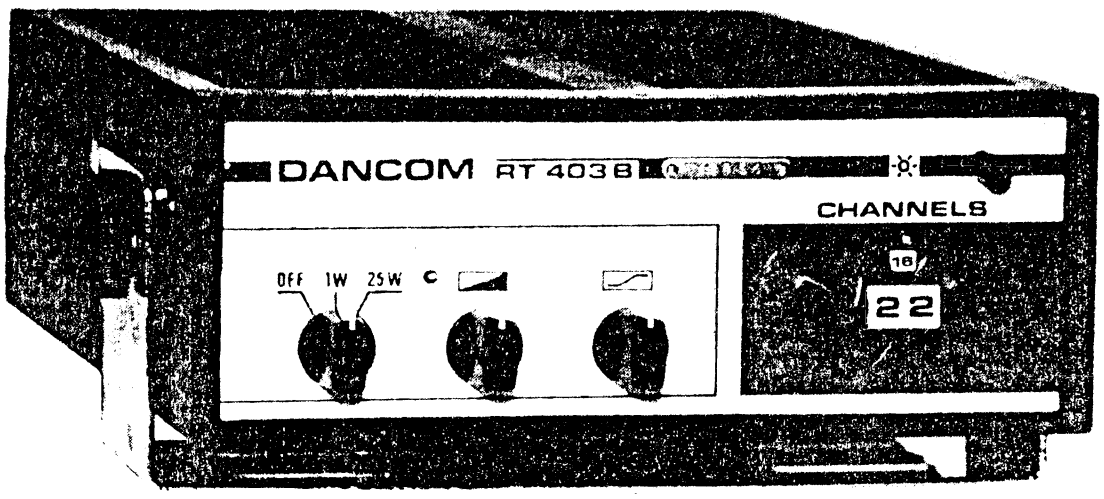
DANCOM



VHF radiotelephone

RT 403 B

DANCOM
Communication - Equipment
9530 STØVRING
DENMARK
Phone 08-37 19 22
Telex 69798

60 CHANNELS
25 WATTS

HANDBOOK FOR RT 403B

Valid from 1st april 1976 for serial numbers from and above 71400.

CONTENTS

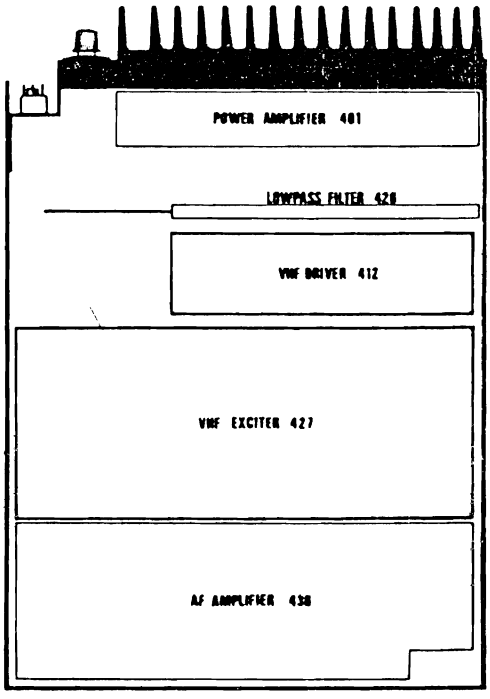
GENERAL DESCRIPTION

TECHNICAL DATA RT 403B

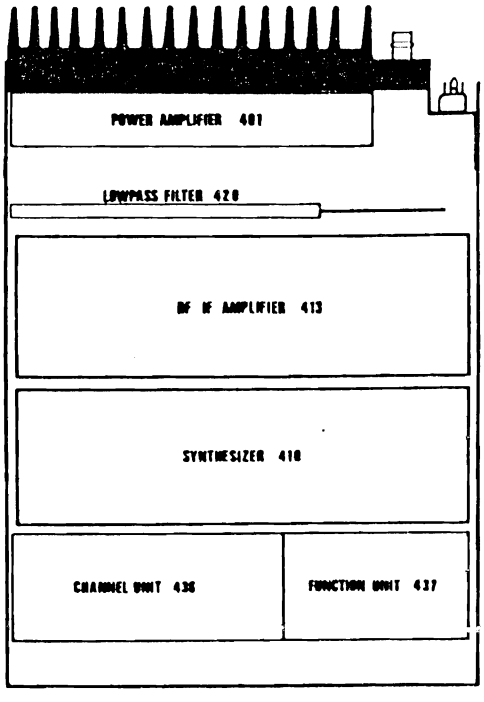
GENERAL:

Modes of operation:	Simplex/Semi-duplex Duplex by means of external filter
Frequency range:	Channels 1-28[x] Channels 60-88 except 75 and 76 x) (Channels 15 and 17 low power)
Private channels:	5
Bandwidth:	2 MHz
Frequency tolerance:	$< \pm 10$ ppm -25°C to +55°C
Power Supply (std.):	12 VDC battery + 30% - 10% Consumption on 12 VDC operation receive app. o,8 amp transmit app. 5,5 amps
Power Supplies optional:	External 24 VDC and External 110/220 VAC
Dimensions and weight:	Height: 69 mm Width: 188 mm Depth: 275 mm Weight: 3,0 kg
Dimmer:	Controlled from front panel

TOP VIEW OF RT 403B



BOTTOM VIEW OF RT 403B



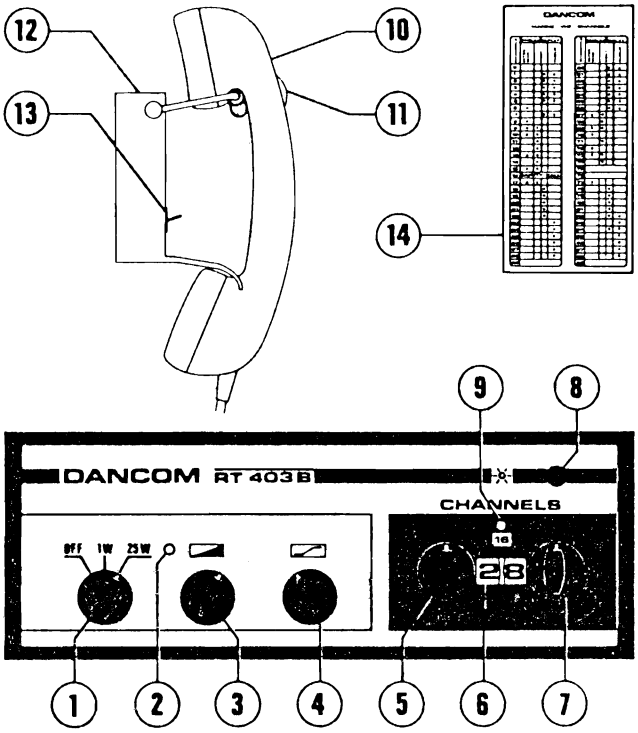
TRANSMITTER:

Type of emission:	P.M.
Power output:	25 watts
Power output reduced:	< 1 watt
Antenna impedance:	50 ohms
Audio response:	+ 1dB - 3dB (300-3000 Hz)
Audio distortion:	≤ 5%
Adjacent channel power:	< -70 dB
Conducted spurious:	< -70 dB
Case radiation:	< 300 uV/meter
Microphone impedance:	200 ohms microtelephone
Frequency deviation:	$< \pm$ 5 KHz

RECEIVER:

AF output power:	4 watts in 4 ohms external speaker
Audio distortion:	< 5%
Squelch:	Controlled from front panel
Usable squelch sensitivity:	6 dB below standard receiver sensitivity

OPERATION.



MAIN SWITCH

In position 1 W or 25 W the station is stand-by, and the dial light is turned on.

Transmission with reduced power in position 1 W.

Transmission with full power in position 25 W.

TRANSMIT INDICATOR

Is alight when the transmitter operates.

AF-GAIN CONTROL

Here the power in loudspeaker and telephone is adjusted to a suitable level.

SQUELCH CONTROL

When turned clockwise, the loudspeaker and the telephone are only on when there is a signal on the selected channel.

CHANNEL SELECTOR

"Ten" positions.

CHANNEL SELECTOR

"One" position.

(8) DIMMER CONTROL

Regulates the dial light in (6)

(9) CHANNEL 16 - SAFETY AND CALLING

When the radio is operating on channel 16, the indicator will be alight.

(10) MICROTELEPHONE

(11) KEY

For transmitter.

(12) CRADLE

When the microtelephone is in cradle, the KEY circuit is switched off.
LOUDSPEAKER is coupled in.
CH 16 watch is released.

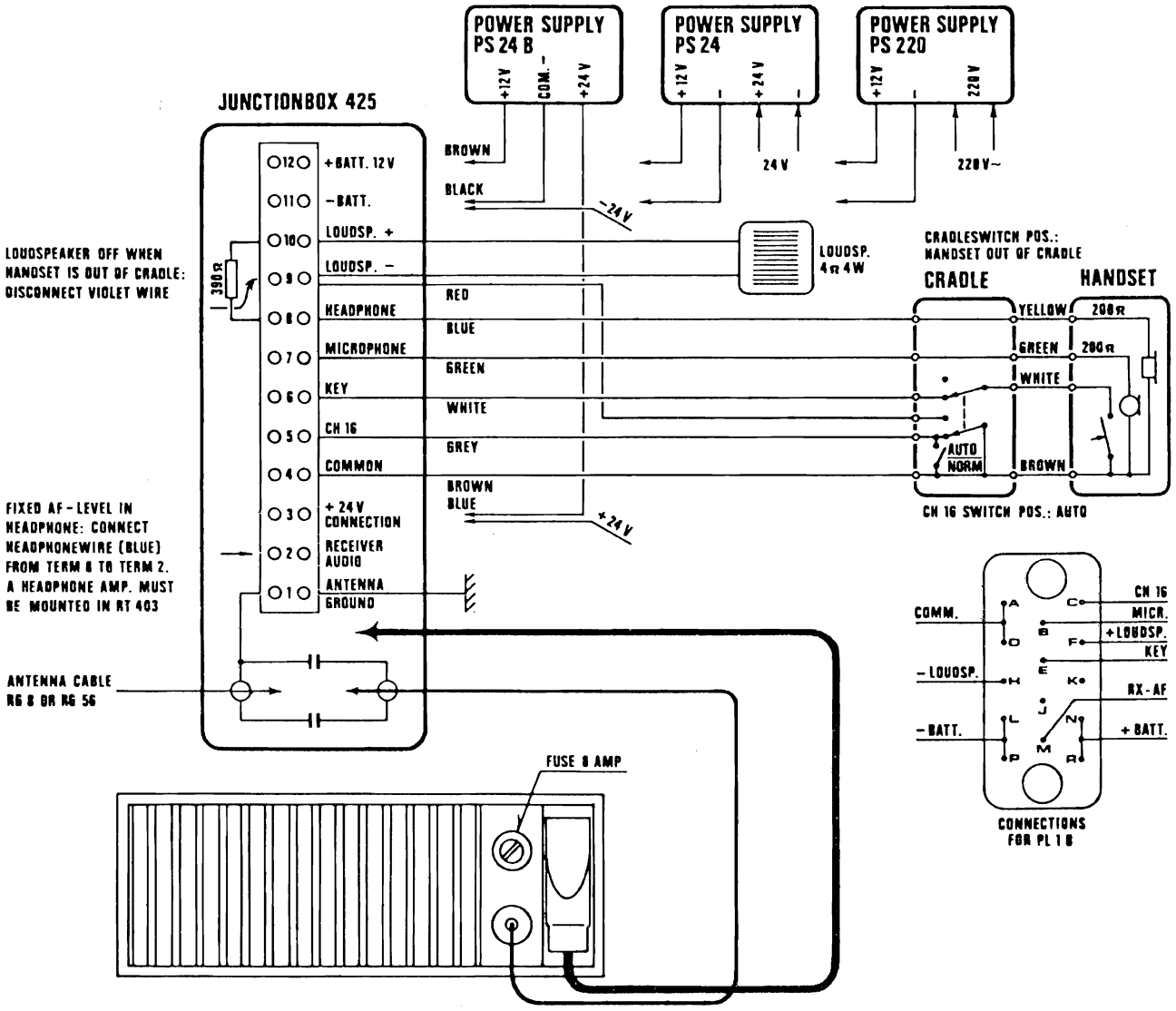
(13) CH 16

AUTO: CH 16 watch ON.
NORM: CH 16 watch OFF.

(14) CHANNEL CARD

With all international channels.

INSTALLATION.



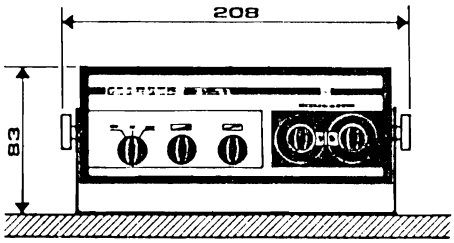
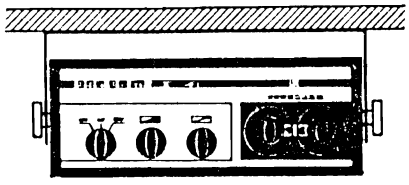
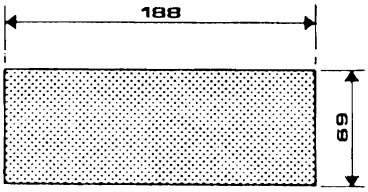


