

# **SHIPMATE**

## **RS 8000**

### **MARINE VHF RADIOTELEPHONE SERVICE MANUAL**

**NO: 9002**

**RS RAUFF & SØRENSEN A/S**

Søndervang 14. 9530 Støvring  
DENMARK





## TABLE OF CONTENT

1. TABLE OF CONTENT
2. SPECIFICATIONS
  - 2.1. General
  - 2.2. Transmitter
  - 2.3. Receiver
  - 2.4. Selcall
3. OPERATION
4. INSTALLATION
5. FREQUENCY TABLE
6. MECHANICAL LAY OUT
7. BLOCKDIAGRAM
8. CIRCUIT DESCRIPTION
  - 8.1. General
  - 8.2. Receiver
  - 8.3. Synthesizer
  - 8.4. TX-driver
  - 8.5. Modulator
  - 8.6. TX-power amplifier
  - 8.7. Channel codes
9. ALIGNMENT
  - 9.1. Alignment of receiver RF and IF
  - 9.2. Alignment of VCO
  - 9.3. Alignment of Tx-driver
  - 9.4. Alignment of channel frequency
  - 9.5. Alignment of VHF PA
  - 9.6. Alignment of modulator
  - 9.7. Alignment of receiver AF and SQ
  - 9.8. Alignment and coding of SELCALL
10. OPTIONS
  - 10.1. 24 V regulator
  - 10.2. Selcall
11. DIAGRAM
12. PARTS LISTS

## 2. SPECIFICATIONS

### 2.1. GENERAL

Channels:	55 international marine channels 15 private channels available
Channel spacing:	25 KHz
Mode of operation:	Simplex/Semiduplex
Temperature range:	-20°C to +55°C
Frequency stability:	±10 ppm
Supply voltage:	12 V Battery 24 V by separate converter
Current drain:	Transmit high power (25 W), 4,5 A Transmit low power (1 W), 1,5 A Stand by 0,7 A
Dual Watch:	Channel 16 plus an operator selected channel
Aut. Ch. 16:	Separate push button for channel 16
Weight:	2,5 kg
Dimensions:	56 x 160 x 210 mm

All measurements according to CEPT.

### 2.2. TRANSMITTER

Frequency range:	155,0 MHz - 159,0 MHz
Power output:	25 Watts, 1 W reduced power
Spurious emission:	-80 dB
AF response:	6 dB/octave
Modulation:	±5 KHz
Ant. impedance:	50 ohms

### 2.3. RECEIVER

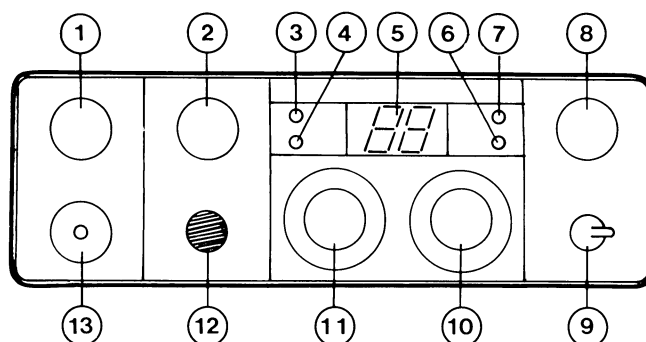
Frequency range:	155,0 MHz - 159,0 MHz 159,6 MHz - 163,6 MHz
Sensitivity:	0,3 µV/12 dB SINAD
Intermodulation:	70 dB
AF output power:	4 W in 4 ohms
Squelch:	Adjustable from 6 dB to 20 dB SINAD
Distortion:	3%

### 2.4. SELCALL

Alarm:	Acoustic signal in loudspeaker Light indication for received sel- call and/or for received CQ-call
Ext. Alarm:	Relay contact Max. 100 V Max. 1 A. Max. 10 VA

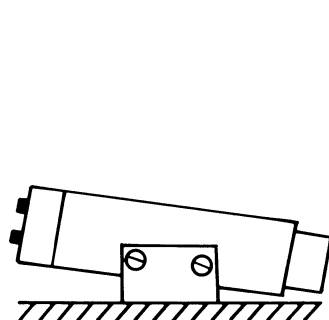
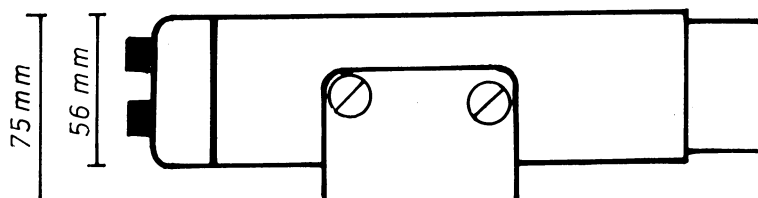
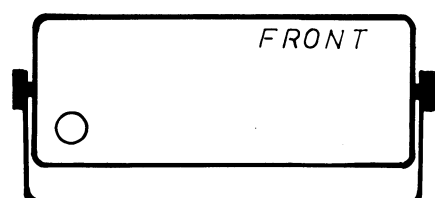
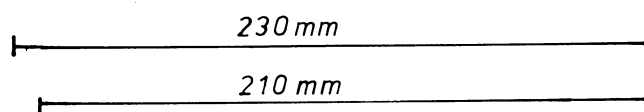
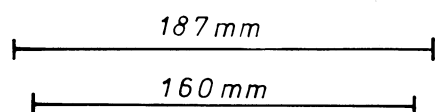
Build in automatic test facility for the selcall.

## 3. OPERATION

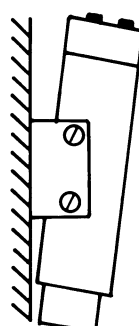


1. ON/OFF switch and volume control for external loudspeaker. The volume control will have no influence on microtelephone and alarm signals from the SELCALL.
2. Squelch and transmitter power control. The receiver noise in periods with no signal will be muted when the knob is turned clockwise. 25 W transmitter power when the knob is pushed in. 1 W transmitter power when the knob is pulled out.
3. Transmitter indicator. Indicates that the transmitter is operating.
4. DUAL WATCH indicator. Indicates that the DUAL WATCH function is on and it is not possible to transmit.
5. Channel indicator.
6. CALL indicator. Indicates that a selective tone call is received either from your own testbutton or from a coast station.
7. CQ indicator. Indicates that a CQ/ALARM call is received either from your own testbutton or from a coast station.
8. Dimmer control and DUAL WATCH switch. By means of the dimmer control the light intensity in channel display and indicators can be regulated. DUAL WATCH is on when the knob is pulled out. DUAL WATCH is off when the knob is pushed in.
9. TEST ON/OFF switch for SELCALL. Pressing the switch in position TEST for app. 1 second the SELCALL facility can be tested. The CALL and CQ indicators will be illuminated and a tone signal will be heard in the loudspeaker. By pressing the switch in position ON/OFF the light in the CALL and CQ indicators will be switched off.
10. Channel selector. Selects second channel digit.
11. Channel selector. Selects first channel digit.
12. CH 16 knob. When it is pushed the radiotelephone operates on the calling and distress channel. The channel display will indicate 16. The channel selectors and DUAL WATCH are out of function. By pushing the CH 16 knob again the radiotelephone switch back to the original mode.
13. Handset connector.

