REGIONAL INITIATIVES – ASIA-PACIFIC

Wireless broadband masterplan
FOR THE INDEPENDENT STATE OF SAMOA

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Telecommunication Development Sector

Wireless broadband masterplan for the Independent State of Samoa

October 2012

The wireless broadband masterplan for the Independent State of Samoa has been prepared as part of the ITU wireless broadband masterplan project for countries in the Asia-Pacific region in conjunction with the Korean Communications Commission (KCC). ITU would like to thank the Korean Communications Commission for supporting the ITU wireless broadband master plan project for countries in the Asia-Pacific region and in particular for Samoa. The project objectives are to:

- carry out an assessment of existing policy and regulatory frameworks with a view to facilitate deployment of wireless broadband technologies taking into account convergence trends and provide recommendations for future requirement in selected pilot countries.

- demand side assessment and take up of applications, content and services that are envisaged by the users with wireless broadband in Asia-Pacific region in general and the four pilot countries in particular; and

- examine key policy and regulatory issues including but not limited to licensing, spectrum access/interconnection, deployment of new technologies, rollout out obligations, incentive based regulation, infrastructure sharing, universal service obligations etc. in each of the selected pilot countries and provide concrete recommendations to promote broadband wireless services vis-à-vis identified national priorities and international best practices.

This report was prepared by ITU experts Mr Scott W Minehane and Mr Rajesh Mehrotra with extensive input from the ITU Regional Office for Asia and the Pacific in Bangkok, Thailand, and Mr Kikwon Kim. ITU gratefully acknowledges the assistance of Mr Tuloa Fetufou Aiono and the Ministry of Communications and IT, Samoa, as well as the assistance of Mr Gordon Toy and the staff of Windsor Place Consulting in the preparation of this report.

Executive summary

This report provides an analysis of the current state of the Samoa broadband capability and provides recommendations for the development of an effective wireless broadband technology. It also considers key regulatory aspects for the provision of wireless broadband services throughout the country.

The Government of Samoa is committed to ensuring that all Samoans have access to effective wireless broadband services, and to encouraging a content-rich environment that will facilitate a growing online community. Samoa presents its own unique set of challenges in developing wireless broadband. Samoa is the smallest and most isolated of the four countries considered by ITU for the development of the masterplan project (the others being Myanmar, Nepal and Viet Nam). Samoa is a Pacific Island nation with a population of some 180 000 people. The country's policy requirements are therefore based predominantly on these factors.

The recommendations in this report are focused on achieving the maximum gains in terms of coverage, and on ensuring that the provision of fast and effective broadband services can be achieved in a short period of time. Key considerations in the Samoa wireless broadband masterplan include:

- the economic and social importance of broadband and its role in improving productivity and providing information and services;
- the structure of the Samoa telecommunication market and the current regulatory framework;
- broadband access targets and future spectrum requirements;
- key technologies, including GSM, W-CDMA/HSPA, WiMAX and LTE; and
- the need for international connectivity.

With these considerations in mind the masterplan reaches the following conclusions:

1. Given the abundance of spectrum relative to the country's requirements, Samoa has the luxury of having greater flexibility to manage spectrum allocation than required of more populous countries. Samoa is capable of providing high speed broadband to the entire population with its current mix of technologies such as W-CDMA/HSPA utilising spectrum below 1 GHz.
2. There is a need to ensure that operators are given the opportunity to utilise the most efficient technologies available in order to provide affordable services. The government is in a position to facilitate the early availability of the 700 MHz band in order to encourage the deployment of LTE technology.
3. It is recommended that the Office of the Regulator (OOTR) should continue to provide a high degree of spectrum availability for wireless broadband services. In the absence of real competitive tension, the focus ought be on the most effective means of pricing spectrum.
4. Greater high speed international connectivity needs to be secured by securing long term capacity on key cable systems such as Pacific Fibre.
5. The Government of Samoa could greatly encourage the development of new and existing content by using a range of tools, including education programmes, subsidies and government leadership.

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1. Introduction

1.1 Project background

Based on an objective assessment of needs and priority, the Independent State of Samoa was one of the four countries (the others being, Myanmar, Nepal and Viet Nam) selected by the International Telecommunication Union (ITU) in which ITU developed national pilot wireless broadband masterplans. The ITU Guidelines for the preparation of national wireless broadband masterplans for the Asia Pacific region provides the reference framework for the development of a national wireless broadband development. It was used extensively in the development of this report.

As a Pacific-island microstate, Samoa is an ideal candidate for the wireless broadband masterplan. Its underdeveloped fixed-line infrastructure, its relative isolation and its topology mean that in order for it to reap the full benefits of economic integration and trade with its larger regional neighbours such as Australia and New Zealand, it must harness the full benefits and offerings arising from the use of converged ICT services. It can do this quickly through wireless broadband infrastructure developed via an achievable and transparent framework.

As such this masterplan forms an important input into the broader policies and strategies of the government that address the digital divide in Samoa and develop the implementation plans to propel the nation into an advanced ICT economy. These policies are being developed by the Ministry of Communication and Information Technology (MCIT).

1.2 Structure of the masterplan

This masterplan comprises six main topics of analysis and recommendations:

(i) broadband: global and regional context (section 2);

(ii) Samoa and the wireless broadband market (section 3);

(iii) medium to long term goals to optimise wireless broadband for Samoa (section 4);

(iv) key considerations of the masterplan (section 5);

(v) facilitating applications and content (section 6);

(vi) conclusions, recommendations and roadmap (section 7).

1.3 Consistency with national broadband policy

The purpose of the masterplan is to provide recommendations for the development and growth of Samoa's wireless broadband services, and to ensure that the country experiences the maximum gains from the suite of technologies available. The Government of Samoa and the Office of the Regulator (OOTR) have already begun the process of expanding the country's broadband capability, and this work will continue with the publication of the Masterplan.

The government's National Broadband Policy 2012 (see Appendix A) outlines the country's policy framework and objectives in accordance with international experience and the country's own specific requirements. ITU experts assisted with the formulation of this policy. The recommendations of this masterplan are, as much as possible, consistent with the policy and aim to augment the policies that the government has already committed to. More information on the government National Broadband Policy is provided in section 4.1.

2. Broadband: Global and regional context

There is now almost a global consensus on the importance of broadband to a market's economic growth and the social interaction of citizens. The ability to access and provide data rich applications and content has become a pre-requisite for global trade and is fast becoming a necessary component of interaction between members of the public as well as government. While broadband connectivity is simply a means of accessing and providing data in as fast a manner as possible, its role has been identified as of high enough importance for it to warrant the characterisation of a 'human right'.[1]

Aside from the practical benefits of broadband, such as greatly enhanced ease of accessing and providing data-rich content, numerous studies have documented the positive relationship between broadband access and national prosperity. A World Bank study emphasised the importance of broadband penetration for developing economies having concluded that every 10 per cent increase in broadband penetration provides a 1.38 per cent increase in GDP.[2]

Likewise, other studies project a boost to Malaysian GDP by 2020 as part of the modelling of the impact of Malaysia's High Speed Broadband (HSBB) project[3] and that 10 per cent higher broadband penetration in a specific year is correlated with 1.5 per cent greater labour productivity growth over the following five years.'[4]

Broadband networks are able to deliver a host of applications and services that other mediums are simply not capable of. These services include:

- e-commerce;
- e-banking;
- e-government;
- e-education;
- paper-less work;
- improved education / training; and
- telemedicine / e-health.

Given these factors, broadband and improving broadband is now an international focus of development work including that done by the United Nations (UN),[5] ITU and UNESCO.[6] This has resulted in broadband targets being incorporated within the UN Millennium Development Goals prompting the creation of the Broadband Commission as a joint undertaking of ITU and UNESCO.

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1 www.broadbandcommission.org/Documents/Broadband_Challenge.pdf

2 Christine Zhen-Wei Qiang and Carlo M. Rossotto with Kaoru Kimura, Chapter 3 Economic Impacts of Broadband, in World Bank, Information and Communication for Development 2009: Extending Reach and Increasing Impact (IC4D2009).

3 Windsor Place Consulting, A high level cost benefit analysis of Malaysia's broadband deployment, Melbourne, 17 December 2007

4 Booz & Company *Digital Highways: The Role of Governments in 21st Century Infrastructure* (2009)

5 See www.un.org

6 See www.unesco.org

2.1 UN Millennium Development Goals

The UN Millennium Development Goals (MDGs) comprises of eight specific targets for developing nations to achieve by 2015.[7] Telecommunications and broadband fall with the eighth goal of developing a global partnership for development with sub-target 8(F) stating that 'In cooperation with the private sector, make available the benefits of new technologies, especially information and communications'.

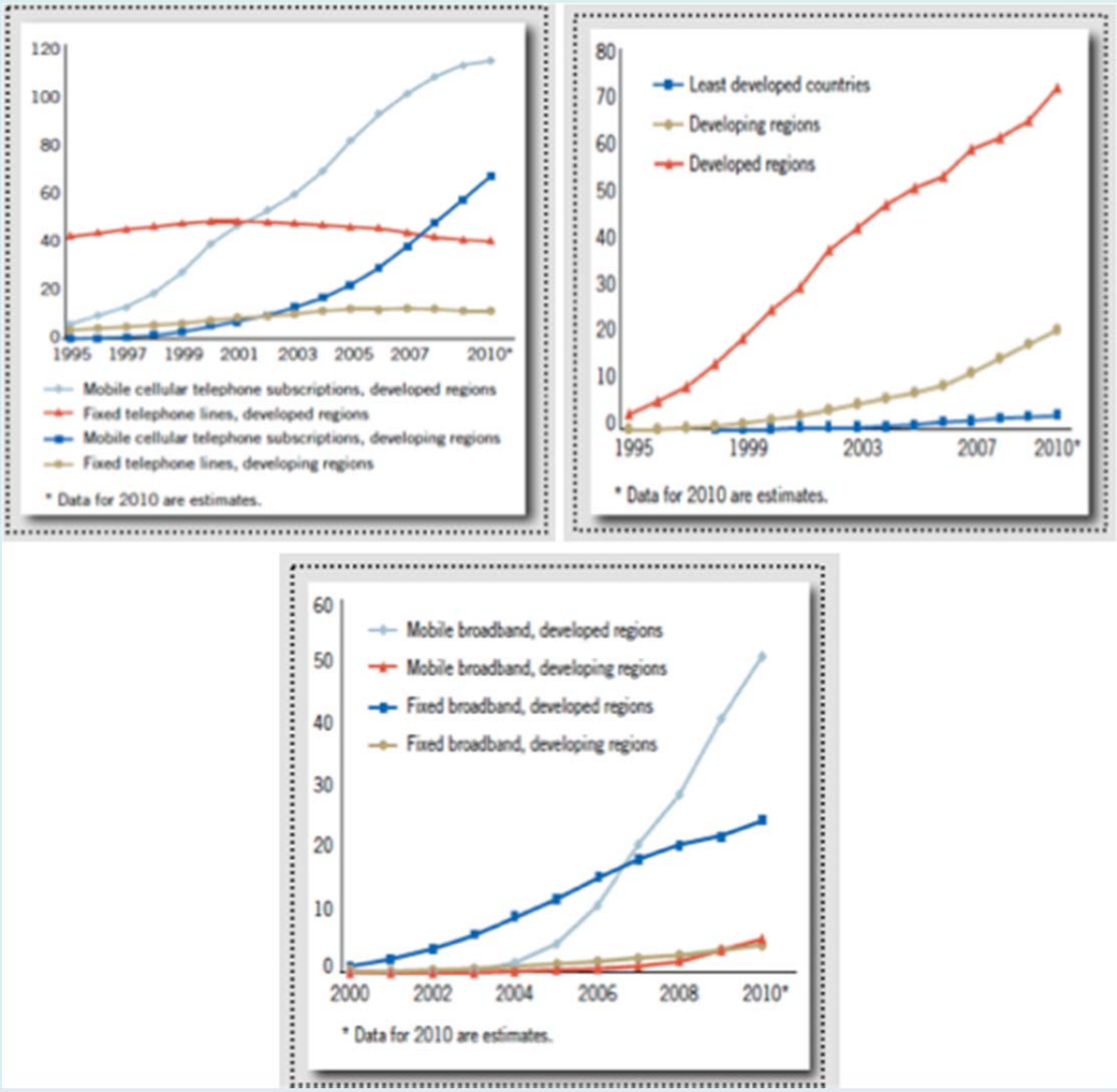
Measured against the agreed indicators by the number of fixed telephones, mobile cellular subscriptions and the number of Internet users per 100 population, significant progress has been made globally (see Figure 1).

This masterplan is consistent with target 8F[8] of the MDGs and following the successful achievement of the masterplan goals, will be a significant factor in reducing the digital divide between Samoa and its more developed Asia-Pacific counterparts.

[7] These are namely: (1) Eradicate extreme poverty and hunger; (2) Achieve universal primary education; (3) Promote gender equality and empower women; (4) Reduce child mortality; (5) Improve maternal health; (6) Combat HIV / AID, malaria and other diseases; (7) Ensure environmental sustainability; and (8) Develop a global partnership for development.

[8] www.itu.int/ITU-D/ict/mdg/goals.html#g8

Figure 1: Fixed telephone lines and mobile cellular subscriptions - Internet users - broadband subscriptions (per 100 inhabitants)



Source: UN Millennium Development Goals Report, telecommunications indicators 2011[9]

2.2 Broadband Commission

Until recently, broadband policy was largely the domain of national governments and the focus of regional initiatives. However, the creation of the Broadband Commission for Digital Development in May 2010, a joint effort by ITU and UNESCO, is a clear evidence of shifting paradigm. The Commission was set up with the aim of engaging in 'advocacy and high-level thought leadership' to demonstrate that broadband networks:

- are basic infrastructure in a modern society – just like roads, electricity or water;
- are uniquely powerful tools for accelerating progress towards the MDGs;

[9] http://mdgs.un.org/unsd/mdg/News.aspx?ArticleId=59

- are remarkably cost-effective and offer impressive returns-on-investment (ROI) in both developed and developing economies alike;
- underpin all industrial sectors and are increasingly the foundation of public services and social progress;
- need to be promoted by governments in joint partnership with industry, in order to reap the full benefits of broadband networks and services.'[10]

Within the context of the masterplan, these conclusions and regulatory considerations are important as they provide both guidance and clarity. With respect to these considerations, the masterplan will be consistent with the focus of the Commission and its recommendations and policies.

The Commission debated the possible way of defining broadband and conceded that delineations such as upstream / downstream speeds are arguably inadequate due to rapid technological advances. Instead, they believed that focus on core concepts, such as *always-on* service (the user isn't required to make a new connection to the server each time) and *high capacity* (capable of carrying lots of data per second) would be preferred alternatives as they would not be as constraining nor subject to frequent revision.[11]

In the report, *Broadband: A Platform for Progress*[12], the Commission discussed a range of issues for governments to consider when deploying broadband networks. Conclusions that emerged from the report included, *inter alia*:

- infrastructure policy should be goal oriented and not focused on particular technologies;
- pricing or other access barriers should be removed;
- associations between infrastructure and a type of service should be avoided;
- infrastructure sharing is beneficial and should be encouraged; and
- fibre-optic networks are likely the preferred backhaul network solution, but depending on national geography / topology, may need to be complimented by wireless infrastructure.[13]

The report identifies a number of considerations to be taken into account by governments and regulators in developing economies that are grappling with the challenges associated with increased broadband access. There are a number of areas in this regard that are of particular relevance to this wireless broadband masterplan. These are summarised in Table 1.

The Commission endorsed the 'Broadband Challenge' in October 2011 whereby broadband connectivity was recognised as a human right and a crucial driving force behind economic growth. Importantly, governments were urged to adopt policy platforms that would facilitate broadband network deployment and service uptake. Member States were advised against retaining policies that would limit market entry and tax ICT services unnecessarily. Governments were encouraged to promote coordinated standards of interoperability and achieve maximum utility for scarce radio spectrum. It was seen as necessary to review existing regulatory and legislative frameworks, many of which reflect outmoded 20th century models and ensure that information flows are free and unhindered.[14]

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[10] See www.broadbandcommission.org

[11] Refer to www.broadbandcommission.org/Reports/Report_2_Executive_Summary.pdf

[12] www.broadbandcommission.org/Reports/Report_2.pdf

[13] *Ibid.*

[14] www.broadbandcommission.org/Documents/Broadband_Challenge.pdf

Table 1: Broadband challenges

No.	Issue	Details
1.	Attracting investment in broadband	This may include: • reduce investment / regulatory barriers; • encourage infrastructure sharing; • introduce innovative spectrum management mechanisms; and • amend regulatory frameworks to eliminate discriminatory rules that favour one company / industry over another.
2.	Addressing persistent gaps in the market	It is recognised that in cases where infrastructure deployment is highly expensive or impractical, the Government may need to be proactive in addressing bottlenecks. Authorities also need to maintain cognisance over possible adverse implications of hyper-competition, which may dampen sector investment. The universal service fund may pose challenges as changing definitions of services may require the government to address issues of which entities are required to contribute.
3.	Funding broadband	The Commission stated that true access gap (a shortfall between market-based measures and universal access) may need to be addressed in circumstances where there is evidence that regulatory incentives and lower-cost network alternatives are not enough to encourage supply in certain instances. Government may address these issues vis-à-vis remedies relating to issuing special licences in defined locations, funding local community initiatives, providing direct financial support to operators or mandating the deployment of broadband access networks. [15]

The Commission adopted a set of four broadband targets to be achieved by 2015:

i. all countries should have a national broadband plan / strategy or include broadband in their universal access / service definitions;

ii. entry level broadband services should be made affordable in developing countries through adequate regulation and market forces (for example, amounting to less than 5 per cent of average monthly income).;

iii. forty per cent of households in developing countries should have Internet access;

iv. Internet user penetration should reach 60 per cent worldwide, 50 per cent in developing countries and 15 per cent in least developed countries.

It should be noted that ITU is optimistic that all of these targets will be either met or exceeded by 2015. In order to reap the benefits of wireless broadband, Samoa must strive to meet and exceed these aspirational targets.

2.3 Other global developmental trends in broadband policy and regulation

In recent years, several key trends have emerged with respect to broadband policy and regulation. Governments around the globe have become increasingly cognisant about the importance of high-speed networks and their link to economic growth. As a consequence, there has been a substantial increase in government participation and intervention within the ICT sector. Broadly speaking, this intervention consists of:

- the encouragement of private sector participation via improved access arrangements, simplified licensing and deregulation;

[15] *Ibid*

- the development of national broadband plans / policies;
- financial support in the form of subsidies, tax breaks, grants and loan assistance;
- expanding the scope of universal service obligations (USO) to encompass broadband services;
- updating regulatory regimes to take into account the convergence of media and communications; and
- redirecting universal service funds (USFs) to enable broadband in rural / isolated / low-income areas.

In addition, regulators are coming to terms with the need to prepare for a material increase in the demand for scarce spectrum. Global spectrum management arrangements are evolving to meet changing patterns of use and demand for spectrum. Following a trend that began in Australia, Japan, the United States, and New Zealand, steps are being taken to reduce the involvement of government and let market mechanisms govern the allocation and destination of use of spectrum including:

- the allocation of spectrum through price-based selection processes – especially auctions – or alternative proxy methods to impose apparatus charges which reflect the value of the spectrum;
- the owners of spectrum rights are increasingly free to decide which technology to use and which services to provide with it;
- the introduction of spectrum trading in some markets (in line with spectrum liberalisation) is allowing spectrum rights to be allocated via market mechanisms to the users that value it the most; and
- the increasing prevalence of spectrum leasing arrangements which allows a spectrum owner to sub-lease part or all of their allocated frequencies.

3. Samoa and the wireless broadband market

3.1 Country overview

With approximately 183 000 inhabitants, Samoa is comprised of two main islands with a total of 2 821 sq. km land area in the Pacific Polynesian region as shown in Figure 2. Three quarters of the nation's population resides on the island of Upolu. Samoa's interior is mountainous and hilly, with typically flat coastlines.

Figure 2: Samoa geography

Source: http://travelworld.thecheers.org/Samoa

In the past, the Samoa economy has typically been dependent on foreign aid, agriculture and fishing. Services are growing in importance, with tourism now accounting for 25 per cent of GDP. In September 2009, a devastating tsunami hit the Upolu south coast destroying some 20 villages, causing a significant loss of life and damage estimated by the Samoa Government at approximately USD 150 million. In 2011, GDP was estimated at USD 1 112 billion, having grown 2 per cent for the year. GDP per capita is approximately USD 6 000.

Unemployment is an estimated 5 per cent of a total labour force of 66 000. Significant industries include auto parts, building materials and food processing. Samoa's agricultural sector is largely geared towards tropical fruits (coconuts and bananas) as well as coffee. American Samoa and Australia are the nation's largest export partners, comprising of 45.4 and 30.1 per cent of total exports, respectively. Typical exports include fish, coconut, beer, clothing and automotive parts.

Samoa is a net importer, with typical commodities comprising of foodstuffs, machinery / equipment and industrial supplies. Its three largest import partners include New Zealand, China, Fiji, and Singapore.

3.2 Current market structure and competition

At present, according to the ITU *Measuring the Information Society Report 2011*, the broadband market in Samoa is underdeveloped and penetration is low. Table 2 details the leading indicators on the Samoa telecommunication sector.