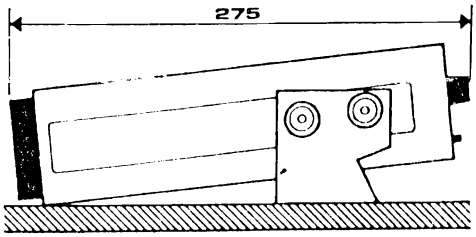
TABLE TOP MOUNTING



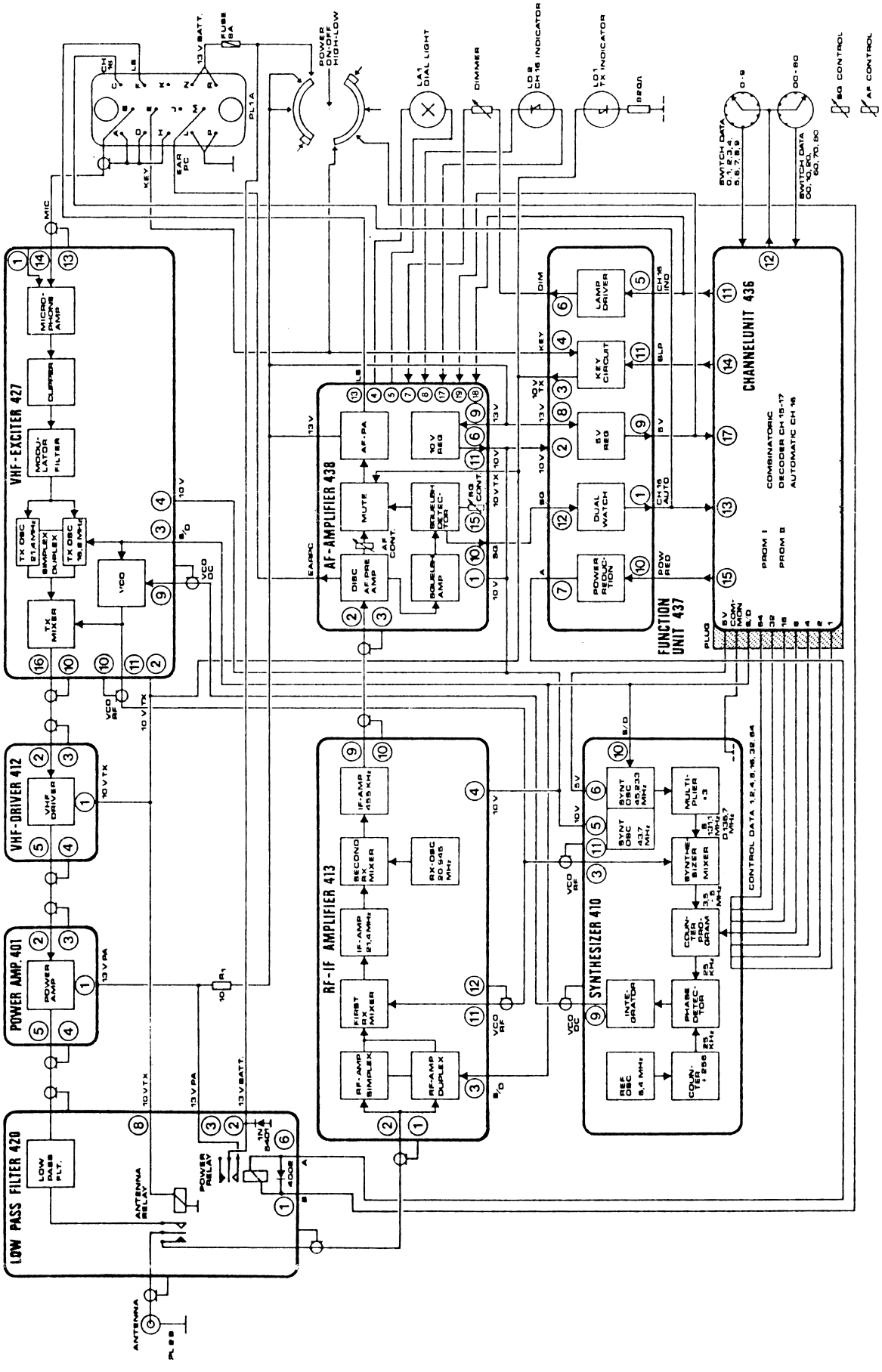
DECK HEAD MOUNTING



CUT OUT REQUIRED FOR PANEL MOUNTING



BULKHEAD MOUNTING



WIRING DIAGRAM

Ch	TX freq	RX freq	Mo.freq	VCO fr	Sy.osc	Sy.fr.
1	156.o5o	16o.65o	16,8	139.25o	45.233	3.55o
2	156.1oo	16o.7oo	16,8	139.3oo	45.233	3.6oo
3	156.15o	16o.75o	16,8	139.35o	45.233	3.65o
4	156.2oo	16o.8oo	16,8	139.4oo	45.233	3.7oo
5	156.25o	16o.85o	16,8	139.45o	45.233	3.75o
6	156.3oo	156.3oo	21,4	134.9oo	43.7oo	3.8oo
7	156.35o	16o.95o	16,8	139.55o	45.233	3.85o
8	156.4oo	156.4oo	21,4	135.ooo	43.7oo	3.9oo
9	156.45o	156.45o	21,4	135.o5o	43.7oo	3.95o
1o	156.5oo	156.5oo	21,4	135.1oo	43.7oo	4.ooo
11	156.55o	156.55o	21,4	135.15o	43.7oo	4.o5o
12	156.6oo	156.6oo	21,4	135.2oo	43.7oo	4.1oo
13	156.65o	156.65o	21,4	135.25o	43.7oo	4.15o
14	156.7oo	156.7oo	21,4	135.3oo	43.7oo	4.2oo
15	156.75o	156.75o	21,4	135.35o	43.7oo	4.25o
16	156.8oo	156.8oo	21,4	135.4oo	43.7oo	4.3oo
17	156.85o	156.85o	21,4	135.45o	43.7oo	4.35o
18	156.9oo	161.5oo	16,8	14o.1oo	45.233	4.4oo
19	156.95o	161.55o	16,8	14o.15o	45.233	4.45o
2o	157.ooo	161.6oo	16,8	14o.2oo	45.233	4.5oo
21	157.o5o	161.65o	16,8	14o.25o	45.233	4.55o
22	157.1oo	161.7oo	16,8	14o.3oo	45.233	4.6oo
23	157.15o	161.75o	16,8	14o.35o	45.233	4.65o
24	157.2oo	161.8oo	16,8	14o.4oo	45.233	4.7oo
25	157.25o	161.85o	16,8	14o.45o	45.233	4.75o
26	157.3oo	161.9oo	16,8	14o.5oo	45.233	4.8oo
27	157.35o	161.95o	16,8	14o.55o	45.233	4.85o
28	157.4oo	162.ooo	16,8	14o.6oo	45.233	4.9oo

CH	TX freq	RX freq	Mo.freq	VCO fr	SY.osc	Sy.fr
6o	156.o25	16o.625	16,8	139.225	45.233	3.525
61	156.o75	16o.675	16,8	139.275	45.233	3.575
62	156.125	16o.725	16,8	139.325	45.233	3.625
63	156.175	16o.775	16,8	139.375	45.233	3.675
64	156.225	16o.825	16,8	139.425	45.233	3.725
65	156.275	16o.875	16,8	139.475	45.233	3.775
66	156.325	16o.925	16,8	139.525	45.233	3.825
67	156.375	156.375	21,4	134.975	43,7	3.875
68	156.425	156.425	21,4	135.o25	43,7	3.925
69	156.475	156.475	21,4	135.o75	43,7	3.975
7o	156.525	156.525	21,4	135.125	43,7	4.o25
71	156.575	156.575	21,4	135.175	43,7	4.o75
72	156.625	156.625	21,4	135.225	43,7	4.125
73	156.675	156.675	21,4	135.275	43,7	4.175
74	156.725	156.725	21,4	135.325	43,7	4.225
75	-	-	-	-	-	-
76	-	-	-	-	-	-
77	156.875	156.875	21,4	135.475	43,7	4.375
78	156.925	161.525	16,8	14o.125	45.233	4.425
79	156.975	161.575	16,8	14o.175	45.233	4.475
8o	157.o25	161.625	16,8	14o.225	45.233	4.525
81	157.o75	161.675	16,8	14o.275	45.233	4.575
82	157.125	161.725	16,8	14o.325	45.233	4.625
83	157.175	161.775	16,8	14o.375	45.233	4.675
84	157.225	161.825	16,8	14o.425	45.233	4.725
85	157.275	161.875	16,8	14o.475	45.233	4.775
86	157.325	161.925	16,8	14o.525	45.233	4.825
87	157.375	161.975	16,8	14o.575	45.233	4.875
88	157.425	162.o25	16,8	14o.625	45.233	4.925

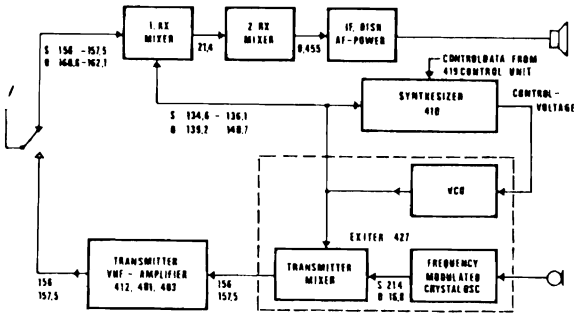
FREQUENCY TABLES.

CH.selector		PROM input code					PROM I output code							
o-8o	o-9	(1)	(2)	(4)	(8)	(16)	S/D	64	32	16	8	4	2	BLP
o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
o	1	1	o	o	o	o	o	o	o	o	1	1	1	1
o	2	o	1	o	o	o	o	o	o	1	o	o	o	1
o	3	1	1	o	o	o	o	o	o	1	o	o	1	1
o	4	o	o	1	o	o	o	o	o	1	o	1	o	1
o	5	1	o	1	o	o	o	o	o	1	o	1	1	1
o	6	o	1	1	o	o	1	o	o	1	1	o	o	1
o	7	1	1	1	o	o	o	o	o	1	1	o	1	1
o	8	o	o	o	1	o	1	o	o	1	1	1	o	1
o	9	1	o	o	1	o	1	o	o	1	1	1	1	1
1	o	o	o	o	o	1	1	o	1	o	o	o	o	1
1	1	1	o	o	o	1	1	o	1	o	o	o	1	1
1	2	o	1	o	o	1	1	o	1	o	o	1	o	1
1	3	1	1	o	o	1	1	o	1	o	o	1	1	1
1	4	o	o	1	o	1	1	o	1	o	1	o	o	1
1	5	1	o	1	o	1	1	o	1	o	1	o	1	o
1	6	o	1	1	o	1	1	o	1	o	1	1	o	1
1	7	1	1	1	o	1	1	o	1	o	1	1	1	o
1	8	o	o	o	1	1	o	o	1	1	o	o	o	1
1	9	1	o	o	1	1	o	o	1	1	o	o	1	1
2	o	o	o	1	1	o	o	o	1	1	o	1	o	1
2	1	1	o	1	1	o	o	o	1	1	o	1	1	1
2	2	o	1	1	1	o	o	o	1	1	1	o	o	1
2	3	1	1	1	1	o	o	o	1	1	1	o	1	1
2	4	o	o	1	1	1	o	o	1	1	1	1	o	1
2	5	1	o	1	1	1	o	o	1	1	1	1	1	1
2	6	o	1	1	1	1	o	1	o	o	o	o	o	1
2	7	1	1	1	1	1	o	1	o	o	o	o	1	1
2	8	o	1	o	1	o	o	1	o	o	o	1	o	1
2	9	1	1	o	1	o	o	o	o	o	o	o	o	o

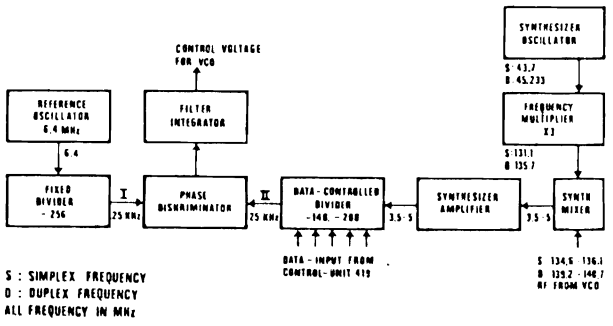
Ch.selector		PROM input code					PROM II output code							
8-8o	o-9	(1)	(2)	(4)	(8)	(16)	S/D	64	32	16	8	4	2	BLP
6	o	o	o	o	o	o	o	o	o	o	1	1	o	1
6	1	1	o	o	o	o	o	o	o	o	1	1	1	1
6	2	o	1	o	o	o	o	o	o	1	o	o	o	1
6	3	1	1	o	o	o	o	o	o	1	o	o	1	1
6	4	o	o	1	o	o	o	o	o	1	o	1	o	1
6	5	1	o	1	o	o	o	o	o	1	o	1	1	1
6	6	o	1	1	o	o	o	o	o	1	1	o	o	1
6	7	1	1	1	o	o	1	o	o	1	1	o	1	1
6	8	o	o	o	1	o	1	o	o	1	1	1	o	1
6	9	1	o	o	1	o	1	o	o	1	1	1	1	1
7	o	o	o	o	o	1	1	o	1	o	o	o	o	1
7	1	1	o	o	o	1	1	o	1	o	o	o	1	1
7	2	o	1	o	o	1	1	o	1	o	o	1	o	1
7	3	1	1	o	o	1	1	o	1	o	o	1	1	1
7	4	o	o	1	o	1	1	o	1	o	1	o	o	1
7	5	1	o	1	o	1	o	o	o	o	o	o	o	o
7	6	o	1	1	o	1	o	o	o	o	o	o	o	o
7	7	1	1	1	o	1	1	o	1	o	1	1	1	1
7	8	o	o	o	1	1	o	o	1	1	o	o	o	1
7	9	1	o	o	1	1	o	o	1	1	o	o	1	1
8	o	o	o	1	1	o	o	o	1	1	o	1	o	1
8	1	1	o	1	1	o	o	o	1	1	o	1	1	1
8	2	o	1	1	1	o	o	o	1	1	1	o	o	1
8	3	1	1	1	1	o	o	o	1	1	1	o	1	1
8	4	o	o	1	1	1	o	o	1	1	1	1	o	1
8	5	1	o	1	1	1	o	o	1	1	1	1	1	1
8	6	o	1	1	1	1	o	1	o	o	o	o	o	1
8	7	1	1	1	1	1	o	1	o	o	o	o	1	1
8	8	o	1	o	1	o	o	1	o	o	o	1	o	1
8	9	1	1	o	1	o	o	o	o	o	o	o	o	o

CIRCUIT DESCRIPTION

SIGNALPATH FOR RT 403B



SIGNALPATH FOR SYNTHESIZER 410



SYNTHESIZER 410

A synthesizer is a control unit which together with a Voltage Controlled Oscillator produces requested frequencies of high stability.

A data input in the synthesizer controls the VCO frequency.

The synthesizer replaces i.a. the channel oscillators used previously. Therefore, the RT 403 B does not require any channel crystals.

The synthesizer consists of:

REFERENCE OSCILLATOR
FIXED FREQUENCY DIVIDER
PHASE DISCRIMINATOR
INTEGRATOR FILTER
DATA-CONTROLLED FREQUENCY DIVIDER
SYNTHESIZER MIXER
SYNTHESIZER OSCILLATOR
MULTIPLIER

REFERENCE OSCILLATOR

The reference oscillator X_3, T_{10} is a crystal oscillator of high stability.

With counter on TP 2 it is adjusted at P_1 to 6.400.00 MHz.

The oscillator is succeeded by an amplifier T_{11} amplifying the signal to 5 V p.p. (TTL level).

FIXED FREQUENCY DIVIDER

The divider consists of IC_4, IC_5.

Each integrated circuit is dividing its input frequency with 16.

The output frequency is

$$f_{ref} = \frac{6,4 \cdot 10^6}{16 \cdot 16} = 25 \text{ KHz}$$

This frequency can be tested on TP 5.

PHASE DISCRIMINATOR

The phase discriminator IC_3 is a digital type. Input I is a firm 25 KHz reference frequency. Input II has relation to the VCO frequency.

If input II is higher than 25 KHz, the discriminator gives a voltage of 2,25 V. If input II is lower than 25 KHz or missing, the voltage given by the discriminator is 0,75 V. If input II is at 25 KHz but with a phase difference to input I, positive or negative pulses are given within the range 0,75 - 2,25 V.

INTEGRATOR FILTER

The function of the filter is to remove 25 KHz remnants and to integrate the pulses from the phase discriminator to a DC voltage. The output voltage to VCO will lie between 2 and 9 volt.

The influence of the DC control voltage on the VCO frequency has the result that input II always is 25 KHz.

DATA-CONTROLLED FREQUENCY DIVIDER

The signal to input II comes from the data divider IC_1, IC_2. The signal consists of negative peak pulses with a pulse width of approx. 100 n sec. The divider is set to divide with 128 + data input from Channel-unit 436.

See PROM output table pg. 6.

Data input = PROM output.

Example:

CH 66: 128 + data input = 128 + 16 + 8 + 1 = 153

See example on page 8.

Thus the input frequency to the divider will be 25 KHz · 153 = 3,825 MHz.

The divider can be controlled to divide between 128 and 256.

RT 403 B operates with dividing numbers between 141 and 197.

Thus the input frequency for the divider will lie between

25 KHz · 141 = 3.525 MHz

25 KHz · 197 = 4.925 MHz

SYNTHESIZER AMPLIFIER

The input signal to the data-divider comes from the synthesizer amplifier T_2, T_3, T_4. Here the signal from the synthesizer mixer is amplified from approx. lo mV up to 5 V p.p. (TTL level).

SYNTHESIZER MIXER

The synthesizer mixer converts the VCO frequency to a frequency at which the integrated data-dividers are able to operate. The VCO signal passes through a buffer stage T_1 before being fed to the synthesizer mixer.

SYNTHESIZER OSCILLATOR

The synthesizer oscillator is an overtone crystal oscillator T 8 which oscillates at 43.700 MHz X_1 on simplex channels, and at 45.233,3 MHz X_2 on duplex channels.

The changing over is operated from the S/D line over T_7, D_6.

The frequencies of the oscillator are adjusted with L_5 and L_4 respectively.

MULTIPLIER

The frequency of the synthesizer oscillator is tripled in the multiplier T 9 and filtered in L_6, L_7.

The output frequency of the multiplier to the synthesizer mixer is 131.1 MHz and 135.7 MHz. The reason for using two frequencies is that it is preferable to keep the frequency to the data divider within the same frequency range 3.5 - 5 MHz whether simplex or duplex channels are used.

By changing channels from simplex to duplex the VCO frequency will leap up 4.6 MHz (the VCO frequency being used to the 1st mixer in RX). As the synthesizer oscillator at the same time leaps up 4.6 MHz, the difference frequency to the data-dividers stays in the same range.

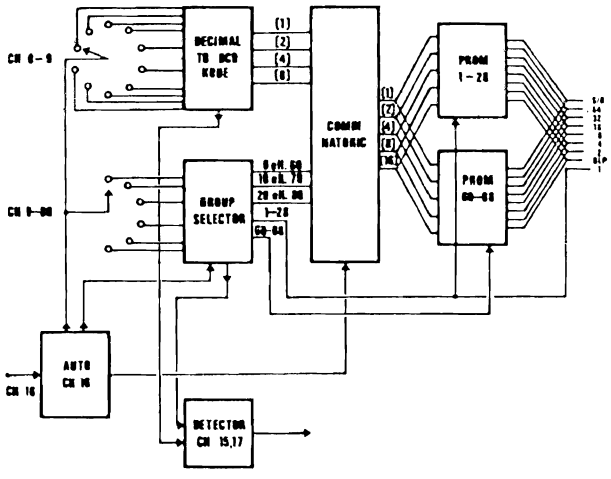
Therefore, all channels will lie from 3.5 MHz to 5 MHz on TP 6 with 25 KHz intervals.

CHANNEL-UNIT 436

The channel-unit converts the information from the channel selector into a code which is suited for calling the PROM memory cells x). The output from the PROM memory cells controls the synthesi and is hereby also controlling the frequency of station.

x)
PROM means Programable Read Only Memory. The PRO contents a memory with 32 words, the address of each word is a binary number between 0 and 31 which can be selected on the input lines. Each word consists of 8 memory cells, and each of the is connected to an output line. The memory cells are programmed by DANCOM.

FLOW SHEET



DECIMAL TO BCD CODER

The coder consists i.a. of D_1 - 15.

