

Recommendation ITU-R F.2172-0

(02/2026)

F Series: Fixed service

Radio-frequency channel and block arrangements for fixed service systems operating in the 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz ranges



Foreword

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Series of ITU-R Recommendations

(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	Radio-wave 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.2172-0

Radio-frequency channel and block arrangements for fixed service systems operating in the 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz ranges

Question ITU-R 247-1/5

(2026)

Scope

This Recommendation describes channel and block arrangements in the portions of the frequency range 130.0-174.8 GHz allocated to the fixed service. The arrangements are based on a 250 MHz basic channel raster from which $N \times 250$ MHz channel size can be defined and are proposed for either frequency division duplex (FDD) or time division duplex (TDD) applications. Alternative duplex schemes, such as flexible frequency division duplex (fFDD)¹ or full duplex (FD)² may also be considered.

Keywords

130-174.8 GHz, FDD, flexible FDD, Full Duplex, Channel Raster

Acronyms/Abbreviations

DS	Duplex separation
EESS	Earth exploration satellite service
FD	Full duplex
FDD	Frequency division duplex
fFDD	flexible FDD
FS	Fixed service
P-P	Point-to-point
RR	Radio Regulations
TDD	Time division duplex

Related ITU-R Recommendations

Recommendation ITU-R P.676 – Attenuation by atmospheric gases

Recommendation ITU-R P.838 – Specific attenuation model for rain for use in prediction methods

Recommendation ITU-R F.1519 – Guidance on frequency arrangements based on frequency blocks for systems in the fixed service

¹ Flexible Frequency Division Duplex (fFDD) systems allow required TX/RX isolation without traditional RF duplex filters, but through separate TX/RX antennas and/or digital cancellation capability, allowing narrower duplex spacing.

² Full Duplex (FD) systems use the same channel for go/return (as TDD systems), but for 100% of the time; they should provide necessary TX/RX isolation through separate TX and RX antennas and digital cancellation, rather than through duplex filter as in conventional FDD systems.

Report ITU-R F.2558 – Studies on unwanted emission levels outside the allocated bands for fixed service systems operating in frequency bands from 94.1 GHz to 174.8 GHz for the protection of Earth exploration-satellite service (passive) operating in adjacent bands where footnote No. **5.340** of the Radio Regulations applies

NOTE – In every case the latest edition of the Recommendation/Reports in force should be used.

The ITU Radiocommunication Assembly,

considering

- a) that there is need for very high capacity fixed links to provide backhauling of mobile cells and other multi-Gbit/s data links;
- b) that the propagation characteristics of the frequency bands 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz are ideally suited for use of short-range FS links with various occupied bandwidths in very high-density networks for applications in particular for backhaul/fronthaul for next generation mobile networks;
- c) that FS applications may require different radio-frequency channel arrangements;
- d) that advanced point-to-point system technologies permit to use radiofrequency channels either unpaired (TDD or FD³) or paired as narrow duplex systems (fFDD)⁴;
- e) that, in some cases, a flexible sub-band or block arrangement can accommodate various FWS technologies;
- f) that, as the propagation loss difference in the 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz is within the range of 1 dB for the hop lengths of up to 1 km, this also suggests the possibility of using these bands together for FDD links with large duplex separation, if necessary;
- g) that narrower duplex separation is also possible with advanced digital cancellation techniques and, when considering the very short wavelength in these bands, a small separate transmitter/receiver (TX/RX) antenna integral to the same equipment is feasible,

recognizing

- a) that ITU RR No. **5.340** prohibits all emissions, inter alia, in the bands 148.5-151.5 GHz, 164-167 GHz, therefore care should be taken to limit the out-of-band emissions from FS operating in the bands 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz into those adjacent bands;
- b) that Recommendation ITU-R F.1519 provides guidance on frequency arrangements based on frequency blocks for systems in the fixed service;
- c) that the frequency bands 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz are allocated on a primary basis to fixed service, as well as other co-primary services,

³ Full Duplex (FD) systems use the same channel for go/return (as TDD systems), but for 100% of the time; they should provide necessary TX/RX isolation through separate TX and RX antennas and digital cancellation, rather than through duplex filter as in conventional FDD systems.

