



Recommendation ITU-R F.746-10
(03/2012)

**Radio-frequency arrangements for fixed
service systems**

F Series
Fixed service



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Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
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V	Vocabulary and related subjects

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.746-10

Radio-frequency arrangements for fixed service systems

(Question ITU-R 247/5)

(1991-1994-1995-1997-1999-2001-2002-2003-2006-2007-2012)

Scope

This Recommendation provides general guidelines for developing radio-frequency arrangements for fixed wireless systems. It also presents a summary of all the current radio-frequency arrangements contained in various Recommendations and provides in various Annexes specific radio-frequency channel arrangements not covered in the scope of other specific Recommendations.

The ITU Radiocommunication Assembly,

considering

- a) that according to Article 5 of the Radio Regulations several frequency bands are allocated to the fixed service (FS) on a worldwide basis;
- b) that other frequency bands are also allocated to the FS on a regional basis;
- c) that systems are already in use and expected to be used more extensively in the future;
- d) that it may be desirable to interconnect fixed wireless systems (FWSs) on international circuits in these frequency bands;
- e) that in studies carried out so far, some bands have not been the subject of Recommendations for specific radio-frequency channel arrangements which might be fitted into an international pattern as has already been done in other parts of the frequency spectrum;
- f) that an index of recommended radio-frequency channel arrangements would be of assistance to the ITU-R;
- g) that single- and multi-carrier digital FWSs are both useful concepts to achieve the best technical and economic trade-off in system design,

recommends

- 1 that homogeneous patterns are preferred as the basis for radio-frequency channel arrangements;
- 2 that the preferred radio-frequency channel arrangements should be developed from the homogeneous pattern in accordance with the alternated, co-channel band reuse, or interleaved band reuse radio-frequency channel arrangements (see Note 1) as shown in Figs 1a), 1b) and 1c) respectively.

The main parameters affecting the choice of radio-frequency channel arrangements are:

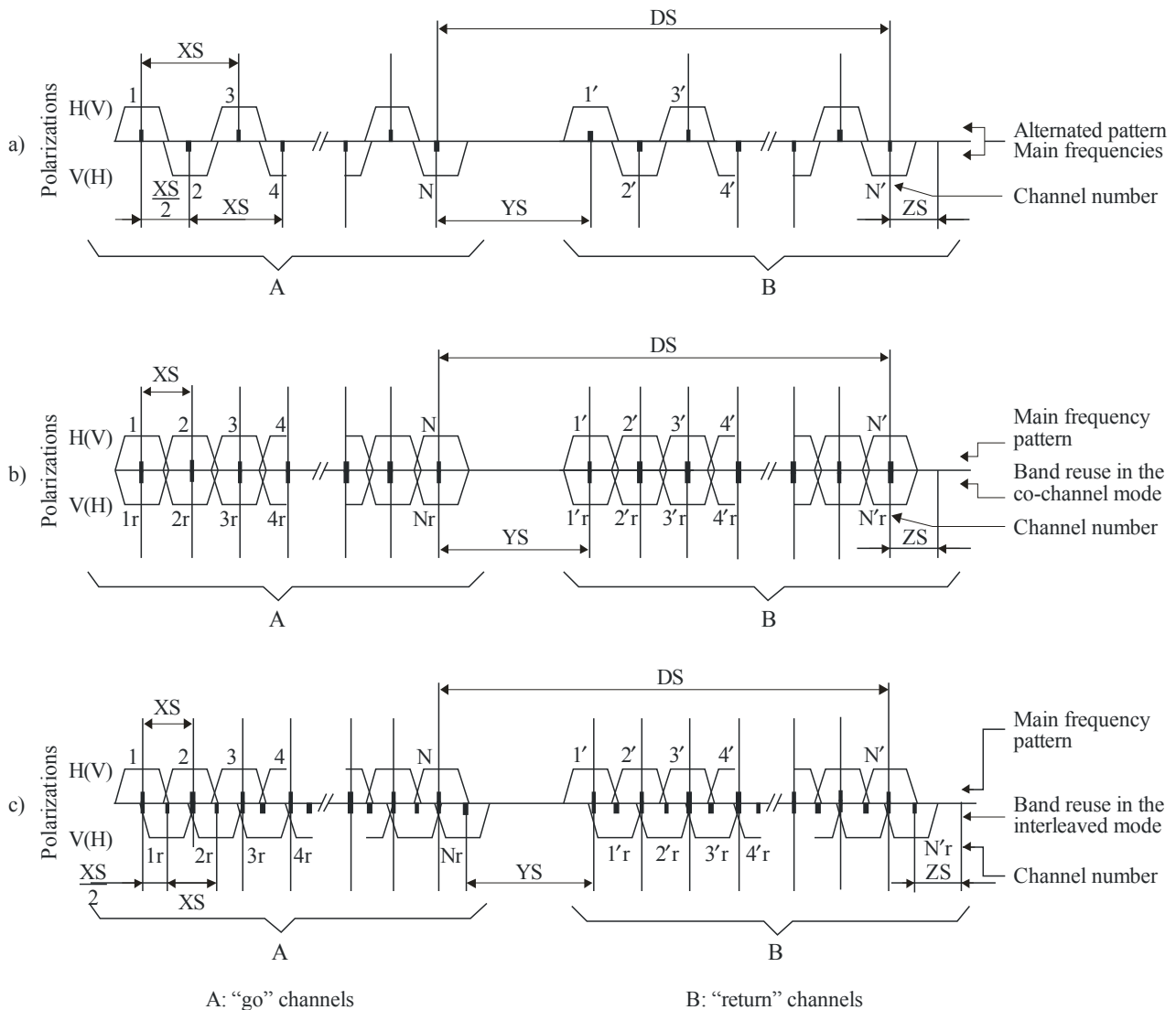
- XS* defined as the radio-frequency separation between the centre frequencies of adjacent radio-frequency channels on the same polarization and in the same direction of transmission; Recommendation ITU-R F.1191 defines that *XS* is equal to twice the *channel separation* for the alternated radio-frequency channel arrangement of Fig. 1a), and is equal to the channel separation for the co-channel and interleaved band reuse radio-frequency channel arrangements of Figs 1b) and 1c).