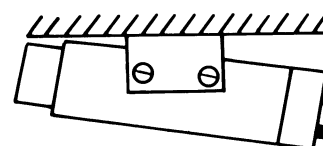
## 4. INSTALLATION



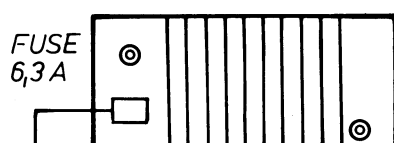
TABLE



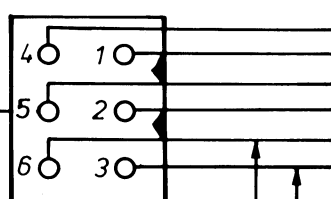
BULKHEAD



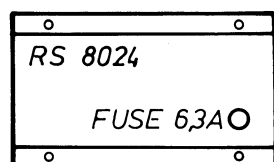
DECKHEAD



ANTENNA CONNECTOR  
PL 259 50 Ohm  
CABLE RG 8/RG 56

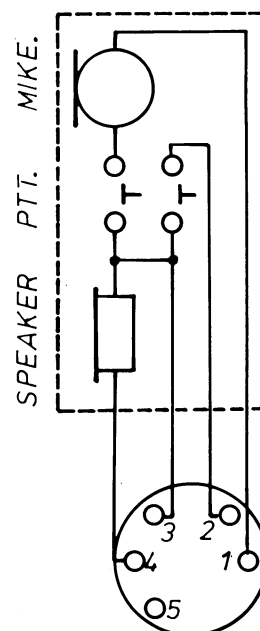


LOUDSPEAKER  
4 Ohm, 4 Watts  
ALARM RELAY  
FROM SELCALL  
BATT. -12 VOLT  
BATT. +12 VOLT



POWER CABLE  
MINIMUM 1,5 mm<sup>2</sup>  
BATT - 24 VOLT  
BATT + 24 VOLT

HANDSET

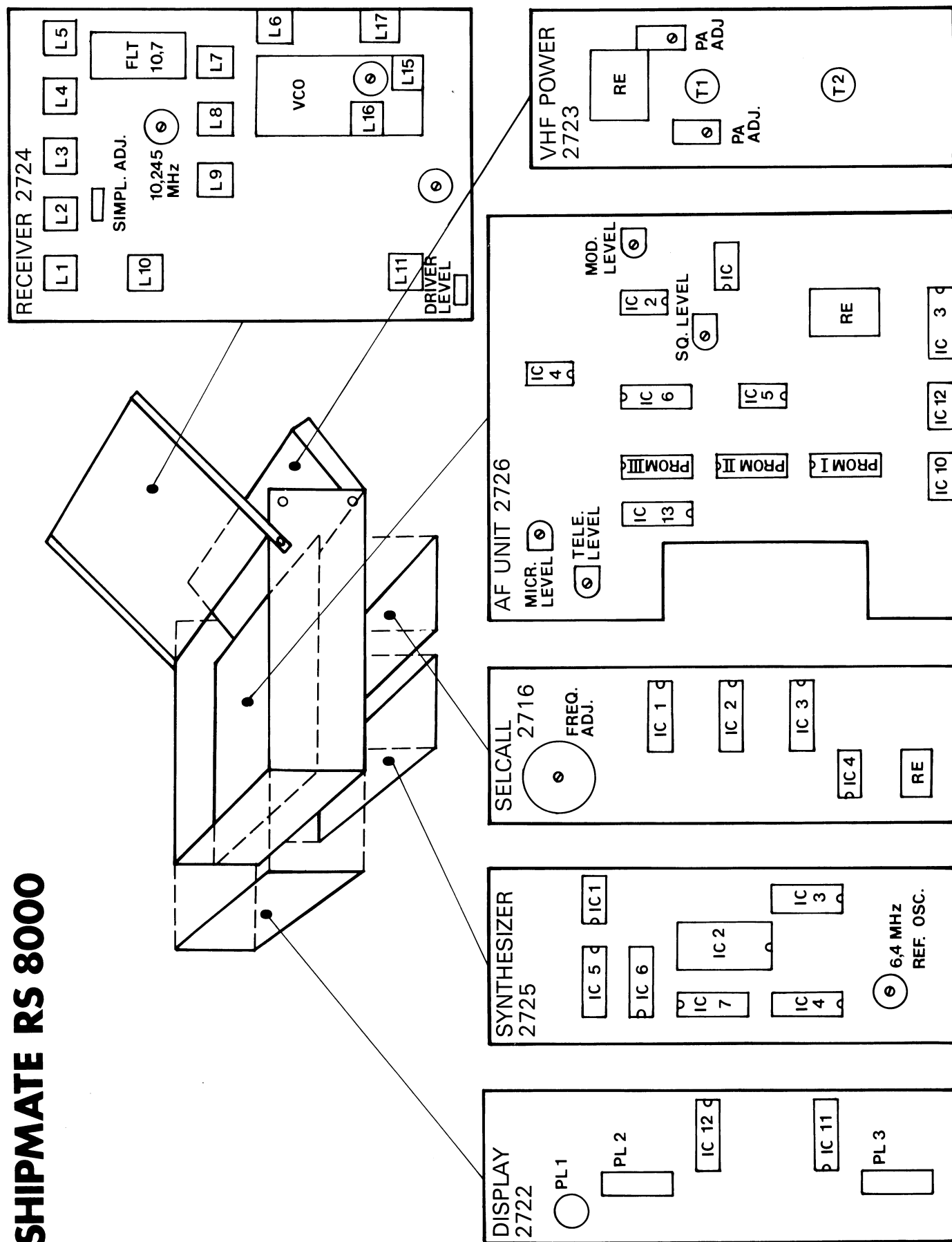


5. FREQUENCY TABLES

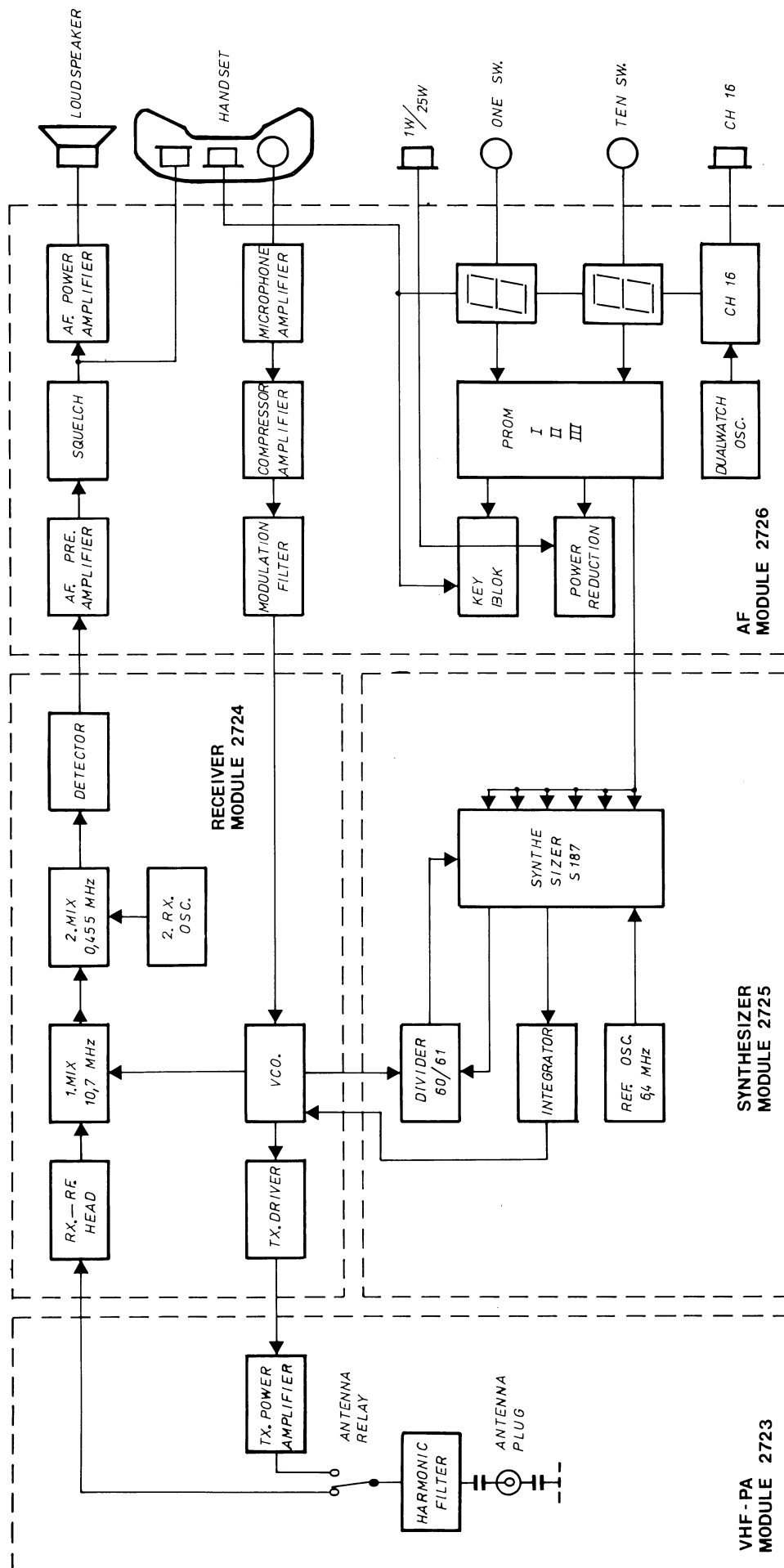
CH	Tx-FREQ.		Rx-FREQ.		SY-FREQ.		CHANNEL	Tx-FREQ.		Rx-FREQ.		SY-FREQ.		CHANNEL	Tx-FREQ.		Rx-FREQ.		SY-FREQ.	
	MHz	MHz	MHz	MHz	MHz	MHz		MHz	MHz	MHz	MHz	MHz	MHz		MHz	MHz	MHz	MHz	MHz	MHz
1			160.650	149.950	156.800	146.100	16			156.800	146.100	156.800	146.100	60			160.625	149.925	156.875	146.175
1	156.050			156.050	156.800	156.800	16	156.800			156.800	156.025	156.025	77	156.875			156.875	156.875	156.875
2		160.700		150.000	156.850	146.150	17		156.850	156.850	146.150	149.975	149.975	78		156.925	161.525	150.825	150.825	150.825
2	156.100			156.100	156.850	156.850	17	156.850			156.850	156.075	156.075	78	156.925			156.925	156.925	156.925
3		160.750		150.050	161.500	150.800	18		161.500	161.500	150.800	150.025	150.025	79			161.575	150.875	150.875	150.875
3	156.150			156.150	156.900	156.900	18	156.900			156.900	156.125	156.125	79	156.975			156.975	156.975	156.975
4		160.800		150.100	161.500	150.850	19		161.500	161.500	150.850	150.075	150.075	80		157.025	161.625	150.925	150.925	150.925
4	156.200			156.200	156.950	156.950	19	156.950			156.950	156.175	156.175	80	157.025			157.025	157.025	157.025
5		160.850		150.150	161.600	150.900	20		161.600	161.600	150.900	156.225	156.225	81		157.075	161.675	150.975	150.975	150.975
5	156.250			156.250	157.000	157.000	20	157.000			157.000	156.225	156.225	81	157.075			157.075	157.075	157.075
6		156.300		145.600	161.650	150.950	21		161.650	161.650	150.950	156.275	156.275	82		157.125	161.725	151.025	151.025	151.025
6	156.300			156.300	157.050	157.050	21	157.050			157.050	156.325	156.325	82	157.125			157.125	157.125	157.125
7		160.950		150.250	161.700	151.000	22		161.700	161.700	151.000	156.425	156.425	83		157.175	161.775	151.075	151.075	151.075
7	156.350			156.350	157.100	157.100	22	157.100			157.100	156.425	156.425	83	157.175			157.175	157.175	157.175
8		156.400		145.700	161.750	151.050	23		161.750	161.750	151.050	156.375	156.375	84		157.225	161.825	151.125	151.125	151.125
8	156.400			156.400	157.150	157.150	23	157.150			157.150	156.375	156.375	84	157.225			157.225	157.225	157.225
9		156.450		145.750	161.800	151.100	24		161.800	161.800	151.100	145.725	145.725	85		157.275	161.875	151.175	151.175	151.175
9	156.450			156.450	157.200	157.200	24	157.200			157.200	156.425	156.425	85	157.275			157.275	157.275	157.275
10		156.500		145.800	161.850	151.150	25		161.850	161.850	151.150	145.775	145.775	86		157.325	161.925	151.225	151.225	151.225
10	156.500			156.500	157.250	157.250	25	157.250			157.250	156.475	156.475	86	157.325			157.325	157.325	157.325
11		156.550		145.850	161.900	151.200	26		161.900	161.900	151.200	145.825	145.825	87		157.375	161.975	151.275	151.275	151.275
11	156.550			156.550	157.300	157.300	26	157.300			157.300	156.525	156.525	87	157.375			157.375	157.375	157.375
12		156.600		145.900	161.950	151.250	27		161.950	161.950	151.250	145.875	145.875	88		157.425	162.025	151.325	151.325	151.325
12	156.600			156.600	157.350	157.350	27	157.350			157.350	156.575	156.575	88	157.425			157.425	157.425	157.425
13		156.650		145.950	162.000	151.300	28		162.000	162.000	151.300	145.925	145.925							
13	156.650			156.650	157.400	157.400	28	157.400			157.400	156.625	156.625							
14		156.700		146.000								145.975	145.975							
14	156.700			156.700								156.675	156.675							
15		156.750		146.050								146.025	146.025							
15	156.750			156.750								156.725	156.725							

# SHIPMATE RS 8000

## 6. MECHANICAL LAY OUT



## 7. BLOCKDIAGRAM



## 8. CIRCUIT DESCRIPTION

### 8.1. GENERAL

RS 8000 is built up of the following modules:

- RF MODULE with receiver RF section, Tx-driver and VCO.
- AF MODULE with receiver AF section, modulator and channel selector logic.
- SYNTHESIZER MODULE with counters, ref. oscillator and integrator.
- DISPLAY MODULE with the channel displays.
- PA MODULE with Tx-PA, harmonic filter and antenna relay.

In S187 there are 3 counters.

M-counter

A-counter

Reference-counter.

### 8.2. RECEIVER:

The receiver is a double superheterodyne with 1st IF 10.7 MHz and 2nd IF 0.455 MHz.

The RF head is with a junction FET and tuning diodes.

The main selectivity is in the crystal filter on 10.7 MHz.

In 2nd IF there is a ceramic filter. From the quadrature detector the AF leaves the RF MODULE and appears on the AF MODULE.

The AF signal comes to the squelch amplifier with an active filter where only frequencies higher than 7 KHz are amplified. In the squelch detector the noise signal is compared with the threshold level from the squelch potentiometer and depending on the signal to noise level the AF-muting circuit is blocked or open.

When the AF signal has passed the AF deemphasis amplifier and the AF-muting circuit it is amplified in the telephone amplifier. From there it comes to the telephone level potentiometer and the volume control.

In the monolithic loudspeaker amplifier the AF signal is amplified to max. 4 Watts.

### 8.3. SYNTHESIZER:

The synthesizer consists of a large scale integrated MOS circuit, a high speed divider and a reference oscillator. The VCO signal comes from the VCO on the RF-MODULE. It is buffered and applied to the ELC divider where it is divided by 10 or 11 depending on the control voltage from S187 pin 15.

4 J-K multirators in TTL logic forms together with the ECL divider a 60/61 divider. The frequency input for S187 is about 2.5 MHz.

### 8.4. TX-DRIVER:

In the Tx-driver the VCO signal is amplified to a suitable level for Tx power amplifier.

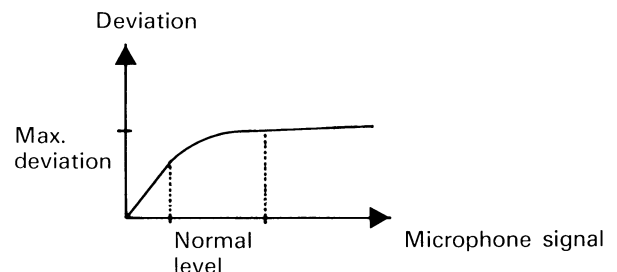
In order to avoid transmission when the synthesizer is out of lock e.g. in the moment when the key is pressed - there is a blocking circuit combining the key and a out of lock information from the synthesizer.

### 8.5. MODULATOR:

The modulator consists of a preamplifier with the pre-emphasis network a compressor amplifier a fullwave detector and an active low pass filter.

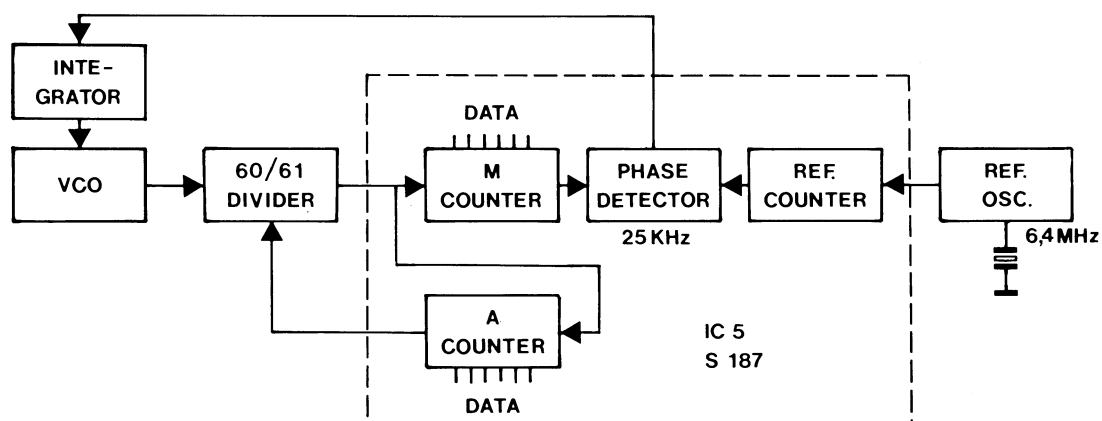
The microphone signal is amplified in the preamplifier and the compressor amplifier.

If the signal after detection in the fullwave detector is bigger than the threshold voltage of the attenuator-transistor, the signal will automatically be reduced to a constant level.



### 8.6. TX-POWER:

The Tx-power amplifier consists of two power transistors. The tuned circuits are in stripline technique. The total gain is 20 dB.





## 8.7. CHANNEL CODES

CHANNEL		PROM I				PROM II					PROM III				
Receiver	ORD	M4 9	M2 10	M1 11	A32 12	ADD	A4 9	A8 10	A2 11	A1 12	ADD	A16 9	RP 10	M8 11	BL 12
0	128	1	1	1	1	128	1	1	1	1	128	1	1	1	1
1	136	0	1	1	1	136	0	1	1	0	136	1	0	0	0
2	132	1	0	0	0	192	0	0	0	0	132	0	0	0	0
3	140	1	0	0	0	200	0	0	1	0	140	0	0	0	0
4	130	1	0	0	0	160	1	0	0	0	130	0	0	0	0
5	138	1	0	0	0	168	1	0	1	0	138	0	0	0	0
6	134	0	0	1	0	224	1	0	0	0	134	0	0	0	0
7	142	1	0	0	0	232	0	1	1	0	142	0	0	0	0
8	129	0	0	1	0	144	0	1	0	0	129	0	0	0	0
9	137	0	0	1	0	152	0	1	1	0	137	0	0	0	0
10	160	0	0	1	0	130	1	1	0	0	160	0	0	0	0
11	168	0	0	1	0	138	1	1	1	0	168	0	0	0	0
12	164	0	0	1	0	194	0	0	0	0	164	1	0	0	0
13	172	0	0	1	0	202	0	0	1	0	172	1	0	0	0
14	162	0	0	1	0	162	1	0	0	0	162	1	0	0	0
15	170	0	0	1	0	170	1	0	1	0	170	1	0	0	0
16	166	0	0	1	0	226	0	1	0	0	166	1	0	0	0
17	174	0	0	1	0	234	0	1	1	0	174	1	0	0	0
18	161	1	0	0	1	146	0	0	0	0	161	0	0	0	0
19	169	1	0	0	1	154	0	0	1	0	169	0	0	0	0
20	144	1	0	0	1	129	1	0	0	0	192	0	0	0	0
21	152	1	0	0	1	137	1	0	1	0	200	0	0	0	0
22	148	1	0	0	1	193	0	1	0	0	196	0	0	0	0
23	156	1	0	0	1	201	0	0	1	0	204	0	0	0	0
24	146	1	0	0	1	161	1	1	0	0	194	0	0	0	0
25	154	1	0	0	1	169	1	1	1	1	202	0	0	0	0
26	150	1	0	0	1	225	0	0	0	0	198	1	0	0	0
27	158	1	0	0	1	233	0	0	1	0	206	1	0	0	0
28	145	1	0	0	1	145	1	0	0	0	193	1	0	0	0
29	153	1	1	1	1	153	1	1	1	1	201	1	1	1	1

CHANNEL		PROM I				PROM II					PROM III				
Receiver	ADD	M4 9	M2 10	M1 11	A32 12	ADD	A4 9	A8 10	A2 11	A1 12	ADD	A16 9	RP 10	M8 11	BL 12
60	208	0	1	1	1	133	0	1	0	1	208	1	0	0	0
61	216	0	1	1	1	141	0	1	1	1	216	1	0	0	0
62	212	1	0	0	0	197	0	0	0	1	212	0	0	0	0
63	220	1	0	0	0	205	0	0	1	1	220	0	0	0	0
64	210	1	0	0	0	165	1	0	0	1	210	0	0	0	0
65	218	1	0	0	0	173	1	0	1	1	218	0	0	0	0
66	214	1	0	0	0	229	0	1	0	1	214	0	0	0	0
67	222	0	0	1	0	237	1	0	1	1	222	0	0	0	0
68	209	0	0	1	0	149	0	1	0	1	209	0	0	0	0
69	217	0	0	1	0	157	0	1	1	1	217	0	0	0	0
70	240	0	0	1	0	135	1	1	0	1	240	0	0	0	0
71	248	0	0	1	0	143	1	1	1	1	248	0	0	0	0
72	244	0	0	1	0	199	0	0	0	1	244	1	0	0	0
73	252	0	0	1	0	207	0	0	1	1	252	1	0	0	0
74	242	0	0	1	0	167	1	0	0	1	242	1	0	0	0
75	250	1	1	1	1	175	1	1	1	1	250	1	1	1	1
76	246	1	1	1	1	231	1	1	1	1	246	1	1	1	1
77	254	0	0	1	0	239	0	1	1	1	254	1	0	0	0
78	241	1	0	0	1	151	0	0	0	1	241	0	0	0	0
79	249	1	0	0	1	159	0	0	1	1	249	0	0	0	0
80	192	1	0	0	1	132	1	0	0	1	144	0	0	0	0
81	200	1	0	0	1	140	1	0	1	1	152	0	0	0	0
82	196	1	0	0	1	196	0	1	0	1	148	0	0	0	0
83	204	1	0	0	1	204	0	1	1	1	156	0	0	0	0
84	194	1	0	0	1	164	1	1	0	1	146	0	0	0	0
85	202	1	0	0	1	172	1	1	1	1	154	0	0	0	0
86	198	1	0	0	1	228	0	0	0	1	150	1	0	0	0
87	206	1	0	0	1	236	0	0	1	1	158	1	0	0	0
88	193	1	0	0	1	148	1	0	0	1	145	1	0	0	0
89	201	1	1	1	1	156	1	1	1	1	153	1	1	1	1
16RA	255	0	0	1	0	255	0	1	0	0	255	1	0	0	0

