

STORNOPHONE 800
PERSONAL RADIOTELEPHONE
TYPE CQP814S
1 (3) C18S4TQ
146 - 174 MHz

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80 - 12

CQP814S 1(3)C18S4TQ

Specifications are based on GPO specification MPT 1301, and CEPT specifications. Figures in brackets are guaranteed values.

GENERAL.

| | |
|-----------------------------|----------------|
| Frequency range | 146 - 174 MHz. |
| Channel separation | 12.5 kHz |
| Maximum frequency deviation | 2.5 kHz |
| Modulation frequency range | 300 - 2400 Hz |
| VHF bandwidth | 1.5 MHz |
| Number of channels | 4 synthesized. |
| Antenna impedance | 50 Ω |

Temperature range:

| | |
|-------------------|---------------|
| Operating | -25°C to 55°C |
| Functioning | -30°C to 60°C |
| Crystal types see | 19J706581 |

RF power output.

Measured at $V_B = 11V$ and 25°C. Degradation under extreme conditions according to CEPT.

CQP 814s 1W: 0.1 - 1 W \pm 1 dB

CQP 814s 3W: 1.0 - 3.0W \pm 1 dB

Crystal frequency range 47.6 - 57.9 MHz

Crystal frequency calculation: $f_{xtal} = \frac{f_{TX, min} - N_{min} \cdot 0.00625}{3}$ MHz

Frequency stability \pm 5ppm

Spurious radiation (GPO) $<$ 0.2 μ W

Side band noise (CEPT) - 70 dB (-60 dB)

Modulation frequency characteristic, CEPT relative to 1000 Hz, 6 dB/octave:

(+ 0, -2.5dB) 700 - 2400 Hz.

(-2.5, -9dB) 300 - 700 Hz.

Modulation distortion (CEPT 750 μ s de-emp.) 1 (5) %

FM hum and noise (CEPT) -45 dB (-40 dB)

RECEIVER.

| | | |
|---|---------------------------------------|--------------------------------|
| Sensitivity | | |
| 1 μ V e.m.f. 1.75kHz deviation, S/N | | ≥ 20 dB |
| Squelch sensitivity | | 0.5 μ V emf and S/N > 15dB |
| Crystal frequency range | | 121.4 - 152.6 MHz |
| Crystal frequency calculation | $f_{RX, min} - N_{min} \cdot 0.00625$ | 21.4MHz |
| Frequency stability | | ± 5 ppm |
| Modulation pass band | | ± 4 kHz (± 2.5 kHz) |
| Adjacent channel selectivity (GPO) | | 70 dB (60 dB) |
| Spurious selectivity (GPO) | | 75 dB (70 dB) |
| Blocking (GPO) | | 100dB (90 dB) |
| Spurious radiation CEPT | | < 2 nW |

AF output power:

| | |
|---|----------------------|
| $R_L = 25 \Omega$, 1 kHz, $V_B = 11$ V distortion 10%: | 300mW (240mW) |
| AF distortion: Δf 1.75kHz, 1kHz, 240mW | 2% (7%) |
| AF frequency characteristic CEPT | |
| relative to 1000 Hz -6dB/octave | 0/-1.5dB (+1dB/-3dB) |

SUPPLY VOLTAGE AND CURRENT DRAIN.

| | |
|------------------------|--------------|
| Nominal supply voltage | 11 V |
| Supply voltage range | 9.9 - 13.5 V |

Transmitter current drain:

| | |
|--|---------------|
| Without tone equipment ($V_B = 11$ V) | |
| 1W | 330mA (360mA) |
| 3W | 730mA (780mA) |

Receiver current drain:

| | |
|--|--------------|
| Without tone equipment ($V_B = 11$ V) | |
| Standby | 15mA (18 mA) |
| Receive (250mW AF) | 75mA (90 mA) |

GENERAL DESCRIPTION

CQP814S 1(3)C18S4TQ

The CQP 814s1 (3)C18S4TQ portable radiotelephone is a combination transmitter and receiver for PM radio communication service on synthesized frequencies.

The CQP814s is remote controlled and fitted with 4 channels plus pilot tone signaling equipment.

A complete radiotelephone unit consists of seven sections, beginning from the bottom these are:

- 1) the battery
- 2) the transmitter
- 3) the synthesizer
- 4) the receiver
- 5) the frequency control unit
- 6) the pilot tone unit
- 7) the control unit

Remote control.

A control unit CB 811 containing the transmitter key, the speaker/microphone, antenna AN 814, and 3-step volume control is connected to the set by means of a cable.

For easy identification, each set has type label showing the type and specification.

Batteries.

To power the equipment the following battery types are available:

BU 802/BU 808 nickel-cadmium (NiCd) battery 10.8V, 225 mAh.

BU 807 nickel-cadmium (NiCd) battery 10.8V, 450 mAh.

The batteries are encased in high-impact cast plastic cassette with snap action locks, automatically securing the battery when slid into place.

Battery Chargers.

Available battery chargers:

| | |
|--------|--|
| CU 801 | Charging unit with two outlets for BU 802, automatic type. |
| CU 802 | Charging unit with ten outlets for BU 802, automatic type. |
| CU 804 | Charging unit with one outlet. A switch selects high or low charging current as to charge the different battery types. |
| CU 805 | Charging unit with six outlets and built-in timer, for all types of batteries. |

The battery chargers can be operated from either a 110V or 220V AC mains.

Pilot Tone Equipment.

The radio set is fitted with pilot tone unit (receiver/transmitter) TQ 801a which is contained in a separate panel placed between the control head and the frequency control unit.

Carrying Devices.

The following devices are available for carrying the CQP 800U:

| | |
|---------|---|
| CK 801a | carrying harness for all types of equipment, mounting hardware, short and long straps, belt and clamps. |
| CK 802 | screw mounted pocket clip. |
| CK 803a | shoulder strap with retainer for remote control unit. |

CIRCUIT DESCRIPTION

CQP814S 1(3)C18S4TQ

Transmitter Circuit (see block diagram).

The transmitter section consists of the following modules:

| | |
|----------|---|
| XO 817 | Crystal oscillator |
| AA 802 | Modulation amplifier |
| FN 807G1 | Modulation filter for 20/25 kHz channel separation. |
| or | |
| FN 807G2 | Modulation filter for 12.5kHz channel separation. |
| RA 811 | Buffer amplifier. |
| PA 811a | 1st power amplifier |
| PA 812a | 2nd power amplifier and antenna switch |
| FN 811 | Antenna filter |
| AD 801 | ADC circuit |
| VR 801 | Voltage regulator |

Modulation amplifier AA 802 and FN 807G1/FN 807G2.

The modulation amplifier function is carried out by the modulation amplifier, AA 802 in conjunction with a modulation filter, FN 807G1 or FN 807G2. The microphone signal is applied to an operational amplifier; the degree of negative feedback, and thus the amplifier gain, can be adjusted by means of an external resistor. In radio sets with built-in tone transmitters or sequential tone transmitters, the microphone amplifier is disabled by the tone key. The amplifier AF signal is applied to a limiter via a differentiating network. The limiter is likewise an operational amplifier utilising negative feedback. Following the limiter is an active lowpass filter where the active element is another operational amplifier. The active filter removes any harmonics of the original input signal that arise during limiting action, and it also keeps the frequency excursions within the tolerances required for the channel spacing used in the particular equipment.

Buffer amplifier RA 811.

The amplifier buffers the output from the synthesizer. A single transistor grounded emitter stage with a tuned collector circuit is used.

Power amplifier PA811a and PA 812a.

The output power from the buffer amplifier (approx. 10mW) is amplified to the required antenna power (0.1 to 1.5W) in a three-stage amplifier composed of the PA811a and the PA 812a modules.

PA811a contains two amplifier stages. The collector voltage to the first transistor is supplied via the ADC circuit, and is variable. If more gain is required to drive the following PA812a stage, the collector supply (ADC) voltage will rise. On the other hand, if the drive signal is more than enough, the ADC voltage will drop.

PA812a contains the transmitter final amplifier plus a circuit for electronically switching the antenna between the transmitter and the receiver.

Collector current for the second transistor in PA811a passes through the switching diodes, whereby they can be considered to be virtual short circuits. This connects the power amplifier output to the antenna while short circuiting the receiver input. When receiving, the diodes become reverse biased, effectively isolating the transmitter from the antenna while connecting the antenna to the receiver input.

ADC circuit AD 801.

The transmitter output current is kept very nearly constant by means of the ADC circuit. The voltage drop across a small resistor (1.2 Ω) in the output transistor's collector return is monitored by the ADC stage, which then regulates the collector voltage to the first transistor amplifier in the PA811a stage with the net effect of cancelling any variations and thus keeping the RF output at a constant value.

The amount of current through the output stage, and thus the output power, can be set by means of a resistor mounted on the mother board.

Antenna filter FN 811.

A nine-pole, low-pass filter having a cutoff frequency of 180 MHz is inserted between the transmitter output and the antenna. The filter suppresses any harmonics created in PA 812a.

Receiver Circuit.

The receiver is a double conversion superheterodyne using intermediate frequencies of 21.4 MHz and 103.5 kHz.

Channel selectivity is achieved by means of a crystal filter in the first IF circuit. The number of channels fitted to the radio depends on the frequency control unit used.

An electronic squelch circuit is used. The squelch threshold can be set with a resistor on the motherboard. A push button on the control panel can cancel the squelch.

The receiver consists of the following modules:

| | |
|---------|---|
| RC 811a | Receiver converter |
| XF 803 | Crystal filter for 20/25 kHz channel separation |
| or | |
| XF 804 | Crystal filter for 12.5 kHz channel separation |
| IC 801 | IF converter |
| IA 801 | 1st IF amplifier |
| IA 802 | 2nd IF amplifier and discriminator |
| SQ 801a | Squelch circuit |
| AA 801a | AF amplifier |

Receiver Converter RC 811a

The RC811a converts the frequency of the antenna signal to the 1st IF frequency of 21.4 MHz. The incoming signal path from the antenna is through the antenna filter, FN 811, and then via the antenna switching circuit in PA 812a to the input of the RC811a. The signal then passes through a two-element band-pass filter to a field effect transistor (J-FET) operating as a grounded gate amplifier. After amplification, the signal passes through a three element band pass filter. This filter is what mainly determines the selectivity of the converter. The signal is then connected to the mixer, which uses another JFET. The mixer uses a grounded source configuration with gate injection. The injection signal is applied through a double tuned bandpass filter.

The IF signal is taken off via a combination autotransformer/L network to match the impedance of the following crystal filter.

Crystal Filter XF 803 and XF 804.

The crystal filter unit comprises an eight-pole monolithic crystal filter and an impedance matching transformer for matching the output to the impedance of the following IF converter. Practically all of the receiver selectivity is achieved in the crystal filter.

XF 803 is employed in equipment with 20/25 kHz channel spacing.

XF 804 is employed in equipment with 12.5 kHz channel spacing.

IF Converter IC 801.

The first IF frequency (21.4 MHz) is converted to the second IF frequency (103.5 kHz) in this module, which contains an amplifier, a mixer and an oscillator. The output signal is taken off from a center tap on the coil in the mixer transistor's collector circuit and applied to an intermediate frequency amplifier, IA 801.

IF Amplifier and Discriminator IA 801 and IA 802.

The first intermediate frequency amplifier, IA 801, consists of two differential amplifiers in cascade. The output signal is applied to the second intermediate frequency amplifier, IA 802, which contains a 103.5 kHz bandpass filter, a quadrature detector, a lowpass filter and an audio frequency amplifier.

The IF amplifier, detector and AF amplifier are all included in one integrated circuit.

The balanced quadrature detector has excellent AM suppression and contains only one tuned circuit. Inserted between the detector and the AF amplifier is an active lowpass filter which removes any superimposed IF signal. The detector bandwidth and the audio amplifier output voltage can be regulated by means of two external resistors on the mother board.

AF Amplifier AA 801a.

The audio frequency signal from IA 802 is fed to the AA 801a AF amplifier where it is amplified to the desired audio power level. First the signal passes through an active highpass filter that suppresses any pilot tones or low frequency noise.

An integrated circuit containing two separate amplifiers makes up the Filter- and output stages. The volume control is inserted between these two amplifiers. The de-emphasis is performed in the output amplifier feedback network.

The audio signal path can be blocked by grounding the squelch terminal (5). When the voltage on terminal 5 is more than 5V the audio amplifier will operate normally.

Squelch Circuit SQ 801a.

The receiver squelch circuit operates automatically, according to the noise content of the antenna signal. Weak signals contain greater noise than acceptable signal levels. The output AF signal from IA 802 is also present at the input to SQ 801a, where it must first pass through an active highpass filter that suppresses frequencies under 7 kHz. Higher frequencies become amplified, then detected and whenever the signal-to-noise ratio is objectionable, the detected noise signal will be sufficient to turn off the audio amplifiers by depriving them of their collector voltage. With an acceptable signal strength at the antenna, the noise content will be too low to trigger the squelch, and the positive collector supply ($+V_{CC}$) will be available to the audio amplifiers, allowing them to operate normally. An external resistor sets the squelch to open the path for a signal-to-noise ratio of ≥ 12 dB SINAD. A pushbutton on the control head allows manual cancelling of the squelch function

Synthesizer Circuit.

Principle.

This part of the radio generates signals with the frequencies required for the receiver injection and for the transmitter power amplifiers. The output frequencies are obtained by means of a phase-locked-loop (PLL). The output signal from the synthesizer is generated in a voltage controlled oscillator (VCO), oscillating at the desired output frequency. In order to reduce the current consumption the PLL is working at a few MHz, therefore the VCO signal is down-converted by mixing with a signal (with frequency f_{XO}) from a crystal controlled oscillator. The down-converted signal (named f_S) from the mixer is applied to a programmable frequency divider. The output signal from the divider is compared with a fixed reference signal (f_{ref}) in a phase comparator. The output of the phase-comparator is a voltage proportional to the frequency difference between the reference frequency and the output frequency of the programmable divider.

By applying the output voltage from the phase comparator to the VCO it is possible to control the VCO frequency. Changing the programmable divider's division ratio (N) will cause a change in the VCO frequency. When the circuit is working the following equation holds:

$$f_{VCO} = f_{XO} + N \cdot f_{ref}$$

The synthesizer consists of the following modules.

| | |
|--------|---|
| FG 811 | Voltage controlled oscillator for the receiver. |
| FG 812 | Voltage controlled oscillator for the transmitter. |
| RA 812 | Buffer amplifier. |
| MX 811 | Mixer for down-converting the VCO signal. |
| XO 811 | Down-converting crystal oscillator for the receiver. |
| XO 817 | Down-converting crystal oscillator for the transmitter. |
| IA 803 | Buffer amplifier to increase the signal from MX 811. |
| PL 801 | Phase-lock-circuit, programmable divider, and reference signal generator. |

FG 811 Voltage Controlled Oscillator.

