CONTENTS

ALL WAVE MARINE RECEIVER

745 Ea

1 - GENERAL

The superheterodyne all wave communications receiver is of the highest grade and covers the frequency ranges 14 to 21 Kc/s and 85 Kc/s to 30,3 Mc/s in twelve bands ; in its shortwave bands it operates with double frequency conversion. The frequency bands are selected with pushbuttons. For incremental control of receiving frequencies above 15 Mc/s the second oscillator can be detuned by up to 100 Kc/s in ganged tuning with the circuits of the first intermediate frequency. Each 100 Kc/s scale division on the main scale can be checked against a built-in crystal spectrum generator.

Temperature-compensated layout of the frequency-determining stages, temperature-resistant materials and components and impregnation of moisture-sensitive components makes the receiver widely immune to climatic conditions and suitable even for deep-sea navigation.

The receiver may be operated from AC or DC ship's main or from 24 volts storage battery.

It may be supplied either as a separate unit contained in a robust metal cabinet for bench mounting or be incorporated in the SAIT console as Main or Emergency receiver.

2 - TECHNICAL DATA

Types of reception :

A1	Unmodulated telegraphy in all frequency bands
A2	Modulated telegraphy in the frequency bands between 170 and 30.300 Kc/s
A3	Telephony in the frequency bands between 170 and 30.300 Kc/s

2.1.- FREQUENCY RANGE

14 to 21 Kc/s and 85 Kc/s to 30.3 Mc/s in twelve bands.

Band 1	14 to 21 Kc/s (xx)
2	85 to 175 Kc/s
3	170 to 350 Kc/s
4	340 to 730 Kc/s
5	720 to 1540 Kc/s
6	1500 to 3100 Kc/s (x)
7	3100 to 6300 Kc/s (x)
8	6000 to 0,200 Kc/s (x)
9	9700 to 15,200 Kc/s (x)
10	14,700 to 20,200 Kc/s (x)
11	19,700 to 25,200 Kc/s (x)
12	24,700 to 30,200 Kc/s (x)

(x) The up to 100 Kc/s that can be set on the frequency interpolator scale have to be added to the frequency values read on the main scale.

(xx) 14 to 25 Kc/s optional.

2.2.- TUBE COMPLEMENT

	European type	U.S.A.type
4 tubes	EF 93	6BA6
3 tubes	EK 90	6BE6
4 tubes	ECC 82	12AU7
2 tubes	EAA 91 or EB 91	6 AL5
1 tube	EL 90	6AQ5

1 tube	EM 34	6 CD7
1 stabilizer tube (input protection)	108 C1	OB2

2.3.- SCALE GRADUATION

in band 1 with 1-kc/s divisions	≤	100 kc/s per mm
2 with 5-kc/s divisions	≤	1 kc/s per mm
3 with 10-kc/s divisions	≤	1.5 kc/s per mm
4 with 10-kc/s divisions	≤	3 kc/s per mm
5 with 20-kc/s divisions	≤	5 kc/s per mm
in bands 6 to 12 with 100-kc/s divisions	≤	25 kc/s per mm
with incremental control		1 kc/s per mm

2.4.- R.F. INPUT

Bands 1 to 6 — high-impedance, unbalanced

7 to 12 — 75 , unbalanced

Receiver is operation — after about one minute

Warmup for full calibrating accuracy — two hours

Setting error in the bands 6 to 12 after calibrating the main tuning control agains the 100-Kc/s spectrum — 1 Kc/s

Frequency drift (measured during a 10-hour operating period after 2hours of warmup) with mains voltage variations of ± 5 %

and 5 C temperature variation in the range + 10 C to + 40 C

in the bands 1 to 5 — $\pm 10^{-3}$

6 to 12 — $\pm 2 \times 10^{-4}$

Parasitic oscillator voltage at the receiver input

(fundamental plus harmonics)

with termination into a dummy antenna

Bands 1 to 11 — 100 v

Bands 12 — 200 v

Selectivity :

Band	Class-of-emission	Attenuation 6 db for a detuning of f_1 (kc/s)	Attenuation 46 db for a detuning of f_2 (kc/s)	Edge steepness $F = \frac{40}{f_2 - f_1}$ (db per kc/s)
1 and 2	A1	± 0.3	± 1.6	30
3 to 12	A1	± 0.8	± 3.1	17
3 to 12	A2/A3narrow	± 1.1	± 4.4	12
3 to 12	A2/A3 wide	± 3.0	± 7.0	10

Image frequency rejection :

Band 1	70 db
2	50 db
3	60 db
4	80 db
5	50 db
6 to 11 (12)	50 (40) db

IF rejection at input :

Band 1	= 70 db
2	= 50 db
3	= 80 db
4	= 60 db
5	= 60 db
6 to 12	= 50 db

2.5.- INTERMODULATION

For an unmodulated useful signal of 100 μv

and an interfering signal of 10 mv with 50% modulation, 20 kc/s away 10 %

Sensitivity and signal-to-noise ratio for 1 into 10 kΩ(at audio output)

Band	Class-of-emission	signal-to-noise ratio (db)	Input EMF (μv)
1	A1	10	≦ 3.0
2 to 4	A1	10	≦ 2.0
6 to 12	A1	10	≦ 0,6
4 and 5	A3	20	≦ 40
6 to 12	A3	20	≦ 10

Range of control for the pitch of the beat note = ± 3000 c/s

Audio gain control manual

RF gain control automatic (AVC)or manual

Variation of the audio output voltage

With a change in RF input voltage from 10 μv to 50 mv < 4 db

Charging time constant of the AVC system

With classes-of-emission A1 and A2/A3 0.1 sec

Discharge time constant of the AVC

With class-of-emission A1 0.5 to 1 sec
With class-of-emission A2/A3 0. 1 sec

Noise limiting action continuously adjustable and disconnectable

Bandwidth of the audio amplifier

At the 3-db-down points
With respect to the 1 kc/s response 300 to 5000 c/s

Distortion factor with 1.5 μ audio output ≦ 10%

Unweighted noise at the loudspeaker

With full audio gain and minimum RF gain ≦ 90 mv
Corresponding to a signal-to-noise ratio ≦ 60 db

2.6.- AUDIO OUTPUTS

Headphone terminal 1 mw; 3_i = 500 Ω

Internal on/off loudspeaker 2 w / 5 Ω

Terminal for external loudspeaker 0.6 w / 5 1Ω

Line output 1 mw / 600 Ω

2.7.- POWER SUPPLY

AC Mains :
Via built-in power sypply unit.
may be adjusted for 110 - 125 - 220 - 250 volts
operation at 40 to 60 c/s - Input power :
about 100 VA.

DC Mains : Receiver fitted as independent unit
opération from DC Mains 110 - 220 volts
or 24 volts storage battery via vibrator, inverter
or rotary converter.

Receiver included in SAIT Console
When the ship's mains is DC, the receiver is
powered by the Console's Main Converter 110 volts
single phase output.

Permissible voltage variation of the power supply ± 10 %

2.8.- DIMENSIONS AND WEIGHT

Front panel (When the receiver is included in SAIT Console)

Width :	52 cm
Height :	30,4 cm.

In metal cabinet with shock absorbers (When fitted as independent Unit)

Width :	55 cm
Height :	35,0 cm
Depth :	38 cm
Weight :	approx. 35 Kgs.

3.- BASIC FUNCTION

The receiver performs in different ways in the twelve bands. Four different functional patterns can be distinguished; they are associated with the various bands as follows :

Functional pattern A with bands 1 and 2

B with bands 3 and 5

C with band 4

D with bands 6 to 12

The differences by reference to functional circuit diagrams showing merely the subassemblies activated at the time, not however switches and relays, are described hereafter.

3.1.- BANDS 1 AND 2

(See DWG 4.92 Fig. 2)

In the bands 1 and 2 only signals of class A1 are to be received. The set operates with single frequency conversion. The frequency of the tunable first oscillator is 50 kc/s above the receiving frequency. The intermediate frequency of 50 kc/s so generated in the mixer stage is doubled in the following stage to give 100 kc/s, i.e. raised to the frequency position of the following IF amplifier.

This IF signal passes trough the second half of a quadruple-tuned band filter. Subsequently the IF channel splits into a narrowband and a wide-band branch. In the wide-band branch the AVC voltage is produced; in the narrow-band branch the A1 signal is amplified once more and finally translated to the audio position with a carrier differing but slighty from 100 kc/s. Audio stages with noise limiter and a final stage amplify the audio signal (difference of intermediate frequency and variable heterodyning frequency) to be output level desired.

3.2.- BANDS 3 AND 5

(See DWG 4.62 Fig. 3)

Also in these bands the receiver operates with single frequency conversion, but the first oscillator frequency is now 100 kc/s above the receiving frequency so that the 100-kc/s IF signal comes about already in the first mixer stage. It travels trough both halves of the quadruple-tuned filter. Subsequently the signal passes the same subassemblies as with bands 1 and 2. The narrow-band IF amplifier branch (Dwg.4.9.1) heterodynes and demodulates the signal (anode bend detection) in receiving signals of class A1, the upper wideband IF amplifier branch supplying the AVC voltage. In the reception of signals of class A2/A3 the upper IF amplifier path effects the demodulation (diode detection); in the lower IF amplifier path the AVC voltage is gained.

3.3.- BAND 4

(See DWG 4.6.2 Fig. 4)

In this band the receiver operates with double frequency conversion with the second oscillator set at a fixed frequency. The first oscillator is of variable frequency and operates 1180 kc/s above the receiving frequency. The IF1-signal of 1180 kc/s so generated in the first mixer stage is applied to the second mixer stage via a double-tuned filter. The fixed-tuned second oscillator operates at 1280 kc/s that an IF signal of 100 kc/s comes about in the second mixer stage. The quadruple-tuned filter and the stages following in the signal path equal those for bands 3 and 5.

3.4.- BANDS 6 TO 12

(See DWG 4.6.2.Fig. 5)

The receiver operates with double frequency conversion also in these bands. If it is tuned with the main scale alone, the electrical conditions are the same as described for band 4.

With the incremental tuning scale, however, (frequency interpolator) the IF1 filter and the second oscillator can be ganged-tuned trough up to 100 kc/s, their frequency difference always equalling the constant second intermediate frequency (see also paragraph 4.3.6). Since the incremental tuning control does not affect the frequency of the first oscillator, the receiving frequency changes to the same extent (but in opposite direction) as the first intermediate frequency. The RF circuits need not be returned, for they are sufficiently wideband.

The class-of-emission switch varies the couplings in the quadruple-tuned filter of the IF2 amplifier and thus the bandwidth according to the three positions "A1", "A2/A3 Narrow" and "A2/A3 Wide". The following circuitry again equals that for the other groups of bands.

3.5.- BLOCK DIAGRAM

" The functional circuit diagram (Dwg.4.9.1) shows the basic interconnection of the individual receiver stages and control elements.

At the antenna input the protective measures against overload of the input circuits are symbolized (neon lamp, protective lamps, cut-off relay A). The input signal reaches the RF preselector stage which is switched to the band desired at the time with twelve pushbuttons. By pressing the callibrating key a signal of 100 kc/s or a multiple thereof can be applied from the calibrating oscillator to the control grid of the first tube. In this procedure the antenna, the BFO and the incremental frequency control are automatically disconnected.

Contacts of the relays B and C lead the signal from the first mixer stage via the doubler to the second half of the quadruple-tuned filter (IF2), or directly to the input of the quadruple-tuned filter, or via IF1-filter and the second mixer stage with second oscillator to the input of the quadruple-tuned filter. The operating condition of the relays B and C depends on the band selected with the pushbuttons. The quadruple-tuned filter feeds into a narrow-band and a wide-band IF stage. In class-of-emission A1 the narrow-band (lower)IF path supplies the signal voltage which is heterodyned with a frequency of about 100 kc/s in the A1-demodulator, while the AVC voltage comes about at a diode behind the wide-band(upper)IF path. In class A2/A3 this diode supplies the demodulated signal, and the other diode which is fed by the lower IF stage, derives the AVC voltage.

The AVC voltage controls the preselector stage, first mixer stage, second mixer stage and last IF stage. The gain can also be adjusted by hand with the control "RF Gain".

A common switch for class-of-emission and bandwith connects the demodulator activated at the time to the volume control which is followed by the audio section with noise limiter and final stage.

3.6.- FREQUENCY SCHEDULE

Band	Receiving frequency in kc/s	Frequency of 1st oscillator in kc/s	1st intermediate frequency in kc/s	Frequency of 2nd oscillator in kc/s
1	14 to 21	64 to 71	(50)	-
2	85 to 175	135 to 225	(50)	-
3	170 to 350	270 to 450	(100)	-
4	340 to 730	1520 to 1910	1180	1280
5	720 to 1540	820 to 1640	(100)	-

6	1500 to 3100 + (0 to 100)	2680 to 4280	1180 -(0 to 100)	1280 -(0 to 100)
7	3100 to 6300 + (0 to 100)	4280 to 7480	1180 -(0 to 100)	1280 -(0-to 100)
8	6000 to 10,200 + (0 to 100)	7180 to 11,380	1180 -(0 to 100)	1280 -(0 to 100)
9	9700 to 15,200 + (0 to 100)	10,880 to 16,380	1180 -(0 to 100)	1280 -(0 to 100)
10	14,700 to 20,200 + (0 to 100)	15,880 to 21,380	1180 -(0 to 100)	1280 -(0 to 100)
11	19,700 to 25,200 + (0 to 100)	20,880 to 26,380	1180 -(0 to 100)	1280 -(0 to 100)
12	24,700 to 30,200 +(0 to 100)	25,880 to 31,380	1180 -(0 to 100)	1280 -(0 to 100)

2nd intermediate frequency : 100 kc/s for each band

Frequency doubling : for bands 1 and 2 only

4.- FUNCTIONS OF THE SUBASSEMBLIES

4.1 - RF SECTION

(See DWG.4.9.4, stages 1 and 3)

A neon stabilizer tube V101 (1 R62) is connected across the antenna terminal of the device to prevent overvoltage across the antenna coils.

The antenna lead passes via contact aII.2 of relay K-101. This relay is controlled via de keying line of the transmitter of the same station; for the time this transmitter operates, the antenna input of the all-wave receiver is connected to chassis ground. Contact aII.2 is also opened, when the calibrating key is depressed, with simultaneous energization of the indicating lamp I-101 "Cal." by contact AI-1. The protective lamp I-102 limits the current in the antenna coils and so protects the input circuit from overload due to neighboring transmitters of higher power. The protective lamp I-501 performs in addition the same function for the bands 1 to 5.

With operation in the bands 6 and 7 two wavetraps for the first intermediate frequency (L-525 = C-530 with f_o=1150 kc/s and L-500 = C-500 with f_o=1110 kc/s) are connected across the input; in band 3 a 100-kc/s wavetrap (L-526 = C-531) and in the bands 1 and 2 a 50-kc/s wavetrap (L-551 = C-563) are effective. The preselector section 1 C-102 of the main tuning capacitor and the control grid of the preselector tube V103 (1 Rö1) are connected via the pushbutton assembly to the preselector coil used at the time. To suppress parasitic resonances, the six tuning coils not used at the time are connected to chassis ground. The anode lead of the preselector tube includes the interstage circuit corresponding to the band chosen; via the pushbutton assembly it is connected to the second control grid of the first mixer stage 3 V104 (Rö1) and the second section of the variable capacitor. All tuned circuits except the one actuated at the time are connected to ground via the pushbutton assembly.

4.2 - CALIBRATING OSCILLATOR

(See Dwg. 4.9.4, stage 2)

The calibrating oscillator is energized via the contact E3 by pressing the calibrating button. Cathode, control grid and screen grid of tube V101 (2 Rö1) function as a triode section that produces a crystal-controlled fundamental of 100 kc/s. The following section screen grid - suppressor grid - anode amplifies this wave with simultaneous shaping of its waveform in a way that its anode circuit carries all harmonics required for calibration at frequencies up to 30 mc/s. Via capacitors C-106 and C-105 the calibrating wave passes to the control grid of tube V101 (1 Rö1); the output coupling is so proportioned that all harmonics appear with about the same amplitude at tube V101 (1 Rö1).

Independently of the beat-frequency oscillator V305b (11 Rö2) whose anode voltage is disconnected when the calibrating button is pressed, the audible calibrating beat note comes about by heterodyning the IF2 wave with the 100-kc/s crystal wave. Via the variable voltage divider R-106, R-107 (for adjusting the volume of the calibrating notes) it is taken from the control grid of tube V103 (2 Rö1) and applied via C-109 to the last IF stage with tube V302 (9 Rö1).

For accurate setting of the frequency to 100 kc/s or a harmonic thereof, the beat note pitch must be zeroed with the main tuning capacitor.

For offsetting crystal tolerances, the crystal frequency can be slightly pulled with the trimmer C-106.

The contact E6 is independent of the calibrating button and serves for energizing the calibrating oscillator if its frequency is to be checked without disconnecting the antenna (see par. 4.7.2).

4.3.- FIRST MIXER STAGE AND FIRST OSCILLATOR

(See Dwg 4.9.4. stages 3 and 4)

The first mixer stage with tube V104 (3 Rö1)translates the receiving signal with the wave produced in the first oscillator tube V105a (4 Rö1). With the capacitor C-135 this oscillator is ganged-tuned together with the preselector circuit and interstage circuit. Depending on the band chosen, the frequency of the oscillator wave is above the receiving frequency by 50, 100 or 1180 kc/s (or in operation with frequency interpolator by some value between 1180 and 1080 kc/s). (Paragraph 4.3.6). The need for producing in the first stage of conversion different intermediate frequencies depending on the band used at the time is due to the wide over-all frequency range of the all-wave receiver. In the bands 1 and 2 the first mixer stage produces a difference frequency of 50 kc/s which does not coincide with any receiving frequency. After doubling its frequency, this signal is applied directly to the IF2 section which is fixed-tuned at 100 kc/s. Since in the bands 1 and 2 only A1 reception is desired, such doubling of the sideband-to-carrier interval, i.e. of the audio signal frequency is inconsequential.

In band 3 the signal is translated to the 100 kc/s position in the first mixer stage so that no doubling is required. This band is therefore suitable for A2/A3-signals as well.

In band 4 the receiver operates with double frequency conversion. The first intermediate frequency of 1180 kc/s secures high image frequency rejection, and the second intermediate frequency of 100 kc/s provides excellent rejection of interfering signals at nearby frequencies.

In band 5 the signal is translated directly to the 100-kc/s position, for an intermediate frequency of 1180 kc/s would fall in the receiving range.

In the bands 6 to 12 the receiver operates as in band 4 with double frequency conversion, but for incremental detuning the IF1 filter and the second oscillator can be simultaneously detuned by up to 100 kc/s. Since the input circuits are sufficiently wideband, they do not participate in this incremental tuning procedure.

In all bands the first oscillator operates in a Hartley circuit with cathode feedback (anode grounded). The oscillator wave is extracted in the cathode circuit for application to the first control grid of the first mixer tube.

4.4 - DOUBLER

(See Dwg.4.9.4, stage 5)

The anode circuit of the first mixer tube V104 (3 Rö1) includes the contacts c^{II} and b^{I} of the relays K-201 and K-202. In the contact positions c^{II2}, b^{I1} (bands 1 and 2) the mixer tube feeds into a 50-kc/s circuit (L-201/C-204). Via a 100-kc/s wave-trap (L-203/C-205) and another 50-kc/s circuit (L-204/C-206) the signal reaches the control grid of the doubler tube V201 (5 Rö1)which is loaded by the second half of the 100-kc/s quadruple-tuned filter. This tube receives the screen grid voltage via contact T1...2b of the push-button assembly ; the tube receives its anode voltage via switch SW301a for bandwidth control.

