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June 18,1998

Federal Communications Commission
Authorization and Evaluation Division
Laboratory Division
7435 Oakland Mills Road
Columbia MD 20146

Dear Sir or Madam,

In reference to the application under FCC ID:E675JS0029, we, Compliance Engineering Service, Inc., on behalf of PowerWave Technologies,Inc. request that the following material submitted with the application be withheld from public disclosure:

> Addendum 1, Schematics/Part Lists Multicarrier Cellular Amplifier System, Gen.2.5/MCR3100, MCR4100 Series Subracks and MCA 9100-50 Amplifier/ Document part number:044-05025 Rev.A.

The requested material contains schematics, part lists and block diagrams that are confidential and would not normally be considered public knowledge or be made available to the public.

Best Regards

Compliance Engineering Service, Inc.

Mike C. I. Kuo / Vice President

POWERWAVE
TECHNOLOGIES

INSTALLATION & SERVICE MANUAL

MCR3100 and MCR4100 SERIES SUBRACKS
MCA 9100-50 AMPLIFIER

MULTICARRIER CELLULAR AMPLIFIER SYSTEM

869-894 MHz
40 TO 175 WATTS AVERAGE POWER
-65 dBc INTERMODULATION DISTORTION

04 November 1997

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044-05024 Rev. A

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SECTION 1
GENERAL DESCRIPTION

1-1. INTRODUCTION

This manual contains information and procedures for installation, operation, and maintenance of Powerwave's multicarrier cellular amplifier systems. The manual is organized into five sections as follows:

Section 1. General Description
Section 2. Installation
Section 3. Operating Instructions
Section 4. Principles of Operation
Section 5. Maintenance

1-2. GENERAL DESCRIPTION

The MCA9100-50 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 amplifier system is available in two subrack configurations: the MCR3100 system with up to 135 watts output, employing three MCA9100-50 amplifiers, one PWIC-24A 24-way combiner, and an MCR3100 19-inch center-mount subrack (figures 1-1 and 1-3); and the MCR4100 system with up to 175 watts output, employing four MCA9100-50 amplifiers, one PWIC-24A-1 24-way combiner, and an MCR4100 24-inch center-mount subrack (figures 1-2 and 1-4). The plug-in Model MCA9100-50 amplifier modules can each provide 50 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. 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 down-time. 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.

The MCR3100 and MCR4100 subracks each contain an RF power splitter/combiner and a summary logic module that monitors the functional status of all plug-in amplifiers. The rear panels of the subracks interface with the host system via the system RF I/O connectors, an RF output sample connector, and either a form C remote status six-position terminal block (style A) or D-sub miniature connectors to control and monitor the system and each amplifier (styles B and C). Primary power for the amplifier system is +27 Vdc.

Each amplifier module has a status connector which allows the host system to monitor the amplifier module performance. The front panel of each amplifier module has unit level status/fault indicators and an RF on/off/reset switch. Cooling for each plug-in amplifier module is provided by two fans mounted on the front and rear of the module. The fans draw outside air through the front of the module and exhaust hot air out through the rear of the module.

The system utilizes a 24-way input combiner to allow 24 simultaneous narrowband RF signals to be input to the system (see figures 1-3 and 1-4).

1-3. FUNCTIONAL AND PHYSICAL SPECIFICATIONS

Functional and physical specifications for the amplifier system are listed in tables 1-2 and 1-3.

1-4. EQUIPMENT CHANGES

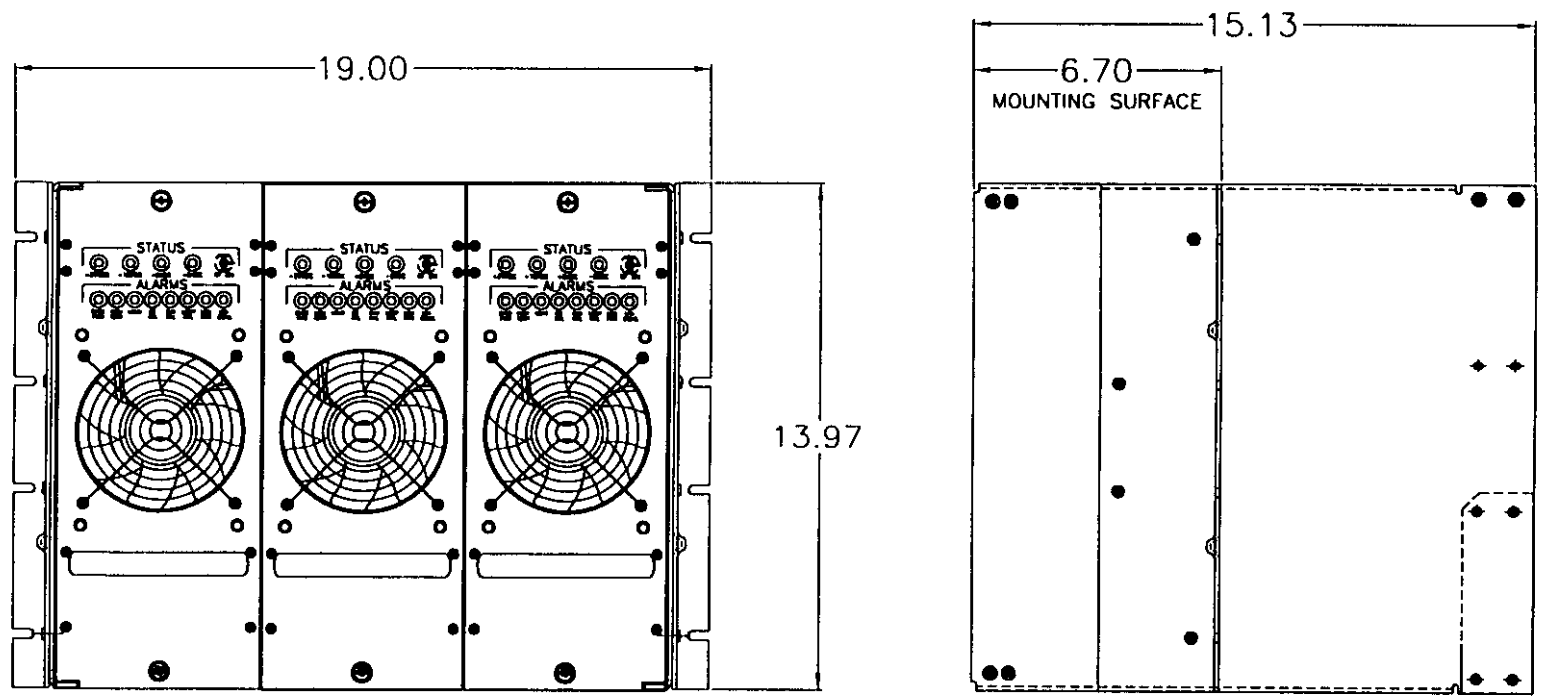
Powerwave Technologies, Inc. reserves the right to make minor changes to the equipment without notice, including but not necessarily limited to component substitution and circuitry changes. Such changes may or may not be incorporated in this manual, although it is our intention to keep each manual as up-to-date as possible. To that end, we ask that you, our customer, share with us information acquired in field situations which might be of assistance to another user. If you share it with us, we'll pass it around.

1-5. ORDERING INFORMATION

Table 1-1 following gives the part numbers and descriptions to be used when ordering either an entire system or individual major components that comprise the system.

Table 1-1. Major System Components

SYSTEM ORDER NUMBER	DESCRIPTION OF SYSTEM NUMBER	SUB-COMPONENT MODEL NUMBER	QTY PER SYSTEM	DESCRIPTION OF SUB-COMPONENT MODEL NUMBER
MCR3100	120 W 869-894 MHz MCPA System for Base Station Equipment.	MCA9100-50	3	50 W 869-894 MHz MCPA Module.
		PWIC-24A	1	24-Way Input Combiner in a 19" Center-Mount Configuration.
		MCR3100	1	3-Way 19" Center-Mount Configuration Subrack.
MCR4100	175 W 869-894 MHz MCPA System for Base Station Equipment.	MCA9100-50	4	50 W 869-894 MHz MCPA Module.
		PWIC-24A-1	1	24-Way Input Combiner in a 24" Center-Mount Configuration.
		MCR4100	1	4-Way 24" Center-Mount Configuration Subrack.



FRONT

RIGHT SIDE

Figure 1–1. MCR3100 with Three Amplifier Units, Center Mount Configuration.

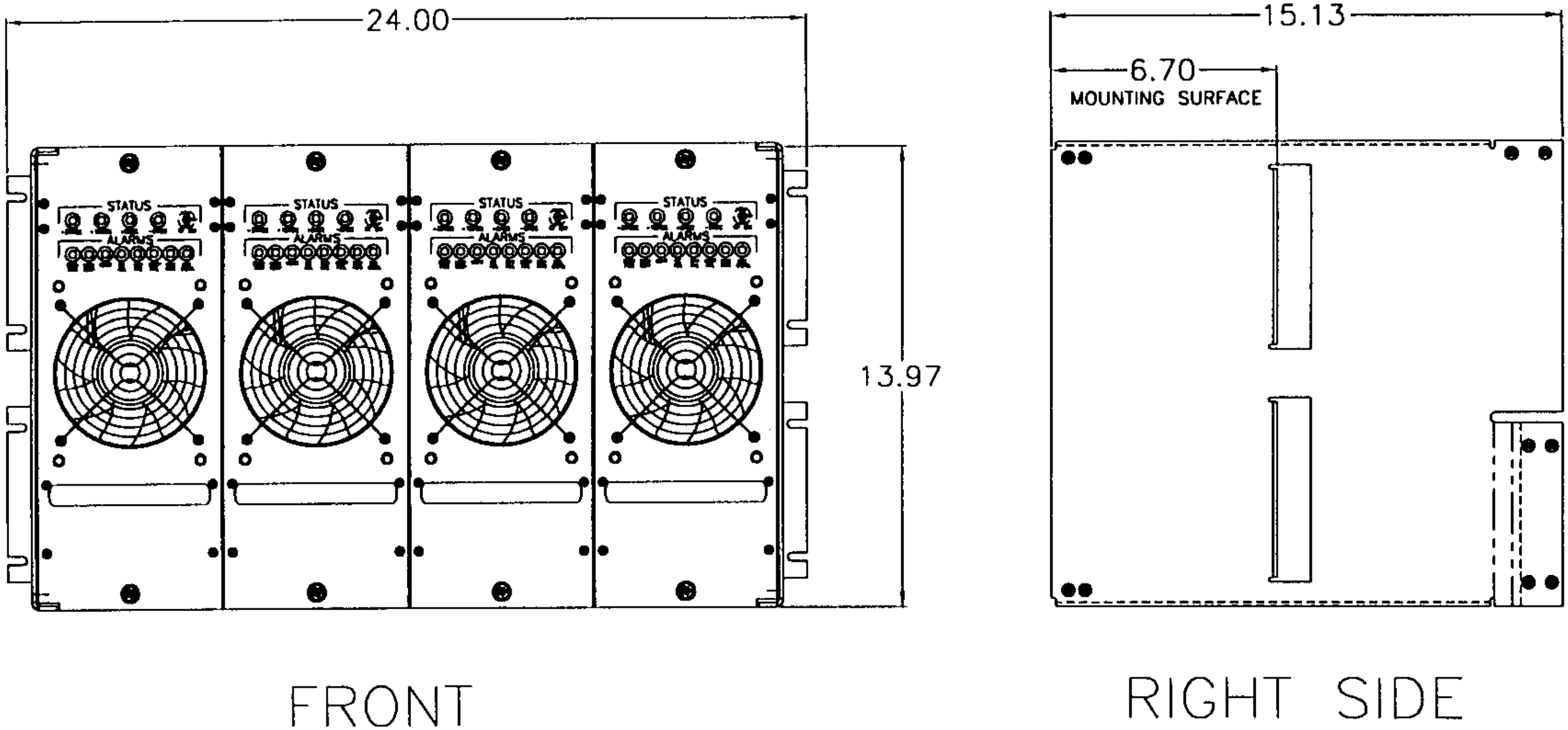


Figure 1-2. MCR 4100 with Four Amplifier Units, Center Mount Configuration.

