



ECC Decision (14)02

Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks (MFCN)

approved 27 June 2014

amended 10 March 2023

EXPLANATORY MEMORANDUM

1 INTRODUCTION

This ECC Decision aims at harmonising implementation measures for mobile/fixed communications networks (MFCN) in the frequency band 2300-2400 MHz for time division duplex (TDD) use¹. It includes the least restrictive technical conditions (LRTC), taking into account the existing standardisation framework and activities at the worldwide level, and an appropriate frequency arrangement.

For the purpose of this ECC Decision, licensed shared access (LSA) is the recognised approach by CEPT for administrations wishing to introduce MFCN while maintaining the current incumbent use. Regulatory provisions based on LSA can ensure long term incumbent use of the band.

ECC conducted in 2022 a review of this ECC Decision and, based on this assessment, developed harmonised LRTC suitable for 5G New Radio (NR) including active antenna systems (AAS) as well as LTE with AAS.

2 BACKGROUND

The CEPT has recognised the importance of the availability of common and minimal (least restrictive) technical conditions for the band 2300-2400 MHz as well as the need to ensure a long term possibility for incumbent usage. These technical conditions will provide significant economies of scale and facilitate the introduction of new applications depending on national decisions.

The following principles have been considered to define the frequency arrangement:

- a common frequency arrangement to facilitate roaming, border coordination and to achieve economies of scale for equipment, whilst maintaining the flexibility to adapt to national circumstances and market demand;
- careful consideration on block sizes for the band plan.

It should be noted that there may be a requirement of coordination between administrations implementing national frequency arrangements (see ECC Recommendation (14)04 [1]).

When defining LRTC, the block edge mask (BEM) concept has been developed by CEPT to facilitate implementation of spectrum rights of use which are as technology neutral as possible.

In order to maintain the required flexibility for administrations regarding the non-mandatory introduction of MFCN in this band, a block edge mask has been developed, equally applying for full or partial implementation of the harmonised frequency arrangement.

This revision of the ECC Decision aims to reflect the development of MFCN technologies, in particular the introduction of 5G NR and AAS.

The updated analysis presented in ECC Report 347 [2] confirmed that:

- the band plan established for non-AAS MFCN is applicable also for AAS MFCN;
- the LRTC in terms of a BEM as contained in the previous version of this ECC Decision remains applicable for non-AAS base stations; and
- a new BEM is required and has been developed for AAS base stations for which total radiated power (TRP)² is the metric.

¹ The TDD frequency arrangement offers flexibility for the time interval used for downlink and the time interval used for uplink transmissions.

² TRP is a measure of the total power that an antenna 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.

When considering the introduction of AAS MFCN systems in the 2300-2400 MHz frequency band, there is a need to ensure coexistence with non-AAS MFCN systems already in operation in the band.

In CEPT countries, the band 2300-2400 MHz is currently used by the following systems/services beside MFCN:

- Telemetry (both terrestrial and aeronautical telemetry);
- Other governmental use (e.g. Unmanned Aircraft Systems (UAS));
- Programme making and special events (PMSE) applications (SAP/SAB video links);
- Amateur, as a secondary service.

Licensed shared access (LSA) is the recognised approach by CEPT for administrations wishing to introduce MFCN while maintaining the current incumbent use. Necessary requirements are to be established by the national regulators to share the band through LSA, assessing the protection of the incumbent use of the band.

LSA, as defined by RSPG in [3] is “A regulatory approach aiming to facilitate the introduction of radiocommunication systems operated by a limited number of licensees under an individual licensing regime in a frequency band already assigned or expected to be assigned to one or more incumbent users. Under the LSA approach, the additional users are authorised to use the spectrum (or part of the spectrum) in accordance with sharing rules included in their rights of use of spectrum, thereby allowing all the authorised users, including incumbents, to provide a certain Quality of Service (QoS)”.

LSA is further described in ECC Report 205 [4]. It allows a detailed management of network deployment and effective control of the sharing arrangement, as opposed to licence-exempt regulatory approach. A key feature of LSA is that it allows offering a predictable quality of service for the incumbent as well as for the LSA licensee, each having exclusive access to that spectrum at a given location and at a given time.

LSA is considered to provide an alternative solution to access spectrum resources for MFCN when the classic approach of clearing and re-farming is not achievable.

The ECC has developed two ECC Reports which address sharing and adjacent band compatibility studies between MFCN in the band 2300-2400 MHz and other services/systems, ECC Report 172 [5] which covers non-AAS MFCN systems³ and ECC Report 347 [2] which covers AAS MFCN systems. These two reports conclude that sharing between MFCN systems 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 thereof. Studies were performed assuming worst case scenarios and not considering LSA. Therefore, administrations wishing to implement MFCN under LSA are strongly advised to conduct national studies in order to foster more efficient sharing and to consider in their studies the impact of MFCN topologies.

In cases where geographical restrictions, e.g. exclusion zones, are dependent on unwanted emission levels, the exclusion zones may be larger when MFCN with AAS is used compared to MFCN with non-AAS, or may even be impracticable. This is because it may not be possible to implement the necessary operator-specific filtering for AAS with current technology due to complexity issues.

