



Securing the Digital dividend across the entire ASEAN:

A report on the status of the implementation of the
APT700 Band

August 2018





Status of APT700 Implementation in ASEAN

Delays in securing the digital dividend....

- Delays in implementing the digital switchover and securing the digital dividend in the 700 MHz has meant that generally, the deployment of networks utilising APT700 in ASEAN have been slower than was foreseen.

... but there is strong support

- However, there is strong support across ASEAN for the release of more harmonised IMT spectrum to underpin the very strong growth in regional wireless demand.
- It is incongruous that the adoption of APT700 has been more heralded in other parts of the world than in ASEAN - whose markets form a key part of the APT's membership.
- In the coming 6 to 12 months, the successful resolution of key cross-border co-ordination bottlenecks, should do much to accelerate the adoption of APT700 in ASEAN.



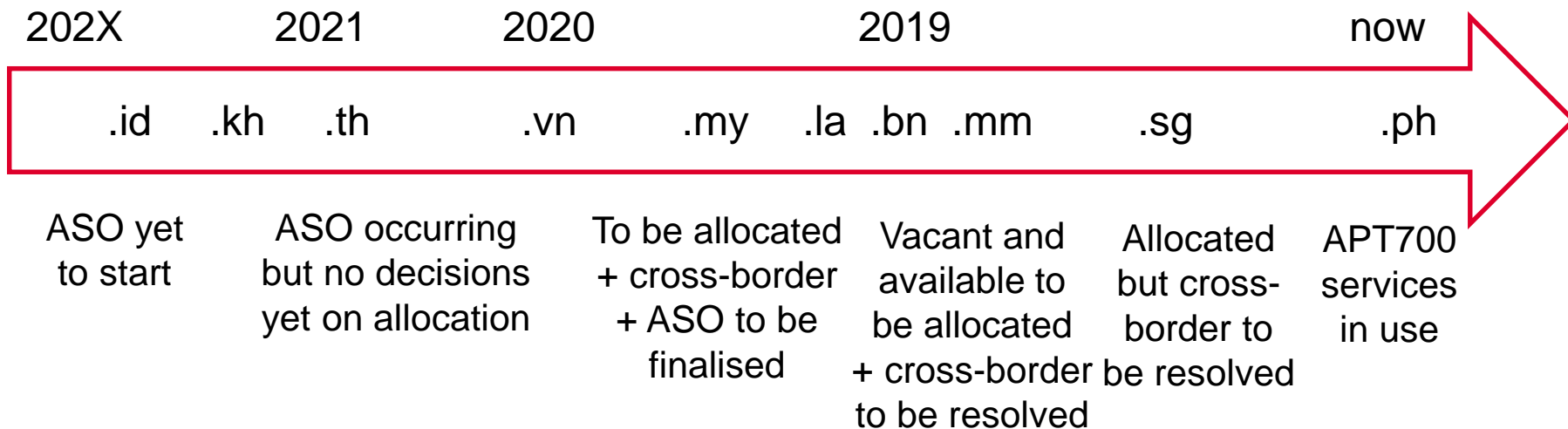
Status of APT700 Implementation in ASEAN