In the bands 3 and 5 the first frequency conversion produces an IF signal of 100 kc/s which via the relay contacts c^{II2}, b^{I2} reaches the input of the quadruple-tuned filter in stage 9. In these bands no anode current flows in the second mixer tube V202 (6 Rö1), since the contact set c^{I} disconnects the screen grids from their supply voltage. Also disconnected is the doubler stage V201 (5 Rö1) by T1 ... 2b.

In the bands 4 and 6 to 12 the variable double-tuned filter of the first intermediate frequency is in the anode lead of the first mixer stage V104 (3 Rö1).

4.5 - INTERMEDIATE FREQUENCY 1, 2nd MIXER STAGE AND 2nd OSCILLATOR

(See Dwg.4.9.4., stage 6 and 7)

In the bands with single frequency conversion these stages are inactivated. In those bands with double frequency conversion the double-tuned filter of the 1st IF (1180 kc/s or 1080 to 1180 kc/s) is connected via the contact c^{II1} of relay K-201 to the anode of the first mixer tube V104 (3 Rö1). The output of this filter goes to the control grid of the second mixer tube V202 (6 Rö1). Dwg.4.9.4 shows the condition "Interpolator On". When the relays K-203, K-204 now receive a pulse of current, the associated contacts transfer and the fixed capacitors C-216 and C-219 are connected in parallel to the filter coils L-205 and L-206. The double-tuned filter is so fixed-tuned to 1180 kc/s. At the same time the contact d^{II1} connects the oscillator coil L-209 to the trimmer capacitor C-233. The second oscillator now operates permanently at 1280 kc/s; i.e. the frequency intermolator is inactivated.

The relays K-203 and K-204 are energized either via the contact E1 when the calibrating button is pressed or via the pushbutton contacts T1 ... 5 or T4b when any of the lower bands is selected. The relays receive further a pulse of current by the momentary contact T1 to T12 of the pushbutton system when a band is changed, or via the control contact S11 with any minute shift of the main tuning control.

With energization of relay K-204 the contact set d^{I1} closes to act as a holding contact via the normally closed pushbutton contact S12 on the frequency interpolator knob assembly. The indicating lamp"Interpolator On" (I-101) goes out.

The second oscillator and the second mixer stage are applied via c^{I1} to the regulated operating voltage +150 v only, if the relay K-201 is energized by pushing any of the buttons 4 and 6 to 12.

4.6 - INTERMEDIATE FREQUENCY 2, DEMODULATION, GENERATION OF THE AUTOMATIC CONTROL VOLTAGE.

(See Dwg.4.9.4., stages 8, 9, 10, 11)

The anode lead of the second mixer stage V202 (6 Rö1) goes to the input circuit of the quadruple-tuned 100-kc/s filter, whose bandwith can be varied in three steps with the class-of-emission switch SW302a/b/SW301a, depending on the class-of-emission selected. At the output of this filter two amplifier stages are arranged with tubes V302 (9 Rö1) (with L-307/L-308) and V301 (8 Rö1) (with L-309/L-310) of which the latter is narrower in bandwidth. In class A1 it is used for amplifying the signal. In this setting the control grid of tube V301 (8 Rö1) is connected to the AVC voltage lead via L-305 and switch S1b; the gain of tube V302 (9 Rö1) is not controlled, however. The filter in the anode circuit of tube V302 (9 Rö1) is of greater bandwidth and followed by the diode section V303a (10 Rö1) which in class-of-emission A1 produces the AVC woltage for application to the AVC line via the switches SW304b and SW305.

In the position A2/A3 the switch SW301b disconnects the AVC line from tube V301 (8 Rö 1). The primary of the IF2 filter after tube (Rö1) is connected to the diode section V303b (10 RO2) at whose anode the AVC voltage is taken in class-of-emission A2/A3. The signal is here amplified by tube V302 (9 Rö1) whose control grid is connected to the AVC line via R-307, SW304a. The tubes V101 (1 Rö1), V104 (3 Rö1) and V202 (6 Rö1) are connected to the AVC line in all classes-of-emission.

In class-of-emission A1 the narrow-band branch is thus used for amplification of the signal, and the wide-band branch for deriving the AVC voltage; with the classes A2 and A3 conditions are reverse.

In class-of-emission A1 the switch SW 303a which connects the volume control R-323 to the demodulator active at the time is applied to the anode of tube V305a (11 Rö1). The control grid of this tube which operates in the lower bend of the characteristic, receives beside the input signal a 100-kc/s wave generated by the beat-frequency oscillator (tube V305 (11 Rö2)). The capacitor C-342 can vary the frequency of this oscillation by ± 3kc/s. An additive mixing os this wave with the on/off keyed carrier results in an audio beat note whose pitch depends on the setting of capacitor C-342.

With the switch SW303b the BFO is disconnected from its supply potential in the classes-of-emission A2/A3; it is also disconnected with contact E4 whenever the calibrating button is pressed.

The RF and IF gain of the receiver can also be controlled by hand. For this purpose the switch SW305 disconnects the AVC line from the regulating diode and applies it to the wiper of the potentiometer R-320 which is connected to a negative potential. A depression of the cálibrating button connects with contact E2 the AVC line always to the regulating diode, irrespective of the position of SW305.

4.7 - AUDIO STAGE, NOISE LIMITER

(See Dwg.4.9.4, stages 10 and 12).

After amplification in tube V304a (10 Rö3) the audio signal is applied in stage 12 to a double diode whose cathodes are interconnected and applied to a variable negative bias. The diode section V307a (12 Rö1) becomes conducting only at voltages exceeding a minimum depending on the cathode bias; negative peaks beyond a certain value thus are limited. On the other hand the diode section V307b (12 Rö2) becomes conducting only at voltages not exceeding a certain maximum; positive peaks beyond a certain value thus are limited as well. The onset point of the limiting action can be adjusted with the aid of the potentiometer R-346 corresponding to the respective receiving conditions. With the switch SW306 the limiting action can be disabled.

4.8 - AUDIO STAGE AND FINAL STAGE

(See Dwg.4.9.4, stages 12, 13 and 14).

After the noise limiter the audio signal reaches the second amplifier stage V304b (12 Rö3) and ultimately the final stage V308 (13 Rö1). The anode circuit of the final tube includes an output transformer which besides the winding for the built-in loudspeaker has terminals for the connection of 600Ω lines as well as high-impedance outputs for a second loudspeaker and headphones. The built-in loudspeaker can be silenced with the push-pull switch SW307 combined with the volume control R-323.

4.9 - TUNING INDICATION

(See Dwg. 4.9.4, stage 11)

The control grid of the tuning indicator tube V306 (11 Rö3) (magic-eye tube) is connected to the AVC line. With reconnection of the receiver for manual control the indicating tube remains connected to the AVC line so that a tuning indication is possible also with manual control.

4.10 - POWER SUPPLY UNIT

(See Dwg.4.9.4., stage 15).

The power supply unit, stage 15, feeds the receiver. The power transformer can be reconnected for primary voltages of 110, 125, 220, and 250 v. Operation from DC mains or storage battery is possible via a vibrator inverter or rotary converter. Its input circuit can be looped via two switch contacts in the receiver that are ganged with the switch of the power transformer. The vibrator inverter (or rotary converter) is so also under control of the receiver on/off switch.

The power transformer has three secondary windings The heater winding is so designed that apart from the 6.3-v tap for the heater supply of the receiver tubes a voltage of about 9.5 v is available which supplies regulated 6.3 v for heating the two oscillator tubes via the Thernewid resistor (resistance with negative temperature coefficient) R-402 and ballast resistor R-401. From the 9.5-v AC the DC supply voltage for the relay circuits is also derived via a rectifier 403 and filter capacitor C-401.

A secondary winding (220 v AC) produces 230 v DC for the anode and screen grid supply via a rectifier bridge 401 and filter network C-402/C-403, L-401.

A regulated voltage of 150 V is taken at the neon stabilizer tube V401 (15 Rö1) for the anode supply of the oscillator tubes and the screen grid supply of the mixer tubes. Via a rectifier bridge 402 and filter chain C-404/C-405, R-404 another secondary winding (127 v AC) produces a voltage of 115 v for manual control and noise limiting which is negative with respect to chassis ground.

5.- LAYOUT

The all-wave receiver consists of five different subassemblies mounted in a common frame of strong angle iron.

1. Input section
2. Calibrating oscillator
3. Converter section
4. Amplifier section
5. Power supply unit.

The annexed Figs.1 and 2 show top and bottom views of the receiver slide-in chassis. The left of the slide-in chassis accomodates the input section which comprises the RF and oscillator circuits with pushbutton assembly and three-section variable capacitor for coarse tuning. The associated tubes V101 (1 Rö1), V104 (3 Rö1) and V105a/b (4 Rö1/2) (RF prestage, first mixer stage, and first oscillator) are arranged at the bottom of the chassis below the variable capacitor.

Behind the variable capacitor the calibrating oscillator is arranged which produces a 100-kc/s spectrum with the aid of a crystal and the oscillating and harmonic-generating stage V103 (2 Rö1).

At the right beside the variable capacitor the converter section is arranged with doubler stage V201 (5Rö1), second mixer stage V202 (6 Rö1), second oscillator with buffer stage V203a/b (7 Rö1/2) as well as a three-section variable capacitor for the frequency interpolator.

All stages of the IF2 section (filters,amplifier stages V301 (8 Rö1) and V302 (9 Rö1), demodulator and AVC voltage diodes V303a/b (10 Rö1/2) as well as the additionally shielded BFO V305a/b (11 Rö1/2) are in the amplifier section in the righthand half of the frame. This subassembly contains further the audio stages : Amplifier V304a (10 Rö3), noise limiter V307a/b (12 Rö1/2), amplifier V304b (12 Rö3) and final stage V308 (13 Rö1) with output transformer. The indicating tube V306 (11 Rö3) mounts above the amplifier section on the front panel.

The power supply unit (annexed Fig.1) is arranged at the rear of the frame. It comprises the power transformer (rear right) the filter choke (rear left) and in-between a neon stabilizer tube, ballast resistor, filter capacitors and rectifiers. The layout plan (annexed Fig. 4) shows the details of the setup.

For DC the subassemblies are interconnected via wires (cableforms) decoupled with lead-trough capacitors and for AC via shielded cables. Apart from the power supply all subassemblies have separate electrical shielding; after removal of the cableforms and shielding cables they can be taken down singly. It should be noted that the input section requires realignment after any dismounting and remounting, Sometimes need may even arise for a redrawn main scale. For this reason the input section should never be dismounted outside the factory, if possible.

The main tuning capacitor is controlled with the tuning knob via bronze strip and gearing on the bay frame. With knob pulled outward the coarse drive is activated for sweeping the scale range in $3^3/4$ revolutions. With the knob pushed (fine drive) such coverage takes $15x3^3/4$ = about 56 revolutions.

With the front panel all subassemblies in the frame integrate to a slide-in chassis accomodated in a rugged dripwaterproof metal cabinet and attached to the latter by four screws at the corners of the front panel. When the receiver is fitted as independent unit, shock mounts are provided.

The receiver slide-in chassis can also be inserted into a bay.

6.- OPERATION

6.1 - PROCEDURES PRIOR TO PLACING INTO OPERATION

a) Equipping the slide-in chassis

The receiver is mostly supplied with tubes inserted. Insert into the correspondingly lettered holders electron tubes, stabilizer tubes, and the control crystal supplied as separate items. For this purpose loosen the four red-ringed screws at the corners of the front panel and withdraw the slide-in chassis in a forward direction from the casing by the two handles.

b) Setting the operating voltage

The receiver leaves the factory adjusted for 220-v AC mains. For operation from 110, 125 or 250 v AC supplies the mains voltage adjuster should be shifted accordingly. It is accessible at the rear of the slide-in chassis after withdrawing the latter from the casing. The mains voltage value, for which the unit is set, appears in a window at the rear of the cabinet.

If only DC mains are available in case of an independent fitting, a corresponding vibrator inverter or rotary converter should be connected in tandem with the power lead of the receiver. The mains and the vibrator inverter should be connected to the three-terminal safety sockets at the rear of the receiver. In this way the vibrator inverter input is also brought under control of the on/off switch of the receiver.

For operation on DC mains the receiver incorporated in SAIT Console is powered by the Console's main converter.

c) Antenna and ground

Connect a reliable ground lead to the grounding terminal at the rear of the device. Connect the antenna via the coaxial antenna jack to the device.

d) Headphone, loudspeaker, audio line.

A geadphone ($\leqq$ 2 kΩ) can be connected to the jack pair on the front panel.

Two additional jack pairs at the rear of the device serve for the optional connection of an external loudspeaker ($\leqq$ 5 kΩ) and a 600-Ωline (audio power 1 mw.)

With simultaneous operation of the internal and external loudspeakers each receives 0.6 watts at most.

e) Keying line

If a transmitter is operated together with the receiver, it may happen that it feeds considerable power into the receiving antenna. In such case connect the jack pair "Keying Line" at the rear of the receiver via a two-wire line to the corresponding jacks of the transmitter. When its carrier appears, a relay closes the keying line circuit and so energizes relay 1 Rel A in the receiver to disconnect the antenna from the receiver input.

6.2 - PLACING THE RECEIVER INTO OPERATION

(See Dwg.4.9.5)

a) Energization

Operate the power switch to "On". Illumination of the scale indicates the energized condition of the receiver; within about one minute it is ready for operation. Its full frequency stability is attained after about two hours of warmup.

b) Preparatory settings

With one of the twelve pushbuttons select the desired band as a first step. Before tuning-in on the desired station, operate the other controls as follows :

Operate the class-of-emission and bandwidth switch to "A1", "A2/A3" "Narrow"or "A2/A3 Wide" corresponding to the desired class-of-emission. Bring the control "RF Gain" to its zero position; this simultaneously activates the automatic volume control (AVC). Operate the control for the noise limiter to "Off". Turn on the loudspeaker by pushing the audio control and set the latter for a medium volume.

c) Tuning in the bands 1 to 5

In these bands the frequency interpolator is inactive. Tune the receiver with the control knob; in so doing set the scale index directly to the desired frequency (control knob pulled : coarse tuning; control knob pushed : fine tuning). Checking of the 100-kc/s points aginst the built-in crystal spectrum is possible by pressing the calibrating button; the red display "Calibration" becomes lighted in such case. Set the main tuning control for zero beat. The deviation between index and scale mark can so be determined and taken into account in setting the desired frequency.

Check the tuning conditions against the "Magic-Eye-Tube" In class-of-emission A1 set the control "A1 Pitch" for the desired pitch. To eliminate interfering noise the noise limiter can be activated and set correspondingly.

d) Tuning in the bands 6 to 12

In all these bands the incremental fine scale with its high reading accuracy can be used beside the main scale. This "heterodyning frequency interpolator" is established by the tunable second oscillator.

By reference to an example let us explain the setting to a given frequency. A frequency 13,678 kc/s is assumed as desired. Such setting requires only the following few operations :

- Press pushbutton 9 for the range 9700 to 15,300 kc/s.
- Set the control "Tuning" in the coarse drive (knob pulled) to the 100-kc/s value of the desired frequency, i.e. 13,600 kc/s.
- By pressing the pushbutton "Calibration" (red display "Calibration" becomes lighted) and slow rotation of the knob "Tuning" in the fine drive (knob pushed) make the beat note zero by reference to the crystal spectrum. The index of the incremental tuning scale may be in any position; it is of no influence onto the calibrating procedure.

Important : After releasing the pushbutton "Calibration" the index of the main scale must no longer be shifted.

- By temporary pushing of the knob "Frequency Interpolator" (White display "Frequency Interpolator" becomes lighted) activate the incremental tuning action and set its control now for the tens and units. (i.e. the figure "78" in this case).

This leaves the receiver accurately tuned to the desired frequency 13,678 kc/s. The index of the interpolator scale need not be set to "0" beforehand. The white display "Frequency Interpolator" indicates that any kilocycle value set on the fine scale has to be added to the setting of the main scale in the bands 6 to 12.

Whenever a new frequency is being set, i.e. the knob "Tuning" is rotated or some other band selector button is pushed, the "Frequency Interpolator" is automatically disconnected and the display "Frequency Interpolator" becomes dark. The value just set on the incremental scale is new inconsequential.

e) Setting for the classes-of-emission
(See Dwg.4.9.5)

The position without AVC, i.e. with activated control "RF Gain" will be used, for instance, only if the received radio signals show slow lading or noneat all. Stations whose signals hardly are above the interfering noise can be better received with manual control, for in case of automatic control large noise peaks are liable to shut down the receiver gain.

By activating the control "Noise Limiting" such noise peaks can be widely suppressed. This control must be so set that the useful signal is passed without distortion.

- Class-of-emission A1

Before tuning in on an A1-station, bring the index of the control "A1 Pitch" to a vertical upward position, hence between the two tapering arrow ends. With the main scale, and, if applicable, the incremental scale, tune the receiver to the station in a way that the frequency of the beat note becomes virtually zero (dead interval between audible beats). Subsequently adjust the control "A1 Pitch" for the desired pitch.

- Class-of-emission F1-Manual Morse

Operate the class-of-emission switch to "A1".

Before the tuning procedure itself the index of the control "A1 Pitch" must point upward. Adjust the RF gain with the control "Gain RF".

With the aid of the main scale and, if need arises, incremental scale tune the receiver to the transmitting station in a way that the lower of the two shifted carrier positions is associated with zero beat.

During reception adjust the pitch control or the incremental scale in a way that, if possible, only the mark elements are audible and the space elements are silent due to the zero beat method.

- Classes-of-emission A2 and A3

Corresponding to the demanded bandwith operate the class-of-emission switch to "A2/A3 Narrow" or "A2/A3 Wide".

In these classes-of-emission the control "A1 Pitch" is ineffective.

7.- MAINTENANCE

7.1 - CLEANING, SERVICING, SUPERVISING

Since the all-wave receiver is built for rough conditions of use, it needs servicing only at intervals of about 2 to 3 months under normal climatic environment and in dry operating rooms. Equipment permanently used in vehicles or under adverse climatic conditions should be serviced about every four weeks. The intervals stated do not for the indicating lamp "Frequency Interpolator" and the crystal oscillator (see paragraphs 4.7.1.e and 4.7.2)

Generally the following is required :

a) Cleaning the receiver inside and outside including servicing of the surfaces.

b) Servicing the bearing points onrotating parts.

c) Cleaning and servicing of exposed contacts (power switch and class-of emission switch)

d) Supervision of the operating voltage and tubes
(See table, Dwg.4.9.)

e) Supervision of the indicating, scale, and protective lamps.

Important : Check the lamp lighting the display "Frequency Interpolator" daily, if possible. When the frequency interpolator is activited, the display indicates by lighting that in the short-wave bands 6 to 12 the numerical values of the incremental scale, in kilocycles are to be added to the frequency getting of the main scale; satisfactory performances of this indicating lamp thus is of extreme importance.

The indicating and scale lamps have screw bases and are protected by paint against coming loose. For replacing lamps the holders can be galled off the holding brackets in the direction of the lamp exis.

All work must be carried out with care by well (trained personnal, observing the demands applying for fine mechanical equipment. Permissible tools are dry washed lintfree cloths, clean brushes with positively attached bristles, grease-free compreased air at a precessure not exceeding 1 at (14 1bsi) and satisfactory screwdrivers, pliers and pincers.

Near coils including adjusting screws, variable capacitors, trimmers, ans switch springs maximum care must be exercised in order to avoid mistune of frequency-determining parts.

Only a bare minimum of grease and oil should be used; as a rule "too little" will be preferable to "too much". Use always only best grease and oil free of resin and acid.

