INSTRUCTION MANUAL

TS 600 G

SOMMERKAMP®

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TS 600 G
TRANSCEIVER

SERVICE AND MAINTENANCE

1.1 GENERAL

Your Model TS-600G Transceiver was carefully aligned at the factory for maximum output and sensitivity. Except for minor transmitter section and receiver section "peaking" adjustments, presented in the following paragraphs, servicing should be handled only by an authorized service agency. For In-Warranty service, send your transceiver prepaid to your nearest Sommerkamp Service Agency or to: Sommerkamp Electronic, Lugano 3, Box 176, Switzerland. For the name of your nearest Sommerkamp Service Agency, contact your Sommerkamp Field Sales Office. Unauthorized or improper field service may void the Warranty or be in violation of government regulations. Replacement transistors, crystals and certain other components should be obtained from Sommerkamp or Service Agencies.

1.2 TROUBLESHOOTING TRANSISTORIZED TRANSCEIVERS

The following general information will aid in troubleshooting transistorized transceivers.

If transistor emitter voltage is high or there is no difference between the base and emitter voltage, it is an indication of a shorted bypass capacitor or an open emitter resistor. A low emitter voltage indicates an open transformer or a defective resistor or transistor. If the collector voltage is low or equal to the emitter voltage, this indicates shorted or leaky transistor. A zero or close to zero collector voltage indicates an open transformer or decoupling resistor. In a defective stage, check for proper base and collector bias. If these are incorrect check the following.

1. Transformers
2. Capactors
3. Transistors
4. Resistors

Another point to check in the case of incorrect bias on AGC stage is the AGC line and the detector which furnishes a portion of the voltage. Check the printed circuit board for cold or broken solder joints or no solder on component leads, wires, etc. In addition, inspect the printed circuit board for broken lands or delamination.

CAREFUL

While performing repair work or troubleshooting the TS-600G, care should be taken to avoid damaging components, especially transistors. Low wattage soldering irons should be used. Heat sinks should be used to prevent thermal damage to components. Place the heat sink on the component lead between the connection being soldered or unsoldered and the compoment. Carefully inspect all work for cold solder joints or solder splash shorts. Shorts could cause damage to semiconductors.

Replacement of defective components or repare or printed circuits should be made where incorrect voltage or resistance measurements indicate faulty circuitry. A break in a printed circuit land can easily be repaired with an insulated jumper wire across the break. The serviceman is reminded not to replace transistors before a thorough check is made. The Transistor is a dependable component and not subject to replacement as frequently as a vacuum tube.

1.3 SERVICING EQUIPMENT

To properly service the TS-600G the following servicing equipment is recommended:

A. 20,000 ohm/volt Multimeter or VTVM (Hewlett-Packard Model 412 or equivalent). Either type of meter can be used to make all required voltage measurements.

B. Audio Generator (Hewlett-Packard 200 series or equivalent). It is helpful in diagnosing and correcting problems in the audio section.

C. 30% AM Modulated 27Mhz RF Signal Generator (Hewlett-Packard Model 606B or equivalent), with the output calibrated in microvolts and the output impedance of 50-ohm. It is used to aid in locating problems in the RF section of the receiver. The calibrated output will insure proper sensitivity after repair. If a calibrated output is not available, a signal from another station can be monitored to check whether incoming signal strength is normal.

D. Modulated 455Khz Generator (Hewlett-Packard Model 606B or equivalent). It is used for adjustments of IF amplifiers.

E. Oscilloscope covering audio frequencies. It is very helpful in looking at the detector output when troubleshooting the receiver section and also in locating problems in the audio-modulation section.

F. R.F. wattmer (0-5) watts (Bird Model 43 or equivalent). It is used to determine proper operation of the transmitter section. A wattmeter reading both forward and reflected power is recommended. For installation, it will also determine whether problems exist in the transmitter section or the antenna system.

G. 50-ohm dummy load (Bird Model 80A or equivalent). The transmitter section should never be operated without a proper antenna or dummy load attached. To minimize interference while troubleshooting the transmitter section, a dummy load should be used. Two (2) 100 ohm two watt carbon resistor in parallel, soldered to a coaxial cable plug, may be used satisfactorily.

H. Frequency meter or counter (Hewlett-Packard Model 524 or equivalent). If components are replaced in the transmitter oscillator section or frequency problems exist in the transmitter section, the frequency meter assures compliance with FTZ rules and regulations. The frequency meter should be accurate within 0.00050% which is one-tenth the allowable tolerance for this equipment.

