Shipmate RS9000

(scanned from photocopy - not complete manual)

VER 910
DENNE VERSIONER INKLUDERE:
1: FRI SENDER MODE
2: SENDER FOELGER MODTAGER FREKVENS,NAAR TUNINGS HJUL DREJES (SEPC10)
3: INGEN CHECK AF TUNING AF ANTENNE KORREKT UDFOERT !!!!!
4: BRUG DERFOR ALTID TEST KNAPPEN,NAAR DER SKIFTES FREKVENS,FOR AT SE
OM DER ER DAARLIGT SWR FORHOLD (SE LAMPE LOW P).
*
SPECIAL FUNKTIONS

SPEC 1	ENT	: LOUDSPEAKER ON
SPEC 2	ENT	: LOUDSPEAKER OFF
SPEC 3	ENT	: TUNING WHEEL ON
SPEC 4	ENT	: TUNING WHEEL OFF
SPEC 5	ENT	: SQUELCH ON
SPEC 6	ENT	: SQUELCH OFF
SPEC 10	ENT	: CLARIFIER ON
SPEC 11	ENT	: CLARIFIER PRESET
SPEC 12	ENT	: SIDETONE ON (A1A)
SPEC 13	ENT	: SIDETONE OFF (A1A)
SPEC 14	ENT	: AUTOTUNE ON
SPEC 15	ENT	: AUTOTUNE OFF
SPEC 16	ENT	: BEEP ON
SPEC 17	ENT	: BEEP OFF
SPEC 18	ENT	: TUNING WHEEL RX + TX FRQ
SPEC 19	ENT	: TUNING WHEEL ONLY RX FRQ
SPEC 20	ENT	: PROM VER.
SPEC 21	ENT	: LAMPTEST ON
SPEC 22	ENT	: LAMPTEST OFF
SPEC 25	ENT	: ALC STATUS

ERROR CODES

ERROR 1	: RECEIVER FREQUENCY IS OUTSIDE THE DUPLEX BANDS.
ERROR 2	: TRANSMITTING FREQUENCY AND RECEIVING FREQUENCY ARE TOO CLOSE TO EACH OTHER BY DUPLEX.
ERROR 4	: TRANSMISSION NOT ALLOWED,WRONG MODE OF OPERATION OR WROG TRANMITTING FREQUENCY
ERROR 5	: TUNER HAS NOT BEEN ACTIVATED SINCE THE LAST FREQUENCY SHIFT
ERROR 6	: EMPTY CHANNEL
ERROR 10	: RX SYNTHESIZER OUT OF LOCK
ERROR 11	: TX SYNTHESIZER OUT OF LOCK
ERROR 12	: ALC ERROR IN EXCITER
ERROR 13	: TUNE ERROR,TUNE TIMEOUT
ERROR 14	: KEYBOARD DAMAGED

5. PREVENTIVE MAINTENANCE

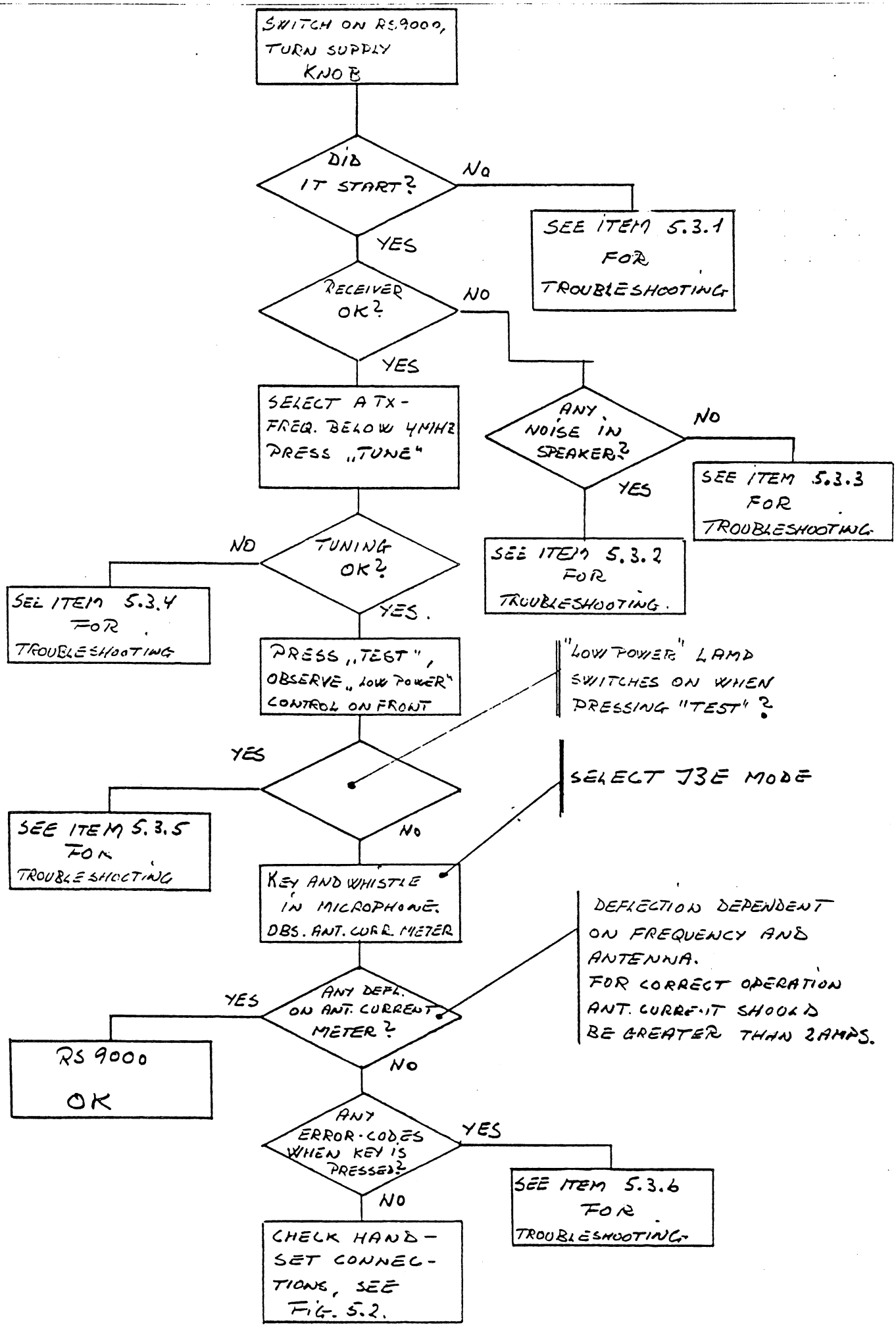
5.1 GENERAL

This chapter is written to help you with the most elementary and commonly appearing errors in the device or when installing the device.
Typical errors are defective fuses, missing cable connections, poor antennas etc.
By means of this chapter all the errors mentioned can be repaired on site by people with a superficial knowledge of radio engineering.
If there are any errors in your RS 9000 radiotelephone, they will automatically be displayed, after which it may be necessary to call in a service technician.
When displaying error-codes, please see chapter 10 LIST OF ERROR-CODES.

5.2 COMMON ERRORS WHEN INSTALLING ANTENNAS

In order to profit fully from the RS 9000 radiotelephone, you must check that the supply batteries are always charged and well-kept.
Cable eyes and other connections from the batteries must likewise be kept fastened and clean from verdigris.
The antenna installations must be made according to the directions stated in chapter 7, and now and then the connections on the lead-in horns and down-leads from the antennas should be checked.
When using porcelain lead-ins be aware that cracks in the lead-in may occur if exposed to blows.
This may result in flashover from the transmitter to the hull, which means reduced or at worst no range at all.
The earth connection from RS 9003/4 Tuner must always be securely fastened, and be aware of corrosion, if any, in connecting points etc.

Fig. 5.1. Flow Chart.



5.3 SIMPLE SERVICE, USE OF FLOW CHART

If the device does not work properly, it is important to carry out the trouble-shooting in a systematic way.
To start by exchanging the fuses is not expedient if it turns out that the error is due to incorrect operation of the device.
Due to the many functions incorporated in RS 9000, it may be difficult to operate in a correct way until a familiarity with the operation of the device has been obtained.
If there is an error in RS 9000, it is recommendable to use the flow chart shown in fig. 5.1.
The flow chart contains a systematic description of the functions in RS 9000.
There will also be references to other chapters in the manual where current errors are stated.

5.3.1 No response when switching on RS 9000

1) Check that the control and power supply cables are correctly fitted between RS 9001/2 transceiver and RS 9003/4 tuner. Cf. fig. 5.2 (1) and (2) .

2) Check, by means of a voltmeter, correct supply voltage (12/24 V) and polarity on the battery connection of the tuner, cf. fig. 5.2 (3) .

3) Check fuses at the back of the tuner and exchange if necessary, cf. fig. 5.2 (4) and (5) .

F4: 25 A slow, 6.3 x 32 mm

F5: RS 9003 6.3 A slow, 5 x 20 mm
RS 9004 3,15 A slow, 5 x 20 mm

4) If there is still no response, remove the cover of the tuner (cf. paragraph 3.4).
Check the three fuses in s.m. power supply, cf. fig. 5.3, and exchange if necessary.

5.3.2 Receiver silent

1) Check that "ant att" on the front is not activated.

2) Check that the antenna plug is connected to the receiver, cf. fig. 5.2 (6) .

3) Check the antenna installation for breakages and short circuits.

4) The receiver being silent may also be due to an error in the RS 9030 Simplex relay.

5.3.3 No hissing sound in loudspeaker

1) Turn the "rf-gain" on the front maximum clockwise, after which the "signal-levelmeter" drops to zero.

2) Check that the "duplex" key is not activated. By duplex operation the internal loudspeaker is switched off.

3) If the receiver is still not working, call in a service technician.

5.3.4 Error when tuning

1) If the tuner did not start after pressing the "tune" knob it may be due to the fact that the "man/auto" switch on the tuner is in position "man", cf. fig. 5.4.

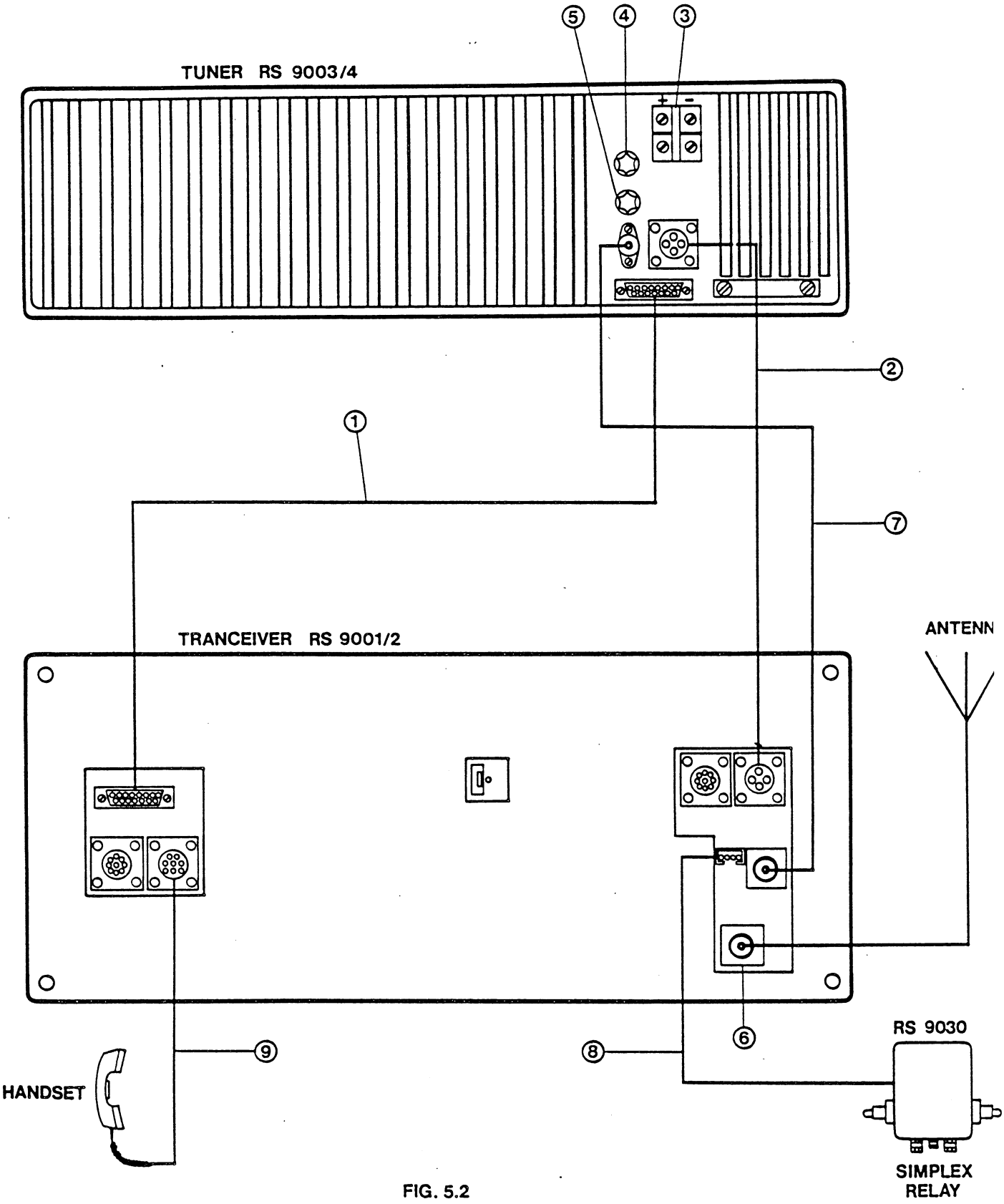

TUNER RS 9003/4
5
4
3
2
1
7
TRANCEIVER RS 9001/2
ANTENN
RS 9030
9
8
6
HANDSET
SIMPLEX
RELAY

FIG. 5.2

During normal operation the switch should be in position "auto".

2) If the tuner did not start at all, but after a while error 13 was displayed, the error may be due to the following:

   a) The coaxial cable between transceiver and tuner is not fitted or defective, cf. fig. 5.2 (7) .

   b) The transmitter antenna is not connected, or perhaps an error in connection with the antenna installation, cf. paragraph 5.2.

   c) When using RS 9030 simplex relay, check that the relay control cable is correctly fitted, cf. fig. 5.2 (8) .

3) If error in tuner, call in a service technician.

5.3.5 Transmitter in low power

Try pressing the "tune" knob.
When tuning is finished, press the "test" key.
If the low power lamp on the front switches on it may be due to the following:

1) Fault in connection with the antenna installation, cf. paragraph 5.2.

2) Fault in tuner, call in a service technician.

5.3.6 Display of errors when testing the transmitter

ERROR 1 : The receiver frequency is outside the duplex band.

ERROR 2 : The distance between transmitter and receiver frequencies is too small for duplex operation.

ERROR 4 : Wrong selection of modulation type. Transmission of H3E is only permitted on distress and security frequencies.

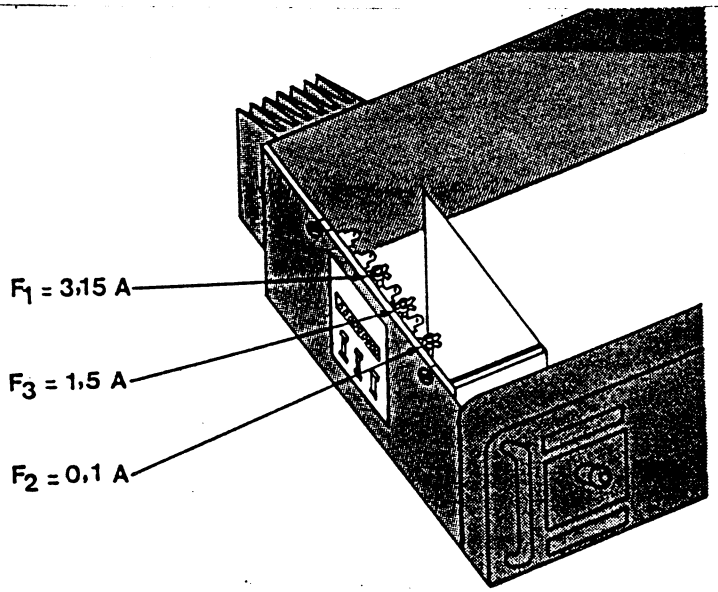


FIG. 5.3

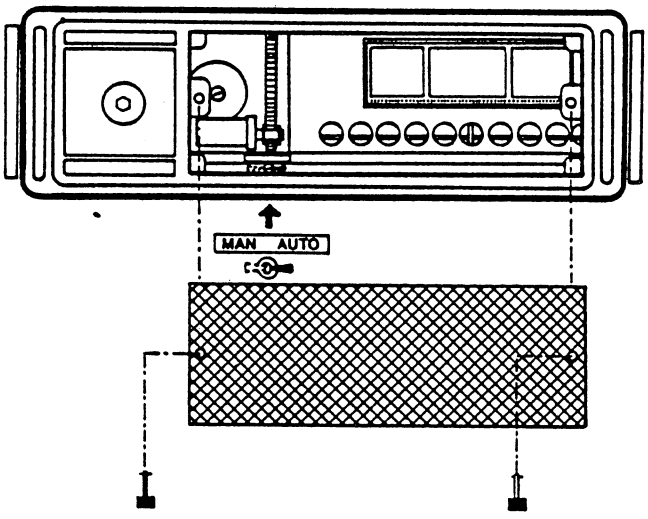


FIG. 5.4

6. MAINTENANCE AND SERVICE

6.1 MAINTENANCE

The RS 9000 SSB Radiotelephone does not require an actual routine maintenance, it is, however, recommendable to have the device overhauled at an authorized workshop approx. every 5 years.
In the tuner the moving parts of the variable coil may be worn. Thread, wheels, axles and toothed belt are worn as time goes on and may have to be renewed as well.
In the transceiver there is a back-up battery on the computer board, pcb 2891. This battery is only guaranteed a life of 5 years.

6.2 NECESSARY TEST EQUIPMENT

The below test equipment is recommendable for trouble shooting of RS 9000:

- Multimeter, e.g. Fluke 75
- Oscilloscope 0-50 MHz, e.g. Philips PM3217
- Tone generator, e.g. Bang & Olufsen TG7
- Signal generator, e.g. Marconi 2002b
- Frequency counter, e.g. Philips PM6681
- Distortion meter, e.g. Philips 6309
- Power meter, e.g. bird model 43, 250 W 0-30 MHz
- Dummy load 50 ohm, 250 W
- Dummy load 100 ohm +250 pF, 250 W, cf. fig. 6.1
- DC-power supply 12 or 24 V, e.g. Shipmate RS 9000/220

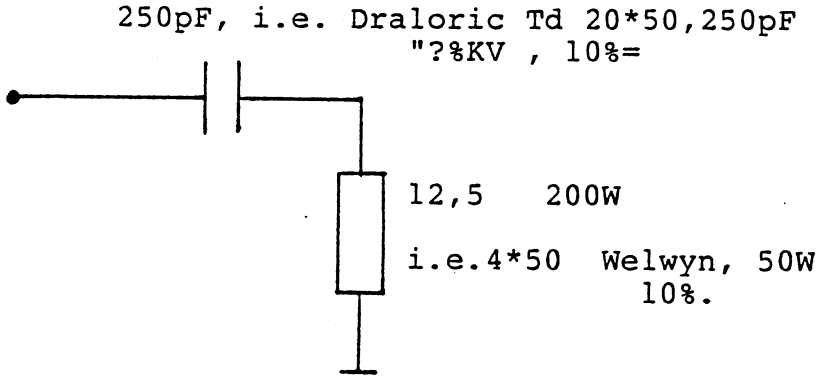


Fig.6.1. Dummyload for the CT band, 1,6-4,0MHz.

6.3 SERVICE

Service and trouble shooting are only to be carried out at an authorized workshop and only by technicians in possession of the necessary test equipment and who have a thorough knowledge of the mode of operation of the device.

