

Wayne-Dalton Corp.
FCC Part 15, Certification Application
Model 3BTM-D372

October 5, 2001

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Wayne-Dalton Corp.

MODEL: 3BTM-D372

FCC ID: KJ8HHT-372DSW

DATE: October 5, 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

TABLE OF CONTENTS

AGENCY AGREEMENT LETTER OF CONFIDENTIALITY

SECTION 1

GENERAL INFORMATION

Product Description

SECTION 2

TESTS AND MEASUREMENTS

Configuration of Tested
Test Facility
Test Equipment
Modifications
Periodic Operation
Field Strength of Fundamental Emission
Field Strength of Spurious Emissions
20 dB Bandwidth of Fundamental Emission
Frequency Tolerance of Carrier Signal
Radiated Digital Device Emissions
Power Line Conducted Emissions

SECTION 3

LABELING INFORMATION

SECTION 4

BLOCK DIAGRAM(S)/SCHEMATICS

SECTION 5

PHOTOGRAPHS

SECTION 6

USER'S MANUAL

LIST OF FIGURES AND TABLES

FIGURES

Test Configuration
Photograph(s) for Spurious and Fundamental Emissions
Field Strength of Fundamental Emission
Field Strength of Spurious Emissions
Bandwidth of Fundamental Emission

TABLES

EUT and Peripherals
Test Instruments
Field Strength of Fundamental Emission
Field Strength of Spurious Emissions
Bandwidth of Fundamental Emission
Radiated Emissions
Power Line Conducted Emissions

SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is a Wayne-Dalton Corp., Model 3BTM-D372. The EUT is a 3-button hand 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. The antenna is etched directly on the PCB board. It has an irregular shape which resembles the letter "G". The upper horizontal track measures 0.325" x 0.040", the vertical track measures 1.185" x 0.040", and the lower horizontal track measures 0.515" x 0.040", and the last vertical track 0.0555" x 0.040".

Related Submittal(s)/Grant(s)

The EUT will be used with DoC approved receivers.

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 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

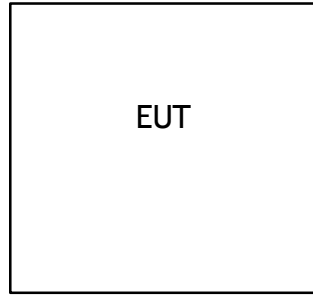


FIGURE 2

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)	3BTM-D372	372-9/02	KJ8HHT-372DSW (Pending)	None

TABLE 2**TEST INSTRUMENTS**

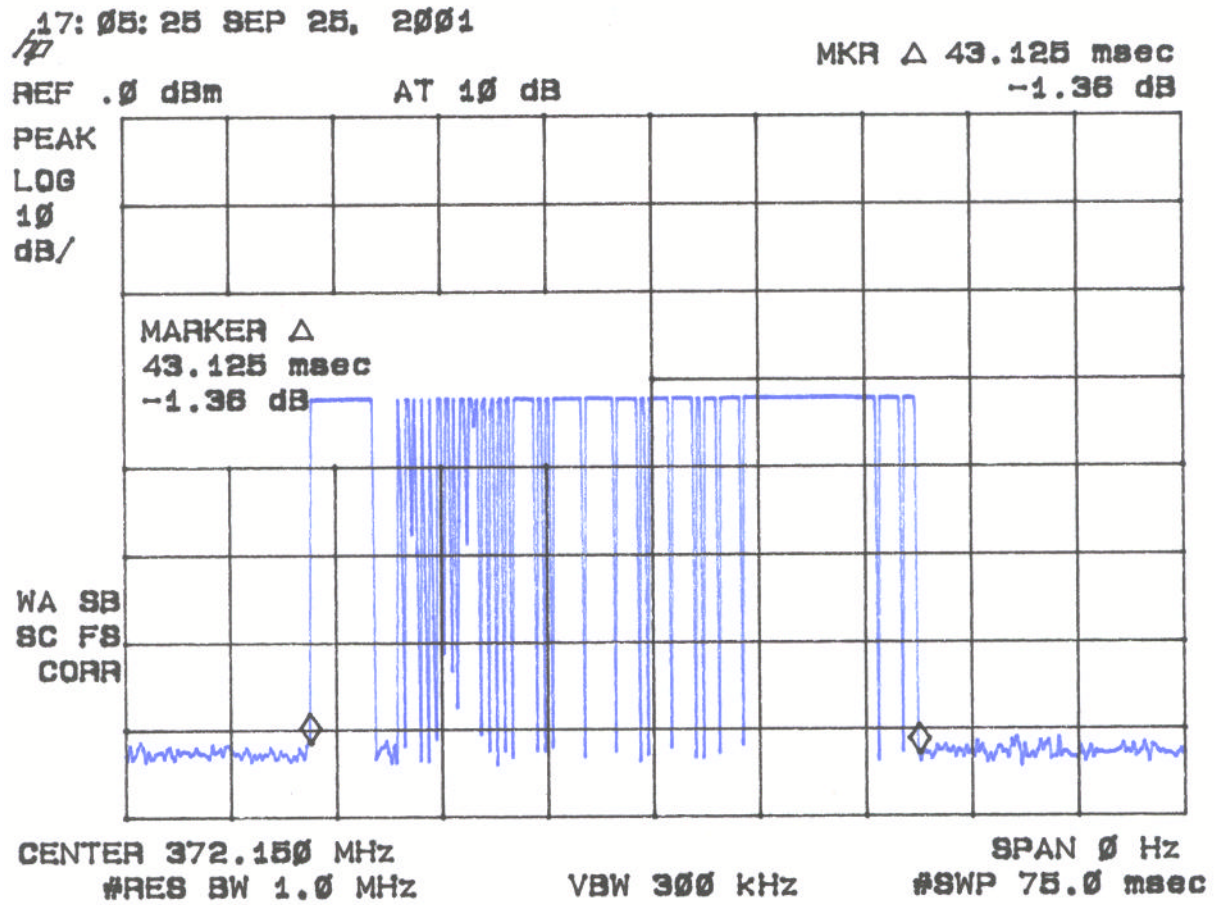
TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
BICONICAL ANTENNA	EMCO	3110	9307-1431
BILOG ANTENNA	CHASE	CBL6112	2584
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 transmitter is a 3 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 43.125 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 (101.25 msec) never exceeds a series of 71* long (412.5 μ s) and short (262.5 μ s) pulses. Assuming any combination of short or long pulses may be obtained for the data due to encoding the worse case transmit duty cycle would be considered 3.15 msec (preamble) + (66 x 412.5 μ s) per 101.25 msec = 30.4% duty cycle. Figures 5a through 5f show the characteristics of the pulse train for one of these functions.

