The Director, National and Community Broadcasting,
Department of Communications and the Arts

Re: Review of Australian Broadcasting Services in the Asia Pacific

To Whom It May Concern

I wish to submit for this review the following arguments for retaining shortwave radio broadcasts as part of the mix of broadcasting services for the Asia-Pacific region because shortwave radio, by its nature, has advantages that other technologies do not have. These are summarised below and expanded on in the body of the submission.

Summary

1) Radio Australia must embrace digital distribution via the Internet and satellite, but those alone cannot give Australia a voice. Shortwave radio is the only technology that will project Australian influence across all the Pacific, a region where there are scattered populations with low incomes and a lack of infrastructure.

Taken as a global trend, shortwave listeners are declining as the Internet becomes widely available and many global broadcasters make content available for re-broadcast locally but both of these rely on local infrastructure and friendly local governments.

Clare Hill of the Commonwealth Broadcasting Association has said it best: “Shortwave is still considered to be the superior medium in reaching remote areas and poor people. Shortwave's very long distance reaches international and even intercontinental, and when natural disasters bring local transmitters down, it is a key communication tool.” [1]

The Pacific is a region with numerous “ remote areas and poor people” and with more than its fair share of natural disasters. Despite statements from ABC management, the shortwave audience in the Pacific is not declining, and the potential audience is increasing as the technology improves.

There is another audience – Australian, and the citizens of other nations travelling across the Pacific, often in small yachts or other craft, or on holiday.

a) It's all about the wavelength.

Radio transmissions obey the laws of physics. The wavelength of the transmission controls essential factors – the size of the transmitter, the penetration of the signal and the content that it can carry.

Radio waves obey the laws of optics – they diffract (flow around) objects smaller than a half wavelength, they reflect from objects larger than a half wavelength. Long wavelengths penetrate solid materials better than short wavelengths, and some materials better than others.

Transmitting antennas must be a whole-number multiple of a quarter wavelength to be efficient. Large or smaller than this is inefficient and wastes energy.

Medium wave AM broadcasters have wavelengths measured in hundreds of metres. The waves can penetrate vegetation and most building materials (except metal) and will flow around obstacles such as tall buildings and hills, although they are blocked by mountains. These waves are absorbed by the electrically-charged layers of the atmosphere and range is limited to 50-150 kilometres for the average listener. Transmitter towers are large but receivers can be small and cheap.

FM broadcasters use wavelengths of about 3 metres. Transmitting antennas need to be placed quite high and useful range is restricted to line-of-sight - about 40 to 70 kilometres. At this wavelength, signals can penetrate most building material (but not metal) and vegetation, but is shadowed by hills and mountains. Receivers need an external antenna and are more complex. In Tasmania, 7SD Scottsdale has moved to FM, but the signal will not cover Flinders island and the hilly country nearby, so 7SD must continue to operate an AM channel. FM cannot replace medium wave AM for coverage, without additional capital spending.

Digital broadcasters (DAB, DAB+) use wavelengths of about 1 metre. Again, transmissions are

1 www.cba.org.uk 18 Sept 2013

restricted to line-of-sight and, unlike FM, reception is poor in valleys and signals can be shaded by tall buildings. Receivers need to have an external antenna and their power consumption is quite high which places a financial burden on a low-income audience. They require decoder chips which are expensive. Recently Norway closed all AM and FM transmissions and mandated only DAB/DAB+, but found that this would interfere with planned NATO exercises. The DAB+ spectrum allocation overlaps that designated for military aircraft transmissions and which is also used by the US Navy's FLTSATCOM system. The UK has apparently shelved plans to halt further expansion of digital broadcasts citing opposition to the extra expense to the audience of abandoning existing receivers and buying new equipment . DAB is an older technology (1977) and its low quality hindered acceptance. DAB+ gives FM quality audio and can send text and images in side channels, but the terrain is critical for broadcasting. Belgium has embraced DAB+ for its flat plains, but India is reconsidering DAB+ in favour of FM for delivery to villages.

Wireless internet uses WiFi, Bluetooth, 3G, 4G or LTE technologies where wavelength is measured in centimetres. While it can penetrate most building material (except metal) it is severely attenuated and reflections from buildings result in inter-symbol interference leading to dead spots. The range is limited which, in practice, results in a cellular base-station distribution – one every kilometre or so – needing a high level of capitalisation.

