

TEST RESULT SUMMARY

UNITED STATES STANDARD 47 CFR PARTS 2, 15 & 22

MANUFACTURER NAME	Powerwave Technologies, Inc.
NAME OF EQUIPMENT	Multi-channel Power Amplifier and Dual Combining Shelf
MODEL NUMBER	NTL107AA and NTL107AC
MANUFACTURER ADDRESS	2026 McGaw Avenue Irvine, CA 92614
TEST REPORT NUMBER	A9368F01
TEST DATE	12 November 1999

According to testing performed at BABT Product Service, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in United States Standard 47 CFR Part s 2,15 & 22.

BABT Product Service reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. BABT Product Service shall have no liability for any deductions, inferences or generalizations drawn by the client or others from BABT Product Service issued reports.

As the responsible EMC Project/Division Managers, we hereby declare that the equipment tested at BABT Product Service as specified above conforms to the requirements of United States Standard 47 CFR Parts 2, 15 & 22.

Date: 9 May, 2001

Location: Santa Clara, California
USA

Frank Ibrahim
Engineer In Charge

Dave Wilson
EMC Manager



Certificate No: 1212-01

Not Transferable

EMC EMISSION - TEST REPORT

UNITED STATES STANDARD 47 CFR PART 15, SUBPART B

Test Report File No. : A9368F01 Date of Issue: 9 May, 2001

Model / Serial No. : NTL107AA and NTL107AC / N/A

Product Type : Multi-channel Power Amplifier and Dual Combining Shelf

Applicant : Powerwave Technologies, Inc.

Manufacturer : Powerwave Technologies, Inc.

License holder : Powerwave Technologies, Inc.

Address : 2026 McGaw Avenue
: Irvine, CA 92614

Test Result : ☒ **Positive** ☐ **Negative**

Test Project Number
Reference(s) : A9368F01

Total pages - Test Report : 13

BABT Product Service is a joint venture between TÜV Product Service, Inc. and BABT.

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This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.

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Test Data Sheets and Test Setup Drawing(s) TD1

Appendices

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EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to the following regulations:

- | | | |
|--|---|--|
| ☐ - EN 50081-1 : 1992 | | |
| ☐ - EN 55011 : 1991 | ☐ - Group 1 | ☐ - Group 2 |
| | ☐ - Class A | ☐ - Class B |
| ☐ - EN 55013 : 1990 | | |
| ☐ - EN 55014-1 : 1993 | ☐ - Household appliances | |
| | ☐ - Electric tools | |
| | ☐ - Similar apparatus | |
| ☐ - EN 55014-1 : 1993 / Amendment A1 : 1997 | | |
| ☐ - EN 55015 : 1993 | | |
| ☐ - EN 55015 : 1996 | | |
| ☐ - EN 55015 : 1996 / Amendment A1 : 1997 | | |
| ☐ - EN 55022 / 1987 | ☐ - Class A | ☐ - Class B |
| ☐ - EN 55022 / 1994 | ☐ - Class A | ☐ - Class B |
| ☐ - Amendment A1 : 1995 to EN 55022 : 1994 | | |
| ☐ - Amendment A2 : 1997 to EN 55022 : 1994 | | |
| ☐ - EN 55022 : 1998 | ☐ - Class A | ☐ - Class B |
| ☐ - BS | | |
| ☐ - VCCI | ☐ - Class A ITE | ☐ - Class B ITE |
| ■ - 47 CFR Part 2 | | |
| ■ - 2.985 | | |
| ■ - 2.989 | | |
| ■ - 2.991 | | |
| ■ - 2.993 | | |
| ■ - 47 CFR Part 15, Subpart B | | |
| ■ - 15.107 | | |
| ■ - 15.109 | | |
| ■ - 47 CFR Part 22 | | |
| ■ - 22.917 | | |
| ☐ - AS/NZS 3548: 1995 | ☐ - Class A | ☐ - Class B |
| ☐ - CISPR 11 (1997) | ☐ - Group 1 | ☐ - Group 2 |
| | ☐ - Class A | ☐ - Class B |
| ☐ - CISPR 22 (1997) | ☐ - Class A | ☐ - Class B |

