DNB ENGINEERING, INC.

CERTIFICATION
FOR
INTENTIONAL RADIATOR

per
Part 15 Subpart C
(CFR 47, 15.201, - 15.209 &15.249)

WIRELESS CONTROLLER
Model No. Command Pro 21T18
903.0 – 927.0 MHz

PREPARED FOR APPLICANT:
REMTRON, INC.
1916 W. Mission Rd.
Escondido, Ca 92029-1114

PREPARED BY:
DNB ENGINEERING, INC.
3535 W. Commonwealth Ave.
Fullerton, CA 92833
(714) 870-7781

TRANSMITTAL SUMMARY

Unit tested:	Wireless Controller
Model #:	Command Pro 21T18
FCC ID:	EGT818TX
Specifications:	ANSI C63.4 1992 and CFR 47 FCC part 15 Subpart C
Purpose of Report:	This report was prepared to document the status of the Wireless Controller (903-927 MHz) with requirements of the standards listed above.
Requirements not applicable to EUT	Part 15.37 - Not applicable Emergency Broadcast System - Not applicable Spread Spectrum Exhibit - Not applicable Scanning Receiver - Not applicable
Test Summary	The EUT's compliance status according to the tests performed is as follows.

REQUIREMENTS	STATUS
FCC part 15 Subpart C	
per 15.201-, 15.209 & 15.249	COMPLIANT

The report shall not be reproduced, except in full, without the written approval of DNB ENGINEERING, INC. Results contained in this report relate only to the item tested.

The Command Pro 21T18 met all the criteria pertaining to standards called out for testing.

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1.0 ADMINISTRATIVE DATA

Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 15 Subpart C (CFR 47, 15.201 – 15.209 and 15.249). The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.

All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.

Bryan Broaddus (Para. 1.1)

Manager, Test Dept.

DNB Engineering, Inc.

Tel. (714) 870-7781 FAX (714) 870-5081

1.1.1 Request for Certification Per 2.1033(b)1:

Applicant: Remtron, Inc.
1916 W. Mission Rd.
Escondido, CA 92029-1114

Contact: Art McBride
Phone: (619) 737-7800

Equipment Under Test: Wirless Controller

FCC ID: EGT818TX

1.2 Related Submittals/Grants

None.

1.3 Purpose of Tests

The purpose of this series of tests was to demonstrate the Electromagnetic Compatibility (EMC) characteristics of the EUT. The following tests were performed:

REQUIREMENTS	STATUS
FCC part 15 Subpart C	
Per 15.201- 15.209 &15.249	COMPLIANT

2. TEST DESCRIPTION

2.1 Test Configuration

Configuration	Unit Name - Processor, Monitor Printer, Cable, etc. (indent for features of a unit)	Style/Model/ Part No.	Comments/ FCC ID#
A	Wireless Controller (903-927 MHz)	Command Pro	EGT818TX

2.2 Equipment Description

Please see Appendix A

2.3 Mode of Operation

EUT was placed in three orthogonal positions to determine worst case emissions. Fresh batteries were used for final measurements.

2.4 Antenna Requirement - per 15.203

The antenna is internally fixed.

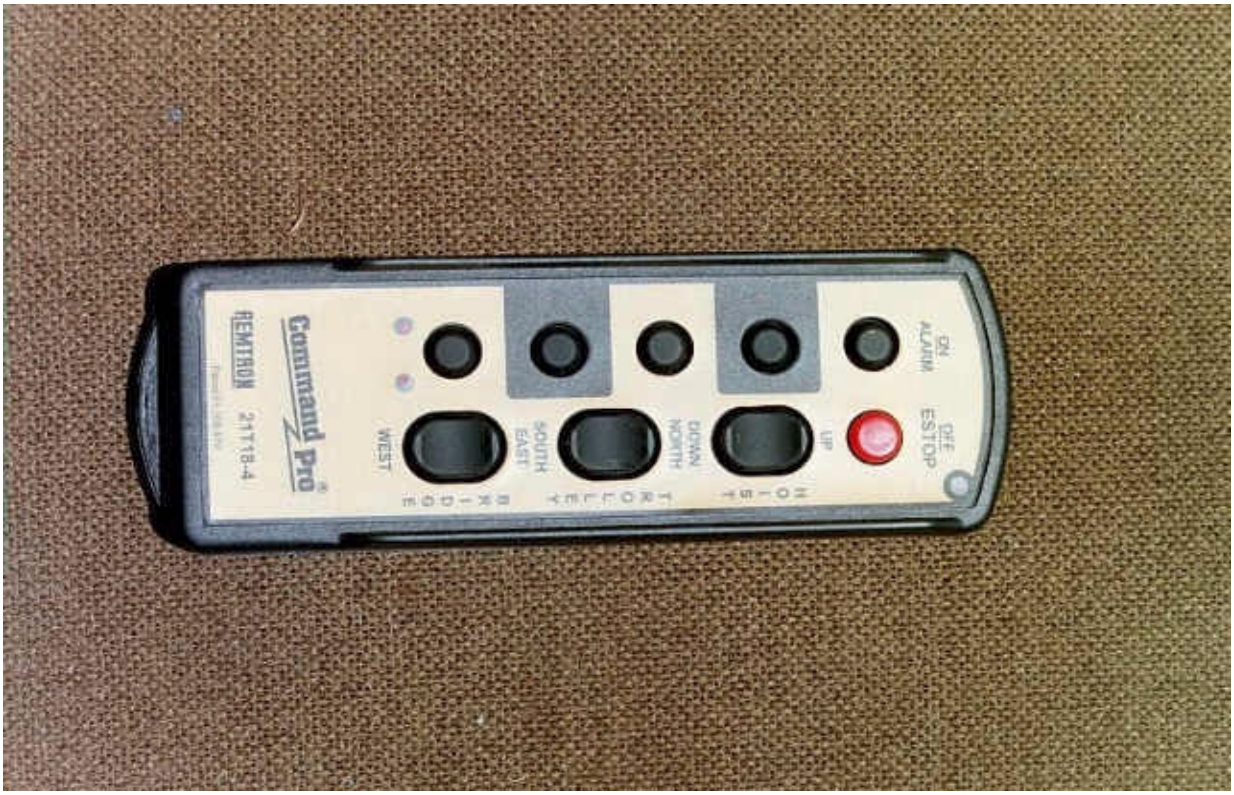
2.5 Circuit Description - per 2.1033(b)4

