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MINIPORT RECEIVER

EB 100

641.8018.08

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- Fig. 11-4 Removal of assemblies (without control unit)
- Fig. 11-5 Removal of control unit

Service documentation

## 5. Maintenance

### 5.1 Electrical Maintenance

The overall design concept of the unit is such that it requires only a minimum of electrical maintenance.

The periodic maintenance of switching contacts is superfluous due to the use of highly selected and tested switches and pushbuttons.

### 5.2 Mechanical Maintenance

Mechanical maintenance is limited to a minimum owing to the almost complete absence of moving parts.

The front panel of the unit is to be cleaned occasionally (depending on the degree of contamination by means of a soft cloth soaked in soap water. It must be remembered to clean the front panel only with a moist cloth (not wet!)) to prevent soap suds from penetrating the unit.

### 5.3 Storage

The unit may be stored in a temperature range of  $-40$  to  $+85^{\circ}\text{C}$ . The built-in battery must be removed in compliance with section 2.6 of the operating manual if the unit should be stored longer than 1 month. In order to minimize damage to the receiver, it must be wrapped in plastic sheet or wax paper.

The unit must be dried out for several hours at an ambient temperature ranging from  $+50$  to  $+70^{\circ}\text{C}$  prior to switch-on should it have become moist despite having been wrapped thoroughly.

## 6. Performance Test

### 6.1 Preliminary Remarks

The test set-up according to Fig. 11-1 is used for most of the performance tests (unless stated otherwise), the unit settings being as follows:

#### Signal generator

AM modulated ( $m = 0.5$ ) or FM modulated ( $f = 150$  MHz), modulated with a deviation of 6 kHz,  $f_{\text{mod}} = 1$  kHz.

#### Receiver EB 100

$f = 150$  MHz, IF bandwidth 15 kHz, AF MOD, attenuator = 0 dB, threshold = -10 dB $\mu$ V, AFC off.

## 6.2 Required Measuring Equipment and Accessories

Item	+ Type of unit, required specifications  * Recommended R&S unit	Type	Order No.	Appli- cation
1	+ RF signal generator 20 to 1760 MHz AM/FM can be modulated 0 to 80 dB $\mu$ V (-107 to -27 dBm)  * Signal Generator	SMG	801.0001.52	6.8 6.9 6.11 6.14 6.16 6.18
2	+ AF voltmeter with CCITT weighting filter 10 Hz to 100 kHz  * Modulation Analyzer	UPA	372.0010.02	6.12 6.17 6.18
3	+ Digital voltmeter 0 to 30 V DC  * Digital Multimeter	UDL 33	388.8011.02	6.8 6.9 6.11 6.12 6.17
4	+ Oscilloscope DC to 30 MHz sensitivity 1 mV  * Oszilloscope	BOP	374.0020.02	6.12
5	+ Selective voltmeter 600 to 1130 MHz -10 to +40 dB $\mu$ V  * Test Receiver	ESV	342.4020.53	6.15
6	+ Resistor 4 ... 4.7 $\Omega$ 0.5 W			6.17
7	+ Squarewave/puls generator  * Function generator	AFG	377.2100.02	6.20

Item	+ Type of unit, required specifications	Type	Order No.	Appli- cation
	* Recommended R&S unit			
8	+ Test mixer	e.g. MD 108		6.20
9	+ SWR Bridge			
	* SWR Bridge	ZRB 2	373.9017.53	6.9

### 6.3 Checking the Fuses F1 and F2

The receiver EB 100 is protected against overcurrent by two fuses (black plastic housing).

Fuse F1 (1 A semi time-lag type) protects the internal receiver circuit.

Fuse F2 (2.5 A time-lag type) protects the charging current circuit of the built-in battery.

#### 6.3.1 Changing the Fuses F1 and F2

The two fuses are located to left and right of the on/off-switch S1 on the tuning unit. The top and bottom cover must be removed (as described in section 8, preliminaries) to permit changing of the fuses. The faulty fuse can be removed from its holder and be replaced using the fuse tongs (691.0362) contained in the service box.

### 6.4 Battery Check

Switch on receiver and press pushbutton TEST. The pointer of the level meter should be within the green range.

### 6.5 Illumination

Switch on receiver and press pushbutton . The level meter and the LCD display are illuminated.

## 6.6 Checking Operation by means of the Keypad

(See operating manual, section 2)

## 6.7 Tuning Knob

Perform several frequency settings using the tuning knob located on the side of the receiver. The step size  $\Delta f$  depends on the IF bandwidth B set on the receiver.

- a)  $\Delta f = 1$  kHz at B = 7.5 and 15 kHz
- b)  $\Delta f = 10$  kHz at B = 150 kHz
- c)  $\Delta f = 10$  kHz at B = 150 kHz (Pulse)

Check function of locking switch:

 corresponds to locked state, i.e. actuation of the tuning knob has no bearing on the frequency setting of the receiver.

## 6.8 Function of Carrier Squelch

(For test set-up, see Fig. 11-1)

- Set the level threshold of receiver to 20 dB $\mu$ V.
- Apply modulated RF signal at 150 MHz.
- The squelch switching point should be audible when changing the level threshold at a generator level of 20 dB $\mu$ V (-87 dBm)  $\pm 5$  dB.
- Check also the squelch switching point at the male connector X4.5 as TTL level change.

## 6.9 Checking the IF Filter

(For test set-up, see Fig. 11-1)

### a) 3-dB bandwidth of the filter 7.5 kHz and 15 kHz

- Apply unmodulated RF signal at 150 MHz and 40 dB $\mu$ V (-67 dBm).
- Measure and note DC voltage at male connector X4.3.
- Increase RF level of signal generator by 3 dB and detune the signal generator frequency to both sides until noted DC voltage is obtained again.
- The minimum and maximum frequencies set on the signal generator correspond to the 3-dB bandwidth.

b) 3-dB bandwidth 150 kHz

(For test set-up, see Fig. 11-2)

- Set signal generator (a) to:  $f = 150$  kHz, level  $60$  dB $\mu$ V  
 $m = 0.5$ ,  $f_{\text{mod}} = 1$  kHz.
- Set signal generator (b) to:  $f = 149.8$  MHz, level  $60$  dB $\mu$ V,  
without modulation.
- Set EB 100 to:  $f_{\text{in}} = 150$  MHz, AM, bandwidth  $150$  kHz.
- Measure AF level and normalize to  $0$  dB.
- Detune signal generator (b) towards to  $150$  kHz until the AF  
level reaches the value of  $-3$  dB and note frequency (lower  
band limit ( $B_L$ )).
- Set signal generator (b) to  $150.2$  MHz; measure AF level and  
normalize to  $0$  dB.
- Detune signal generator backwards to  $150$  MHz until the AF level  
reaches the value of  $-3$  dB and note frequency (upper band limit  
( $B_u$ )).
- $B_3 \text{ dB} = B_u - B_L$ .

c) Selection, 50-dB bandwidth

- Apply unmodulated AF signal at  $150$  MHz and  $60$  dB $\mu$ V ( $-47$  dBm).
- Detune signal generator by  $\pm \Delta f$  until level meter on receiver  
indicates  $10$  dB $\mu$ V (check accuracy of level meter reading using  
the signal generator, if necessary).

d) Nominal values

IF bandwidth	7.5 kHz	15 kHz	150 kHz
$B_{3\text{dB}}$ (kHz)	6.5 to 10	13 to 20	110 to 200
$B_{50\text{dB}}$ (kHz)	$\leq 33$	$\leq 66$	$\leq 750$

6.10 Frequency Accuracy

The tolerance of the temperature-stabilized crystal oscillator cannot be measured when the receiver is closed. See section 10.3.2.2 in this service manual for checking the frequency accuracy of the receiver.

### 6.11 Checking the Signal Level Display and the Level Tone

(For test set-up, see Fig. 11-1)

- Apply unmodulated AF signal at 150 MHz and 40 dB $\mu$ V (-67 dBm).
- Level meter should indicate 40 dB $\mu$ V  $\pm$ 5 dB.
- DC voltage at the male connector X4.3 is 2.35  $\pm$ 0.3 V.
- Increase signal generator level by 40 dB and switch on attenuator -40 dB on the receiver. The level meter should indicate 40 dB $\mu$ V  $\pm$ 5 dB.
- Switch on level tone on receiver and turn threshold knob. The pitch must vary noticeably within a  $\pm$ 15 dB change (lower scale of level meter).

### 6.12 Sensitivity

(For test set-up, see Fig. 11-1)

- The (S+N)/N measurements are carried out with CCITT filter on the male connector X5 or X4.7, the RF input signal being 0 dB $\mu$ V (-107 dBm) and the frequencies to be set on the signal generator and receiver are as follows:

20 MHz, 100 MHz, 200 MHz, 300 MHz etc. ... 999.999 MHz

- Nominal values: for AM (S+N)/N  $\geq$  10 dB  
for FM (S+N)/N  $\geq$  18 dB } B = 15 kHz
- The AF output at FM should be monitored on an oscilloscope starting at 500 MHz so as to make it easier to obtain the IF centre by slightly detuning the generator frequency, if necessary. The IF centre is indicated by an optimum sinewave displayed on the oscilloscope.

### 6.13 Measuring the Image Frequency Rejection

(For test set-up, see Fig. 11-1)

- Be  $f_i = f_s + 2 \times f_{IF}$  where
- $f_i$  = image frequency = frequency of the signal generator
  - $f_s$  = frequency to be set on the receiver
  - $f_{IF}$  = 629.3 MHz for  $f_s < 500$  MHz or  
117.3 MHz for  $f_s \geq 500$  MHz

Three measured values are determined per sub-range, the criterion being compliance of both signal levels at the male connector X4.3 referred to the applied signal  $f_1$  of  $f_s$  at an RF input level of approx. 0 dB $\mu$ V (-107 dBm).

Nominal values:  $f_s < 500$  MHz ... > 80 dB  
 $f_s \geq 500$  MHz ... > 55 dB

#### 6.14 IF Rejection

(For test set-up, see Fig. 11-1)

- Apply intermediate frequency  $f_{IF}$  at a level of 0 dB $\mu$ V (-107 dBm) using an RF signal generator.

$f_{IF} = 629.3$  MHz for  $f_s < 500$  MHz

$f_{IF} = 117.3$  MHz for  $f_s \geq 500$  MHz

- Tune receiver to  $f_{IF}$ . The indication of 0 dB $\mu$ V on the receiver is the reference value for the following measurements.
- Tune receiver to a centre frequency of a sub-range.
- Increase level of signal generator until the level meter of the receiver indicates the value 0 dB $\mu$ V.
- The level difference on the RF signal generator is the IF rejection.

Nominal value per sub-range:

20 to 107.999 MHz .....	> 90 dB
108 to 219.999 MHz .....	> 80 dB
220 to 499.999 MHz .....	> 68 dB
500 to 999.999 MHz .....	> 100 dB

#### 6.15 Oscillator Re-radiation at the Antenna

Voltage measurement at the antenna connection X1 of the receiver using the selective voltmeter or analyzer.

- Tune selective voltmeter to oscillator frequency  $f_o$  of receiver.

$f_o = 649.3$  to 1129.299 MHz for  $f_s = 20$  to 499.999 MHz

$f_o = 617.3$  to 1117.299 MHz for  $f_s = 500$  to 999.999 MHz

- Random check of three frequencies each below and above 500 MHz.
- Nominal value:  $V \leq 5$   $\mu$ V into 50  $\Omega$

6.16 Checking the AF Function

(For test set-up, see Fig. 11-1)

- Apply RF signal at a level of 40 dB $\mu$ V (-67 dBm).
- Switch on AFC on receiver.
- When the signal generator is detuned (detune frequency  $\leq$  bandwidth/2), the indicated frequency of the receiver is to follow the frequency of the signal generator in steps of 1 kHz independent of the set bandwidth.
- The frequency indications of both units must conform within  $< .\pm 3$  kHz.

6.17 AF Output

(For test set-up, see Fig. 11-1)

- Connect dummy load of 4 to 4.7  $\Omega$  to the headphone connector X5.
- Apply RF signal at 150 MHz at a level of 60 dB $\mu$ V (-47 dBm), AM  $m = 0.8$ .

- a) Measure frequency output, referred to 1 kHz:  
At 0.3 or 3,3 kHz ..... 6  $\pm$ 3 dB
- b) Output voltage at 1 kHz and with the volume control on the receiver turned to maximum:  
 $V_{\max.} \geq 0.7$  V

6.18 AF S/N Ratio at  $V_{in} = 1$  mV

(For test set-up, see Fig. 11-1)

- Apply RF signal at a level of 1 mV (-47 dBm).
- Measure AF S/N ratio using AF voltmeter with CCITT weighting at the male connector X5 or X4.7 (BW = 150 kHz).

Nominal values: for AM ( $m = 0.8$ ) ..... > 40 dB  
for FM (dev. = 22 kHz) ..... > 40 dB

6.19 Checking the Power-Down Logic for the CPU D301

The display must be cleared when the unit is being switched off. Furthermore, the pointer of the level meter must at the same time deflect to the left-hand end of the scale.

## 6.20 Checking the Peak Rectifier

(For test set-up, see Fig. 11-3)

- Set function generator to 50  $\mu$ s pulse width and a repetition time of 1 ms.
- Set signal generator to  $f = 150$  MHz, level 50 dB $\mu$ V.
- Measure the smallest pulse width causes an error in indication of -6 dB.
- Nominal value: pulse width  $\leq 70$   $\mu$ s.

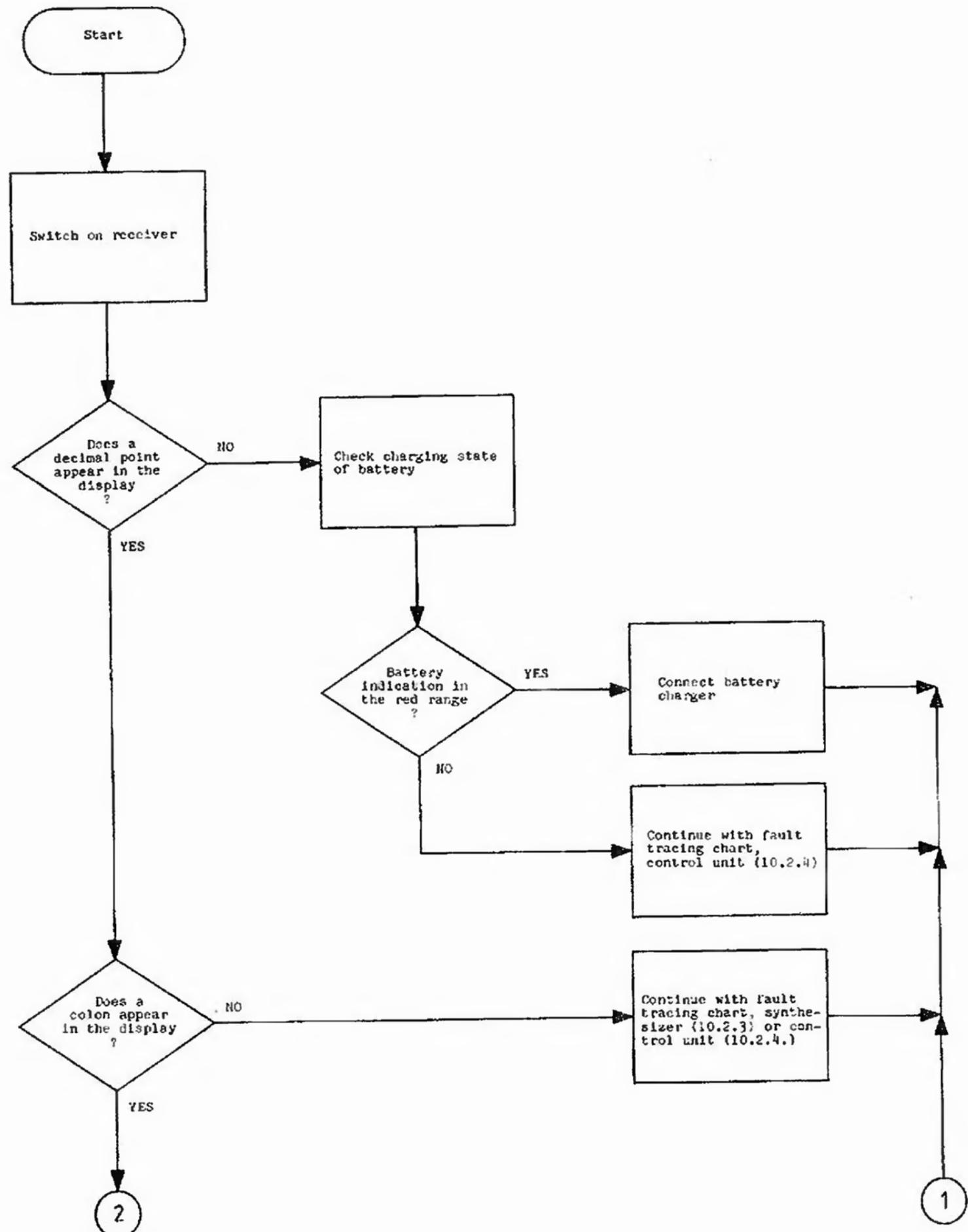
## 6.21 IF Output 10.7 MHz

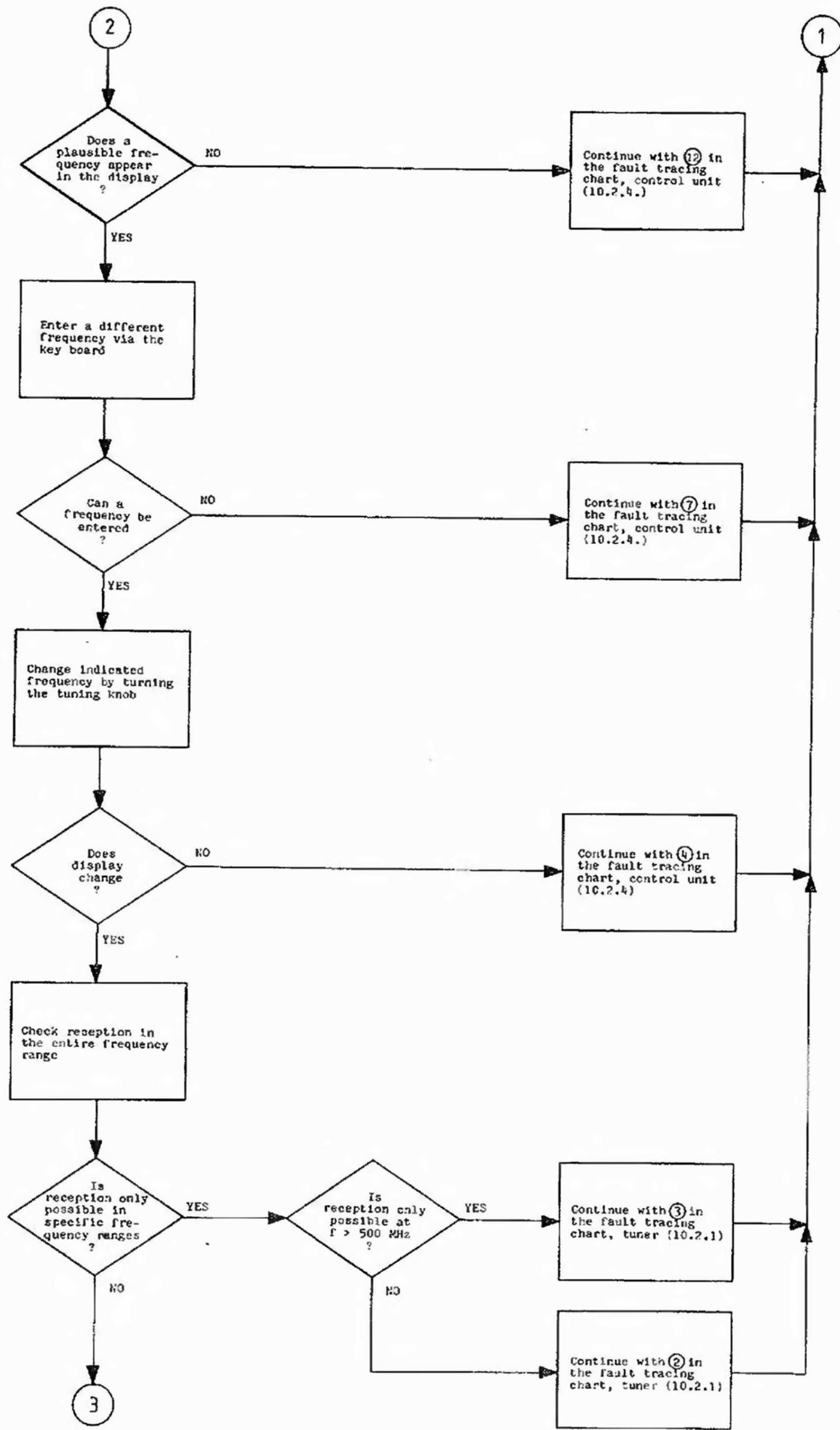
(For test set-up, see Fig. 11-1)

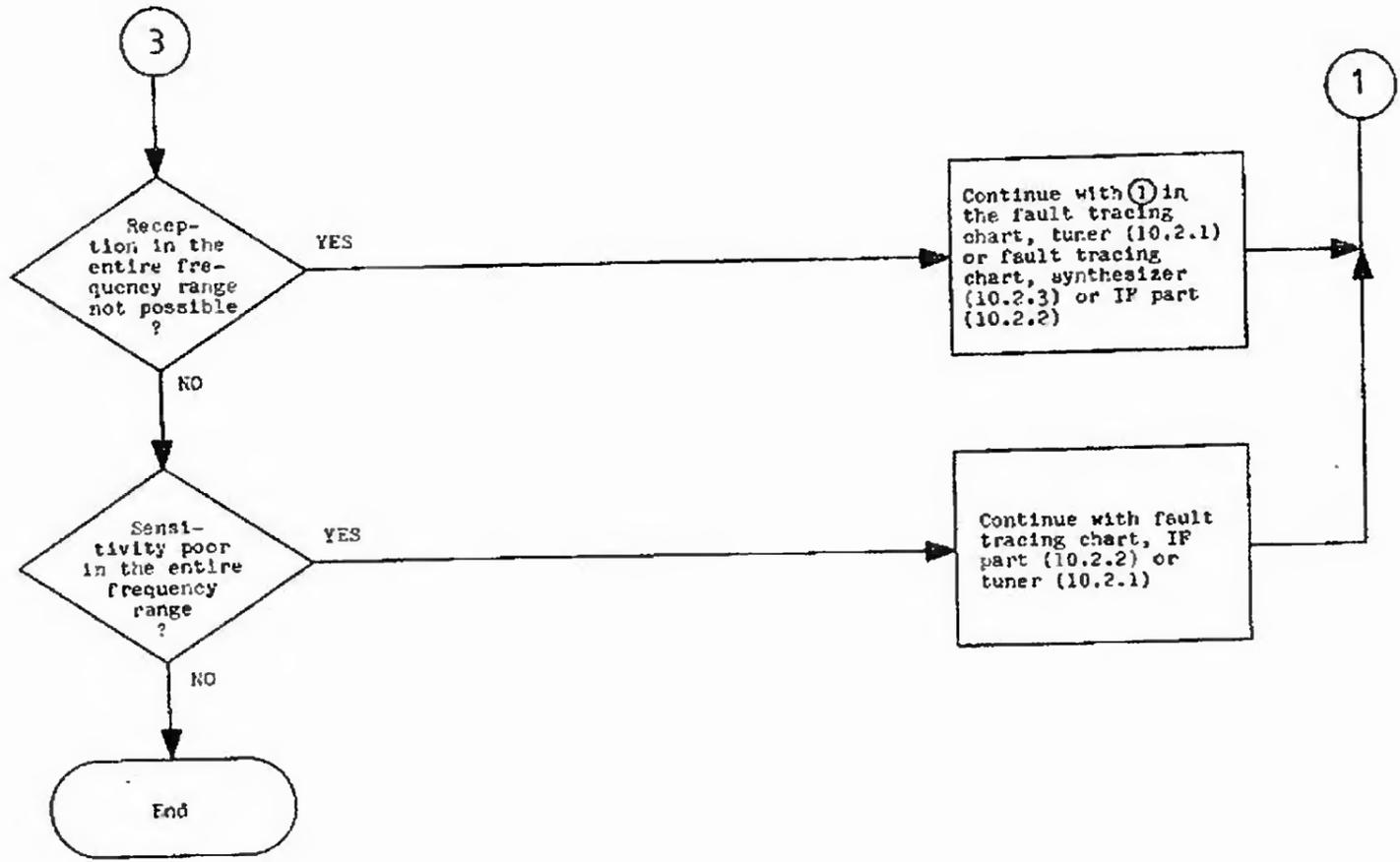
- Set signal generator to  $f = 150$  MHz, level 50 dB $\mu$ V.
- Measure IF level at the IF output (X20) into 50  $\Omega$  using a selective voltmeter.
- Nominal values:  $f = 10.7$  MHz, 15 dB above the antenna level.

## 7. Troubleshooting of Subassembly

In the event of a system failure it is recommended to proceed in compliance with the following fault tracing chart to locate the faulty subassembly. Subsequently, the fault must be localized using the fault tracing chart of the corresponding subassembly.







095 7595-C183

8. Removal of Subassemblies  
(See Figs. 11-4 and 11-5)

Preliminary remarks

If the synthesizer (11-4/3) or the tuner (11-4/4) is established as faulty at the subassembly level the course of the troubleshooting of subassemblies (section 7), further tracing of the fault and the subsequent repair can be performed in situ.

After removing the top cover as well as a screw (11-4/21 and /20), the two subassemblies can be swung out of the receiver such that the components and test points are accessible with the unit being completely operational following the opening of the spring lids on both sides (see also Fig. 8-1);

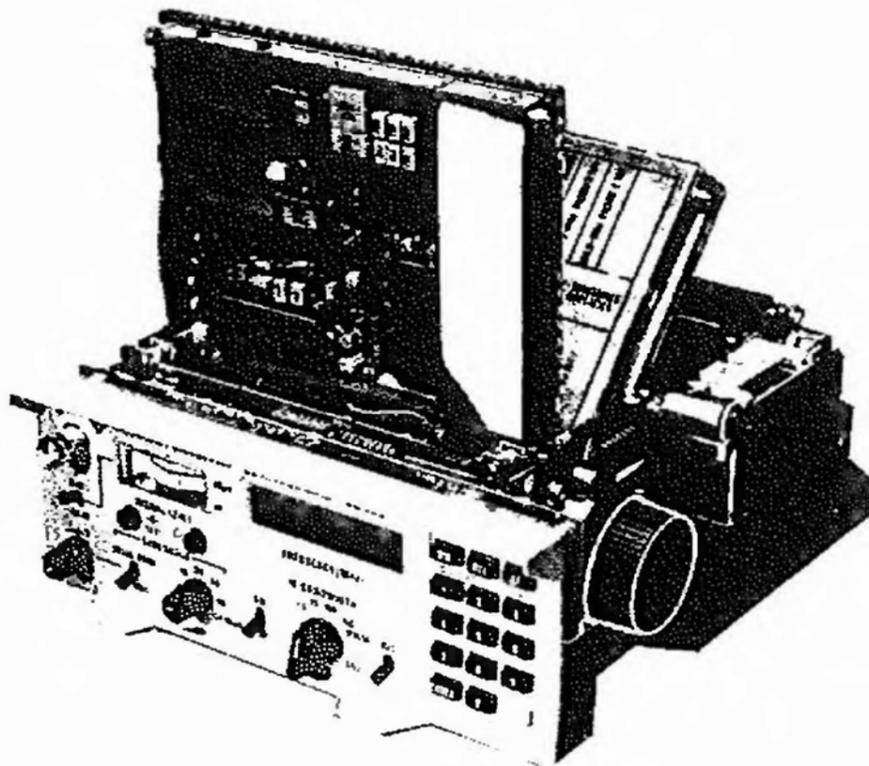


Fig. 8-1 EB 100 with swung-out subassemblies

Preliminaries:

- a) Remove six screws (11-4/1) and take off top cover (11-4/2).
- b) Remove six screws (11-4/15) and take off bottom cover (11-4/14).

8.1 SynthesizerPreliminaries: see a)

- Remove two screws (11-4/21 and /19).
- Undo three RF cables (W11, W12, W15) and female connector X57.
- Remove synthesizer (11-4/3) from the top of the receiver.

8.2 Tuning UnitPreliminaries: see a) and b)

- Disconnect male connector X47 (11-4/12).
- Unsolder two battery cables (11-4/6) from the terminals on the tuning unit (11-4/13).
- Remove six screws (11-4/8) and take off tuning unit.

8.3 TunerPreliminaries: see a), 8.1 and 8.2

- Remove screw (11-4/20).
- Extract locking ring (11-4/11) from shaft (11-4/18) and withdraw completely at the side of the receiver.
- Disconnect female connector X67.
- Disconnect four RF cables (W13 to W16).
- Remove tuner (11-4/4) from the top of the receiver.

#### 8.4 IF Section

Preliminaries: see a), b) and 8.2

- Remove four screws (11-4/9).
- Remove battery brackets (11-4/5) from rear of receiver.
- Undo hexagonal socket screw (11-4/16) from IF bandwidth switch and remove control knob (11-4/17).
- Disconnect four RF cables (W11 to W14).
- Undo two screws (11-4/10).
- Pull out IF section (11-4/7) from rear of receiver.

#### 8.5 Control Unit

Preliminaries: see a), b) and 8.1 to 8.4

- Remove hexagonal socket screws (11-5/9) on the AF and level threshold controller (11-5/10) and pull off control knobs.
- Take off four black rubber caps (11-5/11) from the toggle switches of the front panel.
- Move front panel (11-5/8) toward the front.
- Unsolder four wires (11-5/5) from the level meter.
- Disconnect RF cable (11-5/6).
- Remove six screws (11-5/7).
- Lift PC board (11-5/4) from the front panel.
- Remove four screws (11-5/2) and swing out PC board (11-5/3).
- Undo four screws (11-5/1).

## 9. Circuit Description

### 9.1 Tuner

(see circuit diagram 641.8124 sheet 1 and 2)

The RF signal coming from the antenna is routed to the tuner 20 to 1000 MHz via female connector X66. The RF signal is transmitted to the PIN diode switches D11 and D12 via the 40-dB attenuator N11 which can be switched on at high field strengths. The diode switches route the RF signal to the input selections via signals R1 to R4 depending on the receive frequency and governed by the microprocessor control. The signal path runs via one of the bandpass filters from 20 to 108 MHz (L11 to L15, C11 to C15), 108 to 220 MHz (L20 to L23, L25, C20 to C23, C25) or 220 to 500 MHz (L30 to L34, C30 to C34) for receive frequencies below 500 MHz. An IF trap each (L26, C27 or L35, C35), all tuned to 629.3 MHz, is connected following the bandpass filters of 108 to 220 MHz and 220 to 500 MHz in order to increase the IF rejection. The bandpass filter L40, C40, C41 and the following UHF amplifier with the transistor V46 serve as a preselection for receive frequencies above 500 MHz with the transistor V45 providing the operating point stabilization of transistor V46. A tracking filter comprising the coils L51 to L53 and the tuning diodes V50 to V55 serves for oscillators re-radiation in this frequency range. The filter is tuned by the tuning voltage which is supplied by the microprocessor control via male connector X67.6 depending on the receive frequency.

The RF signal is routed to the broadband amplifier V66 via the PIN diode switch D60 or D61 following preselection. The operating point of V66 is stabilized by transistor V65. The broadband amplifier compensates the attenuation of the preceding filters before the RF signal is routed to the first mixer N80 via a 1000-MHz lowpass filter made up of the coils L70 to L74 and the capacitors C70 and C71. Here, the RF signal is converted to the first IF by means of the oscillator signal supplied by the synthesizer via female connector X65 and amplified by the amplifier N81 in the range 617.3 to 1129.3 MHz. Receive signals below 500 Hz are converted into an IF of 629.3 MHz and those above 500 MHz into an IF of 117.3 MHz.

