MINISTRY OF TRANSPORT AND COMMUNICATIONS
POSTS AND TELECOMMUNICATIONS DEPARTMENT

CONSULTATION PAPER
Future Allocation of E-GSM Spectrum
September 2017

1. INTRODUCTION

1.1 Background

Following the licensing of two new national telecommunications operators in early 2014joining the former incumbent, Myanma Posts and Telecommunications (MPT) who, has management assistance from KDDI and Sumitomo, the Union of Myanmar's liberalised telecommunications sector has seen significant growth in the past 3 years. Citizens and businesses of Myanmar have high levels of demand for mobile cellular services and wireless broadband services in particular. The number of cellular subscribers now exceeds 54 million, making it the 4th fastest-growing mobile market. Data volumes, device mix and growth in Myanmar are more similar to advanced Asian markets than those with the same economic developmental level.

On 12 January 2017, a third private operator, MyTel was licensed and new regional licences for TDD 2600 MHz spectrum were also allocated by the Ministry in late 2016.

Further, in May 2017, after a consultation process with operators, and seeking independent spectrum valuation advice the PTD released the 1800 MHz spectrum band to the major operators. Twelve year spectrum licences for the 1800 MHz spectrum were offered to major operators via a direct allocation method. The major operators have acquired the initial 2 x 10 MHz blocks of 1800 MHz spectrum which have been offered to them and deployed LTE technology under these technology neutral spectrum licences. However, options to purchase an additional 2×10MHz block of spectrum in the same band on a 'first come first served' basis have not yet been exercised.

Prior to the allocation of 1800 MHz spectrum licences, Telenor requested and was granted by the PTD a temporary licence for 6 months of 2 x 2.5 MHz of 900 MHz spectrum in the extended GSM (E-GSM) band.[1] The payment for the temporary use of this spectrum was USD2 million. This temporary licence has been extended and Ooredoo has also sought a temporary licence for 2 x 2.5 MHz of E-GSM spectrum on the same terms which has been granted by the PTD through to February 2018. These E-GSM spectrum allocations are in

[1]E-GSM uses frequency range 880 - 890 MHz (uplink) and 925 - 935 MHz (downlink), and adds 50 channels to the original GSM-900 band.

addition to the 900 MHz (and 2100 MHz) allocations granted as part of the telecommunications operating licences.

The current allocations of 900 MHz spectrum are therefore as detailed in Exhibit 1 below.

Exhibit 1: Current 900 MHz band allocations in Myanmar

Frequency Range (MHz)	Planned user	Bandwidth (MHz)
880-885/ 925-930	Vacant	2 x 5
885 – 887.5/930 – 932.5	Ooredoo (temporary)	2 x 2.5
887.5 – 890/932.5 – 935	Telenor (temporary)	2 x 2.5
890 – 895/935 – 940	Ooredoo Myanmar	2 x 5
895 – 900/940 – 945	Telenor Myanmar	2 x 5
900 – 905/945 – 950	Mytel	2 x 5
905 – 915/950 – 960	MPT	2 x 10

Source: PTD, September 2017

On 8 April 2016.the Ministry issued a document entitled *Spectrum Roadmap: Meet the Needs Over Next 5 Years* which outlined our plans for the release of spectrum especially IMT spectrum. While there are a number of references to the E-GSM spectrum band in this Roadmap, the overall view was that unassigned portions of the 900 MHz band could be made available by PTD for assignment in the next 5 years. The key provisions on the E-GSM band is extracted in Exhibit 2 below.

Exhibit 2: Extract from the Myanmar Spectrum Roadmap dealing with E-GSM

EGSM (880-890/925-935) is unassigned, allowing for two 5 MHz pairs

Two 5 MHz pairs in the EGSM 900 MHz band provides for 2x5 MHz of assignable spectrum There is a history of reported interference in extended GSM band. PTD will consider granting short-term authorizations to interested parties to conduct technical trials. There will be strict terms and conditions associated with these authorizations.

Actions Planned by Ministry/PTD:

1) PTD will provision for the temporary licensing of short-term experimental systems in these bands. Licensees granted authorization will be required as a condition of authorization to provide information supporting their proposed trial, including details of tests to be conducted and commit to file a findings report to PTD at the end of the trial. PTD may also observe or participate in specific tests to be conducted.

