

26th August 2019

DID: 67716688

Ms Aileen Chia
Deputy Chief Executive (Policy, Regulation & Competition Development),
Director-General (Telecoms & Post)
Infocomm Media Development Authority
10 Pasir Panjang Road
#03-01 Mapletree Business City
Singapore 117438
Fax: (65) 6211 2116

Dear Ms Chia,

Public Consultation on Allocation of Spectrum for Enterprise and Public Mobile use

1. Enclosed is PSA's response to the spectrum allocation and we will be glad to meet up for any further clarifications.
2. Thank you.

Yours faithfully,



Mr Nelson Quek Swee Leng
Head of Tuas Development
PSA CORPORATION LIMITED

cc Mr David Foo – As spoken please.
Director Ops-Tech
MARITIME AND PORT AUTHORITY OF SINGAPORE
460 Alexandra Road,
#17-00 PSA Building,
Singapore 119963

1. Port of Singapore – A Strategic Pillar of Singapore’s Current & Future Economy

- 1.1. Singapore’s maritime sector accounts for 7% of its GDP and employs 170,000 across 5,000 establishments. At the heart of the Singapore International Maritime Centre’s pre-eminence is its Port.**
- 1.2. PSA operates the world’s busiest container transshipment hub in Singapore, handling 36.3 million TEUS (twenty-foot equivalent units) in 2018. One seventh of global transshipment volumes is routed via Singapore, making the small city-state a critical node in global trade and geo-political flows.**
- 1.3. The Port also connects local business and markets to more than 600 ports in over 120 countries, thereby contributing to the competitiveness of local industries, and the diversity of choice to local consumers. More importantly, the Port is the main gateway through which food, materials, and other essential goods are imported into Singapore.**
- 1.4. In order to meet the growing demands in scale and complexity of port operations, and to maintain Singapore’s competitive advantage over regional and international rivals, PSA continues to invest heavily in terminal infrastructure, equipment and technology ahead of demand.**

2. Tuas Port: The Smart Megaport of the Future

- 2.1. As highlighted by PM Lee Hsien Loong in his recent National Day Rally speech, Tuas Megaport represents the future of the Singapore Transshipment Hub, where all of PSA’s container terminal operations will eventually be consolidated. Slated to commence operations in phases from 2021 onwards, Tuas Port will be able to handle up to 65 million TEUs per year when completed across the span of the next 2 decades.**
- 2.2. To deliver class-leading service levels at this scale amidst Singapore’s evolving labour landscape and demographics, PSA is investing heavily in automation and other advanced technologies to boost labour productivity and reduce Singapore’s reliance on low-skilled foreign labour.**
- 2.3. Innovations such as driverless Automated Guided Vehicles (AGVs) to move containers within the port, remotely-operated cranes and equipment, as well as intelligent planning and resource management platforms, will not only make Tuas Megaport the single largest container facility in the world, but indeed the world’s largest automated port.**



Fig 2.3.1: Conventional Prime Mover (L) versus driverless AGV (R).



Fig 2.3.2: Conventional Yard Crane (1 operator on site per machine) (L) versus Automated Yard Cranes (remotely operated with up to 1:10 man to machine ratio) (R).

- 2.4. The successful implementation of such technologies requires the presence and support of pervasive network architecture and connectivity in both voice and data communications over and above current specifications. In addition to coping with significant increases in time-critical data communications, the underlying communications infrastructure must also be secure, robust and resilient.

