TRAINING MANUAL

MOTOROLA

Storno

MCR4500-XL

STORNO 440

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MCR4500-XL/STORNO 440
CELLULAR RADIOTELEPHONE
MOBILE/PORTABLE
TRAINING MANUAL

RADIO UNIT PRM6332D15N

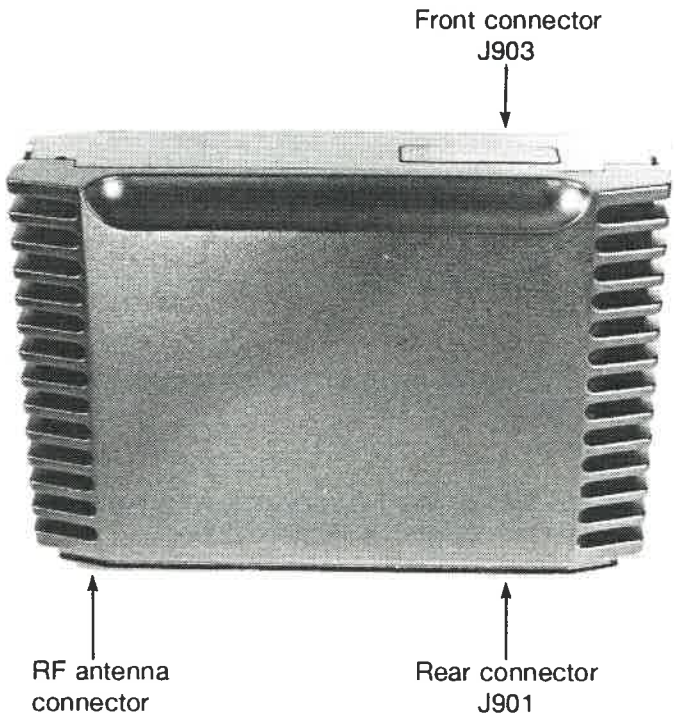
GENERAL DESCRIPTION

APPLICATIONS

The radio unit PRM3662D15 is a DIN-size radiotelephone.
It can be used in a mobile version (remote control) and a transportable version (local control).

In the mobile version, the radio unit is mounted in a cassette. Via the rear connector and a control cable the radio unit is connected to the handset, placed in a hangup cup, a loudspeaker and a VSP microphone. The radio is also supplied through the control cable.

The conversion from mobile to transportable version has to be done by the factory or a service shop. The transportable version consists of a radio unit with carrying handle, a retainer for the handset, the handset, an antenna and a battery.



External Connectors on the Radio Unit PRM3662D15N

MECHANICAL DESCRIPTION

The radio package is constructed with a magnesium casting H-frame and top and sheet metal bottom cover.
The RF-board is mounted to the bottom half of the center shelf, with captives screws. 2 pcs. MCX-connectors on the RF-board go through the H-frame to the duplex filter (RX- and TX-connections). The duplex filter is mounted on the CL-side with M3 screws.

In the H-frame there are 3 walls, which are placed in slots in the PCB for the purpose of RF-shielding between the RX, FS and TX parts of the radio. The RF-section and CL-section are shielded from each other by the H-frame. In addition to this, the RF-section is shielded by a small cover besides the weather protection cover.

The electrical connections between the two sections are made by a feed-through connector, block decoupling all connections, and one feed-through connector for power to the PA-stage.

ELECTRICAL DESCRIPTION

Two PCB's, an RF-board and a CL-board, together constitute the radio unit. The RF-board contains the synthesizer, transmitter and receiver. Audio circuitry, power supplies, modem and logic circuitry are placed on the CL-board.

The duplexer is made as a notch/bandpass filter with four resonators in the RX-branch and three in the TX-branch.
The duplexer is placed on the CL-side of the radio, and connection to the RX/TX-part is made by MCX-connectors. The connection to the antenna connector is also made by an MCX-connector.

The RF3662-board and the CL3001-board of the PRM3662D15 radio unit are described in each their chapters.

The control handset is equally described in a separate chapter.

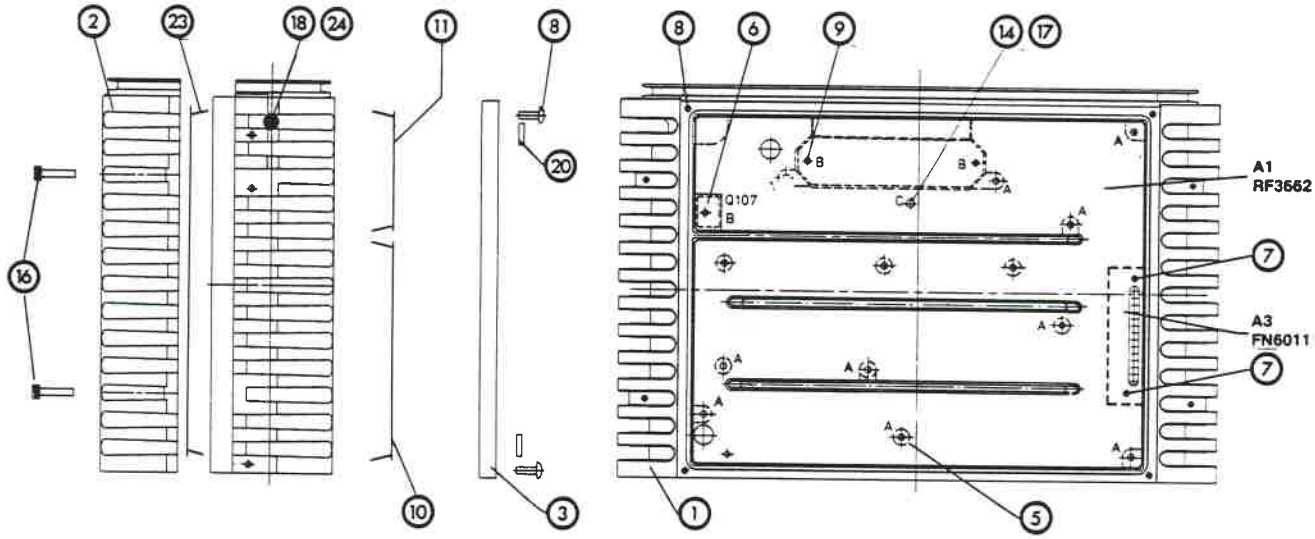
CONNECTORS

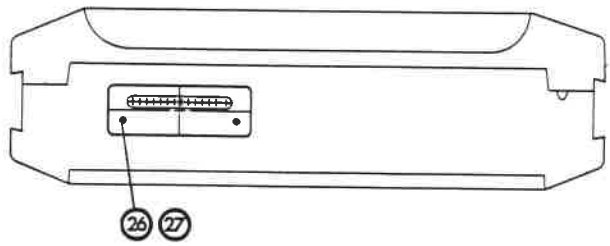
There are two externally accessible connectors on the radio unit:

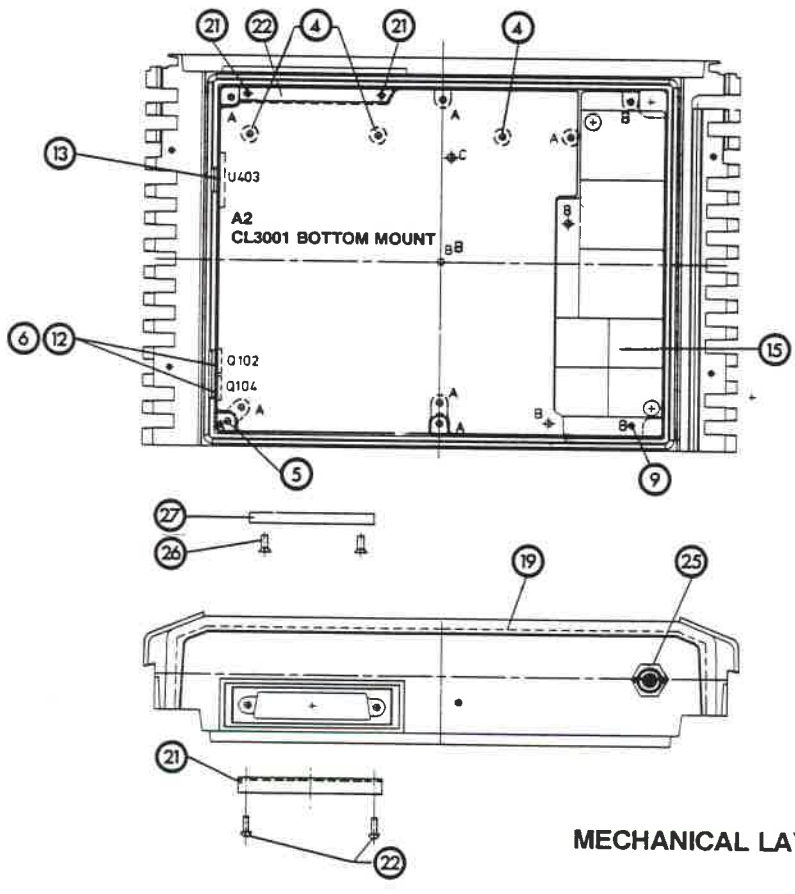
- rear connector J901
- front connector J903

Rear Connector:
The rear connector is the main interface point for external devices. It is a standard sub-D type 25 position male connector with built-in capacitor.

Front Connector:
The front connector serves as interface to different types of control boxes in a local control installation. It is a 13 position, 0.64 mm square pin, female connector.







MECHANICAL LAYOUT & PART NUMBERS
FOR PRT/PRM3662D15

M405.618

ORDERING CODES

STORNO 440

M906661G1 STORNO 440 CCITT MOBILE VERSION

M906648G2	PRM3662D15 MOBILE ASM.
SCN2098A	STORNO 440 HANDSET WITH CCITT KEYPAD
TMN6162B	HANDSFREE MICROPHONE
SSN4002A	LOUDSPEAKER
TRN5095A	HANG-UP CUP
M906649P1	CABLE KIT CC3001
M906646P1	MOUNTING TRAY MN6014
J711238P1	LOGO LABEL
J711239P1	NAME PLATE
J711179P1	WARRANTY CARD
J711316P1	USER MANUAL
J711469P1	MARKING INSTRUCTION
J711456P1	INSTALLATION INSTRUCTION

M906660G1 STORNO 440 CCITT PORTABLE VERSION

L856112G1	FILTER NETWORK FN6012
M906648G1	PRT3662D15 PORTABLE ASM.
SCN2098A	STORNO 440 HANDSET WITH CCITT KEYPAD
M906681P1	TERMINAL BOARD TB6001
M906642G1	MK3001
J709953P1	ANTENNA AN6667 440-470 MHz
L856195G1	BATTERY BU6004 ASM W. LABEL
J711238P1	LOGO LABEL
J711239P1	NAME PLATE
M906597P1	ANTENNA CONNECTOR
A700035P304	2 PCS. FLAT HD. SCREWS M-2.5 x 4.0
J711469P1	MARKING INSTRUCTION
J711179P1	WARRANTY CARD
J711316P1	USER MANUAL
A700036P306	2 PCS. PAN HD. SCREWS M-2.5 x 6.0
03S02019U02	4 PCS. FLAT HD. SCREWS M-3.0 x 12.0
L856239P1	HOOK
M906684P5	HANDLE ASM
K806035P1	CASKET CONNECTOR

ORDERING CODES

MCR4500-XL

M906661G2 MCR4500-XL CCITT MOBILE VERSION

M906648G2	PRM3662D15 MOBILE ASM.
SCN2116A	MCR4500-XL HANDSET WITH CCITT KEYPAD
TMN6162B	HANDSFREE MICROPHONE
SSN4002A	LOUDSPEAKER
TRN5095A	HANG-UP CUP
M906649P1	CABLE KIT CC3001
M906646P1	MOUNTING TRAY MN6014
J711238P2	LOGO LABEL
J711239P1	NAME PLATE
68P84826D83	WARRANTY CARD
J711316P2	USER MANUAL
J711469P1	MARKING INSTRUCTION
J711456P1	INSTALLATION INSTRUCTION

M906660G2 MCR4500-XL CCITT PORTABLE VERSION

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03S02019U02	4 PCS FLAT HEAD SCREWS M-3.0 x 12.0
L856239P1	HOOK
L856184P5	HANDLE ASM
K806035P1	GASKET CONNECTOR

PRM3662D15

TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Frequency range
Transmitter: 453.000 - 457.500 MHz
Receiver: 463.000 - 467.500 MHz

Channel spacing
25.0 kHz

Number of channels
180

Frequency stability
±2.5 kHz

Temperature range
-25°C to +55°C

Antenna impedance
50 Ohm

Mechanical dimensions
D x W x H: 139 mm x 218 mm x 65 mm

Weight
1.7 kg

Autonomous time out
30 s

TRANSMITTER SPECIFICATIONS

Carrier power (W)
15.0 ±1.5 dB

Carrier power control
-10 dB, -20 dB

Carrier rise/decay time
<16 ms

Channel switching time
<20 ms

Conducted spurious 100 kHz - 2 GHz
<-36 dBm

Radiated spurious 30 MHz - 2 GHz
<-26 dBm

Maximum frequency deviation
≤ ±4.7 kHz

FFSK mean frequency deviation
±3.5 kHz to ±0.5 kHz

Adjacent channel power ±25 kHz
>-70 dBc

Audio frequency response
6 dB/oct preemph.

300 Hz	-13.5,	-9.6 dB
500 Hz	-9.0,	-5.0 dB
1000 Hz	0 dB	
3000 Hz	+6.5,	+10.5 dB
3400 Hz	+3.0,	+11.5 dB

AF distortion
<5%

AF intermodulation
<-20 dB

Hum and noise, phoph.
<-40 dB

Stability
6:1

RECEIVER SPECIFICATIONS

RX detection and switching time
<20 ms

Sensitivity, 20 dB psoph.
< 1 uV EMF

Co-channel rejection
0-8 dB

Selectivity ±25 kHz
>70 dB

Spurious rejection
>70 dB

Intermodulation
>67 dB

Blocking
>90 dB/uV

Conducted spurious 100 kHz - 2 GHz
<-57 dBm

Radiated spurious 30 MHz - 2 GHz
<-57 dBm

AF maximum output power at 4 Ohm
5 W

Volume control range
30 dB

AF distortion
<5%

AF intermodulation
<-20 dB

AM suppression
>30 dB

Hum and noise, phoph.
<-40 dB

AF frequency response
6 dB/oct deemph.

300 Hz	+11.5,	+7.5 dB
1000 Hz	0 dB	
3000 Hz	-9.5,	-13.5 dB
3400 Hz	-9.5,	-17.0 dB

Audio muting
>40 dB

RSSI
level 0 at -2 dBuV (EMF): <1 V
level 1 at 10 dBuV (EMF): 1 to 3 V
level 2 at 20 dBuV (EMF): >3 V

POWER SUPPLY

Battery voltage
10.8 - 15.6 V

Current consumption

Off:	<1 mA
Standby:	<250 mA
TX on (15 W):	<6000 mA

CHAPTER
CHAPITRE
KAPITEL

2

PRM3662D15

TEST AND ALIGNMENT PROCEDURE

The Test and Alignment procedure must be done in service mode. To enter service mode connect J901-19 (MAN. TEST) to ground and press the '* '-key for at least 2 seconds.

When you enter a service mode command the display will show a location number and a HEX register. To adjust the various registres it is necessary to know the following key-functions:

- to make advance to the next location: use the '* '-key.
- to store the contents of a newly programmed register: toggle the '* '-key until you are out of the command in question.
- to increment or decrement the contents of a sudden register: use either the 'VOLUME'-key or the 'SHIFT'-key.
- to program a register directly with a HEX-value: use the 'HOOK-SWITCH'-key which transforms following digits (0-5) into HEX (A-F).
- to reset the contents of a newly programmed register to the previously stored value: use the 'HF'-key.

The test and alignment procedure must, for each item, be done in default setting (command 04 #), and in the order described in the following.

Be aware of the fact, that 66 # location 00 and 01 must be set to FF, and that, in default setting, the TX-power is 15 W.

2. LO

1. Connect the frequency counter to TP 3.
   Read the frequency of the TCXO. If it is not 12.800.000 ±2 Hz adjust the TCXO, U201.
2. Connect the signal generator to the antenna terminal.
   Set the signal generator to 465.250 MHz (ch. 091) 20 uV EMF.
3. Enter 11091 # to select channel 91.
4. Connect the frequency counter to TP 8. Read the frequency. If it is not 455.000 ±50 Hz adjust L309.

TX POWER AND FREQUENCY

1. Connect the modulation analyzer to the antenna terminal.
2. Enter the following commands:
   - 11091 # to select channel 091.
   - 121 # to select low TX-power.
   - 05 # to turn carrier on.
3. Read the frequency. If it is not 455.250.000 ±50 Hz adjust L101.

4. Enter 73 # to program APC power level settings starting with location 00.

5. Adjust TX-power according to the table below.

Loc.	TX power
00	0.15 W ± 0.5 dB
01	0.15 W ± 0.5 dB
02	1.5 W ± 0.5 dB
03	15 W ± 0.5 dB
04	9.0 W ± 0.5 dB

6. Enter 11020 # to select channel 020 (453.475 MHz).

7. Enter 73 #. Move to location 05 for "all band" APC power level setting.

8. Adjust TX-power to 15 W (as for location 03 in the above table).

9. Repeat steps 6 to 8 for channel 160 (456.975 MHz) and location 07 (73 #). Do not touch location 06, it is adjusted together with location 03.

10. Enter 123 # to select high TX-power.

11. Enter 11001 # to select channel 001. Check that the TX frequency is 453.000.000 ±50 Hz and that the TX power is within 15 W ±0.5 dB.

12. Enter 11091 # to select channel 091. Check that the TX frequency is 455.250.000 ±50 Hz and that the TX power is within 15 W ±0.5 dB.

13. Enter 11180 # to select channel 180. Check that the TX frequency is 457.475.000 ±50 Hz and that the TX power is within 15 W ±0.5 dB.

TX MODULATION

1. Connect the audio analyzer via a capacitance (47 uF/16 V, + to pin 19) to J901-19 TX HI ON/OFF (test conn.) and connect the modulation analyzer to the antenna terminal.

2. Enter the following commands:
   - 11091 # to select channel 091 (455.250 MHz).
   - 121 # to select low TX-power.
   - 07 # to mute RX-audio.
   - 10 # to unmute TX-audio.
   - 05 # to turn carrier on.

3. Enter 72 # to program APC gain.
   Move to location 01 (microphone gain).

4. Set the audio analyzer to 1 kHz 28 ±1 mV rms (1 kHz/ ±3 kHz deviation). The level has to be measured at the connector to ensure the proper level.
   Check that the deviation is ±3 ±0.125 kHz. If not, adjust the microphone gain.

5. Check that the '+' and '-' deviation difference is < 100 Hz.

6. Enter 72 # to program APC gain.
   Move to location 04 (modulation gain).

7. Increment the level of the audio analyzer with 20 dB. Find the frequency which results in the highest deviation. Adjust the modulation gain to the highest deviation which is ≤ ±4.7 kHz.

8. Check that there is no frequency within the range of 0.3 - 3.4 kHz which results in a deviation $\geq \pm 4.7$ kHz.

9. Set the audio analyzer to 1 kHz 28 ±1 mV rms (1 kHz/ ±3 kHz deviation). Check that the deviation is ±3 ±0.125 kHz. If not repeat steps 3 to 8.

DTMF TONES

1. Connect the modulation analyzer to the antenna terminal.

2. Enter the following commands:
   - 11091 # to select channel 091.
   - 121 # to select low TX-power.
   - 09 # to mute TX-audio.
   - 07 # to mute RX-audio.
   - 05 # to turn carrier on.

3. Enter 33X to turn on DTMF-tone (X = 0-9, *, #). Keep on pressing the # - button to transmit the selected DTMF-tone.

4. Read the deviation. If it is not ±3.75 ±0.5 kHz adjust the DTMF-gain.

5. Enter 72 # to program APC-gain. Move to location 02 (DTMF-gain).

6. Repeat steps 3 to 6 until the deviation is within the specified range.

FFSK DEVIATION

1. Connect the modulation analyzer to the antenna terminal.

2. Enter the following commands:
   - 11091 # to select channel 091.
   - 121 # to select low TX-power.
   - 09 # to mute TX-audio.
   - 07 # to mute RX-audio.
   - 05 # to turn carrier on.

3. Enter 14 # to transmit a continuous 1200 Hz signalling tone. Read the deviation. If it is not 2.7 ±0.1 kHz then adjust R301.

4. Enter 15 # to transmit a continuous 1800 Hz signalling tone. Read the deviation. If it is not 3.7 ±0.1 kHz adjust R301.

5. Repeat steps 3 to 4 until the deviation for the two tones is within the specified range.

MICROPHONE THRESHOLD SETTING

1. Connect the audio analyzer via a capacitance (47 uF/16 V, + to pin 19) to J901-19 TX HI ON/OFF (test conn.) and connect the modulation analyzer to the antenna terminal.

2. Enter the following commands:
   - 11091 # to select channel 91.
   - 121 # to select low TX-power.
   - 10 # to unmute TX-audio.
   - 05 # to turn carrier on.

3. Set the audio analyzer so that the deviation is ±3.7 kHz at 1 kHz.

4. Enter 46 # to read the HEX-value which corresponds to the deviation.

5. Enter 66 # to program the microphone threshold.
Program the HEX-value read at step 4 in the section "PHI TONE" at location 00.

6. Repeat steps 3 to 5 to program the microphone threshold for location 01 with the HEX-value corresponding to ±3.3 kHz deviation.

TX-AF RESPONSE

1. Connect the audio analyzer via a capacitance (47 uF/16 V, + to pin 19) to J901-19 TX HI ON/OFF (test conn.) and connect the modulation analyzer to the antenna terminal.

2. Connect the audio analyzer to the modulation analyzer. Set the modulation analyzer in 'FM'.

3. Enter the following commands:
- 11091 # to select channel 091 (455.250 MHz).
- 121 # to select low TX-power.
- 07 # to mute RX-audio.
- 10 # to unmute TX-audio.
- 05 # to turn carrier on.

4. Set the audio analyzer to 1 kHz and adjust the AF level until 1 kHz/±1 ±0.03 kHz deviation is achieved.

5. Set a 0 dB reference to the AF-rms-level corresponding to 1 kHz deviation. Check that the AF response is in accordance with the table below.

Frequency	Requirement
300 Hz	-13.5, -9.5 dB
500 Hz	-9.0, -5.0 dB
1000 Hz	0 dB
3000 Hz	+6.5, +11.5 dB
3400 Hz	+3.0, +11.5 dB

TX MUTING, DISTORTION AND HUM & NOISE

1. Connect the audio analyzer via a capacitance (47 uF/16 V, + to pin 19) to J901-19 TX HI ON/OFF (test conn.) and connect the modulation analyzer to the antenna terminal.

2. Connect the audio analyzer to the modulation analyzer. Set the modulation analyzer in 'FM'.

3. Enter following commands:
- 11091 # to select channel 091 (455.250 MHz).
- 121 # to select low TX-power.
- 07 # to mute RX-audio.
- 10 # to unmute TX-audio.
- 05 # to turn carrier on.

4. Set the audio analyzer to 1 kHz and adjust the AF level until 1 kHz/±3 ±0.1 kHz deviation is achieved.

5. Set a 0 dB reference to the AF-rms-level corresponding to 3 kHz deviation with the psophometric filter switched on.

6. Enter 09 # to mute TX-audio. Check that the TX-audio muting is < -40 dB.

7. Enter 10 # to unmute TX-audio. Switch off the psophometric filter and switch on the 750 uS de-emphasis filter.

8. Set the audio analyzer to 1 kHz and adjust the AF level until 1 kHz/ ±3 ±0.1 kHz deviation is achieved. Check that the distortion is < 5%.

9. Switch on the psophometric filter and set a 0 dB reference to the AF-rms-level corresponding to 3 kHz deviation. Then set the audio analyzer to 1 kHz, 0 V (no modulation) and check that the hum and noise is < -40 dB.

RX DISCRIMINATOR

1. Connect the signal generator to the antenna terminal. Set the signal generator to 465.250 MHz (ch. 091) 20 uV EMF, 1 kHz/ ±3 ±0.1 kHz deviation.

2. Enter the following commands:
   - 11091 # to select channel 091.
   - 350 # to route the audio to the speaker.
   - 476 # to set the volume to rated level.
   - 09 # to mute TX.
   - 08 # to unmute RX-audio path.

3. Enter 72 # to program APC gain. Move to location 03 (discriminator gain).

4. Connect a 4 Ohm/5 W load to J901-23, 24 LS +, LS- and measure the balanced audio level with the audio analyzer. (The measurement has to be done balanced because the LS + and LS- are DC-coupled.) Adjust discriminator gain until the audio level is 4.7 ±0.3 V rms.

RX-AF RESPONSE

1. Connect the signal generator to the antenna terminal. Set the generator to 465.250 MHz (ch. 091) 1 mV EMF, 1 kHz/ ±1.0 ±0.03 kHz deviation.

2. Enter the following commands:
   - 11091 # to select channel 091.
   - 353 # to route the audio to the ear speaker.
   - 475 # to set the volume to 50% of rated level.
   - 09 # to mute TX-audio.
   - 08 # to unmute RX-audio path.

3. Connect the audio analyzer to J901-11 RX HI (test conn.). Set a 0 dB reference to the AF-rms-level corresponding to 1 kHz deviation.

4. Check that the AF-response is in accordance with the table below.

Frequency	Requirement
300 Hz	+11.5, +7.5 dB
1000 Hz	0 dB
3000 Hz	-8.5, -12.5 dB
3400 Hz	-9.5, -17.0 dB

RX MUTING, DISTORTION AND HUM & NOISE

1. Connect the signal generator to the antenna terminal. Set the generator to 465.250 MHz (ch. 091) 20 uV EMF, 1 kHz/ ±3.0 ±0.1 kHz.

2. Enter the following commands:
   - 11091 # to select channel 091.
   - 353 # to route the audio to the ear speaker.
   - 476 # to set the volume to 50% of rated level.
   - 08 # to unmute RX-audio path.

3. Connect the audio analyzer to J901-11 RX HI (test conn.). Set a 0 dB reference to the AF-rms-level corresponding to 3 kHz deviation, with the psophometric filter switched on.

4. Enter 07 # to mute RX-audio. Check that the RX-audio muting is < -40 dB.

5. Enter 08 # to unmute RX-audio and switch off the psophometric filter.

6. Set the signal generator to 100 mV EMF, 1 kHz/ ±3.0 ±0.1 kHz deviation. Check that the distortion is < 5%.

7. Set the signal generator to 32 uV EMF, 1 kHz/ ±3.0 ±0.1 kHz deviation.

8. Set a 0 dB reference to the AF-rms-level at 3 kHz deviation, with the psophometric filter switched on.

9. Set the signal generator to 1 kHz ±0 kHz deviation (no modulation). Check that the hum and noise is < -40 dB.

RX SENSITIVITY

1. Connect the antenna terminal, via a power combiner to both the modulation analyzer and the signal generator. Put in an attenuator (10 dB) between the antenna terminal and the power combiner.

2. Connect the audio analyzer to J901-11 RX HI (test conn.).

3. Enter the following commands:
   - 11091 # to select channel 091.
   - 123 # to select high TX power.
   - 353 # to route the audio to the ear speaker.
   - 475 # to set the volume to 50% at rated level.
   - 08 # to unmute RX-audio path.
   - 05 # to turn on transmitter.

3. Set the signal generator to 465.250 MHz (ch. 091), 200 uV EMF, 1 kHz/ ±3 ±0.1 kHz deviation. Decrease the RF-level until SINAD(P) = 20 dB is achieved. The RF level has to be < 1 uV EMF.

4. Repeat step 4 at channel 001 (463.000 MHz) and channel 180 (467.500 MHz).

RSSI THRESHOLD SETTING

1. Connect the signal generator to the antenna terminal. Set the frequency to 465.250 MHz (ch 091), and the level according to the table below starting with loc 00.

Loc.	RSSI-threshold
00	-3 dB uV EMF
01	+9 dB uV EMF
02	+19 dB uV EMF
03	-4 dB uV EMF
04	+8 dB uV EMF
05	+18 dB uV EMF

2. Enter 11091 # to select channel 091.

3. Enter 45 # to read the HEX-value which corresponds to the RSSI-level. When reading the RSSI-level for location 00 or 03 it is necessary to read (measure) the RSSI-level about 10 times to get a reasonable average HEX-value.

4. Enter 70 # to program the RSSI threshold settings with the HEX-value read above.

5. Repeat steps 2 to 4 for each RSSI threshold level.

PHI TONE

1. Connect the antenna terminal, via a power combiner, to both the modulation analyzer and the signal generator.

2. Set the signal generator to 465.250 MHz (ch. 091), 20 uV EMF, 4 kHz/ ±0.3 kHz deviation. Set the modulation analyzer bandwidth to the narrowest bandwidth that includes 4 kHz. Verify the presence of ±0.3 kHz deviation.

