CEPT Report xx

Report from CEPT to the European Commission in response to the Mandate

“to review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems”

Report B: Develop channelling arrangements and common and minimal (least restrictive) technical conditions[[1]](#footnote-2), for the 900MHz and 1800MHz, suitable for 5G terrestrial wireless systems in compliance with the principles of technology and service neutrality

**Report approved on xx by the ECC**

# Executive summary

This Report is the second response (Report B) to Task 2 of the Mandate from the European Commission “to review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems”.

According to the schedule set out in the Mandate, this Report addresses Task 2 for the 900MHz and 1800MHz bands. CEPT report 72 (Report A) addressed Tasks 1 and 3 in full (for 900 MHz, 1800 MHz, paired terrestrial 2 GHz, and 2.6 GHz), and Task 2 for the 2 GHz and 2.6 GHz frequency bands.

Systems may use only non-AAS BS in 900 MHz frequency band and may use either non-AAS BS or AAS BS in the 1800 MHz frequency band.

**TABLE OF CONTENTS**

[0 Executive summary 2](#_Toc30014309)

[1 Introduction 5](#_Toc30014310)

[2 Existing regulatory framework for 900MHz and 1800MHz bands 6](#_Toc30014311)

[2.1 Existing Band plan 6](#_Toc30014312)

[2.2 Applicable technical conditions 6](#_Toc30014313)

[3 Developing an approach for a technology neutral framework 9](#_Toc30014314)

[3.1 ECC and EC Requirements for an updated regulatory framework 9](#_Toc30014315)

[3.2 Methodology, basic considerations and general principles 9](#_Toc30014316)

[4 Analysis of 900MHz and 1800MHz bands in the context of the CEPT 5G mandate 12](#_Toc30014317)

[4.1 Summary of In-Band coexistence analysis for 900 and 1800MHz bands 12](#_Toc30014318)

[4.2 Summary of adjacent bands coexistence analysis for 900 bands 12](#_Toc30014319)

[4.3 Summary of adjacent bands coexistence analysis for 1800MHz bands 12](#_Toc30014320)

[5 Recommended technology neutral Framework for 900MHz and 1800MHz bands 13](#_Toc30014321)

[5.1 Requirements for updated EC and ECC decisions 13](#_Toc30014322)

[5.2 Recommended Band plan 13](#_Toc30014323)

[5.3 Recommended Applicable LRTCs 14](#_Toc30014324)

[5.3.1 In-block power limits 15](#_Toc30014325)

[5.3.2 Out-of-block power limits 16](#_Toc30014326)

[5.3.2.1 ETSI HS conducted test requirements per antenna for operating band unwanted emissions in 900/1800MHz band: 16](#_Toc30014327)

[5.3.2.2 ETSI HS TRP radiated test requirements per cell for AAS OTA BS operating band unwanted emissions in 900/1800MHz band: 19](#_Toc30014328)

[5.3.2.3 Recommended Out-of-block power limits 21](#_Toc30014329)

[5.3.3 Other conditions 25](#_Toc30014330)

[6 Conclusions 26](#_Toc30014331)

[7 References 27](#_Toc30014332)

[ANNEX 1: cept mandate 28](#_Toc30014333)

[1. Purpose 29](#_Toc30014334)

[(1) Policy context and inputs 29](#_Toc30014335)

[(2) Justification 31](#_Toc30014336)

[(3) Task order and schedule 31](#_Toc30014337)

[ANNEX 2: Updates to EC Decision 34](#_Toc30014338)

[ANNEX 3: ETSI HS SEM 35](#_Toc30014339)

**LIST OF ABBREVIATIONS**

|  |  |
| --- | --- |
| **Abbreviation** | **Explanation** |
| **5G** | 5th Generation of mobile networks |
| **AAS** | Active Antenna System |
| **BEM** | Block Edge Mask |
| **BS** | Base Station |
| **CBW** | Carrier Bandwidth |
| **CEPT** | European Conference of Postal and Telecommunications Administrations |
| **EC** | European Commission |
| **ECC** | Electronic Communications Committee |
| **e.i.r.p.** | Equivalent Isotropically Radiated Power |
| **ETSI** | European Telecommunications Standards Institute |
| **EU** | European Union |
| **FDD** | Frequency Division Duplex |
| **GSM** | Global System for Mobile Communication |
| **IoT** | Internet of Things |
| **LRTC** | Least Restrictive Technical conditions |
| **LTE** | Long Term Evolution |
| **MFCN** | Mobile/Fixed Communications Networks |
| **non-AAS** | non-Active Antenna Systems |
| **NB-IoT** | Narrow Band-IoT |
| **NR** | New Radio |
| **OOB** | Out Of Band |
| **pfd** | Power flux density |
| **SCS** | Sub-Carrier Spacing |
| **SDL** | Supplemental Downlink |
| **SUL** | Supplemental Uplink |
| **TRP** | Total Radiated Power |
| **UE** | User Equipment |
| **UMTS** | Universal Mobile Telecommunications System |

# Introduction

This Report develops and introduces channelling arrangements and least restrictive technical conditions under the form of a technology neutral block edge mask, as an approach to technical harmonization in 900/1800MHz bands, in replacement of the current existing technical framework based on references to ETSI standards for both bands.

CEPT has conducted in the last months relevant analysis to update the harmonized CEPT framework for 5G and when applicable AAS in 900 MHz and 1800 MHz: CEPT Report 72 [], ECC Report 297 [xx] and corresponding amendments to ECC Decision (06)13 (8 March 2019) [xx].

As a first step, ECC technical framework for the 900 MHz and 1800 MHz frequency bands was updated based on reference of the latest technical standards covering 5G New Radio and AAS.

As a second step, the CEPT plans to adopt during 2020 harmonized technical conditions on the basis of BEM for 900MHz and 1800MHz bands as the long-term regulatory approach.

The compatibility of 5G and when applicable AAS technologies with current systems listed in the existing EC framework (GSM, UMTS, LTE, WiMAX and IoT cellular technologies) and adjacent band systems in 900/1800 MHz frequency bands has already been evaluated in ECC Report 297 [xx] and confirmed to be possible on similar basis as those concluded for LTE non-AAS in CEPT Report 40 [xx], CEPT Report 41 [xx], CEPT Report 42 [xx] and CEPT Report 66 [xx] and in ECC Report 266 [xx].

Based on such studies, the same technical conditions defined in past ECC Decision (06)13 [xx] for LTE were extended for 5G NR non-AAS systems in 900/1800 MHz frequency bands including SUL mode of operation. The same approach applies for AAS (LTE/NR) in 1800 MHz frequency band.

Based on the assessment in ECC report 297 and CEPT report 72, this CEPT Report B identifies least restrictive technical conditions for the 900 and 1800MHz bands in terms of technology neutral BEMs: One based on EIRP for non-AAS systems and one based on TRP for AAS MFCN.

Similar to the other 2100MHz band, the BEM elements for 900/1800MHz band proposed in this report are based on the ETSI harmonized standard that was used to confirm coexistence of NR, LTE and UMTS with in-band systems and adjacent systems in the different ECC and CEPT reports such as ECC Report 297 [xx] for NR/AAS and CEPT Report 40 [xx], CEPT Report 41 [xx], CEPT Report 42 [xx] for LTE non-AAS etc.

Such [wide band] Block Edge Mask (BEM) approach is suitable for next-generation terrestrial wireless systems in 900 and 1800 MHz frequency bands and achieves consistency with the existing minimal and least restrictive technical conditions for other EU-harmonized frequency bands for wireless broadband electronic communications services.

Furthermore, it ensures coexistence with the GSM system in the 900 MHz/1800 MHz frequency bands, pursuant to the GSM Directive [], while delivering a solution, which ensures availability and efficient use of the spectrum for next-generation terrestrial wireless systems in line with the Union’s spectrum policy priorities.

# Existing regulatory framework for 900MHz and 1800MHz bands

## Existing Band plan

The ‘900 MHz band’ means the 880-915 MHz and 925-960 MHz frequency bands;

The ‘1800 MHz band’ means the 1710-1785 MHz and 1805-1880 MHz frequency bands.

Existing MFCN usage in 900/1800MHz band is based on FDD band plan.

In total there are 2 x 35 MHz in 900MHz band and 2 x 75 MHz in 1800 MHz frequency band:



Figure 1: 900 MHz band plan



Figure 2: 1800 MHz frequency band plan

## Applicable technical conditions

Concerning the 900 MHz frequency band (880-915 MHz and 925-960 MHz), in response to the task 1 of the EC mandate, CEPT report 072 provides information on the usage feasibility of the 900 MHz and 1800 MHz frequency bands for 5G, including any limitations of the GSM Directive for 900 MHz.