Please see Appendix A.

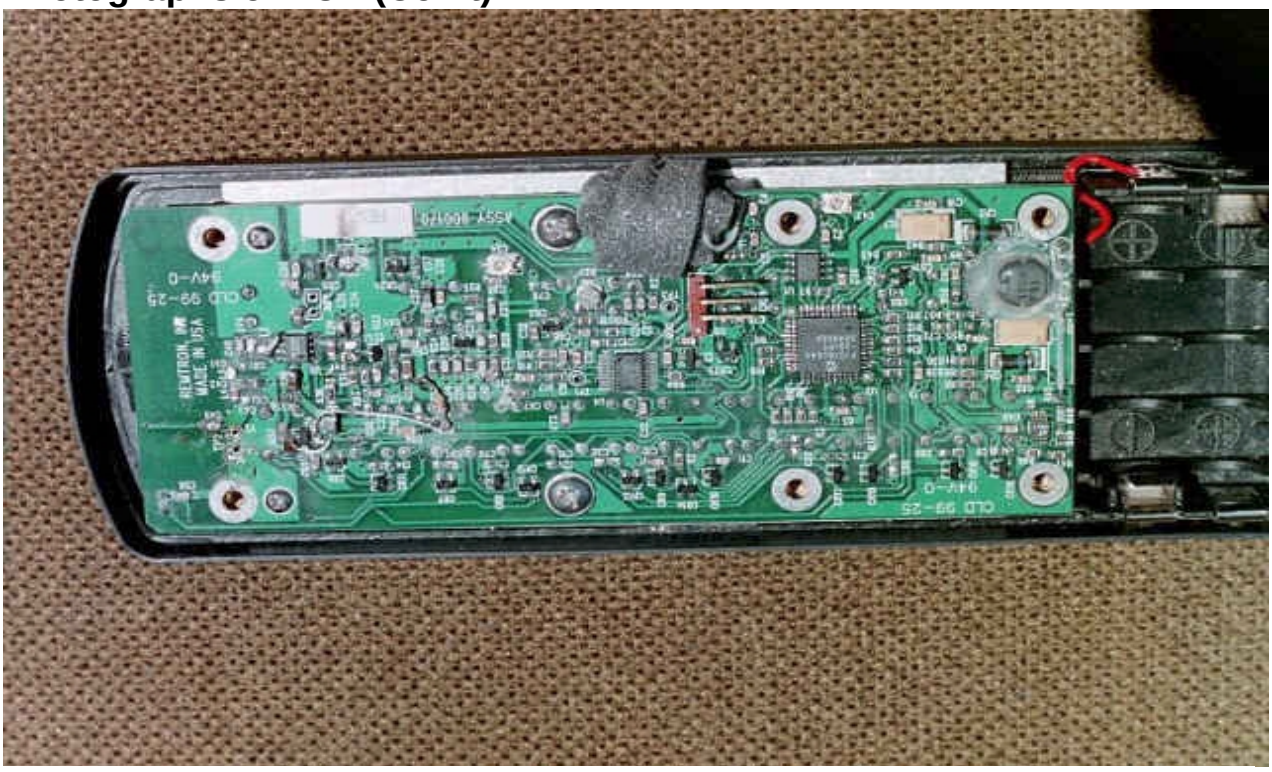
2.6 Schematics

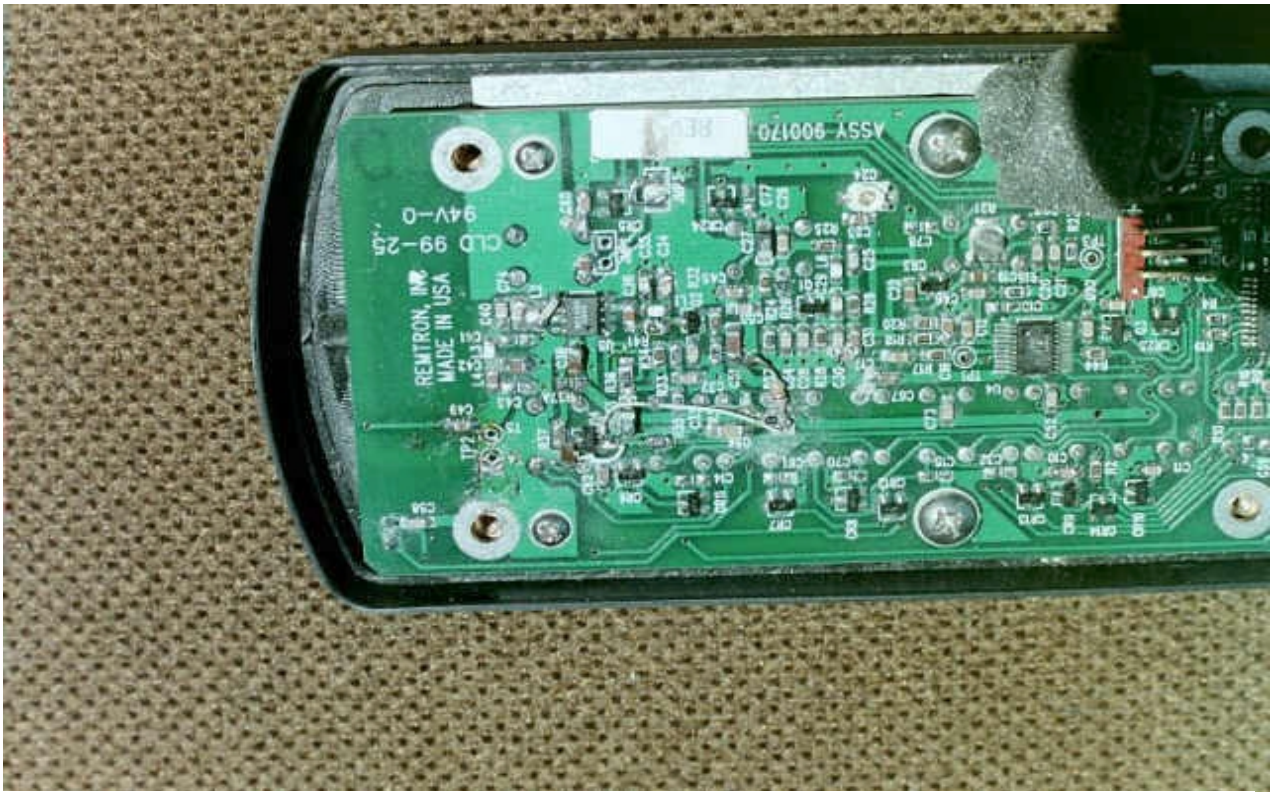
Please see section 5.0

2.7 Photographs of EUT - per 2.1033(b)(7)



Photographs of EUT (Con't)





