Analysis of the suitability and update of the regulatory technical conditions for 5G MFCN and AAS operation in the 2300-2400 MHz band

approved xyz

ECC Report xyz

# Executive summary

This report studies the update of the 2300-2400 MHz MFCN band to include 5G and AAS. The work started in the March 2020 52nd ECC Plenary and contains two WIs (PT1\_28/ PT1\_29).

The 2300-2400 MHz frequency band is allocated within CEPT to the following services:

FIXED
MOBILE 5.384A
Amateur
Radiolocation

and is still used beside MFCN frequently for Military systems, Telemetry and PMSE (portable or mobile wireless video and cordless camera).

Therefore this Report contains only a review of harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for MFCN for suitability for 5G while maintaining the current regulatory status of the band.

TABLE OF CONTENTS

[0 Executive summary 2](#_Toc50647108)

[1 Introduction 5](#_Toc50647109)

[2 Existing Regulatory framework for MFCN systems 6](#_Toc50647110)

[2.1 Existing Band plan 6](#_Toc50647111)

[2.2 Existing technical conditions – BEM requirements 6](#_Toc50647112)

[3 Other services and applications in-band and adjacent band 7](#_Toc50647113)

[3.1 Spectrum situation 7](#_Toc50647114)

[4 Suitability of the current technical framework for 5G 8](#_Toc50647115)

[4.1 Suitability for non-aas MFCN Base stations 8](#_Toc50647116)

[4.2 Suitability for AAS MFCN base stations 8](#_Toc50647117)

[5 In-band and Adjacent band coexistence 9](#_Toc50647118)

[5.1 Spectrum situation 9](#_Toc50647119)

[5.2 In-band coexistence 9](#_Toc50647120)

[5.3 Adjacent band coexistence 9](#_Toc50647121)

[5.4 Parameters and scenarios for the relative AAS/non-AAS compatibility study 9](#_Toc50647122)

[5.5 Technical summary 9](#_Toc50647123)

[6 Recommended updates to the Regulatory Framework 10](#_Toc50647124)

[6.1 Recommended Band plan 10](#_Toc50647125)

[6.2 Applicable technical conditions 10](#_Toc50647126)

 [AAS LRTCs for BS 10](#_Toc50647127)

[6.2.1 10](#_Toc50647128)

[6.2.2 MFCN Terminal 12](#_Toc50647129)

[7 Conclusions 14](#_Toc50647130)

[ANNEX 1: PARAMETERS FOR THE INTERFERENCE STUDY IN THE 2600 MHZ MFCN BAND BETWEEN NON-AAS/AAS AND inband/ADJACENT SERVICES 15](#_Toc50647131)

[ANNEX 2: STUDY #1 FOR... 16](#_Toc50647132)

[ANNEX 3: STUDY #2 FOR... 17](#_Toc50647133)

[ANNEX 4: List of References 18](#_Toc50647134)

LIST OF ABBREVIATIONS

|  |  |
| --- | --- |
| Abbreviation | Explanation |
| 3GPP | 3rd Generation Partnership Project |
| AAS | Active Antenna Systems |
| BEM | Block Edge Mask |
| BS | Base Station |
| e.i.r.p. | Equivalent Isotropic Radiated Power |
| LTE | Long Term Evolution |
| NLOS | Non Line of Sight |
| Non-AAS | Non-Active Antenna Systems |
| NR | New Radio |
| OOB | Out of Band |
| OTA | Over The Air |
| RAN | Radio Access Network |
| TRP | Total Radiated Power |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Introduction

This Report analyses the necessary changes in the existing ECC Decision (14)02, [1], for the 2300 - 2400 MHz frequency band in order to introduce 5G, namely New Radio (NR) and Active Antenna Systems (AAS). The analysis is based on existing reports for non-AAS:

* ECC Report 172, "Broadband Wireless Systems Usage in 2300-2400 MHz", [2];

New studies/simulations for AAS with respect to non-AAS within the band coexistence and to adjacent services, RAS and radar, are done. The analysis assumes that the current technical conditions will also remain as part of the regulatory framework to ensure that current and future deployments of non-AAS MFCN will not be impacted. As a result, this ECC Report gives the least restrictive technical condition for the introduction of 5G and updated Block Edge Masks (BEMs).

# BACKGROUND

The frequency band 2300-2400 MHz is allocated to the Mobile Service on a co-primary basis by ITU Radio Regulations [x] in all three ITU regions. WRC-07 identified the band 2300-2400 MHz for IMT, see footnote RR 5.384A.

