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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

x the first digit:

1 presented to TSG for information;

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document identifies use cases and associated guidelines for the provision of services when a 5G public network has an extraterritoriality access component.

This Technical Report (TR) addresses:

- Use cases and associated conditions generating extraterritoriality of public 5G systems (e.g. HAPS covering multiple countries, satellite access covering international waters, aeronautical networks),

- 3GPP features (e.g. emergency calls, PWS, LI, charging) and technical aspects (e.g. MCC/MNC, location of UE/NW) for which extraterritoriality may be relevant, and types of regulations that may be applicable.

- Guidelines on the fulfilment of relevant regulatory requirements (e.g. routing to a core network in a specific country, use of MCC).

This 900 series TR is meant to serve as the basis for technical work in other 3GPP Working Groups when considering the above topics. This TR is not normative. It has been developed by SA1 to capture relevant high-level considerations associated with of the provision of 5G public network and access services in extraterritorial contexts, and provide corresponding guidelines.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.011: Service accessibility

[3] https://www.un.org/depts/los/convention_agreements/texts/unclos/part7.htm

[4] 3GPP TS 22.268: "Public Warning System (PWS) requirements"

[5] 3GPP TS 22.101: Service aspects; Service principles

[6] Global Maritime Distress and Safety System Manual, 2015 Edition, UN IMO, ISBN 978-92-801-1624-3.

[7] SOLAS Consolidated Edition, 2020, UN IMO, ISBN 978-92-801-1690-8.

[8] 3GPP TS 33.126: "Lawful interception requirements"

[9] Data Protection & Privacy Laws, https://unctad.org/page/data-protection-and-privacy-legislation-worldwide, Accessed: 19.10.20.

[10] ITU RADIO REGULATORY FRAMEWORK FOR SPACE SERVICES; https://www.itu.int/en/ITU-R/space/snl/Documents/ITU-Space_reg.pdf

[11] UN Convention No. 10106 , "Convention on Offences and Certain Other Acts Committed on Board Aircraft", Tokyo, 14 September 1963, <https://treaties.un.org/doc/db/Terrorism/Conv1-english.pdf> Accessed 11.02.21.

[12]   UN Convention No. 6456, "CONVENTION ON THE HIGH SEAS", Geneva, 1958. https://sedac.ciesin.columbia.edu/entri/texts/high.seas.1958.html> Accessed 11.02.21[13] Brisibe, T. C. "International law and regulation of aeronautical public correspondence by satellite", Doctoral Thesis, Faculty of Law, Leiden University, 2006.

[13]   Title 47, Chapter I, Subchapter B, Part 22, Subpart H, §22.925 " Prohibition on airborne operation of cellular telephones." United States Federal Communications Commission.

[14]   "Impact of exclusion zone policies on siting base stations: Australian case study analysis". GSMA, August 2012.

[15]   3GPP TS 22.119: "Maritime Communication Services over 3GPP system"

[16]   HCM Agreement: "Agreement between the Administrations of Austria, Belgium, the Czech Republic, Germany, France, Hungary, the Netherlands, Croatia, Italy, Liechtenstein, Lithuania, Luxembourg, Poland, Romania, the Slovak Republic, Slovenia and Switzerland on the co-ordination of frequencies between 29.7 MHz and 43.5 GHz for the fixed service and the land mobile service.", agreed by correspondence in 2020, http://www.hcm-agreement.eu/

[17]   General Data Protection Regulation: "REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the protection of natural persons with regard to the processing of personal data and on the free movement of such data", 27 April 2016

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

example: text used to clarify abstract rules by applying them literally.

3.2   Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

RPOA   Recognized Private Operating Agency
NTN   Non Terrestrial Network

4   Overview

In some cases, PLMN access can be offered through radio access technologies whose coverage could extend well beyond the political borders of countries. This is the case for instance with satellite access, and this could also be the case with High Altitude Platforms. Another example of extraterritorial access is where a PLMN ID is used for a local network on e.g. a ship or plane travelling in/over international waters. When considering RAN sharing on a satellite network or High-Altitude Platform, PLMN IDs as authorised by one administration in one country, could also be transmitted by a RAN another country. A further scenario could be the transmission of an international PLMN ID (as authorised by ITU according to ITU Rec E.212) over a number of countries territories.

When dealing with services over international waters, aeronautical communications, or terrestrial mobile networks, the question of which requirements apply to the design and operation of the corresponding 5G system ?.

Extraterritoriality is considered in this document as either:

-     the location of the UE and its access to the 5G network;

- the location of the 5G network for the services to be delivered.

Guidelines have been developed on this basis for 3GPP specified services of 5G public networks.

5 Overview of territories affected by regulatory requirements on communication

5.1 Introduction

This clause describes different types of territories that are relevant in the discussion of extraterritoriality

5.2 Country

Within the context of the document, a country is defined as the area embedded within a set of borders and for a which a unique set of regulations applies for the provision of communication services through mobile networks.

