

Wayne-Dalton Corp.
FCC Part 15, Certification Application
Model KEP2-0000

April 29, 2001

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Wayne-Dalton Corp.

MODEL: KEP2-0000

FCC ID: KJ8KYE-372BSW

DATE: April 29, 2001

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
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SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is a Wayne-Dalton Corp., Model KEP2-0000. The EUT is a wall mountable keypad transmitter operating at 372.5 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.



00-0489
00-0490

Wayne-Dalton Corp. • Ellyson Industrial Park • 3395 Addison Drive • Pensacola, FL 32514 • 850-474-9890 • FAX 850-474-1254

February 12, 2001

Scott Proffitt
Director of Sales & Marketing
US Tech
3505 Francis Circle
Alpharetta, GA 30201
United States of America

Dear Scott:

SUBJECT: ANTENNA DESCRIPTION FOR 372.5MHZ KEYLESS ENTRY, MODEL: KEP2-0000

The 372.5Mhz keyless entry has an antenna etched directly on the PCB board. The antenna has an irregular shape, which resembles the letter "G". The upper horizontal track measures .325" x .040", the vertical track measures 1.185" x .040", and the lower horizontal track measures .515" x .040", and the last vertical track .555" x .040".

Do not hesitate to call if you have any questions about the system.

Sincerely,

A handwritten signature in cursive script, appearing to read "Richard Bardin", written in dark ink.

Richard Bardin
Electrical Engineer
Wayne Dalton Corp.

5305 ADDISON DR.
PENSACOLA, FL 32514
UNITED STATES OF AMERICA

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

No modifications were made to bring the EUT into compliance with FCC Part 15, Class B Requirements.

Test Equipment

Table 2 describes test equipment used to evaluate this product.

FIGURE 1
TEST CONFIGURATION

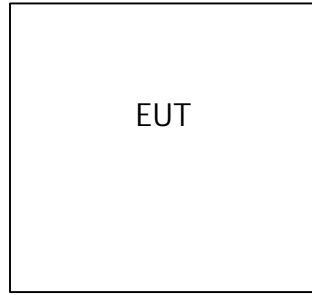


FIGURE 2a

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 Wayne-Dalton Corp. (EUT)	KEP2-0000	Unit B	KJ8KYE-372BSW (Pending)	None

TABLE 2**TEST INSTRUMENTS**

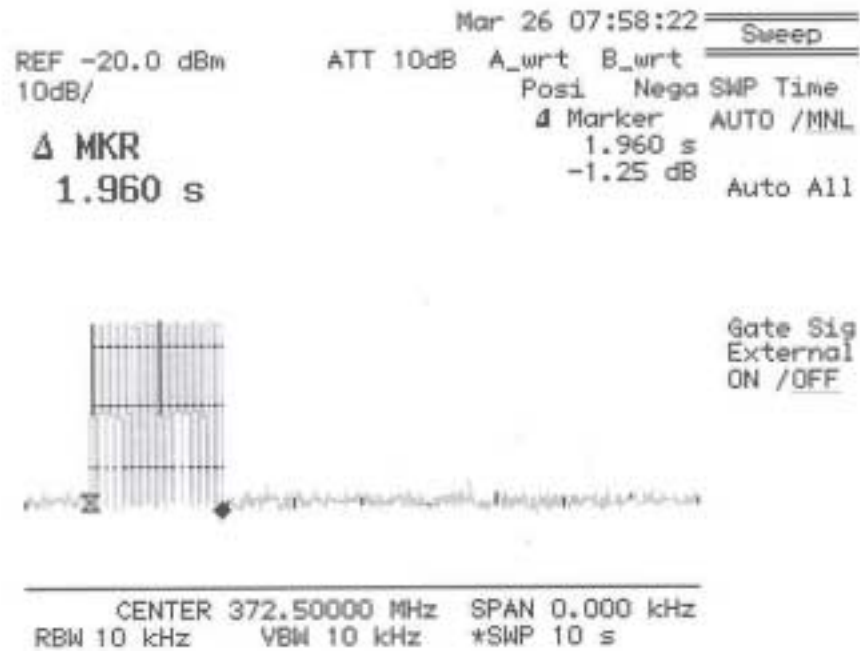
TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
LISN	SOLAR ELE.	8028	910495 & 910494
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

Periodic Operation (47 CFR 15.231(a1))

A transmitter manually activated must automatically deactivate within not more than 5 seconds of being released. The longest period of time the transmitter should take to deactivate is 1.96 sec 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 (125.3 msec) includes a preamble (16 x 0.150 msec) and a series of 66 long (375.0 μ s) and short (187.5 μ s) pulses. Assuming a pseudo-random code generation (50% 0's and 1's) the duty cycle would be calculated as shown below. Figures 5a through 5f show the characteristics of the pulse train for one of these functions.

$$\text{preamble} = 16 \times 0.1875 = 3.0 \text{ msec}$$

$$\text{data} = 33 \times 0.187 + 33 \times 0.375 = 18.546$$

$$\text{Total} = 2.4 \text{ msec} + 18.546 \text{ msec} = 20.946 \text{ msec in a 100 msec period of time}$$

$$\text{Duty Cycle Correction} = 20 \log (0.21546) = -13.3 \text{ dB}$$

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

TABLE 3**FIELD STRENGTH OF FUNDAMENTAL EMISSION**

Test Date: March 18, 2001
UST Project: 00-0489
Customer: Wayne-Dalton Corp.
Model: KEP2-0000

Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
372.5	-40.2	19.5	20,868.9	84,375

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-40.2 + 19.5 + 107)/20)$ = 20,868.9
CONVERSION FROM dBm TO dBuV = 107 dB

