



# ECC Recommendation (14)06

Implementation of Fixed Service Point-to-Point narrow channels (3.5 MHz, 1.75 MHz, 0.5 MHz, 0.25 MHz, 0.025 MHz) in the guard bands and center gaps of the lower 6 GHz (5925 to 6425 MHz) and upper 6 GHz (6425 to 7125 MHz) bands

**Approved 19 September 2014**

**Amended May 2015**

## **INTRODUCTION**

ECC Report 215 provides the technical feasibility of introducing narrow channel spacings in guard bands and center gaps of Fixed Service channel arrangement defined in ERC/REC 14-01 (5925-6425 MHz) and ERC/REC 14-02 (6425-7125 MHz). This Recommendation provides options for administrations consideration.

**ECC RECOMMENDATION (14)06 OF 19 SEPTEMBER 2014 IMPLEMENTATION OF FIXED SERVICE POINT-TO-POINT NARROW CHANNELS (3.5 MHz, 1.75 MHz, 0.5 MHz, 0.25 MHz, 0.025 MHz) IN THE GUARD BANDS AND CENTER GAPS OF THE LOWER 6 GHz (5925-6425 MHz) AND UPPER 6 GHz (6425-7125 MHz) BANDS AMENDED 8 MAY 2015**

“The European Conference of Postal and Telecommunications Administrations,

*considering*

- a) ERC/REC 14-01 defines channels arrangements for high capacity analogue and digital radio-relay systems operating in the band 5925 -6425 MHz;
- b) that ERC/REC 14-02 defines channels arrangements for high, medium and low capacity digital fixed service systems operating in the band 6425-7125 MHz;
- c) that the whole band from 5925 to 7125 MHz is allocated in the CEPT and ITU to the fixed service on a primary basis;
- d) there are technical and economic advantages in adopting harmonized channel plans which favors equipment development;
- e) that ECC Report 215 provides the technical feasibility of introducing narrow channel spacing (25 kHz to 3.5 MHz) in guard bands and center gaps of FWS channel arrangements at 6 GHz;
- f) that ECC Report 215 demonstrates that the 6 GHz band is suitable for introducing narrow channels without causing harmful interferences to other services with appropriate mitigation techniques ensuring compatibility between fixed links and satellite services;
- g) that some administrations use other FS applications different to radio-relay systems in frequency bands 5925- 6425 MHz and 6425-7125 MHz, and therefore some additional measures for coordination in cross border areas may be required;

*recommends*

1. that administrations wishing to implement narrow channels in the lower part of the 6 GHz band, should refer to the channel arrangement described in Annex 1 (and illustrated in Annex 3);
2. that administrations wishing to implement narrow channels in the upper part of the 6 GHz band, should refer to the channel arrangement described in Annex 2 (and illustrated in Annex 3).

*Note:*

*Please check the Office documentation database <http://www.ecodocdb.dk> for the up to date position on the implementation of this and other ECC Recommendations.*

## ANNEX 1: IMPLEMENTATION OF NARROW CHANNELS IN THE GUARD BANDS AND CENTER GAP OF THE 5925-6425 MHz BAND

### A1.1 DERIVATION OF RADIO FREQUENCY CHANNELS

The radio frequency channel arrangement for carrier spacings of 3.5 MHz, 1.75 MHz, 0.5 MHz, 0.25 MHz and 0.025 MHz shall be derived as follows:

Let

$f_0$  be the frequency (MHz) of the center of the band of frequencies occupied,  $f_0 = 6302.4$  MHz;

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

$f_n'$  be the center frequency (MHz) of one radio-frequency channel in the upper half of the band;

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

- a) for systems with a carrier spacing of 3.5 MHz:  
 lower half of the band:  $f_n = f_0 - 134.405 + 3.5 n$   
 upper half of the band:  $f_n' = f_0 + 120.403 + 3.5 n$  where  $n = 1, 2, 3$ .
- b) for systems with a carrier spacing of 1.75 MHz:  
 lower half of the band:  $f_n = f_0 - 133.53 + 1.75 n$   
 upper half of the band:  $f_n' = f_0 + 121.278 + 1.75 n$  where  $n = 1, 2, 3, 4, 5, 6$ .
- c) for systems with a carrier spacing of 0.5 MHz:  
 lower half of the band:  $f_n = f_0 - 132.905 + 0.5 n$   
 upper half of the band:  $f_n' = f_0 + 121.903 + 0.5 n$  where  $n = 1, 2, \dots, 20, 21$ .
- d) for systems with a carrier spacing of 0.25 MHz:  
 lower half of the band:  $f_n = f_0 - 132.78 + 0.25 n$   
 upper half of the band:  $f_n' = f_0 + 122.028 + 0.25 n$  where  $n = 1, 2, \dots, 41, 42$ .
- e) for systems with a carrier spacing of 0.025 MHz:  
 lower half of the band:  $f_n = f_0 - 132.6675 + 0.025 n$   
 upper half of the band:  $f_n' = f_0 + 122.1405 + 0.025 n$  where  $n = 1, 2, \dots, 419, 420$ .