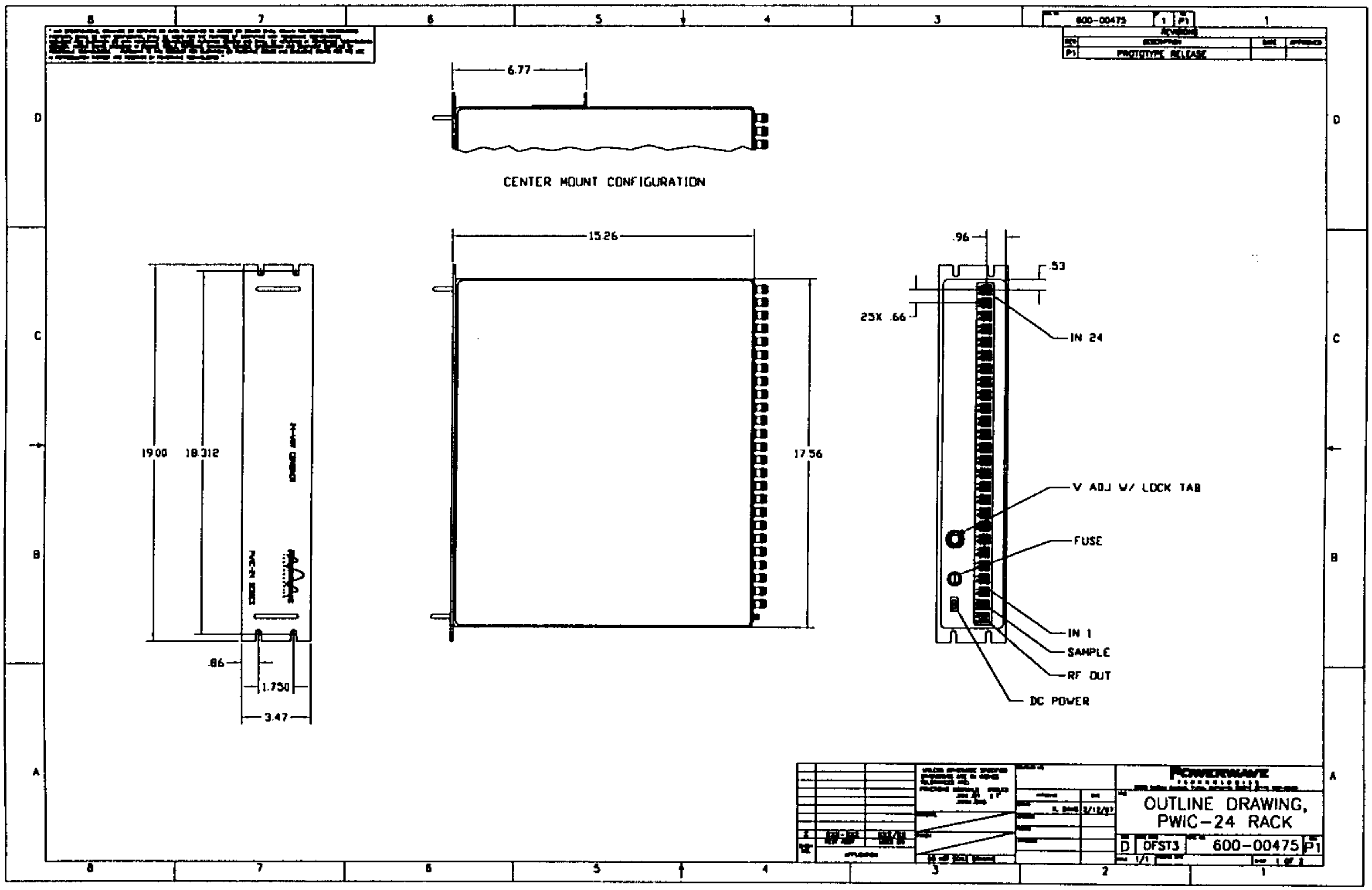


Figure 1-3. PWIC-24A 19-Inch Center-Mount Configuration

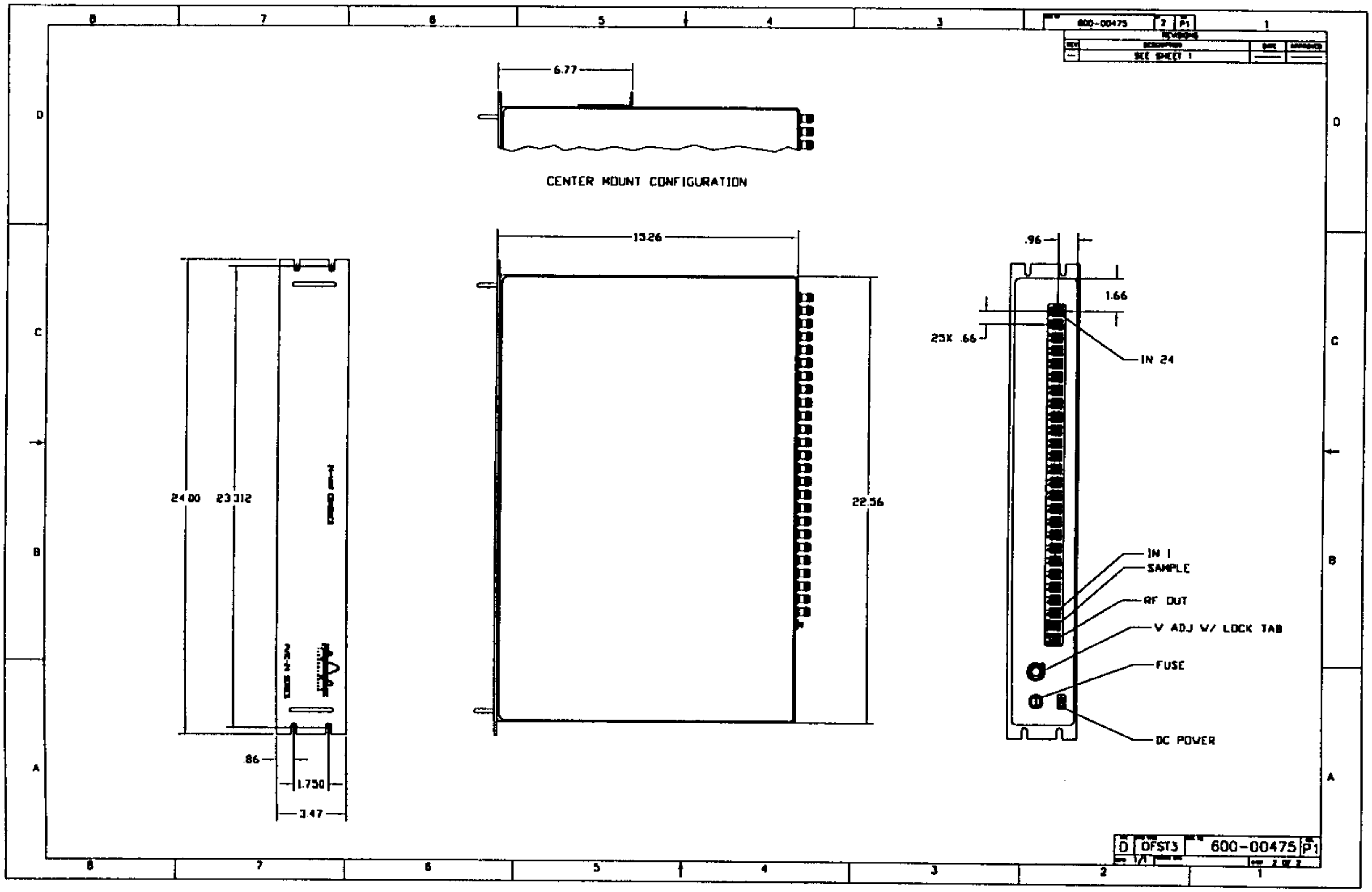


Figure 1-4. PWIC-24A-1 24-Inch Center-Mount Configuration

Table 1-2. Multicarrier Cellular Amplifier System Functional Specifications

Frequency Range	869-894 MHz (25 MHz Bandwidth)	
Total Maximum Input Power	0 dBm	
Total Output Power (Minimum) in MCR3100 or MCR4100 System	40 W typical (1 Module) 90 W typical (2 Modules) 120 W typical (3 Modules) 175 W typical (4 Modules)	
Intermodulation Distortion and In-Band Spurious:	1 Module : -65 dBc (Min) @ +24 to +28 Vdc @ 40 Watts 2 Modules: -65 dBc (Min) @ +24 to +28 Vdc @ 90 Watts 3 Modules: -65 dBc (Min) @ +24 to +28 Vdc @ 120 Watts 4 Modules: -65 dBc (Min) @ +24 to +28 Vdc @ 175 Watts (-55 dBc(Min) @ +23 to +24 Vdc)	
RF Gain at 880 MHz	**3-Unit Subrack** 54.5 dB (1 Module) 58.1 dB (2 Modules) 59.8 dB (3 Modules)	**4-Unit Subrack** 52.5 dB (1 Module) 56.3 dB (2 Modules) 58.0 dB (3 Modules) 59.0 dB (4 Modules)
Gain Flatness:	± 0.7 dB @ 27 Vdc ±1 Vdc	
Gain Variation Over Temperature:	± 1.0 dB @ 27 Vdc ±1 Vdc ± 1.5 dB @ 24 to 26 Vdc	
Output Protection:	Mismatch Protected	
Input Port Return Loss:	-18 dB (Min)	
Harmonics:	Better than -45 dBc	
Out of Band Spurious:	Better than -60 dBc	
Duty Cycle:	Continuous	
DC Input Power:	+27 Vdc ± 1 Vdc, 28 Amps Max per module @ 50 Watts Operational +23 Vdc to 30 Vdc	
Operating Temperature:	0 °C. to +50 °C.	
Storage Temperature:	-40 °C. to +85 °C.	
Operating Humidity:	5% - 95% Relative Humidity (Non-Condensing)	
Storage Humidity:	5% - 95 % Relative Humidity (Non-Condensing)	
DC Input Connectors:	Terminal Block	
Summary Alarm Connector(s):	Six position terminal block (style A) D-Subminiature connectors (styles B and C)	
RF Input Connector:	SMA Female	
RF Output Connector:	Type 7/16 DIN Female*	
RF Output Sample Connector:	SMA Female	
Dimensions: • MCR3100 Subrack: • MCR4100 Subrack:	 13.97" (8U) High, 19" Wide, 16.10" Deep (with amplifiers) 13.97" (8U) High, 24" Wide, 16.10" Deep (with amplifiers)	

* Powerwave recommends mating with a 7/16 DIN Male on RG 214/U cable.