The 117.3-MHz or 629.3-MHz IF signals are routed to the PIN diode switch D91 via the subsequent 650-MHz lowpass filter and the VHF/UHF amplifier V96. The 650-MHz lowpass filter is made up of the coils L90 and L91 as well as the capacitors C90, C91 and C92. The transistor V95 serves to stabilize the operating point of the VHF/UHF amplifier. The IF of 117.3 MHz is conveyed to PIN diode switch D100 by means of the PIN diode switch D91. The IF is routed from the diode switch D100 to the IF section via a 117.3-MHz filter and the female connector X64. The IF filter comprises the coils L112 to L116 and the capacitors C111 to C115.

The IF of 629.3 MHz produced by receive frequencies below 500 MHz is conveyed by the PIN diode switch D91 to the 629.3-MHz filter made up of the coils L100, L101, L104, L105 and the capacitors C103 and C104. The frequency conversion to 117.3 MHz is performed in the subsequent mixer N100 using the 512-MHz signal derived by the crystal oscillator in the IF section. The mixer N100 has a broadband termination of 50  $\Omega$  formed by the coils L102, resistor R101 and capacitor C105. The transistor V106 serves as an amplifier for the 117.3 MHz. Its operating point is stabilized by means of the transistor V105. The transistor V107 inhibits the IF amplifier V106 by interrupting the operating voltage for receive frequencies above 500 MHz.

Having passed the IF amplifier, the IF signal is routed to the PIN diode switch D100 which applies the signal to the subsequent 117.3-MHz filter from where it is routed to the IF section via female connector X64.

## 9.2 IF Section

(See circuit diagram 708.9503.01 S)

The IF signal of 117.3 MHz coming from the tuner is routed to the IF section via female connector X74. From there it is routed to mixer N70 where the signal is converted into an IF of 10.7 MHz with the 128-MHz oscillator signal. The IF signal amplified with the IF amplifier V70 is then routed to an IF selection consisting of the IF filters Z1 to Z3. The filters have bandwidths of 7.5 kHz, 15 kHz and 150 kHz and are switched into the signal path

using switches S1-A and S1-B. The IF signal is further amplified by means of transistor V40 which compensates the insertion loss of the IF filters. Filter Z40 whose bandwidth is 150 kHz is designed for postselection and determines the maximum IF bandwidth. The IF signal is mixed with the oscillator signal of 11.7 MHz produced in the crystal oscillator V50 in the combined IF amplifier/detector N40. Coil L41 and capacitor C46 filter the 1-MHz signal from the mixture products at the output of the mixer, terminal 8 of the IF amplifier/detector N40 and route it to the AM demodulator, terminal 13 of the IF amplifier/detector N40 as well as to the FM demodulator N60. The AF signal produced in the AM demodulator is sent to the control unit via the AF amplifier A72 and the male connector X77.B3. The AF signal produced in the FM demodulator is routed to the AF amplifier A72 whose gain is adjusted according to the selected IF bandwidth by switch S1-B. This AF signal, too, is routed to the control unit via male connector X77.A3.

The operating voltage supply for the 11.7-MHz oscillator V50, the combined IF amplifier/detector N40 and the FM demodulator N60 is performed via the separate regulating circuit A77. This prevents noise pickup via the supply voltage.

The frequency deflection of the receive signal is monitored by analyzing the discriminator DC voltage using the window discriminator N3. A reference voltage is generated by means of the voltage attenuator chain R11 to R15 corresponding to the output voltage of the discriminator N60 at the centre frequency. The reference voltage is adjusted using the potentiometer R13. If there is a deflection from the centre frequency, the window discriminator N3 produces the signals ABL POS (positive deflection), ABL NEG (negative deflection) and ABL GSW (deflection exceeding step size) which are routed to the microprocessor control for evaluation via male connectors X77.A8, .A7 and .B8.

The level indicator voltage is derived from the instantaneous log device and distributed for plug X77.B4 at a level of 0.1 - 3.5 V through the operational amplifiers N1-C and N1-D operating as rectifiers. On switch position "150 kHz Pulse" of the bandwidth control the rectifier is working as a peak rectifier. This ensures that the indicator voltage is reacting for tempo-

rary alterations of input voltages (pulses). On switch position 7.5 kHz, 25 kHz, and 150 kHz the level mean value will be indicated. The potentiometer R101 is for standardization of the level. The level blanking at search run (automatic station finder) is performed by OP N1-B which triggers the FET V97. At V70 collector the level for IF-output 10.7 MHz is taped, amplified and decoupled by N20 and feed to plug X20.

For generating the squelch signal which is routed to the tuning unit via male connector X77.A5, comparator N1-A compares the level voltage to the threshold voltage set on the squelch potentiometer which is provided by male connector X77.B7. The squelch signal inhibits the AF amplifier on the tuning unit if the level voltage is lower than the set threshold voltage.

The amplified level voltage is compared to the switching threshold set on the potentiometer R30 using comparator A73. If the level voltage is above the switching threshold, the ENAFC signal is sent via male connector X77.A4 enabling AFC control by means of the microprocessor control. Thus, the AFC control only responds to receive signals  $> -10$  dB $\mu$ V.

The temperature-stabilized crystal oscillator V80 with the crystal B80 which oscillates at 128 MHz serves as a reference oscillator supplying the mixture frequencies for the tuner, the synthesizer and the IF section. The oscillator signal generated is increased to a level of +5 dBm using amplifier N80 and directed to the mixer N70. The signal is routed at a level of -6 dBm to the synthesizer via female connector X71 where it is required as a reference signal.

The 512-MHz signal required for the synthesizer and the tuner are derived from the 128-MHz oscillator signal by multiplication. For this, the characteristic of the tuning diode V81 produces even-numbered harmonics from the 128-MHz oscillator signal amplified by the amplifier N81. The resonant circuits L90/C100, L91/C103 and L92/C102 filter out the fourth harmonic of the oscillator signal from this spectrum. The level of this 512-MHz signal is increased in the amplifier N90 to +5 dBm. The signal is fed to the tuner at this level via female connector X73 and to the synthesizer at a level of -15 dBm via female connector X72.

### 9.3 Synthesizer

(See circuit diagram 641.8147 S)

The PLL circuit D9 provides the tuning voltage required for the control of the oscillator. The 128-MHz oscillator signal provided by the crystal oscillator in the IF section via female connector X51 serves as a reference. The level is matched to the attenuator D10 using the transistor V16. The attenuator divides the 128-MHz oscillator signal by 40 and routes it to the PLL circuit D9 where the signal is divided by 640 so that an internal reference signal of 5 kHz is available for the PLL circuit.

To obtain the required frequency, the mixer B1 mixes the 512-MHz signal supplied by the IF section via female connector X52 with the frequency of 617.3 to 1129.3 MHz provided by the main oscillator. Amplifier N1 matches the level of the oscillator signal with that of the mixer. The level of the output signal of mixer B1 in the range 105.3 to 617.3 MHz is matched in the amplifiers N2 and N4 with the following divider chain D2, D3, D4 and D8 where the signal is divided by variable divider factors to 5 kHz and 500 Hz which are fed to the PLL circuit D9 as actual value at the terminals 1 and 2. Integrator N3 generates the tuning voltage for the main oscillator from the control voltages derived by comparison from the reference signal and the actual value. The operating voltage of N3 (26 V) is generated from the +12 V voltage using converter U1.

Switchover of the programmable divider D8 is performed by the microprocessor control in the control unit as a function of the receive frequency.

### 9.4 Control Unit

(See circuit diagram 708.9461.01 S sheet 1 to 3)

The core of the control unit is the microprocessor D301, type 80C39 which is an 8-bit processor with two integrated bidirectional I/O ports and an internal RAM having a capacity of 128 bytes.

The integrated RAM together with the RAM D306 serves to store operational data. The operating program is stored in the

EPROM D305. Selection of low-order addresses for RAM or EPROM from the multiplexed address/data bus is performed using latch D307. As it is not possible to address the entire EPROM by means of the 8-bit address, the top 4 bits of the address are supplied when accessing via port 2 of the CPU D301. Using the 12-bit address which is thus available, the lower 4 Kbyte of the EPROM ranging from 0000H to 0FFFH can be addressed.

Access is made possible to the upper 4 Kbyte of the EPROM in the range 1000 to 1FFFH by changing the plug-in jumpers X301 to position 1-2.

Port 1 of the D301 accesses the internal strobe bus via which the LCD display and the data transfer to the synthesizer are controlled. The 3 high-order bits of port P2 of the D301 are directed to the 1-out-of-8 decoder D302 from which the various CS (chip-select) signals are generated. The 4 low-order bits of port 2 are split up into eight bidirectional ports of 4 bits each by means of the I/O expanders D201 and D202 which are informed via a 4-bit control word - transmitted prior to the data - to which port the data are to be transferred. The PROG signal is used to distinguish between the control word and data; the negative edge of the signal denotes a control word and its positive edge marks data.

The evaluation of the receiver operating elements such as keypad in the control unit, tuning knob on the tuning unit and bandwidth converter in the IF section is interrupt-controlled, i.e. an interrupt signal is generated on actuating any of the operating elements and transferred to the D301.

The key encoder D303 evaluates the key matrix. The IRKEY signal is activated by the key encoder D303 on pressing a pushbutton triggering an interrupt of the D301. For this, the D flip-flop D205-B stores the IRKEY signal and generates the interrupt signal using the NOR gate D203. As various operating elements can trigger an interrupt request, the state of the interrupt request lines is read in following activation of the interrupt signal via the port lines 4.1, 4.2 and 5.0 of the I/O expander D201; at the same time it is determined which of the operating elements triggered the interrupt. If triggering was performed by the key encoder D303, the KEYACK signal is issued via port line

7.0 of the I/O expander D201; the signal resets the D flip-flop D205-B thus preparing further interrupt request. At the same time, the key encoder D303 is enabled via the OR gate D308; the encoder places the information concerning the pressed push-button on outputs D0 to D4 of the data bus from where they are read into the D301.

The BRUACK signal is issued via port line 7.1 of the I/O expander D201 and thus the interrupt request stored in the D flip-flop D205-A is reset if the bandwidth changeover switch triggered the interrupt. Information on the new position of the bandwidth changeover switch in the IF section is read in via port lines 5.1 to 5.3 of I/O expander D201.

On triggering the interrupt by the tuning knob on the tuning unit, port line 7.2 of I/O expander C201 sends out the TUNACK signal resetting the interrupt request. The information on the direction the tuning knob is turned is read in by port lines 5.2 and 5.3 of the I/O expander D202.

The tuning voltage for the tracking filter in the tuner is generated via the D/A converter D304. It converts the 8-bit data word supplied by the CPU D301 via the data bus into an analog voltage. The following operational amplifiers N301 and N304 serve for level matching. The tuning voltage is adjusted using potentiometer R322. The rest of the control signals for the tuner are generated by the 3-to-8 decoder D206 from the port lines 6.0 to 6.3 of the I/O expander D202. The corresponding read-in signal (port 1/D7) is supplied by D301 via pin 34.

The astable multivibrator D107 provides the clock frequency for the LCD display P110. The LCD display P110 is selected by means of the BCD to 7-segment decoders/drivers D101 to D106. Select signals are output via port lines 4.0 to 4.3 of the I/O expander D202. Data are output byte-serially, i.e. data for the separate decades of the LCD display P110 are transferred one after the other. The enable signals for the corresponding decoder/driver D101 to D106 arrive from the strobe bus of the synthesizer via the inverting driver D112.

The LCD display P110 (e.g. in the absence of light) is illuminated by the lamps H102 and H103 which are switched on using pushbutton S120 which simultaneously switches on lamp H104 for illuminating meter B101.

The indication can be switched over using switch S119. Signal level is indicated in position 2-3/8-9 and battery test is performed in position 3-4/7-8. The voltage difference between the battery voltage and the derived 5-V operating voltage serves as a criterion for the charging state of the battery.

Switch S116 generates the logic signal AFC-ON which is interrogated by the microprocessor via I/O expander D201 ensuring AFC (in the activated state). The 40-dB attenuator is connected in the tuner using switch S121.

Switch S118 has two tasks. In position 2-3/5-6 it turns on the AF signal selected by switch S117 to the volume potentiometer R111 and the control voltage for the display range of 80 dB to meter B101 and in position 2-1/5-4 the level tone is switched through to the volume potentiometer and the control voltage for the extended display range or 30 dB for the level meter.

## 9.5 Tuning Unit

(See circuit diagram 708.9484.01 S)

The evaluation logic for the tuning knob, the AF amplifier for the loudspeaker or headphone, the level tone generator and the voltage stabilization for the operating voltage +5 V as well as the DC/DC converter for the  $\pm 12$  V supply voltage.

The tuning knob consists of two electronic switches with magnetic locking which operate on the Hall effect, sending out pulses on actuation. The following logic circuit recognizes the direction of rotation from the pulse sequence and sets the D flip-flops D4-A and D4-B. At the same time, the IRQTUN signal is generated triggering an interrupt in the microprocessor control of the control unit. The output of the IRQTUN signal can be inhibited by means of switch S2 preventing inadvertent change of the set frequency by means of the tuning knob.

The AF amplifier N1 serves to amplify the AF signal coming from the control unit. The AF amplifier is switched off by the signal SQLEIN which is activated when the receive level falls short of a set threshold value. The AF signal is reproduced via loudspeaker B3 if no headphone is connected to the jack plug X5. If a headphone is connected, the switch integrated into the jack plug interrupts the signal path to the loudspeaker B5 such that the AF signal can only be heard via the headphone.

The voltage-frequency converter N2 serves as a level tone generator which generates signals of variable pitch depending on the indicated receive level. A control voltage which is proportional to the IF level in dB is generated in the IF section; this voltage is routed to the voltage-frequency converter via female connector X47.14. The level tone resulting from the control voltage is directed to the control unit via female connector X47.15 and can there be inserted into the AF signal path via a switch.

The operating voltages of +5 V and  $\pm 12$  V required in the receiver are generated from the 6-V battery voltage. The voltage regulator U1 stabilizes the +5-V operating voltage. The DC/DC converter U2 generates the  $\pm 12$ -V operating voltage with the low-pass filters L1, C3, C4 and L2, C6, C7 filtering the DC current.

## 10. Troubleshooting and Repair of Subassemblies

### 10.1 Preliminary Remarks

When performing RF measurements make sure to use correctly matched cables and connectors as well as to employ short cable connections.

Among others there are MOS, MOSFET and CMOS components integrated in the subassemblies. These components are extremely sensitive to high external voltages. Static charges may lead to very high discharge surges which could destroy these components.

For this reason, the following minimum requirements must be adhered to when working near these components, if no special working place for CMOS is available:

- Conductive table and floor coverings,
- Working chair with conductive coverings,
- Grounded metallic working top, conductive wristbands with a protective impedance of  $> 200 \text{ k}\Omega$ ,  $< 1 \text{ M}\Omega$  and an insulated lead via a plug,
- Soldering irons with safety grounding,
- All conductive coverings, wristbands and working tops must be interconnected via insulated lines,
- Supply voltage must be switched off during soldering.

#### 10.1.1 Spare Parts

All components and subassemblies have undergone a severe quality control prior to assembly.

A component found to be faulty beyond any doubt by means of measurements, adjustments and operational tests is only to be exchanged in compliance with the parts lists in the annex of this service manual.

This is the only way of guaranteeing the specifications laid down in the operating manual, part 1.

Component manufacturers have been provided with special specifications defined by R & S to ensure maximum reliability for components such as resistors, capacitors, diodes, transistors, integrated and highly integrated components. That is why we recommend to replace faulty components whenever possible, by original ones.

When ordering spare parts, please state the following specifications:

type, order no. and serial no. of the unit, part no. of the parts list as well as designation and part no. of component.

All these details are stated in the attached circuit diagrams, parts lists and parts location drawings.

The components will be changed according to common workshop practice with no particular instructions being required.

#### 10.1.2 Required Measuring Equipment and Accessories

The following test equipment is required for performing the measurements described in this section. Similar test equipment may be used provided the specifications are at least of equal standing.

Item	+ Type of unit, required specifications * Recommended R&S unit	Type	Order No.	Appli- cation
1	+ RF signal generator 0.1 to 1000 MHz AM/FM can be modulated -97 to -27 dBm  * Signal Generator	SMPD	376.8011.52	10.3.1.1 10.3.1.2 10.3.1.4 10.3.2.1 10.3.2.3 10.3.2.4 10.3.3.3
2	+ Frequency analyzer 0 to 1.4 GHz			10.3.1.1 10.3.1.2 10.3.1.4 10.3.3.1 10.3.3.2
3	+ Sweep tester 0.1 to 1300 MHz  * Polyskop with Log. Amplifier  * Scalar Network Analyzer	SWOB 5 SWOB 5-E1  ZAS	333.0019.53 333.5610.02  393.0015.02	10.3.1.3 10.3.1.5 10.3.1.6 10.3.1.7 10.3.1.8 10.3.1.9 10.3.1.10 10.3.1.11 10.3.1.12
4	+ Oscilloscope DC to 10 MHz Sensitivity 1 mV  * Oscilloscope	BOP	374.0020.02	10.3.2.1 10.3.2.3 10.3.5.1 10.3.5.3
5	+ Power meter -10 to 0 dBm 20 to 600 MHz  * RF Millivoltmeter with terminated unit	URV 5 URV 5-Z5	394.8010.02 395.2115.55	10.3.2.2 10.3.2.5
6	+ Frequency counter 1 Hz to 1500 MHz Sensitivity 1 mV			10.3.2.2 10.3.3.3 10.3.3.4
7	+ Power supply unit 0 to 30 V  * DC Power Supply	NGT 35	191.2019.02	10.3.3.2

Item	+ Type of unit, required specifications	Type	Order No.	Appli- cation
	* Recommended R&S unit			
8	+ AF Generator 1 Hz to 10 kHz			10.3.5.2
	* Generator	SPN	336.3019.02	
9	+ Digital multimeter 0 to 30 V			10.3.1... 10.3.5
	* Digital Multimeter	UDL 33		
10	+ Termination 2 x 50 $\Omega$			10.3.2.5 10.3.3.2
	* Termination	RNA	272.4510.50	
11	+ DC isolation			10.3.11
	* DC Isolation		708.9026.00	
12	+ Squarewave/puls generator			
	* Function generator	AFG	377.2100.02	10.3.2.4
13	+ Test mixer	e.g. MD 108		10.3.2.4

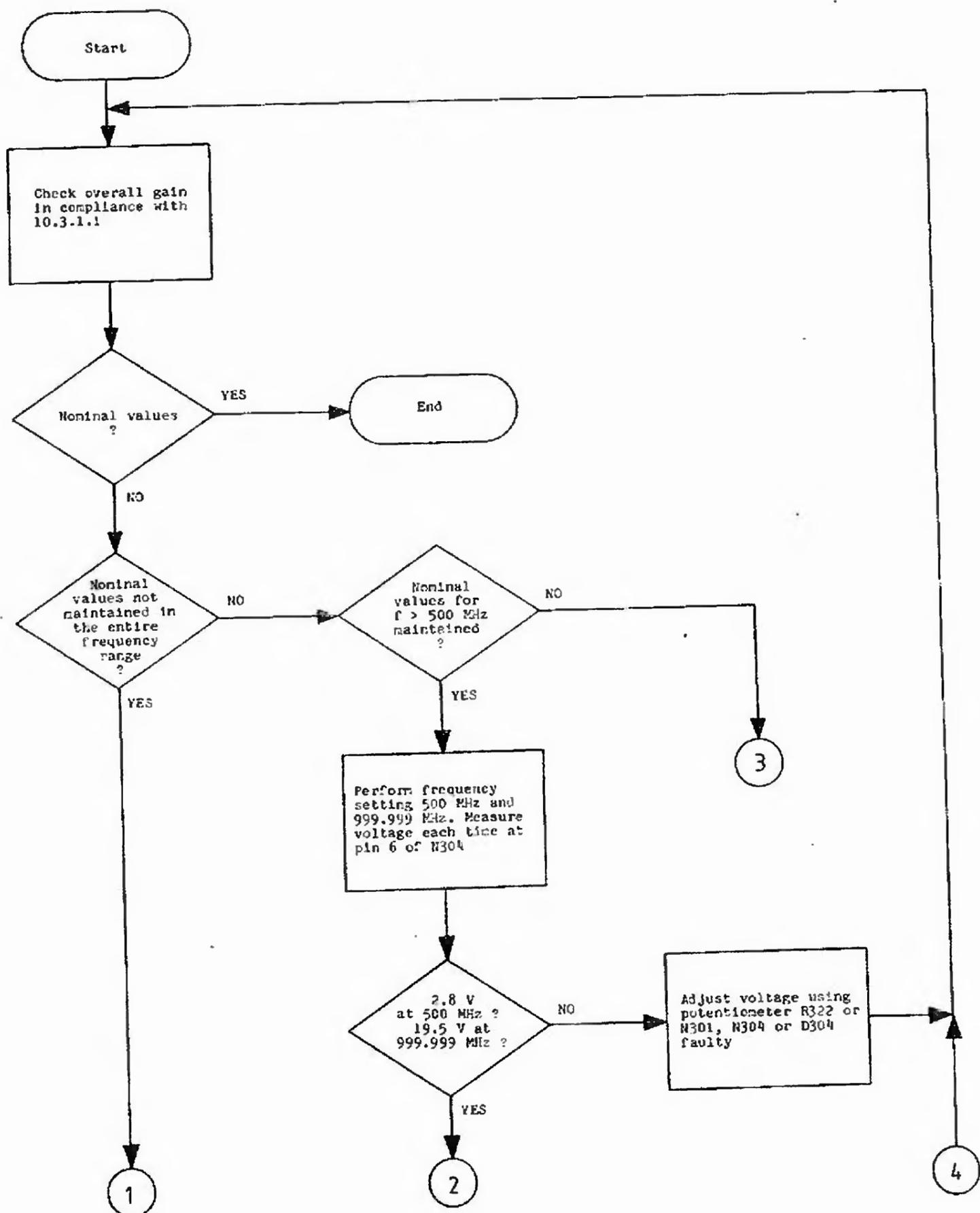
## 10.2 Troubleshooting

For determining a defective component it is recommended to localize the error by checking the nominal values using the systematic instructions given under 10.2.1 to 10.2.5.

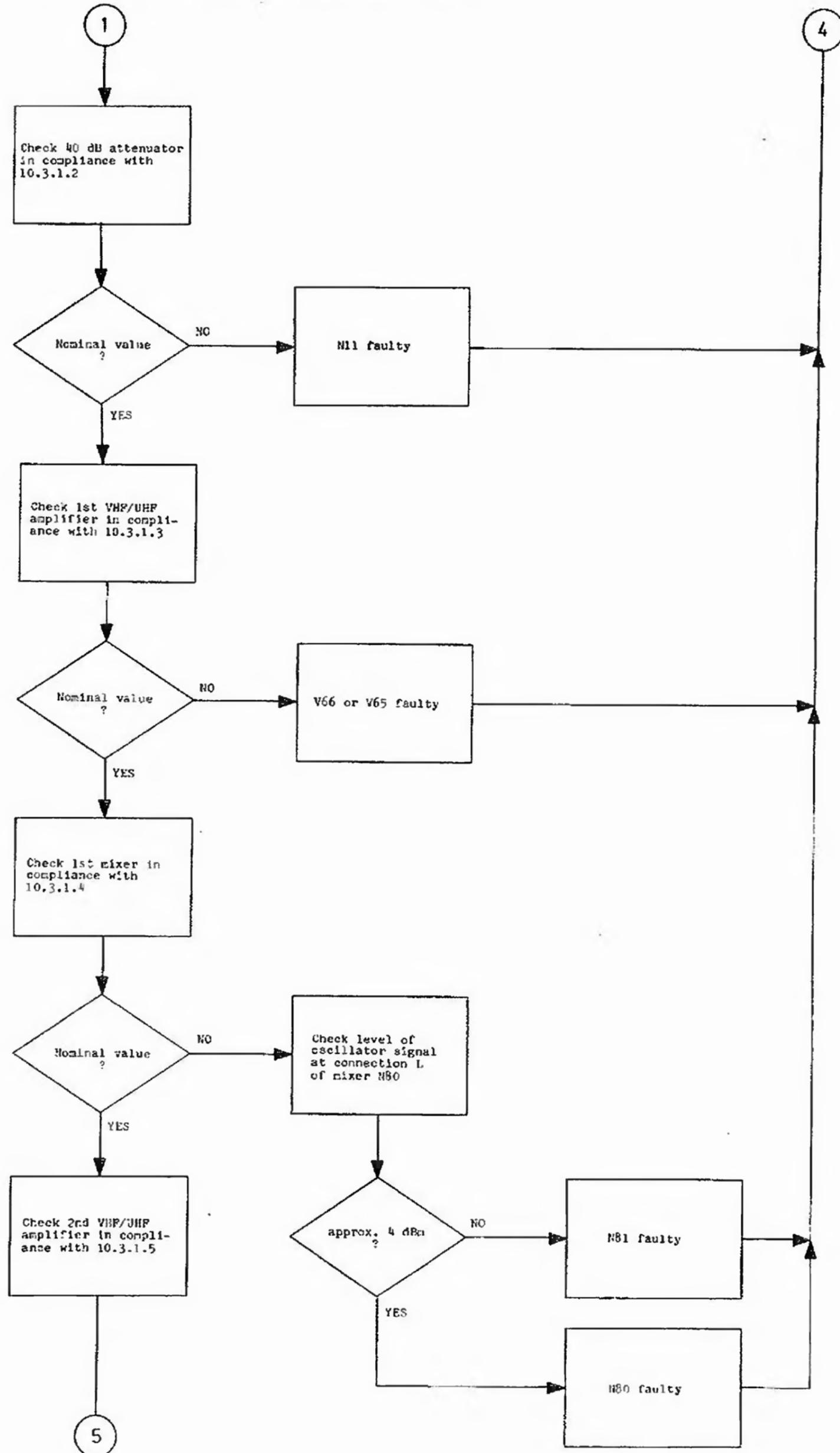
### 10.2.1 Tuner Fault Tracing Chart

Prerequisites for troubleshooting:

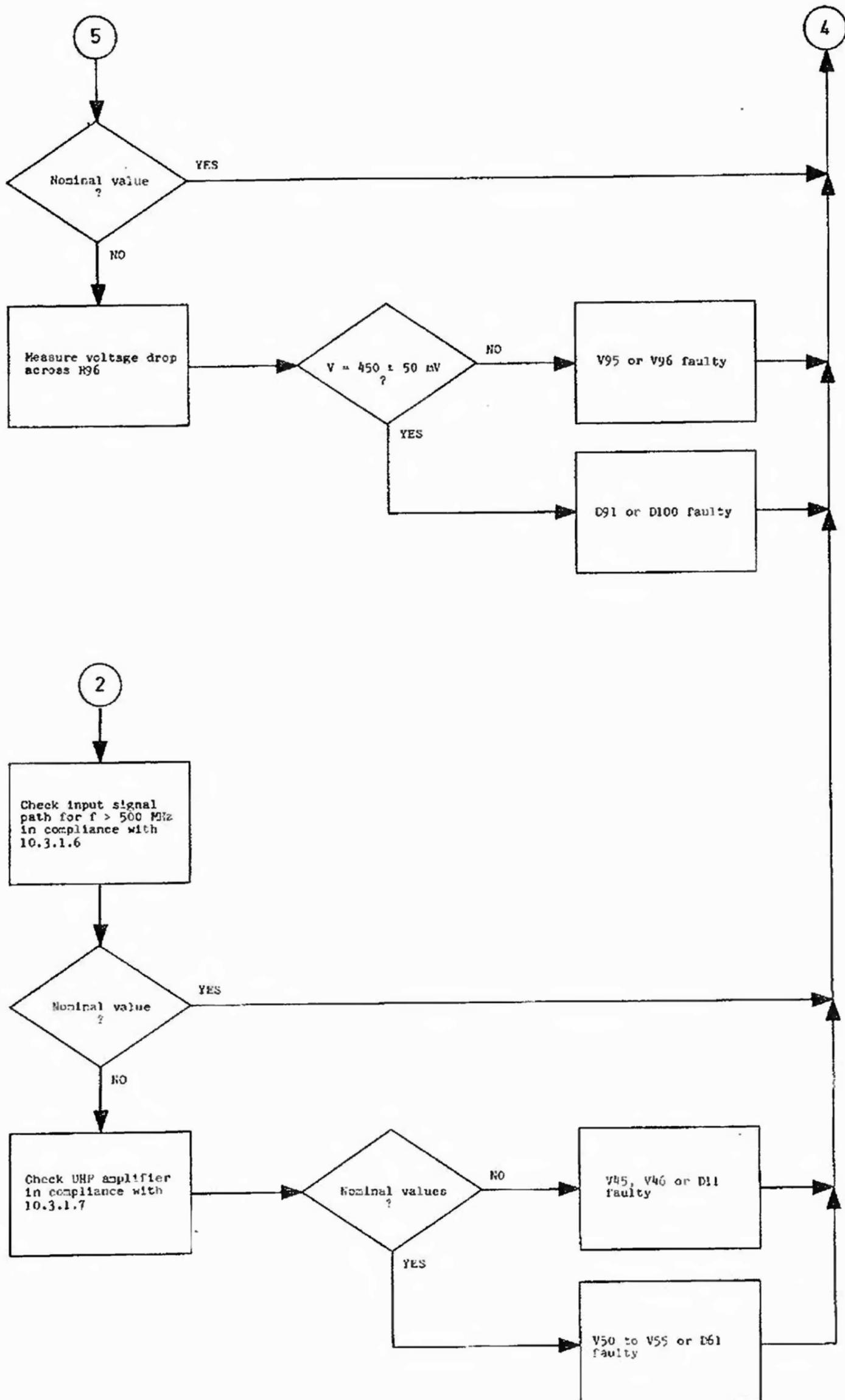
- tuner is adapted in the receiver,
- operational voltages are available.



