CEPT ECC
Electronic Communications Committee

ECC Recommendation (18)02

Radio frequency channel/block arrangements for Fixed Service systems operating in the bands 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz

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INTRODUCTION

The primary use of Fixed Service (FS) foreseen in these bands is for mobile backhaul/fronthaul applications and fixed wireless access. Due to continuous evolution of mobile networks, new applications and deployment scenarios will emerge in the future demanding an ever increasing payload capacity.

The millimetre wave spectrum in the range 92-114.25 GHz attracts increased interest of service providers and systems designers due to the large spectrum availability for FS scenarios.

The use of high efficiency modulation formats, adaptive modulation and MIMO[1] techniques, possibly coupled into BCA[2] links, would also permit large payload increase; information on adaptive modulation and MIMO technique may be found in ECC Report 198 [8] and ECC Report 258 [9], respectively. Therefore, radio links operating in the 92-114.25 GHz bands can fulfil applications supporting multi Gigabit/s capacity per link in an environment with 3 to 4 operators in the same geographical area.

According to Recommendation ITU-R P.676 [1], the atmospheric gas attenuation is still less than about 0.8 dB/km at the 114.25 GHz top edge of the band and, according to the Recommendation ITU-R P.838 [2], the rain attenuation above about 80 GHz becomes practically constant. The attenuation is therefore comparable to that experienced in lower bands, e.g. in the 71 GHz to 86 GHz band considered in ECC/REC/(05)07 [3].

This makes the bands in 92-114.25 GHz range suitable for very high capacity on short range links.

Therefore, the joint use of the 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz bands provides an inviting opportunity to further cope with the future market demand for increasingly very high bandwidth access, in particular for Internet-based applications and backhaul/fronthaul for next generation mobile networks. Fixed radio links may be deployed much quicker and in certain cases (e.g. when radio stations are deployed at street level on urban utilities infrastructures) are more cost efficient than the wired networks. As such, these bands provide sufficient bandwidth for terrestrial fixed links to compete or complement the fibre optic-based access networks.

In the scenario using the 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz bands for Fixed Service, with the average European rain rates, the objectives of 99.99% availability or higher may be satisfied for very high capacity links up to about 1.5 km hop lengths (in Line-of-sight conditions and depending on actual equipment and antenna parameters). Longer hops may be implemented in the less rainy areas or with reduced availability objectives (e.g. in BCA links). These systems would allow a rapid and effective deployment for mobile backhaul/fronthaul and very high capacity broadband in areas where fibre optic cables are not available or are not cost-effective.

The main features of operating fixed radio systems in this part of the spectrum may be summarised as follows:

- availability of very wide bandwidths, allowing for the low cost of traffic in multi service provider operation area;
- feasibility of deploying radio links is much easier in comparison to alternative wire-bound solutions;
- ability to ensure high security because of low possibility of interference/capture of signals.

The use of the spectrum between 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz is a viable solution for fixed links to achieve the above objectives and is also similarly included in ITU-R Recommendation F.2173 [13]

The ECC Report 124 [5] addresses the compatibility between the FS in the bands 71-76 GHz and 81-86 GHz and the passive service in the adjacent band 86-92 GHz, where, the Radio Regulation footnote **5.340** applies. Its results have been already applied also to the FS band 92-94 GHz. Therefore it is assumed that they are

[1] Multiple Input Multiple Output (MIMO), a spatial frequency reuse technique;
[2] Band and Carrier Aggregation (BCA) system, operation on the same link of two different band equipment; e.g. 18 GHz and 80 GHz link, the former giving high availability to the priority traffic portion and the latter offering larger capacity with less availability (i.e. for best effort traffic).

still applicable for the compatibility in the adjacent bands 100-102 GHz, 109.5-111.8 GHz and 114.25-116 GHz, allocated to passive service in between or adjacent to these FS bands.

The choice of the appropriate assignment method and licensing regime remains a decision for national administrations, based on several technical and not technical factors.

Modern Point-to-Point (PP) system technology permits various options of bidirectional links covering both symmetrical and asymmetrical traffic with Time division duplex (TDD) or Frequency division duplex (FDD) duplexing; however, their mixed use in a link-by-link planned network might create difficult and inefficient use of the band.

However, conventional link-by-link planning/coordination procedure might be very challenging due to the expected dense urban deployment, mostly at street lamp posts level; interference due to reflection and diffraction effects cannot be treated as in conventional Line-of-sight only situation. Nevertheless, multiple services and applications can be implemented, with simplified coordination mechanisms, still ensuring, in average, highly efficient re-use of the frequency band.

