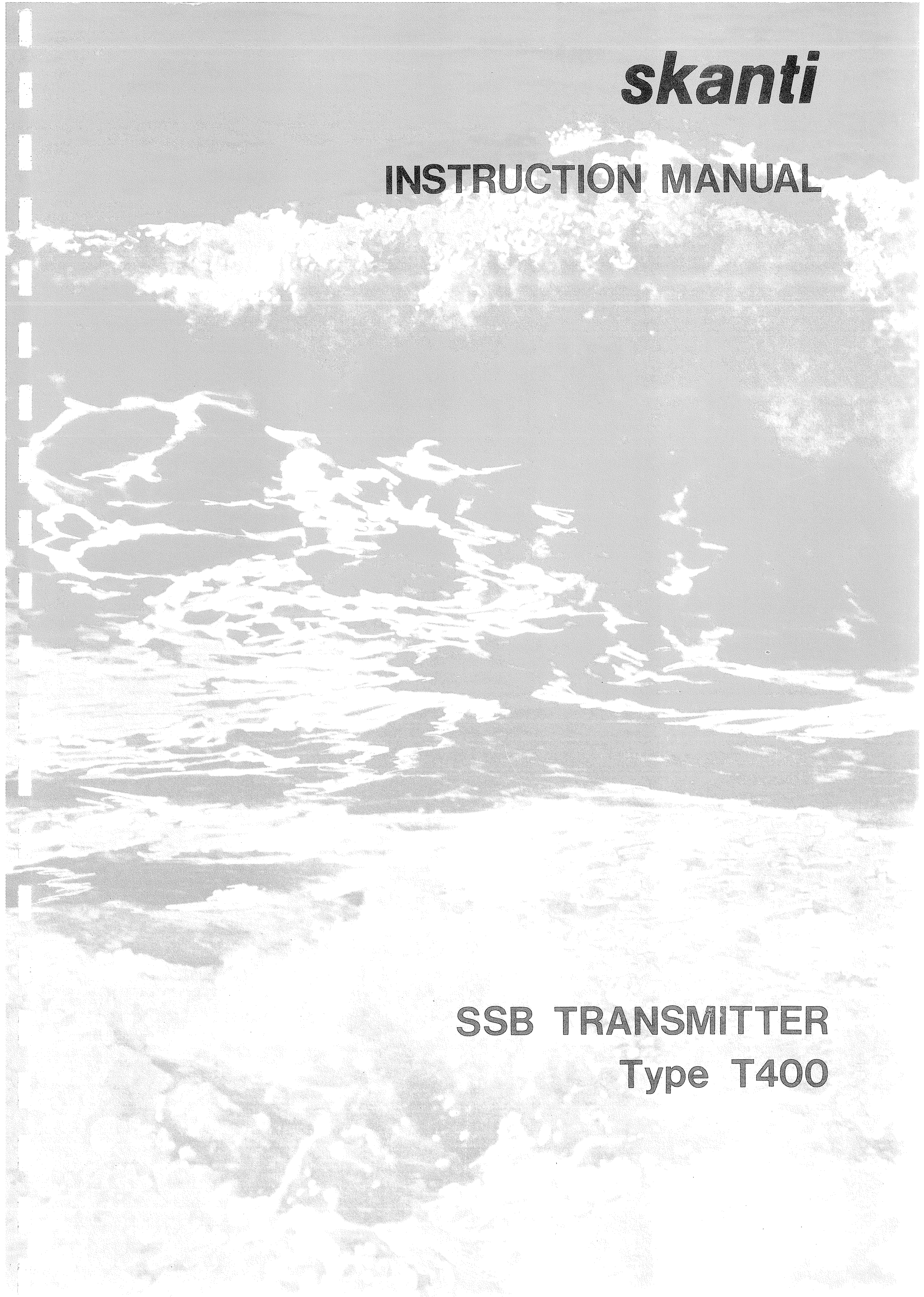
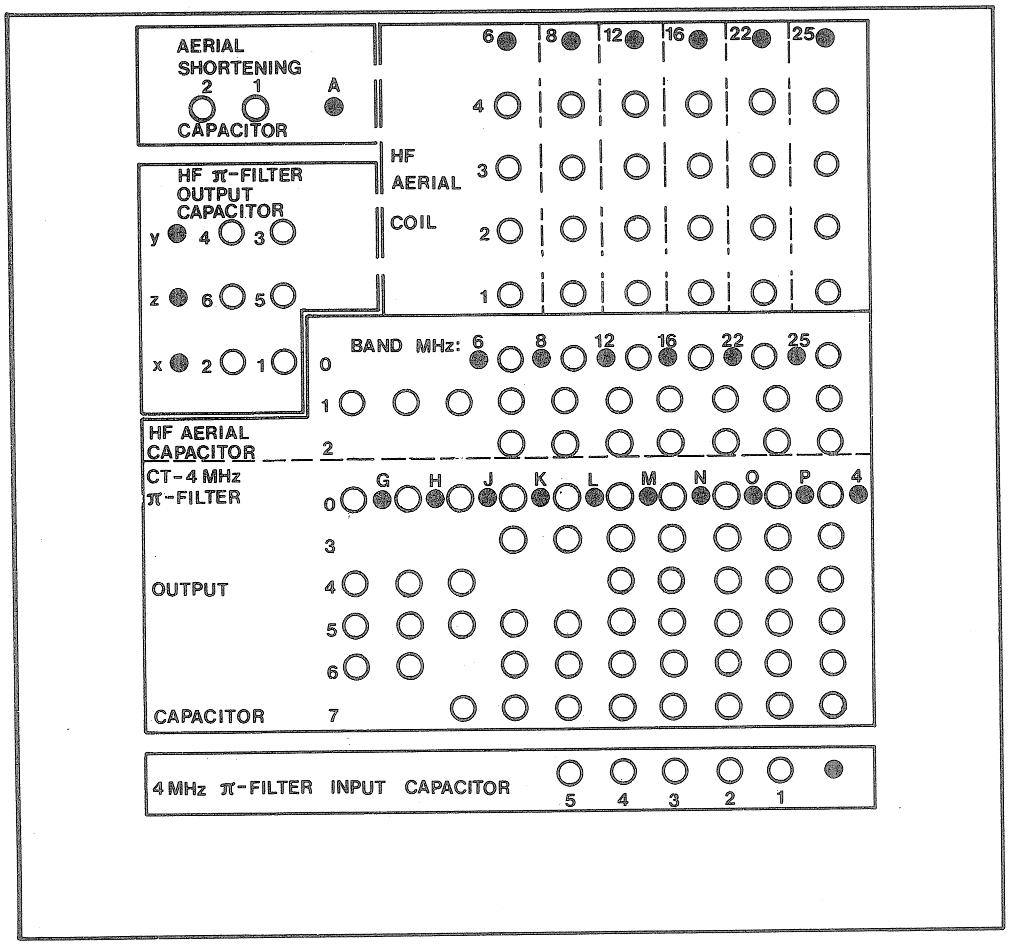


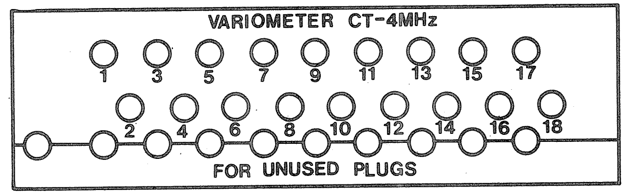
skanti

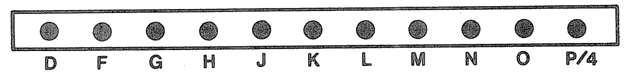
INSTRUCTION MANUAL

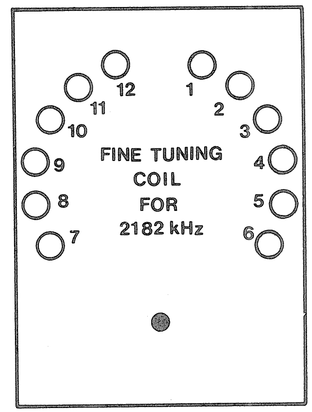
SSB TRANSMITTER
Type T400

1.600. 6-75.









SHIP	T400 no.
MARKËR MED ⊗ OG TEGN EN STREG FRA ● NÅR ANTENNETILPASNING ER OPNÅET	
MARK WITH ⊗ AND DRAW A LINE FROM ● WHEN ADJUSTMENT OF AERIAL TUNING IS COMPLETED	
ADJUSTMENT OF AERIAL TUNING	Tegn. JD / Konf. / T-0294 - S
Carried out by: date:	17 - 1 - 72

T 400

INSTRUCTION MANUAL

CONTENTS

Type T 400

SSB Maritime Radiotelephone Transmitter

Technical Data

Modes

A3H, A3J and A3A, all upper sideband.
On 2182 kHz A3H only.

Operating Frequencies

20 frequencies in the coastal telephony band (CT) 1605-4000 kHz.
8 frequencies in each of the seven HF bands between 4 and 27.5 MHz allocated to the Maritime Radiotelephony Service, except the 6 MHz and 25 MHz bands where four frequencies are provided.

Frequency Accuracy

±100 Hz.

Frequency Stability

±20 Hz in any 15-minute period.

Power Output

Nominal 400W PEP (Peak Envelope Power), with reduction to less than 60W PEP. At all power levels the intermodulation level is below -25 dB according to CCIR specifications.

Aerial

Correct matching to normal ship's aerials with good efficiency at all frequencies.

Unwanted Radiation

According to Radio Regulations.

Overload Protection

The transmitter is capable of withstanding open-circuited or short-circuited aerial terminals for five minutes without damage.

Modulation

Modulation characteristic within 6 dB from 350 Hz to 2700 Hz.

Speech Compression

More than 20 dB linear volume compression for normal speech level.

Noise and Hum Level

More than 40 dB below PEP.

Alarm Generator

A two-tone alarm generator is incorporated.

Controls

POWER switch (MAINS OFF - STAND-BY - FULL - MEDIUM - LOW)
TWO-TONE ALARM switch (TEST - NORMAL - ALARM)
TWO-TONE ALARM push button
MODE switch (A3H - A3J - A3A)
CHECK switch
BAND switch
CHANNEL switch
AERIAL TUNING, HF COARSE switch
AERIAL TUNING HF/CT FINE control

Supply Voltage

24V battery (26.4V nominal) with P 400 Power Pack or
110/220/380/440 single phase AC, 50-60 Hz with P 401 Power Pack

Supply Voltage Variations

DC: -10% to +25%
AC: ±10%

Power Consumption

DC: approximately 750W
AC: approximately 750VA

Environmental Conditions

Ambient temperature range: -15 to +55^{o} C.
CEPT and MPT 1204 (UK) vibration test, extended range.
CEPT and MPT 1204 (UK) damp heat test.

Dimensions

T 400 Transmitter

Rack-mounted:	height	354.8	mm
	width	482	mm
	depth - into rack	380	mm
	depth - overall	425	mm
	weight	19	kg

TRP 400 Radiotelephone

Rack-dimensions	height	768	mm (aerial insulator incl.)
	width	490	mm
	depth	463	mm
	weight (battery operation)	73	kg
	weight (AC mains operation)	88	kg

Calculation of channel crystal frequency f_x from transmitting frequency f_t.

Note that the transmitting frequency is always the carrier frequency.

All frequencies are in kHz.

Band	f_x Channel crystal frequency
1605-4000 kHz	f_t + 1400 kHz
4 MHz	f_t + 1400 kHz
6 MHz	f_t - 2800 kHz
8 MHz	f_t - 4200 kHz
12 MHz	f_t - 8400 kHz
16 MHz	f_t - 12600 kHz
22 MHz	f_t - 18200 kHz
25 MHz	f_t - 21000 kHz

Channel crystals with specification according to SKANTI specification R-0328 are marked with f_t on the case top and with f_x on the case side.

CHANNEL CRYSTAL SPECIFICATION

Holder:	HC-6/U
Frequency:	1.6-6 MHz
Tolerance:	a) ±0.002% at 24°C b) ±0.001% variation from 24°C over temperature range
Temp. range:	-20 to +70°C
Circuit:	Parallel resonance, 30 pF
Drive:	1mV
Activity:	DEF 5271-A
Operating mode:	Fundamental
Marking:	Case top: to be specified in order Case side: R-0328 and nominal crystal frequency

1. INTRODUCTION

1.1. The T 400 is a single-sideband radiotelephone transmitter for telephone traffic in the 1.6-4 MHz coastal telephone band and in the maritime shortwave telephone bands between 4 and 27.5 MHz. The transmitter is crystal controlled and has a total of 68 channel facilities which are distributed as follows: 20 channels in the coastal telephone band and 8 channels in each of the shortwave bands except for the 6 MHz and 25 MHz bands, which have 4 channels each.

The transmitter has provision for emission A3H, A3J and A3A signals, the upper sideband being used in all cases. Except for the driver and power amplifier stages, solid-state circuitry is employed throughout, and widespread use is made of integrated circuits. This coupled with the fact that no crystal ovens are used, causes the transmitter to be ready for operation within one minute after having been started up.

Depending on the type of power pack with which it is used, the transmitter may be powered either from a 24V battery or from AC supply voltages occurring in normal practice.

It is easy to install new channels in the transmitter. The only adjustments to be made consist in aligning the crystal frequency and, in the coastal telephone band, adjusting two tuned circuits. The crystals and tuned circuits become accessible after removal of the cover plate on the left side wall of the transmitter. Crystal trimmer capacitors make it possible to correct the drift caused by natural crystal ageing, which may otherwise within a few years bring the frequencies outside the specification limits.

The dimensions of the transmitter match the 19-inch standard, and the transmitter is intended for being mounted in the same cabinet with its P 400 or P 401 power pack and the R 400 receiver. When so mounted, these three units constitute the TRP 400 transmitter/receiver combination.

Because we at SKANTI are constantly processing the experience gained during the production and operation of our equipment, it is possible for minor modifications to occur relative to the information given in this instruction manual. Wherever practicable, however, any corrections will be listed on a correction sheet at the back of the front cover of this manual.

2. TECHNICAL DESCRIPTION

2.1. For technical Data see first pages of this manual.

2.2. Mechanical

The transmitter is built on a rugged alodine-treated aluminium chassis which is designed so that it also provides RF screening between the individual sections of the transmitter. The chassis has two outside cover plates; they complete the internal screening system and protect against direct signal pickup.

The transmitter is composed of 18 modules most of which are built on printed circuit boards. All of these become accessible on removal of the cover plates. The number of connecting wires to individual modules has been minimized, in part due to extensive use of diode switches.

The chassis divides the transmitter into five sections. In the front compartment behind the front panel are switches, meters, and chain drives for aerial tuning components, placed so as to be easily accessible on removal of the front panel. The top compartment houses the power amplifier stage and its associated aerial tuning circuit. The left side compartment contains the channel oscillator module, /45\, which accommodates 68 crystals. Here, too, are the driver stage units, /48\, /52\ and /53\. In the bottom compartment are the driver valves and their associated output circuits, /51\, /54\, /58\, a meter circuit /49\ and the power amplifier valve sockets. Lastly, the right side compartment houses modules /40\ to /47\ (except /45\), which contain circuits which convert the incoming microphone signal to a single-sideband signal of the desired frequency. Also housed in the right side compartment is module /8\, a 9V voltage regulator.

2.3. Circuit Description, General

2.3.1. The circuit diagram is divided into wiring diagrams on page 7-79 and 7-72 which show interconnections between the modules of which the transmitter is composed, and circuit diagrams of individual modules. Lastly, in the interest of clearness, diagrams of the integrated circuits employed have been included. The block diagram on page 7-39 illustrates the operation of the transmitter.

2.3.2. The microphone signal is fed via the "NORMAL" position of the "TWO-TONE-ALARM" switch to the AF amplifier, /42\. In the "ALARM" position of the same switch, the microphone circuit is disabled and the alarm signal, generated in module /40\, applied to the AF amplifier instead.

The amplified signals are fed to a balanced mixer, /43\, in which they are converted to a 1.4 MHz double sideband signal. The upper sideband is removed in a crystal filter, and the lower sideband is applied to the coastal telephony mixer, /44\.

The coastal telephony mixer converts the signal directly to the desired frequency in the range 1.6-4.2 MHz as an upper sideband signal. Carrier re-insertion, if desired, is also carried out in this mixer, controlled from the "MODE" switch.

The signal, now ready for use, is thereafter fed through the "POWER" switch which permits reducing the power level in two steps of approx. 5 dB each.

The driver amplifier, composed of modules 48, 51, 52, 53, 54 and 58 and controlled from the "BAND" and "CHANNEL" switches, amplifies and filters the signal, which is thereafter stepped up to the desired level in the power amplifier stage.

Aerial tuning is preselected with the "BAND" switch, and fine tuning is performed with "AERIAL TUNING, HF/CT FINE".

The "LEVEL METER" indicates AC voltage swing at the power amplifier anodes. Aerial current is read on the "AERIAL CURRENT" meter.
Aerial current metering is handled by module 50.

Generation of signals in the HF bands between 6 and 25 MHz is carried out by the HF mixer 46, in which a signal from the coastal telephony mixer is combined with a suitable injection signal to produce a signal in the desired HF band. The signal is thereafter filtered and amplified in the driver and power stages, and aerial tuning is performed with "AERIAL TUNING, HF COARSE" and "AERIAL TUNING, HF/CT FINE".

2.3.3. All injection signals required for the 1.4 MHz, coastal telephony, and HF mixers are derived from a master oscillator which is usually located in the associated R 400 receiver.

From the R 400, a coaxial cable feeds a 1.4 MHz square-wave signal via module 47 to the coastal telephony and 1.4 MHz mixers whereas a selected harmonic of 1.4 MHz is employed in the HF mixer. The desired harmonic is selected in module 47, controlled by the "BAND" switch.

Channel information is generated in module 45, controlled by the "BAND" and "CHANNEL" switches, and is used as injection signal in the coastal telephony mixer.

2.3.4. All transistor circuits are powered from voltage regulator 8 whilst the associated power pack and receiver are controlled from the control circuit, module 41.

The P 400 or P 401 power pack used with the transmitter is started with the "POWER" switch. The "CHECK" switch permits measuring the output voltages and checking all valve currents.

2.4. Circuit Description of Individual Modules

/8\ 9V Voltage Regulator

This module contains voltage regulator and over-current protection circuits. By means of resistors 8R7 and 8R8, a fraction (fine adjustment with 8R8) of the output voltage is taken off and compared, in 8TR2, with the reference voltage across 8D8. The collector of 8TR2 is connected to the series regulator composed of 57TR1 and 8TR1, a so-called PNP super Darlington stage.

In order to start the regulator, the base of 8TR2 must receive starting current through capacitor 8C1. When the transmitter is switched off, the capacitor discharges through a resistor in the power pack.

The current-limiting properties of the circuit are due to the fact that emitter resistors 8R5 and 8R6 determine how much current can be drawn by 8TR2 before the zener voltage across 8D8 collapses. When the zener voltage collapses, the regulator will reduce the output voltage, thus further reducing the voltage drop across the zener diode. In other words: the circuit is regenerative, and the output voltage quickly drops to zero. If the current limiter has been in operation it is necessary to switch off the supply voltage for approx. 3 seconds so that 8C1 will have time to discharge. The current at which the limiter operates can be adjusted with the variable emitter resistor 8R6, which is factory preadjusted so that limiting will occur at a load of approx. 3A.

/40\ Two-tone Generator

This circuit is composed of two tone oscillators, 40TR4 and 40TR7, which are tuned to 2.2 kHz and 1.3 kHz, respectively. The oscillators are started and stopped alternately for periods of nominally 250 msec by an astable multivibrator, 40TR5 and 40TR6.

The period time of the multivibrator is determined mainly by resistors 40R18 and 40R19 and by capacitors 40C5 and 40C6.

The operating period of the alarm generator, nominally 45 seconds, is measured by a Miller integrator combined with a trigger circuit composed of 40TR1, 40TR2, and 40TR3. Here, the period time is determined by resistor 40R4 and capacitor 40C2, and the circuit is temperature compensated by diodes 40D1 and 40D2.

/41\ Control Circuit

The transmitter, power pack and associated receiver are controlled by transmit relay 41RL1.

A voltage for remote indication of the "transmit" condition is likewise controlled by the transmit relay.

The relay-coil current is controlled either from the handset key (simplex-semiduplex) or from the "SERVICE" switch of the receiver (duplex). In this connection reference is made to drawings on pages 3-13 and 3-14, showing interconnections between transmitter and receiver.

/42\ AF Amplifier

The microphone signal first passes through an active band-pass filter using transistors 42TR1, 42TR2, 42TR3 and 42TR4. Ths filter removes signals outside the desired passband so as to eliminate any risk that the following compressor might be operated by background noise.

The compressor is composed of transistor 42TR5 and integrated amplifier 42IC1. In it, part of the output signal is taken off and rectified to provide control voltage for transistor 42TR5, which functions as a variable attenuation network.

/43\ 1.4 MHz Mixer

The modulating signal from /42\ is fed to amplifier stage 43TR2, 43TR3 whose collector circuit incorporates three series-connected resistors. By means of the "MODE" switch one, two, or all three resistors may be selected to operate as collector resistor, thus determining the amplitude of the signal applied to the balanced mixer 43IC1. Automatic selection of A3H on the 2182 kHz frequency is carried out by means of transistor 43TR1 which is controlled from the "BAND" and "CHANNEL" switches.

The balanced mixer also receives a 1.4 MHz signal, and a 1.4 MHz double-sideband suppressed-carrier signal is therefore present across the secondary of transformer 43T2. The signal is amplified in 43TR5 and fed through crystal filter 43X1 which removes the upper sideband and attenuates the carrier still further.

/44\ CT Mixer

The 1.4 MHz single-sideband signal generated in module /43\ is now fed to module /44\ via terminal 44-10. The signal passes through hybrid transformer 44T1 and is applied to mixer 44IC2. A signal in the frequency range 3-5.6 MHz is generated in channel oscillator /45\ and amplified by 44IC3 and 44TR3, whereafter it is employed as injection signal for mixer 44IC2.

If, by mistake, a channel is selected for which no crystal is installed, channel-oscillator self-noise in conjunction with the very high gain provided by 44IC3 may cause 44TR3 to be driven on a random frequency. To prevent this, part of the channel oscillator signal is taken off via 44C29, amplified in 44TR5, and rectified in 44TR5. 44TR4 controls the gain in 44IC3 so that the amplifier will be operative only if the signal at terminal 44-1 exceeds a level corresponding to a crystal being installed in the crystal socket selected.

Carrier reinsertion is performed by applying a 1.4 MHz signal to 44IC1. After amplification in 44TR1 and 44TR2 the signal is fed via a diode switching system to hybrid transformer 44T1. The desired carrier level is adjustable with 44R10. The diode switch is controlled both from the "MODE" switch and from module /43\, where A3H will automatically be selected when the "BAND" and "CHANNEL" switches are set at "H" and "1" respectively.

The difference frequency from mixer 44IC2 is taken off across the secondary of transformer 44T3. It is an upper sideband signal in the frequency range 1.6-4.2 MHz. The signal is amplified in 44TR7 from whose collector two paths go to module /46\. Terminal 44-17 is used when the transmitter is working in the range 1.6-4.2 MHz whereas terminal 44-15 is used in the bands between 6 and 25 MHz.

/45\ Channel Oscillator

Crystals are switched in a diode matrix. To select a particular crystal, +9V is fed by the "CHANNEL" switch to the appropriate column terminal, and the "BAND" switch applies 0V to the row terminal.

The oscillator employs transistor 45TR1. The oscillator output signal is applied to a buffer stage, 45TR2, followed by an emitter follower, 45TR3. From the emitter follower, the signal is fed to the output terminal and to an amplifier stage, 45TR4. The output of this amplifier stage is rectified by 45TR5, and the amplified DC signal is fed back to the base of 45TR1, which controls the oscillator gain. This control system means that the level is kept constant and that the content of harmonics of the crystal frequency will be low.

/46\ HF Mixer

When the transmitter is switched for operation in the range 1.6-4.2 MHz the signal from the C1 mixer passes to terminal 46-7 and on through diode 46D3 to terminal 46-8 from where it is fed through a coaxial cable to the "POWER" switch.

When the transmitter is switched for the HF bands, terminal 46-1 receives +9V so that 46D3 blocks whilst 46D1 conducts. A single-sideband signal in the frequency range 2-3.2 Mhz, generated in module /44\, is fed to terminal 46-5. The signal passes through a 7th-order low-pass filter and is applied to balanced mixer 46IC1. The injection signal used for the mixer is a harmonic of 1.4 MHz, selected in module /47\. The harmonic selected is amplified in 46IC2 and in transistors 46TR1 and 46TR2.

The sum frequency from 46IC1 is taken off across the secondary of transformer 46T1 and amplified in transistor 46TR3, the output signal of which is fed to output terminal 46-8.

47 HF Harmonic Filter

A crystal-controlled oscillator is composed of two NAND circuits in integrated circuit 47IC5. Crystal selection is performed by means of diodes controlled from the "BAND" switch.

In order to accomplish the required degree of frequency stability, the oscillator is phase-locked to the master oscillator.
The oscillator output signal is fed to a variable divider, composed of circuits 47IC2 and 47IC3. The divider is controlled from the "BAND" switch in such a manner that the output signal at terminal 15 of 47IC3 is always at 1.4 MHz, following which the signal in 47IC6 is divided so that the output signals at terminals 12 and 13 of 47IC6 are at 700 kHz.

The 1.4 MHz master oscillator signal is fed through 47IC1 in order to produce a sufficiently steep-sided square-wave signal, whereupon the signal is divided in 47IC6 so that the output signals at terminals 8 and 9 of 47IC6 are at 700 kHz.

The two 700 kHz signals are compared in phase detector 47IC4, and the resulting DC voltage controls capacitance diodes 47D21, 47D22 and 47D23, in series with the oscillator crystals.
The resulting signal is taken off across transformer 47T1 and fed to the HF mixer. A locking detector composed of 47IC7 and 47TR1 cuts off transistor 47TR1 when phase-locking conditions have been established. If phase locking is not accomplished or the master oscillator signal is missing, 47TR1 will be saturated. Through terminal 47-9 the locking detector is connected to amplifier 46IC2, with the result that the transmitter output signal in the 6 to 25 MHz shortwave bands can be transmitted only when phase locking has been established.

48 Driver Amplifier

After having been adequately filtered in modules 52 and 53 the signal is applied to the control grid of valve 48V1. The operating point of the valve is controlled by transistor 48TR1. Untuned coupling is used between the anode of 48V1 and the grid of 57V2. The components associated with 57V2 are accommodated in module 48 which also includes eight gain-control potentiometers. The "BAND" switch selects a potentiometer for each band, which feature makes it possible to keep the gain within very narrow limits throughout the frequency range covered by the transmitter.

49 Grid-Voltage Stabilizer

The circuit which stabilizes the grid bias for the driver and power amplifier valves is composed of zener diode 49D1, diode 49D2 and the integrated circuit 49IC1, the last-mentioned operating as a zener diode having a very low temperature coefficient.

Three potentiometers - 49R4, 49R5 and 49R6 - are used for adjusting the no-signal current of the power amplifier valves.

This module also incorporates dropping resistors for the circuits employed for metering the power pack output voltages.

50 Aerial Current Metering Circuit

From the output of the aerial tuning circuit, the aerial wire passes through current transformer 50T1. Three resistors in parallel are connected across the transformer secondary. The AC voltage across the resistors is rectified in diode 50D1.

In order to make it possible to read even low values of aerial current the metering circuit is designed so that the scale of the AERIAL CURRENT meter is logarithmic. This is accomplished by means of the nonlinear resistor 50R5 whilst resistor 50R7 serves the purpose of compensating the temperature dependence of 50R5.

51 Driver Anode Circuit HF

Module 51 carries separate driver anode circuits for each of the seven HF bands. The circuits are selected by diodes controlled from the "BAND" switch. The module also incorporates three choke coils through which the power amplifier control grids are connected to the negative bias source.

52 Driver Grid Circuits CT

Module 52 includes a total of twenty tuned circuits, one for each channel facility in the CT range. Each coil covers the entire range by adjustment of its dust iron core, thus permitting arbitrary placement of all channels. Coil switching is performed with diodes controlled from the "CHANNEL" switch.

53 HF Band-pass Filters

The signal from the "POWER" switch is fed to terminal 53-4. The "BAND" switch selects, in the HF ranges, a band-pass filter which will permit the desired signal to pass through, whereupon the signal is applied to the grid of the first driver valve via terminal 53-8.

In the coastal telephone range, the input and output terminals are short-circuited together by diodes 53D1 and 53D2.

54 Driver Anode Circuits CT

Module 54 has a tuned circuit for each of the twenty channels in the CT range. Each coil covers the entire range by adjustment of its dust iron core, thus permitting arbitrary placement of all channels. Coil switching is performed with diodes controlled from the "CHANNEL" switch.

57 PA Stage and Aerial Tuning

The power amplifier employs three parallel-connected type YL1070 valves operating in Class AB1.

A π-network performs aerial tuning and matching. When using short aerials in the CT band, the π-network is reduced to an inverted L-network.

Tuning the CT and 4 MHz bands

With the "BAND" switch in the A to P inclusive and 4 MHz positions, a suitable amount of anode capacitance is selected in the π-network. When a long aerial is used, a series capacitor as well as capacitors on the output side of the π-network may be switched in. Tuning is performed by first selecting a suitable tap on the π-network variometer and thereafter tuning to resonance with the "AERIAL TUNING HF/CT" control on the front panel.

Tuning on 2182 kHz

is carried out with the "BAND" switch at "H". Aerial matching is carried out with the π-network output capacitor and, if required, the series capacitor. Tuning to resonance is performed by selecting a suitable tap on the variometer (in this setting of the "BAND" switch, the control range of the variometer is restricted) and by selecting a tap on a vernier adjustment coil. Exact tuning to resonance is obtained with the "AERIAL TUNING HF/CT FINE" control on the front panel.

In the HF bands, the anode capacitor and coil of the π-network are fixed-tuned. Coarse adjustment of the aerial is performed with a series coil shunted by a capacitor. Coarse adjustment of the π-network output capacitance is performed with a variable capacitor with indexing, operated by the "AERIAL TUNING HF COARSE" control on the front panel. A variable capacitor operated by the "AERIAL TUNING HF/CT FINE" control on the front panel performs fine adjustment of the π-network and aerial.

All capacitors and coil taps are selected by means of easily accessible plugs and sockets.

Overload Protection

To avoid serve overloading of the three PA valves two PTC-resistors are placed between the valves. If the valves are overloaded the anode dissipation will increase which means that the temperature of the PTC-resistors will start rising.

When the temperature rises above a certain limit the resistance of the PTC-resistors will increase very rapidly, causing transistor 57TR2 to leave the state of saturation and reduce the screen grid voltage for the PA valves.

If for some reason the 1000V anode supply should fail, transistor 57TR2 will cut off and so protect the PA screen grids.

3 INSTALLATION

Correct installation of the equipment is important for good results. Aerials and earth connections must be installed with the greatest care, especially where duplex telephony is desired.

3.1. Types of Installation

The TRP 400 radiotelephone may be powered either from a 24V battery or from 110/220/380/440V AC mains.

The TRP 400 is composed of the following units:

For 24V battery operation:
Type T 400 transmitter.
Type R 400 receiver (with built-in Type R-0290 power pack).
Type P 400 power pack for transmitter.

For AC mains operation (single-phase or two-phase):
Type T 400 transmitter.
Type R 400 receiver (with built-in Type R-0289 power pack).
Type P 401 power pack for transmitter.

The units are connected together in the Type T-0341 cabinet, in which also the connection to the permanent installation is made.

3.2. Removal of Units

The units are mounted on ball tracks and, after removal of the front-panel screws, may be pulled as far out as the built-in stop permits. Then the cables may be unplugged and the individual units removed entirely from the cabinet by lifting the handles slightly while pulling the units out.

When putting a unit back in place care should be taken that the stop screw of each ball track will be positioned in the chassis cut-out provided for the purpose.

3.3. Mounting the Cabinet

The equipment is intended for mounting on a table or directly on a bulkhead. In the latter case, a Type T-0351 bracket with accessories is required.

The drawing on page 3-11 shows drilling plans for both types of mounting.

3.4. Connection to the Permanent Installation

Check that the correct power packs are installed in the equipment and, in the case of AC operation, switched for the correct mains voltage. The cabinet cabling diagram on page 7-77 shows that the terminals to be used for the installation are marked with the letters A-F. Necessary cable cross sections are also indicated.

The drawings on page 3-12 show, in clearer form, only the connections to be made in making the installation. All cables except the transmitter aerial and earth lead should be stripped of insulation behind the transmitter and the individual conductors brought in through the cutout at the bottom of the cabinet rear wall in a loop that is large enough to take up any play between the equipment and the bulkhead.

3.5. Earth Connections

The transmitter earth terminal is located on the top of the transmitter, behind the aerial insulator. From this earth point a 50 x 0.5 mm copper strap should be connected to the hull. The connection should be as short and straight as possible.

The receiver should be connected to the hull using a length of 2.5 sq.mm wire. This wire should connect a separate earth screw, which must not be shared by other equipment. The earth lead should be run as far from the transmitter copper strap as is practicable.

Other cables should be placed as far away as possible from the transmitter and receiver earth leads and under no circumstances parallel with the transmitter copper strap closer than 0.7 m and, for the receiver earth lead, closer than 0.2 m. RF earth connections will cause neither battery nor mains leads to be connected to the hull. If it is desired to connect the battery to the hull it is important to make the connection right at the battery, never in the transmitter. In cases where the installation is carried out so as to include facility for charging during operation through a dropping resistor from a balanced ship's mains (110/220V DC), the battery must not be earthed.

3.6. Aerials

In order to minimize duplex noise, the transmitting and receiving aerials should be kept as far away from each other as possible. Stays, wires, steel masts etc. should either be earthed effectively or insulated.

Likewise in order to minimize duplex noise, every other electric installation such as cable braiding (screens) and instruments should be earthed effectively, and the instruments in question should be fitted with noise-interference suppression devices.

The aerials should be suspended well in the clear, away from objects whose influence on the aerials may vary, such as derricks etc. Insulators should be of the best type having low leakage even when wet.

3.6.1. Receiving Aerial

Length: 6-30 metres. The receiving aerial is to be brought in through a length of 50-ohm coaxial cable, which should be as short as possible, especially in the case of short aerials.

3.6.2. Transmitting Aerial

Length: 15-30 metres inclusive of lead-in. The aerial should be terminated in a feed-through insulator in the roof or side wall of the radio room. The aerial is to be brought in to the transmitter through a length of copper tubing mounted on stand-off insulators. A length of carbon brush cable or some similar flexible bare conductor should be inserted between the last stand-off and the transmitter aerial insulator; any play between the transmitter and bulkhead will then be taken up by the cable.

3.6.3. Built-in Aerial Relay

As shown in the drawing on page 7-77, an aerial relay may be installed in the cabinet. The relay may be installed if the transmitting aerial is to be used for other purposes, for instance for an extra receiver, or if it is desired to perform the installation as a simplex installation with only one aerial.

However, when using short aerials - that is aerials under approx. 20 metres long - excessive voltage will be present across the relay contacts when the transmitter is working on channels in the range 1.6-2.0 MHz.

The built-in aerial relay may therefore be used only if the aerial is longer than approx. 20 metres or if the transmitter is not equipped with channels in the range 1.6-2.0 MHz.

If it is desired to use an aerial relay after all, even if these conditions are not met, it will be necessary to install an external aerial relay. The relay coil should be rated for 24V DC. It should be connected to terminals E and F or to terminals 205 and 210 in the cabinet.

3.7. Extension Speaker

If an extension speaker is to be installed it should have 4 ohms impedance and a power handling capacity of 1W or more.

Note that the extension speaker will be connected to the receiver only when the "POWER" switch of the transmitter is at "MAINS OFF" and "STAND-BY".

In the other positions of the "POWER" switch the extension speaker is replaced by a load resistor incorporated in the transmitter.

If no extension speaker is used, the AF level in the handset ear-piece may be retained if a 4-ohms 3W resistor is connected between terminals C and D.

3.8. Transmitter-On Indication

Indication of the transmitter-on condition can be obtained by means of a voltage (24V at max. 0.2A) which is controlled by the transmit relay and can be taken off between terminals E (-) and F (+).

3.9. Replacement of Power Packs

For replacement of the receiver power pack reference is made to section 3.9 of Instruction Manual for R 400 Receiver.

Two different power packs are available for operation of the transmitter. Either power pack can be placed as the bottom unit of the cabinet.

The P 400 is used for 24V battery operation whilst the P 401 is used for operation from AC mains.

For a complete description of the power packs reference is made to Instruction Manual for P 400 and P 401 Power Packs.

The cabinet cabling is dependent on the type of power pack used. The P 400 24V power pack requires the installation of two plates on which a total of 10 resistors are mounted. These two plates should be mounted inside the TRP 400 cabinet near its top and wired in accordance with the drawing on page 7-77. Furthermore the interlock switch arrangement is dependent on the power pack in use.

The transmitter heater voltage delivered by the power packs depends on the type of power pack used.

The P 400 delivers 21.5V whereas the P 401 delivers 12.6V filament voltage. Five heater dropping resistors are therefore provided in the T 400 transmitter.

The resistors are numbered 57R7, 57R8, 57R10, 57R12 and 57R14, and are located in the front compartment directly behind the front panel.

When using the P 400 power pack (24V battery operation) these resistors must be inserted in the heater circuits. When using the P 401 power pack (AC operation), the resistors are to be short-circuited.

Check if these resistors are correctly wired before connecting the equipment to the permanent installation.

3.10. Installing Channel Crystals

Channel crystals should meet SKANTI Specification stated in the section Technical Data on the first pages of this manual. Calculation of crystal frequency f_x also appears from Technical Data.

The channel crystals become accessible on removal of the cover plate in the left side wall of the transmitter. To install a new crystal, proceed as follows:

3.10.1. Locate the crystal socket corresponding to the desired band and channel number and plug in the crystal.

3.10.2. Connect a frequency counter (resolution 1 Hz, accuracy 10^{-7}) to the crystal oscillator output, terminals 45-20 and 45-21 (common).

NOTE: It is possible for a voltage difference to be present between common and chassis in DC operation.

3.10.3. Set the "BAND" and "CHANNEL" switches to the new channel and adjust, if necessary, the trimmer capacitor associated with the crystal socket so that the oscillator frequency will equal the frequency stated on the side of the crystal case (0/+5Hz).

3.10.4. Remove the frequency chart from the front panel by tipping the Plexiglas plate out. Note the new transmitter frequency - stated on the top of the crystal case - in the frequency chart.

For shortwave channels: Write an "S" before the frequency if it is in the simplex band, and a "D" if it is in the duplex band.

3.11. Adjustment of Driver Grid Circuits in the Coastal Telephone Range (1.6-4 MHz).

Module 52, adjacent to the channel oscillator, contains twenty tuned circuits, one for each channel facility in the coastal telephone range. After a crystal for a new channel in the coastal telephone range has been plugged in, the associated tuned circuit should be located. Turn the "CHECK SWITCH" to the undesignated position adjacent to the "26V" position; set the "MODE" switch to "A3H" and the "POWER" switch to "FULL".

The iron dust core of the coil you have located should now be turned carefully all the way into the coil former. Three interlock switches near the right-hand edge of the cabinet prevent high tension from being present in the transmitter when a unit is pulled out. To permit adjustment, however, the interlock switches can be closed by pulling their pistons down and outwards to locked positions.

Before beginning adjustment of the driver circuits the 1000V high-tension lead should be disconnected by removing the high-tension plug from its socket in the power pack section.

