Recommendations for the use of Mobile Satellite Services (MSS) voice services as a Security Communications Systems (SCS) tool

This document is formally endorsed by the IASMN (the Interagency Security Management Network) in its 34th session (Sept 2021) and is now part of the UN/TESS SCS standards.

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A. Introduction and context

In the past, the UN Security Management System (UNSMS) has used HF radio for long range voice communications when no other infrastructure/services were available. However, in recent years, the use of HF radio as an SCS tool has significantly decreased, partially due to declined technical support and user expertise, its complicated use, and challenges in terms of frequency, channel and common callsigns planning.

The Security Management Operations Manual (SMOM) chapter on SCS Guidelines (March 2021) specifies that *"satellite phones can be used as backup SCS for key UN personnel, and can be used as primary or backup SCS for offices and vehicles"*.

Furthermore, in January 2021, the Inter-agency Security Management Network (IASMN) endorsed the "{TESS+} recommendations on the phase-out of HF Radio as a Security Communications Systems tool" (See reference document on UNSMIN):
"Mobile phones, complemented by portable/mobile satellite phones, are to be considered as the logical and natural replacement for HF radio in the SCS for long-range communications. As such, it is recommended that the UN and NGO community should adopt those alternatives formally and start phasing out the use of HF radio as an SCS tool, as of January 2021. To ensure the smooth transition from HF radio towards a combined use of mobile phones and satellite phones for long-range communications we recommend the transition to start as of now. As of end 2025, HF radio will no longer be a standard SCS tool, with the exception of specific cases"

Mobile Satellite Services (MSS) are defined as all small-sized, satellite-based voice and data services and the devices accessing these services, used as portable (handheld), mobile (in vehicles) and in bases (SOCs, offices and residences). MSS devices and services are a valuable resource for the UN and NGO communities, both for security and operations communications.

The use of MSS **voice** services is a suitable and useful long-distance UN Security Communications Systems (SCS) connectivity tool, often used in combination with mobile phone communications – for long-range and short-range communications – and VHF/UHF radios (for short range communications).

B. Purpose

From TESS' experience in 70+ countries, Mobile Satellite Services are already used in most operational areas and are preferred for long-distance communications, rather than the conventional use of HF radio. However, it appears that in most countries the proper implementation of MSS as an SCS tool lacks clear global guidelines on how to implement MSS as a suitable SCS long distance communications tool.

The purpose of this document is to make recommendations for the selection, use and management of MSS as a standard long-range SCS voice connectivity tool.

C. MSS overview

C.1. Technology and current service providers

MSS have long been a limited market with just a handful of service providers. However, as technology has evolved, new services have been introduced and cost has decreased.

Current network operators employ two different MSS technologies:

- ***Geostationary satellites:*** GEO satellites are deployed at a very high orbit around the earth where satellites move at the same speed as the rotation of the earth. Therefore, from earth, the satellites appear stationary in the sky. Due to the distance from the earth, the area each satellite covers can be quite extensive.
- ***Low Earth Orbit satellites:*** LEO satellites are positioned much closer to the earth's surface and follow a fixed orbit around the earth. This low altitude orbit means each satellite covers a limited area and a relatively high number of satellites are required to provide services globally.

Two of the current network operators (Inmarsat and Thuraya) use GEO satellites while Iridium have deployed a LEO constellation. Whereas Inmarsat and Thuraya have deployed three and two satellites, respectively, Iridium offers services by means of a constellation of 66 satellites. GEO-based satellites often do not cover, or have difficulties in providing services at the poles. In addition, Thuraya's two satellites do not cover the Americas, the southernmost part of Africa nor a large part of the Pacific.

C.2. Modes of operation

The MSS voice mode of operation comes in two flavours:

1. *Telephony mode:* In this mode, the MSS device functions like a mobile phone operating over satellite, i.e. it supports voice calls from the device to other satellite-based networks, and to mobile or fixed terrestrial phone lines globally. In addition, the terminals can send and receive text messages (SMS). MSS telephony services are one-to-one communications: one device calls to (or receive calls from) one other device or service.
2. *Push-to-Talk (PTT) mode*: This service allows "one-to-many", "many-to-one", and "many-to-many" communications (similar to VHF/UHF radio network). In other words, when pressing the "send" button on the PTT MSS device, the message is broadcasted and received by all PTT devices within the same pre-defined "talkgroup" on the same service. In PTT mode, devices can only communicate with other devices within the same pre-defined "talkgroup" and service.

