

# MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Trine Products Company**

MODEL: **425TX**

FCC ID: **H8A425TX**

DATE: **May 10, 1998**

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

## **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 hand held device, it was placed into a continuous mode of transmit and rotated about all 3 axis to obtain worse case results.

### **Test Facility**

Testing was performed at US Tech's measurement facility as described to the FCC and acknowledged in their letter marked 31040/SIT/USTECH.

### **Test Equipment**

Table 2 describes test equipment used to evaluate this product.

**FIGURE 1**  
**TEST CONFIGURATION**

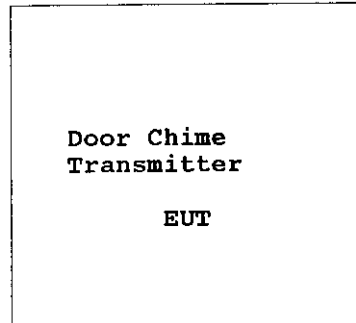


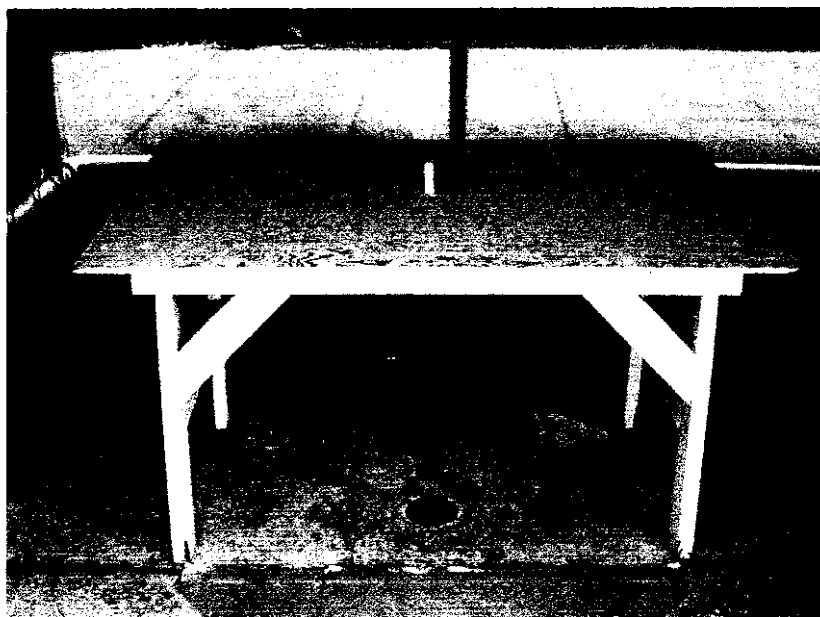
TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Door ChimeTransmitter Trine Products Company (EUT)	425TX	None	H8A425TX (Pending)	None

**FIGURE 2**

**Photograph(s) for Spurious and Fundamental Emissions**



**FIGURE 2**

**Photograph(s) for Spurious and Fundamental Emissions**

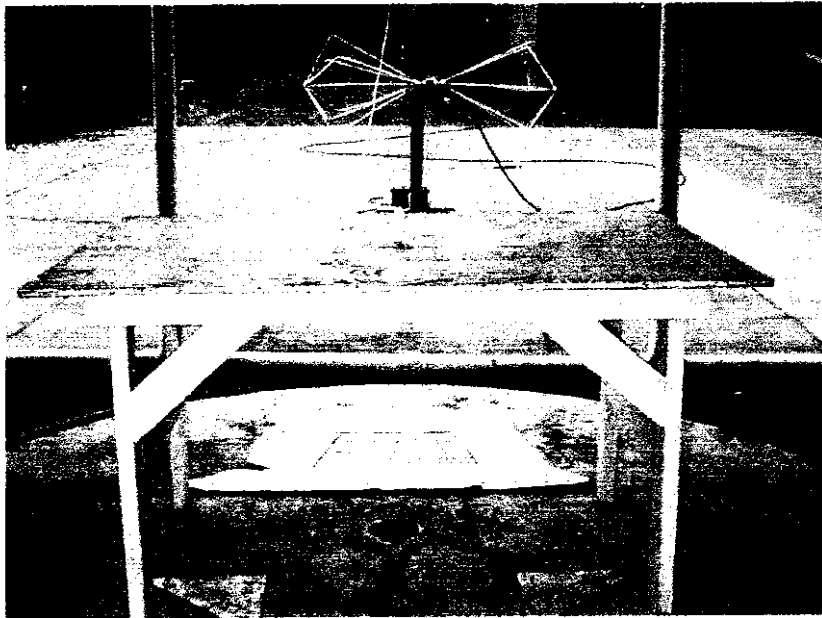


TABLE 2

## 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
ROBERTS ANTENNAS	COMPLIANCE DESIGN	A100	167
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
LISN	SOLAR ELE.	8012-50	N/A
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
FUNCTION GENERATOR	TEKTRONIX	CFG250	CFG250TW15059
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394
BILOG	CHASE	CBL6112A	2238

