5. TECHNICAL DATA

The SKANTI TRP 6000 complies with the SOLAS 74 convention and the ITU Radio Regulations. It meets the CEPT specifications, the UK MPT specifications as well as the national requirements of most countries.

GENERAL

Frequency Generation:	True digital frequency synthesis with 100 Hz resolution.
Frequency Presentation:	Two 5-digit digital LED displays.
Frequency Accuracy:	Better than 40 Hz.
Operating modes:	Duplex, semiduplex and simplex A3A, A3H and A3J (upper side band).
Operating Temperature:	$-10^{o}C$ to $+55^{o}C$.
Frequency Selection:	By common keyboard. 2182 kHz is entered for both transmitter and receiver by a single key, also providing automatic selection of A3H and simplex mode.

RECEIVER

Frequency Range:	Broadcast bands: 100 - 1606.5 kHz Communication bands: 1606.5 - 4500 kHz
Frequency Selection	A search/scanning facility is provided with 1000 Hz resolution in A3/A3H mode. A 100 Hz step function is provided in A3J/A3A mode. A3/A3H mode is automatically selected below 1606.5. kHz.
Sensitivity:	Antenna input for 10 dB SINAD: 0.15 - 1.6 MHz AM: 20 uV 1.6 - 4.5 MHz AM: 6.3 uV SSB: 1 uV measured with high antenna impedance. With 50 ohms input the figures are improved by approx. 6 dB.
Clarifier Control:	Variation ± 100 Hz.
Duplex Filter:	The built-in preselector is automatically disabled by any frequency change. The circuit is re-established (when required) by turning the control knob to one of its extreme positions.
Audio Output:	5 W in 4 ohms to internal and/or external loudspeaker(s)

TRANSMITTER

Output Power:	200 W p.e.p. with TU 6200 400 W p.e.p. with TU 6400 Reduction to less than 60 W p.e.p.
Transmitter Frequencies:	Up to 80 PROM programmable channels, freely distributed in the range 1606.5 to 4220 kHz. Free frequency selection in 100 Hz steps is optionally available where permitted.
Antenna Requirements:	7-18 metres wire and/or whip.
Antenna Tuning	Fully automatic to above antennas and to any load with a resistive impedance from 1 to 75 ohms (minimum series capacitor 100 pF) from 1.6 to 4.2 MHz.
Alarm Generator:	A two-tone alarm generator is incorporated. Full power is automatically selected and the antenna tuning carried out when the alarm is activated.

POWER REQUIREMENTS

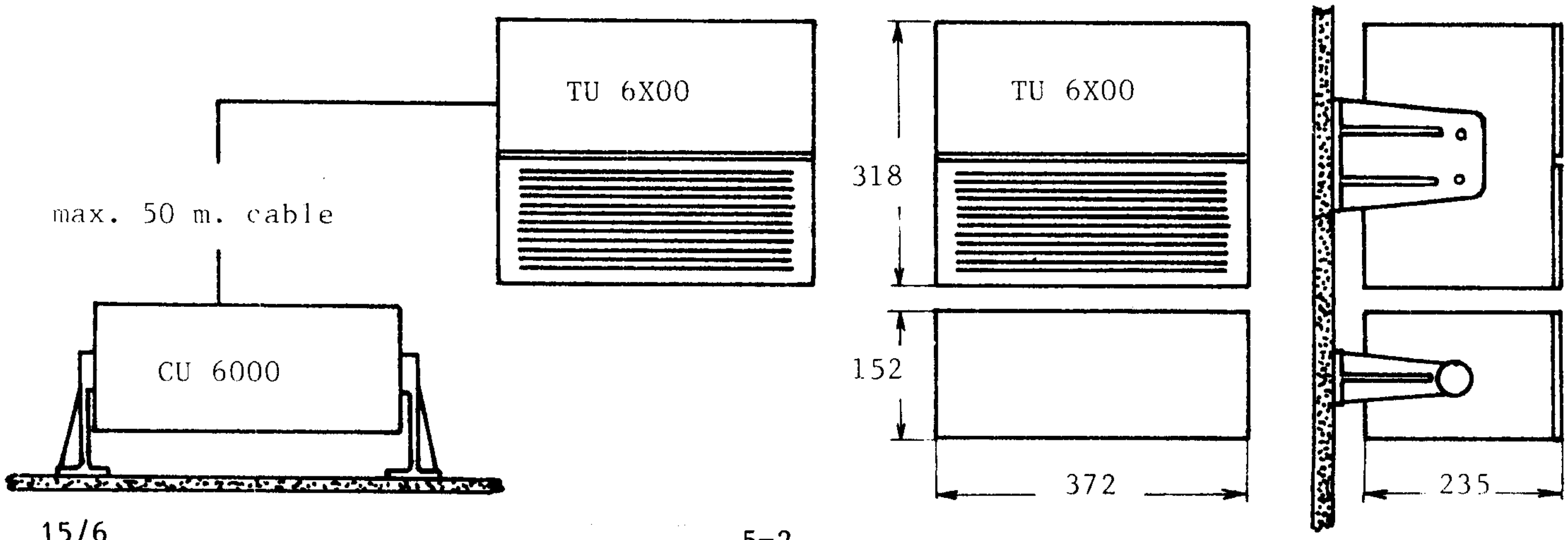
Supply Voltage:	24V DC (+30%, -10%) Connection will not earth supply battery. AC mains by optional external unit.

Consumption:

Operation	400 W p.e.p.	200 W p.e.p.
R	0,75A	0,75A
T/R Unkeyed	2,30A	2,30A
A3J Unmod.	4,00A	3,25A
A3H Unmod.	21,5A	13,0A
A3J Normal speech	11,0A	7,50A
A3H Normal speech	21,0A	13,0A
A3H Transmit alarm	27,5A	15,3A

DIMENSIONS AND WEIGHT

CU 6000:	7.3 kgs
TU 6200:	16.0 kgs
TU 6400:	18.0 kgs



All manual controls on the front panel, with exception of the FILTER control, are connected to this p.c.b. All control signals branch out from this board to the different Control Unit p.c.b.'s, by way of two ribbon cables.

The Keyboard is continuously scanned by the Microprocessor Circuit, located on p.c.b. 402 . Activation of a particular key will load the number corresponding to that key, into the Microprocessor Circuit. This scanning process will also detect whether one of the two frequency tuning pushbuttons has been activated.

A multiplex technique is utilized to present the information, requested by the user, on the R-and-T displays.

For each display element, a BCD-code is sent from the Microprocessor Circuit to the BCD-to-7 Segment Decoder which in turn directly controls a Segment Driver. Concurrently, a display element address is sent to the Scan Decoder where one of the ten Digit Drivers is selected. The display element selected is now permitted to display the data for a length of time. Subsequently, the Microprocessor Circuit will send new data to a new display element, and so forth.

All display elements are updated every second millisecond. The maximum time-on duration for a single display is 200 microseconds. Continuously variable reduction of time-on duration - to the point where no light is visible on the displays - is available with the DIMMER control.

