SP - 1102

Service Manual

Warnings

1. **WARNING! NEVER** connect the transceiver to an AC outlet. This may pose a fire hazard or result in an electric shock.
2. **NEVER** operate the radio transmitter without a suitable artificial load or antenna connected.
3. **NEVER** connect the transceiver to a power source of more than 8.4V DC such as a 13.8V battery.
4. **NEVER** dispose of the battery in fire – it can explode causing personal injury.
5. **NEVER** attempt to disassemble the battery or remove its case material or charging contacts. Do not short the battery terminals.
6. **NEVER** expose the transceiver to rain, snow or any liquids.
7. **NEVER** modify a radio or accessory except as instructed in the service manual, engineering bulletins or formal communication as this may invalidate any warranty, guarantee or type approval.
8. USE the supplied microphone only. Other microphones have different pin assignments and may damage the transceiver.
9. **DO NOT** use or place the transceiver in areas with temperatures below -30°C or above +60°C, In areas subject to direct sunlight, such as the dashboard.
10. **DO NOT** hold the radio in such a manner that the antenna is next to, or touching, exposed parts of the body, especially the face or eyes, while transmitting.
11. **DO NOT** allow children to operate transmitter-equipped radio equipment.
12. **DO NOT** operate the radio near unshielded electrical blasting caps or in an explosive atmosphere, unless it is a type especially designed and qualified for such use.
13. **DO NOT** press and hold the transmit bar (P-T-T) when not actually wishing to transmit.
14. AVOID placing the transceiver in excessively dusty environments.

Contents

Introduction

This Maxon Service Manual is a comprehensive guide to the maintenance and field repair of this equipment. It covers all versions of the SP-1102 Series radio(s). Before using this manual please read the whole of this introductory chapter, this will help you to make the best use of it. If you have not done so already, please also read the warnings immediately in front of this chapter before proceeding any further.

Using this Manual

The organization of this manual has been arranged to enable the location and referencing of information, as quickly as possible.

Section 3 - Installation, Commissioning & Alignment. Describes connections to the radio, how to commission it and how to align the radio should this becomes necessary.

Section 4 - Detailed functional description.

Section 5 - Troubleshooting.

Amendments to this Manual

From time to time during its lifetime, this product will be updated and improved. To cover such changes, amendments to this manual will be issued in the form of replacements and/or additional pages. It is important that anyone working on a product has all the relevant information. Therefore you should incorporate amendments to this manual on receipt. Please follow the instructions accompanying the amendment (in the form of an Engineering Bulletin) and be sure to complete the amendment record at the front of this manual.

On occasion it may be necessary to issue product information more quickly than can be achieved with an amendment. In this case the information will be distributed as a Maxon Engineering Bulletin. Engineering Bulletin numbers are prefixed with a category letter – A, B or C.

E.g. CATEGORY C – ENGINEERING BULLETIN 120

Category C describes how Maxon recommends an improvement and/or a modification to make an improvement to a product

Engineering Bulletin 120 index number allocated to this bulletin.

'A' Category A Engineering Bulletins will only be released if, by using the equipment manufactured by Maxon or its subcontractors, a risk to operator safety or an infringement of Type Approval is probable.

All units affected should be returned for modification to Maxon CIC Europe Works Department on receipt of such a Bulletin.

'B' Category B Engineering Bulletins are for equipment manufactured by Maxon CIC that may have component batch problems.

All equipment affected that is in service must be returned to the Distributor or Dealer workshop for modification. Maxon CIC will supply replacement components free of charge.

'C' Category C Engineering Bulletins are for improvement or modification to equipment manufactured by Maxon.

Dealer/Distributor to modify affected units in the field on the next service call. Maxon will supply components free of charge.

Please place these at the back of this manual and refer to them before carrying out any work. This Service Manual should be updated with any accompanying replacement pages. You may wish to retain the previous issue pages for future reference.

Specification

General

Performance specifications	FCC Compliance
Frequency coverage	148.000~174.000 MHz
Channel spacing	N-BAND 12.5KHz
	S-BAND 25KHz
RF output power	5W
Modulation type	F3E
Audio power	500mW(Int with 4 ohm)
Intermediate frequencies	45.1MHz & 455 KHz
Number of channels	16
Frequency source	Synthesizer
Frequency stability	0.0005%(-30°C to +60°C)
Power supply	Rechargeable Li-on
	Battery 7.5 VDC +/-10%
Current consumption	Off <1 mA
	Standby(Muted) <30 mA(Battery save on)
	<60 mA(Battery save off)
	Unmuted,100%Max AF Power <500mA
	Transmit 5 Watts RF Power <2.0 A
Temperature range operating	Storage from -40°C to +80°C
	Operating from -30°C to +60°C
Humidity	90%-95% at +50°C
Physical dimensions	40X60X195
Weight	0.244 Kg

Transmitter

Test Method TIA / EIA-603 unless stated. Performance without Sub-Audio Modulation.

Power Output

Low Power 1W

Audio Freq. Deviation

	Nominal	Peak
12.5 kHz	+/-2.3KHz	+/-2.5KHz
25 KHz	+/-4KHz	+/-5KHz

With or without audio sub-modulation (10% peak deviation)

Audio Characteristics

(Method as FTZ17 TR 2049 July 1988)

Modulation Type F3E

Within +1/-3dB of limit wrt 1 kHz:

300Hz to 2.55 kHz for 12.5kHz channel spacing

300Hz to 3.0 kHz for 20 / 25kHz channel spacing

TX Spurious Emission (conducted and radiated)

Below 1GHz	Better than –36dBm
1 – 4GHz	Better than –30dBm

MIC Sensitivity

At Accessory/Mic connector	15mV +/- 5mV

Values for 60% peak dev.

Transmitter Audio Distortion (Without CTCSS)

1 kHz	< 5% (nominal)

Transmitter Audio Distortion (With CTCSS)

1 kHz	< 8% (nominal)

Audio frequency = 1 kHz, with any CTCSS freq. combined.

Hum and Noise (Residual Modulation)

Better than 40dB (with PSOPH)

Sub Audio Tones - CTCSS

Tone Range

67 to 250.3Hz @ 1.5% accuracy

Nominal Tone

15% (10-20%) Pk Sys Dev.

Sub Audio Tones - DCS

Tone Standard Normal and Inverted

Tone Deviation 15% (3%) Pk System Dev.

Receiver

Test Method is TIA / EIA-603 unless stated. Performance without Sub-Audio Modulation

Sensitivity

12dB SINAD (nominal)	VHF: Better than –117dBm

Amplitude Characteristic

Within +/- 3dB

Co-channel Rejection

12.5 kHz	From 0dB to –12dB
25 kHz	From 0dB to –12dB

Adjacent Channel Selectivity

	Nominal
12.5 kHz	Better than 60dB
25 kHz	Better than 70dB

Spurious Response Rejection

Better than 60dB (100 kHz – 4GHz)

Intermediation Response Rejection

+/- 25 / 50 kHz	Better than 65dB
+/- 50 / 100 kHz	Better than 65dB

Blocking >85dB (+/-1MHz, +/-5MHz, +/-10MHz)

Rx Spurious Emissions (radiated) - nominal

9 kHz – 1GHz Better than –57dBm

1GHz – 4GHz Better than –47dBm

Audio Power 500mW max. (Internal 4Ω speaker)

AF Distortion

1 kHz < 5% (nominal)

RX Hum and Noise

Method as TIA / EIA-603

12.5 kHz >34dB No PSOPH

25 kHz >40dB No PSOPH

Sub Audio Tones - CTCSS

Tone Range 67 to 250.3Hz @ 0.3% accuracy

Decode Sensitivity

Method (Decrease Signal Level, @ 15% peak dev. with no audio tone)

All Tones <=12dB SINAD

Maintenance and Repair

Introduction

This section covers the tests which should be undertaken prior to customer handover. All of the following tests can be carried out without having to gain access to the interior of the radio.

