

RF Emissions Test Report To Determine Compliance With: FCC, Part 15 Rules and Regulations

Model numbers: CCK-2100 & TSK-2100
October 1, 1999

Manufacturer: Parkervision
8493 Baymeadows Way
Jacksonville, FL 32256

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Section 1

General Information

Manufacturer:	Parkervision 8493 Baymeadows Way Jacksonville, FL 32256
Manufacturer representative:	Mr. Eric Schloesser
Equipment covered by this report:	Model no.s CCK-2100 & TSK-2100
Options covered by this report:	RJ-11 hardwire
Equipment serial no.	M/N: CCK-2100 S/N: 9122180000002 M/N: TSK-2100 S/N: 9122030000006
Test specifications:	To determine compliance with: FCC, Part 15, Subpart C Rules and Regulations, Class B
Test report number:	99- 189A
Test commenced:	April 10,1999
Test completed:	April 29, 1999
Test engineer:	Kent Stewart
Test Facility:	The test facility used to perform these tests is on file with the FCC under file 31040/SIT, 1300F2 and located at:

EMC Testing Laboratories, Inc.
2420 Oak Street West
Cumming, GA. 30041-6456

Section 2

Test report summary sheet 1 of 2

Summary:

Tests	Results
FCC, Part 15, Class B, Radiated emissions:	Pass
FCC, Part 15, Class B, Conducted emissions:	N/A

- 1- The product(s) covered by this report was found to comply with the limits indicated in paragraph 15.109 Subpart B and 15.249, Part 15, Subpart C of the FCC Rules and Regulations.

The conducted emissions test was not performed since the EUT's are battery operated with no means for connection to public mains.

Product description:

The product(s) covered by this report consisted of models CCK-2100 and TSK-2100, battery operated video camera remote controls.

Model CCK-2100 is an intentional pulsed radiator which transmits at 906.3 Mhz utilizing a 48% duty cycle.

Model TSK-2100 is similar to model CCK-2100 except that model TSK-2100 uses a 75% duty cycle, different software codes and keypad layout.

Additionally, both remote controls can be used in the optional hard-wire mode. When operating in the hard-wire mode the rf transmitter is automatically disabled.

Test configuration:

The equipment under test was set-up and configured as specified by the manufacturer.

- 1- The EUT was connected to the following support peripherals and were used only during the optional hard-wire configuration (Configuration 3 and 4). Additionally, the peripherals were moved away from the EUT during emissions testing. There were no peripherals utilized during the testing of the wireless units (Configurations 1 and 2).

A) A power supply, manufactured by Parkervision, model LT-10330 3192.

Test report summary sheet 2 of 2

B) A Camera control box, model CCB-2000, engineering sample.

2- During the testing of the EUT with the optional hard-wire configuration, the EUT utilized the following cables and were connected as indicated below. There were no cables utilized during the testing of the wireless unit.

A) During the testing of the EUT with the optional hard-wire configuration an unshielded, six conductor, RJ-11 type cable provided by the manufacturer was connected from the EUT's RJ-11 port to the camera control box's PVI COM port.

B) The power supply's power output cable was connected to the DC power input port of the camera control box.

Test operation:

For all measurements, the equipment under test was and caused to function in a continuous mode of operation for maximum electrical activity as specified by the manufacturer. Specifically, during testing of configurations 1, 2, 3 and 4 the "ZOOM IN" button was continuously pressed.

Modifications:

The following modifications were required to comply with the indicated limits:

1- None

Conclusion:

With the above indicated modifications, the product(s) covered by this report has been tested and found to comply with the limits indicated in paragraph 15.249 of the FCC, Part 15, Subpart C Rules and Regulations and all subsequent limits indicated therein for a class B device.

Tested by:

Reviewed by:

Kent Stewart
Laboratory Manager
EMC Testing Laboratories, Inc.
October 3, 1999

Gene J. Bailey
Engineering Manager
EMC Testing Laboratories, Inc.
October 3, 1999

Section 2 cont...

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Section 3

STANDARD REFERENCE

The following primary standards were used for this test:

- 1) **ANSI C63.4-1992:** Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 Khz to 40 Ghz.
- 2) **US Code of Federal Regulations (CFR) 1998:** Title 47, Part 15, Radio Frequency Devices, Subpart C, Intentional Radiators.

Section 4

TEST METHOD

INTRODUCTION:

The product(s) covered by this report were subjected to electromagnetic interference emissions measurements to determine compliance with the FCC, Part 15 requirements.

Radiated emissions were measured in accordance with Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 Khz to 40 Ghz, C63.4.

MEASUREMENT CALCULATIONS:

Radiated Emissions:

For radiated emissions measurements, the signal attenuation due to impedance losses in the antenna and signal cable was significant and was added to the spectrum analyzer reading to give corrected signal strength reading. If a preamplifier was used, the signal gain was subtracted from the signal strength reading. Radiated emissions data was specified as microvolt per meter ($\mu\text{V}/\text{m}$) of radiated field strength.