CHANNEL		PROM I				PROM II					PROM III				
Transmit	ADD	M4 9	M2 10	M1 11	A32 12	ADD	A4 9	A8 10	A2 11	A1 12	ADD	A16 9	RP 10	M8 11	BL 12
0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1
1	8	0	0	0	0	8	0	0	1	0	8	0	1	1	0
2	4	0	0	0	0	64	1	0	0	0	4	0	1	1	0
3	12	0	0	0	0	72	1	0	1	0	12	0	1	1	0
4	2	0	0	0	0	32	0	1	0	0	2	0	1	1	0
5	10	0	0	0	0	40	0	1	1	0	10	0	1	1	0
6	6	0	0	0	0	96	1	1	0	0	6	0	1	1	0
7	14	0	0	0	0	104	1	1	1	0	14	0	1	1	0
8	1	0	0	0	0	16	0	0	0	0	1	1	1	1	0
9	9	0	0	0	0	24	0	0	1	0	9	1	1	1	0
10	32	0	0	0	0	2	1	0	0	0	32	1	1	1	0
11	40	0	0	0	0	10	1	0	1	0	40	1	1	1	0
12	36	0	0	0	0	66	0	1	0	0	36	1	1	1	0
13	44	0	0	0	0	74	0	1	1	0	44	1	1	1	0
14	34	0	0	0	0	34	1	1	0	0	34	1	1	1	0
15	42	0	0	0	0	42	1	1	1	0	42	1	0	1	0
16	38	0	0	0	1	98	0	0	0	0	38	0	1	1	0
17	46	0	0	0	1	106	0	0	1	0	46	0	0	1	0
18	33	0	0	0	1	18	1	0	0	0	33	0	1	1	0
19	41	0	0	0	1	26	1	0	1	0	41	0	1	1	0
20	16	0	0	0	1	1	0	1	0	0	64	0	1	1	0
21	24	0	0	0	1	9	0	1	1	0	72	0	1	1	0
22	20	0	0	0	1	65	1	1	0	0	68	0	1	1	0
23	28	0	0	0	1	73	1	1	1	0	76	0	1	1	0
24	18	0	0	0	1	33	0	0	0	0	66	0	0	0	1
25	26	0	0	0	1	41	0	0	1	0	74	1	1	1	0
26	22	0	0	0	1	97	1	0	0	0	70	1	1	1	0
27	30	0	0	0	1	105	1	0	1	0	78	1	1	1	0
28	17	0	0	0	1	17	0	1	0	0	65	1	1	1	0
29	25	1	1	1	1	25	1	1	1	1	73	1	1	1	1

CHANNEL		PROM I				PROM II					PROM III				
Transmit	ADD	M4 9	M2 10	M1 11	A32 12	ADD	A4 9	A8 10	A2 11	A1 12	ADD	A16 9	RP 10	M8 11	BL 12
60	80	0	0	0	0	5	0	0	0	1	80	0	1	1	0
61	88	0	0	0	0	13	0	0	1	1	88	0	1	1	0
62	84	0	0	0	0	69	1	0	0	1	84	0	1	1	0
63	92	0	0	0	0	77	1	0	1	1	92	0	1	1	0
64	82	0	0	0	0	37	0	1	0	1	82	0	1	1	0
65	90	0	0	0	0	45	0	1	1	1	90	0	1	1	0
66	86	0	0	0	0	101	1	1	0	1	86	0	1	1	0
67	94	0	0	0	0	109	1	1	1	1	94	0	1	1	0
68	81	0	0	0	0	21	0	0	0	1	81	1	1	1	0
69	89	0	0	0	0	29	0	0	1	1	89	1	1	1	0
70	112	0	0	0	0	7	1	0	0	1	112	1	1	1	0
71	120	0	0	0	0	15	1	0	1	1	120	1	1	1	0
72	116	0	0	0	0	71	0	1	0	1	116	1	1	1	0
73	124	0	0	0	0	79	0	1	1	1	124	1	1	1	0
74	114	0	0	0	0	39	1	1	0	1	114	1	1	1	0
75	122	1	1	1	1	47	1	1	1	1	122	1	1	1	1
76	118	1	1	1	1	103	1	1	1	1	118	1	1	1	1
77	126	0	0	0	1	111	0	0	1	1	126	0	1	1	0
78	113	0	0	0	1	23	1	0	0	1	113	0	1	1	0
79	121	0	0	0	1	31	1	0	1	1	121	0	1	1	0
80	64	0	0	0	1	4	0	1	0	1	16	0	1	1	0
81	72	0	0	0	1	12	0	1	1	1	24	0	1	1	0
82	68	0	0	0	1	68	1	1	0	1	20	0	1	1	0
83	76	0	0	0	1	76	1	1	1	1	28	0	1	1	0
84	66	0	0	0	1	36	0	0	0	1	18	1	1	1	0
85	74	0	0	0	1	44	0	0	1	1	26	1	1	1	0
86	70	0	0	0	1	100	1	0	0	1	22	1	1	1	0
87	78	0	0	0	1	108	1	0	1	1	30	1	1	1	0
88	65	0	0	0	1	20	0	1	0	1	17	1	1	1	0
89	73	1	1	1	1	28	1	1	1	1	25	1	1	1	1
16TA	127	0	0	0	1	127	0	0	0	0	127	0	1	1	0

## 9. ALIGNMENT

### 9.1. ALIGNMENT OF RECEIVER RF AND IF

Necessary measuring equipment.

Signal generator 0.1u-10 mV 50 ohm

Distortion meter or AF voltmeter.

Oscilloscope.

Frequency counter.

Connect frequency counter to Emitter T8 TP2.

Check the frequency to be 10.245 KHz  $\pm 100$  Hz.

Select CH18 161.500 ohm (VCO=150.800 MHz).

Connect a distortion meter across the loudspeaker terminals.

Connect a signal generator to the antenna connector and tune it to 161.500.0 MHz modulated with 1 KHz  $\pm 3$  KHz deviation.

Connect an oscilloscope to TP1, frequency 455 MHz and sensitivity 0.1V/cm.

Use a non-loading test probe.

Increase the signal generator output until you see a signal in TP1

Tune L9, L8, L7, L6, L5, L4, L3, L2 and L1 to max. signal in TP1.

If the signal in TP1 exceeds 500 mV pp, the signal generator output must be reduced.

L5, L7 and L9 are tuned to minimum distortion of the signal in TP1.

Be sure that the generator still is exactly on the frequency.

L10 is tuned to max. signal in the loudspeaker.

L6 is tuned 1 turn down.

The sensitivity at 12 dB SINAD or S/N must be better than 0,4 uV.

Select CH11 156.550 MHz (VCO=145.850 MHz).

Tune P1 to best sensitivity. At 12 dB SINAD or S/N the sensitivity must be better than 0,4 uV.

### 9.2. ALIGNMENT OF VCO

Necessary measuring equipment.

Voltmeter and RF probe.

Connect a voltmeter in TP3 - VCO-DC.

Select CH28 162.000 MHz VCO 151.300 MHz highest RX frequency.

Adjust C75 to TP3 = 3,5 volt.

Key the transmitter CH28 157.440 MHz.

Check voltage in TP3 to be 4,5-6,5 V.

Select CH6 156.300 MHz VCO 145.600 MHz lowest RX frequency.

Check voltage in TP3 to be 7,5-8,5 V.

Connect a voltmeter with RF probe for output of L17 - (RF input on synthesizer).

Select CH28.

Adjust L15, L17 to max. output - minimum 400 mV.

Check the voltage in TP3 again 3,5 V.

### 9.3. ALIGNMENT OF TX-DRIVER

Necessary measuring equipment.

Voltmeter and RF probe or a voltmeter.

Connect a 47 ohms resistor on the Tx-driver output and measure the voltage or power.

Select CH16 (156.800 MHz) and key the transmitter.

Tune C63, L11 and P2 to max. output minimum 3,5 V/50 ohms - 3,0 W.

At normal drive the voltage drop across R60 is 1,2 V.

### 9.4. ALIGNMENT OF CHANNEL FREQUENCY

Necessary measuring equipment.

Frequency counter.

Connect a frequency counter to the dummy load.

Select CH16 and key the transmitter LOW POWER.

Adjust C10 in 6,4 MHz oscillator Synthesizer module.

Frequency must be 156.800.0  $\pm 500$  Hz.

Normally the frequency is decreasing 500 Hz when the set is heated.

### 9.5. ALIGNMENT OF VHF-PA

Necessary measuring equipment.

VHF power meter.

Connect a 50 dummy load with a power meter.

Select CH14 (156.700 MHz).

Time C7 and C14 to max. output power.

Output power must be 20W  $\pm 2$ W at 12,0 V supply voltage.

Output power can be adjusted with P2 on receiver module.

Normal drive in MRF 237 gives a voltage drop on 2,5 V across R2.

Normal drive in MRF 238 gives a transmitcurrent for the total set at 4-4,5 A.

Switch to reduced power.

Output must be 0,5 W-1 W.

This can be adjusted by changing R118 on AF module.

### 9.6. ALIGNMENT OF MODULATOR

Necessary measuring equipment.

Tune generator.

Oscilloscope.

Deviation meter.

Select CH14 and key the transmitter on LOW POWER.

Connect a deviation meter to the dummy load.

Connect a tone generator to the microphone terminals.

Input 1 KHz 150 mV pp (50 mV RMS) on the terminal.

Turn P6 in middle position.

Connect oscilloscope to TP4.

Check the compressor function. Signal in TP4 must be 2-5 Vpp.

Adjust P5 to a deviation on  $\pm 5$  KHz.

Reduce tone generator input to 5 mV RMS on the terminals.

Adjust P6 to a deviation on  $\pm 3$  KHz.

P6 can be readjusted to the actual microphone level.

Check that the max. deviation still is  $\pm 5$  KHz when the receiver module is locked in the correct position and the TX-power is on maximum.

### 9.7. ALIGNMENT OF RECEIVER - AF AND SQ

Necessary measuring equipment.

Signal generator.

Select CH16 156.800 MHz.

1 KHz mod.  $\pm 3$  KHz div. 1 mV ant.

Adjust P3 to a telephone level of 600 mVpp.

Disconnect the signal generator.

Set SQ potm. in center position.

Adjust P2 to threshold level.

## 9.8. ALIGNMENT AND CODING OF SELCALL

Necessary measuring equipment.

AF generator.

Frequency counter.

RF generator.

Oscilloscope.

Adjust the AF generator using a frequency counter to the first tone in the code.

Connect the AF generator to the modulation input of the RF generator - CH16 deviation  $\pm 1$  KHz.

Short circuit pin 15-16 IC1.

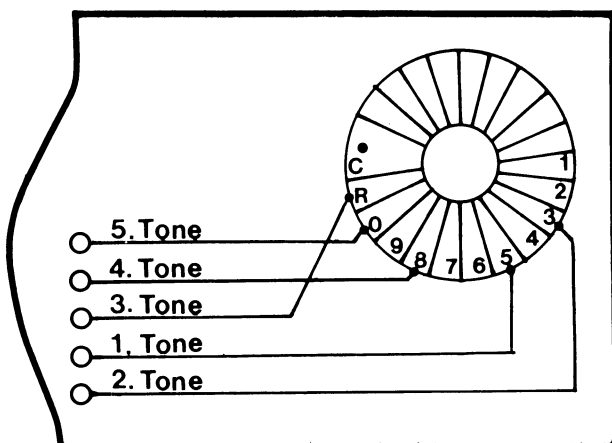
Connect oscilloscope to base of T6 and adjust L1 to maximum signal.

Disconnect the short circuit pin 15-16 IC1.

Connect oscilloscope to pin 13 IC1.

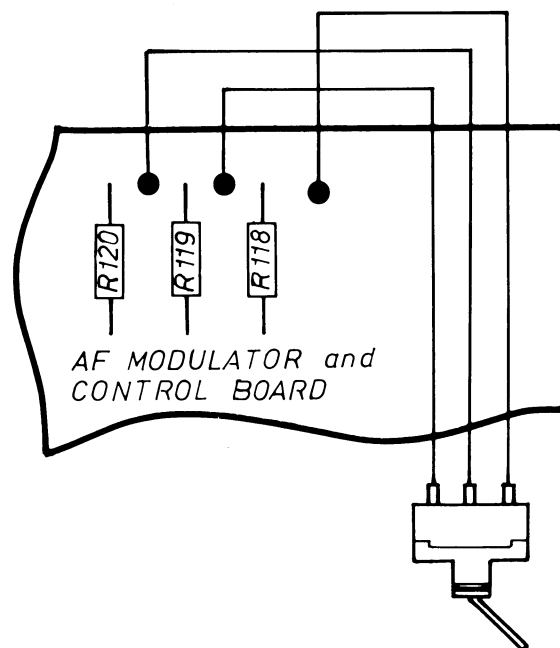
Time of high level 12-15 m sec. determined by R4.

Time of low level 270-350 m sec. determined by R8.