3. PSA Wireless Communications Roadmap

- 3.1. As wireless communications are an essential and critical enabler of PSA's current and planned operating platforms, PSA has in place a development and implementation roadmap for key wireless communications capabilities.
- 3.2. These roadmaps take into account PSA's requirements for both voice (required for man-to-man co-ordination and management of ground operations, occupational safety etc) as well as data (required for IT-based machine-machine or machine-man resource management and deployment systems) communications across all of its current and future operating locations.
- 3.3. Since the previous iteration of the roadmap which was previously shared with IMDA on 19 June 2014 as part of PSA's response to *IMDA's Public Consultation on Spectrum Allocation for IMT and IMT-Advanced Services and Options to Enhance Mobile Competition*, PSA has reviewed and updated the roadmap (attached as Appendix 1) to reflect changes in demand as well as developments in the technical and market landscape.
- 3.4. While earlier roadmaps had envisaged the potential convergence of voice and data communications into a single 4G Long Term Evolution ("LTE") platform from 2021 onwards, a recent review by PSA found such solutions to be lacking in maturity and market adoption, and unsuitable for supporting PSA's present day mission critical applications.
- 3.5. Hence, PSA's roadmap was revised to reflect the need for wireless communications at PSA (including the initial phases of Tuas Terminal) to continue to be driven by the continued use of TETRA-based systems in the interim, up to 2025.
- 3.6. To facilitate this, PSA will reuse up to 3 x eight (8) pairs of frequencies on 800 MHz from the City Terminal (Tanjong Pagar, Keppel, and Brani) for deployment of TETRA Radio system at Tuas.

4. Beyond 2025: Tuas Scale-Up and Solutioning

- 4.1. As operations at Tuas Port scale up and demand for wireless communications increases, PSA will look towards the deployment of converged 5G networks to replace existing platforms from 2025 onwards.
- 4.2. Based on initial assessment, a private 5G network operating on licenced frequency may be required to meet the following critical requirements of the Tuas Megaport:
 - (i) Time critical operation with consistent end-to-end performance:
 - Centralized orchestration of AGV and other automated, wireless communications-intensive operations for improved productivity.
 - Tele-operation of heavy machines with minute controls.

- Tele-operation of heavy machines with minute controls.
 - Critical communication ensuring safe and collaborative man-machine environment.
 - Performance characteristics within the challenging port environment which feature dynamic metallic profiles (ships and container stacks) as well as long container “canyons” which may interfere with consistent and reliable data communications.
- (ii) **Highly reliable and available wireless communication platform:**
- Free from interference with committed SLA for congestion management that a public network cannot offer.
 - As Tuas is located closer to neighbouring countries, licensed frequency is required to mitigate against interruptions to port operations caused by foreign interference.
- (iii) **Cybersecurity vis-a-viz legislated obligations of a Critical Information Infrastructure (CII):**
- Improved privacy and security controls end-to-end, without exposure to public users through a common public network.
- (iv) **Maintainability and performance tuning:**
- Radio planning dedicated to machines’ needs as compared to consumers for public network.
 - Controls over network maintenance to align with Tuas Port’s ground operations requirements instead of at mandated window for public network operators.

