International Telecommunication Union

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R F.387-13

(11/2019)

Radio-frequency channel arrangements for fixed wireless systems operating in the 10.7-11.7 GHz band

F Series

Fixed service

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Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R F.387-13

Radio-frequency channel arrangements for fixed wireless systems operating in the 10.7-11.7 GHz band

(Question ITU-R 247-1/5)

(1963-1970-1974-1978-1986-1990-1992-1995-1999-2002-2006-2010-2012-2019)

Scope

This Recommendation* provides radio-frequency channel arrangements for fixed wireless systems (FWSs) operating in the 11 GHz band (10.7-11.7 GHz), which may be used for high, medium and low capacity fixed service applications including mobile infrastructure. The channel spacing recommended in the main text is 40 MHz with 15 and 55 MHz guardbands as well as a second arrangement also using a channel spacing of 40 MHz but with a 35 MHz guardband. Arrangements with channel spacing other than 40 MHz and used in some countries are also provided in the *recommends* referring to several Annexes.

Keywords

Fixed service, point to point, channel bandwidth, channel arrangement, 11 GHz

Abbreviations

RF Radio frequency

Related ITU Recommendations and Reports

Recommendation ITU-R F.746 Radio-frequency arrangements for fixed service systems

The ITU Radiocommunication Assembly,

considering

a) that, at 11 GHz, digital systems with a capacity of up to 140 Mbit/s or synchronous digital hierarchy or equivalent bit rates seem to be feasible, subject to rainfall conditions;

b) that repeater spacing as well as other aspects of system design in this frequency range must take due cognizance of significant meteorological factors;

c) that it is desirable to interconnect such systems at radio frequencies on international links;

d) that single- and multi-carrier digital fixed wireless systems (FWSs) are both useful concepts to achieve the best technical and operational trade-off in system design;

e) that when very high-capacity links (e.g. twice Synchronous Transfer Mode-1 (STM-1)) are required, further economy may be achieved using system bandwidths wider than the recommended channel separation, associated to highly efficient modulation formats;

f) that the continuously capacity growing request as part of the evolution to IMT-2020, has been increasingly addressed in recent years,

* The structure and format of this Recommendation may need to be revised in the future to include the detailed technical information from the *recommends* part to a separate Annex.

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recommends

1 that the preferred RF channel arrangements for high capacity FWS with a bit rate of the order of plesiochronous or synchronous digital hierarchy or equivalent bit rates (see Note 1) operating in the 11 GHz band 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 RF channel in the lower half of the band (MHz),

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

1.1 that a main pattern (providing up to 12 go and return channels) provides the frequencies of individual channels expressed by the following relationship:

lower half of the band: $f_n = f_0 - 525 + 40\,n$ MHz

upper half of the band: $f'_n = f_0 + 5 + 40\,n$ MHz

where:

n = 1, 2, 3, … 12 in both the lower and the upper bands (for 12-channel arrangement with ZS[1] guardbands of 15 MHz),

or n = 2, 3, 4, … 12 in the lower half of the band, and

n = 1, 2, 3, … 11 in the upper half of the band (for 11-channel arrangement with ZS[1] guardbands of 55 MHz).

The frequency arrangement is illustrated in Fig. 1 (Note 2); alternated, co-polar and frequency reuse arrangements are possible;

1.2 that a second option for main pattern (providing up to 12 go and return channels) with ZS[1] guardbands of 35 MHz provides the frequencies of individual channels expressed by the following relationship:

lower half of the band: $f_n = f_0 - 505 + 40\,n$ MHz

upper half of the band: $f'_n = f_0 - 15 + 40\,n$ MHz

where:

n = 1, 2, 3, … 12, depending on the number of channels.

The frequency arrangement is illustrated in Fig. 2; alternated, co-polar and frequency reuse arrangements are possible;

[1] *ZS* is defined as the radio-frequency separation between the centre frequencies of the outermost radio-frequency channels and the edge of the frequency band.

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FIGURE 1

RF channel arrangement for high capacity FWSs operating in the 11 GHz band according to *recommends* 1.1 (All frequencies (MHz))

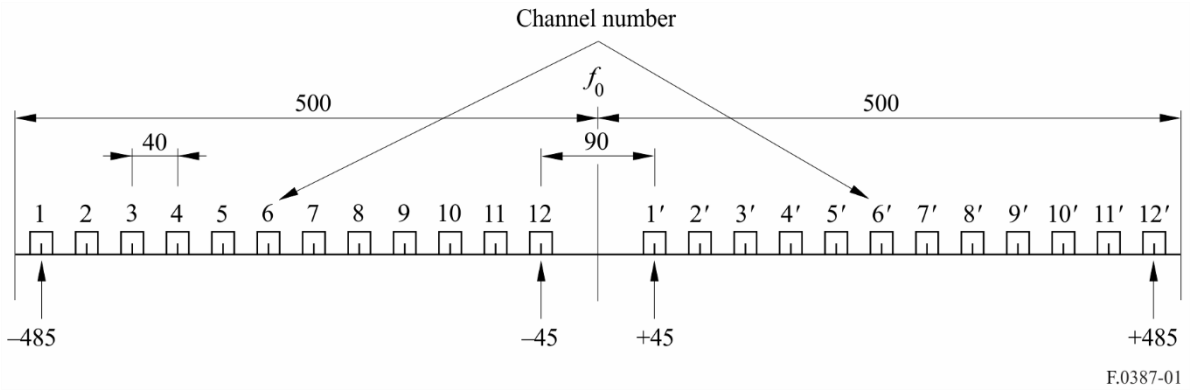
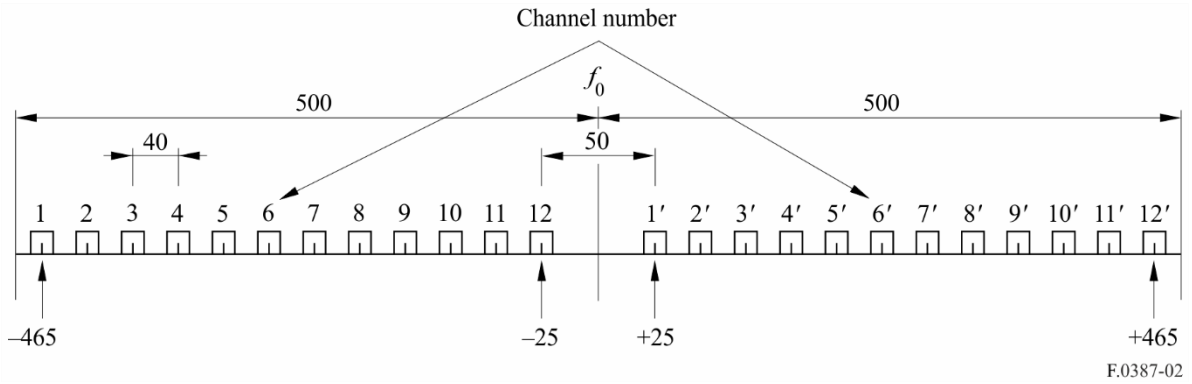


