

# **Technical Handbook**

**SE 550-08-25-1**

**Part 5**

**Alignment**

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## 5 ALIGNMENT

### 5.1 General

For each alignment step a separate page is reserved. On each page the test layout and a view of the p.c.b board with the test and alignment points are given. The test layout also lists the equipment to be used in each case. No significance need be attached to empty (instrument) boxes.

When selecting the RF test set, the high transmitter output (up to 25 W) of the SE 550 should be taken into account. Eventually a suitable attenuator should be connected between the transmitter and the test set.

The test channels are indicated as follows:

- |                      |  |
|----------------------|--|
| - H: highest         | } channel within the band<br>of the SE 550<br>to be tested |
| - M: medium (center) |  |
| - T: lowest          |  |
| - X: any channel     |  |

Unless specified otherwise, all alignments should be made at a supply voltage of 13,2 V and at a ambient temperature between +18 and +28 °C.

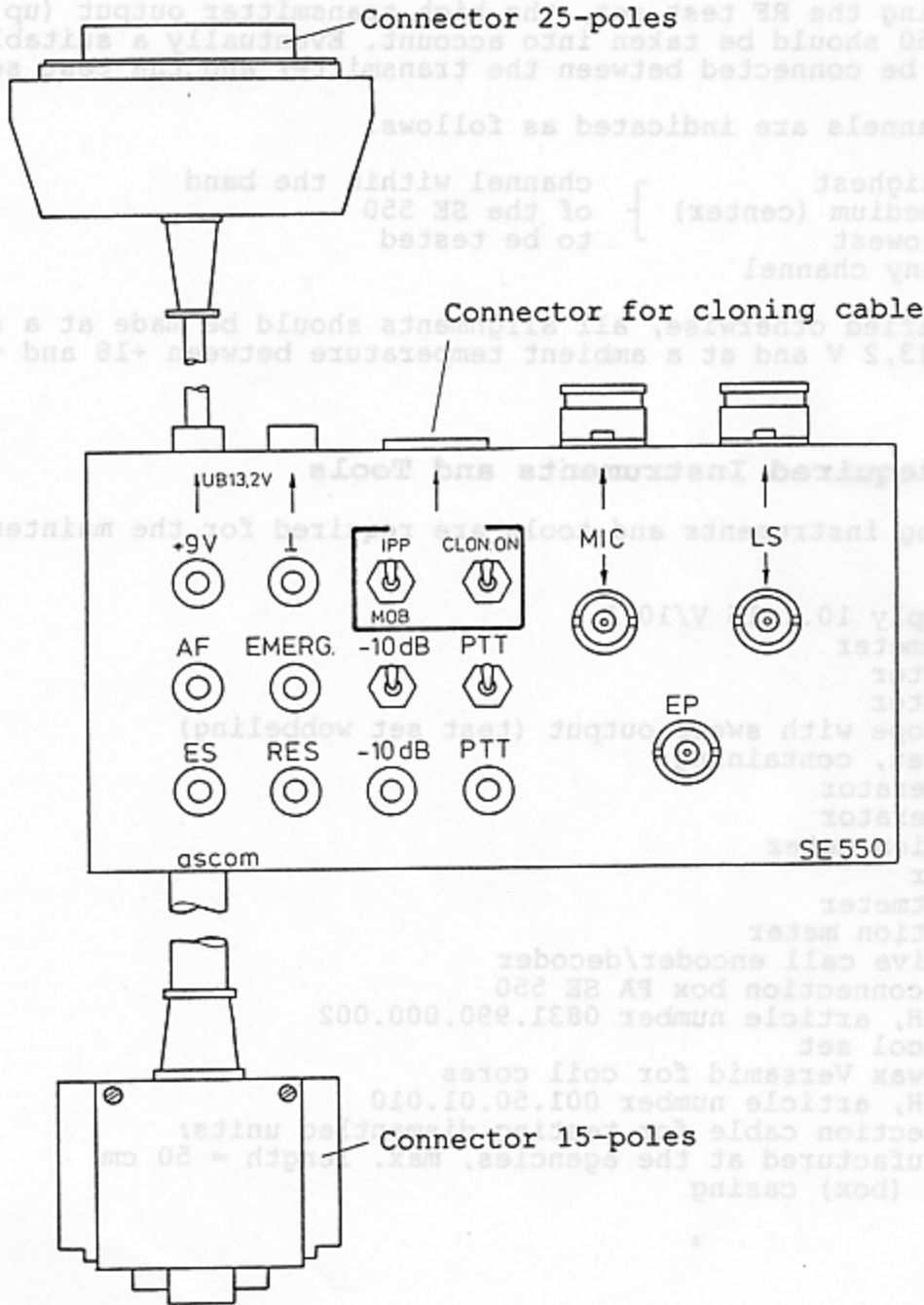
### 5.2 Required Instruments and Tools

The following instruments and tools are required for the maintenance of the SE 550:

- o Power supply 10...16 V/10 A
- o DC amperemeter
- o AF voltmeter
- o DC voltmeter
- o Oscilloscope with sweep output (test set wobbling)
- o RF test set, containing:
  - RF generator
  - AF generator
  - Deviation meter
  - Counter
  - RF wattmeter
  - Distortion meter
  - Selective call encoder/decoder
- o Test and connection box PA SE 550  
Ascom GmbH, article number 0831.990.000.002
- o Regular tool set
- o Securing wax Versamid for coil cores  
Ascom GmbH, article number 001.50.01.010
- o Interconnection cable for testing dismantled units;  
to be manufactured at the agencies, max. length = 50 cm
- o Alignment (box) casing

Drawing Test and Connection Box PA SE 550

Ascom GmbH, article number 0831.990.000.002





**Explanation of control and connector elements on test and connection box PA SE 550**

UB 13,2 V	Supply voltage +13.2 V from power supply unit	
+9 V	Operating voltage +9 V from SE 550	
⊥	Ground	
AF	Earphone output from SE 550	
EMERG.	Releasing emergency call, active = low	
-10 dB	Tx power reduction -10 dB (toggle switch)	
PTT	Tx on/off (toggle switch)	
ES	External signalization, max. 12 V	
RES.	Reserve line	
-10 dB	Tx power reduction -10 dB, controlled by external devices (PC etc.)	
PTT	Tx on/off, controlled by external devices (PC etc.), active = low	
MIC	Two microphone inputs 100 mV	
LS	Two loudspeaker outputs 4 Ω	
EP	Earphone output	
IPP/MOB	Selector switch for interactive parameter programming (IPP) or normal operation (MOB)	
CLON.ON	Cloning on/off switch (selector switch IPP/MOB in position IPP)	