Country	Operational	700 MHz allocation date or expected allocation date	Comments
Brunei Darussalam	No	Post 2019	Band currently vacant and ready for mobile broadband service. AITI and MCMC have not agreed on any technical parameters yet. Malaysian APT700 implementation should facilitate APT700 in Brunei
Cambodia	No	Post 2019	Band licensed to Digital Television and Government has tried to clear but still negotiating with existing licensees. More clarity in Q3, 2018 after Cambodian election
Indonesia	No	Post 2022, unless able to allocated regionally	In part of the country including Java the usage of the 700 MHz spectrum blocked by Supreme Court injunctions. SDPPI seeking alternative approaches to secure spectrum including legislative changes, regional licences etc
Lao PDR	No	Post 2019	MPT supported 700 MHz band for IMT and APT700 band plan since 2015. Interference concerns with Digital Television in neighbouring countries delaying implementation
Malaysia	No	2018 with use from Q1, 2019	The MCMC is evaluating a beauty contest for 8 lots of 2 x 5 MHz of the spectrum will announce more information after the Malaysian election. DSO not finalised but scheduled for the end of 2018 unless changed by new incoming Government
Myanmar	No	Early 2019	Proposed for allocation under Ministry/PTD spectrum roadmap by late 2018. Likely to be post February 2019
Philippines	Yes	June 2016	Acquired from San Miguel Corp. 2 x 10 MHz available for allocation to successful 3 rd New Market Player in 2018
Singapore	No	Early 2019	Auctioned by IMDA in late 2017. DSO delayed and will be completed end of 2018. In discussions with neighbouring country regulators, the MCMC and SDPPI regarding its use in Singapore.
Thailand	No	Post 2020/21	Still being used by digital TV, then subject to refarming and repacking. Government may try and bring forward to 2020/21 depending on analogue TV concession issues and other transition issues
Vietnam	No	2020	APT700 allocation supported by ARFM after clearance of television broadcasting. DSO completed in major urban cities and soon in Delta region. MIC/VNTA also strongly supportive.



Status of APT700 Implementation in ASEAN

Likely timeline in ASEAN for availability and allocation for 700 MHz for IMT and adoption of APT700 Band plan





Key factors holding back the availability of the 700 MHz to IMT services in ASEAN:

- 1) The migration to digital television services from analogue television services
- 2) Cross-border co-ordination issues
- 3) How the 700 MHz band, once it is available, should be allocated

These three factors can be addressed, by *inter alia* understanding costs savings and societal and economic benefits of APT700, resolving cross-border co-ordination issues to minimise harmful interference and for ASEAN regulators to commence consultations in their individual markets on how the 700 MHz spectrum band should be optimally allocated



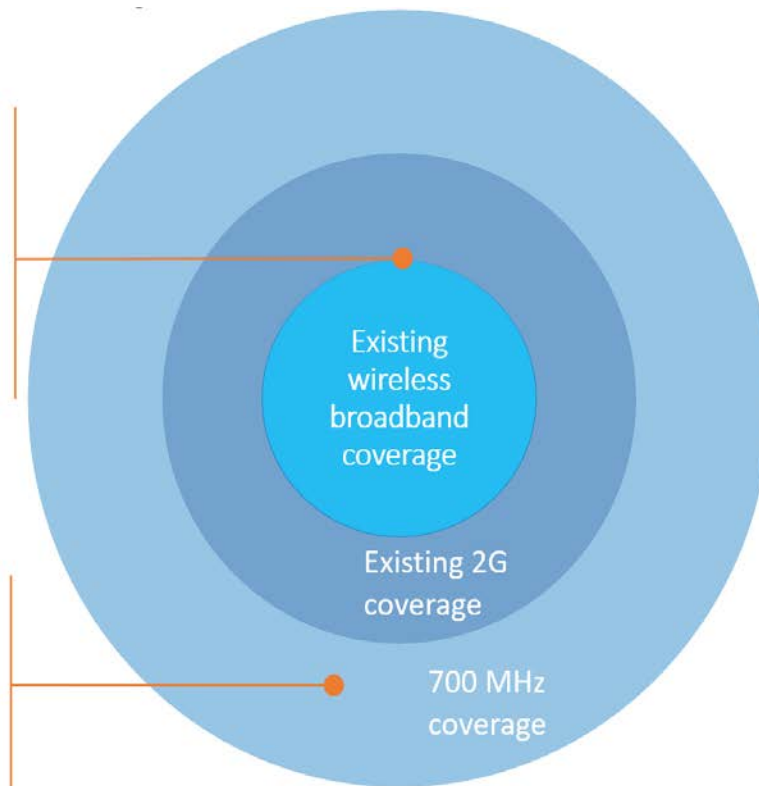
Benefits of 700 MHz deployment over existing IMT spectrum bands

Benefits *within* existing coverage

- increased capacity
- increased speed
- in-building coverage
- in-fill of 'blackspots'
- move from 2G at edge to broadband
- off-loading to 700MHz

Benefits *outside* existing coverage:

- more extensive coverage
- non-line-of-sight coverage
- lower per-area cost deployment
- more rapid deployment





Deployment: Growing APT700 MHz ecosystem

- From the GSA, 44 commercially launched APT700 operators in many countries including large markets like Brazil, Nigeria, Mexico, Japan, Philippines, Egypt, Germany, France, South Korea, Argentina, Saudi Arabia, Peru, Australia, Taiwan and Chile (in order of population) (as at mid 2018).
- Countries with a population of almost 4 billion people have allocated 700 MHz spectrum compatible with APT700/LTE Band 28 devices with an addressable market of more than 1.2 billion people.
- There is a growing maturity of the 700 MHz ecosystem.