*- Note:

36.938 msec (data transmit time) / 562.5 μ s (period of long pulse) = 65.6

12 pulses (preamble transmit) * 262.5 μ s = 3.15 msec

59.4 + 11.5 = 70.9 pulses

Duty Cycle Correction = $20 \log (0.304) = -10.3 \text{ dB}$

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

TABLE 3

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: October 1, 2001
UST Project: 01-0534
Customer: Wayne-Dalton Corp.
Model: 3BTM-D372

Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
372.5	-38.8	20.1	25,989.6	84,375.0

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-38.8 + 20.1 + 107)/20)$ = 25,989.6
CONVERSION FROM dBm TO dBuV = 107 dB

Tested
By: _____



Name: Hernando Orozco

TABLE 4**FIELD STRENGTH OF FUNDAMENTAL EMISSION**

Test Date: October 1, 2001
UST Project: 01-0534
Customer: Wayne-Dalton Corp.
Model: 3BTM-D372

Average Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
372.5	-49.1	20.1	7939.6	8437.5

* Adjusted by duty cycle = $20 \log (0.304) = -10.3 \text{ dB}$

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = $\text{Antilog } ((-49.1 + 20.1 + 107)/20) = 7939.6$

CONVERSION FROM dBm TO dBuV = 107 dB

Tested
By:



Name: Hernando Orozco

FIGURE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)