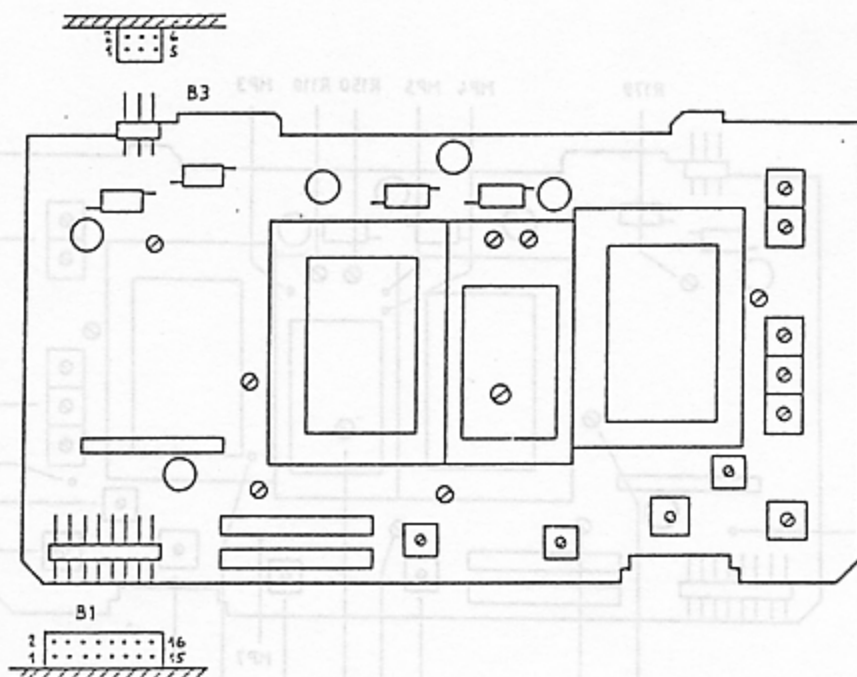
**5.3 Preparing, Disassembly**

1. Demount the SE 550 assemblies as follows:
  - o Control unit, refer to section 4.3 in part 4
  - o Control board, refer to section 4.4 in part 4
  - o RF board, refer to section 4.5 in part 4
2. Carefully re-assemble the boards without the casing. All alignment points are accessible from outside.

5.4 List of Potential Designations

Potential	Designation
+ 60 V	Power supply for the display
+ 9 V	Stabilized voltage +9 V
+ 5 V	Stabilized voltage +5 V
+ E	+9 V, receiver supply
+ S	+9 V, transmitter supply
+ UB, + Batt	Battery voltage +12 V
+ UB/2	Reference voltage
- 10 dB	Control for reduced output power
A/D Data	A/D converter output data
AS	Open collector output for external signalling
CD	Clock, processor bus
Cloning Ein	Cloning on
Cloning TxD	Tx data cloning
Cloning RxD	Rx data cloning
Cloning RTS	Ready to send cloning
Cloning CTS	Clear to send cloning
Da, Data	Data line
Data v. STG	Data from control board
Data z. STG	Data to control board
DTMF	Double frequency signaling
Ein	Switching ON criterion
EN, Enable	Control line
EN OPT IN	Enable input, option board
EN OPT OUT	Enable output option board
FF	Display filament voltage
Gnd	Ground of the transceiver
Hö	Earphone output
LS ein	Loudspeaker ON criterion
Lsp	AF signal to the loudspeaker
Masse	Ground of the transceiver
MI IN	Microphone signal after high pass
MI OUT	Output signal of the microphone amplifier
Mic	AF signal from microphone
Mod	Conditioned AF towards VCO
µP	Microprocessor
NF aus	AF output signal
NF ein	AF input signal
NF OPT IN	AF input, option board
NF OPT OUT	AF output, option board
NF von Dis.	AF signal from discriminator
NF zu Verst.	AF signal to output amplifier
PT z. STG	Subaudio tone to control board
PT v. STG	Subaudio tone from control board
Ref. 400 kHz	Reference frequency 400 kHz
RES	Not connected (reserve)
Rsp	Squelch criterion
Squelch	Carrier criterion
ST	Transmit key
Tx Enable	Transmitter control line
Tx' (+S)	Supply voltage of TX driver stages
Unlock	Unlock criterion of synthesizer
Ur	VCO regulation voltage
Ust	VCO preset voltage
z.b.V.	Not used

## 5.5 RF Board, Connectors and Pin-Assignment

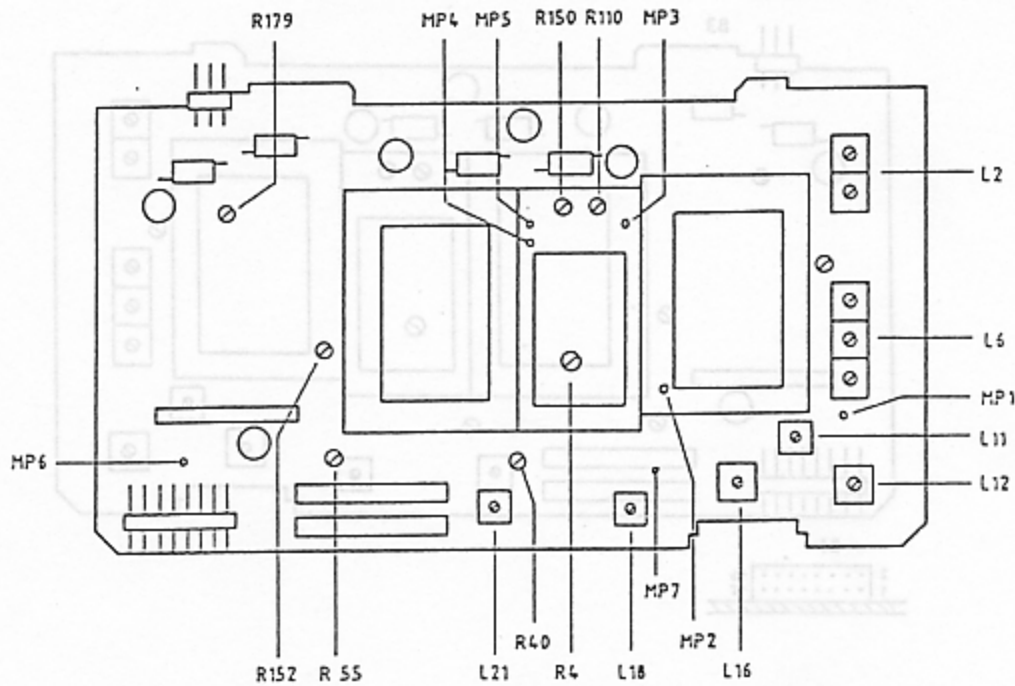


Pin assignment B1	
1	Clock
2	Data out
3	Enable Tx
4	Enable Rx
5	RF data
6	Enable RF
7	Mod vers RF
8	AF
9	RSP Squelch
10	RSSI
11	Reserve
12	+9 V
13	+UB
14	+UB
15	Gnd, ground
16	Gnd, ground

Pin assignment B3	
1	-10 dB
2	Reserve
3	Reserve
4	+ 9 V
5	RSP, Squelch
6	AF to final empl.

These connections are soldered to the inter-connection board.

5.6 RF Board, Test Points and Alignment Elements



Tuning elements

- L2: RF filter (2 circuits)
- L6: RF filter (3 circuits)
- L11: Local oscillator filter
- L12, L16, L18 IF circuits
- L21: Discriminator circuit
- R4: TCXO frequency adjustment
- R40: AF level
- R55: Squelch switching threshold
- R110: Adjustment of receiver VCO
- R150: Adjustment of transmitter VCO
- R152: Max. deviation
- R179: Output power

