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FCC ID: NAHCLCD4

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APPLICANT: AUTOSTART

FCC ID: NAHCLCD4

REPORT #: A\AUTONAH\1384AUT3\1384AUT3TestReport.doc  
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## EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
3-Meter OATS	TEI	N/A	N/A	Listed 1/13/03	1/13/06
Biconnical Antenna	Eaton	94455-1	1057	CAL 3/18/03	3/18/05
Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
Biconnical Antenna	Electro- Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/15/03	4/15/05
Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 4/15/03	4/15/05
Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/15/03	4/15/05
Double -Ridged Horn Antenna	Electro- Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
LISN	Electro- Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03
LISN	Electro- Metrics	EM-7820	2682	CAL 3/12/03	3/12/05
Log-Periodic Antenna	Eaton	96005	1243	CAL 5/8/03	5/8/05

## 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 pre-selector. 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 98.3°F with a humidity of 40%.

**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 Pre-selector 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.

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.

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.

**APPLICANT:** AUTOSTART  
**FCC ID:** NAHCLCD4  
**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.

**TEST DATA (PHASE 1):**

Emission Frequency MHz		Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB	Duty Cycle Factor dB	Field Strength dBuV/m	Margin dB
433.94		70.4	H	2.90	17.00	12.29	78.01	2.81
433.94		72.7	V	2.90	16.42	12.29	79.73	1.09
867.88		29.3	H	4.14	22.86	12.29	44.01	16.82
867.88		30.1	V	4.14	22.14	12.29	44.09	16.74
1,301.85	**	24.2	H	1.35	26.23	12.29	39.49	14.51
1,301.85	**	28.5	V	1.35	26.23	12.29	43.79	10.21
1,735.78		25.8	H	1.57	27.70	12.29	42.78	18.05
1,735.78		28.8	V	1.57	27.75	12.29	45.83	15.00
2,169.70		30.3	H	1.77	28.87	12.29	48.65	12.18
2,169.70		32.2	V	1.77	28.94	12.29	50.62	10.21
2,603.61		33.5	H	1.94	29.63	12.29	52.78	8.04
2,603.61		37.8	V	1.94	29.63	12.29	57.08	3.74
3,037.62		24.7	H	2.11	30.58	12.29	45.10	15.72
3,037.62		28.4	V	2.11	30.58	12.29	48.80	12.02
3,471.58		24.8	V	2.24	31.44	12.29	46.19	14.63
3,471.58		24.8	H	2.24	31.54	12.29	46.29	14.53
3,905.52	**	9.8	H	2.37	32.82	12.29	32.70	21.30
3,905.52	**	10.7	V	2.37	32.64	12.29	33.42	20.58
4,339.40	**	14.7	H	2.50	33.10	12.29	38.01	15.99
4,339.40	**	17.0	V	2.50	32.97	12.29	40.18	13.82

**APPLICANT:** AUTOSTART  
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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

**TEST DATA (PHASE 2):**

Emission Frequency MHz		Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB	Duty Cycle Factor dB	Field Strength dBuV/m	Margin dB
433.94		67.8	V	2.90	16.42	12.29	74.83	5.99
433.94		71.4	H	2.90	17.00	12.29	79.01	1.81
867.88		26.1	H	4.14	22.86	12.29	40.81	20.02
867.88		29.1	V	4.14	22.14	12.29	43.09	17.74
1,301.85	**	25.1	V	1.35	26.23	12.29	40.39	13.61
1,301.85	**	26.6	H	1.35	26.23	12.29	41.89	12.11
1,735.78		24.3	V	1.57	27.75	12.29	41.33	19.50
1,735.78		29.7	H	1.57	27.70	12.29	46.68	14.15
2,169.70		33.5	V	1.77	28.94	12.29	51.92	8.91
2,169.70		38.7	H	1.77	28.87	12.29	57.05	3.78
2,603.61		36.8	V	1.94	29.63	12.29	56.08	4.74
2,603.61		36.9	H	1.94	29.63	12.29	56.18	4.64
3,037.62		24.3	V	2.11	30.58	12.29	44.70	16.12
3,037.62		31.6	H	2.11	30.58	12.29	52.00	8.82
3,471.58		22.7	H	2.24	31.54	12.29	44.19	16.63
3,471.58		24.5	V	2.24	31.44	12.29	45.89	14.93
3,905.52	**	10.8	V	2.37	32.64	12.29	33.52	20.48
3,905.52	**	11.7	H	2.37	32.82	12.29	34.60	19.40
4,339.40	**	13.8	V	2.50	32.97	12.29	36.98	17.02
4,339.40	**	14.0	H	2.50	33.10	12.29	37.31	16.69