The code on the layout drawing is 53R80 = 53380

## 10.2. SELCALL

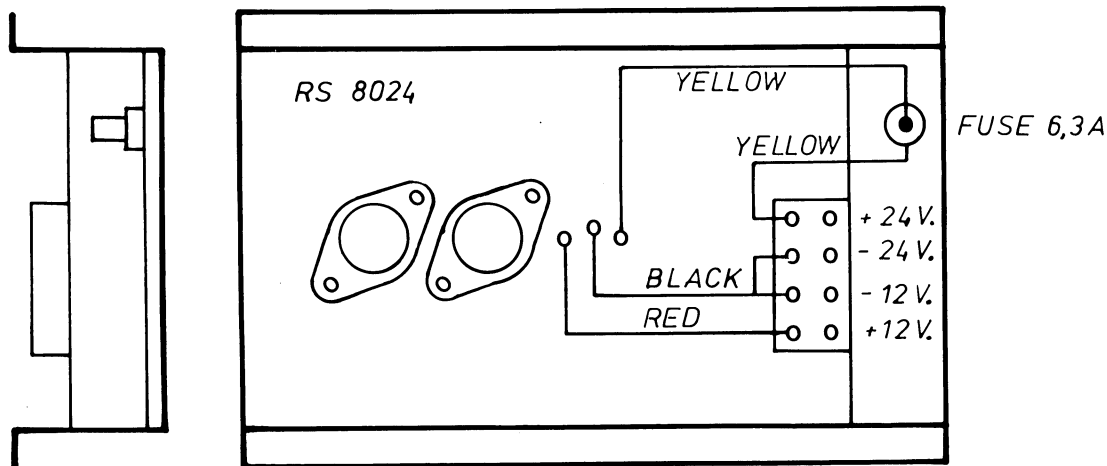


### Tone Frequency

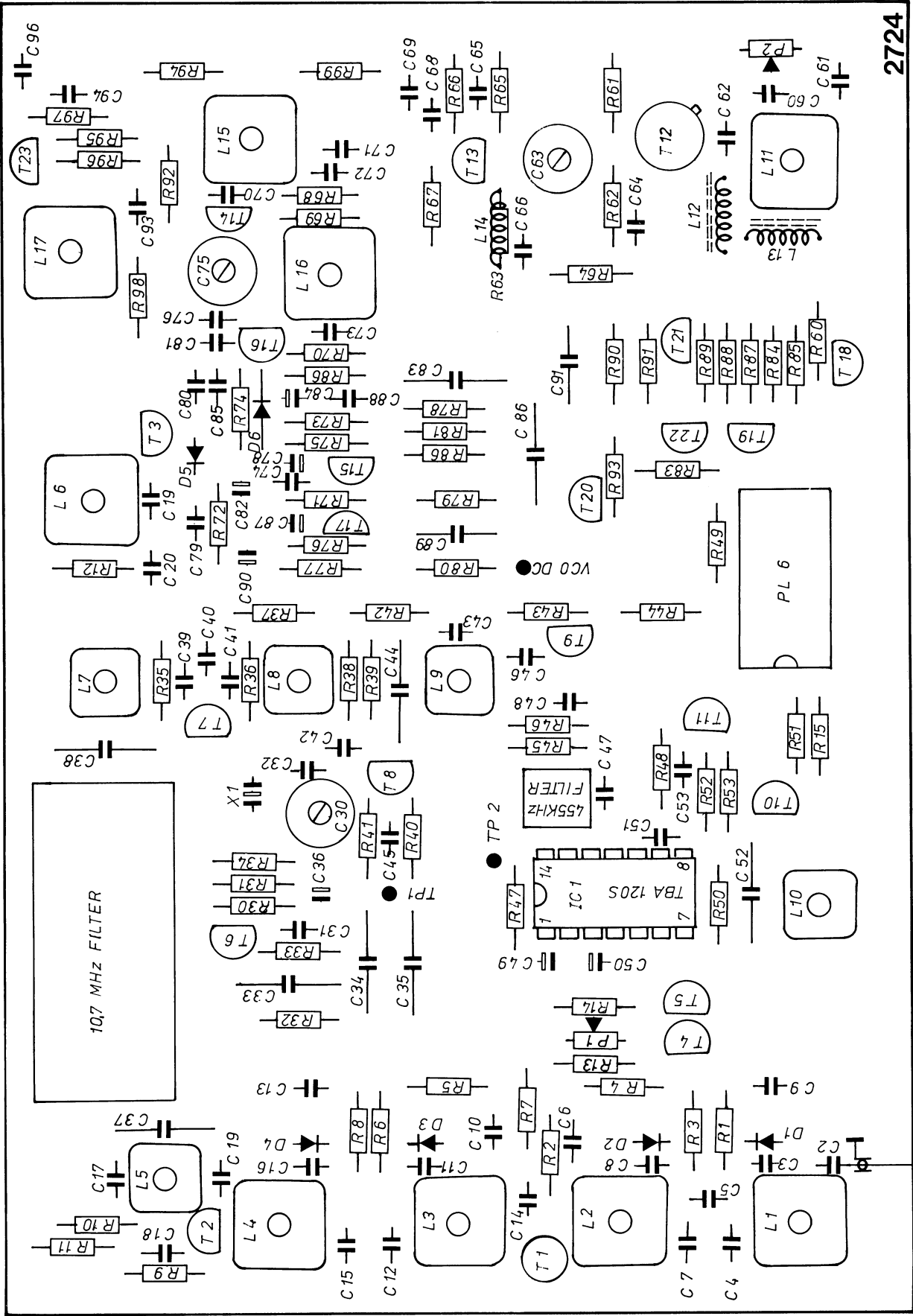
1	1124 Hz
2	1197 Hz
3	1275 Hz
4	1358 Hz
5	1446 Hz
6	1540 Hz
7	1640 Hz
8	1747 Hz
9	1860 Hz
0	1981 Hz
R	2110 Hz

## 10. OPTIONS

### 10.1. 24V REGULATOR

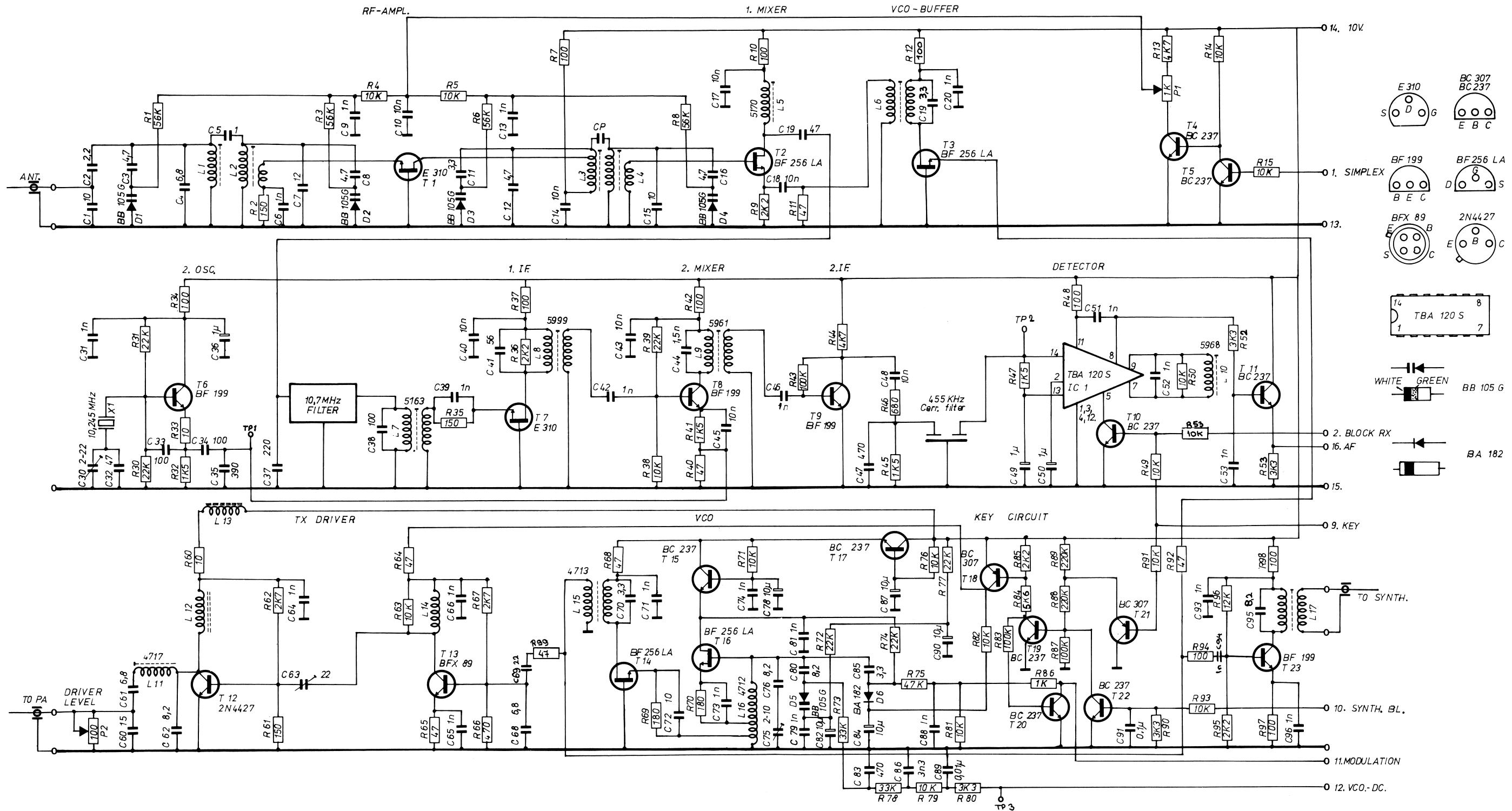




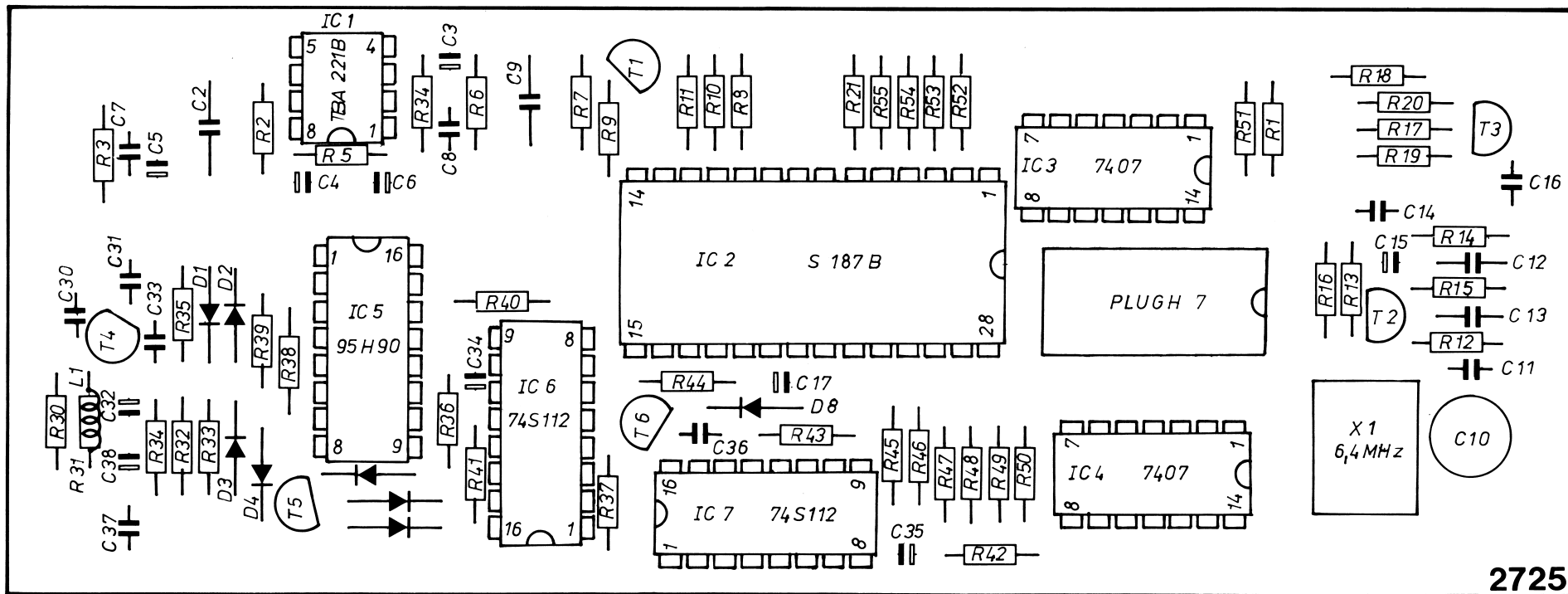


2724

RECEIVER, DRIVER and VCO 2724  
DRAWING NO. 8024

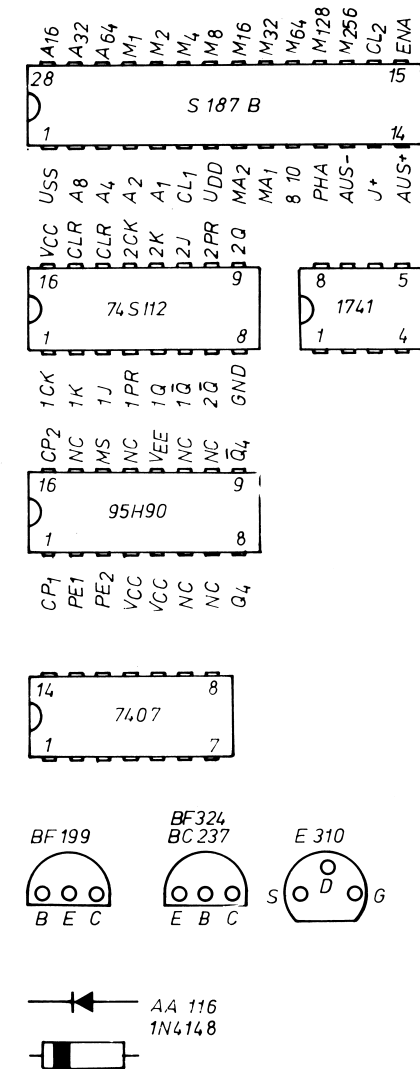
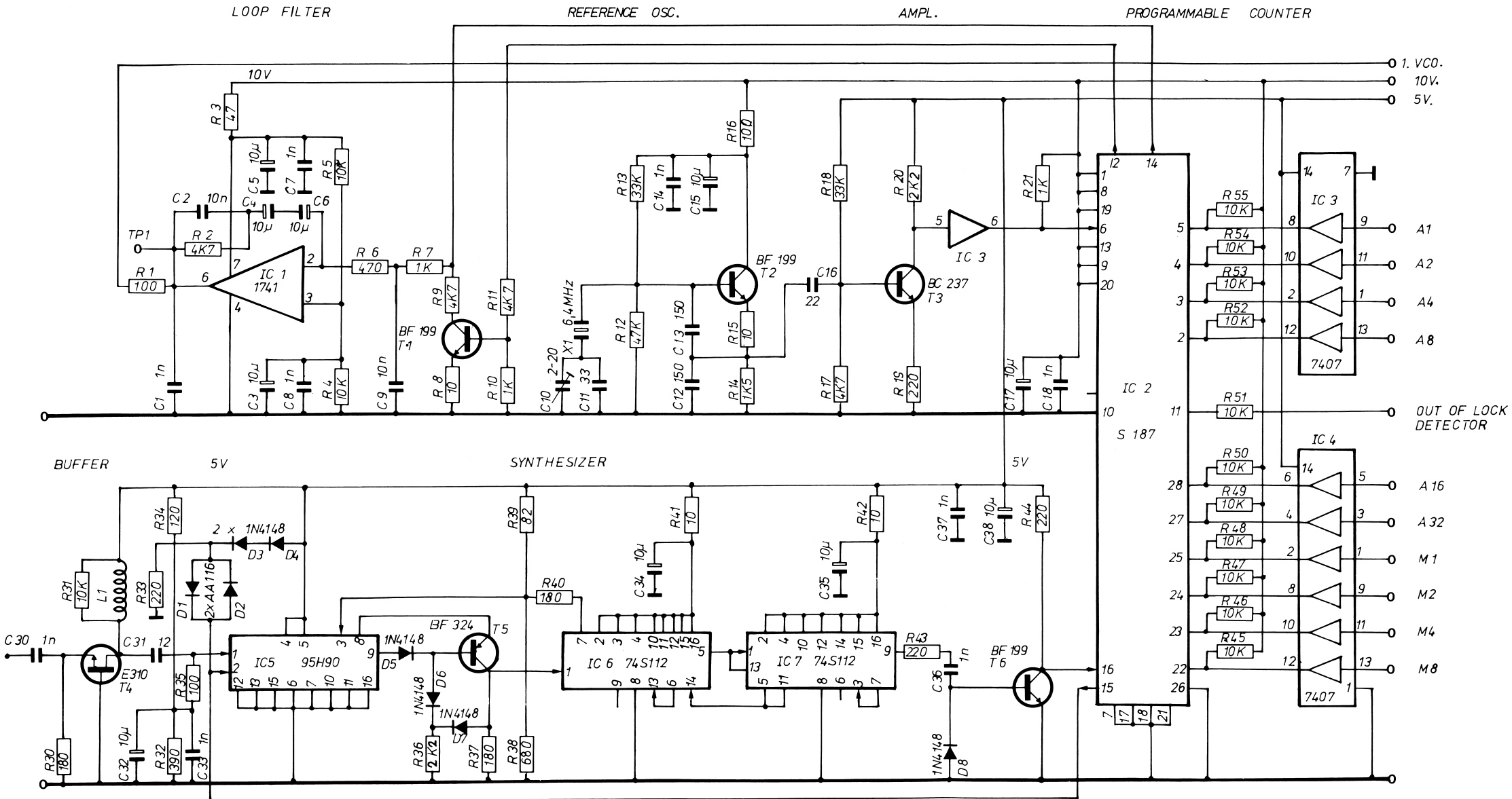


