

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000

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

*for**the*

POOL/SPA CONTROLLER

MODEL: SOL 1000

Prepared for

POLARIS POOL SYSTEMS, INC.
2620 COMMERCE WAY
VISTA, CALIFORNIA 92083

Prepared by: 

DOUG MOON

Approved by: 

KEVIN BOTHMANN

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1547 PLYMOUTH STREET
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DATE: DECEMBER 11, 2000

	REPORT BODY	APPENDICES			TOTAL
		A	B	C	
PAGES	15	16	4	5	40

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TABLE OF CONTENTS

SECTION	TITLE	PAGE
	GENERAL REPORT SUMMARY	04
	SUMMARY OF TEST RESULTS	04
1.	PURPOSE	05
2.	ADMINISTRATIVE DATA	06
2.1	Location of Testing	06
2.2	Traceability Statement	06
2.3	Cognizant Personnel	06
2.4	Date Test Sample was Received	06
2.5	Disposition of the Test Sample	06
2.6	Abbreviations and Acronyms	06
3.	APPLICABLE DOCUMENTS	07
4.	DESCRIPTION OF TEST CONFIGURATIONS	08
4.1	Description of Test Configuration - EMI	08
4.1.1	Cable Construction and Termination	09
5.	LIST 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	RF Emissions	13
7.1.1	Conducted Emissions Test	13
7.1.2	Radiated Emissions Test	14
8.0	CONCLUSIONS	15

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LIST OF APPENDICES

APPENDIX	TITLE
A	Radiated and Conducted Emissions Data Sheets Plot of Bandwidth of Fundamental Frequency
B	Test Setup Diagrams
C	Antenna and Effective Gain Factors

LIST OF FIGURES

FIGURE	TITLE
1	Conducted Emissions Test Setup
2	Plot Map And Layout of Test Site
3	Equipment Configuration Block Diagram

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GENERAL REPORT SUMMARY

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

Associated with the data in this report is a ± 2 dB measurement uncertainty.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form 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: Pool/Spa Controller
Model: SOL 1000
S/N: N/A

Product Description: The Pool/Spa Controller consists of 3 units: a command center, battery charger, and remote control unit. The command center is placed outdoors (near the pool circuit panels), while the battery charger and remote control units are used either indoors or in a remote location away from the command center. It is used to control circulation of booster pumps as well as additional water features such as lights and valve actuators. All of the units have a 916.5 MHz radio.

Modifications: The EUT was not modified during the testing.

Manufacturer: Polaris Pool Systems, Inc.
2620 Commerce Way
Vista, California, 92083

Test Date(s): September 8, 13, and December 1, 2000

Test Specifications: EMI requirements
FCC Title 47, Part 15 Subpart B, Class B
FCC Title 47, Part 15 Subpart C
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.	Complies with the Class B limits of FCC Title 47, Part 15 Subpart B.
2	Radiated RF Emissions, 30 MHz - 1000 MHz.	Complies with the Class B limits of FCC Title 47, Part 15 Subpart B.
3	Radiated RF Emissions, 916.5 MHz - 9165 MHz.	Complies with the limits of FCC Title 47, Part 15 Subpart C. (Section 15.249)

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1. **PURPOSE**

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Pool/Spa Controller Model: SOL 1000. 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 in FCC Title 47, Part 15, Subpart B. The EUT was also tested to determine if the electromagnetic emissions were within the limits defined in FCC Title 47, Subpart C, section 15.249.

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2. ADMINISTRATIVE DATA**2.1 Location of Testing**

The EMI tests described herein were performed at the test facility of Electro Magnetic Test, 1547 Plymouth Street, Mountain View, California 94043.

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 measurement results in this report and the calibration of the test equipment are traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant PersonnelPolaris Pool Systems, Inc.

Jesse Loden Sr. Electronics Engineer

Electro Magnetic Test, Inc.

Doug Moon Test Technician
Tom Nguyen Test Technician
Kevin Bothmann Lab Manager

2.4 Date Test Sample was Received

The test sample was received on September 8, 2000.

2.5 Disposition of the Test Sample

The test sample has been held for further testing.

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
CISPR	International Special Committee On Radio Interference
FCC	Federal Communications Commission

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3. APPLICABLE DOCUMENTS

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

SPEC	TITLE
FCC Title 47, Part 15, Subpart B.	FCC Rules - Radio frequency devices (including digital devices).
FCC Title 47, Part 15, Subpart C.	FCC Rules – Radio frequency devices (intentional radiators) (Section 15.249)
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.

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4. DESCRIPTION OF TEST CONFIGURATION**4.1 Description of Test Configuration - EMI**

The EUT (command center) was connected to the 50 Ω resistors, valve actuators, temperature sensors, and the EUT (battery charger) via its relay, suction valve, return valve, aux valve 1, aux valve 2, water temperature, air temperature, solar temperature, and external device ports, respectively. The EUT also had unterminated cables connected to its heater and 24V aux ports. During the testing process, the EUTs were continuously transmitting data. The receiver circuit in each unit was active throughout the test.

The EUT (battery charger) was tested for the transmitter portion with the movable antenna pointing straight up, to the right, and to the left to find the worst case emissions. The final data was taken with the antenna pointing straight up vertically, which was found to be the worst case.

The EUT (remote control) was tested for the transmitter portion with the movable antenna pointing straight up, to the right, and to the left to find the worst case emissions. The final data was taken with the antenna pointing to the right, which was found to be the worst case. The unit was also tested for the transmitter portion in all three orthogonal positions (X, Y and Z). The final data was taken in the "X" position, found to be worst case.

Complete data for the EUT including the receiver portion as well as the transmitter portion can be found in Appendix A. Also, plots showing the bandwidth of the fundamental frequency for each unit can be found in Appendix A.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration. The cables were moved to maximize the emissions. The final conducted as well as radiated data was taken in this mode of operation. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix A.

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4.1.1 Cable Construction and TerminationCables #1-5

These are 6 foot unshielded cables connecting the EUT (command center) to the 50 Ω resistors. They are hardwired at both ends of the cable. The cables were bundled to a length of 2 feet.

Cables #6-9

These are 17 foot unshielded cables connecting the EUT (command center) to the valve actuators. They are hardwired at both ends of the cable. The cables were bundled to a length of 4 feet.

Cables #10-11

These are 13 foot unshielded cables connecting the EUT (command center) to the temperature sensors. They are hardwired at both ends of the cable. The cables were bundled to a length of 2 feet.

Cable #12

This is an unterminated 11 foot unshielded cable connected to the EUT's (command center) heater and 24V aux ports. It is hardwired the command center end, and is open at the unterminated end. The cable was bundled to a length of 2 feet.

Cable #13

This is a 22 foot unshielded cable connecting the EUT (command center) to the EUT (battery charger). It is hardwired at the command center end and has an RJ11 connector at the battery charger end. The cable was bundled to a length of 4 feet.


