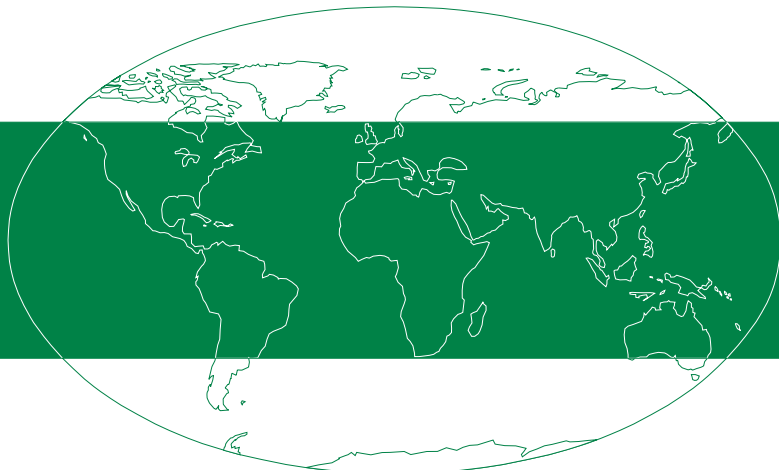


# SAILOR



TECHNICAL MANUAL  
FOR  
PORTABLE VHF TRANSCEIVER  
SP3110/SP3111 & SP3210/SP3211



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# 1 GENERAL INFORMATION

## 1.1 INTRODUCTION

The VHF-transceivers, in the SP3000 programme from **E/C/I**, includes a broad complete range of portable units, which can satisfy any needs in the maritime environment, as well as in land based systems.

There are basic units for the emergency, approved to the GMDSS requirements - there are sophisticated full function models for the particular yachtsman; all based on the same advanced transceiver modules and the same famous mechatronic design known from **E/C/I**.

With these VHF-transceivers, a completely new philosophy has been introduced in portable communication. With the superior speech quality reached on a telephone handset, and a powerfull loudspeaker, a unique combination of general calling facilities and harmonious communication are now available in a single unit.

All these advanced transceivers includes the newest technologies; in components, integration, computer technology and manufacturing; all contributing to a high reliable product, able to withstand the harsh environmental conditions present at sea.

These VHF-transceivers are a part of a complete hand portable programme from **E/C/I**, where you will find a broad range of transceivers with suitable accessories like remote control units, battery packages, fast chargers, carrying cases etc.

In spite of all the precautions taken in the design of these units, a regular service and maintenance is recommended, to increase unit life-time and user safety. Special attention should be given to the rechargeable batteries and their charge terminals for optimum performance and life-time.

**E/C/I** is the leading manufacturer of maritime radio communication equipment - a position which has been maintained by means of constant and extensive product development.

**E/C/I** has a world-wide network of dealers with general agencies in

fifty countries. All our dealers are well-trained, and will be able to make service on all products.

## 1.2 GENERAL DESCRIPTION

With this transceiver programme, front edge technologies in electronic and mechanical design has been combined with decades of experience in development of communication equipment. The result is a range of flexible products, which include a lot of unique qualities, some of these mentioned in the following.

The first multifunction portable VHF, developed to fulfil the GMDSS requirements.

The first multifunction portable VHF, in a watertight special robust polycarbonate housing.

The first multifunction portable VHF, with a large finger-guiding numeric keyboard.

The first multifunction portable VHF, developed for easy single-hand operation.

The first portable emergency VHF transceiver, with a dual-locking and dual leak-current isolated battery package.

The first portable emergency VHF transceiver, with a dedicated long life high capacity emergency battery pack.

The first portable VHF transceiver, with single button selection of operating mode, to enhance calling and communication properties.

The first portable VHF transceiver, with three user programmable channel keys, for quick selection of normal working or distress channels.

The first portable VHF transceiver, with remote control and quick selection of three user programmable channels by means of SP3930.

The first portable VHF transceiver, with an optional tone system interface prepared for ATIS and equivalent systems.

### 1.3 TECHNICAL SPECIFICATION

**SP3110:** Conform to the international GMDSS requirements stated by IMO, and equivalent specifications like ETS 300 225.

#### SP3111 &

**SP3210:** Conform to all common international standards for hand-held VHF-transceivers like ETS's and CEPT, as well as national specifications like MPT, FCC, KSR, FTZ etc.

### GENERAL

Normal channels:	All international simplex channels.
Opt. channels:	Up to 80 ch's in a 12.8 MHz band.
Channel spacing:	25kHz/opt. 12.5kHz
Std. freq. range:	150.8 MHz to 163.6 MHz.
Opt. freq. range:	12.8 MHz in 138 - 174 MHz range.
Operating modes:	Simplex/Semi-dup.
Modulation:	G3EJN (Phase)
Frequency stability:	+/-10ppm/opt.+/-5ppm
Antenna connection:	M8 thread direct matched antenna. Opt. adapter for BNC or TNC.
Temperature range:	-20°C to +55°C
Supply voltage:	7.5V -15% to +40%
Operating time:	Minimum 8 Hours at 10% Tx, 10% Rx and 80% standby w. emergency pack.
Transceiver dimen.:	(H) 195mm, (W) 65mm, (D) 47mm.
Transceiver weight:	460g
Battery weight:	Primary Lithium EMERGENCY pack 200g. Rechargeable NiCd pack 700mAh 190g. Rechargeable NiCd pack 1200mAh 310g.
Housing category:	IP 57

**RECEIVER**

Sensitivity for:	-119 dBm or
12 dB SINAD:	0.25uV p.d.
AF output power	
in speaker mode:	500mW/8 ohms
in telephone mode:	50mW/8 ohms
Distortion THD:	Below 10%
Signal/noise ratio:	Better than 40dB
AF response:	- 6dB/octave
Spurious emission:	Below 2nW
Spurious resp. att.:	More than 70dB
Intermodulation att.:	More than 70dB
Blocking:	More than 90dBuV
Cochannel rejection:	More than 8dB
Adj. ch. selectivity:	More than 70dB

**TRANSMITTER**

RF output power:	2W Hi/0.25W Lo
Adj. ch. power:	Below -70dBc
Spurious radiation:	Below 0.25uW
Af response:	+ 6dB/octave
Distortion:	Below 5%
Signal/noise ratio:	Better than 40dB

Specifications subject to change without further notice.

## 1.4 CONTROLS & READOUT

### COMMON KEYBOARD FUNCTIONS FOR ALL MODELS:



**ON/OFF** switch for the equipment. This pushbutton has to be depressed for at least one second to turn on the transceiver, which will be indicated by read-out of channel number etc. in the LCD display.

To minimize the risk of unintended turn-off, the pushbutton has to be depressed for one second before the set is switching off.



Keyboard lock pushbutton. When this button is depressed for more than one second, the key-sign will show up in the display indicating that the numeric keyboard is locked, thus avoiding unintended change of channel number {quick selection of Ch. 16 is still possible by long-push on "16"}.

The numerical keyboard will be released for use by pressing the pushbutton for more than one second.



Speaker mode selection pushbutton. The AF output level range may be selected for the wanted mode of operation. When the speaker-sign is shown in the display, the audio output level will be in the high range, fitted for the old-fashioned use, with the transceiver held in front of the user.

When there is no speaker-sign shown, the audio output level will be in the low range, fitting the transceiver for convenient use as a normal telephone handset.



Keyboard beep-tone function control. When depressed for more than one second, the audible keyboard feedback will be switched on and off alternately.

If fitted with an optional tone module, a short activation of this key will enter the specific tone module input menu.

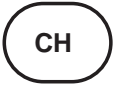


**UP/DOWN** keys for stepwise change on the setting of the selected function. The four functions which may be selected are described below.

The **UP/DOWN** keys will default be active on the audio volume setting, indicated by the VOL-sign.

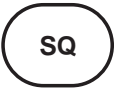


Power level function. When the **PWR**-button has been activated, the actual RF power level sign will be blinking for a period of 2.5 seconds, in which the arrow keys may be used to change the power level setting.



Channel selection function. If the **CH** button is activated, the CH-sign will be blinking for a period of 2.5 seconds, in which the arrow keys may be use to change the channel number, either stepwise or rolling on a continous activation.

If the **CH** button is depressed for more than one second, the receiving frequency for the actual selected channel will be shown in the display as long as the pushbutton is activated.



Squelch level function. If the **SQ** button is activated, the actual squelch-step will be shown above the blinking SQ-sign for a period of 2.5 seconds, in which the setting may be changed by means of the arrow keys.

If the **SQ** button is depressed for more than one second, the automatic squelch facility will be activated, where the lowest step on which the receiver will be muted is selected.



Volume level function. If the **VOL** button is activated, the actual volume-step will be shown below the blinking VOL-sign for a period of 2.5 seconds.

The setting of the volume level can be changed by means of the arrow keys whenever no other signs are blinking in the display.

**ADDITIONAL KEYBOARD FUNCTIONS FOR SP3110 :**

**16** Quick selection of call and distress channel **16**.


**A** Quick selection of user programmable channel-key **A**.


**B** Quick selection of user programmable channel on **B**.

Programming of channel soft-keys:

If this option is enabled, the user may change the channels which can be selected by means of the **quick** channel keys **16**, **A** and **B**.

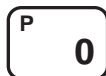
Select the channel you want to have as a **quick** channel by means of

the **CH** -key and the  -keys. When you have the wanted channel

read out in the display, press the  -key followed by a long-push (more than 1 second) on the appropriate channel softkey **16**, **A** or **B**.

**ADDITIONAL KEYBOARD FUNCTIONS FOR SP3210 :**

Quick selection of call and distress channel 16.



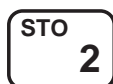
Digits 0 to 9, used for numerical selection of channels.



The SHIFT button activates the second functions on the numerical keypad.



Starts the user programmed scanning sequence.



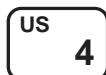
Adds a channel to the programmable scanning sequence.



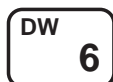
Deletes a channel from the programmable scanning sequence.



Selects the scan dwell time from 1 to 99 seconds. The time chosen is the listening time on a secondary channel receiving a signal when scanning.



Selects the operational mode for the VHF channels as used in the USA.



Selects the dual watch facility.





Can be used to insert a repeater offset for the transmitter on a simplex channel if this function has been enabled.



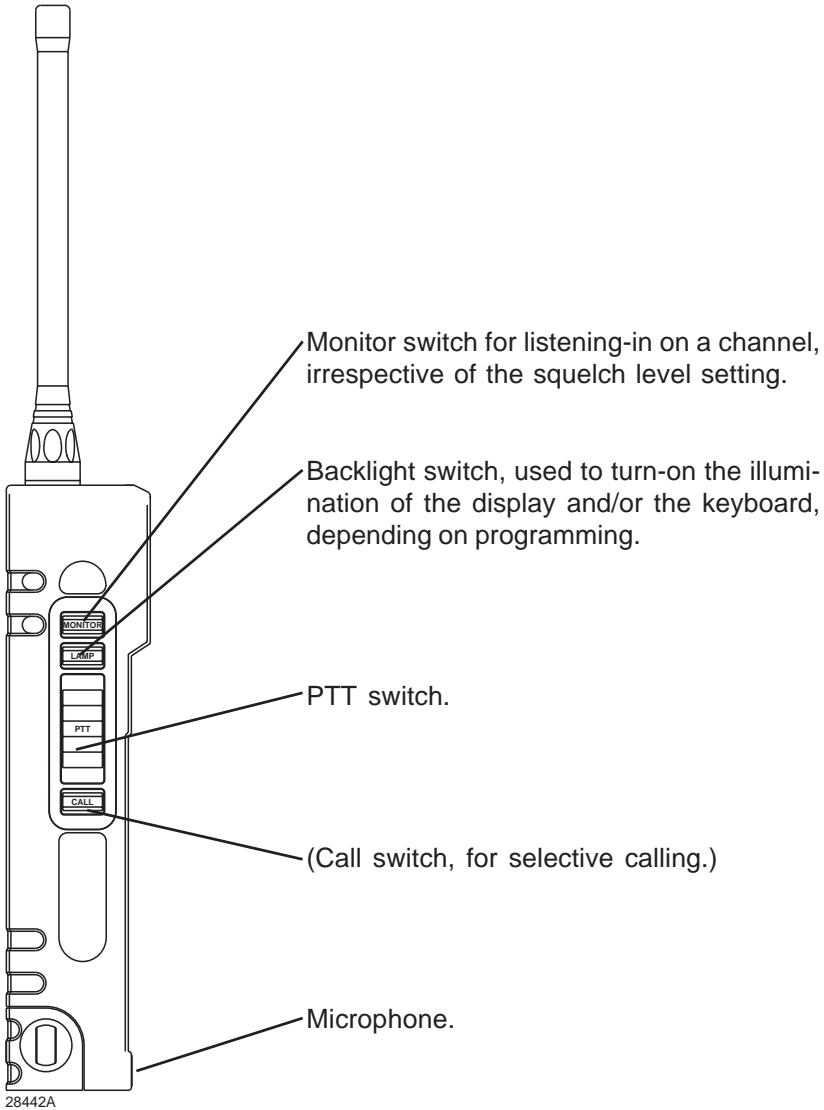
Can be used to invert the Rx and Tx frequencies on duplex channels if this function has been enabled.

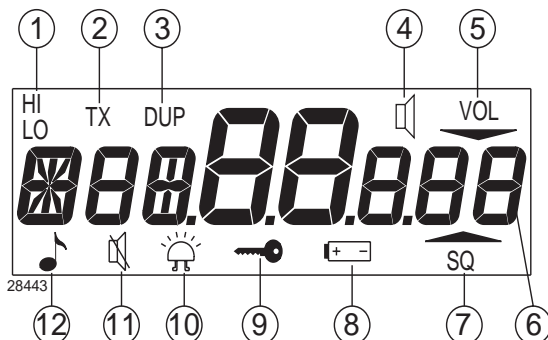


Can be used to change the priority channel, when priority scanning is enabled.



This button is used when additional P-channels is selected. The button may be programmed to act as a prefix for a group of channels or as a single channel prefix.



**DISPLAY READOUT.**

1. **H**igh - **L**ow, TX power level indicators.
2. **T**X on indicator, (carrier is transmitted).
3. **D**UPl ex channel indicator.
4. Volume indicator, on in high level AF power mode.
5. **V**OLume sign, the two digits below indicate the actual volume setting.
6. 8 alpha-numeric digits, used for channel number indication etc.
7. Squelch sign, the two digits above indicates the actual squelch setting.
8. Battery low indicator.
9. Keyboard lock indicator.
10. Individual call alarm indicator.\*
11. AF-mute indicator.\*
12. Tone system ON indicator.\*

\* Functional only in conjunction with optional tone module for selective calling.

## 1.5 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM.

### ANTENNA SWITCH

On this module the RF-signal can be switched between the integral antenna and the coaxial connector, used in applications with a remote antenna.

This module includes, as well, the connector for a Remote Operation Unit.

### Rx-Tx UNIT

This unit includes the main RF circuit blocks, and has at the same time the function as the motherboard for the IF & Filter unit and the Divider & Loop filter unit.

The RF-signal from the antenna switch passes the harmonic filter, which will suppress unwanted harmonic frequencies from the transmitter, and in turn attenuates high frequency spurious signals before they are reaching the receiver front end.

From the Rx/Tx switch is the received signal feed to the RF amplifier through a double tuned bandpass filter. The amplified signal passes another narrow band bandpass filter before it is feed to the first mixer. The input mixer converts the wanted incoming signal to a fixed intermediate frequency of 45 MHz. The output from the mixer is feed to the IF & Filter unit for further signal conditioning.

The local oscillator signal for the mixer is derived from the Rx VCO, running 45 MHz above the received signal frequency. For isolation and amplification, a buffer amplifier is inserted between the oscillator and the mixer.

The signal for the transmitter is derived from the Tx VCO, in which the frequency modulation takes place. The common VCO buffer amplifier and the Tx driver amplifier, gives the needed isolation and power gain, before the signal is feed to the RF power amplifier.

The power sensor derives the level dependent signal for the power level control circuit, which in turn generates an appropriate DC supply voltage for the power amplifier, resulting in a constant forward power level. The reference voltage for the power level control circuit, and so the actual output power level, is derived from a D/A-converter on the interface module, controlled by the microprocessor.

A temperature sensor is included, to protect the output stage from overheating.

This module includes several separate power supplies for different blocks. A 5.6 V supply for the voltage controlled oscillators and

appropriate buffers, switched by the Rx/Tx voltage switch. A 5.6 V supply used for the power amplifier in transmit mode. Finally a step-up converter, producing 17 V's for the synthesizer loop filter is placed here.

The power supply fuse, reverse voltage protection diode and the ON/OFF switch transistor are also placed on this module.

### **DIVIDER & LOOP FILTER**

The frequency reference for the synthesizer is derived from a 14.850 MHz VCXO.

A temperature compensating control voltage for the VCXO, can optionally be derived from a compensation table stored in the EEPROM. The output from the temperature sensor is feed to an A/D-converter on the interface module, and by means of this information the micro-computer can select the appropriate correction voltage.

The output from the crystal oscillator is feed to the synthesizer loop via the reference buffer amplifier, and to the multiplying amplifier which is generating a 44.550 MHz signal, used as the second local oscillator signal on the IF & Filter unit.

The frequency synthesizer is using a dual modulus divider with a prescaler dividing with 64/65. The input signal to the prescaler, coming from the appropriate VCO, is buffered by means of the prescaler buffer amplifier.

A single integrated circuit comprises the reference divider, the variable divider and the phase detector. The loop reference frequency may optionally be selected to suit special frequency resolution, but will in standard maritime applications be 12.5 kHz.

The output from the phase detector is amplified and filtered in the loop filter before the control signal is feed to the voltage controlled oscillators on the Rx - Tx module.

### **IF & FILTER UNIT**

This module is feed with the downconverted received signal at 45 MHz. After the signal has passed the crystal filter, it is amplified in the IF buffer amplifier.

A single integrated circuit includes the second mixer, in which the received signal is converted down to the second IF frequency of 450 kHz. The local oscillator signal for the mixer, comes from the divider & loop filter, and it is amplified in the 2'd LO buffer amplifier.

A ceramic filter on 450 kHz forms the final part of the receiver selectivity. The output signal from this filter is feed to the limiting amplifier, followed by the quadrature demodulator and an adjustable AF

amplifier which delivers the signal for the AF-processor on the interface module.

## **INTERFACE MODULE**

This module includes the microcomputer which takes care of all the internal control functions, decodes the keyboard inputs, and communicates, on a serial one wire link, with external test equipment or options. If the equipment incorporates an optional tone module, the microcomputer communicates with this module on an internal serial link.

An 8 MHz crystal oscillator generates the clock signal for the microcomputer. The same signal is used as the input clock for the AF-processor.

The output port expander converts serial data from the microcomputer to an eight bit parallel control word, used for different internal control functions.

By means of the 2 to 1 wire serial interface, is a two wire full duplex SCI interface on the microcomputer converted to a single wire serial link to external equipment.

An optional EEPROM extension may be used to increase equipment channel capacity.

The units custom designed LCD display is driven in the static mode by means of a single integrated display driver, which has a serial data interface to the microcomputer.

The AF-processor is an ASIC-circuit, which includes all the AF filters for the receiver and the transmitter. The same integrated circuit includes the volume controls, squelch comparators, gain blocks, AGC and limiter, as well as A/D and D/A converters for internal measurement and control functions.

The received signal is amplified in the AF amplifier before it is feed to the internal loudspeaker. This amplifier has its own power supply with a separate control input for stand-by selection, to reduce current consumption in stand-by mode.

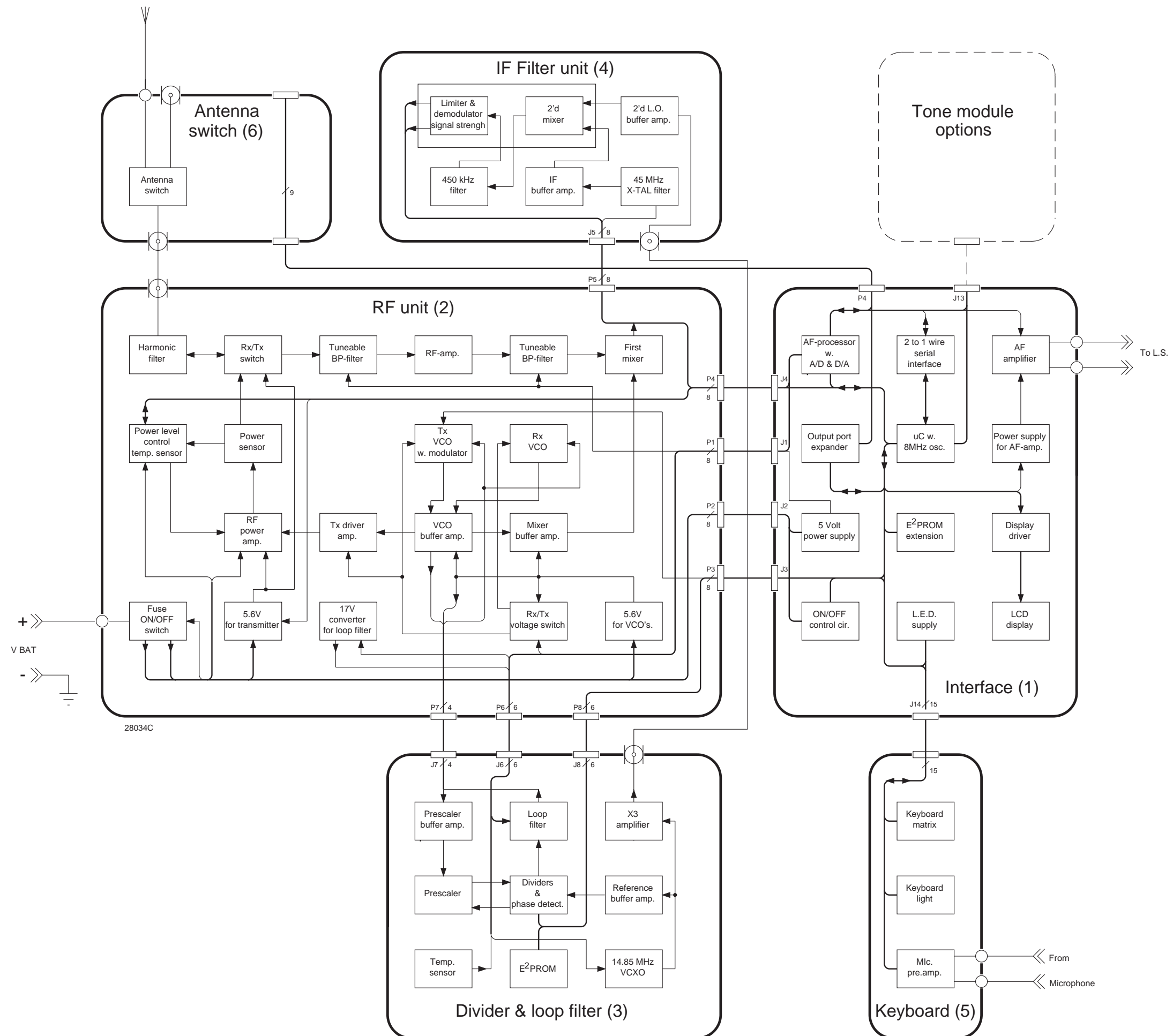
This module includes as well the low drop 5 V voltage supply, the ON/OFF control circuit and voltage supplies for different backlight LED diodes.

## **KEYBOARD**

This module includes the keyboard matrix and the associated LED diodes for nighttime illumination.

On the same module you will find the microphone pre-amplifier which is having its input from the electret transducer, mounted in the equipment housing.

BLOCK DIAGRAM







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## 2 TRANSCEIVER POWER SOURCES

### 2.1 GENERAL INFORMATION

The SP3000 VHF-transceivers can be powered from different kinds of power sources, depending on customers needs and/or application situation.