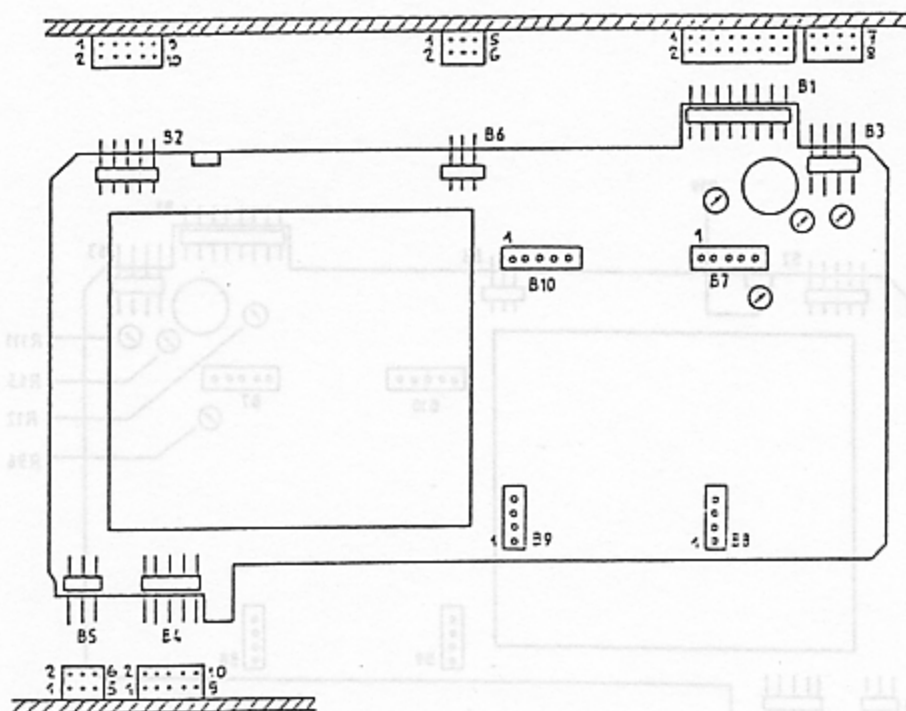
Test points

- 1 RF signal behind L6
- 2 Regulation voltage VCO Rx
- 3 Preset voltage VCO Rx
- 4 Preset voltage VCO Tx
- 5 Regulation voltage VCO Tx
- 6 AF level
- 7 IF adjustment point

B1/12 Voltage 9,3 V



## 5.7 Control Board, Connectors and Pin-Assignment



Pin assignment B1	
1	--
2	--
3	Status
4	St
5	Reserve
6	RXD
7	TXD
8	En/Hors IN/OUT
9	+ 9 V
10	Ground
11	Ground earphone
12	Earphone
13	Ground microphone
14	Micro
15	--
16	--

Pin assignment B3	
1	Modulation → RF
2	AF + disc.
3	RSP
4	RSSI
5	Reserve
6	+ 9 V
7	+ UB
8	Ground

Pin assignment B4	
1	Reserve
2	As
3	AF in
4	Hö
5	ST
6	Emergency call
7	+ 9 V
8	Microphone
9	AF → speaker
10	AF → speaker

Pin assignment B6	
1	+ 5 V
2	Enable
3	Speaker ON
4	AF → speaker
5	Speaker from BG
6	Speaker from BG

Pin assignment B2	
1	AF → speaker
2	AF → speaker
3	--
4	+ UB
5	Clock
6	Data → RF board
7	Enable TX
8	Enable RX
9	Data → RF board
10	Enable RF board

Pin assignment B5	
1	Cloning ON
2	Cloning TXD
3	Cloning RXD
4	Cloning RTS
5	Cloning CTS
6	Ground

Pin assignment B7	
1	AF → option
2	AF → option
3	Micro ground
4	Micro in
5	Micro out

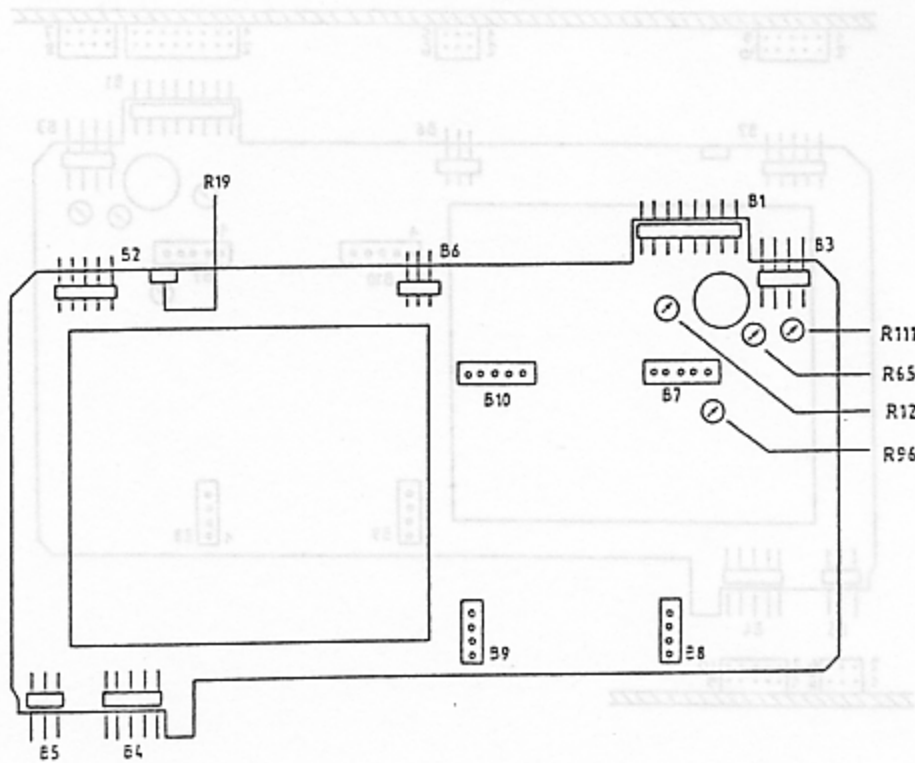
Pin assignment B8	
1	Ground
2	DTMF
3	PT in
4	Clock

Pin assignment B9	
1	Data → A/D conv.
2	Data → STE
3	Data → STE
4	PT → STE

Pin assignment B10	
1	RSSI
2	Enable option →
3	Enable option →
4	+ 5 V
5	+ 9 V

- The connections B1, B2, B5, B6 are soldered.
- B7, B8, B9, B10 are connections to the option p.c.b.

