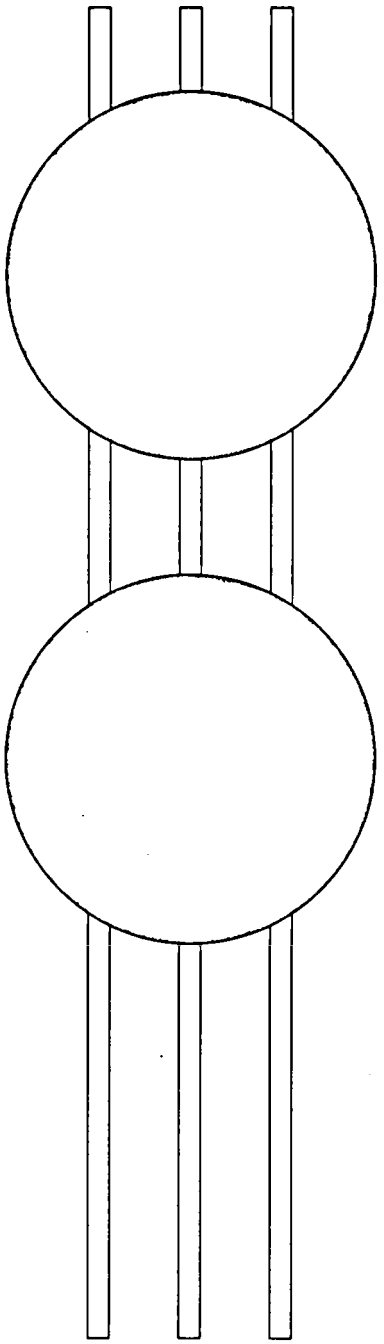
INTERNATIONAL TELECOMMUNICATION UNION

1992 - CCIR RECOMMENDATIONS

(New and revised as of 8 March 1992)

RF Series
FIXED SERVICE



CCIR INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

ISBN 92-61-04571-5

Geneva, 1992

Recommendation 385-5 (1992)

Radio-frequency channel arrangements for radio-relay systems operating in the 7 GHz band

Extract from the publication:
CCIR Recommendations: RF series: Fixed Service
(Geneva: ITU, 1992), pp. 61-66

RECOMMENDATION 385-5*

RADIO-FREQUENCY CHANNEL ARRANGEMENTS FOR RADIO-RELAY SYSTEMS OPERATING IN THE 7 GHz BAND**

(Question 136/9)

(1959-1963-1978-1982-1986-1990-1992)

The CCIR,

considering

a) that it is desirable to be able to interconnect 60, 120 and 300-channel radio-relay systems on international circuits at radio frequencies in the 7 GHz band;

b) that frequency bands 300 MHz wide may be available for such systems;

c) that economy may be achieved, if several go and return channels are connected to one common transmit-receive antenna;

d) that many interfering effects can be minimized by a carefully planned arrangement of the radio frequencies in radio-relay systems employing several radio-frequency channels;

e) that, for reasons of frequency economy, it is desirable to interleave additional radio-frequency channels between those of the main pattern;

f) that it is desirable that the values of the mid-frequencies of the radio-frequency channels be the same for 60, 120 and 300-channel systems;

g) that the spacing between the mid-frequencies of the radio-frequency channels should be such, that the systems can work with the maximum frequency deviation given in Recommendation 404 for such systems,

recommends

1. that the preferred radio-frequency channel arrangement for several radio-relay systems, each accommodating 60, 120 or 300 telephone channels and operating in the 7 GHz band, should be derived as follows (see Fig. 1):

Let: f_0 be the frequency of the centre of the band of frequencies occupied (MHz)

f_n be the centre frequency of one radio-frequency channel in the lower half of this band (MHz)

f'_n be the centre frequency of one radio-frequency channel in the upper half of this band (MHz);

then the frequencies (MHz) of the individual channels are expressed by the following relationships:

lower half of the band: $f_n = f_0 - 154 + 7\,n$ (see Note 1)

upper half of the band: $f'_n = f_0 + 7 + 7\,n$ (see Note 1)

where:

$n = 1, 2, 3, \ldots 20$;

2. that, in a section over which the international connection is arranged, all the go channels should be in one half of the band and all the return channels should be in the other half of the band;