Table 2: Samoa telecommunication indicators

INDICATORS	KEY STATISTICS
Total number of mobile phone subscribers	167 400
Mobile teledensity	91.4 per cent
Total number of fixed subscribers	35 300
Fixed teledensity*	19.3 per cent
Internet users	7 per cent
Fixed broadband subscriptions per 100 inhabitants	0.11 per cent
International internet bandwidth (Mbit/s)	135
International internet bandwidth (bps) per internet user	3 901

Source: ITU Statistics Yearbook 2011

Samoa currently uses a range of technologies to provide broadband services, namely, xDSL, GSM, W-CDMA (namely HSPA+), fibre, satellite and WiMAX.

There is over 90 per cent population coverage of GSM services in Samoa and recently the provision of wireless broadband services has been facilitated by releasing spectrum in the Extended GSM (e-GSM) band.[16] This has resulted in both mobile operators, namely Bluesky Samoa and Digicel offering HSPA+ and W-CDMA broadband services covering about 50 per cent of the population. Bluesky, along with other operators, offers lower speed EDGE services. However, prices for wireless data services from Bluesky Samoa and Digicell remain high.

WiMAX utilising the 2.3 GHz band with WiMAX technology is provided by CSL subsidiary, Zoom. Coverage extends to most of the Vaitele area and surrounding regions.

[16] From 880 to 890 and 925 to 935 MHz.

The competitiveness and efficiency of any broadband market is determined in part by its international connectivity. This is particularly pertinent for an isolated island nation such as Samoa, which requires external connectivity via satellite or submarine cable (or both) to transmit or access data externally. There is currently a submarine cable providing international connectivity to neighbouring Pacific islands, Hawaii and mainland United States.[17]

The Government of Samoa proposal, *Spectrum Plan for Mobile Broadband (GSM and e-GSM)*, as prepared by the OOTR, is attached as Appendix D.

3.3 Current retail market structure

There are two leading telecommunication operators in Samoa, Bluesky and Digicel as detailed in Box 1.

Box 1: Blue Sky and Digicell – Samoa's largest operators[18]

BlueSky Samoa, formerly known as SamoaTel, is the country's dominant provider of fixed services. The company is fully privately owned. Twenty-five per cent of its equity belongs to the Unit Trust of Samoa, the other 75 per cent by BlueSky Communications. BlueSky Communications, controlled by Latin America's eLandia Group, acquired BlueSky Samoa in early 2011 for USD 11 million. The company launched what it describes as 4G HSPA+, delivering speeds of up to 21 Mbit/s in December 2011.

Digicel Samoa, owned by the Digicel Group, is the dominant provider of mobile broadband services. It provides both pre-paid and post-paid plans, and networks cover the entire coastal areas of the country which is about 95 per cent of the population. Digicel Samoa launched its HSPA+ Services on, 16 March 2012.

According to responses to the wireless broadband survey in mid-2011, there are a total of five operators providing wireless broadband services in Samoa, in addition to GSM/W-CDMA, WiMAX and satellite.

3.4 Regulatory framework

The *Telecommunications Act 2005* governing telecommunications in Samoa, encompasses licensing and spectrum management to interconnection and the regulation of retail tariffs. The Act also established the Office of the Regulator (OOTR) in 2006. The Samoa Government is in the process of reviewing the existing legislation and regulations with a view to implement changes by 2020. Details of the legislative and regulatory instruments relevant to wireless broadband services in Samoa is provided in Appendix B. Below the key aspects of the regulatory framework are summarised.

3.4.1 Office of the Regulator (OOTR)[19]

The objective of the OOTR in Samoa is to establish a fair and unbiased regulatory and licensing environment to foster national and international investment in telecommunication services in the country.

[17] Additional opportunities to secure greater international connectivity may present themselves in the future and are likely to receive Government support.

[18] Company sources including http://investor.elandiagroup.com/sec.cfm

[19] www.regulator.gov.ws

The OOTR is responsible for protecting the interests of end-users of telecommunication services by ensuring fair and equitable competition in all areas of the telecommunication market.[20]

The OOTR is required to carry out the following key responsibilities:

- license telecommunication and broadcasting services;
- manage and licence radio spectrum usage;
- administer the national numbering plan;
- manage competition in the telecommunication sector;
- provide consumer protection services;
- approve equipment type;
- resolve telecommunication disputes; and
- promote telecommunication market development.

Further responsibilities, functions and powers of the Regulator are stated in the *Telecommunications Act 2005* as amended, the *Broadcasting Act 2010*, the *Postal Act 2010* and the *Electricity Act 2010*.

3.4.2 Licensing

The *Telecommunications Act* governs the licensing of operators in Samoa. The Act requires persons or organisations to hold a licence in order to operate a network or provide a telecommunication service. Individual licences are required for *inter alia* bandwidth services, including wireline and wireless broadband internet services. The *Telecommunications Licence Fee Regulations 2007* sets the fees for the application and renewal of licences. There is no specific category for broadband services or wireless broadband services.

3.4.3 Spectrum management

Management of spectrum is governed by Part V of the Act. The regulator is responsible for the management, allocation and assignment of frequencies in the radio spectrum, and has the power to make or amend rules for this purpose. The Radio Spectrum Fees Regulations 2007 sets out radio licence application and renewal fees pursuant to the Act.

3.4.4 Access and interconnection

Part VII of the Act governs interconnection and in particular provides a requirement for all service providers to enter into negotiations with other providers to maintain connection between networks and ensure access to facilities. Dominant service providers are required to maintain interconnection and must do so on no less favourable terms with charges based on cost.

3.4.5 Retail tariff regulation

Part VII of the Act regulates tariffs. Only dominant service providers are required to file with and obtain the approval of the OOTR on tariffs, rates and charges for provisioning of telecommunication services in the markets where they have been designated as dominant service providers. The dominant service providers are required to ensure that the tariffs for telecommunication service shall be based on the cost

[20] OOTR was established in 2006 under the *Telecommunications Act 2005* to provide regulatory services for the telecommunication sector in Samoa. However, the Broadcasting and Postal Services Acts 2010 were recently approved by Parliament, which also provide regulatory framework for broadcasting and postal sectors in Samoa. Currently, the Office of the Regulator comprises a staff complement of eleven (11) persons. In addition to the position of Regulator, there are four (4) divisions – Regulatory and Consumer Affairs Division, Spectrum and Technical Services. Legal Division, Division and Administration and Accounting Division.

of efficient service provision and not contain excessive charges. The regulator has the power to issue an order on tariff regulation applicable to all services providers relating to price cap regulation, rate rebalancing and other forms of cost-based regulation.

3.4.6 Competition

Under Part V of the Act, every service provider whose gross revenues in a specific telecommunication market constitutes 40 per cent or more of the total gross revenues of all service providers in that market shall be presumed to be a dominant service provider. The Act prohibits anti-competitive conduct and sets out actions which are considered an abuse of a dominant position.

3.4.7 Universal service obligation

Part IV of the Act empowers the OOTR to propose, with ministerial approval, policies and principles relating to the provision of universal service. The Act provides for the establishment of a universal access fund, and empowers the minister to call for individual licensees to contribute.

3.5 Spectrum utilisation

One of the key responsibilities of the OOTR is to manage and license radio spectrum usage. Consequently, the OOTR is tasked with frequency planning, formulation of the National Frequency Allocation Plan (NFAP), channelling plans as per the ITU-R Recommendations, frequency assignments and issue of radio licences, monitoring of the radio spectrum to check adherence with licensed parameters and also for physical inspection of licensed radio communication hardware and international frequency coordination.

With the proliferation of new technologies, the development of a National Spectrum Plan is essential to provide the basis for development and spectrum utilisation activities in the country amongst the user. OOTR is currently in the process of consulting on a newly developed National Spectrum Plan scheduled to be finalised in the third quarter of 2012.

The Spectrum Management Policy[21] and Frequency Allocation Table[22] have both been approved by Cabinet and are currently being implemented.

The current key spectrum bands for wireless services and hence wireless broadband are the 900 and 2300 MHz bands.

3.6 Key regulatory challenges

There are two key challenges which are worthwhile to highlight in this masterplan:

- ***Infrastructure sharing.*** In order to ensure the most efficient network deployment, affordable services and to reduce unsightly masts and antenna, it is critical for Samoa to have a quality infrastructure policy. The *Co-Location and Infrastructure Sharing Policy and Guidelines* were approved by Cabinet in March 2012. This policy and guidelines represents an important step towards limiting duplication and reducing infrastructure requirements.
- ***Technology neutrality and flexible rights of spectrum use.*** Flexible rights for the spectrum use should be actively considered for key allocations by suitably incorporating spectrum trading and technology neutrality. In order to facilitate fair competition between technologies, the OOTR should strive, to the extent possible, to make their regulations, licensing requirements and regulatory fees technically neutral. The key to technology neutrality is not to pick 'winning' technologies and thus forego the possibility that a provider could implement more cost-effective technologies, either now or later.

[21] See www.regulator.gov.ws/files/documents/spectrum.pdf

[22] See www.regulator.gov.ws/files/documents/Allocation-Table.pdf

Digital dividend spectrum can be secured by not clearly the 700 MHz band which is currently used for rebroadcasting and linking. Fortunately, Samoa does not use this band as a primary broadcasting band.

4. Medium to long term goals to optimise wireless broadband for Samoa

4.1 'Better Connections to the World' – the Samoa National Broadband Plan

The Government of Samoa is committed to continuing the growth already seen in the country's telephone penetration and to facilitating the expansion of broadband services for businesses, households and communities. The National Broadband Plan outlines the policy approach adopted by the Government of Samoa and the Ministry of Communications and Information Technology (MCIT), and aims to maximise access with the optimal mix of technologies. OOTR has also developed an Universal Access Policy which *inter alia* aims at maximising access to broadband technology.

The National Broadband Policy has been developed by the government with assistance from ITU as part of this project and details policies tailored to Samoa in light of international experience and best practice. The policy recognises that access to broadband services is essential for the continued growth of the Samoa economy, with investment in broadband technology shown to deliver the greatest benefits in terms of GDP and national productivity. The Samoa Government has identified increased broadband access as being essential to securing the economic and social priorities of the nation.

The plan covers future allocations of spectrum, which will focus on the 700 MHz 'digital dividend' band for the implementation of LTE services, along with the 900 MHz band which will take advantage of the country's existing GSM infrastructure. Other issues such as international connectivity, the facilitation of extra backhaul capacity and infrastructure sharing are also discussed in this document.

4.2 Broadband access targets

The Samoa Government has adopted ambitious targets for broadband access as detailed in Table 3. The following adoption targets have been set for 2015 and 2020 in consultation with the Government.

Table 3: Wireless broadband adoption targets, 2015 and 2020 (%)

	2015			2020	
	Households	**Business**		**Households**	**Business**
Urban	11-20	~30	**Urban**	31-40	~60
Rural	0-10	11-20	**Rural**	21-30	~40

Source: MCIT, 2011

Along with the broad targets outlined above, the government also has a number of specific targets to be achieved over the next five-years. These include:

- *Community Access*: Communities over 200 people to have access to broadband services;
- *Individual Access*: 20 per cent of Samoans are to have access to broadband of 256 Kbit/s, with 60 per cent having access over 2 Mbit/s speeds;
- *Community Broadband Centres*: All Samoan communities with broadband access shall have the option to establish a Community Broadband Centre;
- *School Access*: 100 per cent of all schools to have broadband access (as part of the Schoolnet project); and
- *Government Access*: The proportion of transactions between citizens and government are able to be conducted online.

Given the state of existing ICT infrastructure and current penetration levels, these targets are demanding and will require the commitment of significant resources and collaboration between stakeholders.

4.3 Future spectrum supply / demand

Effective management of scarce spectrum forms an essential aspect of the Samoa plan to greatly increase broadband penetration using wireless technologies.

The OOTR plans to allocate up to 100 MHz of additional spectrum in the next few years below 1 GHz, depending on demand to facilitate wireless broadband services. This additional spectrum will firstly be allocated in the 900 MHz band (this was done in late 2011) and then in the 700 MHz 'digital dividend' band for LTE services. The latter is to take account of, if possible, the *Common Position in Asia APT Wireless Forum* (recently renamed AWG) so as to access cheaper equipment and devices, and to secure international roaming.

In the OOTR paper titled 'Spectrum Management Policy & Guidelines',[23] a proposed plan for the 700 MHz band was discussed. The OOTR expressed its desire to devote this band for wireless access services on a technology-neutral basis. In particular, the 698-763 MHz and 776-794 MHz bands were to be allocated for commercial services and digital TV.

Allocating additional spectrum for wireless broadband is a priority due to the need to generate certainty and encourage deployment. The government and the OOTR are currently in the process of implementing this policy.[24]

While globally the number of wireless broadband subscribers exceeds the number of fixed broadband subscribers (and will do so in Samoa) and will continue on an explosive growth path based on current growth estimates, the pressures on spectrum are not profound given the relatively small and distributed population. While it is arguable, under any scenario based on the above national broadband targets that the 900 MHz spectrum[25] would be sufficient to support wireless broadband users, two other factors are important. The first is to reduce the costs of providing that wireless broadband services and the second is to facilitate device compatibility and roaming.

In such circumstances, the allocation of 700 MHz for wireless broadband services (and LTE and its successor LTE-A) is critical. Operators, the OOTR and the government may also wish to consider the allocation of spectrum in Apia and perhaps the tourist areas of 1800 MHz for LTE services (this band looks like being the global roaming band for LTE) and/or 2100 MHz for additional 3G network capacity.

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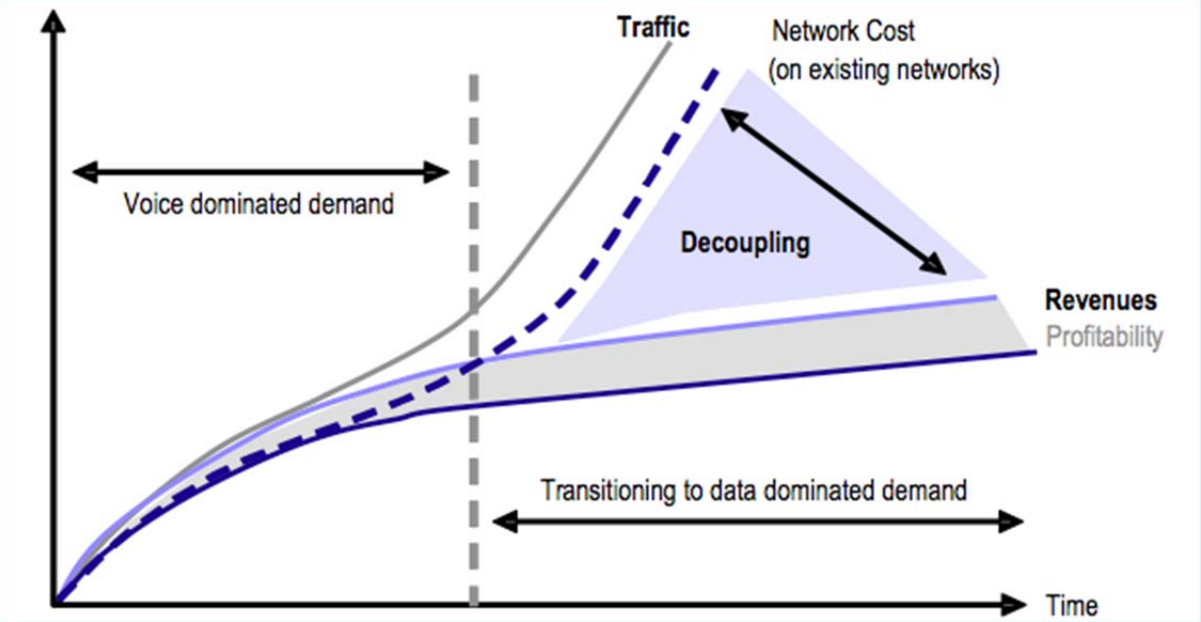
[23] See www.regulator.gov.ws/files/documents/spectrum.pdf page 11

[24] Consideration should be given to assigning some lower frequencies to existing 2.3 GHz operators as well as the major two operators.

[25] Especially if , if WCMDA Release 9 with DC-HSPA+ and successor technologies were utilised.

As the industry embraces mobile broadband, data demand on the network is increasing rapidly, and operators need to find a cost efficient way to continue providing the service. A ten-fold increase in mobile data traffic could translate to a less than 10 per cent increase in revenue for operators. LTE serves as the common migration path for all existing mobile standards to address the cost challenge (see Figure 3).

Figure 3: Benefits of LTE: decoupling revenue and traffic



Source: UBS, 2009[26]

5. Key considerations for the wireless broadband masterplan

5.1 Enabling the wireless broadband end-to-end ecosystem

The key elements of wireless broadband masterplan are to enable the end-to-end eco-system which provides connectivity and content to consumers (Figure 4). While the focus of the masterplan is necessarily on the customer access networks, this masterplan examines five key factors which are critical in facilitating the broadband penetration in Samoa. These are namely:

(i) policy and regulatory aspects (see section 5.2);

(ii) technology aspects (see section 5.3);

(iii) spectrum management aspects (see section 5.4);

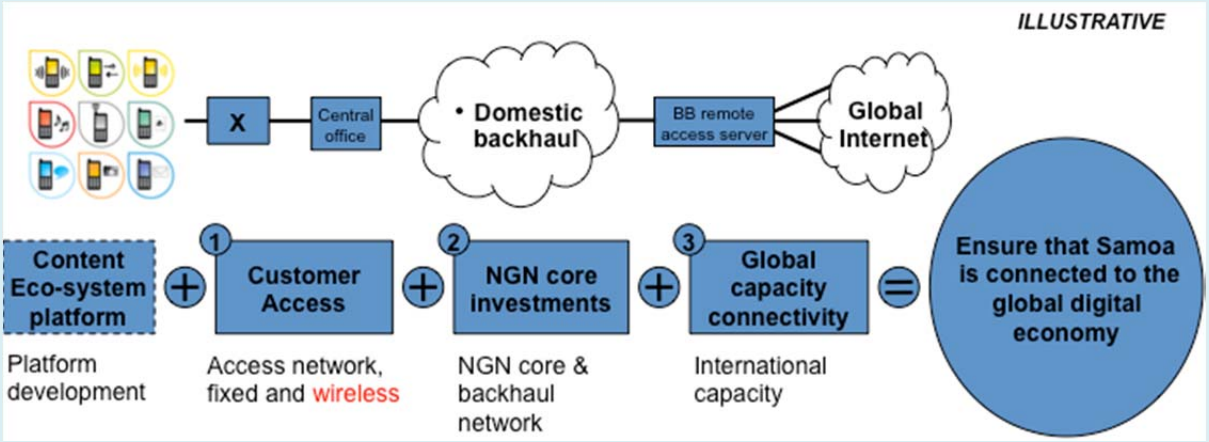
(iv) International connectivity (see section 5.5);

(v) facilitating content and applications (See section 6).

Each of these will be examined in turn below.

[26] UBS Investment Research, Asia Telecom Sector: LTE Implications for Asian Mobile operators, 25 June 2009.

Figure 4: End-to-end broadband connectivity



Source: Author

5.2 Policy and regulatory aspects

The policy and regulatory aspects are covered in detail elsewhere in this masterplan (see for example Appendix B). For the most part, following the endorsement of the National Broadband Policy and subject to promulgation of quality infrastructure sharing guidelines, there are few omissions in the Samoa regulatory framework.

Going forward the government and the OOTR need to remain focused on providing a high degree of spectrum availability for wireless broadband services especially in relation to spectrum below 1 GHz. In the case of Samoa, price based allocation methodologies (e.g. auctions) for the use of spectrum are unlikely to yield any positive results for government revenue due to an abundance of spectrum relative to the country's requirements. There is also a lack of competitive tension, with two telecommunication firms servicing a population of approximately 180 000 people, which means it would be very difficult to find a price for spectrum under market conditions created by an auction.

Spectrum pricing could then be set to cost recovery of the OOTR and/or by way of benchmarking.

This masterplan therefore suggests that the priority for the Samoa Government should be to ensure that all firms that are able to provide wireless broadband services are given the opportunity to do so. Therefore, the best course of action would be to determine the capabilities of the existing firms in the market and allocate spectrum based on their ability to fulfil the specified service obligations and technological requirements.

5.3 Technology aspects

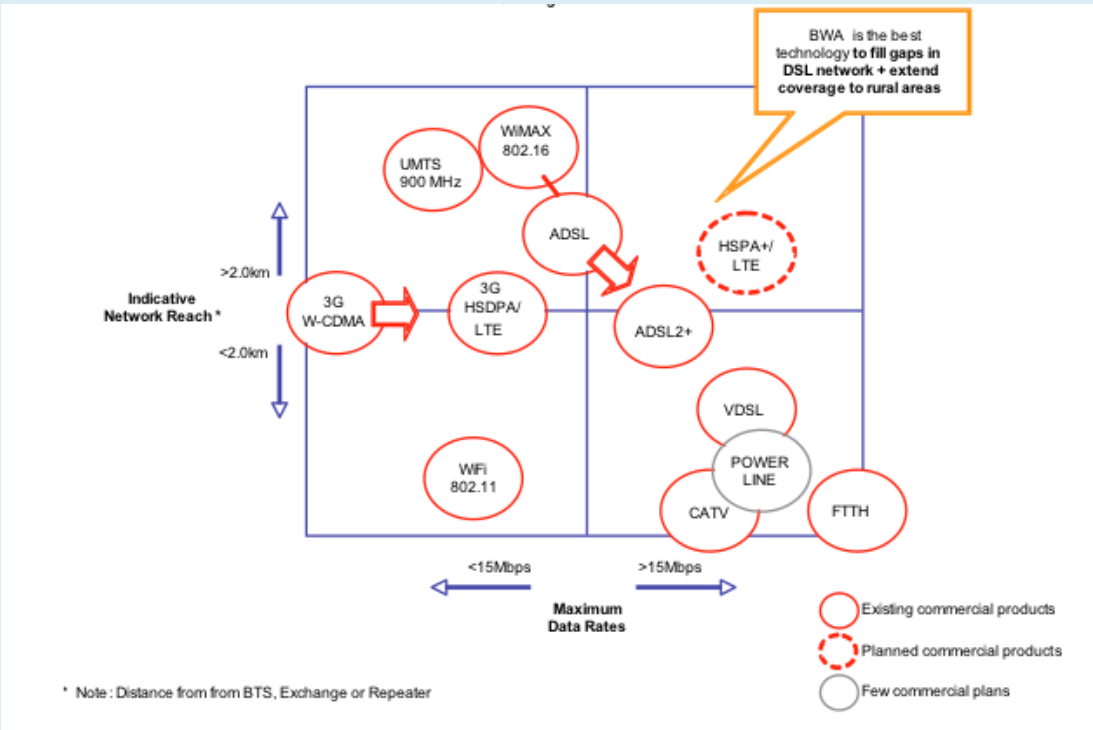
5.3.1 Introduction

While the ITU advocates a technology-neutral approach, this does not mean that no particular mobile technology is preferred over another. What a technology-neutral approach does is ensure that operators are not hamstrung into continuing supplying a particular service when cheaper and more efficient substitutes are available. When selecting a mobile technology and deploying it in a designated frequency band, it is important to consider whether the said technology is harmonised. Harmonised technology ensures interoperability and cheaper telecommunication equipment. This section will address the issues relating to technology harmonisation and canvas the major mobile technologies available for Samoa.

