

**Wayne-Dalton Corp.  
FCC Part 15, Certification Application  
Model KEP2-0433**

**April 29, 2001**

## MEASUREMENT/TECHNICAL REPORT

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

**MODEL:** KEP2-0433

**FCC ID:** KJ8KYE-433ASW

**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  
Fax Number: (770) 740-1508

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# SECTION 1

## GENERAL INFORMATION

## **GENERAL INFORMATION**

### **Product Description**

The Equipment Under Test (EUT) is a Wayne-Dalton Corp., Model KEP2-0433. 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.



01-0154  
01-0155  
01-0156

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

PRODUCT  
DESCRIPTION

Dear Scott:

SUBJECT: ANTENNA DESCRIPTION FOR 433.92MHZ KEYLESS ENTRY, MODEL: KEP2-0433

The 433.92Mhz 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, reading "Richard Bardin".

Richard Bardin  
Electrical Engineer  
Wayne Dalton Corp.

## 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.

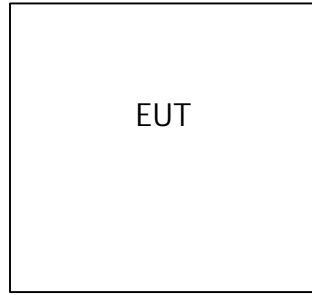
### **Modifications**

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)	KEP2-0433	Unit A	KJ8KYE-433ASW (Pending)	None

**TABLE 2****TEST INSTRUMENTS**

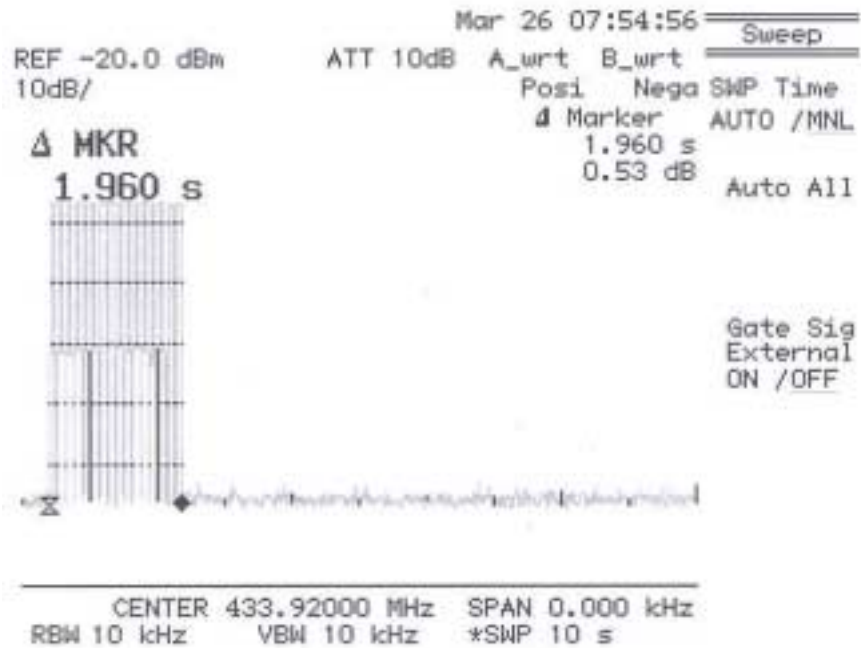
<b>TYPE</b>	<b>MANUFACTURER</b>	<b>MODEL</b>	<b>SN.</b>
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	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 (89.25 msec) never exceeds a series of 71\* long (337.5  $\mu$ s) and short (112.5  $\mu$ s) pulses. Assuming any combination of short or long pulses may be obtained due to encoding the worse case transmit duty cycle would be considered  $71 \times 337.5 \mu\text{s}$  per 89.25 msec = 26.8% duty cycle. Figures 5a through 5f show the characteristics of the pulse train for one of these functions.

\*- Note:  $37.875 \text{ msec (data transmit time)} / 637.5 \mu\text{s (period of long pulse)} = 59.4$   
 $7.3125 \text{ msec (preamble transmit time)} / 637.5 \mu\text{s (period of long pulse)} = 11.5$   
 $59.4 + 11.5 = 70.9 \text{ pulses}$

Duty Cycle Correction =  $20 \log (0.268) = -11.4 \text{ dB}$

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

## TABLE 3

## FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: April 29, 2001  
 UST Project: 01-0154  
 Customer: Wayne-Dalton Corp.  
 Model: KEP2-0433

## Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
433.92	-43.1	21.3	18,151.1	109,967

## SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog  $((-43.1 + 21.3 + 107)/20)$  = 18,151.1  
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested

By: Name: Sam Wismer

**TABLE 4****FIELD STRENGTH OF FUNDAMENTAL EMISSION**

**Test Date:** April 29, 2001  
**UST Project:** 01-0154  
**Customer:** Wayne-Dalton Corp.  
**Model:** KEP2-0433

**Average Measurement**

<b>FREQ. (MHz)</b>	<b>TEST DATA (dBm) @ 3m*</b>	<b>ANTENNA FACTOR + CABLE ATTENUATION</b>	<b>RESULTS (uV/m) @ 3m</b>	<b>AVERAGE FCC LIMITS (uV/m) @ 3m</b>
433.92	-54.5	21.3	4885.4	10,997

