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M Series: Mobile, radiodetermination, amateur and related satellite services

Guidance on the harmonization of spectrum for existing and future Railway radiocommunication Systems between Train and Trackside (RSTT) within the frequency bands allocated to the mobile service and operating in accordance to the Radio Regulations

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RA	Radio astronomy
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S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R M.2171-0

Guidance on the harmonization of spectrum for existing and future Railway radiocommunication Systems between Train and Trackside (RSTT) within the frequency bands allocated to the mobile service and operating in accordance to the Radio Regulations

(2026)

Scope

This Recommendation provides guidance on frequency ranges to facilitate harmonization of frequency bands within the existing Mobile Service allocations for existing and future railway radiocommunication systems between train and tracksides (RSTT) on global or regional levels.

Keywords

Railway radiocommunication Systems between Train and Trackside, RSTT, Train, Trackside, frequency ranges, frequency bands, harmonization

Related ITU Recommendations, Reports and Handbooks

Recommendation ITU-R M.1732 – Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies

Recommendation ITU-R M.1787 – Description of systems and networks in the radionavigation-satellite service (space-to-Earth and space-to-space) and technical characteristics of transmitting space stations operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz

Recommendation ITU-R M.1902 – Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 215-1 300 MHz

Recommendation ITU-R M.2030 – Evaluation method for pulsed interference from relevant radio sources other than in the radionavigation-satellite service to the radionavigation-satellite service systems and networks operating in the 1 164-1 215 MHz, 1 215 1 300 MHz and 1 559-1 610 MHz frequency bands

Report ITU-R M.2418 – Description of Railway Radiocommunication Systems between Train and Trackside

Report ITU-R M.2442 – Current and future usage of railway radiocommunication systems between train and trackside

Report ITU-R M.2458 – Radionavigation-satellite service applications in the 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz frequency bands

Report ITU-R M.2513 – Studies regarding the protection of the primary radionavigation-satellite service (space-to-Earth) by the secondary amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz

Report ITU-R M.2532 – Amateur and amateur-satellite services characteristics and usage in the 1 240-1 300 MHz frequency band

Handbook on Amateur and amateur-satellite services

Abbreviations and Glossary

ASMG Arab Spectrum Management Group

ATU African Telecommunications Union

CBTC Communications based train control

CEPT European Conference of Postal and Telecommunications Administrations

GSM-R Global System for Mobile communications – Railway

RCC Regional Commonwealth in the field of Communications

RSTT Railway radiocommunication Systems between Train and Trackside

TCS Train control system

Harmonized frequency range: In the context of this Recommendation, a range of frequencies harmonized at a global or regional level over which relevant radio equipment is envisaged to be capable of operating in specific frequency bands/conditions; however, the actual use may be limited according to national and regional conditions and requirements.

Railway radiocommunication systems between train and trackside: Radiocommunication systems providing improved railway traffic control, passenger safety and improved security for train operations

The ITU Radiocommunication Assembly,

considering

a) that railway transportation contributes to global economic and social development, especially for developing countries;

b) that the main categories of applications of Railway radiocommunication Systems between Train and Trackside (RSTT) are Train Radio, Train Positioning Information, Train Remote and Train Surveillance;

c) that many administrations wish to facilitate RSTT interoperability, in particular for cross-border operations, effective use of spectrum resources and for minimizing the risk of interference;

d) that information and radiocommunication technologies in railway radiocommunication systems between train and trackside provide improved railway traffic control, passenger safety and improved security for train operations, and benefit from using frequency bands allocated to mobile service on primary basis;

e) that the deployment of RSTT requires significant infrastructure investment and would benefit from a stable radio spectrum regulatory environment;

f) that international standards and harmonized spectrum facilitate deployment of RSTT based on readily available cost-effective technologies that would help to provide economies-of-scale for the railway industry;

g) that some national and international railway organizations and standards bodies have begun investigating and developing technical standards for new technologies for railway radiocommunication systems;

h) that implementation of future RSTT needs to take into account the development of railway industry and relevant standards as well as regional and national priorities;

i) that the evolving traffic safety related applications of railway transportation may require additional spectrum considerations;

j) that interoperability of technologies could facilitate various functions, for instance dispatching commands, operating control and data transmission, into railway train and trackside systems to also meet the needs of a high-speed railway environment,