* CEPT confirms that within 900 MHz, narrowband systems including GSM and various cellular IoT systems will continue to be in operation commercially for the foreseeable future. This issue will be carefully addressed in this report while developing LRTC (BEM in 900 MHz) in order to develop harmonised technical conditions taking into account the need for coexistence with narrow band systems including GSM and various cellular IoT systems;
* CEPT confirms, as per ECC Report 297 [xx] and CEPT Report 40 [x], that when narrowband systems including GSM and various cellular IoT systems are in operation in 900 MHz and 1800 MHz bands there is a need for:
	+ A frequency separation of 200 kHz or more between NR channel edge of one network and the nearest GSM channel edge of the neighbouring network when wideband and GSM systems are operating in an uncoordinated manner. No frequency separation is required for coordinated operation;
	+ A frequency separation of 200 kHz or more between the standalone NB-IoT channel edge of one network and the NR channel edge of the neighbouring network.

This 200 kHz frequency separation requirement is already covered by the relevant ETSI standard [EN 301 908-24 and EN 301 908-25] due the channel characteristics of 5G NR (5 MHz or above channel bandwidth).

ECC technical framework for the 900 MHz and 1800 MHz frequency bands was revised in March 2019, in order to reference the latest technical standards covering 5G New Radio. The CEPT plans to adopt during 2020 harmonized technical conditions on the basis of BEM for both frequency bands as the long-term regulatory approach.

The table below lists the relevant CEPT/ECC/EU documents for 900/1800 MHz MFCN frequency bands.

Table 1: Band specific regulatory framework

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Band | Report | ECC Decision | EC Decision based on CEPT reports | Cross-border coordination |
| 900 MHz | ECC Report 297 []ECC Report 266 [6]ECC Report 229 [7]ECC Report 146 [8]ECC Report 82 [9]ECC Report 96 [10]CEPT Report 66 [5]CEPT Report 42 [4] CEPT Report 41 [3]CEPT Report 40 [2]CEPT Report 72 [] | ERC/DEC/(94)01 [11]ERC/DEC/(97)02 [12]ECC/DEC/(06)13 [1] | EC Decision 2011/251/EU [13]EC Decision 2009/766/EC [14] | ECC/REC(05)08 [15]ECC/REC(08)02 [16]  |
| 1800 MHz | ECC Report 297 []ECC Report 266 [6]ECC Report 146 [8]ECC Report 82 [9]ECC Report 96 [10]CEPT Report 66 [5]CEPT Report 42 [4] CEPT Report 41 [3]CEPT Report 40 [2]CEPT Report 72 [] | ERC/DEC/(95)03 [17]ECC/DEC/(06)13 [1] | EC Decision 2011/251/EU [13]EC Decision 2009/766/EC [14] | ECC/REC(05)08 [15]ECC/REC(08)02 [16] |

The harmonized technical conditions from ECC and EC decisions applicable to 900 MHz and 1800 MHz MFCN frequency bands are summarized in table below:

Table 2: Overview of technical conditions in MFCN bands

|  |  |  |
| --- | --- | --- |
| Band | In-band  | Adjacent bands |
| 900 MHz + 1800 MHz | EC Decision 2009/766/EC [14]EC Decision 2011/251/EU [13]EC Decision 2018/637/EU [ ]The following technical parameters shall be applied as an essential component of the conditions necessary to ensure coexistence in the absence of bilateral or multilateral agreements between neighbouring networks, without precluding less stringent technical parameters if agreed among the operators of such networksCarrier separation of 5 MHz or more between two neighbouring UMTS networks Carrier separation of 2.8 MHz or more between a neighbouring UMTS network and a GSM networkFrequency separation of 200 kHz or more between the NR/LTE/Wimax channel edge and the GSM carrier's channel edge.No frequency separation between NR/LTE/Wimax channel edge and the UMTS carrier's channel edge.No frequency separation between Wimax channel edges between two neighbouring Wimax networks.No frequency separation between LTE channel edges between two neighbouring LTE networks.No frequency separation between NR channel edges between two neighbouring NR networks.ECC/DEC/(06)13 [1]LTE MTC/eMTC: this was considered as included in LTE operation. No specific requirements in addition to LTE and the applicable harmonised standardsNB-IoT Standalone mode: A frequency separation of 200 kHz or more between the standalone NB-IoT channel edge of one network and the UMTS/LTE channel edge of the neighbouring network.A frequency separation of 200 kHz or more between the standalone NB-IoT channel edge of one network and the GSM channel edge of the neighbouring network.NB-IoT In-band mode: the same parameters apply as for LTENB-IoT Guard band mode: A frequency separation of 200 kHz or more between the NB-IoT channel edge and the edge of the operator’s block, taking into account existing guard bands between operators’ block edges or the edge of the operating band (adjacent to other services). | No specific emission limits but recommendations on coordination, with the following systems, are available in various ECC/CEPT Reports as listed in the previous table:-PMR/PAMR above 915 MHz, -GSM-R in 876-880 / 921-925 MHz,-Aeronautical systems above 960 MHz,-Fixed Service operating above 1805 MHz |

# Developing an approach for a technology neutral framework

## ECC and EC Requirements for an updated regulatory framework

EC issued a follow-up mandate to CEPT (RSCOM18-19rev1-July 2019) to Review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-Generation (5G) terrestrial wireless system.

The following are important elements from the EC mandate:

* Such mandate should deliver harmonised least restrictive technical conditions, including sharing conditions if needed, for next-generation (5G) terrestrial wireless systems in EU-harmonised bands including 880-915 and 925-960 MHz frequency bands ('900 MHz band), 1710-1785 MHz and 1805-1880 MHz frequency bands ('1800 MHz band').
* These conditions should take into account relevant 5G usage scenarios related to wireless broadband and the Internet of Things, and meet the overarching purpose of ensuring efficient spectrum use.
* For the 900 MHz and 1800 MHz frequency bands, it is relevant to consider a Block Edge Mask (BEM) approach to technical harmonization, which is suitable for next-generation terrestrial wireless systems and achieves consistency with the existing minimal and least restrictive technical conditions for other EU-harmonised frequency bands for wireless broadband electronic communications services. Such an approach should replace in the long term the current technical framework based on references to ETSI standards for both bands. Furthermore, it should ensure coexistence with the GSM system in the 900 MHz/1800 MHz frequency bands, pursuant to the GSM Directive (Council Directive 87/372/EEC as amended by Directive 2009/114/EC of the European Parliament and of the Council), while delivering a solution, which ensures availability and efficient use of the spectrum for next-generation terrestrial wireless systems in line with the Union’s spectrum policy priorities.

More specifically, CEPT was mandated to perform the following tasks with view to creating sufficiently precise conditions for the development of EU-wide equipment CEPT:

* Task 1: Review the EU-harmonized technical conditions for use of the 900 MHz, 1800 MHz, with view to their suitability for 5G terrestrial wireless systems (Such as based on the usage of active antenna systems) which provide electronic communications services as well as other relevant services or applications, and assess the approach to adapting the EU-harmonized technical conditions for 5G use, if needed. In particular, for the 900 MHz frequency band, such assessment should address any potential constraints (e.g. regarding efficient spectrum use), which result from the requirement to ensure co-existence with the GSM system, pursuant to the GSM Directive (Council Directive 87/372/EEC as amended by Directive 2009/114/EC of the European Parliament and of the Council).
* Task 2: Based on the results under Task 1, develop channelling arrangements and common and minimal (least restrictive) technical conditions (Such as the definition of appropriate Block Edge Masks) for the aforementioned frequency bands, which are suitable for 5G terrestrial wireless systems in compliance with the principles of technology and service neutrality.

## Methodology, basic considerations and general principles

**Protection of GSM**

CEPT confirms in its mandate that within 900 MHz, narrowband systems including GSM and various cellular IoT systems will continue to be in operation commercially for the foreseeable future. This issue will be carefully addressed in this report while developing LRTC (BEM in 900 MHz) in order to develop harmonised technical conditions taking into account the need for coexistence with narrow band systems including GSM and various cellular IoT systems;

GSM (including EC-GSM-IoT) is subject to Council Directive 87/372/EEC amended by Directive 2009/114/EC, ERC Decision (94)01, ERC Decision (95)03, ERC Decision (97)02, EC decision 2009/766/EC and GSM related ETSI Harmonised standard in particular EN 301 502 and EN 301 511.

**Narrow band systems versus wireless broadband electronic communications services**

The spectrum mask of GSM, EC-GSM-IoT systems and NB-IoT is based on a 200-kHz channel configuration, whereas the spectrum mask of UMTS, Wimax, LTE and NR systems including LTE-MTC/eMTC is based on larger Bandwidth channel configuration.

