May 14, 1999

Mike Perkins
ShareWave, Inc.
5175 Hillsdale Circle
5175 Hillsdale Circle

Subject: FCC Emissions Report, spread spectrum radioPowerWave Rev. 2A

Dear Mr. Perkins:

A report has been completed detailing the results of the FCC electromagnetic emissions testing performed on the spread spectrum radio PowerWave Rev. 2A. A complete report and application have been sent to the FCC requesting a Class II Permissive Change for the spread spectrum radioPowerWave Rev. 2A under the FCC ID: N9PSW1-2450. Enclosed is a copy of the complete package sent to the FCC.

We will periodically check the status of this application and immediately communicate any problems, should they arise. Based on the typical application delay, we may expect the request to be approved around the 4th week of July 1999.

If you have any questions, please don't hesitate to call us at 408-245-7800.

Sincerely,

Mark Briggs
Manager, EMC Consulting Services

MB/bab
Enclosure: Copy of Application Package

File: R31475

May 14, 1999

Chief, Equipment Authorization Branch,
Authorization and Evaluation Division,
Office of Engineering and Technology
FEDERAL COMMUNICATIONS COMMISSION
P.O. Box 358315
Pittsburgh, PA 15251-5315

Gentlemen:

The enclosed documents constitute a formal submittal and request for a Class II Permissive Change pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding changes to intentional radiators. A change is being proposed to the ShareWave model PowerWave Rev. 2A, which would result in changes to the performance characteristics originally reported to the Commission. Since the PowerWave Rev. 2A is presently certified, an emissions test has been performed to demonstrate that it continues to comply with FCC Part 15 limits for intentional radiators.

This submittal was prepared by Elliott Laboratories, as duly authorized agent. A copy of the letter of our appointment as agent is enclosed. Please also find enclosed a check in the amount of $180.00 for the application fee.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

Mark Briggs
Manager, EMC Consulting Services

MB/bab
Enclosures: Application Fee
FCC Form 159
FCC Form 731
Agent Authorization Letter with Anti-Drug Abuse Statement
Request for Confidentiality
Emissions Test Report with Exhibits

Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator on the ShareWave, Inc. Model: PowerWave Rev. 2A

FCC ID:	N9PSW1-2450
GRANTEE:	ShareWave, Inc. 5175 Hillsdale Circle El Dorado Hills, CA 95762
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	May 14, 1999
FINAL TEST DATE:	March 18, 1999

AUTHORIZED SIGNATORY: _____

Mark Briggs
Manager, EMC Consulting Services

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SCOPE

An electromagnetic emissions test has been performed on the ShareWave, Inc.spread spectrum radiomodel PowerWave Rev. 2A pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the ShareWave, Inc.model PowerWave Rev. 2A and therefore apply only to the tested sample. The sample was selected and prepared by Mike Perkins of ShareWave, Inc..

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested sample of ShareWave, Inc.model PowerWave Rev. 2A complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

EMISSION TEST RESULTS

The following emissions tests were performed on the ShareWave, Inc.model PowerWave Rev. 2A. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

120V, 60Hz

Frequency MHz	Level dBuV	Power Lead	FCC §15.207 Limit	FCC §15.207 Margin	Detector QP/Avg	Comments
1.949	46.8	Neutral	48.0	-1.2	QP	

LIMITS OF ANTENNA CONDUCTED POWER

The manufacturer measured the spurious emissions conducted from the EUT's antenna port in accordance with the limits detailed in FCC Rules Part 15 Section 15.247. All emissions were more than 20dB below the highest in-band signal level. An exhibit of this report contains the test data and graphs taken by the manufacturer.

LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

Frequency MHz	Level dBuV/m	Pol V/H	FCC Limit	FCC Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
4880.317	51.6	V	54.0	-2.4	Avg	170	1.0	

LIMITS OF POWER AND BANDWIDTH

Power, Bandwidth and Power density measurements were made by the manufacturer. The results (graphical plots) are contained in an exhibit of this report.

The maximum peak power output was 24.3 dBm (18.0dBm average) on the low channel.
The minimum 6 dB bandwidth was 18.6 Megahertz on the low channel.
The maximum power spectral density was -2.7dBm in a 3kHz band averaged over 1 second.

MEASUREMENT UNCERTAINTIES

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.2

COMPLIANCE EXPLANATION

When the measurement uncertainties (see above section) associated with the emission test methods and equipment used are taken into consideration there are four possible results as detailed below:

Complied
All measurements recorded were below the specification limit by a margin greater than the measurement uncertainty.

Probably Complied
One or more measurements recorded were below the specification limit by a margin less than the measurement uncertainty. It is not possible to determine that the unit complied with a 95% confidence level from the results. There is a high probability that the product tested does comply.