The Samoa Government National Broadband Policy focuses on the utilisation of the sub-1 GHz spectrum region, and in particular the 700 MHz and 900 MHz bands. The great benefit of lower spectrum ranges is increased propagation, which means broadband services are capable of reaching a larger geographic area and a higher number of people. This is particularly important for Samoa, which will rely on the greater range achieved by lower frequencies to ensure maximum coverage (see comparison in Figure 5).

The current aim of the government is to use the 700 MHz band for the deployment of LTE technology. This will ensure the country has the capacity to take advantage of 4G broadband services and the growth that is expected to take place in this area. In the following sections we examine GSM, W-CDMA, LTE, WiMAX, wireless offload and satellite technologies.

Figure 5: A comparison of different access technologies



Source: Author

GSM

Key wireless services in Samoa operate on the 900 MHz band utilising GSM technologies. Such an allocation is consistent with the majority of countries worldwide (GSM operates mainly on 900 and 1800 frequency bands, although in North America it operates on 1900 MHz).

In the transition from 2G to 3G a number of standards have been developed, which are categorized as 2.5G. These are add-ons to the 2G standards and mainly focus on deployment of efficient IP connectivity within the mobile networks. Data access is provided by General Packet Radio Service (GPRS) and offers throughput rates of up to 40 kbit/s. As of Q2 2010, there were over 4.42 billion GSM subscriptions.[27]

[27] www.gsacom.com//downloads/charts/GSM_market_share_global.php4

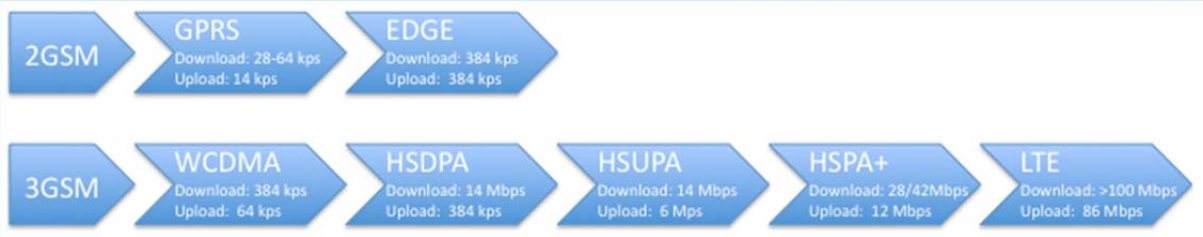
W-CDMA/HSPA

W-CDMA is the access scheme defined by ITU to be the main technical platform for UMTS or Third Generation mobile services. W-CDMA services are to operate within the following frequency bands: 1920 MHz – 1980 MHz and 2110 MHz – 2170 MHz. ITU had selected W-CDMA as one of the global telecommunication systems for the new IMT-2000 3G mobile communications standard. In W-CDMA interface different users can simultaneously transmit at different data rates and data rates can even vary in time. W-CDMA is capable of delivering up to 384 kbit/s in outdoor environments and up to 2 Mbit/s in fixed indoor environment. W-CDMA is currently at release 9.

High Speed Packet Access (HSPA) is a set of technologies that allow W-CDMA operators to run their networks at broadband speeds. Peak downlink and uplink throughput is at 14.4 and 5.7 Mbit/s, respectively. HSPA+, which harnesses MIMO (multiple in, multiple out) enables peak data rates of up to 42 Mbit/s.

The roadmap for wireless technology evolution from GSM to W-CDMA to LTE services is shown in Figure 6.

Figure 6: Wireless technology roadmap



Source: Ericsson and Qualcomm, 2009.

As of January 2012, there are reportedly 241 HSPA+ network commitments with 187 HSPA+ networks having been launched. Total subscribers amount to 822.4 million (including 469 million HSPA subscribers).[28]

As case studies show (see Box 2) that the cost of 3G coverage with UMTS900 can save operators between 50 to 70 per cent of mobile network costs (including Capex and Opex) versus UMTS2100. UMTS900 can more cost effectively provide 3G and mobile broadband services in rural and regional areas. There is also an added benefit of improved indoor coverage.

Using the nation's existing GSM infrastructure makes sense to achieve a rapid transition to widespread wireless broadband in Samoa. Samoa currently uses the GSM and e-GSM bands to facilitate W-CDMA at 900 MHz. Both of Samoa's providers operate networks using HSPA+ technology.

Box 2: Case study: Optus UMTS900 network

In 2008, Australian carrier Optus launched the world's largest UMTS900 network. With almost 1 000 base stations, the network covers over 96 per cent of the population.

Given Australia's population distribution, fixed broadband penetration is relatively low and demand for wireless broadband high. Optus recognised this as an opportunity to compete with Telstra's national coverage and decided to expand its 3G network to enable high-speed data services. Optus had launched a UMTS2100 network in 2005, but UMTS900 was recognised as more cost effective for rural areas.

[28] www.gsacom.com/news/gsa_fastfacts.php4

Deployment

Recognising the potential of UMTS900 to economically extend coverage to low-density areas, the regulator (ACMA) quickly approved the deployment.

From a strategic perspective, Optus chose to focus on areas where GSM usage was lower. It used its existing network infrastructure, overlaying coverage on existing 2G base stations and in urban areas, co-locating with UMTS2100.

Results

The use of UMTS900 technology enabled Optus to deliver a better quality network at a lower cost, with each base station covering a greater geographical area than UMTS2100 due to reduced path-loss. Using UMTS2100 to achieve the same coverage outcomes would have cost at least AUD 800 million. With UMTS900, capital expenditure was reduced to less than AUD 500 million.

In addition, the deployment delivered unexpected benefits to the 2G service. When re-farming the 900MHz spectrum, Optus' focus on site optimisation led to increased 2G performance in some cases.

The only barrier to further success noted by Optus was handset availability: at December 2008, just 7 of 34 of Optus handsets were compatible with UMTS900 but the operator has plans to increase this number.

5.3.3 LTE

LTE is the latest standard in the mobile network technology evolution that follows from the GSM/EDGE and UMTS/HSxPA network technologies. It is a project of the 3rd Generation Partnership Project (3GPP).[29] The current LTE specification Release 9 provides downlink peak rates of at least 100 Mbit/s, an uplink of at least 50 Mbit/s. LTE supports scalable carrier bandwidths, from 1.4 MHz to 20 MHz and supports both frequency division duplexing (FDD) and time division duplexing (TDD). The next step for LTE evolution is LTE Advanced and is currently being standardized in 3GPP Release 10.

In October 2010, ITU accepted and officially designated LTE-Advanced as an IMT-Advanced (4G) technology, while the 3GPP published Release 10 of the LTE standard in March 2011 and has frozen the set of features for LTE Advanced.[30] One of the major reasons for aligning LTE with the call for IMT-Advanced is that IMT conforming systems were candidates for the spectrum bands identified at WRC07. Such moves made LTE a truly global standard compared with the fragmentation of earlier wireless standards. Commercialisation of LTE Advanced systems are expected in the 2014-15 timeframe.

In January 2012, ITU confirmed the status of LTE Advanced and Wireless MAN-Advanced technologies were both granted IMT-Advanced Technology status by ITU (Box 3).

Box 3: ITU announcement on 4G technology

In January 2012, LTE-Advanced and Wireless MAN-Advanced technologies were both granted IMT-Advanced Technology status by ITU. After undergoing evaluation by ITU and meeting the specification requirements, the technologies are now officially accorded 4G status.[31]

ITU is responsible for setting mobile technology standards worldwide. The approval signifies the next stage in the evolution of LTE, which is set to deliver vast improvements in speed and efficiency.

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[29] The 3rd Generation Partnership Project (3GPP) is a collaboration between groups of telecommunications associations, to make a globally applicable third generation 3G mobile phone system specifications within the scope of the IMT-2000 project of the ITU. 3GPP specifications are based on evolved GSM specifications. 3GPP standardization encompasses Radio, Core Network and Service architecture. See www.3gpp.org and for LTE specifically see www.3gpp.org/article/lte

[30] 3GPP is setting the Release 11 requirements in 2011 with its completion scheduled for late 2012.

[31] ITU, '*IMT-Advanced standards announced for next-generation mobile technology*', media release, 18 January 2012

The new technology will be significantly faster than 3G, with speeds above 100 Mbit/s. It will also make more efficient use of radio-frequency spectrum, meaning higher data transfers will be possible with a lower bandwidth requirement. The new technology will facilitate the growing demand for data transfer over mobile networks.

According to the GSA, as of January 2012 there are 226 LTE network commitments in 76 countries and 59 pre-commitment trials. There were approximately 3.6 million subscriptions at this time. By 2015, an expected 744.2 million will subscribe to LTE. [32]

5.3.4 WiMAX

WiMAX is the popular name of IEEE802.16 standard. It serves as both a fixed and wireless access technology. Coverage of 50 km and capacity of around 70 Mbit/s is a reality with this technology. It is, however, important to note that the capacity offered over long distances is only a fraction of the maximum capacity, and WiMAX as access technology is offered in distances of 5 to 10 km. WiMAX is thought of by some as a good complementary / competitive infrastructure to traditional broadband. Another important aspect is that 70 Mbit/s will only be achieved if frequency bandwidth of 20 MHz is allocated and assigned by the local authorities. Many regulators will probably assign smaller frequency bands to the potential WiMAX operators. A competing technology to the mobile version of WiMAX (IEEE.802.16e) is LTE.

By mid-2011, global subscribers (including fixed WiMAX) were said to number approximately 20 million. The number of mobile WiMAX subscribers is expected to rise to 59 million by 2015.[33]

5.3.5 Why LTE is the recommended technology following 3G/W-CDMA

LTE is acknowledged as the next step for a superior mobile broadband experience, targeting capacity and data rate enhancements to support new services and features requiring higher levels of capability and performance. LTE will enhance more demanding applications such as interactive TV, mobile video blogging, advanced games and professional services with significantly higher uplink and downlink data rates, supported by the necessary network architecture and technology enhancements.

Most importantly, as shown in Figure 7, LTE is more spectral efficient than other air interface technologies. As such, LTE reduces the cost per GB delivered which is essential for addressing the mass market, and supports a full IP based network and harmonisation with other radio access technologies.

In a survey of major operators, the great majority (some 88 per cent) indicated that they were already considering LTE upgrades for their next generation networks, with likely deployments in 2011 and beyond. This is consistent with the fact that LTE has had rapid global acceptance with 49 commercial LTE networks having been launched in 29 countries, some 226 operators in 76 countries are investing in LTE and there are 59 pre-commitment trials in 17 more countries. It is also expected that at least 119 LTE networks will be in commercial service in 53 countries by the end of 2012.[34]

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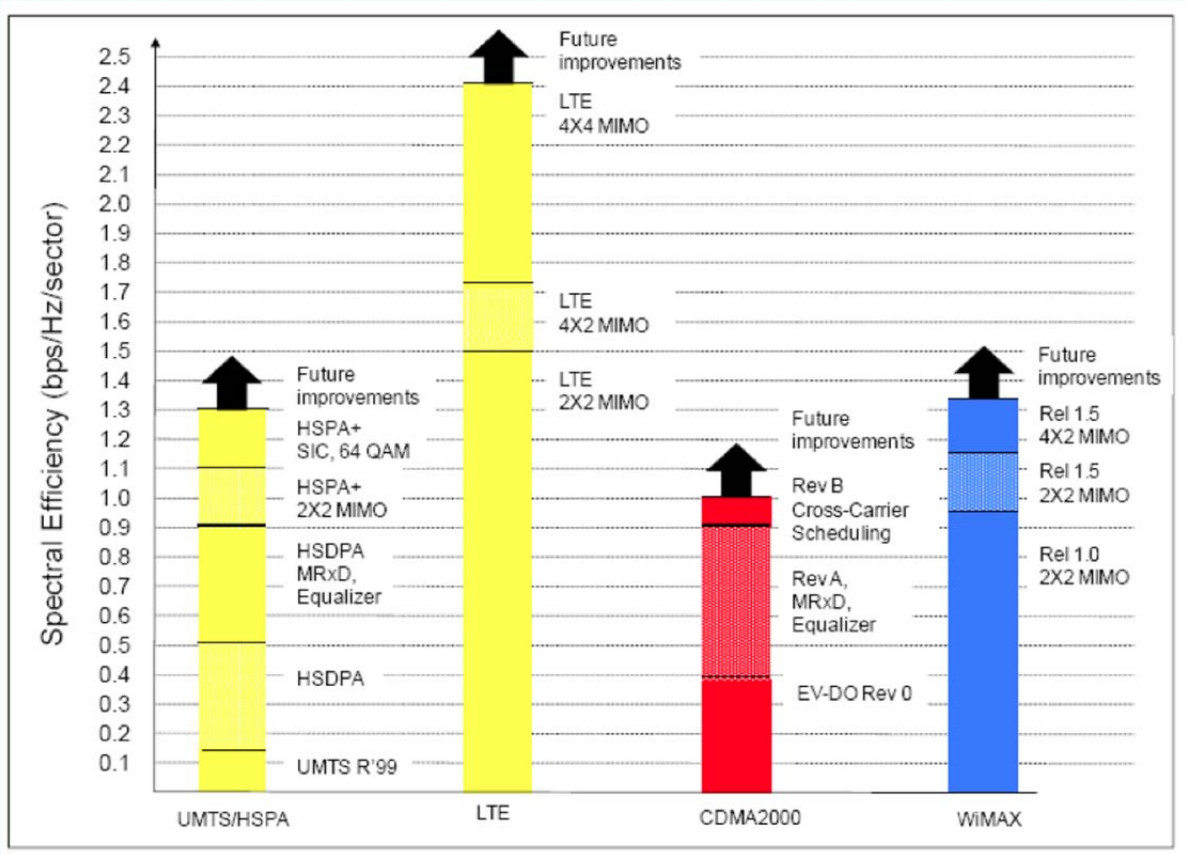
[32] www.gsacom.com/news/gsa_fastfacts.php4 & www.electronics-eetimes.com/en/lte-subscribers-to-account-for-10-percent-share-by-2015.html?cmp_id=7&news_id=222910064

[33] www.fiercewireless.com/story/wimax-forum-trumpets-20m-global-subscribers/2011-08-17 & www.eweek.com/c/a/Enterprise-Networking/Mobile-WiMax-Subscribers-to-Reach-59-Million-by-2015-Report-442841/

[34] GSA, *GSM/3G Market/Technology Update*, 5 January 2012.

Figure 7: Summary of downlink spectral efficiencies for various air interfaces and antenna schemes

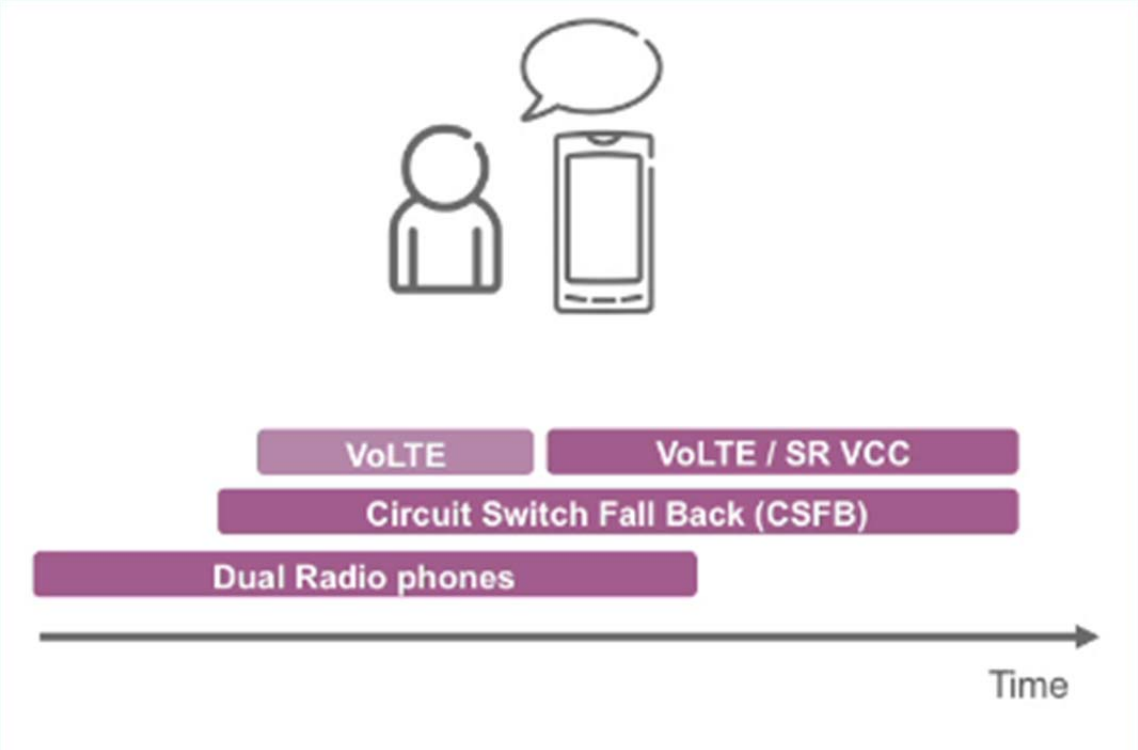


Source: 3G Americas, MIMO and Smart Antennas for 3G and 4G Wireless systems, Practical Aspects and Deployment Considerations, May 2010, page 58

A possible complication in relation to voice over LTE seems to have been resolved with the first VoLTE call on a commercial network (Verizon) in the world in February 2011. It is expected that VoLTE should be widely available globally in 2012.

More broadly, there are a number of steps to provide optimal voice services on LTE networks and devices. Firstly, the current approach is to use dual radiophones that utilise the 2G networks in the mobile phone for all voice calls. Secondly, voice calls will be provided over LTE with circuit switch fall back (CSFB) to the 2G networks where necessary (e.g. no coverage). Lastly, the ultimate approach will be to adopt Single Radio Voice Call Continuity ('SR VCC') for VoLTE, which uses an IP Multimedia Subsystem (IMS) for call anchoring and handover and is based on a third party call control mechanism. This allows a mobile phone with an on-going voice call to transition to the circuit-switch domain in the event of loss of LTE coverage. An IMS-based SRVCC provides QoS control, flexible charging, and better user experience. The options for addressing on LTE networks are detailed in Figure 8.

Figure 8: Options for Addressing Voice on LTE



Source: Informa Telecoms & Media and Ericsson, LTE Early Launch Strategies: Who and Why? Webinar, 21 June 2011

5.3.6 Wireless offloading

As wireless data and broadband services grow in Samoa the MCIT should safeguard the quality of wireless services by encouraging operators that adopt network offloading techniques. These include Wi-Fi offloading, Femtocell deployment, smart repeaters and distributed antenna systems. Network offloading should be facilitated by MCIT policy as it alleviates capacity constraints, and is a sensible allocation of spectrum resources. Specifically, the ability to utilise open access spectrum (such as 2.4 and 5 GHz) to support those small number of cell sites/locations which face congestion has considerable merit. An analysis of the potential use of off-loading techniques should form part of the needs and valuation models for additional spectrum.

5.3.7 The role for satellite

Satellites are valuable part of the broadband infrastructure strategy. They are able to provide ubiquitous connectivity and are very well suited for areas which are either underserved or unserved by terrestrial networks. They are able to augment and combine with terrestrial network and once launched can accelerate the availability of high-speed Internet services in such areas. As an added bonus, satellite communication does not have any last mile issues and can provide a high degree of reliability in the event of disasters, etc.

There has also been recent technological innovation in relation to satellite technology, similar in a way to wireless broadband communications. The new generation of satellite broadband systems known as HTS (High Throughput Satellite) have a number of new features:

- spot beam technology, where switchable beams illuminate much smaller areas (100s of km^2 instead of 1000 km^2);
- beam coverage forms a honeycomb / cellular pattern with frequency reuse;
- this concept of frequency reuse drastically increases overall capacity;

- use of Ka band leads to smaller antenna dishes; and
- satellite broadband services with frequency reuse, faster speeds and smaller dish antennas in Ka band drive down the costs to a much lower level.

