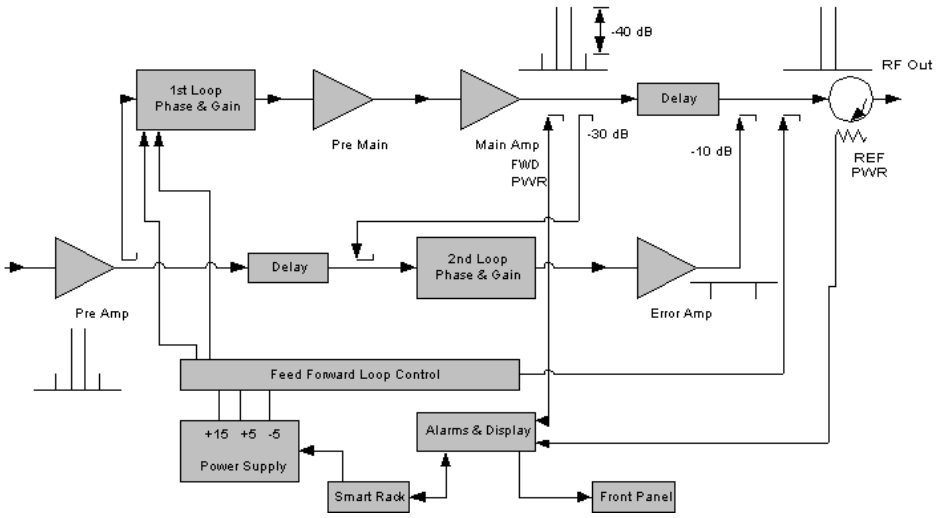
Section 3 Principals Of Operation

3.1 Multi-Carrier Power Amplifier (MCPA) Functional Description

The MAF 900-60S MCPA is a linear, feed-forward multi-carrier power amplifier. The operating frequency of the amplifier is 935 to 940 MHz. The amplifier is designed to operate with a 2-way paging base station radio transceiver using GMSK modulation. Minimum channel spacing is 25 kHz. Each amplifier has a digital control board that controls the amplifiers performance and continuous IMD cancellation over temperature and phase. Continuously comparing active paths with passive references, and correcting for small variations through the RF feedback controls maintain constant gain. An LED on the front panel of the amplifier monitors status of the amplifier. Multi-color LED changes conditions when alarming of the amplifier. When MCPA failure occurs, the alarm signal would be transmitted to the host system via the D-subminiature connector at the rear of the amplifier. The amplifier is compliant to the requirements of FCC Part 90 with respect to spurious emissions.

The amplifier is composed of:

- A preamp
- A pre-main amplifier
- A main amplifier
- A pre-error and error amplifier
- Alarm monitoring and control



Multi-Carrier Power Amplifier Functional Block Diagram

2.1 Pre- Amplifier

The input of the amplifier uses two stages of class AB amplification that provide approximately 13.5 dB of gain in the 5 MHz band from 935 MHz to 940 MHz. The amplifier operates on + 27 Vdc.

3.3 Three-Stage Pre-Main Amplifier

The input of the amplifier uses three stages of class AB amplification, which provide approximately 32 dB of gain in the 5 MHz band from 935 MHz to 940 MHz. The amplifier operates on + 27 Vdc and a bias voltage of + 5 Vdc. The logic controls the +5 Vdc bias that shuts down the amplifier.

3.4 Main Amplifier

The signal provides approximately 11 dB of gain in the 935 MHz to 940 MHz frequency band. The main amplifier operates on +27 Vdc, and a + 5 Vdc bias voltage. The alarm logic controls the +5 Vdc bias voltage.

The main amplifier employs class AB amplification for maximum efficiency. The error amplifier and feed forward loops are used to correct signal non-linearity introduced by the class AB main amplifier. The error amplifier operates in a class AB 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 pre-main amplifier. The output from the pre-main amplifier is fed to the class AB main amplifier.

The signal output from the main amplifier is sampled using a coupler. The sampled 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 signal.

3.5 Pre-Error and Error Amplifier

The pre-error and error amplifiers operate on +27 Vdc, and a +5 Vdc bias voltage. The error amplifier applies approximately 30 dB of cancellation signal to the output of the main amplifier.

3.6 Alarm Monitoring and Control

During routine operation, all normal variations are automatically compensated for by the feed-forward loop control. However, when large variations occur beyond the adjustment range of the loop control, a loop fault will occur. When this happens, the alarm LED will illuminate RED on the front panel of the amplifier. The amplifier will be in the shut down mode of operation. Reset of the amplifier is necessary for normal operation to resume.

3.7 Loop Control Circuit

The primary function of the 1st loop is to provide an error signal for the 2nd loop. The primary function of the 2nd loop is to amplify the error signal to cancel out spurious products developed in the main amplifier. The input signal is amplified by a pre-amplifier 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 1st loop control section phase shifts the main input signal by 180 degrees and constantly monitors the output for correct phase and gain.

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

3.8 Amplifier Module Cooling

Although each amplifier contains it own heat sinks, forced air is required for cooling the heat sinks. This forced air-cooling pulls heat away from the heat sinks maintaining optimum operation of the amplifiers. This ensures that the amplifier will operate to specification across the specified operating temperature ranges.

3.9 Power Distribution

Primary DC power for the amplifier is provided by the host system. The amplifier has a DC/DC converter and voltage regulator that converts the +27 Vdc to +15 Vdc, +12 Vdc, and +5 Vdc, for internal use. +27 Vdc for the MCPA is supplied by the sub-rack, through the D-subminiature connector on the rear of the MCPA.