RECEIVER, DRIVER, VCO. 2724  
 DIAGRAM NO. 7008



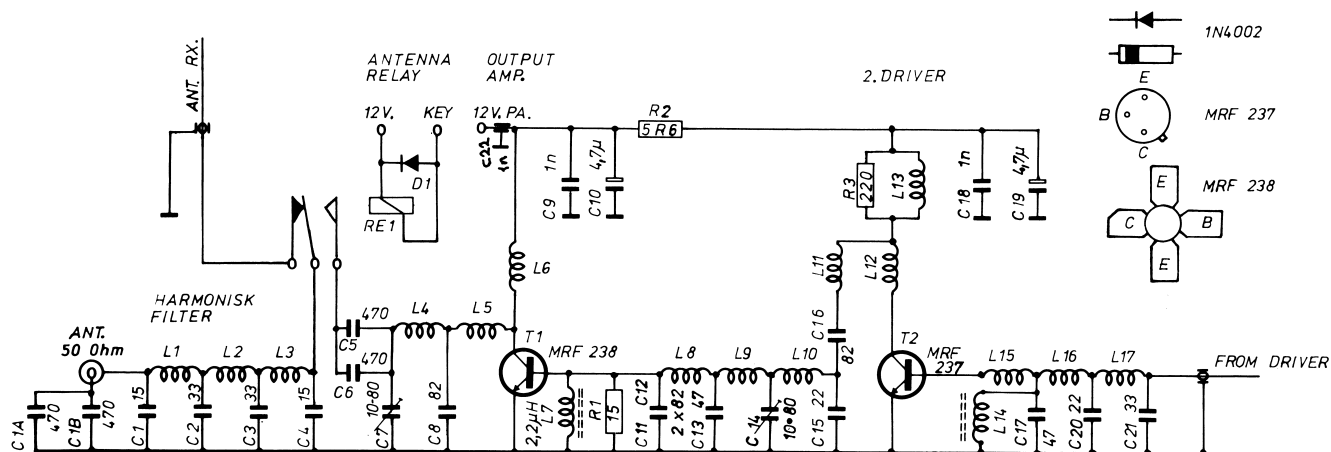
2725

SYNTHESIZER 2725  
DRAWING NO. 8025

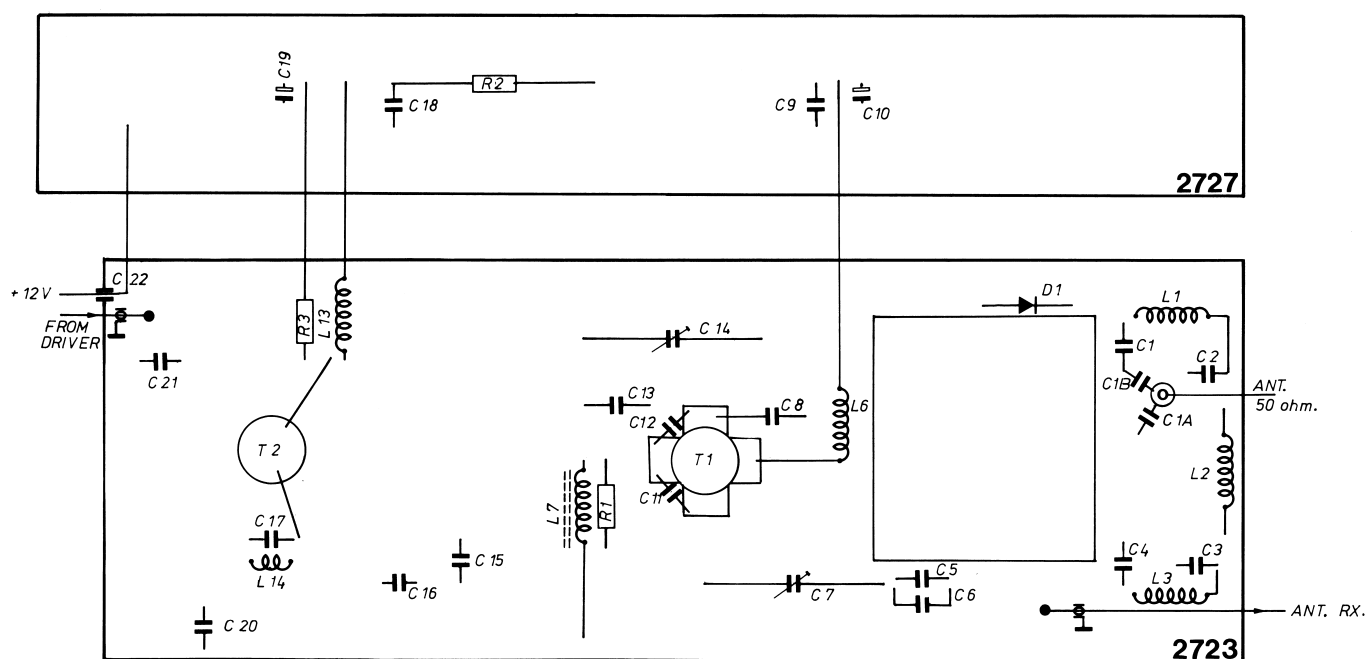


**SYNTHESIZER 2725  
DIAGRAM NO. 7010**

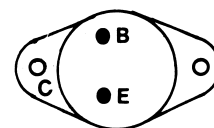
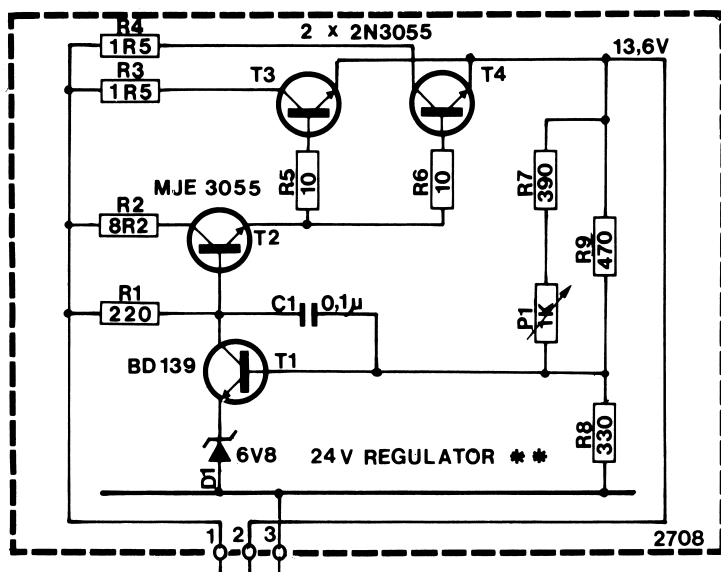




VHF PA. 2723  
DIAGRAM NO. 7011



VHF PA. 2723  
DRAWING NO. 8023



2N3055

MJE 3055

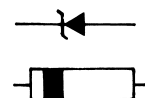


E C B

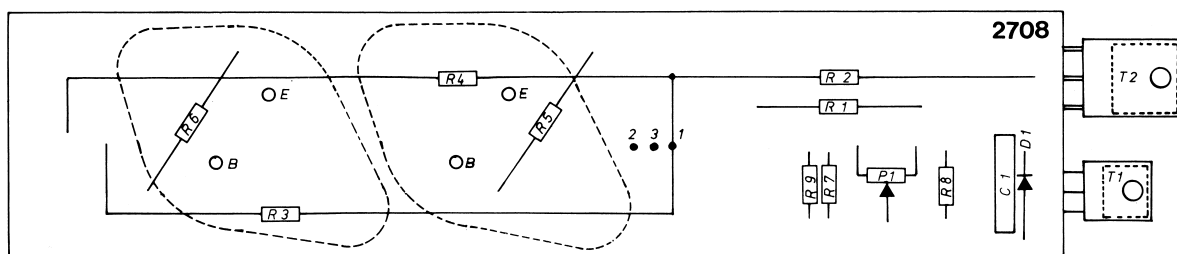
BD 139



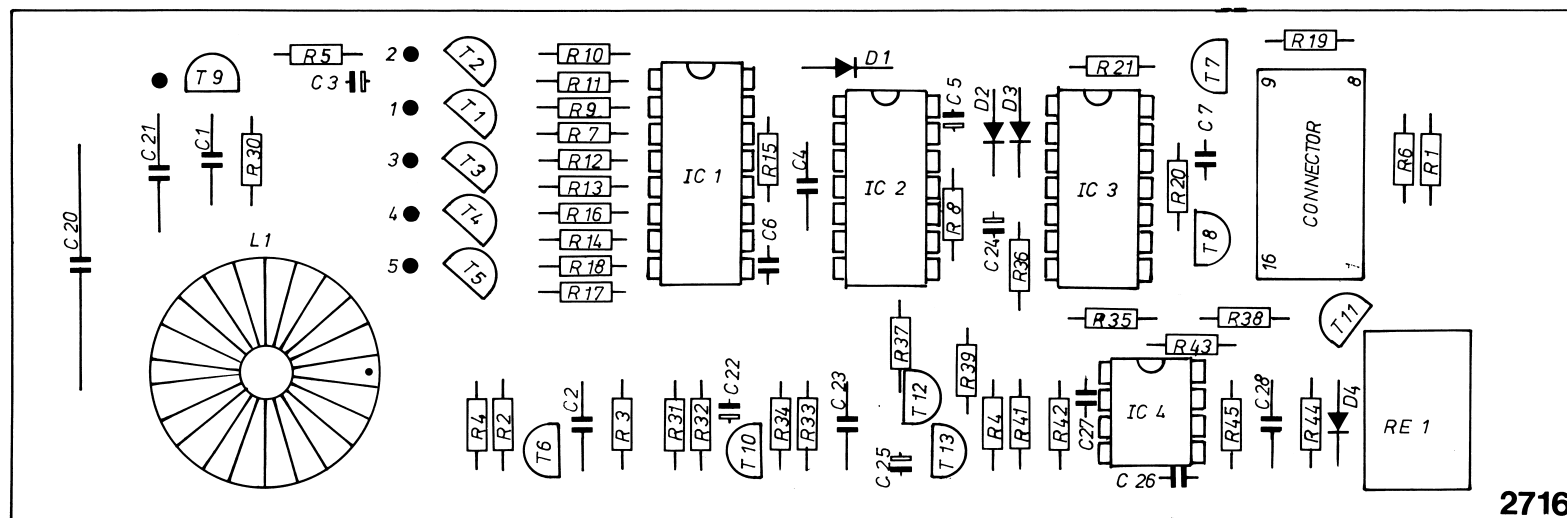
E C B



6V8



BACK MODULE  
24V REGULATOR  
8008

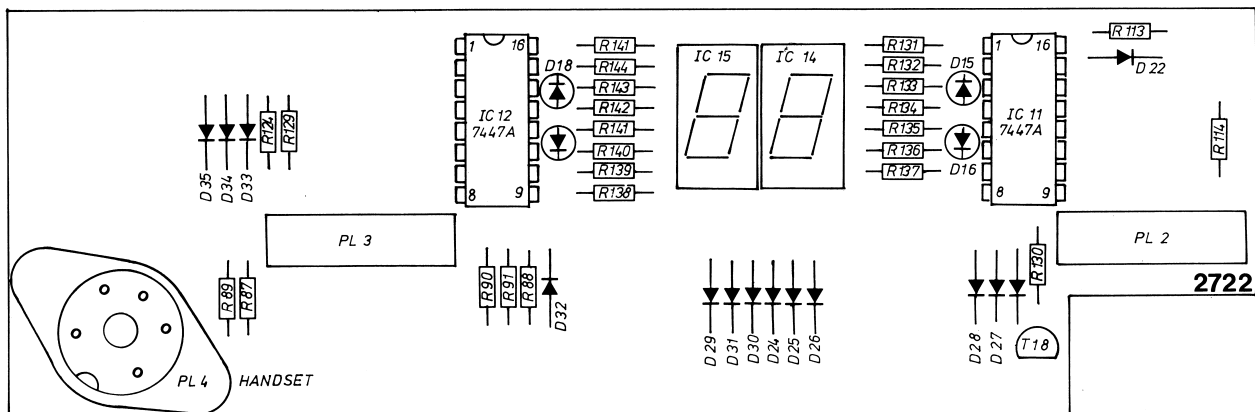
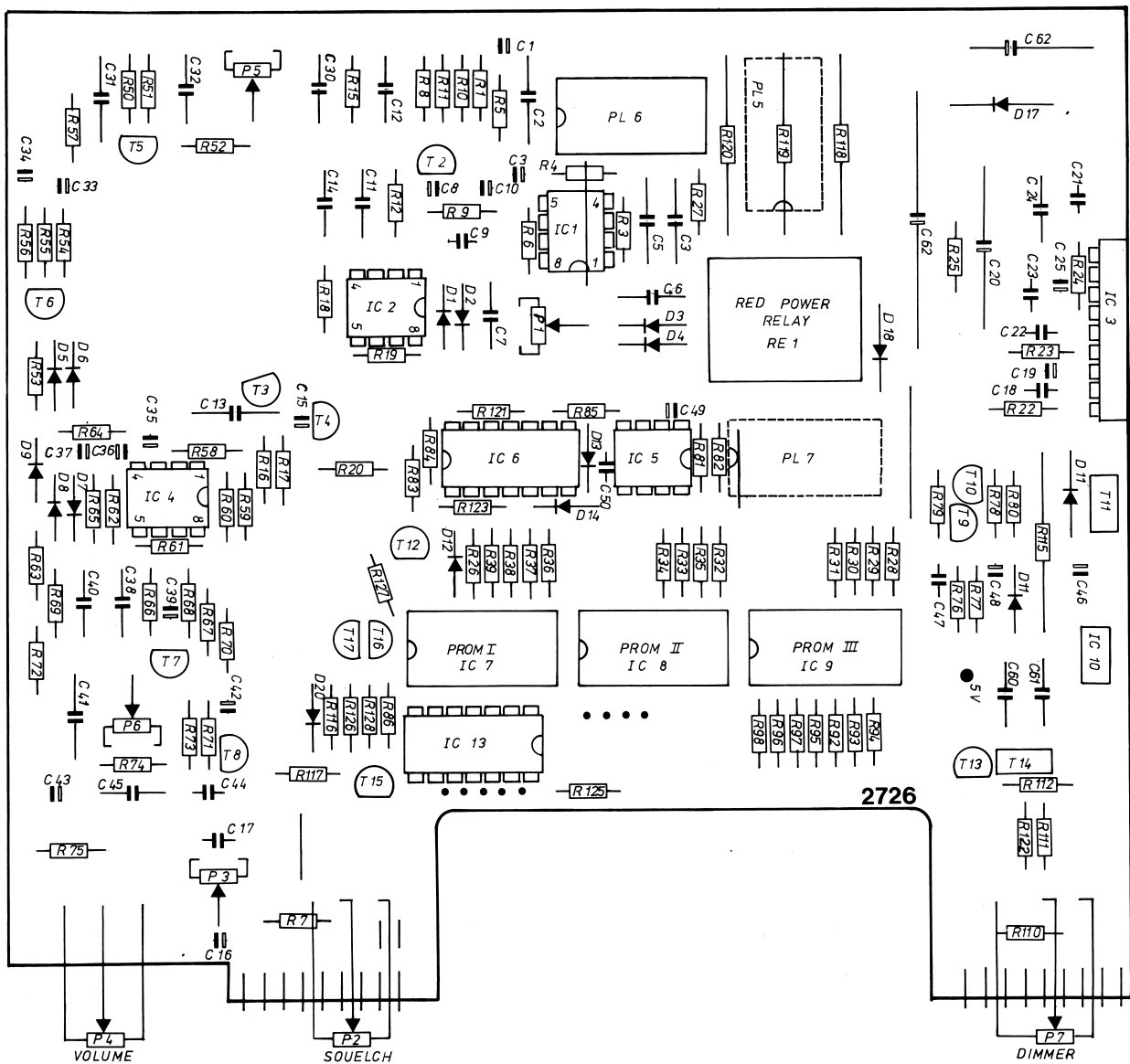


