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Preface

This standard was prepared by the Radio Communication in the Rail Corridor Development Group, overseen by the RISSB Operations Standing Committee.

Objective

The objective of this Standard is to define functional requirements for radio communication systems that will:

(a) mitigate the risk associated with identified hazards;

(b) facilitate compliance with the Rail Safety National Law; and

(c) identify the roles of Rail Infrastructure Managers (RIM) and Rolling Stock Operators (RSO) in providing, operating, maintaining and removing radio communication systems.

Radio communication in the rail corridor is essential for the safe and efficient operation of the railway.

Rail Transport Operators (RTO) are legally required to ensure safe railway operations. While each operator meets this obligation through their own safety management system, safety critical communications shall be coordinated and consistent across operators. Despite differences in technology, communication systems shall enable seamless and reliable communication for users across all RIM boundaries and interfaces.

Compliance

There are four types of provisions contained within Australian Standards developed by RISSB:

(a) Requirements.

(b) Recommendations.

(c) Permissions.

(d) Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term ‘shall’.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term ‘should’.

Recommendations recognize that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term ‘may’.

Constraints – provided by an external source such as legislation. Constraints are identified within the text by the term ‘must’.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities or interfacing organisations where the risk may be shared.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix A.

Appendices in RISSB Standards may be designated either “normative” or “informative”. A "normative" appendix is an integral part of a Standard and compliance with it is a requirement, whereas an "informative" appendix is only for information and guidance.

Commentary

Commentary *C Preface*

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

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Section 1 Scope and general

1.1 Scope

This standard sets out basic requirements for safety critical radio communication between those whose work is in or associated with the rail corridor. It applies to network controllers, train crews and persons working in the rail corridor.

This standard applies to new radio communication systems and associated infrastructure; it is not retrospective in its application.

For the purpose of this standard, radio communication includes voice or data information transmitted by wireless systems.

This standard excludes radio communication within railway stations, except when communicating directly with train crew, and excludes communication between fixed locations where radio use is optional rather than essential.

1.2 Normative references

The following documents are referred to in the text in such a way that *some* or all of their content constitutes requirements of this document:

- AS 7470:2024, *Human Factors Integration and Technical Requirements for Rail Engineering Projects*
- AS 7495:2024, *Rolling Stock Communication Equipment*
- AS 7502:2016, *Road Rail Vehicles*
- AS 7527:2019, *Rolling Stock Event Recorders*
- AS 7533:2021, *Driving Cabs*
- AS 7722:2016, *EMC Management*
- AS 7770:2018, *Rail Cybersecurity*
- *RISSB Code of Practice Safety Critical Communications*
- *Rail Safety National Law*
- *Radiocommunications Act 1992*
- *ACMA, Frequency Assignment Practice - Guideline No 7 - Assigning Rail Industry Spectrum in the 400 MHz Band*
- *ACMA, Radiocommunications Assignment and Licensing Instruction RALI MS22 400 MHz Plan*

NOTE:

Documents for informative purposes are listed in a Bibliography at the back of the Standard.

1.3 Defined terms and abbreviations

For the purposes of this document, the following terms and definitions apply:

1.3.1

availability
percentage of time that an item or system is able to perform its designed function

1.3.2

communication system
radio communication system that is the subject of this standard

1.3.3
effective isotropic radiated power (EIRP)
the power radiated by the antenna system, taking into account gain and losses

emergency message
information transmitted to alert affected persons to an imminent or actual incident or emergency. the emergency message may be transmitted as voice, data or both

1.3.4
latency
time that elapses from the moment a signal is sent to the moment it is received; often affected by the distance the signal has to travel and the length and speed of the physical cable

1.3.5
radio communication
wireless transmission and reception of information including voice or data

1.3.6
RIM
rail infrastructure manager as defined by Rail Safety National Law

1.3.7
RSO
rolling stock operator as defined by the Rail Safety National Law

1.3.8
RTO
rail transport operator as defined by Rail Safety National Law

1.3.9
safety critical communications
communications that, if not delivered or not delivered accurately or promptly, could result in death, serious injury or incur significant damage to property, infrastructure or the environment

General rail industry terms and definitions are maintained in the RISSB Glossary. Refer to: https://www.rissb.com.au/glossary/

Section 2 Function

2.1 Access

The communication system shall be accessible on an operational and safety needs basis by personnel who are required to work within the rail corridor, or control work in the rail corridor, including, but not limited to, the following:

(a) network controllers
(b) rail traffic crews
(c) shunters and terminal operations staff
(d) track workers
(e) infrastructure maintainers
(f) incident response coordinator
(g) security personnel

2.2 Information conveyed

2.2.1 Broadcast messages

The communication system shall be able to broadcast information to members of pre-defined groups.