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

EQUIPMENT TYPE	MANU-FACTURER	MODEL	SERIAL NUMBER	FCC ID
POOL/SPA CONTROLLER (EUT SYSTEM)	POLARIS POOL SYSTEMS, INC.	SOL 1000	N/A	???-12-200X
COMMAND CENTER (EUT #1)	POLARIS POOL SYSTEMS, INC.	SOL 1000	N/A	???-12-200X
BATTERY CHARGER (EUT #2)	POLARIS POOL SYSTEMS, INC.	SOL 1000	N/A	???-12-200X
REMOTE CONTROL (EUT #3)	POLARIS POOL SYSTEMS, INC.	SOL 1000	N/A	???-12-200X
VALVE ACTUATOR #1	JANDY	JVA2440	2JVA441943	N/A
VALVE ACTUATOR #2	JANDY	JVA2440	17JVA241943	N/A
VALVE ACTUATOR #3	JANDY	JVA2440	13JVA241943	N/A
VALVE ACTUATOR #4	JANDY	JVA2440	11JVA241943	N/A
TEMPERATURE SENSOR #1	POLARIS POOL SYSTEMS, INC.	N/A	N/A	N/A
TEMPERATURE SENSOR #2	POLARIS POOL SYSTEMS, INC.	N/A	N/A	N/A


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5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
Spectrum Analyzer	Hewlett Packard	8566B	3013A07296	July 31, 2000	1 Year
RF Preselector	Hewlett Packard	85685A	3010A01157	October 29, 1999 November 3, 2000	1 Year
Quasi-Peak Adapter	Hewlett Packard	85650	2521A00584	July 31, 2000	1 Year
Preamplifier	Com Power	PA-102	1482	March 1, 2000	1 Year
Preamplifier	Com Power	PA-122	2113	October 7, 1999 October 7, 2000	1 Year
RF Attenuator	Mini-Circuits	CAT-10	Asset #1000	December 7, 1999	1 Year
LISN	Com Power	LI-200	12012	April 27, 2000	1 Year
LISN	Com Power	LI-200	12214	April 27, 2000	1 Year
LISN	Com Power	LI-200	1767	April 27, 2000	1 Year
LISN	Com Power	LI-200	1768	April 27, 2000	1 Year
Biconical Antenna	Com Power	AB-100	01557	November 13, 1999 November 11, 2000	1 Year
Log Periodic Antenna	Com Power	AL-100	16037	November 13, 1999 November 11, 2000	1 Year
Horn Antenna	Com Power	AH-118	10062	N/A	N/A
Antenna Mast	Com Power	AM-400	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Compaq	Series 3284	X637BBS20212	N/A	N/A
Printer	Epson	P930A	3HR1398903	N/A	N/A
Plotter	Hewlett Packard	7470A	2308A96499	N/A	N/A

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6. **TEST SITE DESCRIPTION**

6.1 **Test Facility Description**

Please refer to section 7.1.1 and 7.1.2 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 (command center) was grounded through the safety ground in its power cord.

The EUT (battery charger) was not grounded.

The EUT (remote control) was not grounded.

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7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests.

7.1 RF Emissions**7.1.1 Conducted Emissions Test**

The HP 8566B spectrum analyzer was used as a measuring meter along with the HP 85650A quasi-peak adapter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak detector was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the spectrum analyzer offset was adjusted accordingly to read the actual data measured. The LISN output was read by the HP 8566B spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for the conducted emissions test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 1992. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The initial test data was taken in manual mode while scanning the frequency ranges of 0.45 MHz to 1.6 MHz, 1.6 MHz to 5 MHz and 5 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable and peripheral placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the spectrum analyzer span adjusted to 1 MHz.

The final data was collected under program control by the HP 85869PC software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave.

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7.1.2 Radiated Emissions Test

The HP 8566B spectrum analyzer was used as a measuring meter along with the HP 85650A quasi-peak adapter. The Com Power Preamplifier PA-102 and Com Power Preamplifier PA-122 were used to increase the sensitivity of the instrument. 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 HP 85650A quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was 120 kHz from 30 MHz to 1 GHz and 1 MHz from 1 GHz to 9.165 GHz.

Broadband biconical, log periodic and horn antennas were used as transducers during the measurement. The biconical antenna was used from 30 MHz to 300 MHz, the log periodic antenna was used from 300 MHz to 1 GHz, and the horn antenna was used from 1 GHz to 9.165 GHz. The frequency spans were wide (30 MHz to 88 MHz, 88 MHz to 216 MHz, 216 to 300 MHz, 300 MHz to 1 GHz, and 1 GHz to 9.1 GHz) during preliminary investigations. The final data was taken with a frequency span of 1 MHz. Furthermore, the frequency span was reduced during the preliminary investigations as deemed necessary.

The open field test site of Electro Magnetic Test, 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 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.



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8.

CONCLUSIONS

The Pool/Spa Controller Model: SOL 1000 meets all of the **Class B** requirements of the FCC Title 47, Part 15, Subpart B and FCC Title 47, Subpart C, section 15.249.



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APPENDIX A

RADIATED AND CONDUCTED EMISSIONS DATA SHEETS

Electro Magnetic Test, Inc.
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000

Radiated Emissions Test Data

Purpose of Test: ☒ QUALIFICATION ☐ ENGINEERING ☐ MANUFACTURING AUDIT
FCC Class B Test Date: 12-01-00
Company Name: POLARIS POOL SYSTEMS, INC.
EUT Model Number: SOL 1000
EUT Serial Number: N/A
EUT Description: POOL/SPA CONTROLLER

Test Setup Configuration

EUT Clock Speeds: 8 MHz

EUT Power Cords: ☐ SHIELDED ☒ NOT SHIELDED
EUT tested at: ☐ LOW SPEED ☐ HIGH SPEED
EUT is: ☒ IN COMPLIANCE ☐ OUT OF COMPLIANCE with FCC Class B.

EUT Modifications during this test:
☐ MODIFIED ☒ NOT MODIFIED

Modifications: _____

NOTE: A formal report on passing data will be generated when required.
Design, debug and consultation services are available at all times.

Test Engineer: TOM NGUYEN

Electro Magnetic Test, Inc.

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FCC Class B Test Date: 12-01-00
 Company Name: POLARIS POOL SYSTEMS, INC.
 EUT Model Number: SOL 1000
 EUT Description: POOL/SPA CONTROLLER

RADIATED EMISSION TEST RESULTS

Freq	Ampl	M	P	A	Ht	Dist	Ori	Gain	ACor	CCor	DCor	CorAmp	Limit	Margin	Flags
MHz	dBuV	-	-	-	m	m	deg	dB	dBuV/m	dB	dB	dBuV/m	dBuV/m	dB	FH---
=====	=====	=	=	=	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====

THE FOLLOWING READINGS ARE FOR THE RECEIVER PORTION OF THE EUTS

FCC PART 15.109 (30MHz - 1000MHz)