Currently, Iridium – and recently Inmarsat - offer both global MSS PTT and telephony services while Thuraya currently only provides telephony on its network.

D. Evaluation and conclusions

D.1. Infrastructure and usage

Due to its infrastructure, being space-based, these services have several operational benefits, and a few limitations, over terrestrial-based communications systems (such as radio or mobile phone systems).

A major benefit is that these services are available over larger areas, and in remote environments without a local terrestrial infrastructure. These services are less affected by human-made and natural disasters than terrestrial-based services. Conversely, MSS are typically more prone to importation, licensing and use restrictions imposed by governments than other SCS connectivity systems. In conflict areas, MSS services can be intentionally jammed or blocked over larger areas.

Satellite-based communications always depend on a clear line-of-sight from the user's device to the satellite. To operate well, the MSS terminals must have a strong signal from the satellite network. This condition is critical for MSS, which typically use limited power and small antennae, and are often used "on the move" where the surroundings might (temporarily) obstruct the view towards the satellite (e.g. buildings in urban areas, dense vegetation etc.). Consequently, MSS devices will not, by themselves, function (or function reliably) from within a building, from underneath tree canopies, inside a vehicle or even in a metropolitan area with tall buildings.

Furthermore, the handheld/mobile terminals are equipped with high-gain antennas that are also directional. In practical terms, this means that, when used as a handheld terminal, the antenna must be roughly pointed towards the satellite, rendering its use as a handheld device less effective.

The MSS devices can be supplemented with external antennas and docking stations to extend services inside buildings and vehicles. The external antenna boosts the signal from the satellite network, resulting in higher reliability and availability. Such accessories are available for fixed (e.g. offices) and mobile (e.g. vehicles) installations.

Mobile kits allow for reliable MSS services both while inside the vehicle and while the vehicle is moving. There are two types of vehicles kits:

1. Fixed installation: The docking station and the external antenna are permanently fixed in/to the vehicle.
2. Moveable installation: Both the docking station and the external antenna are temporarily fixed to the vehicle (i.e. docking station with a suction cup and antenna with a magnetic base) and can be removed from the vehicle when not needed. This is useful when field trips are undertaken in rented vehicles, or when there are not enough MSS devices to cover all vehicles in the UNSMS organisations' fleet.

In both scenarios described above, often the MSS device terminal itself can be removed from the vehicle dock. For installations of any device in a vehicle, the manufacturer's technical instructions have to be followed and due care is to be taken not to damage or obstruct any other functions of the vehicle (e.g. the driver's view, key dashboard functions, airbags,..)

Fixed (office) kits extend reliable MSS inside a building. There are two categories of office kits:

1. A base, or fixed, docking unit: This consists of a docking station and an external antenna which allows for use of a MSS device inside a building. The kit is permanently installed, and the MSS device is inserted into the docking station. Some models of docking units have a port to connect to an external telephone handset or telephone system (PABX).
2. An MSS repeater kit: This is used for offices as an alternative to the base kit configuration. The kit extends the signal of the satellite service inside a building, or in blind spots where there is no satellite coverage. It consists of an external antenna and a low loss antenna cable which links the satellite signal to the indoor MSS devices via the satellite repeater. The benefit of this kit over a docking station is that more than one MSS device can be connected and make calls at the same time, while moving freely around the room/building.

Conclusion

Based on the observations above, MSS voice services are a well-suited SCS connectivity solution for operational areas where there is no other (SCS) communications infrastructure available, either as a primary or a backup means of SCS communications.

The limitations of the MSS technology require MSS devices to have a clear view of the sky. MSS can be used as an SCS connectivity tool for vehicles and base stations, when used with external antennas, but face challenges with reliability of service when operated from a vehicle in an urban environment and/or when used as a handheld device.

D.2. Operating modes

MSS have generally been used for telephony services as a conventional satellite phone but recently PTT functionality has been added to some network operators' service catalogue. Although both telephony and PTT use the same satellite network infrastructure, special hardware devices are usually required to access the PTT service. Although there are devices that can be used for both modes, a reboot of these devices is required to switch from one mode to another. Each service mode also requires a separate subscription.

In **telephony mode**, the flexibility to make phone calls to any telephone number globally (landline, mobile phone, another MSS provider) makes it versatile and well-suited as both an SCS tool and as an operational tool.

