MASTERWORKS ELECTRONICS
ADDENDUM TEST REPORT TO FC01-013

FOR THE

WIRELESS WATER LEVEL CONTROL DEVICE, SMARTMISER

FCC PART 15 SUBPART B SECTIONS 15.107 & 15.109
FCC PART 15 SUBPART C SECTIONS 15.209 & 15.231

COMPLIANCE

DATE OF ISSUE: APRIL 5, 2001

PREPARED FOR:

MasterWorks Electronics
630 Martin Ave.
Rohnert Park, CA 94928

P.O. No: 4648
W.O. No: 75911

PREPARED BY:

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CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: April 4, 2001

Report No: FC01-013A

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ADMINISTRATIVE INFORMATION

DATE OF TEST:	April 4, 2001
DATE OF RECEIPT:	April 4, 2001
PURPOSE OF TEST:	To demonstrate the compliance of the Wireless Water Level Control Device, SmartMiser, with the requirements for FCC Part 15 Subpart C Sections 15.107, 15.109, 15.209 and 15.231 devices. Addendum is to add corrected >1 GHz test data, add a FCC 15.205 compliance note to the data sheet for radiated emissions 30-1000 MHz and to correct the Analyzer Bandwidth Settings table.
MANUFACTURER:	Cazden Enterprises LLC 307 Sixth Street Petaluma, CA 94952
REPRESENTATIVE:	John Cassacia
TEST LOCATION:	CKC Laboratories, Inc. 5473A Clouds Rest Mariposa, CA 95338

SUMMARY OF RESULTS

As received, the MasterWorks Electronics Wireless Water Level Control Device, SmartMiser was found to be fully compliant with the following standards and specifications:

United States

- FCC Part 15 Subpart B Section 15.107
- FCC Part 15 Subpart B Section 15.109
- FCC Part 15 Subpart C Section 15.209
- FCC Part 15 Subpart C Section 15.231
- ANSI C63.4 1992 method

The results in this report apply only to the items tested, as identified herein.

FREQUENCY RANGE TESTED

Conducted: 450 kHz – 30 MHz
Radiated: 9 kHz – 10 GHz

EUT OPERATING FREQUENCY

The MasterWorks Electronics Wireless Water Level Control Device, SmartMiser was operating at 433.9 MHz.

REQUIRED EUT CHANGES TO COMPLY

None.

APPROVALS

QUALITY ASSURANCE:

Dennis Ward, Quality Manager

Chuck Kendall, EMC/Lab Manager

TEST PERSONNEL:

Randy Clark, EMC/Evaluation Engineer

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

RF transmitter and receiver devices used to maintain the water level in a swimming pool, hot tub, or spa. The transmitter sits in the water and when a certain level of water is reached sends a signal to the receiver which controls the water control valve. The SmartMiser tested was a production unit.

EQUIPMENT UNDER TEST

Wireless Water Level Control Device

Manuf:	MasterWork Electronics
Model:	SmartMiser
Serial:	001
FCC ID:	PHM-SM-500 (pending)

PERIPHERAL DEVICES

The EUT was not tested peripheral devices.

REPORT OF MEASUREMENTS

The following tables report the highest worst case levels recorded during the tests performed on the Wireless Water Level Control Device, SmartMiser. All readings taken are peak readings unless otherwise noted. The data sheets from which these tables were compiled are contained in Appendix B.

Table 1: Transmitter Fundamental Emission Levels

FREQUENCY	METER READING	CORRECTION FACTORS				CORRECTED READING	SPEC LIMIT	MARGIN	NOTES
		Log	Amp	Cable	FCC 15.35				
MHz	dBµV	dB	dB	dB	dB	dBµV/m	dBµV/m	dB	
433.900	92.7	16.8	-25.6	4.4	-20.0	68.3	80.5	-12.2	H
433.970	100.3	16.8	-25.6	4.4	-20.0	75.9	80.5	-4.6	V

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.231(b)
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization

COMMENTS: EUT is a transmitter operating on 433MHz. EUT is manually operated. A -20dB duty cycle correction factor is used in accordance with FCC Part 15.35(c). The following is the calculation used:

20*LOG(12.87*0.666/100) = -21.3dB. CKC used –20dB.

Table 2: Transmitter Highest Radiated Emission Levels: 9 kHz-30 MHz									
	METER	CORRECTION FACTORS				CORRECTED	SPEC		
FREQUENCY	READING	Mag	Amp	Cable	FCC 15.35	READING	LIMIT	MARGIN	NOTES
MHz	dBµV	dB	dB	dB	dB	dBµV/m	dBµV/m	dB	
4.210	28.2	10.3		0.4	-20.0	18.9	29.5	-10.6	N
19.560	28.3	9.2		0.8	-20.0	18.3	29.5	-11.2	N
24.794	25.4	7.8		0.9	-20.0	14.1	29.5	-15.4	N

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.209
Test Distance: 10 Meters

NOTES: N = No Polarization

COMMENTS: EUT is a transmitter operating on 433MHz. EUT is manually operated. The following is the duty cycle calculation used per FCC Part 15.35(c):

20*LOG(12.87*0.666/100) = -21.3dB. CKC used –20dB.

Table 3: Transmitter Highest Radiated Emission Levels: 30-1000 MHz									
	METER	CORRECTION FACTORS				CORRECTED	SPEC		
FREQUENCY MHz	READING dBµV	Log dB	Amp dB	Cable dB	Dist dB	READING dBµV/m	LIMIT dBµV/m	MARGIN dB	NOTES
561.360	60.2	18.8	-25.9	5.1		58.2	61.9	-3.7	V
561.700	47.2	18.8	-25.9	5.1		45.2	61.9	-16.7	H
867.720	45.9	23.0	-25.9	6.5		49.5	61.9	-12.4	V
868.000	35.8	23.0	-25.9	6.5		39.4	61.9	-22.5	H

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.231(b)
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization

COMMENTS: EUT is a transmitter operating on 433MHz. EUT is manually operated. No emissions found in 15.205 restricted bands.

Table 4: Transmitter Six Highest Radiated Emission Levels: 1-10 GHz									
	METER	CORRECTION FACTORS				CORRECTED	SPEC		
FREQUENCY MHz	READING dBµV	Horn dB	Amp dB	Cable dB	Dist dB	READING dBµV/m	LIMIT dBµV/m	MARGIN dB	NOTES
1149.900	52.4	24.3	-35.9	5.0		45.8	54.0	-8.2	V
1285.500	59.3	24.8	-35.8	5.2		53.5	61.9	-8.4	H
1370.000	51.2	25.0	-35.8	5.4		45.8	54.0	-8.2	V
1626.500	50.5	25.7	-35.6	6.0		46.6	54.0	-7.4	H
2618.600	45.2	30.5	-34.7	15.4		56.4	61.9	-5.5	V
3470.000	43.1	34.8	-35.9	13.9		55.9	61.9	-6.0	H

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.231(b)
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization

COMMENTS: EUT is a transmitter operating on 433MHz. EUT is manually operated. 15.209 limit only applies to frequencies within the 15.205 restricted bands.

Table 5: Receiver Six Highest Radiated Emission Levels: 30-1000 MHz									
	METER	CORRECTION FACTORS				CORRECTED	SPEC		
FREQUENCY MHz	READING dBµV	Ant dB	Amp dB	Cable dB	Dist dB	READING dBµV/m	LIMIT dBµV/m	MARGIN dB	NOTES
40.420	34.9	11.1	-25.0	1.1		22.1	40.0	-17.9	V
121.460	30.4	14.3	-25.0	2.2		21.9	43.5	-21.6	V
303.725	27.1	21.3	-24.8	3.7		27.3	46.0	-18.7	H
303.740	28.1	21.3	-24.8	3.7		28.3	46.0	-17.7	V
506.165	29.2	17.6	-25.9	4.8		25.7	46.0	-20.3	H
506.165	28.9	17.6	-25.9	4.8		25.4	46.0	-20.6	V

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.109
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization

COMMENTS: EUT is a receiver for a water level control device. **All readings are ambient noise level.**

Table 6: Receiver Six Highest Conducted Emission Levels: 450 kHz - 30 MHz									
FREQUENCY MHz	METER READING dBµV	CORRECTION FACTORS Lisn dB	dB	dB	dB	CORRECTED READING dBµV	SPEC LIMIT dBµV	MARGIN dB	NOTES
8.619521	32.5	4.3				36.8	48.0	-11.2	B
8.920078	32.5	5.4				37.9	48.0	-10.1	B
9.193311	32.1	4.9				37.0	48.0	-11.0	B
9.261620	32.0	4.6				36.6	48.0	-11.4	B
9.452883	33.5	3.9				37.4	48.0	-10.6	B
9.589499	32.8	3.4				36.2	48.0	-11.8	B

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.107

NOTES: B = Black lead

COMMENTS: EUT is a receiver for a water level control device. Voltage supplied is 120VAC/60Hz.