Examples of MFCN topologies and mobile broadband technologies that may be utilised in the 2300-2400 MHz band under a LSA framework are provided in ETSI Technical Report TR 103 113 [6].

3 REQUIREMENT FOR AN ECC DECISION

The ECC recognises that implementation of MFCN, including IMT systems with AAS and non-AAS providing high data rate applications in the band 2300-2400 MHz based on a harmonised frequency arrangement, will:

- maximise the opportunities and benefits for end users and society;
- benefit capital expenditure for operators;
- reduce development and implementation costs of manufacturing equipment; and,
- secure future long term investments by providing economies of scale.

³ Described as BWS (Broadband Wireless Systems) in ECC Report 172

The opportunity to utilise larger channel bandwidths will assist the provision of high data rates for MFCN.

Therefore, this ECC Decision is required in order to identify technical and regulatory conditions for harmonised use of non-AAS as well as AAS MFCN systems in the band, while protecting the incumbent's usage in the countries that wish to maintain such use.

Furthermore, noting the above, the amount of spectrum available for MFCN may differ from country to country depending upon sovereign national decisions.

ECC DECISION OF 27 JUNE 2014 ON HARMONISED TECHNICAL AND REGULATORY CONDITIONS FOR THE USE OF THE BAND 2300-2400 MHZ FOR MOBILE/FIXED COMMUNICATIONS NETWORKS (MFCN) (ECC DECISION (14)02), AMENDED 10 MARCH 2023

“The European Conference of Postal and Telecommunications Administrations,

considering

- a) that the frequency band 2300-2400 MHz is allocated to the mobile service on a co-primary basis by ITU Radio Regulations [7] in all three ITU regions;
- b) that WRC-07 identified the band 2300-2400 MHz for IMT, see footnote RR 5.384A;
- c) that mobile/fixed communications networks (MFCN) for the purpose of this Decision includes IMT and other communications networks in the mobile and fixed services;
- d) that detailed specifications of IMT radio interfaces are described in Recommendation ITU-R M.1457 [8] for IMT-2000, Recommendation ITU-R M. 2012 [9] for IMT-Advanced and Recommendation ITU-R M.2150 [10] for IMT-2020;
- e) that this ECC Decision leaves flexibility to CEPT administrations to determine the use of this frequency band at a national level;
- f) that non-AAS (non-active antenna systems) MFCN system refers to MFCN base stations that provide one or more antenna connectors, which are connected to one or more separately designed passive antenna elements to radiate radio waves;
- g) that AAS (active antenna systems) MFCN system refers to MFCN base stations and antenna systems where the amplitude and/or phase of the signals from the various antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This is intended to exclude long term beam shaping such as fixed electrical down tilt;
- h) that there is a need to ensure a coexistence between AAS and non-AAS MFCN systems in the 2300 - 2400 MHz band;
- i) that ETSI has specified New Radio (NR) including AAS and also specified AAS support for LTE;
- j) that the deployment of AAS MFCN systems compared to non-AAS MFCN systems will enhance the capacity, bit rates and improve the efficient usage of spectrum;
- k) that AAS MFCN systems should not claim more protection than provided to non-AAS MFCN systems;
- l) that AAS in the 2300-2400 MHz frequency band only applies to base stations;
- m) that this ECC Decision, updating the previous version of ECC Decision (14)02 which entered into force on 27 June 2014, caters for the latest developments at a technical and regulatory level in order to provide relevant conditions for the development of 5G NR and AAS MFCN systems in the 2300-2400 MHz band;
- n) that in the case of uncoordinated MFCN TDD networks in the same geographical area, it is beneficial to synchronise the systems (avoiding simultaneous uplink and downlink transmissions) to improve the efficient usage of spectrum, avoiding the need for restricted blocks or guard bands between different networks and the need for operator-specific filters (at the time of publication of this Decision operator-specific filtering is only an option on non-AAS BS equipment, as it is not possible to cost-effectively implement operator-specific filters on AAS BS equipment) as described in ECC Report 216 [11] and ECC Report 296 [12];
- o) that in case of both non-AAS and AAS MFCN TDD networks, in some situations, special measures from the administration may be needed to ensure inter-operator synchronisation, such as defining a default time reference, default UL/DL ratio, and defining the scope of those measures (e.g. small cells, especially indoor, may be excluded from those measures);
- p) that in the case of unsynchronised MFCN TDD networks, the compliance of two adjacent operators with the BEM requirements may be achieved by introducing frequency separation (e.g. through the authorisation process at national level) between the block edges of both operators. Another option may be for administrations to introduce restricted spectrum blocks. Operators would then be required to limit the power used in the upper or lower part of their assigned spectrum, to limit the interference due to the selectivity of the adjacent operator's receiver;