6.1.2. RECEIVER 401

The antenna RF signal is led through 401-SK1 to a circuit designed to protect the receiver against excessive RF voltage and static electricity discharges, appearing on the antenna.

The RF signal from the protection circuit goes to one of the four input filters. Three of these filters are fixed-tuned and have respective passbands of 100 - 400 kHz, 400 - 1606.5 kHz and 1606.5 kHz - 4499.9 kHz. The fourth filter, used in duplex operation, has a passband with a variable center frequency, controlled by the FILTER knob on the front panel. Center frequency range is 1606.5 - 4499.9 kHz.

A change in receiving frequency will be followed by automatic selection from among the three fixed-tuned filters. The automatic selection is controlled from the Microprocessor via the Gate Circuit. If the duplex filter is to be used the FILTER knob must be turned to one of its extreme positions, where a switch is activated and sets a latch in the Gate Circuit which in turn selects the duplex filter.

During SELFCHECK the antenne input is disabled and a RF CHECK SIGNAL from the EXCITER, p.c.b. 403 , is fed to the Input Filters. The VOLUME/SENSITIVITY GND Switch is also controlled via the Gate Circuit. This switch ensures maximum volume and sensitivity during SELFCHECK, irrespective of the actual settings of the front panel controls. The RF signal from the input filters is mixed, in the 1st mixer, with a 10.8 - 15.2 MHz signal from the RX synthesizer, located on p.c.b. 402 . Mixer output is filtered in a 10.7 MHz double sideband crystal filter, where overall AM selectivity is determined.

The 10.7 MHz IF signal passes a PIN diode attenuator, controlled from the AGC circuit, before being fed to the 2nd Mixer. The other input signal to this mixer is a 9.3 MHx + 100/- 500 Hz signal from the Clarifier Circuit on p.c.b. 402 .

The 2nd IF filtering is selected from the Gate Circuit. In the SSB-mode the output from the 2nd Mixer is fed to a lower sideband crystal filter which determines overall SSB selectivity. In the AM-mode the output is fed to a 1.4 MHz LC-filter.

The filters are followed by the IF Amplifier, the gain of which is controlled by the AGC voltage. A check signal (CHECK 4) is produced by a Detector connected to the output of the IF Amplifier. This facilitates a check for the presence of a 1.4 MHz IF signal during SELFCHECK, provided that the AGC is at failure.

A 1.4 MHz Band-Pass Filter connects the IF Amplifier to the Signal Detector. The integrated circuit of the Signal Detector contains a balanced mixer and a high-gain limiting amplifier. The IF signal is applied balanced to the one input part of the mixer.

In the AM mode, the IF signal is also fed to the amplifier input. This signal is amplified and clipped to constant amplitude and internally connected to the other input part of the mixer where it is mixed with the modulated signal. The difference frequency contains the wanted AF signal.

In the SSB-mode a 1.4 MHz signal, derived from the Reference Divider on p.c.b. 402 , is applied to the amplifier input.

The AF signal is via the VOLUME potentiometer on p.c.b. 400 fed to the AF amplifier which contains a 3 kHz active low-pass filter. AF output excits p.c.b. 401 to enter the handset earpiece and the loudspeaker(s).

The Signal Detector output also contains the sum frequency of the two input signals. This signal is used for the Automatic Gain Control and is taken off across a 2.8 MHz tuned circuit. The signal is amplified before being brought to the AGC Detector. The AGC Detector output controls the overall IF gain of the receiver.

IF gain may also be manually controlled with the SENSITIVITY control on the front panel. However, at frequencies below 1606.5 kHz and when 2182 kHz, is selected by means of the 2182 key, the SENSITIVITY control is disabled so as to allow maximum IF gain irrespective of the actual setting of the control knob.

A check signal (CHECK 5) direived from the AGC Detector, is used to confirm correct AGC circuit operation during SELFCHECK.

6.1.3. CONTROL AND RX SYNTHESIZER [402]

6.1.3.1. Microprocessor Circuit

The Microprocessing Unit (MPU) is the central unit of the Microprocessor Circuit. It responds to inputs and produces outputs in a manner determined wholly by a sequency of instructions referred to as its program. The sequential operation of the MPU is clocked by a 2.8 MHz signal derived from the Reference Divider of the RX Synthesizer.

The program is held in the Read-Only Memory (ROM). The instructions are fetched into the MPU one at a time to be decoded and actioned. The program contains instructions for reading input from the Keyboard; how to display transmitting and receiving frequencies; carrying out of SELFCHECK analysis, to mention a few of the tasks.

The TX Frequency PROM can be programmed to store up to 80 transmitting frequencies. Stored information may be recalled by the user when required. The PROM can be programmed to allow free selection of transmitting frequencies where permitted by the authorities.

The Input/Output (I/O) circuits are utilized by the MPU to communicate with the keyboard, the Displays, the two synthesizers as well as the RAM and the check Multiplexer. The I/O Circuits also delivers a two tone alarm signal to the Exciter.

The Non Volatile Random Access Memory (RAM) is the user-programmable frequency memory. Memory content will not be lost when power is switched off, because a lithium battery will then supply current to the RAM.

The Multiplexer (MUX) is connected to 12 check signal lines from various circuits in the Control Unit. Call-up of the SELFCHECK routine causes the MPU to scan these check signals. Appearance of a check signal indicating a functional error will stop MPU scanning and an error message will be displayed.

MPU start-up procedure is controlled by the Restart Generator, when power is turned on.

The Power Down Detector detects if the 7.5 V supply voltage is decreasing below a certain limit - a warning sign that power will most likely disappear very soon. At this point an order is communicated to the MPU to conclude all current tasks and to await return of power.

6.1.3.2. RX Synthesizer

The reference oscillator of the synthesizer is a 12.6 MHz crystal controlled oscillator. The amplitude stabilized output signal is fed to the Clarifier Mixer and to the Reference Divider.

In the Reference Divider a 2.8 MHz source for the MPU is produced, a 1.4 MHz source for the Exciter and the Receiver, 5 kHz and 500 Hz sources for the I/O circuits as well as a 500 Hz reference frequency for the synthesizer loop.

The 500 Hz reference frequency and the Loop Divider output frequency are compared in the Phase/Frequency Comparator circuit. To obtain lock two conditions must be met: First, the frequency of the two output signals must be the same, i.e. 500 Hz. Second, a very small, but definite, phase difference must exist between the two signals. If this minute phase difference changes, the Phase/Frequency Comparator will immediately produce a correction voltage that will correct the VCO frequency until the original phase difference is reestablished.

A check signal (CHECK 2) used to confirm proper lock of the Synthesizer Loop, is derived from the Phase/Frequency Comparator.

The Loop Filter is designed to stop unwanted noise from modulating the VCO, and to give the loop a proper dynamic response.

The Voltage Controlled Oscillator (VCO) covers a frequency range of 10.8 - 15.2 MHz. The amplitude stabilized output signal is split between two Buffer Amplifiers, one for the injection signal to the Receiver' s 1st Mixer, the other for the Loop Divider.

