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30 March 2011

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Dear Sir/Madam

AUSTRALIAN WIRELESS AUDIO GROUP ('AWAG') SUBMISSION IN RELATION TO CLEARING THE DIGITAL DIVIDEND DISCUSSION PAPER

The Australian Wireless Audio Group ("AWAG") is an Industry funded, non-partisan, representative group which speaks for key manufacturers, wholesalers, retailers and users of wireless audiovisual products currently operating in the 520-820MHz frequency band. We provide a voice to a large, dispersed and disparate group of both commercial and non-commercial Australian users of wireless audiovisual products. We are led by the Australian Music Association who are the trade body for the music products industry, representing wholesalers, manufacturers, retailers and associated services for musical instruments, pro audio, print music, lighting and computer music products (please refer to www.australianmusic.asn.au).

We appreciate the opportunity afforded to AWAG to provide our comments on an issue which is critical not only for our industry but also for the wide range of other sectors of the Australian economy which depend and utilise our products and technology.

Our chief concerns are:

- Securing sufficient spectrum within the now 520MHZ to 694MHZ broadcast spectrum to allow for the existing and future use of wireless audio devices to continue to provide economic, social and cultural benefits to Australians
- Maximising the efficient use of the available spectrum as secondary users under the LIPD
- Creating certainty for users in the period between now and the occupation of the digital dividend by new users
- Working with the government and regulators to ensure a viable outcome for all stakeholders. This will be assured by working with government and the regulator on the development and implementation of an effective communication campaign.

- Achieving the above as soon as possible

AWAG would welcome the opportunity to further discuss these important issues concerning the licensing of wireless audiovisual devices and the future allocation of spectrum to support it. Please contact me directly on 03 9527 6658 or via email at ian.harvey@australianmusic.asn.au.

Yours sincerely



IAN HARVEY
EXECUTIVE OFFICER
AUSTRALIAN MUSIC ASSOCIATION



Australia Wireless Audio Group (AWAG) Submission

in relation to:

**IFC 07/2011 CLEARING THE DIGITAL DIVIDEND DISCUSSION
PAPER: Planning objectives and principles for restacking digital
television channels**

30 March 2011



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Introduction

The Australian Wireless Audio Group (AWAG) is an Industry funded, non-partisan, representative group which speaks for key manufacturers, wholesalers, retailers and users of wireless audiovisual products currently operating in the 520-820MHz frequency band. We are led by the Australian Music Association who are the trade body for the music products industry, representing wholesalers, manufacturers, retailers and associated services for musical instruments, pro audio, print music, lighting and computer music products (please refer to www.australianmusic.asn.au). AWAG's members currently include:

- Jands Pty Ltd;
- Syntec;
- Technical Audio Group;
- Audio Products Group;
- Bosch Communications;
- Audio Telex (Hills SVL); and
- Aerobic Microphones Australia (associate member, -representing fitness industry products).

We appreciate the opportunity afforded to AWAG through the Clearing the Digital Dividend Discussion Paper (Discussion Paper) by the ACMA. The actions taken by the ACMA and Government on this issue are critical for both our industry and the wide range of other sectors of the Australian economy which depend on and utilise our products and technology. Australian wireless users are currently operating in an uncertain environment. They have done so for several years from the earliest mentions of the digital dividend. While some aspects surrounding the issue (such as the actual size and location of the digital dividend) are now understood much remains to be resolved. All parties would benefit from the certainty that an early resolution of the remaining issues will provide.

AWAG's submission to the Discussion Paper largely reiterates the information already provided to the ACMA through other submissions and meetings. For the purposes of contextualising this discussion, we reassert:

- That despite secondary user status wireless audio products enable a significant amount of economic activity¹ as well as providing social and cultural benefits;
- The technology has been adopted by a wide variety of sectors including music and entertainment, tourism, broadcast and news gathering, meetings and conventions, education, worship, fitness among others. In each case the use of wireless audio products is a key enabler in the business or other activities of users;
- The majority of these users (estimated to be in excess of 130,000 devices) are operating within the 694MHz to 820MHZ range and will need to be accommodated elsewhere within the broadcast spectrum subsequent to the reallocation and restack of the spectrum.
- The number of wireless audio devices in use will continue to grow in line with increased economic activity and as new applications are developed.

¹ "Untethering the microphone: An economic study of the benefits of spectrum use for unlicensed wireless audiovisual devices in Australia, updated analysis", March 2010, Windsor Place Consulting.

For the purposes of clarity we have defined the users of wireless audio devices in the following way:

- Community and non-professional users – examples include schools, churches, sporting clubs, non professional individual musicians or entertainers.
- Commercial users – fitness industry, convention industry, tourism operators, tertiary education, professional entertainers and venues, auctioneers etc. Typically these groups use wireless audio devices as a secondary tool of trade.
- Program makers and special event users (PMSE) – these would be classed as professional users and typically include broadcast, news gathering, live production, high profile venues such as the Sydney Opera House. Typically these groups use wireless audio devices as a principal tool of trade.

These definitions are generalisations and some users cross over from profile to profile depending on circumstances. For example, according to this definition Hillsong Church (<http://www.hillsong.com>) would be classified as a community user but their operational profile is that of a PMSE user.

