

*FCC PART 15, SUBPART B and C
TEST REPORT*

for

REMOTE CONTROL

MODEL: K24A-PRF+RFTM

Prepared for

ELECTRONIC SOLUTIONS, INC.
 11811 UPHAM STREET, UNIT #2
 BROOMFIELD, COLORADO 80020

Prepared by:_____

KYLE FUJIMOTO

Approved by:_____

MICHAEL CHRISTENSEN

COMPATIBLE ELECTRONICS INC.
 114 OLINDA DRIVE
 BREA, CALIFORNIA 92823
 (714) 579-0500

DATE: SEPTEMBER 18, 2002

	REPORT BODY	APPENDICES					TOTAL
		A	B	C	D	E	
PAGES	16	2	2	10	10	42	

This report shall not be reproduced except in full, without the written approval of Compatible Electronics.



TABLE OF CONTENTS

Section / Title	PAGE
GENERAL REPORT SUMMARY	4
SUMMARY OF TEST RESULTS	4
1. PURPOSE	5
2. ADMINISTRATIVE DATA	6
2.1 Location of Testing	6
2.2 Traceability Statement	6
2.3 Cognizant Personnel	6
2.4 Date Test Sample was Received	6
2.5 Disposition of the Test Sample	6
2.6 Abbreviations and Acronyms	6
3. APPLICABLE DOCUMENTS	7
4. Description of Test Configuration	8
4.1 Description of Test Configuration - EMI	8
4.1.1 Cable Construction and Termination	9
5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT	10
5.1 EUT and Accessory List	10
5.2 EMI Test Equipment	11
6. TEST SITE DESCRIPTION	12
6.1 Test Facility Description	12
6.2 EUT Mounting, Bonding and Grounding	12
7. Test Procedures	13
7.1 Radiated Emissions (Spurious and Harmonics) Test	13
7.2 Bandwidth of the Fundamental	15
8. CONCLUSIONS	16



LIST OF APPENDICES

APPENDIX	TITLE
A	Laboratory Recognitions
B	Modifications to the EUT
C	Additional Models Covered Under This Report
D	Diagrams, Charts, and Photos <ul style="list-style-type: none">• Test Setup Diagrams• Radiated Emissions Photos• Antenna and Effective Gain Factors
E	Data Sheets

LIST OF FIGURES

FIGURE	TITLE
1	Plot Map And Layout of Test Site



GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested: Remote Control
Model: K24A-PRF+RFTM
S/N: N/A

Product Description: See Expository Statement.

Modifications: The EUT was modified during the testing. Please see the list located in Appendix B.

Manufacturer: Electronic Solutions, Inc.
11811 Upham Street, Unit #2
Broomfield, Colorado 80020

Test Date: September 17, 2002

Test Specifications: EMI requirements
CFR Title 47, Part 15 Subpart B; and Subpart C, Sections 15.205, 15.209, and 15.231

Test Procedure: ANSI C63.4: 1992

Test Deviations: The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 450 kHz - 30 MHz	This test was not performed because the EUT operates on battery power only and cannot be plugged into the AC public mains.
2	Radiated RF Emissions, 10 kHz - 4300 MHz	Complies with the Class B limits of CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.231.



1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Remote Control Model: K24A-PRF+RFTM. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the Class B specification limits defined by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.231.



2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Electronic Solutions, Inc.

Gary Skinner President

Compatible Electronics, Inc.

Kyle Fujimoto Test Engineer
Michael Christensen Test Engineer

2.4 Date Test Sample was Received

The test sample was received on September 16, 2002.

2.5 Disposition of the Test Sample

The sample has not been returned to Electronic Solutions, Inc. as of September 18, 2002.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network



3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
CFR Title 47, Part 15	FCC Rules – Radio frequency devices (including digital devices)
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.



4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

Setup and operation of the equipment under test.

Specifics of the EUT and Peripherals Tested

The Remote Control Model: K24A-PRF+RFTM (EUT) was connected to the keypad. The EUT was continuously transmitting.

The final radiated data was taken in the mode above. Please see Appendix E for the data sheets.



4.1.1 **Cable Construction and Termination**

Cable 1 This is a 1 meter unshielded cable connecting the EUT to the keypad. It has RJ-45 connectors at each end.



