DIGITAL BROADCASTING AND DIGITAL DIVIDEND

CONSULTATION PAPER

TABLE OF CONTENT

Executive Summary

As part of the Geneva 2006 Agreement (GE06) on analogue to digital TV broadcasting migration, NICTA (as the implementing agency) is initiating the consultation process with users and industry players. This initiative is to inform and solicit views on the switch-over plan and how best this can be achieved smoothly with minimum impact and in a timely manner for all stakeholders. The planning and implementation of digital switch-over (DSO) started some fifteen (15) years ago in many countries and PNG without exception will have to do so within a short span of time.

It is important for PNG to embrace worldwide changes in ICT and adapt to these changes as an obligation under the treaties of the ITU Convention. As part of its mandated powers under the NICT Act 2009 (the "Act"), NICTA is taking necessary steps to effect this process of change in consultation with the Department of Communication and Information (DCI) for the benefit of the industry and the users. Whilst adhering to this process, there are consequential impacts that need to be observed and addressed. Apart from others, one such impact is the release of the 'digital dividend' spectrum (DDS) that may be made available to various services. The provision for making and/or modifying the DDS plan under the Act is also subject to consultation except in case of an urgency as determined by NICTA. Furthermore, a Ministerial determination is required for the re-location of spectrum as prescribed under s177 of the Act. Following this public consultation process, NICTA may recommend to the Minister to make a determination.

As PNG's current usage of the TV bands is very minimal, it is envisaged that the transition of DSO and the relocation of users on this bands (UHF Band V) will be coordinated by mutual consensus within industry (existing and potential users) and other stakeholders.

This consultation will result in a clear guideline on how the migration process will be addressed with the subsequent release the DDS for future use.

Invitation to Comment

NICTA invites members of the industry and the general public to make submissions on the issues raised in this paper. Submissions may be sent by post to:

The Acting Manager
Engineering and Resource Planning Department
NICTA
Frangipani Street, Hohola
PO Box 8227
Boroko, NCD 111

Or via facsimile to: +675 300 4829
Or via email to: pyokope@nicta.gov.pg

Electronic submissions in Microsoft Word or Acrobat pdf are preferred.

The closing date for submissions to this discussion paper is 30 December 2011

ACRONYMS

3G	Third Generation of Mobile Telephony
4G	Fourth Generation of Mobile Telephony
AB	Analog Broadcasting
APT	Asia Pacific Telecommunity
AWF	APT Wireless Forum
CDMA	Coded Duplex Multiple Access
DB	Digital Broadcasting
DD	Digital Dividend
DDS	Digital Dividend Spectrum
DCI	Department of Communication and Information
DSO	Digital Switch Over
DTB	Digital Television Broadcasting
DTTB	Digital Terrestrial Television Broadcasting
EU	European Union
FDD	Frequency Division Duplex
GE-06	Geneva Agreement of 2006
GSM	Global Systems for Mobile Communications
ICCC	Independent Consumer and Competition Commission
ICT	Information Communication Technology
IMT	International Mobile Telecommunications
IMT2000	International Mobile Telecommunications 2000
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Bureau
LTE	Long Term Evolution
MMDS	Multichannel Multipoint Distribution Service
NCD	National Capital District
NICTA	National Information and Communications Technology Authority
PNG	Papua New Guinea
PPDR	Public Protection and Disaster Relief
STL	Studio to Transmitter Link
TV	Television
UHF	Ultra High Frequency
USA	United States of America
US	United States

VHF Very High Frequency

DEFINITIONS

Act	NICT Act 2009
Analogue system	A system that represents changing values as continuously variable physical quantities.
Digital Broadcasting	Is the sending and receiving of moving images and sound by digital (discrete) signals in contrast to analogue signal.
Digital system	Uses discrete (discontinuous) values, usually but not always symbolized numerically (hence called "digital") to represent information for input, processing, transmission, storage, etc.
Digital Switch Over	It is the change over from analogue broadcasting to digital terrestrial broadcasting.
Multiplexing	Is a process where multiple analogue signals or digital data streams are combined into one signal.
Radio Frequency (RF)	A frequency of electromagnetic radiation in the range at which radio signals are transmitted, ranging from approximately 3 kilohertz to 300 gigahertz.
Radio Frequency Spectrum	The entire range of electromagnetic communications frequencies, including those used for radio, radar, and television; the radio-frequency spectrum.
Simulcast period	Is the period during which there will parallel provision/transmission of television programme in both analogue and digital mode.
Terrestrial Broadcasting	A broadcast signal transmitted "over-the-air" to an antenna.
Transition period	The period during which switch over from analogue to digital broadcasting will take place.