The tables in the annexed Fig.5 and Dwg.4.9.3 include all necessary information for supervision of the tubes and the operating voltage and for the measurement of the gain per stage.

If a tube should show deviations of more than 10% from the value stated, it must be checked in a tube tester. Should it pass that test, check whether the circuitry around the respective tube has developed a fault.

7.2 - CHECKING THE CRYSTAL OSCILLATOR

At regular intervals of about four weeks the frequency of the crystal oscillator must be compared against a standard frequency. For this purpose withdraw the slide-in chassis from the casing after loosening the four screws at the corners of the front panel, and place the chassis into operation again with antenna connected. (Caution : Receiver is under operating voltage). Tune the receiver subsequently in band 3 to the station Droitwich I at 200 kc/s. Activate the crystal spectrum generator with the pushbutton at the rear of the chassis.

The 100-kc/s wave of the crystal and the IF wave generated from the crystal harmonics heterodyne to give a beat note. As a first step set the main tuning control of the receiver approximately to zero beat. The ordinarily small difference between the second harmonic of the crystal and the standard frequency of the transmitter is evident from a beat note indicated by the magic-eye tube. Minimize the beat frequency by varying the pulling trimmer on the crystal spectrum generator (lettered "100-kc/s Cal.Freq.") (minimum pulsation period about 2 to 3 sec.)

The volume of the 100-kc/s beat notes can be varied with the control "Cal. Oscillator level" inside the set. It must be checked in particular in the shortwave bands with the highest numbers.

After checking and aligning reinsert the chassis into the casing and bolt it in position.

7.3 - REMOVING THE FRONT PANEL

To gain access with repair work to those components that are controlled from the front (e.g. potentiometers, pushbuttons, power switch), the front panel must be removed.

After loosening their tops all controls can be pulled off easily : only in the case of the knob driving the index of the main scale it is requisite to proceed according to the following instruction (Dwg.4.9.2, Fig. 1)

1- Place the receiver with front panel facing upward.

2- Turn the knob in a way that access is gained to one after the other of the two grub screws (1) in the slot (2) of the ring. Loosen the grub screws.

3- Grip and withdraw the slipped-on protective cover (3) with finger nails or pocket knife.

4- Push the knob to the rear position.

5- Screw out the tapered-head screw (4).

6- Pull off the knob slowly and gently from the driving axle. If it should refuse to come off smoothly, open the grub screws about another quarter turn.

After repair and reapplication of the front panel and the other controls reassemble the main tuning control knob in the following order :

1- Place the receiver with front panel facing upward.

2- Slip the knob onto the driving axle.

3- Turn the knob in a way that the two grub screws (1) become accessible one after the other; tighten the screws.

4- Push the knob to the rear position.

5- Screw the tapered-head screw (4) into the axle.

6- Slip the cover (3) onto the control.

7.4 - REPLACING PARTS

1. Notes on mounting work

In replacing defective parts the following should be observed :

a- To avoid connecting errors, it is advisable before taking down a defective part or larger structural unit, to draw a situation plan of the wires and components that must be unsoldered.

b- Screws loosened for repair must be tightened again firmly after repair and protected against coming loose.

c- If need arises for replacing parts, use if possible only original parts and mount and fix them in accurately the same position.

By reference to the annexed photographs in Fig.1 resistors and capacitors can be easily located, and by reference to the annexed Fig.4 coils, switches, relays and lead-trough capacitors.

2. Replacing a coil or a trimmer in the pushbutton assembly

Unsolder the connections to the respective pushbutton strip. After bending up the fastening tabs, take out the strip and replace the coil or the trimmer. Proceed with care and avoid jamming.

3. Dismounting of the pushbutton assembly with variable capacitor C-102/C-132/C-135.

a- Connect an RF generator of constant frequency to the receiver input and tune the receiver. Set the frequency in a way that the grub screws on the axle of the variable capacitor are accessible in this position of the index. Mark in a suitable manner the positions of the variable capacitor and the index, and loosen the connection between the variable capacitor and the gearing system.

In reassembling set the index, the gearing unit, and the variable capacitor to the aforementioned frequency and tighten the grub screws. Using the 100-kc/s crystal spectrum check the agreement between the positions of variable capacitor and index.

b- Unsolder and take down the bracket with the antenna jacks and the antenna relay K-101.

c- Open the connections between crystal spectrum and pushbutton assembly and taken down the box with the crystal spectrum generator.

d- Unsolder the shielded line to the converter.

e- Unsolder the cableform connections to the pushbutton assembly.

f- Unscrew the clips of the power cable from the pushbutton assembly.

g- Loosen the seven fastening screws and take down the pushbutton assembly plus variable capacitor.

h- In reassembling proceed in the reverse order.

4. Replacing the relays

If a relay should fail or give poor performance, replace it (adjustments on relay contacts are permissible only according to special instructions and with suitable tools and measuring facilities).

7.5 - ALIGNMENT

Measuring instruments required :

Frequency meter from 1 to 2 mc/s
Signal generator from 10 kc/s to 30 mc/s (Z_i= 60 Ω)
RF tube voltmeter 0.5 to 2 v
DC tube voltmeter 1 to 5 v.

1. Quadruple-tuned filter and narrow-band double-tuned filter L-309/ L-310 (IF2, 100 kc/s)

Preparation :

a- Unscrew both shielding baffles from the pushbutton assembly (T3 to T12). Unsolder the capacitor C-130 (250 μμf) from the pushbutton assembly. Connect the signal generator via the capacitor C-130 to grid 3 of V104 (3 R01). Disconnect the first oscillator by unsoldering the anode resistor R-122 from the lead-trough capacitor C-139. After the alignment restore the device to the original condition.

b- As a detector in the aligning procedure connect the RF tube voltmeter via 0.5 μμf to the soldering-lug 5 of L-310.

c- Set the receiver to band 3 or 5.

d- Open the RF gain control (R-320) all the way.

e- Set the signal generator accurately to 100 kc/s (check with frequency meter or 100-kc/s crystal) and during the aligning procedure always readjust for a detector voltage of 0,1 v.

Alignment procedure :

In the position "A2/A3 Narrow" of the class-of-emission switch align the filters without additional damping several times in succession for maximum detector voltage (L-309, L-310, L-310, L-301, L-302, L-304, L-305).

2. Double-tuned filter 10Sp1/10Sp2 (100 kc/s).

Preparation :

a- Proceed as under 1.1; 1.3; 1.4; 1.5.

b- Connect the RF tube voltmeter via .5 µµf to soldering lug 5 of L-308 as a detector in the aligning procedure.

c- Prepare a damping network (1000 µµf with 500 Ω in parallel).

Alignment procedure :

Operate the class-of-emission switch to position "A2/A3 Narrow" ; damp down L-307 (terminals 2 and 1) and adjust L-308 for maximum detector indication (core below the chassis)

Subsequently damp down L-308 (terminals 5 and 6) and align L-307 for maximum deflection (core above the chassis).

3. Beat-frequency oscillator (BFO for class A1)

Preparation

a- Proceed as under 4.7.5 - 1a, c and d

b- Turn the control "A1 Pitch" on its axle until the index at the left stop points towards the end of the left-hand arrow; screw the knob in position and turn the pitch control subsequently to the mid-position between the arrows.

c- Set the signal generator accurately to 100 kc/s (check with frequency meter or 100-kc/s crystal).

Alignment procedure :

In position "A1" of the class-of-emission switch align the BFO with L-311 for zero beat in headphone or loudspeaker.

Check : The pitch at the counterclockwise stop shall about equal that at the clockwise stop.

4. Filter L-201/L-204 (50 kc/s); L-203 (100 kc/s)

An alignment is only possible after the alignment under 1.

Preparation

a- Proceed as under 4.7.5- 1a, b and d.

b- Operate the class-of-emission switch to position "A2/A3 Narrow".

c- Set the receiver to band 1 or 2.

d- In aligning always adjust the signal generator with an input signal of 50 kc/s (100 kc/s) for a detector voltage of 0.1 v.

Alignment procedure :

a- At 50 kc/s align L-201 and L-204 for maximum detector voltage.

b- At 100 kc/s align L-203 for minimum detector voltage.

Shuttle several times between the procedures (a) and (b), until no further aligning with L-201, L-204, L-203 is possible.

5. Second oscillator 1280 kc/s (1280 to 1180 kc/s)

Effect the alignment only after a warmup of about two hours. In aligning do not remove the shielding plate or else detuning will occur.

Preparation

a- Connect the frequency meter via about 5 µµf to anode of the tube V202 (6 R61) (soldering-lug 2 of L-301).

b- Set the receiver to band 6 (or 7 to 12).

Alignment procedure

Turn on the frequency interpolator (second oscillator tunable).

a- With the index in position 100 kc/s adjust L-209 for the oscillator frequency 1180 kc/s.

b- With the index in position 0 kc/s adjust the trimmer C-232 to the oscillator frequency 1280 kc/s.

Shuttle between the procedures (a) and (b) until no further alignment with L-209 and C-232 is possible.

c- Turn off the frequency interpolator (second oscillator is fixed). The index position is inconsequential. With the trimmer C-233 adjust to the oscillator frequency 1280 kc/s.

6. Variable intermediate frequency (1180 to 1080 kc/s) and fixed intermediate frequency (1180 kc/s)

An alignment is only possible if the IF2 filters and the second oscillator are aligned. In the aligning procedure do not remove the shielding plate or else detuning will occur.

Preparation :

a- Proceed as under 4.7.5 - 1a, b and d.

b- Set the receiver for band 6 (or 7 to 12).

c- In the aligning procedure always adjust the 1080-kc/s or 1180-kc/s input signal for a detector voltage of 0.1 v.

Alignment procedure :

Activate the frequency interpolator (IF1 variable).

a- In the position "100 kc/s" of the index and with a signal generator frequency of 1080 kc/s adjust L-205 and L-206 for maximum detector voltage.

b- In the position "0 kc/s" of the index and for a signal generator frequency of 1180 kc/s adjust C-215 and C-218 for maximum detector voltage.

Shuttle several times between the procedures (a) and (b) above, until an alignment of L-205, L-206, C-215 and C-218 is no longer possible.

c- Turn off the frequency interpolator (IF1 fixed) index position arbitrary.

At the signal generator frequency 1180 kc/s adjust C-216 and C-219 several times in succession for maximum detector voltage.

7. First heterodying oscillator

Align only after a warmup of about two hours.

Preparation :

a- Screw the shielding plate firmly in position. Check the tube shielding cap for firm seat.

b- No backlash is permissible between the driving axle and the variable capacitor. Check the take-up of the gears and the firm seat of the fastening screws on the axle.

c- Check the adjustment of the index. When the plates of the variable capacitor are enmeshed 15°, the index must be on the second marking line from the upper right-hand scale edge. A 15-degree gauge is supplied with a replacement capacitor. At the right-hand and left-hand stops of the gearing unit the index must be equally away from the end division in each case.

Alignment procedure :

Begin with band 12, subsequently check band 11, etc., to 1 or align them, as the case may be. Align the oscillator at the right-hand end of the scale with the trimmer C 5..., at the left-hand end of the scale with coil L 5... in a way that the scale calibration holds accurately (check against the built-in 100-kc/s calibrating oscillator).

Caution : Beware from aligning to the image frequency in the bands 9 to 12. Check with method (a) or (b).

a- Check with a frequency meter whether the oscillator frequency is the sum of input frequency plus first intermediate frequency.

b- Set the index to the input frequency. Set the signal generator to the image frequency, i.e. the input frequency plus two times the intermediate frequency and connect it to the receiver input. Upon application of a sufficiently high input voltage it must be possible to receive the image frequency; if such is not the case, the oscillator is misaligned (input frequency less intermediate frequency). In such case turn out the trimming core and effect a realignment.

8. IF wavetraps

Preparation :

a- Set the RF gain control R-320 for -3 v at the AVC line. Measure with DC tube voltmeter, connecting "+" to chassis ground and "-" to the white wire at the lead-through capacitor C-243 (lead-in to the shielding box, variable IF).

b- Tuning indication with DC tube voltmeter; connecting "+" to chassis ground and "-" to R-331 (510 kΩ, at the right-hand rear, viewed from the front panel, below the chassis in the corner; clamp the lead to the point where brown and green wires leave).

c- In the bands 1 to 6 connect the signal generator to the input via the CCIR dummy antenna (Dwg.4.9.2, Fig. 6).

In the bands 7 to 12 connect the signal generator via 15 Ω resistor to input (Dwg.4.9.2, Fig. 7).

Alignment procedure :

In band 2 set the receiver to 90 kc/s and the signal generator to 50 kc/s. Align the coil L-551 for minimum voltage indication.

In band 3 set the receiver to 180 kc/s and the signal generator to 100 kc/s. Align the coil L-526 for minimum voltage indication. In band 6 set the receiver to 1.52 mc/s (coarse scale).

a- Activate the frequency interpolator and set it to +70 kc/s (i.e. IF1 = 1110 kc/s); set the signal generator to 1110 kc/s. Align the coil L-500 for minimum voltage indication.

b- Activate the frequency interpolator and set it to +30 kc/s; operate the signal generator to 1150 kc/s. Align the coil L-525 for minimum detector voltage.

9. Input circuits and interstage circuits

Preparation :

a- Proceed as under 8a, 8b, 8c. The lids of the pushbutton assembly must be closed.

b- In the bands 6 to 12 activate at each aligning point the frequency intermolator and set the index to the mid-position (+50 kc/s).

7.6 - ALIGNMENT OF FREQUENCIES FOR TRACKING

Band	Inductive alignment with coarse scale setting and input frequency	Capacitive alignment with coarse scale setting and input frequency
1	14.5 kc/s	20.5 kc/s
2	90.0 kc/sd	165.0 kc/s
3	176.0 kc/s	335.0 kc/s
4	362.0 kc/s	685.0 kc/s
5	745.0 kc/s	1450.0 kc/s
6	1.58 mc/s	3.02 mc/s
7	3.25 mc/s	6.05 mc/s
8	6.2 mc/s	9.8 mc/s
9	10.0 mc/s	14.7 mc/s
10	15.0 mc/s	19.9 mc/s
11	20.0 mc/s	24.7 mc/s
12	25.0 mc/s	29.7 mc/s

Caution : In aligning the input and interstage circuits a correct core position is of primary importance. The following table gives guiding values for the core position in millimeters above the coil body (+) or down in the coil body (–).

7.7 – GUIDING VALUES FOR THE CORE POSITIONS

Band	Input circuit		Interstage circuit		First oscillator	
1	L–502	+2	L–528	–7	L–552	–3
2	L–504	–8.5	L–530	–7.5	L–553	–3
3	L–506	–15	L–532	–6	L–554	–3
4	L–508	–16	L–534	–16	L–555	–4.5
5	L–510	–16.5	L–536	–5	L–556	–2.5
6	L–512	–5	L–538	–6	L–557	–3.5
7	L–514	+3.5	L–540	–4	L–558	–4
8	L–516	–1.5	L–542	–6	L–559	–2.5
9	L–518	+3	L–544	–1	L–560	–1.1
10	L–520	+2.5	L–546	–1.5	L–561	–3
11	L–522	+2	L–548	–2	L–562	–3
12	L–524	–1	L–550	–4	L–563	–1.5

Alignment :

With the coils and the trimmers align the input and interstage circuits for maximum voltage reading at the prescribed alignment of frequencies in the corresponding band; a capacitive adjustment should be the last in each case of alignment. The order in which the bands are aligned is inconsequential. After alignment secure the coil cores and trimmers against rotation.

7.8 - TROUBLE SHOOTING

Fault	Probable cause	Tracking down and detecting the fault	Fault elimination
Receiver remains dead despite application of power	Fuse blown	Check voltage adjuster and fuse	Set the correct mains voltage and insert fuses.
No reception in any band	a. Ballast resistor défective, oscillator receives no heating coltage b. Relay K.101 fails to restore c. Tube V.105a (4 R01) is defective d. Lamp I-102 is defective	a. Check-ballast resistor for continuity b. Check K.101 c. Check tube V.105a (4 R01) d. Check I-102	a. Replace the unit, if defective b. Replace the unit, if defective; clean the contacts of the calibrating pushbutton c. Replace the unit, if defective d. Replace the unit, if defective
In the bands 6 to 12 rotation of the main tuning control activates and inactivates the frequency interpolator temporarily	Control contact on the axle of the frequency interpolator fails	By-pass control contact	Clean the contact and adjust it properly
Frequency interpolator fails to be automatically inactivated with turning of the main tuning control	Take-along switch on the main driving exle fails	Remove front panel and check switching contacts	Clean the switching contacts and replace the lead-in Litz wire, if need arises

Reception in the bands 6 to 12, but pressing and turning of the frequency interpolator knob fails to change the frequency incrementally. The lamp frequency interpolator "On" remains dark	The relays K.203 and K.204 fail	a. The lead-trough capacitors C.224 and C.225 must be at +10V. with respect to chassis ground. If such is not the case, one or both capacitors have a fault to chassis ground b. Check the momentary contact T6-12 in the pushbutton assembly for proper performance	a. Replace the capacitors C.224 and C.225, if defective b. Readjust the momentary contact
In all bands and classes-of-emission settings reception is weak and distorted; limiter fails to operate.	Limiter blocks because of defective electrolytic capacitor C.356	The voltage across capacitor C.356 be 40 V.	Replace the defective components C.356 and R.345
No calibrating beats are audible when the calibrating button is pressed	a. Incorrect setting of the output coupling from the crystal spectrum b. Calibrating crystal defective c. Tube V103 (2 Rö1) defective	a. Check whether heterodyning beats are lacking in the higher bands only b. Check whether calibrating beats are lacking in all bands c. Check tube V103 (2 Rö1)	a. Turn the setting potentiometer at the rear of the crystal spectrum generator for maximum volume of the calibrating beat notes b. Replace the calibrating crystal c. Replace tube V103 (2 Rö1)

In class of emission A1 on/off-keyed carriers cannot be made audible with the pitch control	Stage 11, BFO fails	a. Measure the supply voltages of V.305a(11 Rö1) and V 315b (11 Rö2) b. Check K 201	a. If the anode voltage is missing repair switch SW 303b b. Replace K.201 if defective
Bands 1 and 2 show poor sensitivity	a. Relay K.202 fails b. Tube V.201 (5 Rö1) defective	a. Check the contacts b[11] and b[12] with actuation of the band pushbuttons b. Check tube V.201 (5 Rö1)	a. Replace relay K.202 b. Replace tube V.201(5Rö
Bands 1 to 5 show poor sensivity	I 501 defective	Disassemble I 501 and check for DC continuity	Interrupted: Replace I 501
No reception in the bands 1 and 2; the other bands are in order	a. Relay K.202 fails to be energized b. Contact fault on relay K. 201	a. Energize relay K.202 via a test cord from C.230. If this eliminates the fault it is due to the pushbuttons 1 and 2 of the assembly b. Check the contact sets of relay K.201 for continuity	a. clean contact slide and look for proper adjustment b. Replace relay K.202 or K.201
Equipment output remains dead but magic-eye tube operates	a. In class A1: tube V.305b (11 Rö2) defective b. In class of emission A2/A3 : tube V.303b (10 Rö2) defective	a. Receiver operates in classes A2/A3 b. Receiver operates in class A1	a. Replace tube V.305b (11 Rö2) b. Replace V.303b(10 Rö2)

Class-of-emission switch at A1/A3. Equipment output remains dead, magic-eye tube does not operate, but lights.	Switch S.305 on potentiometer R.320 defective	Receiver operates only with manual control	Replace potentiometer R.320

8.- COMPONENTS LIST

8.1 - INPUT SECTION (STAGES 1 - 2 - 3 AND 4)

(1) References on diagram 4.9.4
(2) References marked on components.

