Wayne-Dalton Corp.
FCC Part 15, Certification Application
Model 5BWS-A372

January 15, 2002

MEASUREMENT/TECHNICAL REPORT

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

MODEL: **5BWS-A372**

FCC ID: **KJ8WST-372ASW**

DATE: **January 15, 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:

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3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
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GENERAL INFORMATION

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is a Wayne-Dalton Corp., Model 5BWS-A372. The EUT is a wall mount 5-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. The antenna is a rectangular loop antenna. The track measures 0.0591", the loops on center dimensions are 1.2126" x 0.4646".

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 wall mounted, it was placed into a continuous mode of transmit and positioned in 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 with the Part 15 requirements, the following modification was made:

1) The R3 was increased from 620 kΩ to 820 kΩ.
2) C3 was changed from 2 pF to 2.2 pF.
3) C2 was changed from 9.1 pF to 5.6 pF.
4) Transistor T1 was changed from MMBTH10LT1 to FMMT918TA.

Test Equipment

Table 2 describes test equipment used to evaluate this product.

FIGURE 1

TEST CONFIGURATION

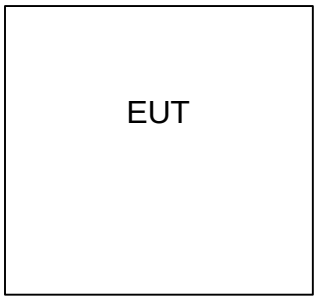


FIGURE 2a

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)	5BWS-A372	None	KJ8WST-372ASW (Pending)	None

TABLE 2

TEST INSTRUMENTS

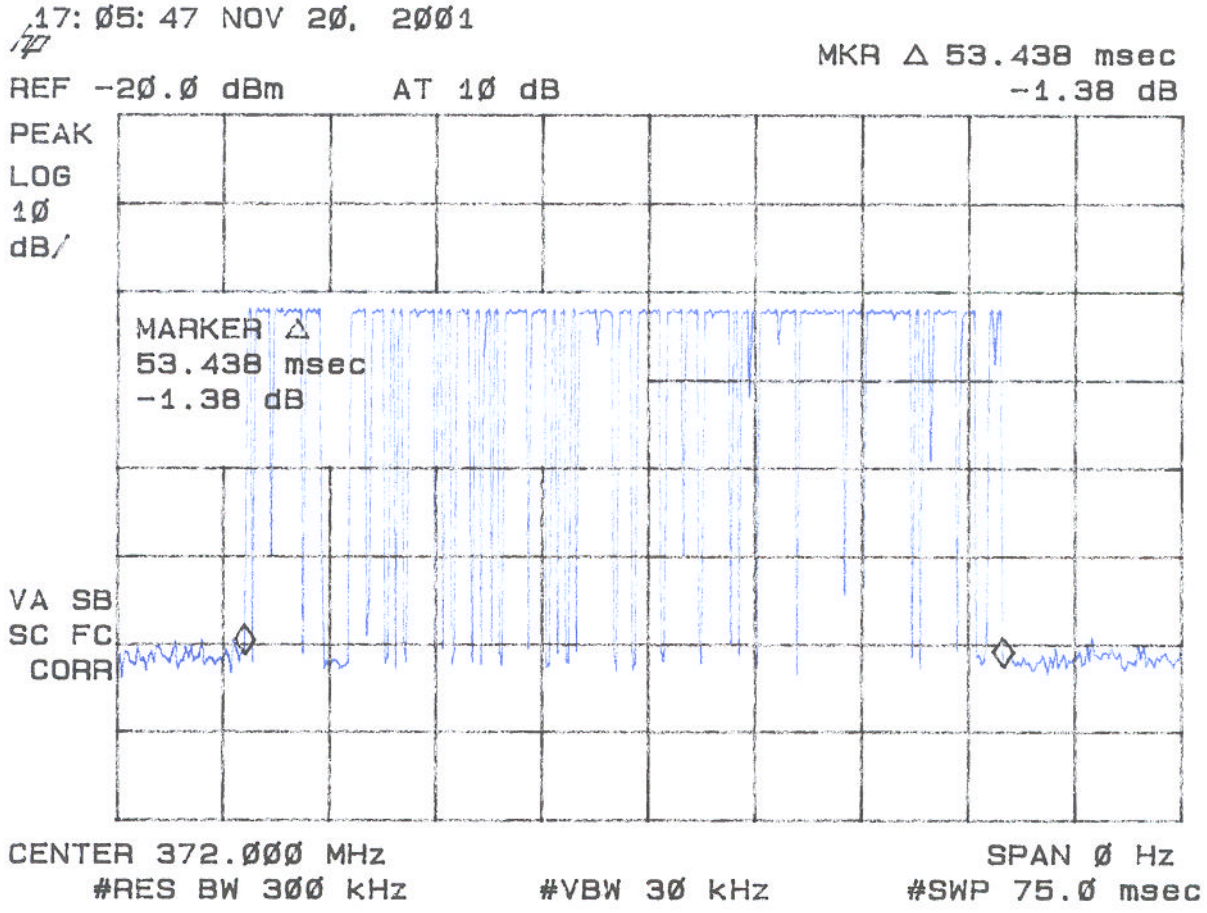
TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
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 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 53.438 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 (116.25 msec) never exceeds a series of *66 long (412.5 µs) and short (225.0 µs) 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 2.8 msec (preamble + following) + (66 x 412.5 µs) per 100 msec = 30.0% duty cycle. Figures 5a through 5f show the characteristics of the pulse train for one of these functions.