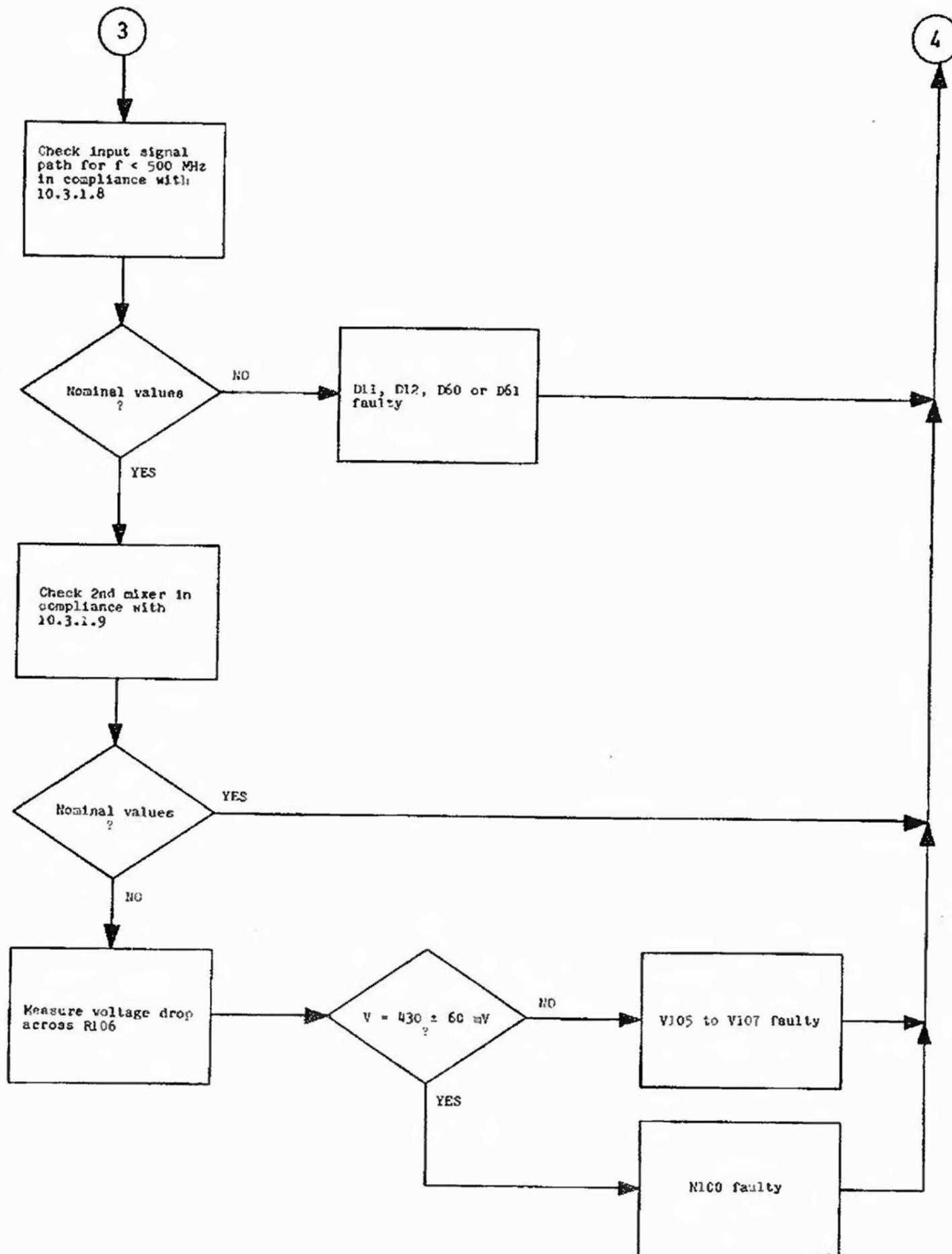
(continued) Tuner fault tracing chart



(continued) Tuner fault tracing chart



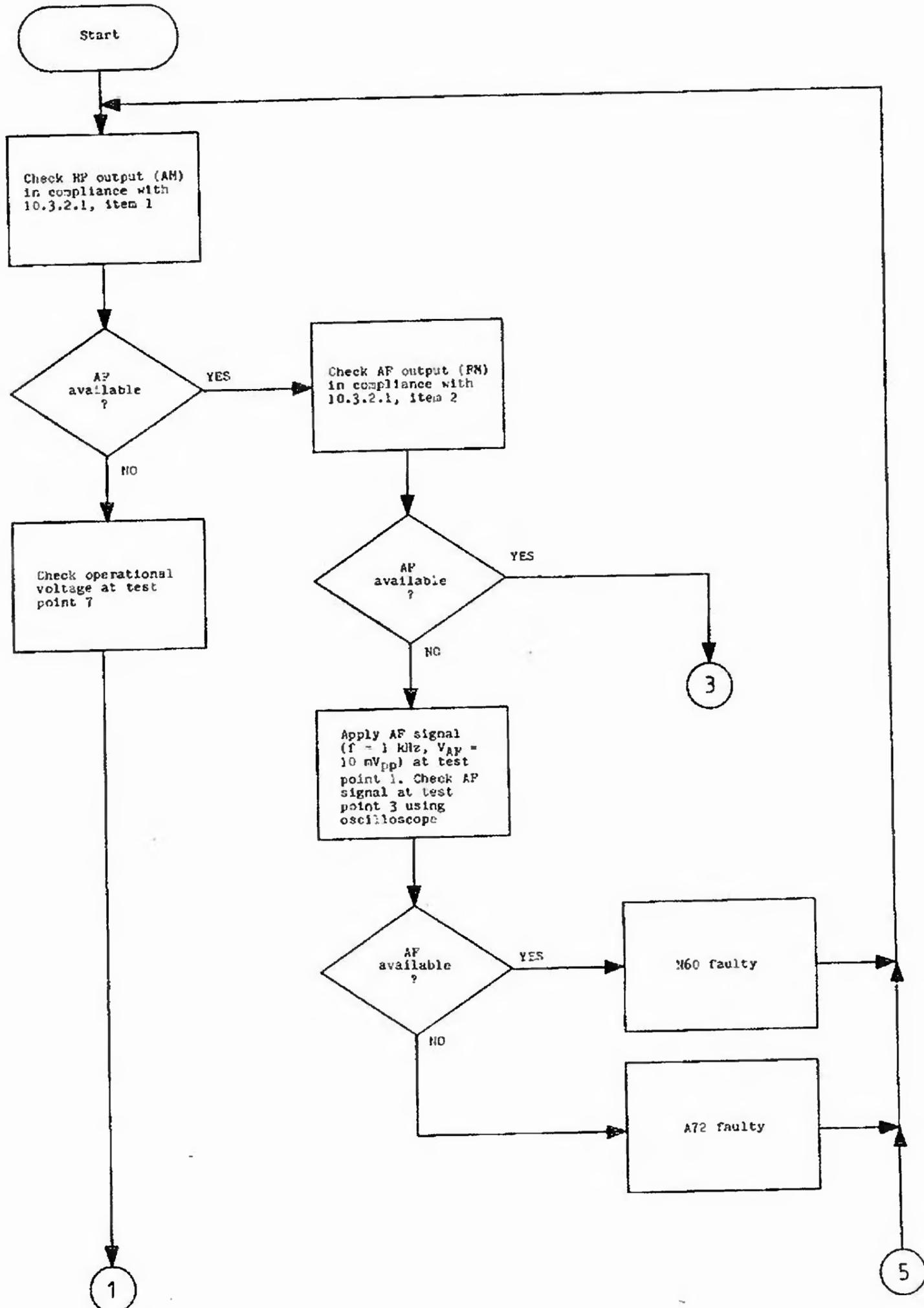
## (continued) Tuner fault tracing chart



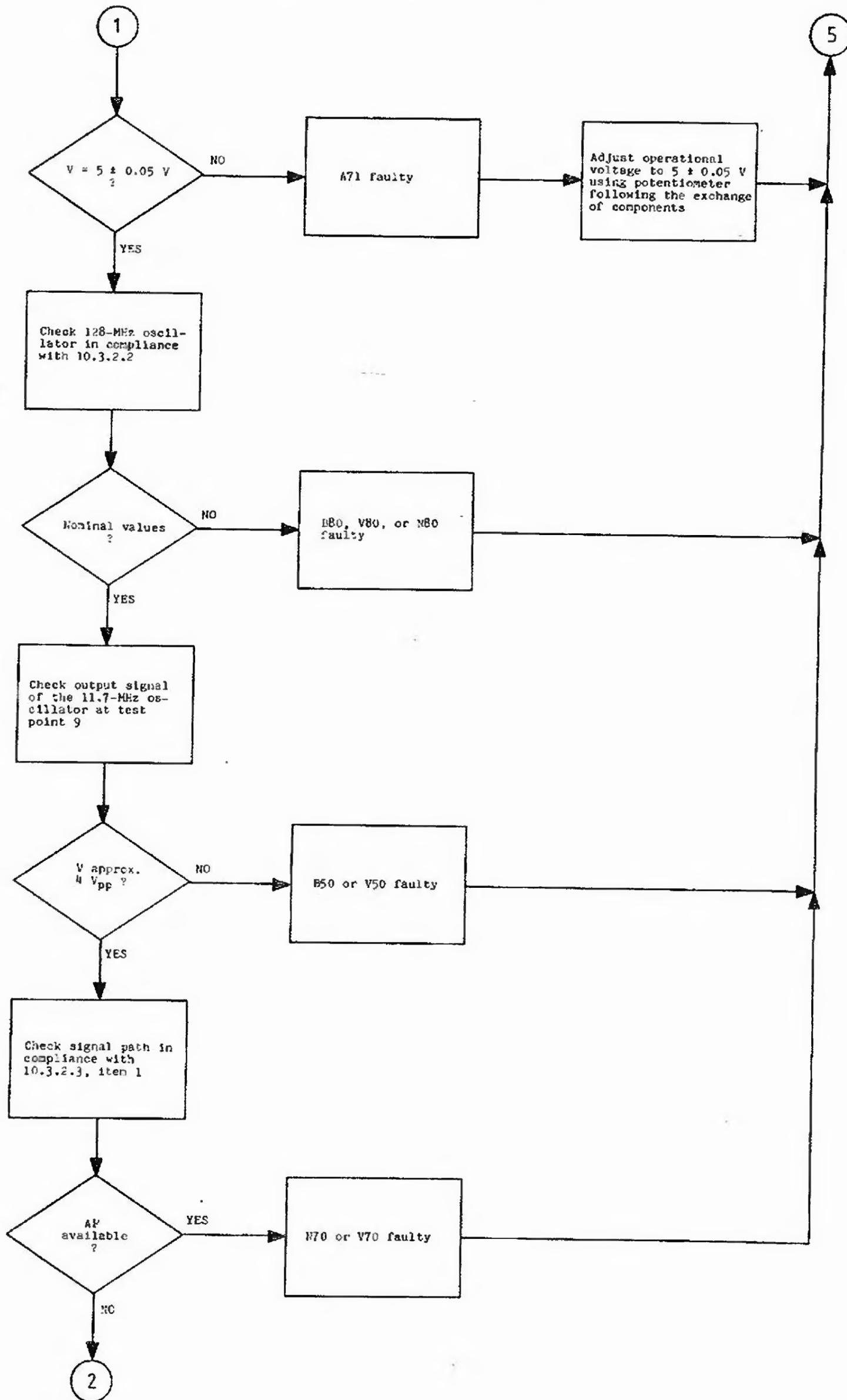
## 10.2.2 IF Section Fault Tracing Chart

Prerequisites for troubleshooting:

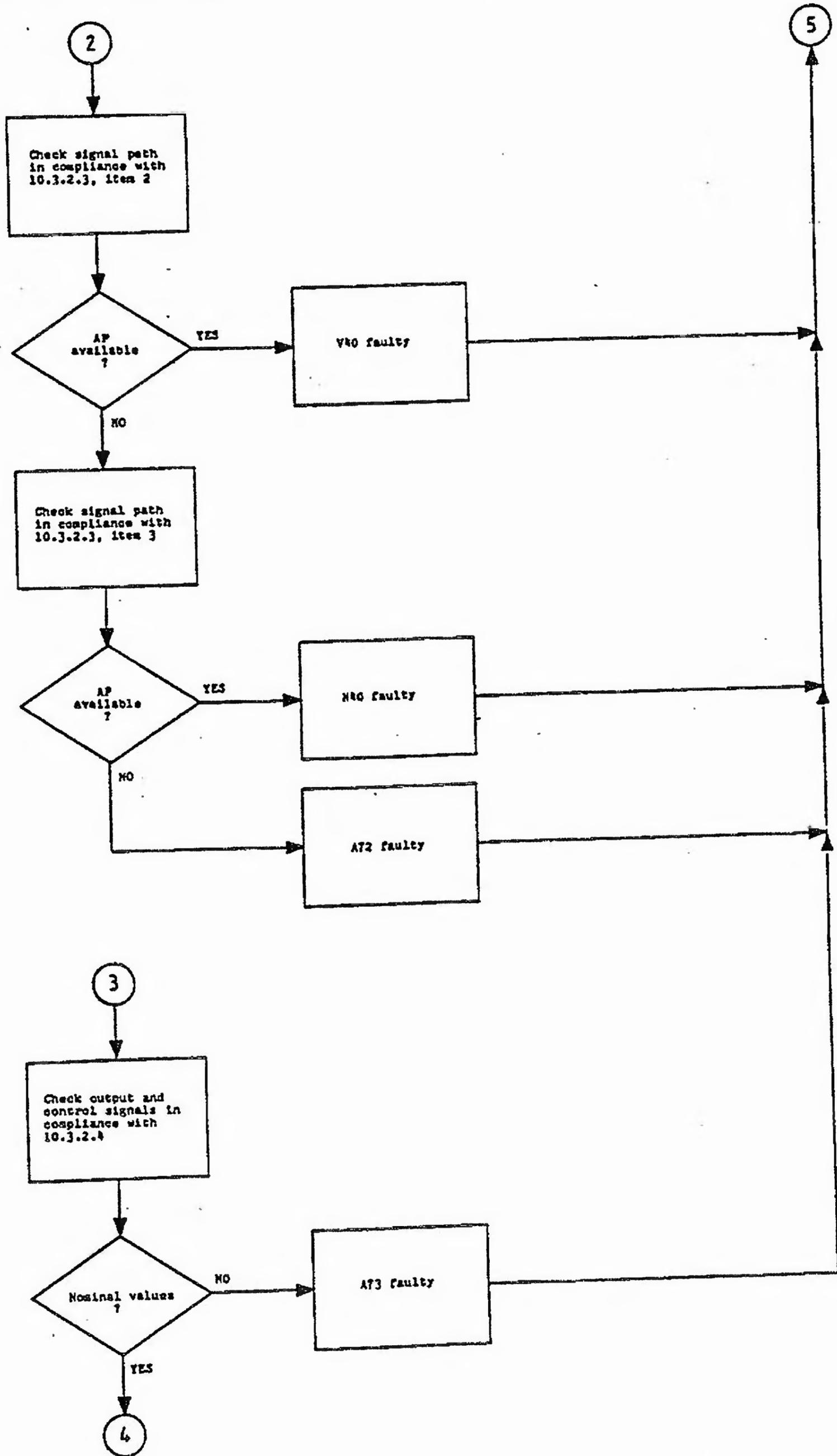
- IF section is adapted in the receiver,
- operational voltages are available.



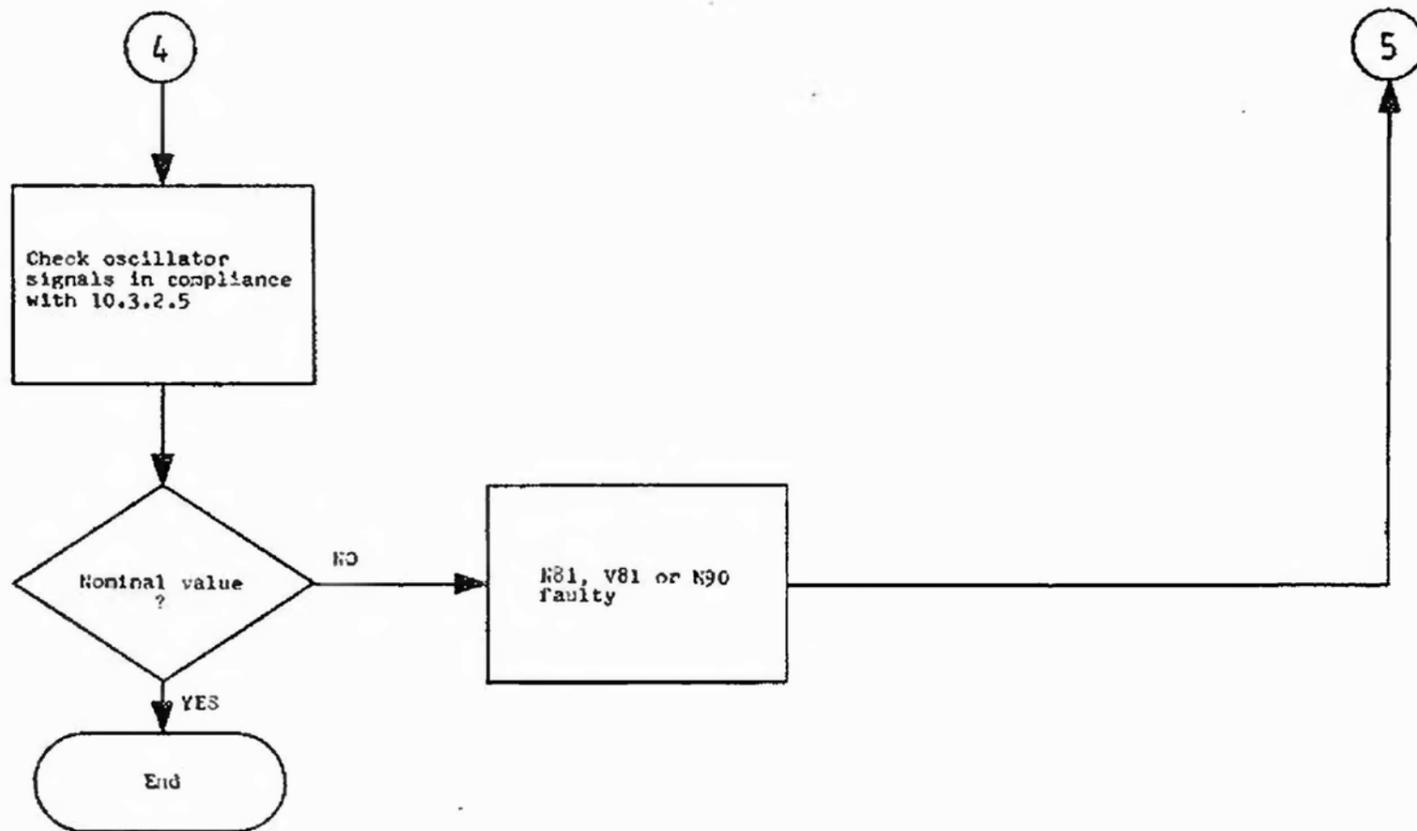
(continued) IF Section fault tracing chart



(continued) IF Section fault tracing chart



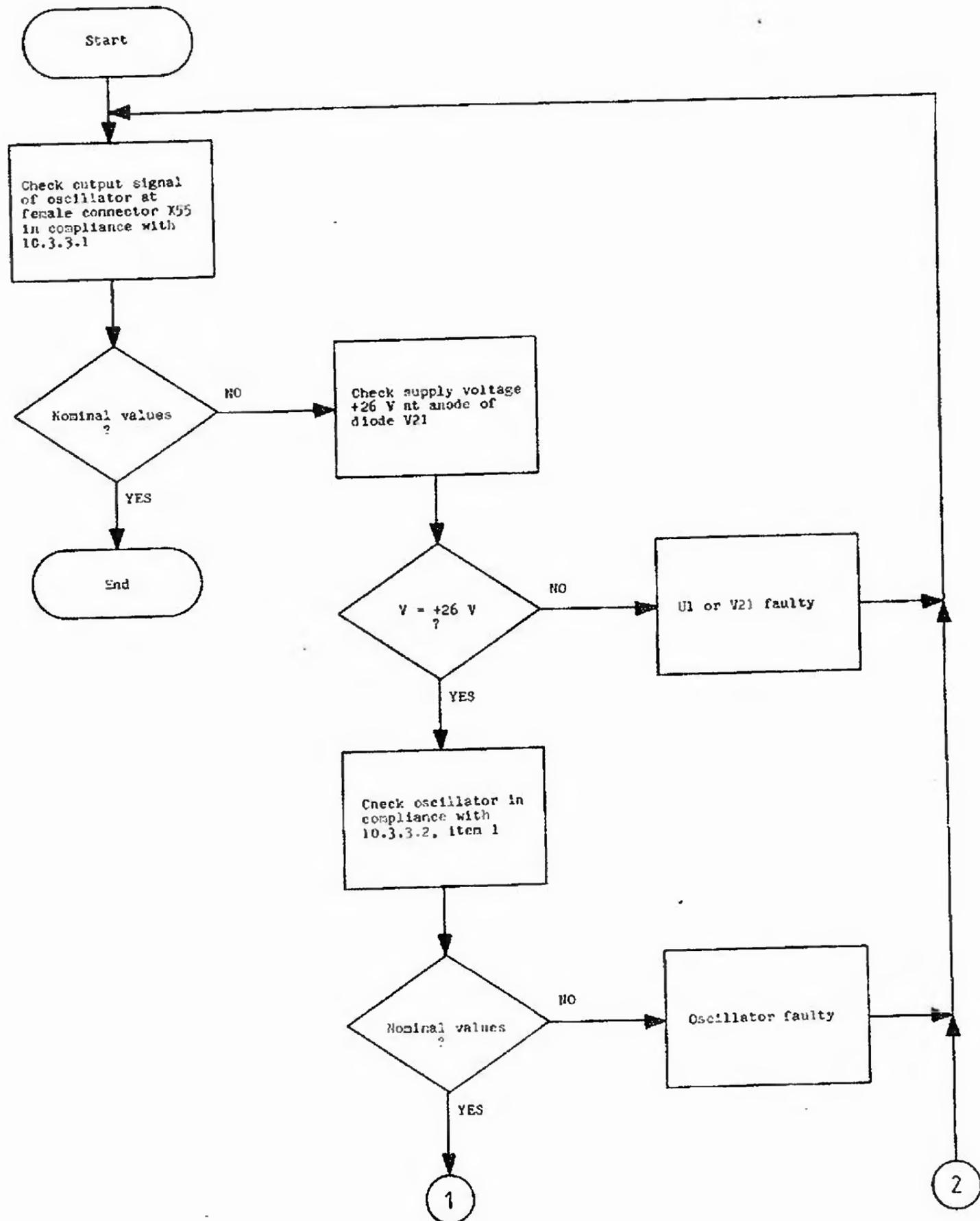
## (continued) IF Section fault tracing chart



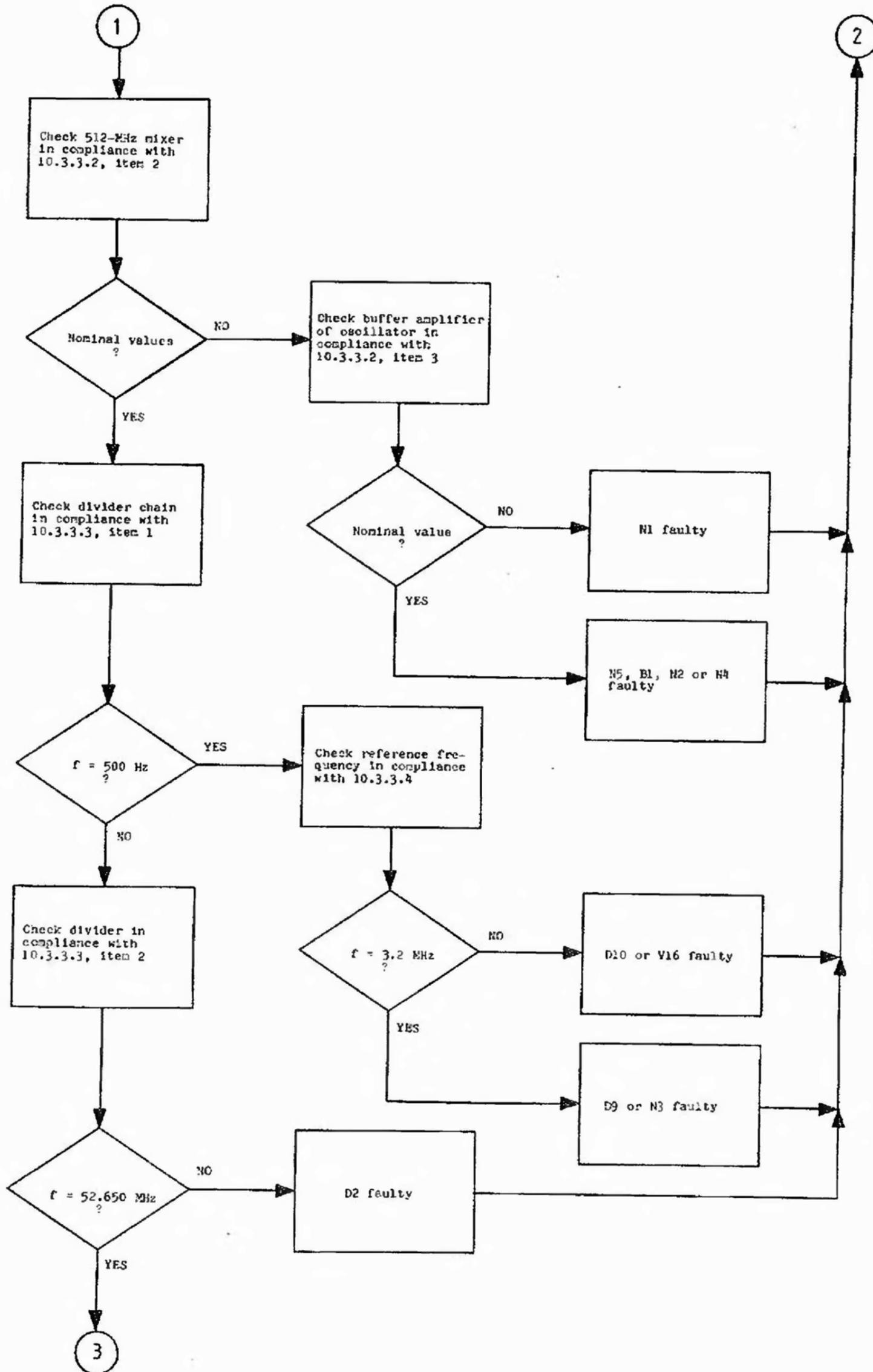
### 10.2.3 Synthesizer Fault Tracing Chart

Prerequisites for troubleshooting:

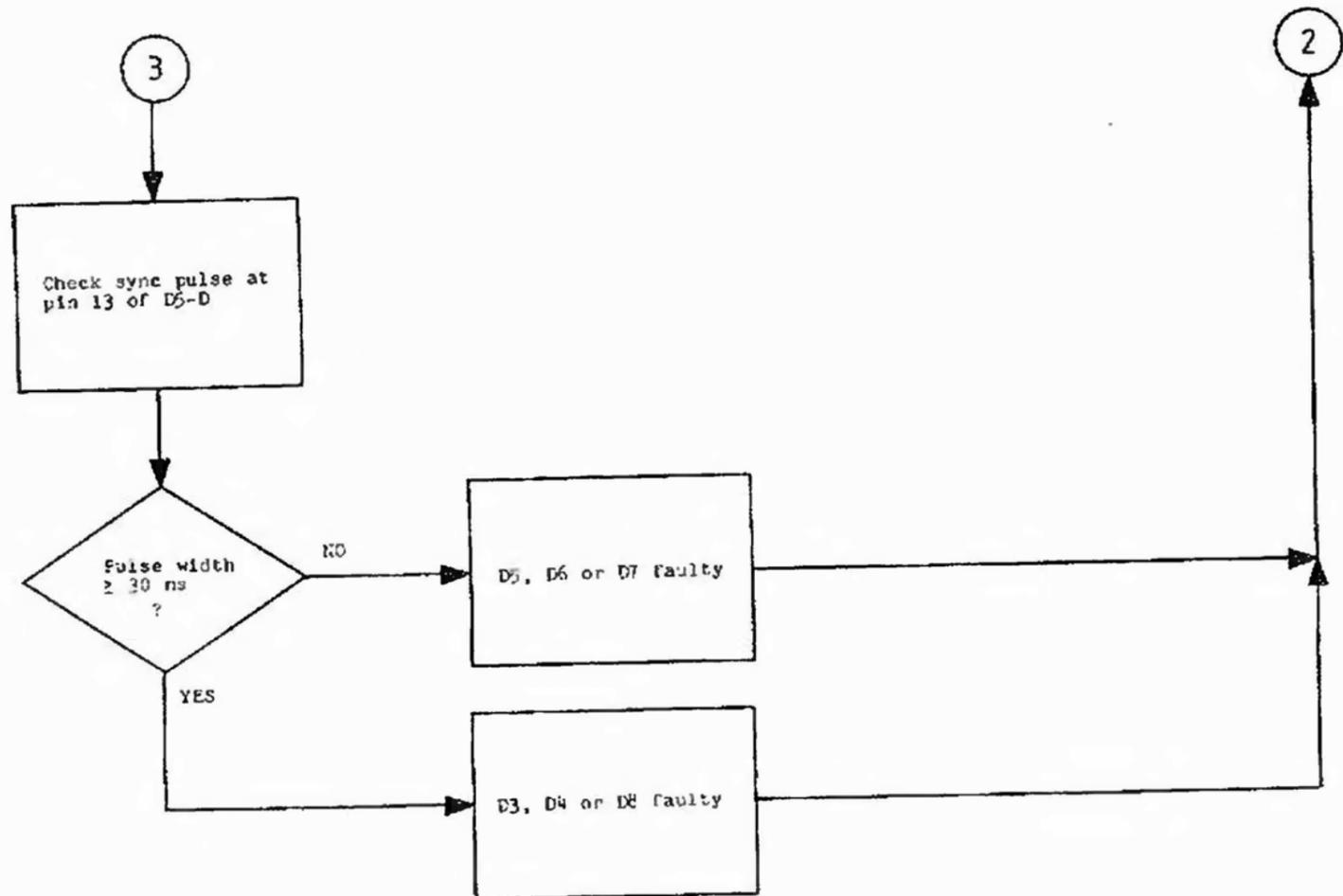
- synthesizer is adapted in the receiver,
- operational voltages are available.



