EUROPEAN
COMMISSION

Brussels, XXX
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COMMISSION IMPLEMENTING DECISION

of XXX

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

(Text with EEA relevance)

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(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Decision No 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 (Radio Spectrum Decision)[1], and in particular Article 4(3) thereof,

Whereas:

(1) The radio communication system currently used for railway operations, namely Global System for Mobile Communications – Rail (GSM-R), is based on specifications that were finalised twenty years ago and, due to technological obsolescence, industrial support for GSM-R is unlikely to be assured much after 2030. The Future Railway Mobile Communication System (FRMCS) will succeed GSM-R as one of the essential elements of the European Railway Traffic Management System (ERTMS). It will support railway digitalisation and service innovation. GSM-R and its successor(s), including FRMCS, are designated as Railway Mobile Radio (RMR).

(2) Compared to GSM-R, FRMCS offers a higher quality of service, uses spectrum more efficiently and is more cost effective. The system is also planned to deliver more in terms of applications such as Automatic Train Operation (ATO) or the Connected Driver Advisory System (C-DAS). Further applications are expected to be introduced progressively. Critical FRMCS railway applications like monitoring and control of critical infrastructure may be operated efficiently using narrow band IoT. FRMCS should be capable of integrating new applications and technological developments over an extended period of time as railway communication systems have a much longer life cycle compared to public electronic communications networks and services.

(3) Therefore, frequency bands should be harmonised to allow for the introduction of FRMCS.

(4) In order to enable parallel operation of GSM-R and its successor during an approximately 10-year migration phase from GSM-R to FRMCS and to benefit from new railway critical applications during and beyond migration, access to sufficient harmonised spectrum for RMR is essential.

(5) In order to support a common approach to spectrum for RMR across the Union, the Commission issued a Mandate to the European Conference of Postal and

[1] OJ L 108, 24.4.2002, p. 1.

Telecommunications Administrations (CEPT) on 12 July 2018, and CEPT responded with its Report 74 on 3 July 2020 and Report 76 on 20 November 2020.

(6) These reports, based on feasibility studies, assess the required amount of spectrum, identify the appropriate spectrum bands, and propose harmonised technical conditions for FRMCS.

(7) Report 74 in particular assesses coexistence with all applications in the adjacent frequency bands.

(8) The harmonised technical conditions for RMR (FRMCS) base stations defined in CEPT Report 76 assume that base stations providing electronic communications services (ECS), which use frequencies above 1920 MHz for reception under Commission Implementing Decision (EU) 2020/667, have enhanced selectivity compared to the current Harmonised European Standards.

(9) The technical feasibility of using commercial mobile networks, taking into account wireless coverage and reliability needs of the railway system, was also considered in CEPT Report 74.

(10) RMR receivers (base stations and cab-radios) should be robust against emissions in adjacent frequencies.

(11) Only FRMCS systems using non-active antenna systems have been considered in CEPT Report 76. Additional studies should be performed in case active antenna systems are considered for FRMCS deployment.

(12) As long as a Member State does not have railway lines in operation, it should be allowed to postpone the implementation of RMR spectrum harmonisation measures until such operation is planned.

(13) Based on national demand, Member States should be allowed to vary the implementation date of RMR spectrum harmonisation measures in the frequency band 1990-1910 MHz between 1 January 2022 and 1 January 2025 at the latest.

(14) Reporting from all Member States to the Commission on the implementation of this Decision, including any developments in the area of spectrum management having a negative impact on interoperability, would help assess its impact at Union level as well as its timely review.

(15) The measures provided for in this Decision are in accordance with the opinion of the Radio Spectrum Committee,

HAS ADOPTED THIS DECISION:

Article 1

This Decision establishes the harmonised conditions for the availability and efficient use of radio spectrum for the Railway Mobile Radio (RMR) in the bands 874.4-880.0 MHz, 919.4-925.0 MHz and 1900-1910 MHz.

Article 2

For the purposes of this Decision, the following definitions shall apply:

(a) ‘RMR terminal’ is an item of mobile radio equipment under the control of the RMR network;

(b) ‘cab-radio’ means a RMR terminal installed on board the train capable of supporting voice and data applications;

(c) ‘equivalent isotropically radiated power (‘e.i.r.p.’)’ means the product of the power supplied to the antenna and the absolute or isotropic gain in a given direction relative to an isotropic antenna.

Article 3

1. By 1 January 2022, Member States shall designate and make available on a non-exclusive basis the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz, in accordance with the Annex.
2. At the latest between 1 January 2022 and 1 January 2025, based on national demand, Member States shall designate and make available on a non-exclusive basis the unpaired frequency band 1900-1910 MHz for Railway Mobile Radio, in accordance with the Annex.
3. Member States shall ensure that networks using the frequency bands referred to in paragraph 1 give appropriate protection to systems in adjacent bands.
4. Member States where no rail services are provided at the date of 1 January 2022 shall only apply paragraph 1 as soon as a rail line is planned to be activated.