\* Adjusted by duty cycle =  $20 \log (0.268) = -11.4 \text{ dB}$

**SAMPLE CALCULATIONS:**

**RESULTS uV/m @ 3m = Antilog  $((-54.5 + 21.3 + 107)/20) = 4885.4$**

**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

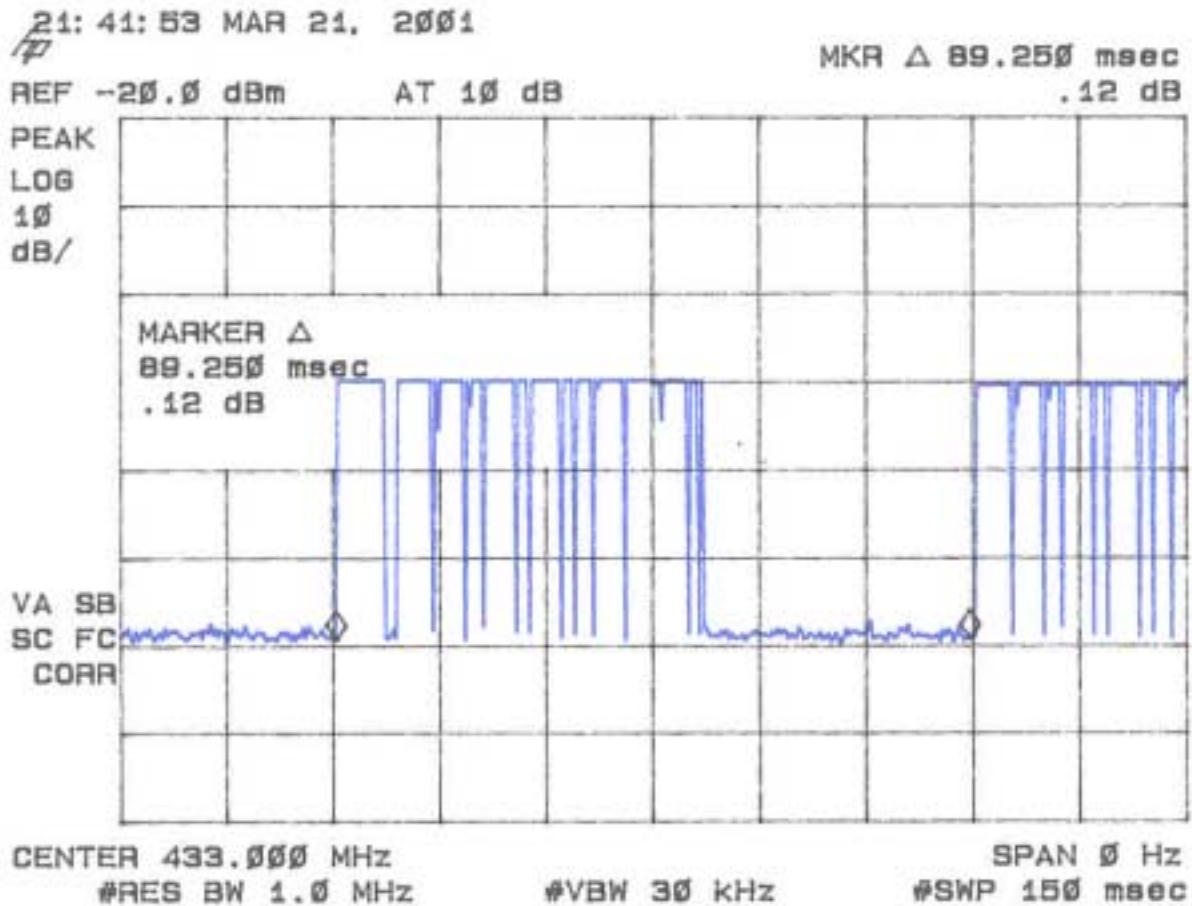


FIGURE 5b

## DUTY CYCLE CHARACTERISTICS

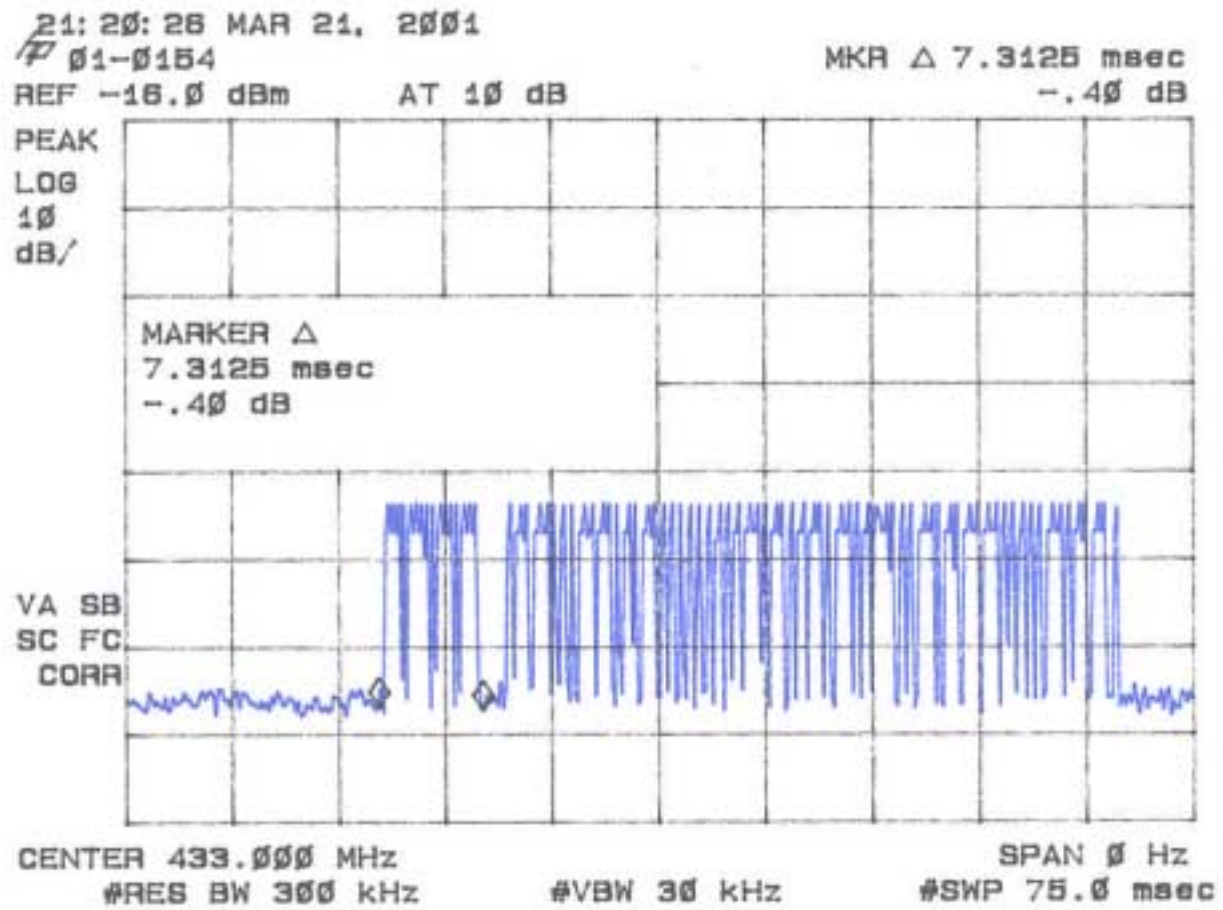


FIGURE 5c

## DUTY CYCLE CHARACTERISTICS

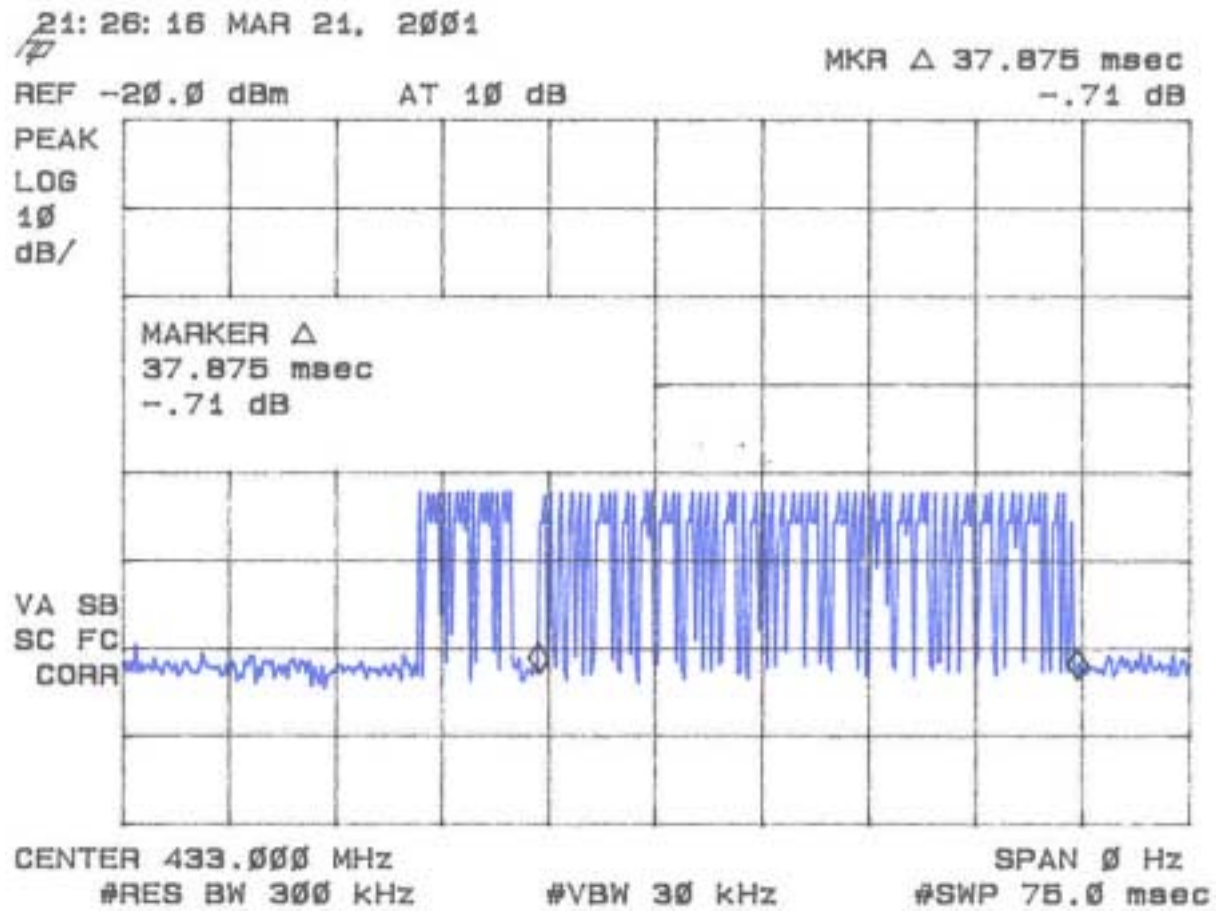