(continued) Synthesizer fault tracing chart



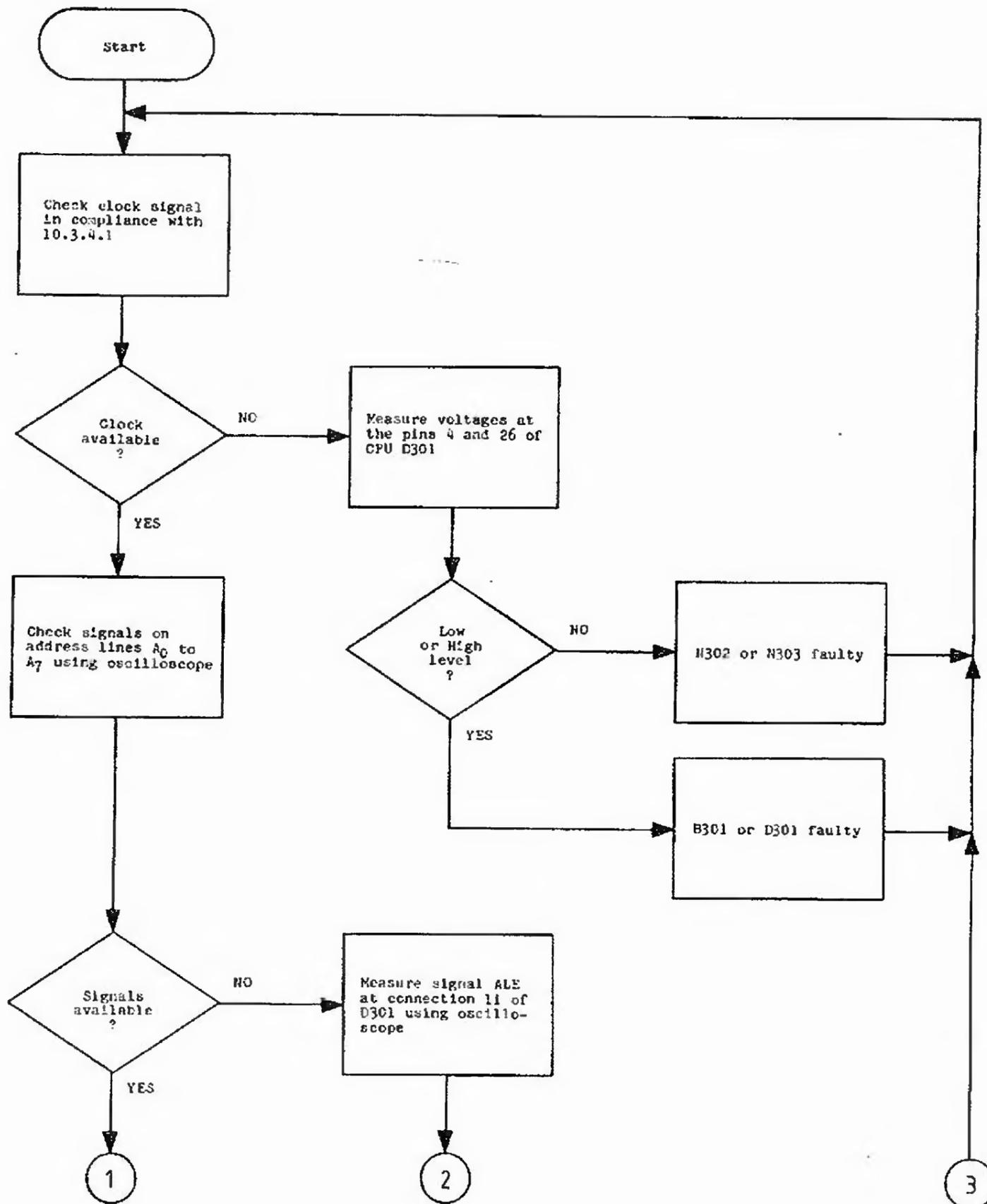
## (continued) Synthesizer fault tracing chart



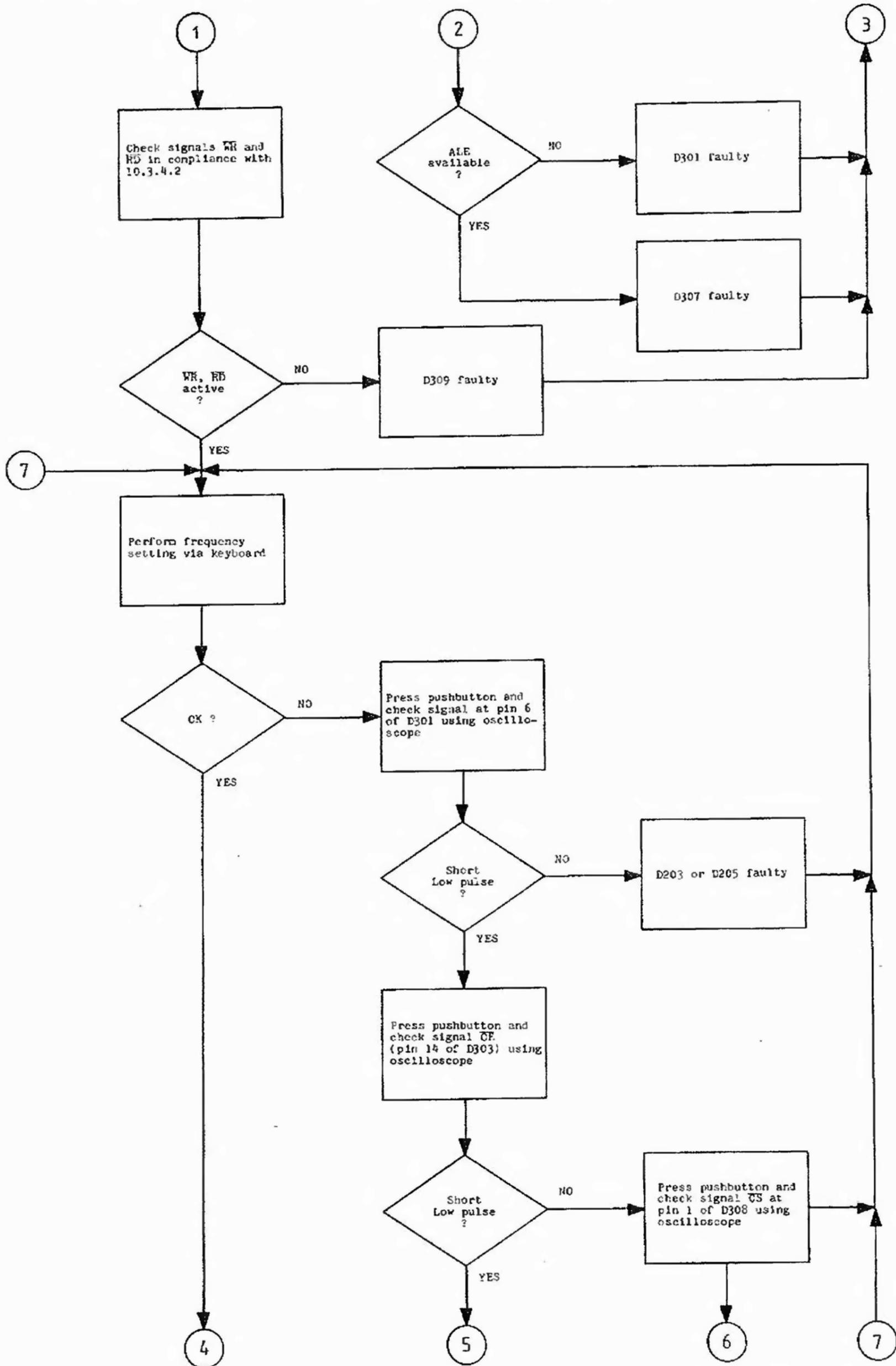
## 10.2.4 Control Unit Fault Tracing Chart

Prerequisites for troubleshooting:

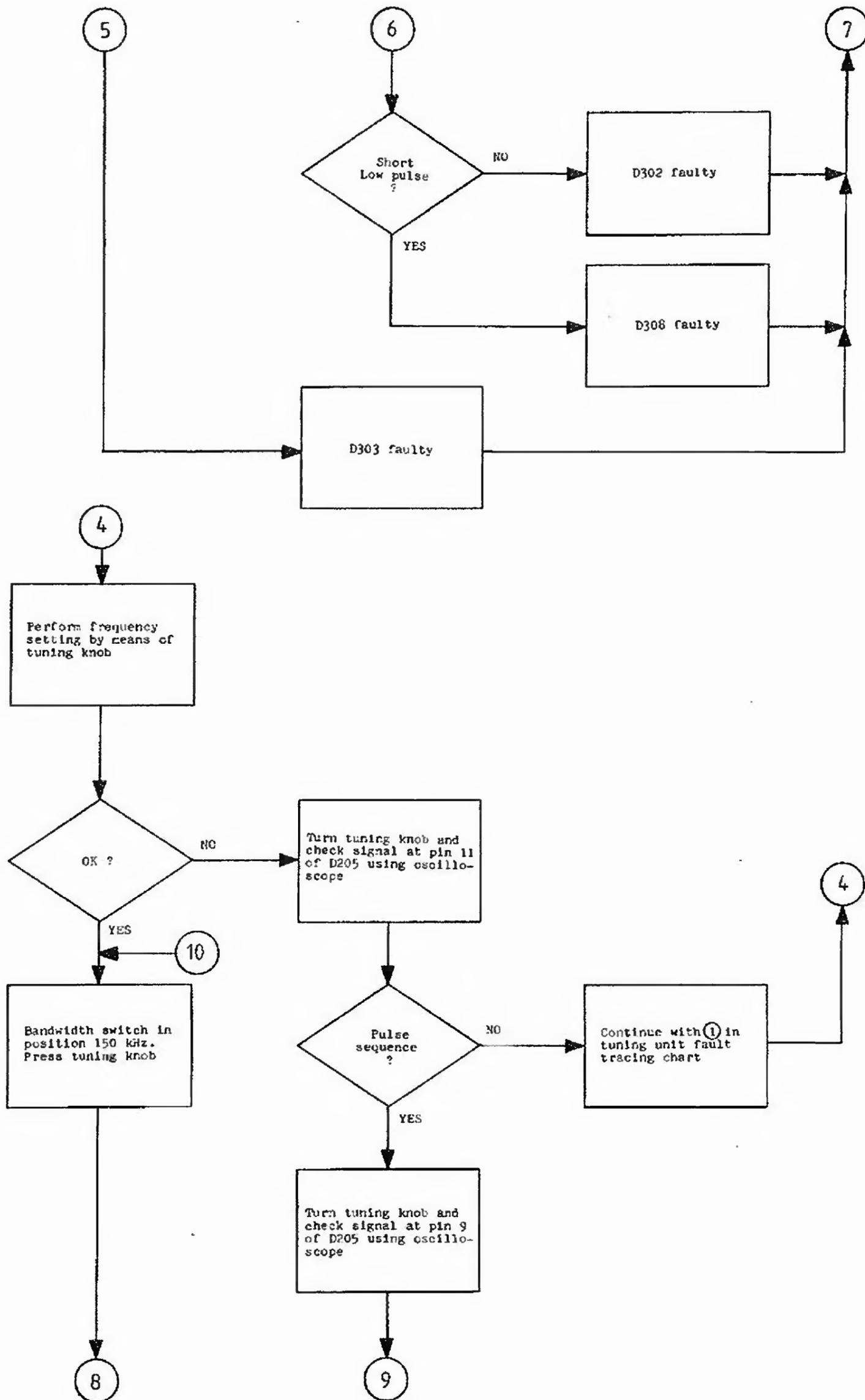
- control unit is adapted in the receiver,
- operational voltages are available.



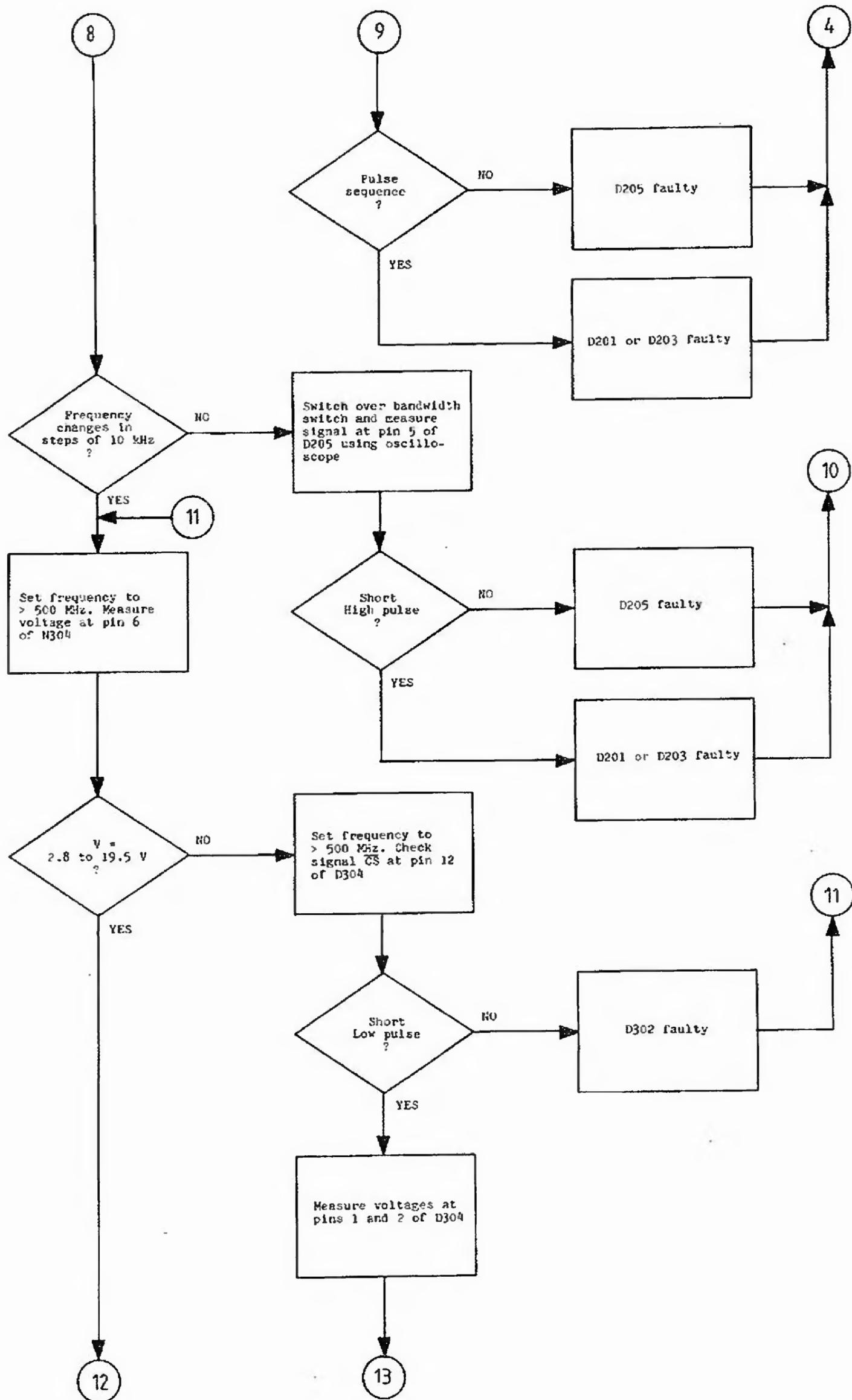
(continued) Control Unit fault tracing chart



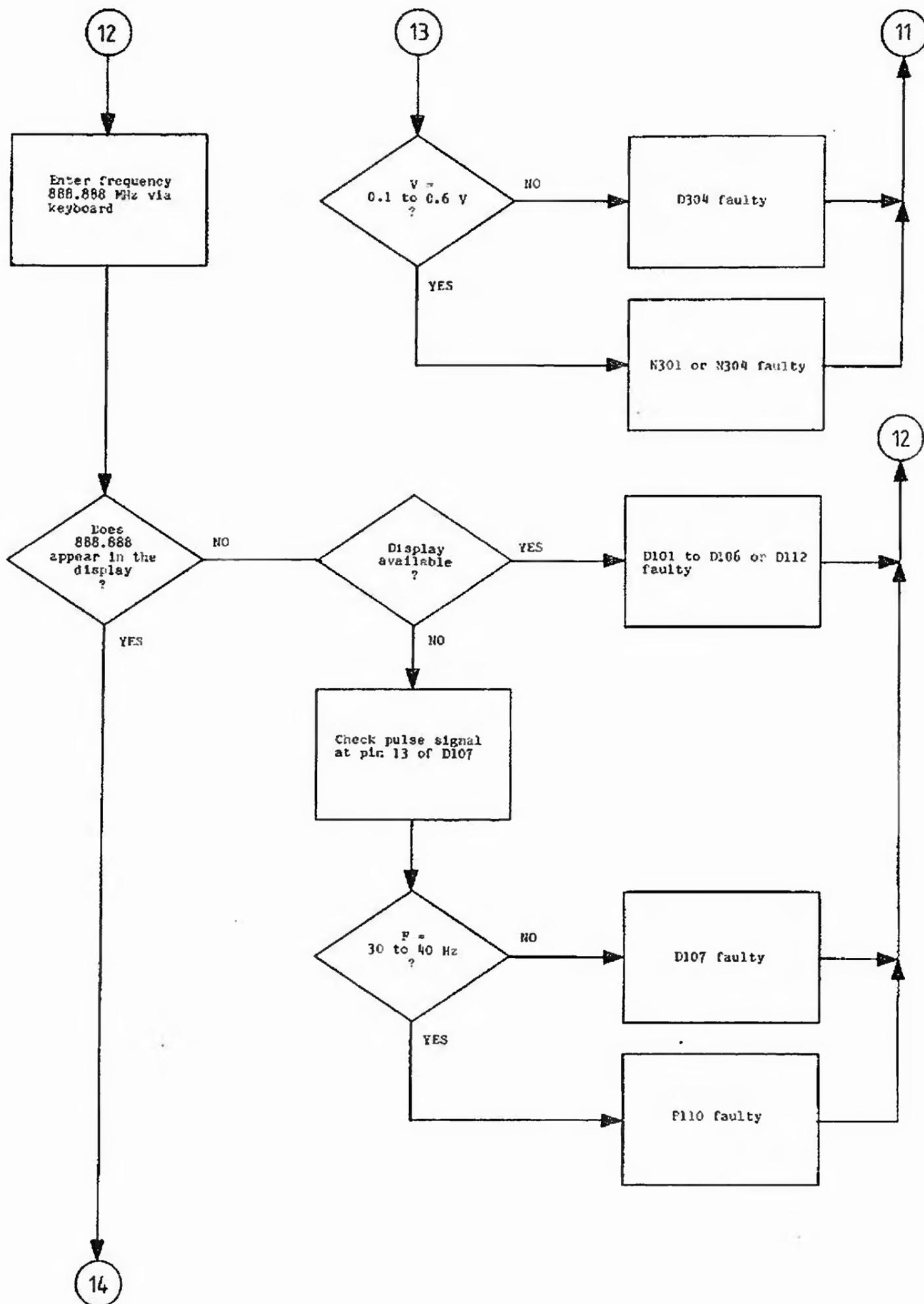
(continued) Control Unit fault tracing chart



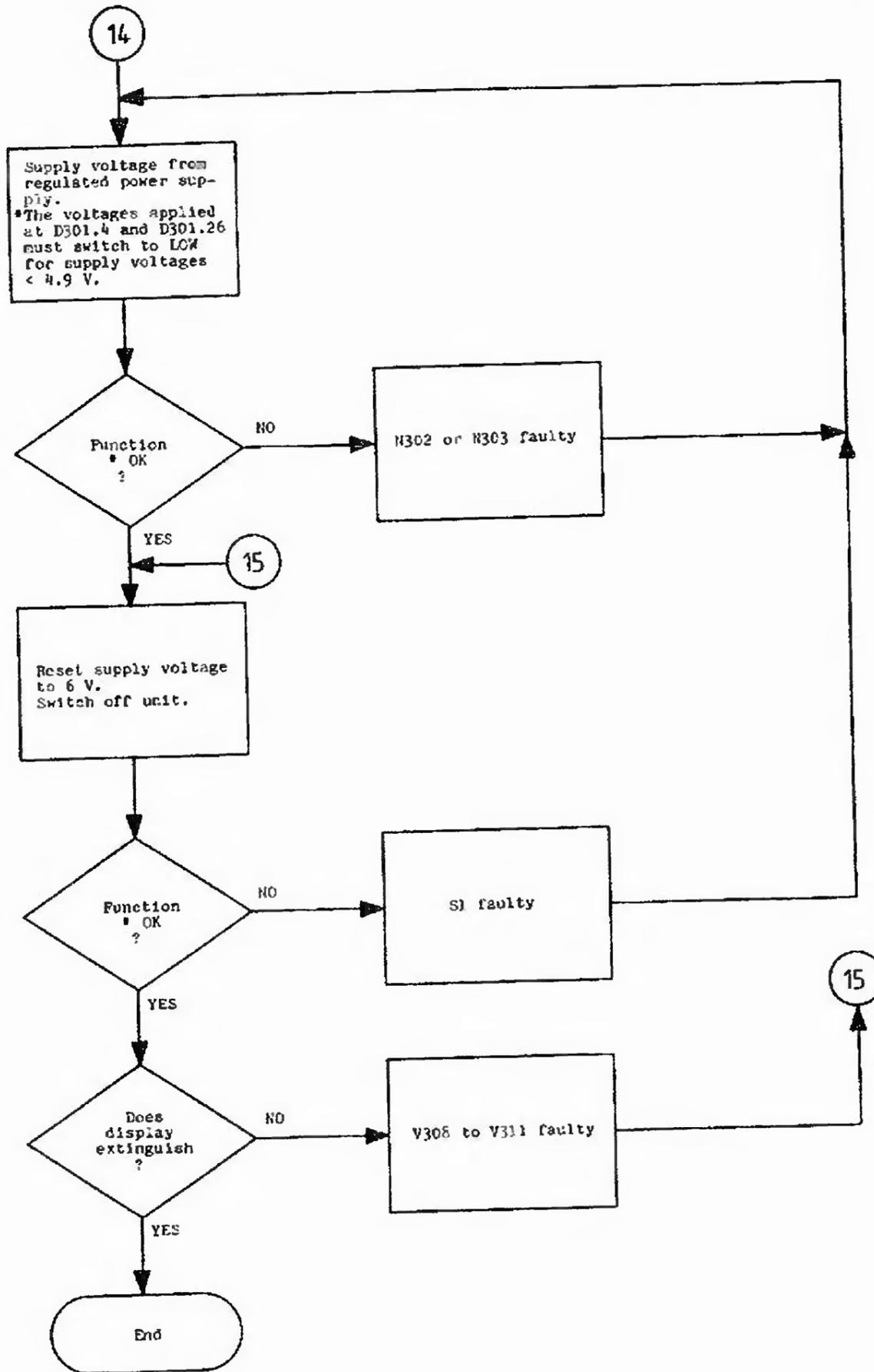
(continued) Control Unit fault tracing chart



(continued) Control Unit fault tracing chart



(continued) Control Unit fault tracing chart

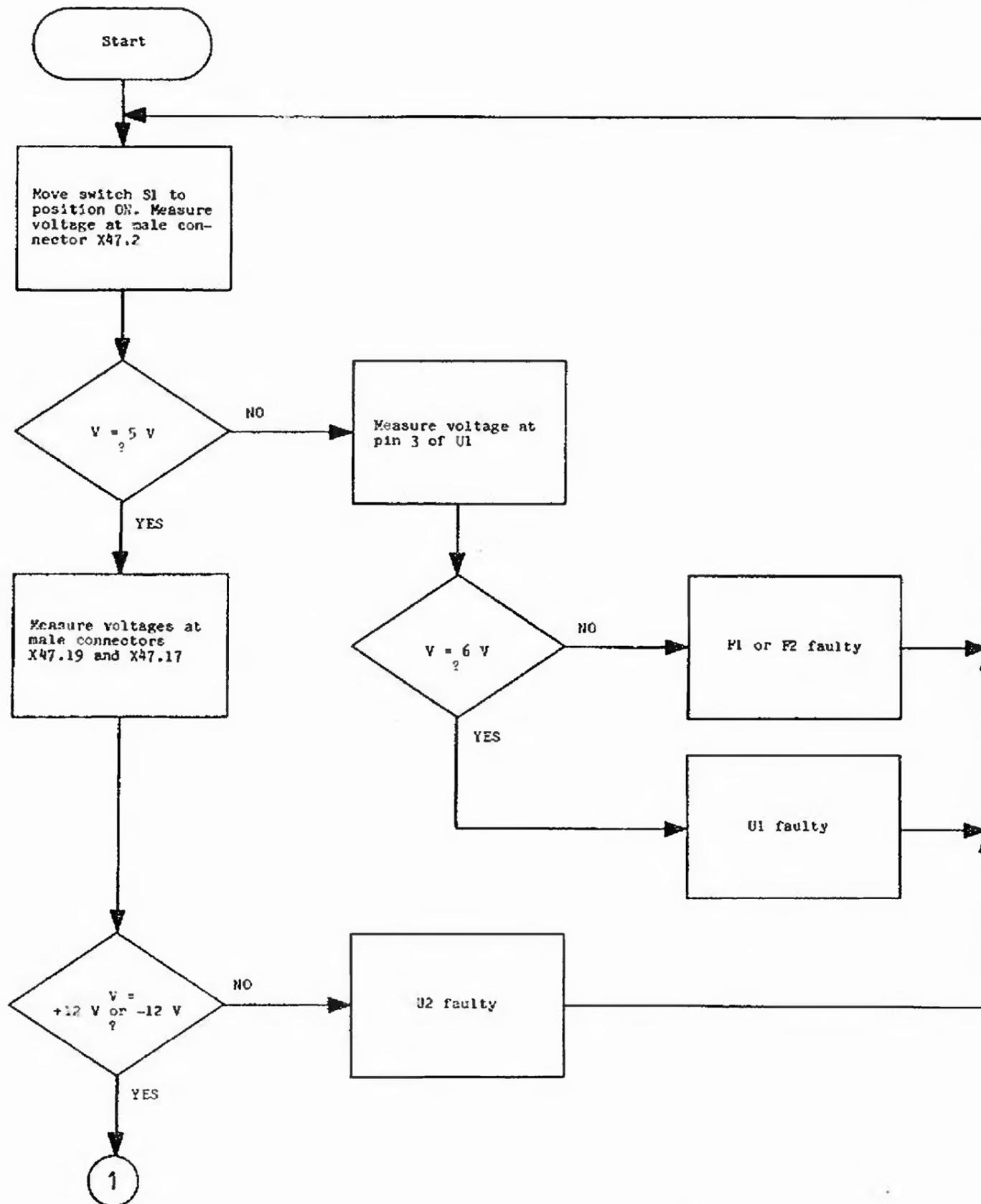


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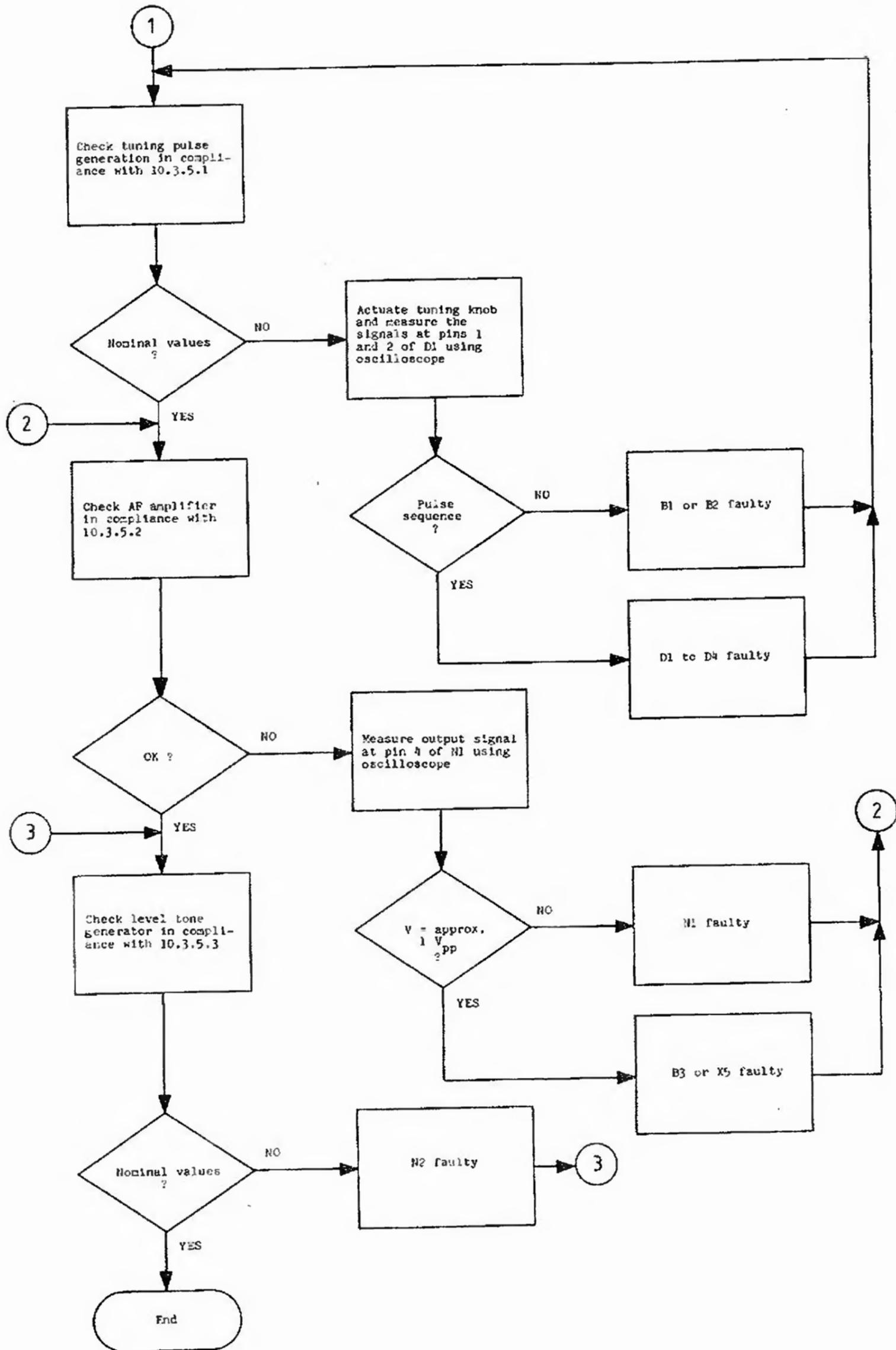
### 10.2.5 Tuning Unit Fault Tracing Chart

Prerequisites for troubleshooting:

- tuning unit is adapted in the receiver,
- operational voltage is applied.



(continued) Tuning Unit fault tracing chart



### 10.3 Electrical Test and Adjustment of Subassemblies

The service manual comprises the following accessories for the electrical test and adjustment of subassemblies:

- Circuit descriptions (section 9)
- Circuit diagrams
- Parts lists
- Parts location plans

The circuit diagrams list the parts location plans which are also included in the annex. The plans indicate the layout of the components and printed tracks. The following sections describe electrical testing and adjustments of the individual subassemblies. Testing of the data sheet specifications is performed in compliance with section 6.

#### 10.3.1 Tuner

The tuner must be adapted in the receiver EB 100 for the performance of the following measurements and adjustments.

##### 10.3.1.1 Checking the Overall Gain

Connect signal generator having an output level of -60 dBm to female connector X66 via DC blocking and frequency analyzer to female connector X64.

Set the following frequencies consecutively on the EB 100 and on the signal generator and measure gain at 629.3 MHz or 117.3 MHz:

Nominal values:	$f_R$ (MHz) (X66)	$f_{IF}$ (MHz) (X64)	Gain
20	20 100 200 300 400 499,999	629,3	+10 +2 dB -3 dB
500			
600			
700			
800			
900	900 999,999	117,3	+10 +6 dB -5 dB
999,999			

10.3.1.2 Checking the 40-dB Attenuator

Connect signal generator having an output level of -60 dBm to female X66 via DC blocking.

Unsolder cable W11 from terminal 8 of the 40-dB attenuator and solder test cable for frequency analyzer to terminal 8.

Set  $f = 200$  MHz on signal generator and move the switch for the attenuator from position 0 dB to -40 dB on the EB 100.

The indication on the frequency analyzer must decrease by 40 dB. Resolder cable W11.

10.3.1.3 Checking the 1st VHF/UHF Amplifier and 1000-MHz Lowpass Filter

Unsolder cable W62 from terminal 5 of the PIN diode switch D60 and connect to test cable. Open line connecting 1000 MHz lowpass filter to mixer and solder second test cable. Connect sweep tester to test cables and sweep in the range 20 to 1300 MHz.

Nominal values: gain  $10 \pm 3$  dB  
attenuation at 1250 MHz  $\geq 15$  dB

Set passband characteristic of the 1000 MHz lowpass filter using trimmer C70 and C71 such that the passband characteristic does not decrease at 1000 MHz.

Unsolder test cable and restore original connections.

10.3.1.4 Checking 1st Mixer

Open signal path at terminal X of mixer N80 and solder test cable to terminal X.

Connect signal generator to female connector X66 via DC blocking having an output level of -60 dBm and frequency analyzer to test cable.

Set several frequencies ranging from 20 to 499.999 MHz on the signal generator and on the EB 100.

Measure mixture product at  $f = 629.3$  MHz using frequency analyzer.

Nominal value of gain:  $2 \begin{matrix} +4 \text{ dB} \\ -2 \text{ dB} \end{matrix}$

Set several frequencies ranging from 500 to 999.999 MHz on the signal generator and on the EB 100.

Measure mixture product at  $f = 117.3$  MHz using frequency analyzer.

Nominal value of gain:  $4 \begin{matrix} +7 \text{ dB} \\ -4 \text{ dB} \end{matrix}$

Unsolder test cable and restore original connection.

#### 10.3.1.5 Checking 2nd VHF/UHF Amplifier

Open signal path preceding capacitor C93 and solder test cable there.

Connect sweep tester to test cable and to female connector X64 and sweep in the range of 100 to 130 MHz. Set a frequency ranging from 500 to 999.999 MHz on the EB 100.

Nominal value of gain at 117.3 MHz: 6 to 9 dB

Adjust the top of the characteristic of the 117.3-MHz bandpass filter for optimum symmetry in compliance with 10.3.1.12, if necessary.

Unsolder test cable and restore original connection.

#### 10.3.1.6 Checking the Input Signal Path for $f \geq 500$ MHz

Unsolder cable W62 from terminal 5 of PIN diode switch D60 and solder test cable in its place.

Connect sweep tester to female connector C66 and to test cable via DC blocking and sweep in the range of 500 to 1000 MHz.

