6.0 Theory of Operation

6.1. General Theory of Operation

The following sections describe the overall transmitter system. Section 6.2 provides a general module description. See Figures 6-1 and 6-2 for the block diagrams.

6.1.1. Internal Communications and Control

The NEWSCASTER VT1 includes the latest in technology. Each module within the NEWSCASTER VT1 Transmitter contains a local microprocessor responsible for control and monitoring of the specific module. Each microprocessor is programmed only with the information needed to perform its specific task. The microprocessors talk back and forth using I^2C, a two-wire network. When the system is started, each module performs a self-test to ensure quality performance.

The front panel microprocessor then polls each module for configuration information. The reason for this polling is if a new module is installed the front panel will re-configure itself with the appropriate menus and selections. This allows for a Plug and Play type of unit. While in operation the front panel continuously monitors all the microprocessors and peripherals to insure performance.

The Control Drawer and RF Head contain an I^2C modem that allows the two units to communicate.

6.1.2. Signal Routing Discription

Analog Mode:
When Analog video is connected to the *Input* connector, it is routed to the Baseband processor. The baseband processor formats the analog video and audio into a baseband composite video signal. The baseband signal is routed to the super-heterodyne up-converting module to 70MHz through the coax (or Optional triax) cable to the RF Head. This module mixes the 70MHz signal with the IFLO to produce a first IF of 1500MHz[1]. The 1500MHz signal is then mixed with the RFLO output of the synthesizer to produce the final RF output frequency. This signal is then amplified to the final output power and directed to the RF output connector (See Figure 6-1).

Digital Mode:
When a digital modem is used, the 70MHz is connected to the *Ext. 70 MHz Input* connector and routed to the super-heterodyne up-converting module through the coax (or Optional triax) cable. This module mixes the 70MHz signal with the IFLO to produce a first IF of 1500MHz. The 1500MHz signal is then mixed with the RFLO output of the synthesizer to produce the final RF output frequency. This signal is then amplified to the final output power and directed to the RF output connector (See Figure 6-1).

The 1500MHz the standard IF. Other IF frequencies are used for special frequencies as specified on the front cover of this manual.

[1] For discussion purposes 1500MHz will be used throughout the manual as the IF frequency. The actual frequency will vary depending upon the actual RF frequency band. Refer to Tables 6-1 through 6-2 for the actual IF used.

6.2. General Module Description

6.2.1. Control Unit *Smart Display* Board

The control board is the heart of the *Smart Display*. All unit controls originate from this control board. The *Smart Display* contains a microprocessor and a variety of peripheral interfaces. Control and monitoring commands originate from the microprocessor to other modules. The other modules reply with status signals that are displayed on either the LCD or various LED's on the front panel.

6.2.2. Baseband Processor Board

See Figures 6-3 and 6-4 for the Audio, and Video Block Diagrams. The baseband processor is located in the Control Unit. The baseband processor accepts composite video, or 1 video, 2 audio (4 Optional) baseband signals and a port to accept additional subcarriers. In addition to accepting these inputs, the baseband processor internally contains both Video and Audio test tones that are individual selected. It processes these inputs to produce a single composite baseband output signal. The baseband processor contains a microprocessor that handles all local board monitoring and control. The microprocessor accepts commands from the *Smart Display* to make all adjustments required.

At the input to the baseband processor there is a video switch used to route video, video test tones, or the test generator (Optional) to the baseband processor.

When video and audio signals are applied separately to the baseband processor, they are processed in individual video and audio channels in the Video Processor. Video signals are filtered, to avoid interfering with the audio subcarrier, and emphasized according to the NTSC or PAL video emphasis curves.

Audio input signals are received from either a microphone or an interconnecting line from an audio mixer or similar device. In the MIC mode, an AGC circuit maintains a near-constant modulation level. The audio signals are emphasized and supplied to FM subcarrier modulators. The audio modulating waveform is monitored by a level detector, which raises an over-modulation alarm if the subcarrier deviation exceeds the preset limit. The output of the FM subcarrier modulators is combined with the video signal and with the external subcarrier port. The composite baseband signal is then routed to the 70 MHz modulator.

When a Composite signal is applied to the Input connector, it is routed to the baseband processor, amplified to a 1-Volt peak-to-peak level, emphasized and routed to the Frequency Synthesizer module for transmission. If the NEWSCASTER VT1's subcarriers are left "ON" they will be combined with the external baseband signal. This allows the ability to insert subcarriers in a baseband repeater configuration.

