

## RECOMMENDATION ITU-R F.637-3\*

**Radio-frequency channel arrangements for fixed wireless systems operating in the 23 GHz band**

(Question ITU-R 108/9)

(1986-1992-1994-1999)

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 both analogue and digital systems are in use in this band;
- d) that the band is used for differing applications by various administrations and that these applications may require different radio-frequency (RF) channel arrangements;
- e) that several types of service with various capacities may be in simultaneous use in this frequency band;
- f) that the band allocated to each service or even to each administration may vary from one country to another;
- g) that the applications in this frequency band may require differing channel bandwidth;
- h) 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;

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\* Radiocommunication Study Group 9 made editorial amendments to this Recommendation in 2002, in accordance with Resolution ITU-R 44.

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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:

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

other reference frequencies may be agreed by the administrations concerned;

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  $ZS$ ).

NOTE 1 – Examples of channel arrangements based on this Recommendation are described in Annexes 1, 2, 3, 4 and 5.

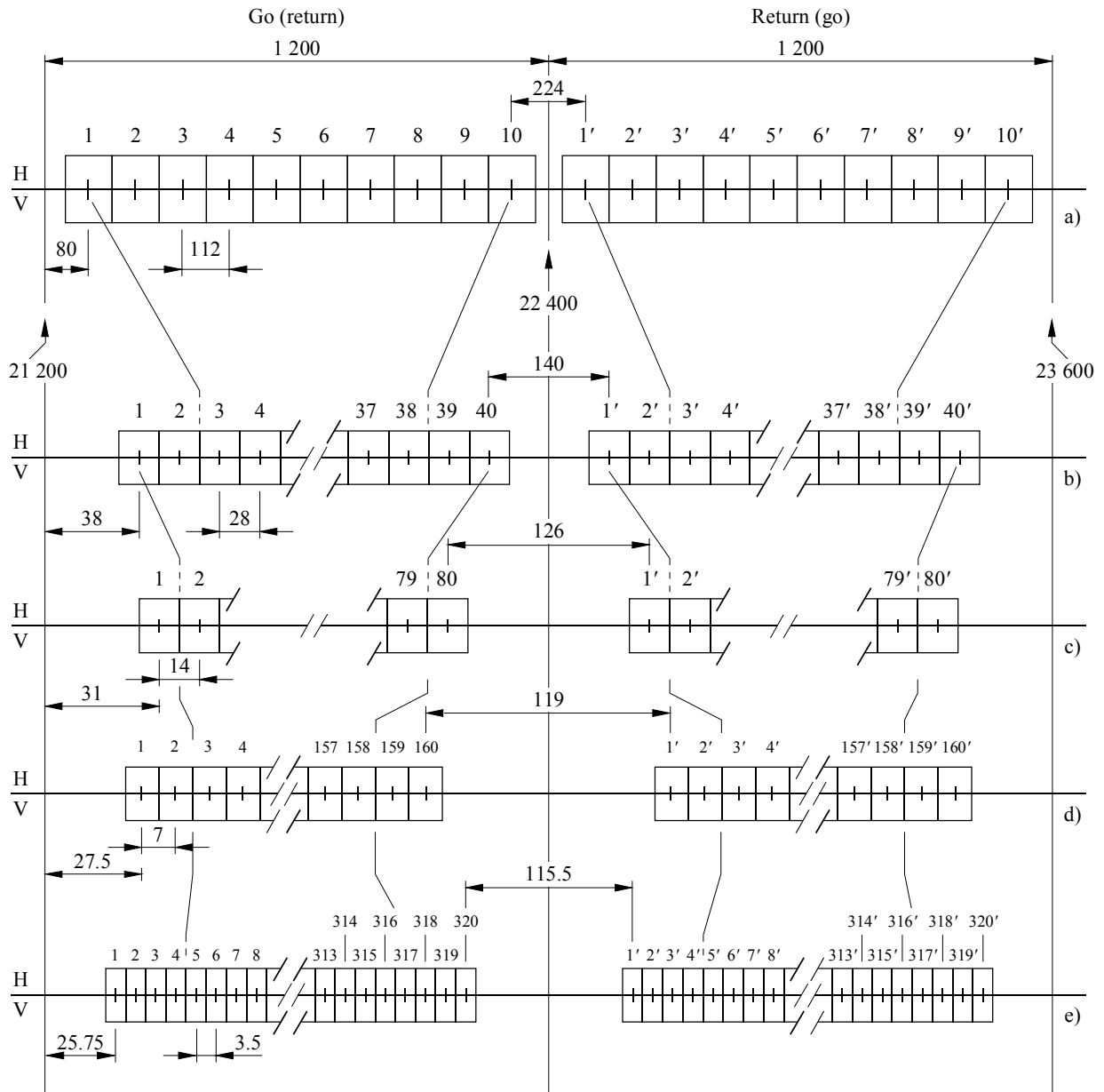
NOTE 2 – Due regard has to be taken that, in certain countries, a 3.5 MHz homogeneous pattern, interleaved by 1.75 MHz from that referred in § 2, is used in conjunction with the main pattern.

