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Radiocommunication Sector of ITU

Recommendation ITU-R F.749-4
(02/2022)

Radio-frequency channel arrangements for systems of the fixed service operating in sub-bands in the 36-40.5 GHz band

F Series
Fixed service

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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.749-4

Radio-frequency channel arrangements for systems of the fixed service operating in sub-bands in the 36-40.5 GHz band

(Question ITU-R 247-1/5)

(1992-1994-2001-2012-2022)

Scope

This Recommendation provides specifications for radio-frequency channel arrangements for systems in the fixed service with channel separations ranging from 2.5 to 224 MHz in the bands 36-37 GHz, 37.0-39.5 GHz, 38.6-40 GHz and 39.5-40.5 GHz. Annex 3 includes block-based arrangements with bandwidths of 50 MHz and 60 MHz in the frequency range 38.06 to 40 GHz.

Keywords

Fixed service, point-to-point, channel bandwidth, channel arrangement, 38 GHz

Abbreviations / Glossary

BWA Broadband wireless access

CEPT European Conference of Postal and Telecommunications Administrations

RF Radio-frequency

Related ITU Recommendations and Reports

Recommendation ITU-R F.746 – Radio-frequency arrangements for fixed service systems

The ITU Radiocommunication Assembly,

considering

a) that the band 36.0-40.5 GHz is allocated to the fixed and mobile services and that the propagation characteristics of this band are ideally suited to short-range digital and analogue radio system applications;

b) that differing applications of various administrations may require different radio-frequency (RF) channel arrangements;

c) that the band may also be used for broadband wireless access (BWA) systems in the fixed service;

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

e) that lower and upper limits of the bands are not uniform and vary internationally;

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

g) 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;

h) that the differing digital hierarchies used in various countries or regions may require the use of homogeneous basic patterns with differing intervals;

i) that allocation of frequency blocks to BWA systems allows flexible deployment of various technologies including provisions for intersystem/services operation and overall spectrum efficiency,

recognizing

that Recommendation ITU-R SM.1540 provides guidelines for managing the unwanted emissions in the out-of-band domain falling into adjacent allocated bands,

recommends

1 that the preferred RF channel arrangements for the band 36.0-40.5 GHz should be based on homogeneous patterns;

2 that the homogeneous pattern with a preferred 3.5 MHz interval be defined by the relation:

$$f_p = f_r + 1 + 3.5\,p \quad \text{MHz}$$

where:

$1 \le p \le 1\,285$

fr: reference frequency of the homogeneous pattern;

3 that the homogeneous pattern with a preferred 2.5 MHz interval be defined by the relation:

$$f_p = f_r + 2.5\,p \quad \text{MHz}$$

where:

$1 \le p \le 1\,799$

f_r: reference frequency of the homogeneous pattern;

4 that the reference frequency of the homogeneous pattern for international connections should be 36 000 MHz;

5 that all go channels should be in one half of any bidirectional band, and all return channels in the other;

6 that the channel spacings, *XS*, the centre gap, *YS*, and the distance to the lower and upper-band limits, Z_1S and Z_2S, should be agreed by the administrations concerned, dependent on the application and channel capacity envisaged (see Recommendation ITU-R F.746 for definitions of *XS*, *YS* and *ZS*);

7 that allocated blocks should result from aggregation of contiguous channels in accordance with the homogeneous patterns.

NOTE 1 – Examples of RF channel arrangements based on *recommends* 2 and 3 are described in Annexes 1 and 2.

NOTE 2 – Due regard has to be taken that, in certain countries, a 3.5 MHz homogeneous pattern, interleaved by 1.75 MHz from that referred in *recommends* 2, is used in conjunction with the main pattern.

NOTE 3 – Examples of BWA system block (sub-band) arrangements are described in Annex 3.

