

CEPT/ERC/RECOMMENDATION T/R 14-04 E (Podebrady 1997)**HARMONIZED RADIO FREQUENCY CHANNEL ARRANGEMENTS AND BLOCK ALLOCATIONS
FOR LOW, MEDIUM AND HIGH CAPACITY SYSTEMS
IN THE BAND 3600 MHz TO 4200 MHz**

Recommendation adopted by the Working Group "Spectrum Engineering" (WGSE):

"The European Conference of Postal and Telecommunications Administrations

considering

- 1) that CEPT has a long term objective to harmonise the use of frequencies throughout Europe;
- 2) that CEPT should develop radio frequency channel arrangements and block allocation rules in order to make the most effective use of the spectrum for point to point (P-P) and point to multipoint (P-MP) applications;
- 3) that the achievement of harmonisation requires the adoption of a minimum number of channel arrangements and block allocation rules;

noting

- a) that Article S.5 of the Radio Regulations allocates the band 3600 MHz to 4200 MHz on a primary basis to the Fixed and Fixed - Satellite service and on a secondary basis to the Mobile service;
- b) that current use of the band 3600 - 4200 MHz in most European countries is according to ITU-R Recommendation F.635 and/or Recommendation F.382;
- c) that ITU-R Recommendation F.635 only sets a basic raster of 10 MHz without defining a specific channel spacing or a duplex spacing;
- d) that ITU-R Recommendation F.382 only uses the band segment 3800-4200 MHz requiring a proposal for a harmonisation of the remaining band 3600-3800 MHz;
- e) that in most European countries there is a need for medium and high capacity radio relay systems for long range applications and/or the allocation of additional spectrum for P-MP systems in the band 3600-4200 MHz;
- f) that the use of the channel arrangements described in Annex A herein for 20/40 MHz channels, results in channel 1 in the lower half of the band extending into the adjacent band 3400 - 3600 MHz;
- g) that frequency separation may be required for un-coordinated deployment of current and future systems;
- h) that cellular deployment of P-MP systems preferably requires the allocation of continuous spectrum to the operator;
- i) that frequency allocations in the neighbouring 3400-3600 MHz band will be based on slots of 0.25 MHz, according to the ERC Recommendation TR 14-03;

recommends

that CEPT administrations having the band 3600-4200 MHz available for the fixed service should adopt channel arrangements in accordance with either:

1) Annex A

which is based on ITU-R Recommendation F.635 for the frequency range 3600-4200 MHz with channel spacings of 40 or 30 MHz and a duplex spacing of 320 MHz;

or

2) Annex B

which is based on ITU-R Recommendation F.382 for the frequency range 3800-4200 MHz and on channel and block allocations derived from frequency slots of 0.25 MHz for the remaining band, 3600-3800 MHz. This latter band may be used for low capacity P-MP or P-P systems in a manner similar to the adjacent band 3400 to 3600 MHz. ”

ANNEX A

PART 1: Harmonisation of the frequency range 3600 to 4200 MHz based on ITU-R Recommendation F.635 with 40 MHz and 20 MHz channels for medium and high capacity systems

An arrangement based on ITU-R Recommendation F.635 with 40 MHz channel spacing would provide a total of 7 "go" and 7 "return" channels.

Let f_0 (=3900 MHz) be the frequency of the centre of the band of frequencies occupied
 f_n be the centre frequency of one radio frequency channel in the lower half of the band
 f'_n be the centre frequency of one radio frequency channel in the upper half of the band,