Such simplified coordination mechanism might be considered where the links coordination, traditionally under the responsibility of the administration, is still required but would be performed by the license holders (i.e. operators); this process could be further simplified where administrations might subdivide the available band in blocks to be separately used by major operators that could be required only to communicate the technical data of the deployed links (for e.g. maintain national Point-to-Point data base and fee calculation). The deployment within blocks of frequency, when they are permanently assigned to an operator, might also permit mixed use of Point-to-Point and/or Point-to-Multipoint systems.

On this subject, ECC Report 80 [4] describes a “light licensing regime” summarised as: *“Light licensing regime, where the position and characteristics of the stations are recorded on a database on a first-come first-served basis, with responsibility for subsequent users to ensure the compatibility with previously notified stations”*.

ECC RECOMMENDATION OF 18(02) OF 14 SEPTEMBER 2018 ON RADIO FREQUENCY CHANNEL/BLOCK ARRANGEMENTS FOR FIXED SERVICE SYSTEMS OPERATING IN THE BANDS 92-94 GHZ, 94.1-100 GHZ, 102-109.5 GHZ AND 111.8-114.25 GHZ, UPDATED 26 SEPTEMBER 2026

"The European Conference of Postal and Telecommunications Administrations,

considering

a) that there is a need for very high capacity fixed links for backhauling of mobile cells and other multi Gbit/s data links;

b) that the ITU Radio Regulations (RR) [11] and the ECA Table [10] allocate the bands 92-94 GHz, 94.1 - 100 GHz, 102-109.5 GHz and 111.8-114.25 GHz on a primary basis to Fixed Service as well as other co-primary services;

c) that ITU RR No. **5.340** prohibits all emissions, inter alia, in the bands 86-92 GHz, 100-102 GHz, 109.5-111.8 GHz and 114.25-116 GHz, and therefore care should be taken to limit the out-of-band emissions from FS operating in the bands 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8 - 114.25 GHz into those adjacent bands;

d) that ITU RR No. **5.149** applies to the frequency range 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8 - 114.25 GHz and urges administrations to take all practicable steps to protect the Radio Astronomy Service from harmful interference;

e) that the ECC Report 124 [5] addresses methodology and emission limits, where appropriate, for the compatibility between the FS in the bands 71-76 GHz and 81-86 GHz and Earth Exploration-Satellite Service (EESS) stations operating in the bands 86-92 GHz and Radio Astronomy Service (RAS) stations operating in the bands 76-77.5 GHz and 79-92 GHz;

f) that ECC Report 124 indications may still be conservatively applicable for the compatibility between FS operating in the bands identified in considering b) and EESS operating in bands identified by considering c) and Radio Astronomy Service (RAS) stations operating in the bands identified in considering d);

g) that the propagation characteristics of the 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz are ideally suited for use of short range FS links with various occupied bandwidths in very high density networks for a range of applications including backhaul/fronthaul for next generation mobile networks;

h) that ECC/REC/(01)05 [6] provides information for planning of Point-to-Point (PP) Fixed Service systems in conventional full Line-of-sight (LoS) deployment;

i) that, the propagation loss difference in the bands 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8 - 114.25 GHz is within the range of less than 0.5 dB/km and this suggests the opportunity of using these bands together for FDD links with suitable wide duplex separation;

j) that modern PP system technologies permit to use radiofrequency channels either unpaired (TDD or FD[3]) or paired as unconventional narrow duplex systems (fFDD[4]), and these may be used when block assignment is considered as a licensing method;

k) that longer links are possible to enhance capacity of conventional lower band links in BCA[2] systems;

l) that links in these bands are expected to be deployed, in urban environment, either above rooftop level or at street level (e.g. light poles, public transport stalls) or both;

m) that ECC Report 282 [12] provides examples and guidelines of expected practical link lengths and performance characteristics of real applications;

n) that alternative to conventional coordination, a form of self-coordination of links within block(s) of channels assigned to major users, could maintain spectrum efficiency and availability for FS avoiding harmful interference among the users;

[3] Full Duplex (FD) systems use the same channel for go/return (as TDD systems), but for 100% of the time; they should provide necessary TX/RX isolation through separate TX and RX antennas and digital cancellation, rather than through duplex filter as in conventional FDD systems.

