

Recommendation ITU-R F.746-11

(12/2023)

F Series: Fixed service

Radio-frequency arrangements for fixed service systems

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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(Also available online at <https://www.itu.int/publ/R-REC/en>)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
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.746-11

Radio-frequency arrangements for fixed service systems

(Question ITU-R 247-1/5)

(1991-1994-1995-1997-1999-2001-2002-2003-2006-2007-2012-2023)

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.

Keywords

Fixed service, fixed wireless system, point to point, channel bandwidth, channel arrangement

Abbreviations

FWS Fixed wireless system

NFD Net filter discrimination

XPD Cross-polar discrimination

Related ITU Recommendations

Recommendation ITU-R P.310 – Definitions of terms relating to propagation in non-ionized media

Recommendation ITU-R F.382 – Radio-frequency channel arrangements for fixed wireless systems operating in the 2 and 4 GHz bands

Recommendation ITU-R F.383 – Radio-frequency channel arrangements for high-capacity fixed wireless systems operating in the lower 6 GHz (5 925 to 6 425 MHz) band

Recommendation ITU-R F.384 – Radio-frequency channel arrangements for medium- and high-capacity digital fixed wireless systems operating in the 6 425-7 125 MHz band

Recommendation ITU-R F.385 – Radio-frequency channel arrangements for fixed wireless systems operating in the 7 110-7 900 MHz band

Recommendation ITU-R F.386 – Radio-frequency channel arrangements for fixed wireless systems operating in the 8 GHz (7 725 to 8 500 MHz) band

Recommendation ITU-R F.387 – Radio-frequency channel arrangements for fixed wireless systems operating in the 10.7-11.7 GHz band

Recommendation ITU-R F.497 – Radio-frequency channel arrangements for fixed wireless systems operating in the 13 GHz (12.75-13.25 GHz) frequency band

Recommendation ITU-R P.530 – Propagation data and prediction methods required for the design of terrestrial line-of-sight systems

Recommendation ITU-R F.595 – Radio-frequency channel arrangements for fixed wireless systems operating in the 14.4-15.35 GHz band

Recommendation ITU-R F.635 – Radio-frequency channel arrangements based on a homogeneous pattern for fixed wireless systems operating in the 4 GHz (3 400-4 200 MHz) band

Recommendation ITU-R F.636 – Radio-frequency channel arrangements for fixed wireless systems operating in the 14.4-15.35 GHz band

- Recommendation ITU-R F.637 – Radio-frequency channel arrangements for fixed wireless systems operating in the 21.2-23.6 GHz band
- Recommendation ITU-R F.701 – Radio-frequency channel arrangements for digital point-to-multipoint radio systems operating in frequency bands in the range 1 350 to 2 690 MHz (1.5, 1.8, 2.0, 2.2, 2.4 and 2.6 GHz)
- Recommendation ITU-R F.747 – Radio-frequency channel arrangements for fixed wireless system operating in the 10.0-10.68 GHz band
- Recommendation ITU-R F.748 – Radio-frequency arrangements for systems of the fixed service operating in the 25, 26 and 28 GHz bands
- Recommendation ITU-R F.749 – Radio-frequency channel arrangements for systems of the fixed service operating in sub-bands in the 36-40.5 GHz band
- Recommendation ITU-R F.1093 – Effects of multipath propagation on the design and operation of line-of-sight digital fixed wireless systems
- Recommendation ITU-R F.1098 – Radio-frequency channel arrangements for fixed wireless systems in the 1 900-2 300 MHz band
- Recommendation ITU-R F.1099 – Radio-frequency channel arrangements for high- and medium-capacity digital fixed wireless systems in the upper 4 GHz (4 400-5 000 MHz) band
- Recommendation ITU-R F.1101 – Characteristics of digital fixed wireless systems below about 17 GHz
- Recommendation ITU-R F.1191 – Necessary and occupied bandwidths and unwanted emissions of digital fixed service systems
- Recommendation ITU-R F.1242 – Radio-frequency channel arrangements for digital radio systems operating in the range 1 350 MHz to 1 530 MHz
- Recommendation ITU-R F.1243 – Radio-frequency channel arrangements for digital radio systems operating in the range 2 290-2 670 MHz
- Recommendation ITU-R F.1488 – Frequency block arrangements for fixed wireless access systems in the range 3 400-3 800 MHz
- Recommendation ITU-R F.1496 – Radio-frequency channel arrangements for fixed wireless systems operating in the band 51.4-52.6 GHz
- Recommendation ITU-R F.1497 – Radio-frequency channel arrangements for fixed wireless systems operating in the band 55.78-66 GHz
- Recommendation ITU-R F.1520 – Radio-frequency arrangements for systems in the fixed service operating in the band 31.8-33.4 GHz
- Recommendation ITU-R F.1567 – Radio-frequency channel arrangement for digital fixed wireless systems operating in the frequency band 406.1-450 MHz
- Recommendation ITU-R F.1568 – Radio-frequency block arrangements for fixed wireless access systems in the range 10.15-10.3/10.5-10.65 GHz
- Recommendation ITU-R F.2004 – Radio-frequency channel arrangements for fixed service systems operating in the 92-95 GHz range
- Recommendation ITU-R F.2005 – Radio-frequency channel and block arrangements for fixed wireless systems operating in the 42 GHz (40.5 to 43.5 GHz) band
- Recommendation ITU-R F.2006 – Radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76 and 81-86 GHz bands

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).