Table 1-3. 24-Way Input Combiner Functional Specifications

Frequency Range	869-894 MHz (25 MHz Bandwidth)
Maximum RF Input Power per Channel	0 dBm Nominal
Range of Maximum RF Input About Nominal	±10 dB
RF Input Power Dynamic Range	Greater than 30 dB
Number of RF Input Signals	24
Maximum RF Output Power per Channel	-30 to -10 dBm (Minimum range for nominal RF input power)
Step Size of RF Output Power	Continuous
Setting Repeatability of RF Output Power	±0.5 dB Maximum
Amplitude Tracking	±0.5 dB Maximum
Phase Tracking	±45 Degrees Maximum
RF Input VSWR	1.4:1 Maximum
RF Input Port-to-Port Isolation	40 dB Minimum
RF Output Noise Floor	-135 dBm/Hz Maximum
RF Output Intermodulation Distortion	-85 dBc Maximum
RF Output VSWR	2:1 Maximum
DC Input Voltage	21 to 30 Volts
DC Input Current	1.0 Amperes Maximum
Sample Port:	-20 dBc Relative to Output
RF Output Power Control	Rear Mounted Calibrated Dial to Allow Setting to within ±0.5 dB
DC Input Connector:	Two AMP 350690-1 pins within an AMP 1-480699-0 housing.
RF Input Connector:	SMA Female or TNC Female
RF Output Connector:	SMA Female
RF Output Sample Connector:	SMA Female or TNC Female
Dimensions: • PWIC-24A: • PWIC-24A-1:	 3.47" (2U) High, 19" Wide, 15.26" Deep 3.47" (2U) High, 24" Wide, 15.26" Deep

SECTION 2
INSTALLATION

2-1. INTRODUCTION

This section contains installation recommendations, unpacking, inspection, and installation instructions for the Multicarrier Cellular Amplifier System. Carefully read all material in this section prior to equipment unpacking or installation. Also read and review the operating procedures in Section 3 prior to installing the equipment. Section 3 contains applicable standards imposed by the Federal Communications Commission. It is important that the licensee perform these tasks correctly and in good faith. Carefully read Parts 73 and 74 of the FCC rules to determine how they apply to your installation. DON'T TAKE CHANCES WITH YOUR LICENSE.

2-2. ELECTRICAL SERVICE RECOMMENDATIONS

Powerwave Technologies recommends that proper AC line conditioning and surge suppression be provided on the primary AC input to the +27 Vdc power source. All electrical service should be installed in accordance with the National Electrical Code, any applicable state or local codes, and good engineering practice. Special consideration should be given to lightning protection of all systems in view of the vulnerability of most transmitter sites to lightning. Lightning arrestors are recommended in the service entrance. Straight, short ground runs are recommended. The electrical service must be well grounded.

Each amplifier system should have its own circuit breaker, so a failure in one does not shut off the whole installation. Circuit breakers should be thermal type, capable of handling an inrush current of 125 Amps, in a load center with a master switch.

2-3. UNPACKING AND INSPECTION

This equipment has been operated, tested and calibrated at the factory. Only in the event of severe shocks or other mistreatment should any substantial readjustment be required. The amplifier system is shipped in two containers. Check the outside of each for instructions regarding unpacking. Carefully open the containers and remove the rack and amplifier modules. Retain all packing material that can be reassembled in the event the that the unit must be returned to the factory.

CAUTION

Exercise care in handling equipment
during inspection to prevent damage
caused by rough or careless handling.

Visually inspect the amplifier rack and modules for damage that may have occurred during shipment. Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in connectors or fans. Inspect all connectors for bent connector pins. If the equipment is damaged, a claim should be filed with the carrier once the extent of any damage is assessed. We cannot stress too strongly the importance of IMMEDIATE careful inspection of the equipment and the subsequent IMMEDIATE filing of the necessary claims against the carrier if necessary. If possible, inspect the equipment in the presence of the delivery person. If the equipment is damaged, the carrier is your first area of recourse. If the equipment is damaged and must be returned to the factory, write or phone for a return authorization. Powerwave may not accept returns without a return authorization. Claims for loss or damage may not be withheld from any payment to Powerwave, nor may any payment due be withheld pending the outcome thereof. WE CANNOT GUARANTEE THE FREIGHT CARRIER'S PERFORMANCE

2-4. INSTALLATION INSTRUCTIONS (Refer to figures 1-3, 1-4, 3-1, and 3-2)

There are two configurations of the amplifier system: MCR3100 with 19-inch subrack, 19-inch 24-way combiner, and three amplifier modules, and MCR4100 with 24-inch subrack, 24-inch 24-way combiner, and four amplifier modules. Both systems are designed for installation in a rack that permits access to the rear of the amplifier system subrack for connection of DC power, RF, and monitor cables. Both systems also contain a 1U size expansion panel.

To install the amplifier system proceed as follows:

1. Install subrack in equipment rack and secure in place with eight screws. Install 24-way combiner in equipment rack and secure in place with four screws. Install expansion panel (with or without brackets) with two screws.
2. Refer to figures 3-1 and 3-2 for the location of all subrack input/output connectors and figures 1-3 and 1-4 for 24-way combiner connectors.
3. Connect antenna cable to J6 RF OUT connector on rear of subrack.
4. Connect transceiver or exciter input to appropriate terminals TC1 through TC24 on the 24-way combiner. Using the 24-inch coaxial cable provided, connect the combiner output (RF OUT) to the subrack input terminal J7 RF IN on rear of subrack.
5. Loosely connect the 24-inch power cable red lead to the +27 V terminal on the subrack and the black lead to the DC RETURN terminal on the subrack; plug the opposite end into the matching connector on the rear of the 24-way combiner. Connect positive primary power to the +27V terminal, negative primary power to the DC RETURN terminal, and ground to the GND terminal on rear of subrack. Tighten the three subrack connections.

WARNING

The MCR3100 and MCR4100 subracks do not have an internal power disconnect. Turn off external primary DC power before removing covers or disconnecting DC power cables.

6. Install the plug-in amplifier modules in the slots of the subrack.
7. Check your work before applying DC voltage to the system. Make certain all connections are tight and correct.
8. Measure primary DC input voltage. DC input voltage should be +27 Vdc ±1.0 Vdc. If the DC input voltage is above or below the limits, call and consult Powerwave before you turn on your amplifier.
9. Refer to section 3 for initial turn-on and check-out procedures.

2-5. AMPLIFIER MODULE STATUS, ALARM, CONTROL, AND POWER CONNECTOR

Each amplifier in the subrack has a separate remote alarm and control connector that is used by the host system to monitor and control the individual amplifier modules. The status, alarm, control, and power connections on the amplifier connector are made through a 17-pin D-Sub male combo connector (figure 2-1) and are listed and described in table 2-1.

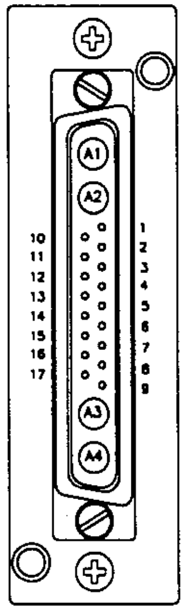


Figure 2-1. Amplifier Connector (on Rear of MCA9100-50 Module)

Table 2-1. Amplifier Module Status, Alarm, Control, and Power Connections

PIN NUMBER	FUNCTION	DESCRIPTION
A1	RF Input	Coaxial Contact
A2	Power Input	+27 Vdc (Power Contact)
A3	Ground	Ground (Power Contact)
A4	RF Output	Coaxial Contact
1	Ground	Ground
2	NC (No Connection)	
3	NC (No Connection)	
4	NC (No Connection)	
5	NC (No Connection)	
6	NC (No Connection)	
7	NC (No Connection)	
8	Fan Fail	TTL signal normally low. A high level indicates that one or both of the fans have failed.
9	Forward Power Monitor	An analog DC signal representing the RF output power of the MCA. The voltage is 4 volts ± 100 mV at the maximum rated output power.
10	NC (No Connection)	
11	Average Power Input	An analog DC voltage representing the average detected power of all the MCAs in a rack. This voltage is derived from dividing the sum of all the forward power voltages in a rack by the number of enabled MCAs. This voltage is used by the MCA to determine a low power fault.
12	NC (No Connection)	
13	Summary Fault	TTL signal normally low. A high level indicates that the MCA has been disabled by a recurring alarm fault.
14	NC (No Connection)	
15	Module Detect	Ground potential. Informs the rack that an MCA is plugged in.
16	Bias Input	TTL signal normally low for an enabled MCA. A high level will disable the MCA.
17	FP Disable Output	TTL signal, low if the front panel switch is in the ON position. A high level indicates the front panel switch in the OFF position.

2-6. SUBRACK MODULE STATUS AND FAN ALARM TERMINAL BLOCK

Each amplifier in the subrack has a set of alarm connections that are connected to subrack relays, the output of which is used by the host system to monitor whether any amplifier module in the system has a fault. The relay output contacts are rated at two amps @ 150 volts. Connections are made to terminal block TB1 in accordance with table 3-2.

2-7. 24-WAY INPUT COMBINER, MODELS PWIC-24A AND PWIC-24A-1

The Model PWIC-24A (19-inch rack mount) and the Model PWIC-24A-1 (24-inch rack mount) are both 24-way combiners which are utilized at the input to the multichannel linear power amplifier system. Each is rack-mounted and has a rear-mounted calibrated dial to allow setting to within ±0.5 dB.

2-8. EXPANSION PANEL

The Multicarrier Cellular Amplifier System includes a 1U size expansion panel which serves two purposes:

1. The spacer panel reserves space for future expansion to higher power systems, and
2. Prevents installation personnel from inadvertently installing other equipment in the space reserved for future expansion.

The expansion panel should be installed immediately above or below the MCR3100 or MCR4100 subrack as appropriate.

SECTION 3
OPERATING INSTRUCTIONS

3-1. INTRODUCTION

This section contains operating instructions for the Multicarrier Cellular Amplifier Systems.