EC-GSM-IoT reuses the same modulation/SEM as GSM, it is perfectly equivalent to 'standard' GSM from an adjacent channel/adjacent band compatibility standpoint, with unchanged SEM and Tx requirements. EC-GSM-IoT is covered by EN 301 502 and EN 301 511. EC-GSM-IoT is allowed in the 900 and 1800 MHz band through the ERC/DEC/(94)01, ERC/DEC/(95)03 and ERC/DEC/(97)02 Decisions with technical conditions relating to GSM (see annex of current ECC DEC (06)13). It is treated in this report as being part of GSM system.

NB-IoT in a standalone mode is different from NB-IoT in-band or guard-band modes in the sense that IoT carrier is deployed independently, in its own narrowband spectrum. It has exactly the same deployment mode as a GSM carrier and is used in 900/1800MHz under similar technical conditions relating to GSM as specified by the current ECC regulatory framework in the bands 900 MHz and 1800 MHz (see Annex of ECC/DEC/(06)13):

* A frequency separation of 200 kHz or more between the standalone NB-IoT channel edge of one network and the UMTS/LTE channel edge of the neighboring network.
* A frequency separation of 200 kHz or more between the standalone NB-IoT channel edge of one network and the GSM channel edge of the neighboring network.

Further consideration should be given in this report on any possible alternative methods to harmonise Standalone NB-IoT in the revised ECC DEC (06)13 other than referencing related ETSI harmonised specifications.

ECC report 266 highlights that LTE-MTC/eMTC is embedded in a 'standard' LTE Carrier, does not modify the LTE SEM and is perfectly equivalent to LTE from an adjacent channel/adjacent band compatibility standpoint. LTE-eMTC allows to use 6 contiguous resource blocks anywhere in a LTE channel for M2M applications, each resource block is 180 kHz, 6x180 =1080 kHz. LTE-MTC and LTE-eMTC are covered by EN 301908-13 and EN 301908-14. LTE-MTC and LTE-eMTC are used under the technical conditions relating to LTE as specified by the current ECC regulatory framework in the bands 900 MHz and 1800 MHz (see Annex of current ECC/DEC/(06)13). If the revised ECC DEC (06)03 is updated with a wideband BEM compatible with LTE/NR this should not pre-empt the deployment of LTE-MTC and LTE-eMTC in the 900/1800MHz bands.

NB-IoT in In-band mode is narrow band system (180 KHz carrier) that is also embedded in an LTE carrier, does not change the power or the LTE Spectrum Emission Mask (SEM), either on the BS or the UE side and is used under the same technical conditions relating to LTE as specified by the current ECC DEC (06)13. The same conclusions as for LTE-MTC/eMTC would apply and defining a wideband BEM compatible with LTE/NR for 900/1800MHz bands should not pre-empt the deployment of LTE-MTC and LTE-eMTC in these bands.

NB-IoT deployed in guard band mode is based on no modification of the LTE out-of-Band emissions on the BS side, beyond a specific frequency separation of 200 kHz or more between the NB-IoT channel edge and the edge of the operator’s block, taking into account existing guard bands between operators’ block edges or the edge of the operating band (adjacent to other services) this could be covered by wideband BEM compatible with LTE/NR for 900/1800MHz bands but the frequency separation needs to be clearly stated in the revised ECC Dec (06)13.

As we can see from the above analyses we have 2 quite distinct groups of systems today harmonised under ECC DEC 06 (13) and through ETSI HS:

* Wideband systems such as UMTS, Wimax, LTE and NR systems and IoT systems such as LTE-MTC/eMTC, NB-IoT with In-band mode and Guard modes (with frequency separation conditions) and any future wideband system can be covered/represented through an LTE/NR compatible mask.
* GSM (including EC-GSM-IoT) and standalone NB-IoT are pure narrowband systems are similar to each other in terms of coexistence conditions and cannot be covered by the LTE/NR mask and need to be treated separated.

**Block Edge Mask (BEM) approach to technical harmonization**

The EC and ECC request to develop common and minimal (least restrictive) technical conditions/BEMs for the 900/1800MHz bands, which are suitable for 5G terrestrial wireless systems in compliance with the principles of technology and service neutrality. The EC mandate inputs that BEM approach need to achieve consistency with the existing minimal and least restrictive technical conditions for other EU-harmonised frequency bands for wireless broadband electronic communications services.

ETSI HS masks defined for LTE/NR in ETSI HS part 18, 23, 24 fulfil both of these 2 considerations for MFCN. Relevant limits from ETSI HS mask are considered below to keep flexibility for operators to continue using in the future within their allocations narrow band systems such as GSM (including EC-GSM-IoT), NB-IOT or LTE 1.4MHz, 3MHz channels.

**Channeling arrangement**

Existing MFCN usage in 900/1800MHz band is based on FDD band plan. [The 900 and 1800 MHz are paired FDD bands with specified DL and UL transmission direction. 3GPP defines in their specification new bands and which band combinations are supported with CA, DC, SDL and SUL, or with variable duplex:

* Operating bands for Carrier Aggregation (CA) combinations in section 5.2A in TS 38.101-1, [1]
* Dual Connectivity (DC), section 5.2B in TS 38.101-1, [1]
* Supplemental Downlink (SDL) and Supplemental Uplink (SUL) bands in Table 5.2-1 in 3GPP TS 38.101-1, [1] or TS 38.104, [2]
* Operating band combinations for SUL in Table 5.2C-1 in TS 38.101-1, [1]
* New FDD bands with variable duplex including spectrum designated for SDL licensed operation and supporting UL sharing, [3]

In the ECC decisions there is no need to define or specify if the spectrum usage as part of CA, SDL, SUL or variable duplex operation is allowed or supported. This is in order to (i) maintain technology neutral specification (ii) any of such additional aggregations to the band shall not influence existing regulations and (iii) as such shall be defined in the ETSI harmonised standard.

SDL in ECC is defined as “that a MFCN supplemental downlink (SDL) is a mobile broadband system, which by means of base station transmitters in the network, uses unpaired spectrum in the downlink to provide a supplemental downlink capacity…”, see e.g. reference [4].]

The ECC decision 06(13) also allows for flexibility such as the SUL option. It is proposed to consider FDD band plan for 900/1800MHz bands with SDL/SUL flexibility as it was proposed for the 2100MHz band in ECCDEC 06(01).

As for other MFCN bands, it is proposed that the BEM for non-AAS systems is defined based on EIRP metric while the BEM for AAS systems is defined based on TRP metric.

Operators are allocated blocks that are multiple of 200KHz often fragmented. Some of the CEPT countries already migrated to contiguous blocks that are multiple of 5MHz mostly in 1800MHz band but also in some limited cases in 900MHz band. It is unlikely that all European countries can migrate in the short term to 5MHz contiguous band plan, due to some current authorisations or national circumstances: e.g. high number of operators not allowing an easy share of 900MHz/1800MHz band on equal basis, fragmented GSM usage and allocations, etc. Therefore flexibility should be given to administrations to choose whether, when and how to migrate to a band plan based on minimum block size of 5MHz.

# Analysis of 900MHz and 1800MHz bands in the context of the CEPT 5G mandate

## Summary of In-Band coexistence analysis for 900 and 1800MHz bands

## Summary of adjacent bands coexistence analysis for 900 bands

## Summary of adjacent bands coexistence analysis for 1800MHz bands

# Recommended technology neutral Framework for 900MHz and 1800MHz bands

## Requirements for updated EC and ECC decisions

The purpose of this ECC Decision is to harmonize the use of the bands 880-915 MHz, 925-960 MHz, 1710-1785 MHz and 1805-1880 MHz, for mobile/fixed communications networks (MFCN) including terrestrial IMT systems other than GSM (including EC-GSM-IoT) that is subject to Council Directive 87/372/EEC, Council Recommendation 87/371/EEC, ERC Decision (94)01, ERC Decision (95)03, ERC Decision (97)02 and GSM related ETSI Harmonized Specifications.

## Recommended Band plan

1. Migration to 5G and channeling for blocks that are not only a multiple of 5 MHz should be discussed.

**Different considerations**

In total there are 2 x 35 MHz in 900MHz band and 2 x 75 MHz in 1800 MHz frequency band:



Figure 1: 900 MHz band plan



Figure 2: 1800 MHz frequency band plan

When such bands are allocated to GSM including EC-GSM-IoT and/or Standalone NB-IoT, a 200MHz channel arrangement needs to be maintained for such systems harmonised in current ECCDEC (06) 13 and through related ETSI HS (see annex 2 of the ECC DEC (06)13)).

For wireless broadband electronic communications services and next-generation terrestrial wireless systems this report recommends an FDD band plan for the 900/1800MHz bands with blocks of minimum size of 5.0 MHz. This is consistent with the assumptions used in coexistence studies performed in ECC report 297, CEPT report 40, CEPT report 41, CEPT report 42, CEPT report 82, and ECC report 96 for NR, LTE, Wimax and UMTS coexistence.