3. Enter the following commands:
   - 11091 # to select channel 091.
   - 121 # to select low TX-power.
   - 25 # to transport the PHI-tone.
   - 09 # to mute TX audio.
   - 07 # to mute RX audio.
   - 05 # to turn on transmitter

4. Enter 69 # to program SAT gain. Move to location 00.

5. Read the deviation. If it is not 0.3 kHz ±0.9 dB adjust SAT gain.

SELF-TEST INSTRUCTIONS

1. INTRODUCTION

The self-test mode may be entered to allow service personnel to control and monitor radio functions via the control unit. This self-test mode operates at two levels:

- Status Display Level — allows the mobile telephone to operate as normal while providing status indications on the control unit display; and
- Servicing Level — takes the mobile telephone out of normal service and allows commands to be entered through the handset keypad to control the operation of the radiotelephone.

2. OPERATING PROCEDURES

2.1 STATUS DISPLAY LEVEL OF SELF-TEST MODE

2.1.1
In the status display level of operation the radiotelephone will place and receive calls as normal. However, the handset will display radio status information, such as operating channel, receive level strength, output power, etc. This display updates once every second. The format and explanation of this status information is given under "02# Radio Status".

2.1.2
When dialing a phone number, the display of status information ceases with the first dialed digit. The telephone number is displayed in the normal manner as entered. When the dialed digit display is empty, the status information display resumes.

2.2 SERVICING LEVEL OF SELF-TEST MODE

This level of operation allows the servicing personnel to take control of the radio operation by entering test commands through the handset keypad. Such parameters as operating channel, output power level, muting, and data transmission can all be selected by entering the corresponding commands. The servicing level may be entered from the status display level by depressing and holding the pound (#) key for 2 seconds. At this time, the radiotelephone will no longer function automatically in the radiotelephone system.

NOTE

The radiotelephone must be in the status display self-test level (see paragraph 2.1) in order to enable the servicing level self-test mode.

HANDSET COMMANDS FOR SERVICE MODE

Keypad Entry	Command Name	Status Display	Description
#	SUSPEND		Terminate normal mode and enter test command mode to suspend the radio. # key must be held for 2 seconds.
01#	RESTART		Restart radio and enter normal mode. (Power up delay approx. 2 seconds.)
02#	RADIO STATUS	AAAABBCDEF	Display the current status of the radio AAAA = Channel number. BB = RSSI status C = Carrier (1=ON) D = Power Level E = Receive Audio (1=ENABLE) F = Transmit Audio (1=ENABLE)
03#	WDOG-EN		Enable resetting of autonomous timer (Watchdog)
04#	INIT		Initialize the radio to the follwoing: - Carrier off - Signal tone off - Phi tone off - DTMF and Audio tones off - RF power level 3 - RX audio unmuted - TX audio unmuted - Channel path set to handset C.P.S. - Watchdog enabled
05#	CARRIER-ON		Turn carrier on.
06#	CARRIER-OFF		Turn carrier off.
07#	RXMUTE		Mute receive audio.
08#	RXUMUTE		Unmute receive audio.
09#	TXMUTE		Mute transmit audio.
10#	TXUMUTE		Unmutes transmit audio.
11xxxx#	LOAD-SYNTH		Load the channel into the synthesizer. The channel number is tested for a valid number. Channels 1-180 are valid, others result in "Error" being displayed.
12x#	SET-ATTN		Set the RF power attenuation level to value represented by x. LEVEL # 0 or 1 Low 0.15 W -20 dB 2 Medium 1.50 W -10 dB 3 High 15.0 W 0 dB & 4 Shut back 11.9 W -1 dB

Keypad Entry	Command Name	Status Display	Description
13#	WDOG-DA		Disable the periodic resetting of the autonomous timer (Watchdog)
14#	ST12ON		Transmit a continuous 1200 Hz signalling tone.
15#	ST18ON		Transmit a continuous 1800 Hz signalling tone.
16#	STOFF		Stop transmitting signalling tone or idle frame.
17#	SIDLE		Transmit idle frame continuously.
18#	READ NAM		Display NAM contents; use * to increment.
20#	SETUP		Transmit a single calling channel message: 735C450000000000 Radio functions affected: Carrier off, phi-tone transponding off, TX audio muted, all TX signalling off.
21#	CDATA		Transmit continuous data, all words being the same as for the SETUP command. The command number will be displayed until the command is terminated by a # key.
22#	FSTS	AAAA	Receive data message counting frame sync's. The command number will be displayed until the command is terminated by a # key. A * will display the current count without terminating the command.
23#	FFSTS	AAAA	Same as FSTS, except all frame sync's (including false) is counted.
24#	RCVEC	AAAA	Receive data message, counting the number of bit errors. The command number will be displayed until the command is terminated by a # key. A * will display the current count without terminating the command.
25#	SATON		Enable transponding of phi-tone.
26#	SATOFF		Disable transponding of phi-tone.
27#	RCVIF	AAAAAAAAAA	Receive one frame and display. This command waits for a complete frame of data to be received. It can be prematurely terminated by a # key.
28#	HITNON		Turn on high tone (1150 Hz).
29#	HITNOFF		Turn off high tone.
30#	LOTNON		Turn on low tone (770 Hz).
31#	LOTNOFF		Turn off high tone.
33x#	DTMFON		Generate a continuous DTMF tone as specified in byte following command. X = 0-9,*,#.
34#	DTMFOFF		Turn off all DTMF tones.

<table>
<tr><th>Keypad Entry</th><th>Command Name</th><th>Status Display</th><th>Description</th></tr>
<tr><td>35x#</td><td>AUDIO PATH</td><td></td><td>Change audio path to x, the following values for x are
<table>
<tr><th></th><th></th><th colspan="2">External spkr. Controls</th><th colspan="2">Handset</th><th></th><th></th></tr>
<tr><th>x</th><th>Path Select.</th><th>ESPK</th><th>Handset C.P.S</th><th>Mic</th><th>Ear Spk.</th><th>External Mic Controls</th><th>APC Opt. Aud</th></tr>
<tr><td>0</td><td>Handsfree</td><td>On</td><td>On</td><td>Off</td><td>Off</td><td>Aux. Mic</td><td>On</td></tr>
<tr><td>1</td><td>Speaker</td><td>On</td><td>On</td><td>Off</td><td>Off</td><td>Mic</td><td>Off</td></tr>
<tr><td>2</td><td>Alert</td><td>On</td><td>On</td><td>Off</td><td>Off</td><td>Mic</td><td>Off</td></tr>
<tr><td>3</td><td>Handset</td><td>Off</td><td>Off</td><td>On</td><td>On</td><td>Mic</td><td>Off</td></tr>
</table></td></tr>
<tr><td>36#</td><td>RCVCF</td><td>AAAAAAAAAA</td><td>Receive data frames continuously. This command waits for a complete frame to be received, and displays it. It waits one sec. before displaying the next message. It can be terminated any time by entering a #.</td></tr>
<tr><td>37#</td><td>RTEMP</td><td>AA</td><td>Displays the radio temperature in DAC units in hex.</td></tr>
<tr><td>38#</td><td>APCSLP</td><td></td><td>Command that invokes the APC sleep mode.</td></tr>
<tr><td>39#</td><td>APCWAK</td><td></td><td>Command that terminates the APC sleep mode.</td></tr>
<tr><td>40xxx#</td><td>SCAN</td><td></td><td>Test command that scans channels. The data following the command is the wait time per channel in milliseconds.</td></tr>
<tr><td>41#</td><td>APCREG1</td><td>AAAAAAAAAA</td><td>Reads and displays APC registers 0-4, two hex digits each. Register 0 is to the left, register 4 to the right.</td></tr>
<tr><td>42#</td><td>APCREG2</td><td>AAAAAAAAAA</td><td>As RDAPC1 except registers 5-9 are displayed. Register 5 is to the left, register 9 to the right.</td></tr>
<tr><td>45#</td><td>RSSI</td><td>AA</td><td>Command to display the RSSI reading for the current channel. In hex.</td></tr>
<tr><td>47xx#</td><td>SET-AUD</td><td></td><td>Sets audio level according to the data byte following the command. (0-lowest, 15-loudest).</td></tr>
<tr><td>50#</td><td>ALT-TEST</td><td></td><td>Command that performs ALT test. The mobile/transportable pin is monitored (1-Carrier on, 0-Carrier off). It is possible to remove the handset without interrupting the command. It is terminated by a #.</td></tr>
<tr><td>51#</td><td>AUD-RSSI</td><td></td><td>Measuring RSSI, providing a tone for each RSSI level. The command is terminated by entering a '#'. RSSI vs. tones:
Less than -2 dB uV : 697 Hz
-2 dB uV - 10 dB uV : 852 Hz
10 dB uV - 20 dB uV : 1000 Hz
More than 20 dB uV : 1209 Hz</td></tr>
<tr><td>52xxxx#</td><td>RF-ADJ</td><td></td><td>Command that scans channels -40, 91, 220, 91, -40, .. etc. continuously. The data following the command (Optional) is the wait time per channel in milliseconds. If no data is entered, the command defaults to 20 msec. It is terminated by #.</td></tr>
</table>

Keypad Entry	Command Name	Status Display	Description
53#	OPTION-EN		Turns the option path on.
54#	OPTION-DIS		Turns the option path off.
55#	PROG-NAM		Program the NAM. NOTE! Will only function in NAM programming mode.
56#	AUTOCYCLE		Puts radio in autocycle mode. The command is terminated by a #. It is allowed to remove the handset.
57#	VSPPHS	AA BB	Programs the VSP nominal offset. Operation as for RSSIPHS. The following locations are available: 00 - VSP nominal offset for Denmark 01 - VSP nominal offset for Sweden 02 - VSP nominal offset for Norway 03 - VSP nominal offset for Finland 04 - VSP nominal offset for Iceland 05 not used
58#	COMPD-ON		Turns the compander on.
59#	COMPD-OFF		Turns the compander off.
64#	PLT-ON		Turns the transmit pilot path on.
65#	PLT-OFF		Turns the transmit pilot path off.
66#	MICPHS	AA BB	Programs microphone threshold according to the data following the command. Operation as for RSSIPHS.
67#	TEMPPHS	AA BB	Programs reference value for 25°C into EEPROM. Operation as for RSSIPHS.
69#	SATPHS	AA BB	Programs SAT gain level. Operation as for RSSIPHS. The following locations are available. 00 - SAT gain level for low RSSI, Less than -63 dBm 01 - SAT gain level for high RSSI, More than -63 dBm
70#	RSSIPHS	AA BB	Programs RSSI threshold settings. AA denotes the location and BB the data at the location. Numbers are in hex. Operation: * Advances to next location, # terminates the command without programming values, HF resets the location to presently programmed information, VOLUME increments the data, SHIFT decrements the data, HOOKSWITCH enables hex mode which transforms the following digit (0-5) into hex (A-F). When the last location is programmed, finish with a * to program values into EEPROM. The following settings are available: 00 - Scan level C, -2 dB uV. Low temperature value. 01 - Scan level B, Standby locking criteria "a", 10 dB uV. Low temperature value. 02 - Scan level A, 20 dB uV. Low temperature value. 03 - Scan level C, -2 dB uV. High temperature value. 04 - Scan level B, Standby locking criteria "a", 10 dB uV. High temperature value. 05 - Scan level A, 20 dB uV. High temperature value.

Keypad Entry	Command Name	Status Display	Description
72#	APC GAIN	AA BB	Programs the APC gain parameters. Operation as for RSSIPHS. Following gain settings can be programmed: 00 - Auxiliary microphone gain (Range 0-F) 01 - Microphone gain (Range 0-F) 02 - DTMF gain (Range 0-3) 03 - Discriminator gain (Range 0-8) 04 - Modulation gain (Range 0-8)
73#	AOC-PWR	AA BB	Programs APC power level settings. Operation as for RSSIPHS. The following locations exist: 00 - Power step 0 (low power 0.15 W, -20 dB). 01 - Power step 0 (As step 0). 02 - Power step 2 (medium power 1.5 W, -10 dB). 03 - Power step 3 (high power 15 W, 0 dB). 04 - Power step 4 (shut back 9.0 W, -?.2 dB). 05 - Frequency band RATIO 0 (channel range #001 - #040) 06 - Frequency band RATIO 1 (channel range #041 - #140) 07 - Frequency band RATIO 2 (channel range #141 - #180) For steps 0-4 the radio is programmed to the appropriate power level. For steps 5-7 the radio is placed at high power level. The ratio that is used is for the channel the radio was on when the command was entered.

NAM PROGRAMMING SEQUENCE

Enter NAM programming mode via Handset test command 55#. The * key advances to the next location. When the last location has been programmed use * to program the NAM and exit. # aborts NAM programming mode without programming the NAM. The HF-key clears the newly entered data and displays previously programmed data.

Step	Default	Description
01	0	Variant number 0 = Nordic NMT 1 = Benelux 2 = Austria
02	5	Home country code. 4 = Iceland 5 = Denmark 6 = Sweden 7 = Norway 8 = Finland
03	712345	Mobile subscriber number (digits 2 to 7 of the phone number). Zeroes are entered as 0, which are then converted to A.
04	123456	Mobile subscriber security code (customer selected). Six-digit number used to control access to various radio features.
05		"A" option bits, Bits are entered MSB first at the far right, then scroll left. For example, defaults will read on the display as 0700010000
	0	Bit 7, Call Timer (1 disabled, 0 enabled)
	0	Bit 6, Service level (1 disabled, 0 enabled)
	0	Bit 5, Electronic Lock (1 disabled, 0 enabled)
	1	Bit 4, auxiliary Alert (0 disabled, 1 enabled)
	0	Bit 3, Roam Alert (alert if ROAM set) (0 disabled, 1 enabled)
	0	Bit 2, Handset Call Processing Speaker (1 disabled, 0 enabled)
	1	Bit 1, V.S.P. Hands-Free (0 disabled, 1 enabled)
	0	Bit 0, V.S.P. Attenuation Bit (1 = 20 dB, 0 = 15 dB)
06		"B" option bits, Bits are entered MSB first at the far right, then scroll left.
	0	Bit 7, External Mute (1 disabled, 0 enabled)
	0	Bit 6, Handset C.P.S. when transportable (0 disabled, 1 enabled)
	0	Bit 5, Horn alert pulses for 1 second (0 disabled, 1 enabled)
	0	Bit 4, Battery meter, automatic shut-off (1 disabled, 0 enabled)
	0	Bit 3, Battery meter readings (1 disabled, 0 enabled)
	0	Bit 2, Push-To-Talk (0 disabled, 1 enabled)
	0	Bit 1, MFT mode (1 disabled, 0 enabled)
	0	Bit 0, Call timer on incoming calls (0 = 20 dB, 1 = 15 dB)

Step	Default	Description
07		"C" option bits, Bits are entered MSB first at the far right, then scroll left.
	0	Bit 7, Not currently assigned.
	0	Bit 6, Not currently assigned.
	0	Bit 5, Not currently assigned.
	0	Bit 4, Not currently assigned.
	0	Bit 3, Not currently assigned.
	0	Bit 2, Not currently assigned.
	0	Bit 1, Not currently assigned.
	0	Bit 0, Not currently assigned.
08	123	Electronic Lock-Unlock code (customer selected)
09	1 = Sweden 1 = Finland 1 = Iceland 0 = Denmark 0 = Norway	Handset keypad arrangement. Defaults to home country. 1 = CCIT 1 2 3 / 4 5 6 / 7 8 9 / * 0 # 0 = ISO 7 8 9 / 4 5 6 / 1 2 3 / 0 * #

CHAPTER
CHAPITRE
KAPITEL

3

RF3662

RADIO FREQUENCY BOARD

RECEIVER

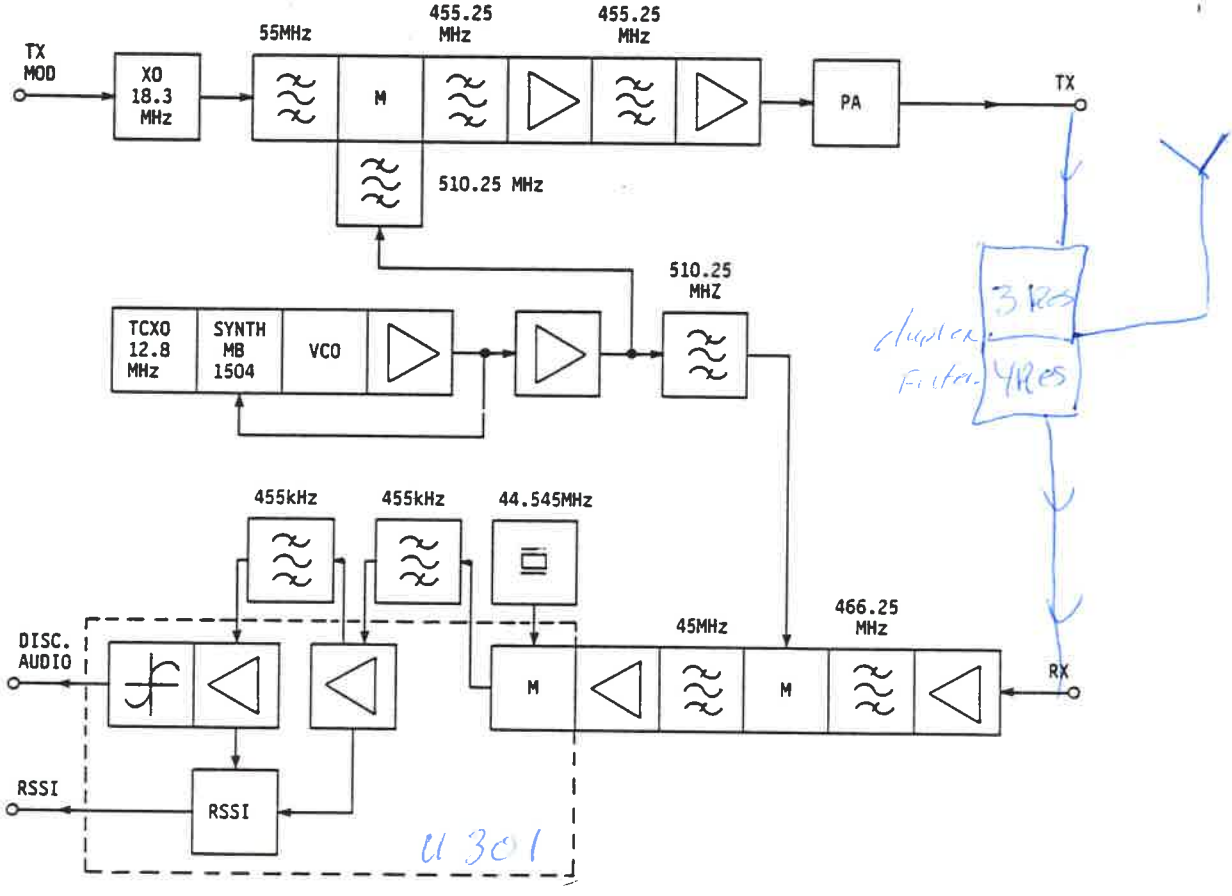
The receiver is a double conversion super heterodyne receiver with high side injection and a first IF at 45 MHz and a second IF at 455 kHz.

RECEIVER FRONT-END

The receiver front-end consists of a grounded emitter bipolar transistor, with active bias network, followed by a two resonator helical filter and a dual-gate mosfet transistor used as an additive mixer. The high side injection for the mixer is fed through a two resonator helical filter.

IF

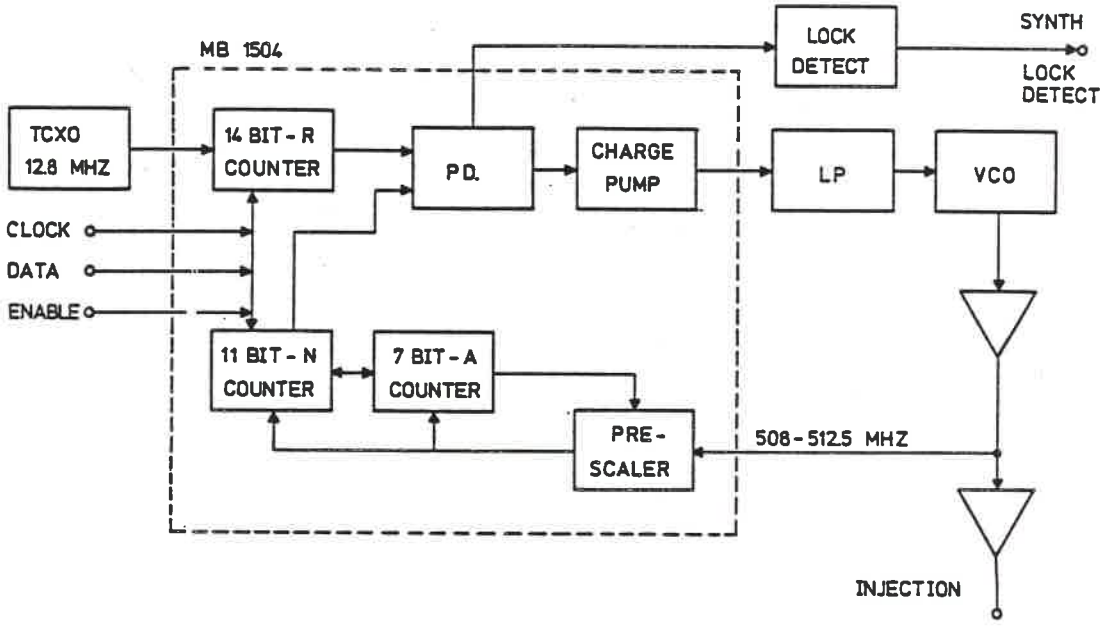
The first IF filter is a 45 MHz crystal filter with two matched resonators, followed by a dual gate mosfet amplifier, the purpose of which is to overcome the noise figures of the following stages. The second IF is built around an IC including crystal controlled second oscillator, active mixer, two 455 kHz amplifiers, discriminator and a received signal strength indicator (RSSI). The selectivity of the second IF is determined by two ceramic filters.



RF3662 BLOCK DIAGRAM

SYNTHESIZER

The synthesizer is a signal loop system operating directly on the injection frequency.



SYNTHESIZER BLOCK DIAGRAM

TCXO

The frequency of the temperature controlled crystal oscillator (TCXO) is 12.8 MHz and the temperature stability of the TCXO frequency is 2.0 ppm.

SYNTHESIZER IC

The frequency of the TCXO is divided down to the reference frequency by the 14 bit R-counter. In the same manner the build-in prescaler, divide ratio 64/65 or 32/33, the 7 bit A-counter and the 11 bit N-counter divide the injection frequency down to the reference frequency. If the two reference frequencies differ, the digital phase detector (PD) will be pulsing. The signal will be "amplified" by the charge pump and change the frequency of the VCO, until the divided down frequency is equal to the reference frequency of the TCXO. When the two frequencies are equal and their phases coincide, the loop will be in lock.

THE LOCK DETECTOR CIRCUIT

If the loop is out of lock, the lock detect output of the synthesizer IC will be pulsing low. Thus, it is necessary that the output of the lock detector circuit is constantly low when the loop is out of lock, and high when the loop is in lock.

VOLTAGE CONTROLLED OSCILLATOR (VCO)

The VCO is a fet oscillator with a ceramic resonator. The VCO is tuned by means of a variable capacitance diode with a DC voltage controlled by the synthesizer through the loop filter. The output from the VCO is fed through a buffer amplifier before being split into two signals. The first signal is returned to the synthesizer IC, and the second one is, after amplification, used as injection for both the TX- and RX-mixer.

TRANSMITTER

The transmitter is basically a chain of amplifiers and filters. The TX begins by an offset oscillator at 18.3333 MHz, followed by a filter at 55 MHz, an active mixer, an exciter with two helical filters and a power amplifier stage (PA).

TX OFFSET OSCILLATOR

The oscillator uses a fundamental crystal series resonance at 18.3333 MHz and a bipolar transistor as the active element. With an adjustable coil is it possible to tune the center frequency. The modulation is added by means of a variable capacitance diode. The oscillator transistor is followed by a buffer amplifier, so that the output is constantly higher than the temperature range.

55 MHz FILTER AND MIXER

The 55 MHz filter is made as a three resonator coil filter with one capacitive and one inductive coupling in order to get a symmetrical bandpass filter. The TX-mixer is is made by a dual gate mosfet transistor, where the 55 MHz signal and the injection is fed to gate 1 of the mosfet transistor.

EXCITER

The exciter consists of two helical filters and two amplifiers and the total gain of the exciter is about 20 dB. The exciter starts with a two resonator helical filter with a 1 dB bandwidth of at least 4.5 MHz, followed by a class A amplifier, one more two resonator helical filter and a class AB amplifier.

POWER AMPLIFIER

The PA-stage is made by a power amplifier module with a nominal output power level of 20 W. The module is built up by three power stages, and the output power reduction of 10 dB and 20 dB is done by regulation of the DC supply to the first stage of the power amplifier module.

REGULATION CIRCUIT

The regulation circuit is made by a directional coupler. This directional coupler detects a small part of the output power just after the PA-stage and sends a DC voltage to the control logic board, where an APC chip detects the voltage and sends a DC voltage back to the first stage of the PA. A higher DC voltage will cause the first stage to turn up the power and this will increase in power will be detected and sent back to the APC chip. In this way the loop is closed, and the APC chip will be controlling the output power of the PA stage. This minimizes the influence of the variations in supply voltage and temperature on the output power.

SPECIFICATIONS

Specifications not explicitely indicated for the RF board will be the same as indicated for the complete radio as such.

