

STORNO RADIOCOMMUNICATION



**FIXED
VHF RADIO STATION
TYPE CQF11-2,-3
136.....174 Mc/s
TYPE CQF31-2,-3
68.....88 Mc/s**

Storno

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TYPE CQF11-2,-3
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C o n t e n t s

CHAPTER I. FIXED VHF RADIO STATION

A. General Description

This technical handbook contents all informations about the following radiotelephone stations:

CQF11-2: 136 .. 174 Mc/s, 50 kc/s channel spacing
 CQF11-3: 136 .. 174 Mc/s, 25 kc/s channel spacing
 CQF31-2: 68 .. 88 Mc/s, 50 kc/s channel spacing
 CQF31-3: 68 .. 88 Mc/s, 25 kc/s channel spacing

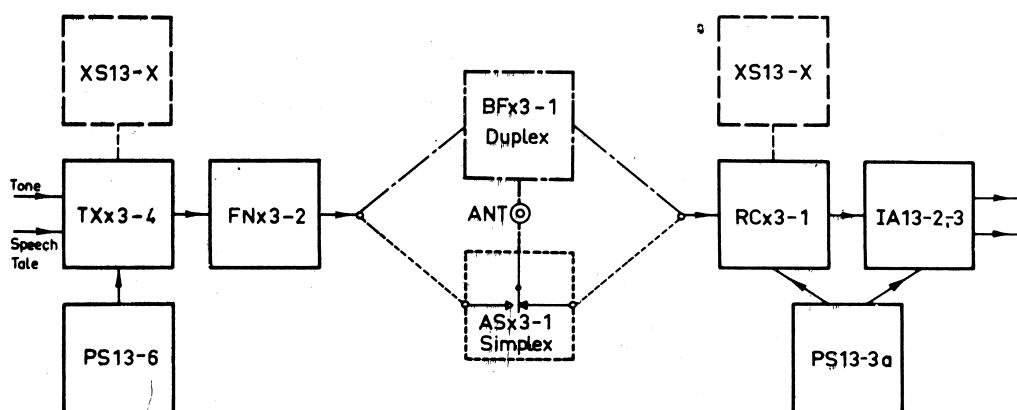
The transmitters are capable of giving approximately 25 or 50 watt output. Furthermore the stations can be equipped with up to 6 channel crystal shift units, if more than 1 channel is required.

The radiostations are delivered for simplex or duplex or repeaterstations. The control equipment in connection with selective calling, repeater functions etc. is described in a separate technical handbook wherein possible modifications in the radio equipment itself are described, too.

The equipment exceed the specifications laid down in the EIA STANDARD and the GPO STANDARD for Land- Mobile Communication.

A standard radiotelephone comprises the following subunits:

| Type | CQF11-2 | CQF11-3 | CQF31-2 | CQF31-3 |
|--------------------------|---------|---------|---------|---------|
| Transmitter | TX13-4 | | TX33-4 | |
| Antenna filter | FN13-2 | | FN33-2 | |
| Receiver converter | RC13-1 | | RC33-1 | |
| IF-amplifier | IA13-1 | IA13-2 | IA13-1 | IA13-2 |
| Transmitter power supply | PS13-6 | | | |
| Receiver power supply | PS13-3a | | | |



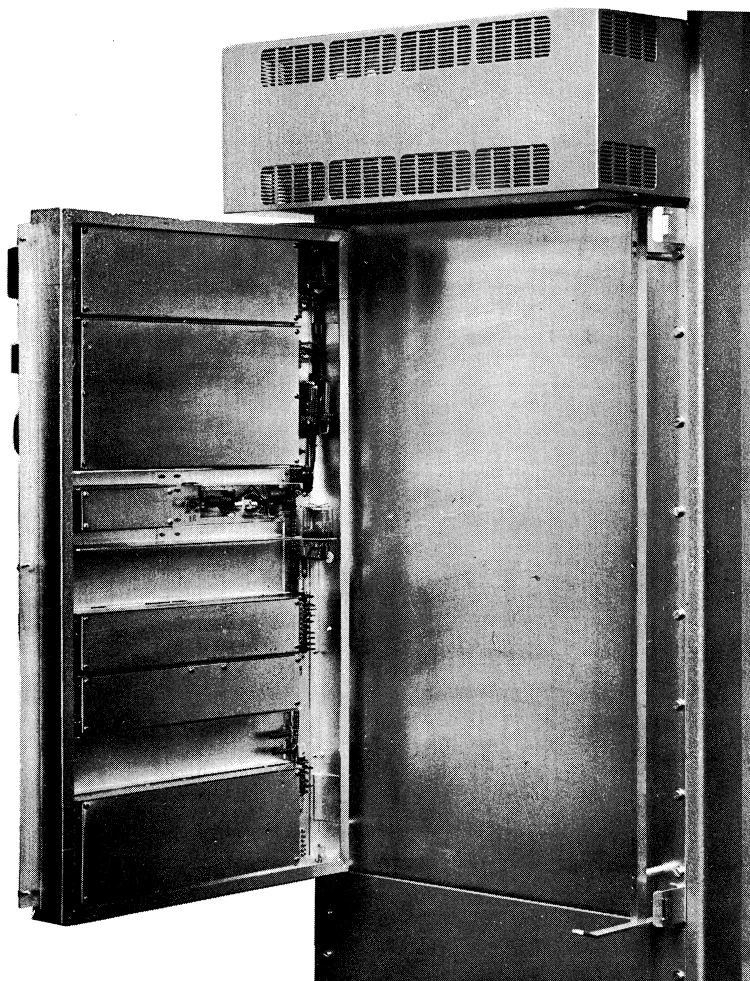
Chapter I. Fixed VHF Radio Station

To the standard module units can be added a variety of similar module units to form a system to individual requirements. The following subunits are described in this handbook and may be supplied as standard:

| Type | CQF11-2 | CQF11-3 | CQF31-2 | CQF31-3 |
|-------------------------|---------|---------|---------|---------|
| Antenna switch simplex | AS13-1 | | | |
| Branching filter duplex | BF13-1 | | BF33-1 | |
| Simplex channel shift | | | | |
| 1 channel | - | XS13-4 | - | - |
| 2-3 channels | XS13-5 | XS13-6 | XS13-5 | XS13-5 |
| 4-6 channels | XS13-7 | XS13-8 | XS13-7 | XS13-7 |
| Duplex channel shift | | | | |
| 1 channel | - | XS13-4 | - | - |
| 2-3 channels | XS13-7 | XS13-8 | XS13-7 | XS13-7 |
| 4-6 channels | XS13-7 | XS13-8 | XS13-7 | XS13-7 |

Construction

A standard radiotelephone consists of subunits (modules), which are mounted on a standard swinging frame suitable for placing in a standard 19" rack. The frame occupies 28" of rack height excluding meter panels, blowers etc.



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A dust cover is placed over the equipment and fixed to the frame by four springs. All modules are mounted so that the valves lie horizontally at right angles to the front face. The rear of the modules is protected from dust and dirt by panels, which may be removed for servicing. During the final alignment procedure, these panels must be in position as the frequency otherwise may be affected.

Three connectors are mounted on the swinging frame - one for the mains supply, one for the signal wiring and one for the meter and the control wires. The transmitter keying relay is placed directly on the frame. RF-coaxial connectors for transmitter and receiver are located on the respective module chassis.

The equipment is cooled by natural convection. For this purpose slots are provided at top and bottom of the dust cover.

The equipment is fully tropicalized.

**Equipment
Location**

Because of the swinging frame system the rack can be placed against a wall which normally occupies the minimum space. Besides all components and valves can be reached from the front.

Ventilation

Installation of the equipment in a small shack or attic where the room temperature may rise far above the outside temperature due to direct sunrays or the heat generated by the equipment itself may necessitate some means of ventilation.

The obvious solution is to install a standard exhaust fan, and to provide an air intake on the shadow side of the building. The fan may be governed by a standard room thermostat of conventional type.

Mains Supply

The supply voltage is normally 110/220 V AC. If this voltage varies up to $\pm 10\%$ then the equipment will meet the specifications in all points except that the transmitter output power will rise or fall with the mains voltage. The equipment will, however, function with voltage variations up to $\pm 20\%$.

If the average mains voltage differs more than $\pm 5\%$ from the nominal values (220/110V), it is recommended to insert an auto-transformer in order to compensate for this difference. If the mains voltage variation is generally in the order of $\pm 10\%$, then a constant voltage device must be inserted between the equipment and the mains supply lines.

B. Service

As mentioned under A. the radiostation can be placed against a wall or placed free as the conditions demand. It should be observed that the ambient temperature during normal operation does not exceed the temperatures stated under C.

Chapter I. Fixed VHF Radio Station

Unpacking

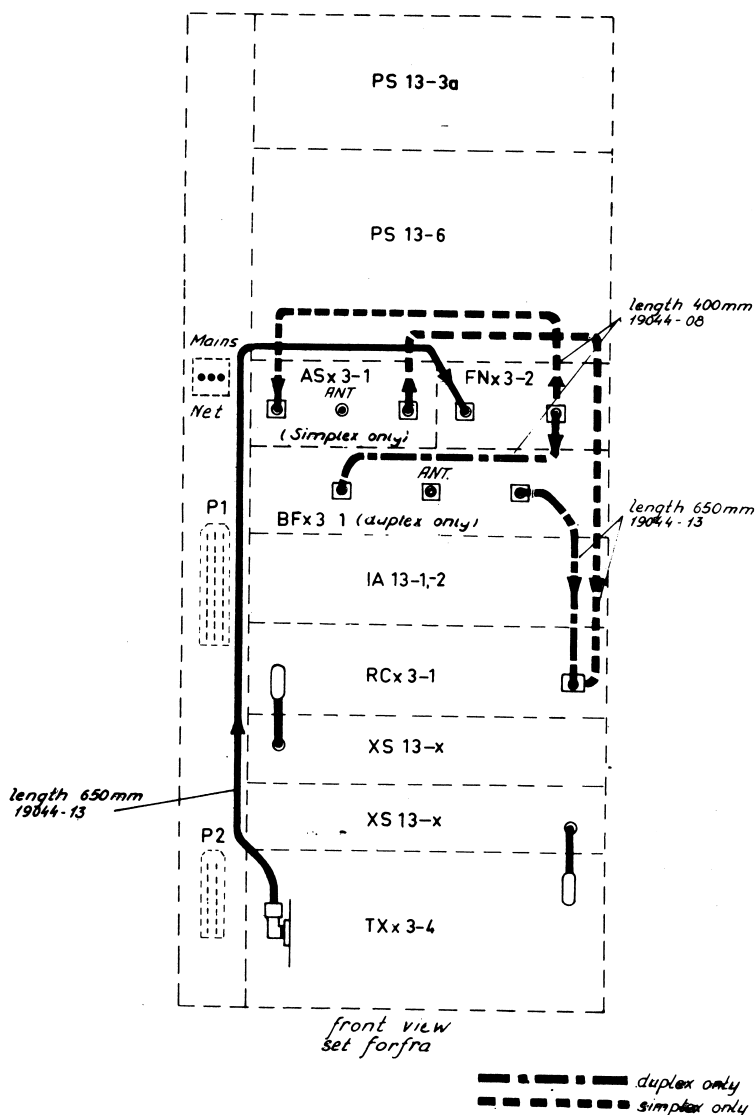
Great care should be taken when unpacking the equipment from its container as damage will result, and considerable delay will occur while spares are shipped.

If any units are shipped separately, see that they are inserted in their proper positions. Check unit types against the packing list.

The equipment is designed to be placed against a wall as this method occupies the minimum space. The equipment should not be operated at temperatures lower than -30°C .

Intercabling

The RF-cabling between the subunits is shown on the following drawing. The ordinary cabling between the subunits is shown on the diagram D 400.032/3 in chapter IV. If the radiostation is equipped with a special control system the cabling diagram in the belonging instruction manual should be followed as this diagram shows all modifications made to suit this particular control equipment.



Initial Testing

Do not attempt any initial testing before carefully reading through the whole instruction manual. Switch on one group of units at a time. If operation is not successful at first, check for installation faults, defective valves, etc.

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Complicated
Faults

If a fault cannot be identified as one of the "simple" faults mentioned above, it is usually due to failure of a component inside one of the subunits. Its location and repair may require a more qualified treatment and the use of test instruments.

Interference
Suppression

If noise is present, such as noise produced by commutation, spark plugs, telegraph apparatus, etc., weak signals will be difficult to hear and therefore some suppression will be necessary. The equipment is constructed with this possibility in mind whenever possible, ferroresistors, decoupling capacitors and coils have been used.

As in all interference suppression problems, the treatment is largely a matter of trial and error, - no absolute 100 % cure is possible, but location of the interference and suppression of it with the aid of capacitors, resistors and chokes will reduce the interference to a practical minimum. Generally the addition of capacitors across the brushes of a commutator will suffice. With the high voltage systems (spark plugs on an internal combustion engine) a high resistance in series with the plug and capacitors on coils and distributors will be sufficient.

Much of the interference is picked up by the antenna so the antenna should be mounted as high and as far away as possible from the offending equipment.

C. Technical Specifications

GeneralFrequency Range

CQF11-2-3: 136 ... 174 Mc/s.

CQF31-2-3: 68 ... 88 Mc/s.

Min. Channel Separation

CQFxl-2: 50 kc/s.

CQFxl-3: 25 kc/s.

Max. Separation between Extreme Channels

CQF11-2-3: 0.8 Mc/s, with stagger-tuning 1.4 Mc/s.

CQF31-2-3: 0.4 Mc/s, with stagger-tuning 0.7 Mc/s.

Number of RF-Channels

Up to 6 RF-channels, but a greater number may be supplied.

Modulation Frequency Band

Speech channel: 0.3 ... 3.0 kc/s.

Tone channel: CQFxl-2: 0.3 ... 8.0 kc/s.

CQFxl-3: 0.3 ... 5.0 kc/s.

Antenna Impedance

50 Ω .

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Temperature Range during Operation

| | Ambient air temperature | |
|---------------------------------|-------------------------|-------------------------|
| | Max. recom. average | Max. during hot days |
| 50 watt interm. 20 % duty cycle | 40°C | 50°C |
| 50 watt interm. 50 % duty cycle | 35°C | 45°C |
| 25 watt continuous | 30°C | 40°C |
| 50 watt continuous | 25°C | 35°C |

Individual transmission intervals may be anything up to approx. 5 minutes, with corresponding standby intervals to give the stated duty cycle.

Permanent damage will not be the result if the above maximum temperatures are exceeded, and the equipment will probably survive occasional peaks up to 10°C higher. The equipment will thus operate with intermittent transmission in any reasonable location, even in tropical climate. For continuous operation, however, it is recommended to provide ventilation or air conditioning, if necessary, in order to obtain maximum reliability and trouble-free operation.

TransmitterOutput Power

50 watt or 25 watt.

Max. Frequency Deviation

CQFxl-2: ± 15 kc/s.

CQFxl-3: ± 5 kc/s.

Frequency Stability

CQFxl-2 + CQF31-3: Better than $\pm 15 \times 10^{-6}$.

CQF11-3: Better than $\pm 5 \times 10^{-6}$.

Frequency Multiplication

$2 \times 4 \times 3 \times 1 \times 1 = 24$.

Spurious Radiation

Harmonics attenuated more than 75 dB.

Spurious attenuated more than 85 dB.

ModulationModulation Characteristic

Speech channel: Phase-modulation within 0.3 ... 3.0 kc/s.

Tone channel: Phase-modulation within 0.3 ... 3.0 kc/s.

Phase-modulation or frequency modulation
within 3.0 ... 8.0 kc/s.

Modulation Input Impedance

600 Ω balanced.

Max. Sensitivity

Tone channel: CQF11-2: -12 dBm at $F_m = 1$ kc/s and $\Delta F = 7.5$ kc/s.

CQF11-3: -22 dBm at $F_m = 1$ kc/s and $\Delta F = 2.5$ kc/s.

CQF31-2: -7 dBm at $F_m = 1$ kc/s and $\Delta F = 7.5$ kc/s.

CQF31-3: -15 dBm at $F_m = 1$ kc/s and $\Delta F = 2.5$ kc/s.

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Speech channel:

CQF11-2: -22 dBm at $F_m = 1$ kc/s and $\Delta F = 7.5$ kc/s.
 CQF11-3: -32 dBm at $F_m = 1$ kc/s and $\Delta F = 2.5$ kc/s.
 CQF31-2: -19 dBm at $F_m = 1$ kc/s and $\Delta F = 7.5$ kc/s.
 CQF31-3: -29 dBm at $F_m = 1$ kc/s and $\Delta F = 2.5$ kc/s.

When the transmitter unit is used in connection with control equipment the levels are set in accordance with the specifications given in the description of the control equipment.

Modulation Distortion (speech channel)

CQFxl-2: Less than 2.5 % for $\Delta F = 7.5$ kc/s at a modulation frequency of 1000 c/s.

CQFxl-3: Less than 2.5 % for $\Delta F = 2.5$ kc/s at a modulation frequency of 1000 c/s.

Modulation Limiter (Speech channel)

The transmitter modulation input is provided with an effective speech limiter restricting the modulation to max. ΔF .

FM Noise and Hum (Speech channel)

CQFxl-2: Attenuated more than 50 dB relative to $\Delta F = 10$ kc/s and $f_m = 1000$ c/s.

CQFxl-3: Attenuated more than 40 dB relative to $\Delta F = 3.3$ kc/s and $f_m = 1000$ c/s.

Valves - tubesValve Complement

| | Europ. | U.S. | S.Q. |
|---------------------|------------|-------|------|
| Modulator amplifier | ECC81 | 12AT7 | 6201 |
| Oscillator | EF91 | 6AM6 | 6064 |
| Phase-mod./doubler | ECC81 | 12AT7 | 6201 |
| Quadrupler | EF91 | 6AM6 | 6064 |
| Tripler | 5654/M8100 | 6AK5 | 5654 |
| Driver | QQE03/12 | 6360 | |
| Power amplifier | QQE06/40 | 5894 | |
| Clipper diodes | 0A200 | | |
| Monitor diode | GEX66 | | |

ReceiverSensitivity

CQF11-2,-3: 12 dB signal/noise ratio for less than 0.9 μ V emf with $\Delta F = 10$ kc/s and $F_m = 1000$ c/s, antenna filter included.

CQF31-2,-3: 12 dB signal/noise ratio for less than 0.8 μ V emf with $\Delta F = 3.3$ kc/s and $F_m = 1000$ c/s, antenna filter included.

Noise Figure

CQF11-2,-3: Max. 6 dB.

CQF31-2,-3: Max. 5 dB.

Squelch Sensitivity

Threshold value is 0.5 μ V (corresponding to a signal/noise ratio of 6 dB).

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2nd I.F.-Selectivity

CQFxl-2: At ± 15 kc/s the attenuation is less than 6 dB.
At ± 35 kc/s the attenuation is at least 70 dB.

CQFxl-3: At ± 6 kc/s the attenuation is less than 6 dB.
At ± 17 kc/s the attenuation is at least 70 dB.

Frequency Stability

CQFxl-2: Better than $\pm 15 \times 10^{-6}$
CQFxl-3: Better than $\pm 5 \times 10^{-6}$.

Spurious Selectivity

Better than 85 dB.

Intermodulation Attenuation

Better than 60 dB.

Demodulation Characteristic

-6 dB/octave in the range 0.3 ... 3.0 kc/s.

Output Impedance

600 Ω balanced.

Standard Test Tone Level

Receiver output: +4 dBm for $\Delta F = 1/2$ max. and fm = 1000 c/s.

Receiver Distortion

Max. 2.5 % for $\Delta F = 1/2$ max. and fm = 1000 c/s.

Max. AF-output

CQFxl-2: +7 dBm for Fm = 1 kc/s and $\Delta F = 1/2$ max.
CQFxl-3: +12 dBm for Fm = 1 kc/s and $\Delta F = 1/2$ max.

When the receiver unit is used in connection with control equipment the levels are set in accordance with the specifications given in the description of the control equipment.

Valves

Valve Complement

| | | Europ. | U.S. | S.Q. |
|--------|----------------------|------------|-------|------------|
| RCx3-1 | RF-amplifier | E188CC | 7308 | E188CC |
| | Mixer 1/quadrupler | ECC81 | 12AT7 | 6201 |
| | Oscillator/doubler 1 | 5654/M8100 | 6AK5 | 5654/M8100 |
| | Doubler 2 | 5654/M8100 | 6AK5 | 5654/M8100 |
| | Mixer 2 | 5654/M8100 | 6AK5 | 5654/M8100 |
| IA13-x | I.F.-amplifier 1 | 5654/M8100 | 6AK5 | 5654/M8100 |
| | I.F.-amplifier 2 | 5654/M8100 | 6AK5 | 5654/M8100 |
| | Limiter 1 | 5654/M8100 | 6AK5 | 5654/M8100 |
| | Limiter 2 | 5654/M8100 | 6AK5 | 5654/M8100 |
| | Discriminator | 0A81 | | |
| | AF-noise amplifier | E188CC | 7308 | E188CC |
| | Noise detector | 0A200 | | |
| | Squelch | E188CC | 7308 | E188CC |

ConsumptionMains Voltage

110/220 Volts AC $\pm 10\%$.

Chapter I. Fixed VHF Radio Station

Consumption

RX + TX operating: approx. 230 VA for 50 watt RF-output
approx. 190 VA for 25 watt RF-output
RX operating, TX standby: approx. 60 VA.

Dimensions

Height: 710 mm (28").
Width: 490 mm (19.5").
Depth: 165 mm (6.5").
Weight: approx. 35 kg (73 lbs).

CHAPTER II. DESCRIPTION OF TRANSMITTER/RECEIVER SUBUNITS

A. General

Module units
= SUBUNITS =

The radiotelephone CQFxl-2,-3 contents the following subunits as a minimum:

- TX13/33-4 25/50 watt transmitter unit with 7 valves.
- FN13/33-2 Antenna filter
- RC13/33-1 Receiver converter with 5 valves.
- IA13-1,-2 IF-amplifier for 50 kc/s and 25 kc/s channel spacing respectively, each containing 6 valves.
- PS13-6 Transmitter power supply.
- PS13-3a Receiver power supply.

Both receiver converter and transmitter are equipped with crystal sockets for 1 channel. The radiostation CQF11-3, however, requires a crystal unit containing an oven even if the equipment is operated on one channel only. If more than one channel is required a crystal unit must be used. Crystal shift units, antenna filters and antenna switch unit are described under D.

On the following pages a detailed description of the circuit of each module unit is given.

Diagrams and part lists are found in chapter V.

B. Transmitter Section

The transmitter section consists of transmitter TX13/33-4, antenna filter FN13/33-2 and transmitter power supply PS13-6.

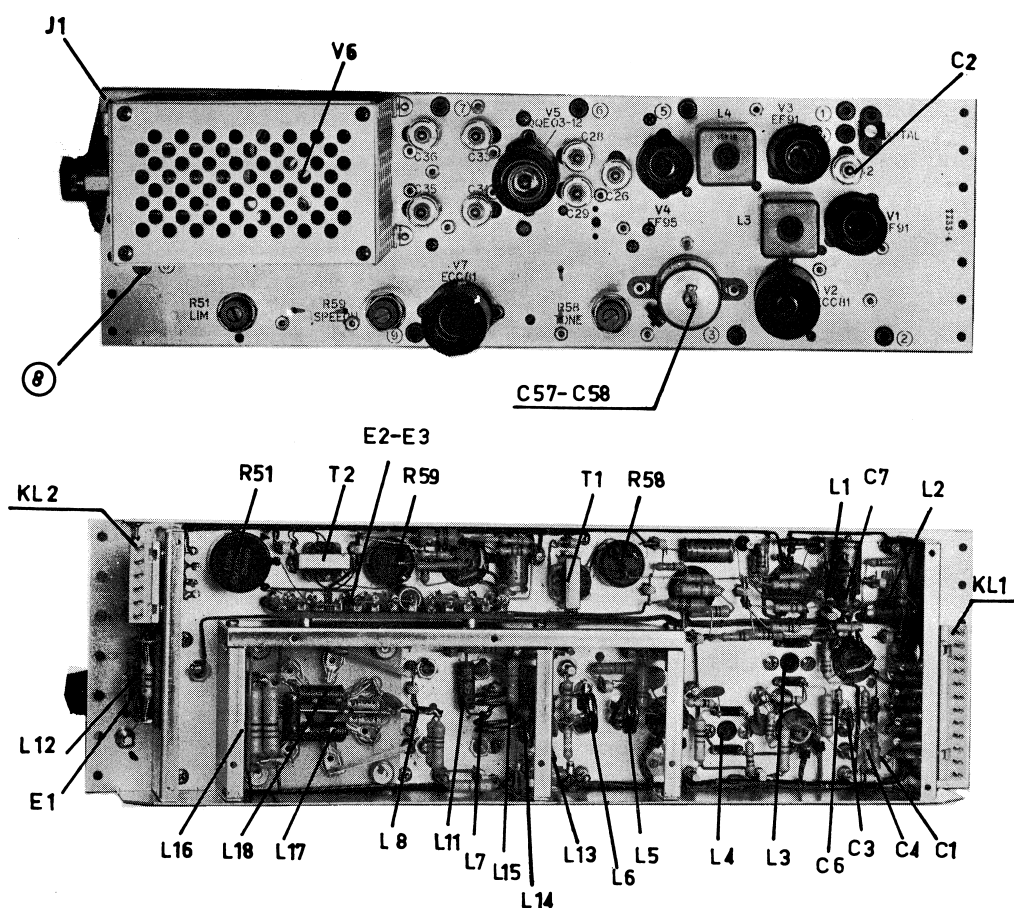
TX13/33-4

The FM-transmitter unit is designed for communication on selected channels in the frequency range 136 .. 156/152 .. 174 Mc/s (TX13-4) or 68 .. 88 Mc/s (TX33-4). The channels spacing may be either 25 kc/s or 50 kc/s and the output may be either 25 or 50 watt. The frequency deviation may be reduced by setting the limiter potentiometer in the modulator circuit.

The transmitter is phase modulated and supplied with two modulation inputs, a speech channel with modulator limiter which operates in the 300 .. 3000 c/s together with a tone channel which has a range of 300 .. 8000 c/s (max. 5000 c/s in the types CQF11-3 and CQF31-3). The max. frequency deviation is 15 kc/s up to 3000 c/s.

The transmitter is crystal controlled with a frequency stability better than $\pm 15 \times 10^{-6}$ within a normal temperature range, and in CQF11-3 the crystal and the oven reduces this figure to $\pm 5 \times 10^{-6}$.

Chapter II. Description of Transmitter/Receiver Subunits

Crystal
Shift Units

When the equipment is operating on 50 kc/s, the transmitter may be operated on a single channel without the use of a crystal shift unit, but if more than one channel is required then a crystal shift unit must be used. In the type CQF11-3 a crystal shift unit containing ovens must be used even if the equipment is working on one channel only.

Mechanical

The transmitter, which occupies 4" of rack space, is built on the module principle and fits into a swinging frame. The swinging frame is mounted on a back plate, which in turn may be mounted in a standard 19" rack.

All power leads and signal carrying leads out or into the unit are fed through capacitors and ferro beads.

Electrical

The crystal oscillator (V1) is a Pierce-Colpitts circuit (see diagram D10846) and the crystal is connected across the screen and control grid. This arrangement gives a reasonably good stability against voltage variations. When a separate crystal shift unit is used the connection is made to the crystal socket on the transmitter chassis as the twin-lead output from the crystal unit terminates in a crystal holder.

Because this connecting lead is to be as short as possible, the crystal unit must be mounted immediately above the transmitter unit. Also the capacitors C1, C2, C3, C4 and C6 must be removed. (See note 1 on the diagram). The grid current may be measured at testpoint 1.

Chapter II. Description of Transmitter/Receiver Subunits

| | |
|------------------------|--|
| Phase Modulator | The oscillator output is fed via the <u>phase shifting</u> network L1-C7, L2 and the coupling capacitor C8 to the phase modulator PM (V2a) which is half an ECC81. The outputs from the speech limiter and the tone input circuits are also fed into the phase modulator. The principle of phase modulation produces a large deviation for a low input level. The input and output voltages of the phase modulator may be measured at testpoints 2 and 3 respectively. |
| Doubler and Quadrupler | The phase modulator is followed by a doubler stage DB (V2b) which is one half of an ECC81. The plate circuit L3, a double filter, is tuned to the second harmonic of the crystal frequency and the output is directly coupled to the quadrupler (V3) EF91. L4 is tuned to the 8th harmonic and resonance may be indicated on a meter connected to testpoint 5. |
| Tripler | From the quadrupler the signal is fed to a tripler stage V4 which is an 5654/M8100. The tuned plate circuit is adjusted by C26 to resonate at the 24th harmonic of the crystal fundamental which is the output frequency. The input to the driver stage is directly coupled to the push-pull driver stage through L5 and L6 and it is balanced by the trimmers C28 and C29. The grid voltage may be checked at testpoint 6. |
| Driver | The driver stage DR (QQE03/12) is a tetrode operating in push-pull which amplifies the signal and feeds it to the power stage. The correct frequency is filtered out by L7 and L8. The output valve (V6) is a QQE06/40 also operating in push-pull which delivers approximately 50 watts of power to the antenna connector J1. By changing the plate voltage and the screen grid resistor, the output may be reduced to 25 watts. C38 is a butterfly capacitor used for tuning the last circuit. A small probe in the proximity of the antenna coupling coil L10 picks up a signal which is rectified by E1 and fed to testpoint 8 and to an external connection. This DC voltage is proportional to the output power and therefore used as a monitor. |
| Monitor | |
| Modulators | <p>All valves in the transmitter are protected from damage if the drive should fail. This is achieved by a fixed negative bias, cathode resistors, screen grid and plate resistors.</p> <p>The transmitter modulator stage has two balanced outputs, one for tones and the other for speech. The tone circuit is a simple matching transformer circuit and the amplitude of the signal is controlled by R58. The range for the tone channel is from 300 to 8000 kc/s (5000 c/s for the 25 kc/s equipment), restricted to 3400 c/s.</p> <p>The speech channel consists of a speech limiter and amplifier with pre-emphasis and de-emphasis circuits which correct the modulation before feeding it to the modulator stage.</p> |
| Speech Limiter | From the transformer and the level setting potentiometer, the signal is fed via the differentiating circuit C68-R57 to the grid of the speech limiter valve V7a. The amplified signal is then fed via the limiter diodes E2 and E3 and the integrating circuit consisting of R48-C63, to the AF valve V7b. Negative feedback is supplied to the valve by C60-R46, C61-R44, which gives the stage a low-pass characteristic with a cut off at |

Chapter II. Description of Transmitter/Receiver Subunits

about 3000 c/s. Thus the harmonic distortion products due to the speech limiter are attenuated so they do not pass to the modulator and the danger of modulation splatter in adjacent channels is greatly reduced.

The limiting level potentiometer, R51 is normally set to give a frequency deviation of ± 15 kc/s when operating on 50 kc/s separation and ± 5 kc/s on 25 kc/s separation. The output from V7b is fed to the grid of the modulation valve.