For instance, in 3GPP TS 22.011 [2], A Public Land Mobile Network is defined as follows:

"

PLMN

A Public Land Mobile Network (PLMN) is a network established and operated by an Administration or RPOA for the specific purpose of providing land mobile communication services to the public. It provides communication possibilities for mobile users. For communications between mobile and fixed users, interworking with a fixed network is necessary.

A PLMN may provide service in one, or a combination, of frequency bands.

As a rule, a PLMN is limited by the borders of a country. Depending on national regulations there may be more than one PLMN per country.

"

NOTE: Regulations can apply beyond the land borders of a country. Generally the regulations that apply within the land borders of a country also apply to the territorial waters (12 nautical miles). Furthermore also Exclusive Economic Zones (200 nautical miles) should be considered as areas where telecommunication regulations can apply. Overseas areas can sometimes have the same regulations, but sometimes will have to be considered as areas with different regulations.

5.3 Exclusion areas

Within a country, some specific areas may be excluded from the general regime which is generally enforced for mobile communication networks. This exclusion regime may be temporary or not, and may be related to some security or safety requirements for instance.

Within a country, some specific areas may be excluded from the general regulatory regime which applies to and is enforced for mobile communications. This exclusion regime may be temporary or not, and may be related to some national security, heterogeneous use of frequency resources (that is, for policies that do not apply uniformly throughout a territory), research or safety requirements for instance. An exclusion area has a well-defined extent within a national territory.

Consideration of Electromagnetic Field regulations for public health are out of scope of this Technical Report. It is assumed that all deployed equipment, whether UE or base station, will comply with all relevant regulations and therefore emissions are not a relevant regulatory consideration for 3GPP standards with respect to Exclusion Areas. Though there are some local governments that pursue exclusion area regulation of this kind, it is a concern both for users (whose service suffers from lack of nearby deployment of base stations) and service providers (whose planning is made more complicated.) [14]

5.4   Maritime Areas

In maritime areas, different regulatory regimes may be applicable according to the type of communication services considered in Maritime Areas:

- Passenger communications

- Operations (including IoT)

- Maritime Traffic Management

  o Surveillance and Tracking

  o Bridge voice communication

  o Search & Rescue communications

High seas are defined in Reference [3] as a maritime area where no sovereignty can be claimed by any state. (see Article 89).

Article 94 stipulates further that the duties of a Flag State is to effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag. In particular this shall include that the master, officers …..are fully conversant …with the applicable international regulations concerning … the maintenance of communications by radio.

5.5   Aeronautical Areas

As for maritime areas, different regulatory regimes may be applicable according to the type of communication services considered in Aeronautical Areas:

- Passenger communications

- Operations (including IoT)

- Air Traffic Management

- Surveillance and Tracking

  - Cockpit voice communication

  - Emergency communications

International regulations and standards apply to all but the first category. It is the first category "Passenger communications" that directly applies to 3GPP standards.

There are two scenarios for Aeronautical areas:

1) Sovereign Airspace

2) International Airspace

The distinction is relevant as different regulations apply.

5.6   Extraterritorial Areas

There are regions that have no territorial claims, e.g. the Antarctic. In these regions, as in the Maritime Areas, no sovereignty is claimed.

Where territorial boundaries are ambiguous, as in disputed or territorial regions, the regulatory implications are described in clause 7.2.

6 3GPP Services/features affected by extraterritoriality

6.1 Introduction

This clause identifies 3GPP services and features that are affected by extraterritoriality and that are considered in the use cases in this Technical Report (see clause 7 and 8).

6.2 Public Warning System

PWS as described in [4] provides the public with alerts, warnings and critical information regarding disasters and other emergencies. The general PWS requirements in [4] are supplemented with regional specific requirements for the Earthquake and Tsunami Warning System (ETWS), the Commercial Mobile Alert System (CMAS), EU-ALERT, and the Korean Public Alert System (KPAS). There is also an Extended PWS, with additional requirements for UEs with no user interface or with a user interface that is incapable of displaying text-based Warning Notifications. In addition, enhancements of Public Warning System (ePWS) is intended to improve the comprehension of a Warning Notification for users with disabilities or for user who are not fluent in the language of the Warning Notifications.

PWS and its different regional variants are generally covered by regulatory requirements (e.g. laws or other regulations). These regulatory requirements can take the form of regulations on operators to support PWS and/or in the form of regulations on devices that are sold in a particular country/region to support PWS. Issues with extraterritoriality can appear when it is not clear which of the national or regional regulatory requirements apply, e.g. in maritime or aeronautical areas. This can include that it is unclear whether PWS should be supported and/or which of the regional versions of PWS must be supported by the operator.

With PWS, Warning Notifications are provided by a Warning Notification Provider. In each country where PWS services are provided, there are procedures in place to determine who (e.g. which agencies or local authorities) can be a Warning Notification Provider. It is unclear whether there will be an organisation with responsibility for coordinating Warning Notifications in extraterritorial areas (e.g. maritime or aeronautical authorities). An alternative is that the network operator selects which Warning Notifications Provider(s) to use for extraterritorial areas. It is clear that a satellite operator with a satellite network covering multiple countries and/or extraterritorial areas will have to interface with multiple Warning Notification Providers.