FIGURE 5d

## DUTY CYCLE CHARACTERISTICS

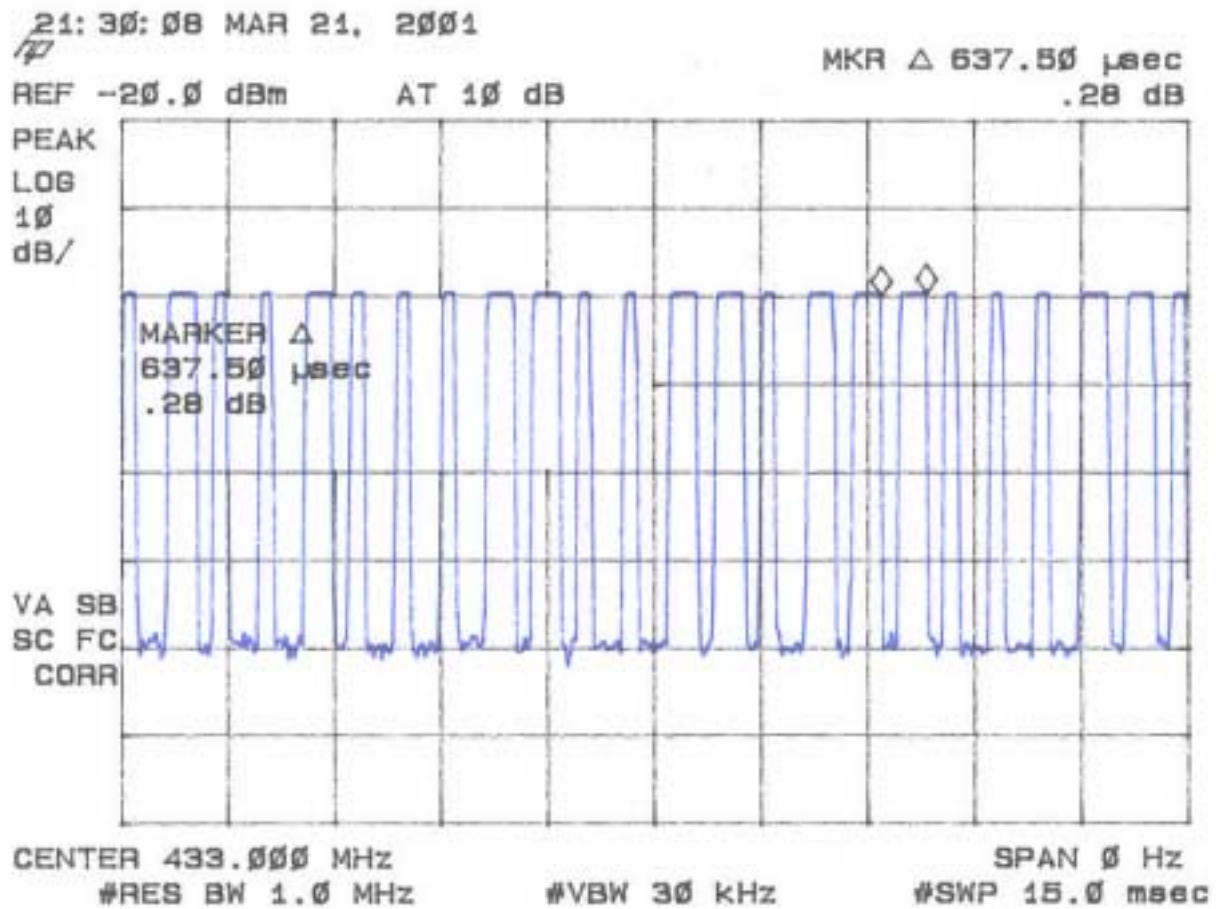




FIGURE 5e

## DUTY CYCLE CHARACTERISTICS

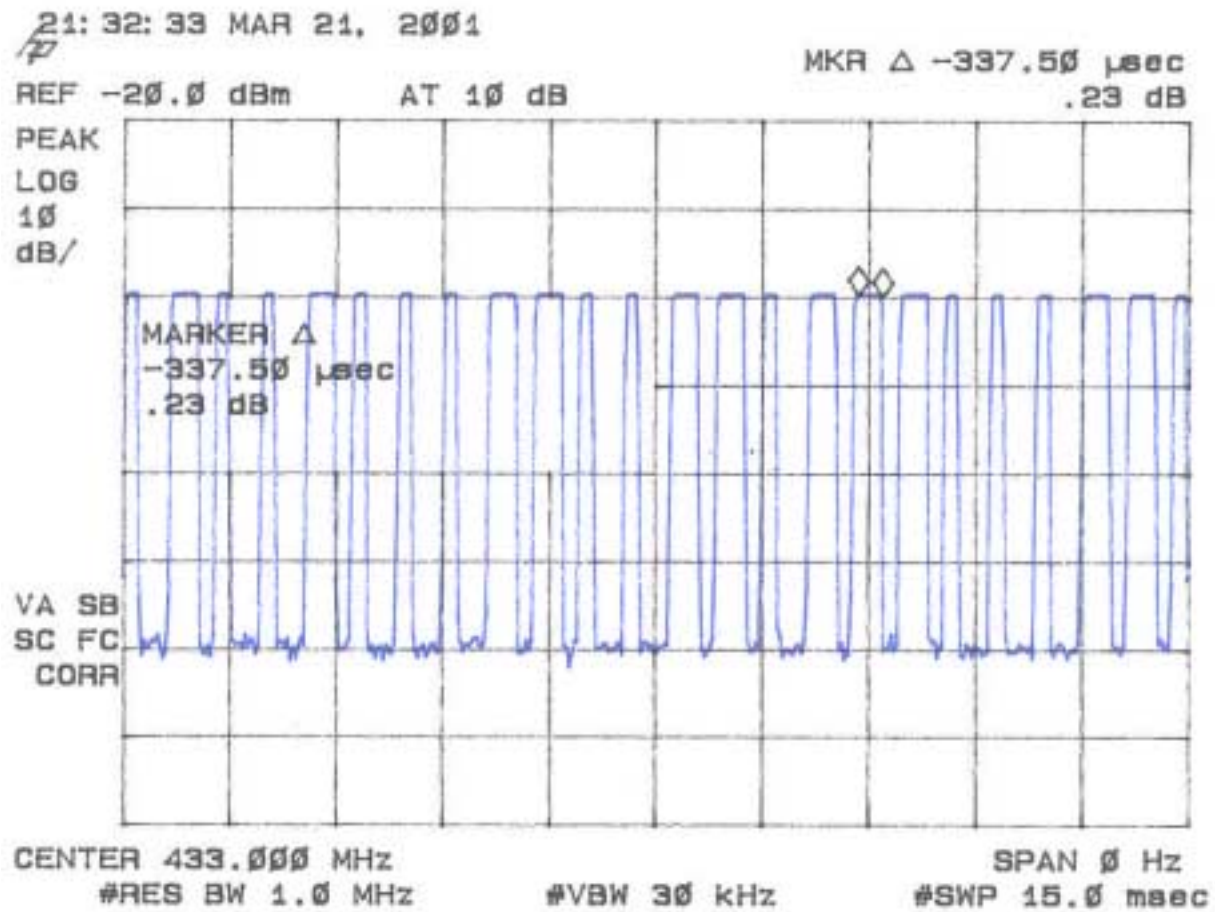
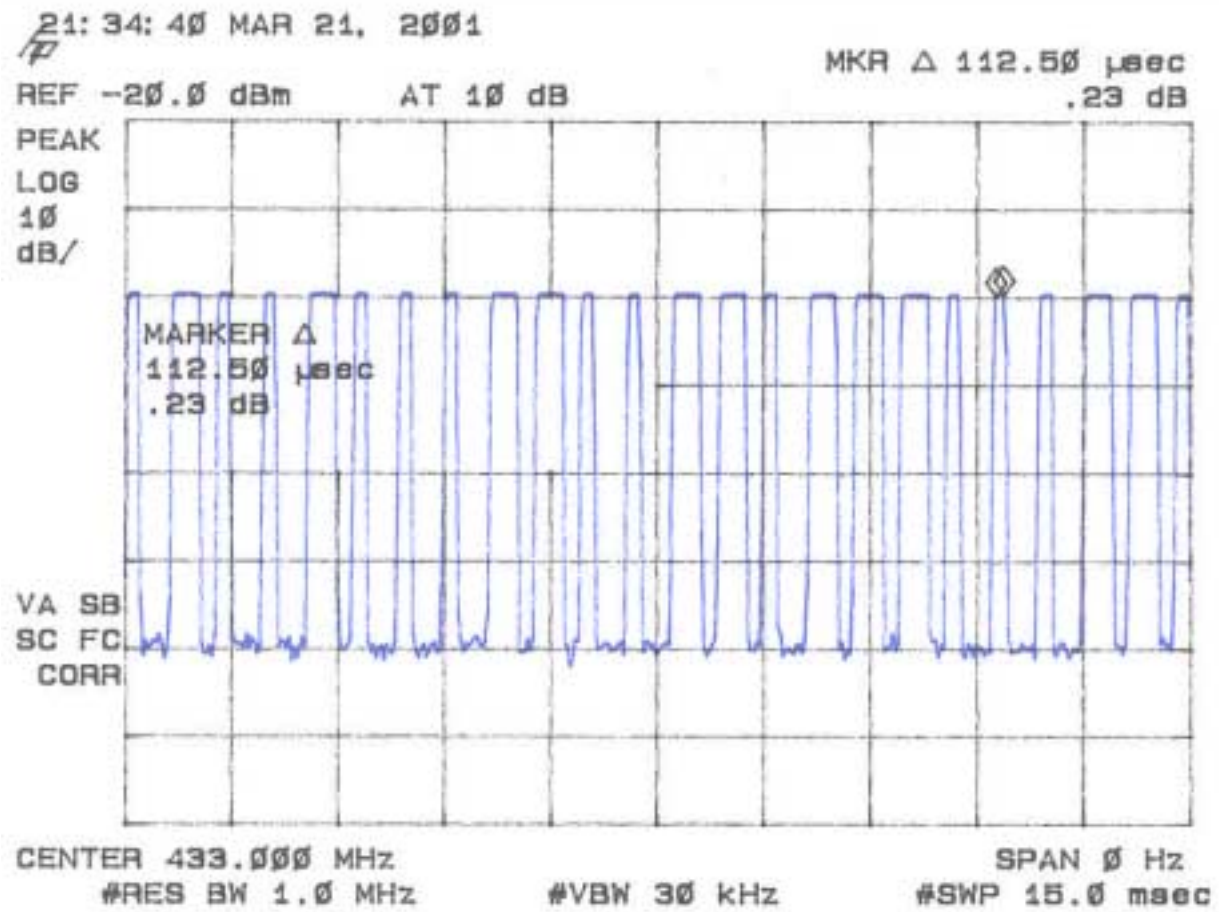