Start by checking whether the error is to be found in the antenna installation, in the DC-supply or in the RS 9000 Radiotelephone.

Error possibilities in connection with the antenna installation and DC-supply are stated in chapter 5.

A number of operations must be carried out so as to encircle the error to a certain part of the RS 9000.

When this has been done, the device is disassembled (cf. chapter 3) and the actual trouble shooting can begin.

By means of the block diagrammes and circuit diagrammes in chapter 8 and the circuit descriptions in chapter 4, it should be possible to locate the defective component.

After the repair the adjusting of the pcb(s) in question is made according to the adjusting procedure in chapter 7.

When the adjustings have been checked, the device is reassembled and a function check of the transceiver is made as stated in paragraph 6.4.

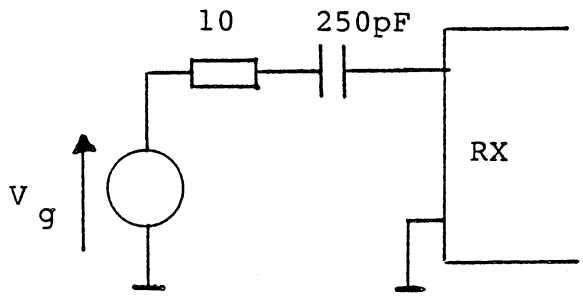
6.4 FUNCTION CHECK

6.4.1 Receiver

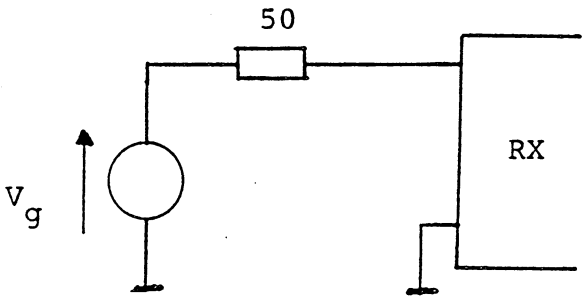
Sensitivity check

Two different generator impedances are used.

1. between 1,6 and 4,0MHz.



2. between 4,0 and30MHz.



Connect the signal generator (cf. above drawings) to RX-ant input on the receiver.
Connect the distortion meter to ext. loudspeaker.
Select frequency (Frx) and mode (AM or SSB) and adjust generator output level to VG according to table 1 below.

FG = { AM (H3E) : Frx, 30% modulated with 1 kHz
SSB (J3E): Frx + 1 kHz, unmodulated

All measurements in the table should produce a signal to noise ratio better than 20 dB at the AF-output.

SENSITIVITY CHECK.

<table>
<tr><th>Mode</th><th>F_{rx} [MHz]</th><th>V_g [emf]</th><th></th></tr>
<tr><td rowspan="3">SSB
(J3E)</td><td>1,6 - 4,0MHZ</td><td rowspan="3">6,3uV</td><td></td></tr>
<tr><td>1,6 -4,0MHZ</td><td>Press PRESEL and adjust PRESEL knob to best signal.</td></tr>
<tr><td>1,6-4,0MHz</td><td>Press 2182 key</td></tr>
<tr><td>AM
(H3E)</td><td>1,6-4,0MHz</td><td>32uV</td><td rowspan="3"></td></tr>
<tr><td>SSB
(J3E)</td><td rowspan="2">4,01-30MHz</td><td>3,6uV</td></tr>
<tr><td>AM
(H3E)</td><td>18uV</td></tr>
<tr><td rowspan="7">SSB
(J3E)</td><td>4,40</td><td rowspan="7">3,6uV</td><td rowspan="7">Press

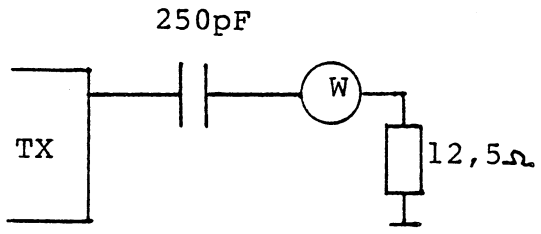
DUPLEX key</td></tr>
<tr><td>6,52</td></tr>
<tr><td>8,80</td></tr>
<tr><td>13,1</td></tr>
<tr><td>17,3</td></tr>
<tr><td>22,65</td></tr>
<tr><td>25,5</td></tr>
</table>

Table 1.

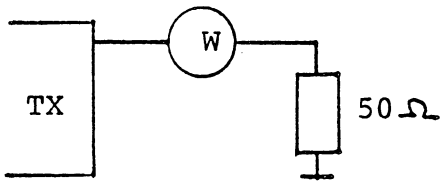
6.4.2 Transmitter

Load the transmitter output with dummy load and wattmeter as indicated below.

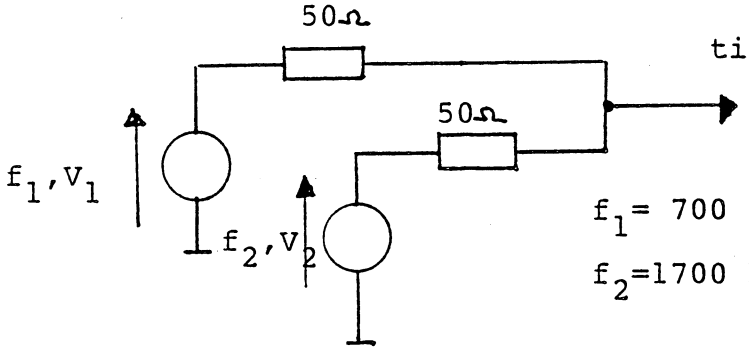
1. Transmitter between 1,6 and 4,0MHz.



2. Transmitter between 4,0 and 30MHz.



Connect two tone generators to Mic 1 input (or Line Mic input - 0dBm) as indicated below.



f_1= 700 Hz, V_1= 75mVrms

f_2=1700 hz, V_2= 75mVrms.

Select SSb (J3E) modulation and tune in th transmitter to the different frequencies and measure the output power by means of a wattmeter or a scope.

Pre-adjust the output voltage on the two tone generators so that the transmitted signal is modulated 100%.

The output signal must not be clipped considerably, cf. fig. 6.2.

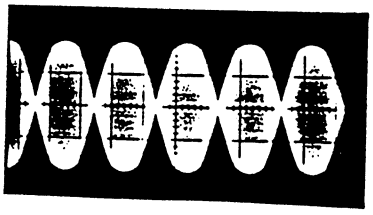


Fig.6.2.

7. ALIGNMENT

7.1 GENERAL TEST CONDITIONS

The pcb in question must be situated in a functioning transceiver/tuner with all necessary control signals present.
As regards the tuner, it must be connected to the transceiver.

7.2 TX-1

Instruments: LF-generator
DC-voltmeter
Oscilloscope, 10 MHz
Frequency counter

7.2.1 TCXO

Measure by means of the frequency counter on J30 (5 MHz to Rx-syntheziser) and adjust P5 to 5,0000 MHz.

7.2.2 5 MHz buffers

Load J27 and J30 with 50 ohm and check that there is 400 mVpp on both outputs.
Load J28 with 50 ohm and check that there is 55 mVpp in mode A1A, J3E and R3E.
Shift to mode H3E and make sure that there is 0 V on J28.

7.2.3 Mic 1

Set P8 (distortion) in position middle.
Connect the LF-generator to mic 1 input (P21 pins 2,5), 10 mVRMS, 1 kHz.
Measure in TP2 and adjust P6 until the compressor goes into limitation (approx. 140 mVpp).

7.2.4 Line mic

Connect the LF-generator to line mic input

(P20 pins 8,9), 1 VRMS, 1 kHz.
Ground line mic key (P20 pin 1).
Measure in TP2 and adjust P7 until compressor goes into limitation (approx. 140 mVpp).

7.2.5 Telex

Press the "telex" key.
Connect the LF-generator to telex input (P20 pins 6,7), 1 VRMS, 1 kHz.
Measure in TP2 and adjust P13 until compressor goes into limitation (approx. 140 mVpp).

7.2.6 A1A

Select A1A.
Ground key 1 (P21 pin 3).
Measure in TP2 and adjust P10 to approx. 130 mVpp.

7.2.7 Earphone

Mode = A1A.
Ground key 1 (P21 pin 3).
Measure on earphone out (P21 pin 1) and adjust P11 to 60 mVpp.

7.2.8 Line out

Mode = A1A.
Measure on line out (P20 pins 4,5) and adjust P12 to 2.2 Vpp in 600 ohm.

7.2.9 5 MHz amplifier, balanced modulator

Mode = J3E.
Measure in TP1 and adjust TR1 and TR2 to max. signal (120 mVpp).
Adjust P2 to best symmetry.

7.2.10 Q4+Q5 amplifier

Load 5 MHz SSB out (P34) with 50 ohm 1/3 W, and measure by means of the scope.
Adjust TR3 and TR4 to max. output (5 mVpp +/-30%).

7.2.11 Carrier reinsertion, attenuator

Press the "2182" key.
Mode = H3E.
Connect the LF-generator to mic 1 input (P21 pins 2,5).
Measure on P34, load with 50 ohm, and adjust P1 to a degree of modulation of approx. 80%.

Attenuator

Set P4 in position middle, and adjust P3 until the same voltage as in item 7.2 is measured.

7.2.12 RF-detector

Mode = A1A.
Measure on RF-detector output (Q12, collector) and check that there is 0 V.
Ground key 1 (P21 pin 3) and check that there is 5 VDC.

7.3 TX-2

Instruments: DC-voltmeter
Oscilloscope, 100 MHz
Signal generator, 0-100 MHz

7.3.1 2. mixer

Mode = J3E.
Cf. paragraph 7.3.7 about ALC.

5 MHz : Turn P1 max. clockwise.
Measure in TP1 and adjust TR1 to max.
5 MHz signal (120-220 mVpp, depending on ALC-status).

40 MHz : Measure on IC1 pin 10, and adjust TR2 to max. 40 MHz signal (300 mVpp).

45 MHz : Measure in TP2 and adjust TR3 to max.
45 MHz signal (500-800 mVpp).

7.3.2 45 MHz x-tal filter

Mode = J3E.
Measure between R24 and C16.
Adjust L16 to max. signal.
Adjust L15 to max. signal.
Adjust L17 to max. signal.
Adjust TR3 to max. signal (20-35 mVpp).

7.3.3 3. mixer

Mode = J3E.
Measure on IC2 pin 12 and adjust TR4 to max.
45 MHz signal (approx. 300 mVpp).
Measure DC above R31 (270E) and adjust P2 to 6.75 VDC.

7.3.4 High pass filter in 46.5-75 MHz input

Adjust L6 and L7 in top.

Connect the signal generator to P31 (46.5-75 MHz input). (-8 dBm = 250 mVpp).
Measure on IC2 pin 5.
Vary the frequency and check that the cut-off frequency is on approx. 44 MHz.

7.3.5 Low pass filter and harmonic filter

Adjust L1, L2, L3, and L13 in top.
TP3 A and B are disconnected.
Connect the signal generator to TP3 B (-20 dBm = 65 mVpp).
Set P3 and P4 in position middle.
Load RF out (P25) with 50 ohm (1/3 W) and measure above this.
Adjust the frequency to 31 MHz. Press the "test" key.
Adjust L2 until the signal barely begins to be damped.
Adjust L1, L3, and L13 in the same way.
Sweep through the frequency range 1.5-40 MHz and note ripple, if any,- especially around the cut-off frequency.
Ripple can be fine adjusted by means of L1 and L3.

7.3.6 RF-amplifier

Mode = J3E.
Press the "test" key.
Measure on RF out (P25) in 50 ohm.
Adjust P3 and P4 to approx. the same biasing current and a output signal of +15 dBm (3.5 Vpp in 50 ohm) with a minimum of harmonic distortion.
Cf. the suggested DC-voltages on the diagramme.
Check the liniarity of TX-2 by varying the TX-frequency from 1.6 to 30 MHz.

7.3.7 ALC

The adjusting is carried out by means of the

ready-trimmed TX-1 and TX-2.
Set up a TX-frequency.
Press "spec 25" and read the ALC-status (0-15).
The ALC-circuit must be adjusted so that P out (P25) is +15 dBm (3.5 Vpp i 50E) when the ALC is = 7 or 8.
P out kan be adjusted by means of P1 and ALC reference by means of P5.
ALC 0 = No damping of the ground frequency
ALC 15 = Max. damping of the ground frequency
ALC is able to damp the signal max. 4 dB.

7.4 RX-1

Instruments: DC-voltmeter
Signal generator
AC-millivoltmeter or
5 MHz scope

7.4.1 RF-amplifier and 1. mixer

Adjust P1 to 0.5 VDC on TP2.
Adjust P2 to 6.75 VDC from TP4 to TP5 (the voltage above R29).
Repeat the adjustments as they influence eachother.

7.4.2 Wide and duplex filters

AGC = OFF.
Measure on RX-2 - TP10 by means of the scope or the AC-millivoltmeter on external loudspeaker.
Alignment frequencies are indicated on the coils in question.

Preselect

Press the "Presel" key.
Turn the variable capacitor maximum clockwise.
TR2 and TR3 are adjusted to max. output.
Check that the filter aligns up to 4 MHz.

7.4.3 Duplex filters

Select the alignment frequency of the filter in question.
Press the "Presel" key and align the 3 coils to max. signal.

7.5 RX-2

Instruments: Signal generator
LF and distortionmeter
DC-voltmeter
Oscilloscope, 60 MHz

7.5.1 40 MHz buffer

Measure on TP2 by means of the oscilloscope and adjust TR7, TR8, and TR9 to max. 40 MHz signal (4-4.5 Vpp).

7.5.2 1. IF-amp., 2. mixer, 2. IF-filter (SSB)

AGC = OFF, Mode = J3E.
Turn the RF-gain max. clockwise.
Connect the signal generator to input P37;
44.999 MHz, 5 mV emf.
Measure on TP4 by means of the oscilloscope and adjust TR-1, TR-2, TR-3, L2, and L3 to max. output 5 MHz (0.2-0.3 Vpp).

7.5.3 2. IF-amp, detector, 10 MHz amplifier

AGC = OFF, Mode = J3E.
Signal generator = 44.999 MHz, 50 uV emf. on input P37.
Measure on TP5 by means of the oscilloscope and adjust to 50 mVpp (5 MHz) by turning the RF-gain on the front.
Adjust L5 to max. 5 MHz signal.

Detector

Adjust RF-gain to 50 mVpp on TP5.
Measure on TP10 by means of the oscilloscope and adjust TR6 to max. LF-out (approx. 0.2 Vpp).

10 MHz amplifier

AGC = ON.
Adjust RF-gain to 100 mVpp on TP5.

Measure on TP9 by means of the oscilloscope and adjust L8 to max. 10 MHz signal (approx. 1 Vpp).

7.5.4 AM-filter, LF-level, AGC offset, RF-levelmeter

AGC = OFF, Mode = H3E.
Signal generator = 45 MHz, 50 uV emf., 30%.
Measure on TP10 by means of the oscilloscope and adjust to 100 mVpp LF-signal by turning the RF-gain.
Adjust TR4 and TR5 to max. signal.

LF-level

AGC = ON, RF-gain = max.
Measure on TP11 (RX-line) and adjust P4 to 300 mVpp.

AGC offset

Measure on TP3 and adjust P3 to 4 VDC.

RF-levelmeter

Adjust P2 so that the deflection on the RF-levelmeter is 1.

7.5.5 Sensitivity of RX-2

1. Mount RX-2 in a functioning device and connect a flat cable. 40 Mhz and 5 MHz signals.

2. Select J3E and turn the RF-gain max. clockwise.

3. Connect the signal generator to the 45 MHz input (P37) and adjust the frequency to 44.999 MHz.
   Connect the distortionmeter to the external loudspeaker output.

4. Adjust the RF-level of the signal generator so that a signal and noise condition of 20 dB SINAD is obtained.

The sensitivity of RX-2 must be better than 0 dB uV emf. (1 uV emf.) for 20 dB SINAD. (typically -2 dB uV emf.).

5. Repeat the measurement for H3E.
   Select H3E and adjust the signal generator on 45.000 MHz, 30% AM, 1 kHz.
   The sensitivity must be better than 14 dB uV emf. (5 uV emf.) for 20 dB SINAD.

7.6 RX-synthesis

Instruments: DC-voltmeter
Oscilloscope, 40 MHz or
Diode probe

7.6.1 Clarifier loop

Turn the clarifier potmeter max. counter-clockwise.
Measure on TP6 and adjust C88 to 3.2 VDC. V
Turn the clarifier potmeter max. clockwise and check that there is approx. 7.5 VDC on TP6. V
Turn the clarifier potmeter from side to side and check that the clarifier loop is in lock, min. 11.0 VDC on TP5.

7.6.2 100 Hz loop

Measure on TP2. Check that there is min. 4.8 VDC, otherwise the 100 Hz loop cannot get into lock. (5,13)

7.6.3 Summing loop

Adjust the RX-frequency to 109.9 kHz.
Measure on TP7 and adjust L11 to 7.5 VDC. V
Adjust the RX-frequency to 29999.9 kHz.
Check that there is approx. 4.2 VDC on TP7. V
During both measurements, check that the summing loop is in lock, i.e. min. 11.0 VDC on TP4.

If error: Check that there is 10 Vpp, 2-4 kHz on IC6 pin 6. ~1.(5,2V) lock ok.

7.6.4 10 kHz loop

VCO I: Adjust the RX-frequency to 100 kHz.
Measure on TP8 and adjust C35 to 2.0 VDC. V
Adjust the RX-frequency to 8999 kHz and check that there is approx. 6.4 VDC on TP8. V (6,3)

VCO II: Adjust the RX-frequency to 9000 kHz.
Measure on TP8 and adjust C45 to 2.0 VDC.
Adjust the RX-frequency to 18999 kHz and
check that there is 6.0 VDC on TP8.

VCO III: Adjust the RX-frequency to 19000 kHz.
Measure on TP8 and adjust C55 to 2.0 VDC.
Adjust the RX-frequency to 29999 kHz and
check that there is 6.0 VDC on TP8.

V out VCO I-III = -4 dBm (400 mVpp/50 ohm

During the above measurements, check that 10 kHz is in lock, i.e. min. 4.8 VDC on TP9.

5,12

7.6.5 VCO detector

Measure on TP11 (CQ23) and check that there is min. 3.4 VDC (VCO ON).

7.6.6 Loops in lock check

If all loops are in lock, 0 V should be measured on TP1.

7.7 TX SYNTHESIS

Instruments: DC-voltmeter
Oscilloscope, 40 MHz or
Diode probe

7.7.1 Multiplier chain

U_{in} P27 = 400 mVpp/50 ohm.

Measure on TP2 and adjust L9 and L10 to max. 10 MHz signal (0.8 Vpp).
Measure on TP3 and adjust L20 to max. 20 MHz signal (0.5 Vpp).
Measure on J35 cable output and adjust L11 to max. 40 MHz signal (125 mVpp/50 E).
Measure on J29 cable output and adjust L12 to max. 40 MHz signal (500 mVpp/50 ohm).

7.7.2 100 Hz loop

Measure on TP4 which must be min. 4.8 VDC to get the 100 Hz in lock.

7.7.3 Summing loop

Select TX-frequency : 1609.9 kHz.
Measure on TP7 and adjust L13 to 7.5 VDC. ✓
Select TX-frequency : approx. 29990 kHz.
Check that there is approx. 4.2 VDC on TP7. ✓
During both measurements, check that the summing loop is in lock, i.e. min. 11.0 VDC on TP6. ✓

If error: Check that there is 10 Vpp/2-4 kHz on IC6 pin 6.

7.7.4 10 kHz loop

VCO I: Select TX-frequency : 1600 kHz.
Measure on TP8 and adjust C37 to 2.5 VDC.
Select TX-frequency : 8999 kHz.

Check that there is 6.7 VDC on TP8.