Annex 1

Radio-frequency channel arrangements in the band 37.0-39.5 GHz used by some CEPT[1] administrations in accordance with *recommends* 2

The radio-frequency channel arrangement for carrier spacings of 224 MHz, 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz shall be derived as follows:

Let f_0 be the centre frequency of 38 248 MHz = f_r + 1 + (642 × 3.5) MHz;

f_n be the centre frequency of a RF channel in the lower half of the band (MHz);

f'_n be the centre frequency of a RF channel in the upper half of the band (MHz);

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

1 Non-interleaved channel arrangements

a) for systems with a carrier spacing of 112 MHz:

lower half of band: $f_n = f_0 - 1\,246 + 112\,n$ MHz

upper half of band: $f'_n = f_0 + 14 + 112\,n$ MHz

where:

n = 1, 2, 3, . . . 10

b) for systems with a carrier spacing of 56 MHz:

lower half of band: $f_n = f_0 - 1\,218 + 56\,n$ MHz

upper half of band: $f'_n = f_0 + 42 + 56\,n$ MHz

where:

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

c) for systems with a carrier spacing of 28 MHz:

lower half of band: $f_n = f_0 - 1\,204 + 28\,n$ MHz

upper half of band: $f'_n = f_0 + 56 + 28\,n$ MHz

where:

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

In addition, where practical, administrations may consider the use of channels with index n = 0 and 41;

d) for systems with a carrier spacing of 14 MHz:

lower half of band: $f_n = f_0 - 1\,197 + 14\,n$ MHz

upper half of band: $f'_n = f_0 + 63 + 14\,n$ MHz

where:

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

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[1] European Conference of Postal and Telecommunications Administrations.

In addition, where practical, administrations may consider the use of channels with index $n = -2, -1, 0$ and 81, 82, 83.

e) for systems with a carrier spacing of 7 MHz:

lower half of band: $f_n = f_0 - 1\,193.5 + 7\,n$ MHz

upper half of band: $f'_n = f_0 + 66.5 + 7\,n$ MHz

where:

$n = 1, 2, 3, \ldots 160$.

In addition, where practical, administrations may consider the use of channels with index $n = -5, -4, -3, -2, -1, 0$ and 161, 162, 163, 164, 165, 166;

f) for systems with a carrier spacing of 3.5 MHz:

lower half of band: $f_n = f_0 - 1\,191.75 + 3.5\,n$ MHz

upper half of band: $f'_n = f_0 + 68.25 + 3.5\,n$ MHz

where:

$n = 1, 2, 3, \ldots 320$.

In addition, where practical, administrations may consider the use of channels with index $n = -11, -10, ..., -1, 0$ and 321, 322, ..., 331, 332.

2 Interleaved channel arrangements

Administrations may consider merging any two adjacent 112 MHz channels recommended in 1a) to create 224 MHz channels, with centre frequencies between the merged channels in interleaved arrangements as in the formulas below and as shown in Fig. 2.

For systems with a carrier spacing of 224 MHz:

Lower half of band: $f_n = (f_0 - 1\,190 + 112\,n)$ MHz

Upper half of band: $f'_n = (f_0 + 70 + 112\,n)$ MHz

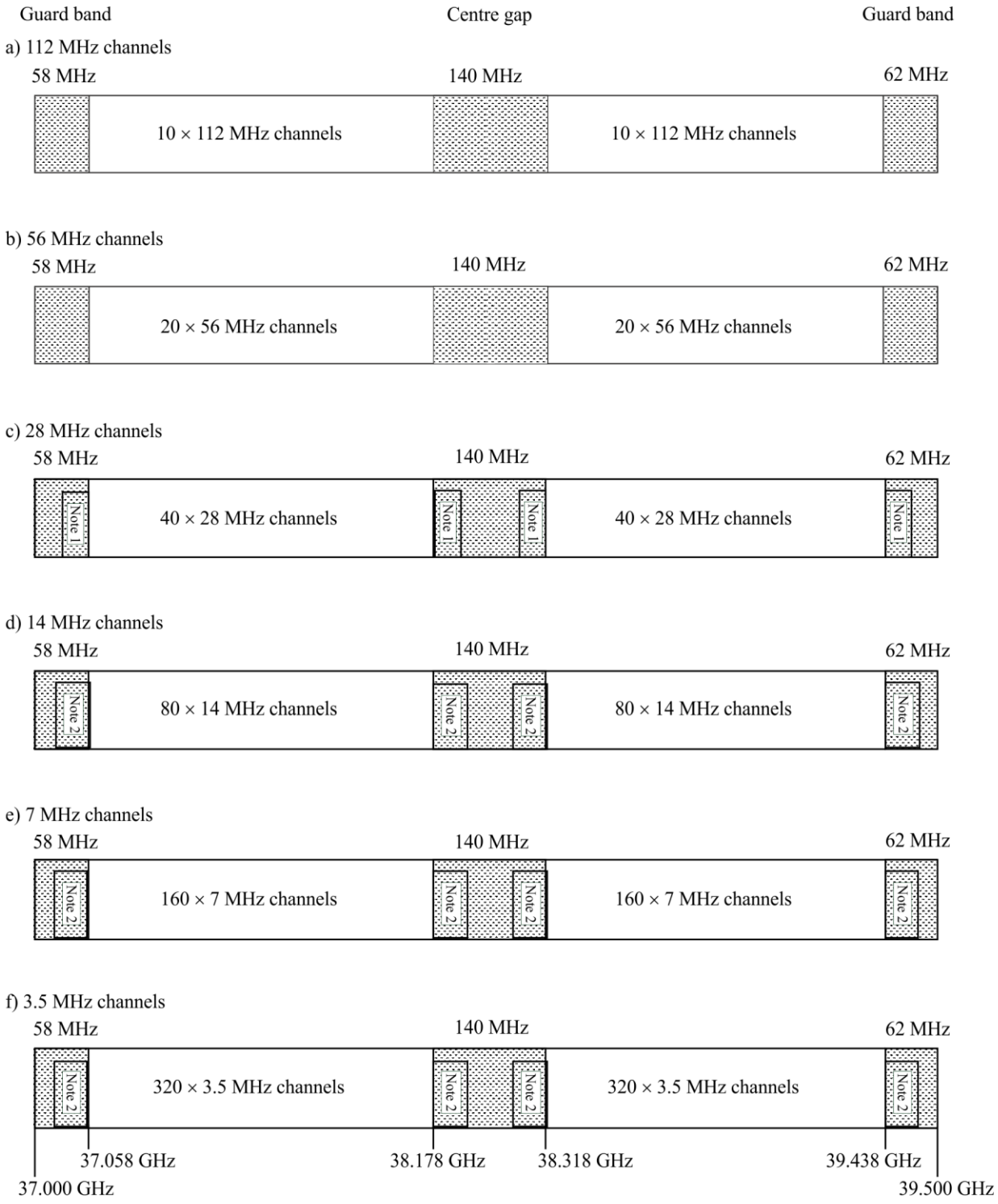
where:

$n = 1, 2, 3, \ldots. 9$

NOTE 1 – The RF channel arrangements of *a*) to *e*) above use channel centre frequencies f_n and f'_n selected from the homogeneous pattern of *recommends* 2. The arrangement *f*) above uses channel centre frequencies spaced by 3.5 MHz but interleaved between the homogeneous pattern of *recommends* 2, with an offset of 1.75 MHz.

