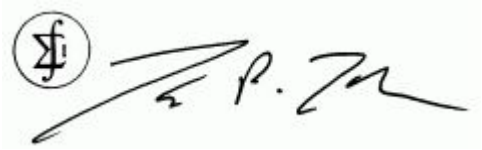
Smith Electronics, Inc.
Electromagnetic Compatibility Laboratories

Radio Frequency Measurement Report
FCC Certification for Intentional Radiator
on the
FieldPro
418 MHz Handheld Transmitter
Model: ProTX-1
FCC ID: O2CPROTX-1

May 31, 2000



Prepared by: Kenneth P. Klann
NARTE Cert. EMC-001505-NE

Prepared for: FieldPro, LLC.
14120 Galehouse Road
Doylestown, OH 44230

Smith Electronics, Inc.
8200 Snowville Rd.
Brecksville, Ohio 44141
Phone: (440) 526-4386
Fax: (440) 526-9205

1.0 Objective:

To perform radiated field intensity measurements to certify that the FieldPro model ProTX-1 418 MHz handheld transmitter meets FCC intentional radiator requirements per CFR 47 1999, Part 15, Subpart C:

- FCC Part 15.203, Antenna Requirement
- FCC Part 15.231(a), Periodic Operation
- FCC Part 15.231(b), Field Strength of Emissions
- FCC Part 15.205(a)(b) & Part 15.209(a)-(e) Restricted Bands of Operation
- FCC Part 15.231(c), Occupied Bandwidth

1.1 Summary:

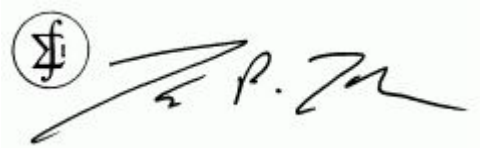
The FieldPro model ProTX-1 (FCC ID: O2CPROTX-1) handheld transmitter has been examined and tested in accordance with FCC Part 15.31, 15.33, & 15.35, and ANSI C63.4-1992, and found compliant with FCC Parts 15.203, 15.231, and 15.205/15.209.

The transmitter's fundamental frequency (418 MHz) meets FCC Part 15.231(b) requirements limiting field strength by 0.56 dB. The worst case measurable harmonic frequency (2090 MHz) meet Part 15.231 by 30.41 dB. The most significant measured emission found in the Part 15.205/209 Restricted Bands was at 1672 MHz and remained 34.28 dB below the limit. Occupied Bandwidth per Part 15.231(c) was 62.0 KHz well within the prescribed limit of 1.045 MHz.

Physical examination of the FieldPro ProTX-1 transmitter determined that the detachable antenna fitted with a reverse SMA connector met FCC Part 15.203 antenna connector requirements. Additionally, transmitter operation was manually actuated by depressing one of the push buttons and that the emissions ceased upon its release, thereby meeting FCC Part 15.231(a) requirements on Periodic Operation.

Therefore, the FieldPro ProTX-1 (FCC ID: O2CPROTX-1) meets all requirements to be certified per requirements of FCC Part 15.201(b).

I, Kenneth P Klann, an engineer at Smith Electronics, Inc., undertook the preparation of this report, performed all measurements contained herein, and attest to their accuracy.



Kenneth P. Klann

The results contained in this report describe the performance of the particular device tested and do not represent endorsement by any government agency. All intentional radiators must be certified by the FCC pursuant to the procedures in Part 2, Subpart J of CFR 47 1999 prior to marketing this device. This report must be reproduced in full. It can only be reproduced in part after obtaining written permission from Smith Electronics, Inc.

2.0 Administrative Information:

Manufacturer:	FieldPro, LLC. 14120 Galehouse Road Doylestown, Ohio 44230
Test Facility:	Smith Electronics, Inc. 8200 Snowville Road Brecksville, Ohio 44141
Contacts:	Jay Howard, President FieldPro, LLC. Phone: (330) 685-7705 (330) 262-1984 E276 Kenneth P. Klann, Test Engineer Smith Electronics, Inc. Phone: (440) 526-4386 Fax: (440) 526-9205
Test Dates:	22 & 31 May 2000

2.1 Equipment Under Test:

FieldPro handheld transmitter
Model: ProTX-1
FCC ID: O2CPROTX-1
SN: Sample #1
Operating Frequency: 418 MHz, based on Linx TXM-418-LC transmitter module.
Antenna: Linx reduced height ¼ wave rubberized, with reverse SMA termination.
Linx PN: ANT-418-CW-HD
Battery: 9 V rectangular

2.2 Modifications to EUT:

None

2.3 Measurement Equipment:

Hewlett Packard spectrum analyzer	Type 8568B with 85680A RF section SN: 2216A02120 85662A display section SN: 2152A03686 85680A quasi-peak adapter SN: 2043A00350 Calibrated: 5/99 Used between: 30-1000 MHz
Hewlett Packard spectrum analyzer	Type 8593EM SN: 3536A00147 Calibrated: 6/99 Used between: 1-4.2 GHz
Singer Instrumentation interference receiver	Model: NM-37/57 SN: 0366-06168 Calibrated: 4/99 Used between: 30-1000 MHz
Hewlett Packard preamplifier	Type 8447D SN: 1726A01282 Gain: 26 dB Frequency range: .075-1700 MHz
Hewlett Packard vector plotter	Type 7407A SN: 2308A39494
Biconical antenna	EMCO model: 3104 Frequency range: 30-200 MHz (Shielded room)
Log periodic antenna	EMCO model: 3146 Frequency range: 200-1000 MHz (Shielded room)
Tuned dipole antenna	Stoddart model: 91598-2 Frequency range: 350-1000 MHz (Open field site)
Horn Antenna	EMCO Model: 3115 Frequency range: 1-18 GHz (Shielded room/open field site)
Coaxial cable type RG-214/U	8 meter length (shielded room <1GHz) 13 meter length (open field <1GHz) 1 meter length (shielded room/open field >1GHz)

3.1 Description:

The FieldPro ProTX-1 transmitter is a low power communications device used to remotely control a game bird ejection device. The bird ejection device incorporates a receiver (FCC ID: O2CPRORX1) that is also subject to FCC Certification, which is discussed under a separate application. The FieldPro system is designed to aid in training of hunting dogs. The major objective of the FieldPro system is to train the dog to point at hidden game birds obscured in brush without disturbing the bird. The bird can be remotely released with this system if the dog approaches too quickly or closely, thus providing correct training reinforcement for the dog.

