

# SALCOM 12-03-0000

## UHF POCSAG Eight Channel Relay Output Receiver

### Technical Manual

#### Description.

The SALCOM 1203 receiver has been designed to receive and decode POCSAG data in the UHF frequency band. The receiver also provides the ability to control up to eight relay outputs using SALCOM paging systems or wide area public paging networks.

#### Operation.

The unit receives and decodes a numeric or alphanumeric pager call. If the received unit number matches the 12-03 unit number, the relay outputs are switched according to the ON/OFF fields of the message.

#### The Receiver.

The receiver consists of a direct conversion receiver device IC1 with a separate synthesised local oscillator. The signal enters the unit through a BNC connector, and then passes through a band pass filter, before entering the receiver device.

Two test point outputs are provided by the receiver device IC1, and can be accessed at P3 pins 1 and 2.

These show the pre detected audio of the receiver, and can be used to tune the previous stages.

Detected data comes from pin 27 of IC1 receiver device.

#### PLL synthesiser.

The local oscillator starts at the oscillator Q5 in a Collpits configuration. The frequency of this stage is controlled by varactor D12 connected to the control loop and synthesiser IC6. The control loop voltage can be measured with a high impedance meter at test point LOOP. The frequency reference is controlled by crystal X3, and can be adjusted by use of CV1. The remaining synthesiser stage is a dual gate FET buffer Q4, driving the oscillator input of the receiver device IC1.

#### The Decoder.

The detected serial data from the receiver IC1 is fed into a microprocessor POCSAG decoder IC2 pin 12, and can be viewed with an oscilloscope on test point P3 pin 3.

The microprocessor device has the following functions:

- ☐ Decode the POCSAG data from the receiver.
- ☐ Load the synthesiser on power up.
- ☐ Check for synthesiser lock and drive the LED.
- ☐ Output decoded POCSAG data via the serial port.
- ☐ Communicate to the user configuration software when needed.

The relays are driven by a buffer device IC7, which is driven by the decoder outputs. An LED and resistor is wired across each relay coil to show status of the relays.

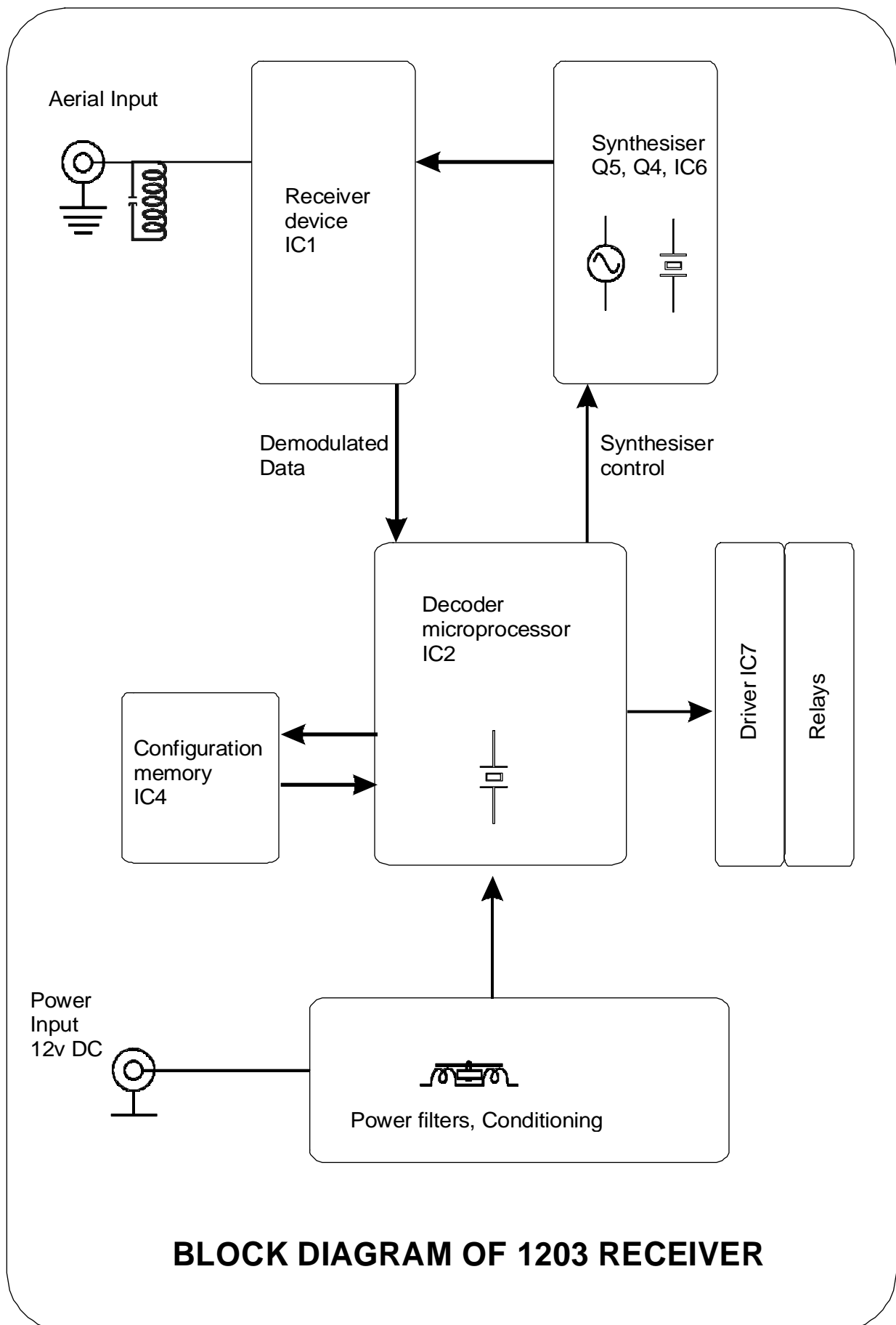
The microprocessor firmware is protected from latch up by an external watchdog circuit IC3. The configuration is held in non-volatile EEROM memory IC4, with a write protection link to prevent accidental corruption in noisy electrical environments.