A check signal (CHECK 1) confirms that the VCO produces an output signal.

The division ratio of the Loop Divider is controlled by the contents of the Serial-to Parralel Shift Registers. Information to these registers is received from the Microprocessor Circuit in serial format. Loop Divider output frequency is 500 Hz, when the loop is locked.

The frequency of the 3.3 MHz Voltage Controlled Crystal Oscillator (VCXO) is determined both by the 100 Hz information, stored in the Shift Registers, and the Clarifier Control Voltage. The control voltages are added in a summing amplifier. VCXO frequency may be varied approximately ± 100 Hz with the CLARIFIER control whereas frequency may be varied 0, 100, 200, 300 or 400 Hz by the 100 Hz information-controlled voltage. The total frequency variation range is thus -100 Hz to + 500 Hz.

The 3.3 MHz signal is mixed with the 12.6 MHx XO frequency in the Clarifier Mixer. The output signal is filtered in a 9.3 MHz band-pass filter and applied to a Buffer Amplifier. The output is amplitude stabilized by means of a detector controlling the 3.3 MHz oscillator gain. A check signal (CHECK 3) used to confirm the presence of adequate output, is drawn from the same detector. The resulting 9.3 MHz +100/-500 Hz signal is led to the Receiver's 2nd Mixer.

6.1.4. EXCITER [403]

6.1.4.1. Signal Path

The AF input signal from the MICROPHONE AMPLIFIER [450], located in the handset, or the two tone alarm signal generated on p.c.b. [402] is fed to the Compressor. The Compressor serves to maintain a constant AF modulation peak level. The regulating voltage, controlling the gain of the Compressor, is drived from the output of the Sideband Amplifier.

A check signal (CHECK 8) is derived from the compressor for checking correct compressor operation.

A 1.4 MHz signal, produced by the Reference Divider in the RX Synthesizer is fed, by way of a Buffer Amplifier, to the 1.4 MHz Level Stabilizer. The stabilized 1.4 MHz signal can be turned on or off by a control line from the Gate Circuit,corresponding to keyed or non-keyed state.

A check signal (CHECK 9) is derived from the Level Stabilizer to indicate if the 1.4 MHz signal is present.

The 1.4 MHz signal is fed to the 1st Mixer where the compressed AF signal is converted into a double sideband suppressed carrier signal at 1.4 MHz. The upper sideband is then removed by the lower sideband crystal filter at the mixer output. The filtered signal is now amplified in the sideband amplifier and fed to the Sideband Level Regulator. The amplification of both regulators are controlled by two control lines from the Gate Circuit in accordance with the mode selected. The amplification ratios are mutually related such that the peak to peak voltage of the combined signal appearing after the two regulators is the same independent of the operating mode.

The 2nd Mixer receives the combined 1.4 MHz A3J, A3A or A3H LSB signal and mixes it with the output signal from the Exciter Synthesizer. The output is passed through one of the two low-pass filters which pass only the difference frequency of the two input signals. Thus the 1.4 MHz LSB signal is converted to an upper sideband signal at the actual transmitting frequency.

If the transmitting frequency is below 2.8 MHz the Gate Circuit selects the 2.8 MHz low-pass filter, otherwise the 4.2 MHz low-pass filter is selected.

The RF signal from one of the two low-pass filters are then fed through an amplifier where RF signal-level control takes place. A trimming potentiometer permits adjustment of the Exciter RF signal output level to the correct value.

RF Power Control is operated from the front panel via the Gate Circuit. A DC voltage selects either low or full output power from the Exciter.

The Check Signal Switch, controlled by the Microprocessor, opens during SELFCHECK so as to deliver an RF CHECK SIGNAL to the Receiver.

6.1.4.2. Exciter Synthesizer

A 1.4 MHz signal, derived from the RX Synthesizer is fed to a Buffer Amplifier, which produces two output signals, one for the 1.4 MHz Level Stabilizer and one for the Reference Divider. In the Reference Divider the 1.4 MHz frequency is divided by 14000 and the resulting 100 Hz signal is applied to the Phase/Frequency Comparator as a reference frequency for the Exciter Synthesizer.

The Phase/Frequency Comparator compares the 100 Hz reference frequency with the output frequency of the Loop Divider. Two conditions must be met to ensure a correct VCO frequency: First, the frequency of the two input signals must be the same, i.e. 100 Hz. Second, the phase error must be within close limits. If the phase error exceeds a certain limit, the Phase/Frequency Comparator will close the Synthesizer Loop and produce a correction voltage which, via the Loop Filter, adjusts the VCO frequency until the original phase difference is reestablished. The comparator will then reopen the Synthesizer loop.

Another DC-signal is derived from the comparator to indicate if the VCO frequency is correct. This DC-signal enters the Gate Circuit, which then produces a check signal (CHECK 10).

The Loop Filter is designed to stop unwanted noise from modulating the VCO, and to give the loop a proper dynamic response.

The VCO covers a frequency range of 3-5.9 MHz. The amplitude stabilized output signal is split between two Buffer Amplifiers, one for the injection signal to the 2nd mixer in the Exciter's signal path, the other for the Loop Divider. A check signal (CHECK 11) indicates if the VCO produces an output signal.

The division ratio of the Loop Divider is controlled by the contents of the serial-to-Parallel Shift Registers. Information to these registers is received from the Microprocessor Circuit in serial format. Loop Divider output frequency is 100 Hz, when the VCO frequency is correct.

6.2.1. POWER SUPPLY MODULE

The DC-power, derived from the battery, have to pass at first a relay switch, controlled by the Overvoltage And Reverse Polarity Protection circuit, an input filter, and a transient protection circuit before it is allowed to flow on to the two converter boards [421] and [422], via Interconnection Board [423]. Power for the AAC is also routed via [423] while power for the PA-module is fed to a 12-pole socket on the power supply module chassis.

6.2.1.1. Switch Mode Power Supply [421]

The input power is fed through an additional Noise Filter before it is supplied to the Converter Driver.

On the secondary side of the converter-transformer one of the rectified outputs is compared to a reference voltage and the result is transferred to the primary side via an optocoupler and is used to control the duty cycle of the flyback converter. This is done by regulating the duty cycles of the pulses, derived from a 20 kHz Oscillator, before they are forming the driving signal for the Converter Driver.

So a regulating loop has been designed in order to keep the output voltage from the converter fairly stable independent of battery voltage variations and different loading conditions on the outputs.

By means of optocouplers in the feedback path the secondary side of the converter is galvanic isolated from the primary side and thereby from the battery.

Two Rectifiers produce 17V and 9V respectively. Of these the 9 V output is regulated while the 17V output is tracking. Each Rectifier is equipped with a Current Sensor and an Overvoltage Protector. The two Sensors, and the Overvoltage Protector, attached to the 9V line, disables the regulating loop and forces the converter into a low-power mode if an abnormal loading condition exists on the outputs.