## ANNEX 1

### **RF channel arrangements in the band 21.2-23.6 GHz in accordance with *recommends 2* (United Kingdom)**

In the United Kingdom, 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 fixed wireless systems  
operating in the 21.2-23.6 GHz band (United Kingdom)**  
(All frequencies in MHz)



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

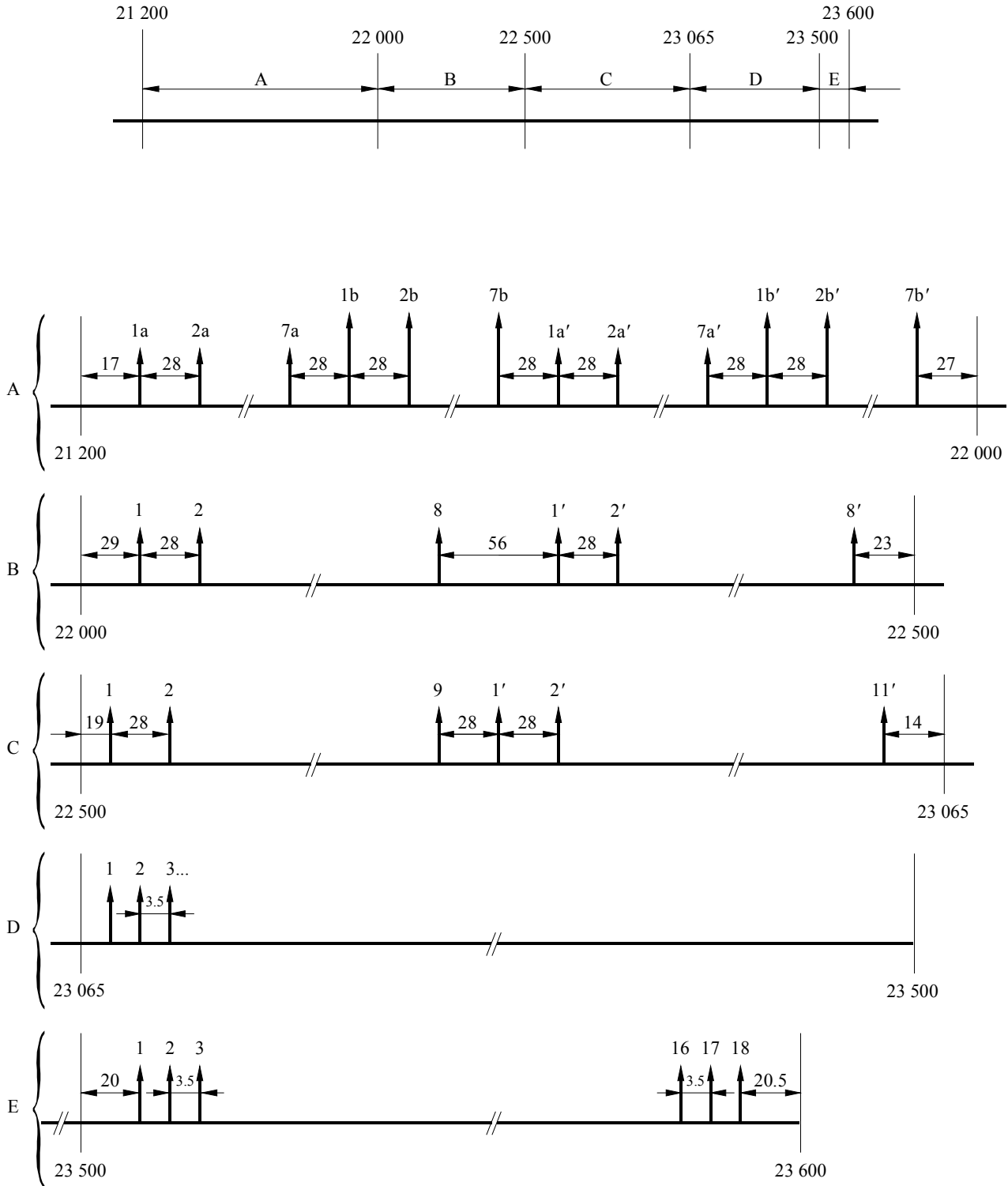
**RF channel arrangements in the band 21.2-23.6 GHz  
in accordance with *recommends 2* (France)**

In France, the use of the band 21.2-23.6 GHz is based on the homogeneous 3.5 MHz frequency pattern as shown in Fig. 2.

