International Telecommunication Union

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Radiocommunication Sector of ITU

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

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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*, **

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;

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* Radiocommunication Study Group 5 made editorial amendments to this Recommendation in December 2009 in accordance with Resolution ITU-R 1.

** Radiocommunication Study Group 5 made editorial amendments to this Recommendation in November 2010 in accordance with Resolution ITU-R 1.

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 f_r be the reference frequency of 55 786 MHz,

f_n 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:

$$f_n = f_r + 28 + 56\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ... 20

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

$$f_n = f_r + 42 + 28\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ... 40

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

$$f_n = f_r + 49 + 14\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ... 80

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

$$f_n = f_r + 52.5 + 7\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ... 160

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

$$f_n = f_r + 54.25 + 3.5\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ... 320.

TABLE 1

Calculated parameters according to Recommendation ITU-R F.746

XS **(MHz)**	***n***	f_1 **(MHz)**	f_{nmax} **(MHz)**	Z_1S **(MHz)**	Z_2S **(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_1S: separation between the lower band edge and the centre frequency of the first channel

Z_2S: 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: f_r be the reference frequency of 55 814 MHz,

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

f'_n 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: $f_n = f_r + 56\,n$

upper half of the band: $f'_n = f_r + 616 + 56\,n$

where:

$n = 1, 2, \ldots 9$

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

lower half of the band: $f_n = f_r + 14 + 28\,n$

upper half of the band: $f'_n = f_r + 630 + 28\,n$

where:

$n = 1, 2, 3, \ldots 18$

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

lower half of the band: $f_n = f_r + 21 + 14\ n$

upper half of the band: $f'_n = f_r + 637 + 14\ n$

where:

n = 1, 2, 3, … 36

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

lower half of the band: $f_n = f_r + 24.5 + 7\ n$

upper half of the band: $f'_n = f_r + 640.5 + 7\ n$

where:

n = 1, 2, 3, … 72

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

lower half of the band: $f_n = f_r + 26.25 + 3.5\ n$

upper half of the band: $f'_n = f_r + 642.25 + 3.5\ n$

where:

n = 1, 2, 3, … 144.

TABLE 2

Calculated parameters according to Recommendation ITU-R F.746

XS **(MHz)**	***n***	f_1 **(MHz)**	f_{nmax} **(MHz)**	f'_1 **(MHz)**	f'_{nmax} **(MHz)**	Z_1S **(MHz)**	Z_2S **(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_1S: separation between the lower band edge and the centre frequency of the first channel

Z_2S: separation between centre frequencies of the final channel and the upper band edge

DS: duplex spacing $(f'_n - f_n)$.

Annex 2

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

Let: f_r be the reference frequency of 56 950 MHz,

f_n 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:

$$f_n = f_r + 100\ n \qquad \text{MHz}$$

where:

$n = 1, 2, 3, \ldots 20$

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

$$f_n = f_r + 25 + 50\ n \qquad \text{MHz}$$

where:

$n = 1, 2, 3, \ldots 40$.

TABLE 3

Calculated parameters according to Recommendation ITU-R F.746

XS **(MHz)**	***n***	f_1 **(MHz)**	f_{nmax} **(MHz)**	Z_1S **(MHz)**	Z_2S **(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_1S: separation between the lower band edge and the centre frequency of the first channel

Z_2S: separation between centre frequencies of the final channel and the upper band edge.