[4] While in conventional FDD systems TX/RX isolation is obtained through RF duplex filter, in flexible frequency division duplex (fFDD) systems the isolation could be obtained through separate TX/RX antennas and/or digital cancellation (similar to XPIC technology); this enhance the TX/RX isolation capability and permits narrower duplex spacing.

o) that as an alternative to conventional coordination, a simple form of coordination, similar to that described in ECC Report 80 [4] as “light licensing”, could maintain spectrum efficiency and availability for FS avoiding harmful interference among the users;

p) that ETSI EN 302 217 [7] provides characteristics of Point-to-Point equipment.

recommends

1. that the use of FS in the 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz bands may be intended for Point-to-Point (PP); also Point-to-Multipoint (PMP) systems provided that suitable deployment methods (e.g. within predefined blocks) are considered;

2. that operating frequencies for PP links in these bands be assigned or recorded on a link-by-link basis or within block assignment provided that inter block compatibility is ensured;

3. that administrations wishing to use the frequency bands 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz for FS links and preferring to implement channel arrangement should consider the basic channel raster given in Annex 1;

4. that FDD duplex channels or blocks arrangements, within combined bands 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz and 111.8-114.25 GHz is shown in Annex 2;

5. that administrations may consider flexible aggregation of those 250 MHz basic channels for composing wider channels, while taking into account appropriate spectrum efficiency;

6. that administrations wishing to use block-based assignment should derive blocks by channel aggregation in line with the example shown in Annex 3, and use them accordingly; blocks should be multiple of 250 MHz wide and their use should permit any suitable channel size and duplex method as shown in the examples given in Annex 3;

7. that administrations wishing to implement a self-coordination mechanism similar to “light licensing” may refer to the example provided in Annex 5;

8. that in order to protect the EESS operations in the bands 86-92 GHz, 100-102 GHz, 109.5-111.8 GHz and 114.25 - 116 GHz, the unwanted emissions at the antenna port of any FS station in that band should respect the mask provided in Annex 4;

Note:

Please check the ECO Documentation Database https://docdb.cept.org/ for the up to date position on the implementation of this and other ECC Recommendations.

ANNEX 1: RADIO FREQUENCY CHANNEL ARRANGEMENTS IN THE BAND 92-114.25 GHZ

A1.1 BASIC CHANNEL RASTER

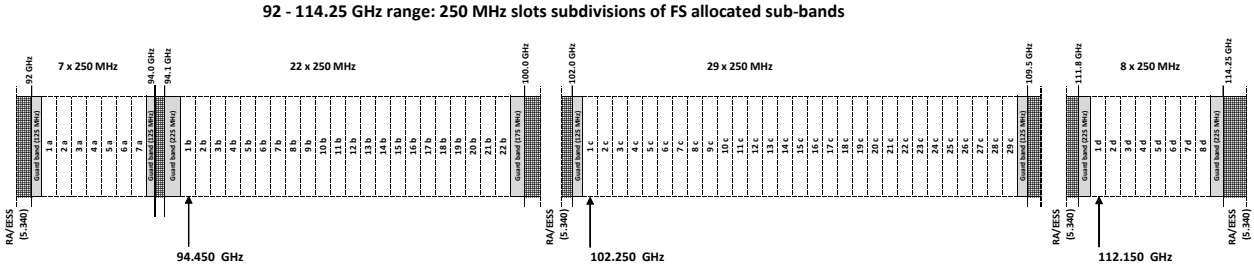


Figure 1: Basic channels raster for FS use in the 92-114.25 GHz band

Figure 1 shows the subdivision of the available bands into 250 MHz elementary channels; at least 125 MHz guard bands are provided.

Centre frequency of channels can be obtained as follows;

F_N = 92 + N*0.250 GHz	N: 1 to 7	Sub-band “a”
F_N = 94.1 + 0.1 + N*0.250 GHz	N: 1 to 22	Sub-band “b”
F_N = 102 + N*0.250 GHz	N: 1 to 29	Sub-band “c”
F_N = 111.8 + 0.1 + N*0.250 GHz	N: 1 to 8	Sub-band “d”

ANNEX 2: CHANNEL ARRANGEMENT FOR FDD USE IN THE 92-114.25 GHZ BAND

Due to the odd coupling of the three sub-bands available, some channels have to remain unpaired.

