CEPT ECC
Electronic Communications Committee

ECC Decision (20)02

Harmonised use of the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz and of the unpaired frequency band 1900-1910 MHz for Railway Mobile Radio (RMR)[1]

approved 20 November 2020

updated 10 June 2022

[1] Comparable technical specifications to those given in this ECC Decision are given in Commission Implementing Decision (EU) 2021/1730 of 28 September 2021. EU Member States and, if so approved by the EEA Joint Committee, Iceland, Liechtenstein and Norway are obliged to implement these EC Decisions

EXPLANATORY MEMORANDUM

1 INTRODUCTION

This ECC Decision addresses the designation of the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz and of the unpaired frequency band 1900-1910 MHz to be used for Railway Mobile Radio (RMR) on a CEPT wide basis.

RMR supports railway operations and especially those in accordance with the Directive 2016/797/EU of the European Parliament and of the Council on the interoperability of the rail system [1] and the Commission Regulation 2016/919/EU on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system [2].

RMR encompasses GSM-R and its successor(s), including the Future Railway Mobile Communication System (FRMCS).

2 BACKGROUND

For the use of GSM-R, Commission Decision 1999/569/EC [2] and ECC Decision (02)05 [4] harmonised the paired frequency bands 876-880 MHz (train-to-ground) and 921-925 MHz (ground-to-train). The designation of a harmonised frequency band enabled the creation of a pan-European radiocommunication network for both passenger and freight trains to travel across EU borders without the need to install any other national radiocommunication system. This fulfilled the requirement of the Interoperability Directive [1].

In order to fulfil the interoperability requirements, to manage the migration without degradation to GSM-R and to benefit from new railway critical applications (such as Automatic Train Operation, remote control of engine, train integrity and sensing), sufficient spectrum for both GSM-R and its successor is essential. This is the purpose of this Decision.

In order to support a common approach to spectrum for the future railway mobile communications system across the European Union, the European Commission issued a Mandate to CEPT in 2018. CEPT Report 74 [8] and CEPT Report 76 [9] provide the response to this Mandate: assessment of the required amount of spectrum, identification of the appropriate spectrum bands, considering the technical feasibility studies, and development of harmonised technical conditions for FRMCS.

CEPT conducted a number of technical studies related to RMR and its coexistence with adjacent applications; they are listed in Annex 4 of this Decision.

3 REQUIREMENT FOR AN ECC DECISION

The allocation or designation of frequency bands for use by a service or system under specified conditions in CEPT administrations is laid down by law, regulation or administrative action. ECC Decisions are required to deal with radio spectrum related matters and to harmonise the use of spectrum across CEPT. It is considered necessary to designate and implement frequency bands for railway operations. The harmonisation on a European basis supports the Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment [9]. A commitment by CEPT administrations to implement an ECC Decision will provide a clear indication that the required frequency bands will be made available on time and on a European-wide basis.

This Decision is further intended to provide a basis for administrations to the free circulation and use of RMR mobile terminals, in the specified frequency bands, as it is essential to be able to use common railway radio equipment in different countries in a common frequency band as well as for border crossing traffic.

This Decision includes harmonised technical conditions for spectrum use by both wideband RMR transmitters and receivers. Additional external filtering to improve the cab-radio receiver performance may be installed at a national level as part of the railway regulation.

ECC DECISION OF 20 NOVEMBER 2020 ON THE HARMONISED USE OF THE PAIRED FREQUENCY BANDS 874.4-880.0 MHZ AND 919.4-925.0 MHZ AND OF THE UNPAIRED FREQUENCY BAND 1900-1910 MHZ FOR RAILWAY MOBILE RADIO (RMR) (ECC/DEC/(20)02), UPDATED 10 JUNE 2022