Environmental Conditions In The Laboratory:

	<u>Actual</u>
Temperature:	: 22 °C
Relative Humidity:	: 46 %
Atmospheric Pressure:	: 102.0 kPa

Power Supply Utilized:

Power supply system : +27 V DC

Symbol Definitions:

- - Applicable
- - Not Applicable

Description of EUT:

The G3X-800 Series (NTL107AA) amplifier is a linear, feed-forward power amplifier that operates in the 25-MHz frequency band from 869 MHz to 894 MHz. The amplifier can simultaneously transmit multiple frequencies, with better than -65 dBc third order intermodulation distortion (IMD). The amplifier system is modular in design, and is ideally suited for use in AMPS/TDMA/CDMA base stations. The plug-in G3X-800 Series (NTL107AA) amplifier modules can each provide 110 watts of power and function completely independently of each other. The amplifier modules are designed for parallel operation to produce high peak power output and backup redundancy for remote applications. The system is housed in the MCR20XX Series (NTL107AC) subrack which holds two G3X-800 Series (NTL107AA) amplifiers to produce up to 200 watts output. All solid-state, the system is designed to provide trouble-free operation with minimum maintenance. The system's modular construction and unique and highly effective LED-based operational status and fault indicators help minimize downtime. The turn-on and turn-off sequences of voltages are fully automatic, as is overload protection and recycling. Inadvertent operator damage from front panel manipulation is virtually impossible.

Measurement Methods

Measurements were made in accordance with ANSI C63.4:1992. All emissions measurements are fully automated.

For conducted emissions, the receiver is swept over the frequency range 450kHz to 30MHz using detector functions as specified in CISPR 16. The measured levels from the receiver are then re-calculated taking into account the LISN and coax cable loss to derive the corrected level. This is then compared with the limits specified in FCC 47 CFR Part 15.107 to determine the compliance of the EUT.

For radiated emissions, the receiver is swept over the frequency range 30MHz to 1000MHz, while the turntable is rotated through 360° and the antenna height is varied between 1m and 4m. The worst-case emission level is recorded for each

frequency and recorded for the full frequency range. The measured levels from the receiver are then re-calculated taking into account the antenna gain, mast amplifier gain and coax cable loss to derive the corrected level. All peak emissions over the limit are re-measured using the CISPR 16 quasi-peak detector, in any case the highest 15 peaks are re-measured. These are then compared with the limits specified in FCC 47 CFR Part 15.109 to determine the compliance of the EUT.

Sample Calculations

These calculations are performed automatically by the control software prior to display. For radiated emissions the corrected level is derived by taking into account the antenna gain, antenna mast amplifier and coax cable loss.

For example, assuming a receiver measurement of 50.0dBμV. Allowing for an antenna factor of 10.0dB/m, a mast amplifier gain of 25dB and a cable loss of 0.64dB, the resultant corrected field strength would be calculated as follows:-

Receiver level = field strength - antenna factor + amplifier gain - cable factor

Corrected field strength = (Receiver level) + (Cable factor) - (Amp gain) + (Antenna factor)

$$= 50.0 + 10.0 + 0.64 - 25$$

$$= 35.64\text{dB}\mu\text{V/m}$$

FCC limits are specified in μV for conducted emissions and μV/m for radiated emissions. These are converted to dBμV and dBμV/m respectively by the control software before results are displayed, limits being converted accordingly. The conversion factor is $20 \log_{10}(\mu\text{V}) = \text{dB}\mu\text{V}$.