2) Develop a policy and consultation to optimize 850 and 900 MHz bands

Source: MCIT, *Spectrum Roadmap: Meet the Needs Over Next 5 Years,* page 56

1.2 Review of the E-GSM spectrum band

Given:

- The requests from major operators to *inter alia* make permanent temporary E-GSM spectrum allocations and/or request additional E-GSM allocations;
- Requests for further extension of arrangements for the E-GSM spectrum band which were only ever meant to be temporary and transitional;
- The views stated in the MCIT Spectrum Roadmap that there is a need to optimise the 900 MHz spectrum band; and
- A recognition by the PTD that the E-GSM spectrum band could potentially both facilitate Myanmar's early move to LTE/4G services (with a wider coverage) and ensure that 2G only customers continue to be provided service while it remains

commercially viable, there is a need for the PTD to undertake a more thorough review of the E-GSM band. This is to ensure that longer term arrangements and allocations maximise the public benefit arising from the use of this important harmonised sub-1 GHz spectrum. The PTD wishes to make a considered and informed plan rather than *ad hoc* decisions based on individual operator requests for E-GSM spectrum.

This consultation paper is a key part of that review and provides an important way for key industry stakeholders to provide their input. It is envisaged that the review of this band will be completed later in 2017 so that current licensees of E-GSM spectrum will be provided with notice of any changes to E-GSM band allocations (if any) before the expiry of their licences.

Please note that while this consultant paper asks specific questions of stakeholders like Q1 and Q2 below, responders are also welcome to make additional comments or suggestions.

Q1. What are the most important considerations for the use of the E-GSM Band? What is the optimal timing for changes to the current allocations of E-GSM spectrum?

Q2. What is the proportion of 2G only handsets in Myanmar? How is that forecast to fall by 2018? By 2020? Are there plans to switch off 2G only systems in Myanmar like which has occurred in Singapore and Australia (2017) and other Asian and global markets? If so, what is the likely timing for such moves?

1.3 The effective size of E-GSM spectrum band in Myanmar

Consistent with the discussion in page 45 of the Spectrum Roadmap, there are a range of interference issues which need to addressed in relation to the 850/900 MHz spectrum bands given the reverse duplex issue. A guard band is a necessity.

According to the APT, for cost effective filtering in base stations, nearly 1.6 to 2.0 MHz of guard band is required between the two inter-band adjacent carriers. Any additional guard band is always good to have, as it would further help in getting increased isolation from filters at lesser cost. The APT's suggested inter-band guard band between Band 5 and Band 8 carriers is detailed in Exhibit 3 below. The PTD understands other guard band solutions have been adopted in other Asian markets ranging from Malaysia 1.32 MHz, Australia 1.6 MHz, Hong Kong 2.5 MHz and New Zealand 5 MHz.[2]

Exhibit 3: Suggested inter-band guard band between Band 5 and Band 8 carriers

Technology in Band 5 (850 MHz band)	Technology in Band 8 (900 MHz band)	Suggested Edge-to-Edge Separation (Guard Band in MHz)
CDMA (1.23 MHz)	GSM (200 kHz)	1.6
CDMA (1.23 MHz)	UMTS (5 MHz)	1.6
CDMA (1.23 MHz)	LTE (5/10/15/20 MHz)	1.8/2.1/2.5/3.0
UMTS (5 MHz)	GSM (200 kHz)	1.6
UMTS (5 MHz)	UMTS (5 MHz)	1.6
UMTS (5 MHz)	LTE (5/10/15/20 MHz)	1.6/1.9/2.3/2.8
LTE (5/10/15/20 MHz)	GSM (200 kHz)	1.8/2.1/2.5/3.0
LTE (5/10/15/20 MHz)	UMTS (5 MHz)	1.6/1.9/2.3/2.8
LTE (5/10/15/20 MHz)	LTE (5/10/15/20 MHz)	1.8/2.1/2.5/3.0

Source: APT, 2014[3]

[2] ITU, Radiocommunications Bureau

[3] APT, *APT Report on Migration Strategy of GSM to Mobile Broadband, APT/AWG/REP-53, September 2014*, page 24

Because there is already a guard band of 1.25 MHz from 878.75 to 880 MHz (paired with 833.75 to 835 MHz paired) it would be prudent that a further guard band of 2.5 MHz in the 900 MHz band of 880 to 882.5 MHz paired with 925.0 to 927.5 MHz should be provided for in Myanmar. This would result in a guard band of 3.75 MHz between the two inter-band adjacent carriers in the 850/900 MHz band which ought to be sufficient.