The proposed 5G technology will operate at millimetre wavelengths which will be blocked by most building materials and vegetation resulting in a need for base-stations every few hundred metres, or every floor level in a building, which makes it a capital-intensive operation.

b) Wavelength controls content delivery where "High bandwidth, Low Cost, Long range – choose two" is the rule.

All engineering solutions are a matter of 'horses for courses' and necessitate trade-offs. Radio engineering is no exception. Long wavelengths can carry only limited bandwidth – this restricts them to voice and audio. Shorter wavelengths can carry more bandwidth – video and high-speed data.

Satellite delivery provides high bandwidth and long range, but at high cost. The Internet delivers high bandwidth and relatively low cost but does not extend further than the cable or fibre it came from. Wireless internet has a limited range. Full cellular coverage requires high investment in infrastructure.

Shortwave radio fills the gap with long range and cheap receivers, but in the past has been restricted to audio bandwidths. However, a new shortwave broadcast mode, DRM[2], provides an impressive sound quality and the ability to transmit images. India will adopt it to replace domestic AM broadcasters. The issue here is that decode chips are very expensive and there are few manufacturers. The receivers are expensive and "eat batteries". From the broadcaster's point of view, DRM is 50% cheaper to operate than AM and has the advantage that up to four channels may be carried on the one signal.

NATO is experimenting with a shortwave format which can carry video, but there is limited published information about it.

2 Digital Radio Mondial – see www.drm.org also Wikipedia

2) Across the Pacific the ABC provides content to local broadcasters and operates FM stations. This is completely inadequate because of the nature of radio at FM frequencies.

The table[3] shows that Radio Australia operates a small number of FM stations in various nations, usually in the capital and perhaps on one other island. These broadcasts cannot extend much beyond the island or valley where the transmitter is located. For comparison, the distribution of local AM, FM and shortwave transmitters is included. Only the Solomon Islands, Samoa and the French possessions can claim that they can serve all of their own populations. Note the presence of the BBC, Radio France International and Voice of China on local transmitters.

Medium wave AM broadcasters are very few. The Solomon Islands have closed their one transmitter in favour of shortwave, with the recent arrival of a new shortwave transmitter provided as aid by Japan.

a) Broadcasting Radio Australia from local transmitters assumes that the host government will always be friendly.

Note how many broadcasting systems are government controlled. Fiji has, in the recent past, shut down independent FM broadcasters.

b) National infrastructure in the Pacific can be fragile and shortwave broadcasts from outside the area have been, and will continue to be, of great service to the people there.

Vanuatu is an excellent example. It has sixteen low-power FM stations, but in most cases the station building is a one-room breeze-block construction with a corrugated iron roof where the transmitter tower is a metal pole stabilised by guy wires. Power comes from a generator. Any Strength 2 or stronger cyclone will put it out of operation. Vanuatu has two AM stations and two shortwave transmitters, but these are also vulnerable. In fact, one is still out of operation from the 2015 cyclone. When the local station goes off-air, local people have tuned to Radio Australia for news. You could repeat that story across the Pacific. In low income countries the digital divide is stark and access to low cost technology is vitally important.

Radio Australia lost its local FM outlet in Port vila for several weeks in 2015 when it was taken off-air as a precaution when Cyclone Pam struck. It remained off-air until a technician could be flown in from Melbourne.

Table below

Ownership Key – 'Gov' government, 'Com' commercial, 'Vol' community volunteers, 'Relig' religious, 'Mines' local mining company.

