1. Description

The SYNTOR X radio is a dual—conversion radio with intermediate frequencies of 53.9 MHz and 10.7 MHz. The factory—tuned preselector filter is wide enough to accommodate all frequencies in the receiver bandwidth without retuning.

The receiver circuits are in the RF internal casting, on the RF board, the personality board, and the common circuits board.

2. Theory of Operation

2. 1 INTRODUCTION

The SYNTOR X radio does not use channel elements to generate the first mixer injection frequency. Instead, the radio applies the frequency synthesizer RF output to the first mixer via a three–pole injection filter. The first mixer is a balanced JFET (junction field–effect transistor) device for Range 2; Ranges 1, 3, 4, and 5 use a single–ended mixer. Range 1 uses high–side injection while Ranges 2 to 5 generate a first intermediate frequency (IF) of 53.9 MHz using low–side injection.

The output of the frequency synthesizer's 14.4 MHz reference oscillator splits and applies part of the signal to the injection tripler. The injection tripler uses a Class C bipolar transistor amplifier to generate the required harmonics. The injection tripler output is tuned at a fixed injection frequency of 43.2 MHz. The second mixer uses the two input signals to generate a second intermediate frequency of 10.7 MHz. The second mixer also uses low–side injection.

2. 2 SECOND IF CIRCUITRY

The second IF circuitry uses several stages of filtering and amplification. Selective IF filtering is done with dual-resonator, mode-coupled monolithic crystals cut to a fundamental frequency of 10.7 MHz. No tuning is required in the second IF or detector circuitry.

The second mixer's output is applied to the four-pole filter (Y250 and Y251) via a matching network, and the output of the first six-pole filter is applied to a matching network, then to a high-gain (approximately 45dB) second IF amplifier (U250). The output of the second IF amplifier goes to a matching network, a four-pole filter (Y252 and Y253), a final matching circuit, and the limiter/detector (U251).

2.3 LIMITER/DETECTOR

The limiter/detector (U251) generates a limiting function and a means for recovering audio from the frequency-modulated carrier. Audio is recovered form the second IF signal by means of a quadrature detector in the limiter/detector and an external two-pole dual-resonator crystal. The recovered audio from the limiter/detector output posses through an emitter-follower buffer (Q250), then goes to the audio stages on the personality board (via the personality board and the control unit). The detector buffer supplies approximately 650 millivolts rms to the control unit.

2. 4 AUDIO AND SQUELCH

Detected audio goes to the optional PL/DPL circuitry, then to the control unit for application to the volume and squelch controls. The adjustable outputs for these voltage dividers go to the radio for application to the respective audio and squelch circuits.

The incoming signals are buffered and filtered by the PL-filter/audio—shaping stages to remove any receive PL tones. These stages consist of quad operational amplifier U440 and associated circuitry up to the input of the audio driver (U441). The audio power amplifier consists of audio driver U441, the driver transistor pairs, and the Class B complementary audio finals, Q448 and Q449. The audio power amplifier amplifies the filtered audio signals, and the amplified audio signal is then transformer—coupled to the external speaker. The transmit time—out timer tone and any tones from option boards are also injected at the input of the audio power amplifier stage.

Squelch muting is controlled at two points: at series—connected FET Q442 in the PL filter and shunt transistor Q441

on the volume wiper line. Q442 is used for squelch muting as well as for muting in the priority Channel Scan mode while the priority channel is being sampled. The MUTE line drives not only transistor Q441, but also the audio driver enable switch, Q447. When the audio driver is disabled, the bias current to the audio finals is removed, thus reducing substantially the current drawn by the radio in the standby mode.

2.5 SQUELCH OPERATION

The squelch control on the control unit varies the signal level of the buffered detector output. This signal, a combination of noise and recovered audio, is shaped by the squelch circuitry, which has good squelch characteristics because of:

- a high-pass filter ahead of the first amplifier to attenuate the audio frequencies to a specific level,
- capacitors C403 and C404, which attenuate noise at frequencies above 22 kHz to leave a band of noise susceptible to detection,
- an input network to the detector that further attenuates audio and any harmonics generated by audio limiting at the output of the second amplifier/limiter.

The filtered noise routes to a positive-peak detector, which adds negative-going spikes at its output. These spikes are forwarded to the integrator and the variable squelch-tail control circuitry. The integrator compares the average DC level of the detector's output with a reference level and generates a fast-responding output signal, VO, as follows: V is greater than 4.5V for squelched, and less than 4.5V for unsquelched.

The detector's output also goes to Q402 via a dual-time constant network consisting of R416, CR403, and R417. If the signal is weak, or in the absence of a signal, the noise spike rate becomes high enough to keep C410 discharged below the turn—on voltage of Q402. The collector of Q402 therefore has a potential of +9.6V. When the signal level increases, Q402 turns on and its collector voltage, VO, begins to decrease. With a strong signal, the collector voltage reaches a minimum level of approximately 4V. For a given level at the integrator output, the voltage across C411 varies directly with VO of Q402.

Q403 generates an output signal (SQUELCH TAIL) that is a delayed and inverted version of the integrator output. The microcomputer mutes the audio when the SQUELCH TAIL signal goes low (0V) and unmutes the audio when the signal goes high (4.8V). The Q403 turn—on voltage at the node between R418 and R422 is approximately 4.5V. This voltage is determined by the 9.6V supply, R420, C411, and the dual-time constant network comprised of R418, R419, and CR404.

With loss of signal, the greater the voltage across C411, the longer it takes the node voltage (R418 and R422) to increase above 4.5V, and thus the longer the SQUELCH TAIL signal remains high after loss of signal. Since C411 charges through R419 and CR404, the SQUELCH TAIL detect time is very short. The integrator output is inverted by Q404 and suppled as a CHANNEL ACTIVITY signal. This is a fast–responding output signal that is used only in Channel Scan operation.

2.6 RECEIVER METERING SOCKET

Use the receiver metering socket (J250) to monitor the performance of the receiver as follows;

 MS1 (pin 1 of the metering socket) shows the IF signal frequency relative to the center frequency of the quadrature detector.