Filament

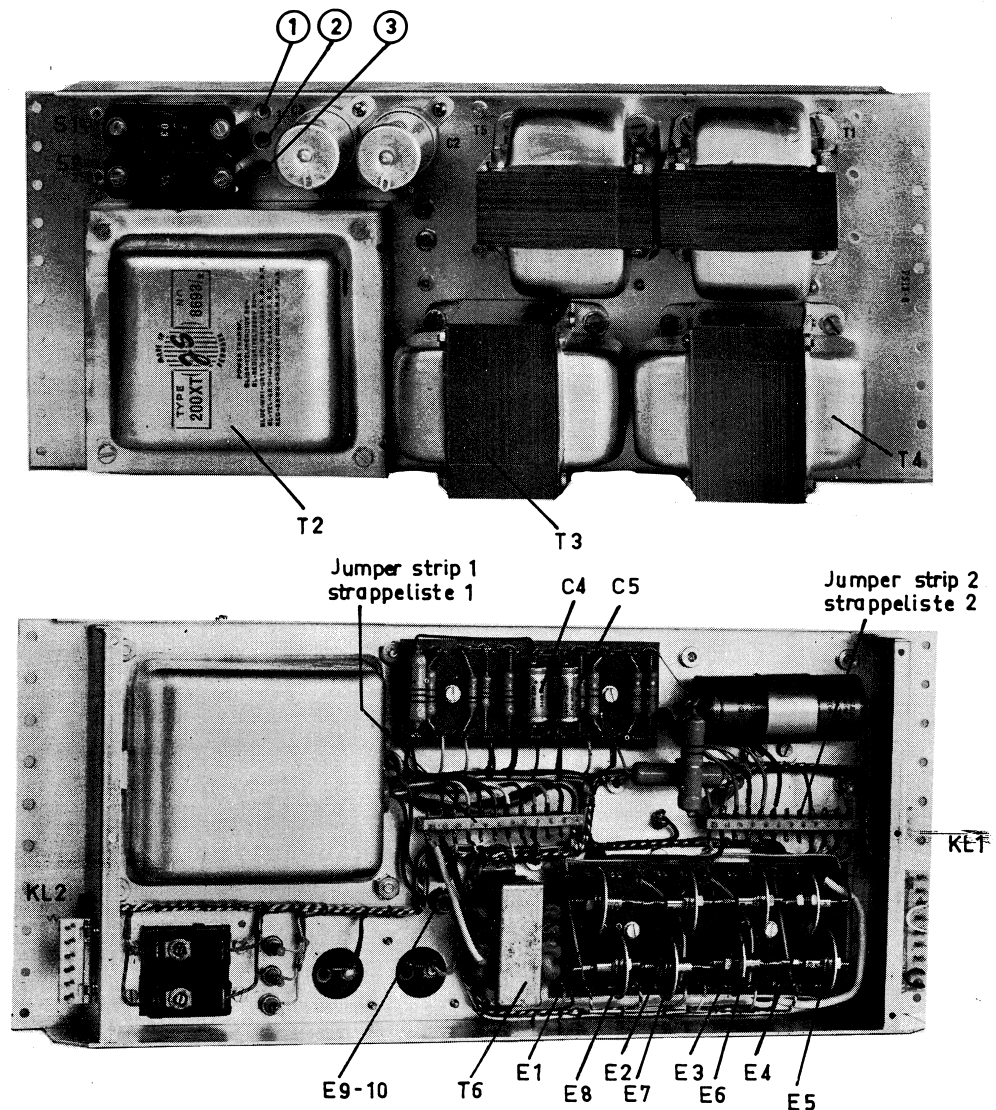
The filament circuit may be used with 12.6 or 6.3 V and is not grounded. If 6.3 V is used then terminals 2 and 4 on K1.1 must be joined.

FN13/33-2

This VHF low pass filter is designed to attenuate the spurious radiation from transmitters in the frequency range 68 .. 88 Mc/s (FN33-2) or 136 .. 174 Mc/s (FN13-2). The low pass filter is a constant K-filter with an impedance of 52Ω , and the filter consist of four T-sections.

PS13-6

The power supply unit PS13-6 is used for supplying plate, bias and filament voltages to the transmitter unit in radio station type CQFxl.



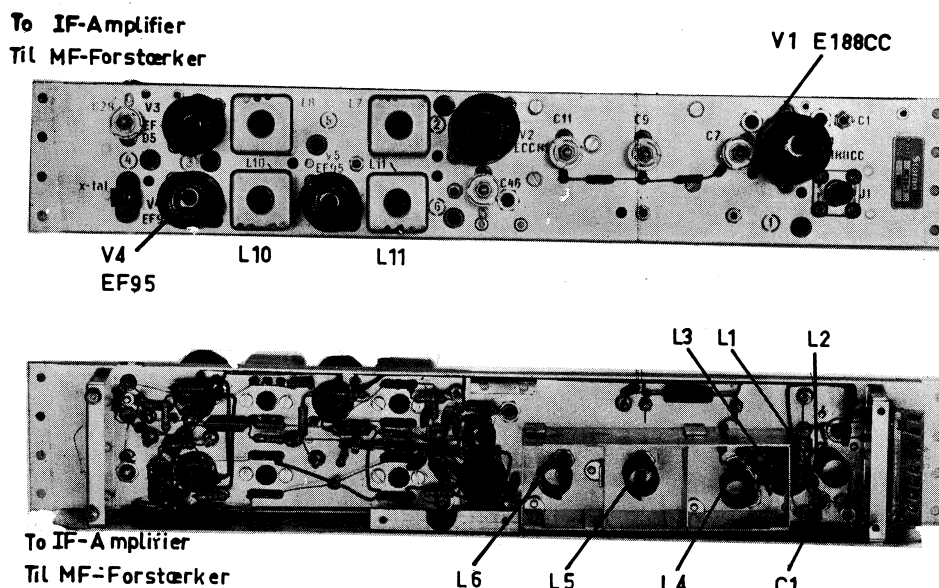
Chapter II. Description of Transmitter/Receiver Subunits

| | |
|--------------|--|
| Construction | The filament transformer T1, the common plate and bias transformer T2, filtering chokes T3, T4 and T5, filtering condensers C1 and C2, and the automatic thermal (ETA) fuses are mounted on the front side of the chassis, while the remaining components are located on the rear of the chassis. |
| Primaries | Both transformers are provided with split primaries for operation from 110 or 220 V AC mains. |
| Secondaries | <p>The low voltage section of T2 has 2 tapings (6 and 7) for adjusting the output voltage as required for the transmitter unit used. The high voltage section of T2 has 3 tapings (8,9 and 10), but the connections of these tapings depend of the unit to which voltage is supplied.</p> <p>The bias section of T2 with bridge rectifier E3 and smoothing condensers and choke supplies a fixed negative bias voltage to the transmitter stages.</p> <p>The low-voltage transformer T1 supplies 6.3 V AC to the filament of the transmitter valves.</p> |

C. Receiver Section

RC13/33-1

The receiver converter amplifies the received antenna signal and converts it to the second intermediate frequency of 455 kc/s. One crystal is used together with a frequency multiplier chain to produce the harmonic, which is mixed with the incoming signal to produce the first intermediate frequency of approximately 10 Mc/s. The fundamental frequency of the same crystal is mixed with the first intermediate frequency to produce the second intermediate frequency. The converter is used in connection with a 455 kc/s IF-amplifier, which is a



Chapter II. Description of Transmitter/Receiver Subunits

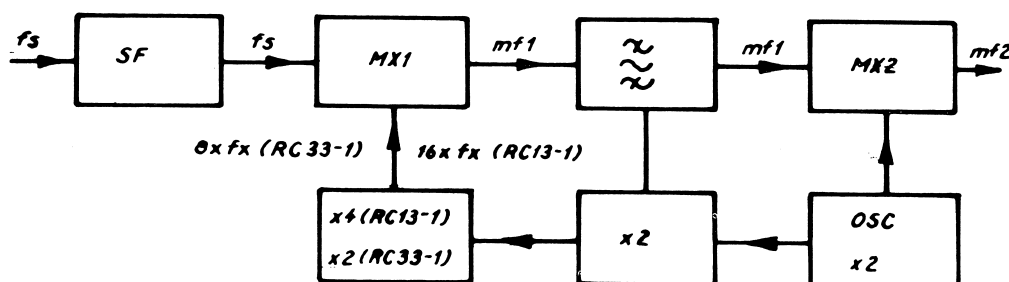
R.F. Circuits

separate subunit. The antenna signal is fed via the antenna connector J1 to the antenna link L1, which is inductively coupled to the circuit C1-L2 in the RF-amplifier V1. V1 is a double triode type E188CC, connected in cascode. The cascode stage is followed by a triple band-pass filter C7-L4, C9-L5 and C11-L6 which gives the receiver a large input selectivity.

The signal is then fed to the control grid of the first mixer stage MX1 (V2a) together with the local oscillator frequency. V2a is one half of a double triode ECC81, the other half forms part of the crystal multiplier circuit.

The plate circuit of the first mixer contains a selective filter which selects the resultant frequency and feeds it to the grid of the second mixer valve MX2 (V3) which is a pentode M8100/5654.

The crystal fundamental is also fed to the grid of the mixer valve MX2 (V3).



Mixing

From the diagram it can be seen that double superhetrodyne reception with only one crystal is used and that the first intermediate frequency is dependent on the signal frequency.

From the diagram the following equations can be obtained for RC13-1:

$$f_s = 16 f_x + If_1 \quad (1)$$

$$If_1 = f_x + 0.455 \text{ Mc/s} \quad (2)$$

Solving for f_x ,

$$f_x = \frac{f_s - 0.455}{17} \text{ Mc/s} \quad (3)$$

where f_s is the input frequency in Mc/s.

Solving for If_1 ,

$$If_1 = \frac{f_s + 7.28}{17} \text{ Mc/s} \quad (4)$$

From (4) it is seen that the change of the 1st intermediate frequency for a given change in signal frequency is:

$$\Delta If_1 = \frac{\Delta f_s}{17}$$

Chapter II. Description of Transmitter/Receiver Subunits

Furthermore the following can be obtained for RC33-1:

$$f_s = 8 f_x + If_1 \quad (1)$$

$$If_1 = f_x - 0.455 \text{ Mc/s} \quad (2)$$

Solving for f_x ,

$$f_x = \frac{f_s + 0.455}{9} \text{ Mc/s} \quad (3)$$

where f_x is the input frequency in Mc/s.

Solving for If_1 ,

$$If_1 = \frac{f_s - 3.64}{9} \text{ Mc/s} \quad (4)$$

From (4) it is seen that the change of the 1st intermediate frequency for a given change in signal frequency is:

$$\Delta If_1 = \frac{\Delta f_s}{9}$$

Multiplier Circuits

The oscillator and 1st doubler, which is a pentode of the type M8100/5654 is a Pierce-Colpitts oscillator with the crystal inserted between the control and screen grids. This arrangement allows the crystal to operate at a very low level and the frequency is independent of normal variations of plate and filament voltages. The oscillator plate circuit Ll0 is tuned to the second harmonic and the signal is fed to the second doubler stage via C37. The oscillator frequency is also fed to the grid of the 2nd mixer from the screen grid.

The second doubler is also M8100/5654 whose plate circuit is tuned to the fourth harmonic of the fundamental by the two-stage filter L11. Oscillator and 2nd doubler grid currents can be measured at test points 4 and 5. The secondary of L11 is coupled to the multiplier, which is the half of an ECC81 (V2b). The multiplier grid current can be measured at test point 6. In the plate of V2b, the 16th (RC13-1) or 8th (RC33-1) harmonic is filtered out by C46-L12 and fed to the first mixer valve.

Extra Channels

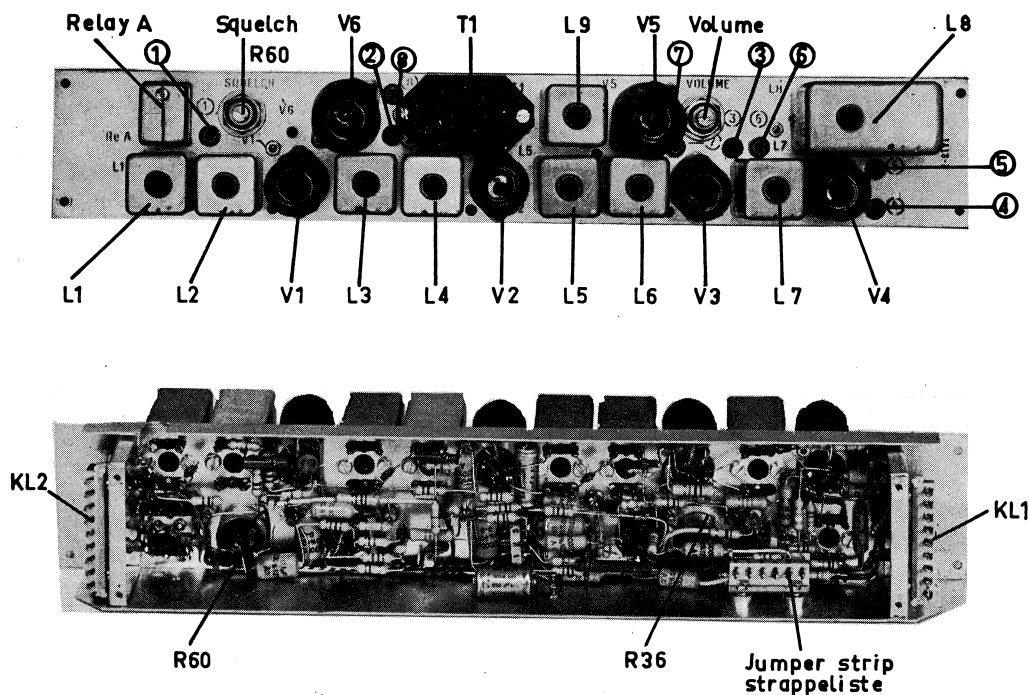
The receiver converter can be supplied with one crystal, but if more than one is used, then a separate crystal shift unit must be employed and placed in a position next to the converter unit. The normal method of mounting is side by side in a rack or cabinet. Connection from the crystal unit to the converter is via a short piece of twinlead cable which is terminated in a crystal holder. The crystal holder is then plugged into the socket on the converter. For 25 kc/s channel spacing RC13-1 is always connected to a crystal shift unit.

The capacitors C26, C27, C28 and C29 must be removed if a crystal shift unit is used. The IF output of 455 kc/s is fed to the IF-amplifiers via a hole in side of the chassis.

Chapter II. Description of Transmitter/Receiver Subunits

| | |
|----------------|---|
| Power Supply | <p>The power for the unit is supplied by a separate supply and is connected to the converter via feed-through capacitors and ferrox beads. A screening plate protects the unit from dust and dirt and also tends to stabilise the receiver. The equipment is designed to operate in the tropics.</p> <p>The heaters may be connected for 6.3 or 12.6 volts operation, but when using 6.3 volts, terminals 6 and 7 on K1.1 are shorted together.</p> |
| IA13-1,-2 | <p>The IF-amplifier unit IA13-1 is used in equipment with a min. channel spacing of 50 kc/s (CQFxl-2), and the IF-amplifier unit IA13-2 is used in equipment with a min. channelspacing of 25 kc/s (CQFxl-3).</p> |
| Function | <p>The I.F. amplifier subunit amplifies the 455 kc/s signal from the second mixer stage in the receiver converter subunit, and after having passed limiting and demodulating circuits the signal is amplified to a suitable level in a line amplifier stage. The subunit also provides a noise operated squelch circuit with facilities for extension of alarm circuits.</p> |
| I.F. stages | <p>The 455 kc/s I.F.-signal is amplified in two stages comprising a total of 3 filters each containing 4 double-tuned circuits (L1/L2 = V1 - L3/L4 = V2 - L5/L6). The amplifier stages are provided with a special AVC-circuitry by which each stage generates a control voltage of its own by grid rectification.</p> |
| Limiter | <p>The I.F. amplifier is followed by two limiter stages (V3 and V4) having different time constants in order to reach the best possible static and dynamic limiter characteristics. A coupling circuit L7 forms the connection between the two limiter valves. The bandwidth of this circuit is large, and it contributes practically nothing to the total selectivity of the receiver.</p> |
| Discriminator | <p>The de-emphasis network gives a -6 dB/octave de-emphasis within the range 0.3 to 3.0 kc/s and a flat characteristic above 3 kc/s. A -6 dB/octave response covering the whole range 0.3 to 8.0 kc/s may be obtained by short-circuiting R53 and a flat response may be obtained by open-circuiting the network C43-R35.</p> |
| Line amplifier | <p>The line amplifier (V5a) amplifies the de-modulated signal to the desired output level.</p> <p>Current feedback in the cathode of the line amplifier valve (V5a) via R38 provides for low distortion and correct output impedance (600Ω). The output level is adjusted by potentiometer R36.</p> |
| Squelch | <p>The squelch circuit consists of a noise amplifier valve (V5b) a combined filter and detector network (L9), and a squelch valve (V6).</p> <p>The signal which controls the operation of the squelch circuitry is taken from the discriminator. The signal is amplified in V5b, and all frequencies below approx. 20 kc/s (in IA13-1) and 5 kc/s (in IA13-2) are strongly attenuated in L9. The noise signals are rectified and applied to the grid of the</p> |

Chapter II. Description of Transmitter/Receiver Subunits



squelch valve (V6a). The rectified noise voltage is positive with respect to ground and to this voltage is added a negative bias voltage, which is taken from the grid of the second limiter valve across R59 - R60. This bias voltage is adjusted by potentiometer R60, and therefore this potentiometer is used for adjustment of the receiver squelch sensitivity. The relay (A) is energized, when a signal is received. If the signal disappears, the rectified noise voltage increases, V6a conducts, the squelch relay (A) is de-energized, and contact a2 breaks the current flow through the line amplifier valve (V5a), and the signal path through the receiver is interrupted.

Alarm

Contact a1 on the squelch relay is brought out to terminal strip kl.2 and may be used for external alarm purposes and automatic switching of units as desired.

Filaments

The filament circuits are connected in such a way that the valves may be operated on 6.3 V or 12.6 V which ever is most convenient.

Test points

All are provided with numbered test points at which the most important currents and voltages can be measured. The grid current in limiter 1 and the discriminator output voltage may also be measured at terminal strip kl.2.

PS13-3a

The power supply unit PS13-3a is used for supplying plate and filament voltages to the receiver unit.

Construction

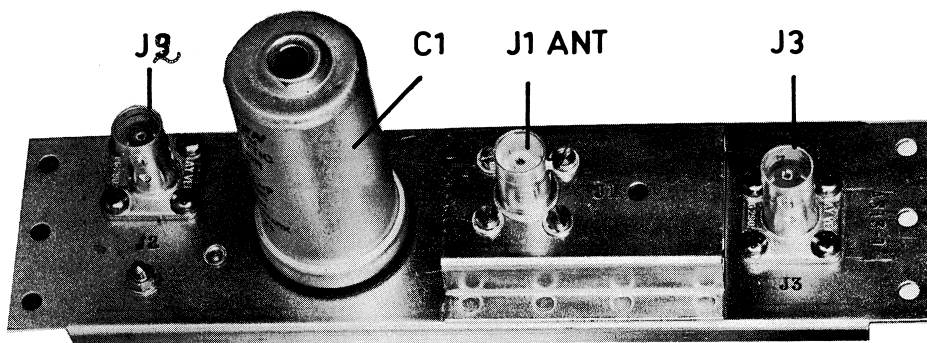
The transformers T1 and T2, the filtering chokes T3 and T4 and the two automatic thermal (ETA) fuses are mounted on the front side of the chassis, while the remaining components are located on the back of the chassis.

Chapter II. Description of Transmitter/Receiver Subunits

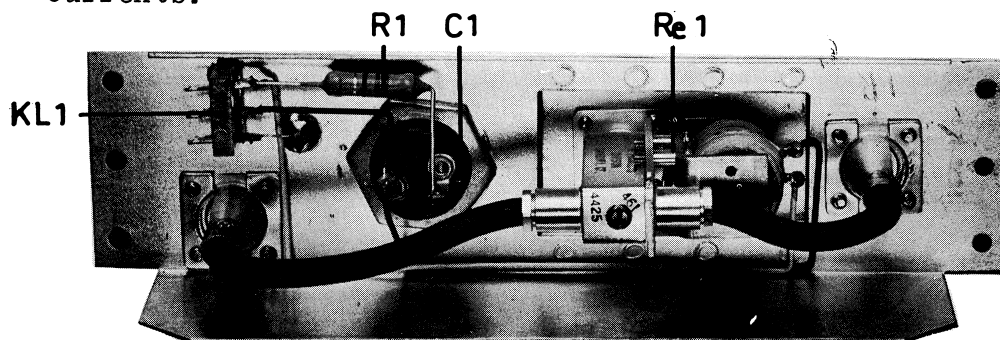
- Primaries** Both transformers are provided with split primaries for operation from 110 or 220 V AC mains.
- Secondaries** The transformer T1 has 3 tapings on the secondary for adjusting the output voltage to the rectifier. The output from the rectifier is smoothed by two pi-filter circuits.
- A low-voltage transformer T2 supplies 6.3 V AC to the filaments of the receiver valves.

D. Common Subunits

AS13-1



The change-over unit AS13-1 contains a co-axial change-over relay with a nominal 52Ω impedance and the unit may be used for frequencies up to 500 Mc/s. The relay has a 0.1 second delay on opening which is produced by condenser C1. The resistor R1 protects the contacts of the start relay from high currents.



BF13-1

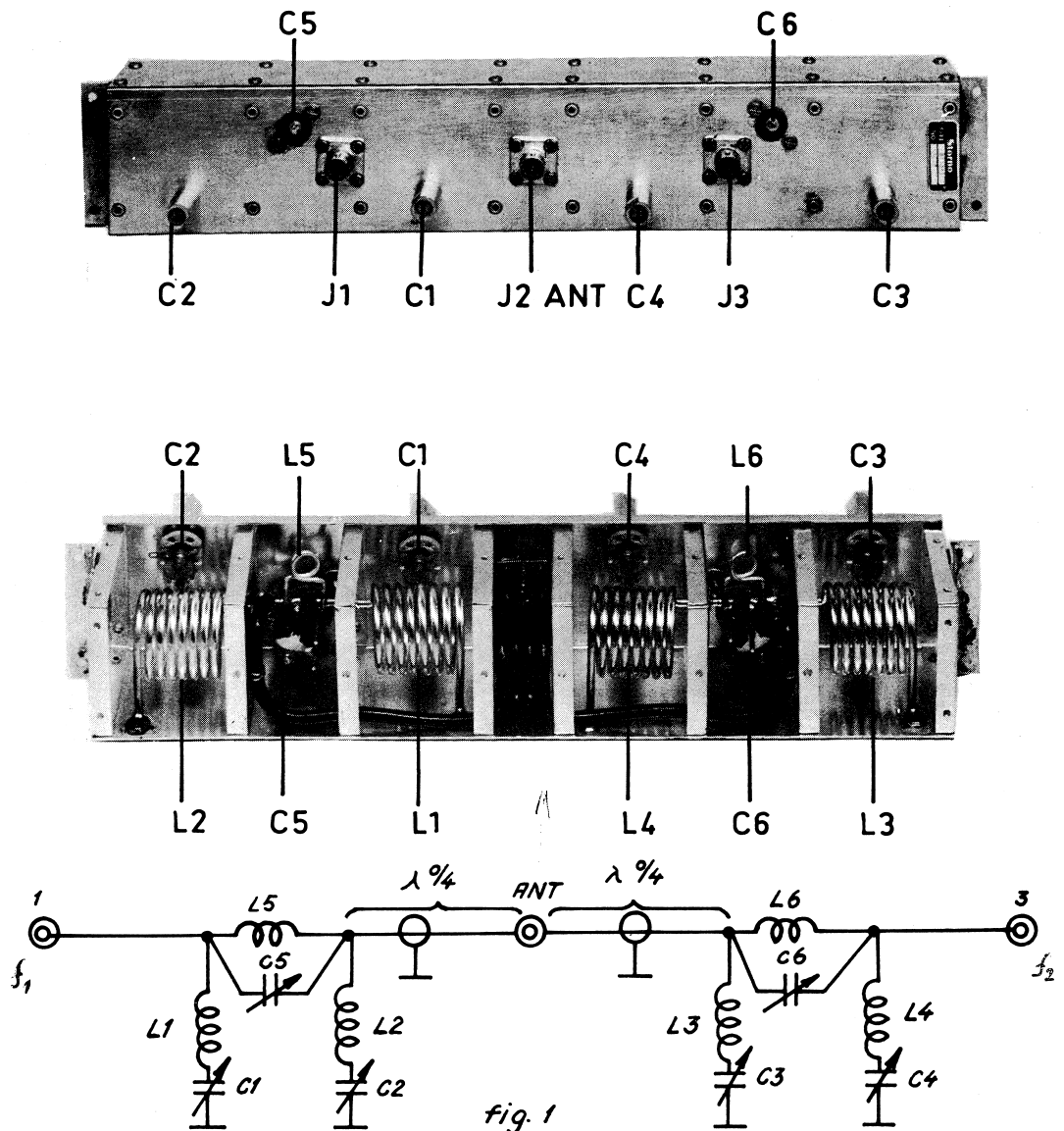
The branching filter BF13-1 connects either two transmitters or one transmitter and one receiver to the same antenna. The frequency spacing is from 4.6 - 12 Mc/s in the frequency band 144 - 174 Mc/s.

Construction

The filter is mounted on a silver plated chassis, divided into compartments, which contain the filter elements.

All controls are mounted on the front face of the chassis, together with the connectors to connect the filter to the antenna and to either the transmitters for duplex operation or receiver and transmitter for duplex operation. The connectors are standard type UG290/U. The whole chassis is screened by a cover plate which is attached by twenty self-cutting screws.

Chapter II. Description of Transmitter/Receiver Subunits



Circuit
analysis

Band stop
function

Fig. 1 shows a simplified diagram of BF13-1. The two identical sections of lumped constants are connected to the common connector (ANT) by means of $\lambda_0/4$ coaxial cables. λ_0 = electrical wavelength at 165 Mc/s.

The isolation between terminal 1 and terminal 3 is achieved by series resonance of L1, C1 - L2, C2 with respect to f_2 and L3, C3 - L4, C4 with respect to f_1 , thus effectively shortening the line for the unwanted signal. This short circuits are transformed by means of the $\lambda_0/4$ coaxial cable to a high impedance at the antenna terminal. An incoming signal from the antenna f_{inst} is thus directed to terminal 1 and a signal f_2 is directed to terminal 3.

Chapter II. Description of Transmitter/Receiver Subunits

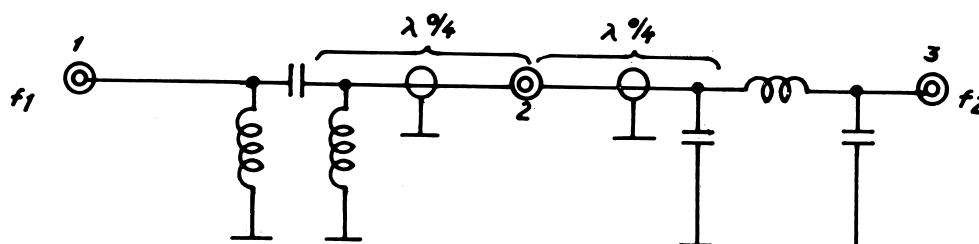
Band pass
functionfig. 2 ($f_1 > f_2$)

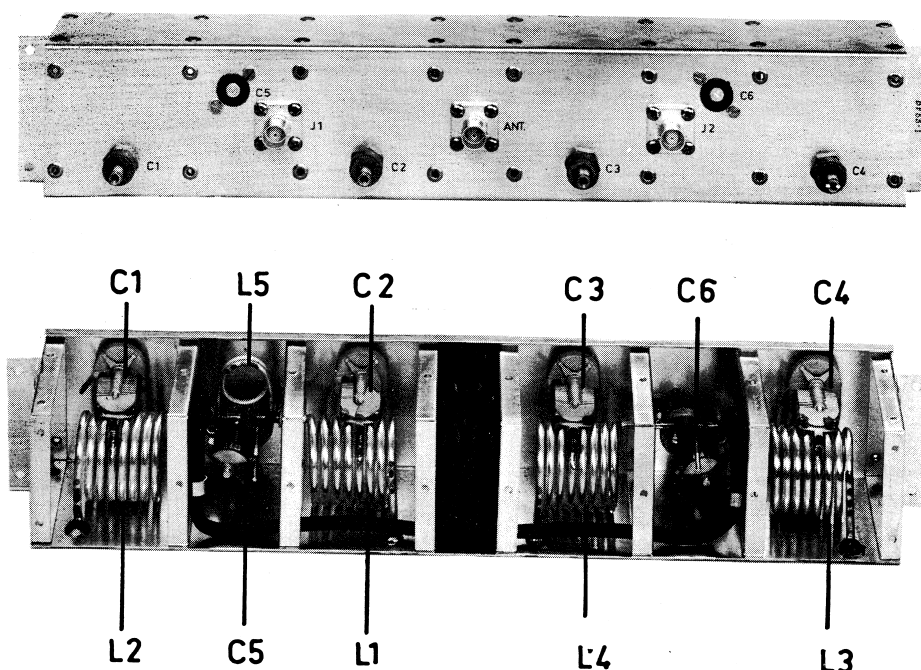
Fig. 2 shows an equivalent diagram of BF13-1 in the band pass case. The series resonance circuits as mentioned above, will act as reactive shunts on the line, positive or negative, depending on which frequency is the highest. To compensate these shunt reactances for the pass band frequencies, a tunable reactance is series to form a π -section with an impedance equal of the characteristic impedance of the coaxial cable used.

BF33-1

The branching filter BF33-1 connects either two transmitters or one transmitter and one receiver to the same antenna. The frequency spacing is from 5.0 - 15.0 Mc/s in the frequency band 68 - 88 Mc/s.

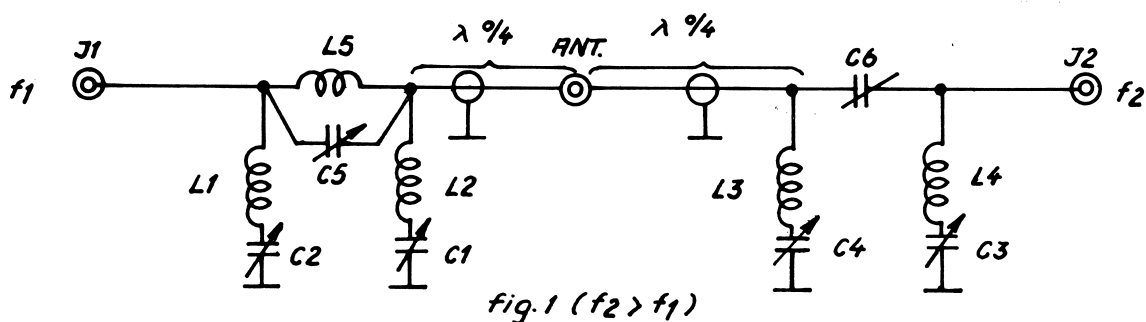
Construction

The filters are mounted on a silver plated chassis, divided into compartments, which contain the filter elements.



All controls are mounted on the front face of the chassis, together with the connectors to connect the filter to the antenna and to either the transmitters for duplex operation or receiver and transmitter for duplex operation. The connectors are standard type UG290/U. The whole chassis is screened by a cover plate which is attached by twenty self-cutting screws.

Chapter II. Description of Transmitter/Receiver Subunits

fig. 1 ($f_2 > f_1$)

Circuit
analysis

Fig. 1 shows a simplified diagram of BF33-1. The two sections of lumped constants are connected to the common connector (ANT) by means of $\lambda_0/4$ coaxial cables. λ_0 = electrical wavelength at 78 Mc/s. The connection of the filter must be made in such a way that the band pass frequency f_2 at J2 is higher than the band pass frequency f_1 at J1.