COMMAND CENTER, REMOTE, AND BATTERY CHARGER WERE ALL TESTED AT THE SAME TIME

VERTICAL POLARIZATION

32.156	41.5	P	V	B	4.0	3.0	315	21.8	12.5	1.1	0.0	33.3	40.0	-6.7	-----
40.265	31.3	P	V	B	1.0	3.0	180	21.8	10.5	1.3	0.0	21.3	40.0	-18.7	-----
51.923	36.5	P	V	B	1.0	3.0	180	21.8	10.8	1.3	0.0	26.8	40.0	-13.2	-----
61.079	41.1	P	V	B	1.0	3.0	225	21.6	10.5	1.4	0.0	31.4	40.0	-8.6	-----
71.209	41.3	P	V	B	1.0	3.0	90	21.4	10.1	1.6	0.0	31.6	40.0	-8.4	-----
85.065	31.6	P	V	B	1.0	3.0	90	21.7	9.3	1.8	0.0	21.0	40.0	-19.0	-----
100.004	43.3	P	V	B	1.0	3.0	225	21.7	9.7	1.9	0.0	33.2	43.5	-10.3	-----
108.555	48.1	P	V	B	1.0	3.0	270	21.7	10.1	1.9	0.0	38.4	43.5	-5.1	-----
116.469	42.5	P	V	B	1.0	3.0	270	21.8	10.5	1.9	0.0	33.1	43.5	-10.4	-----
300.064	24.9	P	V	L	1.0	3.0	0	21.6	15.6	2.9	0.0	21.8	46.0	-24.2	-----
334.115	27.8	P	V	L	1.0	3.0	0	21.7	14.8	3.1	0.0	24.0	46.0	-22.0	-----
366.697	26.9	P	V	L	1.0	3.0	0	21.6	14.9	3.3	0.0	23.5	46.0	-22.5	-----
383.794	26.4	P	V	L	1.0	3.0	0	21.5	15.3	3.4	0.0	23.6	46.0	-22.4	-----
401.466	27.6	P	V	L	1.0	3.0	45	21.4	15.8	3.5	0.0	25.5	46.0	-20.5	-----
552.292	24.0	P	V	L	1.0	3.0	0	21.1	19.1	4.1	0.0	26.1	46.0	-19.9	-----
721.744	23.9	P	V	L	1.0	3.0	0	21.2	20.6	4.8	0.0	28.1	46.0	-17.9	-----
800.023	23.6	P	V	L	1.0	3.0	0	20.3	20.8	5.1	0.0	29.2	46.0	-16.8	-----

HORIZONTAL POLARIZATION

32.157	40.0	P	H	B	1.0	3.0	180	21.8	12.5	1.1	0.0	31.8	40.0	-8.2	-----
40.377	31.7	P	H	B	1.0	3.0	0	21.8	10.5	1.3	0.0	21.7	40.0	-18.3	-----
51.538	32.0	P	H	B	1.0	3.0	0	21.9	10.8	1.3	0.0	22.2	40.0	-17.8	-----
56.791	35.5	P	H	B	1.0	3.0	90	21.7	10.6	1.4	0.0	25.8	40.0	-14.2	-----
60.301	29.5	P	H	B	1.0	3.0	270	21.6	10.5	1.4	0.0	19.8	40.0	-20.2	-----
71.025	37.7	P	H	B	2.5	3.0	180	21.4	10.1	1.6	0.0	28.0	40.0	-12.0	-----
83.726	33.9	P	H	B	3.0	3.0	270	21.7	9.3	1.7	0.0	23.2	40.0	-16.8	-----
109.316	41.3	P	H	B	2.5	3.0	180	21.7	10.1	1.9	0.0	31.6	43.5	-11.9	-----
114.545	42.4	P	H	B	2.5	3.0	225	21.8	10.4	1.9	0.0	32.9	43.5	-10.6	-----
300.071	26.0	P	H	L	3.0	3.0	135	21.6	15.6	2.9	0.0	22.9	46.0	-23.1	-----
334.132	28.2	P	H	L	3.0	3.0	135	21.7	14.8	3.1	0.0	24.4	46.0	-21.6	-----
366.697	25.5	P	H	L	2.5	3.0	180	21.6	14.9	3.3	0.0	22.1	46.0	-23.9	-----
383.796	26.0	P	H	L	2.0	3.0	45	21.5	15.3	3.4	0.0	23.2	46.0	-22.8	-----
401.469	26.4	P	H	L	2.0	3.0	45	21.4	15.8	3.5	0.0	24.3	46.0	-21.7	-----
552.270	23.8	P	H	L	1.0	3.0	0	21.1	19.1	4.1	0.0	25.9	46.0	-20.1	-----
721.722	24.8	P	H	L	1.0	3.0	0	21.2	20.6	4.8	0.0	29.0	46.0	-17.0	-----
800.003	25.4	P	H	L	2.0	3.0	315	20.3	20.8	5.1	0.0	31.0	46.0	-15.0	-----

THE FOLLOWING READINGS ARE FOR THE TRANSMITTER PORTION OF THE EUTS
(FCC PART 15.249) (FIELD STRENGTH OF FUNDAMENTAL, HARMONICS AND SPURIOUS EMISSIONS)

THE FOLLOWING ARE SPURIOUS EMISSIONS FOUND WHILE COMMAND CENTER, REMOTE CONTROL UNIT,
AND BATTERY CHARGER UNIT WERE TRANSMITTING AND RECEIVING SIMULTANEOUSLY.

VERTICAL POLARIZATION

301.483	31.2	P V L	1.5	3.0	45	21.6	15.6	2.9	0.0	28.1	46.0	-17.9	-----
308.945	35.0	P V L	1.5	3.0	90	21.6	15.4	3.0	0.0	31.8	46.0	-14.2	-----
313.464	46.0	P V L	1.5	3.0	90	21.6	15.3	3.0	0.0	42.7	46.0	-3.3	-----
361.465	31.0	P V L	1.0	3.0	45	21.6	14.8	3.3	0.0	27.5	46.0	-18.5	-----
373.486	30.9	P V L	1.5	3.0	45	21.6	15.1	3.3	0.0	27.7	46.0	-18.3	-----
440.972	33.3	P V L	1.5	3.0	90	21.5	17.4	3.6	0.0	32.8	46.0	-13.2	-----
445.482	37.7	P V L	3.0	3.0	45	21.5	17.6	3.6	0.0	37.4	46.0	-8.6	-----

HORIZONTAL POLARIZATION

301.463	26.3	P H L	1.0	3.0	0	21.6	15.6	2.9	0.0	23.2	46.0	-22.8	-----
308.716	30.0	P H L	2.5	3.0	90	21.6	15.4	3.0	0.0	26.8	46.0	-19.2	-----
313.256	39.4	P H L	1.0	3.0	90	21.6	15.3	3.0	0.0	36.1	46.0	-9.9	-----
352.273	29.3	P H L	1.0	3.0	270	21.7	14.6	3.2	0.0	25.4	46.0	-20.6	-----
440.721	29.6	P H L	1.0	3.0	90	21.5	17.4	3.6	0.0	29.1	46.0	-16.9	-----
445.212	39.9	P H L	1.0	3.0	90	21.5	17.6	3.6	0.0	39.6	46.0	-6.4	-----
458.257	34.6	P H L	1.0	3.0	90	21.5	17.7	3.6	0.0	34.4	46.0	-11.6	-----