3-2. LOCATION AND FUNCTION OF SUBRACK AND AMPLIFIER MODULE CIRCUIT BREAKERS, CONTROLS, AND INDICATORS

The amplifier system subracks are rack mountable chassis. The location and function of the system interface connectors and circuit breakers are shown in figures 3-1, 3-2, and 3-3, and are described in tables 3-1 and 3-2. The plug-in amplifier module controls and indicators, are shown in figure 3-4 and are described in detail in table 3-3.

Table 3-1. MCR3100 & MCR4100 Subrack Circuit Breakers, Alarms, and Input/Output Connectors

NO.	NAME	FUNCTION
1	F1, F2, and F3, MCR3100 or F1, F2, F3, and F4, MCR4100	Subrack mounted 50-amp circuit breakers. The breakers are in line with the +27 Vdc source voltage supplied to each plug-in amplifier module.
2	27V and GND Terminals	Input terminals for primary +27 Vdc source voltage and its return.
3	Terminal Block TB1	Six position summary alarms terminal block. (Refer to table 3-2 for individual terminal functions)
4	J6 - RF OUT Connector	Type 7/16 DIN female coax connector. Output to antenna. Refer to table 1-1 for power output level of three/four amplifier module systems.
5	J7 - RF IN Connector	SMA female coax connector. Refer to table 1-1 for power input level to three/four amplifier module systems.
6	J8 RF SAMPLE connector	SMA female coax connector. RF output signal is at -40 dB of signal output to antenna.

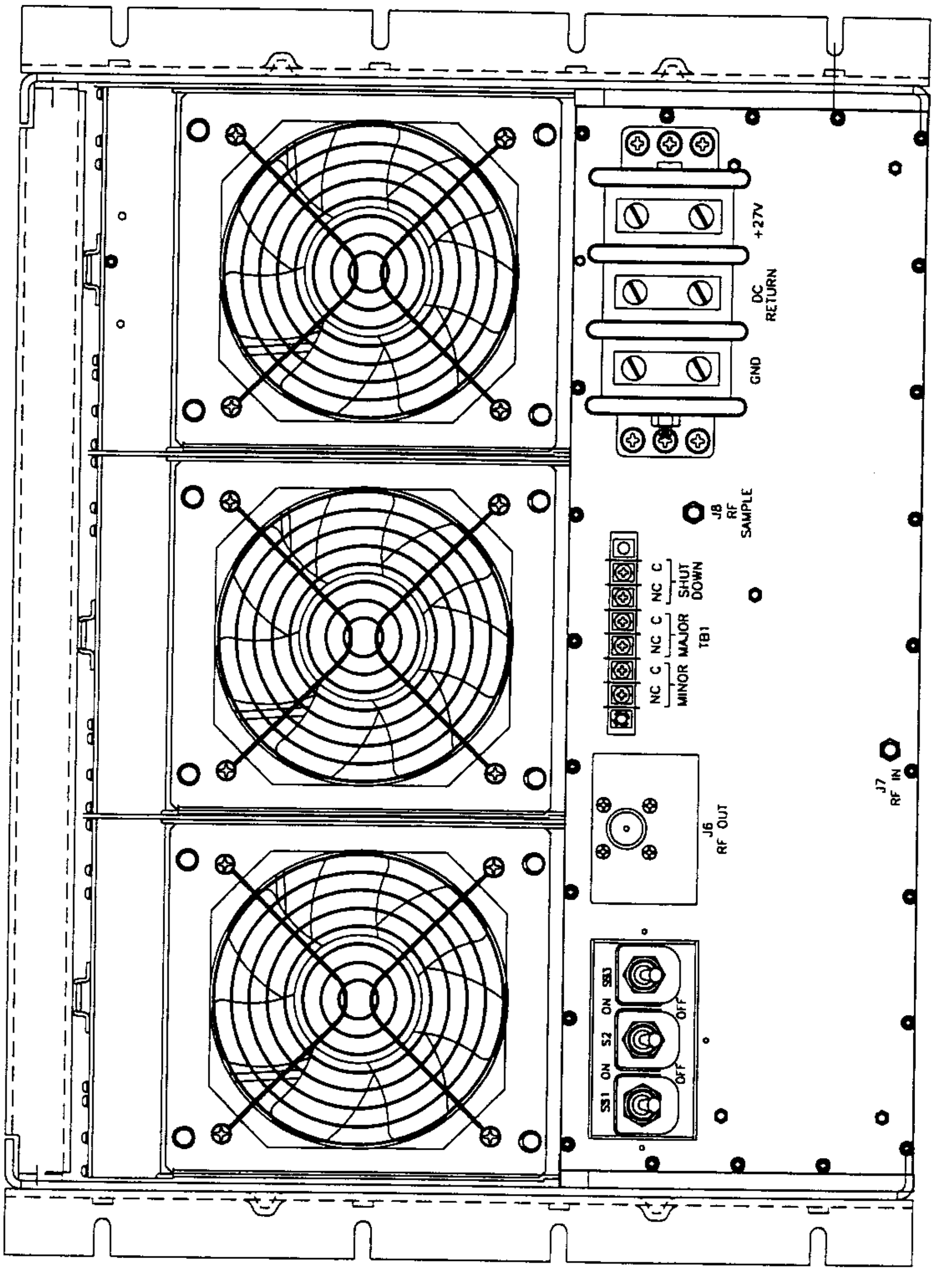


Figure 3–1. MCR3100 with Three Amplifier Units, Rear View

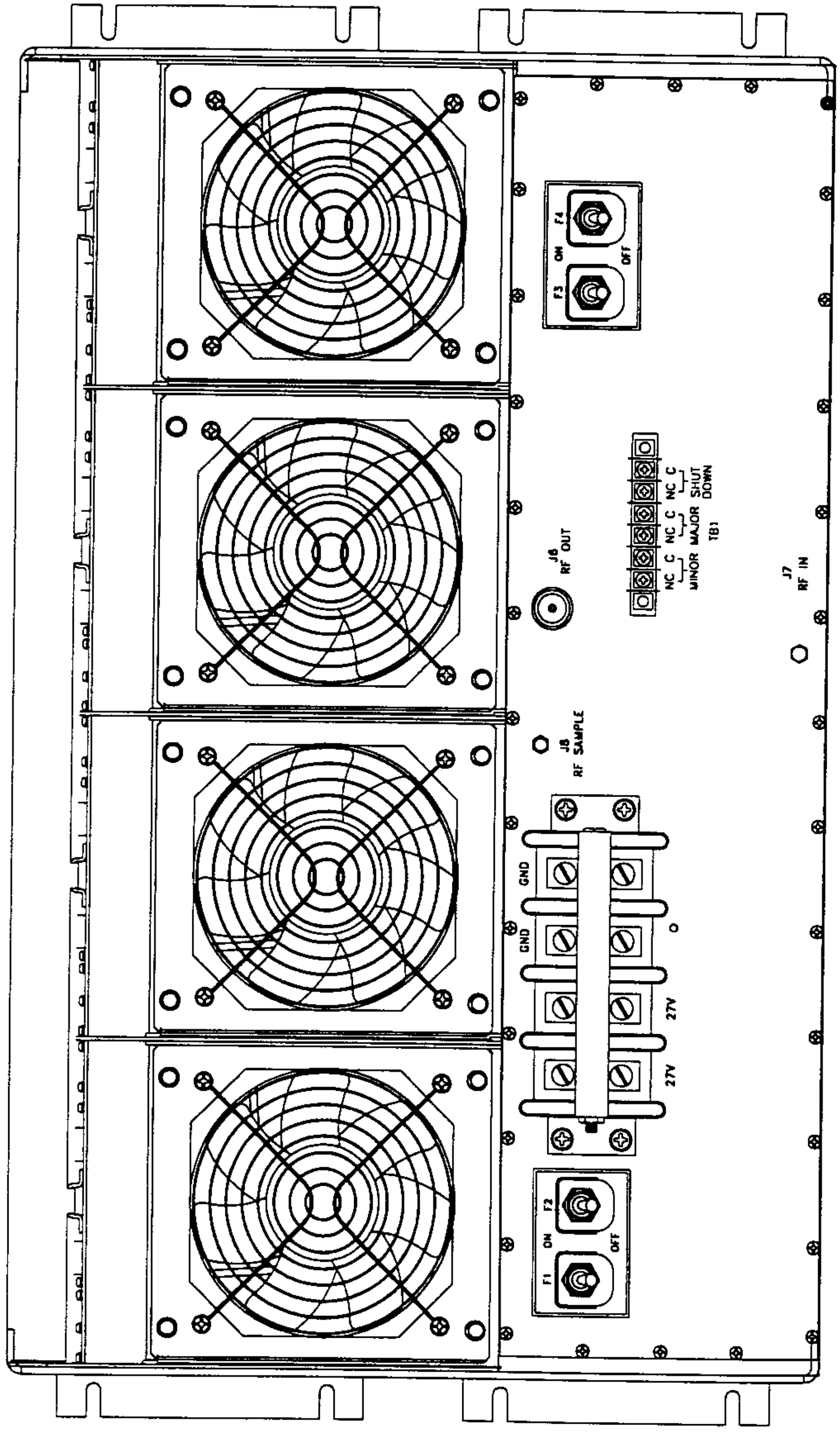


Figure 3-2. MCR4100 with Four Amplifier Units, Rear View

Table 3-2. Terminal Block TB1 Functions

TERMINAL	INTERFACE CONNECTOR PIN	FUNCTION	DESCTIPTION
MINOR - NC	1	Normally closed	Normally closed (continuity between NC and C) when fans are operating normally. Opens when one or both fans fail in any amplifier in that mainframe.
MINOR - C	2	Common	Common to MINOR - NC.
MAJOR - NC	3	Normally closed	Normally closed (continuity between NC and C) when system is operating normally. Opens when both fans fail or when OVER PWR, HIGH TEMP, VSWR, DC FAIL, LOOP FAIL or LOW POWER alarm occurs in any amplifier in that mainframe.
MAJOR - C	4	Common	Common to MAJOR-NC.
SHUTDOWN - NC	5	Normally closed	Normally closed (continuity between NC and C) when all MCAs are operating normally. Opens only if ALL MCAs are disabled. This signifies a mainframe shut-down
SHUTDOWN - C	6	Common	Common to SHUTDOWN - NC