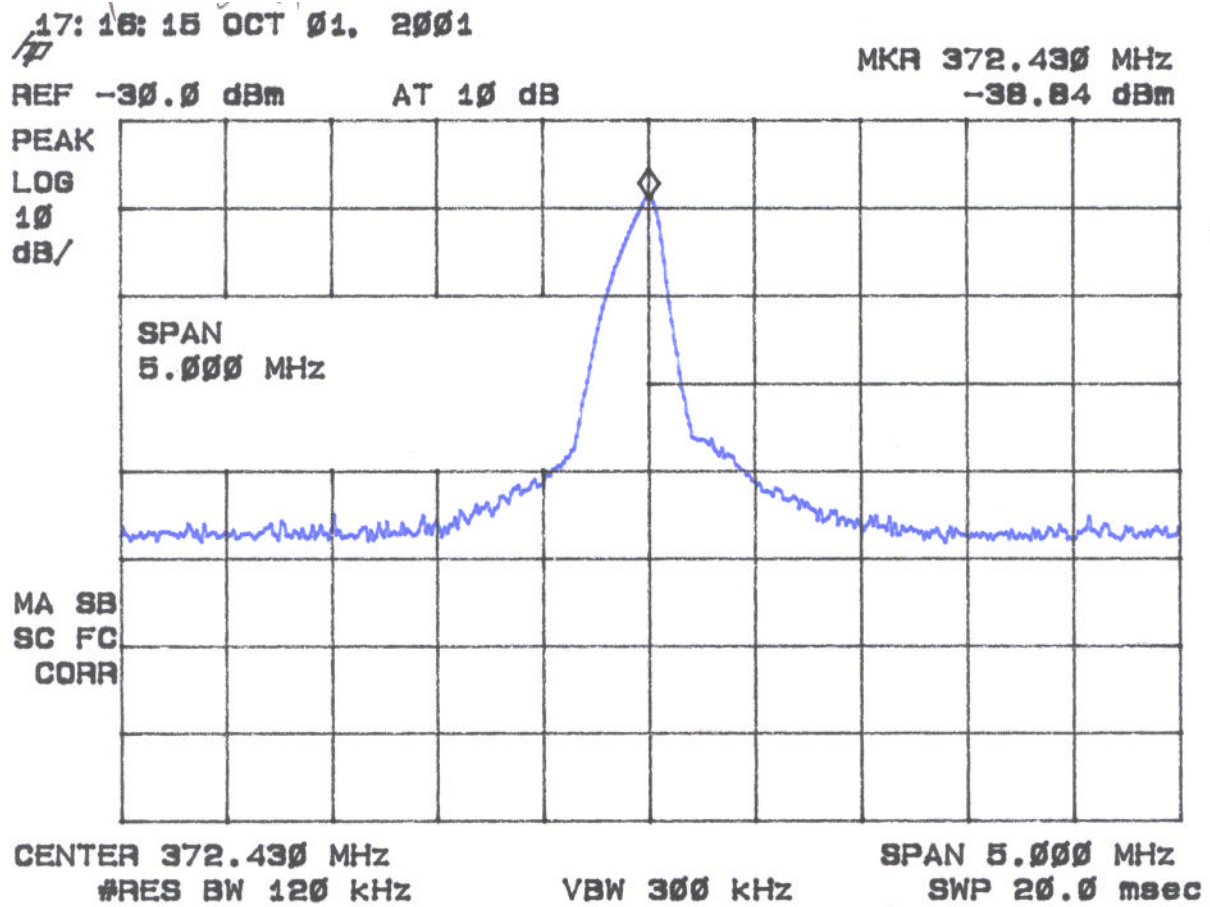


FIGURE 5a

DUTY CYCLE CHARACTERISTICS

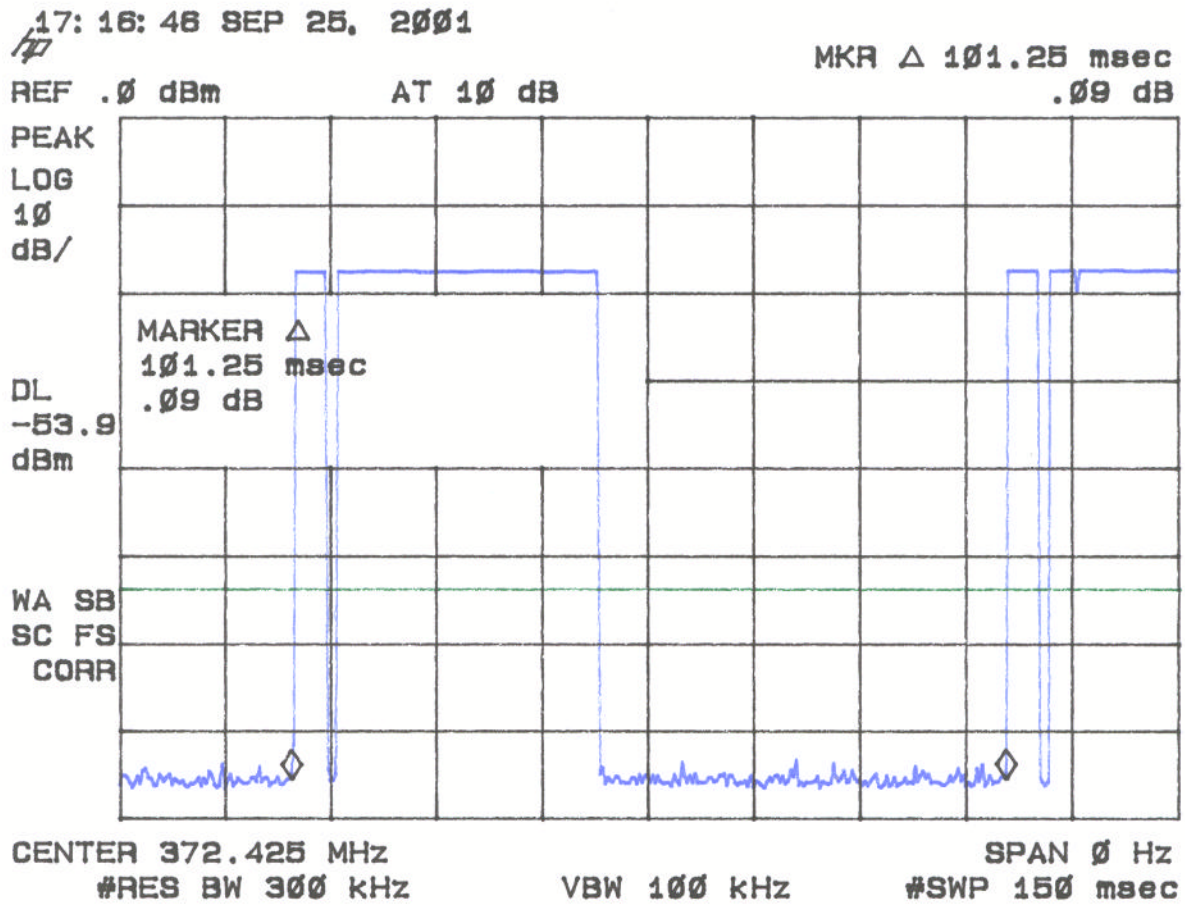


FIGURE 5b

DUTY CYCLE CHARACTERISTICS

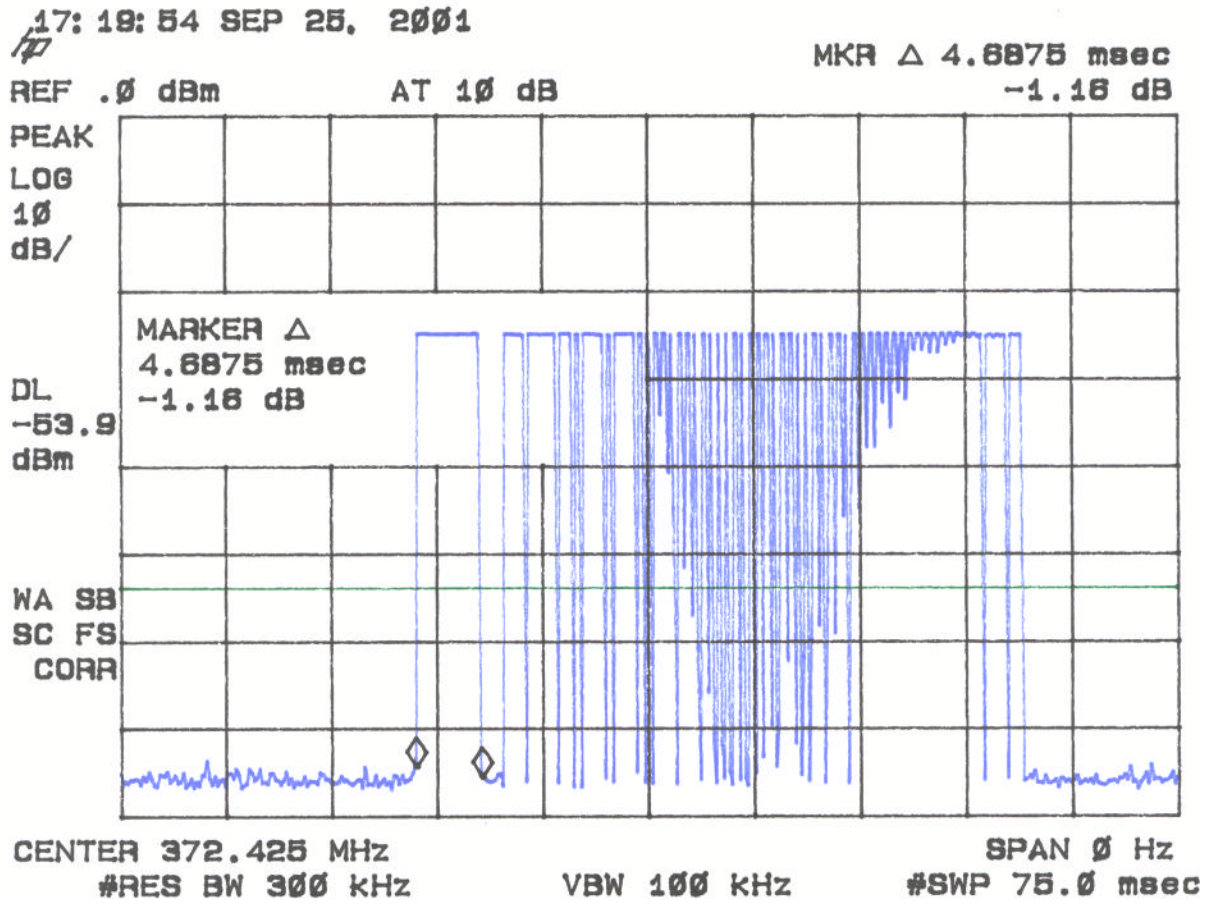


FIGURE 5c

DUTY CYCLE CHARACTERISTICS

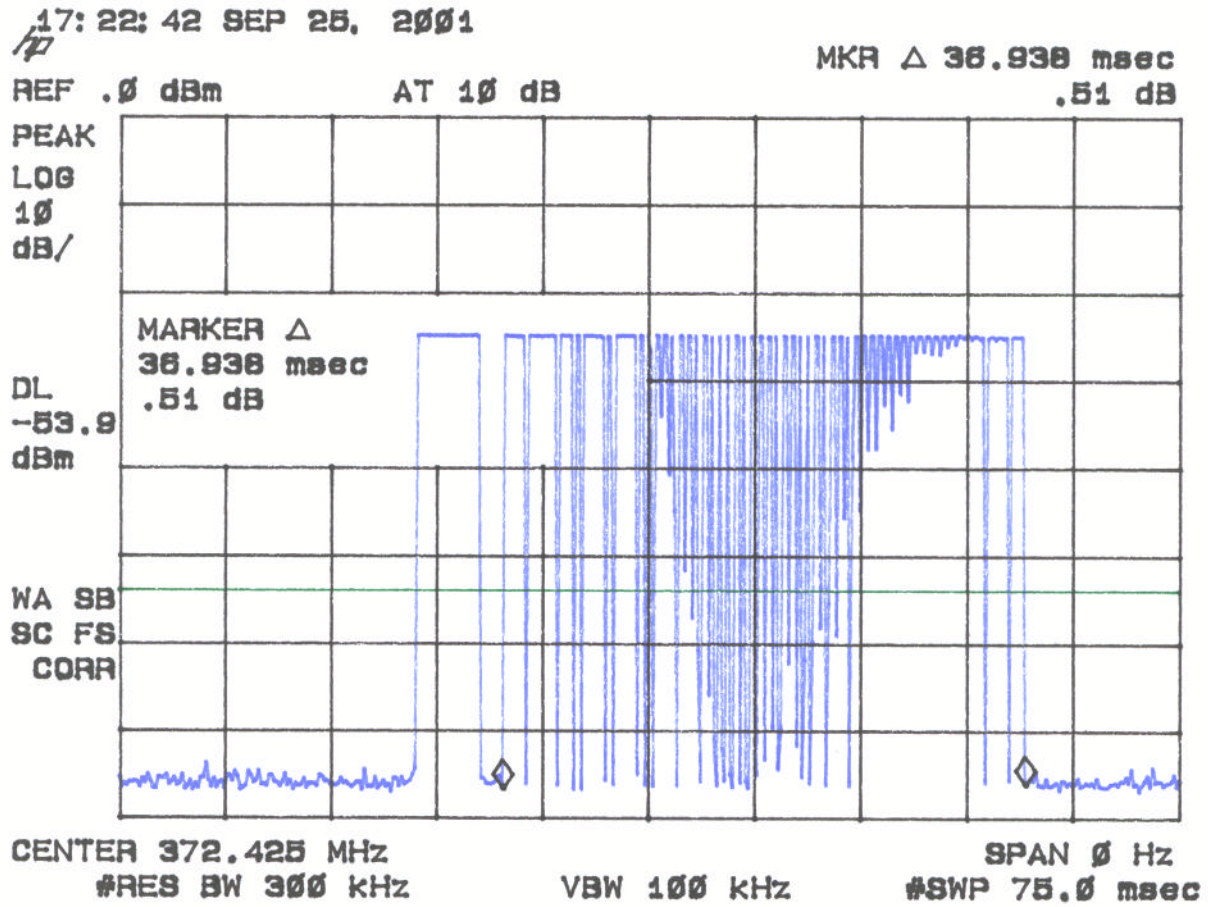


FIGURE 5d

DUTY CYCLE CHARACTERISTICS

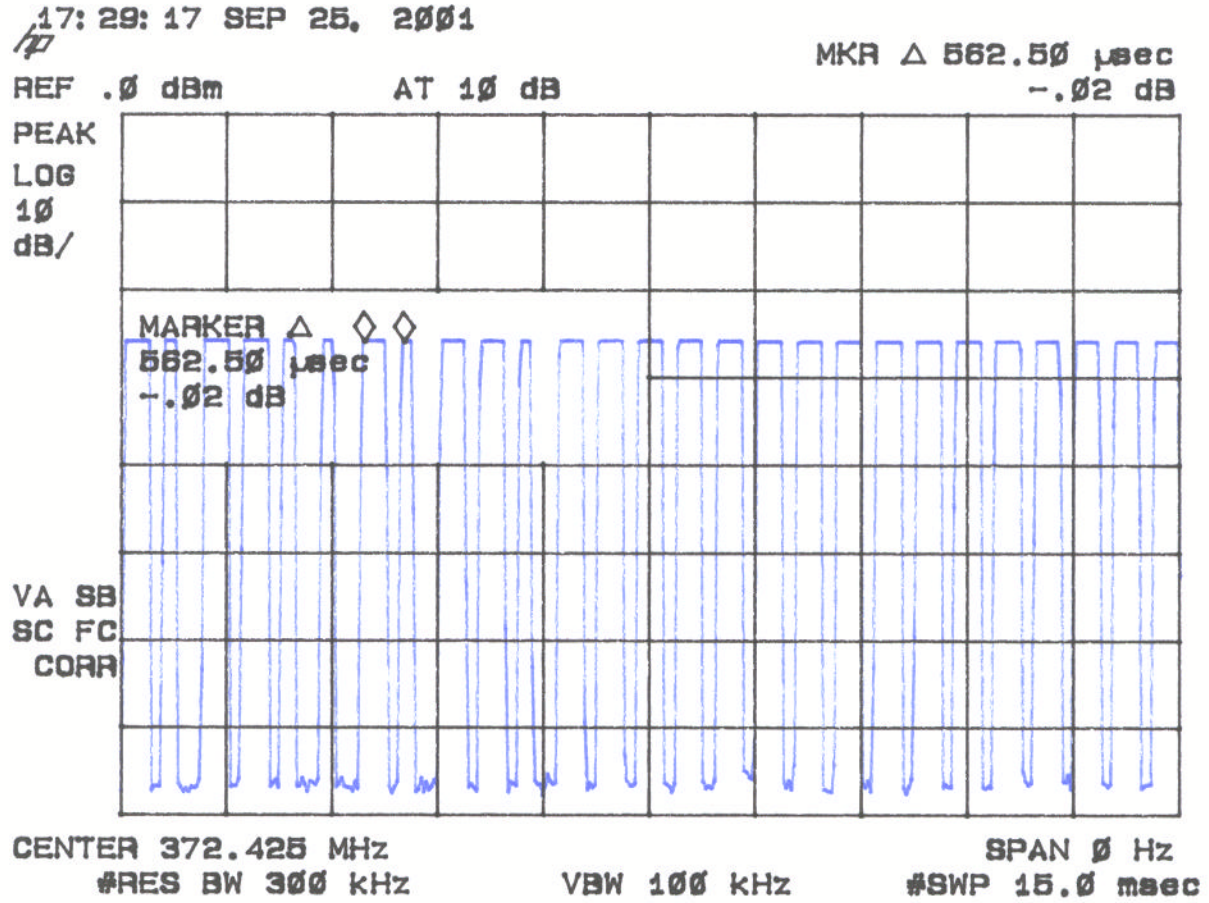


FIGURE 5e

DUTY CYCLE CHARACTERISTICS

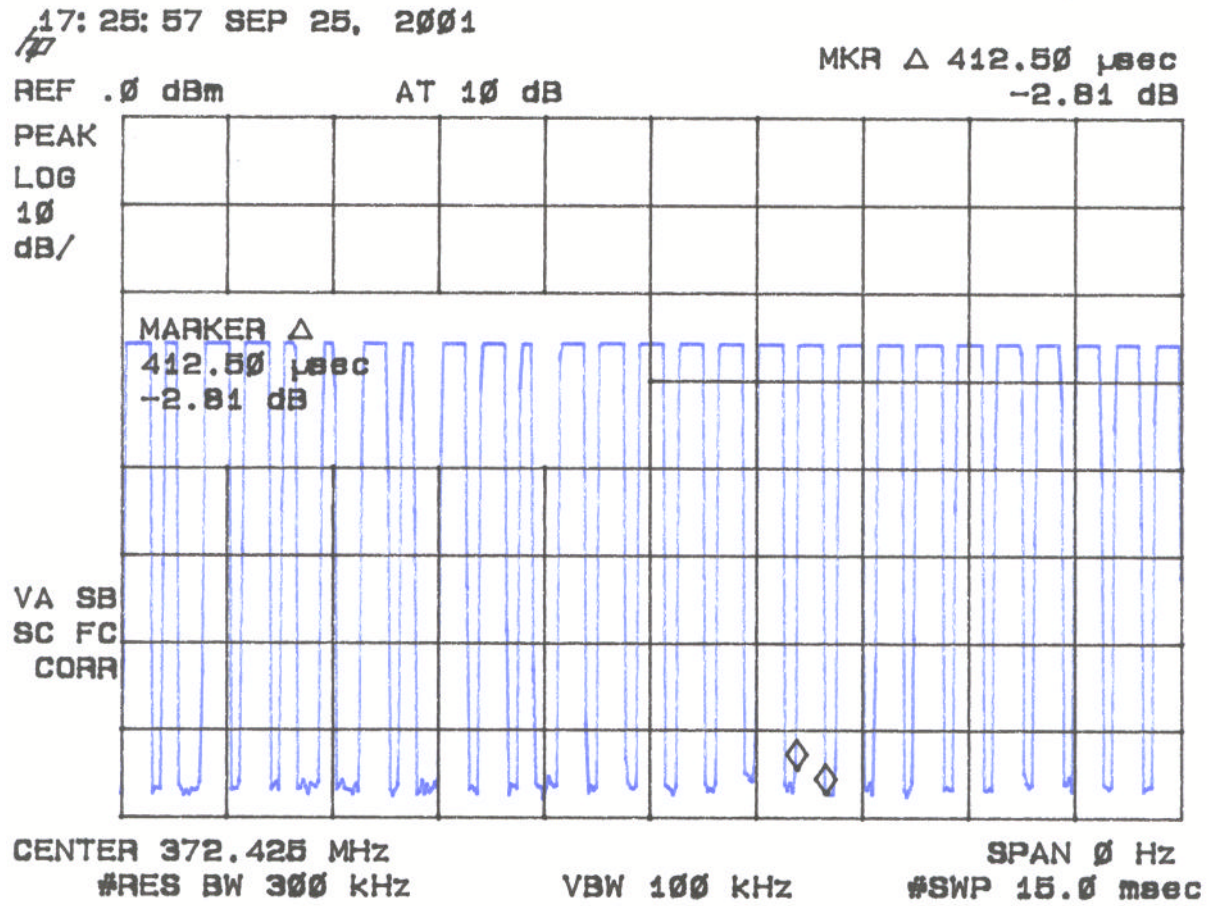
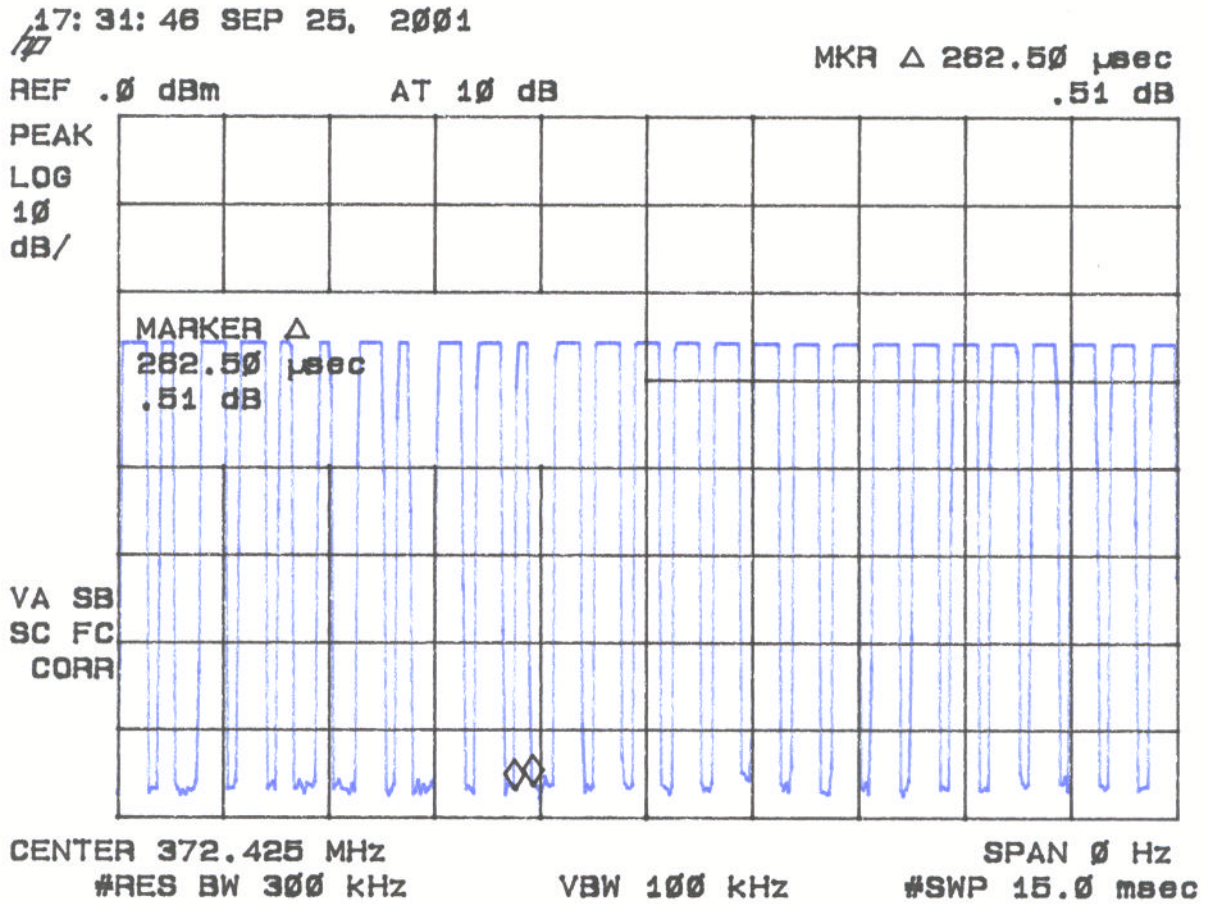


FIGURE 5f

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: October 1, 2001
UST Project: 01-0534