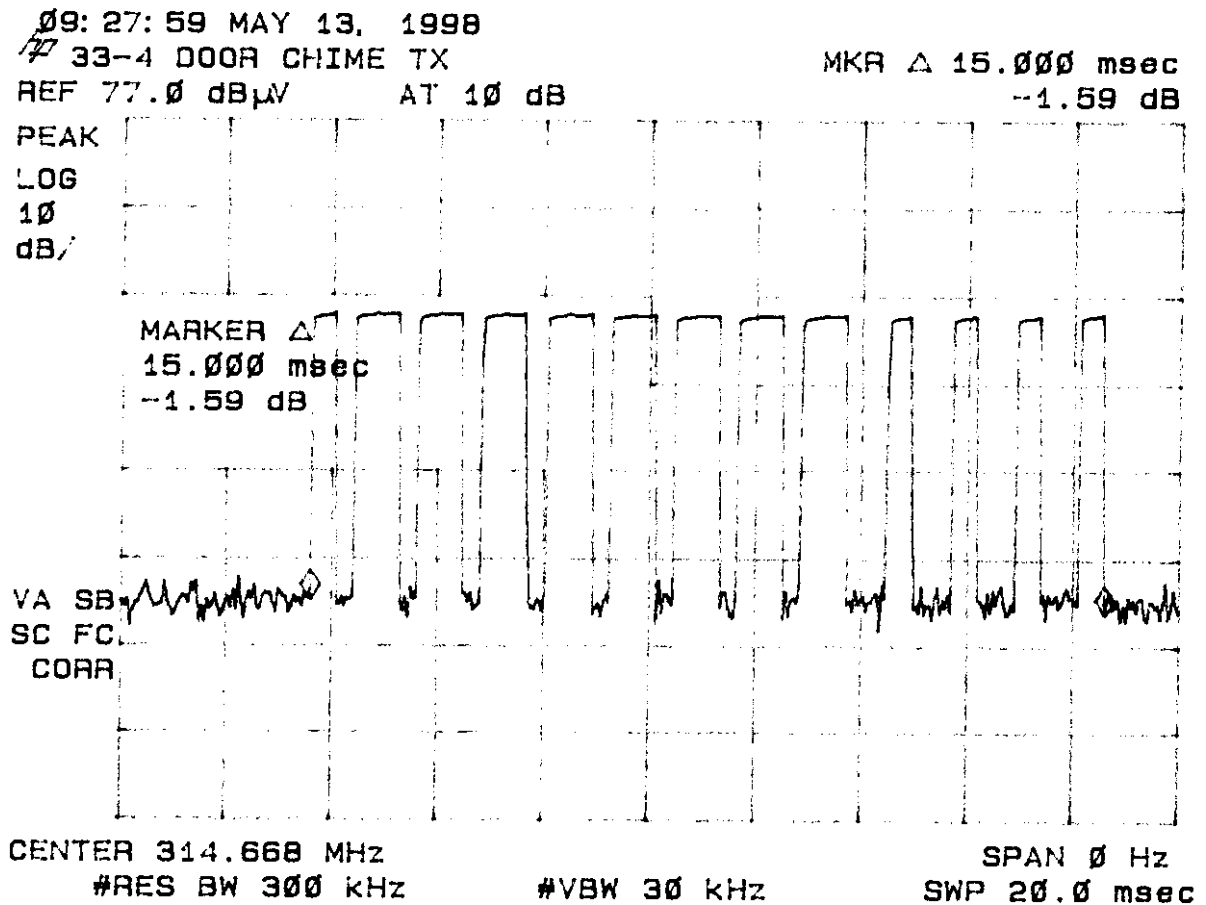


### **Periodic Operation (47 CFR 15.231(a1))**

A transmitter manually activated must automatically deactivate within not more than 5 seconds of being released. The transmitter is a 1 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 15 ms 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 (29.125 msec) never exceeds a series of 13 long (800  $\mu$ s) and short (400  $\mu$ 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 13 x 800  $\mu$ s per 29.125 msec = 36% duty cycle. Figures 5a through 5c show the characteristics of the pulse train for one of these functions.

$$\text{Duty Cycle Correction} = 20 \log(0.36) = -8.8\text{dB}$$

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

TABLE 3

## FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: March 21, 1998  
UST Project: 97-472  
Customer: Trine Products Company  
Model: 425TX

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
314.4	-59.8	19.0	2038.9	60,250

## SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog  $((-59.8 + 19.0 + 107)/20)$  = 2038.9  
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: Name: Erik Collins

TABLE 4

## FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: March 21, 1998  
 UST Project: 97-472  
 Customer: Trine Products Company  
 Model: 425TX

FREQ. (MHz)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
314.4	-68.6	19.0	740.3	6025