1.0 INTRODUCTION

1.1 Background

The migration from analogue to digital broadcasting has already commenced in some countries and is expected to continue throughout the world for the next few years. The actual duration of parallel analogue and digital broadcasting, i.e. the date when the analogue transmissions will end, will vary from country to country (New Zealand and Australia by 2013). For PNG, the transition from analogue to digital TV broadcasting has yet to take place and the NICTA Board has decided to commence the Consultation process which is required for a smooth changeover.

Whilst considering the move, the related concerns of the broadcast services need to be appropriately taken into account.

The switch-over from analogue to digital broadcasting makes it possible to free up a significant amount of spectrum (Digital Dividend). This is as a result of techniques used in digital broadcasting which require less spectrum for the transmission of high quality television signal. The migration process offers a unique opportunity to meet the fast growing demand for wireless communication services by utilizing the freed spectrum to ensure that other important social and economic uses, such as broadband applications have access to this valuable resource. Some countries have already converted to digital and are now using their Digital Dividend (DD). In PNG the conversion date is not necessarily a matter of urgency and will depend on affordability of digital TV receivers. However, the definition, release and allocation process of the DD is a matter of considerable urgency as the spectrum is required for the provision of emerging broadband services.

1.2 Scope

This paper provides a background to major changes in radio frequency usage being planned in order to release the DD and switch-over to fully digital television services. The date for the Digital Switch-Over (DSO) in PNG is yet to be finalized but is expected to occur in the period 2012 to 2015.

The DD is the spectrum that can be made available in PNG by re-farming the television bands and restacking current analog TV services prior to the implementation of digital television broadcasting. The greater technical efficiency of individual digital licences and frequency planning parameters allows a greater number of programmes using less radio frequency spectrum.

This paper does not seek to be comprehensive, or to reach conclusions, but rather, to provide an outline of what NICTA currently sees as the key issues and invites comments from interested parties.

1.3 Overall Objectives

The overall objectives of the DSO related tasks are broadly:

- To vary the terrestrial television broadcasting bands in order to facilitate orderly conversion from analog to digital technology;
- To determine the appropriate date for DSO in PNG or if necessary different dates for various parts of PNG in an efficient manner;
- To determine appropriate policies relating to broadcasting in the digital environment;
- To determine the size and location of the Digital Dividend consistent with regional and global developments in order to maximize benefit from economies of scale;
- To clear the DD spectrum by relocating existing services to other suitable frequencies; and
- To facilitate the allocation of the DD spectrum to interested providers of broadband and other new services to maximize the benefit to PNG while taking into account the cost of relocation of existing services.

2.0 FACTS AND CONSIDERATIONS

2.1 Analog Vs Digital

Prior to 2003 mobile phones in PNG operated on the analog platform. Today all operators use digital technology: Digicel and bemobile use GSM and Telikom use CDMA. This is because digital is superior over analog, and among other things it has better ability to reuse spectrum and therefore is more spectrum efficient than analog.
For the same reasons, analog broadcasting (AB) is being replaced by digital broadcasting (DB). DB also requires much less spectrum than AB to provide the same programs and coverage, making it possible to free up broadcasting spectrum that may be used for other purposes.

DB is already used in the form of MMDS in the NCD area in PNG. Hitron was originally licensed 27 analog channels of 7MHz bandwidth and was providing about 26 television programs including radio programs for many years. It recently switched over to digital providing up to six (6) television programs in one analog channel, offering more than 100 programs and saving spectrum that may be used for other purposes.

