**SINGTEL MOBILE SINGAPORE PTE LTD**

**RESPONSE TO CONSULTATION PAPER ISSUED BY THE INFOCOMM MEDIA DEVELOPMENT AUTHORITY ON EMBEDDED SIM TECHNOLOGY**

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1.1.    This submission is structured as follows:

Section 2 – Introduction
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## 2.    INTRODUCTION

2.1.    Singtel Mobile Singapore Pte Ltd (**Singtel Mobile**) is committed to the provision of state of the art mobile telecommunications services and technologies in Singapore. Singtel Mobile is licensed to provide Public Cellular Mobile Telecommunications Services (**PCMTS**) in Singapore and has acquired Spectrum Right(s) to provide 3G and 4G Long Term Evolution (**LTE**) mobile services. Singtel Mobile has also acquired Wireless Broadband Access (**WBA**) Spectrum Right(s) and is licensed to provide wireless broadband services.

2.2.    Singtel Mobile welcomes the opportunity to make this submission on the Consultation and the various issues identified by IMDA.

2.3.    Singtel Mobile would be pleased to clarify any of the views and comments made in this document, as appropriate.

## 3.    Executive Summary

3.1.    Singtel Mobile generally supports extending the No SIM-lock policy to eSIM devices with the exception of M2M devices, secondary devices and Consumer Internet of Things (**IoT**) devices.

3.2.    Singtel Mobile submits that placing the onus on Mobile Network Operators (**MNO**) to facilitate switching of mobile operator profiles is unnecessarily restrictive to business operations.

3.3.    To support interoperability to the greatest extent possible, IMDA can play an important part in establishing an eSIM device compliance framework to ensure that all eSIM devices sold or used in Singapore comply with the latest GSMA specifications.

3.4.    Singtel Mobile generally supports requiring the adoption of GSMA SAS and ISO 27001 standards and secure the compliance of Relevant Providers in the eSIM OTA Remote Provisioning supply chain with the above-mentioned standards in the provisioning of eSIMs with the exception of eSIM devices for corporate customers that need to be customised such that the device does not support the OTA Remote Provisioning functionality.

3.5.    Singtel Mobile is not aware of any security gaps not presently addressed by GSMA SAS and ISO 27001.

3.6.    Given the low volume of eSIM devices in the market compared to primary devices such as mobile phones, tablets, mobile WiFi (MiFi) and mobile dongle, it may be too early to decide on a suitable provisioning model at this stage. Singtel Mobile considers that it may be prudent to start with a fully outsourced model and move to a fully-owned or hybrid model.

3.7.    The eSIM provisioning model is likely to change the business model for SIM vendors affecting areas ranging from manufacturing to services and licensing. There is also likely to be innovation from MNO, SIM vendors, OEMs, other vertical manufacturers and retail organisations to integrate the provisioning of a collection of eSIM devices to a subscriber account(s) as well as the transfer of devices between accounts.

3.8.    By being an early adopter of the eSIM ecosystem, Singapore will be in a good position to influence and lead how other countries in the region will interact in commercial matters, technology and regulations to enable global interoperability and trust. For example, regulating the need for Public Key Infrastructure certificate authorities and discovery services[1].

3.9.    Singtel Mobile is of the view that a policy position which recognises the viability of eSIM for mass market adoption and is open to the active participation of all players (ie, mobile operators and OEMs) is likely to promote adoption, particularly in Singapore with its high mobile penetration and adoption of IoT-type devices.

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[1] Discovery services are used by devices and operators to ensure a device can connect to an operator with no prior knowledge of the physical network the device sits on

3.10. Singtel is of the view that, unlike the number port arrangement, it is not necessary to limit the support of OTA Remote Provisioning to a single trusted third party which is the model currently employed for number port.

3.11. Singtel Mobile proposes requiring compliance with the GSMA compliance framework published under SGP.24 as part of the existing type approval scheme.

