The Mobile Satellite Services Association (MSSA) is a non-profit industry association, founded in 2024, that seeks to promote and advance the emerging ecosystem for direct-to-device (D2D) and other advanced Non-Terrestrial Network (NTN) services. MSSA supports the efforts of advanced NTN solutions providers, including terrestrial mobile and satellite operators, original equipment manufacturers, infrastructure providers, chip vendors, and others. MSSA is focused on facilitating a global ecosystem utilizing spectrum already allocated and licensed for mobile satellite services (MSS) and well-suited for integration into a broad range of mobile devices. More specifically, MSSA seeks to facilitate global mobile connectivity via satellite through open, standards-based solutions.

MSSA is pleased to provide the below responses to the National Telecom Regulatory Authority (NTRA)'s Satellite D2D consultation in Egypt and looks forward to continued collaboration with the NTRA on this topic in the coming months. In the following sections, MSSA responds to the questions set forth in the consultation document:

1. D2D Deployment

1.1 How could D2D impact Egypt's telecommunications infrastructure and connectivity expansion? Does it complement or potentially disrupt the current network infrastructure?

The consultation document appropriately recognizes that D2D technologies have the potential to expand connectivity significantly in Egypt and the rest of the world. More specifically, innovations in mobile device technology and globally harmonized standards are driving the convergence of satellite services and terrestrial mobile networks. These innovations are allowing satellites to communicate directly with conventional terrestrial mobile handsets and other end-user devices. D2D technologies present exciting opportunities to complement services provided by mobile network operators, close the digital divide, and provide ubiquitous coverage.

D2D technologies will be particularly valuable as a complement to existing terrestrial infrastructure, and will facilitate expanded connectivity to underserved and unserved parts of urban and suburban areas, as well as rural and remote areas. In addition, D2D technologies will help to satisfy short-term, urgent requirements—*e.g.,* with respect to disaster response.

In short, D2D technologies present exciting opportunities to complement services currently being provided by mobile network operators to facilitate ubiquitous coverage in Egypt.

1.2 What is the expected timeline for the commercial implementation of D2D in Egypt?

D2D services can be implemented in MSS spectrum without the need for new allocations or the adoption of new regulations at the national or international level. Indeed, these D2D services can be offered by leveraging existing International Telecommunication Union

(ITU) allocations and the national MSS licensing frameworks that already enable the provision of MSS services, including in the following portions of the L and S bands:

- 1518-1525 MHz (space-to-Earth) paired with 1668-1675 MHz (Earth-to-space);
- 1525-1559 MHz (space-to-Earth) paired with 1626.5-1660.5 MHz (Earth-to-space);
- 1610-1613.8 MHz, (Earth-to-space), 1613.8-1626.5 MHz (Earth-to-space and space-to-Earth) and 2483.5-2500 MHz (space-to-Earth); and
- 1980-2010 MHz (Earth-to-space) paired with 2170-2200 MHz (space-to-Earth).

The introduction of D2D services in MSS spectrum will be accelerated by reliance on 3GPP standards for non-terrestrial networks (NTNs). 3GPP Release 17 enhances features in the 5G Core Architecture to support NTNs for several use cases, including coverage extension, IoT, disaster communication, global roaming, and broadcasting. Building on this foundation, 3GPP Release 18 identifies three specific MSS frequency band ranges under 6 GHz (recognised across all ITU Regions) for NTN implementation.

This approach leverages established 3GPP standards to integrate satellite capability into mass-market mobile devices, supporting the global 5G ecosystem without requiring fundamental regulatory changes.

1.3 What are the key milestones, and how do market, technological, and regulatory factors influence this timeline?

As discussed above, D2D services can be provided in MSS spectrum within existing MSS allocations and regulatory frameworks, and without the need for significant changes thereto. Notably, MSSA members have already successfully demonstrated a proof-of-concept for messaging and emergency communications using standard, unmodified smartphones in both Saudi Arabia and the United Arab Emirates within the MENA region.

