



GUIDANCE CONTROL SYSTEMS Ltd.

Application
For Certification
Offender Transmitter

(FCC ID: OY3PID23)

April 18, 2000



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1.0 GENERAL DESCRIPTION

1.1 Related Submittal Grants

This is single application of the Offender Transmitter for Certification under Part 15.231

There are no other simultaneous applications.

1.2 Product Description

The Offender transmitter allows an enforcement agency to verify that a court-imposed curfew is being observed.

The Offender Transmitter, also called a Personal Identification Device (PID), is worn by an offender. It transmits a signal at regular intervals containing a unique identification number and current status information that allows officials to determine if the offender is present and THE condition of the transmitter.

The transmitter consists of several major components. An ATMEL 8535 running at 1 MHz is used as the CPU. A low power 32 kHz oscillator is used to wake the device from sleep mode. All outgoing data is sent using the radio link and a small loop antenna with data transfer rate 7000 bits per second.

The Offender Transmitter communicates with the Monitoring Unit (Home Receiver) or Hand Held Receiver. These receivers are certified under the manufacturer's Declarations of Conformity.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7498 Hudson Blvd., Oakdale, Minnesota. This test facility has been fully described in our site report dated January, 2000 that was submitted to your office. Please reference our site registration number: 90706, dated April 4, 2000.

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

The Transmitter was powered from 3.6 VDC (two 3.6V Lithium batteries SL-340). The transmitter was mounted on a styrofoam base which allowed the device rotation through three orthogonal axes to determine which configuration produces the highest emissions relative to the limit.

For radiated emissions measurements according to FCC 15.109 and 15.231(e) and bandwidth of emissions measurement according to FCC 15.231(c) the transmitter in continuous mode of operation was used. For transmitting duration and silent period measurement according to FCC 15.231(e) the regular offender transmitter s/n 00001081 was used.

2.2 EUT Exercising Software

The Offender Transmitter was tested in the continuous transmission mode.

2.3 Special Accessories

There are no special accessories necessary for compliance of these products.

2.4 Equipment Modification

No modifications were installed during the testing.

2.5 Support Equipment List and Description

N/A

2.6 Test Configuration Block Diagrams (see Attachments)

3.0 EMISSION RESULTS

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Peak reading on the EMI Receiver to the factors associated with preamplifiers (if any), antennas and cables. A sample calculation is included below.

$$FS = RA + AF + CF - AV$$

Where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB/m

AV = Average Factor (Power Factor)

Assume a receiver reading of 61 dB μ V is obtained. The antenna factor of 19.5 dB and cable factor of 3.5 dB is added. The net field strength for comparison to the appropriate emission limit is 67 dB μ V/m. The average factor of 6dB is subtracted from the readings.

Note: Attached tables show combined antenna factor and cable factor as Antenna Factor.

3.2 Radiated Emission Data (see Exhibit II)

The fundamental output power and harmonic emissions limits are outlined in paragraph 15.231(e). The fundamental field strength allowed at the distance of 3 meters was calculated for 418 MHz the transmitter fundamental frequency to be 72.3 dB μ V/m. The harmonic emissions which lie in the forbidden bands of §15.205 are required to meet the radiated emissions limits of 52.3 dB μ V/m.

Calculation of the field strength of the fundamental frequency:

$$\text{Limit} = 20 \log (1500 \mu\text{V} + (\text{Fund. Freq.} - 260 \text{ MHz}) \times (12500 \mu\text{V} - 3750 \mu\text{V}) / (470 \text{ MHz} - 260 \text{ MHz}))$$

$$\text{Limit} = 20 \log (1500 \mu\text{V} + (418 \text{ MHz} - 260 \text{ MHz}) \times (12500 \mu\text{V} - 3750 \mu\text{V}) / (470 \text{ MHz} - 260 \text{ MHz}))$$

$$\text{Limit} = 20 \log (4133.3) = 72.3 \text{ dB}\mu\text{V/m}$$

Calculation of the field strength of the spurious emissions:

$$\text{limit} = 20 \log (375 \mu\text{V} + (\text{Fund. Freq.} - 260 \text{ MHz}) \times (1250 \mu\text{V} - 375 \mu\text{V}) / (470 \text{ MHz} - 260 \text{ MHz}))$$

$$\text{limit} = 20 \log (375 \mu\text{V} + (418 \text{ MHz} - 260 \text{ MHz}) \times (1250 \mu\text{V} - 375 \mu\text{V}) / (470 \text{ MHz} - 260 \text{ MHz}))$$

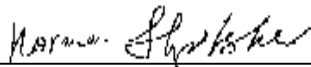
$$\text{limit} = 20 \log (413.3) = 52.3 \text{ dB}\mu\text{V/m}$$

The maximum level of the fundamental signal at 418 MHz was 74.9 dB μ V/m calculated power factor 6dB, so the emissions are 3.4dB margin below the FCC limit (72.3 dB μ V/m). The worst case harmonic emission was 8.5 dB below the FCC limit. Above 960 MHz limits 54dB μ V/m were applied.

Tested by:

Norman Shpilsher
EMC Project Engineer
Intertek Testing Services NA, Inc.

Agent for Guidance Control Systems Ltd.



Signature

Date: 04-18-2000

3.3 TEST EQUIPMENT

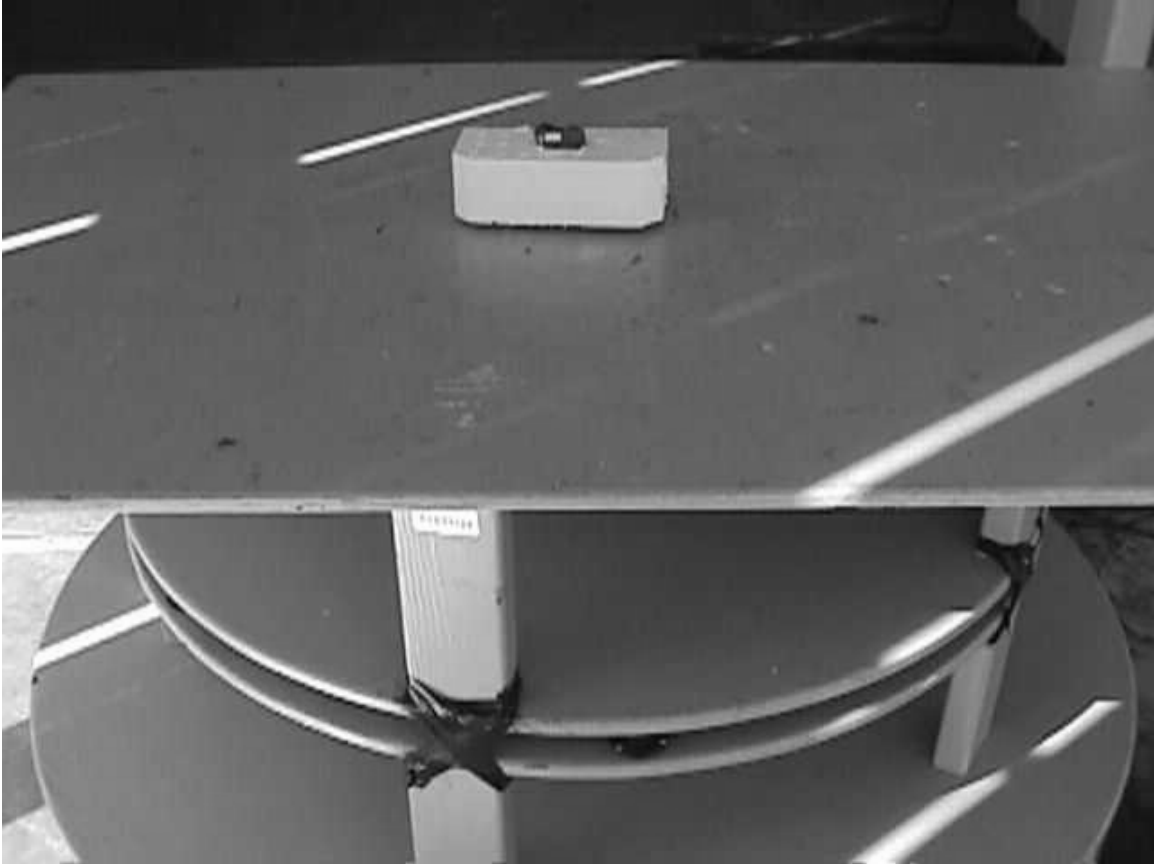
Receivers/Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP 85462A Receiver RF Section	3325A00106	05/99	05/00	X
HP 85460A RF Filter Section	3330A00109	05/99	05/00	X

