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Radiocommunication Sector of ITU

Recommendation ITU-R F.2006

(03/2012)

Radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76 and 81-86 GHz bands

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.2006

Radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76 and 81-86 GHz bands

(2012)

Scope

This Recommendation provides radio-frequency channel and block arrangements for fixed wireless systems (FWS) operating in the 71-76/81-86 GHz range, which may be used for broadband applications and other high-speed networks. The preferred arrangements are based on common homogeneous pattern with elementary slots of 125 MHz. The preferred radio-frequency block arrangements are based on 5 GHz sub-band or block possibly subdivided to form smaller blocks. The preferred channel arrangement provides flexible identification of channel sizes from 250 MHz to 4 500 MHz and duplex frequency either of 2.5 GHz (single sub-band, 71-76 GHz or 81-86 GHz, arrangement) or 10 GHz (joint sub-bands, 71-76 GHz and 81-86 GHz together, arrangements).

The ITU Radiocommunication Assembly,

considering

a) that there is a particular need for fixed wireless systems (FWS) for large data capacity transport, e.g. for uncompressed high-definition television (HDTV) signal transmission or for mobile networks applications, the deployment of which is expected to rapidly grow;

b) that the frequency bands 71-76 GHz and 81-86 GHz are allocated to the fixed service;

c) that the propagation characteristics in these bands are ideally suited for use of short-range high capacity digital radio links in high-density networks;

d) that in these frequency bands high directivity antennas are achievable even with small size antennas, increasing the density of equipment and further reducing risk of interference with same and other services;

e) that several services with various transmission signal characteristics and capacities may be in simultaneous use in this frequency band;

f) that the applications in this frequency band may require different channel bandwidths;

g) that, in some cases, a flexible sub-band or block arrangement, can accommodate various FWS technologies, whilst remaining consistent with good spectrum management principles, including provision for inter-systems/services operation and overall spectrum efficiency;

h) that, when link-by-link frequency coordination is applied, the definition of radio-frequency channel arrangements is preferable;

j) that careful frequency planning permits accommodation of frequency division duplex (FDD) and time division duplex (TDD) applications;

k) that different applications licensed by various administrations may require different radio-frequency channel arrangements;

l) that, in some countries, only limited portions of the two bands may be available for civil applications;

m) that some countries may wish to or already have made these bands available through a flexible simplified approach without any specific channel plan,

noting

a) that Recommendation ITU-R F.1519 provides guidance on frequency arrangements based on frequency blocks for systems in the fixed service;

b) that Report ITU-R F.2107 provides characteristics and applications of fixed wireless systems operating in frequency ranges between 57 GHz and 134 GHz,

recommends

1 that administrations wishing to implement a radio-frequency channel or block arrangement for the 71-76 GHz and 81-86 GHz bands should consider the following homogeneous pattern of 125 MHz slots:

$$fn = 71.0625 + 0.125\ (n - 1)\ \text{GHz}$$

where:

fn : centre frequency of the n-th slot

n = 1 to 40 for the band 71-76 GHz
81 to 120 for the band 81-86 GHz;

2 that administrations wishing to use specific radio-frequency channels or blocks should have size multiple of 250 MHz and should be composed by aggregating 2 or a higher even number of frequency slots from the homogeneous pattern;

3 that administrations wishing to assign sub-bands or frequency blocks for FWS in the frequency bands 71-76/81-86 GHz, should consider the sub-bands or block arrangements presented in Annex 1;

4 that administrations should consider the adoption of carrier centre frequencies, within the preferred frequency blocks, from the channel slots of 250 MHz, as derived in *recommends* 2;

5 that administrations wishing to assign pre-defined channels of 250 MHz, or multiples thereof, either paired or unpaired, should consider the flexible channel arrangements illustrated in Annex 2.