Frequencies
RX: 463 to 467.475 MHz
TX: 453 to 457.475 MHz

Harmonic distortion
<3% deemphasis, 6 dB/octave

Hum & noise
<-43 dB psophometric deemphasis, 6 dB/octave

RF Stand-by current
RX and TX 9.5 V: 140 + 20 mA

Synthesizer lock time
<18 mS +1 kHz to Fo

RX-Sensitivity
Without duplex filter: <0.7 uV (EMF), <-116 dBm, 20 dB psophometric deemphasis, 6 dB/octave

RX Frequency response
300 - 3000 Hz: +0.5 dB
3000 - 4000 Hz: +0.5 dB, -2 dB

RX Conducted spurious
Without duplex filter: <-57 dBm, <2 GHz

TX Frequency response
300-4000 Hz: +1.5 dB

TX RF-harmonic
Without duplex filter: <0 dBm, <2 GHz
With duplex filter: <-36dBm, <2 GHz

TX Spurious
With duplex filter: <-36, <2 GHz

TX Adjacent channel power
Without modulation: <74 dB

TX Output power
Without duplex filter: >20 W

TX Current
<6.0 A, VSWR <2

TX Offset oscillator
+20 ppm

PA-stage stability
With duplex filter: VSWR <6

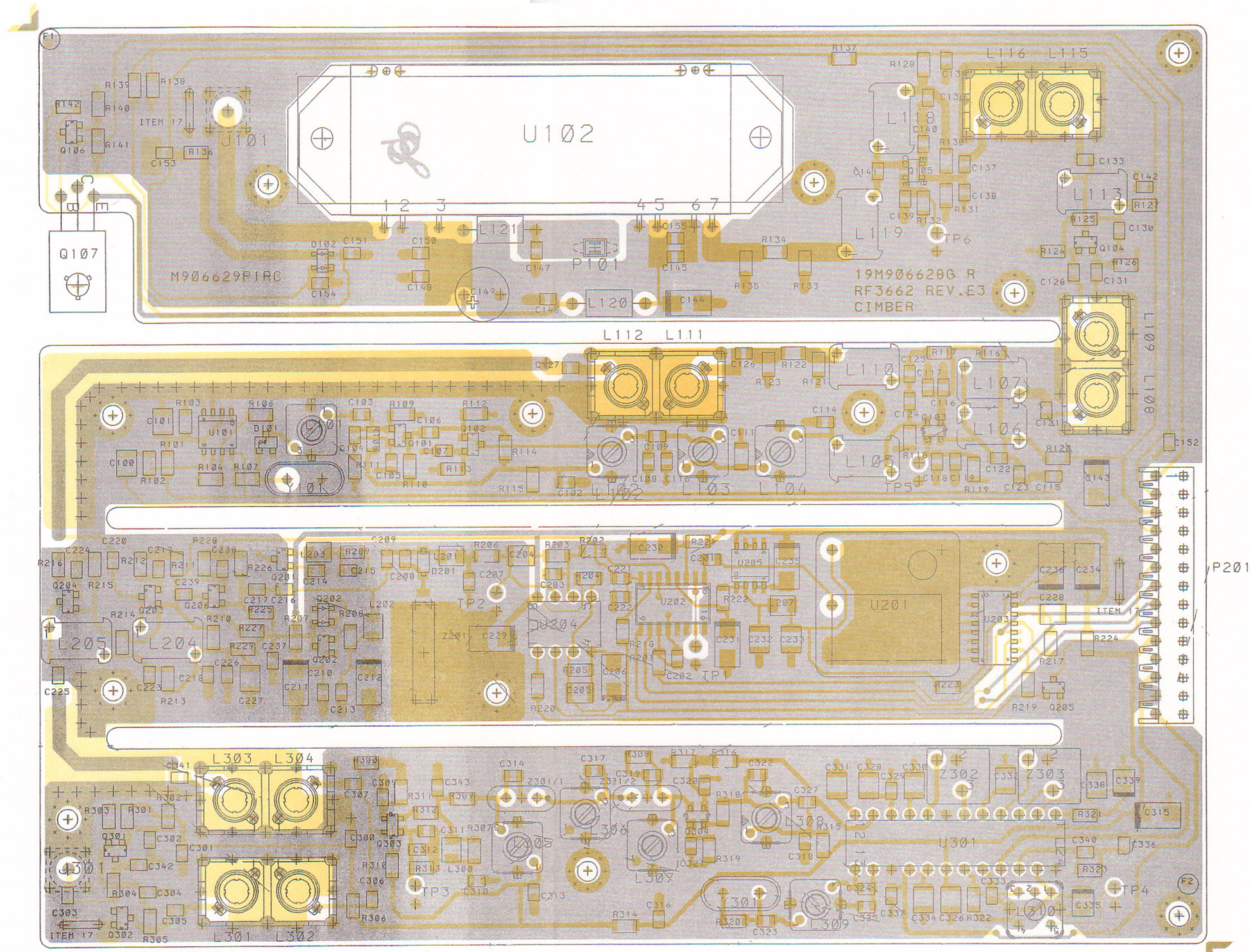
Temperature range
-25°C to +90°C

RF3662

TEST POINTS

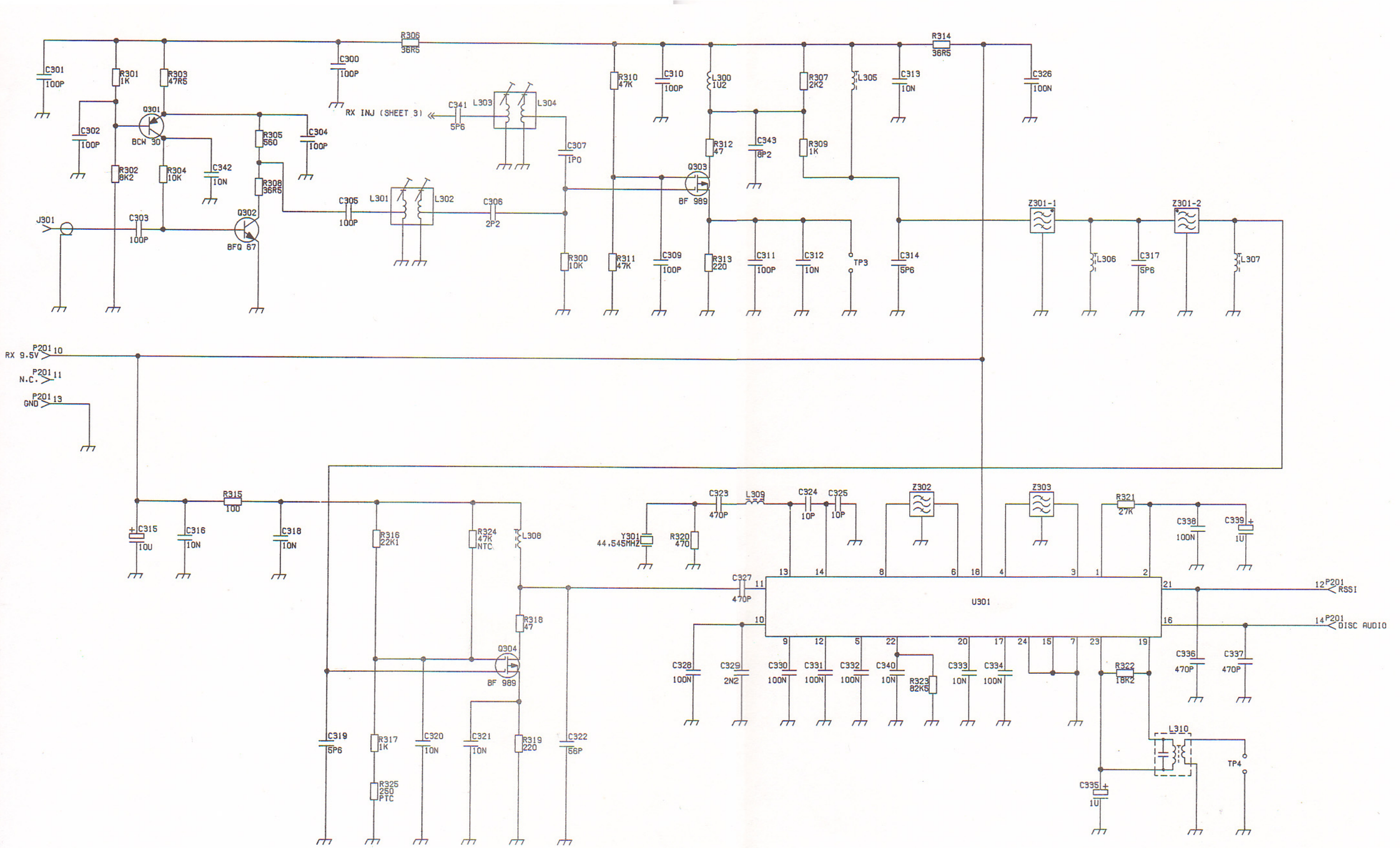
The following test points are all located on the component side of the RF board.

TP1	Input level to the RX mixer.
TP2	Output level of the 45 MHz amplifier.
TP3	Frequency of the TCXO.
TP4	DC voltage to the VCO (Tuning voltage).
TP5	Input level at the TX mixer.
TP6	Input level to the driver transistor.
TP7	Injection level at the RX mixer.
TP8	Frequency of the second IF.
TP9	Output level of the RX mixer.



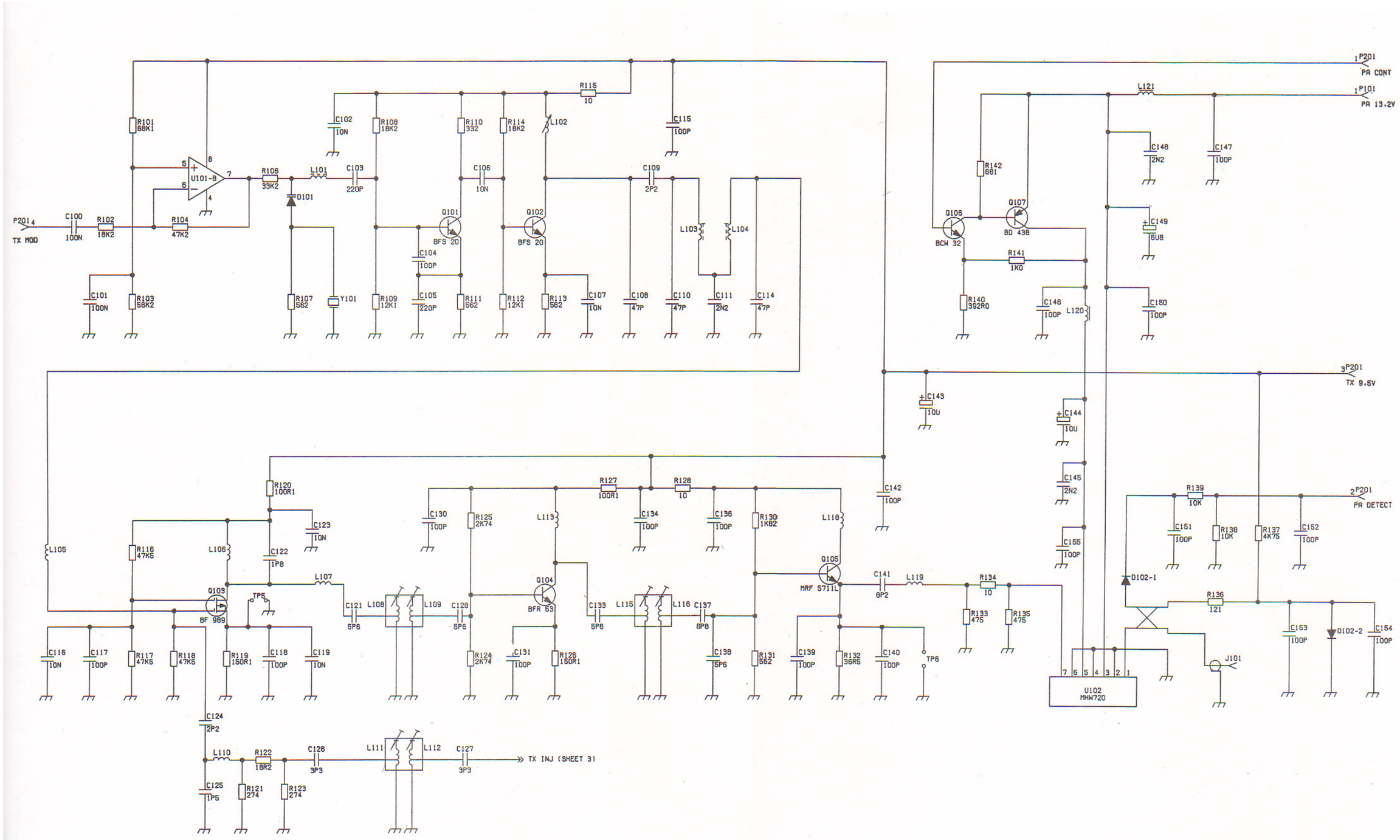
RADIO FREQUENCY BOARD RF3662
COMPONENT LAYOUT

D405.270 CODE NO.M906628G1



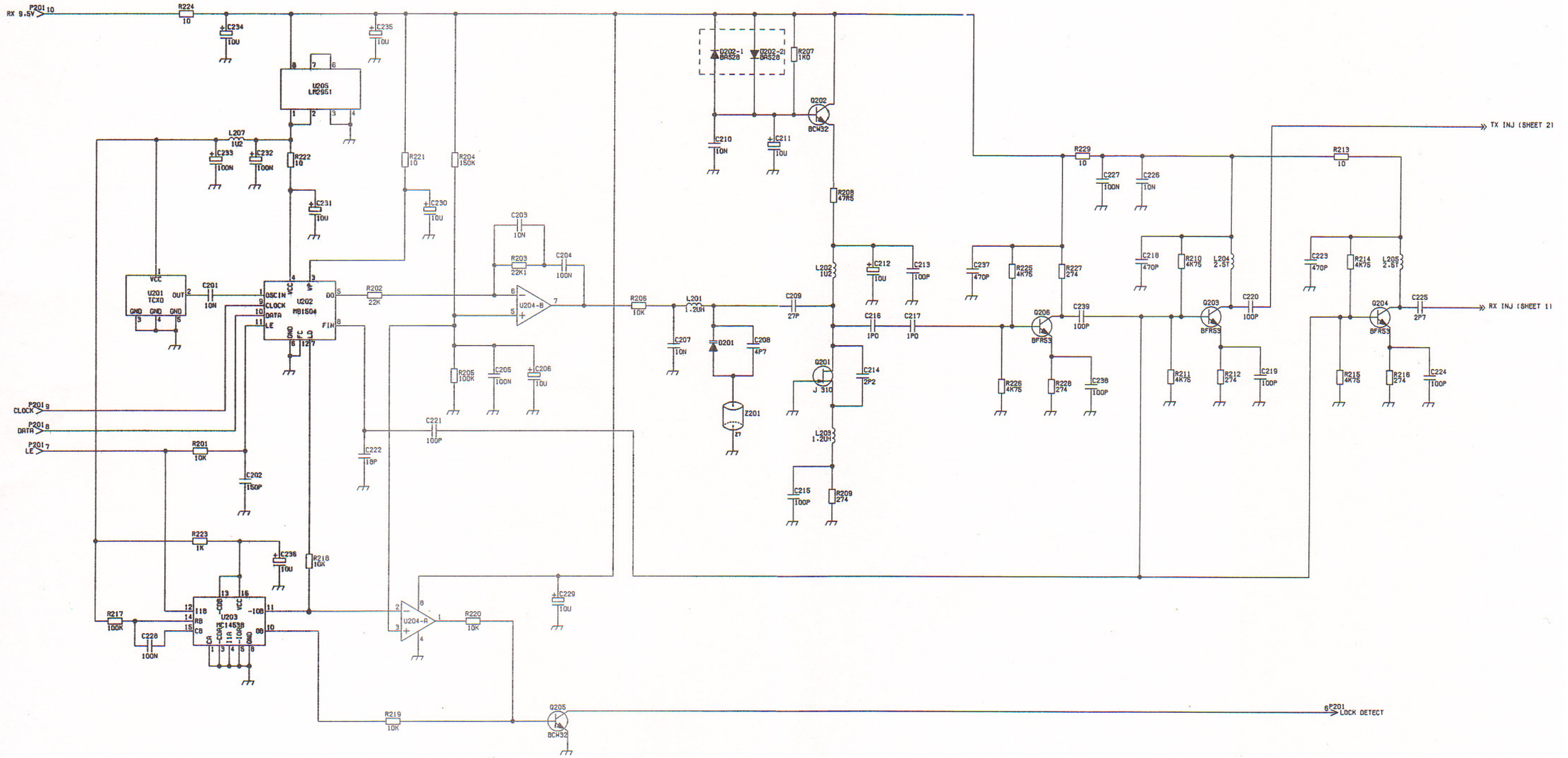
RADIO FREQUENCY BOARD RF3662
RECEIVER CIRCUIT

CODE NO.M906628G1 Sh.1 of 3 | **D405.271**



RADIO FREQUENCY BOARD RF3662
TRANSMITTER CIRCUIT

CODE NO.M906628G1 Sh.2 of 3 | **D405.271**



RADIO FREQUENCY BOARD RF3662
SYNTHEZISER CIRCUIT

CODE NO.M906628G1 Sh.3 of 3 | **D405.271**

CHAPTER
CHAPITRE
KAPITEL

4

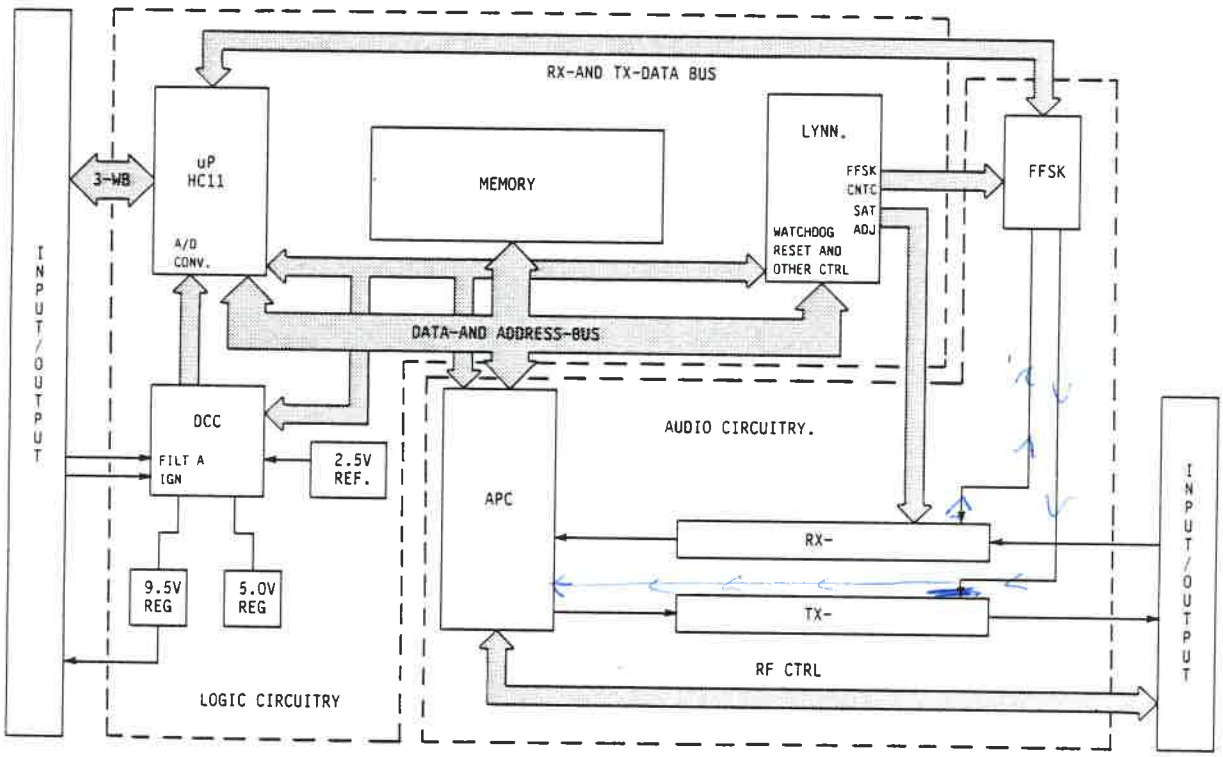
CL3001

CONTROL LOGIC BOARD

CL3001 is both the Common Function - and Control Logic Board for the PRM3662D15N radio.

The circuit comprises the following functions:

- Interconnections/interfaces for the RF-board and accessories.
- APC (Audio Processor Chip) handling the TX and RX lines and the control lines to the RF-board.
- Logic circuitry, voltage regulators.



CL3001 FUNCTIONAL DIAGRAM

LOGIC CIRCUITRY

The logic circuitry of the CL3001 contains the following main sections:

- Microprocessor
- Memory
- General function controller
- Power supply controller

These main sections handle the following functions: On/off control systems, 3-wire bus communications, and communication to the APC

MICROPROCESSOR

The microprocessor is an MC68HC11 (U201) with an on-chip memory system. This system includes 8K byte of ROM (U203), 512 bytes of EEPROM (U202) and 256 byte of static RAM (U204). An eight channel analog-to-digital converter is also provided on-chip.

MEMORY

The logic part of the CL3001 has a standard memory configuration consisting of the MC68HC11's EEPROM and RAM together with the external RAM. Except for the RAM, the external memory is also composed of an 8K x 8 EEPROM and of an 64K x 8 EPROM.

The 64K x 8 EPROM contains all the main program codes. The number assignment module (NAM) is located in the MC68HC11 EEPROM.

It is necessary to expand the MC68HC11 addressing range from the normal 64K map. This is provided by the general function controller.

GENERAL FUNCTION CONTROLLER

The LYNN-chip (U205) is especially designed to interface to the MC68HC11. Its main functions are memory mapping, I/O-control, DTMF-generation and address de-multiplexing.

The memory mapping acts as follows. The 64K mapping area of the MC68HC11 is broken down into several smaller parts. This allows for multiple mapping within the same address space. The EEPROM, ROM1 and ROM2 chip selects and address are controlled by three map registers. The RAM, E-Select-1 and E-Select-2 chip selects are independent of the map registers. It is then possible for the MC68HC11 to address 8K RAM, 128K ROM and 32K EEPROM.

Another important function of the LYNN chip is the watchdog. The watchdog is able to shut down the power supply if a software error occurs.

POWER SUPPLY CONTROLLER

The DCC (U101) contains two 5 V regulators, a low current 5 V regulator (REF 5V) with a capability of 100 µA, and a high current 5 V regulator which is capable of 200 mA with an external series pass device (Q104, Q107). An externally switchable 9.5 V regulator is also contained in the DCC. With an externally series pass device (Q102, Q103) the 9.5 V regulator has a current capability of 1.0 A.

In addition, the DCC provides the ON/OFF and RESET controls.

ON/OFF CONTROL SYSTEMS

Reset during power-up

The DCC controls the reset timing during power-up. The reset-line is held low for at least 100 ms after 5 V comes up. This gives time for the 5 V supply to stabilize as the logic circuitry power up.

Reset 5 V undervoltage detector

The 5 V is continuously monitored by Q206. When the 5 V drops below 3.5 V then Q206 turns off and the reset-line is pulled low.

Reset A + V undervoltage detector

The DCC will pull the reset-line low and turn off the 9.5 V regulator if the A + voltage falls below 5.0 V.

Watchdog

The watchdog line is the output of a 30 s timer. If the timer is not reset by the MC68HC11 at least once every 30 s, the watchdog line will go low, and the DCC will turn off the CL-board.

9.5 V ON/OFF control

When the processor detects, via the A/D converter, that the 9.5 V regulator falls below 7.5 V the 9.5 V ON/OFF line is pulled low, and the DCC turns off the 9.5 V regulator.

ON/OFF sense

The TX HI-ON/OFF line controls the ON/OFF-sense-line which tells the processor, via an A/D converter, that the user has registred to turn the radio ON or OFF depending on the current state.

Ignition sense

The ignition line is connected to A+ through the ignition switch. The ignition-sense-line provides 5 V level transformation to inform the processor via an A/D converter of the state of the ignition line, and turns the radio ON or OFF depending on the current state.

3-WIRE BUS

The 3-Wire Bus (3WB) is used by the transceiver to communicate with up to 6 handsets or peripheral devices. The bus from the transceiver consists of two output lines, TRU and CMP, and one input-line, RTN. TRU and CMP are used to transfer data to devices on the bus and to clock in data on the RTN-line from external devices. The transceiver controls the direction and the rate at which information is passed down the bus. TRN and CMP are both open collector outputs, the devices on the bus must provide their own pull-signs (15 kOhm). The RTN-line must also be pulled up with no more than 15 kOhm to 5 V. If the RTN-line is not pulled up the transceiver will power down..

The transceiver starts a data transmission with a data zero indicating to the devices on the bus that the transceiver is going to send a message. All handsets and peripherals are interrupted by the change in data state.

When a peripheral device or handset wants to send a message it pulls the RTN-line low. The transceiver then proceeds to clock in data by using the TRU and CMP lines.

CONNECTION TO THE AUDIO CIRCUITRY

To make it possible to transfer data concerning signal path and gain to the APC, the APC is connected to the logic circuitry by an 8 bit data-bus and 5 CNTL-lines. The FFSK-modem is connected to the logic circuitry by some of the MC68HC11 ports. It is necessary to control the data transmission on the MC68HC11. This is done by 5 CNTL-lines from the LYNN.

RX AUDIO

There are three different sources to the RX audio input (DISC AUD):

- The nominal RX audio signal, frequency = 1 kHz (3 kHz deviation).
- The PHI TONE, freq. = 4 kHz (0.3 kHz deviation).
- The received FFSK data.

RX AUDIO SIGNAL

The nominal RX audio of 1 kHz frequency is AC coupled to the gain stage (U406-A) before being passed through a 12th order 3.4 kHz lowpass filter (U402) providing sufficient rejection of 4 kHz signals. Before entering the APC (RX) (U401) the signal is attenuated and fed through a peaking filter (U402-A) which adjusts the RX audio frequency repsonse in the APC (RX). The APC (RX) (U401) consists of a gain adj. register for the DISC signal, voice filtering, 6 dB de-emphasis and finally a volume adj. register of +20, -15 dB range. The signal from the speaker output of the APC (RX) is then sent into an external lowpass filter (U405-A) whose purpose it is to remove clock and switching noise and raise the APC's nominal SPEAKER output level on the RX HI line. The signal on RX HI can be transferred to either the handset speaker or to the external speaker through the power amp. (U403). This is operated in a bridge configuration, so care must be exercised as the loudspeaker wires are DC-coupled at approx. BATT A+ ./2. The output power is limited by Q407/Q405 in a 4 Ohm load.

PHI TONE

The received PHI TONE is a tone of approximately 4 kHz (0.3 kHz deviation) is AC coupled through the same gain stage (U406- A) as the RX audio. Next, it is prefiltered by a 2.3 kHz highpass filter (U406-B) that removes RX audio, which could cause overloading in the 6th order 4 kHz narrow bandpass filter (U402). Then it is fed to a variable attenuator (U407) and finally the PHI TONE is summed (U405-D) with the TX audio for transmission.

RX DATA

The RX data (FFSK) is sent through the gain stage (U406-A), de-emphasis and gain adjusted (U302-B) before going into the FFSK modem on pin RX signal input (U301). The 1200 Hz and 1800 Hz signal is now of equal amplitude on RX signal input (U301). The detected data (0 = 1800 Hz, 1 = 1200 Hz) is sent to the microprocessor (U201) from the CLK RX DATA pin (U301).

TX AUDIO

There are three sources leading to the MIC input on the APC (TX) (U401).

- A mic input connected to the handset microphone.
- A VSP (Voice Speaker Processor) mic. input used in the handsfree mode.
- The transmit FFSK data from the MPU.

MIC AND VSP INPUT

The required microphone signal is selected using a multiplier (U408) and then fed through a peaking gain stage (U405-A), which adjusts the APC (TX) (U401) freq. response. Then the TX audio signal passes through the APC (TX) (U401) where it is voice filtered by a bandpass and a combined +6 dB pre-emphasis/clipper stage before summed with the PHI TONE on the external gain stage (U405-D). Finally, it enters a lowpass filter (U405-C), whose purpose it is to remove clock and switching noise caused by the APC, and then the signal is ready on TX MOD.

TX DATA

Transmit data (FFSK) is sent from the MPU to the modem chip (U301). The modem generates a 160 step sine wave FFSK (1200 baud FFSK) that is pre-emphasized (U302-D) and gain adjusted (U302-A) by R301 and summed in the APC (U401) via the pilot pin. The FFSK signal appears on the APC (TX) mod pin and then fed the same way as the TX audio signal to TX MOD.

RF CONTROL LINES

The RF control lines contain:

- The RSSI (Received Signal Strength Indicator) that gives information of the received signal strength voltage from the RF board IF.
- The PA control loop that controls the PA output power.
- Programming lines for the synthesizer to load the synthesizer for the desired channel.

RSSI

The RSSI signal is sent to the APC (U401) where an internal 6-bit companding A/D converts the voltage to a 6 bit binary number. The A/D is structured into 4 separate "cords". The 1st cord is 16 steps wide, with an RSSI input of 0.0 V giving an A/D value of hex 00 to hex 0B depending on the internal offset of the APC chip. The remaining 3 cords are also each 16 steps wide.

PA CONTROL AND PROGRAMMING LINES FOR SYNTHESIZER

Coupled at the radio's PA output is a detector circuit which supplies a detect voltage proportional to the radio's output power. This detect voltage is fed back to the audio/logic board PA SENSE pin, where it is subtracted with a D/A voltage in the APC (U401). The result of the subtracted error voltage is then fed to PA CONT., which regulates the voltage to the driver PA stage. This provides a completed closed-loop control system.

All channels available in the radio are programmed in the synthesizer using the control lines located on the APC (U401). All data is clocked into the synthesizer using the SYNT CLK, SYNT DATA and SYNT ENABLE.

TECHNICAL SPECIFICATIONS

Current Consumption (LS disabled)
With external loads off (Ignition to gnd.): I < 0.5 mA
Standby: I typ 60 mA, max. 70 mA
5.5 W output power (Volume step 6, without handset, 4 Ohm load impedance): < 1350 mA

TX AUDIO

Response
Mic input (TX HI - ON/OFF) = 9 mV

Frequency:		
	100 Hz	< -25 dB
	200 Hz	< -19 dB
	300 Hz	-13.5, -9.5 dB
	500 Hz	-9, -5 dB
	1000 Hz	0 dB ref.
	3000 Hz	+6.5, +11.5 dB
	3400 Hz	+3, +11.6 dB
	4000 Hz	< -1.8 dB
	5000 Hz	< -3.8 dB

Distortion
Mic input (TX HI - ON/OFF) = 28 mV with 750 uS de-emphasis on TX MOD

Frequency:	Distortion:
300	< 3%
500	< 3%
1000	< 3%

Signal to Noise Ratio
Mic input = 28 mV (TX HI - ON/OFF)
With CCITT and 750 uS deemphasis > = 42 dB.
Without CCITT and with 750 uS deemphasis > 20 dB.

TX Data
Vout data: 1200 Hz 279mV RMS + 13mV RMS
1800 Hz 481mV RMS + 24mV RMS

RX AUDIO

Response
Vout LS +, LS- = 1.5 V. Volume step 6. Vin = 33.3 mV (DISC AUD).

100 Hz	< +11.5 dB
300 Hz	+11.5, +7.5 dB
100 Hz	0 dB ref.
3000 Hz	-8.5, -12.5 dB
3400 Hz	-9.6, -18.0 dB
3945, 4000, 4055 Hz	< -30 dB

Distortion
Vout LS +, LS- = 4.70 V. Volume step 6. Vin = 100 mV (DISC AUD), 1000 Hz.
Distortion < 3.5% measured with 30 kHz LP- filter.