⁴ While in conventional FDD systems TX/RX isolation is obtained through RF duplex filter, in flexible frequency division duplex (fFDD) systems the isolation could be obtained through separate TX/RX antennas and/or digital cancellation (similar to XPIC technology); this enhance the TX/RX isolation capability and permits narrower duplex spacing.

recommends

- 1 that the preferred radio-frequency channel or block arrangement for the 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz for FS links should consider using the basic 250 MHz channel raster arrangements given in Annex 1;
- 2 that flexible aggregation of those 250 MHz basic channels for composing wider channels, while taking into account appropriate spectrum efficiency, should be considered;
- 3 that to use block-based assignment, derived by channel aggregation, in line with the example shown in Annex 2, blocks should be multiple of 250 MHz wide and their use should permit any suitable channel size and duplex method as shown in the examples given in Annex 2;
- 4 that traditional FDD duplex channels, may be assigned in the bands 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz, used as paired bands, with the adoption of suitable duplex spacing > 15 GHz; Annex 3, should be considered as an example.

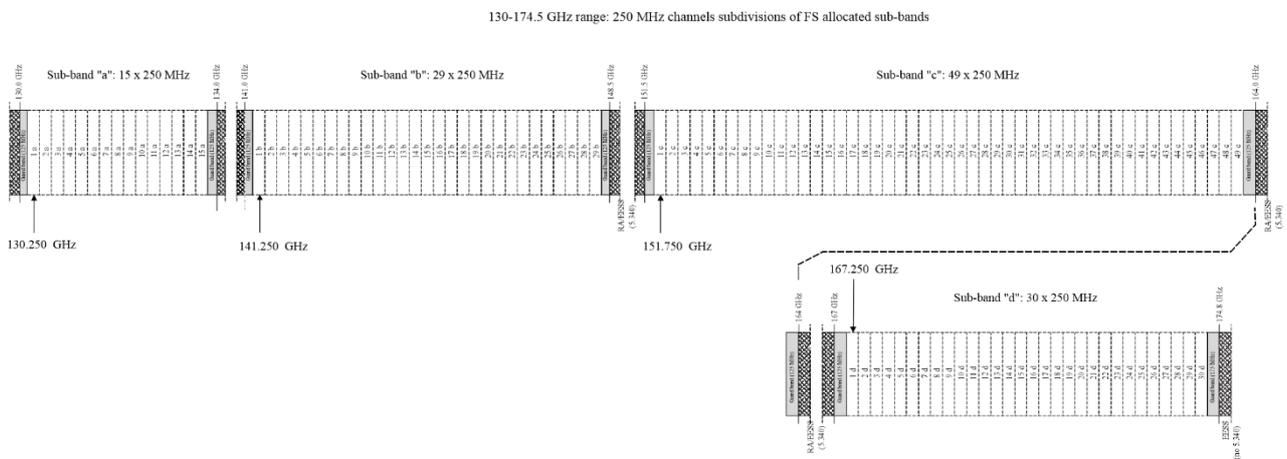
Annex 1

Radio-frequency channel arrangement in the band 130-174.8 GHz

Basic channel raster

Figure 1 shows the subdivision of the available bands into 250 MHz elementary channels; at least 125 MHz guard bands are provided.

FIGURE 1
Basic channels raster for FS use in the 130-174.8 GHz band



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Centre frequency of channels can be obtained as follows:

$F_N = 130 + N \times 0.250 \text{ GHz}$	$N: 1 \text{ to } 15$	Sub-band "a"
$F_N = 141 + N \times 0.250 \text{ GHz}$	$N: 1 \text{ to } 29$	Sub-band "b"
$F_N = 151.5 + N \times 0.250 \text{ GHz}$	$N: 1 \text{ to } 49$	Sub-band "c"
$F_N = 167 + N \times 0.250 \text{ GHz}$	$N: 1 \text{ to } 30$	Sub-band "d"

