GX1100S Circuit Description

Reception and transmission are switched by 16-bit MPU IC Q2008 (R5F212ACSDFP) on the CNTL Unit. The main receiver uses double-conversion superheterodyne circuitry, with a 30.40 MHz 1st IF and 450 kHz 2nd IF. The 1st local is produced by a PLL synthesizer, yielding the 30.40 MHz 1st IF. The 2nd local uses a 29.95 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 MAIN Unit, and pass through a low-pass filter (LPF) consisting of coils L1001 & L1002 and capacitors C1001, C1005, & C1017, and antenna switching diode D1004 (L308CCB) for delivery to the receiver front end.

Signals within the frequency range of the transceiver are passed through a bandpass filter consisting of coils L1009 & L1010 and capacitors C1047, C1050, C1058, & C1064, before RF amplifier Q1019 (3SK294).

The amplified RF is passed through a bandpass filter consisting of coils L1019, L1024, & L1028 and capacitors C1132, C1138, C1145, C1154 & C1160. The pure in-band input signal is delivered to the main 1st mixer Q1027 (3SK131).

Buffered output from the MAIN VCO is amplified by Q1018 and Q1022 (both 2SC5006) and low-pass filtered by coils L1016 & L1022 and capacitors C1034, C1040, & C1049, to provide a pure 1st local signal between 125.650 and 132.875 MHz for delivery to the main 1st mixer.

The 30.40 MHz 1st mixer product is passed through the monolithic crystal filter XF1001 (±6.5 kHz BW), and is amplified by Q1033 (2SC4400).

After that, it delivered to the input of the FM IF subsystem IC Q1036 (NJM2591V). 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 Q1036 (NJM2591V) is produced from crystal X1002 (29.950 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 audio from the FM IF subsystem IC Q1036 (NJM2591V) is amplified by Q1046 and Q1041 (both 2SC4081). The amplified signal is passed through the AF mute switch Q1039 (TC4S66F), the AF AMP mute switch Q1040 (2SK2035) and the front panels volume control. The adjusted audio signal is delivered to the AF power amplifier Q1044 (LA4425A).
The amplified audio signal is delivered to the 8 Ohms internal loudspeaker and external Speaker terminal in the accessory cable.

PLL Synthesizer

The 1st Local signal maintains stability from the dual PLL synthesizer IC Q1031 (TB31202FNG) by using a 29.950 MHz reference signal from crystal X1001. The dual PLL synthesizer IC Q1031 (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 dual PLL synthesizer IC Q1031 (TB31202FNG) divides the 29.950 MHz reference signal by 2396 using the reference counter (12.5 kHz comparison frequency).
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, and 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 consists of Q1025 (2SK210GR) and varactor diodes D1011 and D1013 (both HVU359), which oscillates at 30.40 MHz below from the receiving frequency while receiving, and oscillates at the fundamental transmit frequency during a transmit with direct frequency-modulation using varactor diode D1012 (1SV214). The VCO output passes through buffer amplifier Q1022 and Q1018 (both 2SC5006) to obtain stable output, then applied to the 1st mixer of while receiving, and to the driver amplifier Q1012 (2SC5006) during a transmit.
The DC supply for the VCO is regulated by Q1017 (2SC4154).

Transmitter

The voice from the microphone is passed through the CNTL Unit to the microphone amplifier Q1001 (LM2902PW) on the MAIN Unit, a pre-emphasis network, limiter (IDC: instantaneous deviation control), and low-pass filter network, the audio is

adjusted for optimum deviation level.
The voice or DSC (Digital Selective Calling) encoded signal from the low-pass filter network Q1001 (LM2902PW) is applied to the VCO Q1025 (2SK210GR) which oscillates at the fundamental transmit frequency with direct frequency-modulation using varactor diode D1012 (1SV214). The modulated signal is amplified by the buffer amplifier Q1022 and Q1018 (both 2SC5006), then passed through the diode switch D1007 (DAN235U) to drive amplifiers Q1012 (2SC5006) and RF power amplifier module Q1010 (S-AV37A).
The RF energy then passes through antenna switch D1003 (L308CCB) and low-pass filter (LPF) consisting of coils L1001 & L1002 and capacitors C1001, C1005, & C1017, and finally to the antenna connector.
RF output power from the RF power amplifier module Q1010 (S-AV37A) is sampled by C1008 and C1011 and is rectified by D1002 (1SS321). The resulting DC is fed through Automatic Power Controller Q1024 (LM2904PW) to RF power amplifier module Q1010 (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 80 dB of harmonic suppression prior to delivery of the RF energy to the antenna.