**APPLICANT:** AUTOSTART  
**FCC ID:** NAHCLCD4  
**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

**TEST DATA (PHASE 3):**

Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB	Duty Cycle Factor dB	Field Strength dBuV/m	Margin dB
433.94	70.6	V	2.90	16.42	12.29	77.63	3.19
433.94	73.0	H	2.90	17.00	12.29	80.61	0.21
867.88	29.1	H	4.14	22.86	12.29	43.81	17.02
867.88	29.6	V	4.14	22.14	12.29	43.59	17.24
1,301.85	** 22.4	H	1.35	26.23	12.29	37.69	16.31
1,301.85	** 28.0	V	1.35	26.23	12.29	43.29	10.71
1,735.78	26.6	H	1.57	27.70	12.29	43.58	17.25
1,735.78	28.5	V	1.57	27.75	12.29	45.53	15.30
2,169.70	33.6	H	1.77	28.87	12.29	51.95	8.88
2,169.70	33.8	V	1.77	28.94	12.29	52.22	8.61
2,603.61	34.5	H	1.94	29.63	12.29	53.78	7.04
2,603.61	39.7	V	1.94	29.63	12.29	58.98	1.84
3,037.62	29.0	V	2.11	30.58	12.29	49.40	11.42
3,037.62	31.7	H	2.11	30.58	12.29	52.10	8.72
3,471.58	25.3	H	2.24	31.54	12.29	46.79	14.03
3,471.58	28.7	V	2.24	31.44	12.29	50.09	10.73
3,905.52	** 10.0	H	2.37	32.82	12.29	32.90	21.10
3,905.52	** 12.1	V	2.37	32.64	12.29	34.82	19.18
4,339.40	** 14.7	V	2.50	32.97	12.29	37.88	16.12
4,339.40	** 15.8	H	2.50	33.10	12.29	39.11	14.89

**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:** NAM NGUYEN

**DATE TESTED:** OCTOBER 17, 2003

APPLICANT: AUTOSTART

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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 100 msec. If the pulse train is longer than 100 msec then this number is multiplied by 100 to determine the percentage ON TIME. If the pulse train is less than 100 msec 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 67 short pulses .1 msec long, 16 medium pulses .5 msec long, and 12 long pulses .8 msec long for a total of 100 msec on time within either the 100 msec or the pulse train. In this case the ON time was 24.3 msec long. 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 12.29 %percent.

