

## RECEIVER TRANSFER SWITCHBOARD

The receiver switchboard allows the audio outputs from the receivers to be transferred to remote control station audio circuits. A representative receiver transfer switchboard is shown in figure 1-12. This switchboard contains 10 seven-position switches. Each switch corresponds to a remote control station and each switch position (1 through 5) represents a receiver. Position X allows the circuits attached to the switch to be transferred to another switchboard.

## ANTENNAS

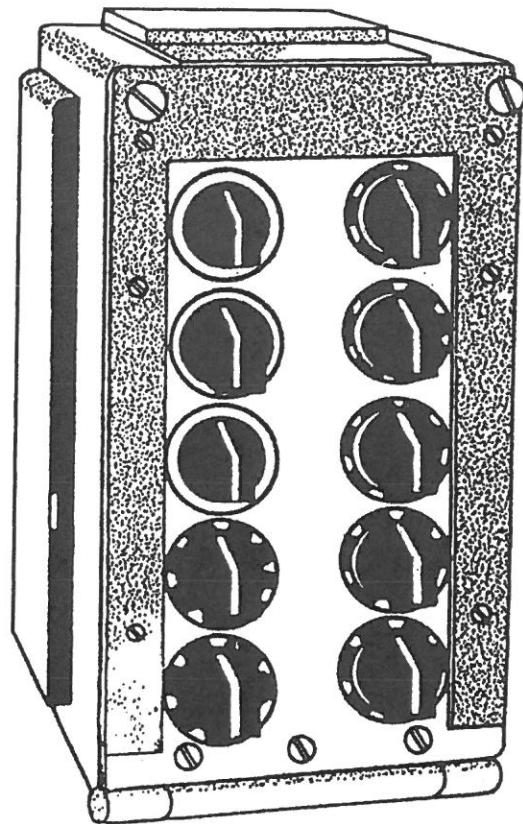
An antenna is a conductor or system of conductors that radiates or intercepts energy in the form of electromagnetic waves. An antenna can be simply a piece of wire; but in practice, other considerations make the design of an antenna system complex. The height above ground, conductivity of the earth, antenna shape and dimensions, nearby objects, and operating frequency are just a few of the factors affecting the radiation field pattern.

Information on antenna theory, basic antennas, and wave propagation will be available in *Antennas & Wave Propagation*, volume 7, of this training series. Currently, you can find information in Navy Electricity and Electronics Training Series (NEETS), Module 10, *Introduction to Wave Propagation, Transmission Lines, and Antennas*, NAVEDTRA 172-10-00-83.

## SYNCHROS AND SERVOS

In many electromechanical systems, the angular position of a shaft must be transmitted from one location to another without an actual mechanical linkage. You have seen examples of this in mast-mounted rotating directional antennas and the automatic tuning function of receivers and transmitters from remote locations. A widely used method employs ac machines that operate as single-phase transformers. These machines are called *synchros*.

Synchro receivers contain sets of gears that do the actual moving of the device to which the synchro is attached. These receivers are light-duty devices, de-



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Figure 1-12.—Receiver Transfer Switchboard (SB-973/SRT).

signed to move small loads or to produce small amounts of torque. When the shaft to be driven at the remote location is connected to an indicating device or some light load, the synchro receiver is capable of developing the necessary torque. But, if the load is a heavy load and more torque is required, torque (power) amplification is required. A control system capable of delivering larger amounts of power or torque is known as a servo mechanism, or *servo*.

You will encounter many systems that use synchros and servos. You can find detailed information about these devices in the *Military Standards Handbook*, MIL-HDBK-225 and NEETS, Module 15, *Synchros, Servos, and Gyros*, NAVEDTRA 172-15-00-85.

power over long distances. It provides eight channels of frequency-division multiplex rtty traffic on each transmission. The AN/FRT-72 transmitter is designed specifically for this purpose. It produces 50-kW peak-envelope power (25-kW average power) and covers a frequency range of 30 to 150 kHz. Low-frequency transmitters are normally used only on shore stations.

### Lf Receive

The low-frequency receive system receives lf broadcasts and reproduces the intelligence that was transmitted. A typical lf receive system is shown in figure 2-4. The antennas receive the lf signal and send it to the multicoupler and patch panel. The multicoupler and patch panel (AN/SRA-17 and AN/SRA-49) allow the operator to select different antennas and connect them to various receivers. In the system shown in figure 2-4, the receiver can be either the AN/SRR-19A or the R-2368A/URR. These receivers operate in the frequency ranges of 30 to 300 kHz and 14 kHz to 30 MHz, respectively.

