



**All-Line, Inc.
FCC Part 15, Certification Application
Model All-Line, RE0012**

January 29, 2004

Report Number: 03-0042
Customer: All-Line, Inc.
Model: RE0012

MEASUREMENT/TECHNICAL REPORT

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

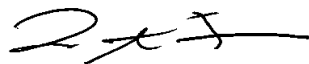
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
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Report reviewed by:



Louis A. Feudi
Operations Manager

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SECTION 1

GENERAL INFORMATION

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GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is the All-Line, Inc. Model RE0012. The EUT is a 6 channel RF Transmitter used as part of a system to remotely control powering on and off of house-hold appliances. The EUT is intended for operation at short range, indoors only. It may be hand-held or wall-mounted. The unit operates at 310 Mhz, +/- 300 Khz, but has 6 different codes (buttons) which may be used to control 6 different appliances. The codes are carried by different switches to accomplish channel separation.

Related Submittal(s)/Grant(s)

The EUT will be used with a DoC Approved receiver.

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SECTION 2

TESTS AND MEASUREMENTS

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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. Fresh batteries, with sufficient voltage were used during test.

Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. Conducted and digital device testing was performed at US Tech's measurement facility. This site has been fully described and registered by the FCC under Registration Number 91037. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

Modifications

The following modification was necessary to bring the EUT into compliance with Part 15, Class B FCC Rules and Regulations:

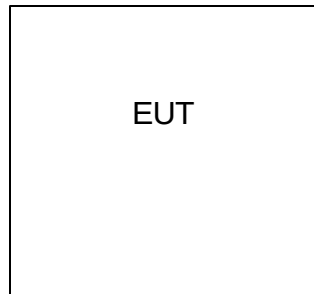
Inductor L1 was changed to a value of 3.9 uH by the manufacturer to significantly reduce radiated emissions below the FCC limits.

Test Equipment

Table 2 describes test equipment used to evaluate this product.

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FIGURE 1
TEST CONFIGURATION



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TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transmitter All-Line, Inc. (EUT)	RE0012	None	PWZRE0012 (Pending)	None

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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
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
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

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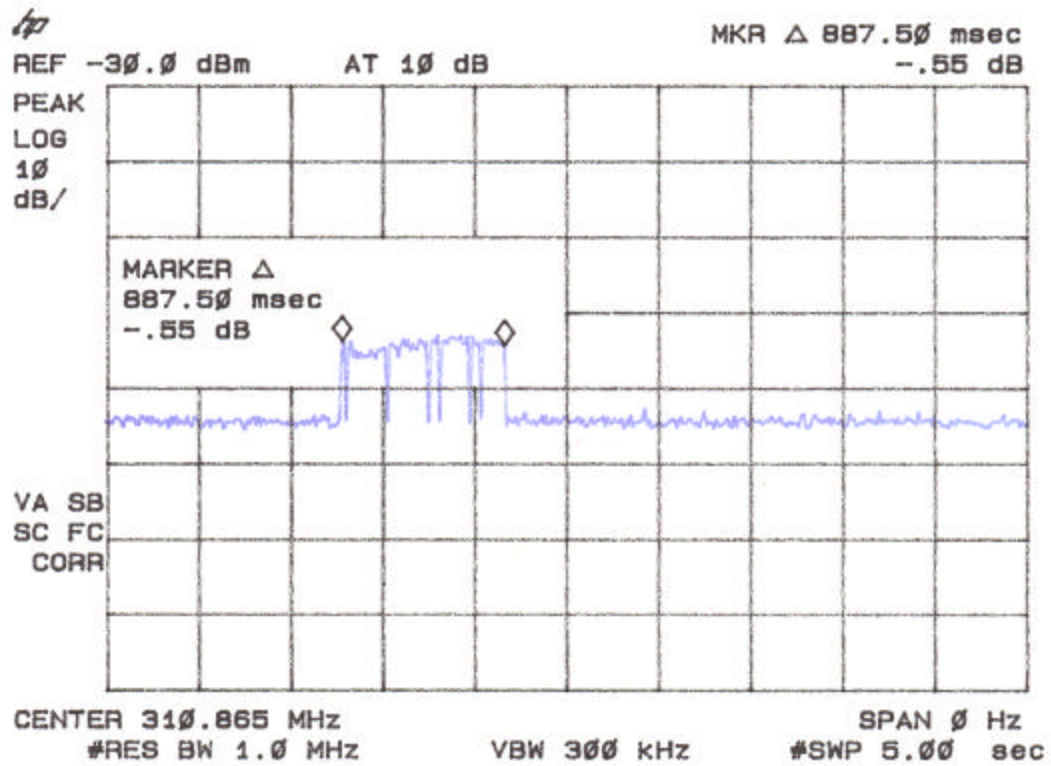
Periodic Operation (47 CFR 15.231(a1))

