

RADIOSYSTEM

UTVECKLINGS AB

100W Power amplifier units

Documentation

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PA - STAGE 100/20W RS 211

Photo PA + PSU 2

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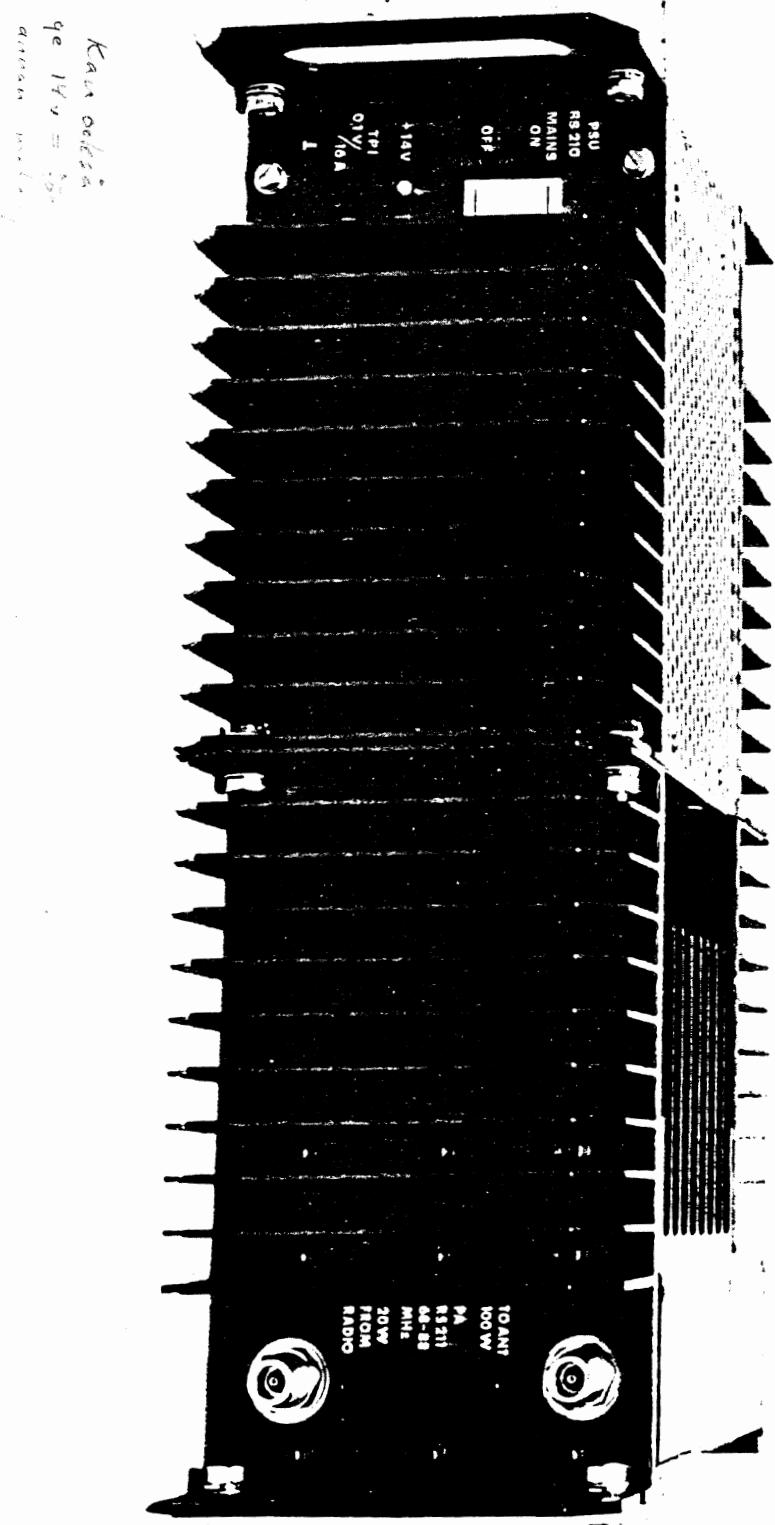
Circuit diagram RS 211 RS 211 01

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4562/o

Specification 100 W Power Amplifiers RS 211, 214, 216, 217, 218.

Modular add-on Power Amplifiers consisting of one PA-module and one companion 220 V/+14 V 19 A PSU-module RS 210. The PA consists of 2 rugged derated push-pull final 80 W transistors with LP-filters and protection in a RFI-screened Al-module with good heat transfer. Capable of continuous operation at max ambient temperature and high SWR. The PA and the PSU, having the same dimensions, are normally mounted together to form a 3e high 200 mm deep 19" unit. The PA can be fed from an external +13.6 V battery, and can as an option be fitted with a Pout monitoring relay, test outputs, or a carrier operated T/R Coaxial by-pass relay for operation at mains failure or with simplex stations. A larger PSU RS 210 A is available which can supply 25 A or 6 A for the Driver and for battery charging.

Model	RS 211	RS 214	RS 216	RS 217	RS 218
1. Frequency range	68 - 88	144 - 174	370 - 425	415 - 470	460 - 512 MHz
2. Output power nom*	80 - 100	80 - 100	80 - 100	80 - 100	80 - 100 W
3. Output power max	120	120	110	110	110 W
4. Input power nom	20	20	7	7	7 W
5. Input power max	25	25	9	9	9 W
6. SWR in	<2 (<3 during faulty antenna)				
7. SWR load	<1.5 normally				
8. SWR protection *	Withstands SWR = ∞ for 24 h at max voltage and temp.				
9. Harmonics	< 2 μ W (-77 dB)				
10. Spurious	<0.2 μ W (-87 dB)				
11. Adj. channel power	<-77 dB				
12. AM-modulation	<3%				
13. Synchronous AM	<1%				
14. Intermod. generation	Δ 3 typ 8 dB, Δ 5 typ 20 dB				
15. Shock resistant	3 x 1000 x 15 g				
16. Temperature range	-25... +55°C ambient				
17. Operation	Continuous 0 - 100% keying				
18. Reflection protection at Pr > 25 W appr -3 dB Po					
19. Temperature " at ths > 80°C appr -3 dB Po					
20. Output indication	Green LED > 50 W = option -1 Relay closure > 50 W = option -2				
21. Test output	via 8 pin socket to +100 μ A 2 k Ω instr. = option -3				
22. Coaxial by-pass	at Pin < 0.25 x nom = option -5				
23. Mains voltage	220 V \pm 10% 47 - 63 Hz				
24. " current	typ 2 A max 3 A RMS				
25. " fuse	\geq 6 AT				
26. " connector	CEE type 22/VI male				
27. " isolation	2000 V				
28. " RFI	VDE 0875 curve N -12 dB				
29. " indication	Yellow LED > +10 V DC				

X) Dependent on supply voltage

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30.	PSU current limit	20 A, fold back to 10 A
31.	OVP protection	>16 V
32.	PA voltage	+14 V nom (+10.8... +15.6 V)
33.	PA current typ/max	16/19 16/19 16/19 16/19 16/19 A
34.	MTBF expected	> 20 000 h
35.	Dimensions	W = 19" = 482 mm with brackets H = 3e = 130 mm D = 200 + 70 mm Weight = 14 kg complete
36.	IN OUT Connectors	Typ NF 50 ohm

Requirements applicable for Driver:

- 4.
- 5.
- 6.
9. < 20 mW
10. inband < 0.04 µW, out of band < 0.2 µW
11. < -71 dB

100/20W POWER AMPLIFIER RS 211

INTRODUCTION

The Power Amplifier contains the PC - card PC 211. As an option the Coaxial By - Pass Relay RS 220 and the Relay Card PC 221 can be mounted.

The required +14V DC is normally supplied by the companion PSU RS 210.

The two RF transistors are mounted with a thin layer of thermal grease to the solid aluminium chassis that is provided with several large convecting fins. With a +14V DC input, approximately 15A is drawn which means that $210 - 100W + 20W = 130W$ is dissipated, without the need for forced ventilation.

The cover is screw sealed to be dust and RFI tight. The +14V input and alarm outputs are all RFI screened to reduce radiation into nearby receivers. The amplifier is fitted with a reflection protection output that will reduce the +14V DC a few volts in case of a high antenna SWR above 1.5.

OPERATION

Any component exchange or soldering on the strip line final amplifier card should be avoided as special precautions as type of solder melting temperature, heat permitted and the mechanical stress and exact positioning of the capacitors and transistors require special training for a proper result.

A unit or PC - Card replacement is instead recommended in the field, if a fault has been localized with input power on and from conclusion of the output power and instrument readings.

If the nominal input power drops more than -2dB below nominal the power gain of the transistors in class B is nonlinear and at a certain level will drop low suddenly. In this transition region some unstability will occur, generating sidebands and it is not recommended to operate below 60W and above 120W output power. Never should the specified maximum input power be exceeded.

When mounting a 100W power amplifier and its PSU in a cabinet, do not cover the air convecting around its all cooling fins. In a 19 inch cabinet leave 1 free and open air space of 44,45mm below, above and behind the unit so that cooling air can pass freely.

If more than 5 channels of 100W are mounted in a 19 inch cabinet with almost continuous operation, a thermostat controlled fan starting at + 40°C should be used.

AMPLIFIER CARD PC 211 100/20W 68-88MHz

The input power is amplified in push-pull in 2 identical transistors. The two 80W rated transistors are normally only driven to 50W to give a total of 100W output and are thus operating well below maximum ratings of collector current and junction temperature. The transistors operate with base and emitters DC - grounded, mounted to a PTFE dielectric strip-line PC - Card.

The maximum permitted collector junction temperature is 200°C, and the thermal resistance j-c is 1.25 °C/W. This means that at a flange temperature of 100°C a maximum dissipation of 80W is permitted per transistor. The transistors are designed to withstand short periods of high SWR. If the high SWR should remain it is necessary to reduce the supply voltage or drive level via the reflection protection sensed at the amplifier output.

The input impedance of the input Balun is broadbanded and input matched by C3,C4 and C1,C2,L2. The 50 ohm termination R1 fed through L1 matches and dissipates a part of the nominal 20W input power at the low frequency high gain end of the input. Also resistors R2,R3 slightly reduce the gain and maximum output power.

The first section of the Balun consists of a short length λ_1 of 50 ohm rigid line whose outer conductor is grounded at the input side. The outer conductor presents a high inductive impedance seen at the output, this impedance is further increased by resonance of C2. λ_2 and λ_3 are series fed in 180° phase opposition and each consists of 25 ohm transforming lines slightly shorter than 90°. The output impedance at each half is thus 6,25 ohm or 12.5 ohm together.

The transistor input impedance is 0.3 - j0.4 ohm. The first element of the base impedance transformation to 6.25 ohms is Rb+Lb+L4. The second element is shunt mica capacitors C9,C10. The third series element is the series inductance L3. The fourth element is shunt capacitor C8. Capacitor C7 is a strip line mica capacitor blocking the base bias. The two wide emitter leads of the strip line flanged transistors are fed to the lower ground plane of the strip line PC - Card via short copper straps. The locations of the symmetrical base C9, C10 and the collector C13, C14 first transformation capacitors are very important with a tolerance of $\pm 0.5\text{mm}$.

The transistor gain at low frequencies (0.5 - 10 MHz) is quite high and resistive damping is used to reduce the generation of oscillating side bands at changing load and drive conditions of the transistor.

The base side is damped by R8 + L20. The collector load is damped by R10,L23. Low frequency feed-back is provided by C12,R6. The +14V supply is decoupled at low frequencies by the capacitors C38,C37.

The collector RF - current is appr. 9,1A RMS so resistive losses must be short and minimal in C13 and C14 as well as in L5. The output coupling capacitor C16 carries 2,8A RMS and is less critical.

The collector current of each individual transistor as drawn from the +14V supply can be measured across the 0,025 ohm R12 resistor on TPIC1 which reads -0,200V at 8A DC.

The output collector transformation up to 6,25 ohms is also of the LP - type with 4 Tchebyscheff sections for flat wide band matching from 0,6 + j 0,4 ohms optimum collector load impedance. The first element is RL + Cc + Lc of the transistor collector plus L5. The second element is the shunt capacitors C13,C14. The third element is the series inductance L6. The fourth element is the shunt capacitor C15.

The two amplified powers are 180° series connected via the output Balun transformer consisting of the 25 ohm lines λ4, λ5 and the 50ohm line λ6. As the lines are shorter than 90°, the capacitors C17 and C18 increase the impedance and improve the balance.

Immediately after the output Balun, a soldering link is available at 50 ohms that enable factory fine tuning of the inductors of the LP - filter setting attenuation and SWR.

Output LP - filtering is done in the 9 section derived LP - filter consisting of L11,12,13,14,15,16,17,18 and C39,40,41,42. Three attenuation peaks are provided by L13 C40, L15 C41, and L17 C42 at 150, 135 and 230 MHz respectively. The second harmonics at 136 to 176 MHz are here attenuated >55dB and >53dB up to 600 MHz for higher order harmonics. In the pass-band the input reflection is < 26dB which corresponds to an input SWR of < 1,10

After the LP - filter there are 2 directional coupling loops that each senses -31 dB of the Forward respectively Reflected output powers, which are then detected in diodes Z1 and Z2. R14,C43 terminate the coupled loops and determine the directivity (~20 dB). Coupling flatness versus frequency is compensated for by C44. Two independent outputs are available with an EMF of +3 VDC at 100W to J6 -5,4 and J6 -1,2 to drive both +100uA instrument test points and level alarms.

SERVICING RS 211

The following instruments are recommended at centralized complete maintenance.

- 1 Directional power meter for measurement of drive power and input reflection.
Type Bird 43 with probes.
- 2 Output power meter and 150W load.
Type Bird 6156.
- 3 Signal generator and power amplifier continuously covering the full bandwidth and power up to the maximum specified input power.
Type hp 8640 + Motorola modules.
- 4 Spectrum analyzer for stability checking
Type hp 8558B
- 5 Network analyzer for passively checking or aligning the output LP - filter attenuation and SWR
Type hp 8505A
- 6 Bi-Directional coupler for sweeping input power and reflection.
Type Narda 3020A
- 7 Coaxial cables RG 214, power attenuators and transitions.
- 8 Coaxial load SWR = 1,5 consisting of several meters of RG 213 providing a forward attenuation of 7dB and a return loss of 14dB giving a 1,5 SWR load with varying phases.
- 9 DC - instruments 100uA, 2 off for measuring collector currents at the current test points.
- 10 Digital multimeter for DC - measurements (RF insensitive)
- 11 Adjustable power supply 0 - 15V
0 - 20A DC. With current limit.

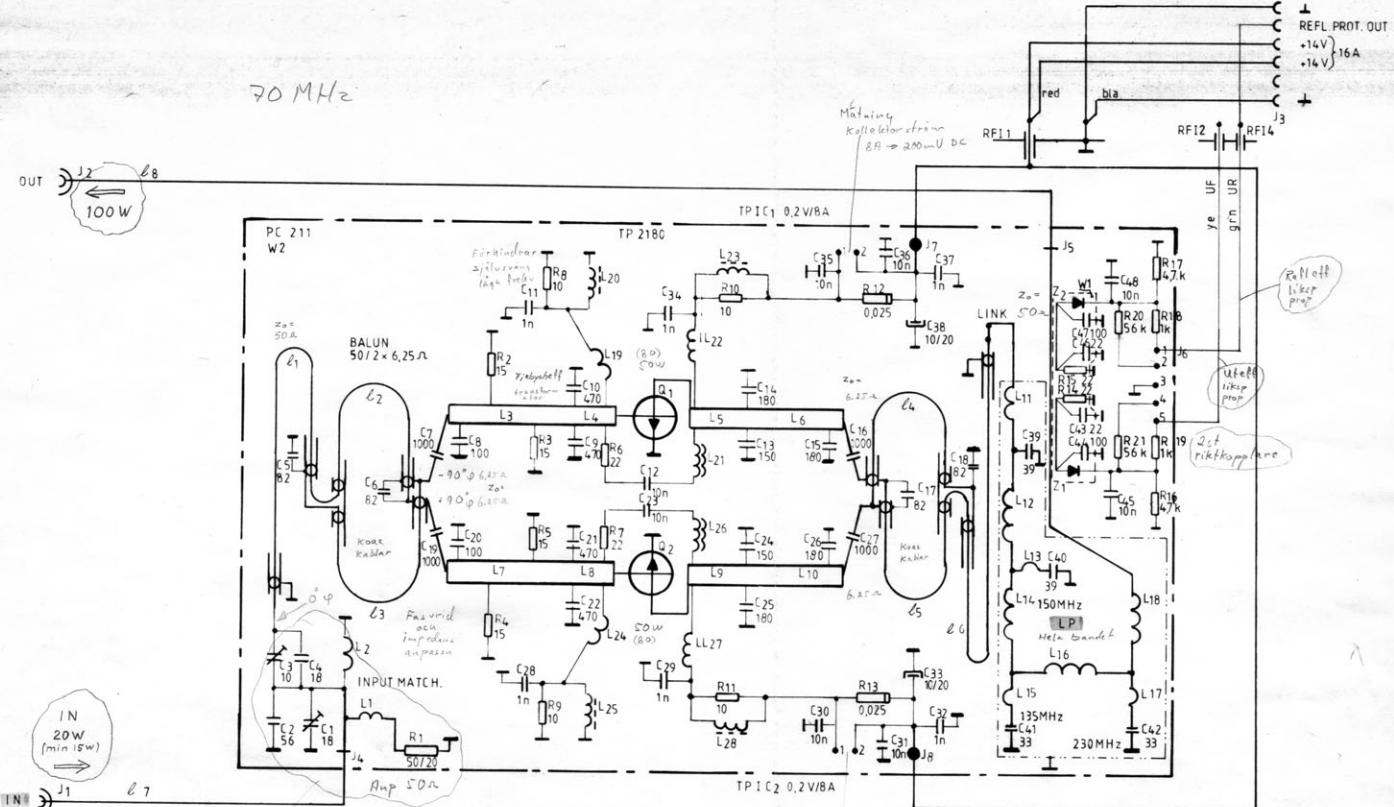
TUNING PROCEDURE

- 1 If not enough instruments are available, simplified measurements can be carried out on the normal operating frequency with the actual driver.
- 2 If the PA is fitted with the coaxial by-pass relay RS 220, it must first be removed.
- 3 Check that the transistor screws are firmly secured.
- 4 Connect 100 uA instruments to the TPIC1 and TPIC2 sockets.
- 5 Remove the socket to J6 during tuning.
- 6 Connect a 150W power meter and load close to the output.
- 7 Connect a driver with nominal power via a directional power meter and the Narda BI - directional coupler.
- 8 Tune C1 and C3 for best input return loss over the band (< -10 dB).
- 9 Check the output power across the band at 15 - 20W input.
If the output at 68 MHz is too low, fine tune C3.
- 10 Connect the 1,5 SWR cable load and the adjustable power supply.
Sweep the band and check stability with the supply 14,5... 10,8 V.
Do not sweep outside the band.