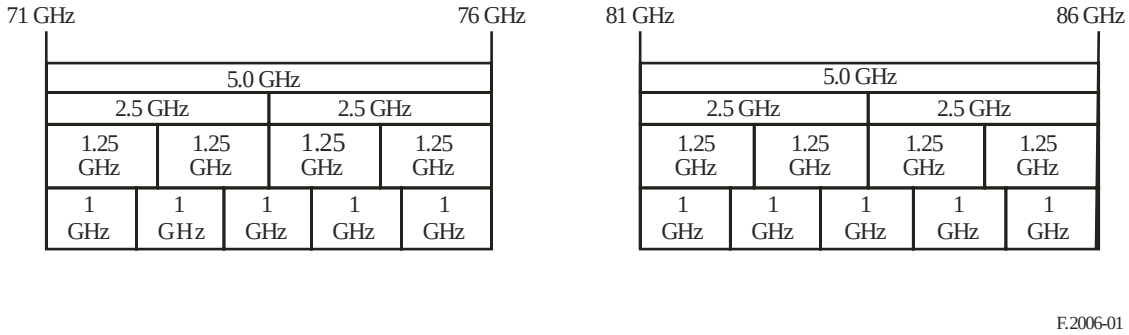
Annex 1

Radio-frequency sub-band or block arrangements in the band 71-76/81-86 GHz

This arrangement is based on the use of the basic 5 GHz sub-bands, which can be subdivided to form smaller paired blocks, as shown in the examples of Fig. 1. According to the needs, other block subdivisions are possible, including blocks of different size.

FIGURE 1

Examples of frequency block arrangement for the ranges 71-76/81-86 GHz



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Annex 2

Radio-frequency channel arrangements in the band 71-76/81-86 GHz

1 Basic 250 MHz channels in the 71-76 GHz and 81-86 GHz bands

Let *fr* be the reference frequency of:
71 000 MHz for the band 71-76 GHz,
81 000 MHz for the band 81-86 GHz

fn be the centre frequency of a radio-frequency channel in the band 71-76 GHz or 81-86 GHz band,

n be the channel number in each band,

then the centre frequencies of individual channels with 250 MHz separation, are expressed by the following relationship:

$$fn = fr + 250 \cdot n \quad \text{MHz}$$

where:

n = 1, 2, 3, ..., 19 for each band

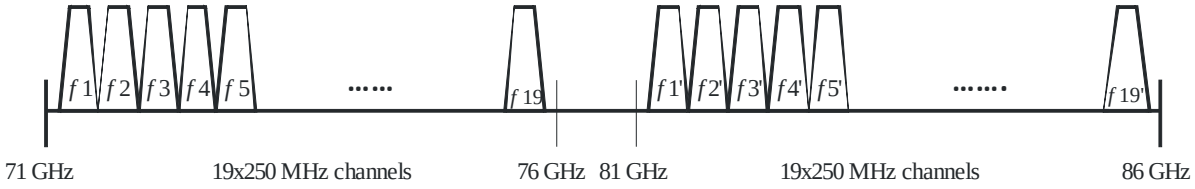
The 19 basic 250 MHz channels derived as above maintain 125 MHz guardband (i.e. ZS = 250 MHz as defined in recommendation ITU-R F.746) at each four band edges.

2 Pairing and aggregating basic channels in frequency bands 71-76/81-86 GHz

The principle of using the 2 × 19 basic channels from within the bands 71-76 GHz and 81-86 GHz jointly in a single duplex FDD arrangement with 10 GHz duplex separation is described in the Fig. 2.