Probably Did Not Comply
One or more measurements recorded were above the specification limit by a margin less than the measurement uncertainty. It is not possible to determine that the unit failed to comply with a 95% confidence level from the results. There is a high probability that the product tested does not comply.

Did Not Comply
One or more measurements recorded exceeded the specification limit by a margin greater than the measurement uncertainty.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The ShareWave, Inc. model PowerWave Rev. 2A is a modular 2.4 GHz direct sequence spread spectrum radio which is designed to be installed in a host device. The sample was received on March 18, 1999 and tested on March 18, 1999. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
ShareWave/ PowerWave/ Radio	FPFCC1

INPUT POWER

The EUT power input is derived from the host set-top box power supply.

PRINTED WIRING BOARDS

The EUT contained the following printed wiring boards during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
ShareWave/Modular	302-102-000	2	FPFCC1	44

ENCLOSURE

The radio enclosure is primarily constructed of fabricated cast metal. It measures approximately 6.6 cm wide by 13.97 cm deep by 1.5 cm high.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number
Sharewave's Falcon Set-Top Box*	005
Sony KV-13M40 Television	4012493

* Radio was installed in the set-top box.

EXTERNAL I/O CABLING

The I/O cabling configuration during emissions testing was as follows:

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Audio cable (streo)	1.0	Set-Top Box/Audio	TV/Audio
S-Video cable	1.0	Set-Top Box/Video	TV/Video

TEST SOFTWARE

The EUT was set to constantly transmit data on either low, center or high channels.

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the ShareWave model PowerWave Rev. 2A being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

PRINTED WIRING BOARD LAYOUT

This radio has a lower cost RF output power amplifier. The original design used a Raytheon RMPA2450 with the output match internal to the IC. This new design uses the same Raytheon IC but with the match external to the IC. The part number for the new IC is RMPA2451.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on March 18, 1999 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers, allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurments made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and thermister mount are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors which are programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

Test Equipment List - SVOATS#2

March 8, 1999

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☐	Elliott Laboratories	2 x (Solar 8028 LISN + 6512 Caps)	LISN-5,	379	12	6/26/98	6/26/99
☐	Elliott Laboratories	300-1000 MHz Log Periodic	EL300.1000	297, (F113)	12	11/30/98	11/30/99
☐	Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	12	6/30/98	6/30/99
☐	EMCO	Biconical Antenna, 30-300 MHz	3110B	801	12	12/12/98	12/12/99
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	487	12	6/18/98	6/18/99
☒	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	530 ~~786~~	12	1/15/99	1/15/2000
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	9/22/98	9/22/99
☐	EMCO	Horn Antenna 18 - 40 GHz	3116	Telogy 55875		6/5/98	6/5/99
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	12	1/4/99	1/4/2000
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	787	12	11/23/98	11/23/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263, (F303)	12	6/8/98	6/8/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/25/98	11/25/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12	11/12/98	11/12/99
☐	Hewlett Packard	Power Meter	432A	259, (F304)	12	2/17/99	2/17/2000
☐	Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	12	1/18/99	1/18/2000
☐	Hewlett Packard	Spectrum Analyzer, 9 KHz-6.5 GHz	8595E-041-103-	Metric, 885	12	5/11/98	5/11/99
☐	Hewlett Packard	Thermistor Mount	478A	652	12	2/17/99	2/17/2000
☐	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	4/27/98	4/27/99
☒	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	4/27/98	4/27/99
☒	Rohde& Schwarz	Pulse Limiter	ESH3Z2	811	12	12/8/98	12/8/99
☒	Rohde & Schwarz	Test Receiver	ESN	775	12	6/22/98	6/22/99

File Number: D30899

Date: 3/18/99

Engr: Mehran M Birgani

All calibration of equipment is traceable to a national standard of measurement such as NIST.

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T30899 7 Pages
Client provided test data 23 Pages

The following data was provided by Sharewave for inclusion in the report:

Test Summary:

	Low Channel	Center Channel	High Channel
Peak Output power (dBm)	24.3	23.9	23.9
Average Output power (dBm)	18	18.3	18.4
PSD (dBm/3kHz)	-2.7	-3.0	-2.8
Bandwidth	18.6	19.2	19.2

Additionally, plots were made of the emissions conducted from the antenna port showing emissions were more than 20dB below the fundamental level.

Client:	ShareWave, Inc.	Date:	3/18/99	Test Engr:	Mehran Birgani
Product:	PowerWave Rev. 2A	File:	T30899	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SV OATS #2	Contact:	Dale Dorando
Spec:	FCC Part 15	Page:	1 of 4	Approved:	
Revision	1.0				

Ambient Conditions	
Temperature:	23.2 °C
Humidity:	RH %

Test Objective

The objective of this test session is to perform final qualification testing the EUT defined below relative to the specification(s) defined above.