The Warning Notifications likely include the following five elements:

- Event Description

- Area Affected

- Recommended Action

- Expiration Time (with time zone)

- Sending Agency

The Warning Notification Provider will provide information determining in which area the Warning Notifications should be distributed. Based on the geographical information indicated by the Warning Notification Provider, it shall be possible for the operators to define the Notification Area based on their network configuration of the area coverage such as distribution of cells.

With satellite networks, it is possible that the area covered by a single cell is much larger than a cell area in the terrestrial network. This can become a problem when satellite coverage and terrestrial coverage overlap. The difference in coverage areas may cause confusion between users of different types of access that get different messages even though they are in the same location. Furthermore, satellite users may receive information that is not targeted at the area they are in. A possible way of addressing these issues is by filtering Warning Notifications on the UE based on Area Affected information within the Warning Notification and location information available on the UE.

6.3 Charging and Billing

Several countries have concluded that income deriving from satellite services is income generated within their territory. This implies that the satellite operator may be subject to paying value added and income tax for the services provided to customers in that country.

It is therefore important that the charging and billing system of the satellite operator can identify in which country a UE was located when it was receiving services from the satellite network.

6.4 Emergency calls

Requirements for emergency calls are listed in [5].

Different countries and regions can have different types of emergency calls. Furthermore, similar types of emergency calls may use different numbers in different countries. [5] provides the following examples:

19	Police (Albania)
100	Police and Fire Brigade (Greek cities)
100	Ambulance and Fire Brigade (Belgium)
112	Police and Ambulance (Italy)
112	General emergency call, all categories (Sweden)
115	Fire Brigade (Italy)
144	Ambulance (Austria)

An issue with extraterritoriality may therefore be that it is not clear which emergency call numbers need to be supported. Fortunately, the UE will be able to recognize many of the emergency call numbers and translate a call to an emergency number to an emergency number request. That way on most phones you can either use 911 or 112 to make an emergency call, irrespective of where you are. Note that this is not the case for all emergency call numbers. A non-terrestrial network operators will have to take the location of the UE into account to determine which emergency call numbers apply for which purposes in case the UE has not recognised the emergency call number as a general emergency call.

One of the main aspects related to extraterritoriality is that emergency calls need to be routed to the correct Public Safety Answering Point (PSAP). Routing to the right PSAP may be done based on the basis of UE determined location; it is assumed it is in the best interest also of the UE owner to route to the right PSAP.

A specific issue is to determine what kind of emergency call support should be provided in extraterritorial areas (e.g. at sea outside territorial waters). Users may expect support for emergency calls in areas where there is no clear PSAP that would be able to organise an emergency response. For maritime users the GMDSS (Gross Maritime Distress Safety System) [6] in the context of SOLAS (Saving of Lives at Sea) [7] provides a communication system for emergency response. Satellite operators may provide both GMDSS and/or terrestrial emergency calls. Note that SOLAS regulations impose requirements on maritime users but does not impose regulatory requirements on satellite operators to provide GMDSS and/or emergency calls.

6.5 Lawful Intercept

Interception requirements are subject to national law and international treaties and should be interpreted in accordance with applicable national policies.

Lawful Intercept requirements may apply both on the HPLMN and the VPLMN. In both the HPLMN and the VPLMN, the operator will have to provide Intercept Related Information and Content of Communication.

Requirements universally called out in regional interception regulatory requirements are supported by the system defined in [8]. There may also be requirements unique to a specific region or country.

In many cases, national regulation will require that LI activity is performed entirely within a particular legal jurisdiction. Specifically information indicating the target of interception, is often not allowed to be provided to

networks outside the jurisdiction of the particular country of the law enforcement agency that request interception. This may e.g. imply that the satellite ground station and/or base station and the core network all have to be in the same country as the UE, unless countries have made specific agreements. It should therefore be possible to route satellite communication to the right core network based on UE location.

Location Dependent Interception, (LDI) allows a 3GPP network to service multiple interception jurisdictions within its service area. Multiple law enforcement agencies with their own interception areas can be served by the 3GPP network. All the information or rules given for interception within a 3GPP network apply to interception within an Interception Area (IA) when LDI is invoked. A target may be marked in one or more different IAs within the same 3GPP network.

Depending on national requirements, the network operator may be required to report the location of a LI target at the beginning and end of a call and/or session. It may also be a national requirement for the CSP to report the location:

- during on-going communications;

- for any mobility management event detected in the 3GPP core network which includes a target's location change or update.

The location information associated with target communication reported to the law enforcement agency shall be at least location information trusted by the 3GPP network (i.e. the location information is either 3GPP network derived or verified).

NOTE: Country-specific regulations may include further requirements on location (e.g. on the frequency of reporting)

6.6 Data Retention Policy in cross-border scenarios and international regions

Data protection laws, and in particular data retention policies vary between countries [9]. While many of these laws refer to financial transactions, use of a mobile telecommunication system in some sense involves charging records which are directly related to commercial transactions.