5.4 Spectrum management aspects

5.4.1 Background

ITU has been a driving force for over two decades for the development of global broadband mobile telecommunication system. International Mobile Telecommunications (IMT), supported by fixed telecommunication networks (e.g. PSTN/Internet) provides access by means of one or more radio links to a wide range of telecommunication services.

IMT is the generic ITU name for 3G/4G technologies. Radio spectrum below 1 GHz is optimum for the needs of developing countries, due to the ability to serve larger rural areas from a single cell site compared to spectrum above 2 GHz. The 2007 World Radio Conference made valuable strides in identifying additional spectrum for IMT, both below 1GHz and above 2 GHz.

The concept of identifying spectrum for potential use by IMT, in the ITU Radio Regulations, gives global equipment manufacturers some guidance on the range of frequency bands in which IMT services are likely to be deployed, leading to economies of scale and minimizing product costs. The identification "for those administrations wishing to deploy IMT" allows use by other services to which the spectrum is allocated and does not convey any priority for IMT over those other radio-based services. Appendix C details those IMT allocated bands.

IMT-Advanced provides a global platform on which to build the next generations of mobile services – fast data access, unified messaging and broadband multimedia – in the form of exciting new interactive services and applications. New studies/techniques are leading to increased spectrum utilization and spectrum efficiency and allowing spectrum resources to be shared between users. Those objectives are detailed in Box 4.

Box 4: Objectives for the efficient management of spectrum

Efficient management of the radio spectrum is a key component for the promotion of broadband access. In planning the implementation of IMT, the following objectives are desirable:

- to ensure that frequency arrangements for the implementation of IMT have longevity, yet allow for the evolution of technology;
- to facilitate the deployment of IMT, subject to market considerations and to facilitate the development and growth of IMT;
- to minimize the impact on other systems and services within, and adjacent to, the bands identified for IMT;
- to facilitate worldwide roaming of IMT terminals;
- to integrate efficiently the terrestrial and satellite components of IMT;
- to optimize the efficiency of spectrum utilization within the bands identified for IMT;
- to enable the possibility of competition;
- to facilitate the deployment and use of IMT, including fixed and other special applications in developing countries and in sparsely populated areas;
- to accommodate various types of traffic and traffic mixes;
- to facilitate the continuing worldwide development of equipment standards;
- to facilitate access to services globally within the framework of IMT;

- to minimize terminal costs, size and power consumption, where appropriate and consistent with other requirements;
- to facilitate the evolution of pre-IMT-2000 systems to any of the IMT terrestrial radio interfaces and to facilitate the on-going evolution of the IMT systems themselves;
- to afford flexibility to administrations, as the identification of several bands for IMT allows administrations to choose the best band or parts of bands for their circumstances;
- to facilitate determination, at a national level, of how much spectrum to make available for IMT from within the identified bands;
- to facilitate determination of the timing of availability and use of the bands identified for IMT, in order to meet particular user demand and other national considerations;
- to facilitate development of transition plans tailored to the evolution of existing systems;
- to have the ability for the identified bands, based on national utilization plans, to be used by all services having allocations in those bands;
- to enforce licensing conditions and adherence to licensed technical parameters; and
- to effect cross border coordination to eliminate / mitigate cross border interference situations.

5.4.2 Spectrum needs and frequency arrangements based on technology selection

Rec. ITU-R M.1768 contains the methodology for calculation of spectrum requirements for the future development of the terrestrial component of IMT-2000 and systems beyond IMT-2000. This generic methodology can be used for differing market for a range of cellular system architectures. Specifically, the technical process of estimating spectrum requirements for mobile communications has to be based on four essential issues namely:

- definition of services;
- market expectations;
- technical and operational framework; and
- spectrum calculation algorithm.

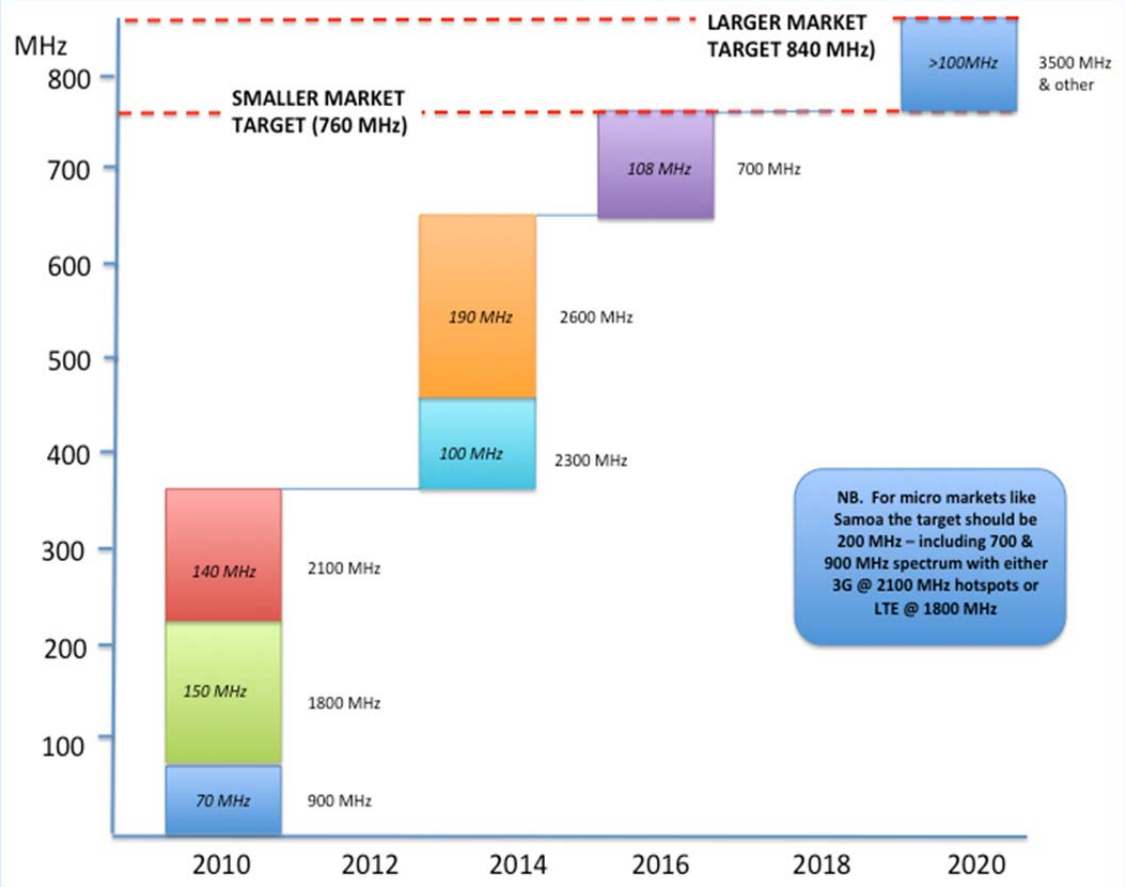
In the case of Samoa, given its population, demographics and other factors, a detailed assessment is arguably moot because existing technology options can for the foreseeable future (up to 2020) with the optimal levels of capital expenditure, provide high speed wireless broadband to most, if not all, Samoans. As mentioned previously, the focus for the Samoa Government should be the successful allocation of spectrum space below 1 GHz for the implementation of W-CDMA/LTE wireless technology. This will not require an allocation of the size that is currently planned by other countries with highly developed broadband markets, particularly the United States, United Kingdom and Australia.

As such, this masterplan prefers an approach of using the overall spectrum requirements in a manner consistent with ITU-R Report M.2078 (2006).[35] In the case of Samoa, on balance, the aggregate target for spectrum to be allocated to wireless services ought be 200 MHz of spectrum (See Figure 9).

Ideally this would comprise the 700 and 900 MHz bands plus perhaps, 2100 MHz allocations in Apia (for W-CDMA hotspots) and/or 1800 MHz in Apia and the tourist areas (for LTE deployment at 1800 MHz). As the 700 MHz band (is approx. 108 MHz – or 90 MHz in usable spectrum), the 900 MHz e-SGM band is 70 MHz and then perhaps 10-20 MHz of paired spectrum (40 MHz in total) in the 1800 and/or 2100 MHz band totals 200 MHz in aggregate.

[35] See ITU-R Report M.2078 *Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced*, 2007

Figure 9: Recommended aggregate spectrum allocations to wireless broadband services



Source: Author

In terms of the best practice approach, ideally the Samoa Government and the OOTR should adhere to the ITU Global Symposium for Regulators (GSR) 2005 Best Practice Guidelines for Spectrum Management to Promote Broadband Access when allocating spectrum for wireless broadband. Table 4 details a condensed form of these Guidelines, and forms the basis of spectrum allocation for wireless broadband in the Samoa National Broadband Policy.

Table 4: ITU GSR Best practice guidelines for spectrum management[36]

No	Guideline objectives	Key Provisions
1.	**Facilitate the deployment of innovative broadband services and technologies**	• Reduce unnecessary restrictions on spectrum use • Adopt harmonised frequency plans defined by ITU-R recommendations[37] • Reduce or remove regulatory barriers to market entry • Ensure operators have access to as wide a choice as possible for spectrum

[36] www.itu.int/ITU-D/treg/bestpractices.html

[37] Refer to the list of ITU-R Recommendations on IMT at www.itu.int/ITU-R/index.asp?category=information&rlink=imt-advanced-rec&lang=en. Harmonised frequency plans are contained in ITU-R Recommendation M.1036-4 (March 2012).

No	Guideline objectives	Key Provisions
2.	**Promote transparent and non-discriminatory spectrum management policies**	• Consult widely and publicly • Implement stable decision making processes • Publish forecasts of spectrum usage and allocation needs • Publish frequency allocation plans and overview of assigned spectrum • Clearly define and implement stable and predictable spectrum authorisation rules and decision-making processes and procedures
3	**Embrace technology neutrality**	• Facilitate spectrum use for fixed and mobile services • Provide guidelines to mitigate inter-operator interference • Adapt to technological convergence and avoid picking winners
4	**Adopt flexible use measures for wireless broadband services**	• Avoid onerous rollout and coverage obligations • Licence conditions that allow operators to provide a full range of converged services • Provide incentives for smaller new operators to deploy infrastructure at low cost • Adopt lighter regulation for rural and isolated areas • Allow secondary spectrum trading • Promote spectrum sharing
5	**Ensure affordability**	• Set reasonable spectrum fees • Design tender or auction processes to ensure affordability of services
6.	**Optimise spectrum availability**	• Facilitate the effective and timely access to spectrum • Spectrum pricing should not be pushed up due to restrictive supply • Accommodate new and emerging technologies
7.	**Manage spectrum efficiently**	• Ensure reliance on market forces, economic incentives and technical innovation • Allocate spectrum in an economically efficient manner • Promote and encourage usage of spectrum efficient technologies
8.	**Ensure a level playing field**	• Prevent spectrum hoarding: regulators should set a maximum limit to the amount of spectrum one operator may obtain
9.	**Harmonise regional and international standards and practices**	• Reflect global technical and security standards in national arrangements • Ensure inter-operability for global roaming • Implement policies and allocations that are consistent with regional and global best practice and standards
10.	**Adopt a broad approach to promote access**	• Introduce supporting regulatory measures such as competitive safeguards, open access and universal service incentives • Lower or remove import duties on broadband wireless access equipment • Coordinate spectrum management policy and practice with other regulatory instruments (i.e. competition and trade policy, universal service measures etc.)

Source: ITU, GSR 2005 Best Practice Guidelines for Spectrum Management to Promote Broadband Access, www.itu.int/bestpractices

5.5 Additional connectivity

Since the working life of the current cable (American Samoa Hawaii – ASH Cable) is around seven or eight years, there is the need to look at other alternative submarine cables for continuation of services into the future.

5.5.1 Ensuring international connectivity

While Samoa currently has sufficient international capacity now and for the next five years, the need to ensure low cost, low latency, high-speed long-term international connectivity is paramount for an isolated island country.

Pacific Fibre[38] is a New Zealand-based enterprise that aims to build a high capacity submarine fibre cable connecting Australia, New Zealand and the continental United States. As the routing of this cable is within 50 km of Samoa, there are discussions concerning the possible establishment of new connectivity to the country.

Specifically, Samoa is in discussions with Pacific Fibre, as is the Territory of American Samoa, about the possibility of routing the Pacific Fibre Cable such that it would pass Samoa and American Samoa and allow each country to connect to the Cable. The proposed connection, known as the Island Connection Project, involves the rerouting of the PFL cable past Samoa, with connection to the PFL Cable using branching units and cable spurs. The Samoa Government has indicated some interest in the Island Connection Project, and Pacific Fibre has put forward a proposed agreement. While still subject to commercial negotiations, connectivity to the Pacific Fibre would help to guarantee Samoa's broadband future and facilitate wireless broadband in the country.

5.5.2 Government support of broadband access and backhaul

Infrastructure will be key to ensuring full access across Samoa's islands. Providing support for backhaul transmission throughout the network should be a priority for the government and may require some government support in order to achieve broadband coverage for the entire population. It is important to note that using sub 1 GHz spectrum should ensure universal access or near universal access in Samoa.

A number of different investment models are available to the government to support additional broadband infrastructure to secure 99-100 per cent population coverage. These range from direct and targeted investment to public private partnerships (PPPs) and purely private partnerships. There may be a need for targeted investment or for the government to assume some risk in order to deal with current and future infrastructure bottlenecks, particularly where there is reluctance from the private sector to enter the market.

While there is a clear plan in place to build the country's broadband capacity in conjunction with existing operators, support for extra capital outlay to extend the network's coverage would constitute only a small proportion of total spending and would greatly benefit those who do not currently have access to broadband. Both fibre construction and wireless are options for the transmission of backhaul, and the Samoa Government will encourage and provide fast tracking for the network where it is required. The government will determine which technology is most appropriate based on the need to prioritise the development of the network backbone. On the access side, the Samoa Government should consider a targeted scheme of funding the Capex required for the additional few BTS which may be required to move from over 90 per cent to nearly complete coverage.

[38] www.pacificfibre.net

5.5.3 National broadband highway

The Samoa Government is considering the construction of a government intranet in Samoa that will connect the provinces of Upolu and Savaii with the capital Apia. The network will rely predominantly on existing Samoa Tel infrastructure, with fibre transmission throughout Upolu and microwave transmission throughout Savaii. The network will provide the government with a means of communicating with the citizens of Samoa using the full suite of voice, image and multimedia services, as well as allowing it to store and exchange information securely. The proposal has been supported by the offshore loan credits and has been met with interest by the Samoa Government.

6. Facilitating applications and content

6.1 Stimulating the content sector in emerging economies

It is arguable that there is a circular relationship between applications and content on the one hand, and broadband uptake on the other. The higher the penetration of broadband services, the more data and content rich applications consumers demand. At the same time, the more attractive and relevant the content and applications are, the more consumers will demand broadband in order to participate in those markets.

There are a number of means through which the government can intervene in order to create an enabling environment for content production industries and ultimately drive demand for their services.

6.1.1 Educate content entrepreneurs

Governments can work to stimulate the domestic content sector by educating their national ICT workforce with the outlook and the set of skills that are necessary for the requisite innovation and technical expertise which will allow the market to expand.

New courses at existing technical / educational institutions may be developed so as to encompass issues associated with applications / content. It may be necessary for the government to train teachers/trainers with a range of input skills for content production (e.g. graphic design, animation, information technology). An example from Australia is shown in Box 5. Overseas expertise may need to be harnessed for the training of a skilled and dynamic workforce in areas such as management, finance and creative process development.

Box 5: Digital media courses at the Australian Film Television and Radio School[39]

The Australian Film Television and Radio School (AFTRS) offers a number of specialist postgraduate courses within the digital media field of study.

A 'Graduate Certificate in 3D Animation' provides "A comprehensive, specialist course designed to develop the professional skills of digital artists through production-focused learning…. [and] course provides a thorough grounding in the art of 3D animation using AutoDesk Maya software.

The course offers a number of modules aimed at giving students a grounding in both the technical and business side of the 3D animation sector:

- 3D Graphics Fundamentals;
- Character Animation Foundations;
- Collaborative;

[39] See www.aftrs.edu.au

- Creative Research;
- Industry Brief;
- Introduction to Running Your Own Creative Business; and
- Key Figures in Animation

…"

The government should also be open to obtaining overseas assistance in developing appropriate competency/skill measures and standards/certification.

6.1.2 Subsidise content production

In order to improve the supply of content, financial tools such as direct outlays and tax measures may be employed by the government. Each tool possesses unique policy design issues that must be properly addressed prior to implementation.

6.1.3 Regulatory options

Regulatory measures provide the means to stimulate content production with relatively low direct costs to governments. For example, local content rules may provide a domestic content quota – in Australia, this was a key driver behind the early development of content production.

As discussed in 6.1.2, policy design issues, such as the location on the value chain where the intervention occurs and preferences for the type of content development will need to be considered.

6.1.4 Direct government action and leadership

Governments can take the lead to develop and deploy online/wireless services. If there exists good access to bandwidth and devices, online and wireless delivery can be a highly cost effective to provide information about government services and some of the services themselves in a much more equitable manner. Initiatives should not be limited to national governments: regional and local government can provide important and useful information to local residents and businesses.

6.2 The prevailing environment in Samoa

Locally created content has not yet reached a stage equal to that of fully developed markets. Due to the small size of Samoa's population, it is likely that the country will rely to some extent on content generated in connected markets. However Samoa already has a significant range of content services with a variety of applications. While there is much to be done in terms of encouraging the development of new and existing content, Samoa's content providers have shown that they have the ability to deliver innovative products that will greatly enhance the population's access to information and other services.

The Samoa Government is focused on encouraging the creation of content, and the first step involves providing greater access to broadband services. With a greater proportion of the population connected online, there is a greater demand for content and a bigger market to develop for. As access grows, Samoa can continue to develop a base of key online services, such as electronic funds transfer, online government services, e-health, and a range of cultural and educational content.

6.2.1 Government

Samoa's government departments all have frequently updated websites with detailed information, including major reports and studies, scheduled cabinet meetings, budget and forecasts, national accounts and information on access to government services. The Ministry of Education, Sports and Culture, for example, contains calendars of sporting and cultural events held throughout the country. Although the majority of government web content is in English, it nevertheless facilitates a high degree of transparency in government activity and the dissemination of important information for citizens of Samoa.

6.2.2 Education

The National University of Samoa has a web presence that includes news and updates regarding the university's activities, as well as course information and a virtual classroom that allows students to access information while away from campus. Each faculty provides information about courses and subjects available, however more comprehensive information on course content is still lacking. Robert Louis Stevenson School, a non-profit school in Apia, has a website with the school's latest newsletters and information for students and parents.

6.2.3 Media outlets

Many media outlets also provide internet-based news and content services. The largest circulating newspaper, Samoa Observer, has a wealth of online content, as do foreign news outlets W Samoa and Topix. Samoa radio stations, such as Magik and Talofa FM, have daily schedules published online via the Radio Polynesia website, but currently there is no online audio available.

6.2.4 Tourism

The tourism industry has a strong web presence in Samoa. Almost all major hotels, resorts and tour operators have websites introducing their services and providing online services to book accommodation and plan itineraries. Of central importance is the Samoa Tourism Authority website, which provides information to tourists about accommodation, car rentals, sport, restaurants, and general information about the country and its culture. Because of the importance of tourism to the Samoan economy, this sector provides some of the most impressive online content.

6.2.5 BlueSky b2b

In November 2011, BlueSky announced the launch of a new e-credit service, 'b2b' (BlueSky 2 BlueSky). This service allows prepaid mobile customers to transfer between WST (Tala) 1 and 100 of credit up to ten times daily to one another.[40] This is an innovative product that makes it easier for mobile users to utilise the full amount of their credits by sharing with others and smoothing their consumption of mobile data and other services. This is an example of how, despite the small size of the Samoa telecommunication sector, it is developing commercially attractive products that bring new ideas to the market.

[40] www.blueskysamoa.ws/?page_id=2021

7. Conclusions and recommendations

Globally, the early stages of the mobile broadband revolution occurred in 2006/07 as key enablers, primarily around technology, began to converge. These enablers will continue to drive mobile broadband's rapid adoption and market share gains from fixed technologies, such as DSL. As indicated by the US Federal Communications Commission (FCC) broadband wireless services are having profound economic and social consequences even in developed country markets:

> *"Wireless mobility has become central to the economic, civic, and social lives of … [our citizens]. We are now in the midst of a transition from reliance on mobile voice services to increasing use of and reliance on mobile broadband services, which promise to connect [our] citizens in new and deeper ways … [the] mobile wireless market will be essential to realizing the full benefits to … consumers and channeling investment toward vitally important national infrastructure. A vibrant mobile wireless market is also essential to driving innovation, not only within the mobile market itself, but also in markets – current and future – for which wireless mobility is a key enabler."*[41]

For Samoa, the stakes are even greater. Wireless broadband – provided along with high-speed international capacity – offers the promise of economic, social and environmental benefits for Samoa and its people.

Although technology neutrality is and ought to be a widely accepted principle for the efficient allocation of spectrum, the deployment of W-CDMA and LTE wireless technology with the capability of reaching the highest number of people should be seen as a priority for Samoa and is endorsed under this masterplan.

In the case of Samoa, where there are only a limited number of telecommunication providers servicing a very small population, the allocation of spectrum for wireless broadband will necessarily take place in consultation with the existing operators. With an abundance of spectrum relative to the requirements of the market, the focus should be on ensuring that spectrum in the sub-1 GHz range is made available – with the 700 MHz being optimal from 2013 – and that existing operators can make full utilisation of it. If there is a willingness on the part of the existing operators to invest so as to provide this service then the government/OOTR should ensure that it is facilitated in the national benefit.