The FieldPro ProTX-1 transmitter operates at 418 MHz and is designed around a Linx TXM-418-LC transmitter module. The transmitter is pulse modulated. The transmitter is equipped with four momentary contact push buttons to operate the transmitter. Each push button changes the pulse coding; thereby, the transmitter is capable of controlling four separate receivers. The transmitter operates only when a push button is depressed and ceases operation after the button is released. This characteristic allows the transmitter to meet FCC requirements of Part 15.231(a) regarding periodic operation.

The transmitter is equipped with a rubberized (flexible) antenna. The antenna is detachable and replaceable by the end user. The antenna connector is a nonstandard so that a replacement must be ordered from FieldPro. The antenna connector is a reverse polarity SMA designed to meet FCC Part 15.203 antenna requirements.

3.2 Field Strength of Emissions:

Initial measurements of radiated emissions form the 418 MHz transmitter was performed in a shielded room using a spectrum analyzer (HP 8566B & 8593EM) over a frequency range of 0.03-4.18 GHz to characterize the emissions. The test setup is recorded in Pictorial-1. These measurements were performed with broadband antennas at a 1-meter distance using a peak detector. The frequencies of the generated emissions were recorded so they could be reexamined later, on the open field site. The transmitter was well behaved and produced no spurious signals other than harmonics of the fundamental. Emissions were detectable to the fifth harmonic (2.09 GHz). There were no detectable emissions from the digital device that controls the functions of the transmitter.

3.2.1 Duty Cycle:

Since the transmitter is pulse modulated, and the FCC limits of Part 15.231 are predicated upon linear average detector function, the average level of the measured emissions can be found by measuring the peak values and correcting them for duty cycle. The procedures for determining the duty cycle are as follows:

1. The transmitter was operated continuously, by depressing and holding one of the four push buttons, to generate a pulse packet train. The test setup is recorded in Pictorial-2.

2. The spectrum analyzer (HP 8568B) center frequency was set to 418 MHz with the resolution bandwidth set to 1 MHz (1.4 MHz impulse) and frequency span set to 0 Hz, thereby placing the analyzer into time domain mode.
3. The analyzer's sweep time and triggering was adjusted to display the pulse packet. The pulse packet train was recorded (plotted) for this report.
4. The analyzer's marker (in time domain mode) was used to measure the width (at -6 dB points) of the various pulses within a pulse packet, the length of the pulse packet, and the blanking interval between adjacent packets. Each of one of the four push buttons on the transmitter was examined to determine which maximized the duty cycle.
5. The duty cycle factor is the sum of the pulse widths over 100 mS period (that yield the maximum on time) divided by 100 mS. The duty cycle factor is multiplied by the measured peak value in uV/m (using the peak detector function) to find equivalent linear average level (in uV/m) as expressed in the FCC limit. Similarly, the duty cycle factor can be expressed in dB by taking 20 Log (duty cycle factor). Hence, a measured peak value in dBuV/m (using the peak detector function) is added to the duty cycle factor (dB) to yield the equivalent linear average level (in dBuV/m).

The pulse packet train characteristics for the transmitter examined here is shown in Figures 1-6. Pressing one of the four different buttons on the transmitter changes the relative position of two long pulses located near one end of the pulse packet. These long pulses are labeled as "L" in Figures 1-4. Note that the pulse packet length is 30.25 mS (Figure 4), the blanking interval between packets is 62.75 mS (Figure 5), the short and long pulse widths within a packet are 300 and 600 uS, respectively (Figure 6). This yields a pulse packet period is 93 mS (sum of the packet length and blanking interval). Each packet contains 23 short pulses @ 300 uS and 2 long pulses @ 600 uS giving a total on time of 8.1 mS. Since each packet period is 93 mS and we desire to average over a 100 mS period, an additional 7 mS segment is required from a second packet. To maximize the duty cycle, the additional 7 mS can be obtained from either of the pulse packets in Figures 3 & 4. The additional on time gained from the 7 mS segment consists of 4 short pulses @ 300 uS and 2 long pulses @ 600 uS for an on time of 2.4 mS. The sum of the pulse widths over the 100 mS period is 10.5 mS yielding a duty factor of 0.105 or –19.58 dB.

3.2.2 Radiated Emissions, Open Field Site:

Having identified the signals of interest in the shielded room, and determined the duty cycle correction for the transmitter, transmitter certification measurements were performed on the open field site. The open field measurements will determine compliance with FCC Parts 15.231(b) and 15.205(a)(b)/15.209(a)-(e) regarding field strength of emissions. The open field site located at the Smith Electronics 8200 Snowville Road facility (FCC Registration Number: 90938) was used for all tests. The test setup is recorded in Pictorials 3 & 4.

Prior to commencing open field measurements the transmitter was fitted with a new battery and the antenna supplied by the manufacturer. The transmitter was placed on a 1-meter high wooden test stand capable of being rotated 360 degrees. The handheld transmitter was examined in three orthogonal axes. The transmitter was rotated on the test stand in each of the orthogonal

positions, while the height of the measuring antenna was varied, to peak the level of the emissions. This process was repeated for both horizontal and vertical antenna polarizations. The open field test was performed at a measurement distance of 3 meters for the fundamental (418 MHz) and second harmonic using a tuned dipole antenna. A 1-meter measurement distance was employed for the upper harmonics using a horn antenna. The upper harmonic signals were of insufficient strength to be measured at a 3-meter distance. All measurements were made with the detector function set to peak mode. Measurements made at 1 GHz and below used a Singer NM-37/57 receiver employing a 100 KHz resolution bandwidth (140 KHz impulse). Above 1 GHz, a HP 8593EM spectrum analyzer was used with a 1.0 MHz 6-dB resolution bandwidth (1 MHz impulse). The maximum detected level for each frequency is recorded in the table below.