Customer: Wayne-Dalton Corp.
Model: 3BTM-D372

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	-65.6	26.9	2605.1	8,437.5
1091.0**	-40.9	-7.4	856.5	5,000.0
1120.0**	-41.9	-7.4	743.9	5,000.0
1495.0**	-43.7	-5.9	773.4	5,000.0
2239.0**	-54.4	-1.2	370.3	5,000.0

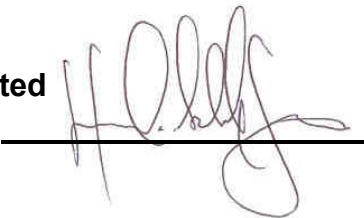
**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-65.6 + 26.9 + 107)/20)$ = 2605.1
CONVERSION FROM dBm TO dBuV = 107 dB

Tested

By:



Name: Hernando Orozco

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

Test Date: October 1, 2001
UST Project: 01-0534
Customer: Wayne-Dalton Corp.
Model: 3BTM-D372

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	-75.9	26.9	796.2	843.8
1091.0**	-51.2	-7.4	261.7	500.0
1120.0**	-52.2	-7.4	236.3	500.0
1495.0**	-54.0	-5.9	227.3	500.0
2239.0**	-64.7	-1.2	113.1	500.0

* Adjusted by duty cycle = $20 \log (0.304) = -10.3 \text{ dB}$

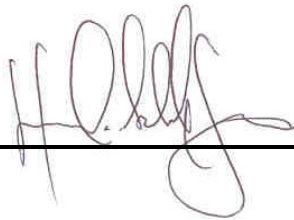
** Denotes restricted band of operation

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-75.9 + 26.9 + 107)/20) = 843.8$

CONVERSION FROM dBm TO dBuV = 107 dB

Tested
By:



Name: Hernando Orozco

FIGURE 6a

SPURIOUS EMISSIONS 16.231(b)