In **PTT mode** the requirement for all personnel using this service to be part of the same "talkgroup" poses some practical challenges. For example, all UNSMS organisations need to agree on using same "talkgroup", and as such, need to ensure their MSS service provider provides access to this "talkgroup".

Conclusion

Both modes of operations are suitable for use as a communications tool by the UNSMS, but the use cases differ. Telephony mode is best suited when MSS is a backup SCS and not regularly used. In this mode, the flexibility to make phone calls to any telephone number makes it more versatile as a communications tool. On the other hand, PTT mode is a suitable solution if MSS is used by most UNSMS organisations in the operational area and is frequently used for security communications. Due to the requirement for all users to be part of the same "talkgroup" this service is less flexible than telephony mode.

D.3. Cost and management

Satellite-based communications services typically have a higher operational cost than the terrestrial alternatives. Due to higher usage costs and the absence of good management tools, improper use of MSS services poses a higher financial cost or risk for inappropriate use by UNSMS organisations' personnel. MSS in PTT mode has a fixed cost (a fixed monthly subscription fee which allows unlimited use), while MSS as a telephony service has a fixed and a variable cost (a fixed monthly subscription fee, plus a per minute/SMS charge).

One of the biggest challenges with MSS telephony services is to manage the cost of using the services. UNSMS organisations usually receive post-factum invoices for monthly usage of telephony services, which only allows post-factum monitoring of potential misuse of MSS services. To address this issue, MSS service providers have opened access to their subscription management systems allowing the management and monitoring of all aspects of each MSS device subscription in real-time. For example, the subscription management system may allow the set-up of alarms to flag excessive usage, notifying selected personnel if certain device usage thresholds are reached.

Conclusion

With the availability of the subscription management tools described above and active management of MSS subscriptions, the risk of excessive costs can be mitigated. Having the ability to, in real-time, activate and deactivate a subscription also provides increased flexibility, i.e. subscriptions can be kept in stock in a non-active mode until it is needed and then be ready for service immediately.

D.4. Services subscriptions

The current MSS service providers all support either pre-paid or post-paid subscriptions:

1. Pre-paid: A pre-defined amount of call time is purchased and loaded onto the SIM card of the MSS device. When the amount is consumed, no more calls can be made before the balance is topped up. Usually, unused units expire at the end of a predefined term (typically 1, 3, 6 and 12 months).
2. Post-paid: The MSS service provider records the length and cost of all calls being made and aggregates them into a monthly invoice sent to the subscriber.

Post-paid plans typically offer lower usage costs than pre-paid subscriptions. On the other hand, post-paid plans have a fixed monthly subscription fee which is charged whether the service is used or not. The monthly fee does often include a few free calling minutes, but the amount varies between providers.

Depending on the usage pattern, either type of subscription could be cost-effective. For example, in a low-risk operational area where an MSS will only be used exceptionally (when other SCS services are unavailable), it might be more cost-effective to use a pre-paid subscription with a smaller amount and a 12-month validity rather than pay a monthly fixed fee for a service with limited use.

Beyond the cost perspective, the risk with a pre-paid subscription is that the pre-paid "call credit" can run out at a critical moment, when communications are most needed. In those circumstances it can take time to "top off" the pre-paid subscription for that device. This issue is avoided when using post-paid subscriptions.

Conclusion

Both post and pre-paid subscriptions have their pros and cons. Post-paid ensures that the subscription is active and do not run out of call credit at a critical time. However, pre-paid plans can offer cost efficiencies and maintain the risk profile in certain scenarios.

E. SCS recommendations

E.1. Overall recommendation

MSS devices installed in a vehicle or base (SOC, office or residence), with a **docking station** and **external antenna** can be used as a primary or backup SCS connectivity. Installed in a vehicle, the MSS is primarily to be used **in non-urban areas**. The use of handheld MSS devices is discouraged as a standard primary or backup SCS, but can be used as a "**last resort**" means of SCS communications.

To be used as a long-distance SCS connectivity tool, it is paramount that MSS connectivity is reliable and is ready to provide service whenever needed. To achieve this, the requirements below must be met in terms of MSS configuration and usage.

E.2. Recommendations for fixed installations

Fixed installations include MSS used from inside UNSMS SOCs, offices and residences.

