AUSTRALASIAN RAILWAY ASSOCIATION

Association Number A03958 | ABN 64 217 302 489

AUSTRALASIAN RAILWAY ASSOCIATION SUBMISSION

To

The Department of Communications and the Arts/ The International Telecommunications Union (ITU)

On the

Railway Radiocommunications Systems between Train and Trackside (RSTT) Spectrum in Australia

The ARA

The Australasian Railway Association (ARA) is a not-for-profit member-based association that represents rail throughout Australia and New Zealand. Our 140 members include rail operators, track owners and managers, manufacturers, construction companies and other firms contributing to the rail sector.

The ARA thanks Benjamin Bourne, A/g Assistant Director, International Radiocommunications/Spectrum and Security Branch, Department of Communications and the Arts for the opportunity to provide this submission. For further information regarding this submission, please contact Maria Morozova, Senior Program Manager at ARA, via mmorozova@ara.net.au or +61 499 919 496.

The Australian Rail Industry and the Rail Industry Radio Spectrum

Australia is facing a number of challenges including significant population growth, increasing urban congestion, the move towards a carbon constraint economy and ensuring energy security. These challenges must be dealt with in a holistic manner in conjunction with the Federal and State Governments' wider policy objective of achieving a sustainable and liveable community. In addition to the effort to meet the above challenges, Australia also needs to maintain its dynamic domestic economy and international competitiveness.

Australia's Rail industry is the sixth largest network in the world, moving more than 850 million people per year and 1.4 billion tonnes of freight.[i]

Due to the escalation in service demand, all rail services are under pressure to increase capacity, improve service reliability and maximise efficiency. Improvements to rail services are reliant on the uptake of advanced telecommunication systems to deliver voice and broadband data. The critical factor of technological development across Rail industry is applying harmonisation and integration principals and it is particularly important in relation to the radiofrequency spectrum use by rail entities in Australia.

The Rail industry's telecommunications networks in Australia rely heavily on radio spectrum within the dedicated sector of 400MHz band and increasingly 1800 MHz band. Use of radio systems operating in this radiofrequency band are the basis for harmonisation and interoperability of mobile commutations systems used for safety and operational purposes across all facets of the Rail industry.

In broad terms the 400 MHz spectrum is required to support existing infrastructure and is primarily used for voice and long-distance communications. The 1800MHz spectrum is required for new train control broadband systems. Together, 400 MHz and 1800 MHz spectrum are used for the following daily activities:

- Track maintenance safety
- Train control
- Prevention of derailments
- Emergency response and safety critical train radio communications
- Signalling
- Automatic train protection/braking
- Security
- Passenger safety through on-train help points
- Train speed control
- Shunting

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- Crowd control

The ARA manages access to the 400 MHz Rail Industry Only spectrum on behalf of the Rail industry in accordance with the Australian Communications and Media Authority (**ACMA**) Frequency Assignment Practice (**FAP7**). Industry use of the spectrum as outlined in FAP7 ensures a consistent, agreed and coordinated approach by all stakeholders.

By way of background, the ARA Telecommunications Committee collaborated with the ACMA to secure ongoing access to the 400MHz spectrum against a background of increasing use of this band for existing government and commercial users. The ACMA is currently in the process of reviewing the 400MHz band in order to address congestion issues and achieve harmonised government spectrum, enabling interoperability between agencies across state jurisdictions—and benefiting public safety in the process. The deadline for the final milestone of the 400 MHz project is 31 December 2018, after that, non-compliant licences will either not be renewed or operate under an exception arrangement.

With regards to 1800MHz radiofrequency spectrum, it was initially acquired in 2006 by the five state rail authorities responsible for metropolitan rail systems in Sydney, Melbourne, Brisbane, Perth and Adelaide. This was a strategic acquisition to secure spectrum necessary for the implementation of advanced rail safety and control systems up to the year 2015. GSM-R, using 1800MHz spectrum, has been selected as the preferred telecommunications to support very high-density metro operations being implemented in Melbourne and Sydney.

CONCLUSION

While the data provided on behalf of the industry demonstrates that the rail entities in Australia still utilise the legacy bands and systems, the strategic approach to take forward in terms of the RI spectrum future in Australia would be a full transition and pertinacity in use of the spectrum within 400MHz band (dedicated section) and 1800 MHz band. The Rail industry believes the consistency in regard to the RI spectrum will ensure harmonisation and interoperability within rail in Australia.