The oscillator is a Hartley-type LC-oscillator. A JFET in grounded gate is used as the active element. Part of the tuning capacitance is provided by a variable capacitance diode. By changing the bias voltage to the diode, the oscillation frequency is changed.

FG 812 Voltage controlled Oscillator.

The oscillator is a Hartley-type LC-oscillator. A JFET in grounded gate is used as the active element. Part of the tuning capacitance is provided by a variable capacitance diode, thereby making it possible to control the oscillation frequency by an applied DC voltage. The transmitter modulation signal is fed to another variable capacitance diode, thereby it is possible to modulate the VCO frequency with the modulation signal.

Buffer Amplifier RA 812.

This module serves a dual purpose. The input stage buffers the output from the VCO. During receive the receiver injection is obtained from the amplifier and during transmit the signal to the transmitter is obtained from the buffer.

The module also contains part of the isolation amplifier, which is used to prevent the signal from the down-conversion crystal oscillator from interfering with the injection signal to the receiver and likewise for the transmitter signal.

Down-conversion mixer MX811.

In this module is the last part of the isolation amplifier and the down-conversion mixer. The active element in the mixer is a junction FET. Both signals are injected into the gate.

The isolation amplifier prevents the reverse transmission of the crystal oscillator signal. Otherwise the oscillator signal would cause spurious signals in the receiver/transmitter.

Receiver down-conversion oscillator X0811.

This oscillator is a Hartley-type crystal oscillator. The transistor operates as a grounded base amplifier. A variable capacitance diode tunes the collector circuit. As described earlier the VCO frequency (f_{VCO}) is found as shown:

$$f_{VCO} = f_{XO} + N \cdot f_{ref} \quad \text{or}$$

$$f_{XO} = f_{VCO} - N f_{ref}$$

The VCO oscillates at the receiver injection frequency, which is 21.4 MHz less than the receiving frequency. An exact calculation of the crystal frequency is dependent on the choice of division ratio N.

The selection of division ratio is described in the appropriate programming instructions for the frequency control unit.

Transmitter down-conversion oscillator X0817.

The oscillator is a Colpitts type crystal oscillator. The oscillation frequency is one third of the output frequency. A tuned circuit in the collector load is tuned to the third harmonic of the crystal frequency. The output frequency is therefore three times the crystal frequency.

Variable capacitance diodes are inserted in series with the crystal. In this way it is possible to modulate the crystal oscillator with the transmitter modulation signal.

In the transmitter both the VCO (FG812) and the crystal oscillator is modulated. The modulation of the two oscillators is adjusted for equal frequency deviation. As a result of this the deviation on the output frequency from the mixer is cancelled. This is done because the phase-comparator will not function correctly when it's input signal is modulated.

The VCO in the transmitter is oscillating on the transmitting frequency.

The frequency of the XO is found from the following equation:

$$f_{VCO} = f_{XO} + N \cdot f_{ref} \quad \text{or}$$

$$f_{XO} = f_{VCO} - N \cdot f_{ref}$$

The exact calculation of the crystal frequency is dependent on the actual choice of division ratio N. Selection of division ratio is described in the appropriate programming instructions for the frequency control unit used.

Buffer amplifier IA803.

The amplifier provides the PL circuit with sufficient drive level. A pair of complementary emitter **followers** in the output stage makes the amplifier able to supply drive currents for capacitive loads.

Phase-lock-loop PL801.

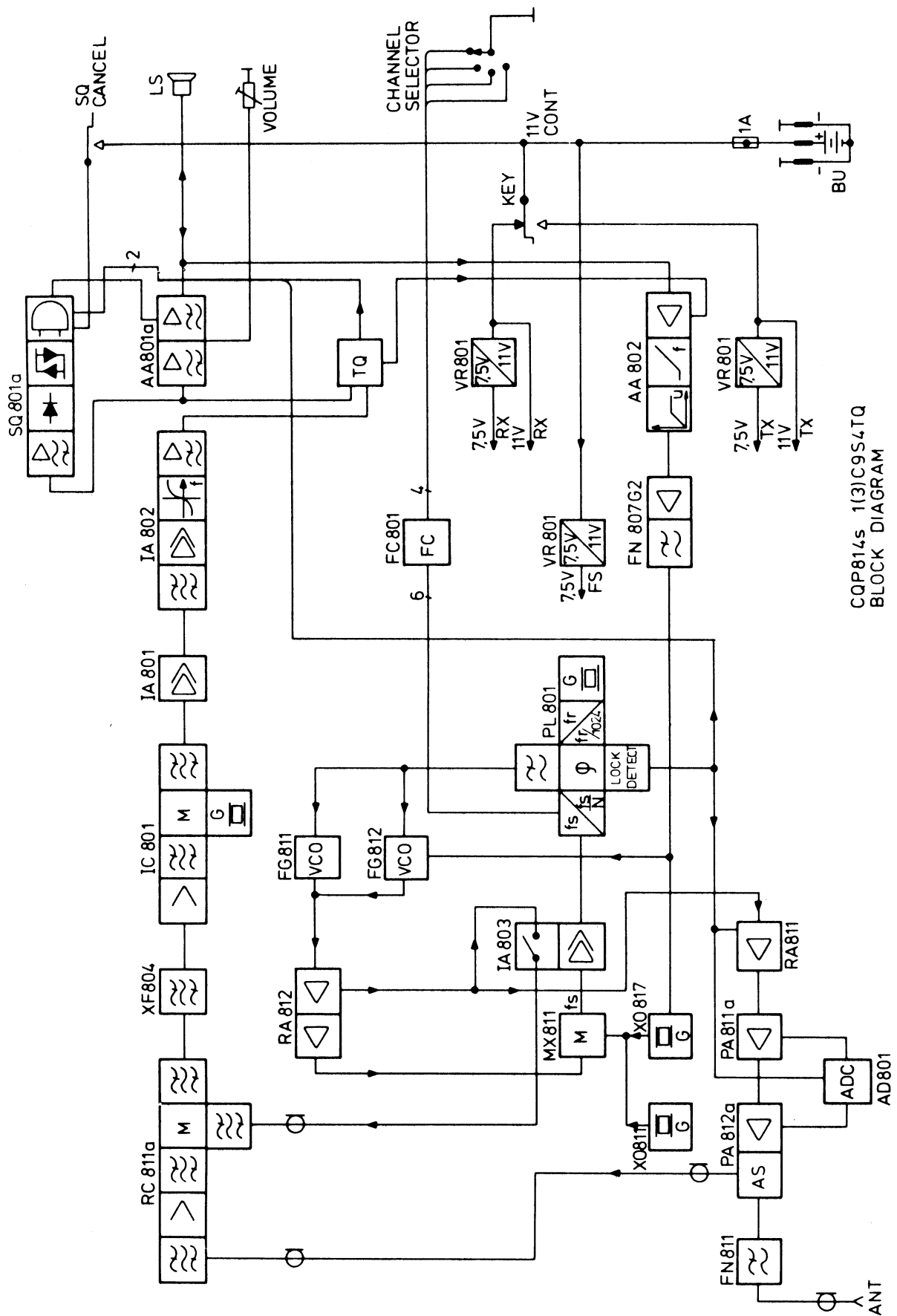
The different circuits are contained in an integrated circuit. The following are covered in the IC:

- 1) Programmable divider, which divides the synthesizer frequency down to the reference frequency.
- 2) Phase comparator which provides the control signal for the VCO's. A logic signal, showing the lock condition, is also provided.
- 3) A crystal controlled oscillator a fixed divider to generate the reference frequency which sets the channel spacing.

Some switching circuits to mute the receiver/transmitter during the out-of-lock condition, are also contained in the module.

Voltage regulator VR801.

Because of variations in the battery voltage as the battery discharges, three VR801 type voltage regulators are employed in the receiver, transmitter and synthesizer circuits. The voltage is stabilized at 7.5 V. The regulators are short circuit protected.

CQP814s 1(3)C9S4TQ
BLOCK DIAGRAM

ADJUSTMENT PROCEDURE

CQP814S 1(3)C18S4TQ

The following measuring instruments are required for tracing faults in and making adjustments to the transmitter/receiver circuits:

| | |
|---------------------------|--------------------------------|
| Control unit C35 | code 95Bo363-01 |
| | including |
| Test cable | code 19B0027 |
| Test cable adaptor | code 41.0206 |
| Antenna connector adaptor | code 41.0201 |
| RF test probe | code 95.0059 |
| DC ampere meter | 10mA/100mA/1A |
| DC voltmeter | $Z_{in} \geq 10M\Omega$ |
| AC voltmeter | $Z_{in} \geq 2M\Omega // 50pF$ |
| FM signal generator | 146 - 174MHz |
| AF generator | $Z_{out} = 600\text{ ohm}$ |
| RF wattmeter | 0 - 2W |
| Deviation meter | |
| Distortion meter | |
| Oscilloscope | |
| Power supply | 0 - 20V/1A |
| | Preset current |
| | limiter 0 - 0.5A |
| Frequency counter | |

OPERATING CONTROL UNIT C35.

The control unit and test cable C35 are designed for testing and adjusting STORNOPHONE 800.

The instruments connect to the unit and remain connected during the procedure.

The front panel of the unit is divided into three parts.

1. The TEST CONTROLS are used to control the radio circuits.
2. The BFO is a 21.4MHz crystal controlled oscillator.
3. The INSTRUMENT TERMINAL is used for measuring instrument connections.

Connection on the rear panel.

TEST PLUG

34 - way connector for the test cable.

POWER SUPPLY

Jacks for power supply.

CURRENT MONITOR

Jacks for current monitor.

Connections on the front panel.

RF PROBE

Jacks for RF probe.

DCVM

Jacks for DC voltmeter.

AF PROBE

BNC connector for AF probe.

Probe consist of shielded leads to be connected whenever measuring of audio is desired.

DEV(M(AF)

BNC connector for the AF output of the deviation meter.

ACVM

BNC connector for the AF voltmeter, distortion meter and oscilloscope.

MOD INPUT

BNC connector for the AF generator.

Toggle switches.

SQ OFF

Disables the squelch circuit of the receiver (loudspeaker continuously open).

KEY

Switches the transmitter on, the receiver off, and connects the AF generator input jack to the LS/MICR switch.

TONE KEY

For radios with sequential tone transmitter. (CQP 810U)

TX GATE

Switches the transmitter's +7.5V on/off.

ON - OFF

21.4MHz crystal controlled BFO on/off.

| | |
|----------------|--|
| LINE OUT | Switches the AC voltmeter between the LINE OUT and the LS/MICR. |
| ACVM | Switches the AC voltmeter between the LINE OUT - LS/MICR switch and DEVM(AF) - AF PROBE switch. |
| DEVM(AF) | Switches the AC voltmeter input between the DEVM(AF) and the AF PROBE (AC voltmeter). |
| DCVM switch | 6-position DC voltmeter switch. <ol style="list-style-type: none"> 1. SUPPLY voltage 2. RX +7.5V stabilized RX voltage. 3. RC receiver converter test point. 4. PLL out of lock voltage. 5. ADC voltage. 6. RF PROBE. |

AMPLITUDE BFO output attenuator.

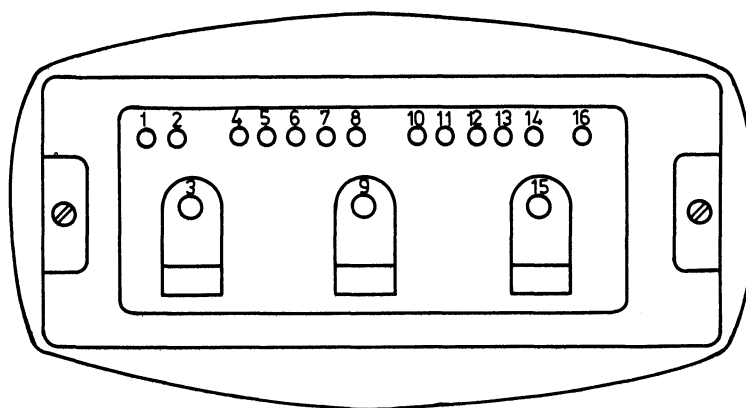
Test point function.

- 1 PLL out of lock voltage.
- 2 +7.5V RX regulator gate.
- 3 DC ground (connected to point 15)
4. ADC voltage.
- 5 Audio output - microphone input.
- 6 Tone key (CQP 810U only).
- 7 +7.5V TX regulator gate.
- 8 +V_B battery voltage measured after the fuse.
- 9 +11V battery.
- 10 +11V TX.
- 11 +7.5V RX stabilized.
- 12 Squelch disable.
- 13 Receiver converter test point.
- 14 21.4MHz signal input.
- 15 DC ground (connected to point 3).
- 16 Discriminator and receiver line output.

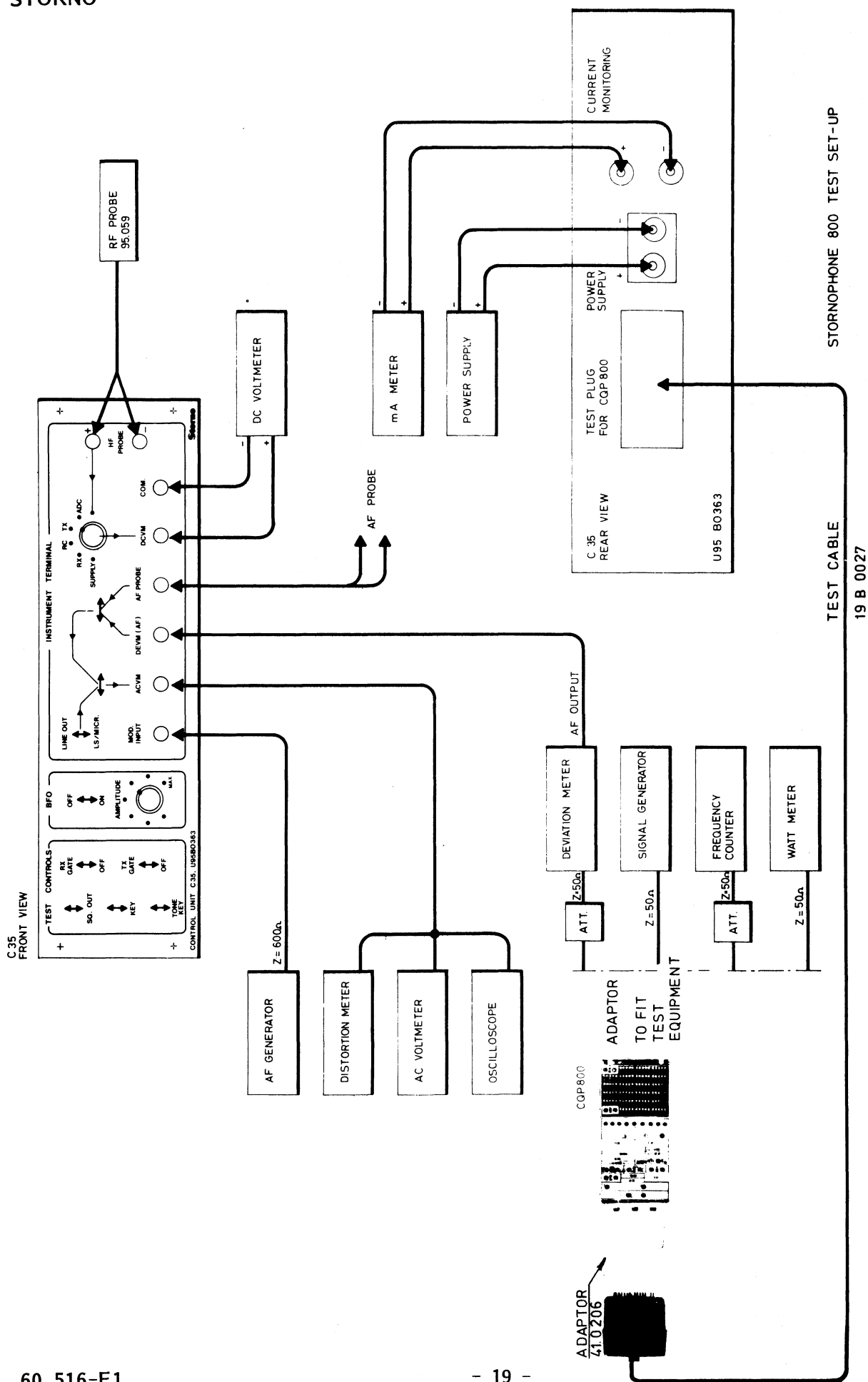
STORNO

STORNO

BOTTOM VIEW



CQP 800 TEST POINT LOCATION



TRANSMITTER ADJUST.

