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FCC ID: PFUPE1012

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TEST EQUIPMENT LIST

1. Spectrum Analyzer: HP 8566B-Opt 462, S/N 3138A07786, w/
preselector HP 85685A, S/N 3221A01400, Quasi-Peak Adapter
HP 85650A, S/N 3303A01690 & Preamplifier HP 8449B-OPT H02,
S/N 3008A00372
2. Biconnical Antenna: Eaton Model 94455-1, S/N 1057
3. Biconnical Antenna: Electro-Metrics Model BIA-25, S/N 1171
4. Log-Periodic Antenna: Electro-Metrics Model EM-6950, S/N 632
5. Log-Periodic Antenna: Electro-Metrics Model LPA-30, S/N 409
6. Double-Ridged Horn Antenna: Electro-Metrics Model RGA-180,
1-18 GHz, S/N 2319
7. 18-26.3GHz Systron Donner Standard Gain Horn #DBE-520-20
8. Horn 40-60GHz: ATM Part #19-443-6R
9. Line Impedance Stabilization Network: Electro-Metrics Model
ANS-25/2, S/N 2604
10. Temperature Chamber: Tenney Engineering Model TTRC, S/N 11717-7
11. Frequency Counter: HP Model 5385A, S/N 3242A07460
12. Peak Power Meter: HP Model 8900C, S/N 2131A00545
13. Open Area Test Site #1-3meters
14. Signal Generator: HP 8640B, S/N 2308A21464
15. Signal Generator: HP 8614A, S/N 2015A07428
16. Passive Loop Antenna: EMCO Model 6512, 9KHz to 30MHz, S/N
9706-1211
17. Dipole Antenna Kit: Electro-Metrics Model TDA-30/1-4, S/N 153
18. AC Voltmeter: HP Model 400FL, S/N 2213A14499
19. Digital Multimeter: Fluke Model 8012A, S/N 4810047
20. Digital Multimeter: Fluke Model 77, S/N 43850817
21. Oscilloscope: Tektronix Model 2230, S/N 300572

TEST PROCEDURE

GENERAL: This report shall NOT be reproduced except in full without the written approval of TIMCO ENGINEERING, INC.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.4-1992 using a HEWLETT PACKARD spectrum analyzer with a preselector. The bandwidth of the spectrum analyzer was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz. The ambient temperature of the UUT was 88°F with a humidity of 60%.

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TEST PROCEDURES CONTD.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

Example:

Freq (MHz)	METER READING + ACF = FS
33	20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

ANSI STANDARD C63.4-1992 10.1.7 MEASUREMENT PROCEDURES: The UUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The UUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from 30 MHz to 10th harmonic of the fundamental.

Peak readings were taken in three (3) orthogonal planes and the highest readings were converted to average readings based on the duration of "ON" time.

Measurements were made by TIMCO ENGINEERING INC. at the registered open field test site located at 849 N.W. State Road 45, Newberry, FL 32669.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

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NAME OF TEST: RADIATION INTERFERENCE

RULES PART NO.: 15.231

REQUIREMENTS:

Fundamental Frequency MHz	Field Strength of Fundamental dBuV	Field Strength of Harmonics and Spurious Emissions (dBuV/m @ 3m)
40.66 to 40.70	67.04	47.04
70 to 130	61.94	41.94
130 to 174	61.94 to 71.48	41.94 to 51.48
174 to 260	71.48	51.48
260 to 470	71.48 to 81.94	51.48 to 61.94
470 and above	81.94	61.94

THE LIMIT FOR AVERAGE FIELD STRENGTH dBuV/m FOR THE FUNDAMENTAL FREQUENCY= 80.82 dBuV/m. NO FUNDAMENTAL IS ALLOWED IN THE RESTRICTED BANDS.

THE LIMIT FOR AVERAGE FIELD STRENGTH dBuV/m FOR THE HARMONICS AND SPURIOUS FREQUENCIES = 60.82 dBuV/m. SPURIOUS IN THE RESTRICTED BANDS MUST BE LESS THAN 54dBuV/m OR 15.209.