2.2 Digital Dividend Spectrum (DDS)

Since DB required less spectrum than AB to provide the same programs and coverage, a significant quantity of spectrum is released as a result of the DSO. This spectrum is referred to as ‘digital dividend’ spectrum (DDS).

The boundary between the DDS and the rump broadcasting spectrum varies among countries. In order to harmonize global IMT2000 spectrum allocations and achieve economies of scale, the ITU has designated the DDS for IMT2000.

Several countries in Region 3 including PNG have designated the 698 – 862 MHz band for IMT2000. This band has superior signal propagation characteristics than higher frequency bands – the signal can penetrate buildings and go longer distances and requires about a third of the number of base stations and other infrastructure to achieve the same coverage compared to 1.8GHz. This band is therefore very suitable and necessary for the last mile access to the National Broadband Network.

Although PNG has aligned itself with the APT, NICTA is required to formally determine the scope and framework of the DDS in general, and in particular:

- the location and size of the DDS;
- the guard bands of both sides of the DDS;
- the technology, standard, channel arrangement (Technical Framework); and
- the DDS licence allocation mechanisms (Licensing Framework).

2.3 Switching from Analog to Digital Broadcasting (DSO)

Some countries have introduced DB more than 15 years ago. Some countries have completed DSO and others are still in the process of doing so. The transition from AB to DB and DSO varies among countries depending on many factors, such as existing broadcasting infrastructure and level of penetration of satellite and cable TV, maturity and cost of available equipment, status of economic development, demand for new services and digital TV sets, etc.

DSO involves determinations of commencement dates for DB, the duration of the period for simulcast of both AB and DB, and DSO dates beyond which AB ceases. There may be different periods/dates for different regions of a country.

In PNG the power to re-allocate spectrum is vested in the Minister, who may make such determination not earlier than six (6) months after a recommendation from NICTA following public consultation, The National Television Service (KUNDU 2) is operating several transmitters in the DDS which will need to be reallocated to other spectrum to enable other services to use this spectrum. It is reasonable that the other service providers may meet the cost for the re-allocation of these transmitters.

2.4 New Television Broadcasting Installations

Modern television transmitters are able to transmit both AB and DB. In those areas where DB will be required to be implemented it is necessary that all new television transmitters must have the ability to easily switch over from analog to digital format.

2.5 Moratorium of New and Existing Licences in the DDS

Pending the final decisions on the DDS it is necessary to suspend the issuance of new licenses. Furthermore, the renewal of existing licences in the DDS should be subject to mandatory reallocation to another frequency in those areas where there is demand for 4G spectrum.

Any existing broadcasting and STL apparatus licences should therefore be renewed with the condition to switchover to digital by a certain date depending on location

2.6 Broadcasting Digital Audio Consideration

Although the provision for digital audio (sound) is also included in the overall AB to DB switch-over, it is not considered significant at this stage as implementation can be done over an appropriate time depending on the broadcasters' requirement and need to do so. Therefore this part is not included in this paper.

3.0 CONSULTATION ISSUES

3.1 Consultation issue: *Value and use of spectrum for non-broadcasting services*

In light of the availability of UHF spectrum for DTT and other digital broadcasting services provided for in the Region 3 allocations, it is appropriate to consider the potential uses of digital dividend spectrum for non-broadcasting uses and the value of such services to PNG citizens, consumers and the PNG digital economy. In this regard, the industry, could yield high levels of value but have quite different specific requirements for digital dividend radio spectrum.

3.1.1 Views regarding the value to PNG society, consumers and PNG's digital economy of non-broadcasting services

The UHF spectrum band is considered to be valuable spectrum due to its advantageous propagation characteristics. Such favorable propagation characteristics allow for wide area coverage, reasonable building penetration and high capacity bandwidth.

NICTA considers that digital electronic communications networks should not be restricted to carrying particular types of applications and services. However any spectrum options that may arise as part of the digital dividend plan may require NICTA to have regard to the new applications and services likely to arise.

In order to best inform its considerations regarding value of non-broadcasting services NICTA would welcome input on the potential levels of value, including any social value which may be produced for PNG consumers and citizens and PNG's digital economy, arising from non-broadcasting uses in the digital dividend spectrum.