"The European Conference of Postal and Telecommunications Administrations,

considering

a) that Railway Mobile Radio (RMR) encompasses GSM-R and its successor(s), including the Future Railway Mobile Communication System (FRMCS);

b) that *railway interoperability* means the ability of a rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance;

c) that RMR and ETCS, as constituents of ERTMS, offer an interoperable railway communication and signalling system to all European railway networks and that spectrum harmonisation for railways is part of this process;

d) that, in order to enable parallel operation of GSM-R and its successor during migration and to benefit from new railway critical applications during and beyond migration, access to sufficient harmonised spectrum for RMR is essential;

e) that RMR is not a safety service (ITU Radio Regulations No. 1.59) [18];

f) that railway balises have been harmonised in Commission Decision 2006/771/EC [11] as amended[2] and in ERC Recommendation 70-03, annex 4 [12];

g) that the paired frequency bands 876-880 MHz (train-to-ground) and 921-925 MHz (ground-to-train) are used for GSM-R as defined in Commission Decision 1999/569/EC and were harmonised in ECC Decision (02)05 [4];

h) that the paired frequency bands 873-876 MHz and 918-921 MHz may be used on a national basis as extension bands for GSM-R as considered in ECC Decision (19)02 [7];

i) that CEPT Report 74 [8] and CEPT Report 76 [9] provide the response to the Mandate[3] from the European Commission to CEPT, on assessing the required amount of spectrum, identifying appropriate spectrum bands, studying technical feasibility and developing harmonised technical conditions for FRMCS;

j) that the migration from GSM-R to FRMCS is expected from 2024 onwards;

k) that the least restrictive technical conditions (LRTC) for wideband RMR in 1900-1910 MHz assume that MFCN base stations (BS) receiving above 1920 MHz have an enhanced selectivity compared to the current Harmonised European Standards, which would facilitate coexistence with RMR BS transmitting up to 65 dBm e.i.r.p., and that current MFCN BS located near an RMR radio site may need to be adapted so that they do not suffer interference;

l) that operators of commercial mobile networks in 1920-1980 MHz should have, sufficiently far in advance, information on the rollout of a new RMR BS in 1900-1910 MHz;

m) that ECC Report 229 [13] proposes a systematic approach based on a coordination/cooperation process and guidelines for the dialogue between RMR and MFCN licensees as well as with the spectrum administration and that CEPT Report 74 gives an example of a coexistence criterion as part of a national coordination procedure;

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[2] entries '19', '23' and '28'

[3] Ares(2018)3947109 - 25/07/2018 at https://ec.europa.eu/digital-single-market/en/news/radio-spectrum-cept-mandates-0

n) that RMR receivers should be robust against emissions adjacent in frequency;

o) that ETSI has developed the Harmonised European Standards EN 301 502 [14] for GSM base stations and EN 301 511 [15] for GSM mobile stations, which cover GSM-R;

p) that ETSI will develop Harmonised European Standards for the successor(s) to GSM-R;

q) that the spurious emission limits defined in ERC Recommendation 74-01 [17] are applicable unless stricter requirements in this Decision apply, and that the spurious emission domain for the wideband base station starts 10 MHz from the band edge;

r) that RMR terminals fulfil the criteria for individual licensing exemption listed in ERC Recommendation 01-07 [16] and therefore RMR terminals are exempt from individual licensing either implicitly by the rights of use granted to the RMR network or by other national regulation;

s) that, to avoid blocking of the mobile terminal by a narrowband interferer adjacent in frequency, a 200 kHz frequency separation may be required between RMR and MFCN and this issue can be addressed at national level;

t) that coordination may be needed in 1900-1910 MHz between RMR and existing national PPDR applications;

u) that, in some worst case scenarios, measures to enable coexistence between DECT in 1880-1900 MHz and RMR in 1900-1910 MHz might be needed, when information on DECT local deployment is available;

v) that in EU/EFTA countries the radio equipment that is under the scope of this Decision shall comply with the RE Directive. Conformity with the essential requirements of the RE Directive may be demonstrated by compliance with the applicable harmonised European standard(s) or by using the other conformity assessment procedures set out in the RE Directive.

DECIDES

1. that, for the purpose of this ECC Decision, the following definitions apply:

   a) an RMR terminal is a mobile radio equipment under the control of the RMR network,

   b) a cab-radio is an RMR terminal installed on-board the train capable of supporting voice and data applications (e.g. ETCS);

2. that CEPT administrations shall:

   – designate the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz and the unpaired frequency band 1900-1910 MHz for Railway Mobile Radio (RMR) on a non-exclusive basis,

   – allow free circulation and use of RMR terminals subject to the provisions of this Decision[4];

3. that the following technical and operational parameters apply to RMR in the frequency bands mentioned above:

   – the technical conditions for GSM-R in 874.4-880.0 MHz / 919.4-925.0 MHz are specified in Annex 1,

   – the least restrictive technical conditions (LRTC) for a single wideband RMR carrier in 874.4-880.0 MHz / 919.4-925.0 MHz are specified in Annex 2,