Regulations for data retention as part of data privacy and trade law exists for different sovereign states. In some cases there are negotiated treaties between bordering sovereign states regarding the law applicable in cross-border regions.

The NTN access provider and PLMN operator identify the location of the UE. If the location is ambiguous with respect to the sovereign state territory in which the UE operates, then a cross-border condition arises. The NTN access provider and PLMN operator apply the regulations according to the regulations, treaties and conventions that apply to that particular cross border region. This means, in effect, retaining data according to a specific (single) set of regulations.

Data associated with the UE's activity, such as charging records and other operational information is maintained according to international regulations (where no national regulation exists, e.g. on the high seas,) and according to sovereign state law, where this law applies. Where there is ambiguity, the data retention regulation to apply depends on international treaties between the neighbouring sovereign states.

6.7 Network access

Countries provide frequency licenses for terrestrial networks. Non-terrestrial networks can cover multiple countries and extraterritorial areas. When a non-terrestrial network uses spectrum that is subject to licensing in a specific country or region the non-terrestrial network will have to ensure it has permission from the countries or regions that are covered [10]. Note furthermore it may be possible that a non-terrestrial network cannot get the same frequency bands in all countries or regions it covers. Non-terrestrial networks will have to ensure that their use of radio spectrum in each country or region complies with the frequency license they have in that country or region and the frequency regulation of the sovereign territories which border that country or region.

Regional/national regulators may also define exclusion areas where non-terrestrial communication is not allowed. Operators of non-terrestrial network should ensure that their networks do not provide service in exclusion areas. Further consideration of this is given in clause 7.4 when UEs are in an exclusion area and in clause 8.3 for non-terrestrial networks operation with respect to exclusion areas.

National regulators can assign numbers and identifiers to the network operator (e.g. Mobile Network Code, IMSI/SUPI ranges, E.164 numbers). Also the ITU can provide MNCs (with the Mobile Country Code 901) and E.164 numbers

(country code 88x). Mobile and satellite networks broadcast one (or more in case of network sharing) Mobile Country Code (MCC) and Mobile Network Code (MNC) combinations. Broadcast of the MCC for one country in another country should be avoided. This may be a challenge for satellite operators that have large radio cells. An option is to use the international MCC 901. Using the international MCC is also a good choice for extra-territorial areas.

7   5G ET UE location related used use cases

7.1   Introduction

This clause describes use cases for which Extraterritoriality is expressed with respect to the UE and its access to the 5G network.

7.2   Regulatory implications for UEs in border regions

7.2.1   Description

This use case considers a common scenario in which the UE operates in a location not definitively within one sovereign territory. There are regulations that apply to each sovereign territory. How should the UE and network behave in this situation?

There are two aspects of this use case – frequency regulation and operational regulation (e.g. lawful interception.)

Where there are frequency emissions aspects, there are pre-existing regulations as a result of bilateral or multilateral negotiations between sovereignties. Where this is not successful, the ITU may be involved. It is therefore assumed that there are radio emissions restrictions across borders.

Examples of border regions include:

- Along a river or natural feature defining a border

- In disputed territory

- In a border region which is too complex to entirely control all radio transmissions

In ITU regulations this is termed a 'cross-border' scenario.

In cross-border scenarios where there is ambiguity (or impossibility to adequately restrict emissions across the borders) there may be special arrangements, e.g. an exclusionary zone. In a specific example, there are frequencies that are of concern to Russia, so a treaty with Finland restricts use of these within a number of km of the border it shares with Russia.

For a UE operating in a cross-border scenario, especially with access provided by a NTN network operator, the situation is more complex and is treated below.
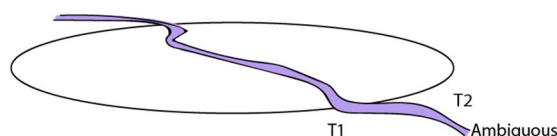

Figure 7.2.1-1 Ambiguous territory served by NTN access

Figure 7.2.1-1 depicts an ambiguous strip of territory between two sovereign territories T1 and T2. A UE whose subscriber is 'Amalia' is currently in this cross-border location, between T1 and T2. The NTN network operator 'BigSky' provides access to Amalia's UE. The PLMN that Amalia's UE will register with is PLMN A. The CN of PLMN A may be in T1, T2, on the NTN platform or located in a third sovereign territory.

Amalia turns on her UE. The UE registers with access provided by BigSky to PLMN A.

The access, as it straddles T1 and T2, must use frequency that is already in compliance with regulations of T1 and T2.

PLMN A determines Amalia's UE's location and determines that it is an ambiguous cross-border region.

In T1, the regulatory regime of T1 applies (e.g. for Lawful Interception.) In T2, the regulatory regime of T2 applies. In the ambiguous zone it is not clear whose regulations applies. This requires specific consideration, as in some cases, where there are access restrictions, data retention and privacy laws, mandatory encryption of traffic, etc. the regulations may not be compatible: it may be impossible to apply both the regulations of T1 and T2 at the same time. In these cases, there must be a negotiated and harmonized set of regulations between T1 and T2.