Turn on the transmitter by turning the receiver "SERVICE" switch to "duplex"; pull out the knob of the "CHECK SWITCH" and turn the iron dust core of the coil referred to out of the coil former until the first maximum reading is observed on the "LEVEL METER".

3.12. Adjustment of Driver Anode Circuits in the Coastal Telephone Range (1.6-4 MHz).

Module 54 below the chassis also has twenty tuned circuits for use in the coastal telephone range. The procedure in adjusting these circuits is identical with that described in section 3.11. except that the "CHECK SWITCH" should be set the undesignated position adjacent to the "-36V" position. Note that the circuit associated with channel 1 (2182 kHz) is factory pre-adjusted.

When the circuits for the channels in use have been adjusted for maximum "LEVEL METER" reading, the readings obtained should be compared with the reading obtained for channel 1. If one or more channels show higher "LEVEL METER" readings than that obtained for CHANNEL 1, the iron dust core(s) of the channel(s) should be re-adjusted so that all channels show readings lower than, or equal to, the CHANNEL 1 reading.

3.13. <u>Driver Circuits for the Shortwave Bands (4-25 MHz).</u>

The driver circuits for the shortwave bands are located in modules /51\ and /53\. Because the placement of the shortwave bands is know, all driver circuits for these bands are factory pre-adjusted.

3.14. <u>Adjustment of Aerial Tuning.</u>

NOTE: In order to obtain the highest degree of accuracy, the adjustment procedure stated below is carried out with the "POWER"-switch set at "FULL".

To avoid excessive voltages in the coupling field it is, however, recommended that initial setting up is made with the "POWER"-switch set at "MEDIUM" which implies that the "LEVEL METER" reading should be approximately 15 at resonance.

Final adjustment should then be made with the "POWER"-switch set at "FULL" and "LEVEL METER" reading should be within the red scale sector

3.15. <u>Adjustment of Aerial Tuning in the Coastal Telephone and 4MHz Bands.</u>

This adjustment should first be performed on the lowest-frequency channel. Insert plug "A" of "AERIAL SHORTENING CAPACITOR" coupling field in socket "2". Set "POWER" switch to "FULL". Set "MODE" switch to "A3H". Set "BAND" switch to "D". This will connect the largest possible capacitor on the input side of the π-circuit.

All plugs in the "CT-4MHz π-FILTER OUTPUT CAPACITOR" coupling field should now be inserted in the sockets designated "O". The π-filter circuit output capacitor will then have its minimum value. Thereafter select, with the plug of the band in question on the variometer coupling panel, at all the following resonance settings, that tap with the lowest number on the "VARIOMETER CT-4 MHz" coupling field which, with the transmitter turned on, provides a possibility of tuning to resonance by turning the "AERIAL TUNING HF/CT FINE" knob. In other words, maximum reading on the "AERIAL TUNING HF/CT FINE" knob which is not one of its extreme positions.

If resonance cannot be obtained in band "D", try with the "BAND" switch set to next permitted band ("F"), continuing as described until resonance is obtained or the last permitted band has been reached; see Table I.

Table I:

Channel Frequency, MHz			Permitted Band Switch Settings
1.60	-	1.85	D, F, G and J
1.85	-	2.10	D, F, G, J and K
2.10	-	2.40	D, F, G, J, K and L
2.40	-	2.70	D, F, G, J, K, L, M and N
2.70	-	3.10	D, F, G, J, K, L, M, N and O
3.10	-	4.00	D, F, G, J, K, L, M, N, O and P

If resonance cannot be obtained, insert plug "A" in socket 1 of the "AERIAL SHORTENING CAPACITOR" coupling field.

Now again attempt to tune to resonance, first in band "D" and thereafter in the following permitted bands until resonance can be obtained.

If resonance can be obtained and the "LEVEL METER" deflects to above the red scale sector, or if resonance cannot be obtained, your aerial is too short!!! It will then be necessary to increase its physical length.

However, if the "LEVEL METER" reading at resonance at the first possible resonance setting is below the red scale sector, the amount of coupling presents a too low value of anode load impedance. Then set the "BAND" switch to the next permitted setting (see Table I) and again tune to resonance.

Continue changing the band setting as described until the "LEVEL METER" reading at resonance is inside the red scale sector or until you reach the last permitted band for the channel frequency employed.

If correct meter reading cannot be accomplished with the "BAND" switch set for the last of the permitted bands, you can add capacitors on the output side of the π-filter by means of the plugs in the "CT-4 MHz π-FILTER OUTPUT CAPACITOR" coupling field from band "G" and onward. Thereafter start in the first band on which resonance was possible. The plug for the band in question should successively be inserted in the sockets 1, 2 ......7 until the "LEVEL METER" reading is inside the red scale sector at resonance.

If correct coupling cannot be obtained in the first band, or if the possibility of obtaining resonance ceases before or in socket 7, an attempt should be made with the next permitted band. If correct coupling cannot be obtained in the last permitted band, your aerial is too long and must therefore be shortened physically!!!

After correct coupling in a band has been obtained, the plugs used for that purpose are not to be touched again.

Tuning on 2182 kHz is performed with the "BAND" switch at "H".
If a lower channel frequency than 2182 kHz is provided, the place of plug "A" in the "AERIAL SHORTENING CAPACITOR" coupling field is already determined.

However, if 2182 kHz is the lowest channel frequency, the place of plug "A" should be determined at that frequency. Start with plug "A" in socket "2". If resonance cannot be obtained, try with plug "A" in socket "1". If resonance can be obtained and the "LEVEL METER" deflects to above the red scale sector, or if resonance cannot be obtained, your aerial is too short. Resonance adjustments are performed on 2182 kHz by first setting the "AERIAL TUNING HF/CT FINE" knob in the middle of its range - that is, 3/4 turn from one end. Insert the plug in the "FINE TUNING COIL FOR 2182 kHz" coupling field in socket "6". Using plug "H" in the "VARIOMETER CT-4 MHz" coupling field, find the socket that provides maximum "AERIAL CURRENT" meter reading.

Next, using the plug in the "FINE TUNING COIL FOR 2182 kHz" coupling field, find the socket that provides maximum "AERIAL CURRENT" meter reading. Lastly, tuning to exact resonance is carried out with the AERIAL TUNING HF/CT FINE" knob.

If resonance has been accomplished and the place of plug "A" determined, the reading of the "LEVEL METER" should thereafter be brought into the red scale sector. If the "LEVEL METER" reading is below the red scale sector it is necessary to cut in capacitors on the output side of the π-filter, using plug "H" in the "CT-4MHz π-FILTER OUTPUT CAPACITOR" coupling field. Successively insert plug "H" in the sockets 1, 2 ......7 until the "LEVEL METER" reading is inside the red scale sector at resonance.

If correct reading has not been obtained when socket 7 has been reached, your aerial is too long.

Coupling on the 4 MHz band is adjusted with the "BAND" switch at "4". The π-filter input capacitor can be selected with the plug in the "4 MHz π-FILTER INPUT CAPACITOR". The five sockets in this coupling field therefore perform the same function as the settings of the "BAND" switch in the CT band.

The procedure is as described above. Instead of altering the setting of the "BAND" switch, the place of the plug in the "4 MHz π-FILTER INPUT CAPACITOR" coupling field should be changed, starting with the plug in socket "1".

3.16. Aerial Tuning in the 6, 8, 12, 16, 22 and 25 MHz Short-wave Bands.

Set the "BAND switch to the desired band. This will cause a fixed capacitor to be connected across the π-filter input, also a fixed π-filter coil.

In the "HF AERIAL COIL" coupling field, insert the plug for the desired band in socket "1".

In the "HF AERIAL CAPACITORS" coupling field, insert the plug for the desired band in socket "O".

The "HF π-FILTER OUTPUT CAPACITOR" coupling field is used only for the 6, 22 and 25 MHz bands. Insert plug "x" for the 6 MHz band in socket "1", plug "y" for the 22 MHz band in socket "3", and plug "z" for the 25 MHz band in socket "5".

Set "POWER" switch on front panel to "FULL".

Set "MODE" switch on front panel to "A3H".

Turn the transmitter on and with the "AERIAL TUNING HF COARSE" switch on the front panel first set at "1", attempt tuning to resonance with the "AERIAL TUNING HF/CT FINE" knob on the front panel - in other words, tune for maximum reading on the "AERIAL CURRENT" front-panel meter. If this cannot be accomplished or can only be accomplished with the "AERIAL TUNING HF/CT FINE" knob in one of its extreme positions, try with the "AERIAL TUNING HF COARSE" switch at "2", "3" etc. until resonance is obtained.

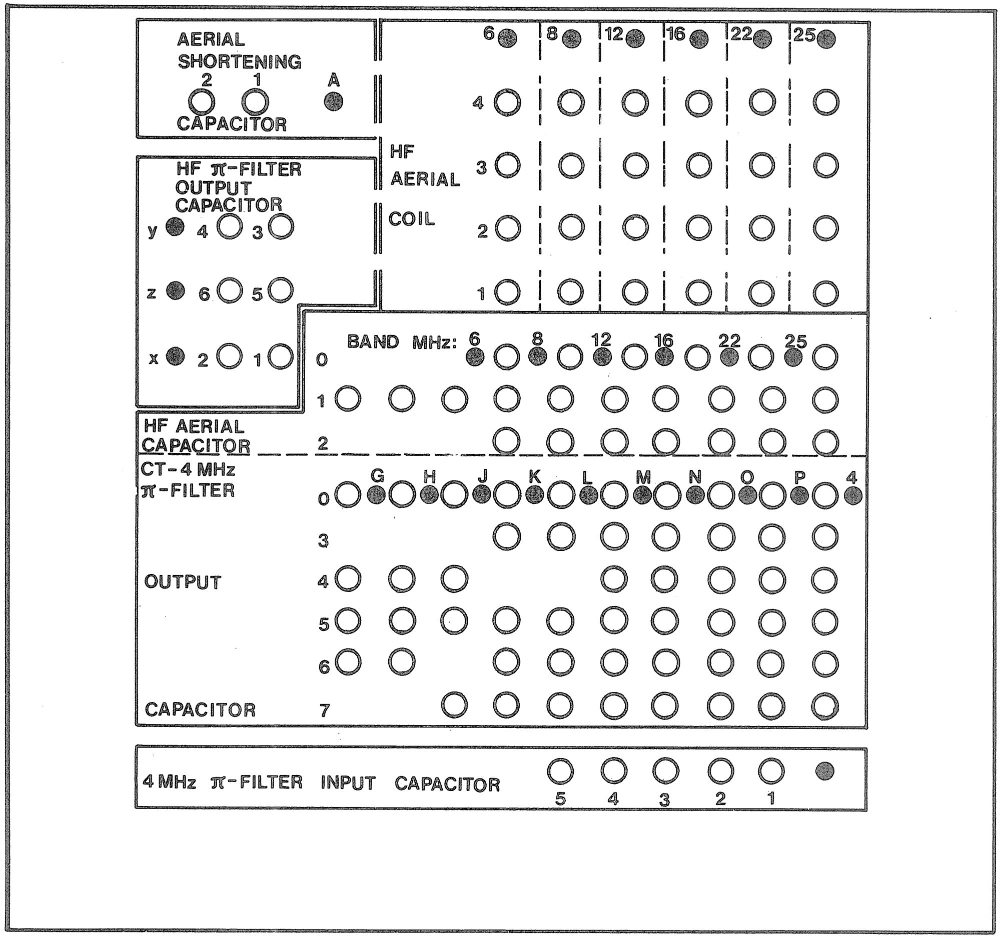
If the "LEVEL METER" needle is outside the red scale sector, the "AERIAL TUNING HF COARSE" switch should be set to a higher number until the meter reading is inside the red scale sector at resonance.

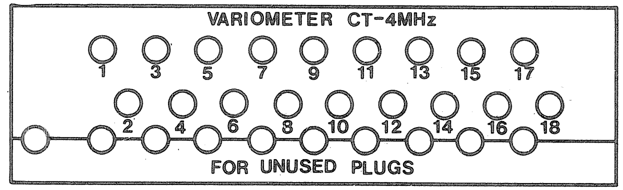
For the 6, 22 and 25 MHz bands, the range of the "AERIAL TUNING HF COARSE" switch can be increased by means of the "HF π-FILTER OUTPUT CAPACITOR" coupling field.

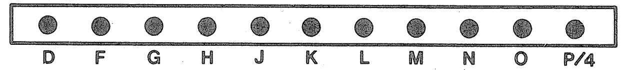
If correct resonance setting and "LEVEL METER" reading cannot be obtained in these three HF bands by means of the preceding adjustments, plug "x" for the 6 MHz band may be inserted in socket "2", plug "y" for the 22 MHz band in socket "4", and plug "z" for the 25 MHz band in socket "6", thereafter again trying with the "AERIAL TUNING HF COARSE" switch at "1", "2" etc. until resonance setting and correct meter reading are obtained.

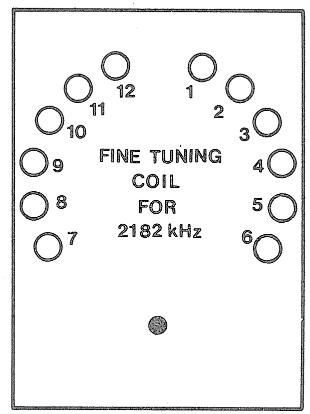
If it continues to be impossible to obtain resonance and/or correct meter reading, try to insert the plug of the "HF AERIAL COIL" coupling field for the question in sockets "2", "3" or "4" until resonance is obtained and the "LEVEL METER" needle is inside the red scale sector.

If it continues to be impossible to obtain resonance and/or correct meter reading, try to insert the plug of the "HF AERIAL CAPACITORS" coupling field for the band in question in socket "1" or "2" and thereafter attempt to obtain resonance and correct meter reading by means of the "AERIAL TUNING HF COARSE" and "AERIAL TUNING HF/CT FINE" knobs and the plug of the "HF AERIAL COIL" coupling field.

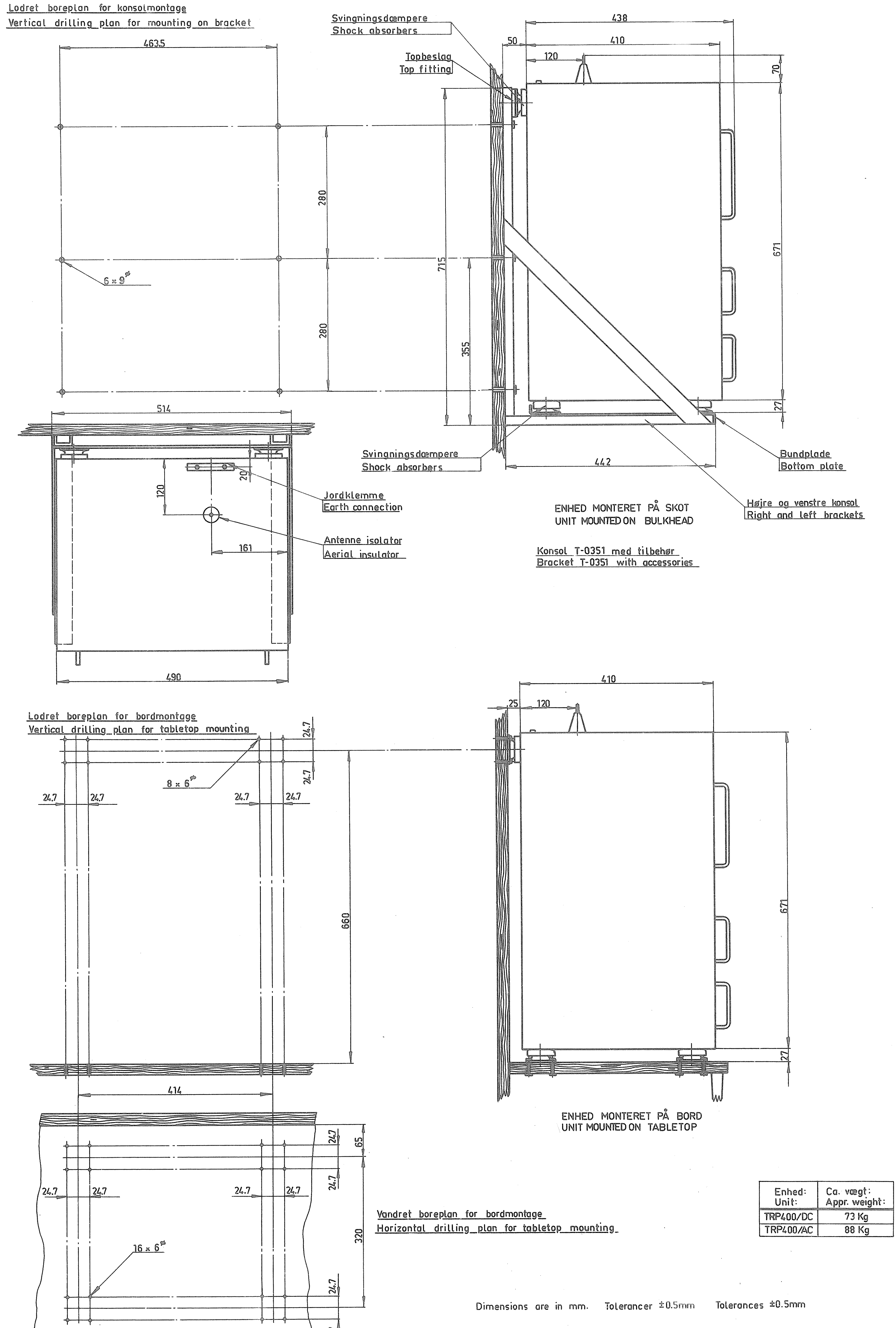








SHIP	T400 no.
MARKĔR MED ⊗ OG TEGN EN STREG FRA ● NÅR ANTENNETILPASNING ER OPNÅET	
MARK WITH ⊗ AND DRAW A LINE FROM ● WHEN ADJUSTMENT OF AERIAL TUNING IS COMPLETED	
ADJUSTMENT OF AERIAL TUNING	Tegn. JD / Konf. / T-0294-5
Carried out by: date:	17-1-72

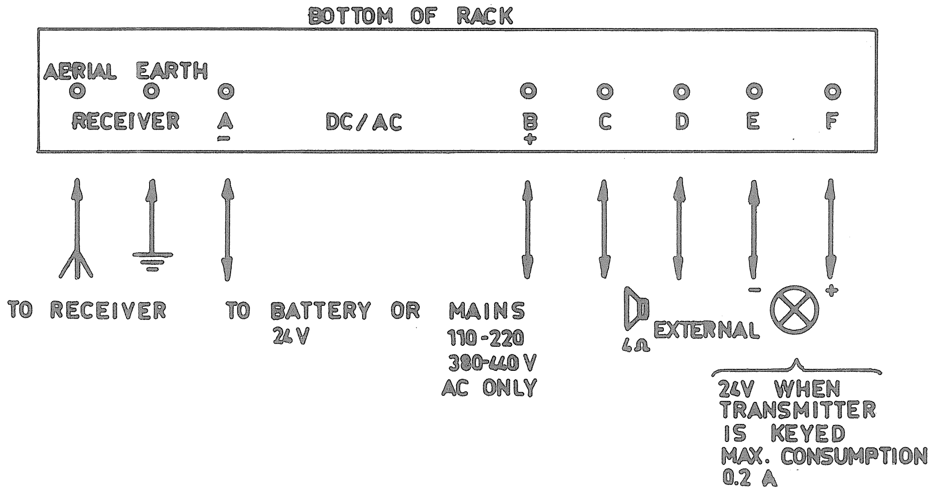


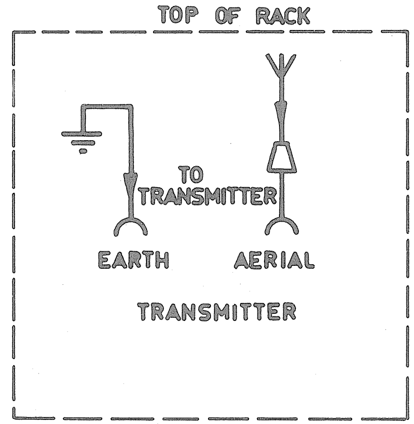
Enhed: Unit:	Ca. vægt: Appr. weight:
TRP400/DC	73 Kg
TRP400/AC	88 Kg

Dimensions are in mm. Tolerancer ±0.5mm Tolerances ±0.5mm

T-0352-1 MOUNTING OF TRP400 ON BULKHEAD OR TABLETOP

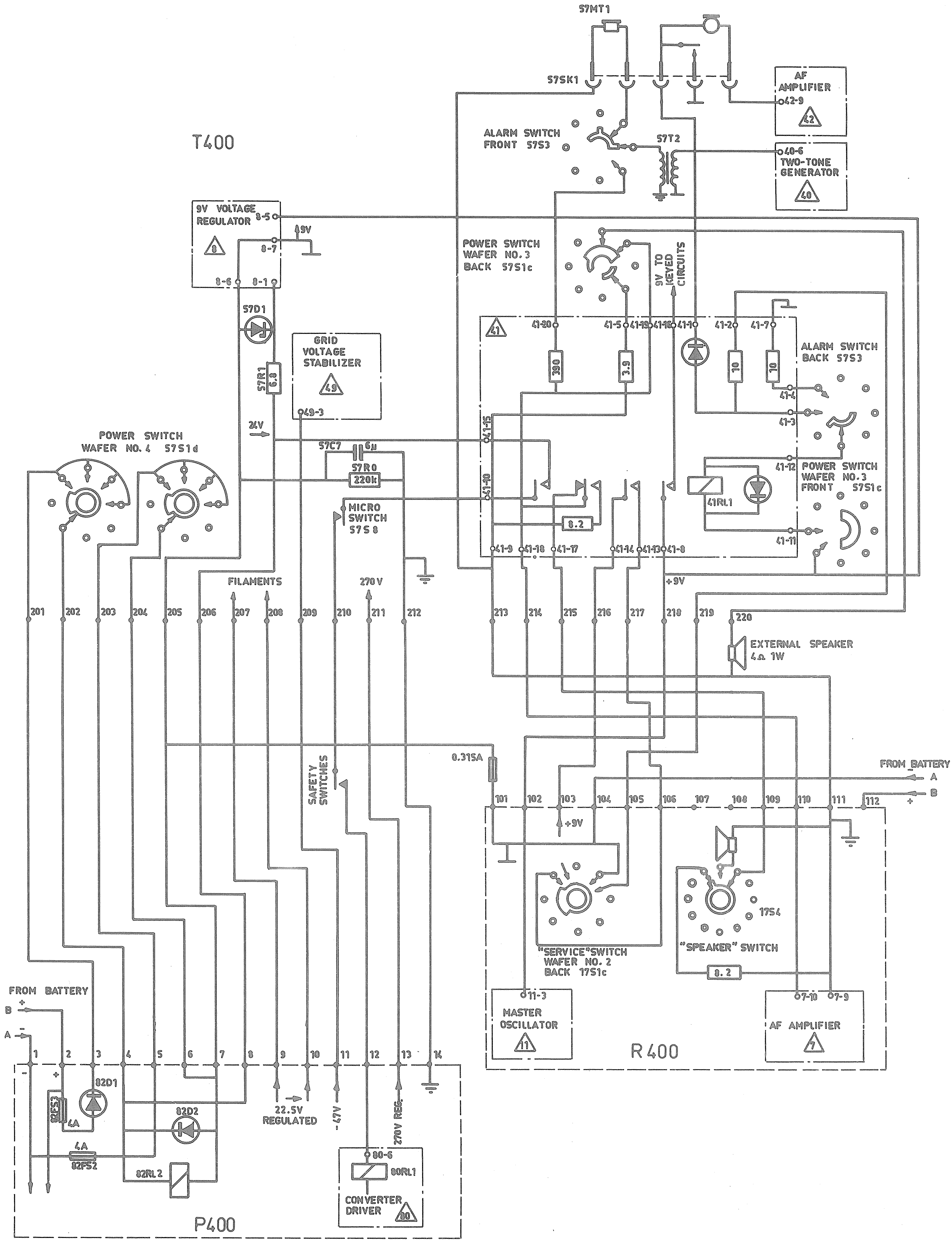
CAUTION: IN INSTALLATIONS FOR DUPLEX OPERATION IT IS NECESSARY TO USE SEPARATE EARTH CONNECTIONS FOR RECEIVER AND TRANSMITTER



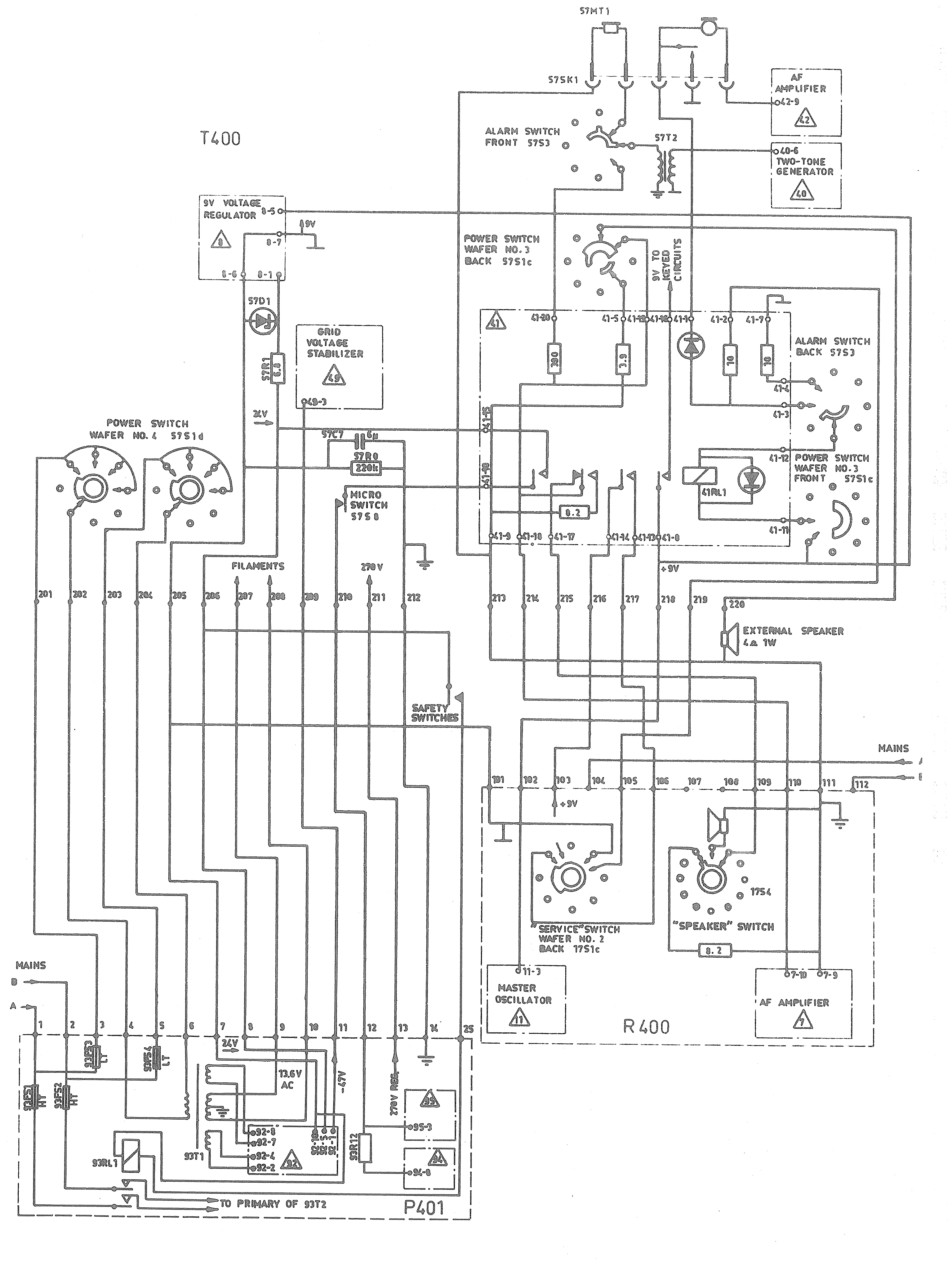


FOR BATTERY OPERATION USE PLASTIC CABLE MIN. 2 x 16mm^2
FOR MAINS OPERATION USE PLASTIC CABLE MIN. 2 x 2.5mm^2
FOR EXTERNAL CABLE USE PLASTIC CABLE MIN. 2 x 1.5mm^2

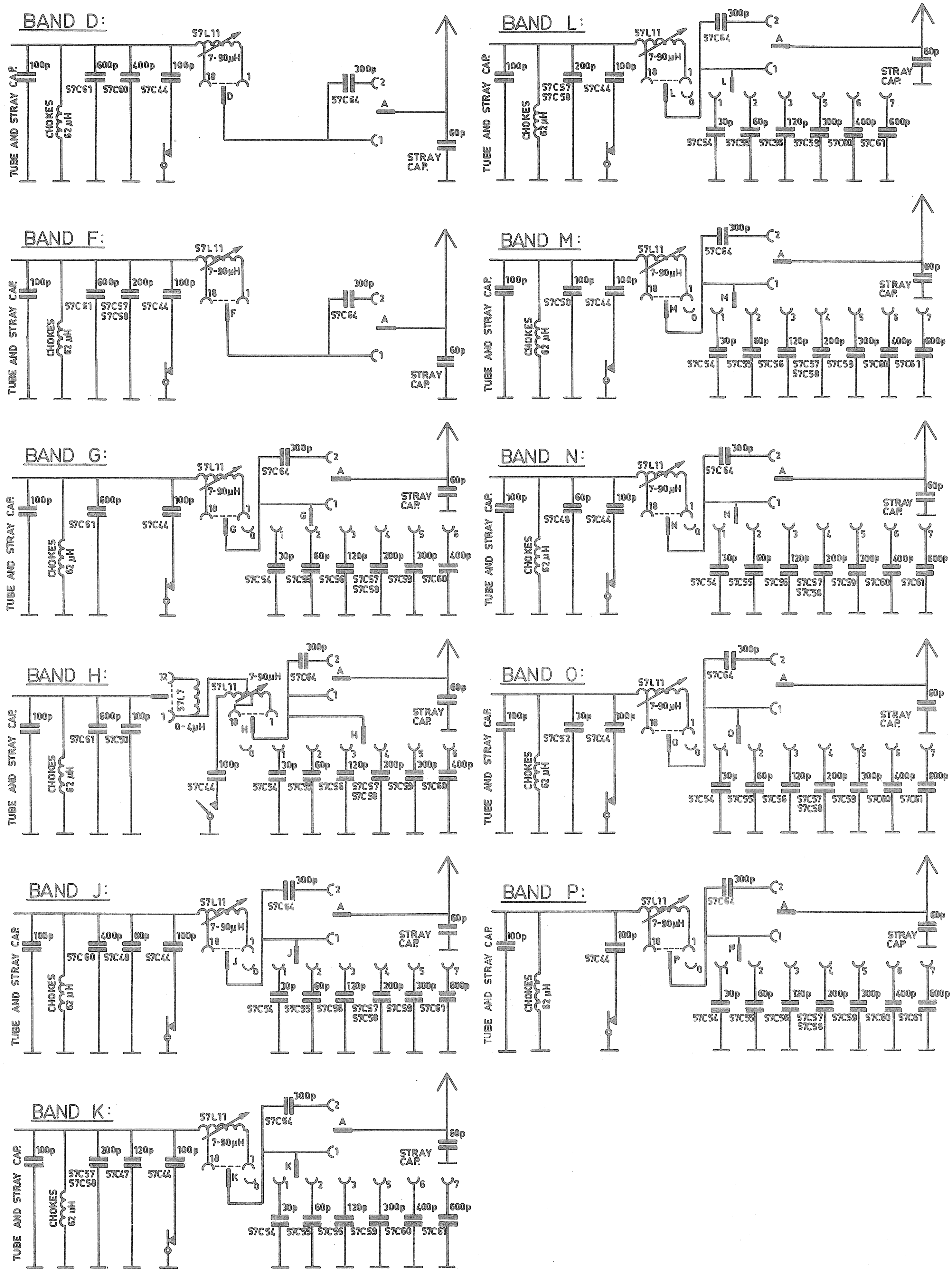
EARTH CABLE FOR RECEIVER PLASTIC CABLE MIN. 2.5mm^2
EARTH FOR TRANSMITTER 100 x 0.5mm COPPER STRIP
AERIAL CABLE FOR RECEIVER COAXIALCABLE TYPE T3234 (AS93M) 50Ω OR RG 212 U



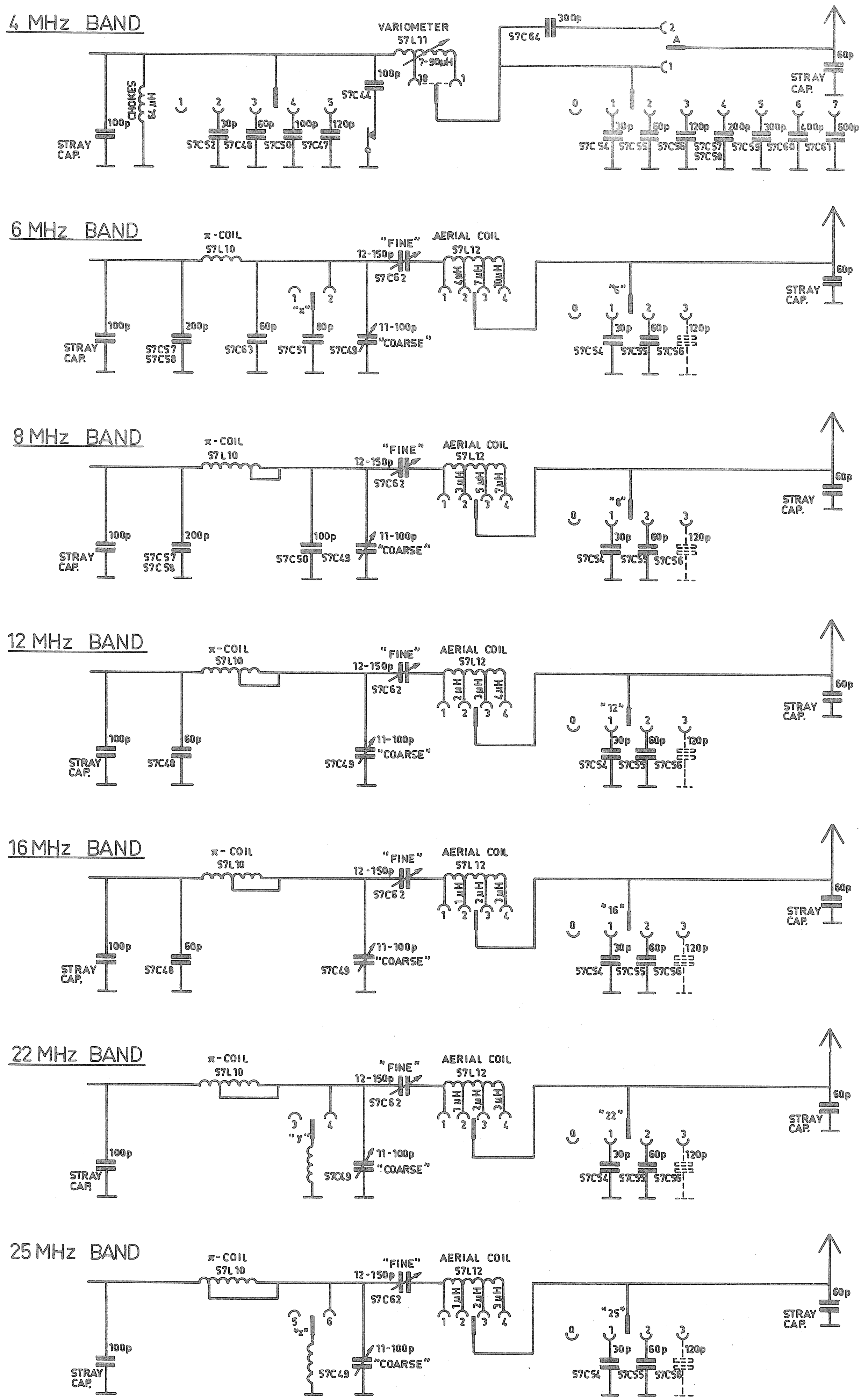
T-0183-2 SIMPLIFIED DIAGRAM INTERCONNECTIONS BETWEEN UNITS TRP 400 DC VERSION



T-0104-1 SIMPLIFIED DIAGRAM INTERCONNECTIONS BETWEEN UNITS TRP 400 AC VERSION



T- 0605 - 1 AERIAL TUNING CIRCUITS FOR CT- BANDS



T - 0606 - 1 AERIAL TUNING CIRCUITS FOR HF - BANDS

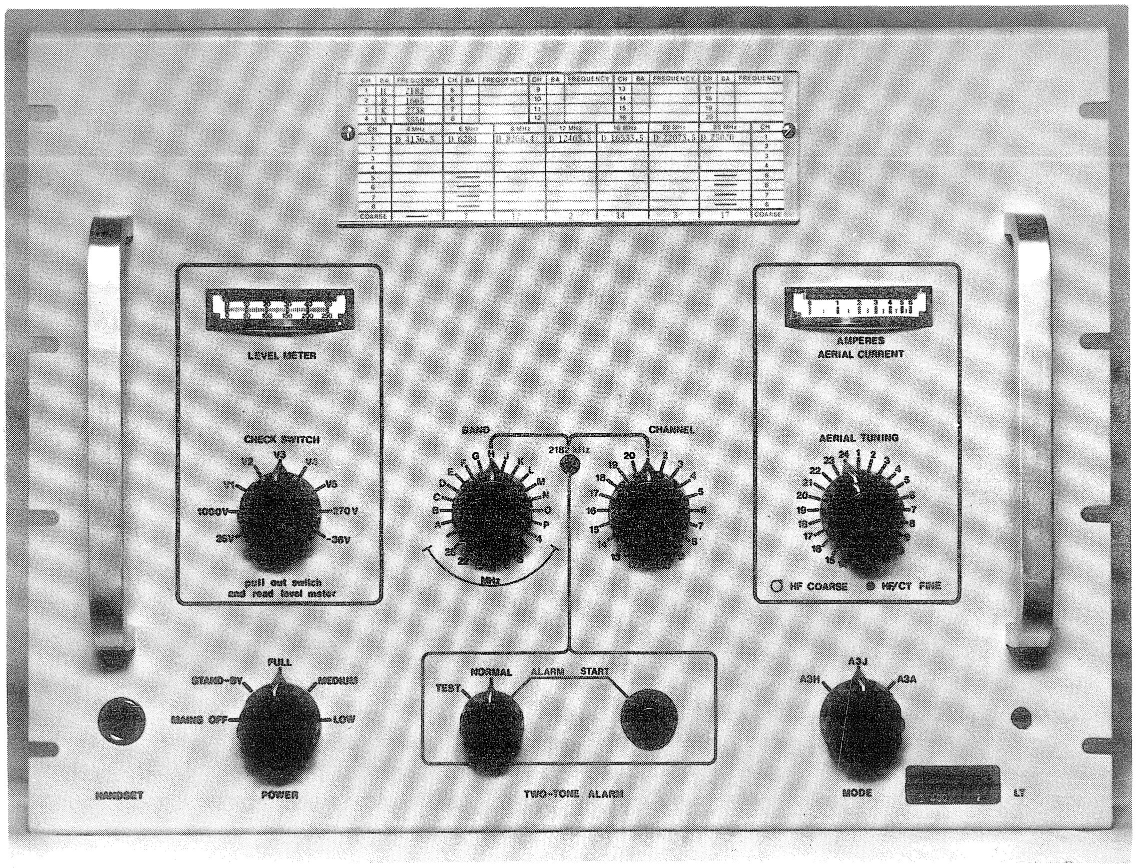


Fig. 4.1 Front panel and operating controls.

