



CEPT Report 83

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

“Compatibility between MCV services using non-AAS 5G NR technology and terrestrial systems capable of providing electronic communications services in the paired 1800 MHz and the paired 2600 MHz frequency bands”

Report approved on 10 March 2023 by the ECC

0 EXECUTIVE SUMMARY

This Report was prepared in response to the EC Mandate to assess compatibility between MCV services and terrestrial systems capable of providing electronic communications services in the 1800 MHz and the paired 2600 MHz frequency bands and develop harmonised technical conditions for possible revision of Commission Implementing Decision 2010/166/EU for: non-AAS 5G NR on board vessels in the paired 1710-1785 / 1805 - 1880 MHz ('1800 MHz') and the paired 2500-2570 / 2620-2690 MHz ('paired 2600 MHz') frequency bands.

ECC Decision (08)08 [1] was updated in March 2022 and includes now technical operational requirements for 2G, 3G, 4G and 5G on board vessels (MCV) systems to ensure operational compliance with land-based networks operating in the same frequency bands.

This Report refers to ECC Report 336 [2], which provides the comparison between LTE and 5G NR system parameters and on-board vessels deployment parameters. Based on the comparisons, it is concluded that similar regulatory technical conditions for MCV LTE systems apply also to MCV 5G NR non-AAS.

The compatibility study for LTE in the 1800 and 2600 MHz band carried out in ECC Report 237 [3] shows that the probability for interference/capacity loss in the 2600 MHz band is lower than in the 1800 MHz band, therefore a separate simulation scenario for 5G NR with AAS in the 2600 MHz band is considered unnecessary.

The comparison of simulation results of land MFCN 5G NR AAS network capacity loss caused by MCV 5G NR non-AAS system with the land MFCN LTE non-AAS network capacity loss caused by MCV LTE non-AAS system shows that with the regulatory technical and operational conditions described in ECC Report 237 the loss is below the required protection threshold of 1%.

The overall results in ECC Report 336 show that a 5G non-AAS on board a vessel may be compatible with 5G NR non-AAS and AAS land networks in the 1800 and 2600 MHz band without additional measures.

CEPT proposes in this Report relevant updates to the EC Decision on MCV coherent with the recent update of the ECC framework on MCV (see ECC Decision (08)08) which are sufficient to ensure the protection of LTE and 5G NR land networks.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
5G NR	5G New Radio
AAS	Active Antenna Systems
BS	Base Station
CEPT	European Conference of Postal and Telecommunications Administrations
DAS	Distributed Antenna System
ECC	Electronic Communications Committee
ETSI	European Telecommunications Standards Institute
GSM	Global System for Mobile communications
LTE	Long Term Evolution
MCV	Mobile Communications on-board Vessels
MFCN	Mobile/Fixed Communications Networks
NM	Nautical Mile
non-AAS	non-Active Antenna Systems
PLMN	Public Land Mobile Network
RRC	Radio Resource Control
UE	User Equipment
UMTS	Universal Mobile Telecommunications System

1 INTRODUCTION

Since 5G NR technology has been made available to the Mobile/Fixed Communications Networks (MCFN), the newly published ECC Report 336 [2] focuses on the use of new technology and band combinations on board vessels. The new technology/band combinations envisaged for the MCV systems is 5G NR non-AAS in the 1800 MHz and 2600 MHz bands. Since 5G NR in the 1800 MHz and 2.6 GHz bands benefits from harmonisation at EU level [4] and since this technology was not part of the ECC Report 237 [3], ECC Report 336 studied the compatibility between 5G NR non-AAS on board with land-based networks using 5G NR in the 1800 MHz and 2.6 GHz bands.

The specific parameters needed for AAS in the studies are given in ECC Report 336, section 2. The other land-based networks and the MCV networks scenarios and parameters remain the same as in ECC Report 237. The possible interferences from MCV networks to land-based networks are studied since MCV networks shall not cause harmful interference to, or claim protection from, any other authorised system. A total of five sub-scenarios have been addressed in ECC Report 336 to cover all the technology/band/network topology combinations. The simulation results are presented in ECC Report 336, annex 1-4. The conclusions are given in section 3 of this Report.

2 BACKGROUND

This Report is the Report from CEPT to the European Commission in response to the EC Mandate “to undertake technical studies on Mobile Communications services on board Vessels (MCV)” in regard to compatibility studies between wideband Mobile Communication services operating 5G-NR non-AAS system in 1800 MHz and 2.6 GHz bands on board Vessels (MCV) and land-based MFCN networks.

