Section 4 Principles of Operation

4-1 Introduction

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

4-2 RF Input Signal

This amplifier may be installed in a base station system as either a stand-alone module (i.e. in a micro-cell application), or combined with multiple amplifiers in a combining subrack product available from Powerwave. In either case, the maximum input power for all carrier frequencies should not exceed the limits specified in table 1-2. For proper amplifier loop balance and to ensure compliance with FCC rules, the out of band components of the input signals should not exceed -40 dBc. The input VSWR presented to the amplifier should be 2:1 (or better) to maximize the transfer of input power to the amplifier; this is particularly important when the amplifier is not installed in a Powerwave manufactured combining subrack.

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.

4-4 G3S-800-180-029 Amplifier Module

The G3S-800-180-029 amplifier is a linear, feed-forward power amplifier that operates in the 25 MHz frequency band from 869 MHz to 894 MHz. The amplifier modules are designed for parallel operation to achieve high peak power output, and provide system redundancy when installed in multi-module amplifier subracks manufactured by Powerwave. The Powerwave amplifier system is ideally suited for unmanned remote locations.

The amplifier module, figure 4-1, has an average output of 180 watts power (1800 watts peak power) with intermodulation products suppressed to better than -60 dBc below carrier levels. The amplifier provides an amplified output signal with constant gain and phase. 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. 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.

The amplifier module is comprised of:

- Predistorter
- Pre-amplifiers
- 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 AB mode. The RF input signals are ampli-

fied 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 220 watts. The signal is output to several couplers and a delay structure.

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.

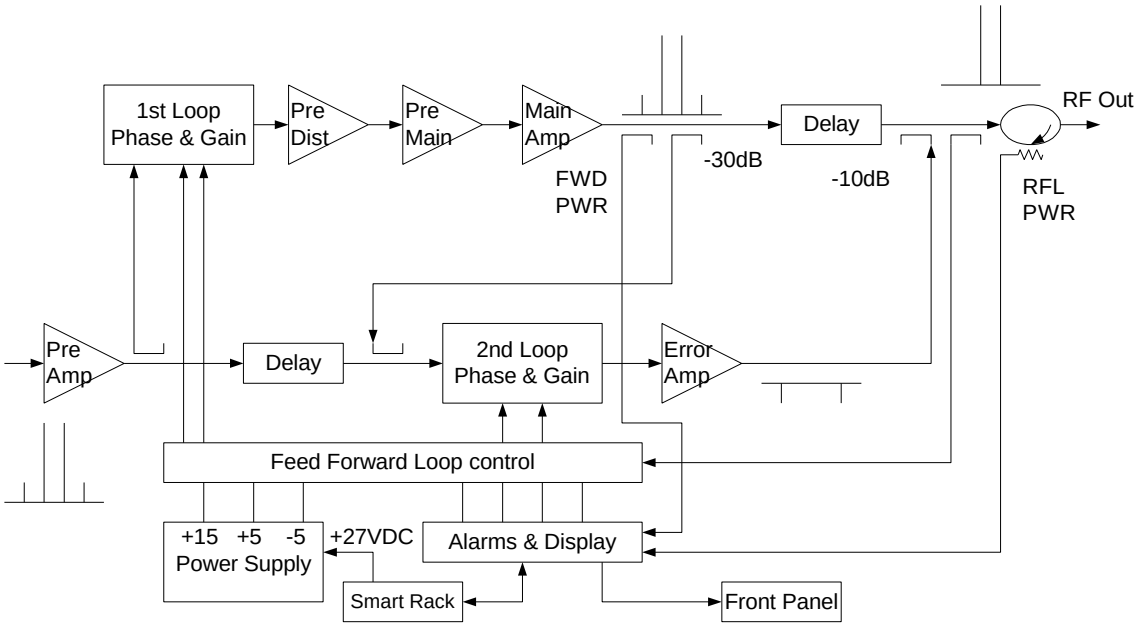

Figure 4-1 G3S-800-180-029 Power Amplifier Module Functional Block Diagram

4-4.1 Main Amplifier

The input and output of the amplifier employ two-stage, class AB amplifiers which provide approximately 32 dB of gain in the 25 MHz frequency band from 869 to 894 MHz. The amplifier operates on +27 Vdc, and a bias voltage of +5 Vdc, and is mounted directly on a heat sink that is temperature monitored by a thermostat. If the heat sink temperature exceeds 90° C, a high temperature fault occurs. The alarm logic controls the +5 Vdc bias voltage that shuts down the amplifier.

4-4.2 Error Amplifier

The main function of the error amplifier is to amplify the distortion signal generated by the 1st Loop, 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.

4-4.3 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 on the front panel indicators and output via a 21-pin connector on the rear of the module to the subrack summary board

for subsequent remote monitoring via the ALARMS connector. Refer to paragraph 2-6 as well as figure 2-2 and table 2-3 for a description of the ALARMS connector.

4-4.4 Amplifier Module Cooling

Although each amplifier module contains its own heat sink, it is cooled with forced air. Four fans are used for forced air-cooling and redundancy. The fans, 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.

4-5 Power Distribution

Primary DC power for the system is provided by the host system to the MCR30829-1-3 Series or compatible subrack. 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.

4-6 Intermodulation

The G3S-800-180-029 amplifier is designed to deliver a 180-watt composite average power, multicarrier signal, occupying a bandwidth less than or equal to 25 MHz, in the band from 869 to 894 MHz. The maximum average power for linear operation, and thus the amplifier efficiency, will depend on the type of signal amplified.

Three or more CW tones of equal input power 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 -60 dBc or better.

4-7 Alarms

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