References (1)	(2)	Description	Value	Remarks
STAGE 1				
C 500	C34	Plastic Foil Capacitor	170 pF	-
C 501	C 1	Air Dielectric Trimmer	25 pF	82753/25EV alvo(1)
C 502	C 2	" " "	16 pF	82753/16EV alvo(1)
C 503	C 3	" " "	16 pF	" " "
C 504	C 4	" " "	16 pF	" " "
C 505	C 5	" " "	16 pF	" " "
C 506	C 6	" " "	16 pF	" " "
C 507	C 7	" " "	25 pF	82753/25EV alvo(1)
C 508	C 8	" " "	25 pF	" " "
C 509	C 9	" " "	25 pF	" " "
C 510	C10	" " "	25 pF	" " "
C 511	C11	" " "	25 pF	" " "
C 512	C12	" " "	25 pF	" " "
C 513	C13	Plastic Foil Capacitor	70 pF ±2,5% 125V.	DN 70/2. 5/125B310
C 514	C14	Ceramic Capacitor	15 pF Sirutit 10	Sad 15/0.4/700B371
C 515	C15	" "	15 pF Rd D 50 2.5%	Stettner (2)
C 516	C16	" "	50 pF Konstit 100 %	Rd 50/2/250-2x16 B 3714
C 517	C17	" "	50 pF Rd D 20 2%	Stettner 250V. (2)
C 518	C18	" "	50 pF Rd D 20 2%	" "
C 519	C19	" "	20 pF Rd D 20 2%	" "
C 520	C20	Plastic Foil Capacitor	1000pF ±2.5% 125V.	DN 1000/2.5/125B 3101
C 521	C21	" " "	700 pF ±2.5% 125V.	DN 700/2.5/125B 3101
C 522	C22	" " "	200 pF ±2.5% 125V.	DN 200/2.5/125B 3101
C 523	C23	" " "	140 pF ±2.5% 125V.	DN 140/2.5/125B 3101
C 524	C24	" " "	80 pF ±2.5% 125V.	DN 80/2.5/125B 3101
C 525	C25	" " "	20 pF ±1 pF 125V.	DN 20/1/125B3101
C 526	C26	" " "	" " "	" " "
C 527	C27	" " "	" " "	" " "
C 528	C28	" " "	25 pF ±2.5% "	DN 25/2.5/125B3101

C 529	C29	Plastic Foil Capacitor	25 pF ±2.5% 125V.	DN 25/2.5/125B3101
C 530	C30	" " "	160 pF ±2.5% 125V.	DN 160/2.5/125B3101
C 531	C31	" " "	90 pF ± 2.5% 125V.	DN90/2.5/125B3101
C 532	C32	Ceramic Capacitor	5 pF Sirutit 10	Sad 5/0.4/700B3717
C 533	C33	Plastic Foil Capacitor	100 pF ±2.5% 500V.	DN100/2.5/500B3101
C 101	C39	Soldering Lead-trough capacitor	2500/350V.	Duko 2500/350B 3705
C 102	C40	3 Gang Variable Capacitor	250 pF 1 Paket	C002 DC/3x250E Valvo
C 103	C41	Plastic Foil Capacitor	250 pF/2.5% 500V.	EN/250/2.5/500B 3101
C 104	C43	Metallized-Paper Capacitor	0.1 µF 200 V.	6 ko mpd 843 aaB2611
R 101	W 1	Carbon-film Resistor	560 KΩ 10% 0.5W.	SBT Vitrohm (3)
L 500	L28			
L 501	L1	Antenna Coil I	Funk by empf/115 U1	
L 502	L2	Preselector Coil I		
L 503	L3	Antenna Coil II	" " " U2	
L 504	L4	Preselector Coil II		
L 505	L5	Antenna Coil III	" " " U3	
L 506	L6	Preselector Coil III		
L 507	L7	Antenna Coil IV	" " " U4	
L 508	L8	Preselector Coil IV		
L 509	L9	Antenna Coil V	" " " U5	
L 510	L10	Preselector Coil V		
L 511	L11	Antenna Coil VI	" " " U6	
L 512	L12	Preselector Coil VI		
L 513	L13	Antenna Coil VII	" " " U7	
L 514	L14	Preselector Coil VII		
L 515	L15	Antenna Coil VIII	" " " U8	
L 516	L16	Preselector Coil VIII		
L 517	L17	Antenna Coil IX	" " " U9	
L 518	L18	Preselector Coil IX		
L 519	L19	Antenna Coil X	" " " U10	
L 520	L20	Preselector Coil X		
L 521	L21	Antenna Coil XI	" " " U11	
L 522	L22	Preselector Coil XI		
L 523	L23	Antenna Coil XII.	" " " U12	
L 524	L24	Preselector Coil XII		
L 525	L25	Wavetrap coil 1130 kc/s	" " " U13	
L 526	L26	Wavetrap coil 100 kc/s	" " " U40	
L 101	L27	Heater choke	" " " U39	
I 101	LA1	Pilot lamp	7V 0.3 A.	Osram(4)L.N.3341
I 102	LA2	Protective lamp	40V 10/Elektromobil	Osram 6340BA 20d

I 501	LA3	Protective lamp	260/220V 10/7	Osram BZM E 14
K 101	Re1A	Antenna Relay	Trls.151 y	TBV 65018/74d
V 101	T1	Input tube	EF 93/6BA6	Siemens
V 102	R2	Protective neon gap	108 C1/OB 2	"
STAGE 2				
C 105	C 1	Ceramic Capacitor	Sad 1 pF ±0.4pF Elit	B 3711
C 106	C 2	" "	Sad 0.5 pF/20% Elit	B 3711 700 V.
C 107	C 3	" "	8000 pF ±20% 250V.	SKR 16/8000D
				3000 St(2)
C 108	C 5	Plastic Foil Capa-	80 pF/2.5% /500 V.	EN 80/2.5/500
		citor		B3101
C 109	C 6	Ceramic Capacitor.	40 pF Rd D 20 2%	Stettner 250 V (2)
C 110	C 7	Plastic Foil Capa-	50 pF/2.5/125 V.	DN 50/2.5/125VB
		citor	VK 122 ME	3101
C 111	C 8	Tubular Trimmer	C3/60 VK 64023	Valvo (1)
C 112	C 9	Soldering Lead-trough	2500 pF 350 V.	Duko 2500/350B3705
		Capacitor		
C 113	C10	" " "	" " "	" " "
C 100	C11	" " "	" " "	" " "
R 102	R 1	Carbon Film Resistor	1.2KΩ 10% 0.5 W	SBT Vitrohm (3)
R 103	R 2	" " "	68 KΩ 10% 0.5 W	" " "
R 104	R 3	" " "	100 KΩ 10% 0.5 W	" " "
R 105	R 4	" " "	68 KΩ 10% 0.5 W	Vitrohm (3)
R 106	R 5	" " "	390 KΩ 10% 0.5 W	" "
R 107	R 6	Setting Potentiometer	10 KΩ lin 0.2 W	LN 100 Ruwido (6)
V 103	T 1	Calibrating Oscil-	EF 93/6BA6	Siemens
		lator Tube		
XTAL 101	Q 1	Control Crystal	100 kc/s	Rel BV 673 R 8
STAGE 3				
C 534	C 1	Air-dielectric	25 pF	82753/25E Valvo (1)
		Trimmer		
C 535	C 2	" "	16 pF	82753/16E Valvo (1)
C 536	C 3	" "	16 pF	" " "
C 537	C 4	" "	16 pF	" " "
C 538	C 5	" "	16 pF	" " "
C 539	C 6	" "	16 pF	" " "
C 540	C 7	" "	25 pF	82753/25E Valvo (1
C 541	C 8	" "	25 pF	" " "
C 542	C 9	" "	25 pF	" " "
C 543	C10	" "	25 pF	" " "
C 544	C11	" "	25 pF	" " "
C 545	C12	" "	25 pF	" " "
C 546	C13	Plastic Foil Capa-	90 pF ±2.5% 125 V.	DN 90/2.5/125VB
		citor		3101

C 547	C14	Ceramic Capacitor	15 pF Sirutit	Sad 15/0.4/700B 3717
C 548	C15	" "	20 pF ± 2.5% SKR 12	Sad 20/2.5/700 D50 Stettner (2)
C 549	C16	" "	50 pF ± 0.4pF RD Konstit	50/0.4/500 B 3714
C 550	C17	" "	50 pF ±2% D20 Rd2%	250V.Stettner (2)
C 551	C18	" "	40 pF ±2% D20 Rd2%	" "
C 552	C19	" "	20 pF ±2% D20 Rd2%	" "
C 553	C20	Plastic Foil Capacitor	1000pF ±2.5% 125 V.	DN1000/2.5/125B 3101
C 554	C21	" " "	700 pF ±2.5% 125 V.	DN700/2.5/125B3101
C 555	C22	" " "	200 pF ±2.5% 125 V.	DN200/2.5/125B3101
C 556	C23	" " "	140 pF ±2.5% 125 V.	DN140/2.5/125B3101
C 557	C24	" " "	80 pF ±2.5% 125 V.	DN80/2.5/125B3101
C 558	C25	" " "	20 pF ± 1 pF 125V.	DN20/1/125B3101
C 559	C26	" " "	" " "	" " "
C 560	C27	" " "	" " "	" " "
C 561	C28	" " "	25 pF ±2.5% 125 V.	DN25/2.5/125B3101
C 562	C29	" " "	" " "	" " "
C 114	C30	Metallized Paper Capacitor	0.1 µF 250V.Sicatrop	0.1/250V.B2530
C 115	C31	Ceramic Capacitor	Sad 160 pF 500 V. Sibatit	Sad 160/500B3721
C 116	C32	Matellized Paper Capacitor	0.1 µF250V.Sicatrop	0.1/250V.B2530
C 117	C33	Ceramic Capacitor	8000 pF ±20% 250 V.	SKR 16/8000pF/D3000
C 118	C34	Ceramic Soldering lead-trough Capacitor	2500 pF 350 V.	B 3705
C 119	C35	" " "	" "	"
C 120	C36	" " "	" "	"
C 121	C37	" " "	" "	"
C 122	C38	" " "	" "	"
C 123	C39	" " "	" "	"
C 124	C40	" " "	" "	"
C 125	C41	" " "	" "	"
C 126	C42	" " "	" "	"
C 127	C43	Ceramic Capacitor	8000 pF 20% 250 V.	SKR 16/8000 D3000 (2)
C 128	C44	Metallized Paper Capacitor	0.1 µF 200V.6 kompd	843 aa B 2611
C 129	C45	" " "	" " "	" " "
C 130	C46	Platic Foil Capacitor	250 pF 2.5% 125 V.	DN 250/2.5/125B 3101
C 131	C47	" " "	40 pF 2.5% 125 V.	DN40/2.5/125B3101
C 132	C48	3 gang variable Capacitor	(2nd.Capsection (contained in C102	Valvo (1)

C 563	C49	Plastic Foil Capacitor	140 pF ±2.5% 500 V.	DN 140/2.5/500B 3101
C 133	C50	Soldering lead-trough Capacitor	2500 pF 350 V.	B 3705
C 138	C62	" " "	" "	"
C 140	C64	" " "	" "	"
C 141	C65	" " "	" "	"
C 564	C51	Ceramic Capacitor	5 pF Circuit 10	Sad 5/0.4/700B3717
C 134	C52	Metallized Paper Capacitor	0.1 μF200V-5 Kompd	843 aa B 2611
R 503	R 1	Carbon Film Resistor	2.2 KΩ 10% 0.5 W	SBT Vitrohm (3)
R 108	R 2	" " "	150 KΩ 10% 0.5 W	" "
R 109	R 3	" " "	12 KΩ 10% 1 W	ABT "
R 110	R 4	" " "	1 KΩ 10% 0.5 W	SBT "
R 111	R 5	" " "	560 KΩ 10% 0.5 W	" "
R 112	R 6	" " "	220 KΩ 10% 0.5 W	" "
R 113	R 7	" " "	12 KΩ 10% 1 W	ABT "
R 114	R 8	" " "	560 KΩ 20% 0.5 W	SBT "
R 115	R 9	" " "	100 KΩ 10% 0.5 W	" "
R 116	R10	" " "	100 KΩ 10% 0.5 W	" "
R 117	R12	" " "	22 KΩ 10% 0.5 W	" "
R 118	R13	" " "	12 KΩ 10% 0.5 W	" "
R 119	R16	" " "	12 KΩ 10% 0.5 W	" "
R 120	R17	" " "	1 KΩ 10% 0.5 W	" "
R 121	R18	" " "	100 KΩ 10% 0.5 W	" "
R 124	R 4	" " "	100 KΩ 10% 0.5 W	" "
R 126	R14	" " "	24 KΩ 10% 1.0 W	" "
R 127	R15	" " "	24 KΩ 10% 1.0 W	" "
L 527 L 528	L 1 L 2	Anode Coil)Interm. Grid Coil)Circuit I	Funk bv emf.115U15	
L 529 L 530	L 3 L 4	Anode Coil) Grid Coil) " II	" " U16	
L 531 L 532	L 5 L 6	Anode Coil) Grid Coil) " III	" " U17	
L 533 L 534	L 7 L 8	Anode Coil) Grid Coil) " IV	" " U18	
L 535 L 536	L 9 L10	Anode Coil) Grid Coil) " V	" " U19	
L 537 L 538	L11 L12	Anode Coil) Grid Coil) " VI	" " U20	
L 539 L 540	L13 L14	Anode Coil) Grid Coil) " VII	" " U21	
L 541 L 542	L15 L16	Anode Coil) Grid Coil) " VIII	" " U22	

L 543	L17	Anode Coil)Interm.	Funk bv empf.115U23	
L 544	L18	Grid Coil)CircuitIX		
L 545	L19	Anode Coil) " X	" " U24	
L 546	L20	Grid Coil)		
L 547	L21	Anode Coil) " XI	" " U25	
L 548	L22	Grid Coil)		
L 549	L23	Anode Coil) " XII	" " U26	
L 550	L24	Grid Coil)		
L 551	L25	100 Kc/s Wave trap 50 Kc/s	" " U14	
L 102	L26	Heater choke	" " U39	
V 104	T 1	1st.Mixer Tube	EK 90/6 BE6	Siemens
STAGE 4				
C 565	C 1	Air Dielectric Trimmer	25 pF	82753/25E Valvo(1)
C 566	C 2	" "	"	" " "
C 567	C 3	" "	"	" " "
C 568	C 4	" "	"	" " "
C 569	C 5	" "	16 pF	82753/16E "
C 570	C 6	" "	25 pF	82753/25E "
C 571	C 7	" "	"	" " "
C 572	C 8	" "	"	" " "
C 573	C 9	" "	"	" " "
C 574	C10	" "	"	" " "
C 575	C11	" "	"	" " "
C 576	C12	" "	16 pF	82753/16E Valvo(1)
C 577	C13	Plastic Foil Capacitor	440pF±2.5% 125 V.	DN440/2.5/125B3101
C 578	C14	" " "	637pF " "	DN637/ " "
C 579	C15	" " "	603pF " "	DN603/ " "
C 580	C16	" " "	171pF " "	DN171/ " "
C 581	C17	" " "	2645pF " "	DN2645/" "
C 582	C18	" " "	490pF " "	DN490/ " "
C 583	C19	" " "	986pF " "	DN986 " "
C 584	C20	" " "	615pF " "	DN615 " "
C 585	C21	" " "	570pF " "	DN570 " "
C 586	C22	" " "	184pF " "	DN184 " "
C 587	C23	" " "	125pF " "	DN125 " "
C 588	C24	" " "	71 pF " "	DN71.2/" "
C 589	C25	" " "	500pF " "	DN490 " "
C 590	C26	" " "	10 pF± 21pF 125 V.	DN10/1/125B 3101
C 591	C27	" " "	15 pF± 21pF 125 V.	DN15/1/125B 3101
C 592	C28	Ceramic Capacitor	25pF±0.4pF Sirutit	Sad 25/0.4/700B377
C 593	C29	" "	15pF± " "	Sad 15/ " "

C 594	C30	Ceramic Capacitor	25pF ±0.5pF Rd/D45	250V Stettner (2) Rd 65/2/250
C 595	C31	" "	65pF ±2%Konstit 100	3x20 B 3714
C 596	C32	" "	50pF ±2% Rd/D20	250V Stettner (2)
C 597	C33	" "	60pF ±2% Rd/D20	" "
C 598	C34	" "	20pF ±2% Rd/D20	" "
C 599	C35	Plastic Foil Capacitor	1000pF±2.5% 125 V.	DN1000/2.5/125B 3101
C 600	C36	" " "	500 pF " "	DN 500/ " " "
C 601	C37	" " "	360 pF " "	DN 360/ " " "
C 602	C38	" " "	140 pF " "	DN 140/ " " "
C 603	C39	" " "	120 pF " "	DN 120/ " " "
C 604	C40	" " "	100 pF " "	DN 100/ " " "
C 605	C41	" " "	80 pF " "	DN 80/ " " "
C 606	C42	" " "	50 pF " "	DN 50/ " " "
C 607	C43	" " "	40 pF " "	DN 40/ " " "
C 608	C44	" " "	30 pF " "	DN 30/ " " "
C 609	C45	" " "	25 pF " "	DN 25/ " " "
C 610	C46	" " "	20 pF ± 1 pF 125V	DN 20/1/125 B3101
C 611	C47	" " "	16 pF ± 1 pF 125V	DN 16/1/125 "
C 612	C48	" " "	10 pF ± 1 pF 125V	DN 10/1/125 "
C 613	C49	" " "	25 pF ±2.5pF 125V	DN 25/2.5/" "
C 614	C50	" " "	" " "	" " "
C 615	C51	" " "	" " "	" " "
C 616	C52	" " "	" " "	" " "
C 617	C53	" " "	" " "	" " "
C 618	C54	Ceramic Capacitor	15 pF ±0.4 Sirutit	15/0.4/700 10 Sad B3717
C 619	C55			
C 620	C56	Plastic Foil Capacit.	12 pF ±1 pF 125 V.	DN 12/1/125 B3101
C 621	C57	" " "	10 pF ±1 pF 125 V.	DN 10/1/125 B3101
C 622	C58	Ceramic Capacitor	15 pF ±0.4pF Sirutit Sad	15/0.4/700 B 3717
C 135	C59	3 Gang Variable Capacitor	3rd Cap section contained in C102	
C 136	C60	Soldering Lead-trough Capacitor	2500 pF 350 V.	B 3705
C 137	C61	" " "	" "	"
C 139	C63	" " "	" "	"
C 142	C66	Metallized Paper Capacitor	0.01 µF 200 V.	6 kompd843 aaB2611
C 143	C67	" " "	" "	" "
R 121	R 1	Carbon film resistor	22 KΩ 10% 0.5 W.	SBT Vitrohm (3)
R 122	R 2	" " "	470 Ω " "	" "
R 123	R 3	" " "	20 KΩ " "	" "
R 506	R 5	" " "	220 Ω " "	" "
R 507	R 6	" " "	2.2KΩ " "	" "

R 125	R 7	Carbon film resistor	20 KΩ 10% 0.5W.	SBT Vitrohm (3)
L 552	L 1	Osc. Coil I	Funk bv.empf.115U27	
L 553	L 2	" " II	" " " U28	
L 554	L 3	" " III	" " " U29	
L 555	L 4	" " IV	" " " U30	
L 556	L 5	" " V	" " " U31	
L 557	L 6	" " VI	" " " U32	
L 558	L 7	" " VII	" " " U33	
L 559	L 8	" " VIII	" " " U34	
L 560	L 9	" " IX	" " " U35	
L 561	L10	" " X	" " " U36	
L 562	L11	" " XI	" " " U37	
L 563	L12	" " XII	" " " U38	
L 103	L13	Heater choke	" " " U39	
V105a V105b	T1) T2)	1st.Osc.Tube	ECC82/12 AU7	Siemens

8.2 – FREQUENCY CONVERTER SECTION (STAGES 5 – 6 AND 7)

(1) References on diagram 4.9.4
(2) References marked on components.

