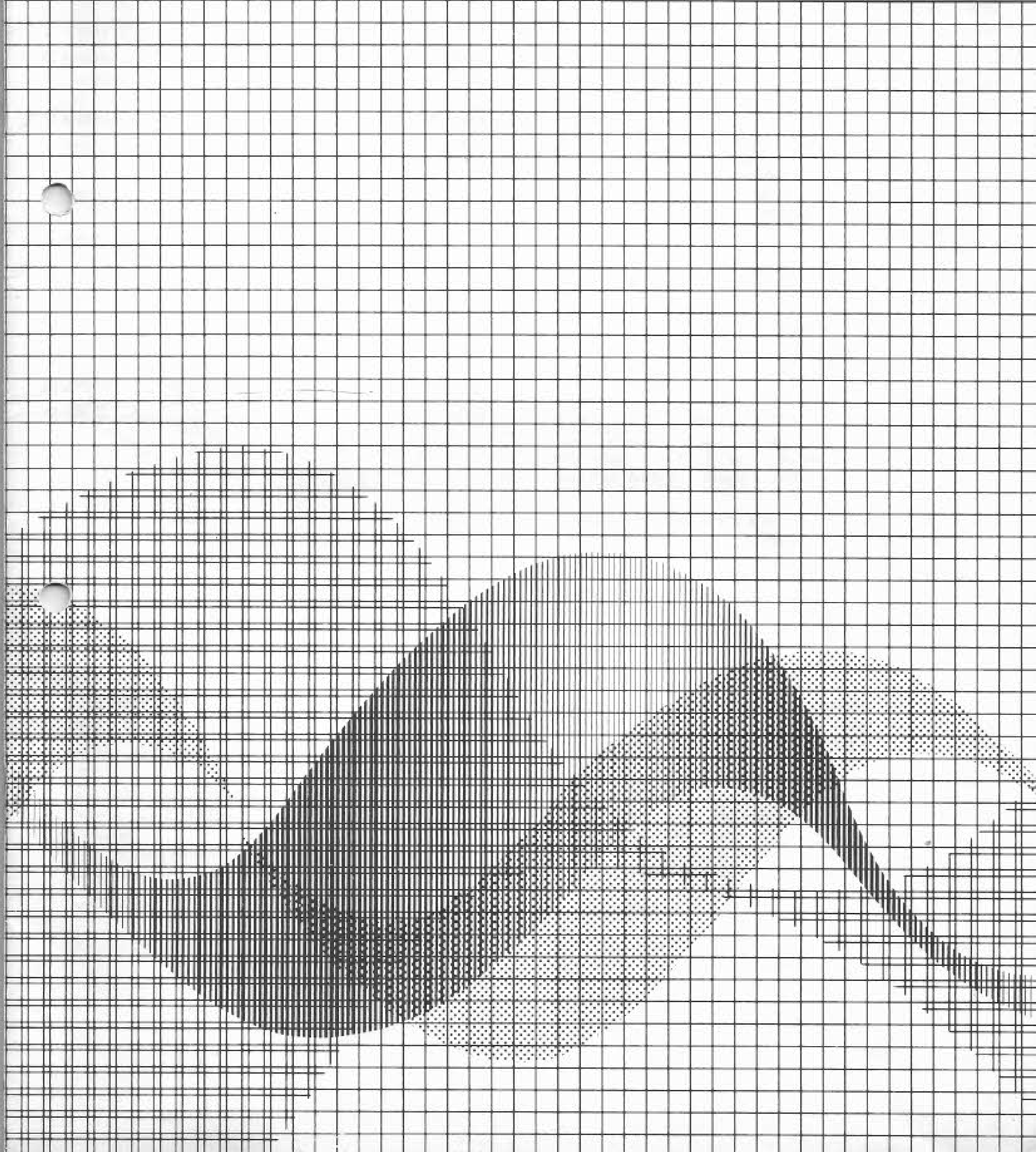
PHILIPS

World Receiver



English — page 3
Figures — page 28

Français — page 6
Figures — page 28

Deutsch — Seite 9
Abbildungen — Seite 28

Nederlands — pagina 12
Figuren — pagina 28

Español — página 15
Figuras — página 28

Italiano — pagina 18
Figure — pagina 28

Svenska — sida 21
Figurer — sida 28

Suomi — sivu 24
Kuvat — sivu 28

English

SHORTWAVE RECEPTION

Your new radio receiver will enable you to receive a number of frequency bands. Most of these are well known and tuning in to the desired station quickly becomes a routine matter as they have a fixed wavelength/frequency and are therefore always to be found in the same place on the tuning dial.
However, for shortwave broadcasting this is unfortunately not always the case. Shortwave stations have to change their wavelengths fairly often. In the shortwave band in the 10 to 100 metre wavelength range (corresponding to frequencies of 30-3 MHz) eight bands between 10 and 50 metres have therefore been allocated to shortwave broadcasting, as well as three bands between 60 and 120 metres for broadcasting in the tropical area of the world, which is roughly between 30° north and 30° south of the equator.
Most shortwave broadcasting bands, which are shown in table 1, have been allocated on a world-wide basis and can be used for international broadcasting. So far they are the only wavelengths permitting direct radio reception over large distances. They are therefore used not only for broadcasting but also by radio amateurs, as well as in aeronautical and maritime navigation, etc.
Your receiver is well equipped for shortwave reception. However, to make proper use of this facility requires a certain amount of knowledge. The following information will therefore be of help to you.

SHORTWAVE BROADCASTING BANDS

Wave-length	Frequency band	Frequency range	Remarks
120 m	2 MHz	2.30- 2.495 MHz	1)
90 m	3 MHz	3.20- 3.40 MHz	1)
75 m	4 MHz	3.95- 4.00 MHz	2)
60 m	5 MHz	4.75- 5.06 MHz	1)
49 m	6 MHz	5.95- 6.20 MHz	
41 m	7 MHz	7.10- 7.30 MHz	3)
31 m	9 MHz	9.50- 9.775 MHz	
25 m	11 MHz	11.70-11.975 MHz	
21 m	13 MHz	13.60-13.80 MHz	
19 m	15 MHz	15.10-15.45 MHz	
16 m	17 MHz	17.70-17.90 MHz	
13 m	21 MHz	21.45-21.75 MHz	
11 m	25 MHz	25.60-26.10 MHz	

1) Tropical bands, not allocated to broadcasting outside the tropical area.