Recommended Test Equipment

The alignment and performance test procedures assume the use of the following equipment. The functions of most of the equipment may be found in a "Communications Test Set". This type of equipment is available from a number of test equipment manufacturers.

Throughout this book, reference will be made to the use of the Communications Test Set. Where applicable, the equivalent discrete item of test equipment may be used. For example, if measuring power, a stand-alone power meter and a dummy load could be used instead of the Test Set.

Discrete Test Equipment

RF Signal Generator

RF Power Meter

RF Frequency Counter

Spectrum Analyzer and notch filter (optional)

Audio Signal Generator

Audio Power Meter

SINAD Meter

Modulation Meter

Oscilloscope

Voltmeter

DC Power Supply, 0 - 15V 5A min.

Combined Equipment

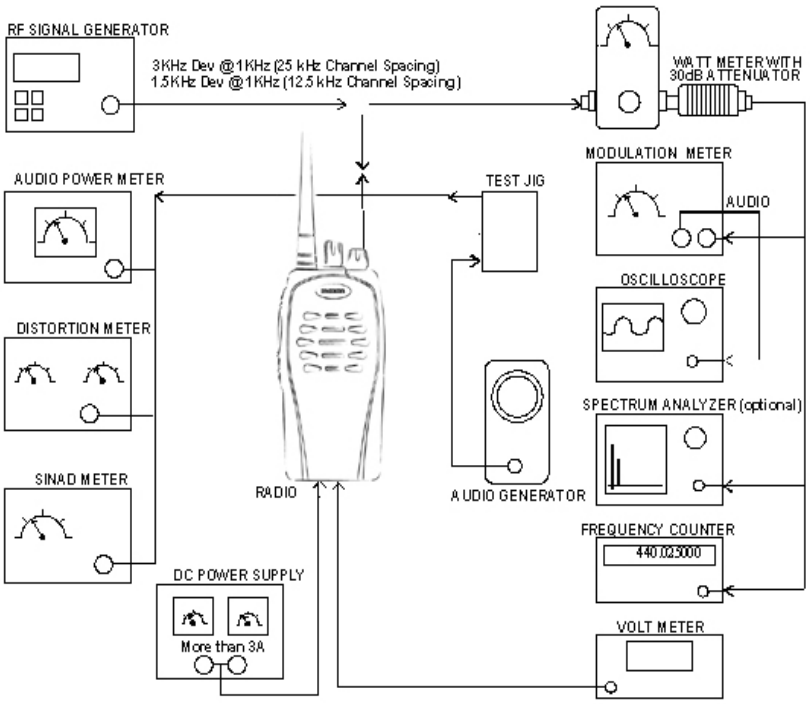
Communications Test Set (e.g. HP 8920B, Stabilock 4040 or similar).

Accessories

SP -1102

Note: Use fig.1 as a suggested connection diagram to connect up the recommended discrete test equipment.

Test Equipment Configuration



(Fig. 1)

Prerequisites

For the following tests, signal generator modulation level should be set to Average System Deviation, i.e. 60% of maximum system deviation.

The level should therefore be set to:

N-BAND 1.5 kHz for 12.5 kHz channel spacing

S-BAND 3 kHz for 25 kHz channel spacing

EEPROM programming

Ensure that the EEPROM has the required customer parameters programmed, otherwise ensure that a test EEPROM is programmed with at least the lowest, middle and highest RX/TX frequencies prior to aligning the VHF scanning mobile radio.

Test Equipment Connection

Test equipment connections for performance and Alignment tests are shown in figure 1.

Connect the power supply leads as follows:

1. Ensure the power supply is switched off.
2. Positive lead of the power supply to the red wire terminal tag of the 7.5V D.C. connector.
3. Negative lead of the power supply to the black wire terminal tag of the 7.5V D.C. connector.

Transmitter Performance Tests

Power Output

a) Connect the transmitter to the Communications Test Set (CTS) with the power meter set to read 5W for the SP-1102

b) Set the power supply to 7.5Vdc and connect a dc voltmeter across the power supply to monitor the supply voltage.

c) Set the CTS to the same frequency as the radio and then set the PTT to start transmitting. Check and record the power output. The nominal power output is 5W

d) Reduce the power supply voltage to 6.6Vdc and then set the PTT to start transmitting. The output power should be greater than 65% of the level measured above.

Frequency Error

a) Using the frequency counter check that the transmit frequency is within +/- 750Hz of the frequency which is programmed into the radio.

Distortion and Deviation Measurements

a) Set the radio to the middle TX frequency. Connect the oscilloscope to the AF output of the modulation meter.

b) Set the audio signal generator to 1 kHz tone, low output impedance and adjusts its level for 60% system deviation:

12.5 kHz channel spacing	1.5kHz dev
25 kHz channel spacing	3kHz dev

c) Press and hold the PTT button.

d) Measure the audio distortion. This should be less than 5%.

e) Increase the audio signal generator level by 20dB (10x voltage). The peak deviation should be:

12.5 kHz channel spacing	<= 2.0 kHz dev
25 kHz channel spacing	<= 3.5 kHz dev

f) Release PTT.

When CTCSS and DCS performance checks are also required, ensure that the lowest, middle and highest RX/TX frequencies include: (see below for suggested test channel set-up).

Lowest RX/TX freq. ch.	67.0 Hz CTCSS
Middle RX/TX freq. ch	DCS Code 023
Highest RX/TX freq. ch	250.3 Hz CTCSS

The middle RX/TX frequencies should be halfway between the lowest and the highest frequencies.

Receiver Performance Tests

Sensitivity

Set the radio to the correct channel.

SINAD performance test is used to test the sensitivity of the radio receiver.

Select the required frequency to be measured (without CTCSS enabled)

a) Connect the RF signal generator, modulated with a 1 kHz tone, to the radio.

b) Set the frequency of the RF signal generator, to correspond with to the RX frequency of selected channel

c) Connect the SINAD voltmeter to the external speaker socket on the radio. Ensure that the radio has been programmed to path the audio to the external accessory socket.

d) If signal is not present press the monitor button. Set the volume control to mid-range.

e) Set the RF signal generator deviation to:

12.5 kHz channel spacing	1.5 kHz dev
25 kHz channel spacing	3kHz dev

f) Adjust the RF signal generator level until the SINAD meter reads 12dB.

g) Check that the signal generator

RF level is < -117dBm (0.31µVpd).

Squelch

a) Ensure that both the radio and the signal generator are set to the appropriate channel spacing.

b) With the above setting, reduce the RF level to –130dBm (speaker should be muted).

Adjust the RF output level until the radio unmutes. Sinad reading should be in the range of 8db to 12db.

Audio Output

a) Set the RF signal generator to 1mV Pd (-47.0dBm) and the tone and deviation as above.

b) Connect the audio power meter set to 8Ω to the external speaker socket on the radio.