Table 1: FieldPro ProTX-1 Transmitter Sample #1, Open Field Test Results

Frequency MHz	Measurement Distance meters	Measured Level dBuV	(+) Antenna Factor dB	(+) Coax Factor dB	(+) Duty Cycle Factor dB	(-) Preamp Gain dB	Actual Level dBuV/m	(-) FCC Limit dBuV/m	dB vs. FCC Limit
418.03	3.00	75.50	21.60	2.20	-19.58	0.00	79.72	80.28	-0.56
836.06	3.00	17.00	28.30	3.50	-19.58	0.00	29.22	60.28	-31.06
1254.09	1.00	49.50	24.80	0.40	-19.58	26.00	29.12	69.83	-40.71
1672.13*	1.00	47.90	26.50	0.40	-19.58	26.00	29.22	63.50	-34.28
2090.17	1.00	29.90	28.60	0.50	-19.58	0.00	39.42	69.83	-30.41
2508.20	1.00	26.20	29.30	0.50	-19.58	0.00	36.42	69.83	-33.41
2926.23	1.00	27.40	30.70	0.60	-19.58	0.00	39.12	69.83	-30.71
3344.26	1.00	27.50	31.70	0.70	-19.58	0.00	40.32	69.83	-29.51
3762.30*	1.00	27.10	32.70	0.70	-19.58	0.00	40.92	63.50	-22.58
4180.33	1.00	27.10	33.00	0.70	-19.58	0.00	41.22	69.83	-28.61

*Restricted Band

Measurements at and above 2508 MHz represent the noise floor of measurement system.

FCC limit at 418 MHz is 10,333 uV/m (80.28 dBuV/m) @ 3 m.

FCC limit of harmonic emissions is 1033.3 uV/m (60.28 dBuV/m) @ 3 m or 3100 uV/m (69.83 dBuV/m) @ 1 m.

FCC limit in restricted bands is 500 uV/m (54.0 dBuV/m) @ 3 m or 1500 uV/m (63.5 dBuV/m) @ 1 m.

Based on these measurements, the FieldPro ProTX-1 transmitter is in compliance with FCC Parts 15.231(b) and 15.205(a)(b)/15.209(a)-(e) regarding field strength of emissions.

3.3 Occupied Bandwidth:

The occupied bandwidth of the FieldPro transmitter was measured to determine compliance with FCC Part 15.231(c). The FCC limits the occupied bandwidth to 0.25 percent of the fundamental frequency. For the FieldPro transmitter operating at 418 MHz this limits the occupied bandwidth at the 20 dB down points to 1.045 MHz.

To measure occupied bandwidth of the transmitter; the spectrum analyzer (HP 8568B) resolution bandwidth was initially set to 1 MHz (1.4 MHz impulse) at a center frequency of 418 MHz. The detector function was set to peak mode. The reference level was then set at the peak of the highest amplitude emission observed at the fundamental frequency of the operating transmitter. The wide bandwidth is used to ensure that all significant spectral components of the emission fall with in the spectrum analyzer's bandpass to yield the highest possible signal level from the transmitter. Now the resolution bandwidth was set to 10 KHz (14 KHz impulse) and the center frequency of the spectrum was adjusted to align the peak the transmitted emission to the center of the display of the spectrum. The occupied bandwidth is then measured using the analyzer's marker function to determine frequency width at the 20 dB down points from the reference level established previously. The test setup is shown in Pictorial-2.

The FieldPro transmitter's occupied bandwidth was measured for each of the four push buttons that actuate the transmitter. In Figure 7 are the results of the occupied bandwidth measurements with the transmitter's red push button depressed. In reviewing Figure 7 the plot shows the occupied bandwidth to be 62.0 KHz at the –20 dB points. Figure 8 displays the transmitter performance within +/- 5 MHz of the center frequency, showing the freedom of spurious responses. Similar (identical) performance was found for the remaining push buttons. Note the peak level of the emission remains at the reference level established using the 1 MHz bandwidth, hence there is no evidence pulse desensitization (this is expected as the pulse repetition frequency is much less than the bandwidth of the analyzer and the pulse widths are too wide to generate a pulse spectrum).

Based on these measurements, the FieldPro ProTX-1 transmitter is in compliance with FCC Part 15.213(c) for occupied bandwidth.

4.0 Conclusion:

The FieldPro model ProTX-1 (FCC ID: O2CPROTX-1) handheld transmitter has been examined and tested in accordance with FCC Part 15.31, 15.33, & 15.35, and ANSI C63.4-1992, and found compliant with FCC Parts 15.203, 15.231, and 15.205/15.209.