Band stop
function

The isolation between terminal 1 and terminal 2 is achieved by series resonance of L1, C2 - L2, C1 with respect to f_2 and L3, C4 - L4, C3 with respect to f_1 , thus effectively short-circuiting the line for the unwanted signals. This short circuits are transformed by means of the $\lambda_0/4$ coaxial cable to a high impedance at the antenna terminal. An incoming signal from the antenna f.inst. f_1 is thus directed to terminal 1.

Band pass
function

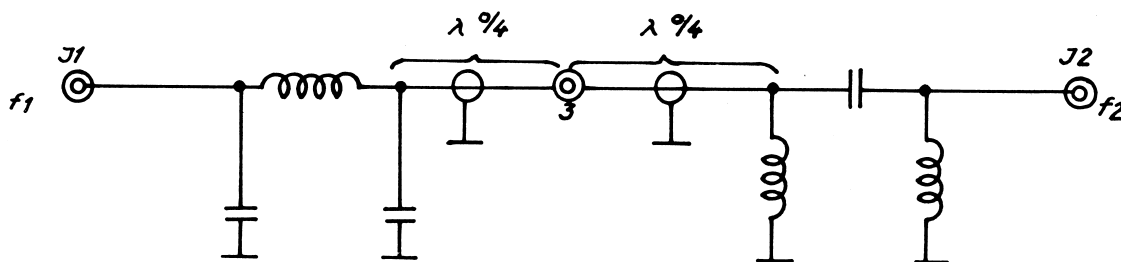
fig. 2 ($f_2 > f_1$)

Fig. 2 shows an equivalent diagram of BF33-1 in the band pass case. The series resonance circuits as mentioned above, will act as reactive shunts on the line, positive or negative, depending on which frequency is the highest. To compensate these shunt reactances for the pass band frequencies, a tunable reactance is added in series to form a π -section with an impedance equal of that of the characteristic impedance of the coaxial cable used.

XS13-x

The crystal shift units of the types XS13-4, -5, -6, -7, and -8 are used in STORNO VHF radio stations in connections with the units TX13-4, TX33-4, RC13-1 and RC33-1.

| | 1 Channel | 3 Channels | 6 Channels |
|--------------|-----------|------------|------------|
| With oven | XS13-4 | XS13-6 | XS13-8 |
| Without oven | none | XS13-5 | XS13-7 |

Chapter II. Description of Transmitter/Receiver Subunits

Construction

Each crystal shift unit is mounted on a metal chassis, but for the relay wiring is used printed wiring boards. In order to facilitate later extension of the number of channels and to compensate for the capacities of the lacking relays an artificial "relay-load" is used. These plug-in "relay-loads" are replacing the relays in the crystal shift units not fully extended.

A 6-channel crystal shift unit contains one relay for each transmitter crystal and one relay for each receiver crystal. They are separated by a shield and the 6-channel crystal shift units may consequently be used for duplex operation.

A 3-channel crystal shift unit contains a common relay for the transmitter and receiver crystals, and thus it cannot be used for duplex operation. A duplex station for 2 channels will therefore contain a 6-channel crystal shift unit and the lacking 4 relays are replaced by 8 artificial "relay-loads".

The crystal shift units are supplied with relays for either 6 V operation or 12 V operation depending on the control equipment, which can be either an extended local control type or a remote control type.

Connections

The crystal shift unit is mounted on the common radio frame between transmitter and receiver converter. The crystal shift unit is connected with the transmitter and receiver oscillators by an ordinary wire, which is run through a hole in the chassis to the crystal socket in the radio units.

Function

The shifting of channels are made at the control console, where the channel selector, either directly or by relays, grounds the relay in the crystal shift unit corresponding to the crystal of the selected channel. In 6-channel crystal shift units are used two relays for each channel.

Relay-load

The artificial "relay-load" is a small plug-in printed wiring board with a printed capacitance equivalent to the relay capacitance. The pins of the relay-load permits the unit to be plugged directly into the relay sockets.

Two types of "relay-loads" are used - one for each type of relays used (12 V relays for extended local control equipment and 6 V relays for remote control equipment).

E. Additional Technical Specifications**TX13/33-4**

See also Technical Specifications in Chapter I. on page 1-9

Output Power

25 or 50 watts, depending on plate voltage.

Antenna Impedance

50 Ω .

Chapter II. Description of Transmitter/Receiver Subunits

Maximum Power

30 watt, 60 watt intermittent.

Impedance

Filter impedance

VSWR Less than 1.7 in the nominal range.

Connector

BNC UG-290/U.

PS13-6Nominal output voltage (Kl. 1-6).

500 V DC, 420 V DC and 375 V DC.

Max. permissible plate current

220 mA - (loaded with Kl. 1-7 in mA - 110 mA).

Approximate output voltage

250 V tag loaded with 100 mA

| Transformer tappings | 5 - 6 8 - 9 | 5 - 6 9 - 10 | 5 - 6 8 - 10 |
|-------------------------|----------------|-----------------|-----------------|
| No load | 464 V | 521 V | 690 V |
| 100 mA load | 392 V | 422 V | 550 V |
| 200 mA load | 364 V | 393 V | 516 V |

If transformerappings 5 - 7 is used in stead ofappings
5 - 6 the voltage values increase with approx. 15 V.

Plate voltage

Nominal output voltage (Kl.1-7).

250 V DC.

Max. permissible plate current

110 mA + (220 mA - load in mA on Kl. 1-6).

Approximate output voltage

500 V tag loaded with 180 mA.

| Transformerappings | 5 - 6 (300V) | 5 - 7 (315V) |
|--------------------|-----------------|-----------------|
| No load | 265 V | 280 V |
| 50 mA load | 255 V | 270 V |
| 100 mA load | 245 V | 260 V |

Bias voltage

Nominal bias voltage

-33 V DC.

Max. permissible bias current

30 mA.

Filament

Max. permissible filament current

At 6.3 V AC: 4.2 Amp.

Chapter II. Description of Transmitter/Receiver Subunits

RC13/33-1

Overall Gain

Approx. 30 dB (from antenna input to MX2 grid).

Crystal

Crystal multiplication

RC13-1: $2 \times 2 \times 4 = 16$.

RC33-1: $2 \times 2 \times 2 = 8$.

Calculation of Crystal Frequency

RC13-1: Crystal frequency = $\frac{\text{Receiver frequency in Mc/s} - 0.455 \text{ Mc/s}}{17}$

RC33-1: Crystal frequency = $\frac{\text{Receiver frequency in Mc/s} - 0.455 \text{ Mc/s}}{9}$

Crystal Frequency Range

RC13-1: 8.0 Mc/s to 10.2 Mc/s.

RC33-1: 7.6 Mc/s to 9.83 Mc/s.

Crystal Frequency Adjustment

$\pm 25 \times 10^{-6}$ by the trimmer, when loaded with 30 pF.

Crystal Specification

| | 50 kc/s Eq. | 25 kc/s Eq. |
|----------------------|--|---|
| Crystal type | Storno 98-1 | Storno 98-4 |
| Loading capacity | 30 pF | 30 pF |
| Temp. characteristic | $+15 \times 10^{-6}$ from -20° to $+70^{\circ}\text{C}$ | $+5 \times 10^{-6}$ from $+80$ to $+90^{\circ}\text{C}$ |
| Crystal holder | American HC-6/U British DEF5271D | American HC-6/U British DEF5271D |
| Mil. type spec. | NATO type 1 CR-18/U | NATO type 1 CR-36/U |

IF

Calculation of 1st IF

RC13-1: $\text{IF}_1 = \frac{\text{Receiver frequency in Mc/s} + 7.28}{17} \text{ Mc/s.}$

Or if the crystal frequency is known,

$\text{IF}_1 = \text{Crystal Frequency in Mc/s} + 0.455 \text{ Mc/s.}$

RC33-1: Calculation of 1st IF

$\text{If}_1 = \frac{\text{Receiver frequency in Mc/s} - 3.64}{9} \text{ Mc/s.}$

Or if the crystal frequency is known,

$\text{If}_1 = \text{Crystal Frequency in Mc/s} - 0.455 \text{ Mc/s.}$

RC13-1: 1st Intermediate frequency Range

9.3 to 10.7 Mc/s.

RC33-1: 1st Intermediate frequency Range

7.15 to 9.38 Mc/s.

Consumption

Anode Consumption

Approx. 25 A at 150 V.

Chapter II. Description of Transmitter/Receiver Subunits

Heater Consumption

1.27 A at 6.3 V or 0.635 A at 12.6 V.

| Valves | Valve Complement | Europ. | American | Spec. Qual. |
|--------|------------------|------------|----------|-------------|
| | RF-Amplifier V1 | E188CC | 7308 | E188CC |
| | 1st. Mix. V2 | ECC81 | 12AT7 | 6201 |
| | Oscillator V4 | M8100/5654 | 6AK5 | M8100/5654 |
| | 2nd. Doubler V5 | M8100/5654 | 6AK5 | M8100/5654 |
| | 2nd. Mixer V3 | M8100/5654 | 6AK5 | M8100/5654 |

IA13-1,-22nd intermediate frequency

455 kc/s.

Attenuation

IA13-1: ΔF = ± 5 kc/s, attenuation maximum 6 dB.

ΔF_o = ± 35 kc/s, attenuation minimum 70 dB.

IA13-2: ΔF = ± 5 kc/s, attenuation maximum 2 dB.

ΔF_o = ± 12 kc/s, attenuation minimum 34 dB.

Gain

Voltage amplification

At 455 kc/s from grid of 2nd mixer in receiver converter to grid of 1st limiter in 2nd I.F. amplifier: approx. 108 dB.
In one I.F. stage incl. filter losses: approx. 36 dB.

Discriminator

Discriminator curve

IA13-1: ΔF = ± 15 kc/s, I = approx. ± 18 μ A.

IA13-2: ΔF_o = ± 10 kc/s, I = approx. ± 9 μ A.

Frequency deviation

IA13-1: Max. ± 15.0 kc/s.

IA13-2: Max. ± 5.0 kc/s.

Output

Output impedance

600 Ω $\pm 20\%$, balanced.

Output level

IA13-1: With F_m = 1.0 kc/s and ΔF = ± 10 kc/s: +10 dBm.

IA13-2: With F_m = 1.0 kc/s and ΔF = ± 2.5 kc/s: +12 dBm.

When used in connection with control equipment the level in set according to the level diagram in the special technical handbook for the control equipment.

Distortion

Distortion

IA13-1: F_m = 1.0 kc/s, ΔF = ± 5 kc/s: max. 2%.

F_m = 1.0 kc/s, ΔF = ± 10 kc/s: max. 5%.

IA13-2: F_m = 1.0 kc/s, ΔF = ± 3.3 kc/s: max. 3%.

F_m = 1.0 kc/s, ΔF = ± 5 kc/s: max. 6%.

Consumption

Total plate current

At 150 V DC: approx. 40 mA.

Total filament current

At 6.3 V: 1.4 Amp.

Chapter II. Description of Transmitter/Receiver Subunits

Test points

Measurements at test points

A standard instrument 1000 Ω /50-0-50 μ A must be used.

| Test point no. | Location | Full meter deflection |
|----------------|--------------------|-----------------------|
| 1 | I.F. 1, cathode | 5 Volts |
| 2 | I.F. 2, cathode | 5 Volts |
| 3 | Limiter 1, grid | 50 Volts |
| 4 | Limiter 2, grid | 50 Volts |
| 5 | Discriminator | |
| 6 | Line ampl., cath. | 2 Volts |
| 7 | Noise ampl., cath. | 2 Volts |
| 8 | Relay Valve, cath. | 5 Volts |

PS13-3a

Input Voltage

110 V or 220 V AC.

Plate voltage rectifier

Nominal output voltage

150 V DC.

Maximum permissible plate current

100 mA.

Approximate output voltage

| Transformer tapings | 8-9-10 (130V) | 7-9-11 (140 V) | 6-9-12 (150 V) |
|---------------------|------------------|-------------------|-------------------|
| No load | 210V | 230V | 250V |
| 80 mA load | 135V | 150V | 165V |
| 100 mA load | 125V | 140V | 150V |

Test points

Standard testmeter

50-0-50 μ A, R = 1000 Ω .

Test point no 1 Plate voltage: full deflection = app. 200V.

Test point no 2 Plate current: full deflection = app. 100mA.

Filament transformer

Maximum permissible filament current

At 6.3 V AC: 4 Amp.

AS13-1

Impedance

Nominal 52 Ω .

Capacity

Maximum 100 watts.

Relay Voltage

12.6 V.

Opening Delay

Approx. 0.1 secs.

Chapter II. Description of Transmitter/Receiver Subunits

BF13-1Frequency Range

144 - 175 Mc/s.

Duplex Spacing

4.5 - 12.0 Mc/s.

Isolation

Max. Isolation between Units

70 - 75 dB.

Isolation36 - 40 dB at a band width of ± 0.7 Mc/s.

Losses

Insertion Losses

At a frequency spacing of 4.5 Mc/s: 0.7 - 1.2 dB (depending on the band width).

At a frequency spacing of 9.0 Mc/s: 0.3 dB.

Nominal Impedance50 Ω .Max. standing Wave Ratio1.5 for 4.5 Mc/s ± 0.7 Mc/s.

Power

Power Handling Capacity

70 watts at 4.5 Mc/s duplex spacing.

BF33-1Frequency Range

68 - 88 Mc/s.

Duplex Spacing

5.0 - 15.0 Mc/s.

Isolation

Max. Isolation between Units

70 - 86 dB.

Isolation55 - 57 dB at a band width of ± 0.3 Mc/s.

Losses

Insertion Losses

At a frequency spacing of 5.0 Mc/s: 0.5 - 0.6 dB (depending on the band width).

At a frequency spacing of 15.0 Mc/s: 0.2 dB.

Nominal Impedance50 Ω .Max. standing wave Ratio1.5 for 5.0 Mc/s ± 0.3 Mc/s.

Chapter II. Description of Transmitter/Receiver Subunits

PowerPower Handling Capacity

70 watts at 5.0 Mc/s duplex spacing.

Note: In case the transmitter frequency is higher than the receiver frequency the transmitter must be connected with the right hand side (terminal J2) of the filter and the receiver with the left hand side (terminal J1). In case the receiver frequency is higher than the transmitter frequency the connections mentioned above must be reversed.

CHAPTER IV. ALIGNMENT PROCEDURE

A. General

Introduction

The adjustment procedure described in the following is intended as an aid in aligning a VHF radio station and therefore is not to be considered the only correct procedure. Certain adjustments can with advantage be performed differently if more advanced measuring equipment is available. However, the directions given here should only be departed from in cases where the technician can foresee with certainty that modified alignment methods will not degrade the specifications stipulated or complicate subsequent alignment procedures.

Only such skilled radio technicians as have already acquainted themselves with the operation of the STORNO radio station should perform adjustment and repairs.

Placing the Equipment into Operation

Before being dispatched from STORNO, each individual radio station has been checked and tested. In the absence of any special agreement, the testing department has:

1. Inserted quartz crystals for the channels ordered.
2. Aligned the complete radio telephone so that the accuracy of the transmitting and receiving frequencies is better than 2×10^{-6} .
3. Adjusted the receiver's power output and the speech limiter clipping level according to specifications; and
4. adjusted and tested the built-in control equipment (if provided).

When the installation has been completed and its proper execution checked, it will normally be necessary to retune the transmitter PA tank circuit with the proper antenna filter and antenna connected. The transmitter's modulation sensitivity should also be checked.

This adjustment procedure has been developed for use with the following types of radio telephone equipment:

- CQF11-3 (136-174 Mc/s), 25 kc/s channel separation.
- CQF31-3 (68-88 Mc/s), 25 kc/s channel separation.
- CQF11-2 (136-174 Mc/s), 50 kc/s channel separation.
- CQF31-2 (68-88 Mc/s), 50 kc/s channel separation.
- CQF13-2 (152-174 Mc/s), Maritime radiostation

Measuring Equipment

Each section of this adjustment procedure begins by specifying the types of measuring instruments that are a condition for performing the alignment in question in the correct and proper manner. Reference is made to a number of measuring instruments which STORNO has developed specifically for service and adjustment of STORNO radio equipment, but other measuring equipment may of course be used if its specifications are similar to, or better than, the specifications for the corresponding STORNO measuring instruments.

Chapter IV. Alignment Procedure

B. Transmitters TX13-1,-4 and TX33-4

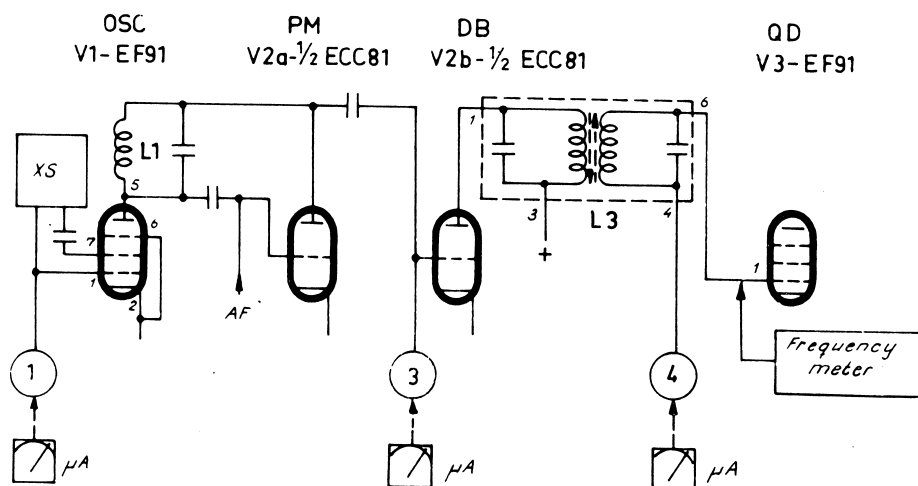
Alignment of Crystal Shift Unit and Oscillator

Instruments

The following measuring instruments are required:

Frequency meter with an accuracy better than 2×10^{-6} covering the frequency ranges: 5.66 .. 7.32 Mc/s for TX33-4, 12.70 .. 14.50 Mc/s for TX13-1,-4.
50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO type SI06).

If connection to the proper antenna is impossible a dummy load must be used (e.g. STORNO type DL11-1).



Setting-up

This phase of the adjustment should not be commenced until the radio equipment has reached its operating temperature (after at least 10 minutes operation). Furthermore it should be checked that the cover plate of the crystal shift unit is in place and that all crystal shift relays are inserted in their sockets. The capacitance of the relays' contacts form part of the crystal loading capacitances.

The frequency meter must be connected after the doubler stage in order to avoid loading of the oscillator. Set the frequency meter to twice the crystal frequency specified for each channel (due to the doubler stage preceeding).

Connect the microammeter to testpoint 1, and connect the antenna or the dummy load to the transmitter output terminal (J1).

Procedure

- Adjust the crystal trimmers for half capacitance.
- Key the transmitter and check the oscillator grid current in testpoint 1.
- Adjust each crystal trimmer to the correct crystal frequency.

Note: It is important to secure the crystal trimmers from working loose. This can be avoided by laquering.

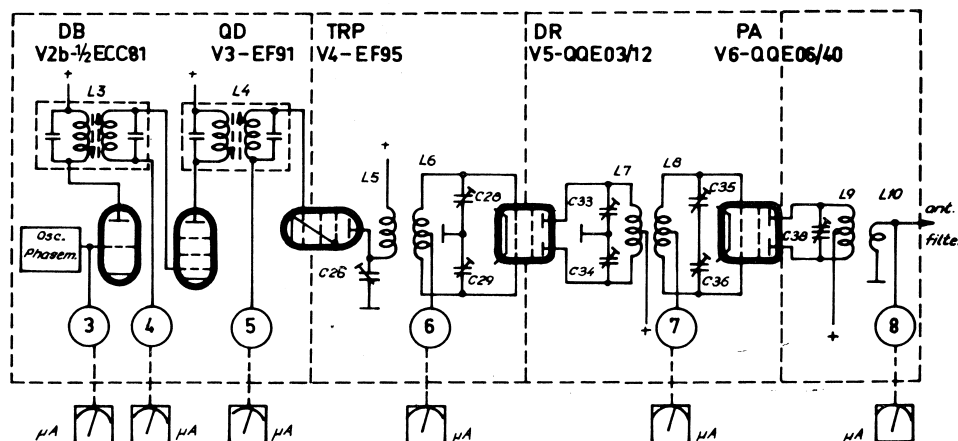
Chapter IV. Alignment Procedure

Alignment of Multipliers and Output Stage

Instruments

The following measuring instruments are required:

50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO type SI06).
 Dummy load, $52 \Omega/60$ watt (STORNO DL11-1).



Setting-up

Connect the dummy load or proper antenna to the antenna connector, and connect the microammeter to testpoint 4.

The following procedure is used if the outer channel separation does not exceed 0.8 Mc/s for TX13-1,-4 and 0.4 Mc/s for TX33-4. For larger channel separations stagger tuning is employed, which is described later.

Procedure

- Key the transmitter.
- Tune L3 for maximum reading on the microammeter. It may prove necessary to tune both primary and secondary circuits several times in order to achieve a proper maximum.
- Connect microammeter to testpoint 5 and tune L4 for maximum reading. It may prove necessary to tune both primary and secondary several times in order to achieve a proper maximum.
- Connect the microammeter to testpoint 6 and set C28 and C29 for equal capacitance.
- Tune C26 for maximum reading on microammeter.
- Tune C28 and C29 for maximum reading, but constantly check that the capacitance of the two condensers are equal. (In approximately the same position).

Note: The coupling between L5 and L6 is very critical. It must be carefully readjusted if misaligned by accident.

- Connect the microammeter to testpoint 7 and set C33 and C34 for equal capacitance. Then tune for maximum reading, but constantly check that the capacitance of the condensers are equal (in approximately the same position).
- Set C35 and C36 for equal capacitance, and tune them for maximum reading. Check constantly that the capacitance of the two condensers are equal (in approximately the same position).
- Connect the microammeter to testpoint 8 and tune C38 for maximum reading. It may prove necessary to retune C33 and C34, and C35 and C36 in order to reach maximum output power, which is indicated by maximum microammeter reading.
- Set the coupling between L10 and L9 for maximum reading.

Chapter IV. Alignment Procedure

Specification

The RF output power must be at least 25 watts or 50 watts, depending on the transmitter strapping.

Note: When antenna filter FN13-1, FN13-2, or FN33-2 is connected and matched to the PA-stage of the transmitter, the nominal output power can be measured only at the output terminals of the antenna filter.

Stagger
Alignment
Procedure

This procedure is used when the outer channel separation exceeds 0.8 Mc/s for TX13-1,-4 or 0.4 Mc/s for TX33-4.

The first section of the alignment procedure must be followed as described above (incl. para d). The remaining procedure consists of switching between the outer channels to make comparisons.

- e) Tune C26 for maximum, but equal readings on the two outer channels.
- f) Tune C28 and C29 for maximum, but equal readings on the two outer channels.

Para g) to k) are as described above.

The stagger alignment is properly completed when the grid drive on the PA-valve is symmetrical about the center frequency, and when the output power from the outer channels are symmetrical about the center frequency and no more than 2 dB down on the outer channels.

Modulation Checking

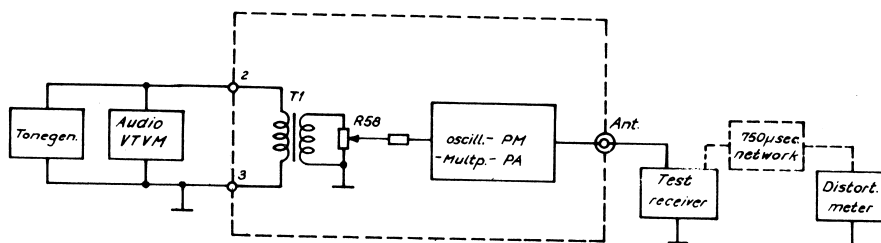
Instruments

The following measuring instruments are required:

- Audio tone generator with an internal resistance of 600 Ω .
- Audio VTVM.
- Test Receiver, calibrated in frequency deviation (STORNO L22).
- Distortion Meter.

Setting-up

Tone Input



Connection of test equipment

Set the tone generator to deliver 1000 c/s and connect it to terminal board kl. 2, terminals 2 and 3. Connect the measuring receiver to the transmitter output terminals and adjust it to the transmitter frequency. Turn potentiometer R58 fully clockwise. Adjust the tone generator to a frequency swing of 10 kc/s. Connect the distortion meter across the AF-output of the test receiver through a 750 μ Sec. network.

Chapter IV. Alignment Procedure

Procedure

- a) Key the transmitter.
 - b) The sensitivity is calculated as follows: The signal from the tone generator is measured by the VTVM and the output signal from the transmitter can be read from the test receiver.
The sensitivity should be:
TX13-1,-4: Better than 250 mV (-10 dB).
TX33-4: Better than 440 mV (-5 dB).
 - c) Adjust the modulation sensitivity by the potentiometer R58.
- Note: The distortion must not exceed 5 % with the distortion-meter connected directly to the output terminals of the test receiver without the delay network. When the delay network is inserted the distortion should not exceed 3 %.

Specification

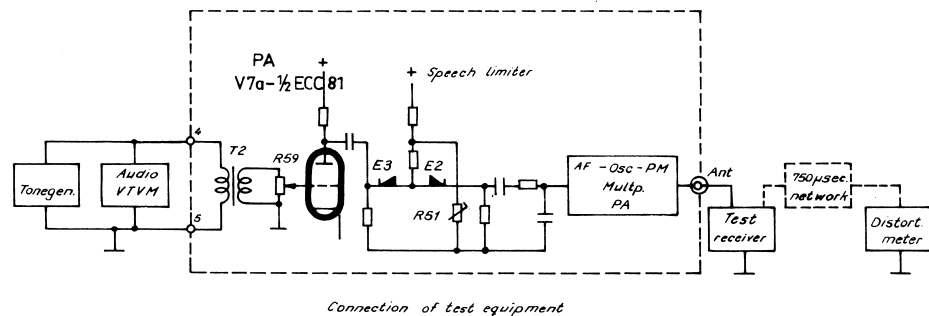
Measuring of frequency curve:

300 c/s = -10.5 dB
 1000 c/s = 0 dB (reference value)
 3000 c/s = +9.5 dB
 6000 c/s = +15 dB.

Tolerances +0.5/-1.5 dB relative to the theoretical curve.
 The measuring values above are taken without delay network and with a constant input level.

Setting-up

Speech Input



Set the tonegenerator to deliver 1000 c/s and connect it to terminal board kl. 2, terminals 4 and 5. Connect the test receiver to the transmitter output terminals and set it to the transmitter frequency. Turn potentiometer R59 fully clockwise.

Procedure

Adjustment of Speech Limiter

- a) Set the output level from the tone generator to the following frequency swing:
 CQF11-3 and CQF31-3: ± 3.3 kc/s
 CQF13-2, CQF11-2, and CQF31-2: ± 10 kc/s.
- b) Increase the output level from the tonegenerator by 20 dB, and adjust the limiter potentiometer R51 until maximum permissible frequency swing stated below is obtained:
 CQF11-3 and CQF31-3: Max. ± 5 kc/s
 CQF13-2, CQF11-2 and CQF31-2: Max. ± 15 kc/s.

Chapter IV. Alignment Procedure

Measuring of Distortion

The distortion should be measured at a frequency deviation, which is $2/3$ of the maximum permissible deviation.

The distortion must not exceed 5 % with the delay network inserted between transmitter output and distortion meter, and 9 % without delay network inserted.

Checking and Adjusting Sensitivity

Set the frequency deviation to $2/3$ of the maximum permissible deviation of the station by adjusting the output level of the tone generator.

The sensitivity should be less than 78 mV (-20 dB) for TX13-1, -4 and less than 110 mV (-17 dB) for TX33-4.

The modulation sensitivity is set by potentiometer R59.

Specification

Measuring of frequency curve:

300 c/s = -12 dB.
 1000 c/s = 0 dB (reference value).
 3000 c/s = +8 dB.
 6000 c/s = +4 dB.

Tolerance: 6 dB per octave $+0.5/-2.0$ dB within 300 .. 3000 c/s relative to 1000 c/s.

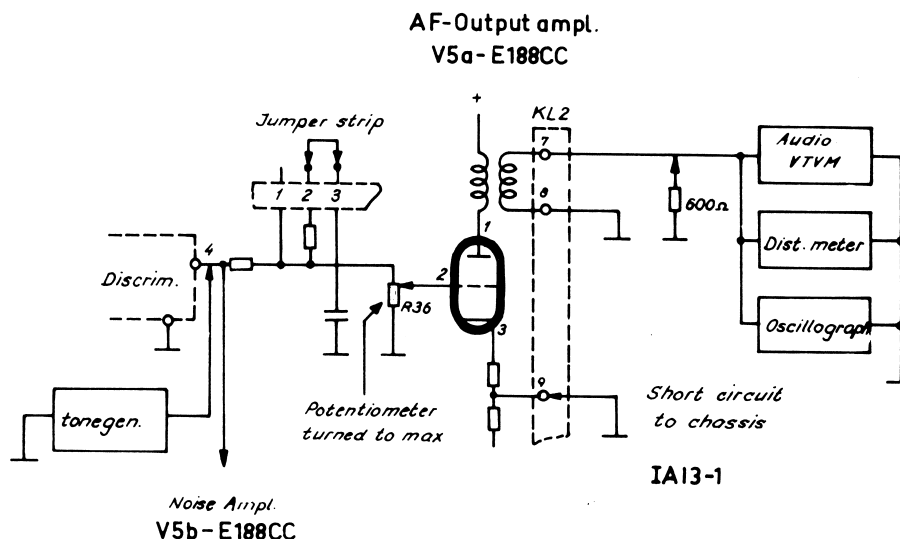
C. Intermediate Amplifiers IA13-1,-2

Adjustment of the AF-Section

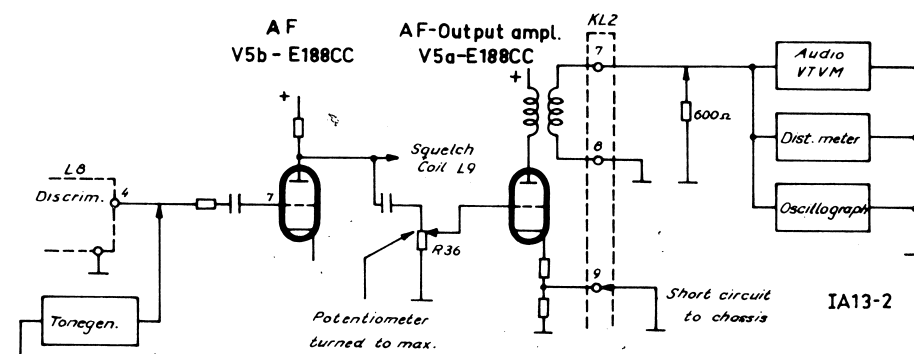
Instruments

The following measuring instruments are required:

Audio tone generator
 Audio VTVM
 Distortionmeter
 Oscillograph
 A 600 Ω resistor.



Chapter IV. Alignment Procedure



Setting-up

Connect the Audio tone generator after the discriminator (between pin 4 on L8 and ground). Terminals 7 and 8 on terminal board kl. 2 (the secondary of the output transformer) must be loaded with a 600 Ω resistor, across which the oscilloscope, the distortionmeter and the audio VTVM is connected.