General Comments

AWAG will focus its comments in this Discussion Paper to three areas, namely:

- (i) How remaining broadcast spectrum might be best configured to allow maximum utilisation of wireless audio devices, as a secondary user into the future;
- (ii) Proposals for the allocation of spectrum for wireless audio devices; and
- (iii) How the clearing and decommissioning of existing wireless audio devices might be best achieved.

AWAG understands the technical arguments for primary users of the broadcast services band that favour a block planning proposal and the economic drivers that substantiate it. However, using existing wireless audio planning tools our research indicates that an interleaved approach to restacking would be more efficacious for our users. The block planning proposal would pose some technical hurdles that reduce the maximum number of wireless audio devices that could be operated in the same area somewhat. These technical issues pertain to the impact of interference due to production of inter-modulation products on wireless audio devices and limitations imposed by the Radiocommunications (Low Interference Potential Devices) Class Licence 2000 (LIPD).

Using Shure Wireless Workbench® (a wireless audio frequency coordination software package) AWAG modelled a number of allocation scenarios to compare usable frequencies for typical wireless audio devices under both a block planned scenario and interleaved. The truncated results are shown below:-

Allocation Scenario	520-578Mhz	578-638MHz	638-698MHz	Total
50% Utilisation, interleave starting at ch 28	28	26	23	77
50% Utilisation, interleave starting at ch 29	28	21	27	76
50% Utilisation, Blocks B & C	10	17	25	52
50% Utilisation, Blocks D & E	31	14	6	51
50% Utilisation, Blocks B & D	20	13	26	59
50% Utilisation, Blocks C & E	26	17	14	57

Both planning scenarios would result in a landscape that will require careful spectrum management however it will result in an asset that is efficiently utilised. It must also be understood that while wireless audiovisual device users may be seen on one level to compete for spectrum, they also play a strategic role as providers of content to major broadcasters and broadband users. Therefore the relationship is somewhat symbiotic as quality of service by both parties is dependent on interference free operation. Within that context we believe there is an argument for further reform and efficiency gains to be made. AWAG considers that there is unlikely to be sufficient spectrum to meet

future needs after the re-stacking if all the other elements currently framing the use of that spectrum remain as per the status quo.

The stress points will be in the larger population centres as usage follows population density. Usage patterns are especially high in the central business districts of the major cities where significant entertainment, tourism, convention, news gathering and other activities coalesce.

As time passes manufacturers are developing products that make more efficient use of spectrum. This has been the case over the past 20 or more years and we expect further efficiency gains in the future. However, as an industry, we expect demand for these products to continue to increase thereby offsetting these gains in spectral efficiency. We anticipate that more consumers will seek the benefits these devices offer while at the same time more applications will be found for their use. An interesting example that recently came to our attention was the recommendation by the French National Institute of Health and Medical Research that teachers use wireless microphones during lessons as a solution to high levels of voice stress amongst teachers and the consequent costs of teacher replacements, medical bills and lost productivity². The new fitness fad Zumba (Latin based dance fitness program) has over 100,000 centres worldwide with in excess of 10 million participants³. This program is also wireless audio dependent.

Illustration of heavy use of wireless audiovisual devices

The scale and scope of the use of wireless audiovisual devices is demonstrated through a sample of spectrum use collated by AWAG in the Sydney CBD on Friday 27 March 2009. The sample shows the distribution of wireless audiovisual devices across the spectrum during a number of productions and events located at The Sydney Entertainment Centre, Sydney Convention and Exhibition Centre, Star City Casino, as well as a number of theatres and sporting venues. This informal survey alone accounted for approximately 290 wireless audio systems in concurrent use and it did not include wireless audiovisual devices used in other significant venues such as the Sydney Opera House which runs 32 systems across its 4 venues each day, the Seymour Centre, City Recital Hall and other public places.

This survey also did not include other activities using wireless audio devices running within the area at that time such as gymnasiums, conferences, meetings or news gathering services.

The detail of this can found in the Appendix A of this submission.

Solution

A good argument can be made to provide some separation between professional large scale, or PMSE users and community / non-professional users who require significantly less spectrum to operate effectively. One suggestion we believe has merit – and could be further investigated by ACMA with inputs from industry - is to allow licensed PMSE users as broad an access to spectrum within the future broadcasting services band as can be made available, while restricting the

² The voice and it's disorders, a collective expert review, 2007, Inserm, French National Institute of Health and Medical Research,

³ Wikipedia

commercial and community users to two or more allocated channels either within the broadcast band or other mutually suitable areas of the spectrum .

This balances the needs of both user profiles, the PMSE user who is often operating more than 40 or 50 devices in one setting (and has higher resource and skill levels) and is therefore looking to access significant amounts of spectrum (see Appendix B) versus the commercial or community user who will typically only operate a small number of devices.

Further details of the proposals that would most suit our industry can be found on pages 15-21 of our Digital Dividend submission⁴.