A frequency separation of 200 kHz or more is required between NR, LTE, Wimax and UMTS channel edge of one network and the GSM channel edge (including EC-GSM-IoT) or the Standalone NB-IoT channel edge of the neighbouring network, where wideband and GSM, EC-GSM-IoT or Standalone NB-IoT systems are operating in uncoordinated manner. No frequency separation is required for coordinated operation

IoT systems such as, LTE-MTC/eMTC and In-Band NB-IoT, that are harmonised through existing ECC DEC 0613 by reference to related ETSI HS (see annex 2), are totally embedded inside the operators LTE channel, therefore they can be covered with the above 5MHz block size.

Guard band NB-IoT can also be embedded inside the operators blocks with the condition that a frequency separation of 200 kHz or more is maintained between the NB-IoT channel edge and the edge of the operator’s block, taking into account existing guard bands between operators’ block edges or the edge of the operating band (adjacent to other services).

Illustration Figures needed for channel arrangement

It is noted that the UMTS channel raster is 200 kHz, which means that the centre frequency must be an integer multiple of 200 kHz. The channel raster for NB-IoT in standalone operation is 100 kHz. Both GSM900 and GSM1800 have channel raster of 200 kHz, as described in ETSI EN301 502.This is a relevant consideration for administrations.

1. Alternative text 1

This report recommends also to allow SDL/SUL flexibility in similar manner as for the 2100MHz band in ECC DEC 06(01) (March 2019) by adding footnote to the band plan section in ECC/EC decision. Similarly to studies conducted for 2100MHz, studies in

1. ’Alternative text 2 (no text)

ECC report 297 and the current conditions in ECC DEC 06(13) (published in March 2019) confirm explicitly that 5G NR systems in frequency bands 880–915 MHz and 1710–1785 MHz may operate in Supplemental uplink mode (SUL).

**Recommended band plan**

1. The frequency band 880-915 MHz[[2]](#footnote-3) is paired with 925-960 MHz[[3]](#footnote-4);
2. The frequency band 1710-1785 MHz[[4]](#footnote-5) is paired with 1805-1880 MHz[[5]](#footnote-6).
3. The duplex direction for FDD carriers in 880-915 MHz/925-960 MHz frequency bands is mobile transmit within the lower band and base transmit within the upper band.
4. The duplex direction for FDD carriers in 1710-1785 MHz/1805-1880 MHz frequency bands is mobile transmit within the lower band and base transmit within the upper band.
5. [For future licensing purposes, assigned blocks shall be in multiple of 5 MHz in the 880-915 MHz/925-960 MHz and 1710-1785 MHz/1805-1880 MHz frequency bands.]
6. [It is up to each administration to decide, based on national circumstances and considering the impact on existing authorizations in its country within the 880-915 MHz/925-960 MHz and 1710-1785 MHz/1805-1880 MHz band, whether, when and how to migrate from its current band plan (mostly based on paired blocks multiple of 200MHz) to the 5MHz block band plan, and any associated conditions.]
7. The footnotes wording and applicability will be revisited after discussions on paragraph in section 3.2 on ”channelling arrangement” in square brackets have concluded.

## Recommended Applicable LRTCs

The BEM is built up by combining Tables 3, 4 and 5, in such a way that the limit for each frequency is given by the higher value out of the baseline requirements and the block specific requirements.

Systems may use only non-AAS BS in 900 MHz frequency band and may use either non-AAS BS or AAS BS in the 1800 MHz frequency band.

[For non-AAS …]

For AAS MFCN base stations in the 1800 MHz band, 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.

Conversion from e.i.r.p. limit per antenna for the non-AAS BS to a corresponding TRP limit is done following the guidelines given in 3GPP TS 38.104 [Ref], assuming a20 dBi antenna gain and giving the value which corresponds to a total of eight beam forming antennas (scaling factor of 9 dB).

1. ’The square bracket values in the tables below for non-AAS is based on 18 dBi antenna gain. Further reference is required to confirm this value.

### In-block power limits

BS In-block requirement

No mandatory limit is defined today in the existing ECC/EC regulatory for 900/1800MHz bands framework nor in ETSI HS relevant to systems authorised in the 900/1800MHz bands namely GSM (including EC-GSM-IoT), UMTS, LTE, Wimax, IoT systems, NR.

The same approach is proposed to be kept for the LRTC approach when updated ECC/EC regulatory framework. In-block limits for non-AAS BS and AAS BS are not necessary.

However, administrations may choose to set an in-Block power limit for the BS if needed on a national or local basis, optional limits are given below in Table 3 of this report to guide administrations based on practical deployments today.

Practically, 900/1800MHz bands have been always used as coverage bands and because of that, the BS transmit power levels and antenna gains deployed in the field are relatively high. For non-AAS BS in 900/1800MHz bands, the transmit power in areas requiring extended coverage (Rural or deep indoor e.g. IoT) can be in the order of the following levels:

* GSM (including EC-GSM-IoT) and generally NB-IoT carrier: EIRP of 62-71 dBm/200KHz. This is based on conducted power of 42-51dBm/200KHz (125W/200KHz) and antenna gain of 20dBi . Such high power is important to fulfil coverage requirements in rural areas or in deep indoor areas for IoT systems/sensors.
* For UMTS, LTE (and NR in the future) carriers: EIRP of 65-69 dBm/5MHz. This is based on conducted power of 45-49dBm/5MHz (80W/5MHz) and antenna gain of 20dBi.

Based on the above, we propose 2 optional limits for non-AAS BS, one for narrow band systems based on 200KHz block/carrier and one for wideband systems based on a 5MHz block/carrier.

For AAS BS, 3GPP specification TS 37.105 clearly states that AAS BS does not support neither GSM operation nor NB-IoT. For that we suggest an optional limit based on 5MHz Block/Carrier.

Table 3: BS in-block non-AAS and AAS power limit

|  |  |  |  |
| --- | --- | --- | --- |
| BEM element | Frequency range | Non-AAS e.i.r.p. | AAS TRP power limit(for 1800 MHz band AAS) |
| In-block | Block assigned to the operator. | Not obligatory.In case an upper bound is desired by an administration, a value of 65-69 dBm/(5 MHz) per antenna may be applied for wideband systems and a value of 62-71 dBm/200KHz per antenna may be applied for narrowband systems. | Not obligatory.In case an upper bound is desired by an administration, a value of 58 dBm/(5 MHz) per cell (1) may be applied. |
| Note: For locations where coordination procedure with adjacent services applies an upper bound on output power can be set by administrations.(1) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors. |

Terminal Station in-block requirement

As for the technical condition for user equipment (UEs) it is recommended that the in-block TRP for mobile UEs does not exceed 27 dBm. The in-block radiated power limit for fixed/nomadic UEs may be agreed on a national basis.

Table 4: In-block power limits for Terminal Stations

| **BEM element** | **Maximum mean power(1)** |
| --- | --- |
| In-block  | 27 dBm |
| (1) The recommended power limit above for mobile terminals is specified as TRP. The in-block radiated power limit for fixed/nomadic UEs may be agreed on a national basis provided that protection of other services, networks and applications is not compromised and cross-border obligations are fulfilled. |

Member States may relax the limit set out in Table 4 for specific deployments, e.g. fixed terminal stations in rural areas provided that protection of other services, networks and applications is not compromised and cross-border obligations are fulfilled.

### Out-of-block power limits

1. ’The explanatory sections can/should be moved to an annex in the final report.

#### ETSI HS conducted test requirements per antenna for operating band unwanted emissions in 900/1800MHz band:

To keep flexibility for operators to continue deploying in the future within their 900/1800MHz allocations both wideband but also narrow band systems such as GSM (including EC-GSM-IoT), NB-IOT or LTE 1.4MHz, 3MHz channels, we have picked below the most relevant MSR BS requirements from ETSI EN 301 908-18 V11.1.2 (2017-04) and EN 301 908-18 V13.1.1 (2019-09) (recently amended with conditions to support IoT systems). These correspond to the limits defined in 3GPP BS conformance test specifications for non-AAS MSR BS in TS37.141 (section 6.6.2.5.2). However, please consider that current 3GPP specifications do not necessarily allow to operate all technologies together on the same time by the same MSR BS e.g. in the time of writing this report NR operation with UTRA or GSM is not supported in 3GPP MSR specification TS37.141.

For an MSR BS operating in 900/1800MHz (bands Category 2) the requirement shall apply outside the Base Station RF bandwidth edges. In addition, for a BS operating in non-contiguous spectrum, it shall apply inside any sub-block gap.