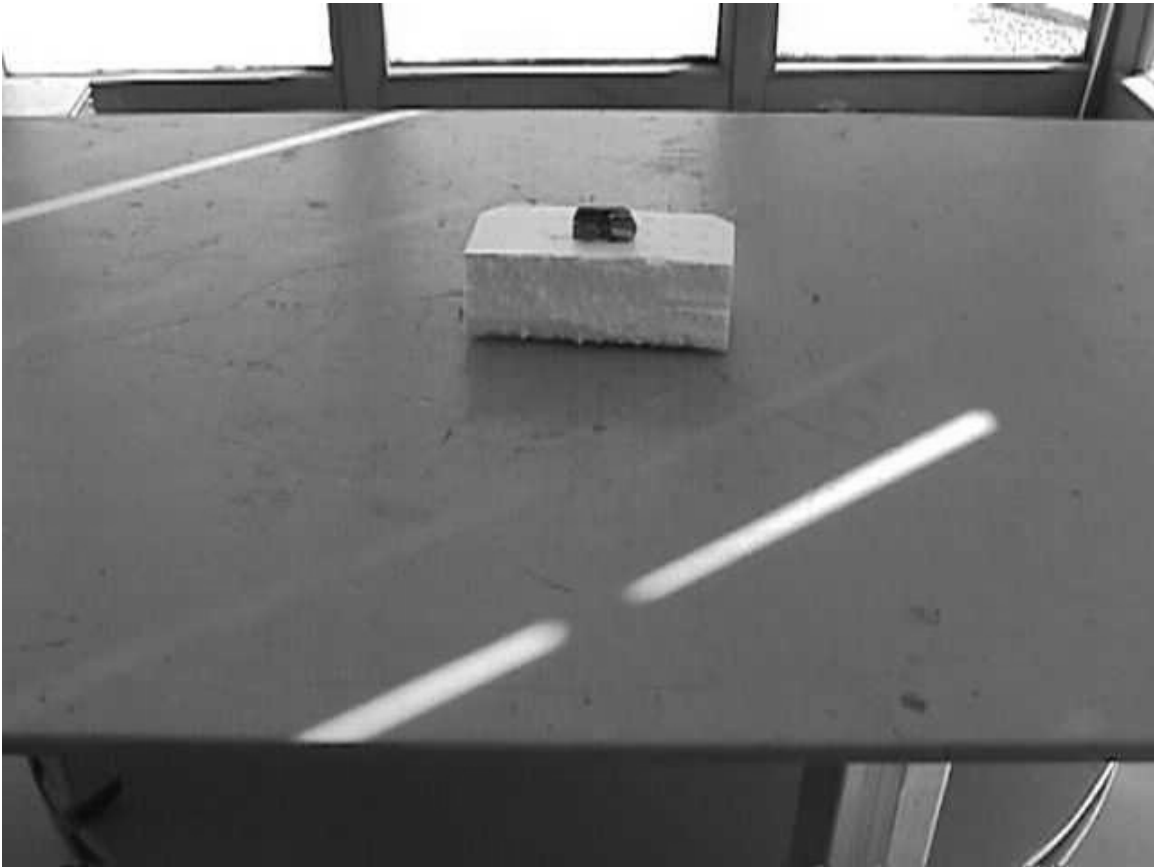
Antennas

DESCRIPTION	SERIAL NO	LAST CAL DATE	CAL DUE	TICK IF USED
Chase Bicono-Log Antenna CBL6112B	2630	03/00	03/01	X
EMCO Horn antenna 3115	9507-4513	07/99	07/00	X

EXHIBIT I
TEST SET UP PHOTOS



Radiated Emissions Test Configuration for the Offender Transmitter



Radiated Emissions Test Configuration for the Offender Transmitter

EXHIBIT II
EMISSIONS TEST DATA

Radiated Emissions

Date: 04-18-2000

Company: Guidance Control Systems Ltd.

Model: Offender Monitoring System, Transmitter

Test Engineer: Norman Shpilsher

Standard: FCC Part 15.231

Note: The table shows the worst case radiated emissions

Measurements below 1 GHz were taken using a CISPR Quasi-peak detector w/RBW 100 kHz

Measurements above 1 GHz were taken using a Peak detector w/RBW 1 MHz

Table # 1

Antenna Polarity	Antenna Hts (m)	Frequency MHz	Reading dBμV	Antenna dB/m	Net at 3m. dBμV/m	Limit dBμV/m	Power Factor (dB)	Margin dB	Comments
V	1.3	418.0	49.1	19.4	68.5	72.3	6.0	-9.8	
H	2.2	418.0	55.8	19.1	74.9	72.3	6.0	-3.4	
V	2.0	836.0	3.6	28.4	32.0	52.3	6.0	-26.3	
H	1.0	836.0	0.3	28.4	28.7	52.3	6.0	-29.6	
V	1.0	1254.0	5.1	28.4	33.5	54.0	6.0	-26.5	
H	1.0	1254.0	6.3	28.3	34.6	54.0	6.0	-25.4	
V	1.0	1672.0	9.3	30.2	39.5	54.0	6.0	-20.5	R
H	1.0	1672.0	9.4	30.1	39.5	54.0	6.0	-20.5	R
V	1.0	2090.0	16.7	32.3	49.0	54.0	6.0	-11.0	
H	1.0	2090.0	17.1	32.1	49.2	54.0	6.0	-10.8	
V	1.0	2508.0	29.1	34.2	63.3	54.0	6.0	3.3	
H	1.0	2508.0	26.3	34.1	60.4	54.0	6.0	0.4	
V	1.0	2926.0	4.0	35.4	39.4	54.0	6.0	-20.6	
H	1.0	2926.0	4.0	35.3	39.3	54.0	6.0	-20.7	
V	1.0	3344.0	7.8	37.1	44.9	54.0	6.0	-15.1	
H	1.0	3344.0	8.7	36.7	45.4	54.0	6.0	-14.6	
V	1.0	3762.0	3.5	38.1	41.6	54.0	6.0	-18.4	R
H	1.0	3762.0	3.5	38.0	41.5	54.0	6.0	-18.5	R
V	1.0	4180.0	7.9	38.7	46.6	54.0	6.0	-13.4	R
H	1.0	4180.0	12.9	38.6	51.5	54.0	6.0	-8.5	R

Comments: R - Restricted Bands of Operation (FCC 15.205)

Emission Bandwidth (See Graph #9):

Measured Bandwidth 390 kHz

Max Bandwidth = 418 MHz $\times$ 0.0025 = 1045 kHz

Transmission Duration (See Graph #10):

Measured Transmission Duration 30 ms

Silent Period (See Graph #11):

Measured silent period for sample s/n 00001081 is 125 sec

Min silent period 10 sec

Calculation of the worse case of the average (power) factor (For sample with continuous mode of operation. See Graph #12):

Sum of the pulses over 100 ms is 50 ms

Power factor = $20\log (100\text{ms}/50\text{ms})$

Power factor = $20 \log (2) = 6 \text{ dB}$

Radiated Emissions

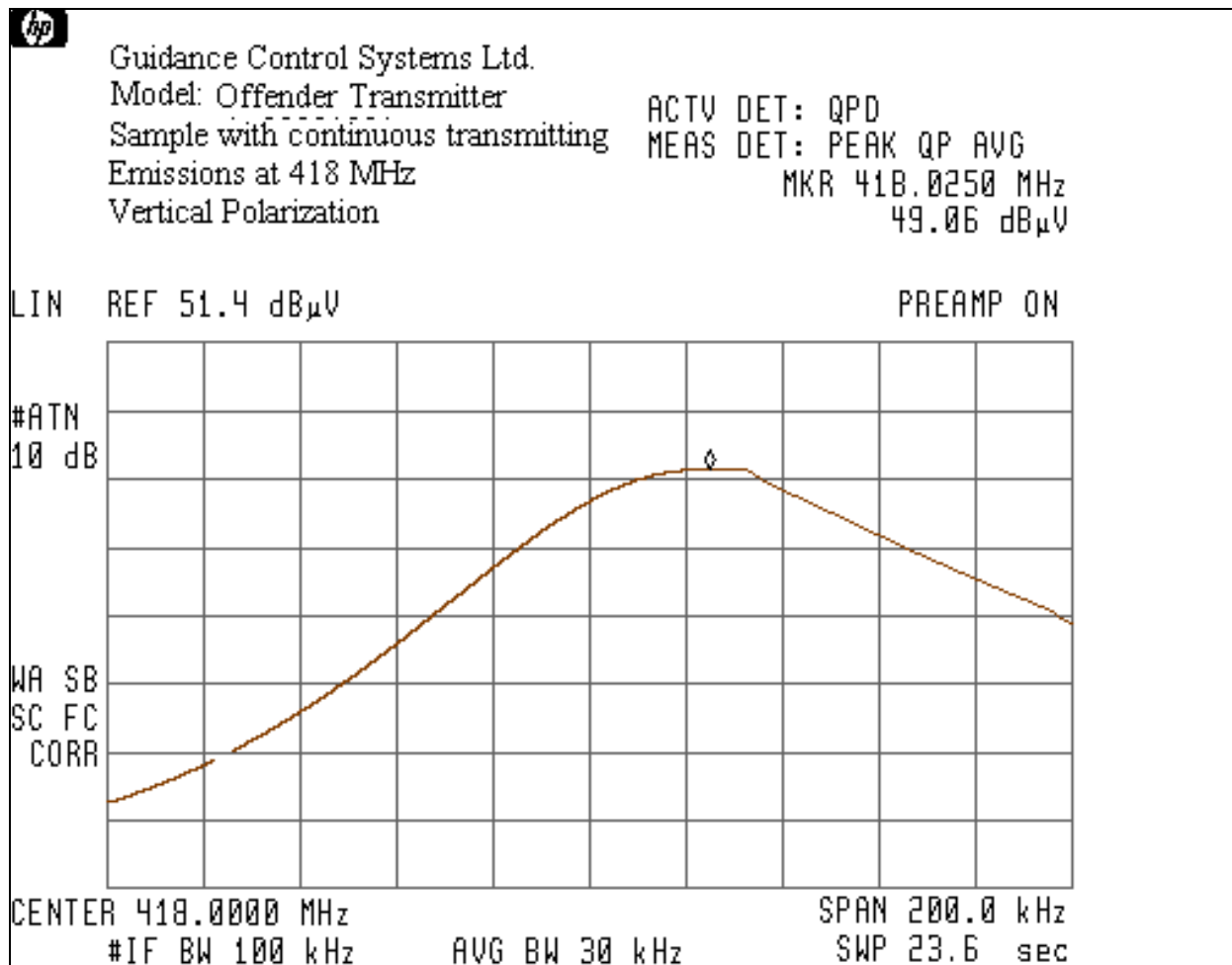
Date: 02-22-2000
Company: Guidance Control Systems Ltd.
Model: Offender Monitoring System, Transmitter
Test Engineer: Norman Shpilsher
Standard: FCC Part 15, Subpart B, 15.109, Class B
Note: The table shows the worst case radiated emissions
 All measurements were taken using a CISPR Quasi-peak detector

