MOTOROLA

EXCITER MODULE

MODEL CLN1234 (403 to 470 MHz)

1 DESCRIPTION

The CLN1234 Exciter Module is described in this section. A general description, identification of inputs and outputs, a functional block diagram, and functional theory of operation are provided. The information provided is sufficient to give service personnel a functional understanding of the module, allowing maintenance and troubleshooting to the module level. (Refer also to the Maintenance and Troubleshooting section of this manual for detailed troubleshooting procedures for all modules in the station.)

General Description

The Exciter Module (in conjunction with the Power Amplifier Module) provides the transmitter functions for the station. Contained within a metal module housing, the exciter board generates a low-level modulated RF signal which is input to the power amplifier module for further amplification and output to the transmit antenna. The Exciter Module interfaces directly with the Station Control Module, which provides control signals and monitoring, and routes transmit audio to the exciter.

These Exciter Modules differ only in the range of operation, as shown in the title of this section. Unless otherwise noted, the information provided in this section applies to all models.

Overview of Circuitry

The exciter board contains the following circuitry:

- Frequency Synthesizer Circuitry – consisting of a phase-locked loop and VCO, generates a modulated RF signal at the transmitter carrier frequency
- RF Isolation Switch – allows the SCM to turn on / off the exciter output signal to the power amplifier module
- A / D Converter Circuitry – converts analog exciter status signals to digital format for transfer, upon request, to Station Control Module
- Local Power Supply Regulation / Filtering – accepts +8V, +10V and +15V inputs and outputs +5V, +10V, and +15V operating voltages.

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2 INPUT AND OUTPUT CONNECTIONS

Figure 1 shows the exciter module input and output external connections.

Figure 1. UHF Exciter Module Input/Output

3 FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the exciter circuitry at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the module in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 2 for a block diagram of the exciter module.

Synthesizer and VCO Circuitry

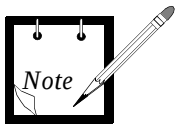
Introduction

As mentioned previously, the exciter module generates a low-level modulated RF signal which is input to the power amplifier module. The RF carrier is generated by a frequency synthesizer consisting of synthesizer circuitry and VCO circuitry. Exciter module control signals, monitoring, and audio processing are handled by the Station Control Module. Functional operation of the exciter circuits is as follows.

Phase-Locked Loop

The phase-locked loop (PLL) IC receives frequency selection data from the SCM microprocessor (via the SPI bus). Once programmed, the PLL IC compares a 2.1MHz reference signal (from the SCM) with a divided-down feedback sample of the VCO output. Depending on whether the feedback signal is higher or lower in frequency than the 2.1MHz reference, up/down correction pulses are generated. (The width of these correction pulses depends on the quantitative difference between the 2.1MHz reference and the VCO feedback.)

The up/down pulses from the PLL IC are fed to a charge pump which outputs a dc voltage proportional to the pulse widths. This dc voltage is then low-pass filtered and fed to the VCO as the CONTROL VOLTAGE.



If a frequency change is requested by the SCM microprocessor, the low-pass loop filter is momentarily bypassed to accelerate the frequency change (via a SYNTH ADAPT signal from the SCM).

VCO

The dc control voltage from the synthesizer is fed to dual VCOs which generate the RF carrier signal. Within each band, one VCO generates signals in the upper half of the band, while the other VCO generates signals in the lower half of the band. Only one VCO is active at a time. Selection of the active VCO is provided by a BANDSHIFT signal from the PLL IC.

The active VCO responds to the dc control voltage and generates the appropriate RF signal. This signal is fed through impedance matching, amplification, and filtering and is output to the RF Switch Circuitry. A sample of the output is returned to the PLL IC to serve as a VCO feedback signal.

Modulation

The active VCO receives an audio / data modulation signal from the Station Control Module via a splatter filter and a low-pass filter / attenuator. This VCO modulation signal modulates the active VCO to produce a modulated low-level RF carrier signal.

Low-frequency modulation signals (below the loop filter corner) tend to be interpreted by the PLL as VCO frequency error. A modulation compensation signal is added to the PLL control voltage to cancel out this effect and allow for low frequency modulation.

RF Switch Circuitry

The modulated RF signal from the VCO is fed through a buffer / attenuator to an RF switch circuit. Signal TX ENABLE from the SCM controls the switch. The RF signal is output to a BNC connector mounted in one corner of the module, just outside the module cover. A short coaxial cable connects the exciter output to the power amplifier module.

Data Communications

Communications with Station Control Module

Data communications between the exciter and the Station Control Module microprocessor (µP) is performed via a Serial Peripheral Interface (SPI) bus. This bus allows the SCM µP to send data to the synthesizer PLL IC (to select frequency) and to read the A / D Converter IC (next paragraph).