Roadmap for the government / regulator: Action items and timeline for action

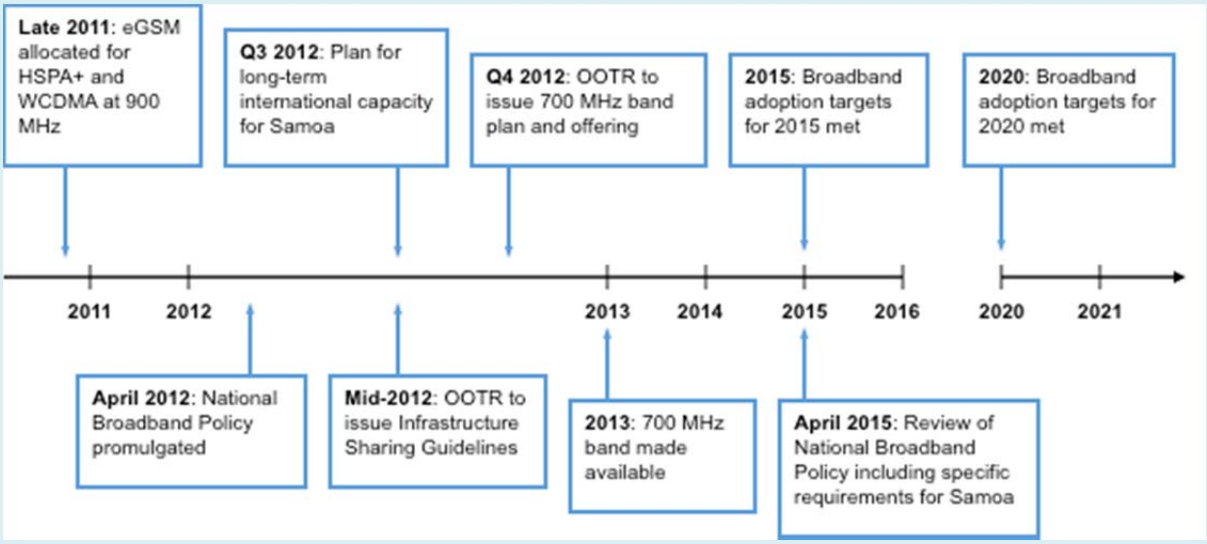
The key milestones and actions for the Government of Samoa and the OOTR are detailed in Table 5 and Figure 10. Such milestones and actions are consistent with the government's National Broadband Policy and the current work programmes of the OOTR. It is important that active monitoring be undertaken by the MCIT to address the action items and to achieve broadband targets as provided for this masterplan and the government's broader National Broadband Policy.

[41] FCC, Notice of Inquiry, *Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless including Commercial Mobile Services*, Docket FCC 09-67, released 27 August 2009, page 2

Table 5: Key recommended action items

Date	Action
Late 2011	e-GSM spectrum allocated for WCMDA/HSPA+ at 900 MHz
April 2012	National Broadband Policy promulgated
Mid-2012	OOTR to issue Infrastructure Sharing Guidelines
Q3 2012	Plan for long-term international capacity for Samoa
Q4 2012	OOTR to issue 700 MHz band plan and offering
2013	700 MHz band made available
2015	Broadband adoption targets for 2015 to be met
April 2015	Review of National Broadband Policy including specific requirements for Samoa
2020	Broadband adoption targets for 2020 to be met

Figure 10: Recommended timeline for action



Source: Author

Appendix A

DRAFT [VERSION 4]

"BETTER CONNECTIONS TO THE WORLD

Samoa's National Broadband Policy"

1. Introduction
- *1.1 Background / Context*
- *1.2 This Policy*

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8. Roadmap to Samoa's Better Connections to the World

9. Implementation and the Future

9.1 Role of National ICT Committee

9.2 The future

1. Introduction

1.1 Background / Context

Globally, many countries – both developed and emerging – are concerned with developing more sophisticated strategic positions for country broadband adoption and are undertaking comprehensive national broadband plans to significantly and rapidly increase their access to broadband services and its performance. Internationally, the Broadband Commission[42] has set four clear, new targets for making broadband policy universal and for boosting affordability and broadband uptake:[43]

- ***Target 1:*** *Making broadband policy universal*. By 2015, all countries should have a national broadband plan or strategy or include broadband in their Universal Access / Service Definitions;
- ***Target 2:*** *Making broadband affordable.* By 2015, entry-level broadband services should be made affordable in developing countries through adequate regulation and market forces (amounting to less than 5 percent of average monthly income);
- ***Target 3:*** *Connecting homes to broadband.* By 2015, 40 percent of households in developing countries should have Internet access; and
- ***Target 4:*** *Getting people online.* By 2015, Internet user penetration should reach 60% worldwide, 50 percent in developing countries and 15 percent in less developed countries ('LDCs').

Following its successful policies which have seen significant increases in the country's telephone penetration the Government of Samoa is now committed to facilitating the growth of broadband services and cementing the nation's place within the global connected ICT community. Broadband platforms promote the convergence of voice, data and audio-visual services onto a single network. Only with a higher adoption rate of broadband services will Samoans be able to truly integrate themselves into globalised trade, commerce and society of the 21st century.

While the private sector has shown initiative in rolling out some broadband services, the Government is committed to a national, guided approach to facilitate an increase in the supply and uptake of broadband. Broadband is now too important to leave solely either to the market or commercial players to invest sufficiently and quickly enough to secure country advantages. The proposition that broadband infrastructures are "essential to the future of Samoa" is strongly endorsed by the Government.

1.2 This Policy

This Policy has been prepared by the Ministry of Communications and Information Technology ('MCIT') following public consultation in late 2011 and early 2012. It has been developed taking into account the applicable legislative regime detailed in the *Telecommunications Act 2005* and the *Broadcasting Act 2010*. It is consistent with the objectives detailed in section 3 of the *Telecommunications Act*.

The Government believes that it is necessary for policies, especially in areas involving both public and private sector input, to be formulated and enacted in as transparent manner as possible. This public consultation means that Samoa's national broadband policy is both practicable and reflective of broad consensus in the country.

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[42] Jointly established in May 2010 by the ITU (www.itu.int) and UNESCO (www.unesco.org)

[43] See www.broadbandcommission.org/slider/targets.aspx

2. Definition of Broadband

Broadband is a term used to describe a network connection that exceeds designated speeds. It is widely used and the precise speed at which a network connection is deemed to be a broadband service varies. The International Telecommunications Union ('ITU') has previously provided multiple definitions of what constitutes a broadband service. For example, the Standardization Sector defines broadband as a network connection speed of between 1.5 to 2 Mbps while the Development Sector defines broadband as a connection speed of greater than 256 Kbps. In recent times, the ITU's definition has changed and now broadband is defines as a cluster of concepts namely always-on, high-capacity, and combined provision of voice, data and video at the same time.

Samoa does not wish to limit technology and sector progress by aligning ourselves with a minimum broadband speed. We instead prefer the new ITU definition and will define 256 Kbps as a 2012 broadband benchmark which will be expected to exceed 512 Kbps or 1 Mbps in the short term. Much higher speeds are expected in the future given rapid technological developments in both fixed and wireless technology.

3. Why Broadband is so Important to Samoa

The challenge for Samoa is to go from having widely available telecommunications services (especially cellular mobile services) to widespread affordable broadband access. Again, we are very fortunate that there is a range of broadband technologies including wireless broadband which will facilitate increases in broadband adoption in Samoa. However, significant investments will need to be made.

The benefits of broadband are numerous and cannot be overstated. Research from the World Bank shows that investment in higher-end technologies – such as broadband networks – have been shown to deliver the greatest benefits on GDP growth.[44] As such a 10 percent increase in fixed line teledensity seems to increase GDP by around 0.5 percent. The same increase in mobile teledensity increases GDP by some 0.7 percent. And a 10 percent increase in broadband penetration can boost GDP by an average of 1.3 percent.

Social benefits arising from the proliferation of broadband services include improved quality of education and healthcare arising from enhanced communications services and access to data. Social inclusion with the wider Samoan communities and families both in and outside of the islands is also fostered through the greater ability for persons to communicate with broadband technologies.

Greater broadband adoption also has the potential to indirectly reduce Samoa's environmentally harmful carbon emissions and the national carbon footprint as part of our national response on climate change. The need for travel is reduced due to the utilisation of telecommuting and video-conferencing.

4. Current State of Broadband in Samoa

4.1 Telecommunications Access / Pricing

At present, according to the ITU's *Measuring the Information Society Report 2011*, the broadband market in Samoa is underdeveloped and penetration is low. Exhibit 1 below details the leading indicators on Samoa's telecommunications sector and Exhibit 2 provides a regional comparison of retail tariffs in Samoa on a Gross National Income ('GNI') basis.

[44] Source: Christine Zhen-Wei Qiang and Carlo M. Rossotto with Kaoru Kimura, Chapter 3 *Economic Impacts of Broadband, in World Bank, Information and Communication for Development 2009: Extending Reach and Increasing Impact* (IC4D2009)

Exhibit 1: Samoa's Telecommunications indicators

INDICATORS	KEY STATISTICS
Total number of mobile phone subscribers	167,400
Mobile teledensity	91.4 percent
Total number of fixed subscribers	35,300
Fixed teledensity	19.3 percent
Internet users	7 percent
Fixed broadband subscriptions per 100 inhab	0.11 percent
International internet bandwidth (Mbit/s)	135
International internet bandwidth (bps) per internet user	3,901

Source: ITU Statistics Yearbook 2011 and MCIT sources

Exhibit 2: ITU Regional Tariff comparisons on a GNI basis, 2011

Country	ICT Price Basket	Fixed Telephone sub-basket as % of GNI per capita 2010	Mobile cellular sub-basket as a % 2010	Fixed broadband sub-basket as a % of GNI per capita 2010	GNI per capita 2009
Fiji	4.7	2.4	5.9	5.7	3,840
Kiribati	39.6	7.6	11.3	251.2	1,830
Micronesia	9.3	4.5	4.4	19.2	2,500
Papua New Guinea	42.8	4.6	23.7	142.5	1,180
Samoa	**12.7**	**5.1**	**7.5**	**25.7**	**1,630**
Timor-Leste	21.5	8.4	7.9	48.3	2,460
Tonga	8.8	2.3	4.0	19.9	3,260
Vanuatu	35.9	18.8	10.7	78.3	2,620

4.2 Infrastructure

Samoa currently uses a range of technologies to provide broadband services including namely, xDSL, GSM WCDMA (namely HSPA+), Fibre, Satellite and WiMAX.

While there is over 90 percent GSM population coverage in Samoa and recently the provision of wireless broadband services has been facilitated by releasing spectrum in the EGSM band. This has resulted in one of the mobile operators, namely Bluesky Samoa offering HSPA+ broadband services covering more than 70 percent of the population. They along with other operators offer lower speed EDGE services. However, prices for wireless data services from Bluesky Samoa and Digicell remain high.

WiMAX is provided by CSL subsidiary, Zoom. Coverage extends to most of the Vaitele area and surrounding regions.

The competitiveness and efficiency of any broadband market is determined in part by its international connectivity. This is particularly pertinent for an isolated island nation such as Samoa, which requires external connectivity via satellite or submarine cable (or both) to transmit or access data externally. There is currently a submarine cable providing international connectivity to neighbouring Pacific islands, Hawaii and the mainland United States. Additional opportunities to secure greater international connectivity may present themselves in the future and are likely to receive Government support.

5. Broadband Technology Options

5.1 Fixed – Optical fibre, cable etc

Fixed broadband technologies comprise a range of services including DSL, cable and optical fibre. Since there is limited fixed copper network infrastructure in Samoa, there is limited ability to use such PSTN networks for the provisioning of xDSL services (although the reduced use of copper lines for voice services may provide an opportunity to use such lines for broadband access from the fibre backbone). The deployment of new last mile access network infrastructure utilising entirely fibre technology would be prohibitively expensive for Samoa given its mountainous and tropical topology and as such wireless broadband options are likely to be the most cost-effective for last mile connectivity.

5.2 Wireless Broadband

This encompasses a variety of 3G and 4G standards such as UMTS, HSPA+, WiMAX and LTE/LTE-A. Typical user speeds vary widely, but for the most part are slower than their fixed counterparts. Unlike fixed technologies, wireless broadband utilises scarce radio spectrum and require base-station infrastructure.

It is arguable that given differences in fixed and mobile uptake, Samoa's population like other global markets is more receptive to an emphasis on wireless broadband deployment. Certainly, using wireless broadband services will allow a much faster deployment of broadband services to Samoans.

5.3 Satellite

Satellite provides wide-ranging coverage at varying speeds (1 Mbit/s average). It is typically prohibitively expensive and generally only suited for use in isolated areas.

According to the *National Communications Sector Policy 2005*, a 174-degree Intelsat Satellite provides international connectivity to Australia, New Zealand and the US mainland. The continued use of this satellite and the operation of the earth station in Apia are important for backup and backhaul redundancy services.

(Note :Bluesky Satellite International Bandwidth of 4 MBit/s will be transferred to the Sumarine Fibre cable in 3 weeks times. The Satellite use after the transfer is to be confirmed soon)

6. National Broadband Targets and Plan

6.1 Economic and Social Priorities

The 'Strategy for the Development of Samoa 2008-2012', while currently subject to revision outlines the Government's aspirational economic and social targets to be obtained over the current four-year timeframe. Broadly speaking, Samoa seeks to achieve:

- Sustained macroeconomic stability;
- Private sector led growth and employment creation;
- Improved education outcomes;
- Improved health outcomes;

- Community development through improved economic and social well-being;
- Improved governance; and
- Environmental sustainability and disaster risk reduction.

The Strategy Paper also details the Government's goals for the telecommunications sector. It hopes to improve access and affordability in part by administering a new regulatory framework. This new framework will address a number of issues relating to, *inter alia*, the development of interconnection agreements, the regularisation of licensing procedures, the management of international gateway access and the establishment of a compensation regime for the universal service obligation.

6.2 Broadband Priorities

The mission statement of the MCIT is to *inter alia* '*To ensure all sectors of the community and Government have access to high quality, affordable, and safe ICT*.'[45] Achieving the key priorities of the 'Strategy for the Development of Samoa 2008-2012' is likely to be facilitated with greater broadband penetration.

There are a number of achievable priorities that are closely related to the extent of broadband development and uptake as detailed in Exhibit 3 below.

Exhibit 3: Key broadband priorities

IMPROVE ACCESS	ENSURE AFFORDABILITY	FACILITATE INFRASTRUCTURE	INCREASE UTILISATION
• Consider use of universal access policy • Promote access of broadband services	• Increase competitive framework	• Initiatives to encourage infrastructure deployment/sharing and co-location • Address infrastructure gaps • Protect critical infrastructure	• E-Government • ICT education & training • Participation in regional and global workshops • Disaster communication systems

6.2.1 Access

Access to content via broadband connectivity vastly expands economic opportunities and the possibilities and scope of personal interaction. All Samoans stand to reap substantial benefits from being able to communicate and access content from any location. The Government may consider expanding the scope of the universal service commitment to encompass access to broadband services if access to broadband services is not significantly enhanced in the short and medium term. It will also provide for broadband access in commercially non-viable areas. In addition, the ability for users to access government and private organisations via broadband services is accepted practice in developed nations and the Government will take this fact into account.

6.2.2 Affordability

Accessible but prohibitively expensive broadband services will not achieve national priorities. Ensuring broadband affordability is an important goal for the Government. Affordability will only be obtained through an improved competitive framework that facilitates a number of operators participating into Samoa's broadband market. Policies will be implemented which will facilitate and encourage private sector investment and participation. A technology-neutral approach to broadband technology means that winners will not be picked and the local market will adopt the most efficient, practical services.

[45] See 'National Strategic Plan for ICT 2004-2008'

Infrastructure sharing and co-location are other regulatory options which are to be encouraged. Sharing reduces the cost base and the need to duplicate infrastructure. It is therefore an important factor in facilitating the improved affordability of broadband services.

6.2.3 Infrastructure

Improved infrastructure is an essential priority for the Government's desire to increase the penetration of broadband services. Absent direct intervention, this can be obtained through a variety of mechanisms such as public / private partnerships ('PPPs'), subsidies and tax breaks.

The Government will also explore the possibility of facilitating increased international connectivity. This may be necessary given the bandwidth requirements that would result from substantially increased wireless broadband penetration.

6.2.4 Utilisation

Adequate access and infrastructure will not of themselves lead to acceptable broadband uptake in the absence of sufficient skills and capacity. The Government is committed to providing extensive training and workshops for both the user and supplier sides of broadband technology. It also commits to participating in regional and global workshops. A comprehensive suit of e-government services, perhaps through a dedicated Government network must be deployed so as to encourage broadband uptake and greatly enhance service delivery and transparency.

6.3 Broadband Adoption Targets

Exhibit 4 details the broadband adoption levels targeted by the Government of Samoa for 2015 and 2020, respectively.

Exhibit 4: Broadband Adoption Targets

	2015			2020	
	Households	Businesses		Households	Businesses
Urban	11-20%	~30%	**Urban**	31-40%	~60%
Rural	0-10%	11-20%	**Rural**	21-30%	~40%

**From ITU Survey Response*

There are a number of other specific broadband targets to be achieved over the next five-years comprise:

- *Community Access*: communities over 200 people to have access to broadband services:
- *Individual Access*: 20 percent of Samoans are to have access to broadband of 256 Kbit/s, with 60 percent having access over 2 Mbit/s speeds:
- *Community Broadband Centres*: All Samoan communities with broadband access shall have the option to establish a Community Broadband Centre;
- *School Access*: 100 percent of all schools to have broadband access (as part of the Schoolnet project); and
- *Government Access*: The proportion of transactions between citizens and Government are able to be conducted online.

The Ministry will work with other Ministries including but not limited to the Health Ministry to determine whether other sector specific broadband targets should also be set for the next five years.

7. Supporting the Broadband ecosystem

7.1 Improved Spectrum Management

7.1.1 Current Allocations

Effective management of scarce spectrum is an essential aspect of Samoa's plan to greatly increase broadband penetration using wireless technologies.

7.1.2 Future Allocations

The OOTR plans to allocate up to 100 MHz of additional spectrum in the next few years below 1 GHz, depending on demand to facilitate wireless broadband services. This additional spectrum will firstly be allocated in the 900 MHz band and then in the 700 MHz 'digital dividend' band for LTE services. The latter is to take account of, if possible, with the *Common Position in Asia APT Wireless Forum (recently renamed AWG) so as to* access cheaper equipment/devices and secure international roaming.

In the 'Spectrum Management Policy & Guidelines', a proposed plan for the 700 MHz band was discussed. The OOTR expressed its desire to devote this band for wireless access services on a technology-neutral basis. In particular, the 698-763 MHz and 776-794 MHz bands were to be allocated for commercial services and digital TV.

Allocating additional spectrum for wireless broadband is a priority due to the need to generate certainty and encourage deployment. The Government and the OOTR are currently in the process of implementing this policy.

7.1.3 Best Practice Guidelines

Samoa will adhere to the ITU's 'Best Practice Guidelines for Spectrum Management' as a means of promoting broadband access. Exhibit 5 details a condensed form of these Guidelines and will form the basis of future spectrum allocations.

Exhibit 5: Best Practice Guidelines for Spectrum Management

Objectives	Policies
Facilitate the deployment of innovative broadband services and technologies	• Remove unnecessary restrictions on spectrum use & embrace minimal regulation • Release spectrum promptly and allocate spectrum to facilitate new competition
Promote transparent and non-discriminatory spectrum management policies	• Consult widely & publicly • Publicise decisions & consultation process • Implement stable and predictable decision-making process
Embrace technology neutrality	• Adapt to technological convergence and avoid picking winners. Let the market determine appropriate technology
Adopt flexible use measures for wireless broadband services	• Provide incentives for smaller new operators to deploy infrastructure at low cost • Adopt lighter regulation for rural and isolated areas • If spectrum scarcity becomes an issue, allow secondary market trading. • Promote shared-use bands where practical.
Ensure affordability	• Set reasonable spectrum fees.

Objectives	Policies
Optimise spectrum availability	• Provide timely equipment authorisations and accommodate new & emerging technologies
Manage spectrum efficiently	• Allocate spectrum in an economically efficient manner • Promote and encourage usage of spectrum efficient technologies
Ensure a level playing field	• Prevent spectrum hoarding by setting caps
Harmonise regional and international standards & practices	• Implement policies and allocations that are consistent with regional and global best practice and standards
Adopt a broad approach to promote access	• Coordinate spectrum management policy and practice with other regulatory instruments (i.e. competition & trade policy, universal service measures. etc)

7.1.4 eGSM Band Plan

The OOTR has implemented a plan that authorises the utilisation of eGSM frequency for wireless broadband (eg WCDMA at 900 MHz). The Government considers that using the nation's existing GSM infrastructure is a sensible means of fast-tracking the country's move towards widespread wireless broadband up-take.

The particulars of the plan permit the extension of the current 900 MHz band deployments. Compatibility is not a significant concern as most equipment is backwards compatible with the extended frequency range. Most smartphones are capable of operating in the UMTS 900 MHz range, as are wireless broadband dongles.

7.2 Facilitating Backhaul

The Government will work with existing operators to encourage investment in higher speed backhaul transmission capacity to facilitate the deployment of wireless broadband services with a high quality of service and higher end to end speeds. Where possible it will encourage and provide fast tracking for optical fibre construction as well as investment in fibre and microwave backhaul transmission facilities.