If this position is adopted by the PTD then 2 x 7.5 MHz of E-GSM spectrum from 882.5 to 890 MHz paired with 927.5 to 935 MHz would be available for allocation in Myanmar.

Q3.	What should be the size of guard band in the 850/900 MHz band? Does your view on the size of this guard band change over time? With technologies (for example as the 850 MHz band converts from using CDMA to LTE)?
Q4.	Do you agree that 2 x 7.5 MHz of E-GSM spectrum is available for allocation in Myanmar? If not, what E-GSM spectrum do you consider is available for allocation?
Q5.	Are there any additional cross-border interference issues which would need to be addressed if the E-GSM is licensed in Myanmar?

2. ALLOCATION PROCESS FOR THE E-GSM SPECTRUM BAND

Spectrum allocation is one of the most important factors influencing the performance of the mobile sector. Allocation has a direct impact on the value of mobile businesses, the level of competition, consumer satisfaction and the long-run sustainability of the sector as a whole. Traditionally, the "*command and control"* or direct allocationapproach to spectrum management has been the model of choice. This model has been supplantedby market mechanisms for in-demand bands in most markets, due to technological advances and market liberalisation in the past decade, which have dramatically increased the pace of spectrum consumption.

The so-called '*spectrum crunch*' has placed great pressure on global sector regulators to efficiently manage demand for frequencies across an increasingly diverse set of competing users. Having said that, there remains a need to allocate spectrum in different ways depending on band and harmonised use.

In Myanmar in accordance with Article 11(a) of the *Spectrum Rules 2013*: *"The procedure for authorizing the right to use Radio Spectrum, the conditions for participation in the authorization of spectrum rights and the charges payable for spectrum rights are identified for each Radiocommunication Service below, and, without limiting the methods which may be used, may include any one or a combination of the following methods:*

i. by auction;

ii. by tender; or

iii. by fixed price."

From the Ministry's perspective, there are advantages and disadvantages in all methods which may be used to allocate the E-GSM spectrum in Myanmar. A direct allocation, assuming there is agreement on the price to be paid would be faster but spectrum auctions are more transparent. There are also strong arguments that the E-GSM particular spectrum band should be allocated directly given *inter alia* additional to the 900 MHz spectrum allocations granted to the major operators in their operating licences, the deployment of 900 MHz compatible networks by the major operators, it is spectrum more usable for legacy 2G services, etc.

While the PTD's priorities are stated below (see Exhibit 4),the Ministry has yet to finalise its view on the optimal approach which ought to be adopted for the allocation of the E-GSM spectrum in Myanmar. Key to the PTD's decision is assessing the level of market demand for E-GSM spectrum. Certainly, in accordance with global exemplar practice the PTD does not expect to undertake a spectrum auction if demand does not exceed supply.

Exhibit 4: Ministry Priorities for the allocation of the E-GSM spectrum band

Priority	Suggested Objectives
1	An efficient and transparent spectrum allocation process
2	Promoting competition in the market with the aim to improve quality of service and reduce costs of services thereby benefiting Myanmar consumers
3	Development of telecommunications industry in Myanmar including infrastructure and higher speed 4G/LTE (and LTE-A) services thereby increasing capacity to serve increasing consumer demands and facilitating the transition from legacy 2G services to 4G/LTE services
4	Revenue to the State

Q6. What is your preference for the process which should be adopted for the allocation of e-GSM spectrum? Is a direct allocation or spectrum auction preferred? Who should be permitted to acquire and/or bid for E-GSM spectrum?

Q7. Are you interested in acquiring E-GSM spectrum? What is the strength of your interest?

Q8. Do you concur with the Ministry priorities for the allocation of the E-GSM spectrum band? If not, what priorities would you recommend and why?

3. PROPOSED PRICING OF E-GSM SPECTRUM IN MYANMAR

What determines the value of spectrum? The value or price of spectrum is determined by a range of factors, including the spectrum's highest value use, changes in technology and its availability across spectrum users, Ministry's spectrum allocation plans, etc. In short, value of spectrum may be summed up as:

> *V = f{physical characteristics, geographic coverage, licence regulations and conditions, technological change, underlying demand, policy certainty, etc.}*

There are two general methods used for calculating spectrum price (i) direct calculation method (using some form of net present value (NPV) or cost reduction approach), and (ii) market-based relative benchmarking method (which incorporates current/recent market information).

