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Wayne-Dalton Corporation
FCC Part 15, Certification Application
Model 5BWS-A372
Test Dates: June 14 & 18, 2002
Issue Date: July 15, 2002

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Wayne-Dalton Corporation**

MODEL: **5BWS-A372**

FCC ID: **KJ8WST-372BSW**

DATE: **July 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:

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 Corporation, 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 Corporation 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 width measures .060", the loops on center dimensions are 1.210" x .500". One of the long sides measures only .690" making the loop not fully closed.

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

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

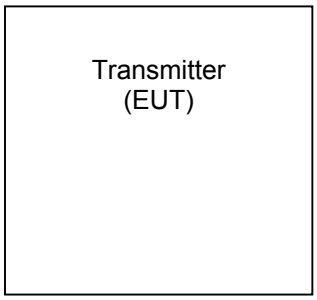


FIGURE 2a

Photographs for Spurious and Fundamental Emissions

FIGURE 2b

Photograph(s) for Spurious and Fundamental Emissions

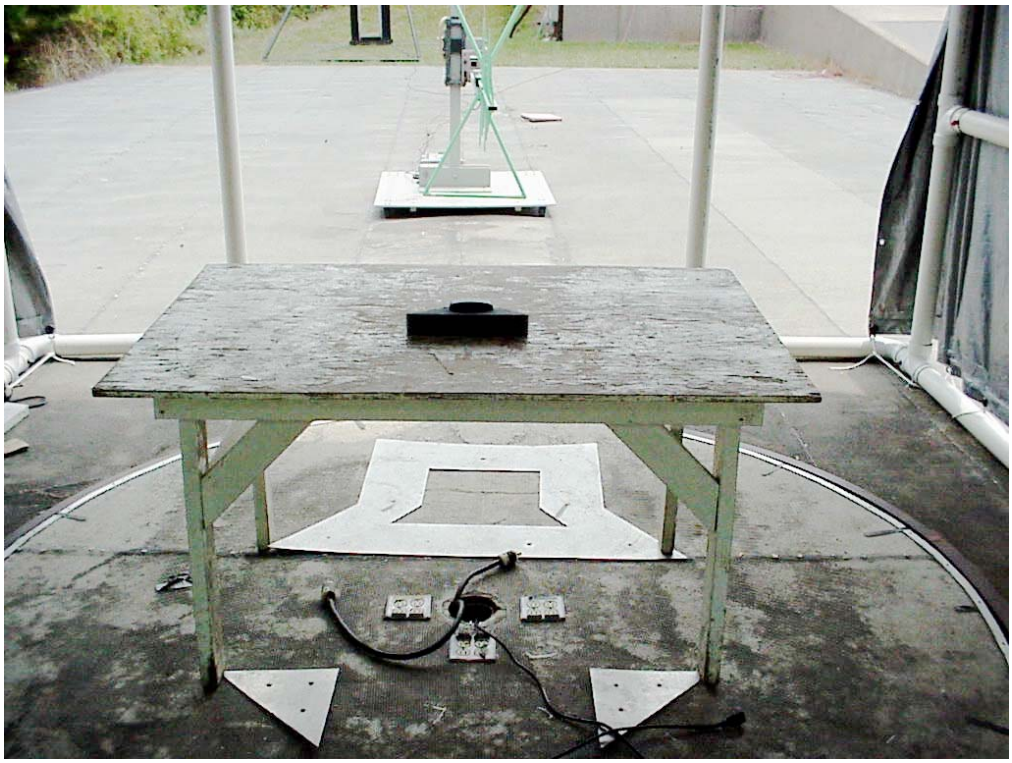


TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transmitter Wayne-Dalton Corporation (EUT)	5BWS-A372	06/12/02	KJ8WST-372BSW (Pending)	None