- 11 Check the output reflection detector with the 1,5 SWR load and J6 removed, that the UR voltage is + 0,7...1,0V across the band.
- 12 Check with 1,0 load and 100W output that UR does not exceed 0,5V across the band.
- 13 Connect J6 and check that the +14V from the PSU regulates down when the RF - load is removed..
- 14 Also check that the PA restarts with the mains switch or when the drive is quickly removed and applied.
- 15 Remount the Coaxial Relay if used. Specially check that the short coaxial cable at the relay output not is twisted or hurt or that any cables are in contact with RF points on the PC. Check that the baluns are free around C5 and C18.
- 16 At a replacement of transistor, mica capacitor or coils it shall be soldered with type 96/4% Pb/Ag (melting temperature of 235°C)
- 17 At a replacement of transistor a thin layer of silicon grease compound shall be used. Screw mount the transistor to the chassis before soldering. If the PC card has been removed, check that the flanged resistor and the transistors are tightly screwed to the cooler.
- 18 After a possible replacement of the coaxial cables λ7 or λ8, the thru-plating on the PC card must be reassured by a tubular rivet which is soldered on booth sides of the PC card before the cable is mounted again.
- 19 After any repair in the LP-filter, the input SWR and harmonic attenuation shall be checked at the link point to have a return loss <-26dB.
- 20 The current unbalance in normal operation should be below 3A.
Any collector current should never exceed 9A.

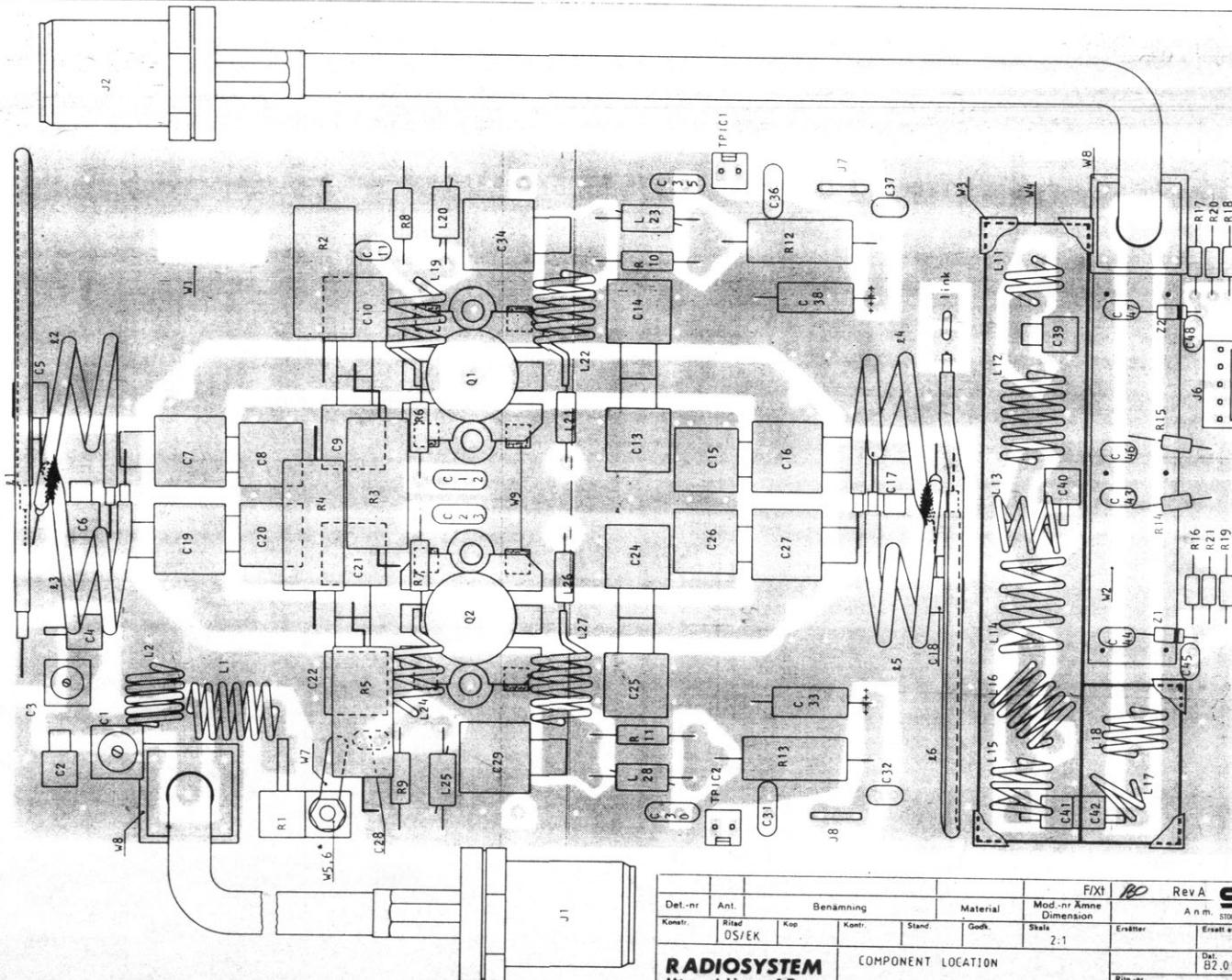
TYPICAL TEST DATA

	68	78	88	MHz
Output Power at 15W in	90	98	84	W
IC 1	6,6	6,5	6,4	A
IC 2	6,0	6,4	5,0	A
Output Power at 20W in	95	110	95	W
IC 1 (<9A)	7,4	7,0	6,8	A
IC 2 (<9A)	6,6	7,0	5,2	A
Input reflection (<-10dB)	-14	-18	-14	dB
UF at 100W (2,75±0,5V)		3,2		V
UR at 1,0 SWR (<0,5V)		0,3		V
UR at 1,5 SWR (0,7...1,0V)		0,7		V
Stability SWR = 1,5 +14V 15...20W				ok
Stability SWR = 1,5 +10,8V 15...20W				ok
Voltage reduction of PSU at SWR = ∞				ok
Visual inspection + screws secured				ok



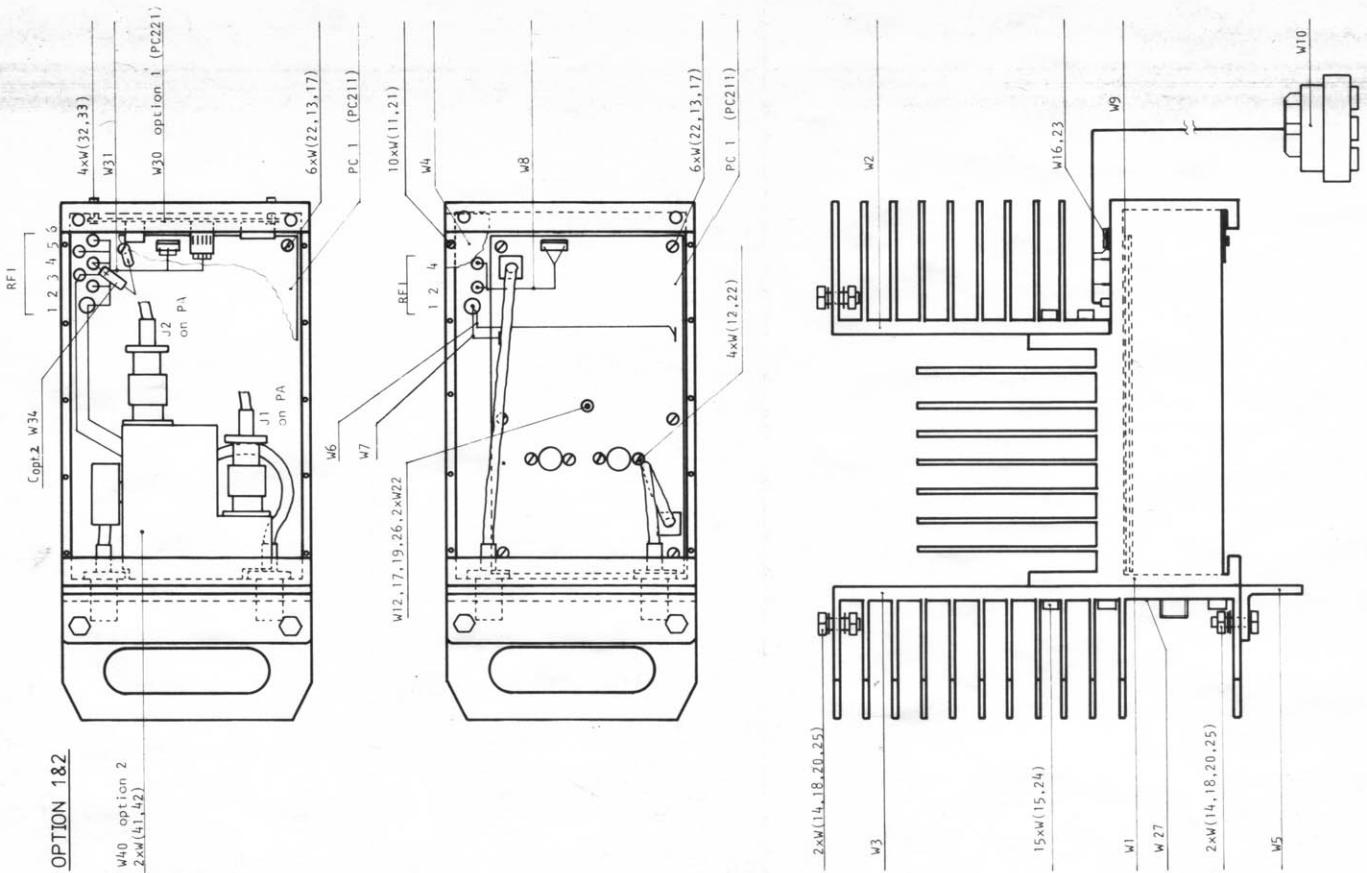
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RADIOSYSTEM Utvecklings AB Stockholm						Dat	82 01 29						
Nr Ant	Ändring och/eller medd.-nr	Datum	Inf.	Godk.	Nr Ant	Ändring och/eller medd.-nr	Datum	Inf.	Godk.	Rit.-nr	F/xt	RS 211	RS 211 01

* tas bort vid montering i chassie



Det.-nr.		Ant.		Benämning		Material	Mod. nr & Ämne	F/Xt	Rev A	SRA
Konstr.	Ritad	OS/EK	Kop.	Konstr.	Stand	Godk.	Dimension			STOCKHOLM SWEDEN
							2-1			
RADIOSYSTEM Utviknings AB Stockholm										
COMPONENT LOCATION										
PC 211										
F/Xt RS 211 05										

OPTION 182



SRA
Stockholm-Sweden

F/Xt BO Rev A

Dat.

62.01.22

Ritn.-nr

Det.-nr	Ant.	Benämning		Material	Mod.-nr Amme Dimension	An m.			
Konstr.	Rifad	OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utviklings AB Stockholm							1:2		
COMPONENT LOCATION									
PA-100/20W 68-88 MHz									
RS 211								F/Xt RS 211 04	

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	God
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP	
Qty	Item	Component	Value	tol.	Manufact.	Type			
1	RFI 1	Filter	25A		Eire	1202-052			
2	RFI 2	"	5A		Ferroperm	9/0168.62			
	RFI 4	"	5A		"	9/0168.62			
1	PC 1	PA-board assy.			RS	PC 211			
1	W1	Chassie, body			RS	RS 211 08			
1	W2	Cooler, rear			RS	RS 211 07			
1	W3	" , front			RS	RS 211 06			
1	W4	Cover plate			RS	RS 211 12			
1	W5	Mounting support			RS	RS 210 10			
1	W6	Cable			RS	RS 211 23			
1	W7	"			RS	RS 211 23			
1	W8	Cabling set, internal			RS	RS 211 23			
1	W9	Insulating disk			RS	RS 211 22			
1	W10	Cabling set, external			RS	RS 211 24			
10	W11	Screw	ECS M2,5x6						
5	W12	"	ECS M3x6						
6	W13	"	ECS M3x10						
4	W14	"	M6S 6x20						
15	W15	"	MC6S 6x12						
1	W16	"	ECS M4x6						
7	W17	Crimp nut	M4		USM				
4	W18	Nut	M6M 6						
1	W19	Washer	BRB 0,5x3,5x7,5						
4	W20	"	BRB 1,7x6,5x12						
10	W21	Spring washer	SCHNORR 2,7						
12	W22	" "	SCHNORR 3,2						
1	W23	" "	SCHNORR 4,3						
15	W24	" "	SCHNORR 6,3						
4	W25	" "	FBB 1,5x6,5x12						
1	W26	Hexagonal spacer	M3 45mm		BIX Enint				
1	W27	Panel text			RS	RS 211 29			

SRA

F/Xt *BO* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad	Kop.	Kontr.	Stand.	Göck.	Skala	Ersätter	Ersatt av	
	OS/EK								
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								F/Xt RS 211 02	

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STOCKHOLM · SWEDEN

F/xt *10* Rev A STOCKHOLM · SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	A n m.	
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RADIOSYSTEM Utvecklings AB Stockholm	OS/EK						Blad 2:2	Dat. 82. 03. 08
STYCKLISTA PA 100/20W 68-88MHz RS 211			Parts List			Ritn.-nr F/Xt RS 211 02		

RADIOSYSTEM

Utvecklings AB
Stockholm

STYCKLISTA Parts List
PA 100/20W 68-88MHz
RS 211

Blad 2:2

Dat 82. 03.08

Ritn.-nr

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	God.
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP		
Qty	Item	Component	Value	tol.	Manufact.	Type				
1	R1	Resistor, RF	50Ω	20W	Pyrofilm	PPT 515-20-3,50				
4	R2	" , carbon	15Ω	2W	AB	HB				
	R3	" "	15Ω	2W	AB	HB				
	R4	" "	15Ω	2W	AB	HB				
	R5	" "	15Ω	2W	AB	HB				
2	R6	" "	22Ω	0,5W	AB	EB				
	R7	" "	22Ω	0,5W	AB	EB				
4	R8	" "	10Ω	0,5W	AB	EB				
	R9	" "	10Ω	0,5W	AB	EB				
	R10	" "	10Ω	0,5W	AB	EB				
	R11	" "	10Ω	0,5W	AB	EB				
2	R12	" , wire-wound	0,025Ω 5%		Vitrohm	350-8L				
	R13	" "	0,025Ω 5%		"	"				
2	R14	" , metal	22Ω	1%	Resista	MK 2				
	R15	" "	22Ω	1%	"	"				
2	R16	" "	4K7Ω	1%	"	"				
	R17	" "	4K7Ω	1%	"	"				
2	R18	" "	1KΩ	1%	"	"				
	R19	" "	1KΩ	1%	"	"				
2	R20	" "	56KΩ	1%	"	"				
	R21	" "	56KΩ	1%	"	"				
1	C1	Capacitor, trimmer	18pF		Ph	2222 809 09003				
1	C2	" , mica	56pF	2%	Jahre	49.43	250V			
1	C3	" , trimmer	10pF		Ph	2222 809 05002				
1	C4	" , mica	18pF	±1	Jahre	49.43	250V			
4	C5	" "	82pF	±2	"	"	"			
	C6	" "	82pF	±2	"	"	"			
6	C7	" "	1000pF	10%	Unelco	J101				
2	C8	" "	100pF	2%	Jahre	49.53	500V			
4	C9	" "	470pF	2%	"	"	"			
	C10	" "	470pF	2%	"	"	"			
4	C11	" , ceramic	1nF		Ph	2222 630 01102				
8	C12	" "	10nF		"	2222 640 02103				
					F/Xt	BO	Rev A			
Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.		
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skaia	Ersätter	Ersatt av		
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA PC 211				Parts List		Blad	Dat 82.01.13	
								Ritn.-nr		
								F/Xt	RS 211 03	

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	God
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP		
	Otv	Item	Component		Value	tol.	Manufact.	Type		
	2	C13	Capacitor, mica		150pF	2%	Jahre	49.53	500V	
	4	C14	" "		180pF	2%	" "	" "	"	
		C15	" "		180pF	2%	" "	" "	"	
		C16	" "		1000pF	10%	Unelco	J101		
		C17	" "		82pF	2%	Jahre	49.53	250V	
		C18	" "		82pF	2%	" "	" "	"	
		C19	" "		1000pF	10%	Unelco	J101		
		C20	" "		100pF	2%	Jahre	49.53	500V	
		C21	" "		470pF	2%	" "	" "	"	
		C22	" "		470pF	2%	" "	" "	"	
		C23	" , ceramic		10nF		Ph	2222 640 02103		
		C24	" , mica		150pF	2%	Jahre	49.53	500V	
		C25	" "		180pF	2%	" "	" "	"	
		C26	" "		180pF	2%	" "	" "	"	
		C27	" "		1000pF	10%	Unelco	J101		
		C28	" , ceramic		1nF		Ph	2222 630 01102		
		C29	" , mica		1000pF	10%	Unelco	J101		
		C30	" , ceramic		10nF		Ph	2222 640 02103		
		C31	" "		10nF		"	"	"	
		C32	" "		1nF		"	2222 630 01102		
	2	C33	" , tantal		10µF	20V	Kemet	T110 B106 M02AS		
		C34	" , mica		1000pF	10%	Unelco	J101		
		C35	" , ceramic		10nF		Ph	2222 640 02103		
		C36	" "		10nF		"	"	"	
		C37	" "		1nF		"	2222 630 01102		
		C38	" , tantal		10µF	20V	Kemet	T110 B106 M02AS		
	2	C39	" , mica		39pF	±1	Jahre	49.43	250V	
		C40	" "		39pF	±1	"	" "	"	
	2	C41	" "		33pF	±1	"	" "	"	
		C42	" "		33pF	±1	"	" "	"	
	2	C43	" , ceramic		22pF	NPO	Ph	2222 631 10229		
	2	C44	" "		100pF		"	2222 631 58101		
		C45	" "		10nF		"	2222 640 02103		
		C46	" "		22pF	NPO	"	2222 631 10229		
		C47	" "		100pF		"	2222 631 58101		
							F/Xt	BO	Rev A	SRA
	Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
	Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skaia	Ersätter	Ersatt av	
Océ 7361-44	RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA			Parts List			Blad 2:4	Dat. 82.01.13
SMS 687 1.11	PC 211								Ritn.-nr	
									F/Xt	RS 211 03

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Godk.
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP	
Qty	Item	Component	Value	tol.	Manufact.	Type			
	C48	Capacitor, ceramic	10nF		Ph	2222 640 02103			
	1	L1	Coil	Ø 5 n=6	RS	RS 211 25			
	1	L2	"	Ø 5 n=4	RS	RS 211 25			
	L3	Printed coil							
	L4	" "							
	L5	" "							
	L6	" "							
	L7	" "							
	L8	" "							
	L9	" "							
	L10	" "							
	1	L11	Coil	Ø 5 n=2	RS	RS 211 25			
	1	L12	"	Ø 6 n=6	RS	RS 211 25			
	1	L13	"	Ø 5 n=3	RS	RS 211 26			
	2	L14	"	Ø 6 n=5	RS	RS 211 26			
	2	L15	"	Ø 6 n=3	RS	RS 211 26			
	L16	"		Ø 6 n=5	RS	RS 211 26			
	1	L17	"	Ø 5 n=1	RS	RS 211 26			
	L18	"		Ø 6 n=3	RS	RS 211 26			
	2	L19	"	Ø 5 n=3	RS	RS 211 27			
	4	L20	Inductor, Fe		Ph	4312 020 36690			
	2	L21	" , RFC	0,1µH	Dale	IM 2			
	2	L22	Coil	Ø 5 n=5	RS	RS 211 27			
	L23	Inductor, Fe			Ph	4312 020 36690			
	L24	Coil		Ø 5 n=3	RS	RS 211 27			
	L25	Inductor, Fe			Ph	4312 020 36690			
	L26	" , RFC		0,1µH	Dale	IM 2			
	L27	Coil		Ø 5 n=5	RS	RS 211 27			
	L28	Inductor, Fe			Ph	4312 020 36690			
	2	ø1	Rigid line		RS	RS 211 17			
	2	ø2	" "		RS	RS 211 18			
	2	ø3	" "		RS	RS 211 19			

F/Xt *EO* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad	Kop.	Konfr.	Stand.	Godk.	Skala	Ersätter	Ersatt av	
	OS/EK								
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA PC 211						Blad 3:4	Dat 02.01.13
		Parts List						Ritn.-nr	
								F/Xt RS 211 03	

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SRA

F/Xt *BO* Rev A STOCKHOLM · SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	A n m.	
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm	STYCKLISTA PC 211	Parts List			Blad 4:4	Dat. Ritn.-nr F/Xt RS 211 03	82 03.08	

Océ
7361-44

PA - STAGE 100/20W RS 214

Photo PA + PSU	See RS 211	
Specification	2	
Description	4	
Circuit diagram	RS 214	RS 214 01
Component location	RS 214	RS 214 04
" "	PC 214	RS 214 05
Parts list	RS 214	RS 214 02
" "	PC 214	RS 214 03

Specification 100 W Power Amplifiers RS 211, 214, 216, 217, 218.