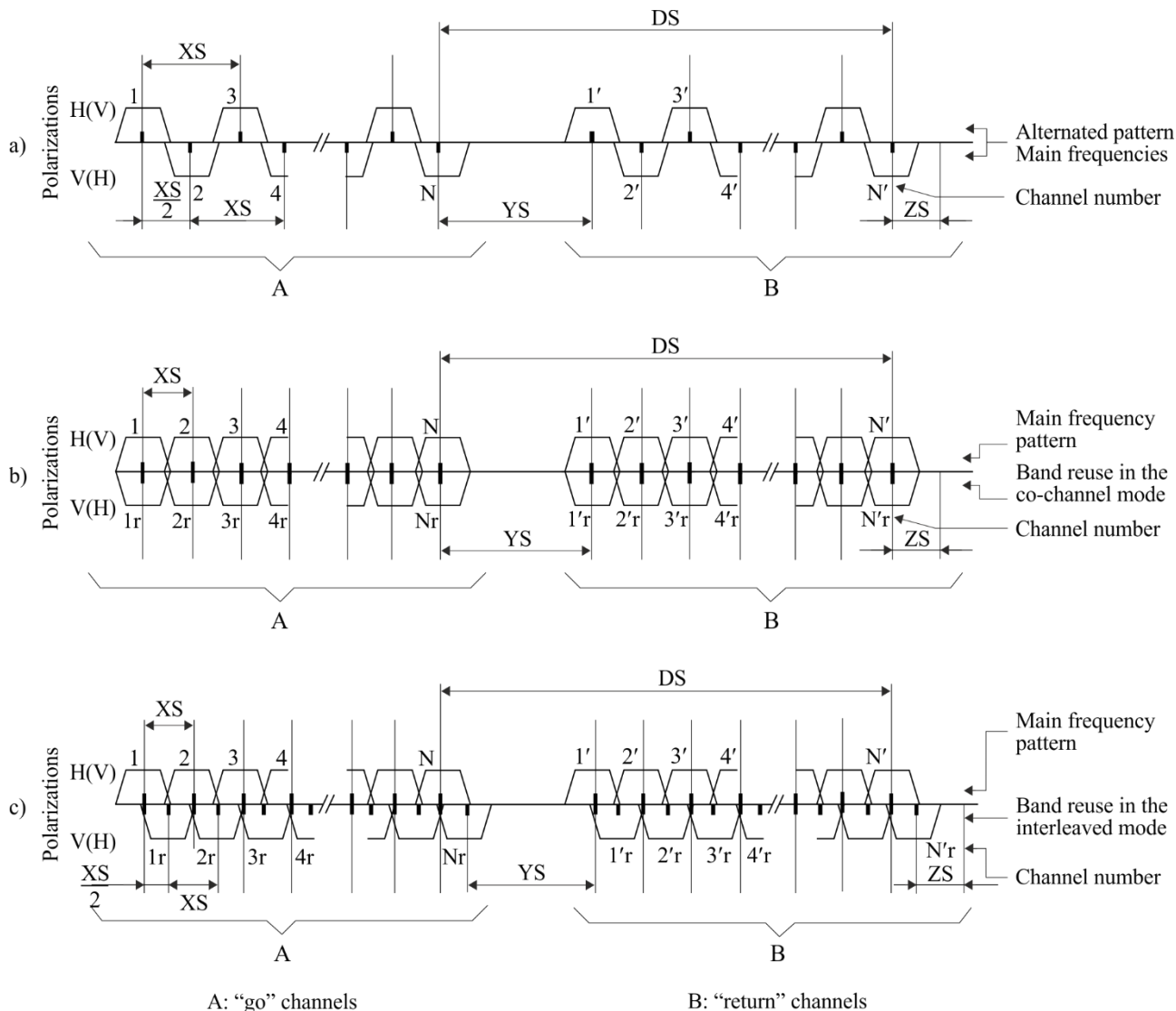
The channel separation is sometimes identified with the term radio-frequency *channel spacing* and also considered equal to the *channel bandwidth*.

- 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, *Z₁S* refers to the lower separation and *Z₂S* 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.