Radiated emissions ($\mu\text{V}/\text{m}$) = Analyzer reading (μV) plus
antenna factor (dB) plus cable factor (dB) minus Amplifier gain (dB)

RADIATED EMISSIONS MEASUREMENT:

Radiated emissions measurements were performed at an open field test site. The receiving antenna was positioned 3 or 10 meters from the equipment under test as indicated below, along the center axis of the test site. Measurements were made with broadband antennas and if necessary, detected emissions were verified with dipole antennas. The dipole antenna was manually tuned to the signal frequency by adjusting the length of the antenna elements. The radiated emissions were measured for both the horizontal and vertical signal planes by rotating the antennas. Additionally, the

EUT was rotated by the turntable and the antenna height was raised and lowered 1 to 4 meters to locate the maximum emission strength at each frequency.

Emission measurements made from 30 Mhz to 1000 Mhz were made at an antenna to EUT distance of 10 meters.

Emission measurements made from 1000 Mhz to 10 Ghz were made at an antenna to EUT distance of 3 meters.

The following antennas were used to measure the radiated emissions within the specified frequency spans.

<u>Antenna</u>	<u>Frequency Span</u>
Biconical	20 - 200 Mhz
Log Periodic	200 - 1000 Mhz
Dipoles	20 - 1000 Mhz
Horn	1-18 Ghz

INSTRUMENTATION:

Radiated strength measurements were taken with a spectrum analyzer. Radiated emissions are measured with broadband and tuned dipole antennas. The test equipment consists of the following:

<u>Test Equipment</u>	<u>Model No.</u>	<u>Serial No.</u>	<u>Cal. Due</u>
Spectrum Analyzer	HP 8591A	2919A00171	12-20-99
Spectrum Analyzer	8592L	3649A00744	02-08-00
LISN	94641-1	0145/0146	11-05-99
Biconical Antenna	3110B	1708	10-09-99
Biconical Antenna	BIA-25	2451	10-23-99
Log Periodic	LPA25	1112	10-14-99
Dipole Antenna	DM-105A-T1	31402-110	05-21-99
Dipole Antenna	DM-105A-T2	31402-105	05-21-99
Dipole Antenna	DM-105A-T3	31402-109	05-21-99
Horn Antenna	3115	9405-4264	10-07-99
R.F. Amplifier	QB-820	11602	10-08-99
Preamplifier	8449B	3008A00914	10-08-99

DETECTOR FUNCTION FOR OUT OF BAND EMISSIONS:

The out of band emissions measurements were taken using a peak hold signal detector function. In this mode, the spectrum analyzer makes continuous scans across the frequency band and stores the highest emission value detected at each frequency for all scans. The peak hold integration will detect transient or low duty cycle emissions peak which might be missed on single scan measurement. The emission value at each frequency was a true value.

SPECTRUM ANALYZER SETTING FOR OUT OF BAND EMISSIONS:

For all out of band emissions measurements, the spectrum analyzer was set for a 10 dB input attenuation, 10 dB/Division vertical scale and 90 or 100 dB μ V reference level. The resolution bandwidth is set at 9 KHz for the 0.45 - 30 Mhz span and at 120 KHz for 30 - 1000 Mhz span. The video bandwidth and sweep rate were automatically coupled by the analyzer.

Section 5

RADIATED OUT OF BAND EMISSIONS MEASUREMENTS

Radiated Out of Band Emissions - Section 15.209 Limits

Model number: TSK-2100 (Configuration 1)

Frequency Mhz	Measurement Reading dB μ V	Corrected Reading dB μ V	FCC Limit dB μ V	Minimum Margin dB μ V
Horizontal				
There were no measurable emissions within 20dB μ V of the limits				

Model number: CCK-2100 (Configuration 2)

Frequency Mhz	Measurement Reading dB μ V	Corrected Reading dB μ V	FCC Limit dB μ V	Minimum Margin dB μ V
Horizontal				
There were no measurable emissions within 20dB μ V of the limits				

Section 6

Fundamental Frequency Radiated Emissions Measurements

EMISSION MEASUREMENTS FOR EQUIPMENT OPERATING WITHIN THE BAND 902 - 928:

As per Section 15.249 of the 47 CFR and in accordance with the measurement provisions in Section 15.35, the peak and average emissions field strength of the fundamental frequency and its harmonics were measured.

The average measurements were calculated as indicated in Section 15.35. Since the pulse train exceeded 0.1 second the measured field strength was determined from the average absolute voltage during a 0.1 second interval.

Method used for calculation of measurement:

$$\text{Pulse width} / 100\text{mS} = \text{Duty Cycle}$$

$$\text{Peak Value (uV/m)} \times \text{Duty Cycle} = \text{Average measurement (uV/m)}$$

Additionally the following graphs show that the maximum field strength for the fundamental frequency was in compliance with the peak limits as indicated in Section 15.249.