*- Note:
According to the manufacturer, the transmit cycle consists of a preample (12 pulses) + data pulses (66 pulses) + following pulses (2 pulses)
[12 pulses (preamble transmit) + 2 (following data) * 200.0 µs = 2.8 msec

Duty Cycle Correction = 20 log (0.300) = -10.46 dB

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

TABLE 3

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: January 29, 2001
UST Project: 01-0617
Customer: Wayne-Dalton Corp.
Model: 5BWS-A372

Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
372.5	-49.6	19.5	6988.2	84,375.0

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-49.6 + 19.5 + 107)/20) = 6988.2
CONVERSION FROM dBm TO dBuV = 107 dB

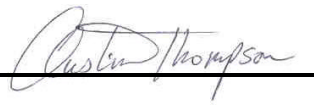
Tested By:  **Name: Austin Thompson**

TABLE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: January 29, 2002
UST Project: 01-0617
Customer: Wayne-Dalton Corp.
Model: 5BWS-A372

Average Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
372.5	-60.1	19.5	2089.3	8437.5

*** Adjusted by duty cycle = 20 log (0.300) = -10.46 dB**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-60.1 + 19.5 + 107)/20) = 2089.3
CONVERSION FROM dBm TO dBuV = 107 dB

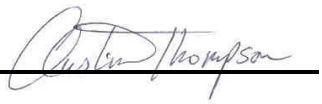
Tested By:  **Name: Austin Thompson**

FIGURE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)

