U.S. TECH
A TRADITION IN TESTING SERVICES

April 23, 2002

Mr. Richard Bardin
Wayne-Dalton Corp.
3395 Addison Dr.
Pensacola, FL 32514

Dear Mr. Bardin:

Enclosed please find Wayne-Dalton Corp.'s file copy of the Part 15 Certification Application for the Model KEP2-B433 Transmitter.

Wayne-Dalton Corp. should expect to receive a certification grant for this product within the next 1-2 weeks.

If you have any questions, please don't hesitate to call. Thank you for your business.

Sincerely,

Timothy R. Johnson
NARTE Certified EMC Engineer
No. EMC-002205-NE

U.S. TECH

A TRADITION IN TESTING SERVICES

Wayne-Dalton Corp.
FCC Part 15, Certification Application
Model KEP2-B433

April 23, 2002

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Wayne-Dalton Corp.**

MODEL: **KEP2-B433**

FCC ID: **KJ8KYE-433BSW**

DATE: **April 23, 2002**

This report concerns (check one): Original grant_X_
Class II change_____

Equipment type: **Low Power Transmitter**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

FIGURES

TABLES

SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

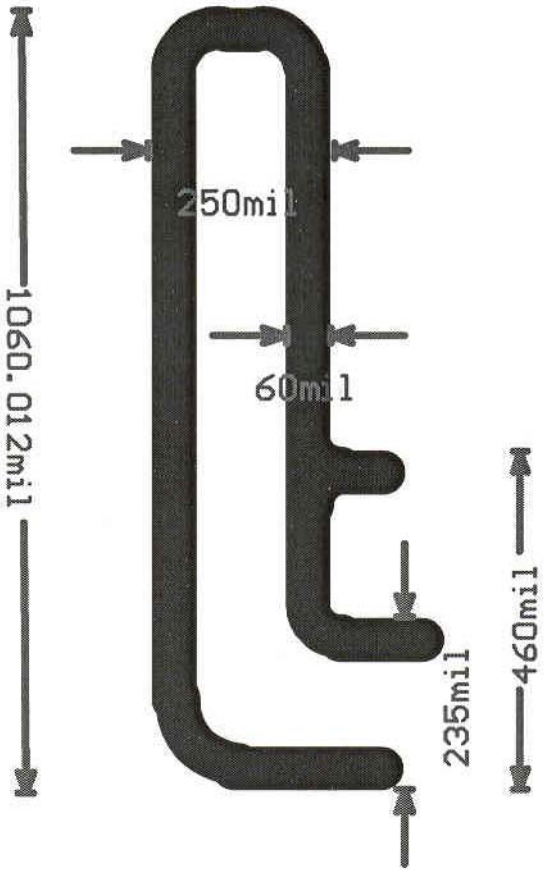
Product Description

The Equipment Under Test (EUT) is a Wayne-Dalton Corp., Model KEP2-B433. The EUT is a wall mountable keypad transmitter operating at 433.92 MHz using OOK modulation for use with Wayne-Dalton Corp. garage door openers.

The EUT incorporates an internal antenna only. Details of this antenna have been provided on the following page from Wayne-Dalton Corp.

Related Submittal(s)/Grant(s)

The EUT will be used with DoC approved receivers.


250mil
60mil
1060.012mil
235mil
460mil

SECTION 2

TESTS AND MEASUREMENTS

TESTS AND MEASUREMENTS

Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

Since the EUT is a wall mounted device, it was placed into a continuous mode of transmit and placed into an upright position.

Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

Modifications

To bring the EUT into compliance to meet the FCC Part 15 requirements, the following modifications were made by U.S. Technologies.

1) Resistor R1 was changed to a 120 kOhm resistor.

Test Equipment

Table 2 describes test equipment used to evaluate this product.

FIGURE 1

TEST CONFIGURATION

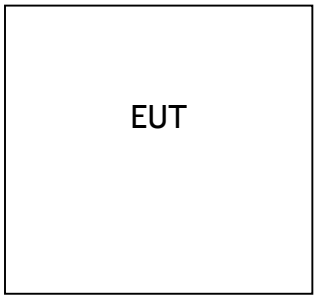


FIGURE 2a

Photograph(s) for Spurious and Fundamental Emissions

FIGURE 2b

Photograph(s) for Spurious and Fundamental Emissions

TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transmitter (EUT) Wayne-Dalton Corp.	KEP2-B433	Unit A "Test 2nd"	KJ8KYE-433BSW (Pending)	None