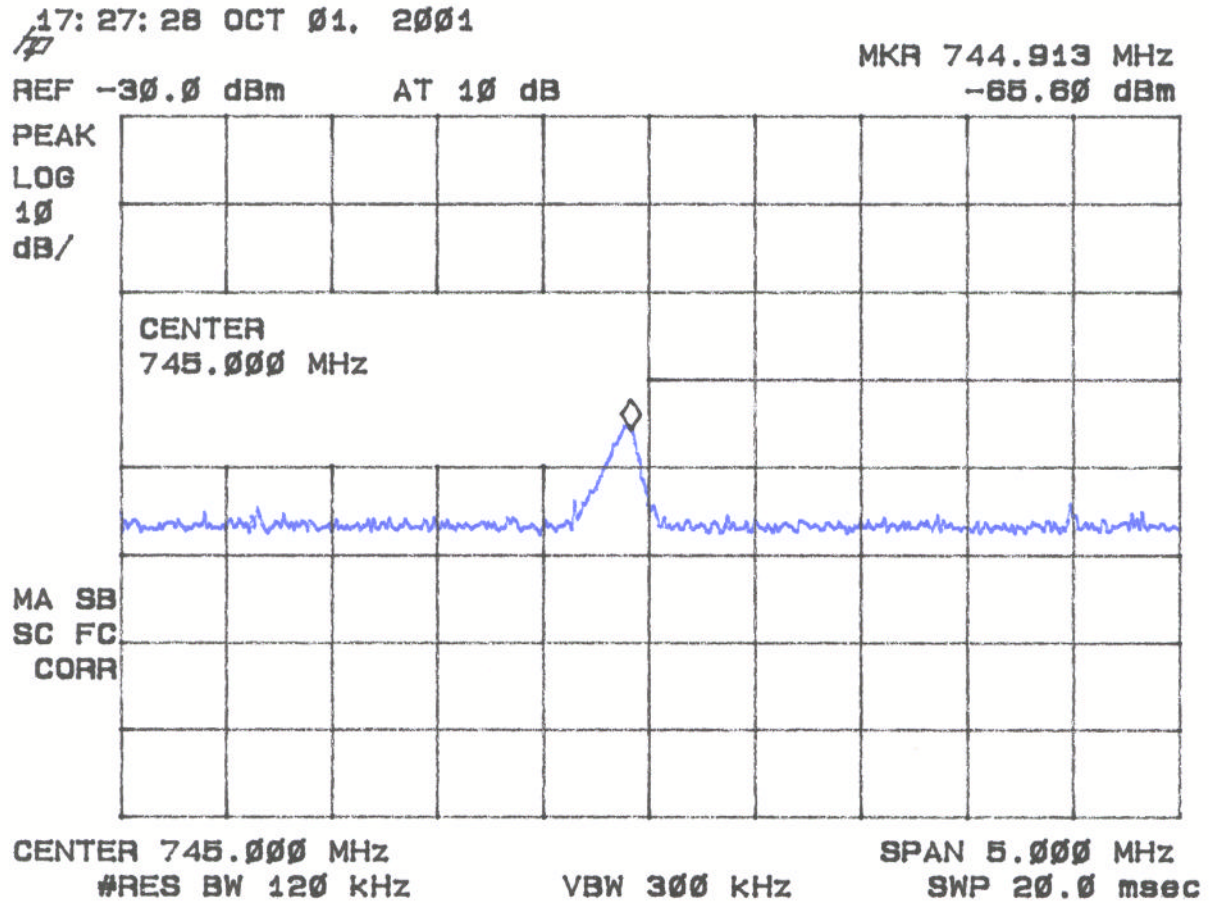


FIGURE 6b

SPURIOUS EMISSIONS 16.231(b)

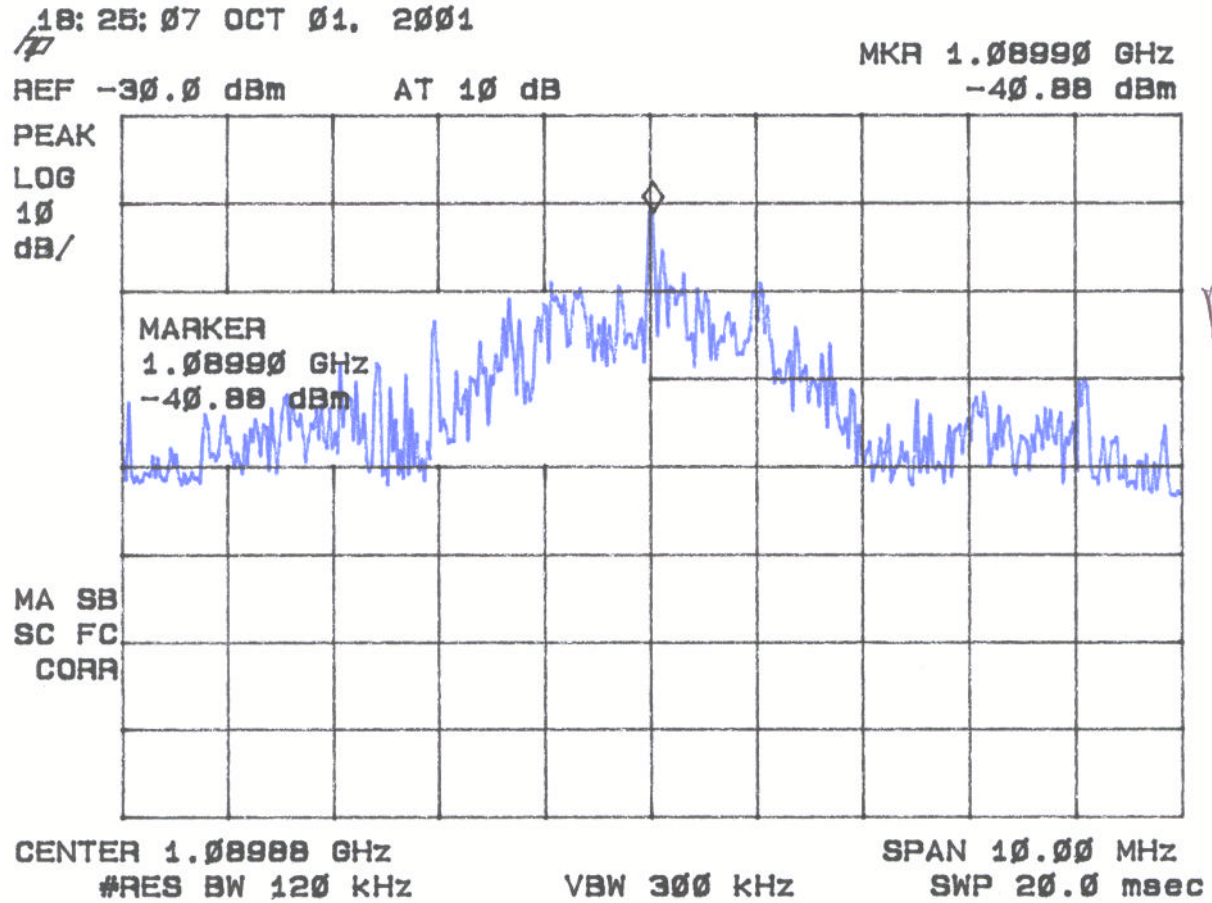
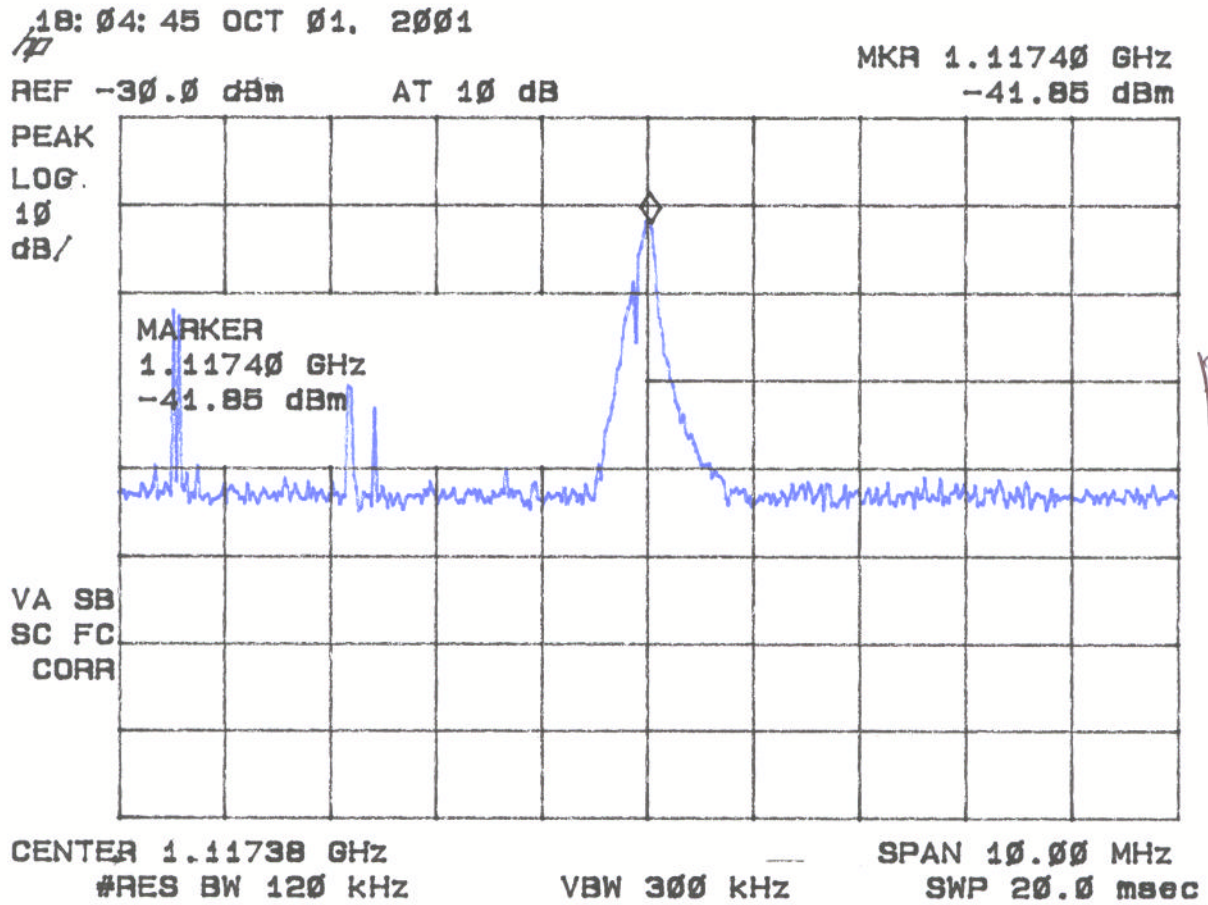


