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**PROPOSED REVISION OF THE APT REPORT ON THE STATUS OF
IMPLEMENTATION OF APT700 BAND PLAN**



**APT REPORT ON
THE STATUS OF IMPLEMENTATION OF APT700 BAND PLAN**

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APT REPORT ON THE STATUS OF IMPLEMENTATION OF APT700 BAND PLAN

1. Introduction

The 9th Meeting of the APT Wireless Group (formerly known as APT Wireless Forum) held in Seoul, Republic of Korea from 13 -16 September 2010 adopted APT Report on Harmonized Frequency Arrangements for the Band 698-806 MHz ([APT Report No.: APT/AWG/REP-14](#)). The arrangement or the band plan was named as APT700. The band plan included the arrangements for both FDD and TDD modes.

Following the development of APT700 at APT Wireless Group (AWG), 3GPP developed the radio interface specifications for both modes of APT700, FDD which is known as Band 28 and TDD which is known as Band 44. APT700 was also included in ITU-R Recommendation M.1036: *Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)*.

APT700 has now been widely recognized as a “Digital Dividend” spectrum for LTE services. All over the world there is a trend to adopt APT700 as the preferable band plan for LTE. Potential market size for APT700 covers more than 4 billion people and industry support is quite strong. Although APT700 provides both FDD and TDD arrangements, FDD arrangements have gained global support. So far 49 countries/territories around the world have either allocated or committed to or recommend APT700 FDD arrangement for deployment. There have been cases of interest for APT700 TDD arrangement as well.

Considering the growing interest for the deployment of LTE services based on APT700, AWG-19 held in Chiang Mai, Thailand from 2 to 5 February 2016, developed the APT Recommendation on *Frequency Arrangements for the Implementation of IMT in the Band 698-806 MHz* which was then subsequently approved by the 40th Session of the Management Committee of the APT (MC-40) held in Nadi, Fiji from 29 November to 2 December 2016. The Recommendation ([No. APT/AWG/REC-08](#)) recommends APT Members to:

1. adopt the harmonized frequency arrangements given in Annex 1 for the deployment of IMT systems in the band 698 - 806 MHz;
2. take into account the implementation aspects detailed in Annex 2 when implementing the frequency arrangements given in Annex 1;
3. coordinate with neighboring countries to avoid risk of interference between Broadcasting and IMT use in this band;
4. coordinate the use of duplex schemes (FDD and TDD) to minimize interference between neighboring countries; and
5. avoid use of both duplex schemes (FDD and TDD) in the same country.

The 22nd Meeting of the APT Wireless Group (AWG-22) held in Busan, Republic of Korea from 25 to 29 September 2017, instructed the APT Secretariat to develop a report on the status of the implementation of the APT700 Band Plan in Asia-Pacific region. AWG-22 also instructed the APT Secretariat to prepare a related questionnaire to develop such status report. AWG-23 approved the Questionnaire and it was circulated to the Members and Associate

Members to gather information regarding the status of implementation of APT700. This report has been developed based on the responses from APT Members.

2. SCOPE

This Report provides information on the status of implementation of the APT700 band plan in Asia-Pacific region based on the survey results.

3. METHODOLOGY AND STRUCTURE OF THE REPORT

This report briefly summarizes and analyzes the responses from 14 APT Member countries in terms of the questions asked. The questions were prepared based on the ‘*recommends*’ part of the APT Recommendation.

The Questionnaire addresses the following key aspects:

- allocation and adoption
- implementation issues
- commercial deployment general feedback.

The responses were analyzed to draw the lessons from the countries which have implemented and deployed systems using APT700 band plan. The report also looked at the issues of some countries which couldn’t implement the band plan up to now. Detailed questionnaire and responses are attached in the annexes.

