RECOMMENDATION ITU-R F.749-1

# RADIO-FREQUENCY CHANNEL ARRANGEMENTS FOR RADIO-RELAY SYSTEMS OPERATING IN THE 38 GHz BAND

(Question ITU-R 108/9)

(1992-1994)

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 channel arrangements;

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

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

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

f) 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;

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

*recommends*

**1.** that the preferred radio-frequency 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:

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

$f_r$ : 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 bi-directional 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*).

*Note 1* – Examples of radio-frequency channel arrangements based on *recommends* 2 and 3 are described in Annexes 1, 2 and 3.

*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.

ANNEX 1

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

The radio-frequency channel arrangement for carrier spacings of 140 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 = $f_r + 1 + (642 \times 3.5)$ MHz;

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

$f'_n$ be the centre frequency of a radio-frequency 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 140 MHz:

lower half of band: $f_n = f_0 - 1\,260 + 140\,n$ MHz

upper half of band: $f'_n = f_0 + 140\,n$ MHz

where:

$n = 1, 2, 3, \ldots 8$

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:

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

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:

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

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:

$n = 1, 2, 3, \ldots 80$

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:

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

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:

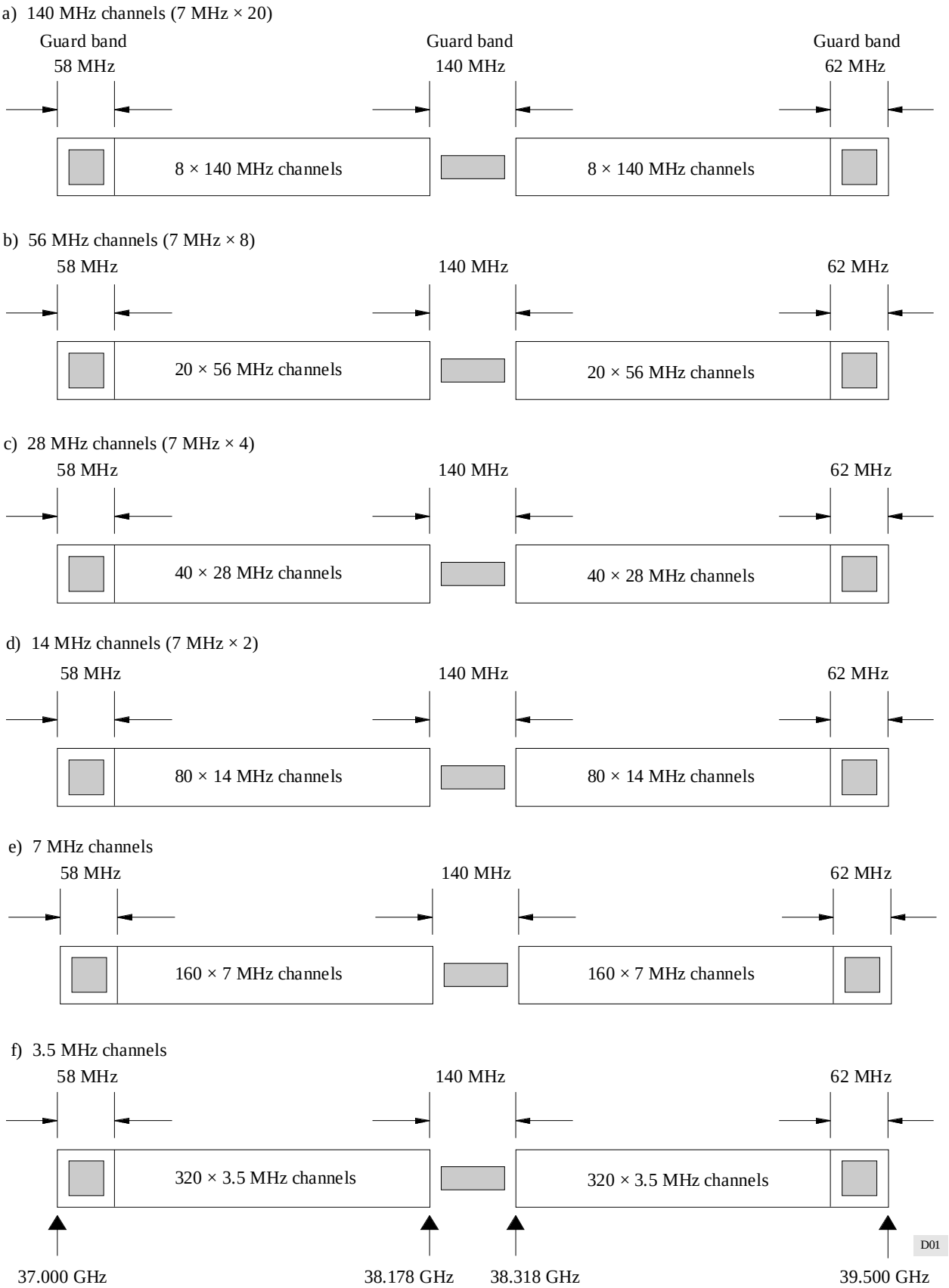
$n = 1, 2, 3, \ldots 320$.

*Note 1* – The radio-frequency 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.

*Note 2* – Figure 1 gives occupied spectrum in the 37.0-39.5 GHz band. The centre and edge guard bands 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.

FIGURE 1

**Occupied spectrum: 37.0 GHz-39.5 GHz band**



ANNEX 2

## Radio-frequency channel arrangements in the band 38.6-40.0 GHz using the homogeneous pattern in accordance with recommends 3 (United States of America)

In the United States of America, the 38.6-40.0 GHz band is allocated to the fixed service.

### 1. Radio-frequency channel arrangement

| Channel Group A | | Channel Group B | |
|---|---|---|---|
| Channel No. | Frequency band limits (MHz) | Channel No. | Frequency band limits (MHz) |
| 1-A | 38 600-38 650 | 1-B | 39 300-39 350 |
| 2-A | 38 650-38 700 | 2-B | 39 350-39 400 |
| 3-A | 38 700-38 750 | 3-B | 39 400-39 450 |
| 4-A | 38 750-38 800 | 4-B | 39 450-39 500 |
| 5-A | 38 800-38 850 | 5-B | 39 500-39 550 |
| 6-A | 38 850-38 900 | 6-B | 39 550-39 600 |
| 7-A | 38 900-38 950 | 7-B | 39 600-39 650 |
| 8-A | 38 950-39 000 | 8-B | 39 650-39 700 |
| 9-A | 39 000-39 050 | 9-B | 39 700-39 750 |
| 10-A | 39 050-39 100 | 10-B | 39 750-39 800 |
| 11-A | 39 100-39 150 | 11-B | 39 800-39 850 |
| 12-A | 39 150-39 200 | 12-B | 39 850-39 900 |
| 13-A | 39 200-39 250 | 13-B | 39 900-39 950 |

### 2. Usage with different RF channel bandwidths

The basic RF channel arrangement described in § 1 provides the necessary flexibility for users requiring larger or smaller RF channel bandwidths, as follows:

– users who require more transmission capacity than can be accommodated by one channel pair could obtain two or more channel pairs;

– users may subdivide the allocated RF channel pairs for applications requiring smaller bandwidths.

ANNEX 3

**Radio-frequency 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 radio-frequency 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 radio-frequency channel in the lower half of the band (MHz);

$f'_n$ be the centre frequency of a radio-frequency 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:

$n = 1, 2, \ldots 113$.

*Note 1* – The centre and edge guard bands 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.