IT'S HOW WE CONNECT

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Summary

This document provides insight into the global and local (Telstra Australia) growth in wireless data, along with forecasts of the applications, device usage and traffic out to 2018. This paper explains how the new 3GPP band (band 28 or APT700) can assist operators to meet this growth in demand. The paper also discusses the benefit of international harmonisation of spectrum bands.

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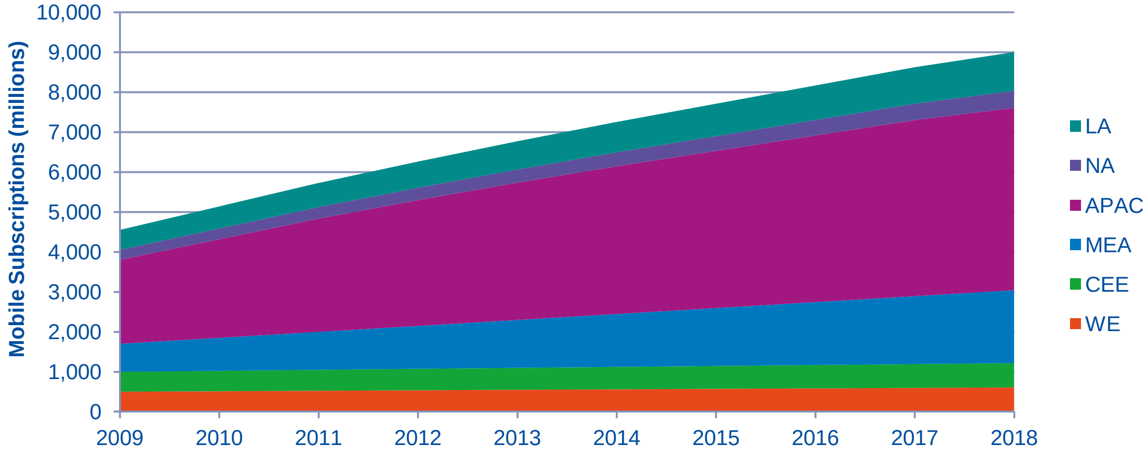
01 Growth in wireless data continues to drive investment in spectrum globally

Growth in wireless data continues to drive investment in cellular network and in particular the acquisition of new spectrum assets by wireless operators. The number of mobile subscriptions in Q1 2013 topped 6.4 billion[1] globally and has grown 8% year on year. The APAC region, roughly split equally between China and the rest of APAC, contributed to most of the global growth in Q1 2013.

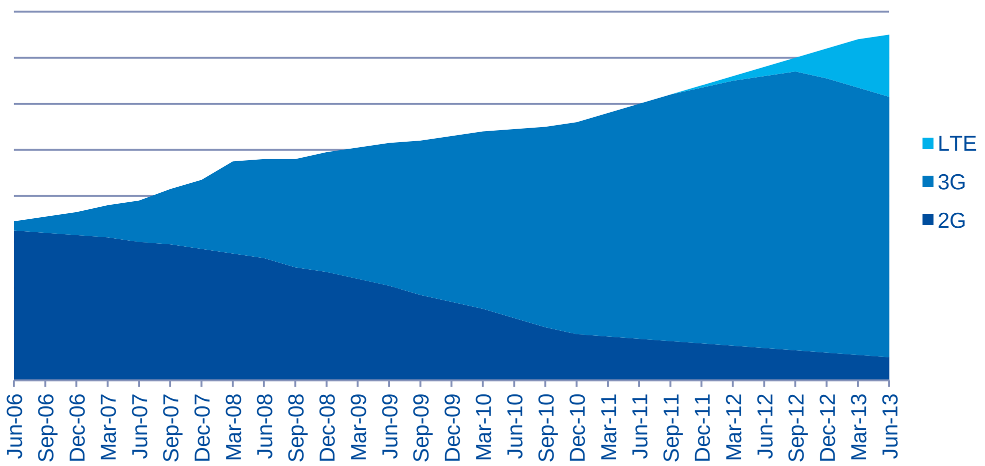


For Telstra in Australia growth in wireless services has steadily continued. With over 100% SIM penetration in Australia, growth in data services and Telstra's network superiority (leading to a net positive churn from other operators) has driven the overall growth for the services in operation.

For Telstra, migration from 2G to 3G started with the launch of the Next G® (3G 850 MHz) network, which was built to match both the coverage of the GSM and CDMA networks. With a single 3G network providing better breadth and depth of coverage than either of the two 2G networks, customers quickly moved to the new network and by 2008 (nearly 2 years from launch) 3G subscribers had exceed 2G subscribers.

With the introduction of Telstra's LTE network in 2011, cellular subscription growth is now driven exclusively by 4G services. In recent months we have seen the rate of 3G traffic growth steady, while 4G traffic is rising increasing substantially.

Telstra's historical subscriber growth and technology breakdown



[1] Ericsson Mobility Report, June 2013

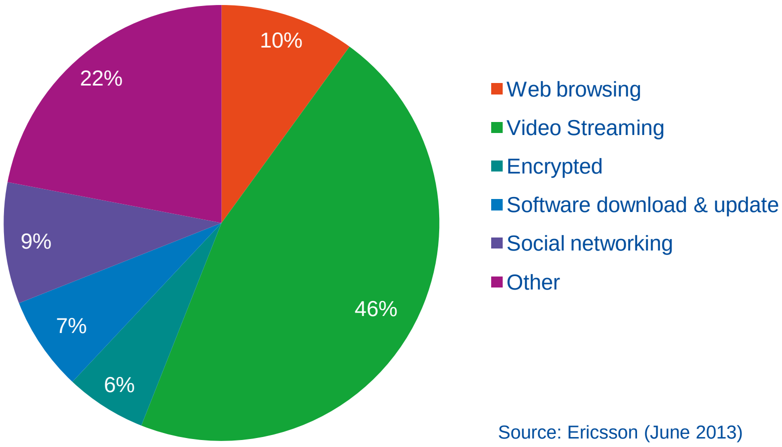
While global mobile subscriptions grow at a relatively linear rate (8% CAGR), the volume of data consumed per subscriber and the resulting total monthly consumed volume is growing exponentially. In most regions, the growth is dominated by mobile PC traffic, however in mature markets, such as North America and Australia smart phones dominate growth in traffic. This shift from mobile PC traffic to smart phones in expected in other markets as they mature.

Although smart phones generally consume less data per subscription than mobile PC wireless devices, the penetration of smart phones is much higher. In Telstra, smart phones are approximately 60% of all devices in operation and contribute to approximately 45% of the total network data.