TABLE A

LIST OF TEST EQUIPMENT

ID #	Equipment	Mfg.	Model	S/N	Cal Date	Cal Due Date
92	Biconical Antenna	A & H	SAS 200/542	06/04/1900	05/08/2000	05/08/2001
341	Log Periodic Antenna	A & H	SAS-200/510	154	05/08/2000	05/08/2001
354	Magnetic Loop Antenna	EMCO	6502	1074	06/16/2000	06/16/2001
327	LISN Set (EUT)	Solar	8028-50-TS-24-BNC	814493 & 814474	06/05/2000	06/05/2001
691	Coax cable # 2 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
401	Pre-Amp (0.1M-1.3GHz)	HP	8447D	1937A02604	04/03/2000	04/03/2001
765	Pre-Amp (1-18 GHz)	HP	8449B	3008A00301	10/27/1999	10/27/2001
502	Spectrum Analyzer-RF Sect.	HP	8566B	2209A01404	07/07/2000	07/07/2001
439	QP Adapter	HP	85650A	2811A01267	07/07/2000	07/07/2001
472	Spectrum Analyzer-Display	HP	8566B	2209A01404	07/07/2000	07/07/2001
1107	25’ long semi-rigid coax	Andrew	FSJ1-50A	Cable # 7	05/10/00	05/10/01
901	Antenna, Horn	EMC Test Systems	3115	9602-4660	11/10/2000	11/10/2001

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ±4dB measurement uncertainty.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

EUT SETUP

The equipment under test (EUT) was set up in a manner that represented its normal use. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions and conducted Tables. Additionally, a complete description of all the I/O cables (receiver only) is included on the information sheets contained in Appendix A.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of table top devices.

I/O cables (receiver portion) were connected to the EUT in the manner required for normal operation of the system. Excess cabling was bundled in the center in a serpentine fashion using 30-40 centimeter lengths.

During conducted emissions testing, the EUT was located 80 centimeters above the conducting ground plane on the same nonconducting table as was used for radiated testing. The metal plane was grounded to the earth through the green wire safety ground. Power to the EUT was provided via 3 meters of shielded power cable from a filter grounded to the metal plane to a LISN. The LISN was also grounded to the plane and attached to the LISN was a 4 ganged grounded outlet whose source was also shielded and 60 cm in length. All other objects were kept a minimum of 1 meter away from the EUT during the conducted test.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect both the radiated and conducted emissions data for the Wireless Water Level Control Device, SmartMiser. For frequencies below 30 MHz the magnetic loop antenna was used. Frequencies from 30 to 300 MHz were tested using the biconical antenna. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. Frequencies above 1000 MHz were tested using the horn antenna. Conducted emissions tests required the use of the FCC type LISN's.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dBµV, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	450 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	10 GHz	1 MHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 - 6 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in the appropriate table. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Wireless Water Level Control Device, SmartMiser.

Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP Quasi-Peak Adapter for the HP Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

When the frequencies exceed 1 GHz, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

TEST METHODS

The radiated and conducted emissions data of the Wireless Water Level Control Device, SmartMiser, was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". For the receiver testing, corrected data was then compared to the FCC Part 15, Subpart B Sections 15.107 & 15.109 emissions limits to determine compliance. For the transmitter testing, corrected data was then compared to the FCC Part 15, Subpart C Sections 15.209 & 15.231.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode. The frequencies below 30 MHz were scanned using the magnetic antenna. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned with the biconical antenna in the same manner, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. Frequencies above 1000 MHz were scanned using the horn antenna. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan a thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation, antenna height and configuration of the peripherals and cables. Maximizing of the cables (receiver portion) was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT cables were being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

Conducted Emissions Testing

For conducted emissions testing, a 30 to 50 second sweep time was used for automated measurements in the frequency bands of 450 kHz to 1.705 MHz, 1.705 MHz to 3 MHz, and 3 MHz to 30 MHz. All readings within 20 dB of the limit were recorded. At frequencies where the recorded emissions were close to the limit, further investigation was performed manually at a slower sweep rate.

FCC Part 15.231(c) - Occupied Bandwidth Measurements

In accordance with Part 15.231(c), the fundamental frequency was kept within the central 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

FCC Part 15.231(a)(4) - Pulse Duration

In accordance with FCC Part 15.231(a)(4), the automatically activated transmission ceased transmissions within less than 5 seconds after activation.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the emissions readings in Tables 1 - 6. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula:

Meter reading (dBµV)
+ Antenna Factor (dB)
+ Cable Loss (dB)
- Distance Correction (dB)
- Pre-amplifier Gain (dB)

= Corrected Reading (dBµV/m)

This reading was then compared to the applicable specification limit to determine compliance.

A typical data sheet will display the following in column format:

#	Freq MHz	Rdng dBuV	Cable	Amp	Bicon	Horn	Log	Dist	Corr dBuV/m	Spec	Margin	Polar
			Mag	LISN								

means reading number
Freq MHz is the frequency in MHz of the obtained reading.
Rdng dBuV is the reading obtained on the spectrum analyzer in dBµV.
Amp is short for the preamplifier factor or gain in dB.
Bicon is the biconical antenna factor in dB.
Log is the log periodic antenna factor in dB.
Mag is the magnetic antenna factor in dB.
Horn is the horn antenna factor in dB.
Cable is the cable loss in dB of the coaxial cable on the OATS.
Dist is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.
Corr dBµV/m is the corrected reading which is now in dBµV/m (field strength).
Spec is the specification limit (dB) stated in the regulations.
Margin is the closeness to the specified limit in dB; + is over and - is under the limit.
Polar is the Polarity of the antenna with respect to earth.
LISN is the line impedance stabilization network factor in dB.
FCC 15.35 is the average correction called in FCC Part 15.35.

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

Not provided by customer at this time.

INFORMATION ABOUT THE EQUIPMENT UNDER TEST	
Test Software/Firmware:	
CRT was displaying:	
Power Supply Manufacturer:	
Power Supply Part Number:	
AC Line Filter Manufacturer:	
AC Line Filter Part Number:	
The EUT has no power cord.	

I/O PORTS	
Type	#

CRYSTAL OSCILLATORS	
Type	Freq. In MHz

PRINTED CIRCUIT BOARDS				
Function	Model & Rev	Clocks, MHz	Layers	Location

Not provided by the customer at this time.