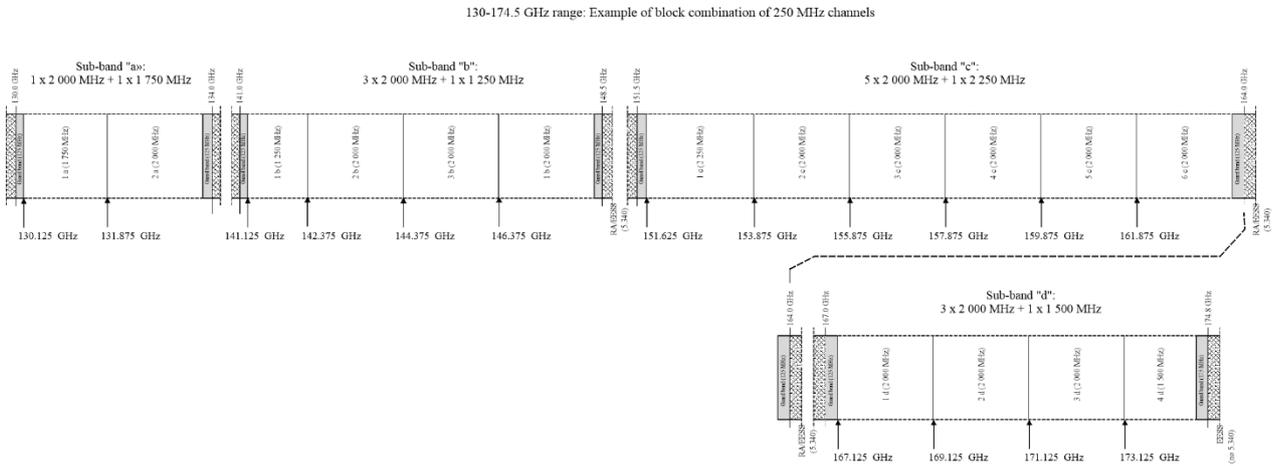
Annex 2

Block based use examples in the 130-174.8 GHz RF band

Aggregation of channels

Figure 2 provides an example of use of blocks covering the overall band.

FIGURE 2
Example showing use of channels aggregated in blocks



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Block size

Block size should be integer multiple of the basic 250 MHz channel size, in principle, no upper limit is given to block size, inside a specific sub-band. In the example given in Fig. 2, an average size of 2 000 MHz (8 basic channels) is considered.

Use of the channels/blocks

Provided that the 250 MHz raster or its aggregations are respected, channels inside the block(s) can be freely used in conventional FDD paired blocks, where the two blocks are used each one for a single direction of the link, or with possible use of go/return channels inside same block(s) (e.g. by switching the overall block between the two directions, as in TDD, or by using continuously the block for both directions, as flexible frequency division duplex fFDD and full duplex FD).

Within each block, symmetric or asymmetric combination of channels for go/return can be possible.

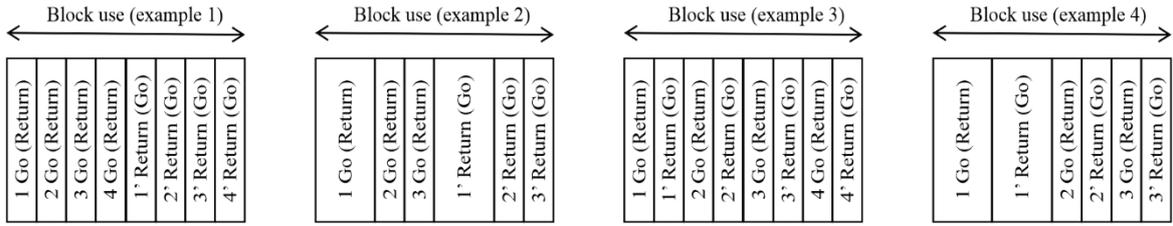
Blocks can be used either alone or paired with suitable spacing > 15 GHz; e.g. in the example of Fig. 2 pairing block 2b with block 4c (with 15.5 GHz duplex spacing) or block 2a with block 2c (with 22 GHz duplex spacing).