I. DC power supply (13.8 ± 0.2 volts @1.5 amp). Since the majority of the equipment is used in vehicles, a power supply simulates mobile operation on the bench. There are many inexpensive battery eliminators on the market that are satisfactory.

J. 8 ohm dummy load. It is used for measurement of the sensitivity and characteristics of the receiver. A carbon or wire-wound resistor of 8 ohm, 3 watts will do.

K. Oscilloscope covering radio frequency at least up to 30Mhz (Hewlett-Packard Model 175A or equivalent). It is used to observe modulated and non-modulated carrier waves to determine there are parastic oscillations and also to set the modulation percentage of the call signal to 90 - 100%.

1.4 VOLTAGE MEASUREMENTS

See Table 1-1, which lists the typical voltage at each transistor and diode. Make all measurements under the following conditions:

A. Unless otherwise noted, set the volume control at minimum and the channel selector at "A" position.

B. Be sure to have a 50 ohm dummy load properly connected for measurements of the transmitter section.

C. The voltage readings are measured between the indicated circuit lands to the chassis ground.

It is recommended that a VTVM be used for these measurements, as the voltage measurements made with a multimeter will yield lower readings in high impedance circuits such as in the base circuits.

1.5 SIGNAL TRACING (See Table 1-2, Signal Levels)

Appropriate test points and the normal receiving signal levels are listed in Table 1-2. The values listed are nominal. Signal levels in a receiver section may differ from those listed by a factor of plus or minum 20 percent without noticeable degradation in performance. A signal generator with an accurately calibrated output attenuator must be used to provide the RF signal voltages indicated. Measurements of injection voltages require the use of an RF VTVM such as the Boonton Electronics Model 91CA. Make RF and audio measurements under the following conditions:

A. For audio measurements, use an audio oscillator as the signal source. Se VOLUME CONTROL at maximum, SQUELCH CONTROL minimum, and terminate the "SP2" output with a 8 ohm resistive load and a VTVM or calibrated oscilloscope.

B. To check RF signal levels, connect the RF signal generator to the point indicated in the table, and rock the generator dial to produce maximum audio output. The generator modulation for 30 percent, 1000 Hz. Note the generator output voltage and compare with the value listed in the table.

1.6 ALIGNMENT PROCEDURE

See Figure 1-1, which indicates the locations of adjustments.

1.6.1 RECEIVER SECTION ALIGNMENT
1.6.1.1 IF ALIGNMENT

A. Set VOLUME CONTROL at maximum, SQUELCH CONTROL minimum and CHANNEL SELECTOR "A" position.

B. Terminate the "SP2" output with a 8 ohm resistor and a VTVM or calibrated oscilloscope.

C. Connect a signal generator to Q2 base through a 0.1uF capacitor, and adjust frequency to center of filter pass band (455Khz) with 30% modulation at 1,000 hz and the output about 17 microvolts.

D. Adjust L5, L6 and L7 for maximum output on VTVM on oscilloscope.

1.6.1.2 RF ALIGNMENT

A. Set VOLUME CONTROL maximum, SQUELCH CONTROL minimum and CHANNEL SELECTOR "A" position.

B. Terminate the "SP2" output with a 8 ohm resistor and a VTVM or calibrated oscilloscope.

C. Connect a 27Mhz AM signal generator to the antenna connector J3. Adjust its output for 1 microvolt with 30% modulation at 1,000 hz and correct receiving frequency carefully.

D. Adjust L1, L2 and L3 for maximum output on VTVM or oscilloscope.

E. Turn the core of L4 (Local oscillator) counterclockwise until the upper end of the core becomes flash with the coil case, by which the oscillation will cease. Then, turn the core clockwise carefully till the oscillation starts and make one more further turn from this point.

1.6.1.3 SQUELCH ALIGNMENT

A. Follow the same procedures as A, B and C in 1.6.1.2.

B. Set SQUELCH CONTROL at maximum.

C. Adjust R6 so that the squelch is open with the signal generator input of 100 microvolts.

1.6.1.4 CALL SECTION ALIGNMENT (Receiver)

A. Connect a frequency counter to "SP1" output.

B. Adjust L8 so as to set the call tone at 1,080 $\pm$ 5Hz while depressing the call switch, S2. Do not tamper with R4, which is for factory adjustment.

C. Turn the power switch off to put the call lamp off.

D. Follow the same procedures as A, B and C in 1.6.1.2.

E. Connect an audio generator to the External AM terminal of the 27Mhz signal generator, and adjust its modulation to 90% at 1,080 $\pm$ 5Hz.