5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT**5.1 EUT and Accessory List**

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
REMOTE CONTROL (EUT)	ELECTRONIC SOLUTIONS, INC.	K24A-PRF+RFTM	N/A	P7RRFTM418
KEYPAD (EUT)	ELECTRONIC SOLUTIONS, INC.	K24A-PRF+RFTM	N/A	P7RRFTM418



5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Radiated Emissions Manual Test – Radiated	Compatible Electronics	N/A	N/A	N/A	N/A
Spectrum Analyzer – Main Section	Hewlett Packard	8566B	2727A04757	Nov. 9, 2001	Nov. 9, 2002
Spectrum Analyzer – Display Section	Hewlett Packard	85662A	2648A15455	Nov. 9, 2001	Nov. 9, 2002
Spectrum Analyzer – Quasi-Peak Adapter	Hewlett Packard	85650A	3303A01688	Nov. 9, 2001	Nov. 9, 2002
Preamplifier	Com Power	PA-102	1202	Oct. 17, 2001	Oct. 17, 2002
Biconical Antenna	Com Power	AB-900	15011	July 15, 2002	July 15, 2003
Log Periodic Antenna	Com Power	AL-100	16101	Oct. 11, 2001	Oct. 11, 2002
Computer	Hewlett Packard	D5251A 888	US74458128	N/A	N/A
Printer	Hewlett Packard	C5886A	SG7CM1P090	N/A	N/A
Monitor	Hewlett Packard	D5258A	DK74889705	N/A	N/A
Loop Antenna	Com-Power	AL-130	17070	June 19, 2002	June 19, 2003
Horn Antenna	Com-Power	AH-118	10073	Jan. 21, 2002	Jan. 21, 2003
Microwave Preamplifier	Com-Power	PA-122	25195	Jan. 7, 2002	Jan. 7, 2003



6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.



7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Com-Power Microwave Preamplifier Model: PA-122 was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 4.3 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results. The loop antenna was also rotated in the horizontal and vertical axis in order to ensure accurate results.



Radiated Emissions (Spurious and Harmonics) Test (con't)

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance to obtain final test data. The final qualification data sheets are located in Appendix E.



7.2 Bandwidth of the Fundamental

The -20 dB bandwidth was checked to see that it was within 0.25% of the fundamental frequency for the EUT. A plot of the -20 dB bandwidth is located in Appendix D.



8. CONCLUSIONS

The Remote Control Model: K24A-PRF+RFTM meets all of the Class B specification limits defined in CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.231.



APPENDIX A

LABORATORY RECOGNITIONS



LABORATORY RECOGNITIONS

Compatible Electronics has the following agency accreditations:

National Voluntary Laboratory Accreditation Program - Lab Code: 200063-0

Voluntary Control Council for Interference - Registration Numbers: R-983, C-1026, R-984 and C-1027

Bureau of Standards and Metrology Inspection - Reference Number: SL2-IN-E-1031

Conformity Assessment Body for the EMC Directive Under the US/EU MRA Appointed by NIST

Compatible Electronics is recognized or on file with the following agencies:

Federal Communications Commission

Industry Canada

Radio-Frequency Technologies (Competent Body)



APPENDIX B

MODIFICATIONS TO THE EUT



MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC 15.231 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

- 1) Change R1 from 200 ohms to 820 ohms



APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT



ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

Remote Control
Model: K24A-PRF+RFTM
S/N: N/A

There were no additional models covered under this report.



