

DESCRIPTION

2.983 (c) This transceiver is being prepared for quantity production.

2.983 (d) Transmitter Description

This transmitter is a microcomputer synthesized FM transceiver operating in the 403 to 512 MHz band.

From 1 to 16 channels may be programmed for use as determined by a EEPROM directing the microcomputer.

Features and Options are available as follows:

- A. 16 Channels
- B. Dual Priority Scan
- C. Transmit High/Low RF power
- D. CTCSS Channel Guard encode/decode with or without STE
- E. CDCSS Digital Channel Guard encode/decode with STE
- F. Type 99 decode (Ericsson or Motorola formats)
- G. GE-STAR encode (Standard or Emergency format)
- H. Home Channel operation (Stand alone or with Emergency GE-STAR)
- I. Carrier Control Timer
- J. Switchable bandwidth: 12.5 kHz or 25.0 kHz channel spacing
- K. Microprocessor XTAL frequency shift for Tx or Rx modes
- L. DTMF encode with Auto-Dial feature (KH-600 models only)

 DESCRIPTION

2.983 (d)

(1)

Type of Emission:
14K4F3E, 10K4F3E

(2)

Frequency Range and Band Splits and Frequency Stability:

<u>Band</u>	<u>Band Splits</u>	<u>Frequency Stability</u>
(403 - 512 MHz)	(403.0 - 440.0 MHz)	+/- 2.5 ppm
	(440.0 - 470.0 MHz)	+/- 2.5 ppm
	(470.0 - 512.0 MHz)	+/- 2.5 ppm

(3)

Range of Operating Power:

The power amplifier consists of PA Module IC7.

The RF power output is regulated by sensing variations in the forward power that is fed to the antenna from the final RF power amplifier and adjusting the voltage on an earlier stage of the PA module to hold the forward power constant. Output power is as follows:

(403 - 512 MHz)	4 watts rated power (high RF power mode)
	1 watt rated power (low RF power mode)

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(continued)

(4)

Maximum Power Rating: 4.0 Watts

Input Maximum	15 Watts
Output	4 Watts

(5)

Final Amplifier Voltage and Currents in Normal Operation:

Power Supply Voltage	7.5 Volts
Current	2 Amps

ACTIVE PARTS LIST

2.983 (d) (6) Active Parts Information

Main Board		Integrated Circuits	
Designator	KG P/N	Generic P/N	Description
IC 1	IC013032	TC75W51FU	OP-AMP IC (DCS MOD/MOD)
IC 2	IC013028	TC4W66FU	SW IC (N/W SW)
IC 3	IC042001	MB1505PF	PLL IC
IC 4	IC013034	TC7W66FU	SW IC (SW)
IC 5	IC013019	TC7S66FU	SW IC (SW)
IC 6	IC013033	TC7W02FU	NOR GATE IC (UNLOCK)
IC 7	IC090018	M68732L	RF-PA IC (UHF-L SPLIT)
IC 7	IC090019	M68732H	RF-PA IC (UHF-M SPLIT)
IC 7	IC090020	M68732SH	RF-PA IC (UHF-H SPLIT)
IC 8	IC013017	TA75S01FU	OP-AMP IC (RF Po COMP)
IC 9	IC013031	TC75S51FU	OP-AMP IC (TUNE-V COMP)
IC 10	IC013007	TA31136FN	IF IC
IC 11	IC013028	TC4W66FU	SW IC (CF-SW)
IC 12	IC013028	TC4W66FU	SW IC (CF-SW)
IC 13	IC013017	TA75S01F	OP-AMP IC (AF BUFF)
IC 14	IC013032	TC75W51FU	OP-AMP IC (BUFF)
IC 15	IC042002	MB88347PFV	D/A Converter IC
IC 16	IC076004	RN5VL55C	RESET IC (5.5V)
IC 17	IC011002	TK11250M	REG IC (CONT5V)
IC 18	IC011007	TK11360M	REG IC (VCO6V)
IC 19	IC011002	TK11250M	REG IC (TX5V)
IC 201	IC090021	M38267E8GP	CPU
IC 202	IC103001	AK2342A	BASE-BAND IC (CTCSS)
IC 203	IC013018	TC4W53FU	MULTIPLEXER IC
IC 204	IC104001	CAT24C04JI	EEPROM
IC 205	IC076003	RN5VL40C	RESET IC (4V)
IC 206	IC011002	TK11250M	REG IC (5V)
IC 207	IC013019	TC7S66FU	SW IC
Sub-Board		Integrated Circuits	
Designator	KG P/N	Generic P/N	Description
IC 401	IC025010	NJM2073D	AF-AMP IC