Amalia's UE, according to the regulatory framework established by T1 and T2, will have set of policies that apply to its telecommunications service. The NTN operator and the PLMN A operator (which could be the same operator) will apply those regulations.

There are three potential ways in which the UE will behave:

1) the UE complies with regulations of _both_ sovereign territories (where this is in accord with regulations and the regulations are not incompatible)), e.g. emergency call regulations in many situations apply on both sides of the border, cross country collaboration can ensure the right assistance is provided even across the border;

2) the UE complies with the bilateral or multilateral regulations established between the territories, e.g. the HCM agreement [16] contains a multilateral regulation on cross border interference;

3) the UE may be in a situation in which a joint (or uniform) regulation applies even though it is in a border region, e.g. the European GPDR regulation [17] is an example of a uniform regulation that applies to all countries within the European Union, including border regions between these countries.

7.2.2   Identified applicable regulatory requirements

Regulatory aspects are specified in several 3GPP TSs and external to 3GPP.

UEs will apply regulations according to the regulations applicable to the sovereign territory in which the UE is positioned.

7.2.3   Potential 3GPP approach

Applying regulation properly to a UE requires detailed information regarding the UE location.

7.3   Regulatory implications for UEs in Vessels

7.3.1   Description

A vessel in this clause refers to either a ship or aircraft. Vessels operate in both international and sovereign waters and airspace. At such times as the vessel is in international waters and airspace, the vessel's passenger communication must comply with the regulations of the territory with sovereignty over the location they are in.

At the same time, the vessel and – this is the point - the UEs operating in that vessel may be subject to regulations _of the country of its registration_. The regulatory context changes when the ship is in port or the aircraft is on the ground. There it is clearly the case that sovereign regulations of the territory apply. However, even in this case, there are some regulatory aspects that relate to the country of registration.

NOTE: Unmanned Aerial Vehicles that are also a UE are not considered in this Technical Report.

7.3.2 Identified applicable regulatory requirements

The Tokyo Convention [11] states that the laws of the country of registration of the aircraft apply to acts committed on board.

The Convention on the High Seas [12] defines the notion of a 'flag state' registration of the vessel. These laws apply to the passengers on board. From Article 6 "Ships shall sail under the flag of one State only and, save in exceptional cases expressly provided for in international treaties or in these articles, shall be subject to its exclusive jurisdiction on the high seas."

This implies that passenger communication requirements of the vessel in international regions are subject to the regulations of the country of registration.

A separate regime applies to vessels in sovereign waters and airspace. In this case, international law is more complex. The Tokyo Convention Article IV states "A Contracting State which is not the State of registration may not interfere with an aircraft in flight in order to exercise its criminal jurisdiction over an offence committed on board except in the following cases:

a) the offence has effect on the territory of such State;

b) the offence has been committed by or against a national or permanent resident of such State;

c) the offence is against the security of such State;

d) the offence consists of a breach of any rules or regulations relating to the flight or manoeuvre of aircraft in force in such State;

e) the exercise of jurisdiction is necessary to ensure the observance of any obligation of such State under a multilateral international agreement."

Thus, it is entirely possible for an aircraft to impose communication regulations of the registered state while at the same time complying with the above convention. This is analogous to the situation of a vessel in national waters.

While an aircraft is in sovereign airspace, regulations may apply to communications by passengers' UEs. For example, over the United States of America, use of mobile telecommunications using a terrestrial radio access is not permitted. [13]

A third important scenario is the ship in port or an aircraft that has landed. In this case the sovereign regulations of the territory apply. However, there are – for telecommunications especially – certain conditions that are necessary to consider. If communications equipment on board the vessel has been certified by their registered state, these certification requirements may apply to communications rather than those of the territory where they are in port. [12]

The relevance to satellite communication arises due to the distinct regulatory implications based not only on the location of the aircraft or vessel, but also its status (is it airborne? Is it at port?)

7.3.3 Potential 3GPP approach

It is recommended that for UEs that are operating outside of sovereign territory, the context of the operation is taken into account, i.e. the national registration of the vessel will determine the regulatory regime applying to the UEs on the vessel.

When a vessel is operating in national waters, or sovereign airspace, the regulations of the corresponding territory apply *in addition* to those of the national registration of the vessel for communication by UEs in that vessel.

When a vessel is in port (i.e. a harbour or an airport), the regulations of the sovereign territory apply for communication by UEs on that vessel. The notable exception to this is that the communication equipment certification of the vessel may be those of the national registration of the vessel.

It is assumed that applicable regulations will be presented to passengers and that passengers will fully comply. From a 3GPP perspective there are no additional standards requirements to identify and comply with related to maritime-specific or airspace-specific regulations for UEs on board vessels.

7.4 Regulatory implications for UEs in Exclusion Areas

7.4.1 Description

UE operations must take into account and comply with exclusion areas. A UE that does not operate in a manner that violates any exclusion area regulations in a given territory obviously is compliant with regulation. Where a UE might violate an exclusion area, it is necessary to control the operation so that the violation does not occur.