Tested**By:**

Name: Sam Wismer

TABLE 4**FIELD STRENGTH OF FUNDAMENTAL EMISSION**

Test Date: March 18, 2001
UST Project: 00-0489
Customer: Wayne-Dalton Corp.
Model: KEP2-0000

Average Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
372.5	-53.5	19.5	4466.8	8,437.5

* Adjusted by duty cycle = $20 \log (0.21546) = -13.3 \text{ dB}$

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-53.5 + 19.5 + 107)/20) = 4466.8$

CONVERSION FROM dBm TO dBuV = 107 dB

Tested

By:



Name: Sam Wismer

FIGURE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)



FIGURE 5a

DUTY CYCLE CHARACTERISTICS

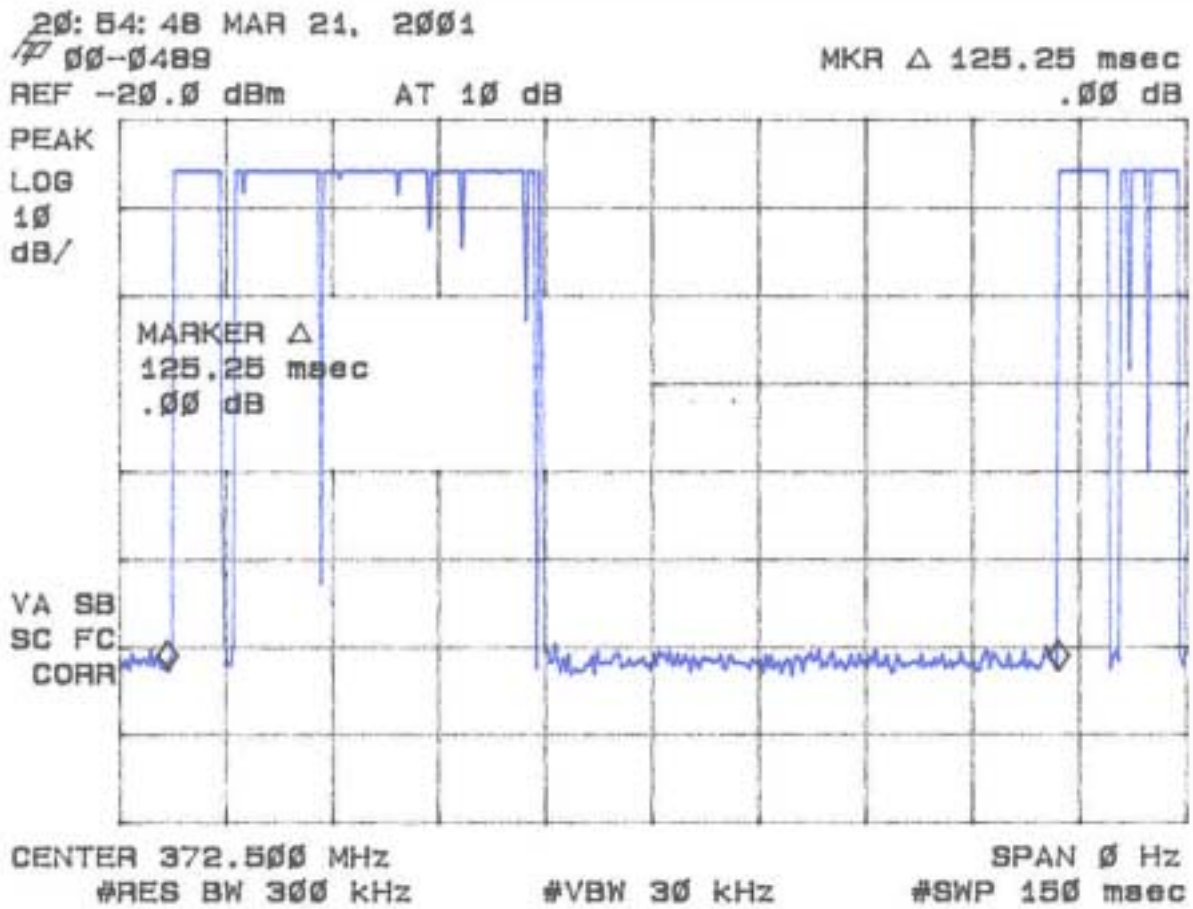


FIGURE 5b

DUTY CYCLE CHARACTERISTICS

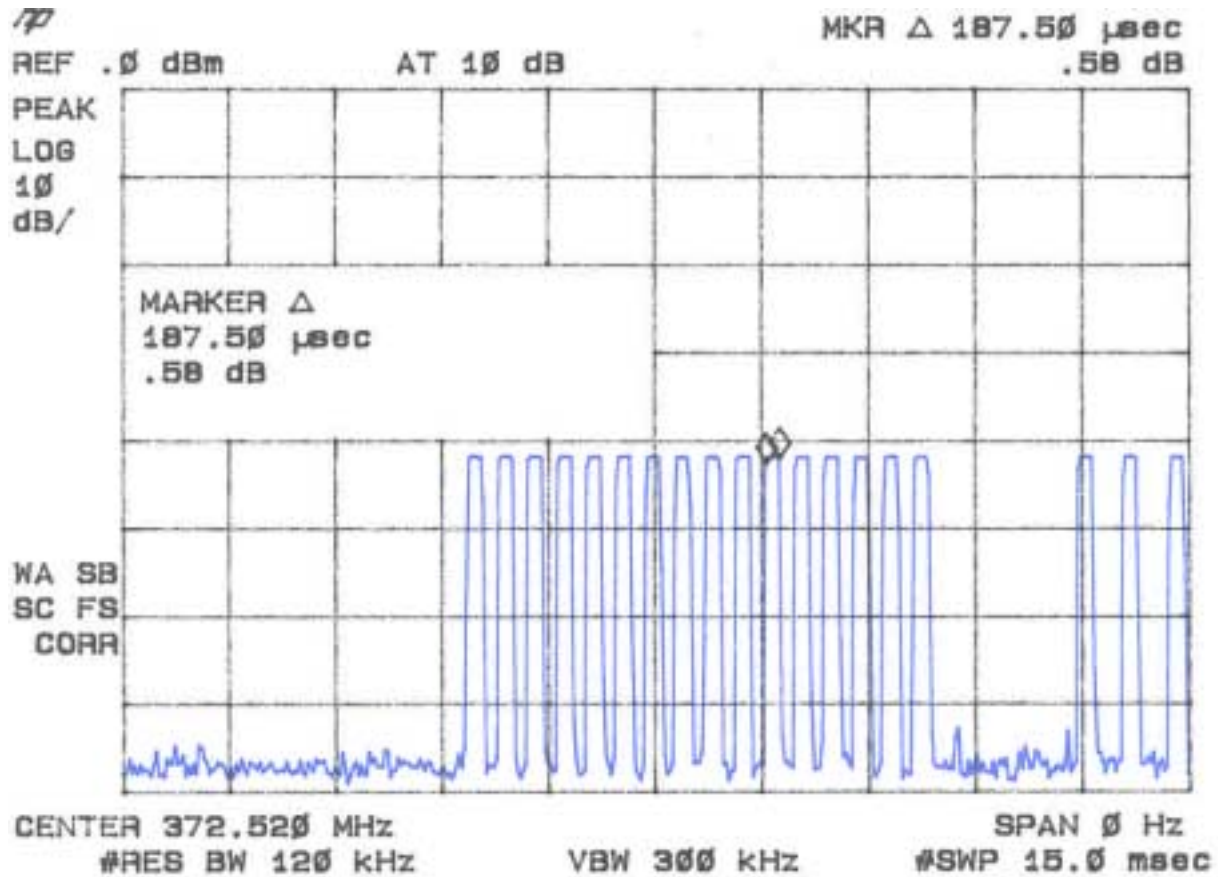


FIGURE 5c

DUTY CYCLE CHARACTERISTICS