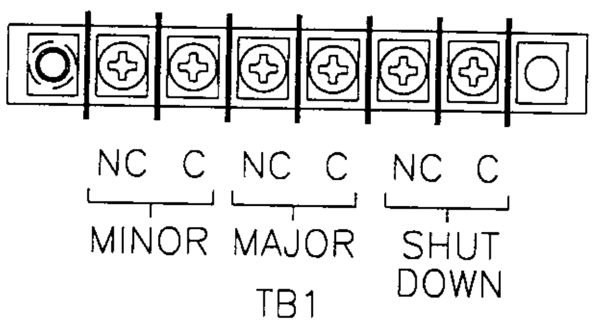


Figure 3-3. Terminal Block TB1

Table 3-3. Amplifier Module Control and Indicators

NO.	NAME	FUNCTION (Note: MCA = Multichannel Amplifier)
1	+28 Vdc Indicator	Green LED. When lit, indicates that the +27 Vdc supply is greater than +23 Vdc and less than +30 Vdc. The LED will blink if the voltage is 28 Vdc to 30 Vdc. If the +27 Vdc indicator goes out, the DC FAIL indicator will illuminate. This indicates that the +27 Vdc voltage dropped below +23 Vdc. A timer is started and the DC fail counter is incremented. After five seconds the fault is analyzed and if it exists the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero. If the DC input voltage exceeds +30 volts, the MCA will be disabled instantaneously, as indicated by the illumination of the LPA DISAB. LED. A timer is started and the DC fail counter is incremented. After five seconds the voltage is measured. If the fault exists the counter is incremented.* If the count equals five before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will remain disabled. If 15 minutes elapse before the counter reaches five, the counter and timer will reset to zero.
2	+15 Vdc Indicator	Green LED. When lit, indicates that the +15 Vdc supply is greater than +14 Vdc and less than +16 Vdc. If the +15 Vdc indicator goes out, the DC FAIL indicator will illuminate. This indicates that the +15 Vdc voltage dropped below +14 Vdc or increased above +16 Vdc. A timer is started and the DC fail counter is incremented. After five seconds the fault is analyzed and if it exists the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.
3	+5VDC Indicator	Green LED. When lit, indicates that the +5 Vdc supply is greater than +4.5 Vdc and less than +5.5 Vdc. If the +5 Vdc indicator goes out, the DC FAIL indicator will illuminate. This indicates that the +5 Vdc voltage dropped below +4.5 Vdc or increased above +5.5 Vdc. A timer is started and the DC fail counter is incremented. After five seconds the fault is analyzed and if it exists the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.
4	-5VDC Indicator	Green LED. When lit, indicates that the -5 Vdc supply is greater than -5.5 Vdc and less than -4.5 Vdc. If the -5 Vdc indicator goes out, the DC FAIL indicator will illuminate. This indicates that the -5 Vdc voltage dropped below -5.5 Vdc or increased above -4.5 Vdc. A timer is started and the DC fail counter is incremented. After five seconds the fault is analyzed and if it exists the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.

NO.	NAME	FUNCTION (Note: MCA = Multichannel Amplifier)
5	RF ON Switch	Three position switch: OFF (down position) - Turns off amplifier module. ON (center position) - Normal amplifier on position. RESET (up position) - When toggled to reset position, all the green LED indicators will turn off and all the red LED indicators will illuminate momentarily (LED test); this will also reset the fault latches. Then a series of fault LEDs will illuminate for 2 seconds to illustrate configuration type. If the switch is held in the reset position, a microcontroller reset will occur. This will be verified by the LEDs toggling state again. The switch is spring loaded to return to the normal ON position when released. If a fault occurs and the MCA is disabled, the alarms can be cleared and the MCA enabled by this reset position. The functions of the switch are disabled for five seconds after a power-up condition.
6	OVER PWR Fault Indicator	Red LED. When lit, indicates the output power from the amplifier exceeded 100 watts. If an over power condition occurs the MCA is immediately disabled. A timer is started and the over power fault counter is incremented. After five seconds the MCA is enabled and the fault is analyzed. If the fault exists, the MCA is again disabled and the counter is incremented.* If the count equals five before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches five, the counter and timer will reset to zero.
7	HIGH TEMP Fault Indicator	Red LED. When lit, indicates that the amplifier heat sink temperature has exceeded 80 °C. If a high temp condition occurs a timer is started and the high temp fault counter is incremented. After five seconds the fault is analyzed. If the fault exists, the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.
8	VSWR Fault Indicator	Red LED. When lit, indicates that the reflected power detected at the amplifier output exceeds 25 watts. If a VSWR condition occurs a timer is started and the VSWR fault counter is incremented. After five seconds the fault is analyzed. If the fault exists, the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.

NO.	NAME	FUNCTION (Note: MCA = Multichannel Amplifier)
9	DC FAIL Fault Indicator	Red LED. When lit, indicates that one of the internal DC voltages dropped below or exceeded the safe threshold level (+23 V<+27 V<+30 V, +14 V<+15 V<+16 V, +4.5 V<+5 V<+5.5 V, or -5.5 V<-5 V<-4.5 V). If a DC fail condition occurs a timer is started and the DC fail counter is incremented. After five seconds the fault is analyzed. If the fault exists, the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur. The fault indicator will latch on and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero. If the DC input violates the +30 volt threshold, the MCA is immediately disabled. A timer is started and the DC fault counter is incremented. After five seconds the fault is analyzed. If the fault exists the counter is incremented.* If the count equals five before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will remain disabled. If 15 minutes elapse before the counter reaches five, the counter and timer will reset to zero.
10	FAN FAIL Fault Indicator	Red LED. When lit, indicates that one or both of the fans has failed. If one fan fails, the FAN FAIL indicator will light. If both fans fail, the FAN FAIL indicator will light, a timer is started, and the fan fail counter is incremented. After five seconds the fault is analyzed. If the fault exists, the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.
11	LOOP FAIL Fault Indicator	Red LED. When lit, indicates that one of the loop control voltages has transitioned above or below safe operating limits. If a loop fail condition occurs a timer is started and the loop fail counter is incremented. After five seconds the fault is analyzed. If the fault exists, the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.
12	LOW PWR Fault Indicator	Red LED. When lit, indicates that the RF power output from the amplifier dropped -2dB (-1,+0dB) below the average power output of all amplifier modules in the rack. If a low power condition occurs a timer is started and the low power fault counter is incremented. After five seconds the fault is analyzed. If the fault exists, the counter is incremented.* If the count equals 25 before the timer reaches 15 minutes, a summary fault will occur, the fault indicator will latch on, and the MCA module will be disabled. Toggling the reset switch will enable the MCA. If 15 minutes elapse before the counter reaches 25, the counter and timer will reset to zero.
13	LPA DISAB. Fault Indicator	Red LED. When lit, indicates that MCA is manually switched off using the front panel RF ON switch, or disabled by a summary alarm.

*While the fault is in evaluation, the LED will blink at a 1 Hz rate.

3-3. INITIAL START-UP AND OPERATING PROCEDURES

The only operating control on each amplifier module is the RF ON - ON/OFF/RESET switch. To perform the initial start-up, proceed as follows:

1. Double check to ensure that all input and output cables are properly connected.

CAUTION

Before applying power, make sure that the input and output of the amplifier are properly terminated at 50 ohms. Do not operate the amplifier without a load attached. Refer to table 1-1 for input power requirements. Excessive input power may damage the amplifier

NOTE

The output coaxial cable between the amplifier and the antenna must be 50 ohm coaxial cable. Use of any other cable, will distort the output.

2. Verify that all front panel switches are in the OFF position.

3. Turn on supply that provides +27 Vdc to the amplifier system. Do not apply an RF signal to the amplifier system

4. Visually check the indicators on the amplifier modules, and verify that the following indicators are on:

   a. LOOP FAIL Indicator (red) should be on.
   b. LPA DISAB. Indicator (red) should be on.
   c. The +28VDC, +15VDC, +5VDC and -5VDC indicators (green) on all amplifier modules should be on.

5. Turn on all front panel switches. All red LEDs should turn off after ten seconds.

6. Turn on external exciter/transceiver and apply RF input signals.

7. Manually reset each amplifier module by momentarily switching the RF ON - ON/OFF/RESET switch to RESET position.

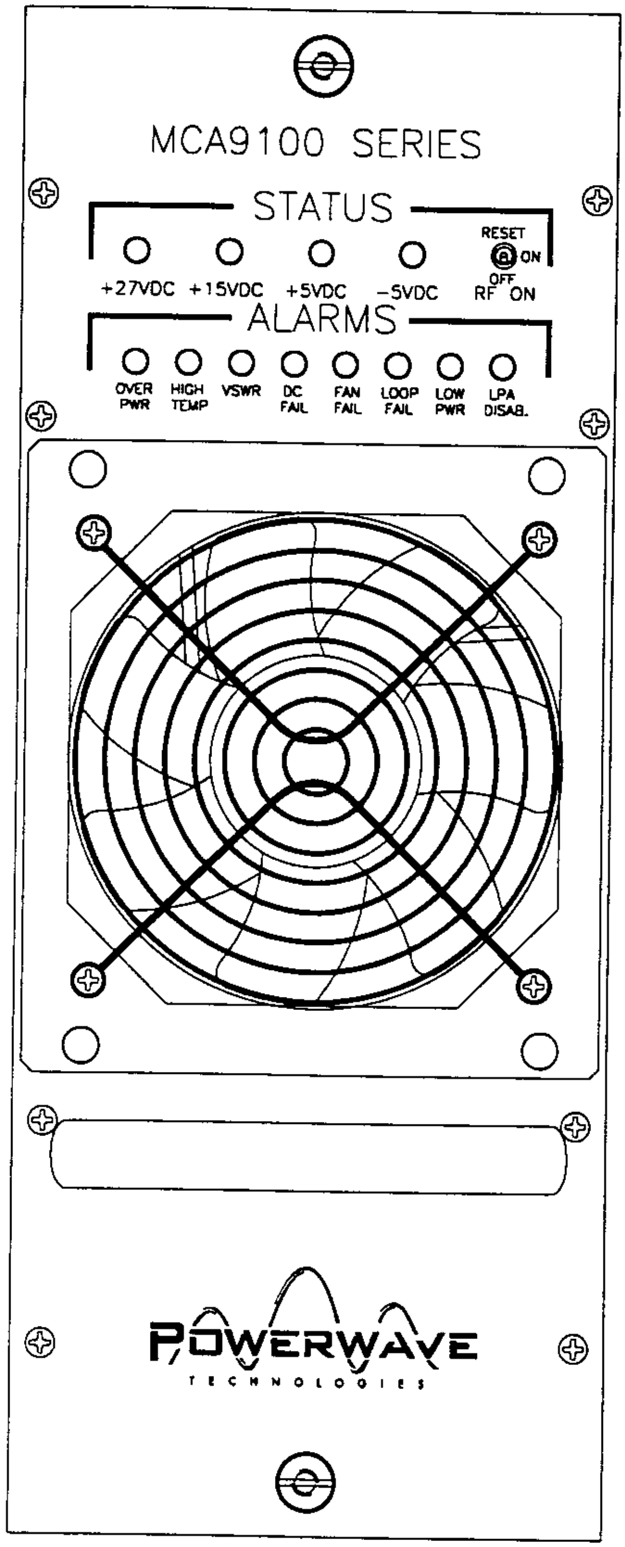


Figure 3-4. Model MCA9100-50 Amplifier Module Control and Indicators

SECTION 4
PRINCIPLES OF OPERATION

4-1. INTRODUCTION

This section contains a functional description of the Multicarrier Cellular Amplifier Systems.

4-2. RF INPUT SIGNAL

The maximum input power for all carrier frequencies should not exceed the limits specified in table 1-1. For proper amplifier loop balance, the out of band components of the input signals should not exceed -40 dBc. The input VSWR should be 2:1 maximum (or better).

