

## RECOMMENDATION ITU-R F.636-3\*

**RADIO-FREQUENCY CHANNEL ARRANGEMENTS FOR FIXED WIRELESS SYSTEMS  
OPERATING IN THE 15 GHz (14.4-15.35 GHz) BAND**

(Question ITU-R 136/9)

(1986-1990-1992-1994)

**Scope**

This Recommendation provides radio frequency (RF) channel arrangements for fixed wireless systems operating in the 15 GHz (14.4-15.35 GHz) band. The main text of this Recommendation presents RF channel arrangements with separations of 3.5, 7, 14 and 28 MHz and Annexes 1 and 2 present arrangements with a separation of 2.5 MHz including those based on a homogeneous pattern.

The ITU Radiocommunication Assembly,

*considering*

- a) that the band 14.4-15.35 GHz is allocated to the fixed service and that in some countries the band 14.5-15.35 GHz is only used for fixed wireless systems;
- b) that, at these frequencies, fixed wireless systems for digital transmissions are feasible with repeater spacings and other features chosen according to rainfall conditions;
- c) that in various countries there are restrictions on the use of various portions of the whole band 14.4-15.35 GHz;
- d) that the homogeneous frequency pattern based on an interval of 14 MHz (see Annex 1) is applicable in the band 14.4-15.35 GHz;
- e) that efficient use of bands of different width can be achieved by selecting all channel frequencies from this homogeneous pattern;
- f) that it may be desirable to interleave additional radio-frequency channels between those of the main pattern,

*recommends*

1. that the preferred radio-frequency channel arrangement for medium-capacity digital fixed wireless operating with a 28 MHz channel spacing should be derived as follows:

Let  $N$  be the number of RF channels;

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

$$\text{lower half of the band: } f_n = f_r + a + 28n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_n = f_r + 3\,626 - 28(N - n) \quad \text{MHz}$$

where:

$f_r$ : reference frequency,

$a = 2\,688$  MHz for the band 14.4-15.35 GHz, and

$a = 2\,786$  MHz for the band 14.5-15.35 GHz,

$n = 1, 2, \dots, N$ , with  $N \leq 16$  for the band 14.4-15.35 GHz,  
and  $N \leq 15$  for the band 14.5-15.35 GHz.

The channel arrangement with  $f_r = 11\,701$  MHz and a frequency spacing of 28 MHz is illustrated in Fig. 1;

\* Radiocommunication Study Group 9 made editorial amendments to this Recommendation in 2007 in accordance with Resolution ITU-R 44.

2. that the preferred radio-frequency channel arrangement for digital fixed wireless systems operating with a 14 MHz channel spacing should be derived as follows:

$$\text{lower half of the band: } f_n = f_r + a + 14n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_n = f_r + 3\,640 - 14(N - n) \quad \text{MHz}$$

where:

$f_r$ : reference frequency,

$a = 2\,702$  MHz for the band 14.4-15.35 GHz, and

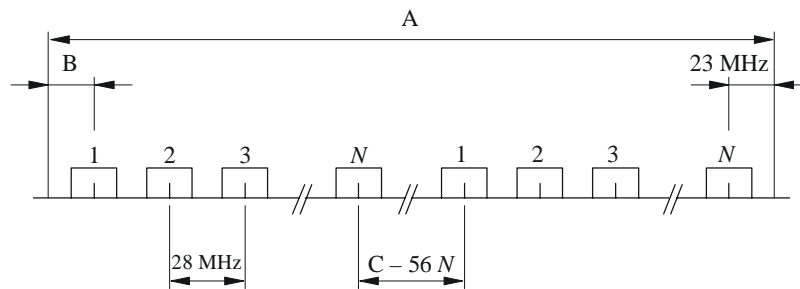
$a = 2\,800$  MHz for the band 14.5-15.35 GHz,

$n = 1, 2, \dots, N$  with  $N \leq 32$  for the band 14.4-15.35 GHz,

and  $N \leq 30$  for the band 14.5-15.35 GHz.

FIGURE 1

**Radio-frequency channel arrangement for fixed wireless systems  
operating in the 15 GHz band: 28 MHz spacing**



(For the band 14.4-15.35 GHz:  $A = 950$  MHz,  $B = 17$  MHz,  $C = 966$  MHz)

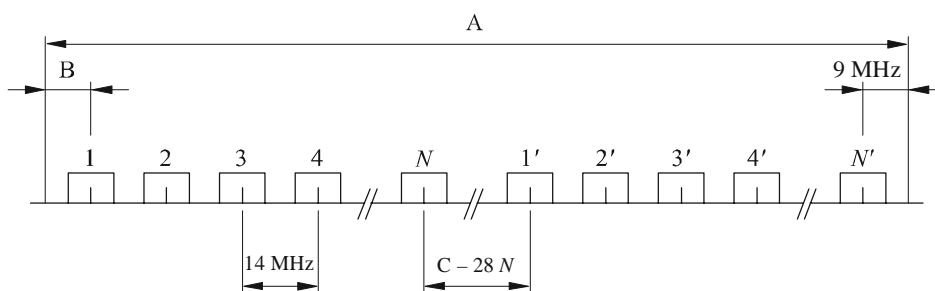
(For the band 14.5-15.35 GHz:  $A = 850$  MHz,  $B = 15$  MHz,  $C = 868$  MHz)