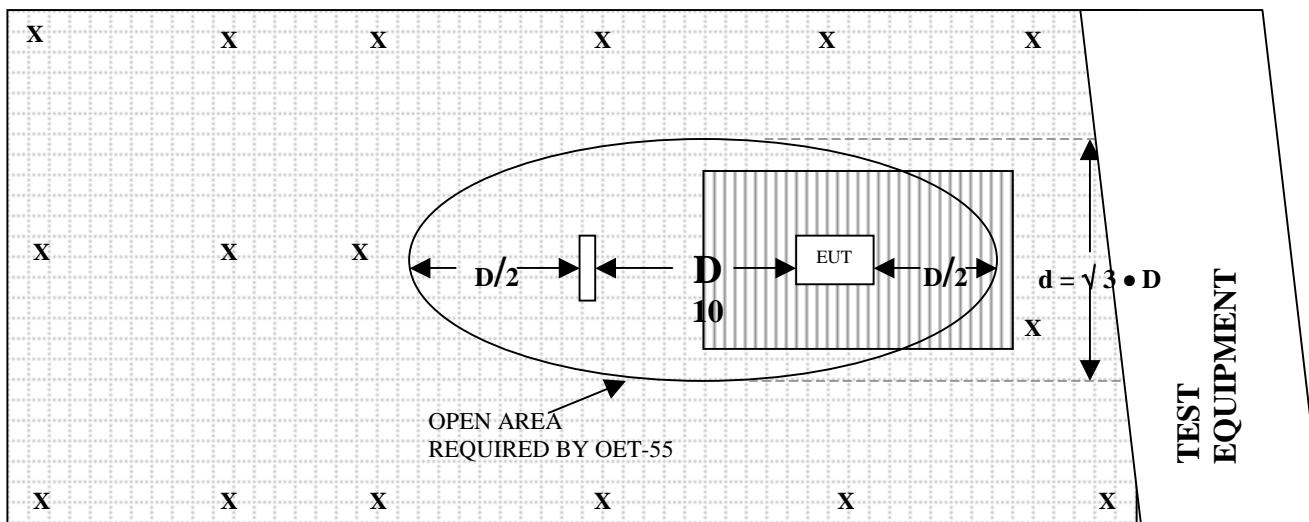
APPENDIX D

DIAGRAMS, CHARTS, AND PHOTOS



FIGURE 1: PLOT MAP AND LAYOUT OF RADIATED SITE

OPEN LAND > 15 METERS



OPEN LAND > 15 METERS

 = GROUND RODS	 = GROUND SCREEN
 = TEST DISTANCE (meters)	 = WOOD COVER



COM-POWER AB-900**BICONICAL ANTENNA****S/N: 15011****CALIBRATION DATE: JULY 15, 2002**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	11.30	120	14.10
35	10.40	125	13.20
40	11.80	140	12.20
45	13.10	150	12.00
50	12.30	160	13.50
60	12.10	175	15.60
70	8.10	180	16.30
80	6.50	200	16.70
90	9.50	250	16.50
100	11.40	300	19.30



COM-POWER AL-100**LOG PERIODIC ANTENNA****S/N: 16101****CALIBRATION DATE: OCTOBER 11, 2001**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
300	14.40	700	20.50
400	15.40	800	22.20
500	16.60	900	23.00
600	19.70	1000	26.60



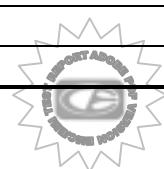
COM-POWER PA-102**PREAMPLIFIER****S/N: 1202****CALIBRATION DATE: OCTOBER 17, 2001**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	35.8	300	35.7
40	36.0	350	35.4
50	36.1	400	35.5
60	36.0	450	35.4
70	35.9	500	34.9
80	35.5	550	35.4
90	35.4	600	35.1
100	36.0	650	35.3
125	36.0	700	34.6
150	35.8	750	34.8
175	35.5	800	34.5
200	35.7	850	34.9
225	35.9	900	33.8
250	35.6	950	33.4
275	35.5	1000	34.5



COM-POWER PA-122
MICROWAVE PREAMPLIFIER
S/N: 25195
CALIBRATION DATE: JANUARY 7, 2002

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	33.7	9.5	31.8
1.1	33.4	10.0	32.2
1.2	33.1	11.0	31.4
1.3	33.1	12.0	30.2
1.4	33.2	13.0	32.9
1.5	32.5	14.0	33.9
1.6	32.7	15.0	32.4
1.7	32.3	16.0	32.2
1.8	32.3	17.0	31.5
1.9	31.4	18.0	32.2
2.0	32.8	19.0	31.2
2.5	33.3	20.0	31.3
3.0	31.7	21.0	31.7
3.5	31.6	22.0	29.7
4.0	31.2		
4.5	31.2		
5.0	31.0		
5.5	31.3		
6.0	32.1		
6.5	32.1		
7.0	31.8		
7.5	32.0		
8.0	33.1		
8.5	32.0		
9.0	30.8		