ACTIVE PARTS LIST

Main Board

Designator	KG P/N	Generic P/N	Description
Q 1	TR013014	2SA1586-Y	Chip Tr (PLL LOOP SW)
Q 2	TR013007	2SC4116-GR	Chip Tr (PLL LOOP SW)
Q 3	TR013007	2SC4116-GR	Chip Tr (VCO REG)
Q 4	TR013018	2SC5065-Y	Chip Tr (F. B BUFF)
Q 5	TR013018	2SC5065-Y	Chip Tr (RF AMP)
Q 6	TR013018	2SC5065-Y	Chip Tr (RF AMP)
Q 7	TR036005	2SC3357T	Chip Tr (RF AMP)
Q 8	TR013007	2SC4116-GR	Chip Tr (Po DET SW)
Q 9	TR078027	DTC144EUA	Chip Tr (Po SW,R1=R2=47kO)
Q 10	TR013018	2SC5065-Y	Chip Tr (LOCAL BUFF)
Q 11	TR078018	UMC5N-TR	Chip Tr (RX REG SW)
Q 12	TR013018	2SC5065-Y	Chip Tr (IF BUFF)
Q 13	TR078027	DTC144EUA	Chip Tr (CF SW,R1=R2=47kO)
Q 14	TR078027	DTC144EUA	Chip Tr (CF SW,R1=R2=47kO)
Q 15	TR013007	2SC4116-GR	Chip Tr (SQ TEMP SW)
Q 16	TR013014	2SA1586-Y	Chip Tr (SQ SW)
Q 17	TR078032	DTA144EUA	Chip Tr (TX SW,R1=R2=47kO)
Q 18	TR078027	DTC144EUA	Chip Tr (RESET SW,R1=R2=47kO)
Q 19	TR078015	DTC343TK	Chip Tr (MUTE SW,R1=4.7kO)
Q 201	TR078027	DTC144EUA	Chip Tr (LIGHT SW,R1=R2=47kO)
Q 202	TR078028	DTC314TK	Chip Tr (MUTE SW,R1=10kO)
Q 203	TR078028	DTC314TK	Chip Tr (MUTE SW,R1=10kO)

Sub-board

Designator	KG P/N	Generic P/N	Description
Q 401	TR078028	DTC314TK	Chip Tr (AF MUTE SW,R1=10kO)
Q 402	TR078029	2SB1188-Q	Chip Tr (AF-AMP REG SW)
Q 403	TR013014	2SA1586-Y	Chip Tr (AF MUTE SW,R1=10kO)
Q 404	TR078027	DTC144EUA	Chip Tr (ALM SW,R1=R2=47kO)
Q 405	TR078027	DTC144EUA	Chip Tr (REG SW,R1=R2=47kO)
Q 406	TR078027	DTC144EUA	Chip Tr (SP MUTE,R1=R2=47kO)

Band Pass Filter Board

Designator	KG P/N	Generic P/N	Description
Q 801	TR013018	2SC5065-Y	Chip Tr (RF PRE-AMP)

ALIGNMENT PROCEDURE

6A-C 2.983 (d) (9)