During the emissions measurement of the fundamental frequency, the antenna was positioned 10 meters from the EUT and with the spectrum analyzer in the Linear mode and the resolution bandwidth set to 10Khz the fundamental frequency was measured. The measurements were performed with the antenna in the horizontal and vertical polarization.

During the emissions measurements of the harmonics of the fundamental frequency, the antenna was positioned 3 meters from the EUT and the spectrum analyzer in the Linear mode and the resolution bandwidth set to 1 Mhz the harmonic emission levels were measured.

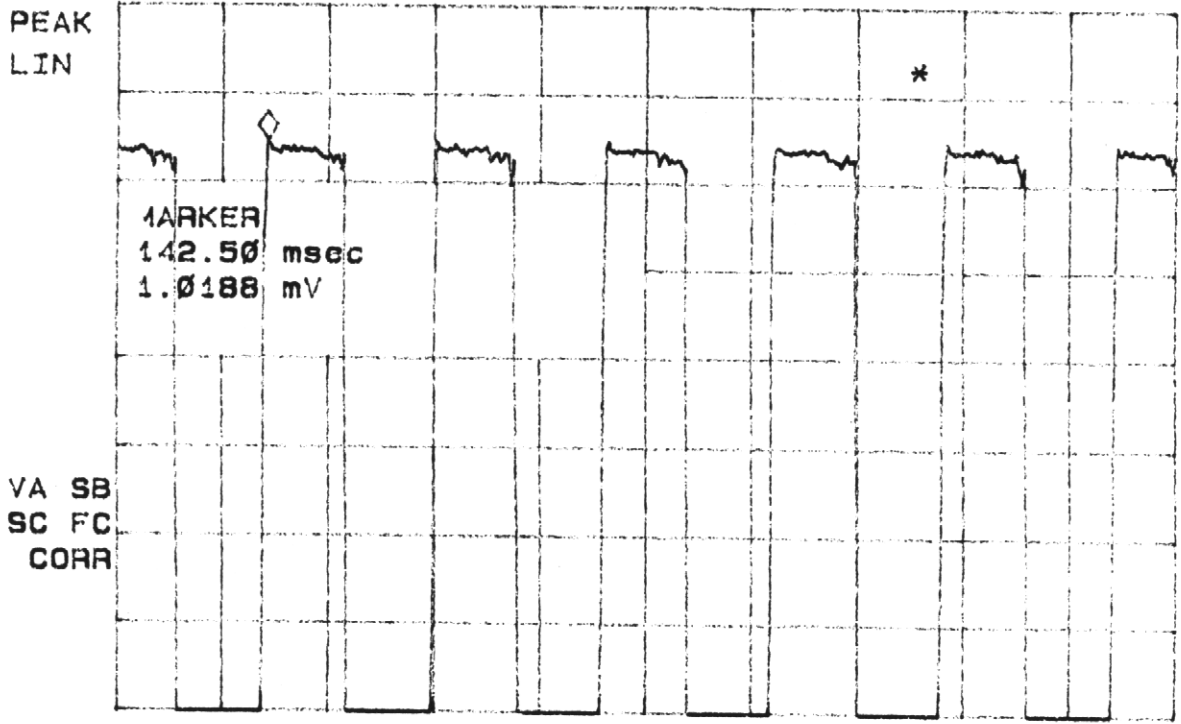
The limits indicated in the tables below have been calculated for the measurement distance as indicated above.

Model: TSK-2100 (Configuration 1)

Frequency Mhz	Detection method	Total Level dBμV/m	FCC Limit dBμV/m	Margin dBμV
Horizontal				
906.3	Average	74.6	83.9	-9.3
1812.6	Average	42.5	53.9	-11.4
2718.9	Average	50.1	53.9	-3.8
3625.3	Average	47.2	53.9	-6.7
4531.5	Average	49.7	53.9	-4.2
Vertical				
906.3	Average	64.7	83.9	-19.2
1812.6	Average	45.6	53.9	-8.3
2718.9	Average	49.4	53.9	-4.5
3625.3	Average	47.2	53.9	-6.7
4531.5	Average	48.6	53.9	-5.3
Horizontal				
906.3	Peak	77.1	103.9	-26.8
1812.6	Peak	45.0	73.9	-28.9
2718.9	Peak	52.6	73.9	-21.3
3625.3	Peak	49.7	73.9	-24.2
4531.5	Peak	52.2	73.9	-21.7
Vertical				
906.3	Peak	67.2	103.9	-36.7
1812.6	Peak	48.1	73.9	-25.8
2718.9	Peak	51.9	73.9	-22.0
3625.3	Peak	49.7	73.9	-24.2
4531.5	Peak	51.1	73.9	-22.8