**Table 1: Calculated parameters according to Recommendation ITU-R F.746**

XS (MHz)	n	$f_1$ (MHz)	$f_n$ (MHz)	$f_1'$ (MHz)	$f_n'$ (MHz)	YS (MHz)	DS (MHz)
3.5	1...3	6171.495	6178.495	6426.303	6433.303	247.808	254.808
1.75	1...6	6170.62	6179.37	6425.428	6434.178	246.058	254.808
0.5	1.....21	6169.995	6179.995	6424.803	6434.803	244.808	254.808
0.25	1.....42	6169.87	6180.12	6424.678	6434.928	244.558	254.808
0.025	1....420	6169.7575	6180.2325	6424.5655	6435.0405	244.333	254.808

XS Separation between centre frequencies of adjacent channels;

YS Separation between centre frequencies of the closest go and return channels;

Z1S Separation between the lower band edge and the centre frequency of the first channel;

Z2S Separation between centre frequencies of the final channel and the upper band edge;

DS Duplex spacing ( $f_n' - f_n$ ).

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6440 MHz

a) 3.5 MHz channels				
2.17 MHz	3 x 3.5 MHz	244.308 MHz	3 x 3.5 MHz	4.947 MHz (note 1)
b) 1.75 MHz channels				
2.17 MHz	6 x 1.75 MHz	244.308 MHz	6 x 1.75 MHz	4.947 MHz (note 1)
c) 0.5 MHz channels				
2.17 MHz	21 x 0.5 MHz	244.308 MHz	21 x 0.5 MHz	4.947 MHz (note 1)
d) 0.25 MHz channels				
2.17 MHz	42 x 0.25 MHz	244.308 MHz	42 x 0.25 MHz	4.947 MHz (note 1)
e) 0.025 MHz channels				
2.17 MHz	420 x 0.025 MHz	244.308 MHz	420 x 0.025 MHz	4.947 MHz

**Figure 1: Occupied spectrum**

Note: This figure depicts the occupied spectrum by the narrow channels in the lower part of the band simultaneously implemented with 40 MHz bandwidth channels in the U6 band. In case of implementation of 30 MHz bandwidth channels in the U6 band, 5 MHz must to be added to the upper guard band (e.g. 9.947 MHz instead of 4.947 MHz).

## ANNEX 2: IMPLEMENTATION OF NARROW CHANNELS IN THE GUARD BANDS AND CENTER GAP OF THE 6425 - 7125 MHz BAND

### A2.1 IMPLEMENTATION OF NARROW CHANNELS (40 MHz CHANNELS)

#### A2.1.1 Derivation of radio frequency channel

The radio frequency channel arrangement for carrier spacings of 3.5 MHz, 1.75 MHz, 0.5 MHz, 0.25 MHz and 0.025 MHz shall be derived as follows:

Let

$f_0$  be the frequency (MHz) of the center of the band of frequencies occupied,  $f_0 = 6\,941.25$  MHz;

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

$f_n'$  be the center frequency (MHz) of one radio-frequency channel in the upper half of the band;

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

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

lower half of the band:  $f_n = f_0 - 180 + 3.5 n$

upper half of the band:  $f_n' = f_0 + 162.5 + 3.5 n$

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

b) for systems with a carrier spacing of 1.75 MHz:

lower half of the band:  $f_n = f_0 - 179.125 + 1.75 n$

upper half of the band:  $f_n' = f_0 + 163.375 + 1.75 n$

where  $n = 1, 2, \dots, 7, 8$ .

d) for systems with a carrier spacing of 0.5 MHz:

lower half of the band:  $f_n = f_0 - 178.5 + 0.5 n$

upper half of the band:  $f_n' = f_0 + 164 + 0.5 n$

where  $n = 1, 2, \dots, 27, 28$ .