The primary regulatory challenge specific to the deployment of D2D in MSS spectrum in Egypt stems from the fact that the NTRA has not yet explicitly recognized that the provision of D2D services within existing MSS spectrum allocations—including to standard, unmodified smartphones—is consistent with existing licenses to provide MSS Global Mobile Personal Communications by Satellite (GMPCS) services. We respectfully urge the NTRA to eliminate this impediment by acknowledging that D2D operations in MSS spectrum are compatible with existing GMPCS Licenses.

1.4 What impact will advancements in 5G and 6G have on D2D growth?

Advancements in 5G and 6G standards will significantly accelerate the growth and capabilities of D2D and other advanced NTN services.

As discussed above, 3GPP Releases 17 and 18 (both 5G standards) have provided the groundwork for the future of D2D and other advanced NTN services, including provisions for integrating satellite-based D2D communication and otherwise laying the groundwork for hybrid terrestrial-satellite networks.

6G standards will aim to facilitate global, uninterrupted coverage, including over oceans, in deserts, and rural areas—an objective that advanced services in MSS spectrum is ideally suited to deliver. Moreover, 6G standards are expected to fully integrate terrestrial, aerial, and satellite networks, making D2D a core feature rather than an add-on.

2. Regulatory and Licensing Framework

2.1 What are the key regulatory challenges specific to D2D deployment within Egypt's regulatory landscape?

As discussed, the primary regulatory challenge specific to the deployment of D2D in MSS spectrum in Egypt stems from the fact that the NTRA has not yet explicitly recognized that the provision of D2D services within existing MSS spectrum allocations—including to standard, unmodified smartphones—is consistent with existing licenses to provide GMPCS services.

At the same time, there are a number of regulatory challenges to the deployment of D2D ***in IMT spectrum*** that should be acknowledged by the NTRA and reflected in its approach to authorizing this approach. Specifically, the provision of D2D services in IMT/MS spectrum bands poses complex technical issues that do not arise where D2D services are provided in MSS spectrum. Among other things, D2D services provided in IMT/MS spectrum pose potential interference risks to mobile network operators and other terrestrial users of that same spectrum. Critically, these interference risks have not yet been evaluated fully in Egypt. Indeed, detailed interference and coexistence studies (among other types of technical analysis) are needed before the NTRA can understand the risks posed by such D2D operations in IMT spectrum, or make informed decisions as to whether such operations should be authorized and, if so, on what terms.

MSSA also notes that D2D operations in IMT/MS spectrum may pose interference risks to MSS services in the L band (above 1518 MHz) and S band (1980-1995 MHz and 2170-2185 MHz), which also must be studied carefully before such D2D operations can be responsibly authorized. These studies have not been completed to date, and potential interference mitigation measures, such as guard bands and power limits, have not been agreed upon. MSSA urges the NTRA to wait for the conclusion of WRC-27 Agenda Item

1.13 before deciding on the most appropriate authorisation approach for D2D in IMT/MS spectrum bands.

2.2 What possible cooperation models can be established between SNOs and national MNOs?

MSSA anticipates that market forces will give rise to a number of business models over time. MSSA encourages the NTRA to afford ecosystem participants flexibility to develop and implement these various business models in Egypt.

2.3 How can responsibilities toward consumer rights, network security, data sovereignty, cross-border data flow, and Lawful Interception requirements be effectively managed?

MSSA expects that many D2D services will be offered in partnership with existing mobile network operators. In such cases, existing regulatory and compliance obligations can be extended to D2D operations through such mobile network operators. The NTRA can, of course, monitor the situation and take corrective action as necessary.

2.4 How can affordable and viable tariff plans be developed to ensure sustainability for all stakeholders?

As noted above, MSSA expects that many D2D services will be offered in partnership with existing mobile network operators (MNOs). MSSA further expects that D2D connectivity can be integrated into existing terrestrial service offerings without significantly increasing costs—including because the costs of market entry to D2D providers should be relatively low as compared to stand-alone terrestrial MNOs.