Note: The audio power meter should be set to 4`Ω.

c) Adjust the volume control on the radio under test to maximum.

The voltmeter should indicate > 1.6VRMS (10% distortion)

The audio power meter should read >500mW. (Load: 4Ω)

This concludes the Performance Tests.

If the Radio should fail any of these tests it will be necessary to turn to the next section on alignment.

Alignment

Warnings

Any repairs or adjustments should only be made by, or under the supervision of a qualified radio-telephone service technician.

Caution

This radio contains static sensitive devices. Static safe precautions should be observed; in particular we would recommend the use of a suitable floor mat, table mat, bonding cords and a wrist strap. The soldering iron should have an earthed tip.

Care should be exercised in the handling of static sensitive components and they should always be transported in the correct containers.

Never remove, or insert, static sensitive devices with the power applied.

Alignment Section Frequency Table

CH	RX(MHz)	Option	TX(MHz)	Option	Band	Power
1	148.125000	None:	148.125000	None:	S	H
2	161.125000	None:	161.125000	None:	S	H
3	173.925000	None:	173.925000	None:	S	H
4	148.125000	None:	148.125000	None:	N	L
5	161.125000	None:	161.125000	None:	N	L
6	173.925000	None:	173.925000	None:	N	L
7	160.125000	Ctcss:67.0	160.125000	Ctcss:67.0	S	L
8	160.125000	Ctcss:136.5	160.125000	Ctcss:136.5	S	L
9	160.125000	Ctcss:254.1	160.125000	Ctcss:254.1	S	L
10	159.125000	Ctcss:67.0	159.125000	Ctcss:67.0	N	L
11	159.125000	Ctcss:136.5	159.125000	Ctcss:136.5	N	L
12	159.125000	Ctcss:254.1	159.125000	Ctcss:254.1	N	L
13	160.125000	Dcs:023	160.125000	Dcs:023	S	L
14	160.125000	Dcs:754	160.125000	Dcs:754	S	L
15	159.125000	Dcs:023	159.125000	Dcs:023	N	L
16	159.125000	Dcs:754	159.125000	Dcs:754	N	L

Note: The Above frequency table should be used whenever the alignment section refers to a channel number.

Disassembly and Re-assembly of the Radio

In order to carry out the following test and alignment procedures it will be necessary to gain access to the inside of the radio.

Care should be exercised when opening up the radio for maintenance or repair.

Removing and replacing the main cover

a) Turn the radio over, so that the radio is upside down.

b) Remove the ANT and volume knob.

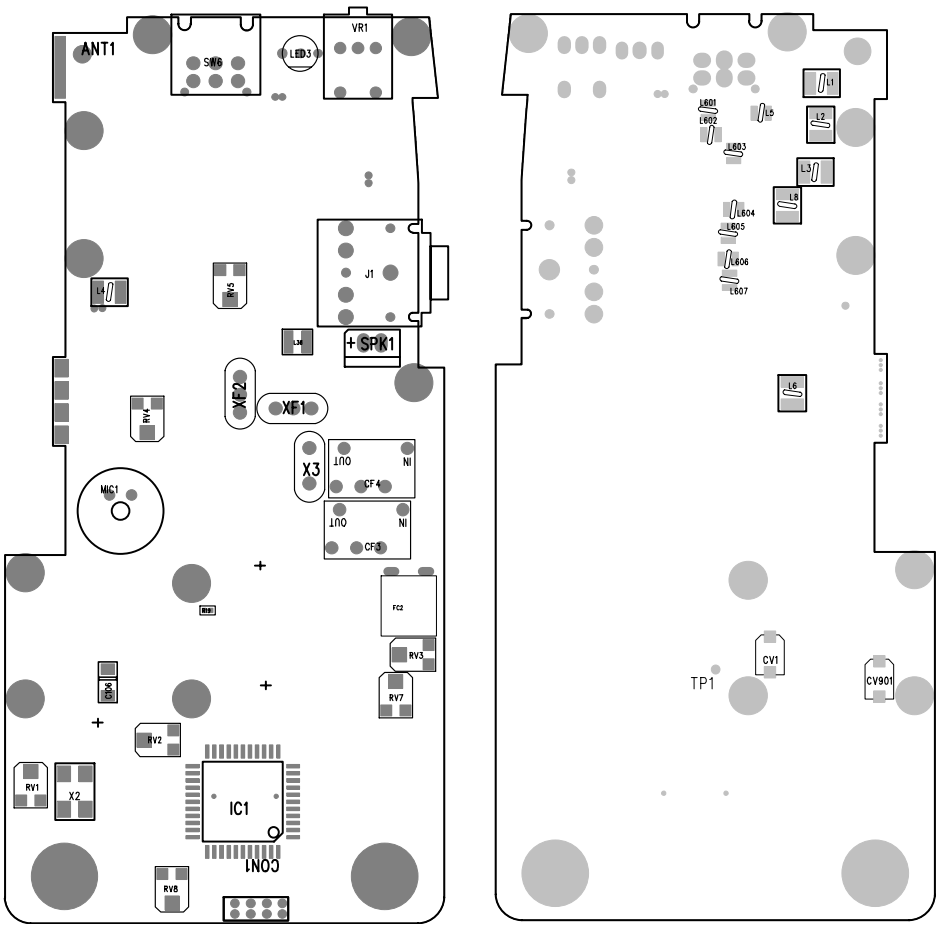
b) Remove the two holding screws.

c) Lift the cover off.

d) Replace the main cover by reversing the above procedure.

Alignment

Alignment drawings required



(Fig.3)

PLL Alignment

TX VCO

a) Select channel 1. (148.025MHz)

b) Set the PTT switch to on. Check that the VCO tuning voltage at TP1 is 0.7~1.0V. (CV1)

c) Set the PTT switch to off. Select Channel 8. (173.975MHz)

d) Set the PTT switch to on and check that the voltage at TP1 is 4.0~4.5V.

e) Set the PTT switch to off.

RX VCO

a) Select channel 1. (148.025MHz)

b) Check that the VCO tuning voltage at TP1 (Please see fig.3) is 0.7~1.0V. (CV2)

c) Select channel 8. (173.975MHz)

d) Check that the voltage at TP1 is 3.5~4.0V.

Transmitter Alignment

TCXO

a) Select channel 1. (148.025MHz)

b) Set the PTT switch to on.

c) Using the frequency counter, adjust the TCXO (RV1), so that the transmit frequency is within +/- 300Hz of the required frequency.

d) Set the PTT switch to off.

If no further alignment is to be carried out, it may be necessary to reset the squelch.

Power

a) Select channel 1. (148.025MHz)

b) Set the PTT switch to on.

c) Adjust the RV4 max(clockwise),RV5 to get Power 5W

Peak Deviation

a) Select channel 1. (148.025MHz)

b) Set the PTT switch to on.

c) Set audio generator to be 1KHz 100mVrms and connect to radio external jack.

d) Adjust the ±2.0-2.5KHz DEV. (RV2) and check S-band to get ±4.0-4.5KHz DEV.

Receiver Alignment

The receiver is, by design, a broadband device. It should require no special alignment unless repairs are performed on the receiver.

The following alignment may be performed:

a) Select channel 1 on the radio.

b) Set the RF generator to the receiver frequency and the RF level to 1mV Pd (-47dBm).

c) Set the AF signal to 1 kHz.

d) Set the deviation to:

12.5 kHz channel spacing	1.5 kHz deviations
25 kHz channel spacing	3 kHz deviations

e) Monitor the audio output level and the distortion, setting the volume control to 1Vrms.