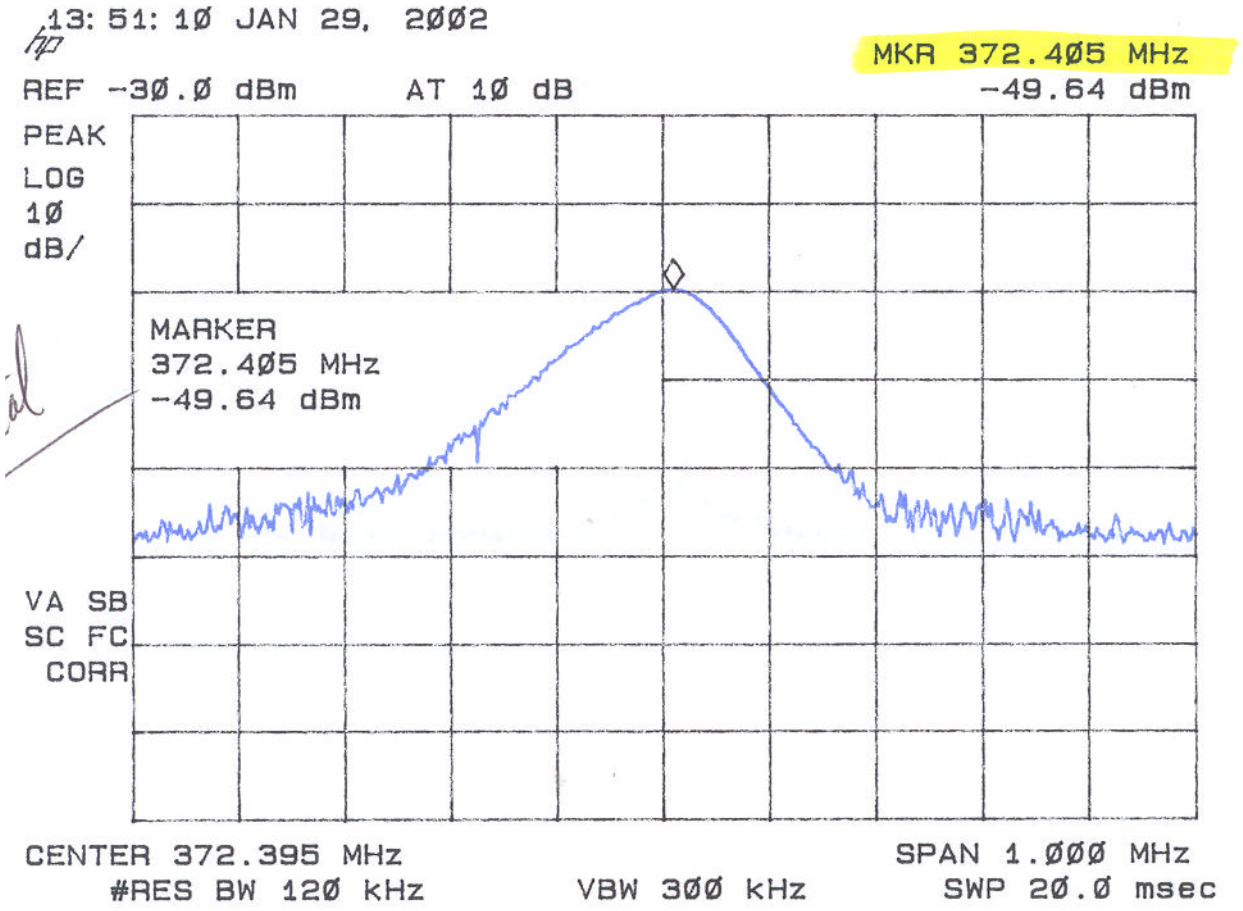


FIGURE 5a

DUTY CYCLE CHARACTERISTICS

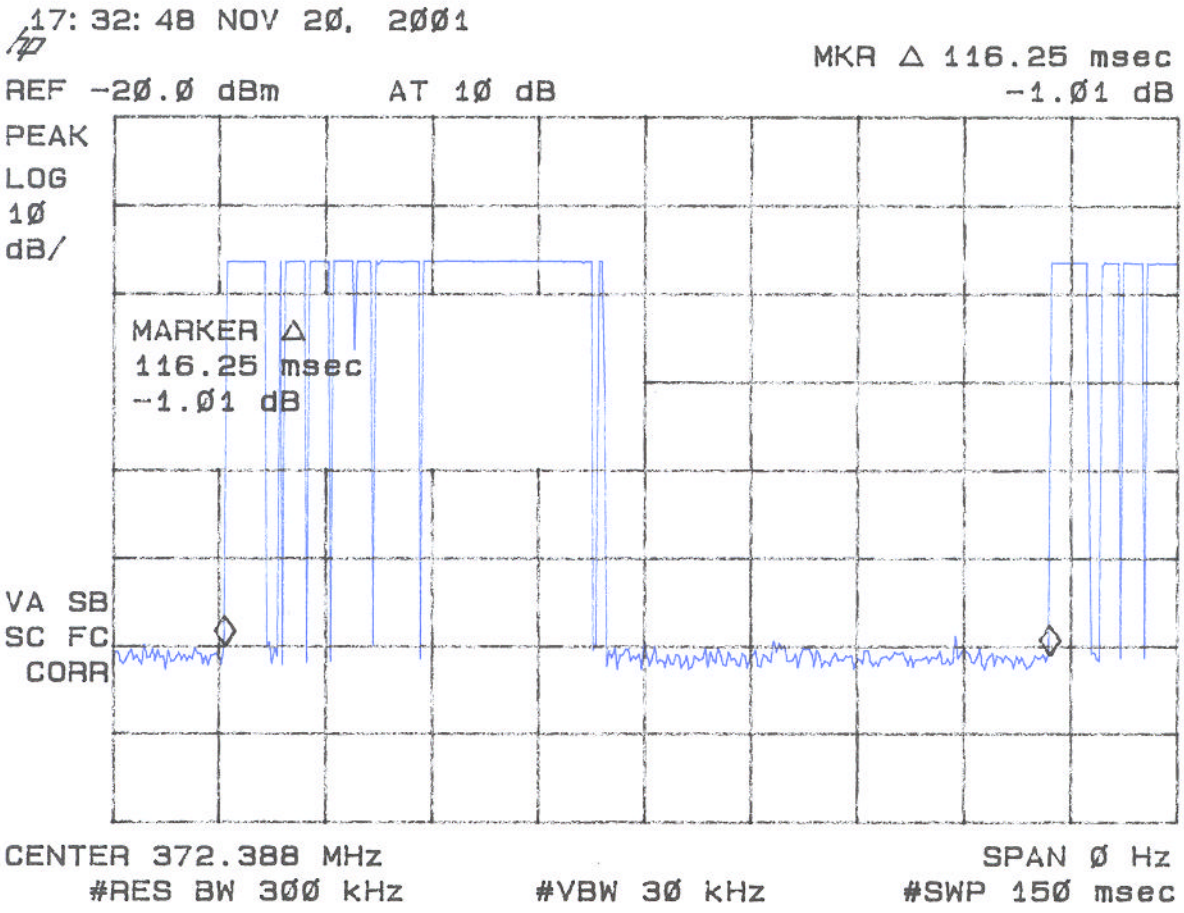


FIGURE 5b

DUTY CYCLE CHARACTERISTICS