TABLE 2

TEST INSTRUMENTS

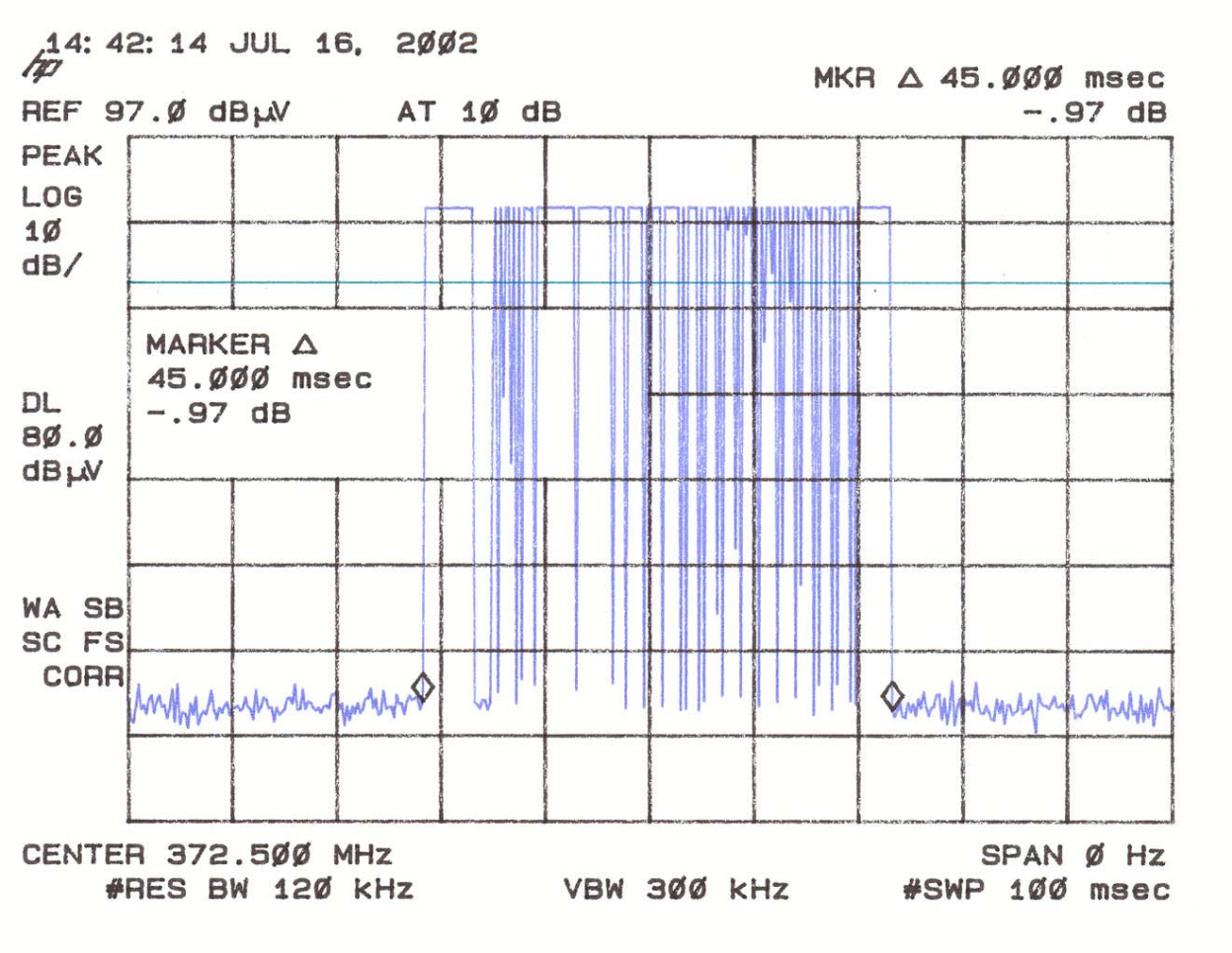
EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A09900	3/27/02
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	2/15/02
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	2/14/02
TEST RECEIVER	ESV	ROHDE & SCHWARZ	881485/040	10/10/01
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	08/22/01
COMB GENERATOR	8406A	HEWLETT-PACKARD	2246A02168	12/27/01
RF PREAMP	8447D	HEWLETT-PACKARD	2944A07436	5/6/02
RF PREAMP	8449B	HEWLETT-PACKARD	3008A00480	5/6/02
HORN ANTENNA	3115	EMCO	9107-3723	7/19/01
BICONICAL ANTENNA	3110	EMCO	9307-1431	7/16/01
LOG PERIODIC ANTENNA	3146	EMCO	3236	11/26/01
CALCULATION PROGRAM	N/A	N/A	Ver. 5.1	N/A

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 45.000 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:

For detailed information regarding the duty cycle, please see Figures 5a through 5f.

Duty Cycle Correction = 20 log (0.2464) = -12.2 dB

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

TABLE 3a

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: July 22, 2002
UST Project: 02-0239
Customer: Wayne-Dalton Corporation
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	-40.95	19.7	19,386.5	84,375.0

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-40.95 + 19.7 + 107)/20) = 19,386.5
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  **Name: David Blethen**

TABLE 3b

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Test Date: July 22, 2002
UST Project: 02-0239
Customer: Wayne-Dalton Corporation
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
372.45	-53.15	19.7	4,758.8	8,437.5

*** Duty Cycle Correction = 20 log (0.2464) = -12.2 dB**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-53.15 + 19.7 + 107)/20) = 4,758.8
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  **Name: David Blethen**

FIGURE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)