TABLE 2

TEST INSTRUMENTS

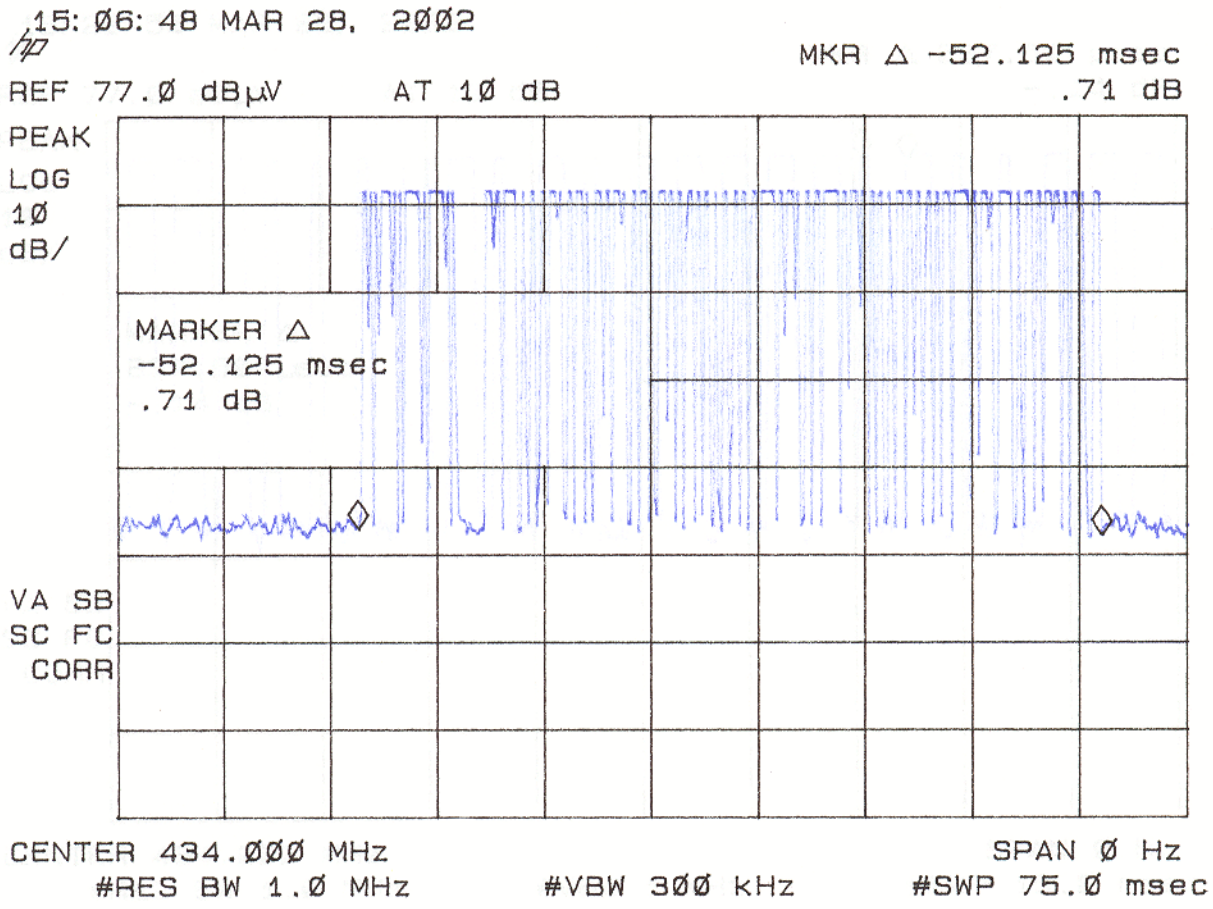
EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	2/15/02
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	2/14/02
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	08/22/01
COMB GENERATOR	8406A	HEWLETT-PACKARD	2246A02168	12/27/01
RF PREAMP	8447D	HEWLETT-PACKARD	2944A07436	5/12/01
RF PREAMP	8449B	HEWLETT-PACKARD	3008A00480	10/9/01
HORN ANTENNA	3115	EMCO	9107-3723	7/19/01
BICONICAL ANTENNA	3110	EMCO	9307-1431	7/16/01
LOG PERIODIC ANTENNA	3146	EMCO	3600	7/18/01
BILOG ANTENNA	CBL6112B	CHASE	2584	2/31/02
CALCULATION PROGRAM	N/A	N/A	Ver. 5.0	N/A

Periodic Operation (47 CFR 15.231(a1))

A transmitter manually activated must automatically deactivate within not more than 5 seconds of being released. The transmitter is a 5 button transmitter. The EUT continues to transmit while each button is being pressed. The EUT ceases transmission almost immediately upon being released and appears to finish the current packet being transmitted. Therefore the longest period of time the transmitter should take to deactivate is a packet length, or 52.125 msec as shown in Figure 3.

FIGURE 3

Periodic Operation 15.231(a)(c1)



Field Strength of Fundamental Emission (47 CFR 15.231b)

Measurements were made using a peak detector. Field strength of the peak fundamental emission is shown in Table 3 and Figure 4.

Duty Cycle Correction During 100 msec:

Each function key sends a different series of characters, but each packet period (124.00 msec) transmits as given below. Figures 5a through 5f show the characteristics of the pulse train for one of these functions.

According to the manufacturer, the transmit cycle consists of a preample (16 pulses) + data pulses (66 pulses) + following pulses (2 pulses). For purposes of the calculations of the data segments, any combination of short or long pulses may be used. Therefore the worse case of all long pulses has been applied.

[16 pulses (preamble transmit) + 2 (following data) * 262.5 µs = 4.7 msec
66 data pulses * 487.5 us = 32.175
Total transmit time in 100 msec = 4.7 + 32.175 = 36.875 msec

Duty Cycle Correction = 20 log (0.369) = -8.6 dB

Field strength of the average fundamental emission is shown in Table 4.