The initial version of the ECC regulatory framework for Mobile Communications on board Vessels (MCV) allowed the use of GSM technology in the 900 MHz and 1800 MHz bands. The framework in ECC Decision (08)08 [1], published on 31 October 2008 was based on ECC Report 122 [5] “The compatibility between GSM use on board vessels and land-based networks”.

ECC Decision (08)08 was updated in 2017 to introduce UMTS in the frequency band 2100 MHz and LTE in the 1800 MHz and 2600 MHz band. This update was based on the ECC Report 237 [3] which examined the necessary compatibility between systems operating on board vessels and land-based networks.

ECC Decision (08)08 was updated again in March 2022 and includes now technical operational requirements for 2G, 3G, 4G and 5G (non-AAS) on board vessels (MCV) systems to ensure operational compliance with land-based networks operating in the same frequency bands.

This Report refers to ECC Report 336 [2], which provides the comparison between LTE and 5G NR non-AAS system parameters and on-board vessels deployment parameters. Sharing and compatibility studies in the ECC Report 336 provide the relevant background for incorporating the 5G technology into ECC Decision (08)08 keeping the technical conditions from ECC Report 237 valid for MCV 5G NR non-AAS system.

3 CONCLUSIONS

Based on the comparisons between LTE and 5G NR system parameters and MCV deployment parameters, it can be concluded that the similar technical and regulatory conditions applied to MCV LTE system can be applied also to MCV 5G NR non-AAS system for protecting both LTE non-AAS and 5G NR non-AAS land networks.

The new simulation results presented in ECC Report 336 [2] and the comparison with results in ECC Report 237 [3] show that 5G NR non-AAS on board a vessel is compatible with 5G NR AAS land networks in the 1800 MHz and 2600 MHz bands without additional measures. The technical and operational conditions given in ECC Report 237 can apply to MCV 5G NR non-AAS system for ensuring the protection of both LTE and 5G NR AAS land networks.

The system requirements for protection of land based MFCN systems are summarised in Table 1.

Table 1: MCV system specific values to protect land networks systems in the 1800 MHz and 2600 MHz band

System	On/off border (from baseline)	Outdoor antennas on/off (from baseline)	On board UE max tx power	Quality criteria QrxLevMin	Indoor on-board BS emission on deck	RRC inactivity release timer	Cell range for the DAS (Note 1)
5G NR non-AAS (1800 MHz and 2600 MHz)	4 NM	12 NM	0 dBm (PcMax)	SSB channel: ≥ -105 dBm/(15 kHz) (Note 2) Data channel: ≥ -83 dBm/(5 MHz) between 4 and 12 NM from the baseline	SSB channel: -120 dBm/(15 kHz) (Note 2) Data channel: -98 dBm/(5 MHz)	2 seconds	400 m
Note 1: The timing advance parameter has to be set according to the corresponding cell range Note 2: For SSB channel bandwidth other than 15 kHz, a conversion factor of $10 \cdot \log_{10}(\text{SSB BW}/15 \text{ kHz})$ should be added							

ANNEX 1: CEPT MANDATE

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**EUROPEAN COMMISSION**

Communications Networks Content & Technology Directorate-General

Connectivity
Radio Spectrum Policy

**MANDATE TO CEPT TO UNDERTAKE TECHNICAL STUDIES ON
MOBILE COMMUNICATION SERVICES ON BOARD VESSELS (MCV)**

1. PURPOSE

The purpose of this Mandate to the CEPT is the study and development of harmonised technical conditions with an aim to include 5G technology in relevant spectrum bands harmonised by the Commission Decision 2010/166/EU on Mobile Communication Services on Board Vessels (MCV) as amended by Decision (EU) 2017/191, in order to facilitate the deployment of advanced MCV services in the Union, in support of the EU policy objectives related to connectivity and digital transformation.

2. EU POLICY OBJECTIVES

The Commission Communication on Connectivity¹ for a competitive digital single market, towards a European gigabit society updated with the Commission Communication ‘2030 Digital Compass: the European way for the Digital Decade’², set out ambitious connectivity objectives for the Union to be achieved through the widespread deployment and take-up of very high capacity networks, including 5G. The Commission Communication ‘5G for Europe: an Action Plan’³ highlighted 5G as a key enabler of the digitalisation of “vertical industries” (such as transport, logistics, automotive, maritime, health, energy, smart factories, media and entertainment).