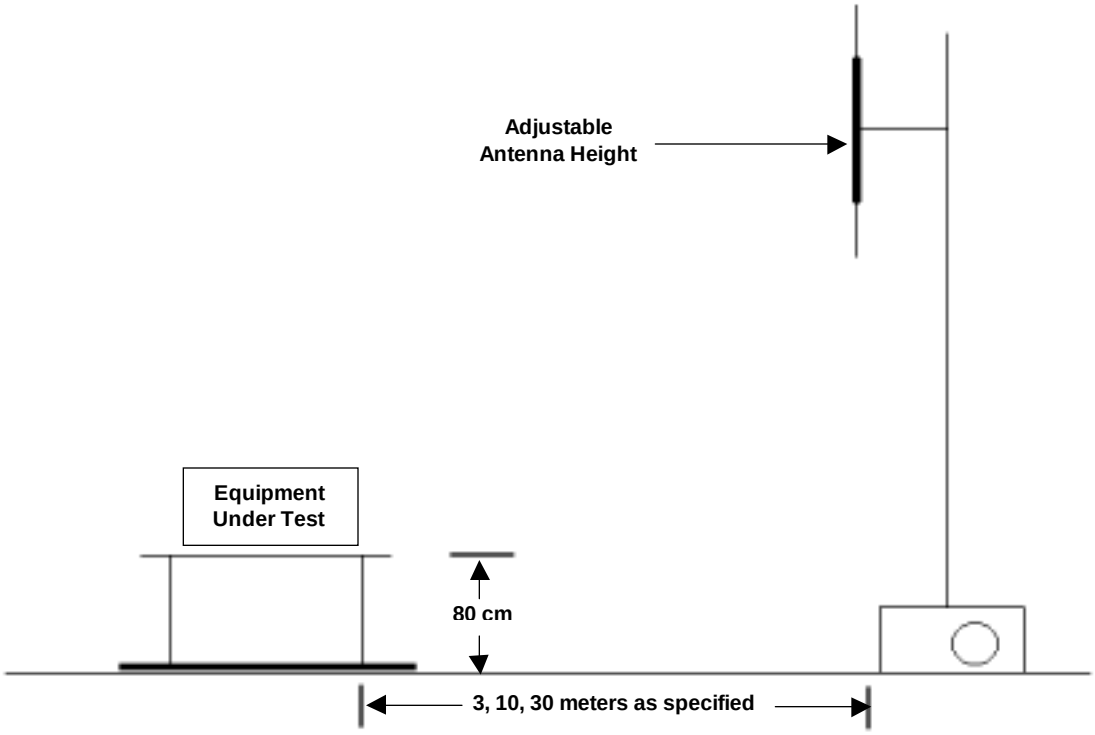
3. EMISSIONS

Per FCC Part 15 Subpart C

3.1 Radiated Emissions Test Setup and Procedure - Per 2.1033(b)(6) Per 2.947(a)

The EUT was placed on a wooden table 1 meter wide and 1.5 meters long, which rests on a low profile, steel-top turntable in a semi-anechoic test site. The top of the table is 80 cm above the ground plane. The turntable can be rotated 360 degrees. Measuring antenna is set at the prescribed distance. (Measurements are made with broad band antennas that have been correlated with tuned dipole antennas). The mast is 4.5 meters high and is self-supporting. The height of the antenna can be varied from 1 to 4 meters. Positioning of the antenna is controlled remotely.

3.1.1 Spurious Radiation Test Site Per 2.1033(b)6



Radiated Test Setup and Procedure - cont'd

The EUT is put into the operational test mode as stated in Section 2.2.1 is then started.

The spectrum analyzer is setup to store the peak emission over the band of the antenna. Peak EUT and ambient emissions are stored while the turntable is rotated 360^0. Peak spectrum analyzer trace is then recorded with the addition of antenna and cable correction factors. The limit is recorded on the same graph. A receiver with CISPR Quasi Peak capabilities is then used on the frequencies identified as the highest with respect to the plotted limit. Ambience is noted on the graph along with EUT emissions. The highest EUT frequencies, with respect to the limit, are maximized.

To maximize emissions levels, the turntable is rotated and the antenna is raised and lowered to determine the point of maximum emanations. The cables are then manipulated at that point to maximize emissions. Measurements are made with the antennas in each horizontal and vertical polarization separately. The data obtained from these tests is corrected with the proper cable, preamplifier and antenna factors. The results are then transcribed onto tables that show the maximum emission levels. The highest emissions are listed in a Radiated Emissions Summary table.