When used as a general communication transceiver, the most convenient power source will be a **rechargeable** NiCd-based battery package.

For the moment two different capacities are available, both with the same physical size.

A standard 700 mAh version for normal use, and a high capacity 1200 mAh version for more demanding application areas.

When used in an emergency, the transceiver may be powered from a super high capacity primary battery pack, SP3905. This battery pack are based on Lithium cells, and is thus a **one time** power source.

For all types of batteries applies, that careful handling and storage will increase battery **life-time** and **capacity** available.

Therefore:

- do not store your batteries at high temperatures for longer periods
- do not expose your batteries to needless bumps and shocks
- do not short-circuit battery terminals
- keep terminals and charging terminals clean

For rechargeable batteries a degraded capacity may be observed, due to either low environmental temperatures or the so-called memory effect - described in part 2.2 concerning rechargeable batteries.

**Attention** should be brought to national laws related to environment and/or rules concerning recirculation & disposal of worn out batteries. All types of batteries will be a source to pollution if **not** handled correct when worn out.

#### **WARNING!**

All types of batteries may explode if exposed to open fire.

## 2.2 RECHARGEABLE BATTERIES

**New batteries** and batteries which have been stored for a long period, must go through **two** charging cycles in the standard charger - **without intervening discharge** - before taken into operation. This procedure will optimize the capacity of your secondary rechargeable NiCd-batteries.

The battery can be stored at room temperature in any charge condition, without any risk of damage to the battery. However, if the battery has been stored for an unknown period of time, it must be fully charged before used.

The only maintenance needed for your NiCd battery is to keep it charged and with clean terminals. The battery must be at normal room temperature when it is charged, and the transceiver must be switched off.

**MEMORY EFFECT.** Your NiCd battery may show a memory effect, indicated by a reduced charging capability. This effect will typically arise if your battery repeatedly are charged after a partly discharge. A battery with memory effect is **not** working optimal.

How to avoid memory effect:

Use your transceiver until the battery is fully discharged, indicated by the equipment. Then fully recharge the battery once a week.

How to brake down a memory effect:

Use your transceiver until the battery is fully discharged then complete a charge cycle.

Repeat this procedure at least three times.

**Note** that rechargeable batteries has a considerable reduced capacity at low environmental temperatures; this phenomenon is normal and the battery will regain the normal capacity when subjected to normal room temperature.

A cold battery, below +10°C can **not** be fast-charged.

The fast chargers from **E/C/I** monitors the battery temperature, and the fast-charge cycle will first begin when the battery has an appropriate temperature.

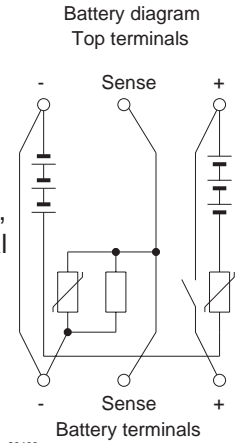
## 2.3 RECHARGEABLE BATTERY TYPES & CHARGING

The rechargeable battery packs, are composed of 6 NiCd cells connected in series.

A so-called poly-fuse, a kind of a PTC-resistor, are connected in series with the cells, acting as a current limiting and short circuit protecting device.

For the charging terminals in the bottom of the battery package, they are short circuit protected, as the plus terminal on the cells and the external terminal are connected in series with a reed-switch.

When the battery are placed in a charger, a magnet in the charger closes the switch making it possible to charge the battery.



A sense terminal on the battery package, are used to indicate the type of battery as well as the temperature of the package. The sense resistor, placed between the sense terminal and the minus terminal on the battery, is a combination of a fixed 1% resistor in parallel with a NTC resistor. The following table shows the nominal and the typical values of these resistors in the two types of batteries.

BATTERY TYPE	NTC (25°C) [kOhm]	Rp [kOhm]	R typ. sense [kOhm]
700 mAh	10	12.7	5.59
1200 mAh	100	127.0	55.95

Both types of batteries can be charged in any type of chargers from **E C I**.

Both the standard 14 hour charger and the fast chargers will charge the batteries with optimum charging currents for each type.

To avoid memory effect (see chap. 2.2) only charge the battery in the standard charger when battery has been completely discharged, indicated by the transceiver.

The battery capacity may be measured by means of the fast chargers with build-in optimizer SP3913/SP3915, which on the same hand will be able to recharge a bad battery.

For further information on charging, look in the appropriate technical manuals.

## 2.4 EMERGENCY BATTERY

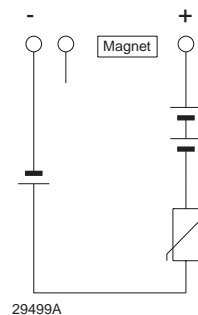
The **GMDSS** VHF-transceiver **SP3110** are supplied with a special emergency battery, to secure a minimum of 8 hours operation at all environmental temperature conditions.

This special emergency battery are composed of 3 lithium cells in series.

A so-called poly-fuse, a kind of a PTC-resistor, are connected in series with the cells, acting as a current limiting and short circuit protecting device.

A small magnet in the top of the battery draws a reed switch in the transceiver, when inserted, thereby informing the  $\mu\text{C}$  that an emergency battery are used.

Battery diagram



The chemistry of the cells are based on a lithium anode and a liquid thionyl chloride cathode with an electrolyte of lithium tetrachloro aluminate in thionyl chloride.

The cells include **no toxic materials**, and they are housed in stainless steel casings. The casings include a vent, and if a cell open at ambient temperature,  $\text{SOCl}_2$  vapours will rapidly combine with air moisture to produce corrosive vapours, **however** these are neither toxic nor flammable.

The cells used are UL recognized.

**Storage.** When stored, the storage temperature should be maintained below +25°C (+95°F). Exposure to temperatures above +50°C (+122°F) should be limited to a few days in any one year.

Areas where cells and batteries are stored must be equipped with type D fire extinguishers.

Long-time storage, specially at elevated temperatures, may beside the reduction in capacity introduce a so-called delay-effect. This effect may increase the turn-on time of the transceiver. However a special electrical circuit in the transceiver will secure that the equipment always will be able to turn on, just **keep the on/off button depressed** until the set turns on.

**Battery test.** The battery may be tested periodically, e.g. by inspection of ship surveyors. The **test duration** must be written on the sticker on the battery. When the **total test time** exceeds 30 minutes of operation with **maximum** 5 minutes of transmission, the battery must be replaced to secure 8 hours of operation at -20°C.

## 2.5 BATTERY HANDLING & TRANSPORTATION

### 2.5.1 RECHARGEABLE SECONDARY BATTERIES.

These batteries can be handled as normal goods, and **no** special precaution should be taken neither under handling nor transportation.

However:

**Attention** should be brought to national laws related to environment and/or rules concerning recirculation & disposal of worn out batteries. All types of batteries will be a source to pollution if **not** handled correct when worn out.

### 2.5.2 LITHIUM PRIMARY BATTERIES (SP3905).

This battery type must be handled with normal care to prevent short-circuit of the battery terminals. **DO NOT** connect the battery to external power sources, other-wise the battery may explode.

The transport of lithium cells and batteries is regulated by UN, the ICAO

(civil aviation), the IMO (maritime organization) and the HM 181 (federal regulations for the USA) and other national organizations.

Each cell contains 1.45 G of lithium, each battery contains 4.35 G.

**NOTE!** The following rules apply for both used **and** unused batteries.

### **AIR FREIGHT.**

The batteries are classified as dangerous goods, and must be packed in special approved boxes for dangerous goods with a preprinted UN-specification.

UN 3091, lithium batteries contained in equipment.

Hazard-label no. 9 (Miscellaneous) must be attached (see next page).

A label with two arrows must be attached as well (see next page).

For some countries, e.g. USA a special orange label must be added, to tell that the batteries must **not** be loaded in passenger aircrafts (see next page).

**FOR EACH SHIPMENT**, a Shippers Declaration for Dangerous Goods must be made out.

### **FREIGHT BY TRUCK.**

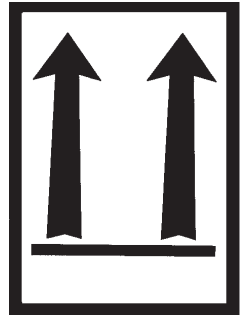
The batteries are **not** classified as dangerous goods, and no special action should be taken.

### **FREIGHT BY SHIP.**

The batteries must be packed and labeled in the same way as used for air-freight packages, as a form with Shippers Declaration for Dangerous Goods must be made out.



## EXAMPLES OF PACKAGING STICKERS.



**ATTENTION**, should be brought to national laws related to environment and/or rules concerning recirculation & disposal of batteries. In some countries and in some urban areas, the collection of batteries, including lithium types, is organized officially. Please contact your authorized regulatory agency for guidelines.

Anyway, if any problems arise concerning disposal, the batteries may be returned to **ECI** for proper treatment.



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### 3. SERVICE

#### 3.1 MAINTENANCE

As this transceiver may be a part of the on-board safety equipment, attention should be given to the performance of the transceiver. Any mechanical deterioration of the transceiver should be avoided, and a regular service check in the service shop, at intervals not exceeding 12 months, is recommended.

The transceiver is delivered with a test sheet, including some of the final test values, recorded at the final production test. If a performance check of the equipment, do not show a good agreement with these values, a complete alignment/repair has to be carried out.

#### 3.2 NECESSARY TEST EQUIPMENT

To carry out a performance check of the transceiver, the following test equipment must be available:

**Test box for SP3000** (729510)

**Multimeter** e.g. Philips type PM2505

**Frequency counter** e.g. Philips type PM 6674

**RF Signal Generator** e.g. Rohde & Schwarz CMT tester.

**RF Power Meter** e.g. Rohde & Schwarz CMT tester.

**RF Modulation Meter** e.g. Rohde & Schwarz CMT tester.

**LF Signal Generator** e.g. Rohde & Schwarz CMT tester.

**LF Distortion Meter** e.g. Rohde & Schwarz CMT tester.

If any of the electronical tuned parameters has to be changed, the SP3000 Programming Interface, H1650, must be available.

### 3.3 PERFORMANCE CHECK

A performance check of the transceiver should include the following measurements, made by means of the SP3000 test box and appropriate instruments.

**NOTE!** The RF signal path insertion loss, of the SP3000 test box with connection cable, is approximately 0,5dB at VHF frequencies and 0,8dB at UHF frequencies.

All levels mentioned below are referred to the terminals at the top of the transceiver.

All measurements are carried out on VHF channel 6.

#### RECEIVER SENSITIVITY.

The receiver sensitivity is controlled by applying a RF-signal to the transceiver input terminal, via the test box, and measure the receiver AF output signal-to-noise ratio.

1. Connect the RF signal generator to the RF in/out terminal on the test box. Adjust the RF output level to 0,3  $\mu\text{V}$ , the carrier must be modulated with a 1 kHz tone and a frequency deviation of  $\pm 3.0$  kHz.
2. Connect the AF distortion meter to the AF from RX output terminal on the test box.
3. Check that the signal-to-noise ratio is better than 12 dB SINAD.

#### RECEIVER AF OUTPUT TO ROU.

The AF output level for a remote operation unit may be checked by means of a signal generator and an AF voltmeter.

1. Connect the RF signal generator to the RF in/out terminal on the test box. Adjust the RF output level to + 60 dB relative to 1  $\mu\text{V}$ , the carrier must be modulated with a 1 kHz tone and a frequency deviation of  $\pm 3.0$  kHz.
2. Connect the AF voltmeter to the AF from RX output terminal on the test box.
3. Check that the AF signal level is  $325 \text{ mV}_{\text{RMS}} \pm 30 \text{ mV}_{\text{RMS}}$ .

**RECEIVER DISTORTION.**

The receiver distortion is controlled by applying a RF-signal to the transceiver input terminal, and then measure the distortion of the AF output from the receiver.

1. Connect the RF signal generator to the RF in/out terminal on the test box. Adjust the RF output level to + 60 dB relative to 1  $\mu$ V, the carrier must be modulated with a 1 kHz tone and a frequency deviation of  $\pm$  3.0 kHz.
2. Connect the AF distortion meter to the AF from RX output terminal on the test box.
3. Check that the distortion of the AF signal is less than 5%.

**TRANSMITTER POWER LEVEL.**

The transmitter power level is measured as the mean power delivered to a 50 ohm load, with the carrier unmodulated. The level is measured on the coaxial outlet in the top of the transceiver.

1. Connect the RF power meter to the RF in/out terminal on the test box.
2. Key the transmitter by means of the PTT switch on the test box.
3. The RF power level should be inside the following limits.

2W version in HI power mode  $1.6 \text{ W} \leq P_{\text{Tx}} \leq 2.2 \text{ W}$

2W version in Lo power mode  
 a.with secondary battery  $0.2 \text{ W} \leq P_{\text{Tx}} \leq 0.3 \text{ W}$   
 b.with primary battery  $0.7 \text{ W} \leq P_{\text{Tx}} \leq 1.0 \text{ W}$

5W version in HI power mode  $4.1 \text{ W} \leq P_{\text{Tx}} \leq 5.4 \text{ W}$

5W version in Lo power mode  $0.2 \text{ W} \leq P_{\text{Tx}} \leq 0.3 \text{ W}$

1W version in HI power mode  $0.7 \text{ W} \leq P_{\text{Tx}} \leq 1.0 \text{ W}$

1W version in Lo power mode  $0.02 \text{ W} \leq P_{\text{Tx}} \leq 0.1 \text{ W}$

**TRANSMITTER CARRIER FREQUENCY.**

The transmitter carrier frequency is measured as the frequency of the unmodulated carrier.

1. Connect the frequency counter to the RF in/out terminal on the test box.
2. Key the transmitter by means of the PTT switch on the test box.
3. The carrier frequency @ 25°C should be 156.300 MHz  $\pm$  500 Hz.

**NOTE!** The following two performance checks is not able to detect errors in the signal path from the sound transducer to the AF processor, however the specific adjustments and the signal path from the ROU-connector may be verified.

If the following two checks are OK, a simple voice check of the modulator should be satisfactory to verify the transducer with its amplifier.

**TRANSMITTER FREQUENCY DEVIATION.**

The transmitter frequency deviation is measured by applying an AF signal to the transmitter modulator and then measure the peak frequency deviation of the carrier.

1. Connect the modulation meter to the RF in/out terminal on the test box.
2. Connect an AF signal generator to the AF to Tx input terminal on the test box. Adjust the output frequency to 1 kHz and the output level to 50 mV<sub>RMS</sub>.
3. Key the transmitter by means of the PTT switch on the test box.
4. Check that the peak frequency deviation is  $\pm$  3.0 kHz  $\pm$  2 dB.

**TRANSMITTER DISTORTION.**

The transmitter distortion is measured by applying an AF input signal to the transmitter modulator and then measure the distortion of the demodulated AF signal.

1. Connect the modulation meter to the RF in/out terminal on the test box. Connect the demodulated AF output from the modulation meter to the AF distortion meter.



2. Connect an AF signal generator to the AF to Tx input terminal on the test box. Adjust the output frequency to 1 kHz and the output level to  $50 \text{ mV}_{\text{RMS}}$ .
3. Key the transmitter by means of the PTT switch on the test box.
4. Check that the distortion of the demodulated AF output is less than 5%.

### 3.4 REPLACEMENT OF MODULES

Due to the advanced technologies used in this series of transceivers, it is recommended to trace faults to module level and then exchange the complete module.

However it should be noticed that some few adjustments need to be made when certain modules are replaced, due to the use of internal electronically tuned parameters.

The absolute minimum adjustments needed, to have an operational unit after module replacement, are mentioned in the following sections.

**NOTE!** Whenever the transceiver unit has been disassembled, it must be assembled according to the instructions outlined in chapter 4 of this manual.

### 3.5 REPLACEMENT OF INTERFACE MODULE

The replacement of this module may impair a lot of the internal settings because the microcomputer on this module holds data for these settings in the internal EEPROM.

If these settings **cannot** be read by means of the software program H1650, it is recommended to have the unit repaired on the factory.

1. Read the complete setup of the EEPROM memory by means of H1650.
2. Replace the defective interface module.
3. Programme the transceiver with the setup file loaded under step 1.

## 3.6 REPLACEMENT OF RF MODULE

If this module are replaced, the transmitter power level settings has to be checked/reprogrammed.

1. Check the RF power levels as described in part 3.3.
2. If needed, programme the power settings by means of direct address programming under H1650. The power level parameters are stored in the following addresses:

\$021	Low power level with primary battery, typical standard value equal to \$12.
\$022	High power level with primary battery, typical standard value equal to \$1C.
\$023	Low power level with secondary battery, typical standard value equal to \$0A.
\$024	High power level with secondary battery, typical standard value equal to \$1C.

## 3.7 REPLACEMENT OF DIVIDER & LOOP FILTER MODULE

Before this module are replaced, it must be determined whether temperature compensation of the crystal frequency are active or not. By means of H1650 read the content of address \$030, convert the content to binary, read bit 5 (bit 0 equal to LSB):

1. If bit 5 is equal to binary 0, temperature compensation are **inactive**, and the module can just be replaced.
2. If bit 5 is equal to binary 1, temperature compensation are **active**, and the module must only be replaced with a module which has been compensated from the factory with appropriate data.
3. Check the carrier frequency as outlined in section 3.3. If temperature compensation are **inactive**, the carrier frequency may be tuned by means of C4.

### 3.8 REPLACEMENT OF IF FILTER MODULE

This module may be replaced without further action. To be sure that the AF level from the module are correct do as follows:

1. Connect the RF signal generator to the RF in/out terminal on the test box. Adjust the RF output level to + 60 dB relative to 1  $\mu$ V, the carrier must be modulated with a 1.0 kHz tone and a frequency deviation of  $\pm$  3.0 kHz.
2. Connect an AF voltmeter to the AF output terminal on pin 6 of the module. The level must be  $150 \text{ mV}_{\text{RMS}} \pm 3 \text{ mV}_{\text{RMS}}$ .
3. If needed adjust R12 to reach the right level mentioned above.



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## 4 MECHANICAL DESCRIPTION

### 4.1 GENERAL REMARKS AND HINTS

This transceiver program has been specially designed to withstand the harsh environmental conditions met at sea; however as a self contained watertight unit, only authorized personel, as **E/C/I** service agents, may make service on these products.

For the **GMDSS** version **SP3110**, a set of tough environmental demands has to be met. Of this reason an extensive test has been carried out, on the factory, in the production process; including vacuum and pressure test's of the housing as well as the final unit.

Therefore, as a part of the safety equipment, these units must be handled with great care when subject to service.

**NOTE!** if this type has been opened or serviced by unauthorized personal, **THE PRODUCT WARRANTY WILL BE LOST.**

The housing material, a special polycarbonate mold, can withstand all normal diesel-/motor-/lubricating oils and fuels met on-board ships.

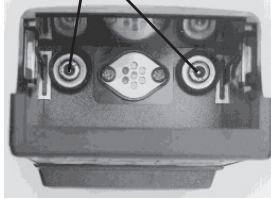
For normal cleaning we recommend the use of normal washing-up liquid and hand hot water.

If the unit has been submersed in acids or alkaline solvents, clean with plenty of hand hot water.

To keep your transceiver watertight, keep sharp edges and points away from the rubber parts and the membrane in front of the speaker baffle.

## 4.2 MECHANICAL DISASSEMBLING & MODULE LOCATION

Disassembling of transceiver unit.



501321



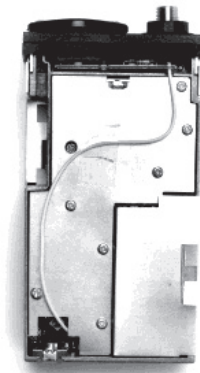
501322

Transceiver unit front view.

Transceiver unit rear view.



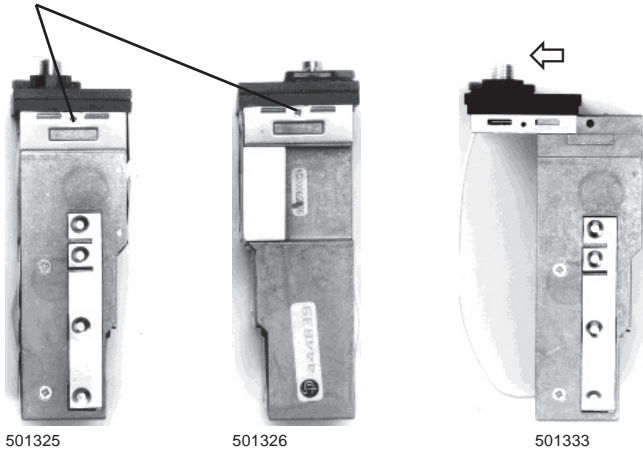
501324



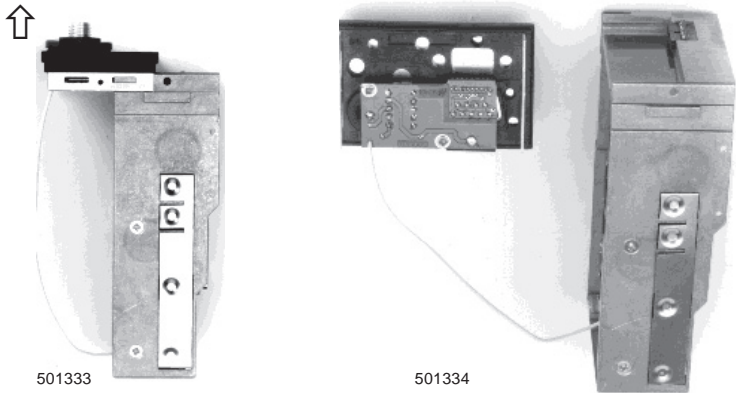
501323



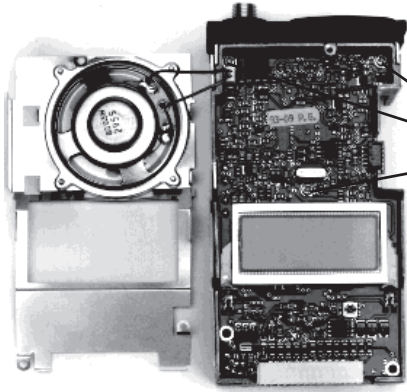
Unscrew to remove transceiver top with Antenna Switch Module.  
(Gently disconnect coax cable connector by means of a tweezer)



Pull gently upwards.



Front view with removed metal shield.



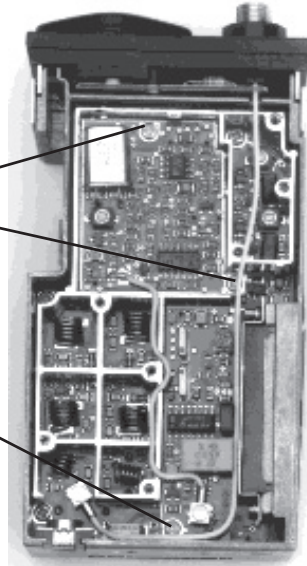
Unscrew to remove Interface Module.  
(Must only be done after the transceiver top has been removed)

501329

Rear view with removed metal shield.

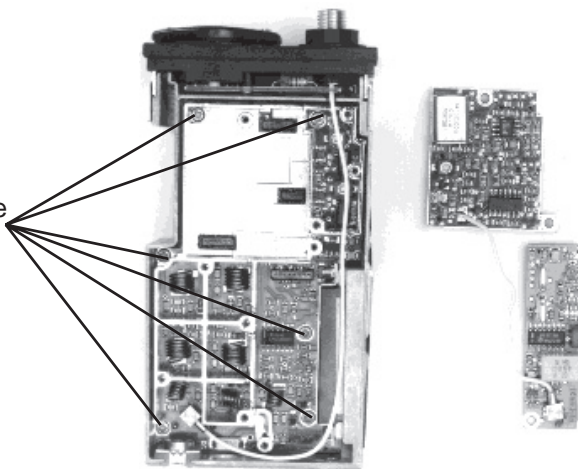
Unscrew to remove Divider & Loop Filter Module.

