
FCC ID: N76CATX001

Prepared for:

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By:

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PTI PROJECT: 99-106

Submitted to:

**Federal Communications Commission
Equipment Authorization Division,
Application Processing Branch**
7435 Oakland Mills Road
Columbia, MD 21048

October 1998

**FCC Type Certification Test Report
of an Intentional Radiator**

**Club-Alert
Golf Club Transmitter
(Transmitter Portion)**

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Certificate of Compliance

Manufacturer: Peggy Berry

Model: Club-Alert Golf Club Transmitter

Serial #: Not Available

FCC ID: N76CATX001

PTI Project: 99-106

Test Dates: August 25 and 26, 1998

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measurement data and this report. I believe them to be true and accurate. The **Club-Alert Transmitter** was tested and found to be in compliance with FCC Part 15 for Intentional Radiators.

Jeffrey A. Lenk
President

1.0 Equipment Under Test (EUT) Description

The **Club-Alert System** is comprised of 5 transmitters and one receiver. Each transmitter is installed into the top of a golf club and the receiver is placed near or attached to the golf bag that normally contains the ‘marked’ clubs. Each club transmitter transmits a unique code at specific intervals. The transmitters and receiver are designed to provide a reliable communication link for a distance of approximately 100 feet. The receiver ‘listens’ for each of the club transmitters and provides a visual and audio alarm if a transmitter code is missing. If the missing clubs are placed back within range of the receiver, the warning will automatically cease.

The **Club-Alert Transmitter** compliant with 47 CFR 15.231 as a periodic transmitter (§15.231 (e)). To minimize the package size, the code generation chip and the RF chip are stacked on top of each other. The identity code of each transmitter module is based on which of the code generation chip outputs is tied to the input of the RF chip. No tuning or alignment of the devices is required. All transmitters and receivers are preset by the manufacturer prior to shipping. Specific test requirements used for Type Certification of the **Club-Alert Transmitter** include the following:

47 CFR 15.231(a) & (e)	Operational Frequency and Use
47 CFR 15.231(e)	Transmission Parametrics
47 CFR 15.231(c)	Occupied Bandwidth
47 CFR 15.231(e)	Peak Output Power
47 CFR 15.231(e)	Out-of-Band Emissions and
& 47 CFR 15.205	Restricted Bands of Operation
47 CFR 15.203	Antenna Requirement

The system tested consisted of the following components:

EUT

<u>Manufacturer & Model</u>	<u>Serial #</u>	<u>FCC ID #</u>	<u>Description</u>
Peggy Berry Club-Alert Transmitter	N/P	N76CATX001	Club-Alert Transmitter

1.1 Equipment Under Test (EUT) Operation

For all tests, the **Club-Alert Transmitter** was constantly transmitting in a typical operating mode. Consultation of the designer indicated that there is no significant difference between emission profiles for this device versus identifier code. The code used for this module represents the maximum pulse train which the unit can be programmed to with respect to the transmission parametric specifications of §15.231(e).

2.0 Operational Frequency Measurement and EUT Use Evaluation

Measurements were made on the **Club-Alert Transmitter** to verify compliance with the operational frequency requirements of § 15.231(a) and (e).

2.1 Test Procedure

Radiated Emissions measurements were made at the Professional Testing "Open Field" Site 3, located in Marble Falls, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

2.2 Test Criteria

Section 15.231(a) states that items subject to application based on this section shall operate within 40.66 to 40.77 MHz and above 70 MHz. Use of the signals transmitted under this part shall be restricted to transmission of short range control signals (garage door openers, alarm systems, etc.). Radio control of toys is not permitted.

Section 15.231(e) further states that devices can be used for other purposes (including those excluded under §15.231(a)) if they meet a revised set of emission limits and meet the duration requirements of §15.231(e).

2.3 Test Results

The **Club-Alert Transmitter** operates at a nominal center frequency of 418 MHz. No other center frequency options are available. The measured center frequency for the sample under test was 418.052 MHz. A plot of the intended transmit signal of the **Club-Alert Transmitter** is included as part of the Occupied Bandwidth data. The intended application for this device is a transmitter for as part of an alarm system for property (golf club) loss. The transmission signal sends an identity code which results in a visual and audible response from the pagers used with the system.