Note

This should not be used for "warping" the radio onto frequency.

- MS2 shows the level of the IF signal at the input of the limiter/detector.
- MS3 shows the second mixer bias current, the proper injection level, and the high-level RF signals at the second mixer output.
- MS4 show the strength of the 14.4 MHz signal generated by the reference oscillator.
- MS5 shows the DC current to the first mixer.

2.7 MEASURING QUIETING

When making 20dB quieting measurements on a radio equipped with internal scan (W492), use the following procedure:

- (1) Unsquelch the radio and set the volume control so there are 5.5Vms of noise at the speaker.
- (2) Squelch the radio.
- (3) Turn the signal generator on at one of the scan frequencies. The radio should stop scanning.
- (4) Adjust the RF level until there is 0.55Vms of noise at the speaker (20dB).

3. Receiver Troubleshooting Procedure

This procedure leads to the cause of sensitivity loss in the SYNTOR X radio. Use equipment form the Recommended Test Equipment list in the Maintenance and Troubleshooting Section of this manual.

(1) Perform the preliminary checks of Table 1. If all the meter indications are correct, go to step 2.

(2) Apply a 20 millivolt signal to the antenna connector. If the meter indication at J250–3 rises above 35 uA, check the low IF amplifiers, filters, and quadrature detector.

Note

Troubleshooting of the low IF and detector is easier when you refer to the meter voltages, RF

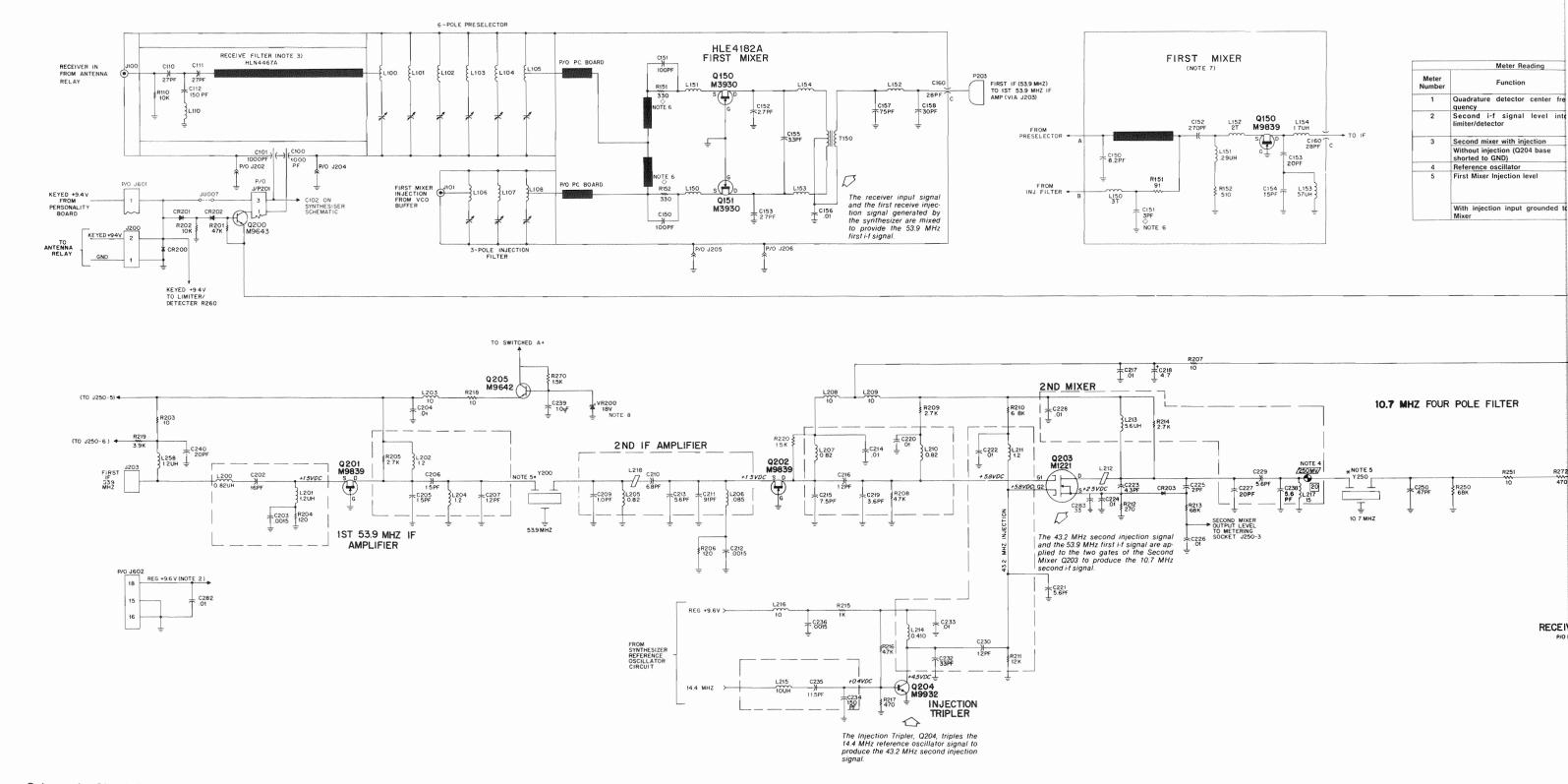
voltages, and DC voltages shown on the receiver schematic diagram at the end of this section.

If the meter indication at J250–3 is less than 35 uA, check the DC voltages of the high IF (Q201, Q202, Q203, and Q204).