TABLE 3

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: March 21, 2002
UST Project: 01-0675
Customer: Wayne-Dalton Corp.
Model: KEP2-B433

Peak Measurement

FREQ. (MHz)	POL. (H/V)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
433.92	V	-39.4	21.3	27,996.4	109,967

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-39.4 + 21.3 + 107)/20) = 27,966.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: David B. Blethen **Name:** David Blethen

TABLE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: March 21, 2002
UST Project: 01-0675
Customer: Wayne-Dalton Corp.
Model: KEP2-B433

Average Measurement

FREQ. (MHz)	POL. (H/V)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
433.92	V	-47.9	21.3	10,401.6	10,997

*** Adjusted by duty cycle = 20 log (0.374) = -8.6 dB**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-47.9 + 21.3 + 107)/20) = 10,401.6
CONVERSION FROM dBm TO dBuV = 107 dB

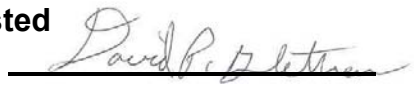
Tested By:  **Name: David Blethen**

FIGURE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)

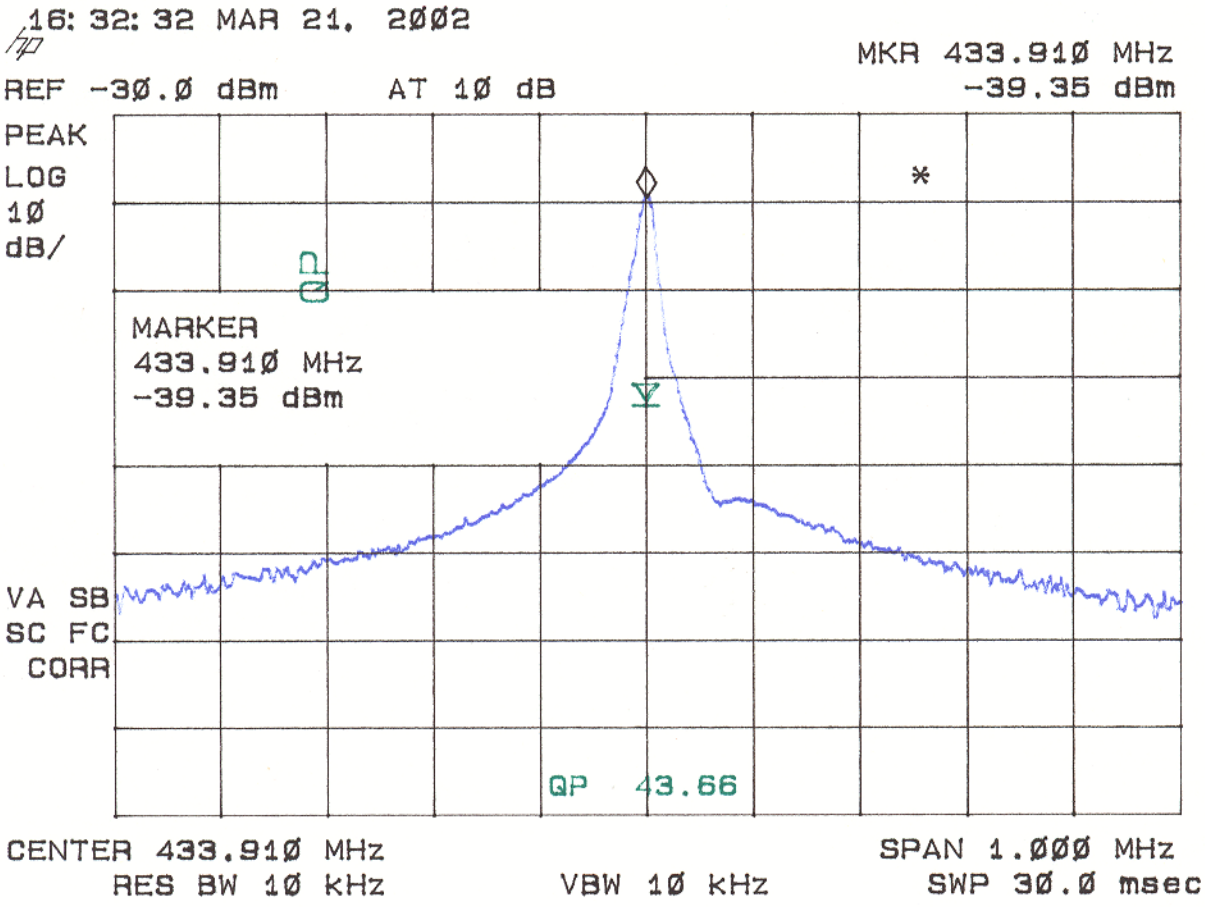


FIGURE 5a

DUTY CYCLE CHARACTERISTICS

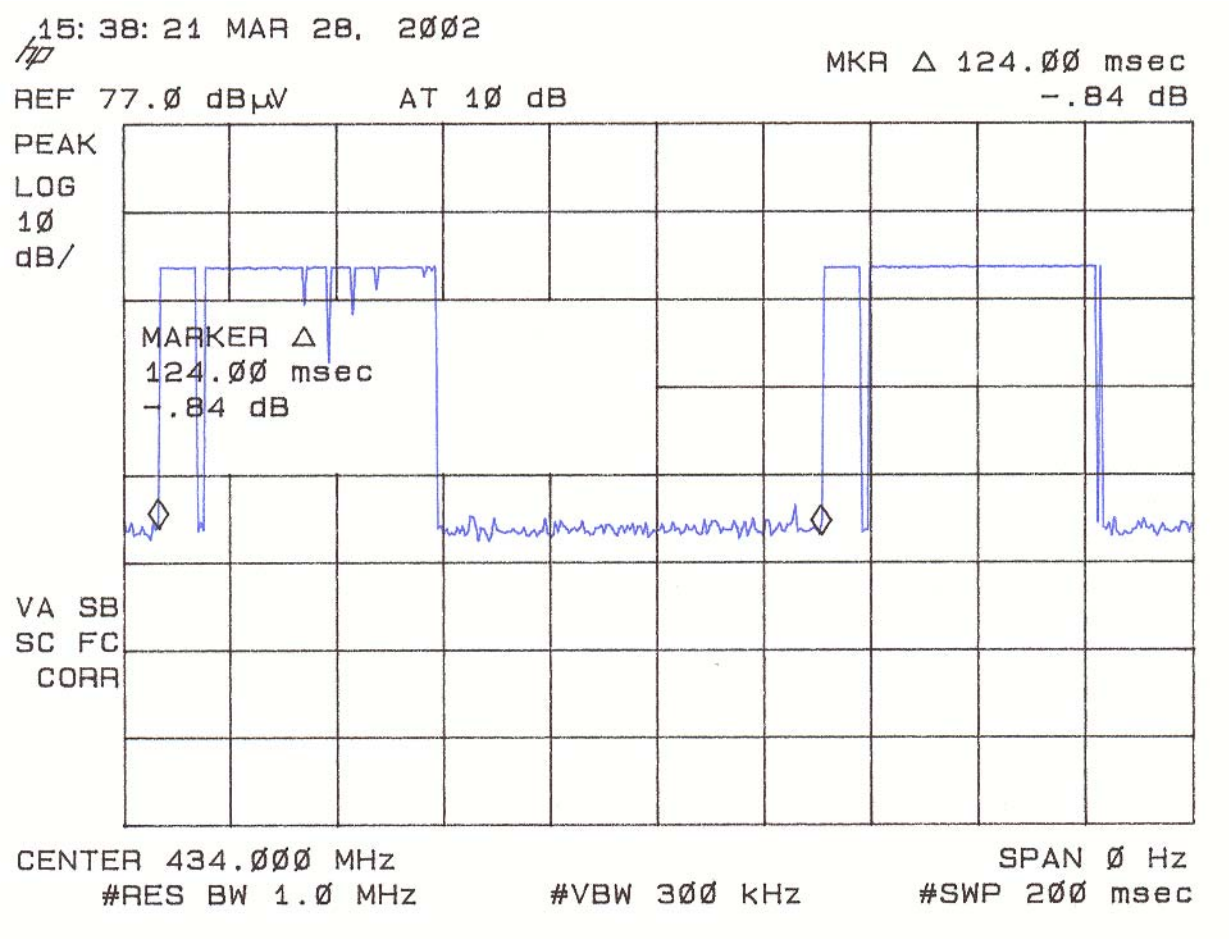


FIGURE 5b

DUTY CYCLE CHARACTERISTICS

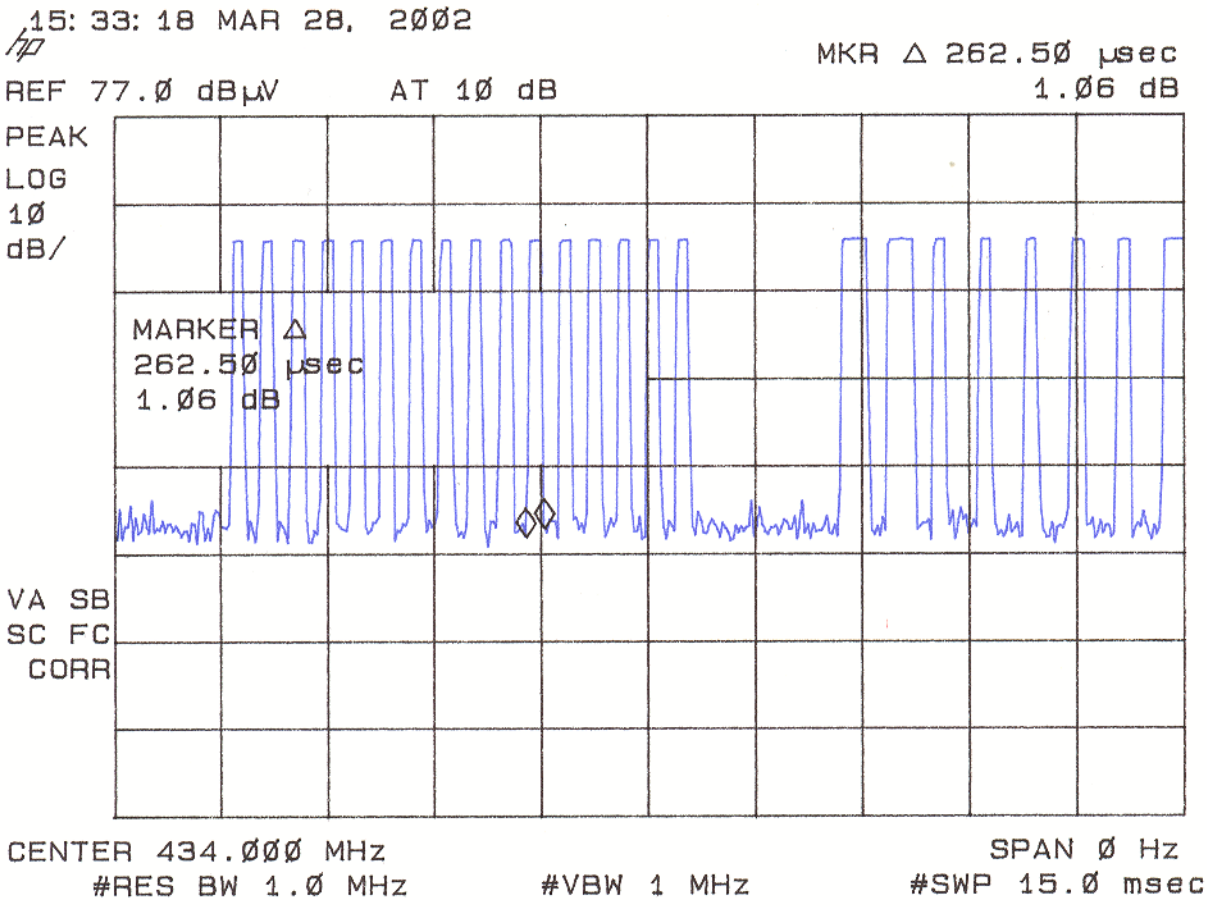


FIGURE 5c

DUTY CYCLE CHARACTERISTICS