Signal to Noise Ratio
Vout RX HI = 405 mV. Volume step 6. Vin = 100 mV (DISC AUD), 1000 Hz.
With CCITT filter: > 48 dB.

Volume Control
Vin = 100 mV, 1000 Hz

Volume step	Gain (rel. nominal) (RX-HI)
470 (0)	-15 dB
471 (1)	-10 dB
472 (2)	-5 dB
473 (3)	0 dB ref.
474 (4)	+5 dB
475 (5)	+10 dB
476 (6)	+15 dB
477 (7)	+20 dB

Tolerance + 1 dB.

PHI TONE RESPONSE

DISC AUD = 10 mV (±0.3 kHz dev.), TX MOD = 30 mV.

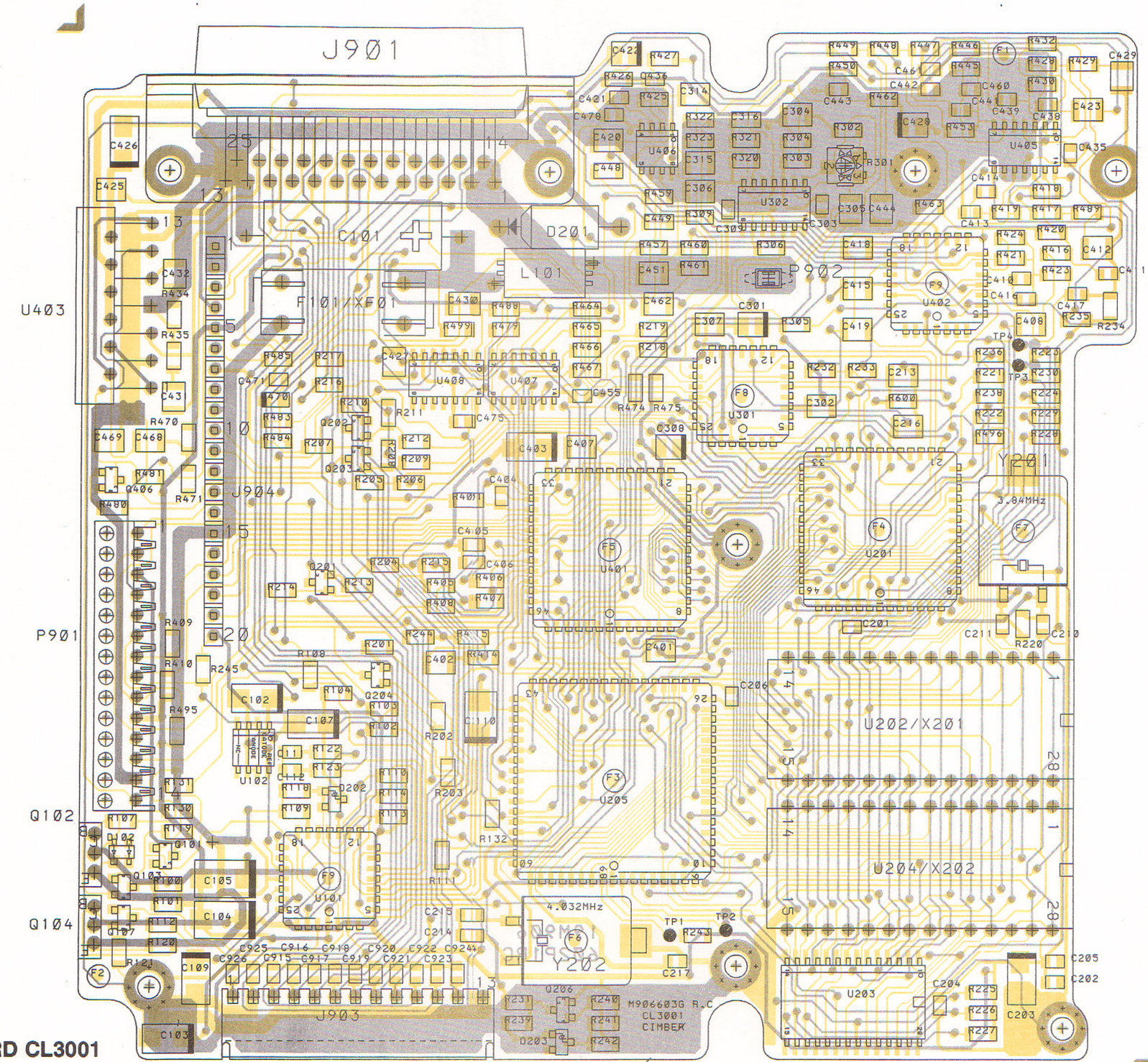
3200 Hz	< -32 dB
3400 Hz	< -30 dB
3800 Hz	-6, +1 dB
3945 Hz	-1, +1 dB
4000 Hz	0 dB ref.
4055 Hz	-1, +1 dB
4200 Hz	-6, +1 dB
5000 Hz	< -32 dB

TEMPERATURE RANGE

Operating: -25°C to +85°C
Storage: -40°C to +85°C

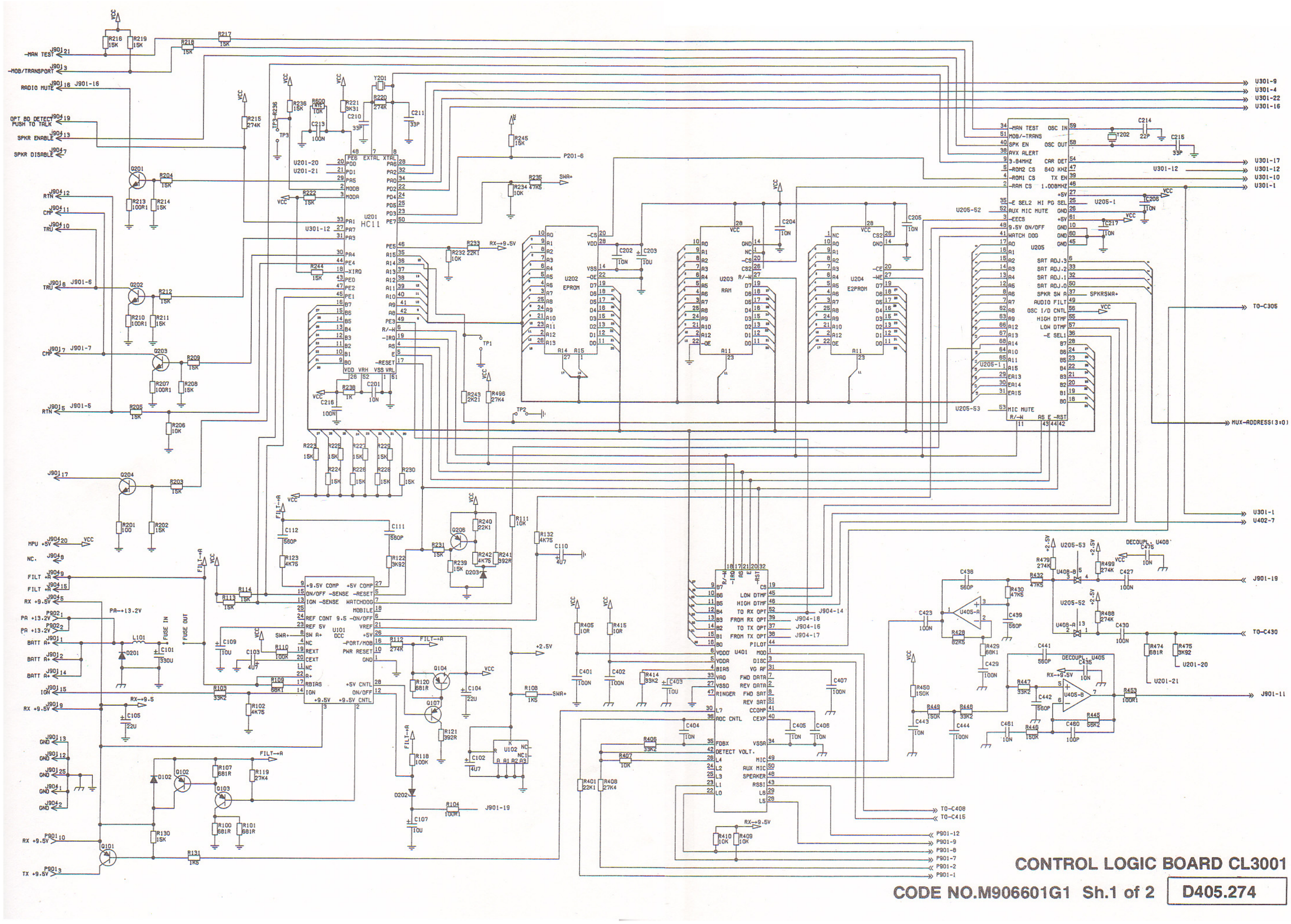
MECHANICAL DIMENSIONS

L x W x H: 132 x 127 x 22 mm (incl. connector)



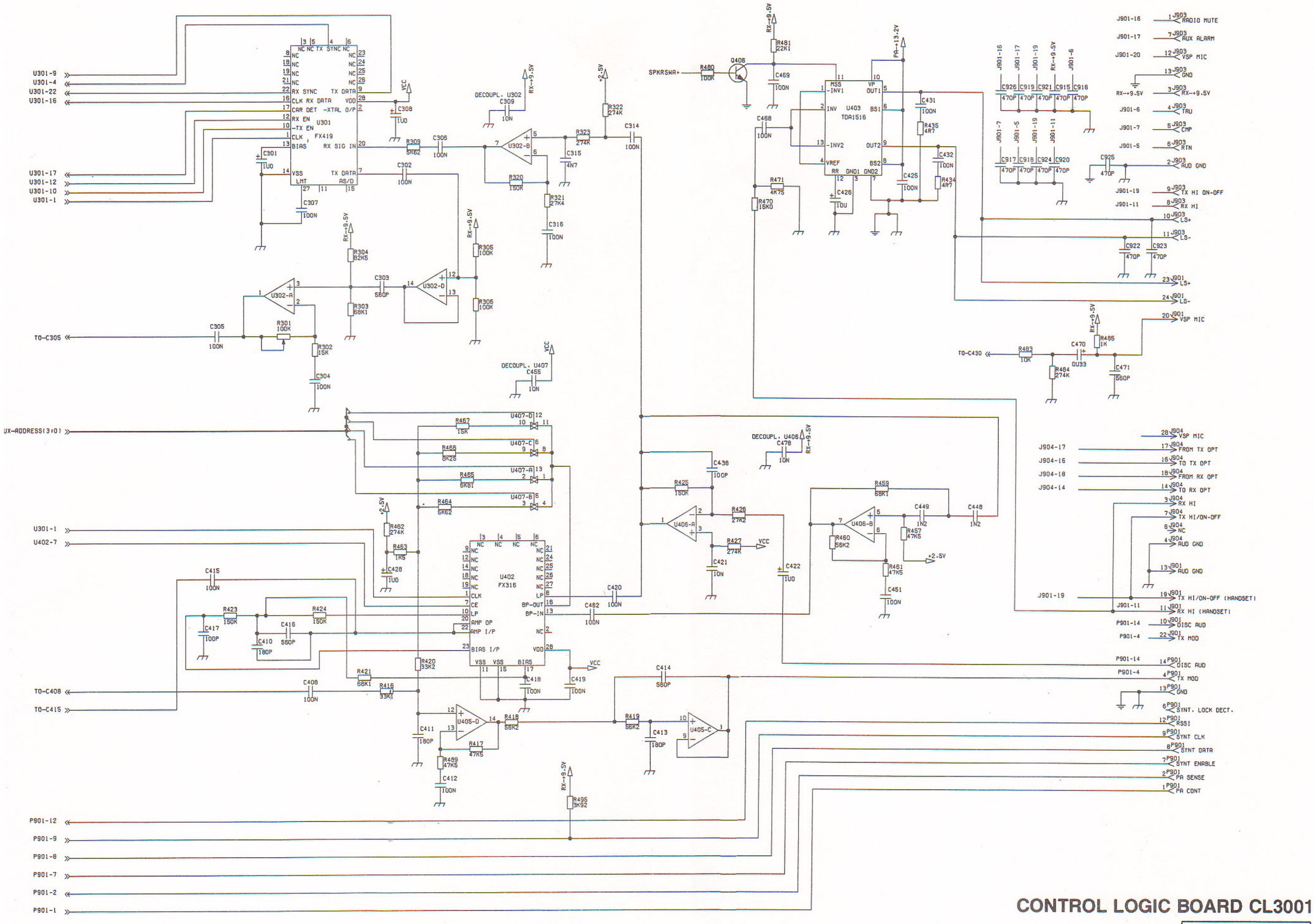
CONTROL LOGIC BOARD CL3001
COMPONENT LAYOUT

D405.273 **CODE NO.M906601G1**



CONTROL LOGIC BOARD CL3001

CODE NO.M906601G1 Sh.1 of 2 | **D405.274**

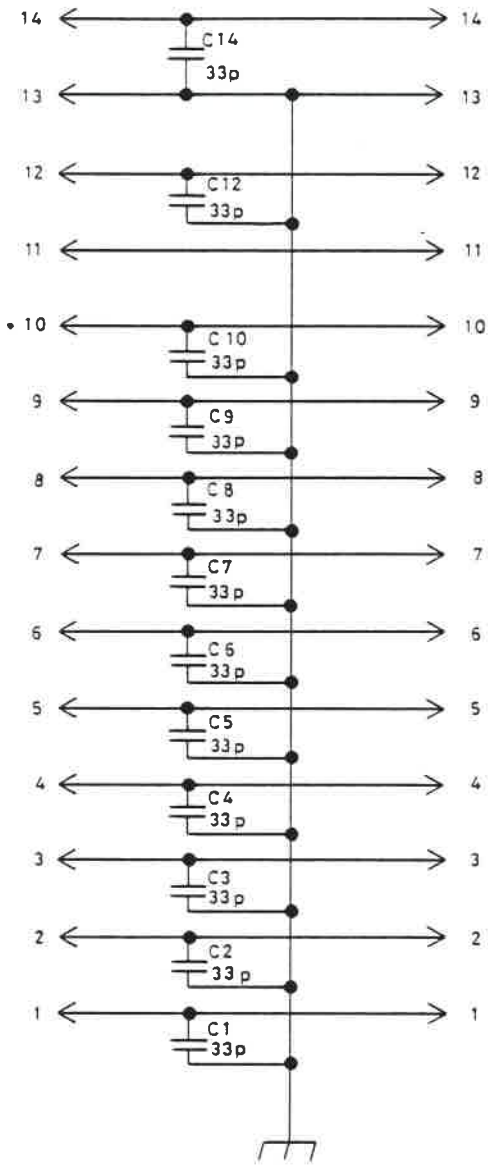


CONTROL LOGIC BOARD CL3001

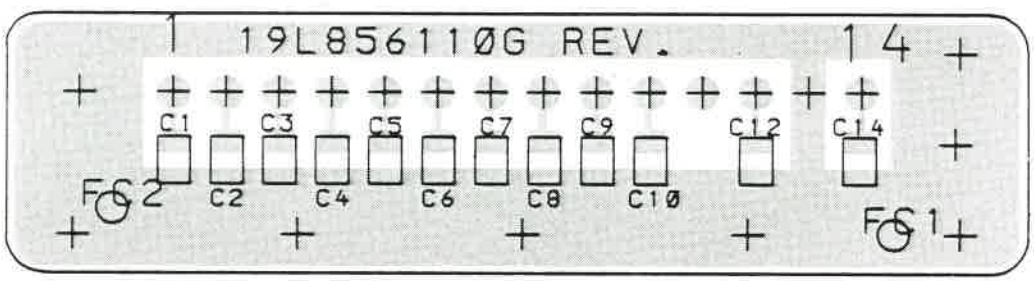
CODE NO.M906601G1 Sh.2 of 2 | **D405.274**

CHAPTER
CHAPITRE
KAPITEL

5

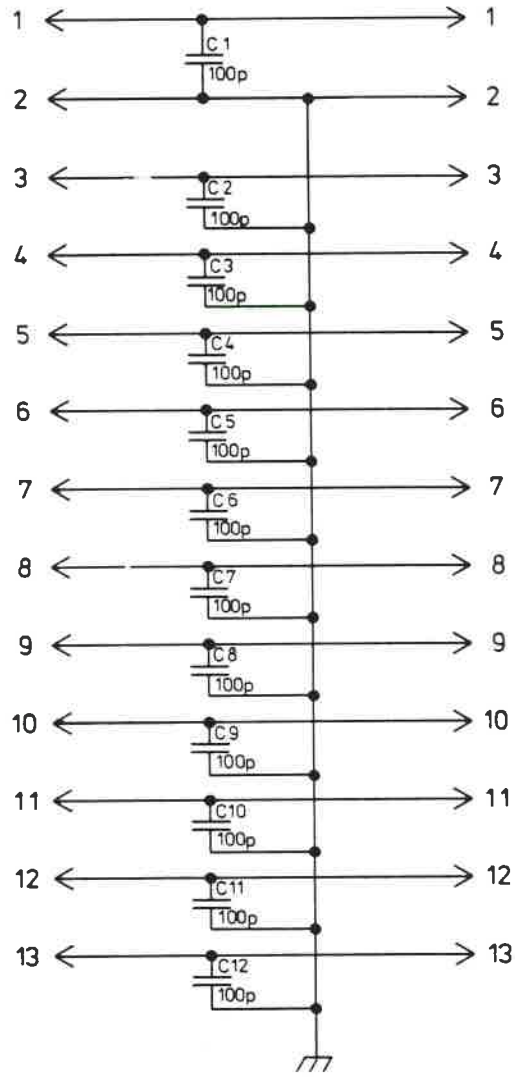


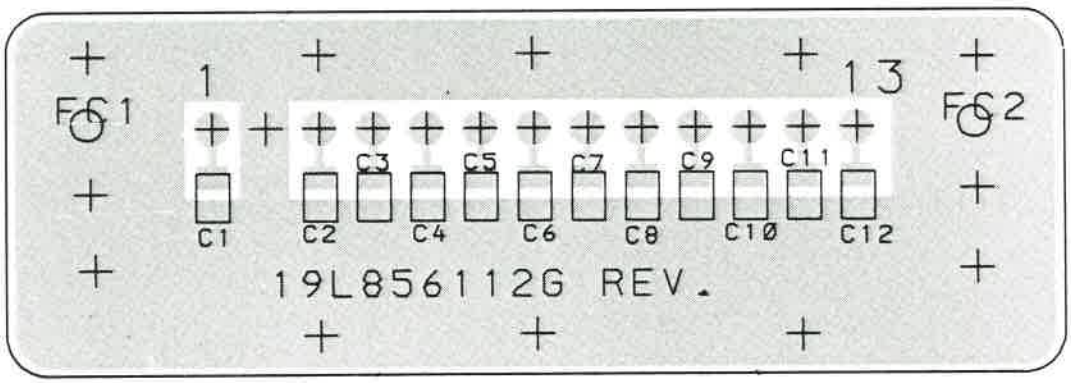
RF CL



FILTER NETWORK FN6011

CODE NO.L856110G1 D405.178





FILTER NETWORK FN6012

CODE NO.L856112G1 | **D405.179/2**

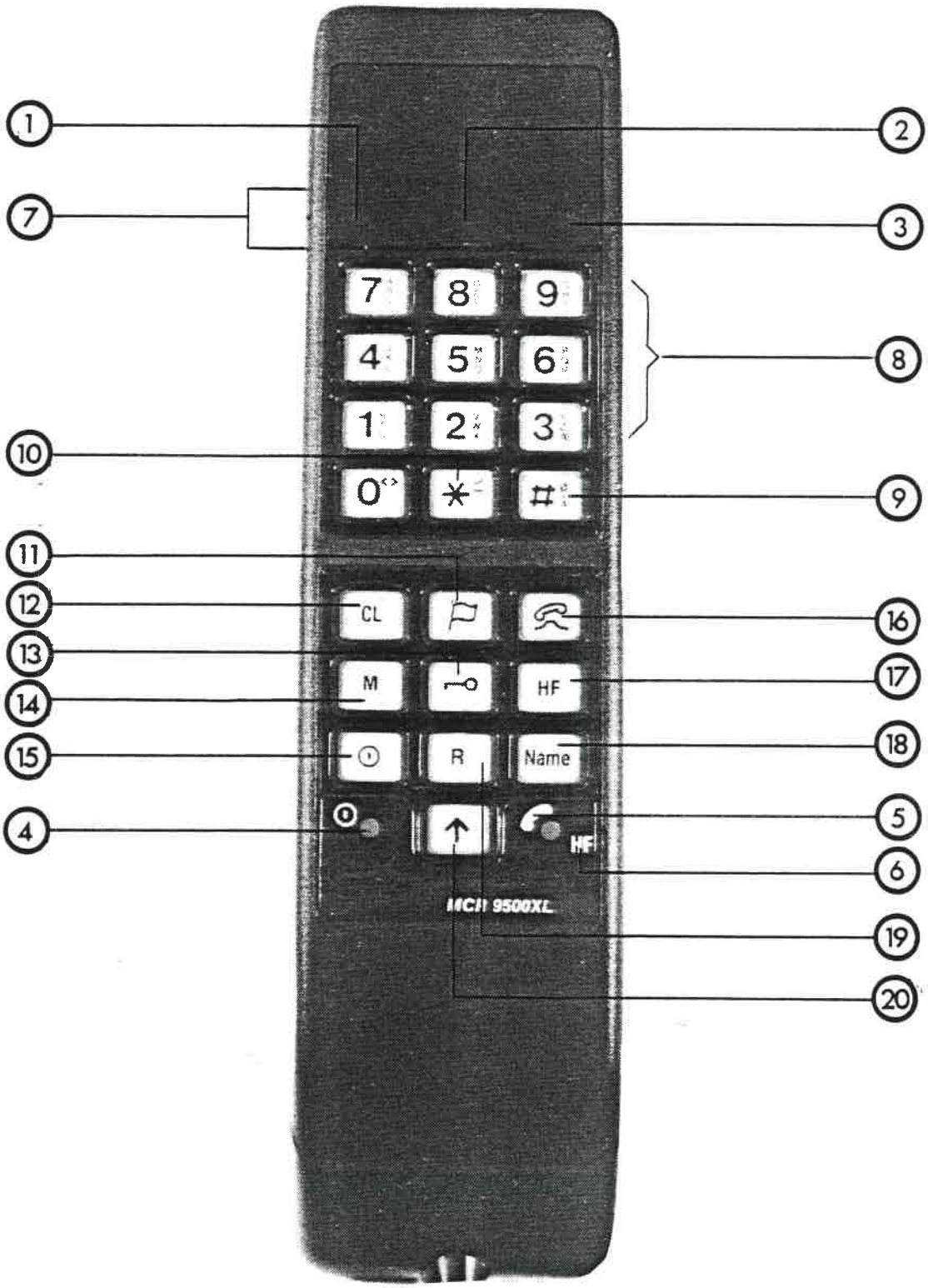
CHAPTER
CHAPITRE
KAPITEL

6

MCR9500-XL

CONTROL HANDSET

KEYS AND INDICATORS



Refer to page 2 for location and cross-reference of the various handset controls and indicators.

DISPLAY

The handset display shows the telephone numbers dialled and provides the status of various mobile telephone operations (maximum 14 digits).

SF, N, S, DK, CH	Country codes: One of these five codes is always shown in the display indicating the selected country of operation. The code momentarily disappears when the display is used for other purposes. SF = Finland, N = Norway, S = Sweden, DK = Denmark, CH = Switzerland.

LIGHT INDICATORS

(1) ○ (green) Call indicator	Illuminates when the radio is able to make and receive calls. Turns off when making or answering a call. The indicator must be on, in order to be able to receive a call, but not necessarily during calling procedure.
(2) △ (red) Roam	Illuminates when an automatic attempt by the radio to update the system about your new location has been unsuccessful. You may still be able to place calls but not to receive them.
(3) □ (yellow) Call received/MFT	Incoming call/Data transmission Flashing illumination together with a ringing signal indicate an incoming call. Steady illumination indicates that the telephone is ready for transmission of Multi Frequency Tone signals to a computer or puplic pager.

(4) ○ (yellow) Power	ON/OFF Steady illumination indicates that the telephone is on.
(5-6) HF Handset indicator Handsfree/Hookswitch	Lifted handset Illuminates during conversation and when the handsfree function is not in use. Flashes when the handsfree function is in use.

VOLUME CONTROLS

The pushbutton on the left side of the handset adjusts the volume of the speaker, the handset audio, and alert tone. By holding the ● button down the volume level is increased and by holding the ● button down the volume level is decreased.

(7) Adjust Speaker Volume	Volume control: Operate the volume button as described above (not during conversation). The speaker volume can also be adjusted during conversation if handsfree mode has been selected.
Adjust Handset Volume	Operate the volume button during conversation with the handset against your ear.
Adjust Ringer Volume	Press [↑] , then operate the volume button.

KEYPAD

When the mobile telephone is switched on the keys are illuminated.

(8) Alphanumeric keys.

(9) Repeat call  Repeat the last dialled number. The last dialled number is always stored in the telephone.

(10) Short number only  For storage of maximum 99 telephone numbers without names. Telephone numbers may contain up till 24 digits. See also (18).

(11) Country select  Country Select key changes the country of operation. The mobile radiotelephone will only function in the country selected. The button cannot be operated during conversation.

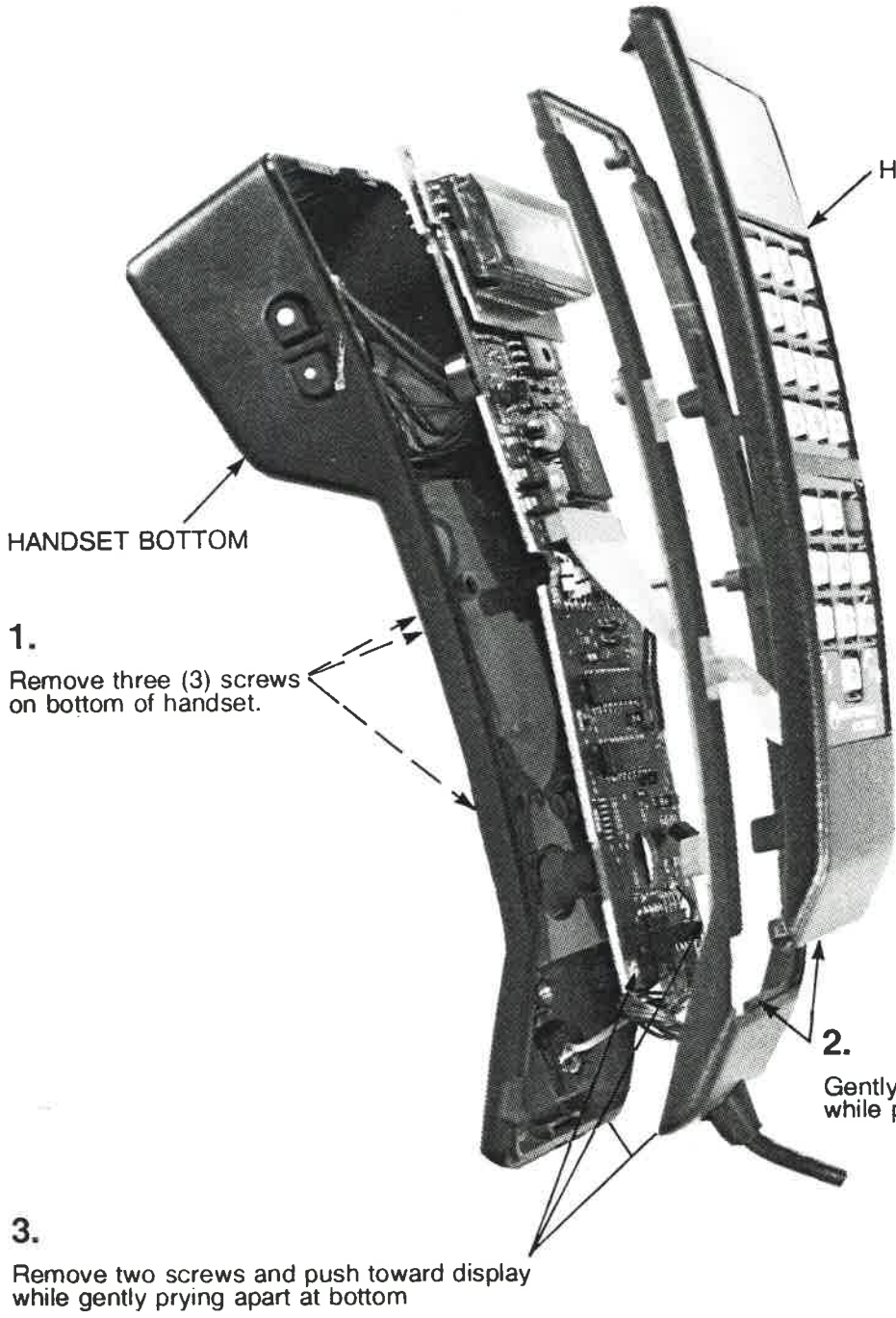
(12) Electronic lock  Electronic lock to prevent unauthorized use. When the radiotelephone is locked the display shows "Locked". However, urgency calls can always be made:
90 000 in Sweden
000 in the rest of Scandinavia.
Note: The lock code is ↑ 1 2 3 unless otherwise programmed.