KEY DECISION

Q. 1. What would you consider to be the levels of value and benefits, including any social value which may be produced for PNG consumers / citizens and PNG's digital economy arising from non-broadcasting uses of the digital dividend?

Q. 2. How in your view could various industry sectors, for example transport, healthcare, education or other public sector industries, benefit from utilizing digital dividend spectrum? Please include details of the potential spectrum requirements of the industry in your answer.

3.1.2 Views on applications and services likely to arise with non-broadcasting use of spectrum

NICTA must provide for the use of digital dividend spectrum on an equitable basis in the interests of PNG consumers. This will require a clear understanding of the needs of the digital economy as a whole by ensuring access to digital dividend services everywhere in the country.

To gain a deeper understanding of the spectrum requirements associated with non-broadcasting use of spectrum, NICTA would value input from respondents on the following key issues:

- types of applications and services envisaged;
- possible spectrum requirements for such applications and services;
- timeframes for making available rights of use to digital dividend spectrum; and
- the potential levels of competition which could result whether in existing or new products and services markets.

KEY DECISION

Q. 3. Please outline your views regarding (i) the types of applications and services which you consider the digital dividend should be used for; (ii) possible spectrum requirements of those applications; (iii) timeframes for making available rights of use for digital dividend spectrum; and (iv) the potential levels of competition which may result in existing or new products and services markets.

Q. 4. Would you consider there to be other key issues which should be considered in terms of gaining a deeper understanding of the spectrum requirements of new applications and services? If so, what are they and please elaborate?

3.2 Consultation issue: *Mixed approach to spectrum allocation in the UHF band*

It has been reported that the majority of benefits from broadcasting associated with the digital dividend come from the migration of existing analogue services to high definition digital and that assigning additional spectrum to broadcasting yields decreasing overall benefits. There is some analysis that also maintain that the economic value of combining broadcasting and other applications in the band in a mixed approach was greater than that of broadcasting alone as, following the migration of existing analogue services to digital, the incremental value of using part of the spectrum for non broadcasting services was greater than that of using it for broadcasting only. It therefore considered that a "mixed approach", whereby spectrum would be assigned to both broadcasting and other services rather than for one use only, would be central to PNG's ability to achieve greater benefit from its digital dividend.

NICTA wishes to obtain the views of stakeholders on the argument that a mixed approach would yield a better economic return than a pure broadcasting approach and whether the concept of a mixed approach to spectrum allocation would be appropriate for PNG's digital dividend.

KEY DISCUSSION

Q. 5. In light of your views on non-broadcasting services, do you consider that a mixed approach to spectrum allocation in the UHF spectrum band should be adopted? Please provide reasons for your view?

3.3 Consultation issue: *Frequency harmonization issues*

Two main issues are relevant in configuring the frequency boundaries of the DDS for spectrum licensing;

- the requirement for any necessary guard bands or a mid-band duplex gap on the frequency boundaries
- the desirability of aligning the frequency boundaries with international arrangements

Guard bands and mid-band gap

It is considered that the most likely use for the DDS will be the delivery of mobile and other cellular telecommunications services to ubiquitous terminals. These services will require guard bands in order to avoid harmful interference to services in neighboring bands. Similarly, to enable duplex arrangements it will be necessary to set aside a mid-range gap.

Due to their primary purpose of providing buffers for potential interference, it is unlikely that spectrum in the guard bands and mid-band gap will be in high demand. In addition, the restrictions imposed on this spectrum are likely to preclude technology-flexible use by licensees. NICTA is therefore considering whether to exclude any guard bands and mid-band gap from the parts of the DDS that will be spectrum licensed.

International harmonization

In determining the frequency boundaries of the DDS, the potential for alignment with the international arrangements is an important consideration.

NICTA's preferred approach is to commence domestic planning in line with the harmonized ITU Region 3 plan while continuing to actively observe and participate in the AWF's current studies and the refined arrangements.