Unscrew to remove IF Filter Module.  
(Gently disconnect coax cable connector by means of a tweezers)



501330

Unscrew to remove  
RF Module.



501331

### 4.3 MECHANICAL ASSEMBLING OF TRANSCEIVER UNIT

If a transceiver unit has been disassembled; great care must be taken to assure proper assembling to maintain watertightness.

**FOR SP3110, THE RUBBER GASKETS MUST BE EXCHANGED!**  
(Request service kit with PART No. 729199)

Transceiver assembling:

**Make sure!** that the top rubber gasket is turned correct, see expanded drawing of gasket below.

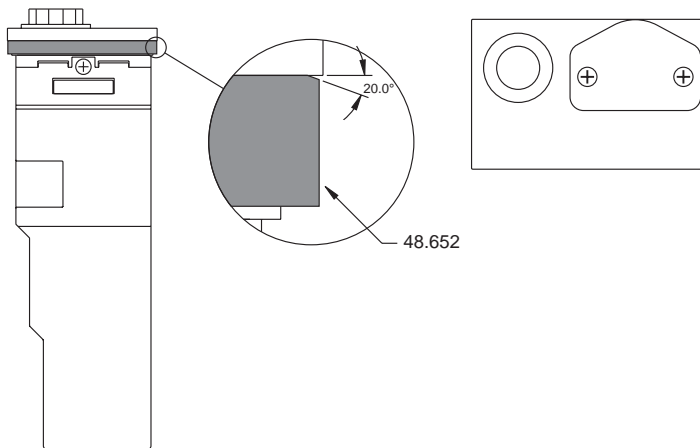
To ensure correct tightning of the screws in the bottom, a torque hexagon head screwdriver must be used.

When the screws are tightened, alternately tighten the two screws a little, to make sure that the unit is smoothly drawn together, with an equal pull in each side of the chassis.

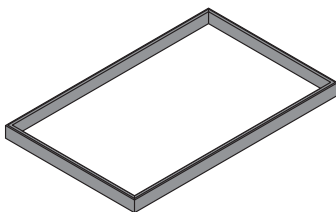
The screws must be tightened with a torque of 4 Kgcm.

Screws in the top cover must be tightened with a torque of 5 Kgcm.

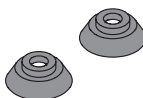
Resealing of SP3110:



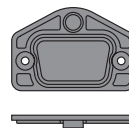
Service kit PART No. 729199 consists of:



1 pcs PART No. 48.652



2 pcs PART No. 48.650



1 pcs PART No. 48.651

29488A

## 4.4 CONNECTION TO REMOTE OPERATION UNIT

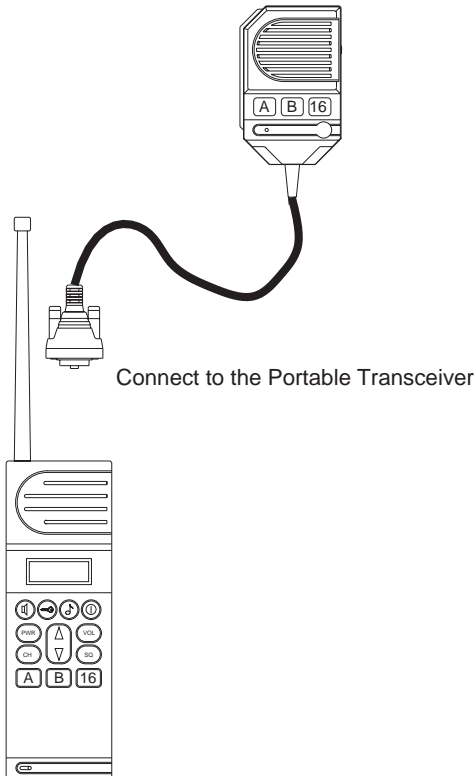
The transceivers may be connected to a Remote Operation Unit SP3930.

Remove the top cover of the transceiver.

Smoothly press the rubber molded connector, on the cable to the Remote Operation Unit, into the top plug.

Fasten the screws tightly with your fingers.

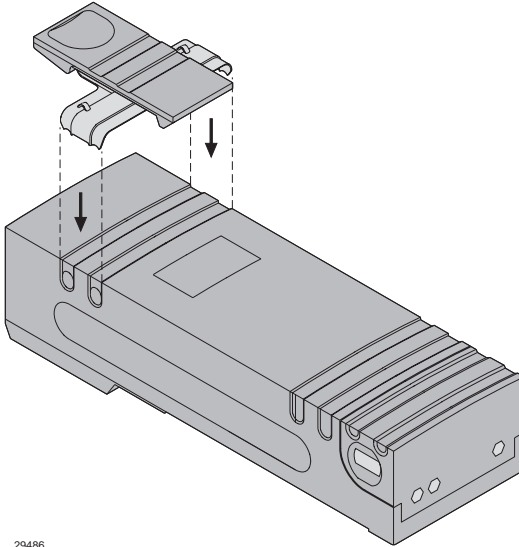
Turn on the transceiver unit.



29489A

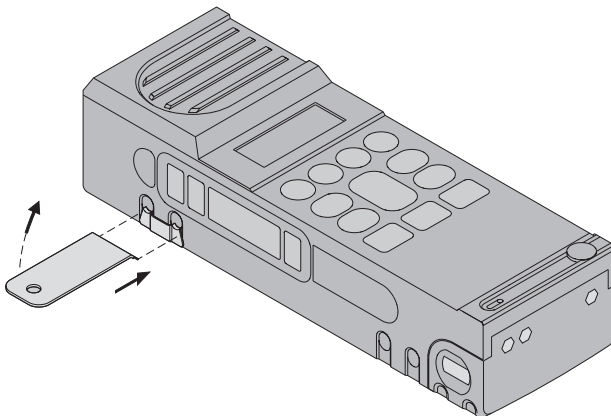
### 4.5 BELT CLIP & STRAP CLIP

Mounting of belt clip or strap clip.



29486

Removal of belt clip or strap clip.



29487

9339





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## 5 CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

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## 5 CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

### 5.1 INTERFACE MODULE (1)

This module comprises all the control signalling circuits as well as the AF circuit elements of the transceiver. This module has connectors for interface to the keyboard module, the RF module, an optional tone system unit and the antenna switch module.

#### ON/OFF CIRCUIT

When the on/off button on the keyboard module is activated, the common cathode node for D1, D3 and D4 will be pulled to ground level, which will turn-on the silicon switch on the RF module. This will in turn power-up the complete unit, and once the microcomputer has started up, the two transistors Q3 and Q4 will turn on, and a self keeping condition has been reached. In this condition, the current path to ground through R9 and Q4 will be able to turn-on externally connected equipment, as e.g. a Remote Operation Unit.

Once turned on, with the on/off button released, the anode of D1 will be pulled high through R8. This node will now be continuously monitored by the  $\mu$ C, and a low level will initiate a turn off sequence, where Q3 and Q4 will be released.

#### +5V POWER SUPPLY

The internal reference and logic supply voltage, is generated by means of an integrated low-drop series regulator U9. With the switched battery voltage as the input voltage, this device creates an extremely stable output voltage of +5V.

#### KEYBOARD LIGHT SUPPLY

The power supply for the keyboard light diodes are supplied through Q14; when pin 7 on U3 are low, the output voltage on the collector of Q14 will be +5V, equal to the internal +5V reference, connected to the base of Q13.

#### DISPLAY LIGHT SUPPLY

The display light are controlled from pin 4 on U3; with this port turned high, a constant current sink are formed by means of D5, R48 and Q12.

### **MICROCONTROLLER**

This VLSI circuit U8, includes a microcontroller with different peripheral subcircuits, as well as an EEPROM, in which the complete channel coding and programmable settings for a standard version are stored.

The microcontroller runs with an 8 MHz clock. The internal oscillator circuit has an 8 MHz crystal X1 as the frequency determining device, with capacitors C38 and C39 as the main load capacitors.

The mode of operation can be determined by means of the switch S5, or via the serial link through the top connector.

The microcontroller takes care of all the internal control and monitor functions, e.g. synthesizer set-up, power set-up, AF-control, display control etc.

The microcontroller scan the keyboard for user input, monitors the switches S1 to S4, and the control signals from a Remote Control Unit, if connected.

### **PERIPHERAL DEVICES**

A single serial to parallel shift register U3, is used as a port expander for the  $\mu\text{C}$ , to control different internal functions.

If the transceiver needs more than 80 channels, an optional memory expansion must be added, by means of an EEPROM U2.

### **DISPLAY FUNCTIONS**

The transceiver status information is read-out by means of a custom designed LCD display. This display, which is of the static driven type to get optimum read-out contrast, is controlled by means of an integrated driver IC U6, which includes the oscillators, the buffers etc. The actual information to be displayed is send by means of a serial link to the  $\mu\text{C}$ .

### **SERIAL COMMUNICATION INTERFACE**

The  $\mu\text{C}$  includes a two wire, bidirectional asynchroneous communication interface (SCI-interface). By means of Q1, U1 and surrounding components, this interface is converted to a single wire bidirectional serial communication interface.

This interface is used for external control of the equipment under production and test.

The same interface is used, when a service agent will programme the transceiver functions and/or channels, by means of a PC and the programming kit H1650, from **E C I**.

**AF POWER SUPPLY**

The AF power amplifier U7, has it's own separate power supply, which can be shut down from the  $\mu\text{C}$ . This series regulator circuit has Q7 as the pass transistor with Q9 and Q10 as a differential pair in the feed-back loop. The internal reference voltage of +5V are fed to the base of Q9. The resistance divider R41 and R42 determines the output voltage, nominal +5,6V.

The output voltage can be shut down to 0V, when the common node of R39 and R40 is raised to +5V.

Transistor Q6 with resistor R37 acts as a current limiting and short term short-circuit protection of the voltage regulator.

**ASIC CIRCUIT U4**

This custom designed ASIC (**A**pplication **S**pecific **I**ntegrated **C**ircuit), includes all the AF-processing circuits of the transceiver, as well as some A/D and D/A converters for internal control of different functions as Tx power level, Rx tune voltage, XTAL oscillator temperature compensation, DC voltage level monitoring etc.

All the settings of this circuit are made by means of a serial protocol controlled by the  $\mu\text{C}$ .

The internal switch-capacitor filters has the 8 MHz  $\mu\text{C}$  clock as the reference oscillator.

The reference voltage to the A/D and D/A converters is taken from the internal +5V reference.

The pre-emphasis filter in the transmitter AF-chain, is realized with external components to determine filter shape. These components are capacitors C4, C5, C8 and resistors R16, R18 and R19.

The time constants for the integrated compressor, is determined by means of R17, C7 and R20.

The filter shape for the noise-squelch filter is determined by capacitors C13, C14, C15 and resistors R27 and R28. Diode D6 forms the detector, with R29, R30 and C17 determining the time constants.

## 5.1.1 ASIC CIRCUIT BLOCK DIAGRAM

This VLSI circuit, has been developed to operate as a standard building block in VHF/UHF transceivers from **E C I**.

This circuit must be powered from +5 V. To minimize power supply cross-talk, different parts have their own power supply input pin. The internal virtual ground amplifier, has an external decoupling capacitor on pin 34.

There are two independent AF chains, one for the Tx chain and one for the Rx chain. Each of these chains has a control bit to enable stand-by mode, to minimize power consumption in stand-by.

### **Tx AF-CHAIN**

In this part there is a complete signal conditioning circuit for a transmitter. The input may be fed to an input OP-amp, with or without filtering depending on application. The next stage is a programmable gain block with 32 steps and a resolution of 0,25 dB. The input to this amplifier may be taken either from the filter/preamplifier and/or the external input - pin 11 - TxAFin.

After this gain block follows a compressor circuit. The attack and decay times are determined by external resistors and a capacitor.

An external input may be coupled directly to the compressor input via the input/output pin 6 TxAFio.

The output from the compressor may be fed to a hard-limiter, or directly to the summing amplifier, before the final post-filter in the Tx path.

The input to the summing amplifier may be selected to come from the external input - pin 11 - TxAFin.

The post filter is realized as a fourth order, low-pass, switch capacitor filter, with programmable roll-off frequency.

The filter output are fed to two independent, gain adjustable amplifiers; each with 32 steps and a resolution of 0,25 dB. Both outputs are followed by an anti aliasing filter, to filter off clock feed-through from the switch capacitor filter SCF1.

### **Rx AF-CHAIN**

In this part there is a complete signal conditioning circuit for a receiver, including filters and amplifiers.

The input from the detector circuit may be fed to a gain adjustable amplifier, with 32 steps and a resolution of 0,25 dB.

After this follows two filters, which can be by-passed each or both,

depending on programming. The input may be selected either from the preamplifier or from an external input/output - pin 13 - RxAFio. The first filter, SCF2, is a second order band-pass filter, giving a slope of -6 dB/octave in the AF pass-band, acting as the receiver de-emphasis filter. The second filter, SCF3, is a fourth order high-pass filter, rejecting frequencies below 300 Hz.

The final filtering is made in a second order low-pass filter, SCF4, the input to which can be selected either from the filter path or from an external input/output - pin 13 - RxAFio.

After the post filter, the signal are divided into two independent gain adjustable amplifiers, one with 32 steps and a dynamic range of 35 dB, the other with 64 steps and a dynamic range of 70 dB. The output from the former are in advance attenuated 20 dB's compared to the output from the latter.

The outputs from the two amplifiers are each available as separate output terminals. Besides an output terminal is available, which may be connected to either of the above mentioned outputs.

### **SQUELCH COMPARATOR**

For the squelch circuit, an integrated comparator with hysteresis is implemented. The input to the comparator may be selected from one of two external input terminals. The comparator input trigger level can be set in 32 steps, ranging from 0,15 V to 3,1 V.

### **OPERATIONAL AMPLIFIERS**

Two wide-band operational amplifiers are available for different filtering and/or gain functions. OP1 can be powered down in stand-by mode by means of a single control bit.

### **OSCILLATOR CIRCUIT**

The clock signal to the switch capacitor filters can be derived, either from an external 8 MHz clock input, or from an on-chip oscillator, with an external crystal as the frequency determining device.

### **D/A CONVERTERS**

Three separate 7 bit D/A converters are available for different analog control functions. The output voltage will range from  $V_{REF-}$  to  $V_{REF+}$  increasing linearly in 128 steps.

**A/D CONVERTERS**

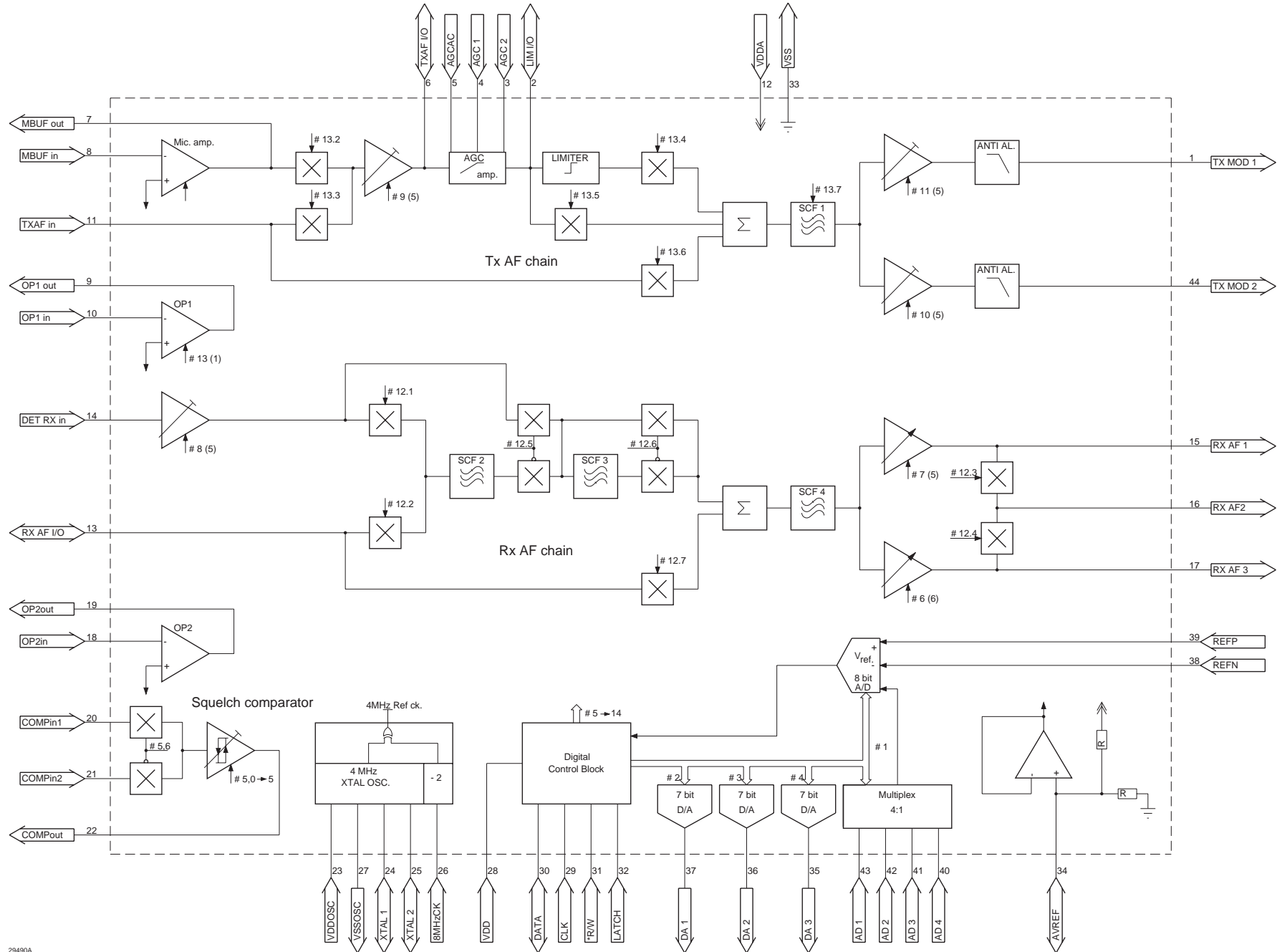
An 8 bit, successive approximation, A/D converter can have the input multiplexed between 4 external input terminals. The input voltage range lies from  $V_{REF-}$  to  $V_{REF+}$ . The A/D converter has a differential nonlinearity of  $\pm\frac{1}{2}$  LSB, and an integral nonlinearity of  $\pm 1$  LSB.

**DIGITAL CONTROL BLOCK**

This part includes all the digital interface/control functions of the complete circuit. There is a clock input, a bidirectional data port, a read/write pin and an input latch.

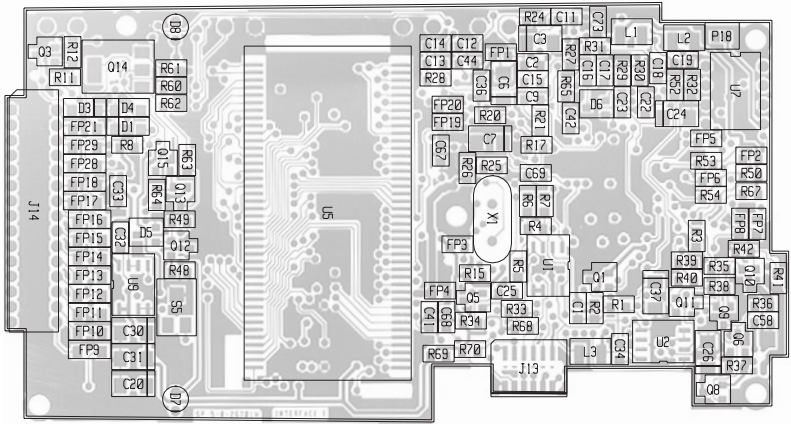


ASIC CIRCUIT BLOCK DIAGRAM

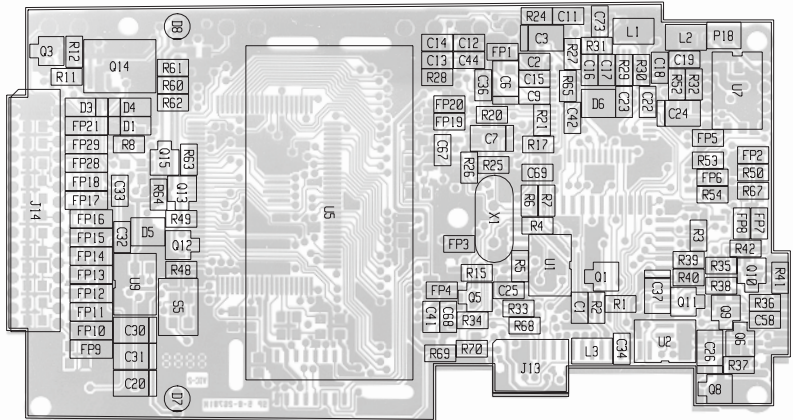




COMPONENT LOCATION INTERFACE MODULE 1

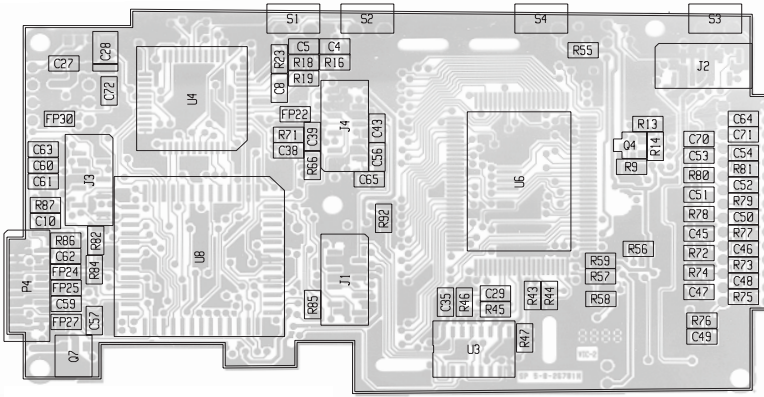


Seen from primary side with primary side tracks.

