

Theory of Operation on Atlantis

The Atlantis Handheld Radio Transceivers are comprised of one main PCB.

The main PCB contains the transmitter, receiver, and control circuits.

1) Receiver

The receiver circuit adopts dual conversion superheterodyne with 1st IF 21.7MHz and 2nd IF 450kHz

Front-end

Front-end consists of pre-selector filter, RF Amplifier, Post-selector filter. The receive signal is routed through C71 and selected by C158, C202, C204, C197, C208, L31, L34, L35, L36 to amplified around 13dB at RF amp. Q17.

This circuit removes unnecessarily spurious 1st Image.

A. First Mixer

The signal from Front-end is input to Q18 base of 1st mixer. 1st local signal generated from VCO is input to Q18, emitter. These two signals are mixed at Mixer into 1st IF signal 21.7Mhz, which is resonated in parallel at C151, L27 and inputted to XF2, Monolithic crystal filter.

B. IF Amplifier

1st IF signal from XF2 is amplified about 15dB at IF amp Q19 and inputted to IC7, IF IC.

IC7 includes 2nd Mixer, 2nd Local Oscillator. The signal from 2nd Mixer is refined removing unnecessary spurious signal and detected through high gain liner amp. This detected signal is inputted to IC7 pin9.

C. AF Amplifier

De-emphasis functions to get 6dB/oct by R124, C145 and this signal controls volume of sound by RV6.

IC10 can operate a speaker as audio current amplifier amplifying the signal. The operating current can be reduced by mute signal.

D. Squelch

The demodulated signal from IC7 is coupled of noise to C106. The noise is filtered and amplified by C199,104, R104, 165 and rectified by double voltage at D17, C105 and transformed to DC level. And this DC signal is

used as the signal to mute RV7 audio.

E. Audio AMP

De-emphasized to -6 dB/Oct at R124, C145, the volume of sound is controlled by RV6.

IC10 is doing low frequency current amplify as audio amplifier to operate a speaker.

IC5 has mute function and if Pin 2, mute port is high, it's on mute. If it is low, it's unmute.

2) Transmitter

The transmitter consists of Buffer, Power Amplifier, Low-Pass Filter, Antenna Switch, Auto-Power Control.

2-1) Buffer

-6 dBm TX RF signal from VCO is amplified to around $+25$ dBm by buffer Q22,23 to have desired output power at final Amp.

Pie style resister attenuator is used between VCO and Buffer Amp. To minimize the effect of load caused by transmit amplifier in TX.

2-2) Power Amplifier

TX RF Signal form buffer Amp. Gains 6Watt output by final Amp IC9.

Collect of IC9 inputted to 5th Low Pass Filter.

2-3) Low Pass Filter

5th Low Pass Filter reduces the unwanted spurious for TX output power from final Amp.

L24, 25, C129, 136, 130 are Chebisheve Filter.

2-4) Antenna Switch

Ant. Switch is to share the antenna in TX and RX. It prevents TX sensitivity from degradation by LPF. Also, it protects receive circuit by blocking TX signal to receive end, turning on D20, 21.

Flow of the signal in RX is designed to minimize the loss of the signal using the character of series resonance of L23, C158.

2-5) Auto-Power Control

This circuit controls TX Power by detection on the current through R149, 174, 175.

The voltage difference from these resistors is amplified by U2-A and gets the voltage comparing the this signal with the reference voltage from R157, 162 at U2-B.

This voltage difference is kept to stable value by RV2 changing Gate voltage of Final Amp.

Power H/L controls output voltage of U2-A. This function is saving the battery.

3) PLL Synthesizer

Reference frequency is 21.25Mhz and this oscillated frequency is compensated in temperature by the variation of D8 capacitor according to the voltage changes from thermistor.

The frequency from VCO is inputted to PLL IC and this inputted signal is divided by the ratio set by data and compared with reference step frequency.

Then, the difference comes to IC8 PD Port.

PD output turns into DC by PLL LPF R113, 118, C119, 125, 153 so that it can vary VCO control voltage to have set frequency.

Parallel resonance of D19, TC4 and L21 generates TX/RX frequency.

For TX and RX switch, Q24 and D18 switch C110 to control TX/RX frequency oscillation range.

4) Audio and Control circuit

IC7 controls all factions of the radio as Microprocessor.

It detects outer condition such as function data on frequency, Power supply switching and make it operate correctly.

IC U2-D consists of LPF to function WX ALERT decoding correctly. Then, it goes to Q23 to be changed to logic signal so that WX Alert Decoding is enabled.

U2-A, B is TX Audio Amp and limiter. It amplifies the voice signal from C-Mic

and have the character of 6dB/Oct Pre-Emphasis.

This voice signal is controlled by RV2 for the volume.

U2-C is 3kHz LPF and has the character that reduces to 18dB/Oct.

This character minimizes the interference of adjacent channel by voice signal.

Alignment

1. Required test equipment

1) Power supply

has to be variable from 5 to 10v and to 3A current.

2) Frequency counter

has to be able to measure up to 500Mhz

3) Power meter

It has 50 Ω impedance and has to be able to measure up to 10 Watts

4) Modulation meter

has to be able to measure up to 50Mhz and S/N ratio must be more than 50 dB

5) Digital voltmeter

Input impedance must be more than 1M Ω

6) Spectrum analyzer

has to be able to measure up to 2000Mhz

7) Signal generator

has to be able to measure up to 1Ghz

8) Dummy Load

With 50 Ω impedance, It has to have 20-30dB attenuation.

9) Audio Distortion meter

has to be able to measure at least less than 3%

10) Audio Generator

has to be able to measure from 10 to 100Khz

If your Radio Communication Tester includes above equipment, just prepare excluded equipment.

Alignment Procedure

This radio is adjusted to meet all condition in production except special case.
Readjustment is not requirement.

The preparation before adjustment.

- 1) Set the Power Supply voltage to 7.2V and then connect to the radio.
- 2) Connect the connector to Radio Antenna terminal.
- 3) Connect the radio to test equipment.

PLL Synthesizer

- 1) Measure the voltage of Control voltage with High impedance voltage meter.
- 2) Adjust TC4 at RX channel 1 to be 2.0V.
Confirm if it is below 4.5V at RX channel 8.
- 4) Confirm if Channel 1 is in 2.0 ± 0.3 in TX.

Adjustment of Transmitter

- 1) Adjust TC3 to tune the set frequency.
- 2) Adjust RV2 of RF Board to tune the set power.
- 3) Set Audio Generator to be 1kHz 120mVrms and connect to Radio External Jack.
- 4) Adjust RV2 of DIG Board to tune desired modulation.

Adjustment of Receiver

- 1) Set SSG RF level to -47dBm @1kHz 60% Dev.
- 2) Adjust T2 to maximize Audio.
- 3) Adjust SSG RF Level and confirm if 12dB Sinad is below -119dBm .
- 4) Adjust RV7 to open Audio at 12dB Sinad.
- 5) Repeat the above in other channels.