COM-POWER AH-118
HORN ANTENNA
S/N: 10073
CALIBRATION DATE: JANUARY 21, 2002

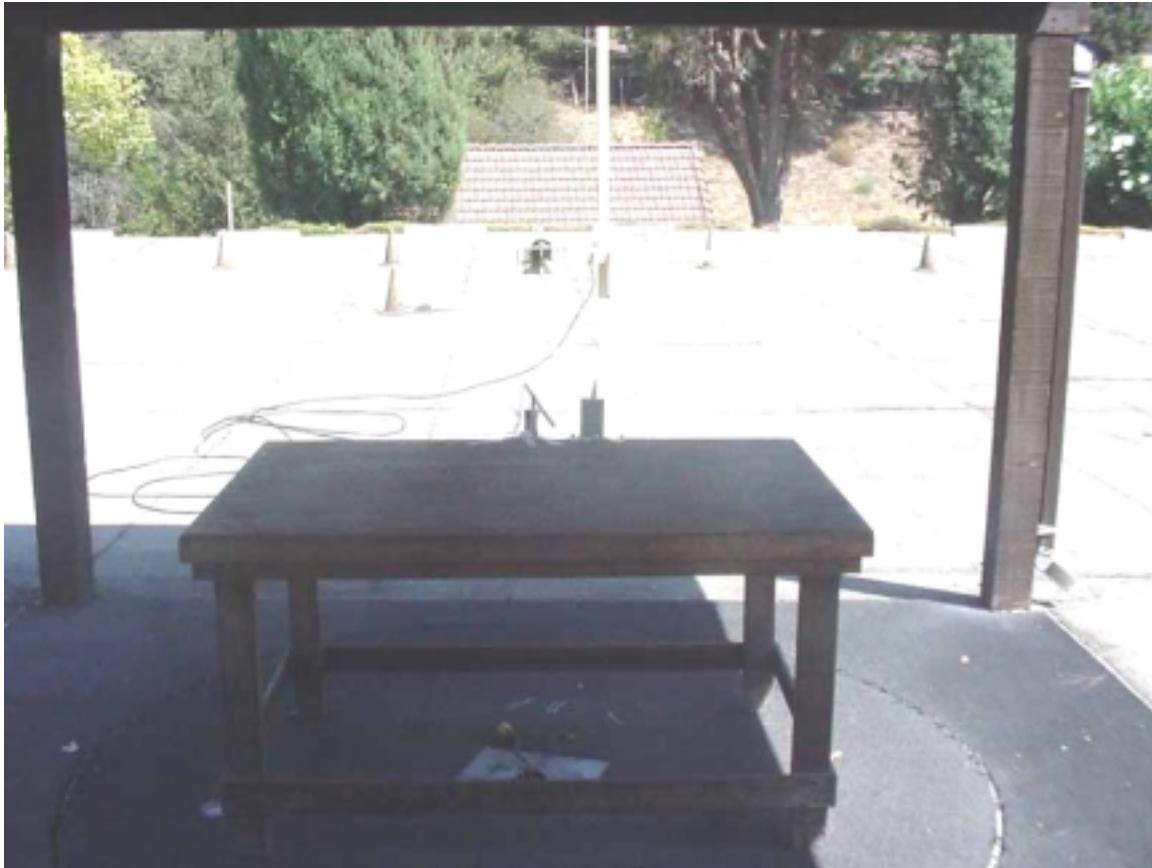
FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	26.6	9.5	41.4
1.5	29.2	10.0	41.8
2.0	32.4	10.5	40.4
2.5	32.3	11.0	37.5
3.0	31.4	11.5	42.2
3.5	31.8	12.0	40.4
4.0	31.1	12.5	43.6
4.5	32.0	13.0	44.2
5.0	33.9	13.5	41.8
5.5	32.0	14.0	43.3
6.0	37.8	14.5	47.0
6.5	36.8	15.0	49.4
7.0	42.4	15.5	49.9
7.5	39.5	16.0	49.9
8.0	41.3	16.5	48.2
8.5	40.3	17.0	44.0
9.0	39.5	17.5	44.8
		18.0	44.7



COM-POWER AL-130**LOOP ANTENNA****S/N: 17070****CALIBRATION DATE: JUNE 19, 2002**

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	-40.4	11.1
0.01	-40.3	11.2
0.02	-41.2	10.3
0.05	-41.6	9.9
0.07	-41.4	10.1
0.1	-41.7	9.8
0.2	-44.0	7.5
0.3	-41.6	9.9
0.5	-41.3	10.2
0.7	-41.4	10.1
1	-40.9	10.6
2	-40.6	10.9
3	-40.5	11.0
4	-40.8	10.7
5	-40.2	11.3
10	-40.7	10.8
15	-41.4	10.1
20	-41.6	9.9
25	-41.7	9.8
30	-42.9	8.6





FRONT VIEW

ELECTRONIC SOLUTIONS, INC.
REMOTE CONTROL
MODEL: K24A-PRF+RFTM
FCC SUBPART B AND C - RADIATED EMISSIONS – 09-17-02

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**





REAR VIEW

ELECTRONIC SOLUTIONS, INC.
REMOTE CONTROL
MODEL: K24A-PRF+RFTM
FCC SUBPART B AND C - RADIATED EMISSIONS – 09-17-02

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



APPENDIX E

DATA SHEETS



RADIATED EMISSIONS
DATA SHEETS



RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.231)