CABLE INFORMATION

Cable #:		Cable(s) of this type:	
Cable Type:		Shield Type:	
Construction:		Length In Meters:	
Connected To End (1):		Connected To End (2):	
Connector At End (1):		Connector At End (2):	
Shield Grounded At (1):		Shield Grounded At (2):	
Part Number:		Number of Conductors:	
Notes:			

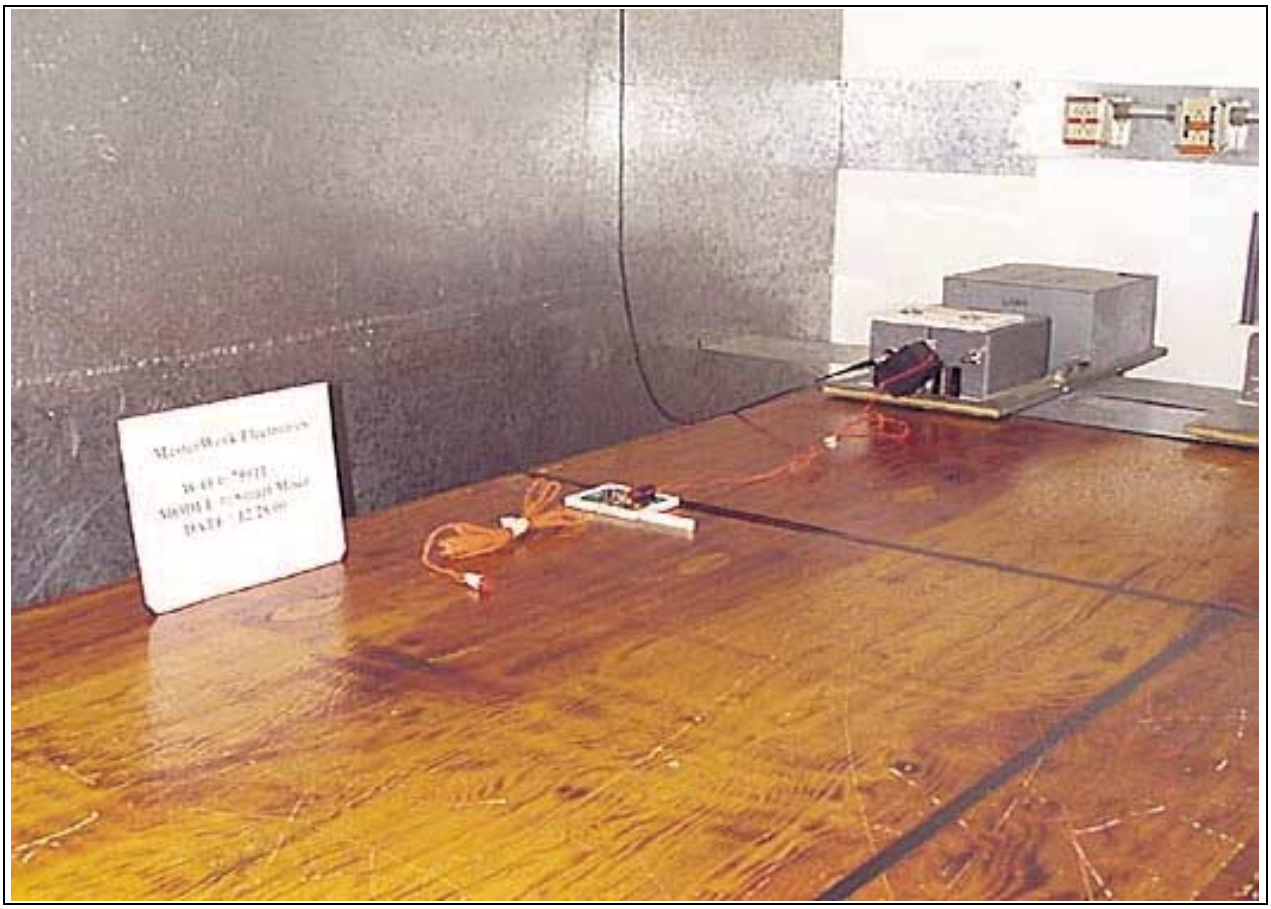
PHOTOGRAPH SHOWING RADIATED EMISSIONS - FCC Part 15.209