Relative Consumption per Device Type (source: Telstra June 2013)

According to Ericsson, the primary driver, globally, for the increases in data volume is video applications. In 2013, video contributed to over 30% of the global wireless data consumption and this is expected to grow to nearly 50% by 2018. This trend, along with the continued increases in content like software downloads and updates may also drive the requirements for cellular broadcast technologies such as Enhanced Multimedia Broadcast and Multicast Services (eMBMS), also known as LTE-Broadcast.

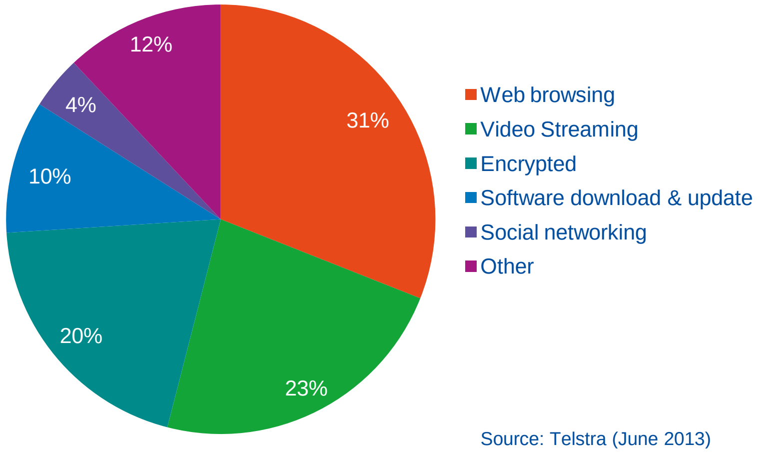
Global Application Breakdown (percentage of total volume)



Source: Ericsson (June 2013)

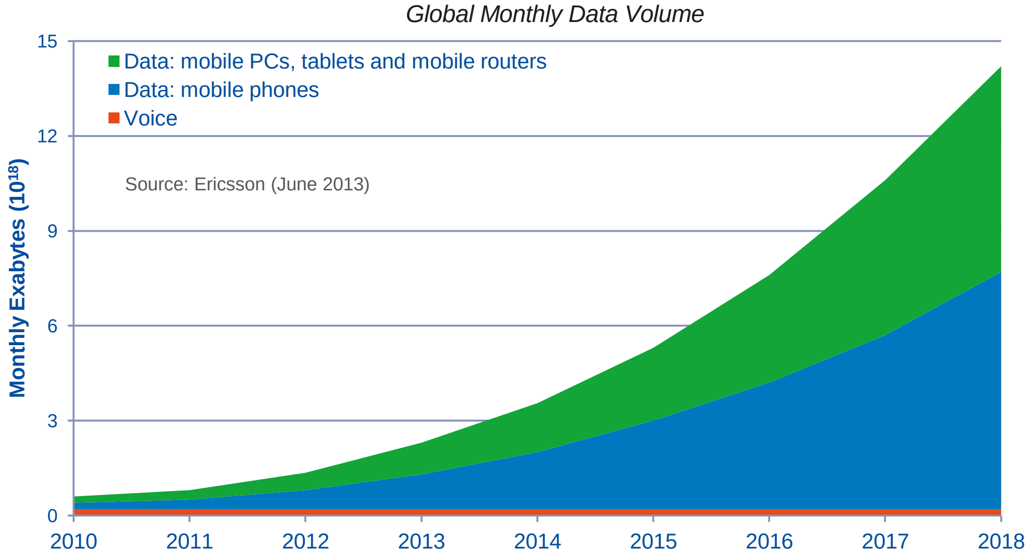
Within Telstra's wireless network, web browsing, including encrypted sessions (typically https) still dominates overall data traffic (31% of traffic). Software download and content is also a significant contributor to data use compared to the global average, likely driven by the high proportion of smart phones in the Telstra network (10% of traffic).

Telstra's Application Breakdown (percentage of total volume)



Globally from 2013 to 2018, wireless data is expected to grow at 50% per year, resulting in a 12 times increase in global mobile data volumes over the same period.

Global Monthly Data Volume



This exponential growth in volume is pushing operators to:

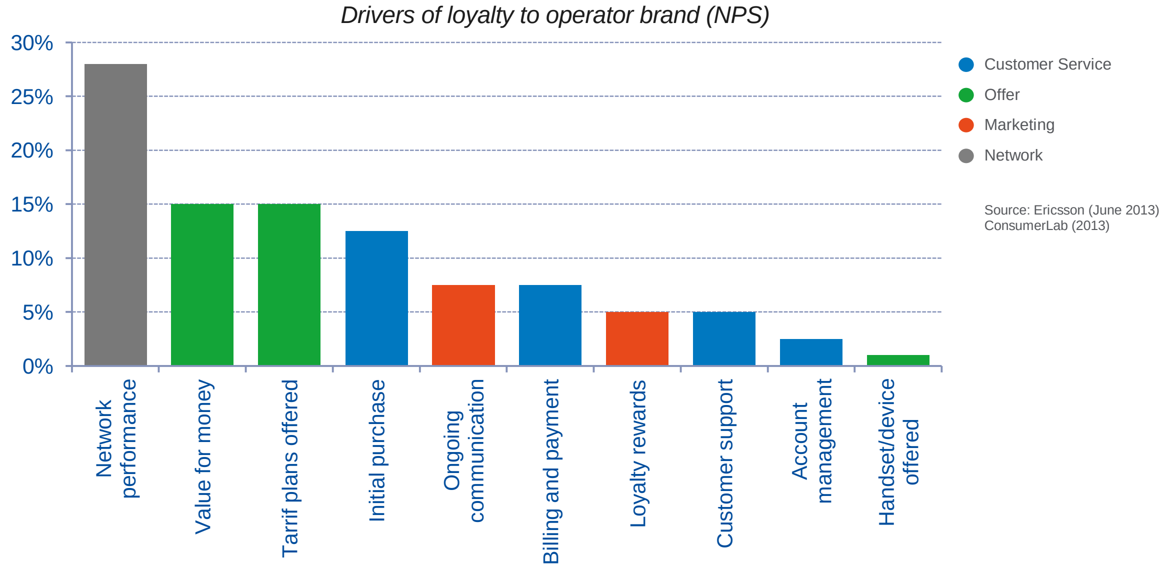
- Adopt technologies that utilise spectrum more efficiently (such as LTE and LTE Advanced),
- Re-farm existing spectrum assets (typically in voice centric technologies in spectrum like 900 and 1800MHz to data efficient technologies like 3G and LTE)
- Expand the breadth and depth of coverage (cell splitting and new sites)
- Acquire new spectrum assets (in 2013 close to AUD2billion was spent by Australian operators on acquiring 700MHz and 2.5GHz spectrum made available through the Digital Dividend)

Beyond the raw volumes of data consumed, wireless networks are providing a social and economic benefit, especially in developing nations where fixed line Internet access is not always available, affordable or reliable.

