WIRELESS LINK FUNCTIONAL DESCRIPTION

The handheld radio is provided as a maintenance tool for the iBAR 100 series of microwave radios manufactured by Nortel Networks. These microwave radios individually operate in the 18, 23 and 38 GHz bands and provide point-to-point connections suitable for carrying 1T1, 2T1 or 4T1 traffic. A typical use for these microwave radios is in cellular backhaul applications. The microwave radios are of a completely integrated design, having RF hardware, modem and power supply contained in one package. A single, shielded multipair cable is used to provide data, control and power connections to the microwave radio. Access to control functions and status parameters are provided by an RS-485 data interface which may be connected to the local network management interface. As an alternative, maintenance personnel may also access a subset of the microwave radio control parameters via a wireless link provided by the handheld radio.

HANDHELD FUNCTIONAL DESCRIPTION

The handheld communicates with the microwave radio via a low power wireless link operating at 418 MHz. The modulation format is 9.6 kb/s on-off keying (OOK) and the data format is a string of bytes consistent with the IEEE-1185 protocol wherein the first byte transmitted in a packet has the parity bit set to one as a start-of-message flag. All following bytes have the parity bit set to zero. A mark signal is represented as carrier off; a space is represented as carrier on. The handheld always initiates communication with the microwave radio and therefore is the master unit. The microwave radio will not respond unless it receives a previously assigned unique address together with a valid command. The transmitted message also contains a message length byte as well as a checksum byte to guard against reception of erroneous commands in the presence of noise or interference. Message lengths vary from a minimum of seven bytes to a maximum of 11 bytes, depending on the command issued. The format of the message transmitted from the handheld is illustrated in Appendix A. See Appendix C for details of the command set. Under no conditions will the transmit time exceed 128 milliseconds

The handheld contains a numeric keypad for operator data entry and display scrolling. Before it can be used, the handheld must be activated by pressing and holding the “enter” key until the display illuminates. A serial number must then be entered before access to any status or control screens is permitted. The handheld will automatically shut itself off if no keypad entries are made within a one minute period. The handheld transmits one message for each operator entry session that is concluded by pressing the “enter” key. Operation of the handheld is described in Appendix B.

HANDHELD HARDWARE DESCRIPTION

A block diagram of the handheld hardware is shown in Fig. 1. Two printed circuit cards are used to contain the entire electronics: the RF assembly contains the transmitter and receiver integrated circuit and the Digital Assembly contains the digital control circuits and connectors to interface with the display module and keypad. The keypad is an assembly integral to the handheld case. These assemblies are powered by four size AA batteries. The antenna connection is through a reverse SMA connector attached to a captivated bracket internal to the case, also serving as the antenna counterpoise. The antenna is a 3.5 in. helical wound flexible monopole with a reverse SMA threaded connector. Peak RF power delivered to the antenna is -4.5 ±2.5 dBm. Receiver sensitivity is approximately –80 dBm.

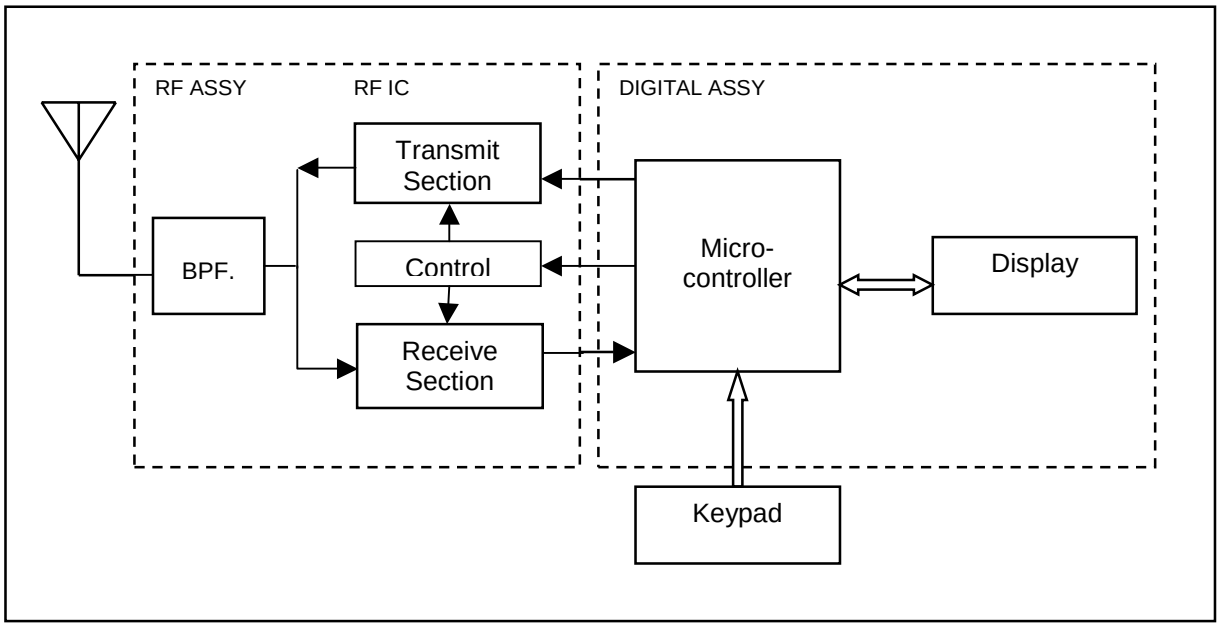

Figure 1 – Handheld Radio Block Diagram

BPF (Bandpass Filter)
The bandpass filter provides RF selectivity to reject unwanted signals beyond ±15 MHz from the center frequency. The filter is a discrete lumped element design having about 5 dB of insertion loss.