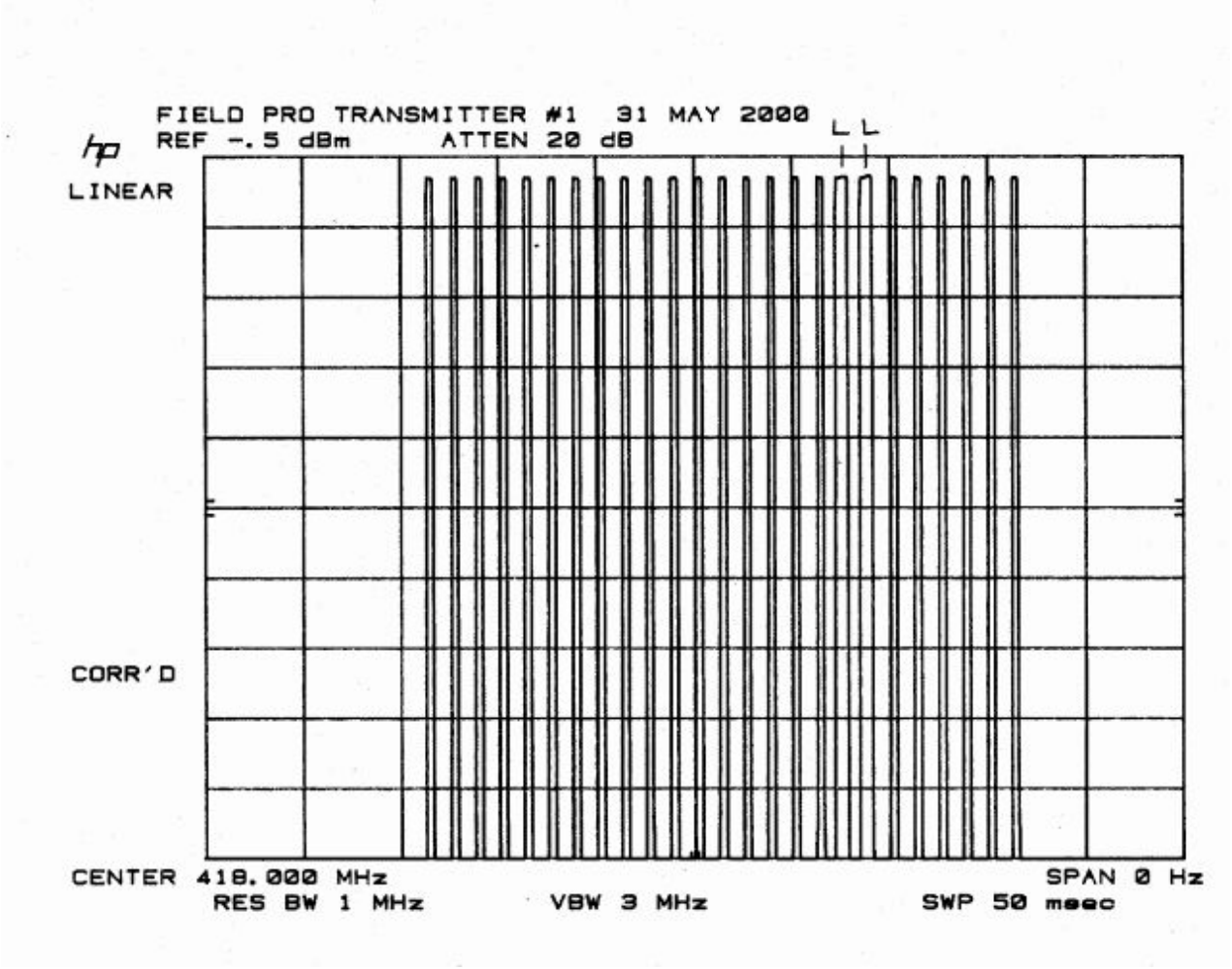


Figure 1
FieldPro ProTX-1 Transmitter
Pulse Output Coding, Single Packet

Red Push Button

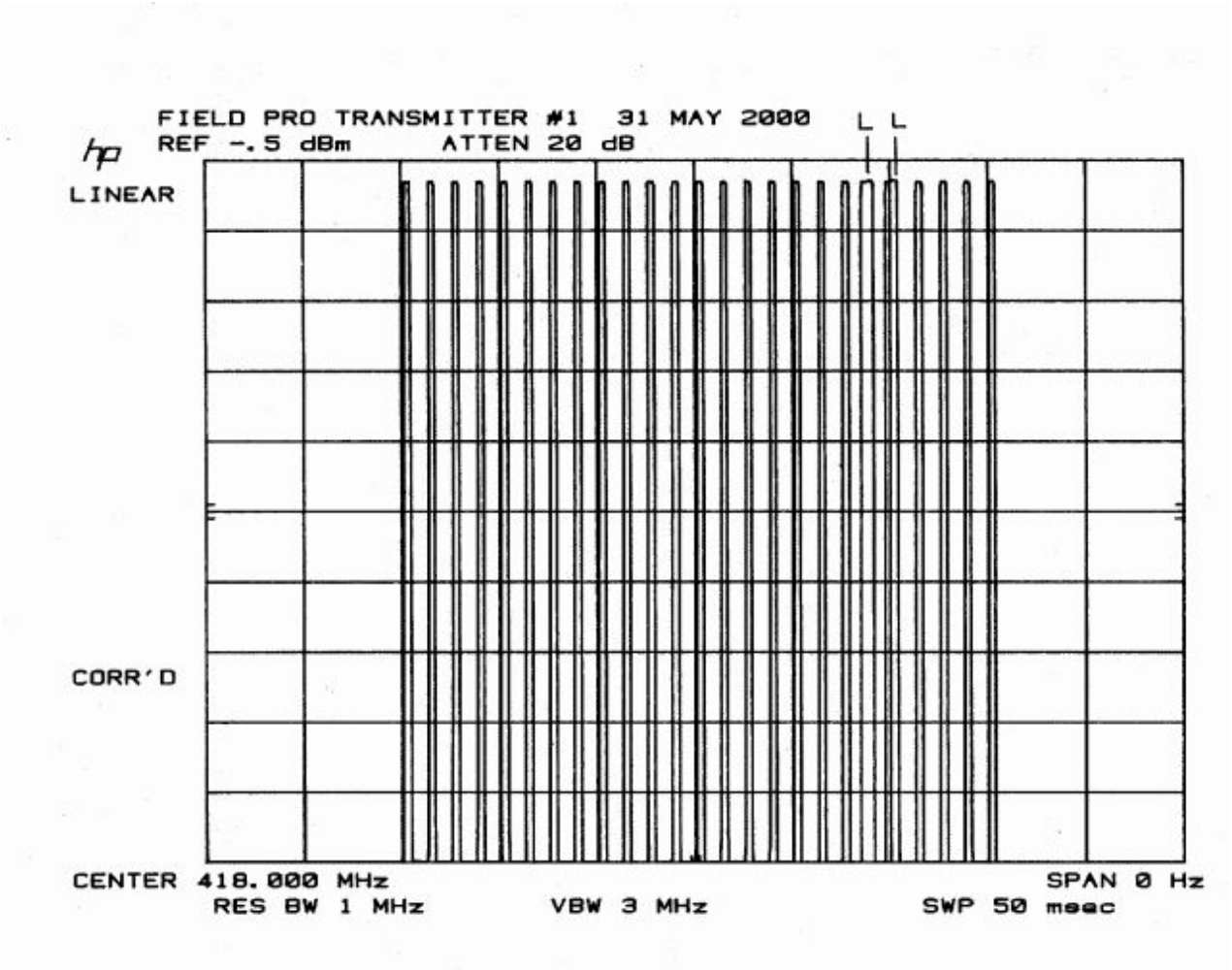


Figure 2
FieldPro ProTX-1 Transmitter