For example, the African Partnership Forum identified in 2008 that access to information and communication can "…increase efficiency, provide access to new markets or services, create new opportunities for income generation and give poor people a voice".

Access to communications services and in particular access to the Internet has and will continue to change and enrich the lives of people across the globe. Mobile communications have been the dominant mode of access to the Internet since 2009[2].

While network traffic grows, consumers are demanding more from mobile networks and are expecting these demands to be met anywhere and at any time. Consumers rank network performance as a key parameter in their advocacy of an operator, rated higher than all other factors.



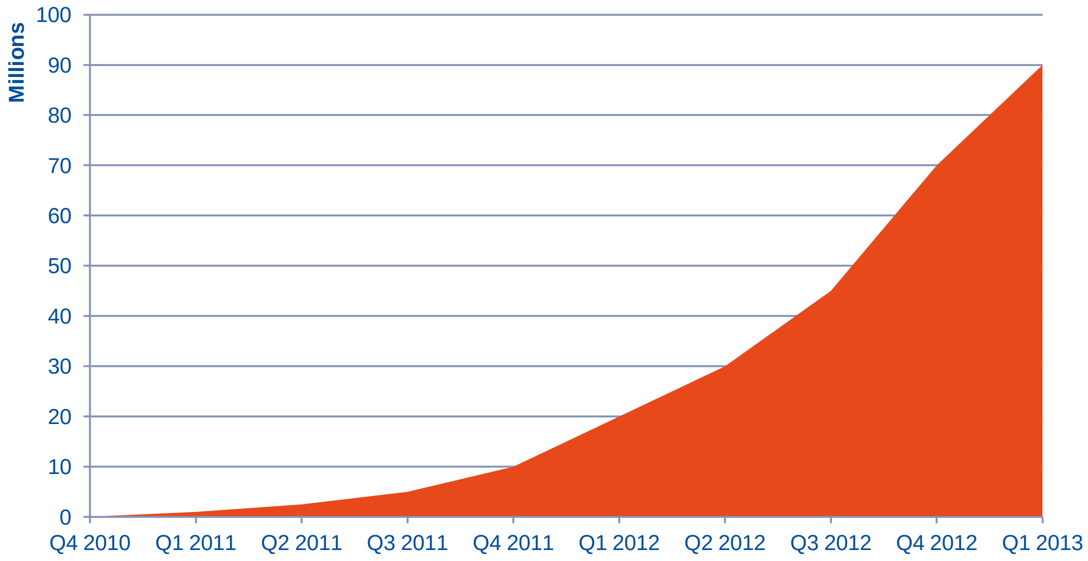
In an increasingly competitive market, and as traffic continues to increase, operators will have an increasing challenge to meet the consumer's expectation of network performance (speed, coverage and reliability). The expansion of coverage of high speed networks is expected to continue to meet part of the customer's expectations. According to Ericsson, 3G networks will continue to expand and will cover 85% of the world's population in 2018, however new spectrum and new technologies, specifically LTE will be required longer term.

02 Adoption of LTE has outpaced all other Generations of Wireless Communications

The rate of adoption of LTE has exceeded that of all other mobile communication technologies. In the four years since commercial services started (December 2009, TeliaSonera), LTE has been deployed by 156 operators across 67 countries, covering 10% of the world's population[3] reaching 60% by 2018 (3G/WCDMA has taken 12 years to reach 55% global population coverage).

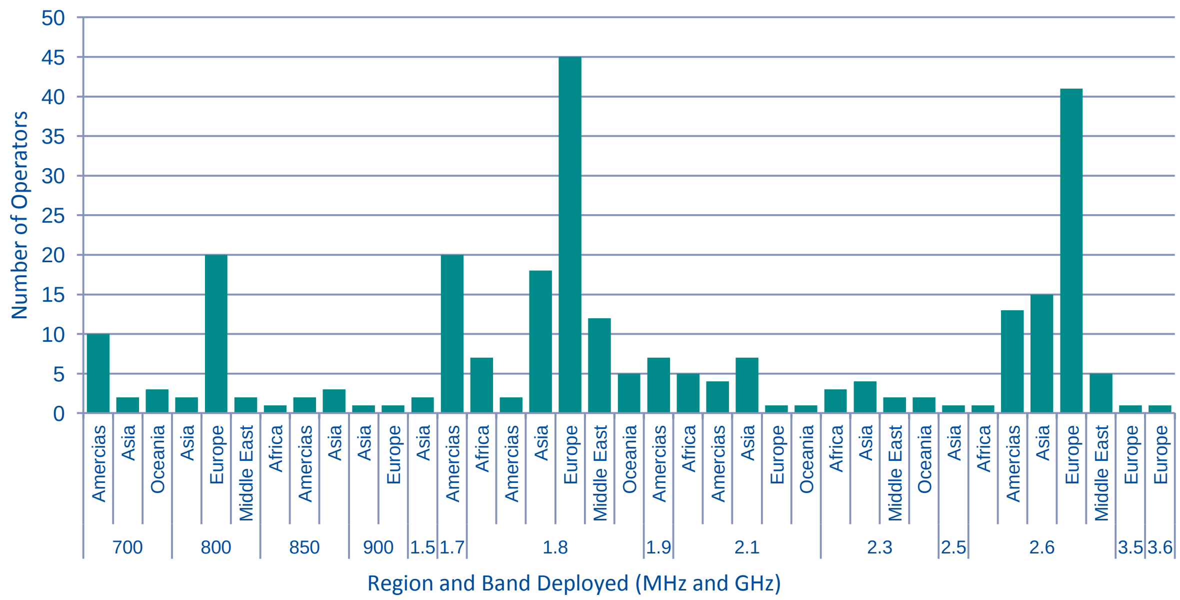
[2] Global mobile broadband subscriptions surpassed fixed Internet connections in 2009
[3] Global Supplier Association (GSA) estimates, Q1 2013.

Global LTE Subscriber Growth 2010-2013[4]



Although LTE was initially standardised to operate in the new 2600MHz band, other bands across the spectrum range have been quickly adopted. However, the majority (225 out of a sample of 272) of deployed or planned LTE networks are in bands greater than 1GHz. Due to the lower propagation characteristics of higher spectrum bands, these networks will struggle to meet the longer term coverage expectations of customers.