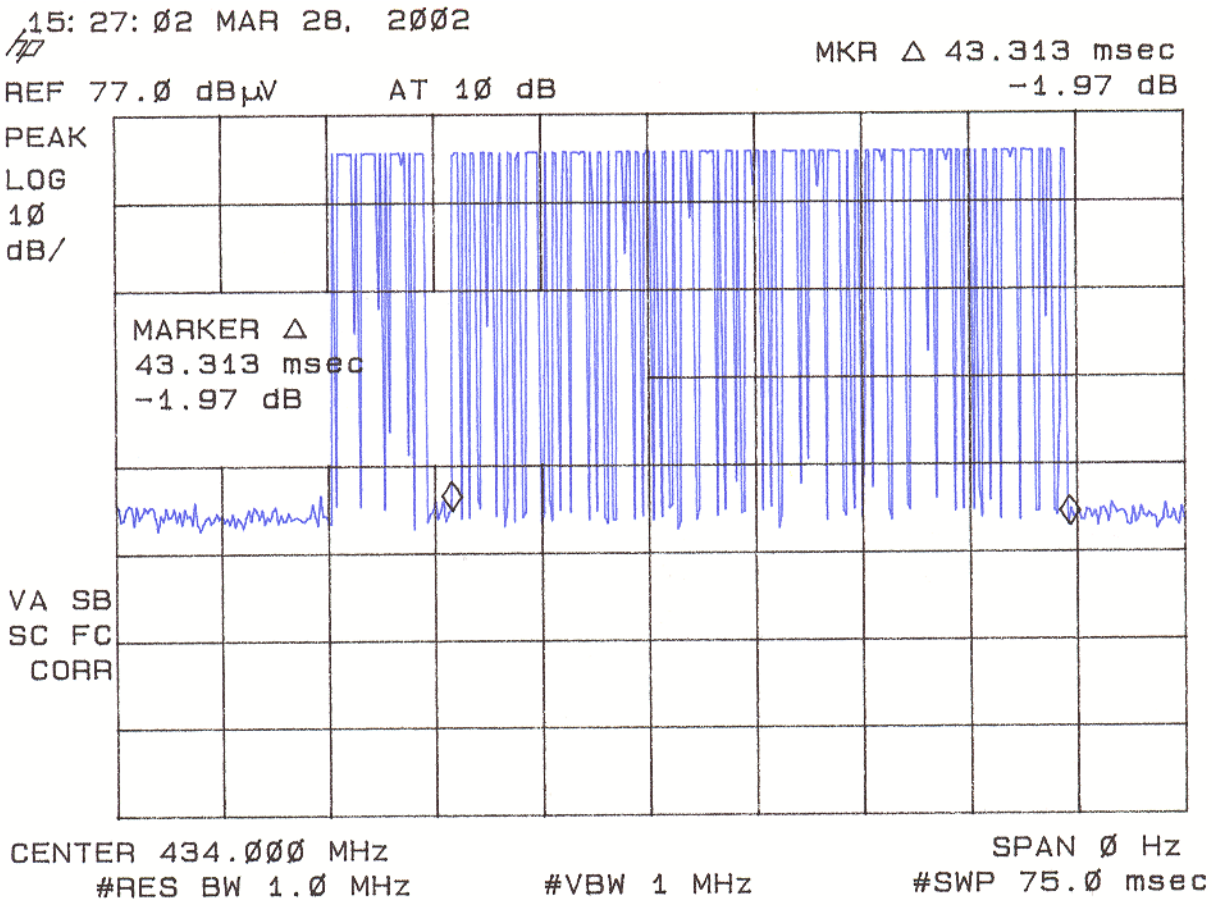


FIGURE 5d

DUTY CYCLE CHARACTERISTICS

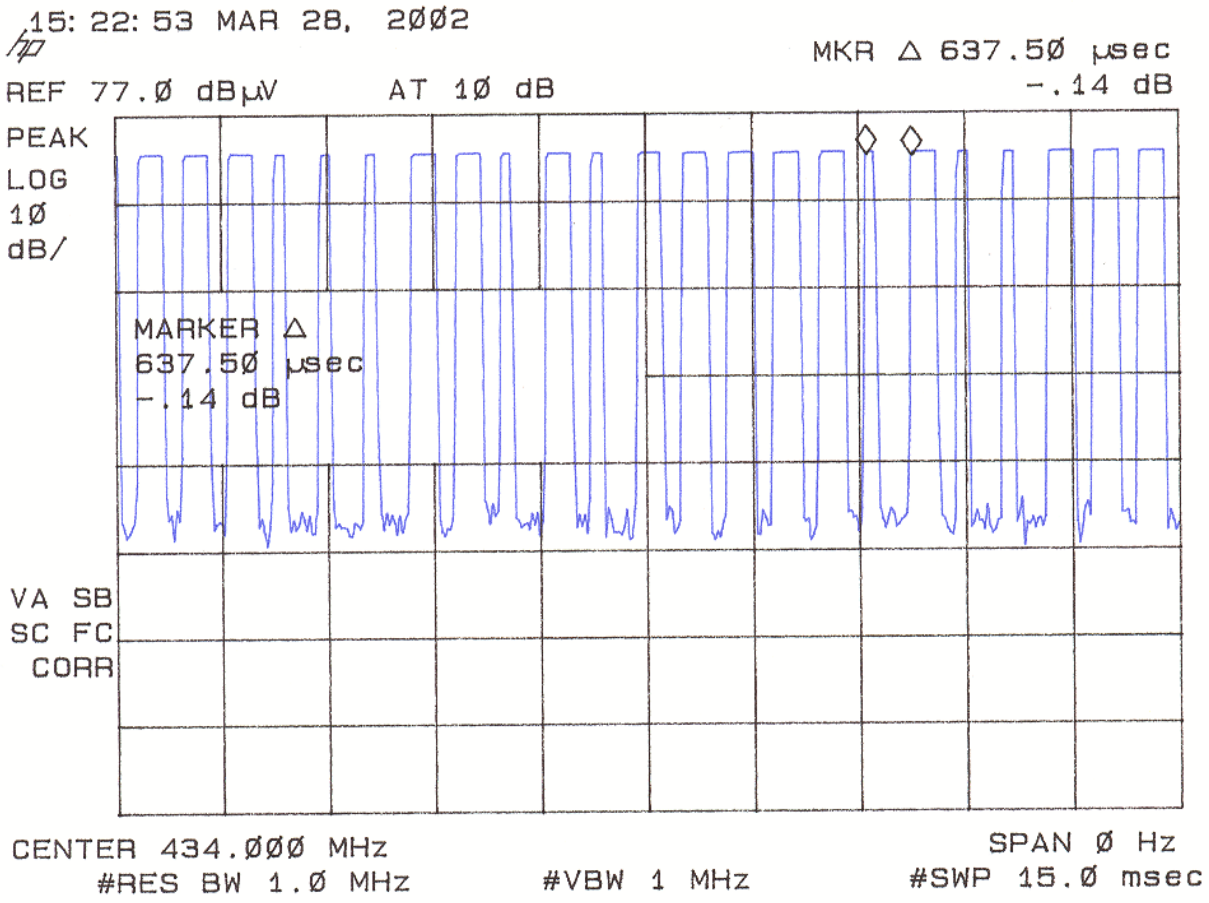


FIGURE 5e

DUTY CYCLE CHARACTERISTICS

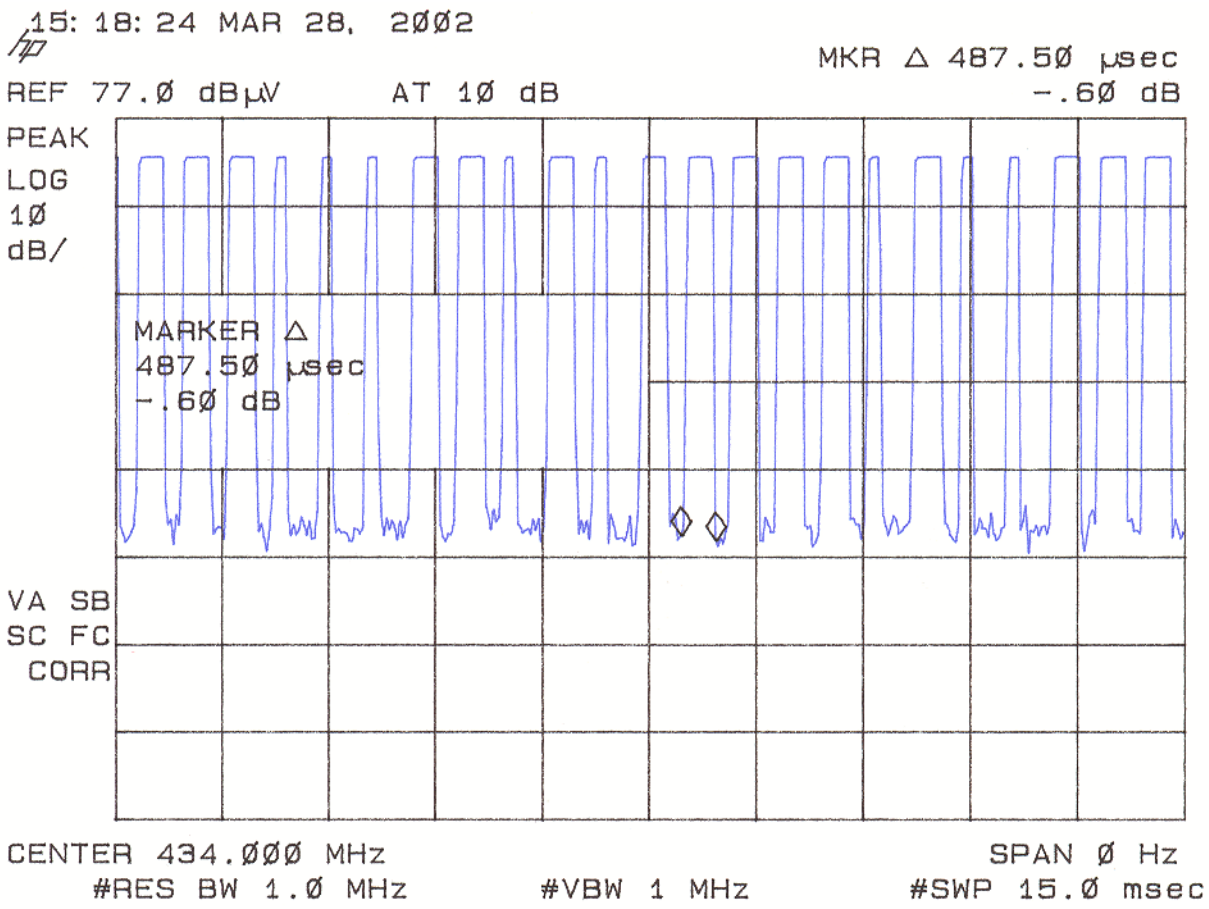
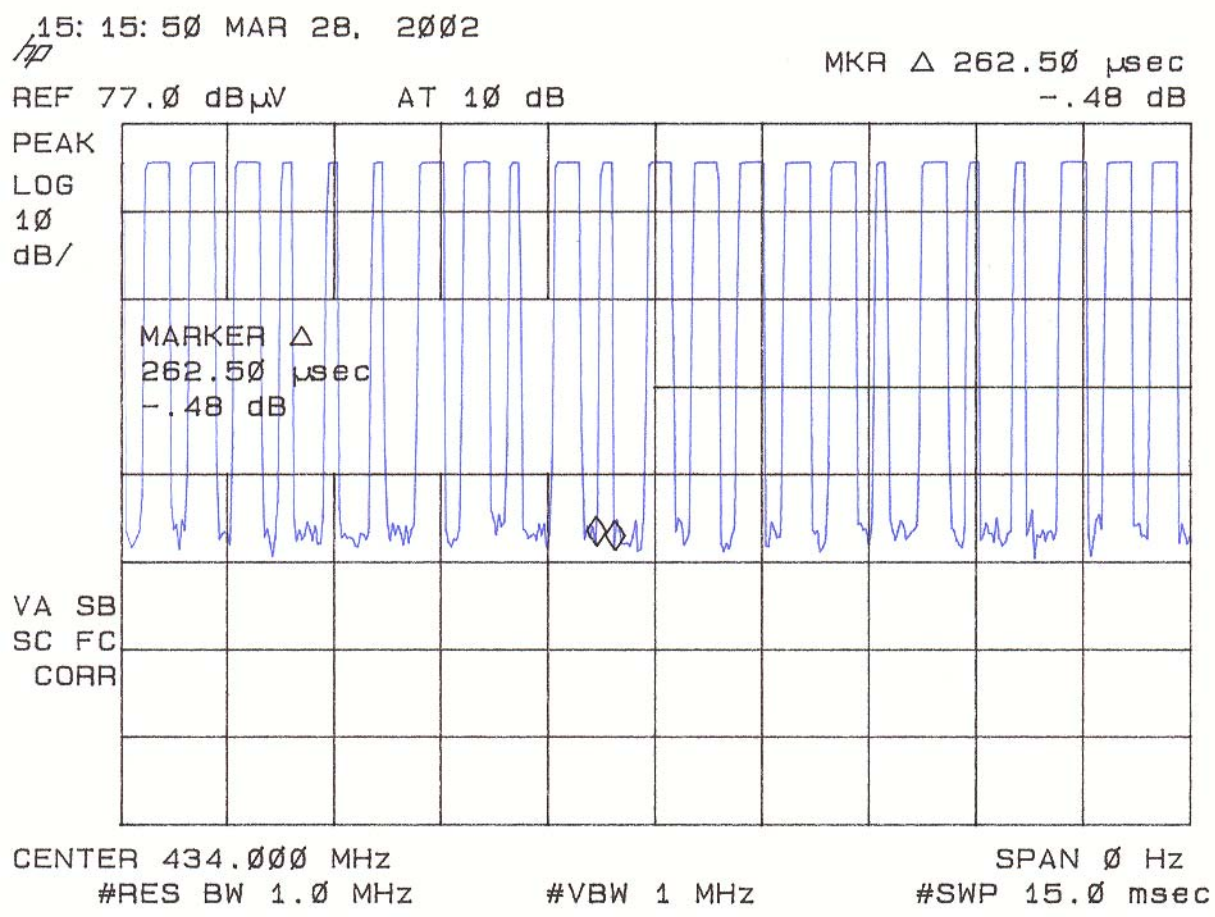


FIGURE 5f

DUTY CYCLE CHARACTERISTICS



Field Strength Of Spurious Emissions (47 CFR 15.231b)

Measurements were made using a peak detector (RBW=VBW=1MHz). Field strength of Spurious Emissions are shown in Table 5 and Figures 6. For comparison to the average limits, duty cycle corrections were made as given in the previous section. Any emission less than 1000 MHz and falling within the restricted bands of 15.205 were not adjusted for averaging and the limits of 15.209 were applied.