THE FOLLOWING READINGS ARE FOR THE COMMAND CENTER TRANSMITTER PORTION

VERTICAL POLARIZATION

FUNDAMENTAL

916.628	85.3	P V L	1.0	3.0	315	20.7	22.6	4.7	0.0	91.9	94.0	-2.1	-----
916.628	78.0	A V L	1.0	3.0	315	20.7	22.6	4.7	0.0	84.6	94.0	-9.4	-----

SPURIOUS EMISSION

1591.963	44.9	A V H	2.0	3.0	135	33.5	28.9	6.0	0.0	46.3	54.0	-7.7	-----
1591.963	36.1	A V H	2.0	3.0	135	33.5	28.9	6.0	0.0	37.5	54.0	-16.5	-----

SECOND HARMONIC

1833.575	48.5	P V H	2.0	3.0	225	33.7	29.9	6.6	0.0	51.3	54.0	-2.7	-----
1833.575	42.8	A V H	2.0	3.0	225	33.7	29.9	6.6	0.0	45.6	54.0	-8.4	-----

SPURIOUS EMISSION

2436.694	42.5	P V H	2.0	3.0	0	33.5	30.1	7.4	0.0	46.5	54.0	-7.5	-----
2436.673	32.9	A V H	2.0	3.0	0	33.5	30.1	7.4	0.0	36.9	54.0	-17.1	-----

THIRD HARMONIC

2749.880	33.4	P V H	1.0	3.0	45	33.1	30.8	7.5	0.0	38.6	54.0	-15.4	-----
2749.880	23.2	A V H	1.0	3.0	45	33.1	30.8	7.5	0.0	28.4	54.0	-25.6	-----

FOURTH HARMONIC

3666.496	31.8	P V H	1.0	3.0	0	31.7	33.1	9.4	0.0	42.6	54.0	-11.4	-----
3666.496	22.9	A V H	1.0	3.0	0	31.7	33.1	9.4	0.0	33.7	54.0	-20.3	-----

FIFTH HARMONIC

4583.120	31.2	P V H	1.0	3.0	0	30.8	33.0	10.6	0.0	44.0	54.0	-10.0	-----
4583.120	22.2	A V H	1.0	3.0	0	30.8	33.0	10.6	0.0	35.0	54.0	-19.0	-----

SIXTH HARMONIC

5499.744	28.9	P V H	1.0	3.0	0	32.0	36.4	11.5	0.0	44.8	54.0	-9.2	-----
5499.744	19.6	A V H	1.0	3.0	0	32.0	36.4	11.5	0.0	35.5	54.0	-18.5	-----

SEVENTH HARMONIC

6416.368	28.5	P V H	1.0	3.0	0	33.2	36.7	12.9	0.0	44.9	54.0	-9.1	-----
6416.368	19.9	A V H	1.0	3.0	0	33.2	36.7	12.9	0.0	36.3	54.0	-17.7	-----

EIGHTH HARMONIC

7332.992	26.2	P V H	1.0	3.0	0	33.0	37.0	14.3	0.0	44.5	54.0	-9.5	-----
7332.992	18.5	A V H	1.0	3.0	0	33.0	37.0	14.3	0.0	36.8	54.0	-17.2	-----

COMMAND CENTER TRANSMITTER PORTION (CONTINUED)

NINTH HARMONIC

8249.633	22.0	P	V	H	1.0	3.0	0	31.8	38.3	15.6	0.0	44.1	54.0	-8.9	-----
8249.633	15.5	A	V	H	1.0	3.0	0	31.8	38.3	15.6	0.0	37.6	54.0	-16.4	-----

TENTH HARMONIC

9166.246	20.4	P	V	H	1.0	3.0	0	30.7	40.6	15.9	0.0	46.2	54.0	-7.8	-----
9166.246	17.0	A	V	H	1.0	3.0	0	30.7	40.6	15.9	0.0	42.8	54.0	-11.2	-----

HORIZONTAL POLARIZATION

FUNDAMENTAL

916.599	86.2	P	H	L	1.0	3.0	225	20.7	22.6	4.7	0.0	92.8	94.0	-1.2	-----
916.599	79.5	A	H	L	1.0	3.0	225	20.7	22.6	4.7	0.0	86.1	94.0	-7.9	-----

SPURIOUS EMISSION

1591.968	42.7	P	H	H	2.0	3.0	135	33.5	28.9	6.0	0.0	44.1	54.0	-9.9	-----
1591.967	33.5	A	H	H	2.0	3.0	135	33.5	28.9	6.0	0.0	34.9	54.0	-19.1	-----

SECOND HARMONIC

1833.581	45.5	P	H	H	1.0	3.0	45	33.7	29.9	6.6	0.0	48.3	54.0	-5.7	-----
1833.581	39.2	A	H	H	1.0	3.0	45	33.7	29.9	6.6	0.0	42.0	54.0	-12.0	-----

SPURIOUS EMISSION

2436.685	35.2	P	H	H	1.5	3.0	180	33.5	30.1	7.4	0.0	39.2	54.0	-14.8	-----
2436.685	24.9	A	H	H	1.5	3.0	180	33.5	30.1	7.4	0.0	28.9	54.0	-25.1	-----

THIRD HARMONIC

2749.872	32.4	P	H	H	1.0	3.0	0	33.1	30.8	7.5	0.0	37.6	54.0	-16.4	-----
2749.872	23.0	A	H	H	1.0	3.0	0	33.1	30.8	7.5	0.0	28.2	54.0	-25.8	-----

FOURTH HARMONIC

3666.489	31.7	P	H	H	1.0	3.0	0	31.7	33.1	9.4	0.0	42.5	54.0	-11.5	-----
3666.489	22.9	A	H	H	1.0	3.0	0	31.7	33.1	9.4	0.0	33.6	54.0	-20.4	-----

FIFTH HARMONIC

4583.114	32.1	P	H	H	1.0	3.0	0	30.8	33.0	10.6	0.0	44.9	54.0	-9.1	-----
4583.114	24.0	A	H	H	1.0	3.0	0	30.8	33.0	10.6	0.0	36.8	54.0	-17.2	-----

SIXTH HARMONIC

5499.744	27.7	P	H	H	1.0	3.0	0	32.0	36.4	11.5	0.0	43.6	54.0	-10.4	-----
5499.744	19.7	A	H	H	1.0	3.0	0	32.0	36.4	11.5	0.0	35.6	54.0	-18.4	-----

SEVENTH HARMONIC

6416.367	28.0	P	H	H	1.0	3.0	0	33.2	36.7	12.9	0.0	44.4	54.0	-9.6	-----
6416.367	20.0	A	H	H	1.0	3.0	0	33.2	36.7	12.9	0.0	36.4	54.0	-17.6	-----

EIGHTH HARMONIC

7332.922	26.2	P	H	H	1.0	3.0	0	33.0	37.0	14.3	0.0	44.5	54.0	-9.5	-----
7332.922	18.5	A	H	H	1.0	3.0	0	33.0	37.0	14.3	0.0	36.8	54.0	-17.2	-----

NINTH HARMONIC

8249.616	22.9	P	H	H	1.0	3.0	0	31.8	38.3	15.6	0.0	45.0	54.0	-9.0	-----
8249.616	16.6	A	H	H	1.0	3.0	0	31.8	38.3	15.6	0.0	38.7	54.0	-15.3	-----

TENTH HARMONIC

9166.235	20.1	P	H	H	1.0	3.0	0	30.7	40.6	15.9	0.0	45.9	54.0	-8.1	-----
9166.235	16.2	A	H	H	1.0	3.0	0	30.7	40.6	15.9	0.0	42.0	54.0	-12.0	-----

THE FOLLOWING READINGS ARE FOR THE REMOTE CONTROL UNIT TRANSMITTER PORTION

WORST CASE EMISSIONS WERE FOUND WITH REMOTE IN THE "X" POSITION AND ANTENNA POSITIONED TO THE RIGHT SIDE.