5.8 Control Board, Test Points and Alignment Elements



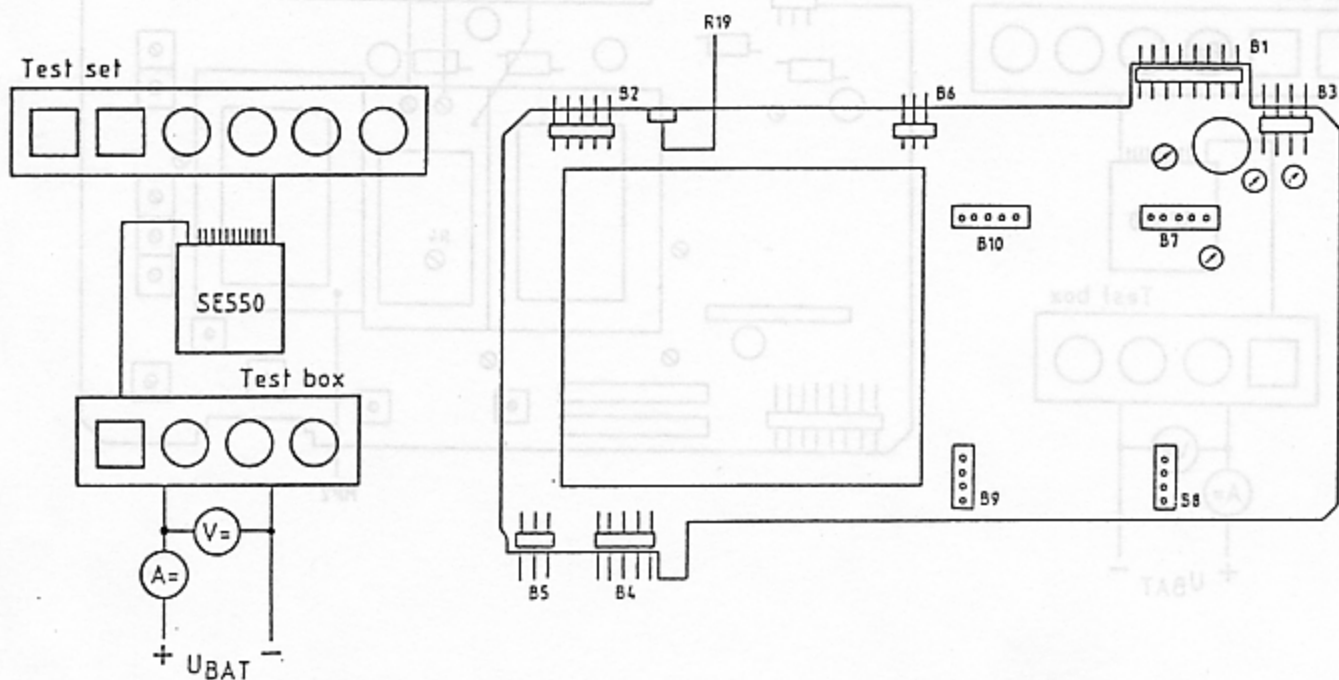
Pin assignment B1		Pin assignment B2		Pin assignment B3		Pin assignment B4		Pin assignment B5		Pin assignment B6		Pin assignment B7	
1	Reserve	1	AF - speaker	1	Ground	1	Reserve	1	AF - option	1	Cloning ON	1	AF - option
2	As	2	AF - speaker	2	DTM	2	As	2	AF - option	2	Cloning TXD	2	AF - option
3	AF In	3	---	3	Clock	3	AF In	3	Micro Ground	3	Cloning RXD	3	Micro Ground
4	HS	4	+ UB	4	Enable RF board	4	HS	4	Micro In	4	Cloning RTS	4	Micro In
5	ST	5	Clock	5	Data - RF board	5	ST	5	Micro Out	5	Cloning CTS	5	Micro Out
6	Emergency call	6	Data - RF board	6	Enable TX	6	Emergency call	6	Pin assignment B8	6	Cloning TX	6	Pin assignment B8
7	+ 9 V	7	Enable TX	7	Enable RX	7	+ 9 V	7	1	7	Enable RX	7	1
8	Microphone	8	Enable RX	8	Data - RF board	8	Microphone	8	2	8	Data - RF board	8	2
9	AF - speaker	9	Data - RF board	9	Enable RF board	9	AF - speaker	9	3	9	Enable RF board	9	3
10	AF - speaker	10	Enable RF board	10	AF - speaker	10	AF - speaker	10	4	10	AF - speaker	10	4
11	Ground earphone	11	Cloning ON	11	Cloning TXD	11	Ground earphone	11	5	11	Cloning TXD	11	5
12	Earphone	12	Cloning TXD	12	Cloning RXD	12	Earphone	12	6	12	Cloning RXD	12	6
13	Ground microphone	13	Cloning RXD	13	Cloning RTS	13	Ground microphone	13	7	13	Cloning RTS	13	7
14	Micro	14	Cloning RTS	14	Cloning CTS	14	Micro	14	8	14	Cloning CTS	14	8
15	---	15	Cloning CTS	15	Ground	15	---	15	9	15	Ground	15	9
16	---	16	Ground	16	Modulator - RF	16	---	16	10	16	Modulator - RF	16	10
			Modulator - RF		AF - disc.				11		AF - disc.		11
			AF - disc.		RSP				12		RSP		12
			RSP		RST1				13		RST1		13
			RST1		Reserve				14		Reserve		14
			Reserve		+ 9 V				15		+ 9 V		15
			+ 9 V		+ UB				16		+ UB		16
			+ UB		Ground						Ground		
			Ground										

**Tuning elements**

R12: Switching threshold of the selcall decoder  
 R19\*: Voltage 9.3 V  
 R65: Deviation  
 R96: Deviation symmetry  
 R111: Tone deviation

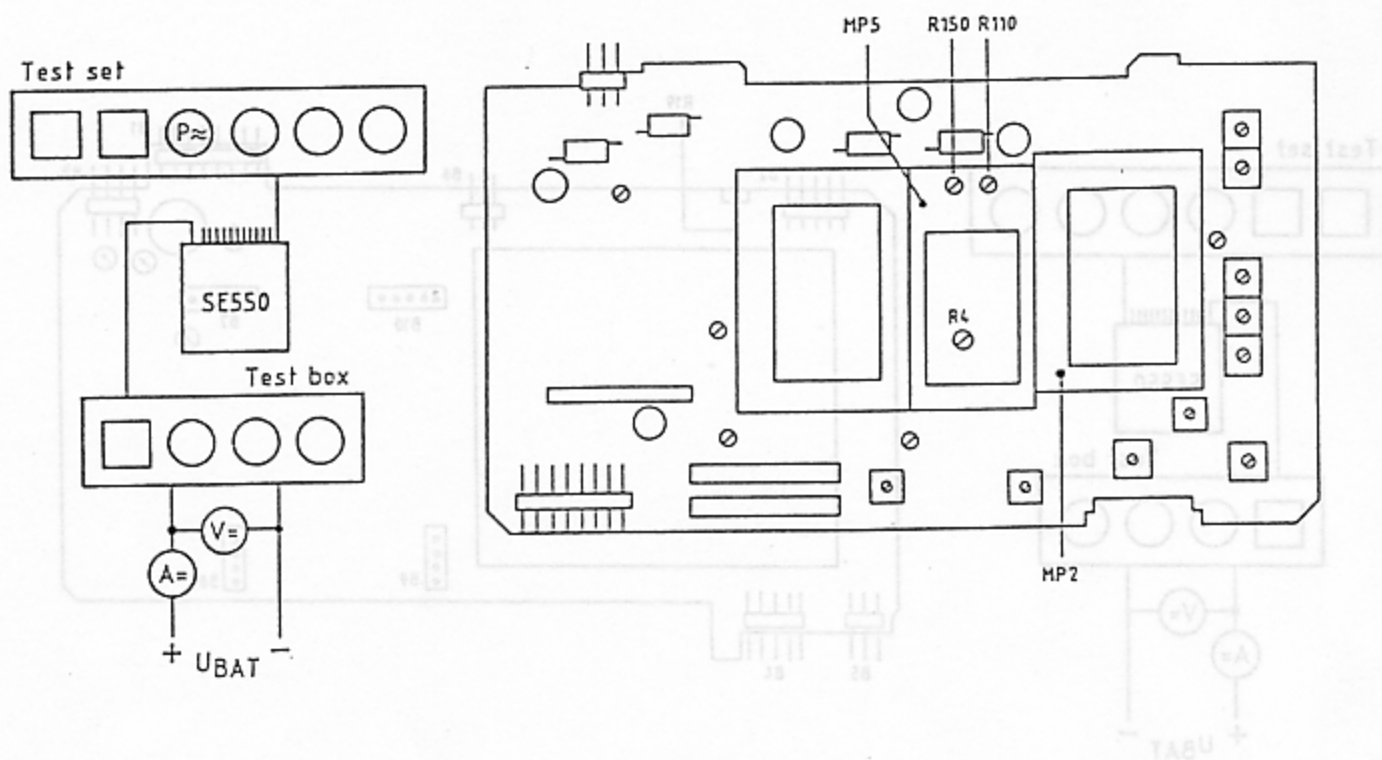
\* R19 is mounted on the stabilizer board.