The operational frequency of the **Club-Alert Transmitter** is within the band specified by §15.231. The end use of this device is a controller meeting the restrictions of §15.231(a). In the next few sections of this report, the Club-Alert Transmitter will be shown to meet the emission and Transmission Parametric requirements of §15.231(e). The **Club-Alert Transmitter** meets the requirements of §15.231 regarding operational frequency and application.

3.0 Transmission Parametrics

Measurements were made on the **Club-Alert Transmitter** to verify compliance with the deactivation requirements of § 15.231(e).

3.1 Test Procedure

Radiated Emissions measurements were made at in a controlled laboratory environment at Professional Testing's Round Rock test facility. A passive electric field probe was placed within 0.5 meters of the EUT. The emission from the EUT was measured with a spectrum analyzer tuned to the center frequency of the **Club-Alert Transmitter** and placed in 'zero span' (receiver) mode. The EUT was operated in the normal transmit mode of operation. This involved transmitting a call to a pager programmed into the EUT and measuring the transmission parametrics of the **Club-Alert Transmitter**. The spectrum analyzer was set in single sweep mode with the trigger set to the normal transmit level.

3.2 Test Criteria

Section 15.231(e) states that a periodic transmitter operated under this part shall provide a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

3.3 Test Results

The duration of the burst code and interval between the bursts was measured. Due to the manner in which the EUT is constructed, the code for each transmitter will never change nor will its interval between bursts.

The maximum transmit code duration of the **Club-Alert Transmitter** was 22.92 milliseconds. A sample of the code acquired for the EUT is shown in Appendix A. Based on this measurement, the interval between the pulses shall be at least 10 seconds apart. The burst interval was then measured. The uncorrected reading of this signal was 9.996 seconds. With a correction for a triggering error. The second signal was being triggered on the leading edge of the burst while the first signal was being triggered on the trailing edge of its burst; inadvertently eliminating the length of one period from the total transmission interval. The corrected burst interval was:

$$9.996 \text{ sec} + 0.02292 \text{ sec} = 10.018 \text{ seconds}$$

A plot of the worst case transmission period for the **Club-Alert Transmitter** is also shown in Appendix A. The **Club-Alert Transmitter** meets the requirements of §15.231(e) regarding Transmit Parametrics.

4.0 Occupied Bandwidth Measurements

Measurements were made on the **Club-Alert Transmitter** to verify compliance with the bandwidth requirements of § 15.231(c).

4.1 Test Procedure

Radiated Emissions measurements were made at the Professional Testing "Open Field" Site 3, located in Marble Falls, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

4.2 Test Criteria

Section 15.231(c) states that the bandwidth of emission shall be no greater than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at points 20 dB below the modulation carrier.

Based on an operating frequency of 418 MHz, the maximum permissible bandwidth of the **Club-Alert Transmitter** is:

$$418 \text{ MHz} * 0.0025 = 1.045 \text{ MHz}$$

4.3 Test Results

Test data for occupied bandwidth testing of the **Club-Alert Transmitter** is located in Appendix B. The EUT was tested in the vertical and horizontal modes to determine possible effect on occupied bandwidth. No change versus position was found.

The measured 20 dB bandwidth of the Club-Alert Transmitter was 47.9 kHz, which is significantly below the maximum bandwidth limit. The **Club-Alert Transmitter** meets the occupied bandwidth requirements of Section 15.231(c).

5.0 Peak Output Power

Measurements were made on the **Club-Alert Transmitter** to verify compliance with the peak output power requirements of § 15.231(e).

5.1 Test Procedure

Radiated Emissions measurements were made at the Professional Testing "Open Field" Site 3, located in Marble Falls, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules. Measurement of the fundamental of the Club-Alert Transmitter were made for the EUT in horizontal and vertical positions for both polarizations of the measurement antenna.

