FTA-750 Circuit Description

Receive Signal Path

Incoming RF from the antenna jack is passed through a low-pass filter and high-pass filter consisting of coils L1037, L1038, L1039, L1041, L1042 & L1043, capacitors C1279,C1280,C1283,C1286,C1288,C1289,C1290,C1291,C1295,C1296,C1299 &C1300 and antenna switching diodes D1027 and D1028 to the receiver front end section.

Signals within the frequency range of the transceiver is applied to the receiver front end which contains RF amplifier Q1047 and varactor-tuned band-pass filter consisting of coils L1018, L1023, L1029, L1034 & L1036, capacitors C1208, C1218, C1220, C1223, C1226, C1233,C1234, C1242, C1245, C1258, C1269 & C1272, and diodes D1022, D1024, D1025 & D1026, then applied to the 1st mixer Q1038.

Buffered output from the VCO is amplified by Q1032 to provide a pure 1st local signal between 155.25 and 210.525 MHz for injection to the 1st mixer. The 47.25 MHz 1st mixer product then passes through monolithic crystal filter XF1001 (4.0 kHz BW) or XF1002 (7.5 kHz BW) which strips away all but the desired signal, which is then amplified by mixer post-amp Q1031.

The amplified 1st IF signal is applied to the AM/FM IF subsystem IC Q1029, which contains the 2nd mixer, 2nd local oscillator, limiter amplifier, noise amplifier and AM/FM detector.

A 2nd local signal is generated by 11.7 MHz TCXO X1001 .The11.7MHz signal mixed with the 1st IF signal within Q1029. The 2nd IF then passes through the ceramic filter CF1001(2.0 kHz BW) or CF1002(10.0 kHz BW) to strip away unwanted mixer products.

In the FM mode, a 2nd IF signal from the ceramic filter CF1002 applied to the limiter amplifier section of Q1029, which removes amplitude variations in the 450 kHz IF before detection of the speech by the ceramic discriminator CD1001. Detected audio from Q1029 is passed through the de-emphasis, consisting of the resistors R1243, capacitors C1320.

In the AM mode, detected audio from Q1029 is passed through the audio amplifier Q2003-3 and ANL circuit, then applied to the AF amplifier Q2003-2. When impulse noise received, a portion of the AM detector output signal from the AM/FM IF subsystem Q1029, including pulse noise is rectified by D2029. The resulting DC is applied to the ANL MUTE gate Q2028, thus reducing the pulse noises.

The processed audio signal from Q2003-3 is passed through the amplifier Q2003-1 and Q2003-2 to the volume control IC Q2016. The audio signal is passed through the volume control IC to the AF amplifier Q2002-2 and audio power amplifier Q1007, providing up to 0.7 Watts to 16ohm loudspeaker.

A portion of the AF signal from the AM/FM IF subsystem Q1029 converted into DC voltage within the IC, and provide to the inversion amplifiers Q1045 and Q1050. These amplifier reduce the amplifier gain of the RF amplifier Q1047 while receiving a strong signal.

Squelch Control

When signal is received, appear the DC squelch control voltage at pin 16 of AM/FM IF subsystem Q1029 according to the receiving signal strength. This DC is applied to pin 92 of microprocessor Q2017.

The DC squelch control voltage is compared with the SQL threshold level by the microprocessor Q2017. If the DC squelch control voltage is lower, microprocessor Q2017 control the volume control IC Q2016. and pin24 of Q2016 goes low. thus disabling the AF audio.

Also, the microprocessor stops scanning, if active, and allows audio to pass through the the volume control IC Q2016.

Transmit Signal Path

Speech input from the microphone is passed through the microphone amplifier Q2013, then applied to the ALC amplifier Q2013. The amplified speech signal is passed through the high-pass filter Q2013 and low-pass filter Q2001-2,3 and 4, which adjust the modulation level, then fed to the AM modulator Q1044.

When using the optional headset, the SIDETONE signal from J1002 becomes “HIGH”, turning Pin79 of Q2017 on; pin 7 of Q1021 therefore a portion of the speech signal applied to the AF power amplifier Q1007 as a monitor signal.