(13) Clear key  Deletes a function or character from the display.

(14) Mute key  Disables the microphone in both normal and handsfree operation.

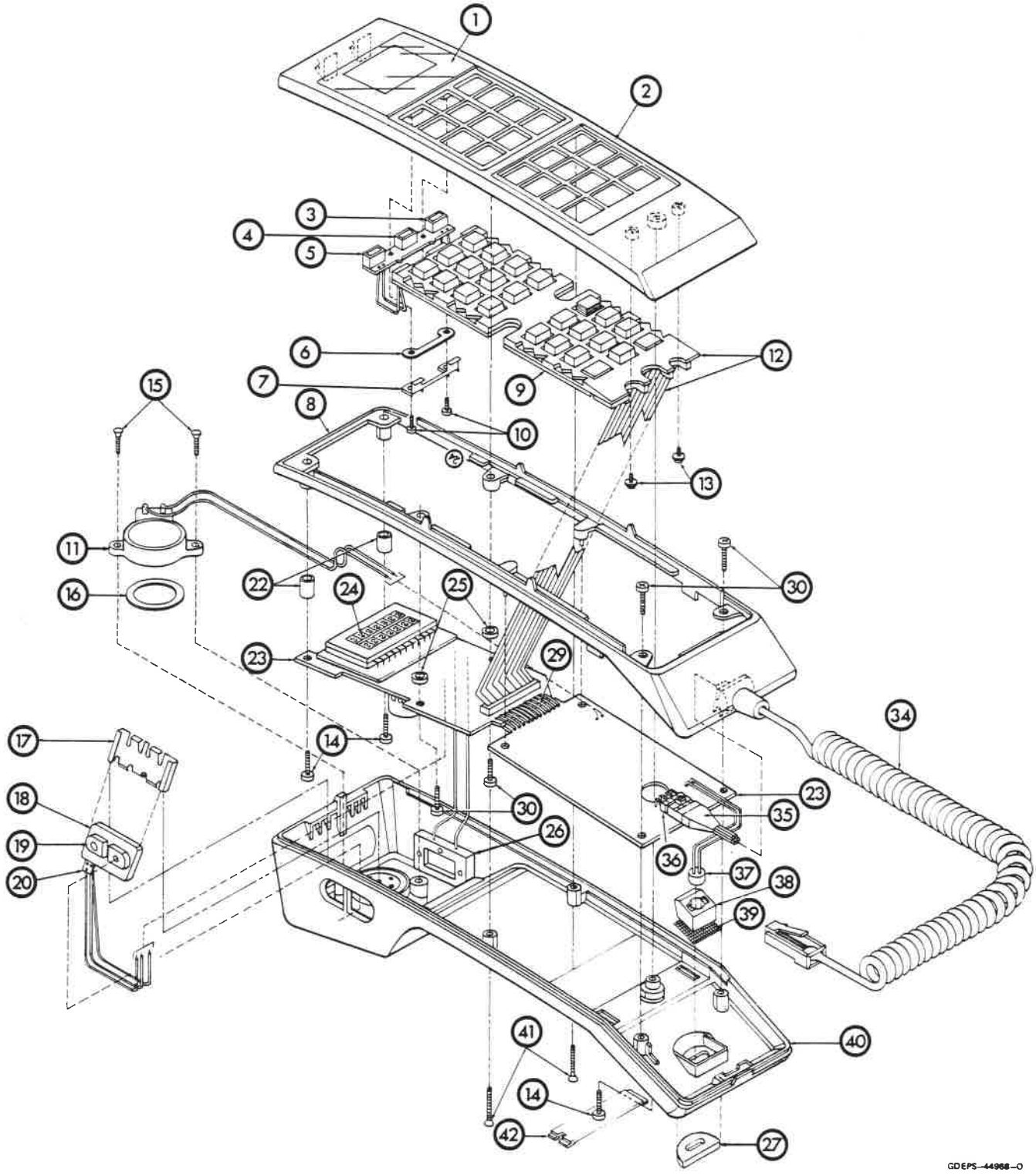
(15) ON/OFF  ON/OFF key.

(16) Lifted handset		Used for initiating a call or for answering an incoming call when the handset is out of its mount. Note: this button never has any effect when the handset is mounted.
(17) Handsfree	HF	Used for initiating a call without lifting the handset.
(18) Short number + name	Name	For storage of telephone numbers with names attached to them. Max. 99 numbers. Telephone numbers may contain up till 24 digits and names may contain up till 13 digits. See also (10).
(19)	R	Reserved for future functions.
(20) Shift key		Used in sequences with other keys for enabling secondary functions.



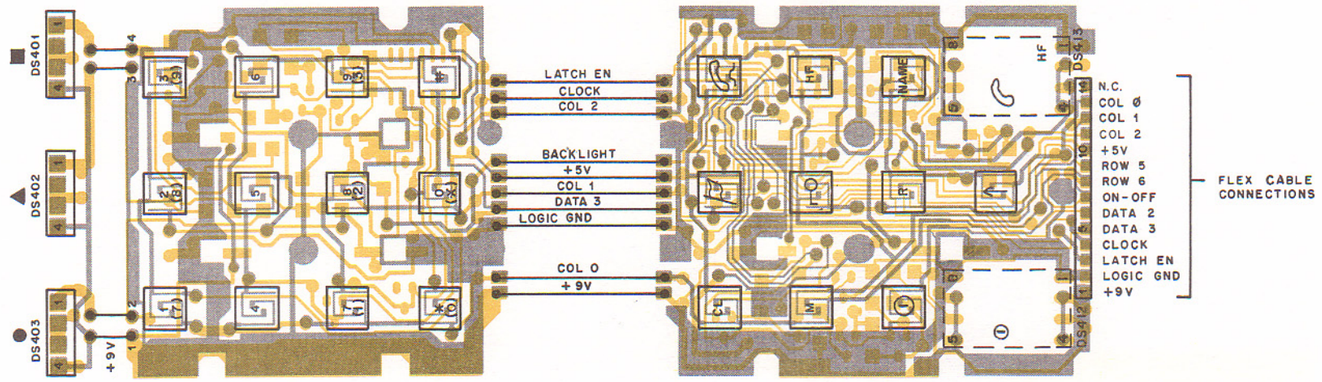
CONTROL UNIT DISASSEMBLY PROCEDURE

M405.495



MCR9500XL
CONTROL UNIT
EXPLODED VIEW

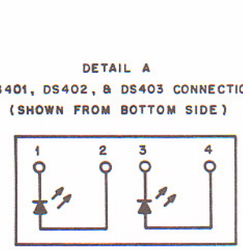
M405.491

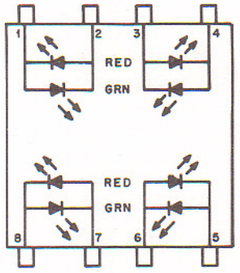


KEYPAD SHOWN FOR CCITT MODEL;
ISO KEYPAD NUMBERS SHOWN IN PARENTESES ( ).

DETAIL B
DS411 & DS412 CONNECTIONS

DETAIL A
DS401, DS402, & DS403 CONNECTIONS
(SHOWN FROM BOTTOM SIDE)

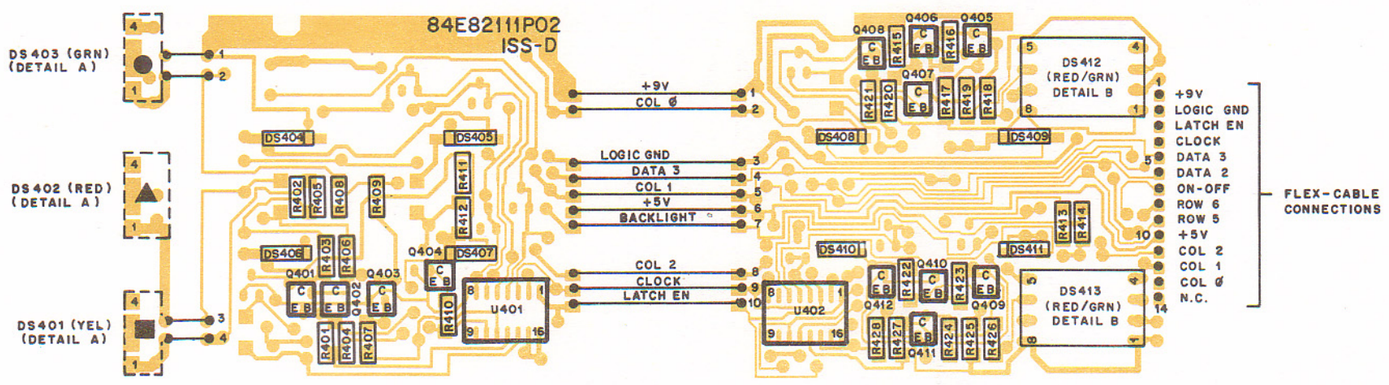




(SHOWN FROM MOUNTING [SOLDER] SIDE.)

SHOWN FROM COMPONENT SIDE

COMPONENT SIDE BD-CEPS-44950-0
SOLDER SIDE (TOP) BD-CEPS-44951-0
● OL-CEPS-44952-0



SHOWN FROM SOLDER SIDE

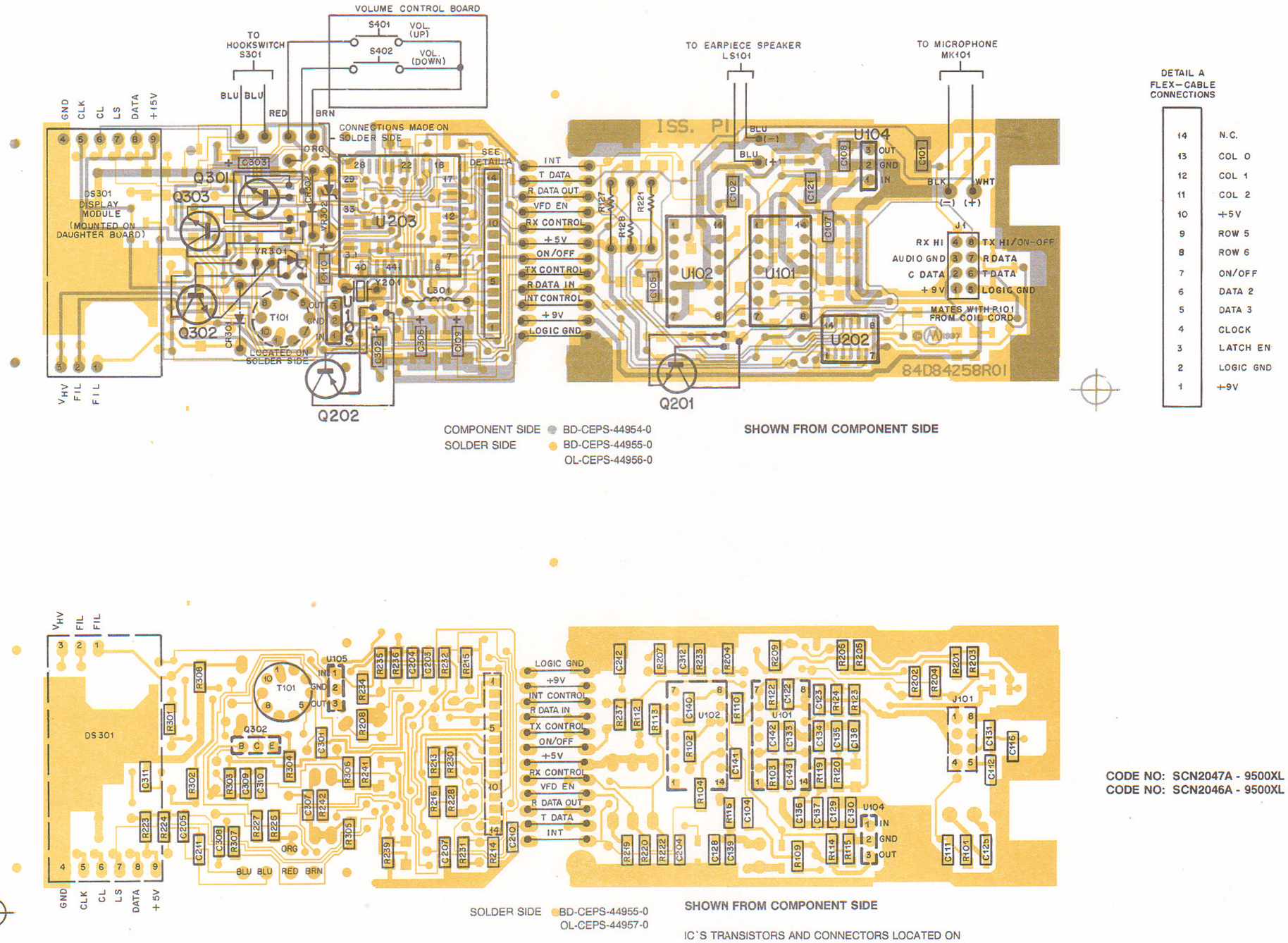
LED'S LOCATED ON COMPONENT SIDE ARE SHOWN HERE WITH DASHED LINES FOR LANDMARK REFERENCE ONLY.

SOLDER SIDE (BOT) BD-CEPS-44951-0(REV)
● 0L-CEPS-44953-0

CODE NO: SLN4724A - CCITT KEYPAD
CODE NO: SLN4723A - ISO KEYPAD

KEYPAD BOARD (ISO/CCITT) COMPONENT LAYOUT

D405.066/2



DETAIL A
FLEX–CABLE CONNECTIONS

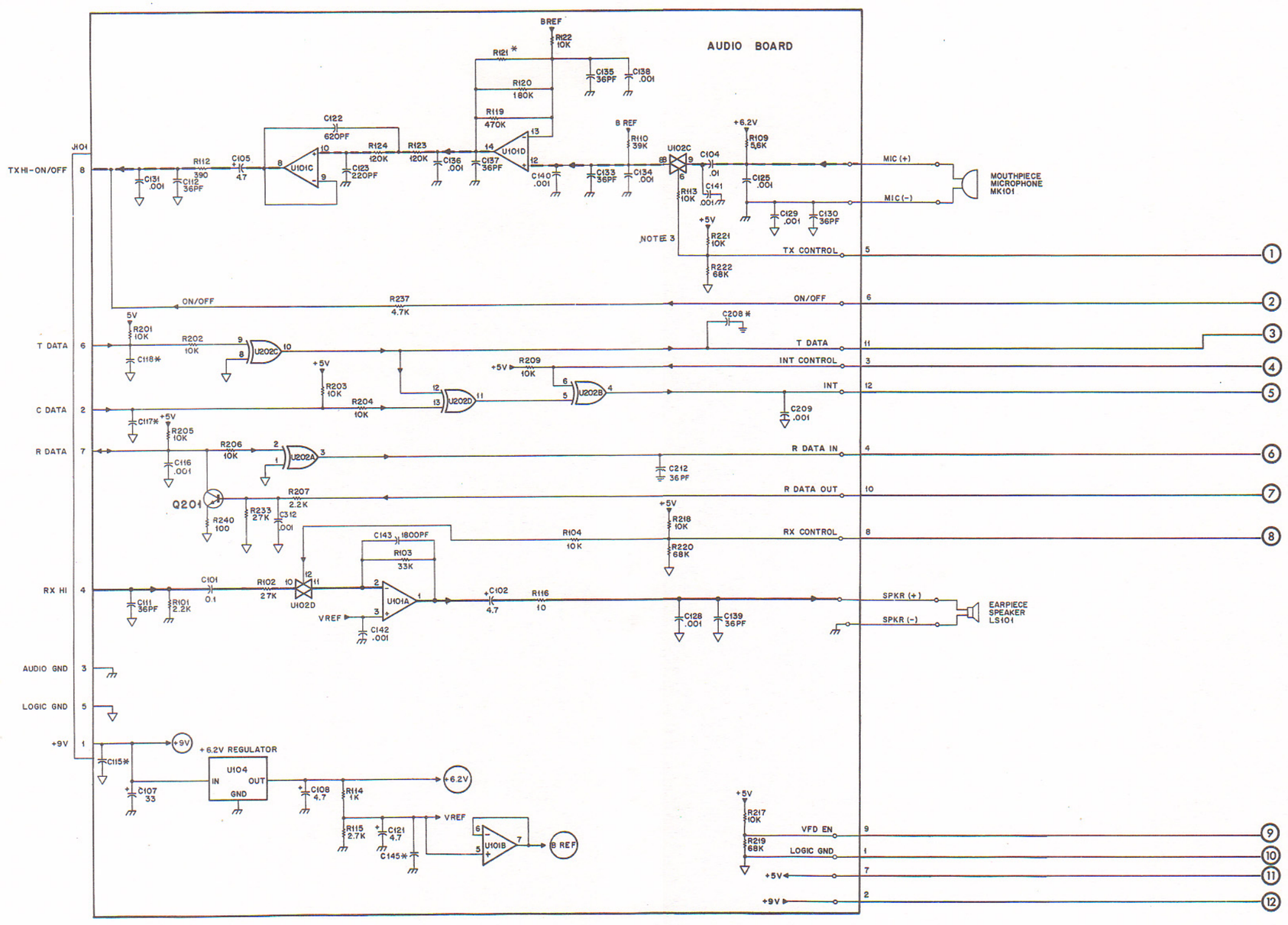
14	N.C.
13	COL 0
12	COL 1
11	COL 2
10	+5V
9	ROW 5
8	ROW 6
7	ON/OFF
6	DATA 2
5	DATA 3
4	CLOCK
3	LATCH EN
2	LOGIC GND
1	+9V

IC`S TRANSISTORS AND CONNECTORS LOCATED ON COMPONENT SIDE ARE SHOWEN HERE WITH DASHED LINES FOR LANDMARK REFERENCE ONLY.

CODE NO: SCN2047A - 9500XL CCITT CONTROL UNIT
CODE NO: SCN2046A - 9500XL ISO CONTROL UNIT

HANDSET BOARD CONTROL UNIT COMPONENT LAYOUT

D405.068/2



Integrated Circuit Power and Ground Connections

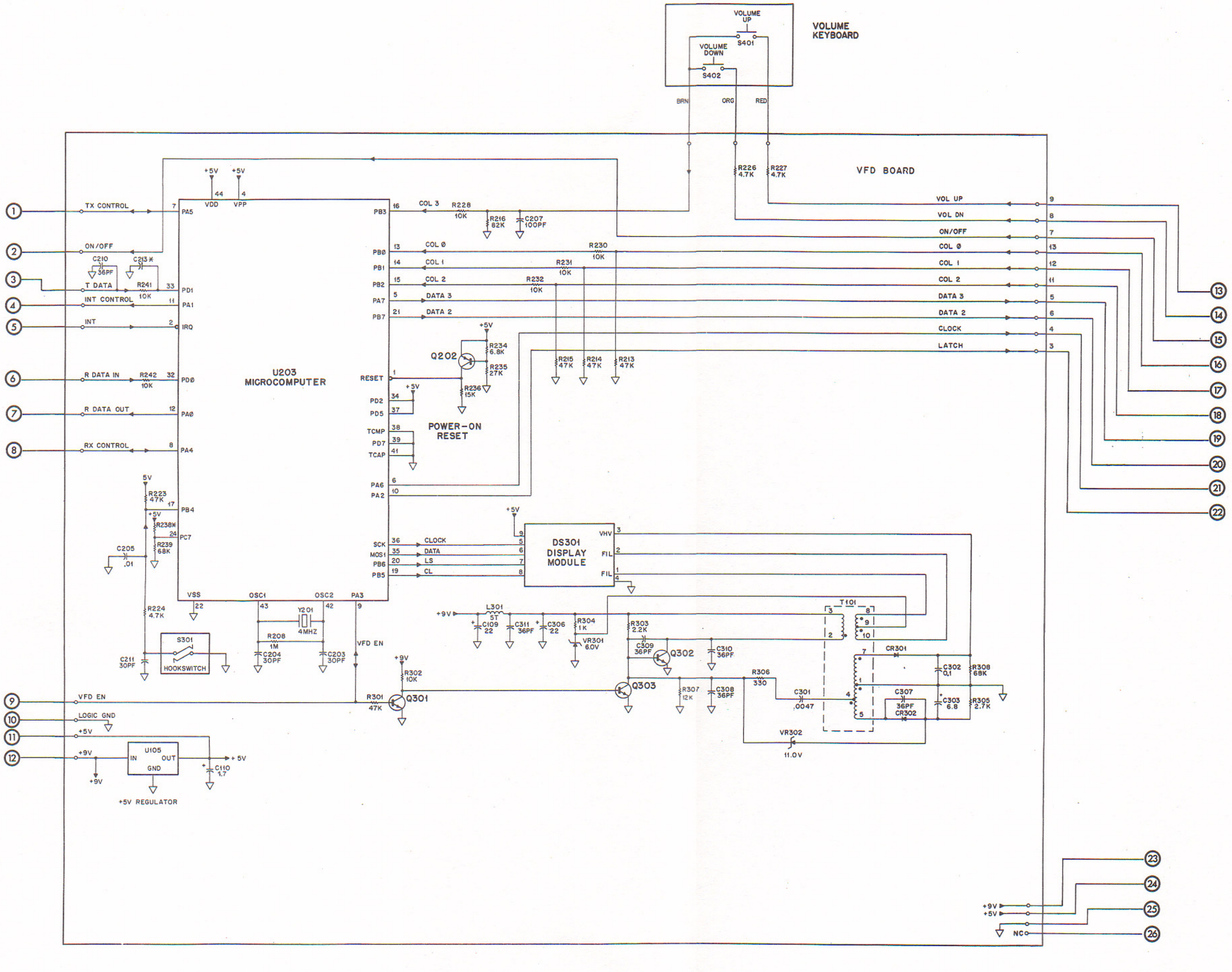
Ref. Desig.	Description	Power Connections			
		VDD	Audio GND	Logic GND	Supply
U101	Quard Differential Op Amp	4 (VCC)	11	-	9 V
U102	Quard Analog Switch	14	7	-	6.2 V
U104	6.2 V Regulator	-	-	-	9 V
U105	5 V Regulator	-	-	-	9 V
U202	Quard Exclusuve OR	14	-	7	5 V
U203	Microprocessor	44	-	22	5 V
U401, 402	8-Stage Shift/Store Register	16	-	8	5 V

NOTES:

1. Unless otherwise stated, all resistor values are in ohms and all capacitor values are in microfarads.
2. upper keypad shown on schematic is for CCITT model. Refer to Detail A fcr ISO model.
3. components marked with an asterisk (*) are not inserted for this model.

MCR9500XL
HANDSET BOARD
CONTROL UNIT
AUDIO BOARD

D405.069



MCR9500XL
HANDSET BOARD
CONTROL UNIT
VDF BOARD
D405.070

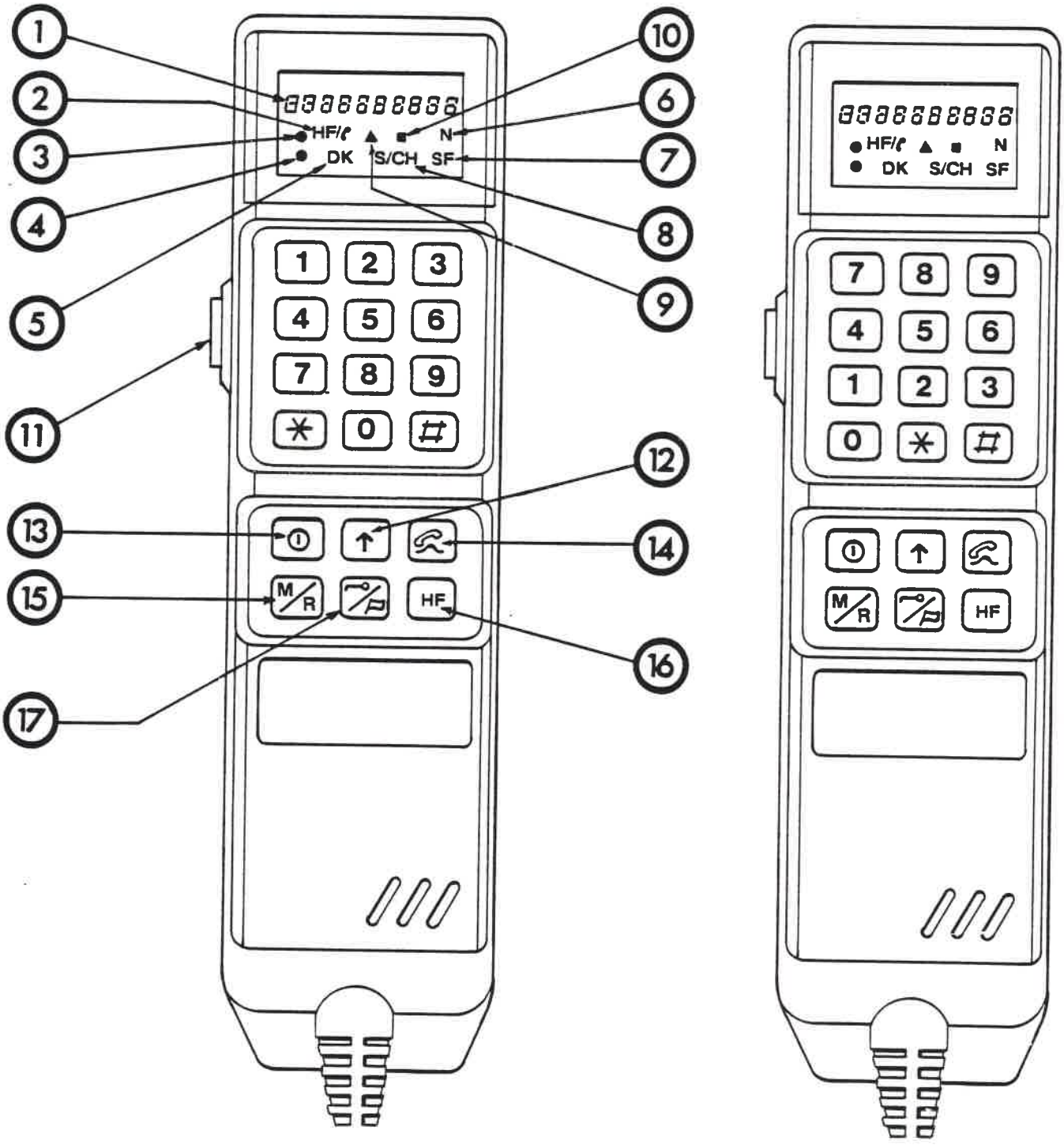
CHAPTER
CHAPITRE
KAPITEL

7

HANDSET PRESENTATION

HANDSET WITH CCITT KEYPAD

HANDSET WITH ISO KEYPAD



HANDSET LAYOUT

M405.450

HANDSET CONTROLS AND DISPLAY

Refer to the accompanying Figure M405.450 for location and cross-reference of the various handset controls and indicators.

DISPLAY

The handset display shows the telephone number dialled and provides the status of various mobile telephone operations.

(1) Dialled Number Display	Displays up to 10 digits of an entered telephone number. Alpha messages relating to feature activiation are also shown here.
(2) HF/✆ (yellow) Hands Free/Hookswitch	Illuminates steadily when a call is in process and Hands Free mode is not in use. Indicator will flash when a call is in process and Hands Free mode has been selected.
(3) ● (green) Service	Illuminates when the radio is able to make and receive calls.
(4) ● (yellow) Power	Steady illumination when the unit is powered on.
(5,6,7,8) DK, S/CH, SF, N (red) Country Codes	One of these four indicators will be illuminated to show the country of operation. See "Country Select,"p__.
(9) ▲ (red) Roam	Illuminates when an automatic attempt by the radio to update the system about your new location has been unsuccessful. You may still be able to place calls but not receive them. See "Roaming,"p__.
(10) ■ (yellow) Call Received/MFT	Flashes whenever an incoming call occurs, extinguishes when you answer the call. If you do not answer the call, the indicator will change to a steady illumination when the calling party terminates the call. See "Unanswered Calls,"p_.

(11) VOLUME CONTROLS

The pushbutton on the left side of the handset adjusts the speaker volume, handset audio, or ringer alert tone. Holding the volume button down increases the volume level in steps until the maximum level is reached, or until the button is released. The next time this button is held down, the volume level will automatically decrease in steps until the minimum level is reached or until the button is released.

Adjust Speaker Volume	Operate the volume button when not in a conversation. The speaker volume will also be adjusted when in a conversation if the Hands Free mode has been selected.
Adjust Handset Volume	Operate the volume button with the handset to your ear and in a conversation.
Adjust Ringer Volume	Press (12) [↑], then operate the volume button.