Emissions Test Conditions: CONDUCTED EMISSIONS (Interference Voltage)The *CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE)* measurements were performed at the following test location:**■ - Test not applicable**

- ☐ - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')
- ☐ - Test area no. 2 – Shielded room (19' x 19' x 8')
- ☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

Test Equipment Used :

Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
☐ - 85462A	Receiver RF Section	Hewlett Packard	3325A00161	4/14/00
☐ - 85460A	RF Filter Section	Hewlett Packard	3330A00160	4/14/00
☐ - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	6A,6B	5/22/00
☐ - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	3A,3B	5/22/00
☐ - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	2A,2B,2C,2D	5/22/00
☐ - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	1A,1B,1C,1D	5/22/00
☐ - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	4A,4B	5/22/00
☐ - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	7A,7B	5/22/00
☐ - DC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	5A,5B	5/22/00
☐ - DC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	8A,8B	5/22/00
☐ - NNLA 8120	Line Impedance Stabilization Network	Rohde & Schwartz	8120490	-----
☐ - NNLA 8120	Line Impedance Stabilization Network	Rohde & Schwartz	8120491	-----
☐ - NNLK 8121	Line Impedance Stabilization Network	Rohde & Schwartz	--	-----

Remarks: Conducted emissions was not done due to the fact that the EUT has DC power input

Emissions Test Conditions: RADIATED EMISSIONS (Magnetic Field)

The *RADIATED EMISSIONS (MAGNETIC FIELD)* measurements were performed at the following test location:

■ - Test not applicable

- ☐ - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')
- ☐ - Test area no. 2 – Shielded room (19' x 19' x 8')
- ☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

Testing was performed at a test distance of :

- ☐ - 3 meters
- ☐ - 10 meters

Test Equipment Used :

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
☐	85462A	Receiver RF Section	Hewlett Packard	3325A00161	4/14/00
☐	85460A	RF Filter Section	Hewlett Packard	3330A00160	4/14/00
☐	87405A	RF Pre-Amplifier	Hewlett Packard	3207A01433	6/23/00
☐	87405A	RF Pre-Amplifier	Hewlett Packard	3207A01433	11/9/99
☐	HFH 2 - Z2	Loop Antenna	Rohde & Schwarz	892 665 / 019	-----

Remarks: _____

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *RADIATED EMISSIONS (ELECTRIC FIELD)* measurements, in the frequency range of 30 MHz-1000 MHz, were tested in a horizontal and vertical polarization at the following test location :

☐ - Test not applicable

- - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')
- ☐ - Test area no. 2 – Shielded room (19' x 19' x 8')
- ☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

Testing was performed at a test distance of :

- - 3 meters
- ☐ - 10 meters

Test Equipment Used :

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	85462A	Receiver RF Section	Hewlett Packard	3325A00161	4/14/00
■ -	85460A	RF Filter Section	Hewlett Packard	3330A00160	4/14/00
■ -	87405A	RF Pre-Amplifier	Hewlett Packard	3207A01433	6/23/00
☐ -	CBL6111	Bilog Antenna	Chase	1122	6/4/00
■ -	CBL6112	Bilog Antenna	Chase	2180	7/21/00

Remarks: _____

Emissions Test Conditions: INTERFERENCE POWER

The *INTERFERENCE POWER* measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location :

■ - Test not applicable

- ☐ - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')
- ☐ - Test area no. 2 – Shielded room (19' x 19' x 8')
- ☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

Test Equipment Used :

Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
☐ - MDS-21	Absorbing Clamp	Rohde & Schwarz	20798	-----
☐ - 85462A	Receiver RF Section	Hewlett Packard	3325A00161	4/14/00
☐ - 85460A	RF Filter Section	Hewlett Packard	3330A00160	4/14/00

Remarks: _____

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range 1 GHz - 10 GHz were performed in a horizontal and vertical polarization at the following test location :

☐ - Test not applicable

- - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')
- ☐ - Test area no. 2 – Shielded room (19' x 19' x 8')
- ☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

Testing was performed at a test distance of:

- ☐ - 1 meters
- - 3 meters
- ☐ - 10 meters

Test Equipment Used :

Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ - 8449B	RF Pre-Amplifier	Hewlett Packard	3008A01235	6/23/00
■ - 8566 B	Spectrum Analyzer	Hewlett Packard	2421A00443	6/7/00
■ - 3115	Horn Antenna	EMCO	99025686	10/25/00