5.2 Test Criteria

Section 15.231(e) requires that the fundamental emission levels for items certified under this part meet the following criteria:

<u>Frequency (MHz)</u>	<u>Maximum Fundamental Level (μV/m)</u>
40.66 to 40.70	1,000
70 to 130	500
130 to 174	500 to 1,500 (1)
174 to 260	1,500
260 to 470	1,500 TO 5,000 (1)
Above 470	5,000

(1) Linear interpolations

The tighter level shall apply at the band edges. Levels are referenced to a test distance of 3 meters. In addition to this table, the fundamental emission of the EUT must also meet the requirements of Section 15.205. For this system, the maximum transmit level is interpolated between 260 to 470 to provide the maximum transmit level for the fundamental using the following procedure (extracted from the July 1998 update of 47 CFR Part 15):

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727(F) - 2454.545$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667(F) - 2833.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

For a signal at 418 MHz, the maximum level of the fundamental is calculated below:

$$\text{Limit } (\mu\text{V/m}) = 16.6667(418) - 2833.3333 = 9,800 \mu\text{V/m} = 79.82 \text{ dB}\mu\text{V/m}$$

5.3 Test Results

The **Club-Alert Transmitter** has a maximum fundamental emission of 79.8 dB $\mu\text{V/m}$. This was measured with the EUT in the horizontal polarization and the measurement antenna in the horizontal polarization. This signal level is below the limit derived in the preceeding paragraph.

Data for this test is contained in Appendix C. The **Club-Alert Transmitter** met the §15.231(b) maximum fundamental signal strength requirement.

6.0 Out-of-Band and Restricted Band Emissions Measurements

Measurements were made on the **Club-Alert Transmitter** to verify compliance with the out-of-band emission requirements of §15.231(e). Measurements were performed for the radiated out-of-band emissions.

6.1 Test Procedure

Radiated Emissions measurements were made at the Professional Testing "Open Field" Site 3, located in Marble Falls, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

6.2 Test Criteria

Section 15.231(e) requires that the spurious emission levels for items certified under this part meet the following criteria:

<u>Frequency (MHz)</u>	<u>Maximum Spurious Emission Level ($\mu\text{V/m}$)</u>
40.66 to 40.70	100
70 to 130	50
130 to 174	50 to 150 (1)
174 to 260	150
260 to 470	150 to 500 (1)
Above 470	500

(1) Linear interpolations

The tighter level shall apply at the band edges. Levels are referenced to a test distance of 3 meters. In addition to this table, spurious emissions of the EUT must also meet the requirements of Section 15.205. For this system, the maximum spurious emission level is 20 dB below the maximum allowed fundamental signal level. Based on the level calculated in Section 5.2, the maximum spurious emission level is:

$$\text{Maximum Spur Level} = 79.82 \text{ dB}\mu\text{V/m} - 20 \text{ dB} = 59.82 \text{ dB}\mu\text{V/m}$$

For tests made at a distance of 1 meter ($> 1 \text{ GHz}$), the maximum emission level is calculated as:

$$500 \mu\text{V/m} * 3 = 1,500 \mu\text{V/m} = 63.5 \text{ dB}\mu\text{V/m}$$

6.3 Test Results

A Hewlett Packard 8566B Spectrum Analyzer utilizing an IF/video bandwidth of 100 kHz/300 kHz was used to record the output signals. Testing was performed over the frequency range 30 MHz to 4.48 GHz. Quasi-peak detection was used for most of the testing below 1 GHz with peak detection used above 1 GHz. Average detection was used for all measurements involving compliance with §15.205.

The data sheets for out-of-band emissions is contained in Appendix D of this report. All measured spurious emissions were less than 61.27 dB μ V/m; therefore, the **Club-Alert Transmitter** met the §15.231(b) radiated emission requirements. In addition, in the restricted bands defined by §15.205, the emissions detected during this test were also below this limit.

7.0 Antenna Requirement

An analysis of the **Club-Alert Transmitter** was performed to determine compliance with Section 15.203 of the Rules. This section requires specific handling and control of antennas used for devices subject to regulation under the Intentional Radiator portions of Part 15.