Deployment: Benefits of APT700

1 Coverage benefits

- The coverage utilising the 700 MHz spectrum is more extensive and of better quality
- The indoor coverage is often better (due the lower indoor propagation loss)
- Adding a 700 MHz layer will equate to better in-building penetration as well as higher speeds with carrier aggregation

2 Faster speeds – Carrier aggregation options with APT700

- The increase in bandwidth is achieved by utilising LTE carrier aggregation/channel aggregation which combines multiple LTE carriers to increase bandwidth and achieve higher data rates of LTE-A and LTE-A Pro.
- This improves the wireless broadband speeds and QoS provided to subscribers



Deployment: Improved speed – CA options with APT700

Configuration	Bands	Max aggregated bandwidth [MHz]	3GPP Release
Carrier Aggregation inter band (2 bands)			
1A-28A	APT700 (b28) & 2100MHz (b1)	40	3GPP R12.6
3A-28A	APT700 (b28) & 1800MHz (b3)	40	3GPP R12.0
7A-28A	APT700 (b28) & 2600MHz (b7)	35	3GPP R13.0
8A-28A	APT700 (b28) & 900MHz (b8)	30	3GPP R14.0
28A-40A	APT700 (b28) & 2300MHz (b40)	40	3GPP R13.2
28A-41A	APT700 (b28) & 2600MHz (b41)	30	3GPP R13.2
28A-42A	APT700 (b28) & 3500MHz (b42)	40	3GPP R13.2
Carrier Aggregation inter band (3 bands)			
1A-3A-28A	APT700 (b28) & 2100MHz (b1) & 1800MHz (b3)	60	3GPP R13.0
1A-7A-28A	APT700 (b28) & 2100MHz (b1) & 2600MHz (b7)	55	3GPP R13.0
1A-8A-28A	APT700 (b28) & 2100MHz (b1) & 900MHz (b8)	50	3GPP R14.1
3A-7A-28A	APT700 (b28) & 1800MHz (b3) & 2600MHz (b7)	60	3GPP R13.0
3A-28A-38A	APT700 (b28) & 1800MHz (b3) & 2600MHz (b38)	80	3GPP R15.2
3A-28A-40A-D	APT700 (b28) & 1800MHz (b3) & 2300MHz (b40)	60-100	3GPP R13.2
3A-28A-41A&C	APT700 (b28) & 1800MHz (b3) & 2600MHz (b41)	60-80	3GPP R14.2
Carrier Aggregation inter band (4 bands)			
1A-3A-7A/C-28A	APT700 (b28) & 2100MHz (b1) 1800MHz (b3) & 2600MHz (b7)	80-100	3GPP R13.3
1A-3A-8A-28A	APT700 (b28) & 2100MHz (b1) 1800MHz (b3) & 900MHz (b8)	70	3GPP R15.0



Deployment: Benefits of APT700

3 Wider IoT service deployment using APT700

- Narrow-Band- Internet of Things (NB-IoT) and LTE-M are set to become the global dominant Low Power Wide Area technologies
- The use of low bands (below 1 GHz) should be a primary goal for mobile operators when offering NB-IoT solutions, with APT700 being an obvious candidate band for deployment of such services.

