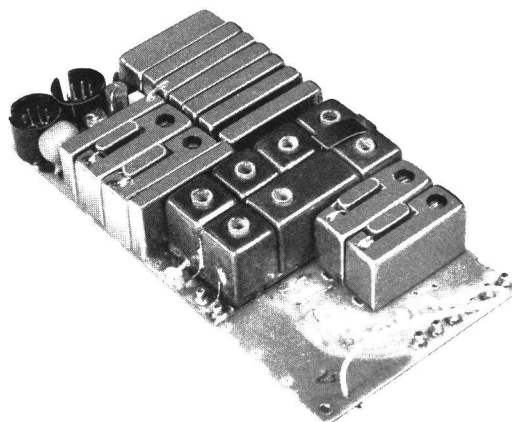


MASTR[®] *Personal Series*

PROGRESS LINE

PE MODELS

66 - 88 MHz, RECEIVER MODELS 4ER87B10, 11, 12 & 13



SPECIFICATIONS *

Type Number	ER-87-B		
Audio Output (EIA)	500 milliwatts at less than 5% distortion		
Channel Spacing	20 kHz		
Sensitivity			
12 dB SINAD (EIA Method)	0.35 μ V		
20 dB Quieting Method	0.40 μ V		
Selectivity			
EIA Two-Signal	-60 dB		
Spurious Response			
Image	-80 dB		
Intermodulation (EIA)	-70 dB		
Audio Response	Within +2 and -10 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference)		
Modulation Acceptance	± 6.5 kHz		
Squelch Sensitivity			
Critical Squelch	0.20 μ V		
Maximum Squelch	Greater than 20 dB Quieting		
Maximum Frequency Spread (MHz)	Frequency	Full Performance	1 dB Degradation in Sensitivity
	66-76 MHz	0.6 MHz	1.2 MHz
	76-88 MHz	0.8 MHz	1.6 MHz

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS!

ADDENDUM #1 TO LBI4664C, LBI4639E,
LBI4642D, LBI4689B and LBI30188A

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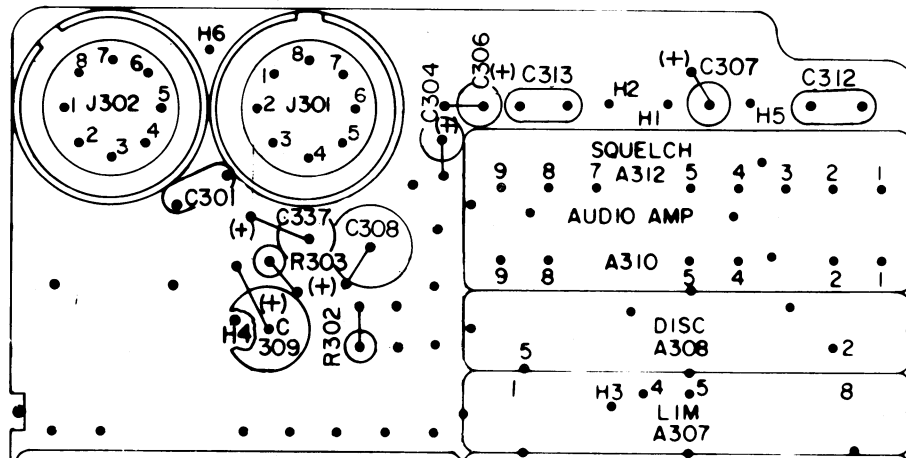
This addendum describes the optional Mobile Detector boards used in Vehicular Repeater applications. Detector boards 19D417493G4,5 are similar to PE receiver boards except that PA module A311, C302, C305, C345 and R301 are not used. Also R306 (3R151P103J) is added.

The Mobile Detector monitors the mobile radio transmit frequencies to determine if a second vehicular repeater is repeating portable-to-base station transmissions. If a portable-to-base transmission is in progress, the mobile detector prevents the Vehicular Repeater from becoming the priority unit.

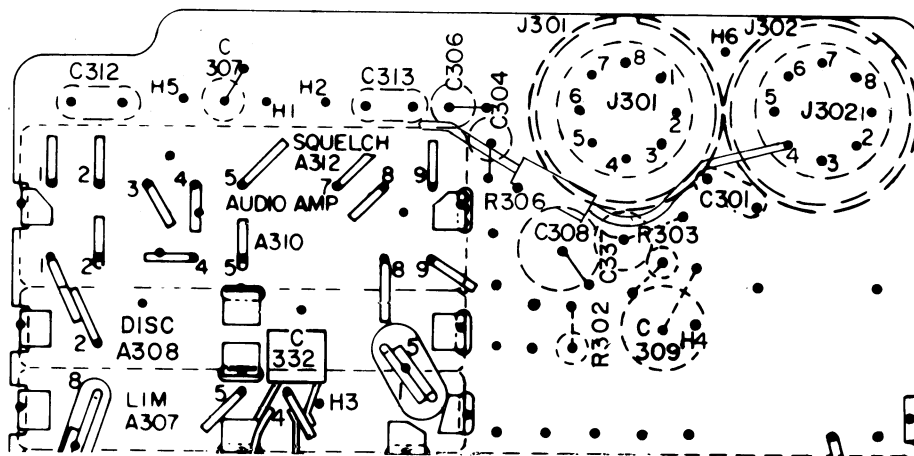
GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.



COMPONENT SIDE



SOLDER SIDE



OUTLINE DIAGRAM

MOBILE DETECTOR
(TYPICAL VIEW)

- * PRESENT ONLY IN GROUPS 4 & 5
■ NOT PRESENT IN GROUPS 4 & 5
▲ PART OF MODIFICATION KIT PL19A130047
SEE PARTS LIST FOR APPLICATION OF
PARTS TO THE APPLICABLE MODEL NO.

