



Recommendation ITU-R F.637-4
(03/2012)

**Radio-frequency channel arrangements for
fixed wireless systems operating
in the 21.2-23.6 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.637-4

**Radio-frequency channel arrangements for fixed wireless systems
operating in the 21.2-23.6 GHz band**

(Question ITU-R 247/5)

(1986-1992-1994-1999-2012)

Scope

This Recommendation provides radio-frequency (RF) channel arrangements for fixed wireless systems (FWS) operating in the 21.2-23.6 GHz band. The main text of this Recommendation presents RF channel arrangements based on the homogeneous patterns with channel separations of 2.5 and 3.5 MHz. Annexes 1 to 4 present example arrangements of these homogeneous patterns used in some countries.

The ITU Radiocommunication Assembly,

considering

- a) that the band 21.2-23.6 GHz is allocated to the fixed and other services;
- b) Resolution 525 of the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992);
- c) that the band is used for differing applications by various administrations and that these applications may require different radio-frequency (RF) channel arrangements;
- d) that several types of service with various capacities may be in simultaneous use in this frequency band;
- e) that the band allocated to each service or even to each administration may vary from one country to another;
- f) that the applications in this frequency band may require differing channel bandwidth;
- g) that a high degree of compatibility between RF channels of different arrangements can be achieved by selecting all channel centre frequencies from a homogeneous basic pattern,

recommends

- 1 that RF channel arrangements for the band 21.2-23.6 GHz should be based on a homogeneous pattern;
- 2 that the homogeneous pattern with a preferred 3.5 MHz interval be defined by the relation:

$$f_p = f_r + 3.5 + 3.5 p$$

where:

$$1 \leq p \leq 685$$

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:

$$f_p = f_r + 4 + 2.5 p$$

where:

$$1 \leq p \leq 959$$

f_r : reference frequency of the homogeneous pattern;

4 that the reference frequency of the homogeneous pattern for international connections should be:

$$f_r = 21\,196 \text{ MHz}$$

other reference frequencies may be agreed by the administrations concerned;

5 that in each bidirectional link all go channels should be in one half of any 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 channel arrangements based on this Recommendation are described in Annexes 1, 2, 3 and 4.