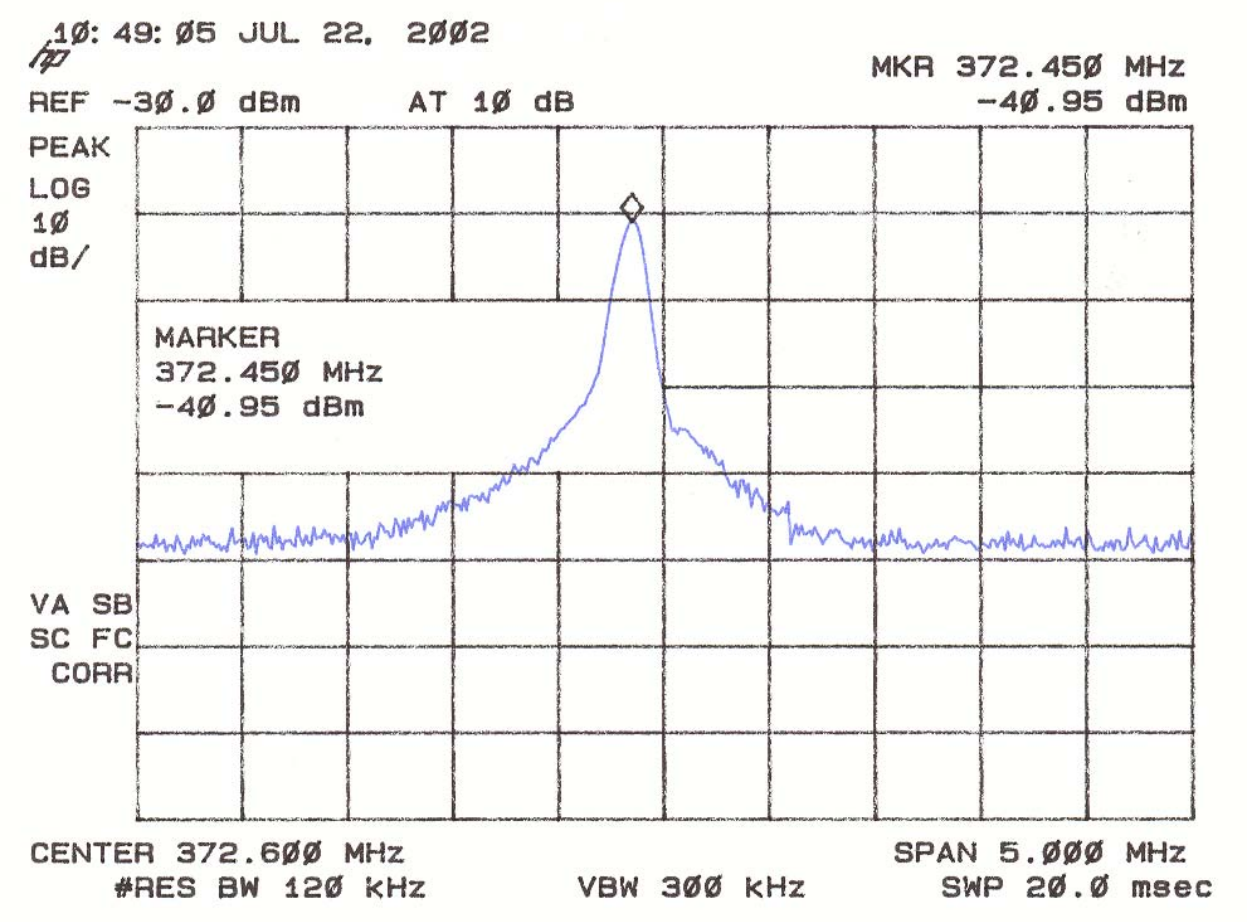


FIGURE 5a

DUTY CYCLE CHARACTERISTICS

Measurement of Duty Cycle over 100 mS interval

Unit Under Test: Wayne-Dalton Corp. Low-Power Transmitter Model #: 5BWS-A372
FCC ID: KJ8HHT-372BSW

Performed By: Richard Bardin Date: 6/12/02

Test Equipment Used: Tektronixs O-scope - TDS 420A
Sylvania RF detector diode - D4112

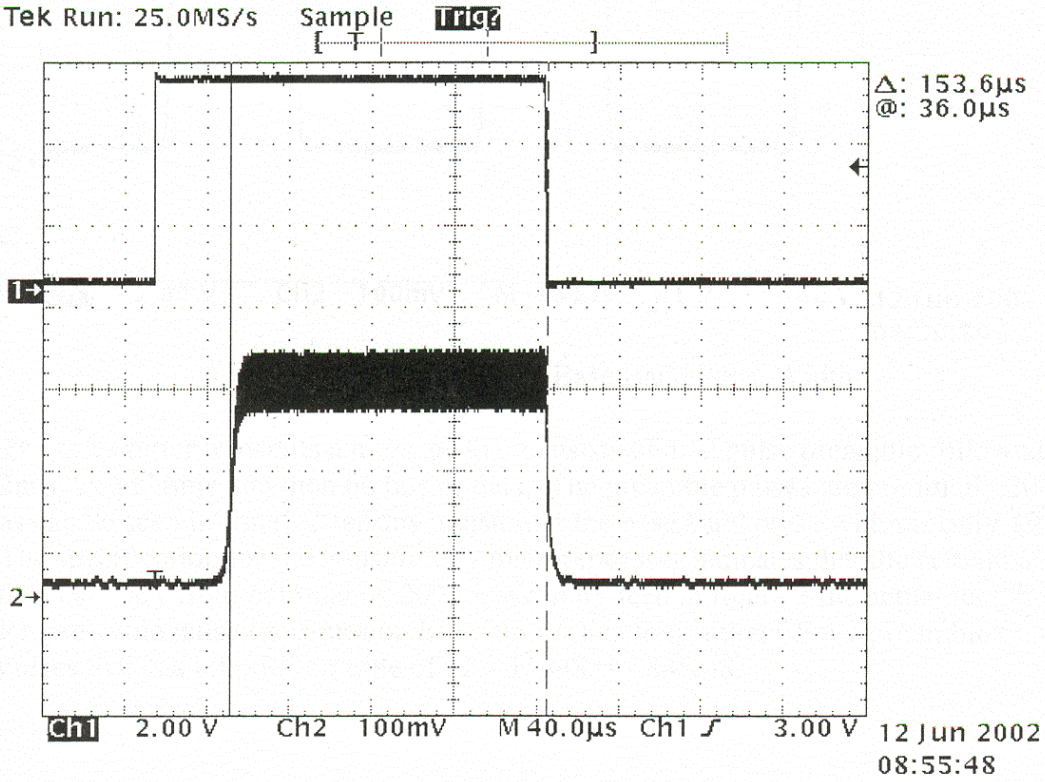


Figure 1. Transmitter Turn-On Delay

Figure 1 illustrates the characteristic turn-on delay of the transmitter. Channel 1 shows the base band TTL pulse from the microprocessor and channel 2 shows the corresponding RF transmission as detected by the RF detector. Note that the turn-on delay is 36 uS.