7.1 Evaluation Procedure

The structure and application of the **Club-Alert Transmitter** were analyzed with respect to the rules. The antenna for this unit is a three inch monopole on top of the unit. The antenna is soldered onto the main board inside the EUT housing, is not accessible by the user and an auxiliary antenna port is not present.

7.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

- (a) Antenna be permanently attached to the unit.
- (b) Antenna must use a unique type of connector to attach to the EUT.

- (c) Unit must be professional installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

7.3 Evaluation Results

The **Club-Alert Transmitter** meets the criteria of this rule by virtue of having an antenna permanently attached to the unit. The EUT is therefore compliant with §15.203.

9.0 Form 731 Information

The following information is provided for inclusion in the FCC Form 731 for the **Club-Alert Transmitter**.

9.1 Emission Designator

This portion of the report details the derivation of the emission designator for this product based on §2.201 of the Rules

Bandwidth:

The **Club-Alert Transmitter** has a measured occupied bandwidth of 47.9 kHz. This measurement is described in Section 4.0 of this report.

Emission Designator::

The RF output signals of the **Club-Alert Transmitter** are dual sideband AM modulation of the 418 MHz RF carrier signal. Based on this information, the emission designator for this product is:

Symbol Position	Parameter	Description	Resulting Symbol
1	Type of Modulation	Amplitude	A
2	Nature of Symbol(s) Modulating the Carrier	Digital Data only, no submodulation	1
3	Type of Information Being Transmitted	Data transmission, telemetry, or telecommand	D

This analysis results in an overall emission designator of A1D47k9.

9.2 Output Power

The rated output power of the **Club-Alert Transmitter** is calculated based on the following formula found in Industry Canada NIR-E document:

$$\text{Power (ERP)} = (E * r)^2 / (30)$$

Where:

E = radiated electric field level in V/m

r = distance from the EUT to the measurement antenna

The method used in this application to calculate ERP goes through the following steps:

- (a) Determine the peak level in dB μ V/m
- (b) Translate this level to μ V/m using the following formula

$$\mu\text{V/m} = 10^{((\text{dB}\mu\text{V/m})/20)}$$

- (c) Translate this level to V/m by dividing by 1×10^6
- (d) Calculate ERP based on the formula at the beginning of this section for a test distance of X meters.

For the **Club Alert Transmitter**, the rated output power in watts is calculated as follows:

Maximum Radiated Fundamental Level = 53.1 dB μ V/m = 0.451 mV/m

Test Distance = 3 meters

$$\text{ERP} = (0.451 \times 10^{-3} \times 3)^2 / (30) = 6.1 \times 10^{-8} \text{ watts}$$

9.3 Main Processor Chip

The processor chip of the **Club-Alert Transmitter** is a Microchip Technology 12C508-04I/SM.

10.0 List of Test Equipment

A list of the test equipment utilized to perform the conducted and radiated emission measurements is given below. The date of calibration is given for each.

<u>Device</u>	<u>Description</u>	<u>Date Last Calibrated</u>	<u>Calibration Due</u>
HP 8566B	Spectrum Analyzer	09/22/97	09/22/98
HP 85650A	Quasi Peak Adapter	09/22/97	09/22/98
MITEQ AFS4-00101800-40-10P-N	Broadband Pre-Amp	05/22/98	05/22/99
Schwarzbeck 8127	LISN	03/05/98	03/05/99
HP 8591E	Spectrum Analyzer	04/29/98	04/29/99
EMCO 3115	Double Ridged Horn Antenna	05/22/98	05/22/99
EMCO 3108	Biconical Antenna	07/22/98	07/22/99
EMCO 3146	Log Periodic Antenna	07/22/98	07/22/99
HP 8447	Broadband Pre-Amp	06/10/98	06/10/99