Pulse Output Coding, Single Packet

Yellow Push Button

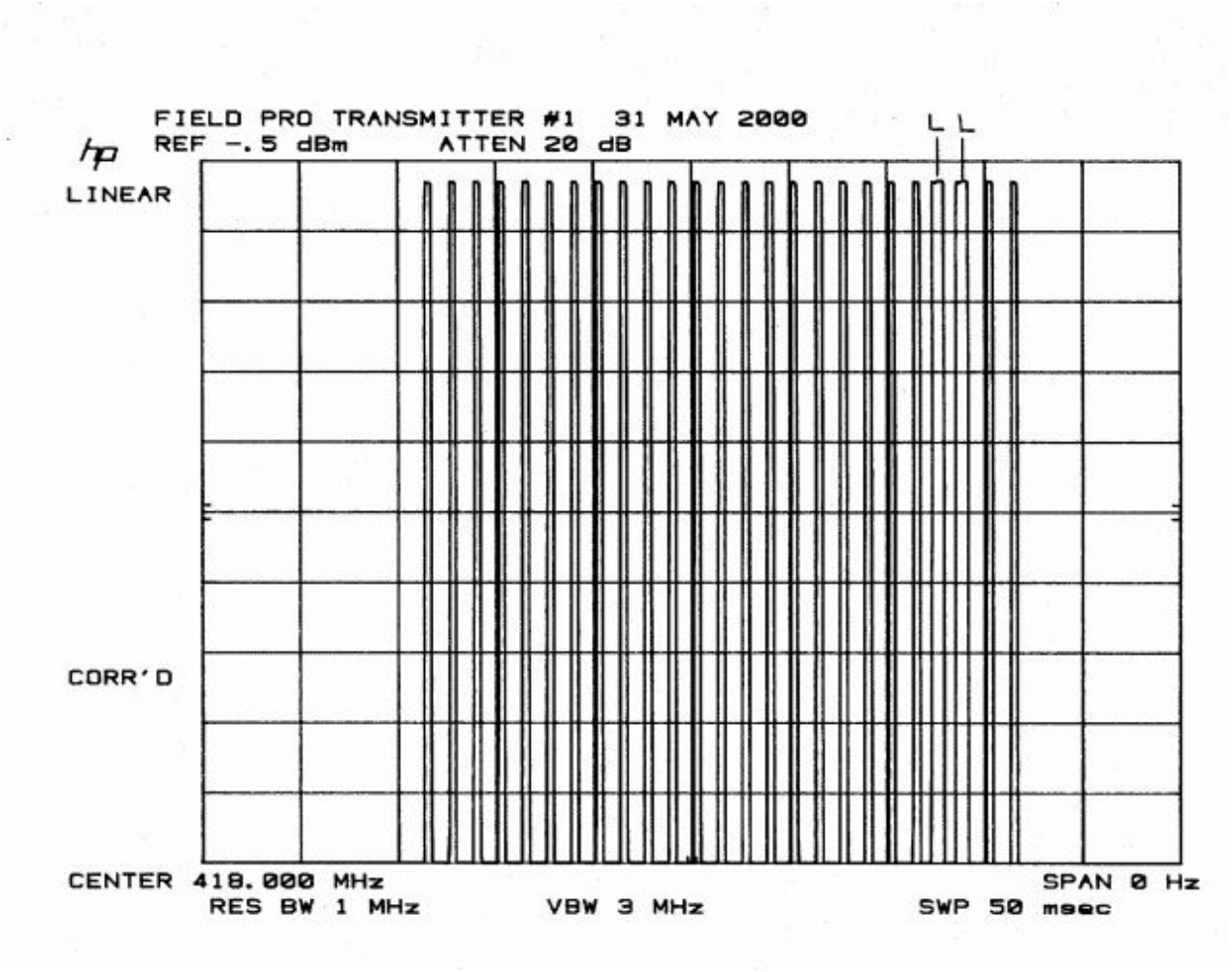


Figure 3
FieldPro ProTX-1 Transmitter
Output Pulse Coding, Single Packet

White Push Button

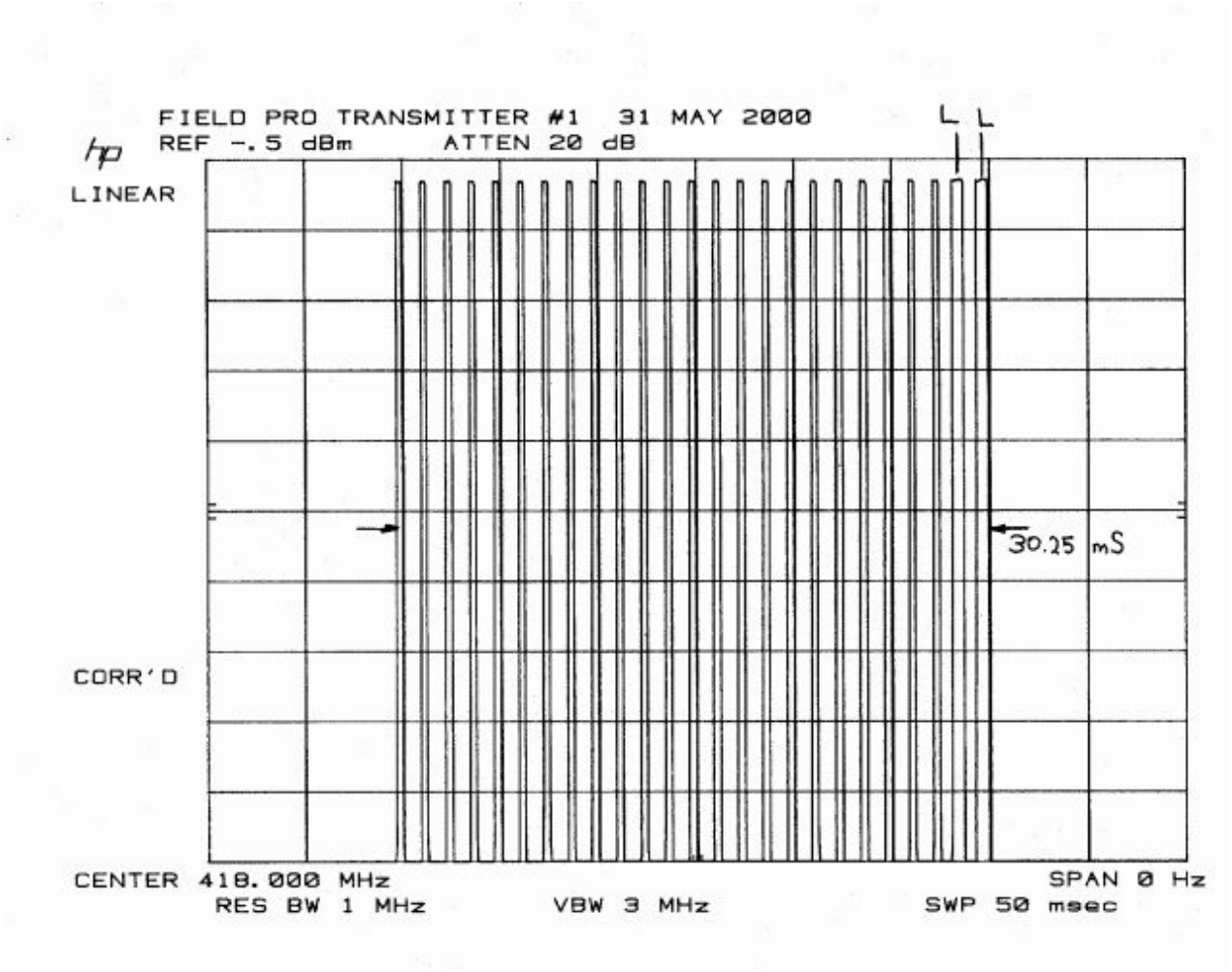