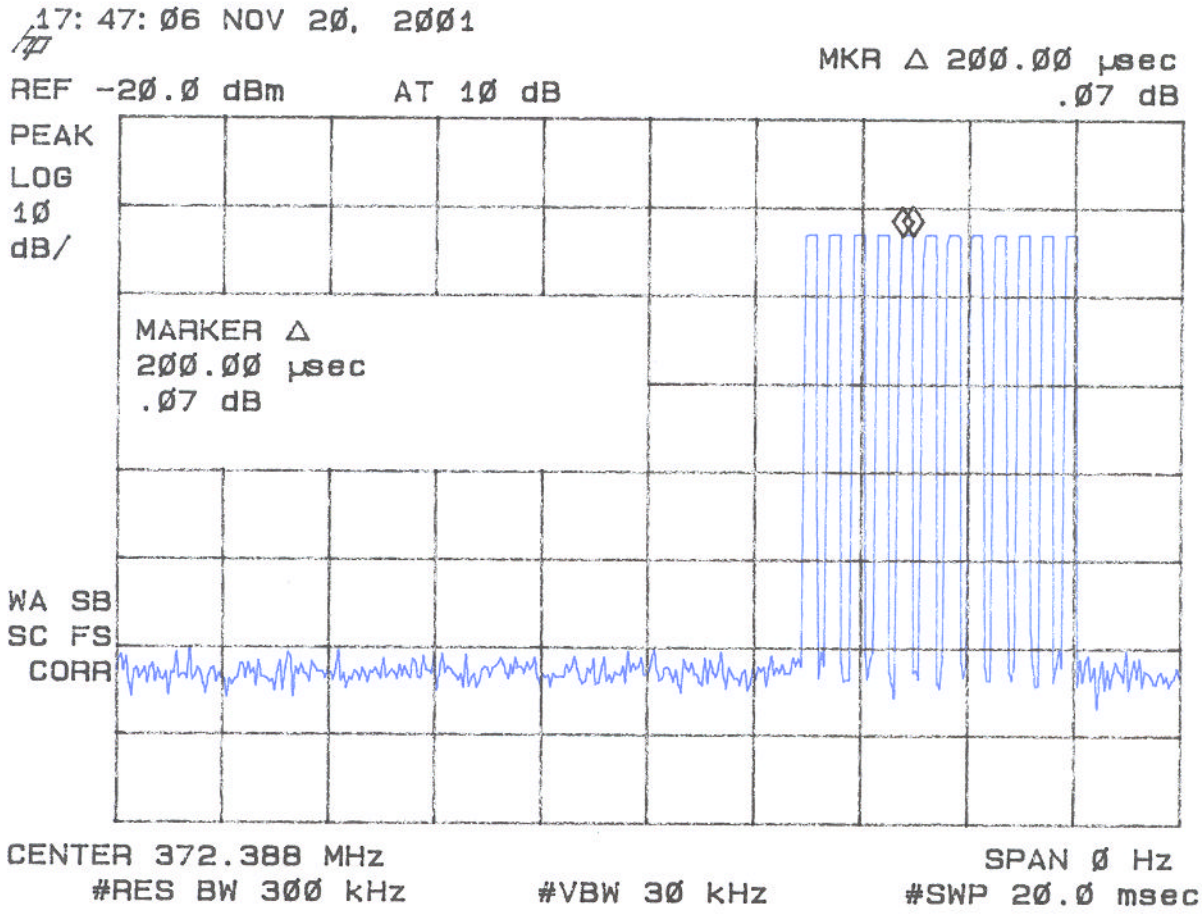


FIGURE 5c

DUTY CYCLE CHARACTERISTICS

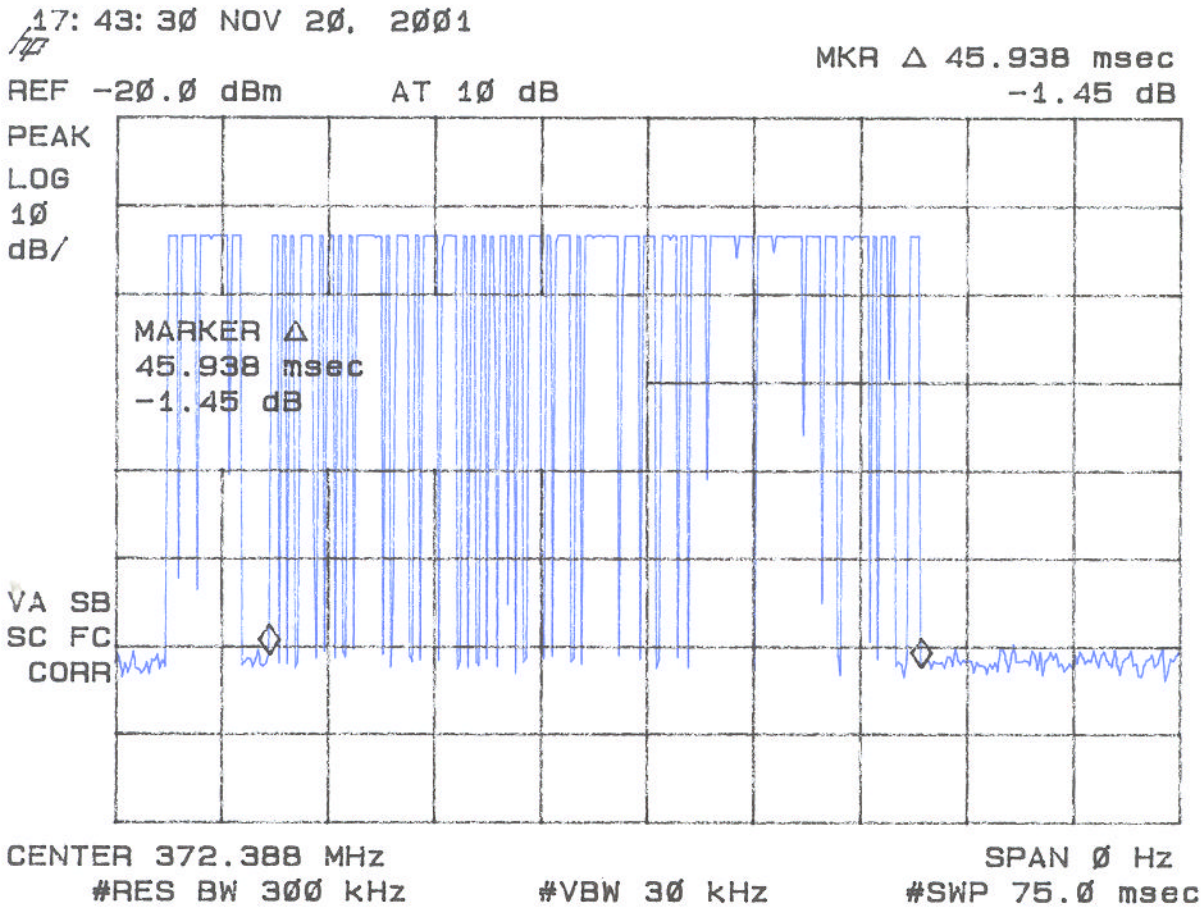


FIGURE 5d

DUTY CYCLE CHARACTERISTICS