2) Not allocated to broadcasting in the Americas. 3.90-3.95 MHz also allocated to the broadcasting areas.
3) Not allocated to broadcasting in the Americas.

A number of changes are to take place in the years ahead. All the frequencies listed above can be received on your receiver, however.
The following formulae can be used for converting wavelength λ (=lambda) to frequency and vice versa:

$$\text{Wavelength } \lambda \text{ (metres)} = \frac{300\,000}{\text{frequency (kHz)}} \text{ or } \frac{300}{\text{frequency (MHz)}}$$

$$\text{Frequency (kHz)} = \frac{300\,000}{\text{wavelength } \lambda \text{ (metres)}}$$

SHORTWAVE SIGNAL TRANSMISSION

Shortwave signals are propagated via the ionosphere, an invisible 'layer' of air which is about 300 km above the earth. The ionosphere is sustained by ultraviolet radiation from the sun, and its state is thus determined by the position of the sun at a given moment. In other words, it depends on such factors as the time of day, the season and the amount of ultraviolet radiation emitted by the sun. This amount varies over an 11-year period.
The signal is transmitted from transmitter to receiver by being reflected between the ionosphere and the earth. During this process fading of the signal takes place. This fading effect is most effective on the longer wavelengths and during hours of daylight.
In general it can be assumed that the ionospheric layer (usually referred to as the F-layer) becomes 'denser' and can therefore reflect higher frequencies (shorter waves, such as the 19, 16 and 13 metre) the longer and the more intensive the radiation reaching it from the sun is. This means that for long distances shorter waves can be used during the day than during the evening.
For short distances between 200 and 2,000 km ionospheric reflection takes place only once. The signal has to be beamed at a steeper angle than for long distances, and thus there is a greater likelihood that it will penetrate the ionosphere and be lost in space. See figure 1. To prevent this, increasingly longer waves (lower frequencies) are used for broadcasting over short distances than for broadcasting over long distances, for which the signal is projected practically parallel to the surface of the earth and reaches the ionosphere at about 1500 km from the transmitter.
The following table can be used as a rough guide for the choice of frequency bands:

