit. See data page 22 and 23 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated

emission levels are shown on Figure 2.

4.3 OCCUPIED BANDWIDTH MEASUREMENTS:

4.3.1 REQUIREMENTS: In accordance with paragraph 15.249(c), emissions radiated outside the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emissions limit of 15.209, whichever is the lesser attenuation.

4.3.2 PROCEDURES: The test item was set to transmit continuously. With an antenna positioned nearby, occupied bandwidth emissions were displayed on the spectrum analyzer. The resolution bandwidth was set to 100 kHz and span was set to 2 MHz. The frequency spectrum near the fundamental was plotted.

4.3.3 RESULTS: The plot of the emissions near the fundamental frequency are presented on data page 24. As can be seen from this data page, the transmitter met the occupied bandwidth requirements.

5.0 CONCLUSION:

It was found that the Fleetwood Group model DS6MA Digicall Spectrum System Student Unit Transmitter, does meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-1992.

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 specification.

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

the data and void this certification.

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

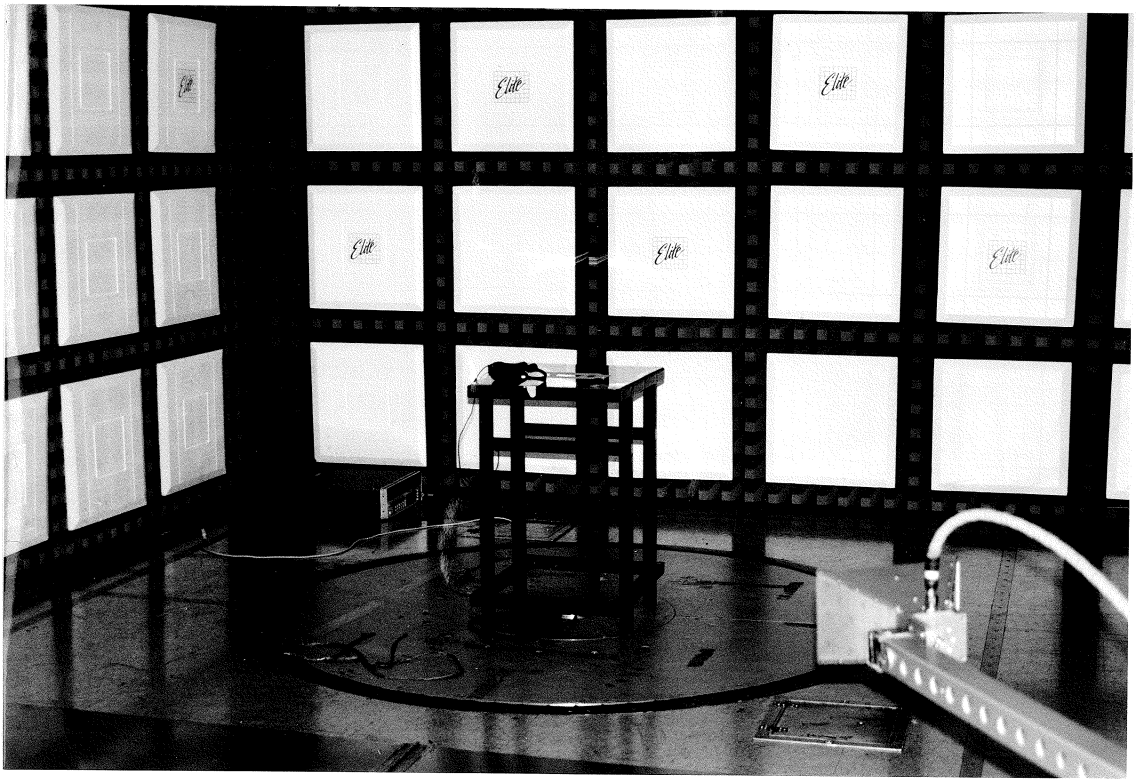
ELITE ELECTRONIC ENG. INC.

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XZG0	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A02724	---		N/A	
Equipment Type: AMPLIFIERS								
APK0	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	3008A00662	1-26.5GHZ	02/15/01	12	02/15/02
Equipment Type: ANTENNAS								
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	12/11/01	12	12/11/02
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	05/09/01	12	05/09/02
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	08/03/01	12	08/03/02
Equipment Type: RECEIVERS								
RAC1	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3407A08369	100HZ-22GHZ	01/16/01	12	01/16/02
RACB	RF PRESELECTOR	HEWLETT PACKARD	85685A	3506A01491	20HZ-2GHZ	05/09/01	12	05/09/02
RAF3	QUASIPEAK ADAPTER	HEWLETT PACKARD	85650A	3303A01775	0.01-1000MHZ	01/17/01	12	01/17/02

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.

Radiated Emissions Worst Case Horizontal Polarization



Radiated Emissions Worst Case Vertical Polarization