6.2.1.2. Blower Converter [422]

By means of the Power Switch on the CU-front panel the Overvoltage and Reverse Polarity Protection circuit is connected to the input lines from the battery except when the switch is in its OFF position.

In case a reverse polarity is applied the relay RL1 will not be activated thereby protecting the whole Power Supply. Also if input voltage exceeds limits RL1 will be deactivated.

If the Overvoltage And Reverse Polarity Protection circuit accepts voltage level and polarity, the RL1 is activated and simultaneously the 20 kHz Oscillator on p.c.b. [421] is powered from p.c.b. [422].

The blower converter produces square wave signals for driving two blowers. Blower no. 1 (on the PA module) is always operating when "T/R" is selected on the power switch. Blower no. 2 (in the AAC-unit) is only in operation when extra cooling is required. The converter has two modes of operation:

a) Blower no. 1 only. Constant speed (slow and quiet).
b) Both blowers. Variable speed (tracks battery voltage, maximum cooling).

In mode a) both frequency and voltage inputs to the converter driver are stabilized.

In mode b) a relay switches in blower no. 2. At the same time the VCO (Voltage Controlled Oscillator) generating the square wave is made to track battery voltage thus generating a higher frequency when battery voltage is high. Also in this mode the voltage stabilizer is bypassed in order to supply maximum power to the blowers.

Mode b) is selected when the input TEMP 1 is taken low. This happens when the temperature sensors on the PA-module reaches a temperature of approx. 60^{o} C.

The keying relay produces a 24 V output signal when KEYLINE goes active. This can be used for external purposes (i.e. antenna relay) but is also used internally to key the PA-module. This is done by activating the stabilizers on this module via "PA PWR CTRL" derived from 24 V when keyed. A delay circuit compensates for the delay in the simplex relay if fitted. If a delay in the keying of the transmitter is unwanted the delay-circuit can be deactivated by removing a jumper.

A tune switch is located on this board to facilitate servicing the AAC.

6.2.2. POWER AMPLIFIER MODULE

6.2.2.1. STABILIZER [442]

The RF signal, produced by the Exciter in the Control Unit, enters via the INTERCONNECTION BOARD [423] .

First, the signal goes through the Protection Attenuator. This attenuator, controlled by the Protection Attenuator Control, protects the succeeding P.A. boards and is activated if one or more of the following three situations occur:

1. The peak value of the output voltage from one of the two P.A.-stages exceeds a certain limit.

2. The SWR measured in the Automatic Antenna Coupler exceeds 2.5

3. The temperature measured at one of the two P.A.-stages exceeds 92^{o}C.

Output of the Protection Attenuator is split-up by the Input Power Splitter circuit. The two-6dB outputs go to their respective P.A. boards. The two boards, POWER AMPLIFIER [441] , are identical.

The output signals from the power amplifiers are combined in the Output Power Combiner, the output of which goes to the Automatic Antenna Coupler.

Two 25.4 Volt regulators deliver supply voltage to the P.A. boards. The base currents of the 25.4 V regulators also serve to provide current to the two Bias Stabilizers. The 4.5 V Regulators supply additional current. The 5.4 V Limiters limit the Bias Supply Voltages.

6.2.2.2. POWER AMPLIFIER [441]

The RF signal is brought through a Gain Adjustment Attenuator (adjustment range approx. 6 dB) before being amplified approx. 21 dB in Driver 1, a class A amplifier.

Subsequently, 18 dB gain is supplied in Driver 2 (class AB, push-pull) before the signal is given 10 dB of final amplification in the P.A. output stage (also, class AB, push-pull). Resulting output power is 225 Watts, PEP, into 35 ohms.

The Peak Detector that monitors the output voltage is connected to the Protection Attenuator Control on p.c.b. [442] .

The Bias Stabilizers supplies the bases of the class AB amplifiers with stabilized bias voltages.

A temperature sensor circuit monitors the temperature of the heat sink. If the temperature exceeds 60^{o}C the BLOWER CONVERTER [422] is alerted and if the temperature exceeds 92^{o}C, the monitor will alert the Protection Attenuator Control on p.c.b. [442] .

6.2.3. AUTOMATIC ANTENNA COUPLER

The RF signal from the Power Amplifier Module is connected to the LOW-PASS FILTER [434] , which removes the harmonics from the signal.

During the tuning sequence a 4.22 MHz Low-pass filter, loaded with 70 ohms at the output, is switched-in. A Directional Coupler extracts information about forward and reflected voltages on the RF signal line following the low-pass filter.

The impedance level is then changed by means of a 50 ohms to 112.5 ohms transformer.

The RF signal is now fed to the L-matching network, comprised of two variable inductors, L1 and L2. A shortening capacitor, C2, may be inserted in series with the antenna.

RF current is measured with the aid of a current transformer before the RF signal is taken from the Automatic Antenna Coupler. A detector rectifies the RF current and provides a signal to the RF lamp on the Control Unit's front panel as well as the Antenna Current Meter on the Transmitter Unit's front panel.

When a TUNE COMMAND is received from the Control Unit, a 20 sec. Timer is started, enabling the 2.5 Hz Clock Generator that makes the Sequential Network step through its tuning sequence.

The first steps are:

1. to inhibit keying
2. to reset Protection Atenuator
3. to switch-in the 4.22 Mhz low-pass tuning filter
4. to disconnect L2 from chassis

The next steps are

1. to cancel the keying inhibit
2. to send a TUNE POWER REQUEST to the Control Unit.
3. to start up Phase Comparator 1, Predriver 1 and Motor 1 Driver.

When Phase Comparator 1 detects a completed adjustment of L1, the Motor 1 Driver is cut off and the Motor 1 Stop Detector outputs a signal,which tells the Sequential Network to move to the next step sequence:

1. to inhibit keying while connecting L2 to chassis
2. to allow keying to resume
3. to start up Phase Comparator 2, Predriver 2 and Motor 2 Driver. Phase Comparator 1 fine-adjusts L1 at the same time L2 is adjusted.