Remarks _____

Equipment Under Test (EUT) Test Operation Mode - Emissions Tests :

The equipment under test was operated under the following conditions during emissions testing:

- ☐ - Standby
- ☐ - Test Program (H - Pattern)
- ☐ - Test Program (Color Bar)
- ☐ - Test Program (Customer Specified)
- ☐ - Practice Operation
- ☒ - Normal Operating Mode (Refer to Appendix B)
- ☐ - _____

Configuration of the equipment under test:

- ☐ - See Constructional Data Form in Appendix B - Page B2
- ☒ - See Product Information Form(s) in Appendix B - Page B2

The following peripheral devices and interface cables were connected during the testing:

- | | |
|--|--|
| ☒ - <u>DC Power Supply</u> | Type : <u>Hewlett Packard 6683A, S/N: U536420224</u> |
| ☒ - <u>RF Signal Generator</u> | Type : <u>HP 4432B , S/N: U538080117</u> |
| ☒ - <u>RF Power Meter</u> | Type : <u>HP 438A , S/N: 3237A07500</u> |
| ☒ - <u>RF Power Sensor</u> | Type : <u>HP 8481A, S/N: U537296108</u> |
| ☒ - <u>50 Ohm 500W Attenuator</u> | Type : <u>Weinschel 53-20-34 , S/N: LJ018</u> |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☒ - Unshielded power cable | |
| ☐ - Unshielded cables | |
| ☒ - Shielded cables (Input & Output) | MPS.No.: _____ |
| ☐ - Customer specific cables | |
| ☐ - _____ | |
| ☐ - _____ | |

Emissions Test Results:**Conducted Emissions, 10/150/450 kHz - 30 MHz**☐ - PASS☐ - FAIL☒ - NOT APPLICABLE

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: Limits shown in the results are in dB μ V rather than μ V.**Radiated Emissions (Magnetic Field), 10 kHz - 30 MHz**☐ - PASS☐ - FAIL☒ - NOT APPLICABLE

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Radiated Emissions (Electric Field), 30 MHz - 1000 MHz☒ - PASS☐ - FAIL☐ - NOT APPLICABLE

Minimum limit margin (QP) _____ 2.3 dB at _____ 863.75 MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: Limits shown in the results are in dB μ V rather than μ V.

This value is within the calculated measurement uncertainty

Interference Power at the Mains and Interface Cables, 30 MHz - 300 MHz☐ - PASS☐ - FAIL☒ - NOT APPLICABLE

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Equivalent Radiated Emissions, 1 GHz - 10 GHz☒ - PASS☐ - FAIL☐ - NOT APPLICABLE

Minimum limit margin for Carrier 869 MHz 9.06 dB at 1737 MHz

Minimum limit margin for Carrier 881 MHz 8.61 dB at 1762.92 MHz

Minimum limit margin for Carrier 894 MHz 8.61 dB at 1762.92 MHz

Maximum limit exceeding _____ dB at _____ MHz

GENERAL REMARKS:

No modifications were necessary in order for the EUT to meet the emissions requirements.

SUMMARY:

All tests according to the regulations cited on page 3 were

■ - Performed

□ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements cited on page 3.

□ - **Does not** fulfill the general approval requirements cited on page 3.

Statement of Measurement Uncertainty

The data and results referenced in this document are true and accurate. There may be some degree or level of measurement uncertainty. As EN 45001 does not allow recommendations to be included in the test report, the reader is encouraged to request a copy of the BABT Product Service policy concerning pass or fail judgment with respect to possible measurement uncertainties.