Before making adjustments to the transmitter circuits check the resistor R_{14} .

The initial value is as shown:

- 6.8k Ω for 0.1 to 0.5W output power.
- 3.9k Ω for 1 W output power.
- 3.3k Ω for 1.5 W output power.
- 3.9k Ω for 3 W output power.

Adjustment of TX - VCO.

1. The frequency control (FC 80X) is programmed as described in the appropriate instruction which is as shown:

| | |
|--------|-----------|
| FC 801 | 19J706502 |
| FC 802 | 1 |

Select the channel closest to the center of the TX frequency range.

Set the FG 812 tuning slug in the outer position.

Connect a DC-coupled oscilloscope (1V/div. - 0.1 - 1ms/div.) to the DCVM terminals on the C35 control unit.

Adjust the power supply to 11V (12V for 1.5W transmitter) and set the current limit to 0.5A.

Set the DCVM switch to TX, the oscilloscope is thereby connected to the lock-indication voltage from the synthesizer.

2. Switch on the supply and KEY the transmitter.

Adjust the tuning slug slowly inwards in FG 812 to obtain a steady trace at $\geq 5V$ on the oscilloscope.

It should be noted, that a possibility exists for obtaining a false lock at frequencies 15 - 20MHz from the correct frequency.

Connect a DC voltmeter to PL 801 pin 2.

Adjust the tuning slug in FG 812 to obtain a voltage reading of $2.5V \pm 0.2V$.

Check on the oscilloscope that the loop has remained in lock during the adjustment (steady trace at $\geq 5V$ on the oscilloscope).

Disconnect the voltmeter.

3. Connect a power meter (50Ω) to the output of the transmitter. A DC voltmeter is connected to the DCVM connection on the C35 control box.
Set the DCVM switch to ADC.
The tuning slug in RA 811 is set in the center position.
4. The following coils are adjusted for maximum current drain.

| | |
|----------------------------|---------------------------|
| L_1 and L_3 in PA 811a | L_2 and L_6 in PA 813 |
| L_3 in PA 812a | L_5 and L_6 in PA 814 |
5. The tuning slug in L_1 in RA 811 is adjusted for minimum ADC voltage. To ease the adjustment it may be necessary to detune L_3 in PA 811a to increase the ADC voltage, in order to get a clear minimum.
6. Repeat the adjustment in step 4. for minimum ADC voltage and max. output power until no further improvement is possible.
7. If the output power is less than the rated value it may be increased by placing a resistor in parallel with R_{14} . The two PA stages shall be readjusted for maximum output power after each change of resistance. The power output shall be within $\pm 1\text{dB}$ of the value required for the set.

Check the power output on all channels.
The ADC voltage shall be less than 10V.

Typical current consumption.

| | |
|----|-------|
| 1W | 330mA |
| 3W | mA |
8. Connect a frequency counter through an attenuator to the antenna connector.
KEY the transmitter.
Adjust L_2 in XO 817 to the channel frequency.
The frequency is to be correct within 0.5ppm at 25°C .
Check the frequencies on all channels.

9. The modulation is adjusted as described in 39.103.

When the modulation is adjusted the distortion on the demodulated signal is checked. The modulation frequency is 1kHz and the deviation is as shown:

| Channel spacing | Deviation |
|-----------------|----------------------|
| 25kHz | $\pm 3.5\text{kHz}$ |
| 20kHz | $\pm 2.8\text{kHz}$ |
| 12.5kHz | $\pm 1.75\text{kHz}$ |

The distortion shall be less than 7 % (without deemphasis) typically 2 %.

RECEIVER ADJUSTMENT.

Before making adjustments to the receiver circuits check the discriminator bandwidth resistor between pin 1 and pin 3 of IA 802.

$$\text{CQP 813-R6} = 5.6 \text{ k}\Omega$$

$$\text{CQP 814-R6} = 27 \text{ k}\Omega.$$

Adjustment of RX - VCO.

1. The frequency control (FC 80X) is programmed as described in the appropriate instruction, which is as shown.

$$\text{FC 801} \quad 19\text{J706502}$$

$$\text{FC 802} \quad 1$$

Select the channel closest to the center of the RX frequency range.
Set the FG 811 tuning slug in the outer position.

2. Set the DCVM switch to SUPPLY.
Adjust the power supply to 11V.
Set the current limiter to 0.1A.

Read the current drain.

$$I_{\text{total}} : < 100\text{mA}.$$

Set the DCVM switch to RX.

Read the stabilized RX voltage.

Requirement: $7.5\text{V} \pm 0.15\text{V}$.

3. Connect a DC - coupled oscilloscope (1V/div. - 0.1 - 1ms/div)
to the DCVM terminals on the C35 control unit.
Set the DCVM switch to TX, the oscilloscope is thereby connected to
the lock - indication voltage from the synthesizer.
4. Adjust the tuning slug in FG 811 slowly inwards to obtain a steady trace
at $\geq 5\text{V}$ on the oscilloscope. This indicates that the synthesizer PLL
is locked. Note that it may be possible to obtain a false lock on the
image frequency. Before continuing the adjustment check that the
receiver is working on the correct frequency.
Connect a DC voltmeter to PL 801 pin 2.
Adjust the tuning slug in FG 811 to obtain a voltage reading of $2.5 \pm 0.2\text{V}$.
Check on the oscilloscope that the loop has remained in lock during
the adjustment (steady trace at $\geq 5\text{V}$ on the oscilloscope).
Disconnect the voltmeter.

5. Set the tuning slugs in L_3 and L_4 to the inner position.
The DCVM switch is set to RC.
Select the channel closest to the center of the RX frequency range.
Adjust L_7 and L_8 in RC 811a for maximum DC-voltage.
6. Set the signal generator to the selected channel frequency.
Modulate the generator with 1kHz to a deviation of $0.7 \times \Delta f$ max.
 - ± 3.5 kHz for 25 kHz channel spacing.
 - ± 2.8 kHz for 20 kHz channel spacing.
 - ± 1.75 kHz for 12.5 kHz channel spacing.
Set the SQ OUT and the LINE OUT - LS/MICR switches down.
Set the ACVM switch to LS/MICR.

The level from the signal generator is set to obtain a SINAD of 12dB, with the volume switch in position II.

During the adjustment the signal generator level should be adjusted to maintain a SINAD of approx 12dB.
 L_4 in RC 811a is adjusted for maximum sensitivity.

The following coils are adjusted for best signal to noise ratio in this order:
 - L_3 in RC 811a
 - L_2 in RC 811a
 - L_1 in RC 811a
 - L_5 in RC 811a
The adjustment of L_7 and L_8 for maximum DC voltage is repeated.
 L_6 in RC 811a is adjusted for minimum distortion.
FG 811 is stopped (removed from the set).
The level from the signal generator is increased until a rise in the RC voltage is seen.
The tuning slugs in L1,2,3,4, and 5 are adjusted for maximum DC voltage.
7. The signal generator level is set to approx. 100 μ V e.m.f. and L1 in XF 800 is adjusted for minimum distortion.

8. Receiver sensitivity measurement.

EIA (electronic Industrie's Association) standard, definition:

The SINAD sensitivity of a receiver is the minimum input signal that will provide at least 50% of the receiver's rated audio output power with 12 dB signal + noise + distortion to noise + distortion.

The sensitivity must be minimum 1.0 μV e.m.f.

Typical value: 0.5 μV e.m.f.

Changing the supply voltage from 9.6 V to 15 V should not influence the sensitivity obtained at 11 V.

The sensitivity check should be repeated on all channels.

9. Checking receiver audio line output.

Modulate the signal generator with 1 kHz and $0.7 \times \Delta f$ max.

± 3.5 kHz for 25 kHz channel spacing.

± 2.8 kHz for 20 kHz channel spacing.

± 1.75 kHz for 12.5 kHz channel spacing.

Set the signal generator output to $100\mu\text{V}$ e.m.f.

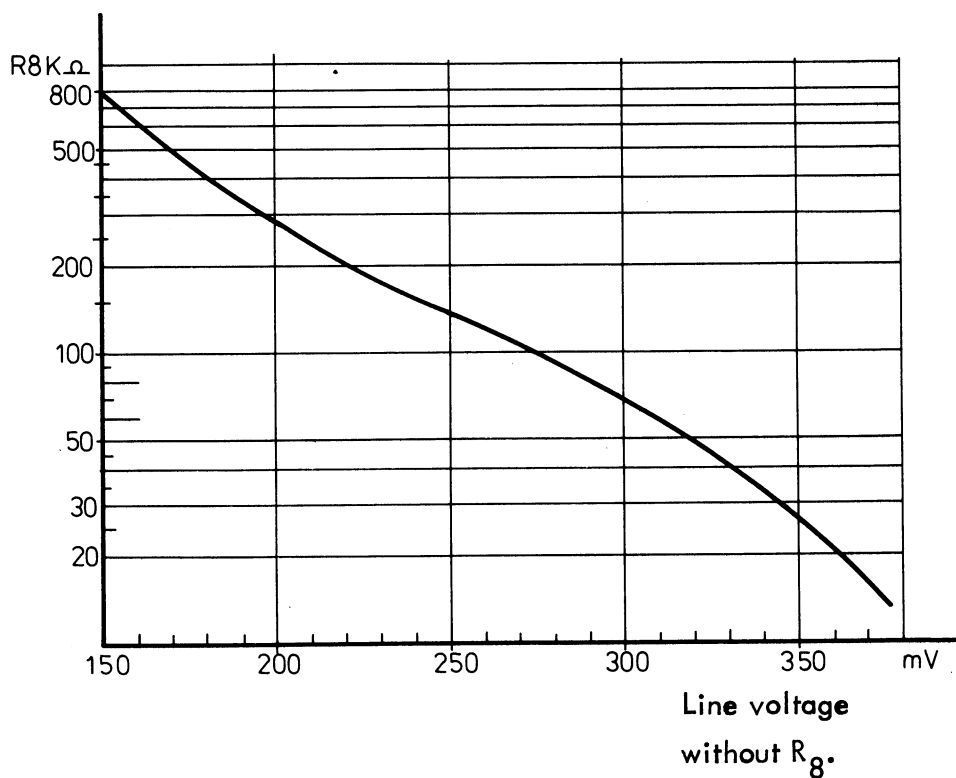
Switch the ACVM to LINE OUT.

Read the AF line voltage.

Requirement: 110mV^{+1}_{-0} dB.

If necessary change resistor value (R_8) in parallel with R_7 (IA 802, pin 5 - 6) until 110mV is obtained.

The graph indicates the value of the resistor, which should be the closest higher standard value.



10. Checking the AF frequency response and distortion.

Set the signal generator output to approx. 100 μ V e.m.f.

Set LINE OUT - LS/MICR switch down.

Turn the volume switch to the 3rd position (III).

Read the AF voltage on the ACVM (reference).

Set the modulation frequency to 300Hz.

AF voltage: +9dB \pm 2dB rel. to 1000Hz.

Set the modulation frequency to 3000Hz.

AF voltage: -10dB \pm 2dB rel. to 1000Hz.

Turn the volume switch to the 4th position (IIII).

Check the total harmonic distortion at 1000Hz.

Requirement: CQP 813s, THD \leq 7%

CQP 814s, THD \leq 8%.

11. Adjustment and checking of the squelch function.

Modulate the signal generator with 1kHz and 0.7 \times Δ f max.

Set the volume to the 4th position (IIII).

Set the SQ OUT switch up.

Increase the RF-generator output until the signal opens the squelch.

Requirement: 10 to 12dB SINAD.

Decrease the value of R5 if SINAD is less than 10dB.

Increase the value of R5 if SINAD is more than 12dB.

12. Checking the overall receiver current drain.

Set the DCVM switch to SUPPLY.

Set the supply voltage to 11V.

Disconnect the signal generator.

Read the current drain on the mA meter.

Requirement: <17mA + current drain of tone equipment.

Set the SQ OUT switch down.

Set the volume switch to the 4th position (IIII).

Read the current drain on the mA meter.

Requirement: <100mA.

13. Oscillator frequency adjustment.

Crystal oscillator XO 811 is factory adjusted for maximum output into 50Ω , and output coil L1 is not to be touched.

Set the generator to the receiver frequency using the frequency counter.

Remove the signal generator modulation and set the output level to $100 \mu\text{V}$ e.m.f.

Turn the BFO on. (On the C35 control unit).

Adjust BFO AMPLITUDE to produce a clear beat tone.

Set ACVM switch to LINE OUT.

Adjust L2 in XO 811 for zero beat as seen on the oscilloscope.

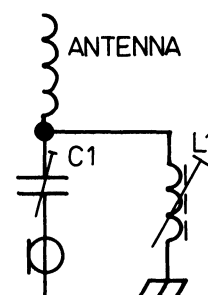
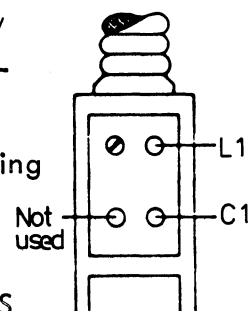
When the adjustment is completed, turn the BFO OFF.