RFI – Radio France International
VoC – Voice of China

3 ITU, WRTH,Klingenfuss - see Sources below.

Pacific Nation	Radio Australia Presence (& others)	Local AM stations	Local FM stations	Local Shortwave	Local stations owned by
Cook Islands	low power, Rarotonga only (+ BBC)	2.5kW, Rarotonga	24, low power, good island coverage		Gov, Com, Vol
Fiji	2 low power, Suva & Nadi	2, 10kW, Suva	low power, all islands, 24 gov, 20 com		Gov, Com, Vol
Kiribati	low power, Bariki only	10kW, Tarawa	7, low power, all islands		Gov, Com, Vol
Marshall Island (USA)		5kW Majuro	6, low power, all islands		Gov/Com
Micronesia, Federated States of (USA)		6, 1kW, all states	9, low power, all islands	1, 1kW, Pohnpei	Gov
Nauru	occasional content on FM		1, low power; 1 not operational		Gov
New Caledonia (France)			55, low power		Gov
Niue	provides news		3, low power		Gov, Com
Papua New Guinea	2, low power, Moresby & Lae	15, 2-15kW, all provinces	more than 50, not all operational, wide coveage	25, 10kW, not all operational	Gov, Com, Relig, Mines
Polynesia, French (France)			56, most low power, some 3kW, all areas		Gov
Samoa	low power, Apia	2, 5kW, Apia	24, low power, good island coverage		Gov, Com, Relig
Samoa, American (USA)			16, low power, all areas		Com, Relig
Solomon Islands	provides news	Closed	16, low power, all areas	2, 10kW, Honiara, Guadalcanal. New Transmitter.	Gov, Com,Relig
Tokelau (NZ)			3, low power, may be inactive		Gov
Tonga	low power, Nuku'alofa (+ VoC)	1, 10kW, Nuku'alofa	19, low power, most islands		Gov, Com, Relig
Tuvalu	(BBC)	5kW, Funafuti	1 low power, Funafuti		
Vanuatu	2 low power, Efate & Espiritu Santo (+ RFI, + BBC +VoC)	2, 10kW, Efate & Espiritu Santo (not operational)	16, low power, most areas	2, 2kW, Efate	Gov, Com
Wallis & Futuna (France)			5, low power, streamed from Paris		Gov

3) Delivery of RadioAustralia material over the Internet will exclude a great deal of the potential audience. There is no Internet access in remote areas, and it is always expensive.

The table[4] shows that for a large percentage of the population of the Pacific, the Internet is delivered by a 3G system to their smart phones. For a good many, the 'internet' is Facebook, where all their emails and news will be found.

a) Internet protocols can limit the quality of service.

The Internet is 'always on' and content is 'on demand' - available at any time. Therein lies its limits. The TCP/IP internet protocols break all content into a series of packets. The audience member contacts Radio Australia's website which responds with a series of packets individually addressed to each audience member. Like a water pipe, if only your tap is turned on, there is a steady flow. If everyone else turns their tap on, you get only a trickle, or the the system can fail, as Optus' delivery of the World Cup did.

Wireless Internet has further problems in that a continual 'handshaking' takes place between base station and handset, slowing delivery further. WiFi and 3G/4G/LTE rely on cellular technology which has a limited range. Full cellular coverage requires high investment in infrastructure. Two new technologies VoLTE and LTEb[5] can overcome bandwidth failures, but only by abandoning the always on' and 'on demand' feature. The base-station becomes a digital broadcaster, but one with a reduced range.

b) Governments hostile to Australian interests can disconnect their citizens from the Internet, or impose a selective firewall.

The “Great Firewall” of China is notorious. In recent years the governments of Egypt, Syria and Libya have completely disconnected from the Internet for a period and almost every government on Earth actively blocks individual websites and monitors searches for specific information. Software to locate dissident postings is readily for sale to authoritarian governments from commercial sources.

c) Internet infrastructure is vulnerable to natural disasters that disrupt electrical power distribution.

Home computers rely on mains electricity or else deliveries of fuel for a generator. Mobile phone base-stations use either generators or solar cells, and can survive for week or so, but the phones themselves require regular charging.

4 Derived from a large number of sources: government websites, tourism websites, published sources (ITU, WRTH see below) and commercial equipment providers.