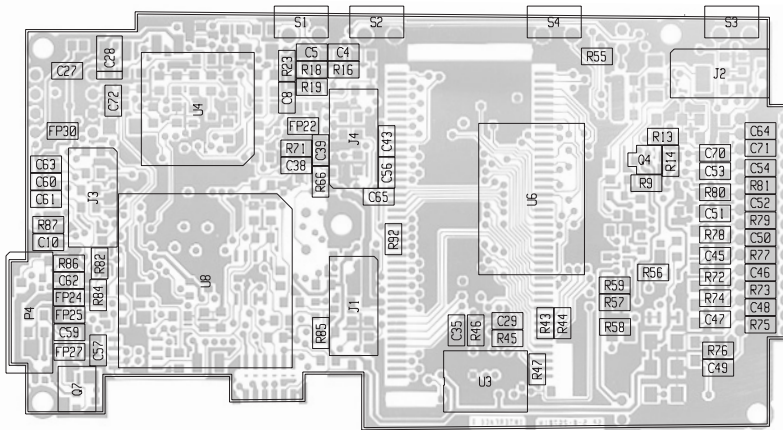


Seen from primary side with secondary side tracks.  
PCB rev. 26701H

COMPONENT LOCATION INTERFACE MODULE 1



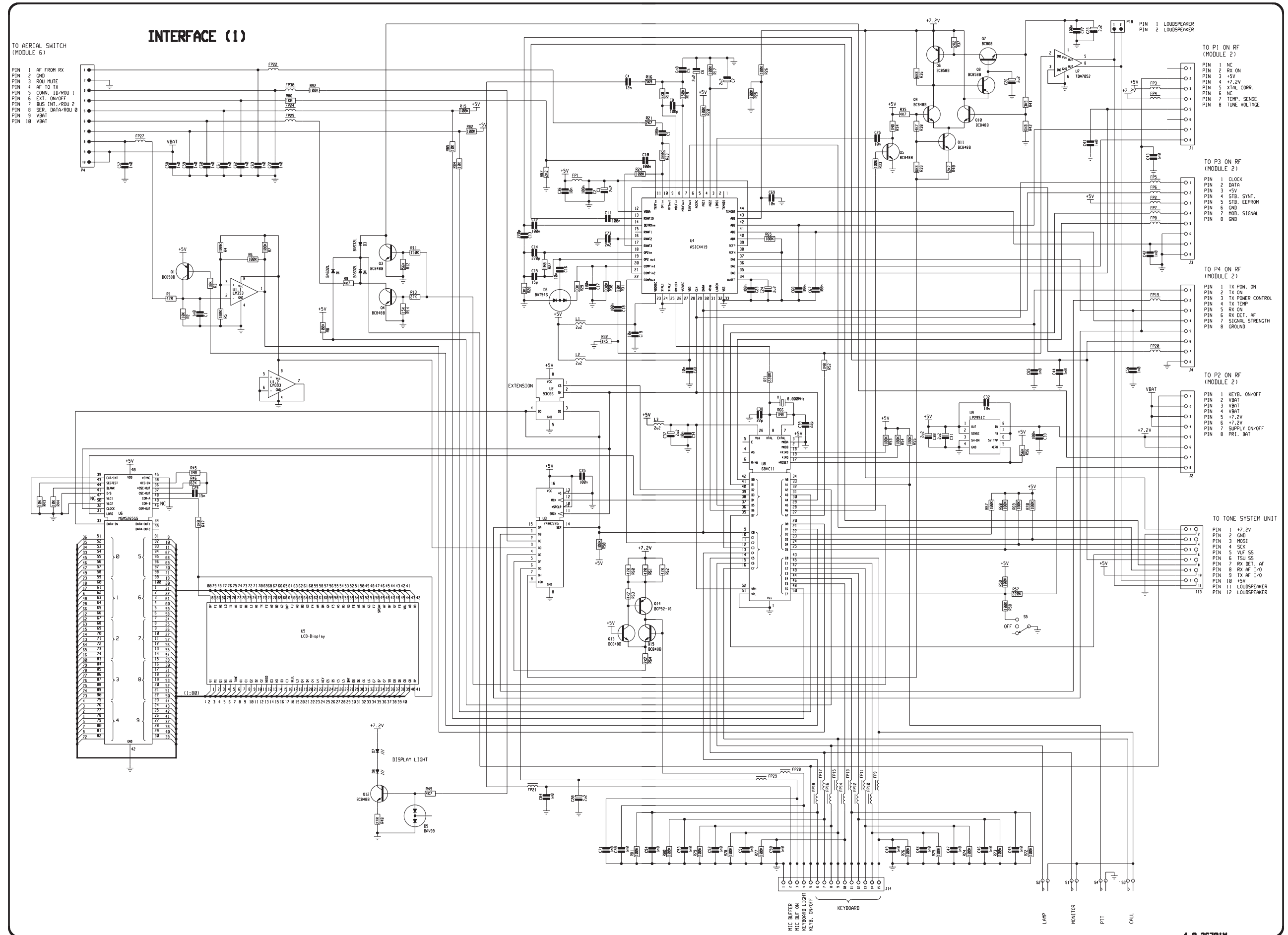
Seen from secondary side with secondary side tracks.



Seen from secondary side with primary side tracks.

PCB rev. 26701H

INTERFACE MODULE 1



4-8-26701M



## 5.2 VHF RF MODULE (2)

This module contains the following main blocks.

1. Receiver front-end & first mixer.
2. Transmitter power amplifier and harmonic filter.
3. Power regulator.
4. 5,6V voltage regulator for the transmitter power amplifier.
5. Voltage controlled oscillators.
6. 5,6V voltage regulator for the synthesizer circuitry.
7. Step-up converter.
8. on/off circuit.

### RECEIVER FRONT-END & FIRST MIXER.

The RF signal is fed into the front-end through the harmonic filter and relay RE2. Notice that the harmonic filter is used both in receive-and transmitmode.

The front-end consists of two double tuned LC-resonance circuits which are separated by the rf amplifier, built up around dual gate mosfet Q6. The resonance circuits are tuned as a function of frequency by means of capacitance diodes D5,D6,D7 and D8. Tuning voltage is delivered from the circuit formed by U2, where the voltage range is increased from 0-5V to 0-15V. From the front-end the signal is led into first mixer, which are built up around dual gate mosfet Q7. The IF1 signal is generated by mixing the RF signal with the local oscillator signal. The IF1 signal is filtered out by the tuned LC-resonance circuit formed by L9,C50 and C52, and then fed to plug P5.

### TRANSMITTER POWER AMPLIFIER AND HARMONIC FILTER.

The amplifier is built up around the integrated circuit U1. The RF signal enters the circuit at pin 1, is then amplified and led out at pin 5 into the power detector. From the power detector the signal is led on to relay RE2 and then into the harmonic filter, which is built up around L3 and L4 with matching capacitors. There are three supply voltages to the power amplifier. MAIN-supply is connected directly to battery voltage VBAT, BIAS-supply is connected to a 5,6V fixed voltage regulator and DRIVE-supply is connected to the power regulator circuitry.

**POWER REGULATOR.**

The regulator is built up of U2,3, U2,4, Q21, Q2 and the power detector, together these components form a control loop. The purpose of this loop is to keep the transmitter power at a constant level regardless of temperature, supply voltage etc., and to protect the power amplifier from damage caused by large VSWR-values at the output.

The power detector consists of a quarter wave transmission line, formed by L2, C20 and C21, and a rectifier formed by D2, D3, C23, R30, R32, R106 and R107. The transmission line is connected to the rectifier through the capacitors C19 and C22. Output from the detector is a DC-voltage that will increase with increasing voltage level of the RF signal on the transmission line. The detector output will also increase when the VSWR-value of the transmission line is increased.

The transmitter power level is set through the voltage at TX POWER CONTROL in P4.

**5,6V VOLTAGE REGULATOR FOR THE TRANSMITTER POWER AMPLIFIER.**

The regulator consists of a differential amplifier U2,2 Which controls the voltage drop across serial transistor Q4 in order to maintain constant output voltage from the regulator. The regulator includes shortcircuit protection formed by Q5. The regulator is turned on and off through TX ON in P4.

**VOLTAGE CONTROLLED OSCILLATORS.**

Both the tx-vco and the rx-vco are of the colpitts-clapp oscillator type built up around a common collector amplifier respectively Q15 and Q16. The oscillating frequency is controlled by feeding the vco control voltage to the capacitance diodes respectively D11 and D13. In rx-mode the vco signal is led through D14 to the vco buffer. The output from the vco buffer is led to P7 through C94 & R87 and to LO1 buffer through D17, where it is amplified and then fed to first mixer as local oscillator signal. In tx-mode the vco signal is modulated by applying the modulation signal to the capacitance diode D12. The vco signal is then led through D15 to the vco buffer. The output from the vco buffer is led P7 through C94 & R87 and to the tx preamplifier through D16. The preamplifier is built up around two transistors Q18 and Q19, and amplifies the vco signal to achieve the correct power level for the transmitter power amplifier.

The selection of the wanted vco is done by means of the circuit formed by Q8, Q9, Q10.



**5,6V VOLTAGE REGULATOR FOR THE SYNTHESIZER CIRCUITRY.**

The regulator consists of a differential amplifier, formed by Q13 and Q14, which controls the voltage drop across the serial transistor Q12 to maintain constant output voltage from the regulator. The regulator contains also a shortcircuit protection formed by Q11.

**STEP-UP CONVERTER.**

This circuit generates supply voltage for the loop filter, located on module 3, and for U4 used to create tune voltage for the receiver front-end. The converter is built up around D9, D10, C61, C62, C63, C64, U3, C66 and R63. The converter frequency is app. 100kHz.

**On/Off CIRCUIT.**

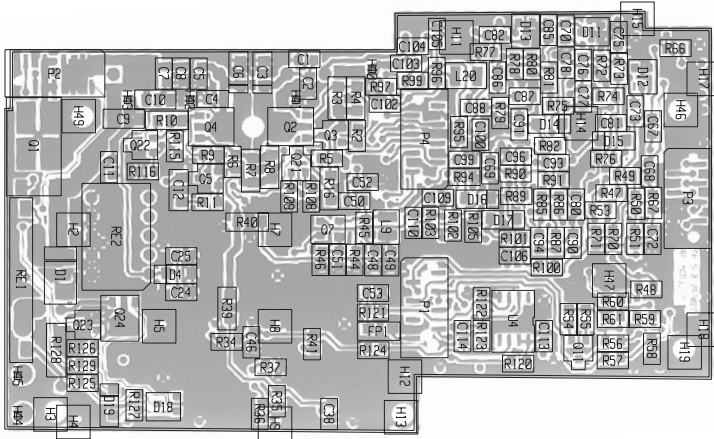
The on/off switch is formed by transistor Q1, which is controlled by SUPPLY ON/OFF in P2.

When a primary battery is used in conjunction with the transceiver, the circuit built up around Q23 and Q24 is armed through the reed relay RE1. The reed relay is activated by a small permanent magnet placed in the primary battery package.

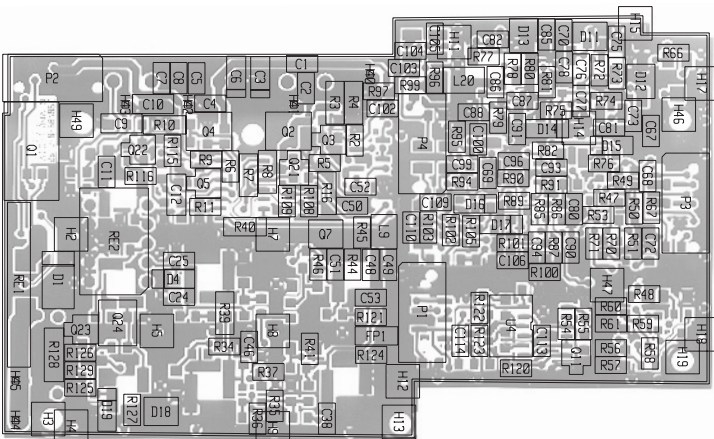
The purpose of the circuit is to inform the microprocessor, by pulling PRI.BAT. in P2 low, that a primary battery is supplying the transceiver, and to load the primary battery with a certain current, when keyboard on/off button is activated, as soon as the button is released, the circuit stops loading the battery. This load secures that the battery will meet specifications even after long storage.



COMPONENT LOCATION VHF RF MODULE 2



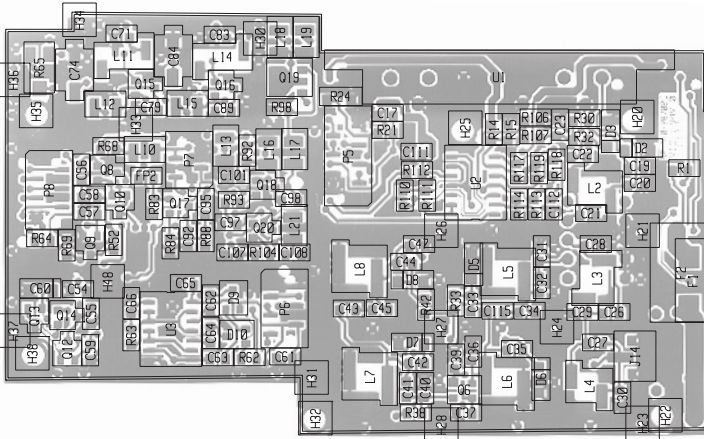
Seen from primary side with primary side tracks.



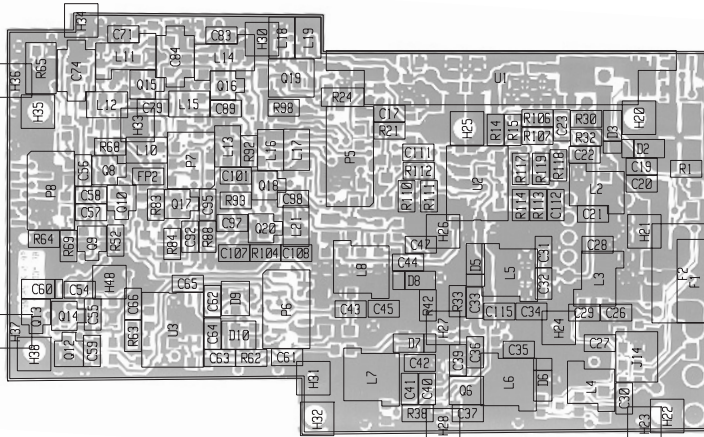
Seen from primary side with secondary side tracks.

PCB rev. 26702C

COMPONENT LOCATION VHF RF MODULE 2



Seen from secondary side with secondary side tracks.

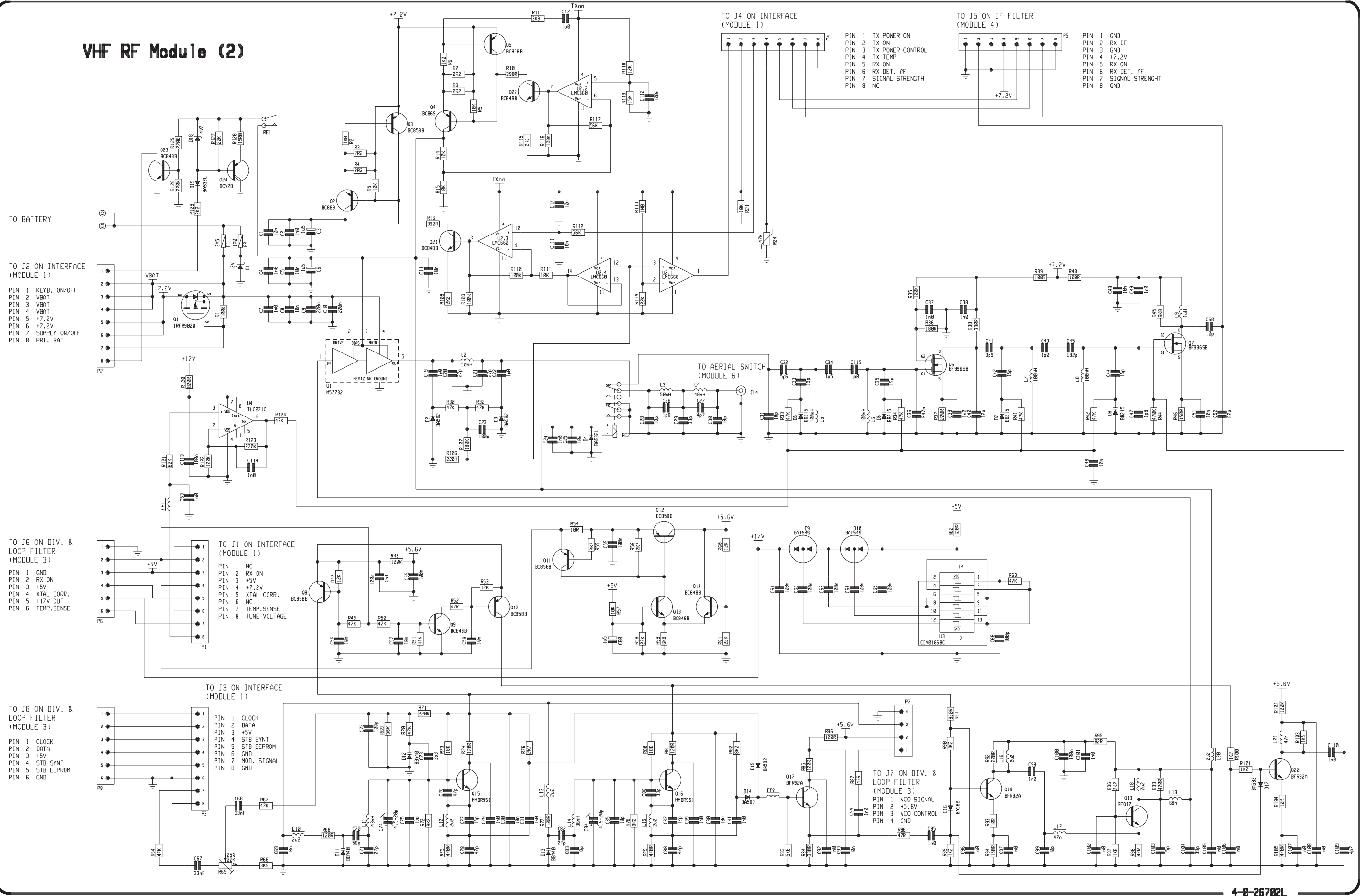


Seen from secondary side with primary side tracks.

PCB rev. 26702C

VHF RF MODULE 2

VHF RF Module (2)



4-0-26702L



### 5.3 DIVIDER & LOOP FILTER (3)

This module contains the following main blocks.

1. Crystal oscillator.
2. Multiplier.
3. Dual modulus prescaler, divider and phasedetector.
4. Loop filter.

#### **CRYSTAL OSCILLATOR.**

The crystal oscillator is of the colpitts type, built up around the common collector amplifier Q1. The oscillator frequency is 14,85MHz. The oscillator signal is led to respectively the multiplier circuit through C35 and the oscillator buffer formed by Q2. From the oscillator buffer the signal is fed to the reference divider through C21.

As to compensate for temperature drift of the crystal the oscillator frequency is adjusted by applying XTAL.CORR. in J6 to capacitance diode D1. A temperature sensor consisting of R35, R36 and NTC resistor R46 creates the TEMP.SENSE voltage in J6. Information about temperature drift of the crystal is placed in EEPROM U2 in table form. As a result of the TEMP.SENSE voltage and the contents in the EEPROM, the microprocessor located on module 1 generates the XTAL CORR. voltage.

#### **MULTIPLIER.**

In order to generate local oscillator signal for second mixer in the receiver, the oscillator frequency is multiplied by three. This multiplication is done by the circuit built up around Q4. The circuit is an ordinary amplifier, where the working point of the transistor is chosen to achieve a large amount of harmonic distortion. The resonance circuit L2, C37 and C39 is tuned to 44,55MHz and filters out the wanted harmonic of the signal.

#### **DUAL MODULUS PRESCALER, DIVIDER AND PHASE DETECTOR.**

The vco signal is fed from J7 to the prescaler buffer, which is formed by Q3. From the prescaler buffer the signal is led on to the dual modulus prescaler U1. The modulus of the prescaler is either 64 or 65 depending on the logic level of the modulus control pin6 of the prescaler. A high level on modulus control pin6 causes the prescaler to divide by 65, and a low level causes the prescaler to divide by 64. The output from the

prescaler is fed to the programmable divider included in the integrated circuit U3. U3 controls the modulus of the prescaler, and divides the prescaler output with the programmable dividing figure. The total dividing figure can be calculated as shown below.

$$N_{total}=A+64*N$$

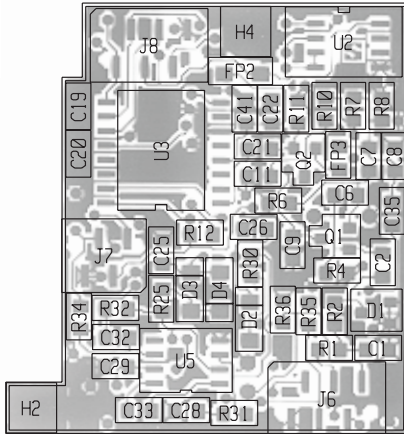
The figures A and N are read into the programmable divider by means of the microprocessor located on module 1. Besides the divider which divides the prescaler output, a programmable reference divider is included in U3. The reference divider divides the crystal oscillator frequency by the dividing figure Nref. The dividing figure is read into the divider by means of microprocessor located on module 1. U3 includes also a phasedetector. The phasedetector compares the phase of the signals coming from respectively the reference divider and the programmable divider. The output is present at pin15 and pin16 and is fed into the loop filter. If the output frequency of the reference divider is less than the output frequency of the programmable divider or if the phase of the reference divider is leading, pin16 is pulsing low, while pin15 remains essentially high. If the output frequency of the reference divider is less than the output frequency of the programmable divider or if the phase of reference divider is lagging, pin15 is pulsing low, while pin16 remains essentially high. If the reference divider output is in phase with the programmable divider output, both pin15 and pin16 remains high except for a small minimum time period, where both are pulsed low in phase.

#### **LOOP FILTER.**

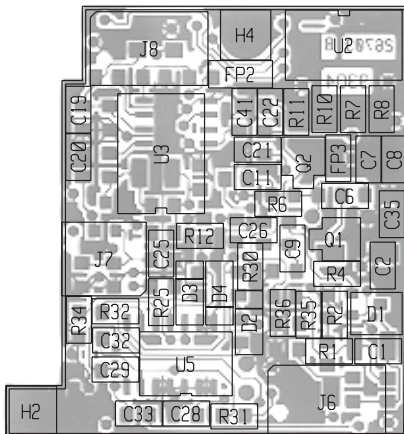
The loop filter prevents the reference frequency originated in the phasedetector from getting through to the vco controle voltage, and determines the closed loop performance of the PLL. The loop filter is built up around operational amplifier U5. The integrated circuit U4 contains four switches, which are switched ON in rx-mode and OFF in tx-mode. By means of the switches the loop filter gain is increased in rx-mode and decreased in tx-mode. This maintains the PLL closed loop performance regardless of whether rx-mode or tx-mode is chosen. The purpose of the diodes D2, D3 and D4 is to decrease the settling time of the PLL after having been affected by a larger change of the dividing figure Ntotal.



**COMPONENT LOCATION DIVIDER & LOOP FILTER MODULE 3**



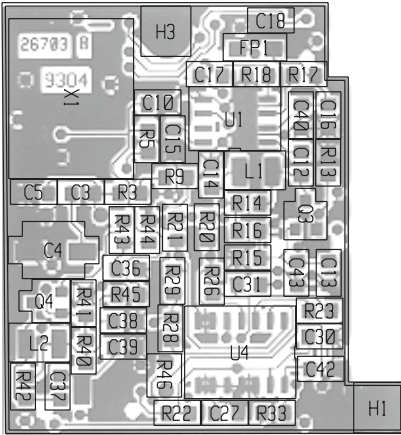
Seen from primary side with primary side tracks.



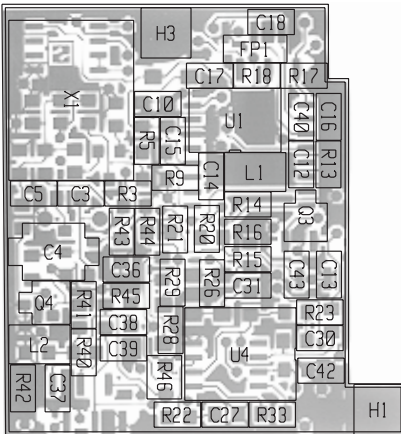
Seen from primary side with secondary side tracks.