4 Societal benefits

- Benefits of increased capacity that flow from increased IMT spectrum use in general
- Greater range and propagation characteristics from APT700 which mean improved coverage and service improvements for consumers
- Rural communities are connected quicker with a better services as a result of expanding coverage due to APT700 deployment
- Lower capital costs of APT700 deployment mean that consumers pay lower prices for connectivity
- Benefits arising from the revenues to governments from allocation of the 700 MHz band spectrum

Benefits of APT700: Country Case Studies

A Philippines



- 700 MHz Band 28 deployments in the Philippines since June 2016, had by end of Q1, 2018 resulted in significant improvements in LTE service experience for customers with APT700 capable devices
- APT700 deployments using pre-existing site and tower infrastructure have resulted in significantly improved service extent and coverage
- The ability of APT700 to support NB-IoT/LTE-M services is excellent given coverage and lower costs

B Australia



- In Australia APT700 spectrum has been instrumental in extending 4G coverage to regional and remote areas of Australia that otherwise would not have been possible to cover economically, or at all.
- Prior to APT700 deployment, Telstra's networks covered approximately 85% of population and 100,000 sq. km. The use of APT700 with existing and new 4G sites has helped push Telstra's 4G coverage to over 99% of the population and more than 1.6m sq. km of Australia.
- Telstra considers that APT700 improves 4G in-building coverage. APT700 means that most urban buildings can now get reasonable in-building 4G coverage without augmentation like dedicated antennas
- Telstra confirms that there are material cost benefits in deploying 700MHz over 1800MHz spectrum. The benefits are most fully realised in lower population density areas of regional, rural and remote Australia.



Spectrum management efforts

- Two key spectrum managements efforts should be pursued for allocating the APT 700 MHz band:

Migration from Analogue to Digital Television

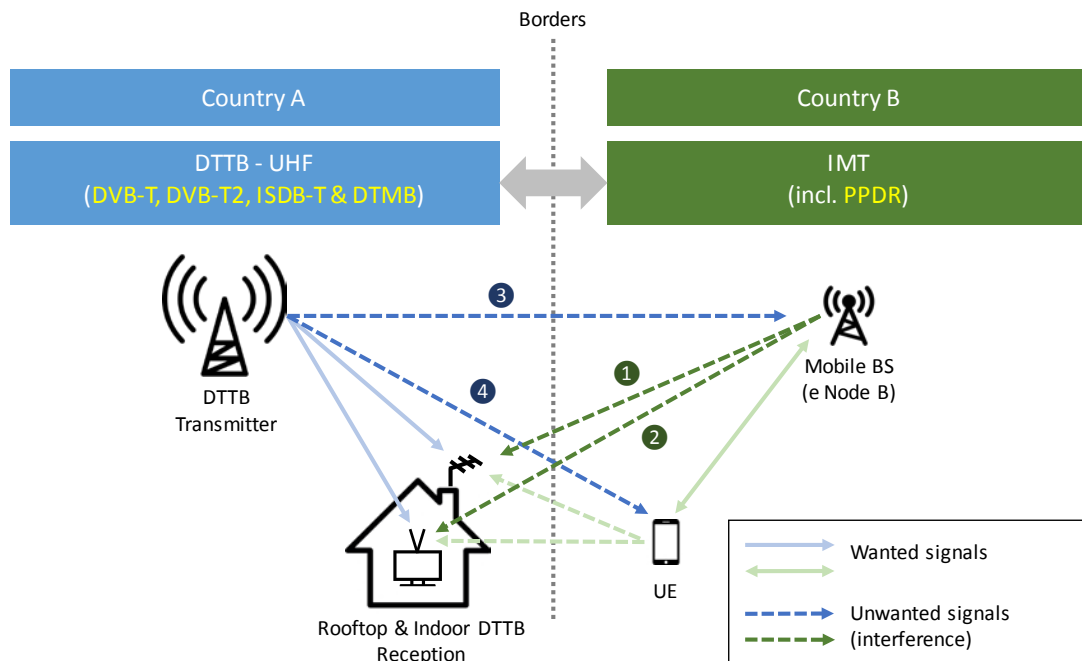
- This should be done in order to free-up spectrum for IMT
- Notably, the Digital Switch Over process was the focus of a 2017 GSMA report "*Practical Recommendations to Digital Migration in ASEAN*"

Cross-border frequency co-ordination

- So as to avoid harmful interference between countries planning or having deployed IMT or DTTB