Modular add-on Power Amplifiers consisting of one PA-module and one companion 220 V/+14 V 19 A PSU-module RS 210. The PA consists of 2 rugged derated push-pull final 80 W transistors with LP-filters and protection in a RFI-screened Al-module with good heat transfer. Capable of continuous operation at max ambient temperature and high SWR. The PA and the PSU, having the same dimensions, are normally mounted together to form a 3e high 200 mm deep 19" unit. The PA can be fed from an external +13.6 V battery, and can as an option be fitted with a Pout monitoring relay, test outputs, or a carrier operated T/R Coaxial by-pass relay for operation at mains failure or with simplex stations. A larger PSU RS 210 A is available which can supply 25 A or 6 A for the Driver and for battery charging.

Model	RS 211	RS 214	RS 216	RS 217	RS 218
1. Frequency range	68 - 88	144 - 174	370 - 425	415 - 470	460 - 512 MHz
2. Output power nom*	80 - 100	80 - 100	80 - 100	80 - 100	80 - 100 W
3. Output power max	120	120	110	110	110 W
4. Input power nom	20	20	7	7	7 W
5. Input power max	25	25	9	9	9 W
6. SWR in	<2 (<3 during faulty antenna)				
7. SWR load	<1.5 normally				
8. SWR protection	Withstands SWR = ∞ for 24 h at max voltage and temp.				
9. Harmonics	<2 μ W (-77 dB)				
10. Spurious	<0.2 μ W (-87 dB)				
11. Adj. channel power	<-77 dB				
12. AM-modulation	<3%				
13. Syncronous AM	<1%				
14. Intermod. generation	Δ 3 typ 8 dB, Δ 5 typ 20 dB				
15. Shock resistant	3 x 1000 x 15 g				
16. Temperature range	-25... +55°C ambient				
17. Operation	Continuous 0 - 100% keying				
18. Reflection protection at Pr > 25 W appr -3 dB Po					
19. Temperature " at ths > 80°C appr -3 dB Po					
20. Output indication	Green LED > 50 W = option -1 Relay closure > 50 W = option -2				
21. Test output	via 8 pin socket to +100 μ A 2 k Ω instr. = option -3				
22. Coaxial by-pass	at Pin < 0.25 x nom = option -5				
23. Mains voltage	220 V \pm 10% 47 - 63 Hz				
24. " current	typ 2 A max 3 A RMS				
25. " fuse	\geq 6 AT				
26. " connector	CEE type 22/VI male				
27. " isolation	2000 V				
28. " PFI	VDE 0875 curve N -12 dB				
29. " indication	Yellow LED > +10 V DC				

X) Dependent on supply voltage

30.	PSU current limit	20 A, fold back to 10 A
31.	OVP protection	>16 V
32.	PA voltage	+14 V nom (+10.8... +15.6 V)
33.	PA current typ/max	16/19 16/19 16/19 16/19 16/19 A
34.	MTBF expected	> 20 000 h
35.	Dimensions	W = 19" = 482 mm with brackets H = 3e = 130 mm D = 200 + 70 mm Weight = 14 kg complete
36.	IN OUT Connectors	Typ NF 50 ohm

Requirements applicable for Driver:

- 4.
- 5.
- 6.
9. < 20 mW
10. inband < 0.04 µW, out of band < 0.2 µW
11. < -71 dB

100/20W POWER AMPLIFIER RS 214

INTRODUCTION

The Power Amplifier contains the PC - card PC 214. As an option the Coaxial By - Pass Relay RS 220 and the Relay Card PC 221 can be mounted.

The required +14V DC is normally supplied by the companion PSU RS 210.

The two RF transistors are mounted with a thin layer of thermal grease to the solid aluminium chassis that is provided with several large convecting fins. With a +14V DC input, approximately 15A is drawn which means that $210 - 100W + 20W = 130W$ is dissipated, without the need for forced ventilation.

The cover is screw sealed to be dust and RFI tight. The +14V input and alarm outputs are all RFI screened to reduce radiation into nearby receivers. The amplifier is fitted with a reflection protection output that will reduce the +14V DC a few volts in case of a high antenna SWR above 1.5.

OPERATION

Any component exchange or soldering on the strip line final amplifier card should be avoided as special precautions as type of solder melting temperature, heat permitted and the mechanical stress and exact positioning of the capacitors and transistors require special training for a proper result.

A unit or PC - Card replacement is instead recommended in the field, if a fault has been localized with input power on and from conclusion of the output power and instrument readings.

If the nominal input power drops more than -2dB below nominal the power gain of the transistors in class B is nonlinear and at a certain level will drop low suddenly. In this transition region some unstability will occur, generating sidebands and it is not recommended to operate below 60W and above 120W output power. Never should the specified maximum input power be exceeded.

The diode D1 prevents reverse voltage rectification into the +14 V PSU input and current limitation, if the RF - Drive is first applied to the PA before the PSU is switched on.

When mounting a 100W power amplifier and its PSU in a cabinet, do not cover the air convecting around its all cooling fins. In a 19 inch cabinet leave 1 free and open air space of 44.45mm below, above and behind the unit so that cooling air can pass freely.

If more than 5 channels of 100W are mounted in a 19 inch cabinet with almost continuous operation, a thermostat controlled fan starting at + 40°C should be used.

AMPLIFIER CARD PC 214 100/20W 144-174MHz

The input power is amplified in parallel in 2 identical transistors. The two 80W rated transistors are normally only driven to 50W to give a total of 100W output and are thus operating well below maximum ratings of collector current and junction temperature. The transistors operate with base and emitters DC-grounded, mounted to a PTFE dielectric strip-line PC-card.

The maximum permitted collector junction temperature is 200°C, and the thermal resistance j-c is 0.7°C/W. This means that at a flange temperature of 100°C a maximum dissipation of 140W is permitted per transistor. The transistors are designed to withstand short periods of high SWR. If the high SWR should remain it is necessary to reduce the supply voltage or drive level via the reflection protection sensed at the amplifier output.

The transistor input impedance at 174MHz is $1.0 + j1.7$ ohm. The first series element of the base impedance transformer is the transistor base lead plus the distance to C9,10. The second shunt element is mica capacitors C9,10. The third series element is L3. The fourth shunt element is C5,6. The fifth series element is L2. The sixth shunt element is C4,52. At the parallel addition point each leg represents a 25 ohm impedance and added 12.5 ohm.

Impedance transformation from 12.5 ohm at the junction point to the input 50 ohm is carried out by the series 7:th element L1 and the shunt 8:th element C1,2.

The two wide emitter leads of the strip line flanged transistors are fed to the lower ground plane of the strip line PC - card via short copper straps. The locations of the symmetrical base C9, C10 and the collector C13, C14 first transformation capacitors are very important with a tolerance of ± 0.5 mm.

The transistor gain at low frequencies (0.5 - 10 MHz) is quite high and resistive damping is used to reduce the generation of oscillating sidebands at changing load and drive conditions of the transistor.

The base side is damped by R8 + L20.. The collector load is damped by R10,L23. Unbalance between Q1 and Q2 is damped in R2 and R5.

The +14V supply is decoupled at low frequencies by the capacitors C38,C37.

The collector RF - current is appr. 7.4A RMS so resistive losses must be short and minimal in C13 and C14 as well as in L4. The output coupling capacitor C16 carries appr. 2.5A RMS and is less critical.

The collector current of each individual transistor as drawn from the +14V supply can be measured across the 0.025ohm R12 resistor on TPIC1 which reads -0.200V at 8A DC.

The output collector transformation up to 50ohm is also of the LP-type with 6 Tchebyscheff sections for flat wide band matching from $1.1 + j 1.4\text{ohm}$. optimum collector load impedance. The first element is $R_L + C_c + L_c$ of the transistor collector plus L4. The second element is the shunt capacitors C13,C14. The third element is the series inductance L5. The fourth element is the shunt capacitor C15.

At the adding junction each leg sees a 25ohm load, and the combination 12.5ohm is stepped up by the fifth series element L10 and the sixth shunt capacitance element C17,18.

Immediately after the output, a soldering link is available at 50 ohms that enable factory fine tuning of the inductors of the LP - filter setting attenuation and SWR.

Output LP - filtering is done in the 9 section derivated LP - filter consisting of L11, 12,13,14,15,16,17,18 and C39,40,41,42.

Three attenuation peaks are provided by L13 C40, L15 C41, and L17 C42 at 350, 286, and 430 MHz respectively. The second harmonics at 288 to 384 MHz are here attenuated $>55\text{dB}$ and $>53\text{dB}$ up to 600 MHz for higher order harmonics. In the pass-band the input reflection is $<26\text{dB}$ which corresponds to an input SWR of <1.10

After the LP - filter there are 2 directional coupling loops that each senses -31 dB of the Forward respectively Reflected output powers, which are then detected in diodes Z1 and Z2. R14,C51 terminate the coupled loops and determine the directivity ($\sim 20\text{dB}$). Coupling flatness versus frequency is compensated for by C44. Two independent outputs are available with an EMF of +2.5 VDC at 100W to J6 -5,4 and J6 -1,2 to drive both +100uA instrument test points and level alarms.

SERVICING RS 214

The following instruments are recommended at centralized complete maintenance.

- 1 Directional power meter for measurement of drive power and input reflection.
Type Bird 43 with probes.
- 2 Output power meter and 150W load.
Type Bird 6156.
- 3 Signal generator and power amplifier continuously covering the full bandwidth and power up to the maximum specified input power.
Type hp 8640 + Motorola modules.
- 4 Spectrum analyzer for stability checking
Type hp 8558B
- 5 Network analyzer for passively checking or aligning the output LP - filter attenuation and SWR
Type hp 8505A
- 6 Bi-Directional coupler for sweeping input power and reflection.
Type Narda 3020A
- 7 Coaxial cables RG 214, power attenuators and transitions.
- 8 Coaxial load SWR = 1,5 consisting of several meters of RG 213 providing a forward attenuation of 7dB and a return loss of 14dB giving a 1,5 SWR load with varying phases.
- 9 DC - instruments 100uA, 2 off for measuring collector currents at the current test points.
- 10 Digital multimeter for DC - measurements (RF insensitive)
- 11 Adjustable power supply 0 - 15V
0 - 20A DC. With current limit.

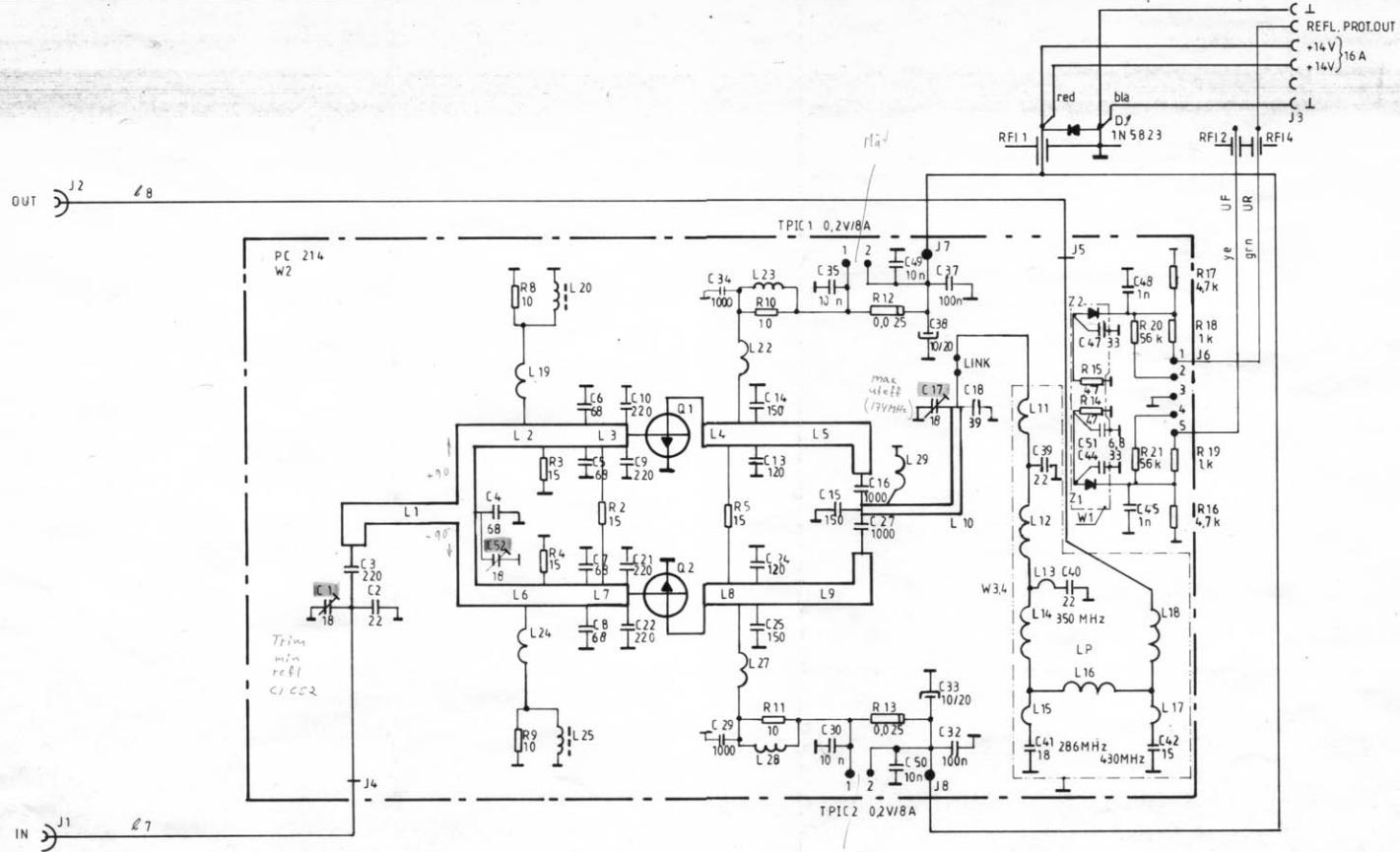
TUNING PROCEDURE

- 1 If not enough instruments are available, simplified measurements can be carried out on the normal operating frequency with the actual driver.
- 2 If the PA is fitted with the coaxial by-pass relay RS 220, it must first be removed.
- 3 Check that the transistor screws are firmly secured.
- 4 Connect 100 uA instruments to the TPIC1 and TPIC2 sockets.
- 5 Remove the socket to J6 during tuning.
- 6 Connect a 150W power meter and load close to the output.
- 7 Connect a driver with nominal power via a directional power meter and the Narda BI - directional coupler.
- 8 Tune C1 and C52 for best input return loss over the band (<-10 dB).
- 9 Tune C17 to max output power at 174MHz.
- 10 Check the output power across the band at 15 - 20W input.
Connect the 1,5 SWR cable load and the adjustable power supply.
Sweep the band and check stability with the supply 14,5... 10,8 V.
Do not sweep outside the band.

- 11 Check the output reflection detector with the 1,5 SWR load and J6 removed, that the UR voltage is + 0,7...1,0V across the band.
- 12 Check with 1,0 load and 100W output that UR does not exceeds 0,5V across the band.
- 13 Connect J6 and check that the +14V from the PSU regulates down when the RF - load is removed.
- 14 Also check that the PA restarts with the mains switch or when the drive is quickly removed and applied.
- 15 Remount the Coaxial Relay if used. Specially check that the short coaxial cable at the relay output not is twisted or hurt or that any cables are in contact with RF points on the PC.
- 16 At a replacement of transistor, mica capacitor or coils it shall be soldered with type 96/4% Pb/Ag (melting temperature of 235° C).
- 17 At a replacement of transistor a thin layer of silicon grease compound shall be used. Screw mount the transistor to the chassis before soldering. If the PC card has been removed, check that the flanged resistor and the transistors are tightly screwed to the cooler.
- 18 After a possible replacement of the coaxial cables λ7 or λ8, the thru-plating on the PC card must be reassured by a tubular rivet which is soldered on booth sides of the PC card before the cable is mounted again.
- 19 After any repair in the LP-filter, the input SWR and harmonic attenuation shall be checked at the link point to have a return loss <-26dB.
- 20 The current unbalance in normal operation should be below 3A.
Any collector current should never exceed 9A.