One of the most significant constraints to use of the broadcast services band by wireless audio devices is the requirement within the LIPD that restricts co-channel operation of LIDP class licensed devices within the coverage area of a broadcasting station. The boundary of the broadcast service coverage area is defined in the Radio Communications LIPD class license as follows;

- coverage area**, for a broadcasting station, means the area surrounding the associated television transmitter within the boundary described by the following field strength limits:
- (a) UHF Band IV: 62 dBuV/metre except rural towns where the limit is 64 dBuV/metre;
 - (b) UHF Band V: 67 dBuV/metre.

The above definition does not take into account the additional protection offered to the primary broadcast services by building structure attenuation when wireless audio devices are operated indoors.

Given that large numbers of such devices are generally operated indoors, AWAG views the current restrictions as overly cautious. In fact, AWAG suggest that many users of wireless audio devices currently may regularly operate inadvertently on frequencies within an active television broadcast services coverage area with very few reports of interference.

The structure of major performance venues such as the Sydney Opera House offer significant radio frequency attenuation limiting break out of low power wireless audio devices operation within the space, and likewise, break in of broadcast transmitters from outside of the space. This effectively limits the possibility of interference to either service.

The LIPD states users must operate at least 400kHz away from the upper and lower edge of adjacent TV channels. Therefore users operating in a free channel flanked either side by an allocated TV service effectively lose 800kHz. This restriction would be minimised if several channels were made available for the exclusive use of wireless audio devices.

AWAG suggests that a relaxation of these limitations in the circumstances described above will help accommodate these devices. It would also assist in ensuring that adequate spectrum is available especially in high use areas such as the inner areas of each of the CBD's of the major cities.

The LIPD also currently imposes the following restriction on wireless audio devices (lines 22 and 22A) "Emission must be frequency modulated and have a maximum bandwidth of 330 kHz" which effectively restricts wireless audio devices to Analogue FM operation only.

Several manufactures of such devices have started developing devices utilising digital modulation and transmission methods which promise to deliver significant improvements in efficiency (greater number of devices per geographical area), audio quality, interference tolerance and security via encryption. However under current LIPD conditions such devices could not be legally operated in Australia.

AWAG respectfully suggests the ACMA give serious consideration to creating an additional category to the LIPD allowing operation of low power digital wireless audio devices within 520 – 694MHz under similar secondary user conditions to existing lines 22 and 22A. It is our understanding that European standards³ already incorporate the use of digital devices in this manner.

AWAG stress that should such a category be created it should operate in addition to existing wireless audio devices, not replace as both will need to operate simultaneously for several years.

Mid Band Gap

The question of the Mid-Band Gap falls outside the issue being dealt with in this request for comment from the ACMA, however, it does in the opinion of AWAG present a potential part solution to the issues raised above in this response. The mid-band gap may be of even of greater significance given our view that a block restack of remaining broadcast spectrum, as favoured by the ACMA, is the least efficient approach of the two available options from the perspective of maximising the use of wireless audio devices.

Given that wireless audio devices are:

- Embedded into the operations and services of many industry sectors and organisations returning financial, social or cultural benefits to users and the country alike; and
- Increasing in both their scale and range of uses;

then there is need to find ways of accommodating their future use. Our view is that the mid-band gap, being harmonised as it is through AWF-7, can meet the needs of many of our non-commercial users, in particular schools, churches and other community groups. It as is anticipated by AWAG the mid-band gap is harmonised across the Asia- Pacific area it does present a viable market for manufacturers to produce and market product into. The outcome domestically is that:

- Congestion within the broadcast spectrum in high use areas can be minimised
- An otherwise commercially non-viable piece of spectrum can be utilised

AWAG's proposal for the use of the mid-band gap can be found in Appendix C of this document

³ ETSI EN 300 422-1 v1.4.2 (2011-01) and ETSI EN 300 422-2 v1.3.0 (2011-01)

Issues Surrounding the Clearing of Digital Dividend Spectrum and Decommissioning of Redundant Wireless Audio Devices

AWAG understands that there are two primary issues that will impede a successful clearance of the broadcast services band and subsequent restack of the digital channel services. These are:-

- the timing and location of the restack; and
- decommissioning of redundant devices.

Timing

AWAG recognises that our primary stakeholders are secondary users of this valuable asset often with a significant and symbiotic relationship with the primary users. In order to ensure our continued role of contributing support to those areas that are significant economic drivers to Australia, we need to be able to provide certainty to our industry as well as the vast range of other industries across Australia who benefit from the use of these devices.

At the moment there is anecdotal evidence of companies being unwilling to invest in large amounts of new equipment as they are uncertain that it will be able to be used once the restack has been completed. We reiterate that these devices have an average usable working life of 10 years so the life expectancy of a product being bought in 2011 or 2012 means that it will still likely be operating in 2020 – some 6 years (and more than half its anticipated useful) beyond the anticipated completion of the digital dividend and switch over processes and within the new regime. For that reason we implore the ACMA to make a decision regarding the location of the restack expeditiously in order to provide our stakeholders with some certainty.

