

## RECOMMENDATION ITU-R F.385-8

**Radio-frequency channel arrangements for fixed wireless systems operating in the 7 GHz band**

(Question ITU-R 136/9)

(1959-1963-1978-1982-1986-1990-1992-1994-2001-2005)

**Scope**

This Recommendation provides RF channel arrangements for fixed wireless systems (FWSs) operating in the 7 GHz band. The main text of as well as Annexes 1 to 5 to this Recommendation present a number of RF arrangements with channel separation of 28, 14, 7, 5 and 3.5 MHz in the frequency range 7 110-7 900 MHz.

The ITU Radiocommunication Assembly,

*considering*

- a) that FWSs at data rates up to 155 Mbit/s, including synchronous digital hierarchy bit rates, may operate in the 7 GHz band;
- b) that frequency bands 300 MHz wide may be available for such systems;
- c) that economy may be achieved if several go and return channels are connected to one common transmit-receive antenna;
- d) that many interfering effects can be minimized by a carefully planned arrangement of the radio frequencies in FWSs employing several RF channels;
- e) that, for reasons of frequency economy, it is desirable to interleave additional RF channels between those of the main pattern,

*recommends*

**1** that the preferred RF channel arrangement for several FWSs, operating in the 7 GHz band, should be derived as follows (see Fig. 1):

Let  $f_0$  be the frequency of the centre of the band of frequencies occupied (MHz),

$f_n$  be the centre frequency of one RF channel in the lower half of this band (MHz),

$f'_n$  be the centre frequency of one RF channel in the upper half of this band (MHz),

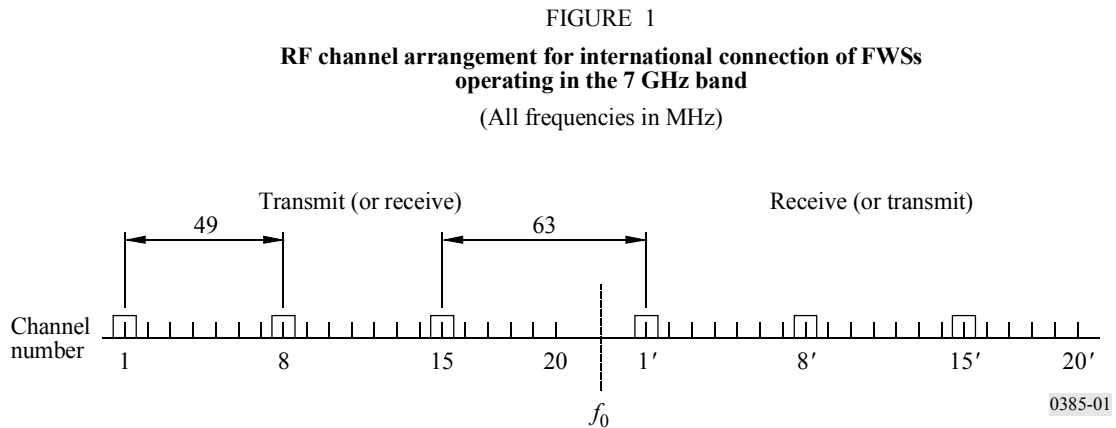
then the frequencies (MHz) of the individual channels are expressed by the following relationships:

$$\text{lower half of the band: } f_n = f_0 - 154 + 7n$$

$$\text{upper half of the band: } f'_n = f_0 + 7 + 7n$$

where:

$$n = 1, 2, 3, \dots, 20;$$



2 that, in a section over which the international connection is arranged, all the go channels should be in one half of the band and all the return channels should be in the other half of the band;

3 that, when common transmit-receive antennas are used and three RF channels are accommodated on a single antenna, it is preferable that the channel frequencies be selected by making:

$$n = 1, 8 \text{ and } 15, \text{ or}$$

$$n = 2, 9 \text{ and } 16, \text{ or}$$

$$n = 3, 10 \text{ and } 17, \text{ or}$$

$$n = 4, 11 \text{ and } 18, \text{ or}$$

$$n = 5, 12 \text{ and } 19, \text{ or}$$

$$n = 6, 13 \text{ and } 20,$$

in both halves of the band;