$dB = 20 \cdot \log(\text{ON time})$

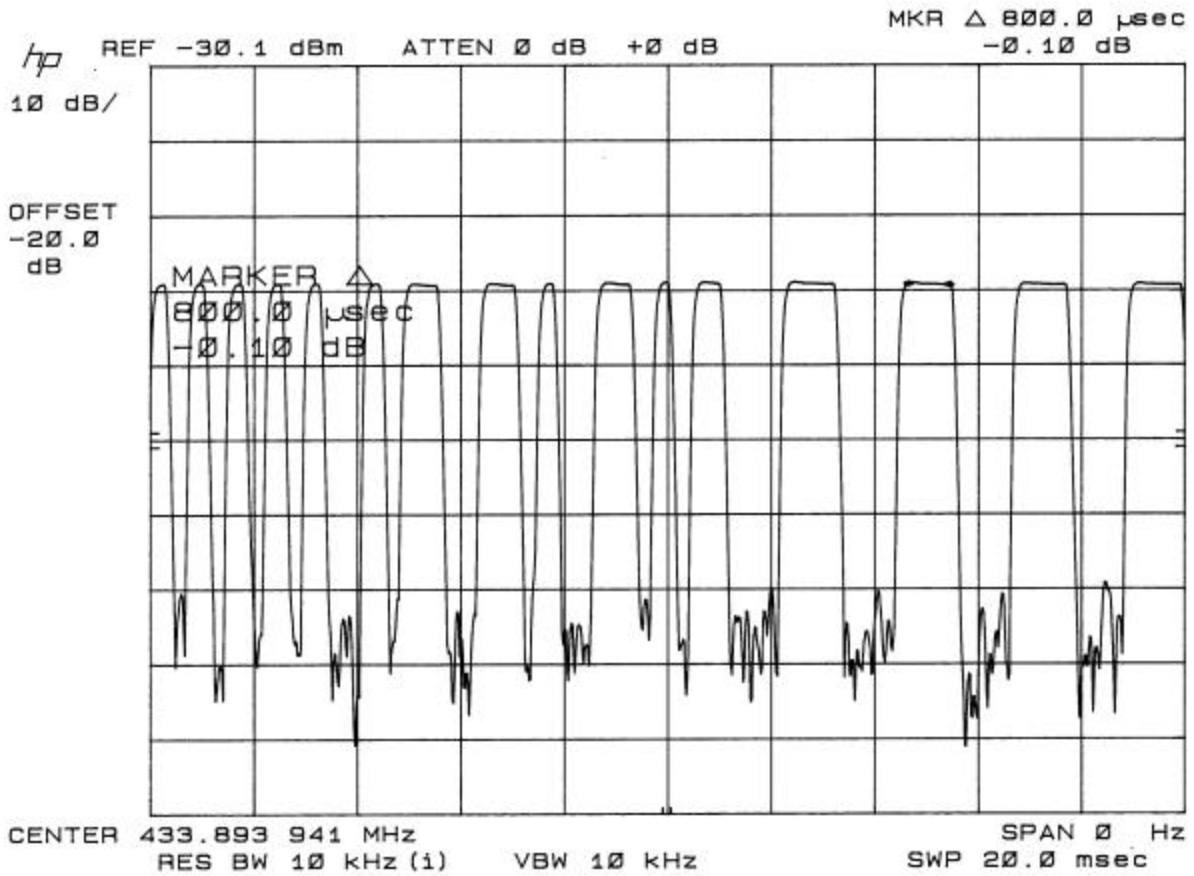
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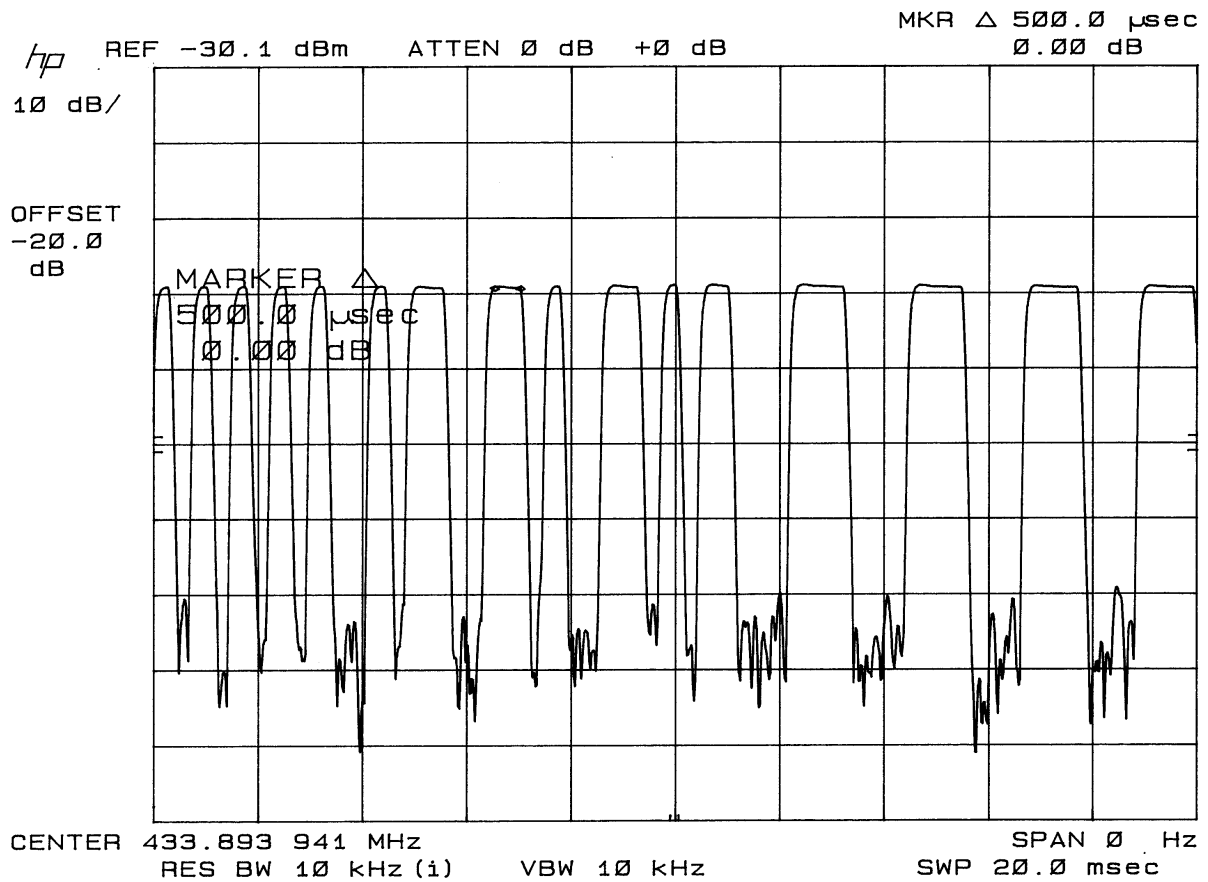
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DUTY CYCLE PLOT  
LONG PULSES