5.9 Operating Voltage 9,3 V



No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	M	R	Set voltage 9.3 V with R19 on stabilization board. Measure on RF board connector B1	B1/12		9.3 ±0.1 V

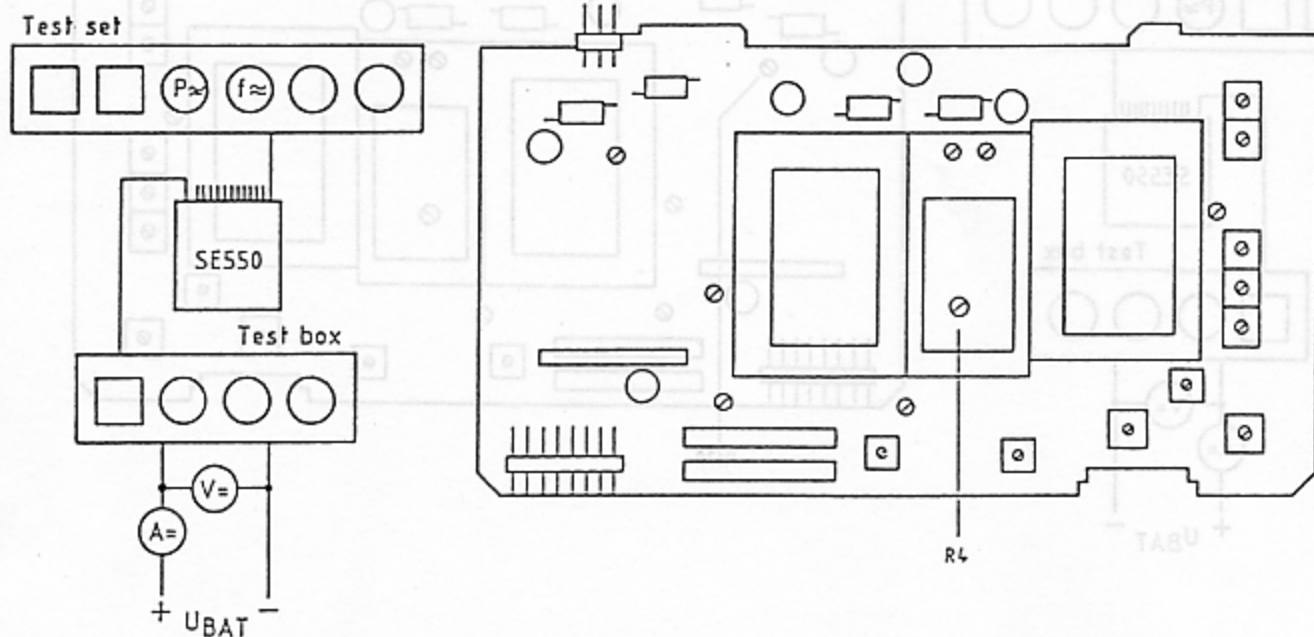
### 5.10 Voltage Controlled Oscillators



No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	L	R	Set control voltage with R110	MP2	UR	5.0 ±0.2 V
2	All	R	Check control voltage for all channels	MP2	UR	3.5...6.5 V
3	L	T	Set control voltage with R115	MP5	UR	5.0 ±0.2 V
4	All	T	Check control voltage for all channels	MP5	UR	3.5...6.5 V