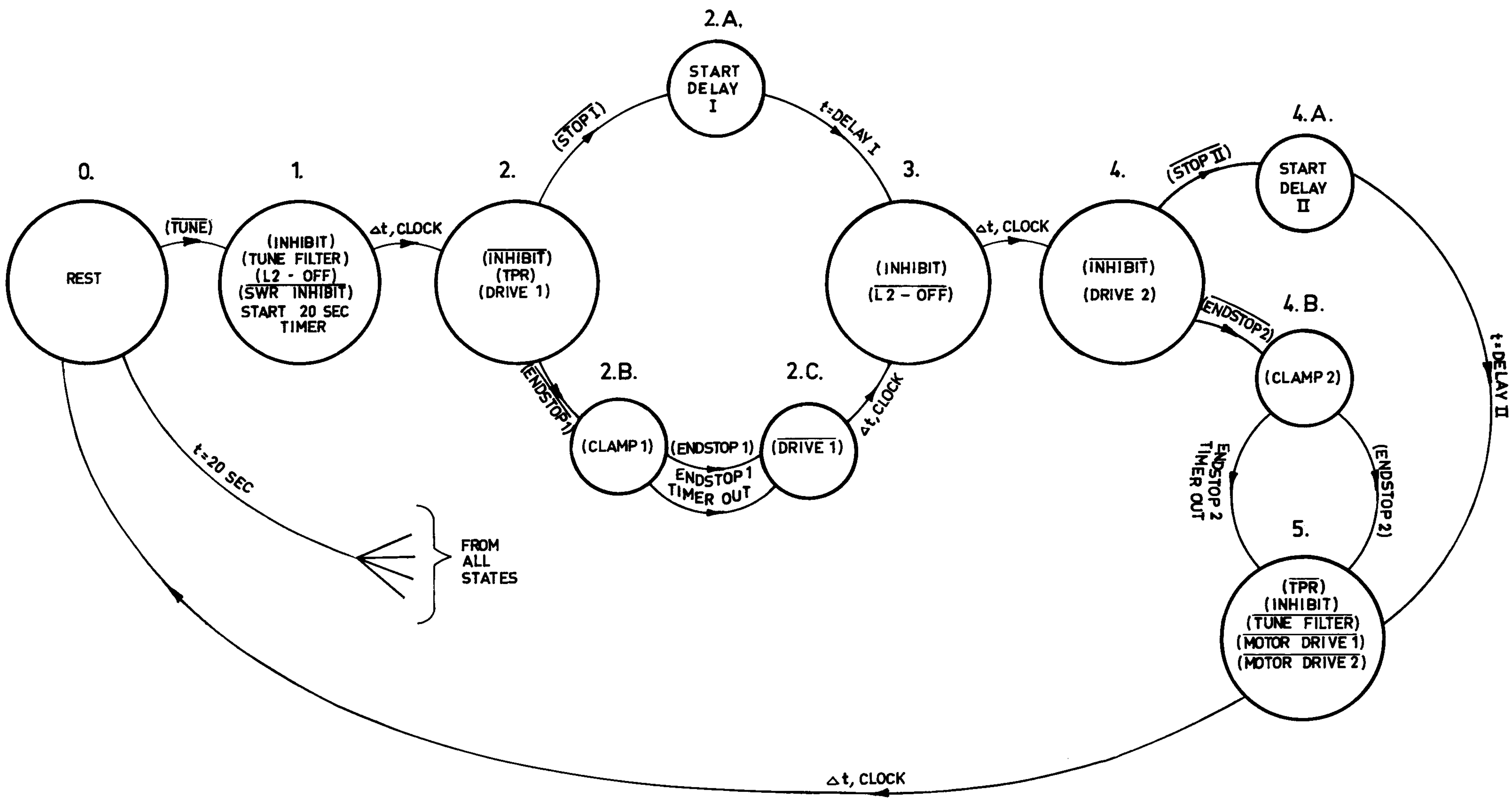
When Phase Comparator 2 detects a correct adjustment of L2, the Motor 2 Driver is cut off and the Motor 2 Stop Detector outputs a signal which causes the sequential Network to progress to the final steps, which are:

1. to cancel the TUNE POWER REQUEST
2. to inhibit keying
3. to disconnect the Tuning Filter
4. to disconnect the Phase Detectors,Predrivers and Motor Drivers
5. to permit keying

Two Endstop Detectors, one for each variable inductor, detect if one of the roller contacts reaches the end of a coil. A signal is then sent to the respective predrivers to force the motor to rotate in the correct direction, independent of the Phase Detector output.

If the tuning sequence has not been concluded within 20 seconds from the tune command the Automatic Antenna Coupler returns to its rest state and awaits the appearance of a new Tune Command, before starting up a new tuning sequence.

TUNING SEQUENCE



7. INSTALLATION

Correct installation of the equipment is important for maximum performance and reliability. Antennas and earth connections must be installed with the greatest care, especially where duplex telephony is desired.

7.1. Control Unit

The Control Unit is suspended in a pair of brackets supplied. The drawing on page 7-9 shows possible mounting positions, overall dimensions and a drilling plan for the necessary holes. The unit can be tilted in the brackets to a convenient angle and fixed in that position by tightening the bolts at the sides.

A frame for flush mounting is optionally available.

7.2. Transmitter Unit

The Transmitter Unit may be mounted up to 15 metres from the Control Unit using a RG-58C/U coaxial cable and a screened 24x0.15 sq.mm multiwire cable for interconnection and up to 50 metres away using heavier cables and junction boxes. In installations where the cable length between the units exceeds 15 metres, use RG-213/U (RG-8A/U) coaxial cable and a screened 24x0.75 sq.mm cable. The unit should be installed in a dry place near antenna lead-in and battery connection. Consideration should be given to accessibility for servicing. The brackets supplied allow for bulkhead or bench mounting. The drawing on page 7-9 shows mounting details. Observe minimum clearances.

7.3. Connection to the Permanent Installation

The TRP 6000 is to be powered from a 24V battery or a separate AC-to-24V DC converter unit. The supply leads are connected to the Transmitter Unit through the cable entry at the rear of the cabinet. Note that fuses must be provided in the supply leads. Maximum voltage drop in the supply leads should be 0.5 Volts. Table 7.1. shows the necessary cable cross sections and external fuse ratings.

Transmitter Unit	Max. cable length to battery	Conductor area	External fuses
TU 6200	6 m	2 x 6 mm^2	25A
	10 m	2 x 10 mm^2	
	16 m	2 x 16 mm^2	
	27 m	2 x 25 mm^2 *)	
TU 6400	5 m	2 x 10 mm^2	50A
	8 m	2 x 16 mm^2	
	13 m	2 x 25 mm^2 *)	

*) Use pin terminal adaptor 343 428 11.

Table 7.1.

7.4. Earth Connections

As the transmitter earth connection is a part of the total antenna system, it is of the utmost importance that the earth connection is constructed to have the smallest possible RF-impedance. Losses in the earth connection will result in a decrease in radiated power which means that the range of the transmitter will be reduced. A poor earth connection will further impede or even make duplex communication impossible.

7.4.1. Transmitter Earth Terminal:

The transmitter earth terminal is located at the rear of the Transmitter Unit.

7.4.2. Steel Ships:

From the transmitter earth terminal a 100 x 0.5 mm copper strap is run uninterrupted to two ½" or M12 bolts welded to the hull as close to the equipment as possible.

7.4.3. Wooden Ships:

From the transmitter earth terminal a 100 x 0.5 mm copper strap is run, preferably uninterrupted, to a copper earth bolt hard soldered to an earth plate having a minimum area of 1 m^2 mounted under the water line. Should it, however, be necessary to break the copper strap, for example to pass through a deck, two ½" or M12 bolts should be used for this feed through. The copper strap should then be continued below deck, after connection to the same two bolts.

The copper strap must not be passed through iron pipes and should be kept a minimum distance of 0.5 m from iron parts of some extent. If this minimum distance cannot be kept the copper strap must be effectively connected to these parts using a strap having the same dimensions.