PCB rev. 26703B

**COMPONENT LOCATION DIVIDER & LOOP FILTER MODULE 3**



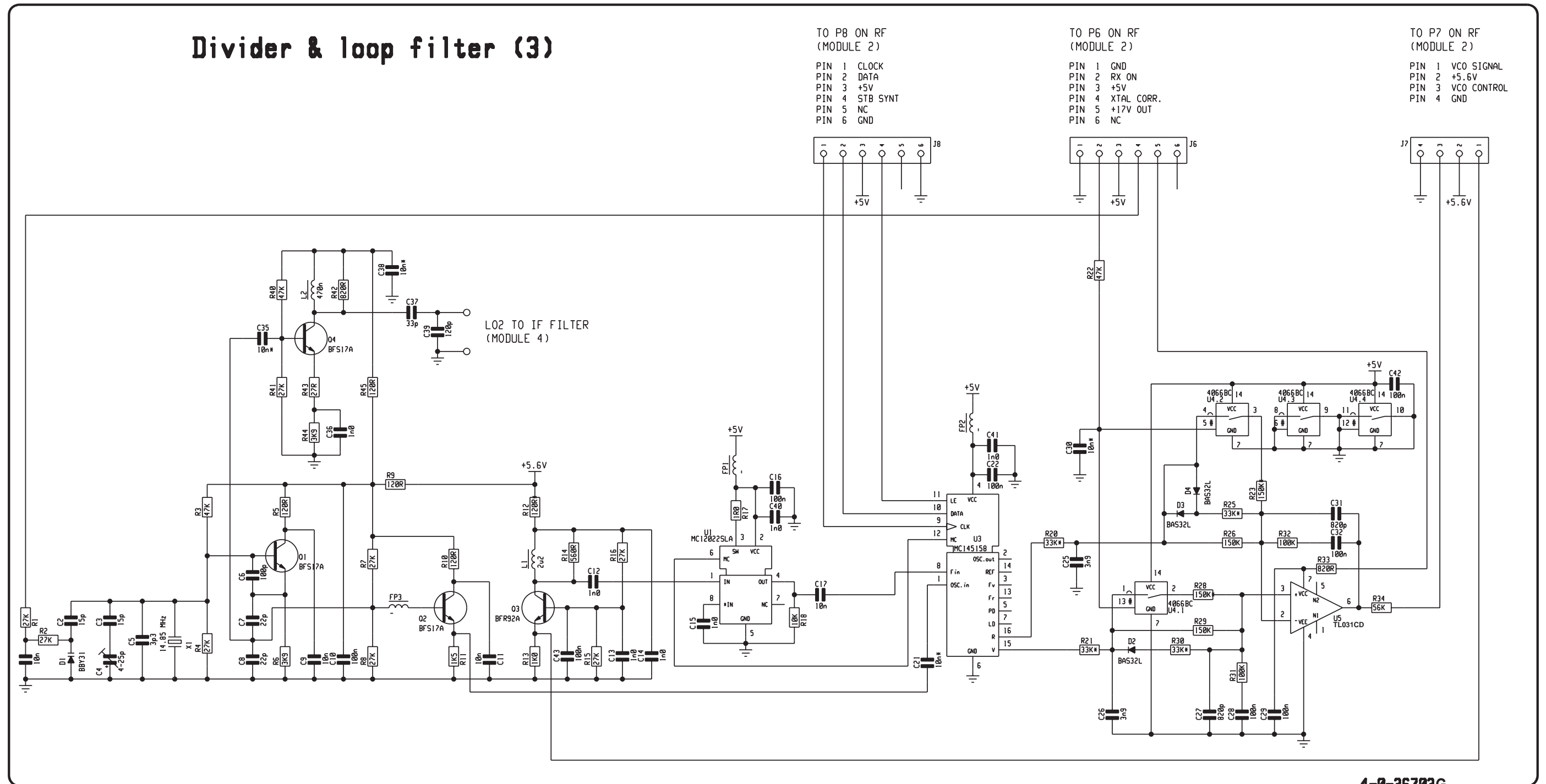
Seen from secondary side with secondary side tracks.



Seen from secondary side with primary side tracks.

PCB rev. 26703B

**DIVIDER & LOOP FILTER MODULE 3**



4-0-26703G

This diagram is valid for PCB rev. 26703B

#### 5.4 IF FILTER MODULE (4)

This module contains the following main blocks.

1. IF1-filter and IF1 amplifier.
2. 2.mixer, IF2-filter & detector.

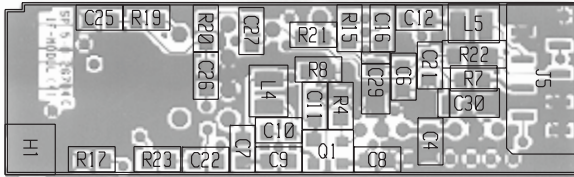
##### **IF1-FILTER AND IF1-AMPLIFIER.**

The filter FL1 is a 4-poled crystal filter with a bandwidth of app. 15kHz. The filter ensures sufficient adjacent channel selectivity at a channel spacing of 25kHz. The IF1 signal is led into the crystal filter from RX IF in J5. After the crystal filter the signal is fed into an IF1 amplifier built up around dual gate mosfet Q1. The amplifier ensures correct impedance matching of the crystal filter and buffers the IF1 signal before entering the 2.mixer.

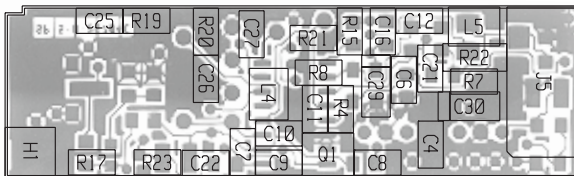
##### **2.MIXER, IF2-FILTER AND DETECTOR.**

The integrated circuit U1 contains the 2.mixer and detector circuit. The IF1 signal is fed to pin16 U1, where it is mixed with 2.localoscillator signal thus creating IF2 signal. The localoscillator signal enters the module at J10, and is fed to the amplifier, formed by Q2, and then led on into 2.mixer at pin1 U1. The IF2 signal is led on to the IF2 filter FL2, which is a ceramic filter. From there the IF2 signal is fed to the detector circuit, consisting of limiter amplifier followed by the quadrature discriminator, where the phase shift network is formed by the ceramic resonator XR1. The detected AF signal is fed to J6 through C12 and FP1.

**COMPONENT LOCATION IF FILTER MODULE 4**

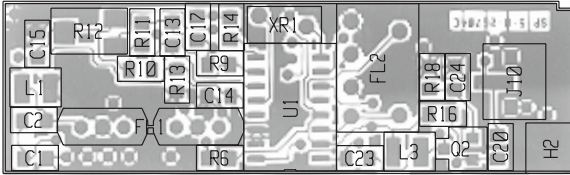


Seen from primary side with primary side tracks.

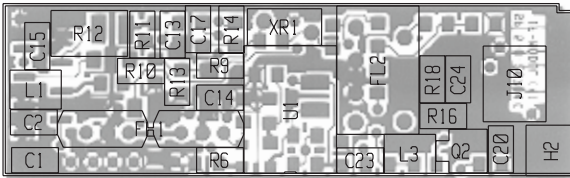


Seen from primary side with secondary side tracks.  
PCB rev. 26704C

**COMPONENT LOCATION IF FILTER MODULE 4**

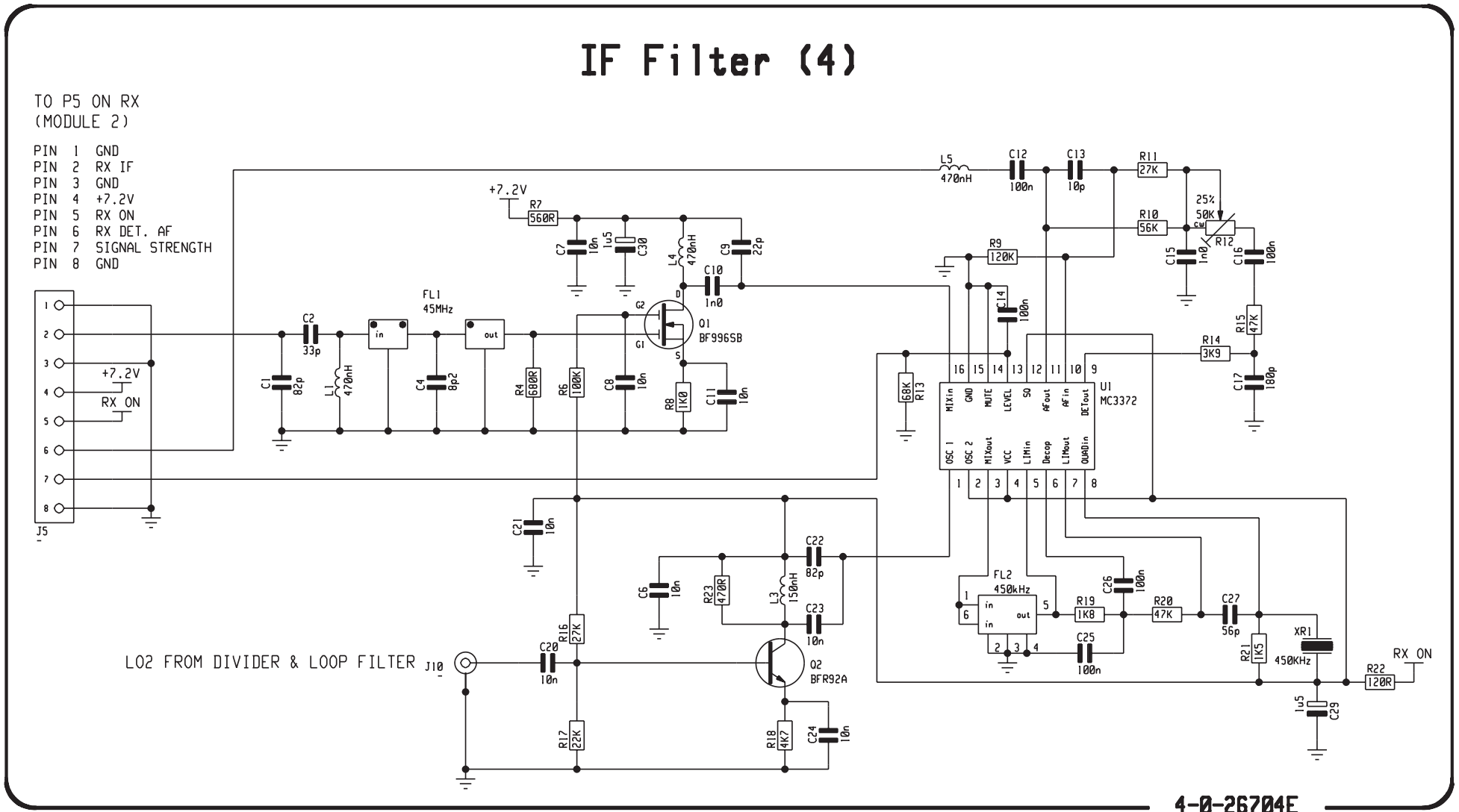


Seen from secondary side with secondary side tracks.



Seen from secondary side with primary side tracks.  
PCB rev. 26704C

IF FILTER MODULE 4

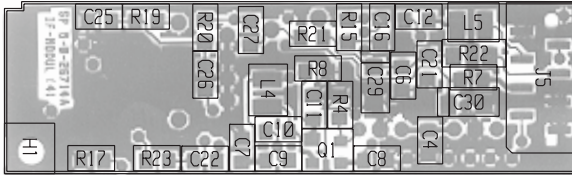


This diagram is valid for PCB rev. 26704C

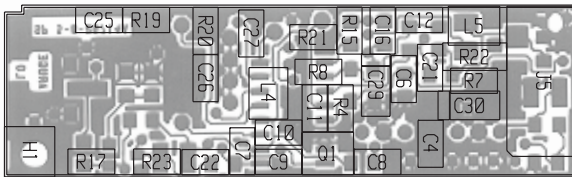




**COMPONENT LOCATION IF FILTER MODULE 4**

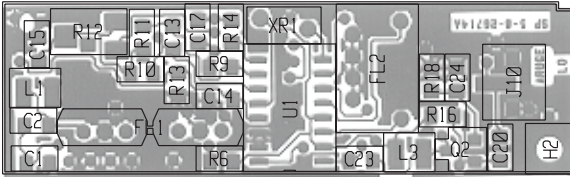


Seen from primary side with primary side tracks.

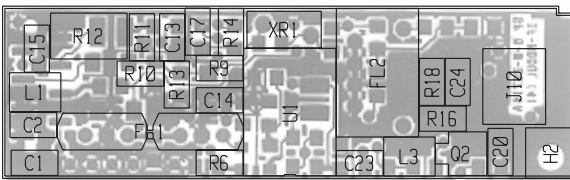


Seen from primary side with secondary side tracks.  
PCB rev. 26714A

**COMPONENT LOCATION IF FILTER MODULE 4**



Seen from secondary side with secondary side tracks.



Seen from secondary side with primary side tracks.

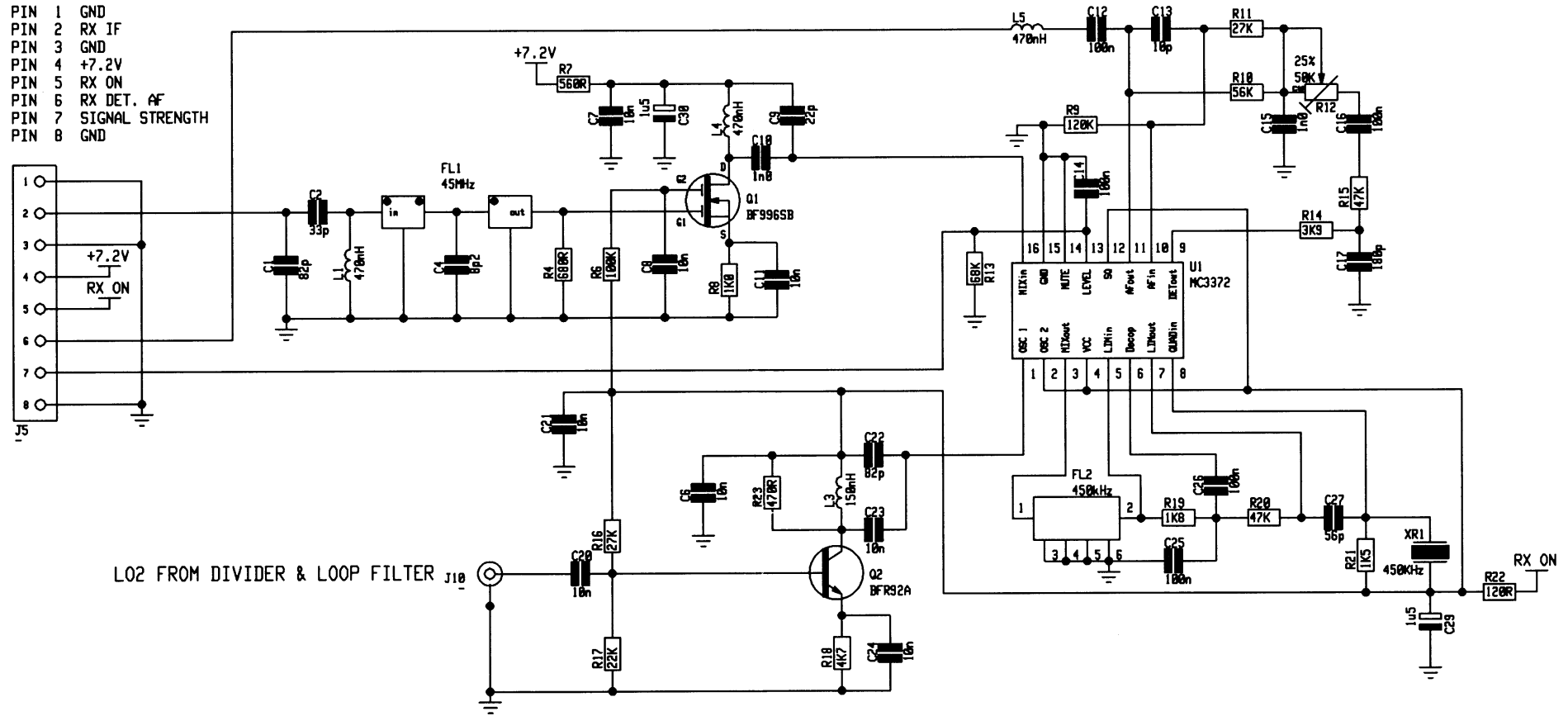
PCB rev. 26714A

IF FILTER MODULE 4

# Narrow BW VHF/UHF IF Filter (4)

TO P5 ON RX  
(MODULE 2)

- PIN 1 GND
- PIN 2 RX IF
- PIN 3 GND
- PIN 4 +7.2V
- PIN 5 RX ON
- PIN 6 RX DET. AF
- PIN 7 SIGNAL STRENGTH
- PIN 8 GND



4-8-26714A

This diagram is valid for PCB rev. 26714A



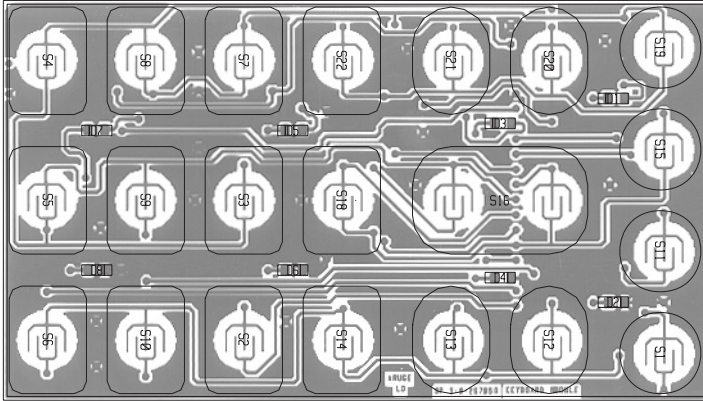
## 5.5 KEYBOARD MODULE (5)

The keyboard module includes the keyboard matrix, which is used for all entries from the keyboard, ie. channel selection, Hi or Lo power mode, squelch level etc. Besides the module include the LED-diodes for keyboard illumination at night time. These diodes are activated using the keyswitch LAMP at the interface module.

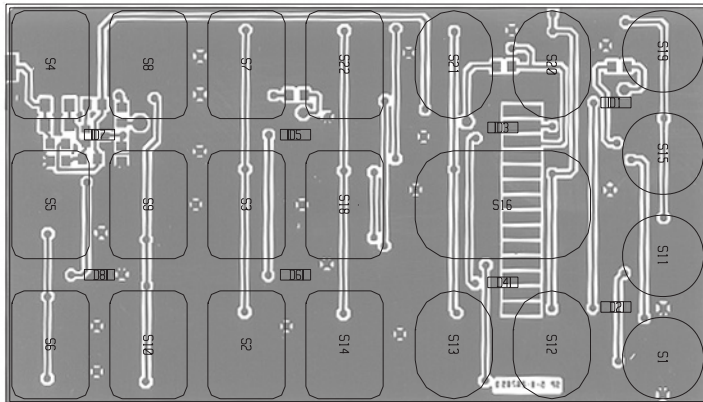
Furthermore the microphone pre-amplifier is included at the keyboard module. The input to the pre-amplifier is delivered from an electret transducer which is mounted in the equipment housing. The signal is fed to Q1 which in accordance with resistors R7 and R5 forms the microphone pre-amplification.



**COMPONENT LOCATION KEYBOARD MODULE 5**

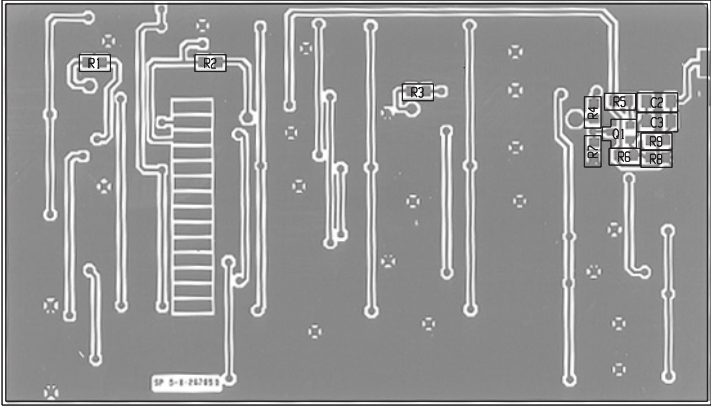


Seen from primary side with primary side tracks.

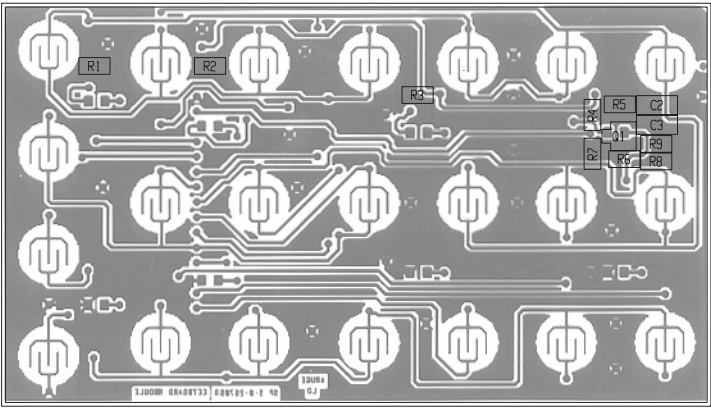


Seen from primary side with secondary side tracks.  
PCB rev. 26705D

**COMPONENT LOCATION KEYBOARD MODULE 5**



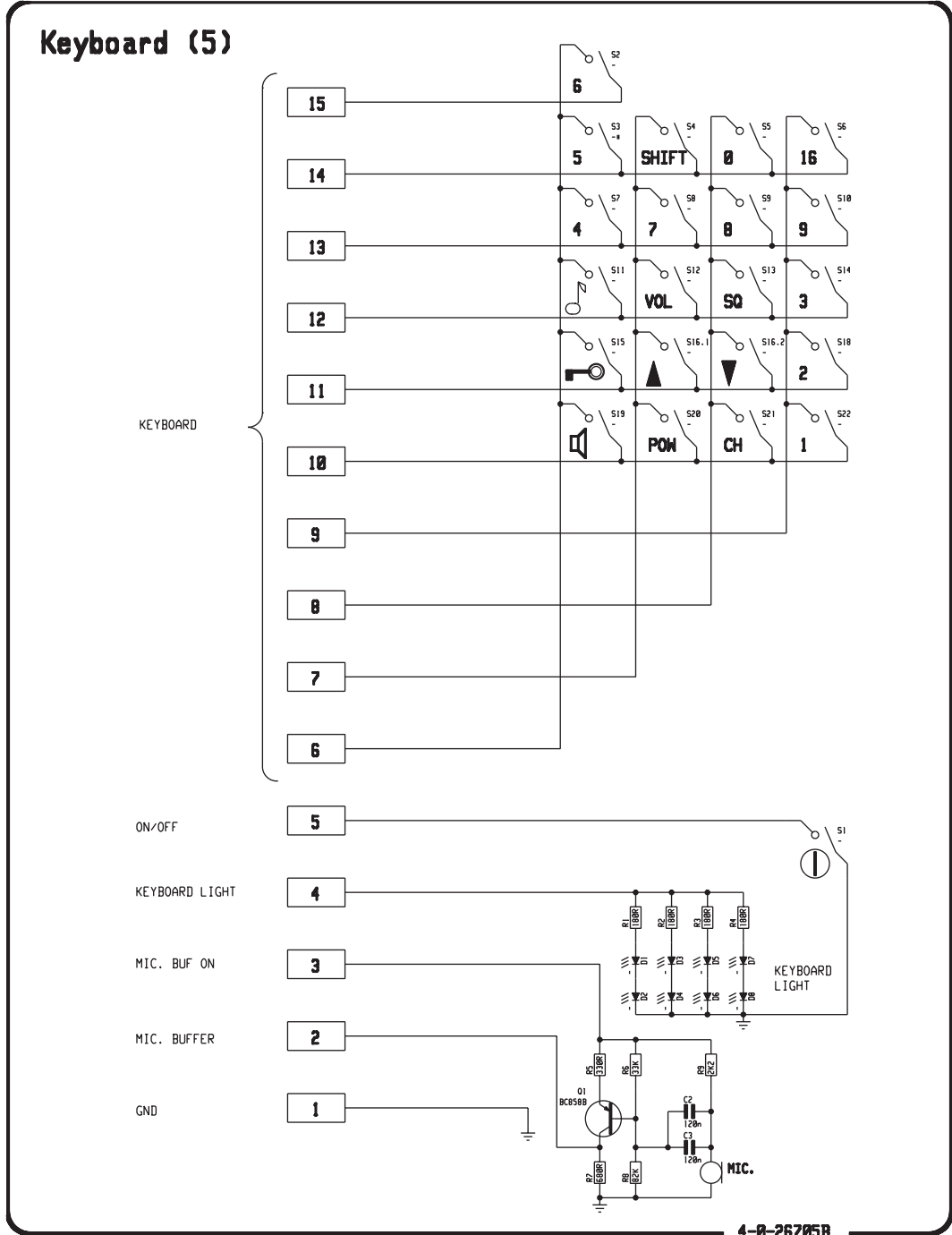
Seen from secondary side with secondary side tracks.