\* Adjusted by duty cycle =  $20 \log(0.36) = -8.8 \text{ dB}$

## SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m =  $\text{Antilog} ((-68.6 + 19.0 + 107)/20) = 740.3$   
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: 

Name: Erik Collins

### FIGURE 4

**FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)**

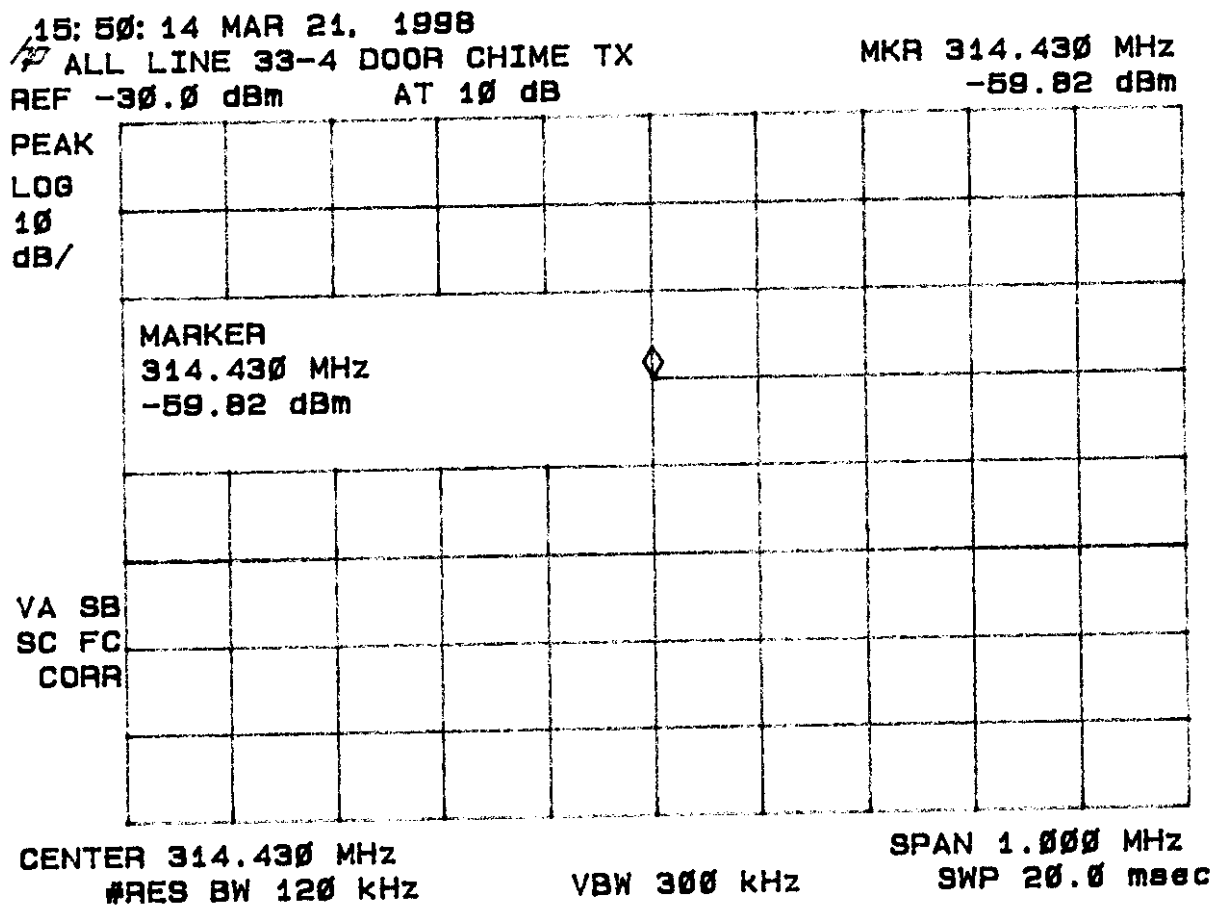


FIGURE 5a  