TYPICAL TEST DATA

	144	160	174	MHz
Output Power at 15W in IC 1	95	100	90	W
IC 2	5,2	5,0	5,1	A
	4,7	4,8	4,5	A
Output Power at 20W in IC 1 (<9A)	95	110	95	W
IC 2 (<9A)	5,6	6,3	5,5	A
	5,2	5,8	4,6	A
Input reflection (<-10dB)	014	-18	-14	dB
UF at 100W (2,5 ± 0,5V)		2,6		V
UR at 1,0 SWR (<0,5V)		0,2		V
UR at 1,5 SWR (0,7...1,0V)		0,7		V
Stability SWR= 1,5 +14V 15...20W				ok
Stability SWR= 1,5 +10,8V 15...20W				ok
Voltage reduction of PSU at SWR = ∞				ok
Visual inspection + screws secured				ok



SRA

F/Xt Bo Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Åmne Dimension		Anm:			
		Konstr.	Ritad	Kop.		Kontr.	Stand.	Göd.	Ska	Ersättar	Ersett av
2											
1											
43											
1.11											
2	Ändring 810116. C22, C10 220p — 270p. C52 tillkommer från SNR 31										
1	Ändring 810112. R6,R7,C11,C12,C28,C23,L 21,L 26 utgår från SNR 21										
Nr	Ant	Ändring och/eller medd.-nr	Datum	Inf.	Göd.	Nr	Ant	Ändring och/eller medd.-nr	Datum	Inf.	Göd.
880 580											

RADIOSYSTEM
Utvecklings AB
Stockholm

PA 100/20 W 144 - 174 MHz

RS 214

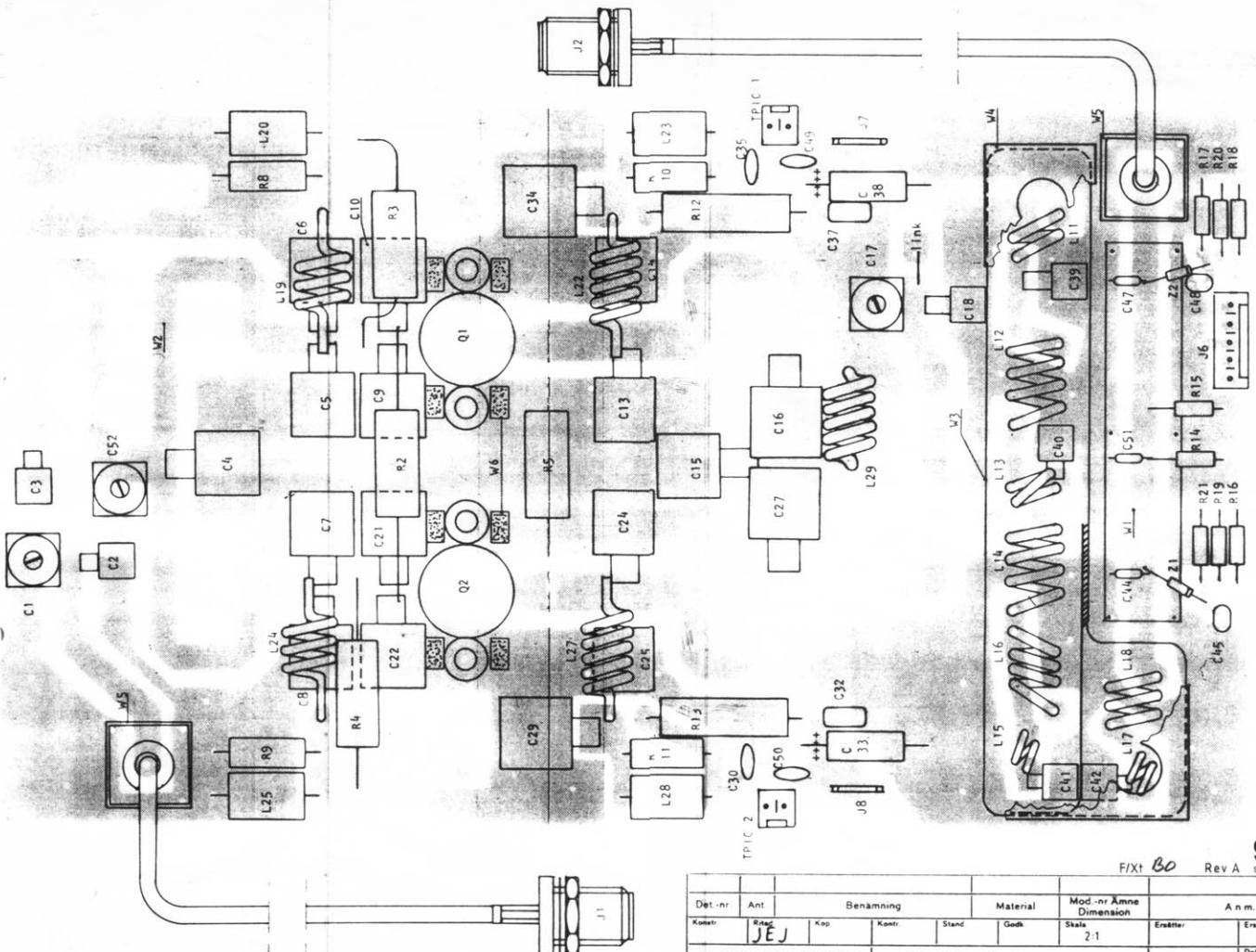
F/Xt

RS 214 01

Rit-nr

Dat.

82.01.29



SRA
STOCKHOLM SWEDEN

F/xt 80 Rev A

Det.-nr	Ant	Benämning		Material	Mod.-nr Åmne	Dimension	A n.m.
Konstr.	Rid	Kap	Kontr.	Stand	Gödk	Stale	Ersättar
JEJ						2-1	
RADIOSYSTEM Utviknings AB Stockholm							
COMPONENT LOCATION							Dat:
PC 214A							82.02.02
						Rid.-nr	
						F/xt RS 214 05	

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Godk.
	An-tal	Pos.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP	
Qty	Item	Component			Value	tol.	Manufact.	Type	
1	RFI 1	Filter			25A		Eire	1202-052	
2	RFI 2	"			5A		Ferroperm	9/0168.62	
	RFI 4	"			5A		"	9/0168.62	
1	D1	Diode					Motorola	IN5823	
1	PC 1	PA-card assy.					RS	PC 214A	
1	W1	Chassie, body					RS	RS 211 08	
1	W2	Cooler, rear					RS	RS 211 07	
1	W3	" , front					RS	RS 211 06	
1	W4	Cover plate					RS	RS 211 12	
1	W5	Mounting support					RS	RS 210 10	
1	W6	Cable					RS	RS 211 23	
1	W7	"					RS	RS 211 23	
1	W8	Cabling set, internal					RS	RS 211 23	
1	W9	Insulating disk					RS	RS 214 10	
1	W10	Cabling set, external					RS	RS 211 24	
10	W11	Screw			ECS M2,5x6				
6	W12	"			ECS M3x6				
6	W13	"			ECS M3x10				
4	W14	"			M6S 6x20				
15	W15	"			MC6S 6x12				
1	W16	"			ECS M4x6				
7	W17	Crimp nut			M4		USM		
4	W18	Nut			M6M 6				
1	W19	Washer			BRB 0,5x3,5x7,5				
4	W20	"			BRB 1,7x6,5x12				
10	W21	Spring washer			SCHNORR 2,7				
13	W22	" "			SCHNORR 3,2				
1	W23	" "			SCHNORR 4,3				
15	W24	" "			SCHNORR 6,3				
4	W25	" "			FBB 1,5x6,5x12				
1	W26	Hexagonal spacer			M3 45mm		BIX Enint		
1	W27	Panel text					RS	RS 214 09	
1	W44	Soldering tag					Elfa	48-9300-4	

F/Xt Rev A SRA

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av	
Océ 7351-44		RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA Parts List			Blad 1:2	Dat 08.03.08	
SMS 687 1.11		RS 214		Ritn.-nr			F/Xt RS 214 02		

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Godk.		
	AN-TAL	POS.	BENÄMNING	VÄRDE	TOL.	FABRIKAT	TYP				
Oty	Item	Component	Value	tol.	Manufact.	Type					
OPTION 1 "Level detector"											
1	W30	Level detector card			RS	RS 220 12 (PC 221)					
1	W31	Cabling set			RS	RS 211 23					
4	W32	Screw	EMS M3x10								
4	W33	Spring washer	SCHNORR 3,2								
2	RFI 5	Filter	5A		Ferroperm	9/0168.62					
	RFI 6	"	5A		"	9/0168.62					
OPTION 2 COAX RELAY											
1	W40	Coax relay			RS	RS 220					
2	W41	Screw	MC6S 4x12								
2	W42	Spring washer	SCHNORR 4,2								
1	RFI 3	Filter	5A		Ferroperm	9/0168.62					
1	W34	Soldering tag			Elfa	48-9300-4					
1	Copt2	Capacitor	10uF 20V		Kemet	T110B106 M02AS					

SRA

F/Xt *BO* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av	
	OS/EK								
RADIOSYSTEM Utvecklings AB Stockholm					STYCKLISTA Parts List			Blad 2:2	Dat 82.03.08
								Ritn.-nr	
								F/Xt RS 214 02	

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Godk.			
	An-tal	Pos.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP					
Oty	Item	Component	Value	tol.	Manufact.	Type							
-	R1	Resistor											
4	R2	" , carbon 2W	15Ω	10%	AB	HB							
	R3	" "	15Ω	10%	"	"							
	R4	" "	15Ω	10%	"	"							
	R5	" "	15Ω	10%	"	"							
-	R6												
-	R7												
4	R8	" " 0,5W	10Ω	10%	AB	EB							
	R9	" "	10Ω	10%	"	"							
	R10	" "	10Ω	10%	"	"							
	R11	" "	10Ω	10%	"	"							
2	R12	" , wire-wound	0,025Ω	5%	Vitrohm	350-8L							
	R13	" "	0,025Ω	5%	"	"							
2	R14	" , metal	47Ω	1%	Resista	MK 2							
	R15	" "	47Ω	1%	"	"							
2	R16	" "	4k7Ω	1%	"	"							
	R17	" "	4k7Ω	1%	"	"							
2	R18	" "	1kΩ	1%	"	"							
	R19	" "	1kΩ	1%	"	"							
2	R20	" "	56kΩ	1%	"	"							
	R21	" "	56kΩ	1%	"	"							
3	C1	Capacitor, trimmer	18pF		Philips	2222 809 09003							
3	C2	" , mica	22pF	±1pF	Jahre	49.43	250V						
1	C3	" "	220pF	10%	Unelco	3HS0006							
1	C4	" "	56pF	2%	Jahre	49.53	500V						
4	C5	" "	68pF	2%	"	"	"						
	C6	" "	68pF	2%	"	"	"						
	C7	" "	68pF	2%	"	"	"						
	C8	" "	68pF	2%	"	"	"						
4	C9	" "	220pF	2%	"	"	"						
	C10	" "	220pF	2%	"	"	"						
-	C11												
-	C12												

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Godk.
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP		
Qty	Item	Component	Value	tol.	Manufact.	Type				
2	C13	Capacitor, mica	120pF	2%	Jahre	49.53	500V			
3	C14	" "	150pF	2%	"	" "	"			
	C15	" "	150pF	2%	"	" "	"			
4	C16	" "	1000pF	10%	Unelco	J 101				
	C17	" , trimmer	18pF		Philips	2222 809 09003				
1	C18	" , mica	39pF	2%	Jahre	49.43	250V			
-	C19									
-	C20									
	C21	" "	220pF	2%	"	49.53	500V			
	C22	" "	220pF	2%	"	" "	"			
-	C23									
	C24	" "	120pF	2%	"	" "	"			
	C25	" "	150pF	2%	"	" "	"			
-	C26									
	C27	" "	1000pF	10%	Unelco	J 101				
-	C28									
	C29	" "	1000pF	10%	"	"	"			
4	C30	" , ceramic	10nF		Philips	2222 640 02103				
-	C31									
2	C32	" "	100nF		Siemens	B37449-F6104-S2				
2	C33	" , tantal	10µF	20V	Kemet	T110 B106 M02AS				
	C34	" , mica	1000pF	10%	Unelco	J 101				
	C35	" , ceramic	10nF		Philips	2222 640 02103				
-	C36									
	C37	" "	100nF		Siemens	B37449-F6104-S2				
	C38	" , tantal	10µF	20V	Kemet	T110 B106 M02AS				
	C39	" , mica	22pF	±1pF	Jahre	49.43	250V			
	C40	" "	22pF	±1pF	"	" "	"			
1	C41	" "	18pF	±1pF	"	" "	"			
1	C42	" "	15pF	±1pF	"	" "	"			
-	C43									
2	C44	" , ceramic	33pF	NPO	Philips	2222 631 10339				
2	C45	" "	1nF		"	2222 630 01102				
-	C46									
	C47	" "	33pF	NPO	"	2222 631 10339				

F/Xt *BO* Rev A **SRA**
Anm. STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	Anm.	
Konstr.	Ritad	OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA Parts List						Blad 2:4	Dat. 82.02.02
								Ritn.-nr	
								RS 214 03	

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Godk.
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP	
	Qty	Item	Component		Value	tol.	Manufact.	Type	
		C48	Capacitor, ceramic		1nF		Philips	2222 630 01102	
		C49	" "		10nF		"	2222 640 02103	"
		C50	" "		10nF		"		"
1		C51	" "		6p8F	NPO	"	2222 631 09688	
		C52	, trimmer		18pF		"	2222 809 09003	
		L1	Printed coil						
		L2	"						
		L3	"						
		L4	"						
		L5	"						
		L6	"						
		L7	"						
		L8	"						
		L9	"						
		L10	"						
1		L11	Coil		Ø 5	n=1,5	RS	RS 214 06	
2		L12	"		Ø 5	n=3,5	RS	RS 214 07	
1		L13	"		Ø 5	n=1	RS	"	
		L14	"		Ø 5	n=3,5	RS	"	
1		L15	"		Ø 3	n=1,5	RS	"	
1		L16	"		Ø 5	n=3,5	RS	"	
1		L17	"		Ø 4	n=1,5	RS	RS 214 08	
1		L18	"		Ø 5	n=2,5	RS	"	
2		L19	"		Ø 5	n=3	RS	RS 214 06	
4		L20	Inductor, Fe		10µH		Philips	4312 020 36690	
-		L21							
2		L22	Coil		Ø 5	n=5	RS	RS 214 06	
		L23	Inductor, Fe		10µH		Philips	4312 020 36690	
		L24	Coil		Ø 5	n=3	RS	RS 214 06	
		L25	Inductor, Fe		10µH		Philips	4312 020 36690	
-		L26							
		L27	Coil		Ø 5	n=5	RS	RS 214 06	
		L28	Inductor, Fe		10µH		Philips	4312 020 36690	
1		L29	Coil		Ø 5	n=5	RS	RS 214 06	

F/Xt *EO* Rev A **SRA**

Det.-nr	Ant.	Benämning		Material	Mod.-nr	Ämne Dimension	A n m.		
Konstr.	Ritad	OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA Parts List PC 214A					Blad 3:4	Dat. 82.02.02	
							Ritn.-nr		
								F/Xt RS 214 03	

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SRA

F/Xt Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m.	
Konstr.	Ritad	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av-
	OS/EK							
RADIO SYSTEM Utvecklings AB Stockholm		STYCKLISTA			Parts List		Blad 4:4	Dat 82.02.02
		PC 214A			F/Xt RS 214 03		Ritn.-nr	

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SMS 687 1.11

PA - STAGE 100/7W RS 217

Photo PA + PSU See RS 211

Specification 2

Description 4

Circuit diagram RS 217 RS 217 01

Component location RS 217 RS 217 04

" " PC 217 RS 217 05

Parts list RS 217 RS 217 02

" " PC 217 RS 217 03

Specification 100 W Power Amplifiers RS 211, 214, 216, 217, 218.

Modular add-on Power Amplifiers consisting of one PA-module and one companion 220 V/+14 V 19 A PSU-module RS 210. The PA consists of 2 rugged derated push-pull final 80 W transistors with LP-filters and protection in a RFI-screened Al-module with good heat transfer. Capable of continuous operation at max ambient temperature and high SWR. The PA and the PSU, having the same dimensions, are normally mounted together to form a 3e high 200 mm deep 19" unit. The PA can be fed from an external +13.6 V battery, and can as an option be fitted with a Pout monitoring relay, test outputs, or a carrier operated T/R Coaxial by-pass relay for operation at mains failure or with simplex stations. A larger PSU RS 210 A is available which can supply 25 A or 6 A for the Driver and for battery charging.

Model	RS 211	RS 214	RS 216	RS 217	RS 218
1. Frequency range	68 - 88	144 - 174	370 - 425	415 - 470	460 - 512 MHz
2. Output power nom ^x	80 - 100	80 - 100	80 - 100	80 - 100	80 - 100 W
3. Output power max	120	120	110	110	110
4. Input power nom	20	20	7	7	7 W
5. Input power max	25	25	9	9	9 W
6. SWR in	<2 (<3 during faulty antenna)				
7. SWR load	<1.5 normally				
8. SWR protection	Withstands SWR = ∞ for 24 h at max voltage and temp.				
9. Harmonics	<2 μ W (-77 dB)				
10. Spurious	<0.2 μ W (-87 dB)				
11. Adj. channel power	<-77 dB				
12. AM-modulation	<3%				
13. Synchronous AM	<1%				
14. Intermod. generation	Δ 3 typ 8 dB, Δ 5 typ 20 dB				
15. Shock resistant	3 x 1000 x 15 g				
16. Temperature range	-25... +55°C ambient				
17. Operation	Continuous 0 - 100% keying				
18. Reflection protection at Pr >25 W appr -3 dB Po					
19. Temperature " at ths >80°C appr -3 dB Po					
20. Output indication	Green LED >50 W = option -1 Relay closure >50 W = option -2				
21. Test output	via 8 pin socket to +100 μ A 2 k Ω instr. = option -3				
22. Coaxial by-pass	at Pin < 0.25 x nom = option -5				
23. Mains voltage	220 V \pm 10% 47 - 63 Hz				
24. " current	typ 2 A max 3 A RMS				
25. " fuse	\geq 6 AT				
26. " connector	CEE type 22/VI male				
27. " isolation	2000 V				
28. " RFI	VDE 0875 curve N -12 dB				
29. " indication	Yellow LED >+10 V DC				

X) Dependent on supply voltage

30.	PSU current limit	20 A, fold back to 10 A
31.	OVP protection	>16 V
32.	PA voltage	+14 V nom (+10.8... +15.6 V)
33.	PA current typ/max	16/19 16/19 16/19 16/19 16/19 A
34.	MTBF expected	> 20 000 h
35.	Dimensions	W = 19" = 482 mm with brackets H = 3e = 130 mm D = 200 + 70 mm Weight = 14 kg complete
36.	IN OUT Connectors	Typ NF 50 ohm

Requirements applicable for Driver:

- 4.
- 5.
- 6.
9. < 20 mW
10. inband < 0.04 µW, out of band < 0.2 µW
11. < -71 dB

100/7 W POWER AMPLIFIER RS 217

INTRODUCTION

The Power Amplifier contains the PC - card PC 217. As an option the Coaxial By - Pass Relay RS 220 and the Relay Card PC 221 can be mounted.

The required +14V DC is normally supplied by the companion PSU RS 210.

The 1+2 RF transistors are mounted with a thin layer of thermal grease to the solid aluminium chassis that is provided with several large convecting fins. With a +14V DC input, approximately 17A is drawn which means that $238 - 100W + 7W = 145W$ is dissipated, without the need for forced ventilation.

The cover is screw sealed to be dust and RFI tight. The +14V input and alarm outputs are all RFI screened to reduce radiation into nearby receivers. The amplifier is fitted with a reflection protection output that will reduce the +14V DC a few volts in case of a high antenna SWR above 1.5.

OPERATION

Any component exchange or soldering on the strip line final amplifier card should be avoided as special precautions as type of solder melting temperature, heat permitted and the mechanical stress and exact positioning of the capacitors and transistors require special training for a proper result.

A unit or PC - Card replacement is instead recommended in the field, if a fault has been localized with input power on and from conclusion of the output power and instrument readings.

If the nominal input power drops more than -2dB below nominal the power gain of the transistors in class B is nonlinear and at a certain level will drop low suddenly. In this transition region some unstability will occur, generating sidebands and it is not recommended to operate below 60W and above 110W output power. Never should the specified maximum input power be exceeded.

When mounting a 100W power amplifier and its PSU in a cabinet, do not cover the air convecting around its all cooling fins. In a 19 inch cabinet leave 1 free and open air space of 44.45mm below,above and behind the unit so that cooling air can pass freely.

If more than 5 channels of 100W are mounted in a 19 inch cabinet with almost continuous operation, a thermostat controlled fan starting at + 40°C should be used.

AMPLIFIER CARD PC 217 100/7W 415 - 470 MHz

The incoming 7W is first amplified to 28W at 50 ohm impedance level available at a soldering link. The input matching is fine adjusted by C1 and C2 and the output power flatness is set by C17. The 50W output rated transistor Q1 has a separately decoupled +14V input lead and it can be separately tuned and measured if needed.