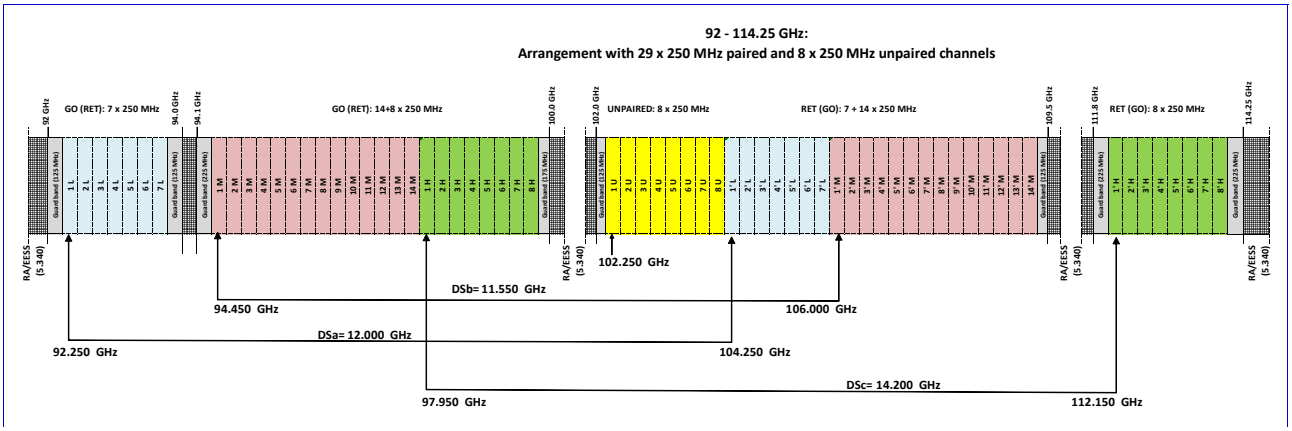


Figure 2: Example showing channels used as FDD in the 92-114.25 GHz band

Go/return channels are subdivided in three sets (L, M and H) as shown in Figure 2. Centre frequencies can be obtained by the following formulas.

Centre frequencies for channels with suffix L in Figure 2

Duplex separation: 12 GHz

$FL_N = 92 + N*0.250$	N: 1 to 7	(channels within sub-band “a”)
$F'L_N = 102 + 2 + N*0.250$ GHz	N: 1 to 7	(channels within sub-band “c”)

Centre frequencies for channels with suffix M in Figure 2

Duplex separation: 11.550 GHz

$FM_N = 94.1 + 0.1 + N*0.250$ GHz	N: 1 to 14	(channels within sub-band “b”)
$F'M_N = 102 + 3.75 + N*0.250$ GHz	N: 1 to 14	(channels within sub-band “c”)

Centre frequencies for channels with suffix H in Figure 2

Duplex separation: 14.200 GHz

$FH_N = 94.1 + 3.6 + N*0.250$ GHz	N: 1 to 8	(channels within sub-band “b”)
$F'H_N = 111.8 + 0.1 + N*0.250$ GHz	N: 1 to 8	(channels within sub-band “d”)

ANNEX 3: PAIRED BLOCK BASED USE IN THE 92-114.25 GHZ BAND

According to recommends 6, channels can be aggregated for composing blocks of frequencies for exclusive use of the licensed operator(s). For a more flexible use, blocks may preferably be paired; however, partially unpaired use might be convenient in certain cases.

A3.1 PAIRED BLOCKS EXAMPLE

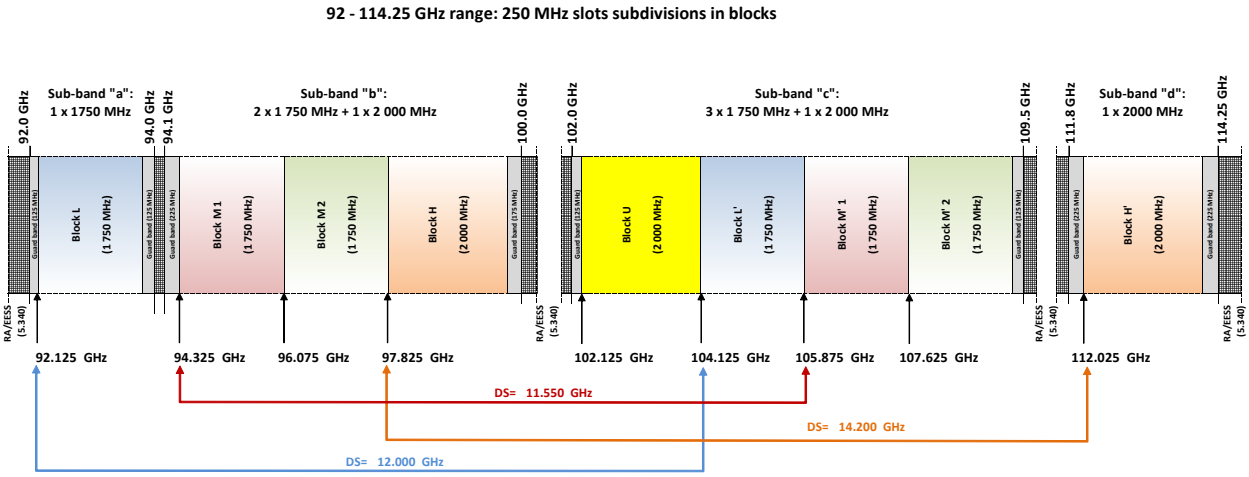


Figure 3: Example showing the use of channels aggregated in paired blocks

It has to be noted that the unpaired channel might be attached to block L' for more asymmetric usage.