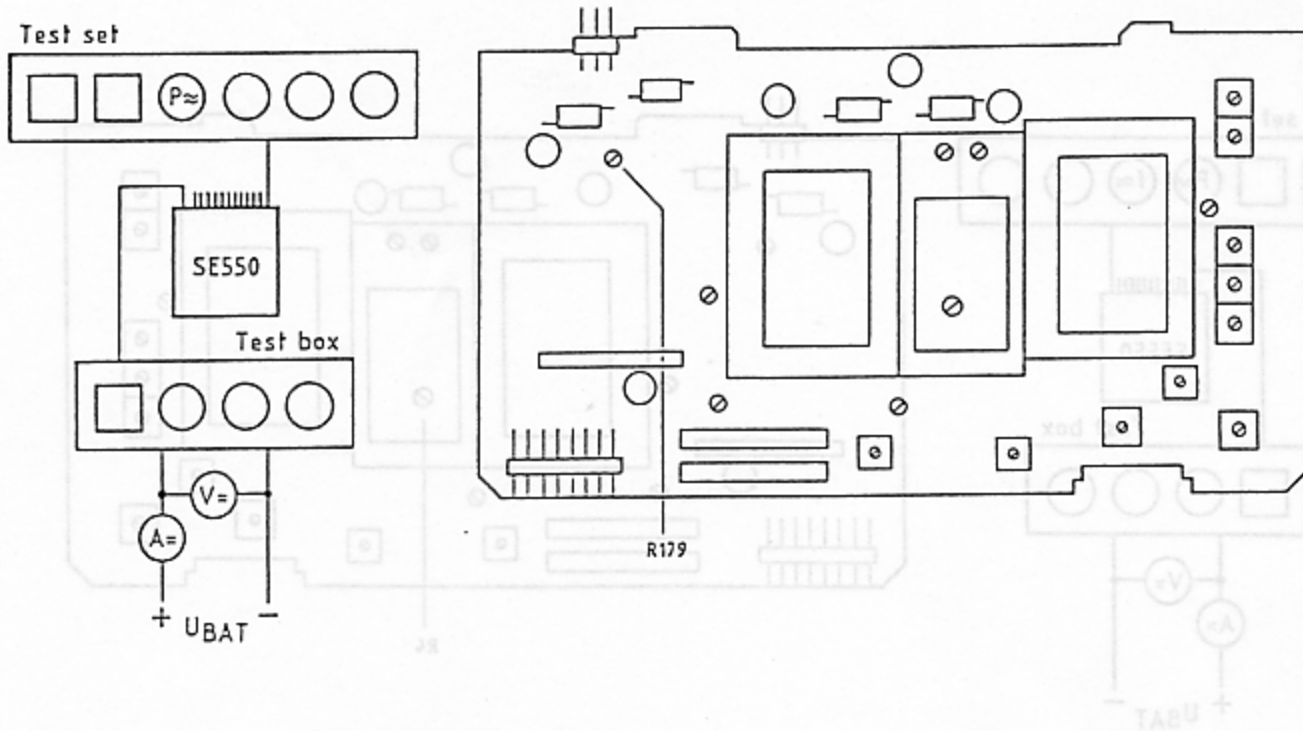


## 5.11 Frequency Setting



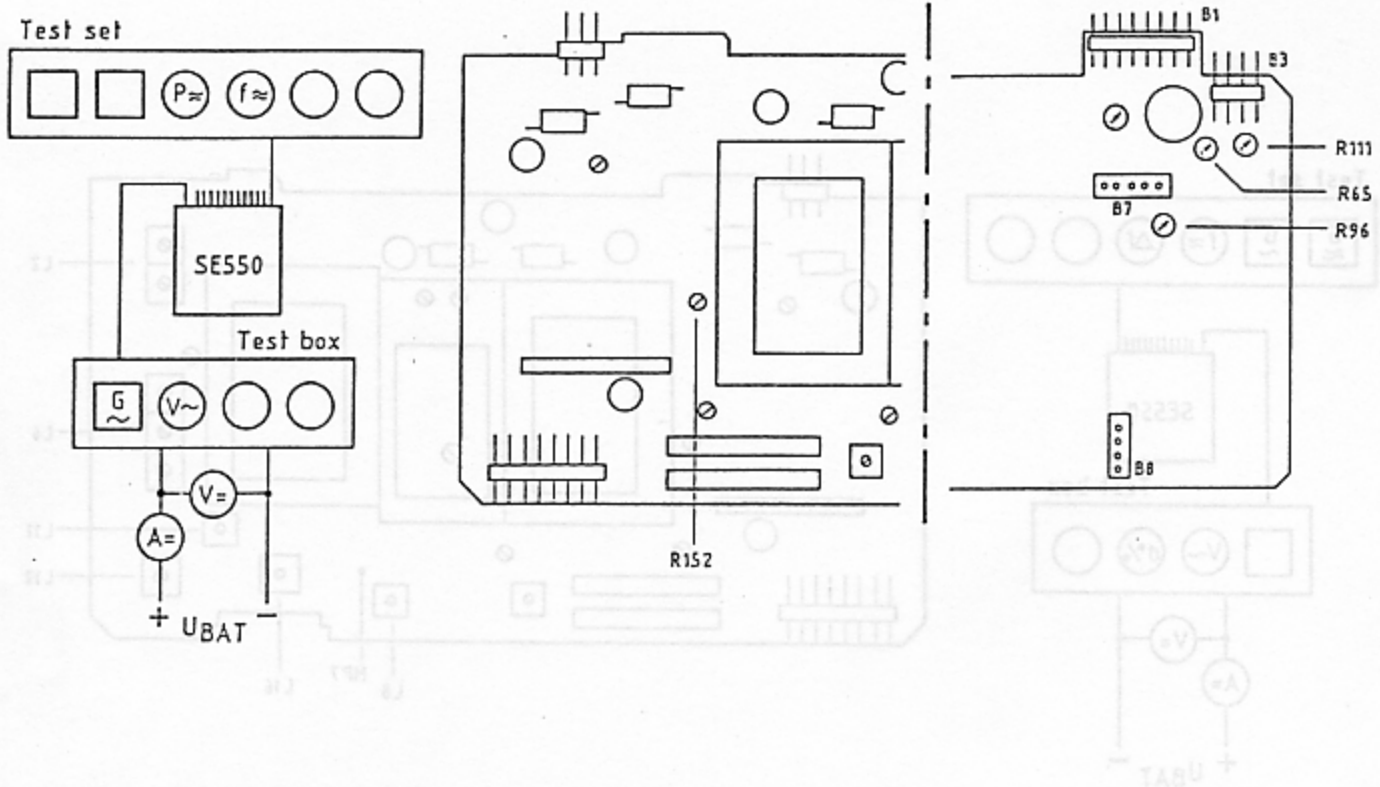
No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	M	T	Set the transmitter frequency f nom. with R4 (TCXO)  <b>NOTE:</b> X102 = BNC connector for antenna	X102		f nom. $\pm$ $\leq 500$ Hz

5.12 Transmission Power



No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1			Adjust the supply voltage to 13.2 V			
2	M	T	Set the transmitter power with R179	X102	Pout	10(25)W ±1.5dB
3	L,M,H	T	Vary the power supply voltage between 10,8 and 15,6 V	X102	Pout	10(25)W ±1.5dB
4	M	T	Measure the reduced output power	X102	Pout	5(1)W ±1.5 dB
			10 W SE 550	X102	Pout	12.5(2.5)W ±1.5 dB
			25 W SE 550	X102	Pout	12.5(2.5)W ±1.5 dB

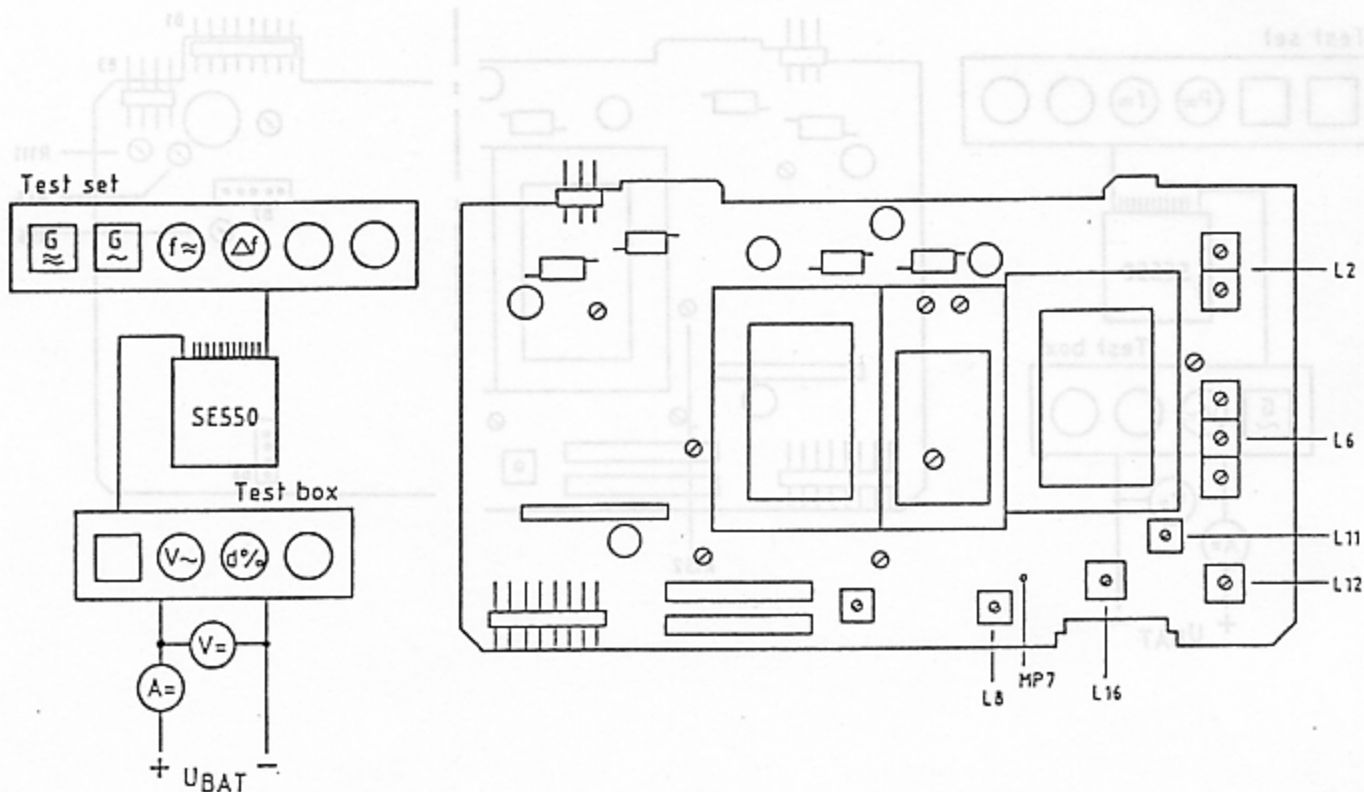
5.13 Modulation



NOTE: BG = control unit

No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1			Feed in modulation signal (Ri = 3 Ω)	BG	MIC	1000 Hz/10 mV
2			Adjust R65 and R111 to medium position			
3	M	T	Set peak deviation Δf max. with R152	X102		Δf = table
4			Feed in modulation signal	BG	MIC	1000 Hz/1 mV
5	M	T	Set nominal deviation Δf nom. with R65	X102		Δf = table
6	M	T	As 1+3, check peak deviation	X102		
7	H,L	T	Check peak deviation referred to channel M	X102		Δ ≤ 100 Hz
8	M	T	Adjust deviation symmetry with R96	X102		Δ ≤ 100 Hz
Channel spacing:	12.5 kHz		Peak deviation: ±1.8...2.5 kHz	Nominal deviation:		±1.3...1.7 kHz
	20 kHz		±3.3...4.0 kHz			±2.2...2.6 kHz
	25 kHz		±4.3...5.0 kHz			±2.8...3.2 kHz