Squelch

a) Connect the RF signal generator to the radio.

b) Set the RF signal generator to the receive frequency of the current channel two.

c) Connect the SINAD meter to the speaker socket on the rear panel.

d) Set the volume control to mid-range.

e) Set the deviation to: 12.5 kHz channel spacing 1.5 kHz

f) Set the AF generator to 1 kHz.

g) With the above setting, reduce the RF level to –130dBm. The radio should be mute.

h) Adjust the RF level until the radio un-mutes. SINAD meter reads 10dB to 12dB. The radio should un-mute. If radio does not un-mute adjust RV7 for 12.5 kHz channel spacing.

This completes the receiver alignment process.

Receiver Performance Tests

SINAD or noise quieting sensitivity performance tests may be used to test the sensitivity of the receiver. Both tests are given below.

12dB SINAD Sensitivity

The SINAD performance test may be used to test the sensitivity of the receiver.

a) Connect the RF signal generator, modulated with a 1 kHz tone, to the radio.

b) Set the frequency to correspond to the Rx frequency of the radio.

c) Using the Audio breakout Box, connect the SINAD voltmeter to the external speaker socket on the radio.

d) Press the monitor if radio is muted button and set the volume control to mid-range.

e) Set the RF signal generator deviation to:

12.5 kHz channel spacing 1.5kHz dev

25 kHz channel spacing 3kHz dev

f) Adjust the RF signal generator level until the SINAD meter reads 12dB.

g) Check that the signal generator RF level is < -117dBm.

Squelch sensitivity

The RF input level to open the squelch is usually set in the range -123.5 dBm to -117dBm (0.15 to 0.3µV). The squelch should open with SINAD set between 8dB and 14dB (no CCITT).

The squelch should close between 2dB and 4dB below the value at which it opens.

Note: Please refer to frequency table whenever a channel number is referred to.

Detailed Functional Description

VHF Transmit

The transmitter is comprised of:

Buffer

Power AMP

Low Pass Filter

Antenna Switch

APC (Auto Power Control) Circuits

Buffer

VCO output level is 0dBm and amplified to +16dBm (UHF)/(VHF). The buffer consists of Q22, 12

Power AMP

The P.A Module consists of 2-stage amplifier (Q9,8) and amplifies the TX signal from +16dBm to +30dBm. The input and the output terminal of the P.A Module are matched 50 OHM.

Low Pass Filter

L10,2,1,23,C69,215,71,163,79,101 are the 7th order Chebyshev low pass filter. Unwanted harmonics are reduced by -36 dBm.

Antenna Switch

When transmitting, the diodes D9 and D5 are forward biased enabling the RF signal passage to the antenna. D5 is shorted to ground inhibiting the RF signal to front-end. In receive the diodes D9 and D5 are reversed biased passing the signal from the antenna through L5 and C602 to the front-end without signal loss.

Automatic Power Control Circuit

This circuit controls TX power by detection on the current through R21,11,103 The voltage difference from these resistors are amplified by IC3-A and gets the voltage comparing the signal with the reference voltage from R110 at IC3-B. This voltage difference is kept to stable value by RV5 changing Gate voltage of final Amp (Q8) .

VHF Receive

The receiver is comprised of:

Front End Filter / RF amplifier

First mixer and first IF amplifier

Second mixer, second IF amplifier and FM detector (AN29160AA)

Mute (Squelch) circuit (AN29160AA)

Speaker audio amplifier (AN29160AA)

Front End Filter / RF amplifier

The receive signal by the antenna is routed through the low pass filter, then onward to the antenna switching circuit consists of L5,D5 The front RF amplifier transistor Q601 consists of the band pass filter C602,78,128,216,610 and L601,3 amplified by Q601 and output to second band pass filter consists of C613,178,618,175,176 and L15,605,16 These are frequency range 148.025 to 173.975 MHz.

First mixer and first IF amplifier

This stage is mixed signals , the signal from front-end RF amplified through band pass filter fed to the gate 1 of the first mixer Q23 .And the first local oscillator signal from the VCO that fed to the gate2 of Q23 .So these the mixer output at drain of Q23 is 45.1MHz and then fed through the XF1-2 these are 45.1 MHz IF crystal filter The crystal filter provides a bandwidth of +/-7.2 KHz from the operating frequency providing a high degree of spurious and intermediation protection. Additionally, a 90 MHz trap (XF1) is also placed at the filter output to provide additional attenuation of the second order IMD. The output of the filter is impedance matched by C137 and R29 to the base of the first of filter IF amplifier Q14

Second mixer, second IF amplifier and FM detector

The output of the first filter amplifier, Q14, is coupled, via C114 to the base of Q31. Q31 is the second mixer .The second local oscillator signal from Q18 is 44.645MHz fed to the emitters of Q31 and converted to 455KHz at the collector and then second IF amplified by Q16 from the output of the second mixer. The mixer output is then routed to CF3 or CF4. These ceramic filters provide the adjacent channel selectivity of 25 KHz or 12.5 KHz bandwidth then fed to pin25 IC2(IFIN). The receiver signal converted to the second IF signal frequency through the FC2, The ceramic filter of 455KHz again. After limiting inside the IC2 and the FM demodulating by the quardrature detector inside the IC2 the signal offers the output through the 29th pin of IC2 .

Mute (squelch) circuit

The mute circuit switches off the power amplifier when no audio signal is present. The squelch circuit consists of IC6 and RV3, RV7 and their associated components. The noise signal form pin 30 of IC2 is amplified by internal amp of IC2and then fed into RV7(N Band) is used to adjust the squelch circuit sensitivity and is normally adjusted to produce noise squelch opening sensitivity of 10dB to 12dB SINAD. By IC 6 this for level control SQ

Speaker audio amplifier

The audio signal which has been FM demodulate in the IC2 has a filter as de-emphasis and 300 HPF from pin29 signal is through pin 44 and filtered signal is out pin48 .From pin48 audio signal is level controlled by internally Volume step .The controlled audio is into the pin53 and amplied 20dB by internal Audio Amp. Then, it turns up the speaker with the maximum output of 0.5W.

VHF PLL Synthesizer

The receiver is comprised of:

12.8MHz TCXO

PLL IC dual modules prescaler(AN29160AA)

Level shifter & charge pump

Reference frequency LPF

VCO

12.8MHz TCXO

The TCXO contains the 2-stage thermistor network compensation and crystal oscillator and modulation ports. Compensation is +/-2.5 PPM or less from -30c to +60c.

PLL IC Dual Modules prescaler

The PLL synthesizer of the signal loop PLL circuit with the reference of 12.80 MHz. The IC2 PLL IC includes all the function such as the reference oscillator, the driver, the phase detector, the lock detector, and the programmable divider. At the reference oscillator, the 12.80 MHz TCXO of the TCXO is connected to the pin 12 of the IC2 to oscillate the frequency of 12.80 MHz. The TCXO is the temperature compensation circuit to maintain the frequency within the allowable error range even under a low temperature of -20° C. The phase detectors send out the output power to the loop filter through 16th pin of the IC2. If the oscillation frequency of the VCO is low compared to the reference frequency, the phase detector sends out output power in positive pulse. If the oscillation frequency of the VCO is high, phase detector send put can maintain the frequency set. The programmable divider maintains the desired frequency with control from the CPU. The dividing ratio, "N" to oscillate the desired frequency is as below: N = VCO oscillation frequency / reference frequency

Level shifter & charge pump

The charge pump is used for changing output signals at PLL IC from 0-2.8V to 0-5V.The loop filter a passive lead-lag filter consisting of R4, R84-86,R197,R229,C2,C38,C84,C106 and IC7 this circuit use IC7 for charge pump which gain is approximate 2 time for through to produce the DC turning voltage for VCO circuit.