3.12. Singtel Mobile agrees that the codes of practice, guidelines and consumer protection measures established by IMDA for the provision of mobile services should remain applicable to the operators who offer telecommunication services for the use of eSIM-enabled Consumer devices to the extent that the codes of practice, guidelines and consumer protection measures do not place overly onerous requirements on the operators.

## 4. Specific Comments

> **Question 1:** IMDA would like to seek views and comments on the policy principle of extending the No SIM-lock policy to eSIM devices.

4.1. Singtel Mobile generally supports extending the No SIM-lock policy to eSIM devices with the following exceptions:

**M2M devices**

4.2. There are cost differences between using a SIM-locked device and an unlocked device. Imposing a No SIM-lock policy denies an enterprise customer the choice of selecting the device suitable for their business. In general, by the time a customer enters into commercial negotiations with the service provider, the customer would have already researched and determined the device that meets their operational needs. If this device is a SIM-locked device, the customer should have the flexibility of choosing this option.

4.3. Furthermore, a customer may wish to vertically integrate the eSIM device(s) to their backend through a Platform as a Service (**PaaS**) provided by the MNO. In such a case, the MNO connectivity and PaaS will be bundled to provide an end-to-end solution to the customer. The device must be SIM-locked to ensure that the solution is functional; porting the device to another service provider would effectively cease all services tied to it thereby disrupting the solution.

**Secondary devices**

4.4. Devices such as wearables may be designated by the device manufacturer as secondary devices with the mobile phone being the primary device. This requires that the wearable be on the same network as the primary device in order for certain features to work

properly. For example, Apple designates the Apple Watch Series 3 LTE as a secondary device and the iPhone as the primary device. The watch must be on the same network as the iPhone in order for the 1 number service feature to work seamless. In such cases, it may be necessary to enforce a SIM-lock policy on the wearable.

**Consumer IoT devices**

4.5.     Some IoT devices contain soldered SIM cards that do not have the ability to support Remote SIM Provisioning (**RSP**). Such devices are typically low cost IoT devices manufactured by small and niche market players who may not have sufficient resources to comply with the RSP standards. Moreover, such devices are typically customised to the customer and/or MNO's specifications and sold exclusively by the MNO as an end-to-end service making it necessary for the device to be SIM-locked.

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**Question 2:** IMDA would like to seek views and comments on the application of the No SIM-lock policy on Consumer devices (e.g., mobile phones, tablets and wearables (such as smart watches and fitness trackers)) where they are eSIM enabled.

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4.6.     Singtel Mobile generally supports the application of the No SIM-lock policy on Consumer devices where they are eSIM enabled with the exception of secondary devices. Please refer to our comments to Question 1.

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**Question 3:** For M2M devices, IMDA would like to seek views and comments on placing the onus on mobile operators to facilitate switching of mobile operator profiles where consumer and enterprise end users request to switch mobile operators.

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4.7.     Singtel Mobile submits that placing the onus on MNOs to facilitate switching of mobile operator profiles is unnecessarily restrictive to business operations. Mobile operator profile switching can be performed by other parties including trusted 3rd parties or an enterprise customer who owns the SM-SR. Furthermore, in instances where Singtel Mobile is not the Lead MNO[2], we do not require the SM-SR to facilitate the profile switching.

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**Question 4:** IMDA would like to seek views and comments on the adoption of GSMA specifications for eSIM devices that are to be sold and used in Singapore to facilitate the deployment of OTA Remote Provisioning functionality.

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4.8.     GSMA specifications serve to enable the rapid adoption of GSMA-compliant eSIM devices. Where the eSIM devices are fully compliant with GSMA specifications, the

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[2] A Lead MNO is the MNO that works directly with the device manufacturer and is responsible for engaging MNO partners in other countries

eSIM in these devices need not be from the same eSIM platform vendor. Therefore, Singtel Mobile strongly supports the adoption of GSMA specifications for eSIM devices that are to be sold and used in Singapore.