FIGURE 2

Combining the 250 MHz channels from 71-76/81-86 GHz bands into a single FDD arrangement with duplex separation of 10 GHz



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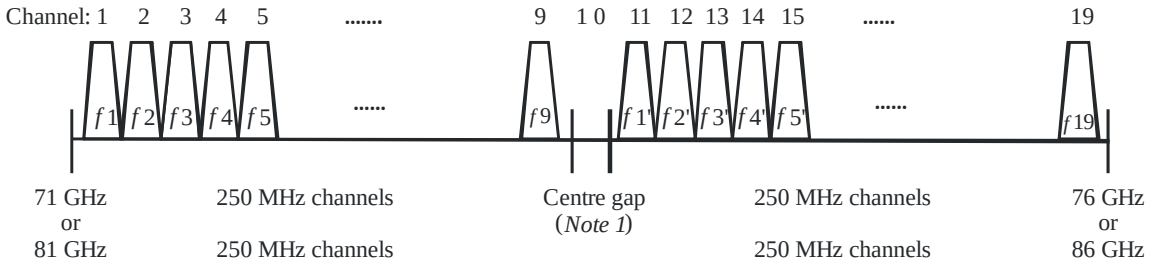
The principle of using the 2 × 19 basic channels within a single band 71-76 GHz or 81-86 GHz with two separate FDD arrangement with duplex separation of 2.5 GHz is shown in Fig. 3.

FIGURE 3

Combining the 250 MHz channels from single 71-76 GHz or 81-86 GHz band into separate FDD arrangement with duplex separation of 2.5 GHz



Note 1 – Wider centre gap may be obtained with wider duplex separation (e.g. centre gap made by basic channels 9, 10 and 11 resulting in 2.75 GHz duplex separation).

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When wider channels are needed, e.g. for very high bitrate and high system gain applications (e.g. employing frequency shift keying modulation and/or gigabit/s or higher capacity), then a flexible number of consecutive 250 MHz channels may be aggregated into FDD channels, as illustrated in Fig. 4, for duplex separation equal or more than 10 GHz, or in Fig. 5, for duplex separation of 2.5 GHz. Administrations that prefer to use of multiple sizes channels in predefined positions may refer to the arrangements in section 4 of this Annex.

FIGURE 4

Example of aggregating multiple 250 MHz channels, possibly alongside with original 250 MHz wide channels within the joint 71-76 GHz and 81-86 GHz FDD arrangement

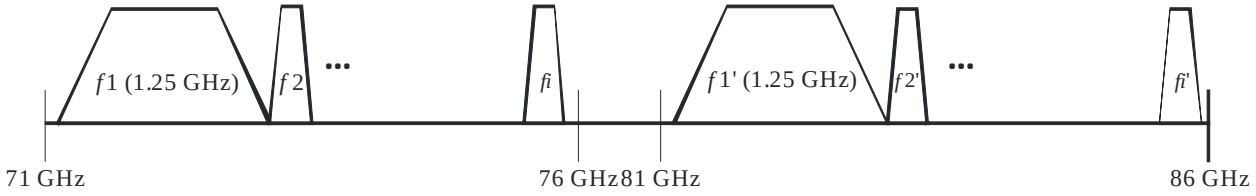

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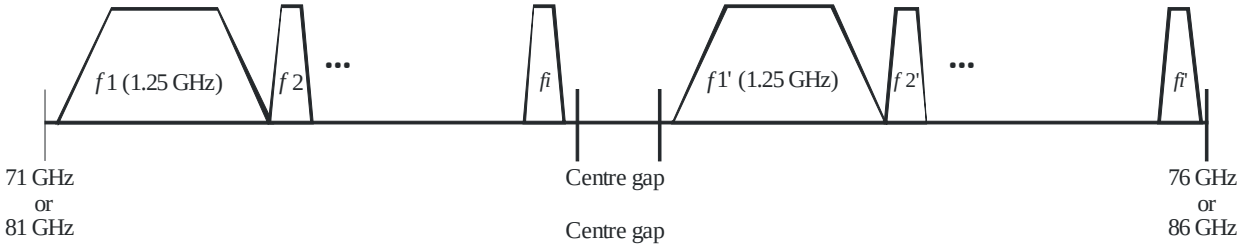
FIGURE 5

Example of aggregating multiple 250 MHz channels, possibly alongside with original 250 MHz wide channels within the single band 71-76 or 81-86 GHz FDD arrangements



