MODULE 20
AN/GRR-18(V)1 RADIO RECEIVER

OBJECTIVE

List the functions of each slice and trace the signal flow through the GRR-18(V)1 Receiver.

PREREQUISITES

Must complete Modules 1, 2, 3, and 15.

INFORMATION

This portion of our trip through the TSC-60 system takes us through the AN/GRR-18(V)1 Radio Receiver. Our roadmap will be the block diagram of the Receiver, Figure 12 in your Diagrams booklet. There are two identical GRR-18 Receivers in the TSC-60(V)2 van. Both are mounted in the 1A31 equipment rack. Since both Receivers are identical, we will consider only one Receiver in our block diagram analysis.

The GRR-18 Receiver is an automatically tuned, remotely controlled radio providing reception of Amplitude Modulation Equivalent (AME), CW, and up to four Independent Sideband (ISB) multiplex channels. The operating frequency is selectable from 2.0000 to 29.9999MHz in 100Hz steps and is phase locked to an internal frequency standard. A connection for an external frequency standard is available. An extremely selective RF front end permits normal Receiver operation with an interfering signal at the antenna of up to 1000 volts rms, 10 percent removed from the operating frequency. Refer to Figure 12 of your Diagrams booklet as we trace signal flow through the Receiver.

When 120 volts AC is applied to the Receiver, the 652J-4 power supply provides 20VDC and 5VDC to the 887B-1 synthesizer. These voltages power the DCU and DCFE circuits in the 887B-1 so that they can receive the power-on command from the computer. When the computer sends the power-on command to the Receiver, the 887B-1 interprets the command, then sends its own power-on command to the 652J-4 power supply and the rack blower. The power-on command is blocked from the power supply until the blower produces air flow. This air interlock will also turn off the power supply should something affect air flow. When the power supply receives the power-on command, it provides all operating voltages for the rest of the Receiver.

The RF input is applied to the 888B-2 amplifier converter. The 888B-2 actually consists of two slices together in one black box, an RF preselector and bandpass filter, and the RF to IF converter. The preselector contains two mechanically tuned bandpass filters that filter unwanted signals to such a degree that a signal of 1000 volts rms, 10 percent removed from the operating frequency, is rejected.

The signal from the bandpass filters is applied to the first mixer and converted to an IF frequency of 109.15MHz. It is then applied to another mixer and converted to the second IF frequency of 10.15MHz. Finally, the signal is applied to another mixer and converted to an IF frequency of 250kHz. This 250kHz signal is applied to the 889B-1 and 889A-2 audio frequency detectors.

For you to understand the audio frequency detectors, we need to discuss the subject of "independent sideband" (ISB).

You should already know that amplitude modulation (AM) simply varies the amplitude of the carrier signal at a rate and amount in accordance with the modulating signal. Single sideband (SSB) modulation removes one of the two sidebands of the AM signal and, in addition, attenuates the carrier signal so that all of the power is in the modulated sideband signal.

Independent sideband (ISB) modulation follows the conventions of SSB except that both sidebands can be present with different information on each. For example, assume you have a 6MHz carrier modulated with frequencies from 0 to 3kHz. The upper sideband signal operating at 6MHz will contain resulting frequencies from 6MHz to 6.003MHz with all frequencies below 6.0MHz filtered out. The same signal on the lower sideband would be from 6MHz down to 5.997MHz, with frequencies above 6.0MHz filtered out. If you used both modulators and filters at the same time, then mixed them together, you could produce both sidebands with different intelligence on each. That's how ISB works.

In the TSC-60 we carry that theory a bit further and add a third sideband above the upper sideband and a fourth sideband below the lower sideband. Given the appropriate circuitry and bandwidth, we could carry this same convention even further into many more sidebands and, therefore, independent channels.

This is basically the way that wideband microwave equipment operates. The main reason we don't use any more sidebands in HF is the bandwidth required. For example, a 24-channel system would require a bandwidth of 75kHz. How many signals of that width could you get into the HF spectrum at the same time without interfering with each other? With microwave frequencies you not only have an exceptionally large frequency spectrum, but the signals are also line-of-sight only. Consequently, two radios that are tuned to the same frequencies will be allowed to operate only a short distance apart without interfering with each other.

In the Receiver, the four sideband signals are separated from each other by very selective bandpass filters. The IF signal is fed to two filters in the 889B-1 which are used to detect the upper (A1) and lower (B1) sidebands. The IF signal is also fed to the 889A-2, which contains filters for the upper upper (A2) and lower lower (B2) sidebands. Following each bandpass filter is a demodulation circuit and an audio amplifier. AGC is developed in the demodulation circuit and applied to the RF translator.

In addition to the upper and lower sideband circuits, the 889B-1 also contains a bandpass filter, a demodulator circuit, and an audio amplifier for the AME signal. The detected AM signal is fed through the signal path for the A1 ISB signal; so a fifth audio path is not required.

The audio outputs of the 889B-1 and 889A-2 are applied to the 599H-3 radio test set. The 599H-3 provides a broadband RF noise generator for the self-test feature of the Receiver. It also provides squelch circuits and anti-vox circuits.

All of the required frequency injection signals for the Receiver are provided by the 887B-1 synthesizer. In addition, the 887B-1 contains the DCU and DCFE circuits to interface the Receiver with the computer. The 887B-1 used in the Receiver is identical to the one used in the Exciter, and the two are interchangeable.

The 652J-4 power supply provides all voltages necessary for the Receiver to operate. In Module 15 we discussed that the unswitched voltages are present even when the Receiver is turned off. When the Receiver is turned on, the switched voltages are provided to the rest of the Receiver. The 652J-4 used in the Receiver is identical and interchangeable with the one used in the Exciter.

That's the GRR-18 Receiver in a nutshell. We'll discuss each of the black boxes, or slices, in more detail in Module 21. Computer control of the Receiver was discussed in Module 15 and operation of the Receiver was discussed in Module 4.

ADDITIONAL INSTRUCTIONS

Answer the review questions and check your answers with the confirmation key. Review the material in the module for any questions you missed. Next, ask your trainer for the KEP questions. After your trainer checks your answers he/she will review the questions missed with you.

REVIEW QUESTIONS

1. What modes of operation does the GRR-18 Receiver provide?

2. Identify the numbers and titles of the slices that make up the GRR-18 Receiver.

3. Which two circuits provide control and interface with the computer, and which slice are they in?

4. Which two slices are contained in the 888B-2 black box?

5. Which slice provides all the injection frequencies required by the Receiver?