The decoder can be programmed by the user to interpret up to four RIC (CAP) codes.

#### Power conditioning.

The power input to the unit comes in via a 2-way screw terminal block. Input filtering and over voltage protection is performed by C35, R27, F1, Z1, C34, C30. This supply is then used to power the relay coils, and can be measured on test point PAD 2.

The main supply is reduced to 5volts by the low dropout series regulator IC5, and can be measured on test point PAD 1.



## TUNING AND SET UP PROCEDURE

### Apparatus required

Signal generator FM +/-4KHz @ 460.000 MHZ carrier (HP 8920A).  
Oscilloscope Dual trace.  
DMM meter ( 20 volts )  
12v power supply, limited to 100mA (SALCOM).  
Trimming tool for coil cores (SALCOM).  
Hewlett Packard test set to generate alpha POCSAG RIC 0116358 level 1(HP8920A)

### Tuning Setup

Tuning to be performed at 460MHz

Connect Signal generator to input BNC of 12-03 board  
Connect DC supply +12v current limited to 100mA.  
Adjust L15 until the voltage at PAD3 Aloop is approx 3v  
Inject a carrier level to give a 50mV sine wave on the scope, approx -50dBm. Some units may require a higher level.

### Tuning Method

Adjust CV1 for a frequency of approx 2KHz (0.5mSec between peaks) on P3 pin 1 (very small amplitude). Either of the two settings found will suffice.  
Maintain a scope display of approx 50mV pp by adjusting the input carrier level.  
Adjust CV4, CV2, CV3 (in that order) for maximum signal on scope. CV3 may have multiple peaks, choose the largest peak. Repeat this several times to maximise the output. Maintain a scope display of approx 50mV pp by adjusting input carrier level. The final scope display should be approx. 20 to 25mV for a carrier input of -95 to -100dBm.  
Re-adjust CV1 to reduce the scope signal frequency until it reaches <100Hz.

### Sensitivity check

Connect scope to P3 pin 3 to a scope input 0.2V/div, AC coupled.  
Increase the carrier frequency by +4KHz at a level of -100dBm.  
Set the scope trace to lie on the centre grid line, reduce the carrier level until the scope display baseline shifts by 0.2v. This should correspond to <-121dBm

### Decoder check

Cycle power off then on.  
Reset the carrier to +0KHz, Inject the following POCSAG message signal at -120dbm using the test set or POCSAG generator and sig gen.  
***RIC 0116358. Type Alphanumeric. Function level 4. Message 01109***  
Check led on 12-03 flashes on for 2 seconds.  
Check message is repeated on serial output, monitor with a terminal program.  
Check relay 1 comes on. Relay goes off after 0.5sec. Should go 5 times.  
Reliable decoding should be obtained at a carrier level of <-121dBm .

## Specification

Enclosure.	170mm x 120mm x 55mm. ABS plastic case. Weather proof. IP565
Supply Voltage	10v to 17v, Nominal 12V.
Current drain	Standby 35mA plus 18mA per relay.
Relay contacts	1Amp @24VDC or 120vAC. 10A @250VAC can be fitted on special order.
Temperature limits	-10 to +50degC
Frequency range	450-470MHz overall, factory set to 455-465MHz Can be set in one of four 5MHz bands on specific order.
Frequency selection method	Synthesised. High vibration crystal conversion available as special order.
RX sensitivity	Approx -120dBm +/-2dB for 1xE-3 BER
Aerial connection	BNC 50ohm
Paging protocol	POCSAG 512 or 1200baud. Also SALCOM POCSAG rapid.
Type Approvals	FCC CFR47 Part 15