There are substantial advantages to PNG service providers and end users in arrangements that are internationally harmonized. The major advantage is the economies of scale that make manufacturing equipment for both users and providers cheaper. Harmonization may also facilitate user features such as global roaming. NICTA is therefore looking at international digital dividend developments in determining its configuration for the DDS.

The major digital dividend plans currently in existence are the European and US plans. Due to original arrangements for European broadcasting services, the European digital dividend (790 – 862 MHz) is in a substantially different frequency range to PNG, meaning there is only a limited overlap (790 – 806 MHz) between the European and PNG digital dividends. It is therefore unlikely for PNG to achieve significant advantages by attempting to partially align with this plan.

The US digital dividend (698 – 806 MHz) aligns more closely with the frequency range that will be available in PNG. However, NICTA considers that the plan implemented in the US is not an efficient use of spectrum because it contains interleaved small blocks of spectrum, requiring more guard bands than a single contiguous block thus making handset design more complex. It would also be undesirable to unilaterally implement a modified version of the US plan, since this would effectively constitute a unique digital dividend plan, contrary to the objective of harmonizing arrangements.

NICTA has therefore focused its efforts for the international harmonization on countries within ITU Region 3 (Asia-Pacific and parts of the Middle East). While many of these countries have not yet decided on the size and configuration of their digital dividend, the band under widest consideration (698 – 806 MHz) falls entirely within PNG's digital dividend (698-806 MHz). This band has been the subject of AWF discussions for harmonization of arrangements for frequency use since March 2008.

Area	Range of digital dividend	Advantages/Disadvantages
PNG	**698 – 806 MHz**	
Europe	790 - 862 MHz	Little overlap with PNG frequency range
United States	698 – 806 MHz	Overlapping frequency range but inefficient arrangements
Asia, Pacific and parts of the Middle East	698 -806 MHz	Similar frequency range and decision made by AWF on harmonized arrangements

Table 1: Summary of digital dividend arrangements

The meeting of the AWF held in September 2010 led to the adoption of harmonized arrangements for both paired and unpaired configurations. The paired arrangement will use conventional duplex and will consist of 2 x 45 MHz blocks with a mid-band gap of 10 MHz. For both the paired and unpaired arrangements there are provisions for guard bands of 5 MHz at the bottom and 3 MHz at the top of the band (see Figure 1).

As the DDS of PNG commences at 698 MHz, this arrangement provides a 12 MHz guard band with adjacent UHF television broadcasting services. While this decision has been taken, the AWF has agreed to undertake further studies to ensure the coexistence of mobile services with adjacent broadcasting services below the 698 MHz spectral boundary. The results of these studies were considered and a recommendation has been adopted in the November 2011meeting.

NICTA is also monitoring international developments for the spectrum above the 698 – 806 MHz band covered by the AWF plan. In particular, although the spectrum in the frequency band 806 – 820 MHz may form part of PNG's digital dividend, the AWF has not included this spectrum in the harmonized plan. As an international consensus is not yet available on the future of the band 806 – 820 MHz, NICTA is likely to allocate this spectrum separately from the rest of the digital dividend.

Timelines

ITU-R Recommendation M.1036 sets out recommended band plans for the IMT and IMT Advanced mobile technologies in different frequency bands[1]. The current draft of this Recommendation now includes the APT band plan.

Finalization of other parts of the Recommendation has occurred at the ITU-R Working Party 5D meeting held in July 2011. The Recommendation has been submitted to ITU-R Study Group 5 for consideration at its meeting in November 2011. Following the outcome of the meeting a recommendation will be submitted for further consideration by the Radiocommunication Assembly that will be held in January 2012.

[1] IMT (International Mobile Telecommunications) and IMT-Advanced are terms used to describe the capabilities of different generations of cellular mobile technologies.

Current Developments

Technical developments to date suggest that a dual duplexer will be required in handsets to cover the whole APT band, i.e. a single duplexer may not be able to cover the whole 45 MHz. This may restrict interoperability throughout the whole band, depending on handset design. Future duplexer designs may change or remove the presently envisaged restrictions.