Equipment Received Date:	<u>On file</u>
Testing Start Date:	<u>8 November 1999</u>
Testing End Date:	<u>12 November 1999</u>

- BABT PRODUCT SERVICE -

Engineer In Charge:

Tester:



Frank Ibrahim
(EMC Engineer)

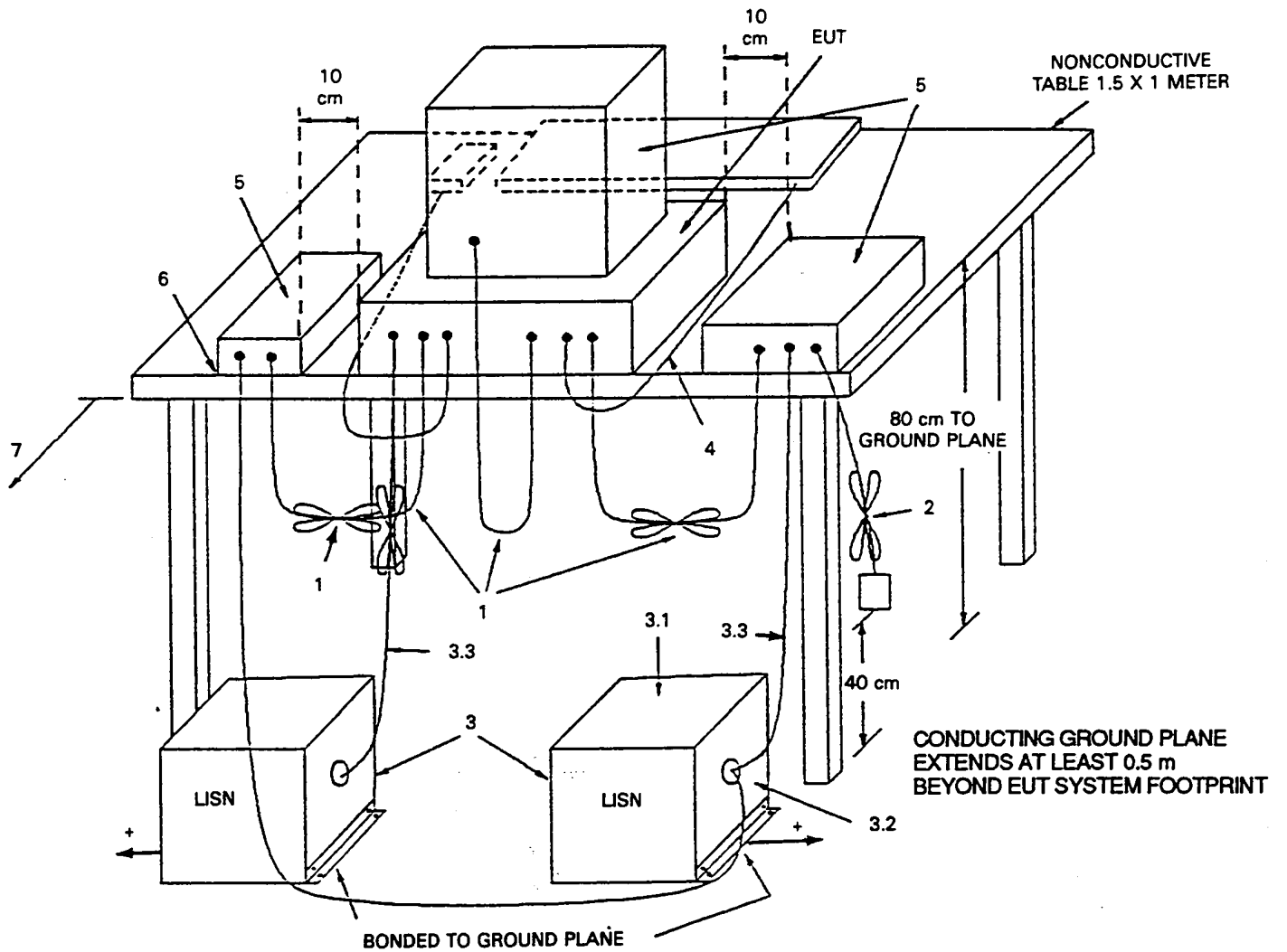
Chin Pang
(EMC Technician)