Reference frequency LPF

The loop filter contains R98, C113and C131. LPF settling time is 12mS with 1 KHz frequency. This also reduces the residual side-band noise for the best signal-to-noise ratio.

VCO

Only one of the VCO runs at a time, which is controlled by Q420 and CPU**.** When the PTT is pressed, CPU goes low (approx. 0V) disabling the receive VCO by the Q420 and biases on Q919 to enable the transmitter VCO.
The receive VCO consists of C7,96,116,151 CV2, L13, L9,26,
Q922 and D8. This VCO oscillates at 45.1 MHz below the programmed receive frequency. The VCO oscillating frequency is tuned by the varicap diode D8**.** The tuning voltage is supplied from the output of the Loop Filter. The output of the VCO is AC coupled (C26 and R5, C21,26) to the synthesizer and the output buffer Q22 respectively.
The transmit VCO consists of C97,102,11,99,107,128,R9,6, CV1, L27,11,14, Q5 and D2. This VCO oscillates on the programmed transmit frequency. The VCO oscillating frequency is tuned by the varicap diode D2. The tuning voltage is supplied from the output of the Loop Filter. The output of the VCO is AC coupled (C26 andR5, C21,26)to the synthesizer and the output buffer Q22 respectively.
The transmit voltage controlled oscillator is directly frequency-modulated and operates on the carrier frequency. In the receive mode, the transmit VCO is disabled and the receive VCO is enabled, producing receive local oscillator signal at a frequency 45.1MHz above the incoming receive frequency. The synthesizer is tune in 5.0KHz or 6.25KHz step.

Troubleshooting

SYMPTOMS	CAUSES	COUNTER MEASURES
Unit does not Work	1. Complete discharge of battery (7.5+/-10%) 2. Fuse blown up 3. 5v voltage source	1. Replace battery. 2. Replace fuse 3. IC5 (5v+/-0.2v)
Warning tone & no work	1. PLL error 2. Filtering Error 3. EEPROM Fail 4. Low battery (lower then 6.0V)	1.CheckTCXO/VCO/PLL IC 2. Check LPF 3. Re-programming 4. Replace or charge battery
Bad RX Sensitivity (-10 to -60dBm)	1. Defective ANT S/W 2. defective front-end 3. Defective mixer 4. IF IC 5. VCO level drop 6. Change of 1'st local frequency	1. check D5,D9 2. Check Q601 3.CheckQ23,Q14 4. Replace IC2 5. RX VCO level >2dBm 6. Retune TCXO
Defective RX	1. VCO frequency change or level drop 2. Defective voltage Source	1. Repair VCO Defective IF IC (IC2) 2. IC5
PLL error	1. Defective 12.8 MHz TCXO 2. Voltage source for RX VCO/TX VCO 3. Defective PLL IC	1. Replace TCXO. 2.Check RX VCO/TX VCO 3. Replace IC2
NO TX power	1. TX buffer 2. PA 3. APC control	1. Check Q10 2. Replace PA Q8 3. Check IC3
Low TX power output	1. APC	1. Re-adjust VR4
No modulation	1. SW IC & Mic amp IC	1. Check IC2
No programming	1. short protector VCC	1. Defective programming lead
NO S.A.T	1. IC1	1. Check IC1

Diagnostic Function

The diagnostic function is designed to inform the user about the operational status of the radio.

The possible audible and visual warnings are:

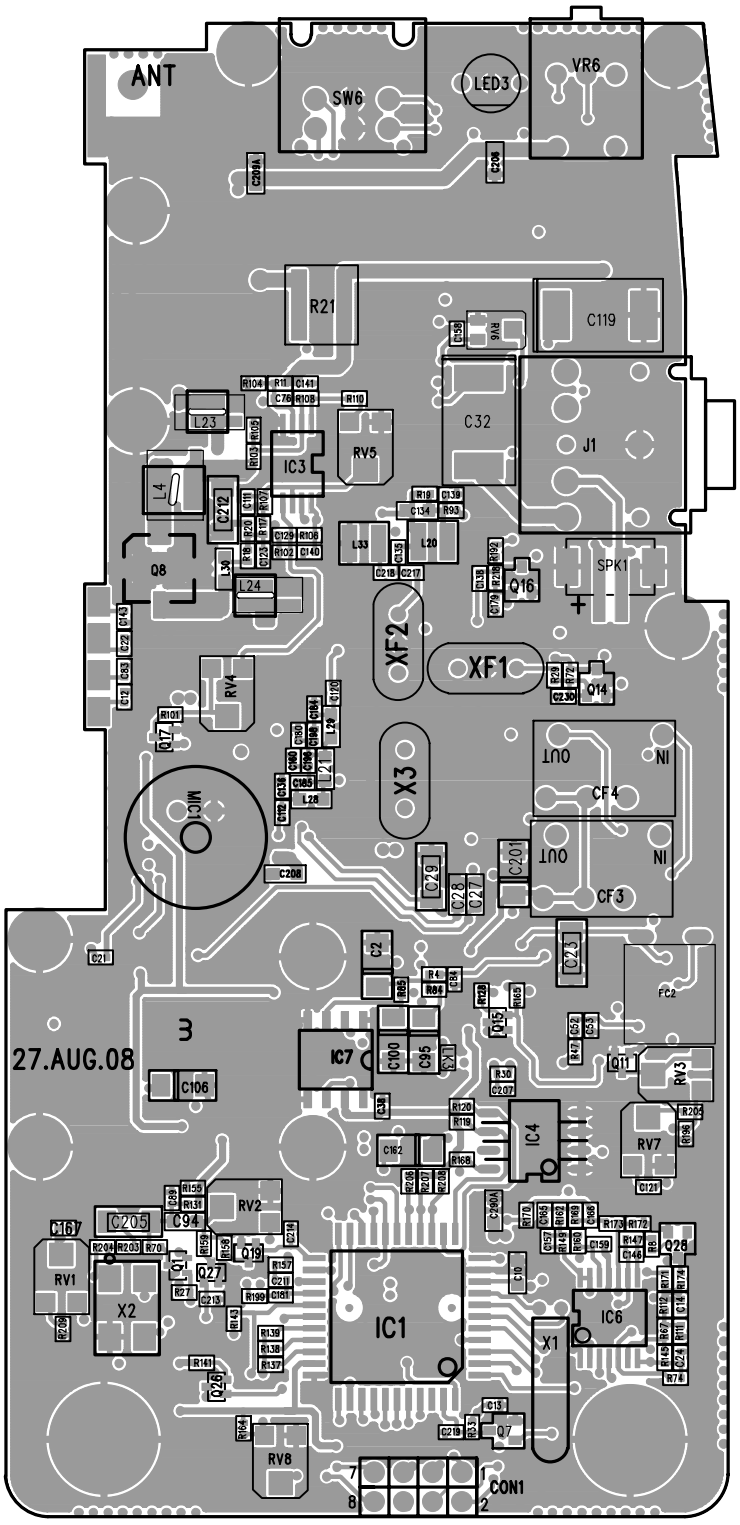
	LCD display	LED colour	Audio tone
Power on		N/A	Melody
Busy		Orange	N/A
Correct call		Green	N/A
Transmit		Red	N/A
Scan		Green flash	N/A
Pri- scan		Green flash	N/A
Busy lock		Orange flash	Single bleep
Time out timer		N/A	Single bleep
Battery Low		Red flash	Triple bleep