Distance between transmitter and receiver	Local summer Day	Local summer Night	Local winter Day	Local winter Night
200- 2 000 km	9-15 MHz	6-11 MHz	9-17 MHz	6-7 MHz
2 000-15 000 km	11-21 MHz	9-15 MHz	11-21 MHz	6-11 MHz
more than 15 000 km: not easy to predict				

While the table can help you in locating the station of your choice, it does not provide direct information, which would require more details.
The problem is that giving the transmission times and wavelengths of radio stations would be unreliable in view of the periodic changes in the use of wavelengths due to natural causes or interference from other stations. The following additional information is therefore provided:

- Most international shortwave radio stations have a timetable and/or programme guide which is often sent to listeners free of charge upon request either by telephone or in writing.
- You can obtain the addresses of shortwave radio stations from your national broadcasting service or the major radio stations in your country.
- Billboard publishes an annual World Radio and TV Handbook for radio enthusiasts which is full of information about stations, transmission times and frequencies (write to: P.O. Box 88, DK-2650 Hvidovre, Denmark).
- Most shortwave radio stations transmit programmes for a limited number of hours for a particular region (e.g. 1 hour a day). These can usually be picked up in the evenings in the reception area.

This information should soon enable you to receive a number of major shortwave stations. Given its international character, listening to shortwave broadcasting can represent an important source of information for you. It is worthwhile, therefore, spending some time in order to acquire experience in this waveband.

TIME ZONES

In 24 hours the earth rotates around its own axis and in one year it rotates around the sun. These movements are the reason for the seasons and the time differences in the world.
Because of the direction in which the earth rotates it is always earlier in the day to the west of where you live and later to the east. The earth is divided into 24 time zones, each with one hour's difference from the next one. They are indicated roughly in the form of an international time chart on your radio.There is assumed to be a single standard time zone called UTC (Coordinated Universal Time), previously called GMT (Greenwich Mean Time). Shortwave radio stations generally announce their programmes in UTC. The international time chart on your receiver enables you to convert this time to your local standard time.

SHIPPING BAND

The waveband between 1606 and 3800 kHz is well known as the shipping band.
Most communication in the shipping band takes place on single-sideband (SSB) and is audible on this receiver. Tuning in to an SSB signal is not as easy as tuning in to a broadcasting channel. Accordingly, it is described in detail in the operating instructions.

SHORTWAVE AMATEUR BANDS

Radio amateurs also use the shortwaves for making contact across the world and you may find it interesting to tune in to one of the amateur bands.

Band	Frequency	Remarks
160 m	1.80- 2.00 MHz	Not allocated in Europe and Africa
80 m	3.50- 3.90 MHz	In some areas 3.50-3.80 or 3.50-4.02 MHz
40 m	7.00- 7.10 MHz	In America: 7.00-7.30 MHz
20 m	14.00-14.35 MHz	
15 m	21.00-21.45 MHz	
10 m	28.00-29.70 MHz	

SSB - SINGLE-SIDE BAND MODULATION

In a normal transmitter a carrier wave, or carrier, is generated. This is the transmitting frequency to which the sound signal from the studio is added.
The total 'modulated' signal is then as shown in figure 2. As well as the carrier, two side bands are produced which extend symmetrically on either side. If the audio signal supplied to the transmitter is in the 50 to 5000 Hz frequency range, two side bands are produced which both contain the 'same' information and which extend 5 kHz on each side, the total 'band width' of the transmitted signal therefore being in this case 10 kHz. The signal shown here can be picked up and made audible by any receiver.
With an SSB transmitter one of the two sidebands, as well as the carrier itself, is suppressed and so only one (modulated) sideband is transmitted. As there is no carrier, an SSB signal cannot be made audible by an ordinary receiver.
In order to be able to receive SSB signals it is therefore necessary to generate the carrier artificially in the receiver and to manoeuvre it into the right position with respect to the SSB signal. The strength of the two signals must also be in the right ratio, which is approximately as indicated in the illustration.
SSB signals can be received by any receiver but for the signals to be audible the receiver requires some auxiliary circuits, such as the BFO. Your receiver is fitted with these additional circuits and it also has the necessary electronic stability for listening to an amateur band without the need for constant tuning. The operating instructions for your receiver describe how to tune into SSB signals.