If no emissions can be found, the lowest harmonics of the EUT clocks within the bands of the standard are tuned into with the receiver. If no emissions are found, the noise floor will be entered into the table and noted. A minimum of six frequencies will be logged. Summary results will reflect only actual emissions from the EUT.

The field intensity measurements are made using standard techniques with a spectrum analyzer or EMI receiver as the calibrated Field Intensity Meter (FIM). Preamplifiers and filters are used when required.

When using the Hewlett Packard Model 8566B Spectrum Analyzer as the FIM, the Analyzer is calibrated to read signal level in dBm. Where:

0 dBm (50 ohms) = 107 dBuV (50 ohms)

The signal level (dBuV) = indicated signal level (dBm) + 107 dB. To obtain the signal level in dBuV/m it is necessary to add the antenna factor in dB.

3.1.2 Example Of Typical Calculation Per 2.1033(b)6

Measurement Distance = 3 Meter		
Reading @ 60 MHz	→	49.0 dBuV
Antenna Factor	+7.5 dBuV	
Cable Loss	+2.0 dBuV	
Preamplifier	-25.5 dBuV	
	-16.0 dBuV →	-16.0 dBuV
Field Strength dBuV/m at 3 Meter	→	33.0 dBuV

The Following FCC limits for acceptance were used:

Limit 902 to 928 MHz (At the Carrier Frequency):
50,000 μV/M = 20 log (50,000) dBμV/M = 94.0 dBμV/M @ 3 Meters

Limit 88 to 216 MHz (Not at the Carrier Frequency):
150 μV/M = 20 log (150) dBμV/M = 43.5 dBμV/M @ 3 Meters

Limit 216 to 960 MHz:
200 μV/M = 20 log (200) dBμV/M = 46 dBμV/M @ 3 Meters

Limit 30 to 88 MHz:
100 μV/M = 20 log (100) dBμV/M = 40.0 dBμV/M @ 3 Meters

Limit >960 MHz:

500μV/M = 20 log (500) dBμV/M = 54.0 dBμV/M @ 3 Meters

3.1.3 Field Strength of Fundamental

Test equipment used for all measurements is provided on page 12

Test results are provided on pages 13 & 14.

3.1.4 Harmonic Radiated Emissions

Test equipment used for all measurements is provided on page 12.

Test results are provided on pages 13 & 14.

3,1,5 Spurious Emissions Not Associated With Fundamental

Per FCC Part 15 Subpart C, 15.209 @ 3meters, No emissions were deleted.