The output power is amplified in push-pull in 2 identical transistors. The two 70W rated transistors are normally only driven to 50W to give a total of 100W output and are thus operating well below maximum ratings of collector current and junction temperature. The transistors operate with base and emitters DC - grounded, mounted to a PTEE dielectric strip-line PC-card.

The maximum permitted collector junction temperature is 200°C, and the thermal resistance j-c is 0.8°C/W. This means that at a flange temperature of 120°C a maximum dissipation of 100W is permitted per transistor. The transistors are designed to withstand short periods of high SWR. If the high SWR should remain it is necessary to reduce the supply voltage or drive level via the reflection protection sensed at the amplifier output. The balun transformer λ_1, λ_2 at the input and λ_3, λ_4 at the output reduces the number of transforming shunt capacitors by series connection of the impedances giving a lower resistive transformation ratio. The first section of the Balun consists of a short length λ_1 of 50 ohm rigid line whose outer conductor is grounded at the input side. The outer conductor presents a high inductive impedance seen at the output relative to ground. For symmetry reasons a grounded inductive outer conductor line λ_2 loads the other output pole. Each line consists of 50 ohm lines slightly shorter than 90°. The output impedance at each half is thus 25 ohm or 50 ohm together, being fed in 180° phase opposition.

The transistor input impedance at 470 MHz is appr. 0.3 - j1.2 ohm. The first element of the base impedance transformation to 25 ohms is $R_b + L_b + L_4$. The second element is shunt mica capacitors C26, C27. The third series element is a series inductance. The fourth element is shunt capacitor C25. Capacitor C22 is a strip line mica capacitor blocking the base bias. The fifth element is the series inductance from C25 through C22 to the center of C20. The sixth element is the shunt capacitance of $2 \times C_{20} + C_{21}$.

The two wide emitter leads of the strip line flanged transistors are fed to the lower ground plane of the strip line PC-card via short copper straps. The locations of the symmetrical base C26, C27 and the collector C30, C31 first transformation capacitors are very important with a tolerance of $\pm 0.2\text{mm}$.

The transistor gain at low frequencies (0.5 - 10 MHz) is quite high and resistive damping is used to reduce the generation of oscillating sidebands at changing load and drive conditions of the transistor.

The base side is damped by R14 + L4. The collector load is damped by R4 + L9. The +14V supply is decoupled at low frequencies by the capacitors C52, 44.

The collector RF-current is appr. 9.1A RMS so resistive losses must be short and minimal is C30 and C31. The output coupling capacitor C38 carries 2.8A RMS and is less critical.

The collector current of each individual transistor as drawn from the +14V supply can be measured across the 0.025 ohm R7 resistor on TPIC1 which reads -0.200V at 8A DC.

Tiebychaff
The output collector transformation up to 25 ohm is also of the LP-type with 6 Tchebyscheff sections for flat wide band matching from 0.6 + j1.6 ohm optimum collector load impedance. The first element is RL + Cc + Lc of the transistor collector plus L. The second element is the shunt capacitors C30, C31. The third element is a series inductance. The fourth element is the shunt capacitors C34, C35. The fifth element is a series inductance. The sixth element is the shunt capacitance of 2xC40 + 41. Here the two amplifier halves of 25 ohm are series added to see a 50 ohm load that is unbalanced in the 1:1 lines ℓ_3 and ℓ_4 .

Immediately after the output Balun, a soldering link is available at 50 ohms that enable factory fine tuning of the inductors of the LP-filter setting attenuation and SWR.

Output LP-filtering is first done in the 4 section derivated LP-filter consisting of L11, C55, L12, L16, C56, L13. In the passband the input reflection is <18dB.

After the LP-filter there are 2 directional coupling loops that each sense -31dB of the Forward respectively Reflected output powers, which are then detected in diodes Z1 and Z2. R16, C62 terminate the coupled loops and determine the directivity (~20dB). Coupling flatness versus frequency is compensated for by C57. Two independent outputs are available with an EMF of +3 VDC at 100W to J6 -5.4 and J6 -1.2 to drive both +100uA instrument test points and level alarms.

The short lines ℓ_6 , ℓ_5 and L15 form an additional 3-section LP-filter attenuating the second harmonic after the measuring diodes Z1, Z2. The lines ℓ_6 , ℓ_5 are open ended short lines that at fundamental are capacitive but at the harmonic provide 90° short circuits. The notches are set at 740 and 940 MHz.

SERVICING RS 217

The following instruments are recommended at centralized complete maintenance.

- 1 Directional power meter for measurement of drive power and input reflection.
Type Bird 43 with probes.
- 2 Output power meter and 150W load.
Type Bird 6156.
- 3 Signal generator and power amplifier continuously covering the full bandwidth and power up to the maximum specified input power.
Type hp 8640 + Motorola modules.
- 4 Spectrum analyzer for stability checking
Type hp 8558B
- 5 Network analyzer for passively checking or aligning the output LP - filter attenuation and SWR
Type hp 8505A
- 6 Bi-Directional coupler for sweeping input power and reflection.
Type Narda 3020A
- 7 Coaxial cables RG 214, power attenuators and transitions.
- 8 Coaxial load SWR = 1,5 consisting of several meters of RG 213 providing a forward attenuation of 7dB and a return loss of 14dB giving a 1,5 SWR load with varying phases.
- 9 DC - instruments 100uA, 2 off for measuring collector currents at the current test points.
- 10 Digital multimeter for DC - measurements (RF insensitive)
- 11 Adjustable power supply 0 - 15V
0 - 20A DC. With current limit.

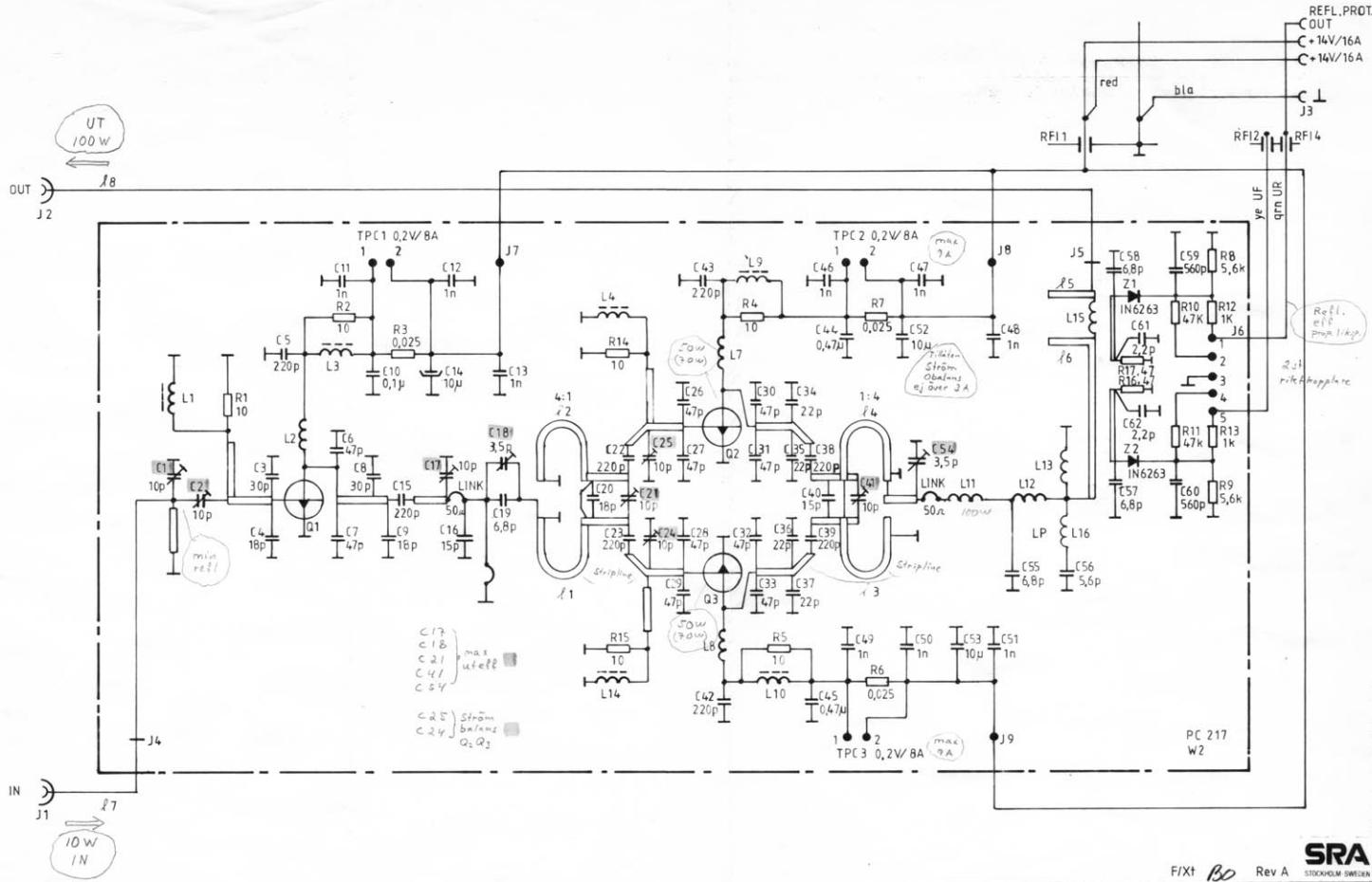
TUNING PROCEDURE

- 1 If not enough instruments are available, simplified measurements can be carried out on the normal operating frequency with the actual driver.
- 2 If the PA is fitted with the coaxial by-pass relay RS 220, it must first be removed.
- 3 Check that the transistor screws are firmly secured.
- 4 Connect 100 uA instruments to the TPIC1 and TPIC2 sockets.
- 5 Remove the socket to J6 during tuning.
- 6 Connect a 150W power meter and load close to the output.
- 7 Connect a driver with nominal power via a directional power meter and the Narda BI - directional coupler.
- 8 Tune C1 and C3 for best input return loss over the band (< -10 dB).
- 9 Tune C17,C18,C21,C41 and C54 for max output power, and check the transistor efficiency at the same time. Tune C24 or C25 for equal current in the transistors Q2 and Q3. Check the output power across the band at 6 - 9W input.

- 10 Connect the 1,5 SWR cable load and the adjustable power supply. Sweep the band and check stability with the supply 14,5... 10,8V. Do not sweep outside the band. When needed retune C24 or C25.
- 11 Check the output reflection detector with the 1,5 SWR load and J6 removed, that the UR voltage is + 0,7... 1,0V across the band.
- 12 Check with 1,0 load and 100W output that UR does not exceed 0,5V across the band.
- 13 Connect J6 and check that the + 14V from the PSU regulates down when the RF - load is removed.
- 14 Also check that the PA restarts with the mains switch or when the drive is quickly removed and applied.
- 15 Remount the Coaxial Relay if used. Specially check that the short coaxial cable at the relay output not is twisted or hurt or that any cables are in contact with RF points on the PC.
- 16 At a replacement of transistor, mica capacitor or coils it shall be soldered with type 96/4% Pb/Ag (melting temperature of 235°C). At a transistor replacement the small temperature sensitive porzellan capacitors at collector and base must first be removed. Use a plier to cool the capacitor body and a soldering iron with not to small tip. When mounting the porzellan capacitors again, they must be soldered with LMP 179°C 62/36/2 Sn Pb Ag and their body cooled by a plier. The position shall be exactly as early.
- 17 At a replacement of transistor a thin layer of silicon grease compound shall be used. Screw mount the transistor to the chassis before soldering. If the PC card has been removed, check that the flanged resistor and the transistors are tightly screwed to the cooler.
- 18 After a possible replacement of the coaxial cables λ 7 or λ 8, the thru-plating on the PC card must be reassured by a tubular rivet which is soldered on both sides of the PC card before the cable is mounted again.
- 19 After any repair in the LP-filter, the input SWR and harmonic attenuation shall be checked at the link point to have a return loss <-18dB.
- 20 The current unbalance in normal operation should be below 3A. Any collector current should never exceed 9A.

TYPICAL TEST DATA

	415	440	470	MHz
Output Power at 7W in IC 1 ($< 4,5A$)	90	98	95	W
IC 2 ($< 9A$)	3,3	3,4	3,5	A
IC 3 ($< 9A$)	7,8	7,8	7,1	A
Input reflection ($<-10dB$)	8,0	7,9	6,8	A
UF at 100W ($2,75 \pm 0,5V$)	-14	-18	-16	dB
UR at 1,0 SWR ($< 0,5V$)		2,9		V
UR at 1,5 SWR ($0,7...1,0V$)		0,3		V
Stability SWR = 1,5 +14V 6 - 9W		0,8		V
Stability SWR = 1,5 +10,8V 6 - 9W				ok
Voltage reduction of PSU at SWR = ∞				ok
Visual inspection + screws secured				ok

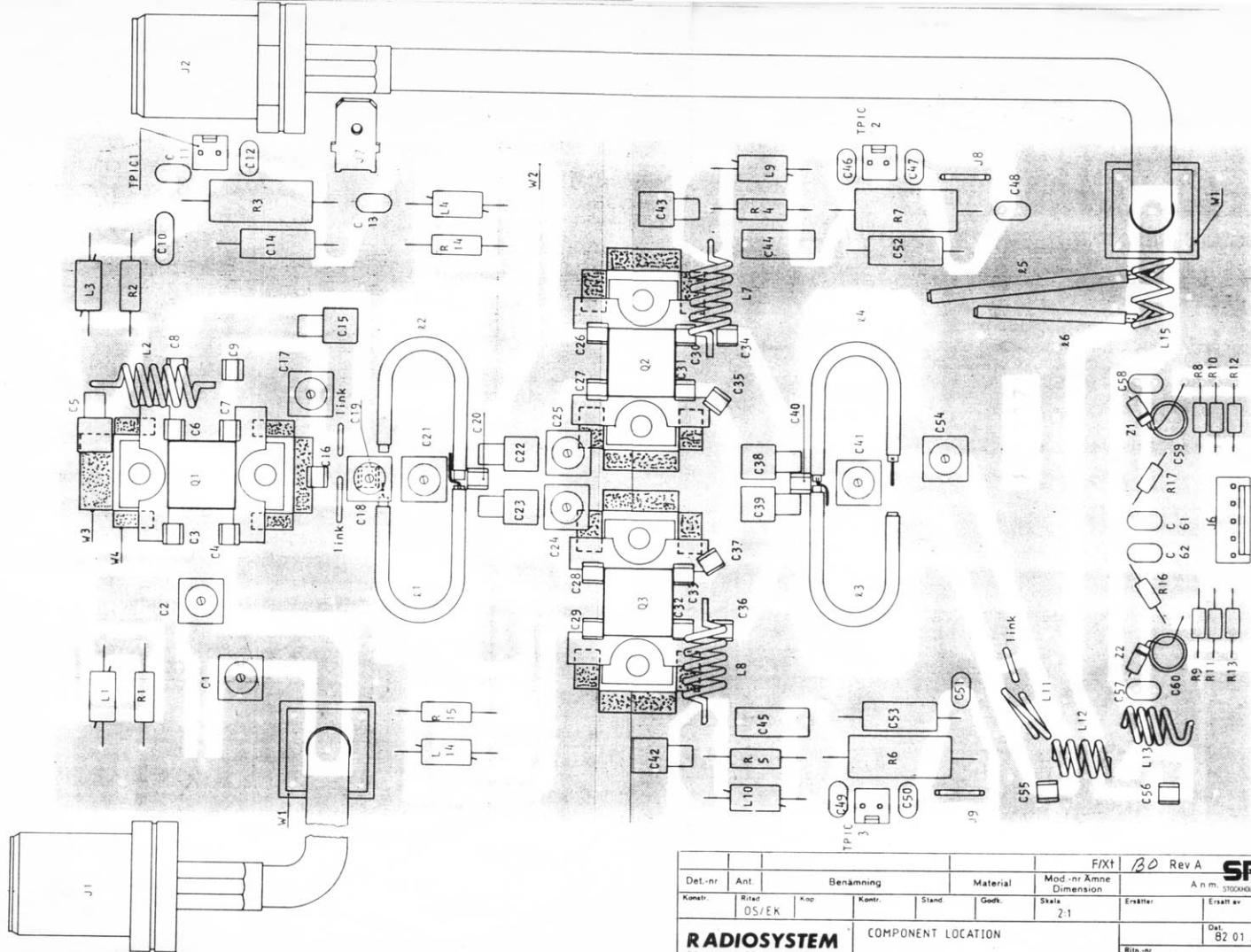


SRA

STOCKHOLM-SWEDEN

F/xt Bp Rev A

Det.-nr	Ant.	Benämning			Material	Mod.-nr Åmme Dimension	A n m.				
		Ritad	Kop.	Kontr.			Stand.	Godk.	Skala	Ersättare	Ersätt av
RADIOSYSTEM Utvecklings AB Stockholm		PA100/7 W		415 - 470MHz						Dat.	82.01.29
										Ritm.-nr	
										F/Xt	RS 217 01



Det.-nr		Ant.	Benämning		Material	Mod.-nr Anne Dimension	F/x:t	B0 Rev A	SRA
Konstr.	Ritad		OS/EK	Kop.	Kontr.	Stand.	Godk.	Stake	Erstattnr
RADIOSYSTEM Utvecklings AB Stockholm									
COMPONENT LOCATION								Riksnr	
PC 217								B2 01 29	
F/x:t RS 217 05									

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Godk.
	An-tal	Pos.	BENÄMNING	VÄRDE	TOL.	FABRIKAT	TYP		
Qty	Item	Component		Value	tol.	Manufact.	Type		
1	RFI 1	Filter		25A		Eire	1202-052		
2	RFI 2	"		5A		Ferroperm	9/0168.62		
	RFI 4	"		5A		"	9/0168.62		
1	PC 1	PA-board assy.				RS	PC 217		
1	W1	Chassie, body				RS	RS 211 08		
1	W2	Cooler, rear				RS	RS 211 07		
1	W3	" , front				RS	RS 211 06		
1	W4	Cover plate				RS	RS 211 12		
1	W5	Mounting support				RS	RS 210 10		
2	W6	Cable				RS	RS 211 23		
1	W7	"				RS	RS 211 23		
1	W8	Cabling set, internal				RS	RS 211 23		
1	W9	Insulating disk				RS	RS 217 11		
1	W10	Cabling set, external				RS	RS 211 24		
10	W11	Screw		ECS M2,5x6					
7	W12	"		ECS M3x6					
8	W13	"		ECS M3x10					
4	W14	"		M6S 6x20					
15	W15	"		MC6S 6x12					
1	W16	"		ECS M4x6					
9	W17	Crimp nut		M4		USM			
4	W18	Nut		M6M 6					
1	W19	Washer		BRB 0,5x3,5x7,5					
4	W20	"		BRB 1,7x6,5x12					
10	W21	Spring washer		SCHNORR 2,7					
14	W22	" "		SCHNORR 3,2					
1	W23	" "		SCHNORR 4,3					
15	W24	" "		SCHNORR 6,3					
4	W25	" "		FBB 1,5x6,5x12					
1	W26	Hexagonal spacer		M3 45mm		BIX Enint			
1	W27	Panel text				RS	RS 217 10		