FIGURE 6c

SPURIOUS EMISSIONS 16.231(b)



[

FIGURE 6d

SPURIOUS EMISSIONS 16.231(b)

18:01:41 OCT 01, 2001

/P

REF -30.0 dBm

AT 10 dB

MKR 1.48988 GHz

-43.74 dBm

PEAK
LOG
10
dB/MA SB
SC FC
CORR

CENTER 1.49000 GHz

#RES BW 120 kHz

VBW 300 kHz

SPAN 10.00 MHz

SWP 20.0 msec

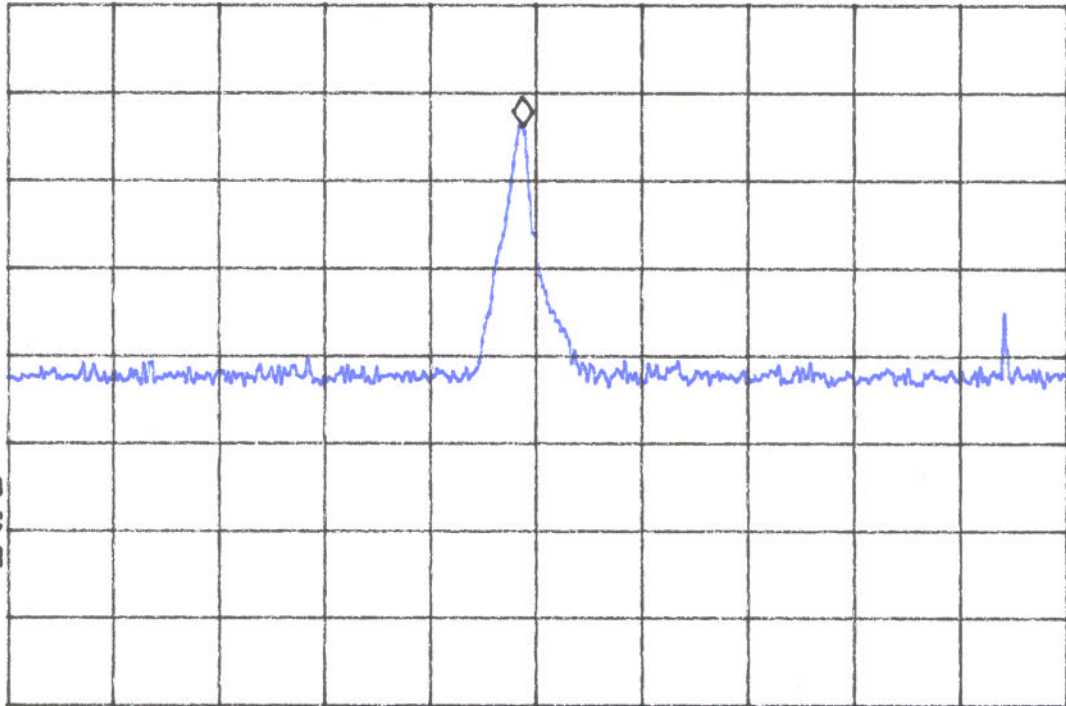
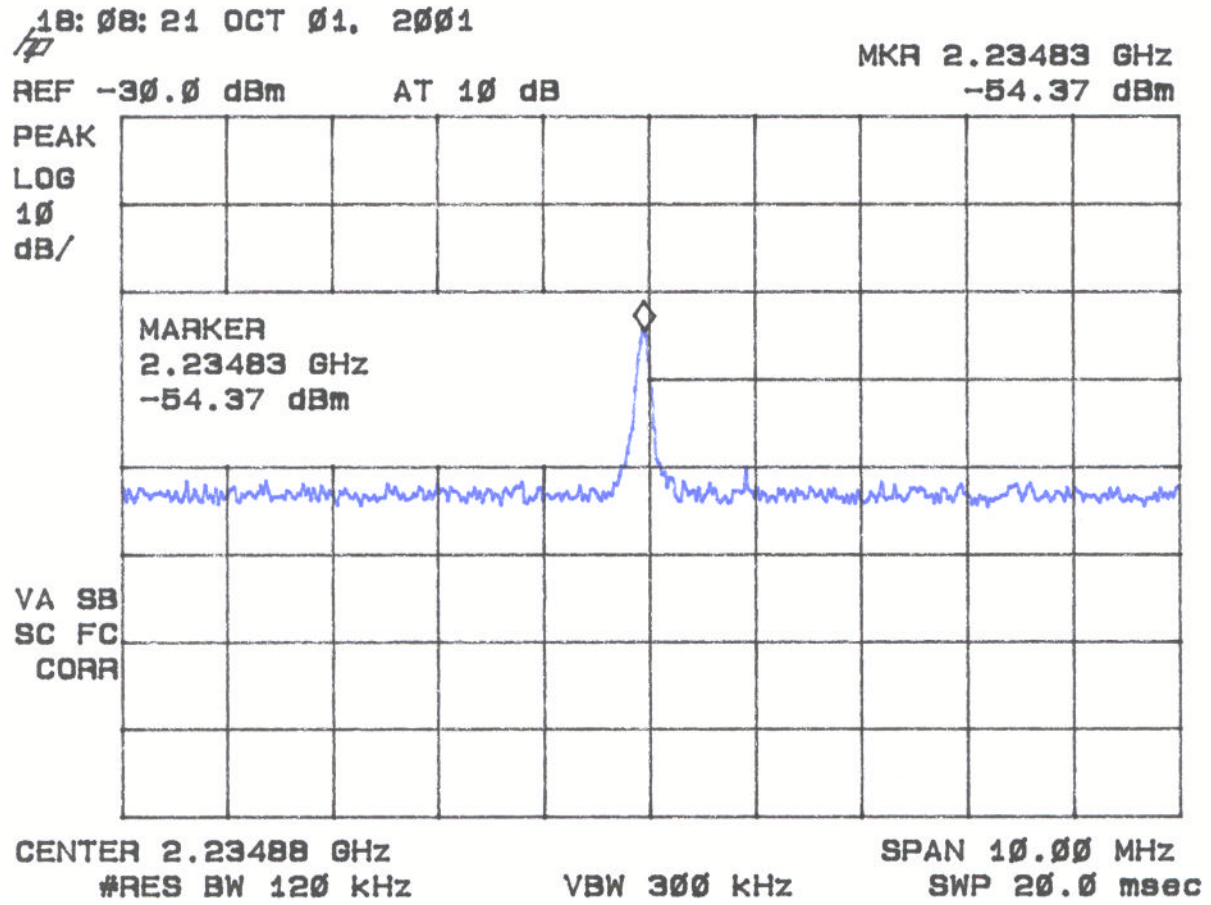