In 900/1800MHz bands (band category2- BC2) the transmit requirements from ETSI HS and 3GPP shall apply with a frequency offset (**Foffset, RAT)** from the lowest and highest carriers to the Base Station RF Bandwidth edges and sub-block edges (if any) as defined the following table:

Table 5: Foffset, RAT for band category 2 (TS 37.141 Table 4.4.2-1)

|  |  |
| --- | --- |
| RAT | Foffset, RAT |
| E-UTRA and NR | BWChannel/2  |
| UTRA FDD | 2.5 MHz |
| GSM/EDGE | 200 kHz |
| Standalone NB-IoT | 200 kHz |

In the case of wide area BS in 900/1800MHz bands, outside the Base Station RF bandwidth edges, conducted emissions shall not exceed the maximum levels specified in the 2 tables, where:

- Δf is the separation between the Base Station RF bandwidth edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.

- f\_offset is the separation between the Base Station RF bandwidth edge frequency and the centre of the measuring filter.

- f\_offsetmax is the offset to the frequency 10 MHz outside the downlink operating band.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

Table 6: Wide Area BS operating band unwanted emission mask (UEM) for BC2 (Table 4.2.2.2.2-1 from ETSI HS EN 301 908-18)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (see notes 4 and 5) | Measurement bandwidth |
| 0 MHz ≤ Δf < 0.2 MHz(Note 1) | 0.015 MHz ≤ f\_offset < 0.215 MHz  | -12.5 dBm | 30 kHz  |
| 0.2 MHz ≤ Δf < 1 MHz | 0.215 MHz ≤ f\_offset < 1.015 MHz | (Note 6) | 30 kHz  |
| (Note 2) | 1.015 MHz ≤ f\_offset < 1.5 MHz  | -24.5 dBm (Note 6) | 30 kHz  |
| 1 MHz ≤ Δf ≤ min(Δfmax, 10 MHz)  | 1.5 MHz ≤ f\_offset < min(f\_offsetmax, 10.5 MHz) | -11.5 dBm (Note 6) | 1 MHz  |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax  | -15 dBm (Notes 3 and 6) | 1 MHz  |
| NOTE 1: For operation with a GSM/EDGE or an E-UTRA 1,4 MHz or 3 MHz carrier adjacent to the Base Station RF bandwidth edge, the limits in table 4.2.2.2.2-2 shall apply for 0 MHz ≤ Δf < 0,15 MHz.NOTE 2: This frequency range ensures that the range of values of f\_offset is continuous.NOTE 3: The requirement is not applicable when Δfmax < 10 MHz.NOTE 4: For MSR BS supporting non-contiguous spectrum operation within any operating band the test 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 ≥ 10 MHz from both adjacent sub-blocks on each side of the sub-block gap, where the test requirement within sub-block gaps shall be -15 dBm/MHz (for MSR BS supporting multi-band operation, either this limit or -16 dBm/100 kHz with correspondingly adjusted f\_offset shall apply for this frequency offset range for operating bands < 1 GHz).NOTE 5: For MSR BS supporting multi-band operation with Inter RF bandwidth gap < 20 MHz operation the test requirement within the Inter RF bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or Base Station RF Bandwidth on each side of the Inter RF bandwidth gap, where the contribution from the far-end sub-block or Base Station RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or Base Station RF Bandwidth.NOTE 6: For MSR BS supporting multi-band operation, either this limit or -16 dBm/100 kHz with correspondingly adjusted f\_offset shall apply for this frequency offset range for operating bands < 1 GHz. |

Table 7: Wide Area BS operating band unwanted emission limits for operation in BC2 with GSM/EDGE or standalone NB-IoT or E-UTRA 1,4 MHz or 3 MHz carriers adjacent to the RF bandwidth edge (Table 4.2.2.2.2-2 from ETSI HS EN 301 908-18)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement(see notes 2, 3, 4 and 5) | Measurement bandwidth |
| 0 MHz ≤ Δf < 0.05 MHz | 0.015 MHz ≤ f\_offset < 0.065 MHz  |  | 30 kHz  |
| 0.05 MHz ≤ Δf < 0.15 MHz | 0.065 MHz ≤ f\_offset < 0.165 MHz  |  | 30 kHz  |
| NOTE 1: The limits in this table only shall apply for operation with a GSM/EDGE or standalone NB-IoT or an E-UTRA 1,4 MHz or 3 MHz carrier adjacent to the Base Station RF bandwidth edge.NOTE 2: For MSR BS supporting non-contiguous spectrum operation within any operating band the test 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.NOTE 3: In case the carrier adjacent to the Base Station RF bandwidth edge is a GSM/EDGE carrier, the value of X = PGSMcarrier - 43, where PGSMcarrier is the power level of the GSM/EDGE carrier adjacent to the Base Station RF bandwidth edge. In other cases, X = 0.NOTE 4: For MSR BS supporting multi-band operation with Inter RF bandwidth gap < 20 MHz operation the test requirement within the Inter RF bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or Base Station RF Bandwidth on each side of the Inter RF bandwidth gap.NOTE 5: In case the carrier adjacent to the RF bandwidth edge is a NB-IoT carrier, the value of X = PNB-IoTcarrier - 43. In other cases, X = 0. |

The above mask corresponds to what has been considered in past ECC and CEPT reports (e.g. CEPT report 40/41/42 and ECC report 82) to confirm suitability of 900/1800MHz bands for the deployment of UMTS, LTE, Wimax, and NR and to confirm coexistence with in-Band systems (including GSM) and adjacent band systems.

In order to derive EIRP limits for non-AAS BS per antenna, an antenna gain of 20dBi is considered. The derived mask applies to MSR non-AAS BS that can support wideband systems (NR, LTE, UTRA) but also GSM and NB-IoT systems.

Note: For Bands below 3GHz, non-AAS BS conducted test requirements limits for operating band unwanted emissions are defined in ETSI HS accounting for a test tolerance of 1.5dB (compared to Core requirements defined in 3GPP). For AAS BS, radiated test requirements limits for unwanted emissions are calculated based on a test tolerance of 1.8dB.

#### ETSI HS TRP radiated test requirements per cell for AAS OTA BS operating band unwanted emissions in 900/1800MHz band:

AAS BS test requirements TRP limits are defined in 3GPP 37.145-2 (section 6.7.5.5.3).

AAS MSR BS in 900/1800MHz bands as defined in 3GPP specifications, does not support GSM, but this band category (BC2) is still applicable for protection of/against GSM operation in 900/1800MHz operating bands.

Besides, NB-IoT in-band, NB-IoT guard band, or standalone NB-IoT operation is not supported by AAS BS as defined in 3GPP.

We have picked here relevant MSR test requirements that keep flexibility to operators including to continue operating 1.4 and 3MHz LTE channels in 900/1800MHz bands. Different mask could be applied if such flexibility is not required.

Note: For AAS BS, radiated test requirements limits for operating band unwanted emissions are defined in ETSI HS and 3GPP conformance testing specifications accounting for a test tolerance of 1.8dB (compared to Core requirements defined in 3GPP).

Table 8: Wide Area operating band unwanted emission mask (UEM) for BC2 for BS not supporting NR (except for BS operating in Band n3 or n8) Wide (Table 6.7.5.5.3-1 of TS37.145-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Notes 2 and 3) | Measurement bandwidth  |
| 0 MHz ≤ Δf < 0.2 MHz(Note 1) | 0.015 MHz ≤ f\_offset < 0.215 MHz  | -3.2 dBm | 30 kHz  |
| 0.2 MHz ≤ Δf < 1 MHz | 0.215 MHz ≤ f\_offset < 1.015 MHz | -3.2-15(f\_offset/MHz-0.215) dBm | 30 kHz  |
| (Note 8) | 1.015 MHz ≤ f\_offset < 1.5 MHz  | -15.2 dBm | 30 kHz  |
| 1 MHz ≤ Δf ≤min(Δfmax, 10 MHz)  | 1.5 MHz ≤ f\_offset < min(f\_offsetmax, 10.5 MHz) | -2.2 dBm | 1 MHz  |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax  | -6 dBm (Note 10) | 1 MHz  |
| NOTE 1: For operation with an E-UTRA 1.4 or 3 MHz carrier adjacent to the *Base Station RF Bandwidth edge*, the limits in table 6.7.5.5.3-2 apply for 0 MHz ≤ Δf < 0.15 MHz.NOTE 2: For MSR RIB supporting non-contiguous spectrum operation within any operating band the *test 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. Exception is f ≥ 10 MHz from both adjacent sub blocks on each side of the sub-block gap, where the *minimum requirement* within sub-block gaps shall be -6 dBm/MHz.NOTE 3: For MSR *multi-band RIB* with *Inter RF Bandwidth gap* < 2×ΔfOBUE MHz operation the *test requirement* within the *Inter RF Bandwidth gap*s is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the *Inter RF Bandwidth gap*.NOTE 8: This frequency range ensures that the range of values of f\_offset is continuous.NOTE 10: The requirement is not applicable when Δfmax < 10 MHz |