	C3	C13	C21	C27	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47	C48	C49	C50	C51	C52	C53	C54	C55	C56	C57	C58	C59	C60	C61	C62	C63	C64	C65	C66	C67	C68	C69	C70	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86	C87	C88	C89	C90	C91	C92	C93	C94	C95	C96	C97	C98	C99	C100	C101	C102	C103	C104	C105	C106	C107	C108	C109	C110	C111	C112	C113	C114	C115	C116	C117	C118	C119	C120	C121	C122	C123	C124	C125	C126	C127	C128	C129	C130	C131	C132	C133	C134	C135	C136	C137	C138	C139	C140	C141	C142	C143	C144	C145	C146	C147	C148	C149	C150	C151	C152	C153	C154	C155	C156	C157	C158	C159	C160	C161	C162	C163	C164	C165	C166	C167	C168	C169	C170	C171	C172	C173	C174	C175	C176	C177	C178	C179	C180	C181	C182	C183	C184	C185	C186	C187	C188	C189	C190	C191	C192	C193	C194	C195	C196	C197	C198	C199	C200	C201	C202	C203	C204	C205	C206	C207	C208	C209	C210	C211	C212	C213	C214	C215	C216	C217	C218	C219	C220	C221	C222	C223	C224	C225	C226	C227	C228	C229	C230	C231	C232	C233	C234	C235	C236	C237	C238	C239	C240	C241	C242	C243	C244	C245	C246	C247	C248	C249	C250	C251	C252	C253	C254	C255	C256	C257	C258	C259	C260	C261	C262	C263	C264	C265	C266	C267	C268	C269	C270	C271	C272	C273	C274	C275	C276	C277	C278	C279	C280	C281	C282	C283	C284	C285	C286	C287	C288	C289	C290	C291	C292	C293	C294	C295	C296	C297	C298	C299	C300	C301	C302	C303	C304	C305	C306	C307	C308	C309	C310	C311	C312	C313	C314	C315	C316	C317	C318	C319	C320	C321	C322	C323	C324	C325	C326	C327	C328	C329	C330	C331	C332	C333	C334	C335	C336	C337	C338	C339	C340	C341	C342	C343	C344	C345	C346	C347	C348	C349	C350	C351	C352	C353	C354	C355	C356	C357	C358	C359	C360	C361	C362	C363	C364	C365	C366	C367	C368	C369	C370	C371	C372	C373	C374	C375	C376	C377	C378	C379	C380	C381	C382	C383	C384	C385	C386	C387	C388	C389	C390	C391	C392	C393	C394	C395	C396	C397	C398	C399	C400	C401	C402	C403	C404	C405	C406	C407	C408	C409	C410	C411	C412	C413	C414	C415	C416	C417	C418	C419	C420	C421	C422	C423	C424	C425	C426	C427	C428	C429	C430	C431	C432	C433	C434	C435	C436	C437	C438	C439	C440	C441	C442	C443	C444	C445	C446	C447	C448	C449	C450	C451	C452	C453	C454	C455	C456	C457	C458	C459	C460	C461	C462	C463	C464	C465	C466	C467	C468	C469	C470	C471	C472	C473	C474	C475	C476	C477	C478	C479	C480	C481	C482	C483	C484	C485	C486	C487	C488	C489	C490	C491	C492	C493	C494	C495	C496	C497	C498	C499	C500	C501	C502	C503	C504	C505	C506	C507	C508	C509	C510	C511	C512	C513	C514	C515	C516	C517	C518	C519	C520	C521	C522	C523	C524	C525	C526	C527	C528	C529	C530	C531	C532	C533	C534	C535	C536	C537	C538	C539	C540	C541	C542	C543	C544	C545	C546	C547	C548	C549	C550	C551	C552	C553	C554	C555	C556	C557	C558	C559	C560	C561	C562	C563	C564	C565	C566	C567	C568	C569	C570	C571	C572	C573	C574	C575	C576	C577	C578	C579	C580	C581	C582	C583	C584	C585	C586	C587	C588	C589	C590	C591	C592	C593	C594	C595	C596	C597	C598	C599	C600	C601	C602	C603	C604	C605	C606	C607	C608	C609	C610	C611	C612	C613	C614	C615	C616	C617	C618	C619	C620	C621	C622	C623	C624	C625	C626	C627	C628	C629	C630	C631	C632	C633	C634	C635	C636	C637	C638	C639	C640	C641	C642	C643	C644	C645	C646	C647	C648	C649	C650	C651	C652	C653	C654	C655	C656	C657	C658	C659	C660	C661	C662	C663	C664	C665	C666	C667	C668	C669	C670	C671	C672	C673	C674	C675	C676	C677	C678	C679	C680	C681	C682	C683	C684	C685	C686	C687	C688	C689	C690	C691	C692	C693	C694	C695	C696	C697	C698	C699	C700	C701	C702	C703	C704	C705	C706	C707	C708	C709	C710	C711	C712	C713	C714	C715	C716	C717	C718	C719	C720	C721	C722	C723	C724	C725	C726	C727	C728	C729	C730	C731	C732	C733	C734	C735	C736	C737	C738	C739	C740	C741	C742	C743	C744	C745	C746	C747	C748	C749	C750	C751	C752	C753	C754	C755	C756	C757	C758	C759	C760	C761	C762	C763	C764	C765	C766	C767	C768	C769	C770	C771	C772	C773	C774	C775	C776	C777	C778	C779	C780	C781	C782	C783	C784	C785	C786	C787	C788	C789	C790	C791	C792	C793	C794	C795	C796	C797	C798	C799	C800	C801	C802	C803	C804	C805	C806	C807	C808	C809	C810	C811	C812	C813	C814	C815	C816	C817	C818	C819	C820	C821	C822	C823	C824	C825	C826	C827	C828	C829	C830	C831	C832	C833	C834	C835	C836	C837	C838	C839	C840	C841	C842	C843	C844	C845	C846	C847	C848	C849	C850	C851	C852	C853	C854	C855	C856	C857	C858	C859	C860	C861	C862	C863	C864	C865	C866	C867	C868	C869	C870	C871	C872	C873	C874	C875	C876	C877	C878	C879	C880	C881	C882	C883	C884	C885	C886	C887	C888	C889	C890	C891	C892	C893	C894	C895	C896	C897	C898	C899	C900	C901	C902	C903	C904	C905	C906	C907	C908	C909	C910	C911	C912	C913	C914	C915	C916	C917	C918	C919	C920	C921	C922	C923	C924	C925	C926	C927	C928	C929	C930	C931	C932	C933	C934	C935	C936	C937	C938	C939	C940	C941	C942	C943	C944	C945	C946	C947	C948	C949	C950	C951	C952	C953	C954	C955	C956	C957	C958	C959	C960	C961	C962	C963	C964	C965	C966	C967	C968	C969	C970	C971	C972	C973	C974	C975	C976	C977	C978	C979	C980	C981	C982	C983	C984	C985	C986	C987	C988	C989	C990	C991	C992	C993	C994	C995	C996	C997	C998	C999	C1000	C1001	C1002	C1003	C1004	C1005	C1006	C1007	C1008	C1009	C1010	C1011	C1012	C1013	C1014	C1015	C1016	C1017	C1018	C1019	C1020	C1021	C1022	C1023	C1024	C1025	C1026	C1027	C1028	C1029	C1030	C1031	C1032	C1033	C1034	C1035	C1036	C1037	C1038	C1039	C1040	C1041	C1042	C1043	C1044	C1045	C1046	C1047	C1048	C1049	C1050	C1051	C1052	C1053	C1054	C1055	C1056	C1057	C1058	C1059	C1060	C1061	C1062	C1063	C1064	C1065	C1066	C1067	C1068	C1069	C1070	C1071	C1072	C1073	C1074	C1075	C1076	C1077	C1078	C1079	C1080	C1081	C1082	C1083	C1084	C1085	C1086	C1087	C1088	C1089	C1090	C1091	C1092	C1093	C1094	C1095	C1096	C1097	C1098	C1099	C1100	C1101	C1102	C1103	C1104	C1105	C1106	C1107	C1108	C1109	C1110	C1111	C1112	C1113	C1114	C1115	C1116	C1117	C1118	C1119	C1120	C1121	C1122	C1123	C1124	C1125	C1126	C1127	C1128	C1129	C1130	C1131	C1132	C1133	C1134	C1135	C1136	C1137	C1138	C1139	C1140	C1141	C1142	C1143	C1144	C1145	C1146	C1147	C1148	C1149	C1150	C1151	C1152	C1153	C1154	C1155	C1156	C1157	C1158	C1159	C1160	C1161	C1162	C1163	C1164	C1165	C1166	C1167	C1168	C1169	C1170	C1171	C1172	C1173	C1174	C1175	C1176	C1177	C1178	C1179	C1180	C1181	C1182	C1183	C1184	C1185	C1186	C1187	C1188	C1189	C1190	C1191	C1192	C1193	C1194	C1195	C1196	C1197	C1198	C1199	C1200	C1201	C1202	C1203	C1204	C1205	C1206	C1207	C1208	C1209	C1210	C1211	C1212	C1213	C1214	C1215	C1216	C1217	C1218	C1219	C1220	C1221	C1222	C1223	C1224	C1225	C1226	C1227	C1228	C1229	C1230	C1231	C1232	C1233	C1234	C1235	C1236	C1237	C1238	C1239	C1240	C1241	C1242	C1243	C1244	C1245	C1246	C1247	C1248	C1249	C1250	C1251	C1252	C1253	C1254	C1255	C1256	C1257	C1258	C1259	C1260	C1261	C1262	C1263	C1264	C1265	C1266	C1267	C1268	C1269	C1270	C1271	C1272	C1273	C1274	C1275	C1276	C1277	C1278	C1279	C1280	C1281	C1282	C1283	C1284	C1285	C1286	C1287	C1288	C1289	C1290	C1291	C1292	C1293	C1294	C1295	C1296	C1297	C1298	C1299	C1300	C1301	C1302	C1303	C1304	C1305	C1306	C1307	C1308	C1309	C1310	C1311	C1312	C1313	C1314	C1315	C1316	C1317	C1318	C1319	C1320	C1321	C1322	C1323	C1324	C1325	C1326	C1327	C1328	C1329	C1330	C1331	C1332	C1333	C1334	C1335	C1336	C1337	C1338	C1339	C1340	C1341	C1342	C1343	C1344	C1345	C1346	C1347	C1348	C1349	C1350	C1351	C1352	C1353	C1354	C1355	C1356	C1357	C1358	C1359	C1360	C1361	C1362	C1363	C1364	C1365	C1366	C1367	C1368	C1369	C1370	C1371	C1372	C1373	C1374	C1375	C1376	C1377	C1378	C1379	C1380	C1381	C1382	C1383	C1384	C1385	C1386	C1387	C1388	C1389	C1390	C1391	C1392	C1393	C1394	C1395	C1396	C1397	C1398	C1399	C1400	C1401	C1402	C1403	C1404	C1405	C1406	C1407	C1408	C1409	C1410	C1411	C1412	C1413	C1414	C1415	C1416	C1417	C1418	C1419	C1420	C1421	C1422	C1423	C1424	C1425	C1426	C1427	C1428	C1429	C1430	C1431	C1432	C1433	C1434	C1435	C1436	C1437	C1438	C1439	C1440	C1441	C1442	C1443	C1444	C1445	C1446	C1447	C1448	C1449	C1450	C1451	C1452	C1453	C1454	C1455	C1456	C1457	C1458	C1459	C1460	C1461	C1462	C1463	C1464	C1465	C1466	C1467	C1468	C1469	C1470	C1471	C1472	C1473	C1474	C1475	C1476	C1477	C1478	C1479	C1480	C1481	C1482	C1483	C1484	C1485	C1486	C1487	C1488	C1489	C1490	C1491	C1492	C1493	C1494	C1495	C1496	C1497	C1498	C1499	C1500	C1501	C1502	C1503	C15
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PARTS LIST			SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
LB130036C			A3		FILTER BOARD 19C327735G1	C306	5491674P27	Tantalum: .47 μ f \pm 20%, 35 VDCW; sim to Sprague Type 162D.
150.8-174 MHz RECEIVER MODEL 4ER59D11 STANDARD MODEL 4ER59D13 CHANNEL GUARD					----- CAPACITORS -----	C307	5491674P31	Tantalum: .033 μ f \pm 20%, 35 VDCW; sim to Sprague Type 162D.
SYMBOL	GE PART NO.	DESCRIPTION	C1	19A134162P3	Variable, ceramic: approx 3.5 to 20 pf; sim to Erie Style 513-001.	C308 and C309	5491674P30	Tantalum: 39 μ f \pm 20%, 10 VDCW; sim to Sprague Type 162D.
A338		FRONT END 19C317295G10 (Replaces 19C317295G8)	C2	19A116114P1	Ceramic: 1 pf \pm 10%, 100 VDCW; temp coef 0 PPM.	C311	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW.
A16		MULTIPLIER/MIXER 19C327738G1	C3	19A134162P3	Variable, ceramic: approx 3.5 to 20 pf; sim to Erie Style 513-001.	C312	19A116192P1	Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL.
A1		MIXER BOARD 19D424746G1	C4	19A116114P4	Ceramic: 1.5 pf \pm 5%, 100 VDCW; temp coef 0 PPM.	C313	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW.
		----- CAPACITORS -----	C5	19A134162P3	Variable, ceramic: approx 3.5 to 20 pf; sim to Erie Style 513-001.	C314*	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW. Deleted by REV D.
C1 and C2	19A116114P2045	Ceramic: 30 pf \pm 5%, 100 VDCW; temp coef -80 PPM.	C1	19A116192P1	----- CAPACITORS ----- Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL.	C345*	19A116192P6	Ceramic: 0.022 μ f \pm 20%, 50 VDCW; sim to Erie 8131-M050-W5R-223M. Added by REV G.
C3	5495323P12	Ceramic: 0.001 μ f +100% -20%, 75 VDCW.	L7	19B216441G3	----- INDUCTORS ----- Helical resonator. (Part of Z29). Includes: Tuning slug.	J301 and J302	19A116122P1	----- JACKS AND RECEPTACLES ----- Feed-thru: sim to Warren Co 1-B-2994-4.
C4	19A116114P3036	Ceramic: 15 pf \pm 5%, 100 VDCW; temp coef -150 PPM.	L8	19B216441G12	Helical resonator. (Part of Z30). Includes: Tuning slug.	P301 thru P308	19A115834P4	----- PLUGS ----- Contact, electrical: sim to AMP 2-332070-9.
C5	5495323P12	Ceramic: 0.001 μ f +100% -20%, 75 VDCW.	L27	19B216441G17	Helical resonator. (Part of Z28). Includes: Tuning slug.			----- RESISTORS -----
C6	19A116114P10073	Ceramic: 180 pf \pm 10%, 100 VDCW; temp coef -3300 PPM.		19C311727P1	----- HELICAL RESONATORS ----- Consists of L27 and 19C327717G1 can.	R301*	3R151P680J	Composition: 68 ohms \pm 5%, 1/8 w. In REV C \times earlier: Composition: 100 ohms \pm 5%, 1/8 w.
C7 and C8	19A116114P3036	Ceramic: 15 pf \pm 5%, 100 VDCW; temp coef -150 PPM.	Z28		Consists of L7 and 19C327717G1 can.	R302	3R151P201J	Composition: 200 ohms \pm 5%, 1/8 w.
C9	5495323P12	Ceramic: 0.001 μ f +100% -20%, 75 VDCW.	Z29		Consists of L8 and 19C327717G1 can.	R303	3R151P150J	Composition: 15 ohms \pm 5%, 1/8 w.
C10	19A116114P1	Ceramic: 1 pf \pm 5%, 100 VDCW; temp coef 0 PPM.	Z30			R304 and R305	3R151P470J	Composition: 47 ohms \pm 5%, 1/8 w.
C11	19A116114P2020	Ceramic: 6 pf \pm 5%, 100 VDCW; temp coef -80 PPM.			RECEIVER BOARD 19D417493G1			RECEIVER KIT 19A130043G5 ----- CAPACITORS -----
C12	19A116114P3056	Ceramic: 56 pf \pm 5%, 100 VDCW; temp coef -150 PPM.	A303*	19C304824G1	Crystal Filter. In REV B \times earlier: Crystal Filter.	C310	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW.
C13	19A116114P2060	Ceramic: 75 pf \pm 5%, 100 VDCW; temp coef -80 PPM.		19C304516G3		C325	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW.
C14	19A116192P1	Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL.	A304	19C311879G3	1st IF Amplifier.	C330*	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW. Added by REV A.
CR1	19A116925P1	----- DIODES AND RECTIFIERS ----- Silicon.	A305	19C304824G1	Crystal Filter.	C332	19A116192P1	Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL.
		----- INDUCTORS -----	A306	19C311879G4	2nd IF Amplifier.	C334	19A116192P1	Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL.
L1	19B226718G1	Coil. Includes: Tuning slug.	A307	19C311876G4	Limiter.	C336	19A116192P1	Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL.
L2 and L3	19A130474P1	Coil.	A308	19C304504G3	Discriminator.	C337	5491674P39	Tantalum: 6.8 μ f \pm 20%, 15 VDCW; sim to Sprague Type 162D.
L4	19A130473P1	Coil.	A309*	19C311878G2	Audio Amplifier. Deleted by REV G.	C338*	19A116192P1	Ceramic: 0.01 μ f \pm 20%, 50 VDCW; sim to Erie 8121 SPECIAL. Deleted by REV B.
L5	19B226750G1	Coil.	A310	19C311995G4	Audio Amplifier. (Includes Tone Filter).			----- MISCELLANEOUS ----- Insulator. (Used with J301 & J302).
L6	19C320379G11	Coil. Includes: Tuning slug.	A311*	19C311877G4	PA. In REV E \times earlier: PA.		19B216316P1	
		----- TRANSISTORS -----	A312	19C311877G2	Squelch.	A314 and A315, thru A323		ASSOCIATED PARTS ----- OSCILLATORS ----- NOTE: When reordering, give GE Part Number and specify exact frequency needed.
Q1	19A115910P1	Silicon, NPN; sim to Type 2N3904.	A313	19C311880G4	Compensator.		4EG28A11	Oscillator Module. 150.8-174 MHz. Fx = $\frac{F_o - 20}{9}$
Q2	19A116960P1	N Type, field effect; sim to Type 2N4416.			----- CAPACITORS -----			----- RESISTORS -----
R1	3R151P182J	Composition: 1.8K ohms \pm 5%, 1/8 w.	C301	5495323P12	Ceramic: .001 μ f +100% -20%, 75 VDCW.	R306	3R151P103J	Cmposition: 10K ohms \pm 5%, 1/8 w. (Used in vehicular repeater applications).
R2	3R151P391K	Composition: 390 ohms \pm 10%, 1/8 w.	C302	19A116178P7	Tantalum: 220 μ f \pm 20%, 6 VDCW.			
R3	3R151P511J	Composition: 510 ohms \pm 5%, 1/8 w.	C303*	19A116089P1	Ceramic: 0.1 μ f \pm 20%, 50 VDCW, temp range -55 to +85°C. Deleted by REV E.			
R4	3R151P102J	Composition: 1K ohms \pm 5%, 1/8 w.	C304	5491674P28	Tantalum: 1.0 μ f \pm 20%, 25 VDCW; sim to Sprague Type 162D.			
R5	3R151P682J	Composition: 6.8K ohms \pm 5%, 1/8 w.	C305	5491674P35	Tantalum: 22 μ f \pm 20%, 4 VDCW; sim to Sprague Type 162D.			

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Receiver Board 19D417493G1
To improve audio sensitivity.
Changed R301.

REV. B - To improve critical squelch operation.
Changed C312.

REV. C - To improve producibility.
Changed A303.

REV. D - To improve audio sensitivity.
Deleted C314 and changed R301.

REV. E - To improve frequency response.
Added C345 to be used with CG receivers.

REV. A - Receiver Kit 19A130043G5
To improve IF filtering.
Added C330.

REV. B - To standardize assemblies.
Deleted C338 and added five washers.

REV. F - Receiver Board 19D417493G1
To improve audio quality.
Changed A311.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

DESCRIPTION

Receiver Type ER-87-B models are single conversion, superheterodyne FM receivers for operation on the 66-88 MHz bands. The complete receiver mounts on a single printed wiring board, and utilizes both discrete components and Integrated Circuit modules. The application of each model receiver is shown in the following chart:

MODEL NUMBER	FREQ. RANGE	NO. OF FREQ.	TONE OPTION
4ER87B10	66-76 MHz	1 thru 8	
4ER87B11	75-88 MHz	1 thru 8	
4ER87B12	66-76 MHz	1 thru 8	Channel Guard
4ER87B13	75-88 MHz	1 thru 8	Channel Guard

References to symbol numbers mentioned in the following text are found on the Schematic Diagram, Outline Diagram and Parts List (see Table of Contents). The typical circuit diagrams used in the text are

representative of the circuits used in the Integrated Circuit modules. A block diagram of the receiver is shown in Figure 1.

Supply voltage for the receiver includes a continuous regulated 5.4 Volts for the compensator module, a continuous 7.5 Volts for the squelch module, and a switched 7.5 Volts for the remaining receiver stages.

CIRCUIT ANALYSIS

OSCILLATOR MODULES A314, A315 and A318 THRU A323

Oscillator Modules A314, A315 and A318 thru A323 (4EG28A30/31) consist of a crystal-controlled Colpitts oscillator (see Figure 2). An entire oscillator module is contained in a metal can with the receiver operating frequency printed on the top. The crystal frequency ranges from 17.2 - 22.2 MHz, and the crystal frequency is multiplied 5 times.