Benchmarking involves using data from spectrum awards in both Myanmar and in other comparable jurisdictions to determine the likely price range of spectrum. Benchmarking derives estimates of spectrum value from revealed willingness to pay for spectrum in other spectrum awards. The benchmarks are therefore based on prices that have been paid by specific buyers in Myanmar and other countries. It is important to ensure comparison countries are properly selected. Awards must be as comparable as possible in all respects:

- Country should have similar income, level of economic development, political development;

- Spectrum should have similar physical characteristics;
- Licences should have similar duration;
- Market should have similar structure, level of competition, existing spectrum holdings, access to technology; and
- Recent, that is within a few years, to ensure that changes in forex to a common currency, GDP/capita and population changes have not varied to greatly and because the nature and use of the 900 MHz band has significantly changed for use for LTE/4G services (LTE Band 8).

Therefore, to determine benchmark prices several factors must be taken into account, and to rebase the source numbers to a benchmark number. This is a simple yet complex process, with a number of steps to be taken and methodologies to be adopted.

Depending on the determined allocation process and the form/length of any E-GSM spectrum licence to be offered the Ministry may engage independent consultants who have significant spectrum management and valuation expertise as well as experience of the Myanmar market to assist it.

The final offered price for E-GSM band spectrum (if a direct allocation) or the reserve price (if a spectrum auction) will be consistent with the domestic and international pricing benchmarks considered by the independent consultants plus standard annual Spectrum Management Fees.

Q9.	Please provide your view – supported by foreign precedents on the price which should be applied to the E-GSM spectrum in Myanmar. Please provide details of other 900 MHz spectrum auctions, renewals, including price per MHz per population, Asian, comparable country exemplars etc
Q10.	Should such spectrum prices be adjusted for smaller spectrum allocation like 2 x 2.5 MHz which is most usable for legacy 2G services rather than future LTE services?
Q11.	How should such spectrum prices be adjusted for a short duration spectrum licence for E-GSM spectrum of say, 3 or 5 years if that was the PTD's preferred approach to the allocation of E-GSM spectrum?

4. OTHER KEY ISSUES RELATING TO THE OFFERING OF E-GSM SPECTRUM LICENCES

There are also a number of other key issues which relating to the potential offering of E-GSM spectrum which need to be addressed including but not limited to spectrum lots, coverage requirements, licence terms, and proposed payment terms. A summary of the proposed approach to other spectrum licensing issues is contained in Exhibit 5 below.

Exhibit 5: Summary ofProposed Approach to other Spectrum Licensing Issues

Spectrum Framework Issues	Licence Condition if applicable	Possible Approaches
Spectrum Lots	n.a	If 2 x 7.5 MHz of E-GSM spectrum is available for allocation, then two options exist for spectrum lots, namely (i) three lots of E-GSM spectrum each comprising 2 x 2.5 MHz and (ii) two lots of E-GSM spectrum with one lot comprising 2 x 5 MHz and the other comprising. 2 x 2.5 MHz of E-GSM spectrum. Optimally if the second option was taken, should there be a refarming of the band to create a larger contiguous block.
Coverage Requirements	n.a	No specific coverage commitment will be included in the E-GSM Spectrum licence band given coverage requirements already contained in the Operating and earlier Spectrum Licences assuming that E-GSM spectrum is restricted to existing 900 MHz spectrum licensees.
Term of Spectrum Licence	1.2	Two options would seem to exist in relation to the term of E-GSM spectrum licence. Namely (i) 11 years – co-terminus with the operating and spectrum licence for 900/2100 MHz spectrum granted to Telenor/Ooredoo and (ii) a shorter licence term of 3 or 5 years reflecting the transitional nature of the E-GSM allocations (eg if the option of 3 lots of 2 x 2.5 MHz of E-GSM spectrum lots was adopted).
Licence Renewal Terms	5.1	The E-GSM spectrum licence expires on its end date. There is no expectation of renewal. The PTD or its successor organization can decide at a later time whether to *inter alia* extend the licences, auction the spectrum and/or a combination thereof in accordance with the applicable Law and Spectrum Rules.
Proposed Payment Terms	10.1	The payment schedule for the E-GSM spectrum allocation will be as follows: i) A First Spectrum Licence Fees Payment, in an amount equal to sixty (60) percent of the Spectrum Licence Fee on the effective date of its Licence; ii) A Second and Final Spectrum Licence Fee Payment, in an amount equal to the remaining twenty (40) percent of the Spectrum Licence Fee within one (1) year after the effective date of its Spectrum Licence.