Furthermore the squelch function must be disabled by shorting pin 9 on terminal board kl. 2 to ground. Turn the AF-potentiometer R36 fully clockwise.

Procedure

- a) Set the output from the audio tone generator to 1 volt and check the frequency curve with reference to 1000 c/s at the following points:

- IA13-1: 300 c/s output voltage from +7 dB to +11 dB
 1000 c/s output voltage 0 dB (reference value)
 8000 c/s output voltage from -9 dB to -11,5 dB.
- IA13-2: 300 c/s output voltage from +7 dB to +11 dB
 1000 c/s output voltage 0 dB (reference value)
 3000 c/s output voltage from -9 dB to -13 dB.

- b) Sensitivity and distortion is checked as follows:

- IA13-1: A tone generator output of 3.5 volt at 1000 c/s should give 2.5 volt across 600 Ω at 1 % distortion. A tone generator output of 10 volt at 1000 c/s should give 7 volt across 600 Ω at 3% distortion.

Tolerances:

- Variations in sensitivity: ±2 dB (25 %)
 Distortion: 1.5 % at 2.5 V out
 5 % at 7 V out.

Note: Only the distortion meter must be connected to the AF-output of the receiver during distortion measurements.

- IA13-2: A tone generator output of 1 volt at 1000 c/s should give 3 volt across 600 Ω at 2 % distortion. A tone generator output of 3 volt at 1000 c/s should give 8 volt across 600 Ω at 6 % distortion.

Tolerances:

- Variations in sensitivity: ±2 dB (25 %)
 Distortion: 3 % at 3 V out
 9 % at 8 V out.

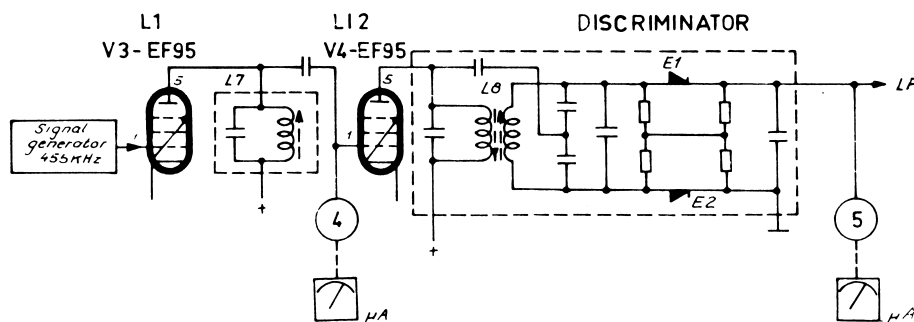
Chapter IV. Alignment Procedure

Alignment of Discriminator

Instruments

The following measuring instruments are required:

Signal generator for 455 kc/s (± 0.2 kc/s)
50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SI06).



Setting-up

Connect the microammeter to testpoint 4. Connect the signal generator to the grid of V3 (pin 1) in the first limiter, and set it to 455 kc/s ± 0.2 kc/s (can be checked by a frequency counter). The output from the signal generator should be set for approx. 60 dB to obtain full limiting and constant reading in testpoint 4 (control grid in second limiter).

Procedure

- Tune L7 for maximum reading.
- Connect the microammeter to testpoint 5 and tune L8 secondary top slug for zero reading.
- Tune L8 primary bottom slug for greatest possible symmetry and sensitivity at ± 15 kc/s from the center frequency.

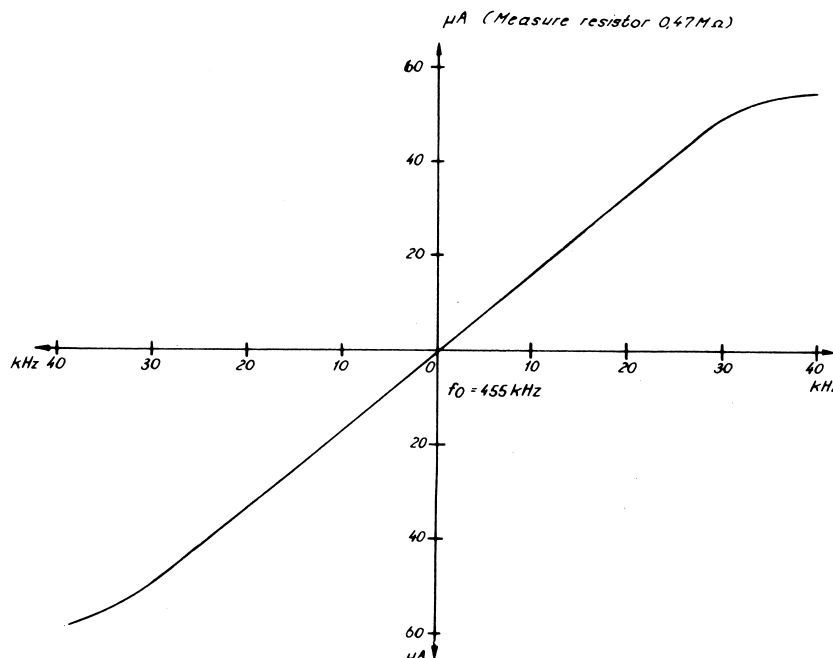
The circuits have some action on each other and it may prove necessary to check the zero point of the secondary several times during the alignment and retune if necessary.

Specification

A typical reading in testpoint 5 for ± 15 kc/s of the center frequency is 25 μA . See also the curve below.

Tolerances: Sensitivity: ± 2 dB (25 %)

Linearity: ± 1 dB (12 %) at ± 15 kc/s.



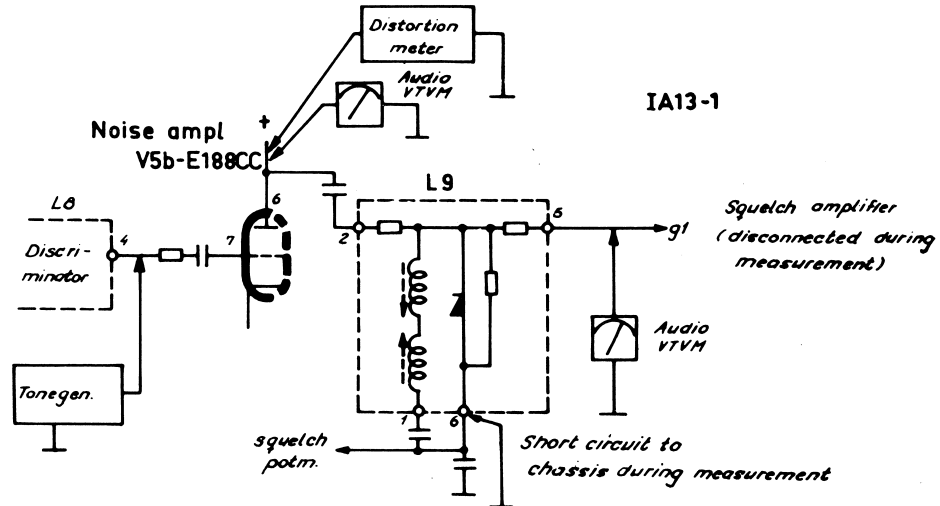
Chapter IV. Alignment Procedure

Alignment of Squelch Filter

Instruments

The following measuring instruments are required:

Audio tone generator
Audio VTVM
Distortionmeter.

Setting-up
IA13-1

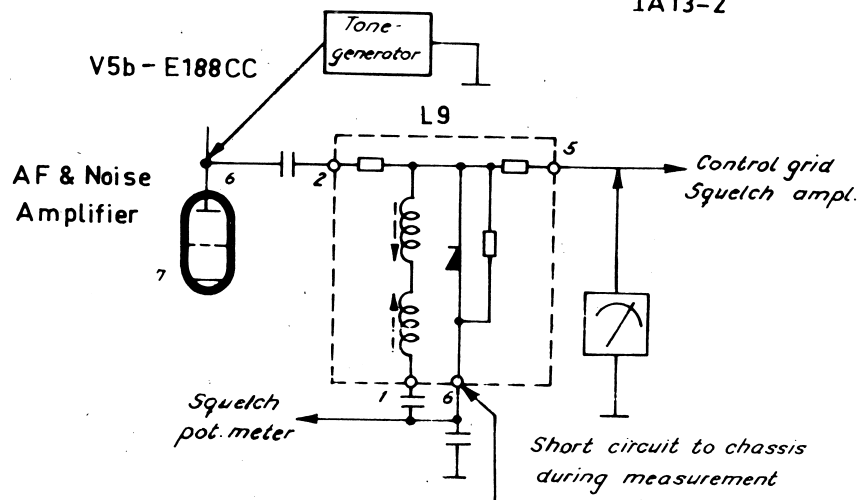
Connect the tone generator after the discriminator (between pin 4 and ground). Connect the audio VTVM between the grid of the squelch valve V6 (pin 2) and ground. Remove the squelch valve V6 from its socket and short circuit pin 6 on L9 to ground. Set the tone generator to give an output of 7 volt.

Procedure

- Check the squelch filter and adjust the series resonance to be lying between 6 and 9 kc/s.
- Check that the output at 20 kc/s is approx. 20 .. 30 dB higher than at 1000 c/s.
- Check the sensitivity and distortion at the plate of the squelch valve V5b at an input voltage from the tone generator of 8 volt at 1000 c/s. The output voltage should be 28 volt at 5 % distortion.

Specification

Tolerances: Sensitivity ± 3 dB.
Distortion: less than 8 %.

Setting-up
IA13-2

Chapter IV. Alignment Procedure

Break the plate and filament supply to the unit. Connect the tone generator to the plate of V5b (pin 6). Connect the VTVM between the grid of the squelch valve V6 (pin 2) and ground. Short circuit pin 6 on L9 to ground. Set the tone generator output to 0.2 volt at 1000 c/s measured by the VTVM.

Procedure

- Check the squelch filter and adjust the series resonance to be lying between 3 and 5 kc/s.
- Check that the output at 15 kc/s is approx. 20 .. 30 dB higher than at 1000 c/s.

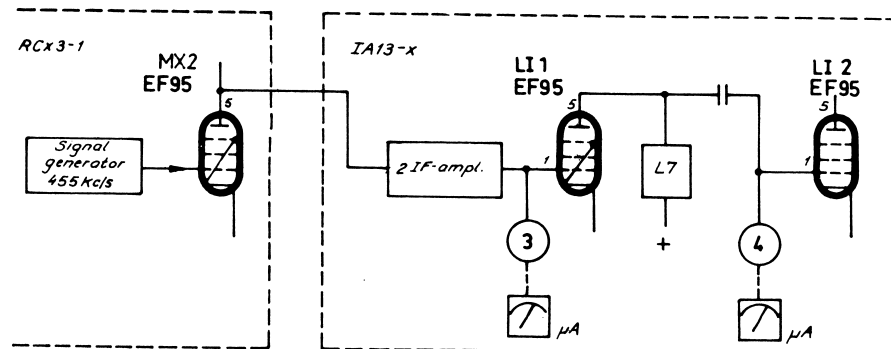
Alignment of 2nd IF by Attenuation Method

Instruments

The following measuring instruments are required:

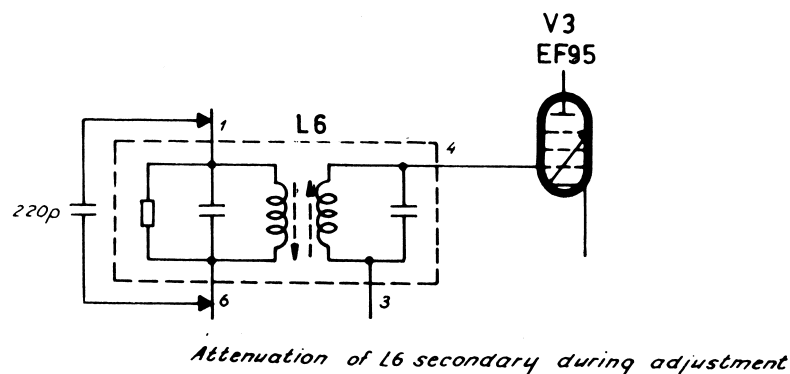
- Signal generator for 455 kc/s (± 0.2 kc/s)
- 50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SIO6)
- 2 condensers each 100 pF (IA13-1) or 220 pF (IA13-2).

Setting-up

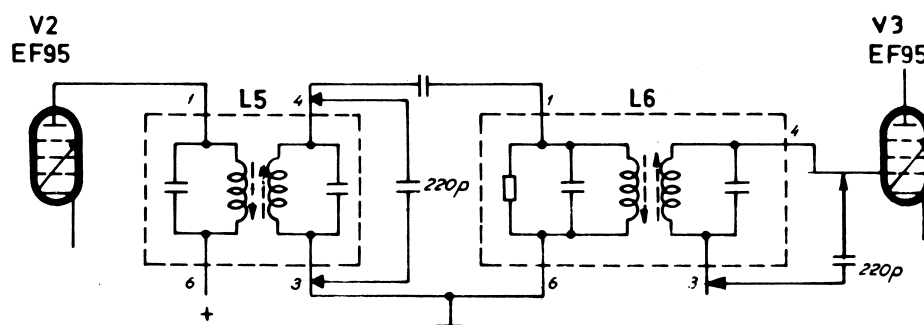


Connect the microammeter to testpoint 4. Set the signal generator to 455 kc/s, and connect it to the control grid of V3 (pin 1) in the second mixer stage of the preceding receiver converter unit RCx3-1. Set the signal generator output voltage to obtain a suitable reading on the microammeter.

The circuits on each side of the circuit to be adjusted should be loaded by a condenser as shown on the illustration (100 pF for IA13-1 and 220 pF for IA13-2). This does not apply to L7, which is a single adjustable coil.



Chapter IV. Alignment Procedure

*Attenuation of L5 and L6 primaries during adjustment*

Procedure

- Tune L7 for maximum reading.
- Load the primary of L6 with the condenser and tune the secondary of L6 for maximum reading.
- Load the secondary of L5 with the condenser and use the detuning condenser from the primary of L6 to detune the secondary of L6. Tune the primary of L6 and the primary of L5 for maximum reading.
- Load the circuits on each side of the secondary of L5. Tune secondary of L5 for maximum reading.
- When completed tuning of L5 and L6 the microammeter must be connected to testpoint 3.
- Tune the circuits L4, L3, L2 and L1 for maximum reading as described above.

Checking Bandwidth

Instruments

The following measuring instruments are required:

Signal generator for 400 .. 500 kc/s (STORNO type L20)
50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SIO6) RF VTVM.

Setting-up

Connect the signal generator to the grid of V3 (pin 1) in the second mixer stage of the preceding receiver converter unit RCx3-1. Connect the microammeter to testpoint 5 in IA13-1,-2. Connect the VTVM to testpoint 3 in IA13-1,-2.

Procedure

- Set the signal generator frequency to obtain zero reading in testpoint 5, and set the attenuator to obtain a reading of 10 μA in testpoint 3. Read the attenuator setting in dB.
- Set the signal generator frequency to ± 5 kc/s from the center frequency for IA13-2 and ± 15 kc/s from the center frequency for IA13-1.
- For each frequency change the attenuator should be reset to keep the reading in testpoint 3 at 10 μA . Read the increased dB value.

Specification

The dB readings should not exceed 2 dB for IA13-2 or 6 dB for IA13-1.

Chapter IV. Alignment Procedure

Measurement of the IF Selectivity

Instruments

The following measuring instruments are required:

Signal generator for 400 .. 500 kc/s (STORNO L20)
50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SIO6)
RF VTVM.

Setting-up

Connect the signal generator to the grid of the second mixer valve V3 (pin 1) in the preceding receiver converter unit RCx3-1. Connect the microammeter to testpoint 5 in IA13-1,-2. Connect the VTVM to testpoint 3 in IA13-1,-2.

Procedure

- Set the signal generator frequency to obtain zero reading in testpoint 5. Adjust the generator attenuator to obtain a 2 μA reading in testpoint 3. Read the attenuator setting in dB.
- Set the generator frequency to ± 12 kc/s from the center frequency for IA13-2 and ± 35 kc/s from the center frequency for IA13-1.
- For each frequency change the attenuator should be reset to keep the reading in testpoint 3 at 2 μA . Read the increased dB value.

Specification

The dB readings should be at least 34 dB for IA13-2 and at least 70 dB for IA13-1.

If the bandwidth and the selectivity is not correct a complete retuning of the IF-circuits must be considered.

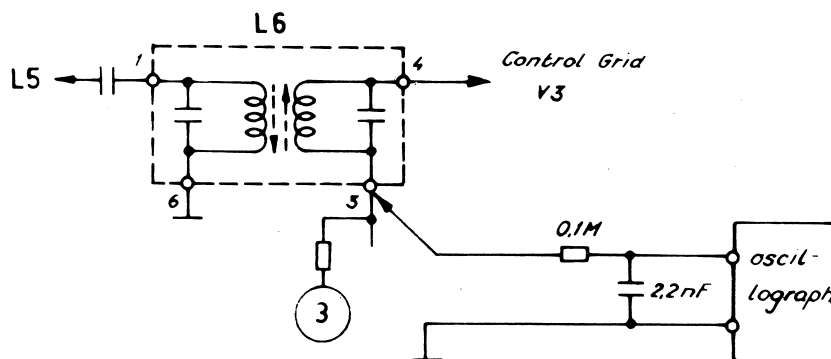
Alignment of the 2nd IF by Sweep Generator and Oscillograph

Instruments

The following measuring instruments are required:

Sweep generator (STORNO L20)
Oscillograph.

Setting-up



Connect the oscillograph to L6, pin 3, by a low-pass filter as shown on the illustration. The sweep generator must be synchronized with the oscillograph, and the signal is applied to L6, pin 1.

Procedure

- Tune L6 secondary (top) for maximum curve height.
- Apply the generator signal to L5, pin 4, and tune L6 primary (bottom) for maximum curve height.
- Apply the generator signal to L5, pin 1, and tune L5 secondary for maximum curve height.

Chapter IV. Alignment Procedure

- d) Apply the generator signal to the grid of V2 (pin 1), and tune L5 primary (bottom) for maximum curve height.
- e) L4, L3, L2, and L1 are tuned in the same manner with the sweep generator connected across the circuit just ahead of the circuit to be tuned. When tuning the primary of L1 the sweep generator should hence be connected to control grid of the second mixer valve in RCx3-1.

Specification

Tolerances: IA13-1: ± 15 kc/s maximum 6 dB attenuation
 ± 35 kc/s at least 70 dB attenuation
 IA13-2: ± 5 kc/s maximum 2 dB attenuation
 ± 12 kc/s at least 34 dB attenuation

Sensitivity: IA13-X: 40 μ V on g1 MXII (high IF dissoldered) =
 10 μ A in testpoint 3 (1st limiter)
 Tolerance: ± 6 dB.

D. Receiver Converters RC13-1 and RC33-1

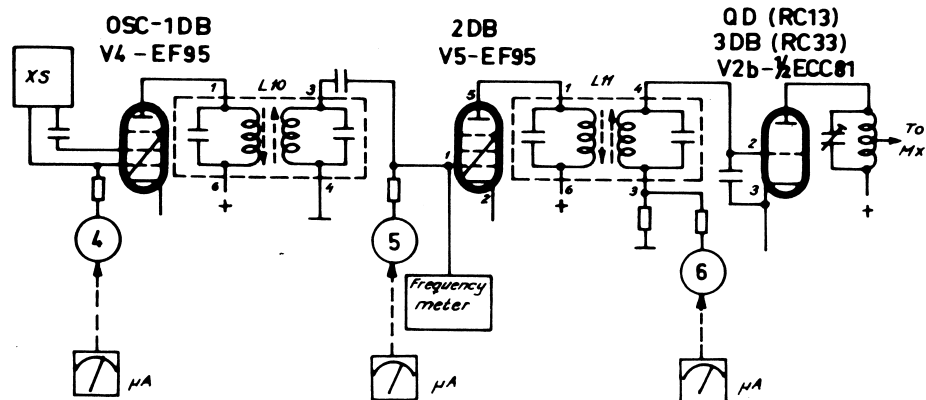
Alignment of the Crystal Shift, Oscillator and Multiplier

Instruments

The following measuring instruments are required:

Frequency meter covering the range 15.2 .. 20.4 Mc/s
 with an accuracy better than 2×10^{-6} .
 50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SIO6).

Setting-up



This phase of the alignment should not be commenced until the radio equipment has warmed up (after at least 10 minutes operation). Furthermore it should be checked that the bottom cover plate of the crystal shift unit is in place and that all crystal shift relays are inserted in their sockets. The capacitance of the relay's contacts form part of the crystal loading capacitances.

The frequency meter must be connected after the common oscillator/doubler stage in order to avoid loading of the oscillator. Set the frequency measuring set to twice the crystal frequency specified for each channel due to the doubling in the oscillator plate circuit L10.

Chapter IV. Alignment Procedure

Procedure

- a) Adjust the crystal trimmers for half capacitance.
- b) Connect the microammeter to testpoint 4 and check the oscillator grid current.
Minimum 10 μA , maximum 50 μA .
- c) Adjust each crystal trimmer at the correct crystal frequency.

Note: It is important to secure the crystal trimmers from working loose, which can be avoided by laquering.

- d) Switch the equipment to the central channel.
- e) Connect the microammeter to testpoint 5, and tune L10 for maximum reading.
RC13-1: At least 30 μA
RC33-1: At least 25 μA .
- f) Connect the microammeter to testpoint 6, and tune L11 for maximum reading.
RC13-1: At least 17 μA
RC33-1: At least 25 μA .

Note: The values stated above apply to a crystal with PI 30 pF = 30 k Ω .

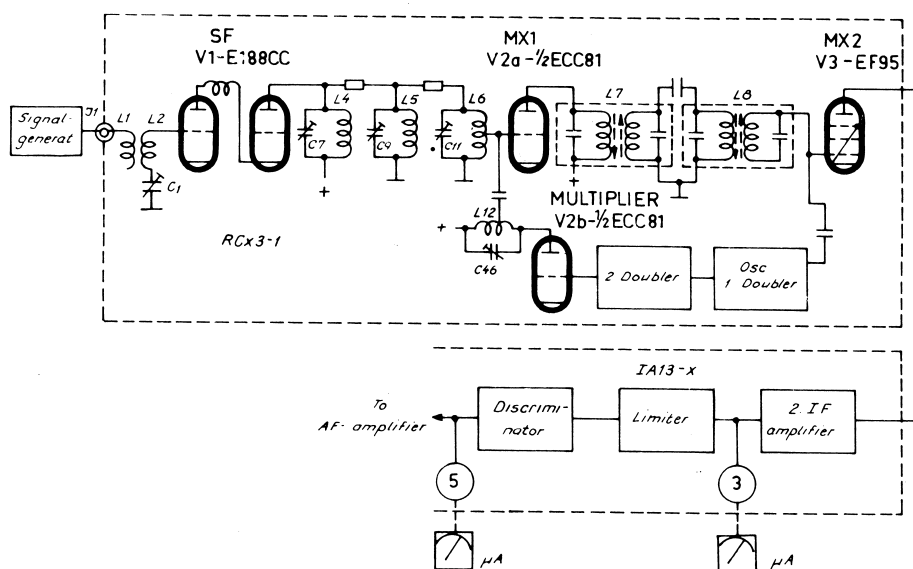
Alignment of 1st IF and SF Amplifier

Instruments

The following measuring instruments are required:

Signal generator covering the ranges 68 .. 88 Mc/s and 152 .. 174 Mc/s.
50-0-50 microammeter, $R_i = 1000 \Omega$ (SI06).

Setting-up



The following procedure is used if the outer channel separation does not exceed 0.8 Mc/s for RC13-1 or 0.4 Mc/s for RC33-1. With larger channel separations stagger tuning is employed as is the case for the maritime equipment, where a channel separation of maximum 1.4 Mc/s is required. Connect the microammeter to testpoint 5 in IA13-1,-2.

Chapter IV. Alignment Procedure

Procedure

- a) Set the signal generator to the receiver frequency of the channel to be tuned, and connect it to the antenna connector J1.
- b) Reset the frequency output from the signal generator to obtain zero reading on the microammeter.
- c) Connect the microammeter to testpoint 3 (1st limiter) in IA13-1,-2.
- d) Adjust the output level from the signal generator to a suitable level, e.g. 10 μ A.
- e) Tune the filter circuits in the 1st IF (L8 and L7) for maximum readings.
- f) Tune the RF-circuits C11, C9, C7 and C1 for maximum reading.
- g) Tune C46 in the quadrupler plate circuit (doubler plate circuit in RC33-1) for maximum reading.

Note: Trimmers C46 and C11 may act on each other and should be readjusted.

WARNING

As a precaution to avoid damage to the attenuator of the signal generator the fuse for the high voltage from the transmitter power supply must be open during alignment in the receiver unit.

Stagger Tuning

The stagger tuning procedure should be followed in cases where the channel separation exceeds 0.8 Mc/s for RC13-1 and 0.4 Mc/s for RC33-1.

Normally it will suffice to tune the circuit C11 - L6 at the lowest frequency (channel). The remaining circuits should be tuned at the centre frequency (channel). The alignment of the receiver converter may be considered satisfactory if the sensitivity (quieting) and gain lie within 3 dB down from the best channel.

Checking Sensitivity

Instruments

The following instruments are required:

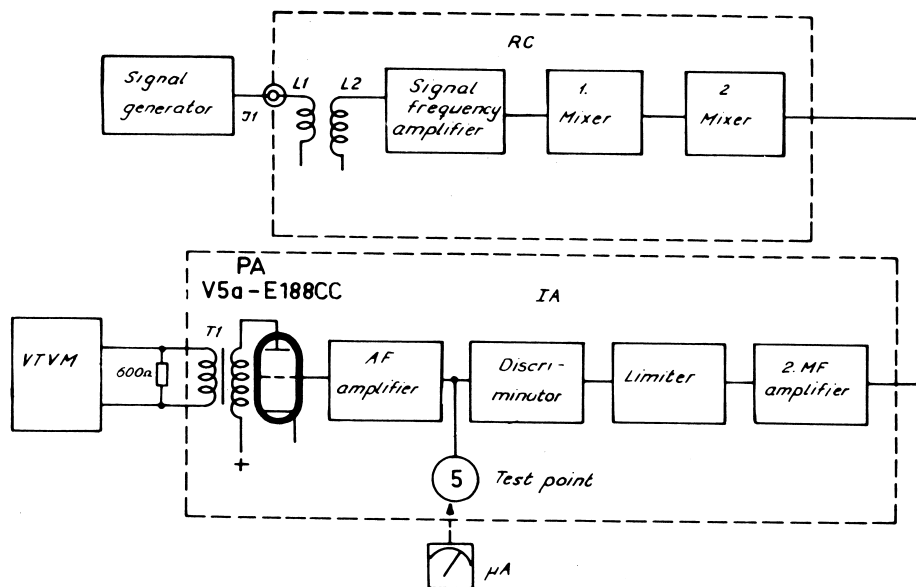
- Signal generator covering the ranges 68 .. 88 Mc/s and 152 .. 174 Mc/s.
- RF VTVM.
- 50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SI06).
- 600 Ω resistor.

Setting-up

Connect the signal generator across the receiver input terminals (J1). Connect the VTVM and a 600 Ω resistor across the secondary of the output transformer (terminal board kl. 2, terminals 7 and 8).

The following procedure should not be completed unless the receiver converter has been aligned at the exact frequencies.

Chapter IV. Alignment Procedure



Procedure

- With no input signal to the antenna input terminal the noise level should be read off the scale on the VTVM.
- Connect the microammeter to testpoint 5 in the discriminator stage.
- Adjust the signal generator to deliver an unmodulated signal at the receiver frequency and check that the microammeter reading is zero.
- Set the output voltage from the signal generator to a level, which gives a 12 dB lower reading on the VTVM than obtained in para a).
- Check that the sensitivity is better than 0.8 μV emf for RC13-1 and 0.7 μV emf for RC33-1.
- Adjust the coupling between L1 and L2 in order to obtain the greatest quieting under the level recorded in para a).
- Retune C11, C9, C7 and C1.

Note: The voltages mentioned above are the unloaded output voltages from the frequency measuring set. Two methods are used when calibrating the attenuator of a signal generator:

- The output voltage engraved on the attenuator is the unloaded generator voltage.
- The output voltage engraved on the attenuator is the voltage across an external load, which corresponds to the output impedance of the signal generator.

In the first example is used the voltage engraved on the attenuator, while the double voltage value engraved on the attenuator should be used in the second example.

WARNING

As a precaution to avoid damage to the attenuator of the signal generator the fuse for the high voltage from the transmitter power supply should be open during alignment of the receiver unit.

Chapter IV. Alignment Procedure

E. Antenna Branching Filter BF13-1

Instruments

The following measuring instruments are required:

50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SIO5, SIO6 or SIO7).

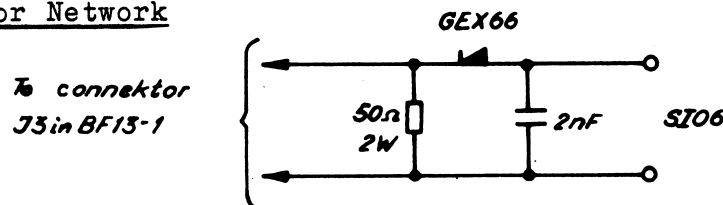
Signal generator covering the range 144 - 174 Mc/s.

Detector network (as shown on diagram below).

A 6 dB 50-50 Ω attenuator network.

Two dummy loads, 50 Ω /60 watt (STORNO DL11-1).

Setting-up

Detector Network

Procedure

The following procedure is to be used in cases where a transmitter and a receiver are connected for duplex operation. Do not feed maximum power into the branching filter until a coarse adjustment of the filter has been completed.

Band-stop

1. Adjustment of the band-stop circuit at the transmitter frequency.

- a) Connect the transmitter to connector J1.
- b) Connect a dummy load to connector ANT (J2).
- c) Connect a dummy load with the service instrument SIO6 in series with connector J3.
- d) Adjust C3 and C4 for minimum reading on the microammeter.

For the final fine adjustment a sensitive indicator should be used. The detector network in connection with the microammeter will suffice.

Note: Owing to the high Q of the circuitry the adjustment must be performed with the utmost care.

2. Adjustment of the band-stop circuit at the receiver frequency.

- a) Connect the receiver to connector J1.
- b) Connect the signal generator to connector ANT (J2).
- c) Connect a dummy load to connector J3.
- d) Adjust the signal generator to the receiver frequency.
- e) Adjust C1 and C2 to obtain minimum limiter current in the receiver unit.

Check the adjustment of the band-stop circuits performed so far (if necessary repeat 1. and 2.).

Band-pass

3. Adjustment of the band-pass circuit at the transmitter frequencies.

- a) Connect the transmitter to connector J1.
- b) Connect a dummy load in series with the service instrument SIO6 to antenna connector ANT (J2).
- c) Key the transmitter.
- d) Adjust C5 for maximum reading on the microammeter.

Chapter IV. Alignment Procedure

4. Adjustment of the band-pass circuit at the receiver frequency.

- a) A correct loading of the filter is obtained by short-circuiting the AVC-circuit in the receiver and inserting a 6 dB 50-50 Ω attenuator network between filter and receiver.
- b) Connect the receiver to connector J3.
- c) Connect the signal generator to the antenna connector ANT (J2).
- d) Adjust the signal generator to the receiver frequency.
- e) Adjust C6 to obtain maximum limiter current (The output from the signal generator should be kept so low that limiting in the receiver is prevented otherwise it will be impossible to get correct maximum indication).