Test Summary

Run #1 - Maximized Radiated Emissions, 1.0 - 24.6 GHz Low Channel

PASS Results: FCC B -8.6 dB QP @ 4849.830 MHz Vertical

Run #2 - Maximized Radiated Emissions, 1.0 - 24.6 GHz Center Channel

PASS Results: FCC B -2.4 dB QP @ 4880.317 MHz Vertical

Note: * indicates that the difference between the level of one or more of the emissions from the system under test and the specification limit is within the measurement uncertainty.

Run #3 - Maximized Radiated Emissions, 1.0 - 24.6 GHz High Channel

PASS Results: FCC B -3.9 dB QP @ 2484.500 MHz Vertical

Run #3 - Conducted Emissions Scan of EUT, 0.15-30.00 MHz, 120V, 60Hz Center Channel

PASS Results: FCC B -1.2 dB QP @ 1.949 MHz Neutral

Note: * indicates that the difference between the level of one or more of the emissions from the system under test and the specification limit is within the measurement uncertainty.

Client:	ShareWave, Inc.	Date:	3/18/99	Test Engr:	Mehran Birgani
Product:	PowerWave Rev. 2A	File:	T30899	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SV OATS #2	Contact:	Dale Dorando
Spec:	FCC Part 15	Page:	2 of 4	Approved:	
Revision	1.0				

Equipment Under Test (EUT) General Description

The EUT is a modular 2.4 GHz direct sequence spread spectrum radio which is designed to be installed in a host device. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during emissions testing to simulate the end user environment. The electrical rating of the EUT is 5 VDC, at .65 Amps.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
ShareWave/ PowerWave Rev. 2A/ Radio	FPFCC1	N9PSW1-2450

Power Supply and Line Filters

The EUT is powered from host device. The host device uses the following AC-DC adapter.

Description	Manufacturer	Model
AC Wall Adapter	MEI	EPA-202W-2A

The EUT is powered from host device. The host device uses the above listed AC-DC adapter.

Printed Wiring Boards in EUT

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
ShareWave/Modular	302-102-000	2	FPFCC1	44

Subassemblies in EUT

Manufacturer/Description	Assembly Number	Rev.	Serial Number
None	-	-	-

EUT Enclosure(s)

The radio enclosure is primarily constructed of fabricated cast metal. It measures approximately 6.6 cm wide by 13.97 cm deep by 1.5 cm high.

Client:	ShareWave, Inc.	Date:	3/18/99	Test Engr:	Mehran Birgani
Product:	PowerWave Rev. 2A	File:	T30899	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SV OATS #2	Contact:	Dale Dorando
Spec:	FCC Part 15	Page:	3 of 4	Approved:	
Revision	1.0				

EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Part Number
None	-	-

Modifications

The following modifications were made to the EUT since the original submittal (application) were approved by the FCC.

This radio has a lower cost RF output power amplifier. The original design used a Raytheon RMPA2450 with the output match internal to the IC. This new design uses the same Raytheon IC but with the match external to the IC. The part number for the new IC is RMPA2451.

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Sharewave's Falcon Set-Top Box*	005	N/A
Sony KV-13M40 Television	4012493	N/A

* Radio was installed in the set-top box.

Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None	-	-

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Audio cable (streo)	1.0	Set-Top Box/Audio	TV/Audio
S-Video cable	1.0	Set-Top Box/Video	TV/Video

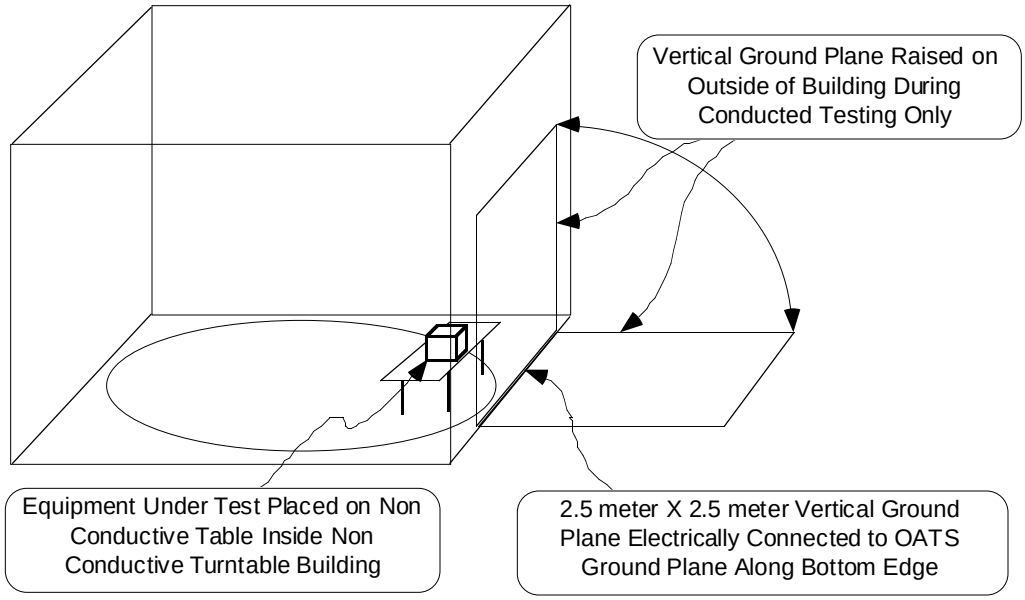
Test Software

The EUT was set to constantly transmit data on either low, center or high channels.