F. Adjust R3 (Call sensitivity adjustment) so as to get the call lamp lighted at the signal input of 1 - 2 microvolts.

1.6.2 TRANSMITTER SECTION ALIGNMENT

1.6.2.1 RF ALIGNMENT

A. Set CHANNEL SELECTOR at "A" position.

B. Remove the shorting test point wire (TP) beside L14.

C. Connect a 0-500 mA DC meter with the positive lead on the circuit land and the negative lead on the collector Q16.

D. Transmit with no load. Adjust L17 for collector current dip.

E. Connector an RF wattmeter (0-5 watts) with 50 ohm dummy load.

F. Turn the core of L12 clockwise to furthermost position, when oscillation ceases. Then turn the core counterclockwise until the oscillation starts and further turn the core for three more turns.

G. Transmit and adjust L14, L16 and L18 for maximum output on the wattmeter. The DC meter should indicate 390mA maximum for 5 watt input to final stage, Q16, with a collector voltage of 12.6 volts DC at TP.

H. Adjust R7 (meter sensitivity adjustment) so as to read the RF power indicator of the set at the center of the black zone on its meter face.

1.6.2.2 MODULATION CHECKING

A. Connect a dummy load with an RF oscilloscope.

B. Check and see if the modulation is normal when spoken into the microphone at transmitting.

C. Check and see if the wave form is normal when the call button is depress at transmitting.

1.6.2.3 CALL SECTION ALIGNMENT

A. Follow the same procedures as A and C in 1.6.2.2.

B. Set R5 (call mod. adj.) for 90 - 100 percent modulation level.

1.7 TROUBLESHOOTING

See Table 1-3-1 for receiver section and Table 1-3-2 for transmitter section.

TABLE 1-1 Voltage Measurements (in DC)

Transistor or Diode		Transistor, Diode Electrodes		
		Collector (Anode)	Base (Gate)	Emitter (Cathode)
Q1	Redeive	8.5	3.0	2.3
	Tramsmit	0	0	0
Q2	R	8.8	3.0	2.4
	T	0	0	0
Q3	R	5.3	2.1	1.5
	T	0	0	0
Q4	R	8.3	3.0	2.4
	T	0	0	0
Q5	R	8.0	2.0	1.4
	T	0	0	0
Q6	R	3.0	0	0
	T	0	0	0
Q7	R (1)	9.0	0.28	0
	R (2)	0.1	0.64	0
	T	0	0	0
Q8	R	9.2	1.4	0.85
	T	9.2	1.4	0.85
Q9	R	13.6	3.2	3.2
	T	13.6	3.2	3.2
Q10	R	2.2	0.7	0.1
	T	2.2	0.7	1.1
Q11	R	13.6	3.2	1.6
	T	13.6	2.2	1.6
Q12 & 13	R	13.6	0.65	-
	T	13.6	0.65	-
Q14	R	13.6	13.6	13.6
	T	12.0	1.4	2.6
Q15	R	0	0	0
	T	6.2	-0.15~-0.2	0
Q16	R	13.8	0	0
	T	12.6	-	-
D5	R	0		9.2
	T	0		0
D8	R	0		9.2
	T	0		9.2
D9	R	0.6		0
	T	0.6		0
D11	R	0		13.8
	T	0		13.8
D12	R	13.6	0	0
	T	13.6	0	0

Remarks: (1)Squelch control set at minimum.
(2)Squelch control set at maximum.

TABLE 1-2 Signal Levels

Signal injection point	Generator output frequency	Generator output voltage	Normal indication
Q10 - Base	1,000Hz	1.2mV	0.5W audio out
D1 - cathode	1,000Hz	27mV	- ditto -
Q5 - base	455Khz	2.3mV	- ditto -
Q4 - base	455Khz	90mV	- ditto -
Q2 - base	27Mhz	14uV	- ditto -
Q2 - emittor	Local oscillator	injection	40-100mV RF
Q1 - base	27Mhz	0.6uV	0.5W audio out
J3 (antenna)	27Mhz	0.6uV	0.5W audio out