4-3. RF OUTPUT LOAD

The load impedance should be as good as possible (1.5:1 or better) in the working band for good power transfer to the load. If the amplifier is operated into a filter, it will maintain its distortion characteristics outside the signal band even if the VSWR is infinite, provided the reflected power does not exceed one watt. A parasitic signal of less than one watt incident on the output will not cause distortion at a higher level than the normal forward distortion (i.e. -65 dBc).

4-4. SYSTEM FUNCTIONAL DESCRIPTION

The amplifier system is comprised of an MCR3100 or an MCR4100 subrack, a PWIC-24A or a PWIC-24A-1 24-way combiner, and three or four MCA9100-50 plug-in power amplifiers. The MCA9100-50 amplifier is a linear, feed-forward power amplifier that operates in the 25 MHz frequency band from 869 MHz to 894 MHz. Typical three and four module systems are shown in figures 4-1 and 4-2. Power output specifications for one to four module systems are listed in table 1-1. Each amplifier is a self-contained plug-in module and is functionally independent of the other amplifier modules. The amplifier modules are designed for parallel operation to achieve high peak power output, and for redundancy in unmanned remote locations. The subrack houses a three- or four-way power splitter/combiner, summary alarm logic, and a voltage regulator. The rear panel of the subrack has I/O connectors that interface with the host system, RF signal source, system antenna, and the system DC power source . The amplifier system can simultaneously transmit multiple carrier frequencies, at an average total power output of 40 watts (one amplifier module in a subrack unit) to 175 watts (4 amplifier modules), with -65 dBc third order intermodulation distortion (IMD).

The RF input (carrier frequencies) to the power splitter will vary depending on the number of amplifier modules in the system. In a four module system, the signal will be split into four signals of equal power and input to the plug-in amplifier modules. The output from each amplifier is an amplified composite signal of approximately 50 watts before combiner losses. All phase and gain corrections are performed on the signal(s) in the individual amplifier modules. The amplifier outputs are fed to a power combiner and combined to form a composite RF output of up to 175 watts. Each amplifier module has an alarm and display board that monitors the amplifier performance. If a failure or fault occurs in an amplifier module, it is displayed on the individual amplifier front panel and the summary form C contact will activate.

The fan/summary alarm module in the subrack is the system fault monitor. When an amplifier is turned off, it is physically disconnected via relays from the combiner. The purpose of the summary alarm board is to control the turn-on and turn-off sequence of the amplifiers and splitter/combiner, and calculate the average power output from all amplifier modules in the system. Timing of fault signals is performed by the system alarm board in the amplifier modules.

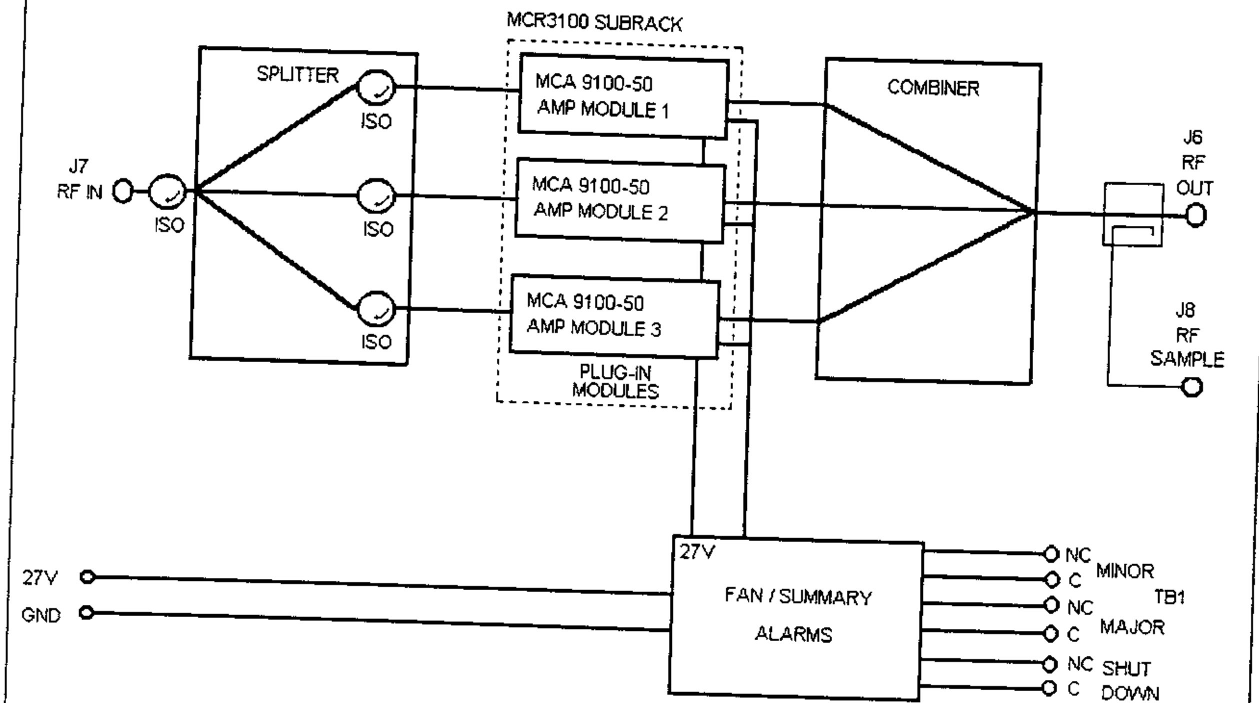


Figure 4-1. MCR 3100 Three Module Amplifier System

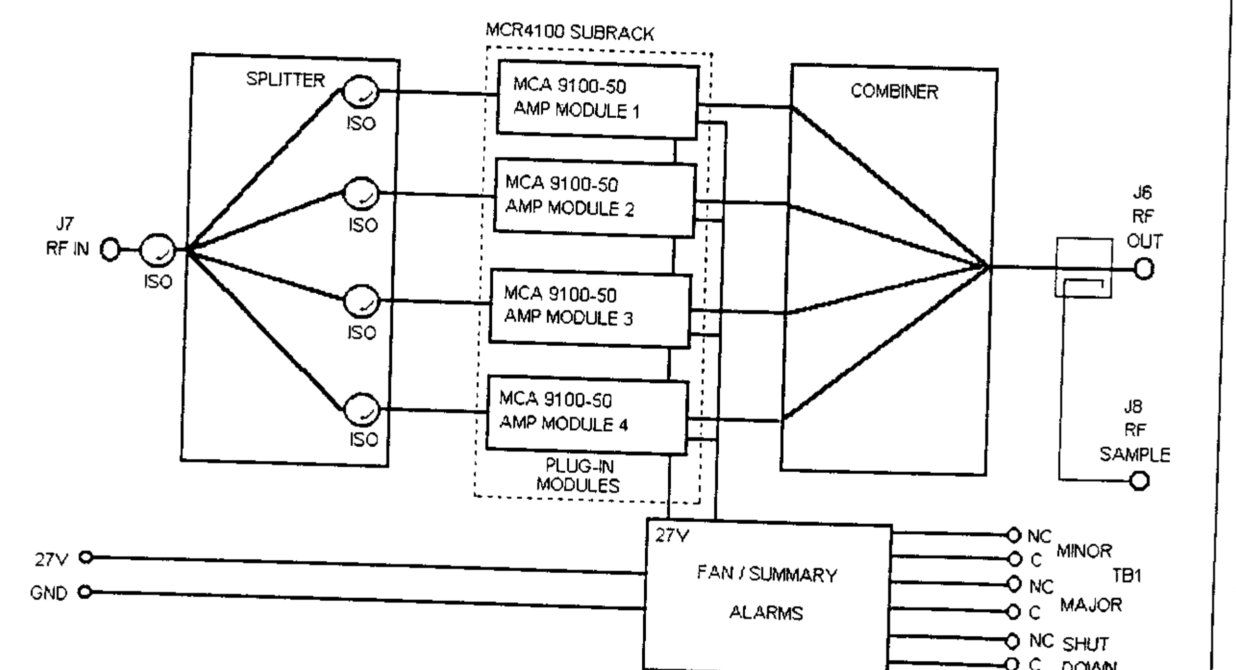


Figure 4-2. MCR 4100 Four Module Amplifier System

4-5. MCR3100 and MCR4100 SUBRACKS

The MCR3100 and MCR4100 subracks (see block diagrams, figures 4-1 and 4-2) are not field repairable. The subrack contains a three- or four-way RF power splitter/combiner, voltage regulator, and summary alarm board. The splitter/combiner has an input splitter and an output combiner, which provide good VSWR and ensure low insertion loss. The splitter/combiner has relays that are activated and deactivated by the summary alarm board when a plug-in amplifier is power sequenced on or is shut down. The voltage regulator provides +5 Vdc and +15 Vdc power to the summary alarm board. The primary function of the summary alarm board is to control the amplifier turn-on and turn-off sequence. Other functions include calculating the average power output from the amplifiers and controlling the relays in the combiner. Additionally, the summary board also controls the form C contacts whose output terminals are connected to rear panel terminal block TB1 (see paragraph 2.5 and table 2-1).

4-6. MCA9100-50 AMPLIFIER MODULE

The amplifier module, figure 4-3, has an average power output of 50 watts (500 watts peak power) with intermodulation products suppressed to better than -65 dBc below carrier levels. The amplifier provides an amplified output signal with constant gain and phase by adding approximately 30 dB of distortion cancellation on the output signal. Constant gain and phase is maintained by continuously comparing active paths with passive references, and correcting for small variations through the RF feedback controls. All gain and phase variations, for example those due to temperature, are reduced to the passive reference variations. The amplifier module is comprised of:

- Preamplifiers
- Main amplifier
- Error amplifier
- Two feed-forward loops with phase-shift and gain controls
- DC/DC power regulator
- Alarm monitoring, control and display panel

The main amplifier employs class AB amplification for maximum efficiency. The error amplifier and feed forward loops are employed to correct signal nonlinearities introduced by the class AB main amplifier. The error amplifier operates in class A mode. The RF input signals are amplified by a preamp and coupled to an attenuator and phase shifter in the first feed-forward loop. The main signal is phase shifted by 180 degrees and amplified in the premain amplifier. The output from the premain amplifier is fed to the class AB main amplifier. The output from the main amplifier is typically 50 watts. The signal is output to several couplers and a delay line.

The signal output from the main amplifier is sampled using a coupler, and the sample signal is combined with the main input signal and input to the second feed-forward loop. The error signal is attenuated, phase shifted 180 degrees, then fed to the error amplifier where it is amplified to a level identical to the sampled output from the main amplifier. The output from the error amplifier is then coupled back and added to the output from the main amplifier. The control loops continuously make adjustments to cancel out any distortion in the final output signals.

The primary function of the first loop is to provide an error signal for the second loop. The primary function of the second loop is to amplify the error signal to cancel out spurious products developed in the main amplifier. The input signal is amplified by a preamplifier and fed to a coupler and delay line. The signal from the coupler is fed to the attenuator and phase shifter in the 1st loop The first loop control section phase shifts the main input signals by 180 degrees and constantly monitors the output for correct phase and gain.