A3.2 BLOCK SIZE

Block size should be integer multiple of the basic 250 MHz channel size; in the example given in Figure 3, 1750/2000 MHz block size is considered. In principle, inside a specific sub-band no upper limit is given to block size, provided that the blocks´ duplex separation is maintained.

A3.3 USE OF THE CHANNELS/BLOCKS

Provided that the 250 MHz raster or its aggregations are respected, channels inside the block(s) can be freely used, in symmetric or asymmetric go/return, inside the block(s) (e.g. in TDD, full duplex (FD[3]) or flexible frequency division duplex (fFDD[4])), in the same or each paired block, or in conventional FDD in paired blocks, (see fFDD examples in Figure 4 and Figure 5 and conventional FDD examples in Figure 6 and Figure 7).

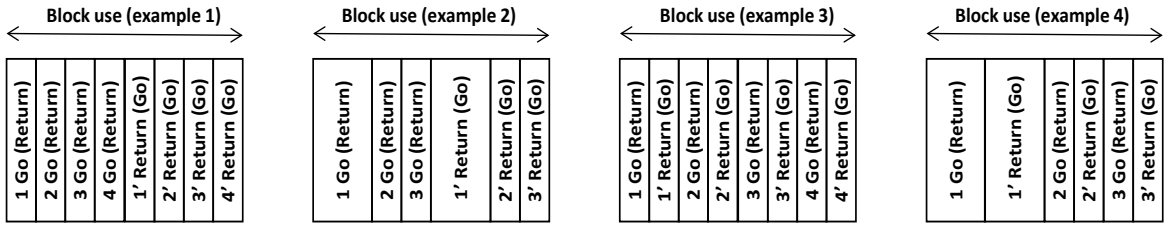


Figure 4: In-block fFDD use examples for symmetric go/return channel size

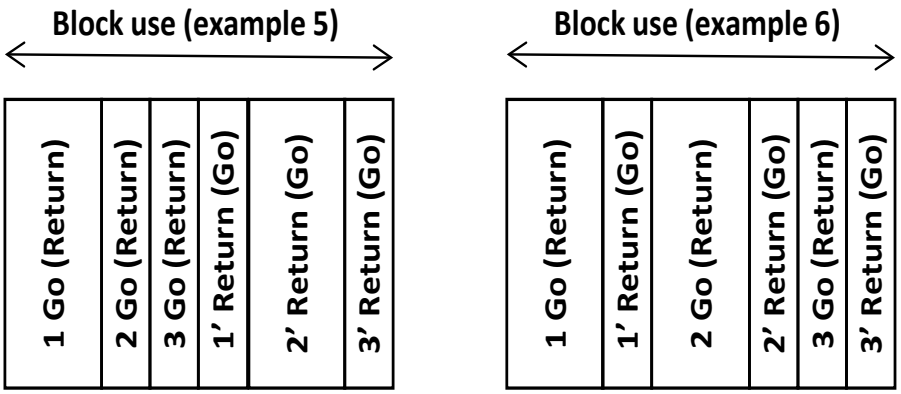


Figure 5: In-block FDD (fFDD) use examples for asymmetric go/return channel size

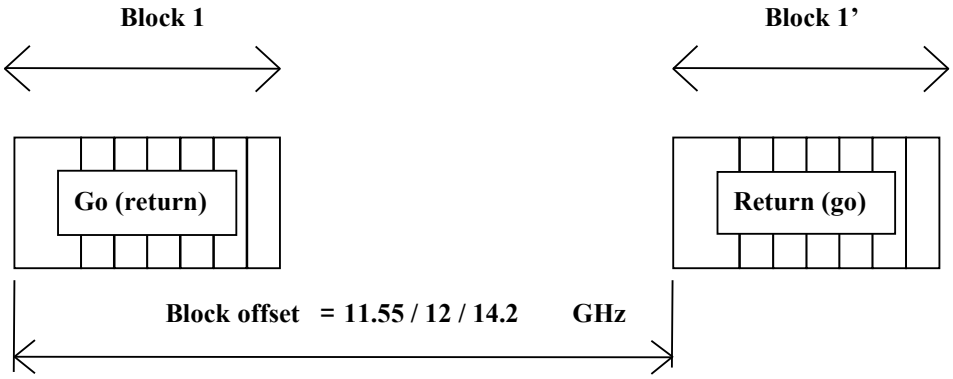


Figure 6: Paired blocks FDD use examples for symmetric go/return channel size

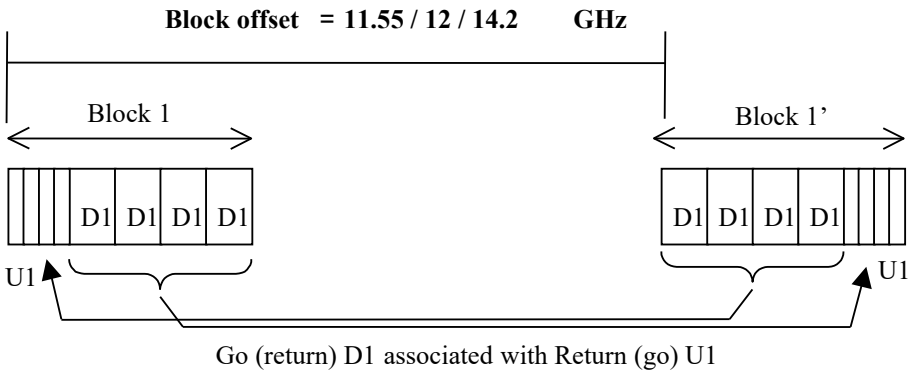


Figure 7: Paired blocks FDD use examples for asymmetric go/return channel size

ANNEX 4: UNWANTED EMISSION MASK FOR FS SYSTEMS FOR THE PROTECTION OF EESS (PASSIVE) OPERATING IN ADJACENT BANDS WHERE RR FOOTNOTE 5.340 APPLIES