AERIALS

The shortwave energy generated by the transmitter is conveyed to the surrounding atmosphere by a transmitting aerial.
The radio wave is then propagated through space at a velocity of 300,000 km per second and, provided there is not too much fading, can be converted by the receiving aerial into a small electrical voltage which is fed into the receiver.
In order to transmit over long distances shortwave radio stations often use directional aerial systems which concentrate the radio energy into a beam in a given direction, so that it will not be audible everywhere in the world.
Your receiver is fitted with 2 built-in receiving aerials: a ferrite aerial and a telescopic aerial.
For all reception, however, the radio signal must be capable of reaching the aerial, and this is not always possible. A concrete block of flats or a metal caravan can create a metallic screening of the signal, this being largely caused in the case of a block of flats by the wire mesh in the concrete.
In cases such as these and for the reception of weak signals an outside aerial is desirable.
This aerial is put up outside the house and is connected by a wire to the external aerial terminal on the radio. Figure 3 gives an idea what this wire aerial looks like.
It is a (bare or insulated) copper wire, about 1 mm in diameter and between 6 and 25 m long, which is installed as high and free-standing as possible. Ceramic or polypropylene insulators are used between the supports and the aerial. These are designed to prevent signal leakage to the supports, especially in wet weather.
For the same reason the aerial wire should be properly insulated where it is fed into the dwelling. The wire aerial is suitable for all frequency ranges except the FM band and is connected to the aerial terminal on the receiver.
If your receiver has a coaxial aerial terminal you can connect the aerial to this.
Coaxial cables are supply lines with a stranded protective metal sheath which makes the cable insensitive to (unwanted) signals from outside. The cable is often used in combination with a TV aerial or, for shortwave radio reception, a dipole aerial or a ground-plane aerial.
These types of aerial are preferred for a certain frequency band which you determine when you choose the dimensions of the aerial. Their properties enable your receiver to receive weak signals or signals from certain preferred directions. This is why an increasing number of shortwave listeners use these 'tuned' aerials.

The dipole aerial

The dipole aerial consists of two identical parts, each of which is 5% shorter than a quarter of the wavelength λ (=lambda) to which you wish to give preference:
½ dipole = ¼ wavelength, minus 5% ($\frac{1}{4}\lambda - 5\%$).
It is illustrated in figure 4.
The aerial is in the middle and has insulators at both ends. The two parts of the dipole linked to the central insulator are connected to the central wire and the protective sheath, respectively, of the coaxial cable which conveys the signal to the receiver. To prevent the contact from breaking at an early date as a result of the weight of the cable it is recommended that the cable should be wrapped once around the insulator and secured with insulating tape. The terminals should preferably be soldered; the joint can be protected against corrosion with a small amount of paint. 75 ohm coaxial cable is preferred.
The dipole aerial is the least sensitive to signals which come from the directions in which it points and the most sensitive to signals which arrive at right angles to the directions in which it points.

The ground-plane aerial

If you require an aerial which is sensitive on all sides with preference for a particular frequency band, or if it is difficult to install a dipole aerial, you will find that a ground-plane aerial will do good service. This aerial, illustrated in figure 5, consists of a vertical 'radiator' which is 3% shorter than a quarter of your preferred wavelength λ:
Radiator = ¼ wavelength, minus 3% (¼λ − 3%).
Directly beneath the radiator, but insulated from it, is the centre of an artificial base consisting of 4 wires or bars of the same length as the radiator. These 4 elements are at right angles to one another and, where possible, point downwards, thus providing the best possible adaptation to the coaxial cable.
This cable is connected in the same way as the dipole aerial, the central wire being connected to the vertical radiator and the protective sheath to the centre of the artificial base. For this centre it is easy to use a round copper plate to which all the wires are connected. It is also recommended that the top of the vertical radiator should either be rounded off or fitted with a metal sphere or round plate.