A transmitter manually activated must automatically deactivate within not more than 5 seconds of being released. The transmitter is a 6 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 16.5 msec as shown in Figure 3.

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FIGURE 3 (a)

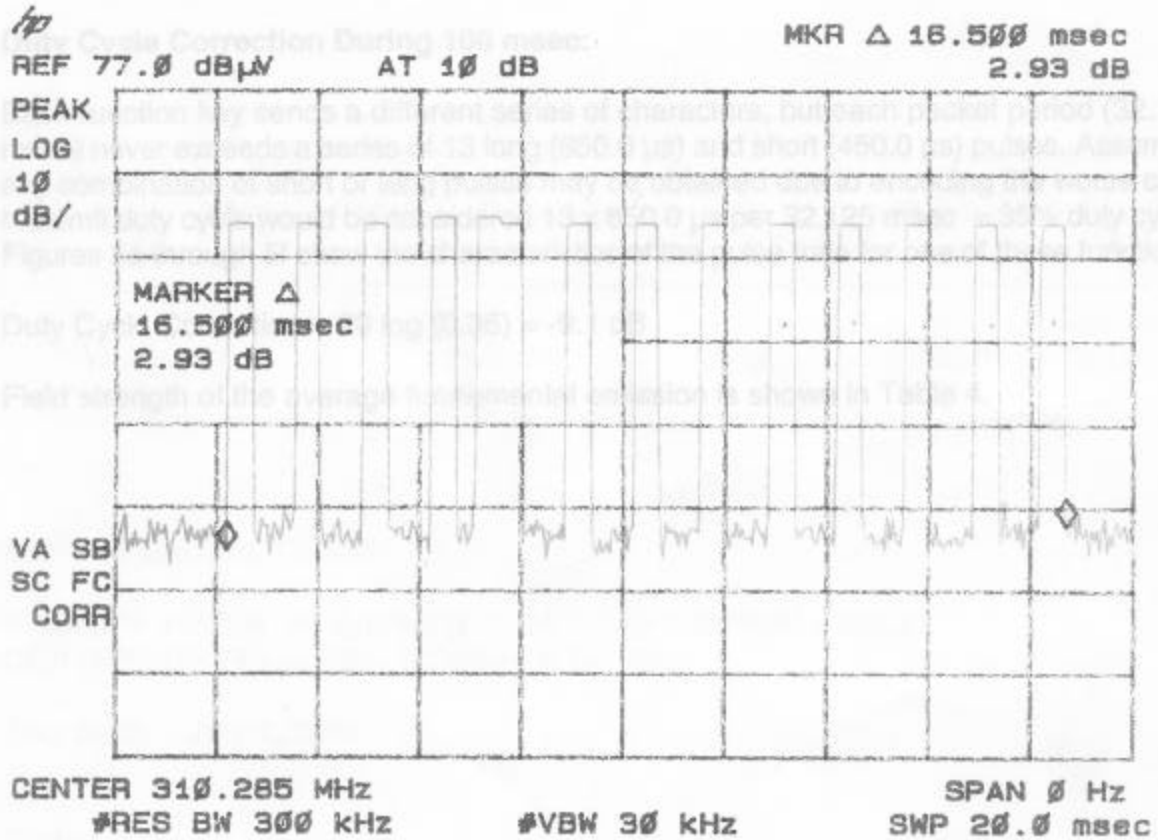
Periodic Operation 15.231(a)(c1)



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FIGURE 3(b)

Measurements were made of the periodic operation of the peak fundamental emission of the peak fundamental emission is shown in Table 3 and Figure 4.