Figure 4
FieldPro ProTX-1 Transmitter
Output Pulse Coding, Single Packet

Blue Push Button

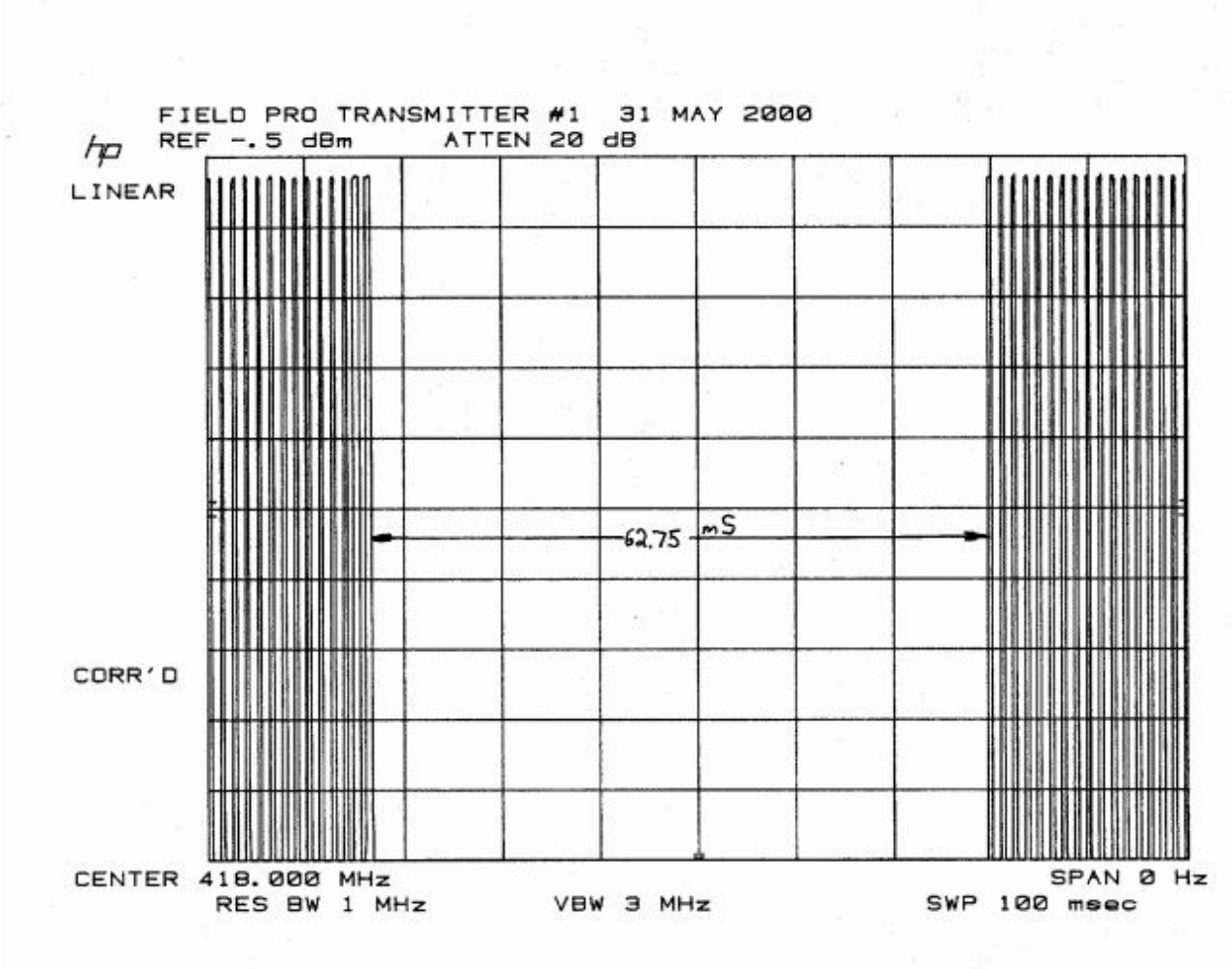


Figure 5
FieldPro ProTX-1 Transmitter
Output Pulse Coding showing Blanking Interval