Emission Frequency MHz		Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB	Duty Cycle Factor dB	Field Strength dBuV/m	Margin dB
433.80		62.7	H	3.10	16.98	15.00	67.58	13.24
867.70		34.3	V	4.20	22.22	15.00	45.66	15.17
1,301.50	**	40.8	V	3.00	25.85	15.00	53.92	0.08
1,735.40		32.0	H	3.00	27.20	15.00	46.92	13.90
2,169.20		31.2	V	3.80	28.42	15.00	47.76	13.07
2,603.10		29.0	V	3.80	29.51	15.00	46.99	13.83
3,036.90		10.7	V	4.80	30.59	15.00	30.13	30.69
3,470.80		15.8	V	4.80	31.68	15.00	36.75	24.07
3,904.60	**	10.4	V	4.80	32.76	15.00	32.86	21.14
4,338.50	**	21.1	V	6.20	33.38	15.00	44.75	9.25

SAMPLE CALCULATION OF LIMIT @ 303 MHz:

(470 - 260)Mhz = 210 MHz

(12500 - 3750)uV/m = 8750 uV/m

8750uV/m/210MHz = 41.67 uV/m/MHz

(303-260)MHz = 43 MHz

43 MHz * 41.67 uV/m/MHz = 1791.81 uV/m

(1791.81 + 3750)uV/m = 5541.81 uV/m limit @ 303 MHz

The transmitter ceases transmitting when the button is released.

TEST RESULTS: The unit DOES meet the FCC requirements.

PERFORMED BY: JOSEPH SCOGLIO

DATE TESTED: AUGUST 14, 2001

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CALCULATION OF DUTY CYCLE:

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero(0) frequency span. A plot is then made of the pulse train with a sweep time of 100milliseconds. This sweep determines the duration of the pulse train, which in this case is milliseconds. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100millisecond Plot the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the UUT is on within 100milliseconds. If the pulse train is longer than 100milliseconds then this number is multiplied by 100 to determine the percentage ON TIME. If the pulse train is less than 100milliseconds the total on-time is divided by the length of the pulse train and then multiplied by 100 to determine the percentage ON TIME. In this case there were 33 short pulses 120 microseconds long and 45 long pulses 360 microseconds long for a total of 20.16 milliseconds on time within either the 100milliseconds or the pulse train. The average field strength is determined by multiplying the peak field strength by the percent on time. In this case the percentage ON time was 18.5%percent.

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DUTY CYCLE PLOT - SHORT PULSES