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The channel arrangement with  $f_r = 11\,701$  MHz and a frequency spacing of 14 MHz is illustrated in Fig. 2;

FIGURE 2

**Radio-frequency channel arrangement for fixed wireless systems  
operating in the 15 GHz band: 14 MHz spacing**



(For the band 14.4-15.35 GHz:  $A = 950$  MHz,  $B = 17$  MHz,  $C = 952$  MHz)

(For the band 14.5-15.35 GHz:  $A = 850$  MHz,  $B = 15$  MHz,  $C = 854$  MHz)

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3. that, in cases where low-capacity radio channels with 7 or 3.5 MHz channel spacing are required, either the channel arrangement given in § 2, in conjunction with similar arrangements shifted respectively by 7 MHz or 3.5, 7 and 10.5 MHz with respect to it, or one of the following channel arrangements, occupying some of the medium capacity radio channels of the 28 MHz channel arrangements, should be used:

*Frequency spacing of 7 MHz:*

$$\text{lower half of the band: } f_m = f_r + a + 28n + 7m \quad \text{MHz}$$

upper half of the band:  $f'_m = f_r + 3\,608.5 - 28(N - n) + 7m$  MHz

where:

$f_r$ : reference frequency

$m = 1, 2, 3$  or  $4$

$n$ : channel number from the basic plan which is being subdivided

$a = 2\,670.5$  MHz for the band 14.4-15.35 GHz, and

$a = 2\,768.5$  MHz for the band 14.5-15.35 GHz.

*Frequency spacing of 3.5 MHz:*

lower half of the band:  $f_m = f_r + a + 28n + 3.5m$  MHz

upper half of the band:  $f'_m = f_r + 3\,610.25 - 28(N - n) + 3.5m$  MHz

where:

$f_r$ : reference frequency

$m = 1, 2, 3, 4, 5, 6, 7$  or  $8$

$n$ : channel number from the basic plan which is being subdivided

$a = 2\,672.25$  MHz for the band 14.4-15.35 GHz, and

$a = 2\,770.25$  MHz for the band 14.5-15.35 GHz;

**4.** 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 is used with a preferred 2.5 MHz channel spacing, or multiples thereof, derived from an homogeneous frequency pattern defined by the relationship:

$$f_p = f_r + 2\,697.75 + 2.5p$$

where:

$1 \leq p \leq 380$

A specific frequency plan, based on this pattern, is described in Annex 2;

**5.** that, in a section through which an 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;

**6.** that both horizontal and vertical polarization shall be used, where possible, for each radio-frequency channel;

**7.** that for digital systems with a capacity of 70 to 140 Mbit/s the same radio-frequency channel arrangement given in § 2 may be used utilizing channel numbers  $n = 2$  and  $6$  in case of co-channel arrangement and  $n = 1, 3, 5, 7$  in case of an alternated arrangement (see Note 3);

**8.** that, when common transmit-receive antennas are used and no more than half the available channels are accommodated on a single antenna, it is preferred that the channel frequencies be either odd or even numbered;

**9.** that, for international connections, the reference frequency should preferably be 11 701 MHz. Other values may be used by agreement between the administrations concerned.

*Note 1* – In order to reduce the possibility of an unacceptable degradation in performance occurring, care should be exercised in using mixed channel arrangement in a radio-relay network. This would especially apply if small-capacity radio-relay links using the channel arrangements described in § 3 and medium-capacity radio-relay links operating in accordance with the main channel arrangements described in § 1 and 2 are both present in close geographical proximity.

*Note 2* – In using the band 14.47-14.5 GHz, it is necessary to take all practicable steps to protect spectral line observations of the radioastronomy service from harmful interference (see No. 5.149 of the Radio Regulations).

*Note 3* – In the case of utilization with digital systems with a symbol rate of more than about 25 MBd care should be taken when using the RF channel 1 at the lower band edge with a guard band of 15 or 17 MHz.

## ANNEX 1

**Homogeneous 14 MHz frequency pattern**

For many purposes the use of a homogeneous frequency pattern based on an interval of 14 MHz is possible.

The radio-channel centre frequencies of the basic pattern are derived from a formula such as:

$$f_p = f_r + 14 p \quad (p = \dots, 0, 1, 2, \dots) \quad \text{MHz}$$

where:

$f_r$ : reference frequency and

$p$ : channel number.

## ANNEX 2

**Description of the radio-frequency channel arrangement referred to in recommends 4**

This radio-frequency channel arrangement uses the 14 500.0-14 714.5 MHz and 15 136.5-15 350.0 MHz portions of the available band with 2.5 MHz channel spacing as follows:

Let  $N$  be the number of RF channels pairs;

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

lower half of the band:  $f_n = f_r + 2\,797.75 + 2.5 n$  MHz

upper half of the band:  $f'_n = f_r + 3\,647.75 - 2.5 (N - n)$  MHz

where:

$f_r$ : reference frequency

$n = 1, 2, \dots, N$  with  $N \leq 84$ .

The frequency arrangement with  $f_r = 11\,701$  MHz is illustrated in Fig. 3.

FIGURE 3

**Radio-frequency channel arrangement for fixed wireless systems operating in the 15 GHz band with 2.5 MHz spacing and  $N = 84$** 

(All frequencies in MHz)