The input lines from the channelswitch to the coder has a value or "weight" of between 0 and 9. On the request that this piece of information is coded to 4 output lines with the weights (1), (2), (4), (8), the output values are found by summing up the weights of the lines with logical

In the following diagram 1 (High) means that the line has > 1,5 V and 0 (Low) that the line is short-circuited or has < o,8 V.

		INPUT									Auto CH
		0	1	2	3	4	5	6	7	8	9	16
OUTPUT	(8)	1	1	1	1	1	1	1	1	0	0	1
	(4)	1	1	1	1	0	0	0	0	1	1	1
	(2)	1	1	0	0	1	1	0	0	1	1	1
	(1)	1	0	1	0	1	0	1	0	1	0	1

GROUP-SELECTOR

The group-selector consists of D_{16-25}. The function is to give a common decade or "10" output for o/6o, 1o/7o, 2o/8o respectively to the combinatoric and to couple in the requested PROM.

			PROM I	PROM II
	(1o-7o)	(2o-8o)	(o-1o-2o)	(6o-7o-8o)
0	1	1	0	1
10	0	1	0	1
20	1	0	0	1
60	1	1	1	0
70	0	1	1	0
80	1	0	1	0

COMBINATORIC

Combinatoric consists of $IC_{1, 2, 5}$. In Combinatoric the BCD code is put together with the "1o" outputs, thus making a pure binary number between 0 and 31 for choice of word in PROM. The code is lying on 5 lines with the weights (1),(2),(4),(8),(16).

PROM

PROM HAS AN ENABLE INPUT. PROM is only active when this input is at zero.

In the channel range 1-28 PROM I is active.
In the channel range 6o-88 PROM II is active.

PROM OUTPUT

S/D: Output is 0 on all duplex channels.
Output is 1 on all simplex channels.

64, 32, 16, 8, 4, 2: These outputs control the variable divider in the synthesizer.

Blocking: The output is 0 when RT 403 B must not transmit on the channel in question e.g. CH 29.

EXAMPLE

The channel selector on CH 66.

PROM input (1) = 0 V
(2) = 5 V
(4) = 5 V Address 2+4 = 6
(8) = 0 V
(16) = 0 V

Group (6o-7o-8o) is at zero, which gives the result that PROM II is coupled in as pin 15 is 0.

The enable line to PROM I is carried out as 1 for control of the synthesizer.

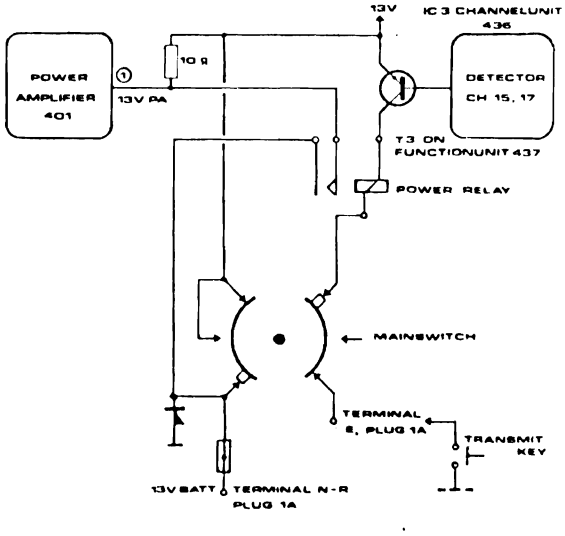
PROM output S/D = 0 V as CH 66 is duplex
64 = 0 V
32 = 0 V
16 = 5 V
8 = 5 V
4 = 0 V
2 = 0 V
BL = 5 V being an allowed chan

Enable input
PROM I : 1 = 5 V

The frequency divider of the synthesizer alway adds 128 to the dividing data, the total divi number thus being 128 + 25 = 153.

FUNCTION-UNIT 437

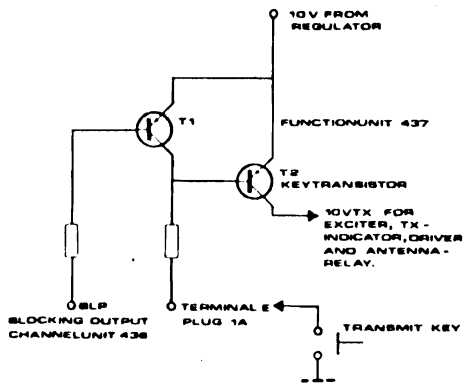
POWER REDUCTION CIRCUIT



In order that the power relay can be activate the following is necessary:

1. The MAIN SWITCH must be set at 25 W.
2. The TRANSMITTER must be keyed.
3. CH 15, 17 must not be selected.

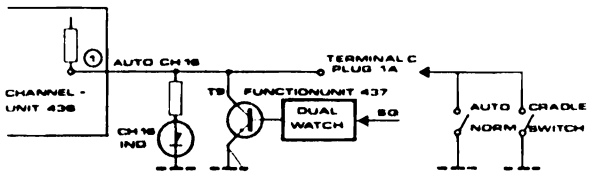
KEY AND BLOCKING CIRCUIT



When the KEY is pressed, the POWER RELAY is activated (only on 25 W) and the KEY TRANSISTOR (when not blocked) will feed the EXCITER with 10 V.

all normal channels the blocking output from the PROM is programmed to logical 1.

AUTO CH 16



When the line AUTO CH is "open" (5 V) and the CH 16 indicator is alight, the channel switches are open, and a logic code for word 26 in the PROMs appears. See connections pin 4, 9, 13 on CHANNEL-UNIT 436.

PROM word 26 can never be selected by means of the channel switches. Normally this word will be programmed for CH 16 but at option it can be programmed for any simplex or duplex channel in the normal or in the private band.

CHECK OF DUAL WATCH

DUAL WATCH will only function when the squelch operates.

Put the microtelephone into the cradle and set the cradle switch in position AUTO.

Turn the squelch knob clockwise until the noise disappears.

Select CH 28 on the channel selector.

Connect a testgenerator to the antenna terminal.

4. Set testgenerator on 156.800 MHz (CH 16).

   Squelch must be open and stay open as long as the carrier is applied.

   Also CH 16 indicator must be alight.

5. Select CH 01 on the channel selector.

6. Same as 4.

7. Set testgenerator on 160.650 MHz.

   Squelch must be open in periodes of 1 sec. interrupted in periodes of approx. 0,1 sec.

8. Remove the microtelephone from cradle or set the cradle switch in position NORM.

   Now the interruptions disappear.

   The DUAL WATCH FUNCTION is changed to a steady watch when a shunt is connected to the oscillator as shown in the diagram for FUNCTION-UNIT 437.

EXCITER 427

MODULATION AMPLIFIER

The dynamic microphone signal (14) is fed to the microphone sensitivity potentiometer P_1.

If a carbon microphone is being used, it must be connected in (1) .

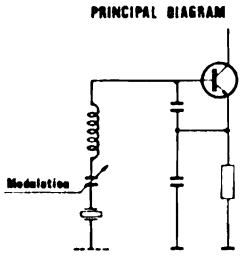
The signal is amplified in IC_1 and preemphasized with 6 dB per octave by R_5, C_7.

The following clipper T_1, T_2 with the symmetry regulation P2 prevents overmodulation. The symmetry can be checked at TP 1. To remove harmonic signals from a clipping of the microphone signal, the signal is fed through a 2nd order active filter T_3 and through a RC-stage R_{20} C_{15}. Totally -18 dB/octave above 6 KHz.

CRYSTAL MODULATION

Simplex channels operate on 21.4 MHz (T8).
Duplex channels operate on 16.8 MHz (T5).
The unused oscillator is being stopped by $T_{6, 7}$ and T_4 respectively.

FLOW SHEET



The crystal is coupled to the oscillator via $L_{2, 4}$.

$L_{1, 3}$ and $D_{2, 3}$ control the exact frequency of the oscillator.

Without modulation L_1 and L_3 are adjusted to 16.8 MHz and 21.4 MHz respectively.

MODULATOR DRIVER

T e modulator driver T 9 is a wide-band amplifier which raises the level from the TX-oscillators to a suitable level for the TX-mixer.

\ :O

In the range 134.6 - 141.6 MHz the Voltage Controlled Oscillator gives a signal to TX-mixer, the RX-m :er, and the synthesizer-mixer.
I return it receives a DC signal from the synthesizer, and this signal is fed to the capacitance diode D_{10}. By that the oscillator is kept at the r quested frequency.
By changing channels between simplex and duplex the VCO frequency leaps 4.6 MHz.

E ample:

VCO frequency CH 16 = 135.4 MHz

VCO frequency CH 18 = 140.1 MHz

The range in frequency is a result of the control voltage on S/D input, T_{11}, R_{44} and D_8.

change from CH 16 simplex to CH 18 duplex the control voltage should not change more than ± 0,5 V.

RF-output (11) 0,2 V.

..(-MIXER

The VCO signal and the modulator signal are mixed a balanced mixer.

Example:

TX-frequency
CH 16: 135.4 + 21.4 = 156.8 MHz
CH 18: 140.1 + 16.8 = 156.9 MHz

VHF DRIVER 412

The function of the driver is to take away unwanted products from the TX-mixer and to drive the PA-stage.

The input is approx. 50 mV from 50 ohms.

The output is approx. 4 V in 50 ohms.

VHF POWER AMPLIFIER 401

The only function of the PA-stage is to give the TX signal power amplification.

In position LOW-POWER the supply voltage from the output stage falls approx. 10 V and the output falls to approx. 1 W.

LOW-PASS-FILTER 420

The function of the filter is to attenuate harmonic frequencies from the PA-stage.

The filter has been made in "strip-line" technique and does not require any re-adjustment.

Attenuation at 160 MHz approx. 0,5 dB

Attenuation at 320 MHz approx. 80 dB

RECEIVER

The RF signal is amplified in one of the 2 RF-heads (one is tuned for simplex channels T 12, the other one is tuned for duplex channels T 5) and fed into the first mixer. The first mixer T6 converts the signal from the RF amplifier to 21.4 MHz by means of the VCO signal.

The 21.4 MHz signal is fed to the IF-amplifier T7 through a crystal filter with 90 dB attenuation on adjacent channels. The signal is then converted to 455 KHz in the second mixer T8 by means of the 2nd 20.945 MHz oscillator T14.

The 2nd IF signal is amplified T9, 10 and fed in the integrated limiter and discriminator. The demodulated signal is integrated with a response of 6 dB per octave in the amplified IC2 and hereafter fed into a power amplifier with 4 Watt out into a 4 ohm load.

From the output of the discriminator a noise signal is fed to the squelch circuit. After being amplified, filtered - app. 20 KHz - and detected the signal is fed to the AF-muting circuit. In case missing or weak signal on the aerial, the AF-signal is short-circuited in T2.

PRIVATE CHANNELS

It is possible to mount up to 5 channels in RT 4 besides the 55 international channels.

In the lower channelband the switch positions 00 29 are unused. In the upper channelband the switch positions 75, 76, and 89 are unused and thereby disposal for tuning in of private channels.

When one of the switch positions mentioned is tuned in, a word is selected in the PROM, which is unprogrammed from the factory. This means that all control connections to the synthesizer are "low".

If a private channel is requested, the matching frequency control code must be calculated. By means of a coding instrument this code is programmed in PROM.

Maximum frequency limits:

TX: 155.000 - 158.500 MHz
RX: 155.000 - 158.500 MHz
159.600 - 163.100 MHz

Utilized bandwidth	1.5	MHz	- normal performance
"	2	MHz	- RX sensitivity loss external channels 1
			TX normal performance
"	2.5	MHz	- RX sensitivity loss external channels 2
			TX power loss on external channels 1
"	3	MHz	RX sensitivity loss external channels 6
			TX power loss 3

ivate channels with frequencies ending in ...00 KHz or ...50 KHz must be coded in the lower channel-band.

If the frequencies end in ...25 KHz or ...75 KHz, hey must be coded in the upper channelband.

Switch Pos.	PROM word	Remarks
30	00 in PROM I	For frequencies ending in ..00 or ..50 KHz
29	11 in PROM I	For frequencies ending in ..00 or ..50 KHz
75	21 in PROM II	For frequencies ending in ..25 or ..75 KHz
76	22 in PROM II	For frequencies ending in ..25 or ..75 KHz
29	11 in PROM II	For frequencies ending in ..25 or ..75 KHz

y private channels below 155.700 MHz (RX 160.300 MHz) it is necessary to couple in the "Special channel" decoder IC 4 Channel-Unit 436, as the ynthesizer data input for dividerbit 128 must e coupled in. Usually this data input pin 9 C 2 on SYNTHESIZER 410 is permantly connected o 5 V. This connection must be cut off, and nstead pin 9 must be connected to "128" output n 436 CHANNEL-UNIT.

The input to the "Special Channel" decoder R, S and TU must be connected to the switch osition of private channels.

Example: Private channel Tx 155.5 and RX 160.1

The channel must be placed in the lower channelband as the frequency ends in ..00 KHz. We can choose channelswitch posotion 29.

Because the frequency is below 155.700 MHz the "Special Channel" decoder must be connected to control divider bit "128".

This means that R must be connected to 2 n the "10" switch. S must be connected o 9 on the "1" switch.

f channel 29 is tuned in both R and S ill be "low" and thereby output "128" is lso low.

he control code must be placed in Word 11 n PROM 1.

he synthesizer frequency will be

f_{TX} - 152.5 MHz

55.5 - 152.5 = 3.000 MHz

viding number = f_{SY}/25 KHz

000/25 = 120

The binary code for 120 = 64+32+16+8

PROM CODE.

S/D	=	0
(128	=	0)
64	=	1
32	=	1
16	=	1
8	=	1
4	=	0
2	=	0
(1	=	0)
BL	=	1

When a PROM with private channels is being mounted, it is necessary to check VCO - DC on TP (9) SYNTHESIZER 410. On the uttermost channels the voltage must lie between the limits 3 and 8 V. Normally it should be unnecessary to readjust RX or TX.

TROUBLE SHOOTING

The purpose of the trouble shooting instruction is to assist in finding the defective circuit as soon as possible.

It is taken for granted that the power supplies always are checked first.

13 V are found on AF-print (9)

10 V are found on AF-print (6)

5 V are found on FUNCTION-UNIT (9)

The defects can be divided into:

1. Function defect
2. Synthesizer defect
3. Channellogic defect
4. Transmitter defect
5. Receiver defect

SYNTHESIZER TROUBLES

Typical fault report:

RX/TX do not function on simplex and/or duplex channels.

RX with white noise.

TX indicator is alight, and the relaies are pulling when TX is keyed.

Check-up: By fault on simplex channels or both simplex and duplex channels tune in on CH 16.

By fault on duplex channels alone tune in on CH 18.

Check VCO-DC (9) on EXCITER.

VCO-Control Voltage higher than 9 V:

The signal path between VCO-RF (11) on EXCITER and TP 7 on SYNTHESIZER is obviously cut off.

Connect oscilloscope to TP 6 with a non-loading probe.

If signal > 3 Vpp 5-7 MHz appears, the defect may be found in the data divider $IC_{1, 2}$.

The divider is checked on pin 7 IC_2 or TP 7 with oscilloscope and non-loading probe.

The pulses in TP 7 are negative and very narrow (app. 100 n sec.).

If the appearing signal in TP 6 is < 1 Vpp, the possibilities are as follows:

The synthesizer oscillator does not oscillate.

The VCO does not oscillate, or the frequency is too much off.

The VCO driver is defect.

The synthesizer is defect.

The synthesizer amplifier is defect.

The synthesizer oscillator is checked with a frequency counter or a MVTM with the RF-probe on TP 1.

Simplex channels 43.7000 MC approx 50 mV.

Duplex channels 45.2333 MC approx 50 mV.

VCO is checked with MVTM RF-probe on (11) EXCITER. Requirement approx 200 mV.

VCO-Control-Voltage lower than 2 V:

The signal path between the reference oscil and TP 5 is obviously cut off.

The reference oscillator is checked on TP 2 > 3 Vpp 6,4 MHz.

The 16-dividers $IC_{4, 5}$ are checked on TP 5 5 Vpp 25 KHz.

If the above circuits are OK, the defect is in the phase discriminator or the integrator the VCO frequency is too much off.

If VCO-DC is 2 V, the voltage in TP 3 must b 2,25 V.

If VCO-DC is 9 V, the voltage in TP 3 must b 0,75 V.

CHANNELLOGIC TROUBLES

Typical fault report A:

RX/TX do not function on one channel.

RX with white noise.

TX indicator is alight, and the relays are p when TX is keyed.

Check-up: Check if the channel selector knob loose.

Check control-data on SYNTHESIZER- on the defective channel.

S/D 64 32 16 8 4 2 1

And compare with table for PROM ou 1=5 V, 0=o,5 V.

If unharmonic, check PROM input (1) (2) (4) (8) (16) and compare with table.

If now harmonic, PROM is defective, PROM output has been short-circuit interrupted or interconnected.
If unharmonic, combinatoric is defe A quick dividing code check is to c the frequency in TP 6 on module 41 compare with table page 5.

RANSMITTER ' TROUBLES

ypical fault report A:

ransmitter does not function (no carrier wave) n simplex channels and/or duplex channels.