VCO II: Select TX-frequency : 9000 kHz.
Measure on TP8 and adjust C46 to 2.0 VDC. ✓
Select TX-frequency : 18999 kHz.
Check that there is 6.2 VDC on TP8. ✓

VCO III: Select TX-frequency : 19000 kHz.
Measure on TP8 and adjust C56 to 2.0 VDC. ✓
Select TX-frequency : 29999 kHz.
Check that there is 6.2 VDC on TP8. ✓

V out VCO I-III = -8 dBm (252 mVpp/50 ohm).

During the above measurements, check that the 10 kHz loop is in lock, i.e. min. 4.8 VDC on TP9.

7.7.5 <u>VCO detector</u>

Measure on TP11 (CQ 25) and check that there is min. 3.4 VDC (VCO ON). 5,12 ✓

7.7.6 <u>Loops in lock check</u>

If all loops are in lock, 0 V should be measured on TP12. ✓

7.8 CONNECTION BOARD

Instruments: DC-voltmeter

1) Measure on TP1 and adjust P1 to +12 VDC.

2) Measure on TP3 and adjust P2 to +12 VDC.

3) Measure on TP5 and adjust P3 to +5 VDC.

7.9 FRONT LOGIC

Instruments: Oscilloscope, 10 MHz

7.9.1 Photointerrupter

Adjust the photointerrupters by measuring on TP1 and TP2.
The photointerrupters are adjusted mechanically until the following is shown on the scope:

7.10 POWER AMPLIFIER

Dummy load (1.6-4 MHz = 10 ohm in series with 250 pF; 4-30 MHz = 50 ohm) is connected to antenna horn.

Instruments: DC-ammeter
Oscilloscope, 30 MHz
Dummy load, 200 W
Signal generator

Before adjusting the PA-stage, the bias jumpers to the PA and driver transistors are removed. The adjustings apply for 12 V and 24 V versions.

7.10.1 Pre-amplifier (Q1)

Insert an ammeter in the 14.4 V supply to the PA-stage (SP2 pin 3).
Key the unmodulated exciter and adjust the bias to 300 mA by means of P1.

7.10.2 Driver (Q3+Q4)

Insert an ammeter in the 12 V or 24 V supply to the PA-stage (SP2 pin 3).
Connect bias jumper J1 to the driver.
Key the unmodulated exciter and adjust the bias to 150 mA by means of P2.

7.10.3 Power amplifier (Q8+Q9)

Connect bias jumper J2 to the power amplifier.
Key the unmodulated exciter and adjust the bias to 450 mA (including the driver) by means of P3.

7.10.4 6 dB attenuator

Press the "low power" key.
Measure on the output of the PA-stage by means of the scope and check that the output has been attenuated 6-7 dB.

7.10.5 Final adjustment

Measure on the output of the PA-stage by means of the scope.
Check that the PA-stage is frequency linear from 1.6-26 MHz within +/-10%.
Connect the signal generator (+15 dBm, 90% AM) to the output of SP3 and adjust P4 to a place just before clipping at the poorest place in the frequency range.

7.11 PA-FILTER

Instruments: Signal generator
Dummy load, 50 ohm
Oscilloscope

7.11.1 Connect the 50 ohm dummy load directly to the filter output by unsoldering L19, and measure by means of the scope above the output.
Connect the signal generator to SP2.
Select a transmitting frequency below 2.4 MHz.

7.11.2 Adjust L1, L2, and L3 to a cut-off frequency of approx. 2.4 MHz and to min. attenuation in the pass band.
The cut-off frequency is checked by varying the frequency of the signal generator.

7.11.3 Select a transmitting frequency between 2.4 and 4.3 MHz.
Adjust L5 to a cut-off frequency of approx. 4.3 MHz and to a min. attenuation in the pass band.

7.12 CONVERTER

Instruments: DC-voltmeter

7.12.1 Measure on SM3 pins 1 and 7.
By a current of 3 A, the voltage is adjusted to 14.4 V by means of P1.
Check that there is 18.3 V +/-0.5 V by 85 mA on SM3 pin 9, and 7.75 V +/-0.2 V by 1 A on SM3 pin 8.

7.13 DETECTOR ASSEMBLY

Instruments: DC-voltmeter

7.13.1 Connect a load of 12.5 ohm 0^{o} to SD3.
Mode = A1A.
Press the "low power" key.
TX-frequency = 6 MHz.
R-detector (C23) and SWR-detector (C16) are adjusted to balance, i.e. 0 V on the output in proportion to the reference.
Check that the phase detector also has 0 V on as output.

7.14 SIDEBAND SWITCH

Instruments: DC-voltmeter

7.14.1 VCXO

Select LSB (spec 8).

Measure on D2 cathode and adjust C13 to 6.0 VDC.

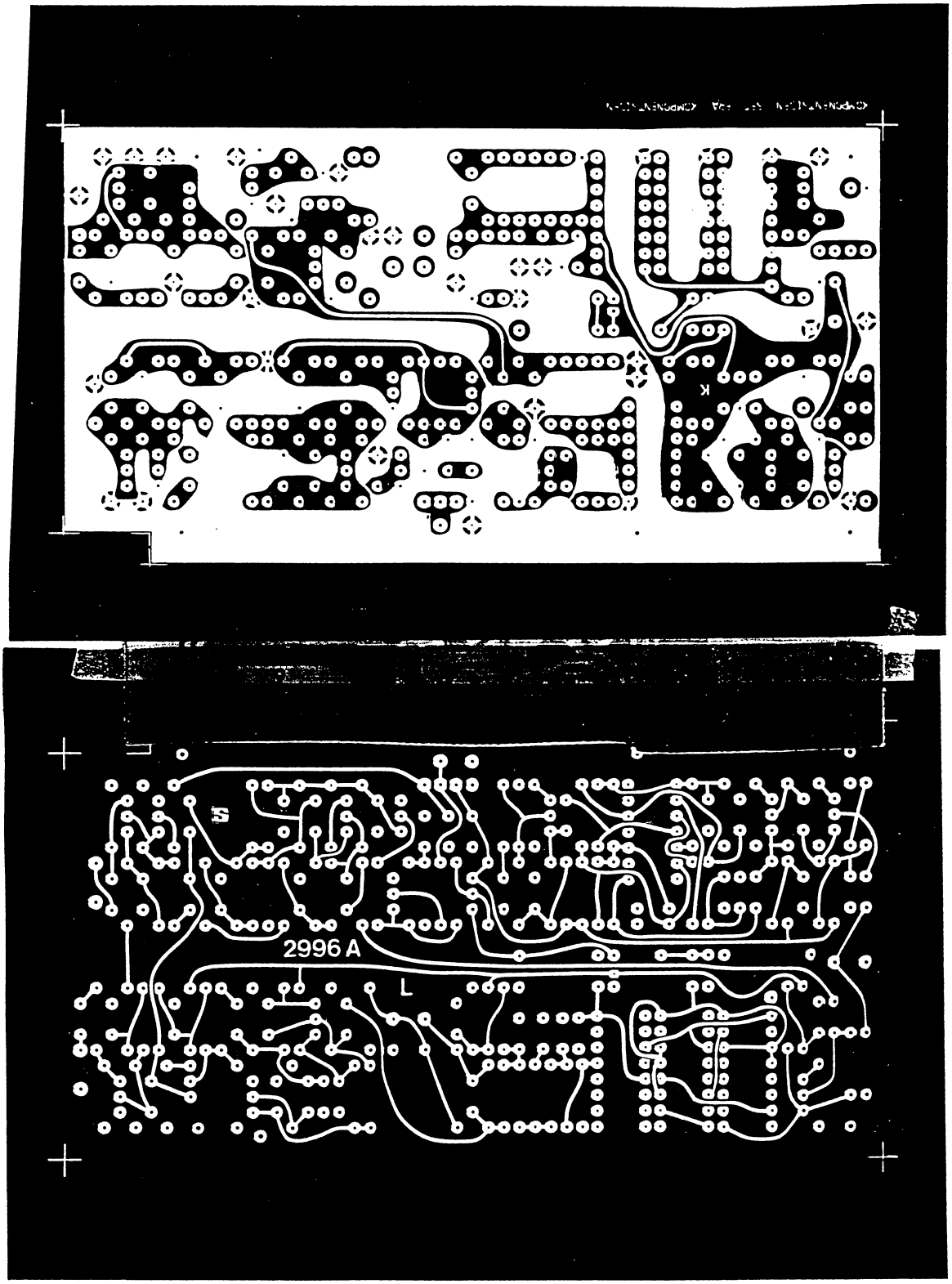
7.15 INSERTION OF LSB PCB NO. 2996

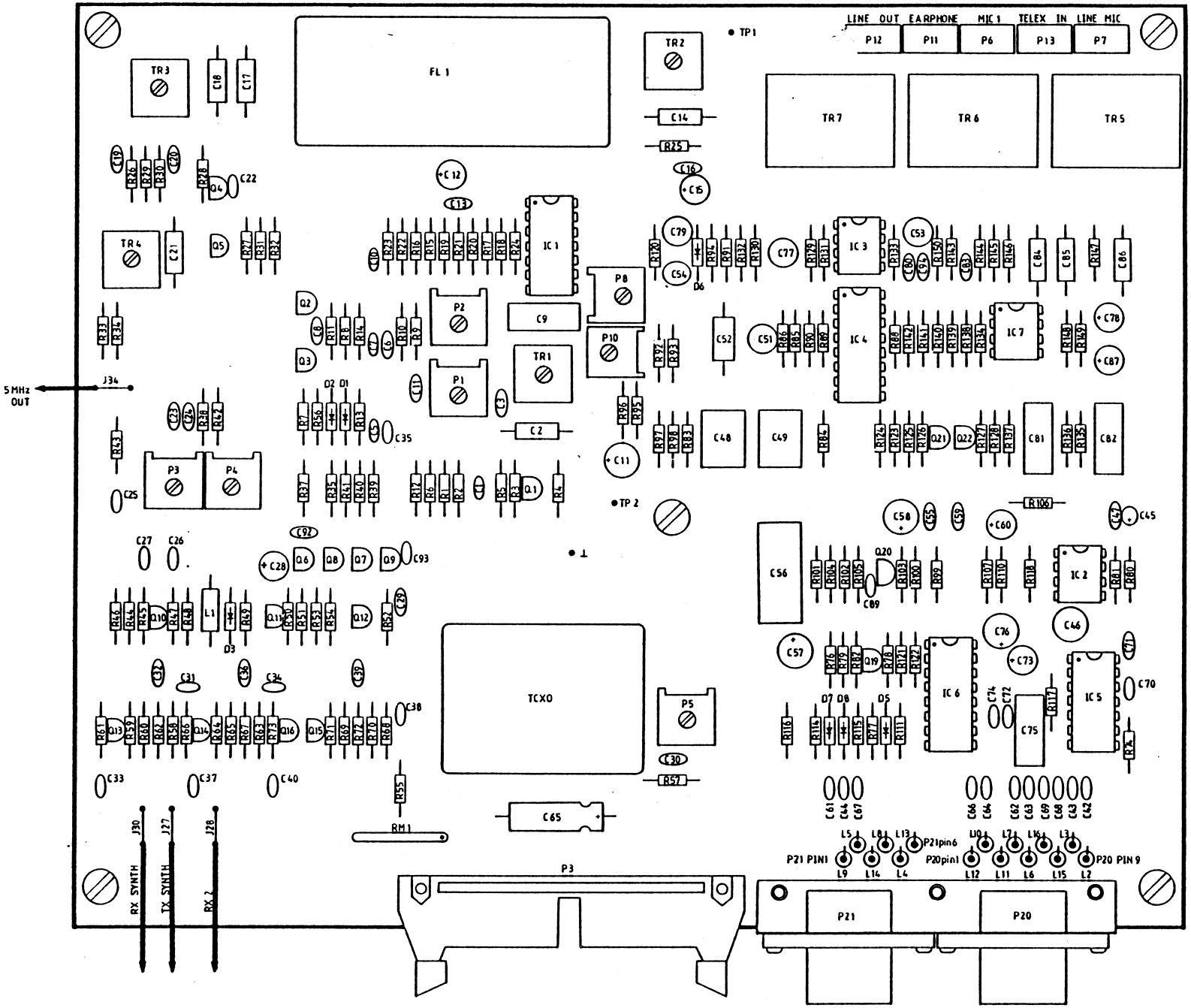
1) Remove R1 and R2 (TX-1 pcb no. 2901).
   Replace R1 by 56 ohm, one pin is put to ground and the conductor lane from R1 to TCXO output (pin 4) is broken.
   Replace R2 by two soldering clips, and mount a coaxial cable with "5 MHz output to TX-1" from LSB pcb no 2996.

2) Remove R70 (TX-1) and replace by 3K3.
   Remove Q15 (TX-1) and replace by 3 soldering clips.
   Connect the emitter clip to ground on LSB pcb (pin 1).
   Connect the basis clip to AM/SSB on LSB pcb (pin 4).
   Connect the collector clip to LSB/USB on LSB pcb (pin 3).

3) Connect a coaxial cable between J28 (TX-1) and "5 MHz input" on the LSB pcb.
   Move over the original coaxial cable on J28 to "5 MHz output to RX-2" on the LSB pcb.

4) Cut loose the collector clip on the soldering side of the TX-1 pcb (2 conductor lanes are broken) and connect a jumper between Q16 basis and the connection point between R69 and R71.
   Connect the disengaged collector clip to P3 pin 19 by means of a jumper.


K
S
2996 A
L



TX 1 2901C
DRAWING No. : 80.2901

RX SYNTHESE 2868 E

100 Hz LOOP

SUM LOOP

SUM MIX

P5

5 v

12 v RX

NC

Coax 1

4 x IC 1 4011

R-VCO SEL A

R-VCO SEL B

ROOL

GND

RLE 2

RLE 1

R DATA

R CLOCK

CLARIFIER-V

R MISS

5V if all loops in lock

TP12

IC2 MC 145158

IC3 1/2 LM 358

IC4 4518

IC5 4046

IC6 M741

IC7 1496

2,5 - 7,3 V dc depending on frequency

If in lock min 10 V dc TP4

D2 1N4148

1N 4148

5MHz BUFFER

5MHz -4dBm (400mVpp)

220mVpp

P30

BC 237 Q13

X1 10,245 MHz

CLARIFIER LOOP

IC8 1496

IC9 14046

PC1 in

PC2 OUT

R1 VCO

R2 VSS in VCO

(in lock min 10V)

TP5

L9 470uH

3,2 V - 7,5 V dc

TP6

CLARIFIER VCO

L10 1147

BC237 Q15

BC 237 Q16

BB 505 G

2 Vpp

SUM VCO

If in lock 2,5 V dc to 4,2 V dc

TP7

BC 237 Q17

BC 237 Q18

BC 237 Q19

BC 237 Q20

SUM BUFFER

IC 7 PIN 6

VCO I
45,1 - 53,99 MHz

VCO II
54,0 - 63,99 MHz

VCO III
64,0 - 74,99 MHz

BC 307 Q24

BC 307 Q5

BC 307 Q8

BF 763 Q2

BF 763 Q3

BF 763 Q4

BF 763 Q6

BF 763 Q7

BF 763 Q9

BF 763 Q10

BF 763 Q22

BF 199 Q11

BF 199 Q21

BC 237 Q12

BC 237 Q23

BB609A

1N4148

FREQUENCY

	LOW	HIGH
VCO I :	2,0 V -	6,4 V dc
VCO II :	2,0 V -	6,0 V dc
VCO III :	2,0 V -	6,0 V dc

IC 10 LF 351

IC 11 MC 145158

IC 12 S 89

If in lock min 4,8 V dc

TP9

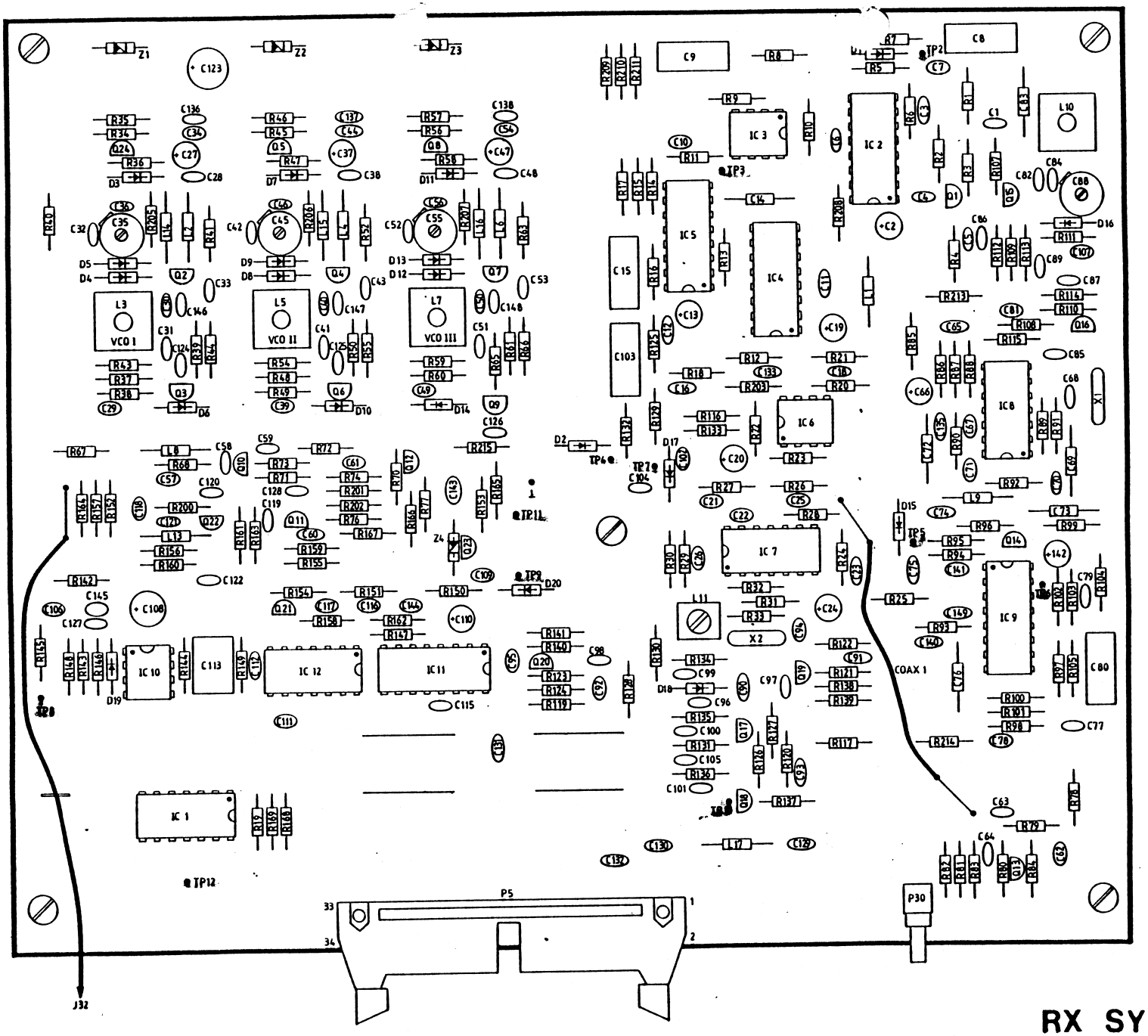
TP8

J32 OUTPUT 45,1 - 75 MHz -4dBm (400 mV pp)

VCO on min 3,6 V dc
VCO off max 0,5 V dc

TP11

10 kHz LOOP



RX SYNTHESE 2868E

TEGN. NR. 80.2868

841122

5 MHz BUFFER

100 Hz LOOP

SUM LOOP

SUM MIX

P1

+5V TX

+12V TX

NC

T VCO SEL A

T VCO SEL B

TOOL

GND

TLE 2

TLE 1

T DATA

T CLOCK

+12V RX

T MISS

NC

COAX 1

IC 1 4011

VCO3

VCO2

VCO1

0V if all loops in lock

IC 2 MC 145158

VDD R=3k

Fin

Clock Data LE VSS LD

IC 3 1/2 LM 358

TP5

3,5-4,6V dc depending on frequency

IC 4 4518

IC 5 4046

VCO in

PCA in

VCO out

PC2 out

LP min

VSS

IC 6 LM 741

10Vpp 2-6KHz

IC 7 1496

TP4 4,8V dc in lock

min. if

min 11V dc if in lock

D1 1N4148

D2 1N4148

SUM VCXO

SUM BUFFER

P27

5MHz in +4dBm (400mVpp)