Table # 2

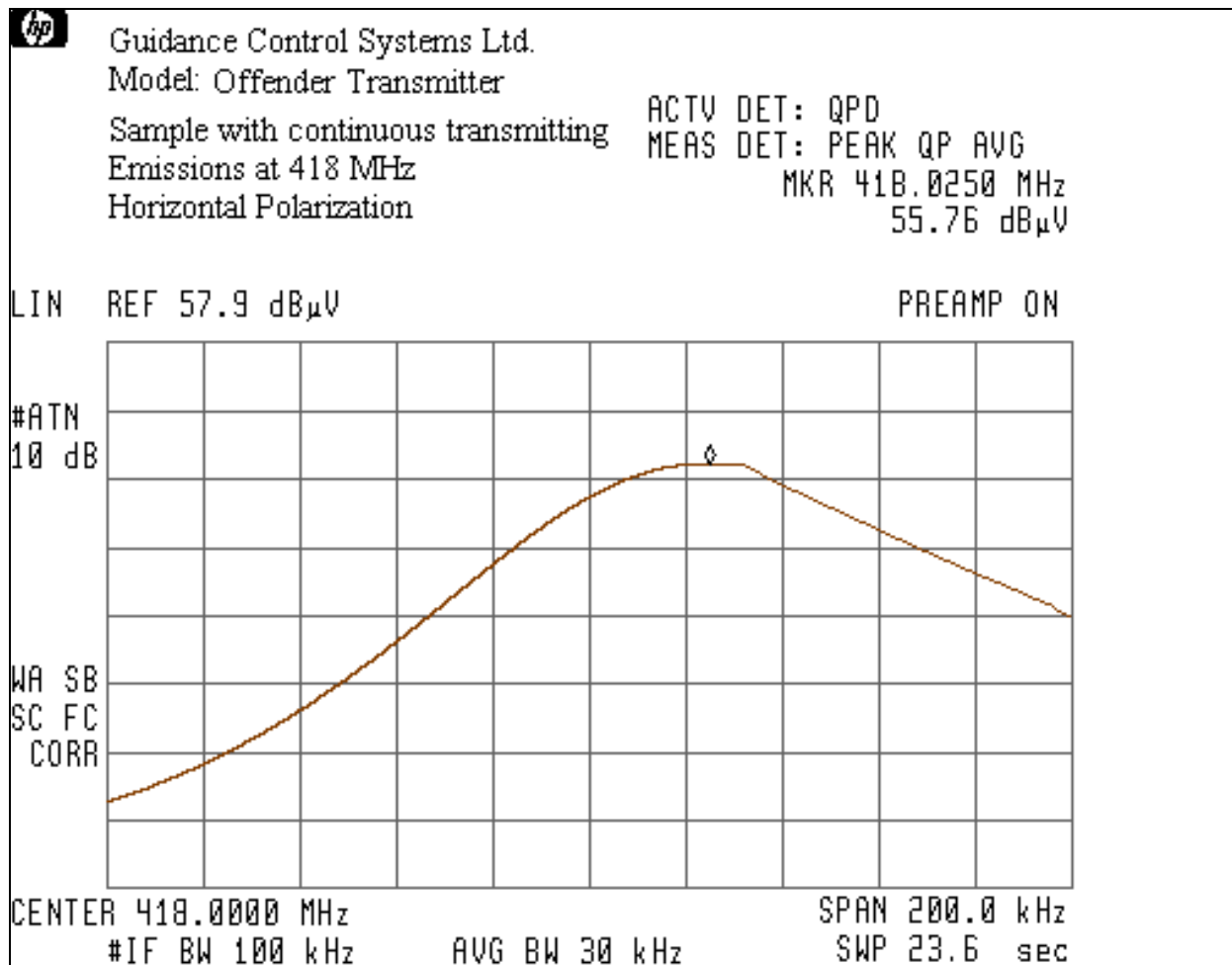
Antenna Polarity	Antenna Hts (m)	Frequency MHz	OP Reading dB _μ V	Antenna Factor(dB/m)	Net at 3m. dB _μ V/m	Class B limi dB _μ V/m	Margin dB	Comments
V	2.7	38.48	4.5	11.9	16.4	40	-23.6	
V	1.4	52.68	5.8	11.2	17.0	40	-23.0	
V	3.9	68.43	15.3	7.8	23.1	40	-16.9	
H	1.0	75.82	9.7	6.9	16.6	40	-23.4	
H	1.9	114.23	7.2	13.1	20.3	44	-23.7	
H	1.4	137.06	2.6	12.3	14.9	44	-29.1	
H	1.2	147.01	5.1	13.4	18.5	44	-25.5	
H	1.2	149.12	5.9	13.8	19.7	44	-24.3	
H	4.0	184.20	5.3	18.4	23.7	44	-20.3	
H	3.5	215.89	11.2	13.7	24.9	44	-19.1	
H	1.7	287.57	12.4	16.2	28.6	46	-17.4	
H	1.6	389.52	4.5	18.5	23.0	46	-23.0	

Comments:

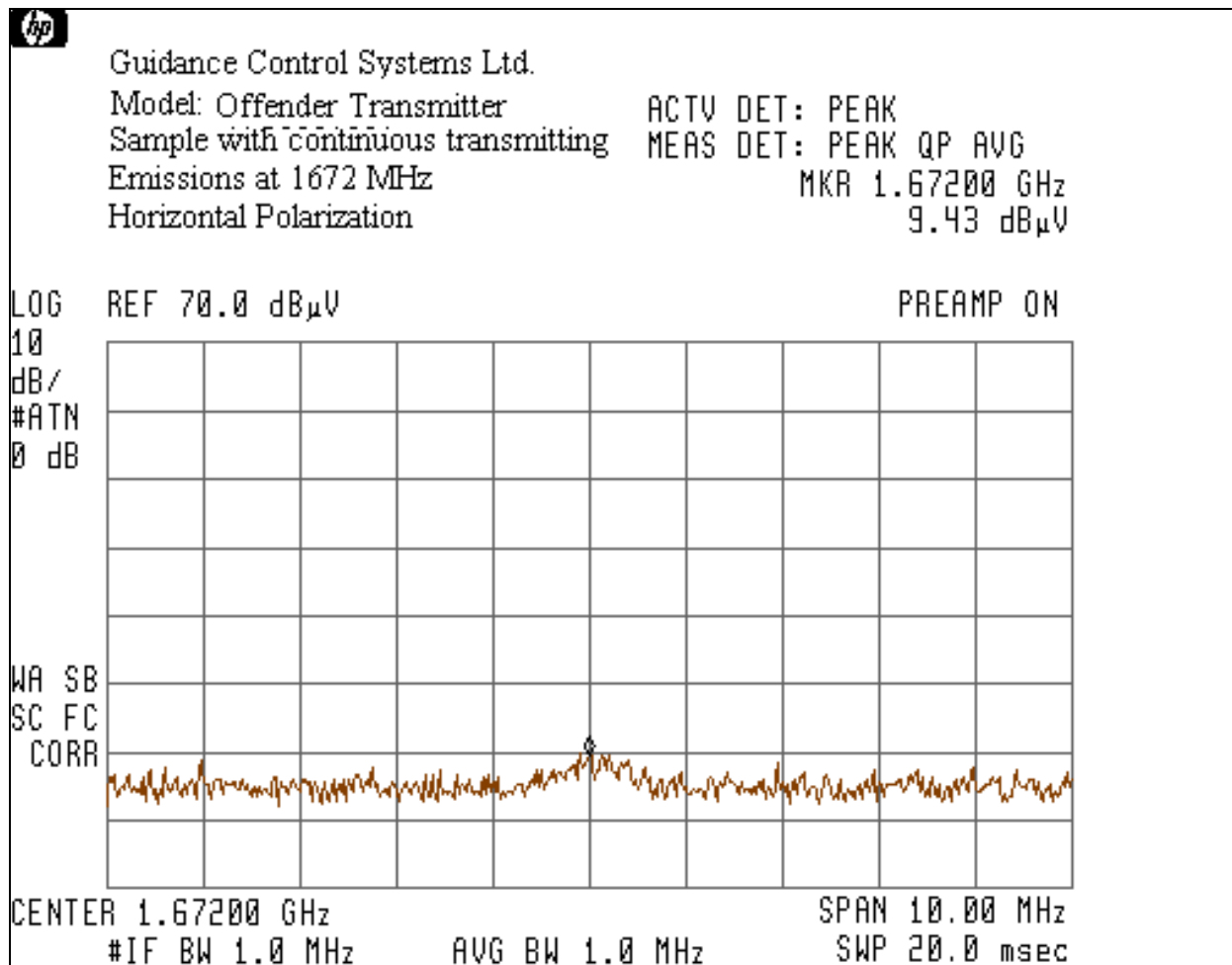
Graph #1
Fundamental Frequency 418 MHz



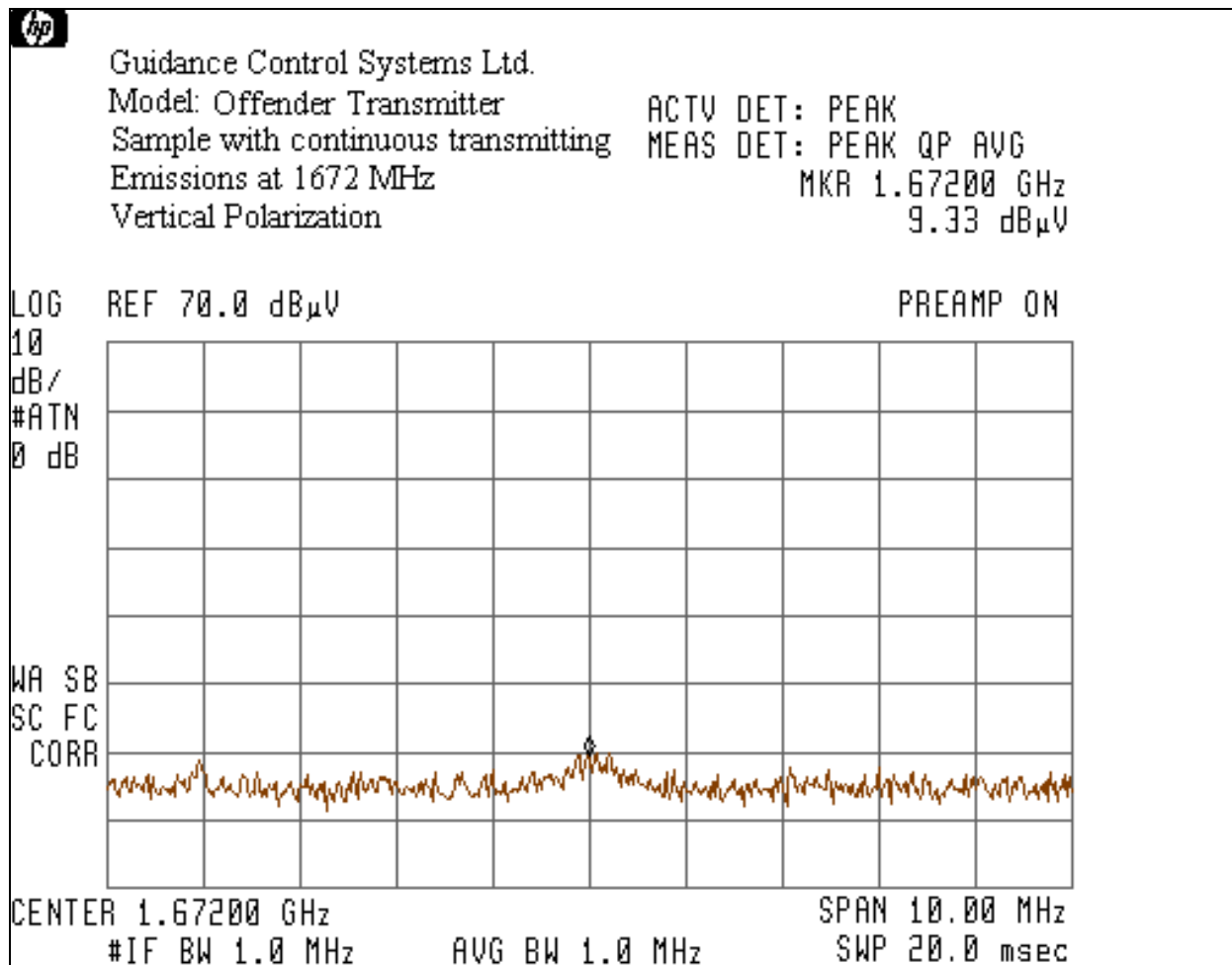
Graph #2 Fundamental Frequency 418 MHz



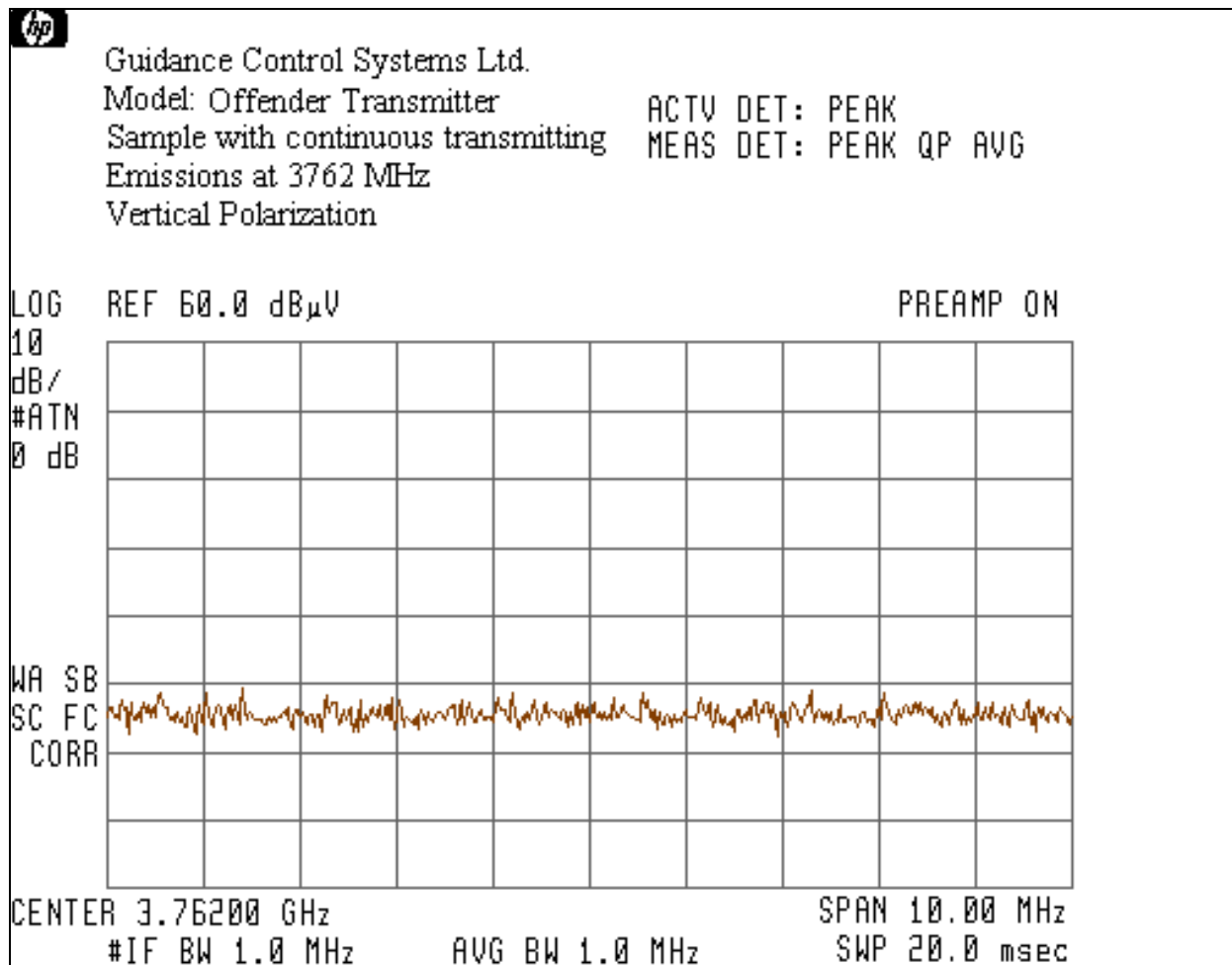
Graph #3
Frequency 1672 MHz, 4th Harmonic