The receiver audio is fed to the SB-973/SRR receiver transfer switchboard. As we explained earlier, this allows the received audio to be connected to numerous pieces of equipment. In figure 2-4, the audio is connected to either an AN/URA-17 or CV-2460 convertor comparator, which converts the received signal to dc for use by the teletype (tty) equipment. From the convertor, the dc signal is fed to a dc patch panel (SB-1203/UG). The signal can then be sent to any crypto equipment attached to the patch panel. The crypto equipment decrypts the signal and routes it to the red patch panel (SB-1210/UGQ). The signal can

then be patched to a teletype printer for plain text printing, or to a reperforator, where a paper tape will be punched and stored for later printing.

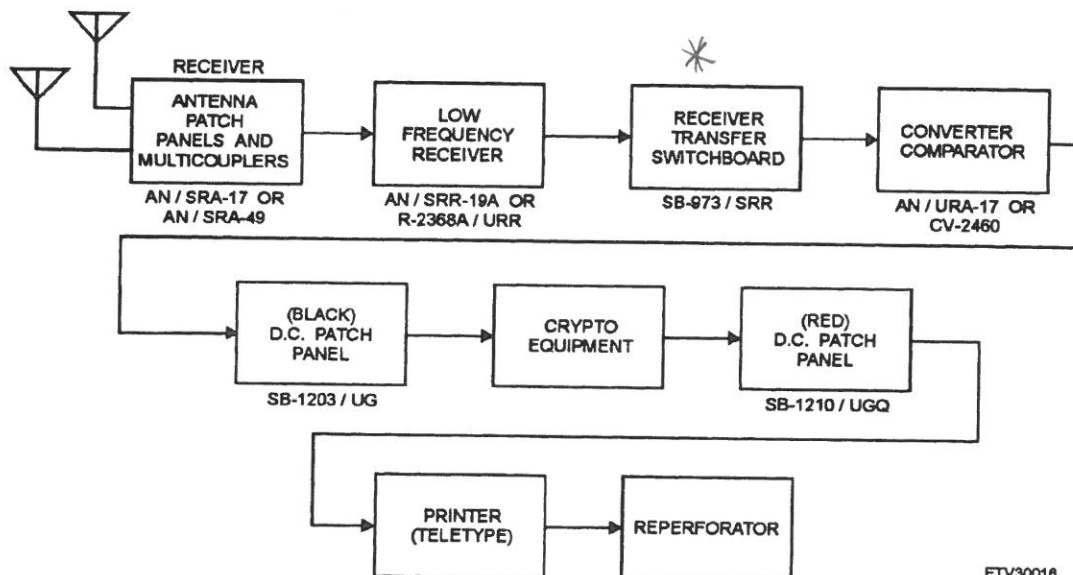
### HIGH-FREQUENCY COMMUNICATIONS

The high-frequency (hf) band is shared by many domestic and foreign users. Portions scattered throughout the band are assigned to the military. The Navy's communications requirements have grown rapidly, severely taxing its portion of the spectrum. Satellite communications has relieved some of this congestion and, for some types of service, has replaced hf for long-distance communications, pushing hf into a back-up role. However, even with the use of satellite communications, hf will continue to be in high demand for sometime. We will cover satellite communications in chapter 3.

Naval communications within the hf band are grouped into four general types: point-to-point, ship-to-shore, ground-to-air, and fleet broadcast. All but the fleet broadcast are normally operated two-way.

### Point-to-Point

Point-to-point systems provide communications over long-distance trunks or via links between fixed terminals. A *trunk* is normally a message circuit between two points using cable, fiber, or telephone circuits. A *link* is a transmitter/receiver system connecting two locations. The two locations normally use directional, high-gain antennas that increase the effective radiated power, reduce the chance of interference, and boost the sensitivity of the



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Figure 2-4.—Lf receive.