Warning: Do not key the transmitter while it is connected to connector J1 as the attenuator of the signal generator will be destroyed. The best way to prevent this is to open the fuse in the transmitter power supply unit.

F. Antenna Branching Filter BF33-1**Instruments**

The following measuring instruments are required:

50-0-50 microammeter, $R_i = 1000 \Omega$ (STORNO SIO5, SIO6 or SIO7).

Signal generator covering the range 68 - 88 Mc/s.

Detector network (as shown on the diagram in BF13-1).

A 6 dB 50-50 Ω attenuator network.

Two dummy loads, 50 Ω /60 watt (STORNO DL11-1).

Procedure

The following procedure is to be used in cases where a transmitter and a receiver are connected to duplex operation. Do not feed maximum power into the filter until a coarse adjustment of the filter has been completed.

A. Transmitter Frequency higher than Receiver Frequency**Band-stop**1. Adjustment of the band-stop circuit at the transmitter frequency.

- a) Connect the transmitter to connector J2.
- b) Connect a dummy load to antenna connector ANT (J3).
- c) Connect a dummy load with the serviceinstrument SIO6 in series to connector J1.
- d) Adjust C1 and C2 for minimum reading on the microammeter.

For the final fine adjustment a sensitive indicator should be used. The detector network in connection with the microammeter will suffice.

Note: Owing to the high Q of the band-stop circuitry the adjustment must be performed with the utmost care.

Chapter IV. Alignment Procedure

2. Adjustment of the band-stop circuit at the receiver frequencies.

- a) Connect the receiver to connector J2.
- b) Connect the signal generator to antenna connector ANT (J3).
- c) Connect a dummy load to connector J1.
- d) Adjust the signal generator to the receiver frequency.
- e) Adjust C3 and C4 to obtain minimum limiter current in the receiver unit.

Check the adjustment of the band-stop circuits performed so far (if necessary repeat 1. and 2.).

Band-pass

3. Adjustment of band-pass circuitry at the transmitter frequency.

- a) Connect the transmitter to connector J2.
- b) Connect a dummy load in series with the serviceinstrument SI06 to antenna connector ANT (J3).
- c) Key the transmitter.
- d) Adjust C6 for maximum reading on the microammeter.

4. Adjustment of the band-pass circuitry at the receiver frequency.

- a) A correct loading of the filter is obtained by short-circuiting the AVC-circuit in the receiver and inserting a 50-50 Ω attenuator network between filter and receiver.
- b) Connect the receiver to connector J1.
- c) Connect the signal generator to the antenna connector ANT (J3).
- d) Adjust the signal generator to the receiver frequency.
- e) Adjust C5 to obtain maximum limiter current in the receiver unit (The output from the signal generator should be kept so low that limiting in the receiver is prevented otherwise it will be impossible to get correct maximum indication).

WARNING: Do not key the transmitter while connected to connector J2 as the attenuator of the signal generator will be destroyed. The best way to prevent this is to open the fuse in the transmitter power supply.

B. Receiver Frequency higher than Transmitter Frequency

Band-stop

1. Adjustment of band-stop circuitry at the transmitter frequency.

- a) Connect the transmitter to connector J1.
- b) Connect a dummy load to antenna connector ANT (J3).
- c) Connect a dummy load with the serviceinstrument SI06 in series to connector J2.
- d) Adjust C3 and C4 for minimum reading on the microammeter.

For the final adjustment a sensitive indicator should be used. The detector network in connection with the microammeter will suffice.

Chapter IV. Alignment Procedure

Note: Owing to the high Q of the band-stop circuitry the adjustment must be performed with the utmost care.

2. Adjustment of the band-stop circuitry at the receiver frequency.

- a) Connect the receiver to connector J1.
- b) Connect the signal generator to antenna connector ANT (J3).
- c) Connect a dummy load to connector J2.
- d) Adjust the signal generator to the receiver frequency.
- e) Adjust C1 and C2 in order to obtain minimum limiter current in the receiver unit.

Check the adjustment of the band-stop circuits performed so far (repeat 1. and 2. if necessary).

Band-pass

3. Adjustment of band-pass circuitry at the transmitter frequency.

- a) Connect the transmitter to connector J1.
- b) Connect a dummy load with the service instrument SI06 in series to the antenna connector ANT (J3).
- c) Key the transmitter.
- d) Adjust C5 for maximum reading on the microammeter.

4. Adjustment of band-pass circuitry at the receiver frequency.

- a) A correct loading of the filter is obtained by short-circuiting the AVC-circuit in the receiver and inserting 6 dB 50-50 Ω attenuator network between filter and receiver.
- b) Connect the receiver to connector J2.
- c) Connect the signal generator to antenna connector ANT (J3).
- d) Adjust the signal generator to the receiver frequency.
- e) Adjust C6 in order to obtain maximum limiter current in the receiver (The output from the signal generator should be kept so low that limiting in the receiver is prevented as it otherwise will be impossible to get a correct maximum indication).

Warning: Do not key the transmitter while connected to connector J1 as the attenuator of the signal generator will be destroyed. The best way to prevent this mishap is to open the fuse in the transmitter power supply unit.

DIAGRAMS and PARTS LISTS

The diagrams with parts lists of all modular units can be found on the following pages. Possible modifications or amendments are given on a special page placed at the end of the handbook.

Spares

When ordering spare parts from STORNO the code numbers on the parts list should be stated together with the type designation of the unit in which the said components was located. The position designation of the component (e. g. R1, C4, etc.) is not sufficient information as the numbering starts right from the beginning for each modular unit.

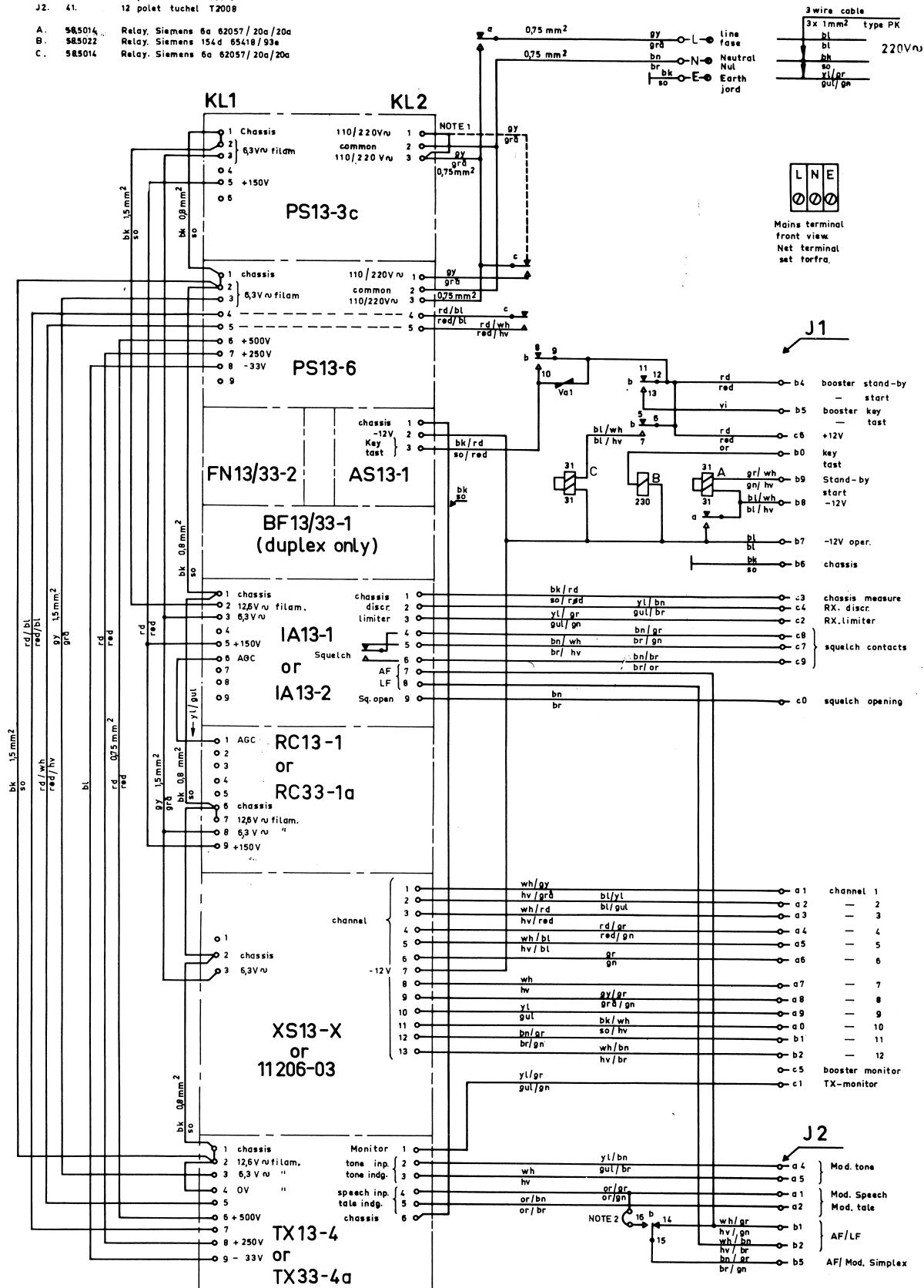
Diagrams

The following diagrams appear on the pages following:

| | |
|-----------|---------------------------------------|
| TX13-4(L) | Transmitter, 136 - 174 Mc/s |
| TX33-4a | Transmitter, 68 - 88 Mc/s |
| RC13-1(L) | Receiver Converter, 136 - 174 Mc/s |
| RC33-1a | Receiver Converter, 68 - 88 Mc/s |
| IA13-1 | Intermediate Amplifier, 50 kc/s |
| IA13-2 | Intermediate Amplifier, 25 kc/s |
| PS13-3c | Receiver Power Supply |
| PS13-6 | Transmitter Power Supply |
| AS13-1 | Antenna Shift Unit, Simplex operation |
| FN13-2 | Antenna Filter, 136 - 174 Mc/s |
| FN33-2 | Antenna Filter, 68 - 88 Mc/s |
| BF13-1 | Branching Filter, 136 - 174 Mc/s |
| BF33-1 | Branching Filter, 68 - 88 Mc/s |
| XS13-4 | Single Channel, crystal oven |
| XS13-5 | 3 Channels |
| XS13-6 | 3 Channels, crystal oven |
| XS13-7 | 6 Channels |
| XS13-8 | 6 Channels, crystal ovens. |

J1. 41. 30 poler tuchel T2070
 J2. 41. 12 poler tuchel T2008

A. 585014. Relay, Siemens 6a 62057/20a/20a
 B. 585022. Relay, Siemens 154d 65418/93a
 C. 585014. Relay, Siemens 6a 62057/20a/20a



Note 1. When using X-tal shift unit XS13-5 in COF31-2/3 (simplex operation) following modifications takes place in PS13-3c:

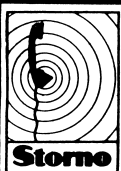
- The connection between term.1 and 3 on KL.2 is removed.
- Term.1 on KL.2 is by a grey wire (0.75mm) connected to the free contact in relay C. (shown dotted).

Note 1. Når krystalskifteenhed XS13-5 benyttes i forbindelse med COF 31-2/3 (ved simplex drift) foretages følgende ændringer i PS13-3c:

- Forbindelsen mellem term.1 og 3 på KL.2 fjernes.
- Term.1 på KL.2 forbindes med en grå ledning (0.75mm) til relæ C's ledige kontakt (vist stiplet).

Note 2. To be disconnected if remarked on the control diagram.

Note 2. Afbrydes hvis bemærkning herom findes på styringsdiagram.



konstr./tegn.
 SM/JEK
 22-9-64
 godk.
 komp. liste

CABLEFORM
 KABLING

CQF 11- 2/3
 CQF 31- 2/3

D400032/3

6-3-64
15-9-65
11-8-66
28-8-67

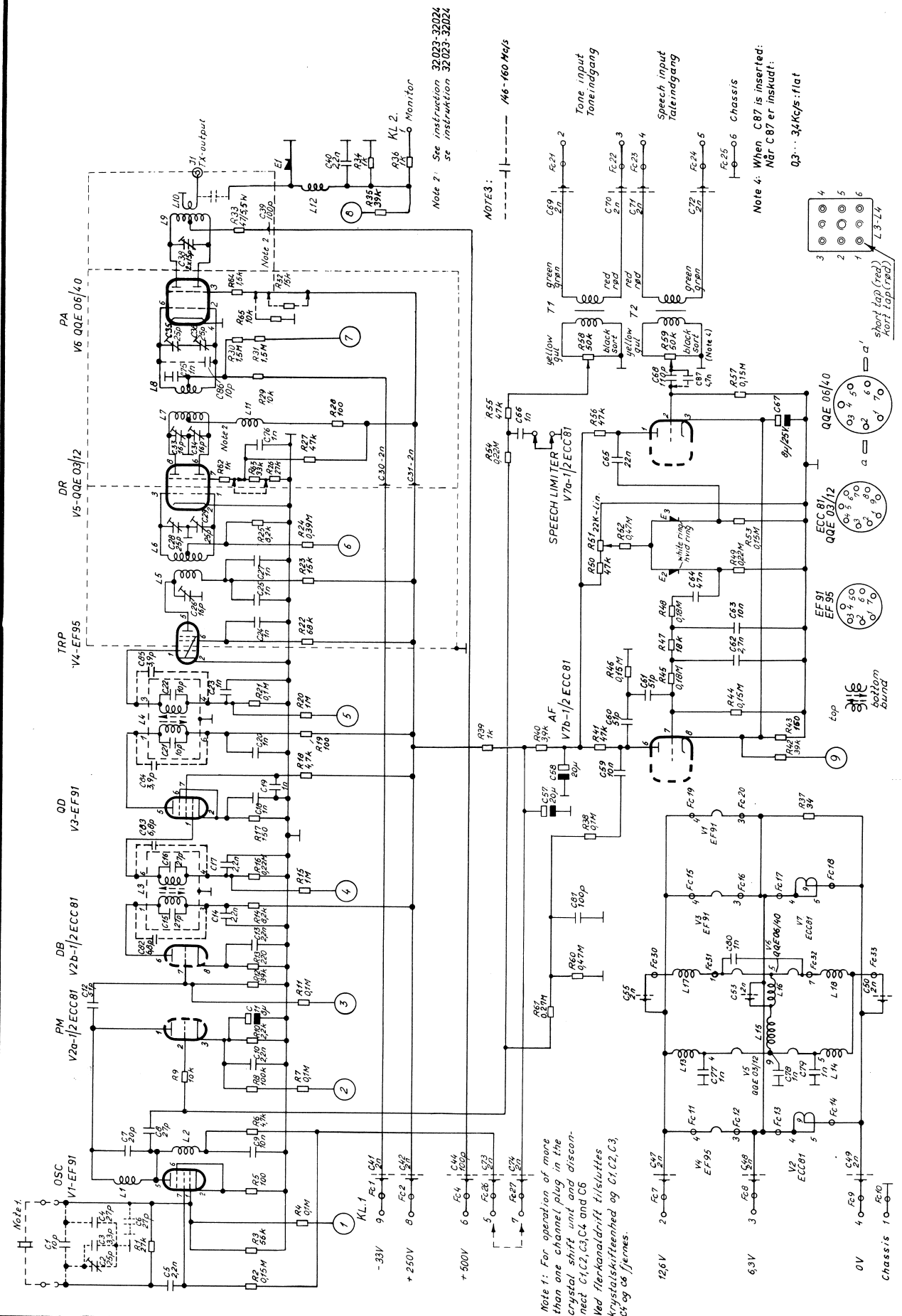


konstr./tegn.
EBN/BM
19-9-63
godk.
komp.lista

TRANSMITTER SENDER

TX13-4a

D400.473

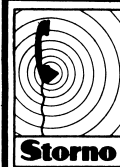


TX13(L) - 4a

| type | no | code | data | | type | no | code | data | |
|------|------|---------|-------------------|----------|------|--------|---------|-----------------------|------|
| | C1 | 74.5042 | 10 pF ±5% | 500V | | R11 | 80.5473 | 0,1 MΩ carbon film | 1/4W |
| | C2 | 78.5005 | 25 pF trimmer | | | R12 | 80.5468 | 39 kΩ | 1/4W |
| | C3 | 74.5096 | 3,3 pF | 500V | | R13 | 80.5441 | 220 Ω | 1/4W |
| | C4 | 74.5056 | 27 pF ±5% | 500V | | R14 | 81.5060 | 8,2 kΩ | 1/2W |
| | C5 | 74.5017 | 2,2 nF | 350V | | R15 | 81.5085 | 1 MΩ | 1/2W |
| | C6 | 74.5056 | 27 pF ±5% | 500V | | R16 | 80.5477 | 0,22 MΩ | 1/4W |
| | C7 | 74.5052 | 20 pF ±5% | 500V | | R17 | 80.5439 | 150 Ω | 1/4W |
| | C8 | 74.5056 | 27 pF ±5% | 500V | | R18 | 81.5057 | 4,7 kΩ | 1/2W |
| | C9 | 76.5030 | 10 nF ±10% | 400V | | R19 | 80.5437 | 100 Ω | 1/4W |
| | C10 | 74.5017 | 2,2 nF | 350V | | R20 | 81.5085 | 1 MΩ | 1/2W |
| | C11 | 73.5008 | 8 uF | 25V | | R21 | 80.5473 | 0,1 MΩ | 1/4W |
| | C12 | 74.5061 | 51 pF ±5% | 500V | | R22 | 81.5071 | 68 kΩ | 1/2W |
| | C13- | | | | | R23 | 81.5063 | 15 kΩ | 1/2W |
| | C14 | 74.5017 | 2,2 nF | 350V | | R24 | 80.5480 | 0,39 MΩ | 1/4W |
| | C15- | | | | | R25 | 80.5460 | 8,2 kΩ | 1/4W |
| | C16 | 74.5056 | 27 pF ±5% | | | R26 | 80.5466 | 27 kΩ | 1/4W |
| | C17 | 74.5017 | 2,2 nF | 350V | | R27 | 81.5069 | 47 kΩ | 1/2W |
| | C18- | | | | | R28 | 81.5037 | 100 Ω | 1/2W |
| | C20 | 74.5015 | 1 nF | 500V | | R29 | 81.5061 | 10 kΩ | 1/2W |
| | C21- | | | | | R30- | | | |
| | C22 | 74.5042 | 10 pF ±5% | | | R31 | 81.5087 | 1,5 MΩ | 1/2W |
| | C23- | | | | | R32 | 84.5014 | 15 kΩ wirewound | 5,5W |
| | C25 | 74.5015 | 1 nF | 500V | | R33 | 84.5003 | 47 Ω | 5,5W |
| | C26 | 78.5016 | 16 pF trimmer | | | R34 | 80.5449 | 1 kΩ carbon film | 1/4W |
| | C27 | 74.5015 | 1 nF | 500V | | R35 | 80.5468 | 39 kΩ | 1/4W |
| | C28- | | | | | R36 | 80.5449 | 1 kΩ | 1/4W |
| | C29 | 78.5004 | 25 pF trimmer | | | R37 | 82.5035 | 34 Ω (2 x 68Ω 1W) | |
| | C30- | | | | | R38 | 80.5473 | 0,1 MΩ carbon film | 1/4W |
| | C31 | 74.5081 | 2 nF | 500V | | R39 | 81.5049 | 1 kΩ | 1/2W |
| | C33- | | | | | R40 | 81.5056 | 3,9 kΩ | 1/2W |
| | C34 | 78.5016 | 16 pF trimmer | | | R41 | 80.5469 | 47 kΩ | 1/4W |
| | C35- | | | | | R42 | 80.5468 | 39 kΩ | 1/4W |
| | C36 | 78.5005 | 25 pF trimmer | | | R43 | 80.5439 | 150 Ω | 1/4W |
| | C38 | 78.5019 | 2 x 15 pF | | | R44 | 80.5475 | 0,15 MΩ | 1/4W |
| | C39 | 74.5068 | 100 pF | 700V | | R45 | 80.5476 | 0,18 MΩ | 1/4W |
| | C40 | 74.5017 | 2,2 nF | 350V | | R46 | 80.5475 | 0,15 MΩ | 1/4W |
| | C41- | | | | | R47 | 80.5464 | 18 kΩ | 1/4W |
| | C42 | 74.5081 | 2 nF | 500V | | R48 | 80.5476 | 0,18 MΩ | 1/4W |
| | C44 | 74.5068 | 100 pF | 700V | | R49 | 80.5477 | 0,22 MΩ | 1/4W |
| | C47- | | | | | R50 | 81.5069 | 47 kΩ | 1/2W |
| | C50 | 74.5081 | 2 nF | 500V | | R51 | 87.5012 | 22 kΩ ±5% pot. meter | 1W |
| | C53 | 74.5081 | 2 nF | 500V | | R52 | 80.5481 | 0,47 MΩ carbon film | 1/4W |
| | C55 | 74.5081 | 2 nF | 500V | | R53 | 80.5475 | 0,15 MΩ | 1/4W |
| | C57- | | | | | R54 | 80.5477 | 0,22 MΩ | 1/4W |
| | C58 | 73.5018 | 20 + 20 uF | 450/500V | | R55 | 81.5069 | 47 kΩ | 1/2W |
| | C59 | 76.5030 | 10 nF ±10% | 400V | | R56 | 80.5469 | 47 kΩ | 1/4W |
| | C60- | | | | | R57 | 80.5479 | 0,33 MΩ | 1/4W |
| | C61 | 74.5061 | 51 pF ±5% | 500V | | R58-59 | 86.5014 | 50 kΩ pot. meter log. | |
| | C62 | 76.5023 | 2,7 nF ±10% | 400V | | R60 | 80.5481 | 0,47 MΩ carbon film | 1/4W |
| | C63 | 76.5011 | 10 nF ±10% | 400V | | R61 | 80.5478 | 0,27 MΩ | 1/4W |
| | C64 | 76.5033 | 47 nF ±10% | 125V | | R62 | 81.5049 | 1 kΩ | 1/2W |
| | C65 | 76.5031 | 22 nF ±10% | 400V | | R63 | 81.5067 | 33 kΩ | 1/2W |
| | C66 | 76.5007 | 1 nF ±5% | 600V | | R64 | 84.5007 | 1,5 kΩ wirewound | 5,5W |
| | C67 | 73.5008 | 8 uF | 25V | | R65 | 84.5012 | 10 kΩ wirewound | 5,5W |
| | C68 | 74.5072 | 110 pF ±5% | 500V | | | | | |
| | C69- | | | | | E1 | 99.5046 | diode GEX66 | |
| | C74 | 74.5081 | 2 nF | 500V | | E2 | 99.5028 | diode OA200 | |
| | C76- | | | | | E3 | 99.5028 | diode OA200 | |
| | C80 | 74.5015 | 1 nF | 500V | | | | | |
| | C81 | 74.5070 | 100 pF ±5% | 500V | | Fc1- | | | |
| -13L | C82- | | | | | Fc33 | 65.5040 | ferroxcube perler | |
| | C83 | 74.5021 | 6,8 pF | 500V | | | | | |
| -13L | C84- | | | | | J1 | 41.5101 | Ant. Connector | |
| | C85 | 74.5091 | 3,9 pF | 500V | | | | | |
| -13L | C86 | 78.5024 | 10 pF trimmer | 400V | | L1 | 62.099 | Spole, drossel/choke | |
| | C87 | 76. | 4,7 nF ±10% | | | L2 | 62.099 | Spole, drossel/choke | |
| | | | | | | L3 | 61.447 | 12,6-14,5 Mc/s | |
| | R1 | 80.5466 | 27 kΩ carbon film | 1/4W | | | | | |
| | R2 | 80.5475 | 0,15 MΩ | 1/4W | | L4 | 61.448 | 50,8-58 Mc/s | |
| | R3 | 80.5470 | 56 kΩ | 1/4W | | | | | |
| | R4 | 80.5473 | 0,1 MΩ | 1/4W | | | | | |
| | R5 | 80.5437 | 100 Ω | 1/4W | | L5 | 62.532 | 152-174 Mc/s | |
| | R6 | 81.5057 | 4,7 kΩ | 1/2W | | L6 | 62.531 | 152-174 Mc/s | |
| | R7 | 80.5473 | 0,1 MΩ | 1/4W | | L7 | 62.506 | 152-174 Mc/s | |
| | R8 | 80.5473 | 0,1 MΩ | 1/4W | | L8 | 62.535 | 152-174 Mc/s | |
| | R9 | 80.5461 | 10 kΩ | 1/4W | -13 | L9 | 62.609 | 152-174 Mc/s | |
| | R10 | 80.5453 | 2,2 kΩ | 1/4W | -13L | L9 | 62.610 | 136-156 Mc/s | |

TX13 (L) - 4a

| type | no | code | data | type | no | code | data |
|------|------|---------|--|------|----|------|------|
| -13 | L10 | 62.608 | 152-174 Mc/s | | | | |
| -13L | L10 | 62.611 | 136-156 Mc/s | | | | |
| | L11 | 63.5002 | 0,56 uH, drossel | | | | |
| | L12 | 63.5004 | 2,2 uH, drossel | | | | |
| | L13- | | | | | | |
| | L15 | 62.474 | spole, drossel | | | | |
| | L16- | | | | | | |
| | L18 | 62.504 | spole, drossel | | | | |
| | T1- | | | | | | |
| | T2 | 60.5003 | 50 k Ω - 600 Ω Transformer | | | | |
| | V1 | 99.5057 | pentode EF91 | | | | |
| | V2 | 99.5054 | duotriode ECC81 | | | | |
| | V3 | 99.5057 | pentode EF91 | | | | |
| | V4 | 99.5002 | pentode EF95 | | | | |
| | V5 | 99.5004 | duotetrode QQE 03/12 | | | | |
| | V6 | 99.5053 | duotetrode QQE 06/40 | | | | |
| | V7 | 99.5054 | duotriode ECC81 | | | | |
| | X1 | 98. | Crystal | | | | |