Table 9: Wide Area BS operating band unwanted emission limits for operation in BC2
with E-UTRA 1.4 or 3 MHz carriers adjacent to the Base Station RF Bandwidth edge (Table 6.7.5.5.3-2 of TS37.145-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 2, 3 and 4) | Measurement bandwidth  |
| 0 MHz ≤ Δf < 0.05 MHz | 0.015 MHz ≤ f\_offset < 0.065 MHz  | Max(15.8dBm-60(f\_offset/MHz-0.015), -3.2 dBm) | 30 kHz  |
| 0.05 MHz ≤ Δf < 0.15 MHz | 0.065 MHz ≤ f\_offset < 0.165 MHz  | Max(12.8dBm-160(f\_offset/MHz-0.065), -3.2 dBm) | 30 kHz  |
| NOTE 1: The limits in this table only apply for operation with an E-UTRA 1.4 or 3 MHz carrier adjacent to the *Base Station RF Bandwidth edge*.NOTE 2: For MSR RIB supporting non-contiguous spectrum operation within any operating band the *test 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.NOTE 3: For MSR *multi-band RIB* with *Inter RF Bandwidth gap* < 2×ΔfOBUE MHz the *test requirement* within the *Inter RF Bandwidth gap*s is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the *Inter RF Bandwidth gap*.NOTE 4: Void.NOTE 8: Void.NOTE 10: The requirement is not applicable when Δfmax < 10 MHz |

The TRP values above can be reused directly to build BEM mask for AAS BS per cell.

#### Recommended Out-of-block power limits

Based on the ETSI HS and 3GPP specifications introduced above and the relevant conducted and radiated test requirements of operating bands unwanted emissions for Wide area base stations (Macro BS) operating in 900/1800MHz band we derive below the EIRP out-of-block power limits for non-AAS BS in 900/1800MHz and TRP out-of-block limits for AAS BS in 1800MHz band.

In 900/1800MHz bands (BC2) these requirements shall apply with narrow band systems central frequencies being placed 200KHz away from the Base Station RF Bandwidth edge.

.

Table 5: BS Baseline requirement

|  |  |  |  |
| --- | --- | --- | --- |
| BEM element | Frequency range | Non-AAS maximum mean e.i.r.p per antenna (for 900 MHz and 1800 MHz band) | AAS TRP power limit per cell (1) (for 1800 MHz band) |
| Baseline  | FDD DL blocks  | [5] dBm/MHz | -6 dBm/MHz |
| (1) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors. |

Table 6: BS Transitional region power limits

|  |  |  |  |
| --- | --- | --- | --- |
| BEM element | Frequency range | Non-AAS maximum mean e.i.r.p per antenna (for 900 MHz and 1800 MHz band) (2), (3) | AAS TRP power limit per cell (1) (for 1800 MHz band) |
| Transitional region | -10 to -5 MHz offset from the lower block edge | 8.5 dBm/MHz | -2.2 dBm/MHz |
| -5 to -1 MHz offset from lower block edge | 8.5 dBm/MHz | -2.2 dBm/MHz |
| *-1.5 MHz < f\_offset ≤ 1.015 MHz***(4)** | -4.5dBm/30KHz | -15.2 dBm/30KHz |
| -1 to -0.2 MHz offset from lower block edge | 7.5 + 15(f\_offset/MHz + 0.215) dBm/30KHz | -3.2 + 15(f\_offset/MHz + 0.215) dBm/30KHz |
| -2 to – 0.15MHz offset from lower block edge | 7.5 dBm/30 kHz | -3.2 dBm/30 kHz |
| -0.15 to -0.05 MHz offset from lower block edge | Max(23.5dBm+160(f\_offset/MHz + 0.065)dB + XdB, 7.5 dBm)/30KHz | Max(12.8dBm+160(f\_offset/MHz + 0.065), -3.2 dBm)/30KHz |
| -0.05 to 0 MHz offset from lower block edge | Max(26.5dBm + 60(f\_offset/MHz + 0.015)dB + XdB, 7.5 dBm)/30KHz | Max(15.8dBm + 60(f\_offset/MHz + 0.015), -3.2 dBm)/30KHz |
| 0 to 0.05 MHz offset from upper block edge*0.015 MHz ≤ f\_offset < 0.065 MHz* | Max(26.5dBm − 60(f\_offset/MHz − 0.015)dB + XdB, 7.5 dBm)/30KHz | Max(15.8dBm − 60(f\_offset/MHz − 0.015), -3.2 dBm)/30KHz |
| 0.05 to 0.15 MHz offset from upper block edge*0.065 MHz ≤ f\_offset < 0.165 MHz* | Max(23.5dBm−160(f\_offset/MHz − 0.065)dB + XdB, 7.5 dBm)/30KHz | Max(12.8dBm−160(f\_offset/MHz − 0.065), -3.2 dBm)/30KHz |
| 0.15 to 0.2 MHz offset from upper block edge*0.165 MHz ≤ f\_offset < 0.215 MHz* | 7.5 dBm/30 kHz | -3.2 dBm/30 kHz |
| 0.2 to 1 MHz offset from upper block edge*0.215 MHz ≤ f\_offset < 1.015 MHz* | 7.5 − 15(f\_offset/MHz − 0.215) dBm/30KHz | -3.2 − 15(f\_offset/MHz − 0.215) dBm/30KHz |
| *1.015 MHz ≤ f\_offset < 1.5 MHz***(4)** | -4.5dBm/30KHz | -15.2 dBm/30KHz |
| 1 to 5 MHz offset from upper block edge*1.5 MHz ≤ f\_offset < 5.5 MHz* | 8.5 dBm/MHz | -2.2 dBm/MHz |
| 5 to 10 MHz offset from upper block edge*5.5 MHz ≤ f\_offset < min(f\_offsetmax, 10.5 MHz)* | 8.5 dBm/MHz | -2.2 dBm/MHz |
|  (1) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.(2) f\_offset is the separation between the Base Station RF bandwidth edge frequency and the centre of the measuring filter (in MHz).(3) In case the carrier adjacent to the Base Station RF bandwidth edge is a GSM/EDGE carrier or NB-IoT carrier, the value of X = PGSMcarrier (resp. PNB-IoTcarrier) − 43, where PGSMcarrier (resp. PNB-IoTcarrier) is the power level of the GSM/EDGE (resp. NB-IoT) carrier adjacent to the Base Station RF bandwidth edge. In other cases, X = 0 (4) This frequency range ensures that the range of values of f\_offset is continuous. |

1. ’In the recommended BEM proposal above it is suggested to keep the detailed slope forumla between 0 and 200KHz in order to allow technlogy neutral coexistence in case narrow band systems/channels are deployed near to the edge of the operators operating band.

The development of the BEM in the 900/1800 MHz considers standalone NB IoT (0 to 0.2 MHz) operation as well as the wideband systems as defined in the ETSI harmonised standard, [3]-[4]. This is in-line with standalone EC-GSM-IoT operation which is explicitly mentioned in the existing ECC Decision for operation in these bands for non-AAS. [1]. Table 5 gives the out-of-block BEM requirements for non-AAS and AAS BS based on [20] dBi non-AAS antenna gain.

1. The BEM below is obtained by integrating applicable regions of of the BEM above. In the final report only one BEM should remain.

|  |  |  |  |
| --- | --- | --- | --- |
| BEM element | Frequency range | Non-AAS maximum mean e.i.r.p per antenna (for 900 MHz and 1800 MHz band) | AAS TRP power limit per cell (1) (for 1800 MHz band) |
| Transitional region | -10 to -5 MHz offset from the lower block edge | [15.5] dBm/5MHz | 4.8 dBm/5MHz |
| -5 to -1 MHz offset from lower block edge | [8.5] dBm/MHz | -2.2 dBm/MHz |
| -1 to -0.2 MHz offset from lower block edge | [17.2] dBm/0.8MHz | 6.5 dBm/0.8MHz |
| -0.2 to 0 MHz offset from lower block edge | [29.5] dBm/0.2MHz  | 5 dBm/0.2MHz  |
| 0 to 0.2 MHz offset from upper block edge | [29.5] dBm/0.2MHz  | 5 dBm/0.2MHz  |
| 0.2 to 1 MHz offset from upper block edge | [17.2] dBm/0.8MHz | 6.5 dBm/0.8MHz |
| 1 to 5 MHz offset from upper block edge | [8.5] dBm/MHz | -2.2 dBm/MHz |
| 5 to 10 MHz offset from upper block edge | [15.5] dBm/5MHz | 4.8 dBm/5MHz |
| Where ΔF is the frequency offset from the relevant block edge (in MHz) of the measurement filter centre frequency.(1) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors. |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |

LTE-MTC/eMTC and In-Band NB-IoT is covered by the LTE harmonised standard (see annex 1 and 2 of ECC DEC 06 13 March 2019) and are embedded inside the LTE carrier. As stated in ECC Report 266 they do not change the power or the LTE Spectrum Emission Mask (SEM). Therefore the BEM proposed above for 900/1800MHz bands based on LTE/NR SEM covers and is compatible with LTE-MTC/eMTC and In-Band NB-IoT technologies usage without any further conditions.