FS transmitters operating in bands adjacent to bands 86-92 GHz, 100-102 GHz, 109.5-111.8 GHz and 114.25 - 116 GHz, where footnote RR No.**5.340** applies, should limit the unwanted emissions at the antenna port, falling into those bands according to the following formulas, where f is the centre frequency of the 100 MHz reference bandwidth expressed in GHz.

- Emission in band 86–92 GHz from FS transmitters operating in 92–94 GHz:
  −55 dBW/100 MHz for 86.05 ≤ f ≤ 91 GHz

  −41 − 14(92 – f) dBW/100 MHz for 91 ≤ f ≤ 91.95 GHz

- Emission in band 100–102 GHz from FS transmitters operating in 94.1–100 GHz:
  −41 − 14(f – 100) dBW/100 MHz for 100.05 ≤ f ≤ 101 GHz

  −55 dBW/100 MHz for 101 ≤ f ≤ 101.95 GHz

- Emission in band 100–102 GHz from FS transmitters operating in 102–109.5 GHz:
  −55 dBW/100 MHz for 100.05 ≤ f ≤ 101 GHz

  −41 − 14(102 – f) dBW/100 MHz for 101 ≤ f ≤ 101.95 GHz

- Emission in band 109.5–111.8 GHz from FS transmitters operating in 102–109.5 GHz:
  −41 − 14(f – 109.5) dBW/100 MHz for 109.55 ≤ f ≤ 110.5 GHz

  −55 dBW/100 MHz for 110.5 ≤ f ≤ 111.75 GHz

- Emission in band 109.5–111.8 GHz from FS transmitters operating in 111.8–114.25 GHz:
  −55 dBW/100 MHz for 109.55 ≤ f ≤ 110.8 GHz

  −41 − 14(111.8 − f) dBW/100 MHz for 110.8 ≤ f ≤ 111.75 GHz

- Emission in band 114.25–116 GHz from FS transmitters operating in 111.8–114.25 GHz:
  −41 − 14(f − 114.25) dBW/100 MHz for 114.3 ≤ f ≤ 115.25 GHz

  −55 dBW/100 MHz for 115.25 ≤ f ≤ 116 GHz

Graphically, the above formulas can be represented by the following figures, where the lower and the higher 100 MHz reference bandwidth slots are intended to be centred at 50 MHz inside the EESS band edges.