Additionally, the Rail Industry would also see possible use of spectrum identified for broad use within the transport industry, such as the Intelligent Transport System (5.9 GHz) to allow greater transport industry integration.

ATTACHMENT A

The information contained in the Attachment A is the result of contribution from the ARA Telecommunications Committee which is comprised of Arc infrastructure, Aurizon, Department of Planning, Transport and Infrastructure South Australia, Genesee & Wyoming Australia, Metro Trains Melbourne, Pacific National, Public Transport Authority of Western Australia, Public Transport Victoria, Queensland Rail, RailCorp, Sydney Trains, Transport for NSW, V/Line and VicTrack. The ARA appreciates the opportunity to collate this information on behalf of rail entities for use of the upcoming International Telecommunications Union (**ITU**) Meeting.

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Proposed further development of the Preliminary Draft New Report ITU-R M.[RSTT_USAGE]

1) Three new columns for Table 5.1.1 Analogue Radio:

#	**43**	**44**		
Use by which Administration(s)	**AUS**	**AUS**	**AUS**	**AUS**
Specific name (if have)	Conventional Train Radio Wayside radio Auto Train Protection	Conventional Train Radio Local Operations	Local Operations	End of Train Monitoring
Frequency Range (MHz)	406-430 408.65 – 409.0375 418.1 – 418.4875 410.625, 411.375, 411.625, 412.375	450-520 450.4125	450.050	450.4125, 450.1125
Radiocommunication Standards				
Channel separation (kHz)	6.25, 12.5, 25 kHz	6.25, 12.5 kHz	12.5 kHz	12.5 kHz
Antenna gain (dBi)	BS: various (typ 2.2, 5.2, 8.2, 11.2) MS: various (typ 2.2, 5.2)	BS: various (typ 2.2, 5.2, 8.2, 11.2) MS: various (typ 2.2, 5.2)	BS: various (typ 2.2, 5.2, 8.2, 11.2) MS: various (typ 2.2, 5.2)	Typ 2.2dBi
Polarization	Vertical	Vertical	Vertical	Vertical
Transmitting radiation power (dBm)	BS: +40 to 47 Mob: +30 to 44 Port: +30 to 37	BS: +40 to 47 Mob: +30 to 44 Port: +30 to 37	BS: +40 to 47 Mob: +30 to 44 Port: +30 to 37	Mob: +30 to 37
e.i.r.p. (dBm)	BS: up to 49.2 Mob: up to 46.1 Port: up to 39.2	BS: up to 49.2 Mob: up to 46.1 Port: up to 39.2	BS: up to 49.2 Mob: up to 46.1 Port: up to 39.2	Up to +39.2 (8.3W)
Receiving noise figure (dB) Fixed Station/Mobile/Portable	BS (typ): 12 Mob/Port (typ): 14	BS (typ): 12 Mob/Port (typ): 14	BS (typ): 12 Mob/Port (typ): 14	Typ 14
Transmission data rate (kb/s)	9.6	9.6	9.6	9.6

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#		43	44		
Transmission distance (km)		5-40	3-40	3-40	1-3
Modulation		FM/FSK	FM/FSK	FM/FSK	FM/FSK
Multiplexing method		FDD	FDD	FDD	FDD
Reception quality		>12dB SINAD	>12dB SINAD	>12dB SINAD	BER < 10^{-3}
Applications	Voice/Dispatch	X	X	X	
	Maintenance	X	X	X	
	Train Control	X	X	X	X
	Emergency	X	X	X	
	Train information				
Scenarios	Railway line	X	X	X	X
	Railway station,	X	X	X	
	Shunting yard	X	X		
	Maintenance Base	X	X		

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2) Update of information in table 5.1.2 Digital Radio (Remove three of these columns)