5. THE RESPONSES TO QUESTIONNAIRES

The following APT Members provided their responses to the questionnaire:

- i. Australia
- ii. Bangladesh
- iii. China (People’s Republic of)
- iv. India
- v. Indonesia
- vi. Islamic Republic of Iran
- vii. Myanmar
- viii. Nepal
- ix. New Zealand
- x. Papua New Guinea
- xi. Republic of Korea
- xii. Singapore
- xiii. Socialist Republic of Viet Nam
- xiv. Thailand

6. SUMMARY AND ANALYSIS OF THE RESPONSES

a) Allocation and adoption of APT700

In Radio Regulation footnote 5.313A Australia, Bangladesh, Brunei Darussalam, Cambodia, China, Korea (Rep. of), Fiji, India, Indonesia, Japan, Kiribati, Lao P.D.R., Malaysia, Myanmar (Union of), New Zealand, Pakistan, Papua New Guinea, the Philippines, Solomon Islands, Samoa, Singapore, Thailand, Tonga, Tuvalu, Vanuatu and Viet Nam, have identified the band

698-790 MHz for use by these administrations wishing to implement IMT. In addition to those APT Members, other APT Members such as Afghanistan, Bhutan, Maldives, Nepal and Sri Lanka also identified the band for using IMT.

Australia has allocated frequency band 703-748/758-803 MHz to IMT operators under a spectrum licence. The technical frameworks (conditions) that underpin spectrum licences are ‘technology flexible’, in that they did not prescribe a specific application (such as IMT), rather it contain technical operating envelopes which are optimized for IMT. Operators could choose to deploy any (allocated) service so long as they meet the conditions of those technical frameworks.

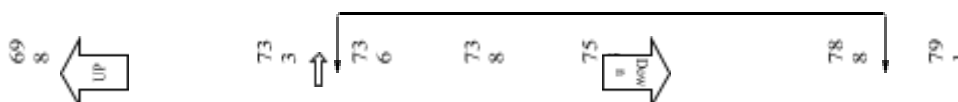
In addition Bangladesh, India, Indonesia, Myanmar, New Zealand, Papua New Guinea, Republic of Korea, Singapore, Socialist Republic of Viet Nam and Thailand have identified the band for IMT services through the amendment of their national frequency plan. In New Zealand, 700 MHz band has been freed up for IMT use following the completion of re-planning of digital terrestrial television channels to frequencies below 622 MHz. Republic of Korea identified some portion of 698-806 MHz for IMT and PPDR in accordance with the decisions taken at WRC-15.

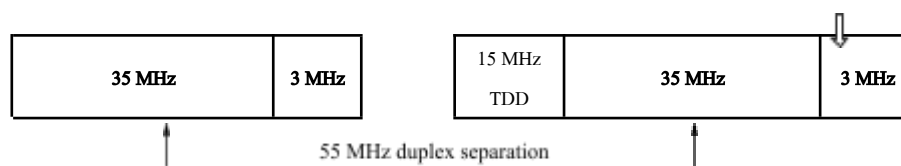
People’s Republic of China has not yet identified the band for IMT as it is still occupied by broadcasting services. Identification of this band for IMT still under discussion in China and it is expected that the assignment to mobile operators can be done no later than 2019. If China decides to support the deployment of IMT, China would be planning to use the APT700 band plan with a higher priority to adopt TDD arrangements.

Islamic Republic of Iran has identified the frequency band 790 – 806 MHz for IMT in National Table of Frequency Allocation (NTFA) and with a footnote under the band 610 – 790 MHz, that the 694 – 790 MHz portion is planned to be released from TV broadcasting. Currently both bands are being used by broadcasting services. Further, the Iranian TV broadcaster is insisting to keep this spectrum for their future requirement for broadcasting (UHD, 3D, etc.).

For commercial deployment of IMT in the APT700 band, Australia, Papua New Guinea and New Zealand have adopted the APT700 arrangement as attached in Annex 1 of the APT Recommendation ([No. APT/AWG/REC-08](#)) with FDD arrangements and assignments being done by operators. Republic of Korea adopted upper duplex of the APT700 band plan for an FDD arrangement. India, Indonesia, Nepal, Singapore and Thailand also have plans to adopt the full APT700 band plan. All of these countries preferred FDD in dual duplexer arrangements. Bangladesh and Myanmar also prefer to adopt APT700 for implementation. However, Bangladesh is delaying the adoption due to the fact that the ecosystem of the APT700 is not yet developed widely in the world and is waiting for the appropriate time.