5 Voice Over LTE and LTE Broadcast.

Pacific Nation	Internet
Cook Islands	Rarotonga and Aitutaki only, some telecom booths. 3G, 4G coming.
Fiji	Best in Suva, Nadi & Pt Denaru. Numerous kiosks and WiFi hotspots but not universal coverage.
Kiribati	Cable fromMarshall islands but coverage is reported as poor, unreliable and expensive.
Marshall Island (USA)	Fibre restricted to Majuro, Ebeye Jaluit, Kili & Wotje. WiFi hotspots and 4G provide most coverage elsewhere.
Micronesia, Federated States of (USA)	Fibre to Pohnpei, planned for Kosrae , Chuuk , & Yap.
Nauru	4g & satellite. Facebook blocked.
New Caledonia (France)	reliable 3G coverage [populated areas, WiFI and Internet cafes.
Niue	WiFi coverage patchy, Fibre being rolled out to villages.
Papua New Guinea	Topography limits coverage. Internet cafes and 3G in most towns, but little access beyond that.
Polynesia, French (France)	fast connections Society Islands, slow elsewhere. WiFi at many post offices. 3G connections most areas.
Samoa	Improving with new undersea fibre, otherwise satellite.
Samoa, American (USA)	new undersea cable. Expensive and slow.
Solomon Islands	3G and Wifi hotspots restricted to capital and main towns. No coverage on smaller islands.
Tokelau (NZ)	Most households have slow internet access, making informal use of a neghbour's wireless connection.
Tonga	Reportedly good coverage with optical fibre to most islands.
Tuvalu	Satellite coverage to all areas but restricts bandwidth to 1Mbps or
Vanuatu	remote islands not covered, but 3G and cable is available most islands, although expensive. Internet cafes still used.
Wallis & Futuna (France)	Satellite coverage to all areas but restricts bandwidth to 1Mbps or less. WiFi in major towns and resorts.

4) Satellite delivery of Radio Australia content misses a good deal of the audience too.

Satellite transmissions can be received over most, but not all, of the Pacific, but the equipment is expensive. As newer Ku band satellites come into operation, reception requires smaller dishes but the equipment and access fees are still expensive. This tends to be the option for well-off expatriates, resorts and government agencies.

Satellite dishes, even small ones, are vulnerable to high winds. Download speeds are usually restricted to 512 to 1024 Mbps.

Satellite broadcasting is of little use when mobile. US experience with direct satellite broadcast to vehicles (Sirius XM)) has not been encouraging. Going to satellite broadcasting would also impose a high cost on low income listeners.

5) Shortwave radio has the ability to cross physical obstacles, such as oceans, and political barriers, such as borders and censorship, in a way that other technologies do not.

"Shortwave radio" is a deliberately vague term that covers radio transmissions from about 2,000 kilohertz (2 Megahertz frequency or 150 metres wavelength) to about 26,000 kilohertz (26 Megahertz to 11 metres). While the term "HF" is often used, this more properly refers to the High Frequency (3 Megahertz to 30 Megahertz) spectrum band. The vaguer term is more useful.

By international treaty [6] and convention, shortwave broadcasting is confined to certain frequency sub-bands to avoid to other users of the spectrum. These sub-bands bands are referred to as the 120 metre, 90m, 75m, 60m, 49m, 41m, 31m, 25m, 22m, 19m, 16m, 13m and 11m bands. Wavelength is important as radio waves obey the laws of optics as they apply at these wavelengths.

Shortwave signals can penetrate vegetation and most building material, but it can also reflect off the electrically charged upper layers of the atmosphere – the ionosphere. Fire a shortwave signal vertically upwards to reflect off the ionosphere and it will provide relatively reliable coverage for a few hundred kilometres around the transmitter. The Solomon Islands Broadcasting Corporation is able to provide coverage of the entire archipelago using this method.

Fire a shortwave signal at an angle and it will glance off the ionosphere to reach a point hundreds or thousands of kilometres distant, for relatively little energy input. Worldwide coverage is possible, depending on hiow much you wish to spend on transmitters and antennas.

Wavelength is important here, as the ionosphere varies in its ability to carry signals with temperature. The 11-year sunspot cycle is important as it provides heat to the ionosphere. Short wavelengths propagate best in daylight and summer, longer wavelengths in the night and in winter. So a broadcaster will use a variety of wavelengths.

Shortwave cannot be stopped at a border. While radio transmissions can be jammed, to some extent, there are always techniques that can be used to minimise the effects of deliberate interference. Speak with older immigrants from the USSR or Eastern Europe and they will tell you how much they relied on the BBC and the Voice of America, even when they were heavily jammed.

a) The potential shortwave audience was once a privileged few. Changes in the technology mean that the potential audience is now "everyone". Other nations have taken advantage of that, but Western nations seem to be unaware of the change.

The photograph contrasts a twentieth century shortwave receiver with one built just three years ago. At 60cm long and weighing 13kg the 1970s receiver was portable only in the strict sense of that word. It was your entire carry-on allowance on the 707. It used mains power but required batteries for the inevitable power outages. Built to high standards it was affordable only by the well-paid expatriate or the Western-educated indigenous elite. They were the shortwave audience global broadcasters targeted. They wrote polite letters in perfect English (or French) to the broadcasters requesting printed programs, so the broadcasters had a good feel for their audience. The BBC thought of them as "decision makers", Voice of America as "opinion leaders" and programming was tailored for them.