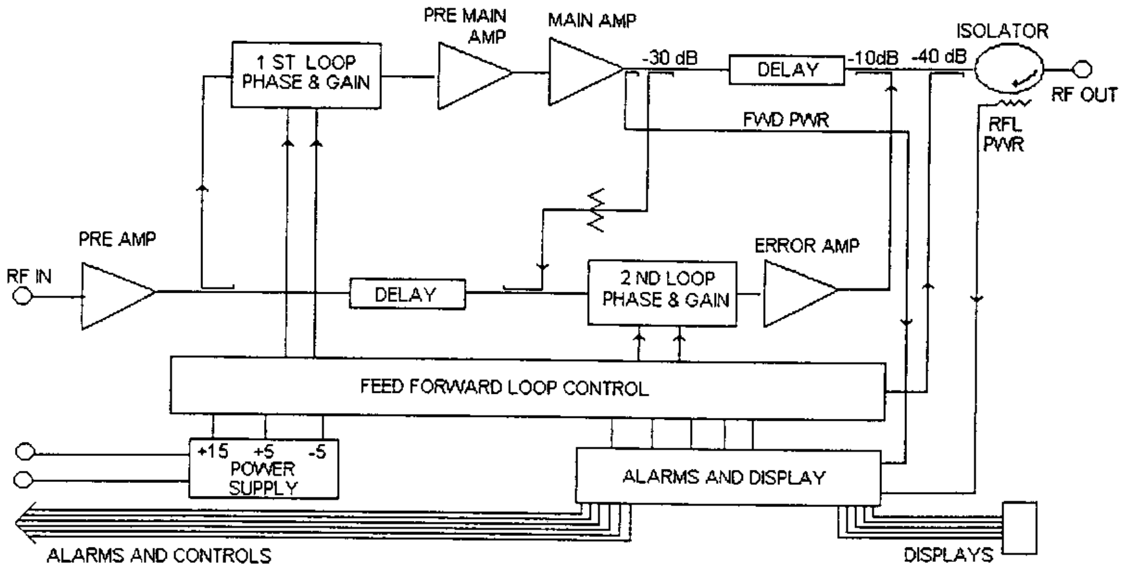


Figure 4-3. MCA9100-50 Power Amplifier Module Functional Block Diagram

The 2nd loop control section obtains a sample of the distortion added to the output signals by the main amplifiers, phase shifts the signals by 180 degrees, then feeds it to the error amplifier where it is amplified to the same power level as the input sample, then couples the error signal on to the main output signal. The final output is monitored by the 2nd loop and adjusted to ensure that the signal distortion and IMD on the final output is canceled out.

4-6.1. MAIN AMPLIFIER

The input and output of the amplifier employ three-stage, class AB amplifiers which provide approximately 54 dB of gain in the 25 MHz frequency band from 869 MHz to 894 MHz. The amplifier operates on +27 Vdc, and a bias voltage of +5 Vdc, and is mounted directly on a heat sink. The alarm logic controls the +5 Vdc bias voltage which shuts down the amplifier.

4-6.2. ERROR AMPLIFIER

The main function of the error amplifier is to sample and amplify the signal distortion level generated by the main amplifier, to a level that cancels out the distortion and IMD when the error signal is coupled onto the main signal at the amplifier output. The error amplifier is a balanced multistage, class AB amplifier, has 40 dB of gain and produces a 90 watt output. The amplifier operates on +27 Vdc, and a bias voltage of +15 Vdc and is mounted directly on a heat sink which is temperature monitored by a thermostat. If the heat sink temperature exceeds 80 °C, the thermostat opens and a high temperature fault occurs.

4-6.3. AMPLIFIER MONITORING

In the main and error amplifier modules, all normal variations are automatically compensated for by the feedforward loop control. However, when large variations occur beyond the adjustment range of the loop control, a loop fault will occur. The alarms are displayed in the front panel indicators and output via a 17-pin connector on the rear of the module to the subrack summary board for subsequent remote monitoring via TB1. Refer to paragraph 2-6 as well as table 3-2 and figure 3-3 for a description of terminal block TB1.

4-6.4. AMPLIFIER MODULE COOLING

Although each amplifier module contains its own heat sink, It is cooled with forced air. Two fans for are used for forced air cooling and redundancy. The fans are located on the front and rear of the amplifier module, draw air in through the front of the amplifier, and exhaust hot air out the back of the module. The fans are field replaceable.

4-7. POWER DISTRIBUTION

Primary DC power for the system is provided by the host system to the MCR3100 or MCR4100 series subracks. The subrack supplies each amplifier module with +27 Vdc directly and via the RF power splitter/combiner. The amplifier module has a DC/DC converter that converts the +27 Vdc to +15 Vdc, +5 Vdc and -5 Vdc.

4-8. INTERMODULATION

The MCA9100-50 amplifier is designed to deliver a 50-watt composite average power, multicarrier signal, occupying a bandwidth less than or equal to 25 MHz, in the bandwidth from 869-894 MHz. The maximum average power for linear operation, and thus the amplifier efficiency, will depend on the type of signal amplified.

4-8.1 TWO TONE INTERMODULATION

When measured with two equal CW tones spaced anywhere from 30 kHz to 25 MHz apart, and at any power level up to the peak power, the third order intermodulation products will be below -65 dBc

4-8.2 MULTITONE INTERMODULATION

Adding more tones to the signal will lower individual intermodulation products. If the frequencies are not equally spaced, the level of intermodulation products gets very low. When the frequencies are equally spaced, those products fall on top of each other on the same frequency grid. The average power of all intermodulation beats falling on the same frequency is called the composite intermodulation; it is -65 dBc or better.

4-9. ALARMS

The presence of several plug-in amplifier alarms can be detected at TB1 on the subrack rear panel. Refer to table 3-2 and figure 3-3 for a description of terminal block TB1.

4-10. 24-WAY INPUT COMBINER, MODELS PWIC-24A AND PWIC-24A-1

The Model PWIC-24 is a 24-way combiner which is utilized at the input to a multichannel linear power amplifier. It is rack-mounted and has a rear-mounted calibrated dial to allow setting to within ±0.5 dB. Twenty-four narrowband RF input signals enter the system through 10 dB attenuators which also provide isolation between the input channels. The combined output passes through an electronically variable attenuator and then is amplified prior to passing through a 20 dB directional coupler at the output. The coupled arm of the directional coupler provides an output sample by which the level of each of the 24 input signals can be adjusted

SECTION 5
MAINTENANCE

5-1. INTRODUCTION

This section contains periodic maintenance and performance test procedures for the Multicarrier Cellular Amplifier System. It also contains a list of test equipment required to perform the identified tasks.

NOTE
Check your sales order and equipment warranty before attempting to service or repair the unit. Do not break the seals on equipment under warranty or the warranty will be null and void. Do not return equipment for warranty or repair service until proper shipping instructions are received from the factory.

5-2. PERIODIC MAINTENANCE

Periodic maintenance requirements are listed in Table 5-1. Table 5-1 also lists the intervals at which the tasks should be performed.

WARNING
Wear proper eye protection to avoid eye injury when using compressed air.

Table 5-1. Periodic Maintenance

TASK	INTERVAL	ACTION
Cleaning		
Air Vents	30 Days	Inspect and clean per para. 5-4
Inspection		
Cables and Connectors	12 Months	Inspect signal and power cables for frayed insulation. Check RF connectors to be sure that they are tight.
Performance Tests	12 Months	Perform annual test per para. 5-5.

5-3. TEST EQUIPMENT REQUIRED FOR TEST

Test equipment required to test the amplifier system is listed in Table 5-2. Equivalent test equipment may be substituted for any item, keeping in mind that a thermistor type power meter is required.

NOTE
All RF test equipment must be calibrated to 0.05 dB resolution. Any deviation from the nominal attenuation must be accounted for and factored into all output readings.

Table 5-2. Test Equipment Required

NOMENCLATURE	MANUFACTURER	MODEL
Signal Generator (4 each)	H.P.	8656B
20 dB Attenuator, 250 Watt	Tenuline	
20 dB Attenuator, 20 Watt	Tenuline	
(2 each)		
Spectrum Analyzer	H.P.	8560E
Coax Directional Coupler	H.P.	778D
Power Meter/Sensor	H.P.	437B/8481A
Four Tone Combiner		
Network Analyzer	HP	8753C
Current Probe		

5-4. CLEANING AIR INLETS/OUTLETS

The air inlets and outlets should be cleaned every 30 days. If the equipment is operated in a severe dust environment, they should be cleaned more often as necessary. Turn off DC power source before removing fans. If dust and dirt are allowed to accumulate, the cooling efficiency may be diminished. Using either compressed air or a brush with soft bristles, loosen and remove accumulated dust and dirt from the air inlet panels.

5-5. PERFORMANCE TEST

Performance testing should be conducted every 12 months to ensure that the amplifier system meets the operational specifications listed in table 5-3. Also verify system performance after any amplifier module is replaced in the field. The test equipment required to perform the testing is listed in table 5-2, and the test setup is shown in figure 5-1.

NOTE

The frequencies used in this test are typical for an amplifier with a 25 MHz band from 869 MHz to 894 MHz. Select evenly spaced F1, F2, F3, and F4 frequencies, that cover the instantaneous bandwidth of your system.

5-5.1. AMPLIFIER SYSTEM PERFORMANCE TEST.

This test is applicable to both the MCR3100 and MCR4100 subracks with one to four plug-in MCA9100-50 amplifier modules. Perform the tests applicable to your system. Refer to table 1-2 for RF power input levels for systems with one to four amplifier modules. To perform the test, proceed as follows:

1. Connect test equipment to the subrack as shown in figure 5-1.

NOTE

Do not apply any RF signals at this time.

2. Turn on all four signal generators and set frequency F1 to 880 MHz, F2 to 883 MHz, F3 to 886 MHz, and F4 to 889 MHz. Adjust each signal generator output so that the sum power output from all four signal generators equals -4 dBm at the output of the 4-way combiner.

SINGLE AMPLIFIER IMD TEST:

3. Adjust attenuator for an input signal at -l0 dBm. Reset amplifier with the front panel ON/OFF/RESET switch, and set switch to ON. Adjust variable attenuator to set amplifier power output on power meter to 40 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc max. Record test data in table 5-3. Switch tested amplifier to OFF.

4. Repeat step 3 for amplifiers 2, 3, and 4, as applicable, for each plug-in amplifier module.

TWO AMPLIFIER IMD TEST:

5. Reset and turn on channel 1 and 2 amplifier modules, and turn off channel 3 and 4 amplifiers. Adjust the variable attenuator to set power output on power meter to 90 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

6. Reset and turn on channel 1 and 3 amplifiers, and turn off channel 2. Adjust the variable attenuator to set power output on power meter to 90 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

7. Reset and turn on channel 1 and 4 amplifiers and turn off channel 3. Adjust the variable attenuator to set power output on power meter to 90 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

8. Reset and turn on channel 2 and 3 amplifiers, and turn off channel 1. Adjust the variable attenuator to set power output on power meter to 90 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

9. Reset and turn on channel 2 and 4 amplifiers, and turn off channel 3. Adjust the variable attenuator to set power output on power meter to 90 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

10. Reset and turn on channel 3 and 4 amplifiers, and turn off channel 2. Adjust the variable attenuator to set power output on power meter to 90 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

THREE AMPLIFIER IMD TEST.