The network controller shall be able to broadcast information to a pre-defined group within the network controller's area of control.

2.2.2 Emergency message handling

See Appendix E, Section 2.2.4 and Section 2.2.5.2 of this document for more information about handling emergency messages.

2.2.3 Acknowledgement and confirmation

The user shall be provided with acknowledgement that the information has been transmitted.

The user shall confirm that the information transmitted has been received.

2.2.4 Call priority

The communication system shall implement a call priority mechanism that automatically suspends lower-priority calls when required to allocate resources for higher-priority (precedence) calls.

Commentary *C2.2.4*

For example, if all resources are occupied and an emergency call (highest priority) needs to be established, any ongoing lower-priority call may be forcibly terminated to ensure the emergency call is connected with the required priority.

2.2.5 Information routing

2.2.5.1 Information addressed to network control

The communication system shall route information from users addressed to the appropriate network controller for the current location of the user.

Except at control boundary areas, where the user can select a specific network controller, the routing of information shall be automatic.

2.2.5.2 Emergency messages

Emergency messages from users other than the network controller shall be delivered automatically to the appropriate network controller.

Emergency messages from network control shall be delivered as broadcast messages with emergency priority to all users within an area determined by the network controller.

2.2.6 Operation at RIM boundary

Where equipped, the RTO shall ensure that the communication system provides timely and reliable communication at the boundary between the RIM and another RIM.

The interface between RIM areas can be between adjacent tracks or at junctions where an incident on one track can affect safety within another RIM's area. Where this hazard exists, the RTOs shall ensure that emergency messages are delivered to all affected users.

2.3 Identification of users

Each device that connects to the communication system shall have an identification code that is included in every message sent over the system.

Where the identification code includes the train describer identity, there shall be a system or process that correctly sets and resets the identification codes at the beginning and end of each journey.

NOTE:

See Appendix B for more information about user identification.

Section 3 Implementation

3.1 System design

The communication system provides functionality that supports the railway infrastructure and operating rules to achieve safe operation of the railway so far as is reasonably practicable.

The communication system shall be specified and designed to meet the required technical performance and functionality.

3.2 Design for the whole system life cycle

The communication system equipment and installation on rolling stock shall be designed to meet the objectives, requirements and outcomes according to AS 7470.

The communication system shall be designed to ensure that it can be constructed, installed and tested, and subsequently operated, maintained, modified and decommissioned safely.

When designing the communication system and its interfaces, strategies for migration to new technologies shall be assessed while maintaining the principles of interoperability as described in AS 7450.

The communication system interfaces shall be well defined. Established non-proprietary standards should be considered so that commercial off-the-shelf equipment modules can be readily deployed.

3.3 Technology

This document does not prescribe specific technologies but requires that systems are designed to accommodate future proofing and upgradability to support interoperability and meet the functional, safety, and lifecycle needs of Australian railways.

Compliance with related standards for equipment approval, human factors, cybersecurity and integration is essential to ensure future-proof, reliable and safe communication systems.

Communication systems shall be designed, so far as reasonably practicable, to support future upgrades, replacements and integration of new technologies over the system lifecycle in line with the requirements detailed in AS 7450, AS 7470, AS 7666, AS 7722 and AS 7770.

3.4 Radio Frequency Spectrum

Radio frequencies for rail transport in Australia are allocated and licensed by the Australian Communications and Media Authority (ACMA).

The Australasian Railway Association (ARA) has successfully lobbied for dedicated spectrum to support safety and interoperability on the Australian rail network.

Rail operators shall use the allocated frequencies and must apply to ACMA for a licence to operate within them.

See Appendix C for more information about the allocation of railway radio frequency spectrum.

3.5 Safety critical information

Safety critical information shall be conveyed in a manner that manages loss, corruption, delay or change in form that would deprive the recipient of the information or present invalid information.

Additional safety features should be incorporated into the safety critical information external to the communications system to manage the loss of integrity during its transmission. Safety features may include the application of network rules as defined in ANHR 2007.

See Appendix D for information related to operating in a degraded mode.

3.6 Interfaces

Interfaces between the communication system and its users shall be designed using a human-factors approach to minimize the risk of error, particularly errors that could contribute to an unsafe situation.

The communication system shall be designed to manage the safety hazards affecting the form or functionality of the interfaces with other equipment, including vigilance systems.

Refer to AS 7470 for more information.