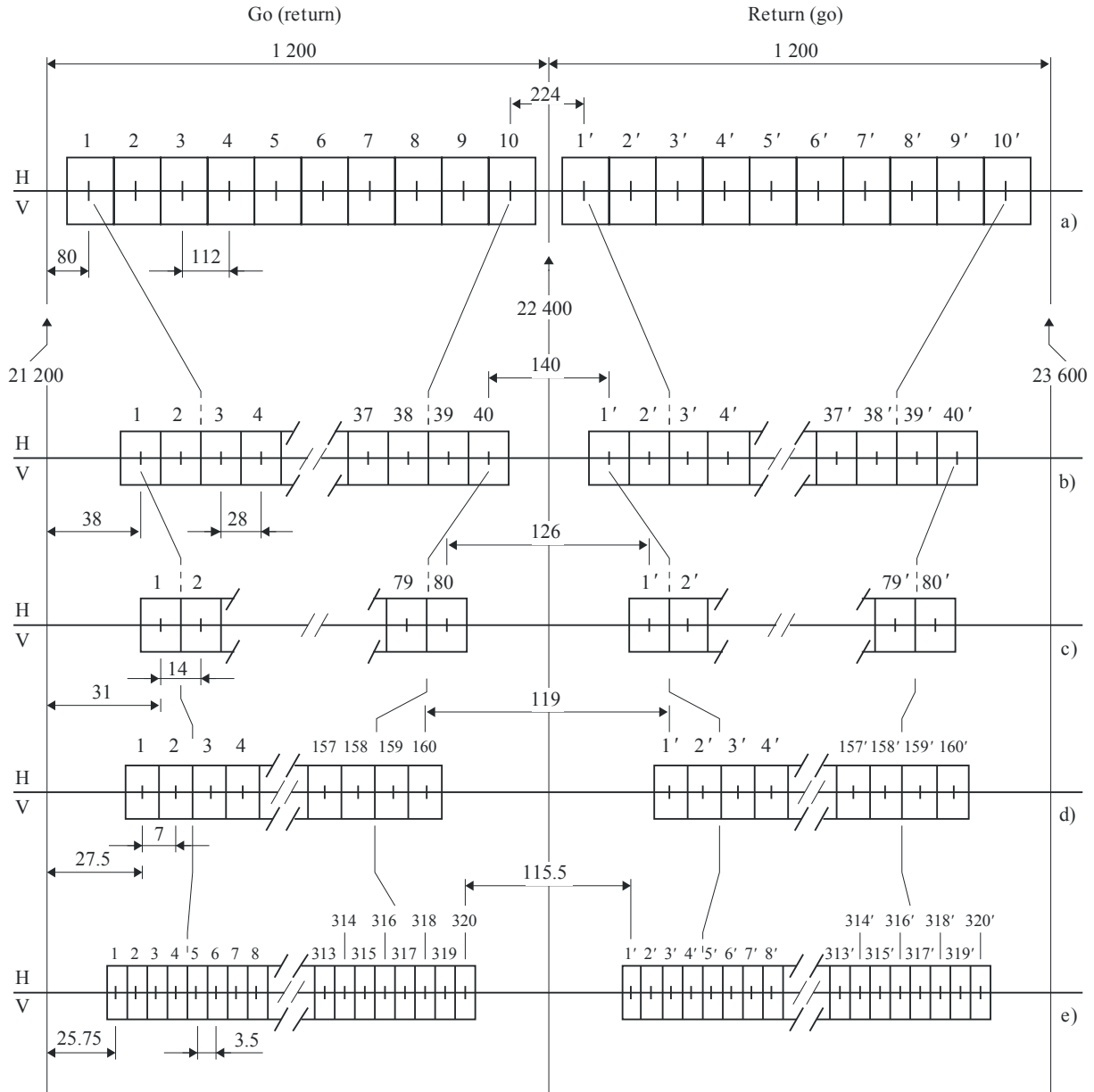
NOTE 2 – Due regard has to be taken that, in certain countries, a 3.5 MHz homogeneous pattern, interleaved by 1.75 MHz from that referred in § 2, is used in conjunction with the main pattern.

Annex 1

RF channel arrangements in the band 21.2-23.6 GHz used in some countries in accordance with *recommends 2*

The use of the band 21.2-23.6 GHz is based on a homogeneous 3.5 MHz frequency pattern. Various channel spacings are accommodated as shown in Fig. 1 and interleaved patterns are also used for the various spacings. In some applications, additional channels can be added in the edge and central guardbands using the homogeneous pattern.

FIGURE 1
**Radio-frequency channel arrangements for digital and analogue FWS
operating in the 21.2-23.6 GHz band**
(All frequencies in MHz)



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NOTE 1 – The RF channel arrangements of Fig. 1e) are derived by the use of carriers interleaved between those of the homogeneous pattern of *recommends 2*.

Annex 2

Radio-frequency channel arrangements for some CEPT administrations in the band 22.0-23.6 GHz in accordance with *recommends 2*

1 Frequency bands 22.0-22.6 GHz paired with 23.0-23.6 GHz

An example of radio-frequency channel arrangements in the band 22.0-22.6 GHz paired with 23.0-23.6 GHz for carrier spacings of 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz is derived as follows:

Let f_0 be the centre frequency of 21 196 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:

$$\text{lower half of the band: } f_n = f_0 + 770 + 112 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_n = f_0 + 1778 + 112 n \quad \text{MHz}$$

where:

$$n = 1, \dots 5$$

b1) for systems with a carrier spacing of 56 MHz providing 9 channels:

$$\text{lower half of the band: } f_n = f_0 + 826 + 56 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_n = f_0 + 1834 + 56 n \quad \text{MHz}$$

where:

$$n = 1, \dots 9$$

b2) for systems with a carrier spacing of 56 MHz providing 10 channels:

$$\text{lower half of the band: } f_n = f_0 + 784 + 56 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_n = f_0 + 1792 + 56 n \quad \text{MHz}$$

where:

$$n = 1, \dots 10$$

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

$$\text{lower half of the band: } f_n = f_0 + 798 + 28 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_n = f_0 + 1806 + 28 n \quad \text{MHz}$$

where:

$$n = 1, \dots 20$$

- d) for systems with a carrier spacing of 14 MHz:
 lower half of the band: $f_n = f_0 + 805 + 14 n$ MHz
 upper half of the band: $f'_n = f_0 + 1813 + 14 n$ MHz

where:

$$n = 1, \dots, 41$$

- e) for systems with a carrier spacing of 7 MHz:
 lower half of the band: $f_n = f_0 + 808.5 + 7 n$ MHz
 upper half of the band: $f'_n = f_0 + 1816.5 + 7 n$ MHz

where:

$$n = 1, \dots, 83$$

- f) for systems with a carrier spacing of 3.5 MHz:
 lower half of the band: $f_n = f_0 + 805 + 3.5 n$ MHz
 upper half of the band: $f'_n = f_0 + 1813 + 3.5 n$ MHz

where:

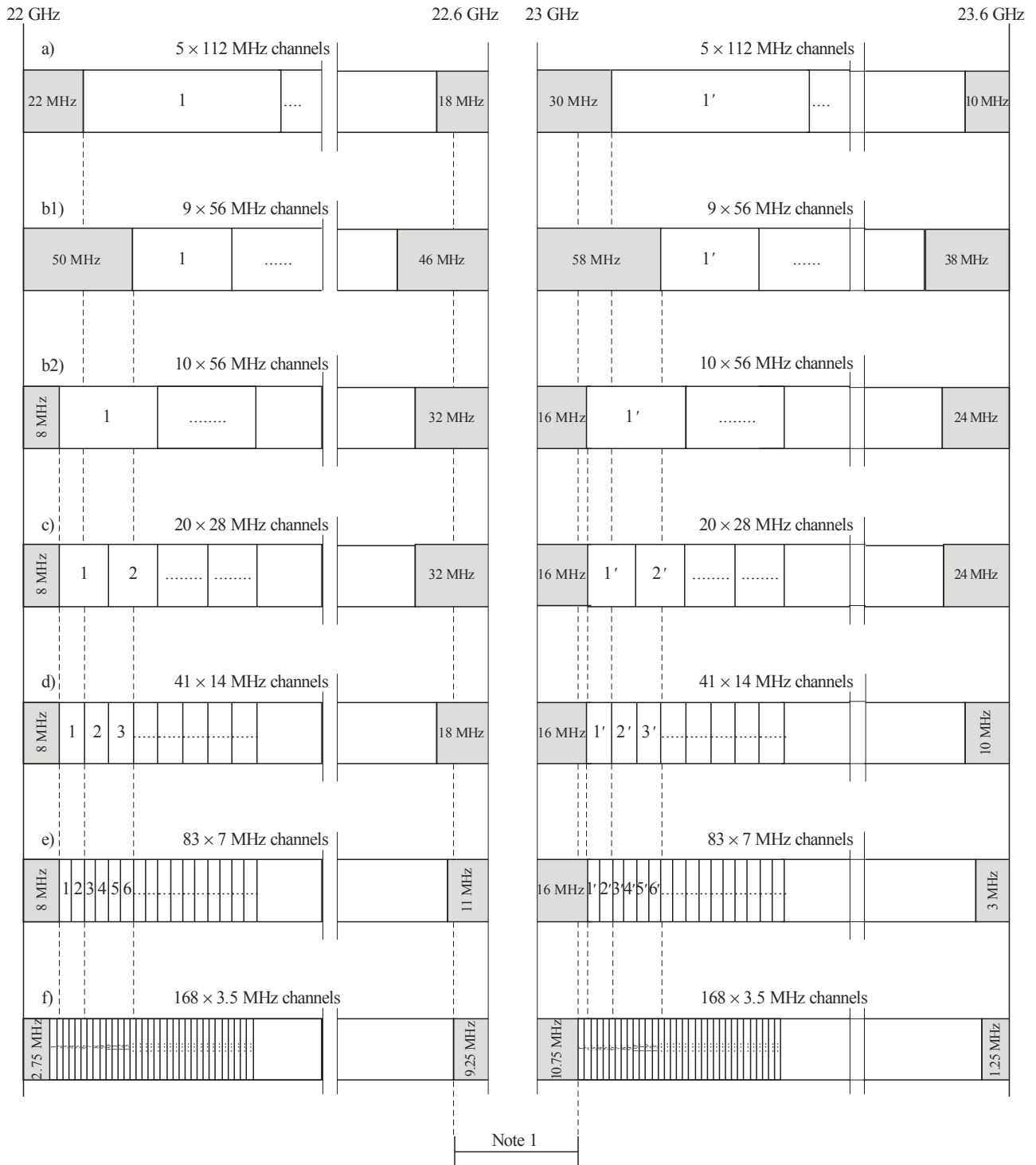
$$n = 1, \dots, 168.$$

NOTE 1 – The radio-frequency channel arrangements of a) to f) above use channel centre frequencies f_n and f'_n selected from the homogeneous pattern of *recommends 2*.

NOTE 2 – Figure 2 gives occupied spectrum in the 22.0-23.6 GHz band.

FIGURE 2

Radio-frequency channel arrangement in the band 22.0-22.6 GHz paired with 23.0-23.6 GHz



NOTE 1 – For the centre-gap channel arrangements, see §§ 2 and 3 of this Annex.

2 Frequency bands 22.59075-22.75875 paired with 22.84275-23.01075 GHz

These bands are portions of the centre-gap of the channel arrangement shown in § 1, combined with the innermost guardbands of the 3.5 MHz arrangement (see Fig. 3).

The preferred radio-frequency channel arrangement for digital point-to-point FWS for carrier spacings of 28 MHz, 14 MHz, 7 MHz and 3.5 MHz should be derived as follows:

Let f_0 be the reference frequency of 21 196 MHz;

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

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

TX/RX duplex separation = 252 MHz;

centre gap = 84 MHz;

then the frequencies of individual channels (Note 1) are expressed by the following relationships:

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

lower half of band: $f_n = (f_0 + 1\,380.75 + 28\,n)$ MHz

upper half of band: $f'_n = (f_0 + 1\,632.75 + 28\,n)$ MHz

where:

$$n = 1, \dots, 6$$

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

lower half of band: $f_n = (f_0 + 1\,387.75 + 14\,n)$ MHz

upper half of band: $f'_n = (f_0 + 1\,639.75 + 14\,n)$ MHz

where:

$$n = 1, \dots, 12$$

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

lower half of band: $f_n = (f_0 + 1\,391.25 + 7\,n)$ MHz

upper half of band: $f'_n = (f_0 + 1\,643.25 + 7\,n)$ MHz

where:

$$n = 1, \dots, 24$$

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

lower half of band: $f_n = (f_0 + 1\,393 + 3.5\,n)$ MHz

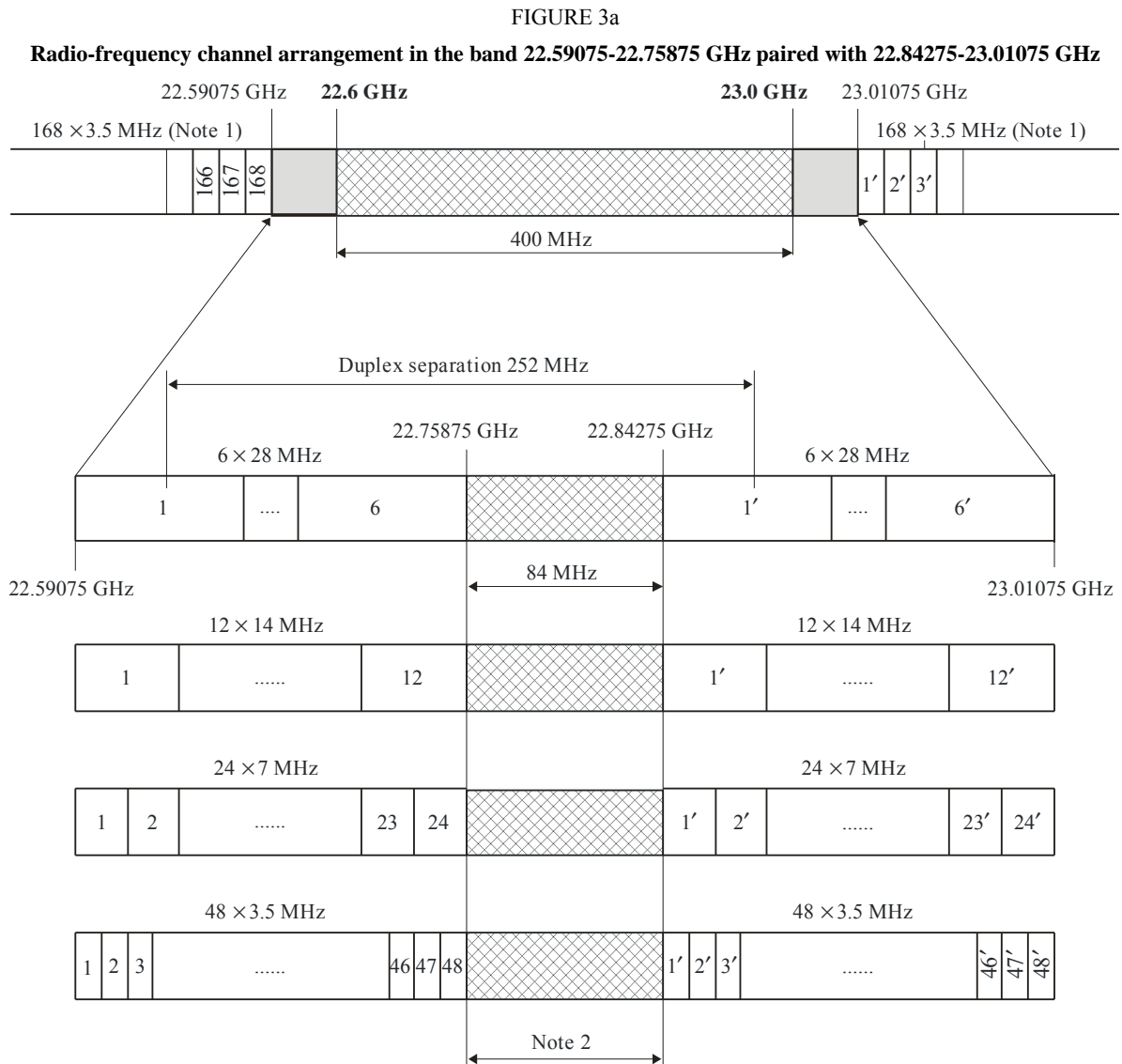
upper half of band: $f'_n = (f_0 + 1\,645 + 3.5\,n)$ MHz

where:

$$n = 1, \dots, 48$$

NOTE 1 – The channels are shown as paired; however, administrations may envisage unpaired use of those channels according to the national need (e.g. for ENG/OB-SAP/SAB applications). Some administrations may also wish to pair some of the channels in the lower half within the 22.6-23.0 GHz band with those in 21.2-21.4 GHz band referred in Annex 4.

NOTE 2 – Figure 3a gives occupied spectrum in the band 22.59075-22.75875 GHz paired with the 22.84275-23.01075 GHz band.