FIGURE 1

Occupied spectrum in non-interleaved channel arrangement: 37.0 GHz-39.5 GHz band

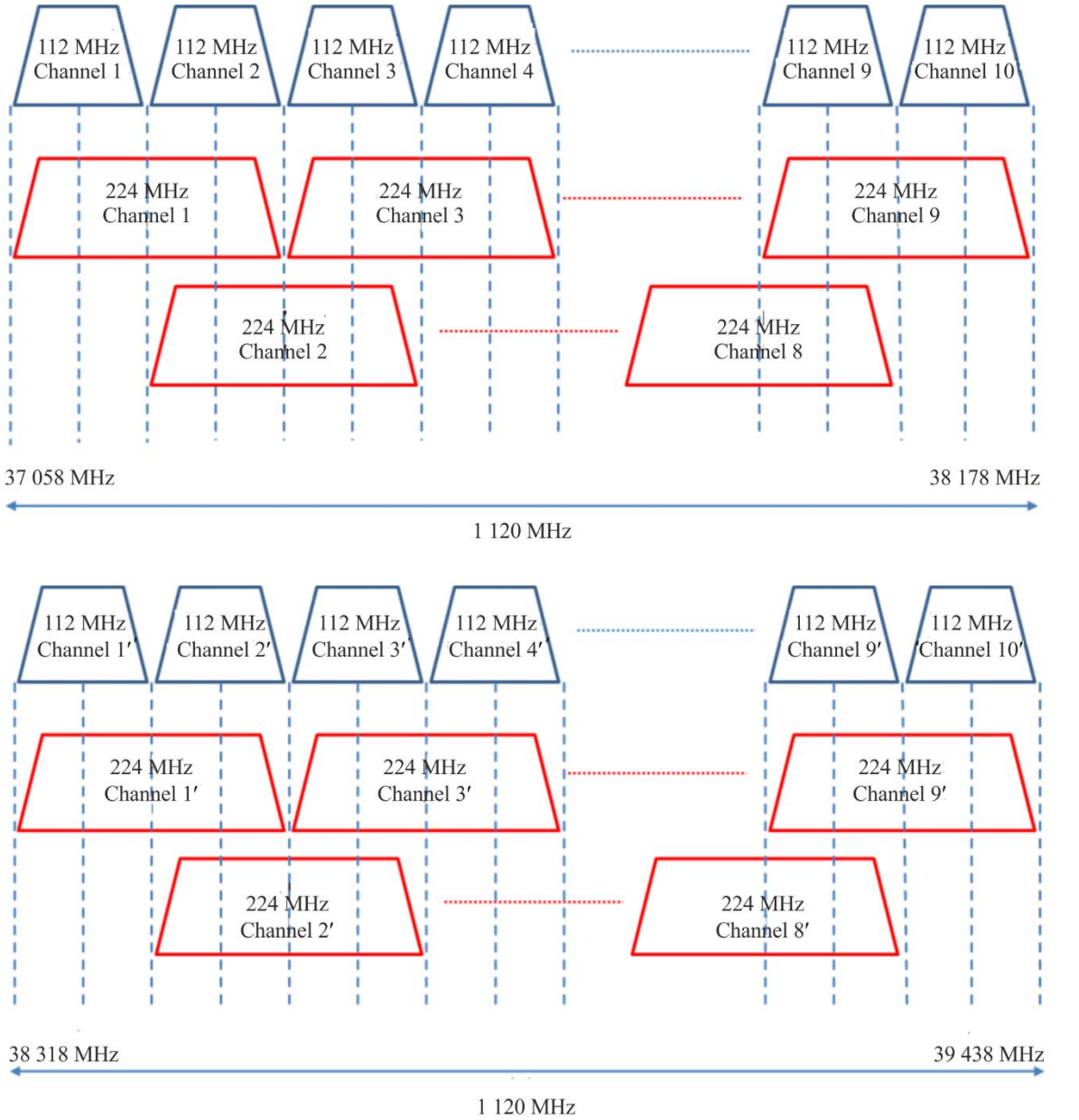


NOTE 1 – One additional 28 MHz channel.

NOTE 2 – 42 MHz for additional 3.5, 7 and 14 MHz channels.

FIGURE 2

Interleaved channel arrangement with channel width of 224 MHz



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Annex 2

RF channel arrangements for radio-relay systems operating in the 36.0-37.0 GHz and in the 39.5-40.5 GHz bands in accordance with *recommends* 2 (Russia)

The RF channel arrangement for carrier spacings of 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz shall be derived as follows:

Let f_0 be the centre frequency of 36 498 MHz = f_r + 1 + (142 × 3.5) MHz for the frequency band 36 000-37 000 MHz, and

f_0 be the centre frequency of 39 998 MHz = f_r + 1 + (1 142 × 3.5) MHz for the frequency band 39 500-40 500 MHz;

f_n be the centre frequency of a RF channel in the lower half of the band (MHz);

f'_n be the centre frequency of a RF channel in the upper half of the band (MHz);