X indicator is alight, relays are pulling when X is keyed.

X OK otherwise synthesizer defect.

neck-up: By fault on simplex channels only or both simplex and duplex channels - set channel selector on CH 14.

By fault on duplex channels tune in on CH 18.

If the power consumption on HIGH POWER is higher than 4 amp, the antenna relay or the LOW-PASS-FILTER may be defective.

If the power consumption is low, check on TP 2 EXCITER with frequency counter or MVTM with RF-probe if the TX-oscilators are oscillating.

Simplex 21.4 MHz approx. 300 mV.

Duplex 16.8 MHz approx. 300 mV.

If OK, and VCO OK there will be input voltage to VHF-DRIVER.

Check RF-level on PA-input (2) with MVTM and RF-probe.

Requirement: > 3 V.

ypical fault report B:

has bad / no modulation.

T E: SET TRANSMITTER ON LOW POWER!

eck-up: Check voltage on (1) EXCITER.

If the voltage is 10 V and a carbon microphone is used, there may be interruption in the external microphone circuit.

Check DC-voltage on IC_1 output.

Requirement: 4-6 V

Check DC voltage TP 1

Requirement: 4-6 V

By full drive 1 KHz, the level in TP 1 is >6 Vpp.

RECEIVER TROUBLES

Typical fault report:

Receiver weak/silent on simplex and/or duplex channels.

Receiver with white noise/dead.

TX OK, otherwise synthesizer defect.

Check-up: If the receiver is completely dead, the SQUELCH circuit or the AF-AMPLIFIER may be defective. If there is a signal in the telephone, the loudspeaker is cutt off.

If the loudspeaker is short-circuited, the telephone is also silent.

If the voltage in (10) AF-AMPLIFIER is higher than 5 V, squelch is open.

Check on TP 2 (top side connection near L2) if there is a signal through the LF-amplifier.

If a signal of 455 KHz modulation with 1 KHz and with deviation ± 3 KHz is connected to (2) , the sensitivity must be 50uV.

During this meansurement unsolder the connection to (2) from the IF-amplifier.

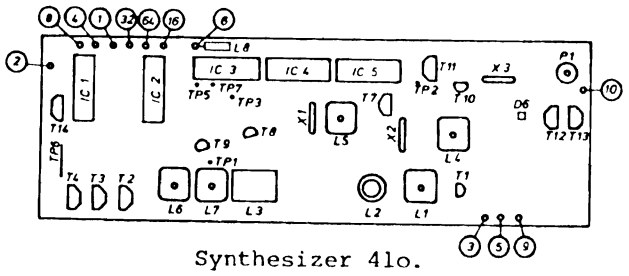
In TP 2 on RF,IF-AMPL. 413 the sensitivi is 1 uV EMF on 21.4 MHz.

Depending on the choice of channel-simplex or duplex - there are 10 V on T_{12} and T_8 respectively.

On the unused RF-channel the voltage must not exceed 1 volt.

ALIGNMENT

ALIGNMENT OF SYNTHESIZER AND VCO



Synthesizer 41o.

Necessary measuring equipment:

Frequency counter 50 MHz 50 mV

Oscilloscope 10 MHz non-loading test probe

Voltmeter

Millivoltmeter with RF-probe or diode probe.

VCO

Set channel selector on CH 18.

Connect voltmeter to (9) EXCITER.

Adjust L_7 EXCITER to 5.5 V.

Set channel selector on CH 17.

Adjust R 44 to 5.5 V in (9) .

Set channel selector on CH 18 again.

Connect MVTM with RF-probe to (11) EXCITER.

Adjust L_8 EXCITER to max. RF.

Requirement > 150 mV RMS.

Connect the frequency counter to TP 2.

Adjust P_1 to 6.400.0 MHz.

If a VHF frequency counter (160 MHz) is not available, the channel frequencies must be laid on as follows:

Connect counter to TP 1.

Adjust on CH 18 L_4 to 45.233.33 MHz.

Adjust on CH 16 L_5 to 43.700.00 MHz.

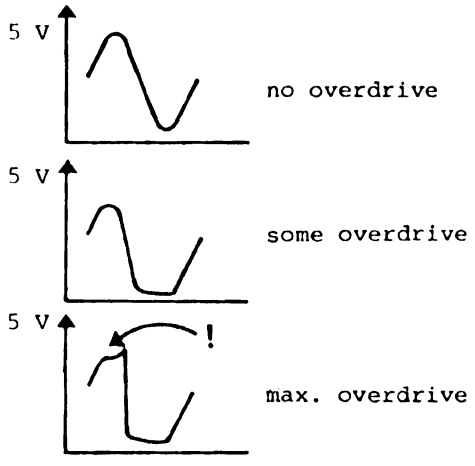
If a VHF frequency counter is available, L_4 and L_5 are adjusted in such a way that the transmitter output frequencies are lying exactly on CH 18 and CH 16 156.900.0 and 156.800.0 MHz. But then the EXCITER first has to be aligned.

Set channel selector on CH 18.

Connect oscilloscope to TP 6 SYNTHESIZER.

N O T E! Remember to use a test probe with a capacitive < 20 pF, and a recisiv loading > 1 Kohm.

Remark the form of the curve and adjust L_1, L_6, and L_7 to max. overdrive.

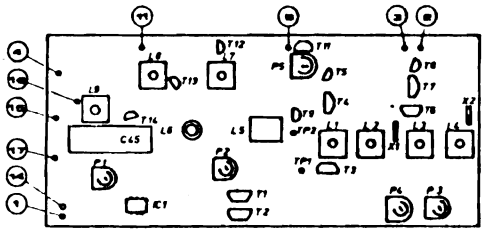


Change over to CH 16.

Re-adjust L_1 and L_7 to max. overdrive.

Check all channel frequencies with a frequenc counter on TP 6, see frequency table.

ALIGNMENT OF EXCITER



Exciter 427.

Necessary measuring equipment:

Frequency counter 50 Mc 50 mV

Oscilloscope

Tone generator

Deviation meter

1. Connect frequency counter to TP 2.

   Turn core in L_4 and L_2 to approx. 6 turns the bottom of the coil form.

   Set LOW-POWER.

   Key transmitter.

   Set channel selector on CH 14.

   Adjust L_3 to 21.400.0 MHz.

   Set channel selector on CH 18.

   Adjust L_1 to 16.800.0 MHz.

2. Connect tone generator 1000 Hz to (14) E

   Connect oscilloscope to TP 1.

   Turn P 1 and P 2 to the middle.

   Adjust input in (14) until clipper limi is obtained. Input app. 6 mV.

   Adjust P 2 to symmetrical clipper.

Connect deviation meter to antenna output.

Adjust P 3 to ± 3,5 KHz deviation on CH 14.

Increase input (14) by 20 dB (ten times).

Vary input frequency (14) 300-3000 Hz.

Check that deviation does not exceed ± 5 KHz.

Set channel selector on CH 18.

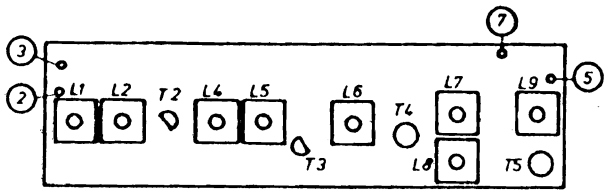
Adjust P_4 to ± 3,5 KHz deviation.

Increase input (14) by 20 dB.

Vary input frequency (14) 300-3000 Hz.

Check that deviation does not exceed ± 5 KHz.

ALIGNMENT OF VHF-DRIVER



VHF-Driver 412

Necessary measuring equipment:

50 ohms load 0,3 W
(may be a carbon film resistor 47 ohms).

MVTM with RF-probe or a diode probe.

—

Dissolder the input cable to the PA-stage.

Terminate it with a 50 ohms load.

Connect RF-probe of MVTM over the load.

Set on CH 14.

Key the transmitter.

Tune L9 on EXCITER and L_1, 2, 4, 5, 6, 7, 8, 9 on VHF-Driver to max. output.

Because of the overdrive the maximum is "flat", but is is necessary to find the maximum for getting a good selectivity.

Requirement on all channels > 3 V output.
Input is approx. 50 mV from 50 ohms.

ALIGNMENT OF POWER-AMPLIFIER

Necessary measuring equipment:

Amp meter 10 A DC

50 ohms Power-meter for 25 W

Oscilloscope 10 MHz.

Unstability-detector

Connect Amp-meter in supply voltage line to RT 403.

Set supply voltage at 13,2 V.

Connect oscilloscope to unstability-detector.

Set on CH 14.

Set HIGH-POWER.

Adjust all trimmers to minimum capacity.

Key transmitter.

Adjust all trimmers beginning from C2 to max. power consumption until there is deflection on power-meter.

Then adjust to max. output power.

After this rough adjustment, C_3 and C_4 are fine adjusted by detuning C_3 a little to less capacity and re-adjusting C4 to max. power.

C_5 and C_6 are fine adjusted in the same way.

Tune C_7 and C_8 to max. output power.

Now the power should be about 25 W.

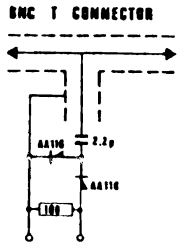
The current consumption of the station should not be more than 6,5 Amp 13,2 V.

In position LOW-POWER the supply voltage for the output stage falls approx. 10 V and the output power falls to approx. 1,0 W.

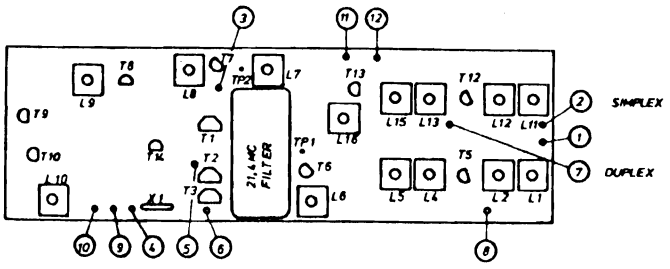
If there is an unstability in the PA-stage during the up-tuning, this will show as short-wave signals on the oscilloscope.

After finishing the up-tuning there must not be unstability on any channel with HIGH or LOW POWER and 15 V supply voltage.

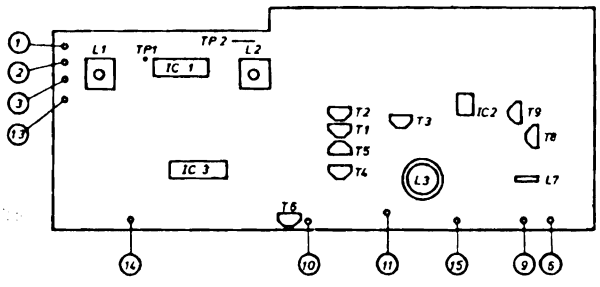
UNSTABILITYDETECTOR



ALIGNMENT OF RECEIVER



RF-IF Amplifier 413



AF-Amplifier 438

Necessary measuring equipment:

Signal generator 0,5 uV - 10 mV 50 ohms
0,455 - 162 MHz.

Distortionmeter or MVTM.

Oscilloscope 10 MHz.

Connect a 4 ohms loudspeaker.

Connect distortionmeter or MVTM across the loudspeaker output.

Connect oscilloscope to TP 1 (AF-circuit board).

Connect signal generator to TP 2. RF-IF board.

Frequency 21.400 MHz.

Modulation 1 KHz.

Deviation ± 3 KHz.

Tune L_2 (AF-circuit board) for maximum AF signal on MVTM.

Tune L_1 (AF-circuit board) L_8, L_9 and L_{10} to maximum signal in TP 1.

N o t e! Decrease input in order to avoid limiting in the primary IF-stages.

Connect signal generator to antenna input.

Frequency 156.800 MHz.

Set on CH 16.

Adjust the core in L_5 and L_{15} to the bottom of the coil form

Listen to the signal in the loudspeaker and tune L_{11}, 12, 13, 15 and L_{16} to maximum sensitivity.

Tune L_6 and L_7 to minimum distortion.

Requirement < 0,8 uV EMF at 20 dB $\frac{S + N}{N}$

or 12 dB $\frac{S + N + D}{N + D}$

Set on CH 18.

Frequency 161.500.0 MHz.

Tune L_1, 2, 4 and L_5 to maximum sensitivity.

Requirement < 0,8 u EMF at 20 dB $\frac{S + N}{N}$

or 12 dB $\frac{S + N + D}{N + D}$

Check sensitivity on CH o1, o6 and 28.

ALIGNMENT OF CHANNEL FREQUE

The adjustment must take place in the follow order:

Set LOW POWER.

Connect frequency counter on TP 2 SYNTHESIZE

Adjust P_1 SYNTHESIZER to 6.400.00 MHz.

Connect frequency counter to TP 2 EXCITER.

Adjust L_3 EXCITER to 21.400.00 MHz CH
Adjust L_1 EXCITER to 16.800.00 MHz CH

With VHF frequency counter.

Connect counter to transmitter output.

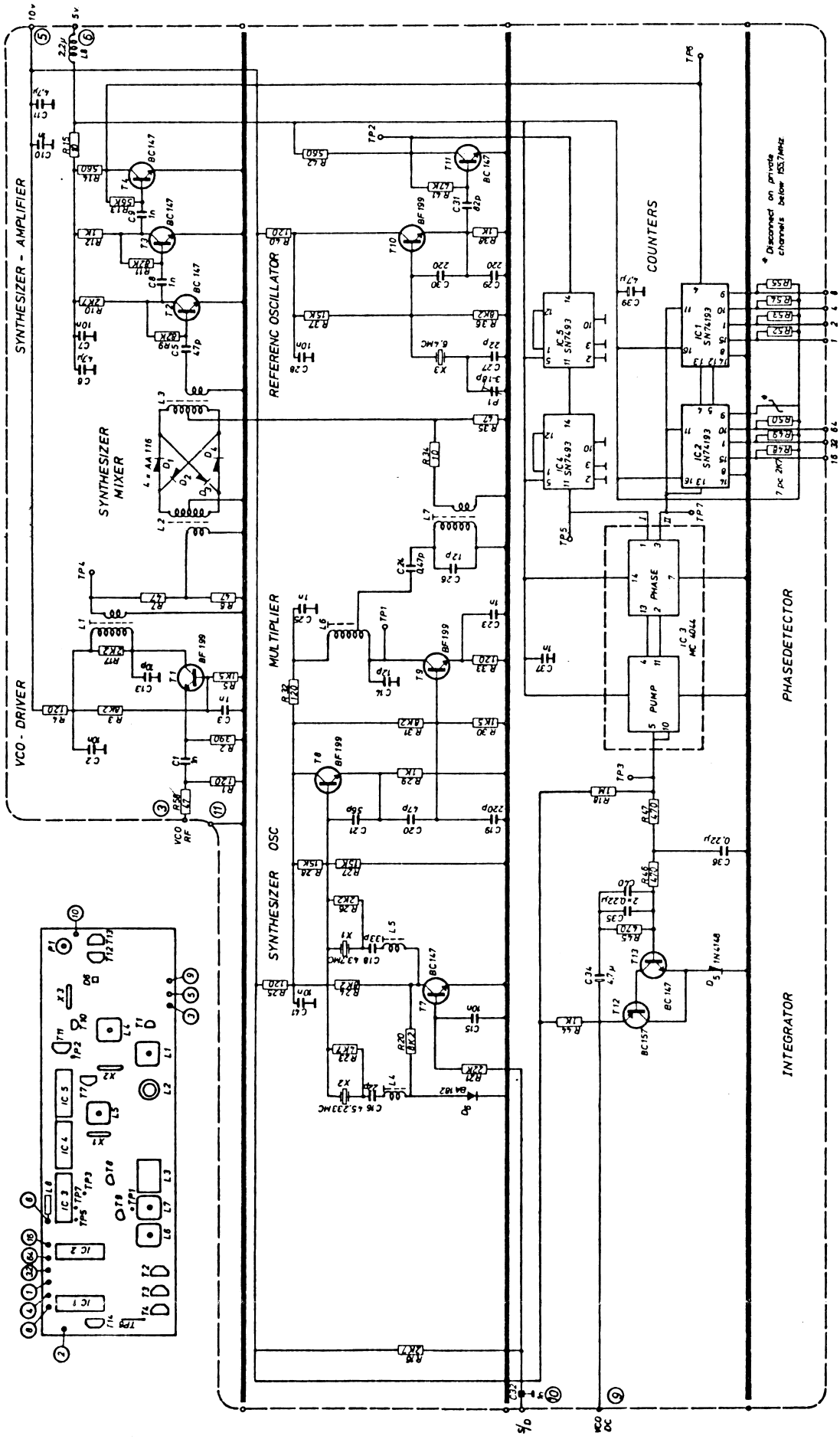
Adjust L_5 SYNTHESIZER to 156.800.00 MHz CH
Adjust L_4 SYNTHESIZER to 156.900.00 MHz CH