Global LTE Planned or Deployed Networks by Region and Band

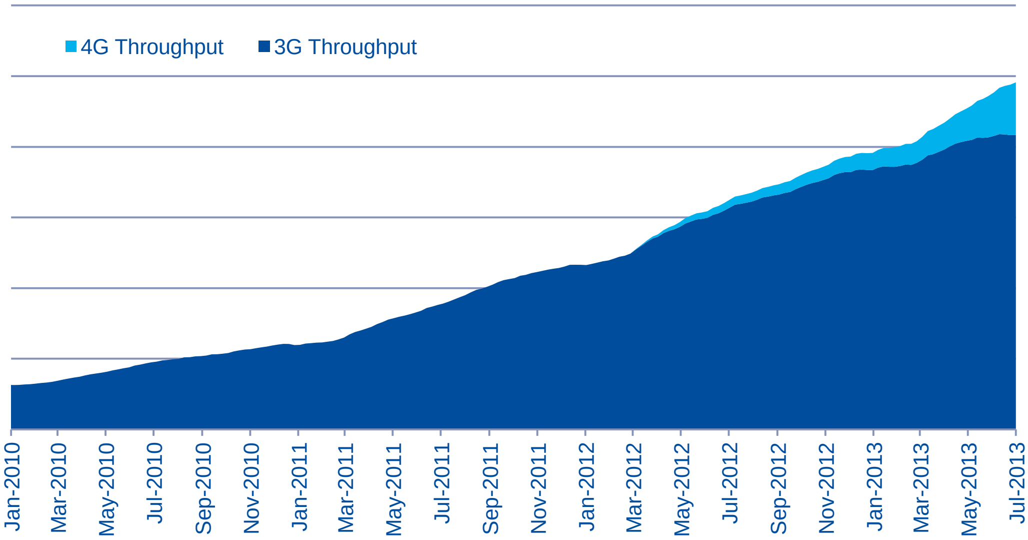


In Australia, Telstra led the industry with an LTE1800MHz deployment covering 66% of the population by the middle of 2013. This network was integrated with the existing 3G DC-HSPA+ 850MHz network, which is used primarily for national coverage outside the LTE footprint, but also for depth of coverage.

[4] Source: Ericsson June 2013

With the Telstra LTE1800 network expansion covering 66% of the population and device penetration approaching 20% at June 2013 there has been a slowing of 3G growth as LTE device penetration increases. With a planned expansion of LTE1800 coverage to 85% of population by December 2013 it is expected that LTE will be the predominant source of traffic growth into the future.

Telstra's wireless traffic growth for 3G and LTE



However, challenges still remain in catering for customer demand. Customers with LTE devices typically use 50% more data than a 3G device, but they do this regardless of the network they are using. As a result, customers with LTE devices generate around 40% data traffic (across 3G and LTE).

Even if the 1800MHz LTE network was deployed at all 3G sites, there would still be gaps in coverage. These gaps would be due to reduced coverage of 1800MHz cells in some regional/remote areas and within buildings. The differences are due to propagation at 850MHz being better than 1800MHz. With continued growth in data, the 3G network would also eventually become congested. Consequently there is a requirement for a low frequency LTE spectrum band to address these issues

The frequency of operation is an important consideration for wireless operators as networks deployed in the higher (1.8 – 3.6GHz) frequency bands will have reduced coverage (per site) compared to traditional voice and data networks. These LTE networks will continue to rely on 3G (and in some cases 2G) networks, to provide continuity of service. However, the new higher frequency bands typically have larger amounts of spectrum available, providing greater capacity for operators.

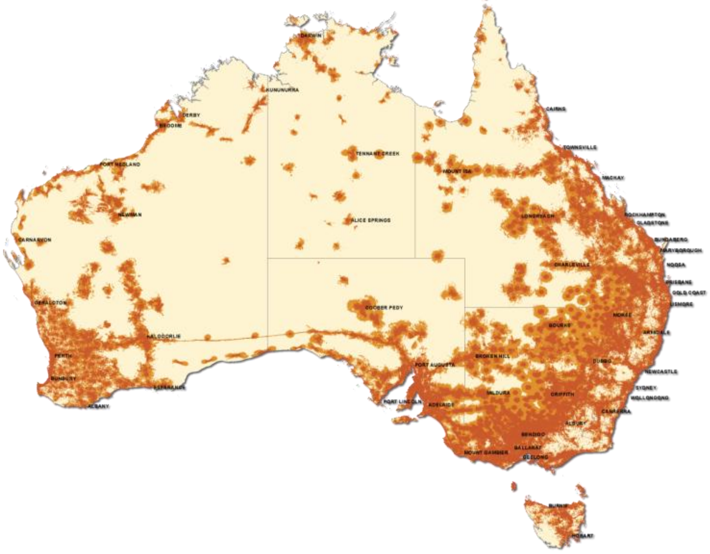
Given the growth in consumption, LTE coverage requires expansion and to eventually equal that of the lower band 2G and 3G networks (such as 3G 850 or 3G900 MHz).

In terms of spectrum, the ultimate goal for operators is to acquire a large contiguous block of low band (sub 1GHz) spectrum suitable for LTE deployment. As countries started the process of digitising television services, and thereby making recovery of a portion of the analogue TV spectrum bandwidth possible, the 700MHz band offered considerable opportunity and was eyed by operators as an ideal band for their future low band LTE requirements.

03 Benefits of Low Frequency Cellular Deployments

The benefits of a low band, high speed data network are well understood by Telstra and other operators with 3G networks in the 850 and 900MHz bands. With the introduction of Telstra's Next G® network in 2006, 3G coverage went from a metro only service (with fall back to EDGE and GPRS outside metro areas), to a national high speed HSPA network which in 2013 covers over 2.3 million square kms of the Australian landmass and reaches 99.3% of the Australian population[5].

Telstra's Next G ® coverage (2.3 million sq. kms, 99.3% population coverage)