40MHz TX +14dBm (125mVpp)

J35

40MHz RX +2dBm (500mVpp)

J29

10 MHz

20 MHz

40 MHz

40 MHz

VCO I, 46,6 - 53,99 MHz

VCO II, 54,0 - 63,99 MHz

VCO III, 64,0 - 74,99 MHz

FREQUENCY

	LOW	HIGH
VCO I :	2,5V -	6,7 V dc
VCO II :	2,0V -	6,2 V dc
VCO III :	2,0V -	6,1 V dc

IC 11 LF 351

IC 9 MC 145158

IC 10 S89

OUTPUT 46,1-75MHz +8 dBm 250mVpp

TP11 VCO on min 3,4 Vdc VCO off max 0,5Vdc

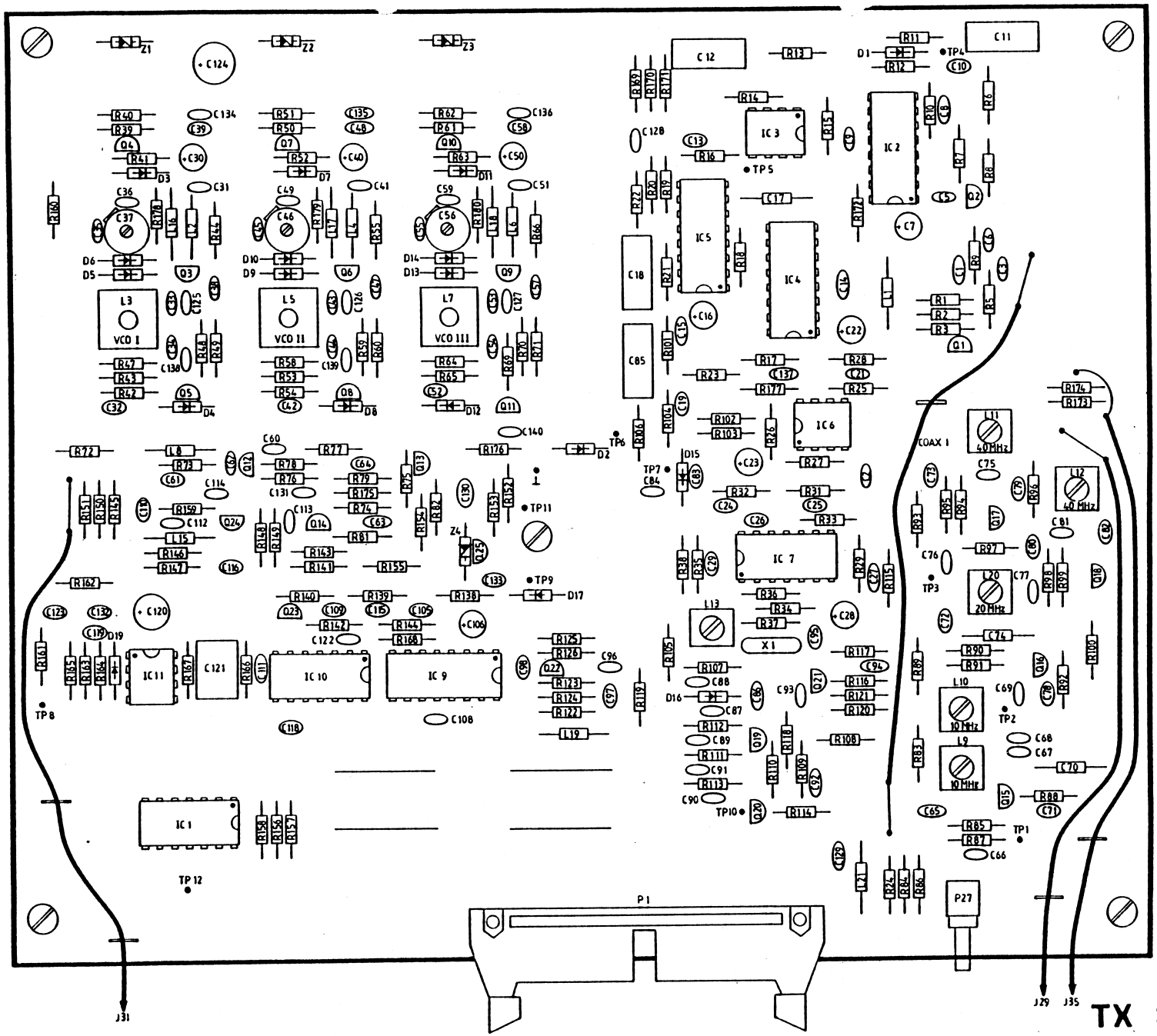
OUTPUT BUFFER

10 KHz LOOP

TX - SYNTHESE 2935C

DIAGRAM No. 92.7164

850118



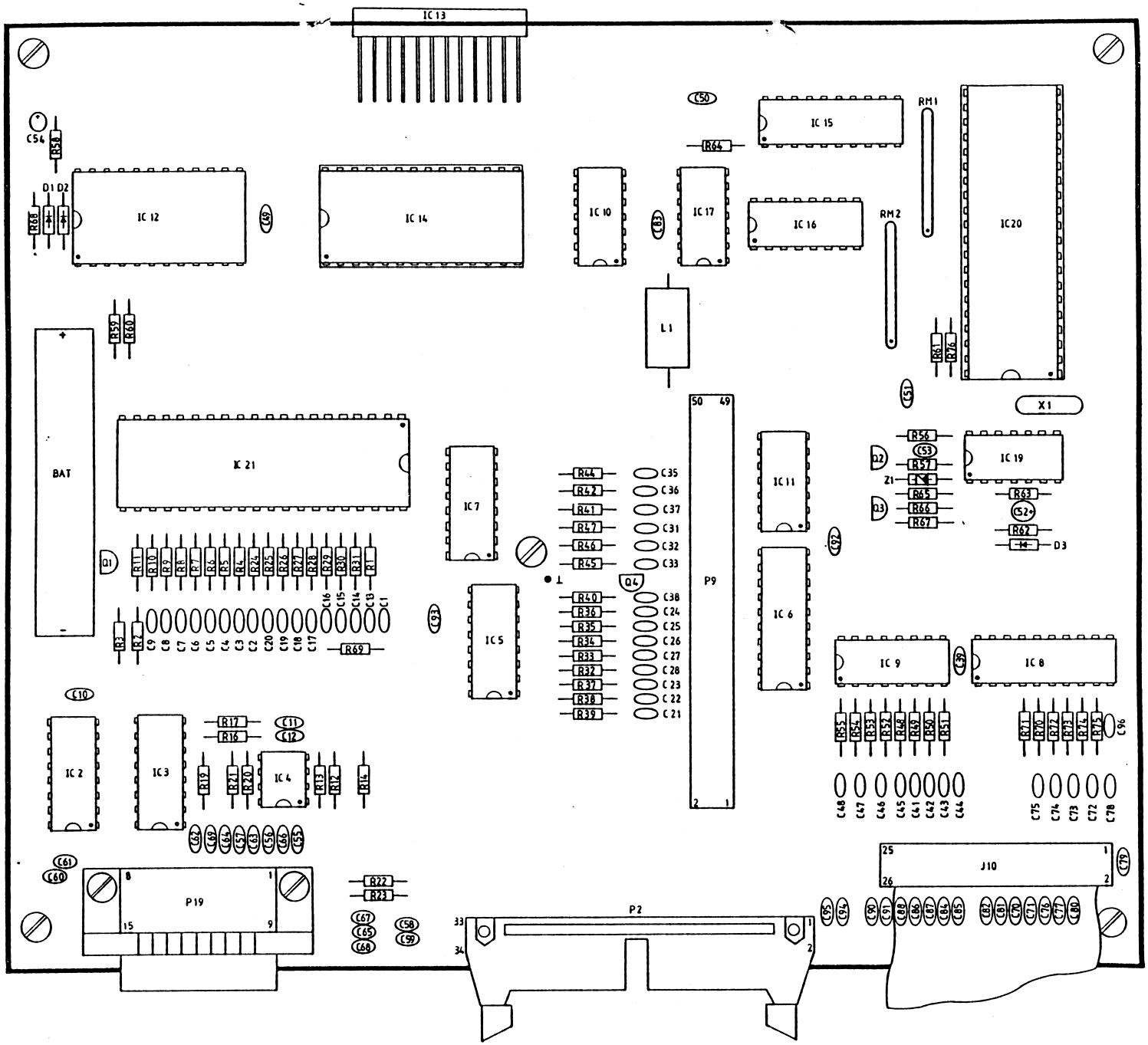
TX SYNTHESE 2935C

TEGN. NR. 80.2935

841122

COMPUTER 2891E

DIAGRAM No. : 92.7162



COMPUTER 2891E

DRAWING No. 80.2891

841122

CONNECTION BOARD 2938C

DIAGRAM No. : 92.7146

VOLTAGE REGULATORS

SUPPLY CHECK

KEY DET.

SQ. DET.

INTERRUPT GATE

-5V CONVERTER

DATA I/O

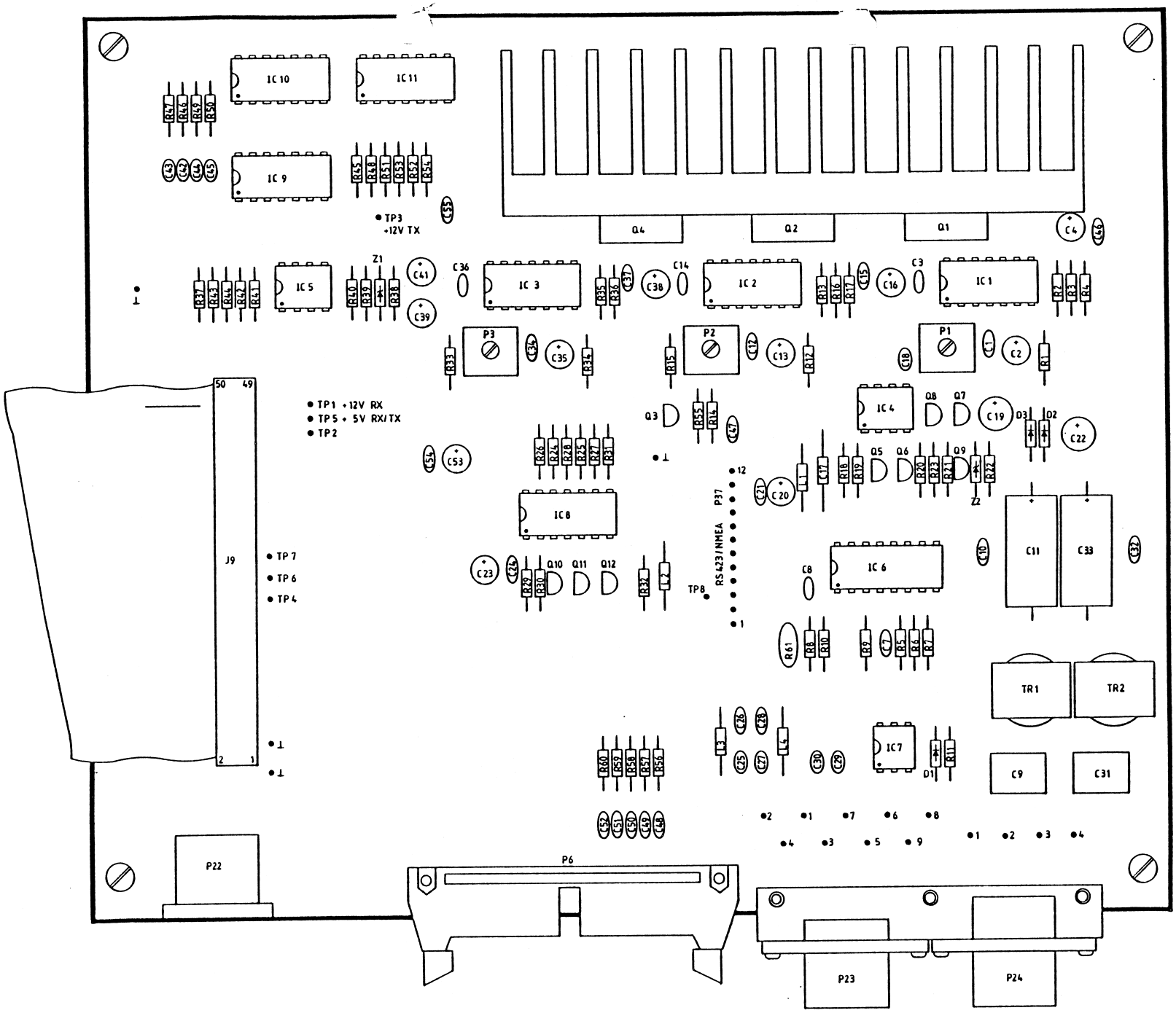
DATA IN NMEA

DATO I/O / DATO OUT RS 423 / NMEA

P37 RS423/ NMEA

DATA ENABLE SOD

Backplane



CONNECTION BOARD 2938C

DRAWING No. 80.2938

P11 CLOCK D LEN 1 DATA I D LEN 2 OE STROBE DATA CLOCK NC OV METER TX METER RX METER GND AF DIM 0V +5V

P10 PIN 18 P10 PIN 16 P10 PIN 10 TO Q3

P10
26 F DATA
24 0V
22 GND AF
20 SWITCH
18 OV METER → P11 PIN 10
16 TX METER → P11 PIN 11
14 F CLARIFIER V → R44
12 RX LINE
10 RX METER → P11 PIN 12
8 F SELECT B
6 F SELECT C
4 DATA 4
2 DATA 2
1 DATA 1
3 DATA 3
5 F CLOCK
7 F SELECT A
9 RF GAIN
12 RX LINE
13 KEY INT
15 OPTO INT
17 SWITCH
19 AF POWER OUT
21 +15V
23 +5V
25 +12V RX

SW1 SUPPLY

IC 12 PIN 9

IC 12 1/3 4053

IC 3 1/6 4049

4094 IC8 STROBE DATA CLOCK OE QG QF QA QB QE VDD VSS

4028 IC 5

IC 9 TDA 1037

VOLUME P4

L1 330µH

Q4 BC237

BC 237 Q5

D9 1N4148

RE1 MZ 12 +12V

P16 SPEAKER TP8 TP7

IC 3 1/6 4049 5V *

1/6 4503 IC 2 TP2

1/6 4503 IC2

GP1S03 IC 6 GP1S03 IC 7

IC10 1/4 4093

IC 10 1/4 4093

TP1

5V WHEN TURNING OPTOWHEEL.