3.7 Security

Measures should be taken to manage theft or interference with communication system equipment by such means as physical protection, alarms and access control measures.

Security measures should include remote disablement, technical and/or procedural registration and authentication.

3.8 Cybersecurity

Cyber security requirements shall be in accordance with AS 7770.

Commentary *C3.8*

Refer to *RISSB Code of Practice – Rail Cyber Security for Rolling Stock & Train Control Systems* and *RISSB Rail Cyber Security (Implementation of AS 7770:2018) Guideline* for more information about cybersecurity.

3.9 Train safety recordings

There shall be a means of making train safety recordings of the information conveyed by the communication system.

Commentary *C3.10*

Refer to AS 7527 and *ONRSR – In-cab audio and video policy: Rail Safety Worker protections* for more information regarding train safety recording.

Train safety recordings are subject to restrictions currently in s131 of the RSNL and regulation 26.

3.10 Rolling stock

AS 7450 lists some of the safety critical communications systems that may be installed on rolling stock.

3.10.1 Equipment installation

The communication system equipment and installation on rolling stock shall be designed to meet the objectives, requirements and outcomes of AS 7533.

The communication system should be operable from each cab that is used as the driving cab of rolling stock.

The communication system interfaces shall be located such that the driver can read the display and operate controls without moving from the primary driving position.

3.10.2 Driver interface

The communication system should provide an indication to the user when delivery of safety critical information is not possible.

Where it is necessary for the rolling stock to be fitted with more than one communications system for interoperability, the RTO should provide a single interface to the driver for all the communication systems (excluding portable, backup and non-network control communications equipment).

The acoustic output of the communication system shall:

(a) be adjustable by the driver but not to the extent that it is inaudible;

(b) be audible and intelligible within the acoustic environment; and

(c) not exceed a sound pressure level of 105 dBA at any driving position.

3.10.3 Equipment verification

To minimize the risk of rolling stock going into service with defective equipment, communication system equipment on rolling stock shall incorporate:

(a) automatic self-testing when the equipment is turned on, periodically, and when required by the user;

(b) visual display of the communication system status; and

(c) a facility to permit the user to:

(i) verify operation of the press to talk button (if used);

(ii) verify operation of the handset (if fitted), microphone and loudspeaker;

(iii) verify operation of displays and user interface devices;

(iv) test the visual and audible indicators and alarms, especially those providing safety critical information; and

(v) test emergency message operation.

3.10.4 Event recording

The communication system equipment should interface to rolling stock event recorders in accordance with AS 7527 except for road rail vehicles. Communication system equipment shall interface to road rail vehicles in accordance with AS 7502.

The communication system should provide the following information to the event recorder:

(a) Activation of emergency call button.

(b) Receipt of an incoming emergency message.

(c) Termination of outgoing or incoming emergency message.

(d) Equipment faults.

(e) Transmitted and received audio and data.

3.11 Design hazard review

The system design and its controls shall be assessed against the performance and safety requirements of the communication system.

A risk assessment may be used to confirm that the system design is safe so far as is reasonably practicable for the requirements.

The communication system network shall be under configuration management suitable to ensure that the required functionality and key performance indicators are achieved.

NOTE:

Refer to AS 7474 for information about management of system safety that addresses Australian legislative requirements and is readily scalable for the scope of rail projects undertaken within Australia.

3.12 Equipment compliance

All communication system equipment shall comply with the *Radiocommunications Act 1992* and shall have an ACMA regulatory compliance mark affixed.

Section 4 Performance

4.1 General

The following performance shall be addressed by the RIM, at a minimum.

The RIM may identify additional performance criteria to those listed in this document. All performance decisions shall be supported by a technical and operational risk assessment providing control to manage the identified risk SFAIRP.

4.2 Reliability & availability

The reliability and availability of the communication system shall be sufficient to ensure that the required safety performance can be achieved.

There shall an alternate or backup system to support safety critical communications.

The design of the communication system shall facilitate safe recovery from credible failure conditions.

4.3 Latency

The latency of the communication system shall be defined by the RIM ensuring that the required safety performance, operational performance and human factors requirements can be achieved.

4.4 Coverage

4.4.1 Coverage requirement

Effective rail system communication coverage should be tailored to the operational environment, with system design taking into account track type, location, traffic density, and the specific activities occurring in each area to ensure reliable, seamless connectivity across all operational scenarios.

The communication system coverage of the rail corridor shall satisfy the requirements of the RIM and the RSO.

The communication system coverage shall be documented. Any areas of poor or no coverage shall be clearly identified, and all users are to be made aware.