14. Antenna Network Adjustment.

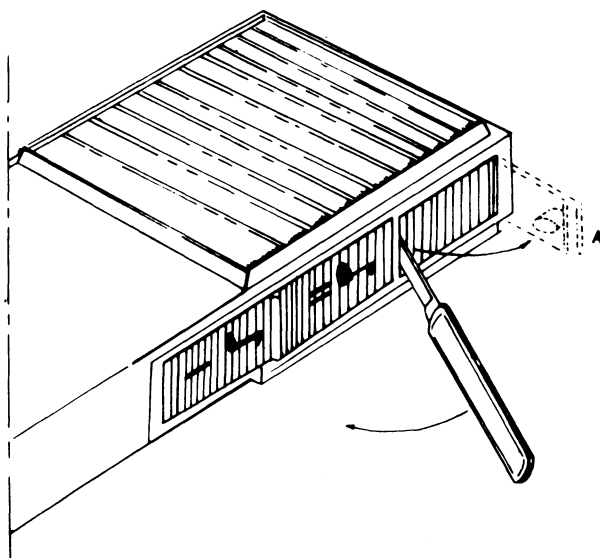
Mount cabinet and loudspeaker panel in position, and screw antenna AN 816 or AN 814 in position. Clip antenna alignment unit TS-D37 (95BO555) in remote control multiplug.

Raise cover "A" on CP808 and remove rubber gaskets giving access to the matching network. Power set by a battery and hold in normal position. Key the transmitter.

Adjust C1/L1 (begin with C1) for maximum indication on TS D37. Repeat until no further increase in indication can be obtained. This completes the antenna network adjustment. Replace gasket and snap cover "A" back into position.



AN 815 AND
AN 816
MATCHING
NETWORK.
15.0316-00



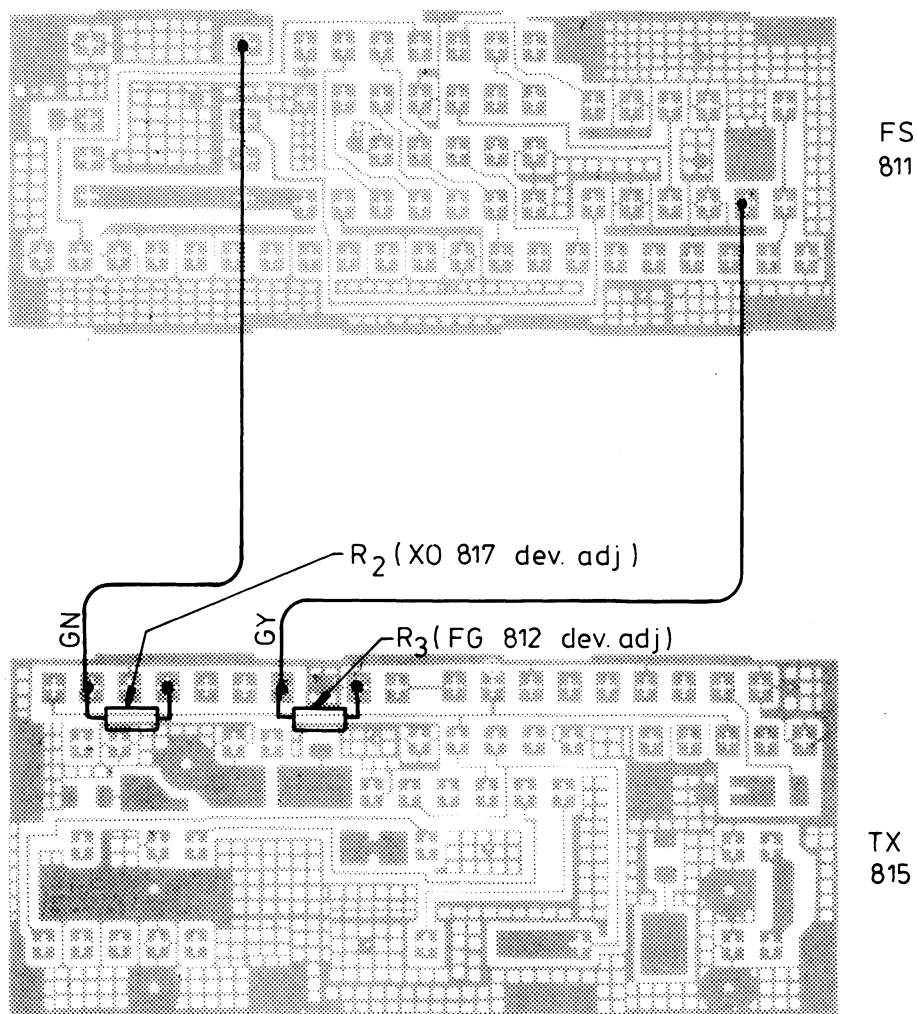
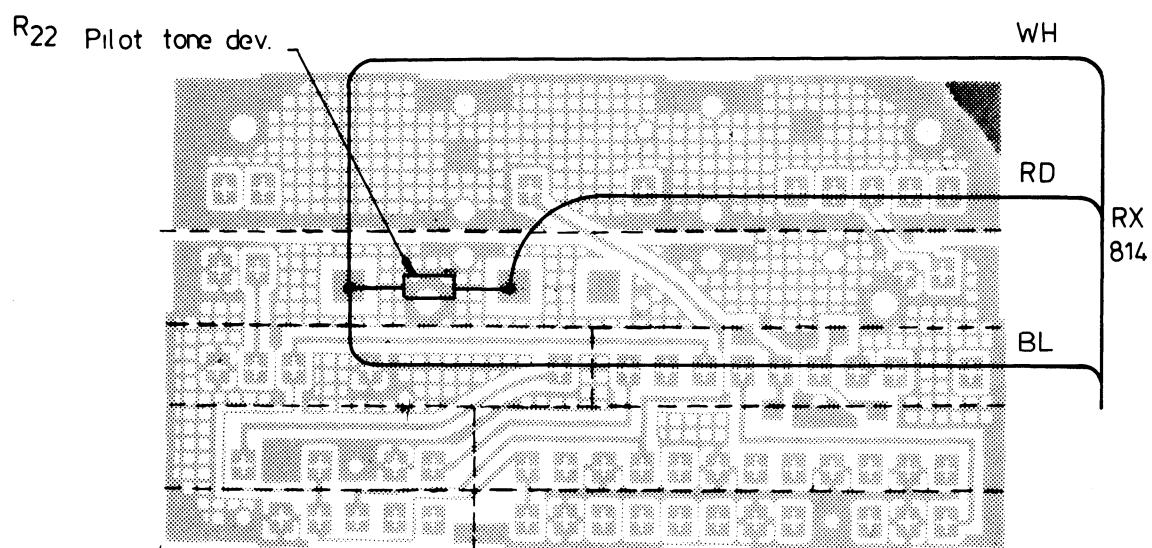
ADJ: OF SETS WITH PILOTTONE MODULATION (Met. Pol.).

Transmitter:

1. The transmitter is adjusted as described in 39.110. Select a channel with a frequency as near as possible to the center of the TX frequency range. Use a channel without pilotone.
Connect a deviation meter to the antenna connector through a damping pad. Check that R_{22} is mounted, if not mount $k\Omega$.
2. Apply the following modulation signal $f_m = 1\text{kHz}$. $U_m = 20\text{mV}$.
Connect a resistance box in place of R_3 (figure). Adjust the value of the resistance to obtain a frequency deviation of $2.2\text{kHz} \pm 0.05\text{kHz}$.
Solder a resistor, as read off the resistance box, into the circuit.
3. Insert a resistance box in place of R_2 (figure).
Set the resistance value to $47\text{ k}\Omega$.
Increase the value of the modulation signal to $U_m = 100\text{mV}$. Note the deviation obtained at $f_m = 1\text{kHz}$.
4. Decrease the modulation signal frequency. Adjust the resistance value so that the deviation obtained at $f_m = 1\text{kHz}$ is not exceeded at lower modulation frequencies. Continue down to $f_m = 100\text{Hz}$.
5. Solder a resistor, as read off the resistance box, into the circuit.
6. Disconnect the main modulation signal. Select a channel with pilotone modulation. Set the TQ801a to the tone frequency required. Check that the pilotone has a deviation of $300\text{Hz} \pm 30\text{Hz}$. If not R_{22} is increased to decrease the deviation or vice versa.
7. Check that the pilotone distortion is less than 10%, and that the frequency is within $\pm 0.5\%$ of the value desired.
8. Apply a modulation signal with a level of 20mV . Check that the frequency deviation (including pilotone) is less than 2.5 kHz for $f_m = 0.3\text{--}3\text{kHz}$.
9. Select a channel without pilotone and set the modulation frequency to 1kHz . Adjust the level to obtain a deviation of 1.55 kHz .
Measure the distortion on the demodulated signal. The value should be less than 7% (typ. less than 4%).

Receiver:

1. The orange wire from TQ801a is connected to 1A802 pin 8.
The receiver is adjusted as described in 39.110.
Except (9) adjustment of line output voltage, and (11) squelch adj.
2. Select a channel with pilot tone. Apply a signal of
1 μ V EMF modulated with 1 kHz to a deviation of 1.75 kHz.
The test signal shall also be modulated with pilot tone to a deviation
of 300 Hz. Remove the 1 kHz modulation signal and check that audio
output level falls more than 20 dB. Measured without any filter.
3. Retain the modulation from 2. and increase the level to 60 dB above
1 μ V.
Set the volume control in the max. position. The voltage across the
loudspeaker should be 2.45 V RMS. If not the resistor R_8 (in parallel with
 R_7) between 1A 802 pins 5 and 6 is changed to obtain the desired value
with a tolerance of ± 1 dB. (2.2-2.7V).
4. Adjustment of squelch SQ 801a.
The test signal shall be modulated with a frequency of 1 kHz to a
deviation of 1.75 kHz. The volume control is set to the max. posi-
tion. The level from the signal generator is adjusted so that the
squelch just opens. The SINAD should be 15 dB and the signal level
shall be more than or equal 0.5 μ V EMF. If SINAD is more than
15 dB R_5 is decreased. It should however be noted that the muting
is not allowed to open the squelch for levels less than 0.5 μ V EMF.
5. Move the orange wire from 1A 802 pin 8 to SQ 801 a pin 7. The set
shall be on a channel which has pilot tone squelch.
6. Apply a 1 μ V EMF signal modulated with a pilot tone deviation of 300 Hz
to the receiver. Check that the receiver opens for the correct pilot tone
frequency.
7. Reduce the pilot tone modulation level until the squelch closes.
The level should thereby be reduced more than or equal to 7 dB.
8. The pilot tone receiver will increase the receiver stand-by current
by typically 0.6 mA.



PROGRAMMING INSTRUCTION

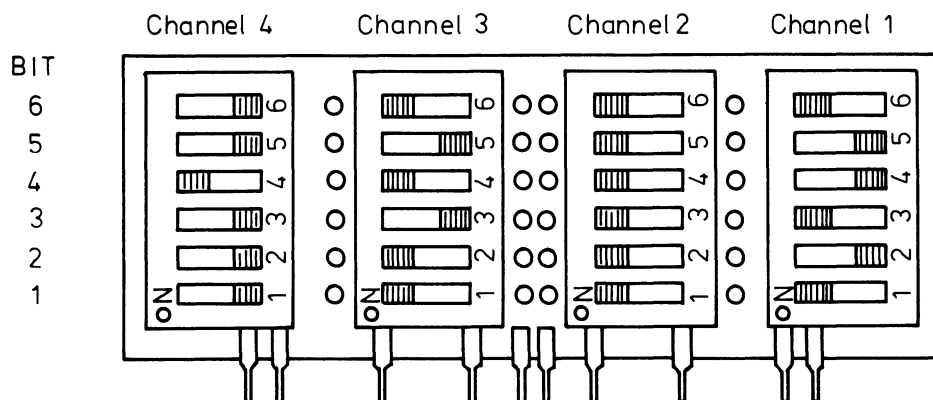
CQP814S 1(3)C18S4TQ

Contents:

1. FC 801.
2. Calculating the synthesized frequency.
3. Programming the FC 801.
4. Table of N - prog.

1. FC 801.

The frequency control unit FC 801 is intended for programming the programmable divider in PL 801. 4 channels can be selected. The FC 801 consists of 24 diodes and 4 six-pole switches - one for each channel.

2. Calculating the synthesized frequency.

The general formula for calculating the VCO frequency is:

$$f_{VCO} = f_{XO} + (N_{min.} + N_{prog}) \times f_{ref.} \quad (1)$$

where

f_{VCO} = the frequency of the VCO (FG 811 or FG 812).

f_{XO} = the frequency of the crystal oscillator (XO 811 or 817)

$N_{min.}$ = the smallest division rate in the programmable divider.

N_{prog} = the division rate set by FC 801.

$f_{ref.}$ = the reference frequency in the phase - detector. $f_{ref.} = 6.25\text{kHz}$.

Example:

CQP 814s 1C9S4TQ : Rx:

$N_{min.}$ programmed by a resistor on the motherboard.

$N_{min.} = 256$.

$f_{XO} = 124.15\text{ MHz}$.

Assume $N_{prog} = 22$ (see the actual progr. later).

$$f_{VCO} = 124.15\text{ MHz} + (256 + 22) \times 0.00625\text{ MHz} = 125.8875.$$

(To extend the example : add the IF : 21.4 MHz

and we get : 147.2875 MHz which is the base Tx frequency for ch. 32).

For a given set of: f_{XO} , f_{ref} and N_{min} the following procedure for calculating the VCO frequency and programming in transmit and receive apply:

Transmit.

The f_{VCO} is directly on the antenna frequency.

From equation (1) it follows that:

$$f_{ant} = f_{VCO} = f_{XO} + (N_{min} + N_{prog}) \times f_{ref.}$$

$$\frac{f_{VCO} - f_{XO}}{f_{ref}} - N_{min} = N_{prog} \quad (2)$$

Ex.: 800 TX freq.: 155.4250 MHz:

$$f_{XO} = 153.65 \text{ MHz.}$$

$$N_{\min} = 256.$$

$$f_{\text{ref}} = 0.00625 \text{ MHz} = 6.25 \text{ kHz.}$$

Inserted in (2) yields:

$$\underline{N_{\text{prog}}} = \frac{155.425 - 153.65}{0.00625} - 256 = \underline{28.}$$

Receive:

The f_{VCO} is on $f_{\text{ant}} - 21.4 \text{ MHz.}$

Equation (2) still holds but with a different f_{XO} , and bearing in mind that $f_{VCO} = f_{\text{ant}} - 21.4 \text{ MHz.}$

Ex.: 800 RX freq.: 147.4125.

$$f_{XO} = 124.15 \text{ MHz.}$$

N_{\min} and f_{ref} the same as above.