2.5 How will the regulatory framework prevent market monopolization and promote fair competition between market players?

MSSA believes that competition can be facilitated by enabling different types of D2D and not allowing one operator to dominate the use of the 1-3 GHz frequency range.

2.6 How can a model be developed that allows MNOs to rent satellite capacities from SNOs (in this case, the spectrum and radio station on satellite will become part of the local terrestrial operator infrastructure using the PLMN of the national operator)? How can integration with the operator's Core Network be achieved in this case?

As noted in response to Question 2.2 above, we expect market forces will give rise to a number of business models that will govern the relationship between market participants, and how D2D capabilities are integrated into terrestrial offerings.

3. Network Integration

3.1 What is the secure architectural design/diagram that would facilitate the integration of D2D services into Egypt's terrestrial networks?

As noted above, MSSA expects that there will be a number of models for integrating D2D services into Egypt's terrestrial networks, consistent with the NTRA's regulatory and policy objectives. MSSA encourages the NTRA to allow sufficient flexibility for operators to develop and implement these various models in response to consumer needs and market forces.

3.2 Which architecture is better to be adopted by the regulatory framework? The Transparent Payload Architecture (Where the satellite functions as an RF signal repeater), or the Regenerative Payload Architecture (where the satellite processes the signal)

See response to Question 3.1, above.

3.3 What are the factors that encourage SNOs to deploy local infrastructure (gateways and PoPs) in Egypt?

See response to Question 3.1, above.

3.4 What measures can be implemented to ensure network security and routing of the national traffic through national infrastructure?

See response to Question 3.1, above.

3.5 How can lawful intercept capabilities be integrated? And what potential impacts might arise on the existing core network infrastructure?

See response to Question 3.1, above.

3.6 What are the challenges and solutions for enabling roaming on D2D networks and ensuring seamless handover between terrestrial networks (MNOs) and D2D networks (SNOs) in Egypt?

See response to Question 3.1, above.

4. Spectrum and Interference Management

4.1 What are the prioritized frequency bands and bandwidth requirements for D2D services in Egypt within IMT frequencies?

As discussed above, the provision of D2D services in IMT/MS spectrum bands poses complex technical issues that do not arise where D2D services are provided in MSS

spectrum—including because IMT/MS bands are used for the provision of terrestrial services, which may not be technically compatible with D2D and other operations in MSS bands. These issues should be studied and addressed before D2D services are authorized in IMT spectrum. Stated differently, such D2D operations in IMT bands should not be "prioritized" at this point in time.

MSSA recommends that the NTRA permit D2D operations in IMT spectrum only after relevant technical and coexistence issues are better understood—including through the completion of preparatory work for WRC-27 under Agenda Item 1.13, and the completion of appropriate coexistence studies outside of that preparatory process—and regulatory recommendations have been developed to address potential issues, such as out-of-band emissions, cross-border interference, and satellite-to-satellite interference.

MSSA urges the NTRA to closely consider any suggestion that D2D uses of IMT spectrum can or should be allowed to proceed on a "non-interference" basis under No. 4.4 of the ITU Radio Regulations before any interference analysis is completed. As noted by the Radio Regulations Board (RRB) in its report to WRC-23,[1] the use of this provision (which permits certain uses on a non-interference basis) in the case of satellite networks should be approached with caution—including because of the high risk that interference that necessarily results from the operation of tens of thousands of satellites in increasingly congested spectrum bands and orbits.

4.2 What are the prioritized frequency bands and bandwidth requirements for D2D services in Egypt within MSS frequencies?

As noted in response to Question 1.2, operators are already utilising existing MSS allocated spectrum to provide D2D and other MSS services in a manner consistent with existing MSS allocations and regulatory frameworks. These include, in particular, existing allocations and frameworks for L- and S-band MSS operations.

