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| **Recommendation ITU-R F.1497-1**  **(02/2002)** |
| **Radio-frequency channel arrangements for fixed wireless systems operating in the band 55.78-59 GHz** |
| **F Series**  **Fixed service** |

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.

# Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU‑T/ITU‑R/ISO/IEC and the ITU-R patent information database can also be found.

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| Series of ITU-R Recommendations  (Also available online at <http://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 |

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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.1497-1[[1]](#footnote-1)\*, [[2]](#footnote-2)\*\*

Radio-frequency channel arrangements for fixed wireless systems  
operating in the band 55.78-59 GHz

(2000-2002)

Scope

This Recommendation specifies radio-frequency channel arrangements for fixed wireless systems using TDD (time division duplex) or FDD (frequency division duplex) with channel separations of 3.5, 7, 14, 28 and 56 MHz in the band 55.78-59 GHz, which has been identified for use for high-density applications in the fixed service (HDFS).

The ITU Radiocommunication Assembly,

considering

a) that the band 55.78-58.2 GHz is allocated to the Earth exploration satellite (passive), fixed, inter-satellite, mobile and space research (passive) services on a primary basis and the band 58.2‑59 GHz is allocated to the Earth exploration satellite (passive), fixed, mobile and space research (passive) services on a primary basis;

b) the band 55.78-59 GHz is as being available for high-density applications in the fixed service (FS);

c) that ITU-R should develop radio‑frequency channel arrangements in order to make the most effective use of the spectrum available;

d) that the propagation characteristics of the 55.78-59 GHz band are ideally suited for use of short-range digital radio links in high-density applications in the fixed service (FS) networks;

e) that in the frequency range a high antenna directivity is achievable even with small size antennas, increasing the density of equipment and further reducing risk of interference with same and other radio services;

f) that differing applications licensed by various administrations may require different radio‑frequency channel arrangements;

g) that the applications in this frequency band may require differing channel bandwidths;

h) that several radio services with various transmission signal characteristics and capacities may be in simultaneous use in this frequency band;

j) that a high degree of compatibility between radio-frequency channels of different arrange­ments can be achieved by selecting channel centre frequencies within a homogeneous basic pattern;

k) that the low end of the frequency band is suitable for the longest hop radio links because the atmospheric attenuation is less than at the top of the band;

l) that the high frequency reuse achievable due to oxygen absorption in the upper portion of the band reduces the requirement for frequency planning techniques and offers the possibility of deregulated telecommunication environments for various low-power, low-cost and short-range radio-relays;

m) that a number of new and existing systems could operate adequately on an unprotected basis in the upper portion of the band, relieving congestion in the lower frequency bands;

n) that the uses envisaged in this band include digital and analogue systems,

recognizing

a) that, in the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration‑satellite service (passive), the maximum power density delivered by the transmitter to the antenna of a fixed service station is limited to –26 dB(W/MHz) in the Radio Regulations,

noting

a) that frequency division duplex (FDD) and time division duplex (TDD) systems may be used simultaneously in the same geographical area providing sufficient measures are put in place to allow successful coordination;

b) that in the upper portion of the frequency range 55.78-59 GHz, oxygen gas absorption attenuation is more than 10 dB/km at sea level;

c) that the high attenuation effectively limits the achievable path length and interference level;

d) that equipment may listen for a free channel before transmission to recognize existing transmissions in order to minimize interference problems and to ensure continued operation of existing transmissions,

recommends

**1** that administrations should consider the channel arrangement given in Annex 1, § 1 for TDD FS system deployment in the frequency range 55.78-57 GHz (see Note 1);

**2** that administrations should consider the channel arrangement given in Annex 1, § 2 for FDD FS system deployment in the frequency range 55.78‑57 GHz (see Note 1);

**3** that administrations should consider the channel arrangement given in Annex 2 for FS system deployment in the frequency range 57-59 GHz (see Note 2);

**4** that the following Notes are considered as part of this Recommendation.

NOTE 1 – The channel arrangements in Annex 1 provide the same centre frequencies for both TDD and FDD operation.

NOTE 2 – Due consideration should be given in the use of the channels at the upper and lower edges of the frequency band 57-59 GHz to ensure compatibility with fixed systems operating in the adjacent bands.

Annex 1  
  
Radio-frequency channel arrangement in the band 55.78-57 GHz

# 1 For FS systems using TDD

Let *fr* be the reference frequency of 55 786 MHz,

*fn* be the centre frequency of a radio-frequency channel in the band 55.78-57 GHz,

then the centre frequencies of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 56 MHz:

*fn*  *fr*  28  56 *n*MHz

where:

*n*  1, 2, 3, ... 20

b) for systems with a channel separation of 28 MHz:

*fn*  *fr*  42  28 *n*MHz

where:

*n*  1, 2, 3, ... 40

c) for systems with a channel separation of 14 MHz:

*fn*  *fr*  49  14 *n*MHz

where:

*n*  1, 2, 3, ... 80

d) for systems with a channel separation of 7 MHz:

*fn*  *fr*  52  7 *n*MHz

where:

*n*  1, 2, 3, ... 160

e) for systems with a channel separation of 3.5 MHz:

*fn*  *fr*    3.5 *n*MHz

where:

*n*  1, 2, 3, ... 320.