Q12. Please provide your view of the proposed spectrum lots for the E-GSM spectrum band? What option above do you prefer and why? Should there be any refarming of the 900 MHz band if the second lot plan was preferred and if so, who would pay?

Q13. Further, if three lots of E-GSM spectrum are to be offered, should each of those lots be treated the same? If not the same, how should they be treated differently eg in terms of price, allocation (ie drawing lots or an assignment round) etc?

Q14. Please provide your view of the proposed term of the E-GSM spectrum licence? What option above do you prefer and why? Or do you have another preference?

Q15. Do you have any further comments on any of the proposed approaches to key other spectrum licensing issues related to the allocation of E-GSM spectrum? Are there other key issues which need to be discussed?

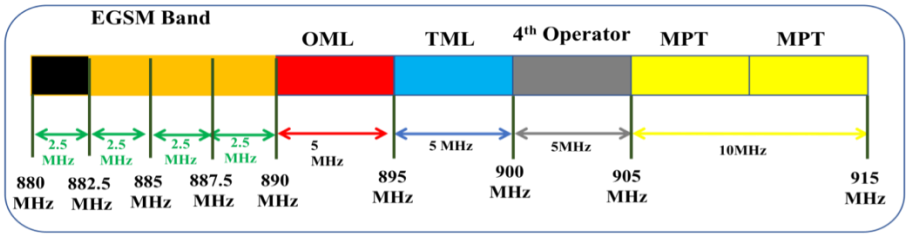
4. PROPOSED BAND PLAN FOR THE 900 MHZ SPECTRUM BAND INCLUDING E-GSM

The proposed band plan for the 900 MHz spectrum band including E-GSM spectrum is set out in Exhibit 6 below.

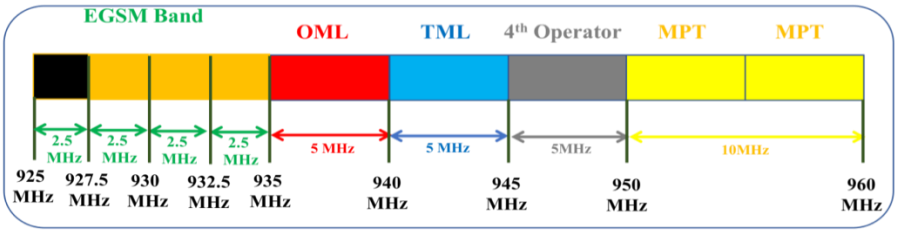
Exhibit 6: Options for the900 MHz Spectrum Band Plan including E-GSM

Option 1

Frequency Usage in 900 MHz (Uplink)

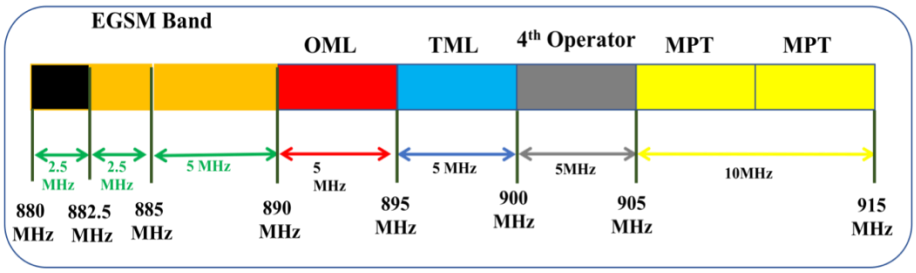


Frequency Usage in 900 MHz (Downlink)