TABLE 1-3-1 Receiver Section General Troubleshooting Procedures

Fault	Test Procedures	Designation	Nominal voltage (in DC)			Sympton	Check-up procedures	Remarks
			Collector	Base	Emitter			
No audio output	See 1.5 Signal tracing A.					No B+	1) Check shorted (+) and (-) lands. 2) Check D8, D5.	
		Q10	2.2	0.7	0.1		Check Q10 level.	1.2mV at base of Q10. 13.5mV at collector.
		Q11	13.6	2.2	1.6		Check Q11 level.	13.5mV at base of Q11. 0.65V at collector.
		Q12, 13	13.6	0.65	-		Check Q12 & Q13 levels.	0.53V at base or base. 6.6V at collector to collector.
	See 1.6.1.2 RF alignment A. B. & C.					No detector output	1) Check D1, 2 & 4. 2) Check relay	
		Q3	5.3	2.1	1.5	- ditto -	1) Check Osc. bias voltage. 2) Align L4.	At Channel "A" position.
		Crystal Y1				- ditto -	1) Replace with known good crystal. 2) Align L4 again.	Check Channel Selector S-1-1 and switch wiring.

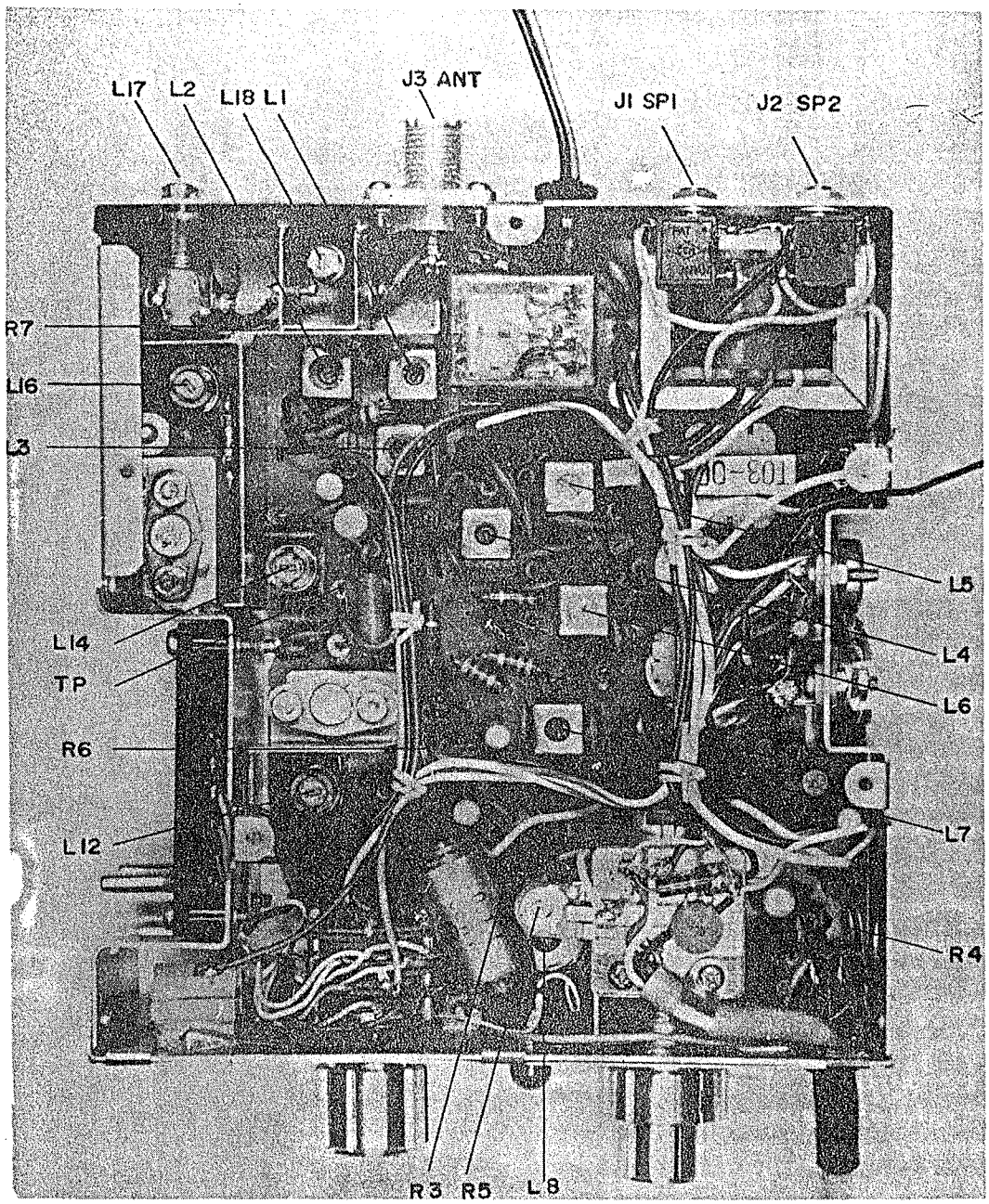
TABLE 1-3-1 Receiver Section General Troubleshooting Procedures (cont'd)