With regard to interference with adjacent services/applications no additional interference from guard band NB-IoT is expected compared to a LTE 5 MHz channel. Regarding operation in the other harmonised MFCN bands (excluding SDL and TDD) it is expected that no additional interference is created by guard-band NB-IoT if placed at least 200 kHz away from the block edge. Also the receiver characteristics of NB-IoT are similar to those of regular LTE receivers. Therefore the conditions of operation of guard band NB-IoT are expected to be similar to those of regular LTE, provided that the currently defined BEMs are fulfilled.

Special consideration is needed on how to handle standalone NB-IoT which usage remains authorised based on related ECC decision 0613 and ETSI HS.

### Other conditions

The spurious emission domain for the base station in these frequency bands start 10 MHz from the band edge and the corresponding limits are defined in current ERC Recommendation 74-01 [Ref].

In addition, MFCN networks making use of AAS systems shall not be granted more protection from systems in adjacent and neighbouring bands than experienced with non-AAS systems.

# Conclusions

# References

1. ECC Decision (06)13: “Designation of the bands 880-915 MHz, 925-960 MHz, 1710-1785 MHz and 1805-1880 MHz for terrestrial UMTS, LTE, WiMAX and IoT cellular systems”, Amended 8 March 2019.
2. ECC Decision (06)01: “The harmonised utilisation of the bands 1920-1980 MHz and 2110-2170 MHz for mobile/fixed communications networks (MFCN) including terrestrial IMT systems”, Amended 8 March 2019.
3. ETSI TS 137 141 V15.8.0 (2019-10), “Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; NR, E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing (3GPP TS 37.141 version 15.8.0 Release 15)”, Table 6.6.2.5.2-1 and Table 6.6.2.5.2-2
4. ETSI TS 138 141-2 V15.3.0, “5G; NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing (3GPP TS 38.141-2 version 15.3.0 Release 15)”, Table 6.7.4.5.1.3-1
5. cept mandate

|  |  |
| --- | --- |
|  | EUROPEAN COMMISSIONCommunications Networks Content & Technology Directorate-GeneralElectronic Communications Networks & Services**Radio Spectrum Policy** |

Brussels, 12 July 2018

DG CONNECT/B4

**RSCOM18-19rev1**

 **PUBLIC**

**RADIO SPECTRUM COMMITTEE**

**Working Document**

**Subject: Draft Mandate to CEPT to review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems**

*This is a Committee working document which does not necessarily reflect the official position of the Commission. No inferences should be drawn from this document as to the precise form or content of future measures to be submitted by the Commission. The Commission accepts no responsibility or liability whatsoever with regard to any information or data referred to in this document.*

**Mandate to CEPT**

 **to review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems**

1. **Purpose**

It is anticipated that next-generation (5G) terrestrial wireless systems will operate in frequency bands that have already been harmonised in the EU for electronic communications services. While this is already possible today based on technology and service neutrality principles, it is important that the existing harmonised technical conditions of use be reviewed to identify potential constraints, and optimised for next-generation systems. The latter would contribute to a leading Union role in 5G development and deployment.

This Mandate is a follow-up to the Commission's mandate regarding technology-neutral harmonised technical conditions suitable for next-generation (5G) use for the 3.6 GHz and 26 GHz pioneer bands[[6]](#footnote-7). It should deliver harmonised least restrictive technical conditions, including sharing conditions if needed, for next-generation (5G) terrestrial wireless systems in the EU-harmonised 880-915 and 925-960 MHz frequency bands ('900 MHz band), 1710-1785 MHz and 1805-1880 MHz frequency bands ('1800 MHz band'), 1920-1980 MHz and 2110-2170 MHz frequency bands ('paired terrestrial 2 GHz band'), and 2500-2690 MHz frequency band ('2.6 GHz band')[[7]](#footnote-8). These conditions should take into account relevant 5G usage scenarios related to wireless broadband and the Internet of Things, and meet the overarching purpose of ensuring efficient spectrum use.

1. **Policy context and inputs**

The ITU-R vision for the next-generation mobile telecommunications[[8]](#footnote-9) outlines three major 5G usage scenarios – enhanced mobile broadband (eMBB), massive machine type communications (mMTC), and ultra-reliable and low latency communications (URLLC).

Deliverables of the 5G Public Private Partnership[[9]](#footnote-10) Infrastructure Association indicate that 5G would offer both an evolution of mobile broadband networks ensuring continuous user experience, and new unique network and service capabilities. In particular, 5G would be a key enabler for the Internet of Things and mission-critical services requiring very high reliability, ubiquitous coverage and/or very low latency. In this regard, use cases originating from connectivity to 'verticals' (i.e. vertical sectors such as transport, healthcare or media) are considered as drivers of 5G requirements from the outset with high priority, in particular within frequency bands below 6 GHz.

In its 5G Action Plan[[10]](#footnote-11), the Commission advances action on the EU-level identification and harmonisation of 5G spectrum regarding pioneer frequency bands as well as **additional** frequency bands, based on the opinion of the Radio Spectrum Policy Group (RSPG).

In its two Opinions on "Strategic Roadmap towards 5G in Europe"[[11]](#footnote-12), the RSPG asserts the importance of existing EU-harmonised spectrum for the rollout of 5G terrestrial wireless systems in the Union as follows:

* 5G needs to be deployed also in bands already harmonized **below 1 GHz**, in particular the 700 MHz band, in order to enable nation-wide and indoor 5G coverage;
* there is a need to ensure that technical and regulatory conditions for **all bands already harmonized** for mobile networks are fit for 5G use.

In this regard, the 900 MHz and 1800 MHz, the 2.6 GHz and the paired terrestrial 2 GHz frequency bands are relevant EU-harmonised frequency bands for next-generation terrestrial wireless systems. In its 5G roadmap, the CEPT highlights the need to revise the technical conditions for these frequency bands with the goal to ensure their suitability for 5G use. Therefore, technical studies are necessary with view to enabling the use of these bands for next-generation terrestrial wireless systems, which use active antenna systems (AAS) and are capable of providing novel services or applications. These studies should consider terrestrial electronic communications services and other relevant use, and foster a European approach to 5G deployment, which benefits to the extent possible from global harmonisation. The CEPT also concludes in its 5G roadmap that the current technical conditions for the 700 MHz, 800 MHz and 1.5 GHz frequency bands are already suitable for 5G use in the context of technology neutrality and the anticipated lack of AAS deployment in those frequency bands.

In particular, for the 900 MHz and 1800 MHz frequency bands, it is relevant to consider a Block Edge Mask (BEM) approach to technical harmonisation, which is suitable for next-generation terrestrial wireless systems and achieves consistency with the existing minimal and least restrictive technical conditions for other EU-harmonised frequency bands for wireless broadband electronic communications services. Such an approach should replace in the long term the current technical framework based on references to ETSI standards for both bands. Furthermore, it should ensure coexistence with the GSM system in the 900 MHz frequency band, pursuant to the GSM Directive[[12]](#footnote-13), while delivering a solution, which ensures availability and efficient use of the spectrum for next-generation terrestrial wireless systems in line with the Union’s spectrum policy priorities.

In this regard, the CEPT is considering an amendment of the current technical framework for the 900 MHz and 1800 MHz frequency bands in early 2019, in order to reference the latest technical standards covering 5G New Radio. The CEPT plans to adopt harmonised technical conditions on the basis of BEM for both frequency bands as the long-term regulatory approach[[13]](#footnote-14). Taking account of progressing 5G standardisation, a transition of the technical conditions to BEM in the 900 MHz and 1800 MHz frequency bands at the EU level, could be facilitated by the specific provision[[14]](#footnote-15) in the Decision 2009/766/EC (as amended), which allows in both bands use of *other systems*, which are not listed in its Annex, under the condition of ensuring coexistence with the GSM system and the systems listed in that Annex. The aforementioned amendment of the CEPT technical framework will facilitate compliance with this provision in the EU context in order to accommodate evolving 5G standards.