4.9.    To support interoperability to the greatest extent possible, IMDA can play an important part in establishing an eSIM device compliance framework to ensure that all eSIM devices sold or used in Singapore comply with the latest GSMA specifications [as manufacturers can decide to use any version of the GSMA specifications, different type of eSIM, etc.]. Although most SM-DP+ can support backward compatibility, not all features will be fully supported. As more consumer and IoT devices are expected to adopt eSIM technology, a compliance framework will be imperative to ensure that all eSIM devices are GSMA-compliant to facilitate the deployment of OTA Remote Provisioning functionality.

4.10.   Notwithstanding the above, eSIM devices for enterprise customers may need to be customised according to business requirements such that the device may not conform to the GSMA specifications on OTA Remote Provisioning. Singtel Mobile submits that so long as the enterprise customer is aware of the consequences of customising a device such that it does not support the OTA Remote Provisioning functionality (ie, the device will not be able to switch to a different MNO profile), the choice of doing so should be left to the customer.

> **Question 5:** IMDA would like to seek views and comments on whether IMDA should require the mobile operators to adopt the GSMA SAS and ISO 27001 standards and secure the compliance of Relevant Providers in the eSIM OTA Remote Provisioning supply chain with the above-mentioned standards in the provisioning of eSIMs.

4.11.   Singtel Mobile generally supports requiring the adoption of GSMA SAS and ISO 27001 standards and secure the compliance of Relevant Providers in the eSIM OTA Remote Provisioning supply chain with the above-mentioned standards in the provisioning of eSIMs with the exception of eSIM devices for corporate customers that need to be customised such that the device does not support the OTA Remote Provisioning functionality. Please refer to our comments in paragraph 4.10.

> **Question 6**: Are there security gaps that GSMA SAS and ISO 27001 do not address, and if so, how should these gaps be plugged to facilitate trust and security in the provisioning of eSIMs, particularly in safeguarding the OTA profile management process.

4.12.   Singtel Mobile is not aware of any security gaps not presently addressed by GSMA SAS and ISO 27001.

4.13. GSMA SAS and its affiliated compliance procedures exist to ensure interoperability, assure security and enable trust in the eSIM ecosystems. The GSMA compliance processes for eSIM are specified in SGP.16 (M2M) and SGP.24 (Consumer). ESIM device manufacturers should be encouraged to comply with these specifications.

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**Question 7**: IMDA would like to seek views and comments on which eSIM provisioning model is best suited for mobile operator's needs, and why.

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4.14. Although there has been a rapid evolution of eSIM technology in the last few years as industry players define the GSMA standards to encourage adoption of eSIM-enabled devices, eSIM devices are still limited to secondary devices such as M2M devices, wearables, etc. The volume of eSIM devices in the market remains low compared to primary devices such as mobile phones, tablets, mobile WiFi (MiFi) and mobile dongle. Similarly, the volume of eSIMs on the Singtel Mobile network remains low compared to total volume of SIMs in use.

4.15. Given the above, it may be too early to decide on a suitable provisioning model at this stage. Singtel Mobile considers that it may be prudent to start with a fully outsourced model [where various functional blocks such as SM-DP+, SM-DP, SM-SR are fully managed by trusted third parties] and move to a fully-owned or hybrid model (e.g. SM-DP is outsourced and SM-SR is fully-owned). The advantages of a commencing with a fully outsourced model while the technology is still at a nascent stage include:
   a. enabling the MNO to deliver proven eSIM technology quickly and to effectively scale the business when necessary, without the complexity of building the infrastructure from scratch;
   b. enabling the MNO to engage vendors that are well versed in digital security and ride on their investments in the latest security technology and infrastructure to fulfil the stringent requirements of the GSMA SAS and ISO27001; and
   c. allowing the MNO to quickly introduce the latest eSIM devices and technology to the market with a reasonable amount of CAPEX investment.