A/D Converter Circuitry

Analog signals from various strategic operating points throughout the exciter board are fed to an A / D converter, which converts them to a digital signal and, upon request by the Station Control Module, outputs the signal to the Station Control Module via the SPI bus.

Voltage Regulator/Filter Circuitry

The voltage regulator circuitry consists of a +5V regulator and filtering circuitry. The +5V regulator accepts a +8V input (from a regulator on the backplane) and generates a +5V operating voltage for the exciter board circuitry.

In addition to the voltage regulator circuitry, +15V from the Station Control Module is filtered for the synthesizer charge pump. Also, +10V (from a regulator on the backplane) is filtered to supply a +10V operating voltage for the exciter board circuitry.

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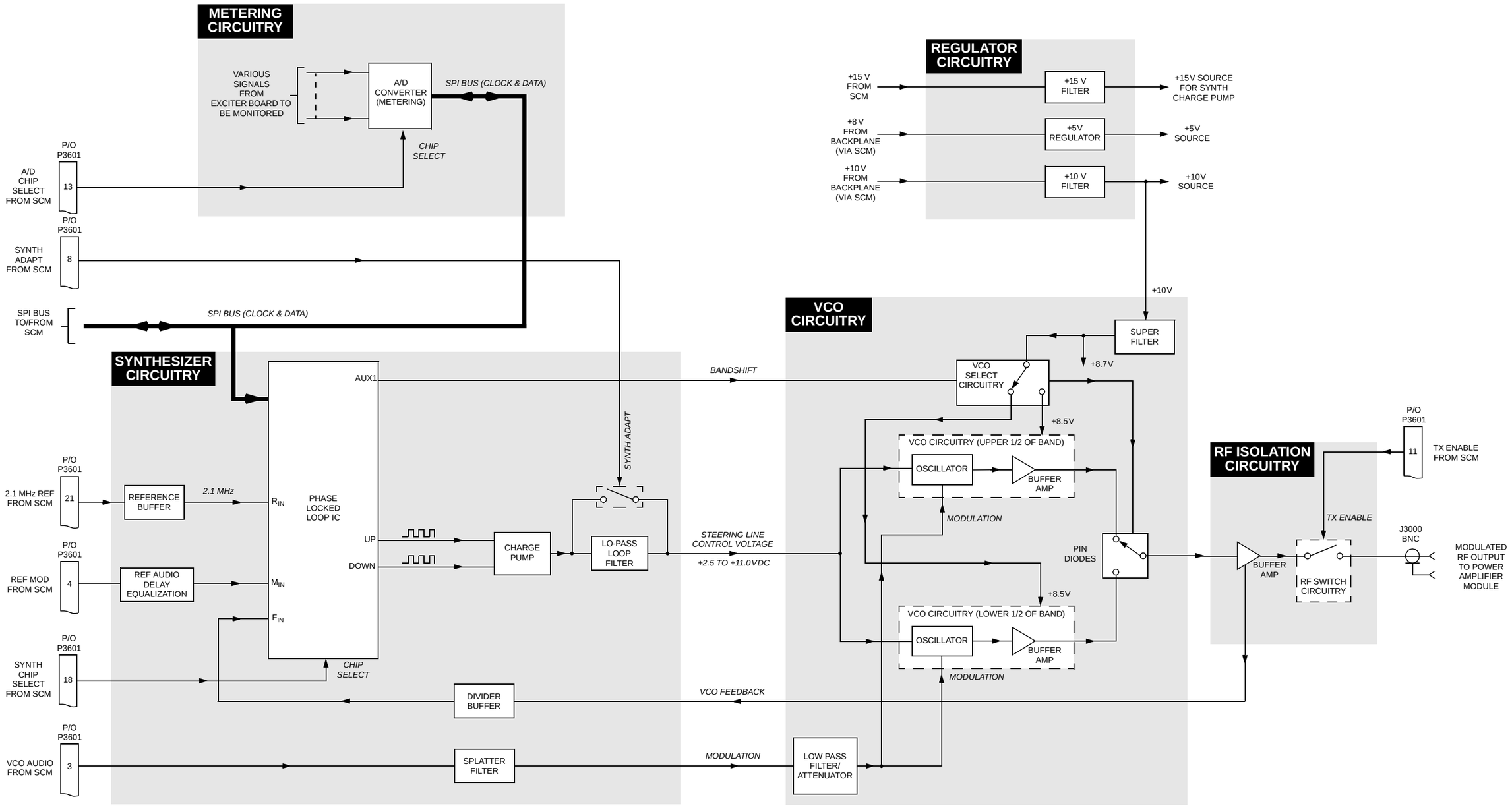

Figure 2. UHF Exciter Module Functional Block Diagram