By contrast the modern Chinese-built receiver can fit in a pocket and will run for weeks on two AA batteries. Now the growing middle-class, and even those with just a few days of work a week, can afford a receiver. They may not be "decision makers" but there are a lot of them and they have

6 International Telecommunications Union www.itu.int an agency of the United Nations. See Section

growing economic and political influence. They are mostly young, and some will occupy positions of influence in time.

These small, cheap shortwave receivers are in wide use in the Pacific, contrary to statements made by ABC management. As these receivers also cover the AM and FM bands, they are not thought of as specialist shortwave receivers - they are just the household radio, but they have good audio quality and match the 1970s receiver for ability to receive shortwave programs.

b) The new receiver technology works in favour of established broadcasters, so losing Radio Australia's frequencies to China was a double blow.

Like many Chinese-built radios, the radio shown is programmable. Programming this radio requires only simple clerical skills and a computer with a USB port, but the vast majority if its users will not have these. So, as a convenience, the radio comes pre-programmed. Western shortwave stations get a few spots, but the vast bulk of pre-programmed stations are Chinese – hundreds of them.

Now the listener who tunes to what was Radio Australia's long-established frequencies will receive the Voice of China. Establishing new frequencies for Radio Australia will also require educating the audience and perhaps re-programming their receivers. Transmitters will also have to be re-aligned to new wavelengths.

In 2018 the Voice of China (VoC) operates 255 frequency allocations in 47 languages. You buy a radio from a Chinese factory and, perforce, receive Chinese programs.

VoC broadcasts popular music and informal magazine-style programs about China. With business advice, travelogues, film reviews and Chinese lessons, VoC has come a long way from the crude propaganda of Mao's time. The VoC news is modelled on the BBC – a few items critical of the Chinese government so that the news appears unbiased and news that the media of the target nation would not normally cover. The developing nations are particularly critical of Western media which often has a very limited and negative viewpoint, but VoCs shortwave news is more palatable. The sub-text of their programming is “China has become prosperous. You can be prosperous too.” A good example of how China's “soft power” works.

c) Shortwave radio is the medium of choice for many nations to communicate with their citizens abroad and to further their interests.

As of January 2018, 243 nations (including autonomous regions eg: Hong Kong or separate political entities eg: Vatican City) had broadcasting systems, mostly domestic. Of these, 87 nations [7], often with smaller economies than Australia, still think it worth while to provide international shortwave broadcasts[8] (and many provide domestic shortwave broadcasts). Sometimes they are maintaining contact with emigres or expatriates, but more often, they are projecting their national interests.

Some governments believe that is in their interests to broadcast to our region. Broadcasts received in the Australasia-Pacific area in February and March 2018 include those from: Afghanistan, Algeria, Angola, Austria, Bangladesh, Brazil, China, Cuba, Ethiopia, France, Germany, India, Indonesia, Italy, Japan, Kuwait, Laos, Madagascar, Mongolia, Myanmar, Nigeria, N Korea, New Zealand, Oman, Peru, Philippines, Romania, Russia, Solomon Islands, S Korea, Sri Lanka, Tajikistan, Thailand, Turkey, UK, USA, Vanuatu, Vietnam, Zambia. Zanzibar and Zimbabwe[9].

d) Shortwave radio is the natural choice to evade censorship or an unsympathetic government and is widely used by governments and non-state actors.

In normal diplomatic usage, operating a shortwave transmitter to promulgate your nation's image and point of view is normal and acceptable, but calling for the overthrow of another government is an act of aggression, so few nations do that openly.

Instead a whole class of broadcasters known as Clandestine and Other Targeted Broadcasters COTB) send their programming to a variety of target nations to advance the cause of separatists or dissidents. They can be openly or covertly sponsored by another nation. Some examples of clandestines monitored recently in Australia (with their target audience) are: Eye Radio (S Sudan), Radio Publique Africaine (Rwanda), Voice of the Straits (China), Voice of Zhanghua (Taiwan), and Voice of Hope (Falun Gong, targeting China). On the other hand, Radio Liberty and Radio Free Asia are examples of Other Target broadcasters openly sponsored by the USA and targeted at most Asian nations.