1. **Justification**

Pursuant to Article 4(2) of the Radio Spectrum Decision[[15]](#footnote-16) the Commission may issue mandates to the CEPT for the development of technical implementing measures with a view to ensuring harmonised conditions for the availability and efficient use of radio spectrum necessary for the functioning of the internal market. Such mandates shall set the tasks to be performed and their timetable. Pursuant to Article 1 of the Radio Spectrum Decision, activities under the Decision must facilitate policy making with regard to the strategic planning and harmonisation of radio spectrum use as well as ensure the effective implementation of radio spectrum policy in the EU while serving the aim of coordination of policy approaches. Furthermore, they shall take due account of the work of international organisations related to spectrum management such as ITU or 3GPP.

The Radio Spectrum Policy Programme (RSPP) requires Member States, in cooperation with the Commission, to take all steps necessary to ensure that sufficient spectrum for coverage and capacity purposes is available within the Union, in order to enable the Union to have the fastest broadband speeds in the world, thereby making it possible for wireless applications and European leadership in new services to contribute effectively to economic growth, and to achieving the target for all citizens to have access to broadband speeds of not less than 30 Mbps by 2020. Furthermore, the RSPP calls on Member States and the Commission to ensure spectrum availability for the Internet of Things (IoT) and to foster the development of standards and the harmonisation of spectrum allocation for IoT communications.

Advances in international standardisation at 3GPP and ITU, as well as rapid international developments regarding 5G trials and spectrum use until 2020, call for a swift and coordinated EU-level process on delivering sufficient and appropriate 5G spectrum in the Union according to anticipated deployment of 5G usage scenarios.

1. **Task order and schedule**

CEPT is herewith mandated to develop harmonised least restrictive technical conditions for the 900 MHz, 1800 MHz, the 2.6 GHz and the paired terrestrial 2 GHz and frequency bands in line with the principles of technology and service neutrality, suitable for *next-generation (5G) terrestrial wireless systems* in line with the policy priorities set out in this Mandate and taking into account relevant needs for shared spectrum use with incumbent uses. CEPT should give utmost consideration to overall EU spectrum policy objectives such as effective and efficient spectrum use and take utmost account of applicable principles established in EU law such as those relating to service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

CEPT is requested to collaborate actively with the European Telecommunications Standardisation Institute (ETSI), which develops harmonised standards for conformity under the Radio Equipment Directive. In particular, CEPT should take into consideration emerging technologies and ETSI harmonised standards, which define 5G systems, facilitate shared spectrum use or foster economies of scale.

More specifically, CEPT is mandated to perform the following tasks with view to creating sufficiently precise conditions for the development of EU-wide equipment:

1. Review the EU-harmonised technical conditions for use of the 900 MHz, 1800 MHz, paired terrestrial 2 GHz, and 2.6 GHz frequency bands with view to their suitability for 5G terrestrial wireless systems[[16]](#footnote-17) which provide electronic communications services as well as other relevant services or applications, and assess the approach to adapting the EU-harmonised technical conditions for 5G use, if needed.

In particular, for the 900 MHz frequency band, such assessment should address any potential constraints (e.g. regarding efficient spectrum use), which result from the requirement to ensure co-existence with the GSM system, pursuant to the GSM Directive13.

1. Based on the results under Task 1, develop channelling arrangements and common and minimal (least restrictive) technical conditions[[17]](#footnote-18) for the aforementioned frequency bands, which are suitable for 5G terrestrial wireless systems in compliance with the principles of technology and service neutrality.

These conditions should be sufficient to mitigate interference and ensure co-existence with incumbent radio services/applications in the same band or in adjacent bands, in line with their regulatory status, including at the EU outer borders.

1. Develop guidance for cross-border coordination.

Overall, the CEPT should provide deliverables under this Mandate according to the following schedule:

|  |  |  |
| --- | --- | --- |
| **Delivery date** | **Deliverable** | **Subject** |
| March 2019  | Draft Report(s) from CEPT to the Commission[[18]](#footnote-19) regarding the paired terrestrial 2 GHz frequency band, and the 2.6 GHz frequency band.Information on the usage feasibility of the 900 MHz and 1800 MHz frequency bands, including any limitations of the GSM Directive. | Description of the work undertaken and the results. |
| July 2019 | Final Report(s) from CEPT to the Commission regarding the paired terrestrial 2 GHz frequency band, and the 2.6 GHz frequency band, taking into account the outcome of the public consultation. | Description of the work undertaken and the results. |
| July 2020 | Draft Report(s) from CEPT to the Commission19 regarding the 900 MHz and 1800 MHz frequency bands. | Description of the work undertaken and the results. |
| October 2020 | Final Report(s) from CEPT to the Commission regarding the 900 MHz and 1800 MHz frequency bands, taking into account the outcome of the public consultation. | Description of the work undertaken and the results. |

CEPT is requested to report on the progress of its work pursuant to this Mandate to all meetings of the Radio Spectrum Committee taking place during the course of the Mandate.

The Commission, with the assistance of the Radio Spectrum Committee and pursuant to Article 4 of the Radio Spectrum Decision, may consider applying the results of this mandate in the Union taking into account any relevant guidance of the RSPG.

1. Updates to EC Decision
2. ETSI HS SEM

The following SEM corresponds to the mask derived from ETSI HS and 3GPP specification. This mask has been and considered in past ECC and CEPT reports (e.g. CEPT report 40/41/42 and ECC report 82) to confirm suitability of 900/1800MHz bands for the deployment of UMTS, LTE, Wimax, and NR and to confirm coexistence with in-Band systems (including GSM) and adjacent band systems.

The ETSI and 3GPP SEM reflected in this table is based on conducted requirements specified per antenna.

1. Regional operating band unwanted emission limits in band 3 and 8 for 5, 10, 15 and 20 MHz channel bandwidth for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirement | Measurement bandwidth  |
| 0 MHz ≤ Δf < 0.2 MHz | 0.015MHz ≤ f\_offset < 0.215MHz  | -14 dBm | 30 kHz  |
| 0.2 MHz ≤ Δf < 1 MHz | 0.215MHz ≤ f\_offset < 1.015MHz |  | 30 kHz  |
| 1 MHz ≤ Δf ≤ 10 MHz  | 1.5 MHz ≤ f\_offset < 10.5 MHz | -13 dBm | 1 MHz  |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax  | -15 dBm | 1 MHz  |

* Δf is the separation between the channel edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.
* f\_offset is the separation between the channel edge frequency and the centre of the measuring filter.
* f\_offsetmax is the offset to the frequency 10 MHz outside the downlink operating band.
* Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.
1. Such as the definition of appropriate Block Edge Masks (BEMs). [↑](#footnote-ref-2)
2. 2 [For SUL operation mode the frequency band 880-915 MHz may be used for NR uplink operation without paired downlink NR channel in the frequency band 925-960 MHz] [↑](#footnote-ref-3)
3. [For SDL operation mode the frequency band 925-960 MHz may be used for NR downlink operation without paired uplink NR channel in the frequency band 880-915 MHz] [↑](#footnote-ref-4)
4. [For SUL operation mode the frequency band 1710-1785 MHz may be used for NR uplink operation without paired downlink NR channel in the frequency band 1805-1880 MHz] [↑](#footnote-ref-5)
5. [For SDL operation mode the frequency band 1805-1880 MHz may be used for NR downlink operation without paired uplink NR channel in the frequency band 1710-1785 MHz] [↑](#footnote-ref-6)
6. Document RSCOM16-40rev3 of 7 December 2016 [↑](#footnote-ref-7)
7. Subject to Commission Decisions 2009/766/EC as amended by 2011/251/EC and (EU) 2018/637 (900/1800 MHz band), 2012/688/EU (paired terrestrial 2 GHz band), 2008/477/EC (2.6 GHz band) [↑](#footnote-ref-8)
8. In the ITU context of "International Mobile Telecommunications for 2020 (IMT2020)", s. ITU Recommendation: [https://www.itu.int/dms\_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I%21%21PDF-E.pdf) [↑](#footnote-ref-9)
9. See <https://5g-ppp.eu/> [↑](#footnote-ref-10)
10. See: <https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan> [↑](#footnote-ref-11)
11. Documents RSPG16-032 final (9 November 2016) and RSPG18-005 final (30 January 2018) [↑](#footnote-ref-12)
12. Council Directive 87/372/EEC as amended by Directive 2009/114/EC of the European Parliament and of the Council [↑](#footnote-ref-13)
13. See CEPT 5G roadmap (document ECC(18)104 Annex 17) and ECC PT1 revised work programme (document ECC(18)104 Annex 19) [↑](#footnote-ref-14)
14. Article 5 of Decision 2009/766/EC (as amended) [↑](#footnote-ref-15)
15. Decision 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community, OJ L 108 of 24.4.2002 [↑](#footnote-ref-16)
16. Such as based on the usage of active antenna systems [↑](#footnote-ref-17)
17. Such as the definition of appropriate Block Edge Masks (BEMs) [↑](#footnote-ref-18)
18. Subject to subsequent public consultation [↑](#footnote-ref-19)