The coverage documentation shall differentiate between the coverage available for fixed equipment with external antennas on trains and the coverage that can be expected from hand-portable devices.

4.4.2 Coverage verification

The RIM shall ensure that at the time of commissioning the communication system (or an extension of the system) that the coverage has been verified as meeting the system requirements and system design details.

The RIM shall ensure that whenever there is a change in rail network, communication system equipment or physical structures adjacent to the rail network, the system coverage is verified as meeting the design requirements, including signal strength and quality.

The RIM shall set in place a means of warning users of any temporary loss or degraded coverage.

4.4.3 Communication system maintenance

The RIM shall have a maintenance plan covering all aspects of the equipment and operation of the communications system including;

(a) coverage;

(b) data retention;

(c) downtime tolerances; and

(d) system logging for data and voice channels.

4.4.4 Coverage design parameters

The RIM shall document and make the following system design parameters available to RTOs:

(a) Assumed rolling stock equipment effective isotropic radiated power (EIRP).

(b) Minimum field strength at 4.5 m above rail level (typical antenna height) achieved in areas defined as having coverage.

(c) Any other performance parameters necessary for reliable operation.

4.5 Electromagnetic compatibility

Electromagnetic compatibility requirements for communications equipment shall be in accordance with AS 7722.

Commentary *C4.4*

AS 7722 defines the requirements for the management of electromagnetic emissions, EMC interface management and susceptibility of devices used in the railway so that all systems used in the railway are electromagnetically compatible. This is to ensure that there is no interference with critical communications regardless of the type of technology selected.

Appendix A Hazard Register (Informative)

Hazard number	Hazard
3.1.1.21	Cyber attack
3.2.1.20	Poor security of plant equipment on site
5.2.1.12	Rolling stock electrical systems generating the same frequency as an infrastructure system frequency, affecting the communication system and thereby causing EMI
7.2.1.3	Miss-communication
8.4.1.1.2.10.7	Ineffective communication with Network Control
8.4.1.1.4.5	Illegal issue
8.4.1.1.4.7	NCOs safety critical information incorrect
8.4.1.1.4.15.1	Ineffective communication with train control
10.1.1.8.2.1	Failed radio / communications system
10.5.1.1.7.7	Communications failure
10.5.1.1.8.8	Inadequate human machine interface
10.5.1.2.2.2	Not completing recording process for one Authority before commencing the next
10.5.1.2.3.3	Recording convention error
10.5.1.2.4.4	Rail traffic location error
10.5.1.2.5.5	Unknown entry by rail traffic
10.5.1.2.6.6	Work on track location error
10.5.1.2.7.7	Rail traffic identification error
10.5.1.2.8.8	Current Authority status error
10.5.1.2.9.9	All those affected not identified / consulted / notified
10.5.1.2.10.10	NCO/NCO/Signaller interface confusion
10.5.1.2.11.11	Conditions affecting network error
10.5.1.2.12.12	Incomplete information recorded
10.6.1.2.3.3	Incorrect rail traffic ID used
10.7	Authority communication error
10.7.1.1	Data Transmission error (User interface display)
10.7.1.2.3.3	Poor quality voice communications facility
10.7.1.2.4.4	Unintended recipient
10.9.1.1.3.3	Unable to stop approaching rail traffic

Appendix B Caller Identification (Informative)

B.1 Unique identification

In most communication systems, the user identification required by Section 2.2.7 is unique so messages can be delivered correctly. The identification code identifies the hardware device and may also identify the function and/or location of the device. For example, a radio transceiver on a train could have a hardware identity for that transceiver or a hardware identity for the vehicle in which it is installed. In addition, the identification code for the train may include the train describer identity (train trip or run number) for the train.

B.2 Ensuring the identity is unique

Identification codes that include the train describer identity need to be correctly set for each journey and cleared at the end of the journey. If the identification code is not set correctly, messages may be routed to the wrong train, thereby compromising the safety of the railway.

Appendix C Radio Frequency Spectrum (Informative)

C.1 400 MHz band – Rail industry radio frequency spectrum

Certain spectrum in the 400 MHz band has been reserved for use by the rail industry. Where the spectrum is not in use by the rail industry it may be assigned to other users, with conditions.

The ACMA has published guidance on assignment of the rail industry spectrum in “Frequency assignment practice Guideline No. 7 — assigning rail industry spectrum in the 400 MHz band”, usually known as “FAP 7”.

The 400 MHz band plan is defined in the “ACMA Radiocommunications Assignment and Licensing Instructions – MS22 – 400 MHz Plan”, usually known as “MS22”.