An additional requirement for an expeditious decision will be the need to execute a public awareness campaign alerting the wireless audio community of the need to decommission their affected products. As stated in previous submissions, our users are quite disparate and many will not be aware of the impact of the digital dividend on the usage of their devices. Again, an elementary proposal formed Appendix D of AWAG's Digital Dividend Green Paper Submission. AWAG estimates that it will take approximately two years to execute a program such as this and are willing to work closely with the relevant body to ensure our common aims are met.

Decommissioning program

Our estimates indicate that somewhere in the order of 100,000 wireless audio devices are likely to have to be decommissioned during the period before 2014 based on the assumption that the new users of the digital dividend will seek to occupy that spectrum as soon as possible and that the LIPD licence will be amended to reflect the digital dividend.

The majority of these are devices that currently operate in the 694MHz to 820MHz, though depending on the final nature of the broadcast re-stack there will be some redundancy amongst devices that operate within the 520MHz to 694MHz.

The decommissioning of these devices will require the support of an education/community awareness program. Many of the users of these devices will not be aware of the impact the digital dividend will have on their use of wireless microphones and that many of these devices will need to be withdrawn from use.

As well as standard forms of advertising the audio industry and music products retailers can play a positive role in communicating directly with their customer base of the need to decommission many of the product in current use.

In addition the ACMA will be familiar with our assertion that the decommissioning and removal of these existing devices is best achieved through some form of buy back or compensation program to users. The details of this are provided on pages 22 and 103 of the AWAG response to the Digital Dividend Green Paper.

AWAG believe that both these elements are required for the decommissioning process to be effective and undertaken in a timely manner.

If, as an outcome of ensuring the digital dividend spectrum is cleared of wireless audio devices are to be centrally collected for decommissioning before compensation can be claimed, then some sort of decommissioning process will need to be instigated. In other markets such as the United Kingdom such a mechanism already exists through the collection systems developed to facilitate the disposal of products in accordance with the Waste Electrical and Electronic Equipment (WEEE) legislation. No such compulsory mechanism exists currently in Australia, so the logistics and associated costs of this must be considered in conjunction with all the other constraints. AWAG are willing to advise on suitable mechanisms that can implemented to execute this.

White Space Devices

We note that for the first time the ACMA has referred to the potential of so called white space devices sharing the remaining broadcast spectrum (5.2.12). We approach this issue with some concern and draw the ACMA's attention to evaluation studies conducted by the Federal Communications Commission (FCC) in the United States of America⁴.

While manufacturers are working towards developing products that are able to co-habit more effectively, our concerns extend to:

- increased competition between wireless audio and whitespace devices for spectrum
- the potential for further wireless audio product redundancies within the 520MHz – 694MHz spectrum
- potential interference between the two types of devices, in particular, in high use locations and in quality critical audio activities such as those provided by the PMSE and news gathering providers.

⁴ OET Report FCC/OET 08-TR-1005 Evaluation of the Performance of Prototype TV Band White Space Devices Phase II.

Appendix A

One evening in Sydney – a study of wireless audio usage in Sydney.

Friday March 27, 2009 was a balmy day in Sydney. The weather had been great and the city was winding down for the weekend – a drink at the pub with friends while the band plays in the corner of the room, dinner followed by a show or maybe even an early season football match. It was an ordinary weekend in Sydney.

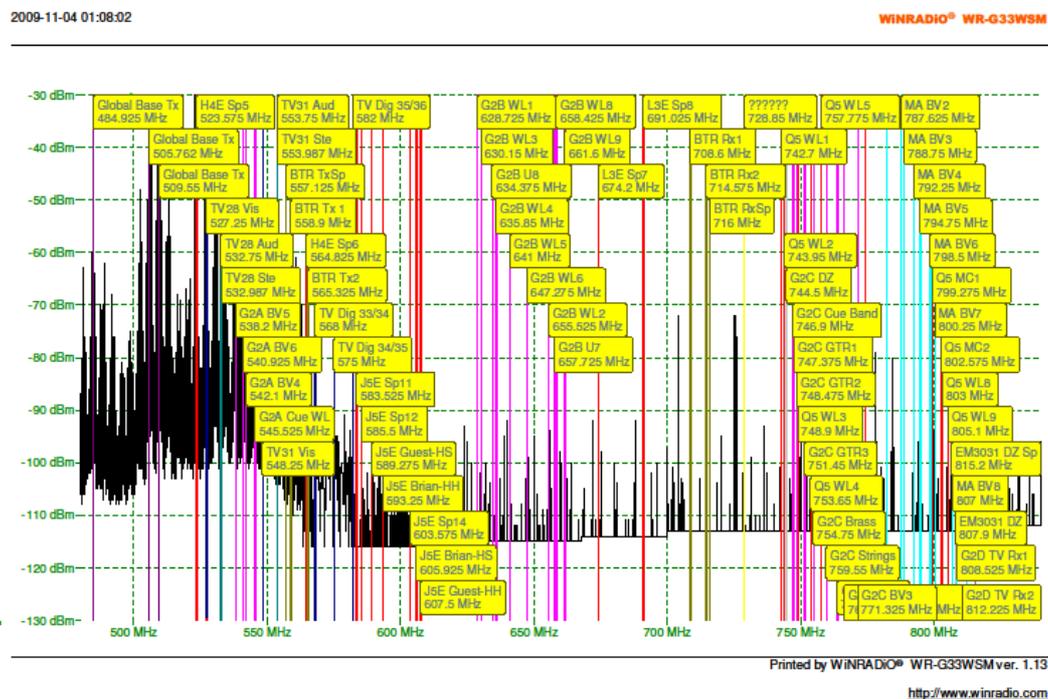
But this simplicity hides some complexity. All of these activities use and depend on wireless audio devices. Looks have a look at this evening more closely.