On wooden ships having a superstructure of metal, this superstructure should also be effectively connected to the copper strap by using stainless steel bolts and preferably pieces of stainless steel strips between the metal parts.

7.4.4. Receiver Earth Terminal:

The receiver earth terminal is located in the receiver antenna connection box. To facilitate duplex operation the instructions given below should be followed.

7.4.5. Steel Ships:

A flexible 2.5 sq.mm earth wire is run from the antenna connection box to a separate ½" or M12 earth bolt welded to the hull as close to the antenna connection box as possible. As an alternative the receiver earth connection may be established at the antenna-end of the coaxial cable.

7.4.6. Wooden Ships:

A flexible 2.5 sq.mm earth wire is run from the receiver antenna connection box directly to the transmitter earth bolt on the earth plate. The earth wire should be run a minimum distance of 0.5 m from the transmitter copper strap. As an alternative the receiver earth connection may be established at the antenna-end of the coaxial cable.

7.4.7. Control Unit Earth Terminal:

The Control Unit earth terminal is located at the rear of the front panel. The Control Unit should be connected to earth if it is separated from the Transmitter Unit.

7.4.8. Steel Ships:

A flexibe 2.5 sq. mm earth wire is run to a separate ½" earth bolt welded to the hull as close to the Control Unit as possible.

7.4.9. Wooden Ships:

A flexible 2.5 sq. mm earth wire is run directly to the transmitter earth bolt on the earth plate. The wire should be run at a minimum distance of 0.5 m from the receiver earth wire.

7.4.10. Other Cables:

Other cables should be placed as far away as possible from the earth leads and under no circumstances parallel with the transmitter copper strap closer than 0.7 m and, for the receiver and Control Unit earth leads, closer than 0.2 m.

7.4.11. Earthing the Battery:

RF earth connections will cause neither battery nor mains leads to be connected to the hull. If it is desired to connect the battery to the hull, it is important to make the connection right at the battery, never in the transmitter. Max. permissible peak voltage between the battery terminals and earth is 250 V.

7.5. <u>Antennas</u>

In order to minimize duplex noise, the transmitting and receiving antennas should be kept as far away from each other as possible. Stays, wires, steel masts, etc. should either be earthed effectively or insulated.

Likewise in order to minimize duplex noise, every other electric installation such as cable braiding (screens) and instruments should be earthed effectively, and the instruments in question should be fitted with noise-interference suppression devices, effective in the range 0.1 MHz to 4.5 MHz.

The antennas should be suspended well in the clear, away from objects whose influence on the antennas may vary, such as derricks etc. Insulators should be of the best type having low leakage even when wet.

7.5.1. Transmitter Antenna Terminal:

The transmitter antenna terminal is located on the front of the Transmitter Unit.

7.5.2. Transmitter Antenna:

The Automatic Antenna Coupler will tune at any frequency in the range 1.6 to 4.22 MHz to wire and/or whip antennas of 7 to 18 metres total length, including earth strap length. See page 7-10.

To ensure the greatest possible radiated power the transmitter antenna should be as long as possible. The antenna should be terminated in a lead-in insulator in the roof or side wall of the radio room. The lead-in insulator should be located in such a way that the distance between the insulator and the transmitter antenna terminal is as short as possible to avoid losses and radiated RF-power inside the radio room which might disturb other equipment.

A short length of coaxial cable type RG-213/U, of which only the braid and the outer insulation is used, is inserted between the lead-in insulator and the transmitter antenna terminal. Both ends of the coaxial screen are soldered to cableshoes of suitable dimensions for the lead-in insulator and the transmitter antenna terminal.

If, for practical reasons, it should be necessary to mount the lead-in insulator some distance from the transmitter, the connection from the insulator to the vicinity of the transmitter should be done with a length of copper tubing mounted on stand-off insulators. A length of coaxial cable, as described above, should then be inserted between the last stand-off and the transmitter antenna terminal; any play between the transmitter and the bulkhead will then be taken up by the cable.

7.5.3. Receiver Antenna Terminal:

The receiver antenna terminal is a UHF-connector (PL 259 type) located in the receiver antenna connection box.

7.5.4. Receiver Antenna:

Length: 7 - 30 m. The receiving antenna should be brought in with a length of coaxial cable, which should be as short as possible, especially in the case of a short antenna.

If a long coaxial cable is used in order to separate receiver and transmitter antennas it will often be advantageous to insert an impedance matching transformer at the antenna end of the coaxial cable.

7.6. Extension Speaker

If an extension speaker is to be installed it should be connected to terminal strip TS1 in the Control Unit. The terminals are located at the rear of the front panel.

An audio power of 5 watts is available into a 4 ohms load. This power can be shared between several loudspeakers if so desired. The built-in speaker in the Transmitter Unit has an impedance of 8 ohms. When connecting the extension speaker(s) the minimum value of the total impedance should be 4 ohms including the built-in speaker. If 5 watts is required in the extension speaker(s), the built-in speaker must be disconnected.

7.7. Equipment-On and Transmitter-Keyed Indications

Indications of equipment-on and transmitter-keyed conditions can be obtained by means of two voltages (both 24 V at max. 0.4A) which are controlled by the Supply Switch and the Keying Relay respectively. The voltages can be taken off at a terminal strip located on the Power Supply Module in the

Transmitter Unit. The terminals are marked 24 V (+) WHEN ON and 24 V (+) WHEN KEYED respectively. The voltages may be used for activating an antenna relay or an earth-free relay in another apparatus, e.g. C.A.S., direction finder or an extra receiver.

7.8. Use of Shortening Capacitor

The shortening capacitor in the Automatic Antenna Coupler is normally shorted when the equipment is delivered from the factory as this gives the highest output power on short antennas. To check if the shortening capacitor is necessary in the actual installation select the highest possible transmitting frequency and activate the TUNE button. If the Automatic Antenna Coupler fails to tune (motor runs for 20 seconds and large variometer roller is positioned to the utmost right) the shortening capacitor must be inserted.

To insert the shortening capacitor pull the Automatic Antenna Coupler unit partly out of the cabinet. Move the connector behind the antenna insulator to the left hand terminal above the capacitor.

If the Automatic Antenna Coupler still fails to tune, the antenna is too long and must be shortened.

7.9. Final Installation Check

7.9.1. 2182 Labels:

Switch to 2182 kHz and press "TUNE".

Remove the frequency table on the front plate of the Automatic Antenna Coupler. Partially remove the self-adhesive plastic film covering the cut-outs on the front plate and place the two red labels marked 2182 so that the arrows point exactly at the positions of the two variometer rollers. See fig. 4.6.1. Replace the self-adhesive plastic film and the frequency table.

7.9.2. Memory Programming:

Program the frequency pairs marked with an RCL number on the frequency table into the user programmable memory as described in chapter 2 of this manual.

7.10. Transmit Frequency PROM Programming

The authorized transmit frequencies are programmed into the transmit frequency PROM normally localized on p.c.b. 402 accessible through a slot in the box, when the two screws securing the front panel have been loosened.