e) for systems with a carrier spacing of 0.25 MHz:

lower half of the band:  $f_n = f_0 - 178.375 + 0.25 n$

upper half of the band:  $f_n' = f_0 + 164.125 + 0.25 n$

where  $n = 1, 2, \dots, 55, 56$ .

f) for systems with a carrier spacing of 0.025 MHz:

lower half of the band:  $f_n = f_0 - 178.2625 + 0.025 n$

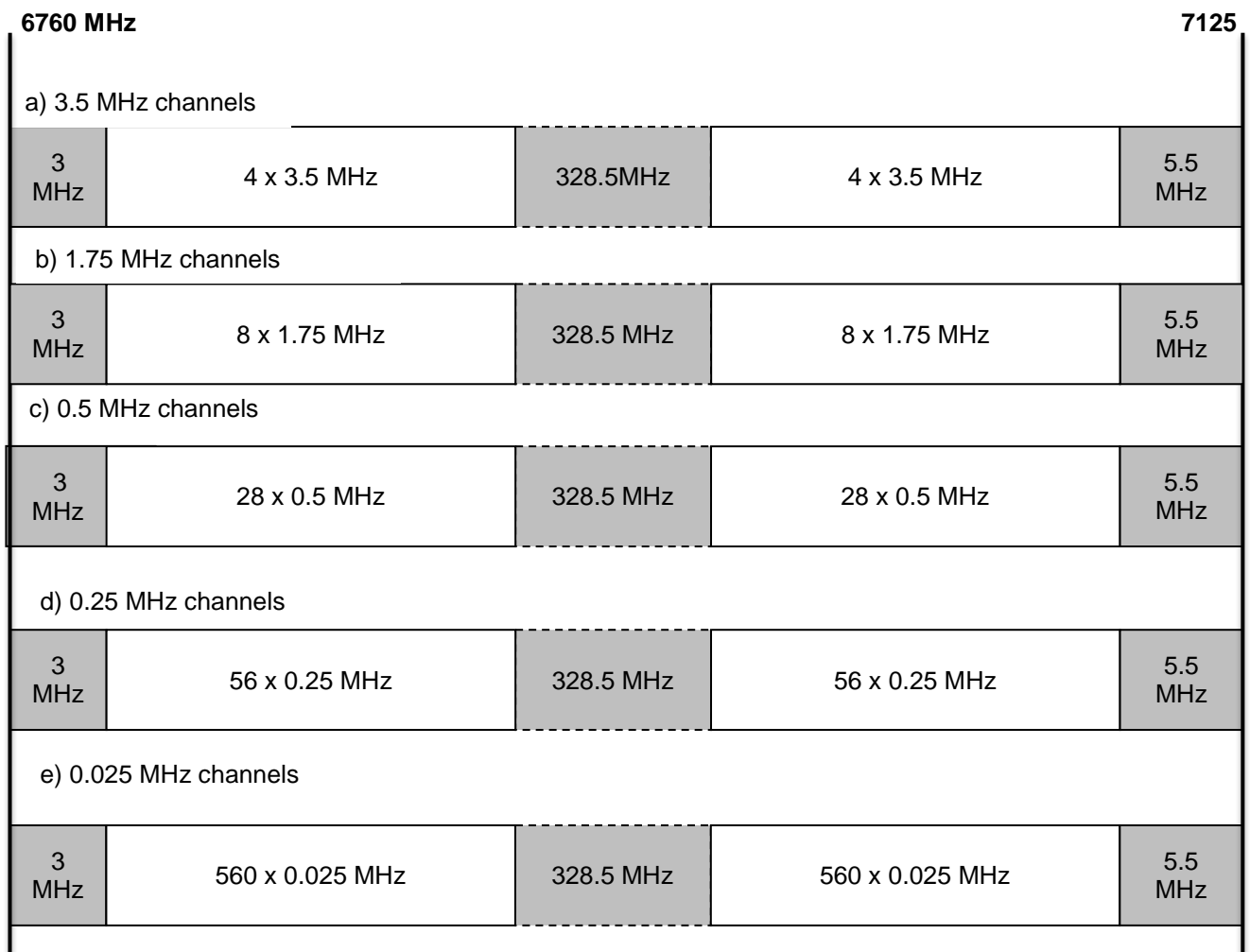
upper half of the band:  $f_n' = f_0 + 164.2375 + 0.025 n$

where  $n = 1, 2, \dots, 559, 560$ .