The carrier signal from the VCO Q1028 passes through the buffer amplifier Q1032 and TX/RX switch D1018.

The signal from D1018 is amplified by Q1037 and Q1040, and ultimately applied to the final amplifier Q1044 which increases the signal level up to 5 watts output power. The transmit signal then passes through the antenna switch D1027, and is low-pass filtered to suppress away harmonic spurious radiation before delivery to the antenna.

Automatic Transmit Power Control

RF power output from the final amplifier is sampled by C1282/C1287 and is rectified by D1029. The resulting DC is fed through the Automatic Power Controller Q1046, thus allowing control of the power output.

Transmit Inhibit

When the transmit PLL is unlocked, pin 7 of PLL chip Q1018 goes to a logic low. The resulting DC “unlock” control voltage is switches off TX inhibit switches Q1013, to disable the supply voltage to transmitter RF amplifiers Q1037, disabling the transmitter.

Spurious Suppression

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to the final transmitting frequency. Additional harmonic suppression is provided by a low-pass filter consisting of L1038, L1042 & L1043 and C1279, C1288, C1291, C1296 and C1299, resulting in more than 60 dB of harmonic suppression prior to delivery of the RF signal to the antenna.

PLL Frequency Synthesizer

PLL circuitry consists of VCO Q1026 and Q1028, VCO buffer Q1032, and PLL subsystem IC Q1018, which contains a reference divider, serial-to-parallel data latch, programmable divider, phase comparator and charge pump.

Stability is maintained by the 11.7 MHz frequency reference TCXO X1001.

In the receive mode, VCO Q1026 oscillates between 155.25 and 210.525 MHz. The VCO output is buffered by Q1032, and applied to the prescaler section of Q1018. There the VCO signal is divided by 32 or 33, according to a control signal from the data latch section of Q1018, before being applied to the programmable divider section of Q1018. The data latch section of Q1018 also receives serial dividing data from the microprocessor Q2017, which causes the pre-divided VCO signal to be further divided in the programmable divider section, depending upon the desired receive frequency, so as to produce a 12.5 kHz derivative of the current VCO frequency.

Meanwhile, the reference divider section of Q1018 divides the 11.7 MHz crystal reference from the reference oscillator section by 936 to produce the 12.5 kHz loop reference. The 12.5 kHz signal from the programmable divider (derived from the VCO) and that derived from the reference oscillator are applied to the phase detector section of Q1018, which produces a pulsed output with pulse duration depending on the phase difference between the input signals. This pulse train is filtered to DC and returned to the varactor D1007 and D1008.

Changes in the level of the DC voltage applied to the varactors affect the reactance in the

tank circuit of the VCO, changing the oscillating frequency of the VCO according to the phase difference between the signals derived from the VCO and the crystal reference oscillator. The VCO is thus phase-locked to the crystal reference oscillator.

The output of the VCO Q1026 is buffered by Q1032 before application to the 1st mixer, as described previously.

For transmission, the VCO Q1028 oscillates between 118 and 137 MHz. The remainder of the PLL circuitry is shared with the receiver. However, the dividing data from the microprocessor is such that the VCO frequency is at the actual transmit frequency (rather than offset for IFs, as in the receiving case).

Receive and transmit buses select which VCO is made active by Q1022 (RX) or Q1027 (TX).

When the power saving feature is active, the microprocessor periodically signals to the PLL IC Q1018 to conserve power, and to shorten lock-up time.

Push-To-Talk Transmit Activation

The PTT switch on the microphone is control to pin 27 and 28 of microprocessor Q2017, so that when the PTT switch is closed, pin 4 of Q1021 goes high, pin 5 of Q1021 gose low. This signals cut off the receiver by disabling the 5 V supply bus at Q1012 which feeds the front-end, FM/AM IF subsystem IC Q1029, and receiver VCO circuitry. At the same time, Q1013 activates the transmit 5 V supply line to enable the transmitter.