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

a) for systems with a carrier spacing of 112 MHz:

lower half of band: $f_n = f_0 - 532 + 112\,n$ MHz

upper half of band: $f'_n = f_0 - 70 + 112\,n$ MHz

where:

n = 1, 2, 3, 4

b) for systems with a carrier spacing of 56 MHz:

lower half of band: $f_n = f_0 - 476 + 56\,n$ MHz

upper half of band: $f'_n = f_0 - 14 + 56\,n$ MHz

where:

n = 1, 2, . . . 8

c) for systems with a carrier spacing of 28 MHz:

lower half of band: $f_n = f_0 - 448 + 28\,n$ MHz

upper half of band: $f'_n = f_0 + 14 + 28\,n$ MHz

where:

n = 1, 2, . . . 15

d) for systems with a carrier spacing of 14 MHz:

lower half of band: $f_n = f_0 - 434 + 14\,n$ MHz

upper half of band: $f'_n = f_0 + 28 + 14\,n$ MHz

where:

n = 1, 2, . . . 29

e) for systems with a carrier spacing of 7 MHz:

lower half of band: $f_n = f_0 - 427 + 7\,n$ MHz

upper half of band: $f'_n = f_0 + 35 + 7\,n$ MHz

where:

n = 1, 2, ... 57

f) for systems with a carrier spacing of 3.5 MHz:

lower half of band: $f_n = f_0 - 423.5 + 3.5\,n$ MHz

upper half of band: $f'_n = f_0 + 38.5 + 3.5\ n$ MHz

where:

n = 1, 2, . . . 113.

NOTE 1 – The centre and edge guardbands may be reduced, by agreement between the administrations concerned, for lower capacity systems by the addition of extra channels using frequencies derived from the homogeneous pattern of *recommends* 2.

Annex 3

RF block arrangements in the band 38.6-40.0 GHz using the homogeneous pattern in accordance with *recommends* 7

1 Arrangement in Canada and the United States of America

1.1 Radio-frequency block arrangement description

In Canada and the United States of America the band 38.6-40.0 GHz is divided into 14 paired frequency blocks (50 MHz + 50 MHz) as follows:

TABLE 1

Radio-frequency block arrangements in Canada and USA

Block designation	Lower frequency blocks	Upper frequency blocks
	Frequency band limits (MHz)	
1	38 600-38 650	39 300-39 350
2	38 650-38 700	39 350-39 400
3	38 700-38 750	39 400-39 450
4	38 750-38 800	39 450-39 500
5	38 800-38 850	39 500-39 550
6	38 850-38 900	39 550-39 600
7	38 900-38 950	39 600-39 650
8	38 950-39 000	39 650-39 700
9	39 000-39 050	39 700-39 750
10	39 050-39 100	39 750-39 800
11	39 100-39 150	39 800-39 850
12	39 150-39 200	39 850-39 900
13	39 200-39 250	39 900-39 950
14	39 250-39 300	39 950-40 000

1.2 Usage

– Block designations are A/A' to N/N' for Canada, and 1-A/1-B to 14-A/14-B for the United States of America.

– Frequency blocks are paired to facilitate frequency division duplex systems. Preference is given to the lower frequency blocks for downlink operation and to the upper frequency blocks for uplink operation. Time division duplex systems may operate in either the lower or upper frequency blocks.

– Operators may subdivide the 50 MHz blocks according to their needs.

– Larger frequency blocks can be made available through the aggregation of 50 MHz paired blocks.

2 Arrangement in Japan

2.1 Radio-frequency block arrangement description

In Japan, the band 38.06-38.48/39.06-39.48 GHz is divided into seven paired frequency blocks (60 MHz + 60 MHz) as follows:

TABLE 2

Radio-frequency block arrangements in Japan

Paired block	Lower frequency block (MHz)	Upper frequency block (MHz)
C1/C'1	38 060-38 120	39 060-39 120
C2/C'2	38 120-38 180	39 120-39 180
C3/C'3	38 180-38 240	39 180-39 240
C4/C'4	38 240-38 300	39 240-39 300
C5/C'5	38 300-38 360	39 300-39 360
C6/C'6	38 360-38 420	39 360-39 420
C7/C'7	38 420-38 480	39 420-39 480

2.2 Usage

– Frequency blocks are paired to facilitate frequency division duplex systems. Preference is given to the lower frequency blocks for uplink operation and to the upper frequency blocks for downlink operation. Time division duplex systems may operate in either the lower or upper frequency blocks.

– Operators may subdivide the 60 MHz blocks according to their needs.

– Larger frequency blocks can be made available through the aggregation of 60 MHz paired blocks.