- q) that administrations implementing MFCN in the 2300-2400 MHz frequency band may choose to make only part of the band available for MFCN;
- r) that in some CEPT countries the band 2300-2400 MHz is used for Telemetry (see RR footnote 5.395, WRC03 [7]), PMSE (SAP/SAB video links) and other services/systems;
- s) that the use of the band 2300-2400 MHz by some incumbent users is generally limited to certain times or to specific geographical locations;
- t) that ensuring the long term incumbent's use is a national decision;
- u) that the introduction of MFCN in the 2300-2400 MHz band in one country can have an impact on incumbent usage in neighbouring countries and thus may require the need for cross-border coordination agreement;
- v) that, as described in ECC Report 347 [2], the conclusions from ECC Report 172 [5] related to isolation, separation or coordination distances with co-channel services (such as aeronautical/terrestrial telemetry) remain valid for AAS MFCN under the assumptions used in the simulations, in particular 46 dBm/(20 MHz) TRP in-block BS power. Higher in-block BS power will typically result in larger coordination distances, noting that coexistence also depends on many other parameters such as the actual radio propagation condition, interferer (i.e. BS) and victim antenna heights, antenna gain, etc.;
- w) that harmonised frequency arrangements facilitate economies of scale and availability of low-cost equipment;
- x) that global roaming is facilitated by harmonised frequency arrangements and circulation arrangements for the use of MFCN terminals;
- y) that Recommendation ITU-R M.1036 [13] identifies the recommended frequency arrangement for the band 2300-2400 MHz for IMT systems;
- z) that some Administrations expressed their intention to introduce MFCN in the 2300-2400 MHz band under licensed shared access (LSA), as defined by RSPG in [3] and as further described in ECC Report 205 [4], on a shared basis with the incumbent services;
- aa) that LSA is to be implemented by administrations on a voluntary basis;
- bb) that under LSA, spectrum is used by either the incumbent(s) or the LSA licensee(s), so that the latter has individual spectrum rights of use / access where and when the spectrum is made available by the incumbent(s), in accordance with the sharing framework defined beforehand;
- cc) that the level of the service that can be delivered by a LSA licensee is dependent on the situation in the band, e.g. the usage scenarios of the incumbent(s) and the corresponding sharing framework established on the basis of the criteria identified in ECC Report 205 [4];
- dd) that LSA provides means for making the 2300-2400 MHz band available to MFCN in a timely manner;
- ee) that in EU/EFTA countries the radio equipment that is under the scope of this Decision shall comply with the RE Directive [14]. Conformity with the essential requirements of the RE Directive may be demonstrated by compliance with the applicable harmonised European standard(s), cited in the Official Journal of the European Union (OJ), or by using the other conformity assessment procedures set out in the RE Directive.

DECIDES

1. that the purpose of this ECC Decision is to provide harmonised regulatory conditions for the use of the band 2300-2400 MHz for mobile/fixed communications networks (MFCN);
2. that, subject to national considerations, the frequency band 2300-2400 MHz is made available for MFCN, while also enabling administrations to maintain the use of the band by incumbent services;
3. that the following technical and operational parameters apply to MFCN within the frequency band 2300 - 2400 MHz:
 - a) the harmonised frequency arrangement is given in Annex 1;
 - b) the least restrictive technical conditions (LRTC) are specified in Annex 2;

4. that, administrations wishing to introduce MFCN in the band, and maintain the long term incumbent use of the band in their territory implementing Licensed Shared Access (LSA), should develop appropriate sharing framework following the guidelines contained in Annex 3;
5. that this Decision **enters into force** on 10 March 2023;
6. that the preferred **date for implementation** of this Decision shall be 10 September 2023;
7. that CEPT administrations shall communicate the **national measures** implementing this Decision to the ECC Chairman and the Office when this ECC Decision is nationally implemented.

Note:

Please check the Office documentation database <https://docdb.cept.org/> for the up to date position on the implementation of this and other ECC Decisions.

ANNEX 1: HARMONISED FREQUENCY ARRANGEMENT

Frequency arrangement shall be based on 20 blocks of 5 MHz as described in Figure 1.

MFCN TDD																				
frequency [MHz]	2300	2305	2310	2315	2320	2325	2330	2335	2340	2345	2350	2355	2360	2365	2370	2375	2380	2385	2390	2395
	2305	2310	2315	2320	2325	2330	2335	2340	2345	2350	2355	2360	2365	2370	2375	2380	2385	2390	2395	2400
Channel bandwidth [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 TDD in the 2300-2400 MHz band

An operator can aggregate several channels of 5 MHz to obtain a wider channel.

Note: Some administrations may choose to only make part of the frequency band 2300-2400 MHz available to MFCN. See also considering q).

ANNEX 2: LEAST RESTRICTIVE TECHNICAL CONDITIONS FOR MFCN IN THE 2300-2400 MHz BAND

The least restrictive technical conditions (LRTC) defined in this annex are in the form of a block-edge mask (BEM) applicable to MFCN as derived from scenarios in ECC Report 203 [15] for non-AAS and ECC Report 347 [2] for AAS.