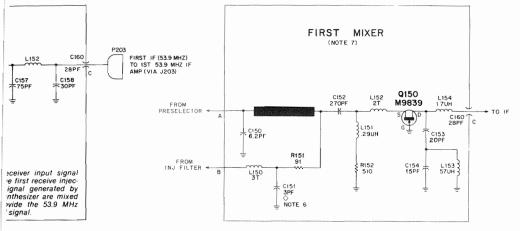
Table 1. Receiver Preliminary Checks

METERING SOCKET PIN	NORMAL INDICATION	IF INDICATION IS INCORRECT
J250-1	25 <u>±</u> 5 uA.	Check the low IF and quad detector. See Note after step 2.
J250–2	a. (without signal): 20 +5 uA. b. (with 20dB quieting signal): should be 2 to 5 uA above first signal.	Go to step 2 of section 3.
J250–3	a. 27 +5 uA. b. (when Q204 base is	a. Check Q203 DC voltages. b. Check Q203 and Q204 shorted: should drop DC voltages 2-3uA.
J250–4	Greater than 10 uA.	Check reference oscillator output level.
J250-5	a. 10–20 uA Range 1, Range 2. b. Shorted (injection output to ground): should drop at least 20%.	a. Check first mixer 25–40 uA for proper DC voltage. b. Insufficient low filter output drive; check VCO and buffer.

RECEIVER FRONT END

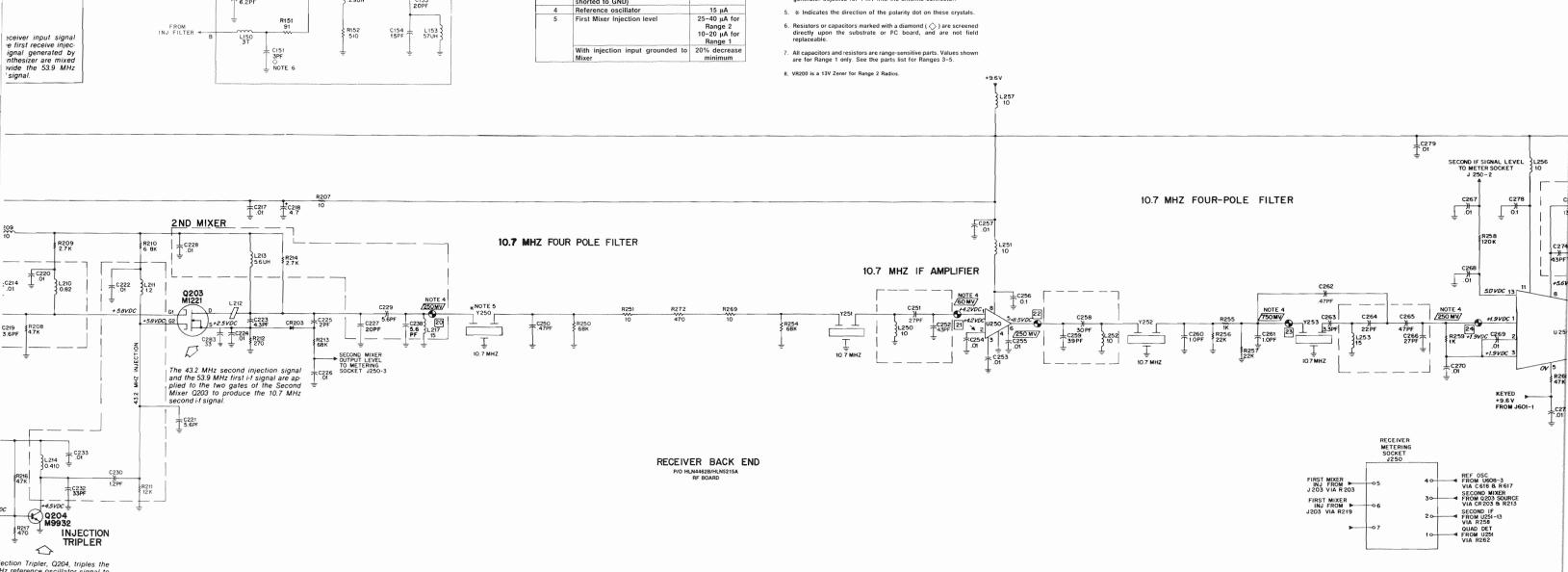


Schematic, Circuit Board Diagrams, and Parts Lists for Receiver PW-0345-F (Sheet 1 of 3) 8/30/88