09:04:23 APR 29, 1999
HORIZONTAL PEAK MDLTSK-2100
REF 1.257 mV AT 10 dB

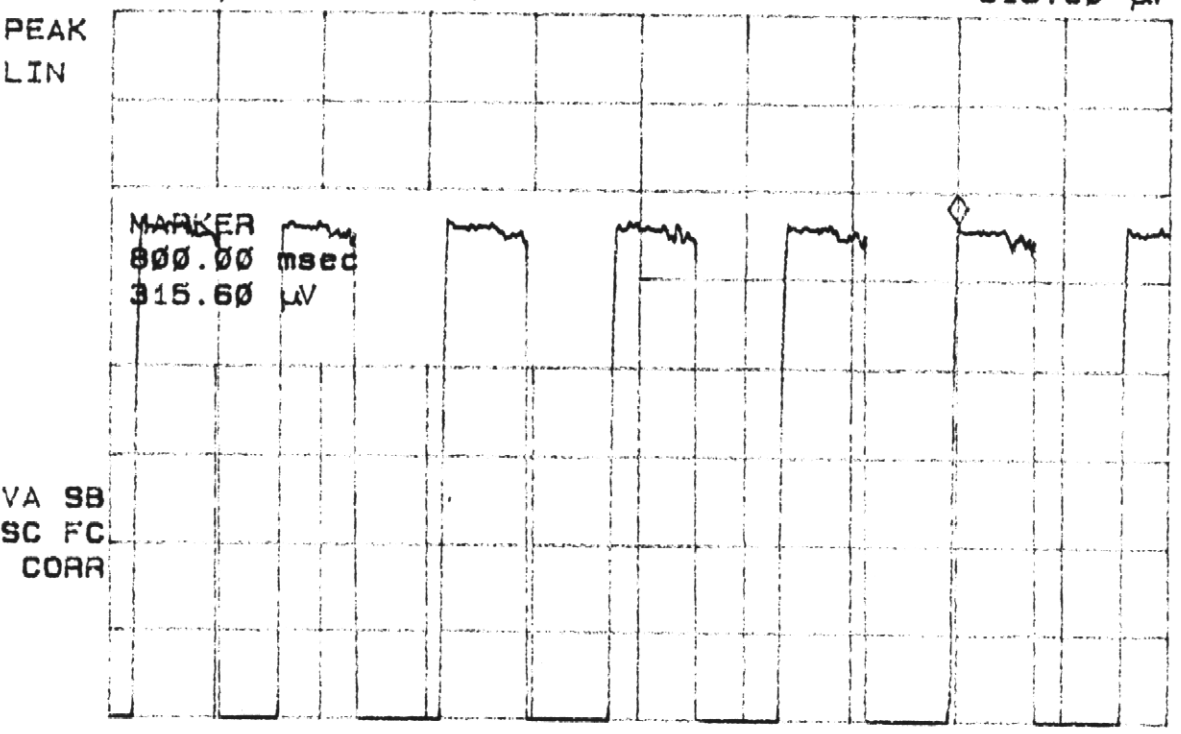
MKR 142.50 msec
1.0188 mV



CENTER 906.3200 MHz SPAN 0 Hz
#RES BW 10 kHz VBW 10 kHz #SWP 1.00 sec

09:14:02 APR 29, 1999
VERTICAL PEAK MDLTSK-2100
REF 446.2 μ V AT 10 dB