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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.

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

Duty Cycle Correction During 100 msec:

Each function key sends a different series of characters, but each packet period (32.125 msec) never exceeds a series of 13 long (850.0 μ s) and short (450.0 μ 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 $13 \times 850.0 \mu\text{s}$ per 32.125 msec = 35% duty cycle. Figures 5a through 5f show the characteristics of the pulse train for one of these functions.

Duty Cycle Correction = $20 \log (0.35) = -9.1 \text{ dB}$

Duty Cycle Characteristics are shown in Figures 5a, 5b, and 5c.

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TABLE 3

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
310.85	-59.02	19.0	2226.8	58333.3	28.4

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m $\text{Antilog} [(-59.02 + 19.0 + 107)/20] = 2226.8$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: July 2, 2003

Tested by
Signature: 

Name: David Blethen

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TABLE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Average Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
310.85	-68.12	19.0	781.1	5833.3	17.46

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m $\text{Antilog} [(-68.12 + 19.0 + 107)/20] = 781.1$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: July 2, 2003

Tested by

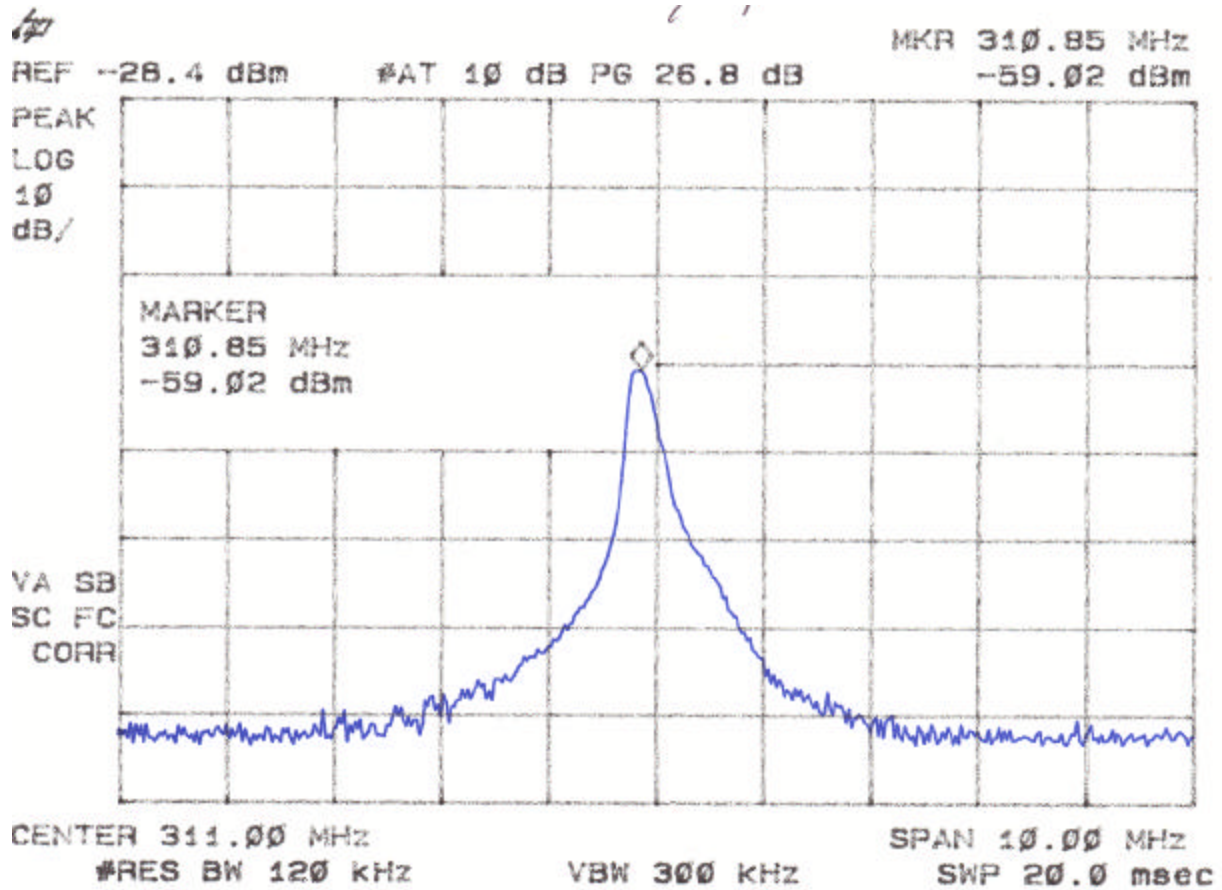
Signature: 