However, after WRC-07, CEPT was not in a position to implement on a harmonised basis the band 2300-2400 MHz for IMT because of the need to maintain the long term incumbent use.

# Existing Regulatory framework for MFCN systems

## Existing Band plan

ECC Decision (14)02,

|  |
| --- |
| TDD(MHz) |
| 2300 MHz2305 MHz | 2305 MHz 2310 MHz | 2310 MHz 2315 MHz | 2315 MHz 2320 MHz | 2320 MHz2325 MHz | 2325 MHz 2330 MHz | 2330 MHz 2335 MHz | 2335 MHz2340 MHz | 2340 MHz2345 MHz | 2345 MHz2350 MHz | 2350 MHz 2355 MHz | 2355 MHz2360 MHz | 2360 MHz 2365 MHz | 2365 MHz 2370 MHz | 2370 MHz 2375 MHz | 2375 MHz2380 MHz | 2380 MHz 2385 MHz | 2385 MHz2390 MHz | 2390 MHz 2395 MHz | 2395 MHz2400 MHz |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Figure 1: Harmonised frequency arrangement for MFCN in the 2300-2400 MHz band, [1]

## Existing technical conditions – BEM requirements

[The ECC Decision (14)02 provides already technical parameters for MFCN non-AAS.]

# Other services and applications in-band and adjacent band

[deployed, planned or switched-off]

In March 2012, the ECC has published ECC Report 172 [xx] which addresses sharing and compatibility studies between broadband wireless systems (BWS) in the band 2300-2400 MHz and other services/systems in the band and in adjacent bands. This ECC Report [xx] concludes that the sharing between BWS and incumbent services in the 2300-2400 MHz band is feasible. [In some cases, there is a requirement for mitigation techniques such as adjacent channel operation, geographical separation, time sharing or a combination of the previous.] ECC Report 172 studies were performed assuming worst case scenarios and not considering sharing opportunities through Licensed Shared Access.

4 sharing scenarios below 2300 MHz

4.1 Space services IN THE BAND 2200-2300 MHz (space To earth)

4.1.1 SRS characteristics (2200-2290 MHz)

4.1.2 SRS characteristics (2290-2300 MHz)

4.2 space service IN THE BAND 2200-2290 MHz (SPACE TO SPACE)

4.3 Deep Space research service (2290-2300 MHz)

4.3.1 Interference from LTE TDD BS to SRS earth stations

4.3.2 Interference from LTE TDD BS to deep space SRS earth stations

4.3.3 Impact of unwanted emission from LTE TDD BS to Deep Space Earth Station receivers

4.4 Telemetry

4.5 Radio Astronomy Service

4.6 Defence systems

4.7 Fixed Service

5 sharing scenarios within 2300-2400 MHz

5.1 SAP/SAB Video Links

[5.2 Telemetry](#_Toc321137260)

[5.2.1 Aeronautical telemetry](#_Toc321137261)

[5.2.2 Terrestrial Telemetry](#_Toc321137262)

[5.2.3 Telemetry characteristics](#_Toc321137263)

[5.2.4 Interferences from LTE to Telemetry](#_Toc321137264)

[5.2.5 Interferences from Telemetry to LTE](#_Toc321137265)

[5.3 UAS (UNMANNED AIRCRAFT SYSTEMS)](#_Toc321137267)

[5.4 BWS versus BWS](#_Toc321137274)

[5.4.2 BWS-UE to BWS-UE](#_Toc321137276)

[5.4.3 BWS-BS to BWS-BS](#_Toc321137277)

[5.5 Amateur Service](#_Toc321137279)

[6 sharing SCENARIOS ABOVE 2400 MHz](#_Toc321137284)

[6.1 Bluetooth](#_Toc321137285)

[6.2 WLAN](#_Toc321137290)

[6.2.2 Impact of LTE TDD BS to WLAN AP](#_Toc321137292)

[6.2.3 Impact of Home WLAN AP on LTE TDD system](#_Toc321137293)

## Spectrum situation

[tbd]

# Suitability of the current technical framework for 5G

1. Do we need Chapter 3?

## Suitability for non-aas MFCN Base stations

[TBD if needed]

## Suitability for AAS MFCN base stations

[TBD if needed]

# In-band and Adjacent band coexistence

## Spectrum situation

The figure below shows the 2300-2400 MHz spectrum situation and the adjacent band and in-band situation to other services as listed in ECC Report 172 [2] and ECC Dec (14)02 [1].