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

40 MHz channel spacing.¹

Lower half of the band: $f_n = (f_0 - 330 + 40 n)$ MHz

Upper half of the band: $f'_n = (f_0 - 10 + 40 n)$ MHz

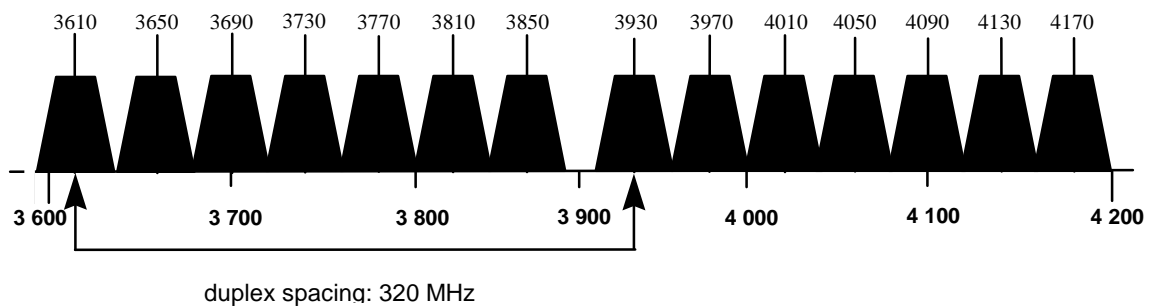
where $n = 1, 2, 3 \dots 7$

20 MHz channel spacing.¹

Lower half of the band : $f_n = (f_0 - 320 + 20 n)$ MHz

Upper half of the band : $f'_n = (f_0 + 20 n)$ MHz

where $n = 1, 2, 3 \dots 14$



¹ Channel 1 of the lower half of the band for both the 40 MHz and the 20 MHz channel arrangement may be used according to national decisions.

PART 2 of Annex A: Harmonisation of the frequency range 3600 to 4200 MHz based on ITU-R Recommendation F.635 with 30 MHz and 15 MHz channels for medium and high capacity systems

An arrangement based on ITU-R Recommendation F.635 with 30 MHz channel spacing would provide a total of 9 “go” and 9 “return” channels.

Let f_0 (=3900 MHz) be the frequency of the centre of the band of frequencies occupied
 f_n be the centre frequency of one radio frequency channel in the lower half of the band
 f'_n be the centre frequency of one radio frequency channel in the upper half of the band

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

30 MHz channel spacing

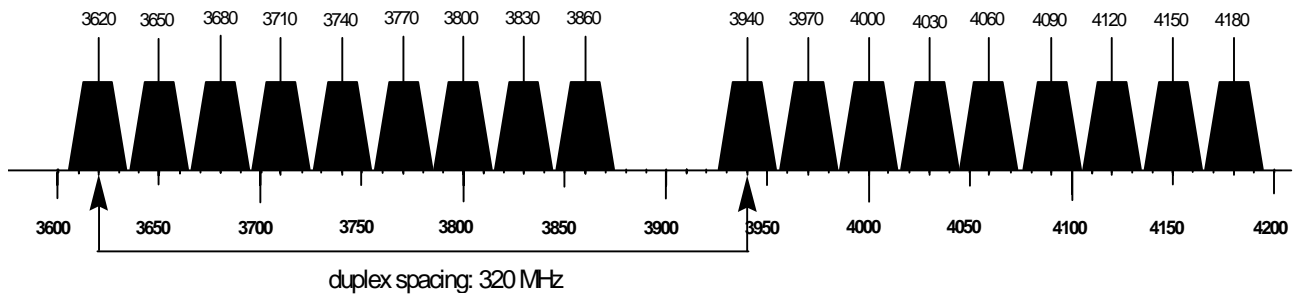
Lower half of the band: $f_n = (f_0 - 310 + 30 n)$ MHz
 Upper half of the band: $f'_n = (f_0 + 10 + 30 n)$ MHz

where $n = 1, 2, 3 \dots 9$

15 MHz channel spacing

Lower half of the band: $f_n = (f_0 - 302.5 + 15 n)$ MHz
 Upper half of the band: $f'_n = (f_0 + 17.5 + 15 n)$ MHz

where $n = 1, 2, 3 \dots 18$



ANNEX B

PART 1: Harmonisation of the frequency range 3800 to 4200 MHz based on ITU-R Recommendation F.382 with 29 MHz channels for high capacity systems

An arrangement based on ITU-R Recommendation F.382 with 29 MHz channel spacing would provide a total of 6 "go" and 6 "return" channels.