References (1)	(2)	Description	Value	Remarks
STAGE 5				
C 201	C 1	Ceramic Soldering lead-trough capacitor	2500 pF 350 V.	Duko2500/350B3705
C 202	C 2	" " " "	" "	" " "
C 203	C 3	Paper Capacitor	0.01 µF 250 V.	Kf 310/2 Roeder-stein (5)
C 204	C 4	Plastic Foil Capa-citor	1000pF±2.5% 125 V.	DN1000/2.5/125B 3101
C 205	C 5	" " "	10000pF±2.5%125 V.	DN10000/ " " "
C 206	C66	" " "	1000pF±2.5% 125 V.	DN1000/ " " "
	7			
	8			
C 207	C 9	Paper Capacitor	0.1 µF 250 V.	KF 410/2 Roeder-stein (5)
C 208	C10	Ceramic Soldering Lead-trough capacitor	2500 pF 350 V.	Duko2500/350B3705
C 209	C11	id.	2500 pF 350 V.	" " " "
C 210	C12	id.	" "	" " " "
C 211	C13	id.	" "	" " " "

R 201	R 1	Carbon Film Resistor	1 KΩ 10% 0.5 W.	SBT Vitrohm (3)
R 202	R 2	" " "	" " "	" "
R 203	R 3	" " "	820Ω " "	" "
R 204	R 4	" " "	68 KΩ " "	" "
L 201	L 1	1st.Circuit)50Kc/s	Funk by empf 115M1	
L 202	L 2	Coupling Coil)filter		
L 203	L 3	100 Kc/s Wavetrap	" " " 115M2	
L 204	L 4	2nd.Circuit 50 Kc/s filter	" " " 115M3	
K 201	Re1C	IF – Relay	Trls 151y	TBv 65018/74d
K 202	Re1B	" "	" "	" "
V 201	T 1	50 Kc/s IF-tube ,	EK 90/6BE6	Siemens
STAGE 6				
C 212	C 1	Plastic Foil Capacitor	20 pF ± 1 pF 125V.	DN 20/1/125B3101
C 213	C 2	Paper Capacitor	0.01 μF 250 V.	Kf 310/2 Roederstein (5)
C 214	C 3	3Gang variable Capacitor	1st.Cap section 0001AA/3 x 16E	Valvo (1)
C 215	C 4	Air Dielectr.Trimmer	25 pF	82753/25E Valvo(1)
C 216	C 5	" " "	"	" " "
C 217	C 6	3 Gang Variable Capacitor	2nd Cap.section contained in C 214	
C 218	C 7	Air Dielectr.Trimmer	25 pF	" " "
C 219	C 8	" " "	"	" " "
C 220	C 9	Plastic Foil Capacitor	20 pF ±1pF 125 V.	DN 20/1/125 B 3101
C 221	C10	Paper Capacitor	0.01 μF 250 V.	Kf 310/2 Roederstein (5)
C 222	C11	Plastic Foil Capacitor	50 pF ±1 pF 125 V.	DN 50/1/125 B 3101
C 223	C12	Paper Capacitor	0.01 μF 250 V.	Kf 310/2 Roederstein (5)
C 224	C 13	Ceramic Soldering Lead-trough Capacitor	2500 pF 350 V.	Duko2500/350B3705
C 225	C14	" " " "	" "	" " "
C 226	C15	" " " "	" "	" " "
C 227	C16	Plastic Foil Capacitor	50 pF 2.5% 125 V.	DN 50/2.5/125B3101
C 228	C17	Ceramic Soldering Lead-trough Capacitor	2500 pF 350 V.	Duko2500/350B3705
C 229	C18	" " " "	" "	" " "
C 230	C19	" " " "	" "	" " "

R 205	R 1	Carbon Film Resistor (3)	1 MΩ ± 10% 0.5 W.	SBT Vitrohm (3)
R 206	R 2	" " "	150Ω " "	" "
R 207	R 3	" " "	27KΩ " "	" "
R 208	R 4	" " "	6.8KΩ " "	" "
R 209	R 5	" " "	27KΩ " "	" "
	6			
	7			
	8			
L 205	L 1	Anode Coil)variable	Funk by empf 115M4	
L 206	L 2	Grid Coil)IF-filter	" " " 115M5	
L 207	L 3	Coupling Coil	" " " 115M8	
L 208	L 4	" "	" " " "	
K 203	ReE	Relay	Trls 151y	TBv 65018/74d
K 204	ReD	Relay	Trls 151y	TBv 65018/74d
V 202	Rö1	2nd. Mixer Tube	EK 90/6 BE 6	Siemens
STAGE 7				
C 231	C 1	3 Gang Variable Capacitor 3rd.Cap.	is contained in C 214	
C 232	C 2	Air Dielectric Trimmer	25 pF	82753/25E Valvo(1)
C 233	C 3	" " "	" "	" " "
C 234	C 4	Ceramic Capacitor	50 pF 2% 250 V.	RdD20/Stettner (2)
C 235	C 5	Plastic Foil Capacitor	500 pF ±2.5% 125V.	DN 500/2.5/125 B 3101
C 236	C 6	" " "	500 pF ±2.5% 125V.	DN 500/2.5/125 B 3101
C 237	C 7	" " "	100 pF ±2.5% 125V.	DN 100/2.5/125 B 3101
C 238	C 8	Ceramic Soldering-Lead-trough Capacit.	2500 pF 350 V.	Duko 2500/350 B 3705
C 239	C 9	" " "	" "	" " "
C 240	C10	Plastic Coil Capacit	5 pF ± 1 pF 500 V.	DN 5/1/500 3101
C 241	C11	Paper Capacitor	0.1 µF 250 V.	Kf 410/2 Roederstein (5)
C 242	C14	Ceramic Soldering Lead-trough Capacit.	2500 pF 350 V.	Duko 2500/350 B 3705
C 243	C15	" " "	" "	" " "
C 244	C16	" " "	" "	" " "
C 245	C17	" " "	1600 pF 250 V.	Bypass 1600/250B 370
C 247	C19	Paper Capacitor	0.05 µF 125 V.	Kf 350/1 Roederstein (5)
C 248	C20	Ceramic Capacitor	10 pF 10% 250 V.	Rd Elit B 3712

R 210	R 1	Carbon Film Resistor (3)	100 KΩ ±10% 0.5W.	SBT Vitrohm (3)
R 211	R 2	" " "	220 KΩ ±10% 0.5W.	" "
R 212	R 3	" " "	1 KΩ ± 10% 0.5W.	" "
R 213	R 4	" " "	10 KΩ ± 10% 0.5W.	" "
L 209	L 1	Oscillator Coil II	Funk bv empf 115M6	
L 210	L 2	Anode choke	" " 115M7	
L 211	L 3	Kathode choke	" " "	
V 203a	T 1	2nd.Osc.Tube	ECC82/12AU7	Siemens
V 203b	T 2	Osc.and buffer stage		
I201	LA1	Indicating lamp for frequency interpolat.	7V/0.3A	Osram L.Nr 3341(4)
SW201	S12			

8.3 - AMPLIFIER SECTION (STAGES 8 - 9 - 10 - 11 - 12 - 13 and 14)

(1) References on diagram 4.9.4.
(2) References marked on components.

STAGE 8				
C301	C 1	Paper Capacitor	0.025/250V.Minityp 85	Kf 325/2 Roederstein (5)
C 302	C 2	" "	0.005/250V. " "	Kf 250/2 "
C 303	C 3	" "	0.1/125 V. " "	Kf 410/1 "
R 301	R 1	Carbon Film Resistor	1 KΩ ± 10% 0.5 W.	SBT Vitrohm (3)
R 302	R 2	" " "	68 KΩ ± 10% 0.5W.	" "
R 303	R 3	" " "	150 KΩ ± 10% 0.5W.	" "
V 301	T 1	IF ampl.tube for A1	EF 93/6BA6	Siemens
STAGE 9				
C 305	C 2	Plastic Foil Capacit.	500 pF 2.5% 125 V	DN 500/2.5/125B 3101
C 306	C 3	" " "	500 pF 2.5% 500 V	DN 500/2.5/500B 3101
	C 4			
C 307	C 5	" " "	500 pF 2.5% 500 V.	DN 500/2.5/500B 3101
C 308	C 6	" " "	0.03 µF 2.5% 125V.	HNO.03/2.5/125B 3107
C 309	C 7	" " "	0.016 µF 2.5%125V.	HNO.016/2.5/125B 3101
C 310	C 8	" " "	500 pF ± 2.5%125V.	DN 500/2.5/125B 3101
C 311	C 9	Paper Capacitor	0.025 µF 125 V Minityp 85	Kf 325/1 Roederstein (5)
C 312	C10	" "	0.1 µF 125 V. id.	Kf 410/1 "

C 313	C11	Paper Capacitor	0.05 µF 250V. id.	Kf 350/2 Roederstein (5)
C 314	C12	Plastic Foil Capacitor	100 pF 2.5% 125 V.	DN 100/2.5/125 B 3101
R 304	R 1	Carbon film Resistor	22 KΩ ± 10% 0.5 W.	SBT Vitrohm (3)
R 305	R 2	" " "	150KΩ ± 10% 0.5 W.	" "
R 306	R 3	" " "	1 KΩ ± 5% 0.5 W.	" "
R 307	R 4	" " "	1 MΩ ± 5% 0.5 W.	" "
R 308	R 5	" " "	22 Ω ± 10% 0.5 W.	" "
R 309	R 6	" " "	22 Ω ± 10% 0.5 W.	" "
L 301	L 1	Anode Coil)	Funk by empf 115V.1	(
L 302	L 2	Circuit Coil II)		(
L 303	L 3	Coupling Coil I/II)		(
L 304	L 4	Circuit Coil III)		(4 Kreisfilter
L 305	L 5	Grid Coil)		(
L 306	L 6	Coupling Coil III/IV)	Funk by empf 115V.2	(
SW301a	S1a	Bandwidthswitch 1deck	Range switch A9	Fa. Mayr. (7)
SW301b	S1b	" 1st deck	" "	" "
SW302a	S2a	" 2nd "	" "	" "
SW302b	S2b	" 2nd "	" "	" "
SW304a	S4a	" 4th "	" "	" "
V 302	T	IF ampf.tube for A2/A3	EF 93/6 BA 6	Siemens
STAGE 10				
C 315	C 1	Paper Capacitor	5000pF 250V Minityp85	Kf 250/2 Roederstein (5)
C 316	C 2	" "	0.025/250V " "	" " "
C 317	C 3	Plastic Foil Capacitor	600/2.5% 125 V.	DN 660/2.5/125 B 3101
C 318	C 4	Paper Capacitor	0.025 pF 125 V." "	Kf 325/1 Roederstein (5)
C 319	C 6	Plastic Foil Capacitor	600 pF 2.5% 125 V.	DN 600/2.5/125B 3101
C 320	C 7	" " "	100 pF 2.5% 125 V.	DN 100/ " " "
C 321	C 8	" " "	300 pF " "	DN 300/ " " "
C 322	C 9	" " "	300 pF " "	DN 300/ " " "
C 323	C10	Paper Capacitor	0.01 µF 125 V.	Kf 310/1 Roederstein (5)
C 324	C11	Plastic Foil Capacitor	300 pF 2.5% 125 V.	DN 300/2.5/125 B 3101
C 325	C12	Paper Capacitor	0.05/125 V.Minityp 85	Kf 350/1 Roederstein (5)
C 326	C13	" "	0.5 /125 V. " "	Kf 450/1 "
C 327	C14	" "	0.01/125 V. " "	Kf 310/1 "

C 328	C15	Electrolytic Capacitor	25 µF 35 V	Elko 25 µF 35 V B 4177-1
C 329	C16	Paper Capacitor	0.1/125 V.Minityp85	Kf 410/1 Roederstein (5)
C 330	C17	" " "	" "	" "
C 331	C18	Plastic Foil Capacitor	300 pF 2.5% 125 V.	DN 300/2.5/125B 3101
R 310	R 1	Carbon Film Resistor (3)	68 KΩ ± 10% 0.5 W.	SBT Vitrohm (3)
R 311	R 2	" " "	2.2KΩ " "	" "
R 312	R 3	" " "	560KΩ " "	" "
R 313	R 4	" " "	51 KΩ " "	" "
R 314	R 5	" " "	330KΩ " "	" "
R 315	R 6	" " "	150KΩ " "	" "
R 316	R 7	" " "	39 KΩ " "	" "
R 317	R 8	" " "	820KΩ " "	" "
R 318	R 9	" " "	1 KΩ " "	" "
R 319	R10	" " "	100KΩ " "	" "
R 320	R11	Potentiometer	100KΩ neg.log.0.2W	Funk empf 115T 228
R 321	R12	Carbon Film Resistor	10KΩ ± 10% 0.5 W.	SBT Vitrohm (5)
R 322	R13	Potentiometer	100KΩ " "	" "
R 323	R14	Potentiometer	1 MΩ pos. log.	Funk empf
R 324	R15	Carbon Film Resistor	2.2KΩ ± 10% 0.5 W.	SBT Vitrohm (3)
R 325	R16	" " "	1 MΩ " "	" "
R 326	R17	" " "	100 KΩ " "	" "
R 327	R18	" " "	51 KΩ " "	" "
R 328	R19	" " "	150 KΩ " "	" "
R 329	R20	" " "	1 KΩ " "	" "
R 330	R21	" " "	220 KΩ " "	" "
R 331	R22	" " "	510 KΩ " "	" "
R 359	R23	" " "	5.6 KΩ " "	" "
L 307	L 1	Bandfilter Coil A2/3	Funk bv empf 115V5	
L 308	L 2	" " "		
SW303a	S3a	Class of emission switch 3rd deck	A 9	Fa. Mayr (7)
SW304d	S4d	Class of emission switch 4th deck	A 9	Fa. Mayr (7)
SW305	S 5			
V 303a	T 1	AVC diode	EB 91/6A1 5	Siemens
V 303b	T 2	Demod. A2/A3		
V 304a	T 3	AF-stage	ECC82/12 AUT	Siemens
STAGE 11				
C 332	C 1	Paper Capacitor	0.025 µF 250 V.	Kf 325/2 Roederstein (3)

STAGE 11

C 332	C 1	Paper Capacitor	0.025 uF 250 V.	Kf 325/2 Roeder-stein (3)
C 333	C 2	Plastic Foil Capacitor	1000 pF 2.5% 100 V.	DN1000/2.5/500B3101
C 334	C 3	" " "	500 pF 2.5% 125 V.	DN 500/2.5/125B3101
C 335	C 4	" " "	500 pF 2.5% 125 V.	DN 500/2.5/125B3101
C 336	C 5	Paper Capacitor	0.025 uF 125 V.	Kf 325/1 Roeder-stein (5)
C 337	C 6	Ceramic Soldering Lead-through Capacitor	2500 pF 250 V.	Duko 2500/350 B3705
C 338	C 7	Paper Capacitor	5000 pF 250 V.	Kf 250/2 Roeder-stein (5)
C 339	C 8	Electrolytic Capacitor	4 uF 350 V.	Elko 4/350 B4371-5 S
C 340	C 9	Plastic Foil Capacitor	100 pF 2.5% 125 V.	DN 100/2.5/125B3101
C 341	C10	" " "	150 pF 2.5% 125 V.	DN 150/2.5/125B3101
C 342	C11	Variable Capacitor	100 pF AC	L.Nr.210 Fa. Hopt (8)
C 343	C12	Paper Capacitor	0.025 uF 125 V.	Kf 325/1 Roeder-stein (5)
C 344	C13	Ceramic disc Capacitor	2.5pF 500V.± 0.4pF	SKE 2/2.5/D20 Stettner
C 345	C14	Ceramic Soldering Lead-through Capacitor	2500 pF 350 V.	Duko 2500/350 B3705
C 346	C15	" " "	2500 pF 350 V.	Duko 2500/350 B3705
C 347	C16	Paper Capacitor	5000 pF 250 V.	Kf 250/2 Roeder-stein (5)
C 348	C17	" "	0.025 uF 125V. Minityp 85	Kf 325/1 Roeder-stein (5)
C 349	C18	Plastic Foil Capacitor	1000 pF 2.5% 500 V.	DN1000/2.5/500 B3101
C 350	C19	Paper Capacitor	0.025 uF 250 V.	Kf 325/2 Roeder-stein (5)
R 332	R 1	Carbon Film Resistor	2.2 kohm ± 10% 0.5W.	SBT Vitrohm (3)
R 333	R 2	" " "	820 ohm ± 10% 0.5 W.	" "
R 334	R 3	" " "	10 kohm ± 10% 0.5 W.	" "
R 335	R 4	" " "	2.7 kohm ± 10% 0.5 W	" "
R 336	R 5	" " "	100 kohm ± 10% 0.5 W	" "
R 337	R 6	" " "	33 kohm ± 10% 0.5 W.	" "
R 338	R 7	" " "	10 kohm ± 10% 0.5 W.	" "
R 339	R 8	" " "	22 kohm ± 10% 0.5 W.	" "
R 340	R 9	" " "	4.7 kohm ± 10% 0.5 W	" "
R 341	R10	" " "	1 Mohm ± 10% 0.5 W.	" "
R 342	R11	" " "	1 Mohm ± 10% 0.5 W.	" "
SW303b	S3b	Class of emission switch 3rd deck	A 9	Fa. Mayr (7)
L 309	L 1	Anode Coil) IF band-	Funk bv empf 115V 3	
L 310	L 2	Grid Coil) filter A1		
L 311	L 3	Grid Coil) Osc.coil	Funk bv empf 115V 4	
L 312	L 4	Anode Coil) A1		
V 305a	T 1	Mixer tube for A1)	ECC 82/12 AU7	Siemens
V 305b	T 2	Osc.tube for A1)		
V 306	T 3	Tuning indicator tube	EM 34/6 CD 7	Siemens

STAGE 12

C 351	C 1	Electrolytic Capacitor	2 uF 350V.	Elko 2/350 B4371
C 352	C 2	Paper Capacitor	0.025 uF 250V.	Kf 325/2 Roeder stein (5)
C 353	C 4	Electrolytic Capacitor	0.5 uF 350V. 385	B 4371-1
C 354	C 5	Paper Capacitor	0.025 uF 125 V.	Kf 325/1 Roeder-stein (5)
C 355	C 6	Electrolytic Capacitor	2 uF 250 V.	Elko 2/250V.B4371-5
C 356	C 7	Electrolytic Capacitor	2 uF 250 V.	Elko 2/250V.B4371-5
R 343	R 1	Carbon Film Resistor	100 kohm ± 10% 0.5W.	SBT Vitrohm (3)
R 344	R 2	" " "	100 kohm ± 10% 0.5W	" "
R 345	R 3	" " "	10 kohm ± 10% 0.5W	" "
R 346	R 4	Potentiometer	5 kohm lin 0.2 W.	Funk empf 115 T 228
R 347	R 5	Carbon Film Resistor	68 kohm ± 10% 0.5W	SBT Vitrohm (3)
R 348	R 6	" " "	330 kohm ± 10% 0.5W	" "
R 349	R 7	" " "	56 kohm ± 10% 0.5W	" "
R 350	R 8	" " "	1 Mohm ± 10% 0.5W	" "
R 351	R 9	" " "	2.2 kohm ± 10% 0.5W	" "
R 352	R10	" " "	10 kohm ± 10% 0.5W	" "
V 307a	T 1	Noise limiting diode)		
V 307b	T 2	Noise limiting diode)	EB 91/6 AL 5	Siemens
V 304b	T 3	AF-stage contained in V 304a		