FIGURE 5f

## 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: April 29, 2001  
 UST Project: 01-0154  
 Customer: Wayne-Dalton Corp.  
 Model: KEP2-0433

## Peak Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
867.804	-67.3	30.2	3120.6	10,997
1301.0**	-43.2	-6.8	713.5	5,000
1735.0	-61.8	-3.9	115.4	10,997
2603.6	-62.5	0.0	168.1	10,997

\*\* Denotes restricted band of operation

## SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog  $((-67.3 + 30.2 + 107)/20)$  = 3120.6  
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  Name: Sam Wismer

TABLE 5b

## FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Date: April 29, 2001  
 UST Project: 01-0154  
 Customer: Wayne-Dalton Corp.  
 Model: KEP2-0433

## Average Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
867.804	-78.7	30.2	839.9	1,100
1301.0**	-54.6	-6.8	192.1	500
1735.0	-73.2	-3.9	31.1	1,100
2603.6	-73.9	0.0	45.2	1,100

\* Adjusted by duty cycle =  $20 \log (0.268) = -11.4 \text{ dB}$

\*\* Denotes restricted band of operation

## SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m =  $\text{Antilog} ((-78.7 + 30.2 + 107)/20) = 839.9$

CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  Name: Sam Wismer

FIGURE 6a

SPURIOUS EMISSIONS 16.231(b)