1/2 IC 1 4012 STEL

IC 10 1/4 4093 +5V

IC 3 4049 STEL

IC 3 4049 P10 PIN 15

IC 3 4049 P10 PIN 13

RM 1 PIN 6,7 NC

RM 2 PIN 5,7 NC

IC 2 4/6x4503

1/2 IC 1 4012

IC 11 LM 723

IC 8 PIN 14

IC 12 1/3 4053

MJE 3055T Q3

BD 139 Q2

BC 307 Q1

CLARIFIER

5V-9,5 V dc +DIM P11 PIN 14

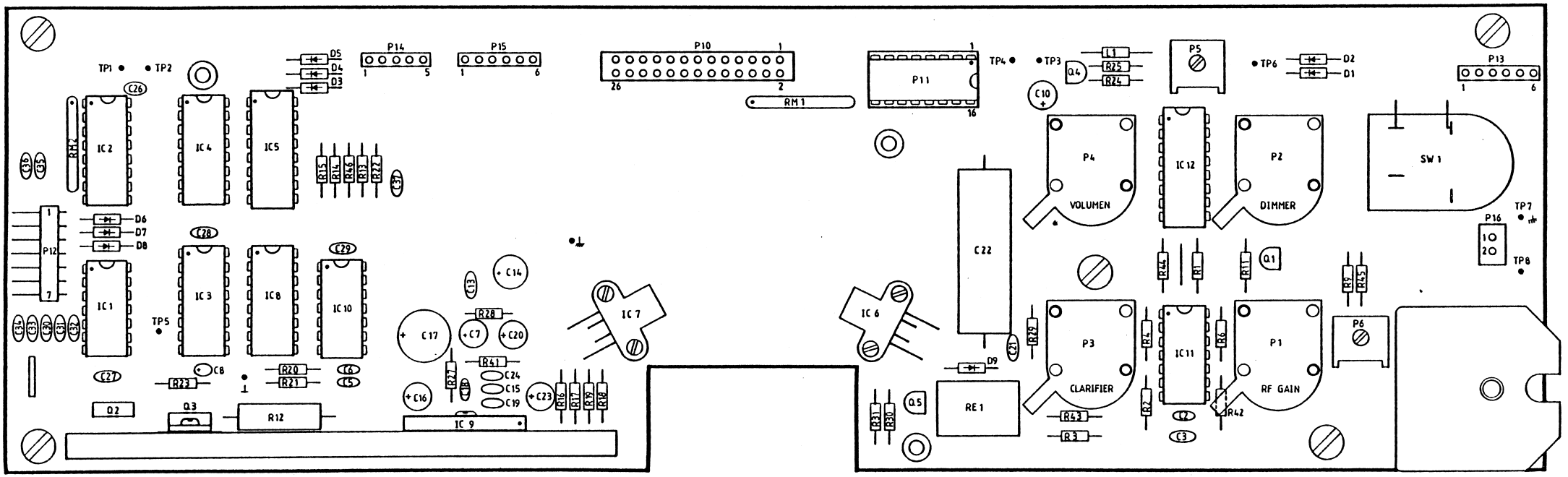
P10 PIN 14

P 13 P15 P14 P12

* VOLTAGE IF NO INTERRUPT FROM KEYBOARD OR OPTOWHEEL

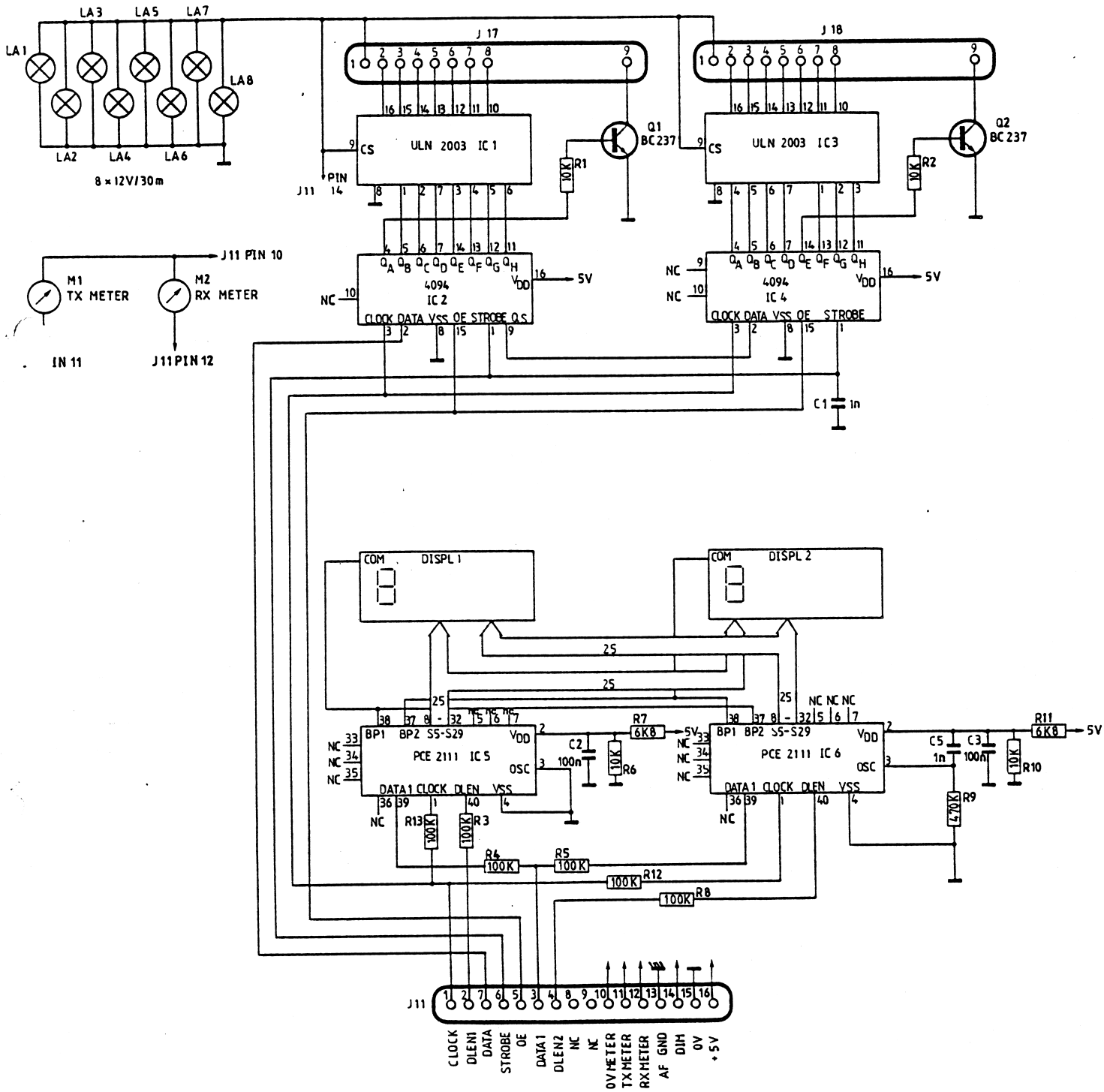
FRONT LØGIO 2899B

DIAGRAM Nr. 92.7148



FRONT LOGIC 2899B

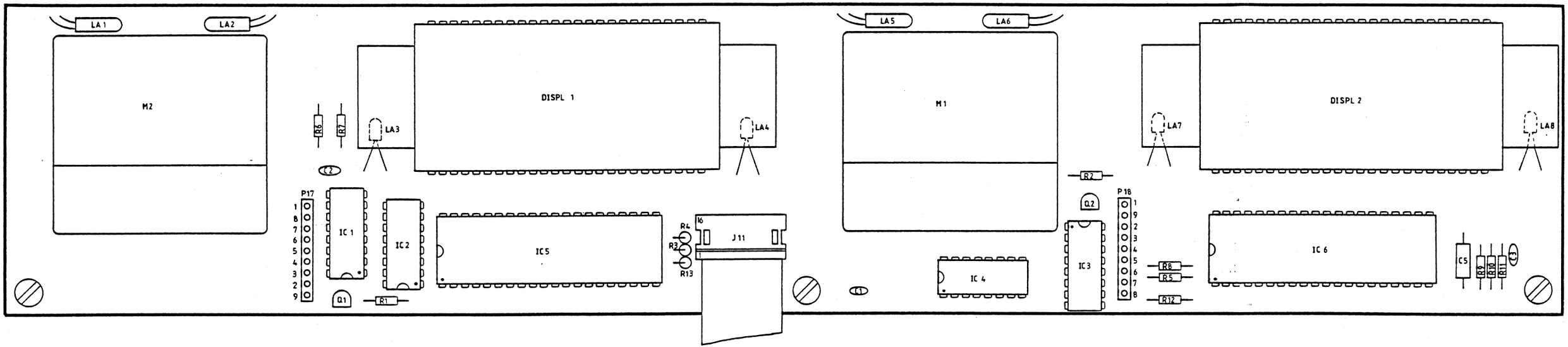
DRAWING No. : 80.2899



LCD DISPLAY 2914B

DIAGRAM No. : 92.7141

841130



LCD DISPLAY 2914B

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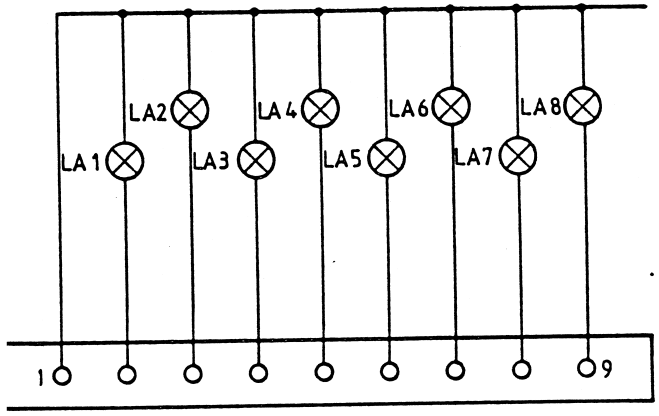
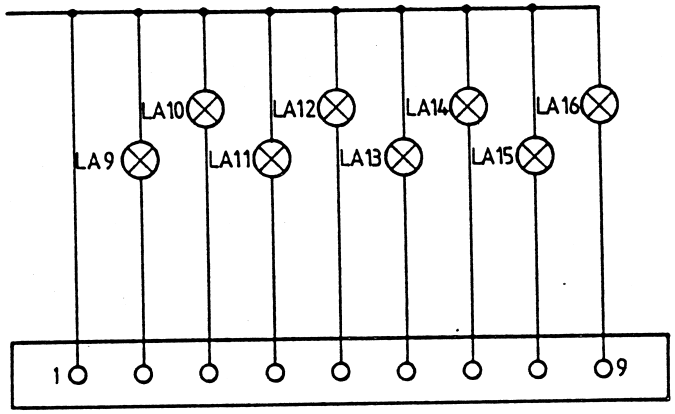