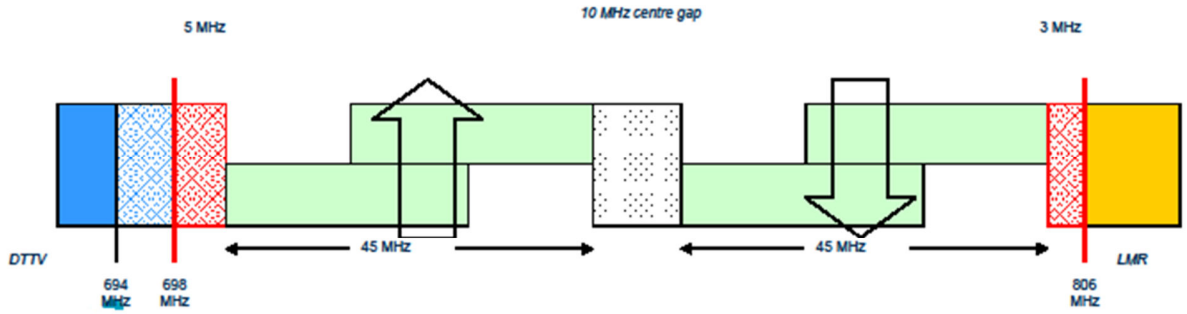

Figure 1: AWF proposed DDS band plan for Region 3

KEY DECISION

Q. 6. Should NICTA align its configuration of the DDS with the harmonized Region 3 (Asia-Pacific) band plan arrangements? If not, what configuration arrangements should NICTA put into place for the DDS?

Q. 7. What are the benefits and risks of NICTA's preferred approach? Is there evidence to support the stated benefits or risks?

3.4 Consultation issue: *Accelerating access to a sub-band*

Bearing in mind the typical lead times involved in bringing new services to market, NICTA wishes to ascertain whether there is interest in spectrum rights of use for some cleared spectrum prior to analogue switch-off of television services in the UHF band.

NICTA places importance on the non-fragmentation of the sub-band(s) but would welcome views on the impact, if any, of delayed access to this spectrum. NICTA also considers that the timing of licence awards for spectrum arising out of the digital dividend needs to be considered regardless of whether there would be early access. It therefore welcomes views on the timing of licence awards for DDS and whether there would be a consensus view regarding:

- The optimal timing of digital dividend licence awards (e.g. how far in advance of switch-off would be practicable); and

- The mechanisms for negotiating early access to spectrum being used by broadcasters (if this is what is desired by industry).

NICTA considers views on the following would also assist it in assessing the issue of access to the digital dividend (whether on an accelerated basis or not):

- Possible opportunity costs of delayed access;
- Benefits in terms of certainty in terms of accelerating access to digital dividend including holding early auctions;
- Time-table of analogue television switch-off in the band;
- Geographical location of potential cleared spectrum; and
- Risk of fragmentation of digital dividend radio spectrum.

KEY DECISION

Q. 8. Do you consider there to be merits in accelerating access to a digital dividend sub-band in PNG? If so, what considerations do you believe would need to be taken into account and how would they impact accelerating access to the digital dividend, for example (i) possible opportunity costs of delayed access; (ii) time-table for analogue television switch-off; (iii) geographic location of potential cleared spectrum bands; (iv) risk of fragmentation of digital dividend; and (v) any other risk/benefits which would need to be considered.

Q. 9. What would you consider to be an optimal time for holding awards for digital dividend spectrum? Please refer to the considerations outlined in question 1 above.

Q. 10. Please qualify your answers to questions 1 and 2 in terms of what benefits might accrue to PNG consumers and citizens and PNG's digital economy if access to a sub-band could be made available as soon as possible.

Q. 11. Please also provide views on the opportunity cost of delayed access to cleared spectrum and the possibility of negotiating early access directly with broadcasting spectrum users.

3.5 Consultation issue: *Spectrum rights arising from DDS*

NICTA considers that rights of use to spectrum comprising PNG's digital dividend should in the interest of promoting market mechanisms and lighter touch regulation generally be made available on a technology and service neutral basis.