-SRA

F/xt *BO* Rev A STOCKHOLM-SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Åmne Dimension	Anm.	
Konstr.	Ritad	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm	OS/EK							
STYCKLISTA PA 100/7W RS 217			Parts List 415-470MHz			Blad 1:2	Dat.	02. 03.08
						Ritn.-nr		
			F/Xt RS 217 02					

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F/xt 80 Rev A

Det.-nr		Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad		Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av	
RADIOSYSTEM		STYCKLISTA PA 100/7W 415-470MHz RS 217						Blad 2:2	Dat.	82.03.08
Utvecklings AB Stockholm								Ritn.-nr		
								F/Xt	RS 217 02	

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Godk.
	An-tal	Pos.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP		
Qty	Item	Component	Value	tol.	Manufact.	Type				
6	R1	Resistor, carbon	10Ω	0,5W	AB	EB				
	R2	" "	10Ω	0,5W	AB	EB				
3	R3	" , wire-wound	0,025Ω	5%	Vitrohm	350-8L				
	R4	" , carbon	10Ω	0,5W	AB	EB				
	R5	" "	10Ω	0,5W	AB	EB				
	R6	" , wire-wound	0,025Ω	5%	Vitrohm	350-8L				
	R7	" "	0,025Ω	5%	" "	"				
2	R8	" , metal	5K6Ω	1%	Resista	MK 2				
	R9	" "	5K6Ω	1%	"	"				
2	R10	" "	47KΩ	1%	"	"				
	R11	" "	47KΩ	1%	"	"				
2	R12	" "	1KΩ	1%	"	"				
	R13	" "	1KΩ	1%	"	"				
	R14	" , carbon	10Ω	0,5W	AB	EB				
	R15	" "	10Ω	0,5W	AB	EB				
2	R16	" , metal	47Ω	1%	Resista	MK 2				
	R17	" "	47Ω	1%	"	"				
7	C1	Capacitor, trimmer	10pF		Ph	2222 809 05002				
	C2	" "	10pF		"	"				
2	C3	" , porcelain	30pF		ATC	100B-300-J-MS-X-500				
3	C4	" "	18pF		"	100B-180-J-MS-X-500				
8	C5	" , mica	220pF	10%	Unelco	3HS0006				
10	C6	" , porcelain	47pF		ATC	100B-470-J-MS-X-500				
	C7	" "	47pF		"	"				
	C8	" "	30pF		"	100B-300-J-MS-X-500				
	C9	" "	18pF		"	100B-180-J-MS-X-500				
1	C10	" , ceramic	100nF		Siemens	B37449-F6104-S2				
9	C11	" "	1nF		Ph	2222 630 01102				
	C12	" "	1nF		"	"				
	C13	" "	1nF		"	"				
3	C14	" , tantal	10μF	20V	Kemet	T110 B106 M02AS				
	C15	" , mica	220pF	10%	Unelco	3HS0006				
2	C16	" , porcelain	15pF		ATC	100B-150-J-MS-X-500				
					F/Xt	Rev A	SRA			
Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m. STOCKHOLM-SWEDEN			
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av		
Océ 7361-44	RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA Parts List				Blad 1:4	Dat 32.01.12		
SMS 687 1.11	PC 217		F/Xt RS 217 03				Ritn.-nr			

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Godk.
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP		
Qty	Item	Component	Value	tol.	Manufact.	Type				
	C17	Capacitor, trimmer	10pF		Ph	2222 809 05002				
2	C18	" "	3p5F		"	2222 809 05001				
2	C19	" , porcelain	6p8F		ATC	100B-6R8-J-MS-X-500				
	C20	" "	18pF		"	100B-180-J-MS-X-500				
	C21	" , trimmer	10pF		Ph	2222 809 05002				
	C22	" , mica	220pF	10%	Unelco	3HS0006				
	C23	" "	220pF	10%	"	"				
	C24	" , trimmer	10pF		Ph	2222 809 05002				
	C25	" "	10pF		"	"				
	C26	" , porcelain	47pF		ATC	100B-470-J-MS-X-500				
	C27	" "	47pf		"	"				
	C28	" "	47pF		"	"				
	C29	" "	47pF		"	"				
	C30	" "	47pF		"	"				
	C31	" "	47pF		"	"				
	C32	" "	47pF		"	"				
	C33	" "	47pF		"	"				
4	C34	" "	22pF		"	100B-220-J-MS-X-500				
	C35	" "	22pF		"	"				
	C36	" "	22pF		"	"				
	C37	" "	22pF		"	"				
	C38	" , mica	220pF	10%	Unelco	3HS0006				
	C39	" "	220pF	10%	"	"				
	C40	" , porcelain	15pF		ATC	100B-150-J-MS-X-500				
	C41	" , trimmer	10pF		Ph	2222 809 05002				
	C42	" , mica	220pF	10%	Unelco	3HS0006				
	C43	" "	220pF	10%	"	"				
2	C44	" , polyester	0,47µF 63V		ERO	MKT 1822-447/065				
	C45	" "	0,47µF 63V		"	"				
	C46	" , ceramic	1nF		Ph	2222 630 01102				
	C47	" "	1nF		"	"				
	C48	" "	1nF		"	"				
	C49	" "	1nF		"	"				
	C50	" "	1nF		"	"				
	C51	" "	1nF		"	"				

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F/Xt 130 Rev A STOCKHOLM-SWEDEN

Det.-nr	Ant.	Benämning		Material	Mod.-nr	Ämne Dimension	A n m.	
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA		Parts List			Blad 2:4	Dat. 82.01.12
		PC 217					Ritn.-nr	

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Godk.			
	An-tal	Pos.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP					
Oty	Item	Component	Value	tol.	Manufact.	Type							
	C52	Capacitor, tantal	10µF	20V	Kemet	T110 B106 M02AS							
	C53	" "	10µF	20V	"	"							
	C54	" , trimmer	3p5F		Ph	2222 809 05001							
	C55	" , porcelain	6p8F		ATC	100B-6R8-J-MS-X-500							
1	C56	" "	5p6F		"	100B-5R6-J-MS-X-500							
2	C57	" , ceramic	6p8F		Ph	2222 631 09688							
	C58	" "	6p8F		"	"							
2	C59	" "	560pF		Draloric	SBFK5 R2000							
	C60	" "	560pF		"	"							
2	C61	" "	2p2F		Ph	2222 631 03228							
	C62	" "	2p2F		"	"							
1	Q1	Transistor			CTC	CME 50-12							
2	Q2	"			"	CME 70-12							
	Q3	"			"	CME 70-12							
2	Z1	Diode			HP	1N6263							
	Z2	"			"	1N6263							
6	L1	Inductor, Fe			Ph	4312 020 36690							
3	L2	Coil	Ø 5	n=5	RS	RS 217 09							
	L3	Inductor, Fe			Ph	4312 020 36690							
	L4	" "			"	"							
-	L5												
-	L6												
	L7	Coil	Ø 5	n=5	RS	RS 217 09							
	L8	"	Ø 5	n=5	"	"							
	L9	Inductor, Fe			Ph	4312 020 36690							
	L10	" "			"	"							
1	L11	Coil	Ø 6,5	n=1	RS	RS 217 09							
1	L12	"	Ø 3,5	n=4	RS	RS 217 09							
1	L13	"	Ø 4	n=4	RS	RS 217 09							
	L14	Inductor, Fe			Ph	4312 020 36690							
1	L15	Coil	Ø 3	n=3	RS	RS 217 09							
	L16	Printed coil											

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F/Xt *BD* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m.		
Konstr.	Ritad	OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm	STYCKLISTA			Parts List			Blad 4:4	Dat.	82.01.12
	PC 217			F/Xt RS 217 03			Ritn.-nr		

Océ
7361-44

SMS 687 1.11

POWER SUPPLY UNIT RS 210

Specification 2

Description 4

Output voltage load line RS 210 35

Circuit diagram RS 210 RS 210 01

Component location RS 210 RS 210 21

" " PC 210A RS 210 18

Parts list RS 210 RS 210 02

" " PC 210A RS 210 03

Specification PSU-module RS 210

This module is mounted to a companion 50 or 100W Power Amplifier module, and will supply +14V 19A DC from a 220 (230)V mains input. Big front and rear heat fins are provided that dissipate the power regulated by 4 parallel connected series regulating transistors. A low voltage drop is maintained in the C-core transformer, full wave diodes, and the series transistors to provide a high total efficiency. Overcurrent protection is provided as well as thermal and SWR downregulation of the output to protect the connected PA from overdissipation under extreme conditions.

1	Mains voltage	220/230V $\pm 10\%$ 47 - 63Hz
2	" current	typ 2 max 3A RMS
3	" fuse	$\geq 6\text{AT}$ external, 3.15AT internal
4	" connector	CEE type 22/VI male
5	" isolation	2000V
6	" RFI	VDE 0875 curve N-12dB
7	Output voltage	+14.0V nom
8	" ripple	< 20mV p - p (100Hz)
9	" current	19A max
10	" current limit	appr 23A fold back to 6A
11	" indication	yellow LED >+10V DC
12	" connector	LMI 36 - 300 6 pole
13	Voltage reduction at high SWR	reduced output at $U_r > +0.7V$
14	Test points U out	U 14V direct
15	" " I out	0.1V/16A DC
16	MTBF expected	40.000 h
17	Dimensions	$W = 19''/2 = 241 \text{ mm}$ $H = 3e = 130 \text{ mm}$ $D = 200 + 70 \text{ mm}$
18	Weight	9.5kg

POWER SUPPLY UNIT RS 210

INTRODUCTION

The PSU is a mains fed conventional regulator employing rectifier diodes and series transistors with minimal voltage drops. Temperature dependent current limit and a reflection protection input are provided to reduce the output voltage and the stress of the connected power amplifier in extreme conditions. A fold-back current limit will reduce the heat dissipated in the series regulated transistors, in case of a permanent short circuit or when charging an exhausted battery. The nominal rating is 220V $\pm 10\%$ mains input and +14V 19A, output with low ripple.

MAINS INPUT

The mains socket input is fused with a 3AT slow blow fuse that can handle the high short inrush current of the C-core 540VA mains transformer. Extra tapping points are provided at 230/220V to provide a resoldering possibility in countries with a constant high mains voltage. An external mains fuse of 6AT is recommended.

Rectification with minimal voltage drop takes place in the full wave centertapped circuit containing the diodes Z1 and Z2. The rectified + output from the common cathodes is isolated against ground via a heat conducting disc. Across the reservoir long-life Al capacitor C1, approximately 1.9V p-p of 100Hz saw tooth is present at 19A DC.

SERIES REGULATOR

Series regulation is obtained through the 4 parallel TO-3 power NPN transistors Q1-4. Base current is provided from Q5 and Q6. The combination has less than 1V total voltage drop at saturation.

Current sharing and measurement is provided by the 4 x 0.025Ω emitter resistors R9-12. The total current is measured by R21-24 and can be read on an instrument on the front panel yellow and red test sockets J5, J4. Here an EMF of 100mV corresponds to 16A output current. The Ri is 550 ohm so a 100uA 1k instrument will deflect 65% at 16A and 100% at 25A.

With 5A per series transistor and an average voltage drop between 2 and 8V a dissipation of 40W per transistor can exist and this requires large heat sinks and thermal grease on the transistors.

R2 is a base leakage resistor, and R1 is a base leakage resistor for Q5.

VOLTAGE REGULATION

The output voltage is sensed by R6, 7, 9 and is compared in a uA 723 Q7-4 with the reference input of ...+2.9V on pin 5. The stable reference is +7.2V supplied by Q7-6 through R27, 28. This +2.9V reference can also be reduced if the transistor Q9 is forced to conduct by either the UR amplifier Q10-5, 6, 7 or the CL amplifier Q10-12, 13, 14 or the Δ U PROTECTION amplifier Q10-9, 10, 8. The network R57, C7 damps the down regulation from selfoscillation.

Amplified output current from Q7 is supplied at pin 11 which feeds the base of the emitter followers Q6 and Q5. Resistor R5 limits the maximum current through Q6 and Z4. R3 protects it from reverse base bias when off.

Inside the uA 723 the output transistor emitter is brought out on pin 10 and the collector on pin 11.

The output regulated +14V can be fine adjusted with the trimmer USET R7.

CURRENT LIMIT

The IC Q8 SG3543 is used to limit the output current as it can operate with a small sense voltage drop supplied by R9-12 in series with the output.

To limit the maximum dissipation in the series transistors to safe levels, a fold-back output voltage load line as seen in drawing RS 21035 is used.

With the output short-circuited, approximately $20V = UC1$ is left across the transistors and 5A can flow corresponding to 100W being dissipated. Normal dissipation is appr. $4V \times 19A = 76W$.

Pin Q8-10 senses the voltage drop across R9-12 via the resistors R13-16 and R17//R18 minus a small fraction of the output voltage determined by R19 + 20, relative to the reference +14V on Q8-11.

With cold heat sinks the maximum tolerated output current can be up to 25A, but with rising temperature a protective reduction will soften the output voltage if 19A is loaded.

At a too high output current Q8-10 will become positive and its output will supply current from pin 12 making Q10-12 positive.

After a voltage gain of 3.7 via R47, Q9 will reduce the +2.9V reference corresponding to an output voltage reduction down to appr. +11V.

At still higher loading the output Q8-13 will conduct the output base drive on Q7-13 starting a further output current reduction.

A too small R26 would mean a too high current limit. Capacitor C3 slows down fast transients.

ΔU RIPPLE PROTECTION

If the mains voltage is reduced below -15%, the minimum ripple voltage across Q1-4 would go below saturation at 1V and cause 100Hz output ripple valley break through. For this reason, at low mains voltages down to 150V AC, the output voltage is reduced down to appr. +10.5V, before the ΔU ripple breaks through.

The average value of UC is sensed via R29 to Q10-3 and the output voltage via R31 to Q10-2. The difference in the two voltages is amplified and fed as a positive voltage to Q10-9 and compared with the fixed reference of +2.2V on Q10-10. If the input differential is below 2.5 VDC, Q10-8 goes positive causing the base of Q9 to conduct and reducing the output voltage until a 2.5V differential exists.

The pins 6,7,4,9 on Q8 and J10 are connected as a differential voltage comparator to control a separate preregulator module.

REFLECTION PROTECTION

The reflection protection function is necessary as a simple means to reduce the power dissipated in the PA in case of antenna faults or high power reflection at the output.

A detected UR DC signal $>+0.7V$ into connector J2 is delayed in C8 and fed into Q10-5 where it is compared to a part of the +7.2V internal reference of Q7. Above the input threshold Q10-7 goes high and via Z9 goes C3 R26 positive. Also R55 and Q9 conduct that will reduce the +2.9V reference input into Q7-6, that sets the output voltage. As the +14V is reduced also the output power and UR is reduced and the dissipation in the PA.

Somewhat depending on input power, frequency cable lengths and load SWR, the +14V will reduce to appr. +10V at full reflection.

BATTERY CHARGING

In case the PSU-unit is used to provide charging for a battery system, the EMF at no load shall not be set higher than 14.4V. The diode Z3 protects the transistors Q1-4 against reverse voltages with the mains off.

The LED on the front panel lights up at about +11V.

SERVICING RS 210

The following instruments are recommended.

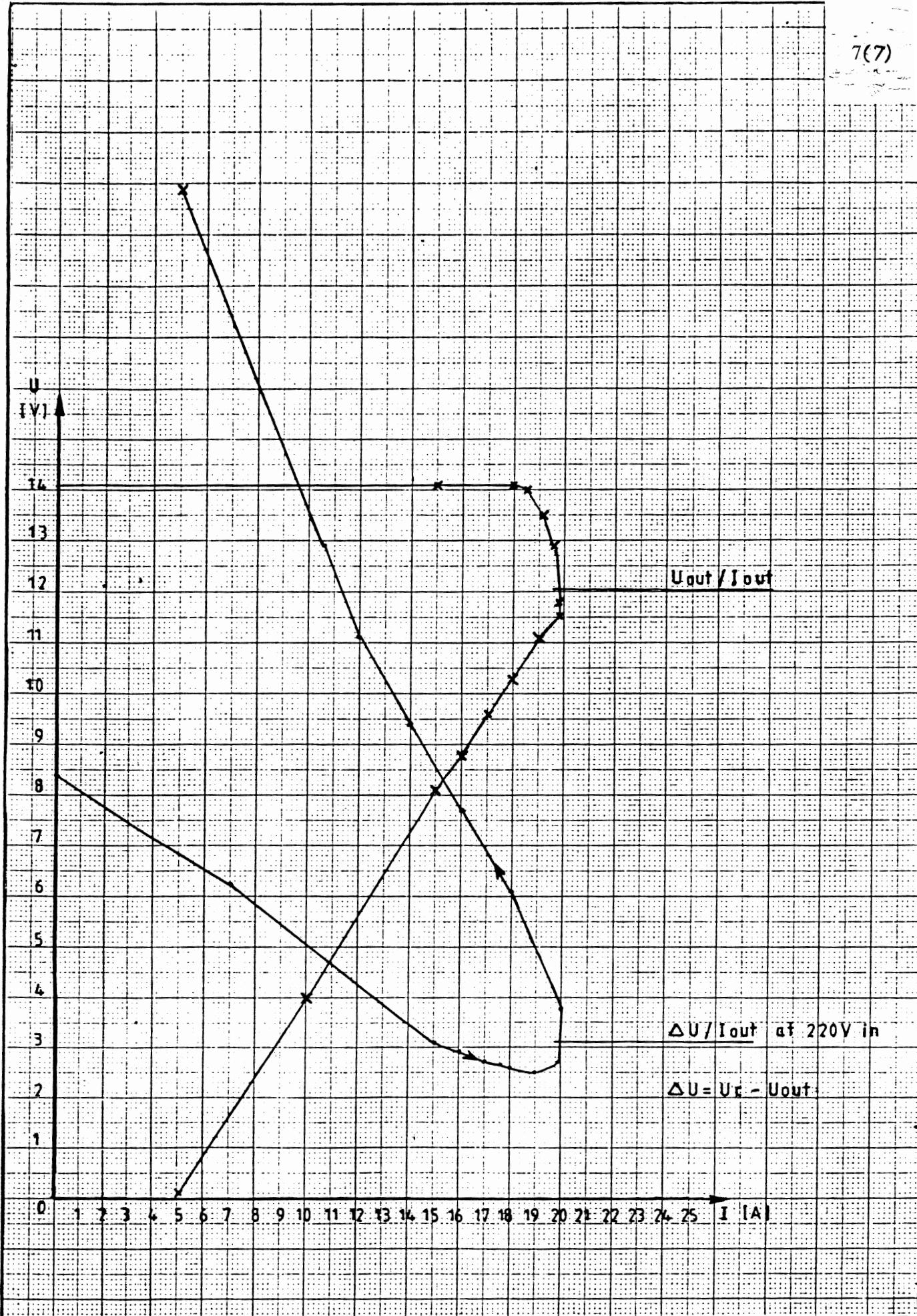
- 1 Variac 0 - 25V 3A with a 5A AC RMS instrument.
- 2 Variable load resistor 0 - 2 ohms 20A
- 3 Digital voltmeter 3,5 figures
- 4 Current DC-meter 0 - 25A
- 5 Oscilloscope 0 - 20MHz