FIGURE 5b

DUTY CYCLE CHARACTERISTICS

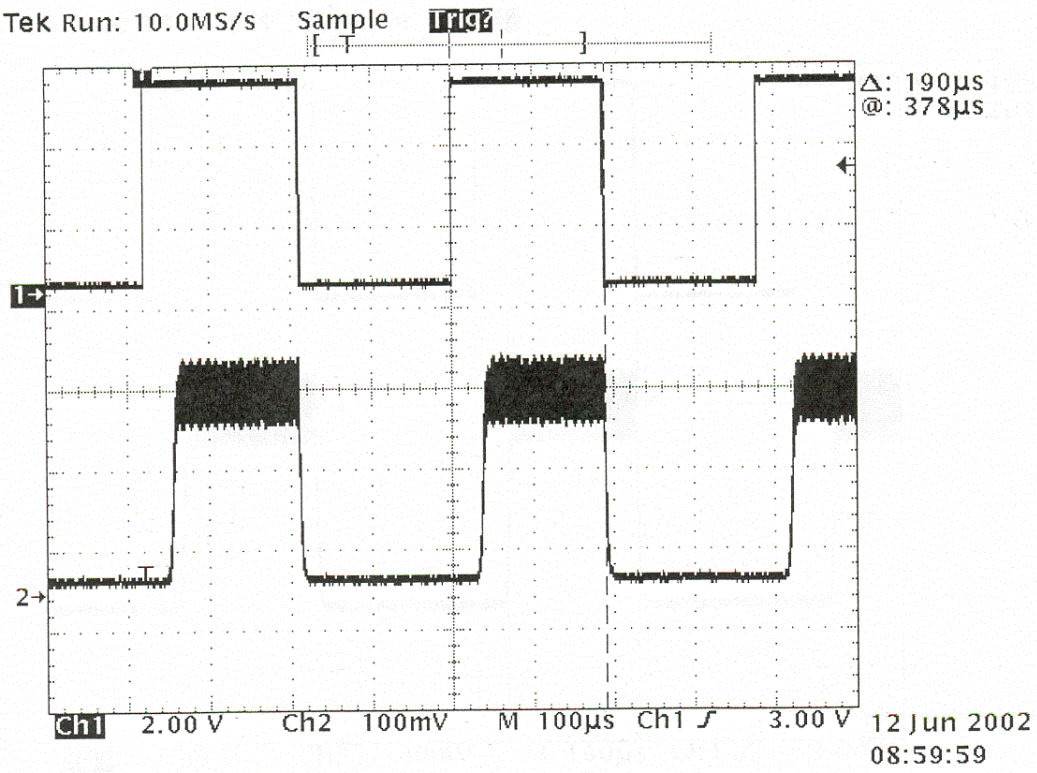


Figure 2. Preamble Base Band Pulse Width

The transmitter transmits a message that consists of a 12 pulse preamble followed by a 2mS "dead" time and then 66 bits of data. The preamble pulses are nominally 200uS, but as can be seen in figure 2 for this transmitter the base band pulse width is only 190uS. The specification for the transmitter's microprocessor indicates that the actual base band data can vary from nominal by 20%. As can be seen in figure 3 the actual length of an RF preamble pulse transmission is 154uS for this transmitter. For a preamble of 12 pulses that is a total RF on time of 12 x 154uS = 1.848mS.

FIGURE 5c

DUTY CYCLE CHARACTERISTICS

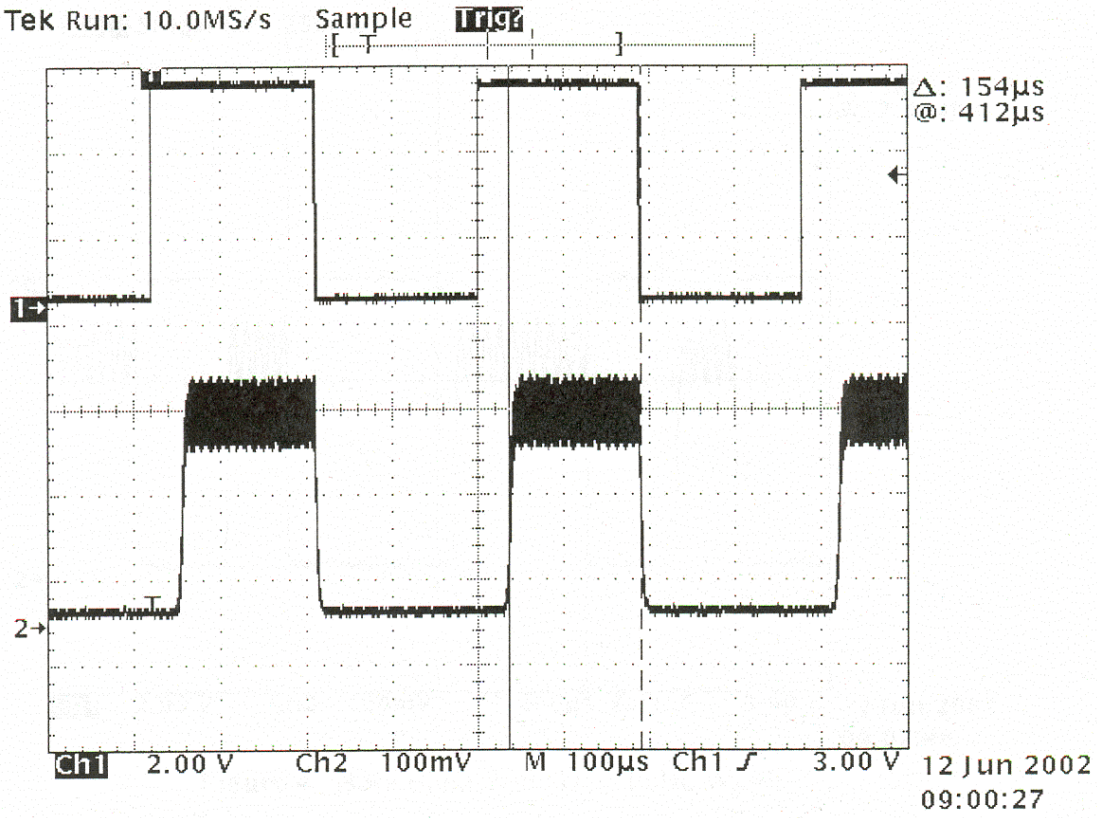


Figure 3. Preamble RF Pulse Width

The Transmitters preamble is followed by 2mS of no transmission and then by 66 bits of data. These data pulses are of a 33/66 PWM format with a nominal period of 600uS. This means that the widest possible data pulse is nominally 400uS. The actual pulse width again, can vary by +/- 20%. Figure 4 shows the base band pulse width of a wide data pulse for this transmitter. Note that it is 380uS. Figure 5 shows the actual RF pulse width as being 336uS. If a worst case (which is actually not possible) is assumed where all 66 bits are wide pulses then the total RF transmission time for the data is 66 x 336uS = 22.176mS.

For the preamble and data the worst-case RF transmission time of this transmitter sample is 1.848mS + 22.176mS = 24.024mS.