Name: David Blethen

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FIGURE 4

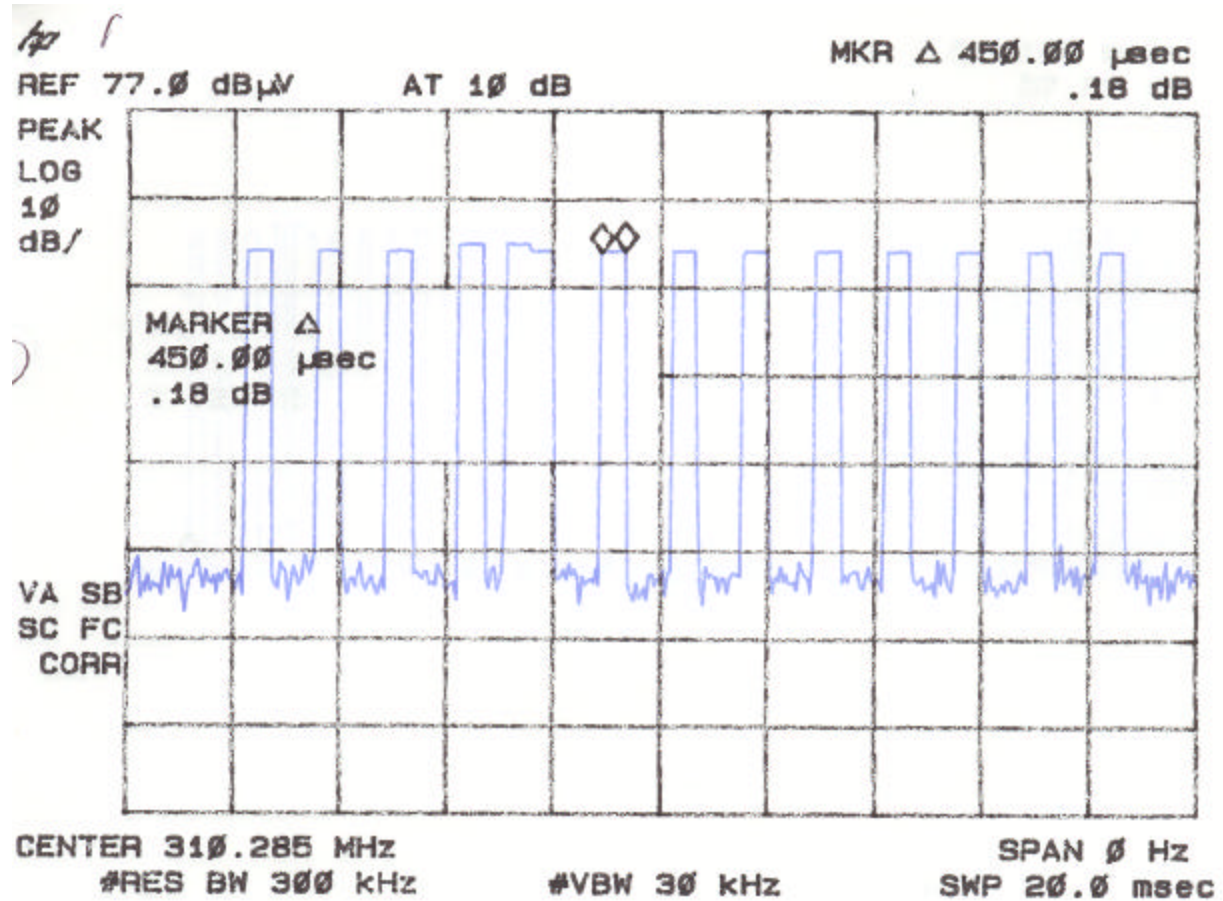
FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)