between packets

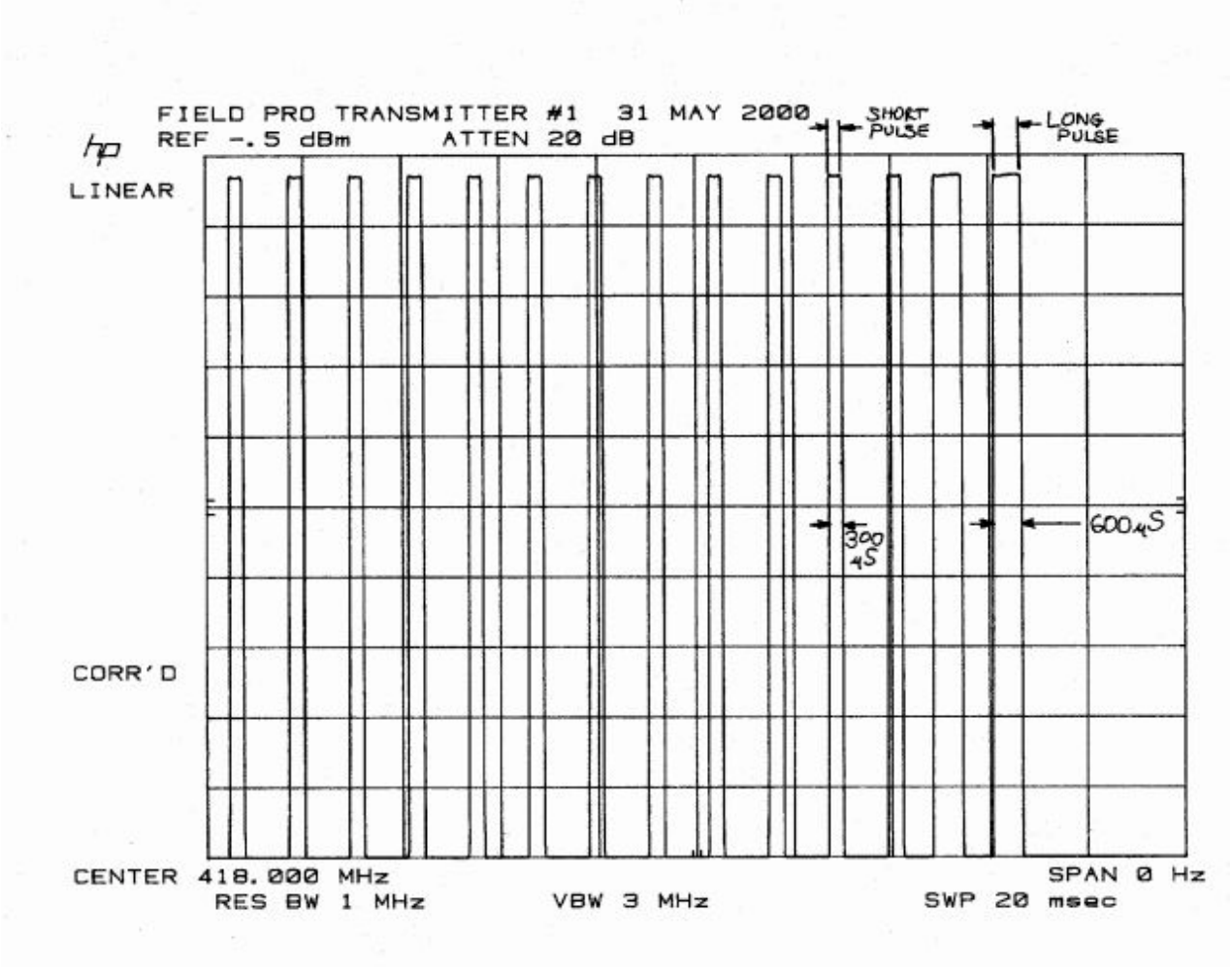


Figure 6
FieldPro ProTX-1 Transmitter
Output Pulse Coding showing pulse widths

within a packet

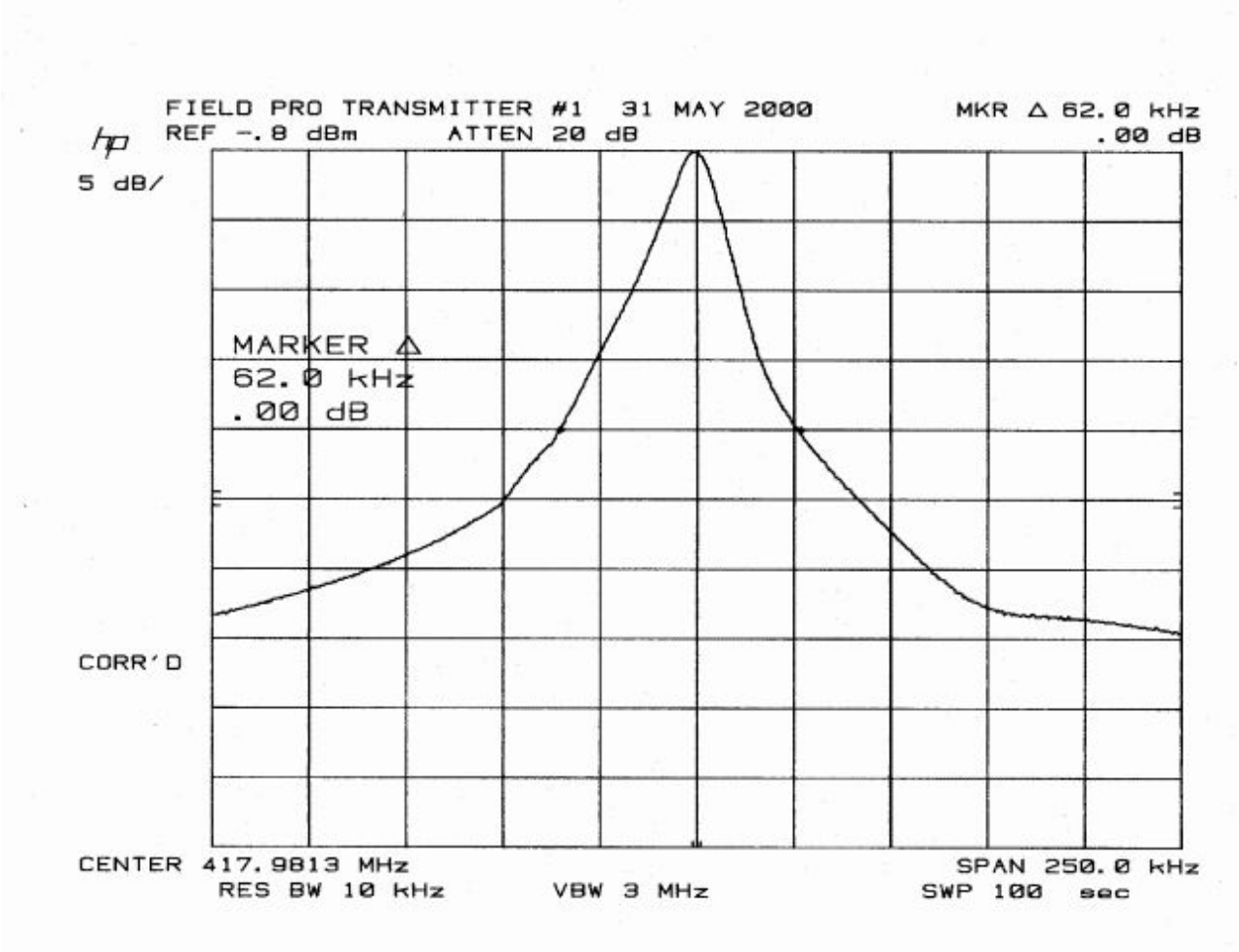