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**Question 8**: Do you see any further developments on the eSIM provisioning models such as opportunities for business to vertically integrate and additional opportunities for third parties to participate in the eSIM ecosystem?

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4.16. The introduction of the eSIM has brought about fundamental changes to the distribution of SIM cards. Customers can now download the SIM profile securely via the eSIM technology which will revolutionise the way telecoms services are sold and bring about a full digitisation of the online sales channel. The eSIM also eliminates logistics and management costs currently incurred for SIM card distribution.

4.17. The eSIM approach will eventually allow for the storage of multiple mobile operator profiles which provides greater visibility of the core and value-add services offered by various mobile operators, locally and worldwide. This would afford local mobile operators the opportunity to tap on the main mobile operator to sell their services globally. Within Singapore, having profiles of the mobile operators in the eSIM offers customers the flexibility in selecting and/or switching mobile operators.

4.18. M2M and IoT device manufacturers can also provide an end-to-end solution through the eSIM devices with cellular connectivity and secured access back to the cloud-based headend. Please refer to our comments in paragraph 4.5.

4.19. Other possibilities include enterprise customers owning the subscription manager, having the subscription manager hosted by a SIM vendor or deploying a hybrid model in which the customer owns the SM-SR and the MNO own the SM-DP.

4.20. The eSIM ecosystem will also change the relationships between (e)SIM manufactures, MNO and original equipment manufacturers (**OEMs**). Given that OEMs will increasingly be sourcing and purchasing eSIMs, they are likely to seek a more efficient means of doing so including separating the supply of the eSIM silicon and the operating system software within the eSIM. There are also likely to be changes in the packaging used for eSIMs – for new devices, the traditional form factors even the so-called M2M form factors (MFF1 and MFF2) are too big and much smaller form factors have already emerged that will save well over 90% of the volume taken up by a traditional SIM card and carrier.

4.21. The net result of this disruption is likely to be a change of business model for SIM vendors affecting areas ranging from manufacturing to services and licensing. There is also likely to be innovation from MNO, SIM vendors, OEMs, other vertical manufacturers and retail organisations to integrate the provisioning of a collection of eSIM devices to a subscriber account(s) as well as the transfer of devices between accounts.

**Question 9**: Given the changes to the SIM landscape, do you see any value capture opportunities for Singapore in relation to eSIM developments and adoption? These could be from a manufacturing or cyber-security function, for example.

4.22. Please refer to our comments in paragraph 4.18.

4.23. By being an early adopter of the eSIM ecosystem, Singapore will be in a good position to influence and lead how other countries in the region will interact in commercial matters, technology and regulations to enable global interoperability and trust. For

example, regulating the need for Public Key Infrastructure certificate authorities and discovery services[3].

> **Question 10**: As eSIM technology is still relatively nascent with few mass market devices using such technology, what additional support is required to encourage the development of the eSIM provisioning ecosystem in Singapore, in particular the OTA profile management function?

4.24.   The primary reason that eSIM technology is not widely adopted yet is the high costs involved in establishing an eSIM solution. A traditional SIM card is relatively low in cost and can be procured through many established market players. Conversely, the eSIM solution requires CAPEX investments on equipment such as SM-DP and SM-DP+, and also incurs customisation costs to provide a seamless end-to-end user experience of the Remote SIM provisioning functionality. These are commercial considerations that each business will need to weigh against their operational plans and Singtel Mobile submits that IMDA should leave it to market forces to drive the development of the eSIM provisioning ecosystem in Singapore.

4.25.   Support from IMDA can be in terms of further developing Singapore into a high tech hub with the infrastructure such as GSMA SAS compliant data centres and cybersecurity technology to host SM-DP and SM-DP+ servers for operators in the South East Asia region. Currently, all SAS-SM accreditation sites are located in European and USA cities. By having SM-DP and SM-DP+ hosted in Singapore, operators in Southeast Asia can enjoy lower latency and faster download time of the eSIM profile.