STAGE 13

C 357	C 1	Electrolytic Capacitor	2 uF 350 V.	Elko 2/350 B 4371-5
C 358	C 2	Paper Capacitor	0.01 uF 250 V.	Kf 310/2 Roeder-stein (5)
R 353	R 1	Carbon Film resistor	100 kohm ± 10% 0.5W	SBT Vitrohm (3)
R 354	R 2	" " "	10 kohm ± 10% 0.5W	" "
R 355	R 3	" " "	330 kohm ± 10% 0.5W	" "
R 356	R 4	" " "	270 ohm ± 10% 1 W.	ABT "
R 357	R 5	" " "	51 kohm ± 10% 0.5W	SBT "
V 308	T 1	Final stage tube	EL 90/6 AQ 5	Siemens

STAGE 14

C 359	C 1	Paper Capacitor	5000 pF 1000 V.	Kf 250/10 Roeder-stein (5)
R 358	R 1	Carbon Film Resistor	560 ohm ± 10% 0.5W	SBT Vitrohm (3)
R 359	R 2	" " "	4.7 kohm ± 10% 2 W.	BBT "
R 360	R 3	" " "	5 ohm ± 5% 2 W.	Zub wd 4c DIN 41404
TR301	Tr1	Output transformer	6 Zub Bv 714055/20 1732	
LS301	Lsp1	Loudspeaker	PM 95/19 CT Trop.	Wigo

STAGE 15

T 401	Tr1	Power transformer	6 Zub.Bv 724 102/35/2468	
L 401	L 3	Power choke	6 Zub.Bv 734 065/27/999	
Rect.401	Rect1	Flat rectifiers	B 250 C 150 Trop.	Siemens
Rect.402	" 2	Rectifier	B 250 C 85 Trop.	Siemens
Rect.403	" 3	Rectifier	E 15 C 250 Trop.	Siemens
C 401	C 1	Electrolytic Capacitor	500 uF 12/15 V.	Elko N 500/12 B 4101
C 402	C 2	" "	32 + 32 uF 350 V.	B 4373-5
C 403	C 3	" " contained in C 402		
C 404	C 4	Electrolytic Capacitor	16 + 16 uF 350 V.	B 4373-5S
C 405	C 5	" " contained in C 404		
C 406	C 6	Paper Capacitor	0.05 uF 500 V.	Kf 350/10 Roeder-stein (5)
I 401	LA1	Scale lamp main scale	7 V. 0.3 A.	Osram (4)L. Nr. 3341
I 402	LA2	" " " "	7 V. 0.3 A.	" "
I 403	LA3	" " " "	7 V. 0.3 A.	" "
I 404	LA4	" " " "	7 V. 0.3 A.	" "
R 401	EW1	Osram balast resistor (double-ended tubular form with blade contact)		Caps Osram (4)
R 402	Th1	Thernewid Resistor	A32 3/400 OR 1/600	Siemens
R 403	R 1	Wire wound resistor with clamp	4 kohm 4 W. ± 10%	Zub.wd.240g.
R 404	R 2	Carbon film resistor	3.3 kohm 1 W ± 10%	ABT Vitrohm (3)
F 401	Si1	Fuse for 220 V.AC	0.6 DIN 41571	Fa.Wickmann (10)
V 401	Rö1	Stabilizer tube	150 C2/OA 2	Siemens
ACCESSORIES				
F 401	Si1	Fuse for 110 V. AC	0.8 DIN 41571	Fa. Wickmann (10)

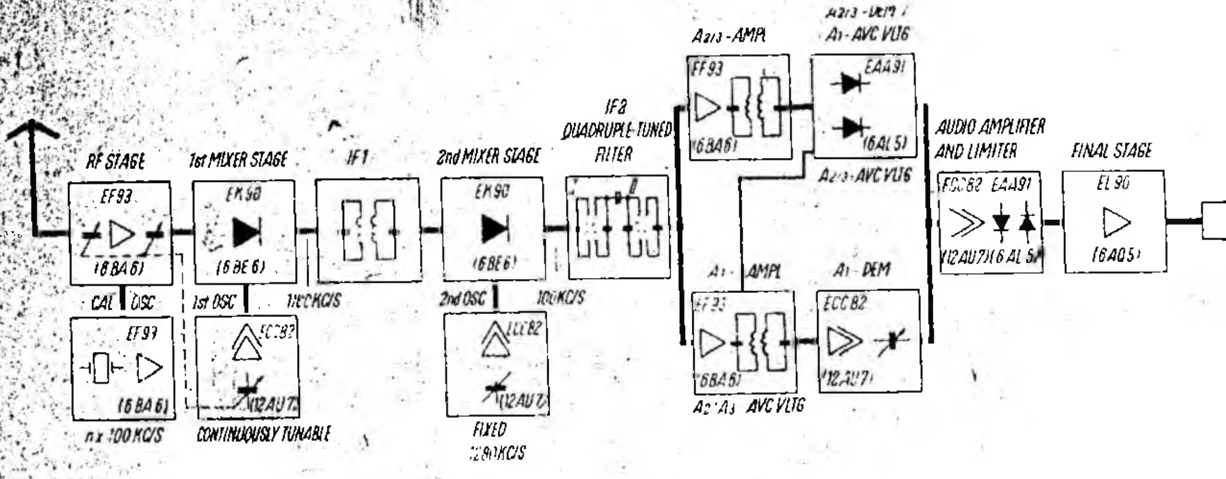


Fig. 4 Functional circuit diagram for band 4

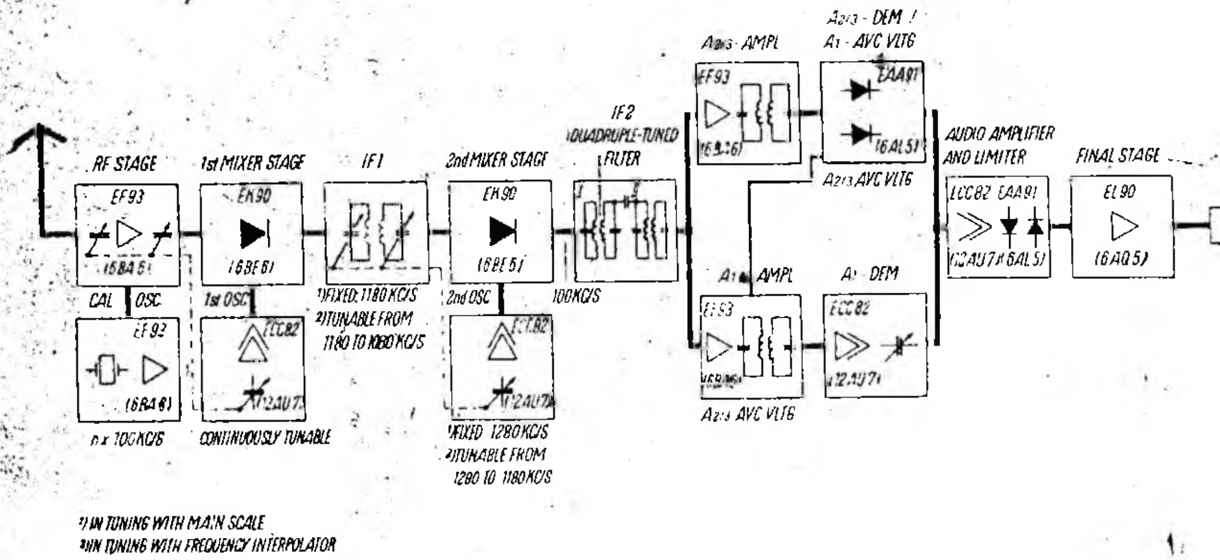


Fig. 5 Functional circuit diagram for bands 6 to 12

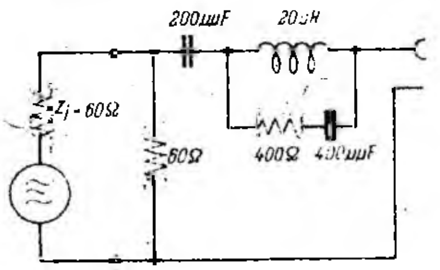


Fig. 6 CCIR dummy antenna

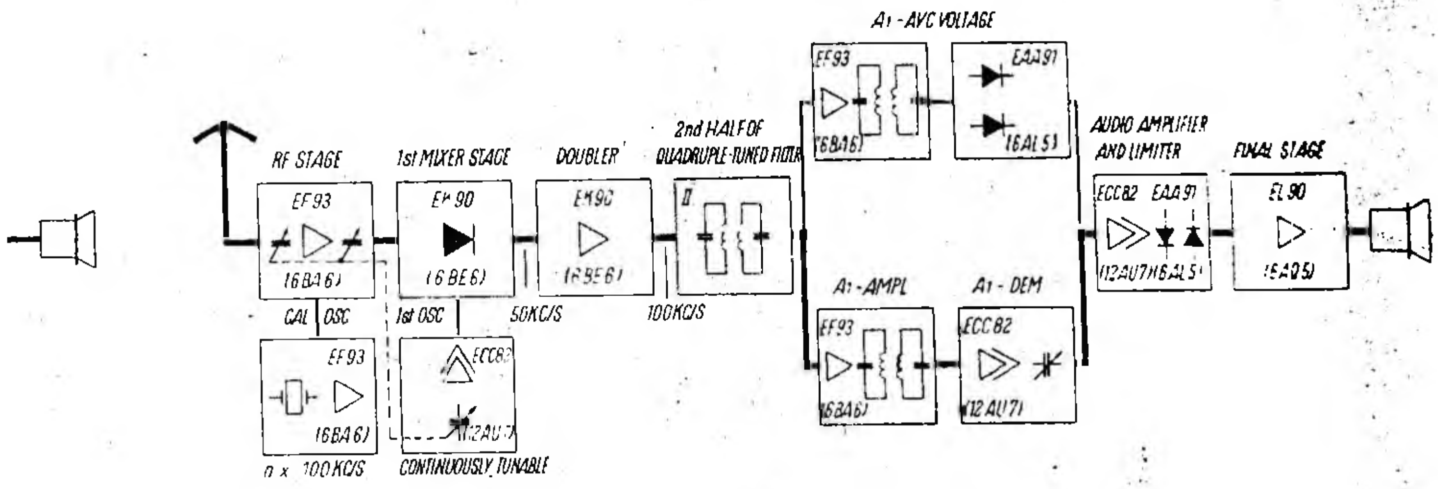


Fig. 2 Functional circuit diagram for bands 1 and 2

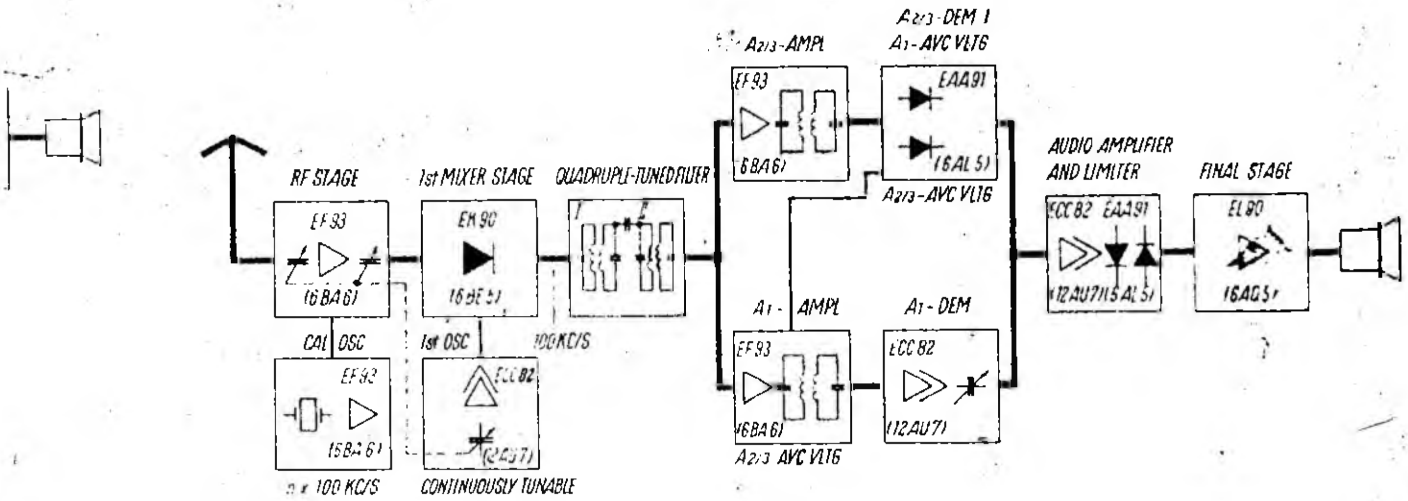


Fig. 3 Functional circuit diagram for bands 3 and 5

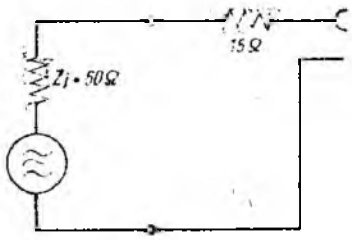


Fig.7 Dummy antenna for the shortwave bands

Nr
M
US
S.A.I.T. Conso
S.A.I.T. Conso
S.A.I.T. Conso
S.A.I.T. Conso
Material
Drawn
2. 5. 61

Drw. 4.9.2.

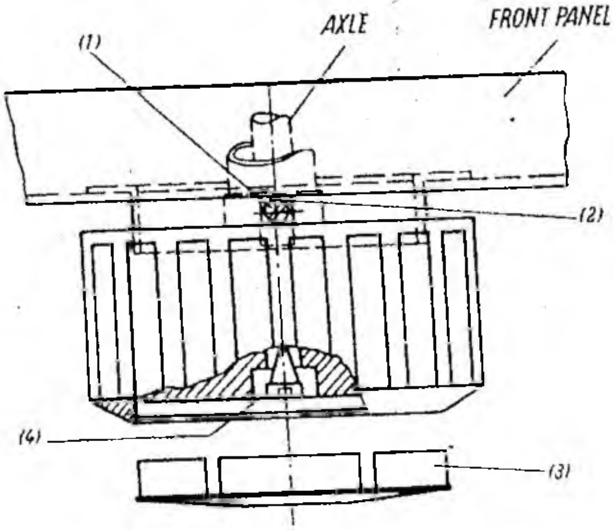


Fig. 1 Control knob for the Index of the main scale

Nr	MODIFICATIONS	Date	Nr	DESIGNATION	Stock Nr

USED FOR	
S.A.I.T. Consoles Type C2 (4·530)	**Main Receiver**
S.A.I.T. Consoles Type P1 (4·529)	Control Knob and
S.A.I.T. Consoles Type P2 (4·531)	Block Diagrams of Receiving Bands
S.A.I.T. Consoles Type M2 (4·535)	

Material	Nbr. of pieces		Replaces	Replaced by
		SAIT ELECTRONICS		
Drawn	Checked		FILE N: 6-304	
2. 5. 61			DWG. N: 20.921	

ITEM DESIGN.	ELEC-TRODE	PIN	MEAS VALUE Ω
1 TUBE 1 EF 93	A	5	1.1k (3.2k)
	G_2	6	10k
	K	7	150
	G_1	1	1.55M
2 TUBE 1 EF 93	A	5	ET 168k (>100M)
	G_2	6	ET 168k (>100M)
	G_1	1	400k
3 TUBE 1 EK 90	A	5	1k
	$G_{2/4}$	6	9.5k
	K	2	220
	G_3	1	175M
4 TUBE 1 ECC 82	A	6	13.5k
	G_I	7	22k
5 TUBE 1 EK 90	A	5	1K
	$G_{2/4}$	6	68k (>100M)
	K	2	820
	G_1	1	12
6 TUBE 1 EK 90	A	5	1K
	$G_{2/4}$	6	>100 M
	K	2	150
	G_3	1	1.9M

ITEM DESIGN.	ELEC-TRODE	PIN	MEAS VALUE Ω
7 TUBE 1/2 ECC 82	A_{II}	1	>100M
	A_I	6	18
	G_{II}	2	100k
	G_I	7	220k
	K_I	8	1k
8 TUBE 1 EF 93 A1-A2/3	A	5	3k
	G_2	6	68k
	K	7	150
	G_1	1	900k-22k
9 TUBE 1 EF 93 A1-A2/3	A	5	2.2k
	G_2	6	68K
	K	7	150
	G_1	1	1M-1.9M
10 TUBE 1/2 EB 91	K_I	1	1K
	K_{II}	5	1K
11 TUBE 1/2 ECC82 A1-A2/3	A_{II}	1	46k
	K_{II}	3	10k
	G_{II}	2	28
	A_I	6	43k-280k
	K_I	8	2.7k
	G_I	7	100K

ITEM DESIGN.	ELEC-TRODE	PIN	MEAS VALUE Ω
11 TUBE 3 EM34	A_1	3	1M
	A_2	6	1M
	G_1	4	1.4M
	L	5	0
10 TUBE 3 12 TUBE 3 ECC82	A_{II}	1	120k
	K_{II}	3	2.2k
	G_{II}	2	1M
	A_I	6	110K
	K_I	8	2.2K
	G_I	7	1M
12 TUBE 1/2 EB 91	K_I	1+5	330K
13 TUBE 1 EL 90	A	5	385
	G_2	6	0
	K	2	270
	G_1	1+7	330k

Anode and screen grid resistors measured against + filter capacitor C402. All other resistances and voltages measured against chassis ground. Unless specified otherwise, one button (T1 to T12) pressed. Values in parantheses: No pushbutton pressed, ET: Calibrating button pressed.

ITEM DESIGN.	ELEC-TRODE	PIN	MEAS VALUE V
1 TUBE 1 EF 93	A	5	220(200)
	G_2	6	95
	K	7	1.7
2 TUBE 1 EF93	A	5	42
	G_2	6	56
3 TUBE 1 EK 90	A	5	225
	$G_{2/4}$	6	95
	K	2	2.2
4 TUBE 1 ECC 82	A	6	90
5 TUBE 1 EK 90	A	5	225
	$G_{2/4}$	6	65
	K	2	2.4
6 TUBE 1 EK 90	A	5	225
	$G_{2/4}$	6	85
	K	2	1.9

ITEM DESIGN.	ELEC-TRODE	PIN	MEAS VALUE V
7 TUBE 1/2 ECC 82	A_I	1	110
	A_{II}	6	230
	K_{II}	8	7.2
8 TUBE 1 EF 93	A	5	210
	G_2	6	70
	K	7	1.1
9 TUBE 1 EF 93	A	5	215
	G_2	6	80
	K	7	1.15
10 TUBE 1/2 EB 91	K_I	1	1.1
	K_{II}	5	0.8
11 TUBE 1/2 ECC 82	A_I	1	110
	K_I	3	6.2
	A_{II}	6	85
	K_{II}	8	7.0

ITEM DESIGN.	ELEC-TRODE	PIN	MEAS VALUE V
11 TUBE 3 EM 34	A_1	3	32
	A_2	6	25
	L	5	230
10 TUBE 3 12 TUBE 3 ECC82	A_I	1	50
	K_I	3	1.3
	A_{II}	6	60
	K_{II}	8	1.6
12 TUBE 1/2 EB 91	K_I	1+5	-0.4
13 TUBE 1 EL 90	A	5	210
	G_2	6	230
	K	2	10.5
HEAT REG			6.3

Voltage measured with AVΩ-Multizet meter (1000Ω/v). Resistances measured with suitable measuring bridge. Voltages at anode and screen grid measured in the 300-v range. Unless specified otherwise, T12 pressed, without RF input signal.