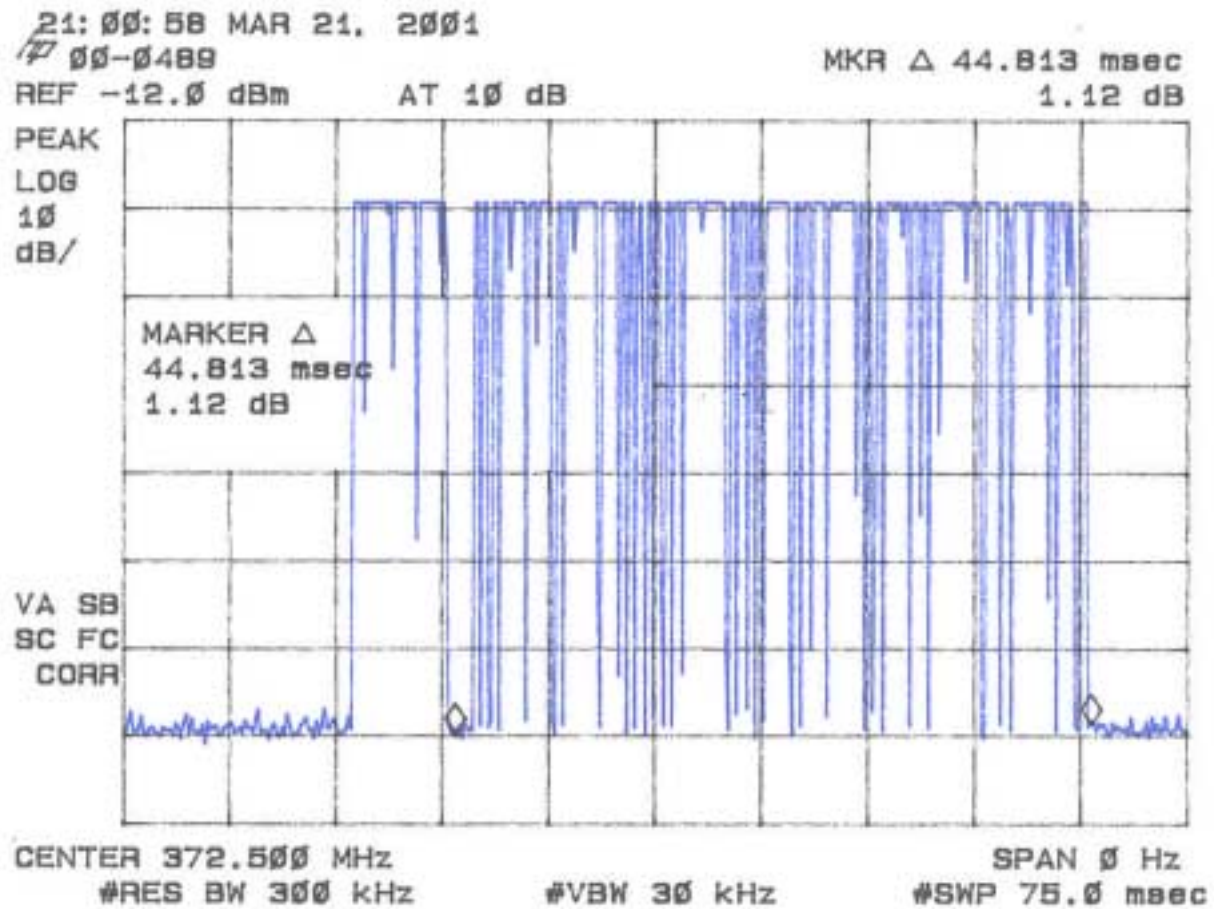


FIGURE 5d

DUTY CYCLE CHARACTERISTICS

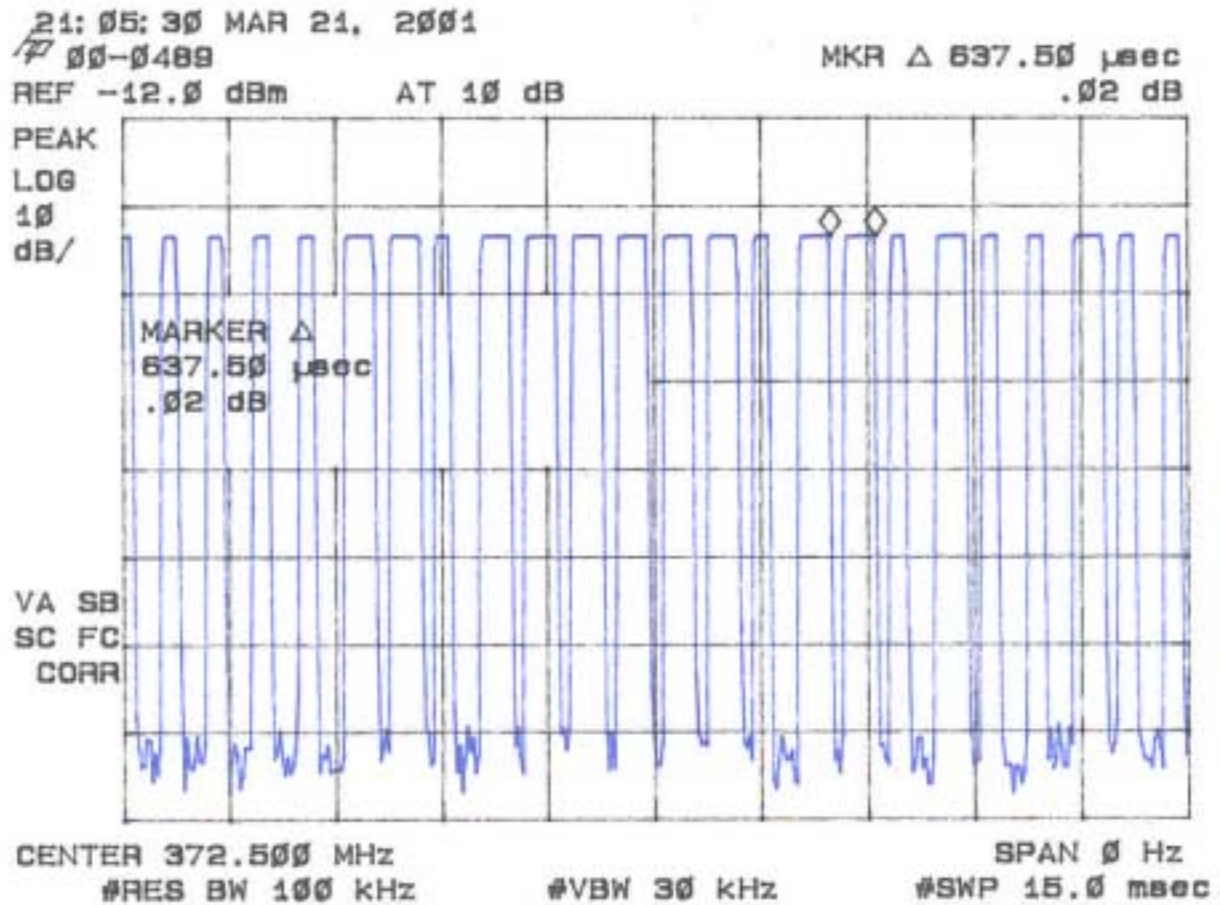


FIGURE 5e

DUTY CYCLE CHARACTERISTICS

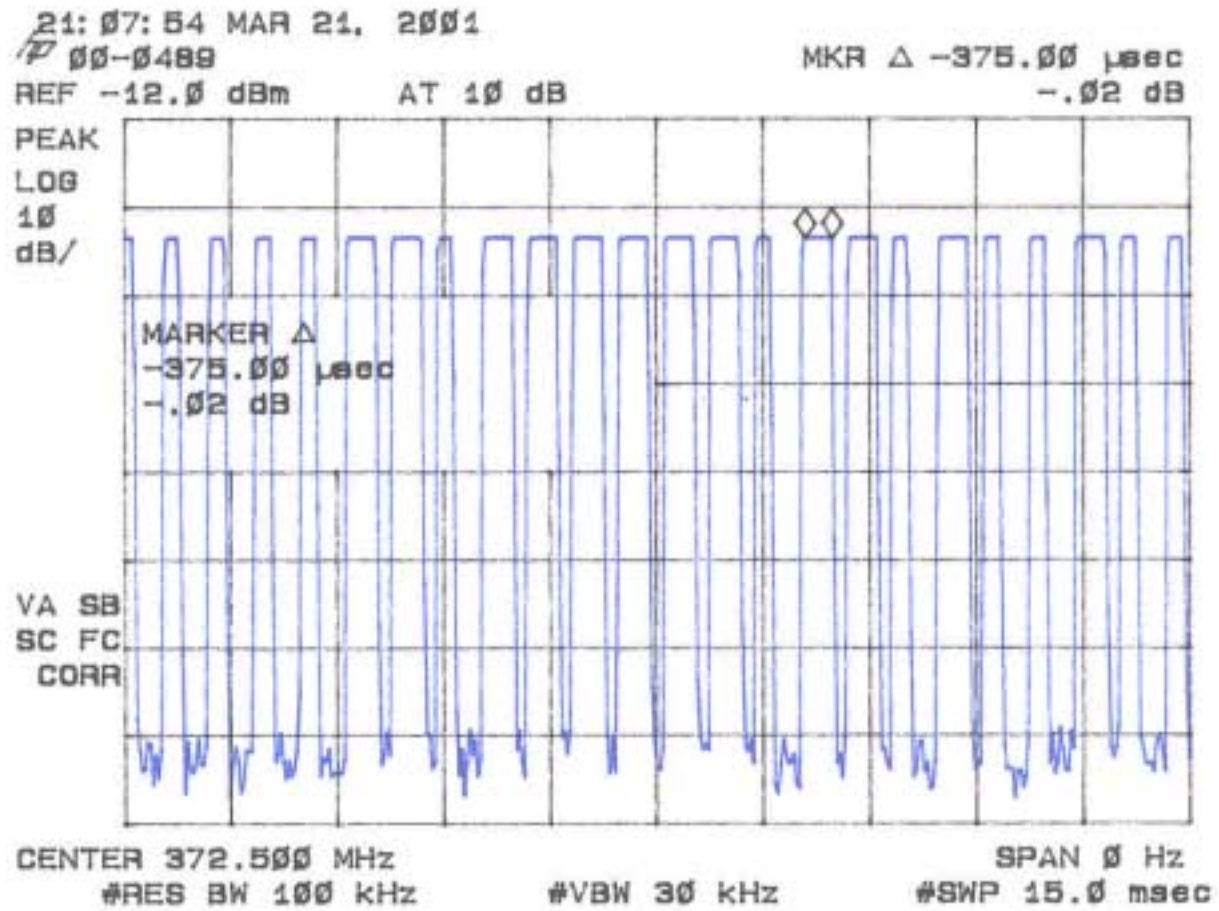
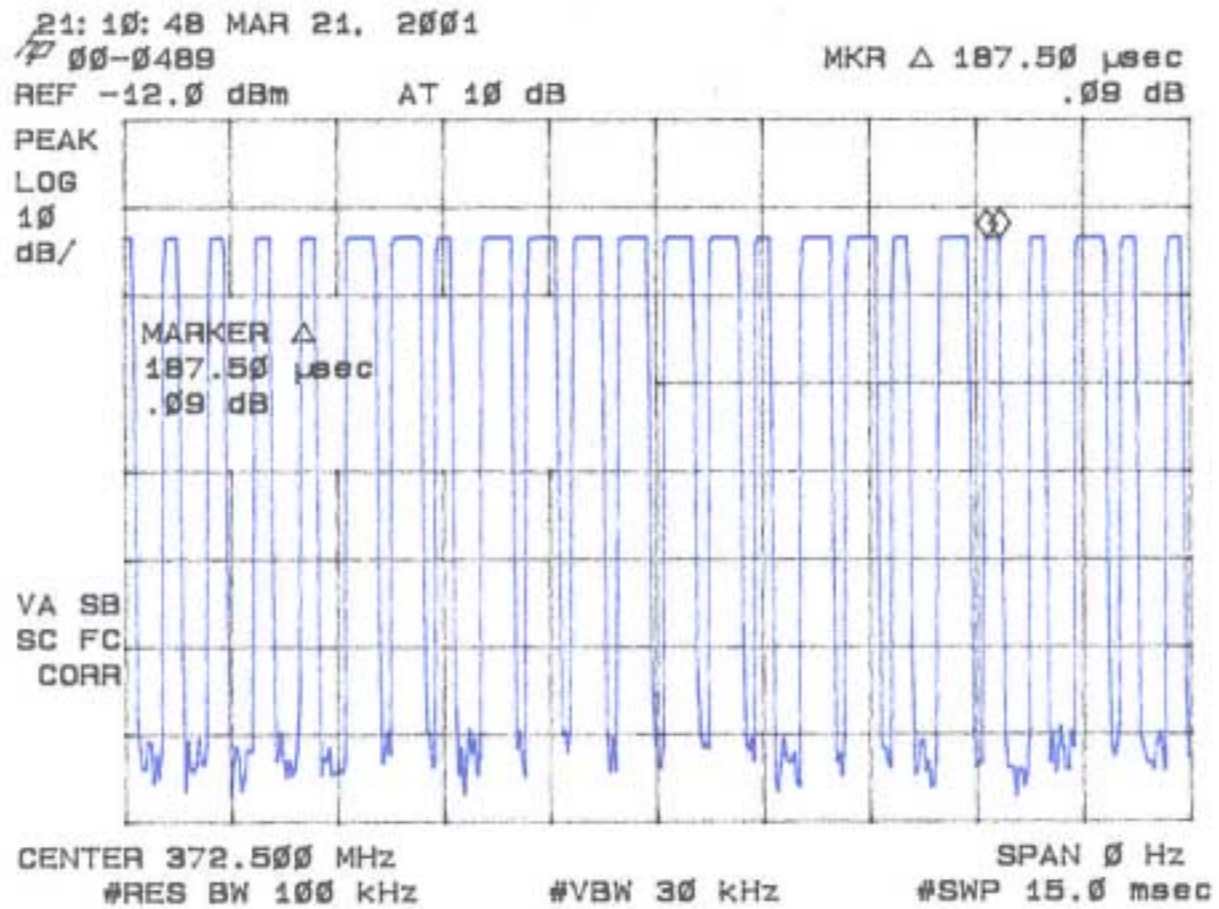