Equation (2) yields:

$$N_{\text{prog}} = \frac{(147.4125 - 21.4) - 124.15}{0.00625} - 256 = 42.$$

3. Programming the FC 801.

The FC 801 will in each channel program 6 bits.

The bits have the following binary weights.

| | | | | | | | |
|--------|---|---|---|---|----|----|----|
| BIT | : | 1 | 2 | 3 | 4 | 5 | 6 |
| WEIGHT | : | 2 | 4 | 8 | 16 | 32 | 64 |

N_{prog} results as the sum of programmed bit-weights. A bit is programmed if the corresponding switch is OFF.

Example.

$$N_{\text{prog}} = 42.$$

$$42 = 32 + 8 + 2.$$

On the FC 801 this would mean:

| | | | | | | | |
|--------|---|-----|----|-----|----|-----|----|
| BIT | : | 1 | 2 | 3 | 4 | 5 | 6 |
| SWITCH | : | OFF | ON | OFF | ON | OFF | ON |

$$N_{\text{prog}} = 22.$$

$$22 = 16 + 4 + 2.$$

| | | | | | | | |
|-----|---|-----|-----|----|-----|----|----|
| BIT | : | 1 | 2 | 3 | 4 | 5 | 6 |
| | | OFF | OFF | ON | OFF | ON | ON |

What happens electrical is that a switch on a selected channel when the switch is on will take the program input low and OFF will take the input high. High input will program the bit-weight.

4. Table of N - prog.

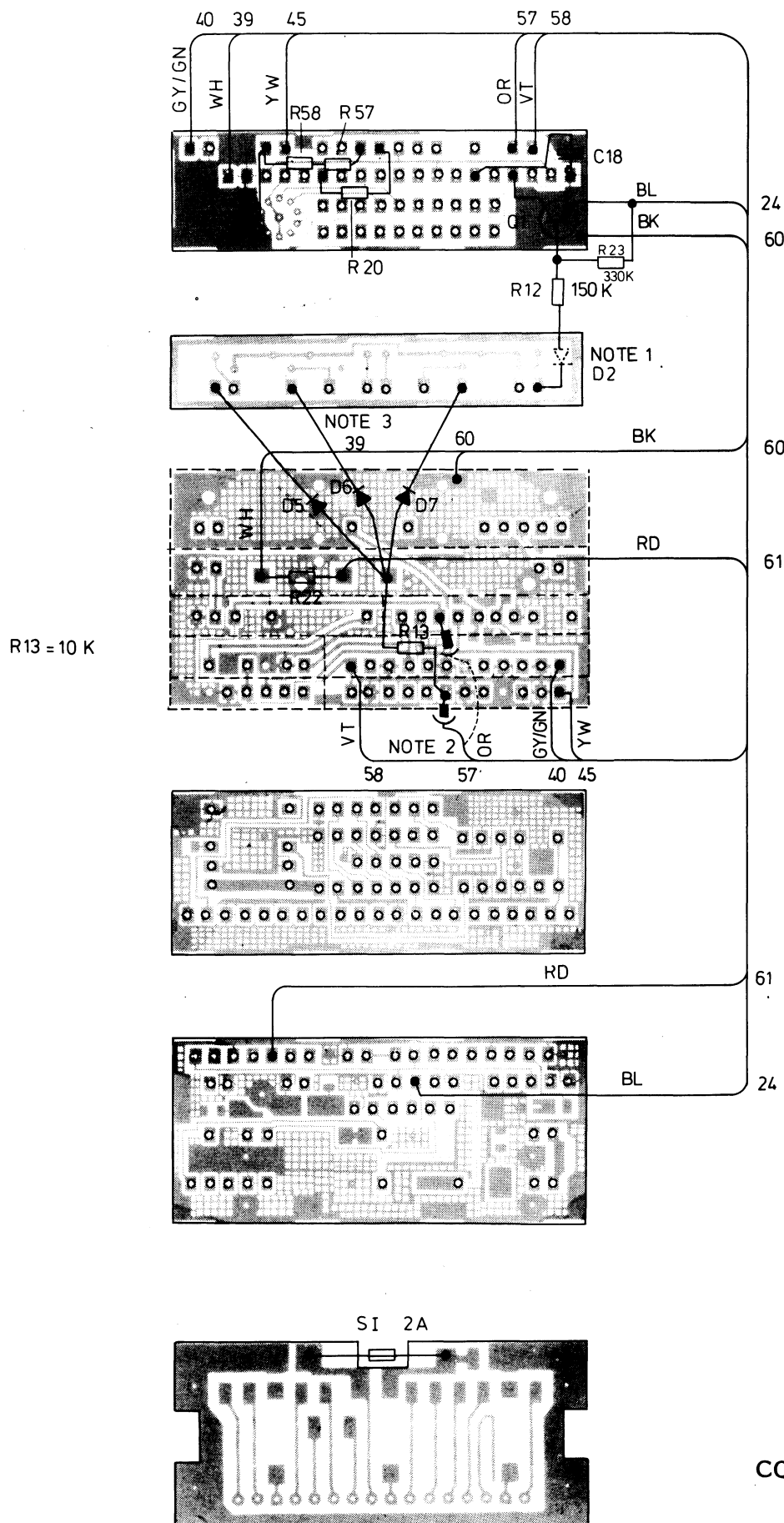
| | | | | SWITCH | | | | | |
|-------------------------|----|-----|-------------------|--------|----|-----|-----|-----|-----|
| <u>CQP 814s RX.</u> | CH | N | N_{prog} | 1 | 2 | 3 | 4 | 5 | 6 |
| 147.150 MHz | - | 256 | 0 | ON | ON | ON | ON | ON | ON |
| 147.850 " | 68 | 368 | 112 | ON | ON | ON | OFF | OFF | OFF |
| 147.900 " | - | 376 | 120 | ON | ON | OFF | OFF | OFF | OFF |
| <u>CQP 814s TX.</u> | | | | | | | | | |
| 155.250 MHz | | 256 | 0 | ON | ON | ON | ON | ON | ON |
| 155.850 " | - | 328 | 72 | ON | ON | OFF | ON | ON | OFF |
| 155.750 " | | 336 | 80 | ON | ON | ON | OFF | ON | OFF |

OFF = "1" ON = "0"

CQP 814s RX & TX.

SWITCH

| MHz | | CH | N | N _{prog} | 1 | 2 | 3 | 4 | 5 | 6 |
|----------|----------|----|-----|-------------------|---|---|---|---|---|---|
| 147.2000 | 155.3000 | 25 | 264 | 8 | 0 | 0 | 1 | 0 | 0 | 0 |
| 147.2125 | 155.3125 | 26 | 266 | 10 | 1 | 0 | 1 | 0 | 0 | 0 |
| 147.2250 | 155.3250 | 27 | 268 | 12 | 0 | 1 | 1 | 0 | 0 | 0 |
| 147.2375 | 155.3375 | 28 | 270 | 14 | 1 | 1 | 1 | 0 | 0 | 0 |
| 147.2500 | 155.3500 | 29 | 272 | 16 | 0 | 0 | 0 | 1 | 0 | 0 |
| 147.2625 | 155.3625 | 30 | 274 | 18 | 1 | 0 | 0 | 1 | 0 | 0 |
| 147.2750 | 155.3750 | 31 | 276 | 20 | 0 | 1 | 0 | 1 | 0 | 0 |
| 147.2875 | 155.3875 | 32 | 278 | 22 | 1 | 1 | 0 | 1 | 0 | 0 |
| 147.3000 | 155.4000 | 33 | 280 | 24 | 0 | 0 | 1 | 1 | 0 | 0 |
| 147.3125 | 155.4125 | 34 | 282 | 26 | 1 | 0 | 1 | 1 | 0 | 0 |
| 147.3250 | 155.4250 | 35 | 284 | 28 | 0 | 1 | 1 | 1 | 0 | 0 |
| 147.3375 | 155.4375 | 36 | 286 | 30 | 1 | 1 | 1 | 1 | 0 | 0 |
| 147.3500 | 155.4500 | 37 | 288 | 32 | 0 | 0 | 0 | 0 | 1 | 0 |
| 147.3625 | 155.4625 | 38 | 290 | 34 | 1 | 0 | 0 | 0 | 1 | 0 |
| 147.3750 | 155.4750 | 39 | 292 | 36 | 0 | 1 | 0 | 0 | 1 | 0 |
| 147.3875 | 155.4875 | 40 | 294 | 38 | 1 | 1 | 0 | 0 | 1 | 0 |
| 147.4000 | 155.5000 | 41 | 296 | 40 | 0 | 0 | 1 | 0 | 1 | 0 |
| 147.4125 | 155.5125 | 42 | 298 | 42 | 1 | 0 | 1 | 0 | 1 | 0 |
| 147.4250 | 155.5250 | 43 | 300 | 44 | 0 | 1 | 1 | 0 | 1 | 0 |
| 147.4375 | 155.5375 | 44 | 302 | 46 | 1 | 1 | 1 | 0 | 1 | 0 |
| 147.4500 | 155.5500 | 45 | 304 | 48 | 0 | 0 | 0 | 1 | 1 | 0 |
| 147.4625 | 155.5625 | 46 | 306 | 50 | 1 | 0 | 0 | 1 | 1 | 0 |
| 147.4750 | 155.5750 | 47 | 308 | 52 | 0 | 1 | 0 | 1 | 1 | 0 |
| 147.4875 | 155.5875 | 48 | 310 | 54 | 1 | 1 | 0 | 1 | 1 | 0 |
| 147.5000 | 155.6000 | 49 | 312 | 56 | 0 | 0 | 1 | 1 | 1 | 0 |
| 147.5250 | 155.6250 | | 316 | 60 | 0 | 1 | 1 | 1 | 1 | 0 |
| 147.5500 | 155.6500 | | 320 | 64 | 0 | 0 | 0 | 0 | 0 | 1 |

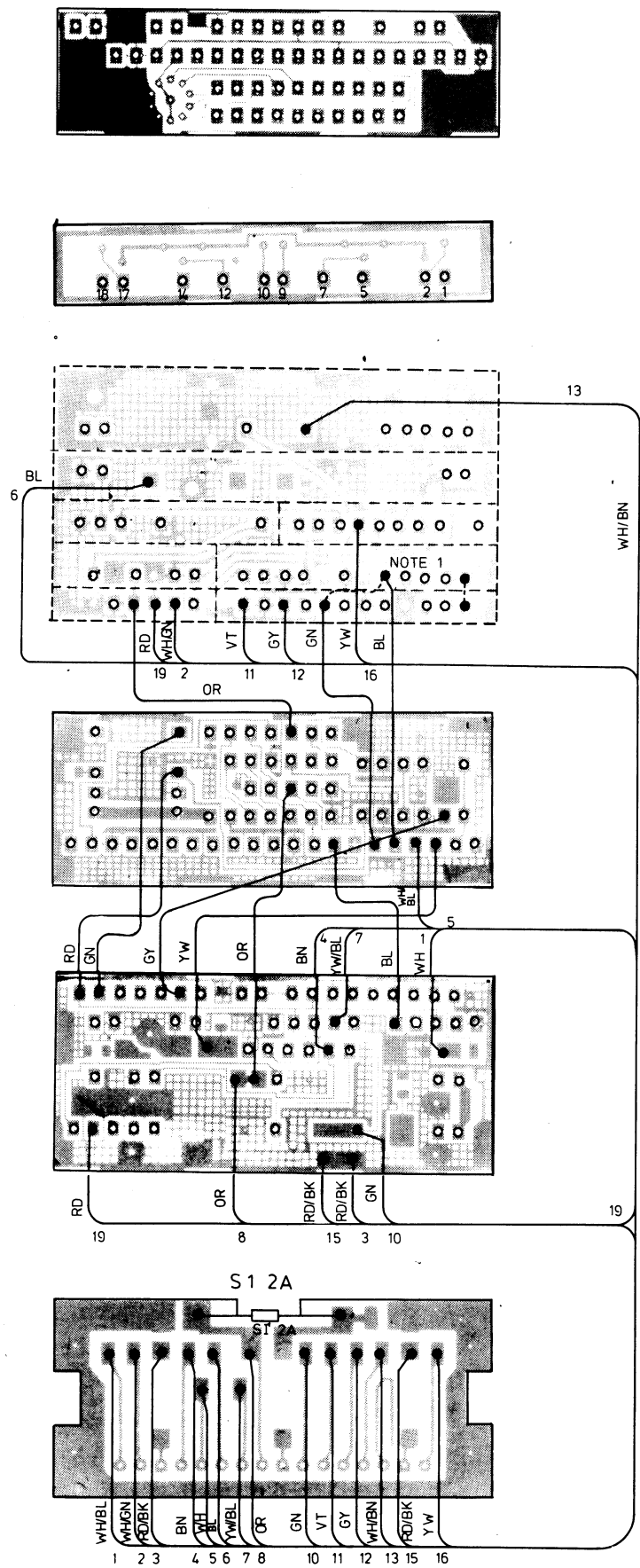


1. Diode included: one for each CH. with TX pilot tone. If only one CH. the diode can be omitted.
2. If pilot tone squelch control is not used. The orange wire is moved to IA 802 Pin 8 (7.5V RX) As shown in dotted line.
3. One diode for each channel with carrier squelch.

R22 ADJUST ON TEST.