4. OPERATING INSTRUCTIONS

4.1. Controls and Their Functions

The "POWER" switch has five positions:

"MAINS OFF": Transmitter is switched off. External speaker of receiver is connected to receiver output.

"STAND-BY" : Power pack is started up and supplies transmitter valves with filament power and grid bias. Power is applied to transmitter oscillators but transmitter cannot be turned on. "LT" lamp comes on and external speaker of receiver is connected to receiver output.

"FULL" : Transmitter can be turned on and PA amplifier valves can be driven to full output. External speaker of receiver is disconnected.

"MEDIUM" : Transmitter can be turned on. PA valves can be driven to approx. 5 dB below full output. External speaker of receiver is disconnected.

"LOW" : Transmitter can be turned on. PA valves can be driven to approx. 10 dB below full output. External speaker of receiver is disconnected.

The "TWO-TONE ALARM" switch has three positions:

"TEST" : Connection between receiver and handset earpiece is broken. Earpiece is connected to alarm generator, which is started. Transmitter cannot be turned on.

"NORMAL" : Earpiece is connected to receiver, and alarm generator cannot be operated. Transmitter can be turned on.

"ALARM" : Earpiece is connected to alarm generator and transmitter is turned on. Alarm generator is ready for transmission of alarm signal.

The "TWO-TONE ALARM START" pushbutton is used to start the alarm generator after the "TWO-TONE ALARM" switch has been turned to the "ALARM" position. The pushbutton is depressed and released, and alarm signal will be transmitted for approx. 45 seconds.

The "MODE" switch has three positions:

"A3H" : Transmission of single-sideband signal with full carrier.

"A3J": : Transmission of single-sideband signal with suppressed carrier.

"A3A" : Transmission of single-sideband signal with reduced carrier.

The "LEVEL METER" indicates anode AC voltage swing at the power amplifier anodes.

The "CHECK SWITCH" is not normally operative. Pulling the switch knob out will switch the "LEVEL METER" to read the voltage or current selected with the switch. When released, the knob will return to its original position.
This switch has nine positions marked as follows:

"26V" : Check of low voltage delivered by power pack.
"1000V" : Check of high voltage delivered by power pack.
"V1" : Check of cathode current of first driver valve.
"V2" : Check of cathode current of second driver valve.
"V3" : Check of cathode current of first output valve.
"V4" : Check of cathode current of second output valve.
"V5" : Check of cathode current of third output valve.
"270V" : Check of screen grid voltage delivered by power pack.
"-36V" : Check of grid bias delivered by power pack.

The "BAND" switch has a total of 24 positions designated A to P which are used in the coastal telephone range and in the 4, 6, 8, 12, 16, 22, and 25 MHz shortwave bands.

The "CHANNEL" switch has 20 positions.

"2182 kHz" pilot lamp. Shows light when power is applied to transmitter, "BAND" switch at "H" and "CHANNEL" switch at "1". This setting corresponds to 2182 kHz.

The "AERIAL CURRENT" meter reads the aerial current. The scale is logarithmic.

The "AERIAL TUNING, HF COARSE" switch is used for coarse aerial tuning in the shortwave bands. The correct setting to use may be read on the frequency chart on the front panel.

"AERIAL TUNING, HF/CT FINE" is used for fine adjustment of aerial tuning.

NOTE: The "SERVICE" switch of the receiver is also used for controlling the transmitter.

The "SERVICE" switch has four positions:

"MAINS OFF" : Receiver is switched off. Transmitter can be turned on by pressing handset key.

"simplex" : Simplex service. Transmitter can be turned on by pressing handset key. Receiver is muted while transmitter is on.

"semi-duplex": Semi-duplex service. Transmitter can be turned on by pressing handset key.

"duplex" : Duplex service. Transmitter is on constantly except that microphone circuit is not closed until handset key is pressed. Receiver is on but built-in speaker is disconnected and only the earpiece is connected to receiver output.

4.2. Tuning to 2182 kHz

(1) Set "POWER" switch to "STAND-BY". "LT" lamp will show light.
(2) Set "TWO-TONE ALARM" switch to "NORMAL".
(3) Set "BAND" switch to "H".
(4) Set "CHANNEL" switch to "1". "2182 kHz" lamp will show light.
(5) Set "POWER" switch to "FULL".
(6) Set "SERVICE" switch of receiver to "semi-duplex".
(7) Press handset key. "AERIAL CURRENT" meter will show reading not later than one minute after operation (1) has been performed.
(8) Adjust "AERIAL TUNING, HF/CT FINE" for maximum reading on "AERIAL CURRENT" meter.
(9) Release handset key.

Transmitter is now ready for operation.

NOTE: The type of service normally used on 2182 kHz is A3H, simplex. When the transmitter is tuned to 2182 kHz, the 'MODE switch is inoperative and its setting therefore unimportant.

4.2.1. Transmitting an Alarm Signal on 2182 kHz

Tune the transmitter as described under 4.2 above and continue as follows:

(1) Set "TWO-TONE ALARM" switch to "ALARM".
(2) Press "TWO-TONE ALARM START" knob and thereafter release it. The alarm signal transmitted may now be monitored in the handset earpiece. After approx. 45 seconds the alarm generator stop. Thereafter return the "TWO-TONE ALARM" switch to "NORMAL". An alarm signal transmission may be interrupted at any time by returning the "TWO-TONE ALARM" switch to "NORMAL".

4.3. Tuning to a Channel in the Coastal Telephony Range

(1) Set "POWER" switch to "STAND-BY". "LT" lamp will show light.
(2) Set "TWO-TONE ALARM" switch to "NORMAL".
(3) Look up desired frequency in frequency chart.
(4) Read channel number under "CH" in frequency chart and set "CHANNEL" switch to that number.
(5) Read letter under "BD" in frequency chart and set "BAND" switch to that letter.
(6) Set "MODE" switch to "A3H".
(7) Set "POWER" switch to "FULL".
(8) Set "SERVICE" switch of receiver to "semi-duplex".
(9) Press handset key.

(10) Turn "AERIAL TUNING, HF/CT FINE" for maximum "AERIAL CURRENT" meter reading.
(11) Release handset key.
(12) Select desired type of service with "MODE" switch and "SERVICE" switch of receiver, and desired power level with "POWER" switch.

Transmitter is now ready for operation.

4.4. Tuning to a Channel in the HF Range

(1) Set "POWER" switch to "STAND-BY". "LT" lamp will show light.
(2) Set "TWO-TONE ALARM" switch to "NORMAL".
(3) Set "BAND" switch to desired band.
(4) Look up desired frequency in frequency chart.
(5) Read channel number under "CH" in frequency chart and set "CHANNEL" switch to that number.
(6) Read number under "COARSE" in selected band in frequency chart and set "AERIAL TUNING, HF COARSE" to that number.
(7) Set "MODE" switch to "A3H".
(8) Set "POWER" switch to "FULL.
(9) Set "SERVICE" switch of receiver to "simplex" or "semi-duplex".
(10) Press handset key.
(11) Turn "AERIAL TUNING, HF/CT FINE" for maximum "AERIAL CURRENT" meter-reading.
(12) Release handset key.
(13) Select desired type of service with "MODE" switch and "SERVICE" switch of receiver, and desired power level with "POWER" switch.

Transmitter is now ready for operation.

5 SIMPLE SERVICE

5.1. Incorrect Operation

If the transmitter is not functioning the way it should a check should be made whether it is being operated correctly. Go through adjustment procedures 4.2, 4.3 or 4.4 if necessary.

5.2. Checking the Aerial Tuning

Aerial tuning may be checked by adjusting the transmitter as described in section 4.2.

Turn the transmitter on but do not speak into the microphone. With the "AERIAL TUNING, HF/CT FINE" control turned for maximum reading on the "AERIAL CURRENT" meter, the needle of the "LEVEL METER" should be inside the red scale sector. If the needle is outside the red scale sector and the transmitter is otherwise functioning normally, the fault should be looked for in the aerial or in the transmitter earth strap.

Accordingly, the following checks should be made:

Have any changes been made in aerial or earth connections since the installation was made?

Have any changes been made in the rigging of the vessel, or in the placement of derricks etc.?

Is leakage present on the aerial, possibly caused by moisture or dirt on the aerial insulators?

5.3. Replacement of Pilot Lamps

The pilot lamps may be replaced without opening the transmitter cabinet. The "LT" lamp is defective if the transmitter is functioning normally and the lamp shows no light. The "2182 kHz" lamp is defective if the lamp shows no light with power applied to the transmitter and the "BAND" and "CHANNEL" switches set at "H" and "1", respectively. To replace a pilot lamp, screw off the cover; the lamp will come out with the cover and a new one may be inserted.

5.4. Voltage Checking

The voltages delivered by the power pack may be checked with the "CHECK SWITCH" on the transmitter front panel. The switch is operated by setting it to the desired position and thereafter pulling the knob out. Readings are made on the "LEVEL METER" while keeping the switch knob pulled out.

5.4.1. Low-tension Checking

With the "POWER" switch at "STAND-BY" and the "CHECK SWITCH" at "26V" the meter should read between 23V and 33V if the equipment is operated from a P 400 power pack (24V battery operation), and between 23V and 29V if the equipment is operated from a P 401 power pack (AC operation). In this position of the "CHECK SWITCH", the meter reads full scale at 50V.

The negative grid bias for the transmitter valves may be checked with the "CHECK SWITCH" set at "36V". Voltage should be 36V ±3V. In this position, too, the meter reads full scale at 50V.

If the meter shows no reading in these positions reference is made to section 5.6.

5.4.2. High-tension Checking

With the "POWER" switch at "LOW", the "MODE" switch at "A3H", the "BAND" and "CHANNEL" switches set to a channel equipped with a crystal, and the "CHECK SWITCH" at "1000V", the meter should read between 1000V and 1100V with the transmitter turned on. Full-scale meter reading corresponds to 2500V in this case.

With the "CHECK SWITCH" at "270V" and otherwise the same settings as above, the meter should read 270V ±15V. Full-scale meter reading corresponds to 500V.

If the meter shows no reading, reference is made to section 5.6.

5.5. Valve-current Checking

Transmitter-valve cathode current may be checked with the "CHECK SWITCH". With the transmitter tuned to 2182 kHz as described in section 4.2., valve current should be within ±10% of the values stated in Chart 5.1.

Set the "CHECK SWITCH" to the desired valve (V1-V5) and thereafter pull out the switch knob. Readings are made on the "LEVEL METER" while keeping the switch knob pulled out.

VALVE	V1	V2	V3	V4	V5
CURRENT mA	29	65-140	123	123	123
FULL-SCALE METER READING mA	50	250	250	250	250

CHART 5.1

5.6. Replacement of Fuses

If the "LT" lamp shows no light and no meter reading is obtained when making the low-tension checks specified in section 5.4.1., a check should be made of the fuses marked "LT FUSES" in the power pack.

If no meter reading is obtained when making the high-tension checks specified in section 5.4.2., a check should be made of the fuses marked "HT FUSES" in the power pack.

Fuse ratings depend on the power pack employed.

Reference is made to Instruction Manual for P 400 and P 401 Power Packs.

NOTE: Do not use fuses of higher ratings than those specified.

5.7. Replacement of Valves

If valve-current measurements afford grounds for suspecting a valve of being defective you may try to replace the valve in question. This requires that the transmitter be opened as described in section 3.2. Highly dangerous voltages are present in the circuits when power is applied to the transmitter.

Set "POWER" switch to "MAINS OFF" and open external supply-voltage main switch before opening the transmitter.

Driver valves V1 and V2 are placed in a horizontal position below the chassis whilst power amplifier valves V3, V4 and V5 are located above the chassis near its rear edge.

6. REPAIR AND ALIGNMENT

6.1. Introduction

Repairs and adjustments on the transmitter should be performed only by qualified technicians, to whom this chapter is addressed. Before attempting any repairs or adjustments, a study of Chapter 2, Technical Description, is recommended.

6.2. Cross-slot Screws

The cross-slot screws used are Pozidriv screws. A Pozidriv screwdriver No. 1 should be used in order to avoid damaging such screws.

6.3. Locating Subunits and Components

Locations of circuit boards in the transmitter appear from the three drawings, pages 7-34 to 7-36. Locations of components on each circuit board appear from the component location drawings against the respective circuit diagrams.

6.4. Locating Faults

Fault finding, as described in section 6.5. below, is aided by test points provided for the purpose of permitting rapid localization of faulty circuit boards on the basis of DC measurements. Since not all types of faults can be traced by means of DC measurements, supplementary AC measurements with an oscilloscope may be required; see section 6.6. To facilitate fault finding on each individual circuit board, typical voltages are listed on the circuit diagrams.

6.5. Test Points

Most circuit boards contain one or more test points that permit checking the active elements on each board. They are small pin-type terminals, colour coded following the standard colour code in addition to being numbered. In the circuit diagrams, test points are marked [TP 1], [TP 2] etc., and typical voltages at the test points are listed there.

Solder terminals on the circuit boards may to a great extent also be regarded as test points. Typical voltages are therefore also listed against relevant solder terminals on the circuit diagrams.

If a voltage measured at a test point differs markedly from the listed value it is a fairly certain indication that the circuit board in question is faulty, assuming that the voltages applied to the circuit board are the correct ones. This should likewise be checked.

6.6. AC Voltages

AC voltages listed in the circuit diagrams are typical voltages. Except for the microphone signal and the 1.4-MHz signal from the receiver, all voltages are generated in the transmitter.

Voltages specified are based on measurement with an oscilloscope having an input impedance of 10 Mohms in parallel with 7 pF, a sensitivity of the order of 50 mV/div and a frequency range of not less than DC - 50 MHz.

AC voltage values measured in the signal path of the transmitter can be measured only if the transmitter is modulated with a two-tone signal.

Two tone generators are used for producing the two-tone signal.

Alternatively, the TWO-TONE ALARM GENERATOR incorporated in the transmitter may be employed.

The procedure in providing the modulating signal is described under 42 Realignment of the AF AMPLIFIER, page 6-3.

6.7. DC Voltages

DC voltages listed in the circuit diagrams are based on measurement with a 25 kohms/volt multimeter. If a stated voltage is dependent on the setting of a control, this is also stated on the circuit diagrams.

6.8. Adjustments

This section describes alignment procedures for each individual module (subunit) that contains adjustable components. Keep in mind that no adjustment should be carried out unless there is a clear indication that it is really necessary. Moreover, adjustments should be carried out only by a qualified technician with the necessary equipment at his disposal.

8 Realignment of 9V VOLTAGE REGULATOR

Measuring equipment: DC voltmeter having an accuracy of 1.5% or better.

Transmitter settings:

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

POWER:	FULL
TWO-TONE ALARM:	ALARM
BAND:	6 MHz

(1) Connect voltmeter between terminals 8-5 (+) and 8-7 (-).

(2) Check that voltage is between 8.9V and 9.1V.
If this is not the case, adjust alignment potentiometer 8R8 (red) for correct voltage.

(3) Check that potentiometer 8R6 (yellow) has been turned against the stop all the way to the left (fully anticlockwise).

40 Realignment of TWO-TONE GENERATOR

Measuring equipment:

Frequency counter having an accuracy better than 10^{-4} and a sensitivity of at least 100 mV.

AF voltmeter or oscilloscope having an input impedance better than 10 kohms.

Transmitter settings:

POWER: STAND BY
TWO-TONE ALARM: TEST

(1) Connect frequency counter between terminals 40-2 and 40-5.

(2) Connect turret terminal designated 1.3 to nearest turret terminal, using a crocodile clip etc.

(3) Adjust coil 40T2 (colour coded brown/orange) until counter reads 1300 Hz ±1 Hz.

(4) Remove connection referred to under (2) above.

(5) Connect turret terminal designated 2.2 to nearest turret terminal (crocodile clip).

(6) Adjust coil 40T1 (colour coded red/red) until counter reads 2200 Hz ±1 Hz.

(7) Remove connection referred to under (5) above and remove connection to frequency counter.

(8) Check that AC voltage between terminals 40-2 and 40-5 is approx. 1.25Vpp.

(9) Set "TWO-TONE ALARM" switch to "ALARM".

(10) Depress and release "TWO-TONE ALARM" push-button. The alarm signal should now be heard from the handset earpiece for a period of 45 sec ±15 sec. The period is counted from the push-button is released until the alarm signal stops.

/42\ Realignment of AF AMPLIFIER

Measuring equipment:

A peak-voltage indicating AF voltmeter or an oscilloscope.

Two tone generators which between them can deliver a signal consisting of two equally strong signals (700 and 2500 Hz) having a total amplitude of 8Vpp (with provision for attenuating the signal to 0.8Vpp (-20 dB)) in 60 ohms.

Generator output impedance: 60 ohms.
Alternatively, the TWO-TONE GENERATOR /40\ incorporated in the transmitter may be used as follows:

Set "POWER" switch to "MAINS OFF".

Connect a 1-kohm resistor between the turret terminal marked 1.3 on module /40\ and terminal 40-5.

Connect a 1 kohm resistor between turret terminal marked 2.2 on module /40\ and terminal 40-5.

When a 20-dB reduction of modulating signal is necessary, this can be accomplished by connecting a 180-ohm resistor between terminals 40-2 and 40-5.

Connect terminals 40-4 and 42-7 together.

Transmitter settings:

POWER: LOW
TWO-TONE ALARM: NORMAL

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

(1) Apply a two-tone modulating signal to the microphone terminals in the handset through a 470-uF/16V capacitor, amplitude 8Vpp. (Alternatively, the built-in TWO-TONE GENERATOR may be used as described above).

(2) Connect peak voltmeter (oscilloscope) between terminals 42-2 and 42-4.

(3) Turn on transmitter by depressing handset key.

(4) Adjust potentiometer 42R20 (red) so that voltage between 42-2 and 42-4 is 3.3Vpp.

(5) Attenuate modulating signal 20 dB.

(6) Adjust potentiometer 42R25 (green) so that voltage between 42-2 and 42-4 is 2.3Vpp. (If the built-in TWO-TONE GENERATOR was employed for making the adjustment, remove the temporary connections and check that the generator is functioning normally).

/43\ Realignment of 1.4 MHz MIXER

Measuring equipment:

Oscilloscope having a sensitivity of the order of 500mV/div, input impedance 10 Mohms in parallel with 7 pF.

Two tone generators as described under /42\ Realignment of AF AMPLIFIER.

Transmitter settings:

POWER: FULL
TWO-TONE ALARM: NORMAL
MODE: A3J
BAND: 6 MHz
CHANNEL: 1

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

(The above assumes that the transmitter contains a crystal in the 6 MHz band. If not, use 8 MHz instead).

(1) Connect oscilloscope between terminals 48-11 and 48-15 (common).

(2) Modulate transmitter with two-tone signal.

(3) Turn on transmitter by depressing handset key.

(4) Adjust potentiometer 43R4 (red) so that voltage between terminals 48-11 and 48-15 is 2.4 Vpp.
(If the built-in TWO-TONE GENERATOR was employed for making the adjustment, remove temporary connections and check that generator is functioning normally).

44 Realignment of CT MIXER

Measuring equipment:

Standard signal generator covering the range 2.5 - 7 MHz and having an accuracy better than 10^{-4}.

Oscilloscope having a sensitivity better than 50 mV/div. Input impedance 10 Mohms in parallel with 7 pF and a 3-dB upper limiting frequency greater than 10 MHz.

Transmitter settings:

POWER:	FULL
TWO-TONE ALARM:	ALARM
MODE:	A3H
BAND:	6 MHz
CHANNEL:	1

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

(The above assumes that the transmitter contains a crystal in the 6 MHz band. If not, use 8 MHz instead).

(1) Connect oscilloscope between resistor 44R9 and terminal 44-8 (common).

(2) Adjust coil 44L1 for maximum response on oscilloscope.

(3) Remove coaxial cable from terminals 44-1 and 44-2 and connect signal generator instead.

(4) Set generator to 2789 kHz, 200mVrms.

(5) Connect oscilloscope between terminals 44-15 and 44-16 (common).

(6) Adjust coil 44L7 for minimum response on oscilloscope.

(7) Set generator to 3000 kHz, 200mVrms.

(8) Adjust coil 44L6 for maximum response on oscilloscope.

(9) Set generator to 6200 kHz, 200mVrms.

(10) Connect oscilloscope between 44R34 and terminal 44-8 (common).

(11) Adjust coil 44L9 for minimum response on oscilloscope.

(12) Reconnect coaxial cable to terminals 44-1 and 44-2.

(13) Connect oscilloscope between terminals 48-11 and 48-15 (common).

(14) Adjust potentiometer 44R10 so that voltage between terminals 48-11 and 48-15 is 1340mVpp.

△46 Realignment of HF MIXER

Measuring equipment:

Standard signal generator covering the range 2 - 6 MHz and having an accuracy better than 10^{-4}.

Oscilloscope having a sensitivity better than 50mV/div. Input impedance 10 Mohms in parallel with 7 pF.

Two tone generators as described under △42 Realignemnt of AF AMPLIFIER.

A. Low-pass filter (46L2, 46L3 and 46L4).

Transmitter settings:

POWER:	LOW
TWO-TONE ALARM:	NORMAL
MODE:	A3J
BAND:	6 MHz
CHANNEL:	A channel with no crystal.

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

(1) Connect terminal 46-4 to terminal 46-2.

(2) Connect oscilloscope across resistor 46R2 (220 ohms).

(3) Connect signal generator between terminal 44-16 (common) and junction of capacitors 44C27 and 44C30.

(4) Set signal generator to 6.00 MHz, 350mVrms.

(5) Adjust coil 46L2 for minimum response on oscilloscope.

(6) Set signal generator to 3.56 MHz.

(7) Adjust 46L3 for minimum response on oscilloscope.

(8) Set signal generator to 3.96 MHz.

(9) Adjust 46L4 for minimum response on oscilloscope.

(10) Check that voltage across 46R2 has not been reduced by more than 2 dB at 3.2 MHz compared with the voltage measured at 2.0 MHz.

(11) Remove connection from between 46-4 and 46-2.

B. Potentiometer 46R13.

Transmitter settings:

POWER:	FULL
TWO-TONE ALARM:	NORMAL
MODE:	A3J
BAND:	6 MHz
CHANNEL:	1

(The above assumes that the transmitter contains a crystal in the 6 MHz band. If not, use 8 MHz instead).

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

(1) Connect oscilloscope between terminals 48-11 and 48-15 (common).

(2) Modulate transmitter with two-tone signal.

(3) Turn on transmitter by depressing handset key.

(4) Adjust potentiometer 46R13 for maximum sharpness of two-tone signal contour on oscilloscope.

(If the built-in TWO-TONE GENERATOR was used for making the adjustment, remove temporary connections and check that generator is functioning normally).

△48 Realignment of DRIVER AMPLIFIER

Measuring equipment:

Standard signal generator covering the range 2.5 - 25 MHz and having an accuracy better than 10^{-4}.

DC voltmeter, 25 kohms/V and having a sensitivity better than 100mV f.s.d.

Oscilloscope, input impedance 10 Mohms in parallel with 7 pF.

50-ohm dummy aerial (200W)

10 ohms in series with 250 pF dummy aerial (200W)

Two tone generators as described under △42 Realignment of AF AMPLIFIER.

A. Compensating coils (48L3 and 48L4).

Transmitter settings:

POWER:	LOW
TWO-TONE ALARM:	NORMAL

Disconnect the 1000V high tension plug from its socket in the power pack section.
Close the power pack's high tension circuit by operating the interlock switch in the cabinet.

(1) Connect DC voltmeter between terminals 48-6 (+) and 48-5 (-).

(2) Remove coaxial cable from terminals 48-11 and 48-12.

(3) Connect signal generator between terminals 48-11 and 48-12 (common) through 0.1 μF/12V capacitor.

(4) Turn on transmitter by depressing handset key.

(5) Set generator to 25 MHZ - 150mVrms and adjust core of 48L3 for maximum voltmeter reading. Core should be turned into coil former.

(6) Set generator to 2,5 MHz - 150mVrms and note down voltmeter reading.

(7) Set generator to 25 MHz - 150mVrms and turn core of coil 48L4 into coil former until voltmeter reading is 5% lower than reading obtained under (5) above.

(8) Reconnect coaxial cable referred to under (2) above (inner conductor to terminal 48-11).

B. Level potentiometer of "CT" band (48R1).

Transmitter settings:

POWER:	FULL
TWO-TONE ALARM:	NORMAL
MODE:	A3H
CHANNEL:	A channel approximately in the middle of the frequency range.
Dummy aerial:	10 ohms in series with 250 pF (approximate setting for coupling field corresponding to this dummy aerial is given in Table 48-1).

(1) Set "BAND" switch, coupling field and variometer so that resonance coincides with PA-valve cathode current of approx. 125 mA.

(2) Modulate transmitter with two-tone signal and set "MODE" switch to "A3J". Connect oscilloscope to dummy aerial.

(3) Check that flat-topping does not occur in PA anode circuit by detuning the PA anode circuit to both sides. If flat-topping ceases it is an indication that aerial matching is not correct, and a different setting must be tried (select a lower band).

(4) With potentiometer 48R1 thereafter increase gain to the point where flat-topping only just occurs in the PA grids or V3, V4, V5 cathode current has reached 155 mA.

Note: The current of 155 mA must not be exceeded even if the flat-topping limit has not been reached.

(5) Remove modulating signal and set "MODE" switch to "A3H". Check that V3, V4, V5 cathode current is approx. 125mA.

C. Level potentiometers, HF bands

Transmitter settings:

POWER:	FULL
TWO-TONE ALARM:	NORMAL
MODE:	A3H

Dummy aerial: 50 ohms (approximate coupling-field setting for this dummy aerial is indicated in Table 48-1).

(1) Set "BAND" switch, coupling field and "AERIAL TUNING" so that resonance coincides with cathode current of approx. 125mA in desired band.

(2) Modulate transmitter with two-tone signal and set "MODE" switch to "A3J". Connect oscilloscope to dummy aerial.

(3) Check that flat-topping does not occur in PA anode circuit by detuning the PA anode circuit to both sides. If flat-topping ceases it is an indication that aerial matching is not correct, and a different setting must be tried (select a lower numbered position of "HF-COARSE, AERIAL TUNING" switch).

(4) With potentiometer 48RX for the desired band thereafter increase gain to the point where flat-topping only just occurs in PA grids or V3, V4, V5 cathode current has reached 155mA.

Note: The current of 155mA must not be exceeded even if the flat-topping limit has not been reached.

Locations and numbers of potentiometers on module 48 appear from the drawing page 7-36.

(5) Remove modulating signal and set "MODE" switch to "A3H". Check that V3, V4, V5 cathode current is approx. 125mA.

Table 48-1

Approximate coupling-field settings.

Dummy aerial: 10 ohms in series with 250 pF

Freq.	BAND	VARIOMETER TAP	π-FILTER OUTPUT CAPACITOR	AERIAL SHORTENING CAPACITOR
2000	F	9	0	A1
2200	G	12	0	A1
2500	G	12	0	A1
3200	J	16	2	A1

Dummy aerial: 50 ohms.

BAND MHz	VARIOMETER TAP	π-FILTER CAPACITOR		AERIAL SHORTENING CAPACITOR
		INPUT	OUTPUT	
4	18	1	5	A1

Dummy aerial: 50 ohms

BAND MHz	AERIAL TUNING HF-COARSE	HF π-FILTER OUTPUT CAPACITOR	HF AERIAL	
			CAPACITOR	COIL
6	21	x : 1	0	1
8	7	-	0	1
12	15	-	0	1
16	16	-	2	1
22	9	y : 3	2	1
25	9	z : 5	2	1

⚠49 Realignment of GRID VOLTAGE STABILIZER

Measuring equipment: none.

Transmitter settings:

POWER: LOW
TWO-TONE ALARM: NORMAL
MODE: A3J
BAND: 6 MHz
CHANNEL: A channel with no crystal

Close the power pack's high-tension circuit by operating the interlock switch in the cabinet.

Locations of the potentiometers referred to below appear from the drawing on page 7-34.

Currents are read on "LEVEL METER" with "CHECK SWITCH" knob pulled out.

At the settings used here, the meter reads full scale at 250mA.

(1) Set "CHECK SWITCH" to V3.

(2) Turn on transmitter by depressing handset key.

(3) Adjust potentiometer 49R4 so that no-signal current of valve 57V3 is 55mA.

(4) Set "CHECK SWITCH" to "V4".

(5) Adjust potentiometer 49R5 so that no-signal current of valve 57V4 is 55mA.

(6) Set "CHECK SWITCH" to V5.

(7) Set potentiometer 49R6 so that no-signal current of valve 57V5 is 55mA.

⚠51 Realignment of DRIVER ANODE CIRCUIT HF

Measuring equipment:

Standard signal generator covering the range 3.8 - 5.5 MHz and having an accuracy better than 10^{-3}.

Transmitter settings:

POWER: FULL
TWO-TONE ALARM: NORMAL
MODE: A3H
BAND: Band to be aligned.

Close the power pack's high-tension circuit by operating the interlock switch in the cabinet.

Anode-circuit resonance is read on "LEVEL METER" with "CHECK SWITCH" in undesignated position next to the "-36V" position and the knob pulled out.

(1) Remove coaxial cable from terminals 44-1 and 44-2 and connect signal generator instead.

(2) Set signal generator to frequency listed in Table 51-1 below (200mVrms).

(3) Turn on transmitter by depressing handset key and adjust coil for band in question for maximum "LEVEL METER" reading.

Table 51-1.

BAND MHz	Signal generator frequency MHz
4	5.50
6	3.40
8	4.04
12	3.98
16	3.90
22	3.85
25	4.00

53 Realignment of HF BANDFILTERS

Measuring equipment:

Standard signal generator covering the range 3.3 - 5.5 MHz and having an accuracy of 10^{-3}.

Oscilloscope having a sensitivity better than 50mV/div. Input impedance 10 Mohms in parallel with 7 pF and 3-dB upper limiting frequency greater than 30 MHz.

Transmitter settings:

POWER: FULL
TWO-TONE ALARM: ALARM
MODE: A3H
BAND: Band to be aligned.

Open the power pack's high-tension circuit by operating the interlock switch in the cabinet.

(1) Remove coaxial cable from terminals 44-1 and 44-2 and connect signal generator instead.

(2) Set signal generator to frequency indicated in Table 53-1 below (200mVrms).

(3) Connect oscilloscope between terminals 53-4 and 53-5.

(4) Turn core of output coil in filter to be aligned all the way out of coil former.

(5) Turn core of input coil in filter to be aligned until maximum response on oscilloscope is obtained.

(6) Turn core of output coil in filter to be aligned until minimum response on oscilloscope is obtained.

(7) Connect oscilloscope to terminals 48-11 and 48-15.

(8) Check that 1-dB band limits are in accorcance with the frequencies indicated in Table 53-1.

Table 53-1

Band	Channel oscillator or Signal Generator frequency Alignment frequency	1 dB band limits Channel oscillator or Signal Generator frequency		1 dB band limits Radiated signal frequency	
		Lower	Upper	Lower	Upper
4 MHz	5470 kHz	5460 kHz	5540 kHz	4060 kHz	4140 kHz
6 MHz	3350 kHz	3400 kHz	3411 kHz	6200 kHz	6211 kHz
8 MHz	3980 kHz	3995 kHz	4080 kHz	8195 kHz	8280 kHz
12 MHz	3850 kHz	3930 kHz	4021 kHz	12330 kHz	12421 kHz
16 MHz	3800 kHz	3860 kHz	3962 kHz	16460 kHz	16562 kHz
22 MHz	3750 kHz	3800 kHz	3900 kHz	22000 kHz	22100 kHz
25 MHz	4300 kHz	4000 kHz	4600 kHz	25000 kHz	25600 kHz

⚠58 Realignment of NEUTRALIZATION

Measuring equipment:

Oscilloscope having a sensitivity better than 50mV/div and an upper 3-dB limiting frequency of not less that 25 MHz.

50-ohm dummy aerial.

Transmitter settings:

POWER:	FULL
TWO-TONE ALARM:	NORMAL
MODE:	A3H
BAND:	4 MHz
CHANNEL:	1

(1) Load transmitter with dummy aerial and tune to resonance.

(2) Unplug power-pack high-tension lead from socket 57PL2.

(3) Connect oscilloscope across dummy aerial.

(4) Turn on transmitter by depressing handset key and adjust trimmer capacitor 58C8 for minimum response on oscilloscope.

(5) Align coil 51L1 as described under ⚠51 Realignment of DRIVER ANODE CIRCUIT HF.

(6) Remove oscilloscope from dummy aerial.

(7) Reconnect high-tension lead.

(8) Repeat procedure for other shortwave bands of transmitter except that alignment on three highest bands is to be made with coils.

7. PARTS LISTS AND CIRCUIT DIAGRAMS

7.1. Numbering

An identification number between △40 and △58 is assigned to each module except for the 9V voltage regulator, which carries No. △8. The designation of a component or terminal includes this number as a prefix - example: 40R3 (resistor R3 on module △40), or 40-2 (terminal No. 2 on module △40. Components that do not belong to any module (chassis-mounted components) carry the prefix 57.

7.2. Switches

Switches with stops are shown in the extreme anticlockwise position. The "BAND" and "CHANNEL" switches are shown in the "H" and "CHANNEL 1" positions, whilst the "CHECK" switch is shown in the "V3" position.

Switch wafer No. 1 is the wafer nearest the front panel, and the front side of a wafer is the side facing the front panel.

7.3. Terminals

Locations of terminals appear from the component location drawings and from the circuit-board location plans.

In the circuit diagrams, each terminal is identified by a number (example: 40-2) and in most cases by an explanatory text. In addition to this, the number of the module and terminal to which the lead connects are indicated (example: △42-8). Where interconnections consist of coaxial cables, only the number of the terminal is given to which the inner conductor of the cable is connected.

7.4. Voltages

Typical DC voltages are indicated in the circuit diagrams next to the points to which they refer and are marked with a "V".

Typical AC voltages are likewise indicated in the circuit diagrams. They are marked with "Vpp" or "mVpp".

For measuring conditions see Chapter 6.

7.5. Test Points

Locations of test points appear from the component location drawings and from the circuit-board location plans. Typical DC voltages at test points are indicated in the circuit diagrams.

ABBREVIATIONS

A = ampere, amperes
C = capacitor
Car. = carbon
Cer. = ceramic
D = diode
F = farad
FS = fuse
H = henry
IC = integrated circuit
k = kilo or 10^3
L = inductor
lin. = linear
log. = logarithmic
m = milli or 10^{-3}
M = mega or 10^6
Mi = mica
MP = metallized paper
μ = micro or 10^{-6}
n = nano or 10^{-9}
NTC = neg. temp. coefficient
p = pico or 10^{-12}
PL = connector (plug)
polyes. = polyester
polyst. = polystyrene
PTC = pos. temp. coefficient
R = resistor
RL = relay
S = switch
SK = connector (socket)
SL = lamp
T = transformer
Tan = tantalum electrolytic capacitor
TR = transistor
V = working voltage DC
Vl... = valve
Vac. = working voltage AC
Var. = variable
Varicap = variable capacitance diode
ww = wire wound
W = watt, watts
W.alum. = wet aluminium electrolytic
X = crystal,crystal osc. or crystal filter

PARTS LIST
FOR
9V VOLTAGE REGULATOR

8

8C 1	1.0 µF	10%	100V	Polyes.
8C 2	100 µF		16V	W.alum.
8C 3	0.47 µF	10%	100V	Polyes.
8C 4	0.1 µF	10%	250V	Polyes.
8D 1- 7	1S920			
8D 8	BZX79 C6V8	Zener		
8D 9-10	1S920			
8R 1	1.0 kohm	5%	1/8W	Car.
8R 2	10 kohms	5%	1/8W	Car.
8R 3	680 ohms	5%	1/8W	Car.
8R 4	68 kohms	5%	1/8W	Car.
8R 5	680 ohms	5%	1/8W	Car.
8R 6	10 kohms	Var.		Car.
8R 7	5.6 kohms	5%	1/8W	Car.
8R 8	1.0 kohm	Var.		Car.
8TR 1	BC161/10			
8TR 2	2N1613			

PARTS LIST

FOR

TWO-TONE GENERATOR

40

40C 1	0.1 µF	±10%	250V	Polyes.
40C 2	10 µF	5%	100V	Polyes.
40C 3	0.15 µF	1%	63V	Polyst.
40C 4	0.1 µF	±10%	250V	Polyes.
40C 5	6.8 µF	5%	100V	Polyes.
40C 6	6.8 µF	5%	100V	Polyes.
40C 7	0.15 µF	1%	63V	Polyst.
40D 1-12	1S920			
40R 1	1 kohm	5%	1/8W	Car.
40R 2	1.82 kohms	1%	1/3W	MR
40R 3	6.81 kohms	1%	1/3W	MR
40R 4	1 Mohm	1%	1W	MR
40R 5	100 ohms	5%	1/8W	Car.
40R 6	4.7 kohms	5%	1/8W	Car.
40R 7	470 ohms	5%	1/8W	Car.
40R 8	10 kohms	5%	1/8W	Car.
40R 9	10 kohms	5%	1/8W	Car.
40R10	1 kohm	5%	1/8W	Car.
40R11	10 kohms	5%	1/8W	Car.
40R12	22 kohms	5%	1/8W	Car.
40R13	1 kohm	5%	1/8W	Car.
40R14	1.8 kohms	5%	1/8W	Car.
40R15	4.7 kohms	5%	1/8W	Car.
40R16	10 kohms	5%	1/8W	Car.
40R17	10 kohms	5%	1/8W	Car.
40R18	56 kohms	5%	1/8W	Car.
40R19	56 kohms	5%	1/8W	Car.
40R20	10 kohms	5%	1/8W	Car.
40R21	4.7 kohms	5%	1/8W	Car.
40R22	1.8 kohms	5%	1/8W	Car.
40R23	1 kohm	5%	1/8W	Car.
40R24	22 kohms	5%	1/8W	Car.
40T 1	TRANSFORMER		SKANTI CODE: T-0072	
40T 2	TRANSFORMER		SKANTI CODE: T-0071	
40TR 1	BC177B			
40TR 2	BC177B			
40TR 3	BC177B			
40TR 4	BC109C			
40TR 5	BC177B			
40TR 6	BC177B			
40TR 7	BC109C			

PARTS LIST

FOR

CONTROL CIRCUIT

△41

41C 1	100 μF		16V	W.alum.
41D 1	1S920			
41D 2	1N5401			
41R 1	390 ohms	5%	1/8W	Car.
41R 2	10 ohms	5%	1/8W	Car.
41R 3	10 ohms	5%	1/8W	Car.
41R 4	8.2 ohms	5%	1W	ww
41R 5	3.9 ohms	5%	3W	ww
41RL 1	RELAY		V23154-D0712-C310	

PARTS LIST

FOR

AF AMPLIFIER

42

42C 1	22 nF	-20/+80%	30V	Cer.
42C 2	8.2 nF	-20/+80%	400V	Cer.
42C 3	22 μF		15V	Tan
42C 4	10 nF	-20/+80%	30V	Cer.
42C 5	51 nF	1%	63V	Polyst.
42C 6	100 μF		16V	W.alum.
42C 7	51 nF	1%	63V	Polyst.
42C 8	15 nF	1%	63V	Polyst.
42C 9	2.7 nF	1%	125V	Polyst.
42C10	0.1 μF	-20/+80%	12V	Cer.
42C11	2.7 nF	1%	125V	Polyst.
42C12	470 pF	1%	125V	Polyst.
42C13	0.1 μF	-20/+80%	12V	Cer.
42C14	0.22 μF	10%	100V	Polyes.
42C15	0.1 μF	-20/+80%	12V	Cer.
42C16	100 μF		16V	W.alum.
42C17	10 nF	-20/+80%	30V	Cer.
42C18	0.22 μF	10%	100V	Polyes.
42C19	470 pF	1%	125V	Polyst.
42C20	39 pF	5%	400V	Cer.
42C21	100 μF		16V	W.alum.
42C22	470 pF	1%	125V	Polyst.
42C23	56 pF	5%	400V	Cer.
42C24	0.1 μF	-20/+80%	12V	Cer.
42C25	22 μF		15V	Tan
42C26	2.2 μF	10%	100V	Polyes.
42C27	22 μF		15V	Tan
42C28	22 μF		15V	Tan
42C29	22 μF		15V	Tan
42C30	0.1 μF	-20/+80%	12V	Cer.
42C31	100 μF		16V	W.alum.
42C32	8.2 nF	-20/+80%	400V	Cer.
42C33	100 μF		16V	W.alum.
42D 1- 9	1S920			
42IC 1	TAA611 B12			
42L 1	100 μH	RF CHOKE	10%	

42

42R 1	27 ohms	5%	1/8W	Car.
42R 2	120 ohms	5%	1/4W	Car.
42R 3	39 kohms	5%	1/8W	Car.
42R 4	5.6 kohms	5%	1/8W	Car.
42R 5	1 kohm	5%	1/8W	Car.
42R 6	15 kohms	5%	1/8W	Car.
42R 7	8.2 kohms	5%	1/8W	Car.
42R 8	270 kohms	5%	1/8W	Car.
42R 9	180 kohms	5%	1/8W	Car.
42R10	3.9 kohms	5%	1/8W	Car.
42R11	3.9 kohms	5%	1/8W	Car.
42R12	47 kohms	5%	1/8W	Car.
42R13	5.6 kohms	5%	1/8W	Car.
42R14	15 kohms	5%	1/8W	Car.
42R15	56 kohms	5%	1/8W	Car.
42R16	3.9 kohms	5%	1/8W	Car.
42R17	820 ohms	5%	1/8W	Car.
42R18	12 kohms	5%	1/8W	Car.
42R19	330 ohms	5%	1/8W	Car.
42R20	1 kohm	Var.		Car.
42R21	1 kohm	5%	1/8W	Car.
42R22	12 kohms	5%	1/8W	Car.
42R23	47 kohms	5%	1/8W	Car.
42R24	470 kohms	5%	1/8W	Car.
42R25	22 kohms	Var.		Car.
42R26	22 kohms	5%	1/8W	Car.
42R27	12 kohms	5%	1/8W	Car.
42R28	10 ohms	5%	1/8W	Car.
42R29	1 kohm	5%	1/8W	Car.
42R30	2.7 kohms	5%	1/8W	Car.
42R31	470 kohms	5%	1/8W	Car.
42R32	10 kohms	5%	1/8W	Car.
42R33	68 kohms	5%	1/8W	Car.
42R34	18 kohms	5%	1/8W	Car.