For non-AAS MFCN base stations, the BEM is expressed in terms of e.i.r.p. limits, and for AAS MFCN base stations, the BEM is expressed in terms of Total Radiated Power (TRP). TRP is defined as the integral of the power radiated by an antenna array system in different directions over the entire radiation sphere. TRP is equal to the total conducted power input into the antenna array system less any losses in the antenna array system.

BEM is related to spectrum licensing and the avoidance of interference between users of spectrum.

A BEM is an emission mask that is defined, as a function of frequency, relative to the edge of a block of spectrum that is licensed to an operator. It consists of in-block and out-of-block components which specify the permitted emission levels over frequencies inside and outside the licensed block of spectrum respectively.

The BEM has been derived:

- to allow coexistence between MFCN applications in the 2300-2400 MHz band and to apply to the harmonised frequency arrangement as described in ANNEX 1;
- to ensure coexistence with the systems above 2400 MHz.

The derived BEM does not take into account coexistence with adjacent services below 2300 MHz for which general guidance is provided in ECC Report 172 [5] and in ECC Report 347 [2].

The derived BEM does also not take into account coexistence with other incumbent services inside the band 2300-2400 MHz. Coexistence with incumbent services is handled in ANNEX 3.

In addition to the BEM, further requirements may be needed in such instances. This can be done at a national level or through cross-border coordination developed by bilateral or multilateral agreements.

The derived BEM shall be applied as an essential component of the technical conditions necessary to ensure coexistence between services at a national level. However, it should be understood that the derived BEM does not always provide the required level of protection of victim services and additional mitigation techniques would need to be applied in order to resolve any remaining cases of interference.

Operators of MFCN in the 2300-2400 MHz band may agree, on a bilateral or multilateral basis, on less stringent technical parameters providing that they continue to comply with the technical conditions applicable for the protection of other services, applications or networks and with their cross-border obligations.

The term block edge refers to the frequency boundary of spectrum licensed to a mobile/fixed communications networks operator. The term band edge refers to the boundary of a range of frequencies allocated for a certain use (e.g. 2300 MHz is the lower band edge for MFCN).

A2.1 TECHNICAL CONDITIONS FOR MFCN BASE STATIONS (TDD)

Technical conditions are applicable to MFCN base stations (BS) with different power levels (macro, micro, pico and femto BS).

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

1. In-block power limit is used for the block assigned to the operator;
2. Transitional regions are determined, and corresponding power limits are used;
3. For remaining spectrum assigned to MFCN TDD, baseline power limits are used.

Table 1: BEM elements for MFCN Base stations

BEM element	
In-block	Block for which the BEM is derived.
Baseline	Spectrum used for TDD, except from the operator block in question and any corresponding transitional regions ⁴ .
Transitional region	<p>Transitional regions apply for unwanted emissions into adjacent TDD blocks allocated to other operators if networks are synchronised.</p> <p>They also apply in-between TDD blocks with a frequency separation of 5 or 10 MHz between each block edge.</p> <p>For immediately adjacent unsynchronised TDD networks, there is no transitional region and the baseline levels apply outside the allocated block.</p> <p>The transitional regions do not apply below 2300 MHz or above 2400 MHz.</p>

Synchronised operation⁵ as referred in the table above means “operation of TDD in two different systems, where no simultaneous uplink and downlink transmissions occur”, as defined by ETSI in TS 137 104 section 3.1 [16] (see also ECC Report 216 on ‘Practical guidance for TDD networks synchronisation’ [11]).

In the tables below, the maximum mean carrier power for Pmax and Pmax’ means the maximum power over the total frequency block assigned to the operator.

A2.1.1 In-block requirements for TDD MFCN base stations

The in-block power limits for the 2300-2400 MHz band for non-AAS and AAS MFCN base stations are defined in Table 2.

Table 2: In-block power limits for non-AAS and AAS BS

BEM element	Frequency range	Non-AAS e.i.r.p. limit (Note 1)	AAS TRP limit
In-block	Block assigned to the operator (2300-2390 MHz)	Not obligatory. In case an upper limit is desired by an administration, a value which does not exceed 68 dBm/(5 MHz) per antenna may be applied.	Not obligatory
	Block assigned to the operator (2390-2400 MHz)	45 dBm/(5 MHz) per cell (Note 2)	31 dBm/(5 MHz) (Note 2)
<p>Note 1: For femto base stations, the use of power control is mandatory in order to minimise interference to adjacent channels.</p> <p>Note 2: In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.</p>			

A2.1.2 Baseline requirements for TDD MFCN base stations

The baseline requirements for unsynchronised (and semi-synchronised) and synchronised non-AAS and AAS MFCN base stations are defined in Table 3.

⁴ In case of unsynchronised adjacent blocks, one operator’s out-of-block signal level has to be reduced to the baseline level before entering into another operator’s block.