Radiated Emissions - Front View of Transmitter

PHOTOGRAPH SHOWING RADIATED EMISSIONS - FCC Part 15.109

Radiated Emissions - Front View of Receiver

PHOTOGRAPH SHOWING CONDUCTED EMISSIONS - FCC Part 15.107

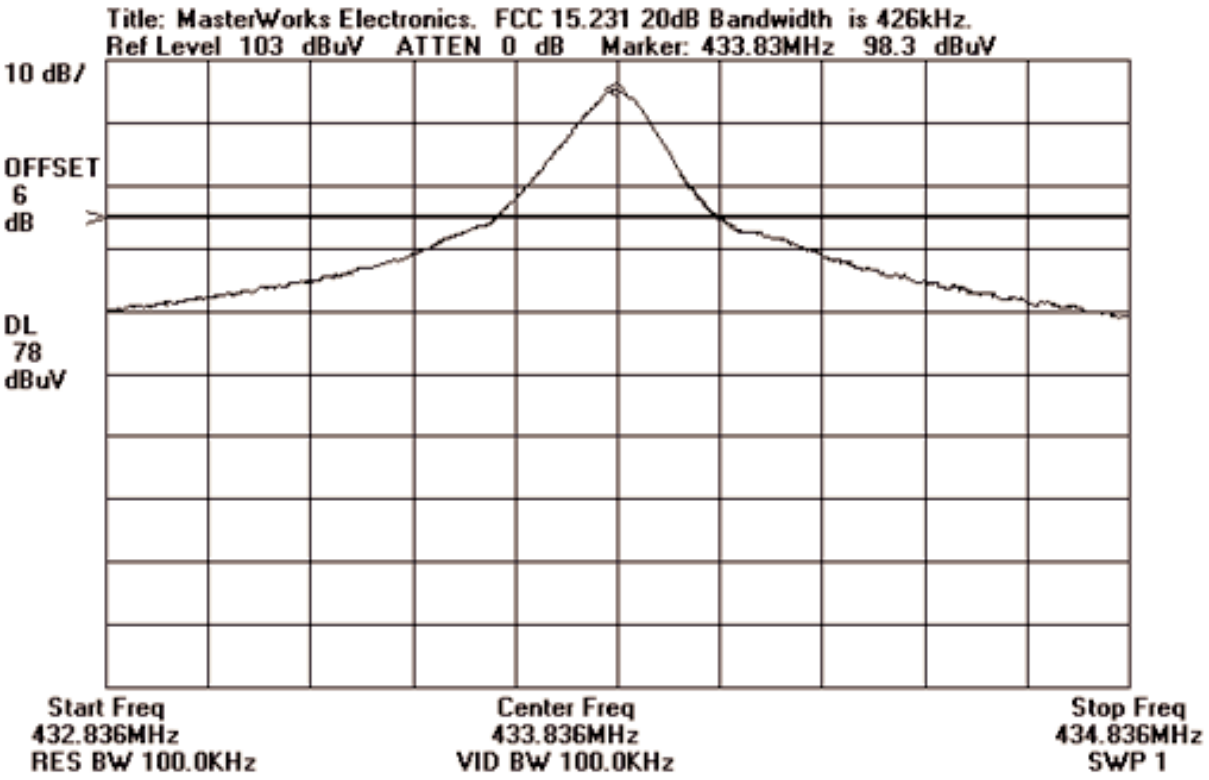


Conducted Emissions - Front View of Receiver

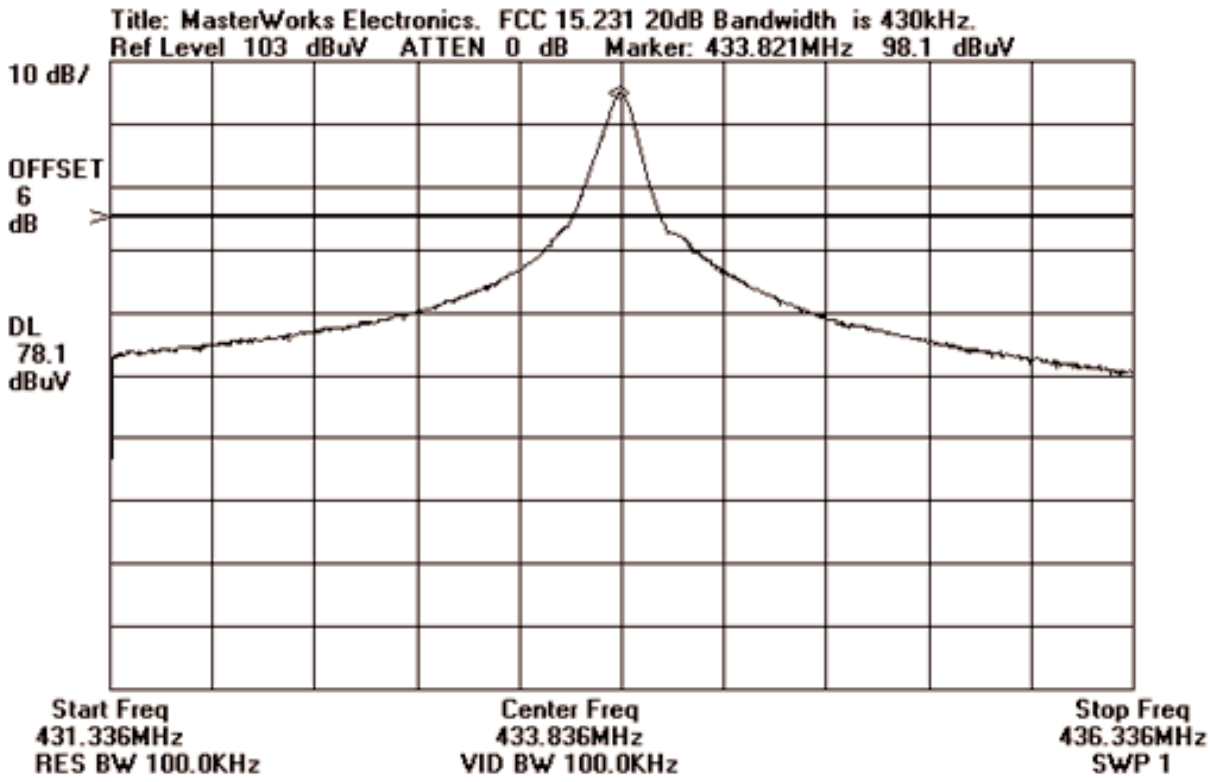
APPENDIX B

MEASUREMENT DATA SHEETS