TEST EQUIPMENT LOG

Customer: Remtron **Test Procedure:** FCC Part 15

EUT: Crane Remote Control **Test Specification:** Radiated Emissions

Model / Part #: Command Pro 21T18-4 **Test Engineer:** John Stanford

Serial #: N/A **Customer Rep:** N/A

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DUE DATE
Spec. Analyzer	HP	HP8568B/2732A04091	4/25/01
Spec. Analyzer	HP	HP8566B/2637A03865	5/15/00
Tower Controller	EMCO	1050	Cal Prior to use
Table Controller	EMCO	1060c	Cal Prior to use
Log Periodic Ant	A & H Systems	SAS-200/512 - 371	07 / 14 / 2000
Pre-Amp	MCL	ZFL2000	03 / 17 / 2001
Coaxial	Belden	RG-214	Cal prior to use
Pre-Amp	Mini-Circuits	0.7 to 4 GHz	03/17/01
Pre-Amp	Mini-Circuits	ZFL-2000	03/17/01
Pre-Amp	Avantek	SWL-88	03/17/01
DRG Antenna	Electrometrics	RGA-60 - 6103	1/12/01

FORM 0010

FCC Fundamental and Harmonic Frequency Test
Remtron Command Pro 21T18 Wireless Controller April 27-28, 2000

Harmonic	Freq (MHz)	Pol	Pos	Angle	Ant Ht (cm)	dBuV/m (Uncorrected)	AF	COAX	AMP	DUTY CYCLE	CF	dBuV/m (Corrected W/O duty cycle)	dBuV/m (Fully Corrected)	dB above 50 mV/m (94 dBuV/m)	dB above 500 uV/m (54 dBuV/m)
	Fund. Freq														
LB	903	H	1	252	144	104.20	23.00	3.50	30.50	12.54	-16.54	100.20	87.66	-6.34	-
LB	903	V	2	91	100	105.20	23.00	3.50	30.50	12.54	-16.54	101.20	88.66	-5.34	-
MB	915	H	1	261	144	107.10	22.90	3.50	30.50	12.54	-16.64	103.00	90.46	-3.54	-
MB	915	V	1	195	256	97.60	22.90	3.50	30.50	12.54	-16.64	93.50	80.96	-13.04	-
MB	915	H	2	145	0	95.60	22.90	3.50	30.50	12.54	-16.64	91.50	78.96	-15.04	-
MB	915	V	2	98	100	106.70	22.90	3.50	30.50	12.54	-16.64	102.60	90.06	-3.94	-
HB	927	H	1	260	144	109.00	22.80	3.50	30.50	12.54	-16.74	104.80	92.26	-1.74	-
HB	927	V	2	91	100	109.70	22.80	3.50	30.50	12.54	-16.74	105.50	92.96	-1.04	-
	@ 903 MHz														
2	1806	H	1	339	301	40.70	27.70	5.61	22.00	12.54	-1.23	52.01	39.47	-	-14.53
3	2709	H	1	0	130	58.20	29.40	7.37	41.00	12.54	-16.77	53.97	41.43	-	-12.57
4	3612	H	1	335	188	47.40	31.30	9.18	39.70	12.54	-11.76	48.18	35.64	-	-18.36
5	4515	H	1	60	152	39.70	32.90	10.51	39.40	12.54	-8.53	43.71	31.17	-	-22.83
6	5418	H	1	264	192	24.00	34.90	12.07	39.80	12.54	-5.37	31.17	18.63	-	-35.37
7	6321	H	1	*	*	19.40	35.80	14.17	39.60	12.54	-2.17	29.77	17.23	-	-36.77
8	7224	H	1	*	*	19.10	36.80	15.96	40.10	12.54	0.12	31.76	19.22	-	-34.78
9	8127	H	1	*	*	18.00	37.10	18.08	40.60	12.54	2.04	32.58	20.04	-	-33.96
10	9030	H	1	*	*	18.50	38.10	18.76	41.30	12.54	3.02	34.06	21.52	-	-32.48
2	1806	V	2	257	100	38.75	27.70	5.61	22.00	12.54	-1.23	50.06	37.52	-	-16.48
3	2709	V	2	146	158	62.40	29.40	7.37	41.00	12.54	-16.77	58.17	45.63	-	-8.37
4	3612	V	2	0	149	48.10	31.30	9.18	39.70	12.54	-11.76	48.88	36.34	-	-17.66
5	4515	V	2	300	100	41.00	32.90	10.51	39.40	12.54	-8.53	45.01	32.47	-	-21.53
6	5418	V	2	48	100	25.90	34.90	12.07	39.80	12.54	-5.37	33.07	20.53	-	-33.47
7	6321	V	2	*	*	20.60	35.80	14.17	39.60	12.54	-2.17	30.97	18.43	-	-35.57
8	7224	V	2	*	*	19.40	36.80	15.96	40.10	12.54	0.12	32.06	19.52	-	-34.48
9	8127	V	2	*	*	19.10	37.10	18.08	40.60	12.54	2.04	33.68	21.14	-	-32.86
10	9030	V	2	*	*	19.10	38.10	18.76	41.30	12.54	3.02	34.66	22.12	-	-31.88
	@ 915 MHz														
2	1830	H	1	148	113	45.00	27.90	5.68	22.00	12.54	-0.96	56.58	44.04	-	-9.96
3	2745	H	1	90	239	54.20	29.10	7.44	41.00	12.54	-17.00	49.74	37.20	-	-16.80
4	3660	H	1	83	153	53.20	31.50	9.29	39.70	12.54	-11.45	54.29	41.75	-	-12.25
5	4575	H	1	320	135	35.10	33.10	10.58	39.40	12.54	-8.26	39.38	26.84	-	-27.16
6	5490	H	1	341	185	24.60	35.00	12.27	39.80	12.54	-5.07	32.07	19.53	-	-34.47
7	6405	H	1	324	100	20.80	36.10	14.33	39.60	12.54	-1.71	31.63	19.09	-	-34.91
8	7320	H	1	*	*	19.40	36.70	16.23	40.10	12.54	0.29	32.23	19.69	-	-34.31
9	8235	H	1	*	*	19.10	37.20	18.16	40.60	12.54	2.22	33.86	21.32	-	-32.68
10	9150	H	1	*	*	19.40	38.10	19.12	41.30	12.54	3.38	35.32	22.78	-	-31.22