FIGURE 5f

DUTY CYCLE CHARACTERISTICS



Field Strength Of Spurious Emissions (47 CFR 15.231b)

Measurements were made using a peak detector. 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 18, 2001
 UST Project: 00-0489
 Customer: Wayne-Dalton Corp.
 Model: KEP2-0000

Peak Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
745.0	-64.1	27.8	3443.0	8438
1117.6**	-36.2	-8.8	1266.3	5000
1490.0**	-36.7	-7.1	1439.6	5000
2607.6	-48.9	-1.9	646.9	8438

** Denotes restricted band of operation

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-64.1 + 27.8 + 107)/20)$ = 3443.0
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  Name: Sam Wismer

TABLE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Date: March 18, 2001
 UST Project: 00-0489
 Customer: Wayne-Dalton Corp.
 Model: KEP2-0000

Average Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
745.0	-77.4	27.8	741.3	843.8
1117.6**	-49.5	-8.8	272.3	500.0
1490.0**	-50.0	-7.1	312.6	500.0
2607.6	-62.2	-1.9	139.6	843.8

* Adjusted by duty cycle = $20 \log (0.21546) = -13.3 \text{ dB}$

** Denotes restricted band of operation

** Denotes restricted band of operation

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = $\text{Antilog} ((-77.4 + 27.8 + 107)/20) = 741.3$

CONVERSION FROM dBm TO dBuV = 107 dB

Tested

By:  Name: Sam Wismer

FIGURE 6a

SPURIOUS EMISSIONS 16.231(b)

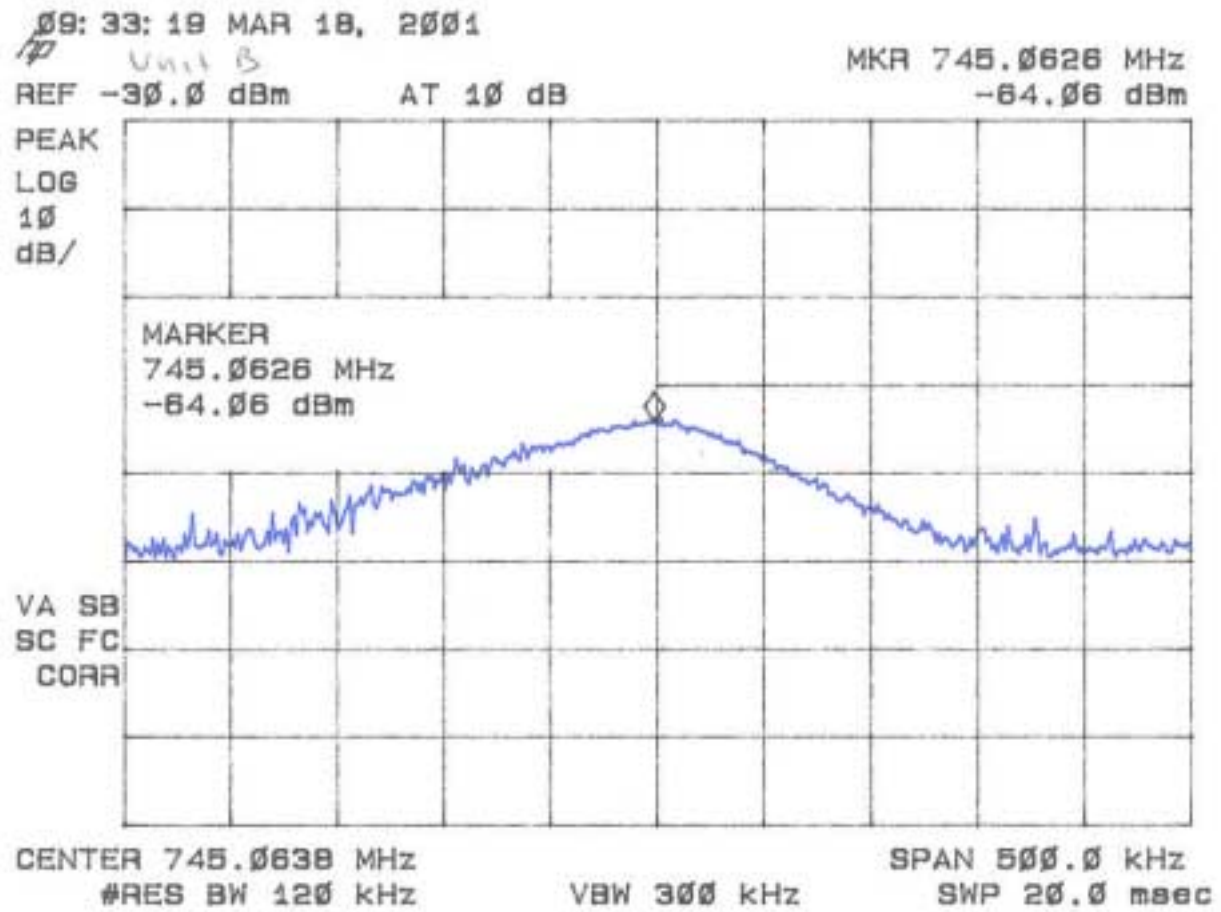


FIGURE 6b

SPURIOUS EMISSIONS 16.231(b)