Drw. 4.9.3.

Nr	MODIFICATIONS	Date	Nr	DESIGNATION	Stock Nr

USED FOR

S.A.I.T. Consoles Type C2 (A-530)
S.A.I.T. Consoles Type P1 (A-529)
S.A.I.T. Consoles Type Q2 (A-531)
S.A.I.T. Consoles Type M2 (A-535)

Main Receiver

Voltage and Resistance Values in Trouble Shooting

Material	Nbr. of pieces

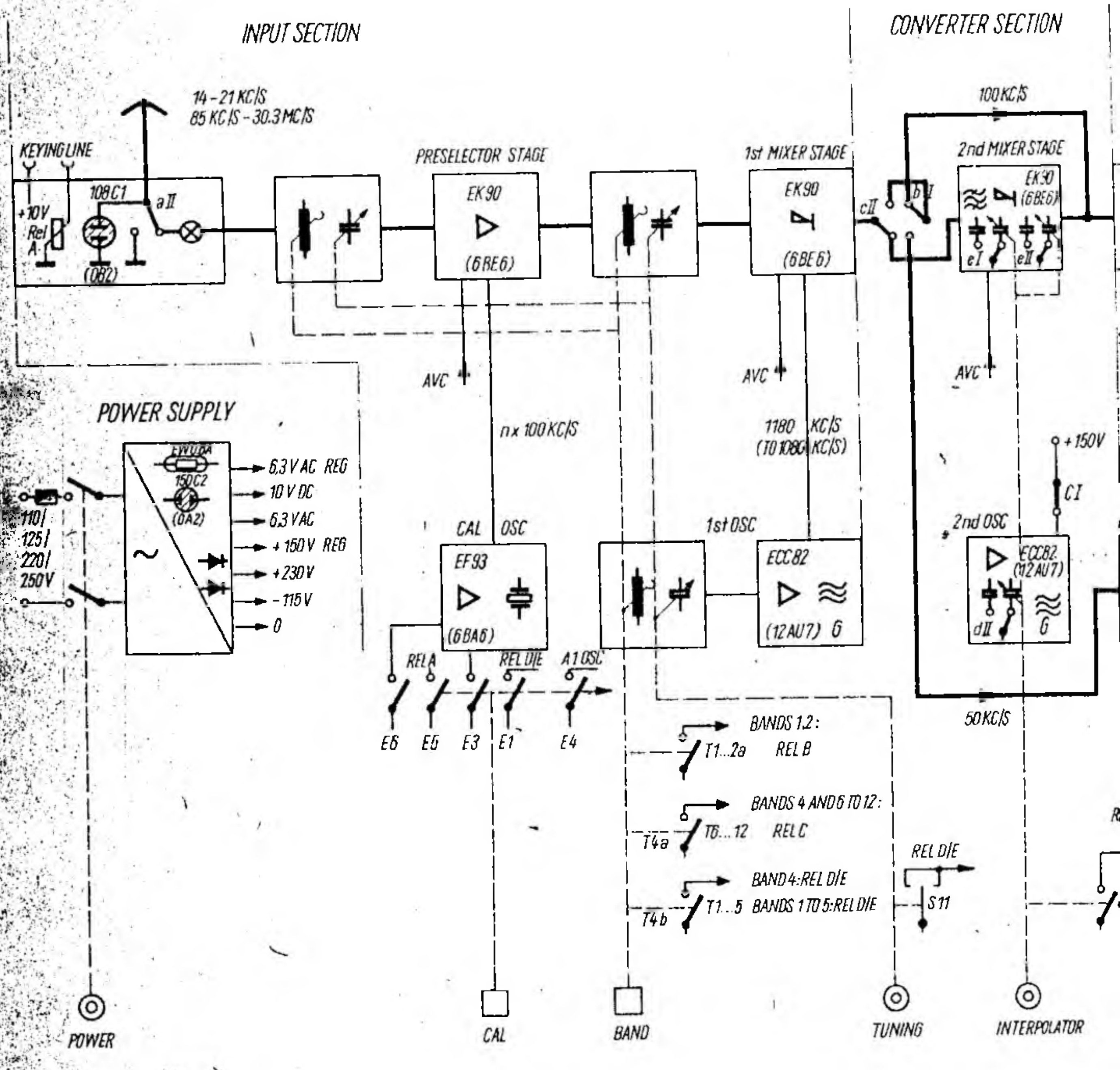
Drawn	Checked
2.5.61	

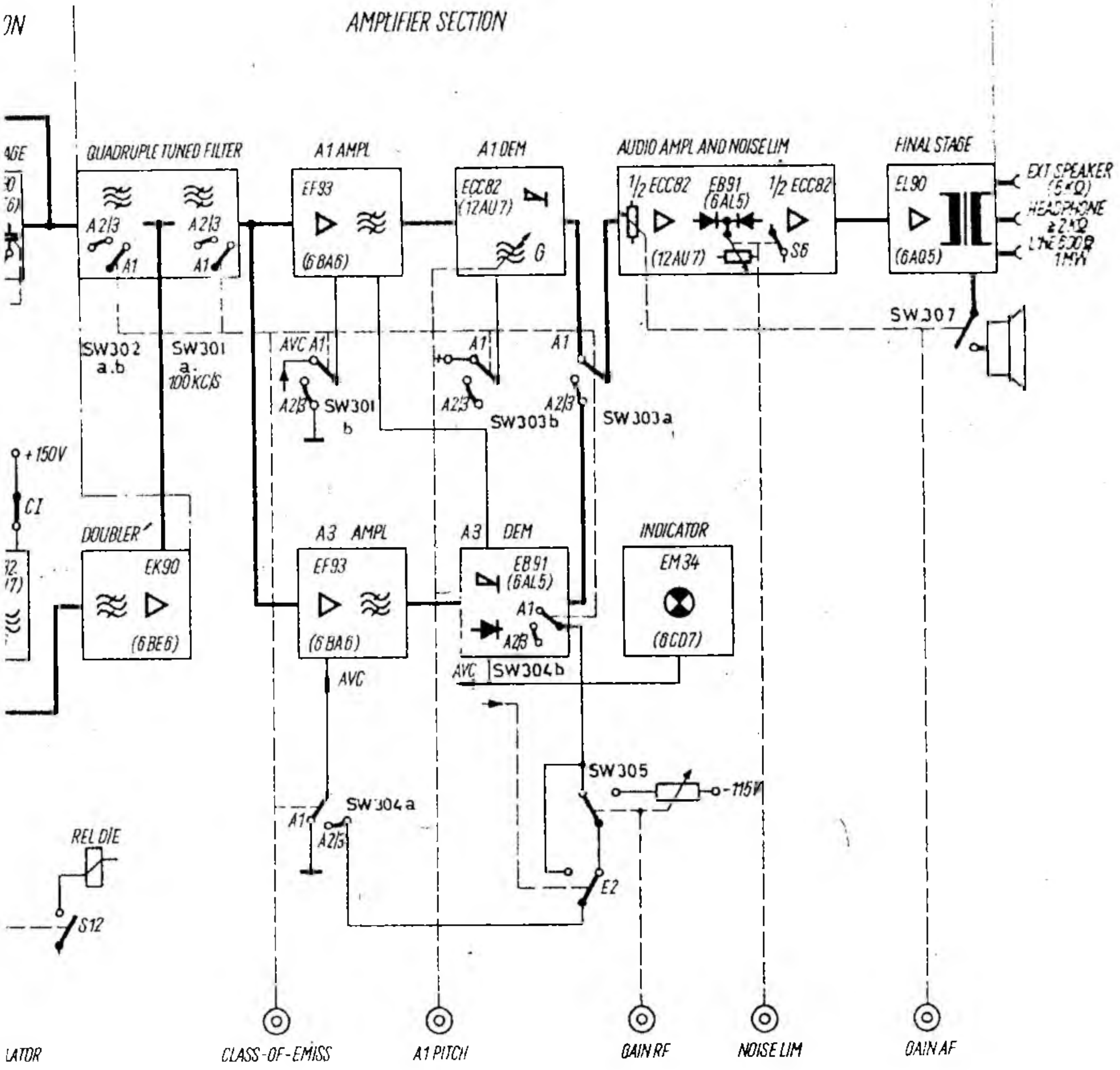
SAIT ELECTRONICS

Replaces	Replaced by

Fil.ty. N: 6-304

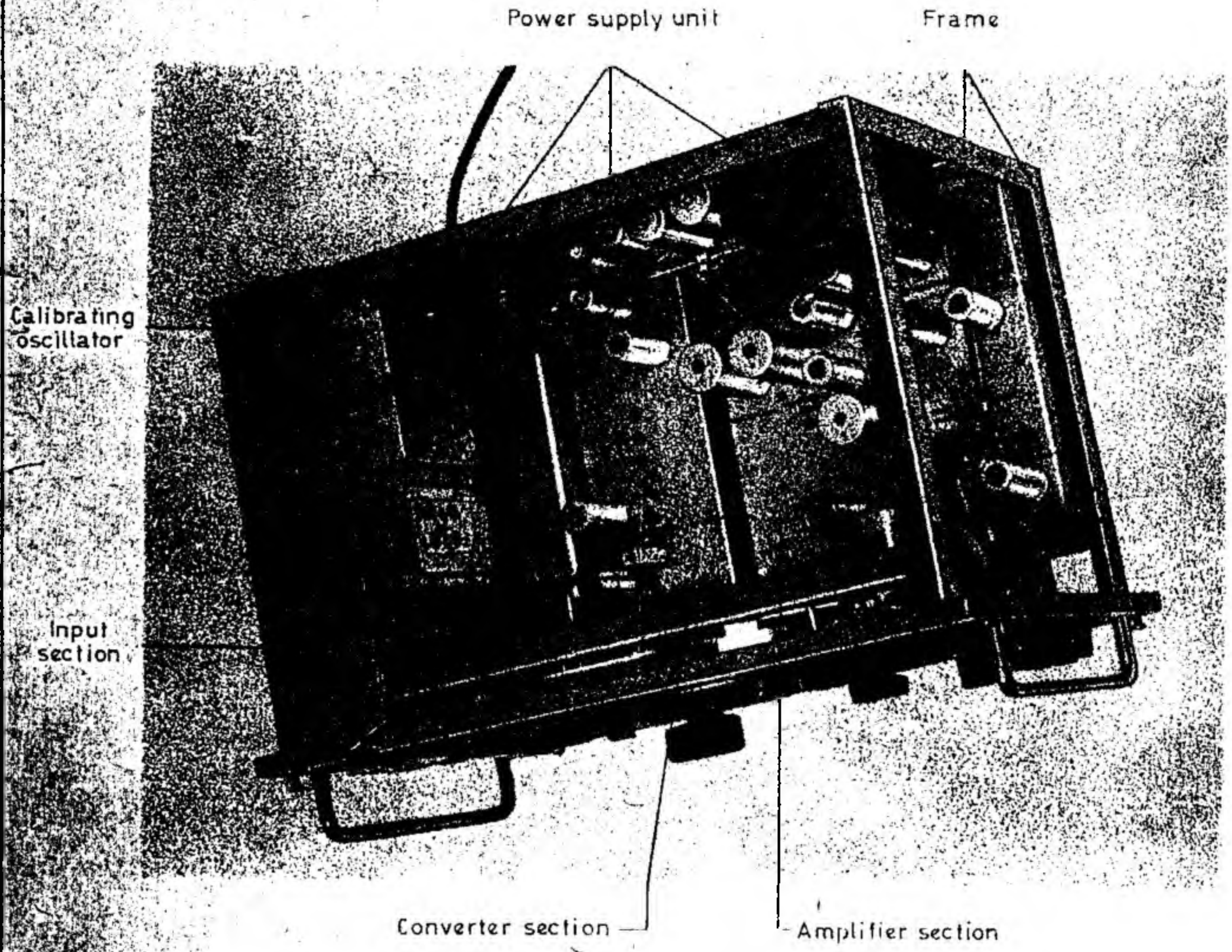
DWG. N: 20.922


INPUT SECTION
CONVERTER SECTION
14 - 21 KC/S
85 KC/S - 30.3 MC/S
KEYING LINE
+10V
Rel A
108C1
(OB2)
PRESELECTOR STAGE
EK90
(6BE6)
1st MIXER STAGE
EK90
(6BE6)
100 KC/S
2nd MIXER STAGE
EK90
(6BE6)
AVC
AVC
AVC
POWER SUPPLY
150C2
(OA2)
6,3 V AC REG
10 V DC
6,3 VAC
+150 V REG
+230 V
-115 V
0
110/
125/
220/
250V
n x 100 KC/S
1180 KC/S
(TO 1080 KC/S)
+150V
CI
2nd OSC
ECC82
(12AU7)
CAL OSC
EF93
(6BA6)
1st OSC
ECC82
(12AU7)
REL A
REL D/E
A1 OSC
E6
E5
E3
E1
E4
50 KC/S
BANDS 1,2:
T1...2a
REL B
BANDS 4 AND 6 TO 12:
T6...12
REL C
T4a
REL D/E
BAND 4: REL D/E
T1...5
BANDS 1 TO 5: REL D/E
T4b
S11
POWER
CAL
BAND
TUNING
INTERPOLATOR

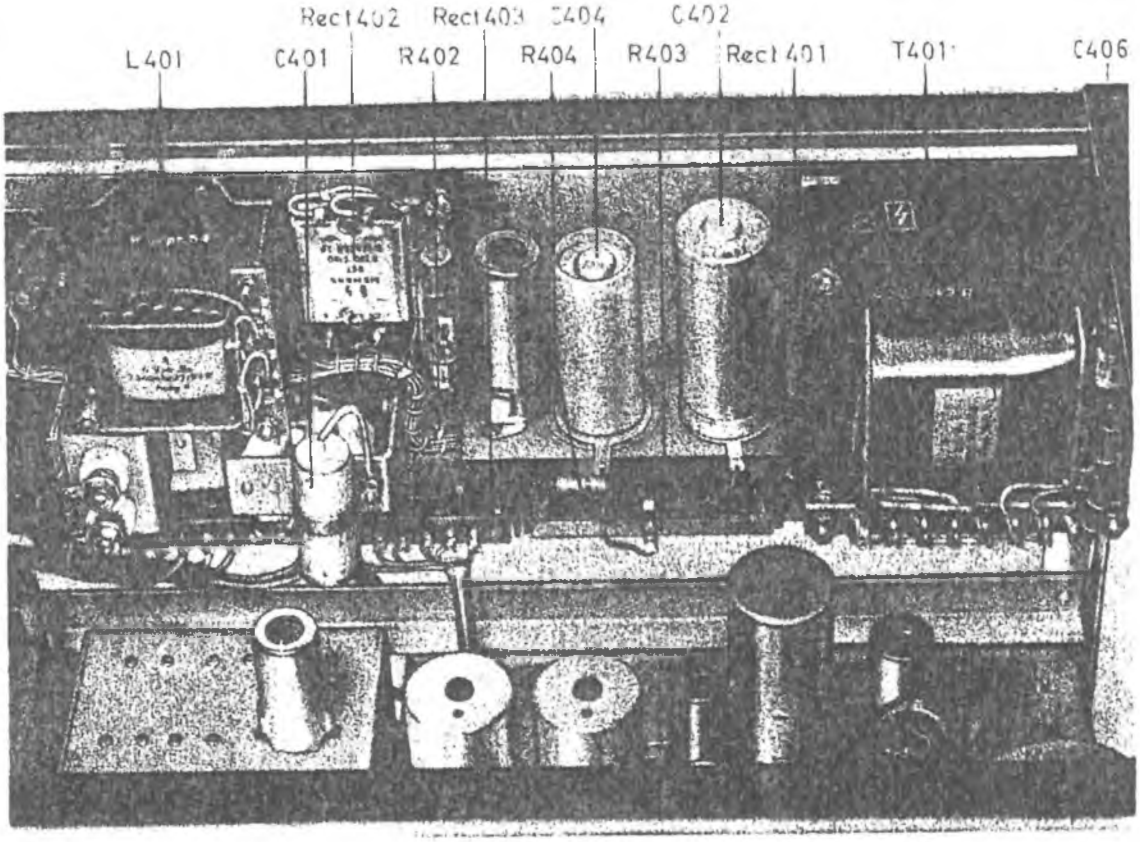


Nr
S.A.L.T Com
S.A.L.T Com
S.A.L.T Com
S.A.L.T Com
Mater
Draw

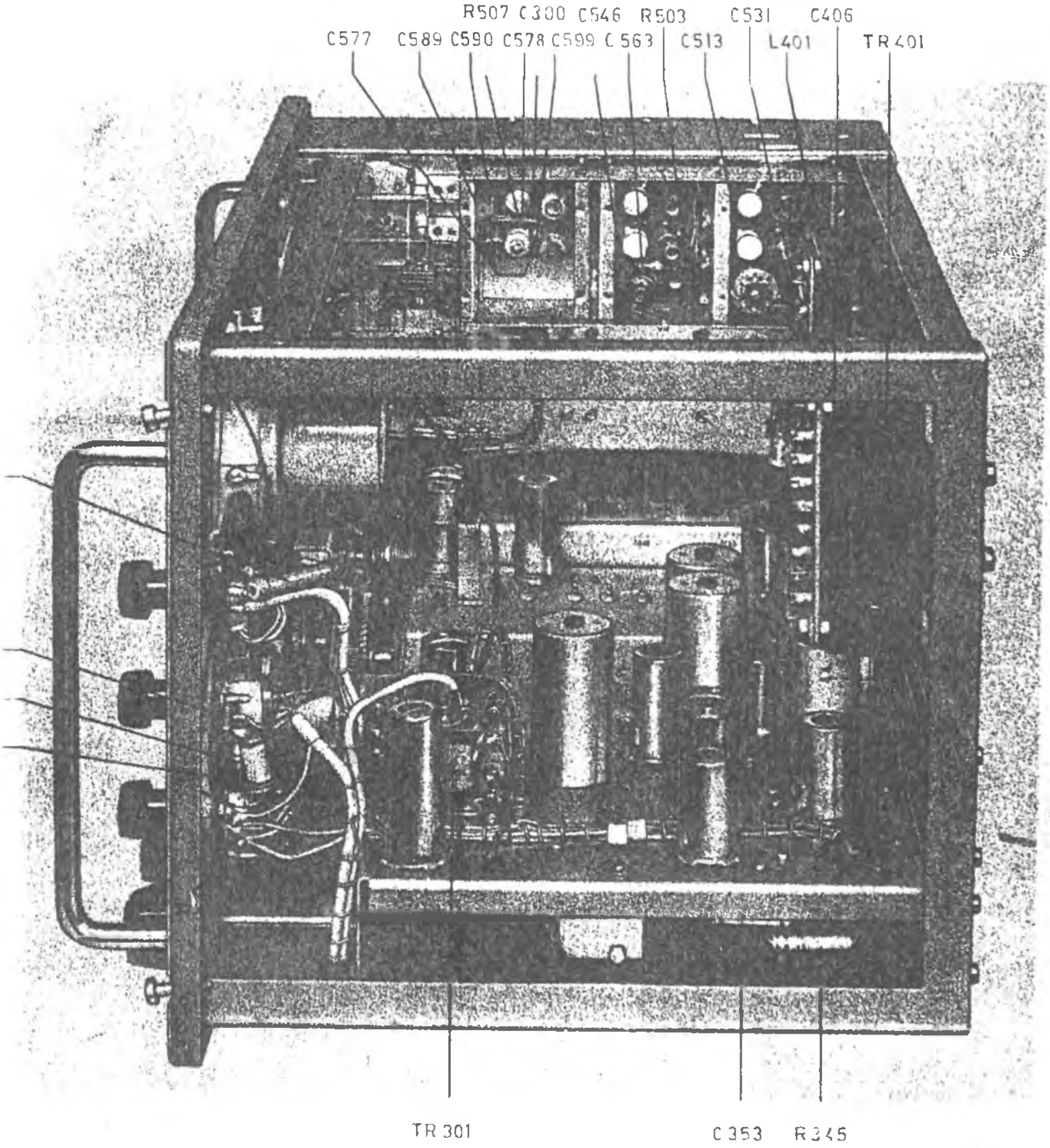
Top view of receiver chassis.