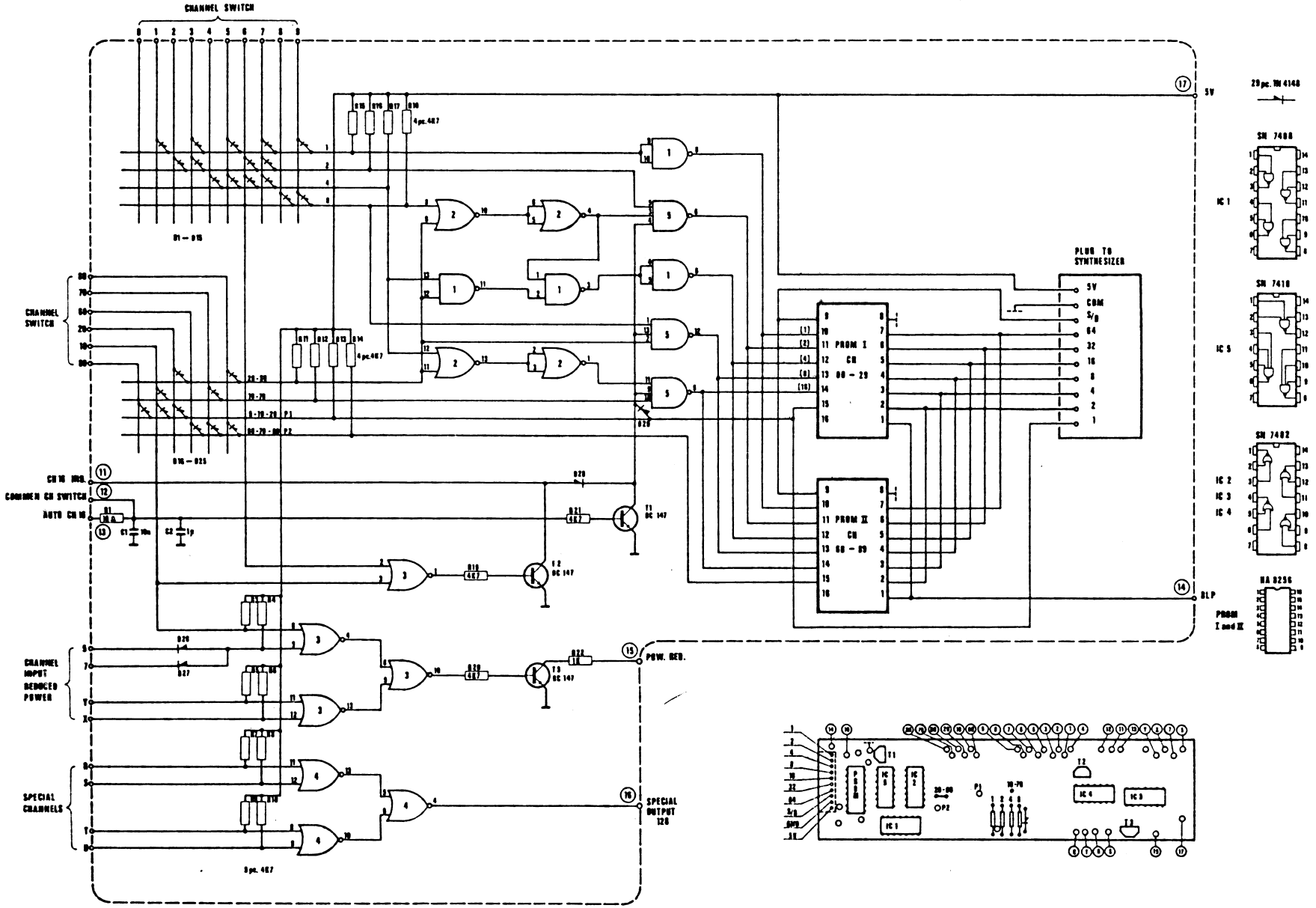
With 50 MHz. counter.

Connect frequency counter to TP 1 SYNTHESIZE

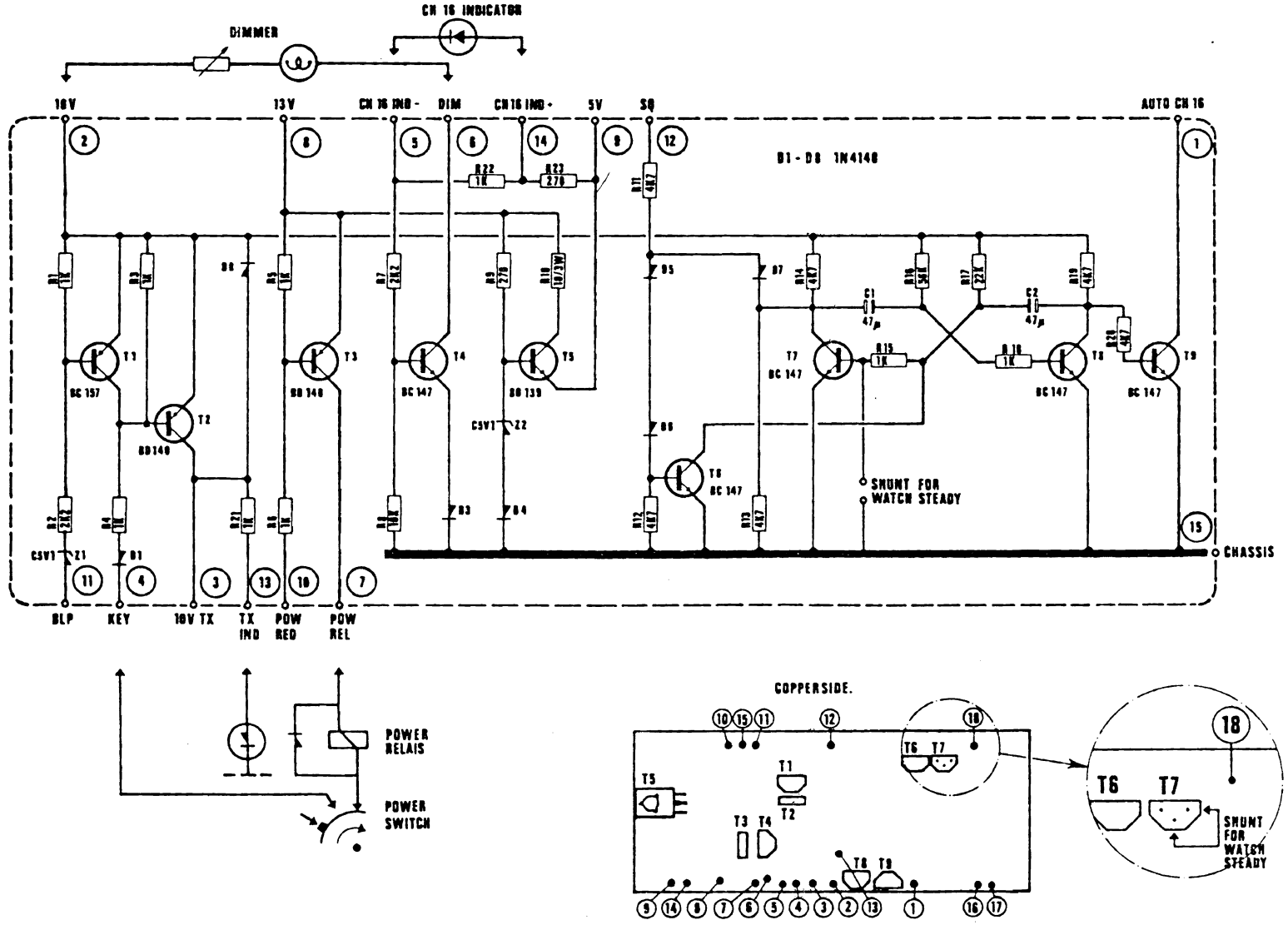
Adjust L_5 SYNTHESIZER to 43.700.00 MHz CH
Adjust L_4 SYNTHESIZER to 45.233.33 MHz CH