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FIGURE 5a

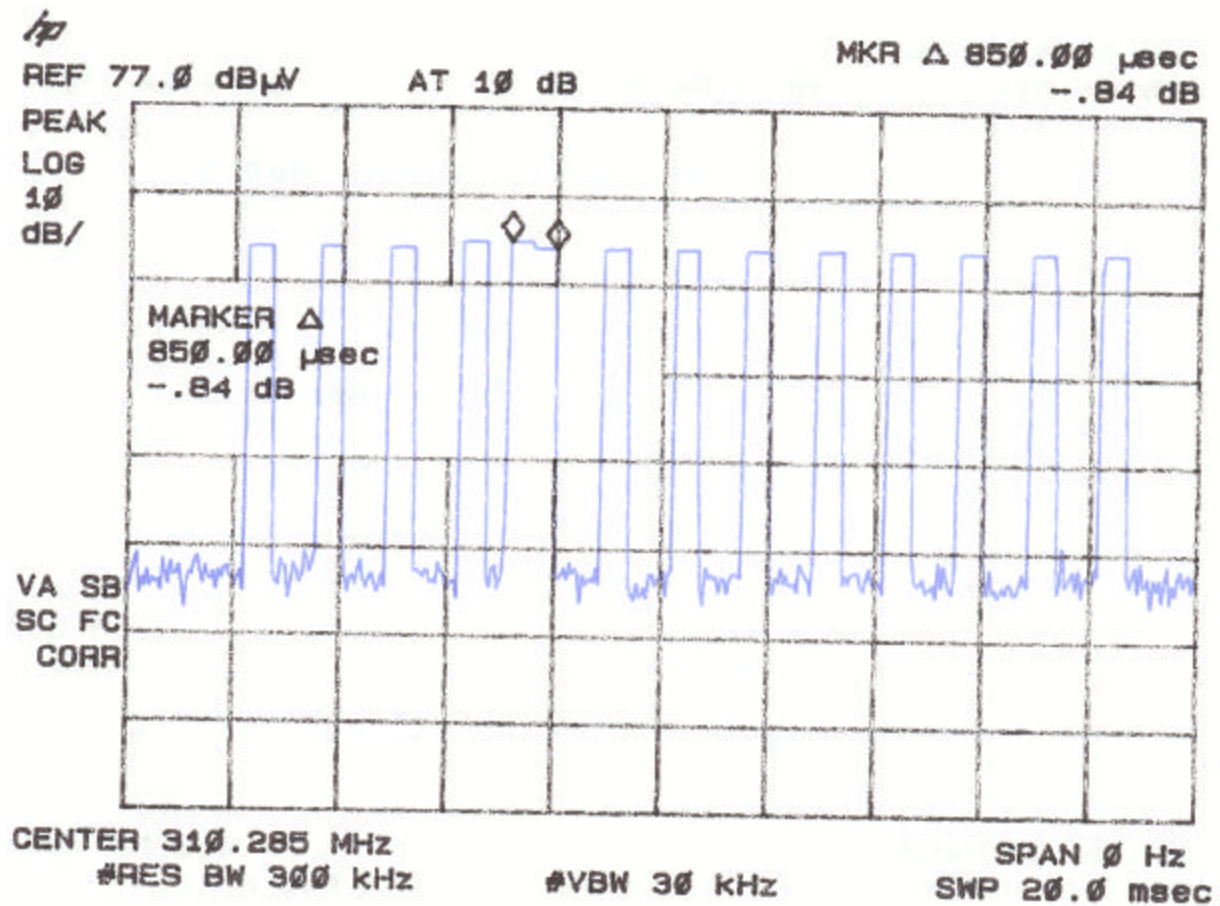
DUTY CYCLE CHARACTERISTICS



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FIGURE 5b

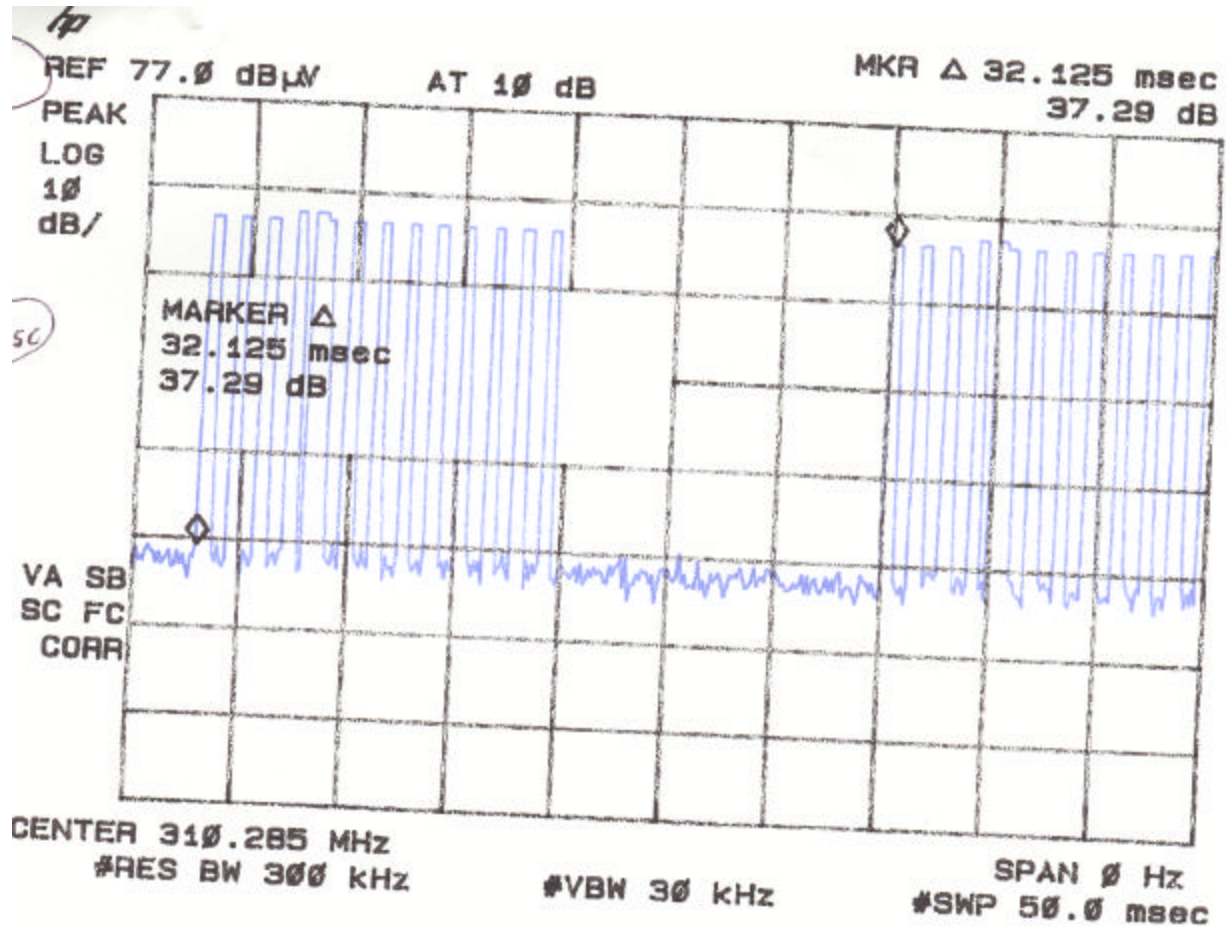
DUTY CYCLE CHARACTERISTICS



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FIGURE 5c

DUTY CYCLE CHARACTERISTICS



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Field Strength Of Spurious Emissions (47 CFR 15.231b)

Measurements were made using a peak detector. Field strength of Spurious Emissions are shown in Tables 5 and Figure 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.