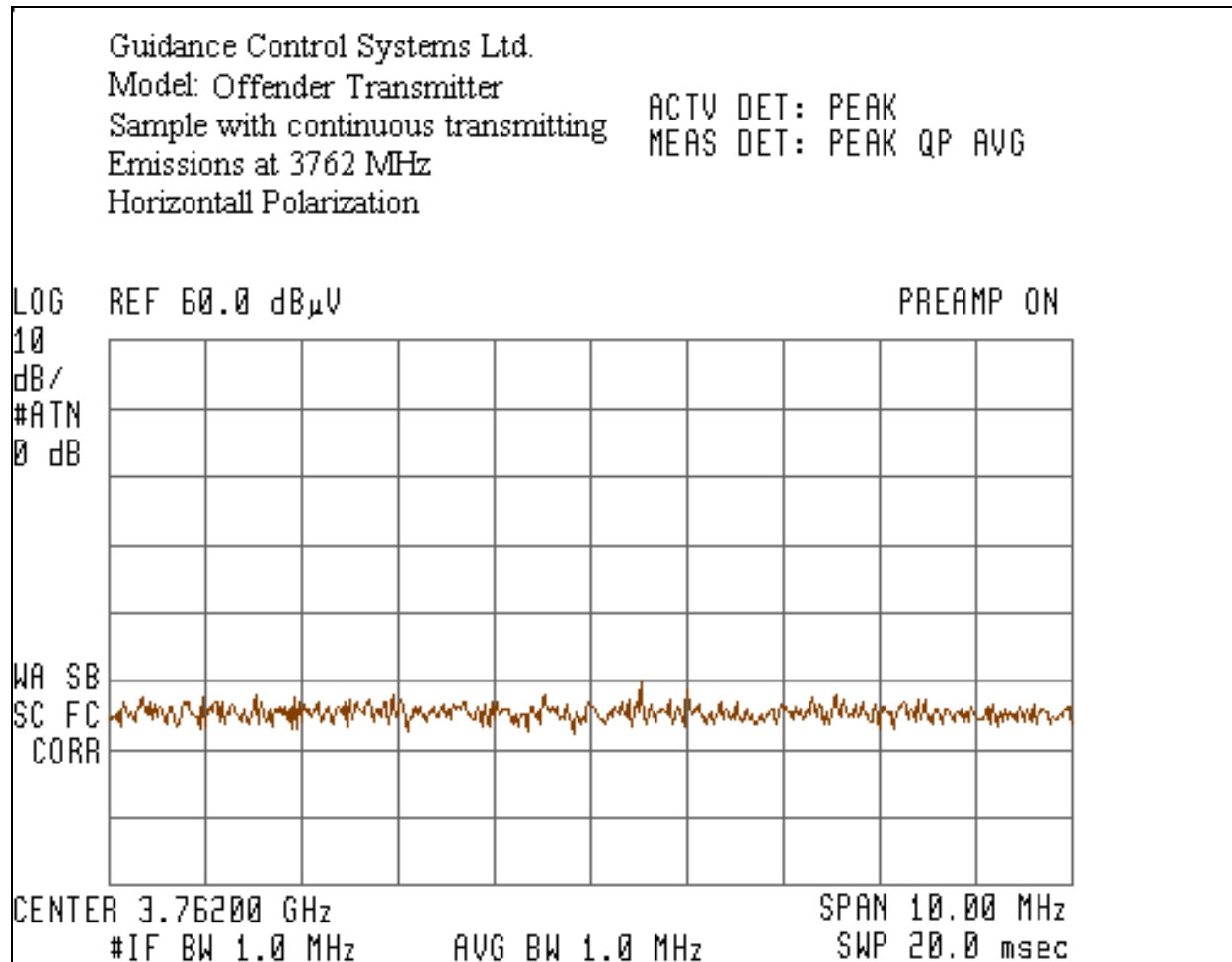
Graph #4
Frequency 1672 MHz, 4th Harmonic



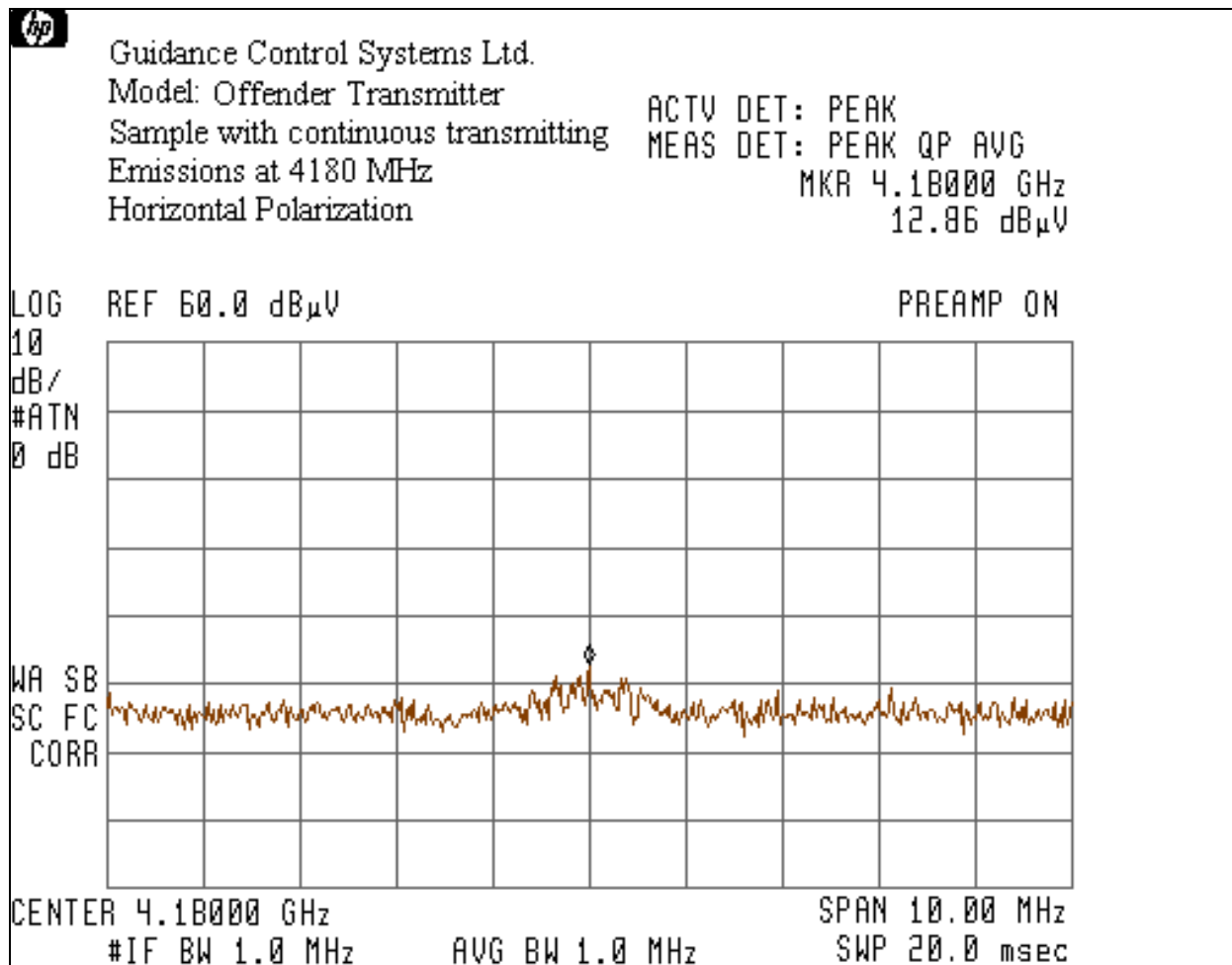
Graph #5 Frequency 3762 MHz, 9th Harmonic



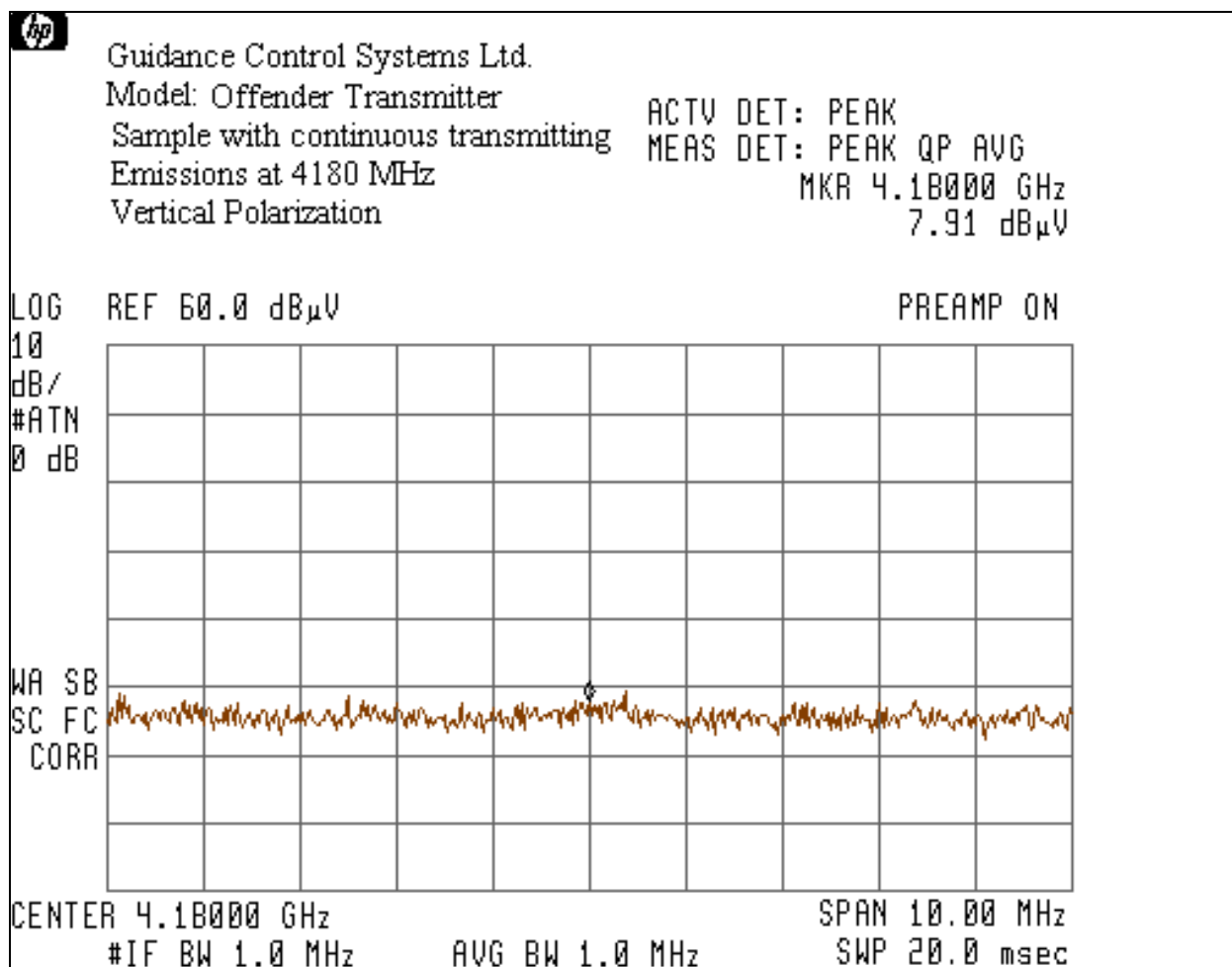
Graph #6 Frequency 3762 MHz, 9th Harmonic