SYNTHESIZER MODULE 410

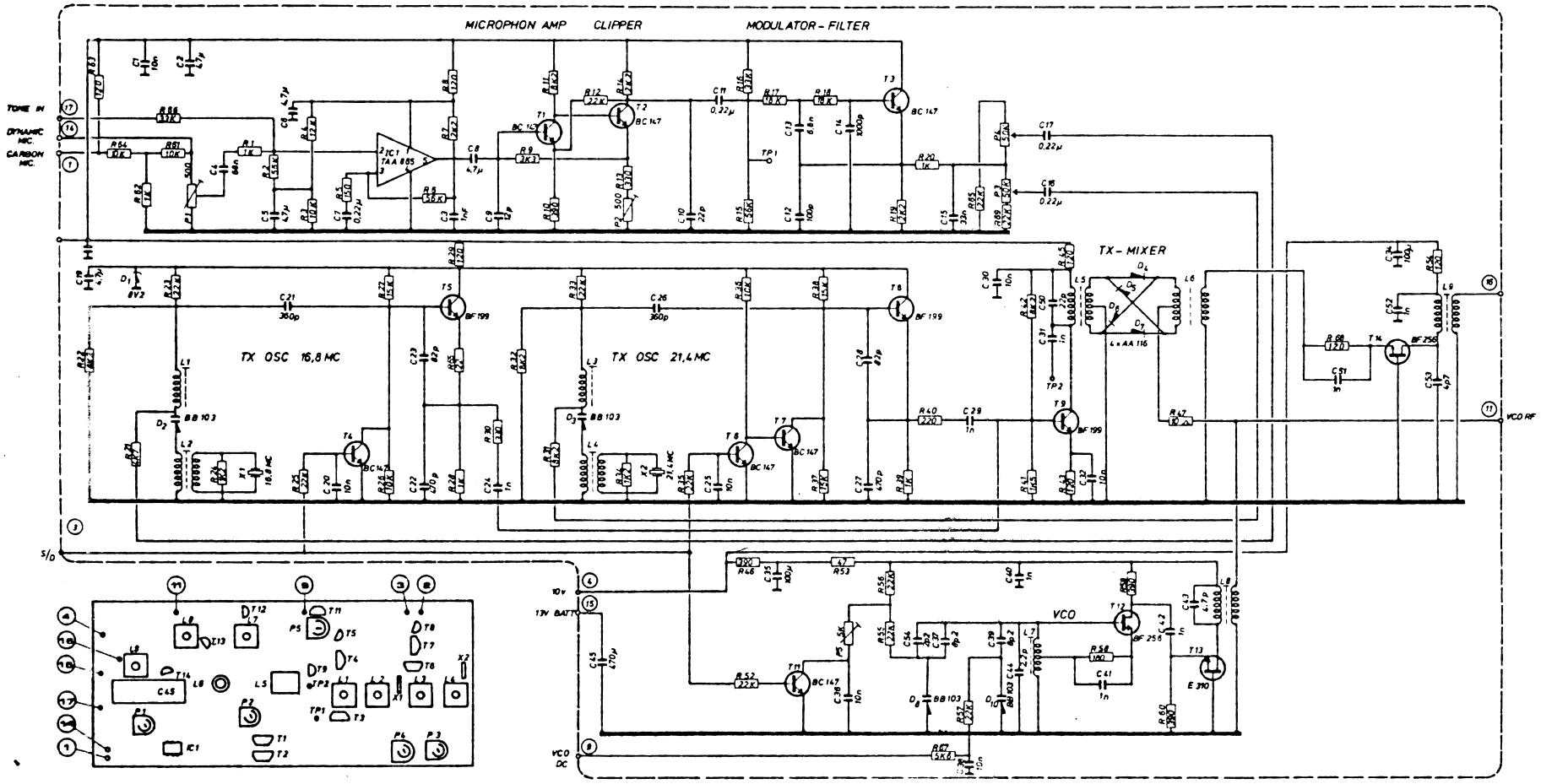




CHANNEL UNIT MODULE 436

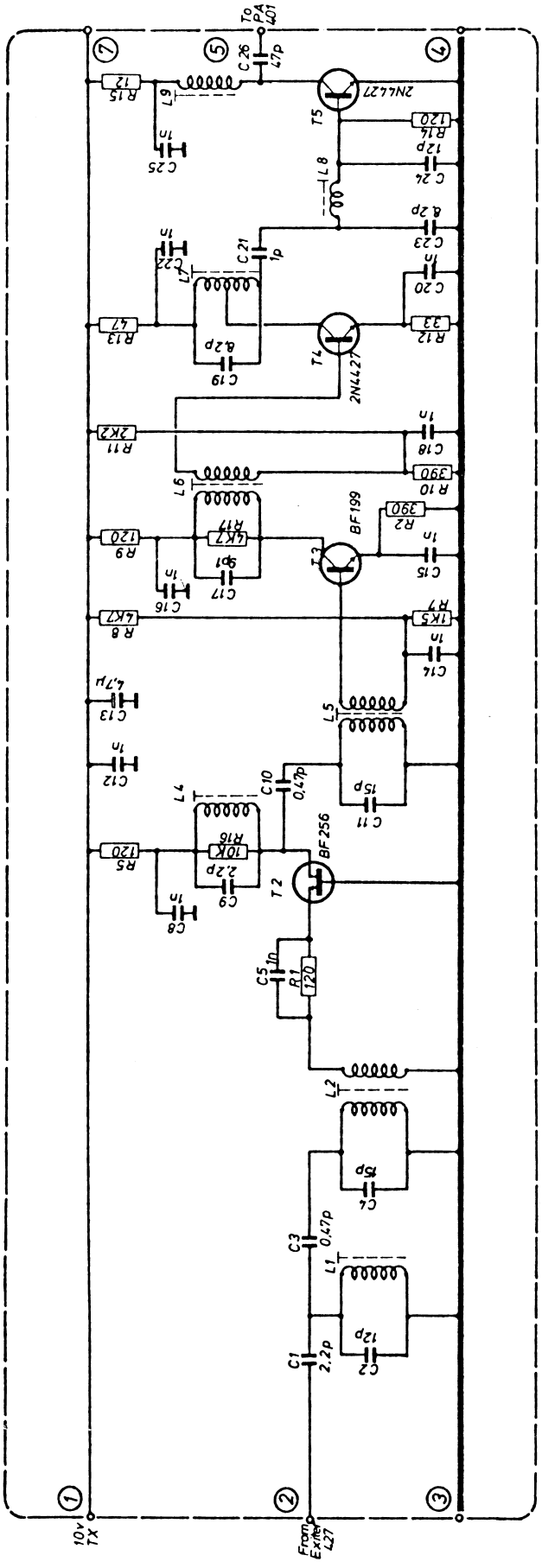


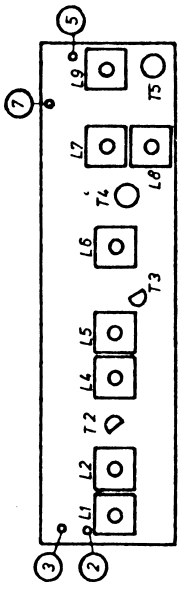
FUNCTION UNIT MODULE 437

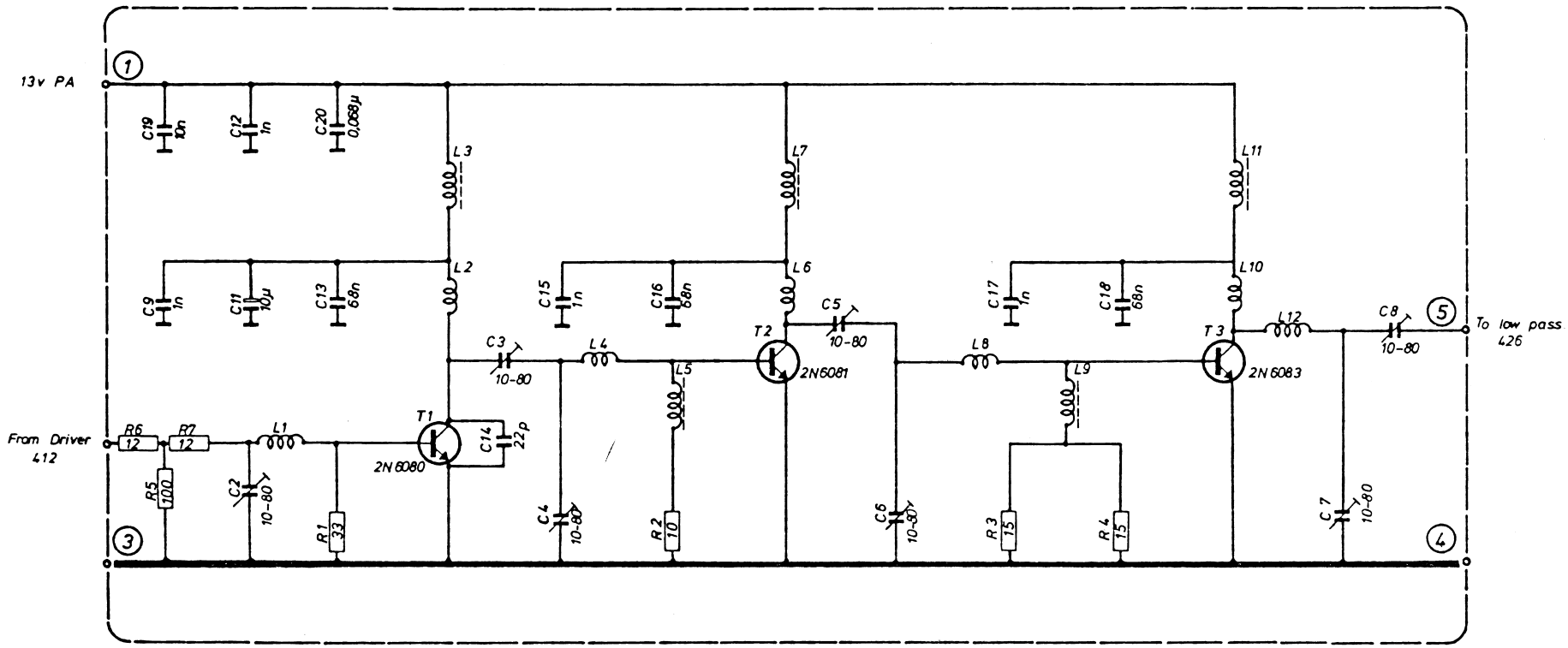


VHF EXCITER. MODULE 427

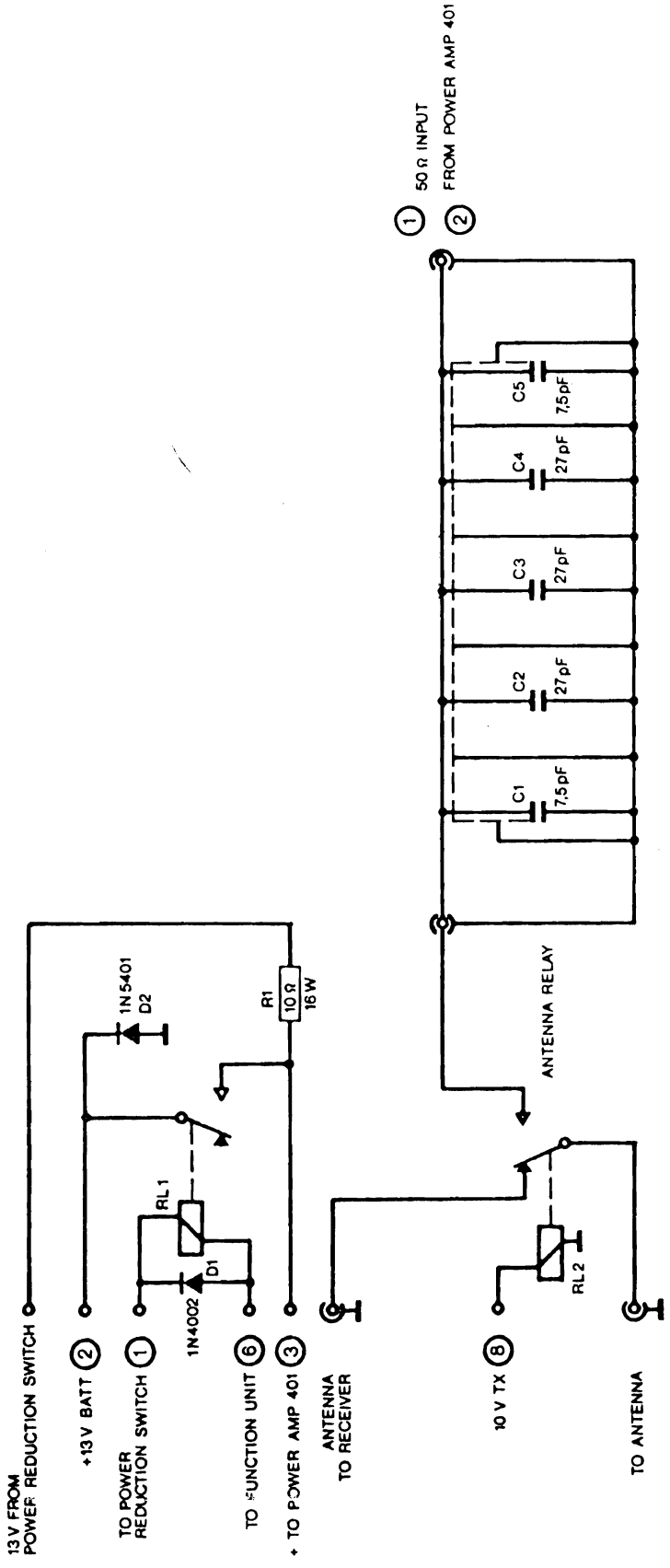
VHF DRIVER. MODULE 412



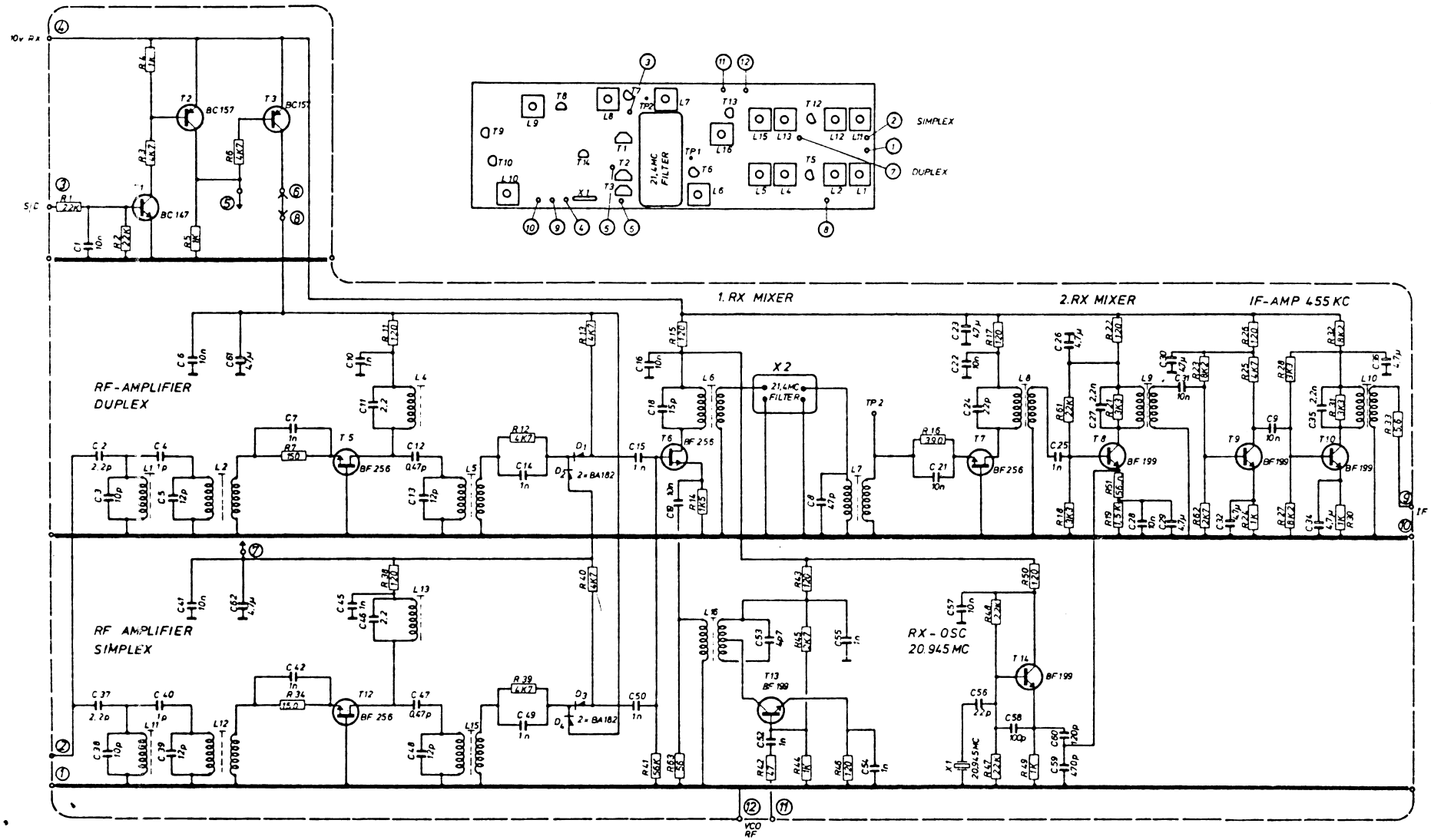




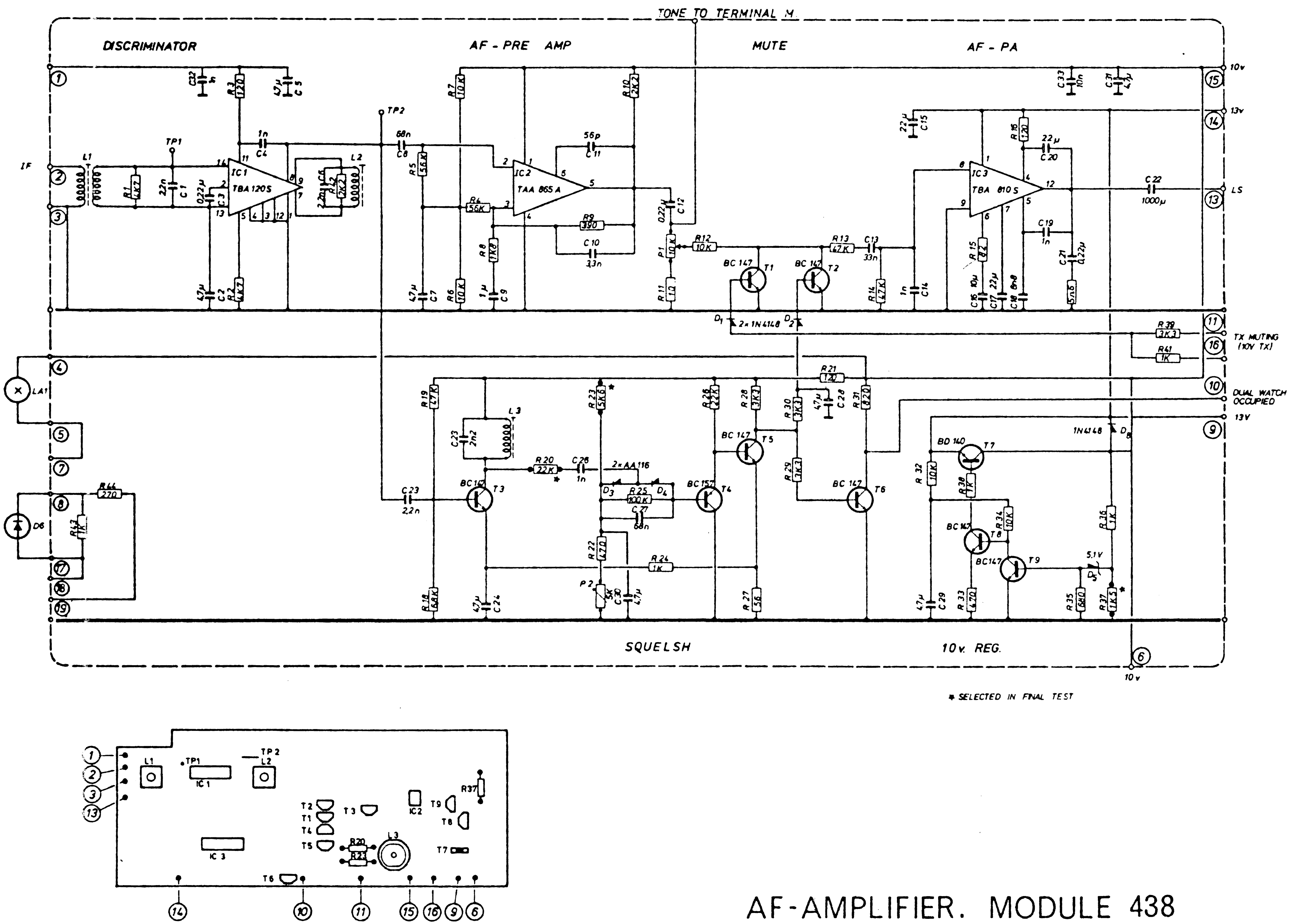
POWER. AMPLIFIER. MODULE 401



LOW PASS FILTER MODULE 420

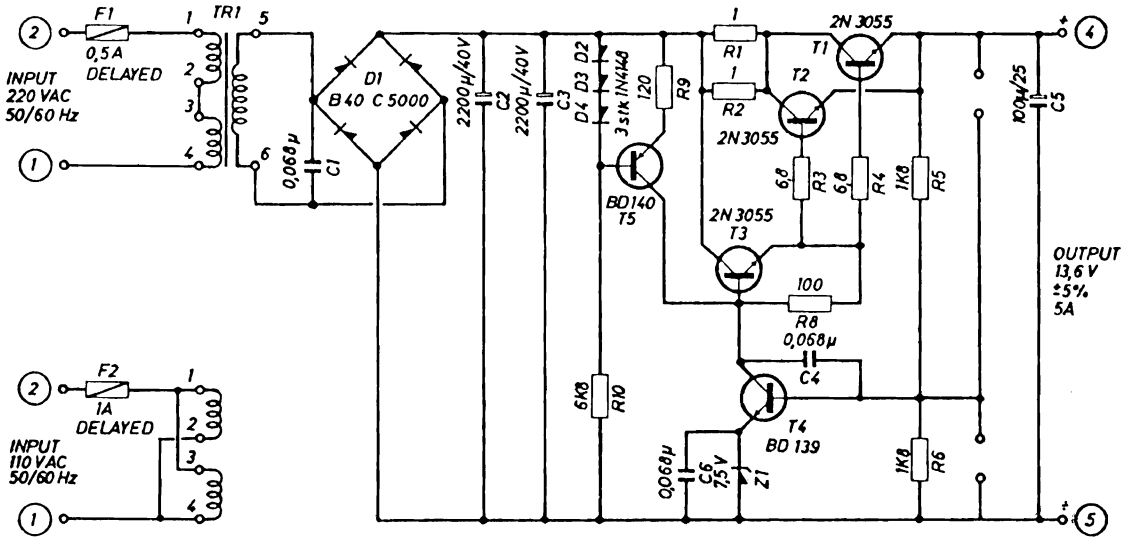


RF-IF-AMPLIFIER. MODULE 413

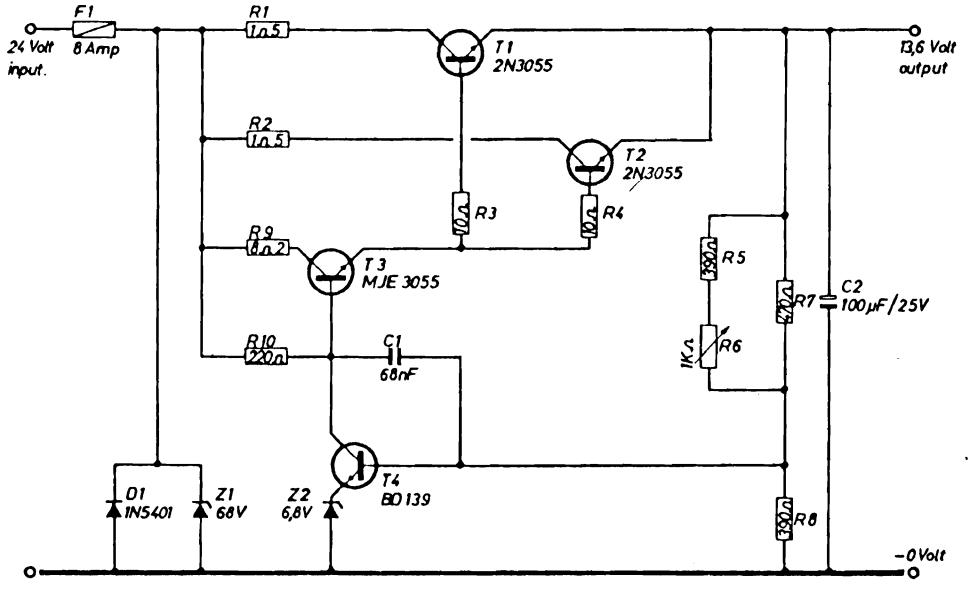


AF-AMPLIFIER. MODULE 438

POWER SUPPLY 220



POWER SUPPLY 24B



SYNTHESIZER MODULE 410

R1	Resistor	120 ohm	5%	0.33W	01.138
R2	Resistor	390 ohm	5%	0.33W	01.144
R3	Resistor	8,2 kohm	5%	0.33W	01.160
R4	Resistor	120 ohm	5%	0.33W	01.138
R5	Resistor	1,5 kohm	5%	0.33W	01.151
R6-7	Resistor	47 ohm	5%	0.33W	01.133
R9	Resistor	82 kohm	5%	0.33W	01.272
R10	Resistor	2,7 kohm	5%	0.33W	01.154
R11	Resistor	82 kohm	5%	0.33W	01.272
R12	Resistor	1 kohm	5%	0.33W	01.149
R13	Resistor	56 kohm	5%	0.33W	01.270
R14	Resistor	560 ohm	5%	0.33W	01.146
R15	Resistor	10 ohm	5%	0.33W	01.225
R16	Resistor	2,7 kohm	5%	0.33W	01.254
R17	Resistor	2,2 kohm	5%	0.33W	01.153
R18	Resistor	1 mohm	5%	0.33W	01.185
R20	Resistor	8,2 kohm	5%	0.33W	01.260
R21	Resistor	22 kohm	5%	0.33W	01.165
R23	Resistor	4,7 kohm	5%	0.33W	01.157
R24	Resistor	8,2 kohm	5%	0.33W	01.160
R25	Resistor	120 ohm	5%	0.33W	01.138
R26	Resistor	2,2 kohm	5%	0.33W	01.153
R27-28	Resistor	15 kohm	5%	0.33W	01.163
R29	Resistor	1 kohm	5%	0.33W	01.149
R30	Resistor	1,5 kohm	5%	0.33W	01.151
R31	Resistor	8,2 kohm	5%	0.33W	01.160
R32-33	Resistor	120 ohm	5%	0.33W	01.138
R34	Resistor	10 ohm	5%	0.33W	01.125
R35	Resistor	47 ohm	5%	0.33W	01.133
R36	Resistor	8,2 kohm	5%	0.33W	01.160
R37	Resistor	15 kohm	5%	0.33W	01.163
R38	Resistor	1 kohm	5%	0.33W	01.149
R40	Resistor	120 ohm	5%	0.33W	01.138
R41	Resistor	47 kohm	5%	0.33W	01.169
R42	Resistor	560 ohm	5%	0.33W	01.146
R44	Resistor	1 kohm	5%	0.33W	01.149
R45	Resistor	470 ohm	5%	0.33W	01.245
R46	Resistor	470 ohm	5%	0.33W	01.145
R47	Resistor	470 ohm	5%	0.33W	01.245
R48-50	Resistor	2,7 kohm	5%	0.33W	01.154
R52-55	Resistor	2,7 kohm	5%	0.33W	01.154
R58	Resistor	47 ohm	5%	0.33W	01.233