Article 4

Member States shall report to the Commission on the implementation of this Decision by 1 January 2025.

Member States shall monitor the use by RMR of the frequency bands subject to this Decision and report their findings, including any impacts on interoperability related to spectrum issues, to the Commission upon request or at their own initiative to allow a timely review of this Decision, where needed.

Article 5

This Decision is addressed to the Member States.

Done at Brussels,

For the Commission
Thierry BRETON

Member of the Commission

EUROPEAN
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Brussels, XXX
[…](2021) XXX draft

ANNEX

ANNEX

to the

Commission Implementing Decision

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

ANNEX

PART A: TECHNICAL CONDITIONS FOR GSM-R IN 874.4-880.0 MHZ and 919.4-925.0 MHZ bands

For GSM-R, the following parameters apply:

GSM-R Downlink centre frequency f_{DL} = 921 MHz + n×0.2 MHz[1] where $\{n \in \mathbb{Z} \mid -7 \leq n \leq 19\}$

GSM-R Uplink centre frequency $f_{UL} = f_{DL} - 45$ MHz

GSM-R channel bandwidth is 200 kHz

Table 1

In-block requirements for GSM-R Base Stations in 919.4-921 MHz uncoordinated deployment

GSM-R channel bandwidth	Maximum e.i.r.p.
200 kHz	= 70.5 dBm + (f_{DL} – 921)×40/3 dB

f_{DL} is the centre frequency in MHz

There is no e.i.r.p. restriction on GSM-R Base Stations transmitting in the 921-925 MHz frequency band. Formula applicable to $f_{DL} \leq 921$ MHz. To allow higher e.i.r.p, the implementation of a coordination procedure or other mitigation measures must be applied.

PART B: TECHNICAL CONDITIONS FOR A SINGLE WIDEBAND RMR CARRIER IN 874.4-880.0 MHZ and 919.4-925.0 MHZ bands

Technical conditions for RMR Base Stations using wideband technologies

The technical conditions defined in this section are in the form of a block-edge mask (BEM) applicable to wideband RMR Base Stations. 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. To allow multiple carriers or higher e.i.r.p. for RMR BS than stated in the harmonised technical conditions, the implementation of a coordination procedure or other mitigation measures must be applied. Base Stations using active antenna systems are prohibited.

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.

[1] GSM-R channel raster of 200 kHz

Table 2

General in-block requirement - not mandatory

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

Table 3

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

RMR channel bandwidth	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.

Table 4

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

RMR channel bandwidth	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 out-of-band 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.	

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[2]: 37 dB minimum;

Uplink power control is mandatory and shall be activated.

[2] ACLR: Adjacent Channel Leakage power Ratio

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.

Technical conditions for RMR receivers using wideband technologies

The band can be accessed if techniques to access spectrum and mitigate interference that provide an appropriate level of receiver performance to comply with the essential requirements of Directive 2014/53/EU are used. Where relevant techniques are described in harmonized standards or parts thereof the references of which have been published in the Official Journal of the European Union in accordance with Directive 2014/53/EU, performance at least equivalent to the performance level associated with those techniques shall be ensured.

Table 7

Requirements on wideband RMR Base Station 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: A bandwidth of 200 kHz for the interfering signal is assumed.

Table 8

Requirements only for wideband RMR cab-radio receiver characteristics[3]

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

Parameter	Value
Level of the wanted signal	RefSens + 3 dB
Maximum interfering signal in 880-918.9 MHz (Note 1)	-26 dBm
Maximum continuous wave interfering signal in 925.6-927 MHz	-13 dBm
Maximum continuous wave 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: A bandwidth of 400 kHz for the RFID interfering signal is assumed.

PART C: TECHNICAL CONDITIONS FOR WIDEBAND RMR IN 1900-1910 MHZ (TDD) band

Technical conditions for RMR Base Stations using wideband technologies

The technical conditions 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. Base Stations with active antenna systems are prohibited.

The following parameters apply:

Table 9

General in-block requirement mandatory for uncoordinated deployment

RMR channel bandwidth	Maximum e.i.r.p.
10 MHz	= 65 dBm/10 MHz (Note 1)
Note 1: Member States may allow a higher e.i.r.p. level, subject to national coordination	

or other mitigation measures.

Table 10

Baseline requirement

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

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.

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.

Technical conditions for RMR receivers using wideband technologies

The band can be accessed if techniques to access spectrum and mitigate interference that provide an appropriate level of receiver performance to comply with the essential requirements of Directive 2014/53/EU are used. Where relevant techniques are described in harmonized standards or parts thereof the references of which have been published in the Official Journal of the European Union in accordance with Directive 2014/53/EU, performance at least equivalent to the performance level associated with those techniques shall be ensured.

Table 11

Requirements on wideband RMR Base Stations 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 Base Station 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[4]

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 Base Station 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.

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