FIGURE 2

RF channel arrangement for high capacity FWSs operating in the 11 GHz band according to *recommends* 1.2



1.3 that when very high-capacity links (e.g. twice STM-1) are required and network coordination permits, with the agreement of the administrations concerned, the use of any two adjacent 40 MHz channels specified in *recommends* 1.1 or *recommends* 1.2 is possible, for wider bandwidth systems, with the centre frequency lying in the central point of the distance between the two 40 MHz adjacent channels;

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 RF channels in the same half of the band different polarizations should preferably be used alternately (see *recommends* 6);

4 that the preferred centre frequency f_0 is 11 200 MHz; other centre frequencies may be used by agreement between the administrations concerned;

5 that when low or medium-capacity digital FWS are to be used in the 11 GHz band, the RF channel arrangement should be in accordance with the pattern in *recommends* 1.2 (see Note 5);

6 that a co-channel dual polarized arrangement may also be used for digital FWS which can be derived from the arrangements given in Figs 1 or 2 by supplementing each channel by its counterpart;

7 that if multi-carrier transmission (see Note 3) is employed, the overall number of *n* carriers will be regarded as a single channel. The centre frequency of that channel should be derived from those referred to in *recommends* 1, disregarding the actual centre frequencies of the individual carriers, which may vary, for technical reasons, according to practical implementations. Operation of

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multi-carrier systems is addressed in greater detail in Annex 1.

NOTE 1 – Actual gross bit rates may be as much as 5% or more, higher than net transmission bit rates.

NOTE 2 – Due regard should be taken that Channels 1 and 12' of this arrangement are centred only 15 MHz apart from the band edges; therefore, limitation in the system bandwidth may be present. In addition, another interleaved channel arrangement with radio-frequency channels shifted 20 MHz below the main pattern in *recommends* 1.1 was also recommended in the previous version of this Recommendation and used in particular in the past for the introduction of digital medium capacity networks in addition to existing analogue ones. Channel 1 of this interleaved arrangement was outside the lower band edge, at 10.7 GHz, and in accordance with No. **5.340** of the Radio Regulations (RR), its use is prohibited; however, in accordance with RR No. **5.483**, this arrangement may still be in use in some countries.

NOTE 3 – A multi-carrier system is a system with n (where $n > 1$) digitally modulated carrier signals simultaneously transmitted (or received) by the same RF equipment. The centre frequency should be regarded as the arithmetic average of the n individual carrier frequencies of the multi-carrier system.

NOTE 4 – Due regard should be taken that in one country a channel arrangement based on 60 MHz channel separation is used. This arrangement is shown in Annex 2.

NOTE 5 – Due regard should be taken of the fact that, in some countries, other RF channel arrangements, based on multiples of 5 MHz channel separation, for medium- and low-capacity digital systems are used. A description of these RF channel arrangements is given in Annex 3.

NOTE 6 – Due regard should be taken that in some countries, other RF channel arrangements based on a 28 MHz channel separation are used. A description of these RF channel arrangements is given in Annex 4.

NOTE 7 – Due regard should be taken that in some countries, other RF channel arrangements based on 80, 60, 40, 30, 20 and 10 MHz channel separations are used. A description of these RF channel arrangements is given in Annex 5.

Annex 1

Description of a multi-carrier system

A multi-carrier system is a system with n (where $n > 1$) digitally modulated carrier signals simultaneously transmitted (or received) by the same radio frequency equipment.

For high capacity multi-carrier transmission, the centre frequency of the channel should coincide with one of the corresponding frequencies of the basic channel arrangements given in *recommends* 1.1 or *recommends* 1.2 or *recommends* 1.3. The channel spacing may be an integer multiple of the basic values defined by *recommends* 1.1 or *recommends* 1.2. Compatibility with existing configurations has to be taken into account when choosing the appropriate alternative.

An example of a co-polar frequency reuse channel arrangement using a two carrier system with 64-QAM is shown in Fig. 3.

The channel arrangement depicted in Fig. 3 is based upon the use of a two-carrier system transmitting 2 × 2 × 155.52 Mbit/s (4 × STM-1) via two carrier pairs using both polarizations in the co-channel arrangement.

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