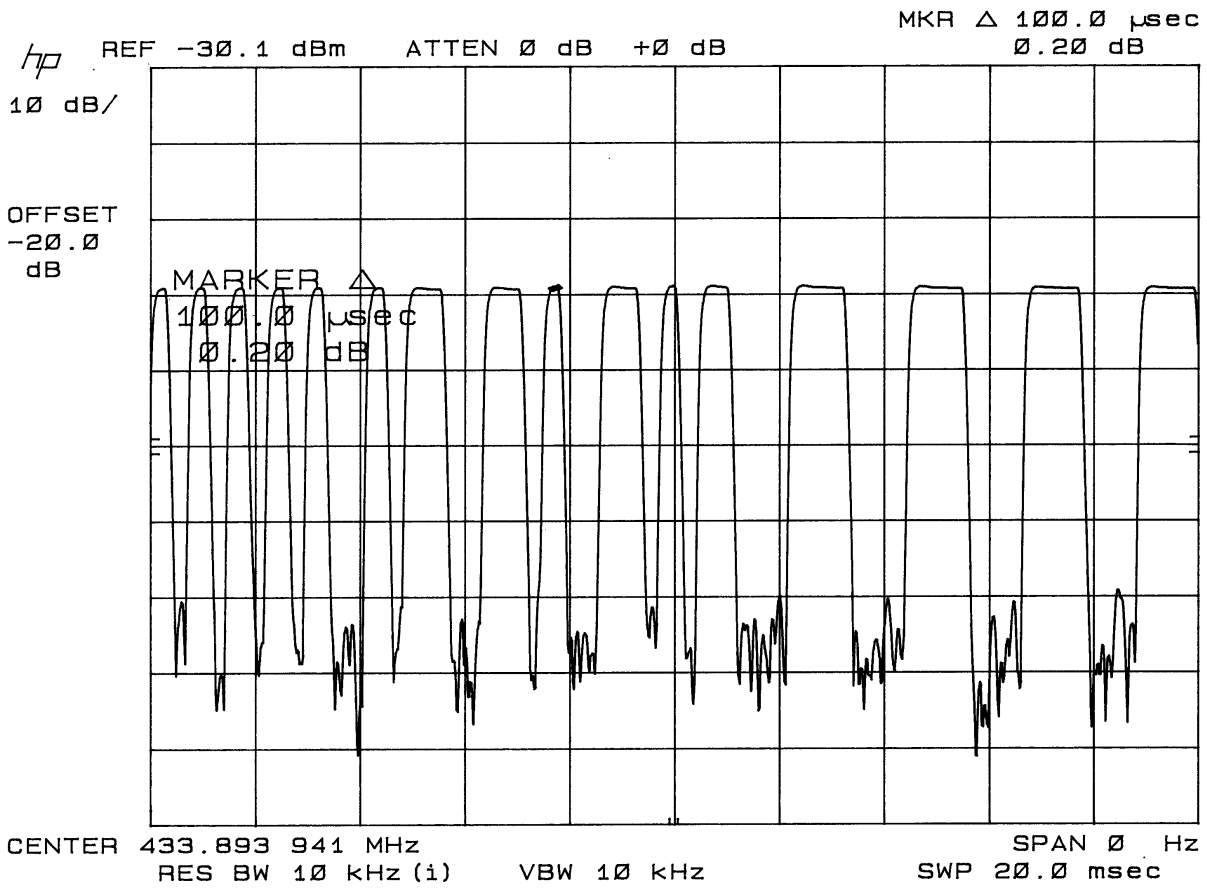




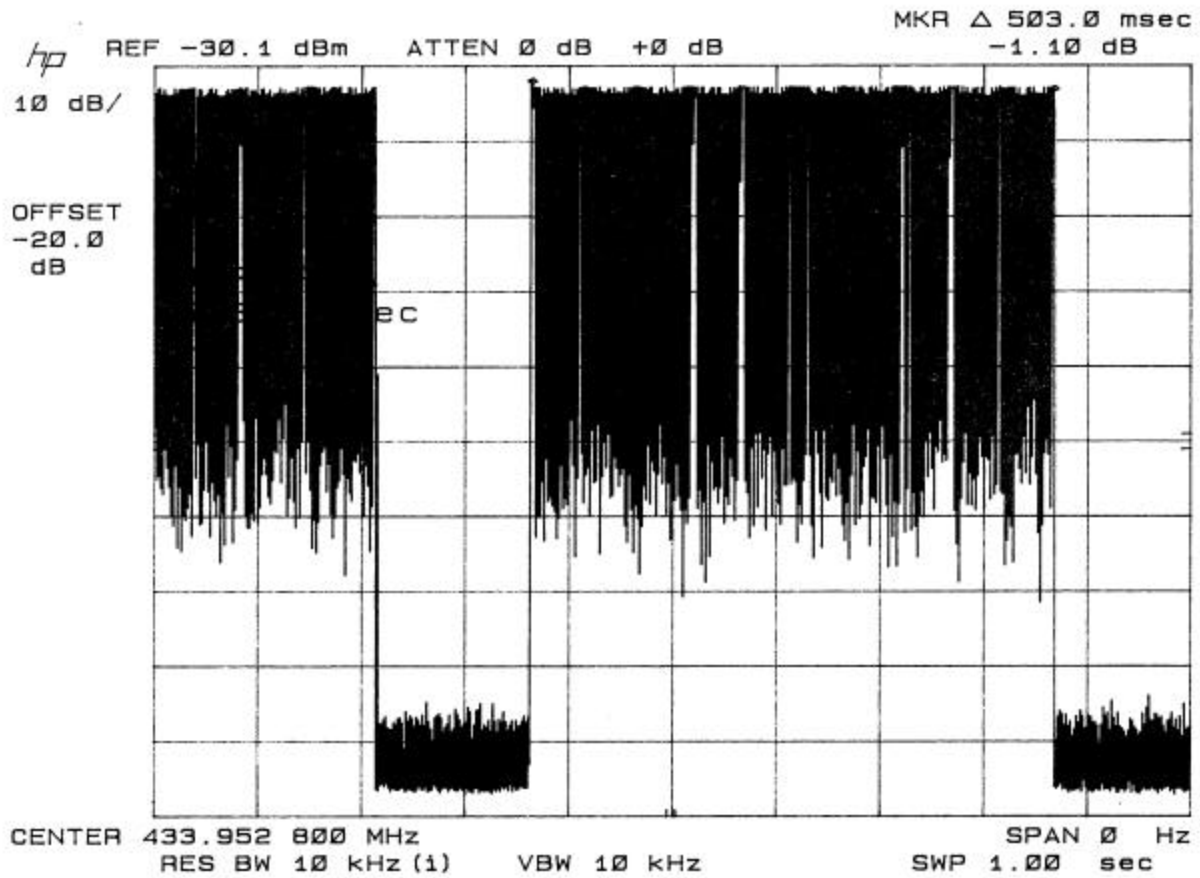
DUTY CYCLE PLOT  
MEDIUM PULSES



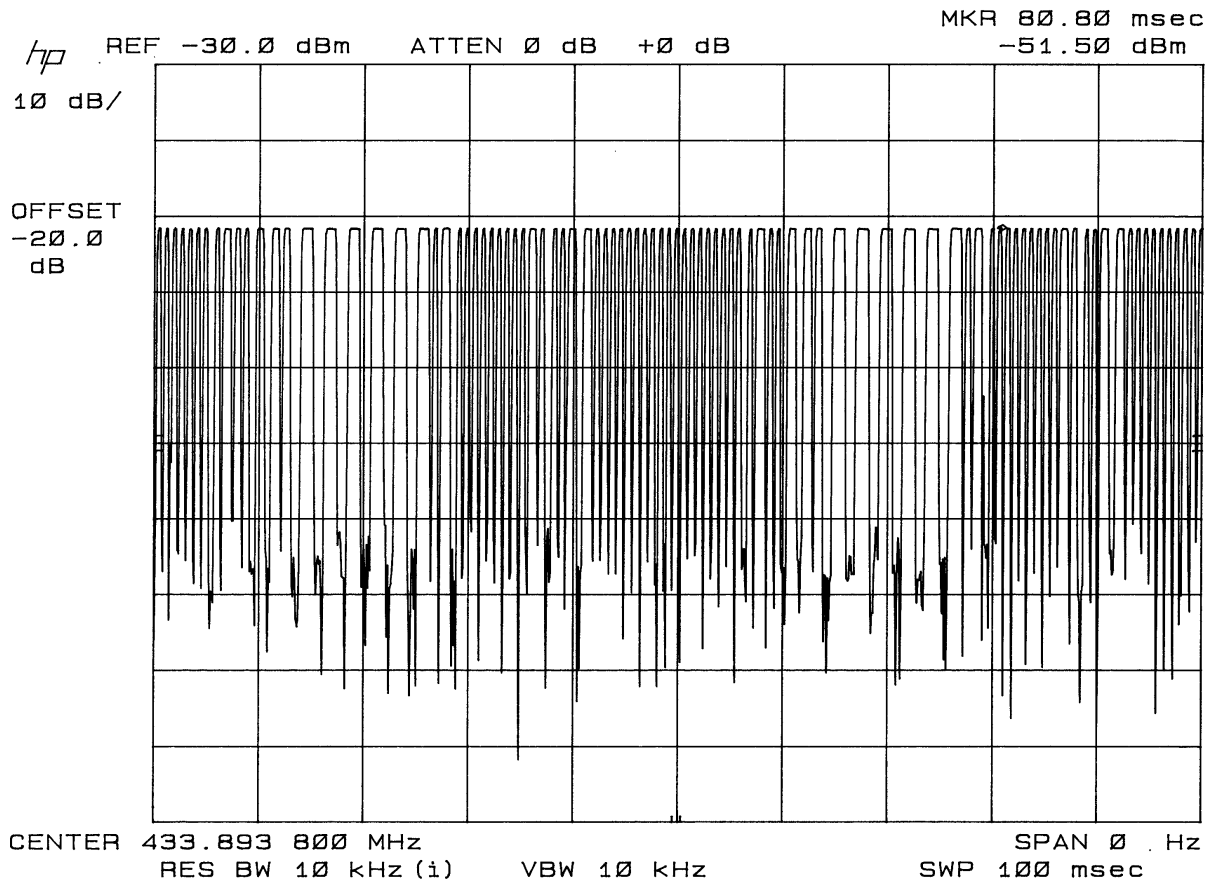
DUTY CYCLE PLOT  
SHORT PULSES



DUTY CYCLE PLOT  
COMPLETE PULSE TRAIN



DUTY CYCLE PLOT  
100 msec SAMPLE



**APPLICANT:** AUTOSTART

**FCC ID:** NAHCLCD4

**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.

$$\begin{aligned} 433.94 \text{ MHz} * .0025 &= 1.08485 \text{ MHz} \\ 1.08485 \text{ MHz} / 2 &= +/- 542.425 \end{aligned}$$

**TEST DATA:**

**THE GRAPH ON THE FOLLOWING PAGE 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:** NAM NGUYEN

**DATE:** OCTOBER 17, 2003

**APPLICANT:** AUTOSTART

**FCC ID:** NAHCLCD4

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# OCCUPIED BANDWIDTH PLOT