6.2.3. 70 MHz Modulator Board

The 70 MHz output is passed through a switch to select either the 70 MHz from the internal modulator or 70 MHz from the external input connector. The output of the baseband processor is routed to the 70 MHz modulator. The baseband signal FM modulates the 70 MHz carrier. The 48 VDC from the power supply is combined with the 70 MHz IF through a diplexer and routed to the RF Interface connector.

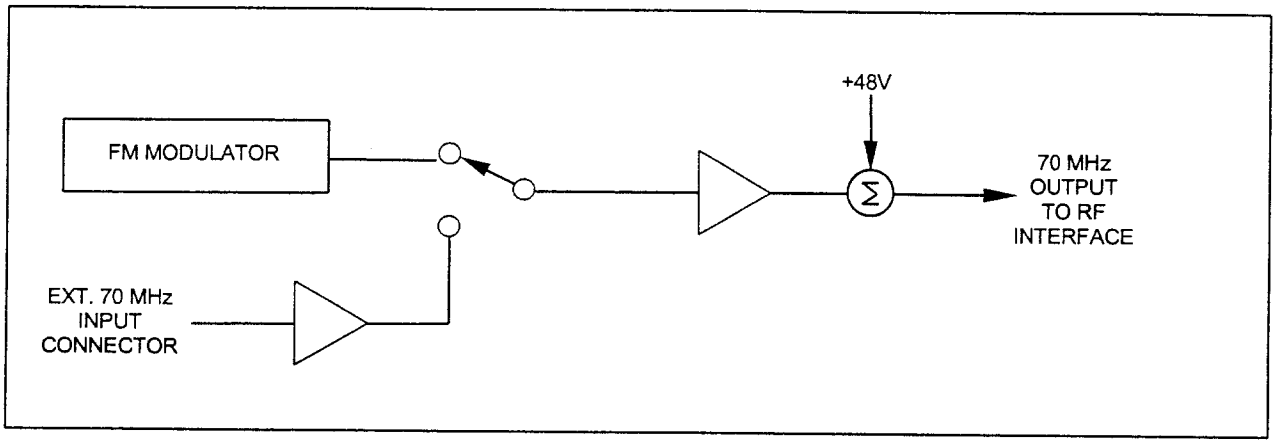

Figure 6-5 Block Diagram 70 MHz Modulator

6.2.5. RF Unit Control Board

The RF Unit contains a control board that is used to control the RF Unit. These controls include the following:

- Setting antenna polarization
- Power amp selection
- RF level (High or Low power)
- Setting the RF frequency
- Power supply voltage monitoring
- RF Unit trouble condition monitoring
- Relay output control

This control board receives all of its commands from the Smart Display in the Control Unit.

6.2.6. IF and RF Microwave Up-Converter and Power Amplifier

The IF signal from the Control Unit is passed through a diplexer to remove the DC from the signal. The IF signal is passed to the IF Up-Converter and the +48 VDC is routed to the RF Head power supply. Two up-converters are used to convert the 70 MHz modulated signal from the Control Unit to the final RF output frequency.

The IF Up-Converter up converts the 70 MHz input signal to the 1500 MHz frequency range. The IF output frequency may differ depending on the final RF output frequency.

The RF Microwave Up-Converter and Power Amplifier up converts the 1500 MHz signal to the final microwave frequency and amplifies it to the required power output level.

6.2.7. IF Up-Converter (P/N 901 I027-XXB)

A block diagram of the IF Up-Converter is shown in Figure 6-12. The 70 MHz input signal from the Control Unit is amplified in the AGC amplifier and inputted to the mixer. This signal is mixed with the synthesizer frequency to produce the 1500 MHz IF. The IF signal is band limited by the Band-Pass-Filter to remove the synthesizer signal. The IF signal is rectified and fed back to the AGC amplifier to maintain a constant -5dBm IF output level as the 70 MHz input signal varies.

6.2.8. RF Microwave Up-Converter (See Tables 6-3 and 6-4)

A block diagram of the RF Up-Converter is shown in Figure 6-13. The 1500 MHz input signal from the IF Up-Converter input is amplified in the AGC amplifier and inputted to the mixer. This signal is combined with the microwave synthesizer frequency to produce the final RF output signal. The RF signal is band limited by the Band-Pass-Filter to remove the synthesizer signal. The filtered RF signal is amplified to the final desired output power level. The RF signal is rectified and fed back to the AGC amplifier to maintain a constant RF output level as the 1500 MHz input signal varies. For FM signals, the AGC is set to full gain to run the PA in a saturated mode. For all digital signals, the AGC is enabled backing the amplifier out of saturation.