VERTICAL POLARIZATION

FUNDAMENTAL

916.464	80.7	P	V	L	2.0	3.0	0	20.7	22.6	4.7	0.0	87.3	94.0	-6.7	-----
916.464	74.1	A	V	L	2.0	3.0	0	20.7	22.6	4.7	0.0	80.7	94.0	-13.3	-----

SPURIOUS EMISSION

1374.632	48.3	P	V	H	1.0	3.0	180	33.6	28.2	5.5	0.0	48.4	54.0	-5.6	-----
1374.632	42.2	A	V	H	1.0	3.0	180	33.6	28.2	5.5	0.0	42.3	54.0	-11.7	-----

REMOTE CONTROL UNIT TRANSMITTER PORTION (CONTINUED)

SECOND HARMONIC

1832.902	48.5	P	V	H	1.5	3.0	135	33.7	29.9	6.6	0.0	51.3	54.0	-2.7	-----
1832.902	41.8	A	V	H	1.5	3.0	135	33.7	29.9	6.6	0.0	44.6	54.0	-9.4	-----

SPURIOUS EMISSION

2291.057	44.3	P	V	H	1.5	3.0	90	33.6	30.6	7.3	0.0	48.6	54.0	-5.4	-----
2291.057	37.7	A	V	H	1.5	3.0	90	33.6	30.6	7.3	0.0	42.0	54.0	-12.0	-----

THIRD HARMONIC

2749.349	41.0	P	V	H	1.5	3.0	135	33.1	30.8	7.5	0.0	46.2	54.0	-7.8	-----
2749.349	32.0	A	V	H	1.5	3.0	135	33.1	30.8	7.5	0.0	37.2	54.0	-16.8	-----

FOURTH HARMONIC

3665.784	37.6	P	V	H	1.5	3.0	90	31.7	33.1	9.4	0.0	48.4	54.0	-5.6	-----
3665.784	26.8	A	V	H	1.5	3.0	90	31.7	33.1	9.4	0.0	37.5	54.0	-16.5	-----

FIFTH HARMONIC

4582.212	31.9	P	V	H	1.0	3.0	90	30.8	33.0	10.6	0.0	44.7	54.0	-9.3	-----
4582.212	23.3	A	V	H	1.0	3.0	90	30.8	33.0	10.6	0.0	36.1	54.0	-17.9	-----

SIXTH HARMONIC

5498.694	28.2	P	V	H	1.0	3.0	90	32.0	36.4	11.5	0.0	44.1	54.0	-9.9	-----
5498.694	19.2	A	V	H	1.0	3.0	90	32.0	36.4	11.5	0.0	35.1	54.0	-18.9	-----

SEVENTH HARMONIC

6415.157	27.0	P	V	H	1.0	3.0	0	33.2	36.7	12.9	0.0	43.4	54.0	-10.6	-----
6415.157	20.0	A	V	H	1.0	3.0	0	33.2	36.7	12.9	0.0	36.4	54.0	-17.6	-----

EIGHTH HARMONIC

7331.600	25.9	P	V	H	1.0	3.0	0	33.0	37.0	14.3	0.0	44.2	54.0	-9.8	-----
7331.600	17.8	A	V	H	1.0	3.0	0	33.0	37.0	14.3	0.0	36.1	54.0	-17.9	-----

NINTH HARMONIC

8247.994	22.7	P	V	H	1.0	3.0	0	31.8	38.3	15.6	0.0	44.8	54.0	-9.2	-----
8247.994	15.4	A	V	H	1.0	3.0	0	31.8	38.3	15.6	0.0	37.5	54.0	-16.5	-----

TENTH HARMONIC

9164.535	19.7	P	V	H	1.0	3.0	0	30.7	40.6	15.9	0.0	45.5	54.0	-8.5	-----
9164.535	15.6	A	V	H	1.0	3.0	0	30.7	40.6	15.9	0.0	41.4	54.0	-12.6	-----

HORIZONTAL POLARIZATION

FUNDAMENTAL

916.470	85.2	P	H	L	1.0	3.0	90	20.7	22.6	4.7	0.0	91.8	94.0	-2.2	-----
916.470	77.9	A	H	L	1.0	3.0	90	20.7	22.6	4.7	0.0	84.5	94.0	-9.5	-----

SPURIOUS EMISSION

1374.634	44.3	P	H	H	1.5	3.0	90	33.6	28.2	5.5	0.0	44.4	54.0	-9.6	-----
1374.634	37.6	A	H	H	1.5	3.0	90	33.6	28.2	5.5	0.0	37.7	54.0	-16.3	-----

SECOND HARMONIC

1832.897	47.9	P	H	H	1.5	3.0	90	33.7	29.9	6.6	0.0	50.7	54.0	-3.3	-----
1832.897	42.0	A	H	H	1.5	3.0	90	33.7	29.9	6.6	0.0	44.8	54.0	-9.2	-----

SPURIOUS EMISSION

2291.062	42.1	P	H	H	2.0	3.0	45	33.6	30.6	7.3	0.0	46.4	54.0	-7.6	-----
2291.062	34.4	A	H	H	2.0	3.0	45	33.6	30.6	7.3	0.0	38.7	54.0	-15.3	-----

THIRD HARMONIC

2749.353	42.5	P	H	H	1.0	3.0	135	33.1	30.8	7.5	0.0	47.7	54.0	-6.3	-----
2749.353	36.3	A	H	H	1.0	3.0	135	33.1	30.8	7.5	0.0	41.5	54.0	-12.5	-----

FOURTH HARMONIC

3665.792	36.4	P	H	H	1.0	3.0	135	31.7	33.1	9.4	0.0	47.2	54.0	-6.8	-----
3665.792	28.3	A	H	H	1.0	3.0	135	31.7	33.1	9.4	0.0	39.1	54.0	-14.9	-----

FIFTH HARMONIC

4582.234	32.7	P	H	H	1.0	3.0	135	30.8	33.0	10.6	0.0	45.5	54.0	-8.5	-----
4582.234	25.0	A	H	H	1.0	3.0	135	30.8	33.0	10.6	0.0	37.8	54.0	-16.2	-----