Up to 80 transmit frequencies may be stored as channel-numbers 20 to 99. The coding chosen is the simplest possible: write down the desired transmit frequency with 100 Hz resolution as a 5-digit number, add a leading "zero" and program the resulting 6-digit number as 3 consecutive bytes (groups of 8 bits) using BCD-code as illustrated by the following example (table 7.2). The frequencies may be programmed in an arbitrary order and cancelled by programming 0000 0000 into the 3 bytes corresponding to the particular frequency. New frequencies can be added until the capacity is exhausted; however no vacant space (locations containing 1111 1111) must be left between programmed frequencies.

PROM-types which can be installed

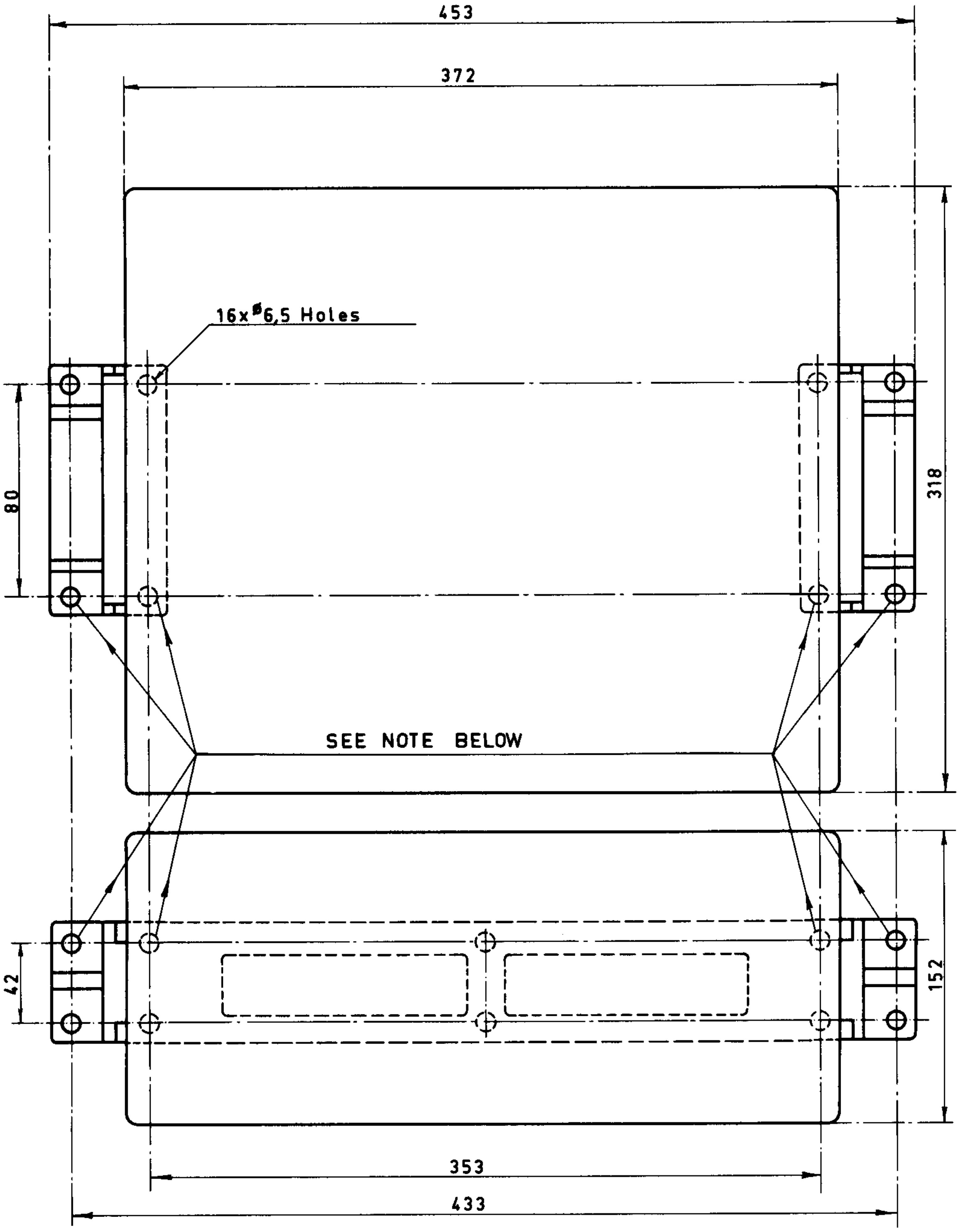
Manufacturer	Types
Monolithic Memories	6335-1 6336-1 5335-1 5336-1 6340-1 6341-1 5340-1 5341-1
Harris	HM-7640 A HM-7641 A
Motorola	MCM 7640 MCM 7641
Fairchild	93438 93448

ADDRESS dec.	ADDRESS hex.	DATA 0_7	0_6	0_5	0_4	0_3	0_2	0_1	0_0	(0_7–0_4)	(0_3–0_0)	
0	00	0	0	0	0	0	0	1	0	(0)	(2)	
1	01	0	0	0	0	0	1	1	0	(0)	(6)	2069 kHz (channel 20)
2	02	1	0	0	1	0	0	0	0	(9)	(0)	
3	03	0	0	0	0	0	0	1	0	(0)	(2)	
4	04	0	0	1	0	0	1	1	0	(2)	(6)	2263.5 kHz (channel 21)
5	05	0	0	1	1	0	1	0	1	(3)	(5)	
6	06	0	0	0	0	0	0	1	1	(0)	(3)	
7	07	0	1	0	1	0	1	1	0	(5)	(6)	3567.5 kHz (channel 22)
8	08	0	1	1	1	0	1	0	1	(7)	(5)	
237	ED	0	0	0	0	0	0	0	1	(0)	(1)	
238	EE	1	0	0	0	0	0	1	1	(8)	(3)	1834 kHz (channel 99)
239	EF	0	1	0	0	0	0	0	0	(4)	(0)	