Schematics and PCB layout Index

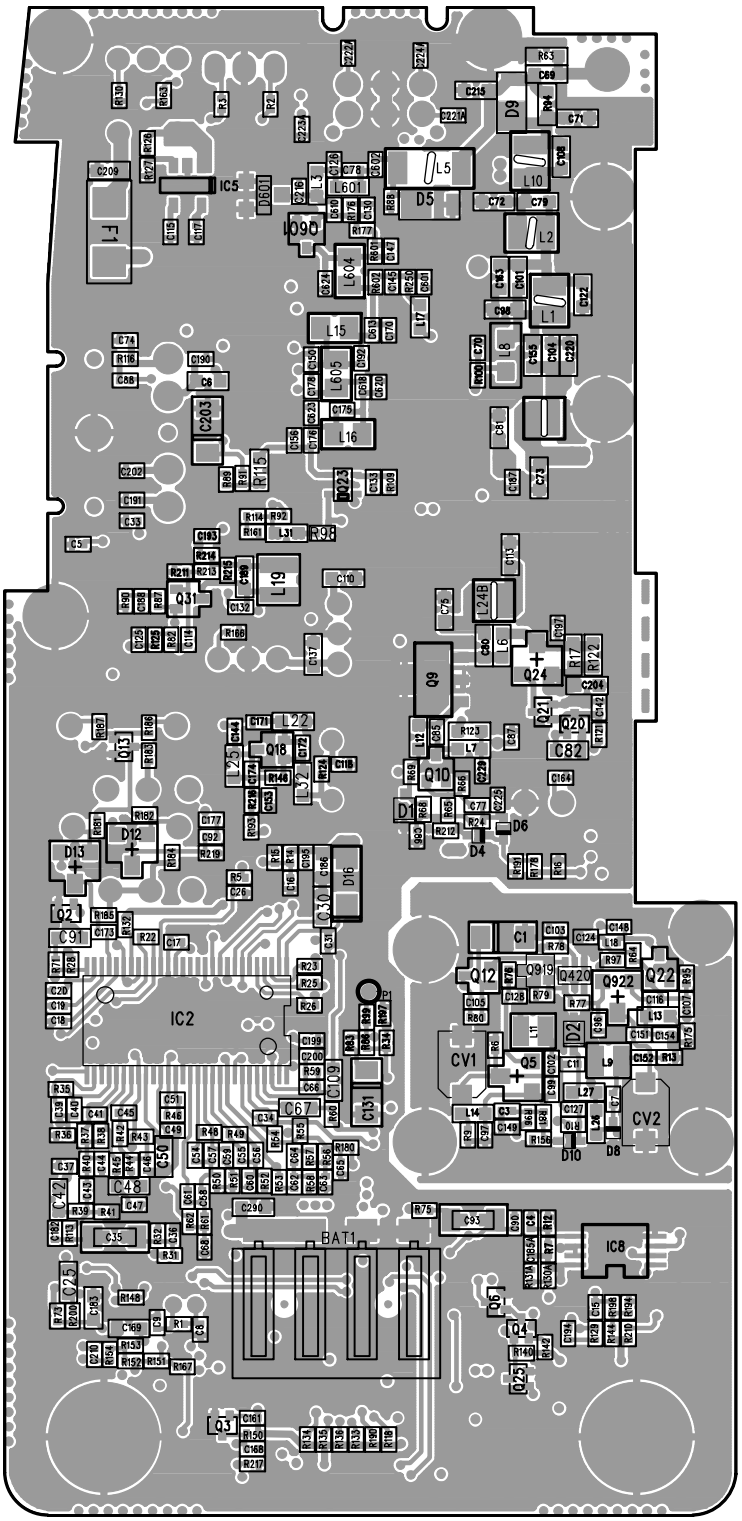
This section contains PCB layouts, block diagrams pertaining to the SP-1102 Series Radio. Associated main schematics may be found in the wallet at the rear of this binder.

Order of drawings	Drawing description	Size of drawing	
Schematics			
1	SP1102Digital Schematic	A4	
2	SP1102 Block diagram	A4	
Reference Layouts			
5	Top PCB	A4	
6	Bottom PCB	A4	
Exploded View			
7	Exploded view with parts	A4	
	Exploded view with parts	A4	