In Islamic Republic of Iran the only utilization of the band is limited to 2x10 MHz of spectrum in rural areas for data networks operating on a secondary basis. The future band plan is consistent with that being used in the CEPT region in which the frequency band pair 698-736/753-791 MHz has been adopted as FDD arrangement and frequency band 738-753 MHz has been considered for TDD use. Also, two 3 MHz paired blocks were considered for IoT applications. However, all of bands are adopted as part of the APT Recommendation's Annex 1. The following figure shows how to arrange the plan in the Islamic Republic of Iran.





The Islamic Republic of Iran also mentioned in their response that the APT700 plan conflicts with CEPT band plan XX and they would lose almost 2x15 MHz spectrum and therefore they are reluctant to adopt immediately. On the other hand People’s Republic of China expects to decide no later than 2019 and Thailand to deploy within the year 2021.

b) Implementation issues of APT700

Annex 2 of the APT Recommendation on *Frequency Arrangements for the Implementation of IMT in the Band 698-806 MHz* focused on two implementation aspects application to APT700 Plan:

- 1) Channel bandwidth: use of 5MHz block approach and channel bandwidth multiple of 5MHz
- 2) Out of band emissions limit: the specification of appropriate UE out of band emission limits to ensure the coexistence of mobile services with adjacent broadcasting services below the 698 MHz spectral boundary is an important aspect of the conventional duplex arrangement in the band 698 - 806 MHz.

Australia, New Zealand and Papua New Guinea has implemented APT700 band based on the above 2 aspects in Annex 2 of the APT Recommendation. In Australia the aspects of out of band emission limit has been incorporated into the technical framework supporting spectrum licenses to be observed in areas where broadcasting services operate on near-adjacent frequencies. Furthermore, in Australia, Telstra’s block had 10 MHz offset from the lower band edge adjacent to the Australian UHF television band and the performance of the UEs complied with the specified emission mask required by the technical framework for the band.

India, Myanmar, Nepal, Singapore, Thailand and Viet Nam decided to follow the implementation aspects as outline in Annex 2 of the APT Recommendation ([No. APT/AWG/REC-08](#)).

The Republic of Korea also took into account the implementation aspect of APT Recommendation. The channel bandwidth of IMT and PPDR is designated as multiple of 5 MHz (2x20 MHz for IMT, 2x10 MHz for PPDR). But out of band emissions limit for the coexistence of mobile services with adjacent broadcasting services below the 698 MHz is not considered because the lower duplex plan is not adopted in Korea.

On the possible issue of interference between broadcasting and IMT use in the APT700 band Indonesia and Singapore have discussed this issue with the neighboring countries. Similarly India and Myanmar had plans to coordinate among neighboring countries while Australia, New Zealand and Papua New Guinea had no issue of interference at this stage.

The response was similar when it comes to the coordination of the use of duplex schemes (FDD and TDD) to minimize the interference between neighboring countries.

To avoid a situation of having both duplex (FDD and TDD) schemes in a country, Australia, Papua New Guinea, New Zealand and Singapore have selected FDD only. Nepal and the Socialist Republic of Viet Nam have also planned to adopt only FDD. However, India, People’s Republic of China and Thailand have plans to adopt only one duplex scheme but did not indicate their preference of FDD or TDD. Further Islamic Republic of Iran mentioned that they had set a guard band between FDD and TDD spectrum, and this is within the TDD spectrum band (about 5 MHz each side).

However, in Indonesia the current status is still in the process to release the 694-806 MHz band from the existing analogue TV broadcasting services. Therefore, there is no definitive plan yet regarding which duplex scheme is to be implemented in the APT700 band plan.

c) Commercial deployment of APT700

According to a recent report by Global mobile Suppliers Association (GSA), APT 700 (Band 28) is already licensed to mobile operators in many countries in the Asia-Pacific region and in other parts of the world. Among the countries in Asia-Pacific there are Australia, Bhutan, Cook Islands, Fiji, Guyana, Japan, Maldives, Mongolia, New Zealand, Papua New Guinea, Philippines, Samoa, Singapore, Republic of Korea, Tokelau and Vanuatu. Among the other countries outside Asia-Pacific are Brazil, Chile, Ecuador, Finland, France, Germany, Iceland, Mexico, Nigeria, Panama, Peru, Saudi Arabia, Suriname and Uruguay. The GSA report further indicates that 44 operators have now launched commercial services using APT700 (Band 28) or at the lower duplexer arrangement of APT700.