⁵ Synchronisation of TDD networks of different operators can be addressed at national level

Table 3: Baseline power limits out of block (in other TDD blocks), within the band, for non-AAS and AAS BS

BEM element	Frequency range	Non-AAS e.i.r.p. limit	AAS TRP limit per cell (Note 1)
Baseline	Unsynchronised (and semi-synchronised) TDD blocks (2300-2400 MHz)	-36 dBm/(5 MHz) per cell (Note 1) (Note 2)	-45 dBm/(5 MHz)
Baseline	Synchronised TDD blocks (2300-2400 MHz)	Min(Pmax-43, 13) dBm/(5 MHz) per antenna	Min(Pmax'-43, 1) dBm/(5 MHz)

Note 1: In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.
Note 2: This value is based on a scenario including all base station classes (macro, micro, pico and femto). A more restrictive scenario may allow a more relaxed value for some BS classes.
Note 3: Pmax is the maximum mean carrier power in dBm for the base station measured as e.i.r.p. per carrier, interpreted as per antenna.
Note 4: Pmax' is the maximum mean carrier power in dBm for the base station measured as TRP per carrier in a given cell.

The additional baseline requirements above 2400 MHz for unsynchronised (and semi-synchronised) and synchronised MFCN base stations, for non-AAS and AAS are defined in Table 4 and Table 5 respectively. Coexistence analysis has shown that these limits must apply at frequencies above 2403 MHz.

Table 4: Additional baseline power limits above 2403 MHz, for non-AAS BS

BEM element	Non-AAS BS maximum mean carrier power	Non-AAS e.i.r.p. limit per cell (Note 1)
Additional baseline	$P_{max} > 42$ dBm	1 dBm/(5 MHz)
Additional baseline	24 dBm $< P_{max} \leq 42$ dBm	(Pmax -41) dBm/(5 MHz)
Additional baseline	$P_{max} \leq 24$ dBm	-17 dBm/(5 MHz)

Note 1: In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.
Note 2: Pmax is the total maximum mean carrier power in dBm for the base station measured as e.i.r.p. per carrier in a given cell.

Table 5: Additional baseline power limits above 2403 MHz, for AAS BS

BEM element	AAS BS maximum mean carrier power	AAS TRP limit per cell (Note 1)
Additional baseline	$P_{max}' > 47$ dBm	-13 dBm/(5 MHz)
Additional baseline	33 dBm $< P_{max}' \leq 47$ dBm	(Pmax' - 60) dBm/(5 MHz)
Additional baseline	$P_{max}' \leq 33$ dBm	-27 dBm/(5 MHz)

Note 1: In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.
Note 2: Pmax' is the maximum mean carrier power in dBm for the base station measured as TRP per carrier in a given cell.
Note 3: CEPT administrations which have already issued licences for AAS BS before the adoption of this ECC Decision with an additional baseline power limit different from the above may apply such limit provided it complies with cross-border obligations, assuming that the overall coexistence as studied in ECC Report 347 [2] is still ensured through other measures (e.g. frequency separation).

A2.1.3 Transitional region requirements for TDD MFCN base stations

The transitional region requirements for unsynchronised (and semi-synchronised) (when applicable) and synchronised non-AAS and AAS MFCN base stations are provided in Table 6.

Table 6: Transitional region power limits (when applicable), for non-AAS and AAS BS

BEM element	Frequency range	Non-AAS e.i.r.p. limit per antenna	AAS TRP limit per cell (Note 1)
Transitional region (Note 4)	-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min(Pmax-40, 21) dBm/(5 MHz)	Min(Pmax'-40, 16) dBm/(5 MHz)
Transitional region (Note 4)	-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min(Pmax-43, 15) dBm/(5 MHz)	Min(Pmax'-43, 12) dBm/(5 MHz)

Note 1: In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.

Note 2: Pmax is the maximum mean carrier power in dBm for the base station measured as e.i.r.p. per carrier, interpreted as per antenna.

Note 3: Pmax' is the maximum mean carrier power in dBm for the base station measured as TRP per carrier in a given cell.

Note 4: The transitional region applies in the case of adjacent TDD blocks if the networks are synchronised, and in-between TDD blocks that are separated by 5 or 10 MHz if the networks are unsynchronised (or semi-synchronised) – in this case, one operator's out-of-block signal has to be reduced to the baseline level for unsynchronised TDD blocks before entering into another operator's block. For immediately adjacent unsynchronised TDD blocks, there is no transitional region and the baseline level for unsynchronised TDD blocks apply outside the allocated block. The transitional region does not apply below 2300 MHz or above 2400 MHz (see A2.1.5).

A2.1.4 BEM implementation for synchronised or unsynchronised TDD MFCN

For two adjacent operators using their systems under synchronised conditions, the defined BEM will normally allow direct adjacent operation of the operator's full-power blocks and the out-of-block region consists both of transitional region and baseline levels.

In the case of unsynchronised TDD networks, the compliance of two adjacent operators with the BEM requirements could be achieved by introducing frequency separation (e.g. through the authorisation process at national level) between the block edges of both operators.