COMPANY	ELECTRONIC SOLUTIONS, INC.	DATE	9/17/02
EUT	REMOTE CONTROL	DUTY CYCLE	40.56 %
MODEL	K24A-PRF+RFTM	PEAK TO AVG	-7.83804107 dB
S/N	N/A	TEST DIST.	10 Meters
TEST ENGINEER	KYLE FUJIMOTO	LAB	A

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 1 OF PAGE 5

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.231)

COMPANY	ELECTRONIC SOLUTIONS, INC.	DATE	9/17/02
EUT	REMOTE CONTROL	DUTY CYCLE	40.56 %
MODEL	K24A-PRF+RFTM	PEAK TO AVG	-7.83804107 dB
S/N	N/A	TEST DIST.	10 Meters
TEST ENGINEER	KYLE FUJIMOTO	LAB	A

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 2 of PAGE 5

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.231)

COMPANY	ELECTRONIC SOLUTIONS, INC.	DATE	9/17/02
EUT	REMOTE CONTROL	DUTY CYCLE	40.56 %
MODEL	K24A-PRF+RFTM	PEAK TO AVG	-7.83804107 dB
S/N	N/A	TEST DIST.	10 Meters
TEST ENGINEER	KYLE FUJIMOTO	LAB	A

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 3 OF PAGE 5

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.231)

COMPANY	ELECTRONIC SOLUTIONS, INC.	DATE	9/17/02
EUT	REMOTE CONTROL	DUTY CYCLE	40.56 %
MODEL	K24A-PRF+RFTM	PEAK TO AVG	-7.83804107 dB
S/N	N/A	TEST DIST.	10 Meters
TEST ENGINEER	KYLE FUJIMOTO	LAB	A

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 4 of PAGE 5

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.231)

COMPANY	ELECTRONIC SOLUTIONS, INC.	DATE	9/17/02
EUT	REMOTE CONTROL	DUTY CYCLE	40.56 %
MODEL	K24A-PRF+RFTM	PEAK TO AVG	-7.83804107 dB
S/N	N/A	TEST DIST.	10 Meters
TEST ENGINEER	KYLE FUJIMOTO	LAB	A

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN
** DELTA = SPEC LIMIT - CORRECTED READING

No Emissions nor Harmonics found after the 5th Harmonic.

PAGE 5 of PAGE 5

Test Location : Compatible Electronics Page : 1/1
 Customer : Electronic Solutions, Inc. Date : 9/17/2002
 Manufacturer : Electronic Solutions, Inc. Time : 15:51:58
 Eut name : Remote Control Lab : A
 Model : K24A-PRF+RFTM Test Distance : 3.0 Meters
 Serial # : N/A
 Specification : FCC Class B
 Distance correction factor (20 * log(test/spec)) : 0.00
 Test Mode : Radiated Spurious Emissions
 10 kHz to 1000 MHz Vertical and Horizontal Polarization
 Temperature 78 Degrees F., Relative Humidity 56%
 Tested By: Kyle Fujimoto

Pol	Freq	Rdng	Cable	Ant	Amp	Cor' d	Limit	Delta
	MHz	dBuV	loss	factor	gain	rdg = R	= L	R-L
1V	31.207	36.10	0.70	11.07	35.83	12.04	40.00	-27.96
2V	32.407	34.10	0.70	10.85	35.85	9.80	40.00	-30.20
3V	34.807	34.10	0.70	10.43	35.90	9.33	40.00	-30.67
4V	38.407	35.50	0.70	11.37	35.97	11.60	40.00	-28.40
5V	45.607	34.00	0.76	12.91	36.06	11.61	40.00	-28.39
6V	301.207	31.60	2.21	14.41	35.69	12.53	46.00	-33.47
Horizontal Polarization								
7V	36.007	32.20	0.70	10.70	35.93	7.67	40.00	-32.33
8V	44.407	34.10	0.75	12.86	36.05	11.66	40.00	-28.34
9V	50.407	34.60	0.80	12.29	36.10	11.60	40.00	-28.40
10V	55.207	33.40	0.80	12.19	36.05	10.35	40.00	-29.65
11V	301.207	34.50	2.21	14.41	35.69	15.43	46.00	-30.57
12V	304.807	34.50	2.22	14.46	35.67	15.51	46.00	-30.49



-20 dB BANDWIDTH

DATA SHEET



BANDWIDTH OF THE FUNDAMENTAL -20 dB
REF 100.0 dB μ V ATTEN 10 dB

MKR Δ 412 kHz
-1.70 dB

hp

10 dB/

DL
67.2
dB μ V

CORR'D

CENTER 418.06 MHz
RES BW 1 MHz

VBW 1 MHz

SPAN 1.00 MHz
SWP 20.0 msec