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NOTE 1 – This is the 3.5 MHz channel arrangement according to § 1 of this Annex.

NOTE 2 – For the centre-gap channel arrangement, see § 3 of this Annex.

3 Frequency band 22.75875-22.84275 GHz

This band is the centre-gap of the channel arrangement in § 2 (see Fig. 3a), which may be used for unpaired channels.

The preferred radio-frequency channel arrangement for digital and analogue point-to-point FWS for carrier spacings of 28 MHz, 14 MHz, 7 MHz and 3.5 MHz should be derived as follows:

Let f_0 be the reference frequency of 22 757 MHz;

f_n be the centre frequency (MHz) of a radio-frequency channel;

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

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

$$f_n = (f_0 - 12.25 + 28 n) \text{ MHz}$$

where:

$$n = 1, 2, 3$$

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

$$f_n = (f_0 - 5.25 + 14 n) \text{ MHz}$$

where:

$$n = 1, 2, \dots 6$$

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

$$f_n = (f_0 - 1.75 + 7 n) \text{ MHz}$$

where:

$$n = 1, 2, \dots 12$$

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

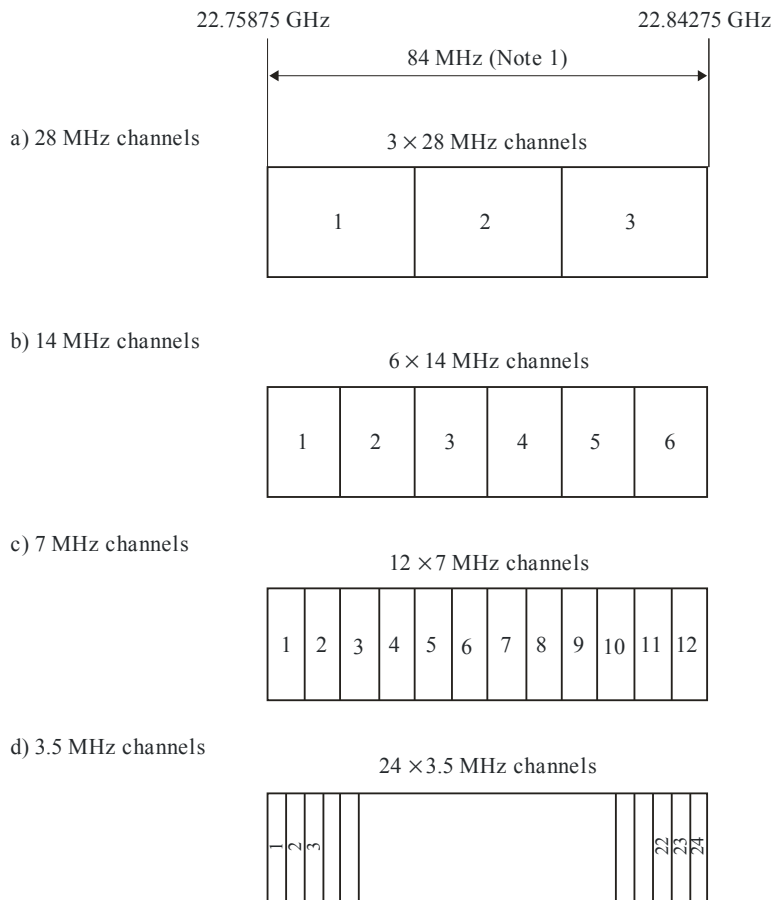
$$f_n = (f_0 + 3.5 n) \text{ MHz}$$

where:

$$n = 1, 2, \dots 24$$

NOTE – Figure 3b gives occupied spectrum in the 22.75875-22.84275 GHz band.

FIGURE 3b
Radio-frequency channel arrangement in the band 22.75875-22.84275 GHz



NOTE 1 – This is the centre-gap of the channel arrangement in § 2 (see Fig. 3a).