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3 Specific channel arrangements for multiple size FDD/TDD aggregated channels in frequency bands 71-76/81-86 GHz

A multiple sizes channel arrangement for these bands depends on the basic assumptions that an administration makes for the deployment, e.g.:

– TDD, FDD or their mixed use of the band;

– Paired FDD assignments with fixed duplex;

– FDD channels paired either in each single band or in cross-band pairing, or both contemporarily;

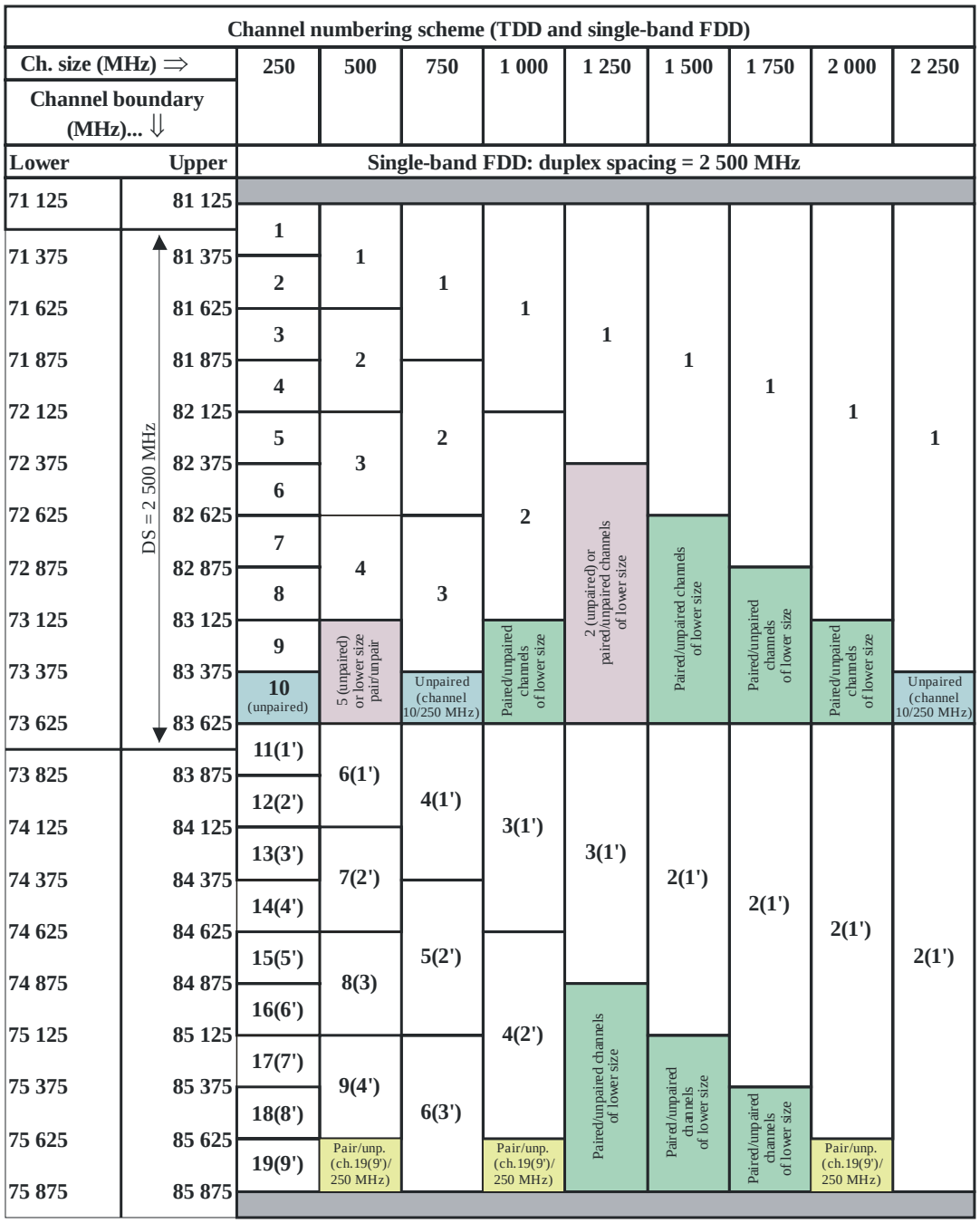
For maximum flexibility all possible channel size of N × 250 MHz are described in the arrangements.