Another option is for administrations to introduce so called restricted channels. Operators would then be required to limit the power used in the upper or lower part of their assigned spectrum, to limit the interference due to the selectivity of the adjacent operator's receiver. Assuming standard performance of the interfered receiver, an in-block level of 4 dBm/(5 MHz) e.i.r.p.⁶ may be used. This limit would be applied to the upper- or lowermost 5 MHz part of an operator's block to protect the adjacent operator, and may be relaxed in case of bilateral agreements between operators.

If the restricted channel solution is selected, the requirements of another operator's out-of-block emissions into this restricted channel may also be relaxed, e.g. so that the transitional level applies. If the requirements on emissions from other operators are not relaxed, the baseline requirement must be met already at the edge of the restricted channel. In this case an adjacent operator may need to apply an internal guard band for the filter roll-off.

A2.1.5 Combination of BEM elements

The BEM elements as described above are combined to provide a BEM for a particular block following the three steps listed above. Examples of such combinations of BEM elements for synchronised and unsynchronised (and semi-synchronised) TDD use are provided in Figure 2 and Figure 3.

⁶ The e.i.r.p. is the total radiated power in any direction at a single location independent of any base station configuration.

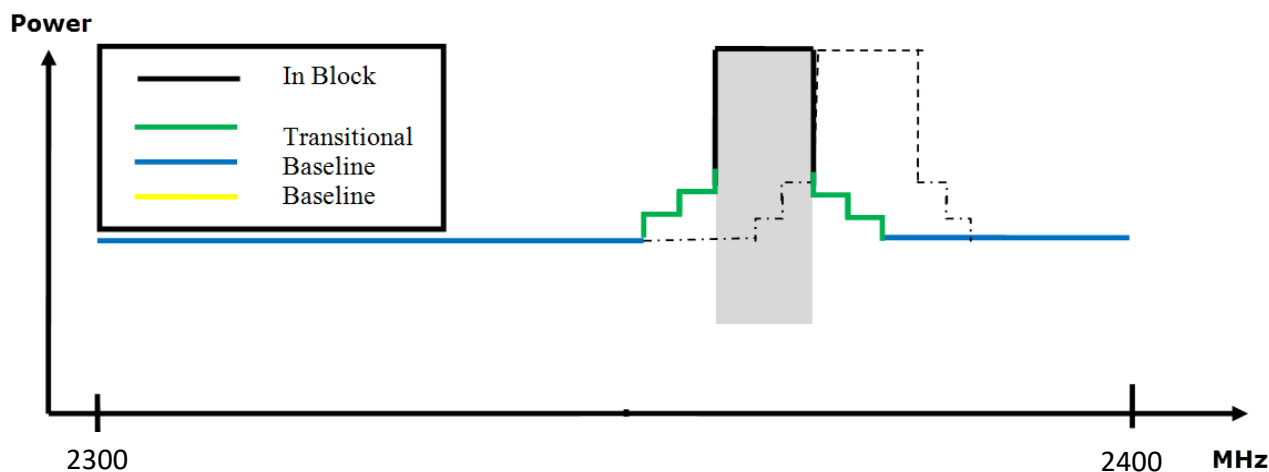


Figure 2: Combined BEM elements for adjacent blocks with synchronised TDD networks

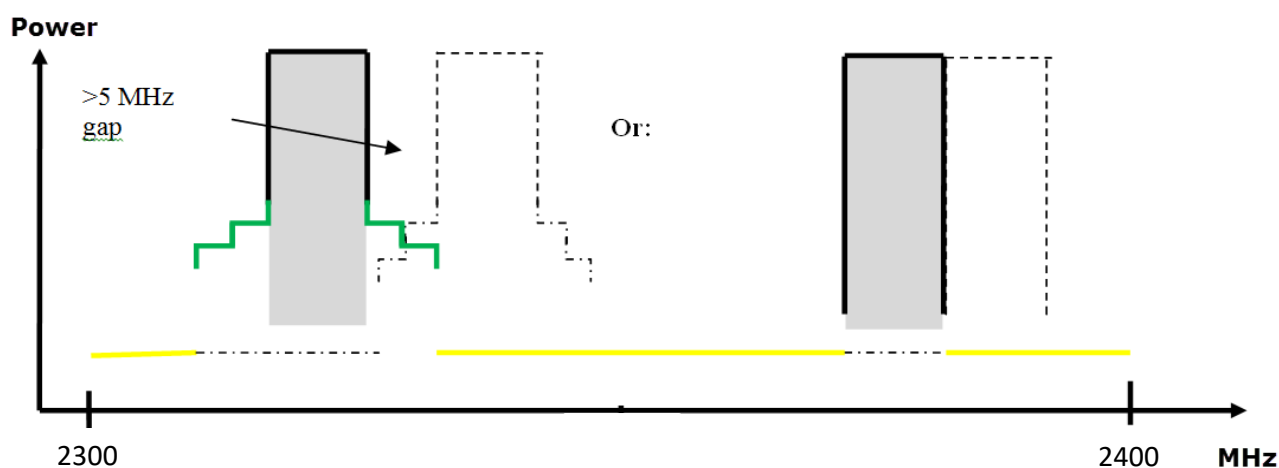


Figure 3: Combined BEM elements for adjacent blocks with unsynchronised TDD networks

A2.2 TECHNICAL CONDITIONS FOR MFCN USER EQUIPMENT

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 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.