TABLE 5a

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Date: March 21, 2002
UST Project: 01-0675
Customer: Wayne-Dalton Corp.
Model: KEP2-B433

Peak Measurement

FREQ. (MHz.)	POL. (H/V)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
2634	V	-62.5	0.6	176.9	10,997

**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-62.5 + 0.6 + 107)/20) = 176.9
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: _____ **Name:** David Blethen

TABLE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Date: March 21, 2002
UST Project: 01-0675
Customer: Wayne-Dalton Corp.
Model: KEP2-B433

Average Measurement

FREQ. (MHz.)	POL. (H/V)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
2634	V	-71.1	0.6	66.8	1,100

*** Adjusted by duty cycle = 20 log (0.374) = -8.6 dB**
**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-71.1 + 0.6 + 107)/20) = 66.8
CONVERSION FROM dBm TO dBuV = 107 dB

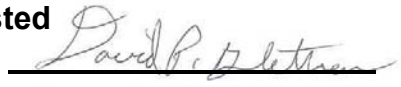
Tested By:  **Name: David Blethen**

FIGURE 6

SPURIOUS EMISSIONS 16.231(b)

PLOTS NOT AVAILABLE

20 dB Bandwidth of Fundamental Emission (47 CFR 15.231c)

The peak 20 dB bandwidth measurement of the fundamental emission is shown in Table 6 and Figure 7.