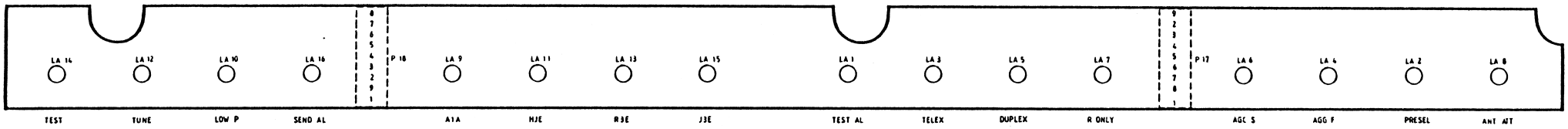
P 17



P 18

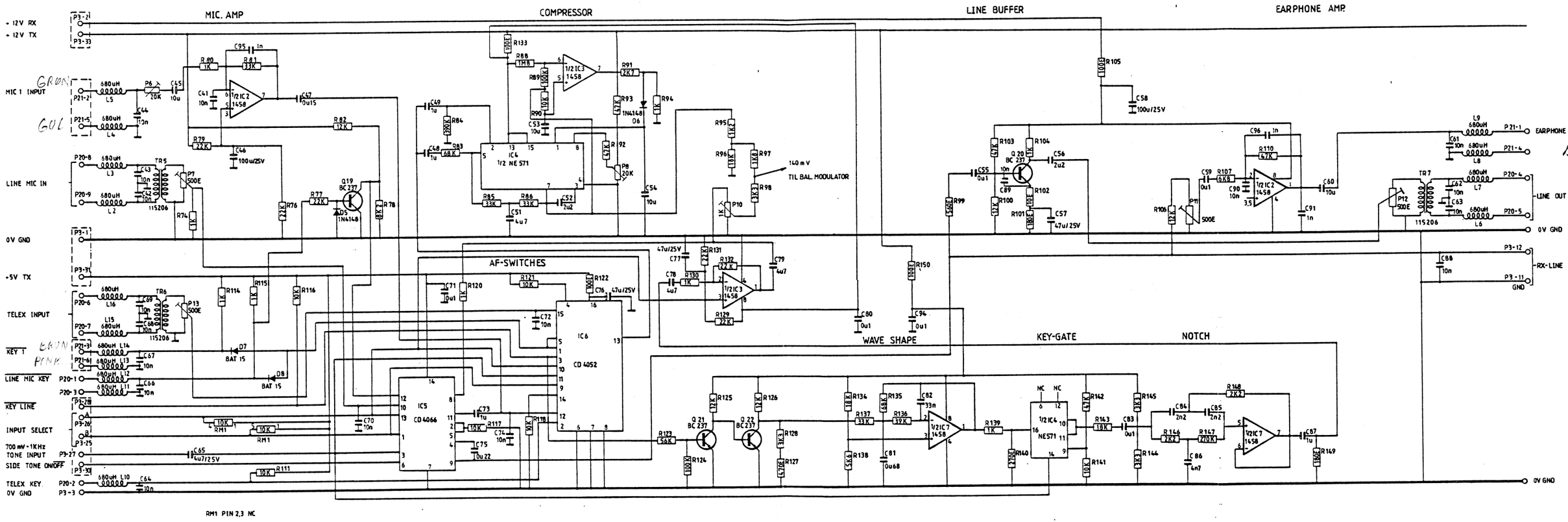
LAMP BOARD 2945 A

DIAGRAM No. 92.7185

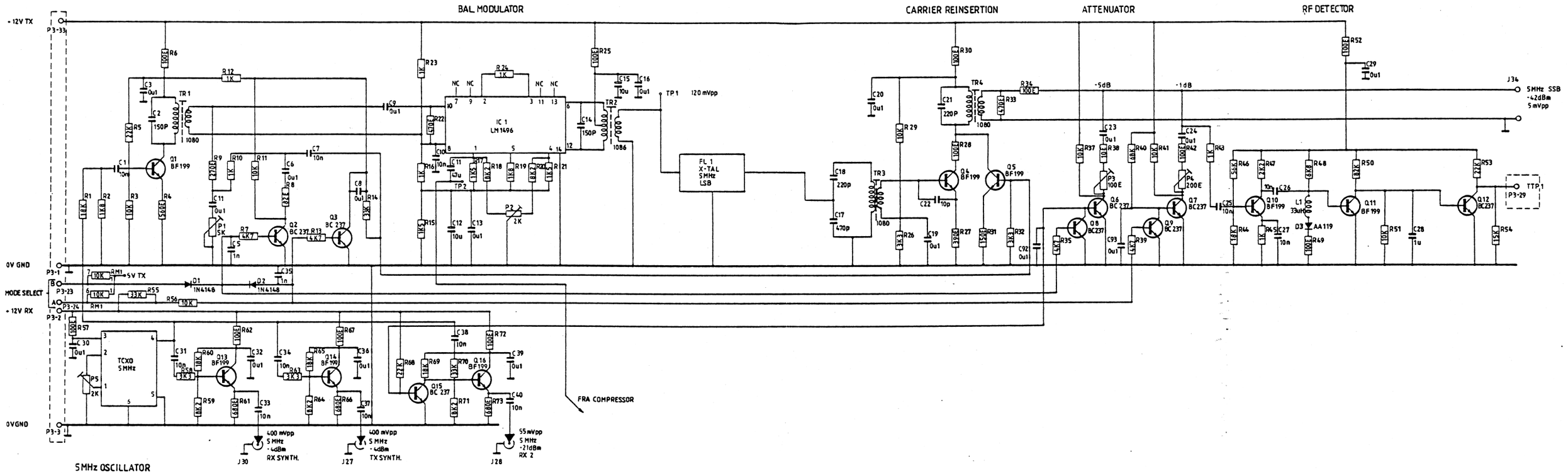


LAMP BOARD 2945A

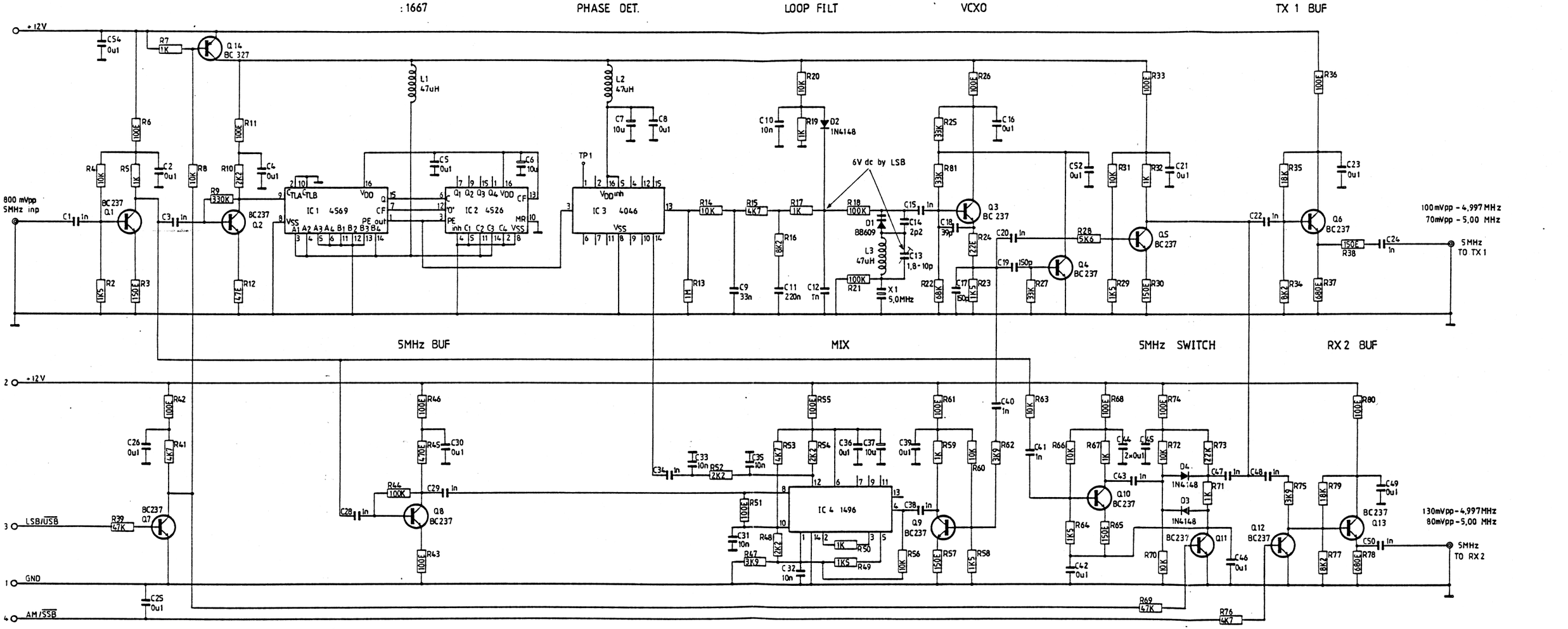
DRAWING No. : 80.2945



DELDIAGRAM AF TX1
AF-ENHED 2901C
DIAGRAM No. 92.7139

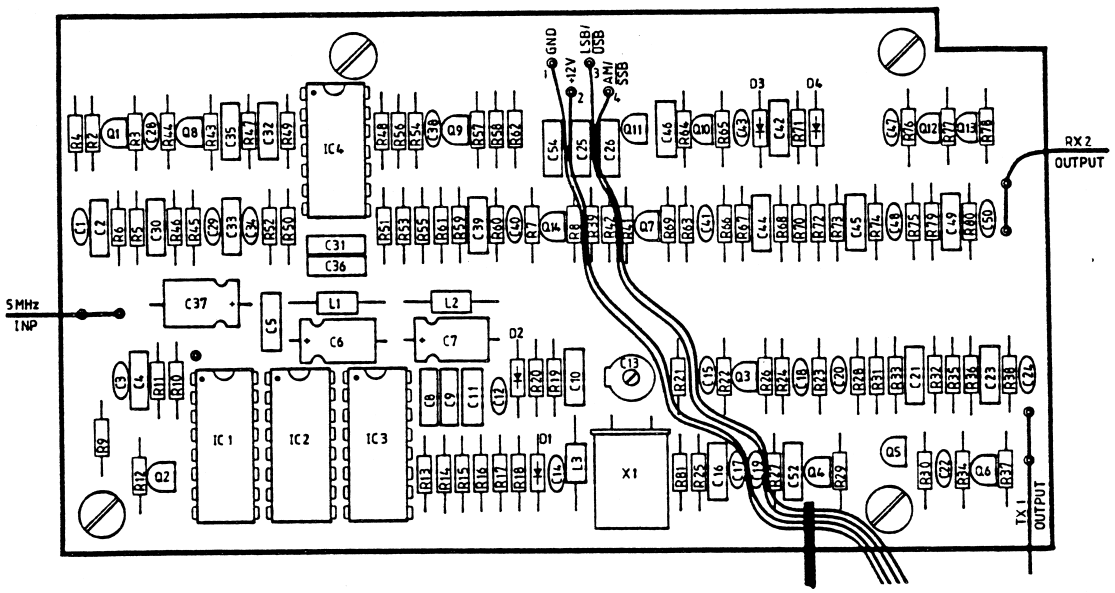


DELDIAGRAM AF TX1
SSB GENERATOR 2901C
DIAGRAM No.92.7140



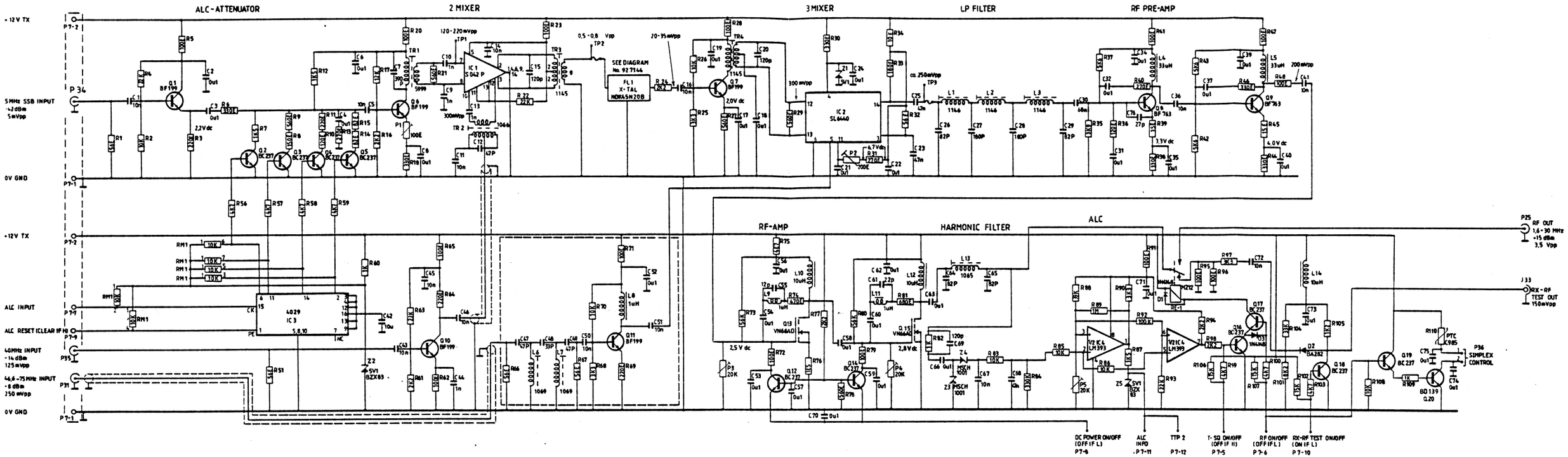
SIDEBAND SWITCH-LSB 2996A

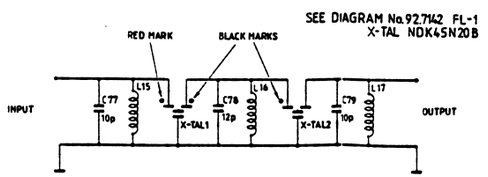
DIAGRAM No. : 92.7190



SIDEBAND SWITCH-LSB 2996A

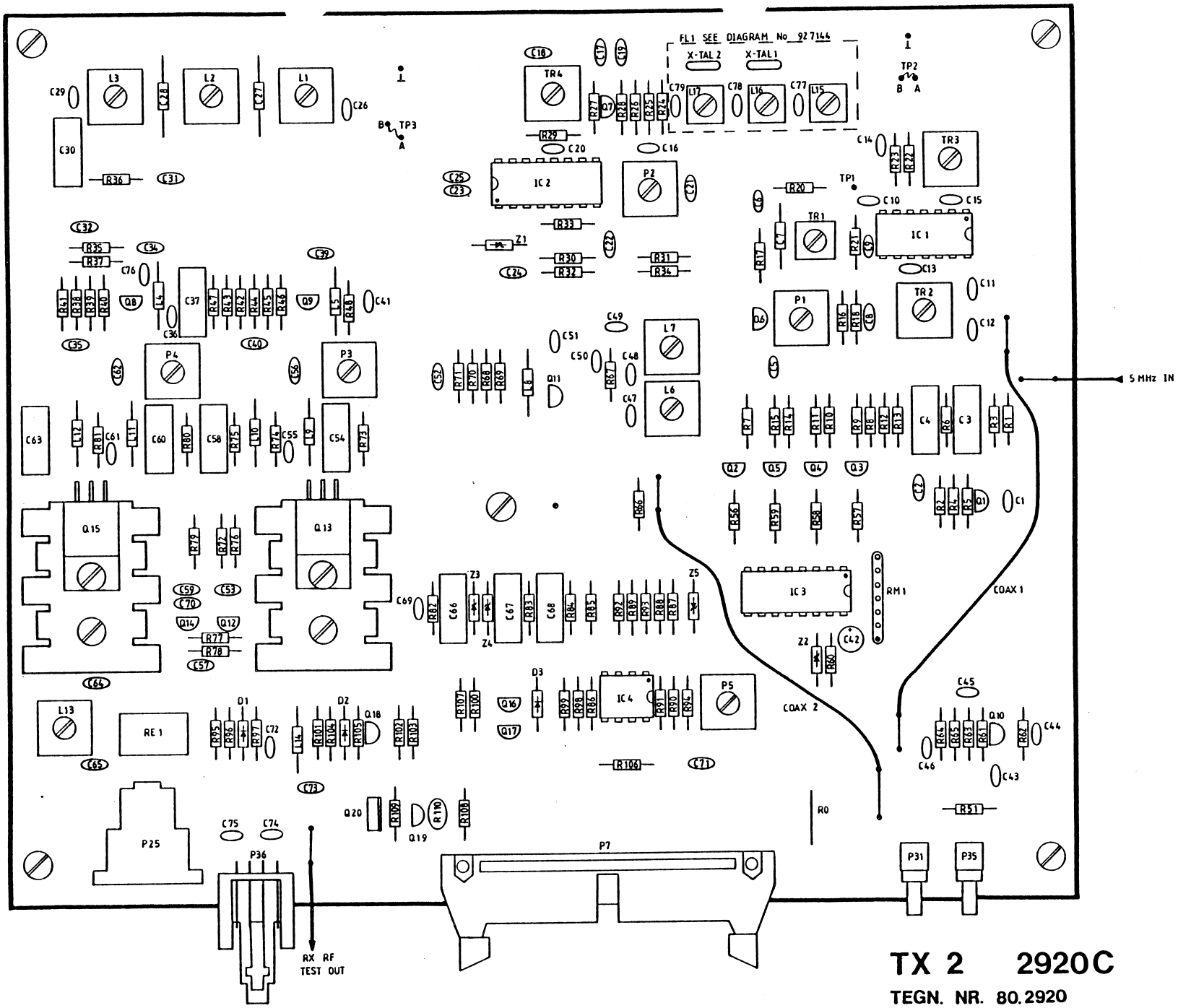
DRAWING No. : 80.2996





FL1 X-TAL NDK45N20B 2920C
DIAGRAM No. : 92.7144

TX2
2.MIX., 3MIX. AND RF-AMP 2920C
DIAGRAM No. : 92.7142



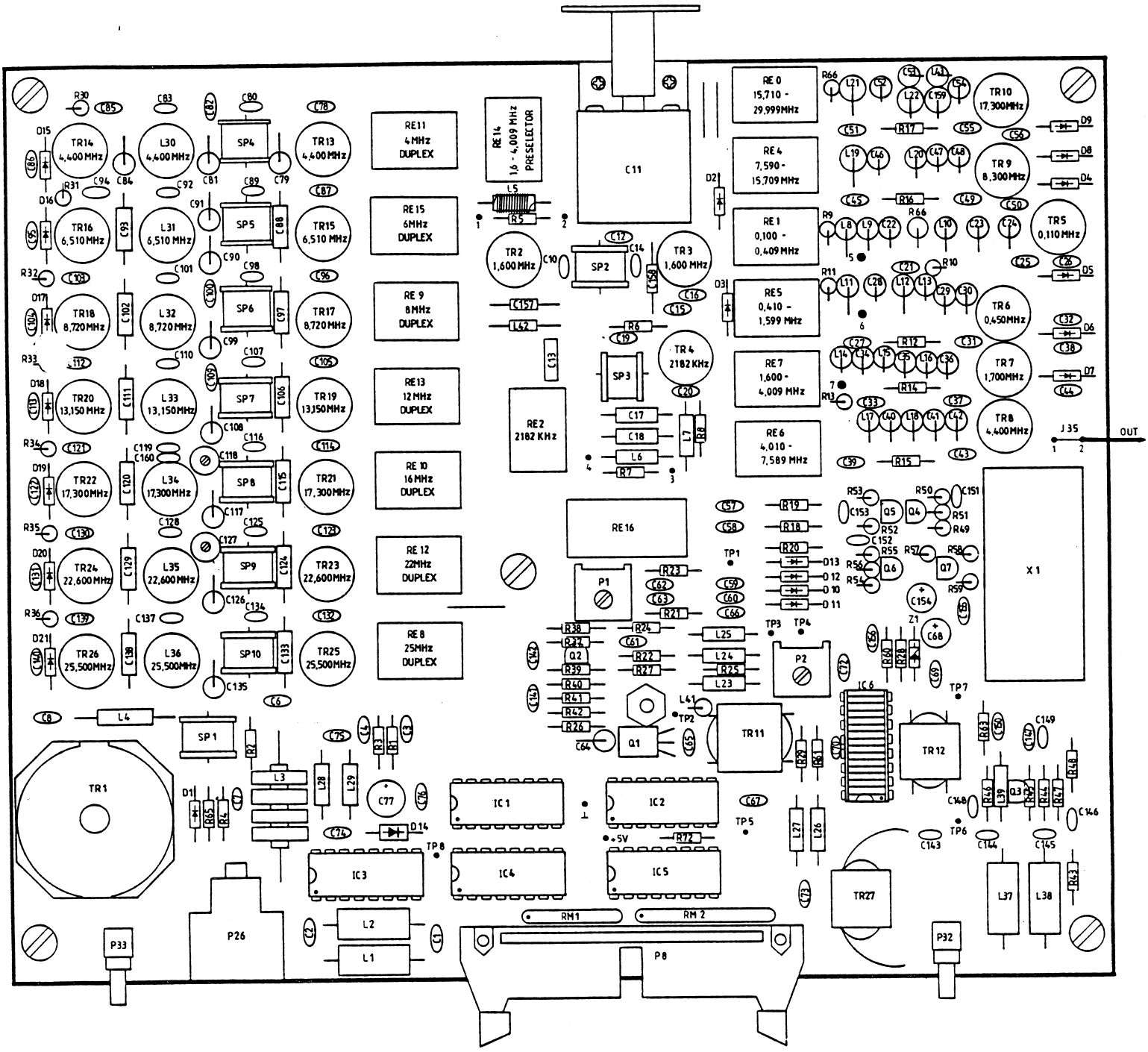
TX 2 2920C

TEGN. NR. 80.2920

841122

P33
RX "ES"
RX ANT
P26
P8
12V RX
12V GND
IC 1,2 OG 3 = ULN 2003
IC4 4028
IC5 4028
R FILT D
R FILT B
R FILT C
R FILT A
ANT ATTENUATOR
5V RX
5V GND
RTP A
RTP B
TP8
RF-AMP
1. MIX
ATTENUATOR
12V
IC6 6440
IC1 45MHz
J37
45MHz OUT
P32
DC-DETECTOR
INJ. BUFFER
45MHz DETEKTOR
1,6-4,009 MHz PRESELECT
2182 KHz
100-409,9 KHz WIDE 1
0,410-1,599 MHz WIDE 2
1,6-4,009 MHz WIDE 3
4,010-7,589 MHz WIDE 4
7,590-15,709 MHz WIDE 5
15,710-30 MHz WIDE 6
4MHz duplex
6 MHz duplex
8 MHz duplex
12 MHz duplex
16 MHz duplex
22 MHz duplex
25MHz duplex