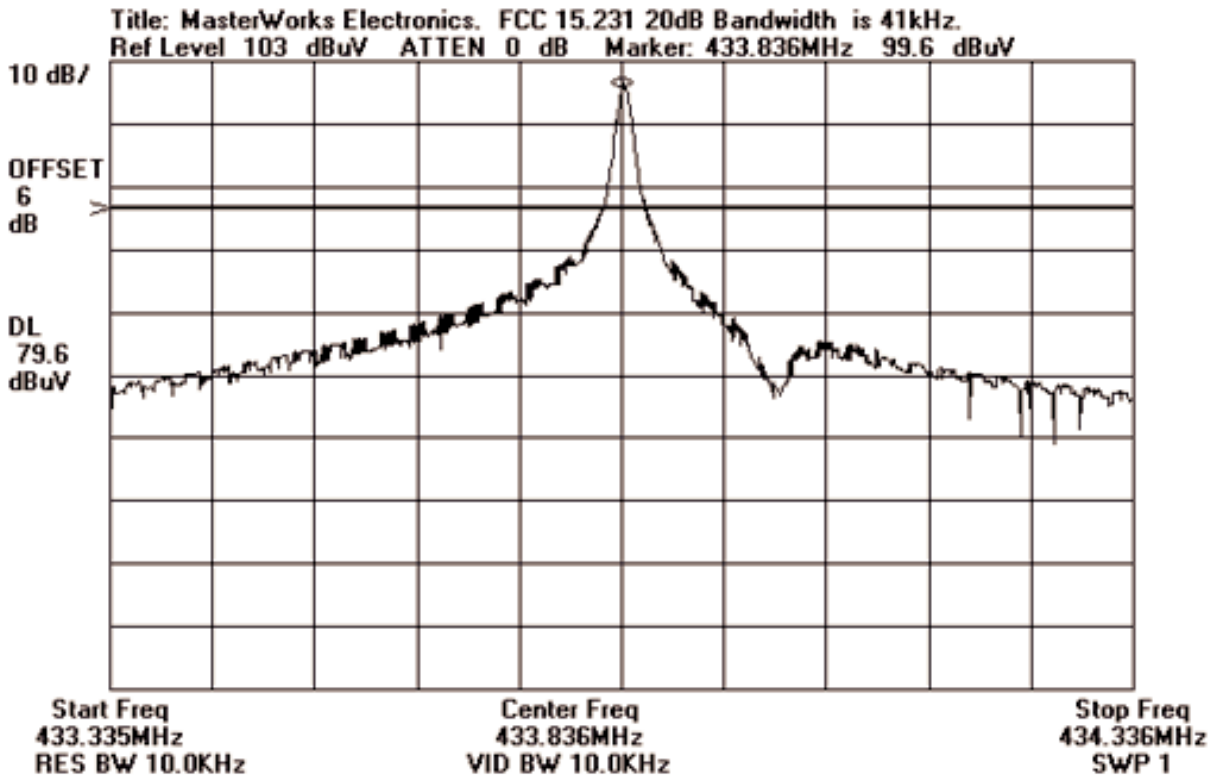
Occupied Bandwidth Plot



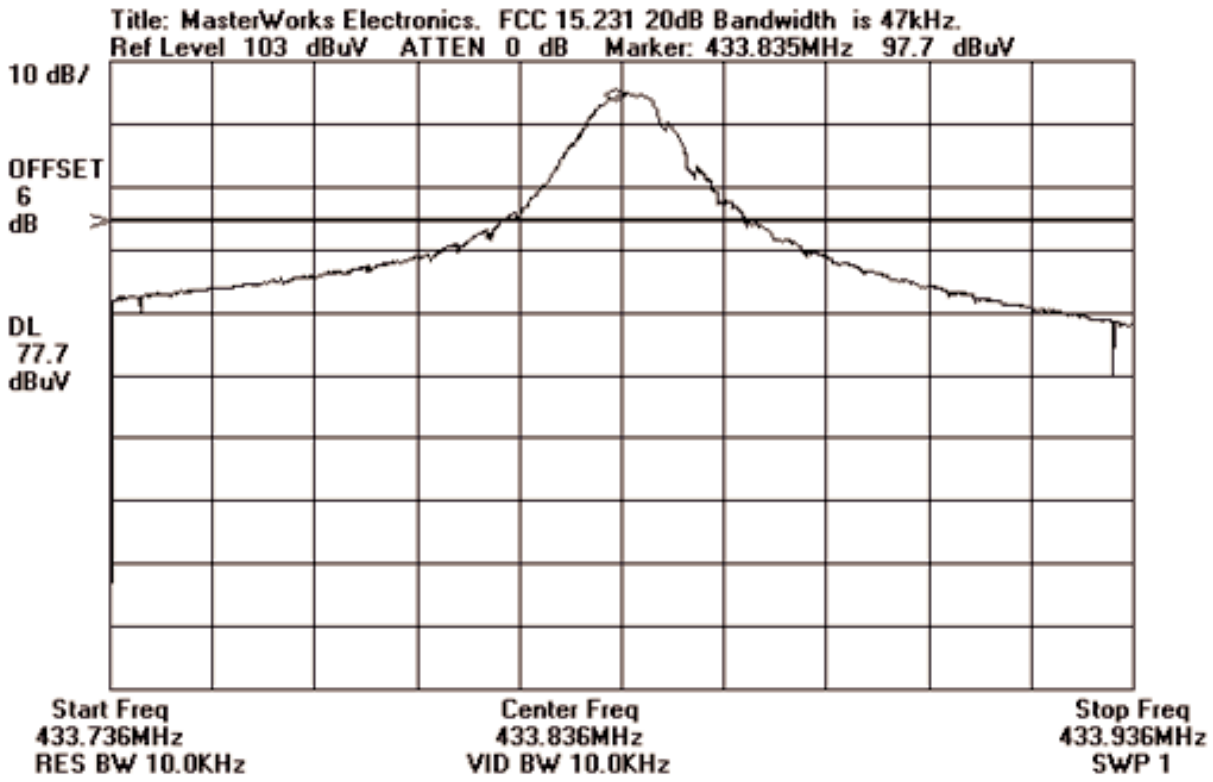
Occupied Bandwidth Plot



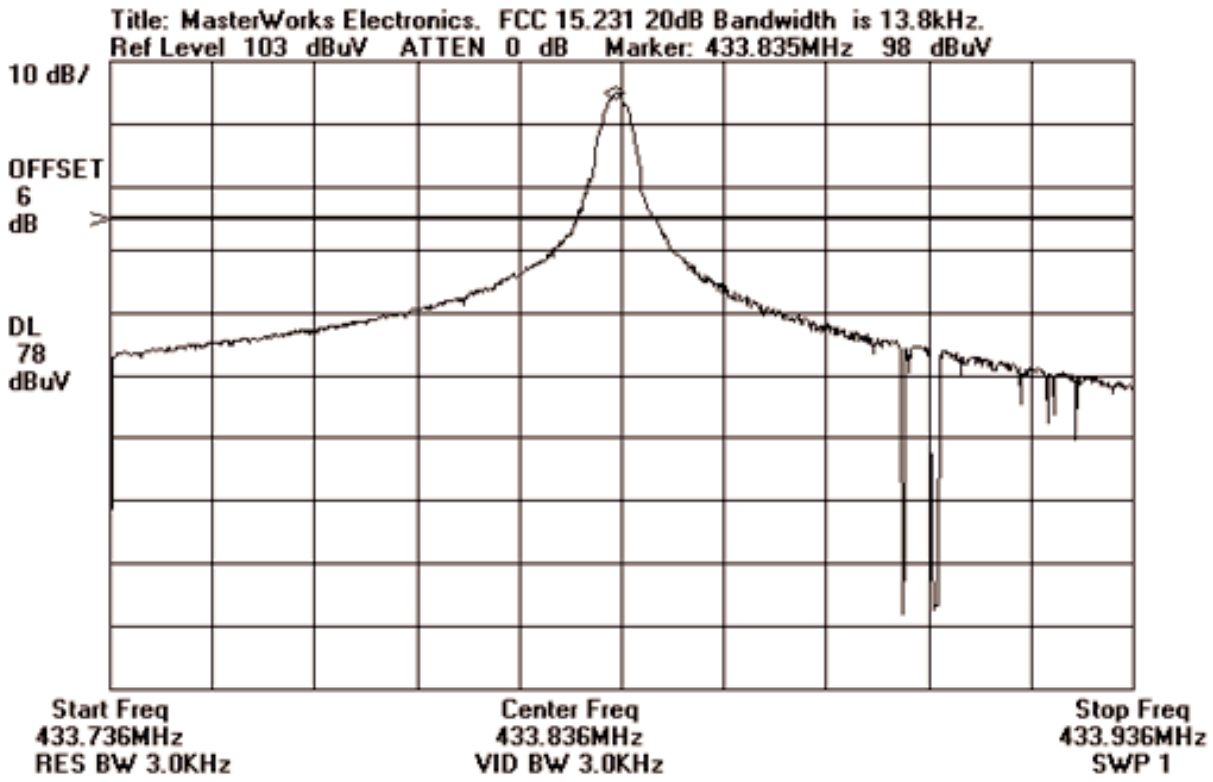
Occupied Bandwidth Plot



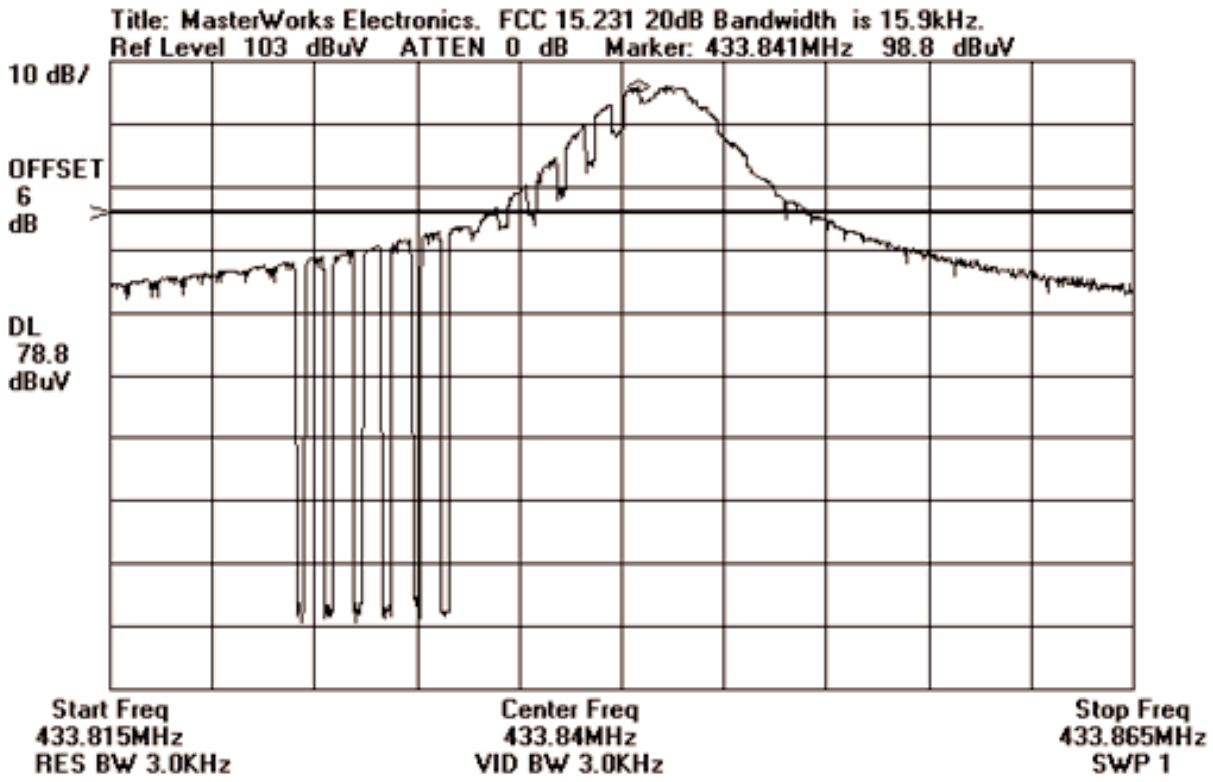
Occupied Bandwidth Plot



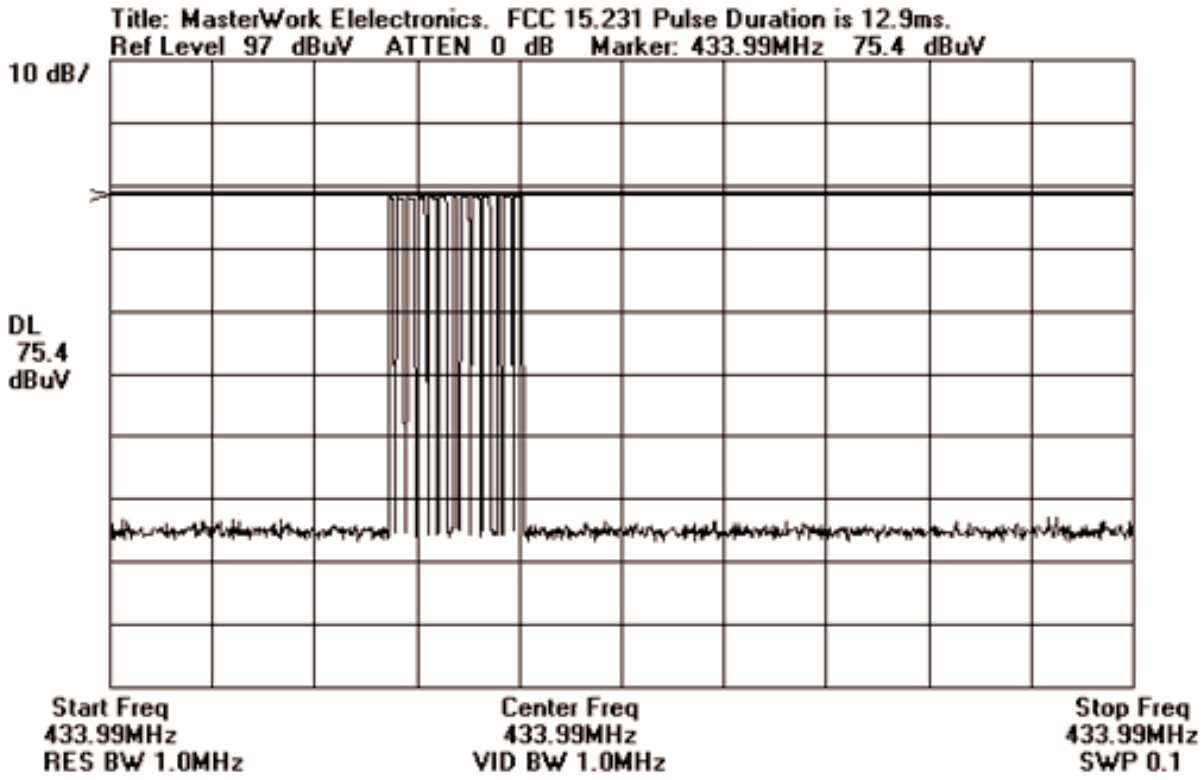
Occupied Bandwidth Plot



Occupied Bandwidth Plot

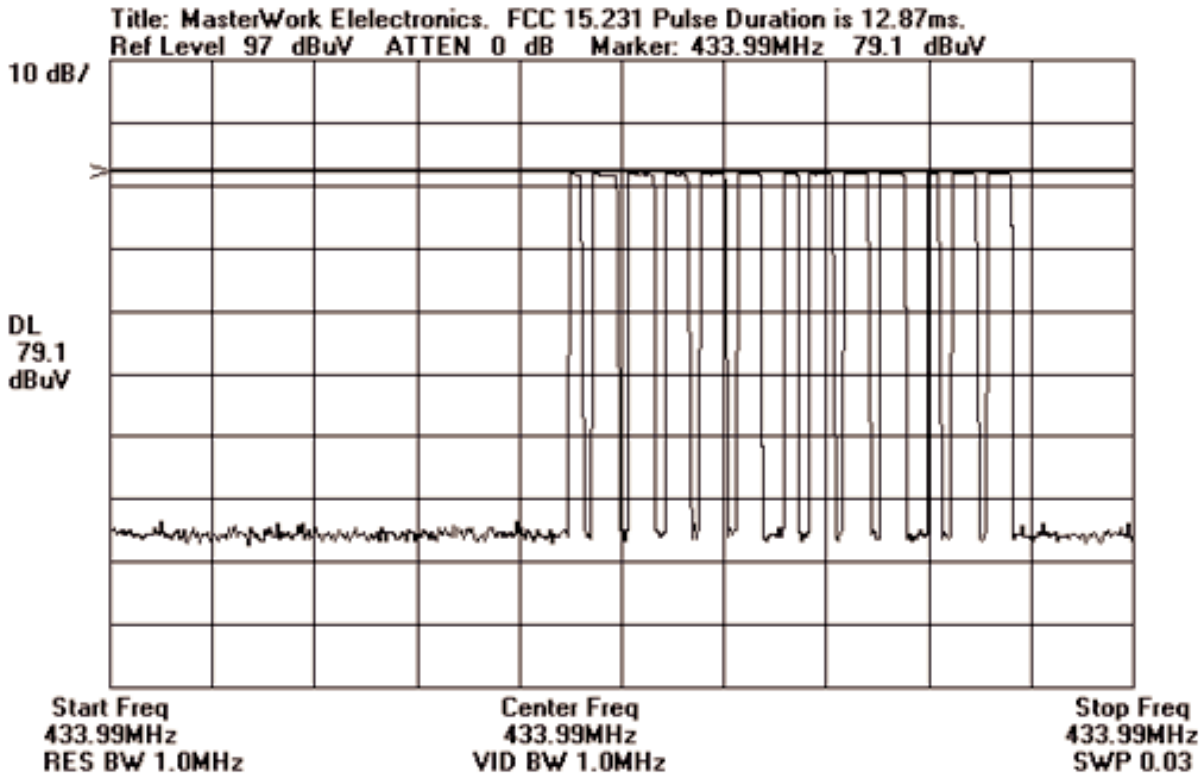