FIGURE 5d

DUTY CYCLE CHARACTERISTICS

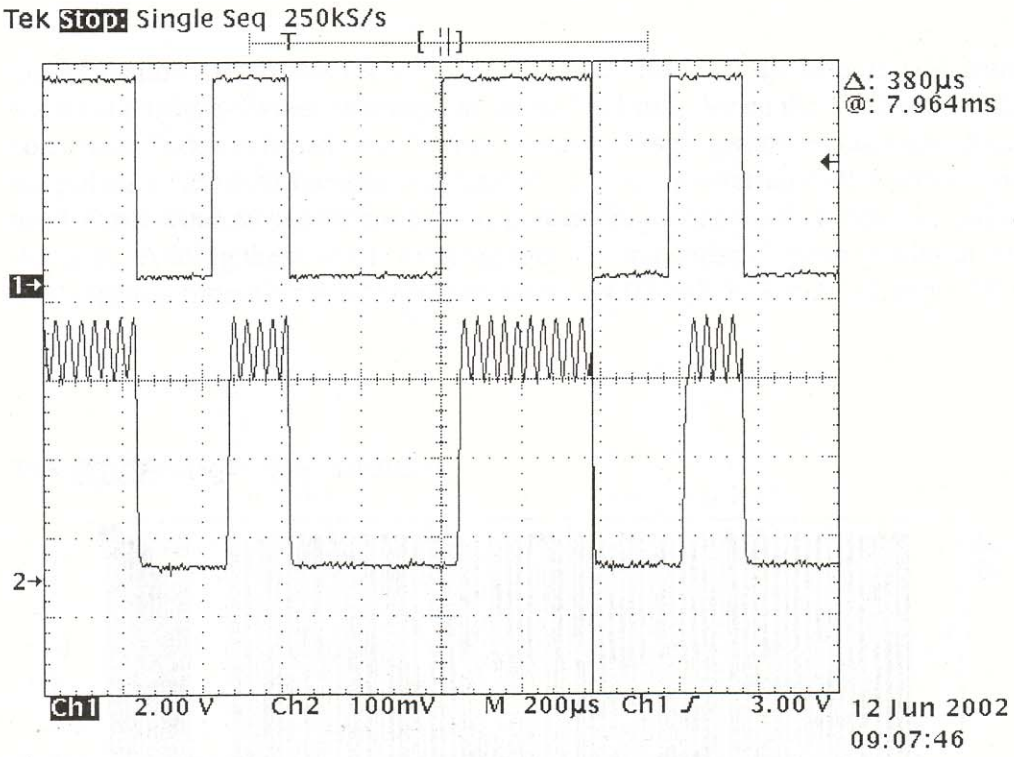


Figure 4. Base Band Wide Data Pulse Width

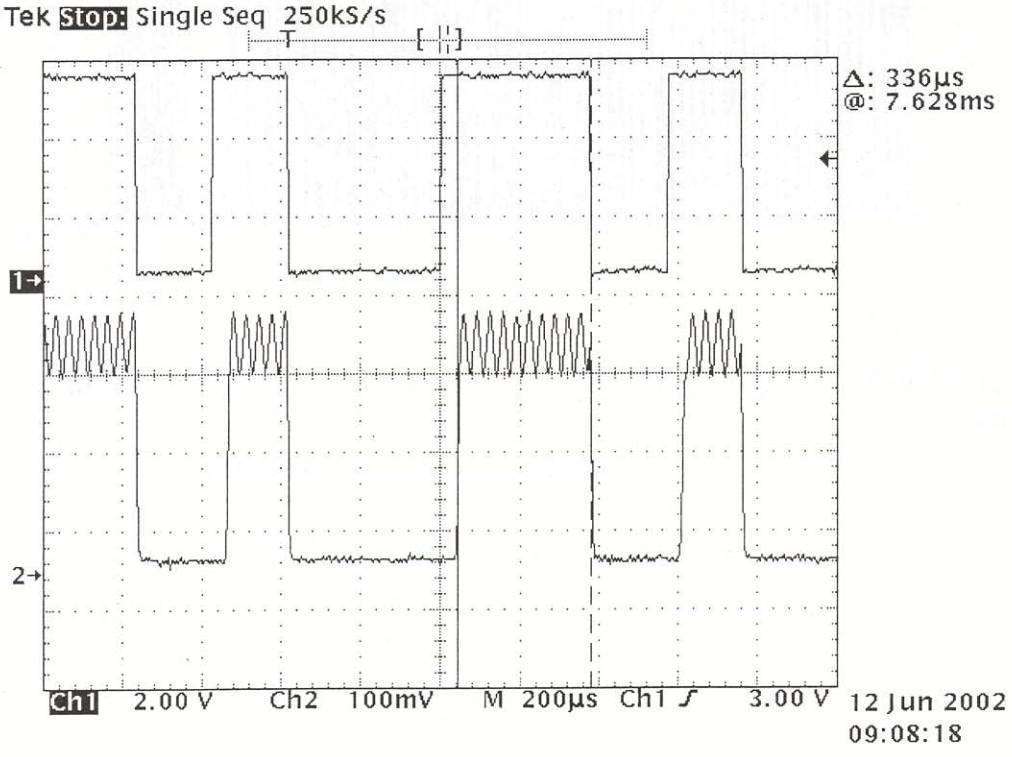


Figure 5. RF Wide Data Pulse Width

FIGURE 5e

DUTY CYCLE CHARACTERISTICS

Figure 6 shows the overall length of the transmitted message as being 44.2mS. Figure 7 shows the time between messages as being 98.4 mS. Since the FCC duty cycle correction factor is based on a 100mS window it is necessary to take into consideration the pulses of the next messages preamble. 1.6 mS of overlap of the second message into the 100mS window has occurred; this places four of the second message pulses into this window. Adding these to the existing total RF transmission time results in a total RF transmission time over a 100mS interval of: 24.024mS + (4 x 0.154mS) = 24.64mS.