Annex 3

Description of the radio-frequency channel arrangements in the band 21.2-23.6 GHz in accordance with *recommends 3* (North America)

In the United States of America, the most widespread use of the 21.2-23.6 GHz band is in the 21.8-22.4 GHz and 23.0-23.6 GHz portions for which a frequency pattern with 50 MHz channels has been adopted. The same pattern is being used in the remainder of the 21.2-23.6 GHz band as usage is spreading. Accordingly, a homogeneous pattern is in use, based on *recommends 3* and given by:

$$f_n = f_r - 21 + 50 n$$

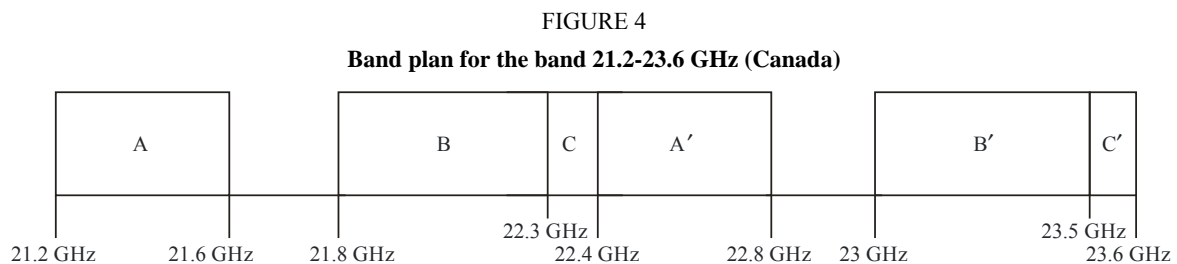
where:

$$n = 1, 2, 3, \dots 48$$

$$f_r \text{ (reference frequency) } = 21\,196 \text{ MHz.}$$

For two-way operation, the go-return separation is about 1 200 MHz. Typical systems in use include digital transmission at data rates between about 1.5 and 8 Mbit/s, and a variety of analogue video systems.

In Canada, the RF channel arrangements for FWS in the band 21.2-23.6 GHz is shown in Fig. 4.



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The above channel arrangement contains three paired blocks: Blocks A/A', Blocks B/B', and Blocks C/C'. In all three blocks, each paired channel has a frequency separation of 1 200 MHz. The channel widths in each block are as follows:

A/A': 50 MHz channels (8 in each block).

B/B': Five available channel widths: 10 MHz, 15 MHz, 20 MHz, 40 MHz and 50 MHz.

C/C': Three available channel widths: 2.5 MHz, 5 MHz and 7.5 MHz.

Annex 4

Radio-frequency channel arrangements in the band 21.2-23.6 GHz in accordance with *recommends 2* (Germany)

Taking into account the fact, that:

- WARC-92 has allocated the band 21.4-22.0 GHz to the broadcasting-satellite service (BSS) on a primary basis in Regions 1 and 3;
- many individual reception units for the BSS are expected to be used and interference from the fixed service (FS) should be minimized;

the operational use of FWS in the sub-band 21.4-22.0 GHz should be avoided.

The band plan based on WARC-92 decisions is shown in Fig. 5a.