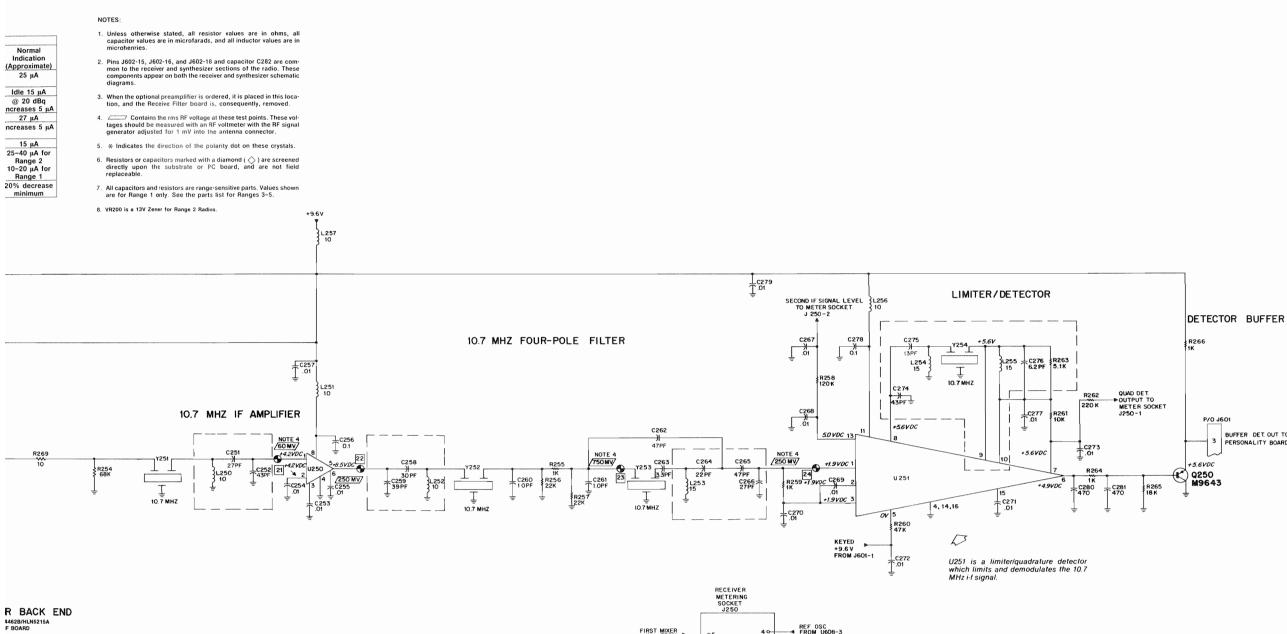


	Meter Reading		
Meter Number	Function	Normal Indication (Approximate	
1	Quadrature detector center fre- quency	25 µА	
2	Second i-f signal level into	Idle 15 µA	
	limiter/detector	@ 20 dBq Increases 5	
3	Second mixer with injection	27 µА	
	Without injection (Q204 base shorted to GND)	Increases 5 p	
4	Reference oscillator	15 µA	
5	First Mixer Injection level	25-40 μA fo Range 2 10-20 μA fo Range 1	
	With injection input grounded to Mixer	20% decreas	

- Pins J602-15, J602-16, and J602-18 and capacitor C282 are common to the receiver and synthesizer sections of the radio. These components appear on both the receiver and synthesizer schematic diagrams.
- Contains the rms RF voltage at these test points. These voltages should be measured with an RF voltmeter with the RF signal generator adjusted for 1 mV into the antenna connector.



ection Tripler, Q204, triples the Hz reference oscillator signal to e the 43.2 MHz second injection