5.14 RF and IF Settings Receiver

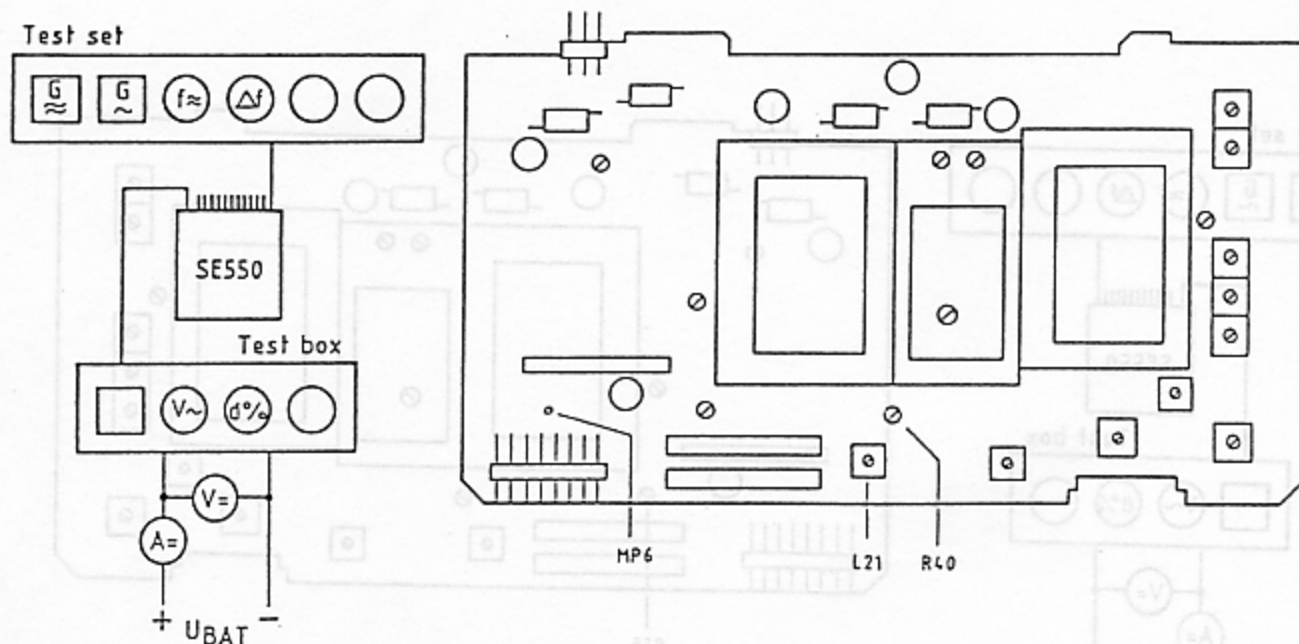


NOTE: BG = control unit

No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	M	R	Wobulate the RF test set. Set the unmodulated receiver frequency	X102		---
2	M	R	Tune RF filter L2, L6, L11 and L18 to maximum level and L12, L16 to minimum ripple	MP7		



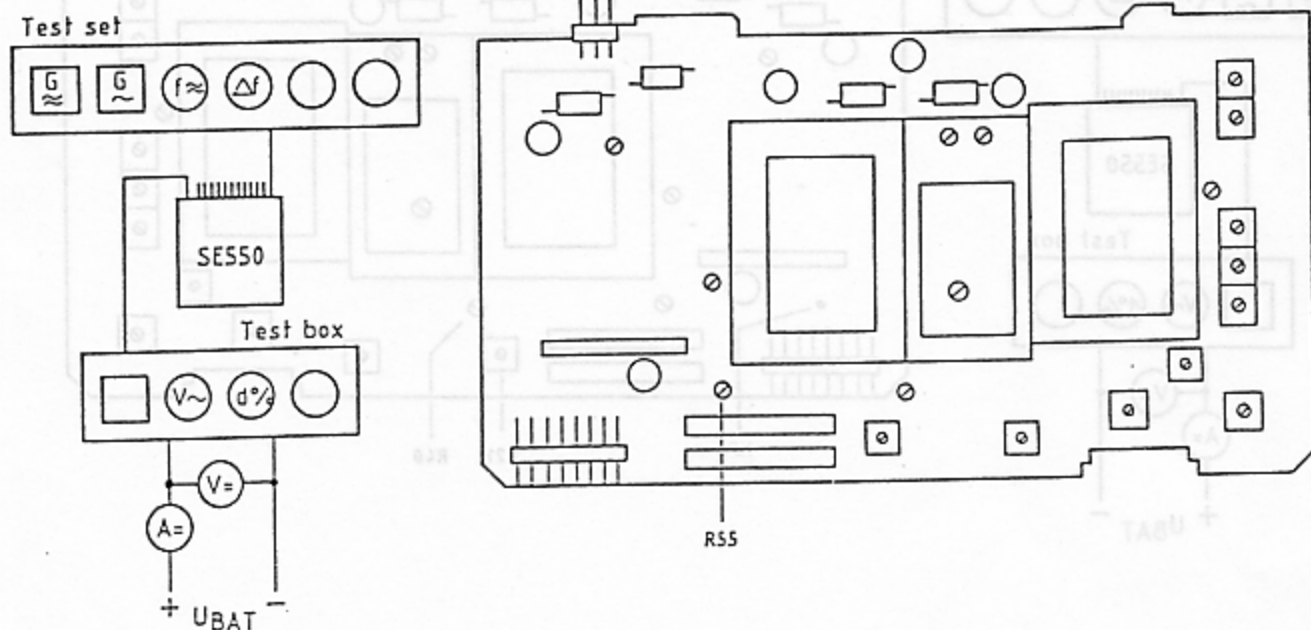
5.15 AF Settings Receiver



Note: PA = Test and connection box PA SE 550

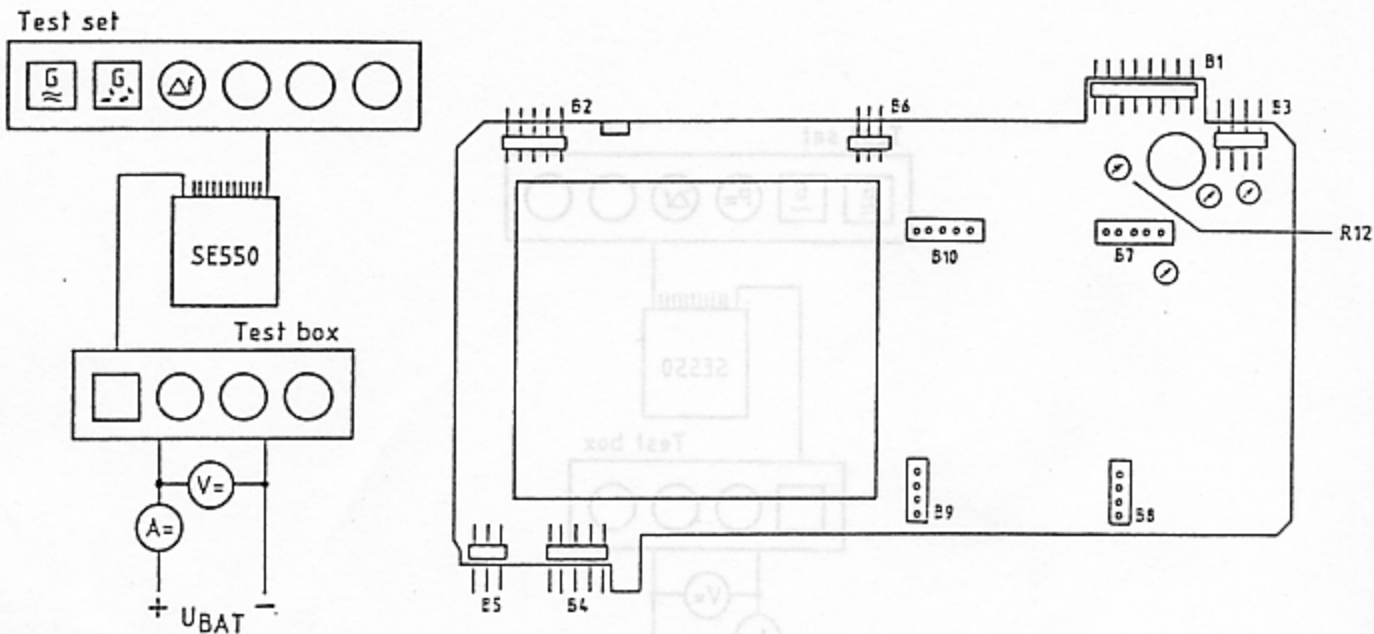
No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	M		Feed in reception frequency, modulation 1000 Hz, $\Delta f = 60\% \Delta f \text{ max.}$	X102		100 $\mu\text{V}$
2	M	R	Tune L21 to maximum AF level	MP6		Maximum
3	M	R	Set AF level with R40	PA	H0	300 mV eff.
4	M	R	Check distortion	PA	H0	$\leq 4\%$