Seen from secondary side with primary side tracks.  
PCB rev. 26705D



KEYBOARD MODULE 5



This diagram is valid for PCB rev. 26705D

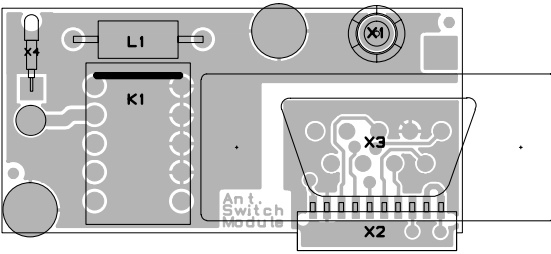


## 5.6 ANTENNA SWITCH MODULE (6)

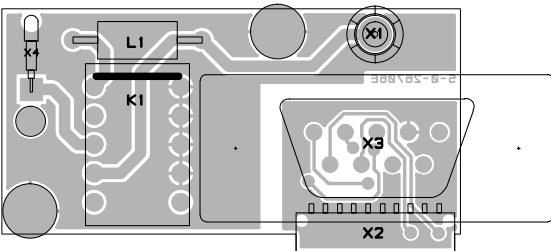
On the antenna switch module it is possible to switch the RF-signal between the integral antenna, AERIAL, and the coaxial connector, EX. AERIAL. This feature can be used in applications with a remote antenna, ie. the Remote Operation Unit, ROU, or the SP3000 testbox. Using these units it is possible to control relay RE1 connecting an external DC supply to the center conductor of the coaxial connector at the antenna switch module.

Furthermore a SUB-D 9 poled connector is included at the antenna switch module. This connector reassures interconnection between the interface module and external equipment. Besides the Remote Operation Unit and the SP3000 testbox, it is also possible to program the SP3000 transceiver using a H1650 programming kit for SP3000 portable transceivers.

**COMPONENT LOCATION ANTENNA SWITCH MODULE 6**

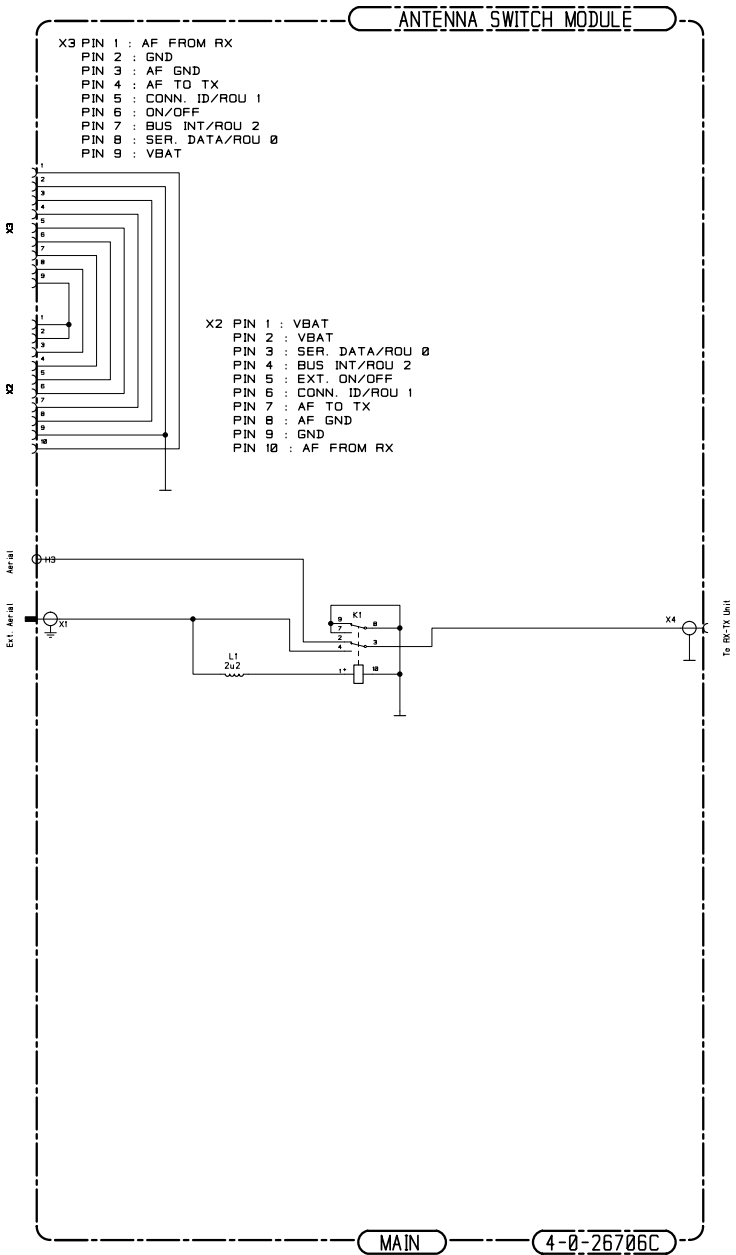


Seen from primary side with primary side tracks.



Seen from primary side with secondary side tracks.  
PCB rev. 26706E

ANTENNA SWITCH MODULE 6





## **CONTENTS**

<b>6</b>	<b>PARTS LIST</b>
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## 6 PARTS LIST

PORTABLE VHF TRANSCEIVER SP3110 GMDSS			ECI A/S	SP3110	803110
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	WASHER *10.2 x *4.1 x 1mm	STAINLESS STEEL A4,SP3000	ECI A/S	1-0-26738	226738
VARIOUS	PLATE FOR SUB-D CONNECTOR	SP3xxx	ECI A/S	1-0-26740	226740
VARIOUS	AIR FILTER, ELEMENT	SP3xxx	ECI A/S	1-0-26804	226804
VARIOUS	COVER FOR PLUG	BLACK PLASTIC SP3000	SANDER PLAST AS	0-3-26753 / PC943A	48.626
VARIOUS	EMERGENCY SIGN FOR SP3110	ENGLISH	HESTBECH	4-0-28466B	53.791
VARIOUS	EMERGENCY SIGN FOR SP3110	GERMAN	HESTBECH	4-0-28613	53.792
VARIOUS	EMERGENCY SIGN FOR SP3110	DANISH	HESTBECH	4-0-29595	53.797
VARIOUS	BELT CLIP FOR SP3XXX	SP3XXX	ECI A/S	0-0-26760	726760
VARIOUS	PORTABLE VHF	BASE UNIT, 2W	ECI A/S		726810
VARIOUS	PLASTIC HOUSING f. SP311x		ECI A/S		72681110
VARIOUS	GASKET KIT SP3xxx		ECI A/S	0-0-29199	729199
VARIOUS	SCREW 4-40-UNC L=3.5mm	PAN HEAD STAINLESS STEEL	S.E.CHRISTENSEN	2-3-26818	86.612
VARIOUS	ALLEN SCREW M4x11mm	STAINLESS STEEL, NICKLED	HFC	2-3-26815D	87.247
VARIOUS	OPERATION MANUAL	SAILOR SP3110, GERMAN	HESTBECH		B3110D
VARIOUS	OPERATION MANUAL	SAILOR SP3110, DANISH	HESTBECH		B3110DK
VARIOUS	OPERATION MANUAL	SAILOR SP3110, ENGLISH	HESTBECH		B3110GB
VARIOUS	MANUAL SP3110/11 AND	SP3210/11 ENGLISH	ECI A/S		M3110GB

PORTABLE VHF TRANSCEIVER SP3111 w. 55 INT.			ECI A/S	SP3111	803111
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	WASHER *10.2 x *4.1 x 1mm	STAINLESS STEEL A4,SP3000	ECI A/S	1-0-26738	226738
VARIOUS	PLATE FOR SUB-D CONNECTOR	SP3xxx	ECI A/S	1-0-26740	226740
VARIOUS	AIR FILTER, ELEMENT	SP3xxx	ECI A/S	1-0-26804	226804
VARIOUS	COVER FOR PLUG	BLACK PLASTIC SP3000	SANDER PLAST AS	0-3-26753 / PC943A	48.626
VARIOUS	EMERGENCY SIGN FOR SP3110	ENGLISH	HESTBECH	4-0-28466B	53.791
VARIOUS	EMERGENCY SIGN FOR SP3110	GERMAN	HESTBECH	4-0-28613	53.792
VARIOUS	EMERGENCY SIGN FOR SP3110	DANISH	HESTBECH	4-0-29595	53.797
VARIOUS	BELT CLIP FOR SP3XXX	SP3XXX	ECI A/S	0-0-26760	726760
VARIOUS	PLASTIC HOUSING f. SP311x		ECI A/S		72681110
VARIOUS	PORTABLE VHF	BASE UNIT, 5W	ECI A/S		726830
VARIOUS	SCREW 4-40-UNC L=3.5mm	PAN HEAD STAINLESS STEEL	S.E.CHRISTENSEN	2-3-26818	86.612
VARIOUS	ALLEN SCREW M4x11mm	STAINLESS STEEL, NICKLED	HFC	2-3-26815D	87.247
VARIOUS	OPERATION MANUAL	SAILOR SP3110, GERMAN	HESTBECH		B3110D
VARIOUS	OPERATION MANUAL	SAILOR SP3110, DANISH	HESTBECH		B3110DK
VARIOUS	OPERATION MANUAL	SAILOR SP3110, ENGLISH	HESTBECH		B3110GB
VARIOUS	MANUAL SP3110/11 AND	SP3210/11 ENGLISH	ECI A/S		M3110GB

PORTABLE VHF TRANSCEIVER			SAILOR SP3210	ECI A/S	SP3210	803210
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.	
VARIOUS	WASHER *10.2 x *4.1 x 1mm	STAINLESS STEEL A4,SP3000	ECI A/S	1-0-26738	226738	
VARIOUS	PLATE FOR SUB-D CONNECTOR	SP3xxx	ECI A/S	1-0-26740	226740	
VARIOUS	AIR FILTER, ELEMENT	SP3xxx	ECI A/S	1-0-26804	226804	
VARIOUS	COVER FOR PLUG	BLACK PLASTIC SP3000	SANDER PLAST AS	0-3-26753 / PC943A	48.626	
VARIOUS	BELT CLIP FOR SP3XXX	SP3XXX	ECI A/S	0-0-26760	726760	

## 6 PARTSLIST

## SP3000 VHF

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOS	BELT CLIP FOR SP3XXX	SP3XXX	ECI A/S	0-0-26760	726760
VARIOS	PORTABLE VHF	BASE UNIT, 2W		ECI A/S	726810
VARIOS	PLASTIC HOUSING f. SP321x		ECI A/S	0-0-26812	72681210
VARIOS	SCREW 4-40-UNC L=3.5mmPAN		S.E.CHRIST.	2-3-26818	86.612
VARIOS	ALLEN SCREW M4x11mmSTAINLESS STEEL		HFC	2-3-26815D	87.247
VARIOS	OPERATION MANUAL	SAILOR SP3210 ENGLISH	HESTBECH		B3210GB
VARIOS	MANUAL SP3110/11 AND	SP3210/11 ENGLISH	ECI A/S		M3110GB

PORTABLE VHF TRANSCEIVER	SP3211	ECI A/S	SP3211	803211
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POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOS	WASHER *10.2 x *4.1 x 1mm	STAINLESS STEEL A4,SP3000	ECI A/S	1-0-26738	226738
VARIOS	PLATE FOR SUB-D CONNECTOR	SP3xxx	ECI A/S	1-0-26740	226740
VARIOS	AIR FILTER, ELEMENT	SP3xxx	ECI A/S	1-0-26804	226804
VARIOS	COVER FOR PLUG	BLACK PLASTIC SP3000	SANDER PLAST AS	0-3-26753 / PC943A	48.626
VARIOS	BELT CLIP FOR SP3XXX	SP3XXX	ECI A/S	0-0-26760	726760
VARIOS	PLASTIC HOUSING f. SP321x		ECI A/S	0-0-26812	72681210
VARIOS	SCREW 4-40-UNC L=3.5mm	PAN HEAD STAINLESS STEEL	S.E.CHRISTENSEN	2-3-26818	86.612
VARIOS	ALLEN SCREW M4x11mm	STAINLESS STEEL, NICKLED	HFC	2-3-26815D	87.247
VARIOS	OPERATION MANUAL	SAILOR SP3210 ENGLISH	HESTBECH		B3210GB
VARIOS	MANUAL SP3110/11 AND	SP3210/11 ENGLISH	ECI A/S		M3110GB

PORTABLE VHF	BASE UNIT, 2W	ECI A/S	726810
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POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOS	RF SHIELD, TOP	SP3xxx	ECI A/S	1-0-26801C/2-3-26801	226801
VARIOS	ENGAGING PLATE	SP 3xxx	ECI A/S	1-0-26820C	226820
VARIOS	SCREW M2x4mmCOUNTERSUNK HEAD STAINLES		HFC	HFC 1875 M2x4 UHRX-A2	86.031
VARIOS			HFC	HFC 266 M2x5 PHJX-Z	88.375
-1	INTERFACE MODULE SP3000	MODULE (1)	ECI A/S	5-0-26701H / 4-0-26701M	62670
-2	2W VHF RF MODULE SP3000	MODULE (2)	ECI A/S	5-0-26702C / 4-0-26702L	728712
-3	VHF DIV. & LOOP FILTER (3)	MODULE (3) SP311x/SP321x	ECI A/S	5-0-26703B / 4-0-26703F	626703
-4	VHF/UHF IF MODULE SP3000	MODULE (4)	ECI A/S	5-0-26704C / 4-0-26704E	626704
-6	ANTENNA SWITCH	MODULE (6)	ECI A/S	5-0-26706D / 4-0-26706B	626706
LS1	LOUDSPEAKER	8 OHMS 1W *45mm	MAEKAWA	SR-451R-A0827	46.030

PORTABLE VHF	BASE UNIT, 5W	ECI A/S	726830
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POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOS	RF SHIELD, TOP	SP3xxx	ECI A/S	1-0-26801C/2-3-26801	226801
VARIOS	ENGAGING PLATE	SP 3xxx	ECI A/S	1-0-26820C	226820
VARIOS	SCREW M2x4mmCOUNTERSUNK HEAD STAINLES		HFC	HFC 1875 M2x4 UHRX-A2	86.031
-1	INTERFACE MODULE SP3000	MODULE (1)	ECI A/S	5-0-26701H / 4-0-26701M	626701
-2	5W VHF RF MODULE SP3000	MODULE (2)	ECI A/S	5-0-26702C / 4-0-26702L	728715
-3	VHF DIV. & LOOP FILTER (3)	MODULE (3) SP311x/SP321x	ECI A/S	5-0-26703B / 4-0-26703F	626703
-4	VHF/UHF IF MODULE SP3000	MODULE (4)	ECI A/S	5-0-26704C / 4-0-26704E	626704
-6	ANTENNA SWITCH	MODULE (6)	ECI A/S	5-0-26706D / 4-0-26706B	626706
LS1	LOUDSPEAKER	8 OHMS 1W *45mm	MAEKAWA	SR-451R-A0827	46.030

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
<b>2W VHF RF MODULE SP3000</b>		<b>MODULE (2)</b>	<b>ECI A/S</b>	<b>5-0-26702C / 4-0-26702L</b>	<b>728712</b>
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	BATTERY TERMINAL+	SP3xxx	ECI A/S	1-0-26797D	226797
VARIOUS	SCREENING ASSY	METALLIZED PLASTIC SP3000	HENN. ANDERSEN	0-3-26791C	48.629
VARIOUS	INSULATING PIECE	12x9.6x3.6mm	SANDER PLAST	0-3-26795A	48.630
VARIOUS	SCREW TAP-TITE	*1x5mm STEEL	DALGAARD AGENTU	S.P. 72.047 PA6 20% MDF2 TAP-TITE M1x5 STEEL	72.047
VARIOUS	VHF RF MODULE SP3000	MODULE (2)	ECI A/S	5-0-26702C / 4-0-26702L	626702
R128-2	RESISTOR MF	15R0 OHM 1% 0.6W	PHILIPS	2322 156 11509	03.154
RE2-2	RELAY 6VDC	1ADC DPDT	NEC	EA2-6	21.072
U1-2	RF POWER MODULE	Po= 5W, 144 - 175MHz	MITSUBISHI	M57732	32.451

<b>5W VHF RF MODULE SP3000</b>		<b>MODULE (2)</b>	<b>ECI A/S</b>	<b>5-0-26702C / 4-0-26702L</b>	<b>728715</b>
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	BATTERY TERMINAL+	SP3xxx	ECI A/S	1-0-26797D	226797
VARIOUS	SCREENING ASSY METALLIZED PLASTIC SP3000		H.ANDERSEN	0-3-26791C	48.629
VARIOUS	SCREW TAP-TITE	*1x5mm STEEL	DALGAARD	72.047 TAP-TITE M1x5 STEEL	72.047
VHF RF MODULE SP3000		MODULE (2)	ECI A/S	5-0-26702C / 4-0-26702L	626702
R128-2	RESISTOR MF	15R0 OHM 1% 0.6W	PHILIPS	2322 156 11509	03.154
RE2-2	RELAY 6VDC	1ADC DPDT	NEC	EA2-6	21.072
U1-2	RF POWER MODULE	Po= 5W, VHF	MITSUBISHI	M57785M	32.452

<b>INTERFACE MODULE SP3000</b>		<b>MODULE (1)</b>	<b>ECI A/S</b>	<b>5-0-26701H / 4-0-26701M</b>	<b>626701</b>
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
C1-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C2-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C3-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C4-1	CAPACITOR CERAM. SMD 0805	12nF 10% X7R 50VDC	MURATA	GRM40 X7R 123 K 50 PT	328.337
C5-1	CAPACITOR CERAM. SMD 0805	6n8F 10% X7R 50VDC	TDK	C2012 X7R 1H 682 K T NiBa	328.334
C6-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C7-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C8-1	CAPACITOR CERAM. SMD 0805	100pF 5% NPO 50VDC	TDK	C2012 COG 1H 101 J T NiBa	323.086
C9-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C10-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C11-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C12-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C13-1	CAPACITOR CERAM. SMD 0805	220pF 5% NPO 50VDC	TDK	C2012 COG 1H 221 J T NiBa	323.090
C14-1	CAPACITOR CERAM. SMD 0805	220pF 5% NPO 50VDC	TDK	C2012 COG 1H 221 J T NiBa	323.090
C15-1	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C16-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C17-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C18-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C19-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C20-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C22-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C23-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
C24-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C25-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C26-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C27-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C28-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C29-1	CAPACITOR CERAM. SMD 0805	15nF 10% X7R 50VDC	MURATA	GRM40 X7R 153 K 50 PT	328.338
C30-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C31-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C32-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C33-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C34-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C35-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C36-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C37-1	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C38-1	CAPACITOR CERAM. SMD 0805	22pF 5% NP0 50VDC	TDK	C2012 COG 1H 220 J T NiBa	323.078
C39-1	CAPACITOR CERAM. SMD 0805	22pF 5% NP0 50VDC	TDK	C2012 COG 1H 220 J T NiBa	323.078
C41-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C42-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C43-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C44-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C45-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C46-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C47-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C48-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C49-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C50-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C51-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C52-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C53-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C54-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C56-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C57-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C58-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C59-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C60-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C61-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C62-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C63-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C64-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C65-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C67-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C68-1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C69-1	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C70-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C71-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C72-1	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C73	CAPACITOR CERAM. SMD 0805	2n2F 10% X7R 50VDC	MURATA	GRM40 X7R 222 K 50 PT	328.328
D1-1	DIODE SMALL SIGNAL	SOD-80 BAS32L	PHILIPS	BAS32L	340.032
D3-1	DIODE SMALL SIGNAL	SOD-80 BAS32L	PHILIPS	BAS32L	340.032
D4-1	DIODE SMALL SIGNAL	SOD-80 BAS32L	PHILIPS	BAS32L	340.032
D5-1	DUAL SWITCH DIODE	BAV99	PHILIPS	BAV99	340.999
D6-1	DIODE DUAL SCHOTTKY	BAT54S	PHILIPS	BAT54S 215	340.310
D7-1	DIODE LIGHT EMITTING	HI.EFF. YELLOW *3mm	TFK	TLHY 4214 AS 12 Z ( 21Z )	25.670
D8-1	DIODE LIGHT EMITTING	HI.EFF. YELLOW *3mm	TFK	TLHY 4214 AS 12 Z ( 21Z )	25.670
FP1-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP2-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP3-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP4-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
FP5-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP6-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP7-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP8-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP9-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP10-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP11-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP12-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP13-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP14-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP15-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP16-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP17-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP18-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP19-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP20-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP21-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP22-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP24-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP25-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP27-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
FP28-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP29-1	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 B 601 S PT	370.021
FP30-1	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001
J1-1	SOCKET 8 POLES	1/20" SIL PCB VERSION	AMP	3-175636-8	376.028
J2-1	SOCKET 8 POLES	1/20" SIL PCB VERSION	AMP	3-175636-8	376.028
J3-1	SOCKET 8 POLES	1/20" SIL PCB VERSION	AMP	3-175636-8	376.028
J4-1	SOCKET 8 POLES	1/20" SIL PCB VERSION	AMP	3-175636-8	376.028
J13-1	SOCKET 2x6 POLES	1/20" PCB VERSION	AMP	4-175639-2	376.004
J14-1	MULTI SOCKET 15 POLES	PITCH=2mm PCB VERSION	MOLEX	5513-15APB	78.915
L1-1	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L2-1	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L3-1	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
P4-1	PLUG 10 POLES	1/20" SIL PCB VERSION	AMP	4-175642-0	375.030
P18-1	PLUG 2 POLES	VERTICAL PCB VERSION	JST	B2B-ZR	78.448
Q1-1	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q3-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q4-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q5-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q6-1	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q7-1	TRANSISTOR AF NPN SOT-89	BC868-25 / BCX68-25	PHILIPS	BC868-25	345.305
Q8-1	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q9-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q10-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q11-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q12-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q13-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q14-1	TRANSISTOR PNP	BCP52-16 1.5W	PHILIPS	BCP52-16 TAPE&REEL 9339 173 20115	346.352
Q15-1	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
R1-1	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R2-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R3-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R4-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R5-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R6-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R7-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R8-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R9-1	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
R11-1	RESISTOR SMD 0805	150k OHM 5% 0.1W	ROHM	MCR 10 EZH J 154	302.074
R12-1	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R13-1	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R14-1	RESISTOR SMD 0805	15k OHM 5% 0.1W	ROHM	MCR 10 EZH J 153	302.062
R15-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R16-1	RESISTOR SMD 0805	3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R17-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R18-1	RESISTOR SMD 0805	6k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 682	302.058
R19-1	RESISTOR SMD 0805	150k OHM 5% 0.1W	ROHM	MCR 10 EZH J 154	302.074
R20-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R21-1	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R23-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R24-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R25-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R26-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R27-1	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R28-1	RESISTOR SMD 0805	3k3 OHM 5% 0.1W	ROHM	MCR 10 EZH J 332	302.054
R29-1	RESISTOR SMD 0805	33k OHM 5% 0.1W	ROHM	MCR 10 EZH J 333	302.066
R30-1	RESISTOR SMD 0805	330k OHM 5% 0.1W	ROHM	MCR 10 EZH J 334	302.078
R31-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R32-1	RESISTOR SMD 0805	1k5 OHM 5% 0.1W	ROHM	MCR 10 EZH J 152	302.050
R33-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R34-1	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R35-1	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056
R36-1	RESISTOR SMD 0805	6k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 682	302.058
R37-1	RESISTOR SMD 0805	2R2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 2R2	302.016
R38-1	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056
R39-1	RESISTOR SMD 0805	6k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 682	302.058
R40-1	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R41-1	RESISTOR SMD 0805	3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R42-1	RESISTOR SMD 0805	6k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 682	302.058
R43-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R44-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R45-1	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R46-1	RESISTOR SMD 0805	82k OHM 5% 0.1W	ROHM	MCR 10 EZH J 823	302.071
R47-1	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R48-1	RESISTOR SMD 0805	27 OHM 5% 0.1W	ROHM	MCR 10 EZH J 27R	302.029
R49-1	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056
R50-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R52-1	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R53-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R54-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R55-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R56-1	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R57-1	RESISTOR SMD 0805	220k OHM 5% 0.1W	ROHM	MCR 10 EZH J 224	302.076
R58-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R59-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R60-1	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R61-1	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R62-1	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R63-1	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056
R64-1	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R65-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R66-1	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R67-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R68-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R69-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R70-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R71-1	RESISTOR SMD 0805	220 OHM 5% 0.1W	ROHM	MCR 10 EZH J 221	302.040