FIRST MIXER INJ FROM ► J203 VIA R203 FIRST MIXER INJ FROM >-J203 VIA R219

P/0 J601

BUFFER DET OUT TO PERSONALITY BOARD

HLN4467A RECEIVE FILTER

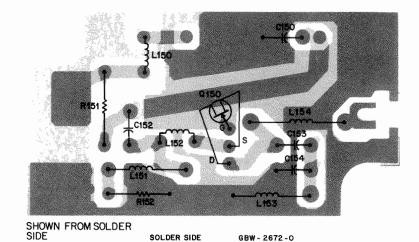
SHOWN FROM SOLDER SIDE



SOLDER SIDE × GDW-0349-0
COMPONENT SIDE * GDW-0350-0

OVERLAY - GDW-0351-0

HLE4181B RANGE 1 HLE4183A RANGE 3, 4 HLE4185 RANGE 5 FIRST MIXER



HLE4182A RANGE 2
FIRST MIXER
INPUT FROM
INJECTION FILTER

THOU FIRST

C157

C157

C157

C157

C158

C159

C159

C150

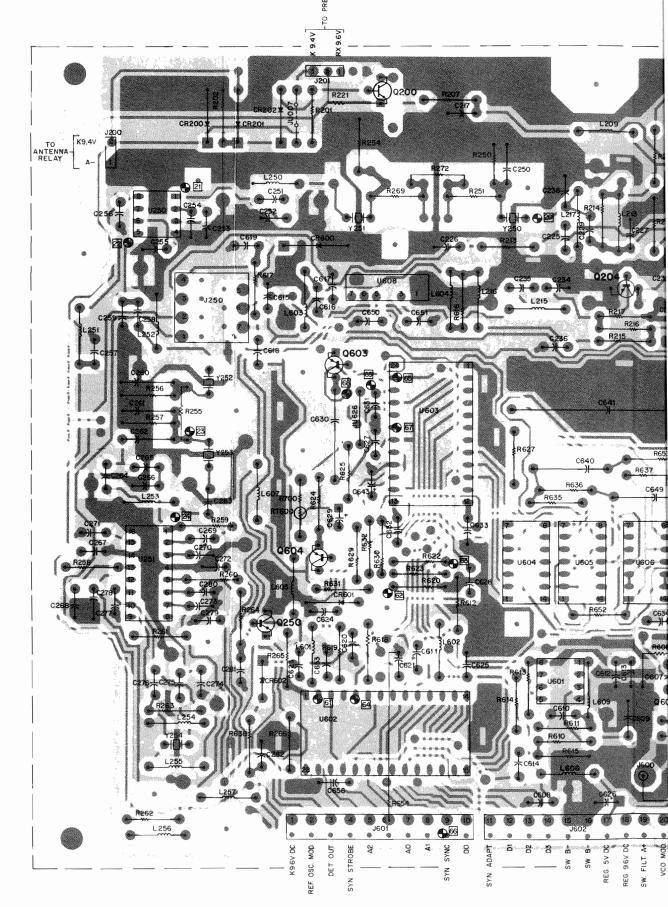
C150

C151

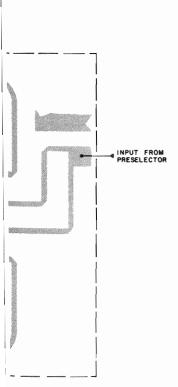
C150

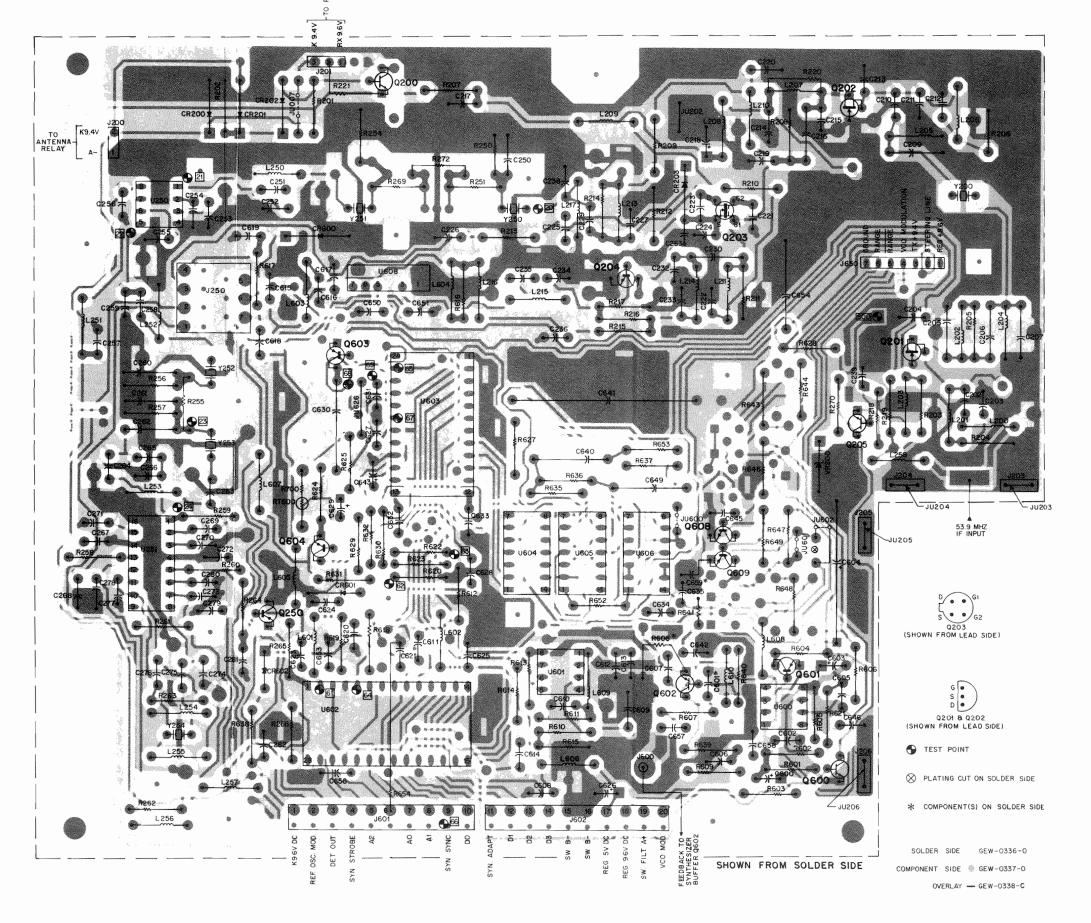
C1

SUBSTRATE GDW-0354-0 OVERLAY-GDW-0355-0 HLN4462B/HLN5215A RF BOARD









RECEIVER Parts Lists

parts list

REFERENCE MOTOROLA

HLN4757A/HLN4758A (with Preamp) Internal Casting (Range 1)
HLN4737A/HLN4488A (with preamp) Internal Casting (Range 2)
HLN5036A/HLN5037A (with preamp) Internal Casting (Ranges 3 and 4)
HLN4940A/HLN4941A (with preamp) Internal Casting (Range 5)

MXW-0348-C

DESCRIPTION

	R.	ANGE 1 PARTS	
		connector receptacle	
J100, 101	09-84135B02	phono	
		coll, RF	
L100	24-80134F01	coded red	
L101-104	24-80134F02	coded blue	
L105	24-80134F07	coded natural	
L106	24-80134F06	coded orange	
L107	24-80134F04	coded yellow	
L108	24-80134F05	coded violet	
		resistor, fixed, ±5%, ¼ ₩	
		unless otherwise stated	
R135	06-11009C41	470 (used with HLN4758A only)	
	n	nechanical part	
	15-84776M07	casting	
		ANGE 2 PARTS	
		connector receptacle	
J100, 101	09-84135B02	phono	
		coll, RF	
L100	24-80134F03	coded green	
L101-104	24-80134F04	coded yellow	
L105	24-80134F03	coded green	
L106	24-80134F01	coded red	
L107	24-80134F04	coded blue	
L108	24-80134F01	coded red	
		resistor, fixed, $\Omega \pm 5\%$, ¼ W	
		unless otherwise stated	
R135	06-11009C41	470 (used with HLN4468A only)	
	п	nechanical part	
	15-84776M09	casting	
	RANG	ES 3 AND 4 PARTS	
	TIMITO		
		connector receptacle	
J100, 101	09-84135B02	phono	
	04.00404540	coll, RF	
L100	24-80134F16	coded orange	
L101-104	24-80134F14	coded violet	
L105	24-80134F15	coded red	
L106	24-80134F13	coded blue	
L107	24-80134F12	coded green	
L108	24-80134F13	coded blue	
		resistor, fixed, Ω ±5%, ¼ W	
D.105	00.440	unless otherwise stated	
R135	06-11009C41	470 (used with HLN5037A only)	
	п	nechanical part	
	15-84776M09	casting	
	R	ANGE 5 PARTS	
	R		
J100, 101	-	connector receptacle	
J100, 101	09-84135B02		
J100, 101	-	connector receptacle phono	
	09-84135B02	connector receptacle phono coll, RF	
L100	09-84135B02 24-80134F08	connector receptacle phono coll, RF coded blue	
L100 L101-104	09-84135B02 24-80134F08 24-80134F11	connector receptacle phono coll, RF coded blue coded red	
L100 L101-104 L105	09-84135B02 24-80134F08 24-80134F11 24-80134F08	connector receptacle phono coll, RF coded blue coded red coded blue	
L100 L101-104 L105 L106	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10	connector receptacle phono coll, RF coded blue coded red coded blue coded brown	
L100 L101-104 L105 L106 L107	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10 24-80134F04	connector receptacle phono coll, RF coded blue coded red coded blue coded brown coded yellow	
L100 L101-104 L105 L106	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10	connector receptacle phono coll, RF coded blue coded red coded blue coded brown	
L100 L101-104 L105 L106 L107	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10 24-80134F04	connector receptacle phono coll, RF coded blue coded red coded blue coded brown coded yellow coded yellow	
L100 L101-104 L105 L106 L107	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10 24-80134F04	connector receptacle phono coll, RF coded blue coded red coded brown coded brown coded yellow coded yellow resistor, fixed, Ω ±5%, ¼ W	
L100 L101-104 L105 L106 L107 L108	09-84135B02 24-80134F08 24-80134F08 24-80134F10 24-80134F10 24-80134F09	connector receptacle phono coll, RF coded blue coded red coded blue coded brown coded yellow coded yellow resistor, fixed, Ω ±5%, ¼ W unless otherwise stated	
L100 L101-104 L105 L106 L107	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10 24-80134F09 06-11009C41	connector receptacle phono coll, RF coded blue coded red coded blue coded brown coded yellow coded yellow resistor, fixed, Ω ±5%, ¼ W unless otherwise stated 470 (used with HLN4941A only)	
L100 L101-104 L105 L106 L107 L108	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10 24-80134F09 06-11009C41	connector receptacle phono coll, RF coded blue coded red coded blue coded brown coded yellow coded yellow resistor, fixed, Ω ±5%, ¼ W unless otherwise stated	
L100 L101-104 L105 L106 L107 L108	09-84135B02 24-80134F08 24-80134F11 24-80134F08 24-80134F10 24-80134F09 06-11009C41	connector receptacle phono coll, RF coded blue coded red coded blue coded brown coded yellow coded yellow resistor, fixed, Ω ±5%, ¼ W unless otherwise stated 470 (used with HLN4941A only)	