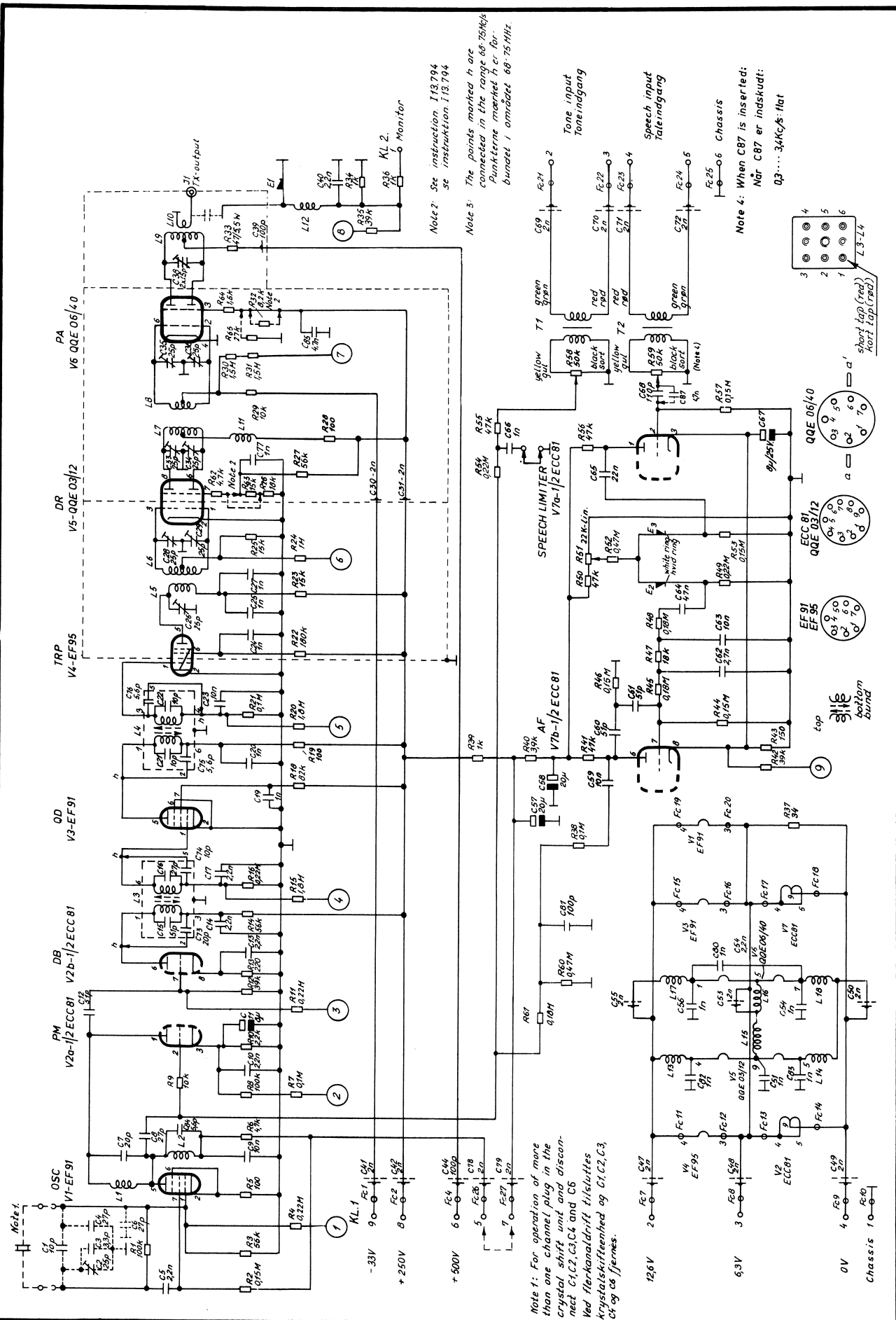


konstr./tegn.
EBN/BM
19-9-63
godk.
komp. liste

TRANSMITTER SENDER

TX33-4a

D400472



TX33 - 4a

| type | no | code | data | | type | no | code | data | |
|------|------|---------|----------------------------|----------|------|------|---------|-----------------------------------|------|
| | C1 | 74.5042 | 10 pF $\pm 5\%$ | 500V | | R3 | 80.5470 | 56 k Ω carbon film | 1/4W |
| | C2 | 78.5005 | 25 pF trimmer | | | R4 | 80.5477 | 0,22 M Ω " " | 1/4W |
| | C3 | 74.5096 | 3,3 pF | 500V | | R5 | 80.5437 | 100 Ω " " | 1/4W |
| | C4 | 74.5056 | 27 pF $\pm 5\%$ | 500V | | R6 | 81.5057 | 4,7 k Ω " " | 1/2W |
| | C5 | 74.5017 | 2,2 nF | 350V | | R7- | | | |
| | C6 | 74.5056 | 27 pF $\pm 5\%$ | 500V | | R8 | 80.5473 | 0,1 M Ω " " | 1/4W |
| | C7 | 74.5052 | 20 pF $\pm 5\%$ | 500V | | R9 | 80.5461 | 10 k Ω " " | 1/4W |
| | C8 | 74.5056 | 27 pF $\pm 5\%$ | 500V | | R10 | 80.5453 | 2,2 k Ω " " | 1/4W |
| | C9 | 76.5030 | 10 nF $\pm 10\%$ | 400V | | R11 | 80.5477 | 0,22 M Ω " " | 1/4W |
| | C10 | 74.5017 | 2,2 nF | 350V | | R12 | 80.5468 | 39 k Ω " " | 1/4W |
| | C11 | 73.5008 | 8 uF | 25V | | R13 | 80.5441 | 220 Ω " " | 1/4W |
| | C12 | 74.5061 | 51 pF $\pm 5\%$ | 500V | | R14 | 81.5070 | 56 k Ω " " | 1/2W |
| | C13- | | | | | R15 | 80.5488 | 1,8 M Ω " " | 1/4W |
| | C14 | 74.5017 | 2,2 nF | 350V | | R16 | 80.5477 | 0,22 M Ω " " | 1/4W |
| | C15 | 74.5011 | 51 pF $\pm 5\%$ | | | R18 | 81.5072 | 82 k Ω " " | 1/2W |
| | C16 | 74.5056 | 27 pF $\pm 5\%$ | | | R19 | 80.5437 | 100 Ω " " | 1/4W |
| | C17 | 74.5017 | 2,2 nF | 350V | | R20 | 80.5488 | 1,8 M Ω " " | 1/4W |
| | C19- | | | | | R21 | 80.5473 | 0,1 M Ω " " | 1/4W |
| | C20 | 74.5015 | 1 nF | 500V | | R22 | 81.5076 | 180 k Ω " " | 1/2W |
| | C21- | | | | | R23 | 81.5063 | 15 k Ω " " | 1/2W |
| | C22 | 74.5042 | 10 pF $\pm 5\%$ | | | R24 | 80.5485 | 1 M Ω " " | 1/4W |
| | C23 | 74.5028 | 10 nF | | | R25 | 80.5463 | 15 k Ω " " | 1/4W |
| | C24- | | | | | R26 | 80.5464 | 18 k Ω " " | 1/4W |
| | C25 | 74.5015 | 1 nF | 500V | | R27 | 81.5070 | 56 k Ω " " | 1/2W |
| | C26 | 78.5005 | 25 pF trimmer | | | R28 | 81.5037 | 100 Ω " " | 1/2W |
| | C27 | 74.5015 | 1 nF | 500V | | R29 | 81.5061 | 10 k Ω " " | 1/2W |
| | C28- | | | | | R30- | | | |
| | C29 | 78.5004 | 25 pF trimmer | | | R31 | 81.5087 | 1,5 M Ω " " | 1/2W |
| | C30- | | | | | R32 | 84.5015 | 8,2 k Ω wirewounded | 5,5W |
| | C31 | 74.5081 | 2 nF | 500V | | R33 | | 47 Ω " " | 5,5W |
| | C33- | | | | | R34 | 80.5449 | 1 k Ω carbon film | 1/4W |
| | C36 | 78.5005 | 25 pF trimmer | | | R35 | 80.5468 | 39 k Ω " " | 1/4W |
| | C38 | 70.5019 | 2 x 15 pF | | | R36 | 80.5449 | 1 k Ω " " | 1/4W |
| | C39 | 74.5068 | 100 pF | 700V | | R37 | 81.5071 | 34 Ω (2x68 Ω) | 1W |
| | C40 | 74.5017 | 2,2 nF | 350V | | R38 | 80.5473 | 0,1 M Ω " " | 1/4W |
| | C41- | | | | | R39 | 81.5049 | 1 k Ω " " | 1/2W |
| | C42 | 74.5081 | 2 nF | 500V | | R40 | 81.5056 | 3,9 k Ω " " | 1/2W |
| | C44 | 74.5068 | 100 pF | 700V | | R41 | 80.5469 | 47 k Ω " " | 1/4W |
| | C47- | | | | | R42 | 80.5468 | 39 k Ω " " | 1/4W |
| | C50 | 74.5081 | 2 nF | 500V | | R43 | 80.5439 | 150 Ω " " | 1/4W |
| | C51 | 74.5015 | 1 nF | 500V | | R44 | 80.5475 | 0,15 M Ω " " | 1/4W |
| | C53 | 74.5081 | 2 nF | 500V | | R45 | 80.5476 | 0,18 M Ω " " | 1/4W |
| | C54 | 74.5015 | 1 nF | 500V | | R46 | 80.5475 | 0,15 M Ω " " | 1/4W |
| | C55 | 74.5081 | 2 nF | 500V | | R47 | 80.5464 | 18 k Ω " " | 1/4W |
| | C56 | 74.5015 | 1 nF | 500V | | R48 | 80.5476 | 0,18 M Ω " " | 1/4W |
| | C57- | | | | | R49 | 80.5477 | 0,22 M Ω " " | 1/4W |
| | C58 | 73.5018 | 20 + 20 uF | 450/500V | | R50 | 81.5069 | 47 k Ω " " | 1/2W |
| | C59 | 76.5030 | 10 nF $\pm 10\%$ | 400V | | R51 | 87.5012 | 22 k Ω $\pm 5\%$ Pot. met. | 1W |
| | C60- | | | | | R52 | 80.5481 | 0,47 M Ω carbon film | 1/4W |
| | C61 | 74.5061 | 51 pF $\pm 5\%$ | 500V | | R53 | 80.5475 | 0,15 M Ω " " | 1/4W |
| | C62 | 76.5023 | 2,7 nF $\pm 10\%$ | 400V | | R54 | 80.5477 | 0,22 M Ω " " | 1/4W |
| | C63 | 76.5011 | 10 nF $\pm 5\%$ | 400V | | R55 | 81.5069 | 47 k Ω " " | 1/2W |
| | C64 | 76.5033 | 47 nF $\pm 10\%$ | 125V | | R56 | 80.5469 | 47 k Ω " " | 1/4W |
| | C65 | 76.5031 | 22 nF $\pm 10\%$ | 400V | | R57 | 80.5479 | 0,33 M Ω " " | 1/4W |
| | C66 | 76.5007 | 1 nF $\pm 5\%$ | 600V | | R58- | | | |
| | C67 | 73.5008 | 8 uF | 25V | | R59 | 86.5014 | 50 k Ω potentiom. log. | |
| | C68 | 74.5072 | 110 pF $\pm 5\%$ | 500V | | R60 | 80.5481 | 0,47 M Ω carbon film | 1/4W |
| | C69- | | | | | R61 | 80.5476 | 0,18 M Ω " " | 1/4W |
| | C72 | 74.5081 | 2 nF | 500V | | R62 | 81.5057 | 4,7 k Ω " " | 1/2W |
| | C73 | 74.5042 | 20 pF (2x10pF) $\pm 5\%$ | | | R63 | 81.5063 | 15 k Ω " " | 1/2W |
| | C74 | 74.5042 | 10 pF $\pm 5\%$ | | | R64 | 84.5007 | 1,5 k Ω wirewounded | 5,5W |
| | C75- | | | | | R65 | 84. | 27 k Ω " " | 5,5W |
| | C76 | 74.5033 | 5,6 pF $\pm 5\%$ | | | | | | |
| | C77 | 74.5015 | 1 nF | 500V | | E1 | 99.5046 | diode GEX66 | |
| | C78- | | | | | E2- | | | |
| | C79 | 74.5081 | 2 nF | 500V | | E3 | 99.5028 | diode OA200 | |
| | C80 | 74.5015 | 1 nF | 500V | | | | | |
| | C81 | 74.5070 | 100 pF | 500V | | Fc1- | | | |
| | C82- | | | | | Fc27 | 65.5040 | ferrøxcube perler | |
| | C83 | 74.5016 | 1 nF | 500V | | | | | |
| | C84 | 74.5004 | 5,6 pF $\pm 0,2$ pF | 500V | | J1 | 41.5101 | Ant. connector | |
| | C85 | 74.5020 | 4,7 nF -20/+50% | 500V | | | | | |
| | C87 | 74.5020 | 4,7 nF -20/+50% | 500V | | L1- | | | |
| | | | | | | L2 | 62.455 | spole, drossel/choke | |
| | R1 | 80.5473 | 0,1 M Ω carbon film | 1/4W | | L3 | 61.457 | Filter, C15, C16, C73, C74 | |
| | R2 | 80.5475 | 0,15 M Ω " " | 1/4W | | L4 | 61.431 | Filter, C21, C22, C75, C76 | |
| | | | | | | L5 | 62.538 | Filterspole/filtercoil | |

TX33-4a

| type | no | code | data | type | no | code | data |
|------|------|---------|-----------------------------|------|----|------|------|
| | L6 | 62.540 | Filterspole | | | | |
| | L7 | 62.537 | Filterspole | | | | |
| | L8 | 62.542 | Filterspole | | | | |
| | L9 | 62.541 | Filterspole | | | | |
| | L10 | 62.539 | Filterspole | | | | |
| | L11- | | | | | | |
| | L12 | 63.5004 | 2,2 μ H | | | | |
| | L13- | | | | | | |
| | L15 | 62.474 | Spole, drossel | | | | |
| | L16- | | | | | | |
| | L18 | 62.504 | Spole, drossel | | | | |
| | T1- | | | | | | |
| | T2 | 60.5003 | 50 k Ω -600 Ω | | | | |
| | V1 | 99.5057 | pentode EF91 | | | | |
| | V2 | 99.5054 | duotriode ECC81 | | | | |
| | V3 | 99.5057 | pentode EF91 | | | | |
| | V4 | 99.5002 | pentode EF95 | | | | |
| | V5 | 99.5004 | duotetrode QQE03/12 | | | | |
| | V6 | 99.5053 | duotetrode QQE06/40 | | | | |
| | V7 | 99.5054 | duotriode ECC81 | | | | |
| | X1 | 98. | Krystal | | | | |

5-10-64
9-5-64

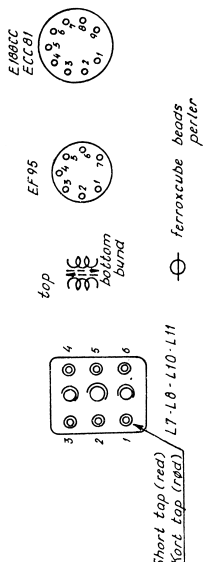
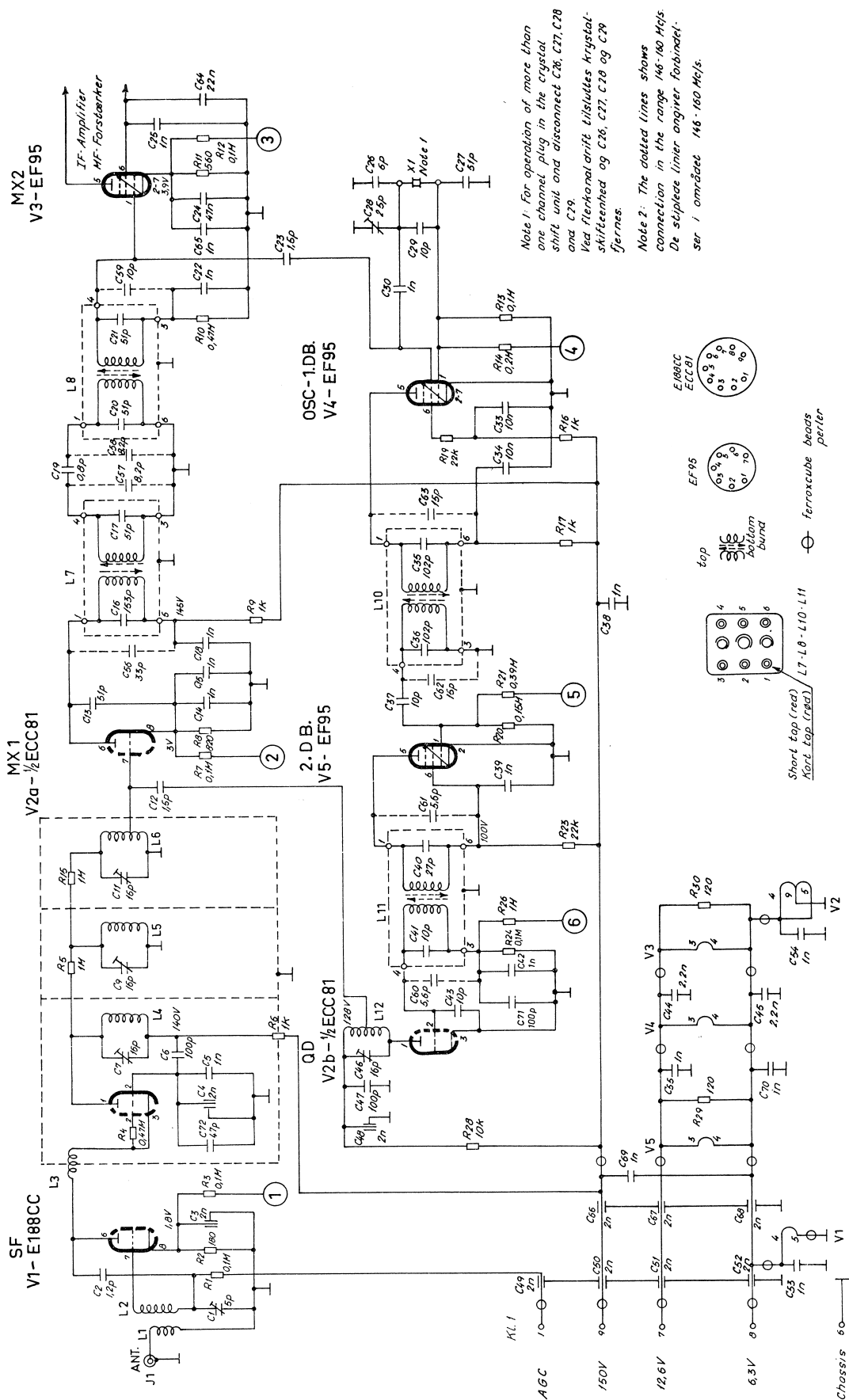


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godk.
komp. liste

RECEIVER CONVERTER MODTAGER KONVERTER

RC13-1
RC13-1L

D10244



RC13-1

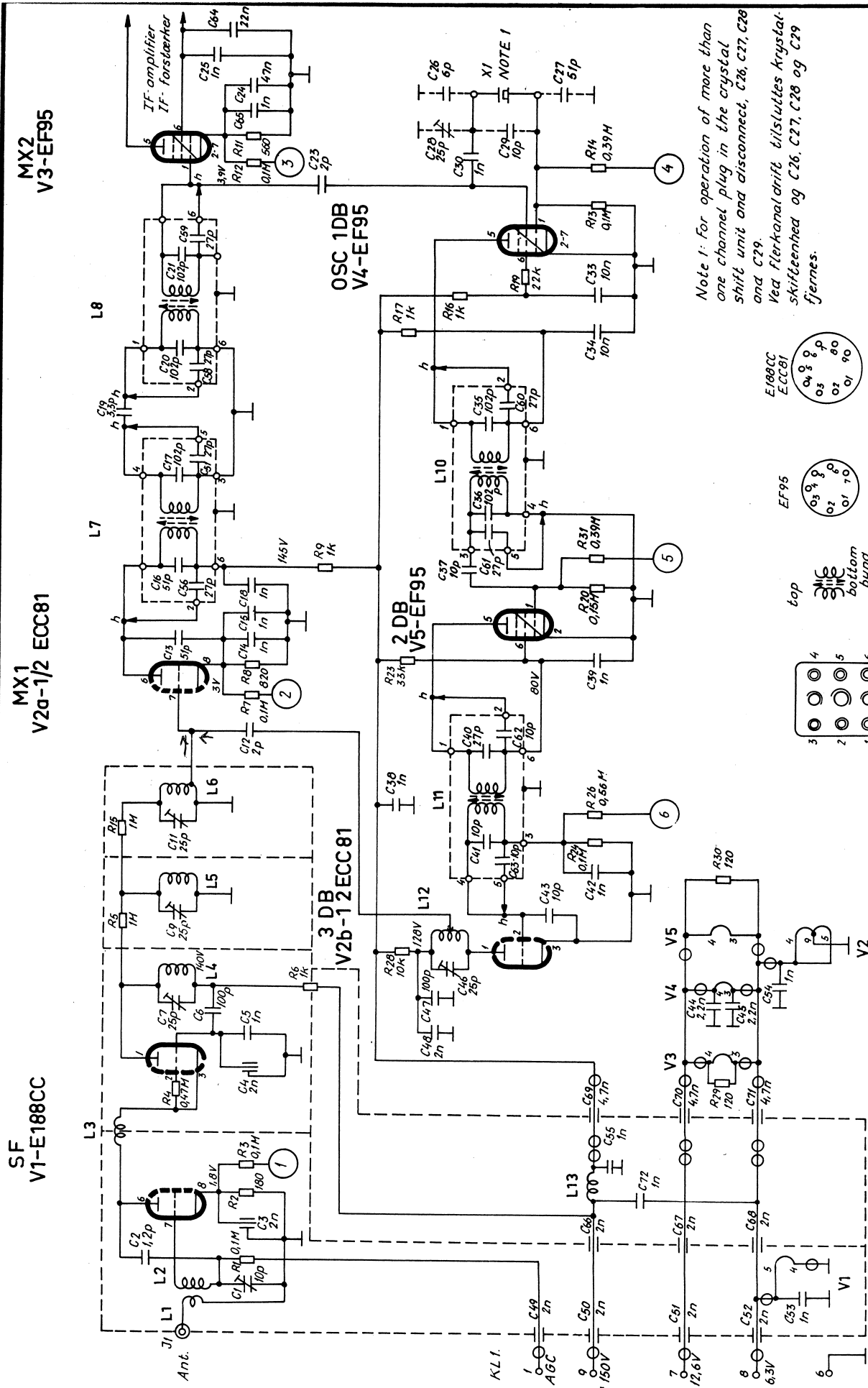
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|------|------|---------|--------------------------|--------------------------|------|-------|---------|--------------------------|------|
| | C1 | 78.5014 | 5pF trimmer | | | R1 | 80.5473 | 0,1 MΩ | 1/4W |
| | C2 | 74.5002 | 1,2pF ±0,1pF | | | R2 | 80.5440 | 180 Ω | 1/4W |
| | C3- | | | | | R3 | 80.5473 | 0,1 MΩ | 1/4W |
| | C4 | 74.5081 | 2 nF | 500V | | R4 | 80.5481 | 0,47MΩ | 1/4W |
| | C5 | 74.5016 | 1 nF | 500V | | R5 | 81.5085 | 1 MΩ | 1/2W |
| | C6 | 74.5069 | 100 pF | 500V | | R6 | 80.5449 | 1 kΩ | 1/4W |
| | C7 | 78.5015 | 16pF trimmer | | | R7 | 80.5473 | 0,1 MΩ | 1/4W |
| | C9- | | | | | R8 | 80.5448 | 820 Ω | 1/4W |
| | C11 | 78.5016 | 16pF trimmer | | | R9 | 80.5449 | 1 kΩ | 1/4W |
| | C12 | 74.5003 | 1,5pF ±20% | | | R10 | 80.5481 | 0,47 MΩ | 1/4W |
| | C13 | 74.5061 | 51pF ±5% | | | R11 | 80.5446 | 560 Ω | 1/4W |
| | C14- | | | | | R12- | | | |
| | C15 | 74.5016 | 1nF | 500V | | R13 | 80.5473 | 0,1 MΩ | 1/4W |
| | C16 | 74.5061 | 3 x 51 pF ±5% | | | R14 | 80.5473 | 0,2MΩ (2x0,1MΩ) | 1/4W |
| | C17 | 74.5061 | 51pF ±5% | | | R15 | 81.5085 | 1 MΩ | 1/2W |
| | C18 | 74.5016 | 1nF | 500V | | R16- | | | |
| | C19 | 74.5023 | 0,8pF ±0,1pF | | | R17 | 80.5449 | 1 kΩ | 1/4W |
| | C20- | | | | | R19 | 80.5465 | 22 kΩ | 1/4W |
| | C21 | 74.5061 | 51pF ±5% | | | R20 | 80.5475 | 0,15 MΩ | 1/4W |
| | C22 | 74.5016 | 1 nF | 500V | | R21 | 80.5480 | 0,39MΩ | 1/4W |
| | C23 | 74.5003 | 1,5pF ±20% | | | R23 | 80.5465 | 22 kΩ | 1/4W |
| | C24 | 76.5033 | 47nF | 125V | | R24 | 80.5473 | 0,1 MΩ | 1/4W |
| | C25 | 74.5016 | 1 nF | 500V | | R26 | 81.5085 | 1 MΩ | 1/4W |
| | C26 | 74.5035 | 6pF | only used | | R28 | 80.5461 | 10 kΩ | 1/4W |
| | C27 | 74.5061 | 51pF ±5% | on one channel | | R29- | | | |
| | | | | 1 kanal | | R30 | 80.5438 | 120 Ω | 1/4W |
| | C28 | 78.5005 | 25pF trim. | benyttet kun ved 1 kanal | | Fc | 65. | ferroxcube beads/perler | |
| | C29 | 74.5042 | 10pF ±0,5pF | 500V | | J1 | 41.5131 | ant. coax connector | |
| | C30 | 74.5016 | 1nF | 500V | | L1 | 62.446 | | |
| | C33- | | | | | L2 | 62.447 | 152-174 Mc/s | |
| | C34 | 76.5030 | 10nF | 400V | | L3 | 62.236 | 152-174 Mc/s | |
| | C35- | | | | | L4 | 62.438 | 152-174 Mc/s | |
| | C36 | 74.5061 | 2 x 51pF ±5% | | | L5 | 62.440 | 152-174 Mc/s | |
| | C37 | 74. | 10pF ±0,5 pF | 500V | | L6 | 62.438 | 152-174 Mc/s | |
| | C38- | | | | | L7 | 61.389 | 9,4-10,7 Mc/s, C16, C17 | |
| | C39 | 74.5016 | 1nF | 500V | | L8 | 61.391 | 9,4-10,7 Mc/s, C20, C21 | |
| | C40 | 74.5056 | 27pF ±5% | | | L10 | 61.445 | 18,4-20,4 Mc/s, C35, C36 | |
| | C41 | 74.5042 | 10pF ±5% | | | L11 | 61.428 | 36-41 Mc/s, C40, C41 | |
| | C42 | 74.5016 | 1nF | 500V | | L12 | 62.439 | 144-164 Mc/s | |
| | C43 | 74.5042 | 10pF ±5% | | | V1 | 99.5052 | duotriode E188CC | |
| | C44 | 74.5017 | 2,2nF | | | V2 | 99.5054 | duotriode ECC81 | |
| | C45 | 74.5017 | 2,2nF | | | V3-V5 | 99.5002 | pentode 5654 | |
| | C46 | 78.5015 | 16pF trimmer | | | | | | |
| | C47 | 74.5069 | 100pF | | | | | | |
| | C48- | | | | | | | | |
| | C52 | 74.5081 | 2nF | 500V | | | | | |
| | C53- | | | | | | | | |
| | C55 | 74.5016 | 1nF | 500V | | | | | |
| 13L | C56 | 74.5085 | 33pF ±5%(13L only) | 500V | | | | | |
| 13L | C57- | | | | | | | | |
| | C58 | 74.5036 | 8,2pF±0,25pF(13L only) | 500V | | | | | |
| 13L | C59 | 74.5042 | 10pF ±5%(13L only) | 500V | | | | | |
| 13L | C60- | | | | | | | | |
| | C61 | 74.5005 | 5,6pF ±0,25pF (13L only) | 500V | | | | | |
| 13L | C62- | | | | | | | | |
| | C63 | 74.5046 | 15pF ±5%(13L only) | 500V | | | | | |
| | C64 | 76.5031 | 22nF ±10% | 400V | | | | | |
| | C65 | 74.5016 | 1 nF | 500V | | | | | |
| | C66- | | | | | | | | |
| | C68 | 74.5081 | 2 nF | 500V | | | | | |
| | C69 | 74.5015 | 1nF -20/+50% | 500V | | | | | |
| | C70 | 74.5015 | 1nF -20/+50% | 500V | | | | | |
| | C71 | 74.5013 | 100pF ±20% | 500V | | | | | |
| | C72 | 74.5088 | 47 pF ±5% | 500V | | | | | |



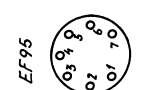
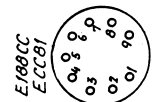
konst./tegn.
EBN/BM
16-9-63
godk.
komp. liste

RECEIVER CONVERTER RC33-1a

D 400.471



Note 1: For operation of more than one channel plug in the crystal shift unit and disconnect, C26, C27, C28 and C29.
Ved flerkanaldrift tilsluttes krystallskifteenhed og C26, C27, C28 og C29 fjernes.

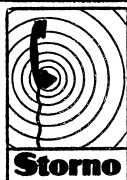


Note 2: The points marked „h” are connected in the range 68-75 Mc/s.
Punkterne mærket „h” er forbundet i området 68-75 Mc/s

Short tap (red)
Aort tap (red)

RC 33 - 1a

| type | no | code | data | | type | no | code | data | |
|------|------|---------|-----------------|-------------------------------------|------|------|---------|------------------|------|
| | C1 | 78.5017 | 10 pF | trimmer | | R12- | | | |
| | C2 | 74.5002 | 1,2 pF | $\pm 0,1$ pF | | R13 | 80.5473 | 0,1 M Ω | 1/4W |
| | C3- | | | | | R14 | 80.5480 | 0,39 M Ω | 1/4W |
| | C4 | 74.5080 | 2 nF | 500V | | R15 | 81.5085 | 1 M Ω | 1/2W |
| | C5 | 74.5016 | 1 nF | 500V | | R16- | | | |
| | C6 | 74.5069 | 100 pF | $\pm 10\%$ 500V | | R17 | 80.5449 | 1 k Ω | 1/4W |
| | C7 | 78.5004 | 25 pF | trimmer | | R19 | 80.5465 | 22 k Ω | 1/4W |
| | C9 | 78.5005 | 25 pF | trimmer | | R20 | 80.5475 | 0,15 M Ω | 1/4W |
| | C11 | 78.5005 | 25 pF | trimmer | | R21 | 80.5480 | 0,39 M Ω | 1/4W |
| | C12 | 74.5028 | 2 pF | $\pm 0,1$ pF | | R23 | 80.5467 | 33 k Ω | 1/4W |
| | C13 | 74.5061 | 51 pF | $\pm 5\%$ | | R24 | 80.5473 | 0,1 M Ω | 1/4W |
| | C14- | | | | | R26 | 80.5482 | 0,56 M Ω | 1/4W |
| | C15 | 74.5016 | 1 nF | 500V | | R28 | 80.5461 | 10 k Ω | 1/4W |
| | C16 | 74.5061 | 51 pF | $\pm 5\%$ 500V | | R29- | | | |
| | C17 | 74.5061 | 2 x 51 pF | $\pm 5\%$ 500V | | R30 | 80.5438 | 120 Ω | 1/4W |
| | C18 | 74.5016 | 1 nF | 500V | | | | | |
| | C19 | 74.5095 | 3,3 pF | $\pm 20\%$ | | Fc | 65.5040 | ferroxcube beads | |
| | C20 | 74.5061 | 2 x 51 pF | $\pm 5\%$ 500V | | | | | |
| | C21 | 74.5061 | 2 x 51 pF | $\pm 5\%$ 500V | | J1 | 41.5131 | coax connector | |
| | C22 | 74.5016 | 1 nF | 500V | | | | | |
| | C23 | 74.5028 | 2 pF | $\pm 0,1$ pF | | L1 | 62.523 | 68-88 Mc/s | |
| | C24 | 76.5033 | 47 nF | 125V | | L2 | 62.302 | 68-88 Mc/s | |
| | C25 | 74.5016 | 1 nF | 500V | | L3 | 62.236 | 68-88 Mc/s | |
| | C26 | 74.5035 | 6 pF | only used on | | L4 | 62.459 | 68-88 Mc/s | |
| | C27 | 74.5061 | 51 pF | $\pm 5\%$ one channel | | L5 | 62.460 | 68-88 Mc/s | |
| | | | | | | L6 | 62.461 | 68-88 Mc/s | |
| | C28 | 78.5005 | 25 pF | benyttes kun trimmer ved 1 kanal | | L7 | 61.404 | 7,15-9,37 Mc/s | |
| | | | | | | | | C16,C17,C56,C57 | |
| | C29 | 74.5042 | 10 pF | $\pm 0,5$ pF | | L8 | 61.406 | 7,15-9,37 Mc/s | |
| | C30 | 74.5016 | 1 nF | 500V | | | | C20-C21,C58,C59 | |
| | C33- | | | | | L10 | 61.446 | 15,2-19,6 Mc/s | |
| | C34 | 76.5030 | 10 nF | 400V | | | | C35,C36,C60,C61 | |
| | C35- | | | | | L11 | 61.405 | 30,4-39,5 Mc/s | |
| | C36 | 74.5061 | 2 x 51pF | $\pm 5\%$ 500V | | | | C40,C41,C62,C63 | |
| | C37 | 74.5042 | 10 pF | $\pm 0,5$ pF 500V | | L12 | 62.462 | 60,8-79 Mc/s | |
| | C38- | | | | | L13 | 62.5004 | 2,2 μ H | |
| | C39 | 74.5016 | 1 nF | 500V | | | | | |
| | C40 | 74.5056 | 27 pF | $\pm 5\%$ | | V1 | 99.5052 | duotriode E188CC | |
| | C41 | 74.5042 | 10 pF | $\pm 5\%$ | | V2 | 99.5054 | duotriode ECC81 | |
| | C42 | 74.5016 | 1 nF | 500V | | V3- | | | |
| | C43 | 74.5042 | 10 pF | $\pm 5\%$ | | V5 | 99.5002 | pentode 5654 | |
| | C44- | | | | | | | | |
| | C45 | 74.5017 | 2,2 nF | 350V | | | | | |
| | C46 | 78.5004 | 25 pF | trimmer | | | | | |
| | C47 | 74.5069 | 100 pF | $\pm 10\%$ | | | | | |
| | C48- | | | | | | | | |
| | C52 | 74.5080 | 2 nF | 500V | | | | | |
| | C53- | | | | | | | | |
| | C55 | 74.5016 | 1 nF | 500V | | | | | |
| | C56- | | | | | | | | |
| | C61 | 74.5056 | 27 pF | $\pm 5\%$ 500V | | | | | |
| | C62- | | | | | | | | |
| | C63 | 74.5042 | 10 pF | $\pm 5\%$ 500V | | | | | |
| | C64 | 76.5031 | 22 nF | $\pm 10\%$ 400V | | | | | |
| | C65 | 74.5016 | 1 nF | 500V | | | | | |
| | C66- | | | | | | | | |
| | C68 | 74.5080 | 2 nF | 500V | | | | | |
| | C69- | | | | | | | | |
| | C71 | 74.5083 | 4,7 nF | -20/+80% 350V | | | | | |
| | C72 | 74.5016 | 1 nF | 500V | | | | | |
| | | | | | | | | | |
| | R1 | 80.5473 | 0.1 M Ω | 1/4W | | | | | |
| | R2 | 80.5440 | 180 Ω | 1/4W | | | | | |
| | R3 | 80.5473 | 0,1 M Ω | 1/4W | | | | | |
| | R4 | 80.5481 | 0,47 M Ω | 1/4W | | | | | |
| | R5 | 81.5085 | 1 M Ω | 1/2W | | | | | |
| | R6 | 80.5449 | 1 k Ω | 1/4W | | | | | |
| | R7 | 80.5473 | 0.1 M Ω | 1/4W | | | | | |
| | R8 | 80.5448 | 820 Ω | 1/4W | | | | | |
| | R9 | 80.5449 | 1 k Ω | 1/4W | | | | | |
| | R10 | 80.5481 | 0,47 M Ω | 1/4W | | | | | |
| | R11 | 80.5446 | 560 Ω | 1/4W | | | | | |

