Section 3 Principals of Operation

3.1 Introduction

This section contains the functional description of the MAF800-100S multi-carrier power amplifier.

3.2 RF Input Signal

The maximum composite input power shall not exceed – 4 dBm. The reference source signal shall not exceed the base station manufacture minimum requirements for intermodulation distortion. For proper loop balance, the out of band components of the input signal shall not exceed –40 dBc. The input VSWR should be 2:1 maximum

3.3 RF Output Load

The load impedance should be equal to or better than 1.5:1 in the operating 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

3.4 Amplifier Functional Description

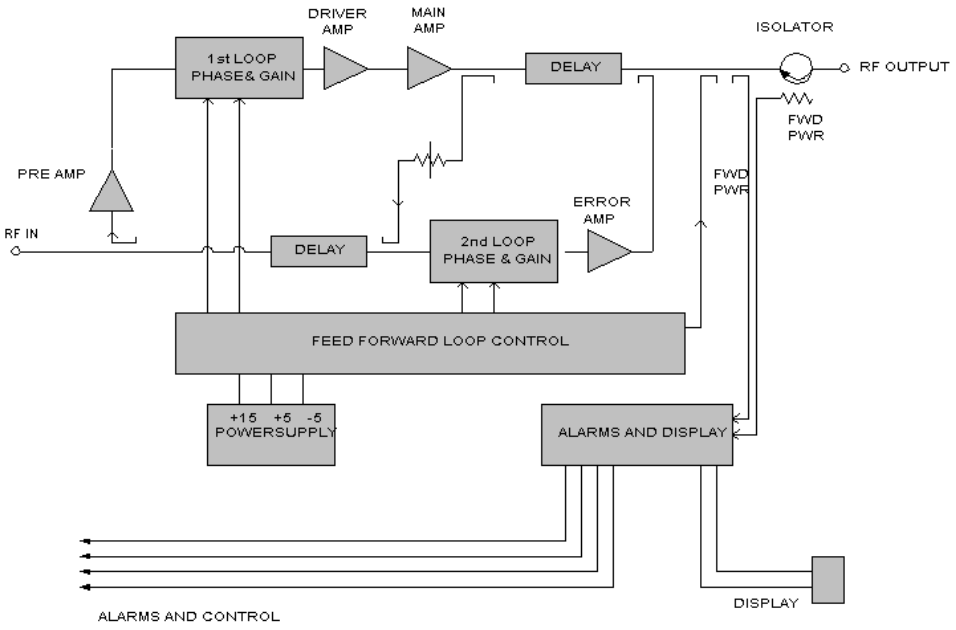
The MAF800-100S amplifier is a linear, feed-forward power amplifier that operates in the 25 MHz frequency band from 869 MHz -894 MHz. The amplifier is designed to operate in an instantaneous bandwidth of 25 MHz. Each amplifier is a self-contained plug in module and is functionally independent of the other amplifier module. The amplifier modules are designed for parallel operation to achieve high peak power output, and for redundancy in unmanned remote locations. Each amplifier in the system can simultaneously transmit multiple carrier frequencies, at an average total power output of 100 Watts, with better than –13 dBm intermodulation distortion.

All phase and gain corrections are performed on the signal (s) in the individual amplifier module. Each amplifier module has an alarm board that monitors the amplifier performance. If a failure or fault occurs in the amplifier module a multi-color LED will change from GREEN to RED. This will be displayed on the front of the individual amplifier front panel.

3.5 MAF800-100S Amplifier Module

The amplifier module has an average output of 100 Watts power with intermodulation products suppressed to better than -13 dBm. The amplifier provides an amplified output signal with constant gain and phase by adding approximately 25 dB of distortion cancellation on the output signal. Continuously comparing active paths with passive references, and correcting for small variations through RF feedback control maintain constant gain and phase. The amplifier module is comprised of:

Preamplifiers
Main Amplifiers
Error Amplifier
Two feed-forward loops with phase–shift and gain controls
DC/DC power regulator
Alarm monitoring, control and LED display lamp



MAF800-100S Block Diagram

The main amplifier employs class AB amplification for maximum efficiency. The error amplifier and feed forward loops are employed to correct signal non-linearity introduced by the class AB main amplifier. The error amplifier operates in class AB mode. The RF input signals are amplified by a preamp and coupled to an attenuator and 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 output from the main amplifier is typically 100 Watts.

The signal output from the main amplifier is sampled using a coupler. 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 passed 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 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 signals 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, and then phase shifts the signals by 180 degrees then feeds the signal to the error amplifier. There it is amplified to the same power level as the input sample and coupled 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 cancelled.

3.6 Main Amplifier

The input and output of the amplifier employ two-stage, class AB amplifiers, which provide approximately 25 dB of gain in the 25 MHz frequency band, from 869 MHz to 894 MHz. The amplifier operates on +27 Vdc, and is mounted directly on a heat sink, which is temperature monitored by a thermal sensor. If the heat sink temperature exceeds 85° C. a high temperature fault occurs. The alarm logic controls the transistor bias voltage; this shuts down the amplifier if bias voltage is out of range.

3.7 Error Amplifier

The primary function of the error amplifier is to sample and amplify the signal distortion level generated by the main amplifier. The error amplifier cancels out the distortion and IMD when the error signal is coupled onto the main signal at the amplifier output. The matching signal levels from the error amplifier are injected back into the main amplifier output reducing any distortion and cancellation of IMD. The error amplifier is a balanced multistage class AB amplifier. It has 75 dB of gain, and produces up to 65 Watt output. The amplifier operates on +27 Vdc and is mounted directly on a heat sink.

3.8 Amplifier Status Monitoring

In the main and error amplifier stages, all normal variations are automatically compensated for by the feed-forward loop control. When large variations occur beyond the adjustment range of the loop control, a loop fault will occur. The amplifier will be disabled, and the LED will be RED. The alarms will be sent via the 21-pin connector on the rear of the module to the sub-rack summary alarm board.

3.9 Amplifier Module Cooling

Each amplifier module has its own heat sinks. All main amplifier components are mounted to the heat sink. Forced air-cooling is used to pull air across the heat sinks for operations in the sub-rack. The fans for this forced air-cooling is located in the sub-rack assembly. The fans are mounted in the rear of the sub-rack assembly. Air is pulled from the front of the amplifier and exhausted out of the back of the rack.

3.10 DC Power Distribution

Primary Vdc for the system is provided by the host system to the sub-rack assembly. The sub-rack supplies the +27 Vdc to the amplifier module. The +27 Vdc is supplied directly through the sub-rack power splitter/combiner board. The amplifier module has a DC/DC converter that converts the +27 Vdc to +12 Vdc, +5Vdc,