E.2.1 In UN common SOCs

1. UN SOCs must be capable of monitoring all types of MSS services used in the operational area. However, it is recommended that each operational area standardise on one MSS service.
2. A base, or fixed docking unit, consisting of a docking station and an external antenna which allows for use of the MSS device from a fixed location in the SOC. The kit is permanently installed, and the MSS device is inserted into the docking station[1].

Alternatively,

3. An indoor MSS repeater which extends the coverage of the satellite signal inside the building where the SOC is located, can be installed, allowing handheld MSS devices to be used inside a building. This repeater kit consists of an external antenna and a low loss antenna cable which extends the satellite signal to the indoor MSS device(s).

E.2.2 Offices and Residences

1. A base, or fixed docking unit, consisting of a docking station and an external antenna which allows for use of the MSS device from a fixed location in the office space. The kit is permanently installed, and the MSS device is inserted into the docking station[1].
2. It is recommended, especially for larger offices, to install a docking unit that has a port to connect to an external telephone handset or telephone system (PABX).

Alternatively,

3. Deploy an indoor MSS repeater that extends the coverage of the satellite signal inside the building space/room.

[1] Note that there are limitations on the length of the antenna cable connecting the docking unit with the external antenna (brand specific).

E.3. Recommendations for mobile installations

Mobile installations include light vehicles, trucks, and water vessels. The recommendations distinguish between UN-owned official vehicles, trucks and vessels and those that are rented or otherwise used temporarily.

E.3.1 UN official/permanent usage vehicles, trucks and vessels

1. The general recommendation is that MSS installations in UN official vehicles, trucks and vessels have docking station and external antenna permanently fixed in place. This particularly applies in high-risk operational areas.
2. The exception would be in low-risk operational areas where a moveable installation would be sufficient.

E.3.2 Rented/Temporary usage vehicles, trucks and crafts.

1. In this scenario, a moveable kit consisting of a device holder, charging cable and external antenna (magnetic or suction attachment), should be used.

E.4 Recommendations regarding MSS mode of operation

1. As a general recommendation, both modes of operations (telephony and PTT) can be used as an SCS primary or backup connectivity system. Which one to adopt, depends on the operational parameters in the individual operational area/country.

2. PTT-based MSS is only recommended to be used for SCS purposes in operations where the MSS is used regularly, and used for security communications by most UNSMS organisations. Most importantly, all UNSMS personnel using this service are required to be part of the same "talkgroup" when using a PTT-based MSS as a primary or backup SCS.

E.5 Recommendations on management of MSS

E.5.1 Subscription type for MSS in telephony mode[2]

1. The general recommendation for MSS subscriptions, when used in telephony mode, should be post-paid and from an international service provider.
2. The exception is for low-risk operations areas where a pre-paid subscription could be used.

E.5.2 Monitoring/Active subscription management

1. MSS telephony services' usage must be actively managed and monitored by the individual UNSMS organisation.
2. It is recommended to select an MSS service provider which allows the subscribing UNSMS organisation to actively self-manage the subscriptions, including monitoring excessive usage, set up consumption alerts and activate/deactivate subscriptions in real time.

[2] In either case, the subscriptions must be actively managed.

E.5.3 Standardize on one single MSS network service

1. It is recommended to use the same MSS service (e.g. or Iridium, or Thuraya, or Inmarsat) for all SCS users within the operational area to ensure the highest reliability and most cost-effective use.
2. Several factors should be considered when selecting a single MSS service as a primary or backup SCS:
    a. Which system(s) are currently already used in the country and how many have been deployed?
    b. Coverage – Does the MSS service cover the operational area? This might need to be verified with technical support personnel (or the local ICT Working Group), as not all MSS services provide global coverage.
    c. Are there local restrictions on the use of certain MSS? Some governments limit the use of specific MSS services within their country.
    d. Usage patterns – How are MSS currently utilised?
    e. What is the costing model for the various MSS services?

E.6. Recommendations on user training

1. Develop user training for MSS services and devices that can be delivered as stand-alone training courses or be incorporated into security-related training programmes.

2. MSS devices are often seen as if they were mobile phones (telephony mode) or VHF devices (PTT mode). MSS devices and services have however, limitations compared to mobile phones or VHF networks. It is, therefore, paramount to train users, both for the SOCs and UNSMS personnel in the field, on the proper use of MSS services/devices and to highlight the limitations and costs of the MSS technology.