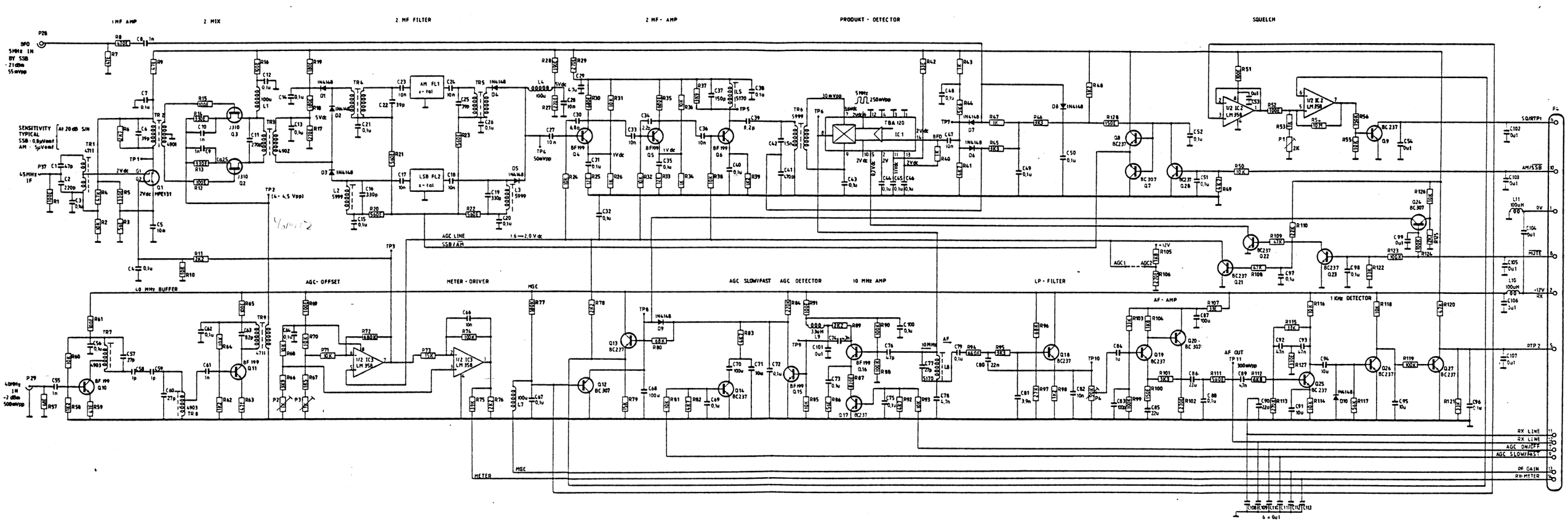
RX-1 2937C
DIAGRAM No. 92.7153
840121



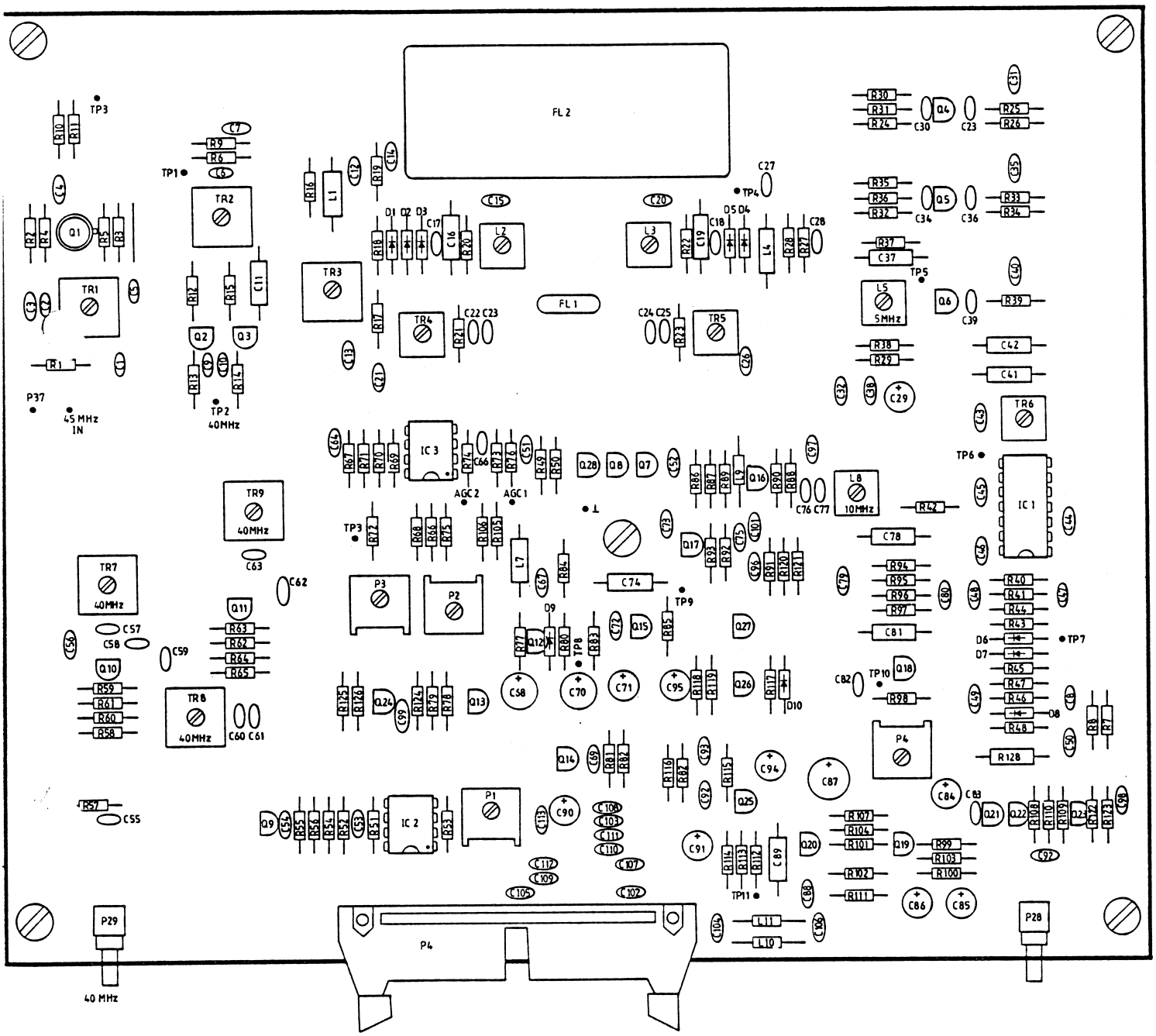
RX 1 2937 C

DRAWING No. : 80.2937

841122

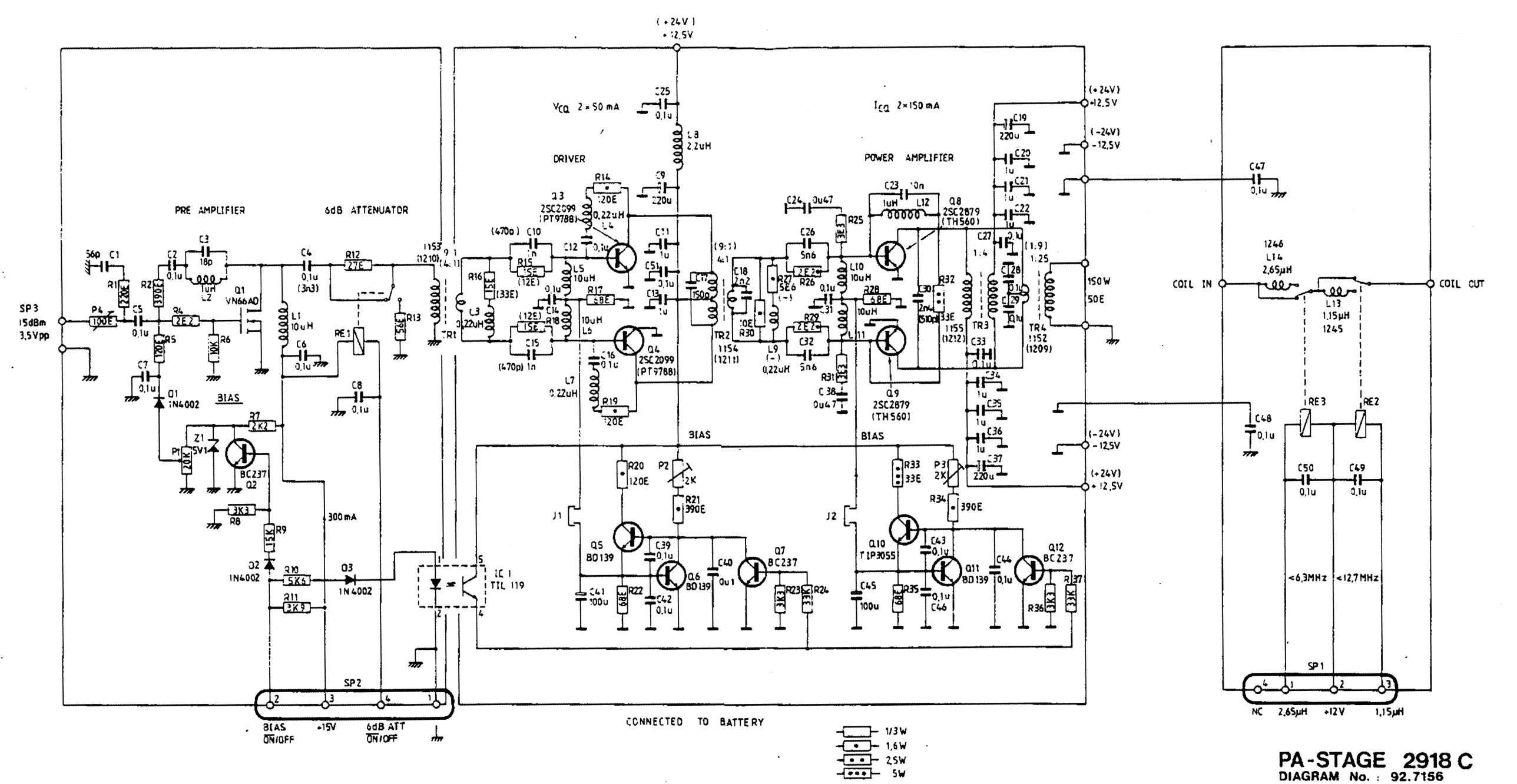


RX 2 2924C
DIAGRAM No. : 92.7136

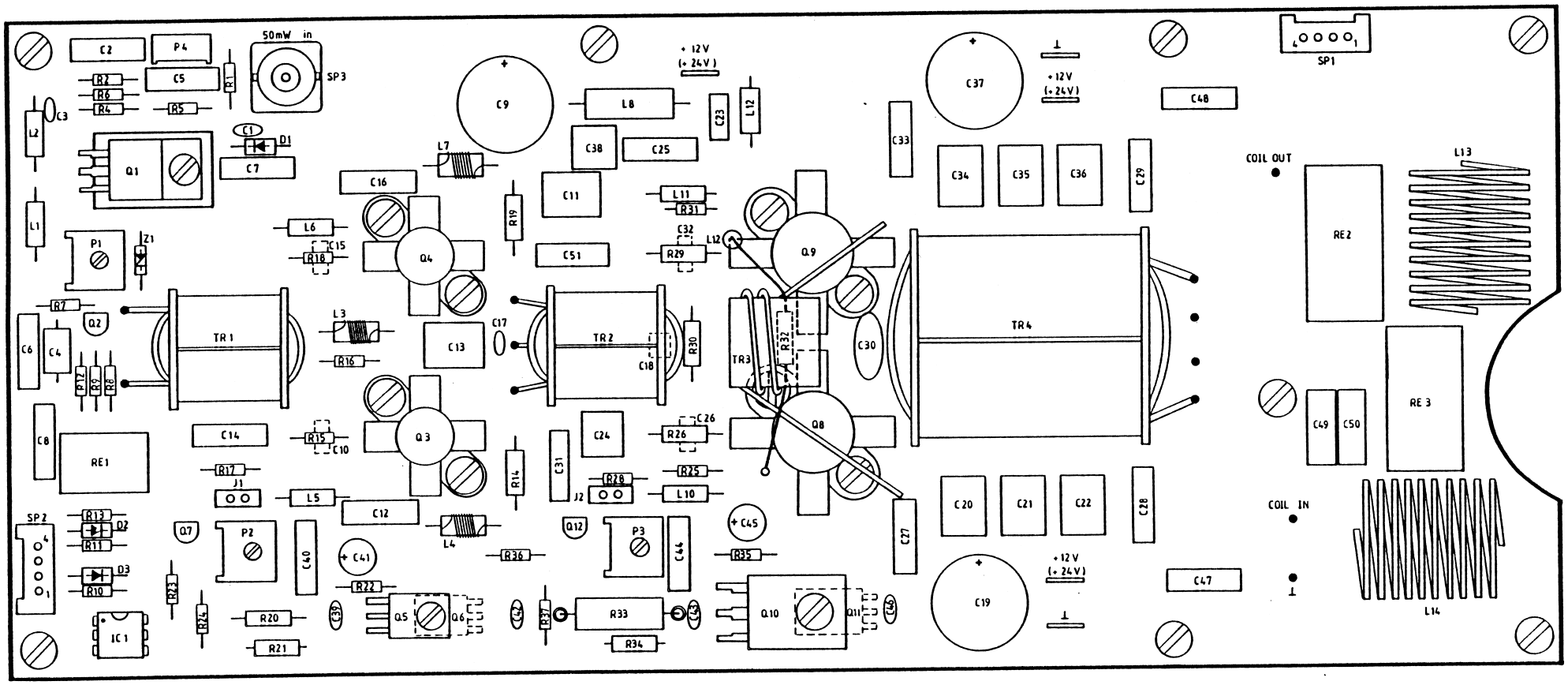


RX 2 2924C

DRAWING No. : 80.2924

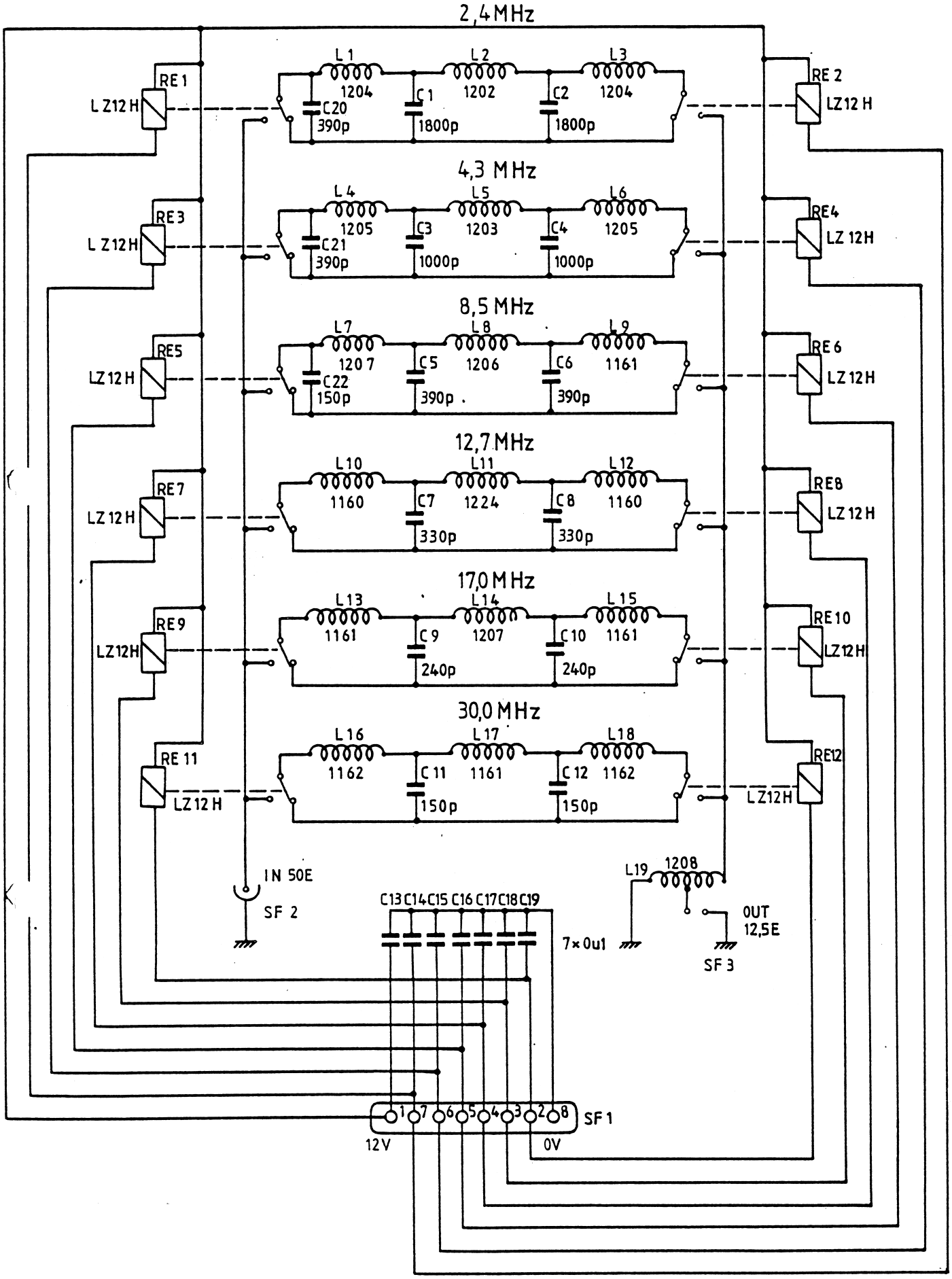


PA-STAGE 2918 C
DIAGRAM No. : 92.7156



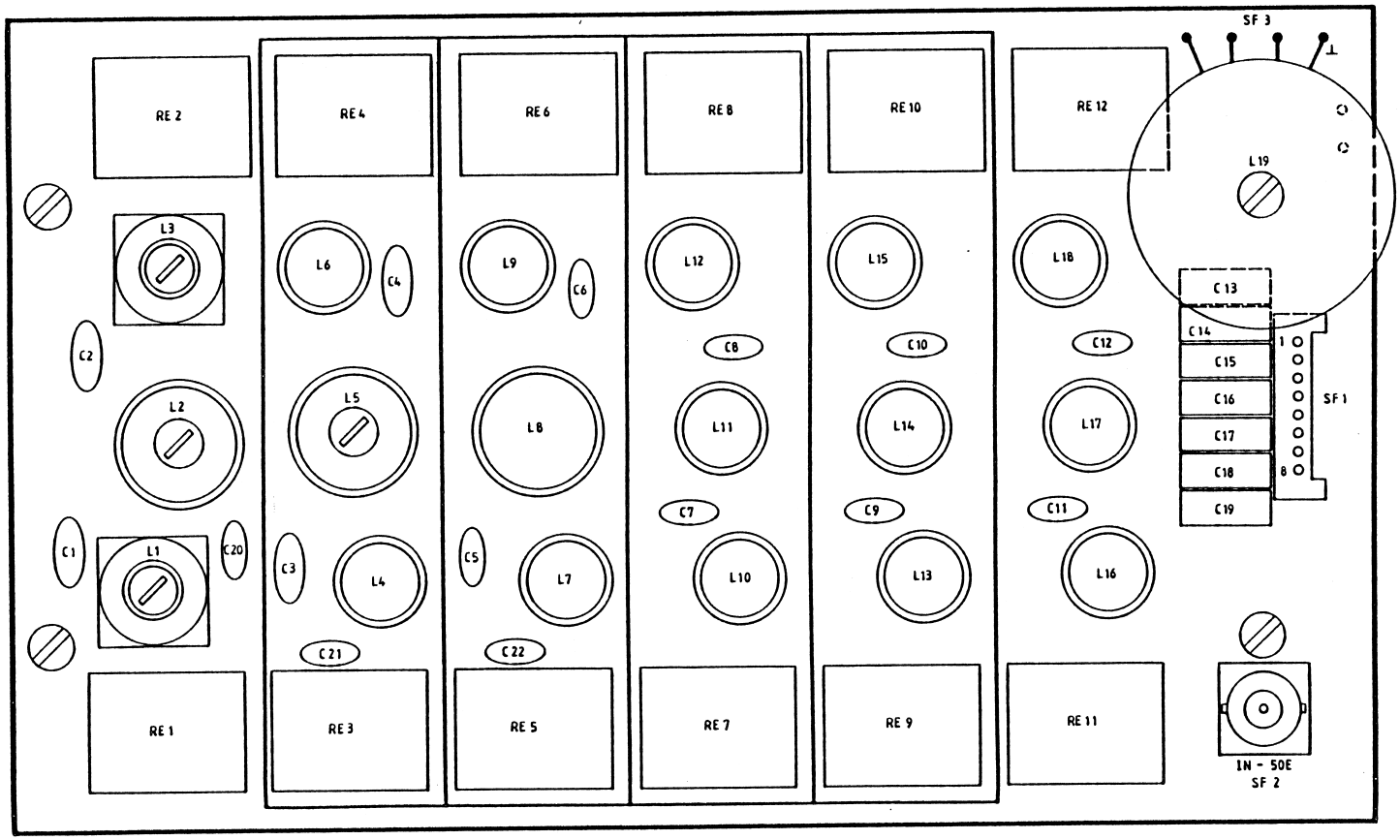
PA-STAGE 2918 C

DRAWING No. : 80.2918



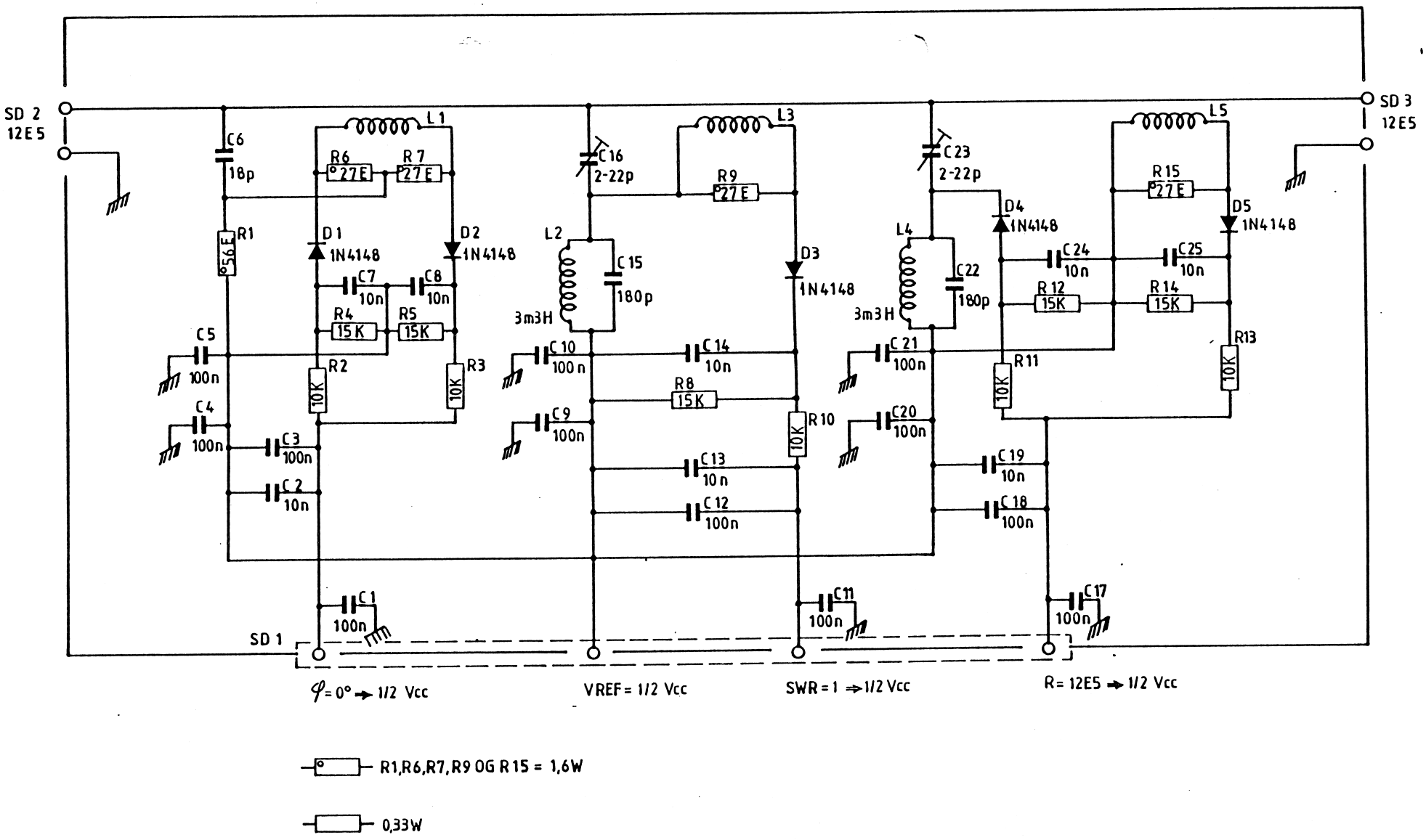
PA FILTER 2892C

DIAGRAM No.92.7150



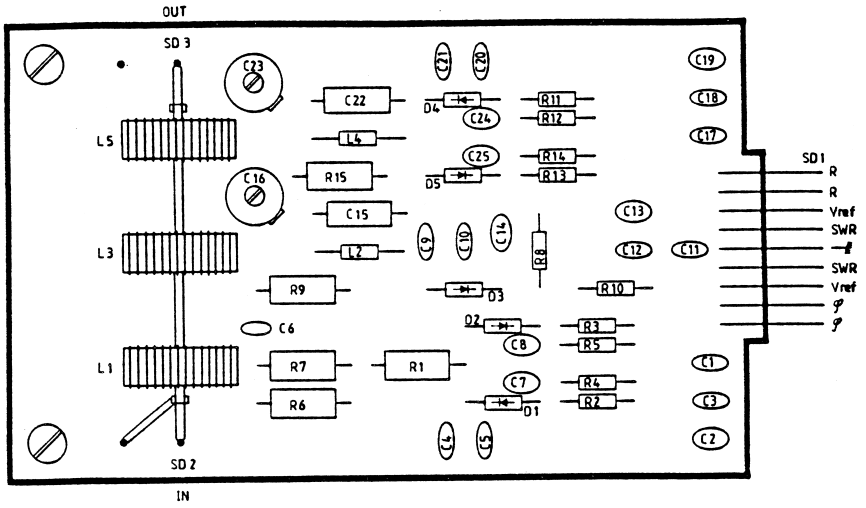
PA-FILTER 2892C

DRAWING No. : 80.2892



DETECTOR ASSEMBLY 2898A

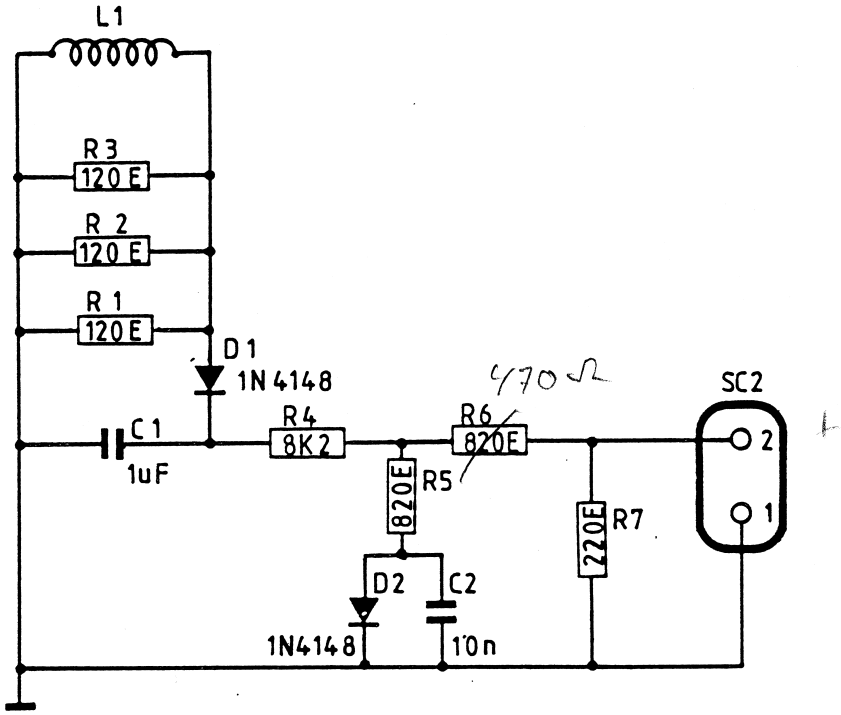
DIAGRAM No.92.7152



DETECTOR ASSEMBLY 2898A

DRAWING No. 80.2898

841130

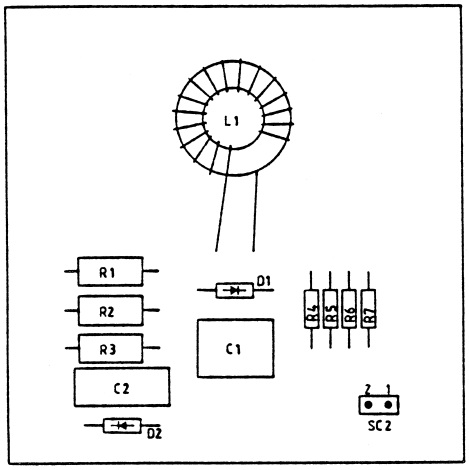


R 1,R2 OG R3 = 1,6W

R4,R5,R6 OG R7= 0,33W

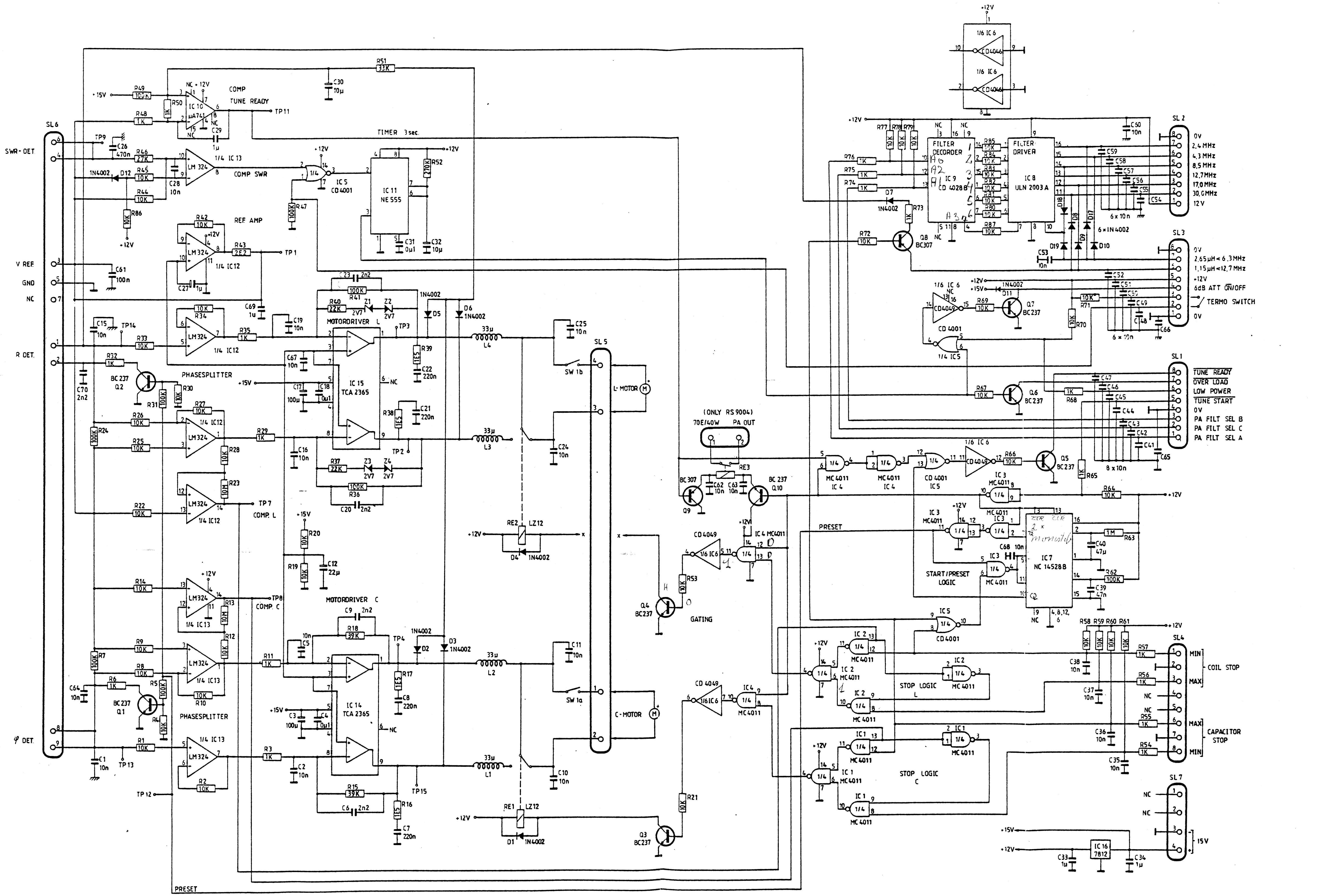
CURRENT DETECTOR 2947A

DIAGRAM No. : 92.7151



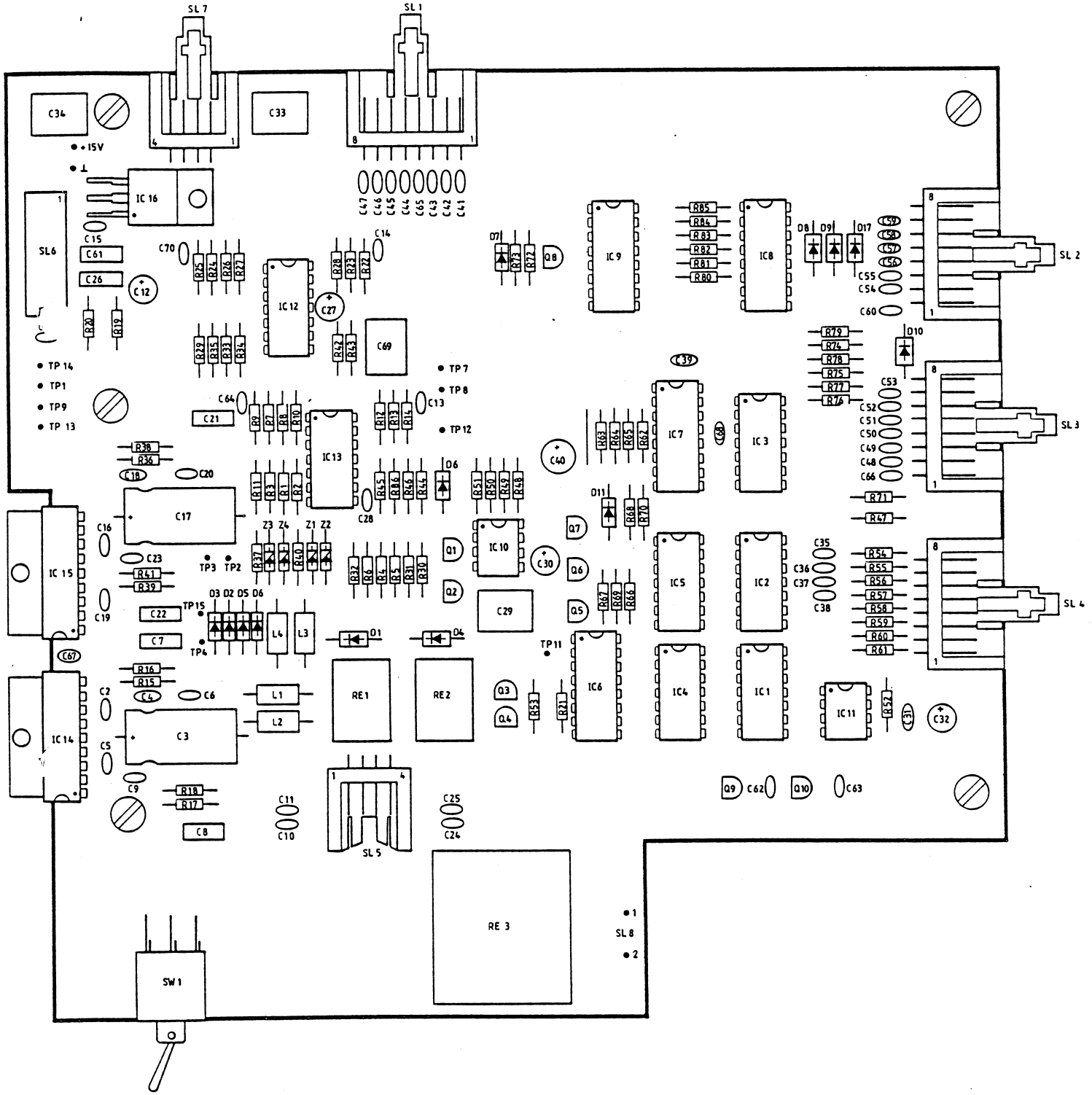
CURRENT DETECTOR 2947A

DRAWING No. : 80.2947



TUNER LOGIC 2917C

DIAGRAM No. : 92.7161

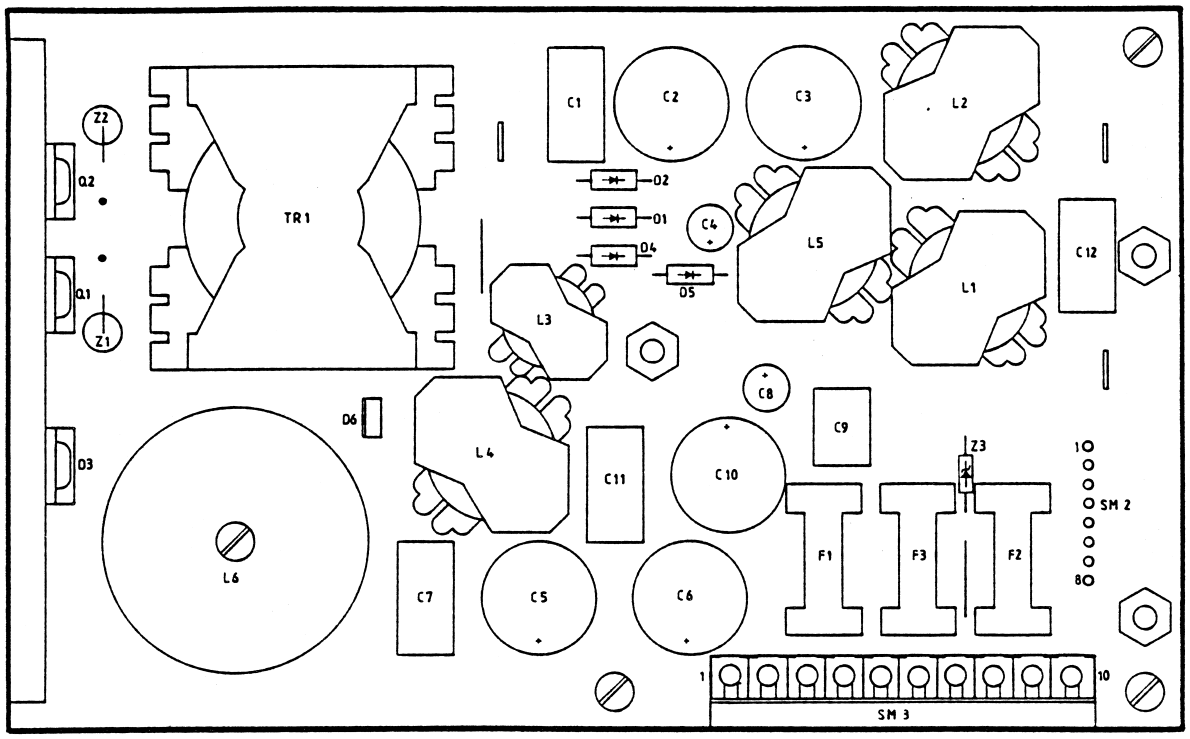


TUNER LOGIC 2917C

DRAWING No. : 80.2917

CONVERTER 2921B
CONVERTER CONTROL 2923 B

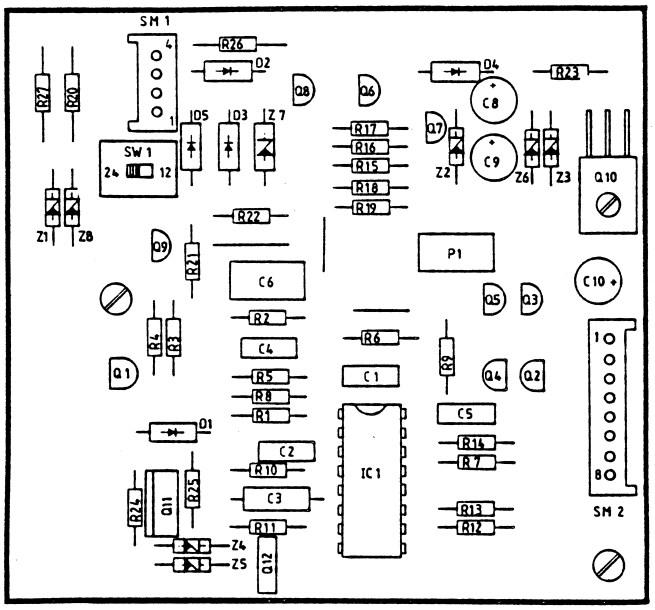
DIAGRAM No. : 92.7165



CONVERTER 2921B

DRAWING No. 80.2921

841129



CONVERTER CONTROL 2923B

DRAWING No. 80.2923

841129

BLOCKDIAGRAM TRANCEIVER RS9001/2

DIAGRAM No. : 92.7196

CABLE FORM, TRANCEIVER, RS 9001/2