Based on the replies from several APT Members, it is found that Australia, New Zealand and Papua New Guinea had assigned the band to commercial operators. Following tables show the assignment of APT700 in respective operators in APT Members:

Australia

Frequency Block (MHz)		Operator	IMT Technology	Channel bandwidth (MHz)	License duration (Years)
Uplink	Downlink				
703-713	758-768	Optus	LTE	10	Expiry December 2029 (all)
713-733	768-788	Telstra	LTE	20	
733-738	788-793	Vodafone Hutchison Australia (VHA)	No deployment to date	5	
738-748	793-803	TPG	LTE (Trial only)	10	

New Zealand

Frequency Block (MHz)		Operator	IMT Technology	Channel bandwidth (MHz)	Licence duration (Years)
Uplink	Downlink				

703 – 723	758 – 778	Spark NZ	FDD-LTE	2 x 20	Period: 18 years Expiration: 2031 (Note 1)
723 – 738	778 – 793	Vodafone NZ Ltd	FDD-LTE	2 x 15	Period: 18 years Expiration: 2031 (Note 1)
738 – 748	793 – 803	Two Degrees Mobile Ltd	FDD-LTE	2 x 10	Period: 18 years Expiration: 2031 (Note 1)

Note 1: The choice of 18-year instead of the conventional 20-year licence is to ensure the alignment of a common licence expiry date for all IMT frequency bands below 1 GHz.

Papua New Guinea

Frequency Block (MHz)		Operator	IMT Technology	Channel bandwidth (MHz)	License duration (Years)
Uplink	Downlink				
703-718	758-773	DigiVoIP	LTE	15 x 15	10-subject to review
718-733	773-788	Digicel (PNG) Ltd	LTE	15 x 15	10
733-748	788-803	Telikom PNG	LTE	15 x 15	10

In Republic of Korea and Singapore the assignment to commercial operators is still pending. Papua New Guinea assigned on an administrative basis and all were issued under spectrum license which gives right for nationwide deployment. The spectrum price was also calculated in accordance with NICTA's prescribed fees. But Australia and New Zealand had assigned the spectrum through auction and the details are the following:

In Australia the licences were auctioned in 2013 (703-733/758-788 MHz) and 2017 (733-748/788-803 MHz). Auction prices are contained in the below table:

Frequency Block (MHz)		Operator	Total price (\$million)
Uplink	Downlink		
703-713	758-768	Optus	649
713-733	768-788	Telstra	1302
733-738	788-793	Vodafone Hutchison Australia (VHA)	286
738-748	793-803	TPG	1260

In New Zealand spectrum auction was completed in June 2014. Details of the New Zealand “700 MHz auction” can be found in <https://www.rsm.govt.nz/projects-auctions/completed/digital-switchover-and-the-digital-dividend/700-mhz-auction-overview>. The table below shows the final result of the auction (price before New Zealand’s 15% Goods and Services Tax):

Operator	Frequency lot	Frequency range	Total price (+GST) in NZD
Spark NZ (formerly Telecom NZ)	Four lots (2 x 20 MHz)	703-723 MHz 758-778 MHz	\$158,100,000 (+GST)
Vodafone NZ Ltd	Three lots (2 x 15 MHz)	723-738 MHz 778-793 MHz	\$68,000,174 (+GST)
Two Degrees Mobile Ltd	Two lots (2 x 10 MHz)	738-748 MHz 793-803 MHz	\$44,000,000 (+GST)
TOTAL	Nine lots (2 x 45 MHz)	703-748 MHz 758-803 MHz	\$270,100,174 (+GST)

In India, the spectrum band was put for auction in 2016. There were no bidders at that time. India plans to put up the band for next round of auction in 2019.

In the case of Singapore the band was awarded via auction, but is pending assignment. A total of 9 lots (2 x 5 MHz per lot) were available for allocation for a duration of 15 years. Reserve price per lot was SGD 20 million (excluding GST). Winning price was SGD 94 million per lot. The winning bidders, M1 Limited, Singtel Mobile Singapore Pte Ltd and StarHub Mobile Pte Ltd were provisionally awarded with 2 lots, 4 lots and 3 lots respectively.