Alignment Procedure

1. Test Equipment

Service Monitor	(HP8920B or equivalent)
DC Voltmeter	(Input Impedance > 1 Mohm)
DC Power Supply	(7.5 Volts at 3 A)
IBM Personal Computer	(or compatible equivalent)
Programming Interface Box	(TQ3370)
Audio Test Box	(TQ0613)
KH Radio Programming Software	[ProGrammer (Conventional Version)]
KH Programming Cable	(RPM 113 2472/1)
KH Battery Eliminator	(BKB 191 203/3)
RF Antenna Adapter	(ST 3559)

Initial setup

Attach Power Supply to KH via KH Battery Eliminator.
 Attach TQ3370 Programming Interface Box to KH UDC connector via Programming Cable.
 Attach Interface Cable between Programming Interface Box and personal Computer.
 Set power supply to 7.5 Volts DC.
 Apply power to KH, and turn radio On/Off switch to On position.
 Execute radio programming software.
 Under software direction, program radio for the following conventional test channels: See Figure

1.

(If test channels are already set to Figure 1, then no further programming is necessary.)
 Turn the radio On/Off switch to the Off position. Remove the programming cable from the TQ3370 box and connect it to the TQ0613 Audio test box.
 Attach an RF coaxial cable (50 ohms) between antenna adapter and the HP8920B.
 Attach a cable from the HP8920B AUDIO OUT port to the TX AUDIO port of the TQ0613 box.
 Attach a cable from the RX AUDIO port of the TQ0613 box to the HP8920B's Audio In port.
 Make sure the HP8920B audio in port status is set to FLOATING.
 Turn radio On/Off switch to On position.

4. Rx Noise Squelch Tuning

- a. Monitor the audio at the internal speaker of the HP8920B.
- b. Set receiver frequency to 420.225, 457.350, or 491.225 MHz (Ch 2 in Figure 1).
- c. Set RF generator level until the Rx SINAD is 8 ± 2 dB SINAD at the HP8920B SINAD meter.
- d. Adjust the squelch opening threshold tracking data until the squelch opens around 8 dB SINAD.
- e. Adjust the squelch closing threshold tracking data until it closes at an RF level that is 1.5 – 2.0 dB lower in signal level than the signal level needed to open the squelch.

ALIGNMENT PROCEDURE

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6. TX Modulation Adjustments
 - a. Set transmitter frequency to 420.025, 457.300, or 491.025 MHz (Ch 2 in Figure 1).
 - a. Set AF generator output level to 100 mVrms.
 - b. Push PTT key on Programming Interface.
 - c. Adjust Tx tracking data until the FM Deviation is 4.5 ± 0.1 kHz.
 - d. Set transmitter frequency to 420.025, 457.300, or 491.025 MHz (Ch 7 in Figure 1).
 - e. Set AF generator output level to zero.
 - f. Push PTT-key on Programming Interface.
 - g. Adjust TX Modulation RV301 until the FM Deviation is $750 \text{ Hz} \pm 100 \text{ Hz}$.
 7. Tx Frequency Adjustment
 - a. Set transmitter frequency to 420.025, 457.300, or 491.025 MHz (Ch 2 in Figure 1).
 - b. Push PTT key on Programming Interface.
 - c. Adjust Tx frequency tracking data until the frequency is within ± 1 ppm.
 8. Transmitter Power Adjustment.
 - a. Adjust Tx power tracking data so that RF power is 5 % above rated power.