The ability of operators to provide comprehensive coverage is facilitated by their access to globally harmonised MSS spectrum, which can be used in accordance with the ITU's longstanding MSS framework. Indeed, the ITU Radio Regulations and Recommendations effectively manage potential interference risks and enable the effective use of these bands (including for D2D). At the same time, the D2D in MSS spectrum approach minimises interference risk in the first instance by avoiding any need to repurpose spectrum for satellite communications or operate on a co-frequency basis with terrestrial networks (as is the case where IMT spectrum is utilised). The fact that operators can provide D2D in MSS spectrum within existing MSS frameworks and frequency allocations has provided

1 See WRC-23/Document 50-E "Report by the Radio Regulations Board to WRC-23 on Resolution 80 (Rev.WRC-07)." https://www.itu.int/md/R23-WRC23-C-0050/en.

certainty and stability that has allowed them to attract capital investment and justify the substantial expenditures necessary to deploy D2D in MSS spectrum. As a result, the industry is progressing with the incorporation of these bands into mobile phones, and existing operators will be able to deliver new and innovative satellite services in addition to D2D, such as IoT.

4.3 How can a spectrum pricing regime be established to balance investment incentives with efficient spectrum utilization?

MSSA believes that spectrum "pricing" can be effectively established through the administrative assignment of satellite spectrum. This approach helps to ensure equitable access to spectrum resources, while avoiding the use of alternative mechanisms, such as auctions, that are unsuitable for use in the case of satellite spectrum (including because such spectrum is subject to international coordination).

Previous international experiences have shown that such alternative mechanisms are not conducive to maximising the socio-economic benefits of space-based services. For example, a study in India concluded that auctions of satellite spectrum could undermine national development goals and recommended alternative allocation methods that support long-term infrastructure growth and digital inclusion.

Pricing via administrative mechanisms also helps to ensure the certainty and stability necessary to facilitate investment. The satellite communications sector is capital-intensive, with high upfront costs and long investment cycles. Therefore, satellite operators place a premium on regulatory certainty, spectrum stability, and favourable licensing conditions to make informed decisions about market entry and long-term investment in Egypt.

4.4 What are the most effective interference mitigation measures for both MNOs and SNOs in the event of cross-border interference caused by the satellite network (D2D), and what procedures should be implemented for resolution?

For reasons discussed above, MSSA believes that the potential for cross-border interference caused by or to D2D operations in MSS spectrum can be effectively addressed using the same mechanisms currently used to address such interference in the case of other MSS services.

In the case of D2D operations in IMT/MS spectrum, the potential for cross-border interference is one of many concerns that is not yet properly understood, and that requires further study, followed by the development and implementation of appropriate mitigation mechanisms.

4.5 What mechanisms can be implemented to detect and prevent unauthorized transmissions within the Egyptian territories?

Given the variety of different business and technical models that are likely to underlie D2D offerings in the future, MSSA does not believe there will be a "one-size-fits-all" solution to the problem of unauthorized transmissions. That said, MSSA acknowledges that this is an important national matter and expects that its members will work with the NTRA to address it in the context of different D2D networks and supply chains.

5. Quality of Service (QoS) and Performance

5.1 How do the QoS parameters and key performance indicators (KPIs) of D2D compare to those of terrestrial IMT systems?

MSSA expects that a variety of D2D solutions will emerge in response to varying customer needs and use cases. Associated QoS parameters and KPIs are likely to vary in kind.

5.2 What are the estimated achievable spectrum efficiency and system capacity for D2D in Egypt?

MSSA is a trade association and not a service provider. That said, it expects that D2D operators will strive to achieve ongoing and incremental improvements in spectrum efficiency and system capacity over time.

5.3 How could geographic and atmospheric conditions in Egypt impact D2D QoS?

Egypt's landscape is predominantly flat desert, which is generally well-suited for satellite services (including D2D offerings).

5.4 How does D2D system performance vary under stress conditions, such as disasters or unplanned events?

D2D systems (and particularly those that use MSS spectrum) are generally robust, performing well under stress conditions such as natural disasters or unplanned events. The satellite links and infrastructure used by such systems are generally more reliable and resilient than those used by terrestrial communication systems. Among other things, satellite links are not dependent on vulnerable ground-based infrastructure, which is often damaged or overloaded during disasters. This makes D2D systems ideal for maintaining communication when terrestrial-only networks fail.