Figure 7
FieldPro ProTX-1 Transmitter

Occupied bandwidth
Red Push Button

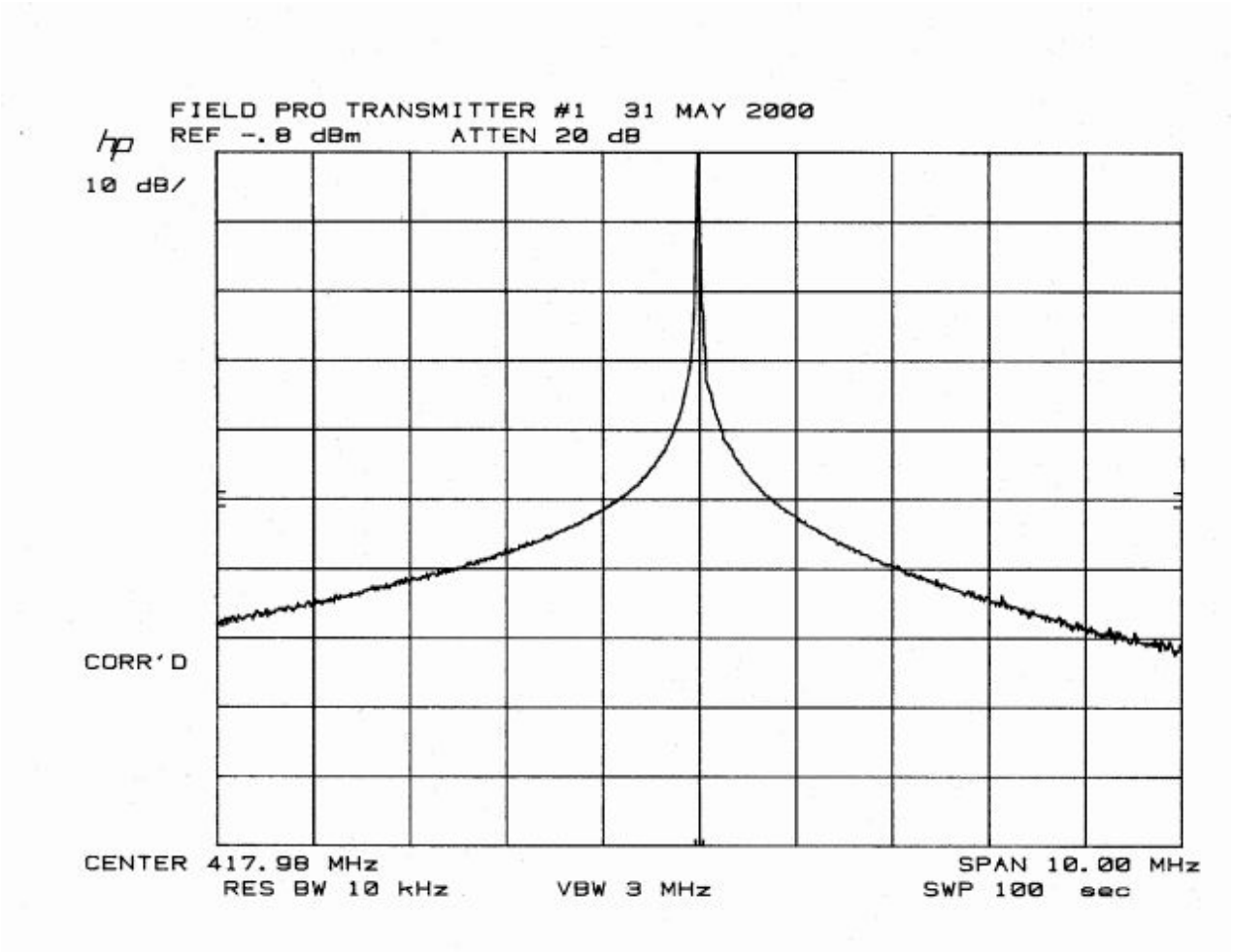


Figure 8
FieldPro ProTX-1 Transmitter

Occupied Bandwidth
Red Push Button