Sydney Entertainment Centre

The Sydney Entertainment Centre was the venue for the “Colour Your World” Conference hosted by Hillsong Church. On this particular evening the event was attended by 12 000 people and the program consisted of live music, audio visual replay and other live presentations. The music was provided by a 30 piece band, 10 singers and a 50 voice choir.

In all there were 62 wireless audio systems in use. These were required for wireless microphones, in ear monitoring and wireless communications.

This is what the spectrum looked like for this event:



Sydney Convention and Exhibition Centre – Darling Harbour

It was a big night for the Australian music industry. Darling Harbour was the venue for the MTV Australia awards. It was evening of red carpet interviews on arrival, live band performances, back stage interviews and, importantly the awards presentations themselves. Not only was the event a live performance, it was a live broadcast as well. There were approximately 74 systems in use throughout the evening including wireless microphones, in ear monitoring systems and communication systems.

Adding to the difficulties at this venue was its geographical proximity to the Sydney Entertainment Centre. Frequency clashes and intermods were going to be an issue. An informal spectrum management system was established by the engineers, however this required constant monitoring. This vigilance was rewarded as disruption to transmissions was minimised and performances were delivered relatively cleanly.

Lyric Theatre – Star City

A little bit further down the road is Star City's Lyric Theatre. 2000 people were enjoying a performance of Andrew Lloyd Weber's "Phantom of the Opera". To facilitate this modern operatic performance, 46 wireless audio systems were deployed.

Capitol Theatre

For those with a slightly different musical taste, "Guys and Dolls" was playing at the Capitol Theatre. At this venue there were 40 systems in use and audience of 2100 people.

Sydney Football Stadium

Fans of the Wests Tigers and Sydney City Roosters were in attendance at the Sydney Football Stadium for their round 3 match of the 2009 NRL Premiership season. A typical NRL match uses approximately 20 systems for on field television commentators, radio broadcasters, referee commentary, live entertainment as well as ground announcements.

These venues are all within a 3km radius of the Sydney GPO.

So is that all that was happening in that space?

What else?

In addition to these illustrations there are a significant number of bars hosting live music and Friday is generally one of the peak trading nights in this part of the city.

This snapshot has not documented wireless audio device use in other significant venues such as the Sydney Opera House which runs 32 systems across its 4 venues each day, the Seymour Centre, City Recital Hall and other public places.

Additionally there are news crews to consider. News crews use 2 systems each – one for audio and another for a link between camera and sound. At any one time in Sydney there can be up to 16 news crews deployed across the greater metropolitan area of Sydney. There are a similar number of current affairs crews.

This is a snapshot of an evening in Sydney. In terms of wireless usage it is a typical evening. This snapshot accounts for 290 systems in use in one small part of the city and is indicative of the usage patterns in other cities across Australia. AWAG's own surveys indicate that there are over 130 000 units sold by AWAG members for in use in Australia. ABS figures indicate that approximately 32000 units are imported each year, and usage is increasing.

Theatre, television, sport, nightclubs, Live Music, Churches, Schools, Hotels, Offices, all use wireless audio systems on a daily basis. 7 days a week.

Whilst the snapshot is an illustration of one area of Sydney, at a specific time, the pattern is repeated across greater Sydney, in Melbourne and to varying degrees in all other capital cities, plus regional cities throughout Australia.

Was this a unique evening in Sydney? No. This is the bread and butter usage of wireless audio devices that will be affected by the digital dividend. It becomes even more complex when special events such as grand finals, car racing, World Cup, Papal visits have to be catered for. This snapshot has not detailed other regular users – sports clubs, schools, amateur theatres, the convention and hospitality industry and gyms.

In an already crowded spectral environment it is necessary that adequate consideration is given to these users. Planning must consider their needs as without access to adequate spectrum, these activities will stop, creating a significant economic impact on an industry that provides and estimated benefit to the Australian economy of between \$291 - \$714 million.⁵

⁵ 10 Year present value estimate - "Untethering the microphone: An economic study of the benefits of wireless audio visual devices in Australia" Windsor Place Consulting, April 2008, p3.