   – the least restrictive technical conditions (LRTC) for wideband RMR in 1900-1910 MHz are specified in Annex 3;

[4] including GSM-R terminals able to operate in 873-876 MHz / 918-921 MHz

4. that CEPT administrations wishing to allow multiple carriers using wideband technologies[5] or higher e.i.r.p. for RMR BS than stated in the technical conditions should consider the implementation of a coordination procedure or other mitigation measures;

5. that this Decision replaces ECC Decision (02)05 [4], ECC Decision (02)09 [5] and ECC Decision (02)10 [6], which are hereby withdrawn;

6. that this Decision enters into force on date: 20 November 2020;

7. that the preferred date for implementation of this Decision shall be date: 20 May 2021;

8. that CEPT administrations shall communicate the national measures implementing this Decision to the ECC Chairman and the Office when this ECC Decision is nationally implemented."

Note:

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

[5] LTE or NR, including NB-IoT

ANNEX 1: TECHNICAL CONDITIONS FOR GSM-R IN 874.4-880.0 MHZ / 919.4-925.0 MHZ

For GSM-R, the following parameters apply:

- GSM-R DL centre frequency f_{DL} = 921 MHz + n×0.2 MHz[6] where $\{n \in \mathbb{Z} \mid -7 \leq n \leq 19\}$
- GSM-R UL centre frequency f_{UL} = f_{DL} – 45 MHz
- GSM-R channel bandwidth is 200 kHz

Table 1: In-block requirements for GSM-R BS in 919.4-921 MHz uncoordinated deployment

GSM-R channel BW	Maximum e.i.r.p.
200 kHz	= 70.5 dBm + (f_{DL} – 921)×40/3 dB
f_{DL} is the centre frequency in MHz Formula applicable to $f_{DL} \leq$ 921 MHz. There is no e.i.r.p. restriction on GSM-R BS transmitting in the 921-925 MHz frequency band.	

[6] GSM-R channel raster of 200 kHz

ANNEX 2: LEAST RESTRICTIVE TECHNICAL CONDITIONS FOR A SINGLE WIDEBAND RMR CARRIER IN 874.4-880.0 MHZ / 919.4-925.0 MHZ

A2.1 TECHNICAL CONDITIONS FOR RMR BS USING WIDEBAND TECHNOLOGIES

The least restrictive technical conditions (LRTC) defined in this section are in the form of a block-edge mask (BEM) applicable to wideband RMR BS. The technical conditions defined in this section are valid for a single RMR carrier using wideband technologies. The BEM is developed on the basis that detailed coordination and cooperation agreements would not be required to be in place prior to network deployment. Only non-AAS[7] BS are considered.

For radio access technologies other than GSM-R, the following parameters apply:

- The lower edge of the lowest Resource Block shall be ≥ 919.6 MHz.

Table 2: General in-block requirement not mandatory

RMR channel BW	Maximum e.i.r.p.
Any of the channel BW	The following value may be used by an administration in case an upper bound is desired: = Min {65 dBm/channel , Maximum e.i.r.p. specific to the channel BW}

Table 3: Specific in-block requirements for 5.6 MHz and 5 MHz channels mandatory for uncoordinated deployment

RMR channel BW	Maximum e.i.r.p.
5.6 MHz	= 62 dBm/5.6 MHz
5 MHz	= 64.5 dBm/5 MHz + (f_{DL} – 922.1)×40/3 dB
f_{DL} is the centre frequency in MHz. NB-IoT in-band operation mode without power boost is allowed. NB-IoT guard-band operation mode and in-band operation mode with power boost are not allowed.	

[7] AAS: Active Antenna System

Table 4: Specific in-block requirements for 1.4 MHz and 200 kHz channels mandatory for uncoordinated deployment

RMR channel BW	Maximum e.i.r.p.
1.4 MHz	= 56 dBm/1.4 MHz + (f_{DL} – 920.2)×40/3 dB (Note 1)
200 kHz (Note 2)	= 70.5 dBm/200 kHz + (f_{DL} – 921)×40/3 dB (Note 3)
f_{DL} is the centre frequency in MHz. Note 1: Formula applicable to $f_{DL} \leq 921.7$ MHz. No specific e.i.r.p. restriction above. Note 2: Applicable to NB-IoT standalone operation mode, which is made of one Resource Block. Note 3: Formula applicable to $f_{DL} \leq 921.0$ MHz. No specific e.i.r.p. restriction above.	