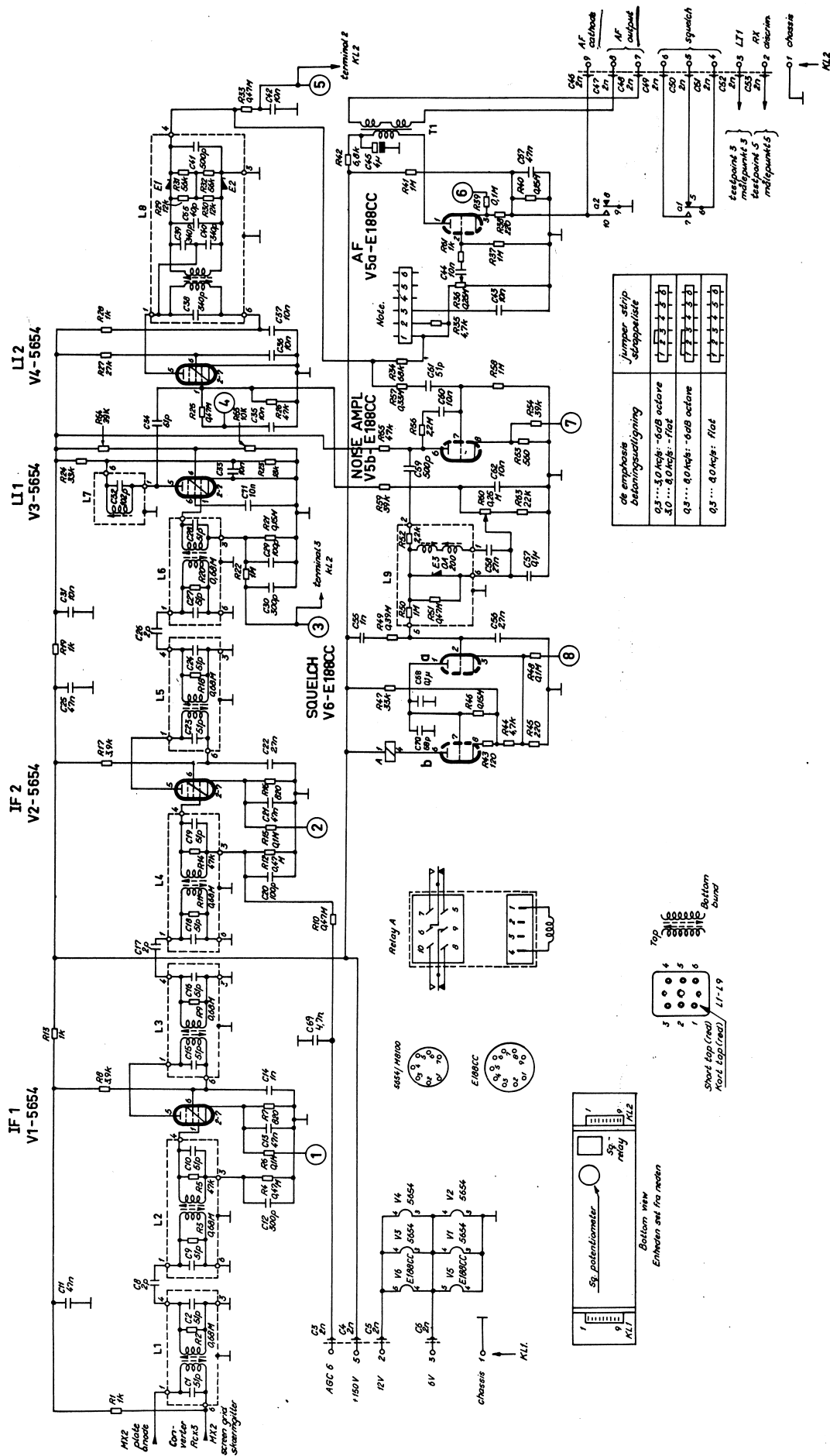


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IF-AMPLIFIER MF-FORSTÆRKER

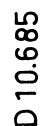
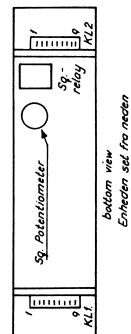
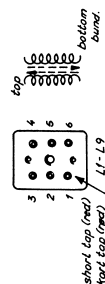
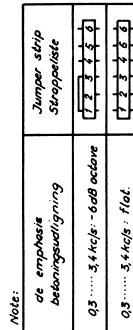
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D10026/2



IA13-1

| type | no | code | data | | type | no | code | data | |
|------|---------|---------|-----------------|----------|------|---------|---------|---|------|
| | C1..C2 | 74.5061 | 51 pF ±5% | TC: -100 | | R33 | 80.5481 | 0.47 MΩ | 1/4W |
| | C3..C6 | 74.5081 | 2 nF | 500V | | R34 | 80.5471 | 68 kΩ | 1/4W |
| | C8 | 74.5028 | 2 pF ±0,1pF | | | R35 | 80.5457 | 4.7 kΩ | 1/4W |
| | C9..C10 | 74.5061 | 51 pF ±5% | TC: -100 | | R36 | 86.5020 | 0.25 MΩ potentiom. (log) | |
| | C11 | 76.5035 | 47 nF ±10% | 400V | | R37 | 80.5485 | 1 MΩ | 1/4W |
| | C12 | 74.5077 | 300 pF | | | R38 | 80.5441 | 220 Ω | 1/4W |
| | C13 | 76.5033 | 47 nF ±10% | 125V | | R39 | 80.5473 | 0.1 MΩ | 1/4W |
| | C14 | 74.5016 | 1 nF | 500V | | R40 | 80.5475 | 0.15 MΩ | 1/4W |
| | C15-C16 | 74.5061 | 51 pF ±5% | TC: -100 | | R41 | 80.5485 | 1 MΩ | 1/4W |
| | C17 | 74.5028 | 2 pF | | | R42 | 81.5059 | 6.8 kΩ | 1/2W |
| | C18-C19 | 74.5061 | 51 pF ±5% | TC: -100 | | R43 | 80.5438 | 120 Ω | 1/4W |
| | C20 | 74.5070 | 100 pF | | | R44 | 80.5457 | 4.7 kΩ | 1/4W |
| | C21 | 76.5033 | 47 nF ±10% | 125V | | R45 | 80.5441 | 220 Ω | 1/4W |
| | C22 | 76.5023 | 2,7 nF ±10% | 400V | | R46 | 80.5475 | 0.15 MΩ | 1/4W |
| | C23-C24 | 74.5061 | 51 pF ±5% | TC: -100 | | R47 | 81.5067 | 33 kΩ | 1/2W |
| | C25 | 76.5035 | 47 nF ±10% | 400V | | R48 | 80.5473 | 0.1 MΩ | 1/4W |
| | C26 | 74.5028 | 2 pF ±0,1 pF | | | R49 | 80.5456 | 0.39 MΩ | 1/4W |
| | C27-C28 | 74.5061 | 51 pF ±5% | TC: -100 | | R50 | 80.5485 | 1 MΩ | 1/4W |
| | C29 | 74.5070 | 100 pF | | | R51 | 80.5481 | 0.47 MΩ | 1/4W |
| | C30 | 74.5077 | 300 pF | | | R52 | 80.5453 | 2.2 kΩ | 1/4W |
| | C31 | 76.5030 | 10 nF ±10% | 400V | | R53 | 80.5446 | 560 Ω | 1/4W |
| | C32 | 74.5061 | 2x51 pF ±5% | TC: -100 | | R54 | 80.5458 | 39 kΩ | 1/4W |
| | C33 | 76.5030 | 10 nF ±10% | 400V | | R55 | 80.5469 | 47 kΩ | 1/4W |
| | C34 | 74.5063 | 51 pF | | | R56 | 80.5489 | 2.2 MΩ | 1/4W |
| | C35-C36 | 76.5028 | 10 nF ±10% | 125V | | R57 | 80.5479 | 0.33 MΩ | 1/4W |
| | C37 | 76.5030 | 10 nF ±10% | 400V | | R58 | 80.5485 | 1 MΩ | 1/4W |
| | C38-C40 | 74.5075 | 2x170 pF ±5% | | | R59 | 80.5468 | 39 kΩ | 1/4W |
| | C41 | 74.5079 | 500 pF | 500V | | R60 | 86.5019 | 0.25 MΩ lin. potentiom. | |
| | C42 | 76.5030 | 10 nF ±10% | 400V | | R61 | 80.5449 | 1 kΩ | 1/4W |
| | C43 | 76.5011 | 10 nF ±5% | 400V | | R62-R63 | 80.5465 | 22 kΩ | 1/4W |
| | C44 | 76.5030 | 10 nF ±10% | 400V | | R64 | 81.5068 | 39 kΩ | 1/2W |
| | C45 | 73.5004 | 4 uF 85 °C | 250V | | R65 | 81.5061 | 10 kΩ | 1/2W |
| | C46-C53 | 74.5081 | 2 nF | 500V | | E1...E3 | 99.5028 | OA200 | |
| | C55 | 74.5016 | 1 nF | 500V | | L1 | 61.435 | 0,455 Mc/s, C1, C2, R2 | |
| | C56 | 76.5023 | 2,7 nF ±10% | 400V | | L2 | 61.438 | 0,455 Mc/s, C9, C10, R3, R5 | |
| | C57 | 76.5036 | 0,1 uF ±10% | 125V | | L3 | 61.437 | 0,455 Mc/s, C15, C16, R9 | |
| | C58 | 76.5032 | 27 nF ±10% | 125V | | L4 | 61.438 | 0,455 Mc/s, C18, C19, R11, R14 | |
| | C59 | 74.5079 | 500 pF ±5% | 350V | | L5 | 61.437 | 0,455 Mc/s, C23, C24, R18 | |
| | C60 | 76.5030 | 10 nF ±10% | 400V | | L6 | 61.439 | 0,455 Mc/s, C27, C28, R20 | |
| | C61 | 74.5061 | 51 pF ±5% | 500V | | L7 | 61.395 | 0,455 Mc/s, C32 | |
| | C62 | 76.5030 | 10 nF ±10% | 400V | | L8 | 61.440 | 0,455 Mc/s, C38, C39, C40, C41, C65, R29, R30, R31, R32, E1, E2 | |
| | C65 | 74.5057 | 40 pF ±5% | TC: -750 | | L9 | 61.427 | High pass filter R50, R51, R52, E3 | |
| | C67 | 76.5033 | 47 nF ±10% | 125V | | ReA | 58.5019 | Squelch relay | |
| | C68 | 76.5036 | 0,1 uF ±10% | 125V | | T1 | 60.5022 | 25 kΩ/1200 Ω | |
| | C69 | 74.5020 | 4,7 nF -20/+50% | 500V | | V1...V4 | 99.5002 | pentode EF95/5654/M8100 | |
| | C70 | 74.5018 | 68 pF ±5% | 500V | | V5...V6 | 99.5052 | duo triode E188CC | |
| | C71 | 76.5030 | 10 nF ±10% | 400V | | | | | |
| | R1 | 80.5449 | 1 kΩ | 1/4W | | | | | |
| | R2..R3 | 80.5483 | 0.68 MΩ | 1/4W | | | | | |
| | R4 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R5 | 80.5469 | 47 kΩ | 1/4W | | | | | |
| | R6 | 80.5473 | 0.1 MΩ | 1/4W | | | | | |
| | R7 | 80.5448 | 820 Ω | 1/4W | | | | | |
| | R8 | 80.5456 | 3.9 kΩ | 1/4W | | | | | |
| | R9 | 80.5483 | 0.68 MΩ | 1/4W | | | | | |
| | R10 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R11 | 80.5483 | 0.68 MΩ | 1/4W | | | | | |
| | R12 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R13 | 81.5049 | 1 kΩ | 1/2W | | | | | |
| | R14 | 80.5469 | 47 kΩ | 1/4W | | | | | |
| | R15 | 80.5473 | 0.1 MΩ | 1/4W | | | | | |
| | R16 | 80.5448 | 820 Ω | 1/4W | | | | | |
| | R17 | 80.5456 | 3,9 kΩ | 1/4W | | | | | |
| | R18 | 80.5483 | 0.68 MΩ | 1/4W | | | | | |
| | R19 | 80.5449 | 1 kΩ | 1/4W | | | | | |
| | R20 | 80.5483 | 0.68 MΩ | 1/4W | | | | | |
| | R21 | 80.5475 | 0.15 MΩ | 1/4W | | | | | |
| | R22 | 80.5485 | 1 MΩ | 1/4W | | | | | |
| | R23 | 81.5064 | 18 kΩ | 1/2W | | | | | |
| | R24 | 81.5067 | 33 kΩ | 1/2W | | | | | |
| | R25 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R26 | 80.5469 | 47 kΩ | 1/4W | | | | | |
| | R27 | 80.5466 | 27 kΩ | 1/4W | | | | | |
| | R28 | 80.5449 | 1 kΩ | 1/4W | | | | | |
| | R29-R30 | 80.5462 | 12 kΩ | 1/4W | | | | | |
| | R31-R32 | 80.5470 | 56 kΩ | 1/4W | | | | | |



IA13-2

| type | no | code | data | | type | no | code | data | |
|------|----------|---------|-------------------------|------|------|---------|---------|---|------|
| | C1..C2 | 74.5061 | 2x51pF ±5% | 500V | | R39 | 80.5473 | 0.1 MΩ | 1/4W |
| | C3..C6 | 74.5081 | 2 nF | 500V | | R40 | 80.5475 | 0.15 MΩ | 1/4W |
| | C8 | 74.5026 | 1,8pF ±0,25pF | 500V | | R41 | 80.5485 | 1 MΩ | 1/4W |
| | C9..C10 | 74.5061 | 2x51pF ±5% | 500V | | R42 | 81.5059 | 6.8 kΩ | 1/2W |
| | C11 | 76.5035 | 47 nF ±10% | 400V | | R43 | 80.5438 | 120 Ω | 1/4W |
| | C12 | 74.5077 | 300 pF ±5% | 500V | | R44 | 80.5457 | 4.7 kΩ | 1/4W |
| | C13 | 76.5033 | 47 nF ±10% | 125V | | R45 | 80.5441 | 220 Ω | 1/4W |
| | C14 | 74.5015 | 1 nF -20/+50% | 500V | | R46 | 80.5475 | 0.15 MΩ | 1/4W |
| | C15..C16 | 74.5061 | 2x51pF ±5% | 500V | | R47 | 81.5067 | 33 kΩ | 1/2W |
| | C17 | 74.5026 | 1,8 pF ±0,25pF | 500V | | R48 | 80.5473 | 0.1 MΩ | 1/4W |
| | C18..C19 | 74.5061 | 2x51pF ±5% | 500V | | R49 | 80.5480 | 0.39 MΩ | 1/4W |
| | C20 | 74.5070 | 100 pF ±5% | 500V | | R50 | 80.5485 | 1 MΩ | 1/4W |
| | C21 | 76.5033 | 47 nF ±10% | 125V | | R51 | 80.5481 | 0.47 MΩ | 1/4W |
| | C22 | 76.5023 | 2,7 nF ±10% | 400V | | R52 | 80.5453 | 2,2 kΩ | 1/4W |
| | C23..C24 | 74.5061 | 2x51pF ±5% | 500V | | R53 | 80.5446 | 560 Ω | 1/4W |
| | C25 | 76.5035 | 47 nF ±10% | 400V | | R54 | 80.5468 | 39 kΩ | 1/4W |
| | C26 | 74.5026 | 1,8 pF ±0,25pF | 500V | | R55 | 80.5469 | 47 kΩ | 1/4W |
| | C27..C28 | 74.5061 | 2x51pF ±5% | 500V | | R56 | 80.5495 | 6.8 MΩ | 1/4W |
| | C29 | 74.5070 | 100 pF ±5% | 500V | | R57 | 80.5475 | 0.15 MΩ | 1/4W |
| | C30 | 74.5077 | 300 pF ±5% | 500V | | R58 | 80.5485 | 1 MΩ | 1/4W |
| | C31 | 76.5030 | 10 nF ±10% | 400V | | R59 | 80.5468 | 39 kΩ | 1/4W |
| | C32 | 74.5061 | 2x51pF ±5% | 500V | | R60 | 86.5019 | 0.25 MΩ lin.potentiom. | |
| | C33 | 76.5030 | 10 nF ±10% | 400V | | R61 | 80.5449 | 1 kΩ | 1/4W |
| | C34 | 74.5063 | 51 pF ±5% | 500V | | | | | |
| | C35..C36 | 76.5030 | 10 nF ±10% | 400V | | E1...E3 | 99.5028 | Diode 0A200 | |
| | C37 | 76.5030 | 10 nF ±10% | 400V | | | | | |
| | C38..C40 | 74.5075 | 2x170pF ±5% | 500V | | L1 | 61.476 | 0.455 Mc/s, C1,C2 | |
| | C41 | 74.5079 | 500 pF ±5% | 500V | | L2 | 61.475 | 0.455 Mc/s, C9,C10,R5 | |
| | C42 | 76.5030 | 10 nF ±10% | 400V | | L3 | 61.476 | 0.455 Mc/s, C15,C16 | |
| | C43 | 76.5011 | 10 nF ±5% | 400V | | L4 | 61.475 | 0.455 Mc/s, C18,C19,R14 | |
| | C44 | 76.5030 | 10 nF ±10% | 400V | | L5 | 61.476 | 0.455 Mc/s, C23,C24 | |
| | C45 | 73.5004 | 4 μF 85° | 250V | | L6 | 61.476 | 0.455 Mc/s, C27,C28 | |
| | C46..C53 | 74.5081 | 2 nF | 500V | | L7 | 61.395 | 0.455 Mc/s, C32 | |
| | C55 | 74.5015 | 1 nF -20/+50% | 500V | | L8 | 61.440 | 0.455 Mc/s, C38,C39,C40, C41,C65,R29,R30,R31,R32, E1,E2 | |
| | C56 | 76.5023 | 2,7 nF ±10% | 400V | | L9 | 61.427 | Filter, R50,R51,R52,E3 | |
| | C57 | 76.5036 | 0,1 μF ±10% | 125V | | ReA | 58.5018 | Squelch relay | |
| | C58 | 76.5036 | 0,1 μF ±10% | 125V | | T1 | 60.5022 | 25kΩ/1200Ω | |
| | C59 | 74.5079 | 500 pF ±5% | 500V | | V1..V4 | 99.5002 | pentode 5654/M8100/EF95 | |
| | C60 | 76.5030 | 10 nF ±10% | 400V | | V5..V6 | 99.5052 | duo triode E188CC | |
| | C61 | 76.5033 | 47 nF ±10% | 125V | | | | | |
| | C62 | 76.5030 | 10 nF ±10% | 400V | | | | | |
| | C65 | 74.5057 | 40 pF ±5% TC:-750 | 500V | | | | | |
| | C66..C67 | 76.5033 | 47 nF ±10% | 125V | | | | | |
| | C68 | 76.5036 | 0,1 μF ±10% | 125V | | | | | |
| | C69 | 74.5020 | 4,7 nF -20/+50% | 500V | | | | | |
| | C70 | 74.5018 | 68 pF ±5% | 500V | | | | | |
| | R1 | 80.5449 | 1 kΩ | 1/4W | | | | | |
| | R4 | 80.5481 | 0,47 MΩ | 1/4W | | | | | |
| | R5 | 80.5480 | 0,39 MΩ | 1/4W | | | | | |
| | R6 | 80.5473 | 0,1 MΩ | 1/4W | | | | | |
| | R7 | 80.5448 | 820 Ω | 1/4W | | | | | |
| | R8 | 80.5456 | 3.9 kΩ | 1/4W | | | | | |
| | R10..R12 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R13 | 81.5049 | 1 kΩ | 1/2W | | | | | |
| | R14 | 80.5480 | 0.39 MΩ | 1/4W | | | | | |
| | R15 | 80.5473 | 0.1 MΩ | 1/4W | | | | | |
| | R16 | 80.5448 | 820 Ω | 1/4W | | | | | |
| | R17 | 80.5456 | 3.9 kΩ | 1/4W | | | | | |
| | R19 | 80.5449 | 1 kΩ | 1/4W | | | | | |
| | R21 | 80.5475 | 0.15 MΩ | 1/4W | | | | | |
| | R22 | 80.5485 | 1 MΩ | 1/4W | | | | | |
| | R23 | 81.5064 | 18 kΩ | 1/2W | | | | | |
| | R24 | 81.5067 | 33 kΩ | 1/2W | | | | | |
| | R25 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R26 | 80.5469 | 47 kΩ | 1/4W | | | | | |
| | R27 | 80.5466 | 27 kΩ | 1/4W | | | | | |
| | R28 | 80.5449 | 1 kΩ | 1/4W | | | | | |
| | R29..R30 | 80.5462 | 12 kΩ | 1/4W | | | | | |
| | R31..R32 | 80.5470 | 56 kΩ | 1/4W | | | | | |
| | R33 | 80.5481 | 0.47 MΩ | 1/4W | | | | | |
| | R34 | 80.5475 | 150 kΩ | 1/4W | | | | | |
| | R35 | 80.5465 | 22 kΩ | 1/4W | | | | | |
| | R36 | 86.5020 | 0.25 MΩ potentiom.(log) | | | | | | |
| | R37 | 80.5485 | 1 MΩ | 1/4W | | | | | |
| | R38 | 80.5441 | 220 Ω | 1/4W | | | | | |



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POWER SUPPLY STRØMFORSYNING

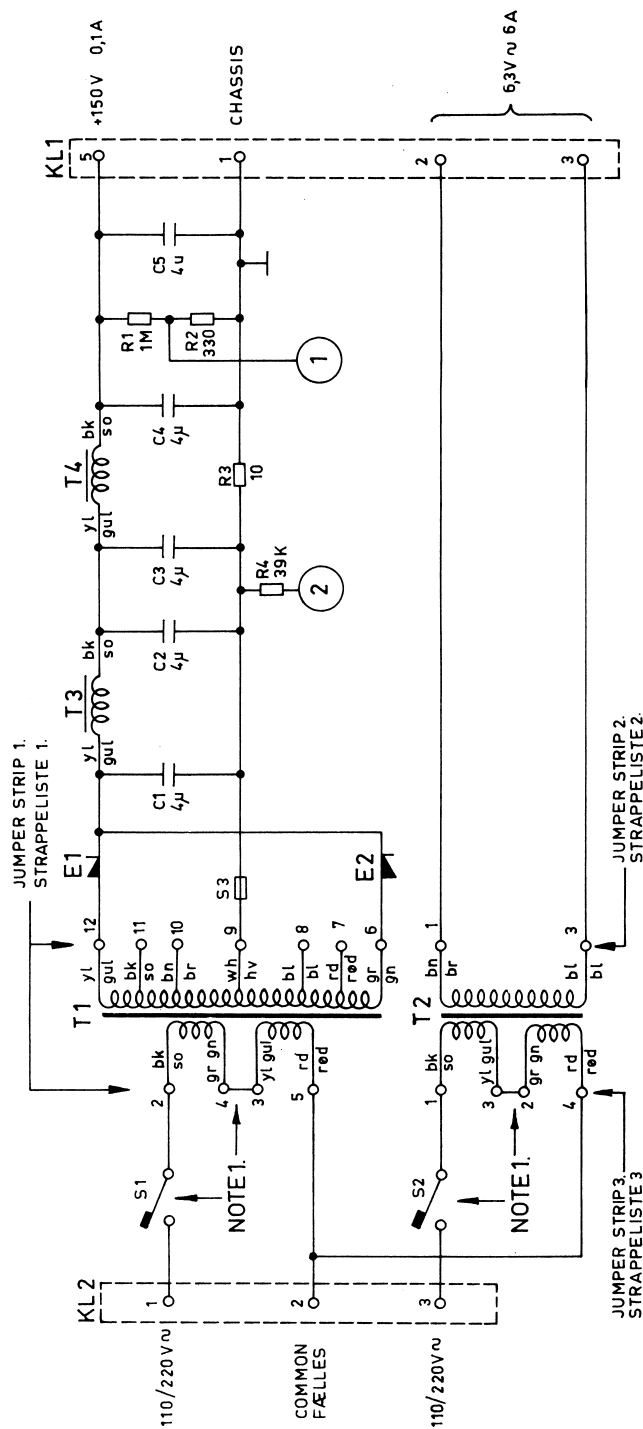
PS13-3c

KODE

TEGN. NR.

D400.154/2

A 4



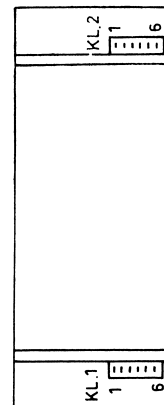
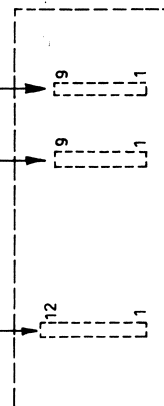
NOTE 1.

| MAINS VOLT NETSPEND. | JUMP STRIP 1. STRAP LISTE 1. | JUMP STRIP 3. STRAP LISTE 3. | S1 | S2 |
|-------------------------|---------------------------------|---------------------------------|-------|-------|
| 110V ~ | 1 2 3 4 5 | 1 2 3 4 | 0,3 A | 0,5 A |
| 220V ~ | 1 2 3 4 5 | 1 2 3 4 | 0,2 A | 0,3 A |

JUMP STRIP 1
STRAP LISTE 1

JUMP STRIP 2
STRAP LISTE 2

JUMP STRIP 3
STRAP LISTE 3

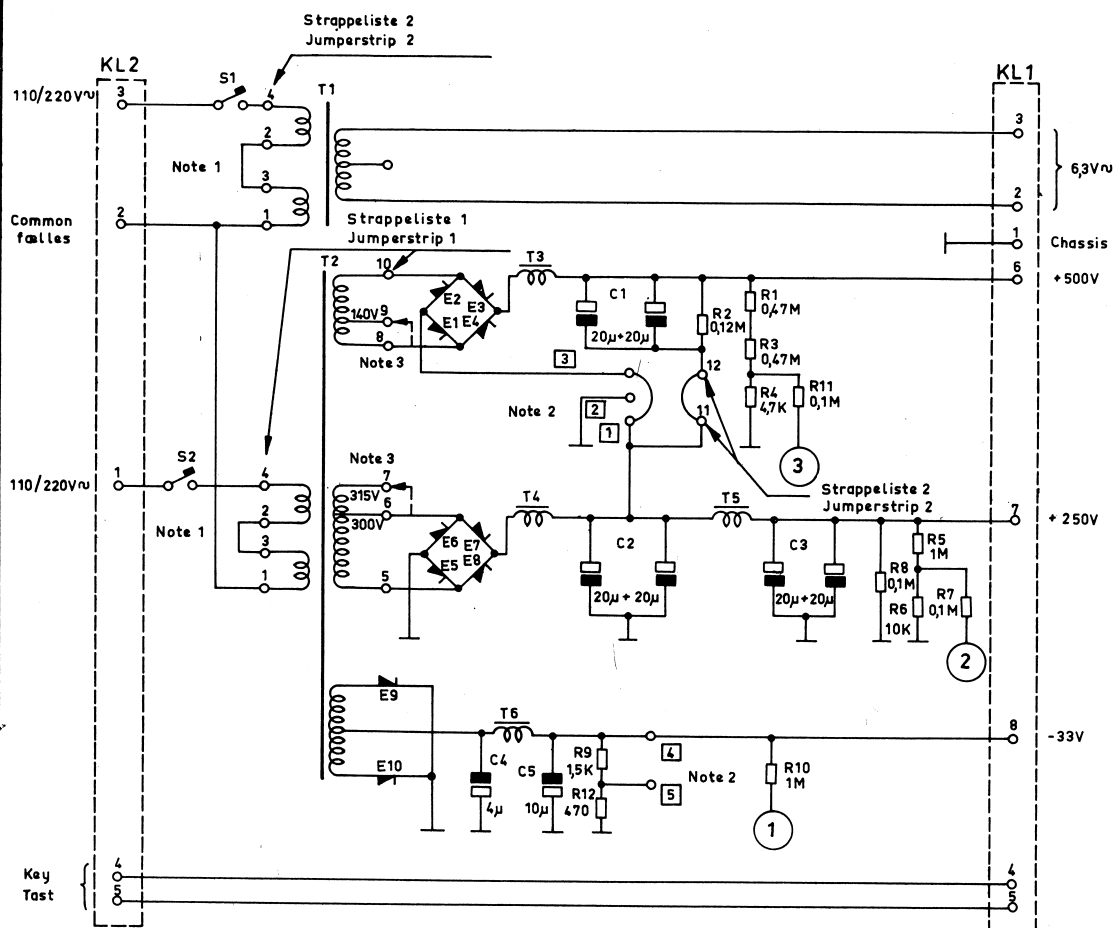


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SET FRA BUNDEN

PS13-3c

| type | no | code | data | | type | no | code | data |
|------|-------|---------|-------------------|------|------|-------|---------|---|
| | C1-C5 | 71.5013 | 4 uF | 350V | | T1 | 60.5056 | primary: 110-220V 50~ secondary: 150-140-130-0-130-140 -150V 0,1A |
| | R1 | 81.5085 | 1 MΩ | 1/2W | | | | |
| | R2 | 80.5443 | 330 Ω | 1/4W | | | | |
| | R3 | 80.5425 | 10 Ω | 1/4W | | | | |
| | R4 | 80.5468 | 39 kΩ | 1/4W | | | | |
| | E1-E2 | 99.5050 | Diode | | | T2 | 60.5129 | primary: 110-220V 50~ secondary: 6,4 V 6A |
| 110V | S1 | 92.5038 | Fuse/sikring 0,3A | | | | | |
| 220V | S1 | 92.5037 | Fuse/sikring 0,2A | | | | | |
| 110V | S2 | 92.5043 | Fuse/sikring 0,5A | | | | | |
| 220V | S2 | 92.5038 | Fuse/sikring 0,3A | | | T3-T4 | 60.5057 | choke 3,5H 0,15A 45Ω |
| | S3 | 92.5023 | Fuse/sikring 2A | | | | | |



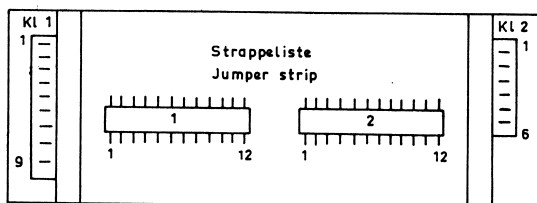
Note 1:

| Primary Voltage Primær spænd. | Strappeliste 1 Jumper strip 1 | Strappeliste 2 Jumper strip 2 |
|----------------------------------|----------------------------------|----------------------------------|
| 220V ~ | 1 2 3 4 | 1 2 3 4 |
| 110V ~ | 1 2 3 4 | 1 2 3 4 |

Note 2:

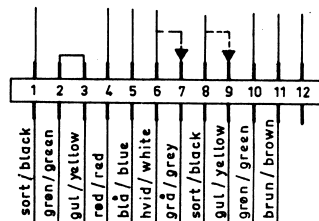
When changing the output voltage of the Power Supply in order to reduce the Transmitter output, see the TX power altering instructions: 32.023 for TX13-4a and 32.024 for TX33-4a.