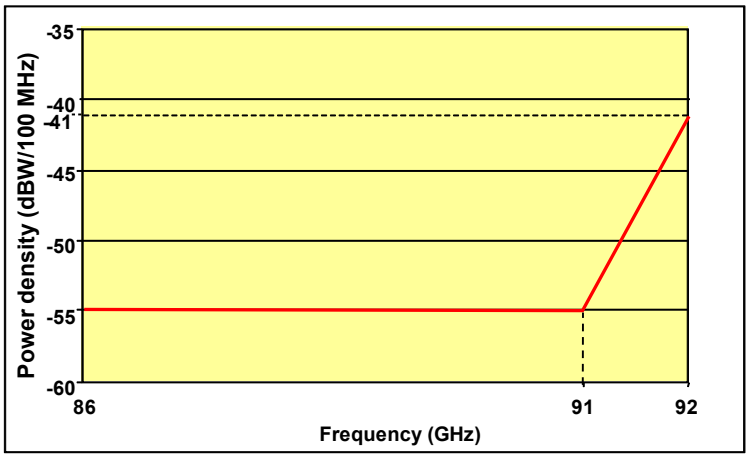


Figure 8: Unwanted emissions in the 86-92 GHz band from FS operating in 92-94 GHz

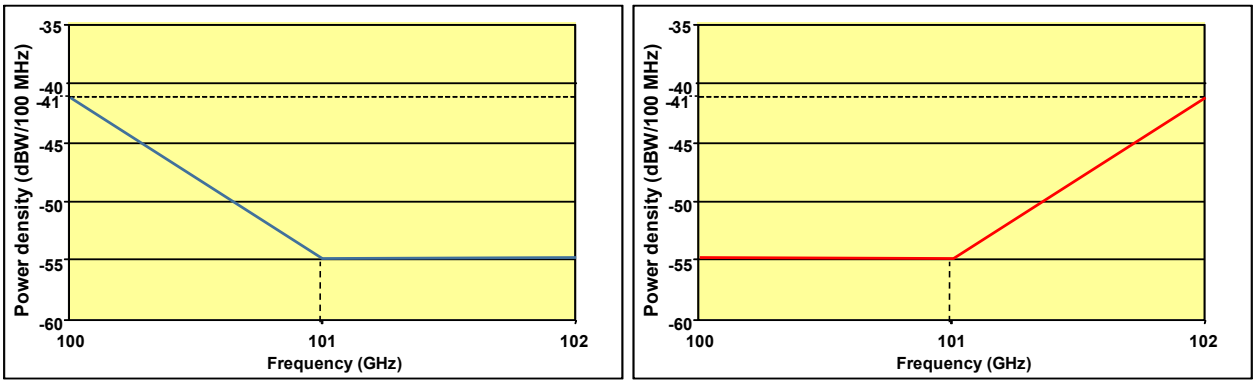


Figure 9: Unwanted emissions in the 100-102 GHz band:

a) from FS operating in 94.1-100 GHz **b) from FS operating in 102-109.5 GHz**

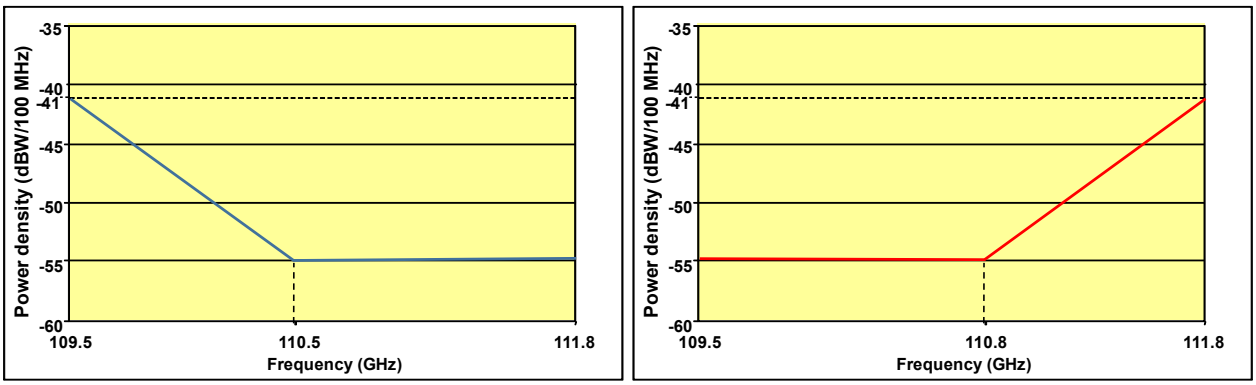


Figure 10: Unwanted emissions in the 109.5-111.8 GHz band

a) from FS operating in 102-109.5 GHz **b) from FS operating in 111.8-114.25 GHz**