C.2 850 MHz band

Significant areas of Australia have train radio communications based on the publicly available cellular network in the 850 MHz band.

C.3 1800 MHz band

GSM-R services in Brisbane, Sydney and Melbourne operate in the 1800 MHz band, so use of this band is preferred to minimise equipment and system cost.

C.4 1900 MHz band

Being introduced Australia-wide for exclusive or coordinated railway use, supporting next-gen digital railway communications systems with increasing harmonization to global practices.

C.5 Telstra 4G LTE700

Foundation of broad public mobile coverage, including rail corridors, but not specific to railway operations; instead, it's used by railways for supplementary or public-facing mobile services.

Appendix D System Management & Operation (Informative)

This informative appendix describes a possible set of responsibility allocations and operational practices.

D.1 Allocation of responsibility

D.1.1 System management

The RIM is responsible for management of the communication system and allocates responsibility for aspects of the communication system to adjoining RIMs and the RTOs.

D.1.2 Performance monitoring

The RIM and RTO should each have arrangements in place to:

(a) ensure that the rolling stock communication equipment is operational;

(b) monitor, where possible, rolling stock communication equipment performance;

(c) share information on rolling stock communication performance as an input to safe train operation (including regular audits and identification of the areas where radio coverage is unacceptable); and

(d) identify, where possible, whether calls connect or fail to connect.

D.1.3 Defect management

The RIM and RTO each have arrangements which enable reporting of defects and unplanned outages in communication systems or equipment, in order that:

(a) effective repairs can take place;

(b) backup and/or alternative communication arrangements and procedures can be introduced, where appropriate;

(c) safety critical failures are immediately brought to the attention of the Network controller and affected train crews and track workers; and

(d) configuration management and risk assessment are used to ensure that changes to configuration will not degrade the functionality and interoperability of the Communication System.

D.2 Operation

D.2.1 Distraction of users

Policy, procedures and training are in place to ensure that users are aware of the risks of a driver using the train communication system whilst moving and that drivers:

(a) are not required to compose a variable content message or transfer a variable content message to hard copy whilst moving;

(b) are not required to respond to calls or messages whilst moving, except necessary calls and messages from Network controllers, subject to the prevailing operational conditions; and

(c) are not required or permitted to initiate calls or send messages whilst moving, except when the driver considers it necessary, having taken into account the safety and operational need.

D.2.2 Misdirection of information

Voice protocols that positively identify the parties in the call may enhance communication accuracy and safety. These protocols are used in addition to any identification information provided by the communication system.

If a driver-initiated call can be routed to more than one Network controller, the RIM has a procedure that specifies the action to be taken by each network controller.

D.2.3 Emergency messages

Emergency messages from users other than the network controller can provide the GPS data location of the caller to the network controller.

D.3 Degraded modes of operation

The communication system may have degraded modes of operation in failure conditions that rely upon human action for safety-critical tasks that are performed by the communication system itself in normal operation.

Rules and procedures should be defined, documented and implemented, with supporting information provided for:

(a) each normal, backup and degraded mode of operation;

(b) the means of transition from one mode to another; and

(c) recovery from credible failure conditions, including electromagnetic interference.

Appendix E Emergency Messages (Informative)

E.1 Design considerations

It is good practice for communication systems to incorporate the following features:

(a) Emergency messages are clearly identified and distinguishable from other messages.

(b) Some form of confidence tone or message is provided during the emergency message transmission process to indicate that:

  (i) transmission of the emergency message has been initiated;

  (ii) the message has been processed;

  (iii) where appropriate, a voice call has been established; or

  (iv) that the emergency message cannot be delivered now.

(c) The network controller responsible for the location of the train or caller is the primary recipient of the emergency message and should have access to a speech connection.

(d) Recipients of the emergency message include users in a pre-defined geographic area, based on the location of the train that initiated the emergency call.

(e) Where the tracks of different RIMs are close enough for an incident on one track to cause fouling of the other track, the RIMs provide a means of ensuring that the emergency message is provided in a timely manner to all affected network controllers, train crews and other personnel that are required to be in the rail corridor.

(f) The emergency message functionality includes provision for trains that enter the pre-defined geographic area after the call has commenced to be aware that there is an emergency and to receive the emergency message.

(g) The communication system makes multiple attempts to deliver an emergency message before advising the initiator that transmission of the message has failed. Both the number of attempts and the elapsed time are taken into account in determining that delivery of the message has failed.

(h) The possibility of multiple emergency messages in the same or overlapping areas is considered in the communication system design and clear instructions or technical solutions are documented and implemented.

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