7.4.2 Identified applicable regulatory requirements

There are several reasons why exclusion areas are defined – for example to reassign spectrum to more than one purpose depending on the location. There is therefore no attempt to exhaustively or completely treat, list or consider the purposes of exclusion areas, though some examples are given.

One example is the use of CBRS spectrum in the United States. Regulations permit use of this spectrum that respects exclusion zones in which Citizens Broadband Radio Service Devices are not allowed to operate.

Another source of such regulations are international treaties in which spectrum that is used in one country can only be employed by a neighbouring country if emissions are prevented in an exclusion zone extending (sometimes several kilometres) from the mutual border.

Scientific and research exclusion areas exist, for example, in the vicinity of some facilities used for astronomical research.

Exclusion areas where no mobile communication is allowed are not something the 3GPP System can enforce, however there are measures discussed in clauses 7.4.3 and 8.3 to restrict service.

Finally, there are areas defined for operation in some cases, and everything else that is not included is implicitly an exclusion area.

7.4.3 Potential 3GPP approach

3GPP network shall be able to restrict radio operations in a specific geographical area.

Firstly, a UE shall not transmit using a frequency that is prohibited in this area.

Secondly a UE shall be prevented to operate if not specifically allowed (by means of a configured Geographic Area.) This has for example been added to the standard for Proximity Services (TS 23.303, 4.5.1.1.2.3.1, TS 23.304, 5.10 and TS 23.501, 5.3.4.1.1.)

7.5 Regulatory implications for UEs in Extraterritorial Areas

7.5.1 Description

Extraterritorial areas, as defined in clause 5.6 in this document, are regions that have no territorial claims. This does not include vessels and aircraft, whose passengers are effectively considered to be subject to the regulations of the country to which the vessel or aircraft is registered. Rather, we consider the rare case where the UE operates in an unclaimed, disputed, or otherwise extraterritorial area. This clause is added for completeness.

7.5.2 Identified applicable regulatory requirements

There are no regulatory requirements in extraterritorial areas.

However, it is essentially impossible for a UE to obtain service in an extraterritorial area except by means of a non-terrestrial access. Non-terrestrial access will be subject to the regulations of the sovereign territory in which the network operates.

An exception may be for UEs that represent a vessel or aircraft (i.e. not the passengers on board). In this case, the UE will have to follow regulatory requirements for maritime or aeronautical communication. For example the International

Maritime Organisation (IMO) sets regulatory requirements for radiocommunication in e.g. the SOLAS (Saving Lives at Sea) convention [7]. Part of the SOLAS regulations is the Global Maritime Distress and Safety System (GMDSS) [6]. Under the GMDSS, all passenger ships and all cargo ships over 300 gross tonnage on international voyages have to carry specified terrestrial and satellite radiocommunication equipment for sending and receiving distress signals and maritime safety information.

7.5.3   Potential 3GPP approach

There are no 3GPP requirements or considerations that apply to a UE operating in an extraterritorial area. 3GPP standards that concern regulatory compliant network operation will apply to the UE's service, however there is no need to consider this category of service specifically. Some regulations may be difficult to apply to a UE in Extraterritorial Areas – for example emergency call service may be impossible to route to an appropriate agency.

UEs that follow maritime or aeronautical regulations may want to select specific non-terrestrial networks that provide such services, overriding e.g. PLMN selection considerations related to emergency calls. Note that requirements for Maritime Communication Services over 3GPP systems are defined in [15].

7.6   Regulatory implications for UEs Migrating between Areas

7.6.1   Description

UEs that operate in a particular regulatory context, as defined in subclauses clause 7, may move to another area, as defined in clause 5. While there may or may not be continuity of service offered in all these situations, the regulatory implications of transitioning (or 'migrating') is considered here.

7.6.2   Identified applicable regulatory requirements

The regulatory implications of the area in which the UE operate apply to the UE at that time. Please refer to the different subsection of clause 7 of this document.

While the UE may move between areas, the UE may continue to be served by the same network. For example, if the UE is served by non-terrestrial access, the UE may pass from one sovereign territory to another, from a sovereign territory onto the high seas, etc. and continue to remain registered on the same network.

For terrestrial access, transition from one sovereign territory generally will entail a change from one PLMN operator network to another. However, there are many cases where a PLMN operator covers multiple sovereign territories with a single PLMN. In border regions, cross border coverage is unintentional. In order cases, e.g. covering small states, enclaves, island states, that are too small to have their own PLMN covering multiple sovereign territories is intentional.

7.6.3   Potential 3GPP approach

3GPP standards support inter-PLMN handover. It is the responsibility of each network operator to comply with regulations of the sovereign territory in which they operate. This may imply that the PLMN will have to determine the location of the UE at regular intervals in order to determine if the UE is migrating from one area to another and subsequently implement the regulatory implications of that. This may imply e.g. that the PLMN will have to terminate its service to the UE, or treat it differently for regulatory services.

8   5G ET Network location related use cases

8.1   Introduction

This clause describes use cases for which Extraterritoriality is expressed with respect to the UE and its access to the 5G network.