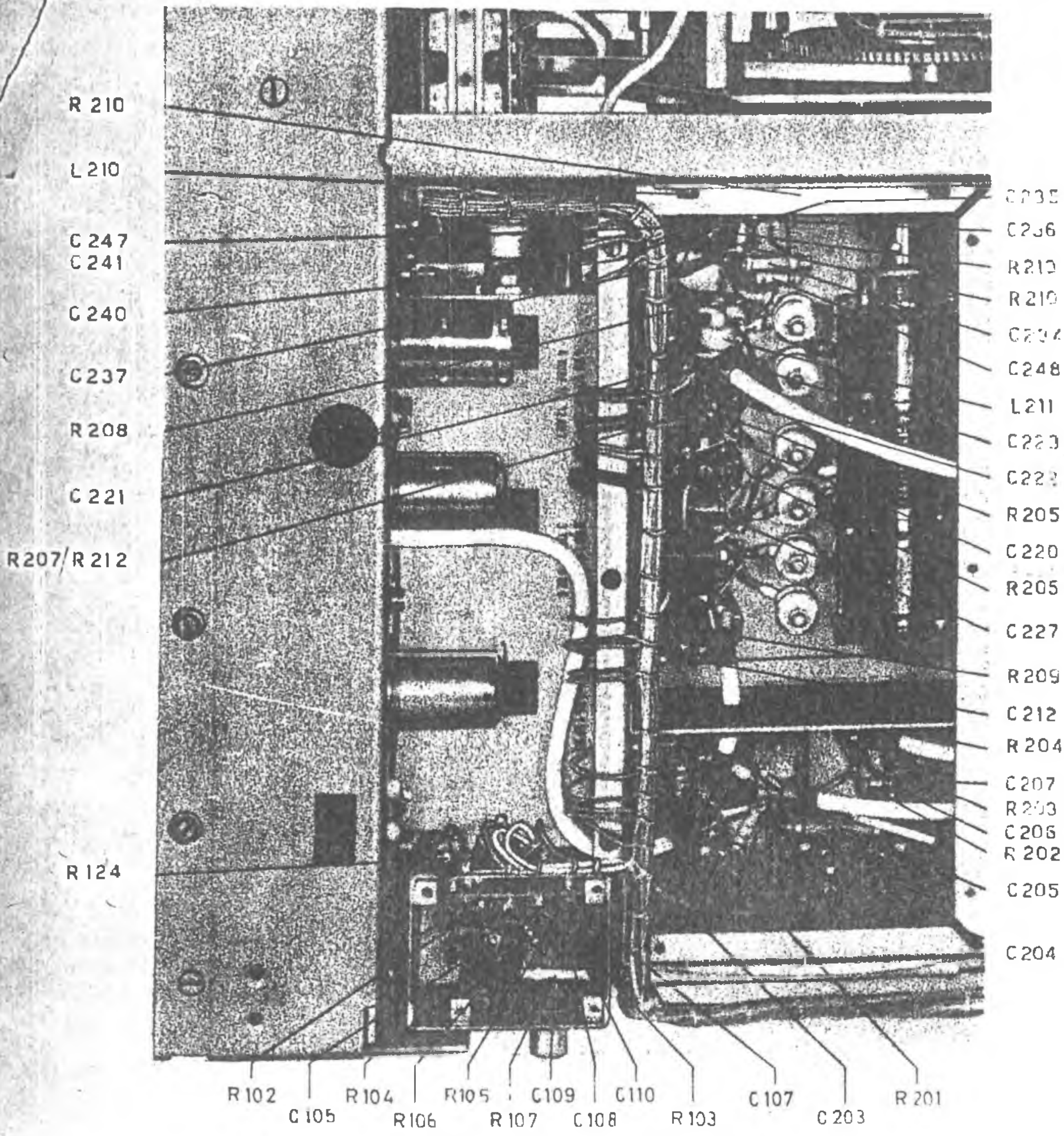
Power supply unit.

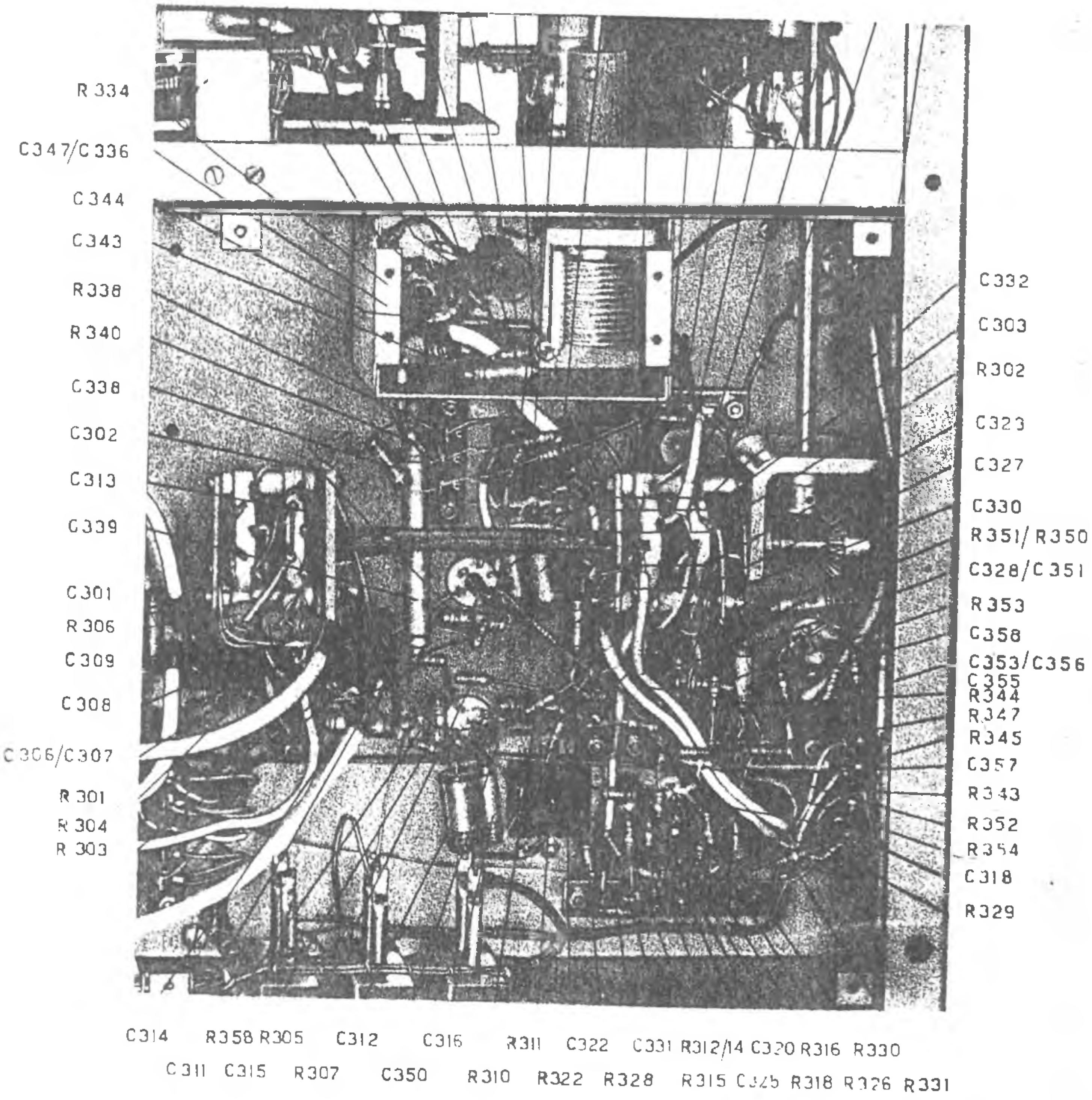


Right-hand view of receiver chassis.

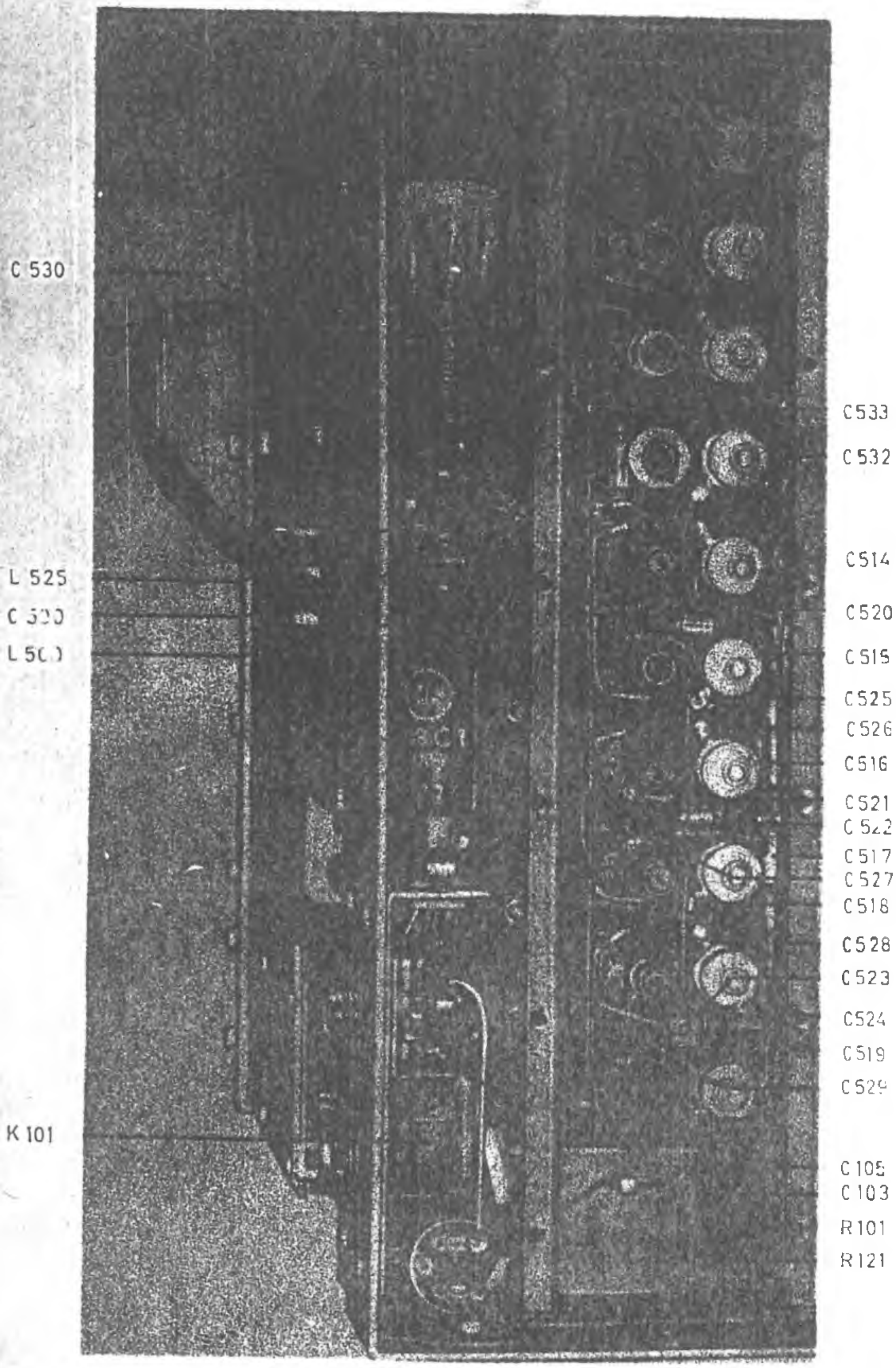


Annexed Fig. 1.

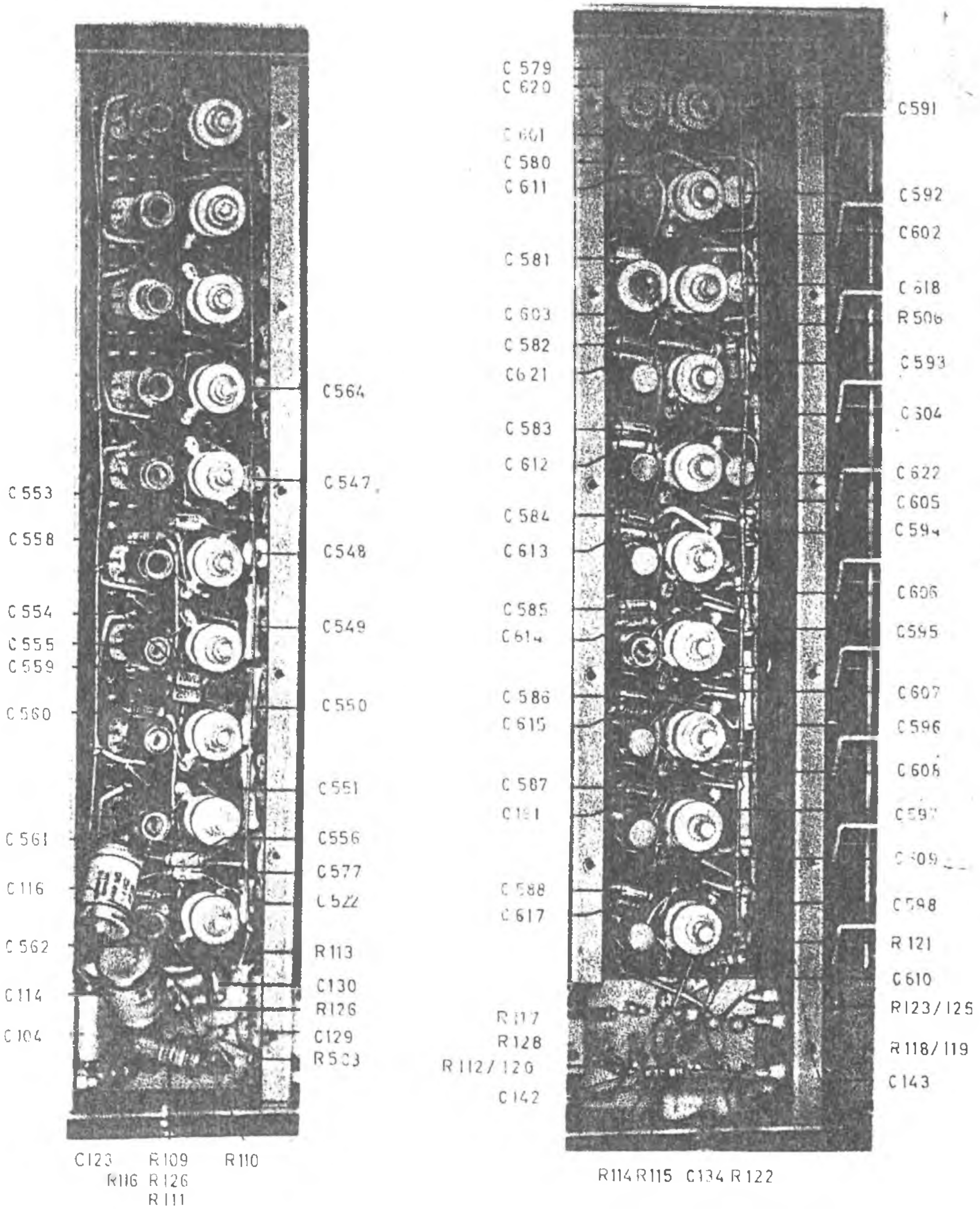

R 210
L 210
C 247
C 241
C 240
C 237
R 208
C 221
R 207/R 212
R 124
R 102
C 105
R 104
R 106
R 105
R 107
C 109
C 108
C 110
R 103
C 107
C 203
R 201
R 210
C 248
L 211
R 205
C 220
R 205
C 227
R 209
C 212
R 204
C 207
C 206
R 202
C 205
C 204



Bottom view of receiver chassis   Annexed Fig. 2.



C 530
L 525
K 101
C533
C 532
C514
C520
C515
C525
C526
C516
C521
C517
C527
C518
C528
C523
C524
C519
C 105
C 103
R101
R121



Input section Annexed. Fig. 3.

IF and RF level plan: Measuring conditions: Noise Limiter "Off"; full volume; RF manu
frequency interpolator "Off"; signal gene

Band	Dummy antenna (see figs. 6.7) Type	Frequency (kc/s)	Volt. (µv)	G_1/V102/EF-93 Frequency (kc/s)	Volt. (µv)	G_3/V104/EK-90 Frequency (kc/s)	Volt. (µv)	G_1/V201/EK-90 Frequency (kc/s)	Volt. (µv)
1	CCIR	18	< 1	18	2	18	350	50	25
2	CCIR	130	< 1	130	2	130	380	50	25
3	CCIR	270	< 1	270	3	270	400	-	-
4	CCIR	550	< 1	550	3	550	50	-	-
5	CCIR	1160	3,5	1160	6	1160	450	-	-
6	CCIR	2400	2,5	2400	7	2400	50	-	-
7	15 Ω	4900	3	4900	4	4900	50	-	-
8	15 Ω	8400	6,5	8400	6,5	8400	60	-	-
9	15 Ω	13000	10	13000	10	13000	70	-	-
10	15 Ω	17700	6	17700	6	17700	70	-	-
11	15 Ω	22700	7	22700	7	22700	65	-	-
12	15 Ω	27300	5	27300	5	27300	65	-	-

Audio level plan: Measuring conditions: Noise limiter "Off"; full volume; coupling c
5-Ω resistor, corresponding to 3 mw into hea

Hot end Volume control R323 Frequency (c/s)	Voltage (mv)	G_1/V304a/ECC-82 Frequency (c/s)	Vltg (mv)
1000	32	1000	28

manual gain control off; RF voltages for audio output power 50 mw ≙ 0.5 v across 5 Ω·

generator Z_i = 60 Ω; coupling capacitor 10,000 μμf

90	G_3/V202/EK·90		G_1/V301/EK·93		G_1/V302/EF93		Notes
lt. r)	Frequency (kc/s)	Volt. (μv)	Frequency (kc/s)	Volt. (μv)	Frequency (kc/s)	Volt. (μv)	
5	-	-	100	0,8	-	-	Bandwidth control at "A1"; signal generator unmodulated; BFO set for about 1000 c/s
5	-	-	100	0,8	-	-	
-	-	-	-	-	100	40	
-	1180	0,9	-	-	100	40	
-	-	-	-	-	100	40	
-	1180	0,9	-	-	100	40	
-	1180	0,9	-	-	100	40	Bandwidth control at "A2/A3 Narrow"; Signal generator 1000 c/s; 30% modulation
-	1180	0,9	-	-	100	40	
-	1180	0,9	-	-	100	40	
-	1180	0,9	-	-	100	40	
-	1180	0,9	-	-	100	40	
-	1180	0,9	-	-	100	40	

ng capacitor 0.1 μf; audio voltages for 50 mw ≙ 0.5 v across internal loudspeaker or headphone jack with 10-kΩ load

G_1 / V304 b / ECC·82		G_1/V308 / EL-90	
Frequency (c/s)	Vltg (mv)	Frequency (c/s)	Vltg (mv)
1000	270	1000	1900

LEVEL PLAN   Annexed Fig. 5