#		10	11	12	13
Use by which Administration(s)		**Remove**	**Remove**	**AUS**	**Remove**
Specific name (if have)				Train Control Radio Wayside Radio	
Frequency Range (MHz)				403-420 408.65 – 409.0375 418.1 – 418.4875	
Radiocommunication Standards				Tier 2 DMR	
Channel separation (kHz)				12.5	
Antenna gain (dBi)				BS: various (typ 2.2, 5.2, 8.2, 11.2) MS: various (typ 2.2, 5.2)	
Polarization				Vertical	
Transmitting radiation power (dBm)				BS: 40 to 47 Mob: 30 to 44 Port: 30 to 37	
e.i.r.p. (dBm)				BS: up to 49.2 Mob: up to 46.1 Port: up to 39.2	
Receiving noise figure (dB) Fixed Station/Mobile/Portable				BS (typ): 12 Mob/Port (typ): 14	
Transmission data rate (kb/s)				9.6	
Transmission distance (km)				5-40	
Modulation				4FSK	
Multiplexing method				TDMA	
Reception quality					
Applications	Voice/Dispatch			X	
	Maintenance			X	
	Train Control			X	
	Emergency			X	
	Train information				
Scenarios	Railway line			X	
	Railway station,			X	
	Shunting yard			X	
	Maintenance Base			X	

Update of information in table 5.1.2 (Continued) (remove this column as it is not an RSTT system)

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#		31
Use by which Administration(s)		**Remove**
Specific name (if have)		
Frequency Range (MHz)		
Radiocommunication Standards		
Channel separation (kHz)		
Antenna gain (dBi)		
Polarization		
Transmitting radiation power (dBm)		
e.i.r.p. (dBm)		
Receiving noise figure (dB) Fixed Station/Mobile/Portable		
Transmission data rate (kb/s)		
Transmission distance (km)		
Modulation		
Multiplexing method		
Reception quality		
Applications	Voice/Dispatch	
	Maintenance	
	Train Control	
	Emergency	
	Train information	
Scenarios	Railway line	
	Railway station,	
	Shunting yard	
	Maintenance Base	

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3) Added two new Columns for Table 5.1.3 Trunked Radio (Continued)

#		14	15
Use by which Administration(s)		**AUS**	**AUS**
Specific name (if have)		Digital Trunked Train Radio	Digital Trunked Train Radio
Frequency Range (MHz)		406-420 408.65 – 409.0375 418.1 – 418.4875	450-470
Radiocommunication Standards		DMR Tier3	TETRA
Channel separation (kHz)		12.5 kHz	25 kHz
Antenna gain (dBi)		BS: +various MS: +various	BS: +various MS: +various
Polarization		Vertical	Vertical
Transmitting radiation power (dBm)		BS (typ): 47 Mob/Port (typ): 41	
e.i.r.p. (dBm)			
Receiving noise figure (dB) Fixed Station/Mobile/Portable		BS (typ): 12 Mob/Port (typ): 14	
Transmission data rate (kb/s)		9.6	
Transmission distance (km)		5-40	5-40
Modulation		4FSK	π/4DQPSK
Multiplexing method		TDMA	TDMA
Reception quality		Variable	Variable
Applications	Voice/Dispatch	X	X
	Maintenance	X	X
	Train Control	X	X
	Emergency	X	X
	Train information		
Scenarios	Railway line	X	X
	Railway station,	X	X

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#		14	15
	Shunting yard	X	X
	Maintenance Base	X	X

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4) One new column for Table 5.1.4 GSM-R (Sydney input)

#		**22**
Use by which Administration(s)		**AUS**
Specific name (if have)		GSM-R
Frequency Range (MHz)		UL: 1770 – 1785 DL: 1865 – 1880
Radiocommunication Standards		ETSI EN 301 502 ETSI EN 301 511 ETSI EN 301 515 ETSI TS 102 281 EIRENE SRS/FRS 3GPP TS
Channel separation (kHz)		200 kHz Bandwidth
Antenna gain (dBi)		BS (typ): 17 Mob/Port: 0-6
Polarization		BS: ±45° cross-polar
Transmitting radiation power (dBm)		BS (typ): +47 Mob: +39 Port: +33, +36
e.i.r.p. (dBm)		BS: Up to +63 Mob/Port: Up to +39
Receiving noise figure (dB) Fixed Station/Mobile/Portable		BS (typ): 12 Mob/Port (typ): 14
Transmission data rate (kb/s per TS)		Voice: 13 CSD: 4.8 GPRS/EDGE: 8 to 29.6
Transmission distance (km)		1 – 3
Modulation		GMSK EDGE: 8PSK
Multiplexing method		FDD/TDMA
Reception quality		C/I ≥ 12 dB for voice on conventional lines RxQual ≤ 4 at 4m above rail tracks
Applications	Voice/Dispatch	X
	Maintenance	X
	Train Control	X
	Emergency	X
	Train information	X
Scenarios	Railway line	X
	Railway station,	X