Ground connection

Especially in dry areas, a ground connection may increase the efficiency of MW, LW and SW outdoor aerials.
To make a proper grounding, bury a copper strip of approximately 3 m long at a depth of 1 m.
The ground contact between the strip and the surrounding soil can be improved by adding charcoal and rock salt in the trench where the strip is laid, before filling the hole.
The best position for the trench is near the house underneath a rain pipe, so that it is watered from time to time.
One end of the copper strip is kept above ground and is firmly connected to a possibly short and relatively heavy copper wire which arrives at the ground terminal of the receiver.

Supplementary details

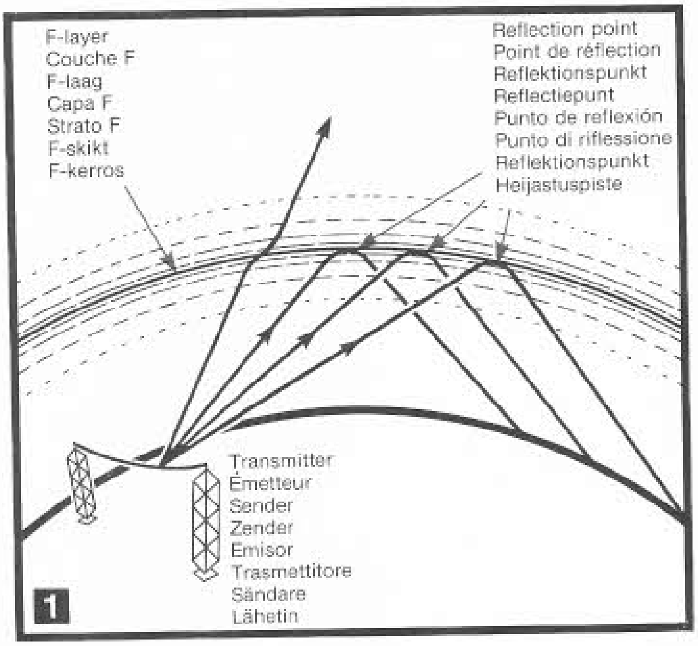
The coaxial supply line does not have to be insulated from its surroundings and can therefore be carried along walls and roofs and secured with clips or in some other way.
To gauge the length of a tuned aerial, examples of which are the dipole and the ground-plane aerials, the middle of the desired shortwave band is often used.

For example:
The 19 m shortwave band goes from 15,100-15,450 kHz. The middle of the band is therefore at 15,275 kHz. This frequency is converted to the corresponding wavelength λ:
Wavelength $\lambda = \frac{300{,}000}{\text{frequency (kHz)}} = \frac{300{,}000}{15{,}275\ \text{kHz}} = 19.64$ m.
¼λ (a quarter of this wavelength) is 4.91 m.

Dipole aerial
½ dipole = ¼ wavelength λ, minus 5% (¼λ − 5%).
A 5% reduction of ¼λ (4.91 m) produces a length of 4.66 m for each half of the dipole. The overall length of a dipole aerial for the 19 m band, including the 3 insulators, is therefore 9.5 m approx.

Ground plane aerial
Radiator = ¼ wavelength λ, minus 3% (¼λ − 3%).
A 3% reduction of ¼λ (4.91 m) produces a length of 4.77 m for the radiator and the bars.