## Parts List

Part Type Designator Footprint		
+5V	PAD1	PAD70S
+10v	PAD2	PAD70S
1K	R30	1206
1K	R5	1206
1K	R12	1206
1K	R55	1206
1K	R32	1206
1K	R31	1206
1M	R18	1206
1N	C38	1206
1N	C20	1206
1N	C18	1206
1N	C26	1206
1N	C33	1206
1N	C32	1206
1N	C10	1206
1N	C9	1206
1N	C8	1206
1UF	C54	1206
1k2	R2	1206
2K2	R24	1206
2K2	R11	1206
2K2	R16	1206
2K2	R9	1206
2K2	R8	1206
2K2	R15	1206
2K2	R10	1206
2K2	R35	1206
2K2	R7	1206
2PIN	P4	SIP2
2PIN	TB5	TERM2
2PIN	TB2	TERM2
2PIN	TB1	TERM2
2PIN	TB4	TERM2
2PIN	TB8	TERM2
2PIN	TB9	TERM2
2PIN	TB10	TERM2
2PIN	TB6	TERM2
2PIN	TB7	TERM2
2R2	R47	1206
2p2	C13	1206
2p2	C50	1206
2p2	C7	1206
2p2	C12	1206
2p2	C6	1206
2p2	C11	1206
3K3	R33	1206
3p3	C39	1206

Part Type Designator Footprint		
3p3	C19	1206
3p3	C49	1206
4K7	R44	1206
4K7	R43	1206
4K7	R20	1206
4K7	R17	1206
4K7	R29	1206
4K7	R28	1206
4K7	R46	1206
4K7	R45	1206
6PIN	P3	SIP6
6p8	C51	1206
6pF	CV3	CAPVAR-SMD
6pF	CV2	CAPVAR-SMD
6pF	CV4	CAPVAR-SMD
7PIN	S2	SIP7
8nH	L3	1008
8nH	L2	1008
8nH	L4	1008
8nH	L1	1008
9.6MHz	X3	XTAL
10K	R42	1206
10K	R3	1206
10N	C47	1206
10N	C48	1206
10N	C37	1206
10N	C1	1206
10R	R21	1206
10R	R23	1206
10R	R22	1206
10R	R27	1206
10R	R25	1206
10R	R13	1206
10R	R14	1206
10R	R40	1206
10p	C43	1206
10uF	C23	RB.1/.2
10uF	C35	RB.1/.25
10uF	C53	RB.1/.25
10uF	C52	RB.1/.25
10uF	C60	RB.1/.25
11.0592MHz	X2	XTAL1
11P	CV1	CAPVAR-SMD
12.5nH	L5	1008
15P	C36	1206
15P	C21	1206
15P	C22	1206
18V 3WZ1	1N400X	

Part Type Designator Footprint		
22p	C14	1206
22p	C15	1206
30-39-0212	PCB1	
39P	C57	1206
40nH	L6	1008
40nH	L7	1008
47k	R57	1206
47uF	C34	RB.1/.25
56K	R19	1206
68P	C56	1206
68R	R39	1206
68R	R41	1206
68R	R26	1206
100K	R38	1206
100K	R37	1206
100N	C25	1206
100N	C30	1206
100N	C31	1206
100N	C29	1206
100N	C40	1206
100N	C42	1206
100N	C41	1206
100N	C24	1206
100N	C62	1206
100P	C45	1206
100P	C28	1206
100P	C44	1206
100P	C27	1206
100nH	L8	1008
220N	C58	1206
220N	C59	1206
220N	C55	1206
220P	C46	1206
330R	R56	1206
330R	R4	1206
330R	R34	1206
330R	R36	1206
330nH	L12	1210
330nH	L13	1210
330nH	L11	1210
100081	L15	TOKO139
AT24C04A	IC4	SO-8
AT89C2051-20SC	IC2	SOL-20
BAS16	D3	SOT-23S
BAS16	D9	SOT-23S
BAS16	D8	SOT-23S
BAS16	D7	SOT-23S
BAS16	D10	SOT-23S

Part Type Designator Footprint		
BAS16	D4	SOT-23S
BAS16	D5	SOT-23S
BAS16	D6	SOT-23S
BAS16	D2	SOT-23S
BBY31	D12	SOT-23S
BC847	Q3	SOT-23S
BF998	Q4	SOT-143S
BNC-PCB-METAL	S1	BNC/RA
BOX ENCLOSURE	BOX1	
COAX-S	P2	ANT
HEF40106BD	IC3	SO-14
J310	Q5	SOT-23S
LED-3MM	D15	LED
LED-3MM	D16	LED
LED-3MM	D13	LED
LED-3MM	D14	LED
LED-3MM	D19	LED
LED-3MM	D20	LED
LED-3MM	D17	LED
LED-3MM	D18	LED
LED RED 3MM	D1	LED
LOOP	PAD3	PAD70S
LP2951	IC5	SO-8
PWRFILTER	F1	SIP3
RL211E	RL6	RL211E
RL211E	RL7	RL211E
RL211E	RL5	RL211E
RL211E	RL8	RL211E
RL211E	RL3	RL211E
RL211E	RL2	RL211E
RL211E	RL1	RL211E
RL211E	RL4	RL211E
S1G	D11	3528
UAA2080T	IC1	SOL-28
UCN2595A	IC7	DIP18
UCN2595A	IC7A	SOL-18
UMA1014T	IC6	SO-16
VCO CAN	CH1	VCO C