N = 1, 2, …..9 resulting in channel size from 250 MHz to 2 250 MHz as described in Fig. 6 for the separate arrangements in 71-76 GHz or 81-86 GHz sub-bands with duplex separation 2.5 GHz.

N = 1, 2, …..18 resulting in channel size from 250 MHz to 4 500 MHz as described in Fig. 7 for the joint arrangement in both 71-76 GHz and 81-86 GHz sub-bands with 10 GHz duplex separation. In this case channels from 250 MHz to 2 250 MHz maintain the same centre frequency of the corresponding channels in previous separate arrangements; this makes easier, when necessary, the contemporary coordination of systems with 2.5 GHz and 10 GHz duplex separation.

FIGURE 6

Channel positions for TDD and single-band FDD applications
(2.5 GHz fixed duplex for all channels)



Legend:

n	Paired (go) or unpaired "n" channel in each band
m (n')	Paired "n" or unpaired "m" channel in each band
	Unpaired channel of same size or paire/unpaired channel(s) of lower size(s) in each band
	Unpaired channel 10 of basic 250 MHz pattern in each band
	Paired or unpaired channel 19(9') of basic 250 MHz pattern in each band
	Paired or unpaired channel(s) of lower size(s) in each band

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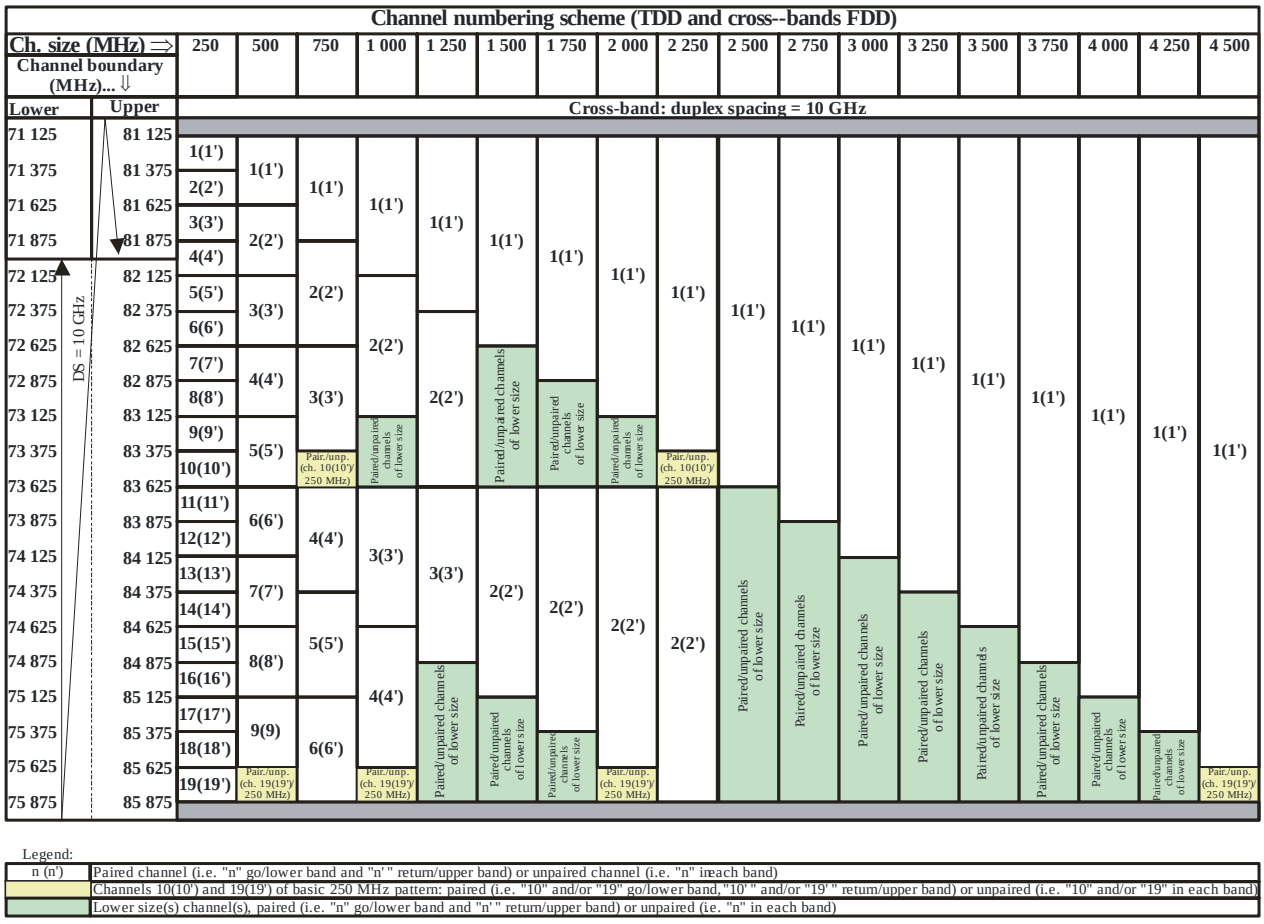
FIGURE 7