DSC Encoder/ Decoder

Encoder

The DSC (Digital Selective Calling) encode signal which D/A converted in the 16-bit MPU IC Q2008 (R5F212ACSDFP) on the CNTL Unit is fed through the low-pass filter Q1001 (LM2902PWR) on the MAIN Unit to the VCO Q1025 (2SK210GR).

Decoder

Incoming the receiving DSC code on the CH70 (156.525 MHz) from the antenna connector are passed through a SUB-RX RF amplifier Q1020 (3SK294) to the bandpass filter consisting of coils L1020, L1026, and L1030 and capacitors C1135, C1143, C1151, C1155 and C1162 then the filtered signal deliver to SUB-RX 1st mixer Q1028 (3SK131).
Buffered output from the SUB VCO Q1024 (2SK520) is amplified by Q1021 (2SC5006) and bandpass filtered by coils L1033 and L1034 and capacitors C1176, C1181 and C1191, to provide a pure 1st local signal (135.125 MHz) for delivery to the SUB-RX 1st mixer Q1028 (3SK131).

The 21.40 MHz 1st mixer product then passes through monolithic crystal filters XF1002 (±6.5 kHz BW) and buffer amplifier Q1034 (2SC4400-3), then delivere to the SUB-RX FM IF subsystem IC Q1038 (NJM2591V). This IC contains the 2nd mixer, 2nd local oscillator, limiter amplifier, FM detector, noise amplifier, and squelch gates.
The 2nd local is produced by crystal X1001 (21.850 MHz) then deliver to the 2nd mixer in the SUB-RX FM IF subsystem IC Q1038 (NJM2591V). The 1st IF is converted to 450 kHz by the 2nd mixer and stripped of unwanted components by ceramic filter CF1002.
Filtered signal from the ceramic filter CF1002 is applied to the limiter amplifier in the SUB-RX FM IF subsystem IC Q1038 (NJM2591V), and then demodulate by the FM detector in the SUB-RX FM IF subsystem IC Q1038 (NJM2591V). Demodulated signal from the SUB-RX FM IF subsystem IC Q1038 (NJM2591V) is passes through the low-pass filter Q1045 (2SC4154E) to the DSC Decoder IC Q1043 (NJM2211M) which the receiving DCS code is decoded. The decoded DCS signal delivered to the 16-bit MPU IC Q2008 (R5F212ACSDFP).
The SUB-RX 1st Local signals maintains stability from the dual PLL synthesizer by using a 29.950 MHz reference signal from crystal X1002. The dual PLL synthesizer IC Q1031 (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 dual PLL synthesizer IC Q1031 (TB31202FNG) divides the 29.950 MHz reference signal by 2396 using the reference counter (12.5 kHz comparison frequency). The reference oscillator feeds to the dual PLL synthesizer IC Q1031 (TB31202FNG).
The SUB 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, and then fed back to the SUB VCO as a voltage with phase error, controlling and stabilizing the oscillating frequency.
The SUB VCO is consisted of Q1024 (2SK520-K4) and varactor diode D1009 and D1010 (all 1SV286B), which oscillates at 134.225 MHz. The SUB VCO output passes through buffer amplifier Q1021 (2SC5006) to obtain stable output.

1050 Hz Weather Alert Decoder (USA version only)

The 1050 Hz Weather Alert signal from the buffer amplifier Q1047 (2SC4154) is applied to 16-bit MPU IC Q2008 (R5F212ACSDFP) on the CNTL Unit.

MPU

Operation is controlled by 16-bit MPU IC Q2008 (R5F212ACSDFP) on the CNTL Unit. This MPU uses a 18.432 MHz crystal X2001 for the system clock.

EEPROM

The EEPROM Q2003 (BR24L64F) on the CNTL Unit retains TX and RX data for all memory channels, prescaler dividing, IF frequency, local oscillator injection side, reference oscillator data and DSC data.