SPECIFICATIONS

1) GENERAL SPECIFICATIONS

* Channel Frequency (GMRS)	462.5625 ~ 462.7250 MHz
* Channel Frequency (FRS)	467.5625 ~ 467.7125 MHz
* Channel Capacity	22
* Frequency Control	PLL synthesize
* Frequency Stability	± 5.0ppm
* Channel Spacing	12.5 KHz
* Ambient temperature	-30°C to +50°C
* Antenna	Fixed 1/4 Wave
* Power Supply	6.0V Alkaline (4 x AAA) 4.8V Ni-MH (4 x AAA)
* Battery Life	AL: 2.0W-14hours, 1000mA-5(TX):5(RX):90(Standby) Ni-MH: 1.6W-10hours, 650mA-5(TX):5(RX):90(Standby)

2) TRANSMITTER

* RF Output (Conduted Power)	GMRS:2.0 W FRS : 0.7W
* Modulation	F3E
* Audio Distortion	<5% at 1 KHz
* Current Drain	2.0W/800 mA
* FM Hum & Noise	35dB Min
* Spurious and Harmonics emission	-60 dBc

3) RECEIVER

* Sensitivity 12dB SINAD	0.25 uV
20dB Quieting	0.35 uV
* Selectivity	-50dB
* Intermodulation	-50dB
* Spurious and Image Rejection	-50dB
* Audio output power	300mW Max at 8 ohm
* FM Hum & Noise	-45dB

4) DIMENSION

* 115 mm(H) x 60mm(W) x 34 mm(D) without antenna

5) BASIC PACKAGE

* Radio
* User's manual

6) OPTION

* Speaker / MIC
* Ear / Mic

FREQUENCY CHARTS

- **GMRS Frequency Chart**

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	462.5625	15	462.5750
2	462.5875	16	462.6250
3	462.6125	17	462.6750
4	462.6375	18	462.5500
5	462.6625	19	462.6000
6	462.6875	20	462.6500
7	462.7125	21	462.7000
		22	462.7250

- **FRS Frequency Chart**

Channel	Frequency (MHz)	Channel	Frequency (MHz)
8	467.5625	13	467.6875
9	467.5875	14	467.7125
10	467.6125		
11	467.6375		
12	467.6625		

- **CTCSS Tone Frequency Chart**

NO	FREQ.(Hz)	NO	FREQ. (Hz)	NO	FREQ. (Hz)
1	67.0	14	107.2	27	167.9
2	71.9	15	110.9	28	186.2
3	74.4	16	114.8	29	179.9
4	77.0	17	118.8	30	186.2
5	79.7	18	123.0	31	192.8
6	82.5	19	127.3	32	203.5
7	85.4	20	131.8	33	210.7
8	88.5	21	136.5	34	218.1
9	91.5	22	141.3	35	225.7
10	94.8	23	146.2	36	233.6
11	97.4	24	151.4	37	241.8
12	100.0	25	156.7	38	250.3
13	103.5	26	162.2	OF	0

THEORY OF OPRATION

1. Circuit Composition and Operation Theory

The basic explanation for the circuit composition GMRS-1200L consists mainly of the one board controlling the analog circuit parts and the digital circuit parts for the other control.

2. Receiver

GMRS-1200L transmission parts is composed in the double conversion system, which has the 1st IF frequency of double 21.7 MHz and the 2nd IF frequency of 450 kHz. With the RF fronted which has an excellent band characteristics and skirt characteristics, the 2 pole MCF used in the 1st IF, and the 3 pole ceramic filter in the 2nd IF, the reception interrupting factors such as the image and the sensitivity repression are reduced for the more stable reception.

2-1. RF Front-end

The signal received by the antenna will be transmitted to the band pass filter through the antenna switching circuit consisted of L16, L17, L18, L19, C95, C96, C97, C98. The front RF amplifier transistor Q1 consists of the L1, C7, C8, R1, R2 input band pass filter and F1 output band pass filter, primarily diminishes the other signal rather than the 1st IF image and other signal within the reception band and amplifier only the necessary signal within the RF.