42TR 1	BC109C
42TR 2	BC177B
42TR 3	BC109C
42TR 4	BC177B
42TR 5	2N4393

PARTS LIST
FOR
1.4 MHz MIXER

43

43C 1- 4	0.1 μF	-20/+80%	12V	Cer.
43C 5	22 μF		15V	Tan
43C 6	100 μF		16V	W.alum.
43C 7	10 nF	-20/+80%	30V	Cer.
43C 8	1 μF	10%	100V	Polyes.
43C 9-12	0.1 μF	-20/+80%	12V	Cer.
43C13	5.6 nF	1%	64V	Polyst.
43C14-15	47 nF	-20/+80%	12V	Cer.
43C16	0.1 μF	-20/+80%	12V	Cer.
43D 1- 6	1S920			
43IC 1	CA3039			
43L 1- 3	100 μH	RF CHOKE	10%	
43L 4	2.2 μH	RF CHOKE	10%	
43L 5- 6	100 μH	RF CHOKE	10%	
43R 1	1.0 kohm	5%	1/8W	Car.
43R 2	43.2 ohms	1%	1/8W	MR
43R 3	5.6 kohms	5%	1/8W	Car.
43R 4	10 kohms	Var.		Car.
43R 5	12 kohms	5%	1/8W	Car.
43R 6	69.8 ohms	1%	1/8W	MR
43R 7	1.0 kohm	5%	1/8W	Car.
43R 8	39 ohms	5%	1/8W	Car.
43R 9	100 kohms	5%	1/8W	Car.
43R10	37.4 ohms	1%	1/8W	MR
43R11	3.9 kohms	5%	1/8W	Car.
43R12	12 kohms	5%	1/8W	Car.
43R13	2.2 kohms	5%	1/8W	Car.
43R14	121 ohms	1%	1/8W	MR
43R15	100 ohms	5%	1/8W	Car.
43R16-17	1.0 kohm	5%	1/8W	Car.
43R18	1.2 kohms	5%	1/8W	Car.
43R19	270 ohms	5%	1/8W	Car.
43R20	18 ohms	5%	1/8W	Car.
43R21	150 ohms	5%	1/8W	Car.
43T 1- 2	TRANSFORMER		SKANTI CODE: T-0077	
43TR 1	BC177B			
43TR 2	BC109C			
43TR 3	BC177B			
43TR 4	BSX19			
43TR 5	2N1613			
43X 1	FILTER	939BB	SSB	

PARTS LIST

FOR

CT MIXER

44

44C 1- 3	47 nF	-20/+80%	12V	Cer.
44C 4	0.1 μF	-20/+80%	12V	Cer.
44C 5	47 nF	-20/+80%	12V	Cer.
44C 6	560 pF	1%	125V	Polyst.
44C 7	22 nF	-20/+80%	30V	Cer.
44C 8	47 nF	-20/+80%	12V	Cer.
44C 9-12	0.1 μF	-20/+80%	12V	Cer.
44C13	47 nF	-20/+80%	12V	Cer.
44C14-15	1.0 nF	1%	125V	Polyst.
44C16-18	0.1 μF	-20/+80%	12V	Cer.
44C19	47 nF	-20/+80%	12V	Cer.
44C20	0.1 μF	-20/+80%	12V	Cer.
44C21-23	47 nF	-20/+80%	12V	Cer.
44C24	22 nF	-20/+80%	30V	Cer.
44C25	47 nF	-20/+80%	12V	Cer.
44C26	22 nF	-20/+80%	30V	Cer.
44C27	1.0 nF	1%	125V	Polyst.
44C28	560 pF	1%	125V	Polyst.
44C29	22 nF	-20/+80%	30V	Cer.
44C30	3.9 nF	1%	63V	Polyst.
44C31-32	680 pF	1%	125V	Polyst.
44C33	0.1 μF	-20/+80%	12V	Cer.
44C34	0.22 μF	-20/+80%	12V	Cer.
44C35	100 pF	1%	125V	Polyst.
44C36	100 uF		16V	W.alum.
44D 1- 5	1S920			
44IC 1	TBA120			
44IC 2	CA3039			
44IC 3	TBA120			
44L 1	COIL		SKANTI CODE: T-0113	
44L 2- 3	100 μH	RF CHOKE	10%	
44L 4	4.7 μH	RF CHOKE	10%	
44L 5	100 μH	RF CHOKE	10%	
44L 6	COIL		SKANTI CODE: T-0116	
44L 7	COIL		SKANTI CODE: T-0113	
44L 8	1.0 μH	RF CHOKE	10%	
44L 9	100 μH	RF CHOKE	10%	
44L10	COIL		SKANTI CODE: T-0614	
44R 1	56 ohms	5%	1/8W	Car.
44R 2	8.2 kohms	5%	1/8W	Car.
44R 3	1.2 kohms	5%	1/8W	Car.
44R 4	820 ohms	5%	1/8W	Car.
44R 5	10 kohms	5%	1/8W	Car.

44R 6	22 kohms	5%	1/8W	Car.
44R 7	82 kohms	5%	1/8W	Car.
44R 8	150 ohms	5%	1/8W	Car.
44R 9	18 ohms	5%	1/8W	Car.
44R10	100 ohms	Var.		Car.
44R11	12 kohms	5%	1/8W	Car.
44R12	470 ohms	5%	1/8W	Car.
44R13	12 kohms	5%	1/8W	Car.
44R14	820 ohms	5%	1/8W	Car.
44R15	270 ohms	5%	1/8W	Car.
44R16	220 ohms	5%	1/8W	Car.
44R17	180 ohms	5%	1/8W	Car.
44R18	10 ohms	5%	1/8W	Car.
44R19	390 ohms	5%	1/8W	Car.
44R20	82 ohms	5%	1/8W	Car.
44R21	100 ohms	5%	1/8W	Car.
44R22	1.0 kohm	5%	1/8W	Car.
44R23	6.8 ohms	5%	1/8W	Car.
44R24	100 ohms	5%	1/8W	Car.
44R25-26	1.0 kohm	5%	1/8W	Car.
44R27-28	56 ohms	5%	1/8W	Car.
44R29	22 kohms	5%	1/8W	Car.
44R30	47 kohms	5%	1/8W	Car.
44R31	1.0 kohm	5%	1/8W	Car.
44R32	82 ohms	5%	1/8W	Car.
44R33	6.8 kohms	5%	1/8W	Car.
44R34	1.0 kohm	5%	1/8W	Car.
44R35	560 ohms	5%	1/8W	Car.
44R36	220 ohms	5%	1/8W	Car.
44R37	10 ohms	5%	1/8W	Car.
44R38	15 ohms	5%	1/8W	Car.
44R39	10 ohms	5%	1/8W	Car.
44R40	10 kohms	5%	1/8W	Car.
44R41	100 ohms	5%	1/8W	Car.
44R42	470 ohms	5%	1/8W	Car.

44T 1	TRANSFORMER	SKANTI CODE: T-0117
44T 2	TRANSFORMER	SKANTI CODE: T-0077
44T 3	TRANSFORMER	SKANTI CODE: T-0118
44T 4	TRANSFORMER	SKANTI CODE: T-0277

44TR 1	BF185
44TR 2	BC109C
44TR 3	BSX19
44TR 4- 6	BC109C
44TR 7	BFW17A

PARTS LIST
FOR
CHANNEL OSCILLATOR

45

45C 1	47 nF	-20/+80%	12V	Cer.
45C 2	0.1 μF	-20/+80%	12V	Cer.
45C 3	680 pF	1%	125V	Polyst.
45C 4-11	18 pF	5%	400V	Cer. NPO
45C12	47 nF	-20/+80%	12V	Cer.
45C13	47 nF	-20/+80%	12V	Cer.
45C14-21	20 pF	Var.		Cer.
45C22-29	18 pF	5%	400V	Cer.NPO
45C30	47 nF	-20/+80%	12V	Cer.
45C31	47 nF	-20/+80%	12V	Cer.
45C32-39	20 pF	Var.		Cer.
45C40-47	18 pF	5%	400V	Cer.NPO
45C48	47 nF	-20/+80%	12V	Cer.
45C49-56	20 pF	Var.		Cer.
45C57	47 nF	-20/+80%	12V	Cer.
45C58	47 nF	-20/+80%	12V	Cer.
45C59-66	18 pF	5%	400V	Cer.NPO
45C67	47 nF	-20/+80%	12V	Cer.
45C68-75	20 pF	Var.		Cer.
45C76-83	18 pF	5%	400V	Cer.NPO
45C84	47 nF	-20/+80%	12V	Cer.
45C85	82 pF	5%	400V	Cer.N150
45C86-93	20 pF	Var.		Cer.
45C94	4.7 nF	-20/+80%	30V	Cer.
45C95-102	18 pF	5%	400V	Cer.NPO
45C103	47 nF	-20/+80%	12V	Cer.
45C104-111	20 pF	Var.		Cer.
45C112-119	18 pF	5%	400V	Cer.NPO
45C120	47 nF	-20/+80%	12V	Cer.
45C121	47 nF	-20/+80%	12V	Cer.
45C122-129	20 pF	Var.		Cer.
45C130	47 nF	-20/+80%	12V	Cer.
45C131-138	18 pF	5%	400V	Cer.NPO
45C139	47 nF	-20/+80%	12V	Cer.
45C140	22 μF	20%	15V	Neto
45C141-148	20 pF	Var.		Cer.
45C149	220 pF	1%	125V	Polyst.
45C150-151	18 pF	5%	400V	Cer.NPO
45C152	47 nF	-20/+80%	12V	Cer.
45C153	47 nF	-20/+80%	12V	Cer.
45C154-159	47 nF	-20/+80%	12V	Cer.
45C160	0.1 μF	-20/+80%	12V	Cer.
45C161	47 nF	-20/+80%	12V	Cer.
45C162-163	20 pF	Var.		Cer.
45C164-165	18 pF	5%	400V	Cer.NPO
45C166	47 nF	-20/+80%	12V	Cer.
45C167-168	20 pF	Var.		Cer.
45C169-170	47 nF	-20/+80%	12V	Cer.
45C171	0.1 μF	-20/+80%	12V	Cer.

45

45D 1-77	1S920			
45L 1- 8	1 mH	RF CHOKE	10%	
45L 9-10	100 µH	RF CHOKE	10%	
45L11-12	1 mH	RF CHOKE	10%	
45R 1	10 kohms	5%	1/8W	Car.
45R 2	15 ohms	5%	1/8W	Car.
45R 3-10	10 kohms	5%	1/8W	Car.
45R11	12 kohms	5%	1/8W	Car.
45R12	82 ohms	5%	1/8W	Car.
45R13	1 kohm	5%	1/8W	Car.
45R14-21	10 kohms	5%	1/8W	Car.
45R22	12 kohms	5%	1/8W	Car.
45R23	82 ohms	5%	1/8W	Car.
45R24	1 kohm	5%	1/8W	Car.
45R25	2.2 kohms	5%	1/8W	Car.
45R26-33	10 kohms	5%	1/8W	Car.
45R34	12 kohms	5%	1/8W	Car.
45R35	82 ohms	5%	1/8W	Car.
45R36	4.7 kohms	5%	1/8W	Car.
45R37	10 kohms	5%	1/8W	Car.
45R38	2.2 kohms	5%	1/8W	Car.
45R39-46	10 kohms	5%	1/8W	Car.
45R47	12 kohms	5%	1/8W	Car.
45R48	82 ohms	5%	1/8W	Car.
45R49	2.2 kohms	5%	1/8W	Car.
45R50	120 ohms	5%	1/8W	Car.
45R51	470 ohms	5%	1/8W	Car.
45R52-59	10 kohms	5%	1/8W	Car.
45R60	12 kohms	5%	1/8W	Car.
45R61	82 ohms	5%	1/8W	Car.
45R62	150 ohms	5%	1/8W	Car.
45R63	180 ohms	5%	1/8W	Car.
45R64-72	10 kohms	5%	1/8W	Car.
45R73	12 kohms	5%	1/8W	Car.
45R74	82 ohms	5%	1/8W	Car.
45R75-83	10 kohms	5%	1/8W	Car.
45R84	12 kohms	5%	1/8W	Car.
45R85	82 ohms	5%	1/8W	Car.
45R86	330 ohms	5%	1/8W	Car.
45R87	2.2 kohms	5%	1/8W	Car.
45R88-95	10 kohms	5%	1/8W	Car.
45R96	12 kohms	5%	1/8W	Car.
45R97	82 ohms	5%	1/8W	Car.
45R98-104	270 ohms	5%	1/8W	Car.
45R105-106	10 kohms	5%	1/8W	Car.
45R107-113	12 kohms	5%	1/8W	Car.
45R114	82 ohms	5%	1/8W	Car.
45R115	12 kohms	5%	1/8W	Car.
45R116-117	10 kohms	5%	1/8W	Car.

45

45R118	12 kohms	5%	1/8W	Car.
45R119	82 ohms	5%	1/8W	Car.
45R120-121	270 ohms	5%	1/8W	Car.
45R122-123	12 kohms	5%	1/8W	Car.

45TR 1	BF185
45TR 2	BF185
45TR 3	BSX19
45TR 4	BF185
45TR 5	BC109C

PARTS LIST

FOR

HF MIXER

46 (in triangle)

46C 1	47 nF	-20/+80%	12V	Cer.
46C 2	0.1 µF	-20/+80%	12V	Cer.
46C 3	383 pF	1%	125V	Polyst.
46C 4	82 pF	5%	400V	Cer.N150
46C 5	464 pF	1%	125V	Polyst.
46C 6	422 pF	1%	125V	Polyst.
46C 7	374 pF	1%	125V	Polyst.
46C 8	324 pF	1%	125V	Polyst.
46C 9	240 pF	1%	125V	Polyst.
46C10	100 pF	1%	125V	Polyst.
46C11	0.1 µF	-20/+80%	12V	Cer.
46C12	0.1 µF	-20/+80%	12V	Cer.
46C13	0.1 µF	-20/+80%	12V	Cer.
46C14	100 pF	1%	125V	Polyst.
46C15	0.1 µF	-20/+80%	12V	Cer.
46C16	22 nF	-20/+80%	30V	Cer.
46C17	22 nF	-20/+80%	30V	Cer.
46C18	0.1 µF	-20/+80%	12V	Cer.
46C19	47 nF	-20/+80%	12V	Cer.
46C20	0.1 µF	-20/+80%	12V	Cer.
46C21	47 nF	-20/+80%	12V	Cer.
46C22	47 nF	-20/+80%	12V	Cer.
46C23	0.1 µF	-20/+80%	12V	Cer.
46C24	240 pF	1%	125V	Polyst.
46C25	0.1 µF	-20/+80%	12V	Cer.
46C26	22 nF	-20/+80%	30V	Cer.
46C27	0.1 µF	-20/+80%	12V	Cer.
46C28	22 nF	-20/+80%	12V	Cer.
46D 1- 3	1S920			
46IC 1	CA3039			
46IC 2	TBA120			
46L 1	100 µH	RF CHOKE	10%	
46L 2	COIL		SKANTI CODE: T-0116	
46L 3	COIL		SKANTI CODE: T-0114	
46L 4	COIL		SKANTI CODE: T-0115	
46L 5	100 µH	RF CHOKE	10%	
46L 6	100 µH	RF CHOKE	10%	
46L 7	100 µH	RF CHOKE	10%	

46

46R 1	150 ohms	5%	1/8W	Car.
46R 2	220 ohms	5%	1/8W	Car.
46R 3	1 kohm	5%	1/8W	Car.
46R 4	120 ohms	5%	1/8W	Car.
46R 5	18 ohms	5%	1/8W	Car.
46R 6	100 ohms	5%	1/8W	Car.
46R 7	18 ohms	5%	1/8W	Car.
46R 8	100 ohms	5%	1/8W	Car.
46R 9	1 kohm	5%	1/8W	Car.
46R10	1 kohm	5%	1/8W	Car.
46R11	150 ohms	5%	1/8W	Car.
46R12	560 ohms	5%	1/8W	Car.
46R13	1.5 kohms	Var.		Car.
46R14	82 ohms	5%	1/8W	Car.
46R15	390 ohms	5%	1/8W	Car.
46R16	2.2 kohms	5%	1/8W	Car.
46R17	10 ohms	5%	1/8W	Car.
46R18	10 ohms	5%	1/8W	Car.
46R19	56 ohms	5%	1/8W	Car.
46R20	470 ohms	5%	1/8W	Car.
46R21	100 ohms	5%	1/8W	Car.

46T 1	TRANSFORMER	SKANTI CODE: T-0120
46T 2	TRANSFORMER	SKANTI CODE: T-0077

46TR 1	BSX19
46TR 2	BSX19
46TR 3	BFW17

PARTS LIST
FOR
HF HARMONIC FILTER

47

47C 1- 4	0.1 µF	-20/+80%	12V	Cer.
47C 5	10 nF	-20/+80%	30V	Cer.
47C 6- 9	33 pF	5%	400V	Cer.N150
47C10	27 pF	5%	400V	Cer.NPO
47C11	22 pF	5%	400V	Cer.NPO
47C12	0.1 µF	-20/+80%	12V	Cer.
47C13	22 µF	20%	15V	Tan.
47C14	10 nF	-20/+80%	30V	Cer.
47C15	0.1 µF	-20/+80%	12V	Cer.
47C16	22 µF	20%	15V	Tan.
47C17-18	0.1 µF	-20/+80%	12V	Cer.
47C19	47 nF	-20/+80%	12V	Cer.
47C20	0.1 µF	-20/+80%	12V	Cer.
47C21	22 µF	20%	15V	Tan.
47C22	6.8 nF	1%	63V	Polyst.
47C23-29	0.1 µF	-20/+80%	12V	Cer.
47C30	18 pF	5%	400V	Cer.NPO
47C31	1.2 nF	1%	125V	Polyst.

47D 1-20	AAZ17
47D21-23	BB104 green
47D24-26	1S920
47D27	AAZ17

47IC 1	SN7400
47IC 2	SN74H72
47IC 3	SN74163
47IC 4	SN7400
47IC 5	SN74H00
47IC 6- 7	SN7473

47L 1- 6	1.0 mH	RF CHOKE	10%
47L 7	100 µH	RF CHOKE	10%
47L 8-14	1.0 mH	RF CHOKE	10%
47L15-16	2.2 µH	RF CHOKE	10%

47R 1- 4	1.0 kohm	5%	1/8W	Car.
47R 5	220 ohms	5%	1/8W	Car.
47R 6	150 ohms	5%	1/8W	Car.
47R 7- 8	1.0 kohm	5%	1/8W	Car.
47R 9	3x3.3 ohms	5%	1/8W	Car.
47R10	39 ohms	5%	1/8W	Car.
47R11	68 ohms	5%	1/8W	Car.
47R12	330 ohms	5%	1/8W	Car.
47R13	100 ohms	5%	1/8W	Car.
47R14	1.0 kohm	5%	1/8W	Car.

47

47R15	33 ohms	5%	1/2W	Car.
47R16-17	1.0 kohm	5%	1/8W	Car.
47R18	470 ohms	5%	1/8W	Car.
47R19	47 ohms	5%	1/8W	Car.
47R20	1.0 kohm	5%	1/8W	Car.
47R21	33 ohms	5%	1/8W	Car.
47R22	100 ohms	5%	1/8W	Car.
47R23	22 kohms	5%	1/8W	Car.
47R24	56 ohms	5%	1/8W	Car.

47T 1	TRANSFORMER	SKANTI CODE: R-0222
47T 2	TRANSFORMER	SKANTI CODE: T-0119

47TR 1	BC109C

47X 1	CRYSTAL	HC-25/U	4.2MHz	SKANTI CODE: T-0279
47X 2	CRYSTAL	HC-25/U	5.6MHz	SKANTI CODE: T-0281
47X 3	CRYSTAL	HC-25/U	9.8MHz	SKANTI CODE: T-0282
47X 4	CRYSTAL	HC-25/U	14.0MHz	SKANTI CODE: T-0283
47X 5	CRYSTAL	HC-25/U	19.6MHz	SKANTI CODE: T-0284
47X 6	CRYSTAL	HC-25/U	22.4MHz	SKANTI CODE: T-0285

PARTS LIST

FOR

DRIVER AMPLIFIER

48

48C 1	0.1 µF	10%	250V	Polyes.
48C 2	47 nF	-20/+80%	12V	Cer.
48C 3- 7	8.2 nF	-20/+80%	400V	Cer.
48C 8	2.2 pF	-20/+80%	400V	Cer.
48C 9	8.2 pF	±0.25pF	400V	Cer.N150
48C10-12	8.2 nF	-20/+80%	400V	Cer.
48C13-14	22 nF	-20/+80%	400V	Cer.
48C15	100 µF		25V	W.alum.
48C16	0.1 µF	-20/+80%	30V	Cer.
48C17	47 nF	-20/+80%	12V	Cer.
48C18	8.2 nF	-20/+80%	400V	Cer.
48D 1	BZX79 C6V8	Zener		
48D 2	1N4148			
48L 1	1 mH	RF CHOKE	10%	
48L 2	220 µH	RF CHOKE	10%	
48L 3	COIL		SKANTI CODE: T-0197	
48L 4	COIL		SKANTI CODE: T-0198	
48R 1	22 kohms	Var.		Car.
48R 2	22 kohms	5%	1/8W	Car.
48R 3	22 kohms	Var.		Car.
48R 4	22 kohms	5%	1/8W	Car.
48R 5	22 kohms	Var.		Car.
48R 6	22 kohms	5%	1/8W	Car.
48R 7	22 kohms	Var.		Car.
48R 8	22 kohms	5%	1/8W	Car.
48R 9	22 kohms	Var.		Car.
48R10	22 kohms	5%	1/8W	Car.
48R11	22 kohms	Var.		Car.
48R12	22 kohms	5%	1/8W	Car.
48R13	22 kohms	Var.		Car.
48R14	22 kohms	5%	1/8W	Car.
48R15	22 kohms	Var.		Car.
48R16	22 kohms	5%	1/8W	Car.
48R17-18	27 kohms	5%	1W	Car.
48R19	3.3 ohms	5%	1/8W	Car.
48R20	5.6 ohms	5%	1/8W	Car.
48R21	255 ohms	1%	1/8W	Car.
48R22	100 ohms	5%	1/8W	Car.
48R23	3.3 ohms	5%	1/8W	Car.
48R24	10 kohms	5%	1/8W	Car.
48R25	5.6 ohms	5%	1/8W	Car.
48R26	499 ohms	1%	1/8W	Car.

48R27	6.8 kohms	5%	1/8W	Car.
48R28	1.0 kohm	5%	1/8W	Car.
48R29	3.3 ohms	5%	1/8W	Car.
48R30	150 ohms	5%	3W	ww
48R31	680 ohms	5%	1/8W	Car.

48TR 1 2N1613

48V 1 EL802

PARTS LIST

FOR

GRID VOLTAGE STABILIZER

49 (in triangle)

49C 1	2.2 µF	10%	100V	Polyes.
49D 1	BZX79 C9V1	Zener		
49D 2	1S920			
49IC 1	TAA550			
49R 1	47 kohms	5%	1/8W	Car.
49R 2	56 kohms	5%	1/8W	Car.
49R 3	390 ohms	5%	1/8W	Car.
49R 4	10 kohms	Var.		Car.
49R 5	10 kohms	Var.		Car.
49R 6	10 kohms	Var.		Car.
49R 7	470 kohms	5%	1W	Car.
49R 8	47 kohms	5%	1W	Car.
49R 9	470 kohms	5%	1W	Car.
49R10	220 kohms	5%	1W	Car.
49R11	4.7 kohms	5%	1/8W	Car.
49R12	4.7 kohms	5%	1/8W	Car.
49R13	4.7 kohms	5%	1/8W	Car.
49R14	470 kohms	5%	1W	Car.
49R15	220 kohms	5%	1W	Car.
49R16	4.7 kohms	5%	1/8W	Car.
49R17	560 kohms	5%	1W	Car.
49R18	47 kohms	5%	1W	Car.
49R19	560 kohms	5%	1W	Car.
49R20	1 kohm	5%	1/4W	Car.
49R21	1 kohm	5%	1/4W	Car.

PARTS LIST

FOR

AERIAL CURRENT METER CIRCUIT

△ 50

50C 1	47 nF	-20/+80%	12V	Cer.
50C 2	47 nF	-20/+80%	12V	Cer.
50D 1	AAZ 17			
50R 1	220 ohms	5%	1W	Car.
50R 2	220 ohms	5%	1W	Car.
50R 3	220 ohms	5%	1W	Car.
50R 4	390 ohms	5%	1/8W	Car.
50R 5	470 ohms	VDR		
50R 6	5.6 kohms	5%	1/8W	Car.
50R 7	470 ohms	NTC		
50T 1	TRANSFORMER		SKANTI CODE: T-0154	

PARTS LIST

FOR

DRIVER ANODE CIRCUIT HF

51

51C 1- 2	8.2 nF	-20/+80%	400V	Cer.
51C 3	330 pF	1%	125V	Polyst.
51C 4- 6	8.2 nF	-20/+80%	400V	Cer.
51C 7	390 pF	1%	125V	Polyst.
51C 8- 9	8.2 nF	-20/+80%	400V	Cer.
51C10	180 pF	1%	125V	Polyst.
51C11-12	8.2 nF	-20/+80%	400V	Cer.
51C13	110 pF	1%	125V	Polyst.
51C14-15	8.2 nF	-20/+80%	400V	Cer.
51C16	82 pF	±5%	400V	Cer.
51C17-18	8.2 nF	-20/+80%	400V	Cer.
51C19	110 pF	1%	125V	Polyst.
51C20-21	8.2 nF	-20/+80%	400V	Cer.
51C22	39 pF	±5%	400V	Cer.
51C23-29	8.2 nF	-20/+80%	400V	Cer.
51D 1- 9	1S920			
51L 1	COIL		SKANTI CODE: T-0217	
51L 2	COIL		SKANTI CODE: T-0224	
51L 3	COIL		SKANTI CODE: T-0218	
51L 4	COIL		SKANTI CODE: T-0219	
51L 5	COIL		SKANTI CODE: T-0220	
51L 6	COIL		SKANTI CODE: T-0221	
51L 7	COIL		SKANTI CODE: T-0222	
51L 8	COIL		SKANTI CODE: T-0223	
51L 9-11	1 mH	RF CHOKE	10%	
51R 1	150 kohms	5%	1/8W	Car.
51R 2	470 kohms	5%	1/4W	Car.
51R 3	470 kohms	5%	1/4W	Car.
51R 4	820 ohms	5%	1/4W	Car.
51R 5	1500 ohms	1%	1/8W	MR
51R 6	150 kohms	5%	1/8W	Car.
51R 7	1 kohm	5%	1/4W	Car.
51R 8	150 kohms	5%	1/8W	Car.
51R 9	1 kohm	5%	1/4W	Car.
51R10	150 kohms	5%	1/8W	Car.
51R11	1.2 kohms	5%	1/4W	Car.
51R12	150 kohms	5%	1/8W	Car.
51R13	1.8 kohms	5%	1/4W	Car.
51R14	150 kohms	5%	1/8W	Car.
51R15	150 kohms	5%	1/8W	Car.

PARTS LIST

FOR

DRIVER GRID CIRCUIT CT

52 (in triangle)

52C 1	0.1 µF	10%	100V	Polyes.
52C 2	8.2 nF	-20/+80%	400V	Cer.
52C 3	390 pF	1%	125V	Polyst.
52C 4	0.1 µF	10%	100V	Polyes.
52C 5	390 pF	1%	125V	polyst.
52C 6	0.1 µF	10%	100V	Polyes.
52C 7	390 pF	1%	125V	Polyst.
52C 8	0.1 µF	10%	100V	Polyes.
52C 9	390 pF	1%	125V	Polyst.
52C10	0.1 µF	10%	100V	Polyes.
52C11	390 pF	1%	125V	Polyst.
52C12	0.1 µF	10%	100V	Polyes.
52C13	390 pF	1%	125V	Polyst.
52C14	0.1 µF	10%	100V	Polyes.
52C15	390 pF	1%	125V	Polyst.
52C16	0.1 µF	10%	100V	Polyes.
52C17	390 pF	1%	125V	Polyst.
52C18	0.1 µF	10%	100V	Polyes.
52C19	390 pF	1%	125V	Polyst.
52C20	0.1 µF	10%	100V	Polyes.
52C21	390 pF	1%	125V	Polyst.
52C22	0.1 µF	10%	100V	Polyes.
52C23	390 pF	1%	125V	Polyst.
52C24	0.1 µF	10%	100V	Polyes.
52C25	390 pF	1%	125V	Polyst.
52C26	0.1 µF	10%	100V	Polyes.
52C27	390 pF	1%	125V	Polyst.
52C28	0.1 µF	10%	100V	Polyes.
52C29	390 pF	1%	125V	Polyst.
52C30	0.1 µF	10%	100V	Polyes.
52C31	390 pF	1%	125V	Polyst.
52C32	0.1 µF	10%	100V	Polyes.
52C33	390 pF	1%	125V	Polyst.
52C34	0.1 µF	10%	100V	Polyes.
52C35	390 pF	1%	125V	Polyst.
52C36	0.1 µF	10%	100V	Polyes.
52C37	390 pF	1%	125V	Polyst.
52C38	0.1 µF	10%	100V	Polyes.
52C39	390 pF	1%	125V	Polyst.
52C40	0.1 µF	10%	100V	Polyes.
52C41	390 pF	1%	125V	Polyst.
52C42	0.1 µF	10%	100V	Polyes.
52D 1-20	1S920			
52L 1-20	COIL		SKANTI CODE: T-0228	

52

52R 1	2.2 kohms	5%	1/8W	Car.
52R 2	150 ohms	5%	1/8W	Car.
52R 3	22 kohms	5%	1/8W	Car.
52R 4	150 ohms	5%	1/8W	Car.
52R 5	22 kohms	5%	1/8W	Car.
52R 6	150 ohms	5%	1/8W	Car.
52R 7	22 kohms	5%	1/8W	Car.
52R 8	150 ohms	5%	1/8W	Car.
52R 9	22 kohms	5%	1/8W	Car.
52R10	150 ohms	5%	1/8W	Car.
52R11	22 kohms	5%	1/8W	Car.
52R12	150 ohms	5%	1/8W	Car.
52R13	22 kohms	5%	1/8W	Car.
52R14	150 ohms	5%	1/8W	Car.
52R15	22 kohms	5%	1/8W	Car.
52R16	150 ohms	5%	1/8W	Car.
52R17	22 kohms	5%	1/8W	Car.
52R18	150 ohms	5%	1/8W	Car.
52R19	22 kohms	5%	1/8W	Car.
52R20	150 ohms	5%	1/8W	Car.
52R21	22 kohms	5%	1/8W	Car.
52R22	150 ohms	5%	1/8W	Car.
52R23	22 kohms	5%	1/8W	Car.
52R24	150 ohms	5%	1/8W	Car.
52R25	22 kohms	5%	1/8W	Car.
52R26	150 ohms	5%	1/8W	Car.
52R27	22 kohms	5%	1/8W	Car.
52R28	150 ohms	5%	1/8W	Car.
52R29	22 kohms	5%	1/8W	Car.
52R30	150 ohms	5%	1/8W	Car.
52R31	22 kohms	5%	1/8W	Car.
52R32	150 ohms	5%	1/8W	Car.
52R33	22 kohms	5%	1/8W	Car.
52R34	150 ohms	5%	1/8W	Car.
52R35	22 kohms	5%	1/8W	Car.
52R36	150 ohms	5%	1/8W	Car.
52R37	22 kohms	5%	1/8W	Car.
52R38	150 ohms	5%	1/8W	Car.
52R39	22 kohms	5%	1/8W	Car.
52R40	150 ohms	5%	1/8W	Car.
52R41	22 kohms	5%	1/8W	Car.

PARTS LIST

FOR

HF-BANDFILTERS

53 (in triangle)

53C 1- 2	8.2 nF	-20/+80%	400V	Cer.
53C 3	0.1 µF	-20/+80%	12V	Cer.
53C 4	47 nF	-20/+80%	12V	Cer.
53C 5	0.1 µF	-20/+80%	12V	Cer.
53C 6	47 nF	-20/+80%	12V	Cer.
53C 7	0.1 µF	-20/+80%	12V	Cer.
53C 8	47 nF	-20/+80%	12V	Cer.
53C 9	0.1 µF	-20/+80%	12V	Cer.
53C10	820 pF	1%	125V	Polyst.
53C11	15 pF	5%	400V	Cer.N150
53C12-13	390 pF	1%	125V	Polyst.
53C14-15	0.1 µF	-20/+80%	12V	Cer.
53C16	10 pF	±0.25pF	400V	Cer.N150
53C17-18	390 pF	1%	125V	Polyst.
53C19-20	0.1 µF	-20/+80%	12V	Cer.
53C21	3.9 pF	±0.25pF	400V	Cer.N150
53C22-23	100 pF	1%	125V	Polyst.
53C24-25	47 nF	-20/+80%	12V	Cer.
53C26	3.9 pF	±0.25pF	400V	Cer.N150
53C27	82 pF	5%	400V	Cer.N150
53C28	100 pF	1%	125V	Polyst.
53C29-30	47 nF	-20/+80%	12V	Cer.
53C31	10 pF	±0.25pF	400V	Cer.N150
53C32	6.8 pF	±0.25pF	400V	Cer.N150
53C33	82 pF	5%	400V	Cer.N150
53C34	100 pF	1%	125V	Polyst.
53C35-36	47 nF	-20/+80%	12V	Cer.
53C37	12 pF	5%	400V	Cer.N150
53C38	3.3 pF	±0.25pF	400V	Cer.NP0
53C39	82 pF	5%	400V	Cer.N150
53C40	100 pF	1%	125V	Polyst.
53C41-42	22 nF	-20/+80%	30V	Cer.
53C43	10 pF	±0.25pF	400V	Cer.N150
53C44	12 pF	5%	400V	Cer.N150
53C45	82 pF	5%	400V	Cer.N150
53C46	100 pF	1%	125V	Polyst.
53C47	22 nF	-20/+80%	30V	Cer.
53C48	1.0 nF	1%	500V	Polyst.
53C49	22 nF	-20/+80%	30V	Cer.
53C50-51	8.2 nF	-20/+80%	400V	Cer.
53D 1-16	1S920			
53L 1- 2	220 µH	RF CHOKE	10%	
53L 3	COIL		SKANTI CODE: T-0225	
53L 4	100 µH	RF CHOKE	10%	
53L 5	COIL		SKANTI CODE: T-0202	

53

53L 6	COIL		SKANTI CODE: T-0201	
53L 7	COIL		SKANTI CODE: T-0204	
53L 8	COIL		SKANTI CODE: T-0203	
53L 9	COIL		SKANTI CODE: T-0206	
53L10	COIL		SKANTI CODE: T-0205	
53L11	COIL		SKANTI CODE: T-0208	
53L12	COIL		SKANTI CODE: T-0207	
53L13	COIL		SKANTI CODE: T-0210	
53L14	COIL		SKANTI CODE: T-0209	
53L15	COIL		SKANTI CODE: T-0212	
53L16	COIL		SKANTI CODE: T-0211	
53L17	COIL		SKANTI CODE: T-0214	
53L18	COIL		SKANTI CODE: T-0213	
53R 1	150 ohms	5%	1/4W	Car.
53R 2- 3	150 ohms	5%	1/8W	Car.
53R 4	330 ohms	5%	1/8W	Car.
53R 5	30.1 ohms	1%	1/8W	MR
53R 6	6.8 kohms	5%	1/8W	Car.
53R 7	4.7 kohms	5%	1/8W	Car.
53R 8	390 ohms	5%	1/8W	Car.
53R 9	270 ohms	5%	1/8W	Car.
53R10	5.6 kohms	5%	1/8W	Car.
53R11	4.7 kohms	5%	1/8W	Car.
53R12	390 ohms	5%	1/8W	Car.
53R13	270 ohms	5%	1/8W	Car.
53R14	10 kohms	5%	1/8W	Car.
53R15	27 kohms	5%	1/8W	Car.
53R16	390 ohms	5%	1/8W	Car.
53R17	270 ohms	5%	1/8W	Car.
53R18	5.6 kohms	5%	1/8W	Car.
53R19	6.8 kohms	5%	1/8W	Car.
53R20	390 ohms	5%	1/8W	Car.
53R21	270 ohms	5%	1/8W	Car.
53R22	3.3 kohms	5%	1/8W	Car.
53R23	5.6 kohms	5%	1/8W	Car.
53R24	390 ohms	5%	1/8W	Car.
53R25	270 ohms	5%	1/8W	Car.
53R26	5.6 kohms	5%	1/8W	Car.
53R27	6.8 kohms	5%	1/8W	Car.
53R28	390 ohms	5%	1/8W	Car.
53R29	270 ohms	5%	1/8W	Car.
53R30	3.3 kohms	5%	1/8W	Car.
53R31	2.2 kohms	5%	1/8W	Car.
53R32	390 ohms	5%	1/8W	Car.
53R33	270 ohms	5%	1/8W	Car.
53T 1	TRANSFORMER		SKANTI CODE: T-0227	

PARTS LIST

FOR

DRIVER ANODE CIRCUIT CT

54 (in triangle)

54C 1	8.2 nF	-20/+80%	400V	Cer.
54C 2	390 pF	1%	125V	Polyst.
54C 3	0.1 μF	10%	400V	Polyes.
54C 4	390 pF	1%	125V	Polyst.
54C 5	0.1 μF	10%	400V	Polyes.
54C 6	390 pF	1%	125V	Polyst.
54C 7	0.1 μF	10%	400V	Polyes.
54C 8	390 pF	1%	125V	Polyst.
54C 9	0.1 μF	10%	400V	Polyes.
54C10	390 pF	1%	125V	Polyst.
54C11	0.1 μF	10%	400V	Polyes.
54C12	390 pF	1%	125V	Polyst.
54C13	0.1 μF	10%	400V	Polyes.
54C14	390 pF	1%	125V	Polyst.
54C15	0.1 μF	10%	400V	Polyes.
54C16	390 pF	1%	125V	Polyst.
54C17	0.1 μF	10%	400V	Polyes.
54C18	390 pF	1%	125V	Polyst.
54C19	0.1 μF	10%	400V	Polyes.
54C20	390 pF	1%	125V	Polyst.
54C21	0.1 μF	10%	400V	Polyes.
54C22	390 pF	1%	125V	Polyst.
54C23	0.1 μF	10%	400V	Polyes.
54C24	390 pF	1%	125V	Polyst.
54C25	0.1 μF	10%	400V	Polyes.
54C26	390 pF	1%	125V	Polyst.
54C27	0.1 μF	10%	400V	Polyes.
54C28	390 pF	1%	125V	Polyst.
54C29	0.1 μF	10%	400V	Polyes.
54C30	390 pF	1%	125V	Polyst.
54C31	0.1 μF	10%	400V	Polyes.
54C32	390 pF	1%	125V	Polyst.
54C33	0.1 μF	10%	400V	Polyes.
54C34	390 pF	1%	125V	Polyst.
54C35	0.1 μF	10%	400V	Polyes.
54C36	390 pF	1%	125V	Polyst.
54C37	0.1 μF	10%	400V	Polyes.
54C38	390 pF	1%	125V	Polyst.
54C39	0.1 μF	10%	400V	Polyes.
54C40	390 pF	1%	125V	Polyst.
54C41	0.1 μF	10%	400V	Polyes.
54D 1-20	1S923			
54L 1-20	COIL		SKANTI CODE: T-0229	
54R 1-20	150 kohms	5%	1/8W	Car.