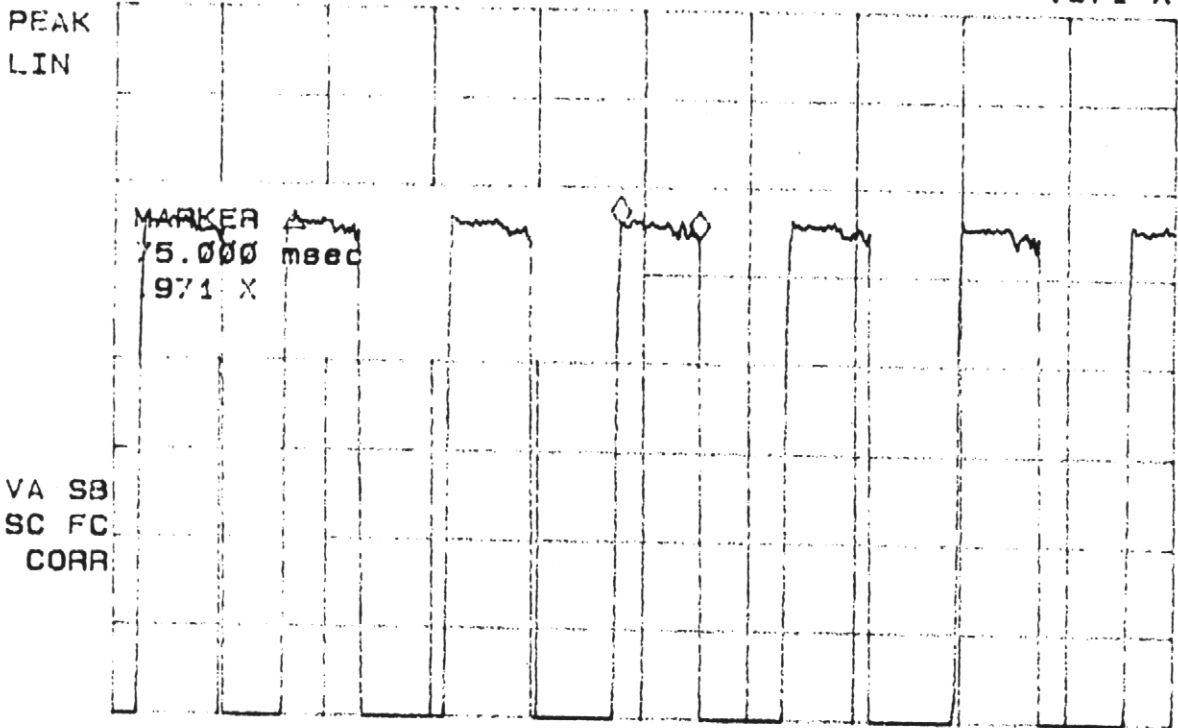
MKR 800.00 msec
315.60 μ V



CENTER 906.3200 MHz SPAN 0 Hz
#RES BW 10 kHz VBW 10 kHz #SWP 1.00 sec

09:19:34 APR 29, 1999
PULSE WIDTH MDLTSK-2100
REF 446.2 μ V AT 10 dB

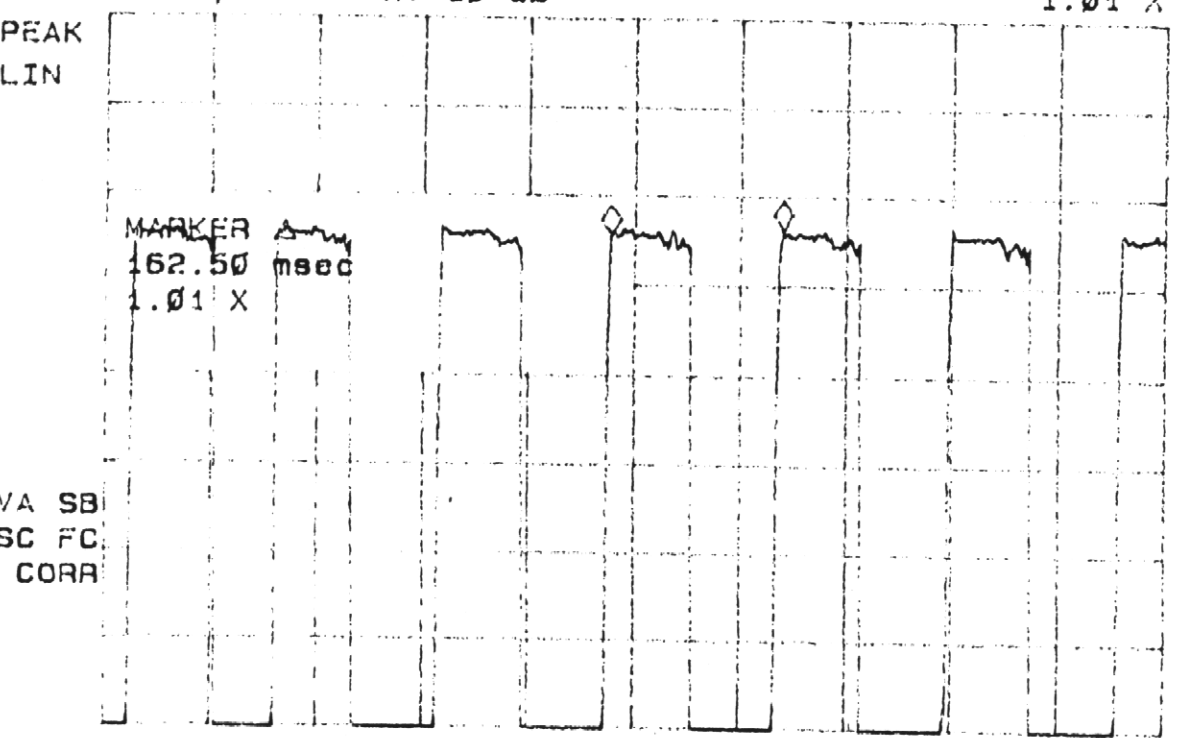
MKR Δ 75.000 msec
.971 X