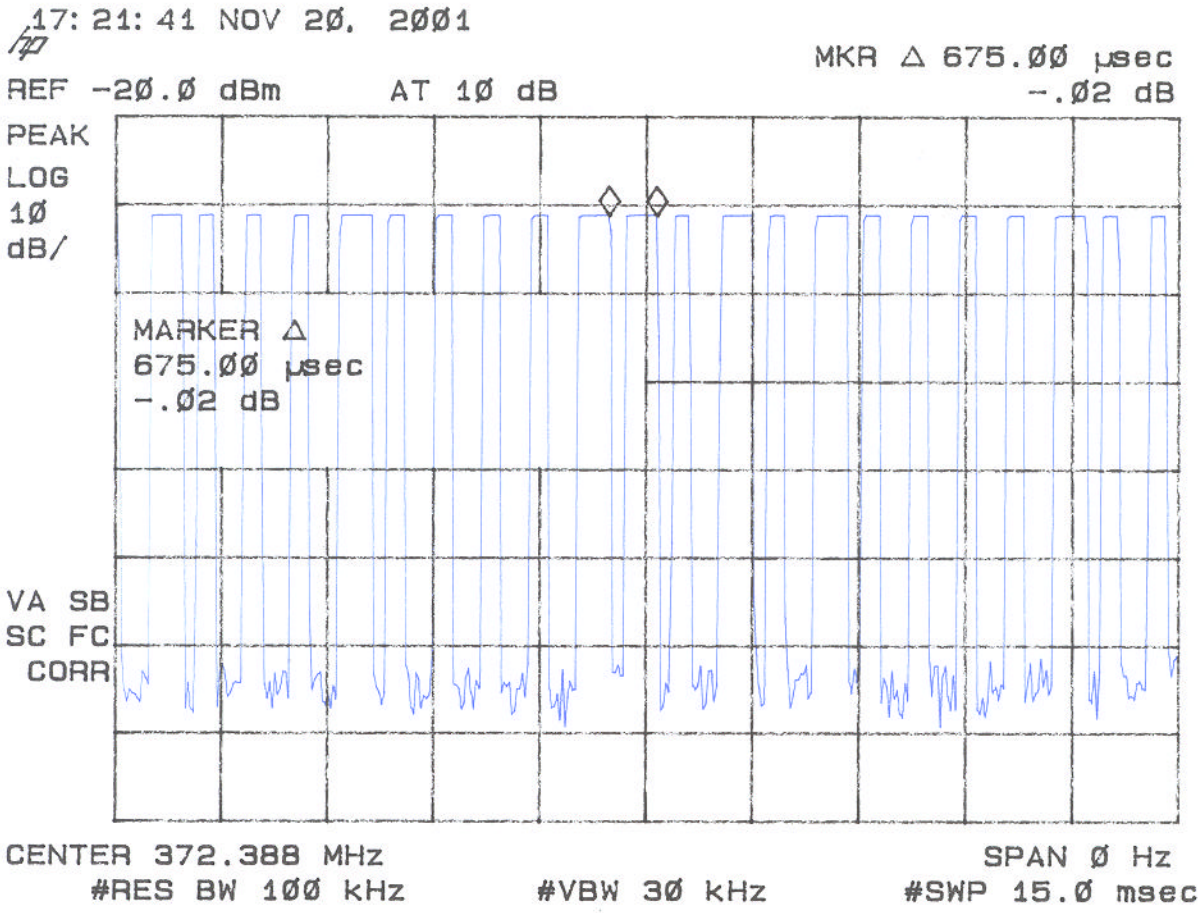


FIGURE 5e

DUTY CYCLE CHARACTERISTICS

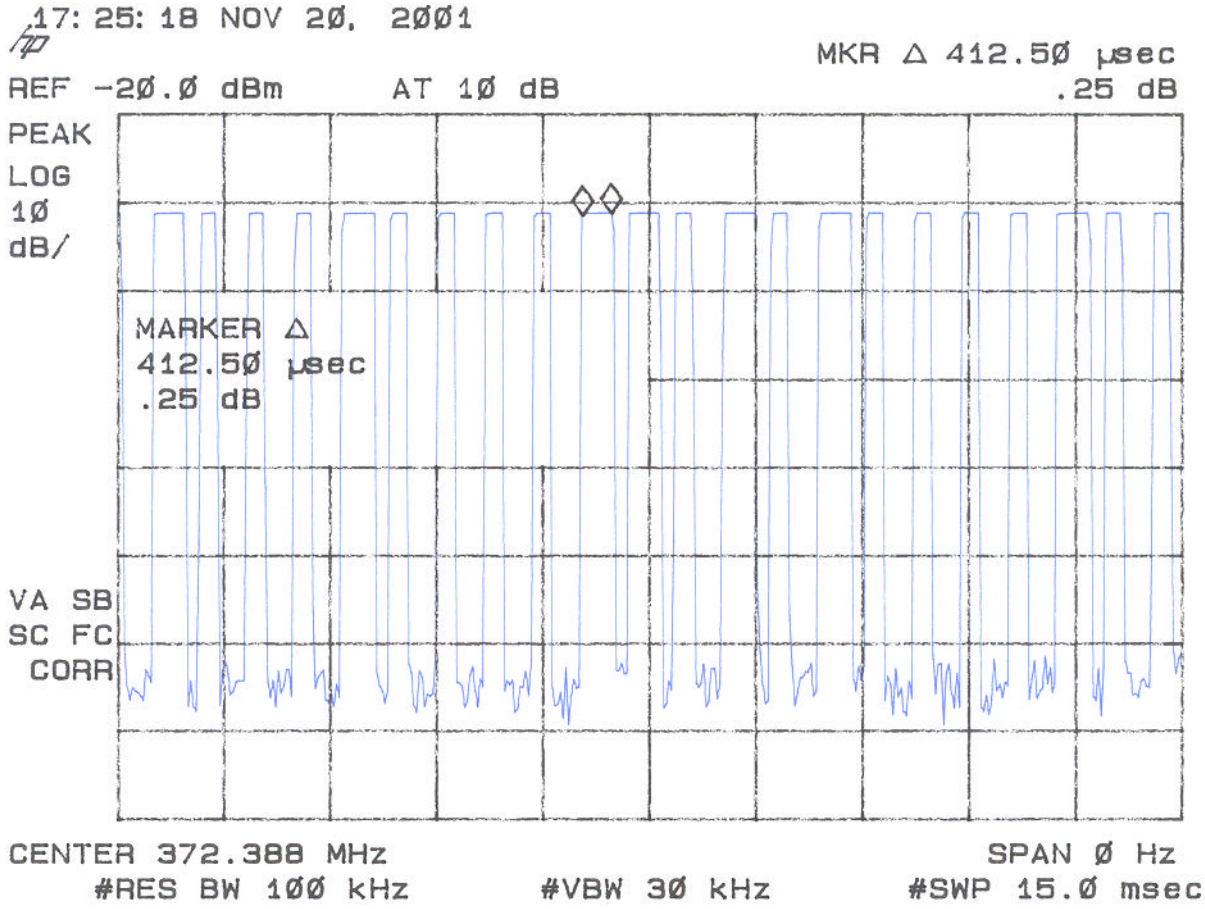
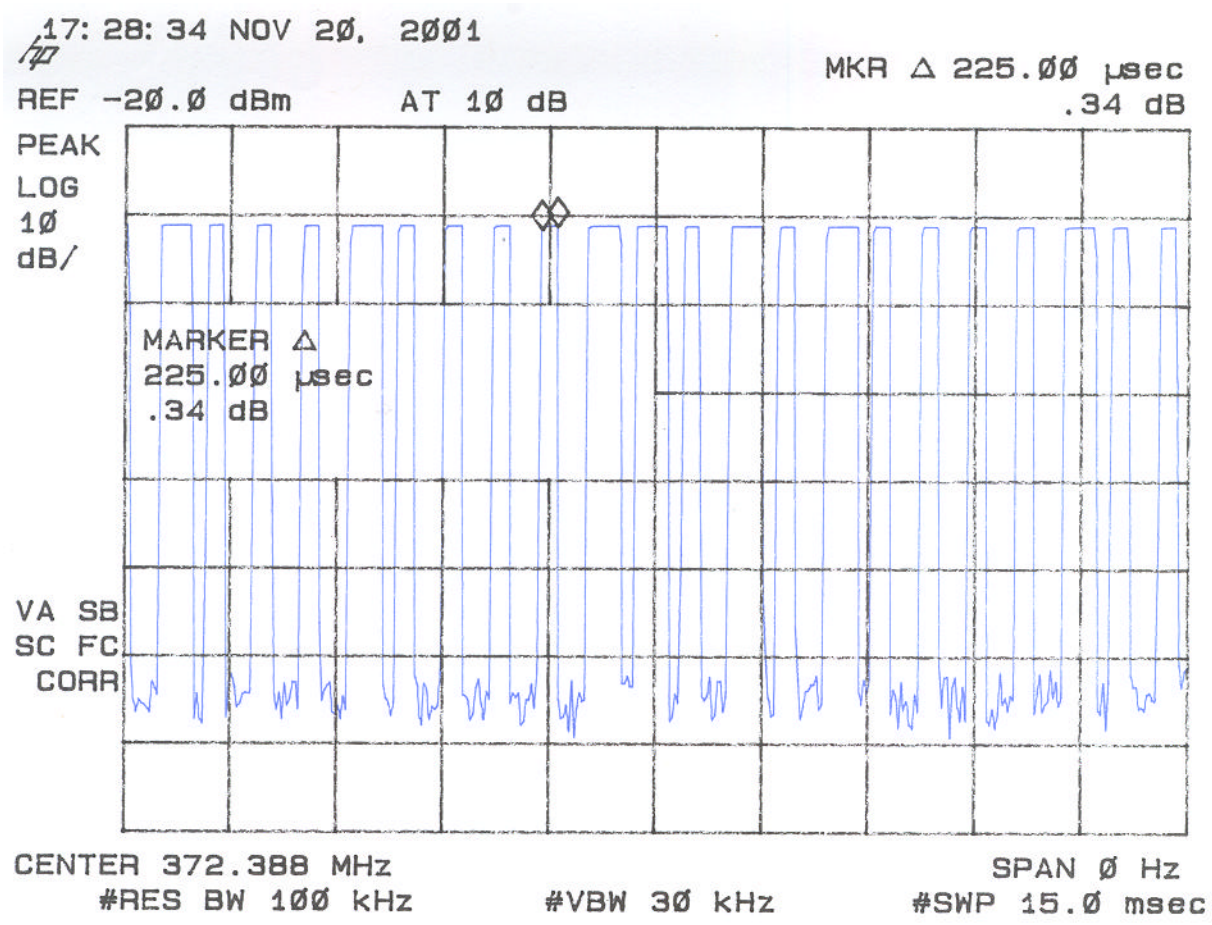