Appendix A

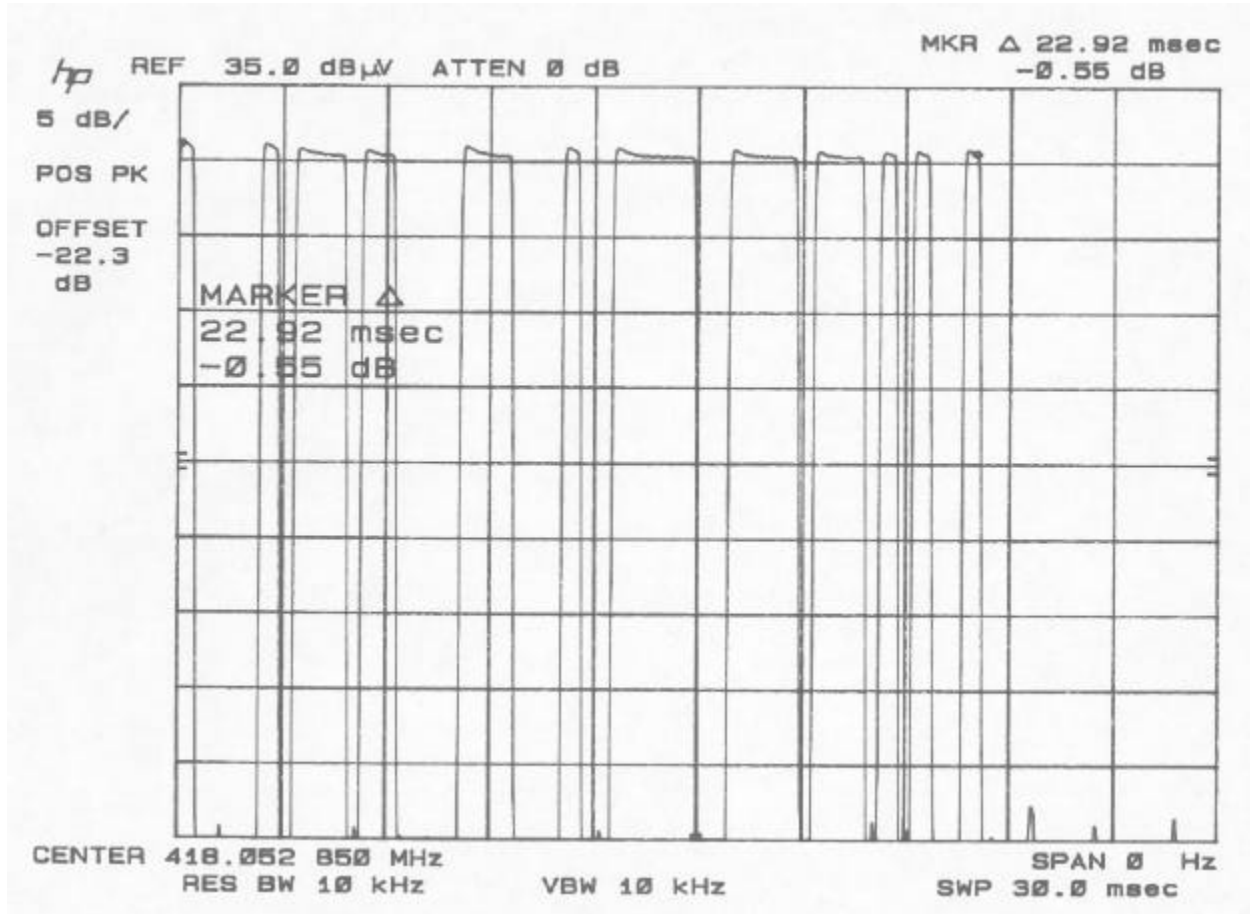
Transmitter Parametrics Test Data

Transmitter Parametrics Data Sheet

Peggy Berry/FLD Systems Club-Alert Transmitter

SERIAL #: Not Available
DATE: August 26, 1998

PROJECT #: 99-106



COMMENT #1: EUT In normal operation

COMMENT #2: Code Duration = 22.92 milliseconds

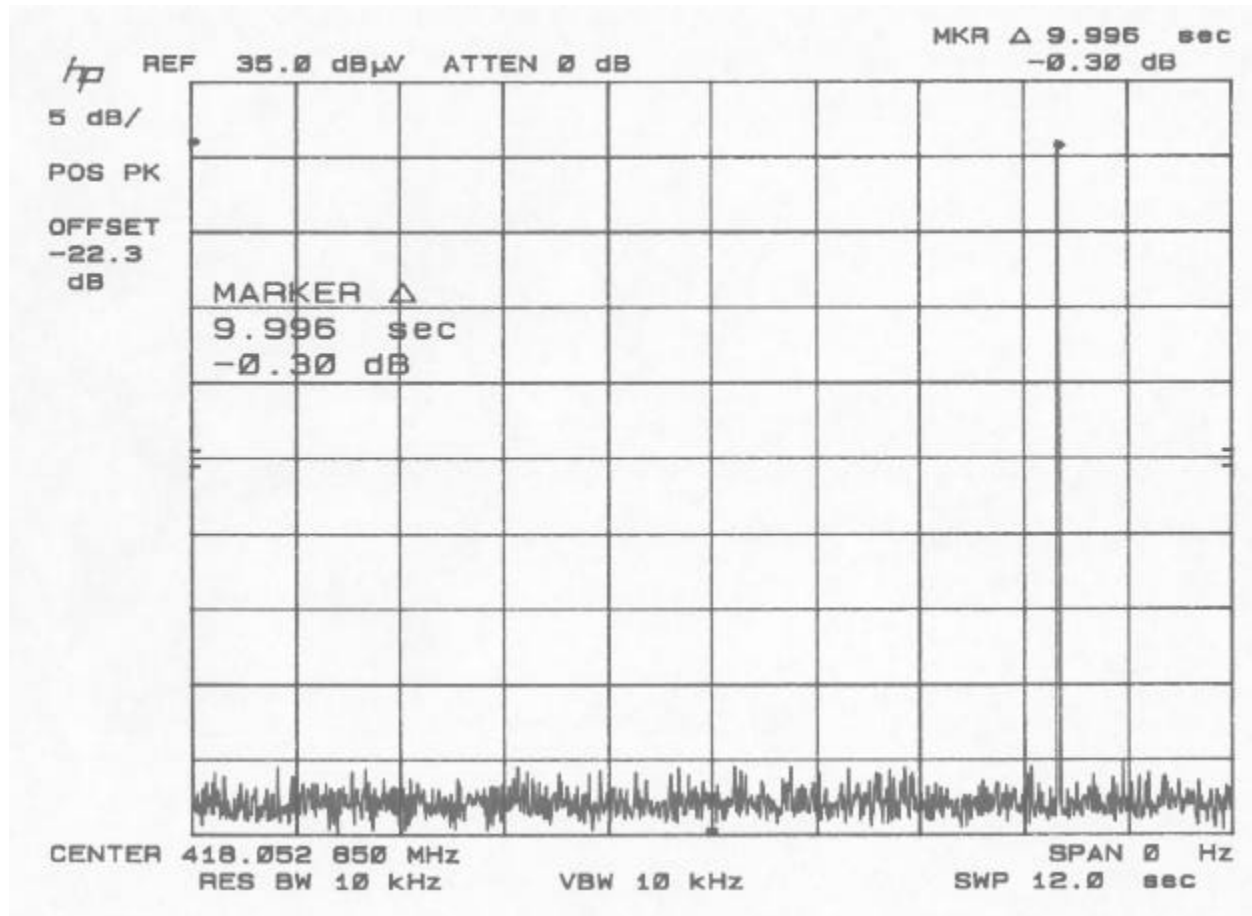
TEST ENGINEER: _____ APPROVED BY: _____
John O'Brien Jeffery Lenk

Transmitter Parametrics Data Sheet

Peggy Berry/FLD Systems Club-Alert Transmitter

SERIAL #: Not Available
DATE: August 26, 1998

PROJECT #: 99-106



COMMENT #1: EUT In normal operation

COMMENT #2: Burst Interval = $9.992 + 0.02292$ seconds = 10.014 seconds
(Includes correction for triggering difference between starting and stopping code bursts).