DUTY CYCLE CHARACTERISTICS

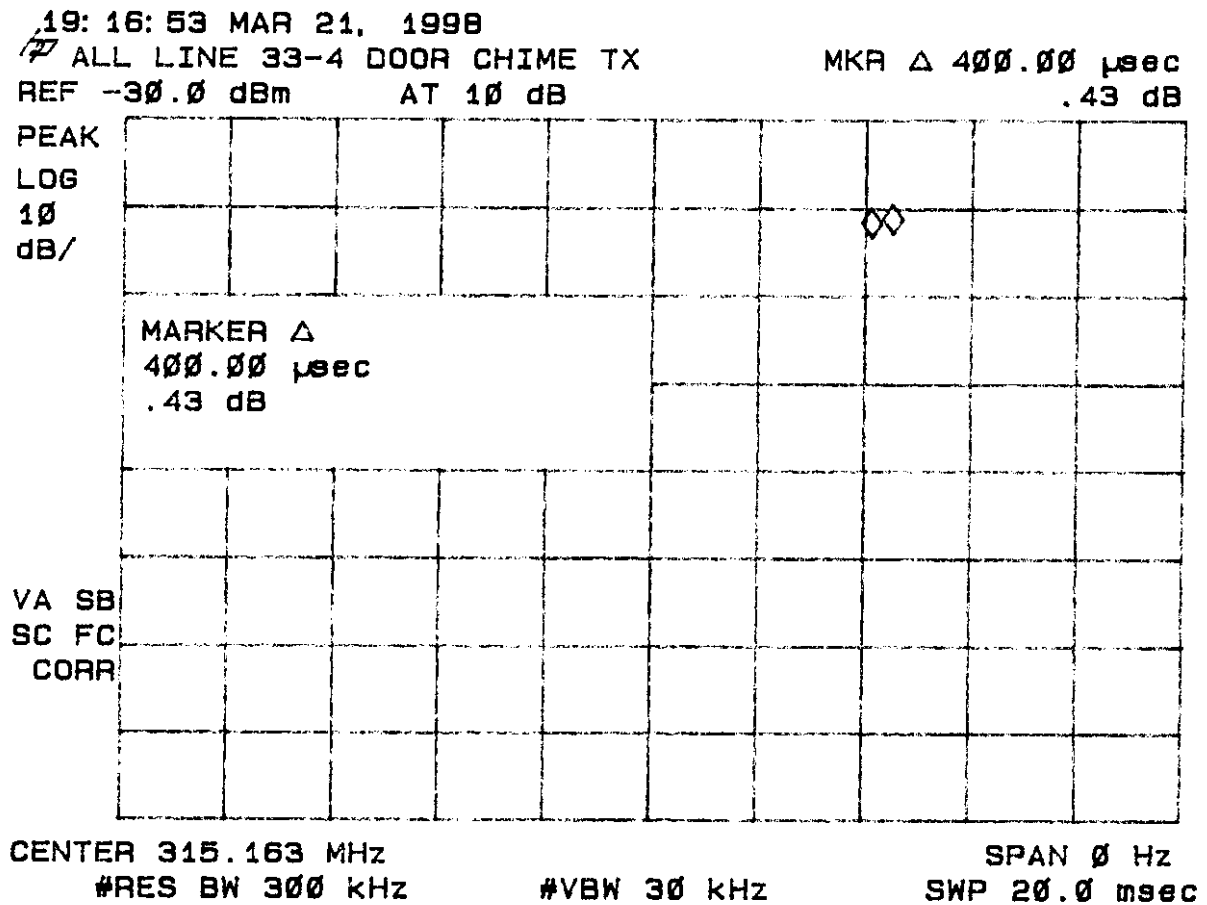


FIGURE 5b

## DUTY CYCLE CHARACTERISTICS

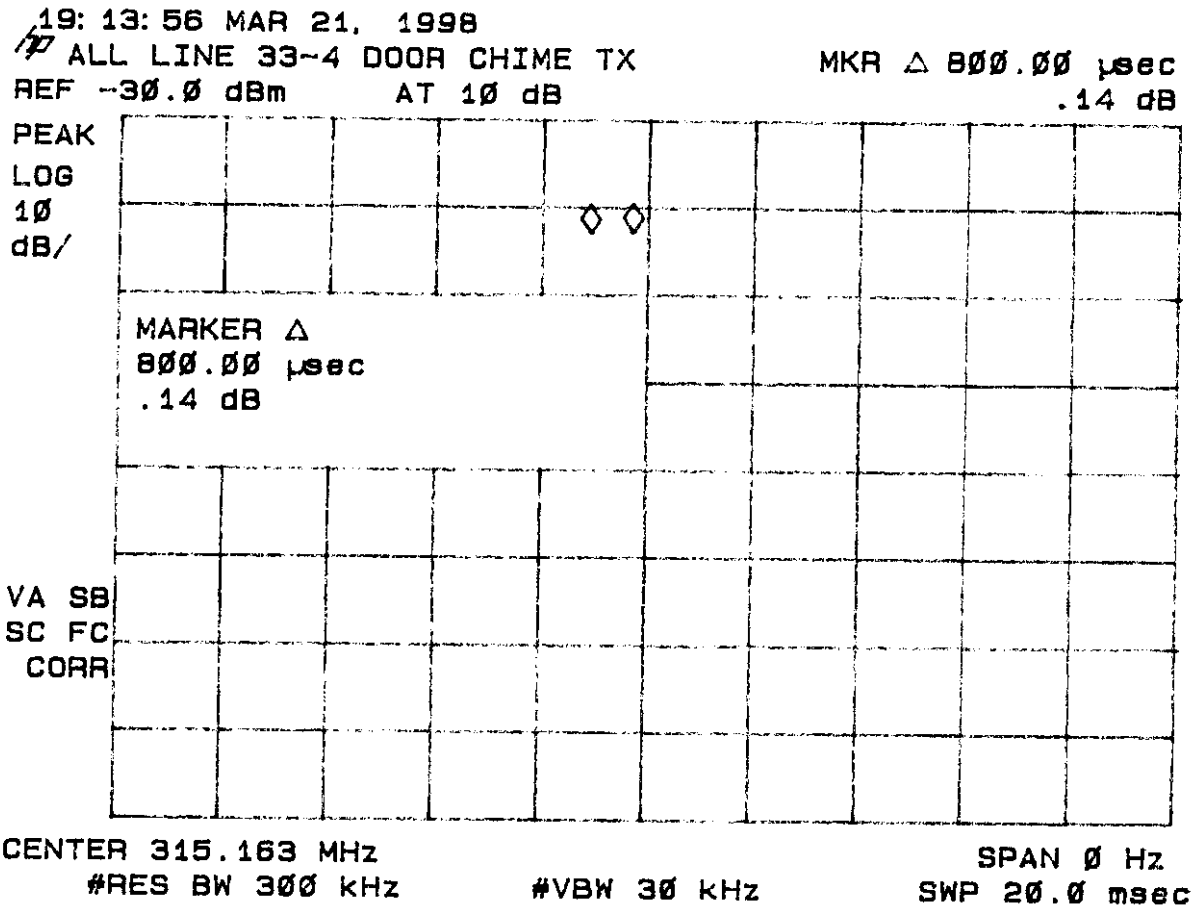
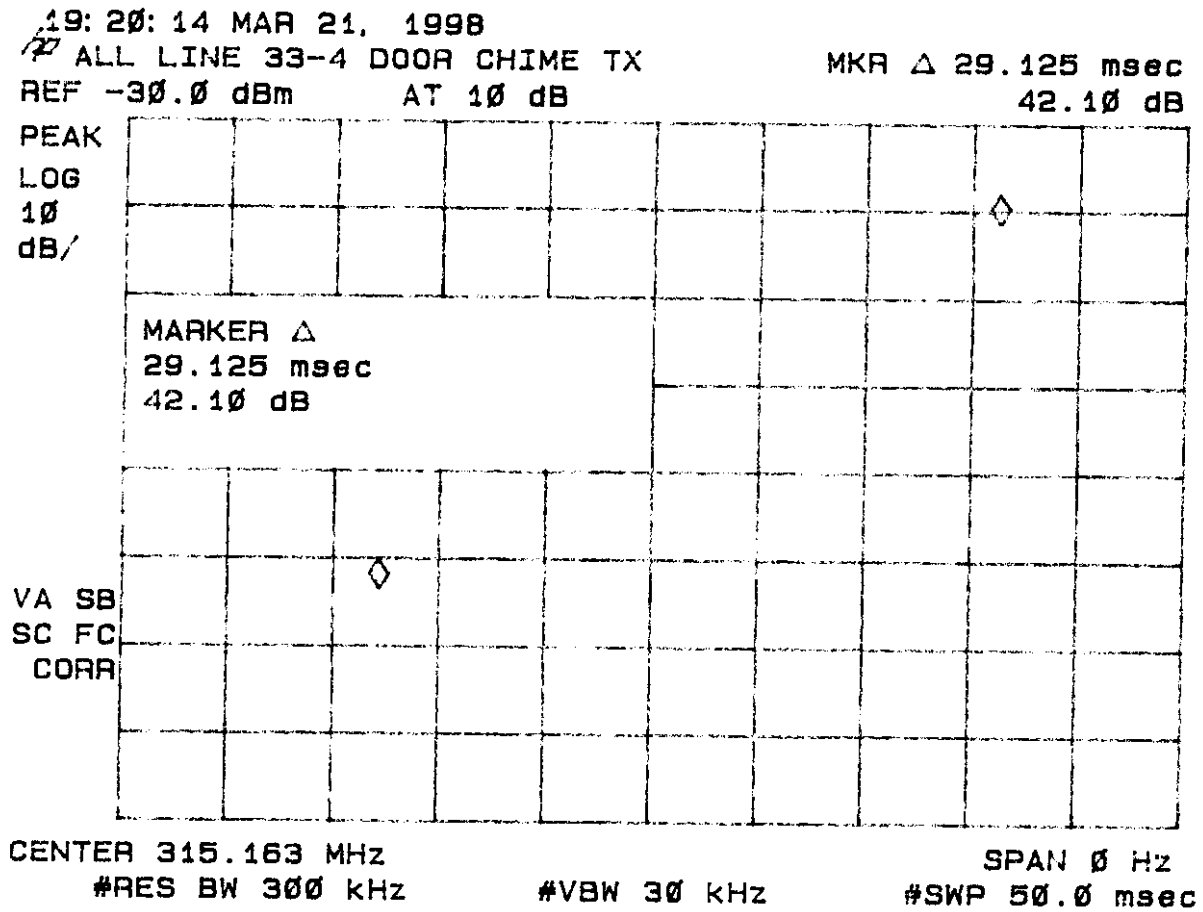