News and current affairs

Approx 58 systems city wide



Lyric Theatre

46 Systems

MTV Awards

74 systems

Sydney Entertainment Centre

62 Systems

Capitol Theatre

40 systems

Sydney Football Stadium

20 systems

Wireless Audio Sales Data 03-09

AWAG Members

Update May 20
2009

Transmitter Freq	Estimated Sales F09	Units Sold FY08	Units sold FY07	Units sold FY06	Units sold FY05	Units sold FY04	Units sold FY03	Total Units
520-540MHz	2		4	36	6	0	0	48
540-560MHz	218	246	16	115	31	214	258	1098
560-580MHz			6	34	0	0	0	40
580-600MHz			0	0	136	164	184	484
600-620MHz	78	42	0	2	609	872	730	2333
620-640MHz	826	718	1629	711	1406	1277	992	7559
640-660MHz	749	863	6	3	7	13	9	1650
660-680MHz	490	631	8	8	28	12	8	1185
680-700MHz			8	4	5	9	13	39
700-720MHz	2749	3406	579	499	376	314	462	8385
720-740MHz	355	433	1343	1698	1210	255	254	5548
740-760MHz	1435	817	558	501	266	253	242	4072
760-780MHz	246	766	1478	909	918	1125	1158	6600
780-800MHz	4118	1473	2561	2865	2685	2798	1489	17989
800-820MHz	3086	3196	7325	5714	7937	9124	7695	44077
Total	14352	12591	15521	13099	15620	16430	13494	101107

Spectrum spread	
700-820Mhz units 03-07	87.09%
700-820Mhz units 03-09	85.72%

Summary of Imports F1998 to F2007*

Based on data provided by the Australian Bureau Of Statistics

Year	Unit Imports	% by AWAG members
1998	34292	n/a
1999	31670	n/a
2000	29068	n/a
2001	24865	n/a
2002	32925	n/a
2003	33147	36.80%
2004	35245	41.99%
2005	35665	38.91%
2006	29865	39.46%
2007	34584	42.08%
Average	32304	39.84%

Appendix B

Two Case Studies from the Program Makers and Special Events (PMSE) sector

The Show Must Go On

Case Study

System Sound, Melbourne

System Sound specialise in providing sound reinforcement and system design for musical theatre. Their business is based on the provision of equipment and personnel for sound and communications under contract to the producers of theatre productions such as *Phantom of the Opera*, *Miss Saigon*, *Wicked* and *Billy Elliot*.

The use of wireless microphone and communications equipment is absolutely critical to the musical theatre industry and organisations like System Sound. Without access to sufficient spectrum to run the on-average 40 radio microphones and 18 channels of communications per show these major productions would not be staged at all. Certainly none of the major productions debuted in the West End or on Broadway would be staged locally without access to the same technical production and staging being available in Australia as it is overseas. This includes the large scale use of wireless audio.

Modern theatrical productions, such as *Billy Elliot*, have been designed to incorporate all the technical and staging benefits that can be derived from the use of radio microphones. The producers and sound designers provide the audience with an experiential sound palate where the sound is often felt as much as heard. For example, some scenes in *Billy Elliot* take place in a coal mine. The drama of these scenes is supported by the use of subsonic sound and a sound palate that has the audience believing they are in fact underground. Together with the modern music genre and immersive surround sound techniques, sound production becomes a critical device in the story telling.

However, even traditional musicals, such as *Guys and Dolls* (which is currently being revived in Melbourne) are being modernised to take advantage of new staging techniques that depend on the use of wireless audio technology. While in some theatres it is *notionally* possible to stage musicals like *Guys and Dolls* without sound reinforcement, the reality is that in 2008 a production without the use of the modern sound and staging would simply fail to gain a commercially viable audience.

Because of the trend to more realistic staging techniques the use of wireless audio devices is forecast to increase into the future. Larger productions, a more dynamic sound environment, larger casts (with all cast members being wireless equipped) are just some examples of how the use of wireless audio devices is increasing. Other trends are also seeing more and more radio mics being used per production. For example, the use of two microphones on the lead characters is an increasing trend. This is done for two reasons. Firstly, for redundancy (no one likes the loss of the vocal from the lead character mid verse) and, secondly, as a result of over dressing (where a

character is wearing two costumes each with a radio microphone attached for the purposes costume change, use of hats, wigs and masks etc) is becoming *de rigueur*.

There is the also an increase in the use of duplex radio communications devices due to OHS requirements. Previously, these devices were used by the stage and front of house managers alone. However, with the increased complexity of staging such as trapdoors or 'flying', stage mechanists need to move freely and untethered to assist performers in these complex manoeuvres often in the darkened stage wings. Wireless communications devices allow these actions to take place in safety.

System Sound are typically involved in staging of up to 6 major shows that are running in Australia at any given time. There are on average a further 4 major productions engineered by others, taking the total to around 10 productions being staged at any time across Australia. In employment terms, around 40 people are engaged by System Sound directly, while a further 600 or so people are indirectly employed providing technical or front of house services to the productions that System Sound service. When all major productions are included, this number rises to more than 1,000 people employed in the delivery of music theatre at any one time.

In economic terms, each of these productions has an average income of around \$1 million per week, or combined around \$500 million annually generated through the sale of approximately 5 million seats. These figures do not include production add-on's, such as the sale of programs or food, nor does it include the economic benefits associated through tourism such as the purchase of hotel room nights or restaurant covers by theatre goers.

To support these productions System Sound supply and operate around 240 radio microphones along with 80 radio communications networks for use by stage management and stage mechanists. Typically, 40 or so radio microphones are used per production along with 18 channels of radio communications. System Sound's total investment in wireless audio products is in excess of \$2.5 million at current value.