Factory Programmed Frequencies

Figure 1

Channel	403 - 440 MHz		440 - 470 MHz		470 - 512 MHz		CTCSS /CDCSS	Wide /Narrow	Tx Power
	Tx Freq.	Rx Freq.	Tx Freq.	Rx Freq.	Tx Freq.	Rx Freq.			
Ch 1	403.050	403.250	440.400	440.450	470.025	470.225		W	H
Ch 2	420.025	420.225	457.300	457.350	491.025	491.225		W	H
Ch 3	439.975	439.750	469.200	469.700	511.975	511.775		W	H
Ch 4	403.050	403.250	440.400	440.450	470.025	470.225		N	L
Ch 5	420.025	420.225	457.300	457.350	491.025	491.225		N	L
Ch 6	439.975	439.750	469.200	469.700	511.975	511.775		N	L
Ch 7	420.025	420.225	457.300	457.350	491.025	491.225	103.5 Hz	W	L
Ch 8	420.025	420.225	457.300	457.350	491.025	491.225	103.5 Hz	N	L
Ch 9	420.025	420.225	457.300	457.350	491.025	491.225	627	W	L
Ch 10	420.025	420.225	457.300	457.350	491.025	491.225	627	N	L
Ch 11	422.125	422.125	452.850	452.850	495.025	495.025	67.0 Hz	W	L
Ch 12	422.125	422.125	452.850	452.850	495.025	495.025	210.7 Hz	N	L
Ch 13	422.125	422.125	452.850	452.850	495.025	495.025	023	W	L
Ch 14	422.125	422.125	452.850	452.850	495.025	495.025	023	N	L
Ch 15	422.125	422.125	452.850	452.850	495.025	495.025		W	L
Ch 16	422.125	422.125	452.850	452.850	495.025	495.025		N	L

CIRCUIT & DEVICE DESCRIPTIONS

2.983 (d) (10-12)

(10) Oscillator and other Frequency Stabilizing Circuit Descriptions:

The frequency reference is a self-contained quartz crystal oscillator (TCXO) module, operating 12.8 MHz.

The TCXO is compensated by internal temperature compensating circuit providing ± 2.5 ppm stability from -30°C to +60°C.

(11) Circuit or devices employed for suppression of spurious radiation:

- a. The radio has metal cover and metal cabinet.
- b. Extensive use of discrete bypass capacitors in the Option and Remote Control Connector of the radio reduces radiation from remote cables.
- c. Low pass harmonic filter follows power amplifier output.
- d. Internal shields surround synthesizer, power amplifier and radio control logic circuitry.
- e. In addition the Control Unit package is metallized to suppress microprocessor radiation.
- f. During acquisition of the synthesizer phase lock loop, the transmitter output is inhibited by an RF gate and the removal of DC voltage to the gain control stage of the RF power chain.

CIRCUIT & DEVICE DESCRIPTIONS

2.983 (d) (10-12)
(Continued)

(11) Circuit or Devices employed for limiting modulation:

- a. Reference is made to the schematic diagram .
Instantaneous audio limiting is accomplished in Audio Signal Processor IC202.
- b. The ASP IC provides both limiting and Post Limiter filtering. The Audio IC runs from a regulated supply voltage, which prevents deviation changes vs. changes in radio power supply voltage. The limiter is set via peak voice deviation tracking data to provide a maximum deviation of ± 4.5 kHz on channels without sub-audible deviation and ± 3.75 kHz on channels with sub-audible deviation. Following the limiter, the mic voice energy plus GE-STAR or DTMF encode signals pass through the post-limiter filter. The output of the PLF is amplified, and then summed and balanced with the sub-audible deviation (either CG or DCG) for input into the modulation inputs of the reference oscillator and the VCO.

(12) Circuit or devices employed for suppression of spurious radiation:

- a. The radio has metal cover and metal cabinet.
- b. Extensive use of discrete bypass capacitors in the Option and Remote Control Connector of the radio reduces radiation from remote cables.
- c. Low pass harmonic filter follows power amplifier output.
- d. Internal shields surround synthesizer, power amplifier and radio control logic circuitry.
- e. In addition the Panel Control Unit package is metallized to suppress microprocessor radiation.
- f. During acquisition of the synthesizer phase lock loop, the transmitter output is inhibited by an RF gate and the removal of DC voltage to the gain control stage of the RF power chain.