FCC Fundamental and Harmonic Frequency Test
Remtron Command Pro 21T18 Wireless Controller April 27-28, 2000

Harmonic	Freq (MHz)	Pol	Pos	Angle	Ant Ht (cm)	dBuV/m (Uncorrected)	AF	COAX	AMP	DUTY CYCLE	CF	dBuV/m (Corrected W/O duty cycle)	dBuV/m (Fully Corrected)	dB above 50 mV/m (94 dBuV/m)	dB above 500 uV/m (54 dBuV/m)
2	1830	V	2	145	118	50.70	27.90	5.68	22.00	12.54	-0.96	62.28	49.74	-	-4.26
3	2745	V	2	183	113	68.30	29.10	7.44	41.00	12.54	-17.00	63.84	51.30	-	-2.70
4	3660	V	2	290	115	55.00	31.50	9.29	39.70	12.54	-11.45	56.09	43.55	-	-10.45
5	4575	V	2	318	100	42.00	33.10	10.58	39.40	12.54	-8.26	46.28	33.74	-	-20.26
6	5490	V	2	5	161	30.90	35.00	12.27	39.80	12.54	-5.07	38.37	25.83	-	-28.17
7	6405	V	2	67	100	24.90	36.10	14.33	39.60	12.54	-1.71	35.73	23.19	-	-30.81
8	7320	V	2	190	111	22.00	36.70	16.23	40.10	12.54	0.29	34.83	22.29	-	-31.71
9	8235	V	2	*	*	19.10	37.20	18.16	40.60	12.54	2.22	33.86	21.32	-	-32.68
10	9150	V	2	*	*	19.60	38.10	19.12	41.30	12.54	3.38	35.52	22.98	-	-31.02
	@ 927 MHz														
2	1854	H	1	324	269	46.90	28.10	5.74	22.00	12.54	-0.70	58.74	46.20	-	-7.80
3	2781	H	1	264	187	60.30	28.80	7.51	41.00	12.54	-17.23	55.61	43.07	-	-10.93
4	3708	H	1	192	146	50.40	31.70	9.39	39.70	12.54	-11.15	51.79	39.25	-	-14.75
5	4635	H	1	85	158	41.20	33.20	10.64	39.40	12.54	-8.10	45.64	33.10	-	-20.90
6	5562	H	1	321	141	31.90	35.00	12.46	39.80	12.54	-4.88	39.56	27.02	-	-26.98
7	6489	H	1	20	196	23.00	36.10	14.48	39.60	12.54	-1.56	33.98	21.44	-	-32.56
8	7416	H	1	337	164	21.70	36.60	16.48	40.10	12.54	0.44	34.68	22.14	-	-31.86
9	8343	H	1	*	*	19.40	37.30	18.24	40.60	12.54	2.40	34.34	21.80	-	-32.20
10	9270	H	1	*	*	19.40	38.10	19.46	41.30	12.54	3.72	35.66	23.12	-	-30.88
2	1854	V	2	153	113	49.20	28.10	5.74	22.00	12.54	-0.70	61.04	48.50	-	-5.50
3	2781	V	2	164	149	64.80	28.80	7.51	41.00	12.54	-17.23	60.11	47.57	-	-6.43
4	3708	V	2	79	146	48.90	31.70	9.39	39.70	12.54	-11.15	50.29	37.75	-	-16.25
5	4635	V	2	324	131	41.60	33.20	10.64	39.40	12.54	-8.10	46.04	33.50	-	-20.50
6	5562	V	2	262	266	28.60	35.00	12.46	39.80	12.54	-4.88	36.26	23.72	-	-30.28
7	6489	V	2	321	200	24.90	36.10	14.48	39.60	12.54	-1.56	35.88	23.34	-	-30.66
8	7416	V	2	48	100	21.40	36.60	16.48	40.10	12.54	0.44	34.38	21.84	-	-32.16
9	8343	V	2	*	*	19.40	37.30	18.24	40.60	12.54	2.40	34.34	21.80	-	-32.20
10	9270	V	2	*	*	19.40	38.10	19.46	41.30	12.54	3.72	35.66	23.12	-	-30.88