4 that for international connections, the centre frequency should preferably be:

$$f_0 = 7575 \text{ MHz for the band } 7425 \text{ to } 7725 \text{ MHz;}$$

other centre frequencies may be used in certain geographical areas by agreement between the administrations concerned, e.g.:

$$f_0 = 7275, 7400 \text{ or } 7700 \text{ MHz;}$$

5 that the channel arrangement and antenna polarization should be agreed between the administrations concerned;

6 that the RF channel arrangements, described in Annexes 1, 2, 3, 4 and 5, may be used.

**Annex 1**

**RF channel arrangement in the band 7 425-7 725 MHz  
with a channel spacing of 28 MHz**

1 This Annex describes a RF channel arrangement for digital FWSs of 34 Mbit/s capacity, operating in the band 7 425-7 725 MHz. The RF channel arrangement is shown in Fig. 2 and is derived as follows:

Let  $f_0$  be the frequency of the centre of the band of frequencies occupied (MHz),  
 $f_n$  be the centre frequency of one RF channel in the lower half of the band (MHz),  
 $f'_n$  be the centre frequency of one RF channel in the upper half of the band (MHz),

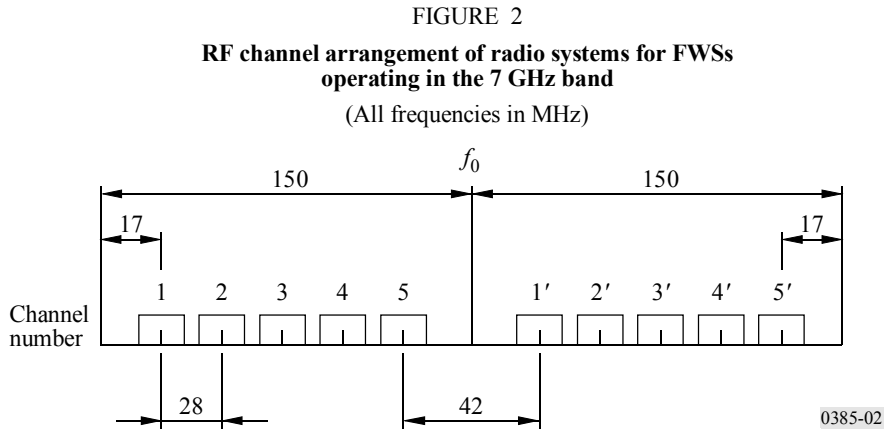
then the frequencies (MHz) of the individual channels are expressed by the following relationships:

lower half of the band:  $f_n = f_0 - 161 + 28 n$

upper half of the band:  $f'_n = f_0 - 7 + 28 n$

where:

$n = 1, 2, 3, 4$  and 5.



2 All go channels should be in one half of the band and all return channels should be in the other half of the band.

3 For adjacent RF channels in the same half of the band, different polarizations may be used for alternate channels or where it is possible, both polarizations may be utilized for each digital radio-frequency channel.

4 When additional digital radio frequencies interleaved between those of the main pattern of Fig. 2 are required, they can be realized by the same  $f_0$  and the following relationship:

lower half of the band:  $f_n = f_0 - 147 + 28 n$

upper half of the band:  $f'_n = f_0 + 7 + 28 n$

where:

$n = 1, 2, 3$  and 4.

5 The preferred centre frequency  $f_0$  is 7 575 MHz.

6 The local oscillators for the lower half of the band should preferably be 70 MHz above the respective channel frequency and for the upper half of the band 70 MHz below the channel frequency. This will ensure that the image frequencies will fall within the band. However, the application of certain techniques, particularly the use of image frequency rejection mixers, helps to overcome this constraint.