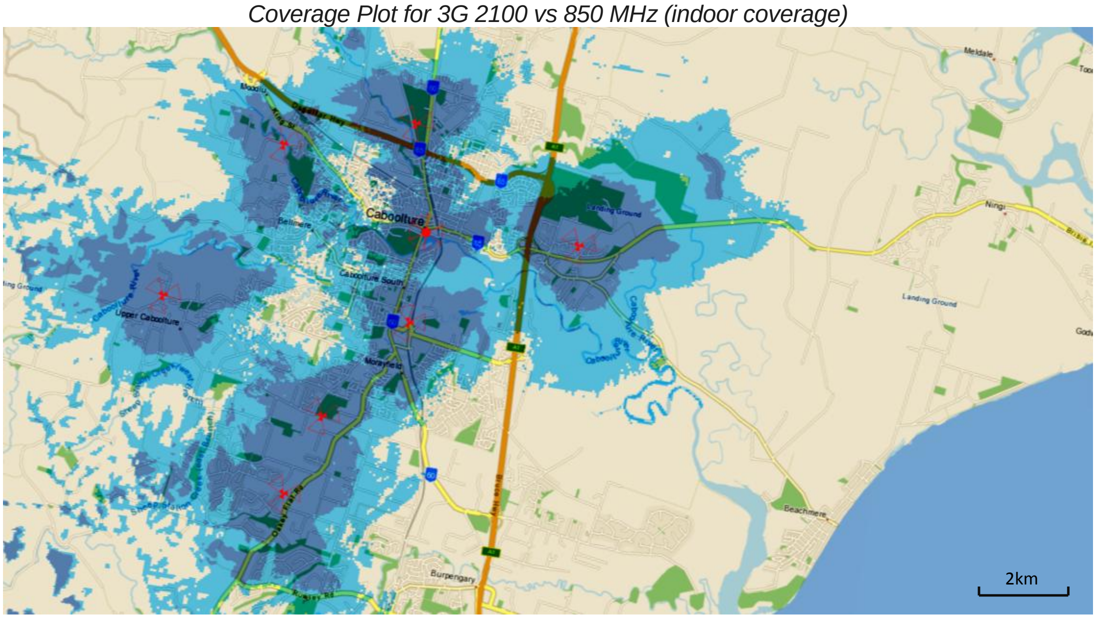
This expansive coverage is enabled by four key aspects:

1. Overcoming the inherent delays in signal transmission over large distances through development of features from the infrastructure vendor (Ericsson)
2. A unique network implementation, providing high capacity and large reach through the deployment of high powered and low noise amplifiers.
3. Conformance to strict device requirements.
4. Operating in the 850MHz band, thereby reducing signal propagation losses.

The Next G® network was designed to replace the CDMA network and also match the depth of coverage of GSM in metro areas. The Telstra Next G® network was originally built using 850MHz spectrum and then later expanded to utilise 2100MHz spectrum for additional capacity. More recently LTE 1800 MHz has been deployed to add further capacity. Unlike other 3G networks operating at 2100MHz, the underlying coverage of the Next G® 3G network (850MHz) means devices do not need to fall back to 2G for service continuity. This simplified the network design and improved the coverage of the network (as entering compressed mode for handover reduces 3G coverage). The coverage benefits from using the lower frequency 850 MHz band are illustrated below.

[5] Telstra network coverage as at June 2013

Coverage Plot for 3G 2100 vs 850 MHz (indoor coverage)



■ 3G 850MHz ■ 3G 2100MHz

When predicting the outdoor (street level) coverage for a cluster of sites with both 3G850 and 2100MHz operational, there is a 25% area coverage (320 compared to 240 sq. kms) advantage with 850 over 2100MHz[6]. However, this coverage advantage is doubled (153 compared to 78 sq. kms) when considering the indoor coverage as shown in the plot above.

With no reliance on 2G for coverage continuity, products and services can be released to market knowing that when customers are in coverage, they will be in 3G coverage. For example, when making a video call a Next G® customer does not need to consider if either the A or B party is in 3G coverage. The same concept applies for watching streaming video, downloading music or downloading or sending e-mails with large attachments.

The rapid transition of customers and traffic from 2G to 3G in Telstra's network also allowed for the refarming of the 2G 900 and 1800MHz spectrum for the deployment of LTE.

The same benefits in coverage advantage afforded by the use of the lower 850MHz band for 3G would apply to the use of the APT700 band for LTE.

04 History of the Digital Dividend Spectrum in Australia

The process of digitisation of television services in Australia was targeted to free up 126MHz in the UHF band (the digital dividend). Given the importance of this spectrum the Australian Communications and Media Authority (ACMA) released a whitepaper seeking views on the best band plan for the digital dividend. Telstra and Telecom New Zealand jointly undertook detailed technical analysis and simulations, and developed a detailed proposal which was submitted to the Asia-Pacific Telecommunity (APT) forum and subsequently to the ACMA. After extensive regional and national consideration of the benefits and implications of this plan, it was endorsed by APT administrations, and adopted by the ACMA.

Starting late April and concluding in May 2013, both the 700MHz and 2500MHz (2600MHz) band were auctioned. A total of 90MHz (2 x 45MHz) within the 700MHz band was allocated for wireless communications as part of the auction. Two operators successfully bid for spectrum, resulting in the sale of 2 x 20MHz to Telstra and 2 x 10MHz to Optus (additional spectrum at 2600MHz was also awarded, but is not covered in this paper).

[6] Coverage prediction considering in-building penetration losses in a flat residential area 50kms north of Brisbane, QLD Australia

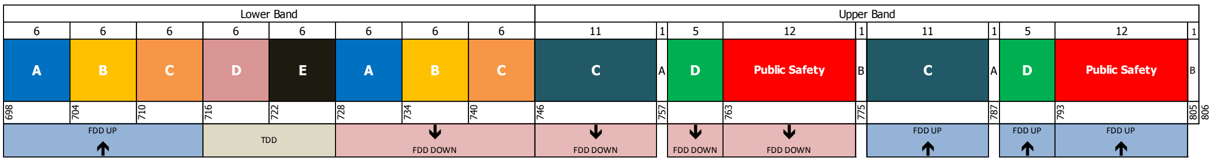
Prior to the auction in Australia, the North American 700MHz band had already gone through the process of digitisation with an auction concluding in 2008. The American Federal Communications Commission (FCC) dictated how this band was to be allocated, subject to a non-contiguous availability timetable, resulting in 5 Blocks:

- Block A: 12 MHz bandwidth (698–704 and 728–734MHz)
- Block B: 12 MHz bandwidth (704–710 and 734–740MHz)
- Block C: 22 MHz bandwidth (746–757 and 776–787MHz)
- Block D: 10 MHz bandwidth (758–763 and 788–793MHz)
- Block E: 6 MHz bandwidth (722–728MHz)

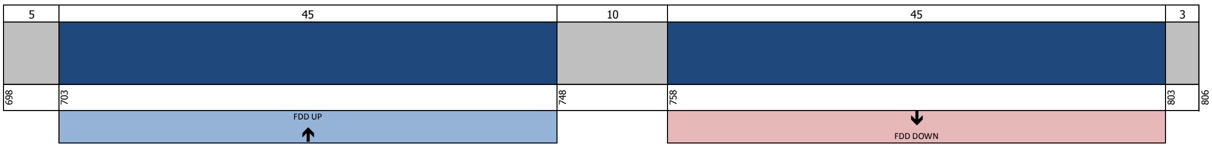
The North American band plan was initially considered for use in Australia as it offered attractive economies of scale, aligned well (and did not overlap) with existing services such as narrow-band fixed links and public safety radio communications. Also, deployment of LTE using an existing band plan would benefit from the global ecosystem of infrastructure and devices.