SIXTH HARMONIC

5498.703	28.4	P	H	H	1.0	3.0	90	32.0	36.4	11.5	0.0	44.3	54.0	-9.7	-----
5498.703	21.8	A	H	H	1.0	3.0	90	32.0	36.4	11.5	0.0	37.7	54.0	-16.3	-----

REMOTE CONTROL UNIT TRANSMITTER PORTION (CONTINUED)

SEVENTH HARMONIC

6415.157	32.2	P	H	H	1.0	3.0	0	33.2	36.7	12.9	0.0	48.6	54.0	-10.4	-----
6415.157	21.0	A	H	H	1.0	3.0	0	33.2	36.7	12.9	0.0	37.4	54.0	-16.6	-----

EIGHTH HARMONIC

7331.639	25.9	P	H	H	1.0	3.0	0	33.0	37.0	14.3	0.0	44.2	54.0	-9.8	-----
7331.639	19.6	A	H	H	1.0	3.0	0	33.0	37.0	14.3	0.0	37.9	54.0	-16.1	-----

NINTH HARMONIC

8248.137	22.1	P	H	H	1.0	3.0	0	31.8	38.3	15.6	0.0	45.0	54.0	-9.0	-----
8248.137	16.5	A	H	H	1.0	3.0	0	31.8	38.3	15.6	0.0	38.6	54.0	-15.4	-----

TENTH HARMONIC

9164.580	20.1	P	H	H	1.0	3.0	0	30.7	40.6	15.9	0.0	45.9	54.0	-8.1	-----
9164.580	15.1	A	H	H	1.0	3.0	0	30.7	40.6	15.9	0.0	40.9	54.0	-13.1	-----

THE FOLLOWING READINGS ARE FOR THE BATTERY CHARGER UNIT TRANSMITTER PORTION

WORST CASE EMISSIONS WERE FOUND WITH THE ANTENNA POSITIONED STRAIGHT UP VERTICALLY.

VERTICAL POLARIZATION

FUNDAMENTAL

916.542	85.3	P	V	L	1.0	3.0	0	20.7	22.6	4.7	0.0	91.9	94.0	-2.1	-----
916.542	77.4	A	V	L	1.0	3.0	90	20.7	22.6	4.7	0.0	84.0	94.0	-10.0	-----

SPURIOUS EMISSION

1374.763	52.1	P	V	H	2.0	3.0	180	33.6	28.2	5.5	0.0	52.2	54.0	-1.8	-----
1374.763	46.6	A	V	H	2.0	3.0	180	33.6	28.2	5.5	0.0	46.7	54.0	-7.3	-----

SECOND HARMONIC

1833.039	48.3	P	V	H	1.0	3.0	180	33.7	29.9	6.6	0.0	51.1	54.0	-2.9	-----
1833.039	41.2	A	V	H	1.0	3.0	180	33.7	29.9	6.6	0.0	44.0	54.0	-10.0	-----

SPURIOUS EMISSION

2291.289	48.2	P	V	H	2.0	3.0	225	33.6	30.6	7.3	0.0	52.5	54.0	-1.5	-----
2291.289	42.2	A	V	H	2.0	3.0	225	33.6	30.6	7.3	0.0	46.5	54.0	-7.5	-----

THIRD HARMONIC

2749.575	39.1	P	V	H	1.5	3.0	135	33.1	30.8	7.5	0.0	44.3	54.0	-9.7	-----
2749.575	30.1	A	V	H	1.5	3.0	135	33.1	30.8	7.5	0.0	35.3	54.0	-18.7	-----

FOURTH HARMONIC

3666.575	34.5	P	V	H	1.0	3.0	0	31.7	33.1	9.4	0.0	45.3	54.0	-8.7	-----
3666.575	23.1	A	V	H	1.0	3.0	0	31.7	33.1	9.4	0.0	33.9	54.0	-20.1	-----

FIFTH HARMONIC

4582.631	31.4	P	V	H	1.0	3.0	0	30.8	33.0	10.6	0.0	44.2	54.0	-9.8	-----
4582.631	23.3	A	V	H	1.0	3.0	0	30.8	33.0	10.6	0.0	36.1	54.0	-17.9	-----

SIXTH HARMONIC

5499.208	28.4	P	V	H	1.0	3.0	0	32.0	36.4	11.5	0.0	44.3	54.0	-9.7	-----
5499.208	21.0	A	V	H	1.0	3.0	0	32.0	36.4	11.5	0.0	36.9	54.0	-17.1	-----

SEVENTH HARMONIC

6415.742	27.0	P	V	H	1.0	3.0	0	33.2	36.7	12.9	0.0	43.4	54.0	-10.6	-----
6415.742	20.0	A	V	H	1.0	3.0	0	33.2	36.7	12.9	0.0	36.4	54.0	-17.6	-----

EIGHTH HARMONIC

7332.264	26.3	P	V	H	1.0	3.0	0	33.0	37.0	14.3	0.0	44.6	54.0	-9.4	-----
7332.264	18.9	A	V	H	1.0	3.0	0	33.0	37.0	14.3	0.0	37.2	54.0	-16.8	-----

NINTH HARMONIC

8248.771	22.9	P	V	H	1.0	3.0	0	31.8	38.3	15.6	0.0	45.0	54.0	-9.0	-----
8248.771	16.2	A	V	H	1.0	3.0	0	31.8	38.3	15.6	0.0	38.3	54.0	-15.7	-----

TENTH HARMONIC

9165.325	20.7	P	V	H	1.0	3.0	0	30.7	40.6	15.9	0.0	46.5	54.0	-7.5	-----
9165.325	16.0	A	V	H	1.0	3.0	0	30.7	40.6	15.9	0.0	41.8	54.0	-12.2	-----

BATTERY CHARGER UNIT TRANSMITTER PORTION (CONTINUED)

HORIZONTAL POLARIZATION

FUNDAMENTAL

916.542	84.9	P H L	1.0	3.0	90	20.7	22.6	4.7	0.0	91.5	94.0	-2.5	-----
916.542	75.4	A H L	1.0	3.0	90	20.7	22.6	4.7	0.0	82.0	94.0	-12.0	-----

SPURIOUS EMISSION

1374.775	51.4	P H H	2.0	3.0	90	33.6	28.2	5.5	0.0	51.5	54.0	-2.5	-----
1374.775	45.9	A H H	2.0	3.0	90	33.6	28.2	5.5	0.0	46.0	54.0	-8.0	-----

SECOND HARMONIC

1833.048	46.5	P H H	1.0	3.0	225	33.7	29.9	6.6	0.0	49.3	54.0	-4.7	-----
1833.048	39.7	A H H	1.0	3.0	225	33.7	29.9	6.6	0.0	42.5	54.0	-11.5	-----

SPURIOUS EMISSION

2291.291	44.2	P H H	3.0	3.0	45	33.6	30.6	7.3	0.0	48.5	54.0	-5.5	-----
2291.280	37.0	A H H	3.0	3.0	45	33.6	30.6	7.3	0.0	41.3	54.0	-12.7	-----

