

## GX1000S Circuit Description

Reception and transmission are switched the 8-bit MPU IC **Q2004 (UPD78F0395)** on the CNTL Unit. The receiver uses double-conversion superheterodyne circuitry, with a 21.4 MHz 1st IF and 450 kHz 2nd IF. The 1st local is produced by a PLL synthesizer, yielding the 21.4 MHz 1st IF. The 2nd local uses a 21.850 MHz crystal oscillator, yielding the 450 kHz 2nd IF. The 2nd mixer and other circuits use a custom IC to convert and amplify the 2nd IF and detect FM to obtain demodulated signals. During transmit, the PLL synthesizer oscillates at the desired frequency directly, for amplification to obtain RF power output. During transmit, voice modulation is applied to this synthesizer. Transceiver functions, such as TX/RX control, PLL synthesizer settings, and channel programming, are controlled using the MPU.

### **RECEIVER**

Incoming RF signals from the antenna connector are delivered to the RF Unit, and pass through a low-pass filter (LPF) consisting of coils L1001 & L1002 and capacitors C1003, C1011, C1024 & C1027, and antenna switching diode **D1003 • D1004 (L308CCB)** for delivery to the receiver front end.

Signals within the frequency range of the transceiver are then passed through a bandpass filter consisting of coils L1010 & L1012 and capacitors C1061, C1067, C1074, C1077, & C1083, before RF amplification by **Q1022 (3SK294)**.

The amplified RF is then passed through a bandpass filter again consisting of coils L1022, L1026, & L1027 and capacitors C1145, C1150, C1155, C1159, C1169, C1170, C1174 & C1179, the pure in-band input signal is delivered to 1st mixer **Q1028 (3SK131)**.

Buffered output from the VCO is amplified by **Q1017 (2SC5006)** and low-pass filtered by coils L1009, L1011, & L1013 and capacitors C1060, C1064, C1071, C1076 & C1079, to provide a pure 1st local signal between 134.65 MHz and 141.875 MHz for delivery to the 1st mixer **Q1028 (3SK131)**.

The 21.4 MHz 1st mixer product then passes through monolithic crystal filters XF1001 ( $\pm 6.5$  kHz BW), and is amplified by **Q1036 (2SC4400-3)** and delivered to the input of the FM IF subsystem IC **Q1029 (TA31136FN)**. This IC contains the 2nd mixer, 2nd local oscillator, limiter amplifier, FM detector, noise amplifier, and squelch gates.

The 2nd local in the FM IF subsystem IC is produced from crystal **X1001** (21.850 MHz), and the 1st IF is converted to 450 kHz by the 2nd mixer and stripped of unwanted components by ceramic filter **CF1001**.

After passing through a limiter amplifier, the signal is demodulated by the FM detector.

Demodulated receive audio from the FM IF subsystem IC is amplified by **Q1033** and **Q1038** (both **2SC4154E**). The audio signal is passed through the AF Mute switch **Q1031** (**2SK2035**) to the AF power amplifier **Q1049** (**LA4425A**), the audio signal is delivered to the 16 Ohm internal loudspeaker and external Speaker terminal in the accessory cable.

### ***PLL SYNTHESIZER***

The 1st Local signal maintains stability from the PLL synthesizer by using a 21.850 MHz reference signal from crystal **X1001**. PLL synthesizer IC **Q1026** (**TB31202FNG**) consists of a prescaler, reference counter, swallow counter, programmable counter, a serial data input port to set these counters based on the external data, a phase comparator, and a charge pump.

The PLL synthesizer IC divides the 21.850 MHz reference signal by 1748 using the reference counter (12.5 kHz comparison frequency). The reference oscillator feeds to the PLL synthesizer IC **Q1026** (**TB31202FNG**), for the 2nd local signal.