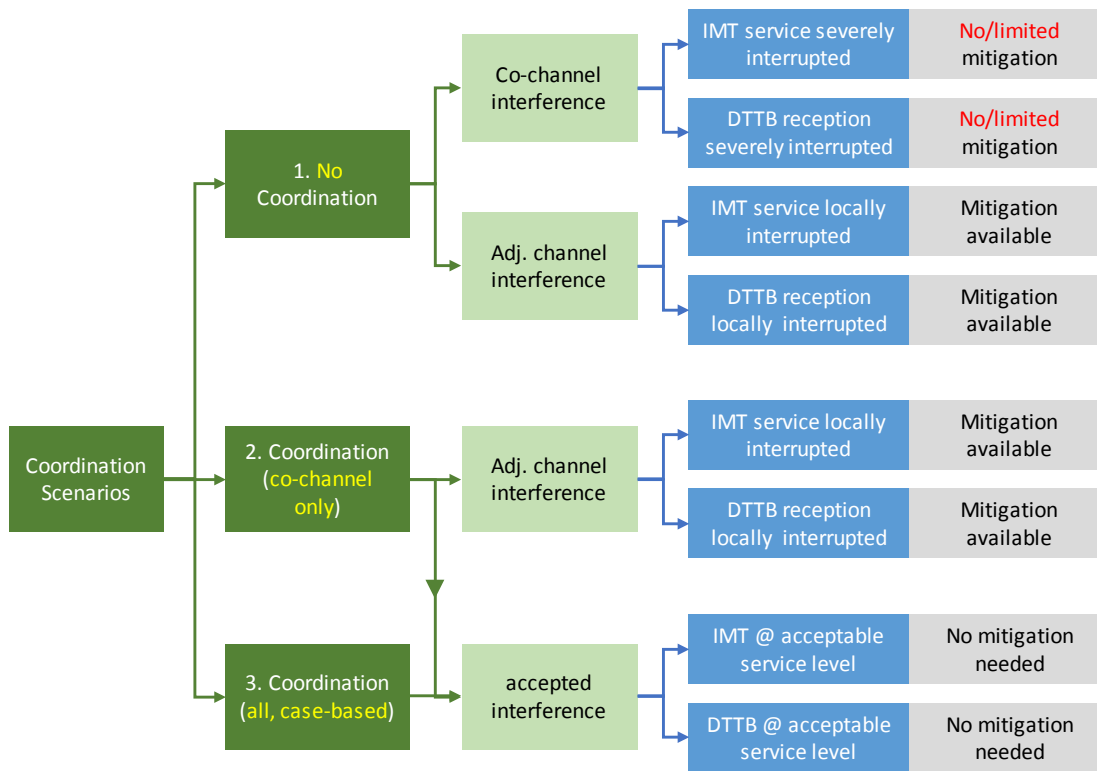
Cross-border frequency coordination: interference between IMT and DTTB services

- Identifying cross-border interference cases is a key step in resolving and managing harmful interference.





Cross border co-ordination: coordination scenarios in ASEAN





Cross border coordination: Interference problems and operational mitigation measures

Overloading
(DTTB and IMT/LTE receivers)

Image channel interference
(ATV and DTTB specific)

Automatic gain controller
(ATB and DTTB specific)