IC1-2	Integrated circuit	SN 47193	36.107
IC3	Integrated circuit	MC 4044	36.111
IC4-5	Integrated circuit	SN 7493	36.105

X1	Crystal	43,7 MHz	50.109
X2	Crystal	45,2333 MHz	50.110
X3	Crystal	6,4 MHz	50.108

C1	Capacitor, cer	1	nF	30V	14.901
C2	Capacitor, cer	10	nF	30V	14.906
C3	Capacitor, cer	1	nF	30V	14.901
C5	Capacitor, cer	47	pF		14.333
C6	Capacitor, tantal	4,7	uF		13.121
C7	Capacitor, cer	10	nF	30V	14.906
C8-10	Capacitor, cer	1	nF	30V	14.901
C11	Capacitor, tantal	4,7	uF		13.121
C13	Capacitor, cer	10	pF		14.125
C14	Capacitor, cer	12	pF		14.126
C15	Capacitor, cer	10	nF	30V	14.906
C16	Capacitor, cer	22	pF		14.129
C18	Capacitor, cer	33	pF		14.131
C19	Capacitor, styrof.	220	pF 5%		10.133
C20	Capacitor, cer	47	pF		14.333
C21	Capacitor, styrof.	56	pF 5%		10.119
C23	Capacitor, cer	1	nF	30V	13.901
C24	Capacitor, cer	0.47	pF		14.109
C25	Capacitor, cer	1	nF	30V	14.901
C26	Capacitor, cer	12	pF		14.126
C27	Capacitor, cer	22	pF		14.129
C28	Capacitor, cer	10	nF	30V	14.906
C29-30	Capacitor, styrof.	220	pF 5%		10.133
C31	Capacitor, cer	82	pF		14.336
C32	Cap. feed-through	1	nF		15.502
C34	Capacitor, tantal	4,7	uF		13.121
C35-36	Capacitor, poly	0.22	uF		11.229
C37	Capacitor, cer	1	nF	30V	14.901
C39	Capacitor, tantal	4.7	uF		13.121
C40	Capacitor, poly	0.22	uF		11.229
C41	Capacitor, cer	10	nF	30V	14.906
P1	Capacitor, var	3,5-18 pF			17.101

L1	Coil		04.0431
L2	Coil		04.0435
L3	Coil		04.0434
L4-5	Coil		04.0430
L6	Coil		04.0433
L7	Coil		04.0432
L8	Choke	2,2 uH	22.106

D1-4	Diode	AA 116	39.102
D5	Diode	1N 4148	39.103
D6	Diode	BA 182	39.101

T1	Transistor	BF 199	33.102
T2-4	Transistor	BC 147	32.101
T7	Transistor	BC 147	32.101
T8-10	Transistor	BF 199	33.102
T11	Transistor	BC 147	32.101
T12	Transistor	BC 157	32.102
[illegible]	Transistor	BC 147	32.101

RF - AMPLIFIER MODULE 413

R1-2	Resistor	22	kohm	5%	0.33W	01.265
R3	Resistor	4.7	kohm	5%	0.33W	01.257
R4-5	Resistor	1	kohm	5%	0.33W	01.249
R6	Resistor	4.7	kohm	5%	0.33W	01.257
R7	Resistor	150	ohm	5%	0.33W	01.239
R11	Resistor	120	ohm	5%	0.33W	01.238
R12-13	Resistor	4.7	kohm	5%	0.33W	01.157
R14	Resistor	1.5	kohm	5%	0.33W	01.251
R15	Resistor	120	ohm	5%	0.33W	01.138
R16	Resistor	390	ohm	5%	0.33W	01.244
R17	Resistor	120	ohm	5%	0.33W	01.138
R18	Resistor	3.3	kohm	5%	0.33W	01.255
R19	Resistor	1.5	kohm	5%	0.33W	01.151
R21	Resistor	3.3	kohm	5%	0.33W	01.255
R22	Resistor	120	ohm	5%	0.33W	01.138
R23	Resistor	8.2	kohm	5%	0.33W	01.260
R24	Resistor	1	kohm	5%	0.33W	01.149
R25	Resistor	4.7	kohm	5%	0.33W	01.157
R26	Resistor	120	ohm	5%	0.33W	01.138
R27	Resistor	8.2	kohm	5%	0.33W	01.160
R28	Resistor	3.3	kohm	5%	0.33W	01.155
R30	Resistor	1	kohm	5%	0.33W	01.149
R31	Resistor	3.3	kohm	5%	0.33W	01.155
R32	Resistor	8.2	kohm	5%	0.33W	01.160
R33	Resistor	5.6	ohm	5%	0.33W	01.122
R34	Resistor	150	ohm	5%	0.33W	01.239
R38	Resistor	120	ohm	5%	0.33W	01.238
R39-40	Resistor	4.7	kohm	5%	0.33W	01.157
R41	Resistor	56	kohm	5%	0.33W	01.270
R42	Resistor	47	ohm	5%	0.33W	01.233
R43	Resistor	120	ohm	5%	0.33W	01.238
R44	Resistor	1	kohm	5%	0.33W	01.149
R45	Resistor	2.7	kohm	5%	0.33W	01.154
R46	Resistor	120	ohm	5%	0.33W	01.138
R47-48	Resistor	22	kohm	5%	0.33W	01.165
R49	Resistor	1	kohm	5%	0.33W	01.149
R50	Resistor	120	ohm	5%	0.33W	01.138
R51	Resistor	56	ohm	5%	0.33W	01.234
R61	Resistor	22	kohm	5%	0.33W	01.265
R62	Resistor	2.7	kohm	5%	0.33W	01.154
R63	Resistor	56	ohm	5%	0.33W	01.134

C1	Capacitor, cer	10	nF	30V	14.906
C2	Capacitor, cer	2.2	pF	NPO	14.117
C3	Capacitor, cer	10	pF		14.125
C4	Capacitor, cer	1	pF	250V	14.113
C5	Capacitor, cer	12	pF		14.126
C6	Capacitor, cer	10	nF	30V	14.906
C7	Capacitor, cer	1	nF	30V	14.901
C10	Capacitor, cer	1	nF	30V	14.901
C11	Capacitor, cer	2.2	pF	NPO	14.117
C12	Capacitor, cer	0.47	pF		14.109
C13	Capacitor, cer	12	pF		14.126
C14-15	Capacitor, cer	1	nF	30V	14.901
C16	Capacitor, cer	10	nF	30V	14.906
C18	Capacitor, cer	15	pF		14.127
C19	Capacitor, cer	10	nF	30V	14.906
C21-22	Capacitor, cer	10	nF	30V	14.906
C23	Capacitor, tantal	4.7	uF	10V	13.121
C24	Capacitor, cer	22	pF	N 150	14.129
C25	Capacitor, cer	1	nF	30V	14.901
C26	Capacitor, tantal	4.7	uF	10V	13.121
C27	Capacitor, styrof.	2.2	nF		10.157
C28	Capacitor, cer	10	nF	30V	14.906
C29-30	Capacitor, tantal	4.7	uF	10V	13.121
C31	Capacitor, cer	10	nF	30V	14.906
C32	Capacitor, tantal	4.7	uF	10V	13.121
C34	Capacitor, tantal	4.7	uF	10V	13.121
C35	Capacitor, styrof.	2.2	nF		10.157
C36	Capacitor, tantal	4.7	uF	10V	13.121
C37	Capacitor, cer	2.2	pF	NPO	14.117
C38	Capacitor, cer	10	pF		14.125
C39	Capacitor, cer	12	pF		14.126
C40	Capacitor, cer	1	pF	250V	14.113
C41	Capacitor, cer	10	nF	30V	14.906
C42	Capacitor, cer	1	nF	30V	14.901
C45	Capacitor, cer	1	nF	30V	14.901
C46	Capacitor, cer	2.2	pF	NPO	14.117
C47	Capacitor, cer	0.47	pF		14.109
C48	Capacitor, cer	12	pF		14.126
C49-50	Capacitor, cer	1	nF	30V	14.901
C52	Capacitor, cer	1	nF	30V	14.901
C53	Capacitor, cer	4.7	pF		14.121
C54-55	Capacitor, cer	1	nF	30V	14.901
C56	Capacitor, cer	22	pF	N 150	14.129
C57	Capacitor, cer	10	nF	30V	14.906
C58	Capacitor, styrof.	100	pF 5%		10.125
C59	Capacitor, styrof.	470	pF 5%		10.141
C60	Capacitor, styrof.	120	pF 5%		10.127
C61-62	Capacitor, tantal	4.7	uF	10V	13.121

T1	Transistor	BC 147	32.101
T2-3	Transistor	BC 157	32.102
T5-7	Transistor	BF 256 LA	34.101
T8-10	Transistor	BF 199	33.102
T12	Transistor	BF 256 LA	34.101

T13-14	Transistor	BF 199				33.102
D1-4	Diode	BA 182				39.101
X1	Crystal	20.945 MHz				50.111
X2	Crystal filter	21.4 MHz				50.207
L1	Coil					04.0444
L2	Coil					04.0461
L4	Coil					04.0446
L5	Coil					04.0447
L6	Coil					04.0448
L7	Coil					04.0421
L8	Coil					04.0450
L9	Coil					04.0423
L10	Coil					04.0424
L11	Coil					04.0444
L12	Coil					04.0461
L13	Coil					04.0446
L15	Coil					04.0447
L16	Coil					04.0465

POWER AMPLIFIER MODULE 401

R1	Resistor	33 ohm	5%	0.33W	01.131
R2	Resistor	10 ohm	5%	0.33W	01.125
R3-4	Resistor	15 ohm	5%	0.33W	01.127
R5	Resistor	12 ohm	5%	0.33W	01.126
R6-7	Resistor	100 ohm	5%	0.33W	01.137
C2-8	Capacitor, var	10-80 pF			17.202
C9	Capacitor, chip	1 nF			15.401
C10	Capacitor, cer	10 nF			14.906
C11	Capacitor, ellyt	10 uF		25V	12.325
C12	Capacitor, cer	1 nF		30V	14.901
C13	Capacitor, poly	0.068 uF	20%		11.223
C14	Capacitor, cer	22 pF			14.129
C15	Capacitor, chip	1 nF			15.401
C16	Capacitor, poly	0.068 uF	20%		11.223
C17	Capacitor, chip	1 nF			15.401
C18	Capacitor, poly	0.068 uF	20%		11.223
C20	Capacitor, poly	0.068 uF	20%		11.223
T1	Transistor w/nut	2N 6080			31.101
T2	Transistor w/nut	2N 6081			31.102
T3	Transistor w/nut	2N 6083			31.103
F1	Fuse	8 Amp	5 x 20 mm		55.406
PL2	Coax.connector	BNC			80.708
L1	Coil				04.0403
L2	Coil				04.0404
L3	Coil				04.0405
L4	Coil				STRIP
L5	Coil				04.0405
L6	Coil				04.0404
L7	Coil				04.0405
L8	Coil				STRIP
L9	Coil				04.0405
L10	Coil				04.0404
L11	Coil				04.0405
L12	Coil				04.0403

VHF-DRIVER MODULE 412

R1	Resistor	120 ohm	5%	0.33W	01.238
R2	Resistor	390 ohm	5%	0.33W	01.244
R5	Resistor	120 ohm	5%	0.33W	01.238
R7	Resistor	1.5 kohm	5%	0.33W	01.251
R8	Resistor	4.7 kohm	5%	0.33W	01.257
R9	Resistor	120 ohm	5%	0.33W	01.238
R10	Resistor	390 ohm	5%	0.33W	01.244
R11	Resistor	2.2 kohm	5%	0.33W	01.253
R12	Resistor	33 ohm	5%	0.33W	01.131
R13	Resistor	47 ohm	5%	0.33W	01.233
R14	Resistor	120 ohm	5%	0.33W	01.238
R15	Resistor	12 ohm	5%	0.33W	01.126
R16	Resistor	10 kohm	5%	0.33W	01.161
R17	Resistor	2.2 kohm	5%	0.33W	01.153
C1	Capacitor, cer	2.2 pF		NPO	14.117
C2	Capacitor, cer	12 pF		30V	14.126
C3	Capacitor, cer	0.47 pF			14.109
C4	Capacitor, cer	15 pF			14.127
C5	Capacitor, cer	1 nF		30V	14.901
C8	Capacitor, cer	1 nF		30V	14.901
C9	Capacitor, cer	2.2 pF		NPO	14.117
C10	Capacitor, cer	0.47 pF			14.109
C11	Capacitor, cer	15 pF			14.127
C12	Capacitor, cer	1 nF		30V	14.901
C13	Capacitor, tantal	4.7 uF		25V	13.221
C14-16	Capacitor, cer	1 nF		30V	14.901
C17	Capacitor, cer	9.1 pF			14.153
C18	Capacitor, cer	1 nF		30V	14.901
C19	Capacitor, cer	8.2 pF			14.124
C20	Capacitor, cer	1 nF		30V	14.901
C21	Capacitor, cer	1 pF		250V	14.113
C22	Capacitor, cer	1 nF		30V	14.901
C23	Capacitor, cer	8.2 pF			14.124

VHF DRIVER MODULE 412

C24	Capacitor, cer	12	pF		14.126
C25	Capacitor, cer	1	nF	30V	14.901
C26	Capacitor, cer	47	pF		14.333
T2	Transistor	BF 256			34.101
T3	Transistor	BF 199			33.102
T4-5	Transistor	2N 4427			31.104
L1	Coil				04.0452
L2	Coil				04.0461
L4	Coil				04.0446
L5	Coil				04.0455
L6	Coil				04.0456
L7	Coil				04.0457
L8	Coil				04.0458
L9	Coil				04.0459