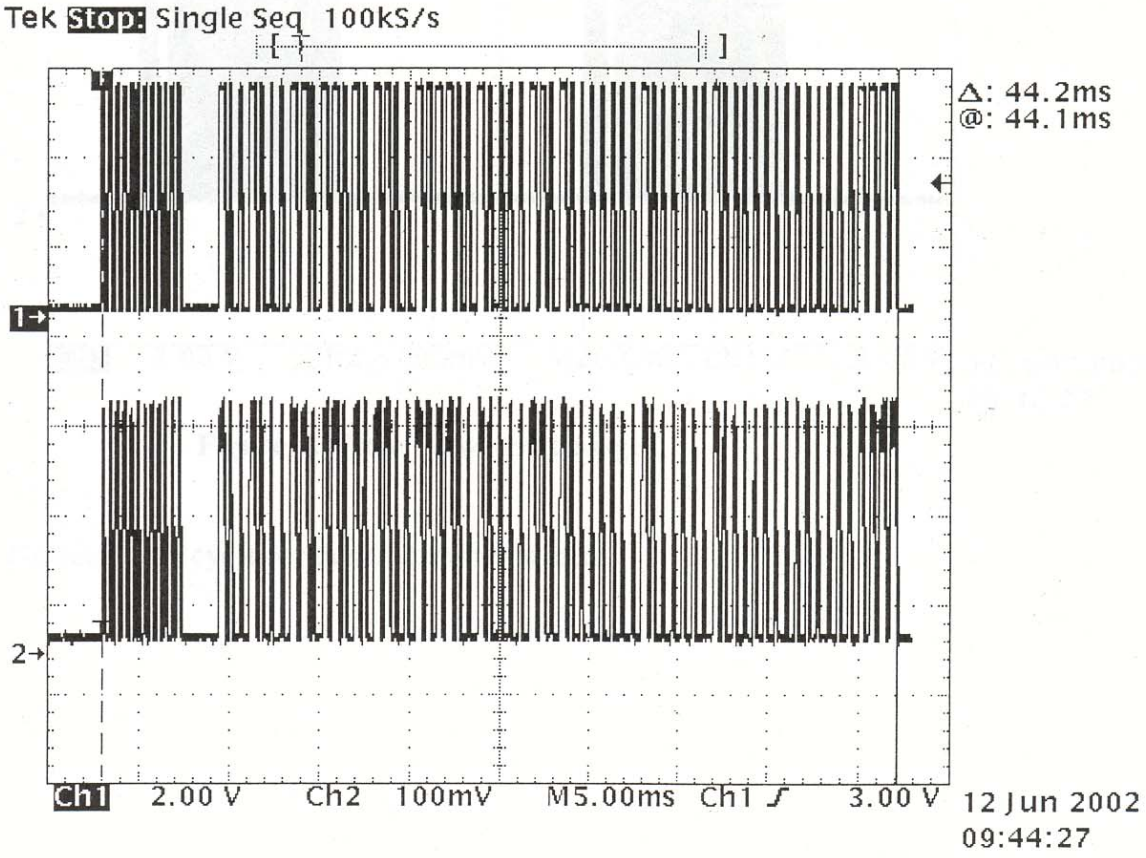


Figure 6. Total Message Time

FIGURE 5f

DUTY CYCLE CHARACTERISTICS

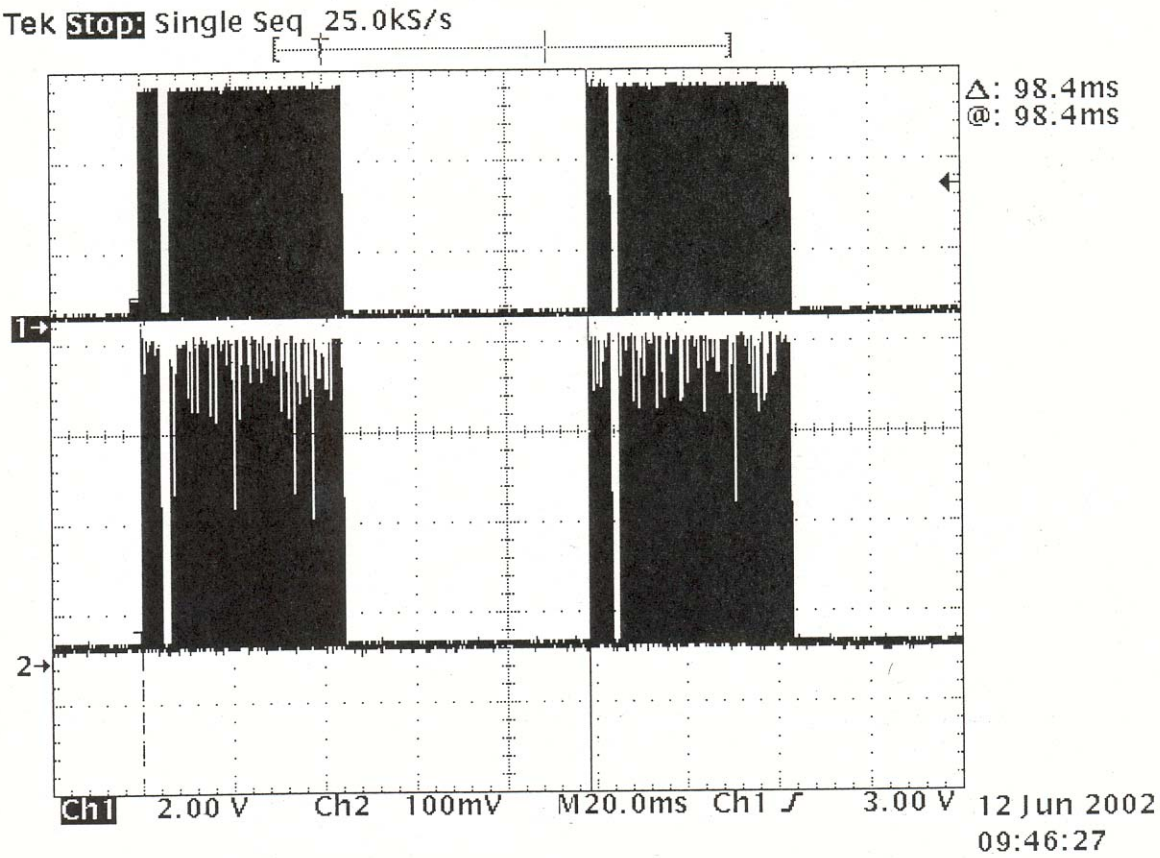


Figure 7. Time Between Messages

The total duty cycle for this transmitter is then:

(24.64 mS/100 mS) x 100% = 24.64% DC

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: June 18, 2002 & July 22, 2002
UST Project: 02-0239
Customer: Wayne-Dalton Corporation
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
744.0	-69.28	28.3	1,999.9	8,437.5
1489.8	-47.05	-5.3	540.1	5,000.0

**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-69.28 + 28.3 + 107)/20) = 1,999.9
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  **Name: David Blethen**

TABLE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Date: June 18, 2002 & July 22, 2002
UST Project: 02-0239
Customer: Wayne-Dalton Corporation
Model: 5BWS-A372