Set frequencies consecutively from 500 to 999.999 MHz in steps of 50 MHz and measure the gain of the set frequency.

Nominal value:  $3 \pm 4$  dB

Trim gain in the 999.999 MHz setting to maximum using potentiometer R2 for adjustment of tracking filter.

Unsolder test cable and restore original connection.

10.3.1.7 Checking the UHF Amplifier

Unsolder inner conductor of cable W40 from coil L51 and connect to inner conductor of test cable. (Solder outer conductor of test cable to shield).

Set a frequency in the range from 500 to 999.999 MHz on the EB 100 and move the switch for the 40-dB attenuator in 0-dB position.

Connect sweep tester to female connector X66 and to test cable via DC isolation and sweep in the range of 500 to 999.999 MHz.

Nominal values:	Gain at 500 MHz	11 ±2 dB
	Gain at 1000 MHz	2 ±2 dB

Unsolder test cable and restore original connection.

10.3.1.8 Checking the Input Signal Path for  $f < 500$  MHz

Unsolder inner conductor of cable W62 from terminal 5 of PIN diode switch D60 and solder test cable in its place.

Connect sweep tester to female connector X66 and to test cable via DC isolation and sweep in the range of 10 to 600 MHz.

Move switch for 40-dB attenuator to the 0-dB position on the EB 100 and set consecutively one frequency each from the ranges 20 to 107.999 MHz, 108 to 219.999, 220 to 499.999 MHz and to measure the passband attenuation.

Nominal values:	-4 ±1 dB
-----------------	----------

The filter for the range of 108 to 219.999 MHz can be adjusted by bending the air-cored coils L20 to L23 and L25 with L22 being primarily used for the bandwidth. The air-cored coils L20, L21 and L25 determine the edge of passband and the ripple.

Nominal value of attenuation at 60 MHz: -35 ±5 dB

Nominal value of attenuation at 300 MHz: -35 ±5 dB

Adjust the IF trap to 629.3 ±1 MHz using trimmer C27.

The filter for the range of 220 to 499.999 MHz can be adjusted by bending the air-cored coils L30 to L33 and L35.

Nominal value of attenuation at 125 MHz:  $-35 \pm 1$  dB

Nominal value of attenuation at 550 MHz:  $-15 \pm 3$  dB

Adjust the IF trap to  $629.3 \pm 1$  MHz using trimmer C35.

#### 10.3.1.9 Checking 2nd Mixer and Subsequent Amplifier

Open signal path preceding capacitor C93 and solder test cable.

Connect sweep tester to test cable and to female connector X64 and sweep in the range of 600 to 650 MHz.

Set a frequency in the range of 20 to 499.999 MHz on the EB 100.

Nominal value of gain at 629.3 MHz: 5 to 11 dB

Adjust the 629.3-MHz filter in compliance with 10.3.1.11 and the 117.3-MHz bandpass in compliance with 10.3.1.12.

Unsolder test cable and restore original connection.

#### 10.3.1.10 Adjustment of the 650-MHz Lowpass Filter

Open signal path between terminal X of the mixer N80 and the capacitor C89.

Solder test cable to capacitor C89.

Unsolder capacitor C93 and solder test cable to the connection between coil L91 and capacitor C92.

Connect sweep tester to test cable and sweep in the range of 20 to 1000 MHz.

Adjust passband by bending coils L90 and L91 such that the characteristic does not decrease at 630 MHz.

Nominal value of transmission loss at 117.3 MHz:  $1 \pm 0.5$  dB

Nominal value of transmission loss at 629.3 MHz:  $1 \pm 0.5$  dB

Unsolder test cable and restore original connections.

10.3.1.11 Adjustment of the 629.3-MHz Bandpass Filter

Unsolder capacitors C100 and C101 and solder two test cables in their places.

Connect sweep tester to test cable and sweep in the range of 500 to 700 MHz.

Adjust centre frequency to 629.3 MHz using trimmers C103 and C104. The filter characteristic must have a symmetrical top.

Change distance between coils L100, L101 and the PC board by bending and set 3-dB filter bandwidth to 5.8 MHz.

Nominal values: Centre frequency ..... 629.3 MHz  
 3-dB bandwidth ..... 5.8 MHz  $\pm 10$  %  
 Transmission loss ..... 4  $\begin{matrix} +0.5 \text{ dB} \\ -1 \text{ dB} \end{matrix}$   
 Attenuation at 700 MHz ... > 40 dB

Unsolder test cable and restore original connections.

10.3.1.12 Adjustment of 117.3-MHz Bandpass Filter

Unsolder inner conductor of cable W90 from terminal 8 of PIN diode switch D100 and solder test cable in its place.

Connect sweep tester to test cable and female connector X64 and sweep in the range of 100 to 130 MHz.

Set a frequency in the range of 500 to 999.999 MHz on the EB 100.

Adjust centre frequency to 117.3 MHz using cores of L112, L114 and L115. A symmetrical characteristic must be produced in the passband.

Nominal values: Centre frequency ..... 117.3 MHz  $\pm 20$  kHz  
 3-dB bandwidth ..... 2 MHz  $\pm 15$  %  
 Transmission loss ..... 7  $\begin{matrix} +0,5 \text{ dB} \\ -1 \text{ dB} \end{matrix}$   
 Attenuation at 128 MHz ... > 45 dB  
 Attenuation at 138 MHz ... > 50 dB

Unsolder test cable and restore original connections.

### 10.3.2 IF Section

The IF section must be adapted in the receiver EB 100 for performing the following measurements and adjustments.

#### 10.3.2.1 Overall Check of IF Section

1) Connect signal generator to female connector X74 and perform the following settings:

$f = 117.3$  MHz at a level of  $40$  dB $\mu$ V ( $-67$  dBm).

AM with  $f_{\text{mod}} = 1$  kHz and  $m = 0.5$

Set IF bandwidth to  $150$  kHz on the EB 100.

Measure the AF signal at test point 3 using oscilloscope.

Nominal values:  $f = 1$  kHz at a level of  $150$  mV $_{\text{pp}} \pm 3$  dB

Decrease output level of signal generator to  $10$  dB $\mu$ V ( $-97$  dBm) to adjust AF signal.

Measure AF signal at pin 15 of N40 using oscilloscope and IF control voltage at pin 16 of N40 using voltmeter.

Adjust to maximum AF level and minimum IF control voltage using coil L41.

Nominal values:  $V_{\text{AF}} = 20$  mV $_{\text{pp}} \pm 5$  mV  
 $V_{\text{con}} = 2.3$  V

2) Switch signal generator to FM and increase output level once more to  $40$  dB $\mu$ V ( $-67$  dBm).

Set deviation on signal generator and IF bandwidth of the EB 100 in compliance with the following table.

Nominal values:

Deviation	IF Bandwidth	AF Voltage
22 kHz	150 kHz	300 mV $_{\text{pp}}$
6 kHz	15 kHz	200 mV $_{\text{pp}}$
2.2 kHz	7.5 kHz	150 mV $_{\text{pp}}$

Set deviation on signal generator to  $40$  kHz and IF bandwidth to  $150$  kHz for adjusting the FM discriminator.



- 3) Apply an AF signal of 1 kHz at a level of  $10 \text{ mV}_{pp}$  at pin 15 of N40 using signal generator.  
Check at test point 3 using the oscilloscope whether an AF signal is available.

#### 10.3.2.4 Checking the Output and Control Signals

##### 1) Frequency deviation

Connect signal generator to female connector X74 and enter  $f = 117.3 \text{ MHz}$  at a level of  $40 \text{ dB}_{\mu\text{V}}$ .  
Measure logic level at male connector X77.B8 using voltmeter.

Nominal value: L level (0 to 1 V)

Set L level (0 to 1 V) at male connector X77.B8 using potentiometer R13 for adjustment of window discriminator at  $f = 117.3 \text{ MHz}$ .

Detune signal generator in steps of 100 Hz from nominal frequency until signal switches to H level (3.5 to 5 V) at male connector X77.B8.

Nominal value: squelch switching point  
<  $\pm 1.5 \text{ kHz}$  from  $f_{\text{centre}}$

##### 2) Signal level (0 to 80 dB)

Apply  $f = 117.3 \text{ MHz}$  at a level of  $10 \text{ dB}_{\mu\text{V}}$  ( $-97 \text{ dBm}$ ) into the female connector X74 using the signal generator.  
Measure voltage at male connector X77.B4.

Nominal value:  $V = 0.47 \text{ V}$

Increase input level to  $80 \text{ dB}_{\mu\text{V}}$  ( $-27 \text{ dBm}$ ) and measure voltage at male connector X77.B4.

Nominal value:  $V = 3.50 \text{ V}$

Adjustment to the nominal values is to perform with potentiometer R101. At an input level  $40 \text{ dB}_{\mu\text{V}}$  ( $-67 \text{ dBm}$ ) set an output voltage of 1.85 V with potentiometer R101. The nominal values must be checked at  $10 \text{ dB}_{\mu\text{V}}$  and  $80 \text{ dB}_{\mu\text{V}}$ . When the level characteristic of the first 20 dB is too flat it can be compensated with potentiometer R37. This adjustment is to repeat several times.

Set bandwidth control to 150 kHz "Pulse" and repeat the above measuring. When increasing the input level the indicator voltage is following quickly the indexed value. When decreasing the input level (e.g. -10 dB) the indicator voltage declines slowly to the nominal value.

### 3) Level blanking

Set bandwidth control to 150 kHz, feed an input level 50 dB $\mu$ V and measure a scale level (aprox. 2.3 V) at plug X77.B4.

Low level = 0 V at plug X77.A7.

Scale level breaks down to 0 V.

High level = 5 V at plug X77.A7. The nominal scale level is indicated.

### 4) AFC Enable (ENAFc)

Apply  $f = 117.3$  MHz at a level of 10 dB $\mu$ V into the female connector X74.

Measure voltage at male connector X77.A4.

Nominal value: L level (0 to 1 V)

To adjust to nominal value, set L level (0 to 1 V) at male connector X77.A4 using potentiometer R30 at an input level of 10 dB $\mu$ V (-97 dBm).

### 10.3.2.5 Checking the Oscillator Reference Signals

Terminate female connectors X71 and X72 into 50  $\Omega$ .

Connect power meter to female connector X73 and measure output level at 512 MHz.

Nominal values:	Output power .....	5 dBm	+2 dB
			-1 dB
	Nonharmonics .....	< 75 dB	

Set output power to maximum using trimmers C100 to C102 for adjustment.

### 10.3.3 Synthesizer

The synthesizer must be adapted in the EB 100 for performing the following measurements.

#### 10.3.3.1 Checking the Oscillator Signal

Set EB 100 to 500.000 MHz.

Measure frequency and level of output signal at female connector X55 using frequency analyzer.

Nominal value:  $f = 617.3 \text{ MHz at } -4 \pm 3 \text{ dBm}$

#### 10.3.3.2 Checking the Oscillator and the 512-MHz Mixer

1) Remove plug-in jumper X5.

Unsolder tuning voltage lead to oscillator from solder terminal 7.

Connect power supply 0 to 25 V to solder terminal 7 and apply tuning voltage.

Measure frequency and level of output signal at female connector X55 using the frequency analyzer.

Nominal values:  $2,5 \pm 0.3 \text{ V} \rightarrow f = 617 \text{ MHz, } -4 \pm 3 \text{ dBm}$   
 $23 \pm 0.5 \text{ V} \rightarrow f = 1129 \text{ MHz; } -4 \pm 3 \text{ dBm}$

2) Terminate female connector X55 into 50  $\Omega$ .

Tune oscillator over the entire frequency range by changing the tuning voltage (2.5 to 23 V) and measure the mixture product (105 to 617 MHz) at male connector X5.2 using the frequency analyzer.

Nominal value:  $0 \begin{matrix} +4 \text{ dBm} \\ -2 \text{ dBm} \end{matrix}$

3) Remove plug-in jumper X4.

Tune oscillators over the entire frequency range by changing the tuning voltage (2.5 to 23 V).

Measure frequency and level of oscillator signal using frequency analyzer.



10.3.4.1 Checking the System Clock

Measure clock signal at pins 2 and 3 of CPU D301 using the oscilloscope.

Nominal value:  $f = 6 \text{ MHz}$

10.3.4.2 Checking the Reading and Writing Signals

Check by means of the oscilloscope whether the signals  $\overline{WR}$  (pin 21) and  $\overline{RD}$  (pin 20) of D306 are activated.

Nominal values: Low level when accessing a memory or external circuits

10.3.5 Tuning Unit

The tuning unit must be adapted in the receiver EB 100 for performing the following measurements.

10.3.5.1 Checking the Tuning Pulse Generation

Move switch S2 in position  $\uparrow$ .

Turn tuning knob clockwise.

Measure the output signals at male connectors X47.8 (IRQTUN), X47.7 (DOWN) and X47.6 (UP).

Nominal values:

X47.8	Pulse sequence, frequency depends on rotating speed
X47.7	L level
X47.6	Pulse sequence, frequency depends on rotating speed

10.3.5.2 Checking the AF Amplifier

Unsolder capacitor C12 and apply an AF signal of  $f = 1 \text{ kHz}$  and a level of  $150 \text{ mV}_{pp}$  at pin 1 of N1 via a coupling capacitor ( $C = 2.2 \text{ }\mu\text{F}$ ) using the AF generator.

Turn threshold controller on front panel of receiver fully to the left.

The 1-kHz signal must be audible in the loudspeaker.  
Resolder capacitor C12.

### 10.3.5.3 Checking the Level Tone Generator

Unsolder resistor R26.

Connect power supply via resistor R27 and vary voltage from  
0.1 to 3.5 V.

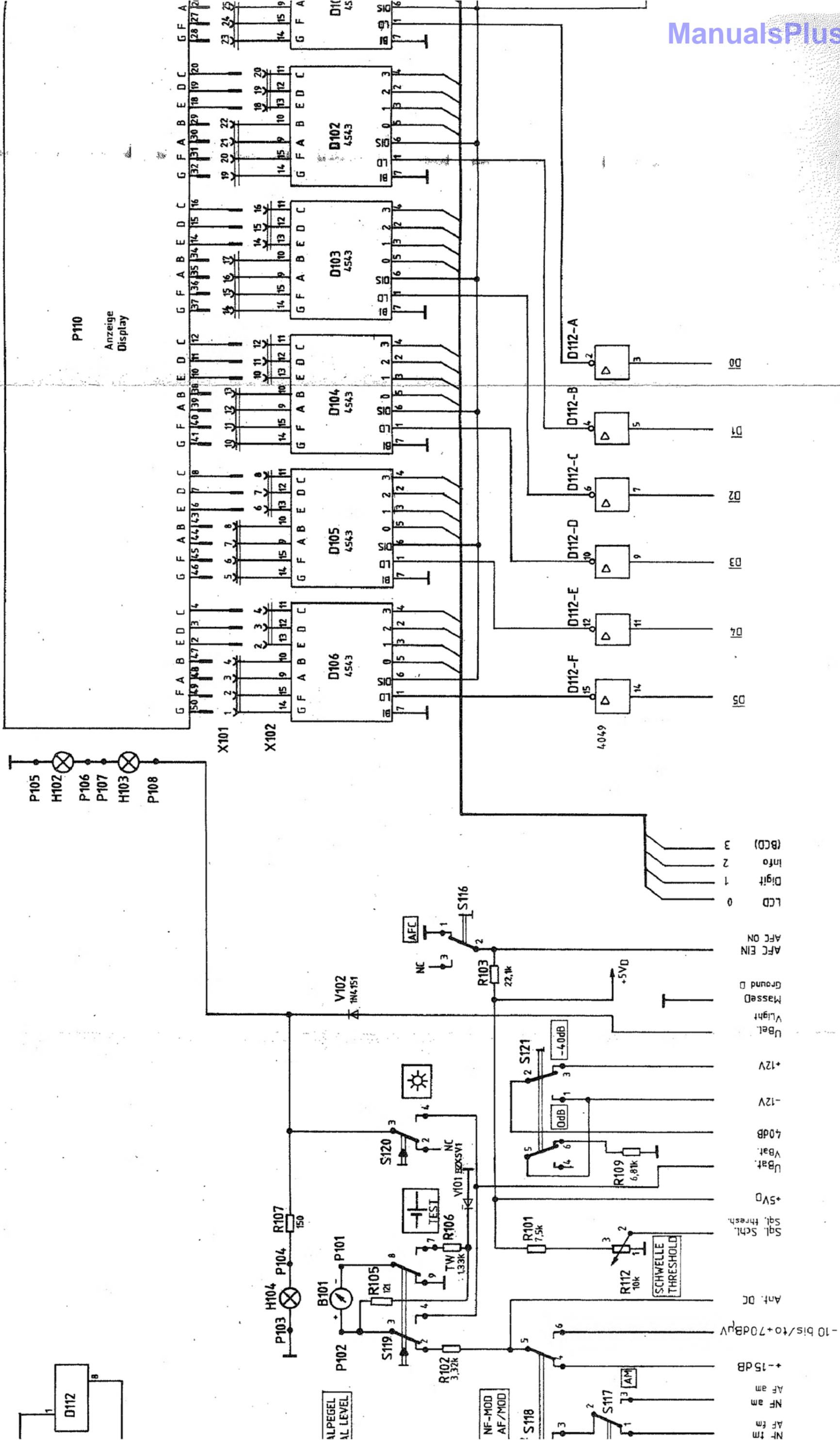
Check output signal at test point 5 using the oscilloscope.

Nominal value:  $f = 200 \text{ Hz to } 1 \text{ kHz}$  at a level of  $150 \text{ mV}_{\text{pp}}$ .

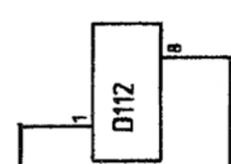
Resolder resistor R26.



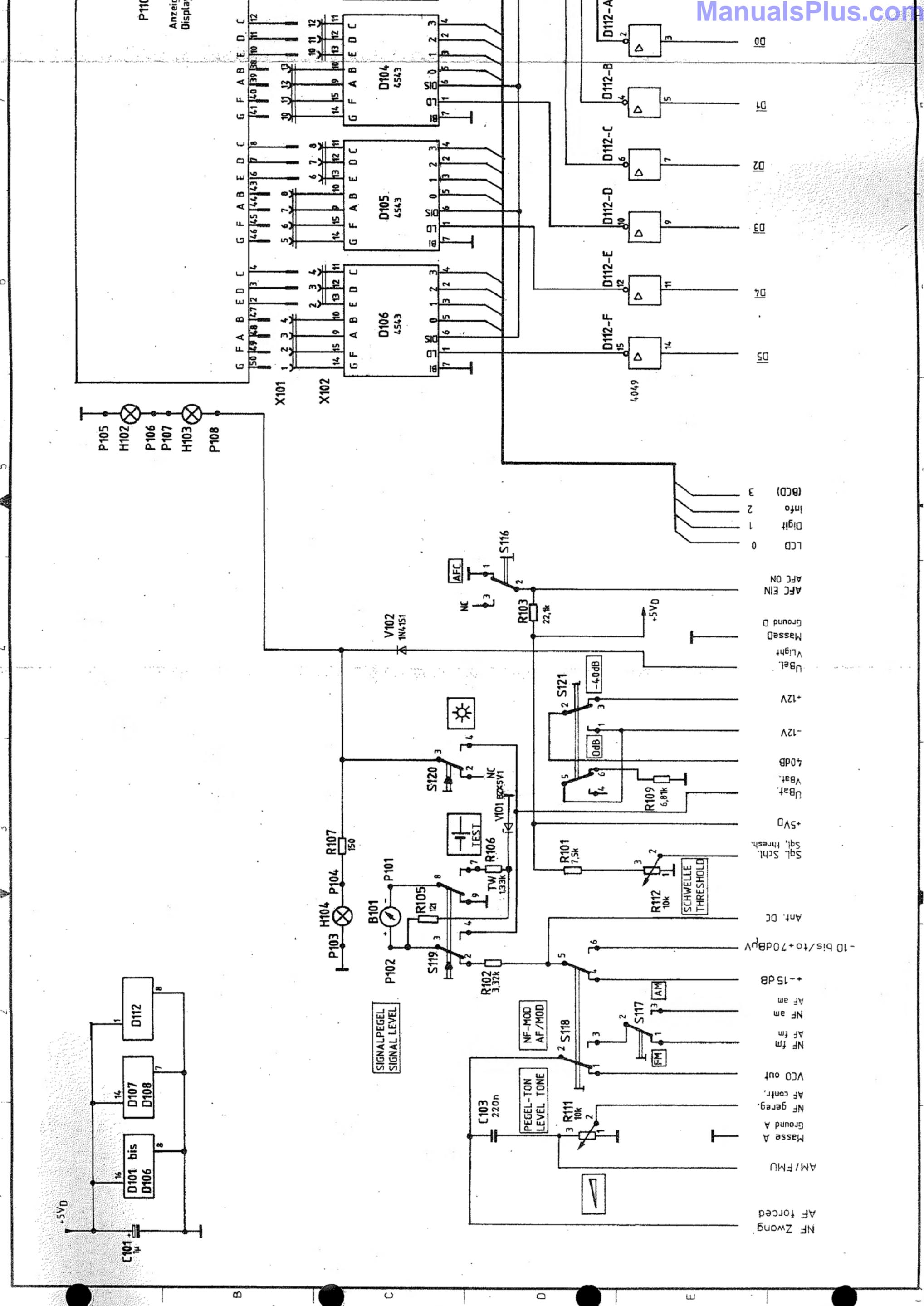
P110  
Anzeige  
Display



- P105
- H102
- P106
- P107
- H103
- P108

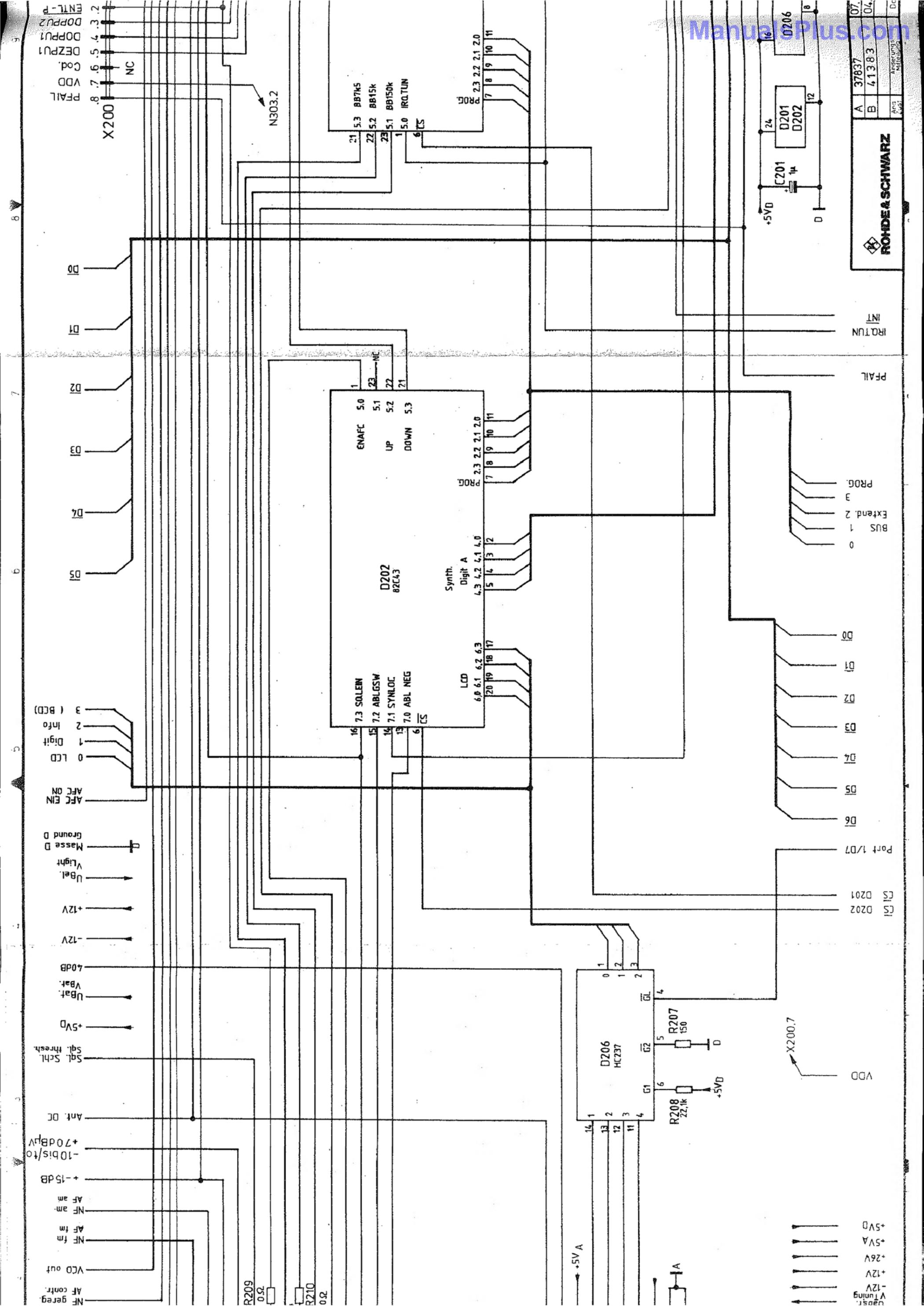


2 3 4 5 6 7 8 9



- NF Zwang
- AM/FMU
- Ground A
- NF gereg.
- AF contr.
- VCO out
- NF fm
- AF fm
- NF am
- AF am
- + -15dB
- 10 bis / to +70dBµV
- Ant. DC
- SqL. Schl.
- SqL. thresh.
- +5Vd
- UBat.
- UBat. 40dB
- 12V
- +12V
- UBat.
- Light
- MasseeD
- Ground D
- AFC EIN
- AFC ON
- LCD
- 0
- 1
- 2
- 3
- Digit
- Info
- 2
- 3
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- D100





ENTL-P  
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DOPPU1  
DEZPU1  
Cod.  
VDD  
FAIL  
X200

N303.2

21 5.3 BB7K5  
22 5.2 BB15K  
23 5.1 BB150K  
1 5.0 IRO.TUN  
6 CS

7 8 9 10 11  
2.3 2.2 2.1 2.0  
PROG.

ENAFc 5.0  
5.1  
UP 5.2  
DOWN 5.3

7.3 SOLEIN  
7.2 ABLGSW  
7.1 SYNLOC  
7.0 ABL NEG  
6 CS

6.0 6.1 6.2 6.3  
20 19 18 17  
LCD

4.3 4.2 4.1 4.0  
5 4 3 2  
Synth. Digit A

0 LCD  
1 Digit  
2 Info  
3 (BCD)

AFC EIN  
Ground D  
Masse D  
Ubel  
V Light  
+12V  
-12V  
Ubat.  
Vbat.  
+5Vd  
Sql. Schl.  
Sql. thresh.  
Ant. DC  
-10dBis/to  
+70dBµV