**Table 2: Calculated parameters according to Recommendation ITU-R F.746**

XS (MHz)	n	f <sub>1</sub> (MHz)	f <sub>n</sub> (MHz)	f <sub>1</sub> ' (MHz)	f <sub>n</sub> ' (MHz)	YS (MHz)	DS (MHz)
3.5	1...4	6764.75	6775.25	7107.25	7117.75	332	342.5
1.75	1...8	6763.875	6776.125	7106.375	7118.625	330.25	342.5
0.5	1.....28	6763.25	6776.75	7105.75	7119.25	329	342.5
0.25	1.....56	6763.125	6776.875	7105.625	7119.375	328.75	342.5
0.025	1....560	6763.0125	6776.9875	7105.5125	7119.4875	328.525	342.5

- XS Separation between centre frequencies of adjacent channels;
- YS Separation between centre frequencies of the closest go and return channels;
- Z1S Separation between the lower band edge and the centre frequency of the first channel;
- Z2S Separation between centre frequencies of the final channel and the upper band edge;
- DS Duplex spacing (f<sub>n</sub>' - f<sub>n</sub>).



**Figure 2: Occupied spectrum**



## A2.2 IMPLEMENTATION OF NARROW CHANNELS AND 30 MHz CHANNELS

### A2.2.1 Derivation of radio frequency channel

The radio frequency channel arrangement for carrier spacings of 3.5 MHz, 1.75 MHz, 0.5 MHz, 0.25 MHz and 0.025 MHz shall be derived as follows:

Let

$f_0$  be the frequency (MHz) of the center of the band of frequencies occupied,  $f_0 = 6\,950$  MHz,

$f_n$  be the center frequency (MHz) of one radio-frequency channel in the lower half of the band,

$f_n'$  be the center frequency (MHz) of one radio-frequency channel in the upper half of the band,

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

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

lower half of the band:  $f_n = f_0 - 175.25 + 3.5 n$

upper half of the band:  $f_n' = f_0 + 164.75 + 3.5 n$  where  $n = 1, 2$ .

b) for systems with a carrier spacing of 1.75 MHz:

lower half of the band:  $f_n = f_0 - 174.375 + 1.75 n$

upper half of the band:  $f_n' = f_0 + 165.625 + 1.75 n$  where  $n = 1, 2, 3, 4$ .

c) for systems with a carrier spacing of 0.5 MHz:

lower half of the band:  $f_n = f_0 - 173.75 + 0.5 n$

upper half of the band:  $f_n' = f_0 + 166.25 + 0.5 n$  where  $n = 1, 2, \dots, 9, 14$ .

d) for systems with a carrier spacing of 0.25 MHz:

lower half of the band:  $f_n = f_0 - 173.625 + 0.25 n$

upper half of the band:  $f_n' = f_0 + 166.375 + 0.25 n$  where  $n = 1, 2, \dots, 27, 28$ .

e) for systems with a carrier spacing of 0.025 MHz:

lower half of the band:  $f_n = f_0 - 173.5125 + 0.025 n$

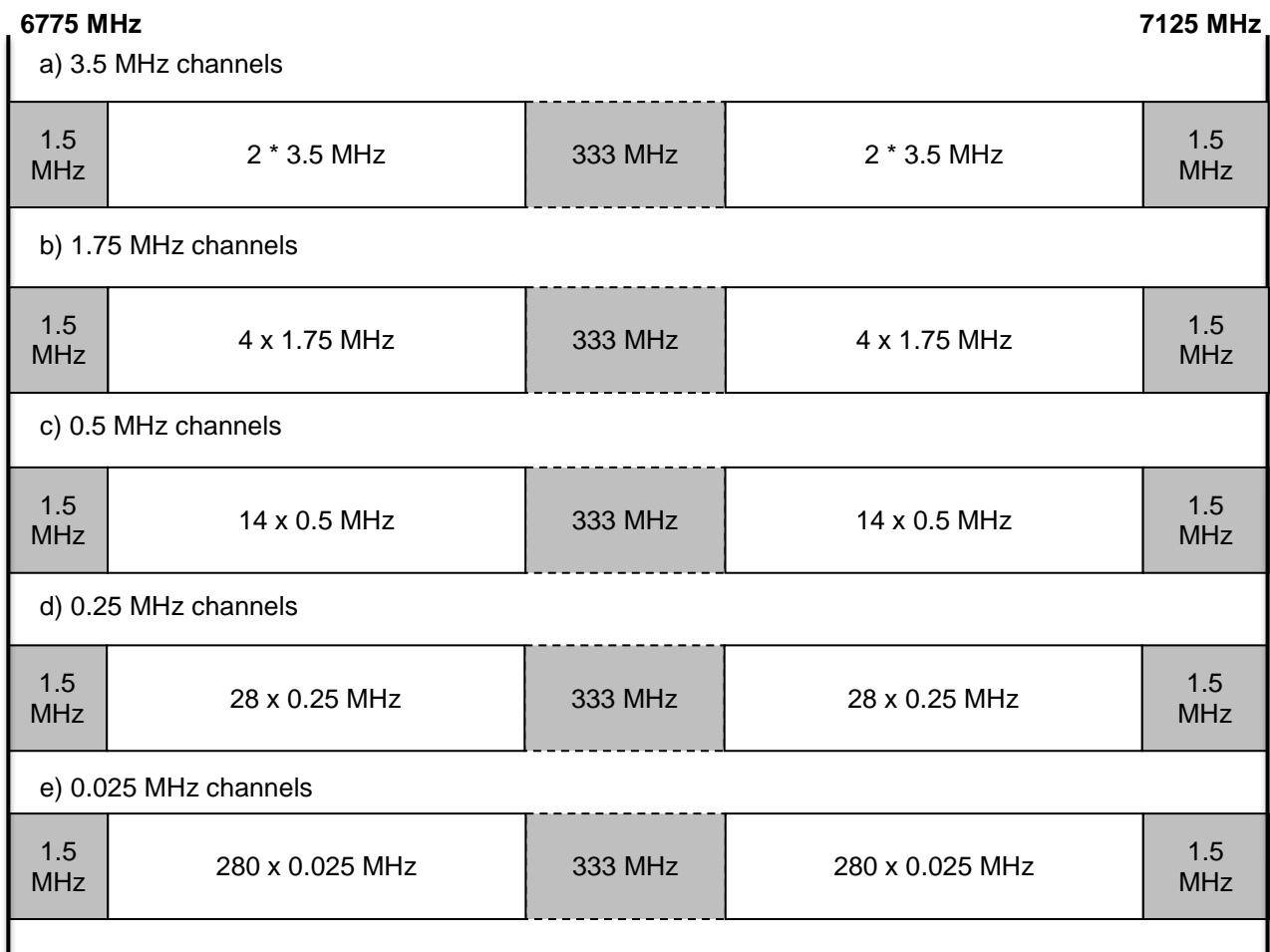
upper half of the band:  $f_n' = f_0 + 166.4875 + 0.025 n$  where  $n = 1, 2, \dots, 199, 280$ .

**A2.2.2 Calculated parameters according to Recommendation ITU-R F.746**

**Table 3: Calculated parameters according to Recommendation ITU-R F.746**

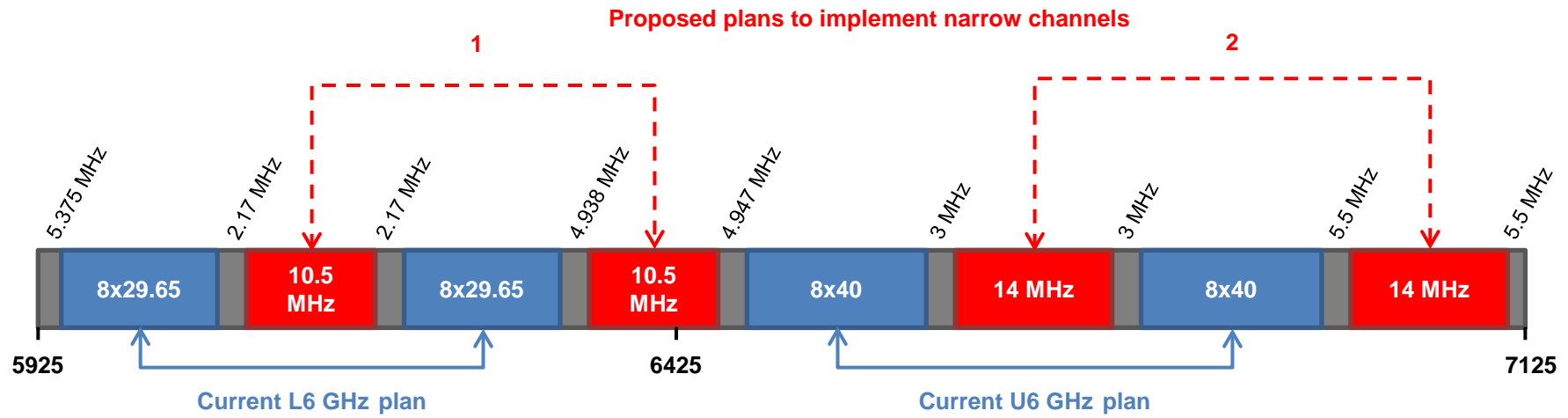
XS (MHz)	n	f <sub>1</sub> (MHz)	f <sub>n</sub> (MHz)	f <sub>1</sub> ' (MHz)	f <sub>n</sub> ' (MHz)	YS (MHz)	DS (MHz)
3.5	1.2	6778.25	6781.75	7118.25	7121.75	336.5	340
1.75	1...4	6777.375	6782.625	7117.375	7122.625	334.75	340
0.5	1...14	6776.75	6783.25	7116.75	7123.25	333.5	340
0.25	1...28	6776.625	6783.375	7116.625	7123.375	333.25	340
0.025	1...280	6776.5125	6783.4875	7116.5125	7123.4875	333.025	340