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
R72-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R73-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R74-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R75-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R76-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R77-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R78-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R79-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R80-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R81-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R82-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R84-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R85-1	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R86-1	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R87-1	RESISTOR SMD 0805	2k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 222	302.052
R92-1	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
S1-1	KEYSWITCH SPST 6.2x6.2mm	50V/10mA,FA=3.5N,KSC243GB	ITT	KSC243GB	373.010
S2-1	KEYSWITCH SPST 6.2x6.2mm	50V/10mA,FA=3.5N,KSC243GB	ITT	KSC243GB	373.010
S3-1	KEYSWITCH SPST 6.2x6.2mm	50V/10mA,FA=3.5N,KSC243GB	ITT	KSC243GB	373.010
S4-1	KEYSWITCH SPST 6.2x6.2mm	50V/10mA,FA=3.5N,KSC243GB	ITT	KSC243GB	373.010
S5-1	ROTARY SWITCH SP	ON-OFF-ON	COPAL	CS-4-12YTA	373.100
U1-1	DUAL COMPARATOR HI.PREC.	LM393/LM393A	NATIONAL	LM393MX/LM393AM	350.550
U2-1	EEPROM 4k BIT SERIAL	XL93LC66/NM93C66	NATIONAL	NM 93C66 M8 (EM8)	356.321
U3-1	8-BIT SHIFT REG. W.LATCH	74HC595	MOTOROLA	MC74HC595D R2	355.296
U4-1	ASIC AF 4419		AMS	ASIC 4419 QFP	356.405
U5-1	DISPLAY LCD	SP3000A	TSD CO. LTD.	SLC-80030-1/C1	342.500
U6-1	160-DOT LCD DRIVER	MSM5265GS	OKI	MSM5265GS-K	356.600
U7-1	AF POWER AMPLIFIER	DIL 8 1W BTL	PHILIPS	TD47052	31.432
U8-1	8-BIT MICROCONTROLLER	SP3xxx SP-C1115F	TOSHIBA	TMP68HC11E9T 2177 SP-C1115F / 2177	356.450
U9-1	VOLTAGE REG. ADJUSTABLE	1c=0.1A, LP2951C	NATIONAL	LP2951CM (LP2951ACM)	350.050
X1-1	CRYSTAL	8.000MHz HC-49/U	NDK	LN-P-0002 Cload = 16pF	39.771
X1-1	INSULATOR SILICONE RUBBER	7.6x3.0x0.5mm	NDK	NKS-4875	48.720

VHF RF MODULE SP3000	MODULE (2)	ECI A/S	5-0-26702C / 4-0-26702L	626702
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POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
C1-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C2-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C3-2	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
C4-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C5-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C6-2	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
C7-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C8-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C9-2	CAPACITOR CERAM. SMD 1206	220nF 10% X7R 16VDC	ROHM	MCH31 2 C 224 K P(K) (MCH31 3 C 224 K K)	328.689
C10-2	CAPACITOR CERAM. SMD 1206	220nF 10% X7R 16VDC	ROHM	MCH31 2 C 224 K P(K) (MCH31 3 C 224 K K)	328.689
C11-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C12-2	CAPACITOR CERAM. SMD 1206	1u0F -20/80% Y5V 16VDC	MURATA	GRM42-6 Y5V 105 Z 16 PT10	328.806
C17-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C19-2	CAPACITOR CERAM. SMD 0805	1p0F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 010 C T NiBa	323.062
C20-2	CAPACITOR CERAM. SMD 0805	27pF 5% NPO 50VDC	TDK	C2012 COG 1H 270 J T 000A	323.079
C21-2	CAPACITOR CERAM. SMD 0805	27pF 5% NPO 50VDC	TDK	C2012 COG 1H 270 J T 000A	323.079

## 6 PARTSLIST

## SP3000 VHF

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
C22-2	CAPACITOR CERAM. SMD 0805	1p0F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 010 C T NiBa	323.062
C23-2	CAPACITOR CERAM. SMD 0805	100pF 5% NPO 50VDC	TDK	C2012 COG 1H 101 J T NiBa	323.086
C24-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C25-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C26-2	CAPACITOR CERAM. SMD 0805	1p8F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 1R8 C T 000A	323.065
C27-2	CAPACITOR CERAM. SMD 0805	4p7F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 4R7 C T NiBa	323.070
C28-2	CAPACITOR CERAM. SMD 0805	18pF 5% NPO 50VDC	TDK	C2012 COG 1H 180 J T NiBa	323.077
C29-2	CAPACITOR CERAM. SMD 0805	33pF 5% NPO 50VDC	TDK	C2012 COG 1H 330 J T 000A	323.080
C30-2	CAPACITOR CERAM. SMD 0805	18pF 5% NPO 50VDC	TDK	C2012 COG 1H 180 J T NiBa	323.077
C31-2	CAPACITOR CERAM. SMD 0805	18pF 5% NPO 50VDC	TDK	C2012 COG 1H 180 J T NiBa	323.077
C32-2	CAPACITOR CERAM. SMD 0805	5p6F +/-0.25pF N150 50VDC	MURATA	GRM40 P2H 5R6 C 50 PT	323.471
C33-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C34-2	CAPACITOR CERAM. SMD 0805	1p5F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 1R5 C T NiBa	323.064
C35-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C36-2	CAPACITOR CERAM. SMD 0805	p47F +/-0.25pF NPO 50VDC	MURATA	GRM40 COG R47 C 50 PT	323.058
C37-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C38-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C39-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C40-2	CAPACITOR CERAM. SMD 0805	12pF 5% NPO 50VDC	TDK	C2012 COG 1H 120 J T NiBa	323.075
C41-2	CAPACITOR CERAM. SMD 0805	3p9F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 3R9 C T NiBa	323.069
C42-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C43-2	CAPACITOR CERAM. SMD 0805	1p0pF +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 010 C T NiBa	323.062
C44-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C45-2	CAPACITOR CERAM. SMD 0805	p82F +/-0.25pF NPO 50VDC	MURATA	GRM40 COG R82 C 50 PT	323.061
C46-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C47-2	CAPACITOR CERAM. SMD 0805	1p8F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 1R8 C T 000A	323.065
C48-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C49-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C50-2	CAPACITOR CERAM. SMD 0805	10pF 5% NPO 50VDC	TDK	C2012 COG 1H 100 D T NiBa	323.074
C51-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C52-2	CAPACITOR CERAM. SMD 0805	82pF 5% NPO 50VDC	TDK	C2012 COG 1H 820 J T NiBa	323.085
C53-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C54-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C55-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C56-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C57-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C58-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C59-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C60-2	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
C61-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C62-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C63-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C64-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C65-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C66-2	CAPACITOR CERAM. SMD 0805	100pF 5% NPO 50VDC	TDK	C2012 COG 1H 101 J T NiBa	323.086
C67-2	CAPACITOR CERAM. SMD 0805	33nF 10% X7R 16VDC	MURATA	GRM40 X7R 333 K 16 PT	328.387
C68-2	CAPACITOR CERAM. SMD 0805	33nF 10% X7R 16VDC	MURATA	GRM40 X7R 333 K 16 PT	328.387
C69-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C70-2	CAPACITOR CERAM. SMD 0805	5p6F 5% NPO 50VDC	TDK	C2012 COG 1H 560 J T NiBa	323.083
C71-2	CAPACITOR CERAM. SMD 0805	27pF 5% NPO 50VDC	TDK	C2012 COG 1H 270 J T 000A	323.079
C72-2	CAPACITOR CERAM. SMD 0805	100pF 5% NPO 50VDC	TDK	C2012 COG 1H 101 J T NiBa	323.086
C73-2	CAPACITOR CERAM. SMD 0805	3p3F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 3R3 C T NiBa	323.068
C74-2	CAPACITOR TRIMMER SMD	4.5-20pF N750	MURATA	TZB04R200BA	335.011
C75-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 820 J T NiBa	323.076
C76-2	CAPACITOR CERAM. SMD 0805	47pF 5% NPO 50VDC	TDK	C2012 COG 1H 470 J T NiBa	323.082
C77-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C78-2	CAPACITOR CERAM. SMD 0805	47pF 5% NPO 50VDC	TDK	C2012 COG 1H 470 J T NiBa	323.082
C79-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C80-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336



## 6 PARTSLIST

## SP3000 VHF

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
C81-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C82-2	CAPACITOR CERAM. SMD 0805	27pF 5% NPO 50VDC	TDK	C2012 COG 1H 270 J T 000A	323.079
C83-2	CAPACITOR CERAM. SMD 0805	18pF 5% NPO 50VDC	TDK	C2012 COG 1H 180 J T NiBa	323.077
C84-2	CAPACITOR TRIMMER SMD	4.5-20pF N750	MURATA	TZB04R200BA	335.011
C85-2	CAPACITOR CERAM. SMD 0805	10pF 5% NPO 50VDC	TDK	C2012 COG 1H 100 D T NiBa	323.074
C86-2	CAPACITOR CERAM. SMD 0805	33pF 5% NPO 50VDC	TDK	C2012 COG 1H 330 J T 000A	323.080
C87-2	CAPACITOR CERAM. SMD 0805	12pF 5% NPO 50VDC	TDK	C2012 COG 1H 120 J T NiBa	323.075
C88-2	CAPACITOR CERAM. SMD 0805	47pF 5% NPO 50VDC	TDK	C2012 COG 1H 470 J T NiBa	323.082
C89-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C90-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C91-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C92-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C93-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C94-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C95-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C96-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C97-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C98-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C99-2	CAPACITOR CERAM. SMD 0805	10pF 5% NPO 50VDC	TDK	C2012 COG 1H 100 D T NiBa	323.074
C100-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C101-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C102-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C103-2	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C104-2	CAPACITOR CERAM. SMD 0805	39pF 5% NPO 50VDC	MURATA	GRM40 COG 390 J 50 PT	323.081
C105-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C106-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C107-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C108-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C109-2	CAPACITOR CERAM. SMD 0805	4p7F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 4R7 C T NiBa	323.070
C110-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C111-2	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C112-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C113-2	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C114-2	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C115-2	CAPACITOR CERAM. SMD 0805	1p0F +/-0.25pF NPO 50VDC	TDK	C2012 COG 1H 010 C T NiBa	323.062
D1-2	TRANSIENT SUPPRESSOR	12V 5%	MOTOROLA	15MB12A-T3	341.510
D2-2	DIODE BAND SWITCHING	BA582/BA782 SOD-123	MOTOROLA	BA582T1	340.650
D3-2	DIODE BAND SWITCHING	BA582/BA782 SOD-123	MOTOROLA	BA582T1	340.650
D4-2	DIODE SMALL SIGNAL	SOD-80 BAS32L	PHILIPS	BAS32L	340.032
D5-2	DIODE CAPACITANCE	BB215 2p0F/28VDC SOD80	PHILIPS	BB215	340.615
D6-2	DIODE CAPACITANCE	BB215 2p0F/28VDC SOD80	PHILIPS	BB215	340.615
D7-2	DIODE CAPACITANCE	BB215 2p0F/28VDC SOD80	PHILIPS	BB215	340.615
D8-2	DIODE CAPACITANCE	BB215 2p0F/28VDC SOD80	PHILIPS	BB215	340.615
D9-2	DIODE DUAL SCHOTTKY	BAT54S	PHILIPS	BAT54S 215	340.310
D10-2	DIODE DUAL SCHOTTKY	BAT54S	PHILIPS	BAT54S 215	340.310
D11-2	DIODE CAPACITANCE	BBY40 4p3F/28VDC	PHILIPS	BBY40	340.640
D12-2	DIODE CAPACITANCE	BBY40 4p3F/28VDC	PHILIPS	BBY40	340.640
D13-2	DIODE CAPACITANCE	BBY40 4p3F/28VDC	PHILIPS	BBY40	340.640
D14-2	DIODE BAND SWITCHING	BA582/BA782 SOD-123	MOTOROLA	BA582T1	340.650
D15-2	DIODE BAND SWITCHING	BA582/BA782 SOD-123	MOTOROLA	BA582T1	340.650
D16-2	DIODE BAND SWITCHING	BA582/BA782 SOD-123	MOTOROLA	BA582T1	340.650
D17-2	DIODE BAND SWITCHING	BA582/BA782 SOD-123	MOTOROLA	BA582T1	340.650
D18-2	DIODE ZENER	4V7 V 5% 1/4W SOT-23	MOTOROLA	BZX84 C4V7 L T1	340.507
D19-2	DIODE SMALL SIGNAL	SOD-80 BAS32L	PHILIPS	BAS32L	340.032
F1-2	FUSE 3A5 FF	290x140 MILS	SHURTER	3402.0015.24	374.015
FP1-2	EMI FERRITE BEAD	3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 A 601 S PT	370.022
FP2-2	EMI FERRITE BEAD	2x1.25x0.9mm 0.2A	MURATA	BLM 21 A 121 S PT	370.001

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
J14-2	SOCKET COAXIAL	PCB VERSION TYPE MMS	RADIALL	R 209 408 302 (052)	376.510
L2-2	COIL	TL553	ECI A/S	6-0-26593A	400553
L3-2	COIL	TL553	ECI A/S	6-0-26593A	400553
L4-2	COIL	TL552	ECI A/S	6-0-26592A	400552
L5-2	COIL	TL554	ECI A/S	6-0-26594A	400554
L6-2	COIL	TL554	ECI A/S	6-0-26594A	400554
L7-2	COIL	TL554	ECI A/S	6-0-26594A	400554
L8-2	COIL	TL554	ECI A/S	6-0-26594A	400554
L9-2	CHOKE FIXED	1u0H 5%	COILCRAFT	1008CS-102-XJBC	337.274
L10-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L11-2	SPRING INDUCTOR	43nH 5% *0.12x0.27"	COILCRAFT	B10T	337.410
L12-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L13-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L14-2	SPRING INDUCTOR	35n5H 5% *3x7mm	COILCRAFT	B09T TAPE&REEL	337.409
L15-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L16-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L17-2	CHOKE FIXED 1210	47nH 5%	SIEMENS	B82412-A3470-J	337.158
L18-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L19-2	CHOKE FIXED 1210	68nH 5%	SIEMENS	B82412-A3680-J	337.160
L20-2	CHOKE FIXED 1210	2u2H 20%	SIEMENS	B82412-A1222-M	337.128
L21-2	CHOKE FIXED 1210	47nH 5%	SIEMENS	B82412-A3470-J	337.158
P1-2	PLUG 8 POLES	1/20" SIL PCB VERSION	AMP	6-175642-8	375.029
P2-2	PLUG 8 POLES	1/20" SIL PCB VERSION	AMP	6-175642-8	375.029
P3-2	PLUG 8 POLES	1/20" SIL PCB VERSION	AMP	6-175642-8	375.029
P4-2	PLUG 8 POLES	1/20" SIL PCB VERSION	AMP	6-175642-8	375.029
P5-2	PLUG 8 POLES	1/20" SIL PCB VERSION	AMP	3-175642-8	375.028
P6-2	PLUG 6 POLES	1/20" SIL PCB VERSION	AMP	3-175642-6	375.026
P7-2	PLUG 4 POLES	1/20" SIL PCB VERSION	AMP	3-175642-4	375.024
P8-2	PLUG 6 POLES	1/20" SIL PCB VERSION	AMP	3-175642-6	375.026
Q1-2	MOSFET POWER, P-CHANNEL	IRFR9020 ME8P06	IR	IRFR9020-TR	347.820
Q2-2	TRANSISTOR MED.POW. PNP	SOT-89,BC869-25/BCX69-25	PHILIPS	BC869-25	346.305
Q3-2	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q4-2	TRANSISTOR MED.POW. PNP	SOT-89,BC869-25/BCX69-25	PHILIPS	BC869-25	346.305
Q5-2	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q6-2	DUAL GATE MOS-FET N-CHANN	BF996S	PHILIPS	BF996S-215	347.096
Q7-2	DUAL GATE MOS-FET N-CHANN	BF996S	PHILIPS	BF996S-215	347.096
Q8-2	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q9-2	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q10-2	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q11-2	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q12-2	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
Q13-2	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q14-2	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q15-2	TRANSISTOR RF NPN	MMBR951	MOTOROLA	MMBR951LT1	345.531
Q16-2	TRANSISTOR RF NPN	MMBR951	MOTOROLA	MMBR951LT1	345.531
Q17-2	TRANSISTOR RF NPN	BFR92A	PHILIPS	BFR92A	345.530
Q18-2	TRANSISTOR RF NPN	BFR92A	PHILIPS	BFR92A	345.530
Q19-2	TRANSISTOR RF NPN	SOT-89 BFQ17	PHILIPS	BFQ17	345.717
Q20-2	TRANSISTOR RF NPN	BFR92A	PHILIPS	BFR92A	345.530
Q21-2	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q22-2	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q23-2	TRANS. AF SMALL SIGNAL	NPN, BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
Q24-2	TRANS. DARLINGTON PNP	SOT89 BCV28	PHILIPS	BCV28	346.427
R1-2	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R2-2	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R3-2	RESISTOR SMD 1206	2R2 OHM 5% 0.25W	ROHM	MCR 18 EZH(JZO) J 2R2	303.016
R4-2	RESISTOR SMD 1206	2R2 OHM 5% 0.25W	ROHM	MCR 18 EZH(JZO) J 2R2	303.016
R5-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R6-2	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048

## 6 PARTSLIST

## SP3000 VHF

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
R7-2	RESISTOR SMD 1206	2R2 OHM 5% 0.25W	ROHM	MCR 18 EZH(JZO) J 2R2	303.016
R8-2	RESISTOR SMD 1206	2R2 OHM 5% 0.25W	ROHM	MCR 18 EZH(JZO) J 2R2	303.016
R9-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R10-2	RESISTOR SMD 1206	390R OHM 5% 0.25W	ROHM	MCR 18 JZO J 391	303.043
R11-2	RESISTOR SMD 0805	3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R14-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R15-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R16-2	RESISTOR SMD 1206	390R OHM 5% 0.25W	ROHM	MCR 18 JZO J 391	303.043
R21-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R24-2	RESISTOR NTC 1206	47k OHM 10% 0.5W	SIEMENS	B57621-C473-K62	310.708
R30-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R32-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R33-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R34-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R35-2	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R36-2	RESISTOR SMD 0805	180k OHM 5% 0.1W	ROHM	MCR 10 EZH J 184	302.075
R37-2	RESISTOR SMD 0805	220 OHM 5% 0.1W	ROHM	MCR 10 EZH J 221	302.040
R38-2	RESISTOR SMD 0805	330 OHM 5% 0.1W	ROHM	MCR 10 EZH J 331	302.042
R39-2	RESISTOR SMD 1206	100 OHM 5% 0.25W	ROHM	MCR 18 JZO J 101	303.036
R40-2	RESISTOR SMD 1206	100 OHM 5% 0.25W	ROHM	MCR 18 JZO J 101	303.036
R41-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R42-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R44-2	RESISTOR SMD 0805	470k OHM 5% 0.1W	ROHM	MCR 10 EZH J 474	302.080
R45-2	RESISTOR SMD 0805	6k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 682	302.058
R46-2	RESISTOR SMD 0805	150 OHM 5% 0.1W	ROHM	MCR 10 EZH J 151	302.038
R47-2	RESISTOR SMD 0805	12k OHM 5% 0.1W	ROHM	MCR 10 EZH J 123	302.061
R48-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R49-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R50-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R61-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R52-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R53-2	RESISTOR SMD 0805	12k OHM 5% 0.1W	ROHM	MCR 10 EZH J 123	302.061
R54-2	RESISTOR SMD 0805	10 OHM 5% 0.1W	ROHM	MCR 10 EZH J 10R	302.024
R55-2	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R56-2	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R57-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R58-2	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R59-2	RESISTOR SMD 0805	6k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 682	302.058
R60-2	RESISTOR SMD 0805	12k OHM 5% 0.1W	ROHM	MCR 10 EZH J 123	302.061
R61-2	RESISTOR SMD 0805	22k OHM 5% 0.1W	ROHM	MCR 10 EZH J 223	302.064
R62-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R63-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R64-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R65-2	PRESET SEALED	20k OHM 25% 0.1W	BOURNS	3374X-1-203-E	310.425
R66-2	RESISTOR SMD 0805	3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R67-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R68-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R69-2	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R70-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R71-2	RESISTOR SMD 0805	220k OHM 5% 0.1W	ROHM	MCR 10 EZH J 224	302.076
R72-2	RESISTOR SMD 0805	8k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 822	302.059
R73-2	RESISTOR SMD 0805	18k OHM 5% 0.1W	ROHM	MCR 10 EZH J 183	302.063
R74-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R75-2	RESISTOR SMD 0805	470 OHM 5% 0.1W	ROHM	MCR 10 EZH J 471	302.044
R76-2	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R77-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R78-2	RESISTOR SMD 0805	8k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 822	302.059
R79-2	RESISTOR SMD 0805	470 OHM 5% 0.1W	ROHM	MCR 10 EZH J 471	302.044
R80-2	RESISTOR SMD 0805	18k OHM 5% 0.1W	ROHM	MCR 10 EZH J 183	302.063