AF AMPLIFIER MODULE 405

R1-2	Resistor	4.7 kohm	5%	0.33W	01.157
R3	Resistor	120 ohm	5%	0.33W	01.138
R4-5	Resistor	56 kohm	5%	0.33W	01.170
R6-7	Resistor	10 kohm	5%	0.33W	01.161
R8	Resistor	1.8 kohm	5%	0.33W	01.152
R9	Resistor	390 kohm	5%	0.33W	01.180
R10	Resistor	2.2 kohm	5%	0.33W	01.153
R11	Resistor	10 ohm	5%	0.33W	01.125
R12	Resistor	10 kohm	5%	0.33W	01.161
R13-14	Resistor	47 kohm	5%	0.33W	01.169
R15	Resistor	82 ohm	5%	0.33W	01.136
R16	Resistor	120 ohm	5%	0.33W	01.138
R17	Resistor	5.6 ohm	5%	0.33W	01.122
R18	Resistor	6.8 kohm	5%	0.33W	01.159
R19	Resistor	47 kohm	5%	0.33W	01.169
R20	Resistor	22 kohm	5%	0.33W	01.165
R21	Resistor	120 ohm	5%	0.33W	01.138
R22	Resistor	470 ohm	5%	0.33W	01.145
R23	Resistor	5.6 kohm	5%	0.33W	01.158
R24	Resistor	1 kohm	5%	0.33W	01.149
R25	Resistor	100 kohm	5%	0.33W	01.173
R26	Resistor	22 kohm	5%	0.33W	01.165
R27	Resistor	56 ohm	5%	0.33W	01.134
R28-30	Resistor	3.3 kohm	5%	0.33W	01.155
R31	Resistor	820 ohm	5%	0.33W	01.148
R32	Resistor	10 kohm	5%	0.33W	01.161
R33	Resistor	470 ohm	5%	0.33W	01.145
R34	Resistor	10 kohm	5%	0.33W	01.161
R35	Resistor	680 ohm	5%	0.33W	01.147
R36	Resistor	1 kohm	5%	0.33W	01.149
R37	Resistor	1.5 kohm	5%	0.33W	01.151
R38	Resistor	1 kohm	5%	0.33W	01.149
R39	Resistor	3.3 kohm	5%	0.33W	01.155
R41	Resistor	1 kohm	5%	0.33W	01.149
R42	Resistor	2.2 kohm	5%	0.33W	01.153
R43	Ressitor	1 kohm	5%	0.33W	01.149
R44	Resistor	270 ohm	5%	0.33W	01.142
C1	Capacitor, styrof.	2.2 nF	5%	160V	10.157
C2	Capacitor, ellyt	4.7 uF		10 V	13.121
C3	Capacitor, poly	0.22 uF			11.229
C4	Capacitor, cer	1 nF		30 V	14.901
C5	Capacitor, ellyt	4.7 uF		10 V	13.121
C6	Capacitor, styrof.	2.2 nF	5%	160V	10.157
C7	Capacitor, ellyt	4.7 uF		10 V	13.121
C8	Capacitor, poly	0.068 uF			11.223
C9	Capacitor, ellyt	1 uF		35 V	13.113
C10	Capacitor, styrof.	3.3 nF	5%	160V	10.161
C11	Capacitor, styrof.	56 pF			10.119
C12	Capacitor, poly	0.22 uF			11.229
C13	Capacitor, poly	0.033 uF			11.319
C14	Capacitor, cer	1 nF		30 V	14.901
C15	Capacitor, ellyt	22 u		35 V	13.329
C16	Capacitor, ellyt	10 u		16 V	13.125
C17	Capacitor, ellyt	22 u		16 V	13.129
C18	Capacitor, poly	0.0068uF	20%		11.111
C19	Capacitor, cer	1 nF		30 V	14.901
C20	Capacitor, ellyt	22 u		16 V	13.129
C21	Capacitor, poly	0.22 uF			11.229
C22	Capacitor, ellyt	1000 uF		16 V	12.249
C23	Capacitor, styrof.	2.2 nF	5%	160V	10.157
C24	Capacitor, ellyt	4.7 uF		10 V	13.121
C25	Capacitor, styrof.	2.2 nF	5%	160V	10.157
C26	Capacitor, cer	1 nF		30 V	14.901
C27	Capacitor, poly	0.068 uF			11.223
C28-31	Capacitor, ellyt	4.7 uF		10 V	13.121
C32	Capacitor, cer	1 nF		30 V	14.901
C33	Capacitor, cer	10 nF		30 V	14.906
C35	Capacitor, cer	4.7 uF		10 V	13.121
D1-2	Diode	1N 4148			39.103
D3-4	Diode	AA 116			39.102
D5	Diode, zener	5.1 V		0.4W	39.707
D8	Diode	1N 4148			39.103

AF-AMPLIFIER MODULE 405

T1-3	Transistor	BC 147	32.101
T4	Transistor	BC 157	32.102
T5-6	Transistor	BC 147	32.101
T7	Transistor	BD 140	30.102
T8-9	Transistor	BC 147	32.101
IC1	Integrated circuit	TBA 120S	35.104
IC2	Integrated circuit	TAA 865A	35.102
IC3	Integrated circuit	TBA 810AS	35.103
L1	Coil		04.0424
L2	Coil		04.0425
L3	Coil		04.0426

VHF EXCITER MODULE 427

R1	Resistor	1 kohm	5%	0.33W	01.149
R2	Resistor	56 kohm	5%	0.33W	01.170
R3	Resistor	10 kohm	5%	0.33W	01.161
R4	Resistor	12 kohm	5%	0.33W	01.162
R5	Resistor	150 ohm	5%	0.33W	01.139
R6	Resistor	56 kohm	5%	0.33W	01.170
R7	Resistor	2.2 kohm	5%	0.33W	01.153
R8	Resistor	120 ohm	5%	0.33W	01.138
R9	Resistor	3.3 kohm	5%	0.33W	01.155
R10	Resistor	390 ohm	5%	0.33W	01.144
R11	Resistor	8.2 kohm	5%	0.33W	01.160
R12	Resistor	22 kohm	5%	0.33W	01.165
R13	Resistor	330 ohm	5%	0.33W	01.143
R14	Resistor	2.2 kohm	5%	0.33W	01.153
R15	Resistor	56 kohm	5%	0.33W	01.170
R16	Resistor	33 kohm	5%	0.33W	01.167
R17-18	Resistor	18 kohm	5%	0.33W	01.164
R19	Resistor	2.2 kohm	5%	0.33W	01.153
R20	Resistor	1 kohm	5%	0.33W	01.149
R21	Resistor	4.7 kohm	5%	0.33W	01.157
R22	Resistor	8.2 kohm	5%	0.33W	01.160
R23	Resistor	22 kohm	5%	0.33W	01.165
R24	Resistor	1.2 kohm	5%	0.33W	01.150
R25	Resistor	22 kohm	5%	0.33W	01.165
R26	Resistor	10 kohm	5%	0.33W	01.161
R27	Resistor	15 kohm	5%	0.33W	01.163
R28	Resistor	1 kohm	5%	0.33W	01.149
R29	Resistor	120 ohm	5%	0.33W	01.138
R30	Resistor	330 ohm	5%	0.33W	01.143
R31-32	Resistor	8.2 kohm	5%	0.33W	01.160
R33	Resistor	22 kohm	5%	0.33W	01.165
R34	Resistor	1.2 kohm	5%	0.33W	01.150
R35	Resistor	22 kohm	5%	0.33W	01.165
R36	Resistor	10 kohm	5%	0.33W	01.161
R37-38	Resistor	15 kohm	5%	0.33W	01.163
R39	Resistor	1 kohm	5%	0.33W	01.149
R40	Resistor	220 ohm	5%	0.33W	01.141
R41	Resistor	1.5 kohm	5%	0.33W	01.151
R42	Resistor	8.2 kohm	5%	0.33W	01.160
R43	Resistor	120 ohm	5%	0.33W	01.138
R45	Resistor	120 ohm	5%	0.33W	01.138
R46	Resistor	390 ohm	5%	0.33W	01.144
R47	Resistor	10 ohm	5%	0.33W	01.125
R52	Resistor	22 kohm	5%	0.33W	01.165
R53	Resistor	47 ohm	5%	0.33W	01.133
R54	Resistor	120 ohm	5%	0.33W	01.138
R55-57	Resistor	22 kohm	5%	0.33W	01.165
R58	Resistor	180 ohm	5%	0.33W	01.140
R59	Resistor	390 ohm	5%	0.33W	01.244
R60	Resistor	390 ohm	5%	0.33W	01.144
R61	Resistor	10 kohm	5%	0.33W	01.161
R62	Resistor	1 kohm	5%	0.33W	01.149
R63	Resistor	120 ohm	5%	0.33W	01.238
R64	Resistor	10 kohm	5%	0.33W	01.161
R65	Resistor	22 kohm	5%	0.33W	01.165
R66	Resistor	33 kohm	5%	0.33W	01.267
R67	Resistor	5.6 kohm	5%	0.33W	01.158
68	Resistor	120 ohm	5%	0.33W	01.138
R69	Resistor	22 kohm	5%	o.33W	01.165
P1-2	Potentiometer	500 ohm			04.145
P3-4	Potentiometer	50 kohm			04.169
P5	Potentiometer	5 kohm			04.157
C1	Capacitor, cer	10 nF		30V	14.906
C2	Capacitor, tantal	4.7 uF		10V	13.121
C3	Capacitor, cer	1 nF		30V	14.901
C4	Capacitor, poly	0.068 uF			11.223
C5-6	Capacitor, tantal	4.7 uF		10V	13.121
C7	Capacitor, poly	0.22 uF			11.229
C8	Capacitor, tantal	4.7 uF		10V	13.121
C9	Capacitor, cer	12 pF			14.126
C10	Capacitor, cer	22 pF		N150	14.129
C11	Capacitor, poly	0.22 uF			11.229
C12	Capacitor, styrof.	100 pF	5%		10.125
C13	Capacitor, poly	6.8 nF			11.111
C14	Capacitor, styrof.	1 nF	5%		10.149
C15	Capacitor, poly	0.033 uF			11.319
C16-17	Capacitor, poly	0.22 uF			11.229
C19	Capacitor, tantal	4.7 uF		10V	13.121
C20	Capacitor, cer	10 nF		30V	14.906

V.. - EXCITER MODULE 427

C21	Capacitor, styrof.	360	pF 5%		10.138
C22	Capacitor, styrof.	470	pF 5%		10.141
C23	Capacitor, styrof.	82	pF 5%		10.123
C24	Capacitor, cer	1	nF	30V	14.901
C25	Capacitor, cer	10	nF	30V	14.906
C26	Capacitor, styrof.	360	pF 5%		10.138
C27	Capacitor, styrof.	470	pF 5%		10.141
C28	Capacitor, styrof.	82	pF 5%		10.123
C29	Capacitor, cer	1	nF	30V	14.901
C30	Capacitor, cer	10	nF	30V	14.906
C31	Capacitor, cer	1	nF	30V	14.901
C32	Capacitor, cer	10	nF	30V	14.906
C34-35	Capacitor, ellyt	100	uF	16V	12.237
C37	Capacitor, cer	8.2	pF	P100	14.151
C38	Capacitor, cer	10	nF	30V	14.906
C39	Capacitor, cer	8.2	pF	P100	14.151
C40-42	Capacitor, cer	1	nF	30V	14.901
C43	Capacitor, cer	4.7	pF		14.121
C44	Capacitor, cer	2.2	pF		14.117
C45	Capacitor	470	uF	40V	12.465
C50	Capacitor, cer	22	pF		14.129
C51-52	Capacitor, cer	1	nF	40V	14.901
C53	Capacitor, cer	4.7	pF		14.121
T1-4	Transistor	BC 147			32.101
T5	Transistor	BF 199			33.102
T6-7	Transistor	BC 147			32.101
T8-9	Transistor	BF 199			33.102
T11	Transistor	BC 147			32.101
T12	Transistor	BF 256LA			34.101
T13	Transistor	E 310			34.107
T14	Transistor	BF 256LA			34.101
IC1	Integrated circuit	TAA 865A			35.102
D1	Diode, zener	8.2V		0.4W	39.708
D2-3	Diode, cap.	BB 103			39.401
D4-7	Diode	AA 116			39.102
D8	Diode, cap	BB 103			39.401
D10	Diode, cap	BB 103			39.401
X1	Crystal	16.8 MHz			50.106
X2	Crystal	21.4 MHz			50.107
L1	Coil				04.0439
L2	Coil				04.0460
L3	Coil				04.0438
L4	Coil				04.0460
L5	Coil				04.0434
L6	Coil				04.0434
L7	Coil				04.0436
L8	Coil				04.0437
L9	Coil				04.0462

CHANNEL UNIT MODULE 436

R1	Resistor	10	ohm 5%	0.33W	01.125
R2-21	Resistor	4.7	kohm 5%	0.33W	01.157
R22	Resistor	1	kohm 5%	0.33W	01.149
C1	Capacitor, cer	10	nF	30V	14.906
C2	Capacitor, tantal	1	uF	35V	13.113
D1-29	Diode	1N 4148			39.103
T1-3	Transistor	BC 147			32.101
IC1	Integrated circuit	SN 7400			36.102
IC2-4	Integrated circuit	SN 7402			36.112
IC5	Integrated circuit	SN 7410			36.103
	IC PROM	Yellow			36.803
	IC PROM	Blue			36.113
	IC Fuse				80.507
	Print connector	11 Poles			80.609

FUNCTION UNIT MODULE 437

R1	Resistor	1	kohm 5%	0.33W	01.149
R2	Resistor	2.2	kohm 5%	0.33W	01.153
R3-6	Resistor	1	kohm 5%	0.33W	01.149
R7	Resistor	2.2	kohm 5%	0.33W	01.153
R8	Resistor	10	kohm 5%	0.33W	01.161
R9	Resistor	270	ohm 5%	0.33W	01.142
R10	Resistor	10	ohm 5%	3 W	02.225
R11-14	Resistor	4.7	kohm 5%	0.33W	01.157
R15	Resistor	1	kohm 5%	0.33W	01.149
R16	Resistor	56	kohm 5%	0.33W	01.170
R17	Resistor	22	kohm 5%	0.33W	01.165
R18	Resistor	1	kohm 5%	0.33W	01.149
R19-20	Resistor	4.7	kohm 5%	0.33W	01.157
R21-22	Resistor	1	kohm 5%	0.33W	01.149
R23	Resistor	270	ohm 5%	0.33W	01.142
C1-2	Capacitor, ellyt				

FUNCTION UNIT MODULE 437

D1-7	Diode	1N 4148		39.103
Z1-2	Zenerdiode	5.1 V	0.4W	39.707
T1	Transistor	BC 157		32.102
T2-3	Transistor	BD 140		30.102
T4	Transistor	BC 147		32.101
T5	Transistor	BD 139		30.101
T6-9	Transistor	BC 147		32.101
	Cooling block			83.115

JUNCTIONBOX MODULE 425

R1	Resistor	390 ohm	0.33W	01.144
C1-2	Capacitor, cer	470 pF		14.910
C3	Capacitor	0.47 uF		11.433
PL3	Multiconnector	14 poles		05.0428
	Screwconnector	12 poles		82.203
	Aluminium connector			65.249
	Microtelephone			28.106
	Microtelephone capsula			
	Microswitch for key			
	Cradle			

POWER SUPPLY 220

R1-2	Resistor	1 ohm 5%	16W	02.513
R3-4	Resistor	6.8 ohm 5%	5W	02.323
R5-6	Resistor	1.8 ohm 5%	0.33W	01.152
R8	Resistor	100 ohm 5%	0.33W	01.237
R9	Resistor	120 ohm 5%	0.33W	01.138
R10	Resistor	6.8 ohm 5%	0.33W	01.159
C1	Capacitor, poly	0.068 uF		11.223
C2-3	Capacitor, ellyt	2200 u	50V	12.553
C4	Capacitor, poly	0.068 uF		11.223
C5	Capacitor, ellyt	100 uF	25V	12.337
C6	Capacitor, poly	0.068 uF		11.223
D1	Rectifier	5A	40V	38.202
D2-4	Diode	1N 4148		39.103
Z1	Zenerdiode	6.8 V	2W	39.709
F1	Fuse	0.8 A	5x20mm	55.404
TR1	Transformer	PS 220		26.107
T1-3	Transistor	2N 3055		30.105
T4	Transistor	BD 139		30.101
T5	Transistor	BD 140		30.102

POWER SUPPLY 24B

R1-2	Resistor	1.5 ohm 5%	16W	02.515
R3-4	Resistor	10 ohm 5%	3W	02.225
R5	Resistor	390 ohm 5%	0.33W	01.144
R6	Resistor	1 kohm		04.149
R7	Resistor	470 ohm 5%	0.33W	01.145
R8	Resistor	390 ohm 5%	0.33W	01.144
R9	Resistor	8.2 ohm 5%	5W	02.324
R10	Resistor	220 ohm 5%	3W	02.241
C1	Capacitor, poly	0.068 uF		11.223
C2	Capacitor, ellyt	100 uF		12.337
D1	Diode	1N 5401		38.102
Z1	Zenerdiode	68 V	2W	39.711
Z2	Zenerdiode	6.8 V	2W	39.709
F1	Fuse	8A	5x20mm	55.409
	Cover	PS 24B		65.332
	Mounting plate			65.333
T1-2	Transistor	2N 3055		30.105
T3	Transistor	MJE 3055		30.108
T4	Transistor	BD 139		30.101

LOW PASS FILTER MODULE 420

R1	Resistor	10 ohm	16W	02.525
C1	Capacitor, cer	7.5 pF		14.150
C2-4	Cap. feed-through	27 pF		15.501
C5	Capacitor, cer	7.5 pF		14.150
D1	Diode	1N 4002		38.103
D2	Diode	1N 5401		38.102
RL1	Relay			27.106
RL2	Relay			27.107

COMPONENTS MOUNTED ON CHASSIS

LD1-2	Light diode			39.301
LA1	Dial Lamp	12V	30mA	55.303
PL1A	Multiconnector	14 p.		80.110
SQ	Potentiometer	5 kohm, lin.		05.205
AF	Potentiometer	10 kohm, log.		05.212
DIM	Potentiometer	250 ohm		05.211
	Rotary switch	3 pos.		86.125
	Rotary swtich	10 pos.		86.113
	Button with line			81.213

COMPONENTS MOUNTED ON CHASSIS

Button without line	81.214
Button cover	81.215
Number dial "1"	81.217
Number dial "10"	81.218
Frontplate "RT 403 B"	69.256
Dial light window	60.149
Cabinet	22.160
Thumbscrew	62.158

ACCESSORIES

Loudspeaker	28.103
Channel table	60.130