7.3 Possible establishment of a Samoan Internet Exchange (SIX)

Currently, Internet traffic of domestic origin must pass through the submarine cable to an external Internet Exchange ('IX') where the data is stored and is subsequently sent downstream to Samoa. This is both costly and inefficient.

The Government will investigate the practicality of establishing a Samoan Internet Exchange ('SIX') with the support of international agencies. This would enable the local exchange of Internet traffic which would normally require overseas conveyance. This would lead to a reduction in operating costs and help achieve the Government's objective of increasing the affordability of broadband services.

An IX will benefit local content due to the providing of cheaper, more efficient and lower latency paths between networks.

7.4 Ensuring International Connectivity

Samoa's international connectivity is provided by submarine cable and satellite.

In mid-2009, the Samoa-American-Samoa ('SAS') cable was completed. This cable ensured the connection between Samoa, American Samoa and Hawaii. It provides more than 40x the current capacity used in both Samoa and American Samoa combined. Other newer international cable projects are being considered regionally which will also be examined by Government, given the need for a longer term fibre optical solution and backup and redundancy facilities.

Enhanced bandwidth and additional connectivity must be considered if broadband adoption targets are to be achieved. Of first and foremost importance is the need to upgrade the network connecting the Upolu and Savaii islands. This is a necessary pre-requisite to meeting the rural / remote adoption targets.

7.5 Supporting Samoan Content / Applications

Supporting Samoan content via national broadband is a priority for the Government. While some may view the advent of broadband and vastly improved international connectivity as a direct challenge to local content due to the ease of access users will have to non-local sources, we instead view this as an opportunity.

The Government will adopt policies on quality Samoan content which is accessible over future broadband infrastructure. As we are a small market of greater than 186,000 people, addressing this will be no small undertaking. However, a greater proportion of population with broadband access means that there is a bigger market to develop for. In effect, this means that the richness of Samoan culture, language and sports will be far easier to access both locally and abroad.

The development of key applications such as e-money and transfer payments, e-governance, e-education, e-health, establishment of broadband community centres, fostering suitable partnership with international donor agencies for securing funding for augmenting the capacity of the submarine cable system, access to bottleneck facilities at reasonable terms and conditions, and technology neutral wireless broadband master plan is important to ensure the accessibility of local content. Samoa does not need to be a technology leader but can be smart in implementing the solutions that are based on learning through international best practices.

7.6 Device availability and affordability

In order in facilitate broadband device availability and affordability, within the next 12 months the Government will assess the availability and affordability of smartphones, tablets, PCs etc in order to determine (i) whether such devices are treated similarly from a taxation and custom duty perspective and (ii) whether reductions in duties and/or streamlining of categories is desirable in terms of public policy.

7.7 Infrastructure Sharing

For a country of Samoa's size and geography, infrastructure sharing should on public policy grounds to be facilitated by the regulatory regime. Replication of broadband infrastructure can be costly, inefficient and unsustainable. Furthermore, there are a number of factors that contribute to the need for Samoa to formulate an infrastructure-sharing framework *inter alia*:

- There are obvious capital expenditure constraints in a country of Samoa's size;
- Samoa's susceptibility to natural disasters such as tropical storms and tsunamis means that infrastructure must be strategically positioned and be of high quality. This is less likely in cases of duplication;
- The unappealing aesthetic value of duplicated infrastructure like towers.
- An unnecessary duplication of towers and other passive infrastructure could have harmful effects on Samoa's environment.

Infrastructure-sharing guidelines were formulated and consulted on by the OOTR in 2011 by not yet formally adopted. Such guidelines which are likely to be adopted in early 2012 addresses passive infrastructure sharing (eg cellular towers, backhaul etc). In the future, active infrastructure sharing may be considered by the OOTR.

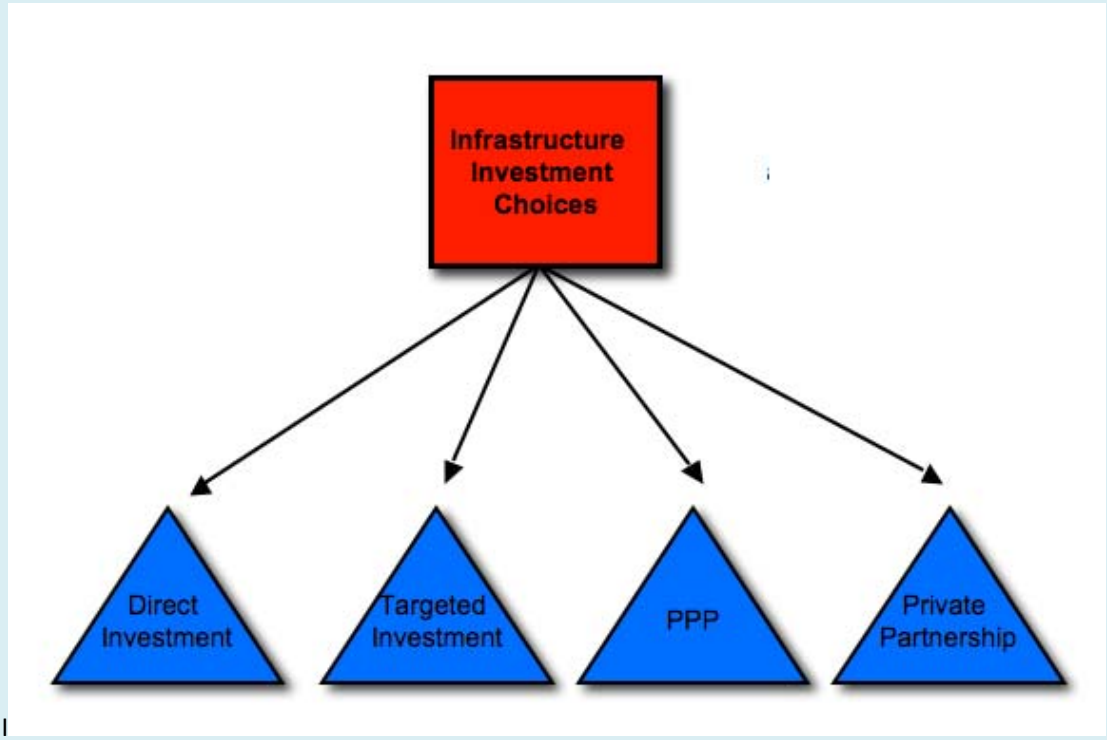
7.8 Financing the Broadband Plan

There are a number of different models for financing the creation of additional broadband infrastructure. These models vary widely and on one end may involve a largely 'hands off' approach whereby the Government creates and enforces a regulatory framework and leaves it to the private sector to meet adoption targets, while on the other end may see direct intervention in the marketplace via a Government-owned entity.

In circumstances where the private sector is reluctant to enter the market, the Government may have a case for assuming some of the risk by forming PPPs and/or granting subsidies. Other forms of indirect finance may include tax-breaks and/or grants. Samoa may also receive sources of funding via concessional finance (including the World Bank) and international aid.

Exhibit 6 below presents the range of investment choice open to the Government.

Exhibit 6: Infrastructure investment



Source: ITU: GSR 2011 Discussion Paper[46]

7.9 Cybersecurity

As Samoa enters the new paradigm of globalised ICT services and telecommunications convergence, attention will need to be turned towards developing an enhanced cyber or Internet security framework. Absence of such a framework may jeopardise foreign investment and lead to reluctance to store data within Samoa's jurisdiction.

From the perspective relating to the provision of Government services, enhanced cyber security is very important in relation to areas such as remote-medical assistance and education.

The form of cyber security measures will be formulated in the near future.

[46] www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR11/documents.html

8. Roadmap to Samoa's Better Connections to the World

This policy is to be achieved over a five to ten-year timeframe. Its short to medium-term focus reflects the essentiality of a prompt and widespread adoption of broadband services. In line with global trends, the Government expects over the next several years, the adoption of IMT advanced technologies to become more prevalent to the extent that it hosts the vast majority of Samoan network connections by that time.

Exhibit 7 below highlights the timeline for key broadband plan targets/milestones in Samoa.

Exhibit 7: Key Broadband plan targets/milestones

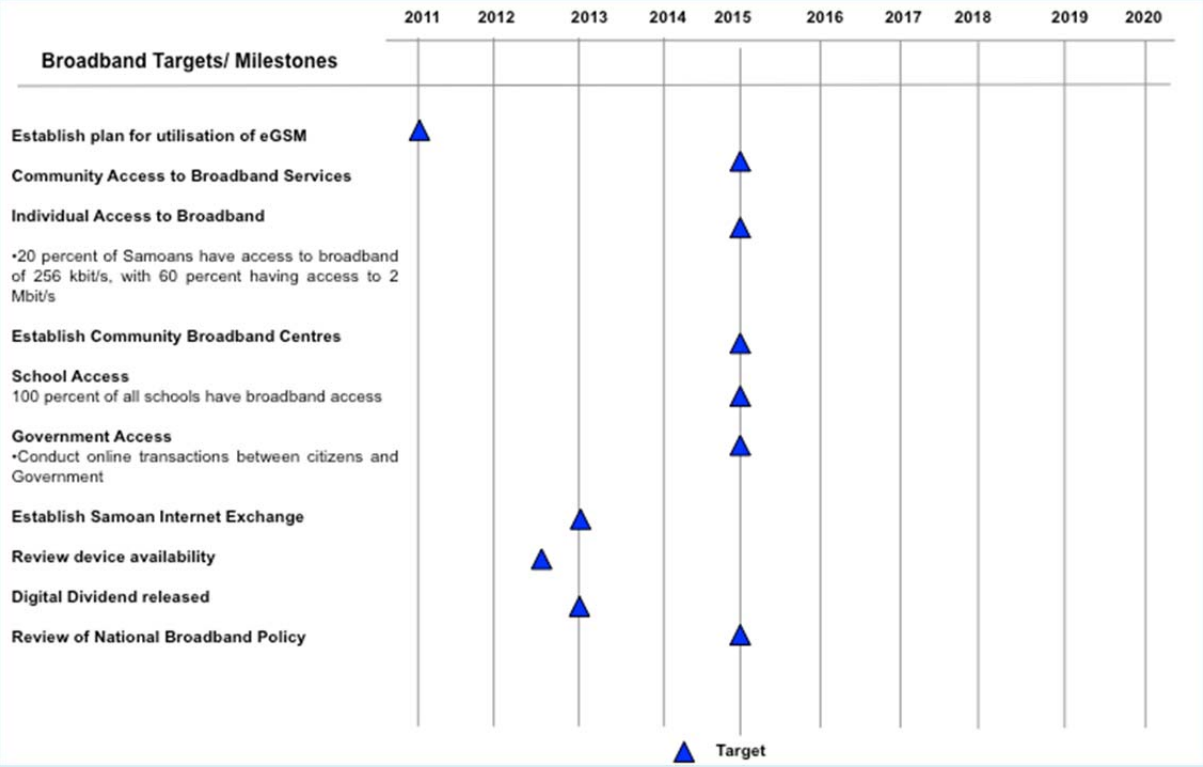
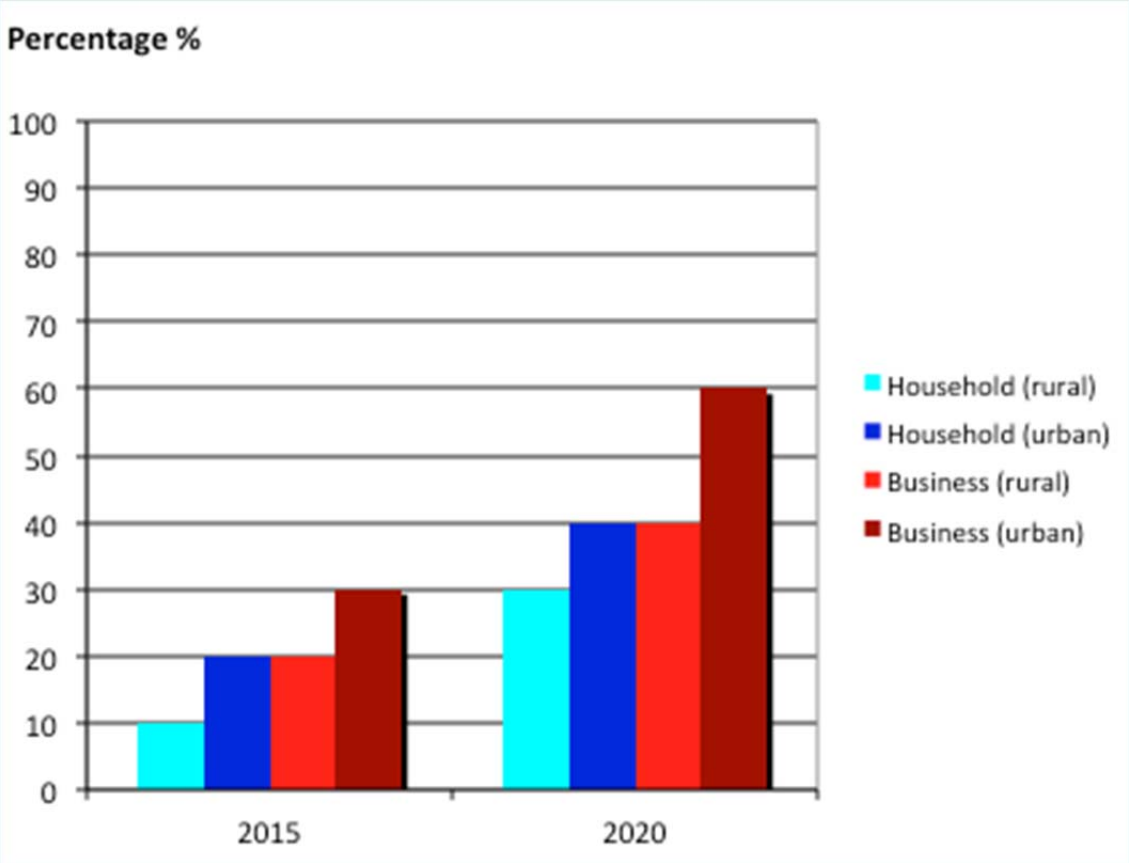


Exhibit 8 below further highlights the broadband penetration targets for business and households in Samoa in 2015 and 2020 respectively.

Exhibit 8: Samoa's Broadband Penetration Targets



9. Implementation and the Future

9.1 National ICT Committee

Following on from the quality work undertaken by the National ICT Committee, its brief will be extended to include a specific broadband mandate. The broadband mandate will guide the implementation of Samoa's broadband policies and will encompass the following areas:

- The development of an implementation plan that is consistent with the framework currently being devised by ITU in consultation with the Samoa Government:
- Coordinating the implementation of the national broadband plan between public and private stakeholders:
- Consulting and advising relevant public and private sector stakeholders on the components of the plan and implementation framework;
- Facilitate the monitoring and measurement of broadband penetration in Samoa;
- Advising the Minister of any shortcomings that have been observed in the implementation process and recommending any necessary alterations; and
- Any additional responsibilities as directed by the Minister.

9.2 The Future

Broadband has become a key component of national economic infrastructure and enabler of competitiveness and economic growth, and offers huge potential for social and economic development in Samoa. In fact, broadband is critical and increasingly important part of economic infrastructure to promote the long-term growth of Samoa's productivity in health, education and government services.

This national broadband plan presents the direction the industry is heading towards as a catalyst to Samoa's continued rapid development and aims to provide broadband connectivity across the country through a combination of wireless and fixed technologies. By formulating a clear policy regime, this broadband policy endeavours to create an investor friendly environment for attracting investments in the sector, envisages leveraging infrastructure to enable all citizens and businesses in both rural and urban areas to participate in the Internet and envisages support to key social sectors such as education, health and government.

The Government will review this national broadband policy in 2015. The review will:

- Provide an important opportunity for Samoans to take stock of where it stands in the global information society, to examine what has worked and what has not, to assess the adequacy of the infrastructure to meet the future needs of both individuals and businesses throughout Samoa, to consider whether the current policy and regulatory framework could be improved to better satisfy these requirements and to ensure cost effective implementations and roll-out mechanisms for wireless broadband;
- Examine whether any amendments are necessary to the *Telecommunications Act 2005* and the *Broadcasting Act 2010* and/or new or amended subsidiary legislation is desirable arising from (i) increased broadband service diffusion and speeds and (ii) the increasing convergence of telecommunications, broadcasting and IT; and
- Assess the societal impacts on Samoan culture, language and society of increased broadband penetration in the country.

- END-

Appendix B: Legislative and regulatory instruments relevant to broadband services in Samoa

A. Introduction

This appendix provides an overview of the legislative and subsidiary legislations that are applicable to the telecommunication sector, focusing on provisioning of broadband services particularly wireless broadband services in Samoa. In particular, this appendix focuses on the following issues:

- licensing of broadband services and wireless broadband services;
- spectrum management and allocation;
- access and interconnection;
- retail tariff regulation;
- competition issues; and
- universal service obligations.

A.1 Communications policy

The National Communications Sector Policy 2005 established the blueprints that have guided telecommunication policy development in Samoa. The government's policy vision was to make communication services modern, available, accessible, affordable and suitable. The policy identified a number of improvement needs which included, *inter alia*:

- upgrading basic telecommunication services
- the provision of accurate and timely data / information from all service providers to the MIC
- fostering necessary competition.

The policy identified several shortcomings within the existing licence framework. It was observed that it might be necessary to add greater specificity to the definition of the term 'service provider' and whether ISPs should be required to obtain a licence in order to operate.

The government committed to a number of implementation strategies to be completed by the end of the decade. These included, *inter alia*:

- *Allowing SamoaTel to provide basic telecommunication and postal services for the remainder of its licence*. Following the end of the licence period in 2009, it was to invite the sector (including SamoaTel) to bid for the awarding of licences in a newly deregulated market.
- *Review tariffs* and include licence provisions which ensure that prices are set at an appropriate level.
- *Add a Community Service Obligations to legislation.* Operators will be required to install phone booths in designated areas and offer a wide range of telecommunication services in main centres.
- *The introduction of service standards*. All operators were required to clear all unsatisfied demand by 2005.
- *Network expansion*. By the end of 2005, operators will be required to increase network capacity. Cellular mobile coverage was to be made available in all inaccessible areas.
- *Improve consumer protection standards.*
- *Monitoring the performance of licensed service providers*

As can be seen, these targets were geared towards the establishment of basic telecommunication services and at the time the deployment of wireless broadband services was not being pursued by the Samoa Government.

A.2 Licensing

A.2.1 Telecommunications Act 2005 as amended by the Telecommunications Amendment Act 2007 and the Telecommunications Amendment Act 2008 (Act)

While the Act does not regulate broadband services and wireless broadband services *per se*, Part III of the Act provides for general regulation of telecommunication licences. In particular, Section 12(1) of the Act requires a person to hold a licence prior to (a) provisioning of telecommunication service to the public for direct or indirect compensation; or (b) own or operate a telecommunication network used to provide a telecommunication service to the public for direct or indirect compensation. Section 12(3) provides further that all telecommunication services and telecommunication networks may be provided without a licence save for those described in subsection (1).

"Telecommunications service" is defined in Section 2 of the Act as "any form of transmission of signs, signals, text, images or other intelligence by means of a telecommunication network but does not include a broadcasting service. [47]

According to the Regulator's website, an individual licence is required for *inter alia* bandwidth services, including wireline and wireless broadband internet access services[48].

A.2.2 Telecommunications Licence Fee Regulations 2007

The *Telecommunications Licence Fee Regulations 2007* sets out the fees for application and renewal of individual and class telecommunication licences which include *inter alia* fixed services, cellular radio services, internet exchange services, international gateway, wholesale internet services and national transmission services[49]. In particular:

- Regulation 3 provides for licence application fees in relation to the particular category of licence applied for;
- Regulation 4 provides for annual licence fee for a category of licence, including the minimum annual licence fee applicable in certain scenarios; and
- Regulation 7 provides for calculation of gross revenue for purposes of calculating the annual licence fee.

There is no specific category for broadband services or wireless broadband services.

A.2.3 Other relevant instruments

The regulator has also issued various orders in relation to licensing which are applicable specifically to a particular licensee. This includes *inter alia*:

- *Order of the Regulator Number 2007/5 on Unlicensed Provision of Broadband Internet Services* which basically required SamoaTel Limited to cease billing for ADSL services and cancel invoices given that it does not hold a licence to provide broadband services; and

[47] "Broadcasting service" is defined as "the transmission of radio or video programming to the public on a free, pay, subscription or other basis, whether by cable television, terrestrial or satellite means, or by other electronic delivery of such programming".

[48] www.regulator.gov.ws/LegalFramework/Licenses/tabid/3132/language/en-US/Default.aspx

[49] See the Schedule of the regulation.

- *Request for the Revocation of Telecom Samoa Cellular Limited Licence dated 26 June 2006 order No. 2010/04* following Digicel's acquisition of TSCL.

A.3 Spectrum management

A.3.1 Act

Part V of the Act provides for regulation of radio spectrum management. According to Section 22 of the Act, the regulator is responsible for the management, allocation and assignment of frequencies in the radio spectrum. This includes *inter alia* preparing and publishing a national radio spectrum plan[50], issuing radio spectrum licences[51], administering radio spectrum fees[52] and allocation of frequency bands[53]. Section 23 of the Act empowers the OOTR to develop rules for radio spectrum management.

A.3.2 Radio Spectrum Fees Regulations 2007

The *Radio Spectrum Fees Regulations 2007* issued pursuant to Section 81 of the Telecommunications Act sets out the radio licence application fee and radio spectrum usage fee for basic services, fixed link services and miscellaneous services. In particular:

- Regulation 3 provides that a person applying for a radio licence or renewal of a radio licence must pay the application fee specified in the Schedules according to the particular category of radio licence; and
- Regulation 4 sets out the annual radio spectrum usage fee for a category of radio licence, and the renewal fee of a radio licence.