- XS Separation between centre frequencies of adjacent channels;
- YS Separation between centre frequencies of the closest go and return channels;
- Z1S Separation between the lower band edge and the centre frequency of the first channel;
- Z2S Separation between centre frequencies of the final channel and the upper band edge;
- DS Duplex spacing (f<sub>n</sub>' - f<sub>n</sub>).

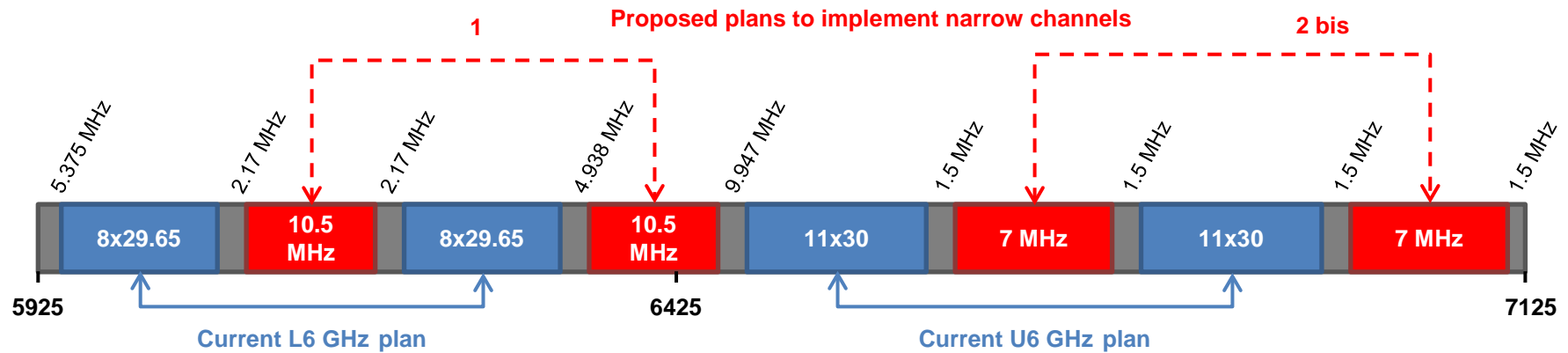


**Figure 3: Occupied spectrum**

**ANNEX 3: ILLUSTRATIONS OF THE IMPLEMENTATION OF NARROW CHANNELS IN THE 6 GHz BAND**



**Figure 4: Illustration of implementation of narrow channels in the lower part of the 6 GHz band and 40 MHz channels in the U6 band**



**Figure 5: Illustration of implementation of narrow channels in the lower part of the 6 GHz band and 30 MHz channels in the U6 band**

#### **ANNEX 4: LIST OF REFERENCE**

- [1] ERC Recommendation 14-01: radio-frequency channel arrangements for high capacity analogue and digital radio-relay systems operating in the band 5925 -6425 MHz
- [2] ERC Recommendation 14-02: radio-frequency channel arrangements for high, medium and low capacity digital fixed service systems operating in the band 6425-7125 MHz
- [3] ECC Report 215: Assessment of the technical feasibility of introducing very narrow channel spacing in some existing plans, in guard bands and center gaps of FWS channel arrangement at 6 GHz and 10 GHz