D0  
D1  
D2  
D3  
D4  
D5  
D6

PFail  
IRO.TUN  
NT

D0  
D1  
D2  
D3  
D4  
D5  
D6

CS D201  
CS D202

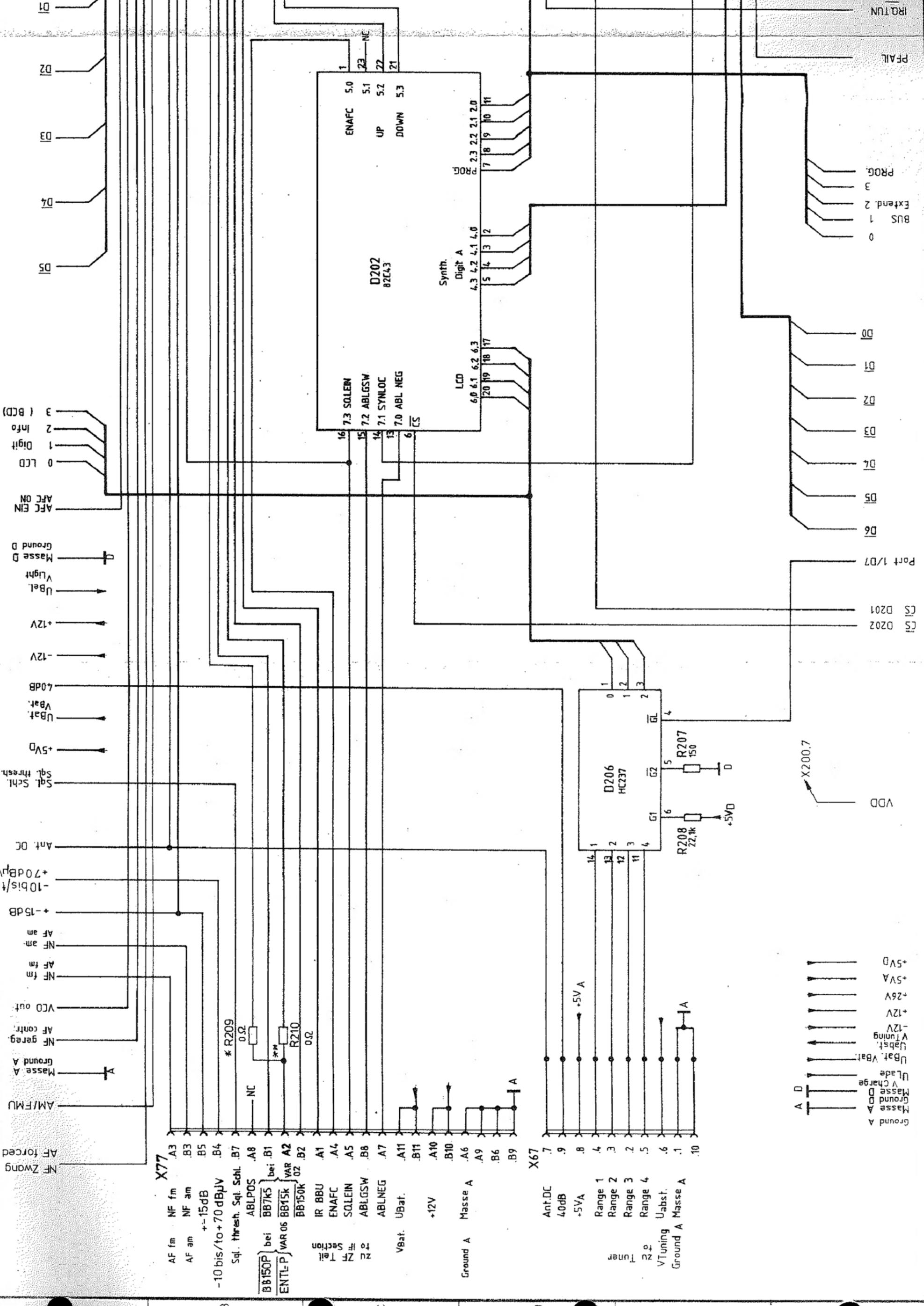
Port 1/07

+5Vd  
+5Va  
+26V  
+12V  
-12V  
V Tuning

R209 0.5Ω  
R210 0.5Ω

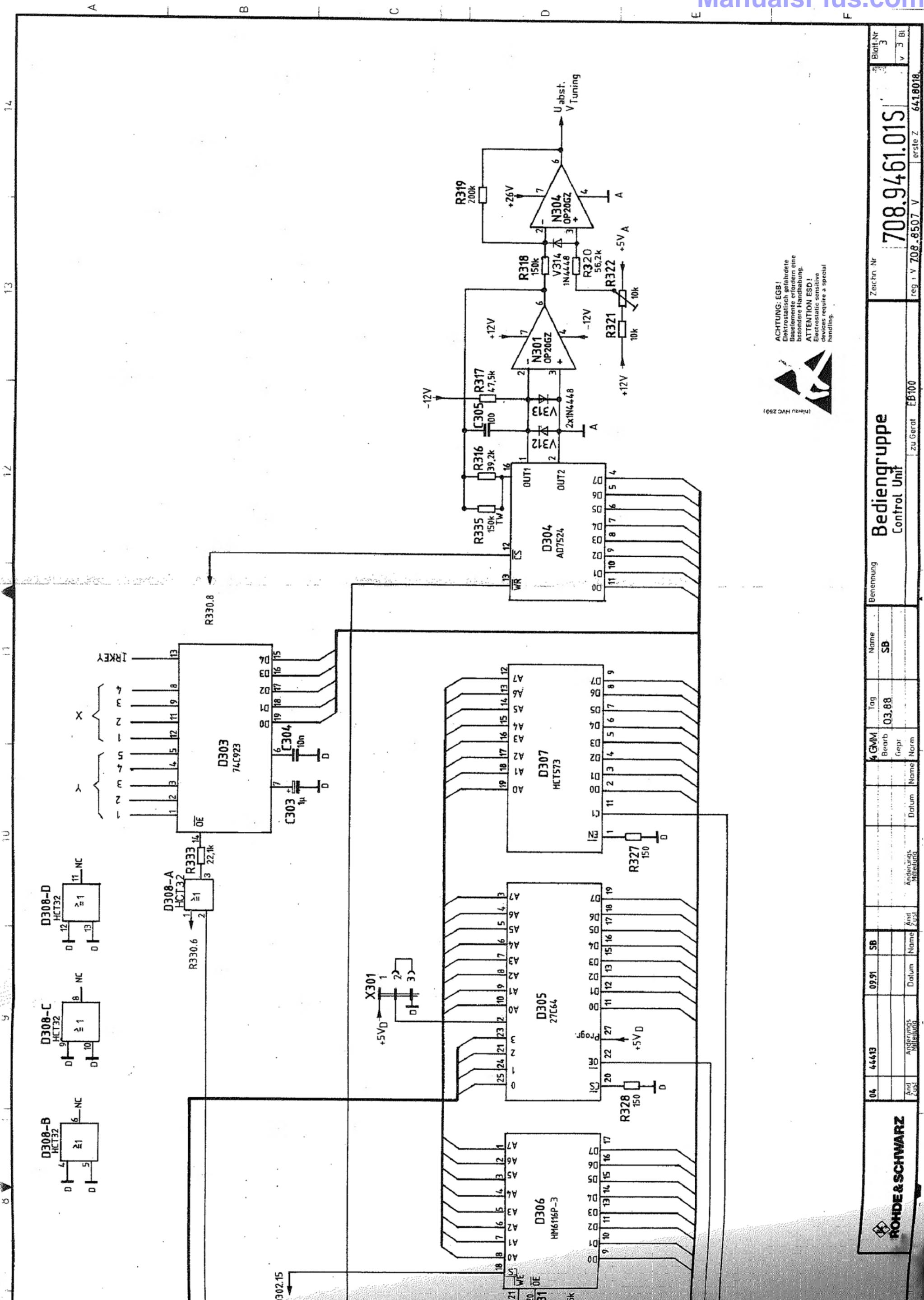
R207 150  
R208 22.1k

C201 1µ



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D100

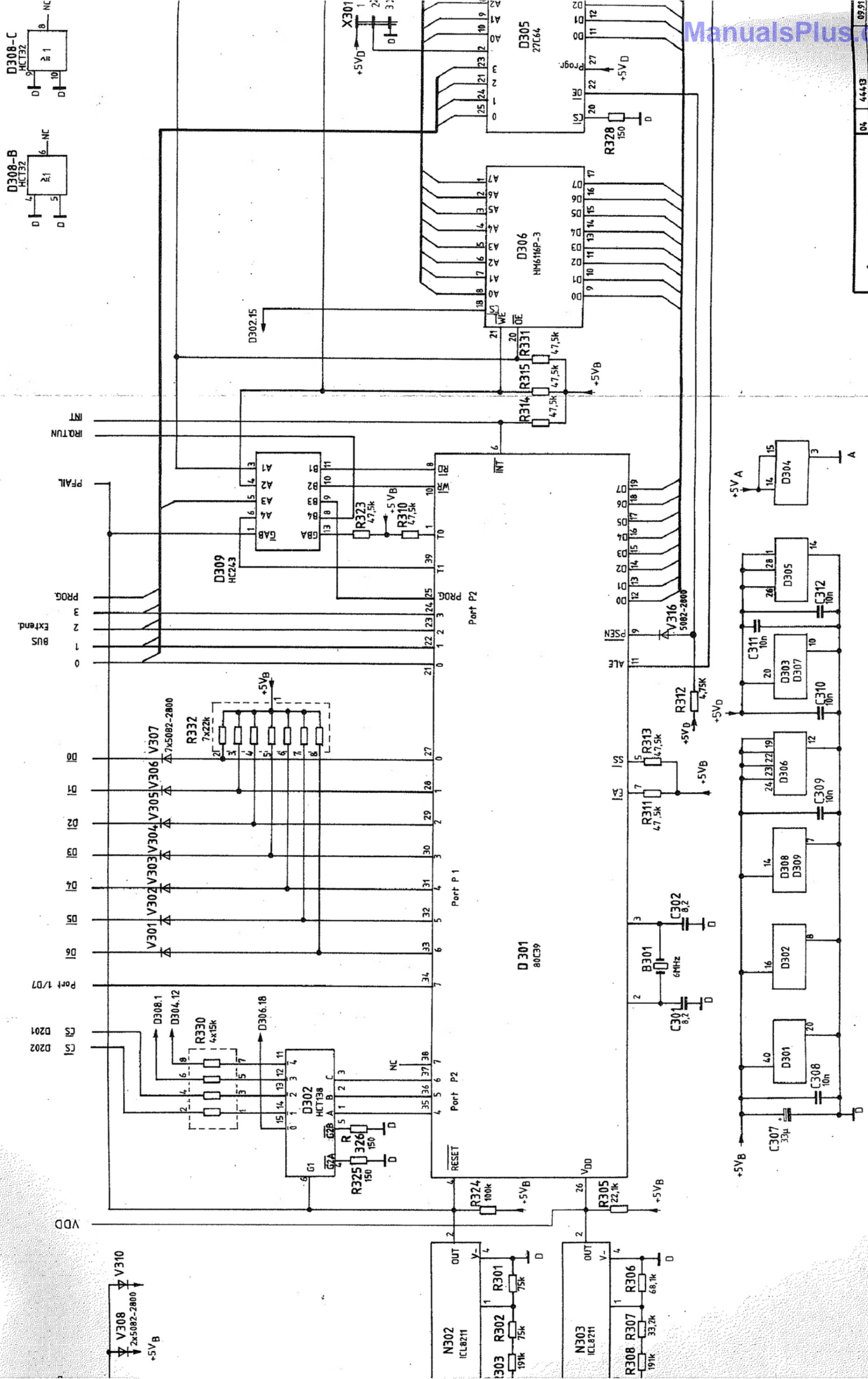
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Extend. 2  
BUS 1  
0  
D0  
D1  
D2  
D3  
D4  
D5  
D6  
Port 1/D7  
CS D201  
CS D202  
VDD  
X200.7  
+5V D  
+5V A  
+26V  
+12V  
-12V  
Uabst. V Tuning  
Ubat. Vbat.  
Ulade V Charge  
Masse D  
Ground D  
Masse A  
Ground A  
A D

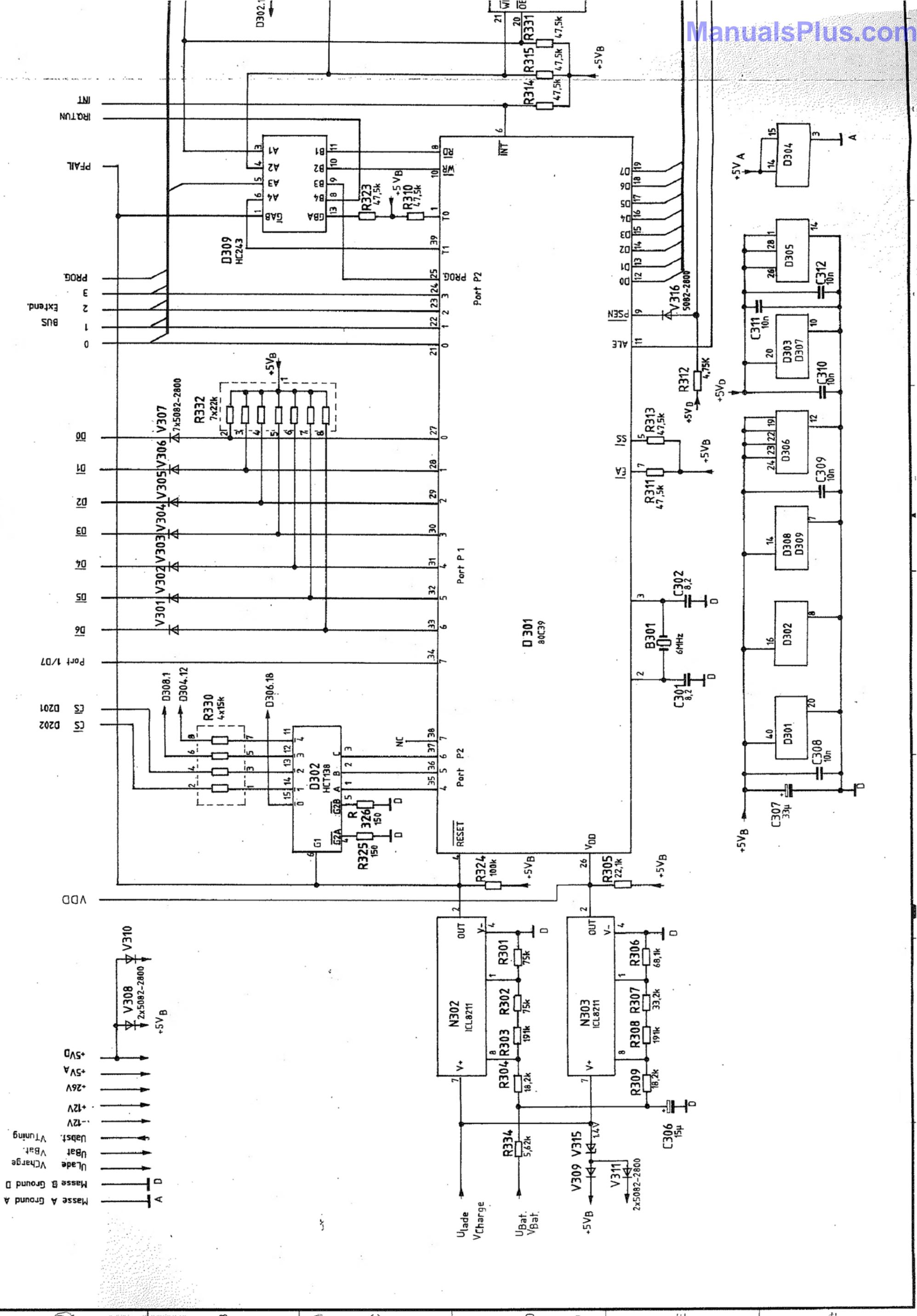


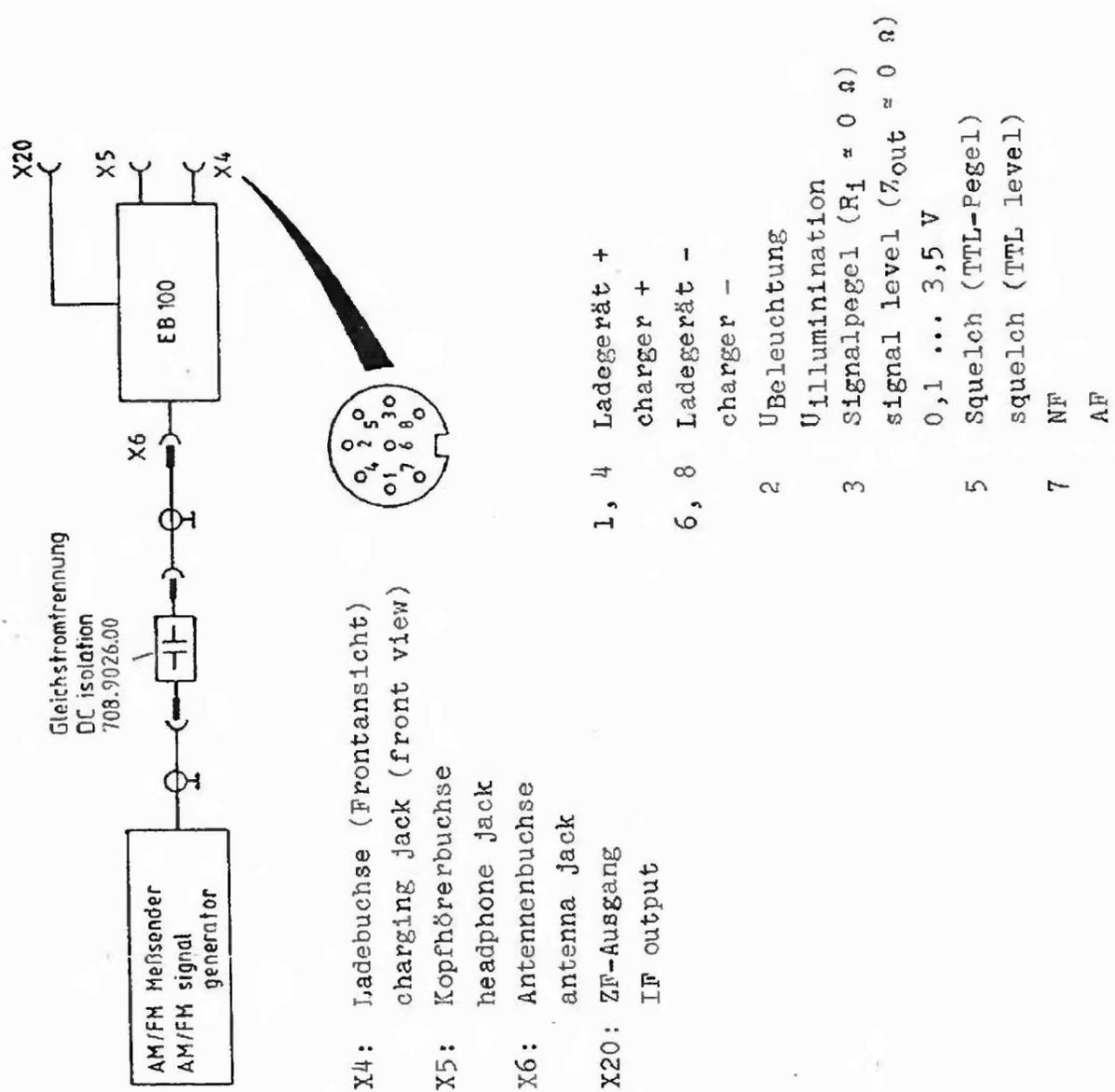

  
**ACHTUNG: ESB!**  
 Elektrostatisch gefährdete  
 Bauelemente erfordern eine  
 besondere Handhabung.  
**ATTENTION ESD!**  
 Electrostatic sensitive  
 devices require a special  
 handling.

Blatt-Nr		3	
Zeichn.-Nr		708.9461.015	
reg. i. V.		708.8507 V	
erste Z.		64.8018	
Benennung		Bediengruppe Control Unit	
Zu Gerät		EB100	
Name		SB	
Tag		03.88	
Bearb.		Gepr.	
Name		Norm	
Datum		Mittelung	
Änderungs-Mittelung		Änderungs-Mittelung	
Änderungs-Mittelung		Änderungs-Mittelung	
Datum		09.91	
Name		SB	
Änderungs-Mittelung		Änderungs-Mittelung	
Änderungs-Mittelung		Änderungs-Mittelung	









- X4: Iadebuchse (Frontansicht)  
charging jack (front view)
- X5: Kopfhörerbuchse  
headphone jack
- X6: Antennenbuchse  
antenna jack
- X20: ZF-Ausgang  
IF output

- 1, 4 Ladegerät +  
charger +
- 6, 8 Ladegerät -  
charger -
- 2 Ubeleuchtung  
illumination
- 3 Signalpegel ( $R_i = 0 \Omega$ )  
signal level ( $Z_{out} = 0 \Omega$ )  
0,1 ... 3,5 V
- 5 Squelch (TTL-Pegel)  
squelch (TTL level)
- 7 NF  
AF

Bild 11-1 Meßaufbau zur Funktionsprüfung  
Fig. 11-1 Test set-up for functional test

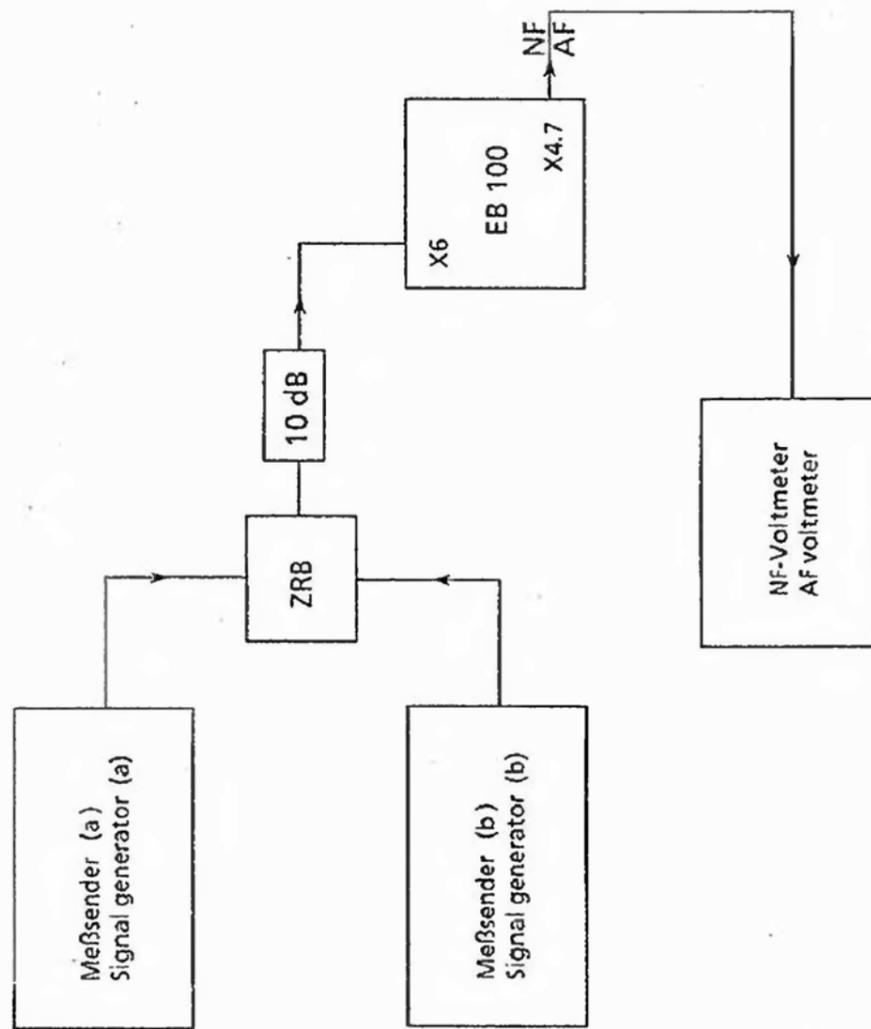


Bild 11-2 Meßaufbau zur Prüfung 3-dB-Bandbreite 150 kHz

Fig. 11-2 Test set-up for checking the 3-dB bandwidth 150 kHz

Testburst-Erzeugung  
Test burst generation

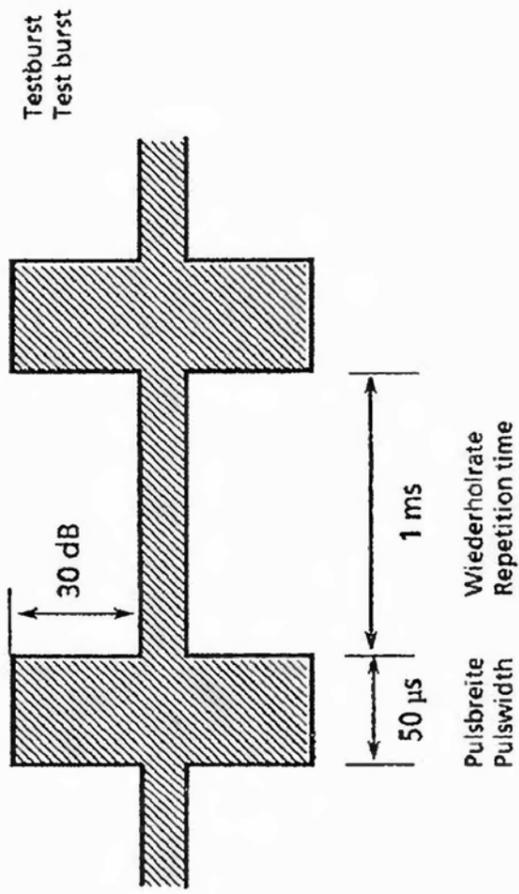
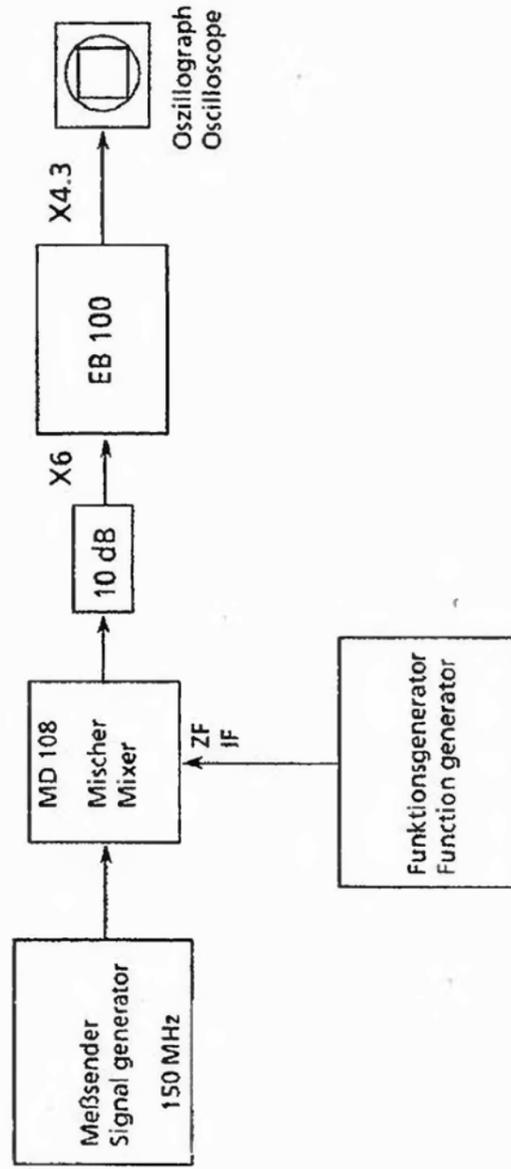


Bild 11-3 Meßaufbau zur Prüfung des Spitzengleichrichters  
Fig. 11-3 Test set-up for checking the peak rectifier

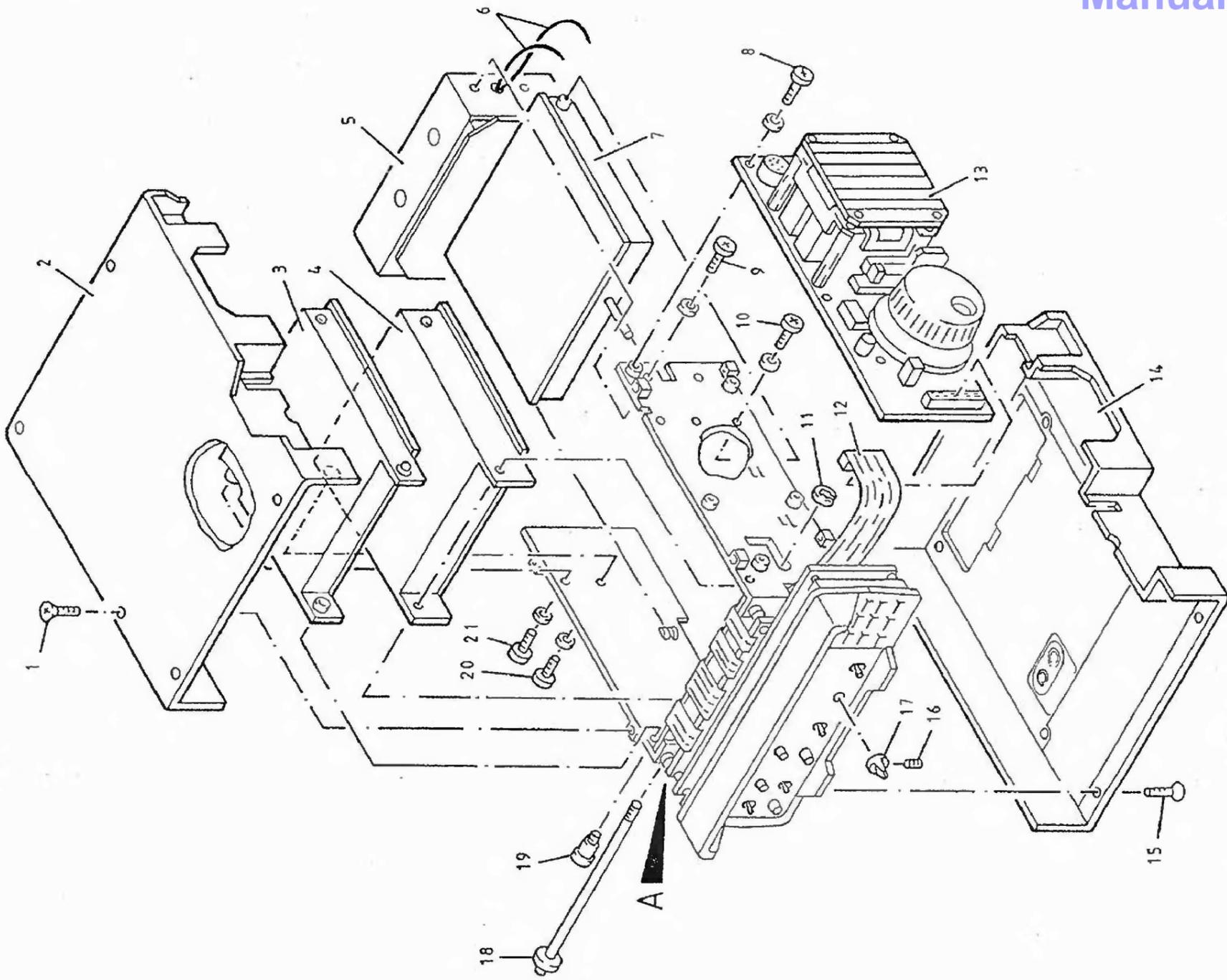
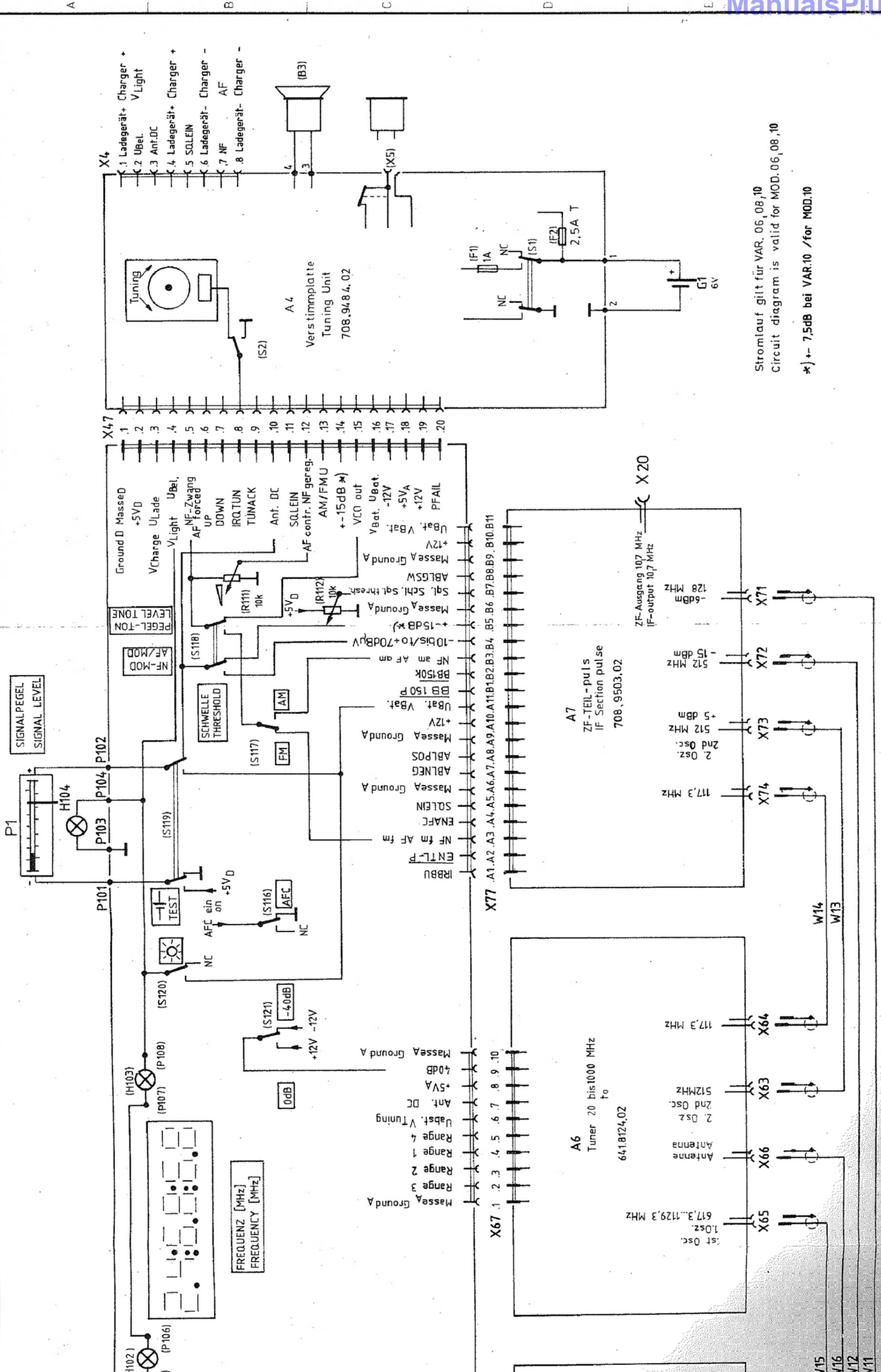
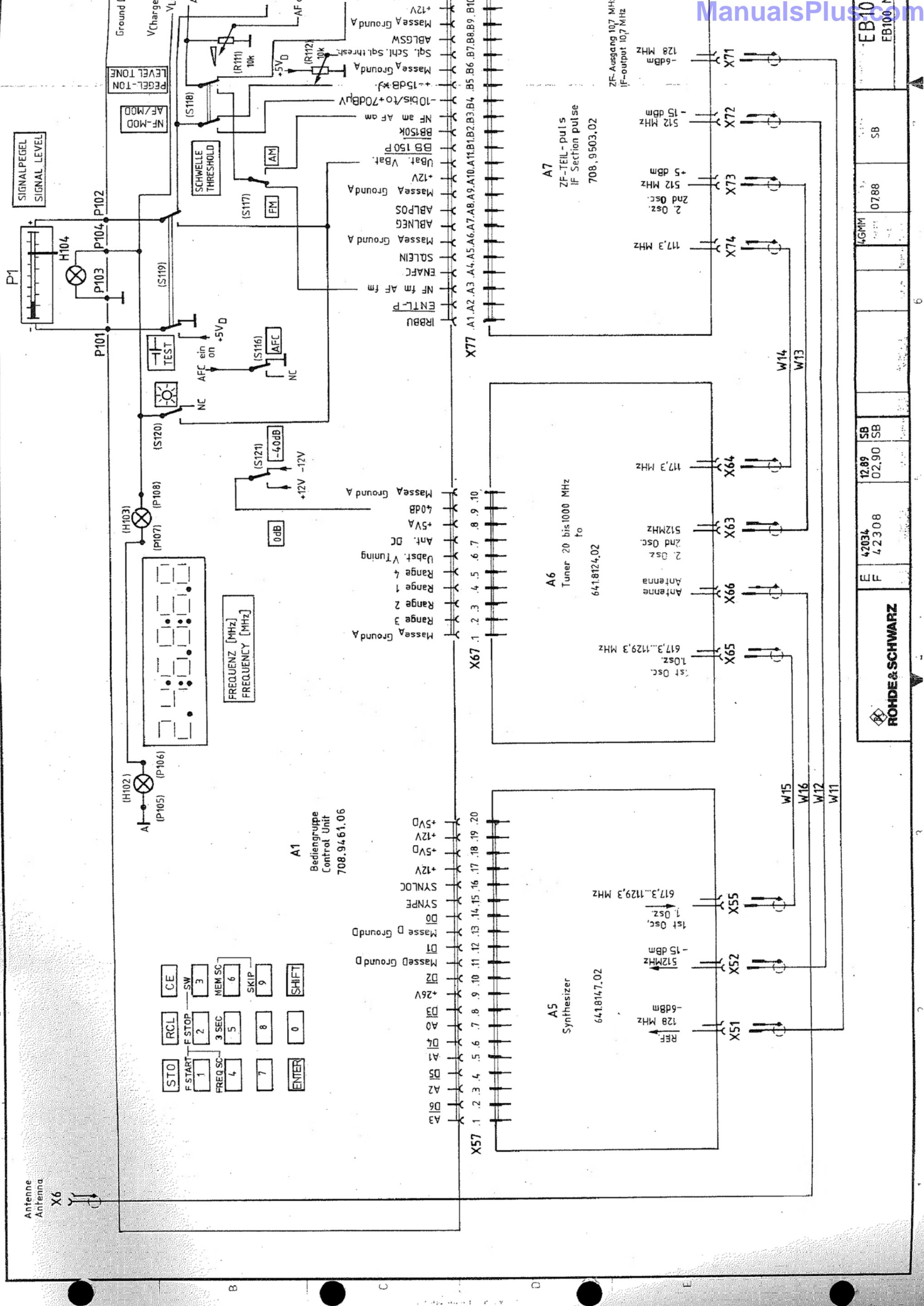