FIGURE 5c

## DUTY CYCLE CHARACTERISTICS



### **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**

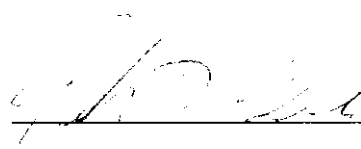
Test Date: March 21, 1998  
 UST Project: 97-472  
 Customer: Trine Products Company  
 Model: 425TX

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
628.6	-72.6	25.7	1008.3	6025
942.9	-83.7	31.9	576.4	6025
1257.38	-61.4	-9.5	63.8	6025
1571.75**	-63.6	-7.8	60.3	5000

\*\* Denotes restricted band of operation

**SAMPLE CALCULATIONS:**

RESULTS uV/m @ 3m = Antilog  $((-72.6 + 25.7 + 107)/20) = 1008.3$   
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: 

Name: Erik Collins

**TABLE 5b**  
**FIELD STRENGTH OF SPURIOUS EMISSIONS**

Test Date: March 21, 1998  
 UST Project: 97-472  
 Customer: Trine Products Company  
 Model: 425TX

FREQ. (MHz.)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
628.6	-81.4	25.7	366.1	602.5
942.9	-92.5	31.9	209.3	602.5
1257.38	-70.2	-9.5	23.2	602.5
1571.75**	-72.4	-7.8	21.9	500.0

\* Adjusted duty cycle =  $20 \log (0.36) = -8.8\text{dB}$

\*\* Denotes restricted band of operation

**SAMPLE CALCULATIONS:**

RESULTS uV/m @ 3m =  $\text{Antilog} ((-81.4 + 25.7 + 107)/20) = 366.1$   
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: 