The principals of the business have been involved in sound production for theatre for more than 30 years. They see the resurgence in public interest in the genre being closely associated with the technical advances introduced in the past decade or so, including staging and lighting but particularly through the use of wireless audio.

Put simply, without wireless audio the show could not go on.

That's Entertainment

Case Study

Chris Kennedy – CEO Norwest Productions, Sydney

Norwest Productions Pty Ltd. is one of Australia's largest professional audio service providers, with offices in Sydney, Brisbane, Melbourne and Bangkok. Norwest provides audio solutions for special

events, arena concerts, sporting events, touring bands, theatre, broadcast, conferences, conventions and other corporate events.

Norwest directly employs approximately 80 people, which includes 50 full-time and about 20-30 regular contracting staff. However, once you start to consider the broad spectrum of people indirectly employed in the coordination of a production (for example a load-in team which can easily include 30-40 people, similarly a cast of a theatre production, the team behind a live television program broadcast to the nation), the number of people involved grows exponentially in relation to the production size.

Annually, Norwest is involved in a vast number of productions of varying scales. These include:

- At least 10 concert tours yearly, with each tour incorporating an average of 6-8 shows attended by hundreds of thousands throughout Australia. Recent acts include, Linkin Park, Iron Maiden, Brooks and Dunn, Keith Urban and Human Nature.
- Nationally broadcast television shows, such as “So You Think You Can Dance”, “Big Brother”, “Australian Idol” etc. which attracts millions of regular viewers each season.
- Sporting Events attended by thousands and broadcast nationally such as the FINA World Swimming Championships, NRL and AFL Football
- Theatre productions which easily draw 20,000 participants weekly such as The Wiggles, Barry Humphries and the Bollywood Show.

When one reflects on the extensive portfolio of productions Norwest is involved in on a day-to-day basis, Norwest estimates their activities reach around 10 million participants weekly. However, when you start to incorporate special events such as the Sydney Olympics (2000), Athens Olympics (2004), Asian Games in Doha (2006), Melbourne Commonwealth Games (2006) into the mix participation can escalate to billions through global TV audiences.

Norwest estimates their activities generate a commercial value of approximately \$20 million annually. In their daily business activities Norwest uses around 500 units of wireless audio devices. With 500 units in operation (each of which cost an average of \$2,000) Norwest’s investment in inventory of wireless audio devices is estimated to be valued at an impressive \$1 million.

These wireless devices are used constantly by Norwest to provide audio solutions for special events, arena concerts, sporting events, touring bands, theatre, broadcast, conferences, conventions and other corporate events. Heavily dependent on such devices in their daily activities, their use and inventory of wireless audio devices is continuously increasing. Norwest first invested in wireless audio devices some 20 years ago (an initial 4 devices) today with around 500 radio mics in the inventory they play such an integral part in his business’ ability to supply professional audio solutions he couldn’t imagine the production industry without them.

Not only are wireless devices of critical importance to the day-to-day activities of Norwest, but they also play a vital role wireless audio devices play in maintaining the strong reputation the Australian production industry holds in the global market. Norwest believe that, “one needs to seriously consider the ramifications if substantial amounts of spectrum were not made available for these devices to be used freely in Australia”.

Would internationally successful productions come to Australia? Australia's ability to attract, for example, successful theatre productions (that rely heavily on wireless microphones) would diminish substantially due to their inability to execute their performance in a satisfactory manner. Gone are the days where unsightly cables are sprawled across a stage. Would executives or corporate presenters understand why a developed country is unable to provide them with spectrum (otherwise available to them globally) to use their wireless devices to execute their messages in a most professional and persuasive manner? What about the detrimental impact the lack of wireless audio devices would have on the flexibility our broadcast environment currently enjoys?

The industry is dependant on these wireless audio devices and the free spectrum required to use them. Without them we cannot enjoy the high standards of production execution, experiences and services we have all grown accustomed to and demand.

If wireless audio devices were unusable due to the confiscation of vital free spectrum, Norwest would lose a substantial chunk of their current business. Also, their sizeable investment in wireless audio devices would become worthless and useless. Mr Kennedy estimates that as much as 30% of their business activities would cease, not to mention the substantial financial expenditure required to replace these units, possibly with inferior substitutes. If the removal of free spectrum would result in such harsh ramifications for one organisation alone, one can only imagine the severe domino effect this would have on a much larger scale.

Norwest's comments indicate that the auctioning off of vital spectrum, its impact on users of wireless audio products and the subsequent rollover effects should not be taken lightly. Special events, arena concerts, sporting events, theatre, broadcast, conferences etc. are vital to Australia's social and cultural wellbeing. The high quality execution and delivery of these events/productions is largely dependant on professional audio solutions, which utilise the flexibility offered by wireless audio devices. Consequently, it is of vital importance that freely accessible spectrum is made available in substantial quantities to make these fundamental, day-to-day activities possible.