The applications are as follows:

- 21.2-22 GHz band (Part A of Fig. 2)  
Television picture transmission  
In this sub-band, two frequency plans are used as shown in Part A of Fig. 2
- 22-22.5 GHz band (Part B of Fig. 2)  
Television picture transmission and telephony or television picture information transmission at 34 Mbit/s
- 22.5-23.065 GHz band (Part C of Fig. 2)  
Television picture transmission, telephony or television information transmission at 34 Mbit/s as well as narrow-band type applications such as:
  - data transmission below 144 kbit/s,
  - additional stereophonic sound channel,
  - additional 2 Mbit/s point-to-point system,
  - TDMA point-to-multipoint system.For narrow-band systems, subdivision of each 28 MHz channel, on the basis of 7 MHz, is adopted.
- 23.065-23.5 GHz band (Part D of Fig. 2)  
FM and AM tele-distribution applications
- 23.5-23.6 GHz band (Part E of Fig. 2)  
Application for non-telephony use.

FIGURE 2  
**Radio-frequency channel arrangements for digital and analogue fixed wireless systems operating in the 21.2-23.6 GHz band (France)**  
 (All frequencies in MHz)



## ANNEX 3

**Radio-frequency channel arrangements for some CEPT administrations  
in the band 22.0-22.6 GHz paired with 23.0-23.6 GHz  
in accordance with *recommends 2***

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:

$$n = 1, \dots, 5$$

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

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

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

where:

$$n = 1, \dots, 9$$

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:

$$\text{lower half of the band: } f_n = f_0 + 805 + 14 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_{;n} = f_0 + 1813 + 14 n \quad \text{MHz}$$

where:

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

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

$$\text{lower half of the band: } f_n = f_0 + 808.5 + 7 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_{;n} = f_0 + 1816.5 + 7 n \quad \text{MHz}$$

where:

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

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

$$\text{lower half of the band: } f_n = f_0 + 805 + 3.5 n \quad \text{MHz}$$

$$\text{upper half of the band: } f'_{;n} = f_0 + 1813 + 3.5 n \quad \text{MHz}$$

where:

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

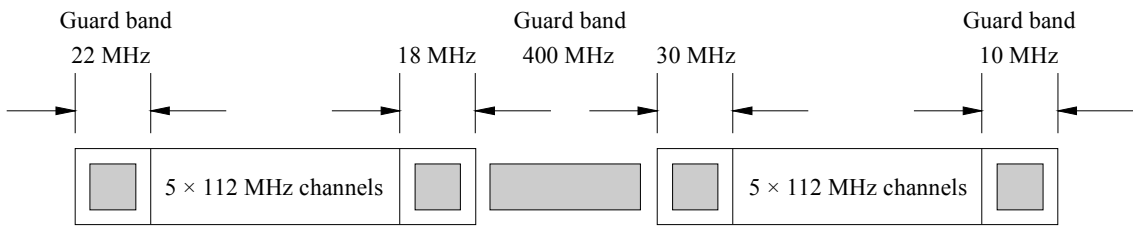
NOTE 1 – The radio-frequency channel arrangements of a) to f) above use channel centre frequencies  $f_n$  and  $f'_{;n}$  selected from the homogeneous pattern of *recommends 2*.

NOTE 2 – Figure 3 gives occupied spectrum in the 22.0-23.6 GHz band.