8.2   Network selection with extra territoriality

8.2.1   Description

Non-terrestrial networks often span multiple countries. This can create issues with network selection. Both with which Mobile Country Code the non-terrestrial network can broadcast, as well as with how to determine the right network for the location of the UE.

Consider the situation in figure, where a satellite network for country A also covers (parts of) country B and country C. Note that in some cases a satellite network may also completely cover a different country. This specifically may be the case with smaller countries (e.g. Vatican City is a different country). In many cases it will be very difficult to target satellite access to only a specific country, without spilling into or completely covering neighbouring countries.
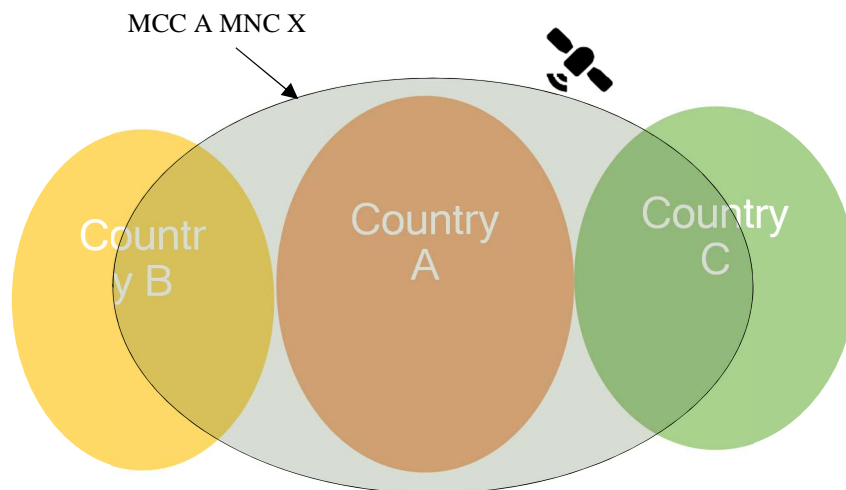

Figure 8.2.1-1: Satellite access covering multiple countries.

8.2.2   Identified applicable regulatory requirements

One of the regulatory requirements relates to lawful intercept. In many cases, local applicable regulatory requirements dictate that the communication for a UE is handled by a core network in the country in which the UE is located. Note that alternative arrangements may also apply.

   NOTE: For example, some countries or islands are too small to have their own mobile network. They therefore rely on a mobile network from a neighbouring country.

Another regulatory requirement is related to the MCC that can be used. Regulatory requirements indicate that MCC usage should be restricted to the country of the MCC represents. However, here in practice there are exceptions to this rule, with e.g. MCCs shared amongst multiple countries.

8.2.3   Potential 3GPP approach

First aspect is to determine which MCC shall apply. For satellite networks that intentionally cover a multitude of countries, a shared MCC (e.g. 90x) is probably best. But satellite networks that focus on a specific country, but may have some cross border coverage, should be allowed to use a national MCC. A specific situation is a satellite access network that is shared among a number of operators from different countries. Here the intention of each of these network operators is to cover their own country with their PLMN ID, but the satellite access network will broadcast PLMN IDs for all the countries that it covers. This may happen especially in areas with multiple smaller countries or island regions, where country specific satellite access networks are not feasible. Agreement from the countries involved is required for cross border use of MCCs.

Next step is to ensure that the correct network is selected, even where there may be relatively large areas where multiple MCCs are broadcast. Selecting a network in the country where the UE is located is the best way to ensure that national regulatory requirements are fulfilled.

NOTE: Networks with shared MCC will have to make their own arrangements to comply with international regulations and all the different regulations of the countries in which they provide services; this is beyond 3GPP specifications.

Assuming localisation of the UE is supported, there are two issues with selecting a network in the country the UE is located in:

-   How to determine which country the location of UE belongs to?

-   Who is responsible for the determination of the country?

The borders of a country can be expressed in a polygon of points with lines in between these points. For some borders this is easily done, but many borders are very irregular requiring very large polygons. Furthermore, country borders are sometimes disputed between different countries and are subject to changes (e.g. regions that gain independence, settlements between countries on borders or the extend of economic zones). This makes creating and maintaining a database of all country borders with sufficient accuracy a complicated and politically sensitive task.

Which country the UE location belongs to in can be determined by the UE or by the network. Note that the UE and the network may come to different conclusions. The network should have the definitive authority to determine if it wants to provide service for the location of the UE.

8.3   Network access and Exclusion Areas

8.3.1   Description

A network must operate according to regulations. Since exclusion areas prohibit terrestrial radio transmissions in a specific region, networks must be deployed taking account of these constraints.

Terrestrial network access emissions with respect to exclusion areas are regulated by both national and international institutions. These regulations and their operational implications are not in scope of 3GPP.

To some extent the problem of network access and exclusion areas is much simpler for terrestrial access. Network access may simply be absent in exclusion zones by means of deployment in which base station transmitters do not cover such regions. International spectrum usage treaty compliance relies upon such placement and configuration of base stations. This approach however does not match either the constraints or the existing regulatory practices of non-terrestrial access.

This section considers network aspects of compliance with exclusion area policy for non-terrestrial access, given the above considerations.