The oscillator frequency is temperature compensated to provide instant frequency compensation, with a frequency stability of $\pm 0.0002\%$ from 0°C to $+55^{\circ}\text{C}$

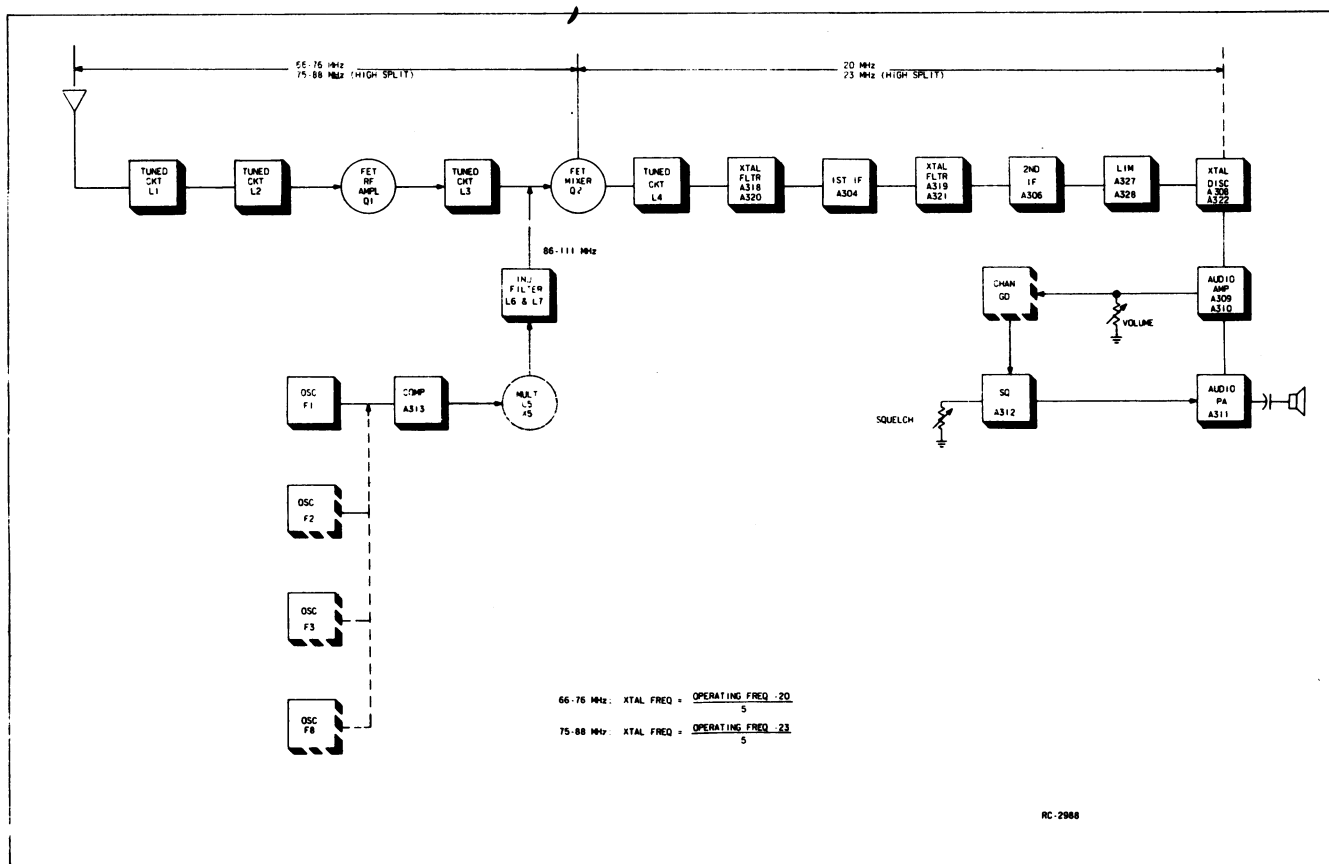


Figure 1 - Block Diagram

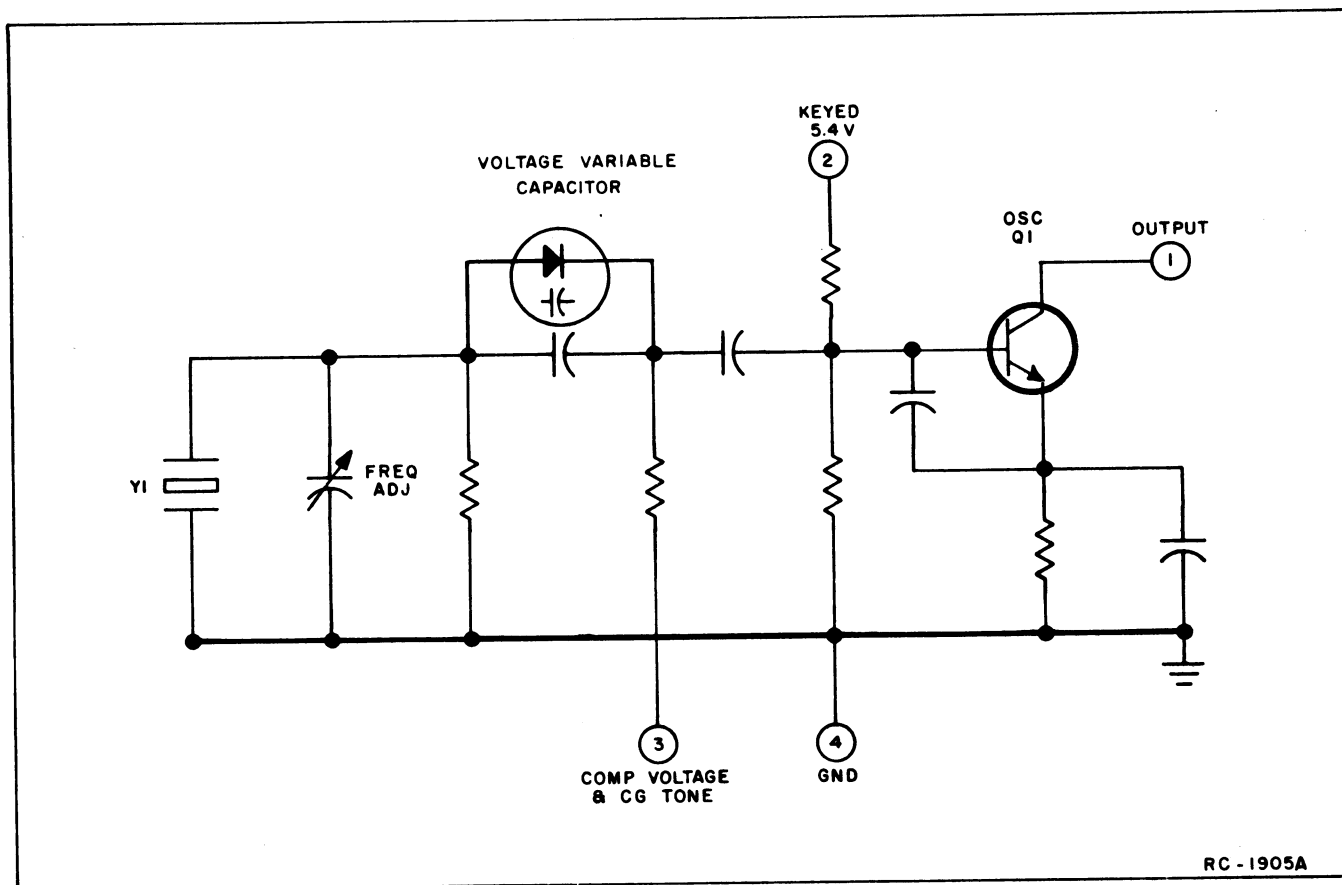


Figure 2 - Typical Oscillator Circuit

and $\pm 0.0005\%$ from -30°C to $+60^{\circ}\text{C}$. The temperature compensation network contained in compensator module A313.

In single frequency receivers, a jumper from H10 to H11 on the system board connects the oscillator module to the continuous 5.4 Volt supply voltage. The oscillator output is applied to compensator A313.

In two-frequency receivers, an additional oscillator module is mounted on the receiver board. The single-frequency supply jumper is removed, and the proper frequency is selected by connecting the 5.4 Volts to the selected oscillator module through frequency selector switch S1 on the control unit.

NOTE

All oscillator modules are individually compensated at the factory and cannot be repaired in the field. Any attempt to remove the oscillator cover will void the warranty.

COMPENSATOR A313

Compensator module A313 contains a buffer-amplifier stage, and the temperature compensation network for the oscillator similar to the compensator used in the transmitter (see Figure 3).

RF from the oscillator is coupled through a DC blocking capacitor to the base of Q1. The output of Q1 connects to multiplier coil L1 on the multiplier assembly.

In the compensation network, the regulated 5.4 Volts at Pin 2 is applied to a thermistor-compensated voltage divider. The output at Pin 3 (2.35 Volts measured with a VTVM) is applied to Pin 3 and to the varactor in the oscillator module. At temperatures below -10°C , the compensated voltage increases to maintain the proper voltage on the oscillator voltage-variable capacitor.

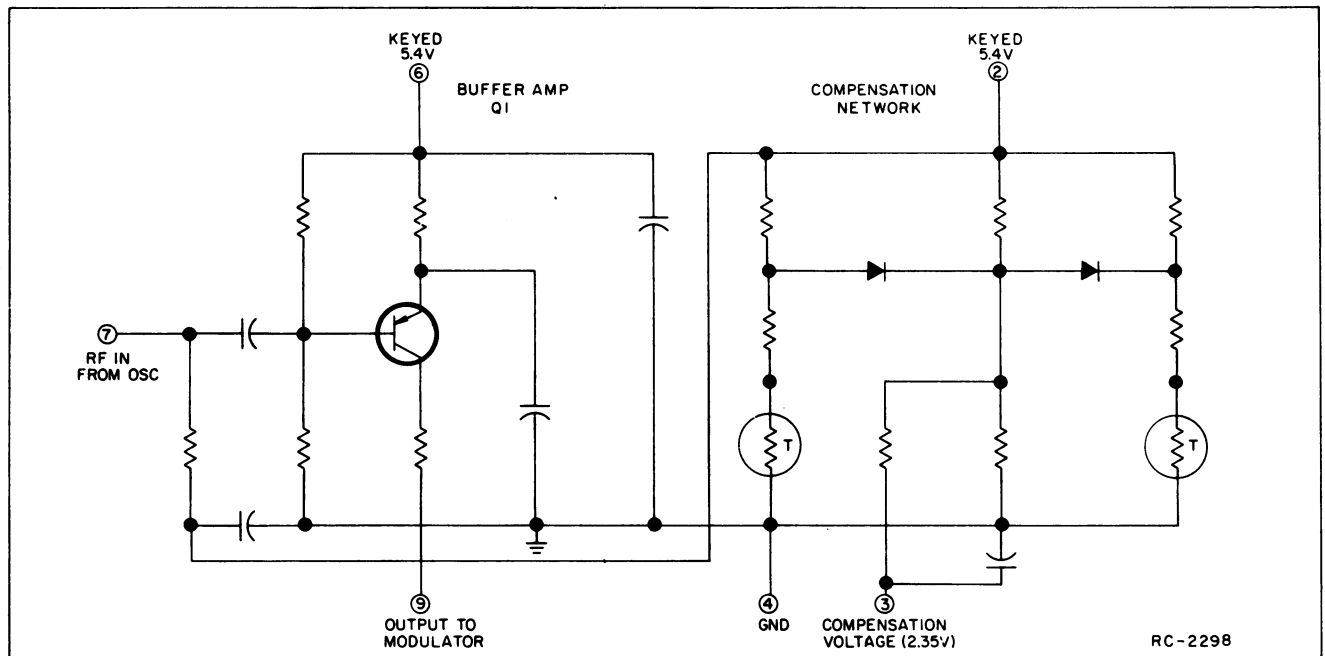


Figure 3 - Typical Compensator Circuit

SERVICE NOTE

An abnormally low VTVM reading (or no reading) at Pin 3 may indicate a short or leakage path in the oscillator. This can be checked by unsoldering Pin 2, raising it off of the printed board and taking another reading. If this reading is normal, the problem is in the oscillator module. If the reading remains low (or zero), the problem is in the compensator.

The RF signal from RF amplifier Q1 and the high side injection frequency from the multiplier applied to the gate of mixer Q2 produces an IF of 20/23 MHz on the drain of Q2. The 20/23 MHz IF is coupled through the mixer drain tuned circuit L4, C7 and C8 to the input of crystal filter A318/A320 or A319/A321.

CRYSTAL FILTERS A318 & A319/A320 & A321

Filter A318/A320 follows the receiver front end and its output is applied to the 1st IF amplifier module. Filter A319/A321 follows the IF amplifier module. The two Crystal Filters provide the major selectivity for the receiver. A318 & A319/A320 & A321 provides a minimum of 85-dB stop-band attenuation.

IF AMPS A304 & A306

An IF amplifier module follows each of the crystal filters, and contains the resistor-matching networks for the filters. A typical IF amplifier circuit is shown in Figure 4.

Each of the IF amplifier modules consists of three R-C coupled amplifier stages that are DC series-connected for reduced drain. The two IF modules provide a total gain of approximately 85 dB.

FRONT END A336/A337

The receiver front end consists of three tuned RF coils, a Field Effect Transistor (FET) RF amplifier stage, a multiplier stage and a FET mixer stage. The RF signal from the antenna is coupled to a tap on RF coil L1. RF from L1 is coupled to L2. A tap on L2 is connected to the gate of RF amplifier Q1. The output of Q1 developed across tuned circuit C5/C19, C6/C20 and L3 is applied to the gate of mixer Q2.