TEST PROCEDURE

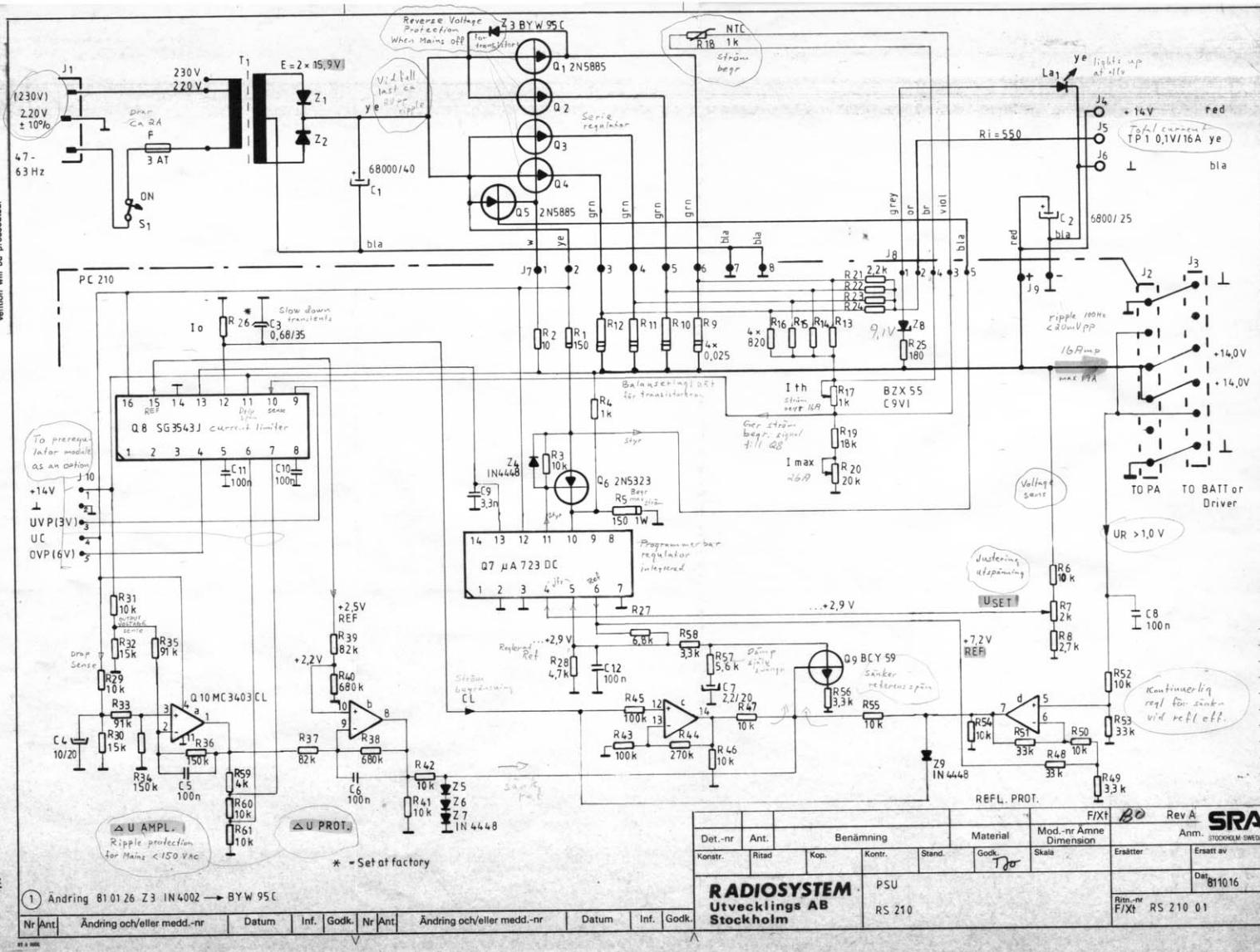
- 1 Set the variac at 0 V, put the digital voltmeter on the load. Increase slowly the input voltage and check that the output voltage follows to + 14,1V unloaded. The primary current should be < 0,5A without load, even at 242 V in.
- 2 If necessary set the + 14,1 at the PSU terminals with R7. Check that the LED + 14 V goes on above + 11 V.
- 3 Connect the load resistor in minimum current position. The current limit is then checked in the following way. Put in 245 V then quickly increase the load to 26 A where the CL is set with R17 and R20, (R20 is normally in full CW position), where the output has dropped appr. 1 V from + 14V. This setting shall be done quickly with cold heat sinks.
- 4 Make a complete short circuit with the load resistor and notice the foldback short circuit current at min 4 A typ 5 A. If the foldback current is too low, starting could be difficult and R26 must be reduced 1 or 2 steps.
- 5 Set the load resistor to 0,88ohm = 16 A and reduce the mains voltage until the +14V drops 0,2 V. Check that the input voltage is < 205 V.
- 6 Set the input voltage to 220V, set the load 0,74ohm to 19 A, connect the oscilloscope AC input at the + 14V output. Reduce the mains voltage until the 100Hz ripple breaks down > 50mVp-p. The input shall be appr. 150 V. The corresponding DC voltage is appr. 10,5 V.
- 7 Check the UR - reflection protection input in the following way. Apply 220V with 16A load. Apply an extenal DC - voltage into the J2 - 2 UR input. Measure the 14 V. output and measure UR >+ 0,7 V at 13,5 V output. Continue and check UR < 1,0 V for an output of ~0 V.

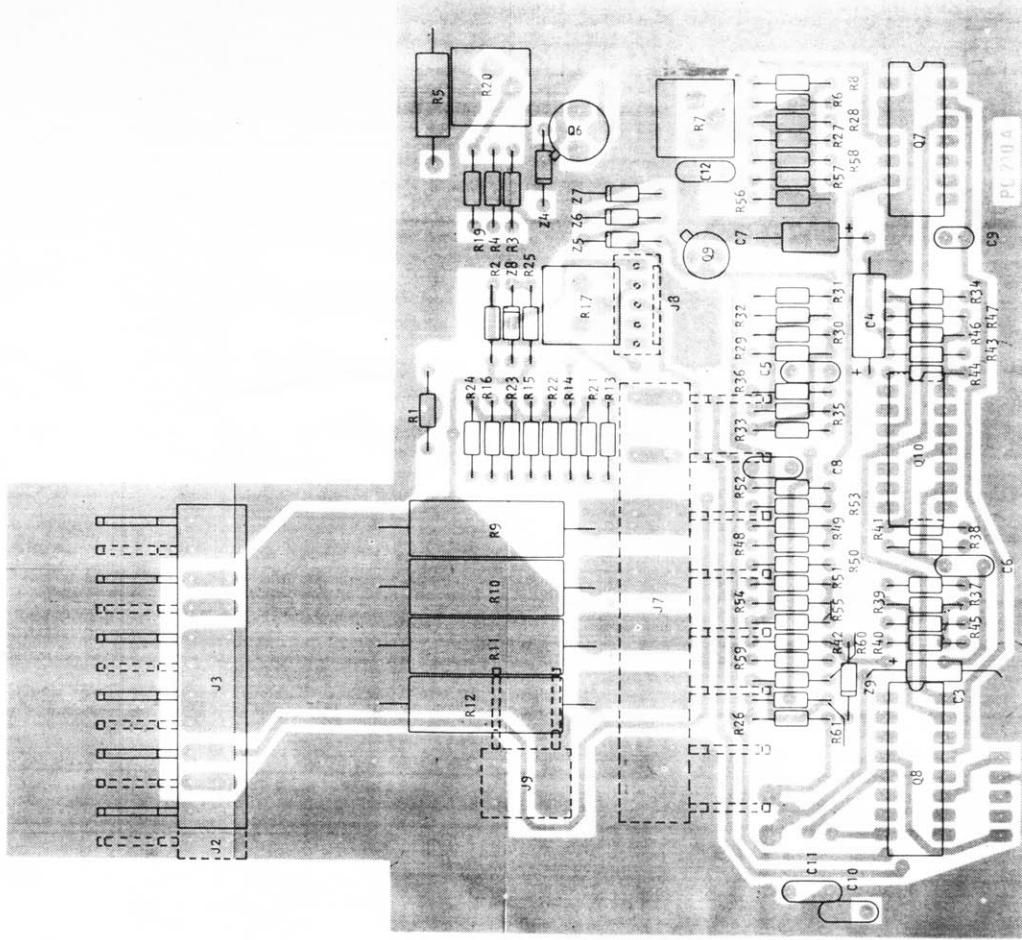
Typical operating DC-values at 220V/14V 19A measured with digital voltmeter.

Q 7 - 4	2,96	VDC	Q10 - 1	3,37	VDC	J 7 - 1	15,32	VDC
5	2,93		2	6,58		2	18,02	
6	7,20		3	6,58		3	14,52	
10	2,58		4	18,06		4	14,53	
11	16,87		5	0,0		5	14,52	
12	18,13		6	0,51		6	15,53	
13	3,77		7	0,19				
			8	0,17		U out	14,41	
Q 8 - 2	1,48		9	2,93				
3	0,06		10	2,21		U C1	0,53	VRMS
4	0,13		12	0,15		U Z2a	15,40	VRMS
5	0,10		13	0,15		U Z2a Io=0	16,0	VRMS
6	1,41		14	0,55		U C1	18,I3	VDC
7	2,79					U C1 Io=0	22,1	VDC
8	0,09		Q 9 e	0,00				
9	0,09		Q 9 b	0,31				
10	14,38		Q 9 c	2,93				
11	14,40		Q 6 e	17,34				
12	0,14		Q 6 b	16,80				
13	3,76		Q 6 c	2,56				
15	2,48							
16	18,08							



Konstr.	Ritad	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
Oc6 7381-44 SMS 687 1.11	RADIOSYSTEM Utvecklings AB Stockholm	4565/o	OUTPUT VOLTAGE LOAD LINE	RS 210			Dat. 820614	
							Ritn.-nr RS 21035	





F/Xt *BO* Rev A SRA
STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning		Material	Mod.-nr Åmne Dimension	A n m.		
Konstr.	Ritad BE/EK	Kop.	Konstr.	Stand.	Godk.	Skala	Ersättar	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm	COMPONENT LOCATION							Dt. 811016
	PC 210A							Ritn.-nr
	F/Xt RS 21018							

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	God.
	AN-TAL	POS.	BENÄMNING	VÄRDE	TOL.	FABRIKAT	TYP		
Qtv	Item	Component	Value	tol.		Manufact.	Type		
1	C1	Capacitor	68mF	40V	Rifa	PEH167HT568			
1	C2	"	6m8F	25V	Rifa	PEH169H468			
1	R18	Thermistor, NTC	1k/25 C		Ph	2322 642 2102			
4	Q1	Transistor			Motorola	2N5885			
	Q2	"			"	2N5885			
	Q3	"			"	2N5885			
	Q4	"			"	2N5885			
	Q5	"			"	2N5883			
2	Z1	Diode			Ph	BYW 92-100			
	Z2	"			Ph	BYW 92-100			
1	Z3	"			Ph	BYW 95C			
1	La	LED	Yellow		O.C	BS-SY 5531			
1	W1	Printed circuit assy.			RS	PC 210A			
1	S1	Panel switch			CARR	AC 482830			
1	J4	Test socket	Red		Elfa	40-6162-8			
1	J5	" "	Yellow		Elfa	40-6164-4			
1	J6	" "	Black		Elfa	40-6160-2			
1	J1	Mains socket			Elproman	8843-SP			
1	F	Fuse	3,15At		S.F				
1	T1	Transformer	540VA		RS	RS 21014			
5	W2	Transistor socket	T0-3		Seifert	TF 3/2			
5	W3	Insulator wafer	T0-3		Thermafilm	43-03-1AP			
1	W4	Cabling set			RS	RS 21020			
1	W5	Nut, nylon	M8		Rifa	PYB 7008			
1	W6	Insulator wafer			RS	RS 21016-1			
2	W7	Insulator tube, teflon	Ø6/5.2x23		RS	RS 21016-2			
2	W9	Washer, nylon	Ø 12x6,4		Colly C.	DIN 125			
2	W10	Clamp assy.			RS	RS 21008			
1	W11	Angle bracket			RS	RS 21019-1			
1	W12	Mounting block			RS	RS 21019-3			
1	W13	Mounting block			RS	RS 21019-4			
1	W8	Heat sink			RS	RS 21019-2			
							F/Xt	BO	Rev A STOCKHOLM-SWEDEN
Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m.		
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter		Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA PSU			Parts List RS 210		Blad 1:3	Dat. 81.12.17	
							Ritn.-nr		
							F/Xt	RS 210 02	

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Go
	AN-TAL	POS.	BENÄMNING	VÄRDE	TOL.	FABRIKAT	TYP		
Qty	Item	Component	Value	tol.		Manufact.	Type		
2	W14	Heat sink				RS	RS 21009		
1	W15	Front heat sink				RS	RS 21005		
1	W16	Rear heat sink				RS	RS 21006		
1	W17	Cover plate				RS	RS 21010		
1	W18	Bar, upper left				RS	RS 21007-1		
1	W19	Bar, lower left				RS	RS 21007-2		
4	W20	Angle bracket				RS	RS 21017		
1	W21	Mounting bracket				RS	RS 21021		
1	W22	Cover				RS	RS 21013		
1	W23	Panel text set				RS	RS 21022		
6	W24	Screw	ECS M3x5						
12	W25	"	ECS M3x12						
4	W26	"	FS M3x6						
2	W27	"	FS M3x10						
8	W28	"	LKCS 3x4						
4	W29	"	LKCS 3x12						
4	W30	Screw	MC6S 4x10						
1	W31	"	ECS M4x8						
9	W32	"	MC6S 5x12						
2	W33	"	MC6S 5x30						
8	W34	"	MC6S 6x12						
2	W35	"	MC6S 6x20						
4	W36	"	M6S 6x16						
4	W37	Crimp nut	M5			Kalei			
2	W38	Nut	M6M 5						
4	W39	"	M6M 6						
4	W40	Washer	BRB 6,5x12x1,5						
4	W41	"	BRB 4,3x8x0,5						
2	W42	"	BRB 5,3x8x1						
							F/Xt	BO	Rev A
									STOCKHOLM-SWEDEN
Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m.		
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter		Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA			Parts List		Blad	2:3	Dat. 81.12.17
		PSU			RS 210		Ritn.-nr		
					F/Xt RS 210 02				

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Fixt *BO* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	A n m.	
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm	STYCKLISTA			Parts List			Blad 3:3	Dat. 81.12.17
	PSU			RS 210			Ritn.-nr F/Xt	RS 210 02

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Go.			
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP					
Qty	Item	Component	Value	tol.	Manufact.	Type							
1	R1	Resistor	150Ω	1%	Resista	MK2							
1	R2	"	10Ω	1%	"	"							
14	R3	"	10kΩ	1%	"	"							
1	R4	"	1kΩ	1%	"	"							
1	R5	"	1W	150Ω	"	MK4							
	R6	"		10kΩ	1%	"	MK2						
1	R7	Potentiometer		2kΩ		Helitrim	72P						
1	R8	Resistor		2k7Ω	1%	Resista	MK2						
4	R9	" , wire-wound	0,025Ω	5%	Vitrohm	350-8							
	R10	" "	0,025Ω	5%	"	350-8							
	R11	" "	0,025Ω	5%	"	350-8							
	R12	"	0,025Ω	5%	"	350-8							
4	R13	"	820Ω	1%	Resista	MK2							
	R14	"	820Ω	1%	"	"							
	R15	"	820Ω	1%	"	"							
	R16	"	820Ω	1%	"	"							
1	R17	Potentiometer		1kΩ		Helitrim	72P						
	R18	- - - - -											
1	R19	Resistor		18kΩ	1%	Resista	MK2						
1	R20	Potentiometer		20kΩ		Helitrim	72P						
4	R21	Resistor		2k2Ω	1%	Resista	MK2						
	R22	"		2k2Ω	1%	"	"						
	R23	"		2k2Ω	1%	"	"						
	R24	"		2k2Ω	1%	"	"						
1	R25	"		180Ω	1%	"	"						
1	R26	" , set at factory											
1	R27	"		6k8Ω	1%	"	"						
1	R28	"		4k7Ω	1%	"	"						
	R29	"		10kΩ	1%	"	"						
2	R30	"		15kΩ	1%	"	"						
	R31	"		10kΩ	1%	"	"						
	R32	"		15kΩ	1%	"	"						
2	R33	"		91kΩ	1%	"	"						
2	R34	"		150kΩ	1%	"	"						
	R35	"		91kΩ	1%	"	"						

F/Xt 80 Rev A SRA STOCKHOLM-SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersättar 811016	Ersatt av	
RADIOSYSTEM Utvecklings AB Stockholm				STYCKLISTA Parts List					
				REGULATOR CARD. PC210A RS 210					
				Blad 1:3 Dat. 81.12.17					
				Ritn.-nr					
				F/Xt RS 210 03					

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Nr	Ant.	Ändring och/eller medd.-nr						Datum	Inf.	Goc			
	AN-TAL	POS.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP					
Oty	Item	Component	Value	tol.	Manufact.	Type							
	R36	Resistor	150kΩ	1%	Resista	MK2							
2	R37	"	82kΩ	1%	"	"							
2	R38	"	680kΩ	1%	"	"							
	R39	"	82kΩ	1%	"	"							
	R40	"	680kΩ	1%	"	"							
	R41	"	10kΩ	1%	"	"							
	R42	"	10kΩ	1%	"	"							
2	R43	"	100kΩ	1%	"	"							
1	R44	"	270kΩ	1%	"	"							
	R45	"	100kΩ	1%	"	"							
	R46	"	10kΩ	1%	"	"							
	R47	"	10kΩ	1%	"	"							
3	R48	"	33kΩ	1%	"	"							
3	R49	"	3k3Ω	1%	"	"							
	R50	"	10kΩ	1%	"	"							
	R51	"	33kΩ	1%	"	"							
	R52	"	10kΩ	1%	"	"							
	R53	"	33kΩ	1%	"	"							
	R54	"	10kΩ	1%	"	"							
	R55	"	10kΩ	1%	"	"							
	R56	"	3k3Ω	1%	"	"							
1	R57	"	5k6Ω	1%	"	"							
	R58	"	3k3Ω	1%	"	"							
1	R59	"	4kΩ	1%	"	"							
	R60	"	10kΩ	1%	"	"							
	R61	"	10kΩ	1%	"	"							
	C1	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -							
	C2	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -							
1	C3	Capacitor, tantal	0,68µF 35V	Kemet	T110 A684 M035AS								
1	C4	" "	10µF 20V	Kemet	T110 C106 M020AS								
6	C5	" ,keramic	100nF	Siemens	B37449								
	C6	" "	100nF	"	B37449								
1	C7	" ,tantal	2µ2F 20V	Kemet	T110 A225 M020AS								
	C8	" ,keramic	100nF	Siemens	B37449	SRA							
						F/Xt <i>BO</i> Rev A STOCKHOLM SWEDEN							
Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.					
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	811016	Ersatt av				
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA Parts List				Blad 2:3 Dat 81.12.17							
		REGULATOR CARD PC210A RS210				Ritn.-nr							
						F/Xt RS 210 03							

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F/Xt *BO* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m.	
Konstr.	Ritad OS/EK	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter 811016	Ersatt av
RADIOSYSTEM Utvecklings AB Stockholm	STYCKLISTA			Parts List			Blad 3:3	Dat. 81.12.17
	REGULATOR CARD PC210A			RS210			Ritn.-nr	F/Xt RS 210 03

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COAXIAL RELAY RS 220

Description 2

Circuit diagram RS 220 RS 220 02

Component location RS 220 RS 220 03

" " PC 220 RS 220 07

Parts list RS 220 RS 220 04

" " PC 220 RS 220 14

Unit location RS 220 + PC 221 RS 220 01

COAXIAL RELAY RS 220

DATA

Frequency range	68 - 470 MHz
Input power max	125 W
Input SWR	< 1.3
Isolation	~ 40 dB
Insertion loss	max 0.3 dB
Supply voltage	+10.8 ... +15.6V
Supply current	200mA activated
Switching time on/off	appr. 15ms
RF input switching	min 2.5 W
External control voltage	+ 9V T ~1mA
Connectors	type N in/out

INTRODUCTION

The Coaxial Relay RS 220 can be installed in the PA to by-pass it for the following purposes.