ILN4467A Recei	ve Filter Board	MXW-0347-A
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed, pF ± 10% 100V unless otherwise stated
C110-111	21-11014H35	27 ±5%
C112	21-11015B03	150
		coil, rf
L110	24-83884G09	choke, 61/2-turns, coded orange
		resistor, fixed, ω ±5%, ¼ watt unless otherwise stated
R110	06-11009C73	10k
	n	nechanical parts
	42-80259A01	coaxial terminal clip

HLE4182A (Range	2) First Mixer	MXW-0352-[
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
capacitor, fixed, p	F, ± 5%, 100V		
C150,151	21-84873H70	100, ± 2%	
C152	21-13740A13	2.7, ± 0.25 pF	
C155	21-84873H01	3.3	
C156	21-13741A45	.01 uF, ± 20%, 50V	
C157	21-13740A52	75, 50V	
C158	21-13740A40	30, 50V	
coil, RF			
L150.L151	24-80091G05	air wound	
L152	24-80140E06	130 nH	
L153,155	24-80140E07	680 nH	
transistor (see not	e)		
Q150, 151	48-84939C30	N-channel FET, type M3930	
transformer			
T150	24-80138F01	toroid	

8/30/88

note: For best performance, order diodes, transistors, and integrated circuits by Motorola

HLE4181B (Range 1) First Mixer HLE4183A (Ranges 3 and 4) First Mixer HLE4185A (Range 5) First Mixer

MXW-0948-B

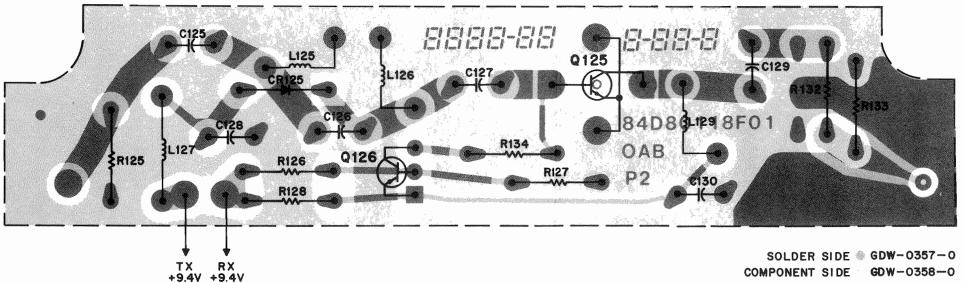
RANGE			REFERENCE	MOTOROLA	DESCRIPTION	
1	1 3 4 5		5	SYMBOL	PART NO.	DESCRIPTION
						capacitor, fixed, pF ± 5%, 100V
			1 1			unless otherwise stated
9	9			C150	21-11014H20	6.2 ± 0.5 pF
_	-	-		C150	21-11014H12	3 ± 0.25 pF
9	-	-	-	C152	21-11015B06	270 ± 10%
_				C152	21-11015B08	390 ± 10%
9	-	-	-	C153	21-11014H32	20
_				C153	21-11014H31	18
₽	- 1	-	-	C154	21-11014H29	15
-		•		C154	21-11014H31	18
						coll, RF
9	0	•		L150	24-11030D02	choke
9				L151	24-82723H28	0.29 μH
9				L152	24-11030D01	choke
9				L153	24-82835G36	0.57 μH
9				L154	24-82835G12	1.7 µH
						transistor (see note)
9				Q150	48-00869839	N-channel FET, type M9839
						resistor, fixed, ±5%, ¼ W
						unless otherwise stated
Ð	-			R151	06-11009A24	91
_				R151	06-11009A22	75
a				R152	06-11009A42	510
-				R152	06-11009A43	560

note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.

Schematic, Circuit Board Diagrams, and Parts Lists for Receiver PW-0345-F (Sheet 3 of 3) 8/30/88