The output of compensator module A313 is applied to a tap on L5 in the multiplier assembly. Multiplier coil L5 is tuned to five times the crystal frequency. The injection frequency output from L5 is coupled through bandpass filter L6, L7, C11/C22, C12, C14/C23 and C15 to the gate of mixer Q2. High side injection is used.

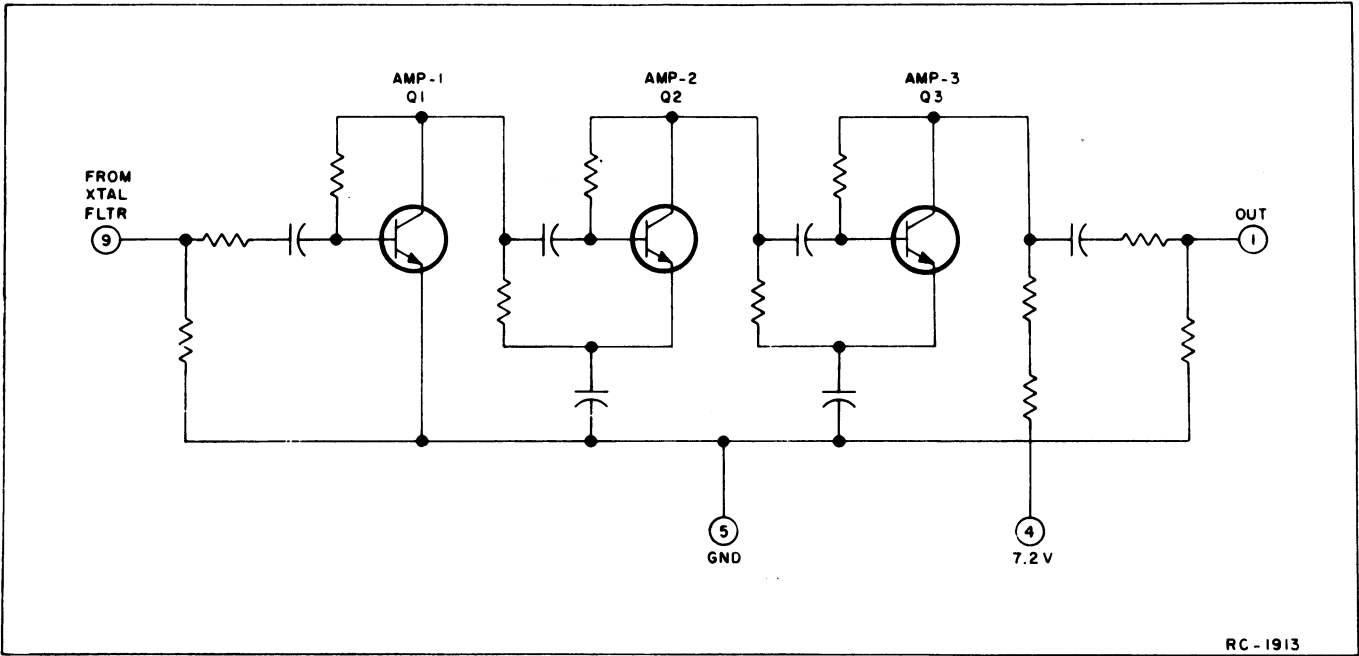


Figure 4 - Typical IF Amplifier Circuit

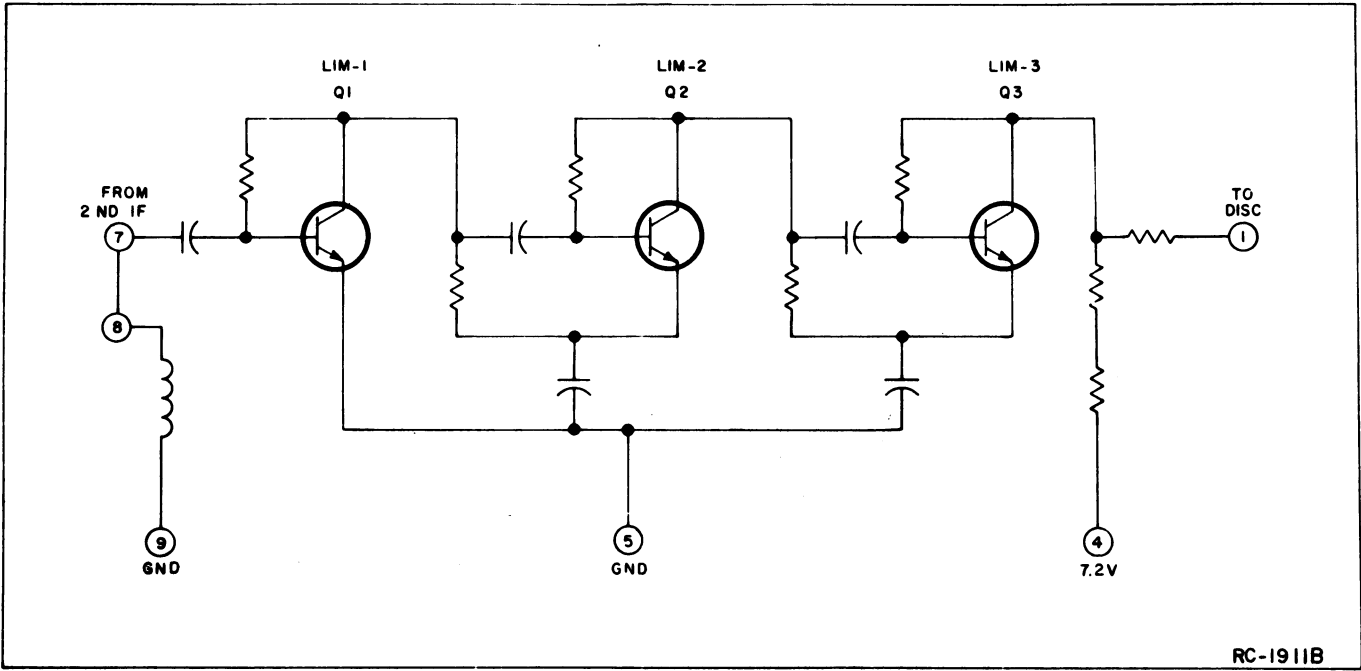


Figure 5 - Typical Limiter Circuit

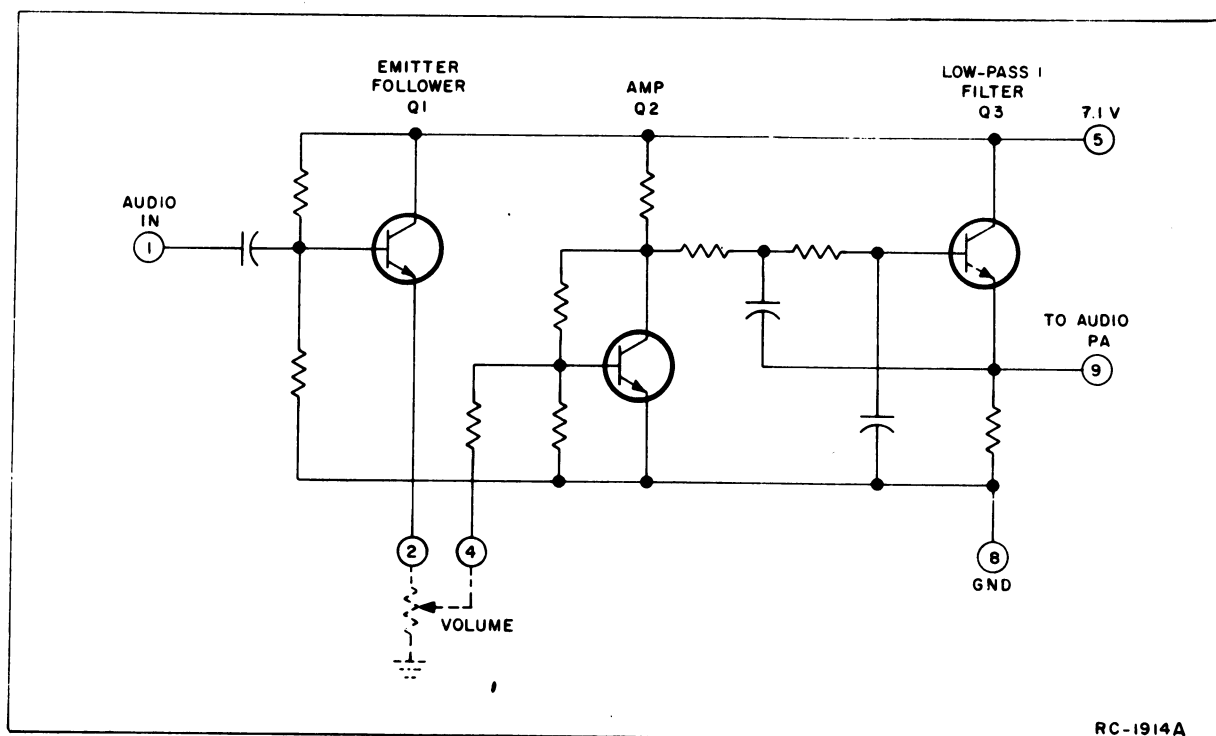


Figure 6 - Typical Audio Amplifier Circuit

LIMITER A327/A328 & DISCRIMINATOR A308/A322

Limiter A327/A328 consists of three R-C coupled limiter stages that are DC series connected for reduced drain. The Limiter module also provides some gain. The output of the Limiter is applied to the discriminator. A typical Limiter circuit is shown in Figure 5.

The receiver uses a 20/23 MHz, fixed-tuned crystal discriminator (A308/A322) to recover the audio from the IF signal. The discriminator output is applied to the audio amplifier module.

AUDIO AMPLIFIER A309/A310

Audio and noise from the discriminator is applied to audio amplifier module A309 (A310 in Channel Guard applications). A typical audio amplifier circuit is shown in Figure 6.

Audio and noise is applied to the base of Q1. This stage operates as an emitter-follower for matching the impedance of the discriminator to the amplifier stage (Q2) and the VOLUME control. The output of Q1 connects from Pin 2 to the base of amplifier Q2 (Pin 4) through the VOLUME control. The output of Q1 is also applied to the input of the Squelch module.

Following amplifier Q2 is an active low-pass filter (Q3). Audio from the filter is connected from Pin 9 to the Audio PA module. In audio amplifier module A323, an active high-pass filter is added in series with the low-pass filter to provide the required tone frequency roll-off.

AUDIO PA A311

When the receiver is quieted by a signal, audio from the active filter is connected to Pin 1 of audio PA module A311, and then to the base of amplifier Q1. Q1 feeds the audio signal to the base of Q2, which drives PA transistors Q4 and Q5. A typical audio PA circuit is shown in Figure 7.

PA transistors Q4 and Q5 operate as complementary emitter-followers, providing a 500 milliwatt output into an 8-ohm load. Audio from Pin 9 is coupled through capacitor C302 on the receiver board to the loud-speaker.

SQUELCH A312

Noise from audio amplifier A309/A310 operates the squelch circuit. A typical squelch circuit is shown in Figure 8.