KEY DISCUSSION

Q. 12. Do you consider that service and technology neutrality should generally be a key principle for spectrum rights of use arising from the digital dividend? Please provide reasons for your view.

3.6 Consultation issue: *Allocating Rights to Use the 700 MHz Band*

Once a band plan has been selected, rights to use the spectrum need to be allocated to users, using an appropriate allocation method.

3.6.1 Current Spectrum Allocation Policies

Current policies for the allocation of spectrum that is suitable for commercial use recognize that investment certainty is best achieved by allocating exclusive long-term rights. The Act allows for allocation of spectrum rights for periods between 5 years or up to 15 years.

In addition, acquisition and/or use of the relevant spectrum may be accompanied by competition safeguards, ensuring that there is competition in the market. NICTA may allocate spectrum by issuing a spectrum licence either on a market basis or an administrative basis that allows efficient spectrum allocation. In circumstances where there is high demand for commercial spectrum (a market), the process for allocating long-term rights needs to determine the users who value the spectrum the most, as this will lead to the most efficient allocation. NICTA may propose a marketing plan that may consists of an auction, tender, commercial negotiations which are typically used for market-based allocation.
In some cases spectrum in high demand is also required to meet public policy objectives that will not be delivered through normal commercial incentives. In these cases, it may be appropriate to reserve from the market allocation some spectrum for that purpose, or to place additional requirements on the use of the spectrum.
In determining market allocations and reserved allocations for a given band of spectrum, commercial and public interests need to be balanced in order to maximize the benefit that spectrum use provides to PNG.

3.6.2 Industry/Consumer Benefits

A key driver for allocation of the 700 MHz band will be additional spectrum capacity for mobile networks to meet increasing consumer demand for data and associated productivity gains for the economy.

A report by Cisco published in February 2011 found that global mobile data consumption increased 2.6-fold in 2010, and is forecast to increase a further 26-fold by 2015. This increasing demand is likely driven by the growth in penetration of smartphones and mobile data-enabled tablet and laptop devices. It can be expected

that some consumers will seek to replace fixed connections in favor of an entirely wireless solution.

3.6.3 Other Public Policy Objectives

One example of Government objectives which may suggest a reservation of spectrum in the 700 MHz band is ensuring adequate resources for radiocommunications used for law enforcement and public safety (termed "public protection and disaster relief (PPDR)" internationally). These are critical public safety communications operated by agencies such as the Police, and Fire and Ambulance services.

There is debate in Australia at present about whether a specific block of 700 MHz spectrum should be reserved to allow the construction of a stand-alone PPDR mobile broadband network that does not rely on commercial infrastructure, or if the services could be delivered under a commercial arrangement with a mobile network operator. Similar issues will need to be considered in PNG.

KEY DECISION

Q. 13. Should spectrum in the 700 MHz band be reserved to meet particular objectives?

Q. 14. What objectives and what criteria should be used to judge how much spectrum needs to be reserved to meet them? Are there other ways of meeting the objectives other than setting aside spectrum?

3.6.4 Allocation Options and Timing

The Act allows NICTA to issue spectrum licences either on a market or administrative basis. NICTA would therefore have to determine the best available option, considering the factors that it views are beneficial to the circumstances presented.

Where NICTA proposes to allocate any spectrum on a market-based allocation, a marketing plan must be prepared which requires a public consultation process in accordance with the Act. The market-based allocations may be made in the form of an auction, tender, commercial negotiations or market-based allocation processes.

If auction is selected as the most appropriate method for a market-based allocation, decisions will be required about the size of the blocks to be auctioned, as well as the type of auction. An auction process would need to be designed accordingly as a marketing plan.

As the spectrum will be available nationwide from an agreed date (and potentially earlier in specific areas), NICTA considers that an allocation process would ideally take place in 2012 to enable band planning. However, finalizing the band plan will be a critical factor for determining the allocation process and timing. This in turn depends on

international uptake of the various frequency plans and corresponding availability of devices for those frequency ranges.

Example - Allocation Considerations for the APT Band Plan
The preferred APT band plan would provide 45 MHz paired able to be allocated for mobile FDD-LTE usage. NICTA would need to consider the appropriate block size. FDD-LTE has been designed to operate with carrier sizes of 1.4, 3, 5, 10, 15, and 20 MHz bandwidths.