The channel separation is sometimes identified with the term radio-frequency *channel spacing* and also considered equal to the *channel bandwidth*.

- YS** defined as the radio-frequency separation between the centre frequencies of the go and return radio-frequency channels which are nearest to each other (also named innermost channels). In the case where go and return frequency sub-bands are not contiguous, such that there is a (are) band(s) allocated: for (an)other service(s) in the gap between, YS shall be considered to include the band separation (*BS*) equal to the total width of the allocated band(s) used by this (these) service(s).
- ZS** defined as the radio-frequency separation between the centre frequencies of the outermost radio-frequency channels and the edge of the frequency band (also defined as *guardband* by Recommendation ITU-R F.1191). In the case where the lower and upper separations differ in value, Z_1S refers to the lower separation and Z_2S refers to the upper separation. In the case where go and return frequency sub-bands are not contiguous, such that there is a (are) band(s) allocated for (an)other service(s) in the gap between, ZS_i will be defined for the innermost edges of both sub-bands and will be included in YS.
- DS** Tx/Rx *duplex spacing*, defined as the radio-frequency separation between corresponding go and return channels, constant for each couple of i -th and i' -th frequencies, within a given channel arrangement.

FIGURE 1

Radio-frequency channel arrangements for the three possible schemes considered in the text



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The choice of radio-frequency channel arrangement depends on the values of cross-polar discrimination (XPD) and on the net filter discrimination (NFD) where these parameters are defined as:

$$XPD_{H(V)} = \frac{\text{Power received on polarization } H(V) \text{ transmitted on polarization } H(V)}{\text{Power received on opposite polarization } V(H) \text{ transmitted on polarization } H(V)} \quad (\text{See Note 2})$$

$$NFD = \frac{\text{Adjacent channel received power}}{\text{Adjacent channel power received by the main receiver after RF, IF and BB filters}} \quad (\text{See Note 3})$$

The XPD and NFD parameters (dB) contribute to the value of carrier-to-interference ratio.

If XPD_{min} is the minimum value reached for the percentage time required, from this value and from the adjacent channel NFD , the total amount of interfering power can be evaluated, and this result must be compared with the minimum value of carrier-to-interference $(C/I)_{min}$ acceptable to the modulation adopted (see Note 4).

Alternated channel arrangements can be used (neglecting the co-polar adjacent channel interference contribution) if:

$$XPD_{min} + (NFD - 3) \geq (C/I)_{min} \quad \text{dB}$$

Co-channel arrangements can be used if:

$$10 \log \frac{1}{\frac{1}{10^{\frac{XPD + XIF}{10}}} + \frac{1}{10^{\frac{NFD_a - 3}{10}}}} \geq (C/I)_{min} \quad \text{dB}$$

Interleaved channel arrangements can be used if:

$$10 \log \frac{1}{\frac{1}{10^{\frac{XPD + (NFD_b - 3)}{10}}} + \frac{1}{10^{\frac{NFD_a - 3}{10}}}} \geq (C/I)_{min} \quad \text{dB}$$

where:

NFD_a : net filter discrimination evaluated at XS frequency spacing;

NFD_b : net filter discrimination evaluated at $XS/2$ frequency spacing;

XIF : XPD improvement factor of any cross-polar interference countermeasure, if implemented in the interfered receiver;

3 that the channel arrangements reported in Fig. 1 may be used for digital FWSs either with single carrier or multi-carrier transmission (see Note 5);

4 that when multi-carrier transmission is employed, the overall number of carriers will be regarded as a single channel whose centre frequency and channel spacing will be that defined according to Fig. 1 disregarding the actual centre frequency of the carriers, which may vary, for technical reasons, according to practical implementations;

5 that where practicable (e.g. in newly exploited or rearranged bands with comparable width) it is useful to have the same duplex separation in different nearby frequency bands;

6 that the following categorization with respect to the transmission capacity may be used in ITU-R Recommendations on digital fixed wireless systems (see also Annex 1 to Recommendation ITU-R F.1101):

- “low-capacity fixed wireless systems” for the transmission of digital signals with gross bit rates up to and including 10 Mbit/s;
- “medium-capacity fixed wireless systems” for the transmission of digital signals with gross bit rates ranging from 10 Mbit/s up to about 100 Mbit/s;
- “high-capacity fixed wireless systems” for the transmission of digital signals with gross bit rates greater than 100 Mbit/s;

7 that Tables 1 and 2 report the summary of presently ITU-R defined radio-frequency channel arrangements with reference to the relevant Recommendation. Some radio-frequency channel arrangements in bands that are not covered by a specific Recommendation, and which are nevertheless used by administrations, are described in Annexes 1 to 8.