PARTS LIST

FOR

CHASSIS (electrical parts)

△57

57C 1- 5	8.2 nF	-20/+80%	400V	Cer.
57C 6	4.7 nF	20%	5kVs	Cer.
57C 7	6 µF	10%	250V	MP
57C 8	0.1 µF	-20/+80%	12V	Cer.
57C 9	180 pF	1%	125V	Polyst.
57C10	47 pF	5%	400V	Cer.N150
57C11	470 µF		16V	W.alum.
57C12-13	22 nF	-20/+80%	30V	Cer.
57C14-15	0.1 µF	10%	250V	Polyes.
57C16	160 pF	5%	400V	Cer.N150
57C17	8.2 nF	-20/+80%	400V	Cer.
57C18-21	0.1 µF	-20/+80%	12V	Cer.
57C22-27	8.2 nF	-20/+80%	400V	Cer.
57C28	10 nF	10%	400V	Polyes.
57C29	47 nF	-20/+80%	12V	Cer.
57C30	10 nF	10%	400V	Polyes.
57C31	47 nF	-20/+80%	12V	Cer.
57C32	10 nF	10%	400V	Polyes.
57C33	47 nF	-20/+80%	12V	Cer.
57C34	0.1 µF	10%	250V	Polyes.
57C35	4 µF	10%	300V	MP
57C36	100 µF		16V	W.alum.
57C37	0.1 µF	10%	250V	Polyes.
57C38	not used			
57C39	not used			
57C40	22 nF	-20/+80%	30V	Cer.
57C41	8.2 nF	-20/+80%	400V	Cer.
57C42	5 pF	10%	2kVs	Cer.P140-100
57C43-44	100 pF	10%	3kVs	Cer.P140-100
57C45	4.7 nF	-20/+80%	5kVs	Cer.lak
57C46	4.7 nF	20%	5kVs	Cer.
57C47	120 pF	10%	3kVs	Cer.N200-300
57C48	60 pF	5%	3kVs	Cer.P140-100
57C49	100 pF	Var.	air	SKANTICODE: T-0165
57C50	100 pF	5%	3kVs	Cer.P140-100
57C51	80 pF	10%	2kVs	Cer.P140-100
57C52	30 pF	10%	3kVs	Cer.P140-100
57C53	40 pF	10%	3kVs	Cer.P140-100
57C54	30 pF	5%	3kVs	Cer.P140-100
57C55	60 pF	5%	3kVs	Cer.P140-100
57C56	120 pF	10%	3kVs	Cer.N200-300
57C57-58	100 pF	5%	3kVs	Cer.P140-100
57C59	300 pF	10%	3kVs	Cer.N200-300
57C60	400 pF	10%	3kVs	Cer.N200-300
57C61	600 pF	10%	3kVs	Cer.N200-300
57C62	150 pF	Var.	air	SKANTICODE: T-0243
57C63	60 pF	10%	2kVs	Cer.P140-100
57C64	300 pF	10%	3kVs	Cer.N200-300
57C65	22 pF	5%	400V	Cer.N150
57C66	180 pF	5%	400V	Cer.

57D 1	BZY93-C39	Zener		
57D 2	BZX79 C6V8	Zener		
57D 3	1S920			

57L 1- 3	COIL	SKANTI CODE: T-0273
57L 4- 6	COIL	SKANTI CODE: T-0161
57L 7	COIL	SKANTI CODE: T-0196
57L 8- 9	COIL	SKANTI CODE: T-0156
57L10	COIL	SKANTI CODE: T-0174
57L11	COIL	SKANTI CODE: T-0230
57L12	COIL	SKANTI CODE: T-0238

57ME 1	LEVEL METER	1 mA	70 ohm SKANTI CODE: T-0110
57ME 2	AERIAL CURRENT	1 mA	70 ohm SKANTI CODE: T-0130

57MT 1	HANDSET	SKANTICODE: T-0338

57PL 2	1 pole connector (plug)	L623p	B&L
57PL 3	antenna	SKANTI CODE: T-0105	
57PL 4	earth	SKANTI CODE: T-0105	

57R 0	220 kohms	5%	1W	Car.
57R 1	6.8 ohms	5%	27W	ww
57R 2	82 ohms	5%	1/8W	Car.
57R 3	180 ohms	5%	1/8W	Car.
57R 4	56 ohms	5%	1/8W	Car.
57R 5	120 ohms	5%	1/8W	Car.
57R 6	5.6 kohms	5%	1/8W	Car. SKANTI CODE: T-0255
57R 7	8.4+7.6 ohms	5%	20W	ww
57R 8	12 ohms	5%	14W	ww
57R 9	470 kohms	5%	1/8W	Car.
57R10	9 ohms	5%	27W	ww
57R11	220 ohms	5%	1/8W	Car.
57R12	9 ohms	5%	27W	ww
57R13	220 ohms	5%	1/8W	Car.
57R14	9 ohms	5%	27W	ww
57R15	220 ohms	5%	1/8W	Car.
57R16	PTC	2322 661 91003		Miniwatt
57R17	68 ohms	5%	1/4W	Car.
57R18-20	1.1 ohms	5%	3W	ww
57R21	PTC	2322 661 91003		Miniwatt
57R22-25	47 kohms	5%	1W	Car.
57R26-28	68 ohms	5%	1/4W	Car.
57R29-31	120 ohms	5%	1/2W	Car.
57R32	470 kohms	5%	1W	Car.
57R33-34	2.2 kohms	5%	1/8W	Car.
57R35-40	1.5 Mohms	5%	1W	Car.
57R41	100 kohms	5%	1/8W	Car.

57RL 1	RELAY	KMK2	24V DC	Keyswitch

57

57S 1a,b,c,d	power	ROTARY SWITCH	SKANTI CODE:	T-0073
57S 2a,b	check	ROTARY SWITCH	SKANTI CODE:	T-0095
57S 3	alarm	ROTARY SWITCH	SKANTI CODE:	T-0093
57S 4	mode	ROTARY SWITCH	SKANTI CODE:	T-0091
57S 5a,b,c,d	band	ROTARY SWITCH	SKANTI CODE:	T-0096
57S 5e,f	neutr.	ROTARY SWITCH	SKANTI CODE:	T-0191
57S 5g til n	band	ROTARY SWITCH	SKANTI CODE:	T-0097
57S 6a,b,c	channel	ROTARY SWITCH	SKANTI CODE:	T-0092
57S 7	alarm	PUSH-BOTTOM SWITCH		
57S 8		MICRO SWITCH	V3/550	VTS
57SL 1- 2	LAMP	12V	913 0012	Schurter
57SK 1	connector (socket)	T3403		Tuchel
57SK 2	connector (socket)	BNC UG 657/isol.		Pre-fact
57T 1	TRANSFORMER		SKANTI CODE:	T-0152
57T 2	TRANSFORMER	Type 0.32-13820		J.S.
57TR 1	2N3055			
57TR 2	2N4240			
57TR 3	2N1613			
57V 1	Not used			
57V 2	YL1371			
57V 3- 5	YL1070			

PARTS LIST
FOR
"FILTER"
57A

57A C 1- 4	2.2 nF	-20/+80%	30V	Cer.
57A C 5- 9	0.1 µF	10%	250V	Polyst.
57A C10	8.2 nF	-20/+80%	400V	Cer.
57A C11-13	2.2 nF	-20/+50%	750V	Cer.
57A C14-17	0.1 µF	10%	250V	Cer.
57A L 1- 8	25 µH	RF CHOKE	3A	
57A L 9-11	100 µH	RF CHOKE	10%	
57A L12-14	2.2 µH	RF CHOKE	10%	
57A L15-18	100 µH	RF CHOKE	10%	
57A L19	2.2 µH	RF CHOKE	10%	
57A PL 1	25 pole connector (plug)		XP25	McMurdo

PARTS LIST
FOR
NEUTRALIZATION

58 (in triangle)

58C 1	8.2 nF	-20/+80%	400V	Cer.
58C 2	20 pF	Var.		Cer.
58C 3	18 pF	5%	400V	Cer.
58C 4	20 pF	Var.		Cer.
58C 5	27 pF	5%	400V	Cer.
58C 6	20 pF	Var.		Cer.
58C 7	27 pF	5%	400V	Cer.
58C 8	20 pF	Var.		Cer.
58C 9	27 pF	5%	400V	Cer.
58C10-12	8.2 nF	-20/+80%	400V	Cer.
58C13	22 pF	5%	400V	Cer.
58C14	8.2 nF	-20/+80%	400V	Cer.
58D 1- 4	1N4148			
58L 1- 2	COIL		SKANTI CODE: T-0242	
58L 3	COIL		SKANTI CODE: T-0241	
58L 4- 5	1 mH	RF CHOKE	10%	
58R 1- 2	470 kohms	5%	1/8W	Car.
58R 3	33 kohms	5%	1/8W	Car.
58R 4- 5	470 kohms	5%	1/8W	Car.
58R 6	10 kohms	5%	1/8W	Car.
58T 1	TRANSFORMER		SKANTI CODE: T-0278	

PARTS LIST

FOR

AC RACK

△71

71PL 1	1 pole plug			BNC
71PL 2	1 pole plug			BNC
71PL 3	1 pole plug			BNC
71S 1	safety switch		D52	Burgess
71S 2	safety switch		D52	Burgess
71S 3	safety switch		D52	Burgess
71SK 1	socket	EARTH		SKANTI CODE: T-0335
71SK 2	socket	ANTENNA		SKANTI CODE: T-0335
71SK 3	socket	25 pole XS25		McMurdo
71SK 4	socket	1 pole L623/S		B&L
71SK 5	socket	EARTH		SKANTI CODE: T-0335
71SK 6	socket	12 pole XS12		McMurdo
71SK 7	socket	25 pole XS25		McMurdo
71SK 8	socket	1 pole L623/S		B&L

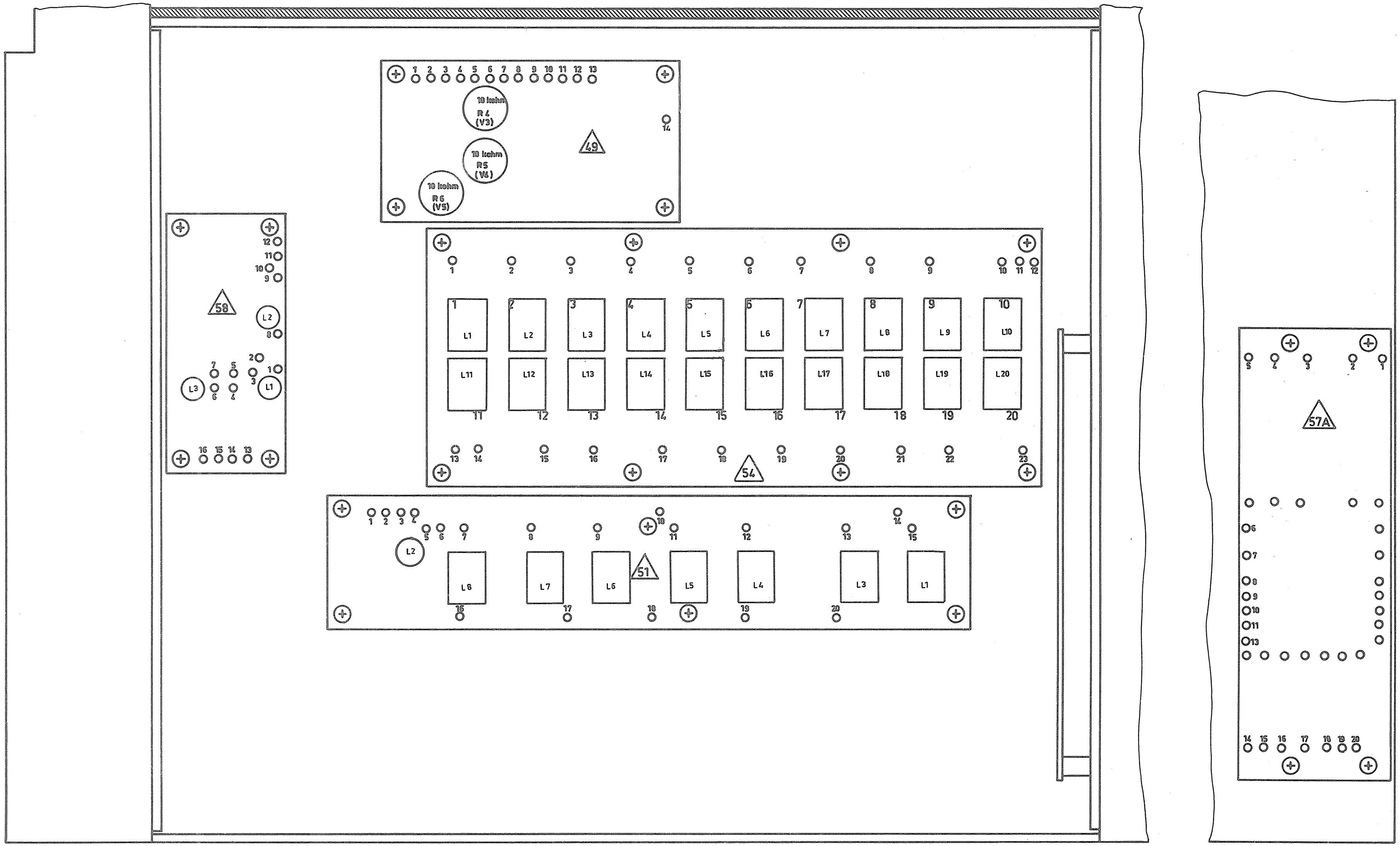
PARTS LIST

FOR

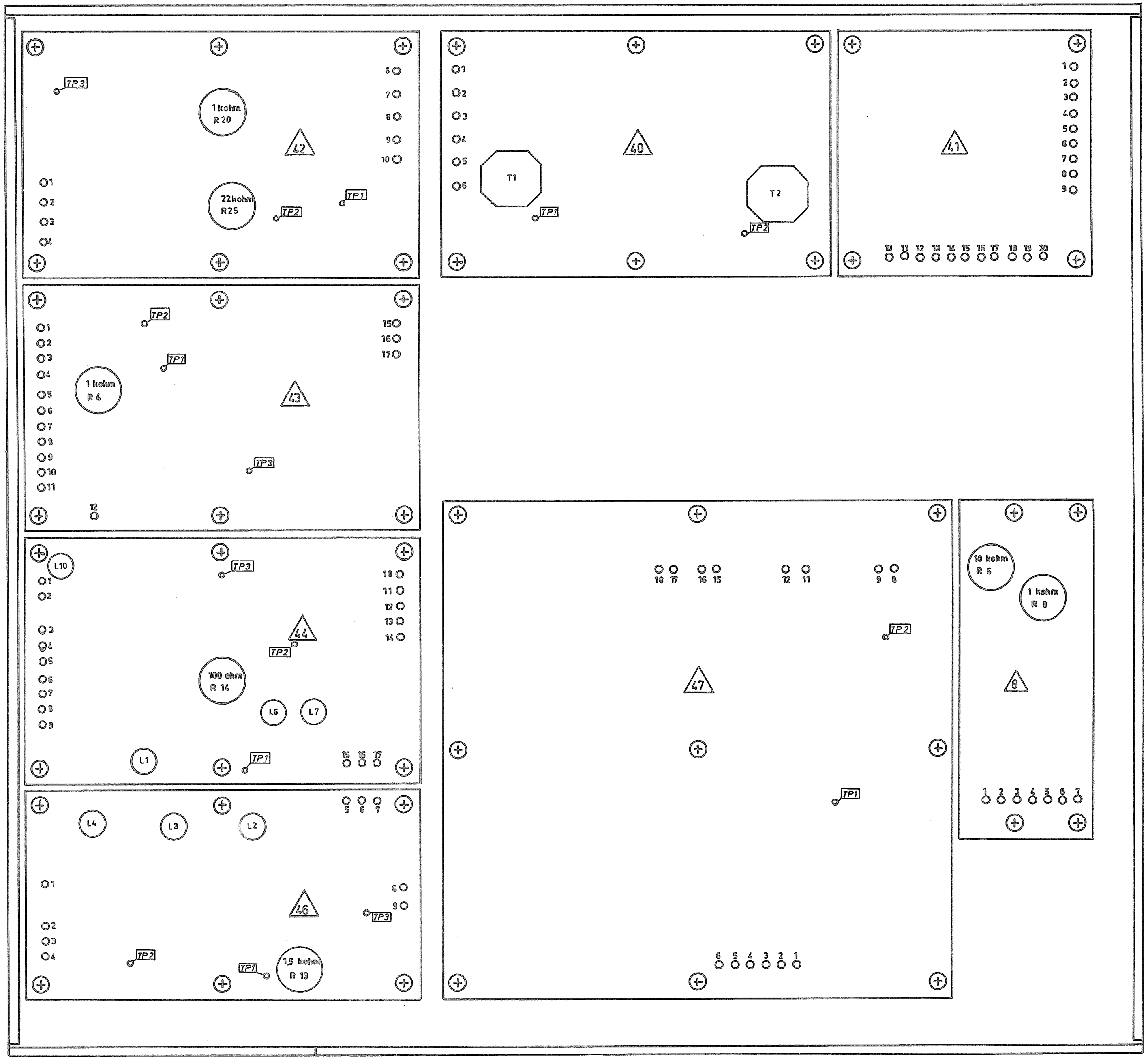
DC RACK

△72

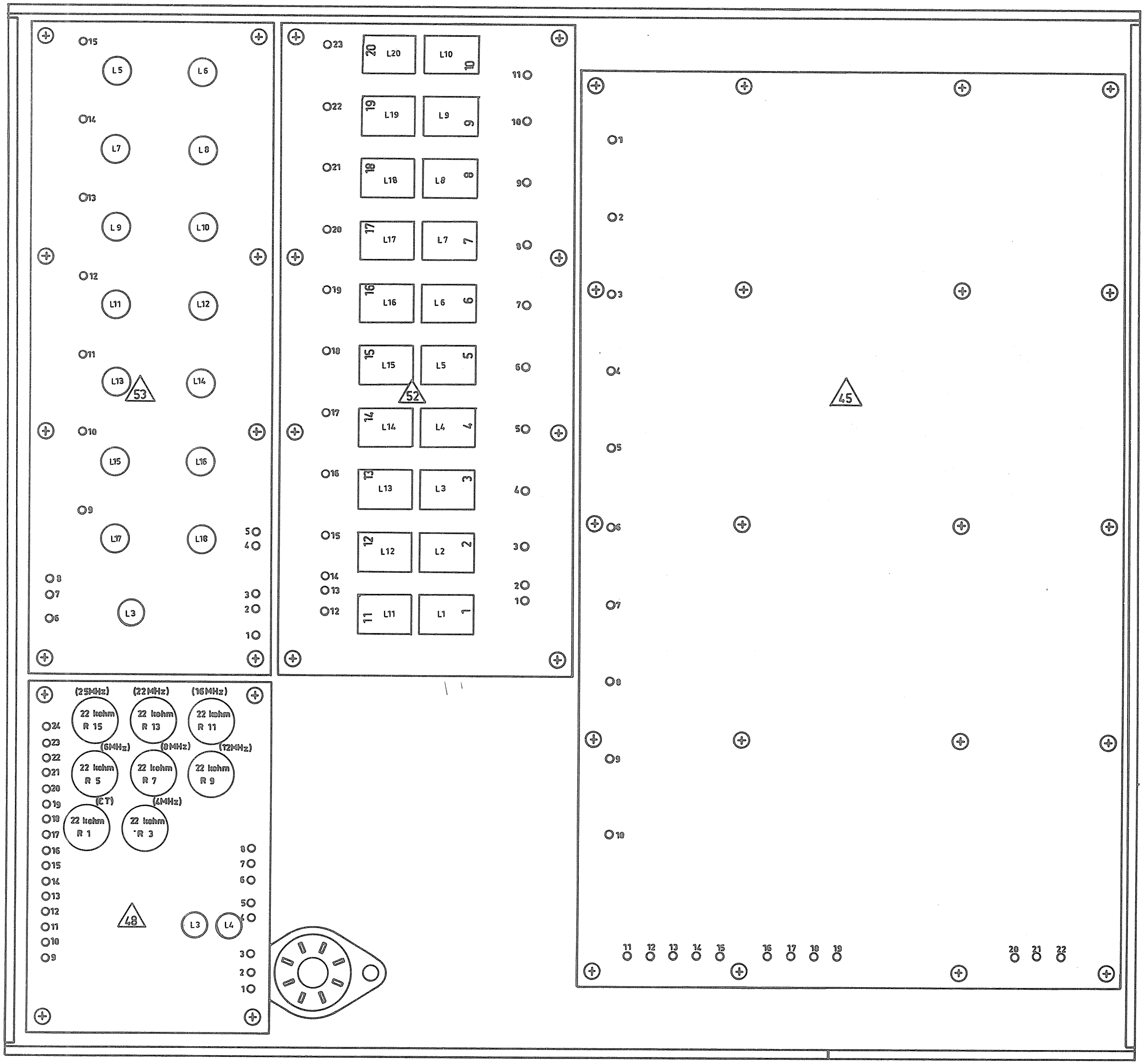
72C 1	8.2 nF	5%	125V	Polyes.
72PL 1- 3	1 pole plug			BNC
72PL 4	1 pole plug			AMP
72R 1-10	6.8 ohm	5%	27W	WW
72S 1- 3	safety switch		D52	Burgess
72SK 1	socket	EARTH		SKANTI CODE: T-0335
72SK 2	socket	ANTENNA		SKANTI CODE: T-0335
72SK 3	socket	25 pole XS25		McMurdo
72SK 4	socket	1 pole L623/S		B&L
72SK 5	socket	EARTH		SKANTI CODE: T-0335
72SK 6	socket	12 pole XS12		McMurdo
72SK 7	socket	25 pole XS25		McMurdo
72SK 8	socket	1 pole L623/S		B&L



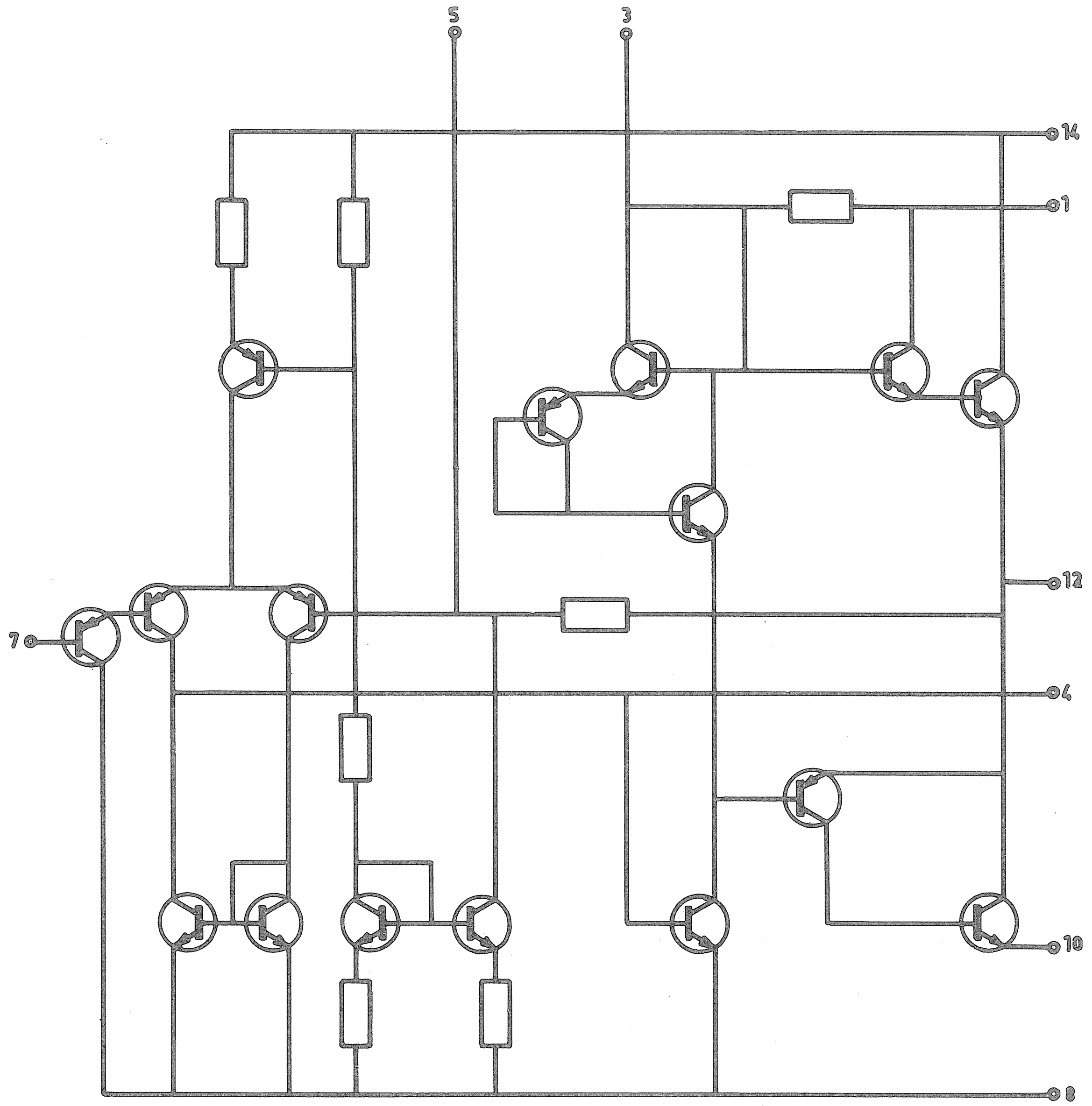
T-0295-1 BOTTOM COMPARTMENT CIRCUIT BOARD LOCATION PLAN



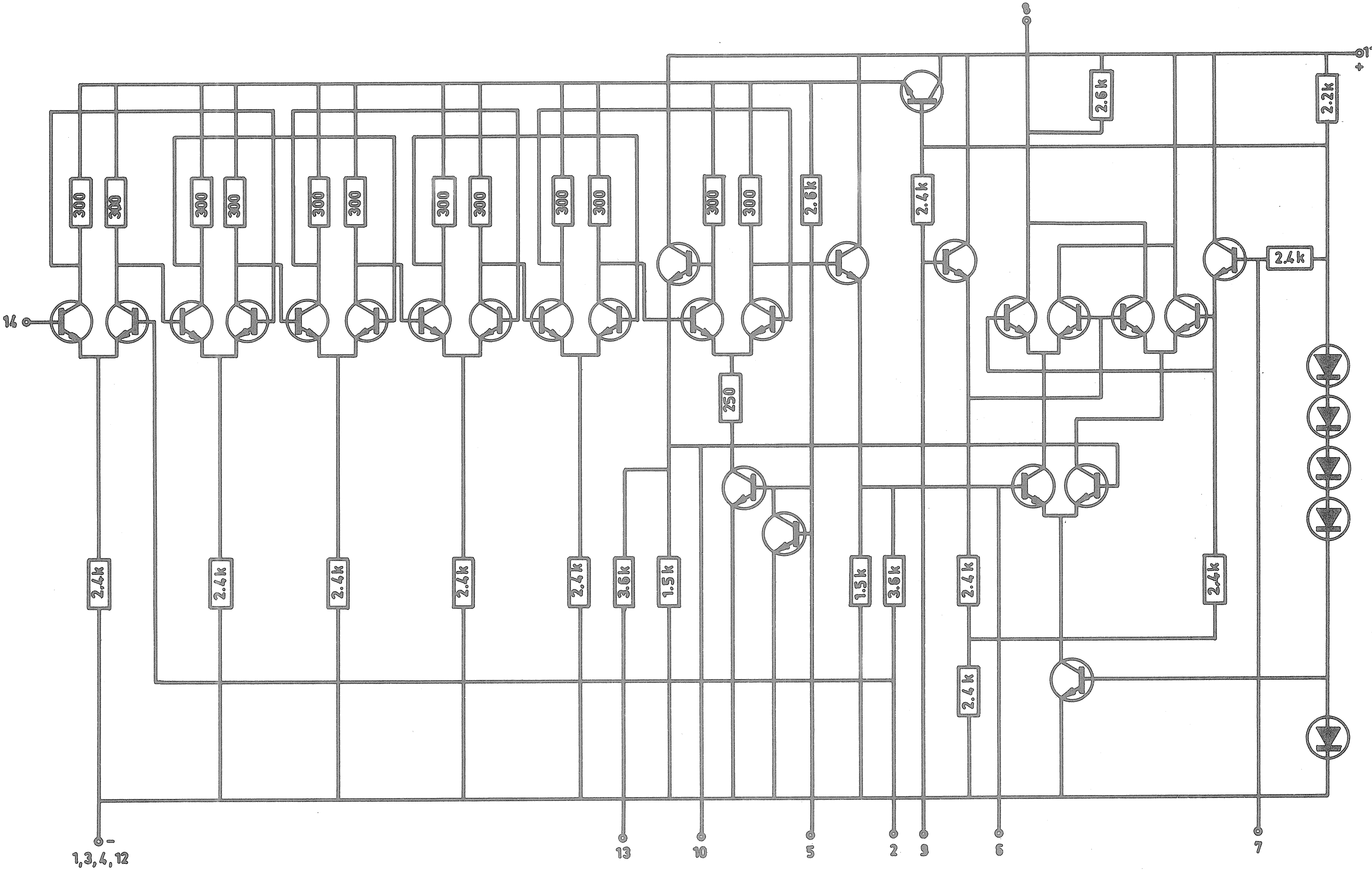
T-0296-1 RIGHT SIDE COMPARTMENT CIRCUIT BOARD LOCATION PLAN



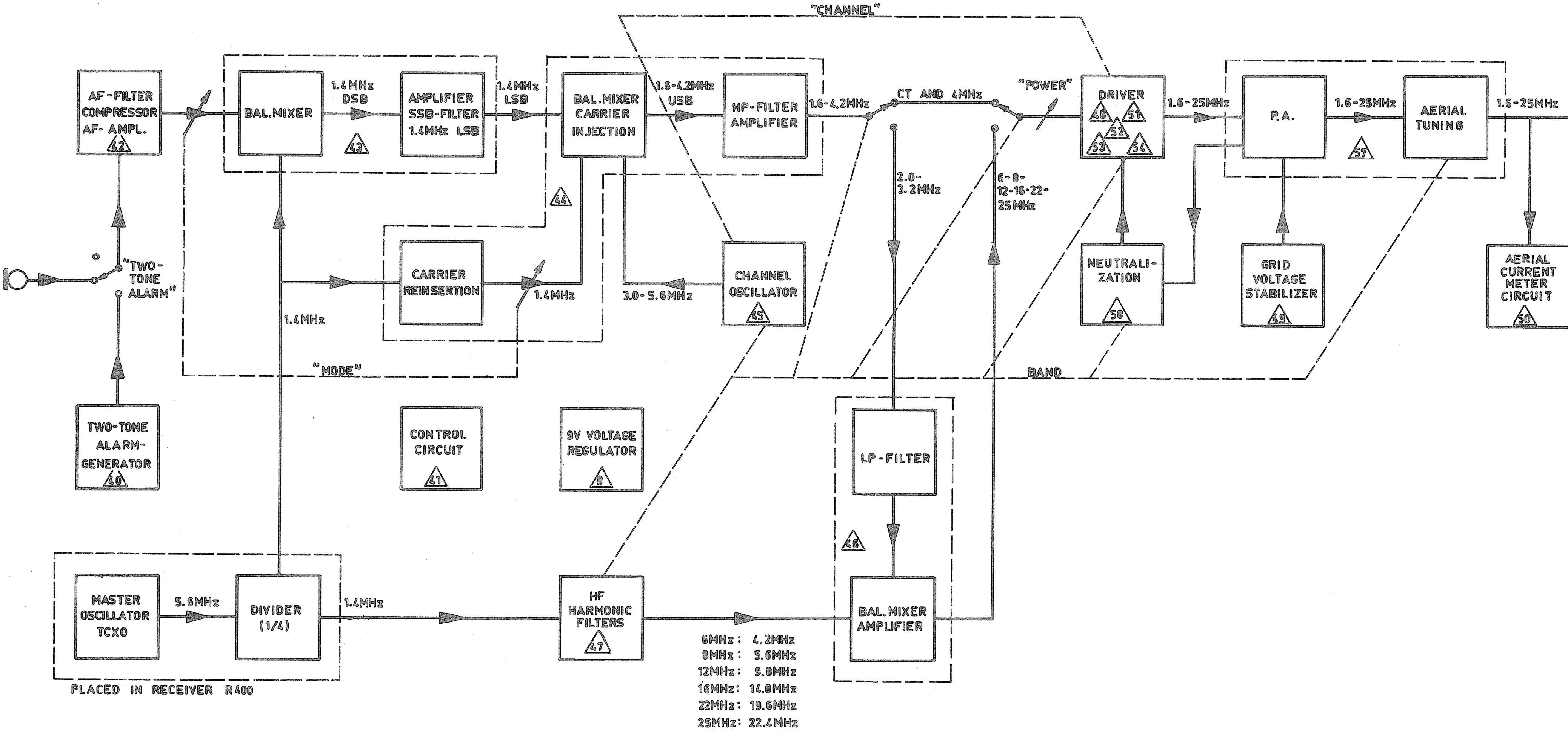
T-0297-1 LEFT SIDE COMPARTMENT CIRCUIT BOARD LOCATION PLAN



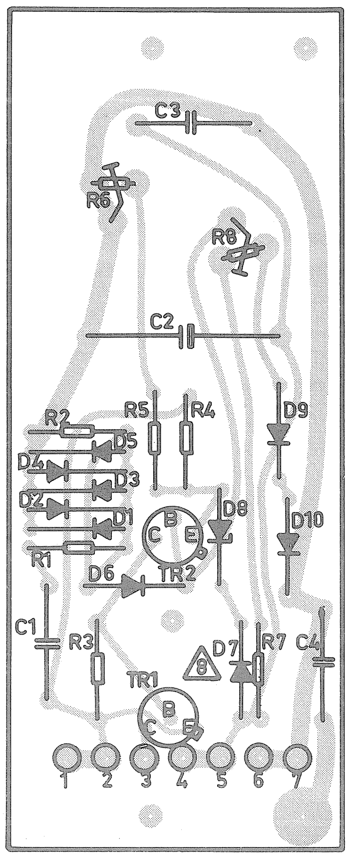
T- 0601 - 1 CIRCUIT DIAGRAM OF TAA 611 B