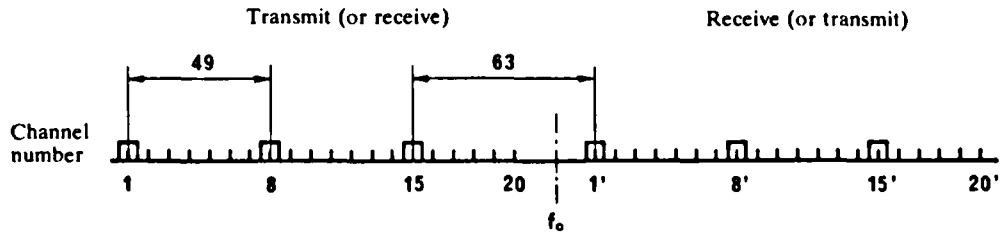
---

* This Recommendation applies only to line-of-sight and near line-of-sight radio-relay systems.

** Subject to agreement between the administrations concerned, higher-capacity systems using the radio-frequency channel arrangement pattern defined in this Recommendation may be accepted if necessary.

FIGURE 1

Radio-frequency channel arrangement for international connection of radio-relay systems for 60, 120 or 300 channels operating in the 7 GHz band
(All frequencies are in MHz)



3. that, when common transmit-receive antennas are used and three radio-frequency channels are accommodated on a single antenna, it is preferable that the channel frequencies be selected by making:

n = 1, 8 and 15, or

n = 2, 9 and 16, or

n = 3, 10 and 17, or

n = 4, 11 and 18, or

n = 5, 12 and 19, or

n = 6, 13 and 20,

in both halves of the band;

4. that for international connections, the centre frequency should preferably be:

f_0 = 7 575 MHz for the band 7 425 to 7 725 MHz (see Note 1);

other centre frequencies may be used in certain geographical areas by agreement between the administrations concerned, e.g.:

f_0 = 7 275, 7 400 or 7 700 MHz (see Note 1);

5. that the channel arrangement and antenna polarization should be agreed between the administrations concerned;

6. that, when systems with 300 telephone channels are operated in a radio-frequency band, channel combinations which result in differences between channel frequencies of less than 14 MHz, should in general be avoided. If sufficient antenna discrimination is available, this precaution may be disregarded.

Note 1 – The formulae for f_n and f'_n and the values for f_0 differ from those given in Recommendation 284 (Los Angeles, 1959). This change has been made so that the "centre frequency" f_0 falls, in reality, in the centre of the band of frequencies occupied.

Note 2 – Due regard should be taken of the fact that in some countries the radio-frequency channel arrangement described in Annex 3 is in use for digital systems with a capacity up to about 140 Mbit/s.

Note 3 – Due regard should also be taken of the fact that in some countries the radio-frequency channel arrangements described in Annexes 1 and 2 are in use for medium and small capacity digital systems.

ANNEX 1

Radio-frequency channel arrangement for small and medium capacity analogue radio-relay systems or medium capacity digital radio-relay systems operating in the 7 GHz band

1. This Annex describes a radio-frequency channel arrangement for digital radio-relay systems of 34 Mbit/s capacity and for coexistence of digital systems and analogue radio-relay systems up to 300 channels, operating in the band 7 425-7 725 MHz. The radio-frequency channel arrangement is shown in Fig. 2 and is derived as follows:

Let f_0 be the frequency of the centre of the band of frequencies occupied (MHz)

f_n be the centre frequency of one radio-frequency channel in the lower half of the band (MHz)

f'_n be the centre frequency of one radio-frequency channel in the upper half of the band (MHz);

then the frequencies (MHz) of the individual channels are expressed by the following relationships:

lower half of the band: $f_n = f_0 - 161 + 28\,n$

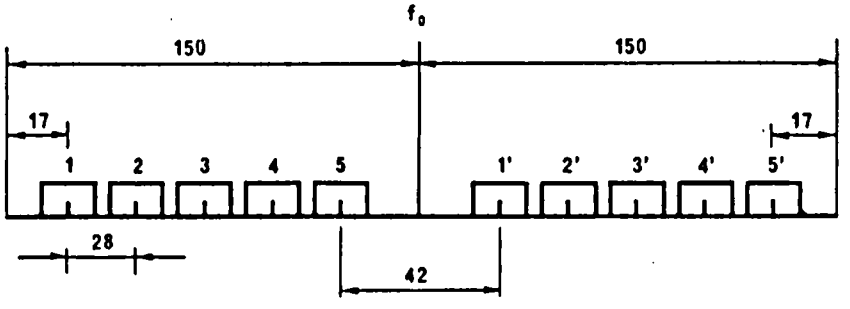
upper half of the band: $f'_n = f_0 - 7 + 28\,n$

where:

$n = 1, 2, 3, 4$ and 5.