TEST ENGINEER: _____ APPROVED BY: _____
John O'Brien Jeffery Lenk

Appendix B

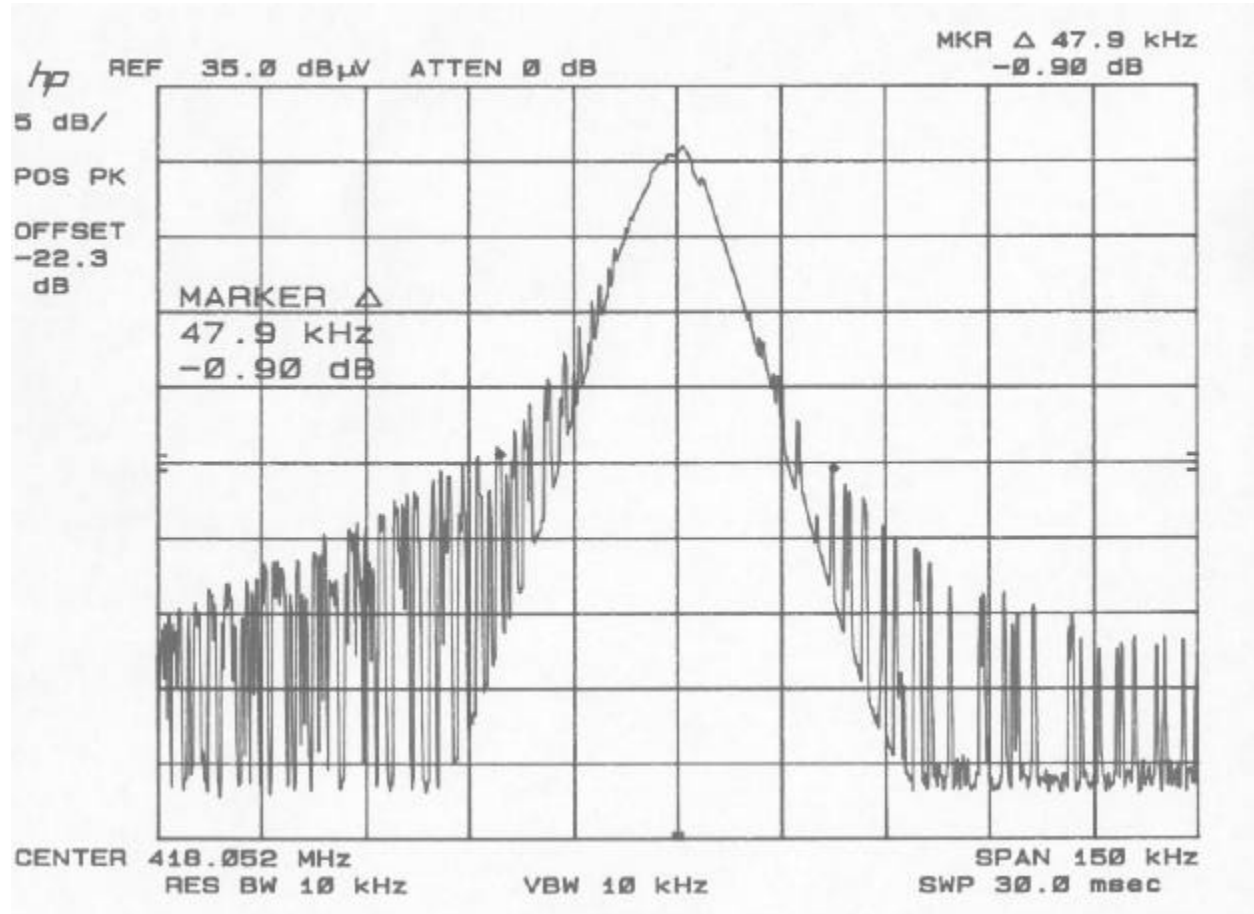
Occupied Bandwidth Test Data

Occupied Bandwidth Data Sheet

Peggy Berry/FLD Systems Club-Alert Transmitter

SERIAL #: Not Available
DATE: August 26, 1998

PROJECT #: 99-106



COMMENT #1: 20dB Bandwidth = 49.7 kHz

COMMENT #2:

TEST ENGINEER: _____ APPROVED BY: _____
John O'Brien Jeffery Lenk

Appendix C

Peak Output Power Test Data

Radiated Emissions Data Sheet**Peggy Berry/FLD Systems
Club-Alert Transmitter**

SERIAL #: Not Available
 DATE: August 25, 1998
 PROJECT #: 99-106

MEASUREMENT DISTANCE (m): 3
 ANTENNA POLARIZATION: See Text
 DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Orient. (V/H)	Antenna Orient. (V/H)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
418.0	V	V	29.9	16.2	1.9	48.0	79.8	-31.8
418.0	V	H	35.0	16.2	1.9	53.1	79.8	-26.7
418.0	H	V	33.7	16.2	1.9	51.8	79.8	-28.0
418.0	H	H	32.4	16.2	1.9	50.5	79.8	-29.3

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1:. Orientation 270 degrees worst case for all configurations

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffery Lenk

Appendix D

Out-of-Band and Restricted Band Radiated Emission Test Data

Radiated Out-of-Band Emissions Data Sheet**Peggy Berry/FLD Systems
Club-Alert Transmitter**

SERIAL #: Not Available
 DATE: August 25, 1998
 PROJECT #: 99-106

MEASUREMENT DISTANCE (m): 3 (1)
 ANTENNA POLARIZATION: Vertical
 DETECTOR FUNCTION: See Text

Freq. (MHz)	EUT Dir. (Deg.)	Antenna Elevation Meters	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
836.0	270.0	1.0	9.3	16.2	1.9	27.4	59.8	-32.4
1254.0	270.0	1.0	12.7	22.2	2.7	37.6	63.5	-25.9
1672.0	270.0	1.0	-1.6	23.5	1.2	23.1	63.5	-40.4
2090.0	270.0	1.0	4.3	24.4	1.2	29.9	63.5	-33.6
2508.0	270.0	1.0	0.9	25.9	1.5	28.3	63.5	-35.2
2926.0	270.0	1.0	9.7	26.8	1.7	38.2	63.5	-25.3
3344.0	270.0	1.0	-3.5	31.3	1.8	29.6	63.5	-33.9
3762.0	270.0	1.0	6.8	31.5	1.8	40.1	63.5	-23.4
4180.0	270.0	1.0	-4.0	31.7	2.2	29.9	63.5	-33.6

$$\text{Corrected Level} = \text{Recorded Level} + \text{Antenna Factor} + \text{Cable Loss}$$

COMMENT #1: 1 meter for measurements above 1 GHz

COMMENT #2: EUT in Vertical polarization

COMMENT #3: All measurements Peak unless otherwise noted

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffery Lenk

Radiated Out-of-Band Emissions Data Sheet**Peggy Berry/FLD Systems
Club-Alert Transmitter**

SERIAL #: Not Available
 DATE: August 25, 1998
 PROJECT #: 99-106

MEASUREMENT DISTANCE (m): 3 (1)
 ANTENNA POLARIZATION: Horizontal
 DETECTOR FUNCTION: See Text

Freq. (MHz)	EUT Dir. (Deg.)	Antenna Elevation Meters	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
836.0	270.0	1.0	9.7	16.2	1.9	27.8	59.8	-32.0
1254.0	270.0	1.0	3.9	22.2	2.7	28.8	63.5	-34.7
1672.0	270.0	1.0	2.8	23.5	1.2	27.5	63.5	-36.0
2090.0	270.0	1.0	0.5	24.4	1.2	26.1	63.5	-37.4
2508.0	270.0	1.0	-2.6	25.9	1.5	24.8	63.5	-38.7
2926.0	270.0	1.0	-3.0	26.8	1.7	25.5	63.5	-38.0
3344.0	270.0	1.0	-4.8	31.3	1.8	28.3	63.5	-35.2
3762.0	270.0	1.0	6.9	31.5	1.8	40.2	63.5	-23.3
4180.0	270.0	1.0	-4.0	31.7	2.2	29.9	63.5	-33.6

$$\text{Corrected Level} = \text{Recorded Level} + \text{Antenna Factor} + \text{Cable Loss}$$

COMMENT #1: 1 meter for measurements above 1 GHz

COMMENT #2: EUT in Vertical polarization

COMMENT #3: All measurements Peak unless otherwise noted

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffery Lenk