ANNEX 3: IMPLEMENTATION OF LSA IN THE 2300-2400 MHz BAND

Administrations wishing to implement MFCN under LSA identify which existing applications need to be considered as incumbent and maintained in the long term.

CEPT countries currently use all or parts of the 2300-2400 MHz frequency band for a variety of applications, in addition to MFCN, including:

- Telemetry, both terrestrial and aeronautical telemetry;
- Other governmental use, e.g. Unmanned Aircraft Systems (UAS);
- PMSE (Commercial SAP/SAB video links);
- Amateur, as a secondary service.

Applications whose usage has to be maintained in the long term are then identified as incumbents.

Once the incumbent applications have been identified, sharing opportunities have to be assessed through studies to be performed. Sharing opportunities can be in time domain, frequency domain or by geographical separation. It is a principle of LSA that for any single location or geographic area, an incumbent and an LSA licensee will not make use of the spectrum at the same time.

A3.1 MFCN UNDER LSA IN THE 2300-2400 MHz BAND

CEPT has developed ECC Report 172 [5] for non-AAS MFCN and ECC Report 347 [2] for AAS MFCN which provide compatibility studies with respect to the potential use of the band 2300-2400 MHz by broadband wireless systems (BWS). Studies in ECC Report 172 and ECC Report 347 did not consider LSA.

Administrations wishing to implement MFCN under LSA are strongly advised to conduct national studies (e.g. defining an adapted propagation model, setting technical characteristics corresponding to the national situation) in order to get a more efficient sharing and to consider in their studies the impact of MFCN topologies.

In order to increase the spectrum usage, one of the technological aspects to be considered is the choice of the topology to be used for the network deployment in the 2300-2400 MHz band. LSA is indeed applicable in the entire HetNet (Heterogeneous Networks) context. This network topology might consist of:

- Macro, micro, pico and femto cell deployment;
- Or a combination of the above deployments.

ETSI TR 103 113 [6] provides examples of MFCN topologies in the 2300-2400 MHz band based on LSA.

For example, in complement to macro cell deployment, micro, pico, femto cell deployments would create the opportunity for sharing in areas where typical macro cell deployments would not be possible due to the need to protect the incumbent.

For the above mentioned topologies where LSA could be applied, the same LRTC as in Annex 2 could be applicable.

A3.2 USAGE SCENARIOS FOR THE INCUMBENT SERVICES

A3.2.1 Usage scenarios for PMSE

The main type of PMSE applications used in the 2300-2400 MHz band is related to temporary video links (portable, mobile with some allowance for airborne use) and cordless cameras as referred to in ERC Recommendation 25-10 [17] and ECC Report 204 [18].

PMSE use in this band may in many cases be characterised as having a high degree of locality and temporality, i.e. confined to the limits of a defined area for an event limited in time. Sharing scenarios will have to be developed to address the several types of PMSE deployment.

A3.2.2 Usage scenarios for telemetry systems

Both airborne and terrestrial telemetry applications are used in the band as described in ECC Report 172 [5]. These are expected to be scheduled activities often planned well in advance.

A3.2.3 Usage scenarios for Unmanned Aircraft Systems (UAS)

UAS is composed of one or several UAV (Unmanned Aircraft Vehicle) and a ground station (GS). UAS uses telecommand (uplink) and telecontrol and video links (downlink). Some UAS uses symmetrical link between UAV and ground station (same bandwidth for the uplink and for the downlink, same modulation, etc.) as described in ECC Report 172 [5]. These are expected to be scheduled activities often planned well in advance.

A3.2.4 Usage scenarios for amateur service

The frequency band 2300-2400 MHz is allocated to the amateur service on a secondary basis by the ITU Radio Regulations [7] in all three ITU regions.

The operational characteristics of amateur stations operating in the 2300-2400 MHz range vary significantly. However based on the IARU Region-1 VHF Managers Handbook [19] and studies for ECC Report 172 [5], they can be categorised as:

- Long range weak-signal reception of Narrowband Terrestrial (e.g. CW, SSB, digimodes) and EME (Earth-Moon-Earth - Moonbounce) operation - notably in the harmonised sub-band 2320-2322 MHz, including propagation beacons;
- Some additional narrowband activity in the 2300-2305 MHz range, including long range EME (Earth-Moon-Earth - Moonbounce) contacts with North America;
- Data, multimedia, and TV repeaters (point-to-point links and area systems) in other parts of the band.

Activity levels vary with propagation conditions and peak when national or international contests, or other activity events, are scheduled.

A3.3 SHARING SCENARIOS WITHIN THE 2300-2400 MHz BAND UNDER LSA

Sharing scenarios are summarised in the following sections based upon the sharing studies reported in ECC Report 172 [5] for non-AAS MFCN systems and in ECC Report 347 for AAS MFCN systems [2]. LSA provides additional opportunities for geographic separation for co-frequency operation, or frequency separation for geographic co-location, depending on the incumbent use.