Table 5: Out-of-band requirements

MHz from block edge (919.4-925 MHz)	e.i.r.p. limit
$0 \leq \Delta f < 0.2$	32.5 dBm/200 kHz
$0.2 \leq \Delta f < 1$	14 dBm/800 kHz
$1 \leq \Delta f < 10$	5 dBm/MHz
On a case-by-case basis, at a national level, higher OOB limits may be applied.	

Table 6: Baseline requirement

Frequency range	e.i.r.p. limit
880-915 MHz	-49 dBm/5 MHz
This requirement prevails over out-of-band requirements.	

A2.2 TECHNICAL CONDITIONS FOR RMR CAB-RADIO USING WIDEBAND TECHNOLOGIES

For radio access technologies other than GSM-R, the following parameters apply:

- Maximum output power: higher than 23 dBm and up to 31 dBm;
- ACLR[8]: 37 dB minimum;
- Uplink power control is mandatory and shall be activated.

[8] ACLR: Adjacent Channel Leakage power Ratio

A2.3 TECHNICAL CONDITIONS FOR RMR TERMINALS OTHER THAN CAB-RADIOS, USING WIDEBAND TECHNOLOGIES

For radio access technologies other than GSM-R, the following parameters apply:

- Maximum output power: 23 dBm;
- ACLR: 30 dB minimum;
- Uplink power control is mandatory and shall be activated.

A2.4 TECHNICAL CONDITIONS FOR RMR RECEIVERS USING WIDEBAND TECHNOLOGIES

Table 7: Requirements on wideband RMR BS receiver characteristics

Parameter	Value
Level of the wanted signal	RefSens + 3 dB
Maximum interfering signal in 870-874.4 MHz (Note 1)	-34 dBm
The antenna connector of the radio module is the reference point. The reference sensitivity (RefSens) is the minimum mean power received at the antenna connector at which a specified minimum performance shall be met. These requirements cover both blocking and third-order intermodulation. Note 1: It is up to ETSI to define a relevant interfering signal against which the conformity test will be performed. In this Decision, CEPT considered a bandwidth of 200 kHz for the interfering signal.	

Table 8: Requirements only for wideband RMR cab-radio receiver characteristics[9]

Parameter	Value
Level of the wanted signal	RefSens + 3 dB
Maximum interfering signal in 880-918.9 MHz (Note 1)	-26 dBm
Maximum CW[10] interfering signal in 925.6-927 MHz	-13 dBm
Maximum CW interfering signal in 927-960 MHz	-10 dBm
Maximum 5 MHz LTE interfering signal (lowest carrier at 927.6 MHz)	-13 dBm
The antenna connector of the radio module is the reference point. The reference sensitivity (RefSens) is the minimum mean power received at the antenna connector at which a specified minimum performance shall be met. These requirements cover both blocking and third-order intermodulation. Note 1: It is up to ETSI to define a relevant interfering signal against which the conformity test will be performed. In this Decision, CEPT considered a bandwidth of 400 kHz for the RFID interfering signal.	

[9] Requirements for RMR terminal receiver other than cab-radio are not covered in this table

[10] CW: Continuous Wave

ANNEX 3: LEAST RESTRICTIVE TECHNICAL CONDITIONS FOR WIDEBAND RMR IN 1900-1910 MHZ (TDD)

A3.1 TECHNICAL CONDITIONS FOR RMR BS USING WIDEBAND TECHNOLOGIES

The least restrictive technical conditions (LRTC) defined in this section are in the form of a block-edge mask (BEM) applicable to wideband RMR BS. The BEM is developed on the basis that detailed coordination and cooperation agreements would not be required to be in place prior to network deployment. Only non-AAS BS are considered.

The following parameters apply:

Table 9: General in-block requirement mandatory for uncoordinated deployment

RMR channel BW	Maximum e.i.r.p.
10 MHz	= 65 dBm/10 MHz (Note 1)
Note 1: In case an administration wishes to allow higher e.i.r.p., coordination or other mitigation measures are required.	