4.26.   Singtel Mobile submits that the development of the eSIM provisioning ecosystem requires regulatory oversight to ensure interoperability amongst all parties ranging from MNOs to device manufacturers which will ensure that eSIMs, provisioning systems and devices will be compatible. To maximize return on investment, it can pay significant dividends if is used in the right situations, and implemented carefully, an eSIM can increase flexibility, optimize cost, and add longevity to devices that operate in the future say IoT.

4.27.   In short, Singtel Mobile is of the view that a policy position which recognises the viability of eSIM for mass market adoption and is open to the active participation of all players (ie, mobile operators and OEMs) is likely to promote adoption, particularly in Singapore with its high mobile penetration and adoption of IoT-type devices. For example, where an OEM has a bilateral agreement with a foreign MNO to provide

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[3] Discovery services are used by devices and operators to ensure a device can connect to an operator with no prior knowledge of the physical network the device sits on

global connectivity, the devices will be locked to the foreign MNO SIM and will permanently roam on the local network if the device is sold in Singapore. In such instances, IMDA should encourage the OEM to provide an alternative means for local mobile operators to also extend their services to the device user (e.g. by providing a physical SIM slot through which the local mobile operator can).

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**Question 11:** What would be the benefits and concerns for mobile operators to engage one trusted third party to provide services in support of OTA Remote Provisioning in Singapore, similar to the existing number porting arrangement.

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4.28.   Singtel is of the view that, unlike the number port arrangement, it is not necessary to limit the support of OTA Remote Provisioning to a single trusted third party which is the model currently employed for number port. The donor operator's eSIM profile and data are not required to be transmitted to the receiving operator to perform the number port. The customer need only download a fresh eSIM profile which contains a new International Mobile Subscriber Identity (**IMSI**), Integrated Circuit Card Identifier (**ICCID**), and  authentication key (**Ki**) from the receiving operator after successful completion of the number porting process.

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**Question 12:** Given the wide variety of applications for eSIM M2M devices, IMDA would like to seek views and comments on the proposed licensing framework and the proposed licence conditions for Consumer and M2M devices that are enabled with eSIM technology.

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4.29.   Recognising the importance of interoperability and security for products supporting eSIM remote provisioning, GSMA has developed a compliance framework for eSIM devices, Embedded Universal Integrated Circuit Card (**eUICC**) and subscription management products SM-DP, SM-SR, SM-DP+ and SM-DS. This is published by GSMA under SGP.24. The eSIM compliance process describes common compliance requirements for the following:
a.   functional interoperability;
b.   eUICC security;
c.   eUICC production site security; and
d.   subscription Management site security

4.30.   Singtel Mobile proposes requiring compliance with the above standard as part of the existing type approval scheme. The suppliers of eSIM-enabled devices shall register the equipment with IMDA and declare conformity to SGP.24. ESIM-enabled consumer and M2M devices containing a Global SIM from an overseas operator should similarly be subject to the type approval scheme and any other licensing requirements imposed by IMDA. Notwithstanding the above, exceptions should be made for customised devices for enterprise customers; please refer to our comments in paragraph 4.10.

> **Question 13**: To the extent where they are relevant, do you agree that the codes of practice, guidelines and consumer protection measures established by IMDA for the provision of mobile services should remain applicable to the operators who offer telecommunication services for the use of eSIM-enabled Consumer devices?

4.31.   Singtel Mobile agrees with the above statement to the extent that the codes of practice, guidelines and consumer protection measures do not place overly onerous requirements on the operators who offer telecommunication services for the use of eSIM-enabled Consumer devices. IMDA should consult with these operators prior to implementing any codes of practice, guidelines and consumer protection measures imposed to ensure that the requirements contained in these are necessary and remain relevant with developments in technology and the eSIM ecosystem.