5.16 Sensitivity Check



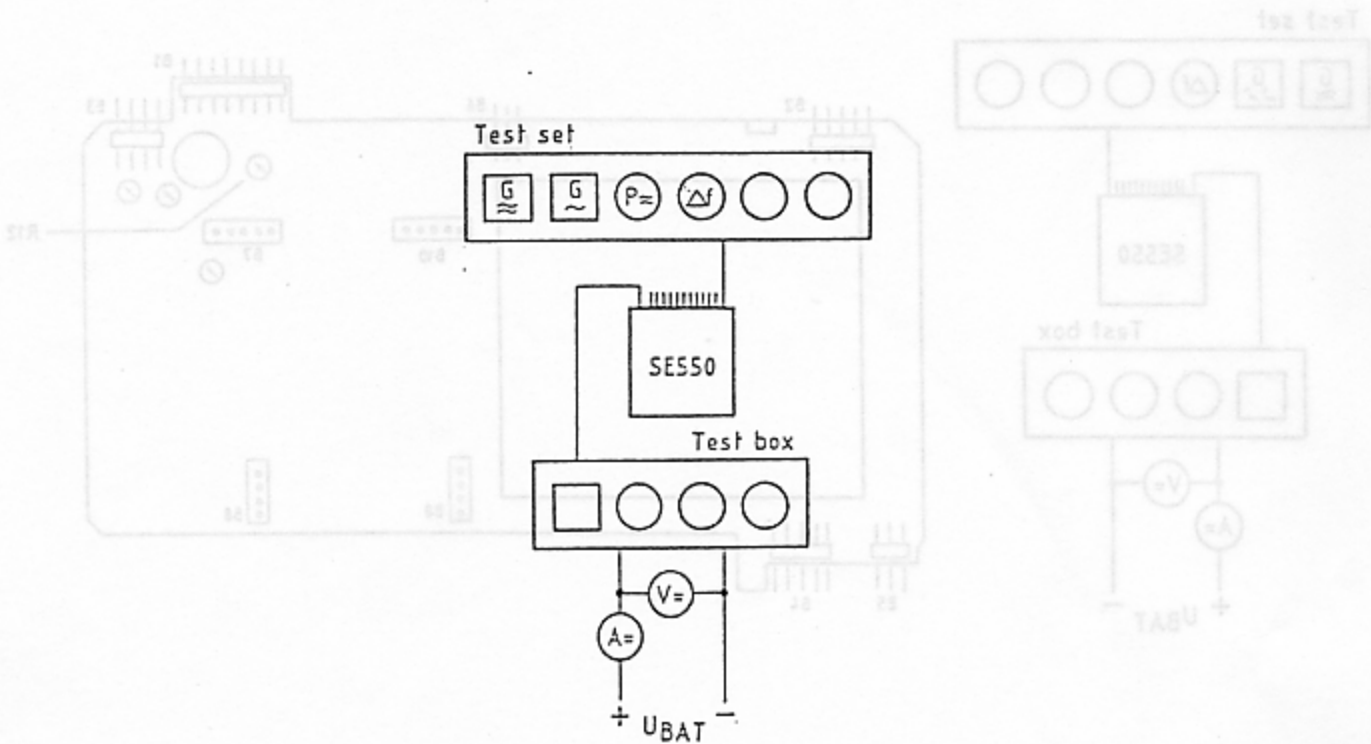
No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1			Feed in reception frequency, modulation 1000 Hz, $\Delta f = 60\% \Delta f \text{ max.}$ Squelch off	X102		0,7 $\mu\text{V}$ EMF (chan. spacing 20/25 kHz) 1,0 $\mu\text{V}$ EMF (chan. spacing 12,5 kHz)
2	All	R	Check S/N ratio	PA	H0	$\geq 20$ dB
3	M	R	Set squelch switching level with R55	PA	H0	19 $\pm 1$ dB (SINAD)
4	M	R	Check switching hysteresis	PA	H0	2...4 dB

5.17 Selective Call, Deviation and Response Threshold



No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	M	R	Feed in reception frequency. Modulate with selective call encoder, code according to decoder	X102		100 $\mu$ V
2	M	R	Set R12 so that decoder responds at $\Delta f$ decoder does not respond at $\Delta f$	X102 X102		$\geq 1$ kHz $\leq 0.4$ kHz
3	M	T	Check selective call encoder deviation*  *The output voltage (and, in consequence, the deviation) is set to a fixed value. If needed, a test PROM containing a single tone encoder may be programmed via IPP at the agency for further tests with selective call	X102		$\geq 80$ % of $\Delta f$

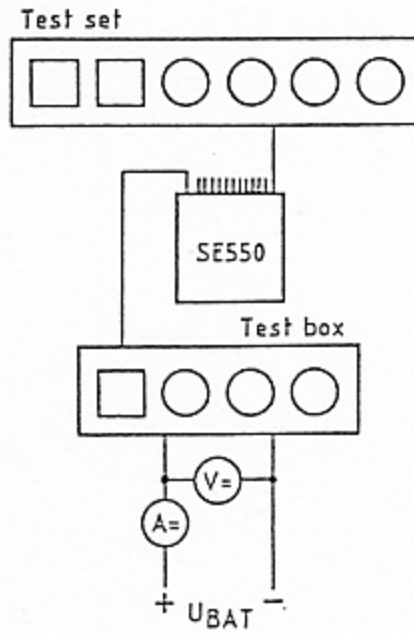
5.18 Tone Squelch, Deviation and Response Threshold



No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	X	T	Select channel with TSQ. Check deviation without modulation signal	X102		approx. 800 Hz
2	X	R	Feed in reception frequency modulated by TSQ frequency. Check whether:  TSQ decoder responds at $\Delta f$ TSQ decoder does not respond at $\Delta f$	X102 X102 X102		100 $\mu$ V  $\geq 400$ Hz $\leq 200$ Hz



5.19 Current Consumption



No.	Chan.	T/R	Setting, alignment, check	Meas. point	Pot.	Set value
1	M	R	Reception, standby	PA		approx. 0.5 A
2	M	R	Reception, squelch open, with modulation	PA		approx. 1.0 A
3	M	T	Transmit 25(10)W	PA		approx. 6(4) A
4			SE 550 switched off	PA		approx. 50 mA