Inclusion of 5G technology in MCV systems would reinforce their connectivity capabilities and provide the highest service standards for communications at sea, whilst making use of the latest available wireless broadband technology. Allowing people to be connected everywhere at all times is at the heart of the Digital Decade Strategy. Seaborne connectivity applications are being used also for cross-border seafaring as well as for cruises within the European Union and need to be seamlessly provided across borders. The inclusion of 5G non-AAS technology in EU-harmonised frequency band for the use of MCV services would

¹ COM(2016)587.

² COM(2021) 118 final.

³ Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions ‘5G for Europe: An Action Plan’, COM(2016) 588 final.

strongly reinforce connectivity capabilities and, therefore, support the Union's Single Market objectives.

This Mandate addresses only the operation of MCV in the territorial seas of the Member States. All other operations (on the high seas, in inland waterways, lakes, ports and harbours etc.) including operation of backhaul connections (e.g., satellite link) are outside the scope of this Mandate.

3. JUSTIFICATION

The first Mandate given by the Commission to CEPT on 8 July 2008 on this subject led to the development of CEPT Report 28 of 26 June 2009, which served as the basis for Commission Decision 2010/166/EU of 19 March 2010 on harmonised conditions of use of radio spectrum for mobile communication services on board vessels (MCV services) in the European Union. The second Commission mandate to CEPT of 16 November 2015 resulted in the CEPT Report 62 of 17 June 2016, which substantiated Commission Decision (EU) 2017/191 amending Decision 2010/166/EU in order to introduce new technologies and frequency bands for MCV services in the Union.

Following the results of the ECC Report 336, the CEPT has accomplished an update of the relevant ECC Decision (08)08 with the inclusion of 5G NR non-AAS for MCV in the 1.8 GHz frequency band and the paired portion of the 2.6 GHz frequency band.

Pursuant to Art. 4 of the Radio Spectrum Decision 676/2002/EC⁴, CEPT is mandated to undertake the work required for the introduction of 5G in the bands specified under Section 4 for MCV based on the principles of technology and service neutrality laid down in the Electronic Communications Code.

4. TASKS AND SCHEDULE

CEPT is hereby mandated to undertake all required activities to:

Assess compatibility between MCV services and terrestrial systems capable of providing electronic communications services in the 1800 MHz and the paired 2600 MHz frequency bands, and develop harmonised technical conditions for possible revision of Commission Implementing Decision 2010/166/EU, for the following scenarios:

- Non-AAS 5G NR on board vessels in the paired 1710-1785 / 1805-1880 MHz ('1800 MHz') and the paired 2500-2570 / 2620-2690 MHz ('paired 2600 MHz') frequency bands.

The CEPT may include, where necessary, guidance on appropriate receiver characteristics for radio equipment as part of the harmonised technical conditions and/or recommend to ETSI to consider the results of those studies when developing relevant harmonised standards.

CEPT should provide deliverables according to the following schedule:

Delivery date	Deliverable	Subject
March 2023	Draft Report from CEPT to the Commission	Description of work undertaken and final results subject to public consultation.

⁴ 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, p.1.

June 2023	Final Report from CEPT to the Commission, taking into account the outcome of the public consultation.	Description of work undertaken and final results.
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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 the Radio Spectrum Decision, may consider applying the results of this mandate in the EU, pursuant to Article 4 of the Radio Spectrum Decision.

ANNEX 2: PROPOSED UPDATES TO EC DECISION

For the Commission Decision 2010/166/EU on Mobile Communication Services on Board Vessels (MCV) as amended by Decision (EU) 2017/191 [6].

This Report suggests that, within the CEPT, the administrations shall allow the use of the 5G NR non-AAS (5 MHz channel bandwidth only) system on board vessels within their territorial sea, excluding internal waters, harbours and ports in the frequency bands 1710-1785/1805-1880 MHz and/or 2500-2570/2620-2690 MHz.

The use of the 5G system shall comply with the technical parameters and operational requirements as follows.