PUSHBUTTON KEYPAD

The upper portion of the mobile telephone keypad (12 buttons) is used for telephone number entry. The lower portion of the keypad (6 buttons) is used to enable specific functions of the mobile telephone.

(12) [↑]	Used in sequences with other buttons to enable secondary features
(13) [⏻] Power	Turns the telephone on and off.
(14) [📞] Send	Used to initiate the call attempt after the number has been dialled (or to answer an incoming call) if the handset is out of its mount. Note: This button never has any effect when the handset is mounted.

(15) M/R
Mute/Register Recall

Register Recall used to enable future system provided features. Mute, which is enabled by the ↑ + M/R sequence, disables the outbound audio of the telephone.

(16) HF
Hands Free

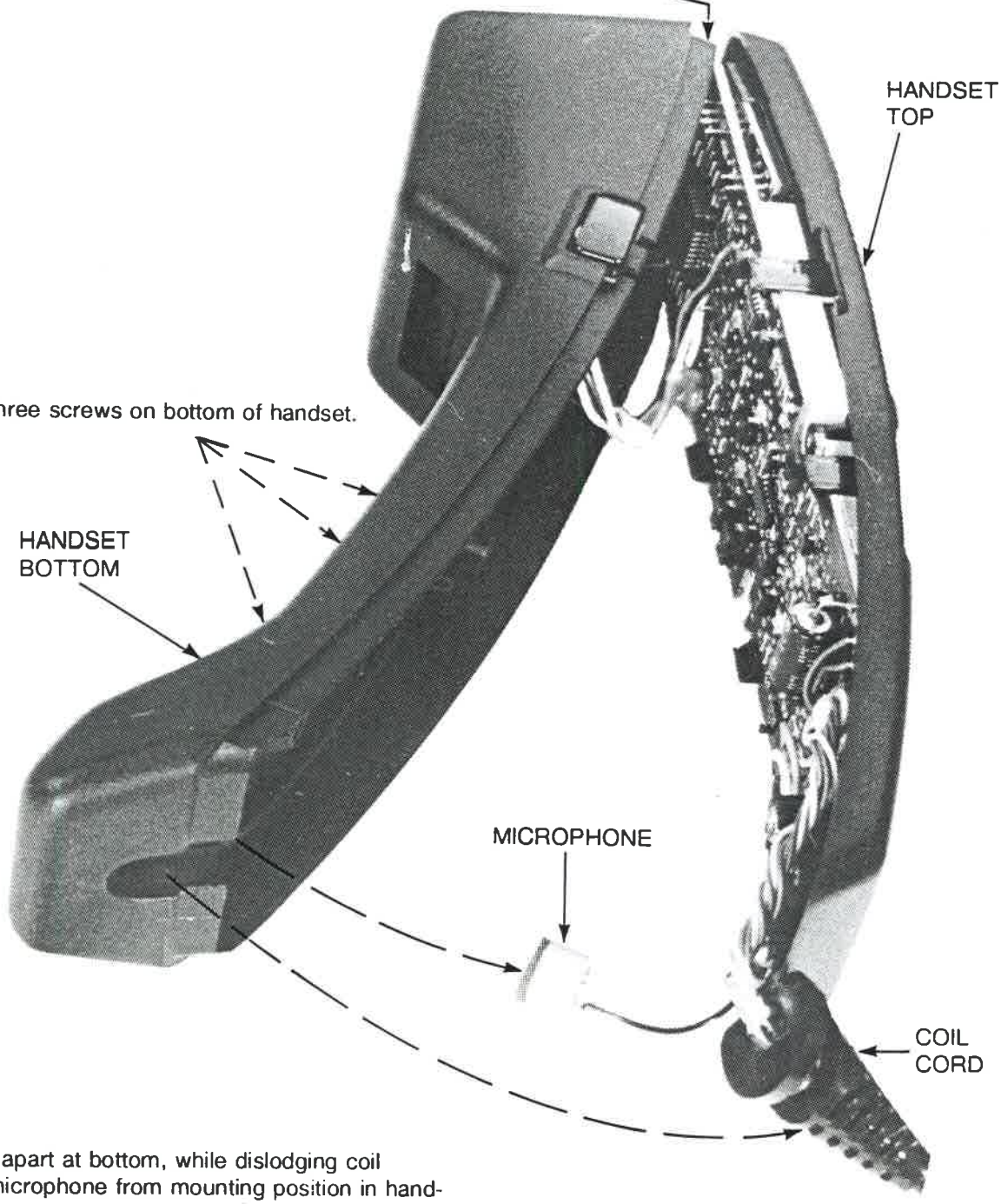
Used to enable/disable the speakerphone method of conducting a conversation instead of using the handset.

(17)
Lock/Country Select

Country Select key changes the country of operation. Lock, enabled by the ↑ + sequence, electronically locks to prevent unauthorized use.

3.

Lift handset top up and out of notches in handset bottom. Handset may now be spread open for service with only the wires for the volume switch, hook-switch, and earpiece speaker holding the two halves together.



1.

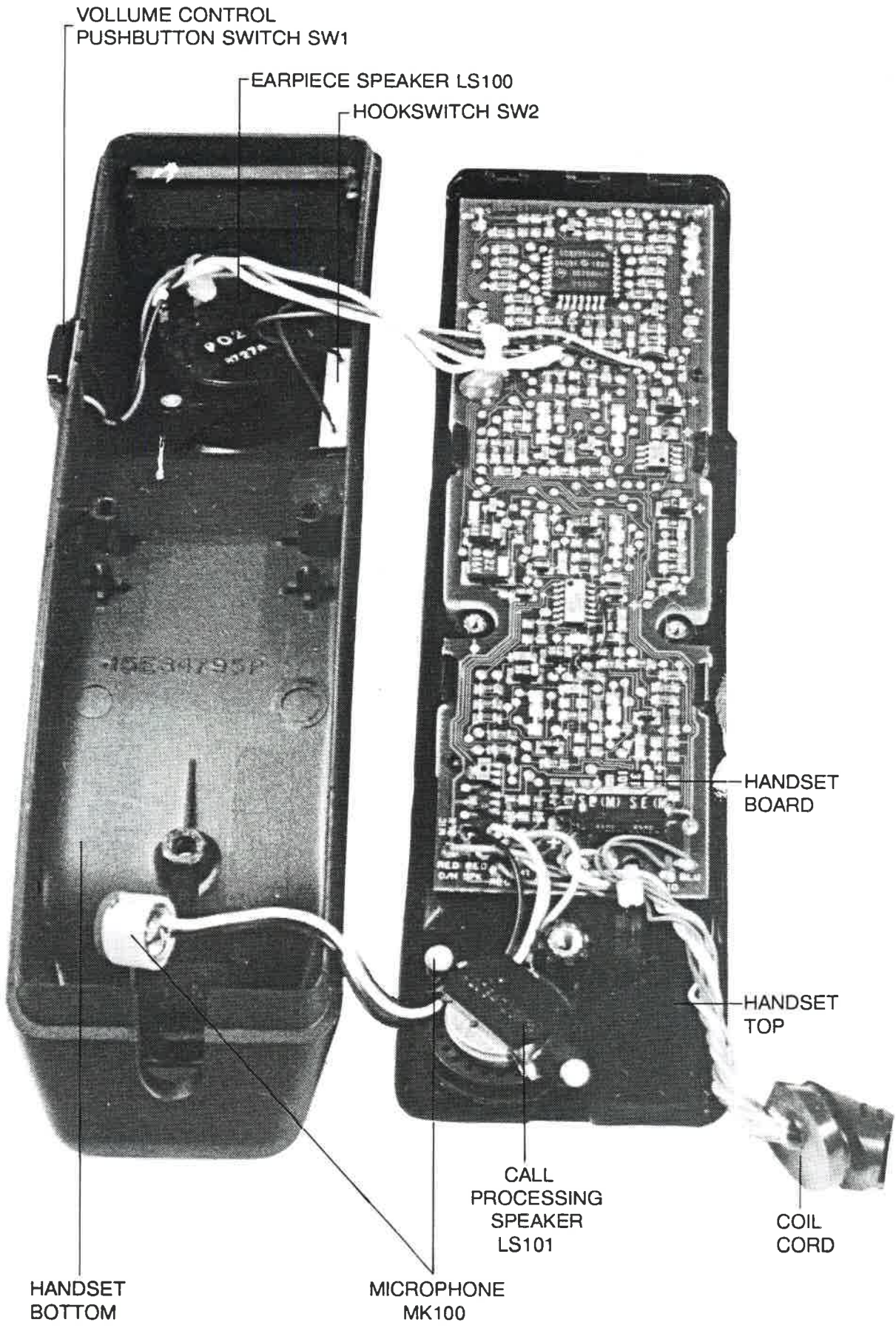
Remove three screws on bottom of handset.

2.

Gently pry apart at bottom, while dislodging coil cord and microphone from mounting position in hand-set bottom.

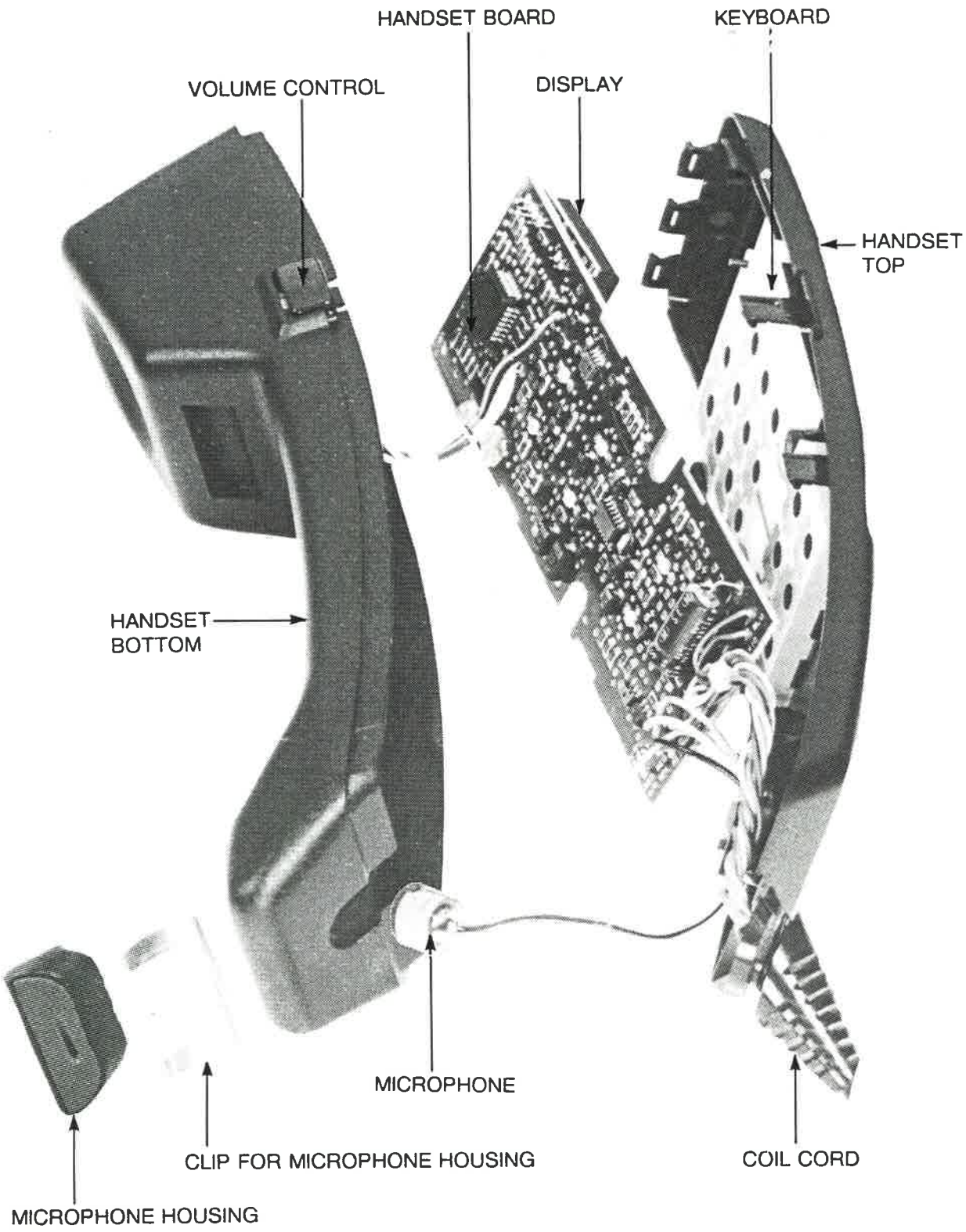
DISASSEMBLY PROCEDURE

- Figure 1 - **M405.444**



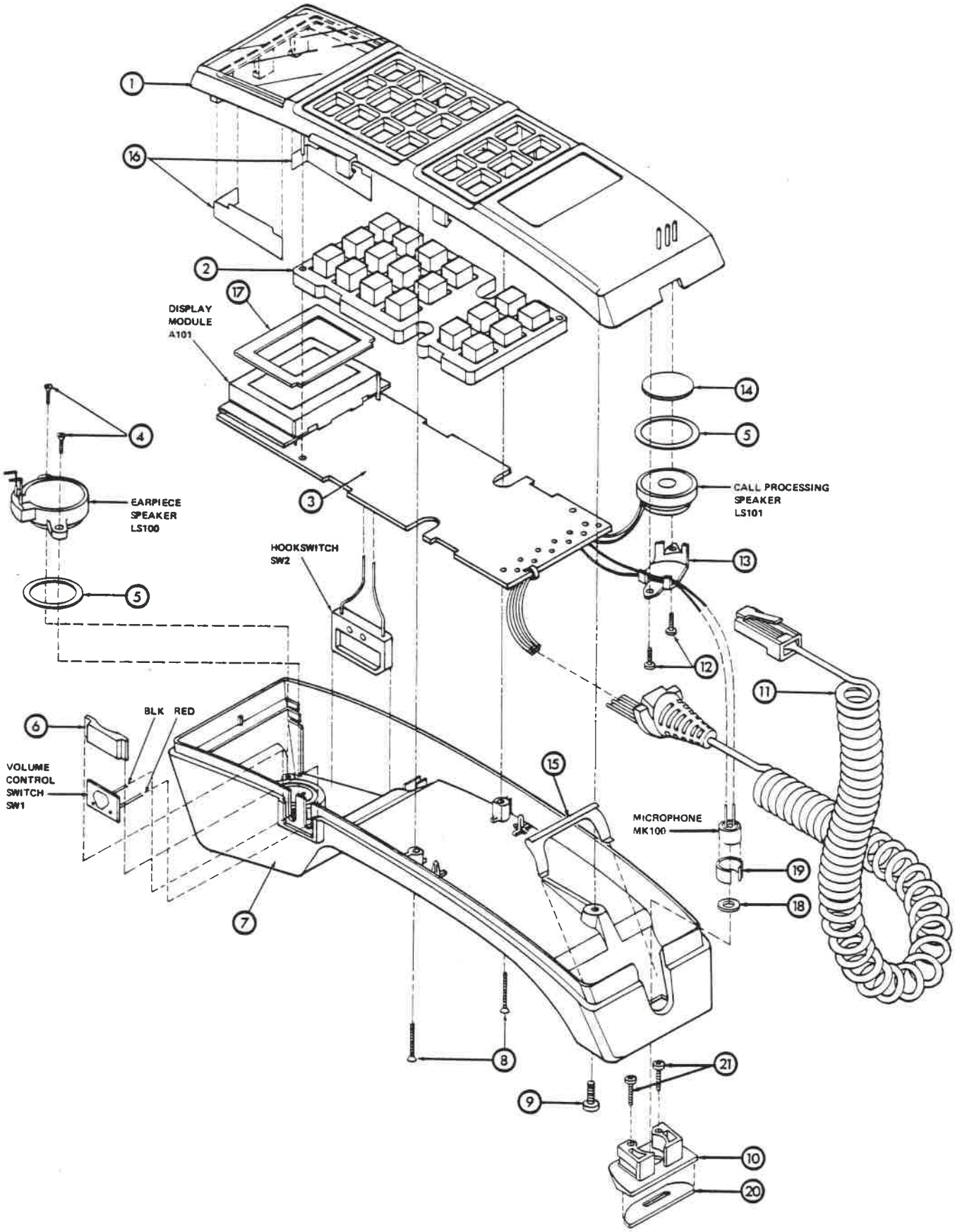
CONTROL UNIT INTERIOR VIEW

- Figure 2 - M405.449



HANDSET PRINCIPAL COMPONENTS

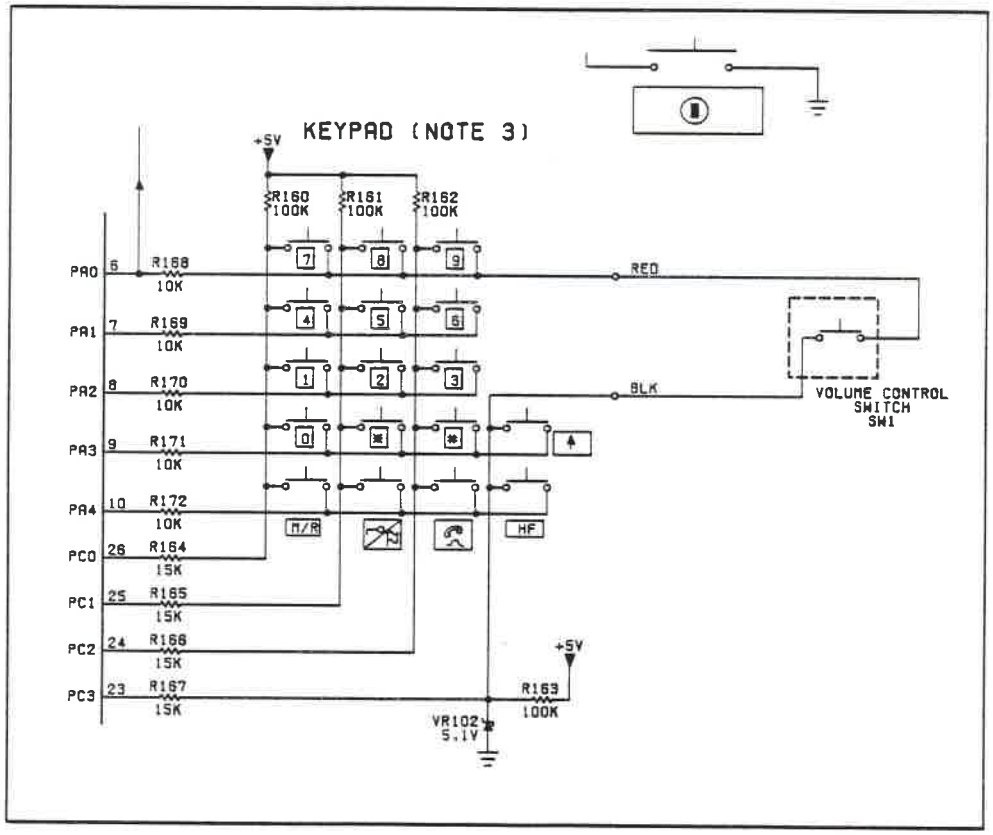
- Figure 3 - M405.445



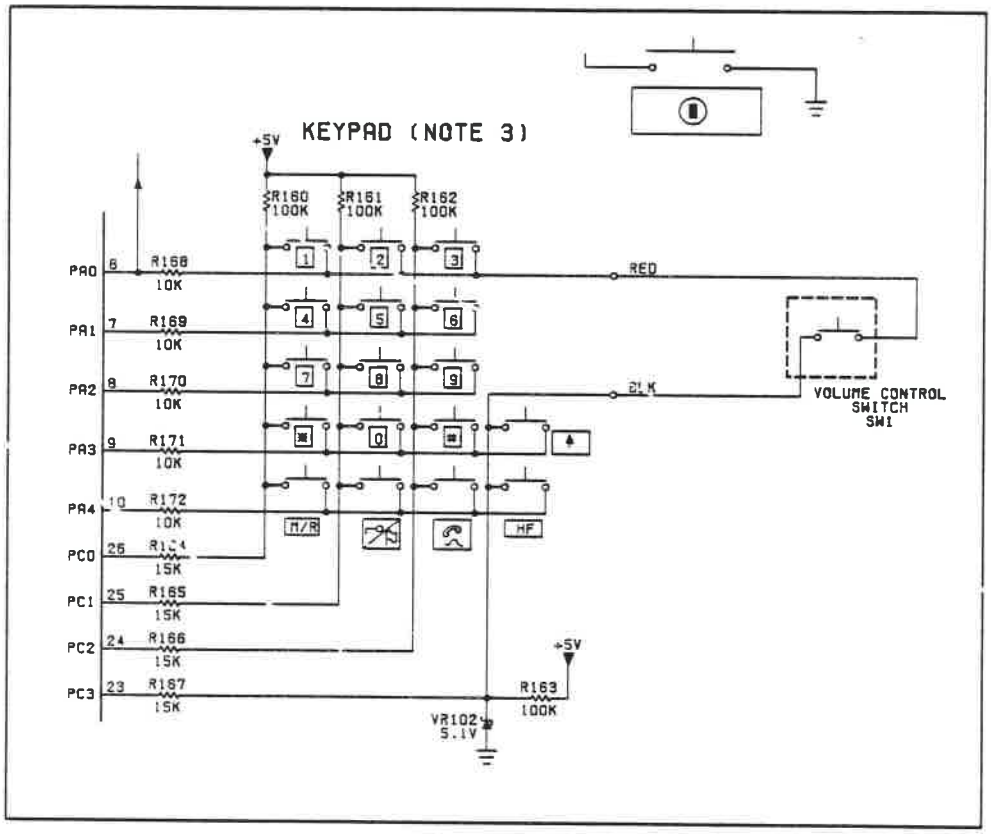
CONTROL UNIT EXPLODED VIEW

M405.446

DETAIL A. KEYPAD LAYOUT FOR MODEL ISO

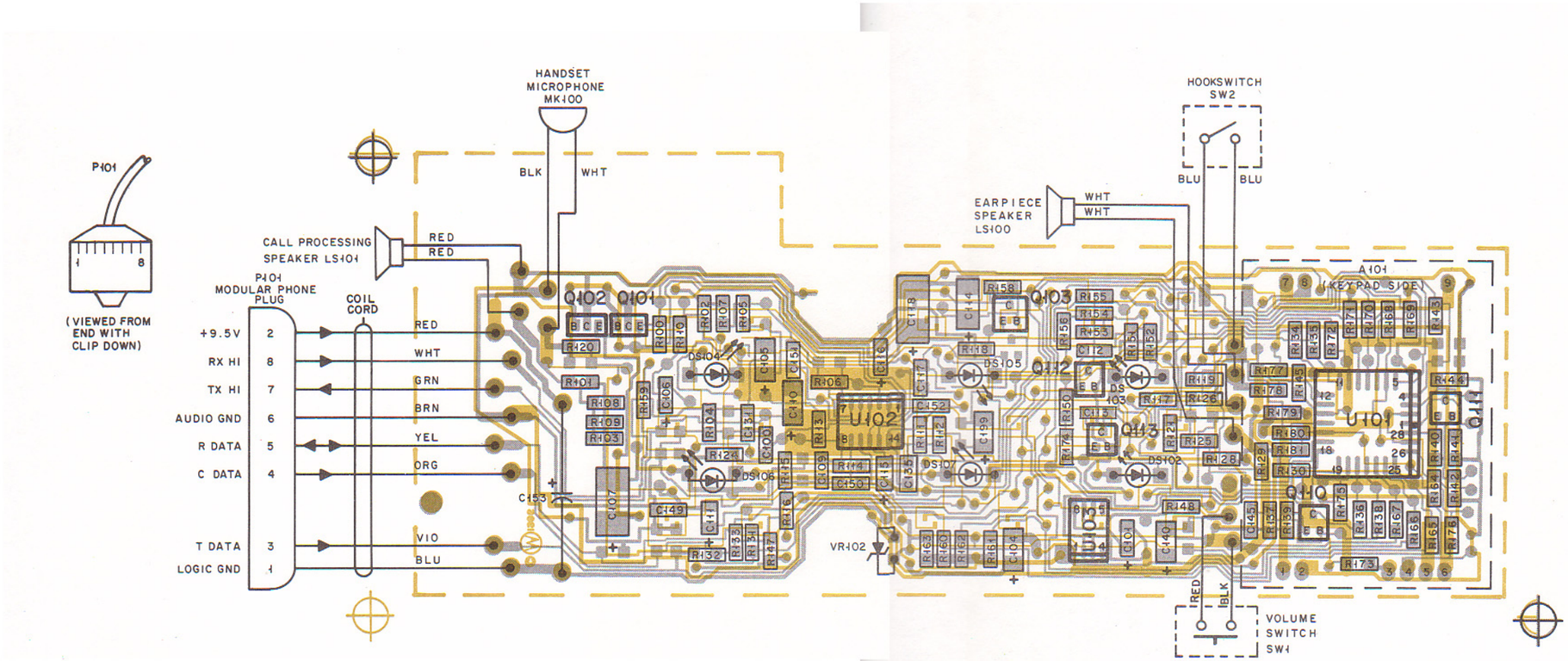


DETAIL B. KEYPAD LAYOUT FOR MODEL CCITT



KEYPAD LAYOUTS, CONTROL UNIT

D404.936



HANDSET BOARD, CONTROL UNIT COMPONENT LAYOUT

D404.937

INDICATOR BOARD

DS403 GRN

DS402 RED

DS401 YEL

UPPER KEYPAD

ROW 1

ROW 2

ROW 3

ROW 4

R408 120

R405 150

R402 120

R409 120

R406 150

R403 120

Q403

Q402

Q401

Q404

R407 1.5K

R404 1.5K

R401 1.5K

R410 620

NC

KEYPAD BACKLIGHT

DS404

DS405

R411 470

DS406

DS407

R412 470

U401

DATA

CLOCK

STROBE

VDD

EN

VSS

+5V

COL 0

COL 1

COL 2

DATA 3

CLOCK

LATCH EN

+9V

W301 FLEX-CABLE

ROW 5

ROW 6

ROW 7

ON/OFF

CL

M

HF

R

NAME

COL 0

COL 1

COL 2

DATA 3

DATA 2

CLOCK

LATCH EN

NC

POWER DS412

HF DS413

RED

GRN

R415 30

R417 1.8K

R416 1.8K

Q405

Q406

Q409

R424 1.8K

R423 1.8K

R422 30

Q410

R419 160

R426 160

R418 160

R425 160

Q407

Q408

Q411

Q412

R420 620

R421 620

R427 620

R428 620

N.C.

U402

KEYPAD BACKLIGHT

DS408

DS409

R413 470

DS410

DS411

R414 470

LOWER KEYPAD

LEGEND

TX AUDIO PATH

RX AUDIO PATH

LOGIC GND

AUDIO GND

DETAIL A

UPPER KEYPAD DETAIL FOR ISO MODEL

COL 0

COL 1

COL 2

MCR9500XL

HANDSET BOARD

CONTROL UNIT

KEYPAD BOARD

D405.071

TX AUDIO AMPLIFIER

RX AUDIO AMPLIFIER (CALL PROCESSING AUDIO)

RX AUDIO AMPLIFIER (EARPIECE AUDIO)

+5V REGULATOR

MICROPROCESSOR

U101 POLLS KEYPAD, DRIVES DISPLAY MODULE, GENERATES AUDIO CONTROL LINES TO AUDIO AMPLIFIER STAGES, AND COMMUNICATES WITH TRANSCEIVER VIA 3-WIRE BUS (T DATA, C DATA, & R DATA).

U103 AND ASSOCIATED CIRCUITRY PROVIDES OPERATING VOLTAGES OF +5V, FILT +5V, FILT +9, AND +9.5V DC FROM +9.5V DC INPUT.

