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INSTRUCTION BOOK (DRAFT)
Jaguar 700P_900MHz

1. Receiver Circuit

The FM dual-conversion super heterodyne receiver is designed for operation in the 935-941 MHz frequency range. The Receiver has intermediate frequencies (IF) of 115.65MHz and 450kHz. Adjacent channel selectivity is obtained by using two band pass filters, a 115.65MHz crystal filter and a 450kHz ceramic filter. The RX detector is the phase digitizer.

1-1 Receiver Front-end

A RF signal from antenna is coupled though the low pass filter/antenna switch, and band pass filter to the input of low noise amplifier Q101. The output of Q101 is coupled through band pass filter to input of 1íst Mixer Z101. Front End selectivity is provided by these band pass filter.

1-2 1íst Mixer

The 1íst Mixer is a Double-Balanced-Mixer Z101, that converts a RF signal the 935-941 MHz range to 115.65MHz 1íst IF frequency. The signal on the output of Z101 is provided to the input of 1íst IF amplifier Q102.

1-3 1íst IF

The 1íst IF signal 115.65MHz from the output of the 1íst Mixer is coupled through 1íst IF amplifier Q102 to Crystal filter FL103. The highly selective crystal filter FL103 provide the first portion of the receiver IF selectivity. The output of the filter is coupled through the impedance-matching net work to IF Receiver U101.

1-4 2índ Mixer, 2índ IF filter and 2índ IF amplifier

IF Receiver U101 is an one-chip IC for digital communication system. It includes 2índ Mixer, 2índ IF amplifier and Limiter amplifier. With the internal circuits of U101, The 1íst IF signal is amplified and applied to the input of 2índ Mixer. The 2índ local injection frequency 115.2MHz is applied from 2índ local amplifier Q104 to another input of the 2índ Mixer. The 2índ Mixer converts a 1íst IF signal 115.65MHz to 2índ IF frequency 450KHz. Then the 2índ IF signal is applied to Ceramic Filter FL105, which provides the 450KHz selectivity. The output of the 2índ IF filter is applied through 2índ IF amplifier and Ceramic Filter FL104 to Limiter amplifier. This IF signal is amplified and balanced outputs, RXIF and RXIF, are sent to HILLARY. These

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two lines, one positive and the other negative, are used to cancel out any noise that might get on the line. These balance outputs is applied to the phase digitizer on HILLARY and detected.

2, Transmitter Circuit

The Transmitter Circuit consists of Modulator IC (U203), Notch Filter, Buffer Amplifier (U202), Low Pass Filter, Band Pass Filter (FL201), PA Module (U201), Automatic Power Control Circuit (Q207, Q201 and U301), Antenna Switch Module (Z302).

2-1 Modulator IC and Notch Filter

The main VCO, in the synthesizer circuit, is programmed to generate the TX local Injection frequencies (896 to 902 MHz and 935 to 941 MHz). The transmitter carrier frequencies are same of TX local Injection frequencies.
Notch Filter consists of C212, C233, C244, and L210. The output of U203 is applied to Notch Filter that is through an attenuator pad R204-R206.

2-2 Buffer Amplifier and Low Pass Filter, Band Pass Filter

The output of attenuator circuit is applied to the Buffer Amplifier U202 that is amplified to +9dBm. The collector voltage for U202 is provided Switch circuit, and is controlled by DPTT.
Low Pass Filter and Band Pass Filter consists of C207, C208, C232, L201 and FL201. These filters are controlled by VCO.BAND.SEL signal from the microcomputer (HILLARY:U700). The output of U202 is applied to PA module input through these Filters.

2-3 PA Module

The input of the PA Module is amplified to about 2W. B+ (7.5 V dc) is connected U201 through RF chokes L211.
The PA Module consists of two stages RF amplifier. The first stage power supply voltage is supplied by power control circuit. The second RF amplifier operates in Class-C. This output can be regulated by power control circuit.

2-4 Automatic Power Control

The Automatic Power Control circuit samples the output power to the antenna to maintain a constant power level across the band. The Automatic Power Control circuit controls the Vcont voltage to PA Module U201.
Directional coupler is include of Antenna Switch Module. Directional coupler provides a sampled signal of transmit power for diode. Diode produce a positive DC voltage proportional to

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the transmitter circuit output power level, that is compared to a comparator (U301) from TX POWER CONT of control unit. The output of U301 is applied to DC amplifier Q207, then the output voltage of Q207 controls to the Vcont of PA Module for constant output power level.