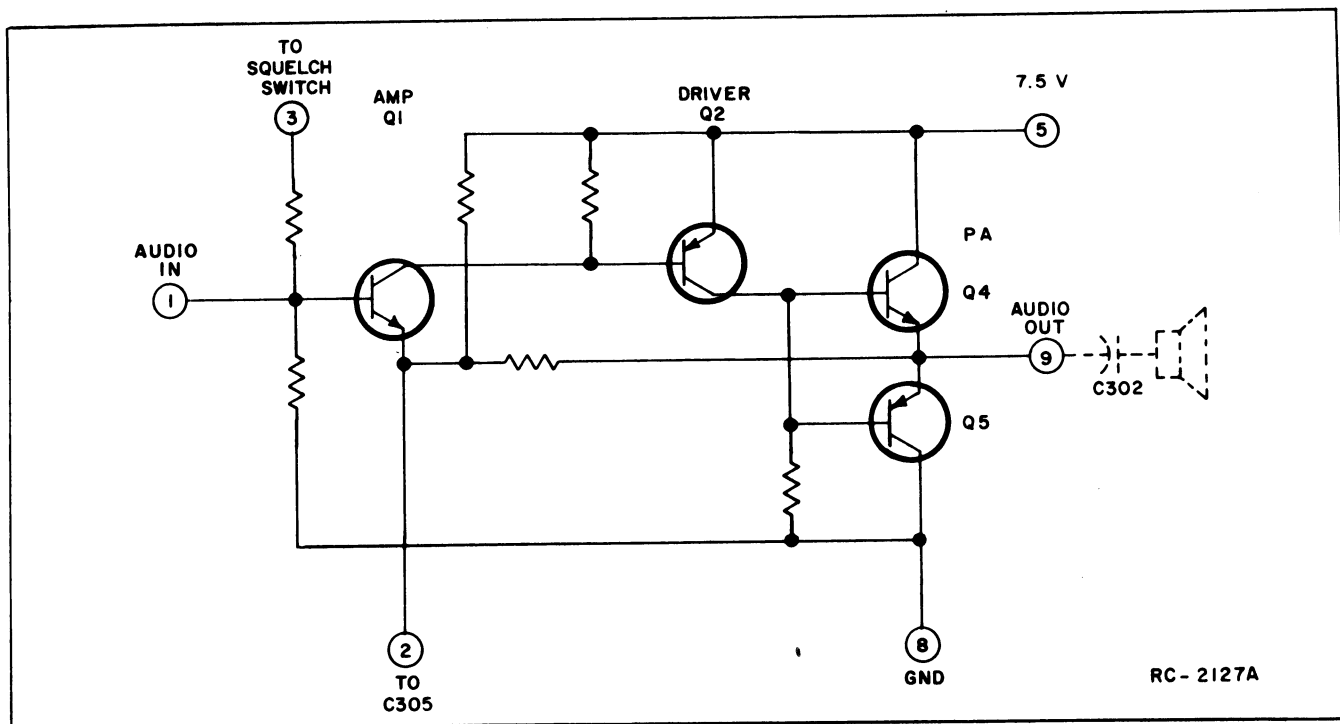


Figure 7 - Typical Audio PA Circuit

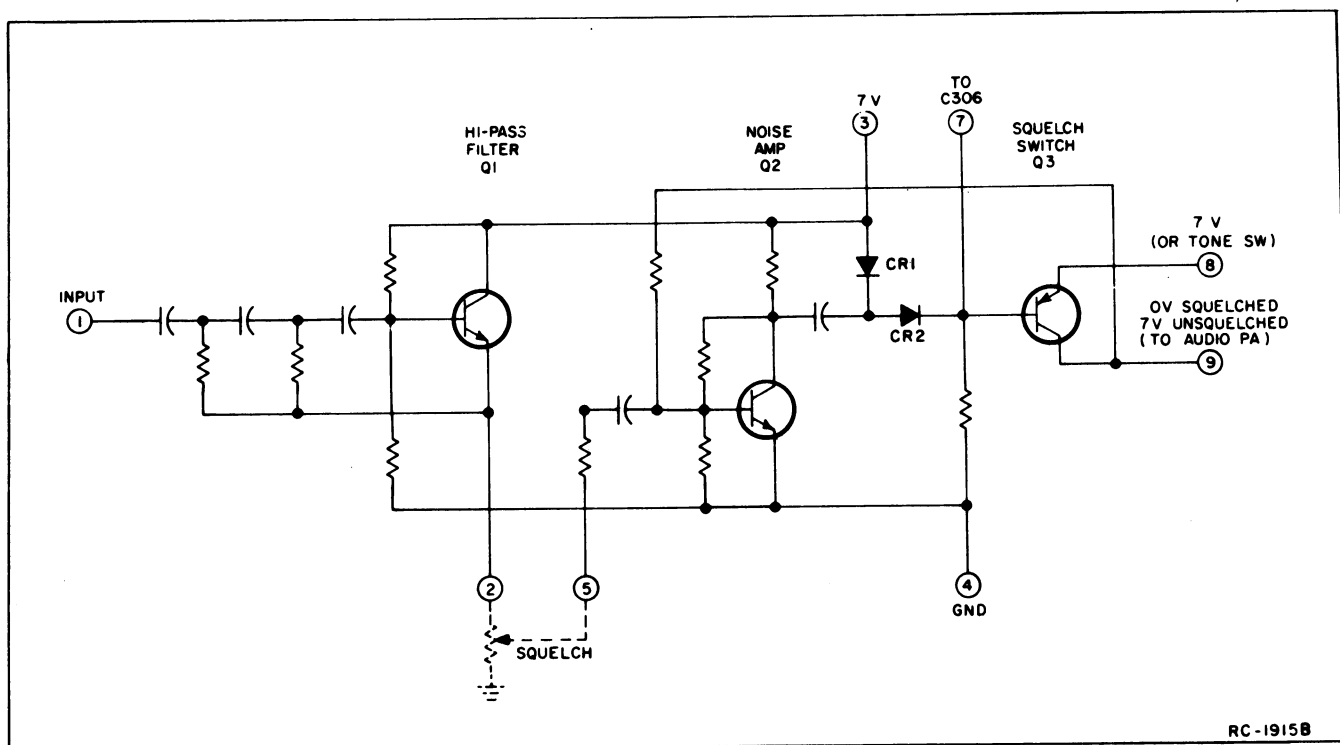


Figure 8 - Typical Squelch Circuit

When no carrier is present in the receiver, the noise output of active high-pass filter Q1 is coupled to the base of noise amplifier Q2 through SQUELCH control R708. R708 controls the gain of the noise amplifier.

The output of noise amplifier Q2 is detected by diodes CR1 and CR2, and the resultant positive voltage turns off the PNP squelch switch Q3. In standard radios, the emitter of Q3 is connected to +7 Volts by means of a jumper from H1 to H2. When noise turns off Q3, its collector drops to ground potential. As the collector of Q3 is connected to the base of amplifier Q1

in the audio PA module, turning off Q3 also turns off Q1, keeping the audio PA turned off.

When the receiver is quieted by a signal, squelch switch Q3 turns on. This applies +7 Volts to the base of amplifier Q1 in the audio PA module, turning the audio PA circuit on so that sound is heard at the speaker.

In tone decoder applications, the 7-Volt jumper from H1 to H2 is removed. The emitter of squelch switch Q3 is connected to 7.5 Volts by a DC switch on the decoder.

RECEIVER ALIGNMENT

EQUIPMENT

- 1. A 20/23 MHz signal source (GE IF Generator Model 4EX9A10 or equivalent) and a 66-88 MHz source connected to Antenna Switch J702 by Receiver Test Cable 19C317633G1.
- 2. GE Test Amplifier Model 4EX16A10 and RF probe 19C311370G1, or equivalent RF voltmeter.
- 3. Distortion Analyzer or AC-VTVM.
- 4. Oscilloscope

PRELIMINARY CHECKS AND ADJUSTMENTS

- 1. In multi-frequency receivers where the maximum frequency spacing is less than one MHz, align the receiver on the F1 channel. Where the frequency spacing is more than one MHz, align the receiver on the center frequency.
- 2. Set the slugs in L1 thru L3 and L5 thru L7 to the bottom of the coil form for frequencies in the high end of the band. Set the slugs near the top of the coil form for frequencies near the low end of the band.
- 3. Connect the Distortion Analyzer or AC-VTVM across the speaker leads.

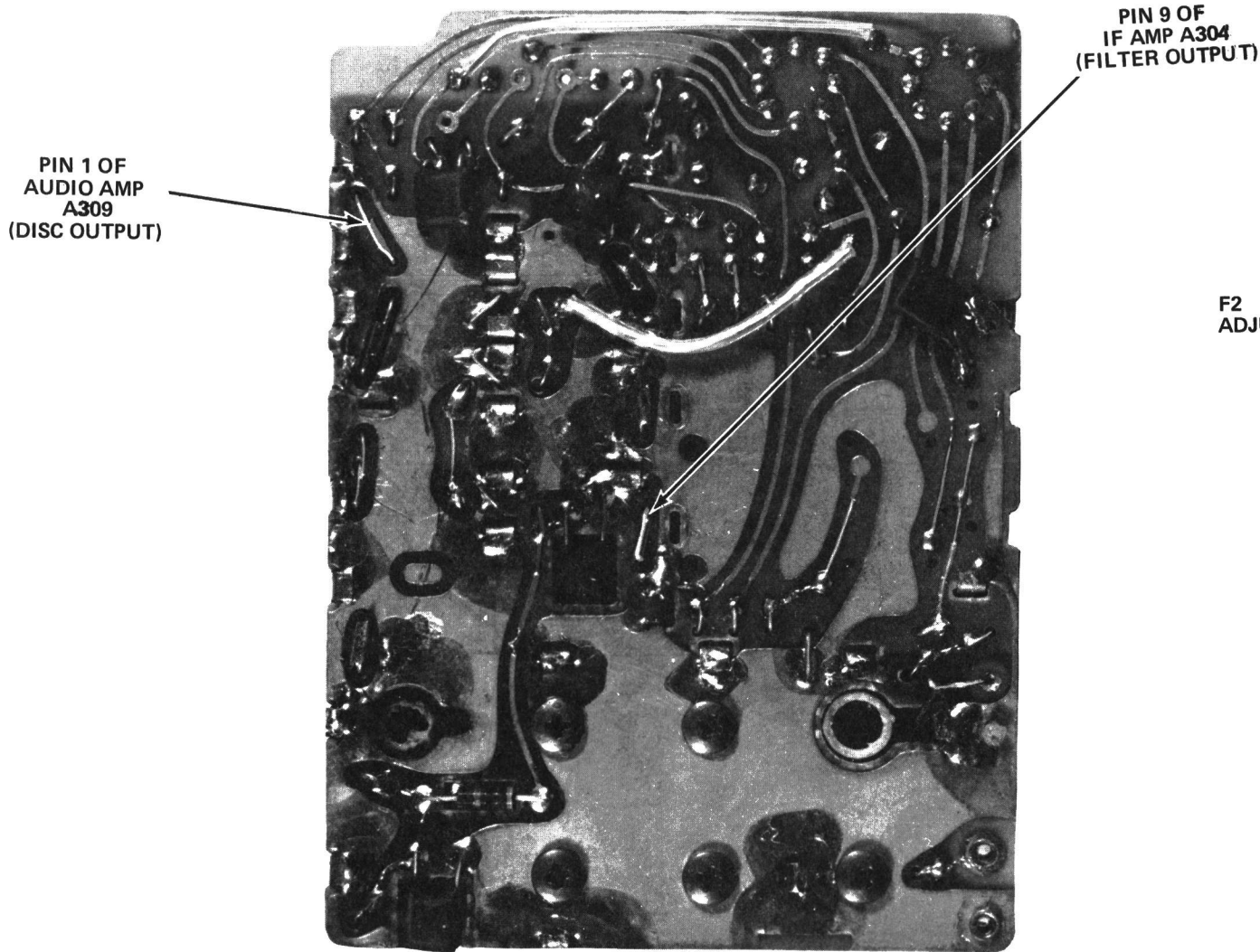
RECEIVER ALIGNMENT

STEP	TUNING CONTROL	PROCEDURE
1.	L1 thru L3 L5 thru L7	Apply an on-frequency signal to J702 and adjust L1, L2, L3, L5, L6 and L7 for maximum quieting sensitivity.
2.	Mixer L4	Modulate the signal generator with a 20-Hz sawtooth wave and a level of ±20 kHz deviation. Connect the output of the RF detector probe to the vertical input of an oscilloscope. Adjust the signal level until the bandpass is displayed on the scope when the detector probe input is connected to the input of the first IF amplifier A304-9. Adjust L4 for maximum flatness of display. <div><p>NOTE</p><p>Set scope vertical sensitivity to maximum DC sensitivity and sweep rate to 2 ms/cm triggered by the sawtooth wave.</p></div>
3.	L1 thru L3 L5 thru L7	With a 10 dB quieting signal level, readjust L1, L2, L3, L5, L6 and L7 for maximum quieting.
FREQUENCY ADJUSTMENT		
4.		While applying an on-frequency signal to J702, loosely couple a 20-MHz signal to the Mixer. Adjust the Oscillator trimmer(s) for a zero beat frequency between the two signals. Alternate Method: Apply a strong 20/23 MHz signal to the Mixer. Measure the output of the Discriminator with a DC-VTVM at Pin 1 of A309/A310. Note the reading. Next, remove the 20/23 MHz signal and apply a strong on-frequency signal to J702. Then tune the oscillator trimmer(s) for the meter reading obtained at Pin 1 of A309/A310.

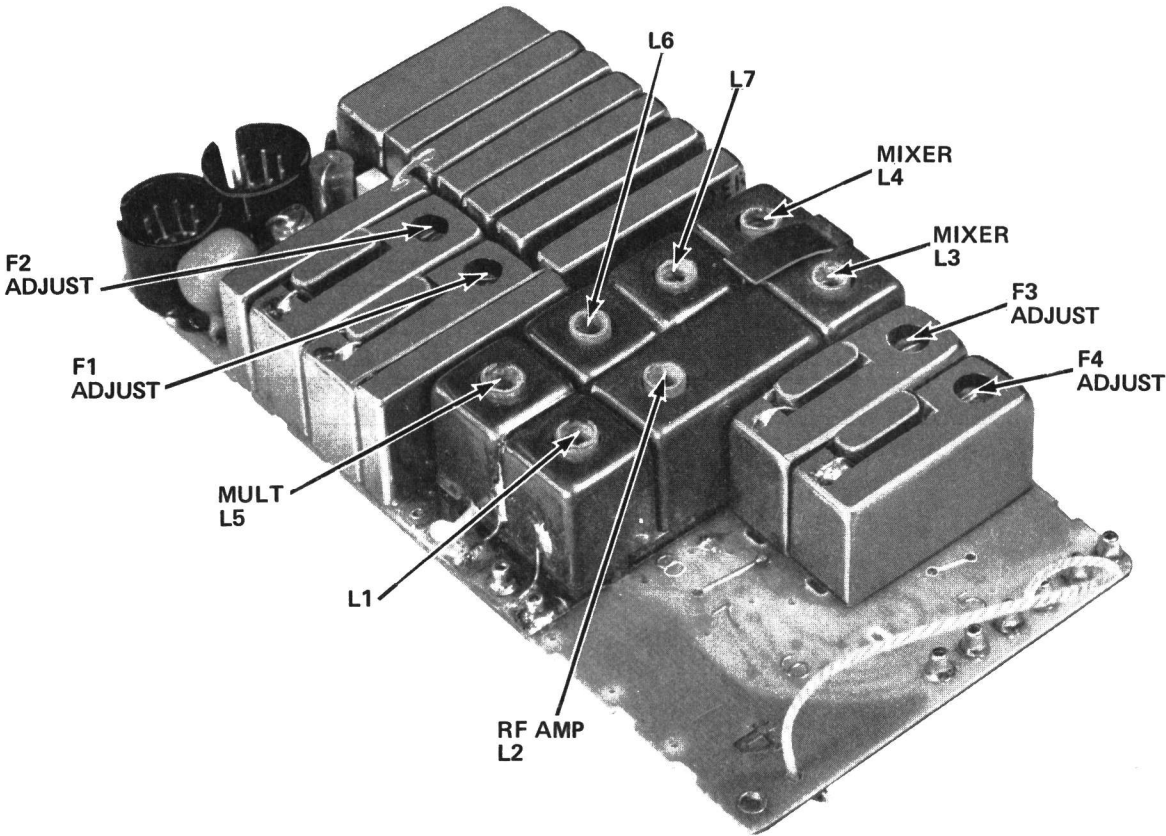
ALIGNMENT PROCEDURE

66—88 MHz RECEIVER
MODELS 4ER87B10, 11, 12 & 13

SOLDER SIDE



COMPONENT SIDE



TEST PROCEDURES

These Test Procedures are designed to help you to service a receiver that is operating --- but not properly. The problems encountered could be low power, poor sensitivity, distortion, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized.