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TABLE 5a

FIELD STRENGTH OF SPURIOUS EMISSIONS

Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
621.73	-74.71	25.9	808.2	5833.3	17.17

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m $\text{Antilog} [(-74.71 + 25.9 + 107)/20] = 808.2$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: July 2, 2003

Tested by

Signature: 

Name: David Blethen

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TABLE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

Average Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
621.73	-83.81	25.9	283.5	583.3	6.27

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m $\text{Antilog} [(-83.81 + 25.9 + 107)/20] = 283.5$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: July 2, 2003

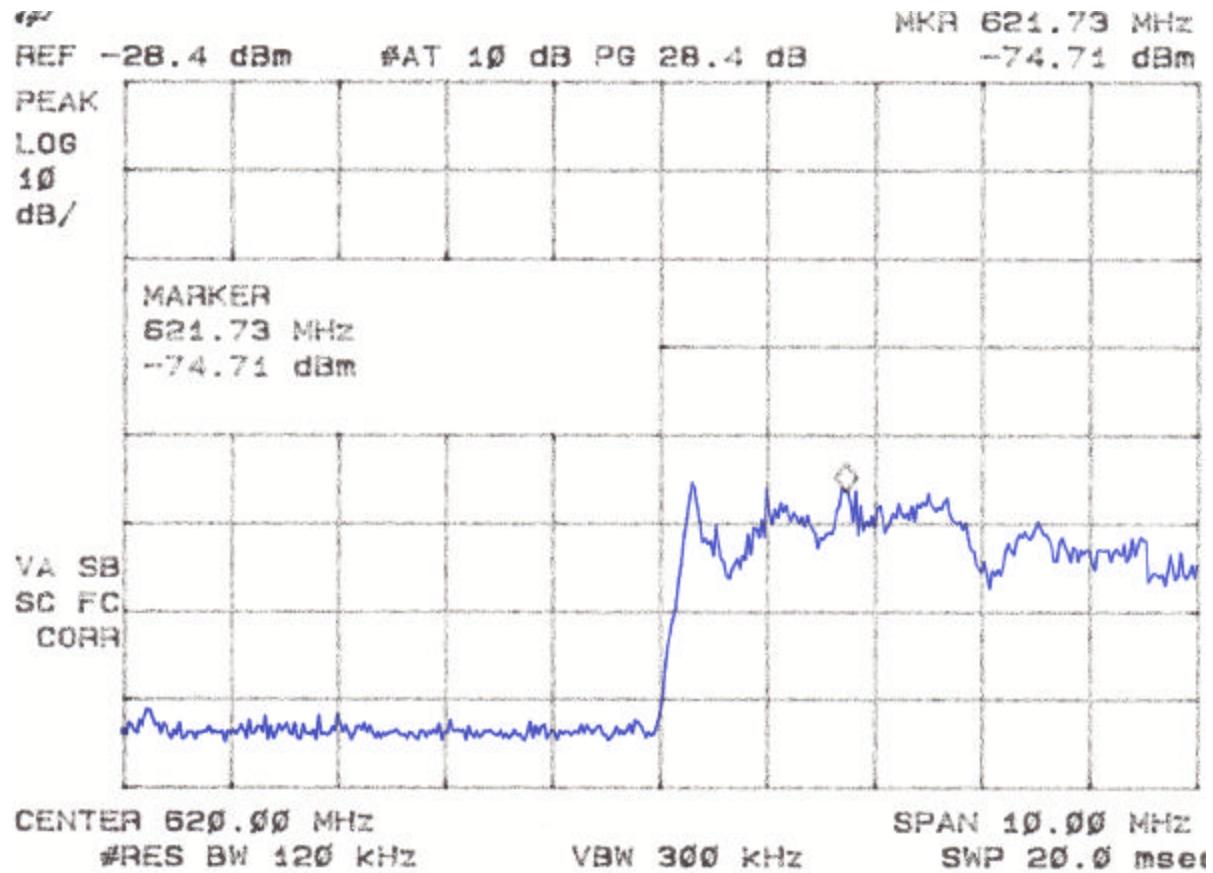
Tested by 
Signature: _____

Name: David Blethen

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FIGURE 6

FIELD STRENGTH OF SPURIOUS EMISSIONS (15.231B)



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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**

FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
310.28	700	776

$$\text{FCC Limit} = (0.25\%) (\text{Center Frequency}) = (0.0025)(30.28) = 776 \text{ kHz}$$

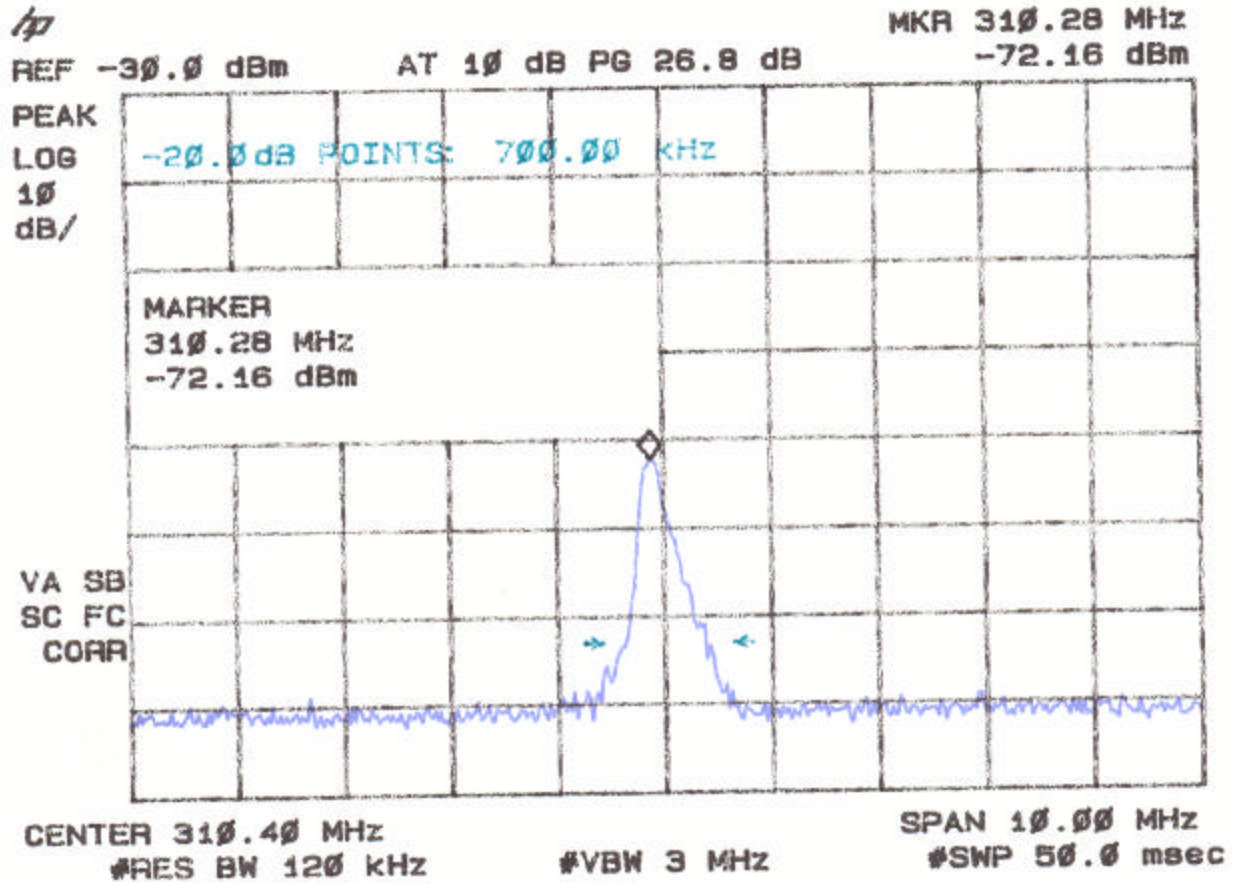
Test Date: July 2, 2003

Tested by 
Signature: _____ Name: David Blethen

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FIGURE 7

20 dB BANDWIDTH OF FUNDAMENTAL EMISSION 15.231(c)



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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.

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TABLE 7
CLASS B
RADIATED EMISSIONS

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				

Test Date:

Tested by
Signature:



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.