FIGURE 5f

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 5a through Table 5b and Figure 6a through Figure 6c. 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: January 29, 2002
UST Project: 01-0617
Customer: Wayne-Dalton Corp.
Model: 5BWS-A372

Peak Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
744.9	-71.9	27.8	1410.6	8437.5
1117.2	-41.7**	-7.4	787.7	5,000.0
1489.6	-50.9**	-5.9	323.6	5,000.0

**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-71.9 + 27.8 + 107)/20) = 1410.6
CONVERSION FROM dBm TO dBuV = 107 dB

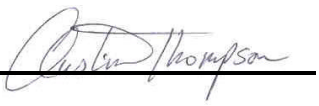
Tested By:  **Name: Austin Thompson**

TABLE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Date: January 29, 2002
UST Project: 01-0617
Customer: Wayne-Dalton Corp.
Model: 5BWS-A372

Average Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
744.9	-82.4	27.8	421.2	843.7
1117.2	-52.2**	-7.4	234.7	500.0
1489.6	-61.4**	-5.9	96.6	500.0

*** Adjusted by duty cycle = 20 log (0.300) = -10.46 dB**
**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-82.4 + 27.8 + 107)/20) = 421.2
CONVERSION FROM dBm TO dBuV = 107 dB

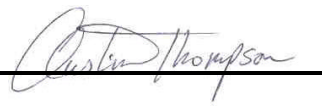
Tested By:  **Name: Austin Thompson**

FIGURE 6a

SPURIOUS EMISSIONS 16.231(b)