FIGURE 5a

Band plan for the band 21.2-23.6 GHz based on WARC-92 decisions

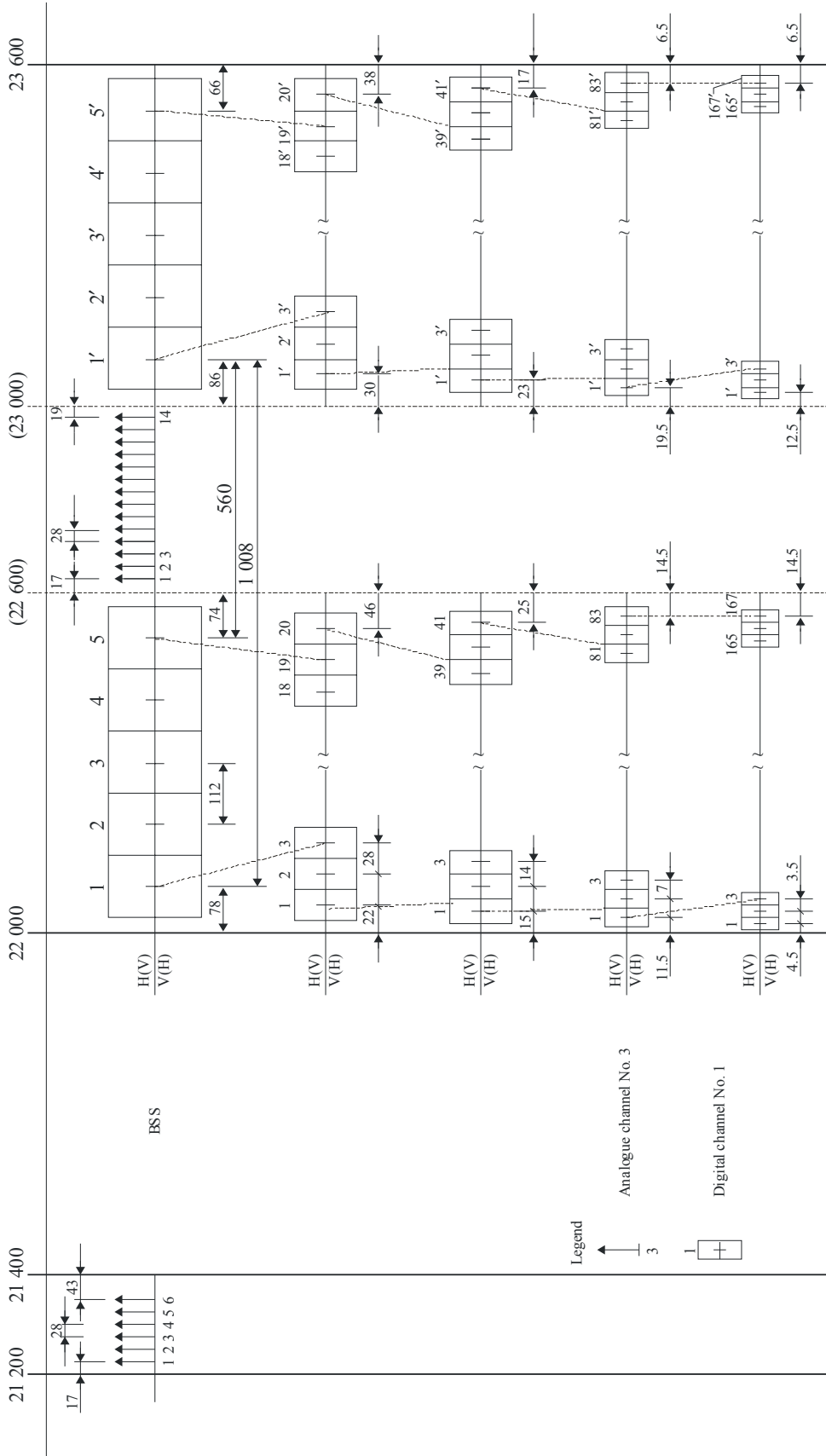
FS simplex TV	Broadcasting- satellite service	FS duplex Go (Return)	FS simplex	FS duplex Return (Go)	
21.2	21.4	22.0	22.6	23.0	23.6

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An application of the band plan (Fig. 5a) for analogue and digital FWS (2 Mbit/s to 155 Mbit/s) is described in detail in Fig. 5b.

NOTE – In Fig. 5b the radio-frequency channel arrangements in the bands 22.0-22.6 GHz paired with 23.0-23.6 GHz are equal to the corresponding ones in § 1 of Annex 2.

FIGURE 5b
Radio-frequency channel arrangements for digital and analogue FWS
operating in the band 21.2-23.6 GHz based on WARC-92 decisions
 (All frequencies in MHz)



F.0637-05b