recognizing

that the provisions of RR Nos. **1.59** and **4.10** do not apply for railway radiocommunication systems,

noting

a) that spectrum planning for RSTT is performed at the national level, taking into account the need for interoperability and benefits of neighbouring administrations using harmonized frequency bands;

b) that some railway systems have been operating in many countries for many years using various frequency bands not listed in Annexes and that these frequency bands will continue to be used for RSTT in the future and require ongoing support;

c) that the continued growth and evolution of RSTT systems may require further study to ensure coexistence and protection of other incumbent services in the same and/or adjacent bands;

d) that railway technologies are heading to autonomous driving without track circuit, and so multiple radiocommunication systems are one of the effective ways to keep train integrity based on present location of the moving trains;

e) that Report ITU-R M.2418 provides the architecture, applications, technologies and operational scenarios of Railway Radiocommunication Systems between Train and Trackside (RSTT) for all types of trains (e.g. high-speed trains, passenger trains, freight trains and metro trains);

f) that Report ITU-R M.2442 provides technical and operational characteristics and the spectrum usage of current and planned Railway radiocommunication Systems between Train and Trackside (RSTT) as well as countries' specific frequency bands used for RSTT,

recommends

1 that administrations should consider using the frequency ranges (or parts thereof), as listed in Annexes 2, 3 and 4, within the bands allocated to the mobile service on primary basis, in order to facilitate regional or global spectrum harmonization for RSTT;

2 that administrations should take practicable efforts to facilitate cross border coexistence between RSTT and other systems operating in the mobile service as well as between RSTT and stations of other services.

Annex 1

Global

No frequency ranges within the existing mobile service allocations for RSTT application are harmonized, or considered for harmonization, at the Global level at this time.

Annex 2

For some countries in Region 1

TABLE 1

Frequency ranges harmonized or considered for harmonization for RSTT in Region 1

Region 1		
Applications	**Frequency ranges within the existing mobile service allocations under consideration or proposed for harmonization by sub-Regional groups**	**Harmonized frequency ranges within the existing mobile service allocations in Region 1**
Train Radio	ATU: Parts of 138-170 MHz[5] 406.1-430 MHz 440-470 MHz 873-880 MHz / 918-925 MHz	876-880 MHz / 921-925 MHz
	ASMG: **GSM-R** 876-880 MHz / 921-925 MHz **EGSM-R** 874.4-880 MHz / 919.4-925 MHz[1] **Railway Mobile Radio (RMR)** 1 900-1 910 MHz [1] **Trunked radio** Parts of 138-174 MHz [1, 5] 410-430 MHz [1] **CBTC & TCS** 2 400-2 483.5 MHz 5 915-5 945 MHz [1]	
	CEPT[2]: 874.4-880 MHz / 919.4-925 MHz, 1 900-1 910 MHz	

[1] This is a frequency tuning range used by some ASMG administrations according to their national needs and technical/regulatory conditions.

[2] CEPT is of the view that regional and global harmonization can only be achieved if there is overlapping spectrum in the related harmonization measures of the regional groups or their sub-regional entities.

TABLE 1 (*end*)

	Region 1	
Applications	**Frequency ranges within the existing mobile service allocations under consideration or proposed for harmonization by sub-Regional groups**	**Harmonized frequency ranges within the existing mobile service allocations in Region 1**
	RCC[3]: Parts of 138-174 MHz[4] 406.2-430 MHz / 440-470 MHz 876-880 MHz / 921-925 MHz 1785-1805 MHz	
Train Positioning	ASMG: Eurobalise 4.059-4.409 MHz 27.09-27.10 MHz	
	CEPT [2]: 27.09-27.10 MHz[5]	See Note 1
Train Remote	RCC[3]: Parts of 138-174 MHz[6] 406.2-430 MHz / 440-470 MHz 876-880 MHz / 921-925 MHz ASMG: **Tower Control** 440-449 MHz[7]	See Note 1
Train Surveillance	ASMG: 2 400-2 483.5 MHz[1] 5 150-5 350 MHz[1] 5 725-5 875 MHz[1]	See Note 1

Note 1: No Frequency ranges within the existing mobile service allocations for this RSTT application are harmonized at this time.

3 This is a frequency tuning range and will be limited to use by these systems according to national and regional constraints, conditions and requirements.