NICTA would also need to consider whether blocks should be offered at auction paired or unpaired, and whether the 10 MHz centre gap should also be offered for sale, and what it could best be used for.

KEY DECISION

Q. 15. For both market-based and administrative-based allocations, when is the best time to allocate spectrum rights to users? What allocation method will deliver the best outcomes?

3.7 Consultation issue: *Competition Safeguards*

The Act is not explicit on competition issues related to spectrum rights, although it is framed to promote fair competition as per s2(a)(ii) and the same principle is captured in the Radio Spectrum Regulation. To some extent, both the Act and ICCC Act cater for protection against an entity taking advantage of market power through spectrum ownership.

It can be useful to apply policies on the acquisition of spectrum to support a competitive allocation. For instance, the Government may determine that the provision of the Act may not be sufficient to promote competition in the 4G cellular market because the market was still emerging and the acquisition of spectrum was fundamental to how competition would develop.

3.7.1 Types of Safeguards

Acquisition Caps
Acquisition caps set out a maximum amount of spectrum that any operator can hold or have an interest in. For example, in a hypothetical 2.1 GHz auction, a cap of 15 MHz paired may apply for a total band of 60 MHz paired, while in a 2.3/2.5 GHz auction, operators could not hold more than 40 MHz unpaired. However, assessing optimal market shares is difficult when the future market and final band plan and spectrum availability are unknown.

Implementation Requirements

Implementation requirements may specify that the spectrum must be used to provide a defined service within a set period of time, thereby preventing spectrum 'hoarding'. For example, mobile operators have rollout and coverage obligations.

KEY DECISIONS

Q. 16. Is there a need for competition safeguards in the allocation of the 700 MHz band? What should the safeguards look like?
One option could be for acquisition caps specific to the 700 MHz band. Alternatively, caps could be applied more generally to the amount of spectrum able to be used for mobile broadband, or to cellular technologies. This approach could allow mobile providers to specialize their holdings depending on the services they wish to provide.

Q. 17. Should there be rollout and coverage obligations? If so, to what extent and within which time frames?

3.8 Consultation issue: *Network Infrastructure Options*

Greater use of shared infrastructure with low barriers to network switching could produce better consumer and industry outcomes. It could also reduce the environmental effects of infrastructure which currently cause some community concern. The allocation of the 700 MHz band could be designed in a way to encourage these outcomes.

Options could include:

1. A single cell site infrastructure operated by a neutral party, with capacity leased on a dedicated or usage basis;

   - Competition in services, but not in coverage or infrastructure.

2. Co-masted sites (co-location), but with otherwise separate equipment;

   - Competition in services, coverage, and most infrastructure, with mandated or commercial roaming provisions.

3. Separate infrastructure largely as at present;

   - Competition in infrastructure, coverage and services, with mandated or commercial roaming provisions.

These options assume the implementation of the APT band plan, which would allow interoperability as far as technically feasible across the entire band, noting that this will be dependent on handset capability.

KEY DECISION

Q. 18. Are additional regulatory measures for network infrastructure for the 700 MHz band needed to promote the best industry, consumer and environment outcomes? What would be the best option and why?

3.9 Consultation issue: *Cost of Conversion*

With the clearing of the DDS, there is potential displacement of existing users (affected user) in the television broadcasting band (UHF Band V). The relocation will require NICTA to make available spare spectrum within the television bands for the migration of these users. To further facilitate the smooth migration, existing equipment (transmitters, synthesizers, filters, coupling units etc) need to be re-tuned or replaced which incurs cost to the affected user. NICTA does consider the impacts and believes some cost sharing method by both the affected and the DDS seekers should be decided and shared. This is only fair that some compensation is provided for the affected user to the expense of the DDS seeker on some agreed terms and conditions.

KEY DECISIONS

Q. 19. How can the users, public or Government assist in the relocation cost?

Q. 20. What would be the suitable mechanism used to relocate the affected spectrum user?