Average Measurement

FREQ. (MHz.)	TEST DATA (dBm) @ 3m*	ANTENNA FACTOR + CABLE ATTENUATION - AMP GAIN	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
744.0	-81.48	28.3	490.9	8,437.5
1,4898	-59.25	-5.3	132.7	500.0

*** Duty Cycle Correction = 20 log (0.2464) = -12.2 dB**

**** Denotes restricted band of operation**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-81.48 +28.3 + 107)/20) = 490.9
CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: _____ **Name:** David Blethen

FIGURE 6a

SPURIOUS EMISSIONS 16.231(b)

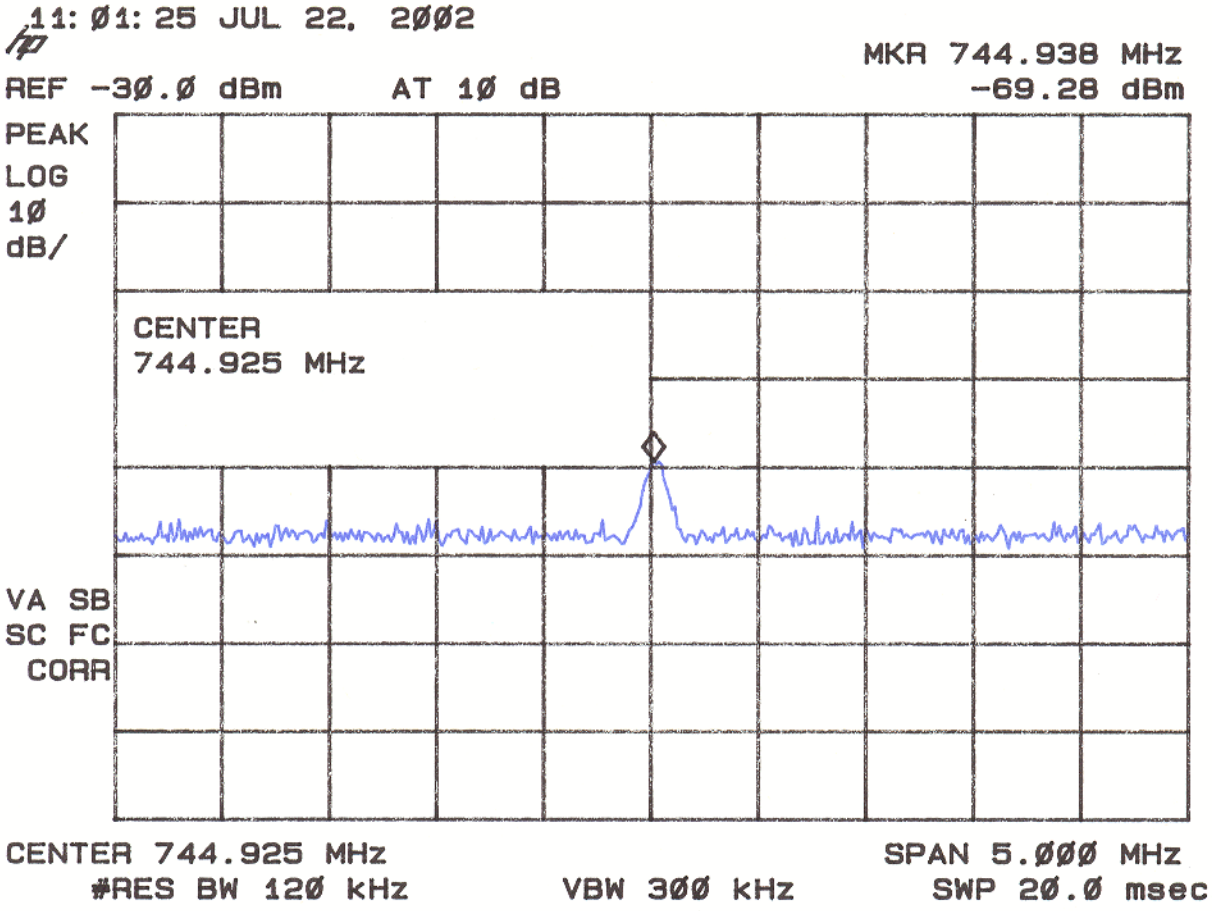
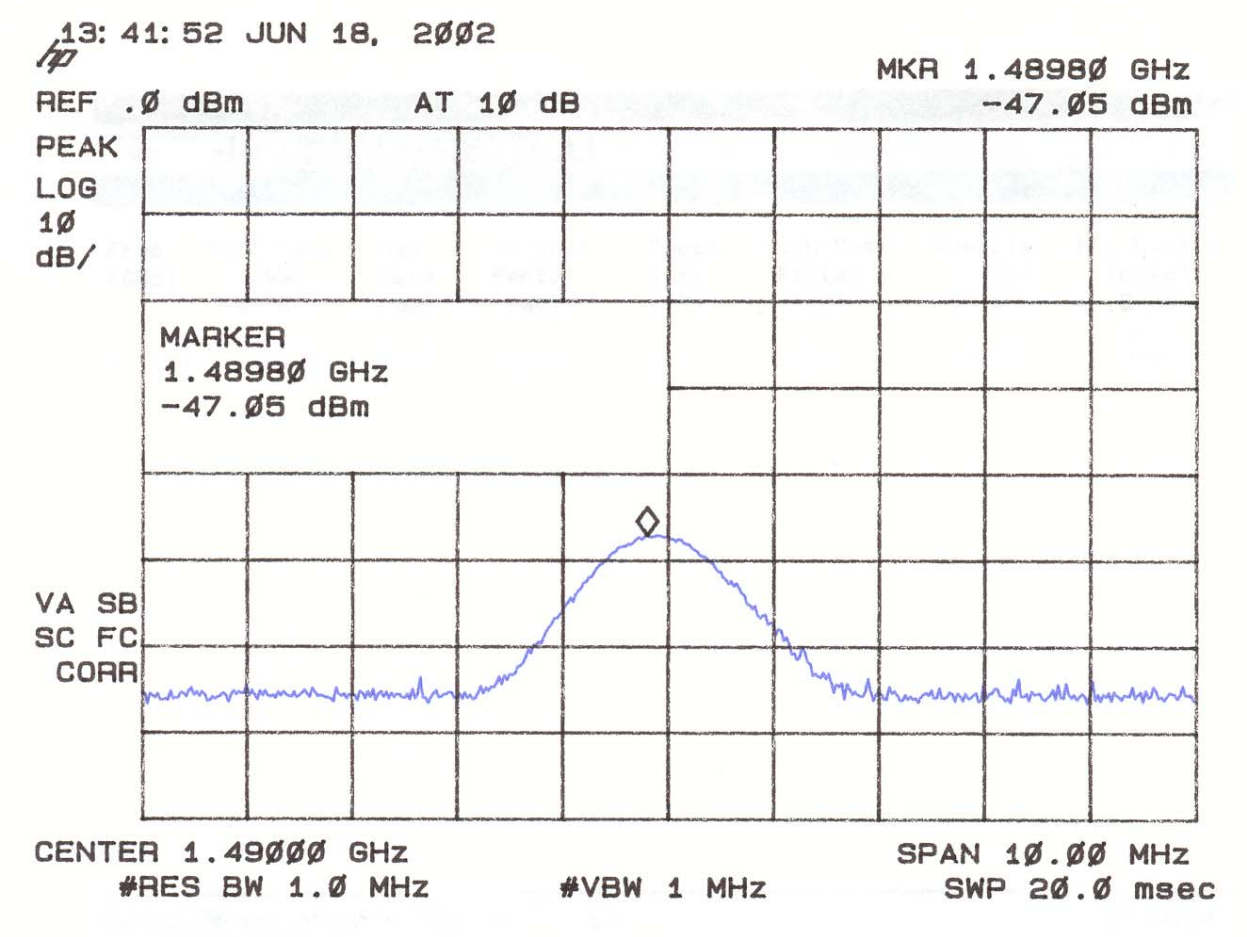


