

RECOMMENDATION ITU-R F.382-8

Radio-frequency channel arrangements for fixed wireless systems* operating in the 2 and 4 GHz bands

(Question ITU-R 136/9)

(1956-1959-1963-1966-1970-1982-1986-1990-1991-1997-2006)

Scope

This Recommendation provides radio-frequency channel arrangements for fixed wireless systems operating in the 2 GHz band (1 700-2 100 MHz or 1 900-2 300 MHz range) and the 4 GHz band (3 800-4 200 MHz range). The channel spacing recommended in the main text is 29 MHz with possible use of the interleaved 14 MHz spacing channels. Another channel arrangement with 28 MHz channel spacing in the range 3 700-4 200 MHz is provided in the Annex. Other arrangements used in some countries are also described in the Notes.

The ITU Radiocommunication Assembly,

considering

- a) that it is sometimes desirable to be able to interconnect fixed wireless systems on international circuits at radio frequencies in the 2 and 4 GHz bands;
- b) that, in a frequency band 400 MHz wide, it may be desirable to interconnect up to six go and six return radio-frequency channels;
- c) that economy may be achieved if at least three go and three return channels can be interconnected between systems each of which uses common transmit-receive antennas;
- d) that many interfering effects can be substantially reduced by a carefully planned arrangement of the radio frequencies in fixed wireless systems employing several radio-frequency channels;
- e) that it may sometimes be desirable to interleave additional radio-frequency channels between those of the main pattern;
- f) that the use of bit rates of 34 Mbit/s may be possible in the 2 GHz band;
- g) that the use of bit rates of 2×34 Mbit/s or 2×45 Mbit/s or 140 Mbit/s or synchronous digital hierarchy bit rates is possible in the 4 GHz band;
- h) that for these digital radio systems, further economies are possible by accommodating up to six go and six return channels on a single antenna;
- j) that frequency block arrangements specifically for fixed wireless access systems in the range 3 400-3 800 MHz are given in Recommendation ITU-R F.1488;

* The term "fixed wireless systems" used in this Recommendation means point-to-point radio relay systems.

k) Resolution 716 of the World Radiocommunication Conference (Geneva, 1995) (WRC-95) urges administrations to ensure that frequency assignments to new fixed service systems do not overlap with the 1 980-2 010 MHz and 2 170-2 200 MHz bands in all three Regions and the 2 010-2 025 MHz and 2 160-2 170 MHz bands in Region 2 mobile-satellite service (MSS) allocations,

recommends

1 that the preferred radio-frequency channel arrangement for up to six go and six return channels for medium and high-capacity fixed wireless systems, in the 2 and 4 GHz bands should be as shown in Fig. 3 and should be 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 in MHz of individual channels are expressed by the following relationships:

$$\text{lower half of the band: } f_n = f_0 - 208 + 29 n$$

$$\text{upper half of the band: } f'_n = f_0 + 5 + 29 n$$

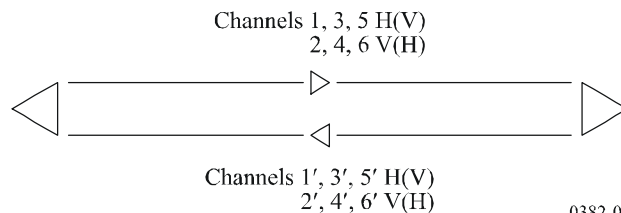
where:

$$n = 1, 2, 3, 4, 5 \text{ or } 6;$$

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;

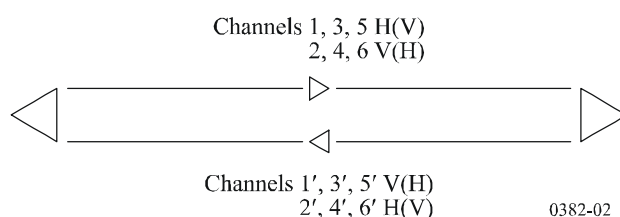
3 that for adjacent radio-frequency channels in the same half of the band, different polarizations should preferably be used alternately; i.e. the odd numbered channels in both directions of transmission on a given section should use H(V) polarization, and the even numbered channels should use V(H) polarization, as shown in Fig. 1 below:

FIGURE 1



NOTE 1 – When antennas for double polarization are used, the arrangement of channels shown in Fig. 2 may be used by agreement between administrations.

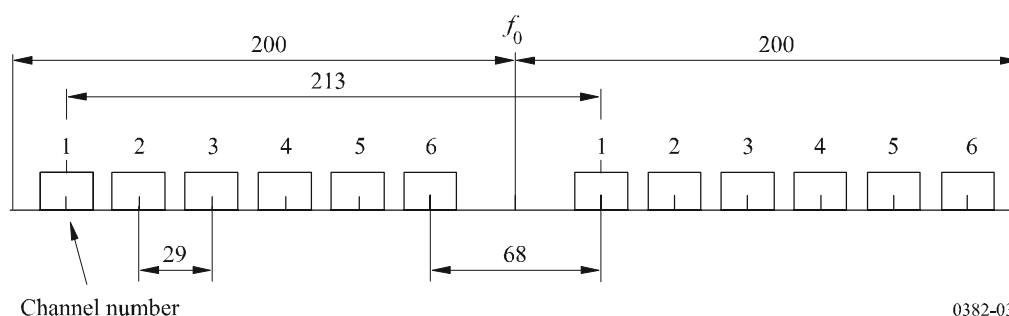
FIGURE 2



4 that, when common transmit-receive antennas are used, and not more than three radio-frequency channels are accommodated on a single antenna, it is preferred that the channel frequencies be selected by either making $n = 1, 3$ and 5 in both halves of the band or making $n = 2, 4$ and 6 in both halves of the band;