FIGURE 2

Radio-frequency channel arrangement of radio systems for radio-relay analogue and digital systems operating in the 7 GHz band
(All frequencies are in MHz)



2. All go channels should be in one half of the band and all return channels should be in the other half of the band.

3. For adjacent radio-frequency channels in the same half of the band, different polarizations may be used for alternate channels or where it is possible, both polarizations may be utilized for each digital radio-frequency channel.

4. When additional analogue radio frequencies are required, they should be interleaved between those of the main pattern of Fig. 2, and can be realized by the same f_0 and the following relationship:

lower half of the band: $f_n = f_0 - 175 + 28\,n$

upper half of the band: $f'_n = f_0 + 7 + 28\,n$

where:

$n = 1, 2, 3, 4$ and 5.

5. When additional digital radio frequencies interleaved between those of the main pattern of Fig. 2 are required, they can be realized by the same f_0 and the following relationship:

lower half of the band: $f_n = f_0 - 147 + 28\,n$

upper half of the band: $f'_n = f_0 + 7 + 28\,n$

where:

$n = 1, 2, 3$ and 4.

6. The preferred centre frequency f_0 is 7575 MHz.

7. The local oscillators for the lower half of the band should preferably be 70 MHz above the respective channel frequency and for the upper half of the band 70 MHz below the channel frequency. This will ensure that the image frequencies will fall within the band. However, the application of certain techniques, particularly the use of image frequency rejection mixers, helps to overcome this constraint.

ANNEX 2

Radio-frequency channel arrangement for medium capacity analogue radio-relay systems or small and medium capacity digital radio-relay systems operating in the 7 GHz band

1. This Annex describes a radio-frequency channel arrangement suitable for digital radio-relay systems up to 19 Mbit/s (1.544 × 12) and allows coexistence of digital systems and medium capacity analogue systems spaced on a 20 MHz interval operating in the band 7435 to 7750 MHz. Coexistence can also be achieved with analogue 960 telephone channels. The radio-frequency channel arrangement is shown in Fig. 3 and is derived as follows:

Let f_0 be the frequency of the centre of the band of frequencies occupied (MHz)

f_n be the centre frequency of one radio-frequency channel in the lower half of the band (MHz)

f'_n be the centre frequency of one radio-frequency channel in the upper half of the band (MHz);

then the frequencies (MHz) of the individual channels are expressed by the following relationships:

lower half of the band: $f_n = f_0 - 152.5 + 5\,n$

upper half of the band: $f'_n = f_0 + 7.5 + 5\,n$

where:

$n = 1, 2, 3, 4, 5, 6, \ldots 28$.

2. All go channels should be in one half of the band and all return channels should be in the other half of the band.

3. The centre frequency f_0 is 7592.5 MHz.

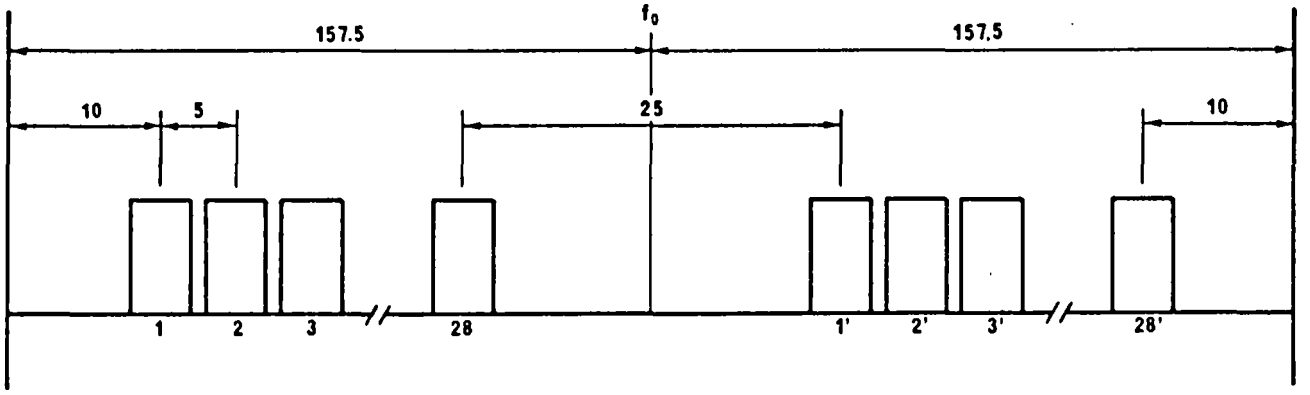
4. For all radio-frequency channels in the same half of the band, the same polarization may be used or, where it is necessary because of the existence of interference, different polarizations may be utilized.