HANDSET MICROPHONE MK100

P/O COIL CORD

P/O P101

CALL PROCESSING SPEAKER LS101

EARPIECE SPEAKER LS100

DISPLAY MODULE (NOTE 2)

SEE NOTE 3

SEE DRAWING D404.936

BACKLIGHTING LEDS

HOOKSWITCH SW2

MIC CNTRL
MIC ON=+5V
MIC OFF=0V

CALL PROC SPKR CNTL
SPKR ON=+5V
SPKR OFF=0V

HDST SPKR CNTRL
SPKR ON=+5V
SPKR OFF=0V

NOTES:

1. UNLESS OTHERWISE STATED, ALL RESISTOR VALUES ARE IN OHMS AND CAPACITOR VALUES ARE IN MICROFARADS.
2. DISPLAY MODULE A101 CONSISTS OF MULTI DIGIT 7-SEGMENT LCD DISPLAY, STATUS INDICATORS, AND OTHER SUPPORT CIRCUITRY ALL CONTRAINED ON A NON-SERVICEABLE DAUGHTER BOARD. REPAIR IS ONLY BY REPLACEMENT OF THE DAUGHTER BOARD.
3. TWO DIFFERENT KEYPADS ARE AVAILABLE FOR THE CONTROL UNIT TO ADAPT TO VARIOUS OPERATING SYSTEMS.
   DETAILS A AND B SHOW KEYPAD LAYOUTS

IC DATA TABLE

REF DESIG	DESCRIPTION	PWR CONNECTIONS VCC	GND
U101	MICROPROCESSOR	28(VDD)	14(VSS)
U102	QUAD OP AMP	4	11
U103	+5V REGULATOR	—	—

LEGEND:
- TX AUDIO PATH (MIC AUDIO)
- RX AUDIO PATH (EARPIECE AUDIO)

HANDSET BOARD, CONTROL UNIT

D404.935

CHAPTER
CHAPITRE
KAPITEL

8

ACCESSORIES OVERVIEW

Part No.	Name/Description
J709953P1	AN6667 Antenna for mounting on the radio unit. Frequency range: 451 - 468 MHz.

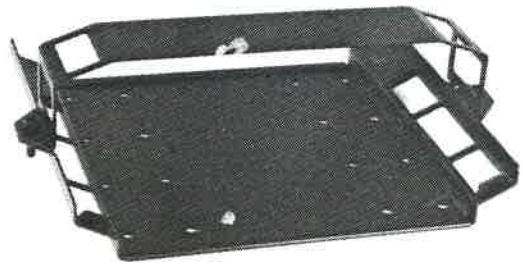
K806123G1	BU6005 This is a 1.2 Ah NiCd Battery Unit. Weight: 0.72 kg. Height: 51 mm

M906566G1	BU6004 This is an optional 5 Ah NiCd Battery Unit. Weight: 1.7 kg. Height: 73 mm.
M906649P1	CC3001 Control cable for the mobile installation. Consists of a 25 position D-connector with cable connections for: 1. Microphone, 2. Loudspeaker, 3. Hang-up cup, 4. Car battery, Alarm, Ignition Switch, Mute

Part No.	Name/Description
L856224P1	CC3002 Extension cable for the VSP microphone. Used for a portable unit in a mobile installation.
L856225P1	CC3003 Speaker extension cable. Used for a portable unit in a mobile installation.
J711280P1	CC3004 Extension cable for the handset hang-up cup. Used for a portable unit in a mobile installation.
NOT YET RELEASED	CC3005 Charger extension cable. Used for a portable unit in a mobile installation. 3006 cc 6040 cigarette lighter stik
K806125G	CU6007 Charging Unit for 220 V. Charging is not able to take place while the transmitter is on. However, charging will take place in stand-by. Max. current 1.2 A.
K806126G	CU6008 Charging Unit for 10 V to 32 V supply. Charging is not able to take place while the transmitter is on. However, charging will take place in stand-by. Max. current 1.2 A.

Part No.	Name/Description

M906632P1 MN6014
Mounting tray for the radio unit when used in a mobile installation.
The radio is fastened to the tray by two unbraco screws.

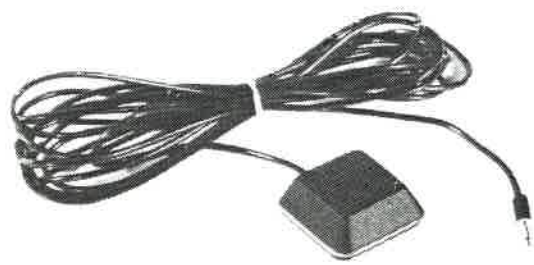


SCN2082A LOUDSPEAKER-MICROPHONE KIT
Kit comprising Loudspeaker SSN4002A, Handsfree Microphone TMN6162A as well as a sun visor mounting clip for the microphone.

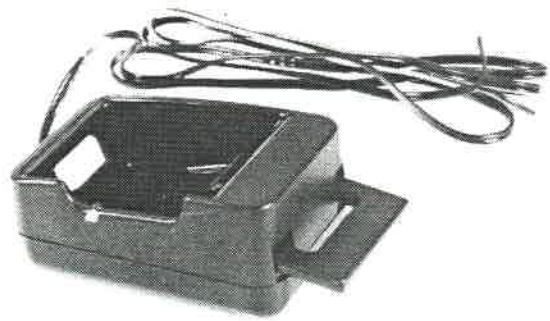
Visor Clip

SSN4002A LOUDSPEAKER
Loudspeaker delivered with connector cable and screws.
For connection either through the control cable, CC3001, in the mobile version, or through the extension cable, CC3003, in the portable version.

TMN6162A HANDSFREE MICROPHONE
Microphone with connector cable for use during handsfree operation.
For connection either through the control cable, CC3001, in the mobile version, or through the extension cable, CC3002, in the portable version.



Part No.	Name/Description
TRN5095A	HANG-UP CUP Hang-up cup for control handset.



BU6004 & BU6005

BATTERY UNITS

The battery units, BU6004/BU6005, are formed to fit the bottom of the radio and is attached by 2 snap fasteners.

The units contain:

- 10 NiCd cells connected in series forming a pack with 2 female spade connectors on flexible wire as termination.

- A printed wiring board (PWB) with spade terminals corresponding to those on the battery pack. Towards radio the PWB is equipped with 6 circular blank terminals, 2 of them connected to a thermistor (NTC) network mounted on the PWB and sensing the temperature rise in the battery pack at the end of charging. The ambient temperature is also sensed to reduce charging to 10% below + 10 deg.C.

- A top plate with miscellaneous informative printing and a slot for engaging the 6 terminals to the radio. At the lower end of the battery pack there is a connector for external charging.

Charging facility can be included in the radio or it can be supplied as an external charger.

HANDLING RECOMMENDATIONS

In order to obtain full capacity on batteries that have been stored for a longer period of time (more than a month) the charge - discharge cycle should be repeated a few times. Nominal capacity will normally be obtained in less than 3 cycles.

TECHNICAL SPECIFICATIONS

Values in paranthesis are for BU6004.

Dimensions
L x W x H: 217 x 65 x 51 mm
(217 x 65 x 73 mm)

Weight
0.725 kg
(1.9 kg)

Capacity (C5)
1.2 Ah
(4 Ah)

Voltage
nomial at 25°C: 12 V

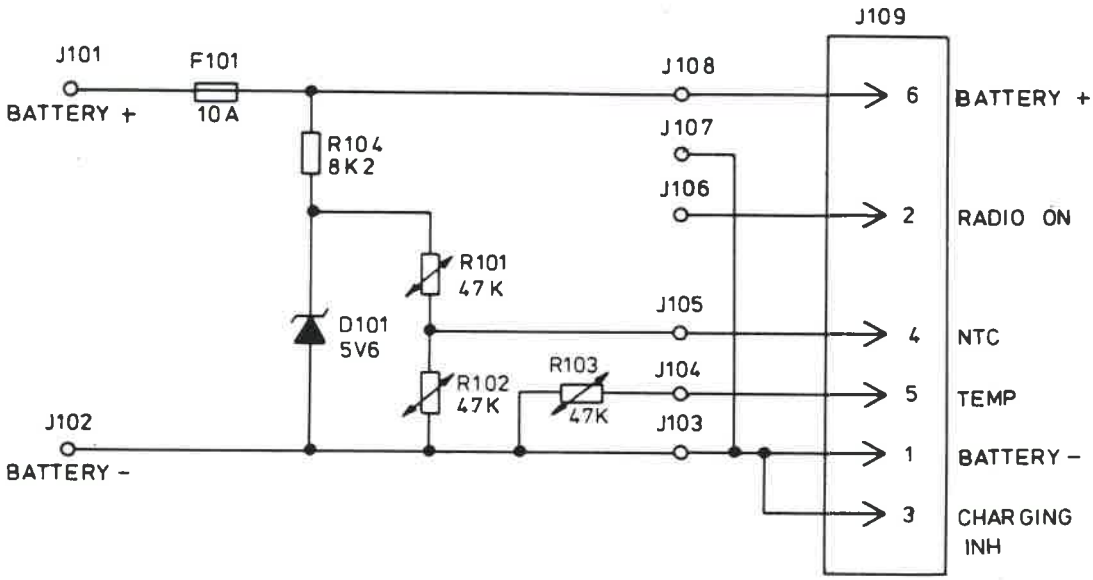
Internal resistance (at 25° C)
DC (incremental): 0.2 Ohm
(0.15 Ohm)
AC: 0.1 Ohm

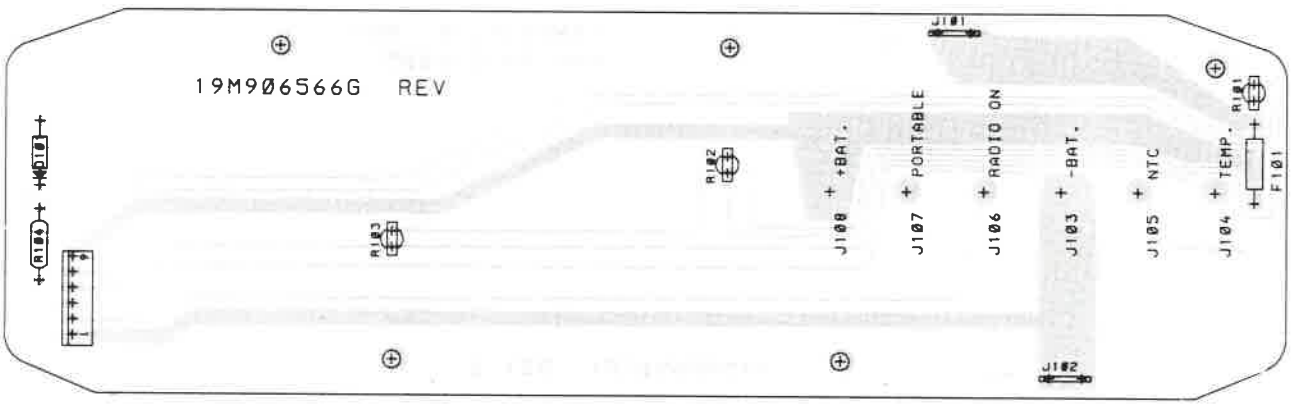
Charging current
recommended max: 1.2 A
(1.2 A)

Temperature range
charging: 10 to 45° C
discharge: -20 to +60° C
storage: -40 to +60° C

Internal fusing:
10 A

Thermistors (NTC):
47 kOhm





BATTERY UNIT BOARD BU6004/BU6005

CODE NO.M906566G1 D405.176/2

DATE: 10/18/1988

Pos	Code No	Description	Qt
D101	J706270P1	DIO SI ZENR 5V6 2% 0.4W	1
F101	J707468P13	FUSE CTG 10.0 A F	1
J101	J706683P1	TERM SPADE TAB 6.3MM	1
J102	J706683P1	TERM SPADE TAB 6.3MM	1
J103	J711026P1	CONTACT PIN	1
J104	J711026P1	CONTACT PIN	1
J105	J711026P1	CONTACT PIN	1
J106	J711026P1	CONTACT PIN	1
J107	J711026P1	CONTACT PIN	1
J108	J711026P1	CONTACT PIN	1
R101	J707406P15	RES THERM NTC 47K 5%	1
R102	J707406P15	RES THERM NTC 47K 5%	1
R103	J707406P15	RES THERM NTC 47K 5%	1
R104	A700019P48	RES DEPC 1/4W 8K2 5%	1
	M906567P1R0	BD PW	1
		NON ELECTRONICAL PART	
	J708296P4	SLV INS ELEC D-0.8/0.15	

Pos	Code No	Description	Qt

CU6008

CHARGING UNIT

FUNCTIONAL DESCRIPTION

The CU6008 is connected to the lighter plug and is used to charge the battery units BU6004 and BU6005.

The CU gets its input voltage from J101 when connected to a lighter plug in a car. Charging is indicated by a red LED.
Charging will take place at a constant current rate until a temperature rise is detected in the battery unit. Then charging will be reduced to 10% and a green LED indicates fully charged battery. The red LED will now be switched off.

Max. charging current is 1.2 A. It is reduced to 10% by temperatures below +10°C or by a difference in temperatures exceeding 7°C between ambient and cell temperature in the battery unit. In the last case the reduction will be kept until the voltage is turned off/on or the radio is turned on. The charging current is reduced to 50% if the radio is turned on.

Indicator lights.

- Red and green off: No charging/battery disconnected
- Red on, green off: Charging*
- Green on, red off: Temperature rise in BU has been attained

* If the output voltage is below approx. 3 V (fully discharged battery or short circuit) the red light will be dimmed or off.

CIRCUIT DESCRIPTION

The regulator Q103, Q105 and D102 is of a conventional analog type. It is switched off by Q101 if the battery is disconnected.
The oscillator U102a works at approx. 70 kHz and gives a triangular voltage to the comparator U102b which is controlled by U102c and d.

The square waved output from U102b goes to the driver set Q107, Q108, which controls Q109. The AC/DC converter is of the fly-back type and consists of Q109, D111, C110 and T101.
D110, R112, R148, C108 and D109 form a snubber circuit which supplies the LED, D109. U102c and D108 control the output voltage while U102d controls the output current in R149. The output current is determined by U101a, c and d.

The output on U101d goes high when the temperature is below +10°C. The duty cycle at Q109 thus decreases until the current is approx. 90 mA. The temperature rise sense U101c, D103 will switch over when the temperature in the BU (R2) rises approx. 7°C above the reference temperature R1 in the BU. It decreases the current to approx. 90 mA, but furthermore the green LED will be activated and the red one deactivated. This condition will continue until U101b goes on (low) or the supply voltage goes off/on. If the radio is on, trickle mode is cancelled by U101b and the current is reduced to approx. 600 mA by U101a.

L101, L102, L103 and L104 with associated capacitors are filters which damp the RF down to the input and output wires.

TECHNICAL SPECIFICATIONS

Input Voltage
J101: Min.: 10.8 V
Max.: 31.2 V

Output Voltage
Min.: 0 V

Max. at 25 deg. C
I load 0 mA: < 16.6 V

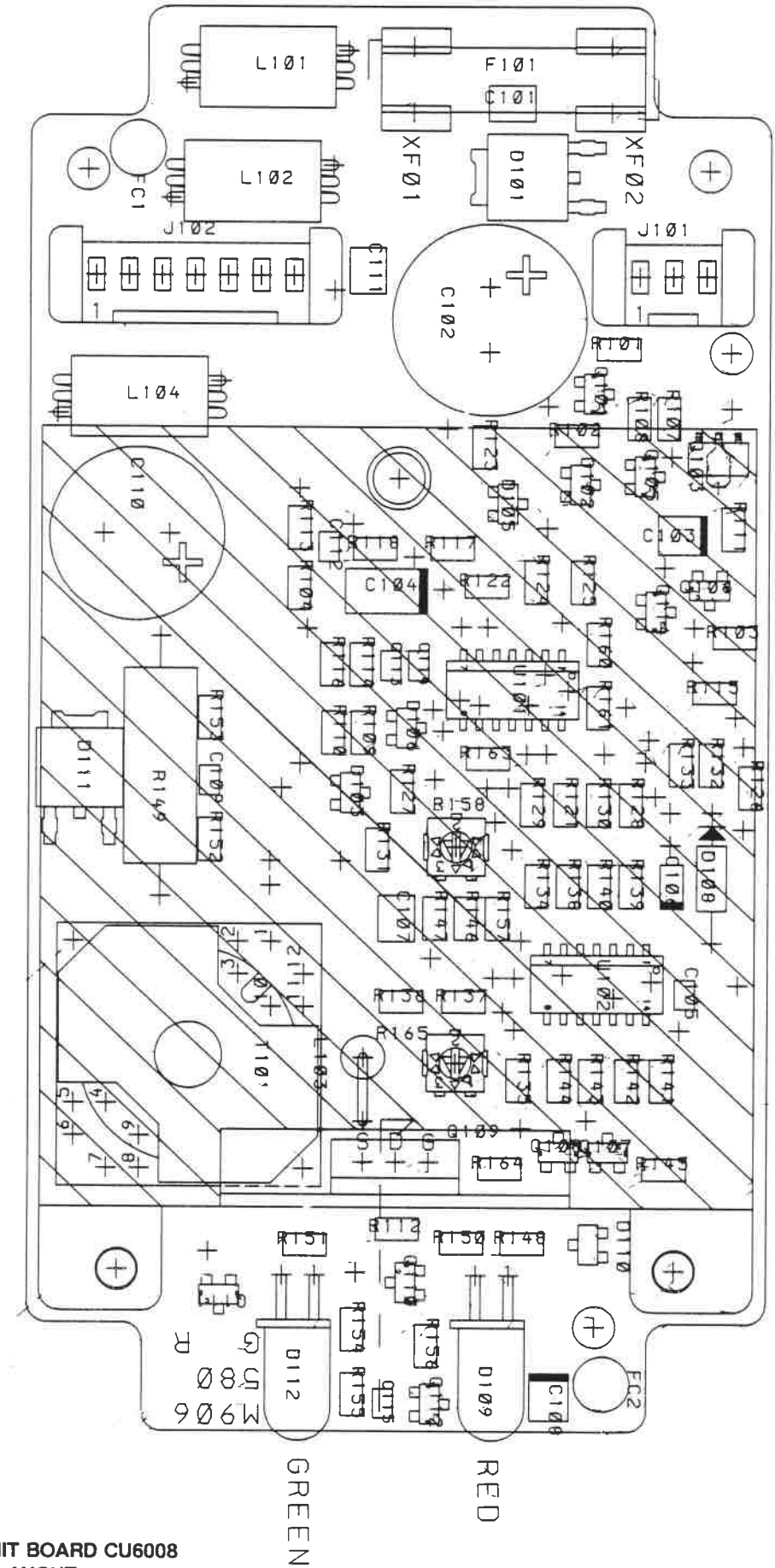
Output Current
At 25 deg. C and 10 < Vout < 14 V
I = 0.86-1.48 A

When the ambient temperature is + 10 ±5°C the current is decreased to:
24-86 mA at 14 V output.

Efficiency
Vin 15.6 Volt on J101.
at 14.0 Volt output > 70%.

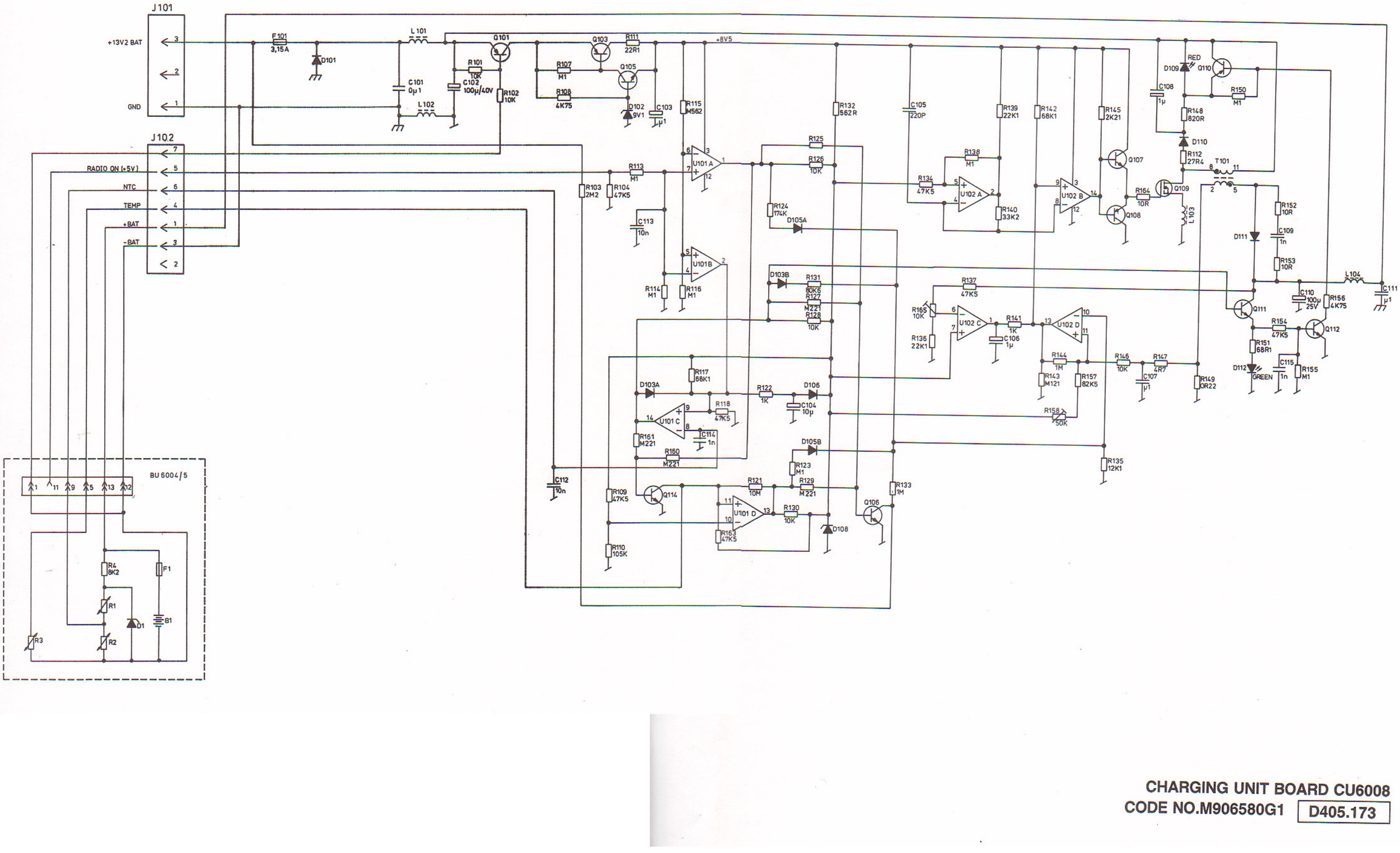
Temperature range
-25 to + 55 deg. C.
Note: The recommended temperature range for charging of BU6004 and BU6005 is + 10 to + 45 deg. C.

Dimensions:
L x W x H: 121 x 65 x 40 mm.



CHARGING UNIT BOARD CU6008
COMPONENT LAYOUT

D405.172 CODE NO.M906580G1



CHARGING UNIT BOARD CU6008
CODE NO.M906580G1 D405.173

DATE: 10/18/1988

Pos	Code No	Description	Qt
C101	J707438P26	CAP CER CL2 100N 10%	1
C102	J706005P14	CAP ELECT 220U 40V	1
C103	J709426P8	CAP TA SOL 1U0 35V	1
C104	J709426P14	CAP TA SOL 10U 16V	1
C105	J707436P69	CAP CER NPO 220P 5%	1
C106	J709426P7	CAP TA SOL 1U0 10V	1
C107	J707438P26	CAP CER CL2 100N 10%	1
C108	J709426P8	CAP TA SOL 1U0 35V	1
C109	J707438P5	CAP CER CL2 1N 10%	1
C110	J706005P10	CAP ELECT 220U 25V	1
C111	J707438P26	CAP CER CL2 100N 10%	1
C112	J707438P14	CAP CER CL2 10N 10%	1
C113	J707438P14	CAP CER CL2 10N 10%	1
C114	J707438P5	CAP CER CL2 1N 10%	1
C115	J707438P5	CAP CER CL2 1N 10%	1
D101	J711085P1	DIO SI PWR MURD 310	1
D102	J707459P8	DIO SI ZENR 9V1 5% 0.2W	1
D103	J711154P1	DIO SI SIG BAS 28	1
D105	J711154P1	DIO SI SIG BAS 28	1
D106	J711154P1	DIO SI SIG BAS 28	1
D108	J706270P1	DIO SI ZENR 5V6 2% 0.4W	1
D109	J707764P1	DIO OPTO RD ESBR5501	1
D110	J711154P1	DIO SI SIG BAS 28	1
D111	J711085P1	DIO SI PWR MURD 310	1
D112	J707764P2	DIO OPTO GN ESBG5501	1
F101	J708970P8	FUSE CTG 3.150 A F	1
J101	J708068P3	CONN PWB MALE RECP 03-CKT	1
J102	J708068P7	CONN PWB MALE RECP 07-CKT	1
L101	J708732P3	COIL RF FIX 2-1/2T	1
L102	J708732P3	COIL RF FIX 2-1/2T	1
L103	J710041P1	CORE TOR FERR	1
L104	J708732P3	COIL RF FIX 2-1/2T	1
Q101	J707387P2	TSTR PNP SI BCW 70	1
Q103	J710334P1	TSTR PNP SI BCX 51	1
Q105	J707386P2	TSTR NPN SI BCW 72	1
Q106	J707386P1	TSTR NPN SI BCW 32	1
Q107	J707386P1	TSTR NPN SI BCW 32	1
Q108	J707387P1	TSTR PNP SI BCW 30	1
Q109	J707836P1	TSTR MFET SI BUZ 21	1
Q110	J707387P1	TSTR PNP SI BCW 30	1
Q111	J707386P1	TSTR NPN SI BCW 32	1
Q112	J707386P2	TSTR NPN SI BCW 72	1
Q114	J707386P1	TSTR NPN SI BCW 32	1
R101	J709328P301	RES MFLM 1/8W 10K 1%	1
R102	J709328P301	RES MFLM 1/8W 10K 1%	1
R103	J707385P225	RES MFLM 1/8W 2M2 5%	1
R104	J709328P366	RES MFLM 1/8W 47K5 1%	1
R107	J709328P401	RES MFLM 1/8W 100K 1%	1
R108	J709328P266	RES MFLM 1/8W 4K75 1%	1
R109	J709328P366	RES MFLM 1/8W 47K5 1%	1
R110	J709328P403	RES MFLM 1/8W 105K 1%	1
R111	J709328P34	RES MFLM 1/8W 22R1 1%	1
R112	J709328P43	RES MFLM 1/8W 27R4 1%	1
R113	J709328P401	RES MFLM 1/8W 100K 1%	1
R114	J709328P401	RES MFLM 1/8W 100K 1%	1
R115	J709328P466	RES MFLM 1/8W 475K 1%	1
R116	J709328P389	RES MFLM 1/8W 82K5 1%	1
R117	J709328P381	RES MFLM 1/8W 68K1 1%	1
R118	J709328P366	RES MFLM 1/8W 47K5 1%	1
R121	J707385P106	RES MFLM 1/8W 10M0 10%	1
R122	J709328P201	RES MFLM 1/8W 1K0 1%	1
R123	J709328P401	RES MFLM 1/8W 100K 1%	1
R124	J709328P424	RES MFLM 1/8W 174K 1%	1
R125	J709328P434	RES MFLM 1/8W 221K 1%	1
R126	J709328P301	RES MFLM 1/8W 10K 1%	1
R127	J709328P434	RES MFLM 1/8W 221K 1%	1
R128	J709328P301	RES MFLM 1/8W 10K 1%	1
R129	J709328P434	RES MFLM 1/8W 221K 1%	1
R130	J709328P301	RES MFLM 1/8W 10K 1%	1
R131	J709328P388	RES MFLM 1/8W 80K6 1%	1
R132	J709328P166	RES MFLM 1/8W 475R 1%	1
R133	J709328P497	RES MFLM 1/8W 1M0 1%	1
R134	J709328P366	RES MFLM 1/8W 47K5 1%	1
R135	J709328P309	RES MFLM 1/8W 12K1 1%	1
R136	J709328P334	RES MFLM 1/8W 22K1 1%	1
R137	J709328P366	RES MFLM 1/8W 47K5 1%	1
R138	J709328P401	RES MFLM 1/8W 100K 1%	1
R139	J709328P334	RES MFLM 1/8W 22K1 1%	1
R140	J709328P351	RES MFLM 1/8W 33K2 1%	1
R141	J709328P201	RES MFLM 1/8W 1K0 1%	1
R142	J709328P381	RES MFLM 1/8W 68K1 1%	1
R143	J709328P409	RES MFLM 1/8W 121K 1%	1
R144	J709328P497	RES MFLM 1/8W 1M0 1%	1
R145	J709328P234	RES MFLM 1/8W 2K21 1%	1
R146	J709328P301	RES MFLM 1/8W 10K 1%	1
R147	J707385P947	RES MFLM 1/8W 4R7 20%	1
R148	J709328P201	RES MFLM 1/8W 1K0 1%	1
R149	J710092P2	RES WW 1/1W 0R22 5%	1
R150	J709328P401	RES MFLM 1/8W 100K 1%	1
R151	J709328P81	RES MFLM 1/8W 68R1 1%	1
R152	J709328P1	RES MFLM 1/8W 10R 1%	1
R153	J709328P1	RES MFLM 1/8W 10R 1%	1
R154	J709328P366	RES MFLM 1/8W 47K5 1%	1
R155	J709328P401	RES MFLM 1/8W 100K 1%	1
R156	J709328P266	RES MFLM 1/8W 4K75 1%	1
R157	J709328P389	RES MFLM 1/8W 82K5 1%	1
R158	J710708P9	RES VAR CERM 50K 20%	1
R160	J709328P434	RES MFLM 1/8W 221K 1%	1
R161	J709328P434	RES MFLM 1/8W 221K 1%	1
R163	J709328P366	RES MFLM 1/8W 47K5 1%	1
R164	J709328P1	RES MFLM 1/8W 10R 1%	1
R165	J710708P7	RES VAR CERM 10K 20%	1
T101	K805623G2	TRANSFORMER	1
U101	J708503P1	IC LIN CMPAR LM 239	1
U102	J708503P1	IC LIN CMPAR LM 239	1
XF01	J708025P1	FUSE HOLDER 5.0X20.0MM	1
XF02	J708025P1	FUSE HOLDER 5.0X20.0MM	1
	M906581P1R0	BD PW	1
		NON ELETRONICAL PARTS	
	L856202P1	HEAT SINK	1
	J710245P1	CORE ACCESS WASH INS	1
	J711159P1	SPC NON MET 5.0/4.0X20	1
	J708316P1	CLIP	1

CHAPTER
CHAPITRE
KAPITEL

9

CONFIGURATION AND INSTALLATION

The radio is available in a remote controlled mobile version, a portable version and a remote controlled portable version. The reconfiguration from a remote radio into a portable radio has to be done by the factory or by your service shop.
Several cables are available in order to enable the use of a portable radio in a mobile installation.