2-2. 1st Mixer

The receiver which has been amplifier in the RF front-end is provided to the base of the 1st mixer Q2. The 1st L/O signal provide from the VCO is supplied to the emitter of Q2 and Converted to the 1st IF 21.7 MHz.

2-3. 1st IF Filter and 1st IF Amplifier

The signal covered by Q2 to 21.7 MHz, the 1st frequency, change its impedance through C13, L5 and then is infused to the fundamental MCF which has the center frequency of 21.7 MHz and the width of +/- 3.75 KHz.
Here, the signal reduces the image and other unwanted signal for the 2nd IF , and changes its impedance again through the R10. Then the signal is infused to the Q6(1st IF amplifier part). The signal infused to the Q6 is amplifier approximately by 20 dB in other to acquire the required reception sensitivity, and infused to the Q6 which functions as the 2nd mixer, the 2nd IF amplifier, and the FM detector.

2-4. 2nd Mixer, and IF, FM Detector (Q6)

The receiver IF signal of 21.7 MHz, which has been infused to Q6 is mixed with the 2nd L/O converted to 450 KHz, the 2nd IF frequency. The receiver signal converted to the 2nd IF signal frequency passed through the CF1, the ceramic filter of 450 kHz again. After the limiting inside the Q6 and the FM demodulating by the quadrature detector inside the Q6, the signal offers the output through the 26th pin of Q6.
The squelch circuit is composed to detect the noises from the received signal demodulate in the 26th pin of the Q6. For this purpose, the noise filter is using the OP amplifier inside the Q6.

2-5. Audio Power Amplifier (Q35)

The receiver audio signal, which has been adjusted to the appropriate electrical volume by controlled CPU and Tone IC are supplied to the 3rd pin of the Q35 and amplified approximately by 20 dB. Then, it turns up the speaker with the maximum output of 0.3 watts.
The 7th pin of Q35 is the audio mute terminal. If a voltage supply to the 7th pin of the Q35 is from VBTT line supplied to this terminal, the Q35 stops functioning as the audio power amplifier regardless of the signal supplied to the 3rd pin of the Q35, and there is no sound emitter from the speaker.

3. Transmitter

The transmitter parts of the GMRS-1200L is designed to amplify the RF signal oscillated and modulated by the synthesizer to approximately 2W by the power FET of Q19, Q20.

3-1. Pre-emphasis

The voice signal input from the microphone is infused to Q6(Mic amplifier part). And The signal is pre-emphasized at the C506, R509. Ther the sigal is MIC amplifierd by Q502A. The signal which comes out of the Q502D is limited to a certain amplitude for the voice signal not to exceed the allowable band width assigned for transmission.

3-2. Tx Power (Q19, Q20)

The transmitted signal of, combined at the driver TR is supplied to the gate of the Q19/Q20 amplifier. The transmitted signal amplifier to 2W here passes the TX LPF of the 2nd characteristics of the L15 and L16, and RX/TX switching takes place by the D4. After this, The signal is provided to the antenna the TX LPF of the 1st characteristics consisted of the L17, L18, L19, C92, C95, C96, C97, C98.

4. Frequency Synthesizer

4-1. Voltage Control Oscillator (VCO)

The VCO of oscillates462.5625 MHz to 462.7250 MHz under the transmission condition and 441.3125 MHz to 441.475 MHz under the reception condition. The VCO consist of the clip oscillator of the Q16 and contains the oscillator frequency of approximately 21.7 MHz during the transmission/reception conversion. That is since the VCO should oscillate relatively low frequency during reception compared to transmission, the D9 is biased by the Q13.
Therefore as a result, the C57 is added in parallel to the resonance circuit of the VCO to oscillate a low frequency. During transmission, a relatively high frequency should be oscillate compared to reception. Therefore, the D9 is adversely biased by the Q13, and as a result , The C57 which is added unparalleled to the circuit of the VCO is removed to oscillate the desired transmission frequency.
The VCO is controlled by the Q6(PLL part) in order to oscillate accurate frequency. The output frequency of the VCO is supplied to the Q6(PLL part) immediately. At the Q6, TCXO (21.25MHz) is compared to the output frequency of the VCO.
The VCO is controlled the loop filter consisted of the R36, R104, L7 and the C50, C49 in order to oscillate the stable frequency wanted for the radio.
The VCO controlled voltage which as passed the loop filter is supplies to the D2 varactor diode, and the VCO an oscillate the PLL programmed frequency by the capacity variance in the D3. In addition, the L8 on the VCO circuit function as frequency for the VCO to be properly controlled by the Q6(PLL part).