MKR Δ 120.0 μ sec
0.00 dB

hp REF 77.0 dB μ V ATTN 0 dB +0 dB

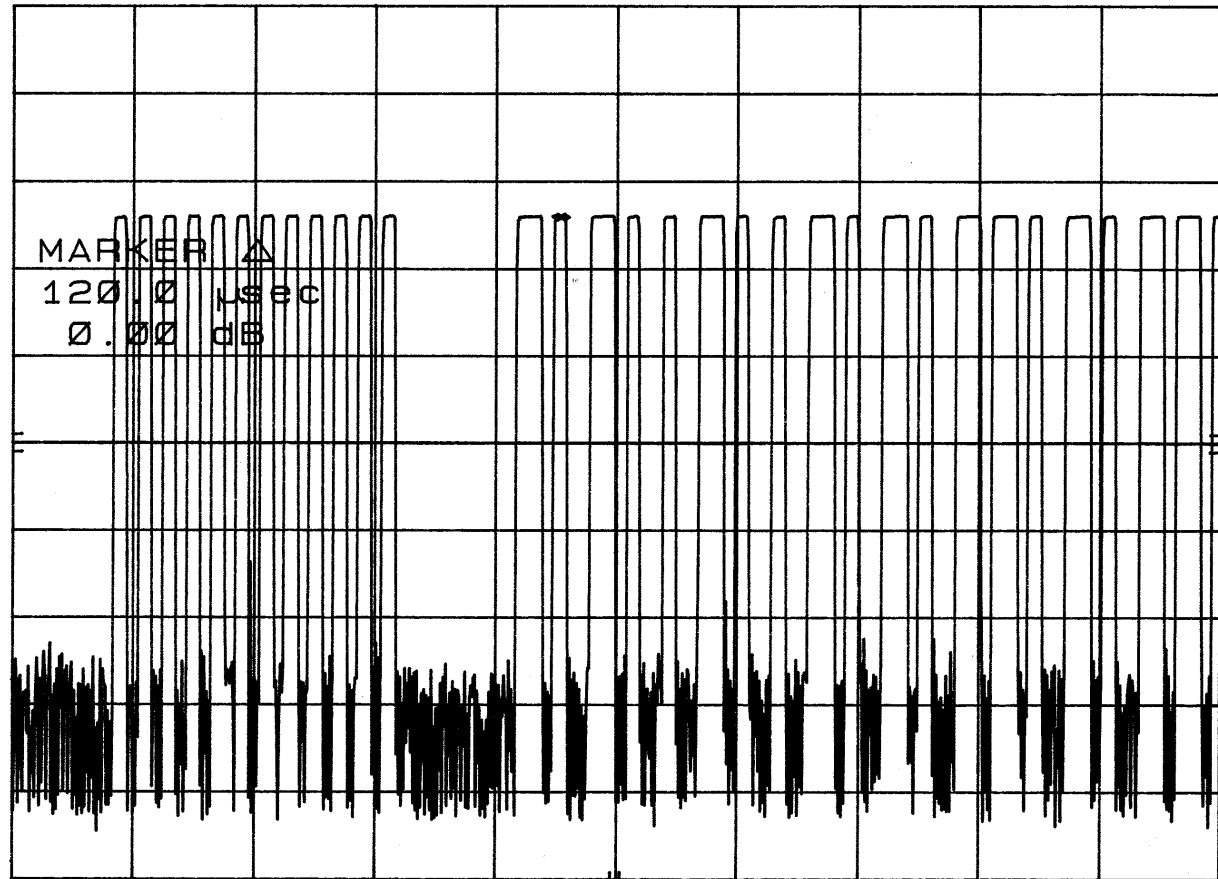
10 dB/

OFFSET
-20.0
dB

DL
27.0
dB μ V

MARKER Δ
120.0 μ sec
0.00 dB

CENTER 433.880 001 MHz SPAN 0 Hz
RES BW 100 kHz (i) VBW 300 kHz SWP 20.0 msec



POLARIS POOL SYSTEMS, INC.
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DUTY CYCLE PLOT - LONG PULSES

MKR Δ 360.0 μ sec
0.50 dB

hp REF 77.0 dB μ V ATTN 0 dB +0 dB