The aerials described above are only a few commonly used types with which it is possible to improve the performance of a receiver. A wide range of these aerials can be found in specialised journals and books for radio amateurs. You will be able to make most of them yourself with relatively simple materials.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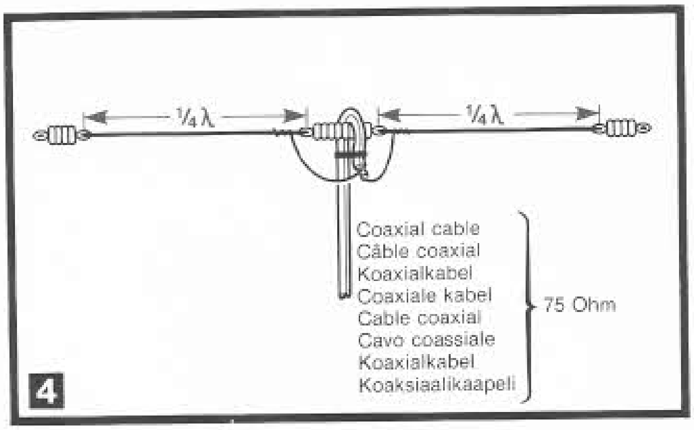
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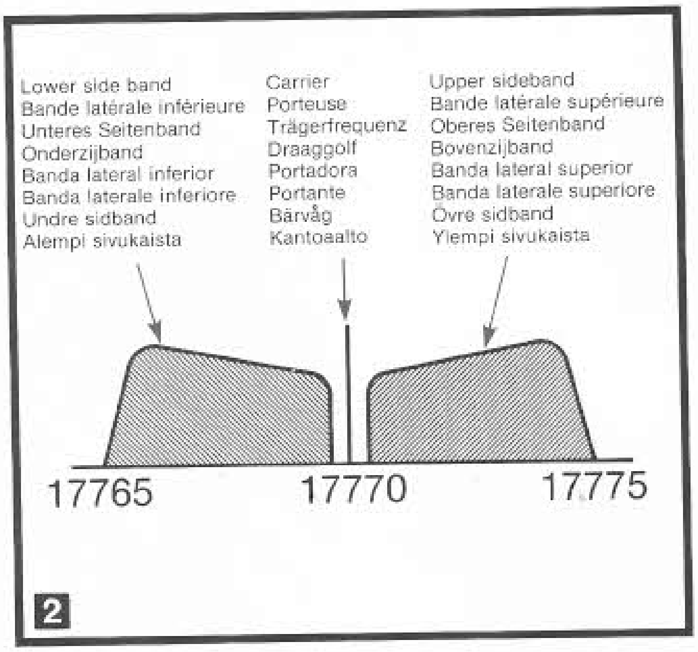
Lower side band
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Unteres Seitenband
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Banda lateral inferior
Banda laterale inferiore