Name: Erik Collins

FIGURE 6A

## SPURIOUS EMISSIONS 15.231(b)

16:03:08 MAR 21, 1998

ALL LINE 33-4 DOOR CHIME TX

MKR 628.630 MHz

REF -30.0 dBm

AT 10 dB

-72.55 dBm

PEAK

LOG

10

dB/

CENTER

628.630 MHz

STEP 314.000 MHz

VA SB

SC FC

CORR

CENTER 628.630 MHz

#RES BW 120 kHz

VBW 300 kHz

SPAN 1.000 MHz

SWP 20.0 msec

FIGURE 6B

## SPURIOUS EMISSIONS 15.231(b)

16:09:00 MAR 21, 1998

ALL LINE 33-4 DOOR CHIME TX

MKR 942.880 MHz

REF -30.0 dBm #AT 0 dB

-83.68 dBm

PEAK  
LOG  
10  
dB/MARKER  
942.880 MHz  
-83.68 dBmVA SB  
SC FC  
CORRCENTER 942.880 MHz  
#RES BW 120 KHz

VBW 300 KHz

SPAN 1.000 MHz  
SWP 20.0 msec

FIGURE 6C

## SPURIOUS EMISSIONS 15.231(b)

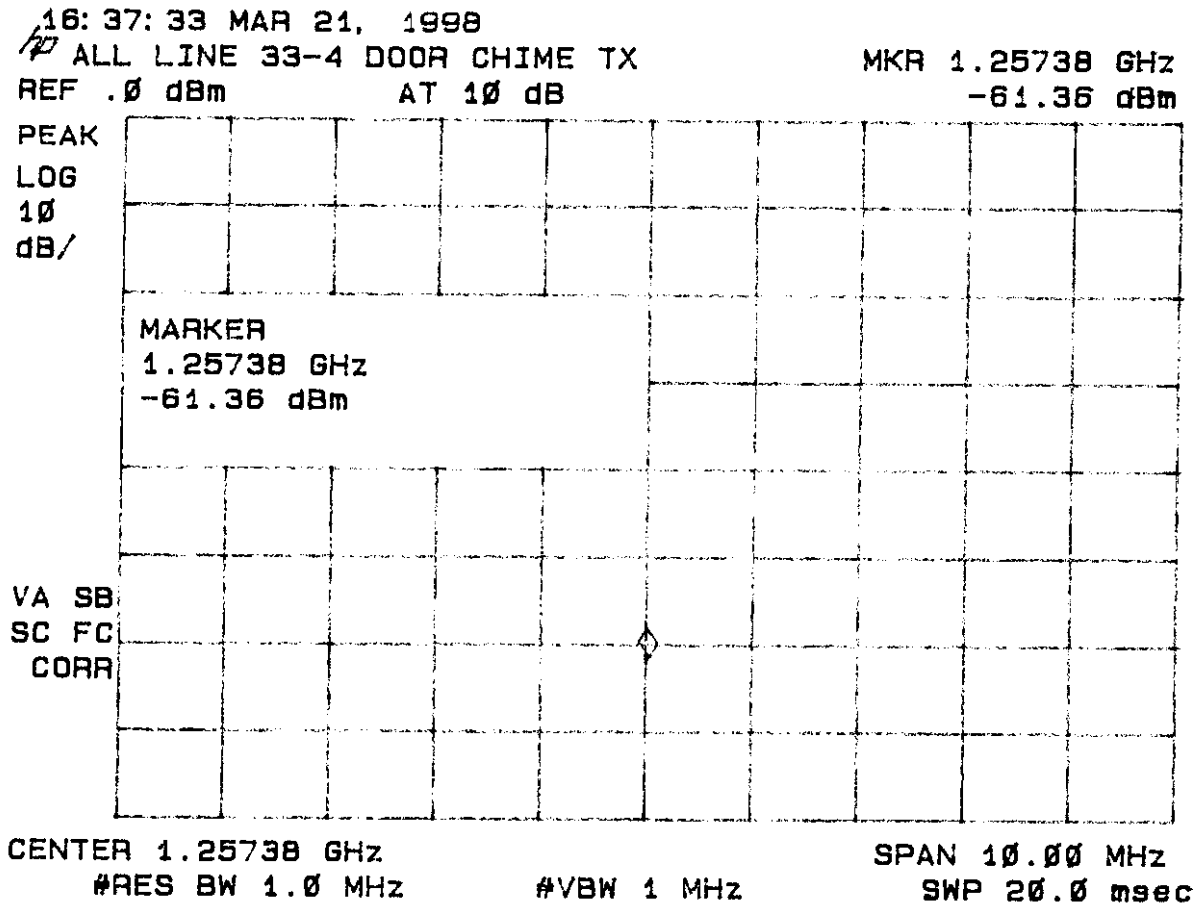
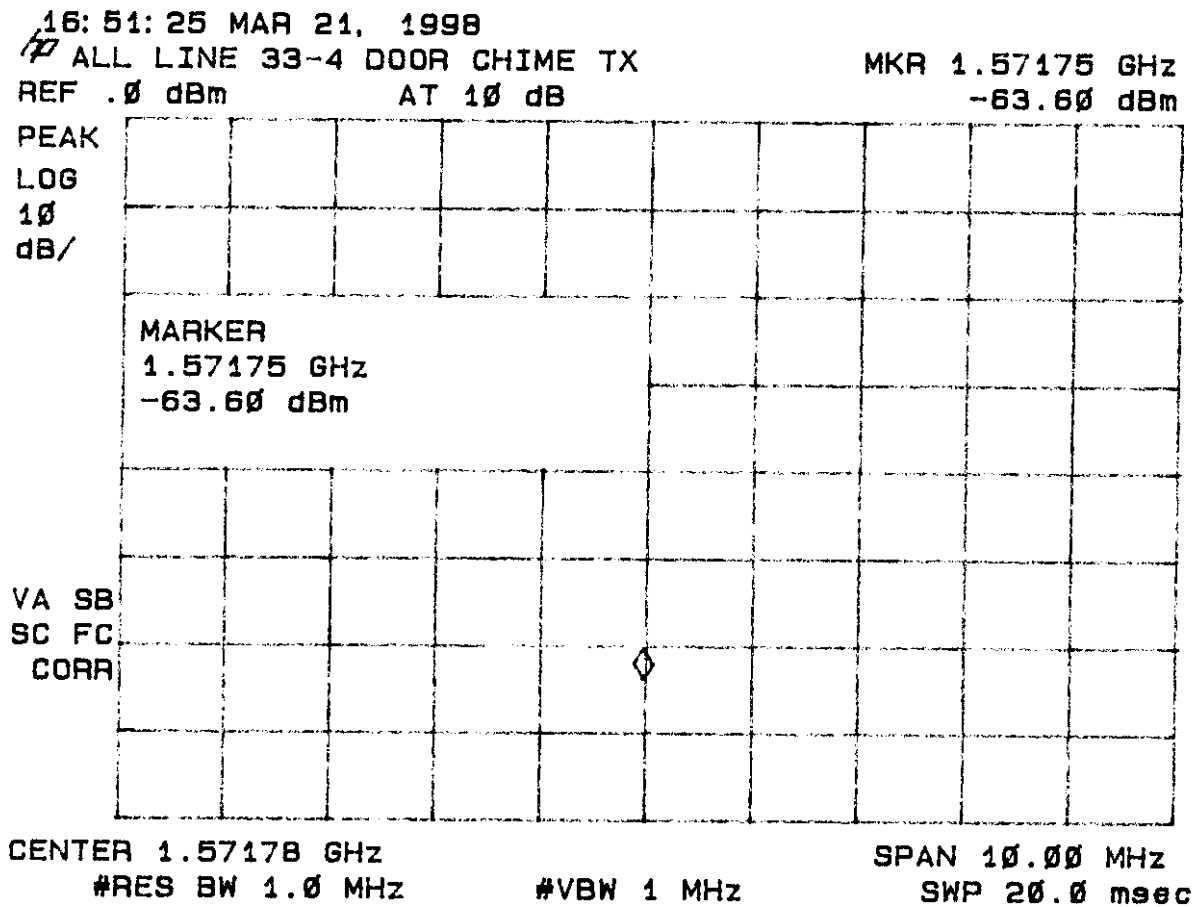