FIGURE 6b

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: June 18, 2002
UST Project: 02-0239
Customer: Wayne-Dalton Corporation
Model: 5BWS-A372

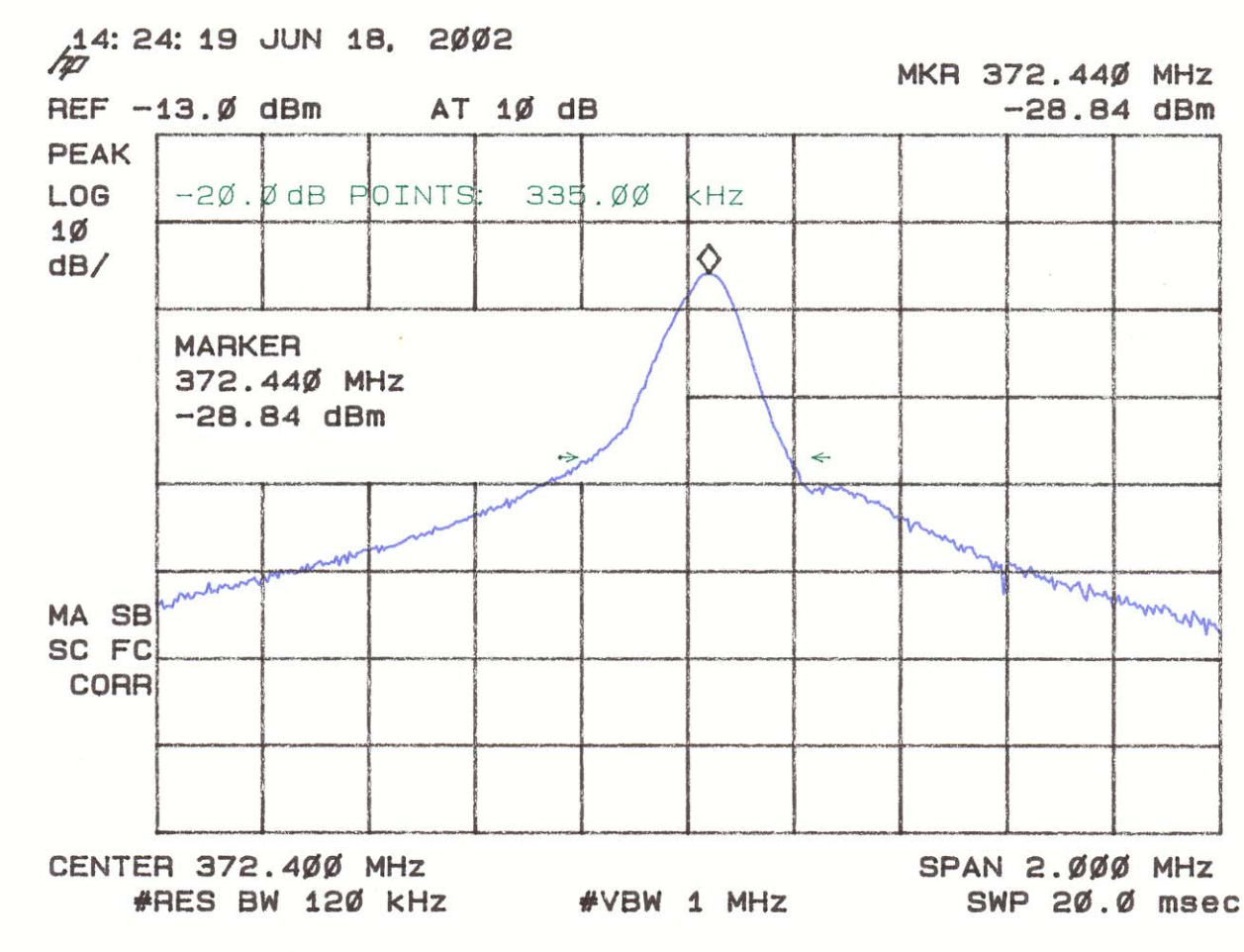
FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
372.440	335	931

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: June 18, 2002
UST Project: 02-0239
Customer: Wayne-Dalton Corporation
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.