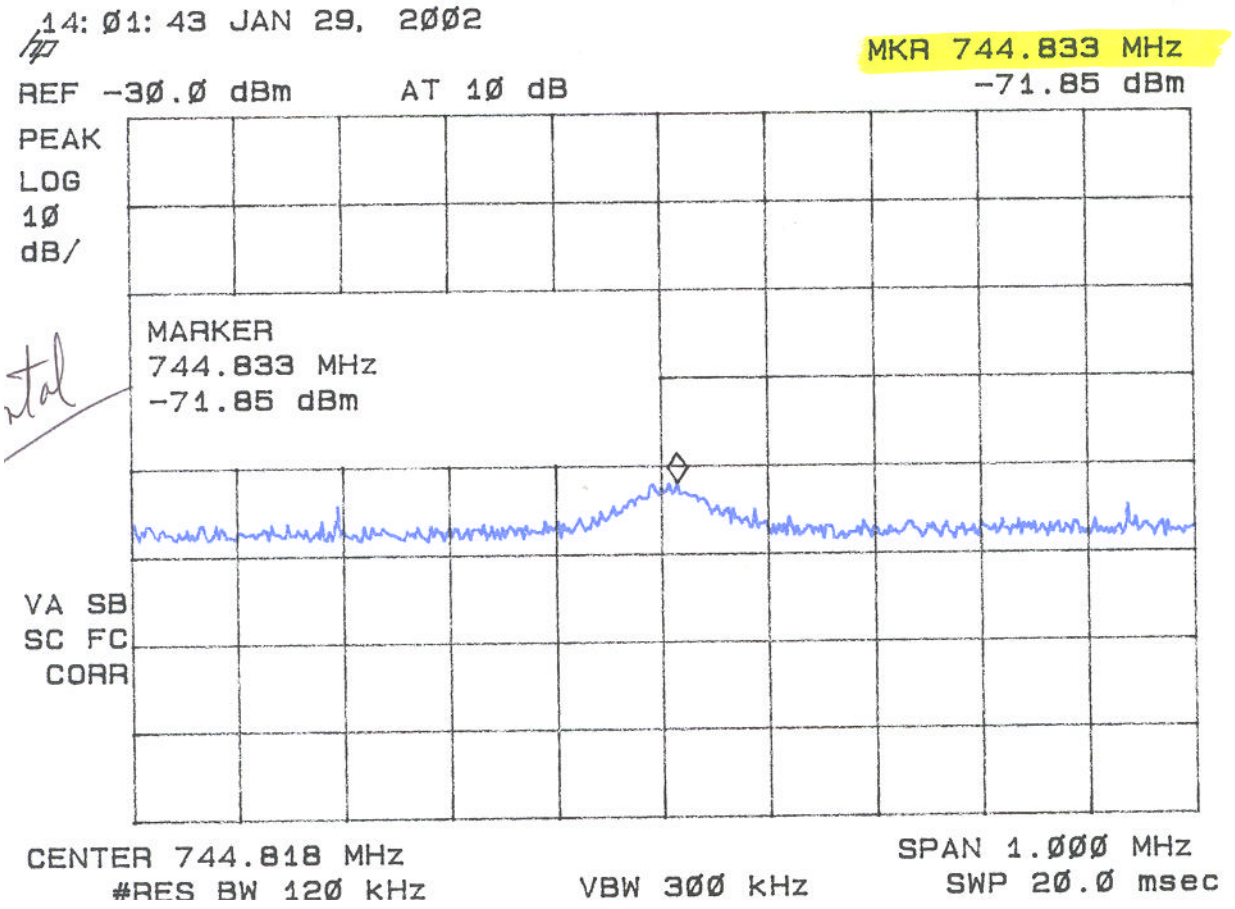


FIGURE 6b

SPURIOUS EMISSIONS 16.231(b)

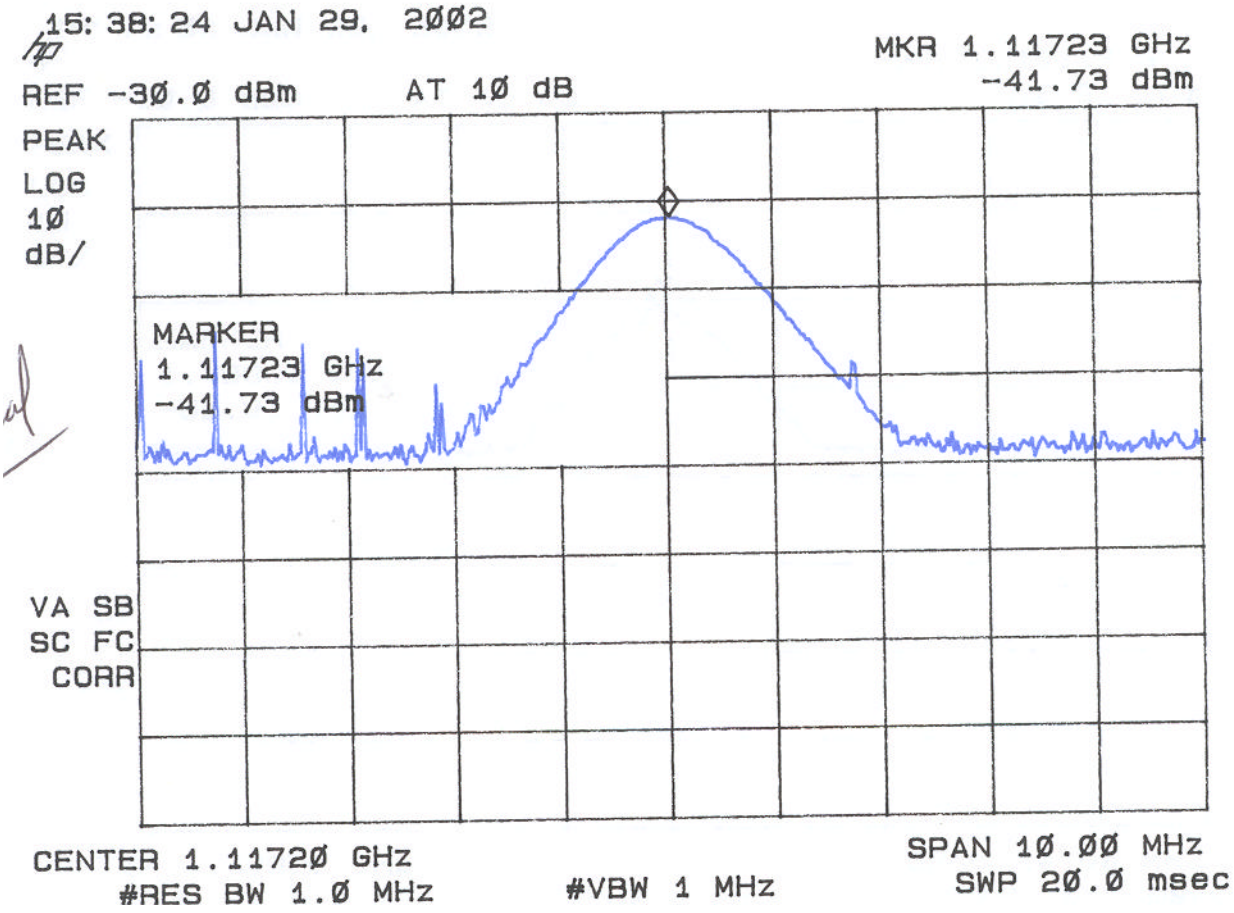
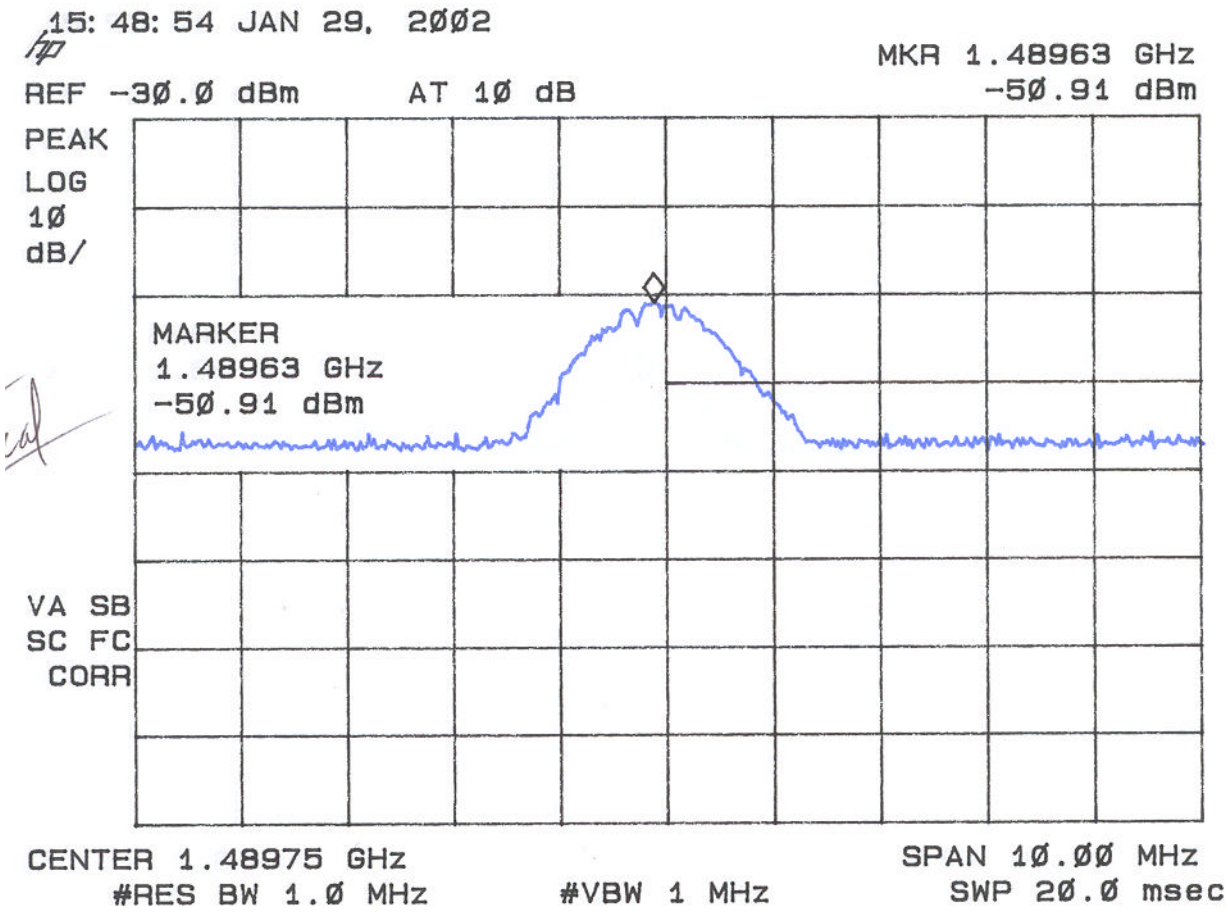