2-5 Antenna Switch Module

The Antenna Switch Module consists of switch circuit and the Low Pass Filter. During transmit, DPTT line from HILLARY is high level. Transistor Q205 turns on supply +7.5V to Antenna Switch Module Z302. When transmitting, the Antenna switch diode is low impedance.

3. Frequency Synthesizer Circui t

It consists of the Reference Oscillator Z305, PLL Frequency Synthesizer chip U305, Loop filter, Rx VCO Z303, and TX VCO Z304.
PLL Frequency Synthesizer chip receives PLL data, and control information from the microcomputer and from this generates the TX/RX RF frequencies. It also provides frequency lock status to the microcomputer.
Rx VCO and TX VCO are locked to the Reference Oscillator by a single direct-divide synthesis loop consisting of the Feedback Buffer, Prescaler, and PLL Frequency Synthesizer chip.
The TX VCO operates over a frequency range of 896-902MHz, 935-941MHz. The Rx VCO operates over a frequency range of 819.35-825.35MHz.

3-1 Reference Oscillator

The reference oscillator consists of a 1.5ppm TCXO (Temperature Controlled Compensated Crystal Oscillator). The standard of reference oscillator frequency is 19.2MHz.
The TCXO is enclosed in a RF shielded can. The TCXO is compensated by internal temperature compensated circuit for both low and high temperature. With no additional compensated the oscillator will provide 1.5 PPM stability from -30_C to +60_C.

3-2 PLL Frequency Synthesizer chip

PLL Frequency Synthesizer chip U305 contains a programmable reference oscillator divider(R), prescaler, phase detector, and programmable VCO dividers (+N, A).
The reference frequency 19.2MHz from the reference oscillator is divided by a fixed integer number to obtain a 12.5KHz channel reference for the synthesizer.
The internal phase detector compares the output of the reference divider with the output of internal counter. The count counter receives as its input the VCO frequency divided by the Prescaler and programmed by the microcomputer.
This results in an error voltage when the phase differ and a constant output voltage when phase-detector input compare in frequency and phase. If a phase error is detected, an error voltage is

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developed and applied to the VCO DC offset and loop filter to reset the VCO frequency. The count of the +N, A counters is controlled by the frequency data received on the SC.CLK, SC.DATA - and SC.SYN1LE- line from the microcomputer.
When a different channel is selected or when changing to the transmit or receive mode an error voltage is generated and appears at the phase-detector output, causing the Phase Locked Loop to acquire the new frequency.

3-3 Loop filter

The Loop filter consists of R314 through R319 and C321 through C326. This filter controls the bandwidth and stability of the synthesizer loop.
When a different channel changing or changing to the transmitter or receiver mode, analog switch is controlled by VCO RX/TX for PLL lock up first. The output of the filter is applied to the varicaps in the transmitter and receiver VCO to adjust and maintain the VCO frequency. The use of to VCO allows rapid independent selection of transmit and receive frequencies across the frequency split.

3-4 RX VCO

The RX VCO consists of low-noise silicon transistor oscillator, and followed by high-gain buffer.
The VCO is switched on and off VCO RX/TX line. When VCO RX/TX is low, the Rx VCO is turned on, transistor Q301 is on. The RX VCO output is typically 0dBm. The output is applied to the PLL Frequency Synthesizer chip for VCO frequency control and as the Receiver frequency to Rx 1íst Mixer through the 1íst Local oscillator buffer amplifier. The VCO voltage need only be set once at some frequency of the band and split, after which it operates over the entire split with no additional tuning.

3-5 TX VCO

The TX VCO is basically the same as the Rx VCO. The VCO consists of silicon transistor oscillator followed by high-gain buffer amplifier. When VCO RX/TX is high, the TX VCO is turned on, transistor Q302 is on.

3-6 Lock Detect

The Lock Detect signal is outputted from synthesizer IC (U305-18). The LOCK (U305-18) is low if a large frequency error exist, and will carry unlock condition to the microcomputer.