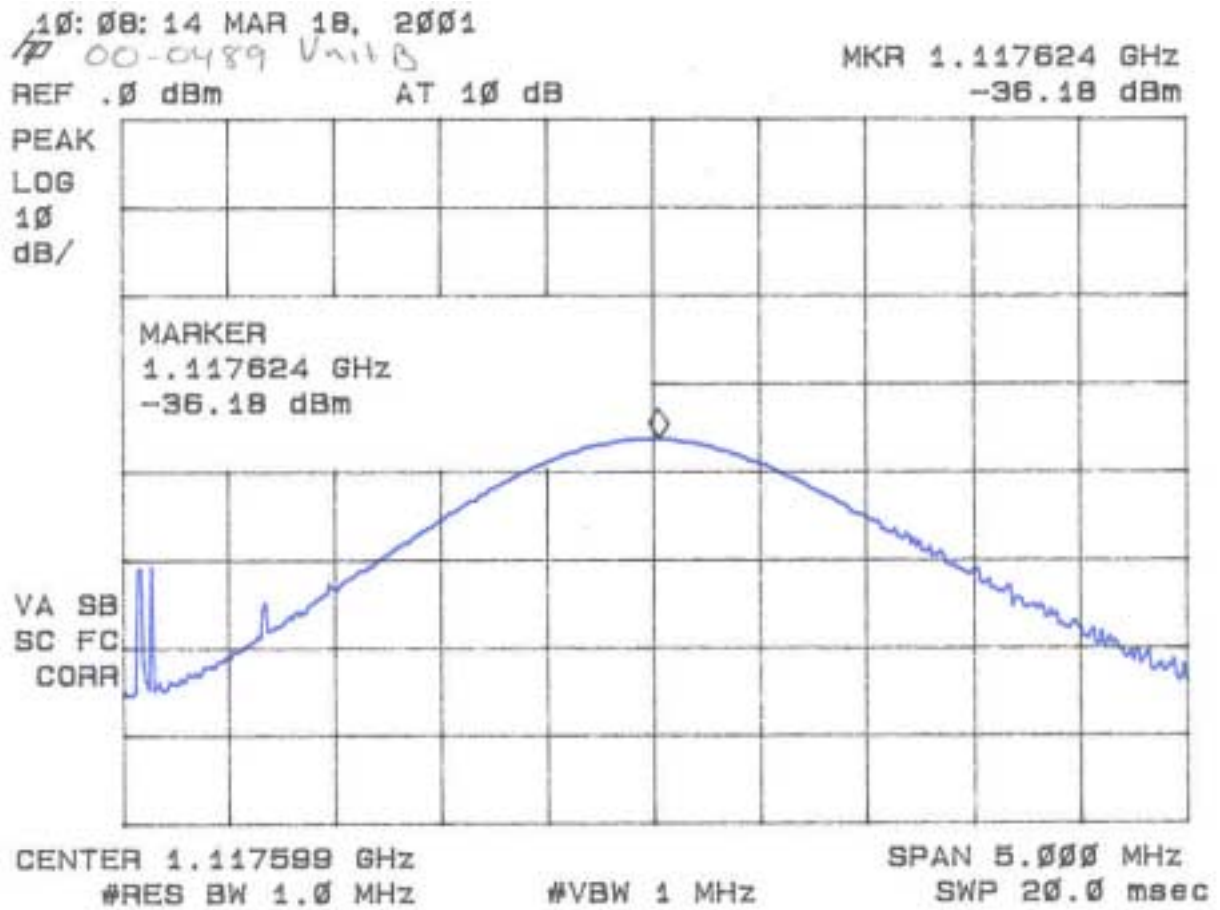


FIGURE 6c

SPURIOUS EMISSIONS 16.231(b)