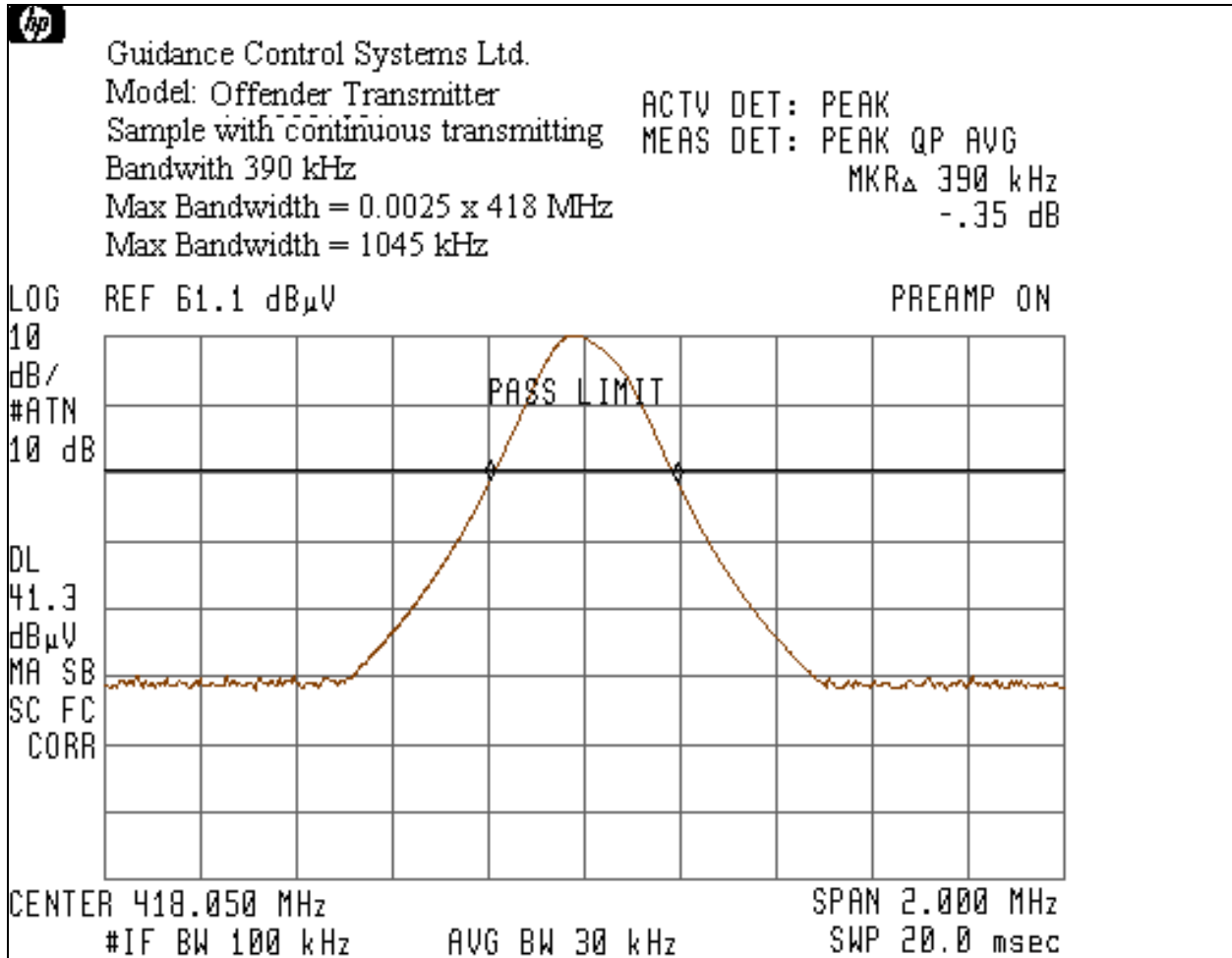
Graph #7 Frequency 4180 MHz, 10th Harmonic



Graph #8 Frequency 4180 MHz, 10th Harmonic



Graph #9
Emission Bandwidth at fundamental frequency

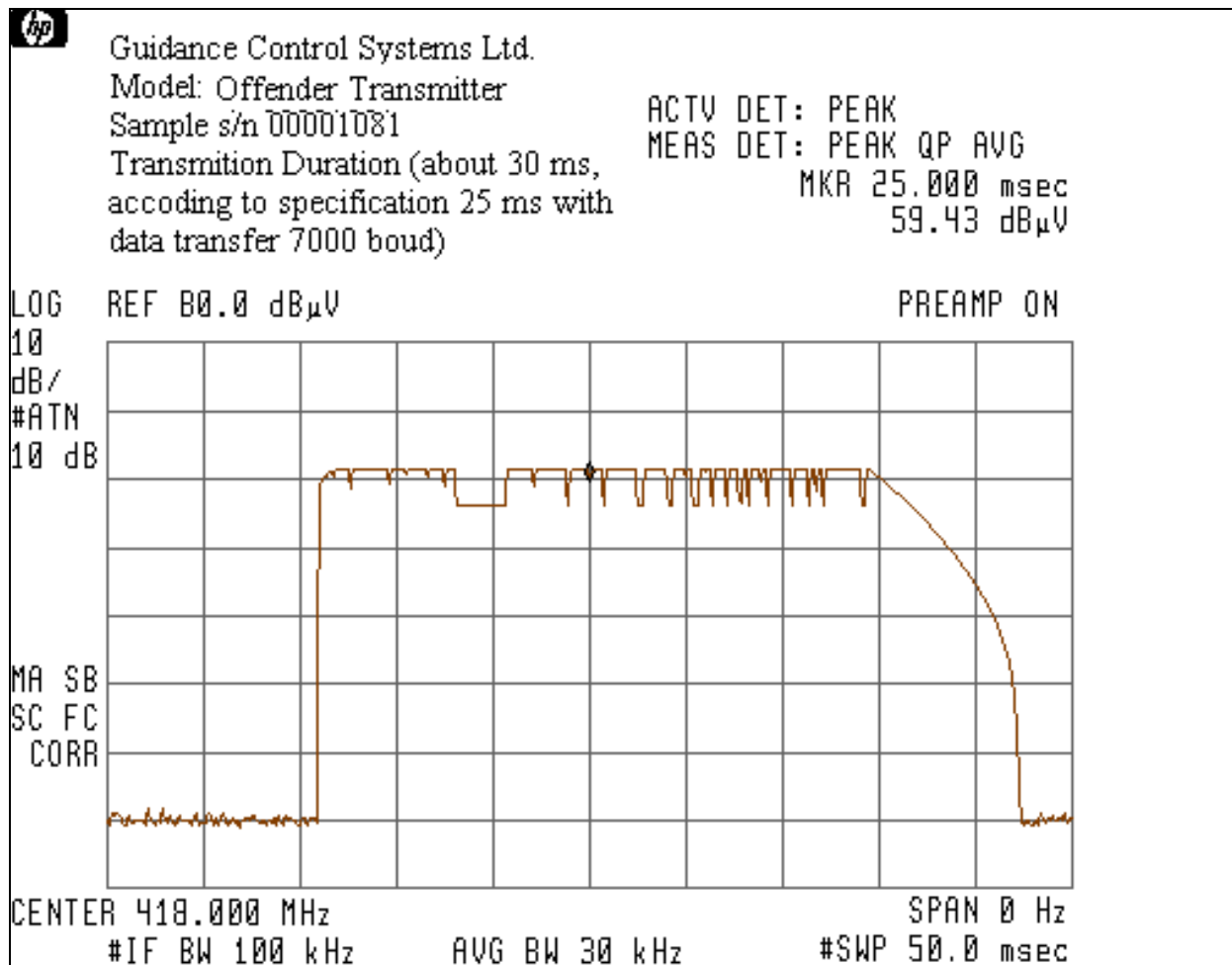


Limits Calculation:

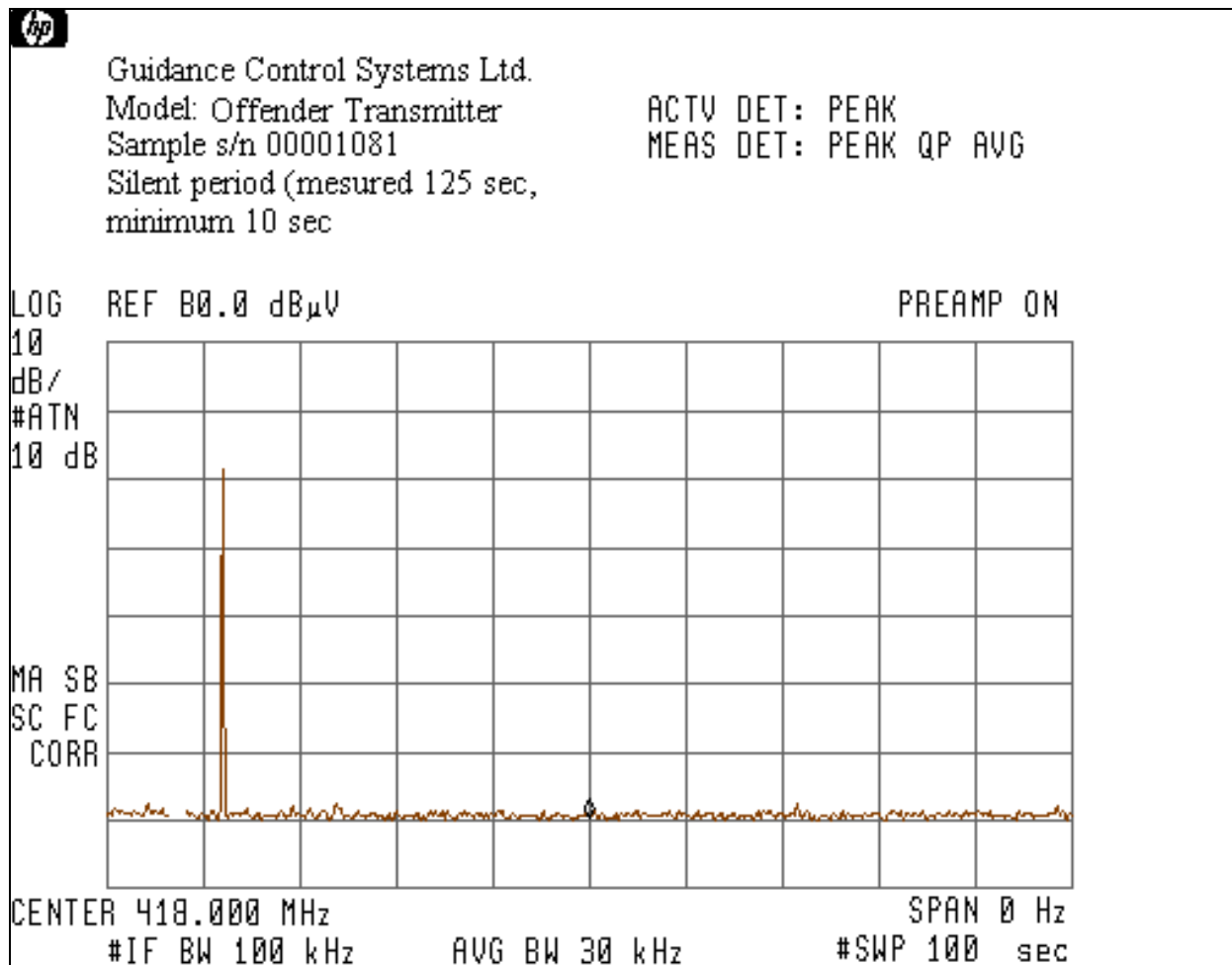
$$\Delta Limit = 0.25\% \times 418 \text{ MHz} = 1.045 \text{ MHz}$$

$$\Delta Measured = 0.390 \text{ MHz}$$

Graph #10 Transmission Duration



Graph #11
Silent Period



Note:

*The measured silent period is 125 sec and the analyzer maximum sweep time is 100 sec.
Because of that the Graph shows one transmission session.*