4 Not all parts of this frequency range are allocated to Mobile service.

5 In CEPT, the frequency range 27.09-27.10 MHz is harmonised for Balise tele-powering and downlink (train to ground) systems including Eurobalise and activation of the Loop/Euroloop, along with the frequency range 0.984-7.484 MHz harmonised for Eurobalise transmissions, i.e. Balise uplink (ground to train) with a centre frequency of 4.234 MHz.

6 Not all parts of this frequency range are allocated to Mobile service.

7 This is a frequency tuning range used by some ASMG administrations according to their national needs and technical/regulatory conditions.

Annex 3

For some countries in Region 2

The frequency ranges/bands presented below provide detailed information on the use of existing Land Mobile Service allocations for RSTT applications. The information was provided by CITEL PCCII and is for information purposes only.

TABLE 2

Frequency ranges considered for harmonization for RSTT in Region 2

Region 2		
Application	**Frequency ranges within the existing mobile service allocations under consideration or proposed for harmonization**	**Harmonized frequency ranges within the existing mobile service allocations in Region 2[8]**
Train Radio	USA: 160.215-161.565 MHz 452.92500/457.92500 MHz 452.95000/457.95000 MHz Parts of 2 000-18 000 MHz	At least two Adm: 148-174 MHz More number of Adm: 160.215-161.565 MHz Greater range of frequencies with at least one Adm: Parts of 136-174 MHz
	CAN: 160.170-161.580 MHz 452/457 MHz	
	B: Parts of 148-174 MHz Parts of 380-400 MHz (TETRA) (2) Parts of 403-470 MHz 459.7875-469.7875 MHz Parts of 900-930 MHz	At least two Adm: Parts of 410-450 MHz and 450-470 MHz More number of Adm: 452.95-457.00 MHz Greater range of frequencies with at least one Adm: Parts of 410-470 MHz
	ARG: Parts of 4.5-7 MHz (2) Parts of 150-170 MHz (2) Parts of 410-450 MHz (2) 450-470 MHz 490-512 MHz (2) 800-900 MHz 1 427-1 525 MHz 7 110-7 725 MHz 17 700-19 700 MHz	At least two Adm: 898.4-928 MHz More number of Adm: 902-928 MHz Greater range of frequencies with at least one Adm: 800-930 MHz
	MEX: 160-174 MHz 350-380 MHz (2) 410-430 MHz (2) 806-814/851-859 MHz (2)	At least two Adm: 1.5 GHz. 2-10.5 GHz and 17.7-18.0 GHz

8 These frequency ranges have not been harmonized yet and they are still under study in Region 2.

TABLE 2

Frequency ranges considered for harmonization for RSTT in Region 2

Region 2		
Application	**Frequency ranges within the existing mobile service allocations under consideration or proposed for harmonization**	**Harmonized frequency ranges within the existing mobile service allocations in Region 2[8]**
	JMC: 162.0375-174 MHz 902-928 MHz 450-470 MHz 21 200-23 600 MHz (2)	More number of Adm: 7 110-7 125 MHz Greater range of frequencies with at least one Adm: Parts of 1 427-19.7 GHz
	BOL: 136-174 MHz	
Train Positioning	USA: 44 MHz (2) 219.500-222 MHz (1) 452.9375-457.9375 MHz (1) 896.8875-897.9875 MHz 935.8875-936.9875 MHz 902-928 MHz	At least two Adm: 220-222 MHz More number of Adm: 220-222 MHz Greater range of frequencies with at least one Adm: 219.5-222 MHz
	BOL: 450-460 MHz (1)	
	CAN: 452.9375-457.9375 MHz (1) 896/935 MHz 902-922 MHz	At least two Adm: 896-897 MHz and 900-935 MHz More number of Adm: 452.95-457.00 MHz Greater range of frequencies with at least one Adm: 896-936 MHz
	B: Parts of 157-170 MHz (VHF Digital) (2) 459.4375-469.7875 MHz(1) Parts of 900-930 MHz 2 400-2 483.5 MHz 5 725-5 850 MHz	At least two Adm: 459-469 MHz More number of Adm: 459-469 MHz Greater range of frequencies with at least one Adm: 450-470 MHz
	ARG: VHF = 240 MHz – 300 MHz (2) UHF = Parts of 410 MHz – 450 MHz UHF = 450 MHz – 470 MHz 458.075 MHz (1) UHF = 470 MHz – 490 MHz (2)	For EoT/HoT: At least two Adm: 452.00-460.00 MHz More number of Adm: 452.9375-457.9375 MHz Greater range of frequencies with at least one Adm: 450.00-469.7875 MHz
	MEX: 220-222 MHz 400 MHz 452-458 MHz (1)	