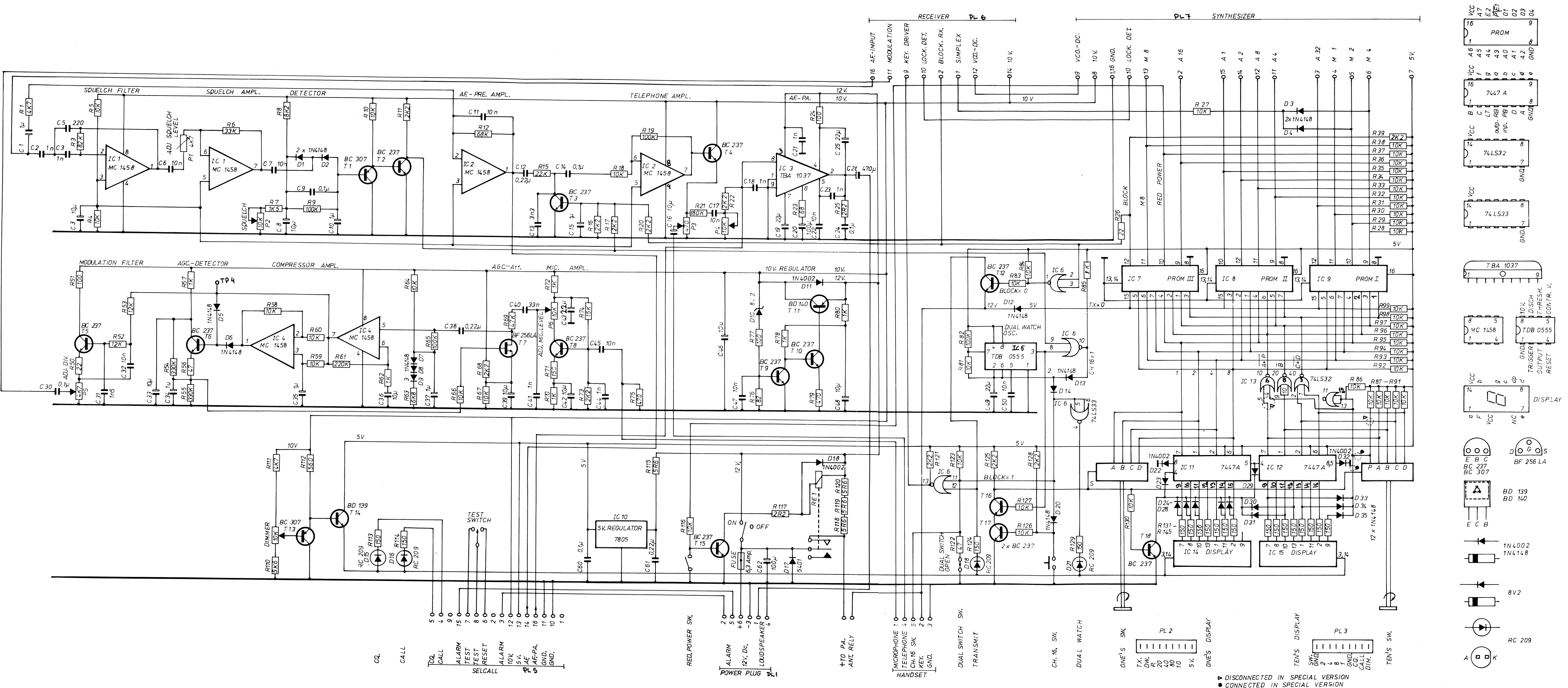
2716

SELCALL 2716









AF, MODULATOR and  
CONTROL - BOARD 2726  
DIAGRAM NO. 7009

## 12. PARTS LISTS

### RECEIVER

R1	Resistor	56 Kohm Philips	2322 211 13563		R51	Resistor	10 Kohm Philips	2322 211 13103
R2	Resistor	150 ohm Philips	2322 211 13151		R52	Resistor	3,3 Kohm Philips	2322 211 13332
R3	Resistor	56 Kohm Philips	2322 211 13563		R53	Resistor	3,3 Kohm Philips	2322 211 13332
R4	Resistor	10 Kohm Philips	2322 211 13103		R60	Resistor	10 ohm Philips	2322 211 13109
R5	Resistor	10 Kohm Philips	2322 211 13103		R61	Resistor	150 ohm Philips	2322 211 13151
R6	Resistor	56 Kohm Philips	2322 211 13563		R62	Resistor	2,7 Kohm Philips	2322 211 13272
R7	Resistor	100 ohm Philips	2322 211 13101		R63	Resistor	10 Kohm Philips	2322 211 13103
R8	Resistor	56 Kohm Philips	2322 211 13563		R64	Resistor	47 ohm Philips	2322 211 13479
R9	Resistor	2,2 Kohm Philips	2322 211 13222		R65	Resistor	47 ohm Philips	2322 211 13479
R10	Resistor	100 ohm Philips	2322 211 13101		R66	Resistor	470 ohm Philips	2322 211 13471
R11	Resistor	47 ohm Philips	2322 211 13479		R67	Resistor	2,7 Kohm Philips	2322 211 13272
R12	Resistor	47 ohm Philips	2322 211 13479		R68	Resistor	47 ohm Philips	2322 211 13479
R13	Resistor	4,7 Kohm Philips	2322 211 13472		R69	Resistor	180 Kohm Philips	2322 211 13181
R14	Resistor	10 Kohm Philips	2322 211 13103		R70	Resistor	180 Kohm Philips	2322 211 13181
R15	Resistor	10 Kohm Philips	2322 211 13103		R71	Resistor	10 Kohm Philips	2322 211 13103
R30	Resistor	22 Kohm Philips	2322 211 13223		R72	Resistor	22 Kohm Philips	2322 211 13223
R31	Resistor	22 Kohm Philips	2322 211 13223		R73	Resistor	33 Kohm Philips	2322 211 13333
R32	Resistor	1,5 Kohm Philips	2322 211 13152		R74	Resistor	22 Kohm Philips	2322 211 13223
R33	Resistor	10 ohm Philips	2322 211 13109		R75	Resistor	47 Kohm Philips	2322 211 13473
R34	Resistor	100 ohm Philips	2322 211 13101		R76	Resistor	10 Kohm Philips	2322 211 13103
R35	Resistor	150 ohm Philips	2322 211 13151		R77	Resistor	22 Kohm Philips	2322 211 13223
R36	Resistor	2,2 Kohm Philips	2322 211 13222		R78	Resistor	33 Kohm Philips	2322 211 13333
R37	Resistor	100 ohm Philips	2322 211 13101		R79	Resistor	10 Kohm Philips	2322 211 13103
R38	Resistor	10 Kohm Philips	2322 211 13103		R80	Resistor	3,3 Kohm Philips	2322 211 13332
R39	Resistor	22 Kohm Philips	2322 211 13223		R81	Resistor	10 Kohm Philips	2322 211 13103
R40	Resistor	47 ohm Philips	2322 211 13479		R82	Resistor	10 Kohm Philips	2322 211 13103
R41	Resistor	1,5 Kohm Philips	2322 211 13152		R83	Resistor	100 Kohm Philips	2322 211 13103
R42	Resistor	100 ohm Philips	2322 211 13101		R84	Resistor	5,6 Kohm Philips	2322 211 13562
R43	Resistor	100 Kohm Philips	2322 211 13104		R85	Resistor	2,2 Kohm Philips	2322 211 13222
R44	Resistor	4,7 Kohm Philips	2322 211 13472		R86	Resistor	1 Kohm Philips	2322 211 13102
R45	Resistor	1,5 Kohm Philips	2322 211 13152		R87	Resistor	100 Kohm Philips	2322 211 13104
R46	Resistor	680 ohm Philips	2322 211 13681		R88	Resistor	220 Kohm Philips	2322 211 13224
R47	Resistor	1,5 Kohm Philips	2322 211 13152		R89	Resistor	220 Kohm Philips	2322 211 13224
R48	Resistor	100 ohm Philips	2322 211 13101		R90	Resistor	3,3 Kohm Philips	2322 211 13332
R49	Resistor	10 Kohm Philips	2322 211 13103		R91	Resistor	10 Kohm Philips	2322 211 13103
R50	Resistor	10 Kohm Philips	2322 211 13103		R92	Resistor	47 ohm Philips	2322 211 13479
					R93	Resistor	10 Kohm Philips	2322 211 13103
					R94	Resistor	220 ohm Philips	2322 211 13221

R95	Resistor	2,2 Kohm	Philips	2322 211 13222	C41	Capasitor cer.	56pF	Ferroperm	9/0116,8
R96	Resistor	12 Kohm	Philips	2322 211 13123	C42	Capasitor cer.	1n	Draloric	EDRU 5
R97	Resistor	100 ohm	Philips	2322 211 13101	C43	Capasitor cer.	10n	Draloric	EDRU 5
R98	Resistor	100 ohm	Philips	2322 211 13101	C44	Capasitor sty.	1,5n	Philips	2222 426 41502
R99	Resistor	47 ohm	Philips	2322 211 13479	C45	Capasitor cer.	10n	Draloric	EDRU 5
C1	Capasitor cer.	10pF	Ferroperm	9/0116,9	C46	Capasitor cer.	1n	Draloric	EDRU 5
C2	Capasitor cer.	2,2pF	Ferroperm	9/0116,9	C47	Capasitor cer.	470pF	Ferroperm	9/129,9
C3	Capasitor cer.	4,7pF	Ferroperm	9/0116,9	C48	Capasitor cer.	10n	Draloric	EDRU 5
C4	Capasitor cer.	6,8pF	Ferroperm	9/0116,9	C49	Capasitor tan.	1u	ITT	1ROM35 SP
C5	Capasitor cer.	1pF	Ferroperm	9/0116,9	C50	Capasitor tan.	1u	ITT	1ROM35 SP
C6	Capasitor cer.	1n	Draloric	EDRU 5	C51	Capasitor cer.	1n	Draloric	EDRU 5
C7	Capasitor cer.	12pF	Ferroperm	9/0116,9	C52	Capasitor sty.	1n	Philips	2222 426 41002
C8	Capasitor cer.	4,7pF	Ferroperm	9/0116,9	C53	Capasitor cer.	1n	Draloric	EDRU 5
C9	Capasitor cer.	1n	Draloric	EDRU 5	C60	Capasitor cer.	15pF	Ferroperm	9/0116,9
C10	Capasitor cer.	10n	Draloric	EDRU 5	C61	Capasitor cer.	6,8pF	Ferroperm	9/0116,9
C11	Capasitor cer.	3,3pF	Ferroperm	9/0116,9	C62	Capasitor cer.	8,2pF	Ferroperm	9/0116,9
C12	Capasitor cer.	4,7pF	Ferroperm	9/0116,9	C63	Capasitor cer.	22pF	Ferroperm	9/0116,9
C13	Capasitor cer.	1n	Draloric	EDRU 5	C64	Capasitor cer.	1n	Draloric	EDRU 5
C14	Capasitor cer.	10n	Draloric	EDRU 5	C65	Capasitor cer.	1n	Draloric	EDRU 5
C15	Capasitor cer.	10pF	Ferroperm	9/0116,9	C66	Capasitor cer.	1n	Draloric	EDRU 5
C16	Capasitor cer.	4,7pF	Ferroperm	9/0116,9	C68	Capasitor cer.	6,8pF	Ferroperm	9/0116,9
C17	Capasitor cer.	10n	Draloric	EDRU 5	C69	Capasitor cer.	22pF	Ferroperm	9/0116,9
C18	Capasitor cer.	10n	Draloric	EDRU 5	C70	Capasitor cer.	3,3pF	Ferroperm	9/0116,9
C19	Capasitor cer.	47pF	Ferroperm	9/0116,8	C71	Capasitor cer.	1n	Draloric	EDRU 5
C20	Capasitor cer.	1n	Draloric	EDRU 5	C72	Capasitor cer.	10pF	Ferroperm	9/0116,9
C30	Capasitor trim.	2-22pF	Philips	2222 808 11229	C73	Capasitor cer.	1n	Draloric	EDRU 5
C31	Capasitor cer.	1n	Draloric	EDRU 5	C74	Capasitor cer.	1n	Draloric	EDRU 5
C32	Capasitor cer.	47pF	Ferroperm	9/0116,8	C75	Capasitor trim.	2-10pF	Philips	2222 808 11109
C33	Capasitor sty.	100pF	Philips	2222 427 41001	C76	Capasitor cer.	8,2pF	Ferroperm	9/0116,9
C34	Capasitor sty.	100pF	Philips	2222 427 41001	C78	Capasitor tan.	10u	ITT	TAG 10M25 SP
C35	Capasitor sty.	330pF	Philips	2222 427 43301	C79	Capasitor cer	1n	Draloric	EDRU 5
C36	Capasitor tan.	1u	ITT	TAG 1ROM35 SP	C80	Capasitor cer.	8,2pF	Ferroperm	9/0116,9
C37	Capasitor sty.	220pF	Philips	2222 427 42201	C81	Capasitor cer.	1n	Draloric	EDRU 5
C38	Capasitor sty.	100pF	Philips	2222 427 41001	C82	Capasitor tan.	10u	ITT	TAG 10M25 SP
C39	Capasitor cer.	1n	Draloric	EDRU 5	C83	Capasitor sty.	470pF	Philips	2222 427 44701
C40	Capasitor	10n	Draloric	EDRU 5	C84	Capasitor tan.	10u	ITT	TAG 10M25 SP
					C85	Capasitor cer.	3,3pF	Ferroperm	9/0116,9