Pulse Duration Plot – 100ms



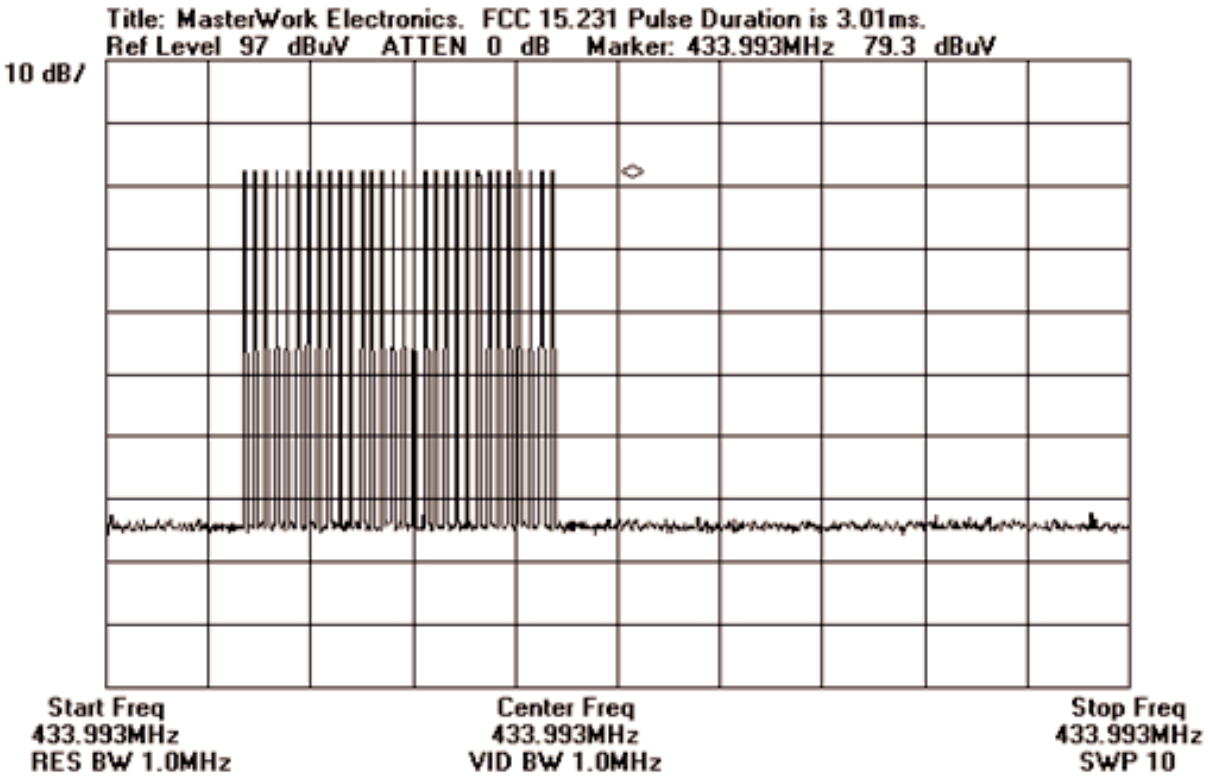
Comments: Pulse train exists for 3.01s, inside this window, the transmitter transmits packets of 12.87ms in length. Each packet is transmitted 1 time within 100ms.

Pulse Duration Plot – 30ms



Comments: The digital signal inside the packet uses 66.6% - 33.3% keying. Thus the packet is only transmitting 66% of the time.