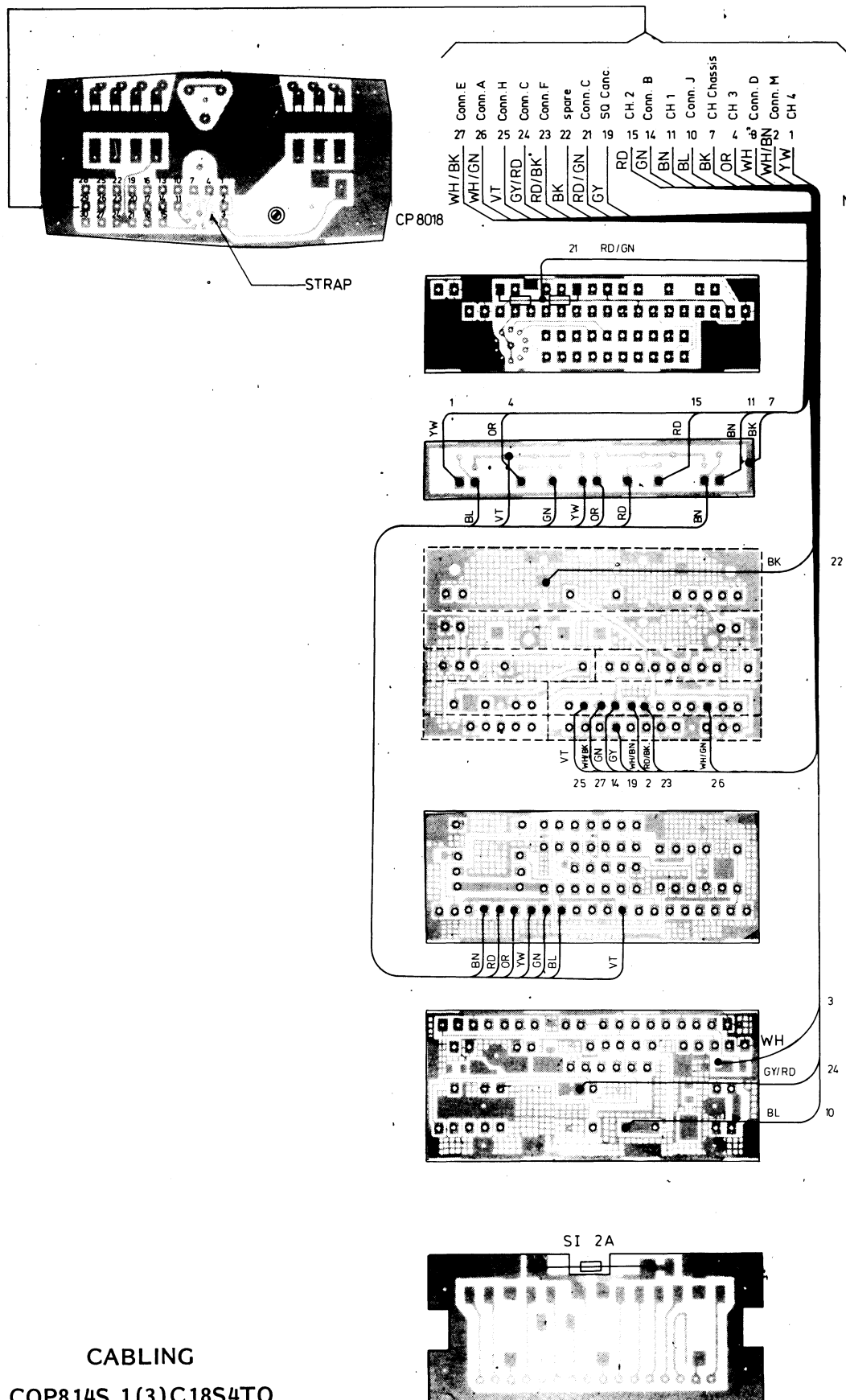
CABLING

CQP814S 1(3)C18S4TQ



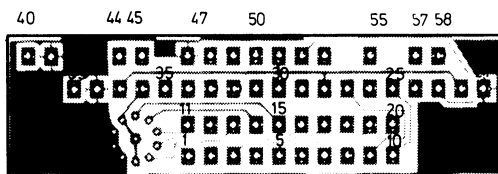
NOTE 1:
REMOVE STRAPS.

CABLING
CQP814S 1(3)C18S4TQ

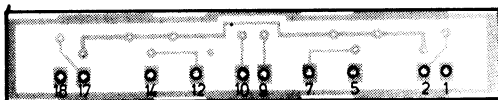


CABLING
CQP814S 1(3)C18S4TQ

T Q 801a



FC 801



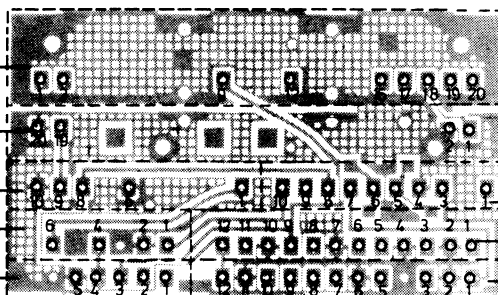
RC 811a

XF 804

IC 801

IA 801

VR 801

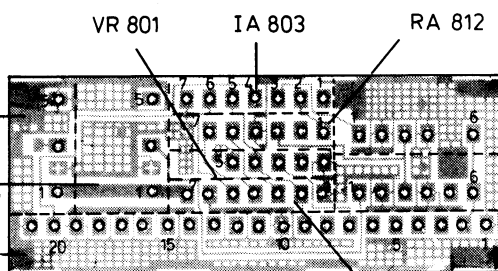


IA 802
AA 802
SQ 801a

XO 811

XO 817

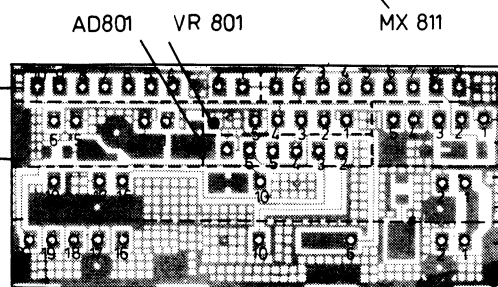
PL 801



FG 811
FG 812

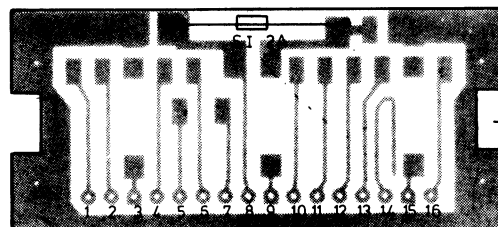
FN 807 G2

FN 811



AA 802
RA 811
PA 811a 1W
PA 813 3W
PA 812a 1W
PA 814 3W

TB 802



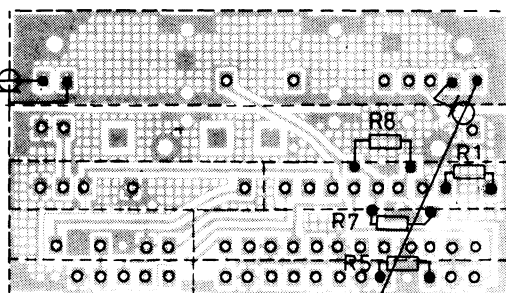
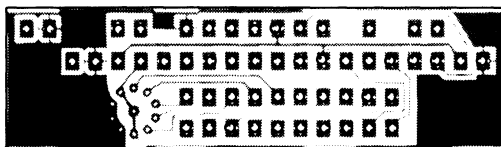
Lock Det.
RX Gate
- battery
ADC
LS
Pilot tone
TX Gate
VB Fused
+ battery
11V TX
7.5 V RX
SQ cancel
osc.inj. level
214 MHz test
- battery
-17dBm
discr.

CABLING
CQP814S 1(3)C18S4TQ

STORNO

STORNO

TO CP 809
ANTENNA SIGNAL

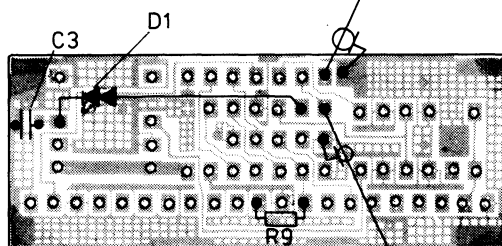


R8 ADJUST ON TEST

R1 = 27K

R7 = 470K

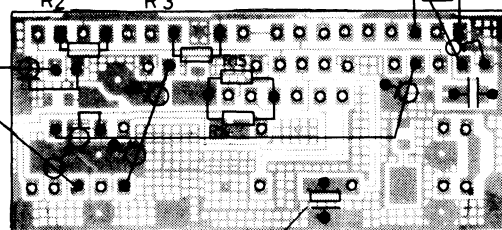
R5 ADJUST ON TEST



C3 = 470 p cer 20%

R9 = 150K

XO 817 FG 812
Dev. Dev.
ADJ ADJ
R2 R3



R2 ADJUST ON TEST

R3 ADJUST ON TEST

R4 = 15K

C4 = 15n cer 10%

R15 ADJUST ON TEST

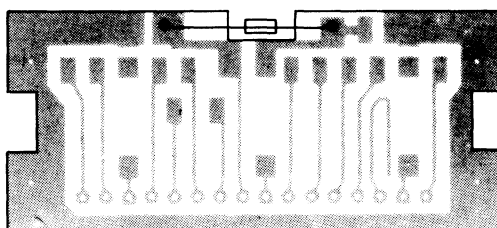
R14 = 3.9 K 1W

R14 = 3.9K 3W

C2 = 1μ TAN. 16V

C2

SI 2A



CABLING

CQP814S 1(3)C18S4TQ

LIST OF STANDARD CRYSTALS

for CQP 810Us.

Contents.

| | | |
|----|-------------------------------------|---|
| 1. | On the use of this list | 1 |
| 2. | Limitations when using FC 801 | 1 |
| 3. | The listing. Explanation of the use | 1 |
| 4. | 20 kHz Channel - spacing | 2 |

1. On the use of this list.

This list of standard crystals is issued as a means of selecting and at the same time ensuring correct use of the crystals for the synthesized equipment CQP 810Us.

The user is reminded that the two frequency-control units FC 801 and FC 802 have different capabilities and therefore have influence on the selection of crystals.

2. Limitations when using FC 801.

Certain limitations is inherent in the FC 801.

These are:

1. Limited bandwidth with 12.5 kHz spacing.
2. Limited BIT-control. (6).
3. Only 4 channels.
4. Fixed RX-TX spacing for each channel, determined by the crystals.

3. The listing. Explanation of the use.

The listing features 3 columns:

X-tal frequency. Frequency coverage 1. Frequency coverage 2.

The x-tal frequency speaks for itself.

The two frequency cover-ranges are used as follows:

Frequency coverage 1 is the preferred range.

If possible the standard crystals should be chosen from this list.

If however the frequency range is such that no single crystal from coverage 1 can cover it, one is forced to choose a crystal from frequency coverage 2.

It means at the same time that a special adjustment of the VCO-control voltage is necessary.

This is described in: 39.110 sh. 6 and sh. 9.

When selecting a crystal from the list it is an advantage to select a crystal with as high a frequency as possible because this could a lower stand-by current consumption in the synthesizer.

The crystal type for a specific country is found in "Crystal type and Calculation" 19J706583.

4. 20 kHz channel - spacing.

Standard crystals having a lower limit in freq. coverage 1 not ending on 5 kHz ex. 155.450 MHz can be used with 20 kHz chan. spacing.

In general the procedure in "crystal type and calculation" 19J706583 must be followed as no specific choice exists in 20 kHz chan. spacing sets.

1. Standard x-tals.

TX.

| X-TAL | FREQUENCY COVERAGE 1 | FREQUENCY COVERAGE 2 |
|----------|-------------------------|-------------------------|
| 47.86667 | 146.000 146.775 | |
| 48.13333 | 146.000 147.575 | |
| 48.39167 | 146.775 148.350 | 146.000 148.350 |
| 48.65833 | 147.575 149.150 | 146.775 149.150 |
| 48.91667 | 148.350 149.925 | 147.550 149.925 |
| 49.18333 | 149.150 150.725 | 148.350 150.725 |
| 49.44167 | 149.925 151.500 | 149.125 151.500 |
| 49.70833 | 150.725 152.300 | 149.925 152.300 |
| 49.96667 | 151.500 153.075 | 150.700 153.075 |
| 50.23333 | 152.300 153.875 | 151.500 153.875 |
| 50.49167 | 153.075 154.650 | 152.275 154.650 |
| 50.75883 | 153.875 155.450 | 153.075 155.450 |
| 51.01667 | 154.650 156.225 | 153.850 156.225 |
| 51.28333 | 155.450 157.025 | 154.650 157.025 |
| 51.54167 | 156.225 157.800 | 155.425 157.800 |
| 51.80833 | 157.025 158.600 | 156.225 158.600 |
| 52.06667 | 157.800 159.375 | 157.000 159.375 |
| 52.33333 | 158.600 160.175 | 157.800 160.175 |
| 52.59167 | 159.375 160.950 | 158.575 160.950 |
| 52.85833 | 160.175 161.750 | 159.375 161.750 |

1. Standard x-tals.

TX

| X-TAL | FREQUENCY COVERAGE 1 | FREQUENCY COVERAGE 2 |
|----------|-------------------------|-------------------------|
| 53.11667 | 160.950 162.525 | 160.150 162.525 |
| 53.38333 | 161.750 163.325 | 160.950 163.325 |
| 53.64167 | 162.525 164.100 | 161.725 164.100 |
| 53.90833 | 163.325 164.900 | 162.525 164.900 |
| 54.16667 | 164.100 165.675 | 163.300 165.675 |
| 54.43333 | 164.900 166.475 | 164.100 166.475 |
| 54.69167 | 165.675 167.250 | 164.875 167.250 |
| 54.95833 | 166.475 168.050 | 165.675 168.050 |
| 55.21667 | 167.250 168.825 | 166.450 168.825 |
| 55.48333 | 168.050 169.625 | 167.250 169.625 |
| 55.74167 | 168.825 170.400 | 168.025 170.400 |
| 56.00833 | 169.625 171.200 | 168.825 171.200 |
| 56.26667 | 170.400 171.975 | 169.600 171.975 |
| 56.53333 | 171.200 172.775 | 170.400 172.775 |
| 56.79167 | 171.975 173.550 | 171.175 173.550 |
| 57.05833 | 172.775 174.350 | 171.975 174.350 |
| 57.31667 | 173.550 175.125 | 172.750 175.125 |

1. Standard x-tals.

RX

| X-TAL | FREQUENCY COVERAGE 1 | FREQUENCY COVERAGE 2 |
|----------|-------------------------|-------------------------|
| 122.2000 | 146.000 146.775 | |
| 123.0000 | 146.000 147.575 | |
| 123.7750 | 146.775 148.350 | 146.000 148.350 |
| 124.5750 | 147.575 149.150 | 146.775 149.150 |
| 125.3500 | 148.350 149.925 | 147.550 149.925 |
| 126.1500 | 149.150 150.725 | 148.350 150.725 |
| 126.9250 | 149.925 151.500 | 149.125 151.500 |
| 127.7250 | 150.725 152.300 | 149.925 152.300 |
| 128.5000 | 151.500 153.075 | 150.700 153.075 |
| 129.3000 | 152.300 153.875 | 151.500 153.875 |
| 130.0750 | 153.075 154.650 | 152.275 154.650 |
| 130.8750 | 153.875 155.450 | 153.075 155.450 |
| 131.6500 | 154.650 156.225 | 153.850 156.225 |
| 132.4500 | 155.450 157.025 | 154.650 157.025 |
| 133.2250 | 156.225 157.800 | 155.425 157.800 |
| 134.0250 | 157.025 158.600 | 156.425 158.600 |
| 134.8000 | 157.800 159.375 | 157.000 159.375 |
| 135.6000 | 158.600 160.175 | 157.800 160.175 |
| 136.3750 | 159.375 160.950 | 158.575 160.950 |
| 137.175 | 160.175 161.750 | 159.375 161.750 |

1. Standard x-tals.

RX

| X-TAL | FREQUENCY COVERAGE 1 | FREQUENCY COVERAGE 2 |
|----------|-------------------------|-------------------------|
| 137.9500 | 160.950 162.525 | 160.150 162.525 |
| 138.7500 | 161.750 163.325 | 160.950 163.325 |
| 139.5250 | 162.525 164.100 | 161.725 164.100 |
| 140.3250 | 163.325 164.900 | 162.525 164.900 |
| 141.1000 | 164.100 165.675 | 163.300 165.675 |
| 141.9000 | 164.900 166.475 | 164.100 166.475 |
| 142.675 | 165.675 167.250 | 164.875 167.250 |
| 143.4750 | 166.475 168.050 | 165.675 168.050 |
| 144.2500 | 167.250 168.825 | 166.450 168.825 |
| 145.0500 | 168.050 169.625 | 167.250 169.625 |
| 145.8250 | 168.825 170.400 | 168.025 170.400 |
| 146.6250 | 169.625 171.200 | 168.825 171.200 |
| 147.4000 | 170.400 171.975 | 169.600 171.975 |
| 148.2000 | 171.200 172.775 | 170.400 172.775 |
| 148.9750 | 171.975 173.550 | 171.175 173.550 |
| 149.7750 | 172.775 174.350 | 171.975 174.350 |
| 150.5500 | 173.550 175.125 | 172.750 175.125 |

Pilot Tone Unit TQ801

The pilot tone unit contains a combined tone transmitter and tone receiver for the Stornophone 800 radiotelephone.