However, the North American plan did not maximise the benefits of LTE, and from a structural aspect was not considered an efficient use of the available spectrum. LTE can be deployed in bandwidths of 1.4, 3, 5, 10 15 or 20MHz (1.4 and 3MHz deployments are uncommon). Since the US band plan retained the legacy 6MHz TV channel raster, lot allocations of 6 and 12MHz were auctioned. Within each lot, there is therefore between 1-2MHz of spectrum un-used (assuming 5 or 10MHz LTE deployment).

US Band Plan



APT700 Band Plan



The only other available 'standardised' low frequency band for LTE deployment was the European band (790MHz to 862MHz). However this structure overlaps with the existing Australian 3G 850MHz (band 5) and is therefore not a practical option – similarly for any other country with operating 850MHz networks.

The development of a new LTE band plan requires considerable effort and time - and results in yet another LTE band variant that further segments the product ecosystem. However, the potential benefits of a new 700MHz band, resulting in optimal usage of the available spectrum could not be ignored.

Telstra recognised the benefits of this 700MHz spectrum and, in collaboration with counterparts in Telecom New Zealand and other industry players, commenced work in 2009 on developing the new 700MHz band plan.

The requirements of the band plan were to:

1. Maximise the use of the band and include carriers of 20 MHz
2. Allow for co-existence with digital TV services
3. Consider the feasibility of user device duplexer and filter construction
4. Consider the harmonics and the impact on GPS receivers integrated within smart phones
5. Where possible, harmonise with existing 3GPP bands.

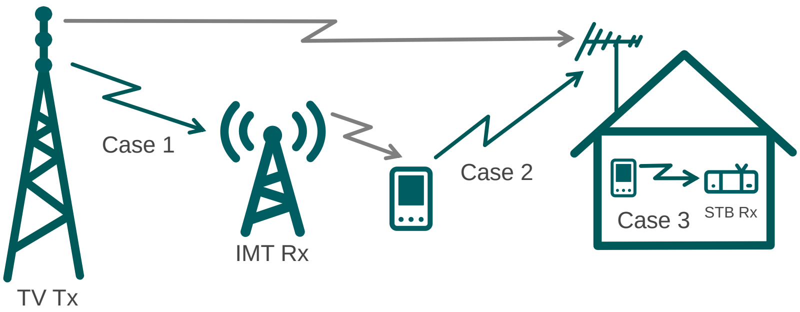
In conjunction with Telecom New Zealand (TNZ), Telstra developed a proposal for the 700MHz band, with the key points being:

1. A total allocation of 90MHz (2 x 45MHz)
2. User equipment transmit in the lower part (703 – 748MHz) of the spectrum and base station transmit in the upper (758 – 803MHz) part
3. A 10MHz duplex separation – to minimise UE-to-UE desensitization in crowded scenarios
4. A lower 5 and upper 3MHz guard band – to minimise interference to/from adjacent services
5. Allocation from 703 to 803MHz (see below)

The Australian Communications and Media Authority (ACMA) had previously suggested that 2 x 50MHz be allocated, with an 8MHz duplex separation. However, due to constraints on filter construction for devices, and concerns over UE-to-UE interference in crowded situations such as on public transport, within stadiums, on footpaths, and other such scenarios, a band separation gap of 10MHz was finally agreed.

The reverse duplex arrangement as used in Europe was proposed by TV broadcasters (concerned about UE interactions with TV receivers) and was briefly considered. This arrangement was eventually rejected as the resulting UE uplink second harmonic emissions would directly fall in the middle of the GPS receive band (around 1580-1610MHz), seriously impacting the location abilities of smart phones with an integrated GPS receiver.

TV broadcasters continued to express concerns about the perceived risk of interference from user equipment (transmitting in the 703 - 748MHz block) into the digital TV receiver, through either the external TV antenna or from a nearby user's mobile device into a 'same-room' or 'though-wall' TV or set top box.



In all cases, the interference to and from mobile and TV services was modelled and shown to be generally insignificant. In the case of LTE handsets, extensive testing was conducted for potential interference with the receiver in the digital TV set top box (STB). The results showed this interference scenario was extremely unlikely.

Locally in Australia, consensus was achieved that required less than a level of -40 dBm (measured in 7MHz) of interference into the TV receiver. Based on the probabilistic studies by Telstra and others submitted to the APT, a regional consensus was developed on the maximum permissible emission by LTE user devices of -34 dBm (averaged over a 7MHz TV channel). As a compromise to the ongoing concerns raised by TV broadcasters, Australia pressed for an optional additional level of protection (to be applied on a local level, where the uppermost TV channel #51 was actually in use) equal to -40dBm (averaged over a 7MHz TV channel). The choice between this more stringent Australian limit and the general APT limit of -34 dBm is a discretionary option available to national regulators/administrations.

Over the period 2010 to 2012, both Telecom New Zealand and Telstra Australia championed the new 700MHz band plan in the Asia-Pacific region, often referred to as Region 3 (Europe being Region 1 and the U.S. Region 2). After final consultations and policy review, the ACMA also endorsed the proposed plan and actively supported it within the Asia-Pacific Telecommunity (APT) for formal adoption within region.

In early 2011, the APT agreed to the proposed band plan and submitted the proposal to the 3G Partnership Project (3GPP) for standardisation. No further global agreement was required as the APT had simultaneously promoted the band to the ITU-R which subsequently designated the band for mobile communications.

In June 2012 the band plan was officially standardised by 3GPP as Band 28.

05 Global commitment to the APT 700MHz Band

Since the standardisation of the APT700 MHz band (Band 28) by 3GPP, chipset and infrastructure vendors and operators globally have progressively indicated their commitment to or interest in the band. Noting the choice between the somewhat fragmented and less-efficient US plan for the band, and the corresponding European option that conflicted with existing 850MHz mobile networks, many nations are naturally drawn to the APT700 plan.

The major RAN infrastructure vendors (Ericsson, NSN[7], Huawei, ZTE) have announced support for Band 28, with at least one vendor being used for deployment in 2013 (others committed to 2014). As vendors move to a split eNodeB architecture, the only component requiring significant change is the radio unit, with baseband and supporting software requiring only software updates.

LTE chipset manufacturers such as Qualcomm are expected to release chipsets supporting Band 28 during the second half of 2013, with device manufacturers following shortly after.

While Australia and New Zealand developed and promoted the APT700 band, a growing number of other countries have now also formally signalled their commitment to the band.

Unlike many other South East Asian countries, Australia and New Zealand do not need to consider inter-country interference. However, for the majority of the region cross border co-ordination and harmonisation is essential. A regional band plan benefits not only the supporting ecosystem, but also simplifies inter-country spectrum co-ordination and resolves cross border interference.