FIGURE 6e

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: September 25, 2001
UST Project: 01-0534
Customer: Wayne-Dalton Corp.
Model: 3BTM-D372

FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
372.5	425	931

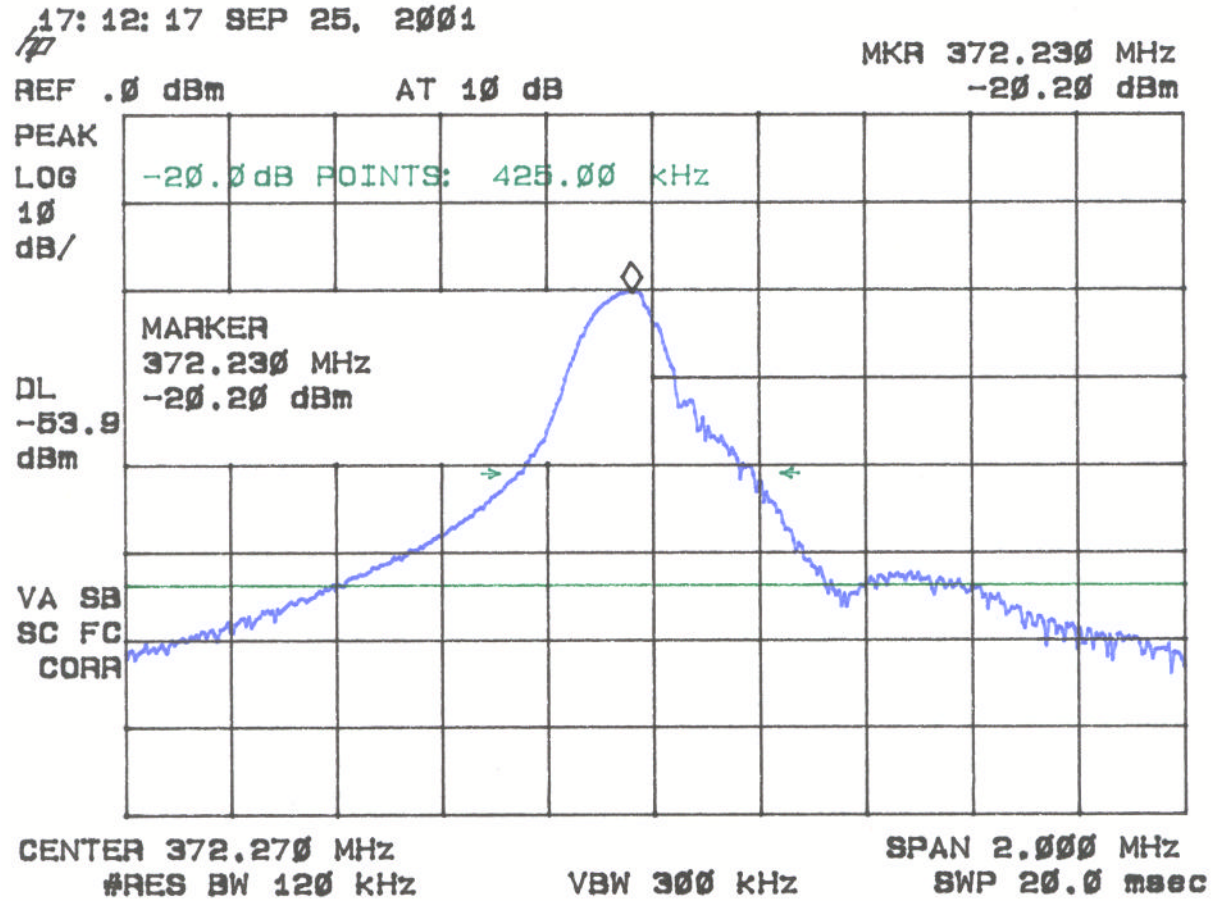
FCC Limit = (0.25%) (Center Frequency) = (0.0025)(372.5 MHz) = 931 kHz

Tested By
Signature: 

Name: Timothy 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)

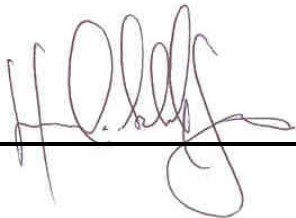
Radiated emissions were evaluated from 30 to 1000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz. Emissions are shown in Table 7.

TABLE 7**CLASS B****RADIATED EMISSIONS**

Test Date: October 1, 2001
UST Project: 01-0534
Customer: Wayne-Dalton Corp.
Model: 3BTM-D372

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: Hernando Orozco

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 3

LABELING INFORMATION