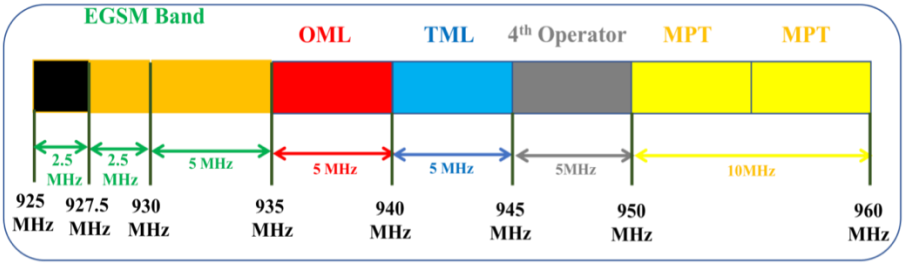


Option 2

Frequency Usage in 900 MHz (Uplink)



Frequency Usage in 900 MHz (Downlink)



Q16.	Do you have any comments on the proposed 900 MHz Spectrum Band plan including E-GSM allocations?

5. RELATIONSHIP BETWEEN THE ALLOCATION OF E-GSM SPECTRUM AND PLANNED OFFERING OF THE 700 MHz SPECTRUM BAND IN MYANMAR

The MCIT's Spectrum Roadmap: Meet the Needs Over Next 5 Years outlined our plans for the release of 700 MHz spectrum in Myanmar in the 2017/18 period.

The PTD notes that GSA reports on the 700 MHz network deployments and the device ecosystem as at July 2017.[4]There are now 34 commercially launched APT700 Band 28 operators in 18 countries including large markets like Brazil, Nigeria, Japan, Philippines, Germany, France, Argentina, Peru, Australia, Taiwan and Chile (in order of population). Countries with a population of almost 1 billion have therefore allocated 700 MHz spectrum compatible with APT700/LTE Band 28 devices.

Further in the region, LTE services will launch in the 700 MHz band in Singapore from 1 January 2018, Malaysia is likely to offer 700 MHz spectrum in 2018 following the planned completion of analogue television switchover in mid 2018 and the Telecom Regulatory Authority of India (TRAI) has just released on 28 August 2017, a consultation paper on the auction of spectrum including *inter alia* the 700 MHz spectrum band.[5]

The PTD also notes that GSA released a paper in May 2017 on the growing maturity of the ecosystem in 700/800 MHz band. Examining the GSA paper, it should be noted that APT LTE Band 28 is only the 12th most popular of all LTE handsets ever released into the market. However, this is historical, and examining those handsets currently on sale on the market there would seem to be strong device vendor support for the APT700 band.

Given the above, there would seem to be no impediments to Myanmar releasing the 700 MHz band in accordance with its Spectrum Roadmap.

Q17. In your view, would the release of E-GSM spectrum by the PTD in Myanmar affect the level of your demand for 700 MHz spectrum? If so, why? And by how much? How strong is the growth in demand for wireless broadband in Myanmar?

Q18. When do you consider that the PTD should offer 700 MHz spectrum to the market? If you support its release, from your perspective what is the preferred way that 700 MHz spectrum should be allocated? Who should be allowed to bid for 700 MHz spectrum?

Q19. Are there any other benefits which you envisage from Myanmar releasing the 700 MHz band in 2017/18 including but not limited to extended rural and regional coverage, improved in-building coverage in urban areas, the ability to offer higher wireless broadband with carrier aggregation, coverage layer for 5G services etc?

[4]Available at www.gsacom.com

[5] See TRAI, *Consultation Paper on Auction of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300-3400 MHz and 3400-3600 MHz bands,* Consultation Paper No. 10/2017, 28 August 2017

6. DRAFT SPECTRUM LICENCES

Attached to and forming an integral part of this consultation paper are the draft Spectrum Licences. Such spectrum licences are consistent with the earlier 2014/2017 Spectrum Licences granted in Myanmar with a number of necessary amendments.

Q20.	Do you have any comments on the draft Spectrum Licences for the E-GSM Band, if a decision is made to continue to offer the E-GSM spectrum in Myanmar?

7. REQUEST FOR COMMENTS

Consistent with the Law, and the *Spectrum Rules 2016*, the Ministry is pleased to provide key stakeholders with an opportunity to comment on any aspect of this E-GSM Spectrum Consultation Paper and the attached draft Spectrum Licence. The PTD would appreciate receiving detailed written responses to the 20 specific questions contained in this Consultation Paper.

Comments must be received in writing via email to ptdspectrum@ptd.gov.mmby ***5pm on 13 October 2017.***

- END -