10 dB/

OFFSET
-20.0
dB

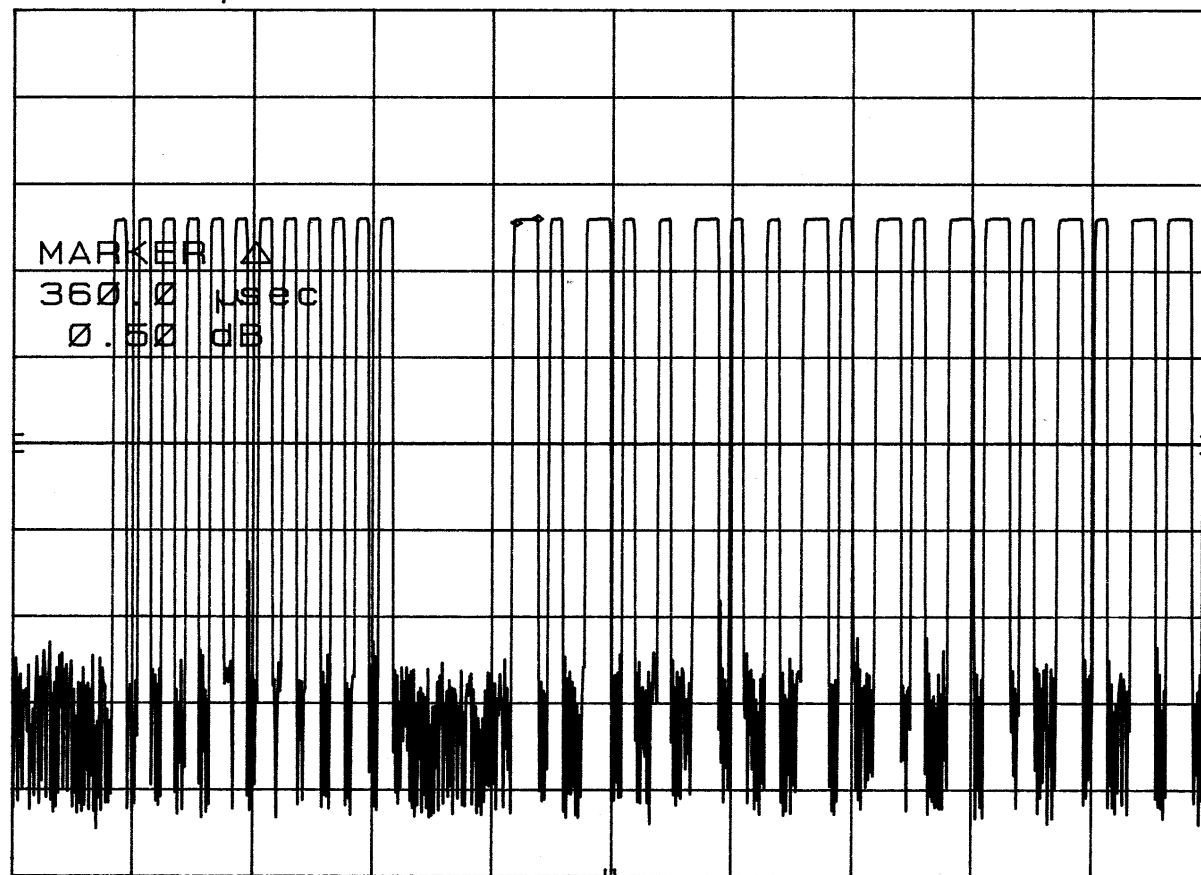
DL
27.0
dB μ V

MARKER Δ
360.0 μ sec
0.50 dB

CENTER 433.880 001 MHz

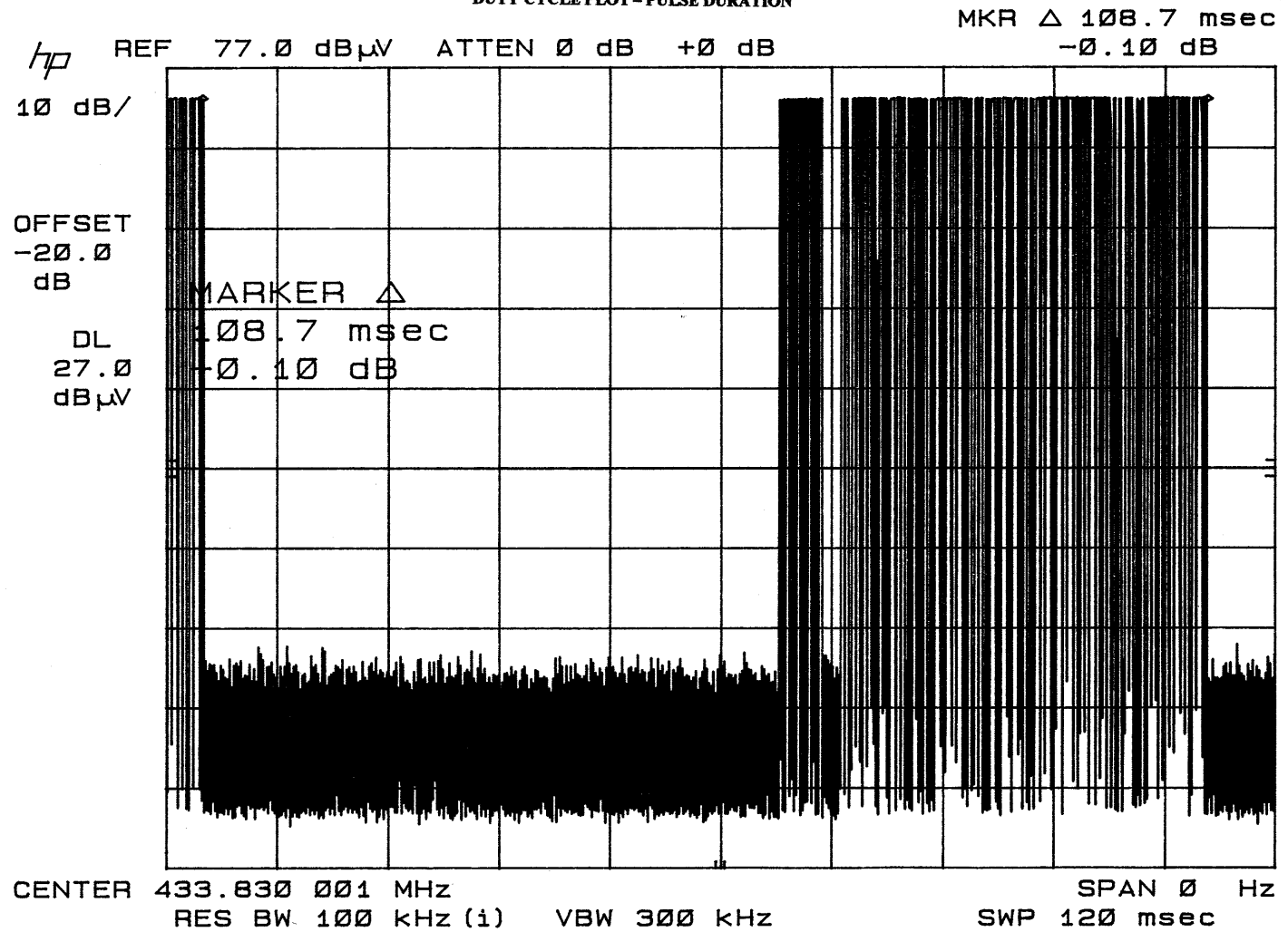
RES BW 100 kHz (1) VBW 300 kHz

SPAN 0 Hz
SWP 20.0 msec



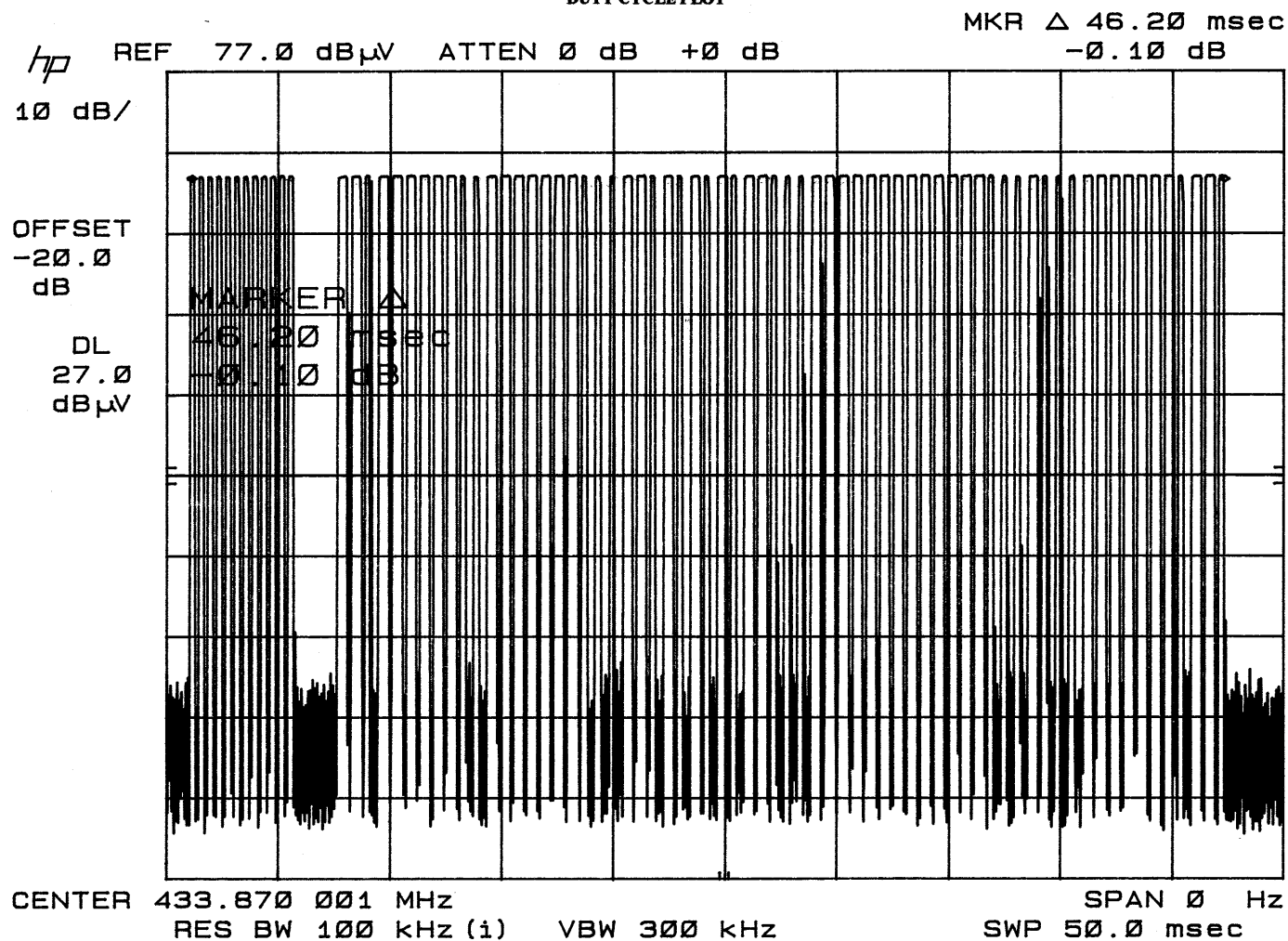
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DUTY CYCLE PLOT - PULSE DURATION



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DUTY CYCLE PLOT



APPLICANT: POLARIS POOL SYSTEMS, INC.

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NAME OF TEST: Occupied Bandwidth

RULES PART NO.: 15.231(C)

REQUIREMENTS: The bandwidth of the emission shall be no wider than .25% of the center frequency for devices operating between 70 and 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

$$\begin{aligned} 433.80 \text{ MHz} * .0025 &= 1.0845 \text{ MHz} \\ 1.0845 \text{ MHz} / 2 &= +/- 542.25 \end{aligned}$$

THE GRAPH IN EXHIBIT 9 REPRESENTS THE EMISSIONS TAKEN FOR THE DEVICE.

METHOD OF MEASUREMENT: A small sample of the transmitter output was fed into the spectrum analyzer and the plot in exhibit 9 was generated. The vertical scale is set to 10 dB per division: the horizontal scale is set to 100 kHz per division.

TEST RESULTS: The unit meets the FCC requirements.