As far as future plan of assignment is concerned Bangladesh would include APT700 band in the next spectrum auction. In Nepal the spectrum is planned to be auctioned within 2019. Nepal feels the ecosystem of the devices and system in APT700 is not mature compared to other IMT bands below 1 GHz. Similarly it is expected that in China the band can be assigned to commercial operators no later than 2019. Socialist Republic of Viet Nam would assign by 2020. However, in the case of Indonesia and Myanmar there is no formal plan yet regarding the time frame for the implementation of APT700. Indonesia is still in the process of stipulating a new Broadcasting Act, together with the Parliament, as this is the main requirement to resolve legal aspects for Analogue Switch-Off (ASO).

Singapore also mentioned that the Singapore and neighbouring countries’ analogue switch off is still pending for APT700 MHz to be fully assigned for IMT in Singapore.

As far as the customer experiences are concerned Australian operator Telstra shared that no exceptional issues have been experienced. Their good RF system engineering practices and appropriate site selection were employed to mitigate potential EMC issues.

The mobile network operators in New Zealand have deployed IMT (LTE) networks nationwide in the APT700 band plan with coverage assessed in 2017 as exceeding 90 percent of the population.

d) Prospects of APT700 and device ecosystem

In general all APT Members (who provided responses) believes that APT700 could be an international harmonized band plan for LTE as it was recognized by over 44 countries worldwide.

Australia emphasizes the proliferation of deployments in the APT700 band within Region 3 and other regions is well known. Australia identified early that this would be a widely used band and that there would be significant economies of scale to be leveraged by industry in making the band available for IMT use. This precipitated from Australia's clearance of broadcasting services from the 'digital dividend' band (694-820 MHz) as analogue TV broadcasting was shut down and digital TV channels were restacked below 694 MHz. Australia is of the view that APT700 will be a key coverage-layer band in the delivery of mobile services domestically, regionally and internationally for many years to come. The telecom operator in Australia, Telstra has experienced excellent wide-area coverage especially in rural and regional parts of the country by the APT700 band.

Bangladesh believes that APT700 is excellent for wide area coverage in regional and rural environments, for in-building coverage, and is an important digital dividend arising from the shift by TV broadcasters to digital transmission. Adoption of the APT700 FDD band plan by many countries has created a major opportunity for near global spectrum harmonization for LTE, ensuring the greatest economies of scale for user devices, capacity for mobile broadband and roaming. Industry and regulators support for the APT700 is strong and it has markets addressing nearly 4 billion people.

According to People's Republic of China, APT700 has now been widely recognized as a "Digital Dividend" spectrum for IMT services and the identification of this band for IMT can improve the frequency use efficiency significantly. The APT700 band plan should be taken into account by the APT Member countries and therefore achieve regional and international harmonized band plan. It is expected China will make this band [available for IMT-2020\(5G\)](#) system

Indonesia is of the view that APT700 band plan will have a good prospect to be the harmonized band plan for the implementation of mobile broadband (LTE, 5G NR and future mobile technologies), both regionally and globally.

Islamic Republic of Iran also believes APT700 plan has now been widely adopted by APT members as well as a large number of countries within the world and these numbers of countries will be grown in the near future. The expectation is that the network equipment vendors as well as user terminal manufacturers would add this plan into their products.

According to Myanmar, APT700 band plan is recognized by 49 countries/territories around the world either allocated or committed to or to recommend APT700 FDD deployment. So it is possible to assign as international harmonized band plan for LTE.

However, Nepal raised concern on the overlapping portion of APT700 (Band 28) with DD800 (Band 20) and believes that ecosystem of devices and systems in Band 20 is better than Band 28. For countries adopting DD800, some portion of APT700 may be affected.

New Zealand re-iterated that the adoption of APT700 band plan has expanded well beyond countries in the Asia Pacific region. It is noted that a number of countries in the Inter-American Region have already adopted the APT700 band plan, while the pan-European 700 MHz band plan (refer to ECC Decision (15)01) is a sub-set of the APT700 band plan. New Zealand is of the view that the wide adoption of APT700 band plan as the harmonised band plan for LTE will

be a good candidate for an anchor layer to support the non-standalone (NSA) operation mode of 5G New Radio (5G NR) networks.