On May 16th 2013 the South Asian Telecom Regulatory Council (SATRC, a work area within APT) announced the adoption of the APT 700MHz frequency band plan. SATRC members include regulatory bodies from Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan and Sri Lanka, representing nearly 2 billion people and just over 1 billion mobile connections as of Q2 2013 estimates.

During their 14th council meeting (SATRC-14), representatives of the nine member countries (with the exception of Iran and Sri Lanka) announced their commitment “to working as equal partners in order to fulfil the tremendous potential of the APT700 MHz Band Plan and to accelerate transition from analogue to digital broadcast TV services in 700MHz band (where applicable) which will free up this spectrum for its highest value use, which is mobile broadband”.

The announcement also made clear that members will ensure “interference free cross-border spectrum usage” while stressing “the importance of actions at the national level to provide a roadmap with clear timelines for 700MHz spectrum availability so that interested stakeholders have the certainty needed to plan networks and investments, and practical co-operation based on their shared interests”.

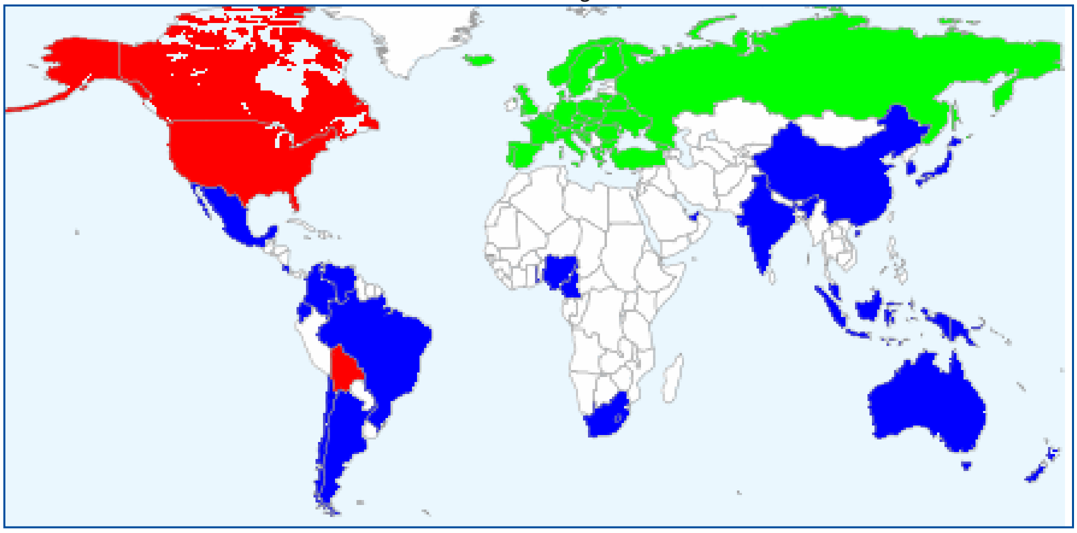
Outside of the SATRC region, other countries in Asia are committed to the APT700 band plan, including China, Indonesia, Malaysia, Singapore, Japan, Korea, Taiwan, Brunei, Papua New Guinea and Tonga.

While the APT700 band was developed with the Asian region in mind, a significant number of countries outside Asia are likely to adopt the band. These markets include the Latin American markets such as

[7] NSN announced in October 2012 support in H2 2013

Brazil, Mexico, Colombia, Ecuador, Chile, Venezuela, Costa Rica, Panama and Uruguay. The African Telecommunication Union (ATU) members have also expressed interest in adopting the APT700 plan once this band is allocated to mobile in the region.

Current Status of 700/800 MHz Digital Dividend Band Plans



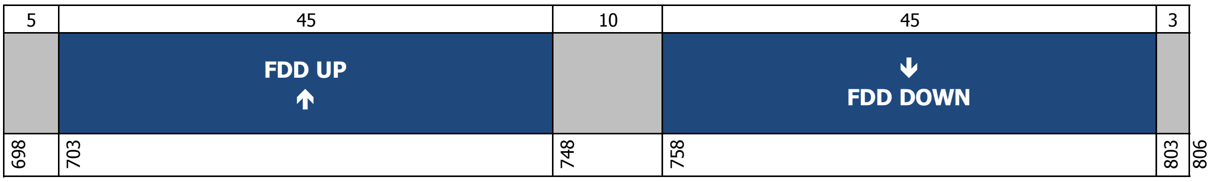
(APT700 commitment shown in blue)

As of the first half of 2013, Japan and Australia have concluded auctions of the 700 MHz band with spectrum licences commencing 1 Jan 2015.

06 Technicalities and Deployment Consideration of the APT 700 MHz Band

The APT700 band is officially known as band 28 within 3GPP. The mobile transmit (FDD uplink) uses the frequency range from 703MHz to 748MHz and base station transmit (FDD downlink) uses the range from 758MHz to 803MHz (as shown below). There is a 10MHz duplex separation. The TDD variant of the band plan makes the entire 100MHz (including the 10MHz FDD duplex separation) available.

APT700 Band Plan

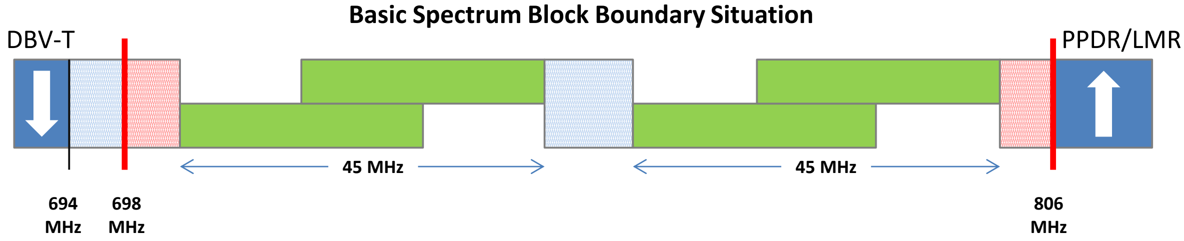


Operators can take advantage of the lower RF path loss that accompanies the lower frequency. In open terrain (Hata Open model) a 2600MHz base station can expect a cell radius of about 14 km with 1800MHz cells achieving 16 km. In comparison, operation at 700MHz will cover 24 km from a 30m tower (much larger coverage distances are possible with cells mounted on hills or mountains).

The increase in cell radius for 700MHz equates to a 300% increase in area coverage over 2600MHz. In dense urban environments the coverage area increase can be up to 7 times. As with 3G at 850 or 900MHz, LTE at 700MHz will have significantly better in-building penetration compared to 1800, 2100 and 2600MHz deployments.

It should be noted that the current LTE standards restrict the maximum coverage of LTE to 100 km using the Random Access Preamble Format 3. This is not expected to pose a problem for most operators, however in extreme circumstances (such as large open flat terrain or out to sea coverage), the 100 km limit may need special consideration and further development by the standards bodies.