TABLE 2

Frequency ranges considered for harmonization for RSTT in Region 2

Region 2		
Application	**Frequency ranges within the existing mobile service allocations under consideration or proposed for harmonization**	**Harmonized frequency ranges within the existing mobile service allocations in Region 2[8]**
	JMC: 26.4200-27.5000 MHz (2) 3.75-4.0 MHz (2) 4.4880-4.6500 MHz (2)	
Train Remote	USA: 220.9625-221.00 MHz 221.9625-220.00 MHz 452.9000-452.96875 457.9000-457.96875 MHz	At least two Adm: 452.00-457.96875 MHz More number of Adm: 452.9000-452.96875 MHz Greater range of frequencies with at least one Adm: 452.00-458.00 MHz USA and CAN report 220 MHz
	CAN: 812/857 MHz (2) 452/457 MHz 220 MHz	
	MEX: 452-458 MHz	
	B: 2 400-2 483.5 MHz	
Train Surveillance	B: Parts of 403-470 MHz (2) (under implementation)	See Note 1
	JMC: 4 800-4 990 MHz (2) 5 470-5 725 MHz (2) (under implementation)	

Note 1: No possible frequency ranges to be harmonized were found at the time of preparing this document.

(1) These frequency ranges are used for EoT/HoT.

(2) Values correspond to ranges not consistent with any other Administration for that type of system

Annex 4

For some countries in Region 3

TABLE 3

Frequency ranges considered for harmonization for RSTT in Region 3

Region 3		
Application	**Frequency ranges within the existing mobile service allocations under consideration for regional harmonization**	**Harmonized frequency ranges within the existing mobile service allocations in Region 3**
Train Radio	VHF Band: 70-74.8 MHz, 75.2-88 MHz, 142-144 MHz, 146-149.9 MHz, 150.05-156.4875 MHz, 156.5625-156.7625 MHz, 156.8375-161.9625 MHz, 161.9875-162.0125 MHz, 162.0375-174 MHz	See Note 1.
	UHF Band: 335.4-399.9 MHz, 406.1-430 MHz, 440-470 MHz, 703-748 MHz, 758-803 MHz, 873-915 MHz, 918-960 MHz, 1 770-1 880 MHz, 1 965-1 975 MHz, 2 155-2 165 MHz	
	SHF Band: 43.5-45.5 GHz, 92-94 GHz, 94.1-100 GHz, 102-109.5 GHz	
Train Positioning	1 676-1 740 kHz, 27.09-27.10 MHz[9], 718-728 MHz, 773-783 MHz, 910.1-914.1 MHz	See Note 1.
Train Remote	Under study	See Note 1.
Train Surveillance	703-748 MHz, 758-803 MHz, 18.86-18.92 GHz, 19.20-19.26 GHz, 43.5-43.7 GHz, 57-66 GHz, 92-94 GHz. 94.1-100 GHz, 102-109.5 GHz	See Note 1.

Note 1: No Frequency ranges within the existing mobile service allocations for this RSTT application are harmonized at this time.

Methodologies for achieving regional spectrum harmonization for RSTT in some countries in Region 3 are provided in the Attachment to this Annex.

[9] This frequency range will operate along with the 3.951-4.516 MHz.

Attachment
to Annex 4

Methodologies for harmonizing frequencies for RSTT in some countries in Region 3

This Attachment shows the methodology used in some countries in Region 3 to identify frequencies for regional harmonization for RSTT employing the "logical OR approach".

For example, according to the materials provided by some administrations within Region 3 in Report ITU-R M.2442, spectrum usage for RSTT in 300-500 MHz within Region 3 are shown below. A wide frequency range can be calculated with logical OR from each frequency bands. Finally, the frequency range is filtered and separated with the condition of existing mobile-service allocations as seen in the figure below.

With this "logical OR approach", each frequency could be involved in harmonized frequency ranges, and each administration would use those frequency ranges or part of thereof for RSTT on their national needs, spectrum requirements, policy objectives and operating environments.