Figure 2: In-band and adjacent services for the 2300-2400 MHz MFCN band

## In-band coexistence

## Adjacent band coexistence

## Parameters and scenarios for the relative AAS/non-AAS compatibility study

The parameters can be found in [TBD]

## Technical summary

Various stakeholders provided simulation results and the details are given in [TBD] to …

# Recommended updates to the Regulatory Framework

## Recommended Band plan

[It is recommended to not change the existing frequency arrangement in ECC Decision (14)02, the frequency arrangement is based on 20 blocks of 5MHz:

Figure 3: Harmonised frequency arrangement for MFCN in the 2300-2400 MHz band, [1]

It is noted that the channel bandwidth for 5G NR is mainly based on a block up to 100MHz for a mobile operator.]

## Applicable technical conditions

[

### AAS LRTCs for BS

For AAS base stations, TRP is the metric to be used for regulatory power limits.

Base station BEM definition

To obtain a BEM for a specific block, the BEM elements that are defined in Table 6.2.1-1 are used as follows:

1. In-block power limit is used for the block assigned to the operator.
2. Baseline is used for synchronised WBB ECS networks except from the operator block in question and corresponding transitional regions.
3. Transitional regions are determined, and corresponding power limits are used.
4. Restricted baseline is used for unsynchronised and semi-synchronised WBB ECS networks,

Table 1: BEM elements and applicable frequencies

|  |  |
| --- | --- |
| BEM element  | Definition |
| In-block | Block for which the BEM is derived. |
| Baseline | Spectrum used for MFCN, except from the operator block in question and corresponding transitional regions. |
| Transitional region | The transitional region applies 0 to 10 MHz below and above the block assigned to the operator. Transitional regions do not apply to TDD blocks allocated to other operators, unless networks are synchronised.The transitional regions do not apply below 2300 MHz or above 2400 MHz. |
| Restricted baseline | Spectrum used for WBB ECS by networks unsynchronised or semi-synchronised with the operator block in question |

#### AAS BS In-Block power

Table 2: In-block power limit

|  |  |  |
| --- | --- | --- |
| BEM element | Frequency range | AAS TRP limit (1) |
| In-block | Block assigned to the operator | Not obligatory.For femto base stations, the use of power control is mandatory in order to minimise interference to adjacent channels. |
| (1) see ECC Report 281  |

#### AAS BS Out-of-block power limits for: Interference between synchronised MFCNs

The following out-of-block power limits are proposed, based on core requirements from MSR BS spec for AAS BS TS 37.105, for coexistence of synchronised MFCN BSs. Less stringent technical parameters, if agreed among the operators of such networks, may also be used.

3GPP Limits

OTA Operating band unwanted emission, minimum requirement for MSR operation

Table 3: Table 9.7.5.2.2-1b: Wide Area operating band unwanted emission mask (UEM) for BS supporting NR (except operation in band n1) and not supporting UTRA in BC1 and BC3 bands above 1GHz.

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirement (Note 1, 2) | Measurement bandwidth (Note 4) |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz  |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -5 dBm | 100 kHz  |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax  | -6 dBm (Note 5) | 1MHz  |
| NOTE 1: For MSR RIB supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is Δf ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be -15dBm/1MHz.NOTE 2: For MSR multi band RIB with Inter RF Bandwidth gap < 2×ΔfOBUE the basic limit within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.NOTE 3: For operation with an E-UTRA 1.4 or 3MHz carrier adjacent to the Base Station RF Bandwidth edge, the limits in Table 6.6.2.2-2 apply for 0 MHz ≤ Δf < 0.15 MHz. |

CEPT TRP limits for AAS BS (through integration of the above 3GPP values)

Table 4: Baseline and transitional power limits for synchronised MFCN networks, for AAS base stations

|  |  |  |
| --- | --- | --- |
| BEM element | Frequency range | AAS TRP limitdBm/(5 MHz) per cell (1) |
| Transitional region | -5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge  | Min(PMax'-40,16) (1)(2) |
| Transitional region | -10 to -5 MHz offset from lower block edge5 to 10 MHz offset from upper block edge | Min(PMax'-43,12) (1)(2) |
| Baseline | Below -10 MHz offset from lower block edge.Above 10 MHz offset from upper block edge.Within 2300 - 2400 MHz. | Min(PMax'-43,1) (1)(2) |
| (1) The transitional regions and the baseline power limits apply to the synchronised operation of MFCN networks as defined in ECC Report 281.(2) PMax' is the maximum mean carrier power in dBm for the base station measured as TRP per carrier in a given cell.Note: for TDD blocks the transitional region applies in case of synchronised adjacent blocks, and in-between adjacent TDD blocks that are separated by 5 or 10 MHz. The transition region does not extend below 2300 MHz or above 2400 MHz. |

#### Out-of-block power limits AAS BEM: Interference between unsynchronised or semi-synchronised MFCN networks

It is proposed to add the following TRP restricted baseline for AAS BS operating in unsynchronised or semi-synchronised mode.