Pulse Duration Plot – 10s



Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362

Customer: **Masterworks Electronics**
Specification: **FCC 15.231(b)**
Work Order #: **75911** Date: 12/28/2000
Test Type: **Radiated Scan** Time: 17:27:12
Equipment: **Irrigation Control Device** Sequence#: 1
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production
S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a transmitter operating on 433MHz. EUT is manually operated. A -20dB duty cycle correction factor is used in accordance with 15.35(c). The following is the calculation used:

20*LOG(12.87*0.666/100) = -21.3dB. CKC used –20dB.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	Amp FCC 15.35	Bicon	Log	Cable	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	433.970M	100.3	-25.6 -20.0	+0.0	+16.8	+4.4	+0.0	75.9	80.5	-4.6	Vert
2	433.900M	92.7	-25.6 -20.0	+0.0	+16.8	+4.4	+0.0	68.3	80.5	-12.2	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362

Customer: **Masterworks Electronics**
Specification: **FCC 15 C PARA 15.209**
Work Order #: **75911** Date: 12/29/2000
Test Type: **Radiated Scan** Time: 15:52:00
Equipment: **Irrigation Control Device** Sequence#: 5
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production
S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a transmitter operating on 433MHz. EUT is manually operated. The following is the duty cycle calculation used:

20*LOG(12.87*0.666/100) = -21.3dB. CKC used –20dB

Measurement Data: Reading listed by margin. Test Distance: 10 Meters

#	Freq MHz	Rdng dBµV	Mag dB	Cable dB	FCC 15.35 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	4.210M	28.2	+10.3	+0.4	-20.0		+0.0	18.9	29.5	-10.6	None
2	19.560M	28.3	+9.2	+0.8	-20.0		+0.0	18.3	29.5	-11.2	None
3	24.794M	25.4	+7.8	+0.9	-20.0		+0.0	14.1	29.5	-15.4	None

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362

Customer: **Masterworks Electronics**
Specification: **FCC 15.231 (b)**
Work Order #: **75911** Date: 12/28/2000
Test Type: **Radiated Scan** Time: 15:01:35
Equipment: **Irrigation Control Device** Sequence#: 2
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production
S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a transmitter operating on 433MHz. EUT is manually operated. No emissions found in 15.205 restricted bands.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Amp dB	Bicon dB	Log dB	Cable dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	561.360M	60.2	-25.9	+0.0	+18.8	+5.1	+0.0	58.2	61.9	-3.7	Vert
2	867.720M	45.9	-25.9	+0.0	+23.0	+6.5	+0.0	49.5	61.9	-12.4	Vert
3	561.700M	47.2	-25.9	+0.0	+18.8	+5.1	+0.0	45.2	61.9	-16.7	Horiz
4	868.000M	35.8	-25.9	+0.0	+23.0	+6.5	+0.0	39.4	61.9	-22.5	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362

Customer: **Masterworks Electronics**
Specification: **FCC 15.231/15.209**
Work Order #: **75911** Date: 04/04/2001
Test Type: **Radiated Scan** Time: 14:54:38
Equipment: **Irrigation Control Device** Sequence#: 4
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production
S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a transmitter operating on 433MHz. EUT is manually operated. 15.209 limit only applies to frequencies within the 15.205 restricted bands.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Pream Horn dB	GHz C dB	GHz C dB	GHz C dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	1150.000M Ambient	64.5	-35.9 +24.3	+3.1	+0.3	+1.6	+0.0	57.9	54.0 Ambient	+3.9	Horiz
2	2618.600M	45.2	-34.7 +30.5	+8.0	+3.5	+3.9	+0.0	56.4	61.9	-5.5	Vert
3	3470.000M	43.1	-35.9 +34.8	+7.2	+3.1	+3.6	+0.0	55.9	61.9	-6.0	Horiz
4	1626.500M	50.5	-35.6 +25.7	+3.8	+0.2	+2.0	+0.0	46.6	54.0	-7.4	Horiz
5	1370.000M	51.2	-35.8 +25.0	+3.4	+0.2	+1.8	+0.0	45.8	54.0	-8.2	Vert
6	1149.900M	52.4	-35.9 +24.3	+3.1	+0.3	+1.6	+0.0	45.8	54.0	-8.2	Vert
7	1285.500M	59.3	-35.8 +24.8	+3.3	+0.2	+1.7	+0.0	53.5	61.9	-8.4	Horiz
8	2168.600M	48.7	-35.0 +27.7	+5.7	+1.4	+3.0	+0.0	51.5	61.9	-10.4	Vert
9	2168.500M	48.5	-35.0 +27.7	+5.7	+1.4	+3.0	+0.0	51.3	61.9	-10.6	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362

Customer: **Masterworks Electronics**
Specification: **FCC B RADIATED**
Work Order #: **75911** Date: 12/29/2000
Test Type: **Maximized Emissions** Time: 17:52:18
Equipment: **Irrigation Control Device** Sequence#: 12
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production
S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a receiver for an irrigation control device.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Amp dB	Bicon dB	Log dB	Cable dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	303.740M	28.1	-24.8	+0.0	+21.3	+3.7	+0.0	28.3	46.0 Ambient Noise Level	-17.7	Vert
2	40.420M	34.9	-25.0	+11.1	+0.0	+1.1	+0.0	22.1	40.0 Ambient Noise Level	-17.9	Vert
3	303.725M	27.1	-24.8	+0.0	+21.3	+3.7	+0.0	27.3	46.0 Ambient Noise Level	-18.7	Horiz
4	506.165M	29.2	-25.9	+0.0	+17.6	+4.8	+0.0	25.7	46.0 Ambient Noise Level	-20.3	Horiz
5	506.165M	28.9	-25.9	+0.0	+17.6	+4.8	+0.0	25.4	46.0 Ambient Noise Level	-20.6	Vert
6	121.460M	30.4	-25.0	+14.3	+0.0	+2.2	+0.0	21.9	43.5 Ambient Noise Level	-21.6	Vert
7	40.515M	30.1	-25.0	+11.1	+0.0	+1.1	+0.0	17.3	40.0 Ambient Noise Level	-22.7	Horiz
8	121.460M	29.1	-25.0	+14.3	+0.0	+2.2	+0.0	20.6	43.5 Ambient Noise Level	-22.9	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362
Customer: **Masterworks Electronics**
Specification: **FCC B COND**
Work Order #: **75911** Date: 12/29/2000
Test Type: **Conducted Emissions** Time: 15:04:32
Equipment: **Irrigation Control Device** Sequence#: 6
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

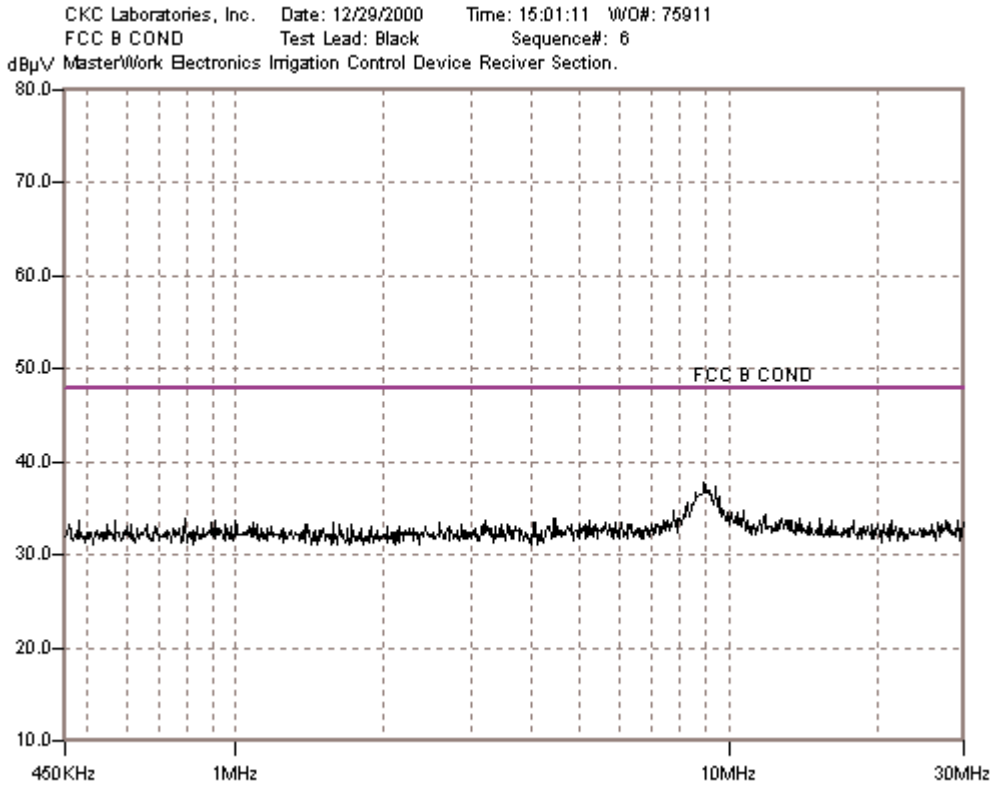
Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a receiver for a water level control device. Voltage supplied is 120VAC/60Hz.