Ved ændring af strømforsynings udgangsspændinger i forbindelse med ændret udgangseffekt se omkoblingsinstruktionerne 32.023 for TX13-4a og 32.024 for TX33-4a.



set fra bunden
bottom view

Note 3



Strappeliste 1
Jumper strip 1

When the unit is used in connection with CBF63-1 the wires from 6 and 8 are moved to 7 and 9 respectively.

Når enheden benyttes i forbindelse med CBF63-1 flyttes ledningerne fra 6 og 8 til henholdsvis 7 og 9.



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godk.
komp.liste

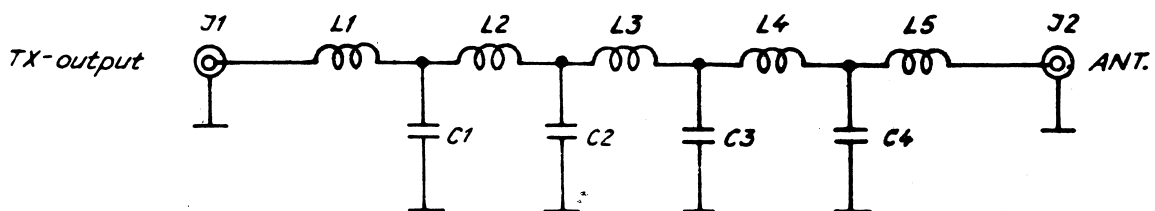
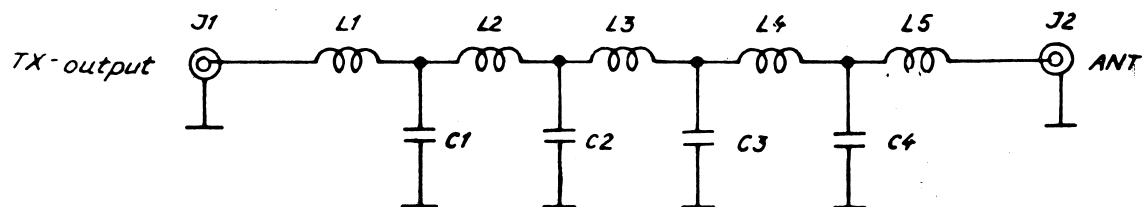
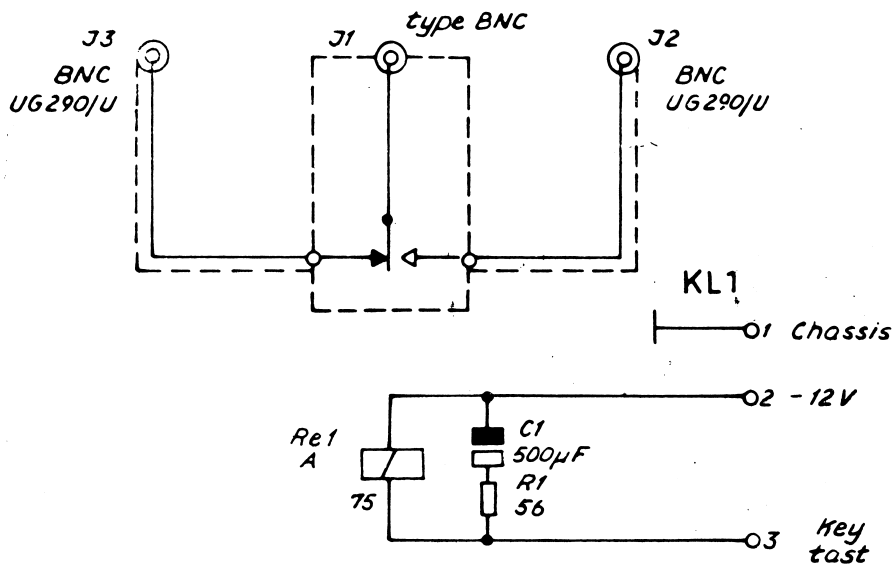
POWER SUPPLY
STRØMFORSYNING

PS13-6

D10900/2

PS13-6

| type | no | code | data | | type | no | code | data | |
|------|-----|---------|-----------------|----------|------|--------|---------|-----------------------|------|
| | C1 | 73.5018 | 20+20 μ F | 450/500V | | E1-E10 | 99.5107 | Diode BY100S | |
| | C2 | 73.5018 | 20+20 μ F | 450/500V | | | | | |
| | C3 | 73.5018 | 20+20 μ F | 450/500V | | | | | |
| | C4 | 73.5004 | 4 μ F | 250V | | S1 | 92.5046 | 0,6 A | 110V |
| | C5 | 73.5013 | 10 μ F | 50V | | S1 | 92.5038 | 0,3 A | 220V |
| | | | | | | S2 | 92.5052 | 3,0 A | 110V |
| | | | | | | S2 | 92.5050 | 1,5 A | 220V |
| | R1 | 81.5081 | 0,47 M Ω | 1/2W | | | | | |
| | R2 | 83.5073 | 0,1 M Ω | 2W | | T1 | 60.5062 | 2x110V/6,3V-4,2A. CT | |
| | R3 | 81.5081 | 0,47 M Ω | 1/2W | | T2 | 60.5094 | 2x110V/0-300-315V | |
| | R4 | 81.5057 | 4,7 k Ω | 1/2W | | | | 0,3A | |
| | R5 | 81.5085 | 1 M Ω | 1/2W | | | | 0-140-315V. 0,2A | |
| | R6 | 80.5461 | 10 k Ω | 1/4W | | | | 32-0-32V 30 mA | |
| | R7 | 80.5473 | 0,1 M Ω | 1/4W | | T3 | 60.5068 | 9H 0,2A 120 Ω | |
| | R8 | 83.5073 | 0,1 M Ω | 2W | | T4 | 60.5069 | 4,5H 0,3A 65 Ω | |
| | R9 | 82.5051 | 1,5 k Ω | 1W | | T5 | 60.5065 | 6H 0,12A 50 Ω | |
| | R10 | 81.5085 | 1 M Ω | 1/2W | | T6 | 60.5029 | 10H 50mA 500 Ω | |
| | R11 | 80.5473 | 0,1 M Ω | 1/4W | | | | | |
| | R12 | 82.5045 | 470 Ω | 1W | | | | | |



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ANT. SHIFT UNIT and ANT. FILTERS
ANT. SKIFTEENHED og ANT. FILTRE

D 400.325

AS13-1

| type | no | code | data | | type | no | code | data | |
|------|----|---------|-------------|---------|------|-----|---------|-------------------------|--|
| | C1 | 73.5068 | 500 μ F | 50/60 V | | J1 | 41.5131 | connector | |
| | R1 | 81.5034 | 56 Ω | 1/2 W | | J2 | 41.5131 | connector | |
| | | | | | | Rel | 58.5006 | Coaxial relay(A) 12 VDC | |

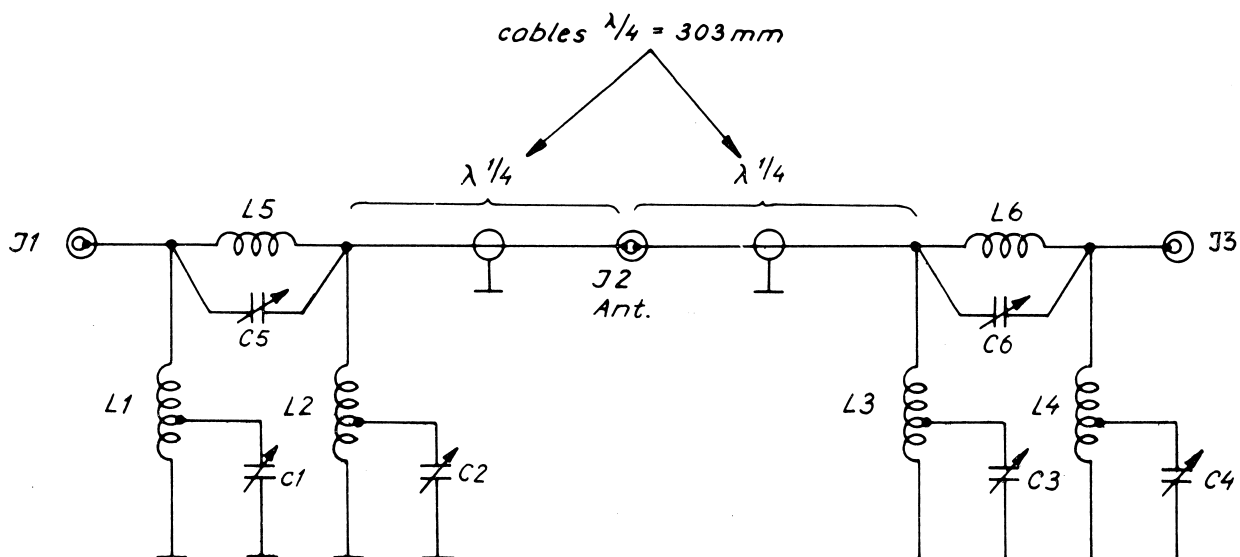
FN13-2

| type | no | code | data | | type | no | code | data | |
|------|--------|---------|-----------------|------|------|--------|---------|-------------|--|
| | C1..C4 | 74.5054 | 25 pF $\pm 5\%$ | 500V | | L4 | 62.548 | filter coil | |
| | L1 | 62.547 | filter coil | | | L5 | 62.546 | filter coil | |
| | L2 | 62.549 | filter coil | | | J1..J2 | 41.5131 | connector | |
| | L3 | 62.549 | filter coil | | | | | | |

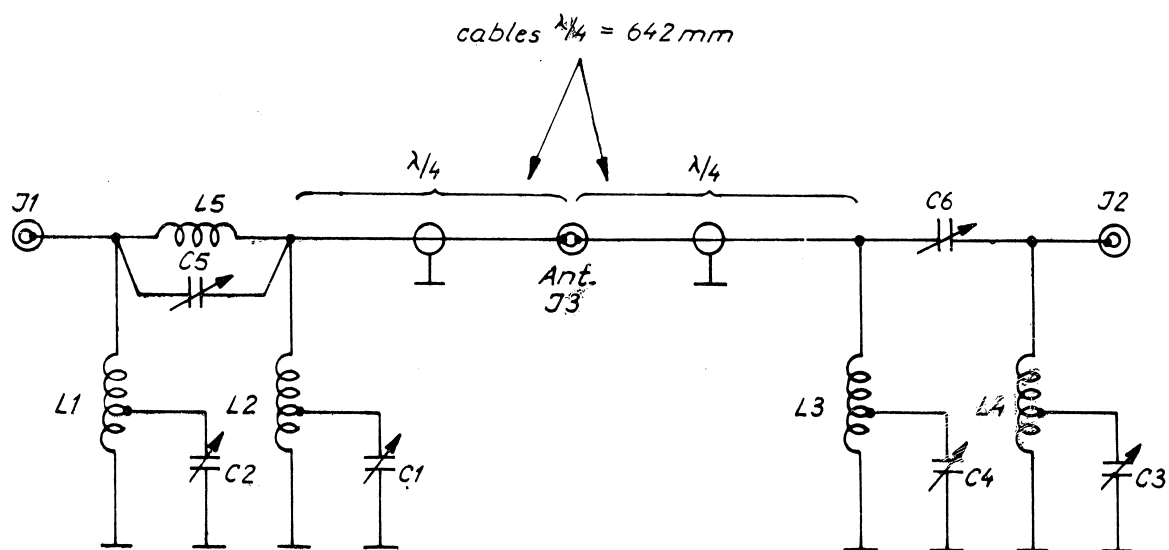
FN33-2

| type | no | code | data | | type | no | code | data | |
|------|--------|---------|-----------------|-------|------|--------|---------|-------------|--|
| | C1..C4 | 74.5060 | 51 pF $\pm 5\%$ | 500 V | | L4 | 62.554 | filter coil | |
| | L1 | 62.551 | filter coil | | | L5 | 62.550 | filter coil | |
| | L2 | 62.552 | filter coil | | | J1..J2 | 41.5131 | connector | |
| | L3 | 62.553 | filter coil | | | | | | |

BF13-1



BF33-1



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BRANCHING FILTER
DELEFILTER BF13/33 - 1

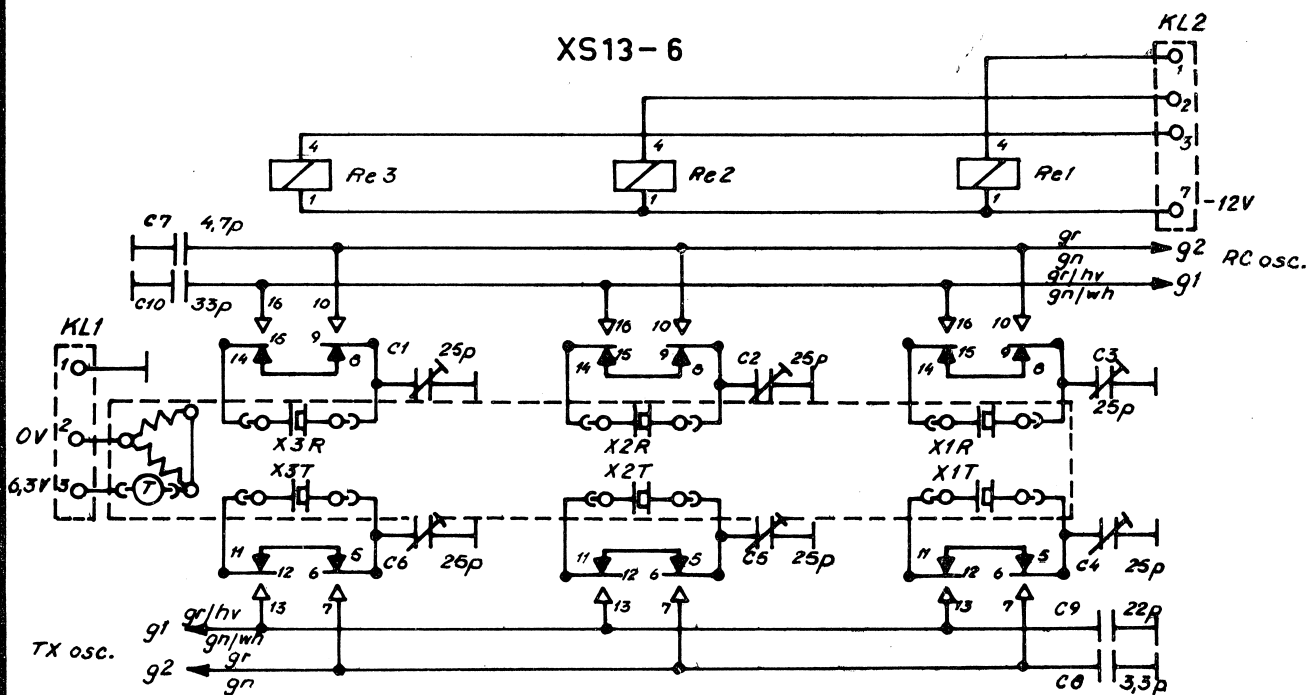
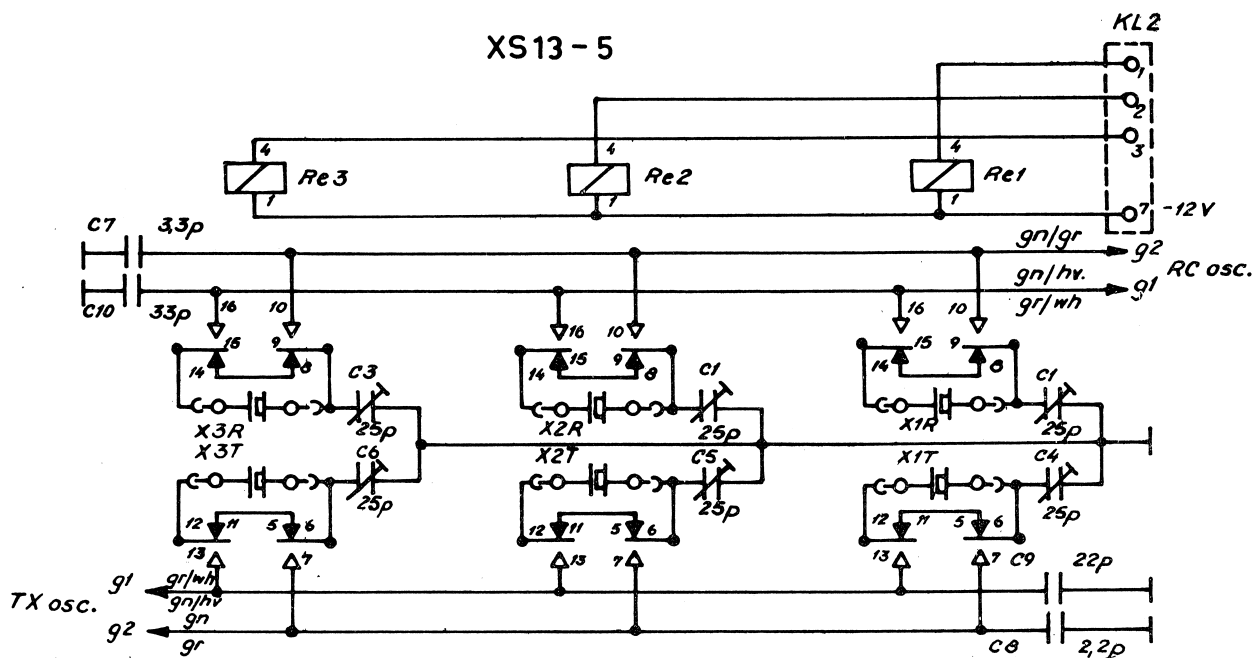
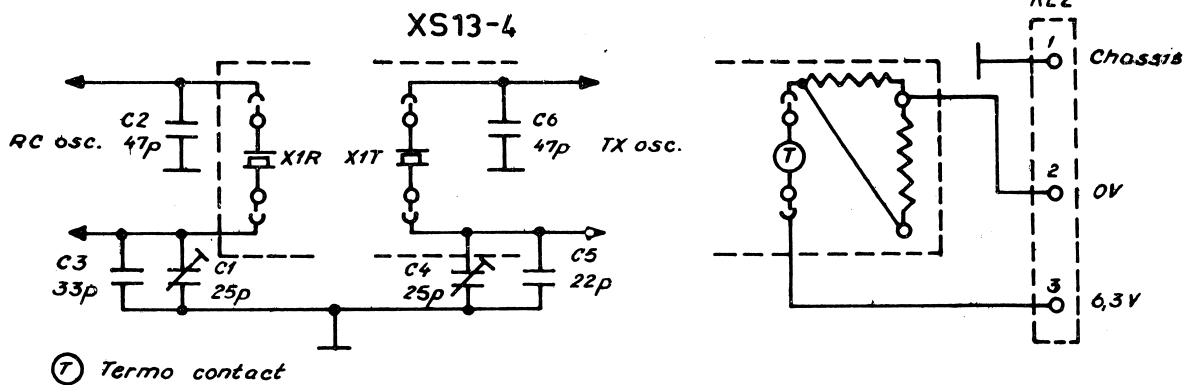
D 10.735
D 10.970

BF13-1

| type | no | code | data | | type | no | code | data | |
|------|--------|--------|-------------|-------|------|--------|---------|-------------|--|
| | C1..C4 | 78.005 | trimmer | 500 V | | L4 | 62.501 | Filter coil | |
| | C5..C6 | 78.006 | 3-40 pF | 700 V | | L5..L6 | 62.503 | " | |
| | L1 | 62.502 | Filter coil | | | J1..J3 | 41.5131 | Connector | |
| | L2 | 62.501 | " | | | | | | |
| | L3 | 62.502 | " | | | | | | |

BF33-1

| type | no | code | data | | type | no | code | data | |
|------|--------|---------|-------------|---------|------|--------|---------|-------------|--|
| | C1..C4 | 78.5011 | trimmer | 5-55 pF | | L4 | 62.544 | filter coil | |
| | C5..C6 | 78.006 | trimmer | 3-40 pF | | L5 | 62.543 | " " | |
| | L1 | 62.545 | filter coil | | | J1..J3 | 41.5131 | connector | |
| | L2 | 62.544 | " " | | | | | | |
| | L3 | 62.545 | " " | | | | | | |



Konstr./legn.
Ba/BH
20-8-62
godk.
komp.liste

X-TAL SHIFT UNITS
X-TAL SKIFTEENHEDER

D 400.199
D 400.226
D 400.230

XS13-4

| type | no | code | data | type | no | code | data |
|------|----|---------|----------------------|------|-----|---------|----------------------|
| | C1 | 78.5005 | 25 pF trimmer | | C5 | 74.5008 | 22 pF $\pm 5\%$ 500V |
| | C2 | 74.5088 | 47 pF $\pm 5\%$ 500V | | C6 | 74.5088 | 47 pF $\pm 5\%$ 500V |
| | C3 | 74.5085 | 33 pF $\pm 5\%$ 500V | | | | |
| | C4 | 78.5005 | 25 pF trimmer | | XTO | 98.5001 | IE6001 X-tal oven |

XS13-5

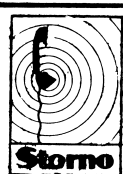
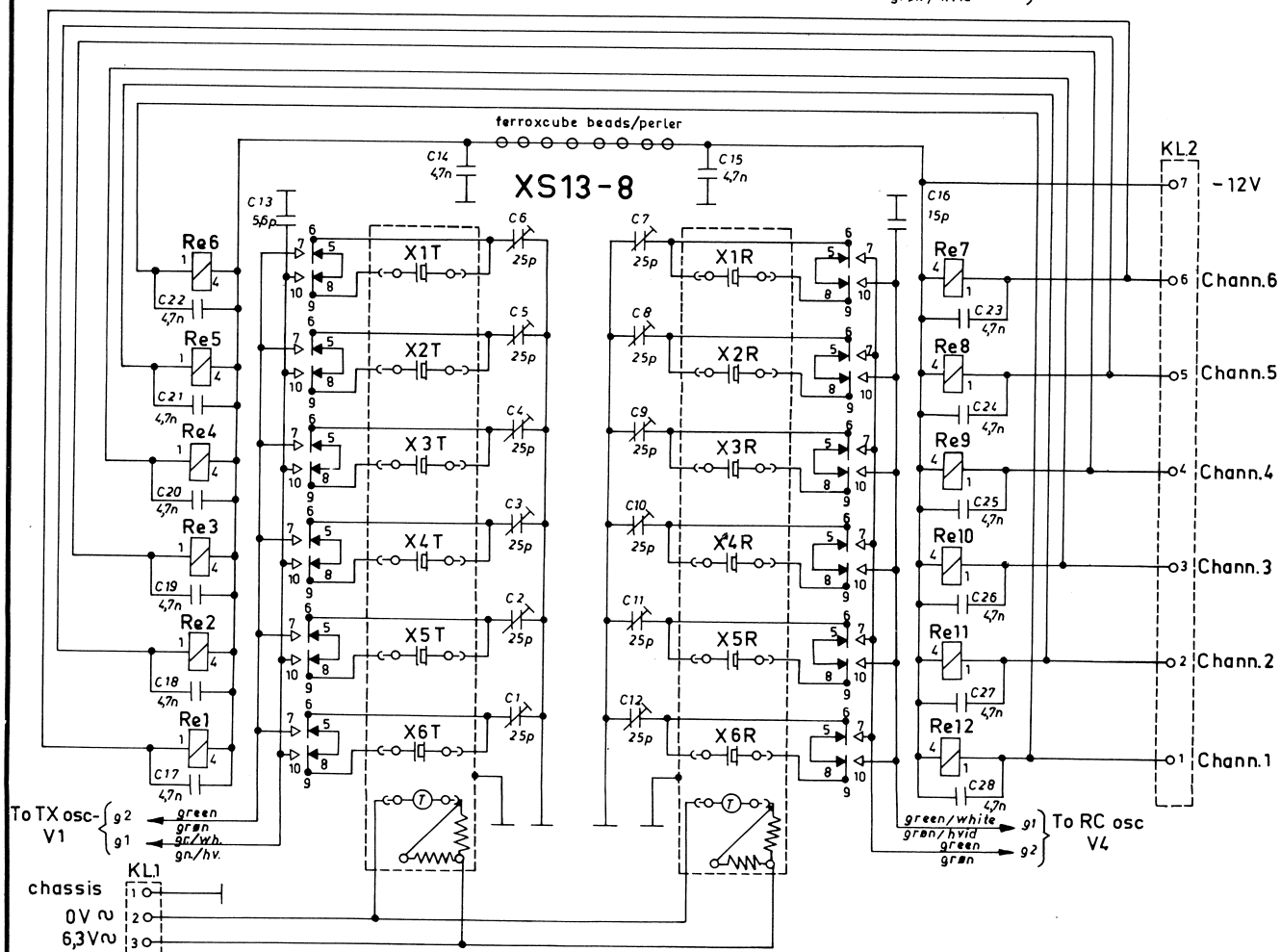
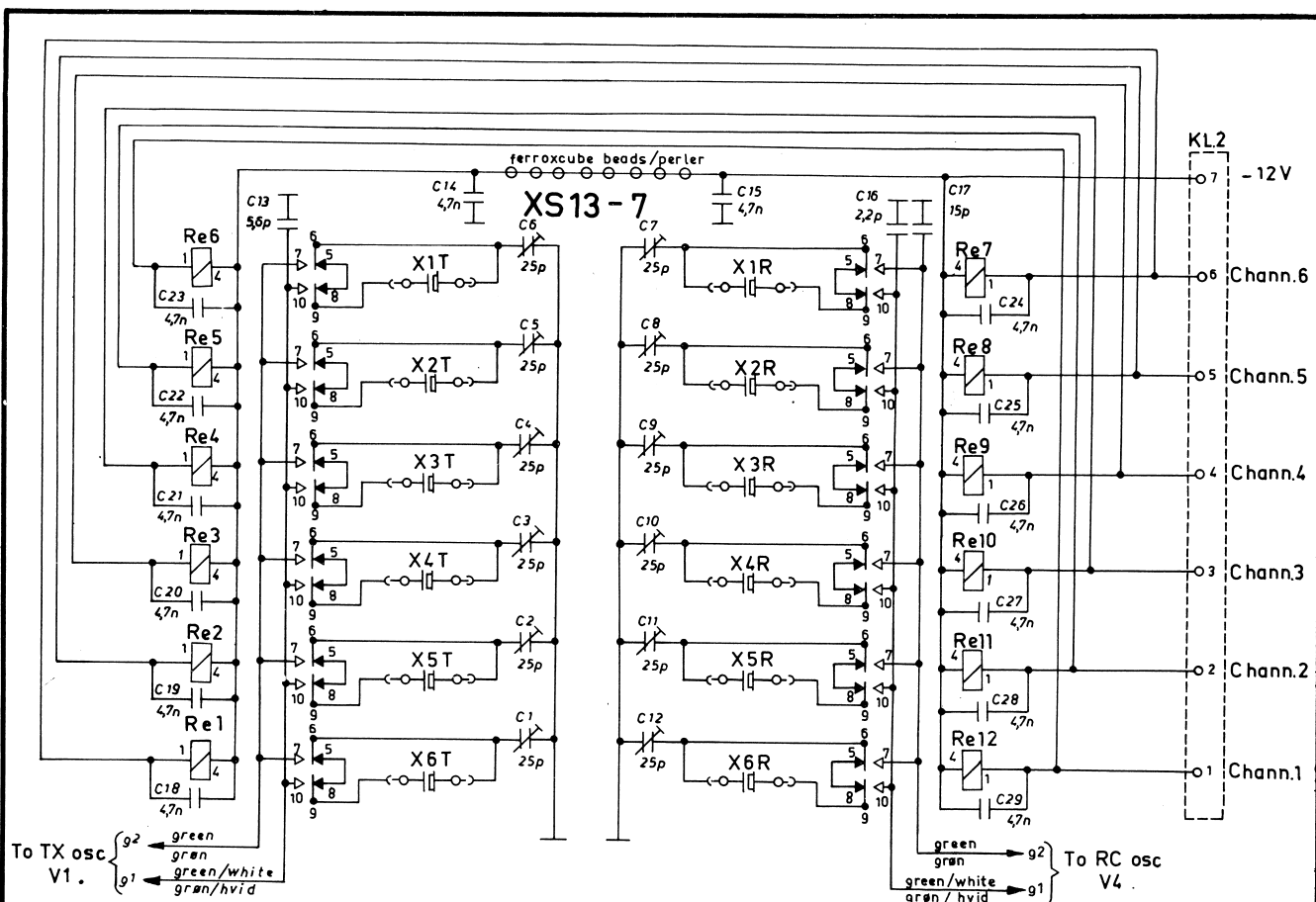
| type | no | code | data | type | no | code | data |
|------|--------|---------|---------------------------|------|----------|----------|---------------------|
| | C1..C6 | 78.5005 | trimmers 25 pF | | C10 | 74.5085 | 33pF $\pm 5\%$ 500V |
| | C7 | 74.5086 | 3.3 pF ± 0.25 pF 500V | | | | |
| | C8 | 74.5029 | 2.2pF ± 0.25 pF 500V | | Rel..Re3 | 58.5019* | Relays |
| | C9 | 74.5008 | 22 pF $\pm 5\%$ 500V | | | | |

XS13-6

| type | no | code | data | type | no | code | data |
|------|--------|---------|---------------------|------|----------|----------|---------------------|
| | C1..C6 | 78.5005 | 25pF trimmers | | C10 | 74.5085 | 33pF $\pm 5\%$ 500V |
| | C7 | 74.5001 | 4.7pF ± 0.25 pF | | | | |
| | C8 | 74.5083 | 3.3pF ± 0.25 pF | | Rel..Re3 | 58.5019* | Relays |
| | C9 | 74.5008 | 22pF $\pm 5\%$ 500V | | | 98.5001 | Crystal oven |

*De angivne relæer er for fjernbetjening. Ved nærbetjening anvendes kode nr. 58.5023 8-24 volt (430 Ω).

The stated relays are for remote control. For ext. local control are code nr. 58.5023 8-24 volt (430 Ω) used.



konst./tegn.
EBN/JEK
27-8-62
godk.
EBN
komp. liste

X-TAL SHIFT UNITS
X-TAL SKIFTEENHEDER

D400218
D400094

XS13-7

| type | no | code | data | type | no | code | data |
|------|---------|---------|---------------------------------|------|------|---------|--------------------------------|
| | C1..C12 | 78.5005 | trimmer 25 pF | | C15 | 74.5029 | 2,2 pF $\pm 0,25$ pF N150 500V |
| | C13 | 74.5004 | 5,6 pF $\pm 0,25$ pF N150 500 V | | Rel- | | |
| | C14 | 74.5046 | 15 pF $\pm 5\%$ N150 500 V | | Rel2 | 58.5020 | relay 12V |

XS13-8

| type | no | code | data | type | no | code | data |
|------|---------|---------|--------------------------|------|----------|---------|-------------|
| | C1..C12 | 78.5005 | trimmer 25 pF | | Rel..R12 | 58.5020 | relay 12 V |
| | C13 | 74.5004 | 5,6 pF $\pm 0,2$ pF 500V | | XTO | 98.5001 | x-tal ovens |
| | C14 | 74.5046 | 15 pF $\pm 5\%$ 500V | | | | |

*De angivne relæer er for fjernbetjening. Ved nærbetjening anvendes kode nr. 58.5023 8-24 volt (430 Ω).

The stated relays are for remote control. For ext. local control are code nr. 58.5023 8-24 volt (430 Ω) used.