Where it is possible, both polarizations may be utilized for each digital radio-frequency channel.

5. Digital radio-frequency channels for 12.6 Mbit/s (1.544 × 8) or 19 Mbit/s (1.544 × 12) systems, can be realized by use of a 10 MHz or 20 MHz interval.

FIGURE 3

Radio-frequency channel arrangement for digital systems operating in the 7 GHz band
(All frequencies are in MHz)



ANNEX 3

A radio-frequency channelling arrangement for the 7 GHz band

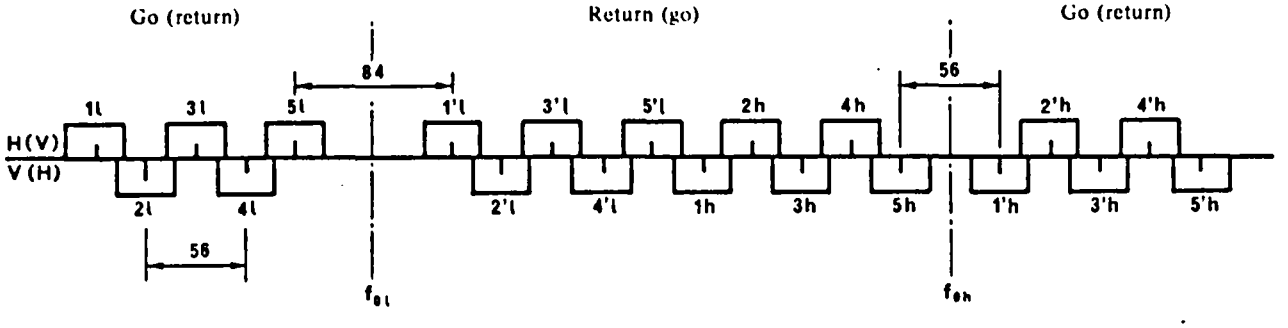
This Annex describes a radio-frequency channel arrangement for the 7 GHz band derived from Note 2. In the higher part of the band the original frequency pattern of Recommendation 284 (Los Angeles, 1959) has been maintained (see Note 1), in order to have a regular frequency pattern for the whole band.

The arrangement provides for up to 10 go and 10 return channels, each accommodating about 140 Mbit/s subdivided in two groups of 5 go and 5 return channels relating to the lower part and the higher part of the band.

The radio-frequency channel arrangement is as shown in Fig. 4 and is derived as follows:

FIGURE 4

Radio-frequency channel arrangement for the 7 GHz band
(All frequencies are in MHz)



Let f_{0l} be the frequency at the centre of the lower part of the band:

$$f_{0l} = 7\,275 \text{ MHz}$$

f_{0h} be the frequency at the centre of the higher part of the band:

$$f_{0h} = 7\,597 \text{ MHz}$$

f_{nl} is the centre frequency of one radio-frequency channel in the lower half of the lower part of the band

f'_{nl} is the centre frequency of one radio-frequency channel in the upper half of the lower part of the band

f_{nh} is the centre frequency of one radio-frequency channel in the lower half of the higher part of the band

f'_{nh} is the centre frequency of one radio-frequency channel in the upper half of the higher part of the band;

then the frequencies in MHz of the individual channels are expressed by the following relationships:

$$f_{nl} = f_{0l} - 182 + 28\,n$$

$$f'_{nl} = f_{0l} + 14 + 28\,n$$

$$f_{nh} = f_{0h} - 168 + 28\,n$$

$$f'_{nh} = f_{0h} + 28\,n$$

where:

$n = 1, 2, 3, 4, 5.$