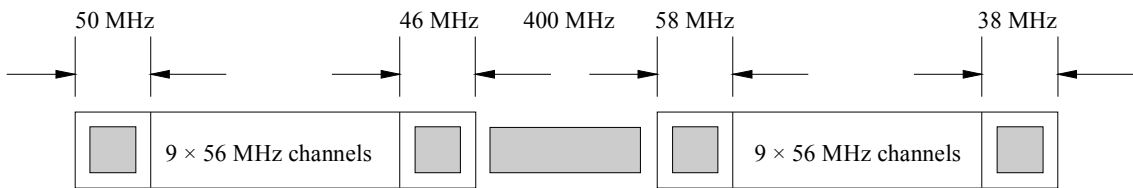
FIGURE 3

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

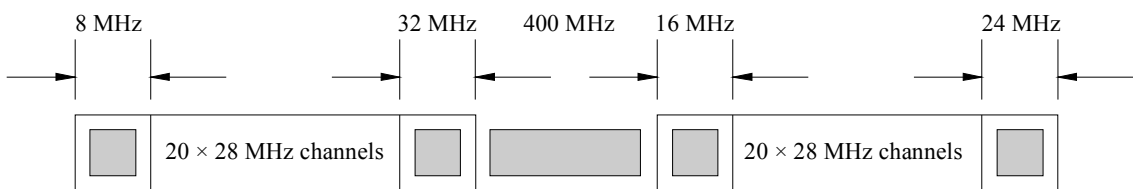
a) 112 MHz channels ( $7 \text{ MHz} \times 16$ )



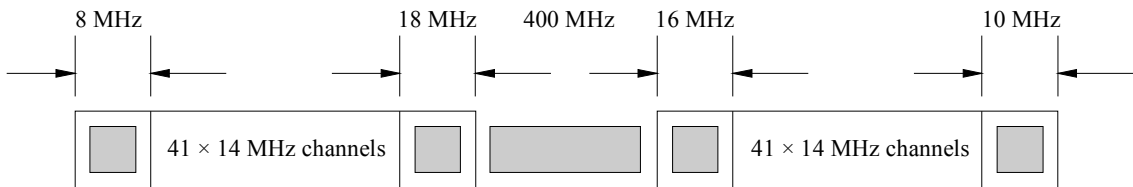
b) 56 MHz channels ( $7 \text{ MHz} \times 8$ )



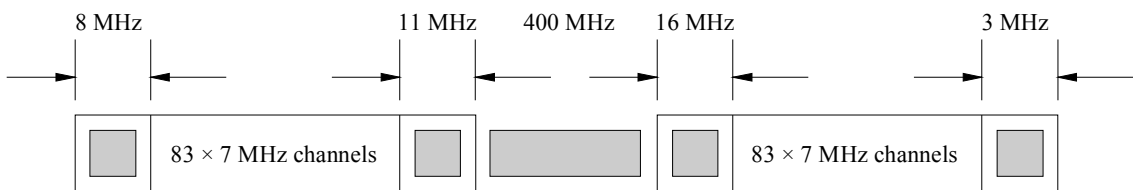
c) 28 MHz channels ( $7 \text{ MHz} \times 4$ )



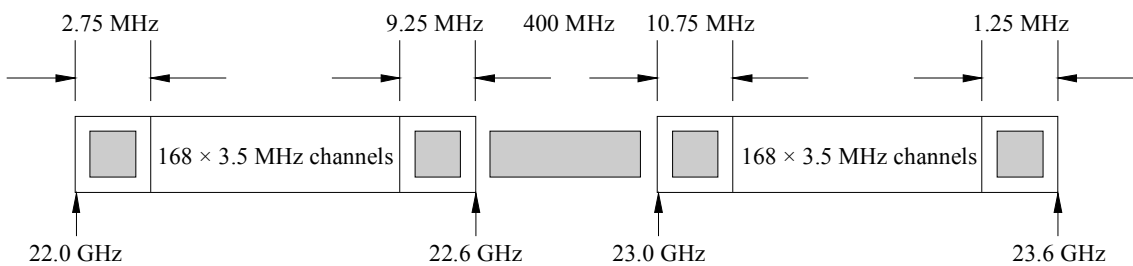
d) 14 MHz channels ( $7 \text{ MHz} \times 2$ )



e) 7 MHz channels



f) 3.5 MHz channels





ANNEX 4

**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 and Canada, 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.

ANNEX 5

**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 fixed wireless systems in the sub-band 21.4-22.0 GHz should be avoided.

The band plan based on WARC-92 decisions is shown in Fig. 4a.

FIGURE 4a  
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. 4a) for analogue and digital fixed wireless systems (2 Mbit/s to 155 Mbit/s) is described in detail in Fig. 4b.

FIGURE 4b  
 Radio-frequency channel arrangements for digital and analogue fixed wireless systems  
 operating in the band 21.2-23.6 GHz based on WARC-92 decisions (Germany)  
 (All frequencies in MHz)