LEGEND

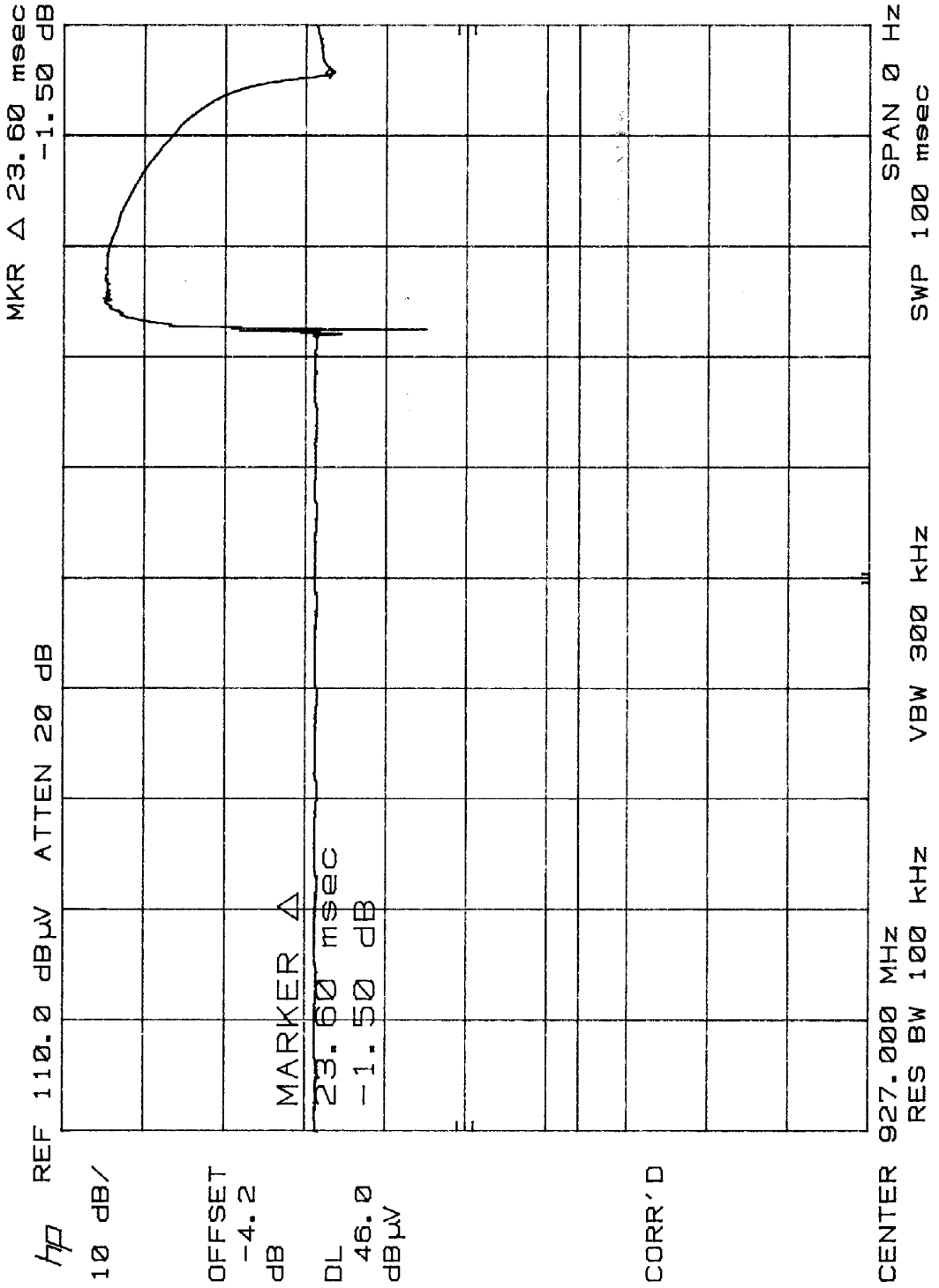
LB Low Band
MB Mid-Band
HB High Band
* Signal too small to resolve peak height and angle
Pos 1 Unit laying flat with top of unit facing antenna at 0 deg position
Pos 2 Unit positioned vertically with front of unit facing antenna at 0 deg position