CENTER 906.3200 MHz SPAN 0 Hz
#RES BW 10 KHz VBW 10 KHz #SWP 1.00 sec

09:21:57 APR 29, 1999
PULSE TRAIN MDLTSK-2100
REF 446.2 μ V AT 10 dB

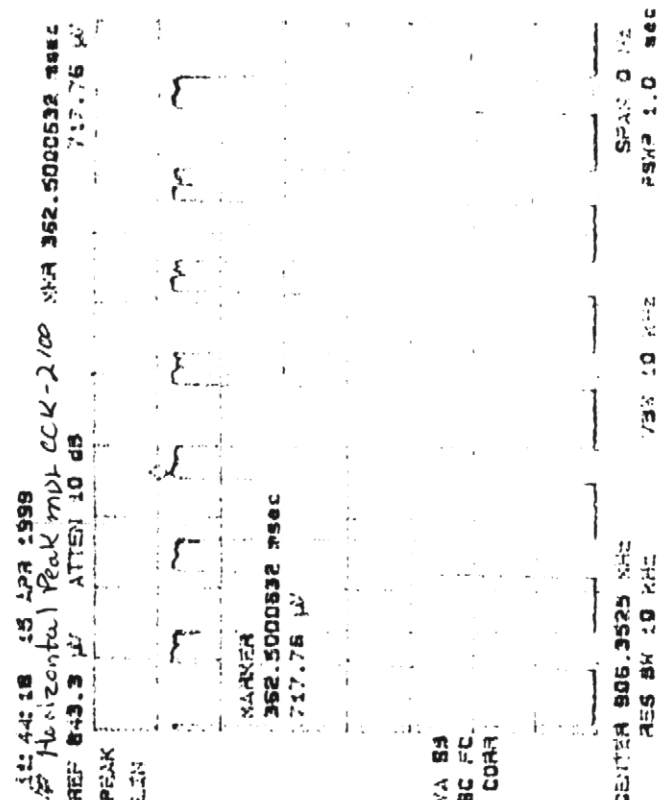
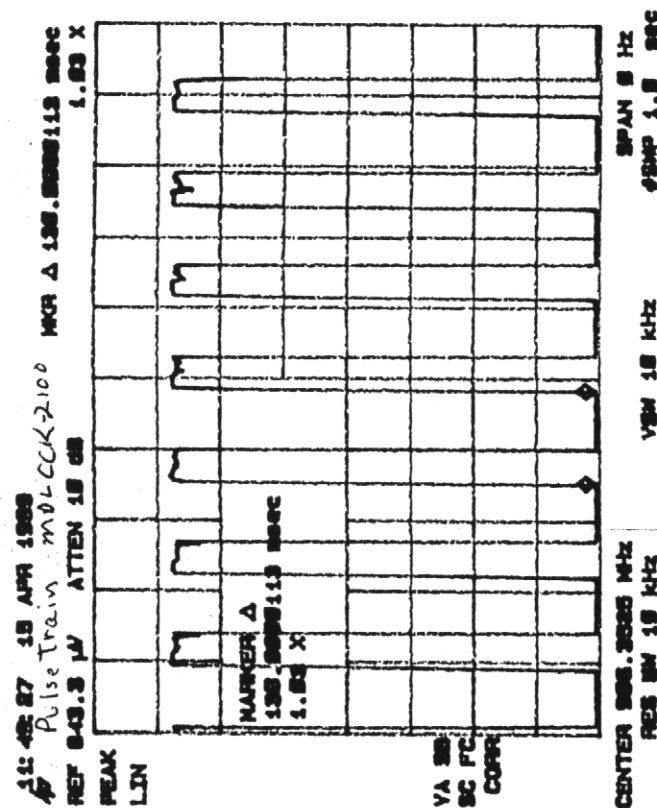
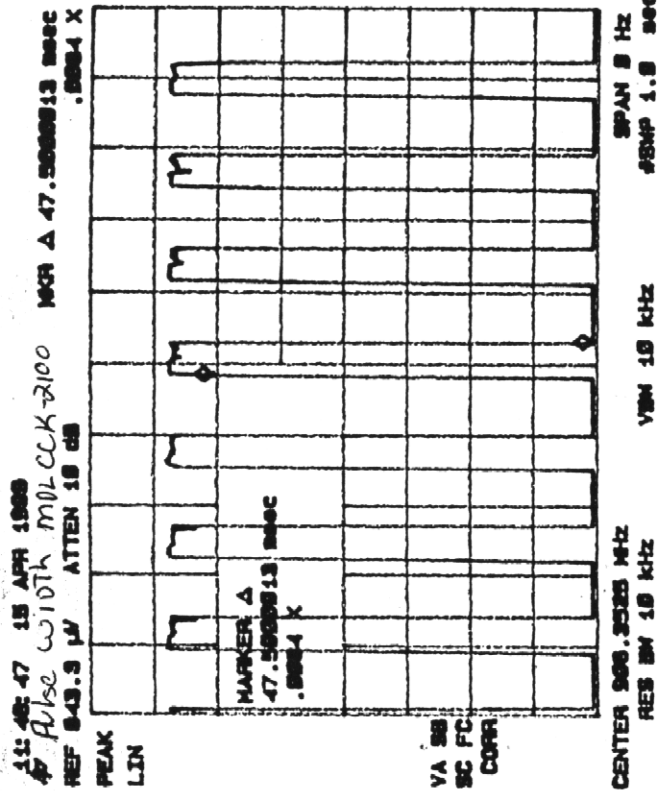
MKR Δ 162.50 msec
1.01 X