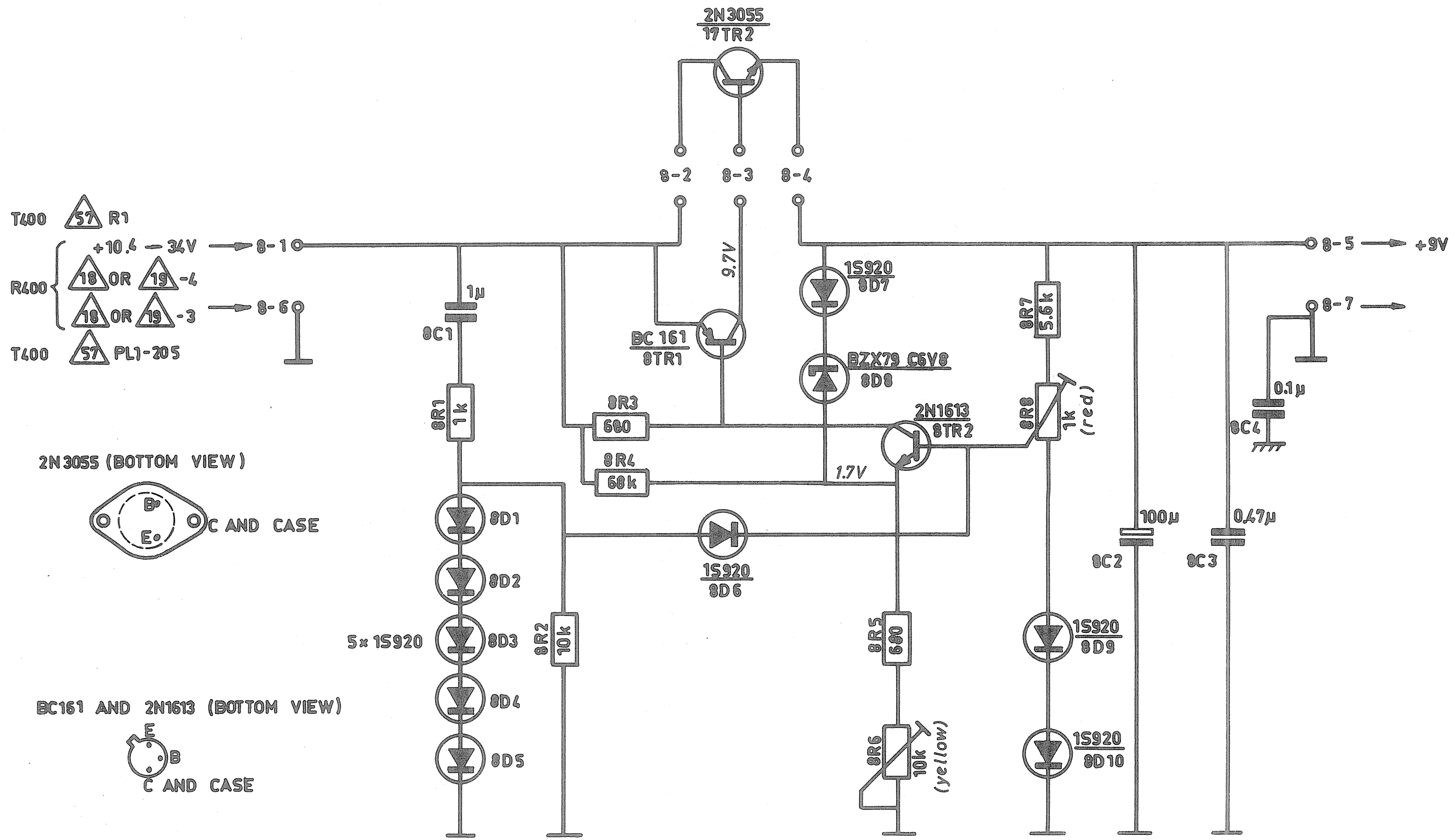
R-0311-1 CIRCUIT DIAGRAM OF TBA 120



T-0121-2 BLOCK DIAGRAM

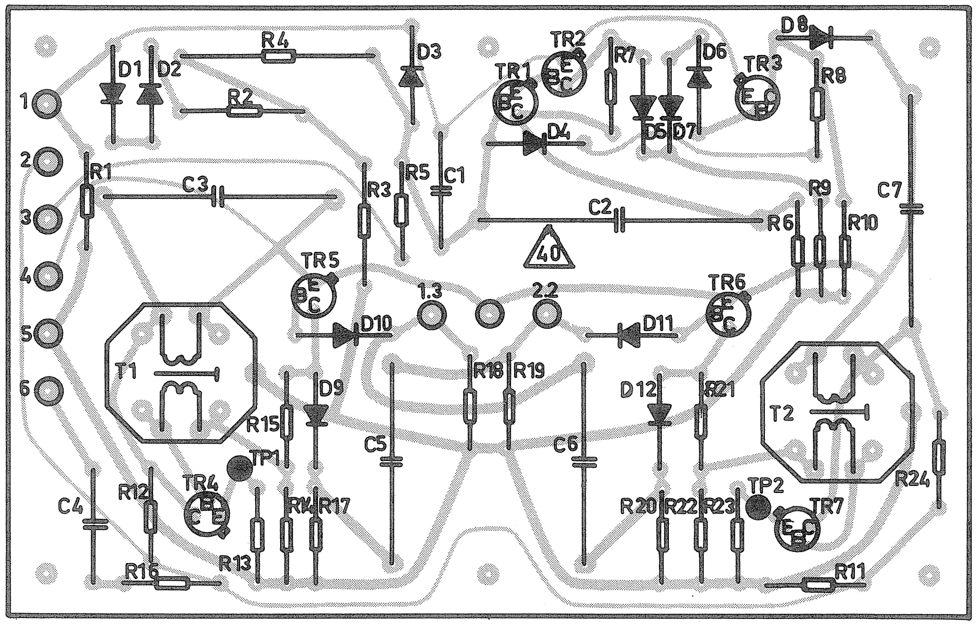


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

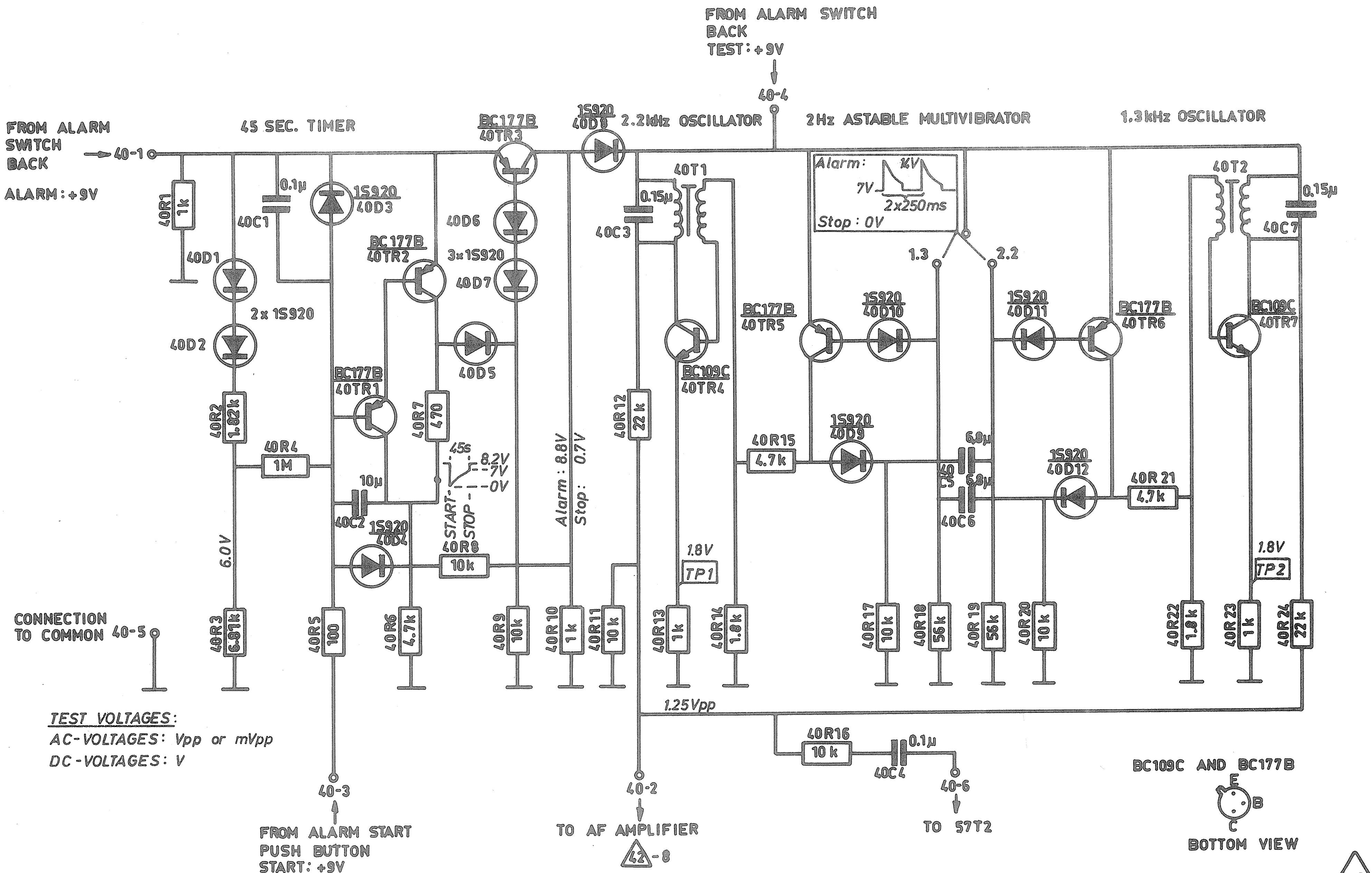


R- 0132 - 1 9V VOLTAGE REGULATOR

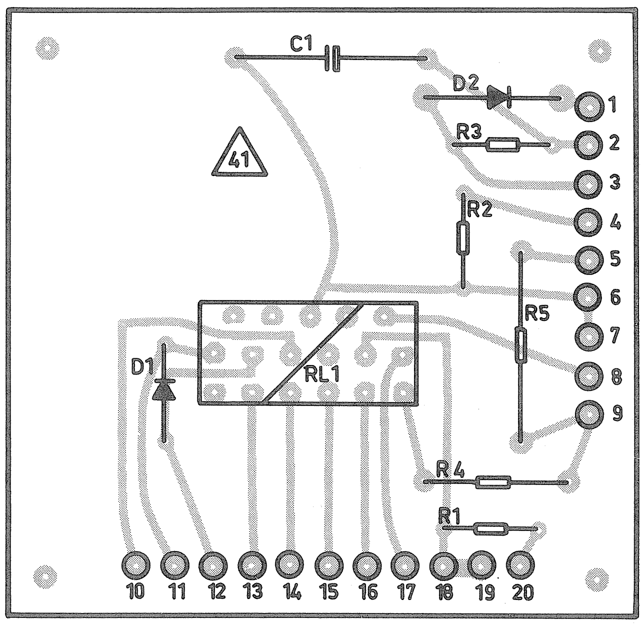
8



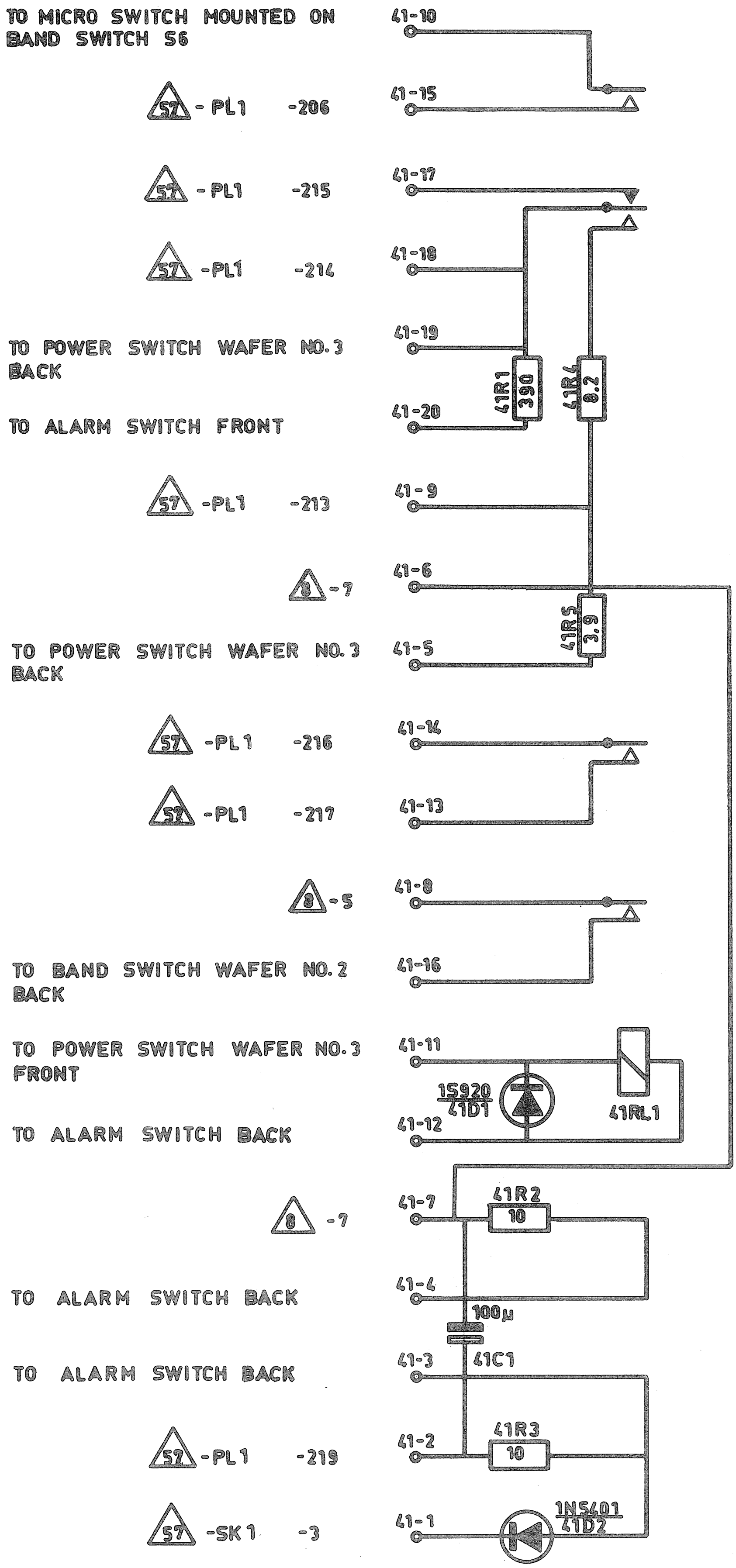
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

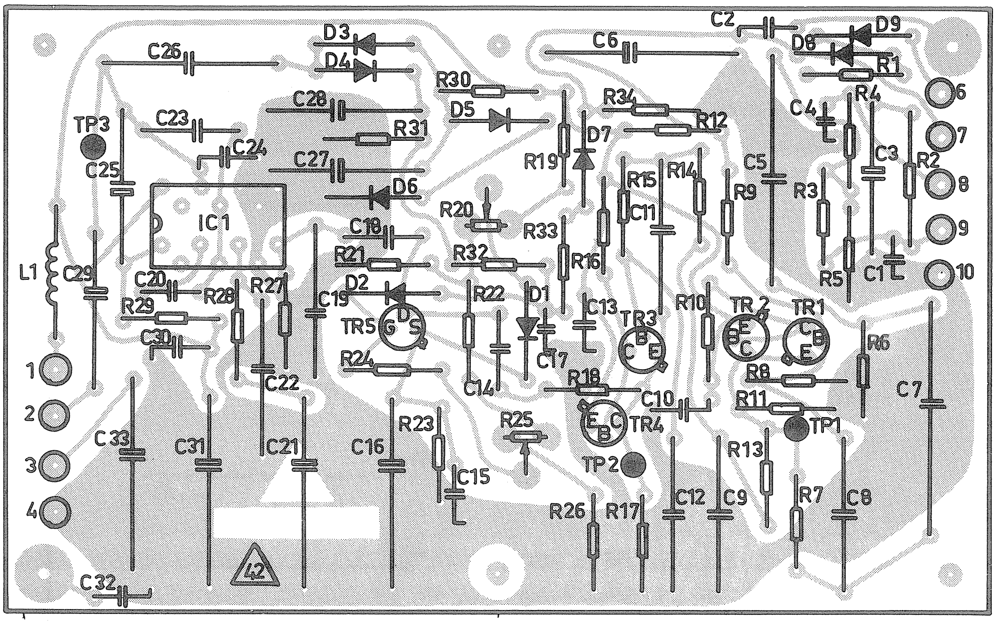


T-0004-2 TWO-TONE GENERATOR

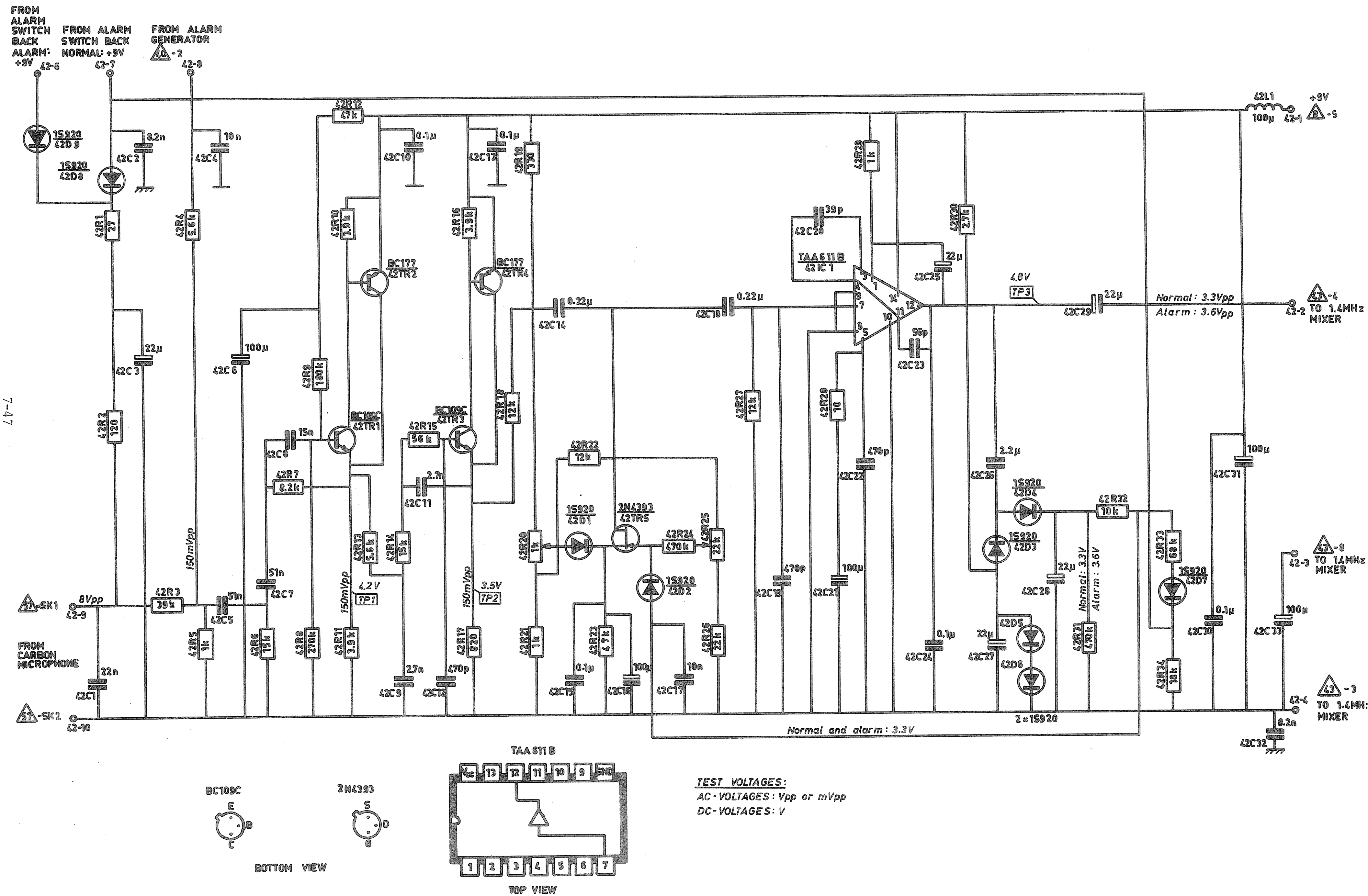


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE


TO MICRO SWITCH MOUNTED ON BAND SWITCH S6
41-10
57 - PL1 -206
41-15
57 - PL1 -215
41-17
57 - PL1 -214
41-18
TO POWER SWITCH WAFER NO.3 BACK
41-19
41R1 390
41R4 8.2
TO ALARM SWITCH FRONT
41-20
57 - PL1 -213
41-9
8 -7
41-6
41R5 3.9
TO POWER SWITCH WAFER NO.3 BACK
41-5
57 - PL1 -216
41-14
57 - PL1 -217
41-13
8 -5
41-8
TO BAND SWITCH WAFER NO.2 BACK
41-16
TO POWER SWITCH WAFER NO.3 FRONT
41-11
1S920 41D1
41RL1
TO ALARM SWITCH BACK
41-12
8 -7
41-7
41R2 10
TO ALARM SWITCH BACK
41-4
100μ
41C1
TO ALARM SWITCH BACK
41-3
57 - PL1 -219
41-2
41R3 10
57 - SK1 -3
41-1
1N5401 41D2

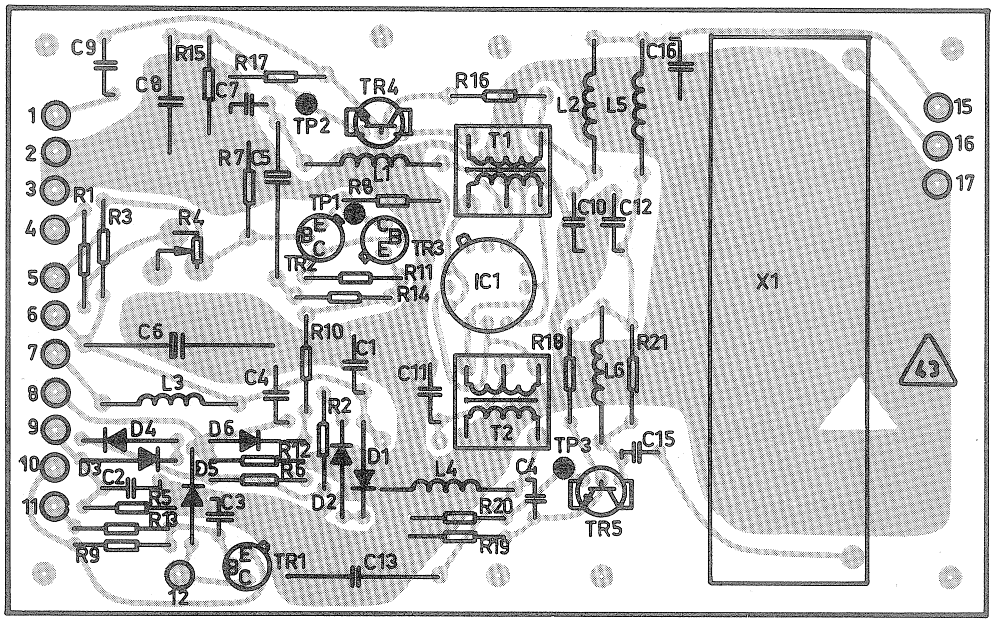


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

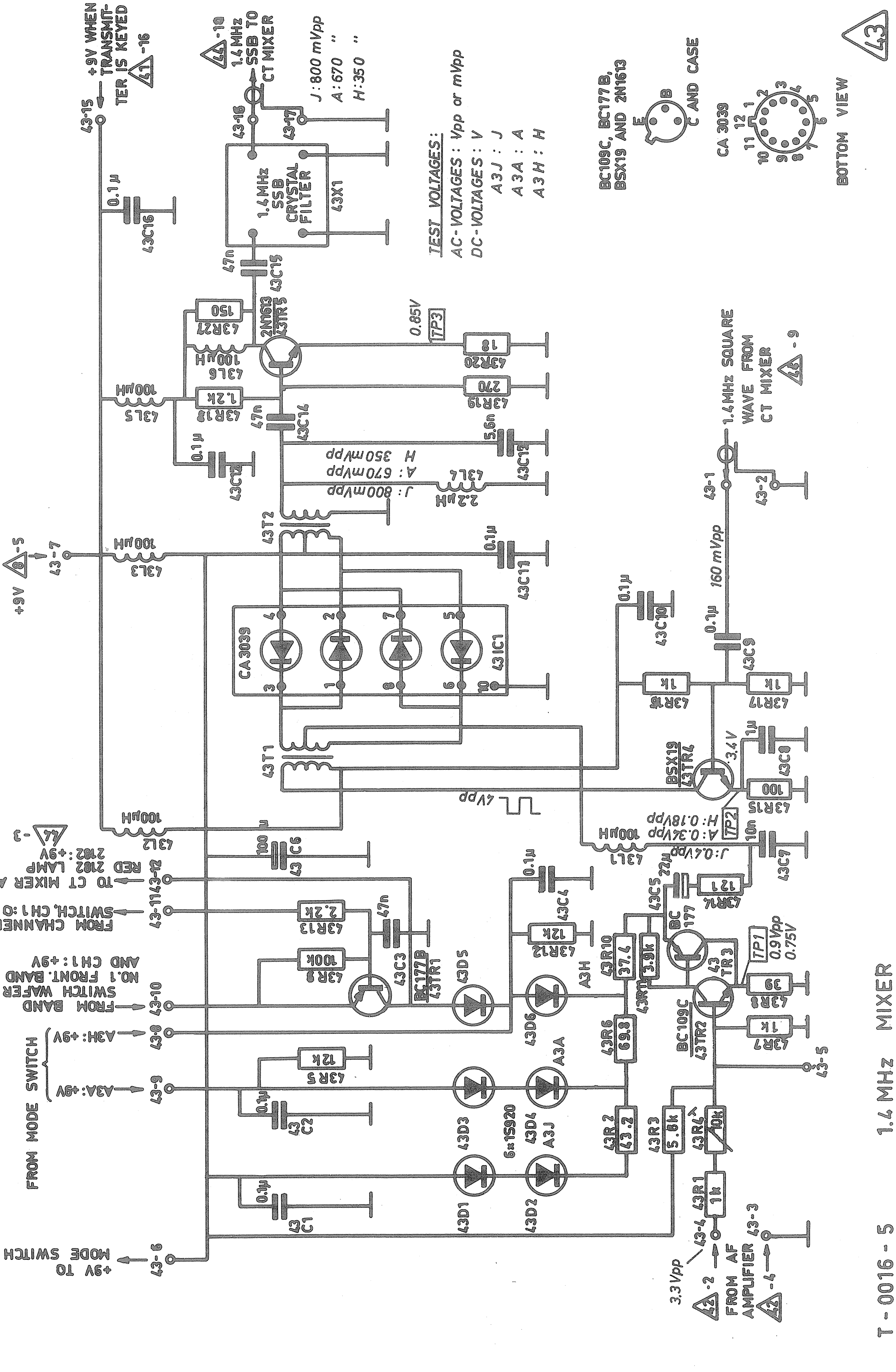


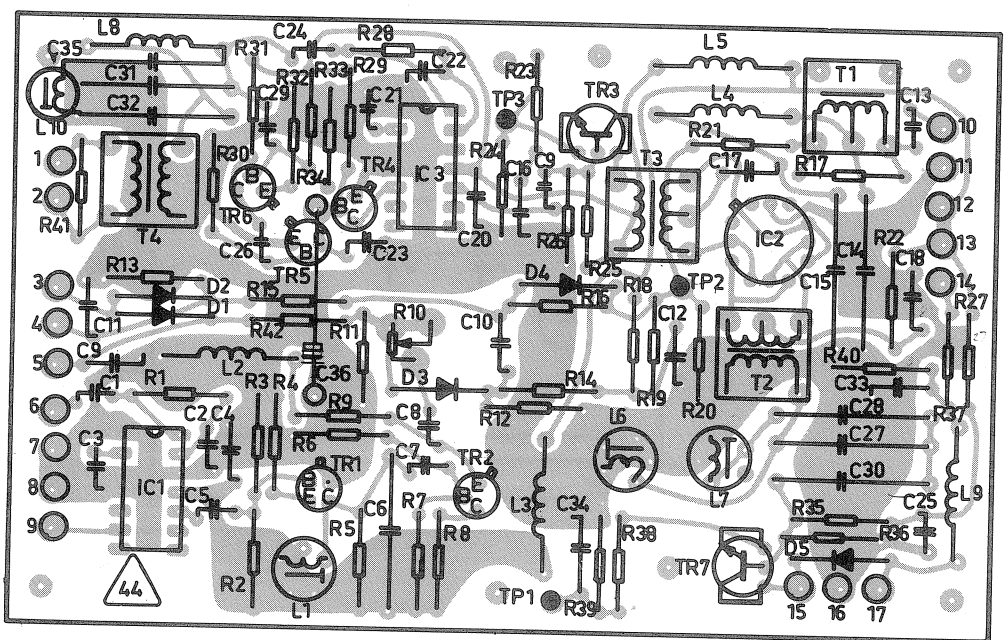
T - 0012 - 5 AF AMPLIFIER

42

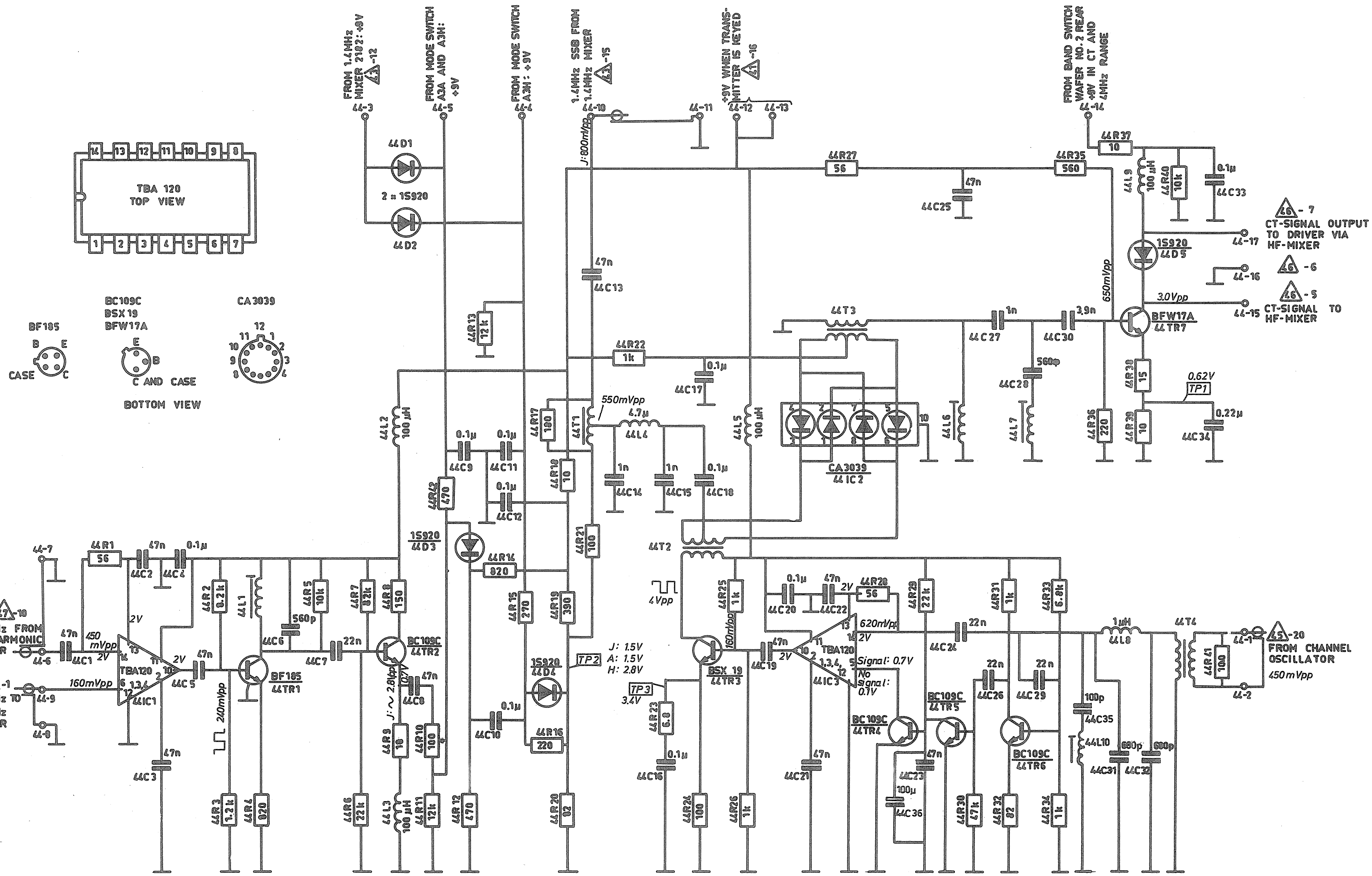


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE


1.4 MHz MIXER
T-0016-5
TEST VOLTAGES:
AC-VOLTAGES: Vpp or mVpp
DC-VOLTAGES: V
A3J: J
A3A: A
A3H: H
1.4 MHz SSB CRYSTAL FILTER
1.4 MHz SSB TO CT MIXER
+9V WHEN TRANSMITTER IS KEYED
1.4 MHz SQUARE WAVE FROM CT MIXER
FROM MODE SWITCH
+9V TO MODE SWITCH
FROM AF AMPLIFIER
FROM BAND SWITCH WAFER NO.1 FRONT. BAND H AND CH1: +9V
FROM CHANNEL SWITCH, CH1: 0 V
TO CT MIXER AND RED 2182 LAMP 2182: +9V
BC109C, BC177B, BSX19 AND 2N1613
C AND CASE
CA 3039
BOTTOM VIEW



PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



TEST VOLTAGES:

AC-VOLTAGES: Vpp or mVpp

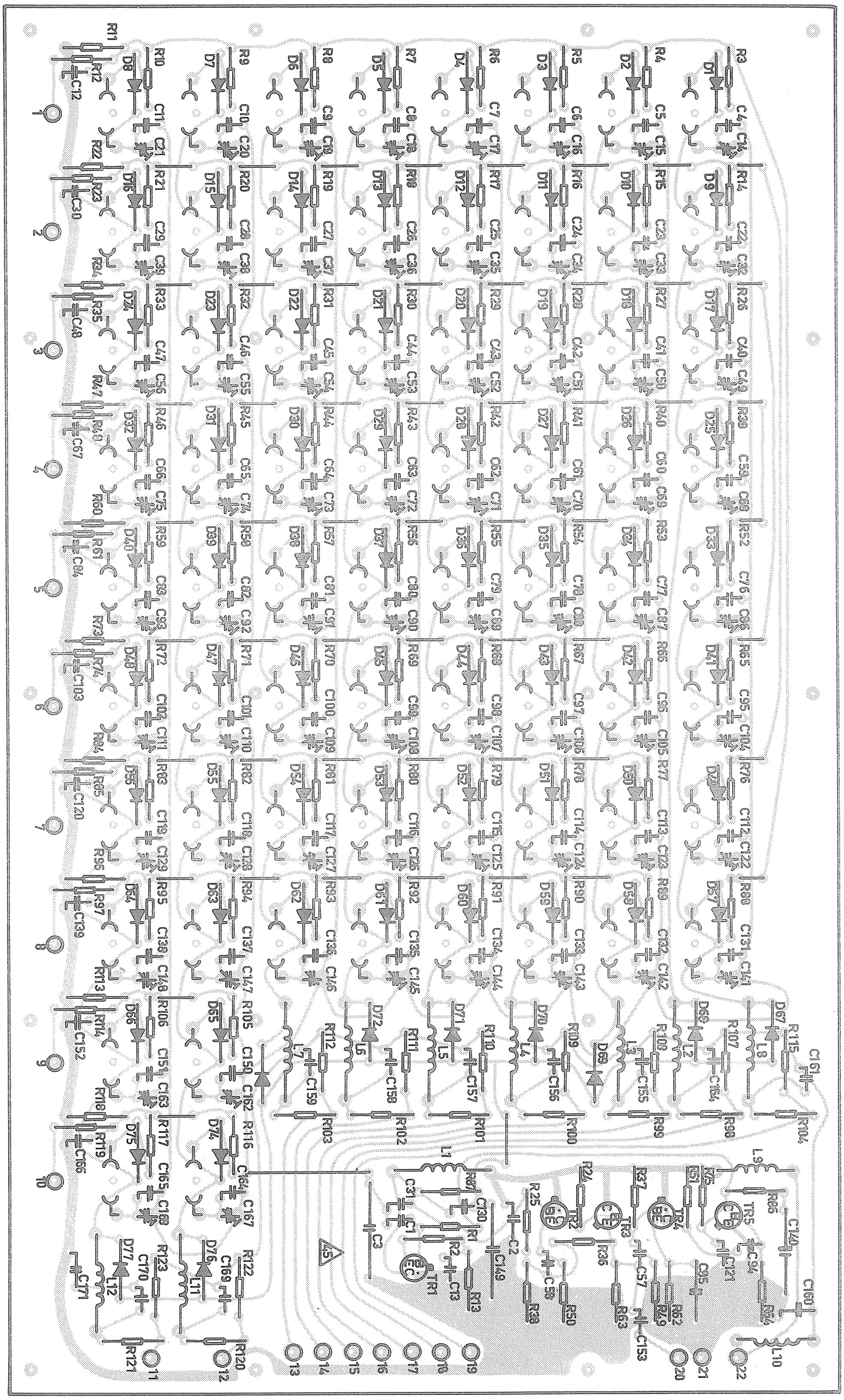
DC-VOLTAGES: V

A3J : J

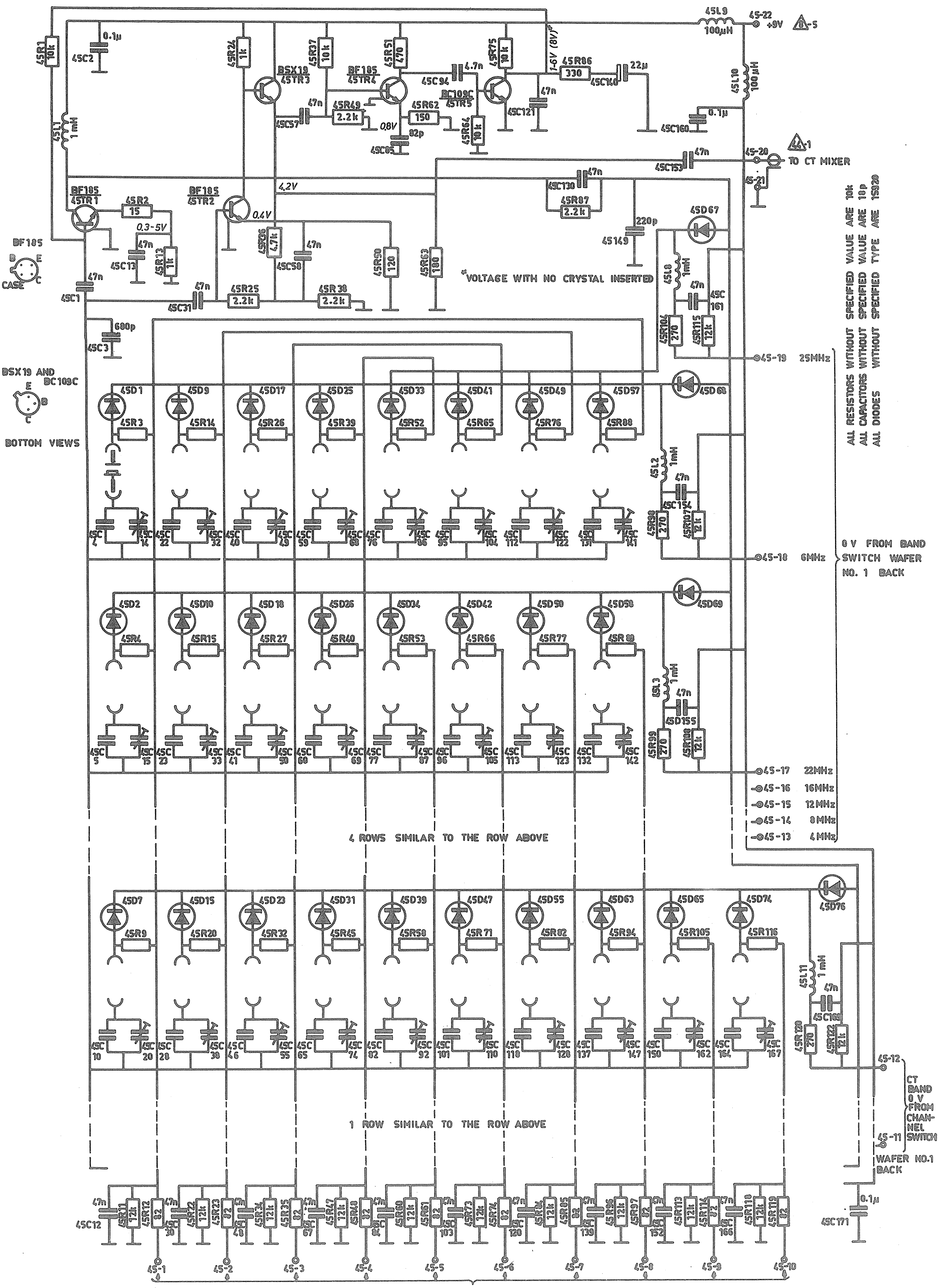
A3A : A

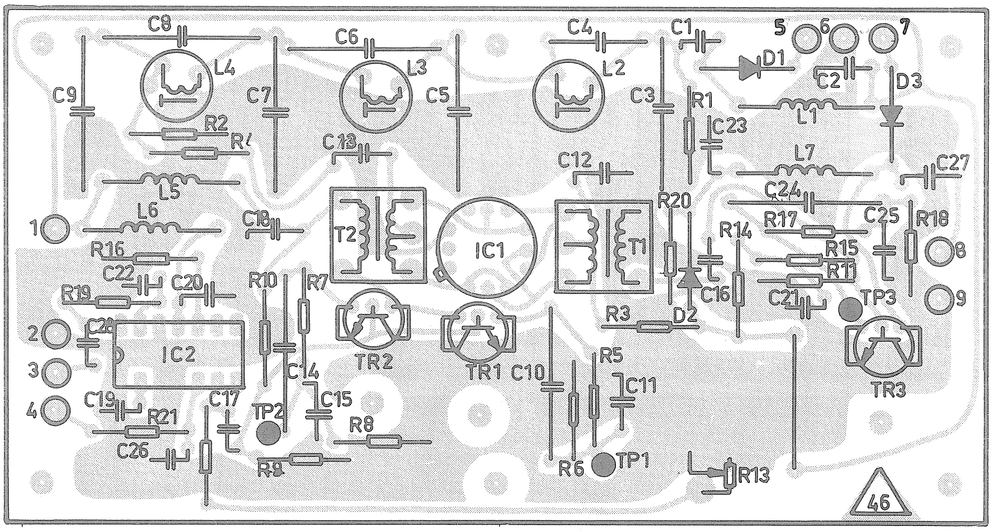
A3H : H

T - 0020 - 4 CT MIXER

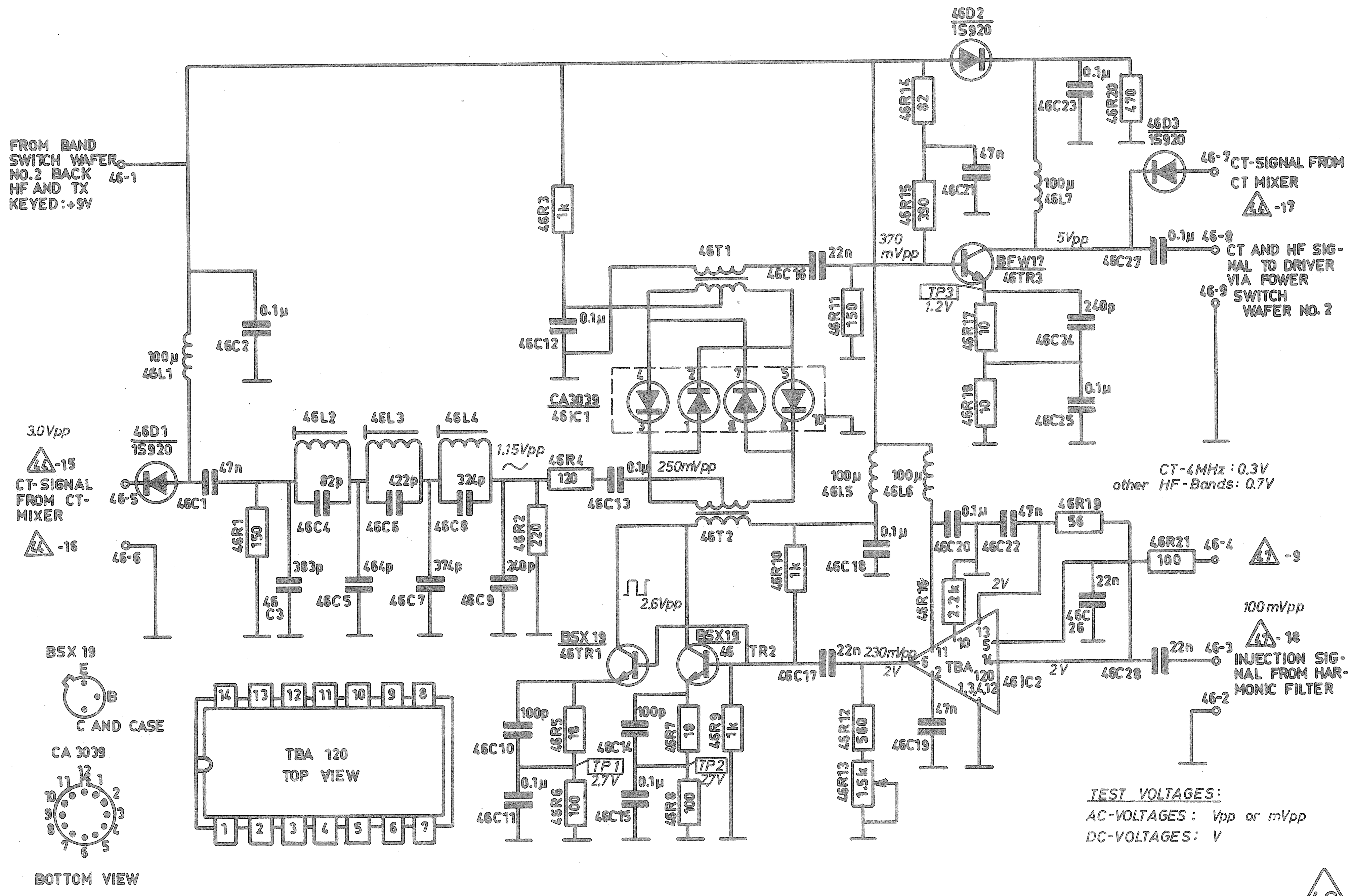


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

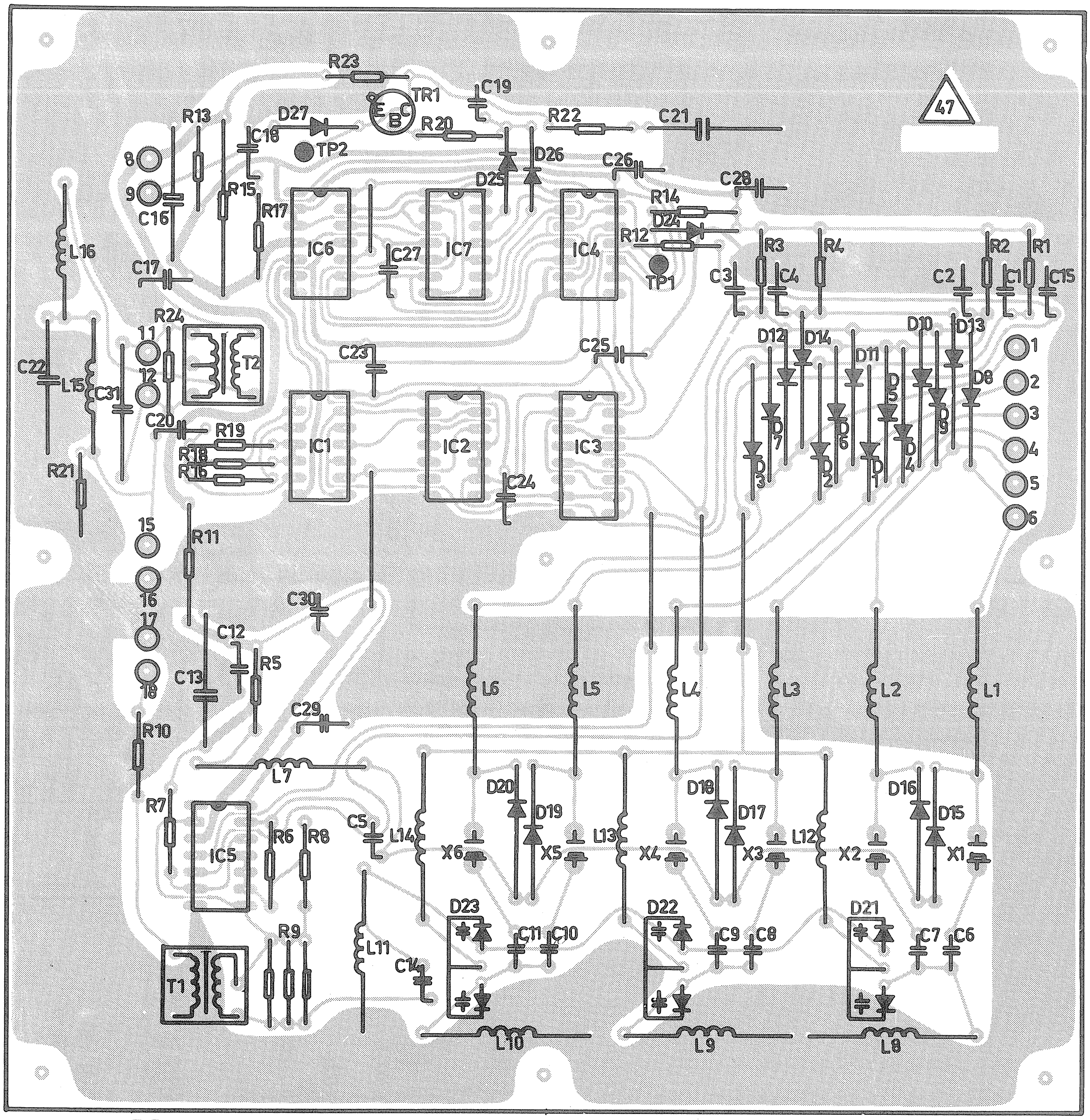

TO CT MIXER
BF185
CASE
BSX19 AND BC109C
BOTTOM VIEWS
*VOLTAGE WITH NO CRYSTAL INSERTED
4 ROWS SIMILAR TO THE ROW ABOVE
1 ROW SIMILAR TO THE ROW ABOVE
+9V FROM CHANNEL SWITCH WAFER NO-1 FRONT
0 V FROM BAND SWITCH WAFER NO. 1 BACK
CT BAND 0 V FROM CHANNEL SWITCH WAFER NO.1 BACK
ALL RESISTORS WITHOUT SPECIFIED VALUE ARE 10k
ALL CAPACITORS WITHOUT SPECIFIED VALUE ARE 10p
ALL DIODES WITHOUT SPECIFIED TYPE ARE 1S920
25MHz
6MHz
22MHz
16MHz
12MHz
8MHz
4MHz



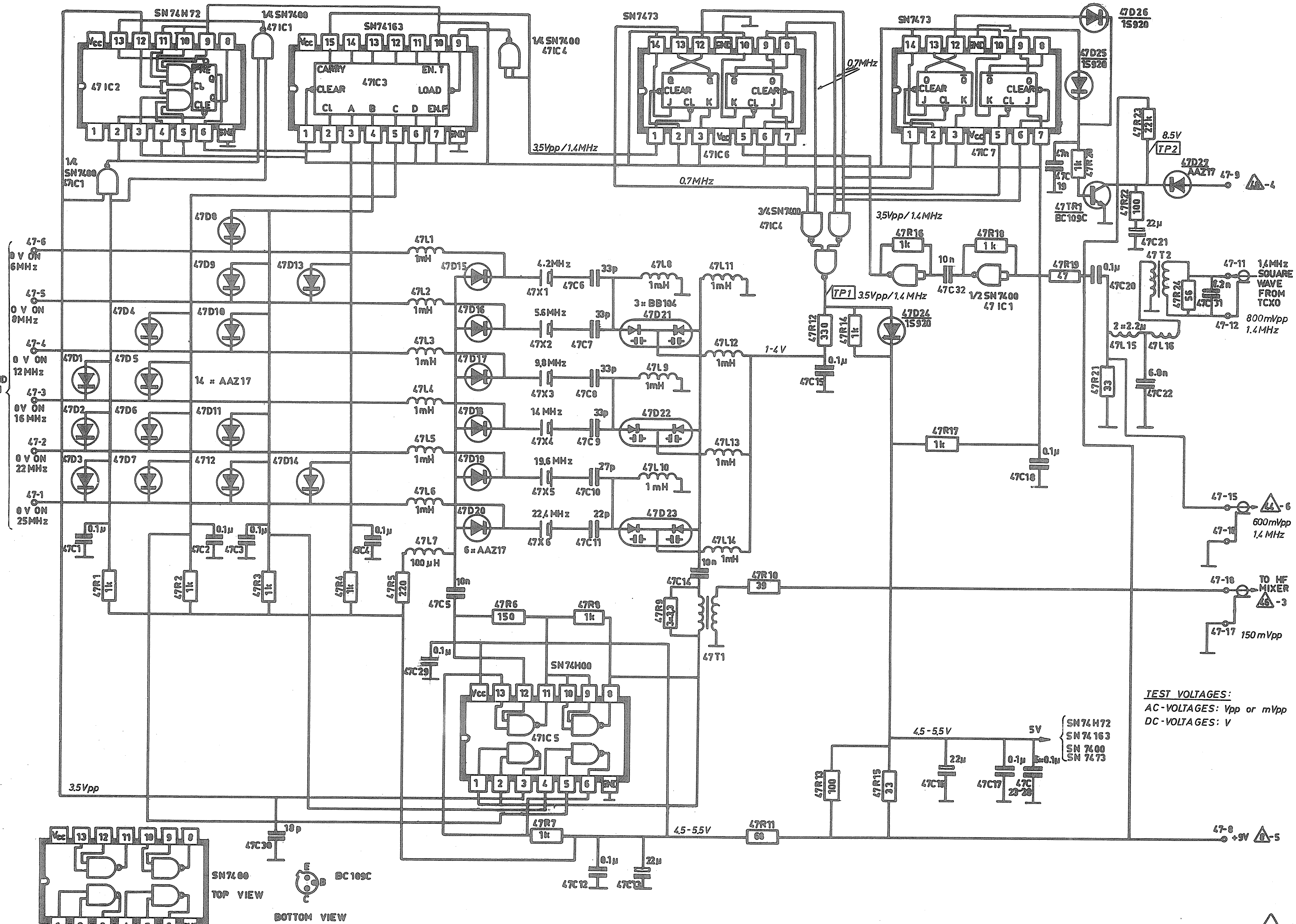
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



T - 0028 - 2 HF - MIXER

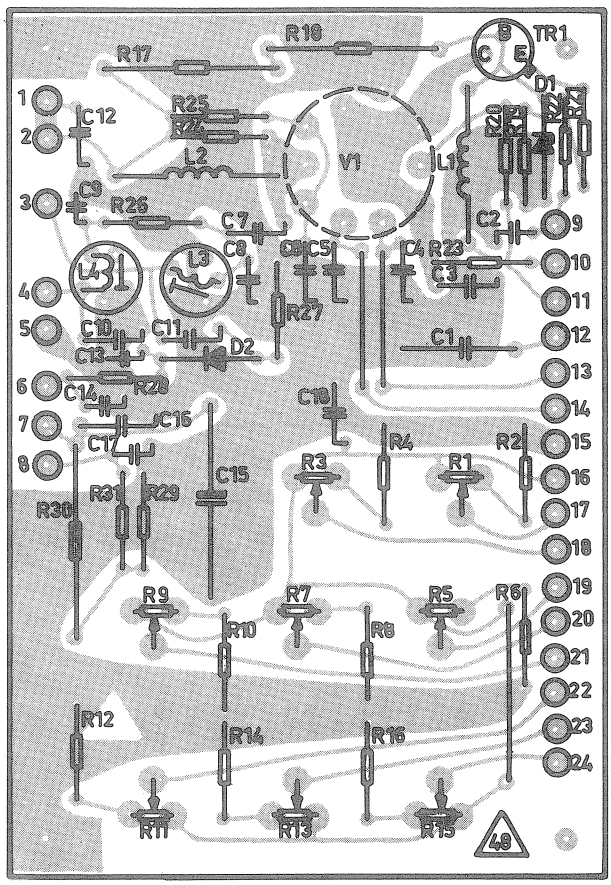


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

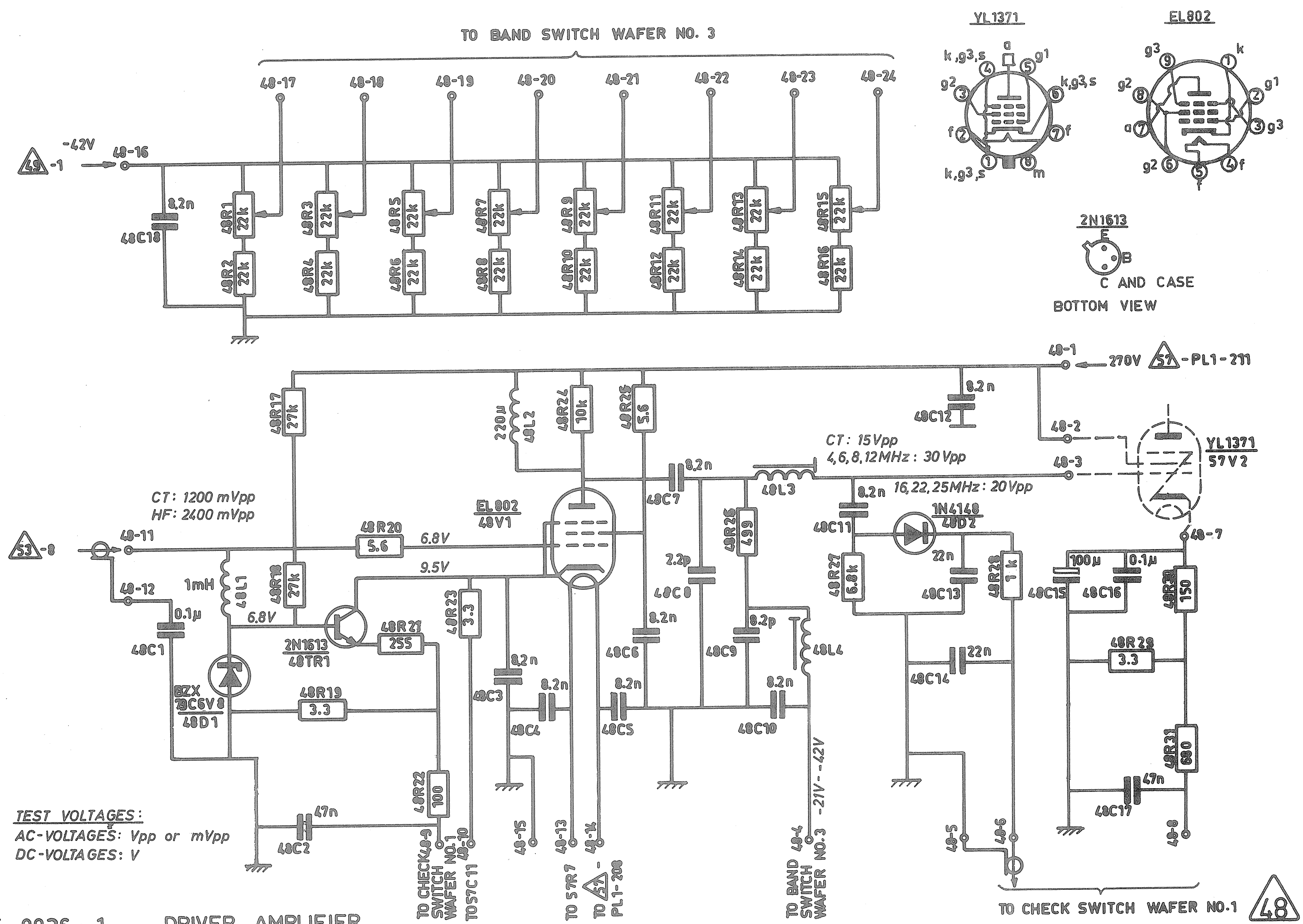


T-0032-4 HF HARMONIC FILTER

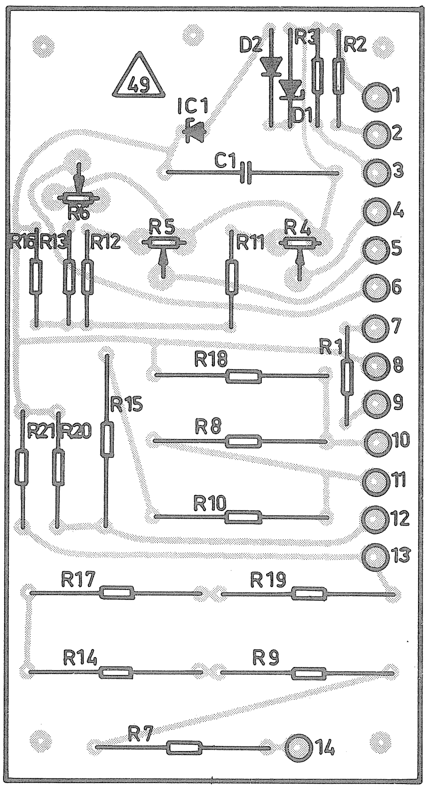
47



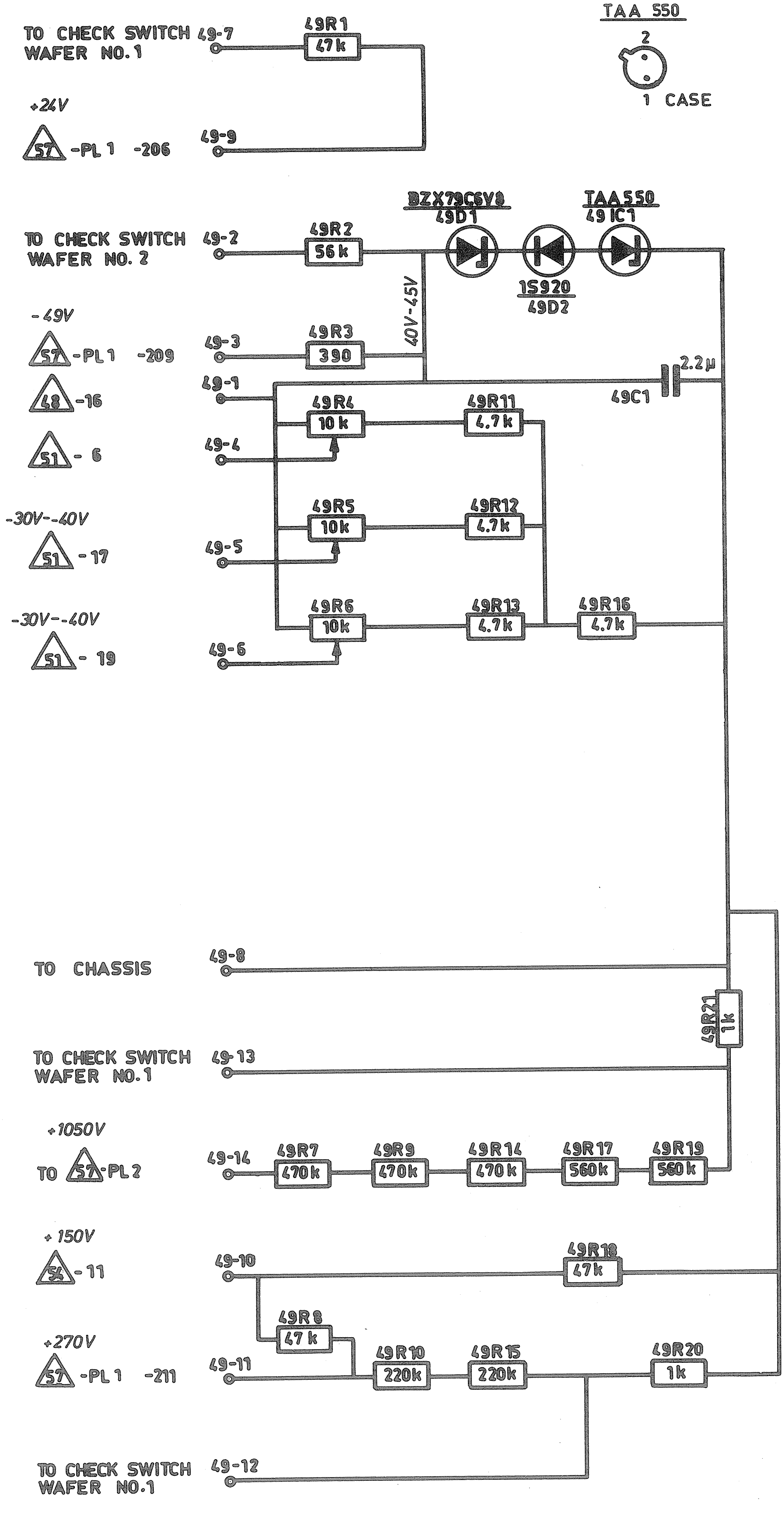
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



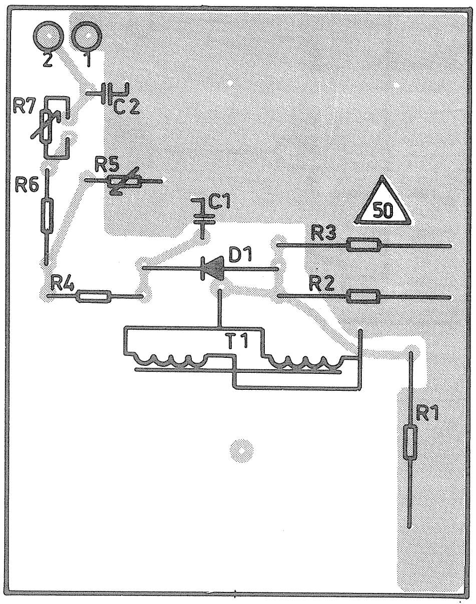
T-0036-1 DRIVER AMPLIFIER



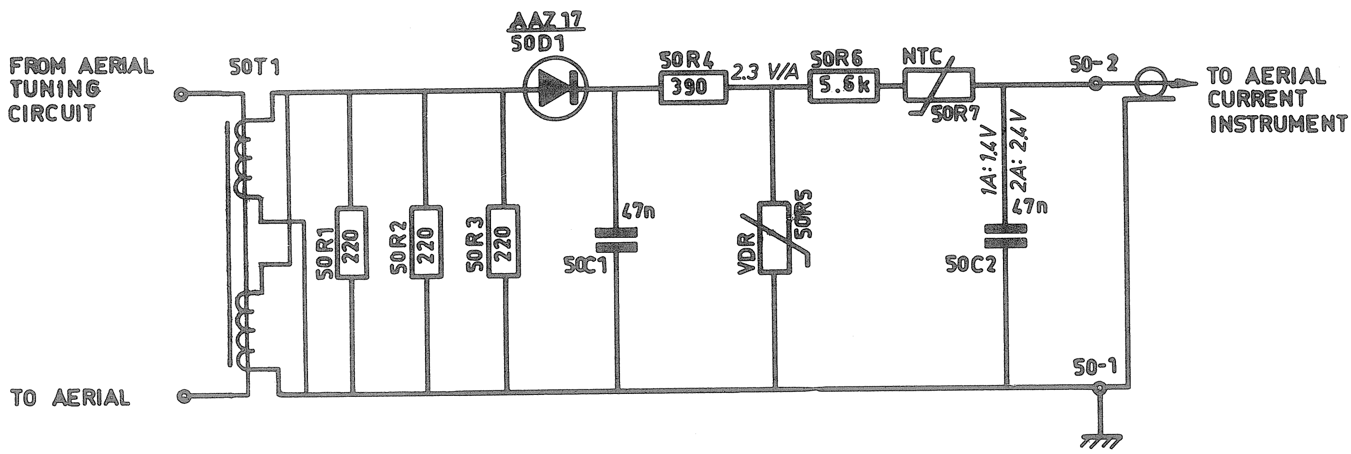
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



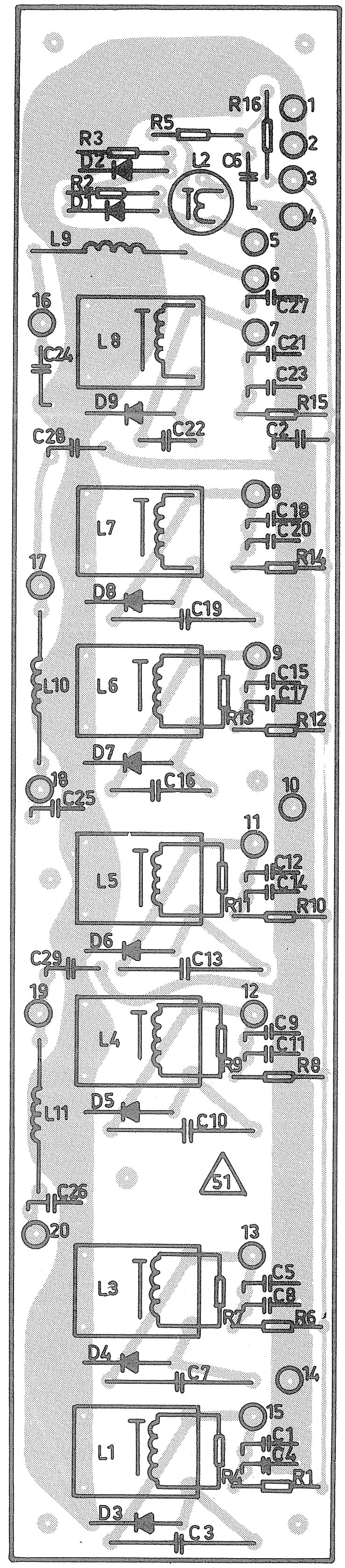
T - 0040 - 1 GRID VOLTAGE STABILIZER



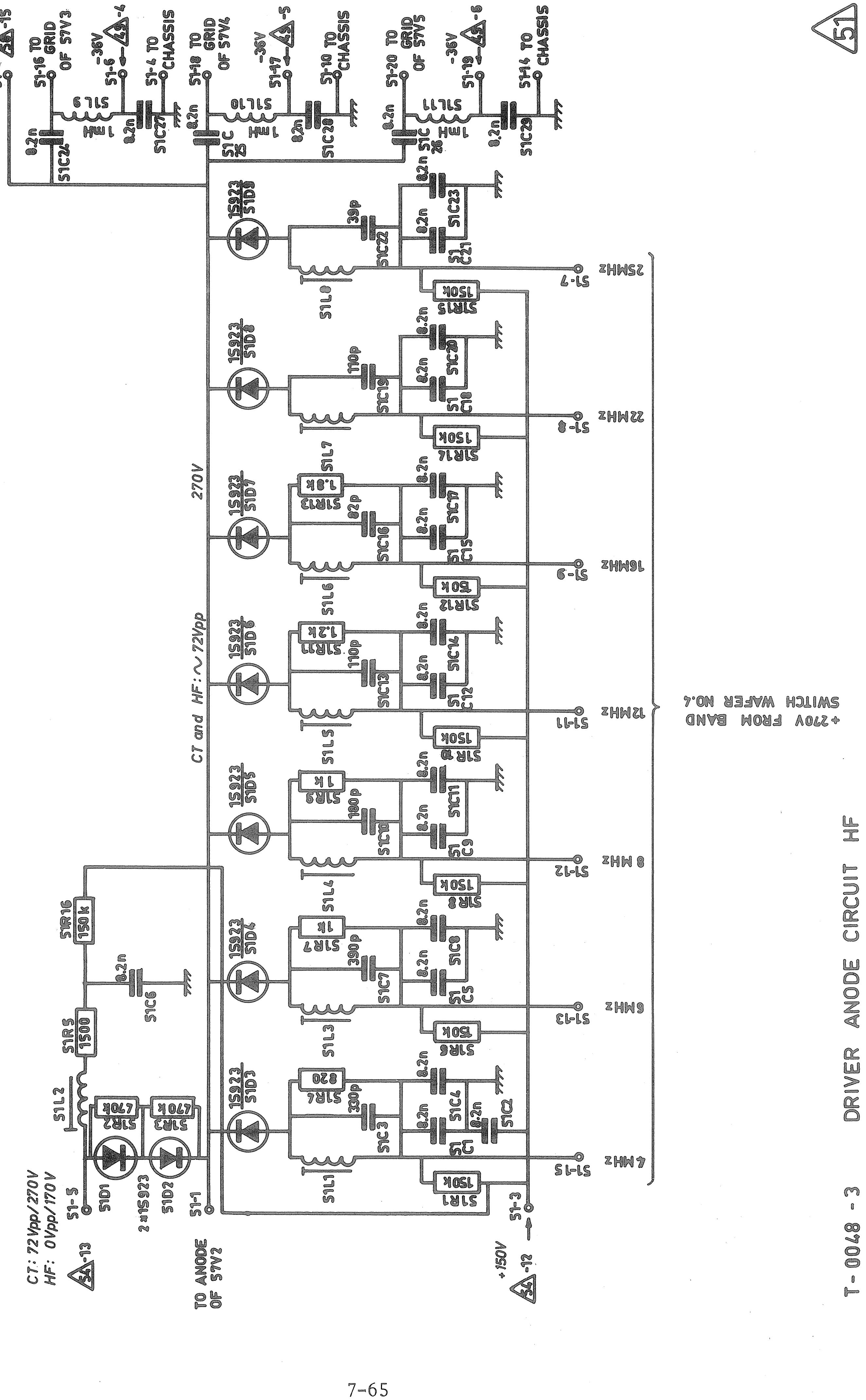
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



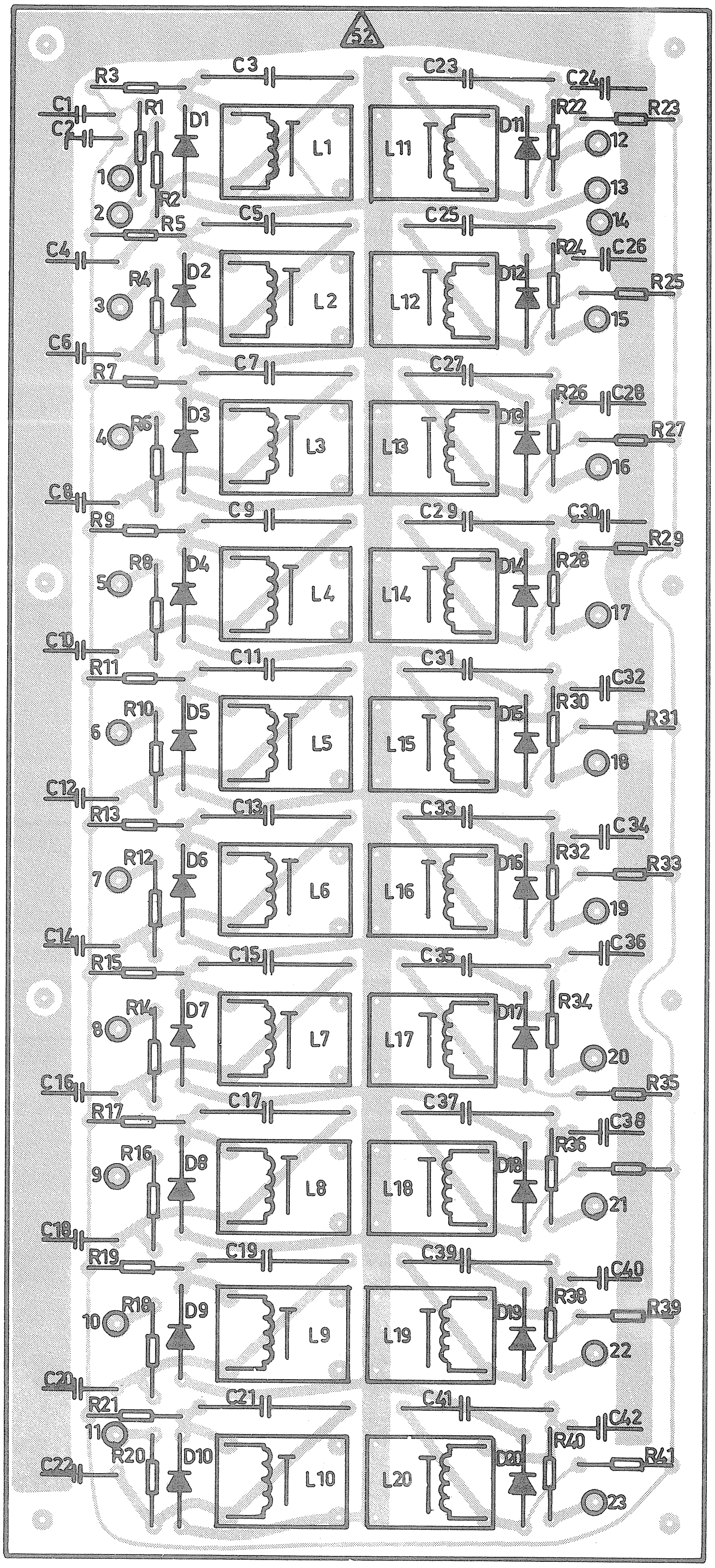
T - 0044 - 1 AERIAL CURRENT METER CIRCUIT



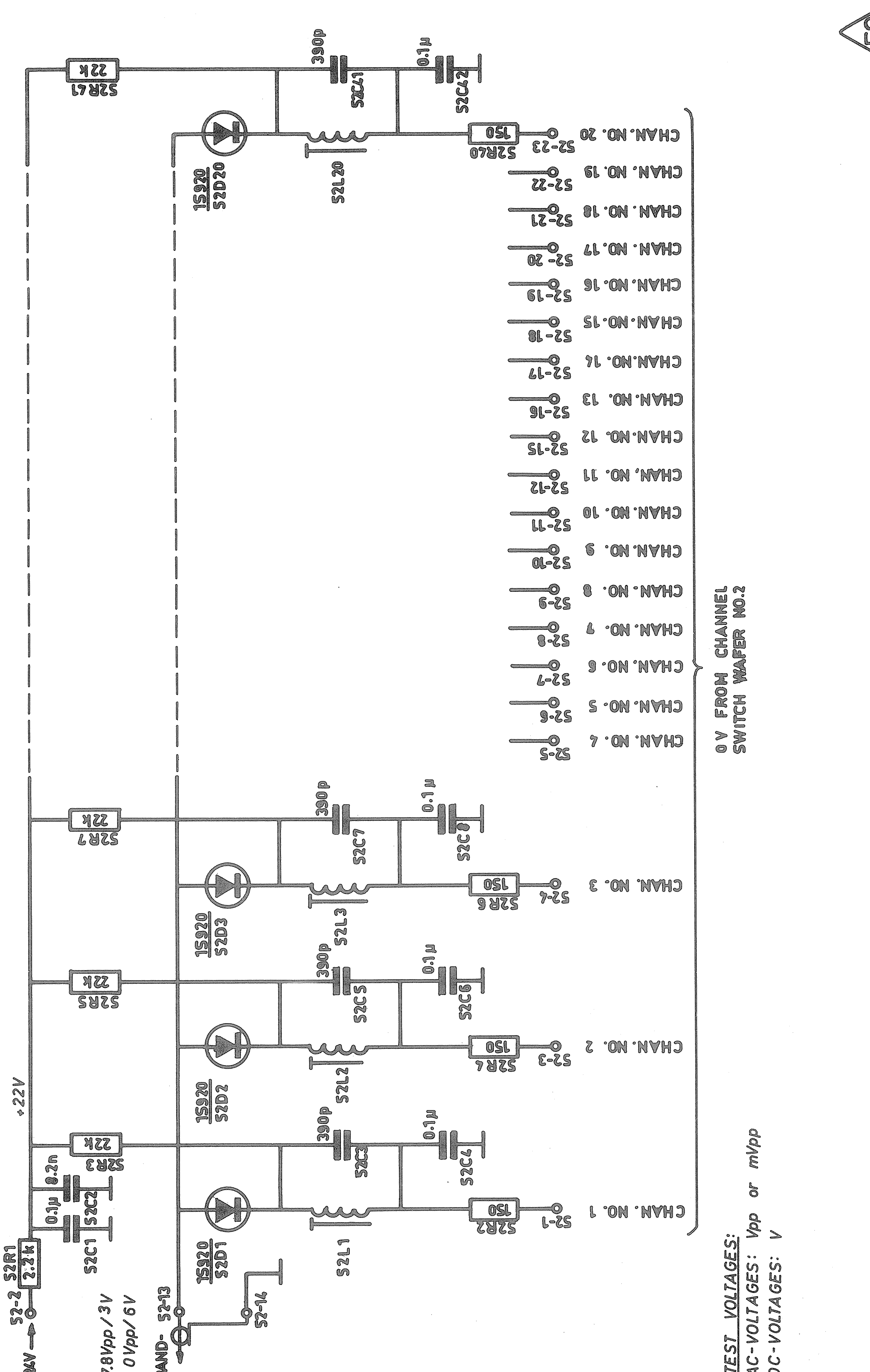
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