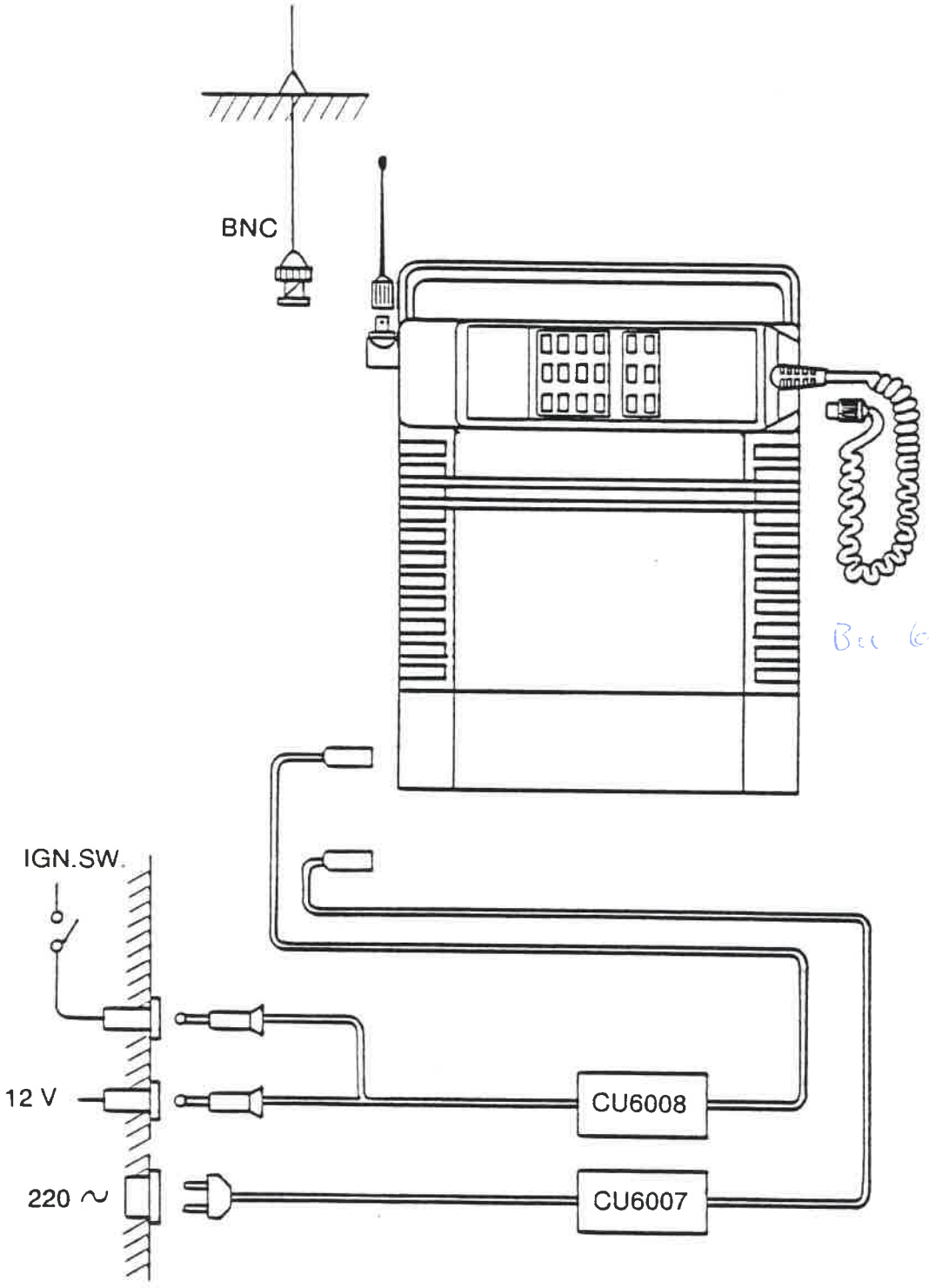
Figure M405.555 shows the portable radio consisting of a radio unit, a retainer for the handset, the handset, an antenna and a battery. The installation drawing also shows different charging possibilities. The charger for 220 Volt is CU6007 and the DC/DC converter for charging via the car cigarette lighter is CU6008.

Figure M405.556 shows the remote controlled mobile installation consisting of the radio unit, a control cable, a hang-up cup, a handset, a loudspeaker and a VSP microphone. Two different handsets are available, viz a handset with ISO keypad and a handset eith. CCITT keypad.

The mobile radio unit is mounted in the mounting tray MN6014.

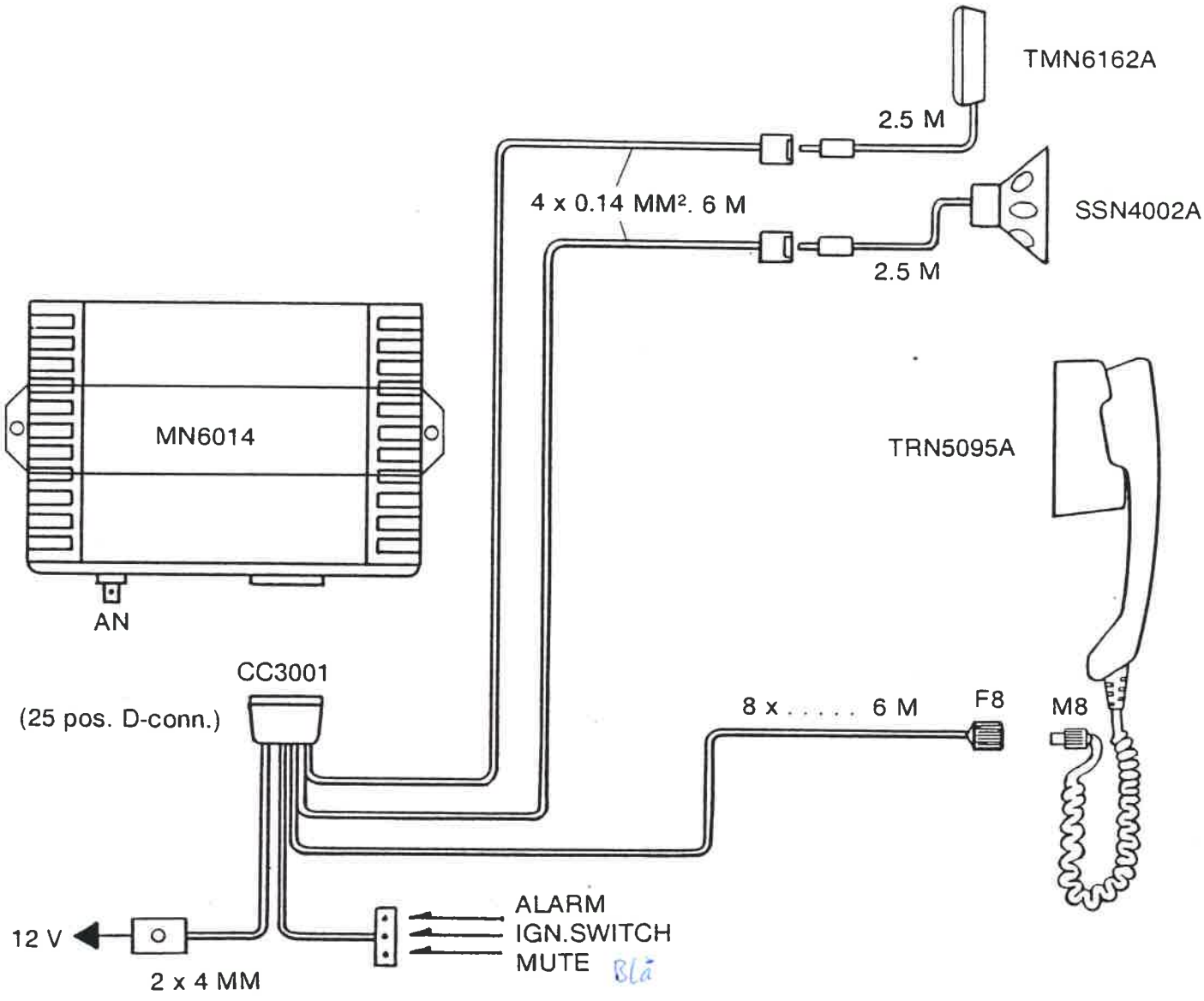
Figure M405.557 shows the portable radio in a remote controlled installation. The handset, the microphone and the loudspeaker are connected to the radio via three extension cables. CC3002 is the cable for connection of the handsfree microphone, CC3003 connects the loudspeaker, and CC3004 is the connection for the handset. Charging of the battery takes place via the CU6008 DC/DC converter which is connected to the car battery by the cable CC3005.

Included in this chapter are also installation drawings of the different accessory units such as microphone and loudspeaker.



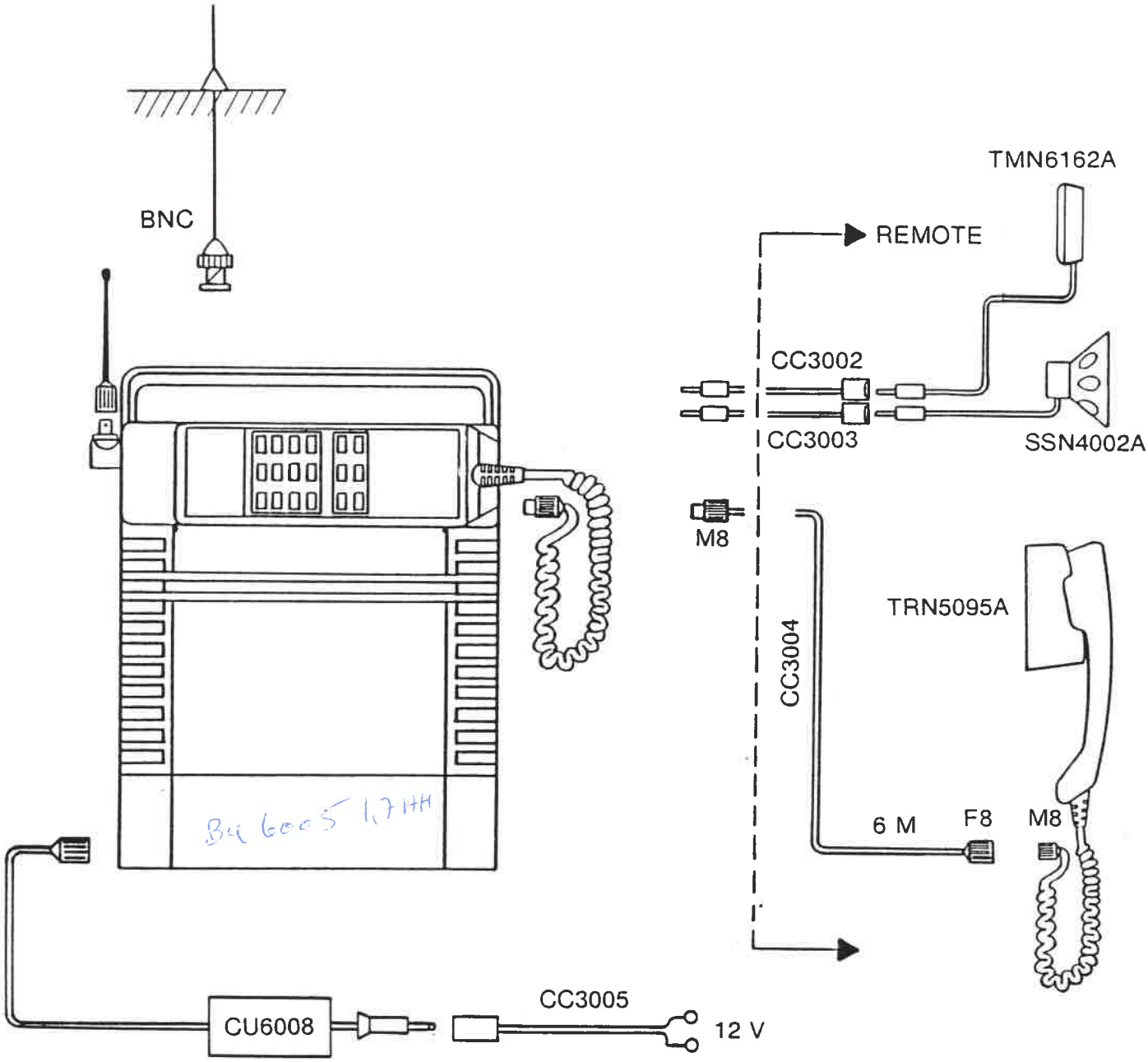
PORTABLE CONFIGURATION

M405.555



MOBILE INSTALLATION WITH HANDSFREE OPERATION

M405.556



PORTABLE CONFIGURATION IN MOBILE INSTALLATION

M405.557

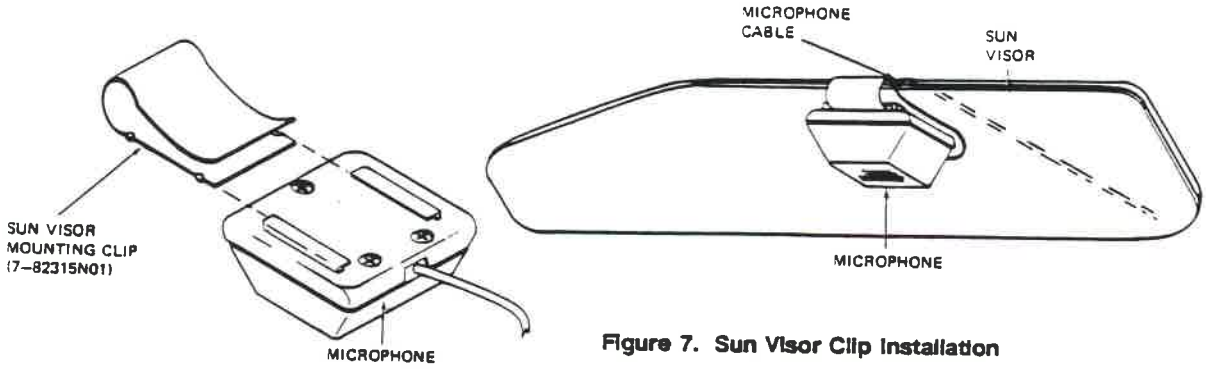


Figure 7. Sun Visor Clip Installation

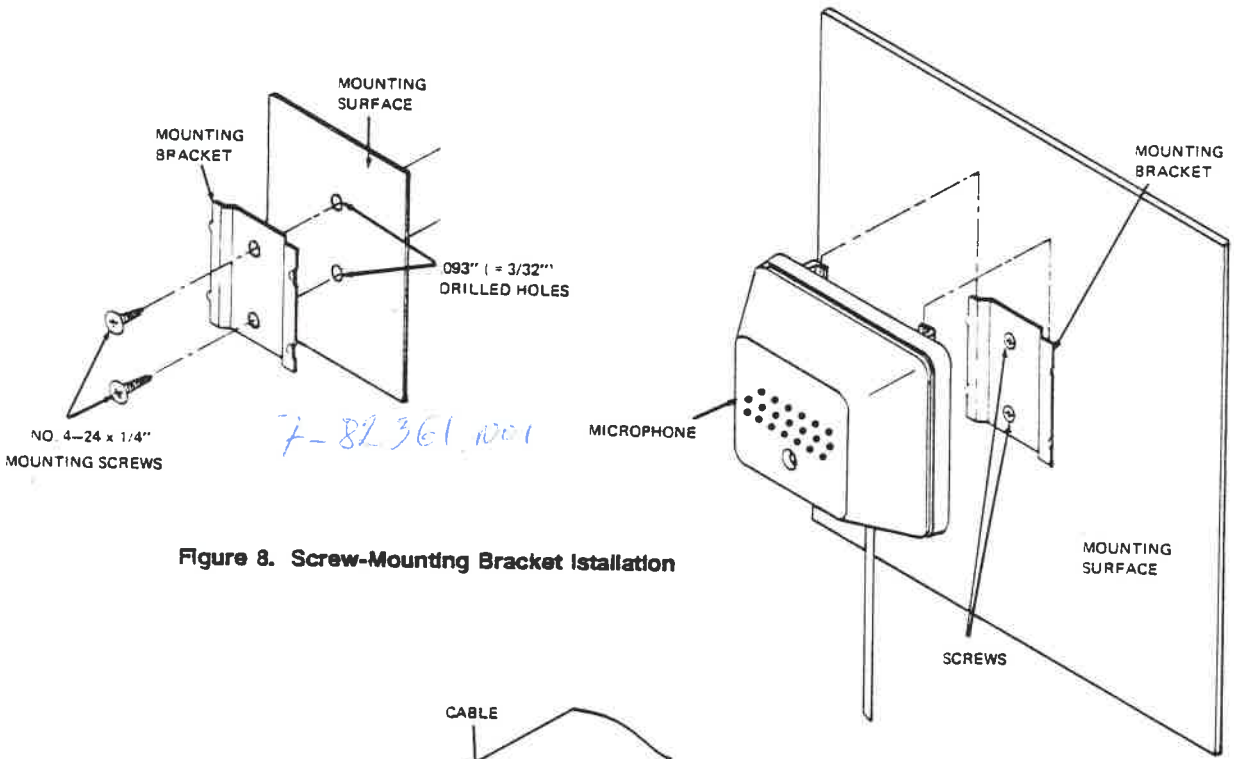


Figure 8. Screw-Mounting Bracket Installation

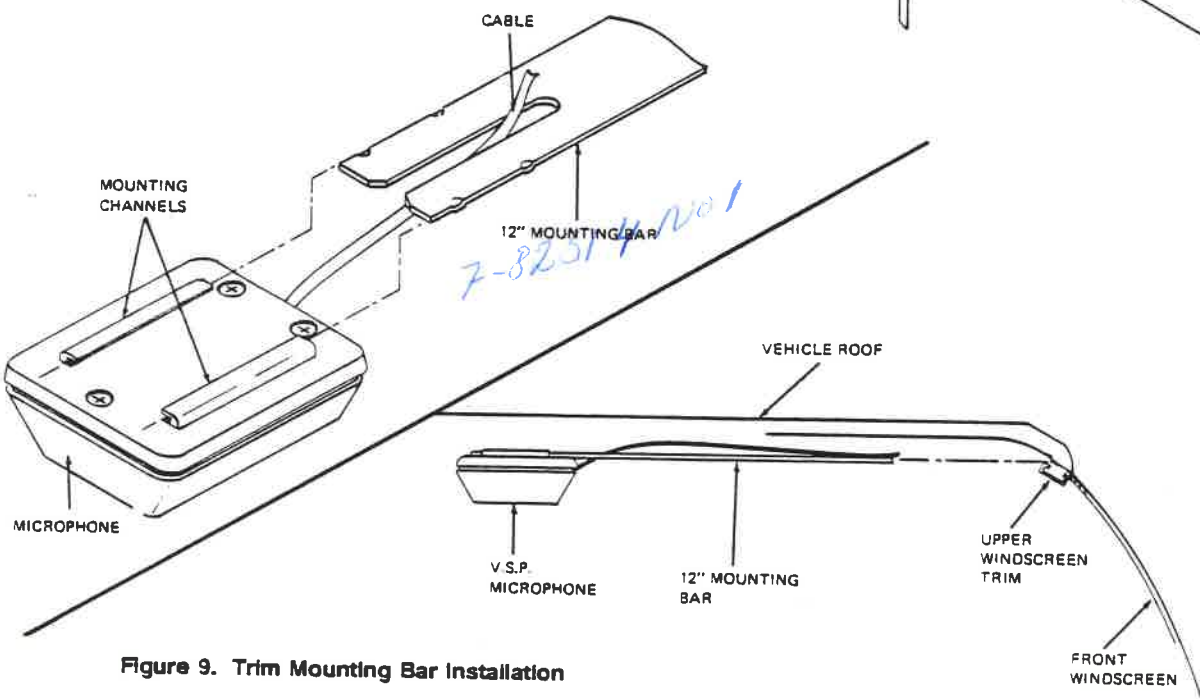
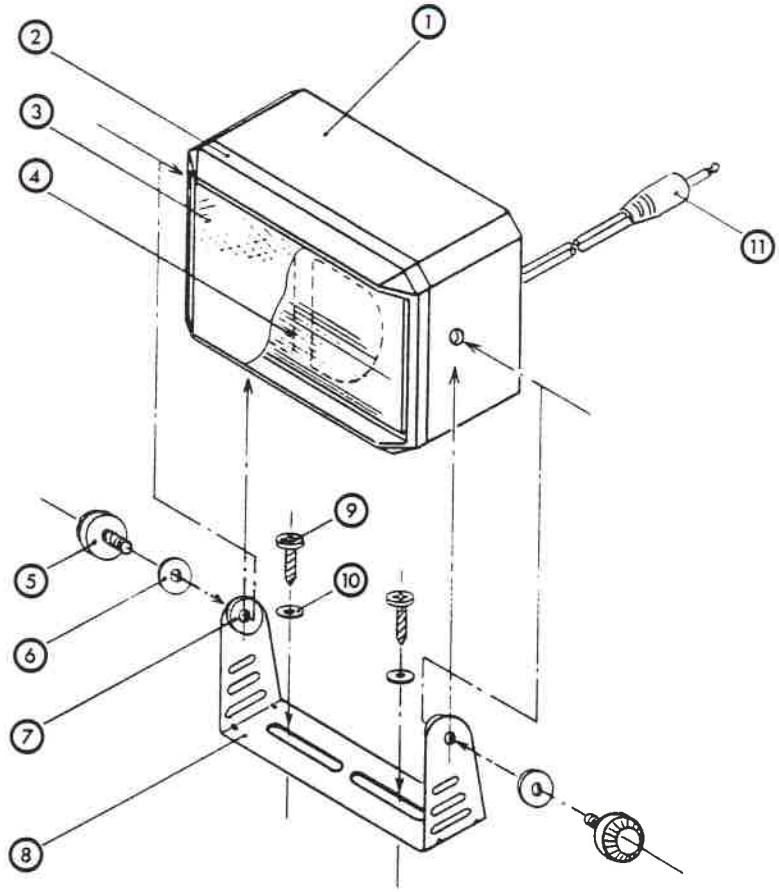
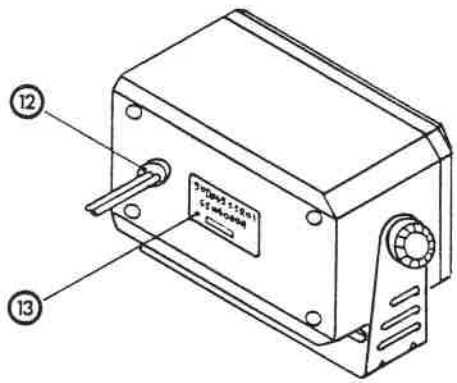


Figure 9. Trim Mounting Bar Installation

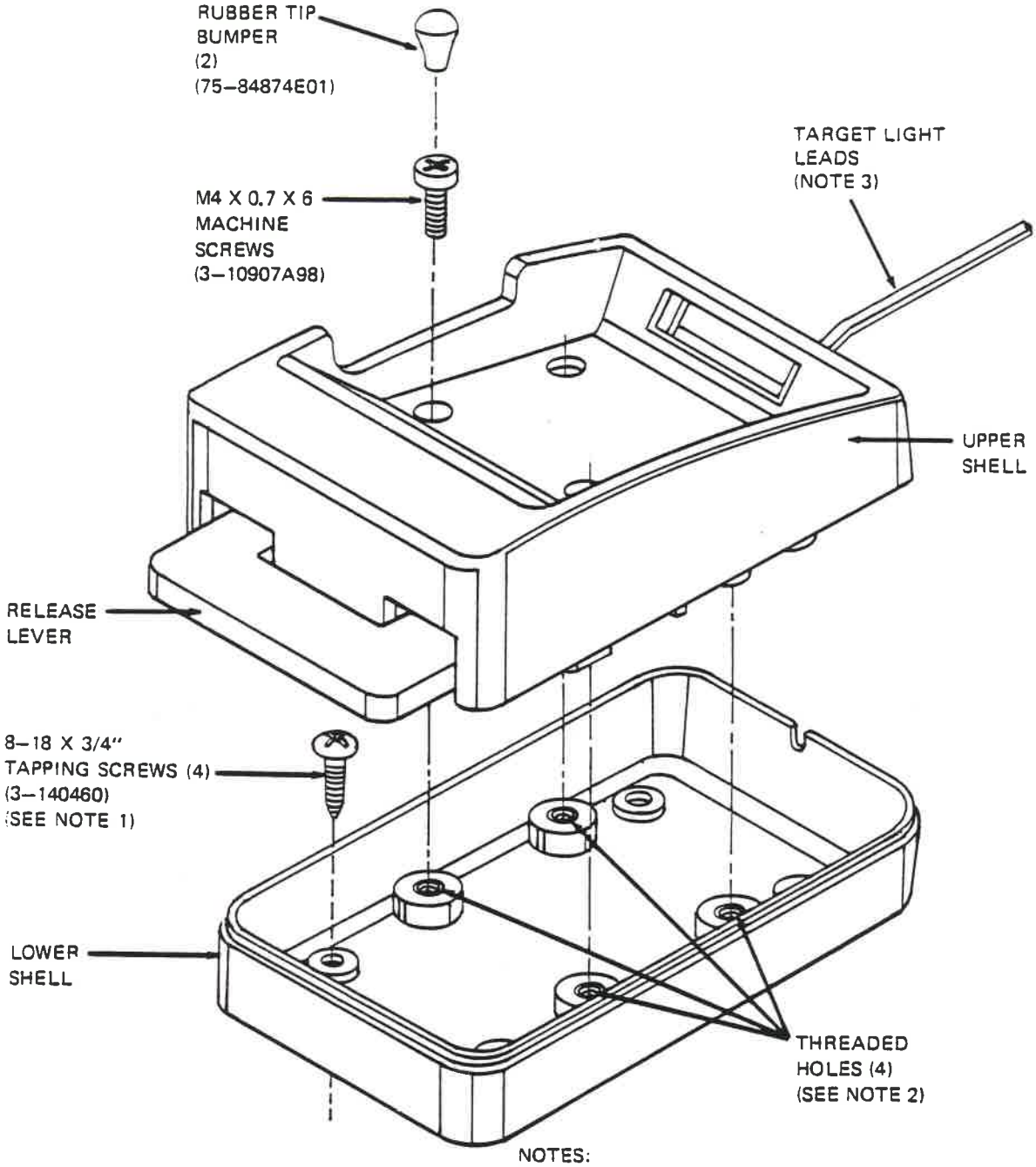




1	Back housing	8	Mounting bracket
2	Front housing	9	Mounting screw
3	Metal grill	10	Mounting washer
4	Dust shield	11	Cable connector
5	Thumb screw	12	Strain relief
6	Insulating washer	13	Part Number
7	Adhering washer	-	----------

SPEAKER MOUNTING

M405.448/2



NOTES:

1. THE FOUR 8–18 TAPPING SCREWS ARE USED ONLY WHEN LOWER SHELL IS MOUNTED DIRECTLY ON A FLAT SURFACE.
2. THE SECOND SET OF FOUR THREADED HOLES IS USED WHEN LOWER SHELL IS MOUNTED ON THE ADJUSTABLE ANGLE BRACKET.
3. THE TRACER LEAD OF THE TARGET LIGHT LEADS SHOULD BE CONNECTED TO A+ (IF THE TARGET LIGHT IS TO BE USED).

STANDARD MOUNTING CUP INSTALLATION

- Figure 3 -

M405.440