TABLE 1

Calculated parameters according to Recommendation ITU-R F.746

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *XS* (MHz) | *n* | *f*1 (MHz) | *fnmax* (MHz) | *Z*1*S* (MHz) | *Z*2*S* (MHz) |
| 56 | 1, ... 20 | 55 870 | 56 934 | 90 | 66 |
| 28 | 1, ... 40 | 55 856 | 56 948 | 76 | 52 |
| 14 | 1, ... 80 | 55 849 | 56 955 | 69 | 45 |
| 7 | 1, … 160 | 55 845.5 | 56 958.5 | 65.5 | 41.5 |
| 3.5 | 1, … 320 | 55 843.75 | 56 960.25 | 63.75 | 39.75 |
| *XS*: separation between centre frequencies of adjacent channels  *Z*1*S*: separation between the lower band edge and the centre frequency of the first channel  *Z*2*S*: separation between centre frequencies of the final channel and the upper band edge. | | | | | |

# 2 For FS systems using FDD

The radio-frequency channel arrangement for channel separations of 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz shall be derived as follows:

Let: *fr* be the reference frequency of 55 814 MHz,

*fn* be the centre frequency (MHz) of the radio-frequency channel in the lower half of the band,

 be the centre frequency (MHz) of the radio-frequency channel in the upper half of the band,

Tx/Rx separation  616 MHz,

band separation  112 MHz,

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

a) for systems with a channel separation of 56 MHz:

lower half of the band: *fr* 56 *n*

upper half of the band: *fr*  616  56 *n*

where:

*n*  1, 2, … 9

b) for systems with a channel separation of 28 MHz:

lower half of the band: *fr* 14  28 *n*

upper half of the band: *fr*  630  28 *n*

where:

*n*  1, 2, 3, … 18

c) for systems with a channel separation of 14 MHz:

lower half of the band: *fr* 21  14 *n*

upper half of the band: *fr*  637  14 *n*

where:

*n*  1, 2, 3, … 36

d) for systems with a channel separation of 7 MHz:

lower half of the band: *fr* 24.5  7 *n*

upper half of the band:  *fr*  640.5  7 *n*

where:

*n*  1, 2, 3, … 72

e) for systems with a channel separation of 3.5 MHz:

lower half of the band: *fr* 26.25  3.5 *n*

upper half of the band:  *fr*  642.25  3.5 *n*

where:

*n*  1, 2, 3, … 144.

TABLE 2

Calculated parameters according to Recommendation ITU-R F.746

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *XS* (MHz) | *n* | *f*1 (MHz) | *fnmax* (MHz) | (MHz) | (MHz) | *Z*1*S* (MHz) | *Z*2*S* (MHz) | *YS* (MHz) | *DS* (MHz) |
| 56 | 1, ... 9 | 55 870 | 56 318 | 56 486 | 56 934 | 90 | 66 | 168 | 616 |
| 28 | 1, ... 18 | 55 856 | 56 332 | 56 472 | 56 948 | 76 | 52 | 140 | 616 |
| 14 | 1, ... 36 | 55 849 | 56 339 | 56 465 | 56 955 | 69 | 45 | 126 | 616 |
| 7 | 1, …72 | 55 845.5 | 56 342.5 | 56 461.5 | 56 958.5 | 65.5 | 41.5 | 119 | 616 |
| 3.5 | 1, …144 | 55 843.75 | 56 344.25 | 56 459.75 | 56 960.25 | 63.75 | 39.5 | 115.5 | 616 |
| *XS*: separation between centre frequencies of adjacent channels  *YS*: separation between centre frequencies of the closest go and return channels  *Z*1*S*: separation between the lower band edge and the centre frequency of the first channel  *Z*2*S*: separation between centre frequencies of the final channel and the upper band edge  *DS*: duplex spacing | | | | | | | | | |

Annex 2  
  
Radio-frequency channel arrangement in the band 57-59 GHz

Let: *fr* be the reference frequency of 56 950 MHz,

*fn* be the centre frequency of a radio-frequency channel in the band 57-59 GHz,

then the centre frequencies of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 100 MHz:

*fn*  *fr*  100 *n*MHz

where:

*n* 1, 2, 3, ... 20

b) for systems with a channel separation of 50 MHz:

*fn*  *fr*  25  50 *n*MHz

where:

*n* 1, 2, 3, ... 40.

TABLE 3

Calculated parameters according to Recommendation ITU-R F.746

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *XS* (MHz) | *n* | *f*1 (MHz) | *fnmax* (MHz) | *Z*1*S* (MHz) | *Z*2*S* (MHz) |
| 50 | 1, ... 40 | 57 025 | 58 975 | 25 | 25 |
| 100 | 1, ... 20 | 57 050 | 58 950 | 50 | 50 |
| *XS*: separation between centre frequencies of adjacent channels  *Z*1*S*: separation between the lower band edge and the centre frequency of the first channel  *Z*2*S*: separation between centre frequencies of the final channel and the upper band edge. | | | | | |

1. \* Radiocommunication Study Group 5 made editorial amendments to this Recommendation in December 2009 in accordance with Resolution ITU-R 1. [↑](#footnote-ref-1)
2. \*\* Radiocommunication Study Group 5 made editorial amendments to this Recommendation in November 2010 in accordance with Resolution ITU-R 1. [↑](#footnote-ref-2)