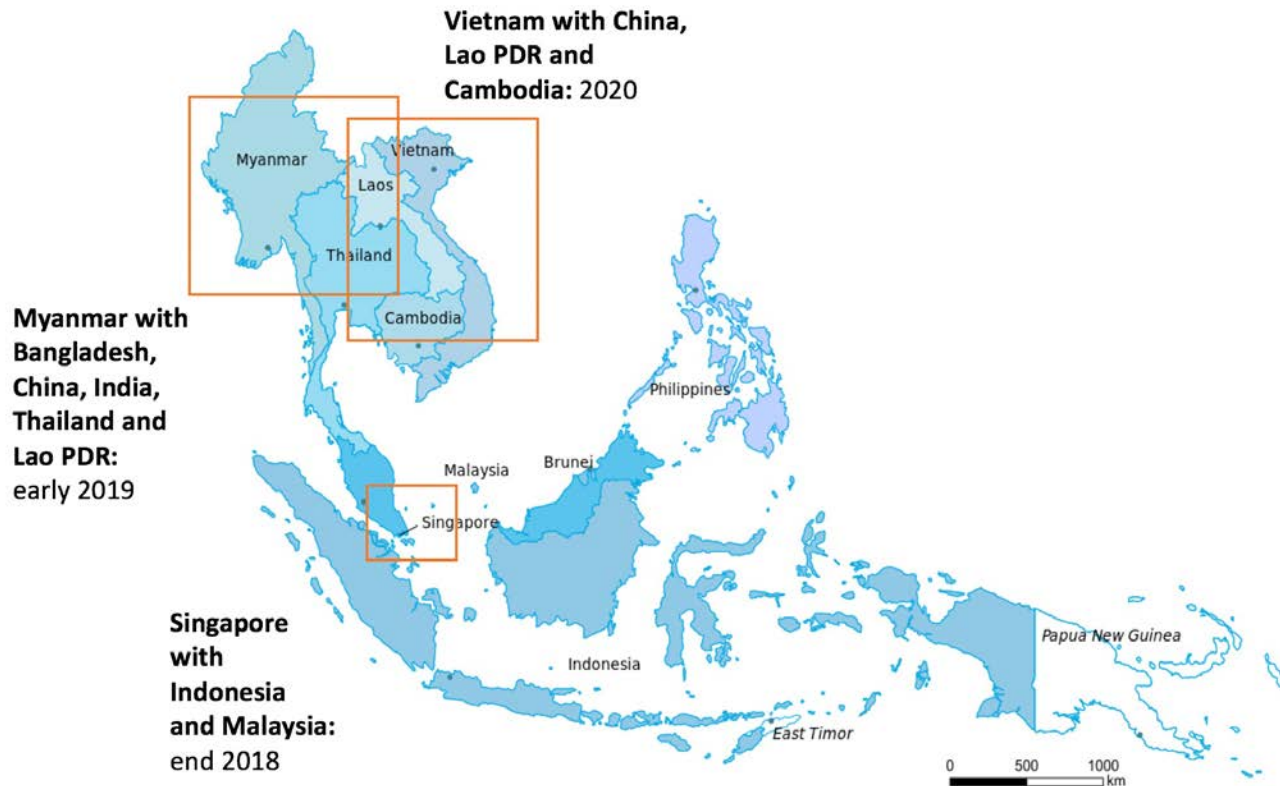
Automatic gain controller
(ATV and DTTB specific)

Operational mitigation measures

- These listed interference types result in different operational mitigation measures which can be applied.
- The operational mitigation measures have a varying impact on the operations of the IMT/DTTB network operators and consumers.
- Consequently, they have a different financial impact.
- The operational measures impacting the LTE or DTTB network operator can be planned well ahead of the deployment.



Cross-border coordination: Critical decision points and timing





Cross border coordination: Recommendations

- Incorporate cross-border frequency coordination in the national licence assignment procedure
- Formalise cross-border frequency coordination
- Identify, agree and calculate interference levels
- Balance licence obligations against operational mitigation
- Plan spectrum for the future

In the coming 6 to 12 months, the successful resolution of key cross-border co-ordination bottlenecks, will do much to accelerate the adoption of APT700 in ASEAN. Similar to the broader consensus model which underpins ASEAN it is hoped that with considerable goodwill these co-ordination issues can be resolved