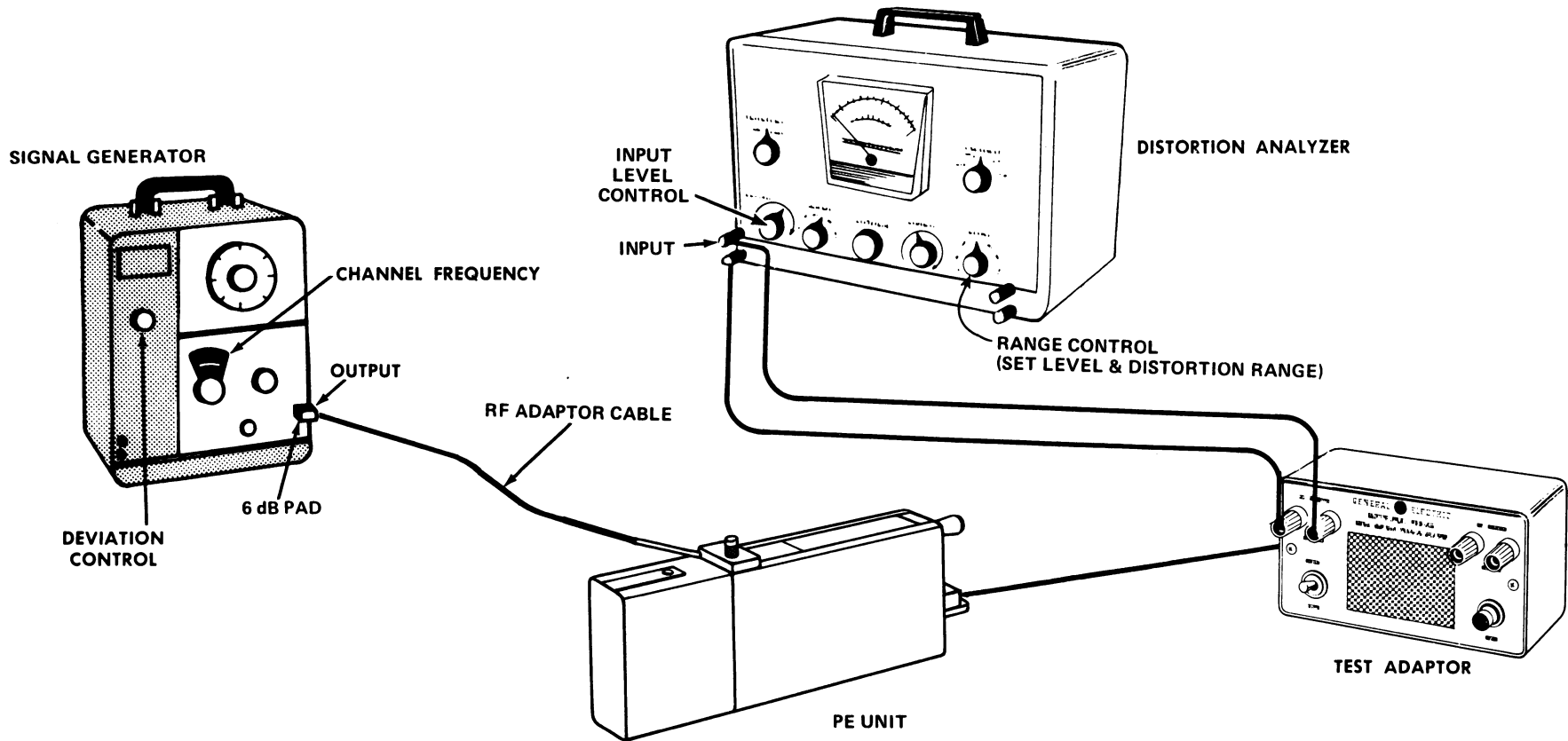
Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-800
- 6-dB attenuation pad
- Test Adaptor Model 4EX12A10
- RF Adaptor Cable 19C317633G1

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1

AUDIO POWER OUTPUT AND DISTORTION TEST PROCEDURE

Measure Audio Power output as follows:

- A. Connect a 1,000-microvolt test signal modulated by 1,000 hertz ± 3.0 kHz deviation to the Antenna Switch J702.
- B. Set the Volume Control for a 500 milliwatt output (2 volts RMS).
- C. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%-10% (5% is typical). If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 0.5 watt, make the following checks:

- D. Battery voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)
- E. Audio Gain (Refer to Receiver Troubleshooting Procedure).

STEP 2

USABLE SENSITIVITY (12 dB SINAD)

TEST PROCEDURE

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

- A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.0-kHz deviation to J702.
- B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)
- C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).
- D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

- E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specification with an audio output of at least 250 milliwatts.

- F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

TEST PROCEDURE

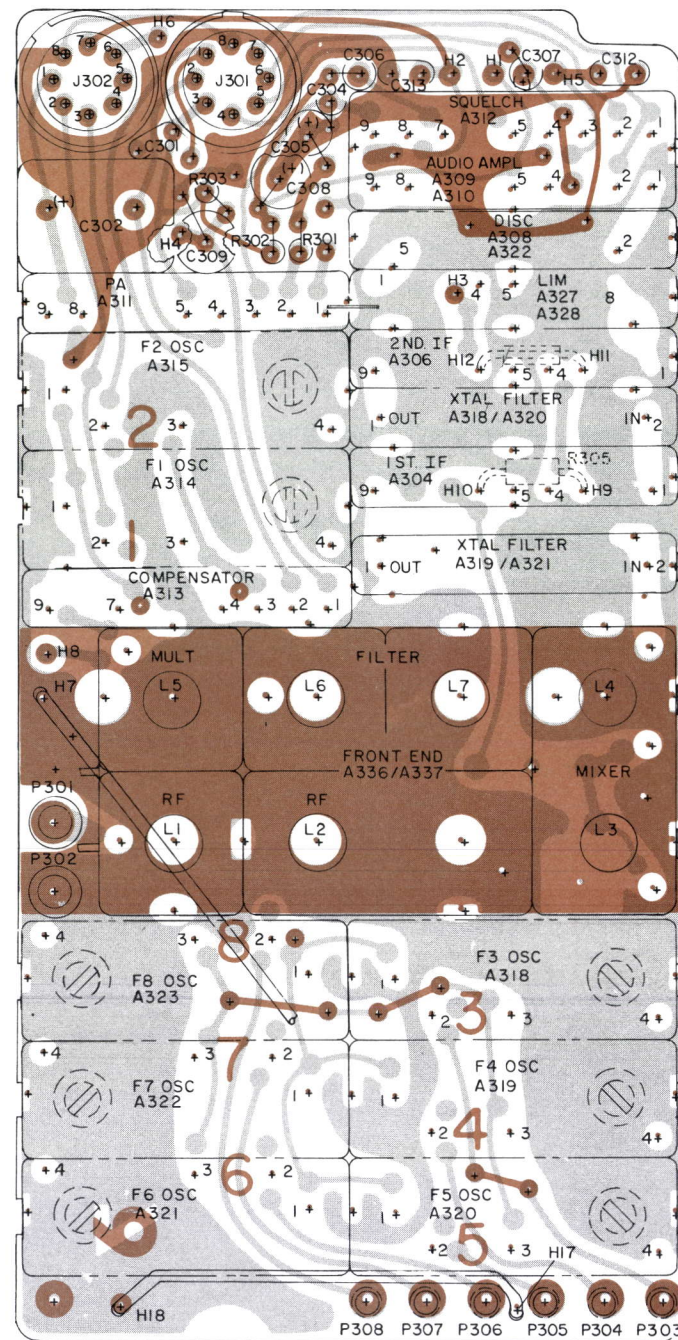
If STEPS 1 and 2 check out properly measure the bandwidth as follows:

- A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.
- B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.
- C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).
- D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ± 7 kHz (but less than ± 9 kHz).

SERVICE CHECK

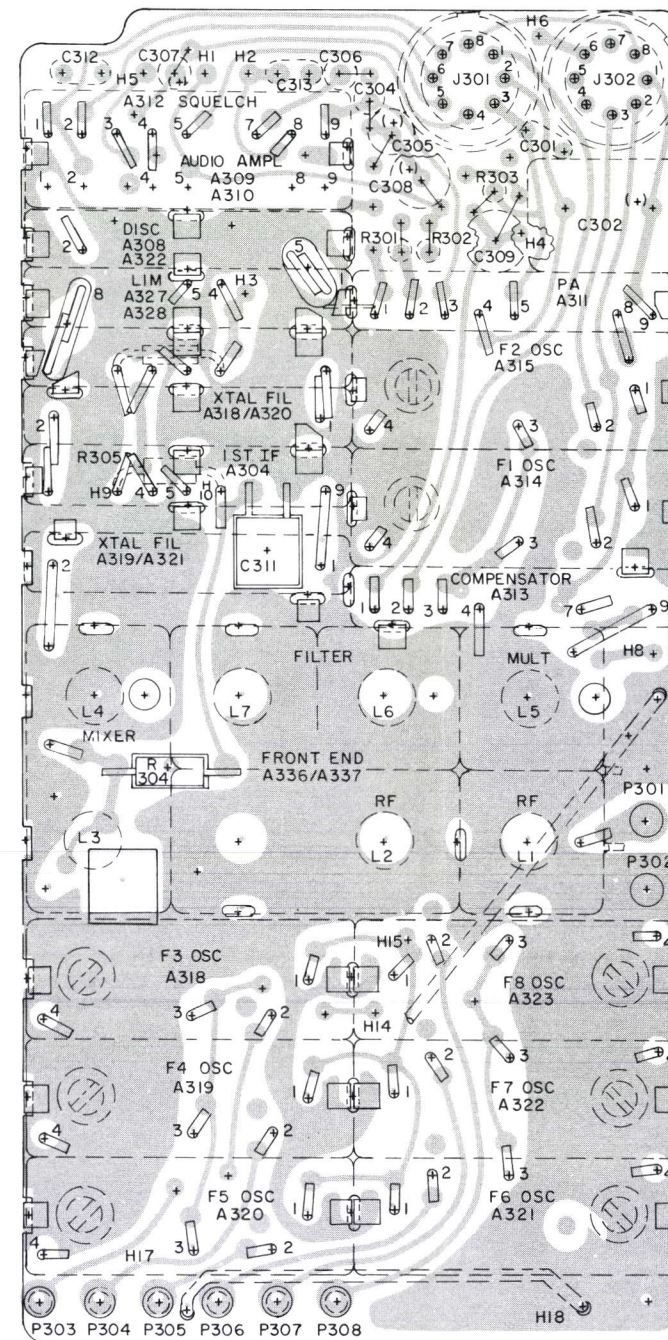
If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

RECEIVER BOARD



COMPONENT SIDE

(19D416896, Sh. 2, Rev. 7)
(19D416896, Sh. 3, Rev. 6)

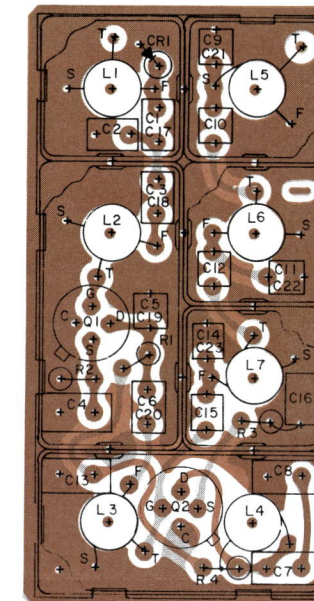


SOLDER SIDE

(19D416896, Sh. 2, Rev. 6)

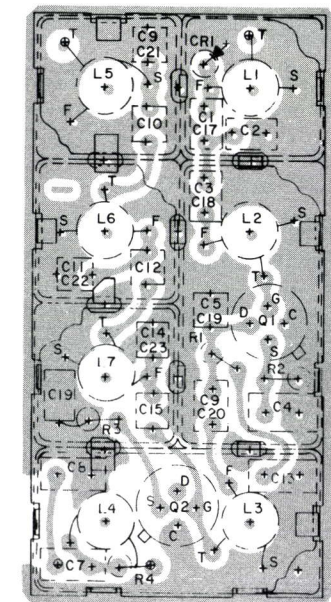
RECEIVER FRONT END

COMPONENT SIDE



(19D423391, Sh. 2, Rev. 0)
(19D423391, Sh. 3, Rev. 0)

SOLDER SIDE



(19D423391, Sh. 2, Rev. 0)