Table 10: Baseline requirement

Frequency range	e.i.r.p. limit
1920-1980 MHz	-43 dBm/5 MHz

A3.2 TECHNICAL CONDITIONS FOR RMR CAB-RADIO USING WIDEBAND TECHNOLOGIES

The following parameters apply:

- Maximum output power: 31 dBm;
- ACLR: 37 dB minimum;
- Unwanted output power in 1920-1980 MHz:
  - -25 dBm/MHz maximum in 1920-1925 MHz;
  - -30 dBm/MHz maximum in 1925-1980 MHz;
- Uplink power control is mandatory and shall be activated.

A3.3 TECHNICAL CONDITIONS FOR RMR TERMINALS OTHER THAN CAB-RADIOS, USING WIDEBAND TECHNOLOGIES

The following parameters apply:

- Maximum output power: 23 dBm;
- ACLR: 30 dB minimum;
- Uplink power control is mandatory and shall be activated.

A3.4 TECHNICAL CONDITIONS FOR RMR RECEIVERS USING WIDEBAND TECHNOLOGIES

Table 11: Requirements on wideband RMR BS receiver characteristics

Parameter	Value
Level of the wanted signal	RefSens + 3 dB
Maximum 5 MHz LTE interfering signal in 1805-1880 MHz	-20 dBm
The antenna connector of the BS receiver is the reference point. The reference sensitivity (RefSens) is the minimum mean power received at the antenna connector at which a specified minimum performance shall be met. These requirements cover both blocking and third-order intermodulation.	

Table 12: Requirements only for wideband RMR cab-radio receiver characteristics[11]

Parameter	Value
Level of the wanted signal	RefSens + 3 dB
Maximum 5 MHz LTE interfering signal in 1805-1880 MHz	-13 dBm
Maximum 5 MHz LTE interfering signal in 1920-1980 MHz	-39 dBm
The antenna connector of the radio module is the reference point. The reference sensitivity (RefSens) is the minimum mean power received at the antenna connector at which a specified minimum performance shall be met. These requirements cover both blocking and third-order intermodulation.	

[11] Requirements for RMR terminal receiver other than cab-radio are not covered in this table

ANNEX 4: LIST OF REFERENCES

[1] Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union

[2] Commission Regulation (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union

[3] Commission Decision 1999/569/EC of 28 July 1999 on the basic parameters for the command-and-control and signalling subsystem relating to the trans-European high-speed rail system

[4] ECC Decision (02)05: "The designation and availability of frequency bands for railway purposes in the 876-880 MHz and 921-925 MHz bands", approved July 2002 and amended March 2013[12]

[5] ECC Decision (02)09: "Free circulation and use of GSM-R mobile terminals operating within the frequency bands 876-880 MHz and 921-925 MHz for railway purposes in CEPT countries, enlarging the field of application of ERC/DEC/(95)01", approved November 2002 and amended March 2011

[6] ECC Decision (02)10: "Exemption from individual licensing of GSM-R mobile terminals operating within the frequency bands 876-880 MHz and 921-925 MHz for railway purposes", approved November 2002 and amended March 2011

[7] ECC Decision (19)02: "Land mobile systems in the frequency ranges 68-87.5 MHz, 146-174 MHz, 406.1-410 MHz, 410-430 MHz, 440-450 MHz and 450-470 MHz", approved March 2019

[8] CEPT Report 74: "Report from CEPT to the European Commission in response to the Mandate on spectrum for the future railway mobile communications system; Spectrum needs and feasibility", approved July 2020

[9] CEPT Report 76: "Report from CEPT to the European Commission in response to the Mandate on spectrum for the future railway mobile communications system

Report B: EU-harmonised technical conditions for the future railway mobile radio communications system (Task 5)", approved November 2020

[10] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC

[11] Commission Decision of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices(2006/771/EC)

[12] ERC Recommendation 70-03:"ERC Recommendation of 6 October 1997 on relating to the use of Short Range Devices (SRD)", approved October 2009 and all subsequent versions

[13] ECC Report 229: "Guidance for improving coexistence between GSM-R and MFCN in the 900 MHz band", approved May 2015

[14] ETSI EN 301 502: "GSM; BS equipment; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU"

[15] ETSI EN 301 511: "GSM; MS equipment; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU"

[16] ERC Recommendation 01-07: "Harmonised regime for exemption from individual licensing for the use of radio spectrum", approved June 2004

[17] ERC Recommendation 74-01: "Unwanted emissions in the spurious domain", approved May 2019

[18] ITU Radio Regulations, Edition of 2020

[12] This ECC Decision (02)05 was withdrawn by the approval of ECC Decision (20)02