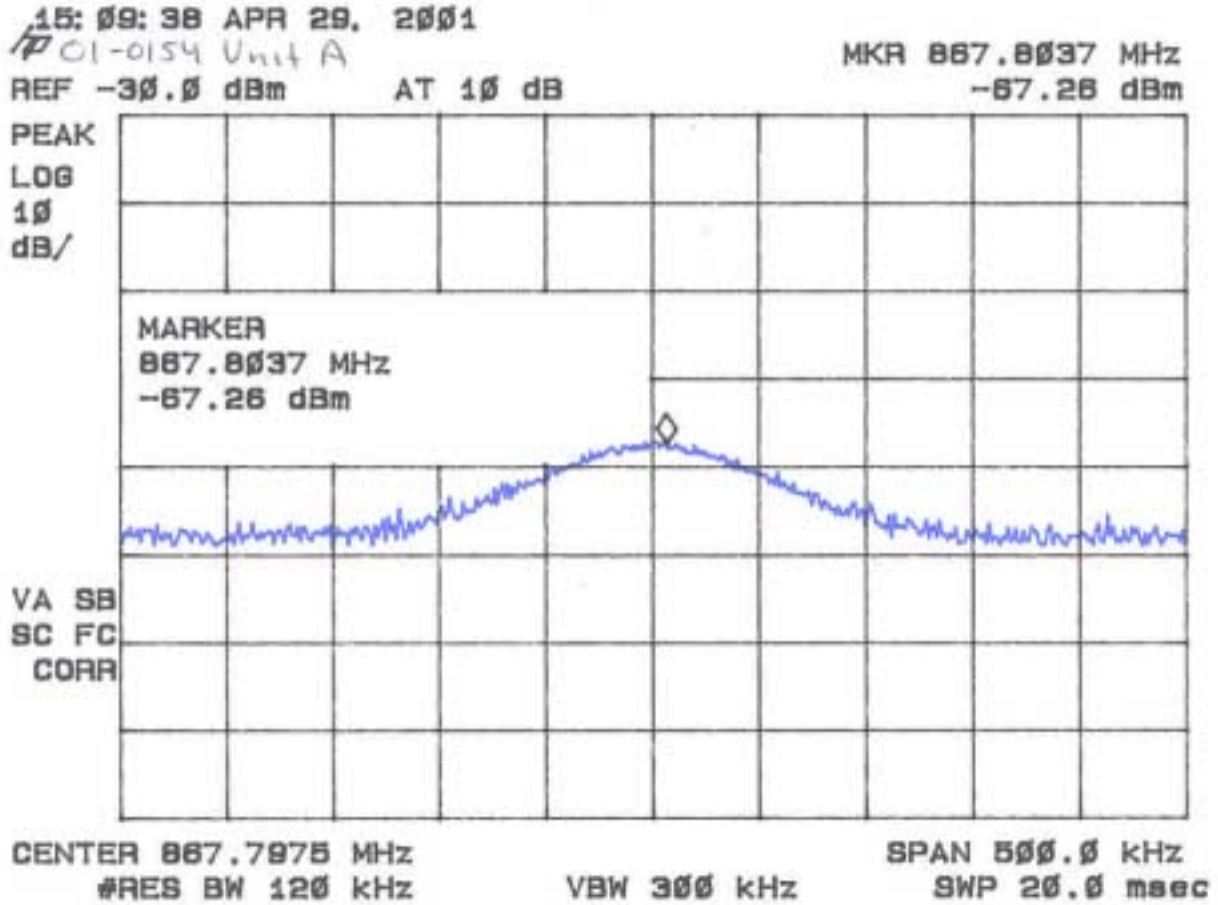


FIGURE 6b

## SPURIOUS EMISSIONS 16.231(b)

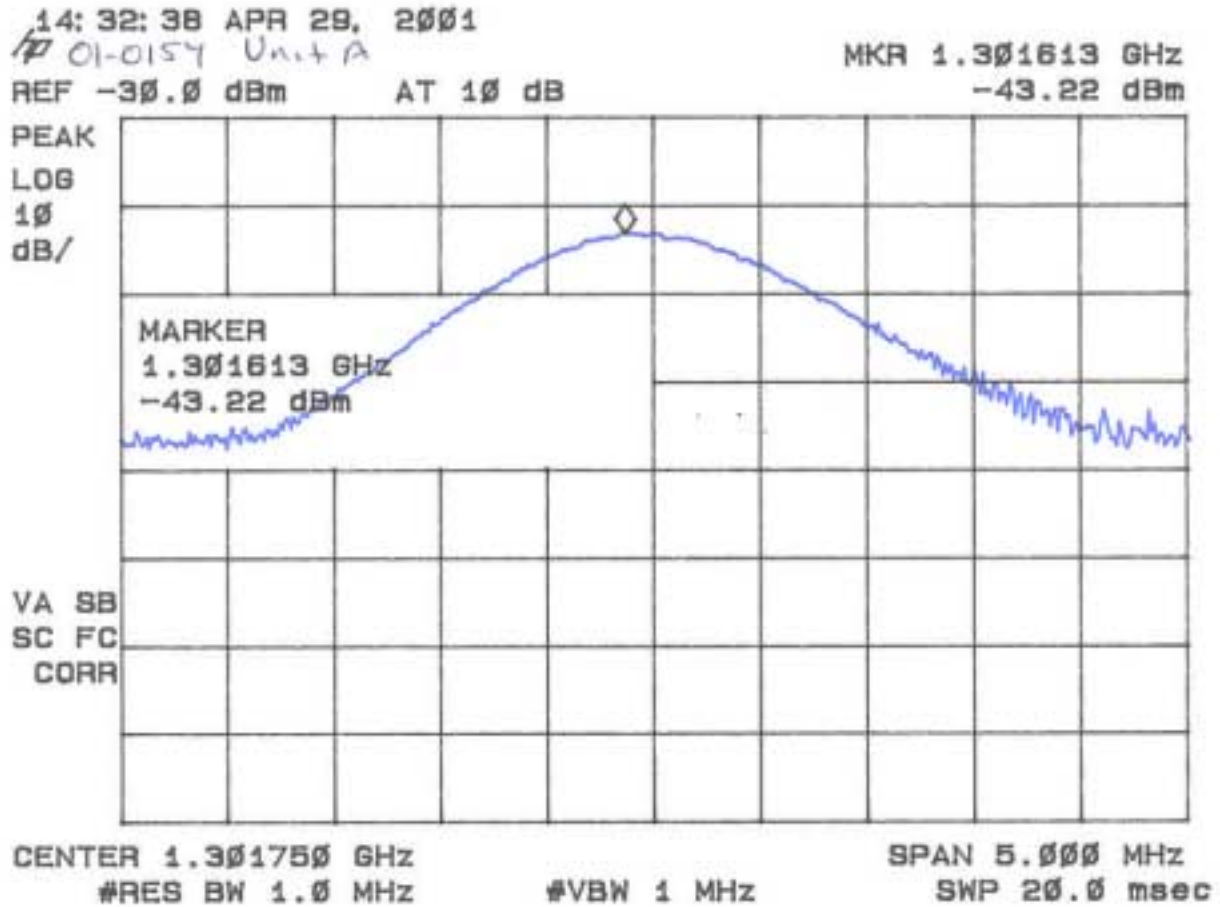