FIGURE 6c

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: November 20, 2001
UST Project: 01-0617
Customer: Wayne-Dalton Corp.
Model: 5BWS-A372

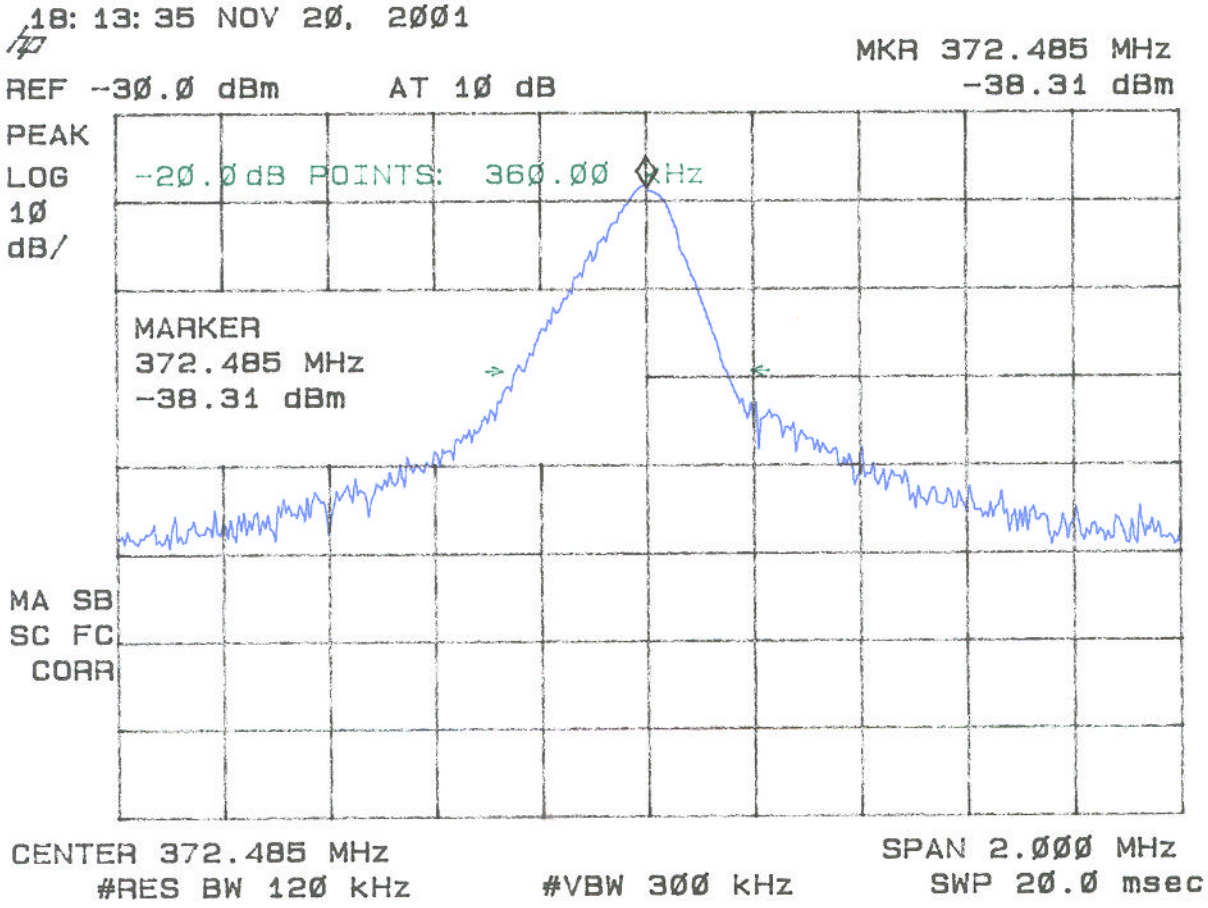
FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
372.5	360	931

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: December 28, 2001
UST Project: 01-0617
Customer: Wayne-Dalton Corp.
Model: 5BWS-A372

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 P. 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.