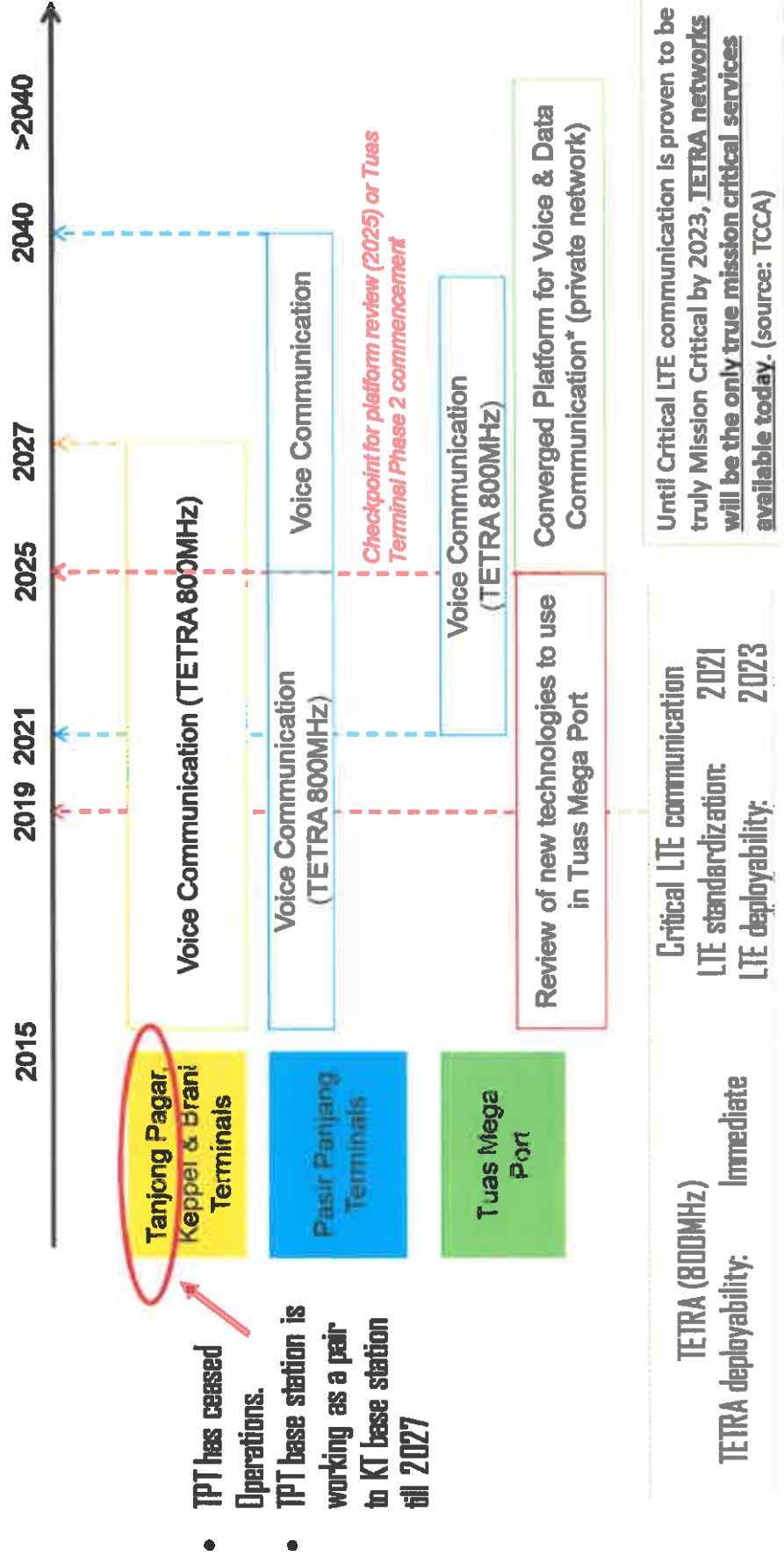
5. Proposal for Licenced Spectrum Allocation

- 5.1. PSA notes the availability of new 800MHz spectrum and, for the reasons above, would like to propose for IMDA to consider allocating part of it for enterprises such as PSA, preferably allowing for technology-neutral deployment.
- 5.2. PSA’s proposal for spectrum allocation has the support of MPA. MPA and DSTA concluded a joint study on the Infocomm requirements for Tuas in 2018. One of the recommendations¹ was to utilise an exclusive spectrum allocation for PSA’s communications network, due to PSA’s unique operating requirements and environment. Based on the recommendations of

¹ Another option proposed was to utilise an exclusive spectrum allocation, leased from one of the telecommunications service provider, that is segregated from public 4G network.

the joint study, MPA supports PSA's request for spectrum allocation to ensure network reliability due to the criticality of PSA operations. This is on the basis that MPA is unaware of other credible and available options which can meet the envisaged Infocomm requirements.

Appendix 1



- TPT has ceased Operations.
- TPT base station is working as a pair to KI base station till 2027

** City Terminal (Tanjung Pagar, Keppel and Brani) will cease operations in 2027.

END OF DOCUMENT