Channel positions for TDD and joint cross-bands FDD applications (10 GHz fixed duplex for all channels)



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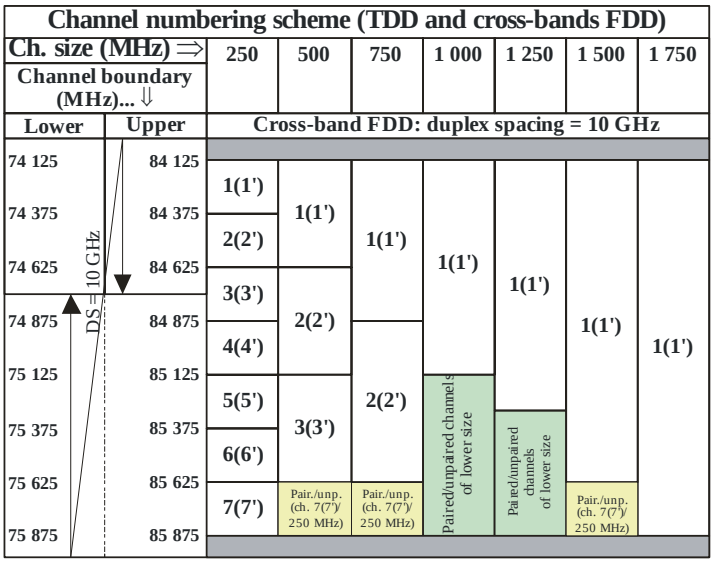
4 Specific channel arrangements for multiple size FDD/TDD aggregated channels in the reduced frequency bands 74-76/84-86 GHz

In case only these reduced portions of the whole bands are available, only the joint arrangement with 10 GHz duplex separation is retained appropriate. It is shown in Fig. 8.

FIGURE 8

Channel positions for TDD and cross-bands FDD applications
(Limited to 74-76 GHz and 84-86 GHz bands with 10 GHz duplex separation)



Legend:

n (n')	Paired (i.e. "n" go/lower band and "n' " return/upper band) or unpaired channel (i.e. "n" in each ba nd)
	Channels 7(7') of basic 250 MHz pattern: paired ("7" go/lower band and "7 " return/upper band) or u npaired "7" channel in each band)
	Lower size(s), paired ("n" go/lower band and "n' " return/upper band) or unpaired "n" channel(s) in each band)

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