The terms "basic services", "fixed link services" and "miscellaneous services" are not defined in the Regulations. As such, it is unclear as to where "broadband service" and "wireless broadband services" sits within this context.

A.3.3 Spectrum plan: Table of frequency allocations

The National Management Spectrum Plan is currently under review and the revised National Spectrum Plan 2009 is to be made public early 2012 after consultation with stakeholders and the public. There is currently a draft Spectrum Management Policy[54] and draft Frequency Allocation Table.[55]

A.4 Access and interconnection

A.4.1 Act

Part VII of the Act regulates interconnection. In particular:

- Section 33 requires interconnection by all service providers to enter into negotiations on interconnection agreements in order to (a) connect and keep connected the service providers telecommunication networks; and (b) provide access to telecommunication facilities[56] which include central officers and other switching equipment locations, mast sites, towers, poles, subscriber access lines and underground facilities; and

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[50] Section 22(2)(c) of the Act

[51] Section 22(2)(g) of the Act

[52] Section 22(2)(h) of the Act

[53] Section 22(2)(i) of the Act

[54] See www.regulator.gov.ws/files/documents/spectrum.pdf

[55] See www.regulator.gov.ws/files/documents/Allocation-Table.pdf

[56] "Telecommunications facility" is defined as "any facility, apparatus or other thing that is used or is capable of being used for telecommunications or for any operation directly connected with telecommunications".

- Sections 34, 35, 36, 37 and 38 require interconnection by dominant service providers, and sets out specific provisions on interconnection including *inter alia* requirement to provide interconnection on no less favourable terms, interconnection charges to be cost based, preparation of reference interconnection offer for approval by the Regulator; and filing of interconnection agreements with the Regulator.

In addition, Section 68 of the Act expressly provides for co-location, particularly for service providers with existing telecommunication network facilities to allow other service providers to co-locate their telecommunication network facilities on those existing facilities.

A.4.2 Other relevant instruments

The regulator has issued various determinations, orders and interim orders to the operators on interconnection charges for *inter alia* mobile terminating rates, fixed terminating rate, outgoing international calls, incoming international calls, international call transit rate, SMS and directory enquiry calls. The rates applicable between the operators varies, and depends on whether the operator is a dominant service provider in the particular market. In addition, it is worth nothing that these determinations and orders are specific to particular operators only. So far, no order has been issued in relation to broadband services and wireless broadband services.

Some of the orders issued include *inter alia*:

- *Interim Interconnection Rates for Fixed and GSM Systems No. 2006/4;*
- *Fixed and Mobile Network Interconnection Termination Rates No 2007/4;*
- *Order for new SamoaTel fixed to mobile rates No. 2008/1;*
- *Interim Interconnection charges order No. 2008/03;*
- *Interim Interconnection charges applicable to Digicel (Samoa) Limited and SamoaTel Limited order No. 2009/01;*
- *Replacement Interconnection charges applicable to Digicel (Samoa) Limited and SamoaTel Limited order No. 2009/02;*
- *Replacement Interconnection charges applicable to Digicel (Samoa) Limited and SamoaTel Limited order No. 2009/03;*
- *Fixed and Mobile Network Interconnection Termination Rates No 2010/01; and*
- *Determination of the Long Term Interconnection charges to be applied to fixed and mobile termination services between SamoaTel Limited and Digicel (Samoa) Limited.*

In addition, the Regulator has also issued determinations and orders other aspects of interconnection including *inter alia*:

- *Order for Digicel to cease carrying international traffic to SamoaTel No. 2007/7;*
- *Re-instatement and Acceptance by Digicel (Samoa) Limited of Incoming International Calls Routed via SamoaTel Limited's Telecommunications Network order No. 2008/04;*
- *Refusal by SamoaTel to Interconnect with Digicel's Digifixed service order No. 2010/02; and*
- *Determination in relation to SamoaTel's refusal to interconnect with Digicel's Digifixed service.*

A.5 Retail tariff regulation

A.5.1 Act

Part VII of the Act regulates tariffs. Only dominant service providers are required to file with and obtain the approval of the Regulator on tariffs, rates and charges for provisioning of telecommunication services in the markets where they have been designated as dominant service providers[57]. Section 40(2) however empowers the Regulator to issue an order to move the filing requirement in certain circumstances. The dominant service providers are required to ensure that the tariffs for telecommunication service shall be based on the cost of efficient service provision and not contain excessive charges.[58]

Section 43 of the Act empowers the Regulator to issue an order on tariff regulation that are applicable to all services providers including *inter alia* price cap regulation, rate rebalancing and other forms of cost-based regulation. In addition, Section 44 of the Act empowers the Regulator to issue an order to require a dominant service provider and other specified service providers to prepare, file or participate in the development of a cost study of the dominant service provider's telecommunication services.

While there is no specific reference to broadband services and wireless broadband services, these services are captured within the definition of "telecommunications services". Therefore, an operator who is determined as a dominant service provider in the broadband services and/or wireless broadband services market will be subjected to Part VII of the Act.

According to the National Communications Sector Policy 2005, tariff rates were last reviewed in 1989.

A.5.2 Other relevant instruments

The regulator has issued *inter alia*:

- the approval of changes to retail pricing structure for SamoaTel Limited No. 2008/02; and
- the approval of retail rates for Digicel's Digifixed service order No. 2011/01.

Basically, these orders set out the regulator's approval of SamoaTel and Digicel's proposed retail rate for its services, and the regulator's position with respect to certain matters relating to the operator's services. Thus far, no specific order has been issued in relation to broadband services and wireless broadband services.

A.5.3 Tariff rates

The following table displays current tariff rates of SamoaTel and Digicel.

SamoaTel		Digicel	
	WST		WST
International call – to NZ/Australia	0.87	Call from a Digicel mobile to a Digicel mobile	0.45
Call from a fixed line to SamoaTel mobile	0.36	International call – to South Pacific	0.65
Call from a fixed line to Digicel mobile	0.66	International call – to NZ/Australia	0.85
Call from SamoaTel mobile to SamoaTel fixed line	0.20	International call – to USA	0.99

[57] Section 40(1) and (6) of the Act

[58] Section 40(3) of the Act.

SamoaTel		Digicel	
	WST		WST
Call from SamoaTel mobile to Digicel mobile	0.60	Call from a Digicel mobile to a fixed line	0.45
		Call from Digicel mobile to SamoaTel mobile	0.70

**1 Samoa Tala (WST) = 0.43855 USD on 22 September 2011*

A.6 Competition issues

A.6.1 Act

Part V of the Act provides for competition policy. According to Section 26(1) of the Act, every service provider whose gross revenues in a specific telecommunication market constitutes 40 per cent or more of the total gross revenues of all service providers in that market shall be presumed to be a dominant service provider in that market unless otherwise specified by the regulator. In relation to a service provider with less than 40 per cent of the total gross revenues in a specific telecommunication market, the regulator has the discretion to designate the service provider as a dominant service provider[59]. The key issue is the determination of "telecommunications market" as the determination of dominance is specific to that telecommunication market.

Other relevant provisions include:

- Section 27 of the Act which sets out actions and activities considered an abuse of dominant position;
- Section 28 of the Act which prohibits a person from engaging in anti-competitive practices;
- Section 29 of the Act which empowers the Regulator to determine whether the actions or activities of a dominant service provider constitute an abuse of dominant position; or amount to an anti-competitive practice; and
- Section 30 of the Act which sets out the remedies for abuse of dominance and anti-competitive practices.

In 2009 the government liberalized the telecommunication market by terminating SamoaTel's exclusivity on international gateway services (i.e. international connections) and creating two new classes of licences referred to as '(i) the Licence for Submarine Cable Landing and the establishment and operation of a Submarine Cable Telecommunications Network and the Provision of certain Telecommunication Services; and (ii) An International Gateway Services License'.[60]

A.6.2 Other relevant instruments

The regulator has issued various orders designating a dominant service provider in a particular communications market. This includes *inter alia*:

- SamoaTel Dominance Order for fixed line telephony and interconnection No. 2006/1;
- TSCL Dominance Order for Cellular Radio Systems No. 2006/2;
- Samoatel Dominance Order for international ISP connectivity No. 2006/5; and
- Digicel Dominance Order No. 2006/6.

[59] Section 26(2) of the Act

[60] Submarine and Cable Services Policy 2009.

A.7 Universal service obligation

A.7.1 Act

Part IV of the Act provides for universal access. Section 20 of the Act empowers the regulator to propose, and the minister to approve policies and principles relating to provision of universal service to telecommunication service. Section 21 of the Act provides for establishment of a universal access fund, including *inter alia* notification by the minister for individual licensees to contribute to the fund, and determine the amount of contributions to be made by those individual licensees.

A.7.2 USP policies

In 2010, Samoa issued a Universal Access Policy[61]. In this policy:

- Broadband connectivity is defined as: "An 'always on' data connection that is able to sustain Internet access services with the minimum upload speed capacity of 256 kbit/s. The connection is made from the service provider to multiple users where the individual subscriber is able to access this interactive service."
- The critical element for the Policy is advancing universal access to community groups who because of their specific characteristics are inadvertently underserved, and in recognition that there are limits to how well the market can or will function to extending service to marginalized groups.
- The policy supports implement targeted interventions that will take into account the potential benefits to all segments of the population, the impact on investment on telecom infrastructure, and the sustainability of the service in the long-term. The objective is to avoid duplication between new programmes and existing projects while addressing market gaps with activities that would eventually become commercially viable and in the long term no longer require universal access fund support. The policy will endeavour to coordinate and harmonize ICT projects and utilize a universal access fund to achieve universal access.
- A universal access fund is to be established and administered by the OOTR.

A.8 International competitiveness

A 8.1 Infrastructure

The competitiveness of a particular telecom market is in part determined by its international connectivity. The National Communications Sector Policy 2005 lists the following infrastructure of the Samoa telecommunication network:

- *six Digital Exchanges:* this includes a main exchange in Apia providing international connectivity;
- *an Extensive Rural Telecommunications Network*: the network utilises a Digital Radio Multiple Access Subscriber System (DRMASS);
- *a Digital Microwave System:* this interconnects all the remote exchanges to the main exchange. Optical fibre technology has replaced some of the microwave links and makes up majority of the backbone areas in some provinces (including 70 per cent of the rural areas of Upolu);
- *the 174-degree Intelsat Satellite provides international connectivity.* Direct circuits are provided to New Zealand, Australia and the United States mainland;
- *Wireless Local Loop (WLL) has been introduced to provide telephone to certain rural areas; and*
- *132 public payphones* in the two main islands.

[61] See www.regulator.gov.ws/files/documents/Universal-Access_Policy(english).pdf

In mid-2009, the Samoa-American-Samoa (SAS) cable was completed. This cable ensured the connection between Samoa, American Samoa and Hawaii. It reportedly provides more than forty times the current capacity used in both Samoa's combined.

The MCIT identified several additional opportunities to secure greater international connectivity through either Pacific Fibre or the World Bank Sub-Project with a minimum of 622 Mbit/s.[62]

[62] 'Broadband – The Future of Communications in Samoa' (ppt).

Appendix C: Frequency arrangements for implementation of IMT

Recommendation ITU-R M.1036-4, Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR), provides guidance on the selection of transmitting and receiving frequency arrangements for the terrestrial component of IMT systems.

The frequency arrangements are recommended from the point of view of enabling the most effective and efficient use of the spectrum to deliver IMT services – while minimizing the impact on other systems or services in these bands – and facilitating the growth of IMT systems.

General considerations regarding technological aspects:

- IMT (IMT-2000 and IMT-Advanced) radio interfaces currently include two modes of operation – frequency division duplex (FDD) and time division duplex (TDD).
- There are benefits in the use of both FDD and TDD modes in the same band; however, this usage needs careful consideration to minimize the interference between the systems, especially, if flexible FDD/TDD boundaries are selected, there may be a need for additional filters in both transmitters and receivers, guard bands that may impact spectrum utilization, and the use of various mitigation techniques for specific situations.
- That selectable/variable duplex technology is considered to be one technique that can assist in the use of multiple frequency bands to facilitate global and convergent solutions. Such a technology could bring further flexibility that would enable IMT terminals to support multiple frequency arrangements.
- When frequency arrangements cannot be harmonized globally, a common base and/or mobile transmit band would facilitate the development of terminal equipment for global roaming. A common base transmit band, in particular, provides the possibility to broadcast to roaming users all information necessary to establish a call.
- Guard bands for IMT systems should be minimized to avoid wasting spectrum.
- When developing frequency arrangements, current and future advances in IMT (e.g. multimode/multiband terminals, enhanced filter technology, adaptive antennas, advanced signal processing techniques, techniques associated with cognitive radio systems, variable duplex technology and wireless connectivity peripherals) may facilitate more efficient use and increase overall utilization of radio spectrum.
- On the aspect of frequency availability it is recommended that administrations make available the necessary frequencies for IMT system development in a timely manner.

The frequency bands identified for IMT services (that accommodate all the technologies) are shared bands with footnotes:

Band (MHz)	Radio Regulation Footnotes identifying the band for IMT
450-470	5.286AA
694-790/698-806*/790-862*,	806 – 960 ADD 5.3XX, MOD 5.313A, MOD 5.317A
1 710–1 885, 1 885-2 025	5.384A, 5.388
2 110-2 200	5.388
2 300-2 400	5.384A
2 500-2 690	5.384A
3 400-3 600	MOD 5.430A, 5.432A, 5.432B, 5.433A

World Radio Conference – 1992

World Administrative Radio Conference –2000

World Administrative Radio Conference – 2007

World Administrative Radio Conference – 2012 (Allocation shall enter into force on 1 January 2013)

* *790-862 MHz (Allocation for Region 1 and 3)*

698-790 MHz (Allocation for Region 2 and 9 countries in Region 3: Bangladesh, China, Rep. of Korea, India, Japan, New Zealand, Papua New Guinea, Philippines, and Singapore)

By taking these Radio Regulations footnotes and relevant resolutions into account, administrations have the flexibility to decide on using these bands at the national level according to each administration's evolution/migration plan.

A minimized number of globally harmonized frequency arrangements in the bands identified for IMT-2000 by one or more conferences will:

- facilitate worldwide compatibility; and
- facilitate international roaming.

Annex 1 (Sections 1 to 6) of Recommendation ITU-R M.1036-4 describes the frequency arrangements for implementation of IMT in the bands identified for this service in the Radio Regulations (RR).

The order of the frequency arrangements does not imply any priority. Administrations may implement any of the recommended frequency arrangements to suit their national conditions. Administrations may implement all or part of each frequency arrangement.

It is noted that administrations may implement other frequency arrangements (for example, arrangements which include different duplex schemes, different FDD/TDD boundaries, etc.) to fulfil their requirements. These administrations should consider geographical neighbouring deployments as well as matters related to achieving economies of scale, facilitating roaming, and measures to minimize interference.

Administrations should take into account the fact that some of the different frequency arrangements in the same band have an overlap of base station transmitter and mobile station transmitter bands. Interference problems may result if different frequency arrangements with such overlaps are implemented by neighbouring administrations.

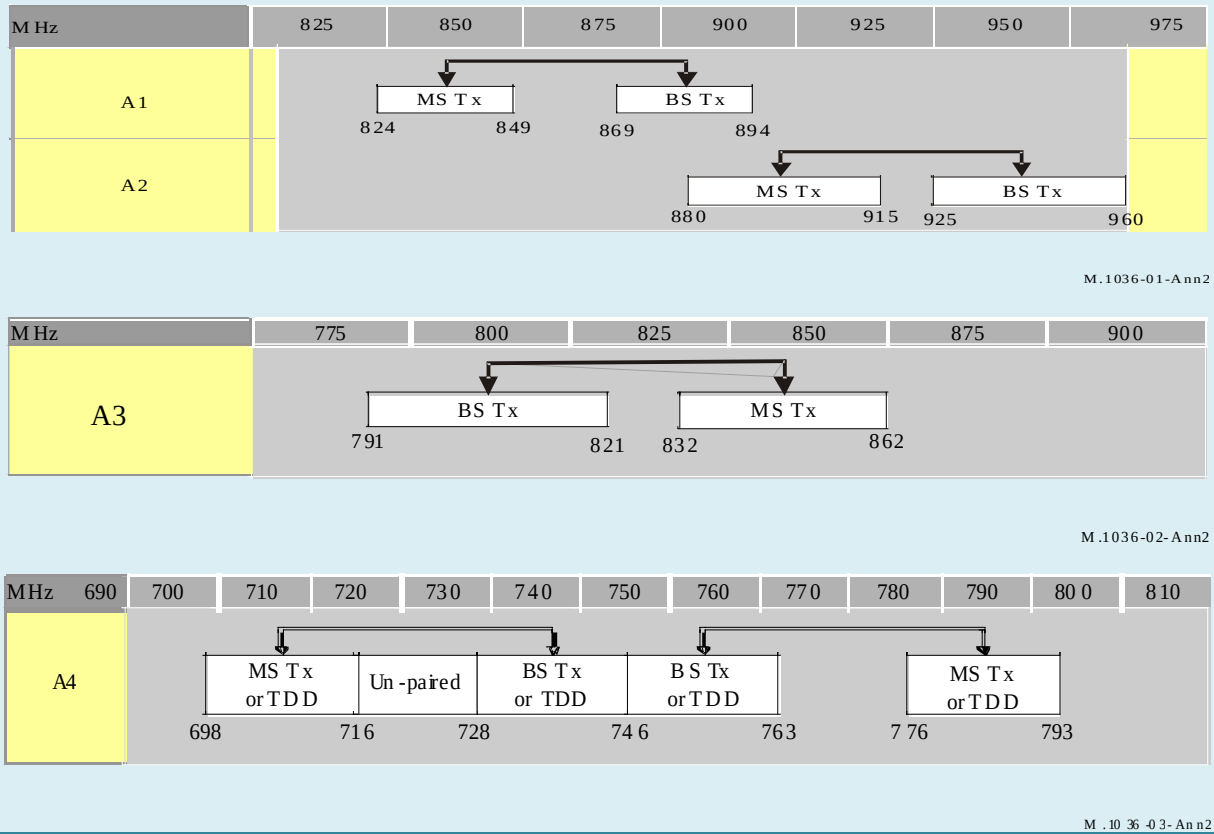
Annex 1 describes ten frequency arrangements for the implementation of IMT in the band 450-470 MHz. The number of frequency arrangements help to accommodate incumbent operations, while maintaining a common uplink/downlink structure (uplink in the lower 10 MHz, downlink in the upper 10 MHz) for FDD arrangements.

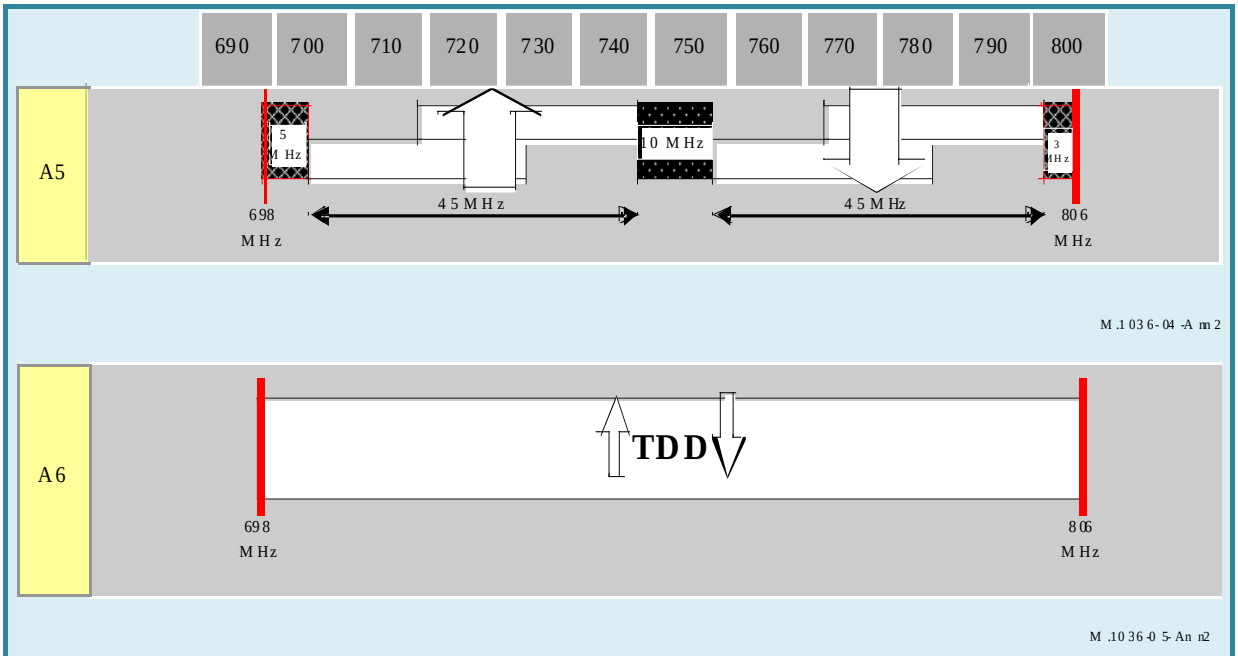
The recommended frequency arrangements for implementation of IMT in the band 698-960 MHz are summarized in Table C.1 and in Figure C.1.