Examples of go/return coexistence inside same block(s) in fFDD for symmetric /asymmetric case are shown in Fig. 3 and Fig. 4 respectively.

Examples of conventional FDD use for symmetric /asymmetric case are shown in Fig. 5 and Fig. 6 respectively.

FIGURE 3

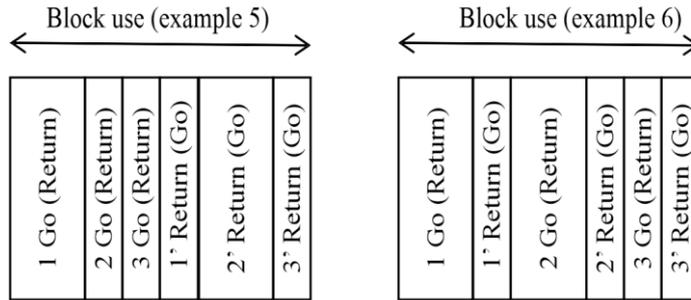
Examples of In-block fFDD use examples for symmetric go-return channel size



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FIGURE 4

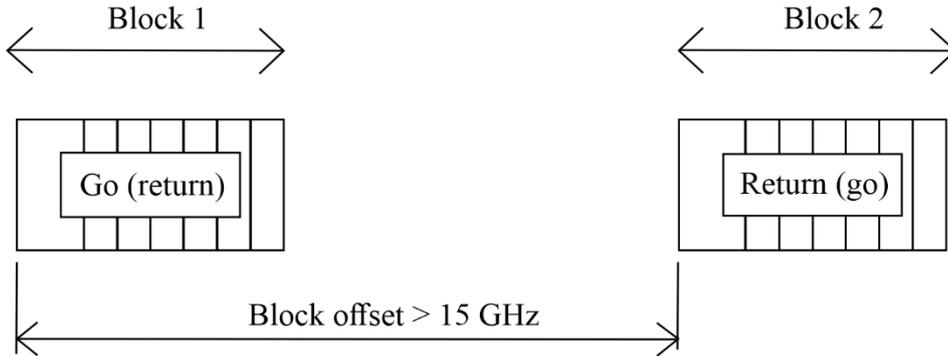
Examples of In-block fFDD use examples for asymmetric go-return channel size



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FIGURE 5

Example of paired blocks FDD use for symmetric go-return channel size



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Go/return channels are subdivided in two sets (A, B) and two unpaired set (UL and UH) as shown in Fig. 7. Centre frequencies can be obtained by the following formulas.

Centre frequencies for channels with suffix A in Fig. 7

Duplex separation (DS): 21.5 GHz

$$FA_N = 130 + N \times 0.250 \quad N: 1 \text{ to } 15 \text{ (channels within sub-band 130-134 GHz)}$$

$$F'A_N = 151.5 + N \times 0.250 \text{ GHz} \quad N: 1 \text{ to } 15 \text{ (channels within sub-band 151.5-164 GHz)}$$

Centre frequencies for channels with suffix B in in Fig. 7

Duplex separation (DS): 15.5 GHz

$$FB_N = 141 + N \times 0.250 \text{ GHz} \quad N: 1 \text{ to } 29 \text{ (channels within sub-band 141-148.5 GHz)}$$

$$F'B_N = 151.5 + 5 + N \times 0.250 \text{ GHz} \quad N: 1 \text{ to } 29 \text{ (channels within sub-band 151.5-164 GHz)}$$

Centre frequencies for channels with suffix UL in in Fig. 7

$$FUL_N = 151.5 + 3.75 + N \times 0.250 \text{ GHz} \quad N: 1 \text{ to } 5 \text{ (channels within sub-band 151.5-164 GHz)}$$

Centre frequencies for channels with suffix UH in in Fig. 7

$$FUH_N = 167 + N \times 0.250 \text{ GHz} \quad N: 1 \text{ to } 30 \text{ (channels within sub-band 167-174.8 GHz)}$$