Furthermore, during our discussions with Norwest they stressed the importance of freely available spectrum contributed to the global competitiveness of Australia as well. We are a developed country, operating in the international market; therefore there is an expectation that Australia will offer basic services that are available in other developed nations. Substantial quantities of freely accessible spectrum, to be utilised by users of wireless audio devices is one of these "basic services". When examining the allocation of RF spectrum, the Government needs to ensure it has considered the full impact their decisions will have on Australia, socially and internationally.

Appendix C

Wireless Audio Options for Mid Band Gap

The Australian Wireless Audio Group in its response to the Digital Dividend Green Paper in March 2010 suggested that the use of the mid-band gap may be suitable as a tool to minimise congestion within the remaining broadcast spectrum (since confirmed to be 520MHz to 694MHz).

Rationale

In March 2008 AWAG had assessed the total number of deployed wireless audio devices within Australia to be around 130,000, with further new deployments running at around 30-35,000 per annum.

Many of these devices are deployed in what we call community use. This is typically, a local musician, band, club, church or school.

In the majority of these cases the users purchase affordable, comparatively low specified products and they are deployed as 'plug and play' products with little understanding by the consumer as to how the product actually works.

In the majority of cases the devices are either used as single units, in pairs or in clusters of 5 to 6 units. They are deployed in:

- low commercial value activities (a local band playing a club, musicians at weddings etc.)
- community activity, such as in churches or schools where they assist in activities such as worship, closed loop hearing support, fetes, sports carnivals, music and arts activity.

Overall, AWAG believe that there were around 55,000 (est 2008) such devices in use across Australia and would climb in number to in excess of 75,000 units by the time the broadcast spectrum above 694MHz has been given over to new users.

Suggested use of the mid-band gap

The mid-band gap proposal by AWAG seeks to provide a place for these users at the same time securing sufficient access to spectrum for commercially scaled users such as the Programme-Making and Special Events (PMSE) users, as well as, users such as the fitness industry, tourism, tertiary education, news gathering and others.

The use of the mid-band gap provides the potential for:

- The growth in use of wireless audio devices (in line with community expectations)
- Certainty of spectrum access for PMSE and other commercial users
- Simplicity of use for community users

Simulations

Two simulations are outlined. They seek to outline the potential usage capacity of systems operating in the proposed mid band gap using both the proposed 8MHz and 10MHz options outline at the Asia Pacific Telecommunity Wireless Forum (AWF- 7)

The simulations use two wireless microphones that would be capable of tuning across the proposed digital dividend bands. These are based on two current Shure products, though they are representative of many similar products currently produced by the leading manufacturers.

Type 1: entry level product based on the capabilities of current Shure PGX products

Type 2: pro level product based on the capabilities of the current Shure UHF-R product

Our reasoning is that carrying capacity increases significantly with the higher end products due to:

- superior front end filtering, and
- better image rejection

These factors result in a closer minimum channel spacing and spectrum efficiency therefore resulting in a greater carrying capacity.

Our proposed use of the mid –band gap is of course focused on the community users who typically purchase the lower cost entry level product for this band. However, in consideration of the fact that we are attempting to predict capacity based on products not yet released, we have built into the simulation some assumptions that newer entry level products, specifically designed to operate in this band may have superior performance to that currently available. The Type 1 therefore product is indicative of the minimum carrying capacity while the Type 2 product reflects what we consider to be the best case scenario.

These two product characteristics translate to the following:

For a Mid band Gap of 8MHz;

Type 1 Product: Entry level = 5 -6 per service area

Type 2 product: Pro standard = 9 – 11 per service area

For Mid band gap of 10MHz;

Entry level product Type 1 = 6 – 7 per service area

Type 2 product: Pro standard = 10 – 12 per service area.

Converting these numbers to usage density is somewhat difficult, however, assuming a working separation of around 200m (this is not based on any hard science but rather from experience in the field) it would be possible to have up to 25 “service areas” per square km.

Extrapolating the numbers above to a geographic distribution we are of the view that the mid band gap has a carry capacity of between:

Mid band Gap of 8MHz;

Type 1 Product: Entry level = 125 – 150 per km²

Type 2 product: Pro standard = 225 – 275 per km²

For Mid band gap of 10MHz;

Entry level product = 150 – 175 per km²

Pro product = 250 – 300 per km²

This kind of capacity would allow the use of several hundred units in the critical areas such as inner Sydney, Melbourne and Brisbane during peak times such as Friday and Saturday nights.

Given also that the use of these devices is well dispersed during the day and in some cases the days of the week as the peak times for their use in entertainment is not, normally the peak time for use in education or worship.

We believe these numbers provide sufficient current and potential future capacity for community use wireless audio.

Conclusion

The mid-band gap is in itself not sufficient to resolve all the issues concerning wireless audio devices post the digital dividend. Access to the remaining white space within 520MHz and 694MHz is required and, included in that, some nationally consistent space within that spectrum for these devices.

The use of these devices and their importance commercially and socially is too widespread to contain their use to just a handful of megahertz.

While we are confident of the hypothesis presented here some real world testing will be required to establish any final specifications for the use of this spectrum.

However, the allocation of significant numbers of community use devices to the mid-band gap in our view offers continuity of use for all those currently, as well as those in the future who want access to wireless audio products.