Fault	Test procedures	Designation	Nominal voltage (in DC)			Sympton	Check-up procedures	Remarks
			Collector	Base	Emitter			
Low sensitivity (after proper alignment) w/squelch at min.	See 1.6.1.2 RF alignment A. B. & C.	Q2 emitter				- ditto -	Check Osc. injection voltage.	40 - 100 mV rms.
		Q1	8.5	3.0	2.3			No signal.
		AGC line					Check Q6	3.0V typical, with no signal.
		Q2	8.8	3.0	2.4			With crystal.
	See 1.6.1.1. IF alignment A.B. & C.	Q4	8.3	3.0	2.4			With no signal.
		Q5	8.0	2.0	1.4			
		Q2, 4, 5				Low detector output	Check IF sensitivity at 455Khz for Q2,4 & 5.	See Table 1-2
Mal-function of Squelch	See 1.6.1.3 Squelch alignment	Q7	9.0	0.28	0			Squelch at Min.
		Q7	0.1	0.64	0			Squelch at Max.
							Check Q7 & D4.	

TABLE 1-5-2 Transmitter section general troubleshooting procedure

Fault	Test procedures	Designation	Nominal voltage (in DC)			Sympton	Check-up procedures	Remarks
			Collector	Base	Emitter			
No output or low output	See 1.6.2 Transmitter Alignment A.B. & C.					No voltage on land	Check microphone cable, wiring, shorted lands, relay	
		Q14	12.0	1.4	2.6	No output at Q14		Ic of Q14: 15-20mA.
		Q14				- ditto -	Measure self bias voltage of Q15 on VTVM	Must be -0.15--0.2Vdc across R70.
		Q15	6.2	-0.15 ~ -0.2	0	No output at Q15	1) Check Ic of Q15 2) Check insulator of Q15	Must be 50-60mA
		Q16	12.6	-	-	No output	1) Check Ic of Q16 2) Check insulator of Q16.	Must be 390mA, typical.
						No output	1) Check C57 2) Check relay	
		Bypass capacitors					Individually shunt all bypass capacitors	To see they are not open.
No modulation or shallow modulation	See 1.6.2.2 Modulation checking A.						Check microphone and its cable. Check T2	

LOCATION OF ALIGNMENTS



PARTS LIST

Description	Schematic symbol	Part No.
Capacitors		
0.001uF, 50V, ceramic	C39, 45, 46	0315 102 516
0.002uF, " "	C21	0315 202 516
0.01uF, " "	C7, 8	0315 103 516
0.01uF, 25V, "	C2, 5, 12	0312 103 317
0.02uF, " "	C47, 48	0312 203 317
0.05uF, " "	C4,6,9,16,17,18,19, 35,52,57,63	0312 503 317
0.1uF, " "	C13,14,15,65	0312 104 317
0.1uF, 12V, "	C23, 26	0318 104 117
0.2uF, " "	C22	0318 204 117
1uF, 50V, Electrolytic	C25	0321 010 510
4.7uF, 16V "	C3, 38	0321 479 210
10uF, " "	C27, 28	0321 100 210
22uF, " "	C37	0321 220 210
33uF, 10V "	C10	0321 330 110
47uF, 6V "	C30, 41	0321 470 110
220uF, 10V "	C42	0321 221 110
1000uF, 16V "	C64	0321 103 210
0.5uF, 10V " (solid alum.)	C36	0324 059 110
1uF, " " "	C24	0324 010 110
0.01uF, 50V, polyester	C20, 34	0331 103 516
0.015uF, " "	C40, 43, 44	0331 153 515
0.03uF, " "	C33	0331 303 516
0.1uF, " Styrol	C32	0341 104 514
5pF, " Mica	C62	0351 050 514
30pF, " "	C49	0351 300 514
50pF, " "	C50	0351 500 514
62pF, " "	C58, 61	0351 620 514
75pF, " "	C54	0351 750 514
90pF, " "	C55	0351 900 514
100pF, " "	C11, 31	0351 101 514
200pF, " "	C51	0351 201 514
380pF, " "	C60	0351 381 514
470pF, " "	C56, 59	0351 471 514
1000pF, " "	C29	0351 102 515
1pF, 500V, Fixed composition	C1	0372 010 525
Resistors		
10 ohm, 10%, 1/2W, Compos.	R73	1802 100 125
47 ohm, " " "	R27, 77	1802 470 125
100 ohm, " " "	R69, 70, 74	1802 101 125
150 ohm, " " "	R58, 60, 63, 68	1802 151 125
270 ohm, " " "	R49, 61, 72	1802 271 125
330 ohm, " " "	R71	1802 331 125
470 ohm, " " "	R28, 29, 38, 75	1802 471 125
560 ohm, " " "	R48, 52	1802 561 125
1K " " "	R10,14,24,39,55,62	1802 102 125
1.5K " " "	R19	1802 152 125
2.2K " " "	R8,20,30	1802 222 125
2.7K " " "	R22	1802 272 125
3.3K " " "	R9,17,67	1802 332 125
3.9K " " "	R37	1802 392 125
4.7K " " "	R11,18,21,25	1802 472 125
6.8K " " "	R12,15	1802 682 125
10K " " "	R16,23,45,56,59,66	1802 103 125
15K " " "	R26, 76	1802 153 125