capacitor, fixed, pr	, ±3%, 100 v (unless o	lilei Mise Stated)
C202	21-11014H30	16
C203	08-11051A02	.0015 uF, 63V
C204	08-11051A07	.1 uF, 63V
C205-206	21-82450B13	1.5, 500V
C207	21-82450B08	1.2, 500V
C209	21-82450B47	1.0, 500V
C210	21-11014N14	6.8, ±.5 pF
C211 C212	21-11014H48	91
C212	08-11051A02 21-11014H19	.0015 uF, 63V
C214	08-11051A07	5.6, ±.5 pF .1 uF, 63V 7.5, ±.5 pF 1.2 500V
C215	21-11014H22	75 + 5 nF
C216	21-82450B08	1.2, 500V
C217	08-11051A07	.1 uF, 63V
C218	23-11013D55	4.7 uF, ±20%,
C219	21-11014H14	3.6, ±.25 pF
C220	08-11051A07	.1 uF, 63V
C221	21-11014H19	5.6, ±.5 pF
C222	08-11051A07	.1 uF, 63V
C223	21-11014H16	4.3, ±.25 pF
C224	0811051A07	.1 uF, 63V
C225	21-11014H08	2, ±.25 pF
C226	08-11051A07	2, ±.25 pF .1 uF, 63V
C227	21-11014H32	20
C228	08-11051A07	.1 uF, 63V
C229	21-11014H19	5.6, ±.5 pF
C230	21-82450B08	1.2, 500V
C232	21-11014H37	33
C233	08-11051A07	.1 uF, 63V
C234 C235	21-11015B03 21-80067A30	150, ±10%
C236	08-11051A02	11.5, ±2. pF, 5 .0015 uF, 63V
C238	21-11014H19	5.6, ±.5 pF
C239	23-11019A21	10 uF, ±20%,
C240	21-11014H32	20
C250	21-82450B37	.47, 500V
C251	21-11014H35	27
C252	21-11014H40	43
C253-255	0811051A07	.1 uF, 63V
C256	0811051A13	.1 uF, 63V .1 uF, 63V
C257	08-11051A07	.1 uF, 63V
C258	21-11014H36	30
C259	21-11014H39	39
C260-261	21-82450B47	1, 500V
C262	21-82450B37	.47, 500V
C263	21-11014H13	3.3, ±.25 pF
C264	21-11014H33	22 47
C265 C266	2111014H41 2111014H35	27
C267-273	08-11051A07	.1 uF, 63V
C274	21-11014H40	43
C275	21-11014H28	13
C276	21-11014H20	6.2, ±.5pF
C277	08-11051A07	.1 uF, 63V
C278	08-11051A13	.1 uF, 63V
C279	08-11051A07	.1 uF, 63V
C280-281	21-11015B09	470, ±10%
C282	08-11051A07	.1 uF, 63V
C283	21-83406D71	470, ±10% 1 uF, 63V 33 pF ±5% 500
diode (see note)		
CR200-203	48-11034A01	silicon
connector receptac		
J200	28-84324M01	male, 2 contac
J201	28-84324M02	male, 3 contac
J202-206 J250	42-83891L01 09-84207B01	mixer clip
J230	U3-042U/DU1	female, 7 conta

REFERENCE	ard Range 2 (Receiver s MOTOROLA		REFERENCE	MOTOROLA	MXW-1115-D
YMBOL	PART NO.	DESCRIPTION	SYMBOL	PART NO.	DESCRIPTION
	F, ±5%, 100V (unless o	therwise stated)	L256-257	24-82723H45	10 uH 1.2 uH
202 203	21-11014H30 08-11051A02	16 .0015 uF, 63V	L258 transistor (see no	24-83397L12	1.2 un
204	08-11051A07	.1 uF, 63V	Q200	48–11043C06	PNP
205206	21-82450B13	1.5, 500V	Q201-202	48-11043C12	N-Channel, FET
207 209	21-82450B08 21-82450B47	1.2, 500V 1.0, 500V	Q203	48-84412L21	dual gate MOS-FET
210	21-11014N14	6.8, ±.5 pF	Q204 Q205	48-11043C16 48-11043C05	NPN NPN
211	21-11014H48	91	Q250	48-11043C06	PNP
212 213	08-11051A02 21-11014H19	.0015 uF, 63V 5.6, ±.5 pF	resistor, fixed, of	nm, ±5%, 1/4 watt (unles	ss otherwise stated)
214	0811051A07	.1 uF, 63V	R200	0611009B23	jumper
215 216	21-11014H22 21-82450B08	7.5, ±.5 pF 1.2, 500V	R201	06-11009A89	47k
217	08-11051A07	.1 uF, 63V	R202 R203	06-11009A73 06-11009A01	10k 10
218	23-11013D55	4.7 uF, ±20%, 20V, tantalum	R204	06-11009A27	120
219 220	21-11014H14 08-11051A07	3.6, ±.25 pF .1 uF, 63V	R205	06-11009A59	2.7k
221	21-11014H19	5.6, ±.5 pF	R206 R207	06-11009A27 06-11009A01	120 10
222	0811051A07	.1 uF, 63V	R208	06-11009A65	4.7k
223 224	21-11014H16 08-11051A07	4.3, ±.25 pF .1 uF, 63V	R209	06-11009A59	2.7k
225	21-11014H08	2, ±.25 pF	R210 R211	0611009A69 0611009A75	6.8k 12k
26	08-11051A07	.1 uF, 63V	R211	06-11009A75 06-11009A35	12k 270
27	21-11014H32	20 1 uF 63V	R213	06-11009A93	68k
28 29	08-11051A07 21-11014H19	.1 uF, 63V 5.6, ±.5 pF	R214 R215	06-11009A59	2.7k
230	21-82450B08	1.2, 500V	H215 R216	06-11009A49 06-11009A65	1k 4.7k
232	21-11014H37	33	R217	06-11009A41	470
133 134	08-11051A07 21-11015B03	.1 uF, 63V 150, ±10%	R218	06-11009A01	10
35	21-80067A30	11.5, ±2. pF, 500V	R219 R220	06-11009A63 06-11009C53	3.9k 1.5k
36	08-11051A02	.0015 uF, 63V	R250	06-11009A93	68k
38 39	21-11014H19 23-11019A21	5.6, ±.5 pF 10 uF, ±20%, 35V, electrolytic	R251	06-11009A01	10 68k
40	21-11014H32	20	R254 R255	06-11009A93 06-11009A49	1k
250	21-82450B37	.47, 500V	R256-257	06-11009A81	22k
51 52	21-11014H35 21-11014H40	27 43	R258	06-11009A99	120k
53-255	0811051A07	.1 uF, 63V	R259 R260	06-11009A49 06-11009A89	1k 47k
256	08-11051A13	.1 uF, 63V	R261	06-11009A73	10k
!57 !58	08-11051A07 21-11014H36	.1 uF, 63V 30	R262	06-11009B06	220k
59	21-11014H39	39	R263 R264	06-11009A66 06-11009A49	5.1k 1k
260-261	21-82450B47	1, 500V	R265	06-11009A79	18k
162 163	21-82450B37 21-11014H13	.47, 500V 3.3, ±.25 pF	R266	06-11009A49	1k
64	21-11014H33	22	R269 R270	0611009A01 0611009A53	10 1.5k
65	21-11014H41	47	R272	06-11009C41	470
66 67–273	2111014H35 0811051A07	27 .1 uF, 63V	integrated circuit	(see note)	
74	21-11014H40	43	U250	51-83977M55	IF amplifier
75 70	21-11014H28	13	U251	51-80069C05	quad detector
.76 .77	2111014H20 0811051A07	6.2, ±.5pF .1 uF, 63V	voltage regulator	(see note)	
78	08-11051A13	.1 uF, 63V	VR200	48-82256C53	18V zener (R1,3,4,5)
79	08-11051A07	1 uF, 63V		48-82256C50	13V zener (R2 only)
180–281 182	21-11015B09 08-11051A07	470, ±10% .1 uF, 63V	crystal (see note)		(viz cinj)
183	21-83406D71	33 pF ±5% 500V (HLN5215A only)	Y200	48-83742M02	filter
ode (see note)		, - , , , , , , , , , , , , , , , , , ,	Y250	91-80011E04	10.7 MHz resonator
R200-203	48-11034A01	silicon	Y251254	91-80011E05	10.7 MHz resonator
nnector recepta				mecha	nical parts
00	28-84324M01	male, 2 contact		Specification and the Arthur State of the Control o	
01	28-84324M02	male, 3 contact		26-84898M01 26-83594M01	circuit board shield (2 used) component side shield (4 used)
02-206	42-83891L01	mixer clip		26-80055K01	can shield (4 used)
50	09-84207B01	female, 7 contact		26-83595M01	detector shield, component side
ll, rf				26-83587M01 26-83586M01	detector shield, solder side solder side filter shield
00	24-83397L13	.82 uH		20-0030019101	
01–202 03	24-83397L12 24-82723H45	1.2 uH 10 uH	note: For heet nor	formance order diodes	8/10 transistors, and integrated circuits by Moto
04	24-83397L12	1.2 uH	part number.	iornance, order diodes,	transistors, and integrated circuits by Moto
05	24-83397L13	.82 uH	F		
06 07	24-82723H48 24-83397L13	.085 uH .82 uH			
08-209	24-82723H45	10 uH			
10	24-83397L13	.82 uH			
11 12	24-83397L12 76-83960B01	1.2 uH ferrite core			
13	24-82835G41	5.6 uH			
14	24-82723H36	.41 uH			
15 16	24-83397L07 24-82723H45	10 uH 10 uH			
17	24-82723F145 24-83397L08	15 uH			
18	76-83960B01	ferrite core			
50 51	24-83397L07	. 10 uH			
51 52	24-82723H45 24-83397L07	10 uH 10 uH			
53	24-83397L08	15 uH			
54255	24-82549D24	15 uH			