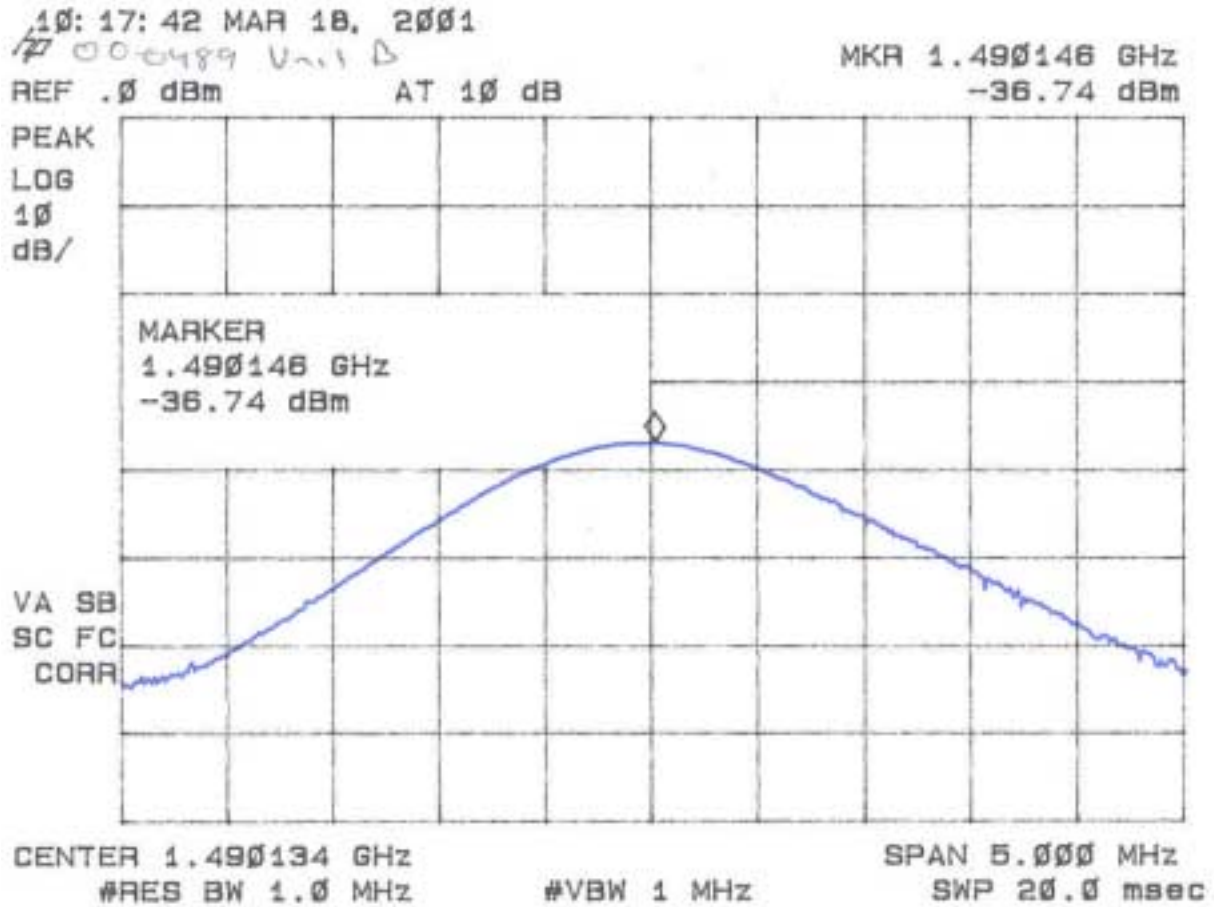
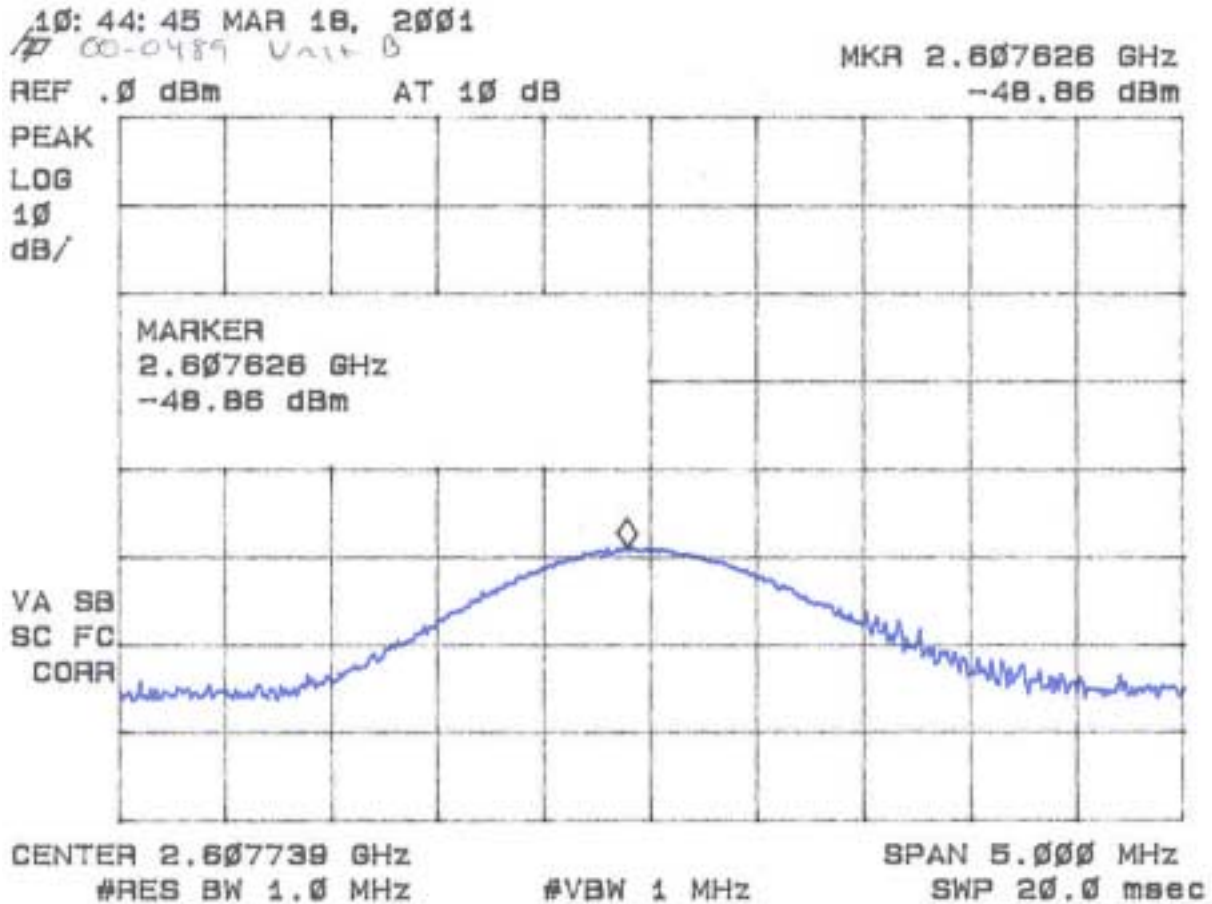


FIGURE 6d

SPURIOUS EMISSIONS 16.231(b)



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: March 18, 2001
UST Project: 00-0489
Customer: Wayne-Dalton Corp.
Model: KEP2-0000

FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
372.5	325	931

FCC Limit = (0.25%) (Center Frequency) = (0.0025)(372.5 MHz) = 931 kHz

Tested By
Signature: _____ **Name:** Tim R. Johnson

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: March 18, 2001
UST Project: 00-0489
Customer: Wayne-Dalton Corp.
Model: KEP2-0000

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:  **Name:** Sam Wismer

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.