THEORY OF OPERATION

This theory of operation covers the Honeywell Models

TR-866 ( ) COM, NV-875( ) NAV

and the NC-861( ) NAVCOM.

Theory of operation

The Honeywell NC-86xx series of radios are a series of aircraft radios intended to be used as “third” or auxiliary navigation and communication radios.

The NC-861B, as tested, consists of the following:

1. VHF com transceiver capable of both 25 Khz and 8.33 Khz channel spacing with an extended frequency range of 118.00 Mhz to 151.975Mhz. The nominal transmitter power is 16W.
2. The VOR/LOC section is capable of VOR and localizer reception in the range of 108.00Mhz to 117.95Mhz.
3. The Glide slope receiver section is capable of reception in the range of 328.6Mhz to 335.4Mhz.
4. The Marker section is capable of reception at 75Mhz.

The specific variations are as listed in table I.

Table I

dash no	Voice Com			Data COM Functions			NAV Functions			
	25Khz	8.33Khz	Ext Freq	Mode 0 ACARS	Mode A ACARS	Mode 2	ILS CAT II	VOR	VDB	ILS Cat III
-801	X	X					X	X		
-802	X	X	X				X	X		
-803	X	X			X		X	X		
-804	X	X			X	X	X	X		
-805	X	X	X		X	X	X	X		
-806	X	X		X		X				
-811	X	X					X	X	X	
-812*	X	X	X				X	X	X	
-813	X	X			X		X	X	X	
-814	X	X			X	X	X	X	X	
-815	X	X	X		X	X	X	X	X	
-816	X	X		X		X	X	X	X	
-821	X	X					X	X	X	X
-822	X	X	X				X	X	X	X
-823	X	X			X		X	X	X	X
-824	X	X			X	X	X	X	X	X
-825	X	X	X		X	X	X	X	X	X
-826	X	X		X		X	X	X	X	X

*Unit tested

VOR/COM receiver

The Com Transceiver and the VOR receiver share a common IF amplifier. This precludes operating the Com receiver and the VOR at the same time.

The received RF signal from either the VOR or Com antenna is routed through the first RF preselector and amplifier stage. The stage gain of this section is approximately 20dB. The delayed AGC is applied to these stages to enhance the clarity of the received signal and to expand the dynamic range of the receiver.

The signal is then further processed in the second preselector stage. The bandwidth limits are set in the first and second preselector stages depending upon the function selected.

The mixer uses high side injection, that is, the local oscillator (LO) operates above the received frequency. This is done to minimize any possible interaction with the other receivers.

The LO is a Voltage Controlled Oscillator with a high and low band. The low band tunes from 129.825MHz to 151.825MHz., for received frequencies of 108.00 to 130.00MHz. The high band LO tunes from 151.825MHz to 173.800MHz for received frequencies of 130MHz to 151.975MHz.

After mixing the receiver RF with the LO, the signal is further amplified in the IF portion of the receiver. The IF operates at 21.825Mhz for all received signals in this portion of the radio. AGC control is applied here to compensate for varying received signal strengths.

The IF differential driver is the final IF stage. The output of this driver is applied t the Analog to digital converter and from there the signal is sent to the appropriate system for further processing.

Selection of radio operating functions are controlled by way of a 429 serial data bus.

VHF Com Transmitter

The VHF com transmitter receives its inputs from the receiver VHF synthesizer and uses a reference frequency of 52.5MHz. The high and low VCOs have the capability to cover the entire range of 108 to 152MHz. The transmitter only operates in the range of 118.00 to 151.975MHz. Either the high or low synthesizer is selected depending upon the transmit frequency selected. The VCO is set up in a phase locked loop to stabilize the frequency sent to the RF amplifiers.

The modulation is received in digitized format and translated into I and Q signals, where they are injected into the vector modulator. The modulated RF signal is sent to 2 stages of preamplifiers and a stage of final amplification where it is then routed to the VHF antenna.

The pre-driver, driver and final stages all have current sense circuitry to monitor their respective current draw. These signals are used to control the biasing of each stage to keep them in a class A operation.

The forward and reverse power detectors are used to monitor the integrity of the transmitted signal.

Glide Slope receiver

The glide slope receiver operates in the range of 328.6Mhz to 335.4Mhz.

Signals form the antenna are first sent to an RF preselector and amplifier. This stage uses a single stage of RF amplification. It also uses two stages of delayed AGC to enhance the dynamic range of the receiver.

The received RF signal is then sent to the mixer which uses high side injection of the LO. The IF amplifier stages operate at 75 MHz, and the LO operates at 404 to 410 MHz. The actual frequency is determined by the VOR/LOC tuning and is paired with the localizer tuning. Localizer frequencies are the odd decimal frequencies in the range of 108.10 to 112.95 MHz. (108.**1**0, 108.**1**5, 108.**3**0, 108.**3**5 etc.)

The last stage of IF is a differential driver and the output of this stage is sent to an A/D converter for further processing.

Marker receiver

The marker receiver is a “0” based converter. That is it receives the 75MHz signal and does not convert it to an IF frequency.

The marker receiver uses a two level sensitivity setting for proper operation at high altitude and low altitude flight operations. The signal is received from the antenna and sent through a roofing filter and then through a 75MHz crystal filter. Only one stage of AGC is used in this system. The bandwidth of the crystal filter is +/- 31KHz. From there the 75MHz signal is sent to the differential driver. The output of the driver is sent to the A/D converter for further processing.