COMPONENT SIDE GDW-0358-0

OVERLAY - GDW-0359-0

parts list

HLE4187A Preamplifier Kit (Ranges 1 and 2) HLE4186A Preamplifier Kit (Ranges 3, 4, and 5)

REFERENCE	MOTOROLA	DESCRIPTION	
SYMBOL	PART NO.		
		capacitor, µF ± 10%, 100V	
		unless otherwise stated	
C125	21-11014H16	4.3μF (Ranges 3, 4 and 5 only)	
C125	21-11014H18	5.1 ± .5 μF (Ranges 1 and 2 or	ıly)
C126	21-11014H12	3 μF (Ranges 3, 4 and 5 only)	
C126	21-11014H13	3.3 ± .25 μF (Ranges 1 and 2 of	nly)
C127	21-11014H17	4.7 μF (Ranges 3, 4 and 5 only)	
C127	21-11014H18	5.1 ± .5 μF (Ranges 1 and 2 or	ıly)
C128	21-11014H32	20 ± 5%	
C129	21-11014H08	2 μF (Ranges 3, 4 and 5 only	
C129	21-11014H13	3.3 ± .25 μF (Ranges 1 and 2 of	nly)
C130	21-11014H29	15 μF (Ranges 3, 4 and 5 only)	
C130	21-11014H36	30 ± 5% (Ranges 1 and 2 only)	
		diode (see note)	
CR125	48-83510F04	current control	
		coll	
L125, 126	24-83884G03	choke, 11/2 turns	
L127	24-82723H28	290 nH	
L129	24-83884H07	choke, 21/2 turns	
		transistor (see note)	
Q125	48-00869870	NPN, type M9870	
Q126	48-00869643	PNP, type M9643	
		resistor, ±5%, ¼ W	
		unless otherwise stated	
R125	06-11009C73	10k	
R126	06-11009C69	6.8k	
R127	06-11009C83	27k	
R128	06-11009C27	120	
R132	06-11009C13	33	
R133	06-11009C25	100	
R134	06-11009C73	10k	

note: For best performance, order diodes, transistors, and integrated circuits by Motorola

RF INTERNAL CASTING RX 9.4 C130 (NOTE 4) 120 R126 6.8K PRESELECTOR Q126 M9643 NOTES: 1. Unless otherwise stated, all resistor values are in TX 9.4 (NOTE 3) L127 290nH P201-1 R132 33 is substituted for the low-pass filter (HLN4250A). CR125 RECEIVER SCHEMATIC J100 RF BOARD L125 1.5T L126 1.5T R135 is connected from the preamplifier PC board to Cl01 in the internal 4. See parts list for component GBW-0356-A

FUNCTIONAL DESCRIPTION

The HLE4187A preamplifier consists of a five-pole, high-pass filter, a PIN diode switch, a bipolar RF amplifier, and an output pad. The high-pass filter, which receives an input signal from the antenna relay via J100, prevents out-of-band interfering signals from degrading receiver performance.

The RF amplifier consists of a bipolar device (Q125) connected in a common emitter configuration. Q126 stabilizes the bias point of the amplifier, and the output pad (R131, R132, and R133) prevents interaction between the amplifier and the preselector. The amplifier runs off a switched +9.4 Vsupply.

The PIN diode switch (CR125), enabled by the keyed 9.4 V supply, prevents power fed back through the antenna switch during transmit from overdissipating the RF amplifier.