TABLE 6

20 dB BANDWIDTH OF FUNDAMENTAL EMISSION

Test Date: April 9, 2002
UST Project: 01-0675
Customer: Wayne-Dalton Corp.
Model: KEP2-B433

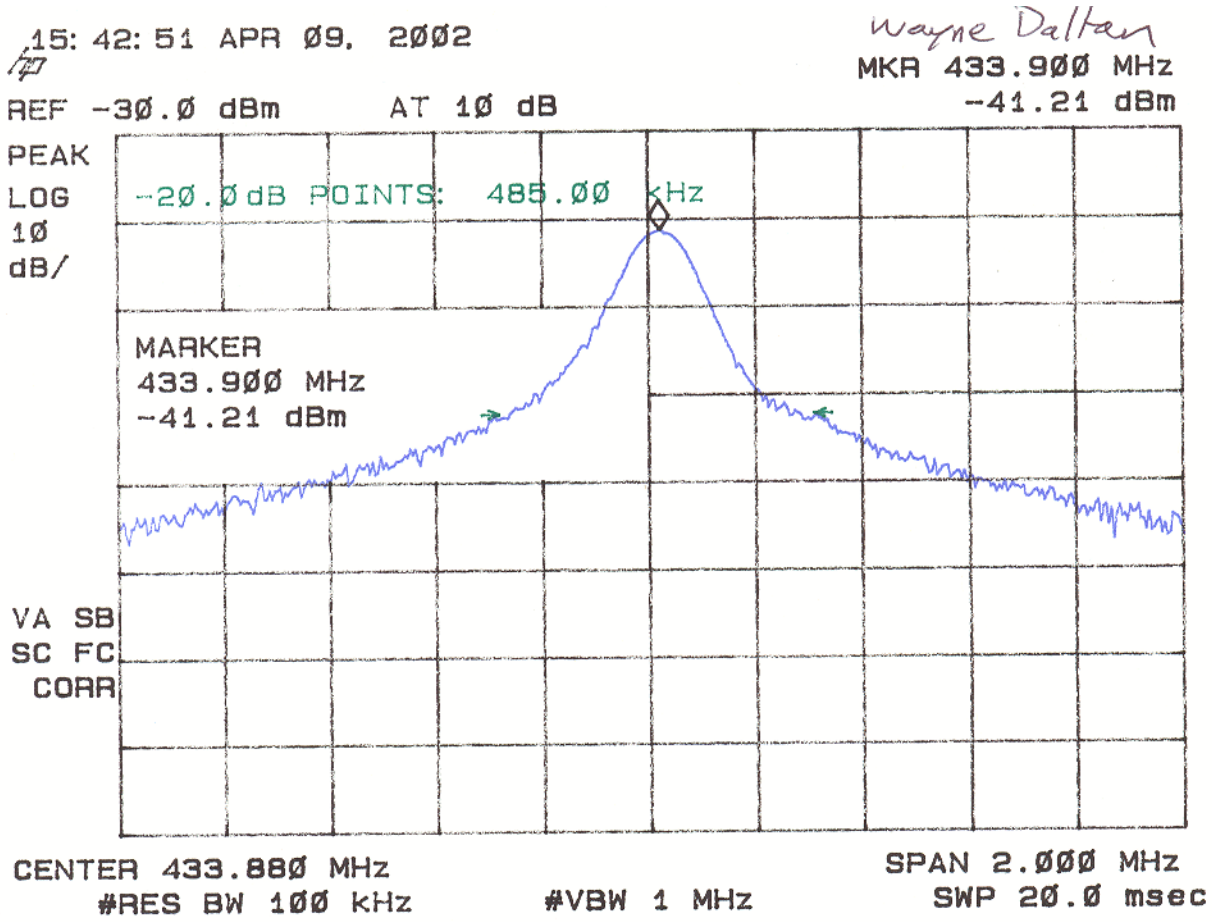
FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
433.920	485	1084

FCC Limit = (0.25%) (Center Frequency) = (0.0025)(433.920 MHz) = 1084 kHz

Tested By
Signature: _____ **Name:** David Blethen

FIGURE 7

20 dB BANDWIDTH OF FUNDAMENTAL EMISSION 15.231(c)



Frequency Tolerance of Carrier Signal (47 CFR 15.231d)

The EUT does not operate in the 40.66 - 40.70 MHz band, therefore frequency tolerance measurements were deemed unnecessary.

Radiated Digital Device Emissions (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 1000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz. Emissions are shown in Table 7.

TABLE 7

CLASS B

RADIATED EMISSIONS

Test Date: April 29, 2001
UST Project: 01-0675
Customer: Wayne-Dalton Corp.
Model: KEP2-B433

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m
Since the digital devices circuitry is used only to enable operation of the transmitter and did not control additional functions or capability, testing of digital device emissions was deemed not necessary.				

Tested By: David R. Blethen **Name:** David Blethen

Power Line Conducted Emissions (47 CFR 15.107a)

The EUT is operated by internal battery power only, therefore power line conducted emissions was deemed unnecessary.