A2.1 FREQUENCY BANDS AND SYSTEMS ALLOWED FOR 5G NR NON-AAS MCV SERVICES

Table 2: Frequency bands and systems allowed for 5G NR non-AAS MCV services

Type	Frequency	System
5G NR non-AAS	1710-1785 MHz (uplink) 1805-1880 MHz (downlink)	5G NR non-AAS complying with the 5G NR Standards as published by ETSI, EN 301 908-24 [7] and EN 301 908-25 [8]
5G NR non-AAS	2500-2570 MHz (uplink) 2620-2690 MHz (downlink)	

A2.2 TECHNICAL AND OPERATIONAL REQUIREMENTS FOR THE SYSTEM

The compatibility between 5G NR non-AAS on board vessels in the 1800 MHz (1710-1785 MHz (uplink)/1805-1880 MHz (downlink)) and 2600 MHz (2500-2570 MHz (uplink)/2620-2690 MHz (downlink)) (The “System”) and land network systems (GSM, LTE/5G NR for the 1800 MHz band and LTE/5G NR for the 2600 MHz band) can be met under the following conditions:

- The System shall be OFF between 0 and 4 NM from the baseline;
- The System outdoor antennas shall be OFF between 4 and 12 NM from the baseline;
- The maximum bandwidth used by the System is 5 MHz in 1800 MHz or 2600 MHz frequency bands;
- The maximum UE transmission power is limited to 0 dBm (PcMax);
- The quality criteria QRxLevMin is set to a value greater than or equals to -105 dBm/(15 kHz) (-83 dBm/(5 MHz)) between 4 and 12 NM from the baseline;
- The indoor System antenna emission on deck is limited to -120 dBm/(15 kHz) (-98 dBm/(5 MHz));
- The RRC inactivity timer of the System is set to 2 seconds;
- The timing advance value is set according to a cell range for the System distributed antenna system of 400 m;
- The PLMN network selection timer is set to 10 minutes in the national water;
- The System carrier centre frequency shall not be aligned with land network carriers.

In order to avoid a harmful interference from the System in the international waters (i.e. above 12 NM from the baseline) towards terrestrial mobile networks base stations, it is recommended to limit Tx power of UE connected to System in the bands 1800 MHz and 2600 MHz in accordance with the following formula:

$$UE \text{ Tx Power (dBm)} = 2+(D-12)*0.75$$

where:

- D is the distance from the baseline and 12 < D <= 41 NM.

This limitation could be included in the license granted by the flag state and the established procedure for complaint in case of interference, as contained in the ITU Radio Regulations [9] could be applied.

Table 3: System specific values to protect land networks systems

System	On/off border (from baseline)	Outdoor antennas on/off (from baseline)	On board UE max tx power	Quality criteria QRxLevMin	Indoor on board BS emission limit on deck	RRC inactivity release timer	Cell range for the DAS (Note 1)
5G NR non-AAS (1800 MHz and 2600 MHz)	4 NM	12 NM	0 dBm (PcMax)	SSB channel: ≥ -105 dBm/(15 kHz) (Note 2) Data channel: ≥ -83 dBm/(5 MHz) between 4 and 12 NM from the baseline	SSB channel: -120 dBm/(15 kHz) (Note 2) Data channel: -98 dBm/(5 MHz)	2 seconds	400 m

Note 1: The timing advance parameter has to be set according to the corresponding cell range

Note 2: For SSB channel bandwidth other than 15 kHz, a conversion factor of $10 \cdot \log_{10}(\text{SSB BW}/15 \text{ kHz})$ should be added

ANNEX 3: LIST OF REFERENCES

- [1] [ECC Decision \(08\)08](#): “The harmonised use of GSM systems in the 900 MHz and 1800 MHz bands, UMTS systems in the 2 GHz band and LTE systems in the 1800 MHz and 2.6 GHz bands on board vessels”, approved October 2008, amended March 2016 and updated June 2017
- [2] [ECC Report 336](#): “Compatibility study between wideband Mobile Communication services operating 5G NR non-AAS system in 1800 MHz and 2.6 GHz bands on board Vessels (MCV) and land based MFCN networks”, approved 4 March 2022
- [3] [ECC Report 237](#): “Compatibility study between wideband Mobile Communication services on board Vessels (MCV) and land based MFCN networks”, approved July 2015
- [4] Commission Decision 2011/251/EU of 18 April 2011 amending Decision 2009/766/EC on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community
- [5] [ECC Report 122](#): “The compatibility between GSM use on board vessels and land-based networks”, approved September 2008
- [6] Commission Implementing Decision (EU) 2017/191 of 1 February 2017 amending Decision 2010/166/EU, in order to introduce new technologies and frequency bands for mobile communication services on board vessels (MCV services) in the European Union
- [7] Draft ETSI EN 301 908-24: “IMT cellular networks; Harmonised Standard for access to radio spectrum Part 24: New Radio (NR) Base Stations (BS) Release 15”
- [8] Draft ETSI EN 301 908-25: “IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 25: New Radio (NR) User Equipment (UE) Release 15;”
- [9] ITU Radio Regulations, Edition of 2020