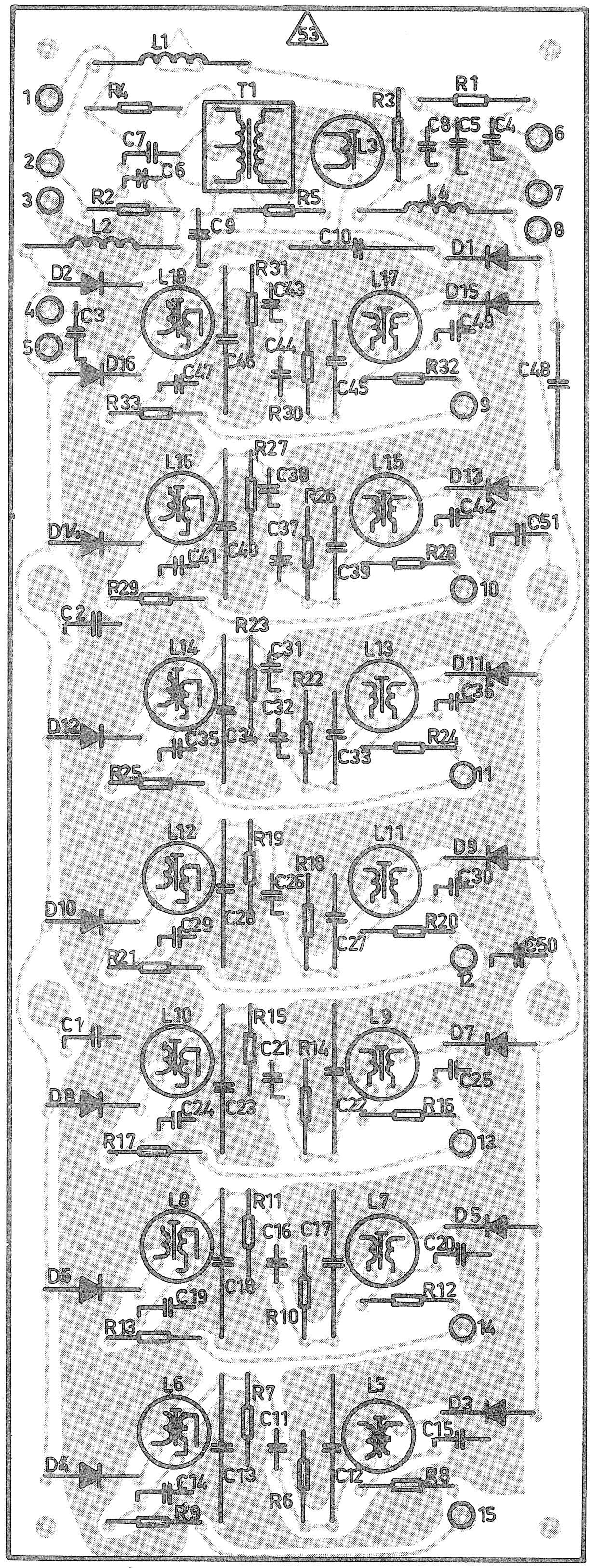
T-0048-3 DRIVER ANODE CIRCUIT HF



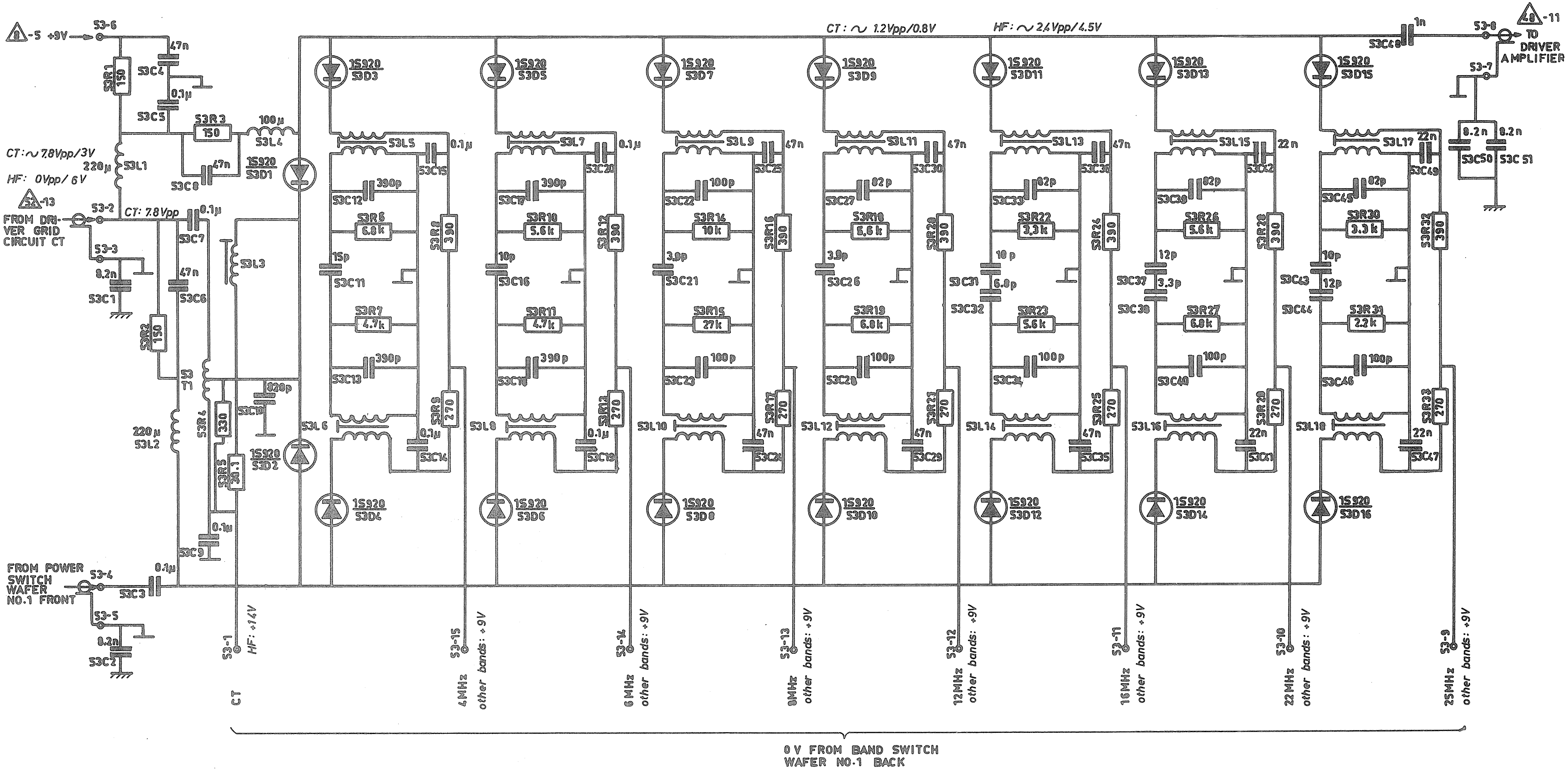
PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE



T-0060-1 DRIVER GRID CIRCUIT CT

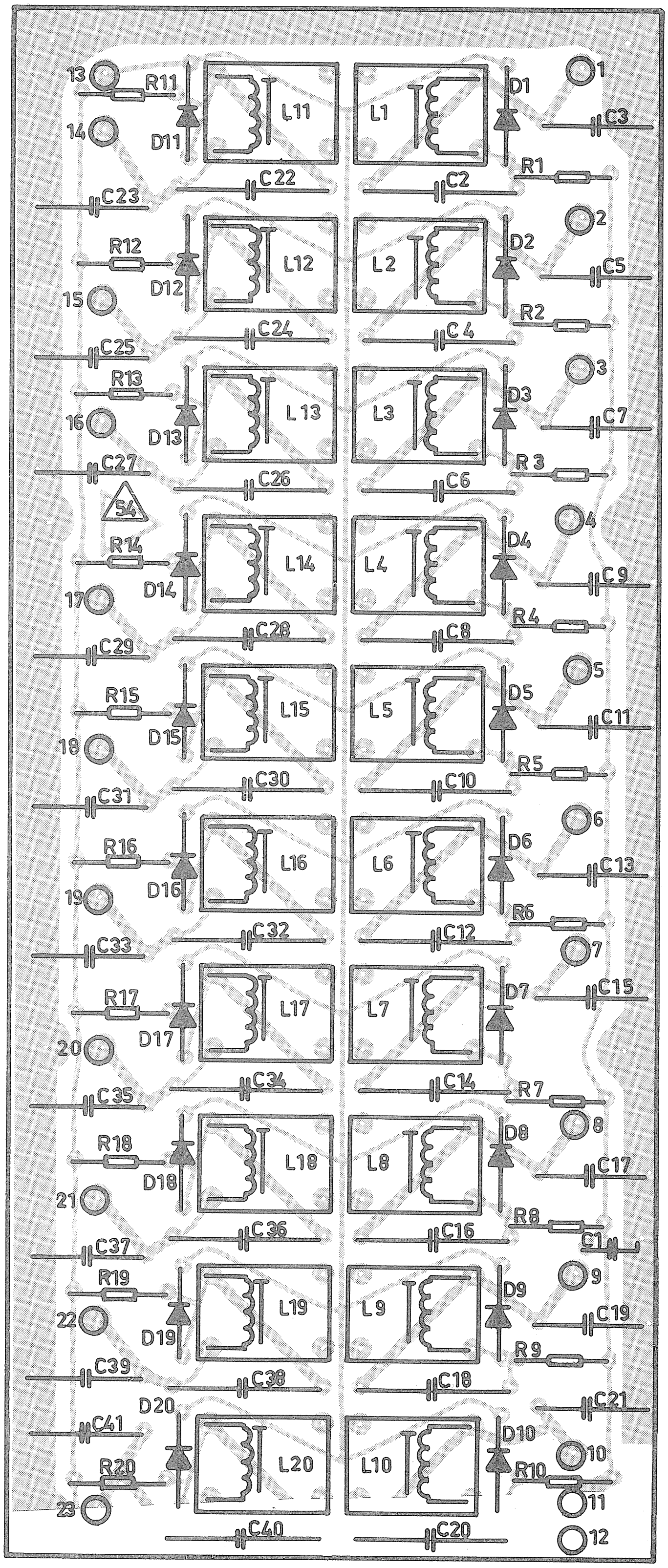


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

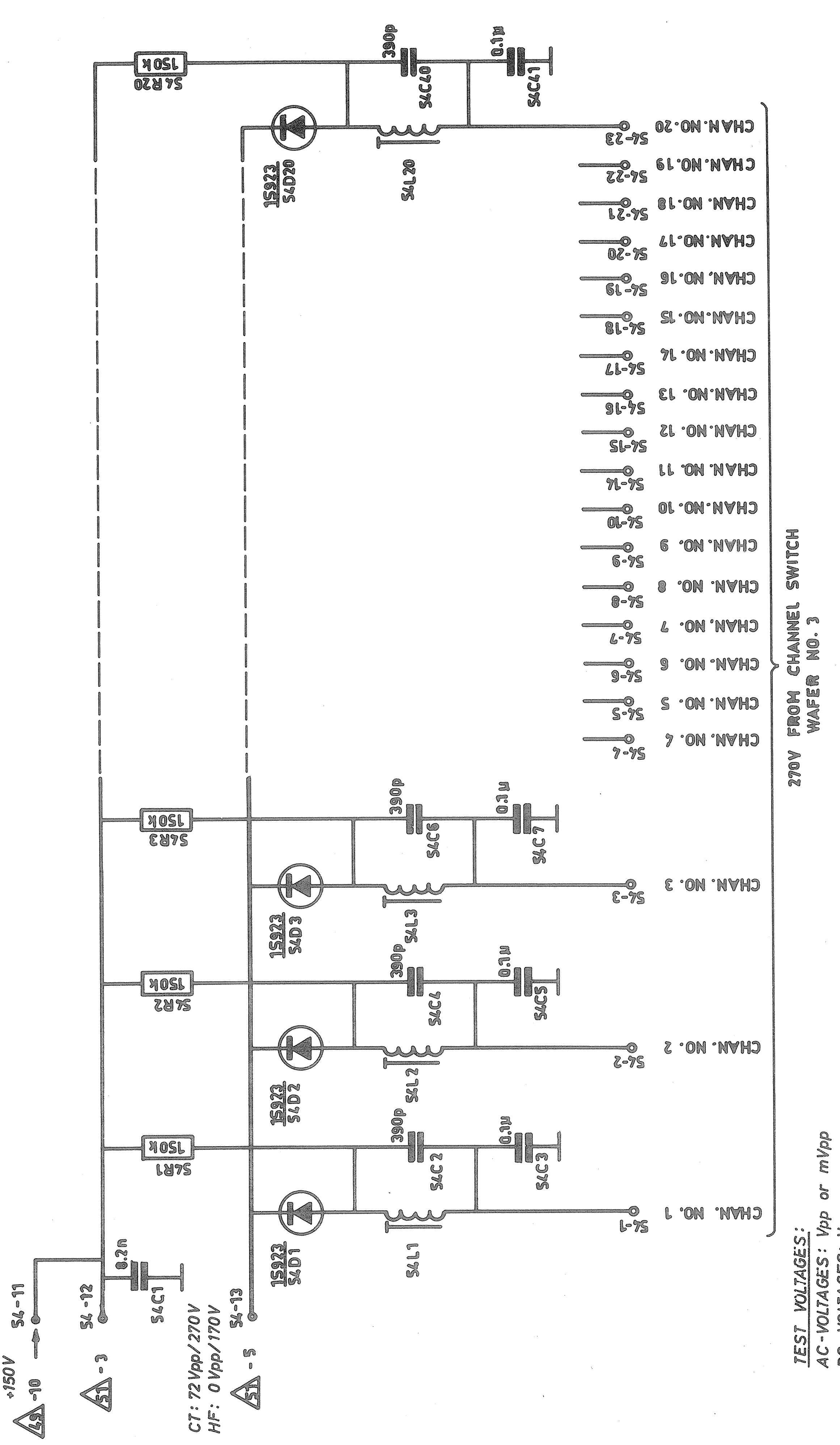


T-0052-4 HF-BANDFILTERS

53

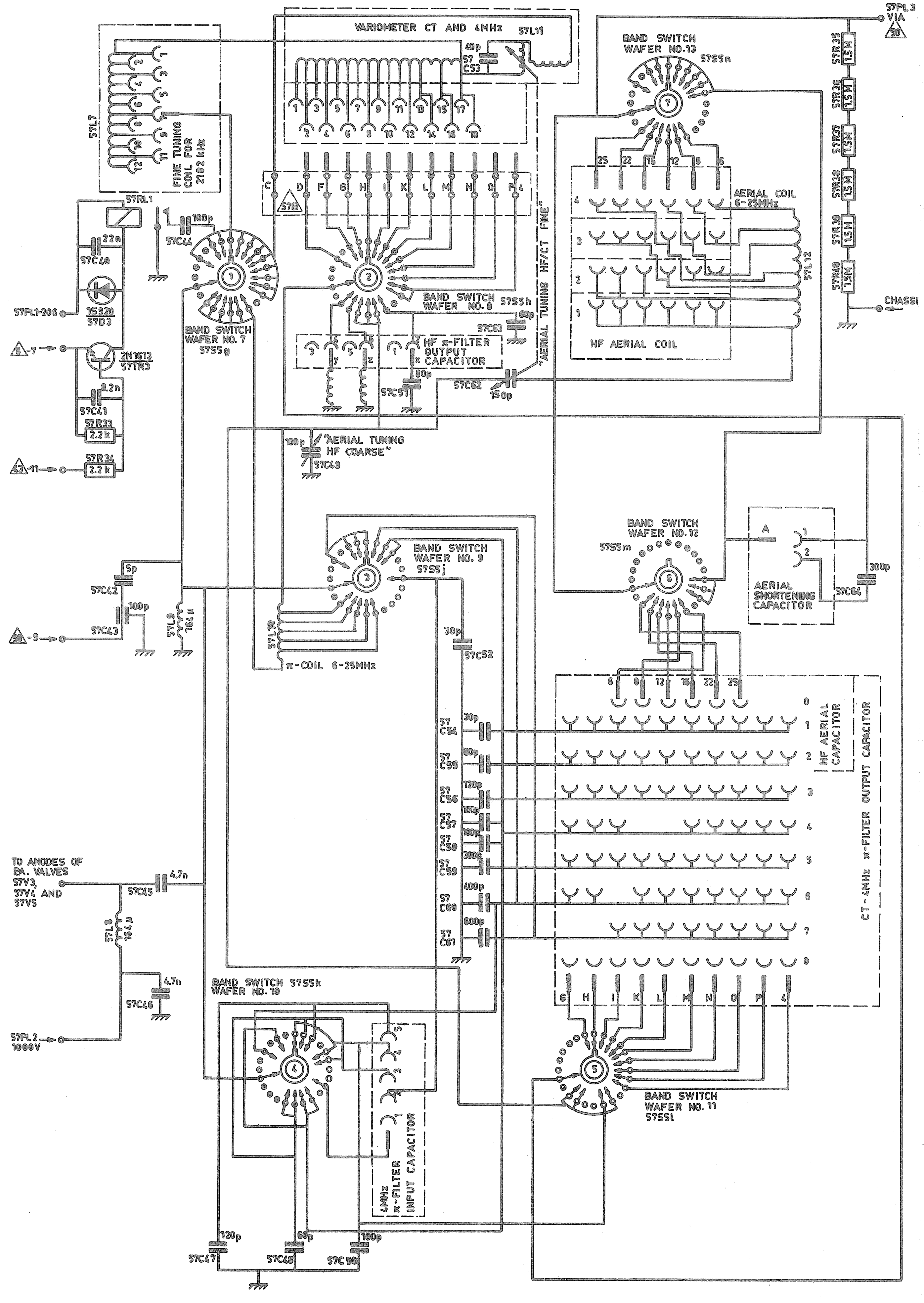


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

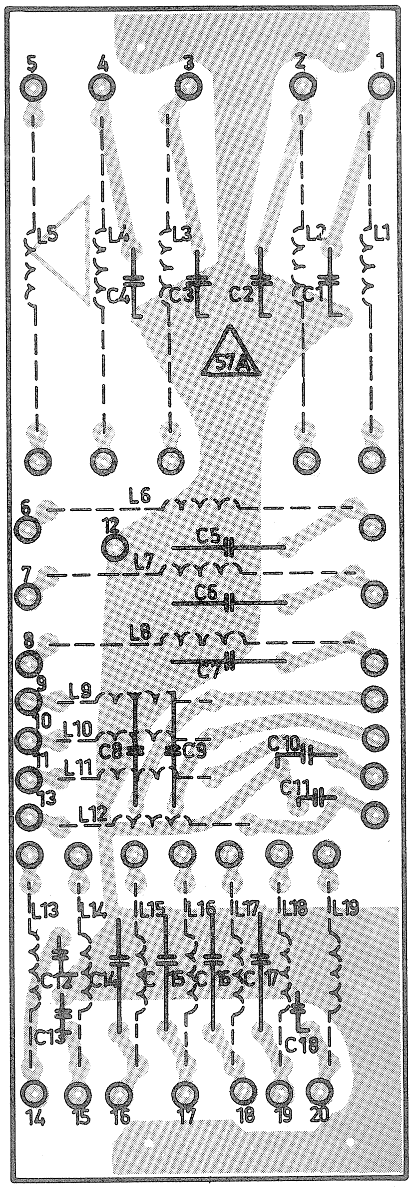


54

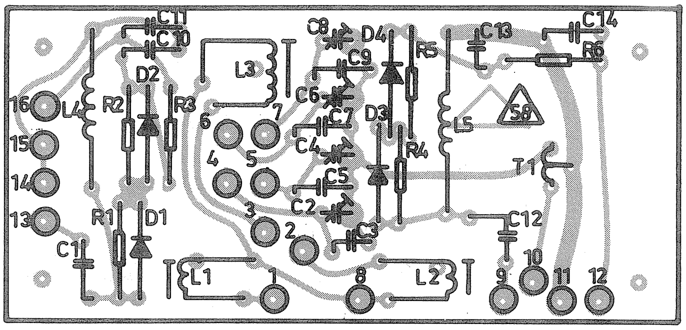
T-0056-2 DRIVER ANODE CIRCUIT CT



VARIOMETER CT AND 4MHz
57L11
40p
57 C53
57PL3 VIA
BAND SWITCH WAFER NO.13
57S5n
57R35 1.5M
57R36 1.5M
57R37 1.5M
57R38 1.5M
57R39 1.5M
57R40 1.5M
CHASSI
57L7
FINE TUNING COIL FOR 2182 kHz
57RL1
22n
57C40
100p
57C44
57PL1-206
1S920
57D3
2N1613
57TR3
8.2n
57C41
57R33
2.2k
57R34
2.2k
BAND SWITCH WAFER NO. 7
57S5g
BAND SWITCH WAFER NO. 8
57S5h
80p
57C63
HF π-FILTER OUTPUT CAPACITOR
80p
57C51
57C62
150p
"AERIAL TUNING HF/CT FINE"
AERIAL COIL 6-25MHz
57L12
HF AERIAL COIL
100p
"AERIAL TUNING HF COARSE"
57C49
BAND SWITCH WAFER NO. 9
57S5j
5p
57C42
100p
57C43
57L9 164µ
57L10
π-COIL 6-25MHz
30p
57C52
BAND SWITCH WAFER NO. 12
57S5m
AERIAL SHORTENING CAPACITOR
300p
57C64
HF AERIAL CAPACITOR
CT-4MHz π-FILTER OUTPUT CAPACITOR
30p 57 C54
80p 57 C55
120p 57 C56
100p 57 C57
100p 57 C58
300p 57 C59
400p 57 C60
600p 57 C61
TO ANODES OF PA. VALVES 57V3, 57V4 AND 57V5
4.7n
57C45
57L8 164µ
4.7n
57C46
57PL2 1000V
BAND SWITCH 57S5k WAFER NO. 10
4MHz π-FILTER INPUT CAPACITOR
BAND SWITCH WAFER NO. 11
57S5l
120p
57C47
60p
57C48
100p
57C50

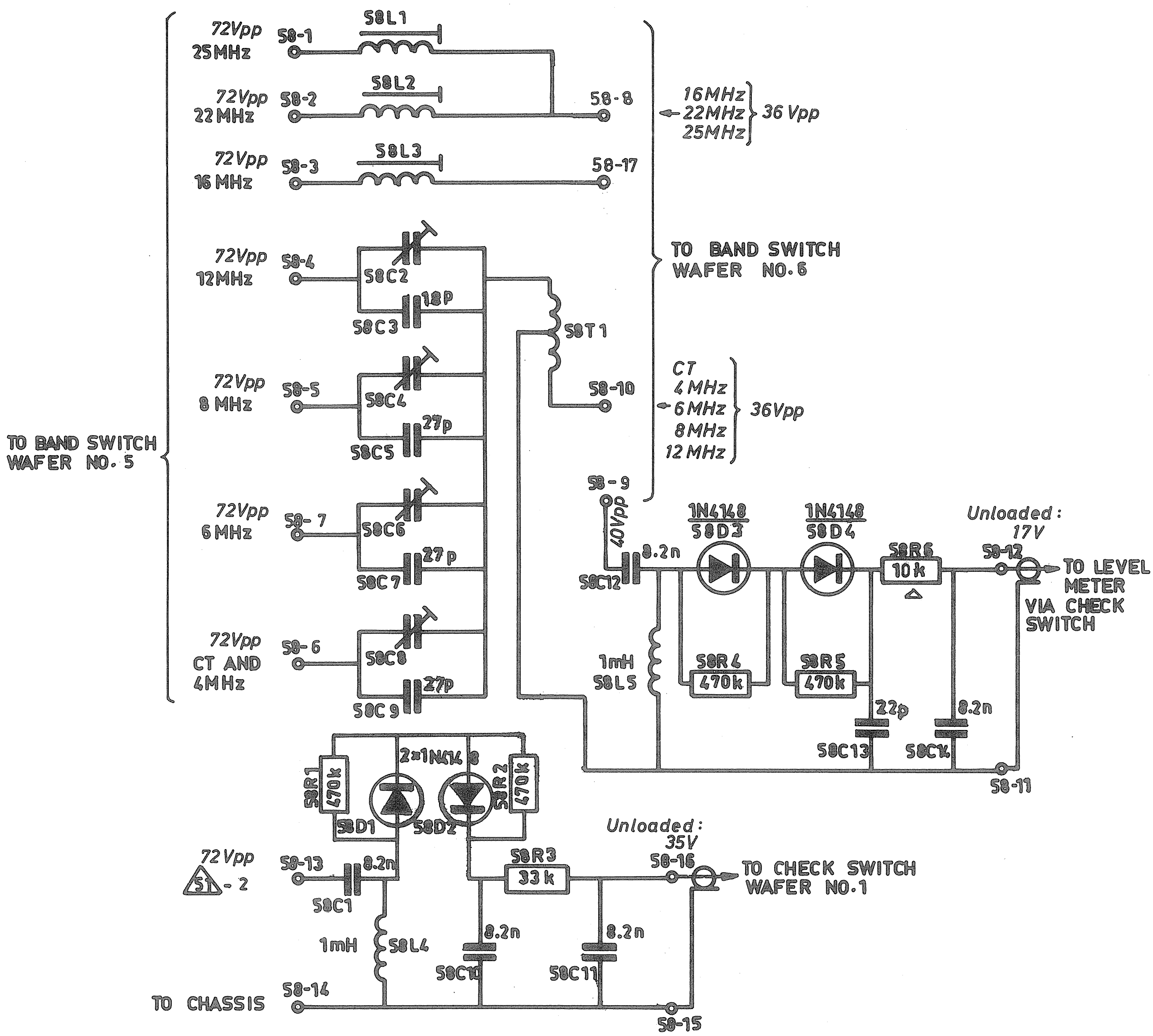


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

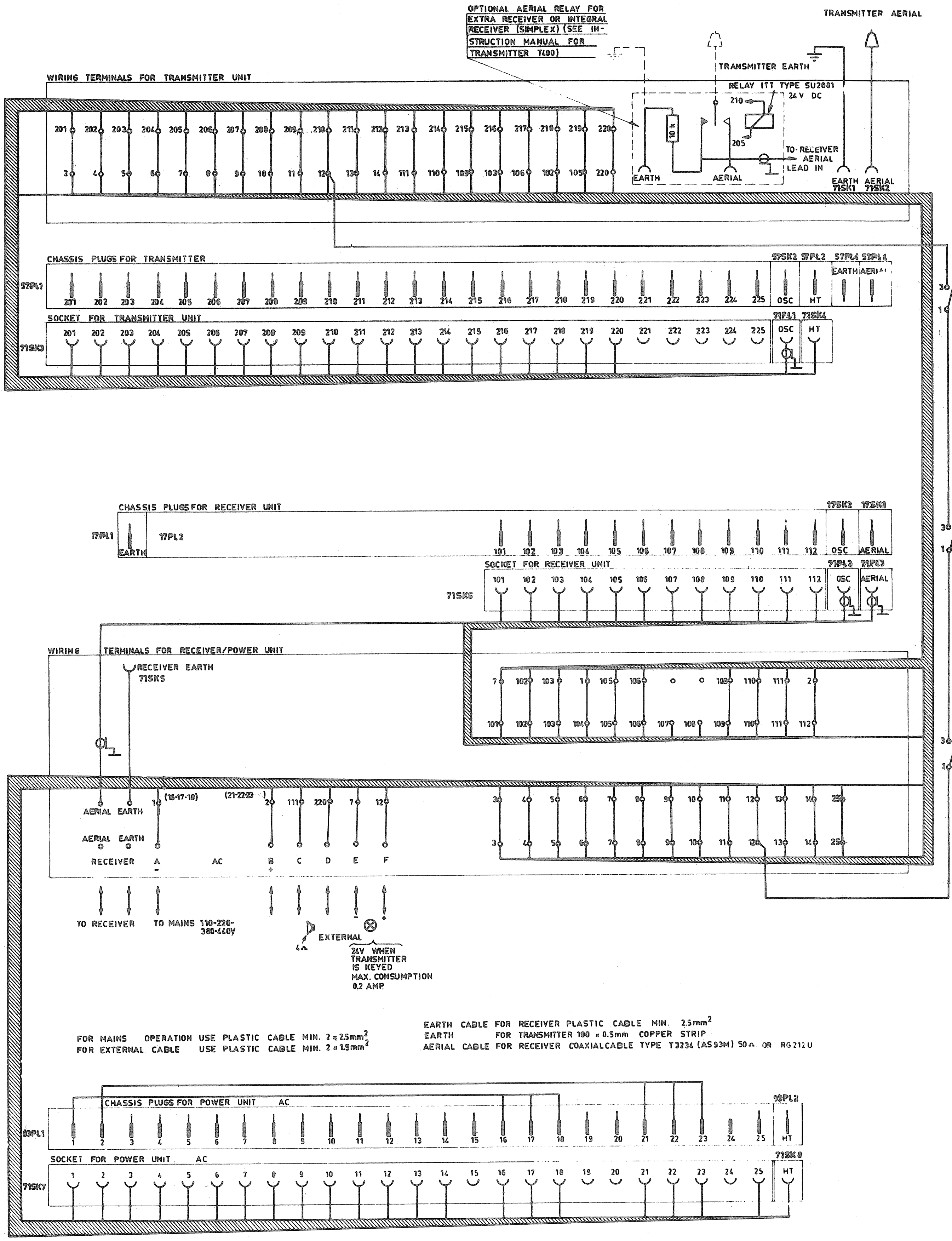


PRINTED CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

T-0149-1



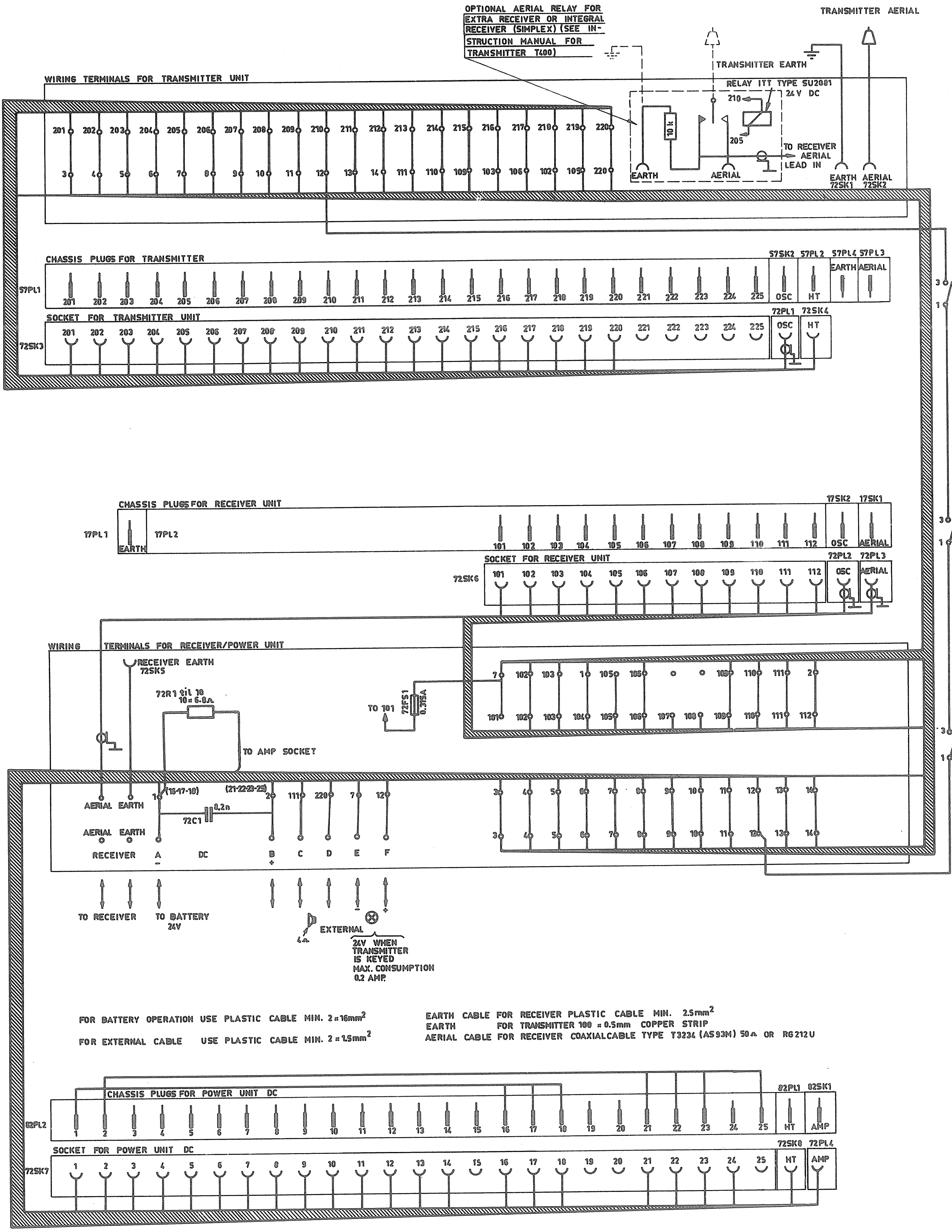
TEST VOLTAGES:
AC-VOLTAGES: Vpp or mVpp
DC-VOLTAGES: V



CAUTION: IN INSTALLATIONS FOR DUPLEX OPERATION IT IS NECESSARY TO USE SEPARATE EARTH CONNECTIONS FOR RECEIVER AND TRANSMITTER.

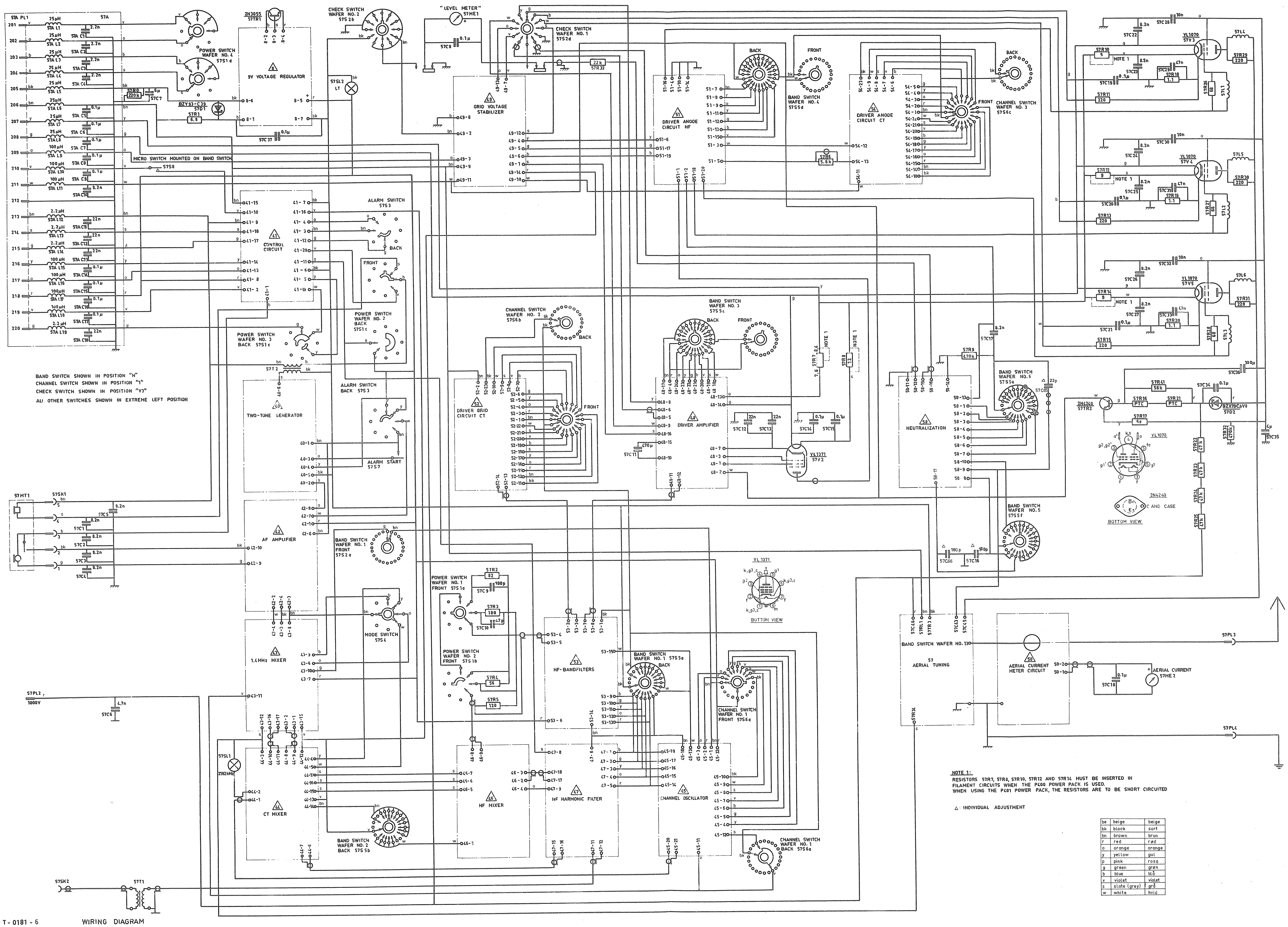
TERMINALS ARE NUMBERED IN THE FOLLOWING ORDER.
POWER UNIT, RECEIVER, TRANSMITTER, EXTERNAL CONNECTIONS.

T-0379-2 RACK INTERNAL WIRING DIAGRAM AC



<u>CAUTION:</u> IN INSTALLATIONS FOR DUPLEX OPERATION IT IS NECESSARY TO USE SEPARATE EARTH CONNECTIONS FOR RECEIVER AND TRANSMITTER.

TERMINALS ARE NUMBERED IN THE FOLLOWING ORDER.
POWER UNIT, RECEIVER, TRANSMITTER, EXTERNAL CONNECTIONS.



NOTE 1:
RESISTORS 57R7, 57R8, 57R10, 57R12 AND 57R14 MUST BE INSERTED IN FILAMENT CIRCUITS WHEN THE P400 POWER PACK IS USED.
WHEN USING THE P401 POWER PACK, THE RESISTORS ARE TO BE SHORT CIRCUITED

△: INDIVIDUAL ADJUSTMENT

be	beige	beige
bk	black	sort
bn	brown	brun
r	red	rød
o	orange	orange
y	yellow	gul
p	pink	rosa
g	green	grøn
b	blue	blå
v	violet	violet
s	slate (grey)	grå
w	white	hvid

T-0181-6 WIRING DIAGRAM