Bild 11-4 Ausbau der Baugruppen (ohne Bedienteil)  
Fig. 11-4 Removal of assemblies (without control unit)



Stromlauf gilt für VAR. 06,08,10  
 Circuit diagram is valid for MOD. 06,08,10  
 \*) +- 7,5dB bei VAR.10 / for MOD.10

ROHDE & SCHWARZ		E	42034 42308	SB	12.89 02.90	SB	07.88	SB	EB100 Miniport Receiver		641.8018.01 S
EB100											



**ROHDE & SCHWARZ**

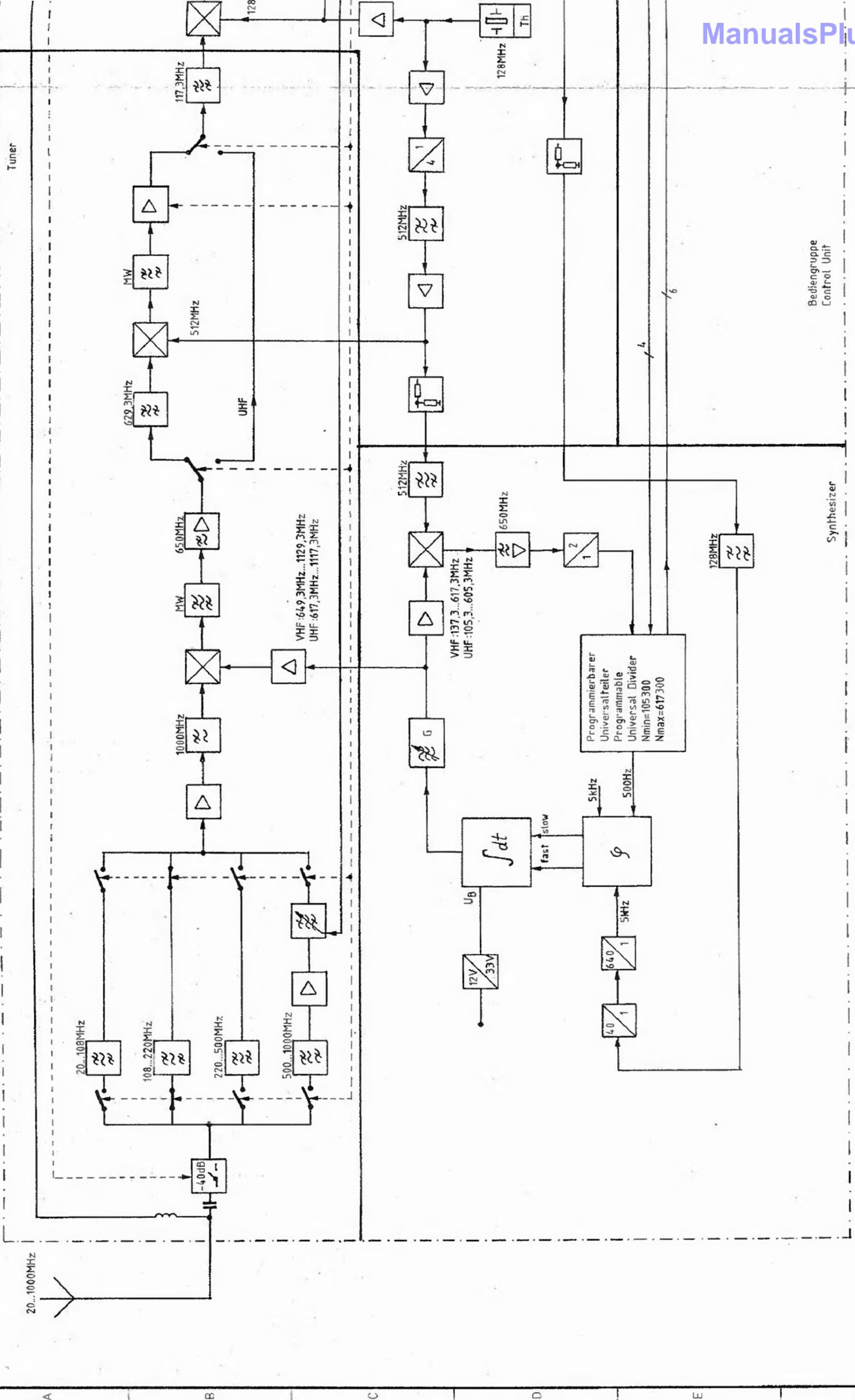
E F 42034 4.23.08 SB SB

4GMM 0788 SB

EB100 EB100 Minif

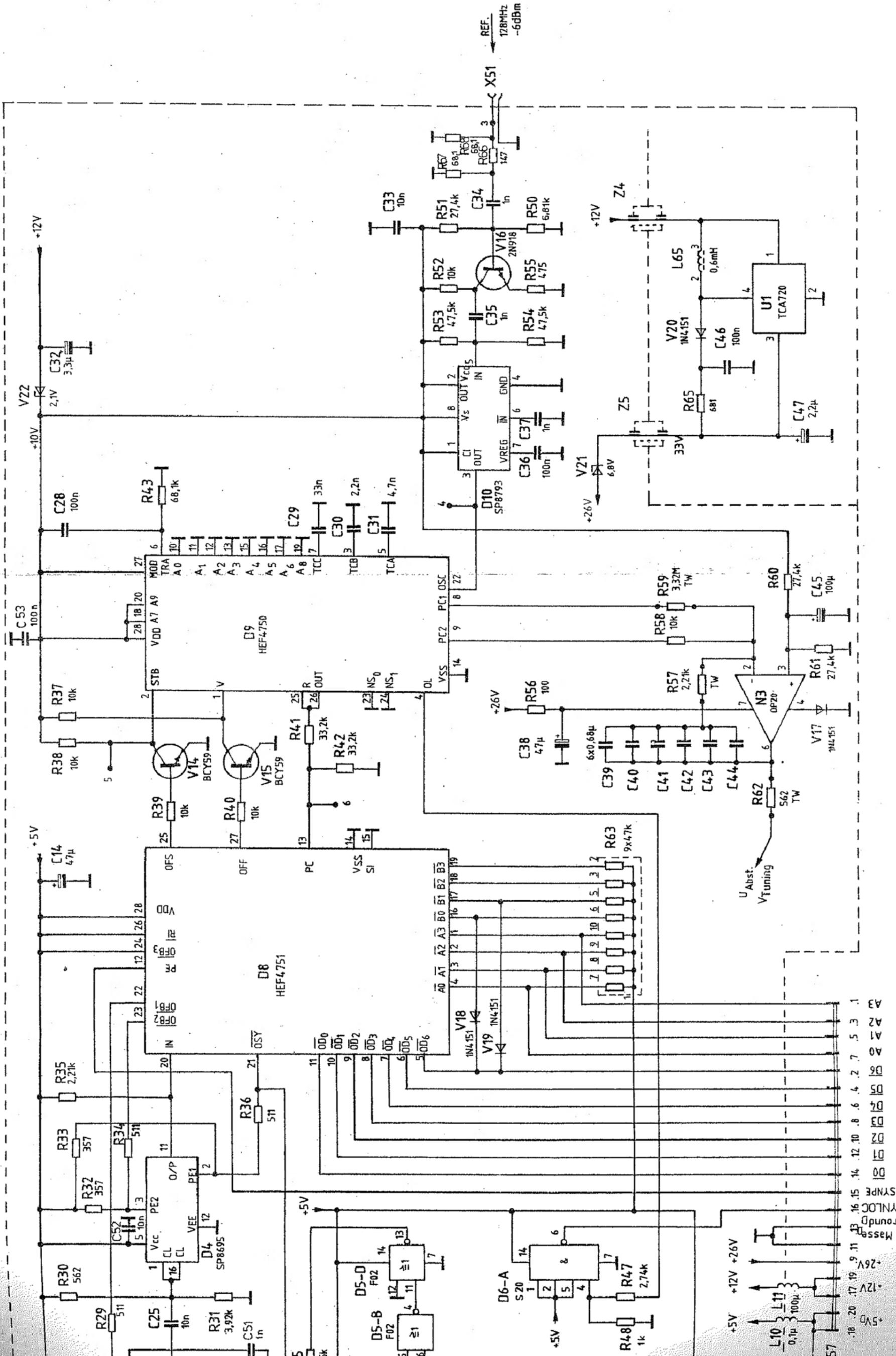






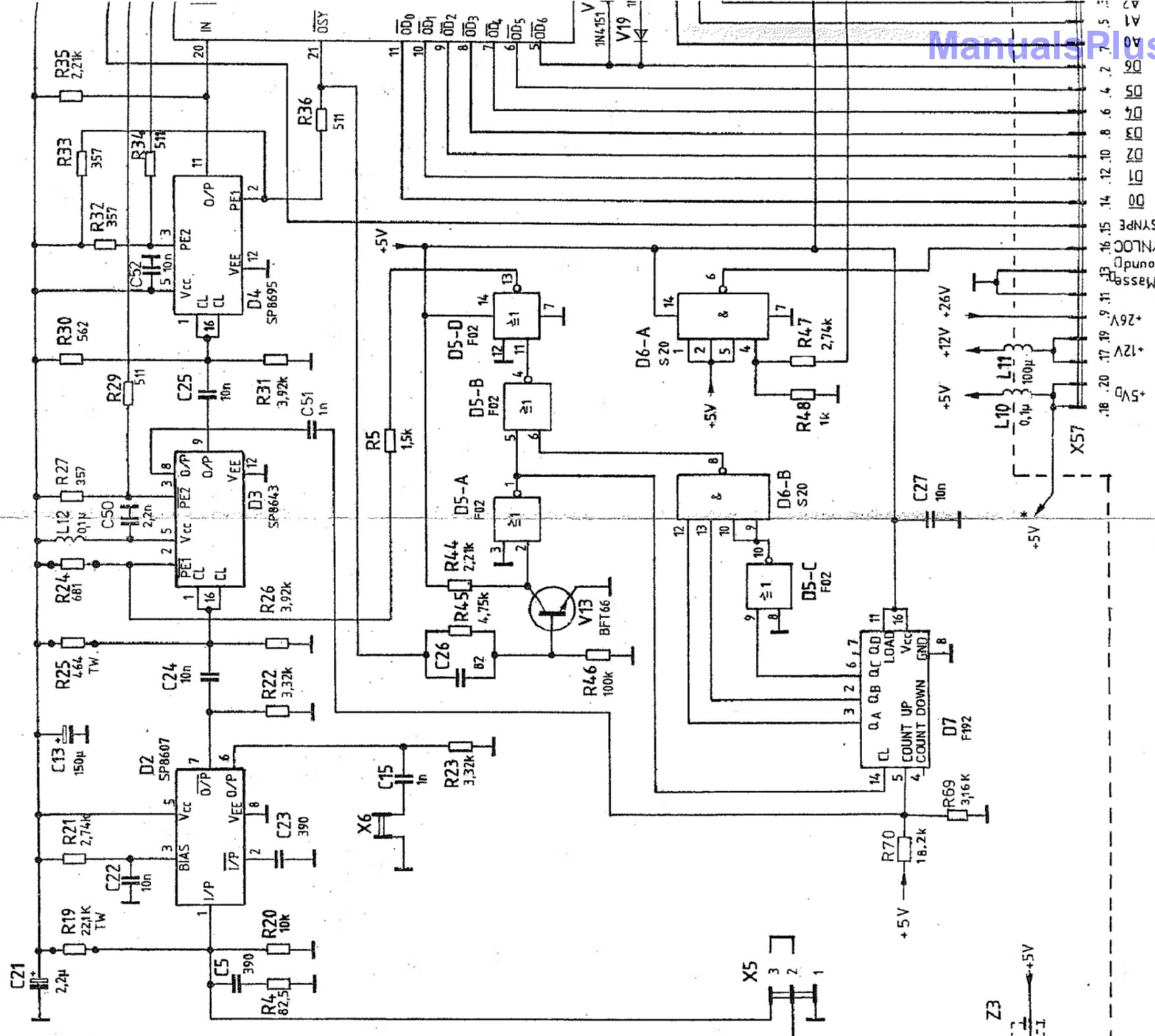
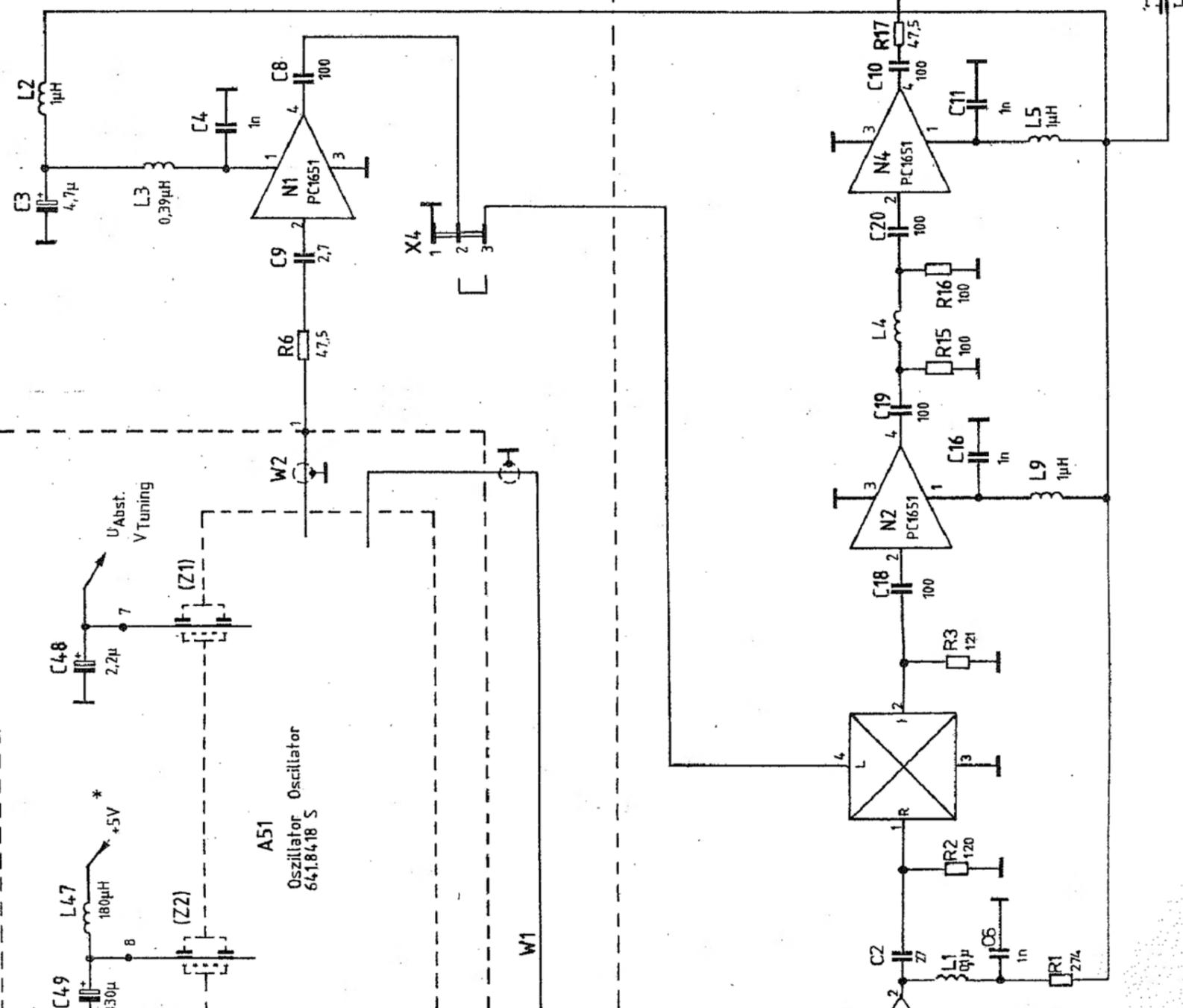
Für diese Inwertige Benennen wir uns die rechte vor

8 9 10 11 12 13 14



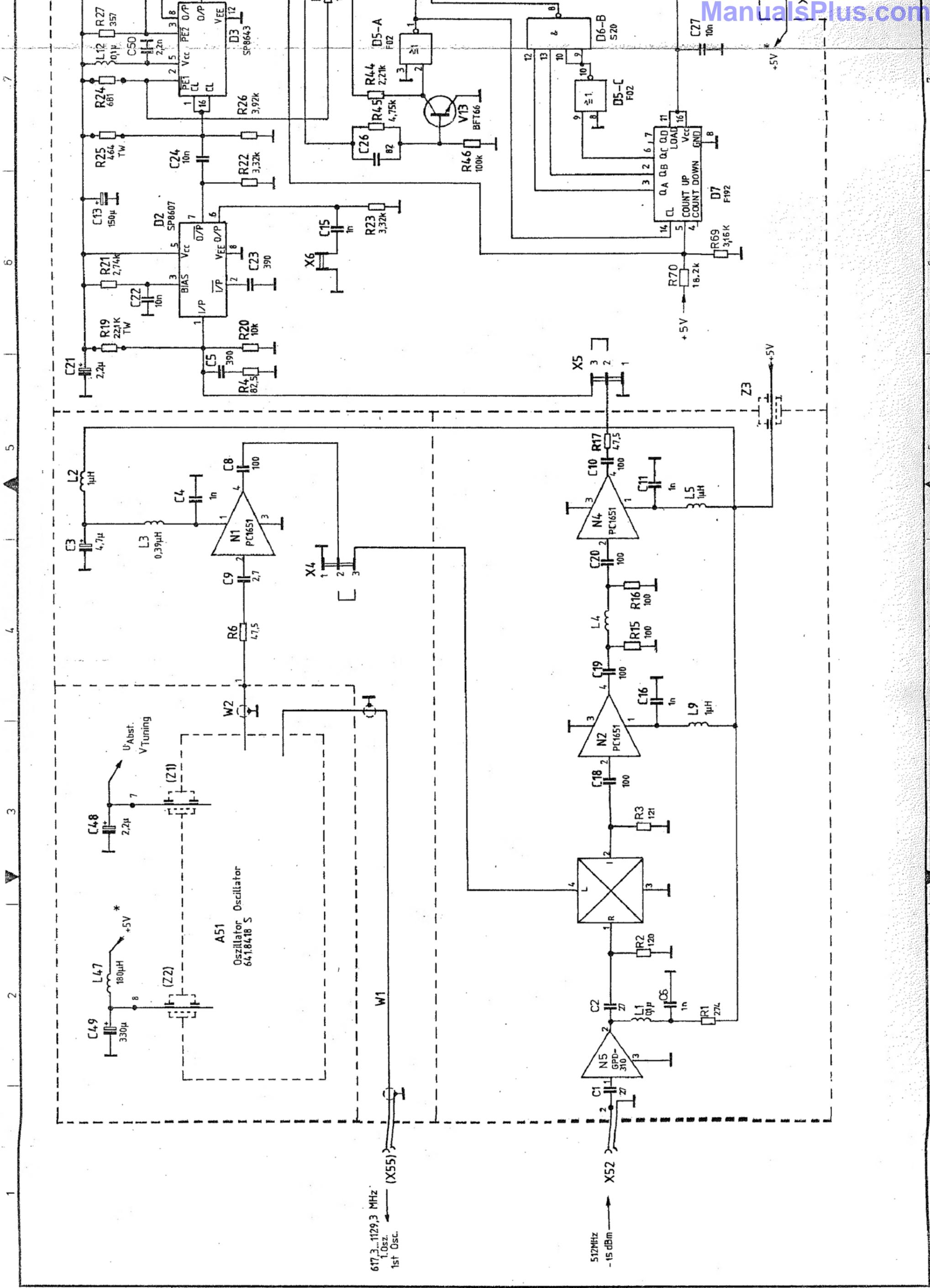
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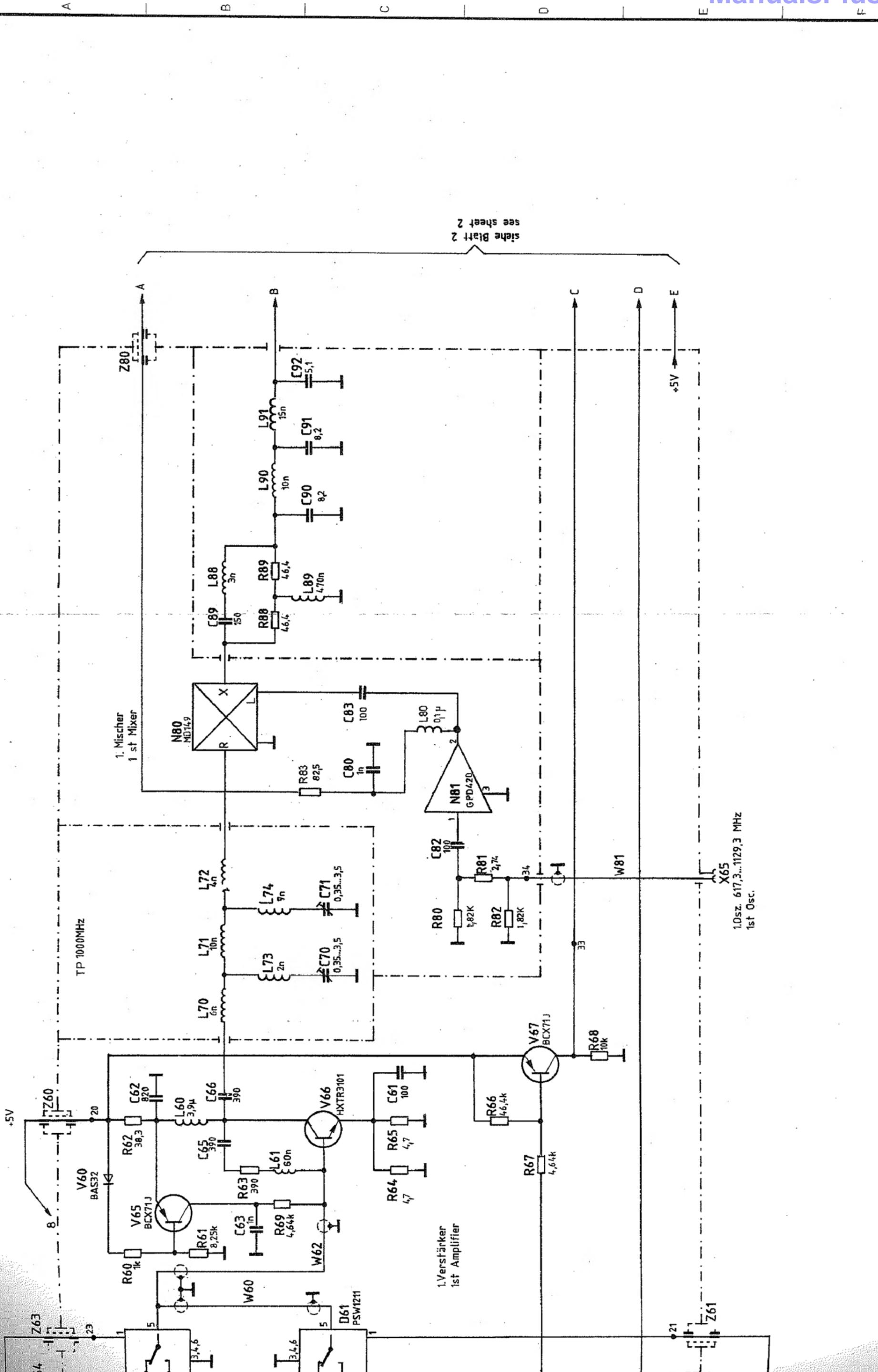
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A	B	C
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ROHDE & SCHWARZ