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
R81-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R82-2	RESISTOR SMD 0805	8k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 822	302.059
R83-2	RESISTOR SMD 0805	5k6 OHM 5% 0.1W	ROHM	MCR 10 EZH J 562	302.057
R84-2	RESISTOR SMD 0805	390 OHM 5% 0.1W	ROHM	MCR 10 EZH J 391	302.043
R85-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R86-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R87-2	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R88-2	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R89-2	RESISTOR SMD 0805	1k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 122	302.049
R90-2	RESISTOR SMD 0805	1k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 122	302.049
R91-2	RESISTOR SMD 0805	820 OHM 5% 0.1W	ROHM	MCR 10 EZH J 821	302.047
R92-2	RESISTOR SMD 0805	220 OHM 5% 0.1W	ROHM	MCR 10 EZH J 221	302.040
R93-2	RESISTOR SMD 0805	10 OHM 5% 0.1W	ROHM	MCR 10 EZH J 10R	302.024
R94-2	RESISTOR SMD 0805	150 OHM 5% 0.1W	ROHM	MCR 10 EZH J 151	302.038
R95-2	RESISTOR SMD 0805	82 OHM 5% 0.1W	ROHM	MCR 10 EZH J 82R	302.035
R96-2	RESISTOR SMD 0805	2k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 222	302.052
R97-2	RESISTOR SMD 0805	1k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 182	302.051
R98-2	RESISTOR SMD 0805	47 OHM 5% 0.1W	ROHM	MCR 10 EZH J 47R	302.032
R99-2	RESISTOR SMD 0805	470 OHM 5% 0.1W	ROHM	MCR 10 EZH J 471	302.044
R100-2	RESISTOR SMD 0805	1k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 122	302.049
R101-2	RESISTOR SMD 0805	1k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 122	302.049
R102-2	RESISTOR SMD 0805	120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R103-2	RESISTOR SMD 0805	1k5 OHM 5% 0.1W	ROHM	MCR 10 EZH J 152	302.050
R104-2	RESISTOR SMD 0805	10 OHM 5% 0.1W	ROHM	MCR 10 EZH J 10R	302.024
R105-2	RESISTOR SMD 0805	470 OHM 5% 0.1W	ROHM	MCR 10 EZH J 471	302.044
R106-2	RESISTOR SMD 0805	220k OHM 5% 0.1W	ROHM	MCR 10 EZH J 224	302.076
R107-2	RESISTOR SMD 0805	180k OHM 5% 0.1W	ROHM	MCR 10 EZH J 184	302.075
R108-2	RESISTOR SMD 0805	2k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 222	302.052
R109-2	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R110-2	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R111-2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R112-2	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R113-2	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R114-2	RESISTOR SMD 0805	22k OHM 5% 0.1W	ROHM	MCR 10 EZH J 223	302.064
R115-2	RESISTOR SMD 0805	2k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 222	302.052
R116-2	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R117-2	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R118-2	RESISTOR SMD 0805	12k OHM 5% 0.1W	ROHM	MCR 10 EZH J 123	302.061
R119-2	RESISTOR SMD 0805	15k OHM 5% 0.1W	ROHM	MCR 10 EZH J 153	302.062
R120-2	RESISTOR SMD 0805	820 OHM 5% 0.1W	ROHM	MCR 10 EZH J 821	302.047
R121-2	RESISTOR SMD 0805	82k OHM 5% 0.1W	ROHM	MCR 10 EZH J 823	302.071
R122-2	RESISTOR SMD 0805	120k OHM 5% 0.1W	ROHM	MCR 10 EZH J 124	302.073
R123-2	RESISTOR SMD 0805	270k OHM 5% 0.1W	ROHM	MCR 10 EZH J 274	302.077
R124-2	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R125-2	RESISTOR SMD 0805	220k OHM 5% 0.1W	ROHM	MCR 10 EZH J 224	302.076
R126-2	RESISTOR SMD 0805	220k OHM 5% 0.1W	ROHM	MCR 10 EZH J 224	302.076
R127-2	RESISTOR SMD 0805	22k OHM 5% 0.1W	ROHM	MCR 10 EZH J 223	302.064
R128-2	RESISTOR MF	15R0 OHM 1% 0.6W	PHILIPS	2322 156 11509	03.154
R129-2	RESISTOR SMD 0805	2k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 222	302.052
RE1-2	REED SWITCH	SPST 10VA FR2024	CP CLARE	FR2024	339.400
RE2-2	RELAY 6VDC	1ADC DPDT	NEC	EA2-6	21.072
U2-2	CMOS QUAD OPAMP	SO14 LMC660	NATIONAL	LMC660CMX	350.605
U3-2	INTEGRATED CIRCUIT	CD40106BC	NATIONAL	MM74C14MX	355.101
U4-2	PROGRAMMABLE CMOS OP-AMP	SINGLE TS271C/TLC271C	TEXAS	TLC271CDR/ACD/BCD	350.610

POSITION	DESCRIPTION	MANUFACTURER	TYPE	PART NO.
<b>VHF DIV.&amp; LOOP FILTER (3) SP311x/SP321x</b>		<b>ECI A/S</b>	<b>5-0-26703B / 4-0-26703G</b>	<b>626703</b>
POSITION	DESCRIPTION	MANUFACTURER	TYPE	PART NO.
C1-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C2-3	CAPACITOR CERAM. SMD 0805 15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C3-3	CAPACITOR CERAM. SMD 0805 15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.076
C4-3	CAPACITOR TRIMMER SMD 4-25P	MURATA	TZBX4Z250BA110T00	335.024
C5-3	CAPACITOR CERAM. SMD 0805 3p3F 0.25pF NPO 50VDC	MURATA	GRM40 COG 3R3 C 50 PT	323.068
C6-2	CAPACITOR CERAM. SMD 0805 100pF 5% NPO 50VDC	TDK	C2012 COG 1H 101 J T NiBa	323.086
C7-3	CAPACITOR CERAM. SMD 0805 22pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T NiBa	323.078
C8-3	CAPACITOR CERAM. SMD 0805 22pF 5% NPO 50VDC	TDK	C2012 COG 1H 220 J T NiBa	323.078
C9-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C10-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C11-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C12-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C13-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C14-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C15-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C16-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C17-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C21-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C22-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C25-3	CAPACITOR CERAM. SMD 0805 3n9F 10% X7R 50VDC	Murata	GRM21 6 R7 1H 392 K A01 L(D)	328.331
C26-3	CAPACITOR CERAM. SMD 0805 3n9F 10% X7R 50VDC	Murata	GRM21 6 R7 1H 392 K A01 L(D)	328.331
C27-3	CAPACITOR CERAM. SMD 0805 820pF 10% X7R 50VDC	MURATA	GRM40 X7R 821 K 50 PT	328.323
C28-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C29-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C30-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C31-3	CAPACITOR CERAM. SMD 0805 820pF 10% X7R 50VDC	MURATA	GRM40 X7R 821 K 50 PT	328.323
C32-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C33-3	CAPACITOR CERAM. SMD 0805 100pF 5% NPO 50VDC	TDK	C2012 COG 1H 101 J T NiBa	323.086
C35-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C36-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C37-3	CAPACITOR CERAM. SMD 0805 33pF 5% NPO 50VDC	TDK	C2012 COG 1H 330 J T 000A	323.080
C38-3	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	Murata	GRM21 6 R7 1H 103 K A01 L(D)	328.336
C39-3	CAPACITOR CERAM. SMD 0805 120pF 5% NPO 50VDC	TDK	C2012 COG 1H 121 J T NiBa	323.087
C40-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C41-3	CAPACITOR CERAM. SMD 0805 1n0F 10% X7R 50VDC	VITRAMON	VJ0805 Y 102 K XAT	328.324
C42-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
C43-3	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM21 B R7 1H 104 K A01 L(D)	328.348
D1-3	DIODE CAPACITANCE BBY31 1p8/28VDC SOT-23	PHILIPS	BBY31 REEL a 3000 STK	340.631
D2-3	DIODE SMALL SIGNAL HIGH-SPEED, BAS32L	PHILIPS	BAS32L 115(135)	340.032
D3-3	DIODE SMALL SIGNAL HIGH-SPEED, BAS32L	PHILIPS	BAS32L 115(135)	340.032
D4-3	DIODE SMALL SIGNAL HIGH-SPEED, BAS32L	PHILIPS	BAS32L 115(135)	340.032
FP1-3	EMI FERRITE BEAD 3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 A 601 S PT	370.022
FP2-3	EMI FERRITE BEAD 3.2x1.6x1.6mm 0.2A	MURATA	BLM 31 A 601 S PT	370.022
FP3-3	EMI FERRITE BEAD 2x1.25x0.9mm 0.2A	Murata	BLM21AF121SN1D	370.001
J6-3	SOCKET 6 POLES 1/20" SIL PCB VERSION	AMP	3-175636-6	376.026
J7-3	SOCKET 4 POLES 1/20" SIL PCB VERSION	AMP	3-175636-4	376.024
J8-3	SOCKET 6 POLES 1/20" SIL PCB VERSION	AMP	3-175636-6	376.026
L1-3	CHOKE FIXED 1210 2u2H 20% SIEMENS		B82412-A1222-M	337.128
L2-3	CHOKE FIXED 1210 470nH 10% SIEMENS		B82412-A3471-K	337.120
Q1-3	TRANSISTOR RF NPN BFS17A / BFS17P	PHILIPS	BFS17A	345.517
Q2-3	TRANSISTOR RF NPN BFS17A / BFS17P	PHILIPS	BFS17A	345.517
Q3-3	TRANSISTOR RF NPN BFR92A PHILIPS		BFR92A ID: P2p	345.530
Q4-3	TRANSISTOR RF NPN BFS17A / BFS17P	PHILIPS	BFS17A	345.517
R1-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065

POSITION	DESCRIPTION	MANUFACTURER	TYPE	PART NO.
R2-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R3-3	RESISTOR SMD 0805 47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R4-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R5-3	RESISTOR SMD 0805 120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R6-3	RESISTOR SMD 0805 3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R7-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R8-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R9-3	RESISTOR SMD 0805 120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R10-3	RESISTOR SMD 0805 120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R11-3	RESISTOR SMD 0805 1k5 OHM 5% 0.1W	ROHM	MCR 10 EZH J 152	302.050
R12-3	RESISTOR SMD 0805 120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
R13-3	RESISTOR SMD 0805 1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R14-3	RESISTOR SMD 0805 560 OHM 5% 0.1W	ROHM	MCR 10 EZH J 561	302.045
R15-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R16-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R17-3	RESISTOR SMD 0805 1R0 OHM 5% 0.1W	ROHM	MCR 10 MZH J 1R0	302.012
R18-3	RESISTOR SMD 0805 10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R20-3	RESISTOR SMD 0805 33k OHM 5% 0.1W	ROHM	MCR 10 EZH J 333	302.066
R21-3	RESISTOR SMD 0805 33k OHM 5% 0.1W	ROHM	MCR 10 EZH J 333	302.066
R22-3	RESISTOR SMD 0805 47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R23-3	RESISTOR SMD 0805 150k OHM 5% 0.1W	ROHM	MCR 10 EZH J 154	302.074
R25-3	RESISTOR SMD 0805 33k OHM 5% 0.1W	ROHM	MCR 10 EZH J 333	302.066
R26-3	RESISTOR SMD 0805 150k OHM 5% 0.1W	ROHM	MCR 10 EZH J 154	302.074
R28-3	RESISTOR SMD 0805 150k OHM 5% 0.1W	ROHM	MCR 10 EZH J 154	302.074
R29-3	RESISTOR SMD 0805 150k OHM 5% 0.1W	ROHM	MCR 10 EZH J 154	302.074
R30-3	RESISTOR SMD 0805 33k OHM 5% 0.1W	ROHM	MCR 10 EZH J 333	302.066
R31-3	RESISTOR SMD 0805 100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R32-3	RESISTOR SMD 0805 100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R33-3	RESISTOR SMD 0805 820 OHM 5% 0.1W	ROHM	MCR 10 EZH J 821	302.047
R34-3	RESISTOR SMD 0805 56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R40-3	RESISTOR SMD 0805 47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R41-3	RESISTOR SMD 0805 27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R42-3	RESISTOR SMD 0805 820 OHM 5% 0.1W	ROHM	MCR 10 EZH J 821	302.047
R43-3	RESISTOR SMD 0805 27 OHM 5% 0.1W	ROHM	MCR 10 EZH J 27R	302.029
R44-3	RESISTOR SMD 0805 3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R45-3	RESISTOR SMD 0805 120 OHM 5% 0.1W	ROHM	MCR 10 EZH J 121	302.037
U1-3	TWO-MODULUS PRESCALER MC12022SLA	Philips	SA701D	355.811
U3-3	PLL FREQ. SYNTHESIZER SERIAL-INPUT	MOTOROLA	MC145158-2-DW R2	351.005
U4-3	QUAD BILATERAL SWITCH CD4066BC	MOTOROLA	MC14066BD R2(R1)	355.066
U5-3	Single JFET Precision Operational Amp. Low Power	TEXAS INSTRUMENTS	TL031CD (ID)	350.522
X1-3	CRYSTAL C1074 14.850MHz 10ppm NC18C	HY-Q	ECI SPEC: C1074	39.839

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**NARROW BW VHF/UHF IF FILTER MODULE (4) ECI A/S 5-0-26714A / 4-0-26714A 626714**


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POSITION	DESCRIPTION	MANUFACTURER	TYPE	PART NO.
C1-4	CAPACITOR CERAM. SMD 0805 82pF 5% NPO 50VDC	TDK	C2012 COG 1H 820 J T NiBa	323.085
C2-4	CAPACITOR CERAM. SMD 0805 33pF 5% NPO 50VDC	TDK	C2012 COG 1H 330 J T 000A	323.080
C4-4	CAPACITOR CERAM. SMD 0805 82pF +/-0.25pF NPO 50VDC	MURATA	GRM40 COG 8R2 C 50 PT	323.073
C6-4	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C7-4	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C8-4	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C9-4	CAPACITOR CERAM. SMD 0805 22pF 5% NPO 50VDC	TDK	C2012 COG 1H 220 J T NiBa	323.078
C10-4	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C11-4	CAPACITOR CERAM. SMD 0805 10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C12-4	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C13-4	CAPACITOR CERAM. SMD 0805 10pF 5% NPO 50VDC	TDK	C2012 COG 1H 100 D T NiBa	323.074
C14-4	CAPACITOR CERAM. SMD 0805 100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
C15-4	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C16-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C17-4	CAPACITOR CERAM. SMD 0805	180pF 5% NPO 50VDC	TDK	C2012 COG 1H 181 J T NiBa	323.089
C20-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C21-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C22-4	CAPACITOR CERAM. SMD 0805	82pF 5% NPO 50VDC	TDK	C2012 COG 1H 820 J T NiBa	323.085
C23-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C24-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C25-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C26-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C27-4	CAPACITOR CERAM. SMD 0805	56pF 5% NPO 50VDC	TDK	C2012 COG 1H 560 J T NiBa	323.083
C29-4	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
C30-4	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
FL1-4	CRYSTAL FILTER	Fc=45MHz,BW=15kHz,BLIT	SHOWA CRYSTAL C	45U15BG / UM-1 x 2	40.038
FL2-4	CERAMIC FILTER	Fc=450kHz BW=16kHz	MURATA	CFZM450E	41.514
J5-4	SOCKET 8 POLES	1/20" SIL PCB VERSION	AMP	3-175636-8	376.028
J10-4	SOCKET COAXIAL	PCB VERSION TYPE MMS	RADIALL	R 209 408 302 (052)	376.510
L1-4	CHOKE FIXED	470nH 5%	COILCRAFT	1008CS-471-XJBC	337.270
L3-4	CHOKE FIXED	150nH 5%	COILCRAFT	1008CS-151-XJBC	337.264
L4-4	CHOKE FIXED	470nH 5%	COILCRAFT	1008CS-471-XJBC	337.270
L5-4	CHOKE FIXED	470nH 5%	COILCRAFT	1008CS-471-XJBC	337.270
Q1-4	DUAL GATE MOS-FET N-CHANN	BF996S	PHILIPS	BF996S-215	347.096
Q2-4	TRANSISTOR RF NPN	BFR92A	PHILIPS	BFR92A	345.530
R4-4	RESISTOR SMD 0805	680 OHM 5% 0.1W	ROHM	MCR 10 EZH J 681	302.046
R6-4	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R7-4	RESISTOR SMD 0805	560 OHM 5% 0.1W	ROHM	MCR 10 EZH J 561	302.045
R8-4	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R9-4	RESISTOR SMD 0805	120k OHM 5% 0.1W	ROHM	MCR 10 EZH J 124	302.073
R10-4	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R11-4	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R12-4	PRESET SEALED	50k OHM 25% 0.1W	BOURNS	3374X-1-503-E (G)	310.450
R13-4	RESISTOR SMD 0805	68k OHM 5% 0.1W	ROHM	MCR 10 EZH J 683	302.070
R14-4	RESISTOR SMD 0805	3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R15-4	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R16-4	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R17-4	RESISTOR SMD 0805	22k OHM 5% 0.1W	ROHM	MCR 10 EZH J 223	302.064
R18-4	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056
R19-4	RESISTOR SMD 0805	1k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 182	302.051
R20-4	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R21-4	RESISTOR SMD 0805	1k5 OHM 5% 0.1W	ROHM	MCR 10 EZH J 152	302.050
R22-4	RESISTOR SMD 1206	120 OHM 5% 0.25W	ROHM	MCR 18 JZO J 121	303.037
R23-4	RESISTOR SMD 0805	470 OHM 5% 0.1W	ROHM	MCR 10 EZH J 471	302.044
U1-4	NBFM IF SYSTEM	MC3372	MOTOROLA	MC3372D	350.570
XR1-4	CERAMIC DISCRIMINATOR	Fc=450kHz, BW=4kHz	MURATA	CDBM450C7	41.507

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**VHF/UHF IF MODULE SP3000      MODULE (4)      ECI A/S      5-0-26704C / 4-0-26704E 626704**


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POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
C1-4	CAPACITOR CERAM. SMD 0805	82pF 5% NPO 50VDC	TDK	C2012 COG 1H 820 J T NiBa	323.085
C2-4	CAPACITOR CERAM. SMD 0805	33pF 5% NPO 50VDC	TDK	C2012 COG 1H 330 J T 000A	323.080
C4-4	CAPACITOR CERAM. SMD 0805	8p2F +/-0.25pF NPO 50VDC	MURATA	GRM40 COG 8R2 C 50 PT	323.073
C6-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C7-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C8-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C9-4	CAPACITOR CERAM. SMD 0805	22pF 5% NPO 50VDC	TDK	C2012 COG 1H 220 J T NiBa	323.078
C10-4	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C11-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336

POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
C12-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C13-4	CAPACITOR CERAM. SMD 0805	10pF 5% NPO 50VDC	TDK	C2012 COG 1H 100 D T NiBa	323.074
C14-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C15-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C16-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C17-4	CAPACITOR CERAM. SMD 0805	180pF 5% NPO 50VDC	TDK	C2012 COG 1H 181 J T NiBa	323.089
C20-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C21-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C22-4	CAPACITOR CERAM. SMD 0805	82pF 5% NPO 50VDC	TDK	C2012 COG 1H 820 J T NiBa	323.085
C23-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C24-4	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C25-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C26-4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C27-4	CAPACITOR CERAM. SMD 0805	56pF 5% NPO 50VDC	TDK	C2012 COG 1H 560 J T NiBa	323.083
C29-4	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
C30-4	CAPACITOR TANTALUM 3216	1u5F 20% 16VDC	ERO	CA 155016 M E17	334.007
FL1-4	CRYSTAL FILTER	Fc=45MHz,BW=15kHz,BILIT	SHOWA CRYSTAL C	45U15BG / UM-1 x 2	40.038
FL2-4	CERAMIC FILTER	Fc=450kHz BW=20kHz	AVX/KYOCERA	KBF-450R-20A	41.513
J5-4	SOCKET 8 POLES	1/20" SIL PCB VERSION	AMP	3-175636-8	376.028
J10-4	SOCKET COAXIAL	PCB VERSION TYPE MMS	RADIALL	R 209 408 302 (052)	376.510
L1-4	CHOKE FIXED	470nH 5%	COILCRAFT	1008CS-471-XJBC	337.270
L3-4	CHOKE FIXED	150nH 5%	COILCRAFT	1008CS-151-XJBC	337.264
L4-4	CHOKE FIXED	470nH 5%	COILCRAFT	1008CS-471-XJBC	337.270
L5-4	CHOKE FIXED	470nH 5%	COILCRAFT	1008CS-471-XJBC	337.270
Q1-4	DUAL GATE MOS-FET N-CHANN	BF996S	PHILIPS	BF996S-215	347.096
Q2-4	TRANSISTOR RF NPN	BFR92A	PHILIPS	BFR92A	345.530
R4-4	RESISTOR SMD 0805	680 OHM 5% 0.1W	ROHM	MCR 10 EZH J 681	302.046
R6-4	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R7-4	RESISTOR SMD 0805	560 OHM 5% 0.1W	ROHM	MCR 10 EZH J 561	302.045
R8-4	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R9-4	RESISTOR SMD 0805	120k OHM 5% 0.1W	ROHM	MCR 10 EZH J 124	302.073
R10-4	RESISTOR SMD 0805	56k OHM 5% 0.1W	ROHM	MCR 10 EZH J 563	302.069
R11-4	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R12-4	PRESET SEALED	50k OHM 25% 0.1W	BOURNS	3374X-1-503-E (73)	310.450
R13-4	RESISTOR SMD 0805	68k OHM 5% 0.1W	ROHM	MCR 10 EZH J 683	302.070
R14-4	RESISTOR SMD 0805	3k9 OHM 5% 0.1W	ROHM	MCR 10 EZH J 392	302.055
R15-4	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R16-4	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R17-4	RESISTOR SMD 0805	22k OHM 5% 0.1W	ROHM	MCR 10 EZH J 223	302.064
R18-4	RESISTOR SMD 0805	4k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 472	302.056
R19-4	RESISTOR SMD 0805	1k8 OHM 5% 0.1W	ROHM	MCR 10 EZH J 182	302.051
R20-4	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R21-4	RESISTOR SMD 0805	1k5 OHM 5% 0.1W	ROHM	MCR 10 EZH J 152	302.050
R22-4	RESISTOR SMD 1206	120 OHM 5% 0.25W	ROHM	MCR 18 JZO J 121	303.037
R23-4	RESISTOR SMD 0805	470 OHM 5% 0.1W	ROHM	MCR 10 EZH J 471	302.044
U1-4	NBFM IF SYSTEM	MC3372	MOTOROLA	MC3372D	350.570
XR1-4	CERAMIC DISCRIMINATOR	Fc=450kHz, BW=4kHz	MURATA	CDBM450C7	41.507

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**KEYBOARD MODULE SP3000      MODULE (5)      ECI A/S      5-0-26705D / 4-0-26705B 626705**


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POSITION	DESCRIPTION		MANUFACTURER	TYPE	PART NO.
C2-5	CAPACITOR CERAM. SMD 1206	120nF 10% X7R 16VDC	MURATA	GRM42-6 X7R 124 K 16 PT	328.687
C3-5	CAPACITOR CERAM. SMD 1206	120nF 10% X7R 16VDC	MURATA	GRM42-6 X7R 124 K 16 PT	328.687
D1-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
D2-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
D3-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
D4-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
D5-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026



## 6 PARTSLIST

SP3000 VHF

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
D6-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
D7-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
D8-5	LED SMD 0805 YELLOW	5mCd/20mA CL170Y	CITIZEN	CL-170 Y-C D-T	342.026
Q1-5	TRANS. AF SMALL SIGNAL	NPN, BC858B	MOTOROLA	BC858BT1 (T3)	345.058
R1-5	RESISTOR SMD 0805	180 OHM 5% 0.1W	ROHM	MCR 10 EZH J 181	302.039
R2-5	RESISTOR SMD 0805	180 OHM 5% 0.1W	ROHM	MCR 10 EZH J 181	302.039
R3-5	RESISTOR SMD 0805	180 OHM 5% 0.1W	ROHM	MCR 10 EZH J 181	302.039
R4-5	RESISTOR SMD 0805	180 OHM 5% 0.1W	ROHM	MCR 10 EZH J 181	302.039
R5-5	RESISTOR SMD 0805	330 OHM 5% 0.1W	ROHM	MCR 10 EZH J 331	302.042
R6-5	RESISTOR SMD 0805	33k OHM 5% 0.1W	ROHM	MCR 10 EZH J 333	302.066
R7-5	RESISTOR SMD 0805	680 OHM 5% 0.1W	ROHM	MCR 10 EZH J 681	302.046
R8-5	RESISTOR SMD 0805	82k OHM 5% 0.1W	ROHM	MCR 10 EZH J 823	302.071
R9-5	RESISTOR SMD 0805	2k2 OHM 5% 0.1W	ROHM	MCR 10 EZH J 222	302.052

<b>ANTENNA SWITCH</b>	<b>MODULE (6)</b>	<b>ECI A/S</b>	<b>5-0-26706E/4-0-26706C</b>	<b>626706</b>
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POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
K1	RELAY 6VDC 1ADC DPDT	NEC	EA2-6		21.072
L1	CHOKE FIXED 2u2H 10%	EPCOS	B78108-T1222-K		20.351
X1	PLUG COAX STRAIGHT MCX CHASSIS VERSION		HUBER?? AG	12MCX 50-0-1c/111	78.461
X2	Socket PCB 10 Poles, Right Angle CC=1.25mm		Tyco/AMP	4-174638-0	376.100
X3	SOCKET SUB D 9 POLES	CANNON	SP SPEC. 3-3-28785	DE-9S-0L2-A197	78.144