The unit consists of a chassis with a motherboard for four subassemblies.

When used as a pilot tone transmitter, the unit generates a low frequency signal for modulation of the transmitter.

Used as a pilot tone receiver the unit, when receiving a pilot tone modulated RF carrier, provide a logic control signal for the squelch circuit.

A 5-position switch on the motherboard is set to one of the 5 frequencies to which the unit has been adjusted. The 5 frequencies are to be selected from a series of 8 in the frequency range 71.9 Hz to 136 Hz. The receiving frequency and the generated frequency are identical.

Circuit Description

Pilot tone receiving mode.

A third order active filter suppresses the speech modulation contents of the input signal. The pilot tone modulation is applied to a limiter stage ensuring a constant drive for the band pass selection circuit. This circuit, which is a second order active filter of the state variable type, determines the tone to which the receiver responds. The selected signal is applied to a detector followed by a DC amplifier. The TQ signal output will assume a low state output ($\sim 0V$), when a tone of the correct frequency is received.

A third order high pass filter suppresses the tone modulation before the speech modulation is applied to the terminal connecting to the AF output amplifier.

Pilot tone transmitting mode.

When keying the transmitter, battery voltage is applied to the transmitter key terminal (24) on the TQ801. The voltage turns diode E7 on thereby opening a regenerative feed-back loop. The charging of C13 injects a pulse into the circuit ensuring a rapid start of oscillations. The generated signal is applied to the pilot tone terminal (39).

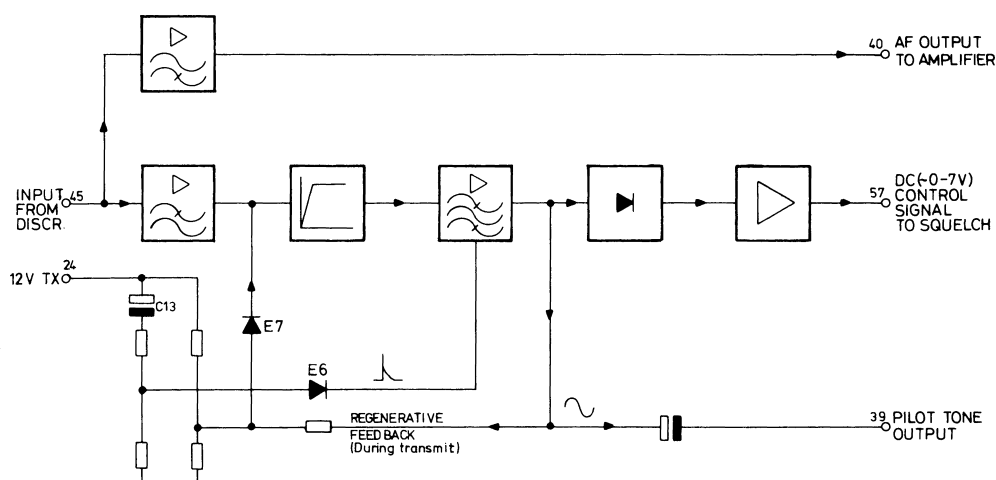
Regarding the mechanical construction the unit is divided into three thick film circuits and one printed circuit, all with plug-in pins for a common motherboard. Thick film circuit 14.0043 contains the low pass and the high pass filters, the limiter and the detector.

Thick film circuit 14.0047 and 14.0049 together with the printed circuit 15.0139 composes the band pass filter.

In order to achieve a frequency tolerance of 0.05% the series resistors R34 - R38 placed on thick film 14.0049 is adjusted during an operational test.

The frequency determining part of TQ801 is sub-assembly 15.0139 consisting of an epoxy glass fibre printed circuit on which six metal film resistors, 2 polystyrene capacitors and ten pins are mounted.

The five frequencies are to be selected from the series below and the corresponding resistor values are given.



| Frequency Hz | period μ sec. | Code no | Description |
|-----------------|----------------------|-------------|-------------------------------------|
| 71.9 | 13908.2 | 89. 5044-00 | 191 k Ω 1% metalfilm 0.25 W |
| 82.5 | 12121.2 | 89. 5041-00 | 143 k Ω 1% metalfilm 0.25 W |
| 94.8 | 10548.5 | 89. 5040-00 | 105 k Ω 1% metalfilm 0.25 W |
| 103.5 | 9661.8 | 89. 5039-00 | 93.1 k Ω 1% metalfilm 0.25 W |
| 110.9 | 9017.1 | 89. 5038-00 | 80.6 k Ω 1% metalfilm 0.25 W |
| 118.8 | 8417.5 | 89. 5037-00 | 71.5 k Ω 1% metalfilm 0.25 W |
| 127.3 | 7855.4 | 89. 5049-00 | 61.9 k Ω 1% metalfilm 0.25 W |
| 136.5 | 7326.0 | 89. 5067-00 | 53.6 k Ω 1% metalfilm 0.25 W |

Normally R27 will have the higher value and the following resistors decreasing values to R31 as the lower.

Technical Specifications

General

Tone frequencies (EIA - RS220)

71.9Hz, 82,5Hz, 94,8Hz, 103,5Hz, 110,9Hz, 118,8Hz, 127,3Hz, and 136,5Hz.

Adjustment tolerance

$$\frac{\Delta f}{f_0} = 0.05\%$$

Frequency stability

0.5%

Temperature range

-25^oC - +60^oC.

Polarity

Negative chassis

Dimensions

56.4mm x 14.3mm x 25.8mm

Tone transmitter

Supply voltage

9,6V - 15V

Current drain

2 mA

Activating signal

Positive

Output impedance

600 Ω ; AC or DC coupling

Load

≥ 1 k Ω

Output level

2.2V \pm 1 dB ($R_L = 10$ k Ω)

Distortion

0.1%

Response time

5 ms.

Tone Receiver

Supply voltage

a: 9.6V - 15V

b: 7.5V stabilized

Current drain

0.6 mA

Activating signal

Continuous tone input

Selectivity

The tone receiver will react with certainty within a bandwidth of $\pm 1\%$, but not to the adjacent tone.

Signal to noise sensitivity

2 dB

Response time

100 ms

Activating input level

15.7 mV \pm 6 dB

Generator impedance of input signal

≤ 3 k Ω

Input impedance

30 k Ω

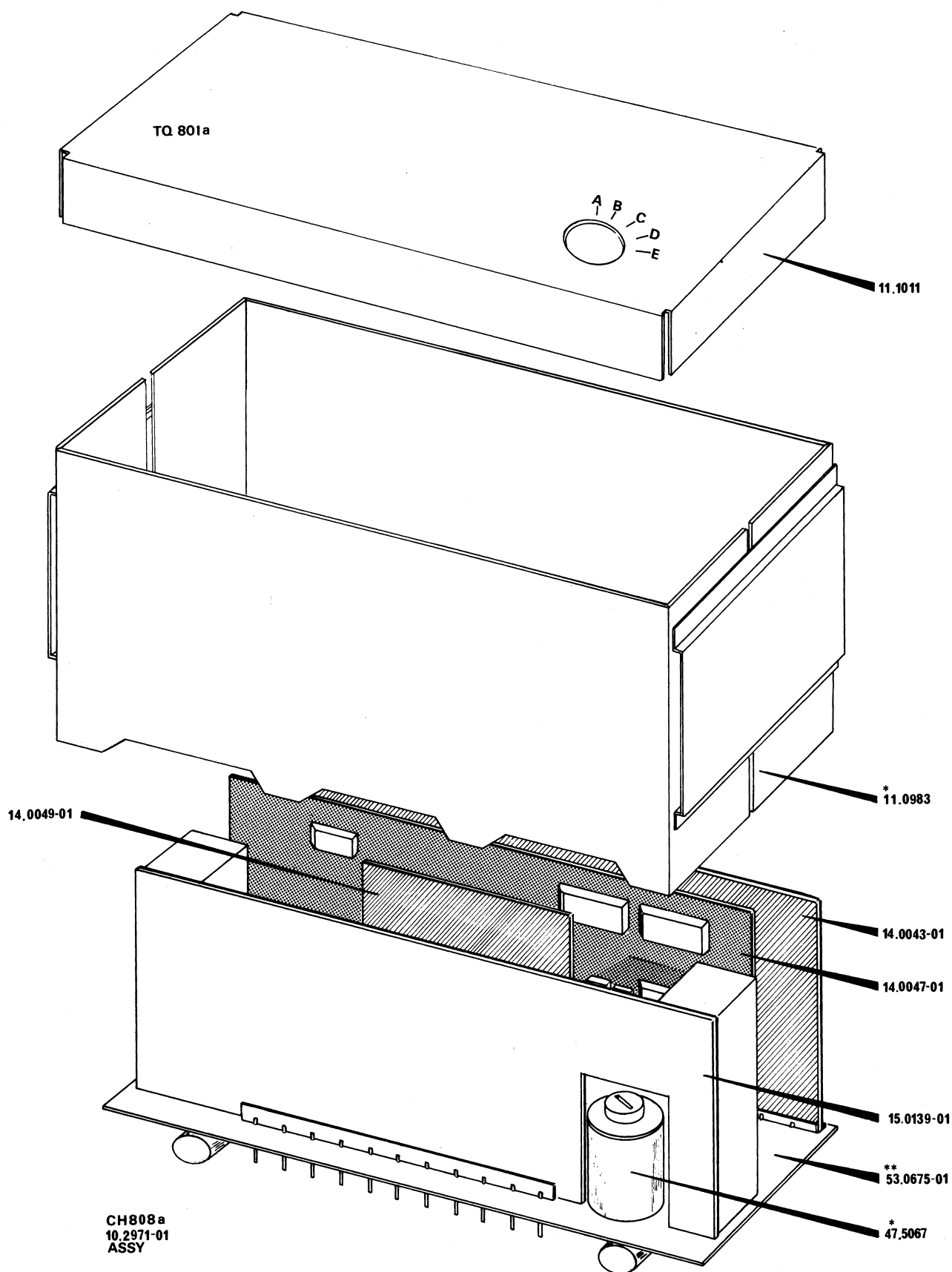
Input frequency response

Flat; linear

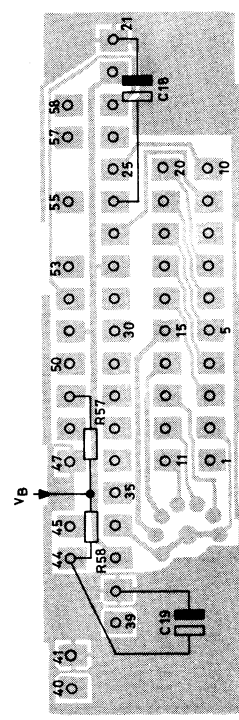
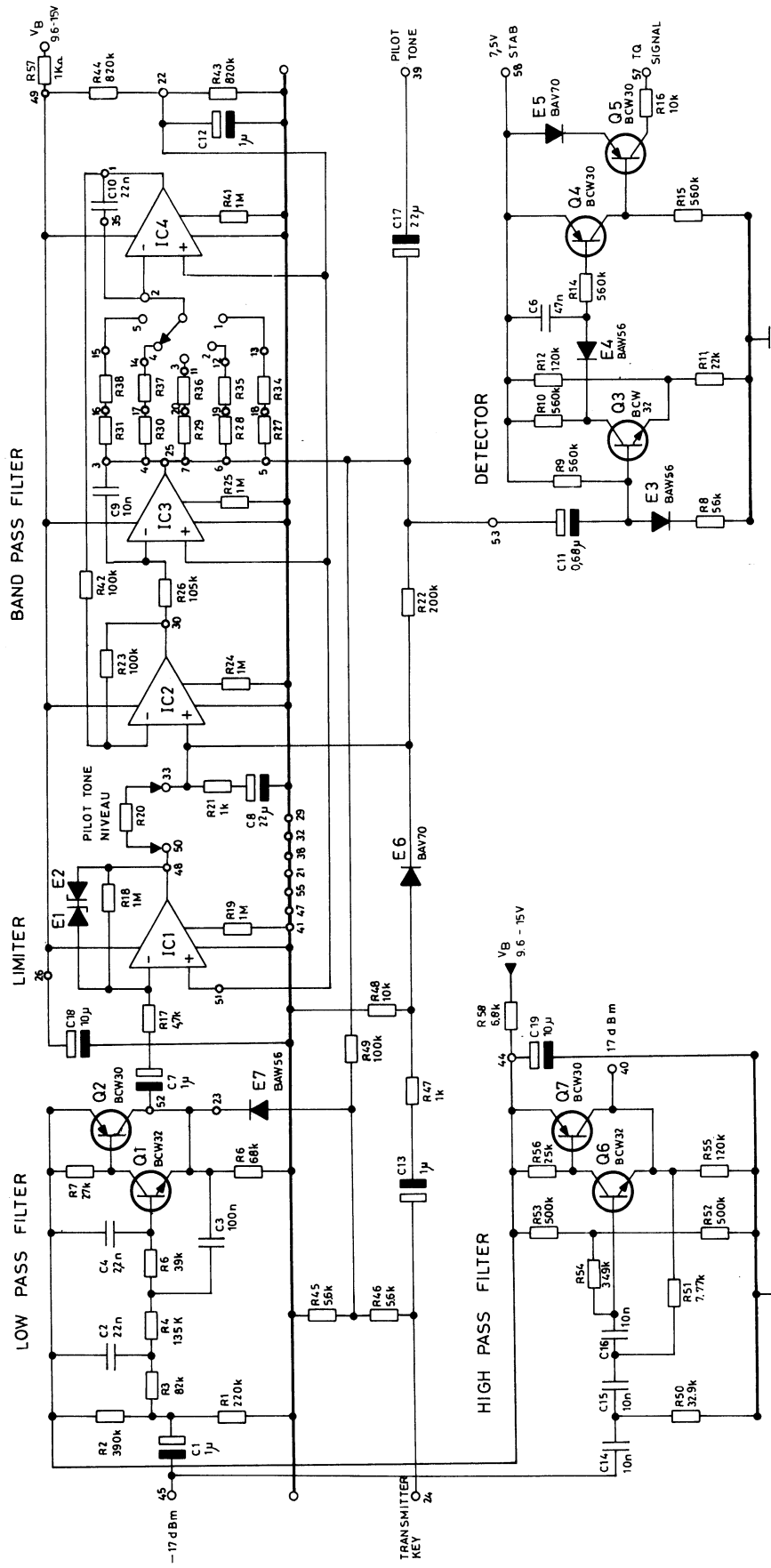
Output level

Not activated: 7 V; Internal resistance 10 k Ω

Activated: Disconnection; Internal resistance ≥ 10 k Ω



PILOT TONE UNIT TQ801a
Mechanical Lay-out



PILOT TONE UNIT TQ801a

D401.804/2

Storno

| TYPE | Nº | CODE | DATA |
|------|----|------|------|
| | | | |
| | | | |
| | | | |

X402.262

OPERATING INSTRUCTIONS CQP814S1(3) C18 S4TQ

The remote controlled radiotelephone is fitted with control head CP809 and control unit CB811. The following control functions are incorporated:

CP809

4-position channel selector with screw-driver setting. Push button for squelch cancelling.