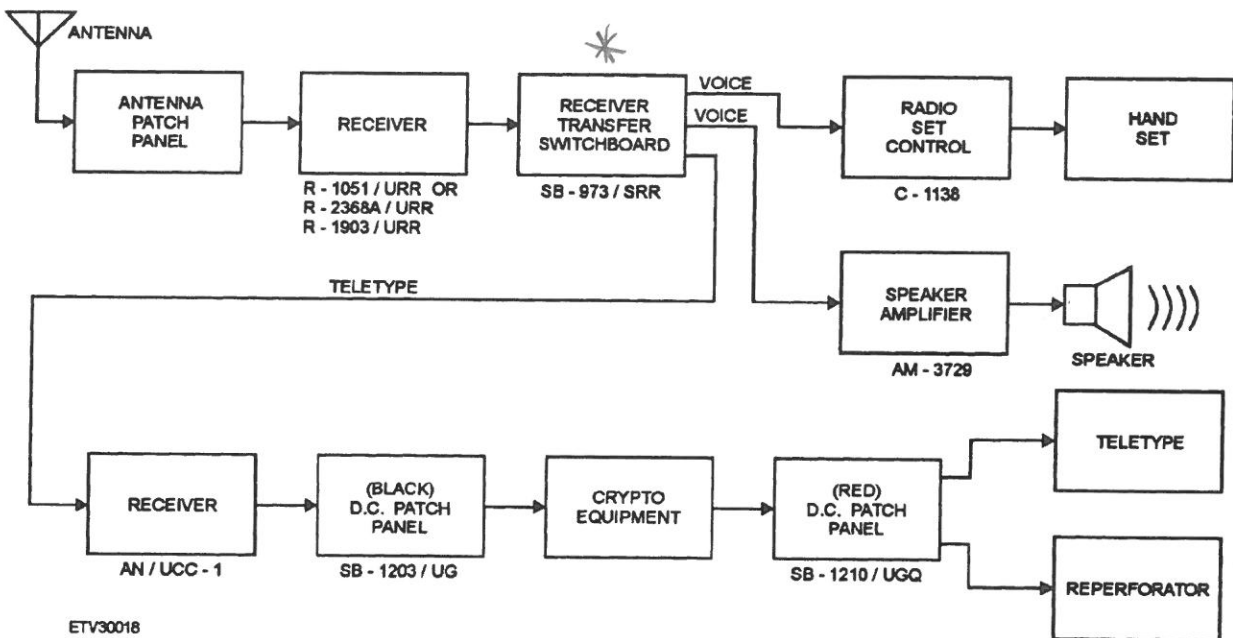


Figure 2-6.—Shipboard hf receive system.

set control. The output of the radio set control is then fed to the switchboard.

The transmitter transfer switchboard allows operators to select the proper transmitter for the selected frequency. The AN/URT-23 transmitter receives its input from the switchboard and changes the signal to a modulated rf signal that is fed to the AN/SRA-34, 56, 57, 58, or AN/URA-38 antenna coupler. The antenna coupler matches the output impedance of the transmitter to the input impedance of the antenna. Antenna couplers also allow more than one transmitter to be connected to the same antenna as long as certain conditions are met. When the signal reaches the antenna, it is radiated into the atmosphere.

### Shipboard Hf Receive

A typical shipboard hf receive system is shown in figure 2-6. A transmitted signal similar to the one previously discussed is received by the antenna and converted from electromagnetic energy to electrical energy. The signal is fed to an antenna patch panel where it can be distributed to any number of receivers.

In figure 2-6, a receiver (R-1051/URR, R-2368/URR, or R-1903/URR) converts the rf signal into either a teletype signal (fsk) or voice. The receiver output is then fed to the SB-973/SRR receiver transfer switchboard. The teletype signal from the switchboard follows the same path used by the low-frequency signal we discussed earlier. Identical pieces of equipment are used. The voice signal from the receiver switchboard is sent to the C-1138 radio set control and

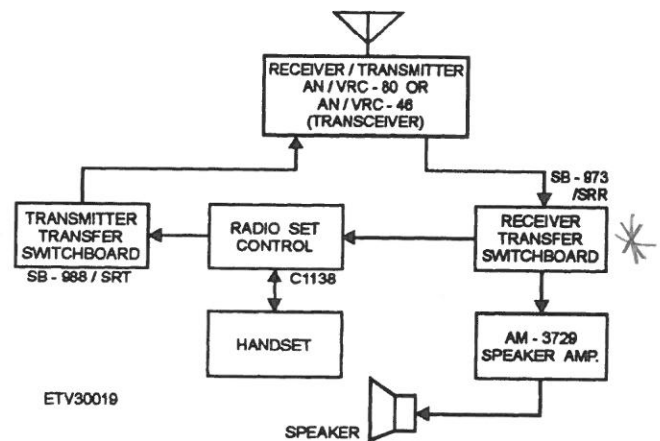


Figure 2-7.—Vhf transmit and receive system.

fed to a handset. The voice signal also can be sent from the switchboard to an AM-3729 remote speaker amplifier and then to a speaker. This allows the user to listen to the signal without having to hold the handset.