The VCO output is divided by the prescaler, swallow counter and programmable counter. These two signals are compared by the phase comparator, and applied to the charge pump. A voltage proportional to their phase difference is delivered to the low-pass filter circuit, then fed back to the VCO as a voltage with phase error, controlling and stabilizing the oscillating frequency. This synthesizer also operates as a modulator during transmit.

The VCO is consisted of **Q1019** (**2SK210GR**) and varactor diodes **D1009**, **D1011** (all **HVU359**), which oscillates at 21.4 MHz below from the receiving frequency. The VCO output passes through buffer amplifier **Q1017, Q1018** (**2SC5006**) to obtain stable output, then applied to the 1st mixer **Q1031** (**3SK131**). The DC supply for the VCO is regulated by **Q1016** (**2SC4154E**).

### ***TRANSMITTER***

Voice audio from the microphone is delivered via the **MIC** connector to the MAIN Unit. After passing through microphone amplifier **Q1001** (**LM2902PW**), a pre-emphasis network, limiter (IDC: instantaneous deviation control), and low-pass filter network **Q1001** (**LM2902PW**), the audio is adjusted for optimum deviation level and delivered to the next stage.

Voice or DSC (Digital Selective Calling) encode signal inputs from the low-pass filter network **Q1001** (**LM2902PW**) is by the VCO **Q1019** (**2SK210GR**) and varactor diode **D1009**, **D1011** (all **HVU359**), which oscillates the fundamental transmit frequency with direct frequency-modulation using varactor diode **D1010** (**1SV214**). The modulated signal passes through buffer amplifier **Q1018** and **Q1017** (both **2SC5006**), diode switch **D1006**

(**DAN235U**) to drive amplifiers **Q1008 (2SC5006)** and RF power amplifier module **Q1014 (S-AV37A)**.

The RF energy then passes through antenna switch **D1003 (L308CCB)** and low-pass filter (LPF) consisting of coils L1001 & L1002 and capacitors C1003, C1011, C1024&C1027 and finally to the antenna connector.

RF output power from the RF power amplifier module **Q1014 (S-AV37A)** is sampled by C1014 and C1021 and is rectified by **D1002 (1SS321)**. The resulting DC is fed through Automatic Power Controllers **Q1002 (LM2904PW)** to RF power amplifier module **Q1014 (S-AV37A)**, thus providing positive control of the power output.

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to the final transmitting frequency, modulated directly in the transmit VCO. Additional harmonic suppression is provided by a low-pass filter consisting of coils and capacitors, resulting in more than 70 dB of harmonic suppression prior to delivery of the RF energy to the antenna.

### ***DSC Encoder/ Decoder***

#### ***Encoder***

The DCS (Digital Selective Calling) encode signal which D/A converted in the 8-bit MPU IC **Q2004 (UPD78F0395)** on the CNTL Unit is fed through the low-pass filter **Q1001 (LM2902PW)** on the MAIN Unit to the VCO **Q1019 (2SK210GR)**.

#### ***Decoder***

The receiving DCS code is demodulated by the FM IC **Q1029**, then fed through the low-pass filter **Q1037 (2SC4154E)** to the DCS Decoder IC **Q1034 (NJM2211M)** which the receiving DCS code is decoded. The decoded DCS signal delivered to the 8-bit MPU IC **Q2004(UPD78F0395)**

### ***1050 Hz Weather Alert Decoder***

1050 Hz Weather Alert signal from the FM IF subsystem IC **Q1029 (TA31136FN)** is demodulated by **Q1033,Q1038 (2SC4154E)** then is applied to the 8-bit MPU IC **Q2004 (UPD78F0395)** on the CNTL Unit.

### ***MPU***

Operation is controlled by 8-bit MPU IC **Q2004 (UPD78F0395)**. The system clock uses a 18.4320 MHz crystal for a time base.

***EEPROM***

The EE-PROM **Q2006 (BR24L08FVT-W)** retains TX and RX data for all memory channels, prescaler dividing, IF frequency, local oscillator injection side, and reference oscillator data.