RF IC Receive Section
The receiver section is part of the RF integrated circuit containing a SAW filter at the antenna input connection to attenuate unwanted signals. The filter is followed by a high gain, sequentially-switched amplifier chain operating at the receiver input frequency. The output of the amplifier chain is fed to an envelope detector circuit whose output is low-pass filtered to remove noise and improve data SNR. The filtered waveform is processed by a data slicer to recover the received data. The output of the receiver module is fed to the digital assembly. A block diagram of the receiver IC is shown in Figure 2.

The receiver module has no internal local oscillators or IF. An internal switching circuit operating at approximately 100 kHz is used to sequentially switch the internal amplifiers to allow high gain operation and prevent oscillation.

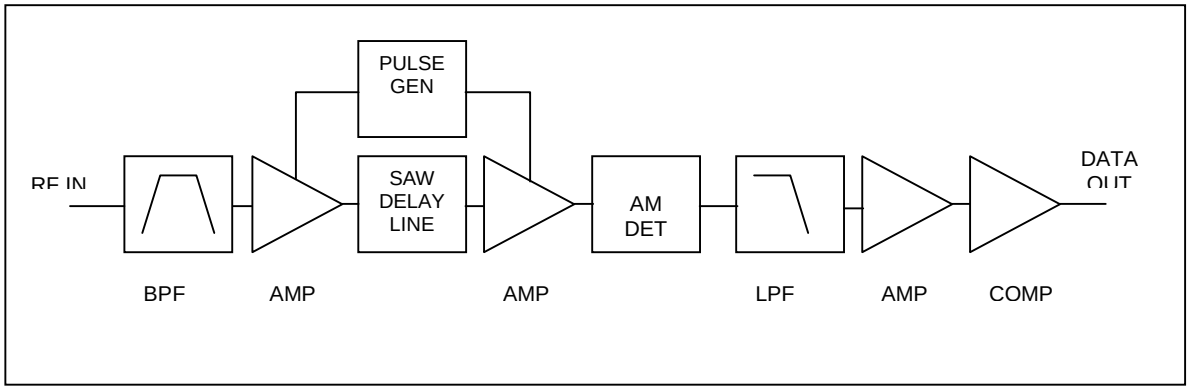

Figure 2 – RF IC Receiver Block Diagram

RF IC Transmit Section

The transmitter section is part of the RF integrated circuit containing a SAW oscillator operating at 418 MHz., followed by an amplifier that produces approximately one milliwatt of RF. The RF output is filtered with a SAW bandpass filter to attenuate the signal harmonic content. The oscillator is switched on by the transmit data from the Digital Assembly. When no data is being transmitted, the Transmit Module is powered off. A block diagram of the Transmitter IC is shown in Fig. 3.

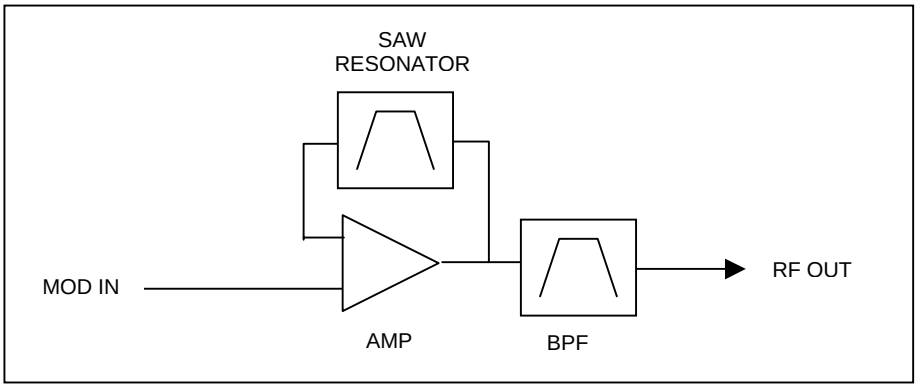

Figure 3 – RF IC Transmitter Block Diagram

Digital Assembly

The digital Assembly contains all the circuits necessary to interface with the keypad, display and the RF Assembly as well as the battery power switch. A 68HC11 microcontroller performs all the control functions as programmed by its embedded code. The master clock for the microcontroller operates at 3.686 MHz.

Serial data is received from the RF Assembly and checked for an address header that matches the address entered by the operator at the beginning of the session. If correct, the subsequent data received is processed and the results passed to the display for viewing.

The keypad is continuously strobed for keystroke entry. Valid data entered is processed into a serial data stream that is fed to the RF Assembly for transmission. As the transmit data is produced, a transmit command is sent to the T/R switch. Immediately following data transmission, the switch is returned to the receive position.

Activation of any keypad key starts a one minute timer. If no other keystrokes occur in this time, the handheld is automatically shut off by disconnecting the battery. The handheld can only be powered on by pressing the keypad “enter” key. Thereafter, the microcontroller holds the handheld in the on state until the timer resets or the operator commands the handheld to power down via a menu option.