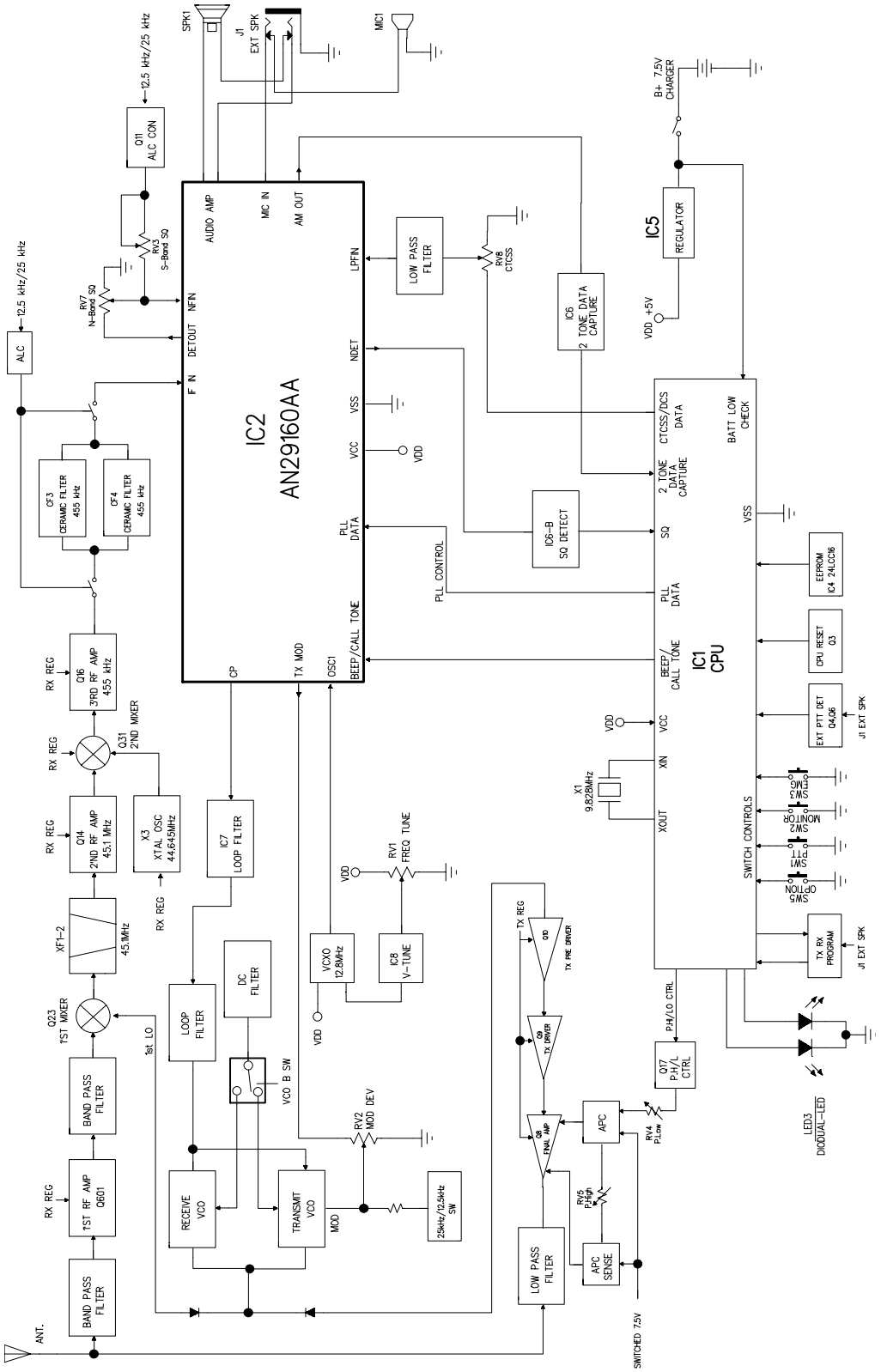
Schematics and PCB layout Index

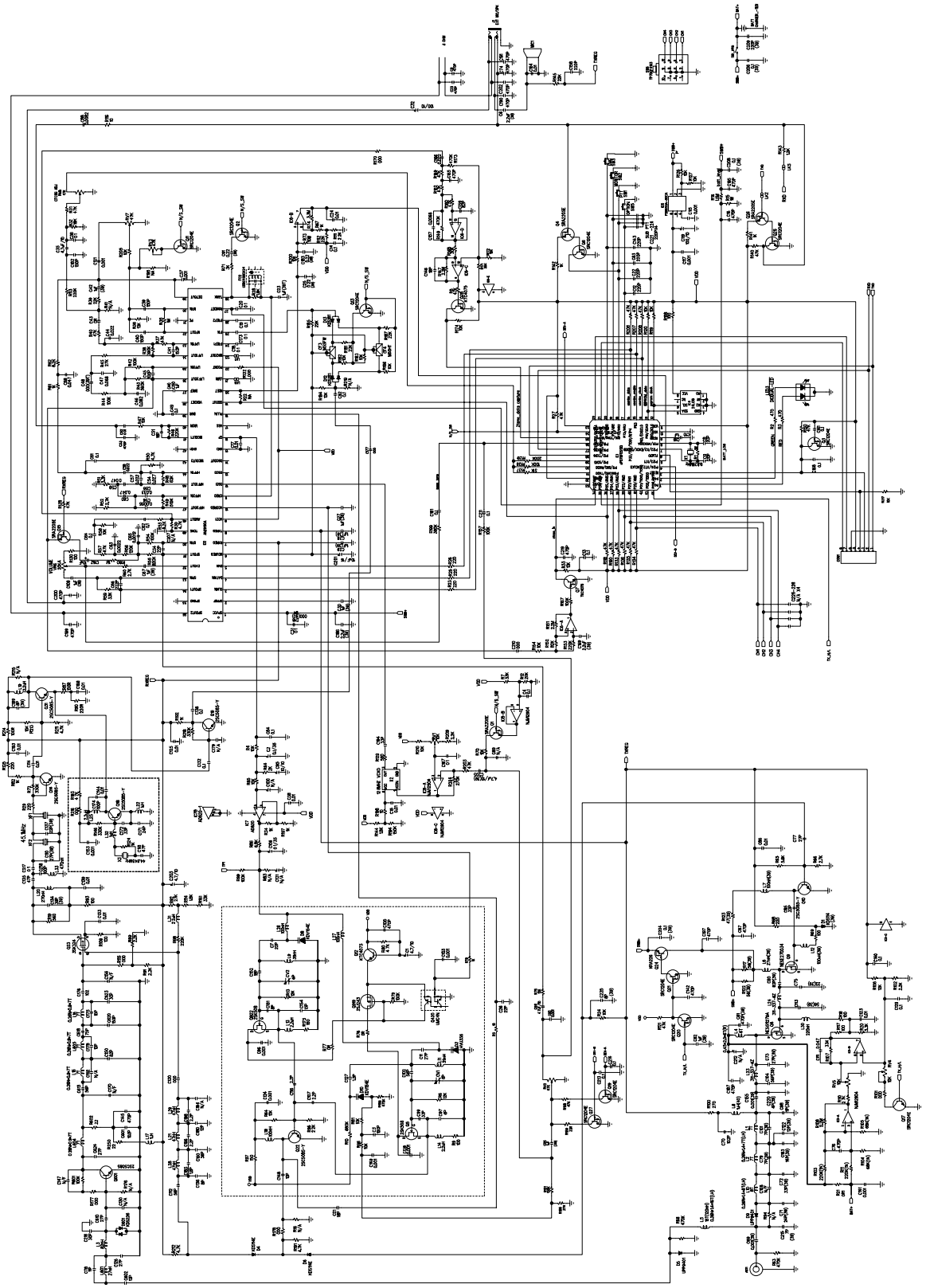


Schematics and PCB layout Index



Schematics and PCB layout Index



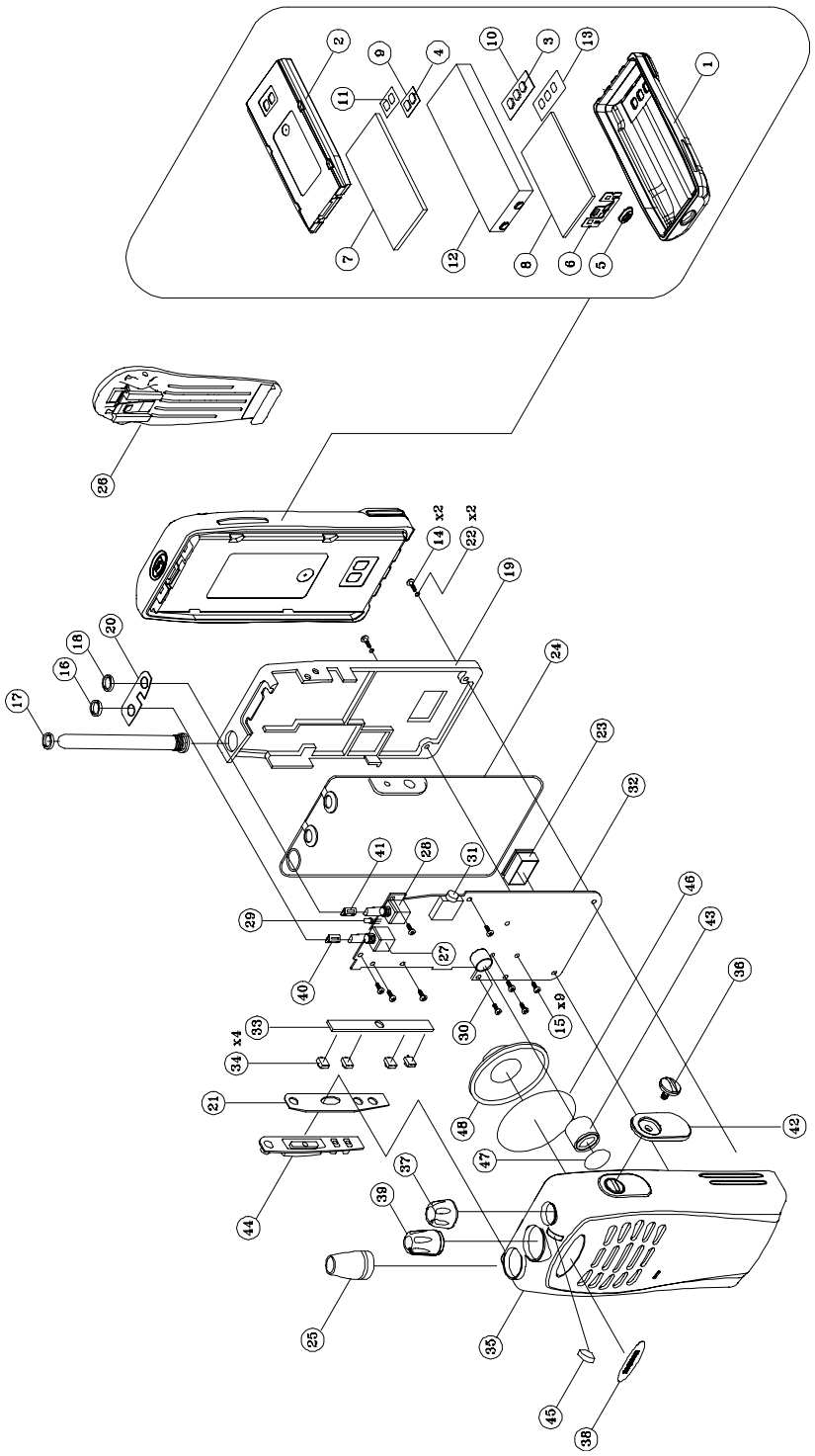


Schematics and PCB layout Index

Parts List & Exploded View

The following pages detail the mechanical and electronic parts for the Maxon SP-1402 Handportable Radio. Refer to Exploded diagram for the SP-1402/1102

Mechanical Exploded View



Parts List

No.	Code No	Name	Description	Unit	Qty
1	834-501295AA	71A309 (BATTERY COVER(SP-0402)	PC BLACK	EA	1
2	834-501294AA	71A312 (BATTERY PACK(SP-0402)	PC BLACK	EA	1
3	832-501105AA	752958(TERMINAL)	BSP T1.2 GOLD-PLATING	EA	3
4	832-501106AA	752958A(TERMINAL)	BSP T0.8 GOLD-PLATING	EA	2
5	834-501296AA	826447 (KNOB LATCH(SP-0402)	PC BLACK	EA	1
6	832-501302AA	826386(LATCH SP-0402)	SUS304 T0.4	EA	1
7	833-501319AA	CUSHION BATT"A"(SL-0305)	RUBBER SPONGE 3.0T	EA	1
8	833-501320AA	CUSHION BATT "B"(SL-0305)	RUBBER SPONGE 1.0T	EA	1
9	932-556714AA	PCB BATTERY A	11.0 X 19.0 X 1.0T	EA	1
10	932-556716AA	PCB BATTERY B	14.6 X 31.2 X 1.0T	EA	1
11	833-501321AA	TAPE TERMINAL C (SL-0305)	DOUBLE TAPE 3M 9448HK	EA	1
12	935-120001BB	BATTERY (LI-7000)	LI-ON BATTERY(1500MA)	EA	1
13	833-501322AA	TAPE TERMINAL B (SL-0305)	DOUBLE TAPE 3M 9448HK	EA	1
14	838-300207BL	600798(+)MACH.W/SCREW PH	2X7(WD=4.7 S=4.5) SUS BLK	EA	2
15	838-600204ZN	612081(+)MACHINE SCREW BH	2X4 ZN-PLAT	EA	9
16	837-501063AA	650359(NUT)	BSBM 1/4 D9.3	EA	1
17	837-501064AA	650362(NUT ANT)	BSBM(MB20) M8 D10	EA	1
18	837-501065AA	650373(NUT VOL)	BSBM(MB20) M6 D8	EA	1
19	832-501299AA	71A245 (BACK COVER(SP-0402)	ALDC12	EA	1
20	832-501300AA	796027(BRACKET VOL SP-0402)	SUS304 T0.5	EA	1
21	832-501301AA	796189(BRACKET PTT PAD SP-0402)	SUS304 T0.4	EA	1