FIGURE 6c

## SPURIOUS EMISSIONS 16.231(b)

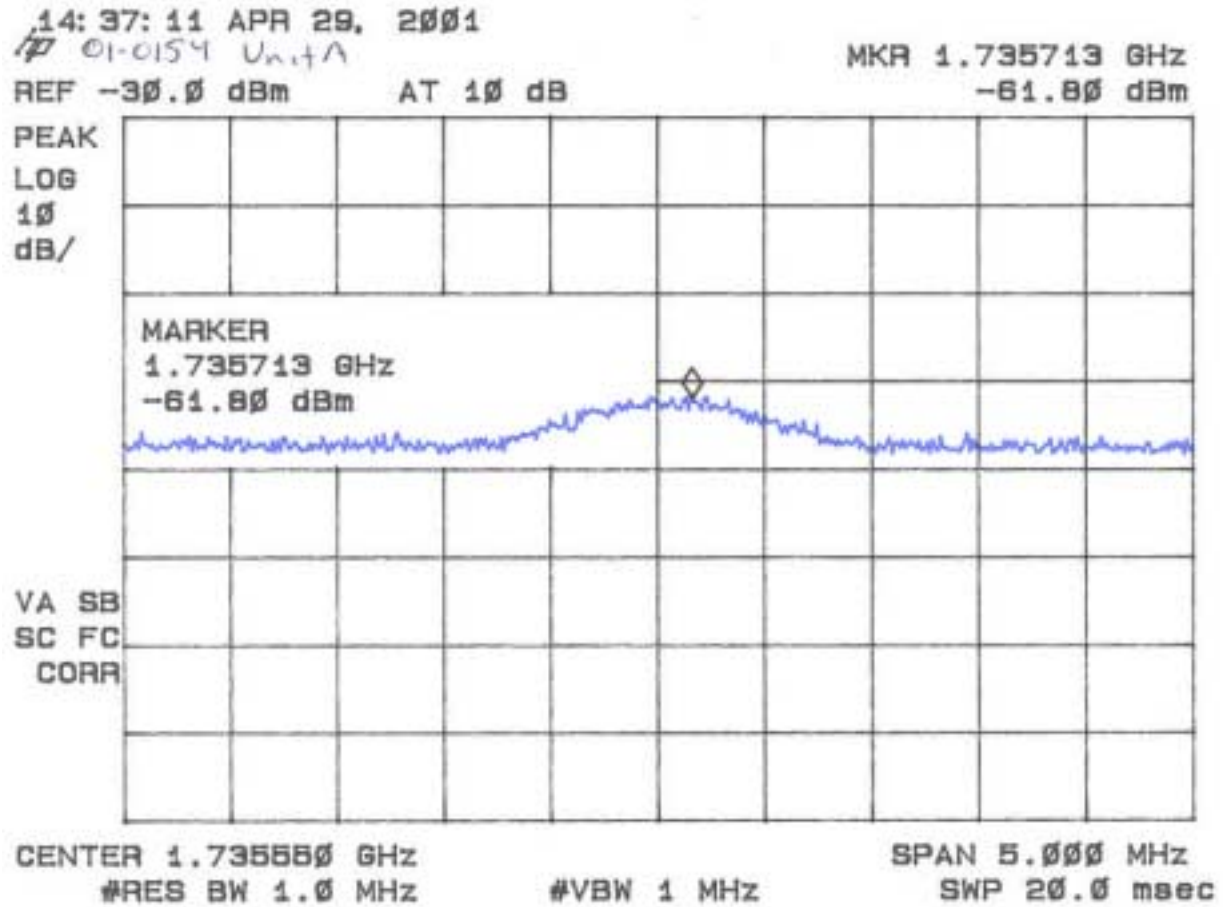
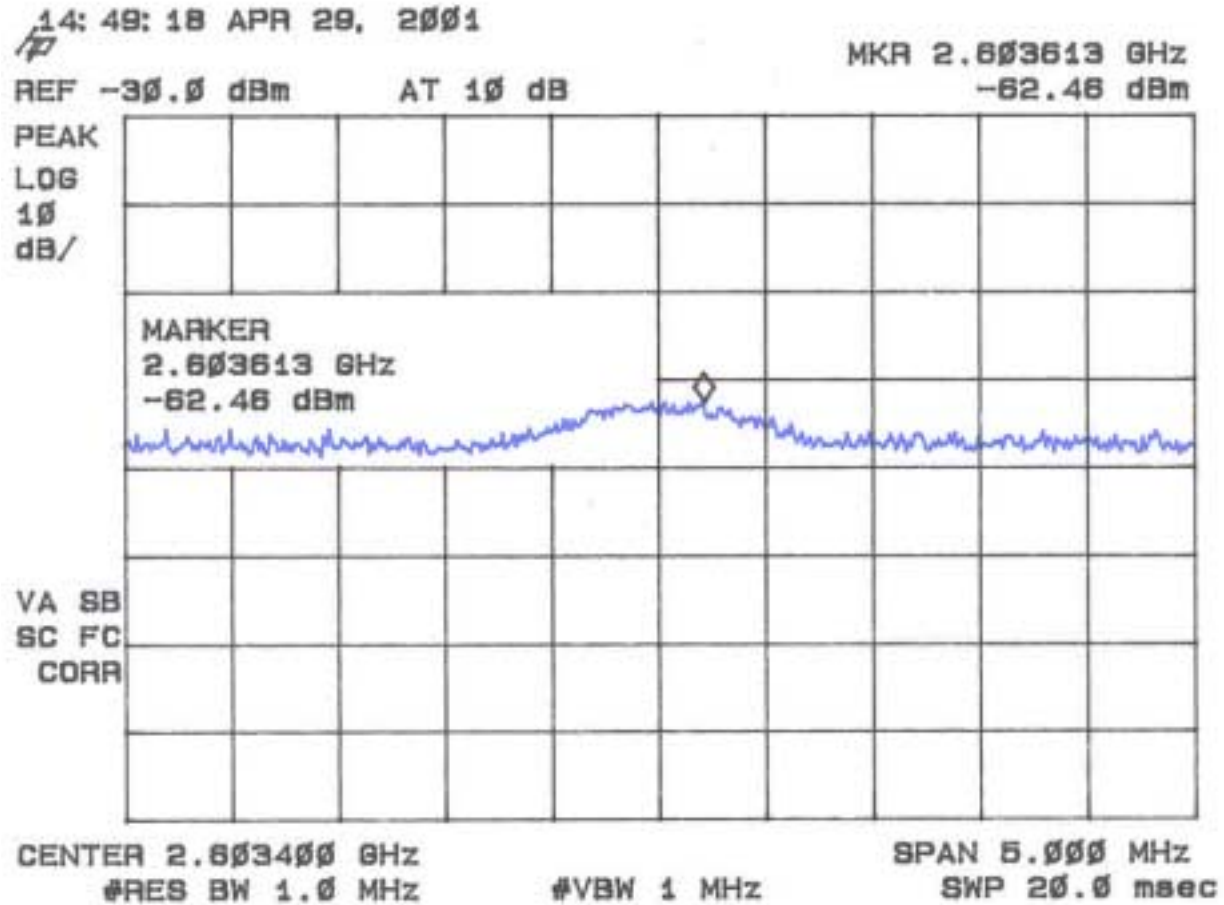