Graph #12 Pulse Train

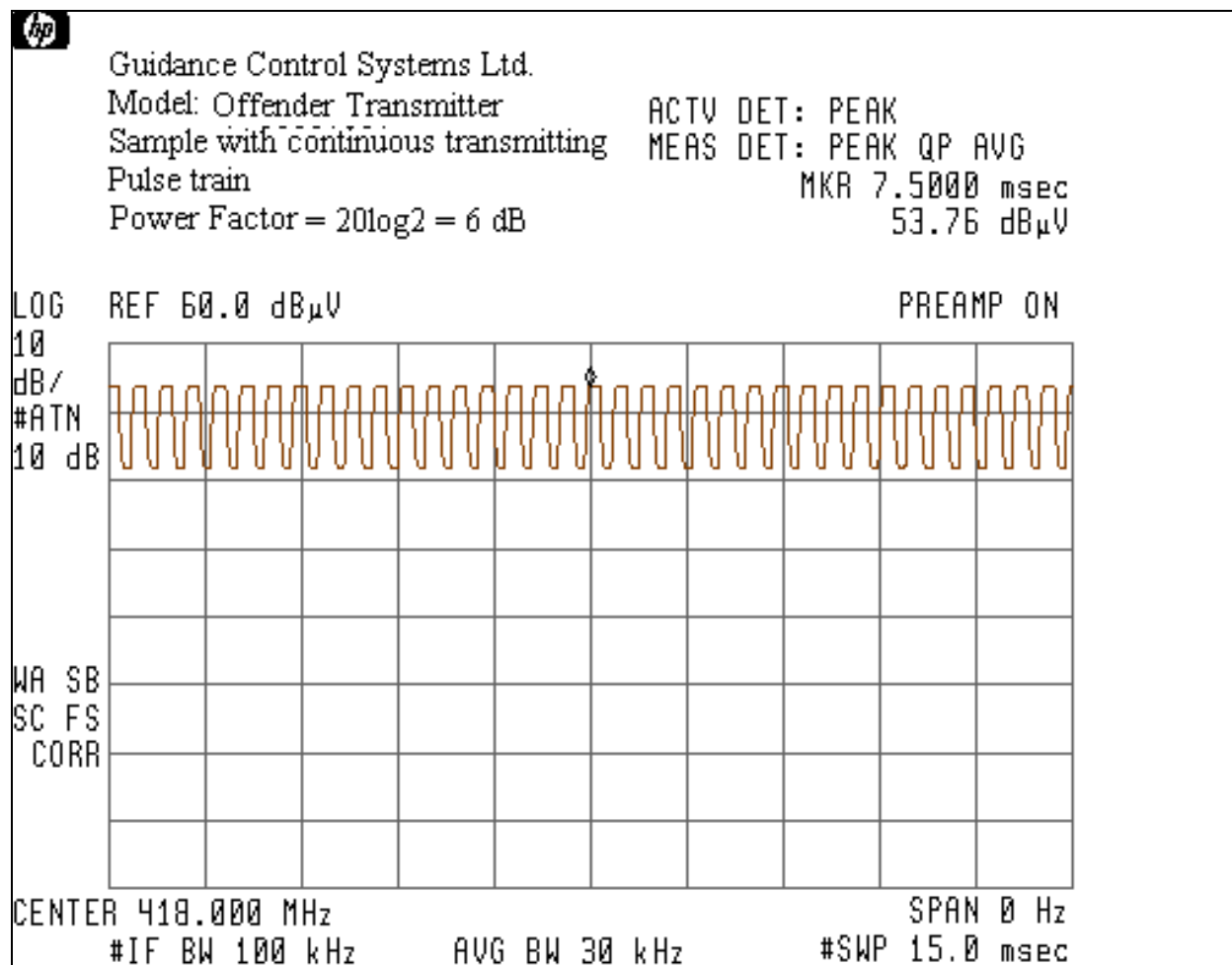


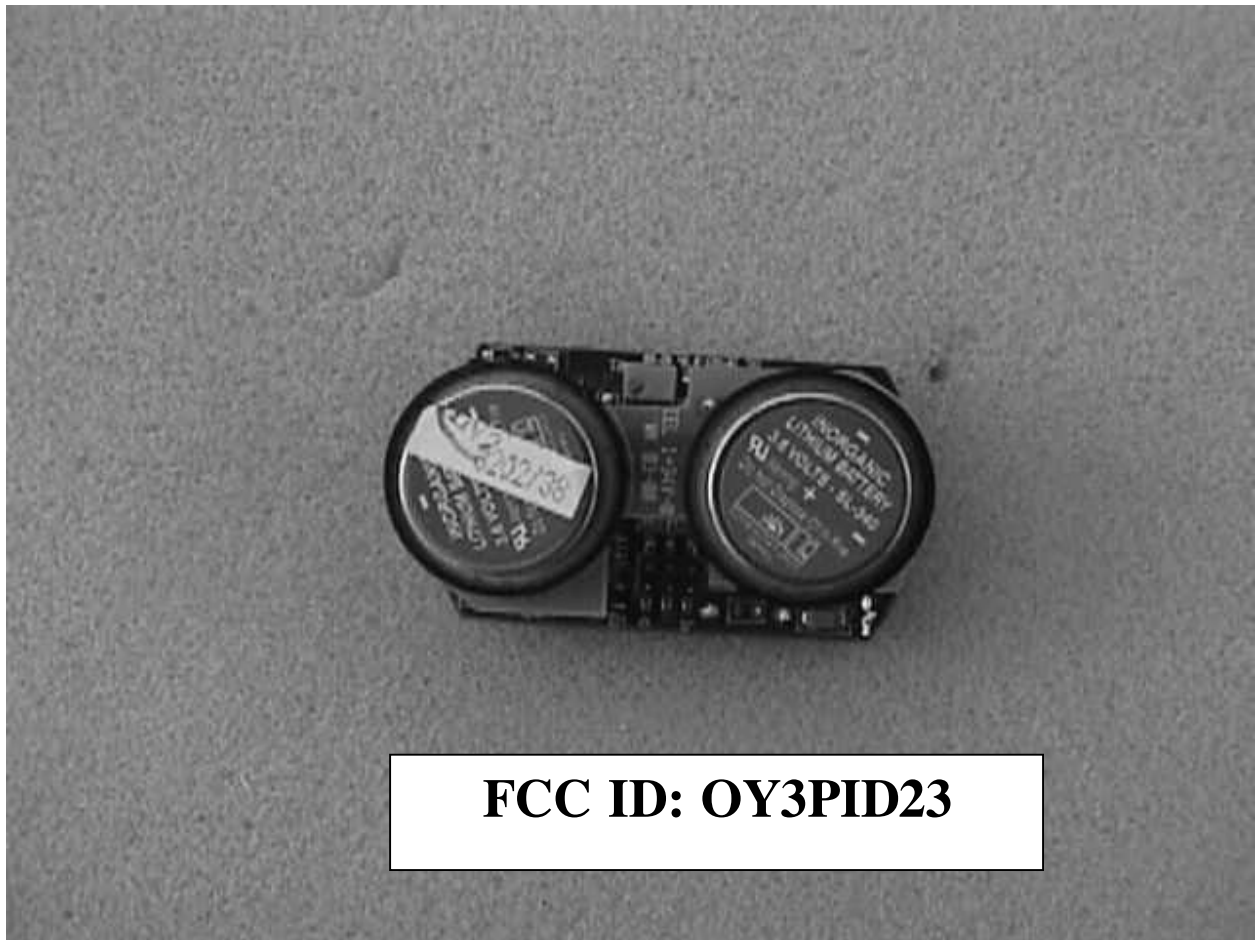
EXHIBIT III

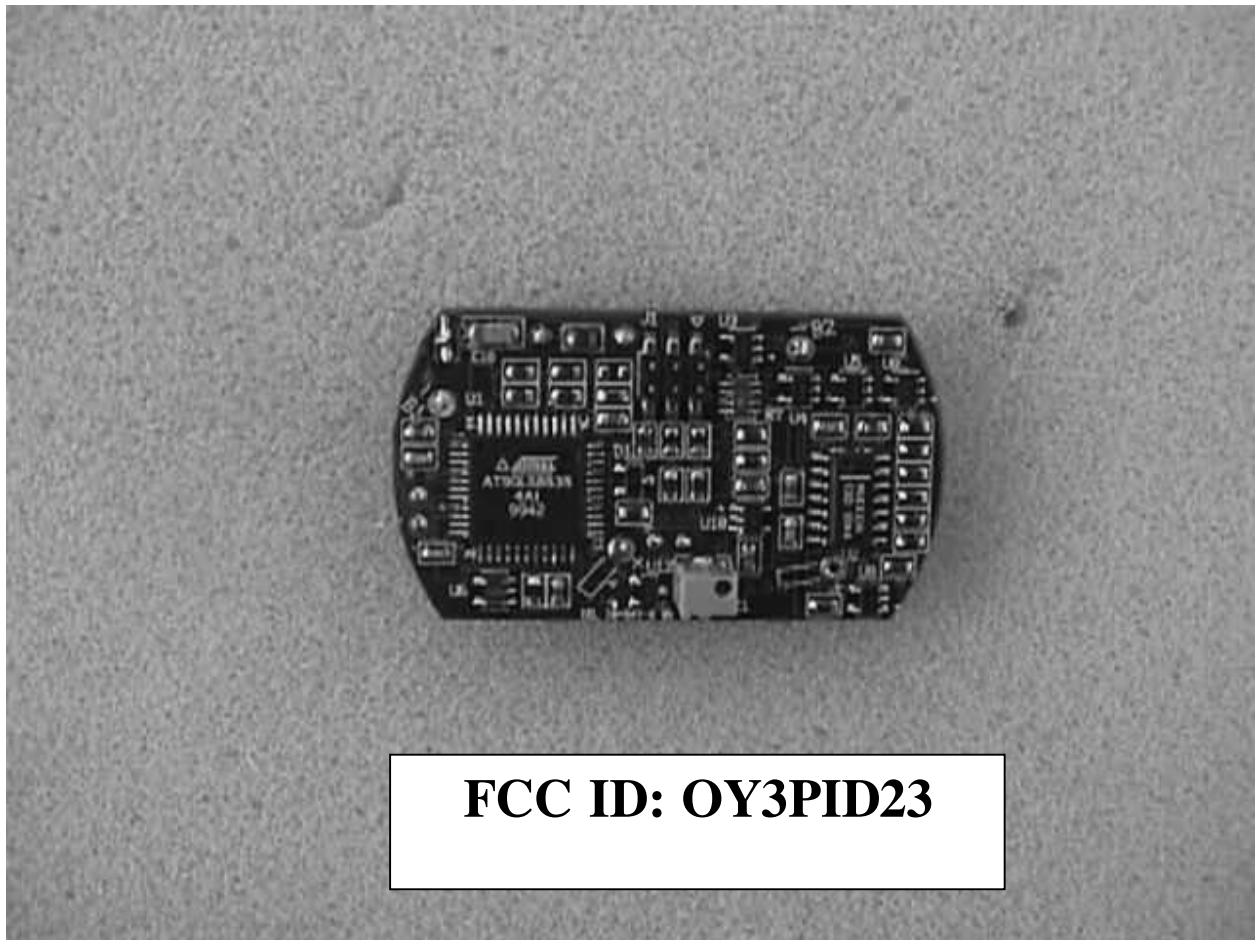
FCC ID LABEL LOCATION

(See ID Label/Location Info. Attachments)

EXHIBIT IV
EQUIPMENT PHOTOS







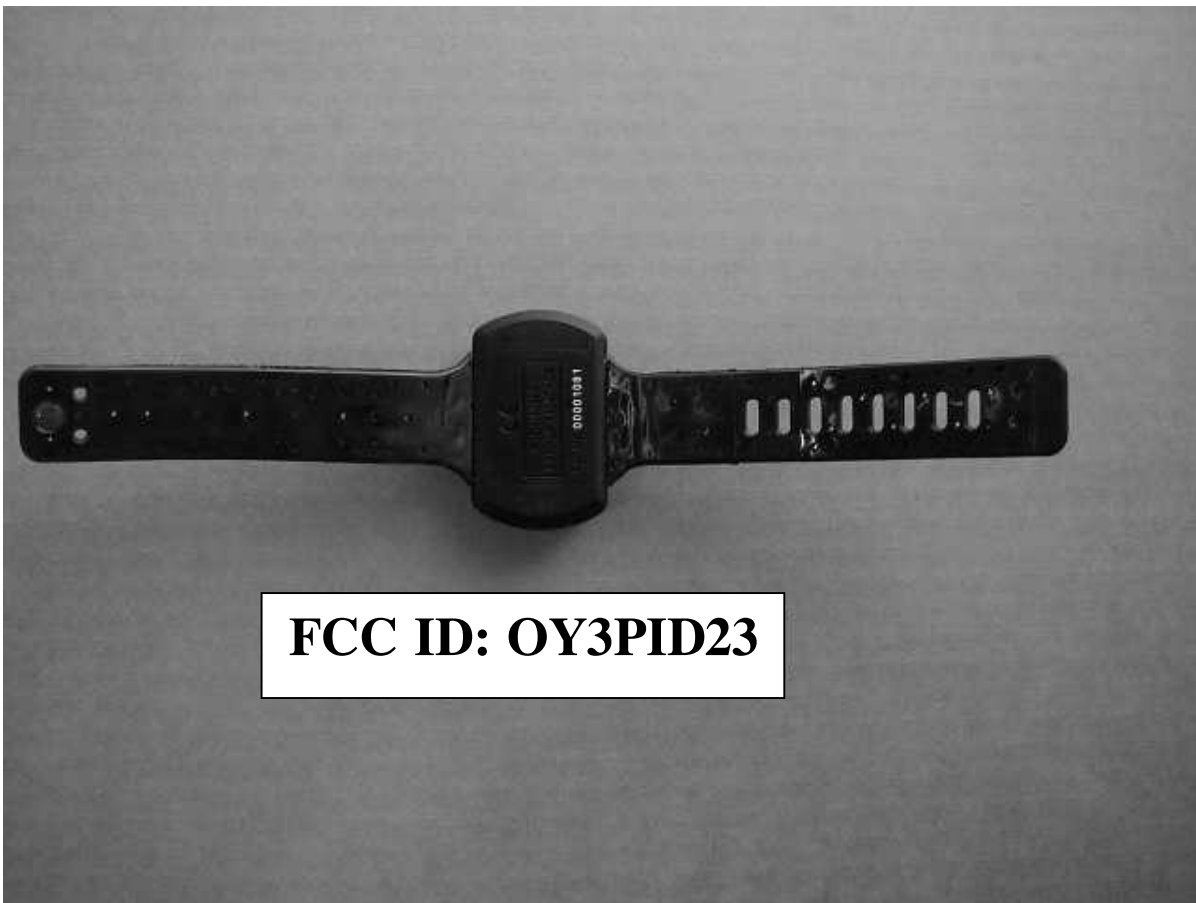


EXHIBIT V

ELECTRICAL SCHEMATICS AND BLOCK DIAGRAM

(See Block Diagram and Schematic Attachments)

EXHIBIT VI

USER MANUAL AND OPERATIONAL DESCRIPTION

(See User Manual and Operational Description Attachments)