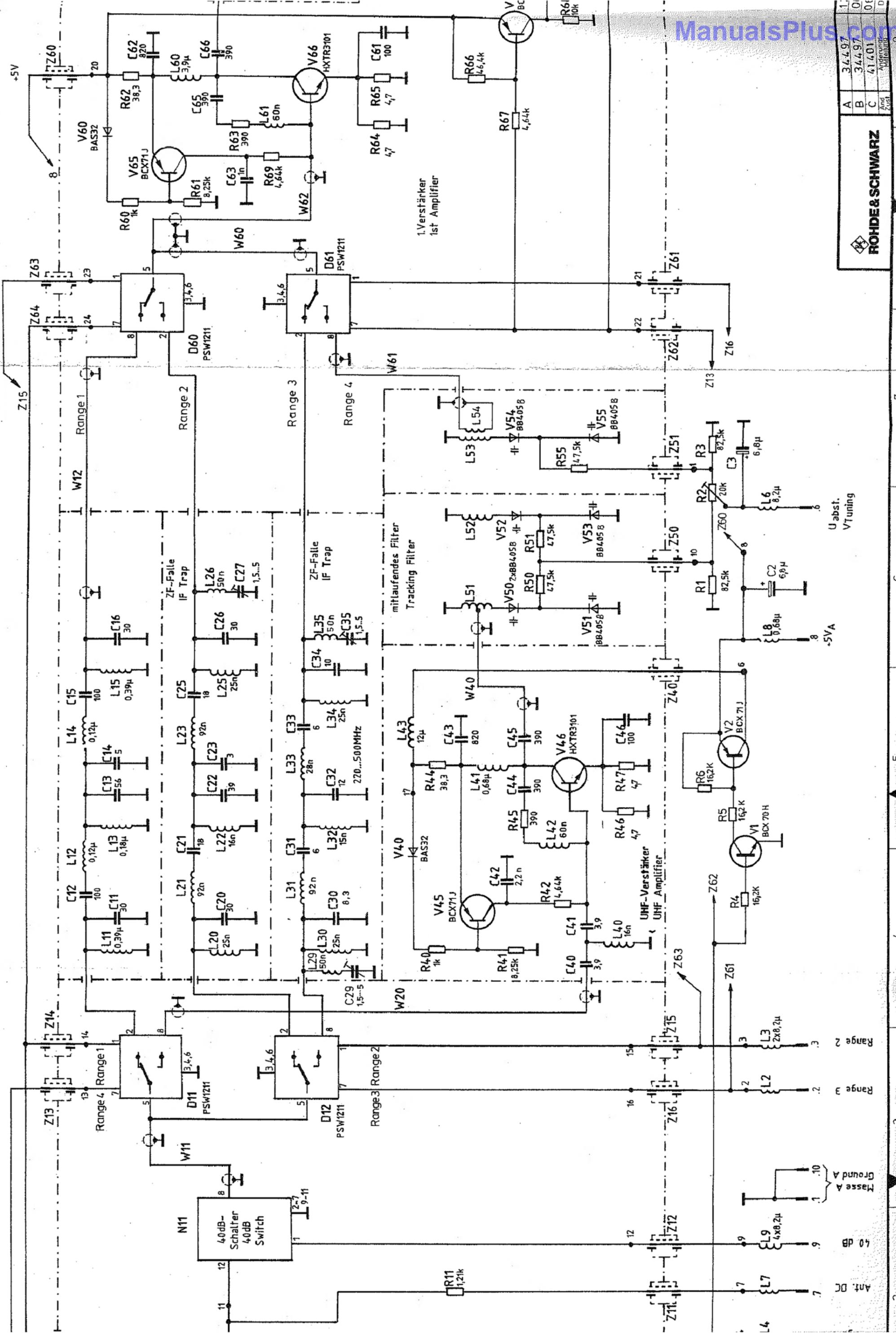


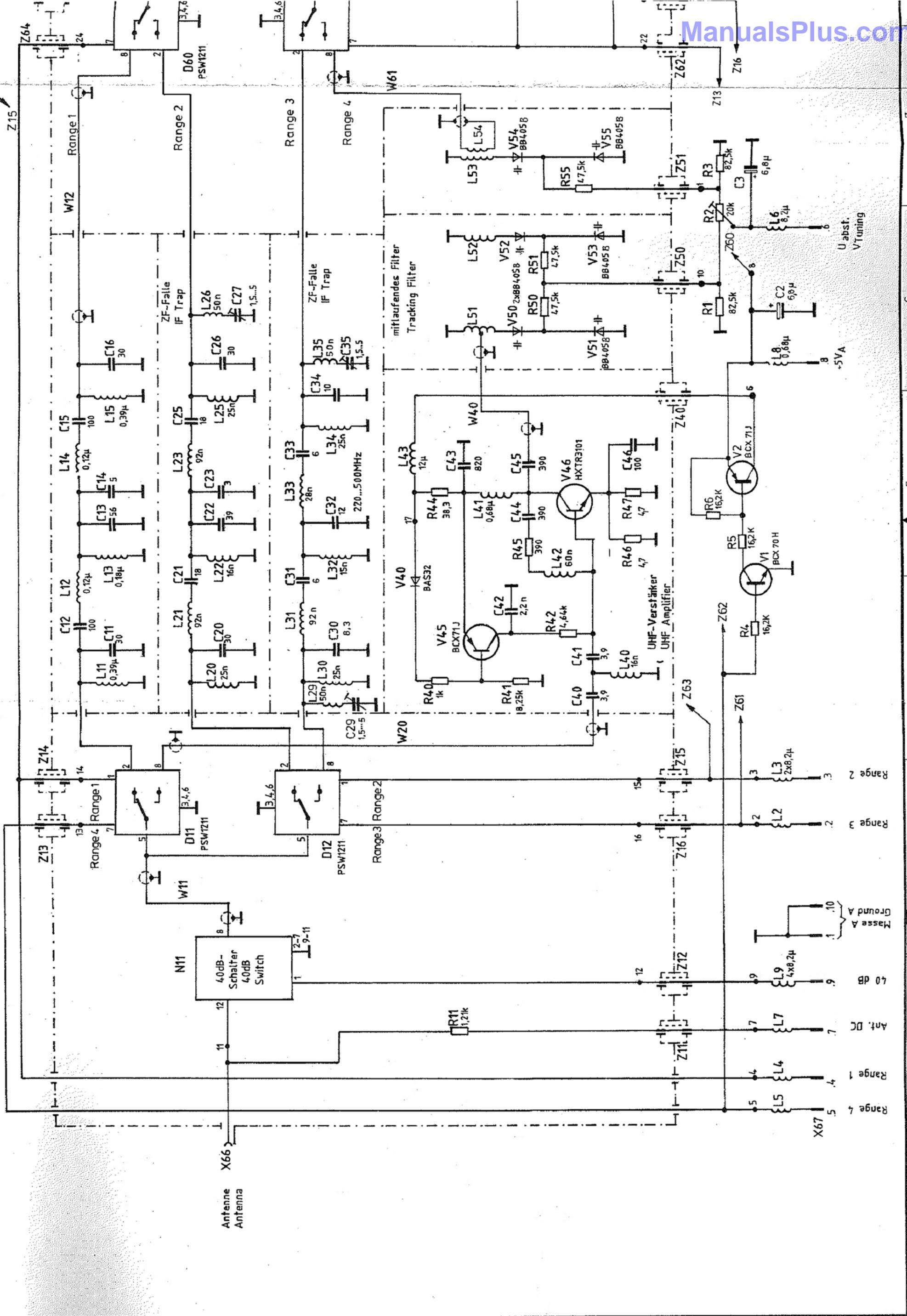


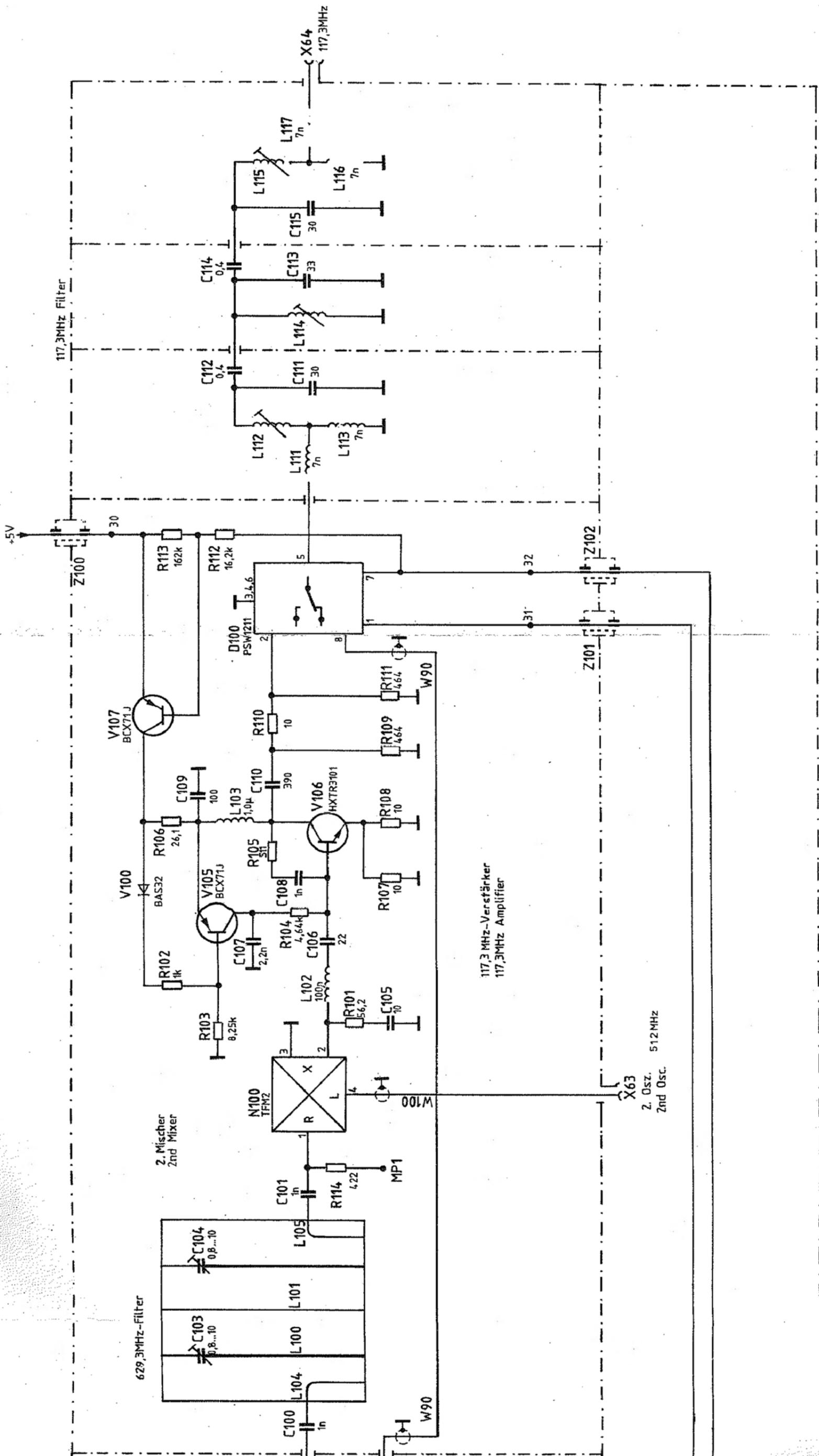
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Benennung EB 100-B4 Tuner 20-1000MHz EB 100-B4 Tuner 20 to 1000MHz		zu Gerat	
4PMM	Name SB	Datum	Name
Bearb. 11.85	Gepr.		
Angelegungs- Mittelwert		Angelegungs- Mittelwert	
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B	344.97	06.86	SB
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Anf. Zusi.		Datum	
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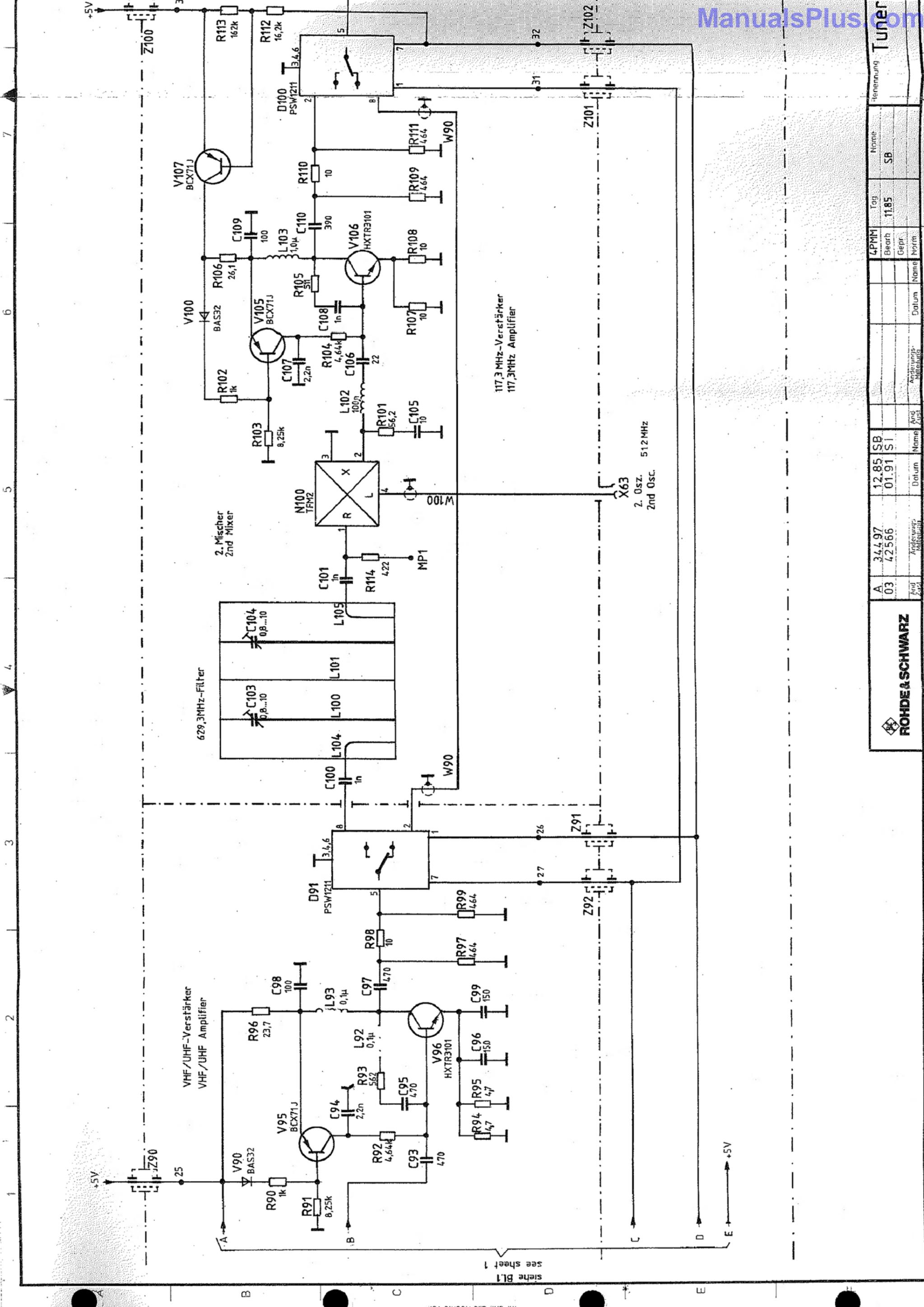
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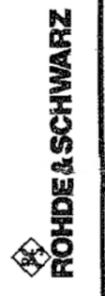


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Beurh		Gepr		Datum											
Name		Name		Name		Name		Name		Name		Name		Name	
Norm		Norm		Norm		Norm		Norm		Norm		Norm		Norm	
Änderungs- Mittelzahl		Änderungs- Mittelzahl		Änderungs- Mittelzahl		Änderungs- Mittelzahl		Änderungs- Mittelzahl		Änderungs- Mittelzahl		Änderungs- Mittelzahl		Änderungs- Mittelzahl	
Zu Gerät		Zu Gerät		Zu Gerät		Zu Gerät		Zu Gerät		Zu Gerät		Zu Gerät		Zu Gerät	
Zeichn.-Nr		641.8124 S		12.85 SB		344.97		03		42566		A		ROHDE & SCHWARZ	
Blatt-Nr		2		01.91		01.91		SI		SI		SI		SI	
reg. v		641.8018 V		01.91		01.91		SI		SI		SI		SI	
ersch. Z		641.8018		01.91		01.91		SI		SI		SI		SI	



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Zechn.-Nr



**ROHDE & SCHWARZ**

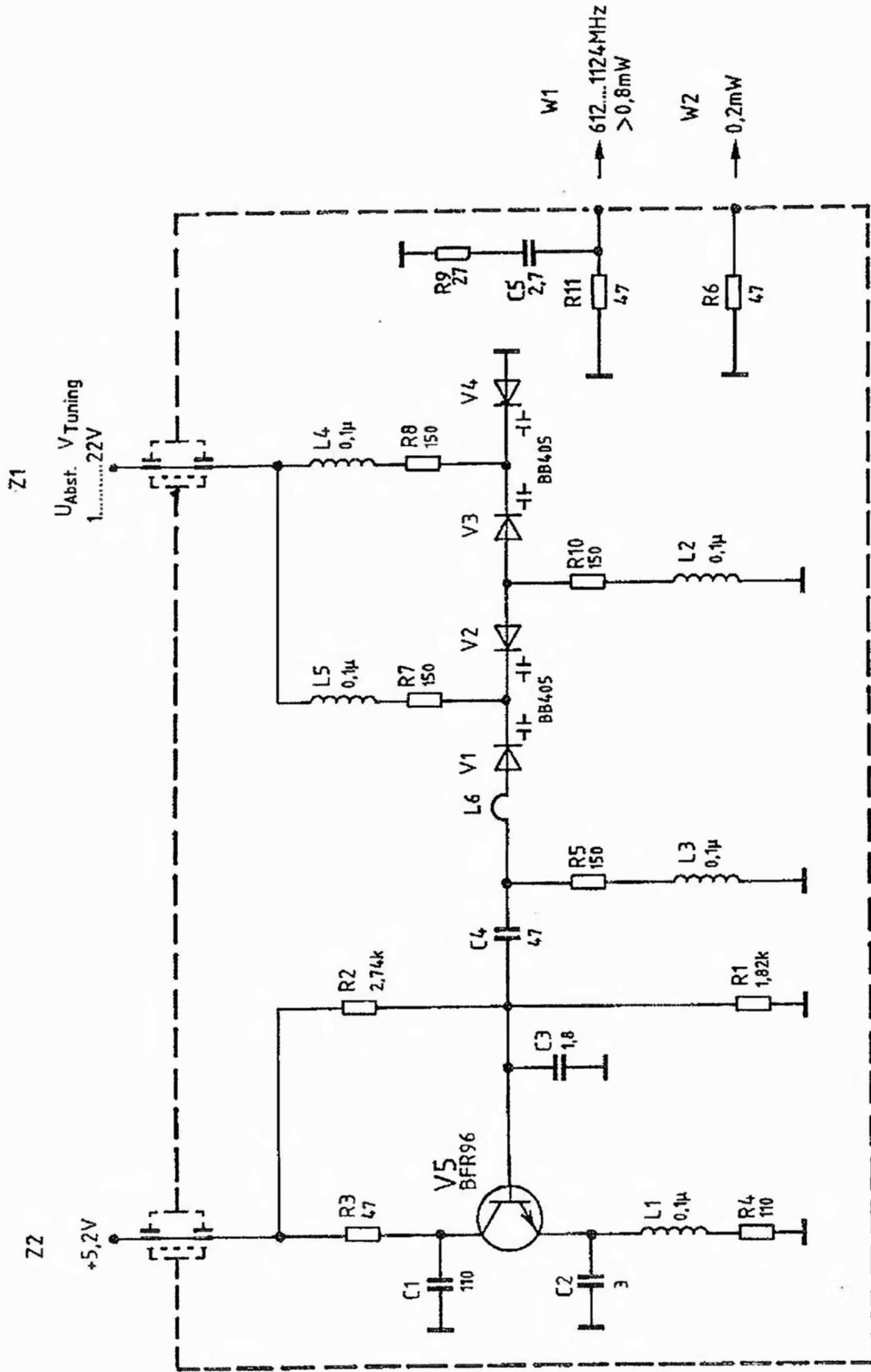
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Änderungs-Mittelzahl	03	42566	01.91	SI

And. Zert.				
Änderungs-Mittelzahl				
Datum				
Name				

APM	Tag	Name
Beach	11.85	SB
Gepr.		
Norm		

Benennung Tuner

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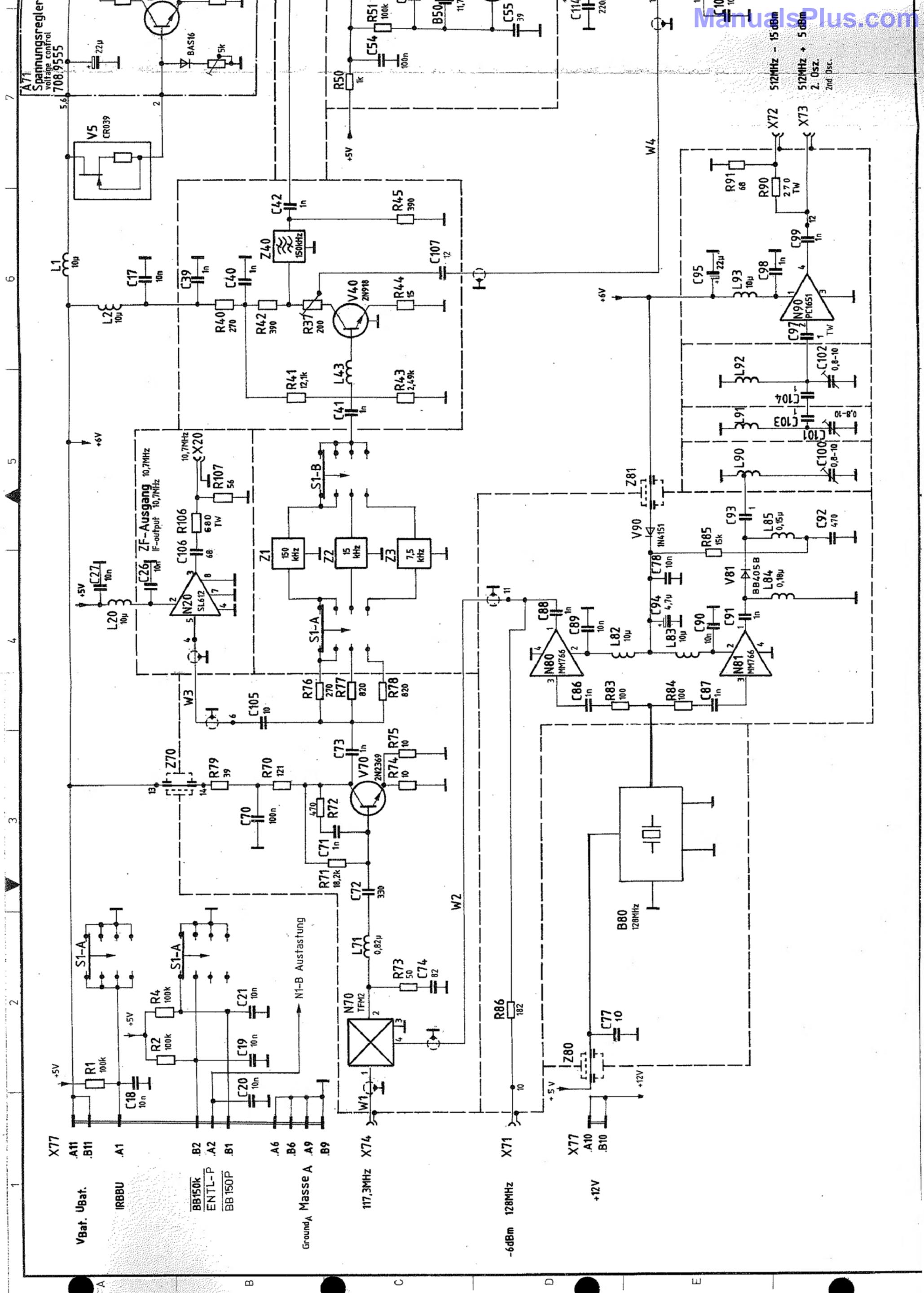
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						Halbzeug, Werkstoff	
				4PME	Tag	Name	
				Bearb.	16.6.84	Cu/Se	
				Gepr.			
				Norm			
						Benennung	
						Oszillator Oscillator	
						Zeichn.-Nr.	Blatt-Nr.
						641.8418 S	1
						v. 1 Bl.	
And. Zust.	Anderungs-Mitteilung	Tag	Name	zu Gerät EB100		reg. i. V.	erste Z.



**ROHDE & SCHWARZ**

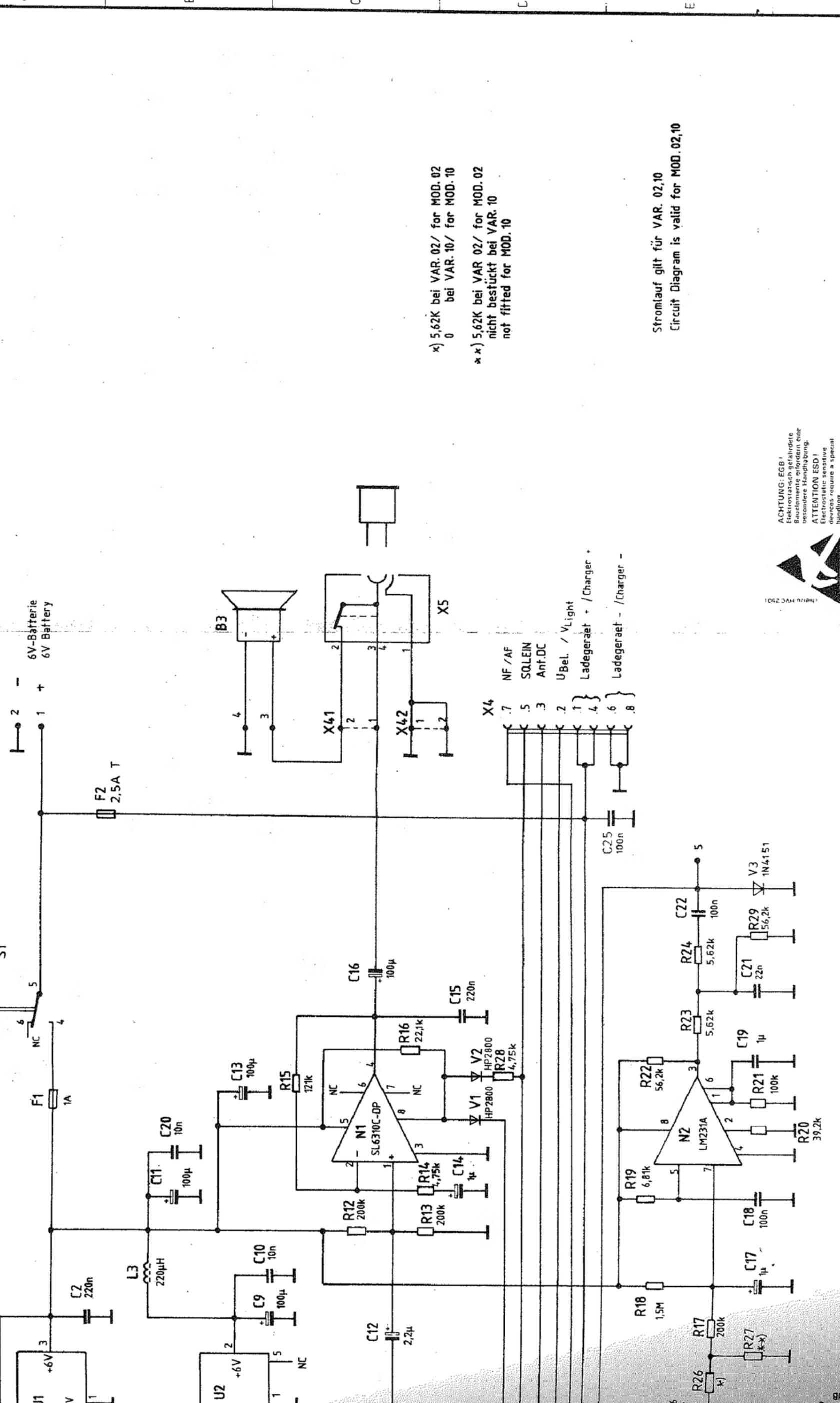








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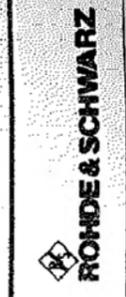
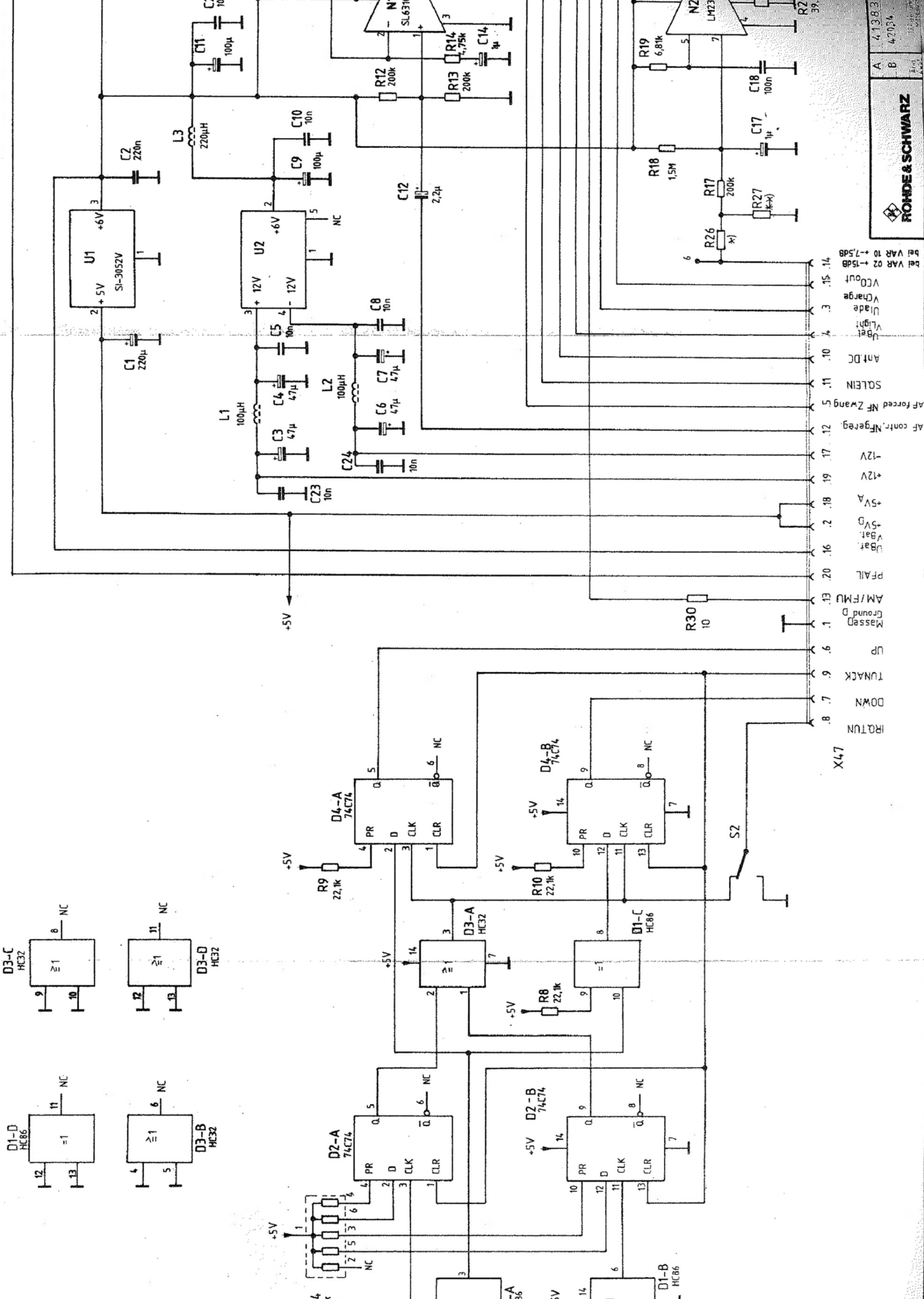
x) 5,62K bei VAR. 02/ for MOD. 02  
 bei VAR. 10/ for MOD. 10  
 \* x) 5,62K bei VAR 02/ for MOD. 02  
 nicht bestückt bei VAR. 10  
 not fitted for MOD. 10

Stromlauf gilt für VAR. 02,10  
 Circuit Diagram is valid for MOD. 02,10



ACHTUNG: ESB!  
 Elektrostatisch gefährdete  
 Bauelemente erfordern eine  
 besondere Handhabung.  
 ATTENTION ESD!  
 Electrostatic sensitive  
 devices require a special  
 handling

Name		SB	
Tag		03.88	
4 GMM	Heute	Norm	
A. 41383 B. 42034 C. 43035 D. 44036 E. 45037 F. 46038 G. 47039 H. 48040 I. 49041 J. 50042 K. 51043 L. 52044 M. 53045 N. 54046 O. 55047 P. 56048 Q. 57049 R. 58050 S. 59051 T. 60052 U. 61053 V. 62054 W. 63055 X. 64056 Y. 65057 Z. 66058 AA. 67059 AB. 68060 AC. 69061 AD. 70062 AE. 71063 AF. 72064 AG. 73065 AH. 74066 AI. 75067 AJ. 76068 AK. 77069 AL. 78070 AM. 79071 AN. 80072 AO. 81073 AP. 82074 AQ. 83075 AR. 84076 AS. 85077 AT. 86078 AU. 87079 AV. 88080 AW. 89081 AX. 90082 AY. 91083 AZ. 92084 BA. 93085 BB. 94086 BC. 95087 BD. 96088 BE. 97089 BF. 98090 BG. 99091 BH. 100092 BI. 101093 BJ. 102094 BK. 103095 BL. 104096 BM. 105097 BN. 106098 BO. 107099 BP. 108100 BQ. 109101 BR. 110102 BS. 111103 BT. 112104 BU. 113105 BV. 114106 BW. 115107 BX. 116108 BY. 117109 BZ. 118110 CA. 119111 CB. 120112 CC. 121113 CD. 122114 CE. 123115 CF. 124116 CG. 125117 CH. 126118 CI. 127119 CJ. 128120 CK. 129121 CL. 130122 CM. 131123 CN. 132124 CO. 133125 CP. 134126 CQ. 135127 CR. 136128 CS. 137129 CT. 138130 CU. 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776767 BN. 777768 BO. 778769 BP. 779770 BQ. 780771 BR. 781772 BS. 782773 BT. 783774 BU. 784775 BV. 785776 BW. 786777 BX. 787778 BY. 788779 BZ. 789780 CA. 790781 CB. 791782 CC. 792783 CD. 793784 CE. 794785 CF. 795786 CG. 796787 CH. 797788 CI. 798789 CJ. 799790 CK. 800791 CL. 801792 CM. 802793 CN. 803794 CO. 804795 CP. 805796 CQ. 806797 CR. 807798 CS. 808799 CT. 809800 CU. 810801 CV. 811802 CW. 812803 CX. 813804 CY. 814805 CZ. 815806 DA. 816807 DB. 817808 DC. 818809 DD. 819810 DE. 820811 DF. 821812 DG. 822813 DH. 823814 DI. 824815 DJ. 825816 DK. 826817 DL. 827818 DM. 828819 DN. 829820 DO. 830821 DP. 831822 DQ. 832823 DR. 833824 DS. 834825 DT. 835826 DU. 836827 DV. 837828 DW. 838829 DX. 839830 DY. 840831 DZ. 841832 EA. 842833 EB. 843834 EC. 844835 ED. 845836 EE. 846837 EF. 847838 EG. 848839 EH. 849840 EI. 850841 EJ. 851842 EK. 852843 EL. 853844 EM. 854845 EN. 855846 EO. 856847 EP. 857848 EQ. 858849 ER. 859850 ES. 860851 ET. 861852 EU. 862853 EV. 863854 EW. 864855 EX. 865856 EY. 866857 EZ. 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A 4.1383  
 B 4.2034  
 bei VAR 10 +7,5dB  
 bei VAR 02 +15dB  
 VCO  
 VCharge  
 Uade  
 Ulight  
 Ubet  
 ANT DC  
 SOLEIN  
 AF forced Nfzang  
 AF contr. Nfzang  
 -12V  
 +12V  
 +5V  
 Vbat  
 -5V  
 Ubat  
 FAIL  
 AM/FM  
 Masse D  
 UP  
 TUNACK  
 DOWN  
 IRATUN

X47  
 1 Masse D  
 2 AM/FM  
 3 FAIL  
 4 Ubat  
 5 -5V  
 6 +5V  
 7 +12V  
 8 -12V  
 9 AF contr. Nfzang  
 10 SOLEIN  
 11 ANT DC  
 12 Ubet  
 13 Ulight  
 14 Uade  
 15 VCharge  
 16 VCO  
 17 bei VAR 10 +7,5dB  
 18 bei VAR 02 +15dB

X47

- 1 Masse D
- 2 +5V
- 3 Ubat
- 4 +5V A
- 5 -12V
- 6 AF contr. Nfgerg
- 7 AF forced Nf Zwang
- 8 SOLEIN
- 9 AN/DC
- 10 Ubel
- 11 Light
- 12 Uade
- 13 VCharge
- 14 VCO
- 15 bei VAR 02 +-15dB
- 16 bei VAR 10 +-7.5dB