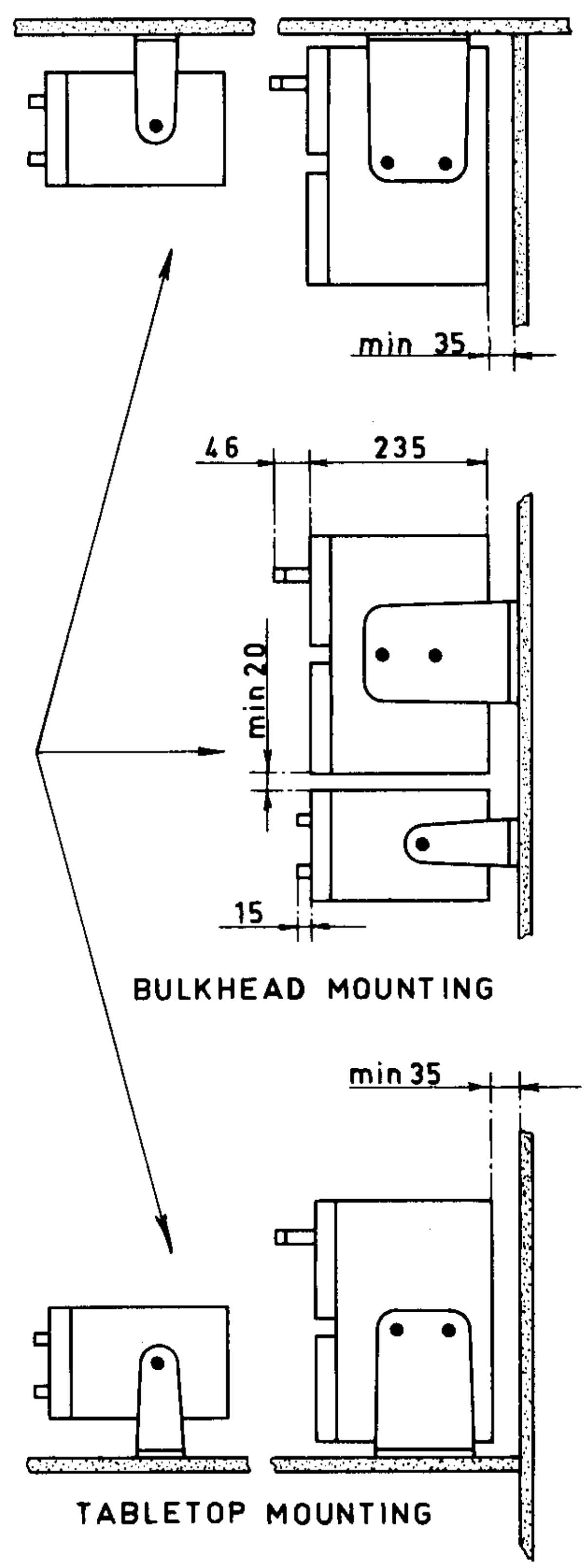
Decimal number	BCD-code
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

Table 7.2

FREQUENCY	ADR	0_7	0_6	0_5	0_4		0_3	0_2	0_1	0_0	
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )
f= kHz		0	0	0	0	(0)					( )
						( )					( )
						( )					( )



DRILLING PLAN



MOUNTING POSSIBILITIES

NOTE : CU 6000 BRACKET MAY BE USED AS A JIG FOR THE MARKING OF TU 6X00 BRACKETS HOLES AS SHOWN.

UNIT:	APPR.WEIGHT:
CU 6000	7.3 kg
TU 6200	16.0 kg
TU 6400	18.0 kg

TOLERANCES: ± 1mm

DIMENSIONS IN mm

MOUNTING OF TRP 6000

343 423 82

THE TRANSMITTER ANTENNA

Important :

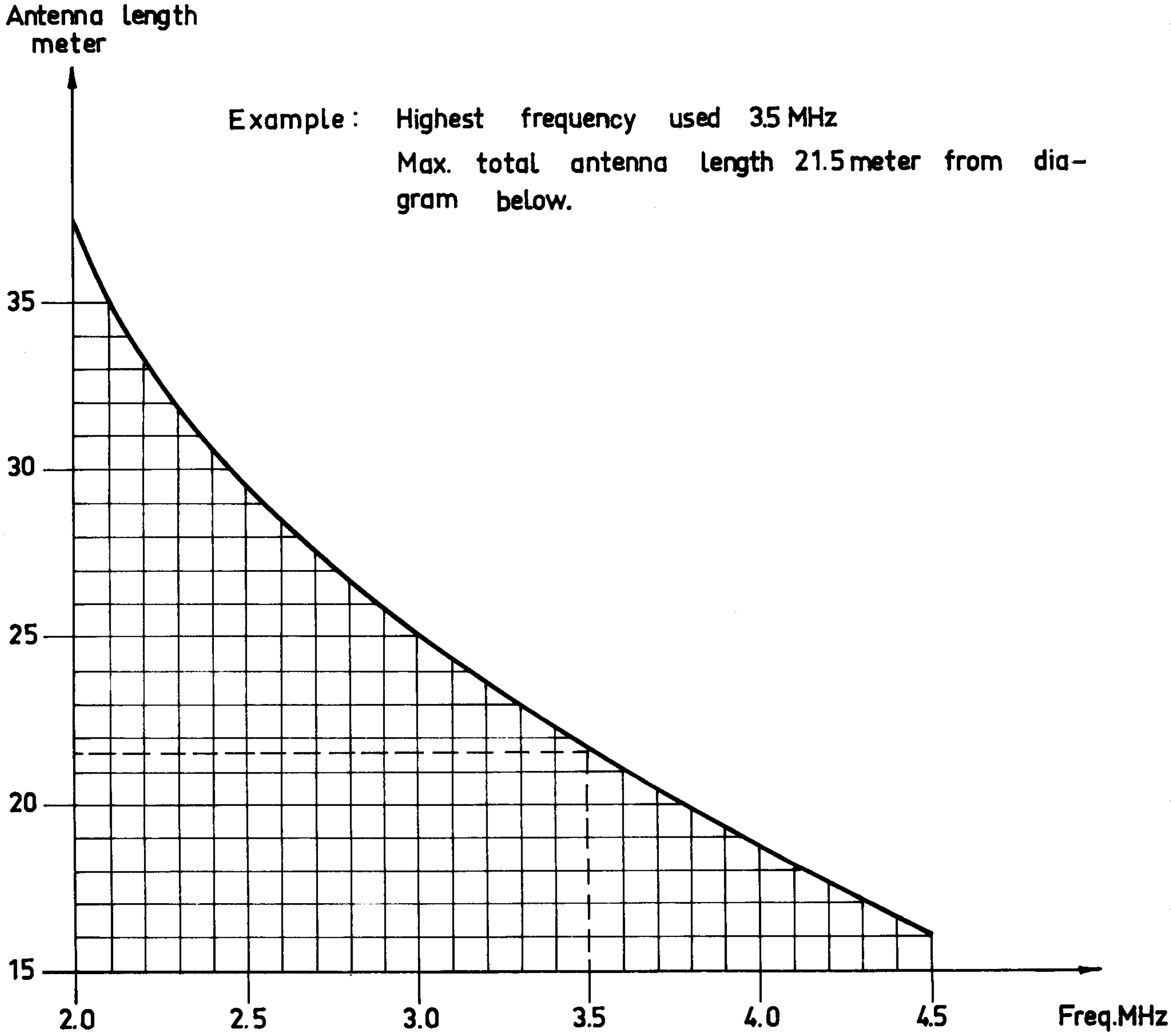
The antenna length must always be shorter than a quarter wavelength on the highest operating frequency.

The maximum length (including down lead and earth connection) versus frequency is shown in the diagram below.

A whip antenna with built-in loading coil is not tuneable above its quarterwave resonance, and therefore is not recommended.

Example : Highest frequency used 3.5 MHz

Max. total antenna length 21.5 meter from diagram below.



Max. Antenna length versus frequency
with the shortening capacitor inserted.