DIAGRAM No. : 92.7194

PA - STAGE
BOARD No. 2918

PRE-AMPLIFIER
6dB ATT.
DRIVER
POWER AMPLIFIER
BIAS
BIAS
BIAS ON/OFF
uP-Control
THERMO SWITCH
+12V or 24V (batt)
+12V or 24V (batt.)

PA IN
15 dBm
3,5 Vpp

PA-FILTER
BOARD No. 2892
1
2
3
4
5
6
+12V

DETECTOR
BOARD No. 2898
R-DET.
SWR-DET.
φ-DET.
Vref.

COILS ON PA STAGE
BOARD No. 2918
+12V
COIL IN 1,6 - 6,3MHz
COIL IN 1,6 - 12,7MHz
L14
L13

C
CAPACITOR STOP
MIN
MAX
L
COIL STOP
MAX
MIN
470pF

CURRENT DET.
BOARD No. 2947
CURRENT DETECTOR
SSB 200W
OUT
ANTENNA

DISPLAY
BOARD No. 2914

TUNER LOGIC
BOARD No. 2917
STABILIZER
+15V
+12V
GATING
Vcc
R
R
REF. AMPLIFIER
Vref. = 1/2 Vcc
6dB att
on / off
SWR. COMPERATOR
FILTER DECODER-DRIVER
TIMER 3sec.
+
LOW POWER
OVERLOAD
FILTER CONTROL
μP - CONTROL
PHASE SPLITTER
PHASE SPLITTER
PRESET
MOTOR DRIVER
MOTOR DRIVER
MOTOR DRIVER
MOTOR DRIVER
C COMPERATOR
Vref.
L COMPERATOR
Vref
TUNE COMPERATOR
TUNE READY
TUNE START
μP - CONTROL
GATING
START/PRESET LOGIC
C STOP LOGIC
L STOP LOGIC

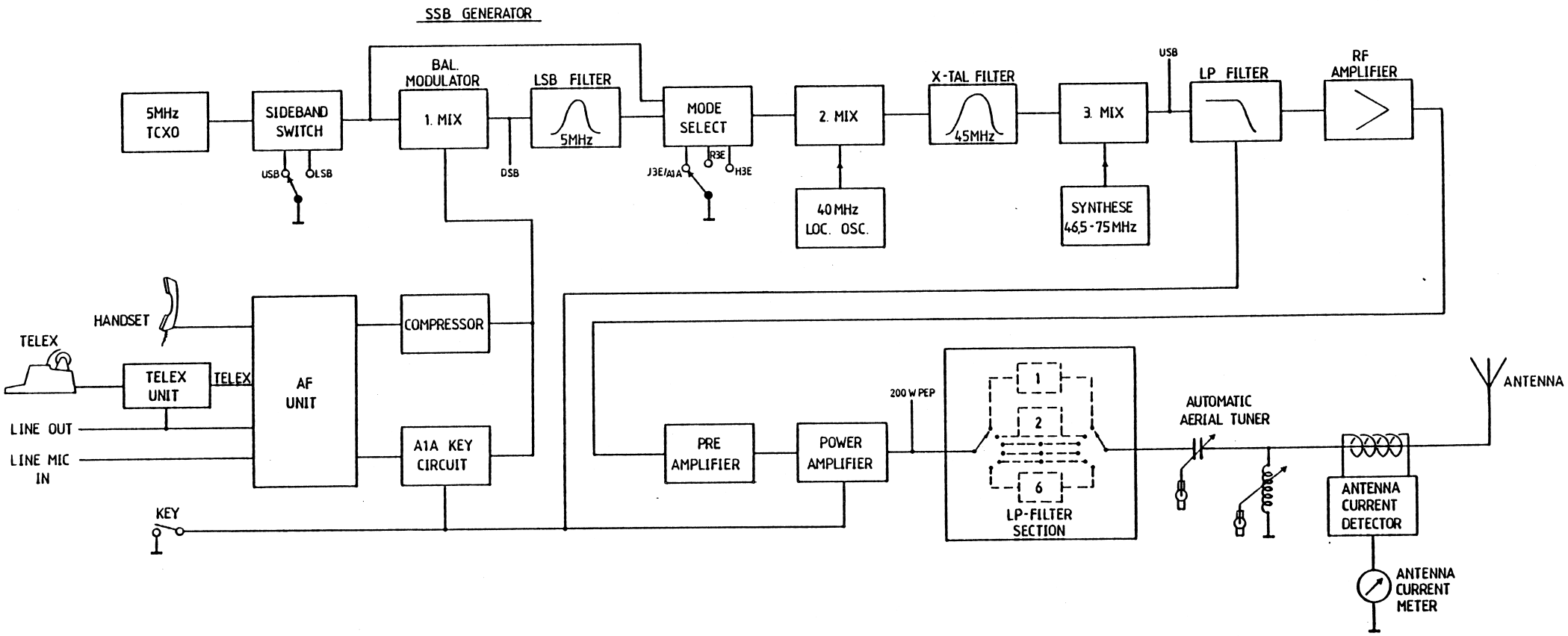
+15V
+12V or 24V dc (batt)
START CIRCUIT
RECTIFIER
RECTIFIER 15V
RECTIFIER 19V
RECTIFIER 8V
CONTROL
OSC.
+15V
+19V
+8V
TO TRANCEIVER
POWER SUPPLY
BOARD No. 2921 and 2923

BLOCKDIAGRAM TUNER RS 9003/4

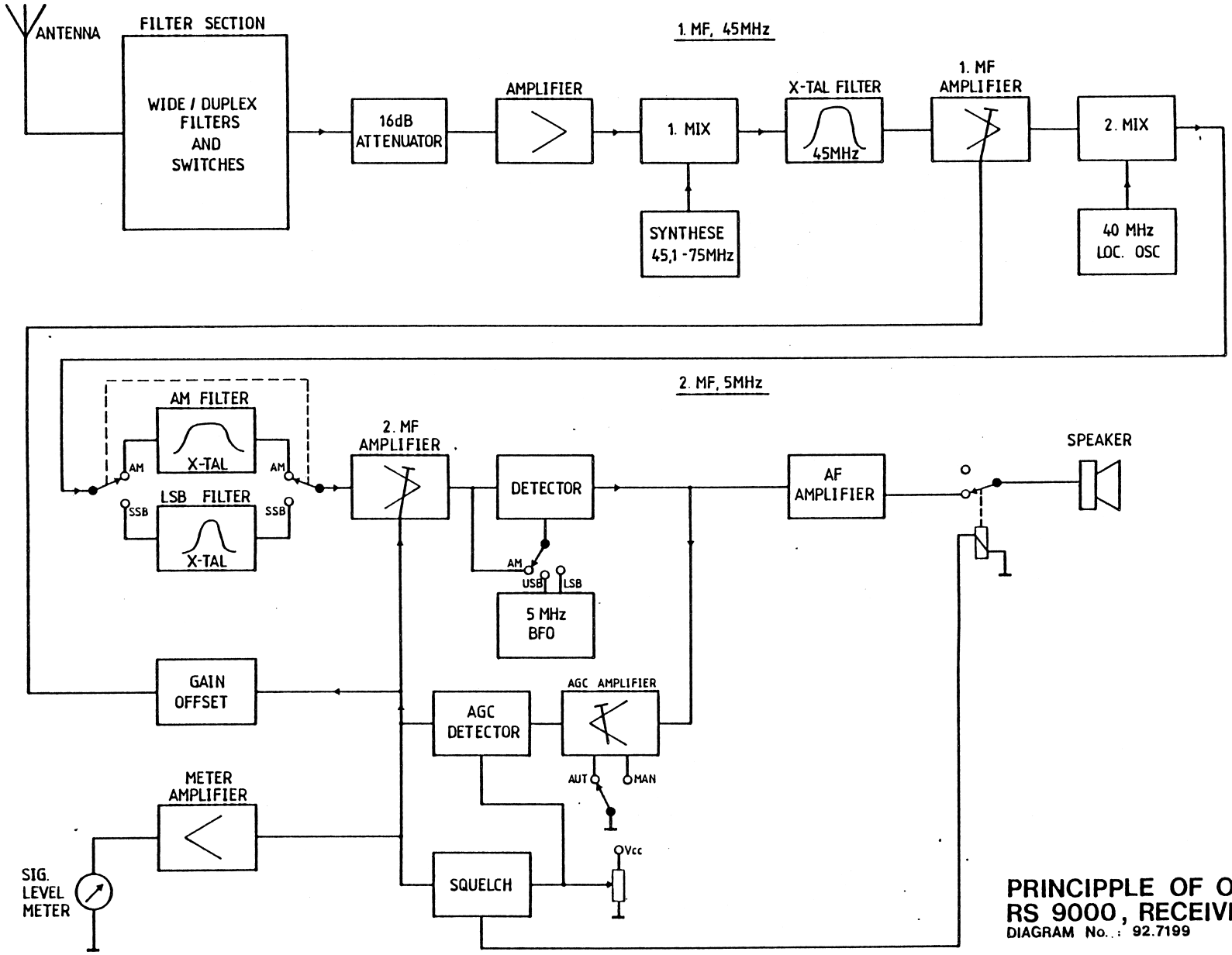
DIAGRAM No. : 92.7191

CABLE FORM, TUNER, RS 9003/4

DIAGRAM No. : 92.7160



PRINCIPPLE OF OPERATION
RS 9000 , TRANSMITTER
DIAGRAM No. : 92.7198



PRINCIPPLE OF OPERATION
RS 9000, RECEIVER
DIAGRAM No.: 92.7199