Religious broadcasters are another group of non-state actors, this time operating in the grey area of seeking to change the religious and cultural orientation of targeted nations. They are mostly protestant evangelicals with a home base in the USA. Examples include WTWW (Tennessee), WWCR (Nashville), the Overcomer Ministry (various foreign outlets) and Reach Beyond (the last having a transmitter in Australia). Vatican Radio has operated several transmitters since the 1920s, and last year had planned to cease all shortwave broadcasts, but they have since reinstated their service to Africa with the realisation that internet streaming will not reach their audience. In recent years Islamic broadcasters have appeared such as Holy Q'ran Radio and Voice of Islam, hosted within our region.

5) Australia may be in breach of an international agreement on disaster relief.

The High Frequency Coordinating Conference (HFCC)[10], in accordance with Article 12 of the ITU Radio Regulations, is preparing the International Radio for Disaster Relief (IRDR) project. The IRDR is a projected system of on-line coordination of shortwave radio frequencies.

In the event of a widespread disaster when local or even regional information networks are overloaded or even destroyed, shortwave transmitters outside the region would be used to provide information to local authorities and the population, easily received on simple equipment. Australia's

7 *2018 World Radio Television Handbook* (WRTH) see Sources below.
8 *2018 Shortwave Frequency Guide* published by Joerg Klingenfuss. See Source below
9 Australian Radio DX Club (ARDXC). See Sources below.
10 http://www.hfcc.org/humanitarian/

contribution would come from the Broadcasting Australia[11] transmitter at Shepparton.

The 2013 World Disaster Report[12] supports the idea that shortwave radio is the preferred platform when other platforms such as FM, satellite or the Internet are unavailable because of loss of infrastructure, remote geography or high cost.

6) Sources. These might be considered 'official' and 'unofficial' with the unofficial sources sometimes the most useful.

ITU – most official, least useful
Shortwave broadcasters register their frequencies and the hours of use with the International Telecommunications Union (ITU). This is an agency of the united Nations, and before that, the League of Nations, but it predates even the League, being founded in 1865 to co-ordinate telegraph and telephone communications. It is the oldest existing international body.

The ITU keeps a central registry, but often nations register frequencies as a gambit to pre-empt others, or as part of forward planning with no intention or ability to operate. A copy is available from the ITU, but it is expensive and may be two or three years out of date. The Australian Signal Directorate probably has a copy as might the Australian Communications and Media Authority. Like the Complete Oxford Dictionary, nice to know that it exists, but not for day-to-day use.

WRTH – the industry standard www.wrth.com, wrth@wrth.com
The World Radio Television Handbook (WRTH) lists all operating AM, FM, TV and shortwave broadcasters worldwide. The committee would find it a useful record of broadcasting in the Asia Pacific region.

Klingenfuss Publications - very useful – www.klingenfuss.org, info@klingenfuss.org
Klingenfuss employ teams of radio monitors worldwide who record every shortwave radio transmission that appears on a regular basis, excluding only one-off transmissions such as military exercises. This is a massive task as the shortwave spectrum is in constant use by aircraft, commercial shipping, yachts, diplomats, meteorologists, navigation devices, humanitarian bodies, disaster relief to name just a few.

They publish a series of printed titles, and databases on CD-ROM listing all regular shortwave transmissions as well as shortwave broadcasters. Their clients in Australia include the ADF and the DSTO, and various military and intelligence agencies across the world.

DXers – volunteer monitors of shortwave broadcasts
DXers are radio enthusiasts who listen to shortwave broadcasts and report on them (as distinct from amateur, or “ham” radio operators who transmit signals). There are 139 DX clubs around the world publishing information which cannot be obtained anywhere else. Their members use high-end receivers and have technical ability.

On-line forums – actual users of shortwave broadcasts
Citizens of the target nations, yachties travelling in the Pacific, light aviation operators, adventure tourists, NGOs, all form part of the audience and monitoring these forums shows a dismay at Radio Australia leaving shortwave.

7) Finally, a map of the world from a radio broadcaster's viewpoint, with our traditional friends and allies distant and the Pacific close by.

11 Broadcasting Australia owns and operates both Radio Australia's & the ABC's transmitters, copying BBC practice.
12 http://www.ifrc.org/PageFiles/134658/WDR%202013%20complete.pdf

Azimuthal Map

Center: 23°41'15"S 133°52'30"E

Courtesy of [redacted]