C86	Capasitor sty.	3,3n	Philips	2222 425 43302	T17	Transistor	Siemens	BC 237B
C87	Capasitor tan.	10u	ITT	TAG 10M25 SP	T18	Transistor	Siemens	BC 307B
C88	Capasitor cer.	1n	Draloric	EDRU 5	T19	Transistor	Siemens	BC 237B
C89	Capasitor poly.	0,01u	Philips	2222 344 55103	T20	Transistor	Siemens	BC 237B
C90	Capasitor tan.	10u	ITT	TAG 10M25 SP	T21	Transistor	Siemens	BC 307B
C91	Capasitor poly.	0,1u	Philips	2222 344 21104	T22	Transistor	Siemens	BC 237B
C93	Capasitor cer.	1n	Draloric	EDRU 5	T23	Transistor	Siemens	BF 199
C94	Capasitor cer.	1n	Draloric	EDRU 5				
C95	Capasitor cer.	1n	Draloric	EDRU 5				
C96	Capasitor cer.	1n	Draloric	EDRU 5	P1	Potentiom. trim. 1 Kohm	Philips	2322 410 03354
CP	Capasitor Stripline				P2	Potentiom. trim. 100 ohm	Philips	2322 410 05051
D1	Diode		Siemens	BB 105G	L1	Coil	R&S	4718
D2	Diode		Siemens	BB 105G	L2	Coil	R&S	4719
D3	Diode		Siemens	BB 105G	L3	Coil	R&S	4720
D4	Diode		Siemens	BB 105G	L4	Coil	R&S	4721
D5	Diode		Siemens	BB 105G	L5	Coil	Neosid	5170
D6	Diode		Siemens	BA 182	L6	Coil	R&S	4713
					L7	Coil	Neosid	5163
					L8	Coil	Neosid	5999
					L9	Coil	Neosid	5961
T1	Transistor		Siliconix	E 310	L10	Coil	Neosid	5968
T2	Transistor		Texas	BF 256 LA	L11	Coil	R&S	4717
T3	Transistor		Texas	BF 256 LA	L12	Coil	R&S	
T4	Transistor		Siemens	BC 237B	L13	Coil	R&S	
T5	Transistor		Siemens	BC 237B	L14	Coil	R&S	
T6	Transistor		Siemens	BF 199	L15	Coil	R&S	4713
T7	Transistor		Siliconix	E 310	L16	Coil	R&S	4712
T8	Transistor		Siemens	BF 199	L17	Coil	R&S	4722
T9	Transistor		Siemens	BF 199				
T10	Transistor		Siemens	BC 237B				
T11	Transistor		Siemens	BC 237B	IC1	Integrated circuit	Siemens	TBA 120S
T12	Transistor		Motorola	2N4427				
T13	Transistor		Siemens	BFX 89				
T14	Transistor		Texas	BF 256 LA	X1	Crystal	R&S	10,245 MHz
T15	Transistor		Siemens	BC 237B				
T16	Transistor		Texas	BF 256 LA				

R44	Resistor	220	ohm	Philips	2322 211 13221
R45	Resistor	10	Kohm	Philips	2322 211 13103
R46	Resistor	10	Kohm	Philips	2322 211 13103
R47	Resistor	10	Kohm	Philips	2322 211 13103
R48	Resistor	10	Kohm	Philips	2322 211 13103
R49	Resistor	10	Kohm	Philips	2322 211 13103
R50	Resistor	10	Kohm	Philips	2322 211 13103
R51	Resistor	10	Kohm	Philips	2322 211 13103
R52	Resistor	10	Kohm	Philips	2322 211 13103
R53	Resistor	10	Kohm	Philips	2322 211 13103
R54	Resistor	10	Kohm	Philips	2322 211 13103
R55	Resistor	10	Kohm	Philips	2322 211 13103

SYNTHESIZER				
R1	Resistor	100 ohm	Philips	2322 211 13101
R2	Resistor	4,7 Kohm	Philips	2322 211 13472
R3	Resistor	47 ohm	Philips	2322 211 13479
R4	Resistor	10 Kohm	Philips	2322 211 13103
R5	Resistor	10 Kohm	Philips	2322 211 13103
R6	Resistor	470 ohm	Philips	2322 211 13471
R7	Resistor	1 Kohm	Philips	2322 211 13102
R8	Resistor	10 ohm	Philips	2322 211 13109
R9	Resistor	4,7 Kohm	Philips	2322 211 13472
R10	Resistor	1 Kohm	Philips	2322 211 13102
R11	Resistor	4,7 Kohm	Philips	2322 211 13472
R12	Resistor	47 Kohm	Philips	2322 211 13473
R13	Resistor	33 Kohm	Philips	2322 211 13333
R14	Resistor	1,5 Kohm	Philips	2322 211 13152
R15	Resistor	10 ohm	Philips	2322 211 13109
R16	Resistor	100 ohm	Philips	2322 211 13101
R17	Resistor	4,7 Kohm	Philips	2322 211 13472
R18	Resistor	33 Kohm	Philips	2322 211 13333
R19	Resistor	220 ohm	Philips	2322 211 13221
R20	Resistor	2,2 Kohm	Philips	2322 211 13222
R21	Resistor	1 Kohm	Philips	2322 211 13102
R30	Resistor	180 ohm	Philips	2322 211 13181
R31	Resistor	10 Kohm	Philips	2322 211 13103
R32	Resistor	390 ohm	Philips	2322 211 13391
R33	Resistor	220 ohm	Philips	2322 211 13221
R34	Resistor	120 ohm	Philips	2322 211 13121
R35	Resistor	100 ohm	Philips	2322 211 13101
R36	Resistor	2,2 Kohm	Philips	2322 211 13222
R37	Resistor	180 ohm	Philips	2322 211 13181
R38	Resistor	680 ohm	Philips	2322 211 13681
R39	Resistor	82 ohm	Philips	2322 211 13829
R40	Resistor	180 ohm	Philips	2322 211 13181
R41	Resistor	10 ohm	Philips	2322 211 13109
R42	Resistor	10 ohm	Philips	2322 211 13109
R43	Resistor	220 ohm	Philips	2322 211 13221

						VHF PA			
C35	Capasitor tan.	10u	ITT	TAG 10M25 SP					
C36	Capasitor cer.	1n	Draloric	EDRU 5		R1	Resistor	15 ohm	Philips 2322 211 13150
C37	Capasitor cer.	1n	Draloric	EDRU 5		R2	Resistor	5,6 ohm	Philips 2322 211 13568
C38	Capasitor tan.	10u	ITT	TAG 10M25 SP		R3	Resistor	220 ohm	Philips 2322 211 13221
D1	Diode		Siemens	AA 116		C1A	Capasitor cer.	470pF	Ferroperm 9/0129,9
D2	Diode		Siemens	AA 116		C1B	Capasitor cer.	470pF	Ferroperm 9/0129,9
D3	Diode		ITT	1N4148		C1	Capasitor cer.	15pF	Ferroperm 9/0116,9
D4	Diode		ITT	1N4148		C2	Capasitor cer.	33pF	Ferroperm 9/0116,8
D5	Diode		ITT	1N4148		C3	Capasitor cer.	33pF	Ferroperm 9/0116,8
D6	Diode		ITT	1N4148		C4	Capasitor cer.	15pF	Ferroperm 9/0116,9
D7	Diode		ITT	1N4148		C5	Capasitor cer.	470pF	Ferroperm 9/0129,9
D8	Diode		ITT	1N4148		C6	Capasitor cer.	470pF	Ferroperm 9/0129,9
						C7	Capasitor trim.	10-80pF	R&S 566420
T1	Transistor		Siemens	BF 199		C8	Capasitor cer.	82pF	Ferroperm 9/0121,9
T2	Transistor		Siemens	BF 199		C9	Capasitor cer.	1n	Draloric EDRU 5
T3	Transistor		Siemens	BC 237B		C10	Capasitor tan.	4,7u	ITT TAG 4R7M25 SP
T4	Transistor		Siliconix	E 310		C11	Capasitor cer.	82pF	Ferroperm 9/0121,9
T5	Transistor		Siemens	BF 324		C12	Capasitor cer.	82pF	Ferroperm 9/0121,9
T6	Transistor		Siemens	BF 199		C13	Capasitor cer.	47pF	Ferroperm 9/0116,8
						C14	Capasitor trim.	10-80pF	R&S 566420
L1	Coil		R&S			C15	Capasitor cer.	22pF	Ferroperm 9/0116,9
						C16	Capasitor cer.	82pF	Ferroperm 9/0121,9
						C17	Capasitor cer.	47pF	Ferroperm 9/0116,8
IC1	Integrated circuit		Motorola	MC 1741		C18	Capasitor cer.	1n	Draloric EDRU 5
IC2	Integrated circuit		Siemens	S. 187		C19	Capasitor tan.	4,7u	ITT TAG 4R7M25 SP
IC3	Integrated circuit		Siemens	7407		C20	Capasitor cer.	22pF	Ferroperm 9/0116,9
IC4	Integrated circuit		Siemens	7407		C21	Capasitor cer.	33pF	Ferroperm 9/0116,8
IC5	Integrated circuit		Farchild	95H90DC					
IC6	Integrated circuit		Texas	74S112		D1	Diode		ITT 1N4002
IC7	Integrated circuit		Texas	74S112					
X1	Crystal		R&S	6,4MHz		T1	Transistor		Motorola MRF 238
						T2	Transistor		Motorola MRF 237



R44	Resistor	4,7 Kohm	Philips	2322 211	134722
R45	Resistor	1 Kohm	Philips	2322 211	131022

R1	Resistor	10 Kohm	Philips	2322 211 13103
R2	Resistor	10 Kohm	Philips	2322 211 13103
R3	Resistor	220 Kohm	Philips	2322 211 13224
R4	Resistor	470 Kohm	Philips	2322 211 13474
R5	Resistor	4,7 Kohm	Philips	2322 211 13472
R6	Resistor	10 Kohm	Philips	2322 211 13103
R7	Resistor	10 Kohm	Philips	2322 211 13103
R8	Resistor	82 Kohm	Philips	2322 211 13823
R9	Resistor	10 Kohm	Philips	2322 211 13103
R10	Resistor	10 Kohm	Philips	2322 211 13103
R11	Resistor	10 Kohm	Philips	2322 211 13103
R12	Resistor	10 Kohm	Philips	2322 211 13103
R13	Resistor	10 Kohm	Philips	2322 211 13103
R14	Resistor	10 Kohm	Philips	2322 211 13103
R15	Resistor	1 Kohm	Philips	2322 211 13102
R16	Resistor	10 Kohm	Philips	2322 211 13103
R17	Resistor	10 Kohm	Philips	2322 211 13103
R18	Resistor	10 Kohm	Philips	2322 211 13103
R19	Resistor	470 Kohm	Philips	2322 211 13474
R20	Resistor	56 Kohm	Philips	2322 211 13563
R21	Resistor	56 Kohm	Philips	2322 211 13563
R30	Resistor	2,2 Kohm	Philips	2322 211 13222
R31	Resistor	5,6 Kohm	Philips	2322 211 13562
R32	Resistor	10 Kohm	Philips	2322 211 13103
R33	Resistor	15 Kohm	Philips	2322 211 13153
R34	Resistor	33 Kohm	Philips	2322 211 13333
R35	Resistor	10 Kohm	Philips	2322 211 13103
R36	Resistor	680 Kohm	Philips	2322 211 13684
R37	Resistor	10 Kohm	Philips	2322 211 13103
R38	Resistor	330 ohm	Philips	2322 211 13331
R39	Resistor	100 Kohm	Philips	2322 211 13104
R40	Resistor	100 Kohm	Philips	2322 211 13104
R41	Resistor	100 Kohm	Philips	2322 211 13104
R42	Resistor	22 Kohm	Philips	2322 211 13223
R43	Resistor	330 ohm	Philips	2322 211 13331

R44	Resistor	4,7 Kohm	Philips	2322 211 13472
R45	Resistor	1 Kohm	Philips	2322 211 13102
C1	Capasitor poly.	0,1u	Philips	2222 344 21104
C2	Capasitor poly.	0,1u	Philips	2222 344 21104
C3	Capasitor tan.	4,7u	ITT	TAG 4R7M25 SP
C4	Capasitor poly.	0,1u	Philips	2222 344 21104
C5	Capasitor tan.	4,7u	ITT	TAG 4R7M25 SP
C6	Capasitor cer.	10n	Draloric	EDRU 5
C7	Capasitor cer.	10n	Draloric	EDRU 5
C20	Capasitor sty.	100n	Rifa	PFE 216 00610F
C21	Capasitor sty.	15n	Philips	2222 426 41502
C22	Capasitor tan.	4,7u	ITT	TAG 4R7M25 SP
C23	Capasitor poly.	0,1u	Philips	2222 344 21104
C24	Capasitor tan.	10u	ITT	TAG 10M25 SP
C25	Capasitor tan.	10u	ITT	TAG 10M25 SP
C26	Capasitor cer.	10n	Draloric	EDRU 5
C27	Capasitor cer.	10n	Draloric	EDRU 5
C28	Capasitor poly.	0,1u	Philips	2222 344 21104
D1	Diode		Siemens	1N4148
D2	Diode		Siemens	1N4148
D3	Diode		Siemens	1N4148
D4	Diode		Siemens	1N4148
T1	Transistor		Siemens	BC 237B
T2	Transistor		Siemens	BC 237B
T3	Transistor		Siemens	BC 237B
T4	Transistor		Siemens	BC 237B
T5	Transistor		Siemens	BC 237B
T6	Transistor		Siemens	BC 307B
T7	Transistor		Siemens	BC 237B
T8	Transistor		Siemens	BC 237B
T9	Transistor		Texas	BF 256 LA