Papua New Guinea, Singapore, Thailand and Viet Nam also focused on the regional and global prospects of APT700 and believe that it has the potential to achieve near global harmonization in the future. They believe that it would be more efficient and economical to implement LTE or LTE Advanced technology at this harmonized band plan which would be beneficial for Asia-Pacific.

While answering the country's future plan to deploy APT700 Bangladesh informed that it is delaying the adoption as the ecosystem of APT700 band is not developed well enough. Bangladesh still believes that the devices in APT 700 band are significantly less in comparison to number of devices in other IMT bands like- 850/1800/2600/2100 MHz bands. Nepal also shares the similar concerns expressed by Bangladesh on device eco-system.

Papua New Guinea expressed that the device compatibility and affordability are always important for users. A single mobile device supporting the prime bands including the APT700 band would be the preferred option for many users. People's Republic of China also agreed that the device ecosystem of APT700 is important for the effective utilization of this frequency band and suggested that the APT Member countries should take APT700 band plan into account and build the ecosystem together.

Australia mentioned that for Telstra the key issue at the early stages of deployment was to ensure the manufacturers supplied devices with full 3GPP band compliant covering the full Band 28 and not just 28A or 28B. Currently, Telstra is working to ensure that future wearable devices would also support Band 28. Subsequently Islamic Republic of Iran, New Zealand, Singapore and Socialist Republic of Viet Nam assured that the increased use of the 700 MHz band by APT Members would increase the demand for LTE devices in Asia-Pacific incredibly. Their responses mentioned that there is a strong evidence of rising regional utilization of 700MHz among the vast majority of Latin American and European countries. Therefore, the 700 MHz band is becoming one of the most popular IMT bands in the world. So, this band would bring opportunities for the vendors.

In reply, Myanmar mentioned that this band plan may lead to Software Define Radio (SDR) devices and hope all mobile devices could include APT700 band in the future.

7. Conclusion

The responses to the questionnaire have provided useful information on the status of implementation of APT700 band in 14 APT Member countries. It could serve as a good reference for other administrations intending to adopt and implement the APT700 in future.

From the responses we could conclude that countries like Australia, Papua New Guinea and New Zealand had successfully implemented the APT700 for IMT services. In addition many other countries are planning to implement in near future. However, countries like Indonesia, Myanmar and People's Republic of China are waiting for the broadcasting services to clear the band. The situation is similar with Singapore and Socialist Republic of Viet Nam.

Finally the apprehension of Bangladesh and Nepal of devices not being available in the APT700 band is also cleared when Australia and New Zealand now do not have this issue on the commercial deployment.

This report would be updated further based on responses from other APT Member countries. It is to be noted that in a number of countries like Bhutan, Maldives and Vanuatu, there are commercial networks in place. However, those countries have not provided responses to the questionnaire. It is expected that those three countries as well as other APT Member countries will submit the responses to the questionnaire at AWG-25/AWG-26.

ANNEX 1

Response to the Questionnaires from APT Members and Associate Members

i. Australia



APT700_Australia_Response.docx

ii. Bangladesh



APT700_Bangladesh_Questionnaire.docx

iii. Bhutan



Bhutan.docx

iv. China (People's Republic of)



APT700_China_Response.docx

v. India



India.docx

vi. Indonesia (Updated Response)



Indonesia.docx

vii. Islamic Republic of Iran



APT700_IRAN_response.docx

viii. Korea (Republic of)



APT700_Korea_Response1.docx

ix. Malaysia



Malaysia.docx

x. Marshall Islands



Marshall Islands.docx

xi. Myanmar (Updated Response)



APT700_Myanmar_Response.docx



Myanmar.pdf

xii. Nepal



APT700_Nepal_Response.doc

xiii. New Zealand



APT700_New_Zealand_Response.docx

xiv. Palau



Palau.docx

xv. Papua New Guinea



APT700_PNG_Response.docx

xvi. Samoa



Samoa.docx

xvii. Singapore



APT700_Singapore_Response.docx

xviii. Sri Lanka



Sri Lanka.docx

xix. Thailand



TH updated.docx

xx. Viet Nam (Socialist Republic of)



Viet Nam.docx

xxi. Cook Islands



Cook Islands.docx

xxii. Hong Kong, China



Hong Kong,
China.docx