Table 5: Restricted baseline power limits for unsynchronised and semi-
synchronised MFCN networks, for AAS base stations in the same geographical area

|  |  |  |
| --- | --- | --- |
| BEM element | Frequency range | AAS TRP limitdBm/(5 MHz) per cell (1) |
| Restricted baseline | Unsynchronised and semi-synchronised blocks.Below the lower block edge.Above the upper block edge.Within 2300-2400 MHz  | TBD |
| (1) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors. |

The out-of-block power limit applies to unsynchronised and semi-synchronised MFCN base stations if no geographic or indoor/outdoor separation is available. Less stringent technical parameters, if agreed among operators of such networks, may also be used, such as where there is appropriate radio isolation (e.g. due to geographic or indoor/outdoor separation) between networks. In addition, depending on national circumstances, CEPT Administrations may define a relaxed alternative “restricted baseline limit” applying to specific implementation cases to ensure a more efficient usage of spectrum.

### MFCN Terminal

The same technical parameters as per current ECC decision are to be maintained i.e.:

In-block requirements for all user equipment

This decision provides a recommended upper limit of 25 dBm for the in-block power of the user equipment (UE).

This power limit is specified as e.i.r.p. for UE designed to be fixed or installed and as TRP [[1]](#footnote-2)[1] for the UE designed to be mobile or nomadic.

A tolerance of up to + 2 dB has been included in this limit, to reflect operation under extreme environmental conditions and production spread.

Administrations may relax this limit in certain situations, for example fixed UE in rural areas, providing that protection of other services, networks and applications is not compromised and cross-border obligations are fulfilled.

]

# Conclusions

This ECC Report

1. PARAMETERS FOR THE INTERFERENCE STUDY IN THE 2600 MHZ MFCN BAND BETWEEN NON-AAS/AAS AND inband/ADJACENT SERVICES
2. STUDY #1 FOR...
3. STUDY #2 FOR...
4. List of References

1. [ECC Decision (14)02](https://www.ecodocdb.dk/download/b02d6dab-2b58/ECCDEC1402.DOCX), "Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks (MFCN)", Approved 27 June 2014

1. [ECC Report 172](https://www.ecodocdb.dk/download/01a8e2ae-8ede/ECCREP172.DOC), "Broadband Wireless Systems Usage in 2300-2400 MHz", March 2012
2. [CEPT Report 55](https://www.ecodocdb.dk/download/77dfd5d8-7dc8/CEPTREP055.DOCX), "Report A from CEPT to the European Commission in response to the Mandate on ‘Harmonised technical conditions for the 2300-2400 MHz (‘2.3 GHz’) frequency band in the EU for the provision of wireless broadband electronic communications services’", Report approved on 28 November 2014 by the ECC
3. [CEPT Report 56](https://www.ecodocdb.dk/download/16fde9f8-9f82/CEPTREP056.PDF), " Report B1 from CEPT to the European Commission in response to the Mandate on ‘Harmonised technical conditions for the 2300-2400 MHz (‘2.3 GHz’) frequency band in the EU for the provision of wireless broadband electronic communications services’", Report approved on 6 March 2015 by the ECC
4. [CEPT Report 58](https://www.ecodocdb.dk/download/46bb826d-3b28/CEPTREP058.DOCX), " Report B2 from CEPT to the European Commission in response to the Mandate on ‘Harmonised technical conditions for the 2300-2400 MHz (‘2.3 GHz’) frequency band in the EU for the provision of wireless broadband electronic communications services", Report approved on 3 July 2015 by the ECC
1. [1] TRP is a measure of how much power the antenna actually radiates. The TRP is defined as the integral of the power transmitted in different directions over the entire radiation sphere. For an isotropic antenna radiation pattern, e.i.r.p. and TRP are equivalent. For a directional antenna radiation pattern, e.i.r.p. in the direction of the main beam is (by definition) greater than the TRP. [↑](#footnote-ref-2)