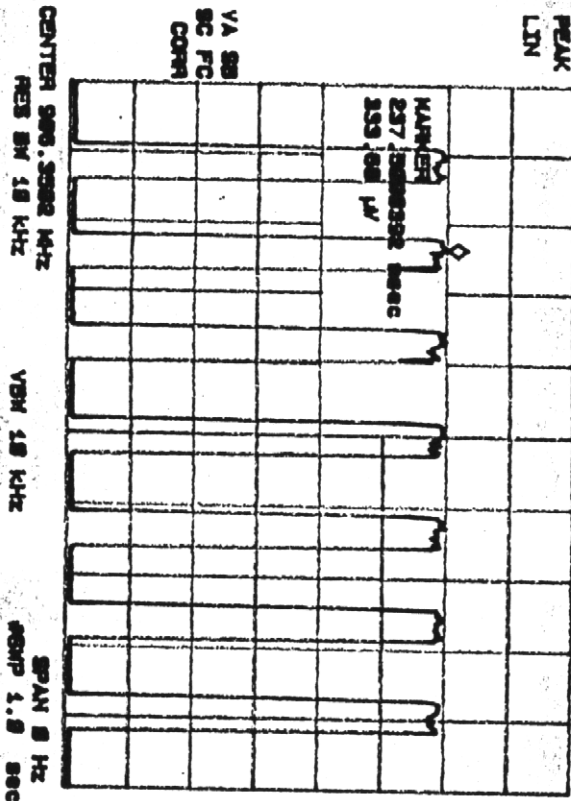
CENTER 906.3200 MHz SPAN 0 Hz
#RES BW 10 KHz VBW 10 KHz #SWP 1.00 sec

Model: CCK-2100 (Configuration 2)

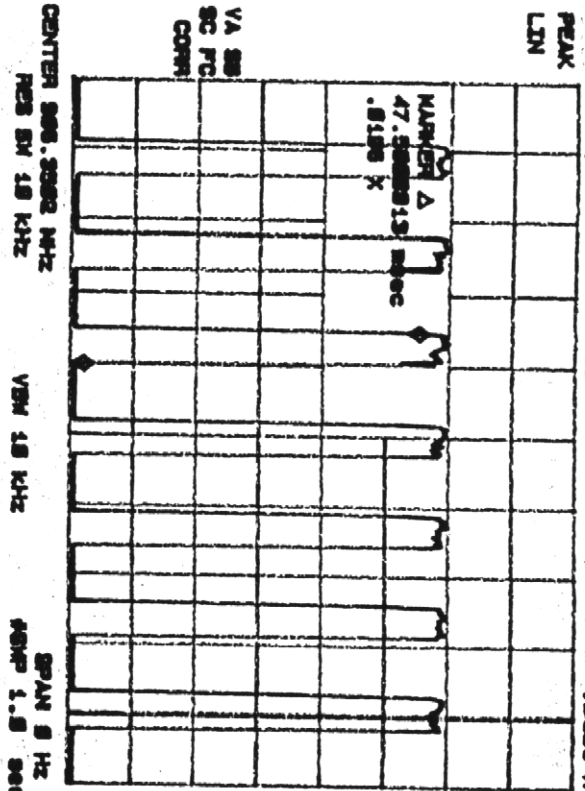
Frequency Mhz	Detection method	Total Level dBμV/m	FCC Limit @ 10 m dBμV/m	Margin dBμV
Horizontal				
906.3	Average	67.6	83.9	-16.3
1812.6	Average	38.8	53.9	-15.1
2718.9	Average	42.7	53.9	-11.2
3625.3	Average	44.7	53.9	-9.2
4531.5	Average	45.6	53.9	-8.3
Vertical				
906.3	Average	61.3	83.9	-22.6
1812.6	Average	38.7	53.9	-15.2
2718.9	Average	42.7	53.9	-11.2
3625.3	Average	43.1	53.9	-10.8
Horizontal				
906.3	Peak	74.0	103.9	-29.9
1812.6	Peak	45.2	73.9	-28.7
2718.9	Peak	49.1	73.9	-24.8
3625.3	Peak	51.1	73.9	-22.8
4531.5	Peak	52.0	73.9	-21.9
Vertical				
906.3	Peak	67.7	103.9	-36.2
1812.6	Peak	45.1	73.9	-28.8
2718.9	Peak	49.1	73.9	-24.8
3625.3	Peak	49.5	73.9	-24.4