				<u>AF MODULATOR</u>			
T10	Transistor	Siemens	BC 237B	R1	Resistor	4,7 Kohm	Philips 2322 211 13472
T11	Transistor	Siemens	BC 237B	R3	Resistor	82 Kohm	Philips 2322 211 13823
T12	Transistor	Siemens	BC 307B	R4	Resistor	10 Kohm	Philips 2322 211 13103
T13	Transistor	Siemens	BC 237B	R5	Resistor	10 Kohm	Philips 2322 211 13103
L1	Tonecoil	R&S		R6	Resistor	33 Kohm	Philips 2322 211 13333
				R7	Resistor	1,5 Kohm	Philips 2322 211 13152
				R8	Resistor	8,2 Kohm	Philips 2322 211 13822
				R9	Resistor	100 Kohm	Philips 2322 211 13104
IC1	Integrated circuit	Motorola	MC 14017	R10	Resistor	10 Kohm	Philips 2322 211 13103
IC2	Integrated circuit	Motorola	MC 14093	R11	Resistor	2,2 Kohm	Philips 2322 211 13222
IC4	Integrated circuit	Motorola	MC 14013	R12	Resistor	68 Kohm	Philips 2322 211 13683
R1	Relay	ITT	MC 12 HG	R15	Resistor	22 Kohm	Philips 2322 211 13223
				R16	Resistor	2,2 Kohm	Philips 2322 211 13222
				R17	Resistor	2,2 Kohm	Philips 2322 211 13222
				R18	Resistor	10 Kohm	Philips 2322 211 13103
				R19	Resistor	100 Kohm	Philips 2322 211 13104
				R20	Resistor	2,2 Kohm	Philips 2322 211 13222
				R21	Resistor	180 Kohm	Philips 2322 211 13184
				R22	Resistor	2,2 Kohm	Philips 2322 211 13222
				R23	Resistor	68 ohm	Philips 2322 211 13689
				R24	Resistor	100 ohm	Philips 2322 211 13101
				R25	Resistor	2,2 ohm	Philips 2322 211 13228
				R26	Resistor	22 ohm	Philips 2322 211 13229
				R27	Resistor	10 Kohm	Philips 2322 211 13103
				R28	Resistor	10 Kohm	Philips 2322 211 13103
				R29	Resistor	10 Kohm	Philips 2322 211 13103
				R30	Resistor	10 Kohm	Philips 2322 211 13103
				R31	Resistor	10 Kohm	Philips 2322 211 13103
				R32	Resistor	10 Kohm	Philips 2322 211 13103
				R33	Resistor	10 Kohm	Philips 2322 211 13103
				R34	Resistor	10 Kohm	Philips 2322 211 13103
				R35	Resistor	10 Kohm	Philips 2322 211 13103
				R36	Resistor	10 Kohm	Philips 2322 211 13103
				R37	Resistor	10 Kohm	Philips 2322 211 13103
				R38	Resistor	10 Kohm	Philips 2322 211 13103



R39	Resistor	2,2 Kohm	Philips	2322 211 13222	R86	Resistor	10 Kohm	Philips	2322 211 13103
R50	Resistor	22 ohm	Philips	2322 211 13229	R87	Resistor	10 Kohm	Philips	2322 211 13103
R51	Resistor	100 Kohm	Philips	2322 211 13101	R88	Resistor	10 Kohm	Philips	2322 211 13103
R52	Resistor	12 Kohm	Philips	2322 211 13123	R89	Resistor	10 Kohm	Philips	2322 211 13103
R53	Resistor	12 Kohm	Philips	2322 211 13123	R90	Resistor	10 Kohm	Philips	2322 211 13103
R54	Resistor	330 Kohm	Philips	2322 211 13334	R91	Resistor	10 Kohm	Philips	2322 211 13103
R55	Resistor	330 Kohm	Philips	2322 211 13334	R92	Resistor	10 Kohm	Philips	2322 211 13103
R56	Resistor	47 ohm	Philips	2322 211 13479	R93	Resistor	10 Kohm	Philips	2322 211 13103
R57	Resistor	1 Kohm	Philips	2322 211 13102	R94	Resistor	10 Kohm	Philips	2322 211 13103
R58	Resistor	10 Kohm	Philips	2322 211 13103	R95	Resistor	10 Kohm	Philips	2322 211 13103
R59	Resistor	10 Kohm	Philips	2322 211 13103	R96	Resistor	10 Kohm	Philips	2322 211 13103
R60	Resistor	10 Kohm	Philips	2322 211 13103	R97	Resistor	10 Kohm	Philips	2322 211 13103
R61	Resistor	220 Kohm	Philips	2322 211 13224	R98	Resistor	10 Kohm	Philips	2322 211 13103
R62	Resistor	1 Kohm	Philips	2322 211 13102	R99	Resistor	10 Kohm	Philips	2322 211 13103
R63	Resistor	6,8 Kohm	Philips	2322 211 13682	R110	Resistor	5,6 Kohm	Philips	2322 211 13562
R64	Resistor	10 Kohm	Philips	2322 211 13103	R111	Resistor	4,7 Kohm	Philips	2322 211 13472
R65	Resistor	100 Kohm	Philips	2322 211 13104	R112	Resistor	560 ohm	Philips	2322 211 13561
R66	Resistor	10 Kohm	Philips	2322 211 13103	R113	Resistor	150 ohm	Philips	2322 211 13151
R67	Resistor	10 Kohm	Philips	2322 211 13103	R114	Resistor	150 ohm	Philips	2322 211 13151
R68	Resistor	2,7 Kohm	Philips	2322 211 13272	R115	Resistor	5,6 ohm	Philips	2322 211 13568
R69	Resistor	47 Kohm	Philips	2322 211 13473	R116	Resistor	10 Kohm	Philips	2322 211 13103
R70	Resistor	1 Kohm	Philips	2322 211 13102	R117	Resistor	2,2 ohm	Philips	2322 211 13228
R71	Resistor	150 ohm	Philips	2322 211 13151	R118	Resistor	5,6 ohm	Philips	2322 211 13568
R72	Resistor	1 Kohm	Philips	2322 211 13102	R119	Resistor	5,6 ohm	Philips	2322 211 13568
R73	Resistor	2,2 Kohm	Philips	2322 211 13222	R120	Resistor	5,6 ohm	Philips	2322 211 13568
R74	Resistor	15 Kohm	Philips	2322 211 13153	R121	Resistor	2,2 Kohm	Philips	2322 211 13222
R75	Resistor	470 ohm	Philips	2322 211 13471	R122	Resistor	47 ohm	Philips	2322 211 13479
R76	Resistor	82 ohm	Philips	2322 211 13829	R123	Resistor	10 Kohm	Philips	2322 211 13103
R77	Resistor	100 ohm	Philips	2322 211 13101	R124	Resistor	150 ohm	Philips	2322 211 13151
R78	Resistor	1 Kohm	Philips	2322 211 13471	R125	Resistor	2,2 Kohm	Philips	2322 211 13222
R79	Resistor	470 ohm	Philips	2322 211 13471	R126	Resistor	10 Kohm	Philips	2322 211 13103
R80	Resistor	1 Kohm	Philips	2322 211 13102	R127	Resistor	10 Kohm	Philips	2322 211 13103
R81	Resistor	10 Kohm	Philips	2322 211 13103	R128	Resistor	2,2 Kohm	Philips	2322 211 13222
R82	Resistor	100 Kohm	Philips	2322 211 13104	R129	Resistor	150 ohm	Philips	2322 211 13151
R83	Resistor	10 Kohm	Philips	2322 211 13103	R130	Resistor	10 Kohm	Philips	2322 211 13103
R84	Resistor	10 Kohm	Philips	2322 211 13103	R131	Resistor	150 ohm	Philips	2322 211 13151
R85	Resistor	1 Kohm	Philips	2322 211 13102	R132	Resistor	150 ohm	Philips	2322 211 13151

R133	Resistor	150 ohm	Philips	2322 211 13151	C20	Capasitor el.lyt	100u	Philips	2222 016 36101
R134	Resistor	150 ohm	Philips	2322 211 13151	C21	Capasitor cer.	1n	Draloric	EDRU 5
R135	Resistor	150 ohm	Philips	2322 211 13151	C22	Capasitor cer.	10n	Draloric	EDRU 5
R136	Resistor	150 ohm	Philips	2322 211 13151	C23	Capasitor cer.	1n	Draloric	EDRU 5
R137	Resistor	150 ohm	Philips	2322 211 13151	C24	Capasitor poly.	0,1u	Philips	2222 344 21104
R138	Resistor	150 ohm	Philips	2322 211 13151	C25	Capasitor tan.	22u	ITT	TAG 22M25 SP
R139	Resistor	150 ohm	Philips	2322 211 13151	C26	Capasitor el.lyt	470u	Philips	2222 032 16471
R140	Resistor	150 ohm	Philips	2322 211 13151	C30	Capasitor poly.	0,1u	Philips	2222 344 21104
R141	Resistor	150 ohm	Philips	2322 211 13151	C31	Capasitor sty.	1,5n	Philips	2222 426 41502
R142	Resistor	150 ohm	Philips	2322 211 13151	C32	Capasitor poly.	10n	Philips	2222 344 55103
R143	Resistor	150 ohm	Philips	2322 211 13151	C33	Capasitor tan.	10u	ITT	TAG 10M25 SP
R144	Resistor	150 ohm	Philips	2322 211 13151	C34	Capasitor tan.	1u	ITT	TAG 1ROM35 SP
R145	Resistor	150 ohm	Philips	2322 211 13151	C35	Capasitor tan.	1u	ITT	TAG 1ROM35 SP
R146	Resistor	150 ohm	Philips	2322 211 13151	C36	Capasitor tan.	10u	ITT	TAG 10M25 SP
R147	Resistor	150 ohm	Philips	2322 211 13151	C37	Capasitor tan.	1u	ITT	TAG 1ROM35 SP
					C38	Capasitor poly.	0,22u	Philips	2222 344 21224
					C39	Capasitor tan.	10u	ITT	TAG 10M25 SP
C1	Capasitor tan.	1u	ITT	TAG 1ROM35 SP	C40	Capasitor poly.	33n	Philips	2222 344 55333
C2	Capasitor sty.	1n	Philips	2222 427 41001	C41	Capasitor sty.	1n	Philips	2222 427 41001
C3	Capasitor tan.	10u	ITT	TAG 10M25 SP	C42	Capasitor tan.	10u	ITT	TAG 10M25 SP
C4	Capasitor sty.	1n	Philips	2222 427 41001	C43	Capasitor tan.	22u	ITT	TAG 22M25 SP
C5	Capasitor sty.	220pF	Philips	2222 427 42201	C44	Capasitor cer.	1n	Draloric	EDRU 5
C6	Capasitor poly.	10n	Philips	2222 344 55103	C45	Capasitor poly	10n	Philips	2222 344 55103
C7	Capasitor poly.	10n	Philips	2222 344 55103	C46	Capasitor tan.	10u	ITT	TAG 10M25 SP
C8	Capasitor tan.	10u	ITT	TAG 10M25 SP	C47	Capasitor cer.	10n	Draloric	EDRU 5
C9	Capasitor poly.	0,1u	Philips	2222 344 21104	C48	Capasitor tan.	10u	ITT	TAG 10M25 SP
C10	Capasitor tan.	1u	ITT	TAG 1ROM35 SP	C49	Capasitor tan.	22u	ITT	TAG 22M25 SP
C11	Capasitor poly.	10n	Philips	2222 344 55103	C50	Capasitor cer.	10n	Draloric	EDRU 5
C12	Capasitor poly,	0,22u	Philips	2222 344 21224	C60	Capasitor poly.	0,1u	Philips	2222 344 21104
C13	Capasitor sty.	3,3n	Philips	2222 425 43302	C61	Capasitor poly.	0,22u	Philips	2222 344 21224
C14	Capasitor poly.	0,1u	Philips	2222 344 21104	C62	Capasitor el.lyt	100u	Philips	2222 016 36101
C15	Capasitor tan.	1u	ITT	TAG 1ROM35 SP					
C16	Capasitor tan.	10u	ITT	TAG 10M25 SP	D1	Diode		ITT	1N4148
C17	Capasitor cer.	10n	Draloric	EDRU 5	D2	Diode		ITT	1N4148
C18	Capasitor cer.	1n	Draloric	EDRU 5	D3	Diode		ITT	1N4148
C19	Capasitor tan.	22u	ITT	TAG 22M25 SP	D4	Diode		ITT	1N4148

D5	Diode	ITT	1N4148	f4	Transistor	Siemens	RC 237B
D6	Diode	ITT	1N4148	T5	Transistor	Siemens	RC 237B
D7	Diode	ITT	1N4148	T6	Transistor	Siemens	BC 237B
D8	Diode	ITT	1N4148	T7	Transistor	Texas	BF 256 LA
D9	Diode	ITT	1N4148	T8	Transistor	Siemens	BC 237B
D10	Diode	Siemens	8V2BZX83	T9	Transistor	Siemens	BC 237B
D11	Diode	ITT	1N4002	T10	Transistor	Siemens	BC 237B
D12	Diode	ITT	1N4148	T11	Transistor	Siemens	BD 140
D13	Diode	ITT	1N4148	T12	Transistor	Siemens	RC 237B
D14	Diode	ITT	1N4148	T13	Transistor	Siemens	BC 307B
D15	Diode	Litronic	RC 209	T14	Transistor	Siemens	BD 139
D16	Diode	Litronic	RC 209	T15	Transistor	Siemens	BC 237B
D17	Diode	Philips	1N5401	T16	Transistor	Siemens	BC 237B
D18	Diode	ITT	1N4148	T17	Transistor	Siemens	BC 237B
D19	Diode	Litronic	RC 209	T18	Transistor	Siemens	BC 237B
D20	Diode	ITT	1N4148				
D21	Diode	Litronic	RC 209				
D22	Diode	ITT	1N4002	P1	Potentiom.	4,7 Kohm Philips	2322 410 03356
D23	Diode	ITT	1N4148	P2	Potentiom.	10 Kohm Rowido	813 342 SPEC.
D24	Diode	ITT	1N4148	P3	Potentiom.	470 ohm Philips	2322 410 03353
D25	Diode	ITT	1N4148	P4	Potentiom.	10 Kohm Rowido	803 301 SPEC.
D26	Diode	ITT	1N4148	P5	Potentiom.	4,7 Kohm Philips	2322 410 03356
D26	Diode	ITT	1N4148	P6	Potentiom.	10 Kohm Philips	2322 410 30507
D27	Diode	ITT	1N4148	P7	Potentiom.	10 Kohm Rowido	813 342 SPEC.
D28	Diode	ITT	1N4148				
D29	Diode	ITT	1N4148				
D30	Diode	ITT	1N4148	RE1	Relay	ITT	LZ 12H
D31	Diode	ITT	1N4148				
D32	Diode	ITT	1N4002				
D33	Diode	ITT	1N4148	IC1	Integrated circuit	Motorola	MC 1458
D34	Diode	ITT	1N4148	IC2	Integrated circuit	Motorola	MC 1458
D35	Diode	ITT	1N4148	IC3	Integrated circuit	Siemens	TBA 1037
				IC4	Integrated circuit	Motorola	MC 1458
				IC5	Integrated circuit	Siemens	TDB 0555
				IC6	Integrated circuit	Texas	74LS33
				IC7	Integrated circuit	Harris	PROM 7611
				IC8	Integrated circuit	Harris	PROM 7611
T1	Transistor	Siemens	BC 307B				
T2	Transistor	Siemens	BC 237B				
T3	Transistor	Siemens	BC 237B				

IC9	Integrated circuit	Harris	PROM 7611
IC10	Integrated circuit	Siemens	7805
IC11	Integrated circuit	Texas	7447A
IC12	Integrated circuit	Texas	7447A
IC13	Integrated circuit	Texas	74LS32
IC14	Display	Philips	COY 81
IC15	Display	Philips	COY 81