4-2. RX/TX Buffer Amplifier (Q17)

The RF signal oscillate at the VCO is provide to the Q2 RX 1st mixer through the Q17 during the reception, and is provide to the Q18 and Q21 power driver amplifier through the Q17 during the transmission.

4-3. PLL Frequency Synthesizer (Q6)

The PLL synthesizer of the signal loop PLL circuit with the reference of 6.25 KHz. The Q6(PLL part) includes all the function such as the reference oscillator, the driver, the phase detector, the lock detector, and the programmable divider. At the reference oscillator, the 21.25 MHz TCXO is connected to the pin 52 of the Q6 to oscillate the frequency of 21.25 MHz. The TCXO (21.25 MHz) is the temperature compensation circuit to maintain the frequency within the allowable error rang even under a low temperature of -30° C. The phase detector send out the output power to the loop filter through 46rd pin of the Q6. If the oscillation frequency of the VCO is low compared to the reference frequency, the phase detector send out output power in positive pulse. If the oscillation frequency of the VCO is high, phase detector send out can maintain the frequency set. The programmable divider maintains the desired frequency with control from the CPU. The dividing ratio, "N" to oscillate the desired frequency is as below :

SEMICONDUCTOR AND FUNCTIONS

Ref No.	Description	Manufacturer	Function
Q1	BFQ67W Vishay		RX RF Amplifier
Q2	BFQ67W Vishay		RX Mixer
Q4	KRA305	KEC	GMRS RF B+ Cotrol
Q5	KTC3875 KEC		GMRS VCO B+ Filter
Q6	AN6311FA	Panasonic	IF Amplifier
			2nd Mixer
			AF Detector
			Noise Squelch
			RSSI
			PLL
			Volume Control
			VOX
Q7	KRA226SKEC		TX B+ Control
Q10	KRA226SKEC		AF IC B+ Control
Q11	KRC404	KEC	AF IC B+ Control
Q12	KRA305	KEC	GMRS VCO B+ Control
Q13	KRC404	KEC	GMRS RX VCO Switching
Q15	KRC402	KEC	AF Mute
Q16	BFQ67W Vishay		GMRS VCO
Q17	BFQ67W Vishay		GMRS VCO Buffer Amplifi re
Q18	BFQ67W Vishay		TX Pre-Amplifier
Q19	2SK3078	Toshiba	TX Power Amplifier
Q20	2SK3078	Toshiba	TX Power Amplifier
Q21	BFQ67W Vishay		TX Driver Amplifier
Q22	BFQ67W Vishay		TX Driver Amplifier-
Q30	KRA305	KEC	Exit PTT
Q35	LM386M	National Semiconductor	AF Amplifire
Q36	R1120N401B	Ricoh	4V Regulator
Q501A,B	LM324MX	National Semiconductor	5-High Pass Filter For Reject CTCSS Tone
Q501C,D	LM324MX	National Semiconductor	5-CTCSS Low Pass Filter
Q502A	LM324MX	National Semiconductor	Mic Amplifier
Q502B	LM324MX	National Semiconductor	OP AMP Center Voltage
Q502C	LM324MX	National Semiconductor	Comparator
Q502D	LM324MX	National Semiconductor	TX Audio Low Pass Filter
Q701	HD6473802	Hitachi	CPU
Q703	KRC404	KEC	CPU Reset
Q710	KRC402	KEC	Mic Mute