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#		22
	Shunting yard	X
	Maintenance Base	

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5) Remove three columns and add one new column for Table 5.1.5 LTE Based RSTT

#		2	3	4	5
Use by which Administration(s)		**Remove and consolidate with Column 5**	**Remove (mobile phone service)**	**Remove (mobile phone service)**	**AUS**
Specific name (if have)					Train Control Radio Digital Train Radio System (DTRS) ETCS Level 2 (proposed)
Frequency Range (MHz)					UL:1770 – 1785 / DL:1865 – 1880
Radiocommunication Standards					3GPP LTE-Adv and beyond
Channel separation (kHz)					5, 10, 15 MHz Bandwidth
Antenna gain (dBi)					BS (typ): 17.6-20.4 Train Mount: 8.5
Polarization					±45°
Transmitting radiation power (dBm)					BS (typ): +46 Mob: +39 Port: +33, +36
e.i.r.p. (dBm)					BS: Up to +54.5dBm/30kHz Mob/Port: Up to +39
Receiving noise figure (dB) Fixed Station/Mobile/Portable					UL: 2.3 DL: 7
Transmission data rate (kb/s)					DL (max): 110000 MIMO UL (max): 38000
Transmission distance (km)					1-5
Modulation					DL: OFDMA UL: SC-FDMA
Multiplexing method					FDD
Reception quality					UL SINR>--6.5 dB DL SINR>-10 dB
Applications	Voice/Dispatch				X
	Maintenance				X

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#		2	3	4	5
	Train Control				X
	Emergency				X
	Train information				X
	Live CCTV				X
	Public Address				X
Scenarios	Railway line				X
	Railway station,				X
	Shunting yard				X
	Maintenance Base				X

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6) Add three new columns for Table 5.2.1 Radiocommunication systems used for Train positioning information (continued-4)

Parameter and usage of Position Systems

#		36	37	38
Use by which Administration(s)		**AUS**	**AUS**	**AUS**
Specific name (if have)		Transponder Eurobalise	Automatic Equipment Identification (AEI)	Hot Box Detector (HBD)
Frequency Range (MHz)		0.325 4.234/27.095	918 -926 920 -926	450.05
Radiocommunication Standards				
Channel separation (kHz)				12.5
Antenna gain (dBi)				
Polarization				
Transmitting radiation power (dBm)			30~36	Variable
e.i.r.p. (dBm)			35 ~ 42	+39 (8.3W)
Receiving noise figure (dB)				
Transmission data rate (kb/s)				
Transmission distance (km)				Varies (typ): 3-5
Modulation				FM
Multiplexing method				
Reception quality				Variable
Applications	Balises	X		
	Loops/Leaky cable			
	Annunciators			X
	Radar Scanners		X	
	Axle counters			
Scenarios Applications	Railway line	X	X	
	Railway station			
	Shunting yard			
	Maintenance Base			

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7) Add two new rows under Shunting Application, change one column for Table 5.3.1 Shunting System (continued-1)

~~Parameter and usage of Position Systems~~

#		**1**
Use by which Administration(s)		**AUS**
Specific name (if have)		Station Radio Yard Radio Worksite Repeater Shunt Radio
Frequency Range (MHz)		403 - 420 408.65 – 409.0375 418.1 – 418.4875 410.625, 411.375, 411.625, 412.375
Radiocommunication Standards		
Channel separation (kHz)		12.5, 25
Antenna gain (dBi)		BS: various (typ 2.2, 5.2, 8.2) MS: various (typ 2.2, 5.2)
Polarization		Vertical
Transmitting radiation power (dBm)		BS: +30 to 37 Mob: +30 to 37 Port: +30 to 37
e.i.r.p. (dBm)		Up to +39.2 (8.3W)
Receiving noise figure (dB) Fixed Station/Mobile/Portable		
Transmission data rate (kb/s)		
Transmission distance (km)		Varies (typically 1-5km)
Modulation		FM
Multiplexing method		
Reception quality		Varies
Applications	Shunting	X
	Maintenance	X
	Voice	X
Scenarios	Railway line	X
	Railway station,	X
	Shunting yard	X
	Maintenance Base	X

[ii] '*Trainline 5' (2017) The Bureau of Infrastructure, Transport and Regional Economics*

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