Report No. A9368F01

Technical Documentation

Test Setup Drawing(s)

Note: Data sheets are in a separate attachment



Appendix A

Test Setups
(Photographs)

Photograph of Test Setup:
Conducted Emissions 10/150/450 kHz - 30 MHz

Not Applicable

Photograph of Test Setup:
Radiated Emissions 30 MHz - 1000 MHz

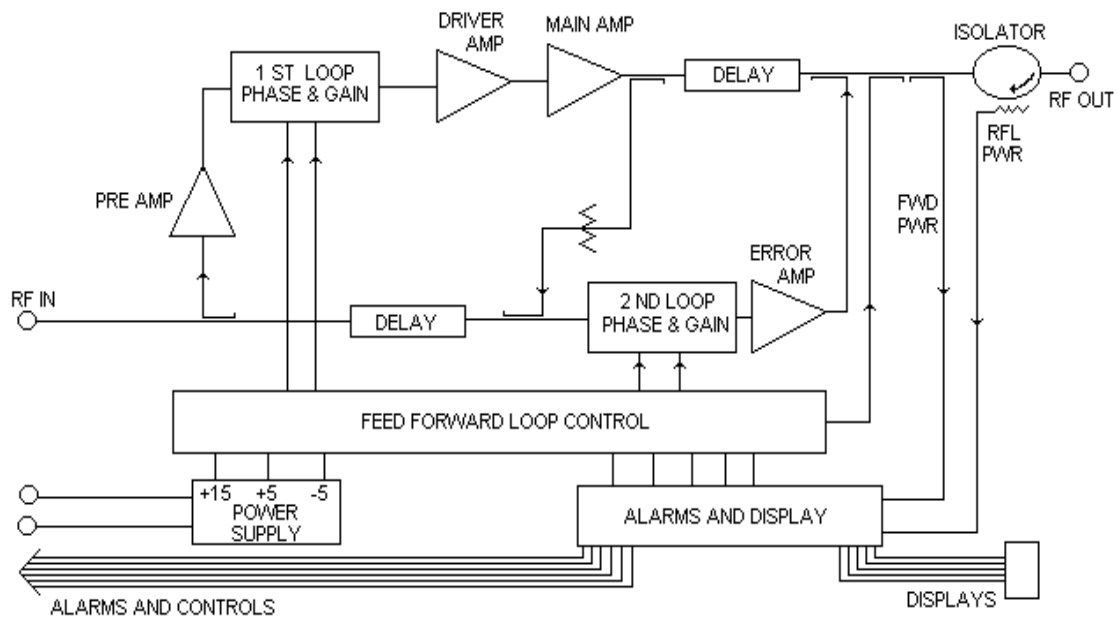
Note: Setup photos are in a separate attachment

Appendix B

Product Information Form(s)