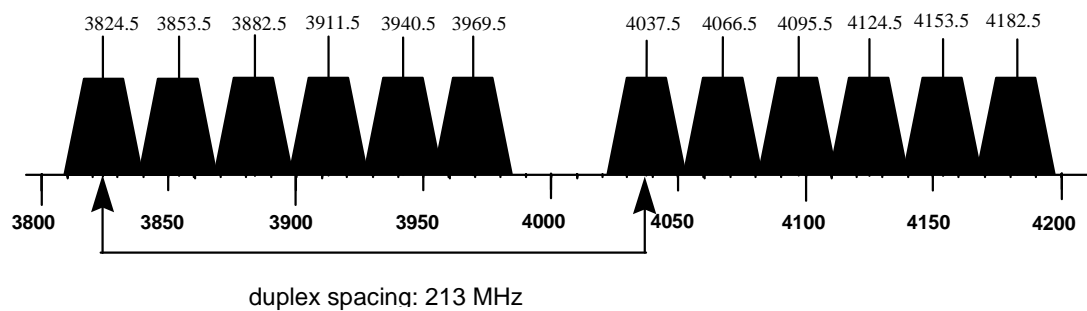
Let f_0 (=4003.5 MHz) be the frequency of the centre of the band of frequencies occupied (MHz)
 f_n be the centre frequency of one radio-frequency channel in the lower half of the band (MHz)
 f'_n be the centre frequency of one radio-frequency channel in the upper half of the band (MHz),

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

$$\begin{aligned} \text{lower half of the band: } f_n &= f_0 - 208 + 29 n, \\ \text{upper half of the band: } f'_n &= f_0 + 5 + 29 n, \end{aligned}$$

where

$$n = 1, 2, 3, 4, 5 \text{ or } 6.$$



**PART 2 of Annex B: Harmonisation of the frequency band 3600 to 3800 MHz;
for point to point and point to multipoint systems**

B2.1: 50 MHz arrangements

B2.1.1 Point to multipoint systems

P-MP systems may be operated in the ranges 3600-3700 MHz and 3700-3800 MHz.

Where a duplex allocation is required, the spacing between the lower edges of the paired sub-bands shall be 50 MHz.

Frequency assignments should in all cases be based on contiguous sets of 0.25 MHz slots within the 3600 MHz to 3800 MHz band,

the frequency of the lower edge of any slot shall be defined by the general equation:

$$f_s = (3600 + 0.25M) \text{ MHz}$$

$$M = 0, 1, 2, 3, 4, \dots, 799$$

Similar expressions can therefore be used to define the lower edge of each sub-band, while the upper edge of each sub-band can be defined by using a second integer, k , as shown in the table below. The purpose of this table is to formalise the description of paired sub-bands given above and to show that both of the sub bands of any allocated pair must be within either the 3600 - 3700MHz or 3700-3800 MHz bands. This leaves the spectrum management authority free to define the width of each sub band as any multiple of 0.25MHz, from 0.25 MHz through to 50 MHz.

3600 - 3700 MHz

Lower sub-band:	0.25N + 3600 to 0.25(N + k) + 3600	MHz
Upper sub-band:	0.25(N + 200) + 3600 to 0.25(N + k + 200) + 3600	MHz MHz
1 <= k <= 200, 0 <= N <= 199, k + N <= 200		

3700 - 3800 MHz

Lower sub-band:	0.25N + 3600 to 0.25(N + k) + 3600	MHz
Upper sub-band:	0.25(N + 200) + 3600 to 0.25(N + k + 200) + 3600	MHz MHz
1 <= k <= 200, 400 <= N <= 600, k + N - 400 <= 200		

In the tables above, k defines the width of each sub-band and N defines the lower edge of each sub-band.

For example: an allocation of a pair of 15 MHz sub-bands at 3620 - 3635 MHz paired with 3670 - 3685 MHz ($N=80$ and $k=60$) would meet the recommendation, while a pair of sub-bands at 3620.125 - 3635.125 MHz paired with 3670.125 - 3685.125 MHz ($N=80.5$ and $k=60$) would not.

P-MP equipment may be used having a duplex spacing other than exactly 50 MHz. However, such equipment must conform to the limits of the block allocation as defined above.

B2.1.2 Point to point systems with a duplex spacing of 50 MHz

Channel centre frequencies are defined at the edges of 0.25 MHz slots as follows.

B2.1.2.1 Systems with 1.75 MHz channel spacing

3600 - 3700 MHz

Lower sub-band:	$f_n = (3600 + 1.75 n)$ MHz	n = 1,2,...,28
Upper sub-band:	$f_n = (3650 + 1.75 n)$ MHz	

3700 - 3800 MHz

Lower sub-band:	$f_n = (3700 + 1.75 n)$ MHz	n = 1,2,...,28
Upper sub-band:	$f_n = (3750 + 1.75 n)$ MHz	

B.2.1.2.2 Systems with 3.5 MHz channel spacing

3600 - 3700 MHz

Lower sub-band:	$f_n = (3598.25 + 3.5 n)$ MHz	n = 1,2,...,14
Upper sub-band:	$f_n = (3648.25 + 3.5 n)$ MHz	