Multiwire socket for CB811.

Auxillary BNC antenna connector.

CB811

3-position volume control.

Push button for keying the transmitter.

Loudspeaker/microphone.

Receiving

Set the channel selector to the channel to be used. Any communication on that channel will now be heard from the loudspeaker.

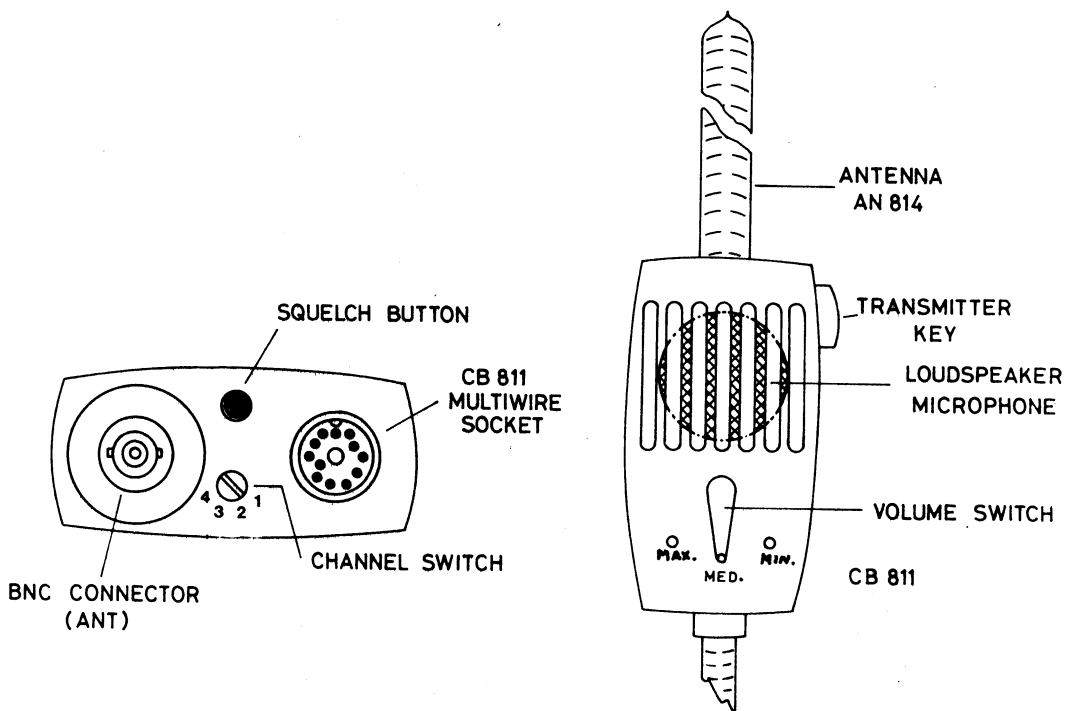
If no signal can be heard, the volume control can be set by pressing the SQ cancelling button while adjusting the volume control for the desired sound level using the background noise for sound.

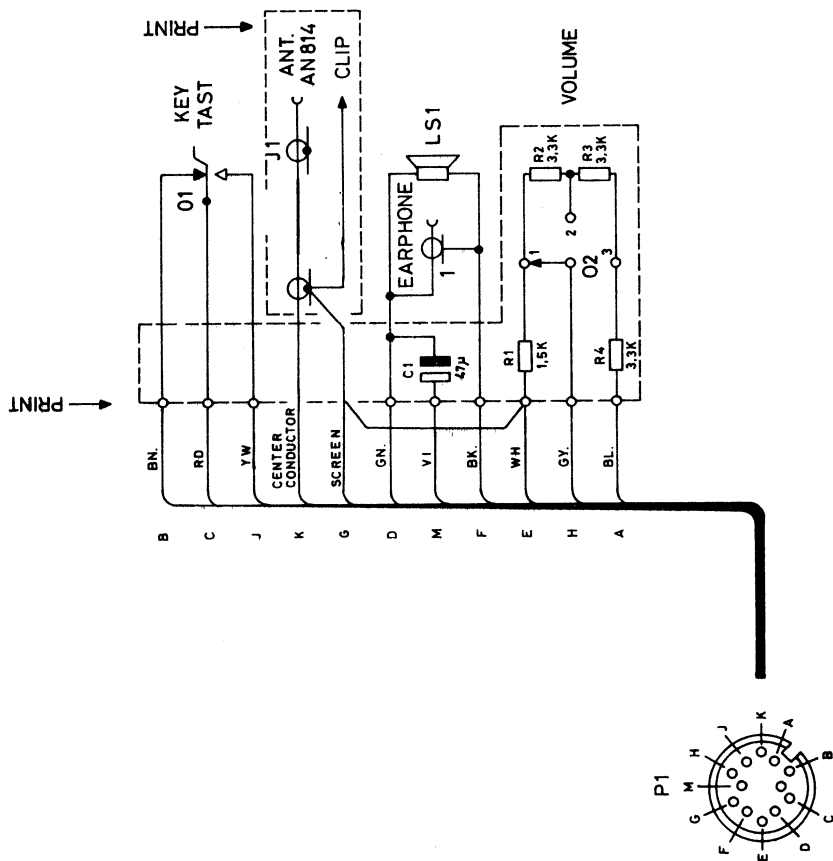
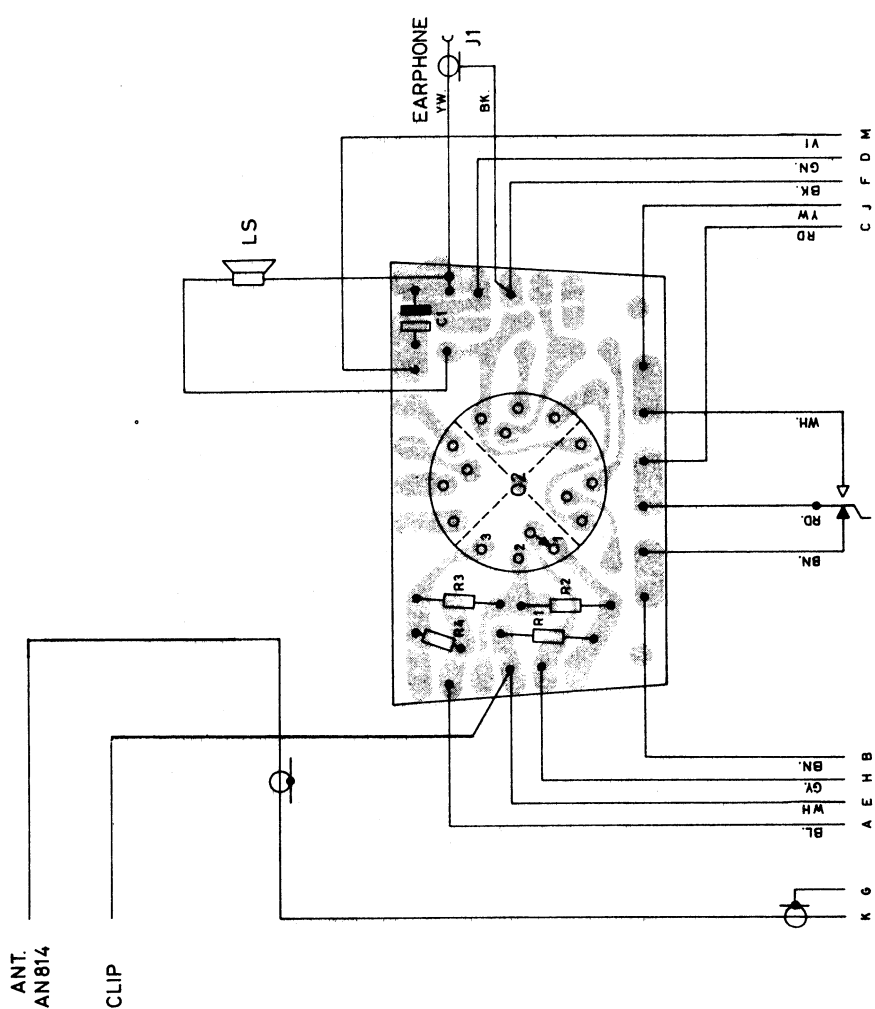
Transmitting

When the channel is clear, press the transmitter key button and speak with a normal voice into the loudspeaker. Release the transmitter key to listen.

On/Off

The radiotelephone has no on/off switch. When no longer in use switch off by removing the battery.





CONTROL UNIT CB 811

D402.169/5
C1854

Storno

| TYPE | Nº | CODE | DATA |
|-------|----|-------------|----------------------------|
| CB811 | | 10. 3245-00 | Control Unit |
| | C1 | 73. 5149 | 47 µF 20% tantal 16V |
| | R1 | 80. 5051 | 1.5 KΩ 5% carbon film 0.1W |
| | R2 | 80. 5052 | 1.8 KΩ 5% " " 0.1W |
| | R3 | 80. 5055 | 3.3 KΩ 5% " " 0.1W |
| | R4 | 80. 5059 | 6.8 KΩ 5% " " 0.1W |
| | O1 | 47. 0621 | Switch; key |
| | O2 | 47. 5072 | Switch; volume |
| | J1 | 41. 5160 | Connector |
| | P1 | 41. 0157 | Connector |
| | LS | 96. 5086 | Microphone |

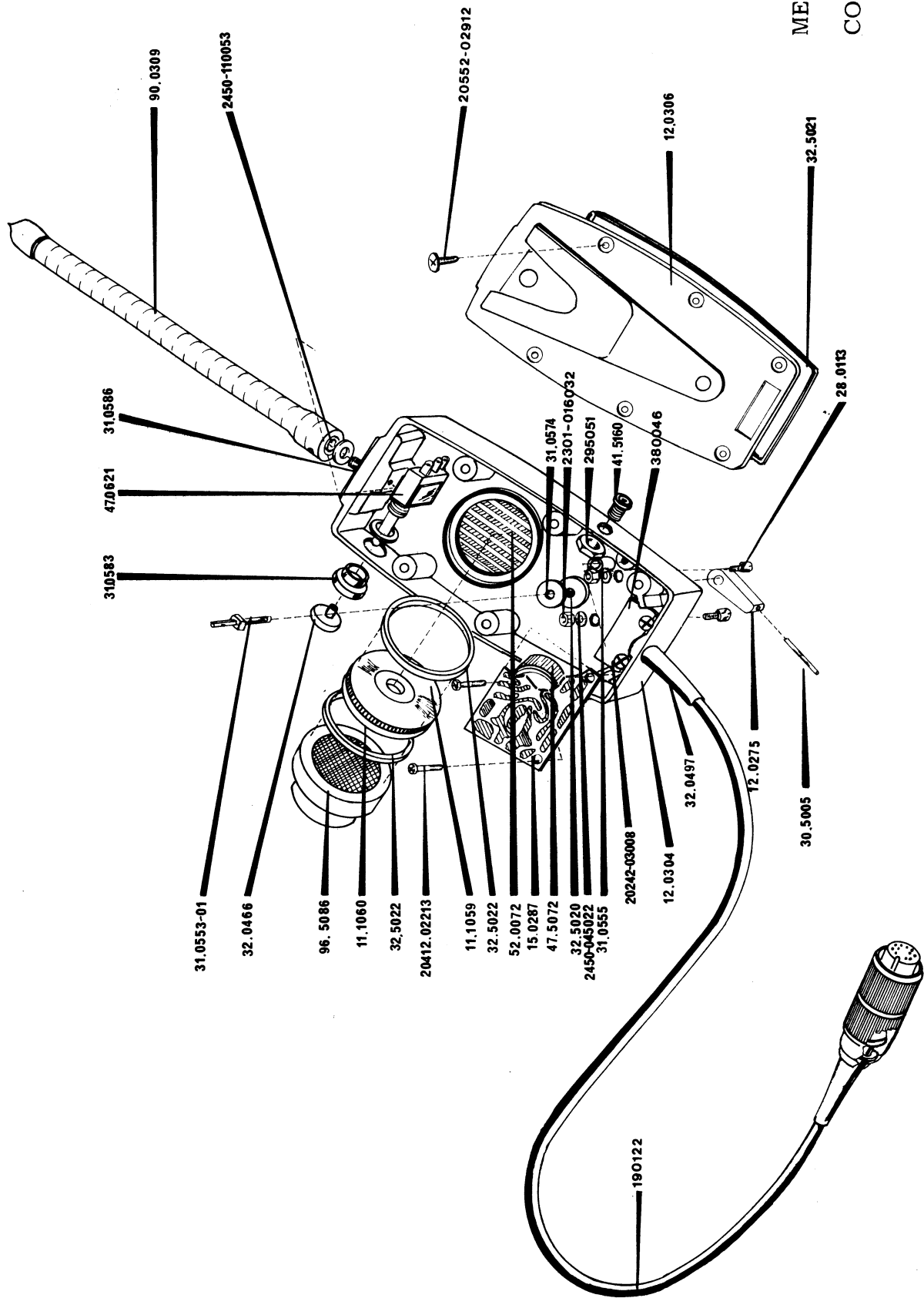
Storno

| TYPE | Nº | CODE | DATA |
|------|----|------|------|
| | | | |

CONTROL UNIT CB811

X402. 260/2

C1854



MECHANICAL LAY-OUT

CONTROL UNIT CB811

14/05.06614

C18 S4