Table C.1: Paired Frequency arrangements in the band 698-960 MHz

Frequency arrangements	Paired arrangements				Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
A1	824-849	20	869-894	45	None
A2	880-915	10	925-960	45	None
A3	832-862	11	791-821	41	None
A4	698-716 776-793	12 13	728-746 746-763	30 30	716-728
A5	703-748	10	758-803	55	None
A6	None	None	None		698-806

Figure C.1: Frequency arrangements for the 698 to 960 MHz band





Source: ITU

Due to different usages in 698-960 MHz between regions – no common solution is possible.

In the arrangement A3, reversed duplex direction mobile transmit in upper band and base transmit in lower band provides better conditions for coexistence with the lower adjacent broadcasting service.

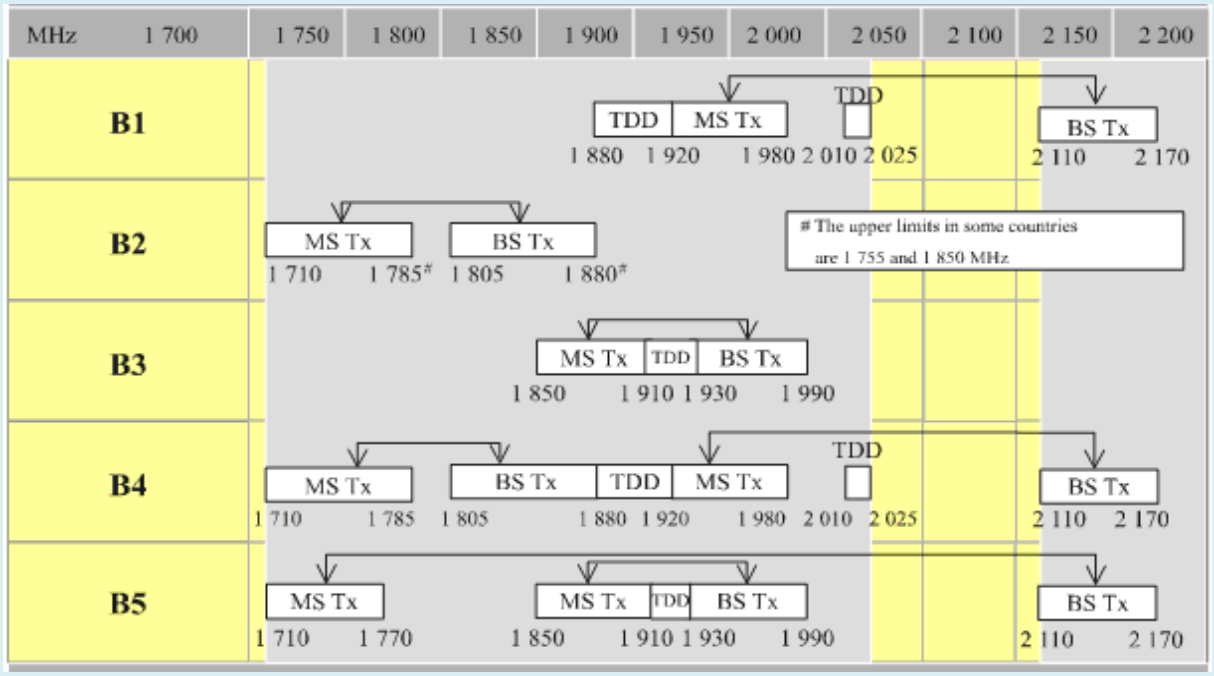
In arrangement A4, administrations can use the band solely for FDD or TDD, or some combination of FDD and TDD. Administrations can use any FDD duplex spacing or FDD duplex direction. However, when administrations choose to deploy mixed FDD/TDD channels with a fixed duplex separation for FDD, the duplex separation and duplex direction as shown in A4 are preferred.

In A5, the 2 x 45 MHz FDD arrangement uses sub blocks with dual duplexer solution and conventional duplex arrangement. Internal guard bands of 5 MHz and 3 MHz are provided at the lower and upper edge of the band for better co-existence with adjacent radio communication services.

In A6, taking into account the external 4 MHz guard band (694-698 MHz), a minimum internal guard-band of 5 MHz at the lower edge (698 MHz) and 3 MHz at the upper edge (806 MHz) needs to be considered.

Frequency arrangements in the band 1710-2200 MHz are depicted in the Figure C.2.

Figure C.2: Frequency arrangements in the 1710-2200 MHz band.

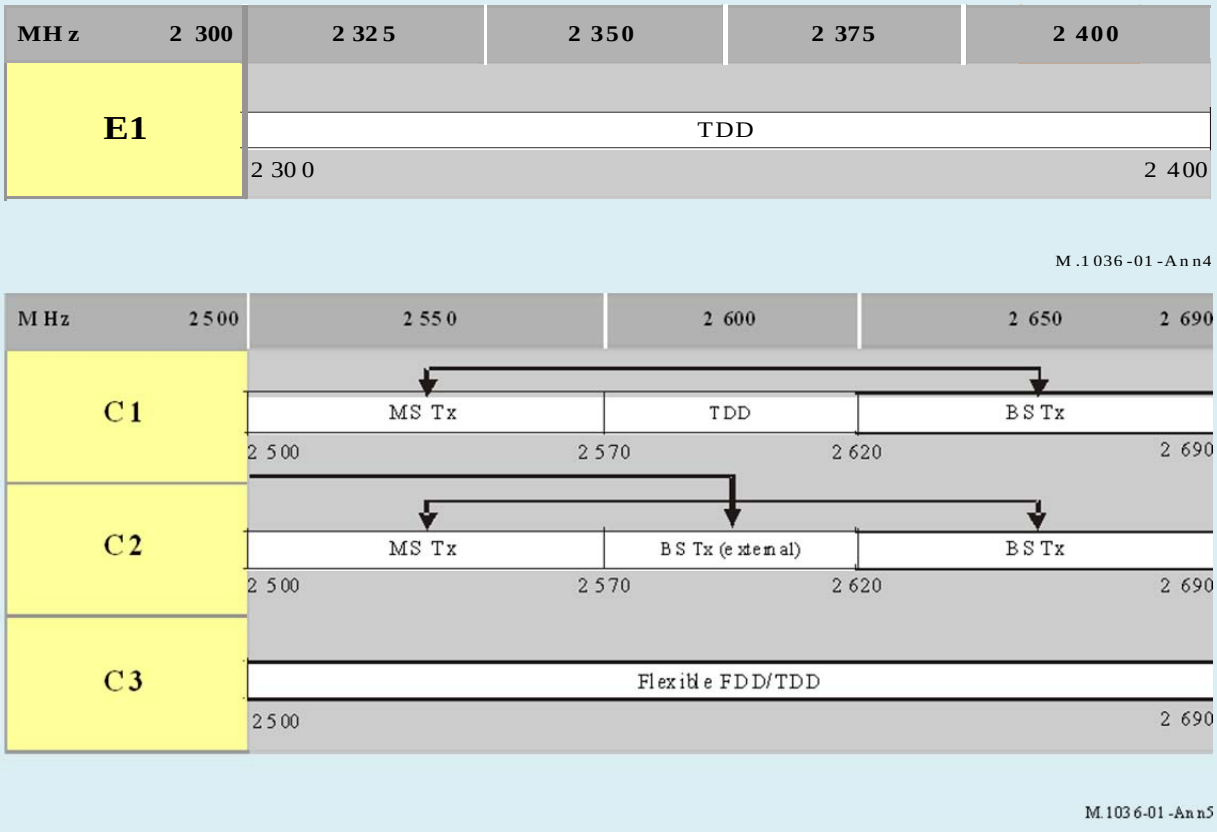


Source: ITU

In bands 1710-2025 MHz and 2110-2200 MHz three basic frequency arrangements (B1, B2 and B3) are already in use by public mobile cellular systems including IMT. Based on these three arrangements, different combinations of arrangements are recommended as described in B4 and B5.

Frequency arrangements in the band 2300-2400 MHz and 2500-2690 MHz are summarised in Figure C.3.

Figure C.3: Frequency arrangements in the 2300-2400 and 2500-2690 MHz bands



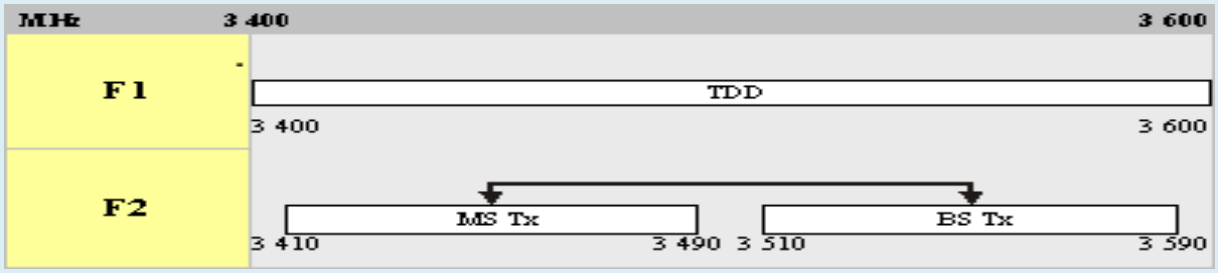
Source: ITU

Table C.2 and Figure C.4 describe frequency arrangements for the band 3400 to 3600 MHz.

Table C.2: Frequency arrangements in the 3400 to 3600 MHz bands

Frequency arrangements	Paired arrangements				Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
F1					3400 – 3600
F2	3410 – 3490	20 MHz	3510-3590	100 MHz	None

Figure C.4: Frequency arrangements for the 3400 to 3600 MHz band



Source: ITU

Appendix D: Government of Samoa

Government of Samoa

Office of the Regulator

Spectrum Plan for Mobile Broadband (GSM & E-GSM)

Prepared by the Office of the Regulator

Introduction

The OOTR is desirous of introducing broadband mobile services in Samoa and to provide a facilitating framework for the introduction of such services. In order that the existing cellular mobile providers have any unnecessary regulatory constraints removed the OOTR is initiating two separate but related consultations on (i) amending the cellular mobile licences to clearly allow for the provision of mobile services and (ii) to allocate necessary spectrum for the provision of same.

The proposal is to do this consultation within a relatively short time frame; one week for comments, one week comments on comments and then one week for Regulator to incorporate comments for Final draft. This time frame is of course subject to comments from the parties (Digicel and Blue Sky SamoaTel) and the regulator would always consider any justified time extension.

The end result expected is that within one month the providers would both be in a position with their licences to provide mobile broadband and the Regulator will be in a position to allocate spectrum for the provision of that service.

The focus would be to make the licences more technology neutral and to remove specific references to technology except where it may be needed and to allocate spectrum in the bands typically used to provide mobile broadband.

This initial proposal does not yet address the 700 MHz band and this will be addressed later when the consultation is held on the Spectrum Management Plan.

This proposal is for the spectrum allocation for mobile broadband provision. The idea is not to label bands as either 3 G or 4G but to allocate as for mobile broadband and the successful applicant apply the technology they consider appropriate as long as the service being provided is mobile broadband. The band allocation would then be service specific but technology neutral.

Background

There are worldwide changes being made for 3G and 4G Spectrum Allocations, the OOTR considered these changes and is working together with International and Regional Regulatory Authorities in managing spectrum allocation for mobile telecommunication technologies. The Plan follows the ITU-

Radiocommunication Recommendation M.1036-3 Frequency arrangements for the implementation of the terrestrial component of the International Mobile Telecommunications-2000 (IMT-2000) in the bands 806 – 960 MHz, 1710 – 2025 MHz, 2110 – 2200 MHz and 2500 – 2690 MHz.

International Mobile Telecommunications-2000 (IMT-2000) are the third generation mobile systems which provide access to a wide range of telecommunications service, supported by the fixed telecommunications network (e.g. PSTN/ISDN/IP), and to other services that are specific to mobile users.

Key features of IMT – 2000

- high degree of commonality of design worldwide;
- compatibility of services within the IMT-2000 and the fixed networks;
- high quality;
- small terminal suitable for worldwide use;
- capability of multimedia applications and a wide range of services and terminals.
- The capabilities of the IMT-2000 systems are being continuously enhanced in line with user needs and technology trends.

Frequency allocation

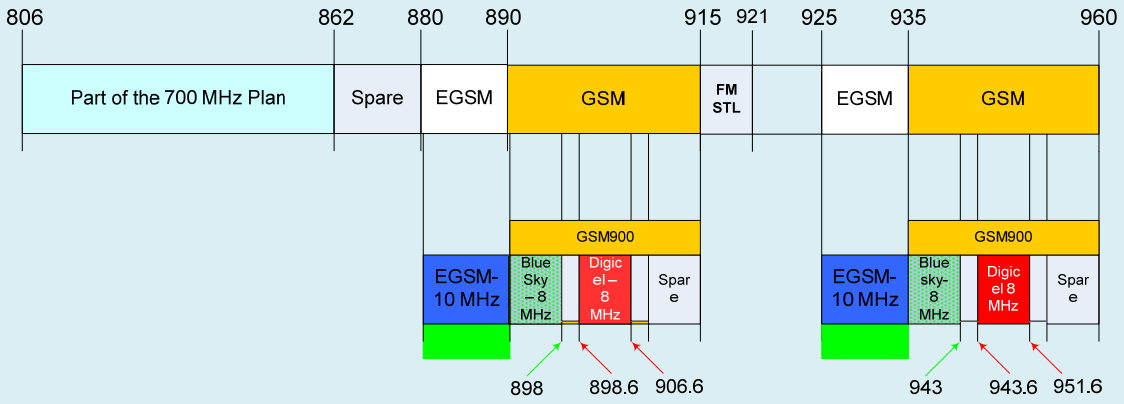
Table 1. Paired frequency arrangements in the band 806 – 960 MHz

Frequency arrangements	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)
A1	824 – 849	20	869 – 894	45
A2	880 – 915	10	925 – 960	45

i. *Centre gap* – the frequency separation between the upper edge of the lower band and the lower edge of the upper band in a FDD paired frequency arrangement.

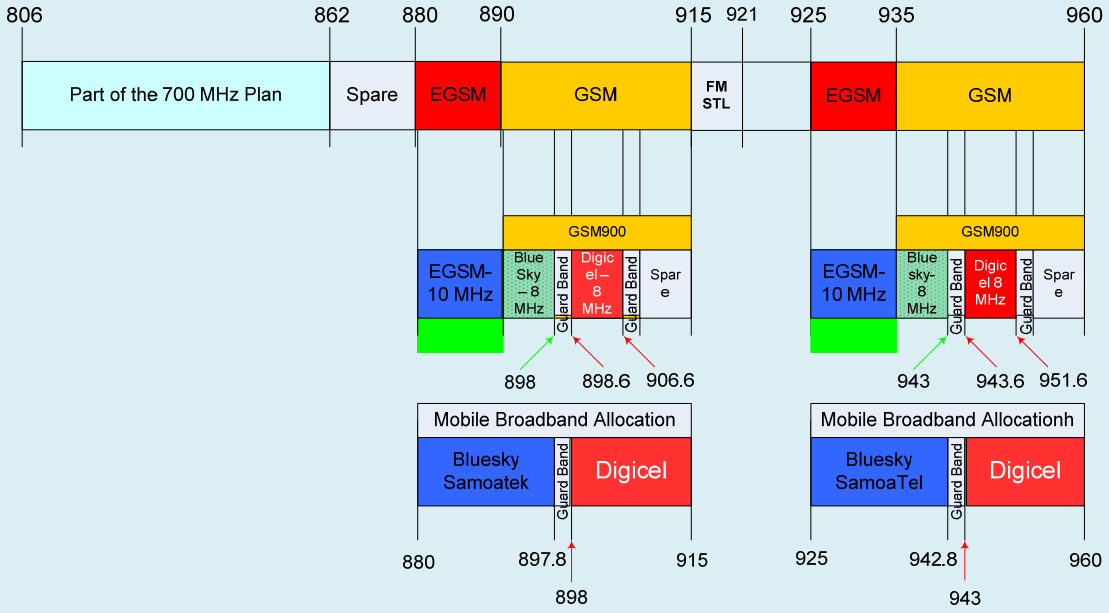
ii. *Duplex band frequency separation* – the frequency separation between a reference point in the lower band and the corresponding point in the upper band of an FDD arrangement.

Recommended frequency arrangements in bands identified for IMT-2000
Band 806 – 960 MHz
GSM900 and E-GSM900 Band Plan Proposal.



The above plan is including the Mobile Service Providers occupied some spectrum at 8 MHz spectrum allocation for GSM technology.

Recommended Allocation.



Reference discussion paper distributed and only two (2) service providers submitted comments for IMT2000 Spectrum Plan or Third Generation Spectrum Plan (3G). The arrangement of the propose plan was basically on the providers commendation the allocation of the available spectrum in GSM 900 MHz Band and the extended of the Lower end of the GSM 900 for the E-GSM.

- Bluesky Samoatel – 17 MHz spectrum of the Lower End of the lower part and Lower End of the Upper part of the 900 MHz Band Mobile Broadband Spectrum.
- Digicel Samoa Ltd – recommended 17 MHz the upper part of the lower end and the upper part of the 900 MHz Band Mobile Broadband Spectrum.

The following table details the of available spectrum for two mobile service providers;

Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter	Duplex separation (MHz)	Service Provider
880 – 897.8	27.2	925 – 942.8	45	Bluesky SamoaTel
898 – 915	28	943 – 960	45	Digicel

Overview on 900 MHz Band Plan

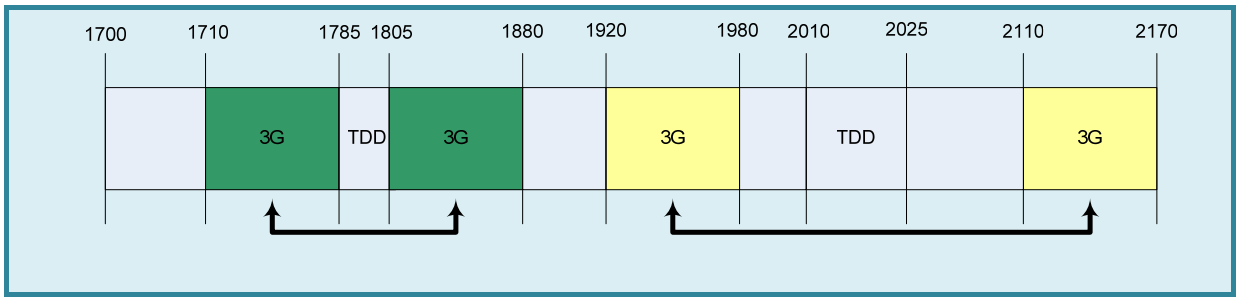
Mobile Broadband Spectrum Allocation.

BlueSky Samoatel	880.000 – 897.800 925.000 – 942.800	880 + (n x 200 kHz) 925 + (n x 200 kHz)	1 – 89	17.8 MHz
Digicel Samoa/CSL	898.000 – 915.000 943.000 – 960.000	898 + (n x 200 kHz) 943 + (n x 200 kHz)	91 – 179	17 MHz

Band 1700 – 2170 MHz

Table 2.
Frequency arrangements in the band 1710 – 2200 MHz

Frequency arrangements	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex Separation (MHz)	Un-paired spectrum (e.g. for TDD) (MHz)
B1	1920 – 1980	130	2110 – 2170	190	1880-1920; 2010-2025
B2	1710 – 1785	20	1805 – 1880	95	none
B3	1850 – 1910	20	1930 – 1990	80	1910 – 1930
B4 (harmonized with B1 and B2	1710 – 1785 1920 – 1980	20 130	1805 – 1880 2110 – 2170	95 190	1900 – 1920 2010 – 2025
B5 (harmonized with B3 and parts of B1 and B2	1850 – 1910 1710 – 1770	20 340	1930 – 1990 2110 – 2170	80 400	1910 – 1930



The Regulator will consider migration of fixed service within this allocation for International Mobile 2000 or Third Generation Mobile Technology (3G) and the Fourth Generation Mobile Technology (4G).

Annex 1: List of acronyms and abbreviations

3GPP	*The 3rd Generation Partnership Project*
ACMA	*Australia Communications and Media Authority*
APT	*Asia Pacific Telecommunity*
ARPU	*Average Revenue per User*
AWS	*Advanced Wireless Services*
BWA	*Broadband Wireless Access*
EGAN	*3GPP Enhanced Generic Access Network*
FCC	*US Federal Communications Commission*
FDD	*Frequency Division Duplexing*
GCF	*Global Certification Forum*
GPRS	*General Packet Radio Service*
GSM	*Global System Mobile*
HSPA	*High Speed Packet Access*
ITU	*International Telecommunication Union*
ITU-R	*ITU Radiocommunication Sector*
IWLAN	*Interworking Wireless LAN*
LTE	*Long Term Evolution*
M2M	*Machine to Machine*
MBMS	*Multimedia Broadcast/Multicast Service*
MCIT	*Ministry of Communication and Information Technology*
MDGs	*Millennium Development Goals*
MVNO	*Mobile Virtual Network Operator*
OOB	*Out-of-band*
OOTR	*Office of the Regulator, Samoa*
PPP	*Public private partnership*
PSTN	*Public Switched Telephone Network*
RAN	*Radio Access Network*
RLANS	*Radio Local Area Networks*
SMS	*Short Message Service*
SON	*Self Organising Network*
SRSPs	*Standard Radio System Plans*
TDD	*Time Division Duplexing*
UMA	*Unlicensed Mobile Access*
UMTS	*Universal Mobile Telecommunications System*
WBB	*Wireless Broadband*
W-CDMA	*Wideband Code Division Multiple Access*
Wi-Fi	*Wireless Fidelity*
WiMAX	*Worldwide Interoperability for Microwave Access*
WRC-07	*World Radiocommunications Conference 2007*
WRC-12	*World Radiocommunications Conference 2012*

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