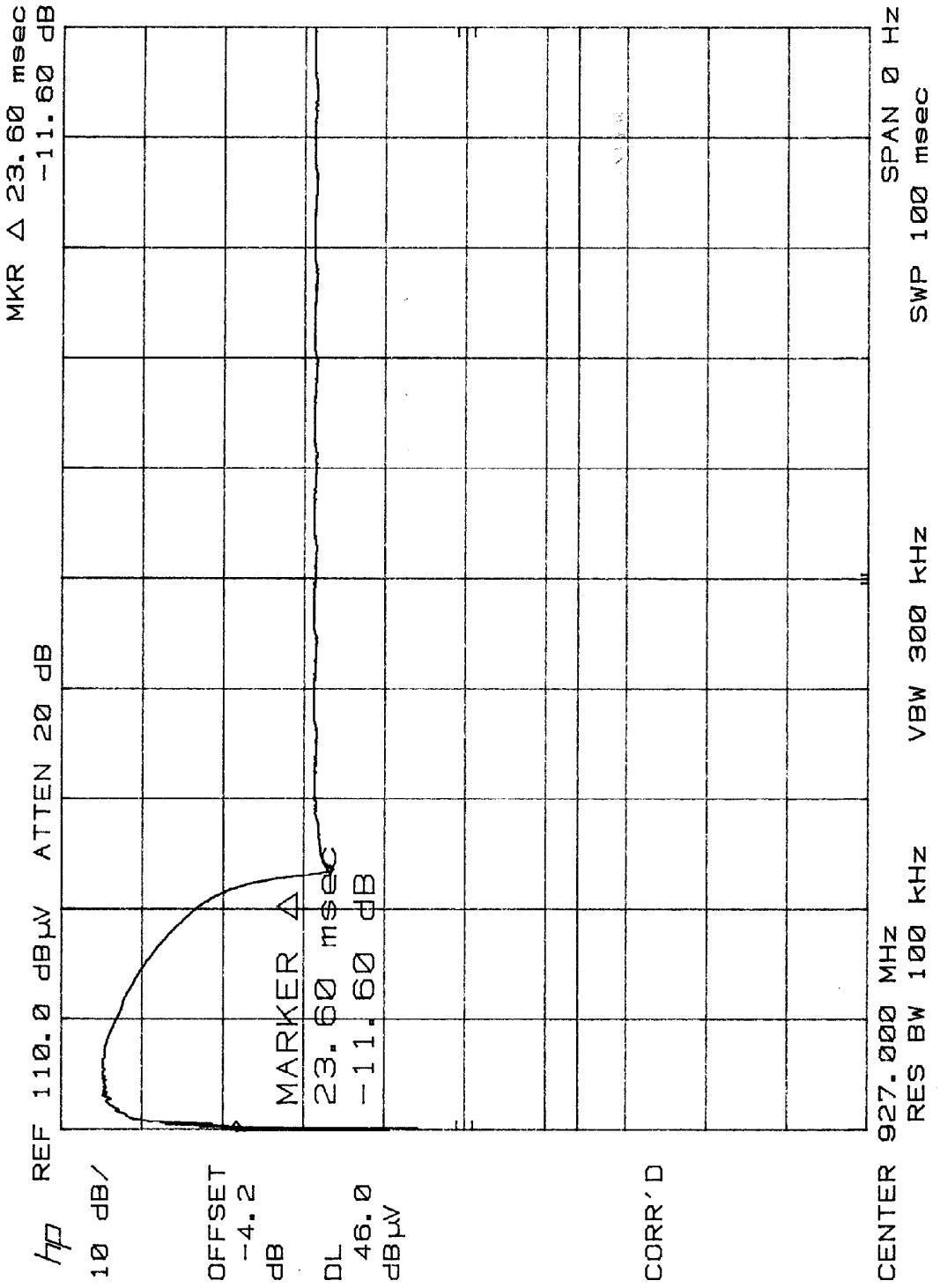
3.1.6 Duty Cycle Correction

Duty cycle correction was determined by counting the number of pulses on over a 100 ms period. The following calculation was applied.

		Time in ms	
Pulse Train Cycle Time		23.6	
Number of long pulses	1	23.6	
Number of Short pulses	0	0	
Total on Time per cycle		23.6	
Number of Cycles per 100 ms	1		
Total on time per 100 ms		23.6	
Percent on per 100 ms			23.6
Total duty cycle correction in dB		-12.54	

Actual plots exhibiting the duty cycle are provided on pages 16 & 17


MKR Δ 23.60 msec
-1.50 dB
SPAN 0 Hz
SWP 100 msec
REF 110.0 dBµV
ATTEN 20 dB
VBW 300 kHz
MARKER Δ
23.60 msec
-1.50 dB
10 dB/
OFFSET
-4.2
dB
DL
46.0
dBµV
CORR'D
CENTER 927.000 MHz
RES BW 100 kHz


MKR Δ 23.60 msec
-11.60 dB
SPAN 0 Hz
SWP 100 msec
REF 110.0 dBµV
ATTEN 20 dB
VBW 300 kHz
MARKER Δ
23.60 msec
-11.60 dB
10 dB/
OFFSET
-4.2
dB
DL
46.0
dBµV
CORR'D
CENTER 927.000 MHz
RES BW 100 kHz

3.1.7 Occupied Bandwidth

The occupied bandwidth at the transmitter's lowest (903 MHz) and highest (927 MHz) frequency was measured with respect to the band limits (902 to 928 MHz). Part 15.249 (c) stipulates that emissions radiated outside of the specified frequency bands (902-928 MHz in this case) shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Part 15.209, whichever is the lesser attenuation. Part 15.209 (a) specifies that the emissions from an intentional radiator shall not exceed the field strength levels in the 216 to 960 MHz band of 200 uV/m (46 dBuV/m).

When transmitting at 903 MHz, emissions measured at 902 MHz (band edge) were 45.1 dBuV/m (< 46 dBuV/m).

When transmitting at 927 MHz, emissions measured at 928 MHz (band edge) were 45.2 dBuV/m (< 46 dBuV/m).

Plots showing the occupied bandwidth are provided on pages 19 – 26.