11. Reset and turn on channel 1, 2 and 3 amplifiers, and turn off channel 4. Adjust the variable attenuator to set power output on power meter to 120 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

12. Reset and turn on channel 1, 2 and 4 amplifiers, and turn off channel 3. Adjust the variable attenuator to set power output on power meter to 120 watts. . Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

13. Reset and turn on channel 1, 3 and 4 amplifiers, and turn off channel 2. Adjust the variable attenuator to set power output on power meter to 120 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

14. Reset and turn on channel 2, 3 and 4 amplifiers, and turn off channel 1. Adjust the variable attenuator to set power output on power meter to 120 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

FOUR AMPLIFIER IMD AND CURRENT TEST:

15. Reset and turn on channel 1, 2, 3, and 4 amplifiers. Adjust the variable attenuator to set power output on power meter to 175 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc maximum. Record test data in table 5-3.

16. With the power amplifier set at 175 watts power output, use the current probe (magnetic field type) and measure the dc current flow from the +27 Vdc power source. Current should be 88 amps maximum. Record test data in table 5-3.

HARMONICS TEST

17. With the power amplifier set at 175 watts power output, use the spectrum analyzer and check the frequency band from 869 MHz to 894 MHz for harmonics. Harmonics should be -45 dBc maximum. Record test data in table 5-3.

SPURIOUS TEST

18. With the power amplifier set at 175 watts power output, use the spectrum analyzer and check the frequency band from 869 MHz to 894 MHz for spurious signals. Spurious signals should be -65 dBc maximum. Record test data in table 5-3.

GAIN TEST:

19. Disconnect spectrum analyzer from test setup, and connect the network analyzer.

20. Set network analyzer as follows:
    a. Power output to 11 dBm.
    b. Frequency start to 869 MHz.
    c. Frequency stop to 894 MHz.
    d. Normalize the network analyzer for gain and return loss.

21. Reset and turn on the channel 1 amplifier, turn off channel 2, 3 and 4 amplifiers. Check the gain across the band from 869 MHz to 894 MHz. Gain should be as specified in table 1-2 ±1 dB. Record test data in table 5-3.

22. Turn off the channel 1 amplifier and reset and turn on the channel 2 amplifier. Check the gain across the band from 869 MHz to 894 MHz. Gain should be as specified in table 1-2 ±1 dB. Record test data in table 5-3.

23. Repeat steps 21 and 22 and individually check and record the gain of each amplifier module in the system. Record test data in table 5-3.

24. Refer to table 5-3. Collectively reset and turn on the amplifier modules in groups of two three and four, as shown in table 5-3, and check the gain of each group. The minimum/maximum gain of each group of amplifiers, should be within the limits shown in table 5-3. Record test data in table 5-3.

INPUT RETURN LOSS TEST:

25. Reset and turn on all amplifier modules in the main frame. Read and record the S_{11} return loss measurement on network analyzer. Record test data in table 5-3.

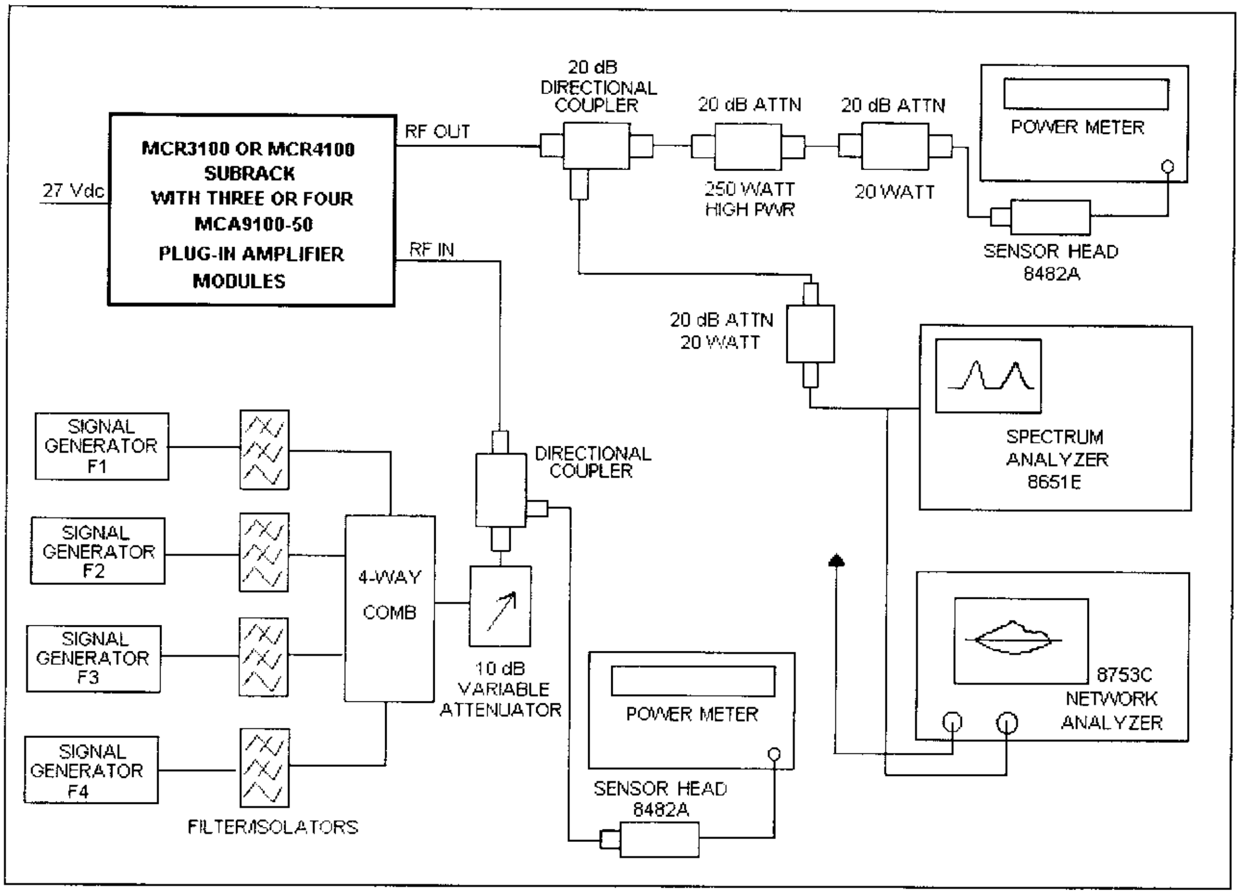


Figure 5-1. Amplifier System Test Setup Diagram

Table 5-3. Multicarrier Cellular Amplifier System Test Data Sheet

DATE ______________________

MCR3100 or MCR4100 SUBRACK S/N ______________________

MODULE #1 S/N ______________________ MODULE #2 S/N ______________________

MODULE #3 S/N ______________________ MODULE #4 S/N ______________________

TEST CONDITIONS:
Load and Source Impedance: 50 Ohms
VSWR: < 1.2:1
Supply Voltage: +27 Vdc ±0.1 Vdc

TEST	SPECIFICATION	MIN	MAX	DATA					
4-TONE IMD One Module	Vcc = 27 Vdc PO = 40 W Freq: 880 883 886 889 MHz		-65 dBc	1	2	3	4		
4-TONE IMD Two Modules	Vcc = 27 Vdc PO = 90 W Freq: 880, 883 886 889 MHz		-65 dBc	1,2	1,3	1,4	2,3	2,4	3,4
4-TONE IMD Three Modules	Vcc = 27 Vdc PO = 120 W Freq: 880 883 886 889 MHz		-65 dBc	1,2,3	1,2,4	1,3,4	2,3,4		
4-TONE IMD Four Modules	Vcc = 27 Vdc PO = 175 W Freq: 880 883 886 889 MHz		-65 dBc	All					
RF Gain One Module	Vcc = 27 Vdc PO = 40 W Freq. = 880 MHz	Table 1-2 -1 dB	Table 1-2 +1 dB	1	2	3	4		
RF Gain Two Modules	Vcc = 27 Vdc PO = 90 W Freq. = 880 MHz	Table 1-2 -1 dB	Table 1-2 +1 dB	1,2	1,3	1,4	2,3	2,4	3,4
RF Gain Three Modules	Vcc = 27 Vdc PO = 120 W Freq. = 880 MHz	Table 1-2 -1 dB	Table 1-2 +1 dB	1,2,3	1,2,4	1,3,4	2,3,4		
RF Gain Four Modules	Vcc = 27 Vdc PO = 175 W Freq. = 880 MHz	Table 1-2 -1 dB	Table 1-2 +1 dB	All					
Harmonics	Vcc = 27 Vdc PO = 175 W 869 - 894 MHz Band	-45 dBc		All					
Spurious	Vcc = 27 Vdc PO =175 W 869 - 894 MHz Band	-60 dBc		All					
Gain Flatness	Vcc = 27 Vdc ±1 Vdc PO =175 W 869 - 894 MHz Band		±0.7 dB	All					
Input Return Loss	Vcc = 27 Vdc PO = 175 W 869-894 MHz Band		-18 dB	All					
DC Power	Vcc = 27 Vdc PO = 175 W 4 Tones		112 Amps	All					

PASS ______________________ FAIL ______________________

Tested by ______________________ Date ______________________

5-6. FIELD REPLACEABLE PARTS AND MODULES

The following parts and modules can be replaced in the field on site by a qualified technician with experience maintaining RF power amplifiers and similar equipment:

1. MCA9100-50 Power Amplifier Modules
2. Cooling Fans
3. PWIC-24 Fuses

5-6.1. MCA9100-50 POWER AMPLIFIER MODULE

To replace a power amplifier module, proceed as follows:

1. Set ON/OFF/RESET switch on the front panel of the amplifier module to OFF.

2. Loosen two screws that secure amplifier module to subrack.

3. Use handle on front of module, and with a steady even pressure, pull module out of chassis.

CAUTION

When removing the amplifier from the subrack, it is very important to support the amplifier such that the rear of the module does not suddenly drop when the guide rail disengages from the track. A drop such as this could damage the rear multipin connector.

5-6.2. COOLING FANS

To replace a cooling fan, proceed as follows:

1. Remove amplifier module from subrack; see paragraph 5-6.1 preceding.

2. Loosen four finger screws that secure fan to amplifier module. Disconnect fan power connector from amplifier module.

3. Install replacement in reverse order of steps 1 and 2 above.

5-6.3. 27 Vdc FUSES

The PWIC-24 (both models) fuse is located on the rear panel of the unit.

PWIC-24 FUSE
Mfr. - Bussman
AGC-3
Fast Acting
250 Vac
1 ¼" Long
¼" Dia.