## VERY-HIGH-FREQUENCY COMMUNICATIONS

The Navy uses the very-high-frequency (vhf) band for mobile communications such as bridge-to-bridge, among boat crews, and for amphibious operations and landing parties.

### Vhf Transmit

A typical vhf transmit and receive system is shown in figure 2-7. On the transmit side, the operator, at a remote location, talks into the handset. The handset is

to an AN/SRA-33 or OA-9123 antenna coupler. The coupler output is then fed to an antenna.

### Uhf Receive

A basic block diagram of a uhf receive system is shown in figure 2-9. Most of the components are the same as those used in the transmit function. We will, therefore, identify by specific designator only the components that are unique to the receive function. The receive signal is picked up by the antenna and fed to the receive side of the transceiver through the antenna coupler. The receiver output is connected to an SB-973/SRR receiver transfer switchboard. It is then connected to either the nonsecure or secure voice system, depending upon the received transmission mode.

When a nonsecure signal is received, the output of the receive transfer switchboard is fed to either the radio set control or to the AM-3729 speaker amplifier, or both, depending on user preference.

If a secure voice transmission is received, the output of the switchboard is connected to the secure

voice equipment and decrypted. This output is fed to the secure voice matrix. The secure voice matrix output is fed to the RPU, where the signal is converted back to its original form.

## SUPERHIGH-FREQUENCY COMMUNICATIONS

As we discussed in the previous chapter, two primary uses of the superhigh-frequency (shf) band are microwave and satellite communications. The AN/FSC-79 SHF terminal and satellite communications will be covered in the next chapter. In the following paragraphs, we will discuss line-of-sight and tropospheric scatter microwave communications.

### MICROWAVE COMMUNICATION SYSTEMS

Microwave systems, such as the AN/FRC-84 and AN/FRC-170(V), are used to relay multiplex signals from point to point. A simplex relay system provides one-way communications and consists of a transmitting terminal, a certain number of repeaters,

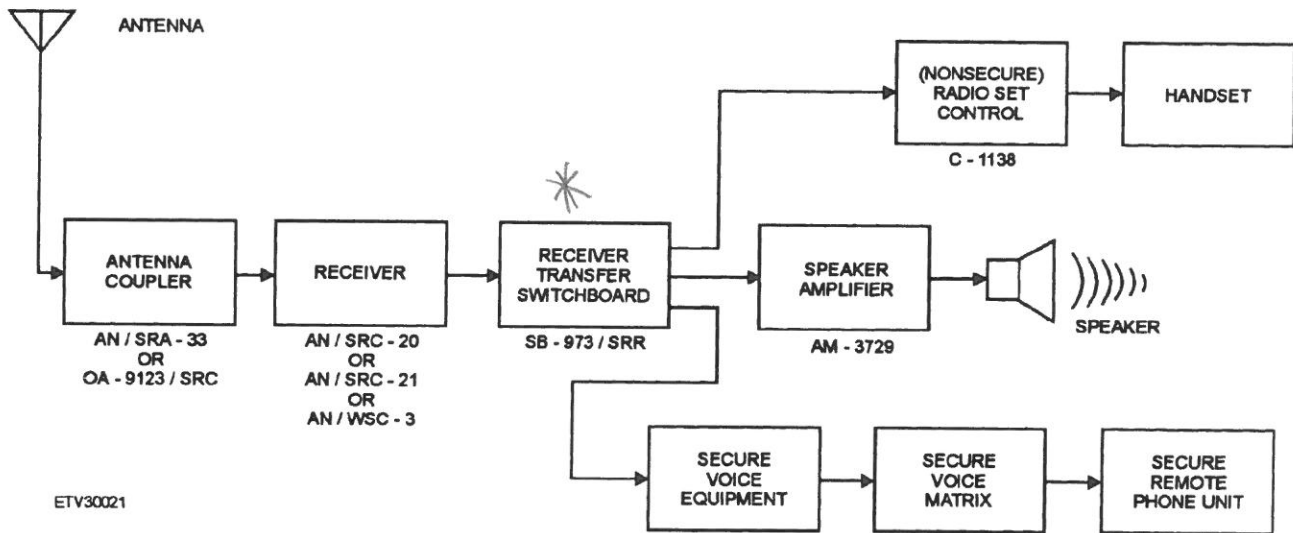


Figure 2-9.—Uhf receive.