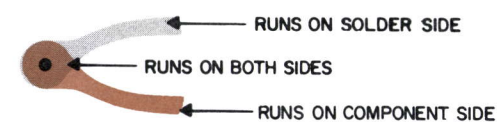


LEAD IDENTIFICATION
FOR Q1 & Q2- VIEW
FROM LEAD END

(19C327318, Rev. 1)

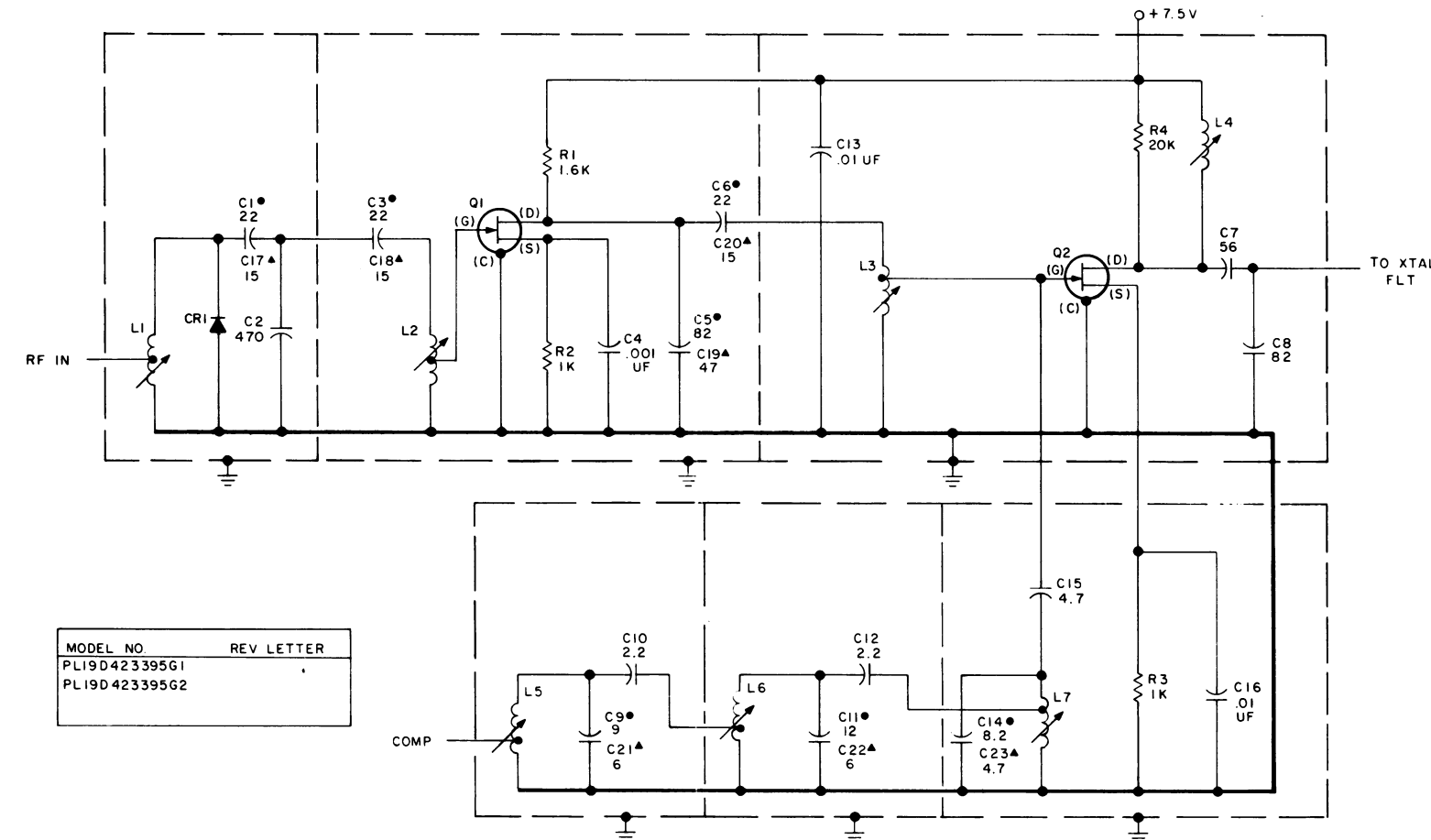
OUTLINE DIAGRAM

66—88 MHz RECEIVER MODELS 4ER87B10, 11, 12 & 13



(19D424225, Rev. 0)

RECEIVER BOARD



ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H= HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

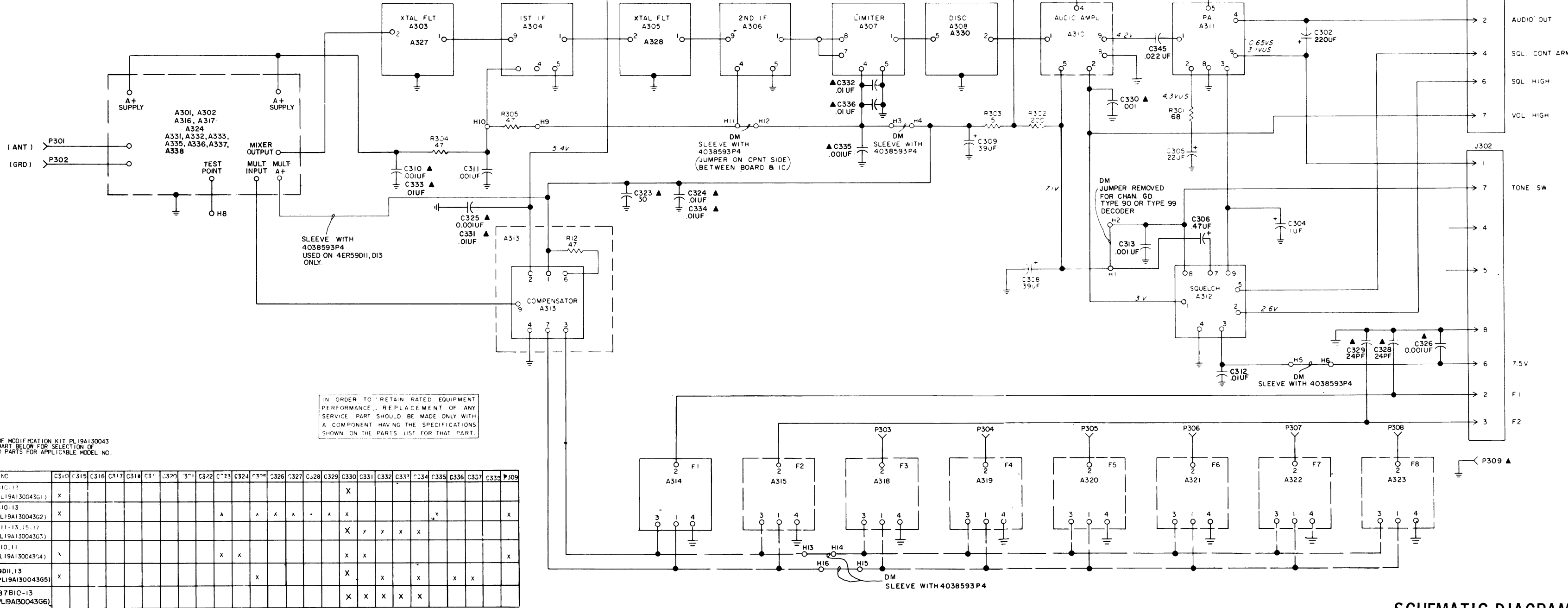
- LO SPLIT 66-76 MHz
- ▲ MID SPLIT 75-88 MHz

(19C321714, Rev. 1)

VOLTAGE READINGS
ALL READINGS TAKEN WITH A DC-VTVM AND MEASURED TO GROUND. READINGS FOLLOWED BY "S" ARE WITH THE RECEIVER SQUELCHED. READINGS FOLLOWED BY "US" ARE WITH THE RECEIVER UNSQUELCHED.

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H= HENRYS.

MODEL NO.	REV. LETTER
PL19D417493G1	G
PL19D417493G2	F
PL19D417493G3	F
PL19A130043G1	A
PL19A130043G2	A
PL19A130043G3	A
PL19A130043G4	A
PL19A130043G5	A
PL19A130043G6	A



▲ PART OF MODIFICATION KIT PL19A130043 SEE CHART BELOW FOR SELECTION OF PROPER PARTS FOR APPLICABLE MODEL NO.

MODEL NO.	C310	C315	C316	C317	C318	C319	C320	C321	C322	C323	C324	C325	C326	C327	C328	C329	C330	C331	C332	C333	C334	C335	C336	C337	C338	C339
4ER59B10-11 (KIT PL19A130043G1)	X																									
4ER59B10-13 (KIT PL19A130043G2)	X																									
4ER59B11-13, 15-17 (KIT PL19A130043G3)																										
4ER59B10-11 (KIT PL19A130043G4)																										
4ER59D11-13 (KIT PL19A130043G5)	X																									
4ER87B10-13 (KIT PL19A130043G6)																										

SCHEMATIC DIAGRAM

66-88 MHz RECEIVER
MODELS 4ER87B10, 11, 12 & 13

PARTS LIST			SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
LBI-30189A								
66-88 MHz RECEIVER MODEL 4E887B10, B11 STANDARD MODEL 4E887B12, B13 CHANNEL GUARD								
SYMBOL	GE PART NO.	DESCRIPTION						
A336 and A337		FRONT END A336 19D423395G1 66-76 MHz A337 19D423395G2 76-88 MHz						
		----- CAPACITORS -----						
C1	19A116114P2041	Ceramic: 22 pf ±5%, 100 VDCW; temp coef -80 PPM.	R1	3R151P162J	Composition: 1.6K ohms ±5%, 1/8 w.	C311	5495323P12	Ceramic: .001 μf +100% -20%, 75 VDCW.
C2	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-A050-WSR-471M.	R2 and R3	3R151P102J	Composition: 1K ohms ±5%, 1/8 w.	C312	19A116192P1	Ceramic: 0.01 μf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C3	19A116114P2041	Ceramic: 22 pf ±5%, 100 VDCW; temp coef -80 PPM.	R4	3R151P203J	Composition: 20K ohms ±5%, 1/8 w.	C313	5495323P12	Ceramic: .001 μf +100% -20%, 75 VDCW.
C4	19A116192P13	Ceramic: 1000 pf ±10%, 50 VDCW; sim to Erie 8121-A050-WSR-102K.			RECEIVER BOARD 19D417493G1 66-76 MHz 19D417493G3 76-88 MHz	C314*	5495323P12	Ceramic: .001 μf +100% -20%, 75 VDCW. Deleted by REV C.
C5	19A116114P6062	Ceramic: 82 pf ±5%, 100 VDCW; temp coef -470 PPM.	A303	19C304824G1	Band Pass Filter.	C345*	19A116192P6	Ceramic: 0.022 μf ±20%, 50 VDCW; sim to Erie 8131-M050-WSR-222M. Added by REV F.
C6	19A116114P2041	Ceramic: 22 pf ±5%, 100 VDCW; temp coef -80 PPM.	A304	19C311879G3	IF Amplifier.	J301 and J302	19A116122P1	Terminal, feed-thru: sim to Warren Co. 1-B-2994-4.
C7	19A116114P2056	Ceramic: 56 pf ±5%, 100 VDCW; temp coef -80 PPM.	A305	19C304824G1	Band Pass Filter.			----- JACKS AND RECEPTACLES -----
C8	19A116114P6062	Ceramic: 82 pf ±5%, 100 VDCW; temp coef -470 PPM.	A306	19C311879G4	IF Amplifier.			----- PLUGS -----
C9	19A116114P2030	Ceramic: 9 pf ±5%, 100 VDCW; temp coef -80 PPM.	A307	19C311876G4	Limiter.	P301 and P308	19A115834P4	Contact, electrical: sim to AMP 2-332070-9.
C10	19A116114P8	Ceramic: 2.2 pf ±5%, 100 VDCW; temp coef 0 PPM.	A308	19C304504G3	Discriminator.			----- RESISTORS -----
C11	19A116114P2033	Ceramic: 12 pf ±5%, 100 VDCW; temp coef -80 PPM.	A309*	19C311878G2	Audio Amplifier. Deleted in G3 by REV F.	R301*	3R151P680J	Composition: 68 ohms ±5%, 1/8 w.
C12	19A116114P8	Ceramic: 2.2 pf ±5%, 100 VDCW; temp coef 0 PPM.	A310	19C311995G4	Audio Amplifier, Tone Filter.			In REV B & earlier:
C13	19A116192P1	Ceramic: 0.01 μf ±20%, 50 VDCW; sim to Erie 8121-M050-WSR-103M.	A311*	19C311877G4	Audio PA.		3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
C14	19A116114P2028	Ceramic: 8.2 pf ±5%, 100 VDCW; temp coef -80 PPM.			In G2 of REV E & earlier, G3 of REV D & earlier:	R302	3R151P201J	Composition: 200 ohms ±5%, 1/8 w.
C15	19A116114P2016	Ceramic: 4.7 pf ±5%, 100 VDCW; temp coef -80 PPM.			Audio PA.	R303	3R151P150J	Composition: 15 ohms ±5%, 1/8 w.
C16	19A116192P1	Ceramic: 0.01 μf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.	A312	19C311880G4	Squelch.	R304 and R365	3R151P470J	Composition: 47 ohms ±5%, 1/8 w.
C17 and C18	19A116114P2036	Ceramic: 15 pf ±5%, 100 VDCW; temp coef -80 PPM.	A313	19C320061G1	Oscillator Compensator.			CAPACITOR KIT 19A130043G6
C19	19A116114P2053	Ceramic: 47 pf ±5%, 100 VDCW; temp coef -80 PPM.			----- OSCILLATORS -----	C330*	5495323P12	Ceramic: .001 μf +100% -20%, 75 VDCW. Added by REV A.
C20	19A116114P2036	Ceramic: 15 pf ±5%, 100 VDCW; temp coef -80 PPM.	A314, A315, A316 thru A323	4EG28A30	Oscillator Module. 66-76 MHz. $F_x = \frac{F_o + F_i F}{5}$	C331 thru C334	19A116192P1	Ceramic: 0.01 μf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C21 and C22	19A116114P2020	Ceramic: 6 pf ±5%, 100 VDCW; temp coef -80 PPM.			NOTE: When reordering, give GE Part Number and specify exact frequency needed.			----- MISCELLANEOUS -----
C23	19A116114P2016	Ceramic: 4.7 pf ±5%, 100 VDCW; temp coef -80 PPM.					19B216316P1	Insulator. (Used with J301, J302).
		----- DIODES AND RECTIFIERS -----					4035306P11	Washer, fiber. (Used with Q1, Q2 on Front End).
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.	A327 and A328	19C304824G3	Band Pass Filter.		19A127737P1	Spring, ground tab. (Soldered to Front End can).
		----- INDUCTORS -----	A330	19C304504G6	Discriminator.			
L1	19C320379G13 19B209436P1 19B228958G2	Coil. Includes: Tuning slug. Coil.			----- CAPACITORS -----			
L2 and L3			C301	5495323P12	Ceramic: .001 μf +100% -20%, 75 VDCW.			
L4	19C320379G11 1B209436P1	Coil. Includes: Tuning slug.	C302	19A116178P7	Tantalum: 220 μf ±20%, 6 VDCW.			
L5	19C320379G15 19B209436P1	Coil. Includes: Tuning slug.	C303*	19A116089P1	Ceramic: 0.1 μf ±20%, 50 VDCW, temp range -55 to +85°C. Deleted by REV E in G1. Deleted by REV D in G3.			
L6 and L7	19B228958G1	Coil.	C304	5491674P28	Tantalum: 1.0 μf ±20%, 25 VDCW; sim to Sprague Type 162D.			
		----- TRANSISTORS -----	C305	5491674P35	Tantalum: 22 μf ±20%, 4 VDCW; sim to Sprague Type 162D.			
Q1 and Q2	19A116960P1	N Type, field effect; sim to Type 2N4416.	C306	5491674P27	Tantalum: .47 μf ±20%, 35 VDCW; sim to Sprague Type 162D.			
			C307	5491674P31	Tantalum: .033 μf ±20%, 35 VDCW; sim to Sprague Type 162D.			
			C308 and C309	5491674P30	Tantalum: 39 μf ±20%, 10 VDCW; sim to Sprague Type 162D.			