Undre sidband
Alempi sivukaista
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Porteuse
Trägerfrequenz
Draaggolf
Portadora
Portante
Bärvåg
Kantoaalto
Upper sideband
Bande latérale supérieure
Oberes Seitenband
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Banda laterale superiore
Övre sidband
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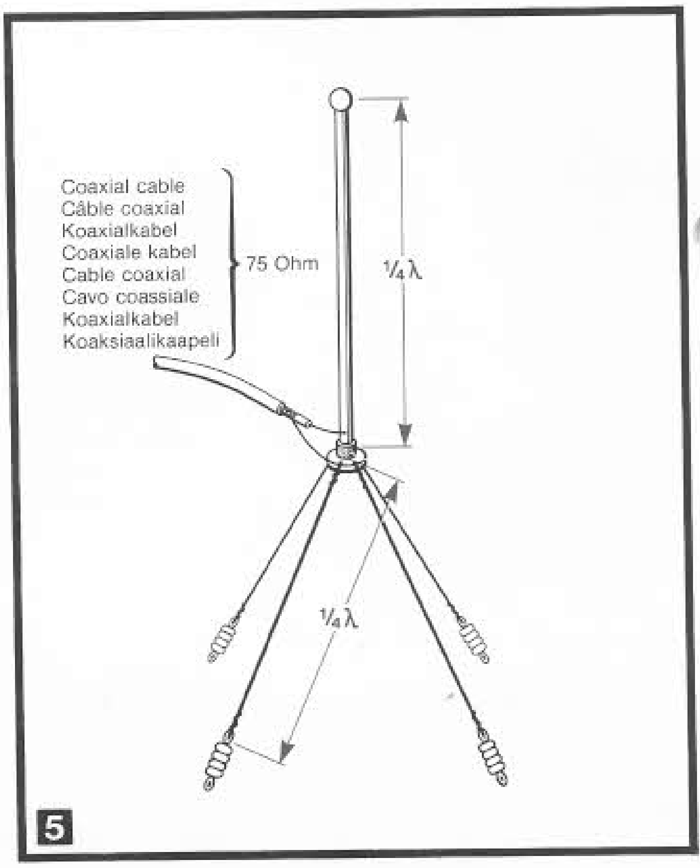
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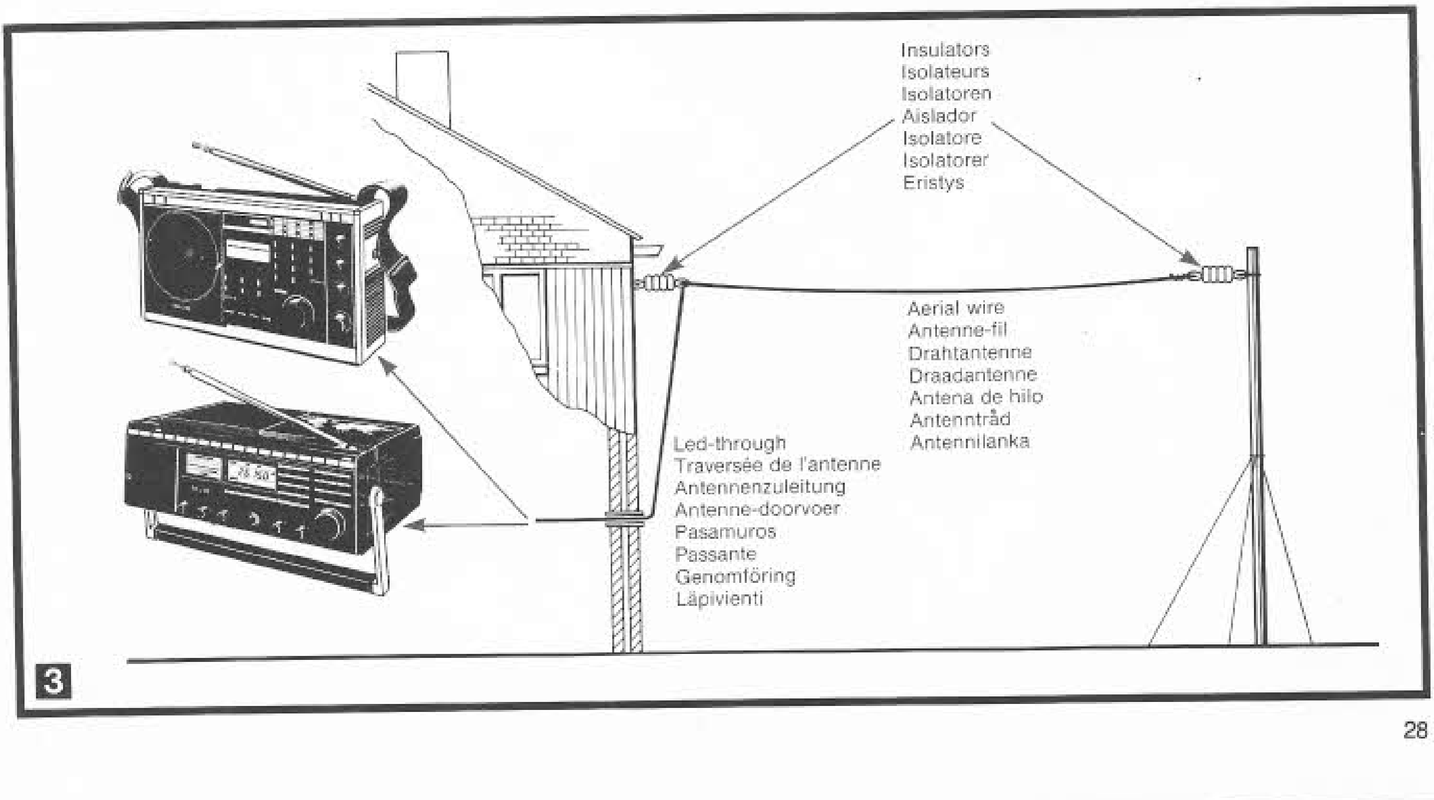
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Antenntråd
Antennilanka
Led-through
Traversée de l'antenne
Antennenzuleitung
Antenne-doorvoer
Pasamuros
Passante
Genomföring
Läpivienti
3