PERFORMED BY: JOSEPH SCOGLIO

DATE: AUGUST 14, 2001

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OCCUPIED BANDWIDTH PLOT

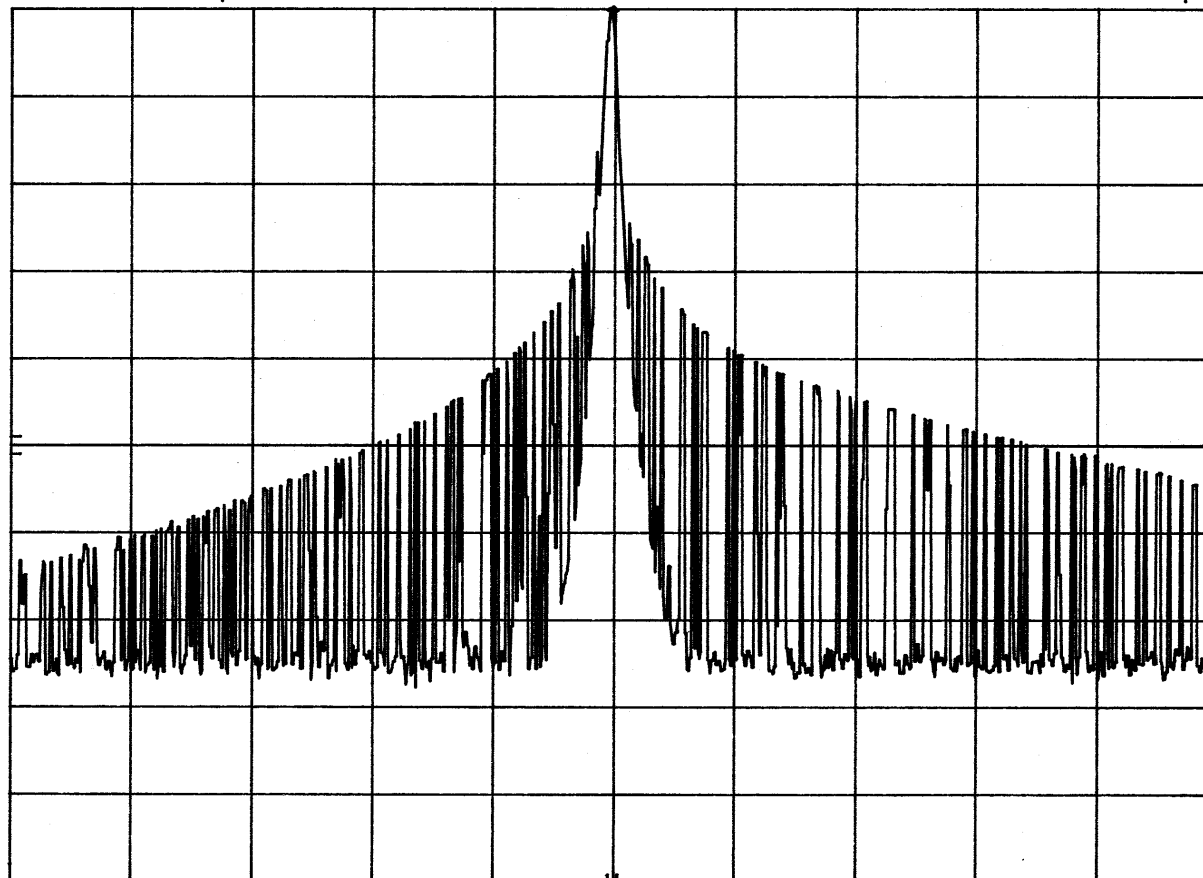
MKR 433.88 MHz
76.90 dB μ V

hp REF 77.0 dB μ V ATTEN 0 dB +0 dB

10 dB/

OFFSET
-20.0
dB

DL
27.0
dB μ V



CENTER 433.9 MHz
RES BW 100 kHz (i) VBW 300 kHz

SPAN 15.0 MHz
SWP 20.0 msec