THIRD HARMONIC

2749.571	37.7	P H H	1.5	3.0	180	33.1	30.8	7.5	0.0	42.9	54.0	-11.1	-----
2749.571	28.4	A H H	1.5	3.0	180	33.1	30.8	7.5	0.0	33.6	54.0	-20.4	-----

FOURTH HARMONIC

3666.139	33.6	P H H	1.5	3.0	0	31.7	33.1	9.4	0.0	44.4	54.0	-9.6	-----
3666.139	23.1	A H H	1.5	3.0	0	31.7	33.1	9.4	0.0	33.9	54.0	-20.1	-----

FIFTH HARMONIC

4582.647	30.5	P H H	1.0	3.0	90	30.8	33.0	10.6	0.0	43.3	54.0	-10.7	-----
4582.647	21.4	A H H	1.0	3.0	90	30.8	33.0	10.6	0.0	34.2	54.0	-19.8	-----

SIXTH HARMONIC

5499.195	27.8	P H H	1.0	3.0	0	32.0	36.4	11.5	0.0	43.7	54.0	-10.3	-----
5499.195	18.3	A H H	1.0	3.0	0	32.0	36.4	11.5	0.0	34.2	54.0	-19.8	-----

SEVENTH HARMONIC

6415.717	27.7	P H H	1.0	3.0	0	33.2	36.7	12.9	0.0	44.1	54.0	-9.9	-----
6415.717	19.1	A H H	1.0	3.0	0	33.2	36.7	12.9	0.0	35.5	54.0	-18.5	-----

EIGHTH HARMONIC

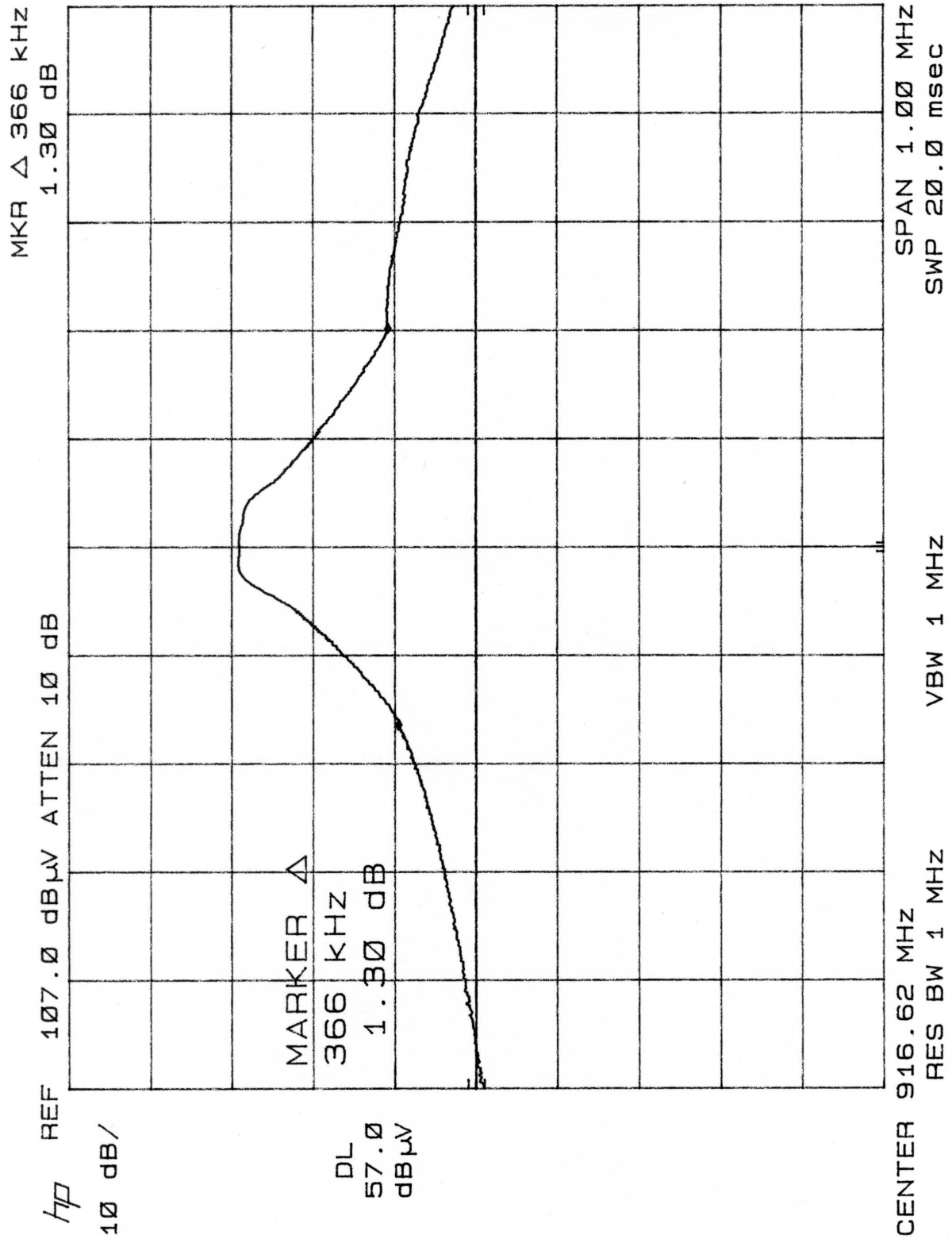
7332.261	26.6	P H H	1.0	3.0	0	33.0	37.0	14.3	0.0	44.9	54.0	-9.1	-----
7332.261	18.2	A H H	1.0	3.0	0	33.0	37.0	14.3	0.0	36.5	54.0	-17.5	-----