## Annex 2

### RF channel arrangement in the band 7 435-7 750 MHz with channel spacings of 5, 10 or 20 MHz

1 This Annex describes a RF channel arrangement suitable for digital FWSs up to 19 Mbit/s ( $1.544 \times 12$ ) and allows coexistence of digital systems and medium capacity analogue systems spaced on a 20 MHz interval operating in the band 7 435-7 750 MHz. The RF channel arrangement is shown in Fig. 3 and is derived as follows:

Let  $f_0$  be the frequency of the centre of the band of frequencies occupied (MHz),  
 $f_n$  be the centre frequency of one RF channel in the lower half of the band (MHz),  
 $f'_n$  be the centre frequency of one RF channel in the upper half of the band (MHz),

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

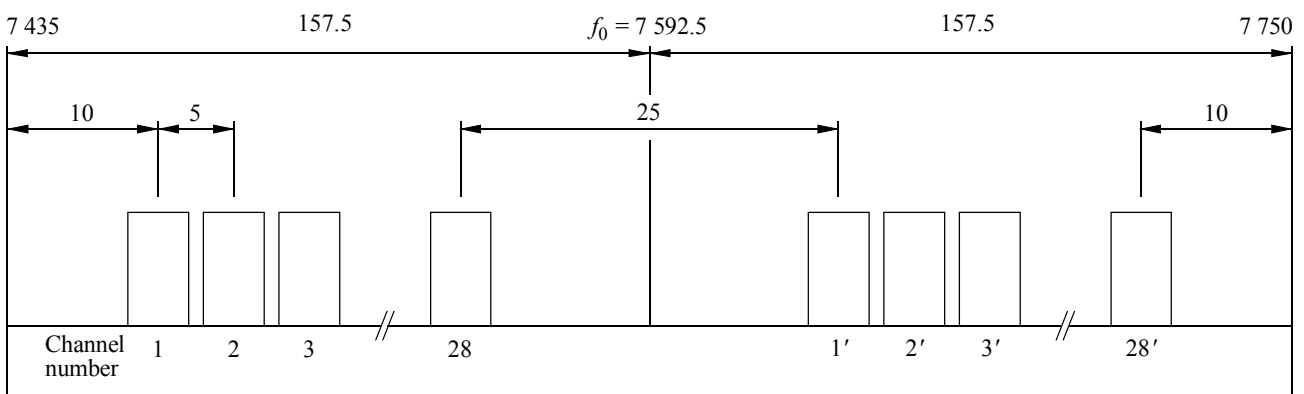
$$\text{lower half of the band: } f_n = f_0 - 152.5 + 5n$$

$$\text{upper half of the band: } f'_n = f_0 + 7.5 + 5n$$

where:

$$n = 1, 2, 3, 4, 5, 6, \dots, 28.$$

FIGURE 3  
RF channel arrangement for digital systems operating in the 7 GHz band  
(All frequencies in MHz)



2 All go channels should be in one half of the band and all return channels should be in the other half of the band.

3 The centre frequency  $f_0$  is 7 592.5 MHz.

4 For all RF channels in the same half of the band, the same polarization may be used or, where it is necessary because of the existence of interference, different polarizations may be utilized.

Where it is possible, both polarizations may be utilized for each digital RF channel.

5 Digital RF channels for 12.6 Mbit/s ( $1.544 \times 8$ ) or 19 Mbit/s ( $1.544 \times 12$ ) systems, can be realized by use of a 10 or 20 MHz interval.

### Annex 3

#### RF channel arrangement in the band 7 110-7 750 MHz with a channel spacing of 28 MHz

This Annex describes a RF channel arrangement for the 7 GHz band.

The arrangement provides for up to ten go and ten return channels, each accommodating about 140 Mbit/s subdivided in two groups of five go and five return channels relating to the lower part and the higher part of the band.