Measurement Data: Reading listed by margin. Test Lead: Black

#	Freq MHz	Rdng dBµV	Cable dB	LISN dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	8.920M	32.5	+0.2	+5.2			+0.0	37.9	48.0	-10.1	Black
2	9.453M	33.5	+0.2	+3.7			+0.0	37.4	48.0	-10.6	Black
3	9.193M	32.1	+0.2	+4.7			+0.0	37.0	48.0	-11.0	Black
4	8.620M	32.5	+0.2	+4.1			+0.0	36.8	48.0	-11.2	Black
5	9.262M	32.0	+0.2	+4.4			+0.0	36.6	48.0	-11.4	Black
6	9.589M	32.8	+0.2	+3.2			+0.0	36.2	48.0	-11.8	Black
7	8.264M	32.7	+0.2	+2.7			+0.0	35.6	48.0	-12.4	Black
8	9.658M	31.8	+0.2	+2.9			+0.0	34.9	48.0	-13.1	Black
9	9.808M	32.3	+0.2	+2.3			+0.0	34.8	48.0	-13.2	Black
10	10.744M	33.0	+0.2	+1.5			+0.0	34.7	48.0	-13.3	Black
11	7.759M	33.1	+0.2	+1.4			+0.0	34.7	48.0	-13.3	Black
12	10.450M	32.9	+0.2	+1.5			+0.0	34.6	48.0	-13.4	Black
13	10.163M	32.7	+0.2	+1.6			+0.0	34.5	48.0	-13.5	Black
14	9.958M	32.5	+0.2	+1.8			+0.0	34.5	48.0	-13.5	Black
15	11.857M	32.9	+0.2	+1.3			+0.0	34.4	48.0	-13.6	Black


CKC Laboratories, Inc. Date: 12/29/2000 Time: 15:01:11 WO#: 75911
FCC B COND Test Lead: Black Sequence#: 6
dBµV MasterWork Electronics Irrigation Control Device Reciver Section.
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC B COND
450KHz
1MHz
10MHz
30MHz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest • Mariposa, CA 95338 • 800-500-4362
Customer: **Masterworks Electronics**
Specification: **FCC B COND**
Work Order #: **75911** Date: 12/29/2000
Test Type: **Conducted Emissions** Time: 15:10:10
Equipment: **Irrigation Control Device** Sequence#: 7
Manufacturer: MasterWork Electronics Tested By: Randal Clark
Model: Production S/N: 001

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Irrigation Control Device	MasterWork Electronics	Production	001

Support Devices:

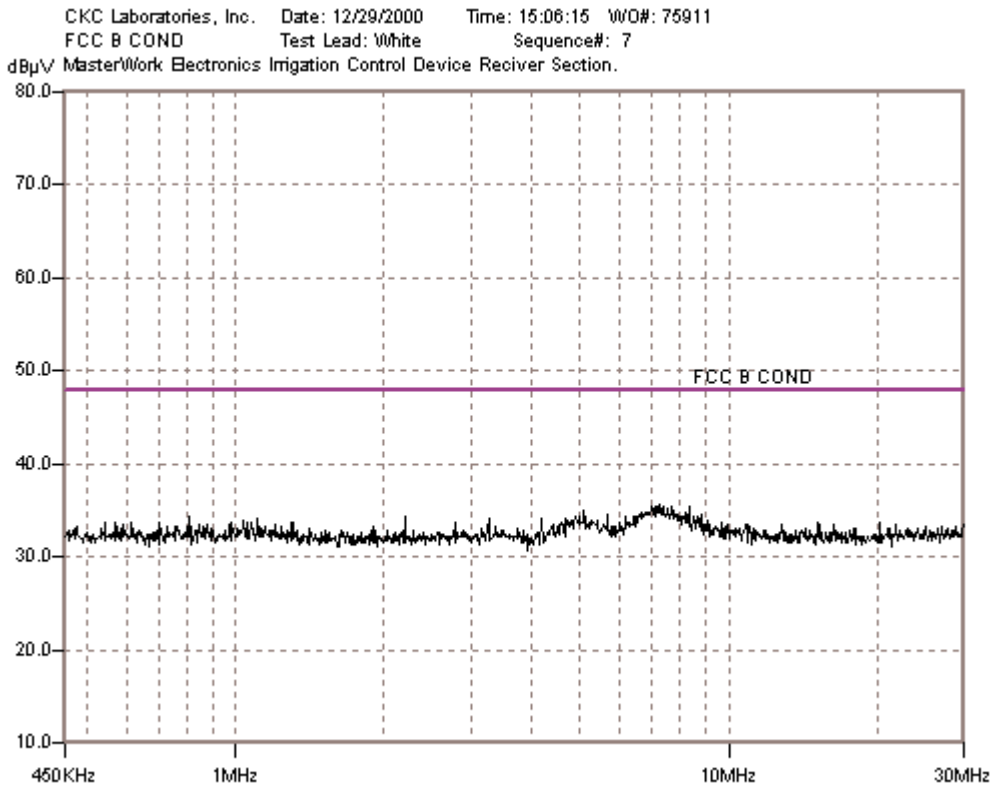
Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is a receiver for a water level control device. Voltage supplied is 120VAC/60Hz.

Measurement Data: Reading listed by margin. Test Lead: White

#	Freq MHz	Rdng dBµV	Cable dB	dB	LISN dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	7.226M	32.3	+0.2		+3.2		+0.0	35.7	48.0	-12.3	White
2	8.346M	33.4	+0.2		+1.9		+0.0	35.5	48.0	-12.5	White
3	7.376M	32.3	+0.2		+3.0		+0.0	35.5	48.0	-12.5	White
4	7.158M	32.1	+0.2		+3.2		+0.0	35.5	48.0	-12.5	White
5	7.117M	32.0	+0.2		+3.3		+0.0	35.5	48.0	-12.5	White
6	7.691M	32.5	+0.2		+2.7		+0.0	35.4	48.0	-12.6	White
7	7.021M	31.8	+0.2		+3.4		+0.0	35.4	48.0	-12.6	White
8	7.568M	32.2	+0.2		+2.8		+0.0	35.2	48.0	-12.8	White
9	7.308M	31.9	+0.2		+3.1		+0.0	35.2	48.0	-12.8	White
10	5.108M	32.7	+0.2		+2.0		+0.0	34.9	48.0	-13.1	White
11	8.169M	32.4	+0.2		+2.1		+0.0	34.7	48.0	-13.3	White
12	7.909M	31.9	+0.2		+2.5		+0.0	34.6	48.0	-13.4	White
13	7.800M	31.8	+0.2		+2.6		+0.0	34.6	48.0	-13.4	White
14	8.824M	33.1	+0.2		+1.2		+0.0	34.5	48.0	-13.5	White
15	5.696M	33.1	+0.2		+1.2		+0.0	34.5	48.0	-13.5	White


CKC Laboratories, Inc. Date: 12/29/2000 Time: 15:06:15 WO#: 75911
FCC B COND Test Lead: White Sequence#: 7
dBµV MasterWork Electronics Irrigation Control Device Reciver Section.
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC B COND
450KHz
1MHz
10MHz
30MHz