FIGURE 6D

## SPURIOUS EMISSIONS 15.231(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 21, 1998  
UST Project: 97-472  
Customer: Trine Products Company  
Model: 425TX

FREQUENCY (MHz)	20 dB BANDWIDTH (KHz)	FCC LIMITS (KHz)
314.0	515.00	785

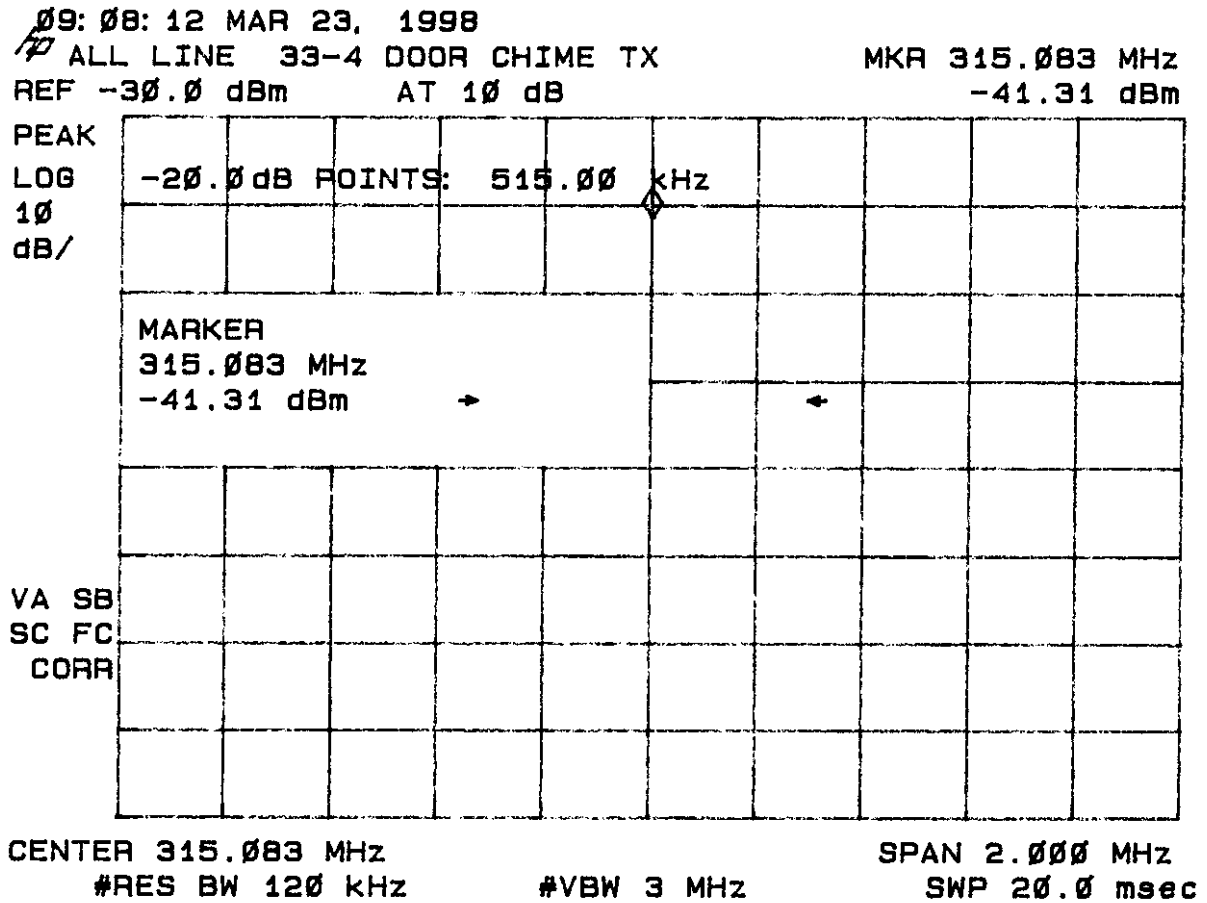
FCC Limit = (0.25%) (Center Frequency) = (0.0025)(314.0) = 785 KHz

Tested By: 

Name: Erik Collins

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 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 21, 1998  
UST Project: 97-472  
Customer: Trine Products Company  
Model: 425TX

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m
NO EMISSIONS DETECTED WITHIN 10 dB OF THE FCC LIMITS				

Tested By: 

Name: Erik Collins

**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.

**SECTION 5**  
**PHOTOGRAPHS**



## **PHOTOS OF THE TESTED EUT**

The following photos are attached:

- Photo 1. EUT, Front View
- Photo 2. EUT, Rear View
- Photo 3. Internal View, Top Side
- Photo 4. Internal View, Bottom Side