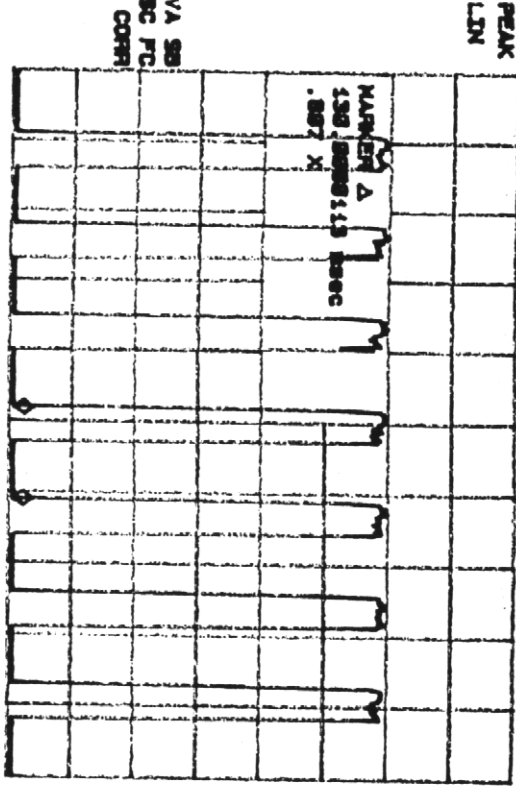
12:18:18 15 APR 1989
 Vertical Peak MOD CCK-2100 MCR Δ 130.000013 msec
 REF 444.0 μV ATTEN 10 dB 333.00 μV



12:22:18 15 APR 1989
 Pulse Width MOD CCK-2100 MCR Δ 47.000013 msec
 REF 444.0 μV ATTEN 10 dB .0100 X



12:22:50 15 APR 1989
 Pulse Train MOD CCK-2100 MCR Δ 130.000013 msec
 REF 444.0 μV ATTEN 10 dB .007 X



CENTER 900.3000 MHz
 RES BW 10 kHz
 VBM 10 kHz
 SPAN 0 Hz
 #COMP 1.0 sec

Section 7

RADIATED EMISSION MEASUREMENTS IN ACCORDANCE WITH 15.109

The radiated emission measurements taken in this section was done to show compliance on the unit, with the unit's optional hardwire configurations.

Model number: TSK-2100 (Configuration 3)

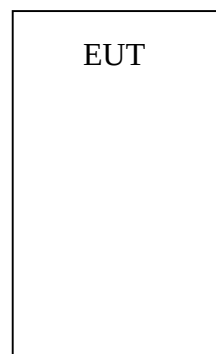
Frequency Mhz	Measurement Reading dBμV	Corrected Reading dBμV	FCC Limit dBμV	Minimum Margin dBμV
Horizontal				
There were no measurable emissions within 20dB μ V of the limits				

Model number: CCK-2100 (Configuration 4)

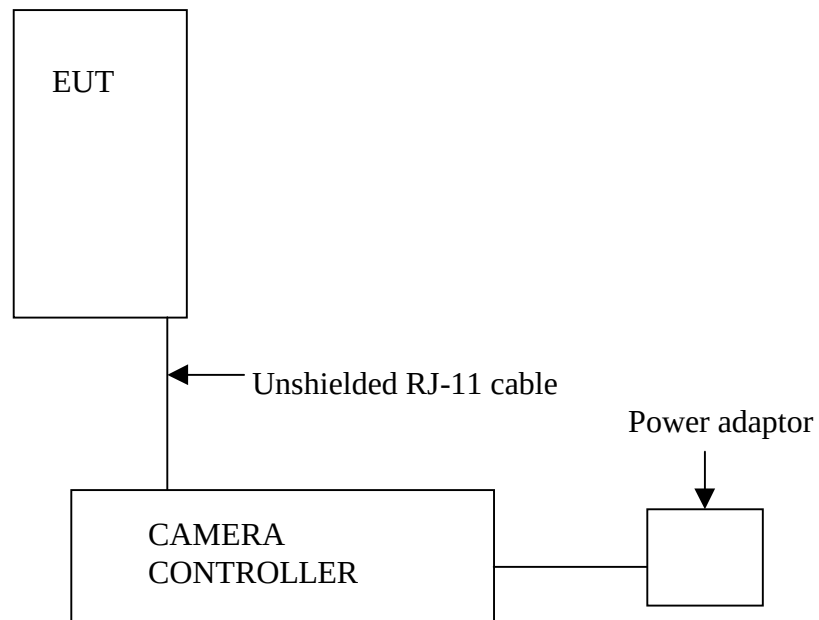
Frequency Mhz	Measurement Reading dBμV	Corrected Reading dBμV	FCC Limit dBμV	Minimum Margin dBμV
Horizontal				
There were no measurable emissions within 20dB μ V of the limits				

Section 8 CONFIGURATION

CONFIGURATION 1 AND 2



CONFIGURATION 3 WITH HARDWIRE OPTION



LAST PAGE ...