3700 - 3800 MHz

Lower sub-band:	$f_n = (3698.25 + 3.5 n)$ MHz	n = 1,2,...,14
Upper sub-band:	$f_n = (3748.25 + 3.5 n)$ MHz	

B.2.1.2.3 Systems with 7 MHz channel spacing

3600 - 3700 MHz

Lower sub-band:	$f_n = (3596.5 + 7 n)$ MHz	n = 1,2,...,7
Upper sub-band:	$f_n = (3646.5 + 7 n)$ MHz	

3700 - 3800 MHz

Lower sub-band:	$f_n = (3696.5 + 7 n)$ MHz	n = 1,2,...,7
Upper sub-band:	$f_n = (3746.5 + 7 n)$ MHz	

B.2.1.2.4 Systems with 14 MHz channel spacing

3600 - 3700 MHz

Lower sub-band:	$f_n = (3593 + 14 n)$ MHz	n = 1, 2, 3
Upper sub-band:	$f_n = (3643 + 14 n)$ MHz	

3700 - 3800 MHz

Lower sub-band:	$f_n = (3693 + 14 n)$ MHz	n = 1, 2, 3
Upper sub-band:	$f_n = (3743 + 14 n)$ MHz	

B2.2: 100 MHz arrangements

B2.2.1 Point to multipoint systems

P-MP systems may be operated in the range 3600-3700 MHz paired with 3700-3800 MHz.

Where a duplex frequency allocation is required, the spacing between the lower edges of each paired sub-band shall be 100 MHz.

Frequency assignments should in all cases be based on contiguous sets of 0.25 MHz slots within the 3600 MHz to 3800 MHz band,

the frequency of the lower edge of any slot shall be defined by the general equation:

$$f_s = (3600 + 0.25M) \text{ MHz}$$

$$M = 0, 1, 2, 3, 4, \dots, 799$$

Similar expressions can therefore be used to define the lower edge of each sub-band, while the upper edge of each sub-band can be defined by using a second integer, k , as shown in the table below. The purpose of this table is to formalise the description of paired sub-bands given above while leaving the spectrum management authority free to define the width of each sub band as any multiple of 0.25MHz, from 0.25 MHz through to 100MHz.

Lower sub-band:	0.25N + 3600 to 0.25(N + k) + 3600	MHz
Upper sub-band:	0.25(N + 400) + 3600 to 0.25(N + k + 400) + 3600	MHz
1 ≤ k ≤ 400, 0 ≤ N ≤ 400, k + N ≤ 400		

In the tables above, k defines the width of each sub-band and N defines the lower edge of each sub-band.

For example: an allocation of a pair of 15MHz sub bands at 3620-3635 MHz paired with 3720-3735MHz ($N=80$ and $k=60$) would meet the recommendation, while a pair of sub-bands at 3620.125 - 3635.125 MHz paired with 3720.125 - 3735.125 MHz ($N=80.5$ and $k=60$) would not.

P-MP equipment may be used having a duplex spacing other than exactly 100 MHz. However, such equipment must conform to the limits of the block allocation as defined above.

B2.2.3 Point to point systems with a duplex spacing of 100 MHz

Channel centre frequencies are defined at the edges of 0.25 MHz slots as follows.

B2.2.3.1 Systems with 1.75 MHz channel spacing

Lower sub-band:	$f_n = (3600.125 + 1.75 n)$ MHz	n = 1,2,...,56
Upper sub-band:	$f_n = (3700.125 + 1.75 n)$ MHz	

B2.2.3.2 Systems with 3.5 MHz channel spacing

Lower sub-band:	$f_n = (3599.25 + 3.5 n)$ MHz	n = 1,2,..., 28
Upper sub-band:	$f_n = (3699.25 + 3.5 n)$ MHz	

B2.2.3.3 Systems with 7 MHz channel spacing

Lower sub-band:	$f_n = (3597.5 + 7 n)$ MHz	n = 1,2,..., 14
Upper sub-band:	$f_n = (3697.5 + 7 n)$ MHz	

B2.2.3.4 Systems with 14 MHz channel spacing

Lower sub-band:	$f_n = (3594 + 14 n)$ MHz	n = 1, 2,..., 7
Upper sub-band:	$f_n = (3694 + 14 n)$ MHz	