22K, 10%, 1/2W, Compos.	R36,42,46	1802 223 125
33K, " " "	R32,33	1802 333 125
82K, " " "	R40	1802 823 125
100K, " " "	R31,47	1802 104 125
150K, " " "	R13,35,41,51	1802 154 125
220K, " " "	R57	1802 224 125
270K, " " "	R34	1802 274 125
330K, " " "	R43,50	1802 334 125
470K, " " "	R44,53,54	1802 474 125
4.7ohm, 2W, wire-wound	R65	1803 479 025
1 ohm, 1W, Metal film	R64	1806 010 015
2K, variable, semi-fixed	R6	5807 016 000
50K, " "	R3,7	5807 015 000
100K, " " (2-P)	R4	5807 017 000
100K, " "	R5	5807 014 000
50K + 5K (ganged, variable)	R1,2	4808 005 001
Transformers		
Driver	T1	2002 019 000
Output	T2	2002 020 000
IFT		
1st	L5	1214 005 000
2nd	L6	1214 006 000
3rd	L7	1214 007 000
Ceramic Filter		
LF-A8	CF1	0610 005 000
Coils		
Antenna, 1st	L1	1215 015 000
Antenna, 2nd	L2	1215 016 000
RF	L3	1215 017 000
Local	L4	1215 018 000
AF tuning	L8	1211 002 000
22 uH (fixed inductor)	L9	1202 021 000
1.7mH (choke)	L10	2003 006 000
Osc. X'mit	L12	1205 027 000
10 uH (fixed inductor)	L11	1202 020 000
6.6 uH, RF choke	L13	1202 017 000
Driver, X'mit	L14	1205 028 000
2.2 uH, RF choke	L15,16,17,18	1202 018 000
Transistors		
2SC945Q	Q6,7,10	1730 945 170
2SC945R	Q8,9,11	1730 945 180
2SC838F	Q4	1730 838 060
2SC838H	Q5	1730 838 080
2SC838J	Q3	1730 838 100
2SC839F	Q2	1730 838 060
2SC839H	Q1	1730 839 060
2SD142M	Q12,13	1740 142 130
2SC815	Q14	1730 815 000
2SC781	Q15	1730 781 000
2SC799	Q16	1730 799 000
2SF656 (thyristor)	D12	0411 011 000
Diodes		
SD46	D1,6,7,10	0401 007 000
1N34A	D2	0401 004 001
SG9150	D3,4,	0402 006 000
F-14B	D11	0402 009 000
1S1209	D9	0403 005 000
RD-9A	D5,8	0405 005 000

Miscellaneous

Printed circuit board, main		1601 021 001
" " " sub		1601 022 000
Lamp, pilot, 18V/110mA	PL2	3220 012 000
" call, 14V/80mA	PL1	3220 013 000
Meter		1301 004 000
Microphone, 600 ohm		5303 001 000
Hanger, microphone		5303 001 100
Plug, 3.5mm		4613 001 001
Crystal, HC25/U	Y1, 2	
Switch, channel selector	S1	1903 003 000
" push	S2	1907 004 000
Speaker, 3.2 ohm, 1.25W		3910 007 000
Holder, crystal		4920 002 000
Stopper, cord		0812 001 000
Cover, lamp		0811 002 000
Jack, antenna		4330 006 000
Jack, speaker	J1,2	1003 002 000
Relay, 4P-2T		1102 001 000
Fuse	F1	3601 001 000