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A Thru E - Receiver Board 19D417493G2

REV. A Thru D - Receiver Board 19D417493G3

Incorporated into initial shipment.

REV. F. - Receiver Board 19D417493G2

Rev. E. - Receiver Board 19D417493G3

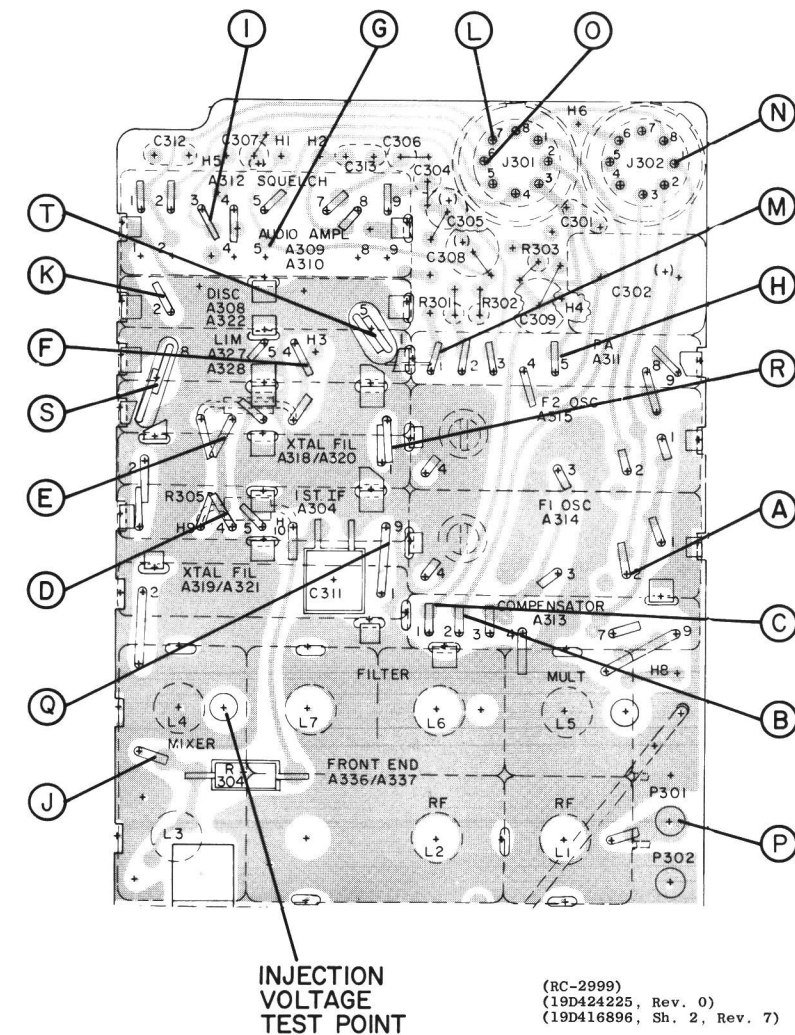
To improve audio quality
Changed A311.

REV. F. - Receiver Board 19D417493G3

To eliminate Non-Channel Guard receiver boards.
Deleted callouts of ■ A309 and circle (●) in front of A310. Deleted callout of C303 .1 μf. And just the circle (●) for C345.
Deleted NOTES: ■ Use for Non-Channel Guard receivers. ● Use for Channel Guard receivers.

REV. A - Capacitor Kit 19A130043G6

To improve IF filtering.
Added C330.



(RC-2996)
(19D424225, Rev. 0)
(19D416896, Sh. 2, Rev. 7)

QUICK CHECKS

SYMPTOM	PROCEDURE
No audio	<ol style="list-style-type: none">1. Check audio waveform at the top of the Volume Control (see Step 2).2. If audio is present, check voltage readings of Audio and Squelch modules (see Schematic Diagram).3. If audio is not present, check gain and current readings of Front End and IF modules (see Steps 1 & 3).
Poor Sensitivity	<ol style="list-style-type: none">1. Measure the injection voltage for a minimum level of 400 millivolts. If the reading is low, check the output of the Oscillator and Compensator modules with an RF voltmeter.2. Measure the gain of the Mixer stage (see Step 3). If low, measure the gain of the RF amplifier and IF modules.
Improper Squelch Operation	<ol style="list-style-type: none">1. Check the noise waveform at the input to the Squelch module and at Squelch Control high (see Step 2).2. Measure the DC voltages for the Squelch module (squelched and unsquelched).

STEP 3-RF GAIN CHECKS (STEPS P THRU T)

EQUIPMENT REQUIRED:

1. RF probe and Test Amplifier Model 4EX16A10 connected to GE Test Set Model 4EX3A11, or an RF voltmeter.
2. A signal generator (M-800 or equivalent) connected to P301 (High) and P302 (Low).

PROCEDURE FOR MIXER & 1ST IF:

1. Switch the Test Set to the Test 1 position and the Test Amplifier to the X50 position.
2. Connect the RF probe across the input of the stage to be measured as shown on the diagram. Increase the signal generator output to obtain a reference reading on Test Set 4EX3A11. Note the Test Set reading and the dB reading on the generator (dB1).
3. Connect the RF probe to the output of the stage to be measured as shown on the diagram. Decrease the generator output until the Test Set reference reading in Step 2 is obtained. Note the dB reading on the generator (dB2).
4. Subtract the dB1 reading from the dB2 reading and check the results with the typical gains shown on the diagram.

Example:
35 dB (dB2)
-15 dB (dB1)
20 dB gain

PROCEDURE FOR 2ND IF:

1. With no signal in, connect the RF probe to the output of the 2nd IF module. Increase the signal generator output until the Test Set reading increases by approximately 0.2 volt. Note Test Set and signal generator reading (dB2).
2. Connect the probe to the input of the 2nd IF module. Increase the signal generator until the Test Set reference reading is obtained, and note the dB reading (dB1).
3. Now subtract dB2 from dB1 to obtain the gain of the 2nd IF amplifier module.

LIMITER CHECK

The Limiter module limits the noise so that the gain of the circuit cannot be measured. The following procedure provides a check to determine if the module is limiting.

1. Switch the Test Amplifier to the X1 position and the Test Set to the Test 1 position. Then connect the RF probe to the output of the Limiter module and check for a reading of approximately 0.4 volt.
2. Increase the signal generator output. There should be no appreciable increase in the limiter output meter reading.

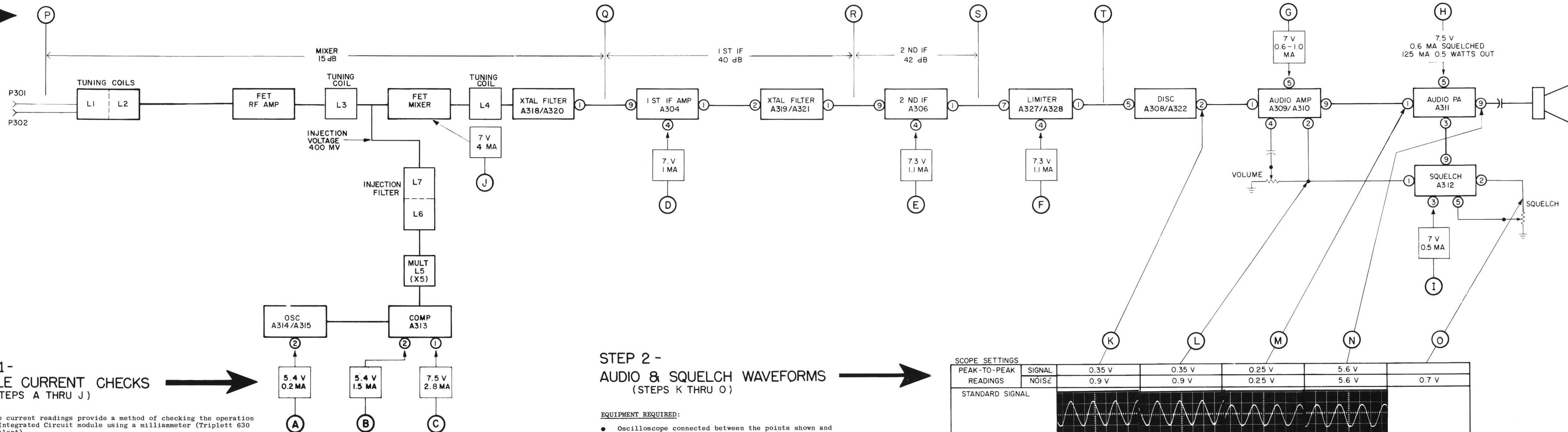
STEP 1- MODULE CURRENT CHECKS (STEPS A THRU J)

These current readings provide a method of checking the operation of each Integrated Circuit module using a milliammeter (Triplet 630 or equivalent).

1. Unsolder the + lead as shown in the Diagram of the module to be checked.
2. Connect the milliammeter in series with the + lead, and check for the indicated current drain and supply voltage. No current drain indicates that the module should be replaced.

CAUTION

When checking the current of Audio PA module A311, do not short Pin 4 to ground or to + (Pin 5). To do so will destroy the Audio PA module.



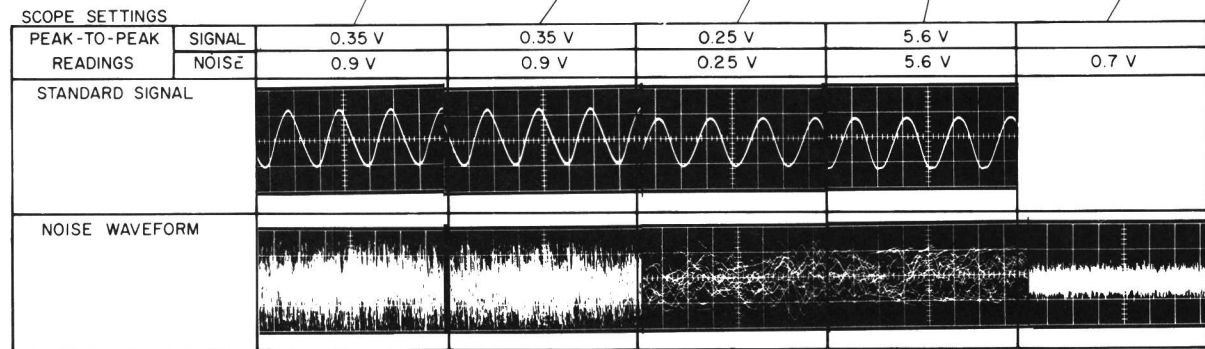
STEP 2 - AUDIO & SQUELCH WAVEFORMS (STEPS K THRU O)

EQUIPMENT REQUIRED:

- Oscilloscope connected between the points shown and ground.
- Signal Generator (Measurements M-800 or equivalent).

PRELIMINARY STEPS:

1. Apply a standard signal to P301. A standard signal is 1000 microvolts on the receiver frequency modulated by one kHz with 3.0-kHz deviation.
2. Set the Volume control for 0.5-watt output.



RC-2996

TROUBLESHOOTING PROCEDURE

66—88 MHz RECEIVER
MODELS 4ER87B10, 11, 12 & 13