CUSTOMER INFORMATION			
COMPANY NAME:		Powerwave Technologies, Inc.	
COMPANY ADDRESS:		2026 McGaw Ave.	
		Irvine, CA 92614	
PHONE NUMBER:		(949) 809-1466	
FAX NUMBER/E-MAIL ADDRESS:		(949) 757-6674 / jdale@pwav.com	
CUSTOMER CONTACT:			
PRODUCT DESCRIPTION			
NAME, MODEL, SERIAL # OF EUT:		Multi-channel Power Amplifier and Dual Combining Shelf , NTL107AA and NTL107AC , N/A	
DESCRIPTION OF EUT:		The G3X-800 Series (NTL107AA) amplifier is a linear, feed-forward power amplifier that operates in the 25-MHz frequency band from 869 MHz to 894 MHz. The amplifier can simultaneously transmit multiple frequencies, with better than -65 dBc third order intermodulation distortion (IMD). The amplifier system is modular in design, and is ideally suited for use in AMPS/TDMA/CDMA base stations. The plug-in G3X-800 Series (NTL107AA) amplifier modules can each provide 110 watts of power and function completely independently of each other. The amplifier modules are designed for parallel operation to produce high peak power output and backup redundancy for remote applications. The system is housed in the MCR20XX Series (NTL107AC) subrack which holds two G3X-800 Series (NTL107AA) amplifiers to produce up to 200 watts output. All solid-state, the system is designed to provide trouble-free operation with minimum maintenance. The system's modular construction and unique and highly effective LED-based operational status and fault indicators help minimize downtime. The turn-on and turn-off sequences of voltages are fully automatic, as is overload protection and recycling. Inadvertent operator damage from front panel manipulation is virtually impossible.	
Components of EUT			
Description	Model Number	Serial Number	FCC ID Number
Multi-channel Power Amplifier	NTL107AA	N/A	E675JS0042
Dual Combining Shelf	NTL107AC	N/A	E675JS0042
OPERATING MODE(S):		200W average power output, multi-channel TDMA, CDMA, AMPS Voice, AMPS Wideband Data.	
I/O CABLES			
CONNECTION	RF Input		
SHIELD	Yes		
CONNECTORS	Metal		
TERMINATION TYPE	SMA		
LENGTH	Variable		
REMOVABLE	Yes		
CONNECTION	RF Output		
SHIELD	Yes		
CONNECTORS	Metal		
TERMINATION	Type N		

TYPE				
LENGTH	Varies			
REMOVABLE	Yes			
CONNECTION	+27 Vdc			
SHIELD	No			
CONNECTORS	Metal			
TERMINATION TYPE	Bolt on			
LENGTH	Varies			
REMOVABLE	Yes			
CONNECTION	-27 Vdc			
SHIELD	No			
CONNECTORS	Metal			
TERMINATION TYPE	Bolt on			
LENGTH	Varies			
REMOVABLE	Yes			
POWER CORDS (N/A)				
UNIT:		UNIT:		
MANUFACTURER:		MANUFACTURER:		
SHIELDED:		SHIELDED:		
LENGTH:		LENGTH:		
POWER INTERFACE				
VOLTAGE / FREQUENCY	+27 VDC			
PHASES/CURRENT:	112 A			
OSCILLATOR FREQUENCIES				
FREQUENCY	EUT LOCATION		DESCRIPTION OF USE	
8 MHz	PCB		Frequency reference	
16 MHz	PCB		Frequency reference	
POWER SUPPLY (N/A) - not part of EUT				
DESCRIPTION	MANUFACTURER	MODEL #	SERIAL #	SWITCHING/LINEAR FREQ.
POWER LINE FILTERS (NA)				
MANUFACTURER	MODEL NO.	QTY.	LOCATION ON EUT	
CRITICAL EMI COMPONENTS (N/A)				
DESCRIPTION	MANUFACTURER	PART # OR VALUE	QTY.	LOCATION ON EUT
DESCRIPTION OF ENCLOSURE:		Aluminum alloy with chem film and paint coatings.		
INTERFACING AND/OR SIMULATORS PERIPHERAL EQUIPMENT:				
DESCRIPTION	MANUFACTURER	MODEL #	SERIAL #	FCC ID
Signal Generator (x2)	Hewlett Packard	E4433B		N/A
DC Power Supply	HP	6683A		N/A
RF Power Meter, Sensor	HP	438A, 8481A		N/A
Attenuator, 50 ohm, 500W	Weinschel	53-20-34		N/A
BLOCK DIAGRAM:				



Appendix C

Change History

Not Applicable

Appendix D

Supplemental Information

Compliance Information

Labeling

Equipment subject to Declaration of Conformity procedures shall be labeled in accordance with Part 2 of the Regulations.

Compliance Statement

Equipment subject to Declaration of Conformity authorization procedures must be accompanied by a compliance information statement when placed on the market, which must contain the following information:-

- 1) Equipment identification
- 2) Statement of compliance with Part 15:-

“This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.”
- 3) Identification and contact details of the responsible party located in the United States.

This statement can either be printed in the user guide or alternatively as an addendum.

The following warning statement must also be included in the equipment manual:-

“Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.”