Administrations wishing to implement MFCN under LSA are strongly advised to conduct national studies in order to get a more efficient sharing and to consider in their studies the impact of MFCN topologies as coexistence between BWS and current users of the band has been studied in ECC Report 172 and in ECC Report 347 in a worst-case analysis.

It is important to note that the level of the service that can be delivered by a LSA licensee is dependent on the situation in the band; it will be determined by the usage scenarios of the incumbent(s) and the corresponding sharing framework. QoS, in particular when it comes to coverage, can only be provided through licensed spectrum where LSA Licensees have full control/knowledge of the interference they face, and therefore have full understanding of the performance that will be delivered by their network equipment.

In cases where geographical restrictions, e.g. exclusion zones, are dependent on unwanted emission levels, the exclusion zones may be larger when MFCN with AAS is used compared to MFCN with non-AAS, or may even be impracticable. This is because it may not be possible to implement the necessary operator-specific filtering for AAS systems with current technology due to complexity issues.

A3.3.1 Coexistence of PMSE (SAP/SAB video links) with MFCN

Incumbent PMSE applications (SAP/SAB video links) can coexist with MFCN applications (non-AAS/AAS) at the same time through the use of either geographic separation if co-frequency operation is expected or a

combination of separation distance and frequency separation if co-located operation is anticipated. However, the details of such a sharing situation may depend on the particular national circumstances, namely the spectrum usage and the type of the authorisation granted by the corresponding administration for the existing applications. Special care may be given to the case of airborne use of PMSE, which may require large separation distances.

A3.3.2 Coexistence of telemetry systems with MFCN

Incumbent Telemetry applications can coexist with MFCN applications (non-AAS/AAS) at the same time through the use of either geographic separation if co-frequency operation is expected or a combination of separation distance and frequency separation if co-located operation is anticipated.

A3.3.3 Coexistence of UAS with MFCN

Incumbent UAS applications can coexist with MFCN applications (non-AAS/AAS) at the same time through the use of either geographic separation if co-frequency operation is expected or a combination of separation distance and frequency separation if co-located operation is anticipated.

A3.3.4 Coexistence of amateur service with MFCN

ECC Report 172 [5] found that regarding radio amateur systems in the 2300-2400 MHz band, operating as a secondary service, it was shown that the required MCL (Minimum Coupling Loss) in relation to non-AAS MFCN system can be achieved by various mitigation techniques. For AAS MFCN similar or improved situation as for non-AAS MFCN can be expected according to ECC Report 347 [2], this is due to the statistical nature of beamforming and the narrow main lobe of amateur stations.

ANNEX 4: LIST OF REFERENCES

- [1] [ECC Recommendation \(14\)04](#): “Cross-border coordination for MFCN and between MFCN and other systems in the frequency band 2300-2400 MHz”, approved June 2014
- [2] [ECC Report 347](#): “Analysis of the suitability and update of the regulatory technical conditions for 5G MFCN and AAS operation in the 2300-2400 MHz band”, approved November 2022
- [3] RSPG Opinion on Licensed Shared Access, November 2013, https://circabc.europa.eu/sd/d/3958ecef-c25e-4e4f-8e3b-469d1db6bc07/RSPG13-538_RSPG-Opinion-on-LSA%20.pdf
- [4] [ECC Report 205](#): “Licensed Shared Access (LSA)”, approved February 2014
- [5] [ECC Report 172](#): “Broadband Wireless Systems Usage in 2300-2400 MHz”, approved April 2012
- [6] ETSI TR 103 113: “System Reference document; Mobile broadband services in the 2300-2400 MHz frequency band under Licensed Shared Access regime”
- [7] ITU Radio Regulations, Edition of 2020
- [8] Recommendation ITU-R M.1457: “Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)”
- [9] Recommendation ITU-R M.2012: “Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)”
- [10] Recommendation ITU-R M.2150: “Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)”
- [11] [ECC Report 216](#): “Practical guidance for TDD networks synchronisation”, approved August 2014
- [12] [ECC Report 296](#): “National synchronisation regulatory framework options in 3400-3800 MHz: a toolbox for coexistence of MFCNs in synchronised, unsynchronised and semi-synchronised operation in 3400-3800 MHz”, approved March 2019
- [13] Recommendation ITU-R M.1036: “Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)”
- [14] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC
- [15] [ECC Report 203](#): “Least Restrictive Technical Conditions suitable for Mobile/Fixed Communication Networks (MFCN), including IMT, in the frequency bands 3400-3600 MHz and 3600-3800 MHz”, approved November 2013
- [16] ETSI TS 137 104: “E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception”
- [17] [ERC Recommendation 25-10](#): “Frequency Ranges for the Use of Terrestrial Audio and Video Programme Making and Special Events (PMSE) applications, editorial update on 28 May 2021
- [18] [ECC Report 204](#): “Spectrum use and future requirements for PMSE”, approved February 2014
- [19] IARU Region-1 “VHF Managers Handbook”