- 1 By-pass the PA in case of PA fault.
- 2 BY-pass the PA in case of 220/+14V fault.
- 3 Cut back to the driver in case of mains fault and battery operation.
- 4 In simplex operation to connect the antenna to the receiver when not transmitting.

DESCRIPTION

The Coaxial Relay RS 220 consists of 2 SPTD mechanical coaxial relays Rel and Re2 which in the off unactivated position make a direct by-pass. An input RF signal from the driver above appr. 2.5W is sensed by C1 and detected in D2 and fed to the transistor comparator Q2 and Q1 that at a certain level across R2 makes Q3 to conduct and attract Rel and Re2 .

R7 provides some hysteresis for the switching on voltage.

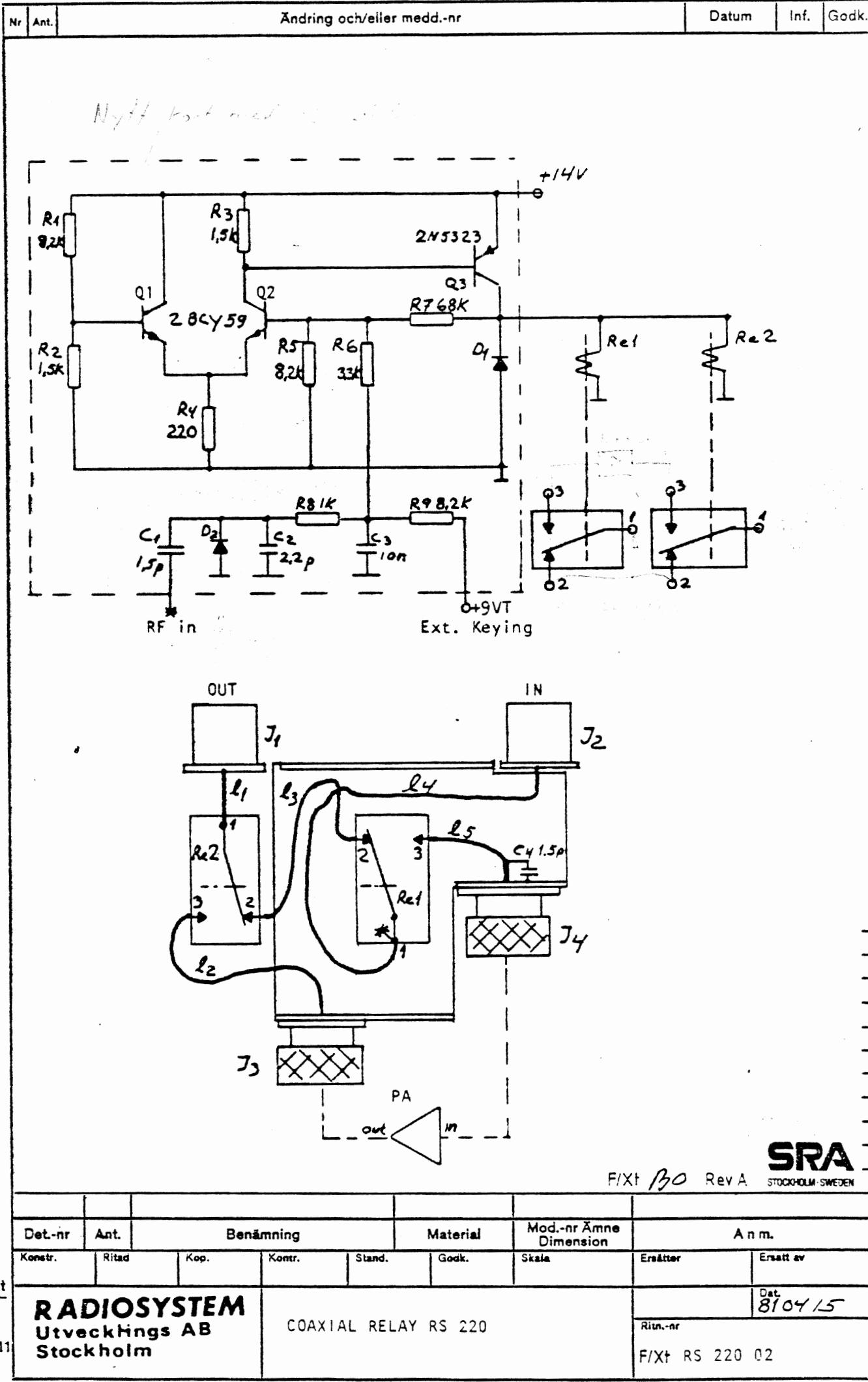
The unavoidable delay time of the mechanical switch of appr. 15 ms means that the switching will be done when the contacts carry RF-currents, and a short burning spark and adjacent channel noise will occur. An input carrier operated switching is thus not normally recommended, and should only be used sparsely.

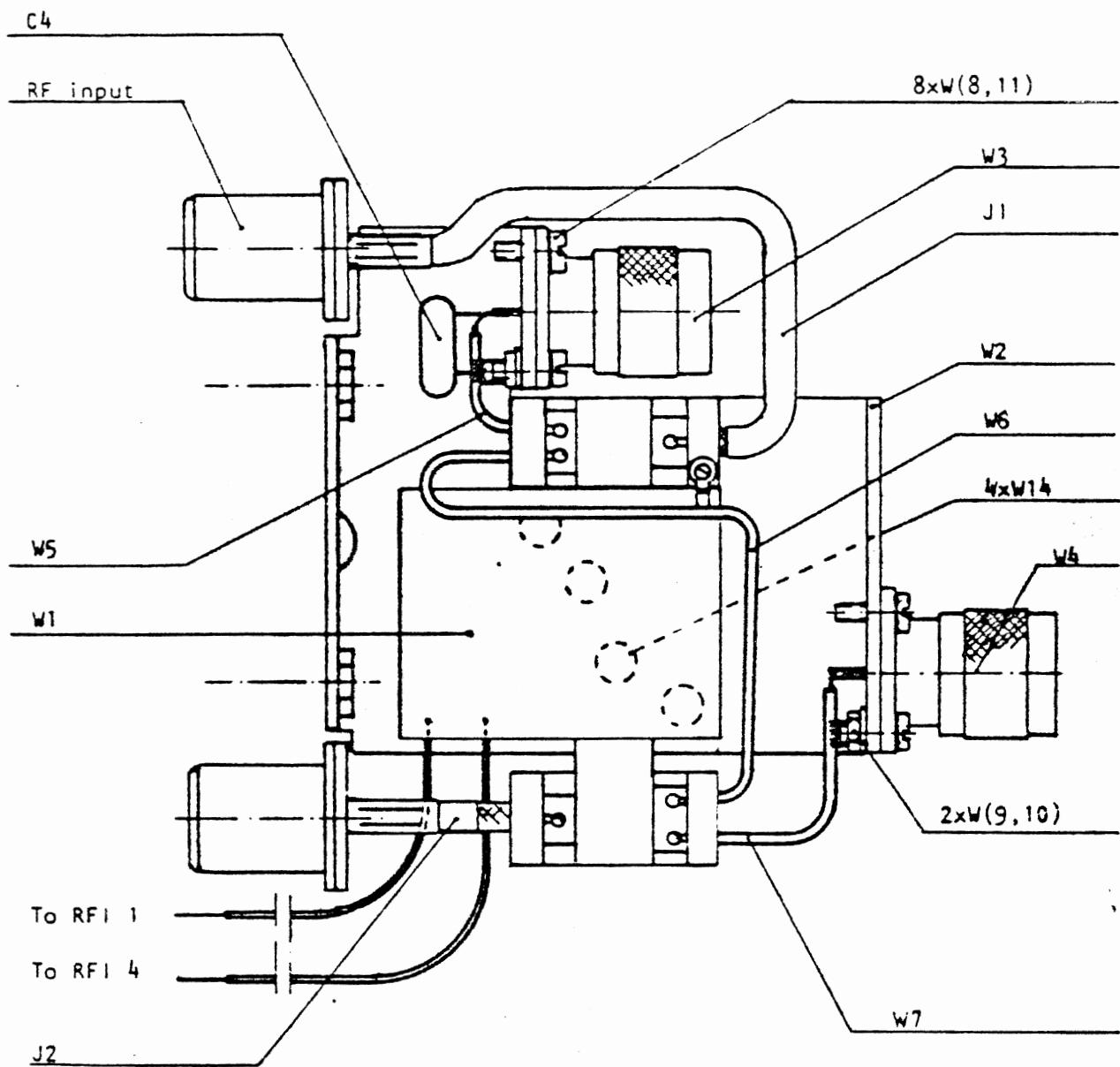
In case of repeated switchings in and out as in simplex operation an External input +9V T control signal from the keyed driver shall be used that is keyed >15ms before the input RF power is applied to the PA.

Heat resistant Teflon insulation is used in the coaxial switches and the internal cables that carry 100W.

If the +14V Supply voltage drops below appr. +10.8V the relays will drop out. The reason could be +14V PSU fault or discharged batteries, or a high antenna SWR that also reduces the supply voltage.

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SRA
STOCKHOLM-SWEDEN

F/Xt *B0* Rev A

Det.-nr	Ant.	Benämning			Material	Mod.-nr Ämne Dimension	An m.	
Konstr.	Ritad	Kop.	Kentr.	Stand.	Godk.	Skala	Ersätter	Ersatt av
	JEJ					1:1		
RADIOSYSTEM Utvecklings AB Stockholm		COMPONENT LOCATION						Dat. <i>82.01.26</i>
SMS 687 1.11		RS 220						Ritn.-nr F/Xt RS 220 03

Nr.

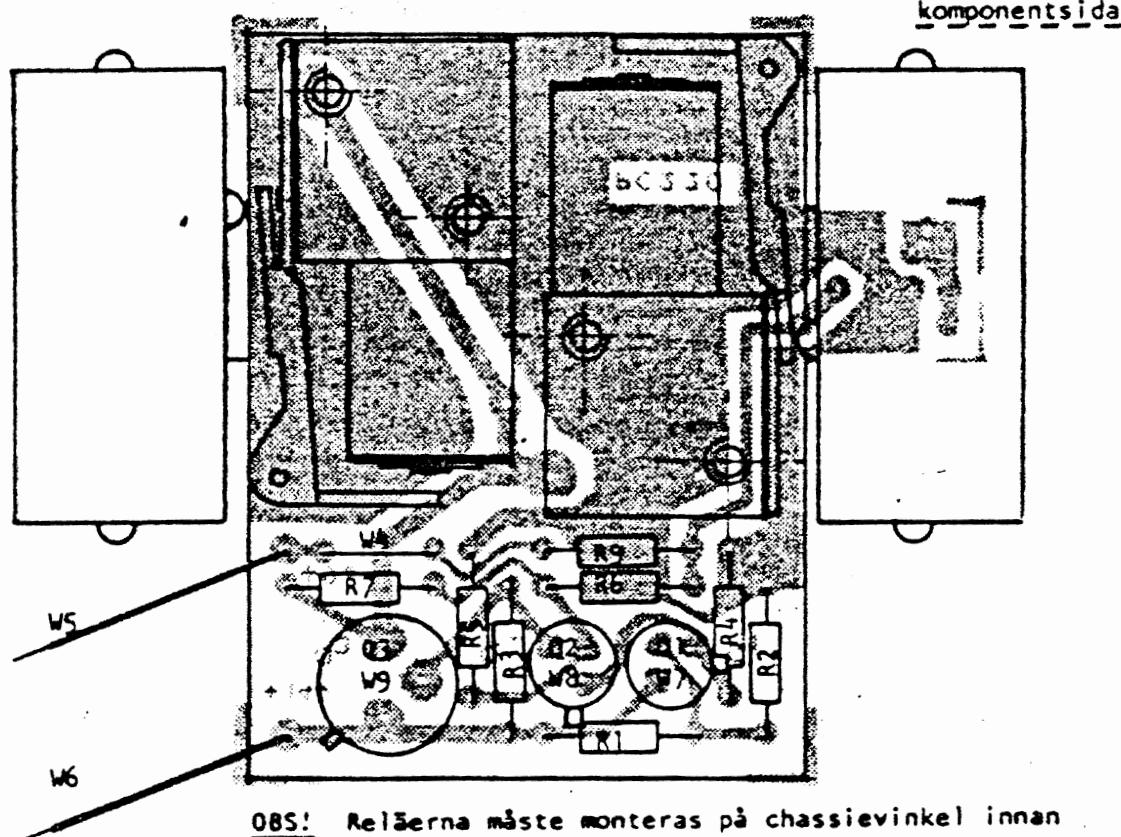
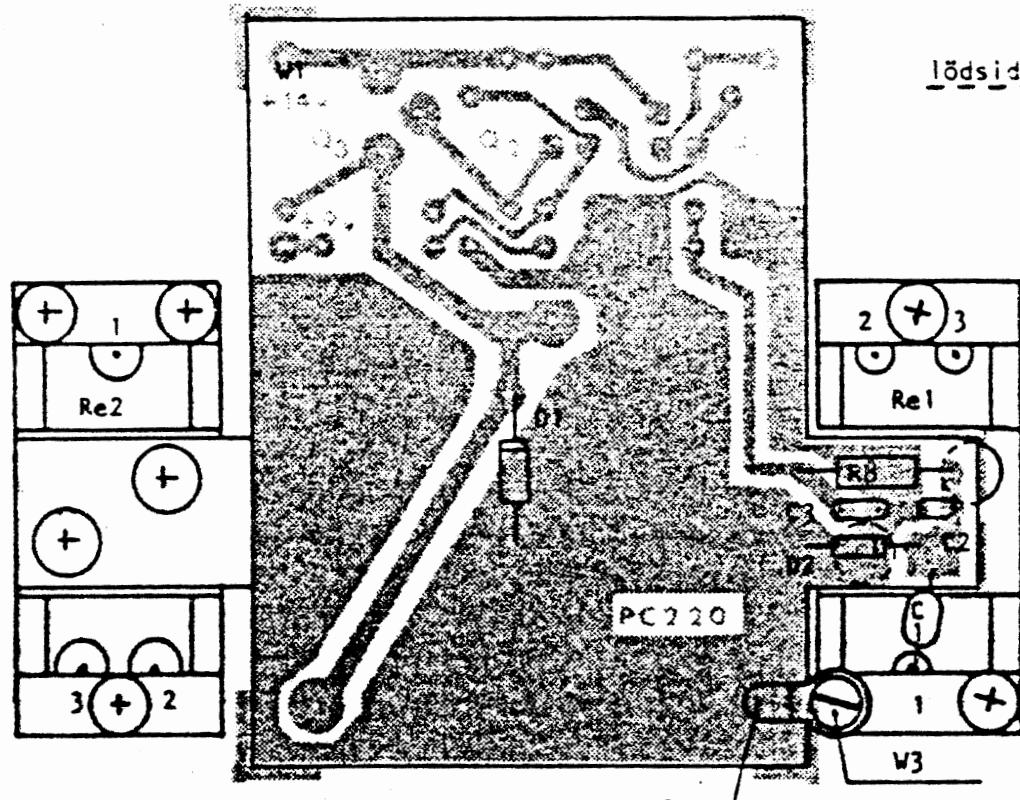
Ant.

Ändring och/eller medd.-nr.

Datum

Inf.

Godk.



OBS! Reläerna måste monteras på chassievinkel innan fastlödning på kretskortet sker.

Det.-nr	Ant.	Beskrivning		Material	Mod.-nr Åmne Dimension	F/Xt	Rev A	SRA
Konstr.	Ritad	Kop.	Konstr.	Stand.	Godk.	Skala	Ersättar	Ersatt av
						2:1		
RADIOSYSTEM Utvecklings AB Stockholm		COMPONENT LOCATION						Dat. 82.01.26
SMS 637 1.11		PC 220						Ritn.-nr F/Xt RS 220 07

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Rev A STOCKHOLM · SWEDEN

Det.-nr		Ant.			Benämning		Material		Mod.-nr		Ämne Dimension		An m.	
Konstr.	Ritad	Kop.	Kontr.	Stand.	Göd.	Skala		Ersätter	Ersatt av					
RADIOSYSTEM Utvecklings AB Stockholm	OS/EK						STYCKLISTA	Parts List	Blad	1:1	Dat	82.01.27		
							RS 220		Ritn.-nr			F/Xt RS 220 04		

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SMS 687 1.11

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Nr	Ant.	Ändring och/eller medd.-nr					Datum	Inf.	Godk.
	An-tal	Pos.	BENÄMNING		VÄRDE	TOL.	FABRIKAT	TYP	
Qty	Item	Component	Value	tol.	Manufact.	Type			
3	R1	Resistor, metal	8k2Ω	1%	Resista	MK 2			
2	R2	" "	1k5Ω	1%	"	"			
	R3	" "	1k5Ω	1%	"	"			
1	R4	" "	220Ω	1%	"	"			
	R5	" "	8k2Ω	1%	"	"			
1	R6	" "	3k3Ω	1%	"	"			
1	R7	" "	68kΩ	1%	"	"			
1	R8	" "	1kΩ	1%	"	"			
	R9	" "	8k2Ω	1%	"	"			
1	C1	Capacitor, ceramic	1p5F		Philips	2222 631 03158			
1	C2	" "	2p2F		Philips	2222 631 03228			
1	C3	" "	10nF		Philips	2222 640 02103			
1	D1	Diode			Philips	1N4002			
1	D2	"			HP	1N6263			
2	Q1	Transistor			Siemens	BCY 59			
	Q2	"			Siemens	BCY 59			
1	Q3	"			RCA	2N5323			
2	Re1	Coax relay			Toyo	CX-120A			
	Re2	" "			Toyo	CX-120A			
1	W1	PC-board			RS	PC 220			
1	W2	Soldering tag			Elfa	48-9300-4			
1	W3	Screw		ECS M2,5x6					
1	W4	Jumper, Cu	Ø 0,5mm		L=15,2 mm				
1	W5	Cable, green	0,22 mm ²	RK	L=190 mm				
1	W6	" , orange	0,22 mm ²	RK	L=190 mm				
2	W7	Mounting pad	T0-18		Elfa	75-6553-4			
	W8	" "	T0-18		Elfa	75-6553-4			
1	W9	" "	T0-5		Elfa	75-6550-0			

SRA

F/Xt *BD* Rev A STOCKHOLM SWEDEN

Det.-nr	Ant.	Benämning			Material	Mod.-nr	Ämne Dimension	An m.	
Konstr.	Ritad	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av	
Océ 7361-44									
RADIOSYSTEM Utvecklings AB Stockholm		STYCKLISTA		Parts List			Blad	1:1	Dat. 82.01.26
SMS 687 1.11		PC 220					Ritn.-nr		
							F/Xt	RS 220 14	