FIGURE 6d

## 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:** April 29, 2001  
**UST Project:** 01-0154  
**Customer:** Wayne-Dalton Corp.  
**Model:** KEP2-0433

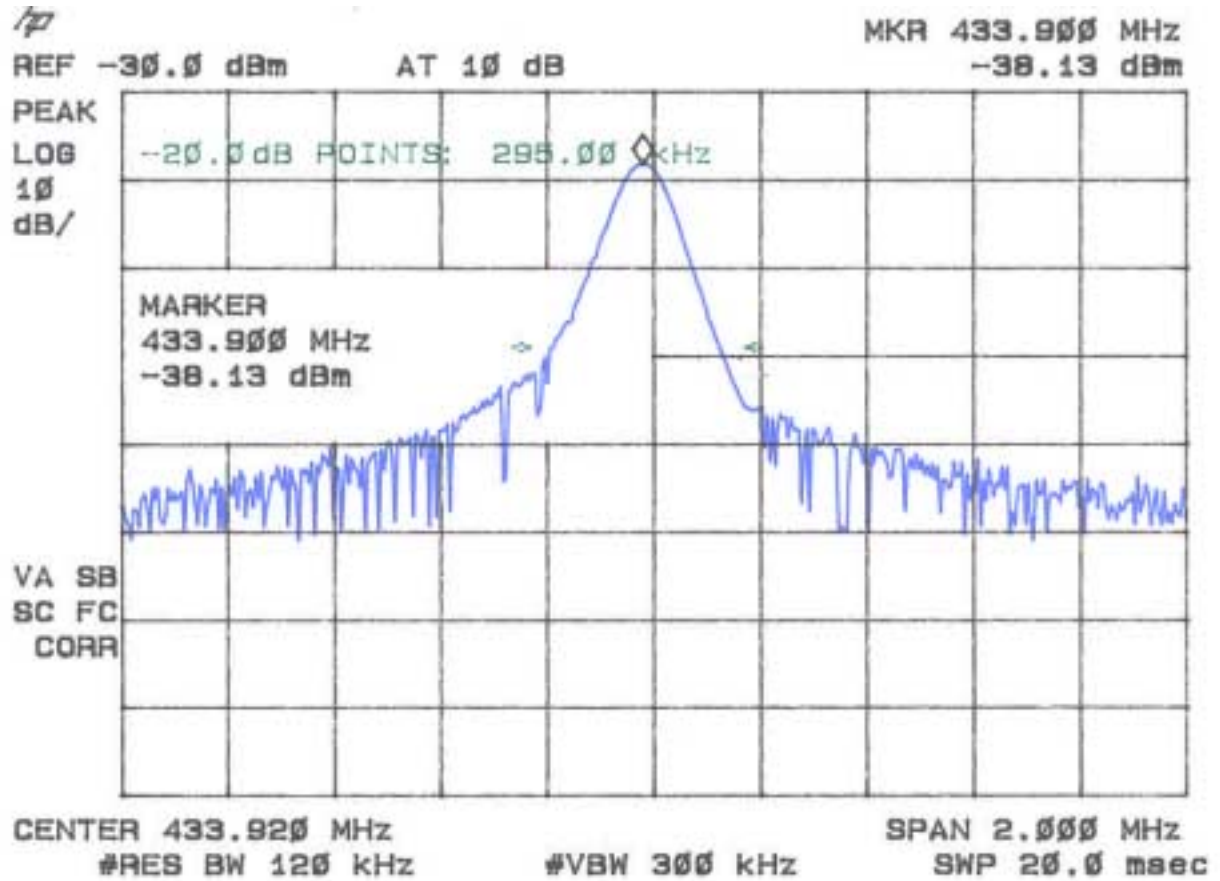
<b>FREQUENCY (MHz)</b>	<b>20 dB BANDWIDTH (kHz)</b>	<b>FCC LIMITS (kHz)</b>
433.920	295	1084

**FCC Limit = (0.25%) (Center Frequency) = (0.0025)(433.920 MHz) = 1084 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:** April 29, 2001  
**UST Project:** 01-0154  
**Customer:** Wayne-Dalton Corp.  
**Model:** KEP2-0433

<b>FREQ. (MHz)</b>	<b>TEST DATA (dBm) @ 3m</b>	<b>ANTENNA FACTOR + CABLE ATTENUATION</b>	<b>RESULTS (uV/m) @ 3m</b>	<b>FCC LIMITS (uV/m) @ 3m</b>
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.