General Test Conditions

During radiated testing, the EUT was connected to 120V, 60Hz power input. The EUT and all local support equipment were located on the turntable for radiated testing and conducted testing.

During conducted emissions testing, the EUT was connected to 120V, 60Hz power input as noted. A 2.5 meter X 2.5 meter ground plane was raised to a vertical position 40 cm from the EUT as shown below:



Test Data Tables

See attached data

Emissions Test Data

Client:	ShareWave, Inc.	Date:	3/18/99	Test Engr:	Mehran M Birgani
Product:	Powerwave Rev. 2A	File:	T30899	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #2	Contact:	Dale Dorando
Spec:	FCC Part 15	Distance:	3 m	Approved:	

Ambient Conditions
Temperature: 13 °C
Humidity: 64 %

Run #1: Maximized Radiated Scan, 1.0-24.6 GHz, Sorted by Margin.
Low Channel

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4849.830	45.4	V	54.0	-8.6	Avg	173	1.0	
4849.830	41.1	H	54.0	-12.9	Avg	140	1.1	
4849.830	55.2	V	74.0	-18.8	Pk	173	1.0	
4849.830	50.8	H	74.0	-23.2	Pk	140	1.1	

Run #2: Maximized Radiated Scan, 1.0-24.6 GHz, Sorted by Margin.
Center Channel

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4880.317	51.6	V	54.0	-2.4	Avg	170	1.0	
4880.317	46.8	H	54.0	-7.2	Avg	140	1.1	
4880.317	64.5	V	74.0	-9.5	Pk	170	1.0	
4880.317	59.0	H	74.0	-15.0	Pk	140	1.1	

Run #3: Maximized Radiated Scan, 1.0-24.6 GHz, Sorted by Margin.
High Channel

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2484.500	50.1	V	54.0	-3.9	Avg	335	1.3	
2484.500	49.8	H	54.0	-4.2	Avg	13	1.6	
2484.500	60.7	V	74.0	-13.3	Pk	335	1.3	
2484.500	60.3	H	74.0	-13.7	Pk	13	1.6	
4910.000	37.4	V	54.0	-16.6	Avg	210	1.0	
4910.000	36.7	H	54.0	-17.3	Avg	227	1.8	
4910.000	53.0	V	74.0	-21.0	Pk	210	1.0	
4910.000	41.8	H	74.0	-32.2	Pk	227	1.8	

Run #4: Conducted Emissions, 120V/60Hz, Sorted by Margin.
Center Channel

Frequency	Level	Power	EN 55022B	EN 55022B	Detector	Comments
MHz	dBuV	Lead	Limit	Margin	QP/Avg	
1.949	46.8	Neutral	48.0	-1.2	QP	
1.903	45.6	Line	48.0	-2.4	QP	
1.411	43.2	Line	48.0	-4.8	QP	
0.810	43.0	Line	48.0	-5.0	QP	
0.988	41.7	Neutral	48.0	-6.3	QP	
1.322	40.7	Neutral	48.0	-7.3	QP	

Note 1:	No Average readings made - QP readings were more than 6dB below the Average limit

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

EXHIBIT 4: Conducted Emissions Test Configuration Photographs

EXHIBIT 4: Conducted Emissions Test Configuration Photographs

EXHIBIT 5: Proposed FCC ID Label & Label Location

Not included - the label and label location
remain unchanged from the original submittal.

EXHIBIT 6:Detailed Photographs of ShareWave, Inc.Model PowerWave Rev. 2A Construction

5 Pages

EXHIBIT 7:Operator's Manual for ShareWave, Inc.Model PowerWave Rev. 2A

Not included - the operator's manual
remains unchanged from the original submittal.

EXHIBIT 8:Block Diagram of ShareWave, Inc.Model PowerWave Rev. 2A

Not included - the block diagram
remains unchanged from the original submittal.

EXHIBIT 9:Schematic Diagrams for ShareWave, Inc.Model PowerWave Rev. 2A

6 Pages

EXHIBIT 10:Theory of Operation for ShareWave, Inc.Model PowerWave Rev. 2A

Not included - the Theory of Operations
remains unchanged from the original submittal.