NINTH HARMONIC

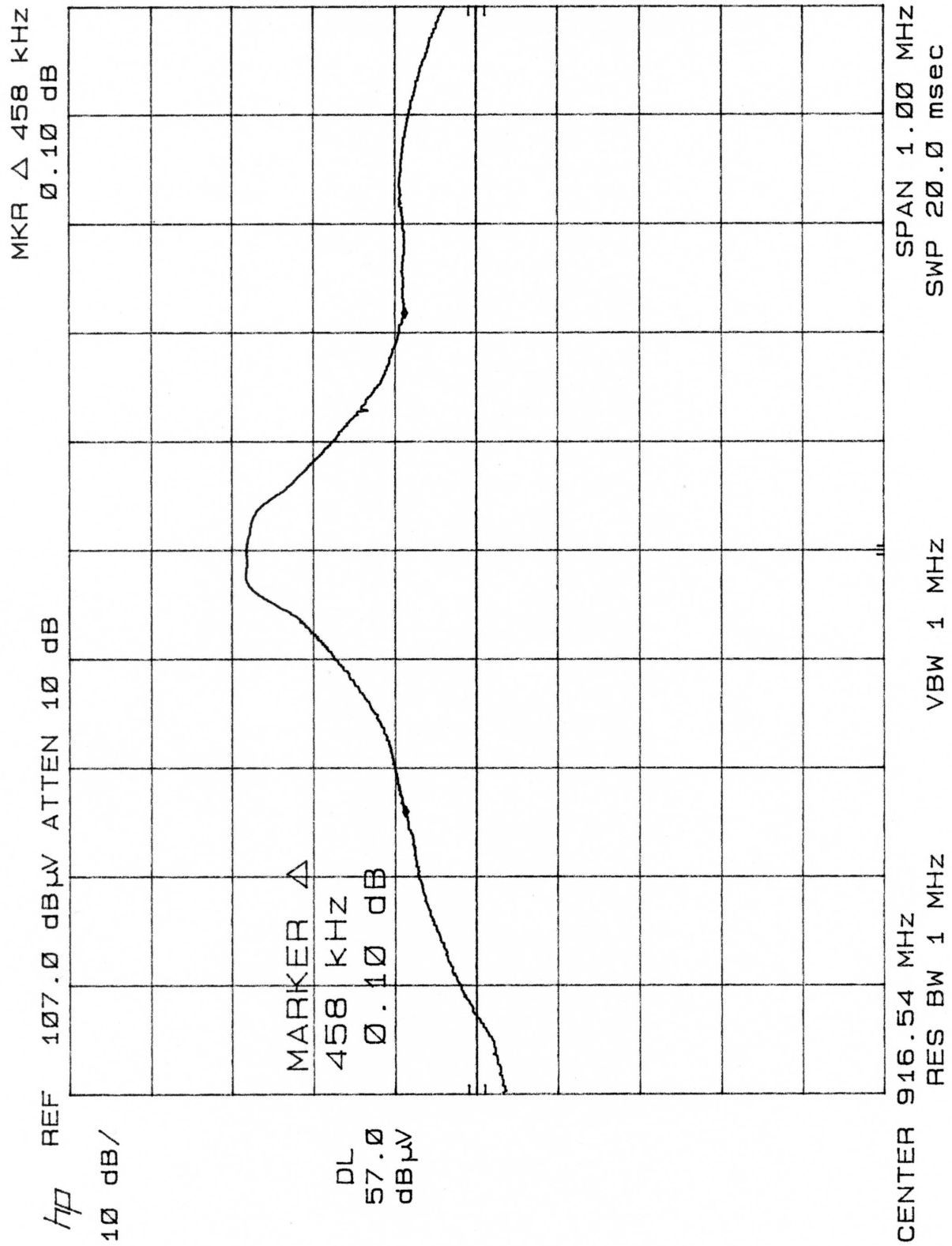
8248.790	23.0	P H H	1.0	3.0	0	31.8	38.3	15.6	0.0	45.1	54.0	-8.9	-----
8248.790	15.2	A H H	1.0	3.0	0	31.8	38.3	15.6	0.0	37.3	54.0	-16.7	-----

TENTH HARMONIC

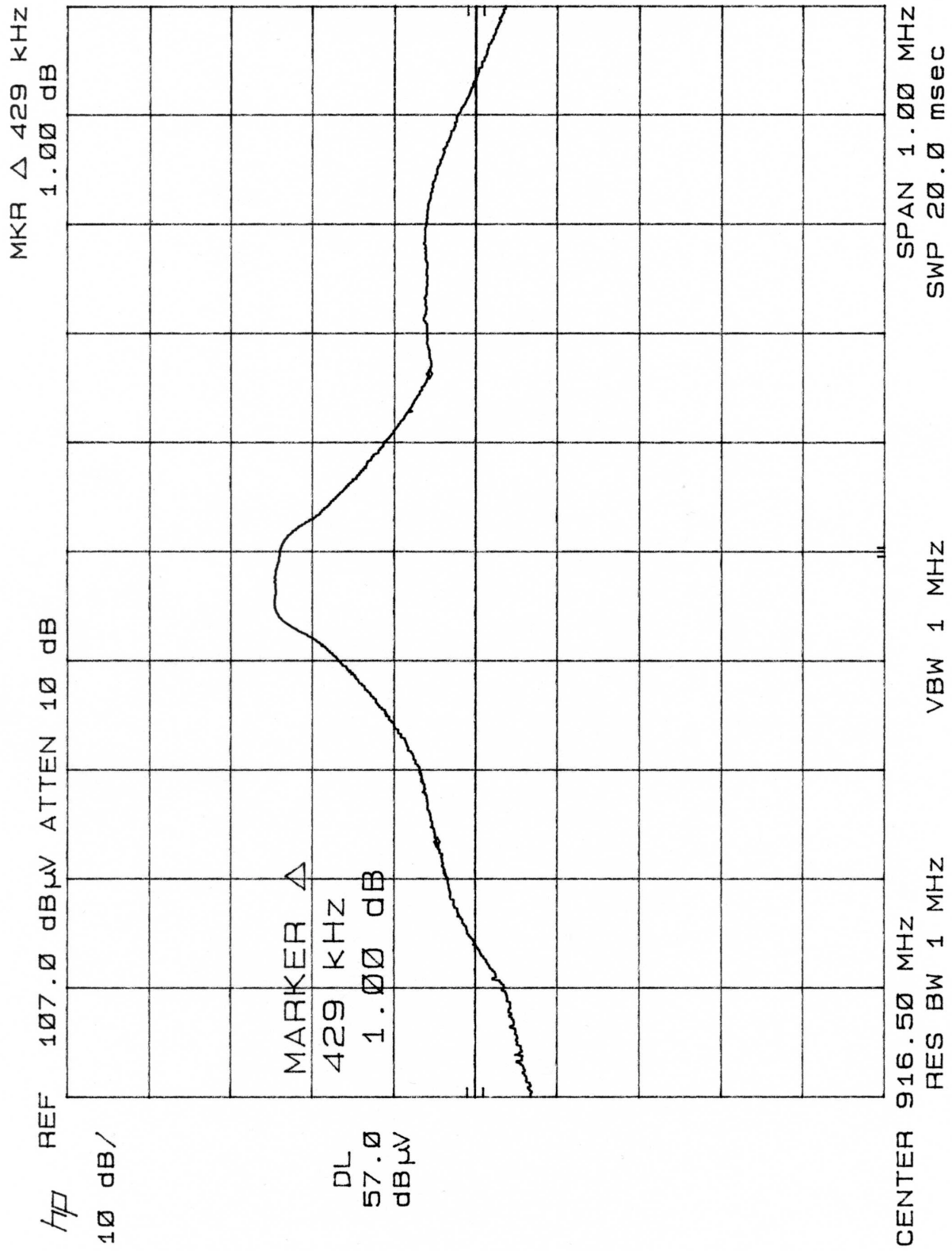
9165.327	20.9	P H H	1.0	3.0	0	30.7	40.6	15.9	0.0	46.7	54.0	-7.3	-----
9165.327	15.0	A H H	1.0	3.0	0	30.7	40.6	15.9	0.0	40.8	54.0	-13.2	-----



PLOT SHOWING BANDWIDTH OF FUNDAMENTAL FREQUENCY (COMMAND CENTER)



PLOT SHOWING BANDWIDTH OF FUNDAMENTAL FREQUENCY (BATTERY CHARGER)



PLOT SHOWING BANDWIDTH OF FUNDAMENTAL FREQUENCY (REMOTE CONTROL)