22	833-501079AA	895452 (GASKET RING)	SILICONE RUBB.BLK	EA	2
23	833-501286AA	896394 GASKET POWER(SP-0402)	SILICONE RUBBER	EA	1
24	833-501287AA	896396 GASKET MAIN(SP-0402)	SILICONE RUBBER	EA	1
25	925-990096AA	4217367 (ANT CONNECTOR)	SMA-R (M)-Q2	EA	1
26	501-502107BC	56004BCA(BELT CLIP ASSY)	BELT CLIP ASSY	EA	1
27	924-221016AA	4300772(SW ROTARY)	EC10SP16-68	EA	1
28	924-437617AA	4504581(VOLUME)	TP76N17N 15F A203	EA	1
29	883-190115VE	2512864Z(LED LAMP)	L-115 VEGW	EA	1
30	927-130005AA	4202456(MIC CONDENSER)	CMP-62	EA	1
31	925-730002AA	4207713Z(JACK STEREO PHONE)	EJS-5-0435M-01	EA	1
32	932-510005AB	PCB MAIN(S5 PMR446)	49.4X102.1X1.0T FR-4	EA	1
33	932-502198AB	PCB PTT(SL-1402)	56.5X7.0X0.8T FR-4,2 LAYER, GOLD.	EA	1
34	924-160010AB	4360300(SW TACT)	SKHUPFE010	EA	4
35	501-502085UP	518174A UPPER COVER ASSY	UPPER COVER ASSY	EA	1
36	837-501067AA	600623(SCREW SECURING SP-0402)	BSBM	EA	1
37	834-501290AA	826639 (KNOB VOL(SP-0402)	PC BLACK	EA	1
38	835-130015AA	795878(OVERLAY)	LEXAN T0.25	EA	1
39	834-501291AA	826642 (KNOB CH(SP-0402)	PC BLACK	EA	1
40	832-501244AA	881609B(SPRING)	SUS3/4H T0.15	EA	1
41	832-501298AA	881764(SPRING VOL SP-0402)	SK5 T0.2	EA	1
42	834-501292AA	896312 (DUST CAP(SP-0402)	PC BLACK	EA	1
43	833-501284AA	896395 (GASKET MIC(SP-0402)	SILICONE RUBBER	EA	1
44	833-501283AA	896459 (PTT PAD(SP-0402)	SILICONE RUBBER	EA	1
45	833-501285AA	896502 LENS LED(SP-0402)	SILICONE RUBBER	EA	1
46	833-501288AA	907557 FELT SPK	FELT T0.15 D37.5	EA	1
47	833-501289AA	907568 FELT MIC(SP-0402)	FELT T0.1 WATER RESISTANT FELT	EA	1
48	927-140013AA	4201824 (MICRO SPEAKER)	SG-4004W1(with PEI)	EA	1
49	931-130012AA	4204834(ANTENNA)	ANT-460Mhz-1 (SW-4004-1-3)	EA	1

Contact details

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