The relatively wide bandwidth available in the band 28 plan means that two duplexers are required in the UE terminal. These two duplexers overlap by some amount allowing operators with centrally located spectrum to still be served from a single duplexer. The upper and lower green bars below represent the UE duplexers. A UE can switch between both duplexers via a front end switch.



The lower duplexer available in a band 28 UE should also be compatible with the proposed 2nd European Digital Dividend (so-called DD2) .The 1st European Digital Dividend (Band 20) uses a reverse duplexer arrangement. This means that the base station transmit for band 20 (791 – 821MHz) is conveniently adjacent to the base station transmit for the lower 33MHz of band 28 (758 – 791MHz). This results in simple interference management between these bands. If the realised UE duplexer filters for DD2 are 30 MHz bandwidth (758 to 788MHz) then this receive path in the UE will harmonise with band 20.

Where deployment of LTE is co-ordinated with the digitisation of the television services (DVB-T), interference between DVB-T and LTE is mitigated through the duplex arrangement and lower 9MHz guard band (694-703MHz).

However, where deployment occurs in a region with neighbouring countries, inter-country interference may need special consideration.

For these regions it is strongly recommended that a common band plan (e.g. APT700) is adopted. Secondly, a coordinated implementation of digital TV services and LTE deployment will also be required to avoid situations where TV transmitters interfere with LTE receivers, specifically the base station receiver.

In terms of the site infrastructure requirements, 700MHz LTE deployments will benefit from lower feeder loss (from the base station transmitter to the antenna). This will allow for radio units to be deployed at the bottom of the tower leaving the upper part of the tower free for 1800/2600 LTE deployments.

Also related to the site deployment, antenna technology currently exists to support multiple frequency bands ranging from 700MHz to 2600MHz using multiple ports in a single radome (e.g. Argus RVVPX310V2). This can reduce the number of antennas required to support a multi-band network.

Finally, looking forward to LTE Advanced (LTE-A), a number of carrier aggregation options will become available during 2014 allowing for the combination of 700 with 1800 or 2600, delivering high capacity, broad coverage, high speed wireless networks.

07 Benefits of APT700 Adoption and Conclusion

As the volumes of mobile data grow (while yield for mobile data continues to flatten or fall in most markets), operators are looking for more economic ways to cater for this demand. As discussed in this paper, this can be achieved through the deployment of newer generation efficient technologies (LTE), the re-use of existing spectrum bands (refarming) and acquiring new spectrum bands (such as APT700).

For LTE deployment, the APT700 band offers several key benefits over other LTE bands:

1. The frequency of operation (sub 1 GHz with increased coverage),
2. Efficient spectrum utilisation offering a contiguous 45MHz (2 x 45MHz for FDD or 1 x 100MHz for TDD operation) and
3. Global adoption (leading to a substantial ecosystem of devices and network infrastructure).

In June 2012 when the APT700 band was standardised, doubts existed over the potential for this new band to have a sufficiently large ecosystem to drive infrastructure and device costs down. Fast forward to 2013 and it's hard to imagine that after only 12 months, the APT700 band has commitments or deployments from countries encompassing more than 2 billion people across the globe.

Document number	Title

08 Definitions

Term	Definition

09 Attachments

Document number	Title

010 Document control sheet

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Issue number	Issue date	Details on the change
1	1 June 2013	Draft Release
2.7	5 July 2013	Final draft release after revision and feedback
2.9	9 July 2013	Document issues for review prior to external publication
3.0	22 July	Final updates and edits

011 Appendix 1 – Global Status of APT700 Plans (July 2013)

Country	Current status
Afghanistan	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Afghanistan is adopting the APT 700 MHz FDD band plan.
Australia	Australia auctioned the 700MHz spectrum in accordance with the APT band plan in May 2013.
Argentina	Argentina adopted the APT 700 MHz FDD band plan in November 2011.
Bangladesh	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Bangladesh is adopting the APT 700 MHz FDD band plan.
Bhutan	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Bhutan is adopting the APT 700 MHz FDD band plan.
Brazil	Brazil confirmed its adoption of the APT 700 MHz FDD band plan in February 2013.
Brunei	Brunei confirmed its adoption of the APT 700 MHz FDD band plan in June 2013.
Chile	Chile confirmed its adoption of the APT 700 MHz FDD band plan in April 2012.
China	China plans to adopt the APT 700 MHz TDD band plan.
Colombia	Colombia confirmed its adoption of the APT 700 MHz FDD band plan in May 2012.
Costa Rica	Costa Rica's regulator has recommended that the APT 700 MHz FDD plan be adopted.
Ecuador	Ecuador confirmed its adoption of the APT 700 MHz FDD band plan in October 2012.
Japan	Japan issued licences in accordance with the APT band plan in 2012.
India	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that India is adopting the APT 700 MHz FDD band plan.
Indonesia	Indonesia confirmed its adoption of the APT 700 MHz FDD band plan in June 2013.
Iran	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Iran is adopting the APT 700 MHz FDD band plan.
Malaysia	Malaysia confirmed its adoption of the APT 700 MHz FDD band plan in June 2013.
Maldives	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Maldives is adopting the APT 700 MHz FDD band plan.
Mexico	Mexico confirmed its adoption of the APT 700 MHz FDD band plan in September 2012.

Nepal	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Nepal is adopting the APT 700 MHz FDD band plan.
New Zealand	New Zealand has adopted the APT 700 MHz FDD band plan and is expected to auction the spectrum in 4Q 2013.
Pakistan	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Pakistan is adopting the APT 700 MHz FDD band plan.
Panama	Panama confirmed its adoption of the APT 700 MHz FDD band plan in October 2012.
Papua New Guinea	Papua New Guinea has confirmed its adoption of the APT 700 MHz FDD band plan and issued initial licences in April 2012.
Singapore	Singapore confirmed its adoption of the APT 700 MHz FDD band plan in June 2013.
Sri Lanka	An announcement by the South Asian Telecom Regulatory Council (SATRC) in May 2013 confirmed that Sri Lanka is adopting the APT 700 MHz FDD band plan.
South Korea	South Korea has indicated its support for the APT 700 MHz FDD band plan.
Taiwan	Taiwan confirmed its adoption of the APT 700 MHz FDD band plan in October 2012.
Tonga	Tonga has confirmed its adoption of the APT 700 MHz FDD band plan and issued initial licences in 2012.
United Arab Emirates	In October 2012 the United Arab Emirates confirmed its adoption of the lower 2x30 MHz duplexer in the APT 700 MHz FDD band plan
Venezuela	Venezuela confirmed its adoption of the APT 700 MHz FDD band plan in April 2013.