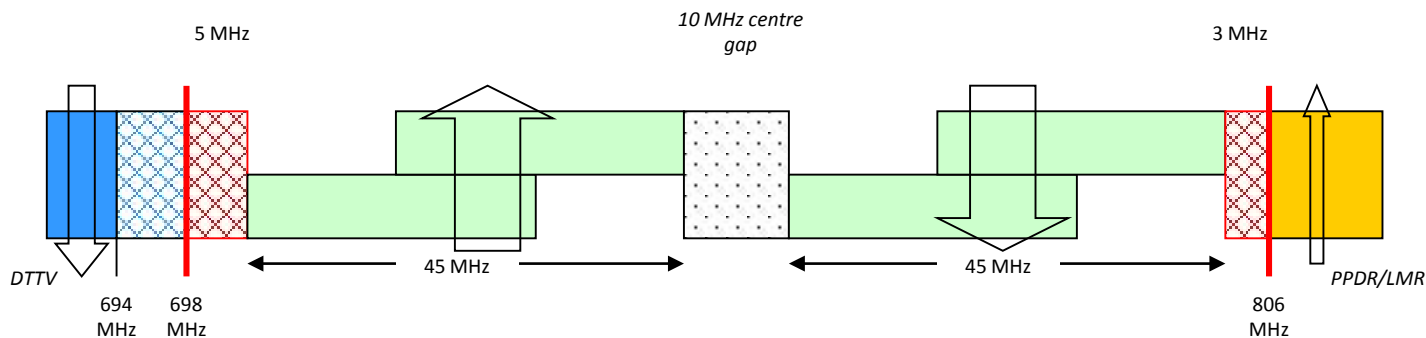
700 MHz allocation: Recommended lot sizes and other issues

- Regionally and globally, most regulators have adopted an approach of allocating APT700 spectrum into 9 lots of 2 x 5 MHz.
- Exemplar practice supports a licence period of 15 to 20 years.
- Coverage obligations, if they are to be imposed, are best put on sub-1 GHz IMT spectrum like 700 MHz spectrum.



700 MHz allocation: Recommended options for co-existence

- The harmonised APT700 Band plan for 698-806 MHz is shown below.
- The guard-bands shown should permit the coexistence of:
 - Trunked land mobile services; and
 - Other IMT services (eg LTE)





700 MHz allocation: Incumbent phase out

- The use of short range devices (e.g. wireless microphones) will be disrupted once the band is assigned.
- It is recommended that ASEAN regulators (12 months before the use of the 700 MHz spectrum band):
 - Communicate to the public and industry about their changes to business and users who may be affected;
 - Restrict the sale of non-conforming devices; and
 - Ensure that vendors of wireless microphones and similar are fully informed.



700 MHz allocation: PPDR Broadband spectrum allocation issues

- Resolution 646 of the ITU encouraged administrations to consider parts of the frequency range of 694-894 for meeting PPDR requirements.
- Reserving 2 x 10 MHz for PPDR Broadband in the 800 MHz band would seem more consistent with ASEAN regional approaches than allocating/reserving 700 MHz spectrum
- It is recommended that regulators can reserve spectrum and should consider contracting MNOs to use their existing infrastructure for faster and lower deployment costs. This is even though additional expenditure will be needed given the need for more “hardened” public safety infrastructure.



Concluding remarks

- There is strong support across ASEAN for the release of more harmonised IMT spectrum
- The three key factors which are holding back the deployment in order of importance are the analogue to digital television migration, cross-border co-ordination issues and how the 700 MHz, once it is available, should be allocated.
- These three factors can be addressed by accelerating the ASO, resolving cross-border co-ordination issues to minimise harmful interference and for ASEAN regulators to commence consultations on how the 700 MHz band should be allocated.

Recommendations

Step 1: Accelerate DSO

Accelerate the DSO process where it is not completed, potentially prioritising those areas of the country where cross-border co-ordination arrangements are required.

Step 2: Consider national frequency table

Review and revise, if necessary, the national frequency allocation table arising from the adoption of the harmonised APT700 band considering co-existence issues.

Step 3: Engage and consult

Engage with ASEAN regulators (and non-ASEAN regulators as required) in order to establish agreed cross-border co-ordination processes for the allocation of the 700 MHz spectrum band for IMT services and deployment of APT700 network infrastructure.

Recommendations

Step 4: Determine optimal allocation

Undertake internal reviews (and market consultation processes with licensed mobile operators, if required) to determine the optimal allocation processes in accordance with national law for the APT700 spectrum.

Step 5: Public announcements

Make public announcements in accordance with national law that the 700 MHz spectrum band will not be available for use by short range devices including wireless microphones after a specified date.

Step 6: Address spectrum management issues

Address any additional national only spectrum management issues which may slow or restrict the adoption of APT700 in a particular ASEAN market.



Thank you

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Any further questions?

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