The RF channel arrangement is as shown in Fig. 4 and is derived as follows:

Let  $f_{0l}$  be the frequency at the centre of the lower part of the band:

$$f_{0l} = 7\,275 \text{ MHz,}$$

$f_{0h}$  be the frequency at the centre of the higher part of the band:

$$f_{0h} = 7\,597 \text{ MHz,}$$

$f_{nl}$  be the centre frequency of one RF channel in the lower half of the lower part of the band,

$f'_{nl}$  be the centre frequency of one RF channel in the upper half of the lower part of the band,

$f_{nh}$  be the centre frequency of one RF channel in the lower half of the higher part of the band,

$f'_{nh}$  be the centre frequency of one RF channel in the upper half of the higher part of the band,

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

$$f_{nl} = f_{0l} - 182 + 28 n$$

$$f'_{nl} = f_{0l} + 14 + 28 n$$

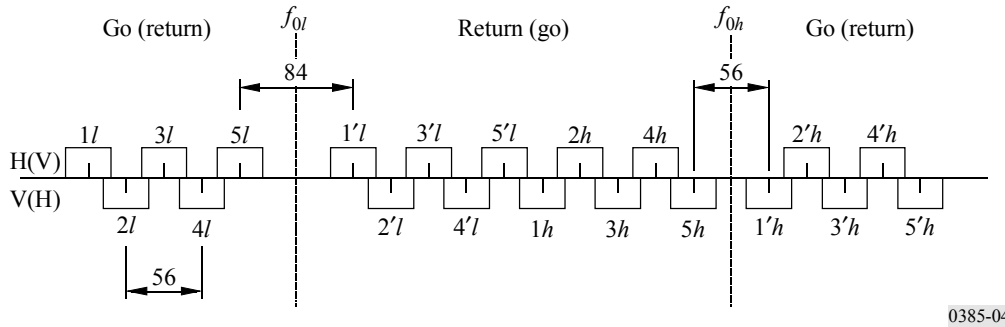
$$f_{nh} = f_{0h} - 168 + 28 n$$

$$f'_{nh} = f_{0h} + 28 n$$

where:

$$n = 1, 2, 3, 4, 5.$$

FIGURE 4  
**RF channel arrangement for the 7 GHz band**  
 (All frequencies in MHz)



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## Annex 4

### RF channel arrangement in the band 7425-7900 MHz with a channel spacing up to 28 MHz

**1** This Annex describes a RF channel arrangement suitable for digital FWSs with a channel spacing up to 28 MHz, and makes provision for eight 28 MHz channels.

The radio-frequency channel arrangement is shown in Fig. 5 and is derived as follows:

Let  $f_0$  be the frequency of the centre of the band of frequencies occupied (MHz),

$f_n$  be the centre frequency of one RF channel in the lower half of the band (MHz),

$f'_n$  be the centre frequency of one RF channel in the upper half of the band (MHz),

then the frequencies (MHz) of individual 28 MHz channels are expressed by the following relationships:

$$f_n = f_0 - 248.5 + 28n$$

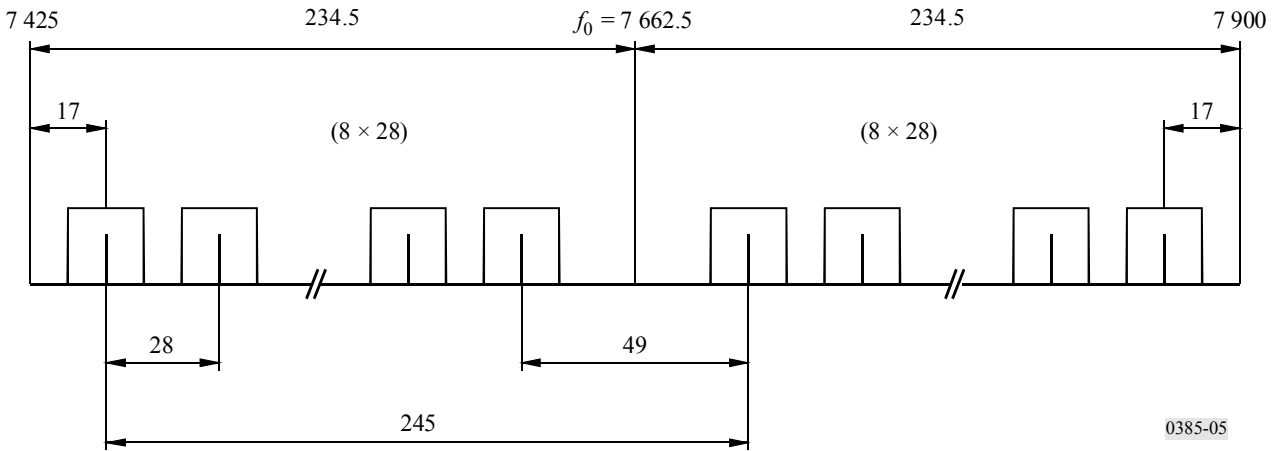
$$f'_n = f_0 - 3.5 + 28n$$

where:

$$n = 1 \text{ to } 8.$$

**2** The eight channels with a spacing of 28 MHz can be subdivided to provide 16 channels with a spacing of 14 MHz or 32 channels with a spacing of 7 MHz. The 28 MHz and 14 MHz channels are centred on the 7 MHz pattern of *recommends* 1 and 4, whilst the 7 MHz channels are interleaved with an offset of 3.5 MHz.

FIGURE 5  
**RF channel arrangement for digital systems operating in the band 7 425-7 900 MHz**  
 (All frequencies in MHz)



The frequencies (MHz) of individual channels are expressed by the following relationships:

for 14 MHz channels:

$$f_n = f_0 - 241.5 + 14 n$$

$$f'_n = f_0 + 3.5 + 14 n$$

where:

$$n = 1 \text{ to } 16$$

for 7 MHz channels:

$$f_n = f_0 - 238 + 7 n$$

$$f'_n = f_0 + 7 + 7 n$$

where:

$$n = 1 \text{ to } 32.$$

**3** All go channels should be in one half of the band and all return channels should be in the other half of the band.

**4** The centre frequency  $f_0$  is 7 662.5 MHz.

NOTE 1 – The first five channels with a spacing of 28 MHz in the lower sub-band of the above channel arrangement align with those in Annex 1, covering the 7 425-7 725 MHz band. The go-return spacing is greater as a result of using the full 7 425-7 900 MHz band.

## Annex 5

### RF channel arrangement for FWSs operating in the 7250-7550 MHz band with channel spacings of 28, 14, 7 and 3.5 MHz

This Annex describes a RF channel arrangement suitable for digital FWSs with channel spacings of 28, 14, 7 and 3.5 MHz.

The RF channel arrangement is shown in Fig. 6 and is derived as follows:

Let  $f_0$  be the frequency of the centre of the band of frequencies occupied (MHz),  
 $f_n$  be the centre frequency of one RF channel in the lower half of the band (MHz),  
 $f'_n$  be the centre frequency of one RF channel in the upper half of the band (MHz),  
 $f_0 = 7400$  MHz,  
 duplex spacing = 161 MHz.

Then the frequencies (MHz) of individual channels are expressed by the following relationships:

a) for a channel separation of 28 MHz:

$$f_n = f_0 - 161 + 28 n$$

$$f'_n = f_0 + 28 n \quad \text{where } n = 1, 2, \dots, 5$$

b) for a channel separation of 14 MHz:

$$f_n = f_0 - 154 + 14 n$$

$$f'_n = f_0 + 7 + 14 n \quad \text{where } n = 1, 2, \dots, 9$$

c) for a channel separation of 7 MHz:

$$f_n = f_0 - 154 + 7 n$$

$$f'_n = f_0 + 7 + 7 n \quad \text{where } n = 1, 2, \dots, 20$$

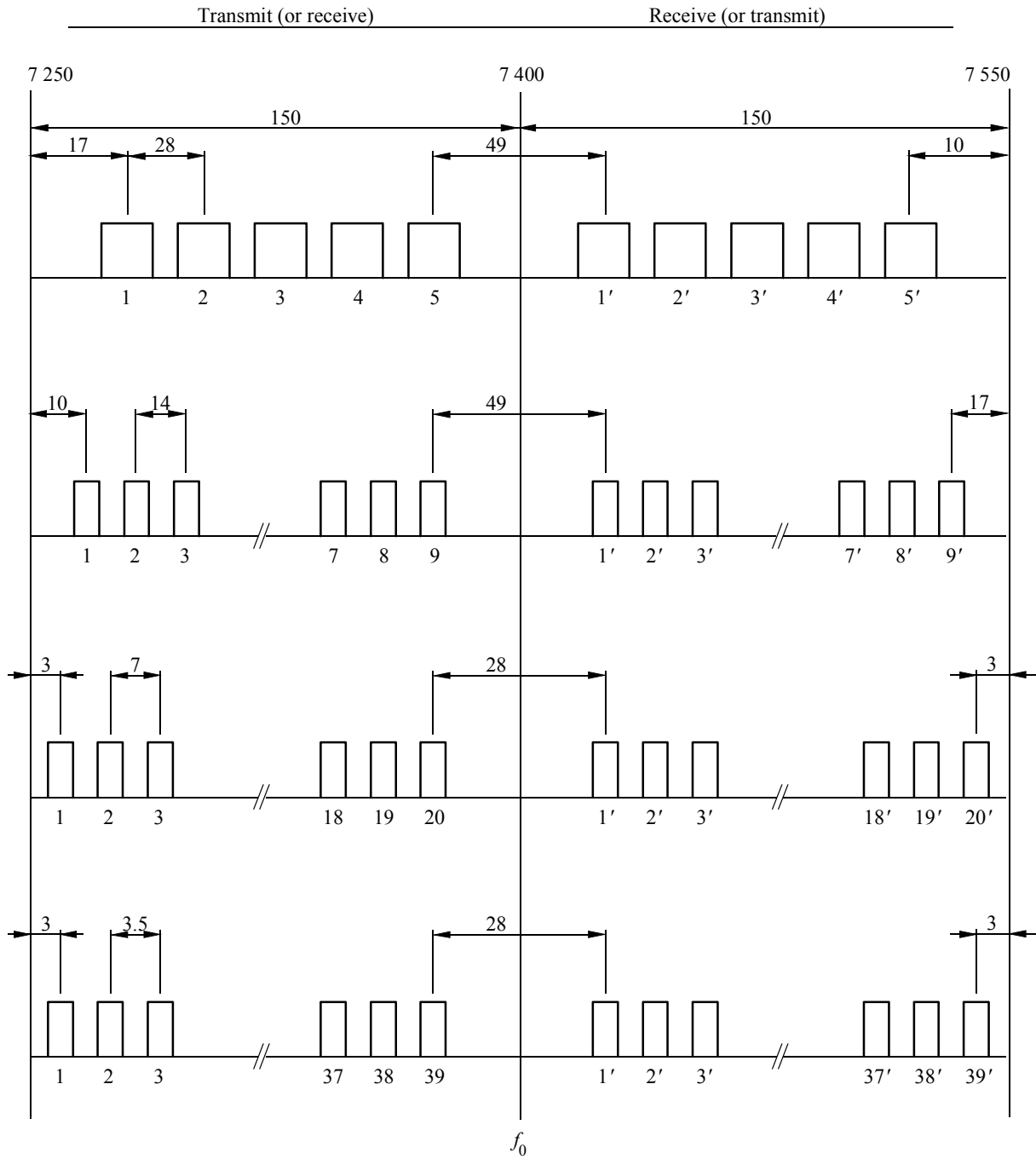
d) for a channel separation of 3.5 MHz:

$$f_n = f_0 - 150.5 + 3.5 n$$

$$f'_n = f_0 + 10.5 + 3.5 n \quad \text{where } n = 1, 2, \dots, 39$$



FIGURE 6  
**RF channel arrangement for FWSs operating in the 7 GHz band  
 with channel spacings of 28, 14, 7 and 3.5 MHz**  
 (All frequencies in MHz)



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NOTE 1 – For the channel spacing of 28 MHz, channel  $f'_5$  may exceed the upper boundary of the 7250-7550 MHz band by 4 MHz, when a channel bandwidth of 28 MHz is used.

NOTE 2 – For the channel spacing of 7 MHz, channel  $f_1$  may exceed the lower boundary and channel  $f'_{20}$  may exceed the upper boundary of the 7250-7550 MHz by 0.5 MHz, when a channel bandwidth of 7 MHz is used.