FIGURE 3

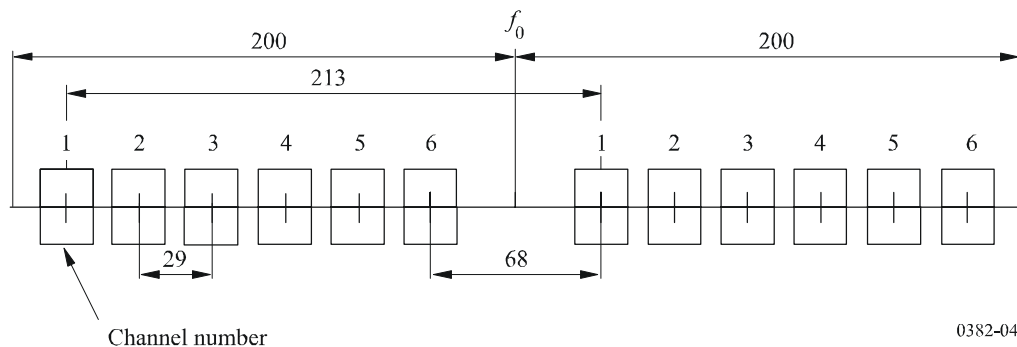
Radio-frequency channel arrangement for radio-relay systems with capacities from 600 to 1 800 telephone channels, or equivalent, in the 2 and 4 GHz bands, or 34 Mbit/s in the 2 GHz band, or 34 to 140 Mbit/s or synchronous digital hierarchy bit rates in the 4 GHz band, for use in international connections
(All frequencies in MHz)



5 that use of frequencies in the 2 GHz band should take into consideration results of ITU-R sharing studies with other services which have a primary allocation with the fixed service. In this regard, alternative channel arrangements given in Recommendation ITU-R F.1098 should be used as appropriate;

6 that in the case of digital fixed wireless systems with a co-channel arrangement, the plan as shown in the Fig. 4, should be used;

FIGURE 4
Co-channel arrangement for digital radio-relay systems operating in the 4 GHz band
(All frequencies in MHz)



7 that when additional radio-frequency channels, interleaved between those of the main pattern, are required, the values of the centre frequencies of these radio-frequency channels should be 14.5 MHz below those of the corresponding main channel frequencies (see Note 4);

8 that to minimize interference within a system, the centre frequency f_0 should preferably be as given below:

$$f_0 = 1\,903 \text{ MHz or } 2\,101 \text{ MHz in the 2 GHz band (see Note 1);}$$

$$f_0 = 4\,003.5 \text{ MHz in the 4 GHz band.}$$

Other centre frequencies may be used by agreement between the administrations concerned (see Note 5).

9 that due regard be taken of the fact that in some countries, mostly in a large part of Region 2 and in certain other areas, another radio-frequency channel arrangement for 4 GHz systems is used. A description of this radio-frequency channel arrangement is given in § 4 of Annex 1 to Recommendation ITU-R F.635. Attention is drawn to the problem of interconnection.

NOTE 1 – In certain countries, particularly in Region 2, it may be preferable to use as centre frequencies:

$$f_0 = 1\,932 \text{ MHz instead of } 1\,903 \text{ MHz, and}$$

$$f_0 = 2\,086.5 \text{ MHz instead of } 2\,101 \text{ MHz.}$$

NOTE 2 – In a number of administrations in Region 1, a radio-frequency channel arrangement given in Annex 1 to this Recommendation is used in the frequency band 3 700 to 4 200 MHz.

NOTE 3 – In the People's Republic of China, the frequency band from 3 400 to 4 200 MHz has been divided into two groups each with a frequency band 400 MHz wide. The radio-frequency channel arrangement is identical to that shown in Fig. 3 of this Recommendation, where $f_0 = 3\,592.0$ MHz and 4 003.5 MHz, respectively.

NOTE 4 – In fixed wireless systems with digital modulation using a bit rate of 2×34 Mbit/s, 2×45 Mbit/s, 140 Mbit/s or synchronous hierarchy bit rates it may not be practicable to use interleaved frequencies, because of the wide bandwidth occupied by the modulated carrier.

NOTE 5 – Interference due to certain harmonics of the shift frequency, which may fall near radio-frequency channel frequencies f_n (MHz) in radio-frequency repeaters, or may fall near $(f_n \pm 70 \text{ MHz})$ in repeaters using an intermediate frequency of 70 MHz, may in certain cases be serious. Such interference may be reduced by choosing a suitable value for f_0 .

Annex 1

Radio-frequency channel arrangement for fixed wireless systems operating in the 4 GHz band with a channel spacing of 28 MHz

This Annex describes a radio-frequency channel arrangement suitable for digital fixed wireless systems with a channel bandwidth of 28 MHz. The radio-frequency channel arrangement is shown in Fig. 5 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),
 $f_0 = 3\,947.5$ MHz,
 duplex spacing = 266 MHz,

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

lower half of band: $f_n = f_0 - 259 + 28 n$

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

where:

$n = 1, 2, \dots 8.$