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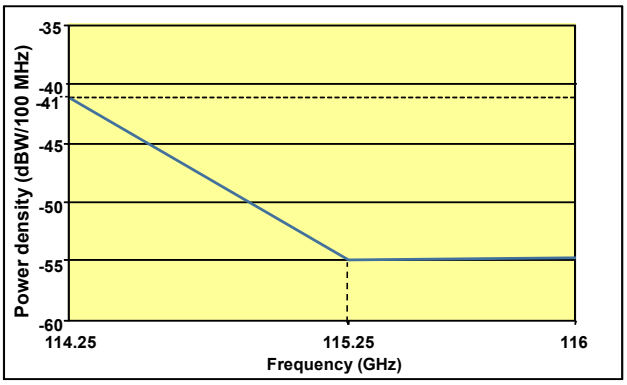


Figure 11: Unwanted emissions in the 114.25-116 GHz band from FS operating in 111.8-114.25 GHz

ANNEX 5: EXAMPLE OF TECHNICAL BACKGROUND FOR IMPLEMENTING A SELF-COORDINATION APPROACH FOR PP FS

To assist the planning of Point-to-Point (PP) fixed links, self-coordination approach, similar to the “light licensing”, described in ECC Report 80 [4], can be considered. Such regimes do not mean “licence exempt” use, but rather using a simplified set of conventional licensing mechanisms and attributes within the scope decided by administrations. This planning is delegated to the licensee.

Administrations intervene for protecting a limited number of sensitive sites while giving greater flexibility elsewhere than it could be allowed without the geographical limitation.

This process requires to record for instance the following set of simple criteria for each authorised link and make the data available publicly to assist in the identification of operational parameters and to conduct interference analyses:

- Date of application (in order to assign priority);
- Transmit, receive centre frequencies and occupied bandwidth;
- Equipment type, specifying relevant transmitter/receiver parameters;
- Link location (geographic coordinates, height/direction of antenna, etc.);
- The antenna gain and radiation pattern.

Subject to the conditions set by the administration, it is left to the operator to conduct any compatibility studies or coordinate as necessary to ensure that harmful interference is not caused to existing links registered in a national database, keeping that analysis available for any dispute resolution. For example, an operator wishing to install a new link could calculate the interference that the new link will create to the existing links in the database. Then it will be possible to determine whether this new link will interfere with existing links. If so, the new link could be re-planned to meet the interference requirements of existing links in the database. Otherwise, the new link may be also co-ordinated with existing operators, who might suffer from the interference.

To assist with the resolution of disputes, licenses are issued with a “date of priority”: interference complaints between licensees may therefore be resolved on the basis of these dates of priority (as with international assignments). Consideration of a maximum time frame between the link registration and its effective operational start is a matter for administrations at national level.

ANNEX 6: LIST OF REFERENCES

[1] Recommendation ITU-R P.676: “Attenuation by atmospheric gases”

[2] Recommendation ITU-R P.838: “Specific attenuation model for rain for use in prediction methods”

[3] ECC/REC/(05)07: “Radio frequency channel arrangements for Fixed Service Systems operating in the bands 71-76 GHz and 81-86 GHz”, approved October 2005, latest amended May 2024

[4] ECC Report 80: “Enhancing harmonisation and introducing flexibility in the spectrum regulatory framework”, approved March 2006

[5] ECC Report 124: “Coexistence between Fixed Service operating in 71-76 / 81-86 GHz and the passive services”, approved September 2008,

[6] ECC/REC/(01)05: “List of parameters of digital point-to-point fixed radio links used for national planning” approved October 2001, revised February 2010

[7] ETSI EN 302 217: “Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas”

[8] ECC Report 198: “Adaptive modulation and ATPC operations in fixed point-to-point systems - Guideline on coordination procedures”, approved May 2013

[9] ECC Report 258: “Guidelines on how to plan LoS MIMO for Point-to-Point Fixed Service Links”, approved January 2017

[10] ERC Report 25: “The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz (ECA Table)”, approved 1994, latest amended January 2025, editorial update 28 November 2025

[11] ITU Radio Regulations, edition of 2024

[12] ECC Report 282: “Point-to-Point Radio Links in the Frequency Ranges 92-114.25 GHz and 130-174.8 GHz” , approved September 2018

[13] ITU-R Recommendation F.2173 “Radio-frequency channel and block arrangements for fixed service systems operating in the 92-94 GHz, 94.1 100 GHz, 102-109.5 GHz and 111.8 114.25 GHz ranges”