8.3.2   Identified applicable regulatory requirements

As described in clause 7.4.2, exclusion area regulations exist to prevent transmissions and service in certain regions.

Non-terrestrial access transmissions are regulated by governments and international institutions, legal and business arrangements and treaties out of scope of 3GPP.

The 3GPP system authorizes UE use of network access (both terrestrial and non-terrestrial) according to network operator policy and applicable regulations. When regulatory requirements prevent access by a particular UE due to its location, the network can deny this access.

It is not possible for the network to completely prevent misuse, for example, if terminal equipment is misused or tampered with to violate policy. The network can support functionality to deny service in such circumstances.

8.3.3   Potential 3GPP approach

The 3GPP network should support a means to identify the location of the UE and apply a corresponding policy that will deny service if the UE operates in an exclusion area.

9 Guidelines

9.1 Introduction

This clause summarizes the key extraterritoriality requirements associated with each of the identified use cases together with the proposed approach to address these requirements in a 5G system.

The following table captures the regulatory guidance for UEs and networks in different operating areas, for the identified regulatory service. In the table below the 'General' column refers to all stage 1 requirements that are specified as 'subject to regulatory requirements' other than those listed in the other columns.

Table 9.1-1: Consolidated Regulatory Services in Scenarios considered in TR 22.926

	PWS	Charging and Billing	Emergency Call	LI	Data Retention	Network Access	General
7.2 UE in border region	[NOTE1]	[NOTE2]	[NOTE2]	[NOTE2]	[NOTE1]	[NOTE2]	[NOTE1]
7.3 UE in Vessels	[NOTE3]	[NOTE3]	[NOTE3]	[NOTE3]	[NOTE3]	[NOTE3]	[NOTE3]
7.X UE in exclusion area	[NOTE4]	[NOTE4]	[NOTE4]	[NOTE4]	[NOTE4]	[NOTE4]	[NOTE4]
7.Y UE in extraterritorial area	[NOTE5]	[NOTE6]	[NOTE5]	[NOTE6]	[NOTE6]	[NOTE6]	[NOTE6]
7.Z UE migrating between areas	[NOTE7]	[NOTE7]	[NOTE7]	[NOTE7]	[NOTE7]	[NOTE7]	[NOTE7]
8.2 Extraterritorial Network Operation						[NOTE2]	
8.M Network operating in an Aeronautic Area or At Sea	[NOTE8]	[NOTE8]	[NOTE8]	[NOTE8]	[NOTE8]	[NOTE8]	[NOTE8]
8.N Network access and exclusion areas	[NOTE9]	[NOTE9]	[NOTE9]	[NOTE9]	[NOTE9]	[NOTE9]	[NOTE9]

[NOTE1] The service is offered by the network operator according to the regulatory regime.
[NOTE2] The service is supported by the network operator according to the regulatory regime, but the location of the UE may be difficult to determine precisely or in an unusual place (offshore, airborne, along the border, etc.)
[NOTE3] The UE may either be in sovereign territory (airspace, waters), in which case the national regulations apply; or the UE may be in international territory (airspace, waters), in which case the regulations are more complex. See 7.3. It may be impossible to offer some regulatory services to UEs in international territories (e.g. emergency call).
[NOTE4] A UE in an exclusion area shall not use the network in a prohibited fashion. It is assumed that regulatory services apply to a UE whether or not it is in compliance with the exclusion area. Specifically, no service is provided to a UE in an exclusion area that is not allowed, though regulatory required services will still be supported (including lawful interception.)
[NOTE5] A UE in an extraterritorial area normally cannot receive national warning messages or perform emergency call. If this is possible, e.g. via non-terrestrial access, this would not be a regulatory service (as no such service has been defined.)
[NOTE6] A UE receiving service while in an extraterritorial area (e.g. from non-terrestrial access) would have no specific regulation applied *to the UE*. Regulations would apply to the network, depending on the territory where the network is located.
[NOTE7] Service for a UE migrating from one area to another will comply with the service of the area the UE is in at the time.
[NOTE8] A vessel or aircraft is a complex regulatory environment because it can operate both in and out of sovereign territory, and it applies regulations of the country to which the vessel or aircraft is registered. See 8.M.
[NOTE9] A network deployment will not violate exclusion area restrictions. See 8.N.

9.2 Guidelines for handling extraterritoriality in the 3GPP system

To support regulated services and features (e.g. Public Warning System, Charging and Billing, Emergency calls, Lawful Intercept, Data Retention Policy in cross-border scenarios and international regions, Network access), 3GPP networks should have the capability to locate each UE in a reliable manner and determine the policy that applies to their operation depending on their location and/or context.

Most terrestrial networks can determine the regulatory policies that apply to the location of UE based on cell areas. For example satellite networks, with generally much larger coverage areas, can maintain a detailed map of borders of areas for which a unique set of regulations applies for the provision of communication services through mobile networks (e.g. Countries including the areas where they claim sovereignty for telecommunication regulations as well as Exclusive Economic Zones).

NOTE: The regulator of the country where the network is located can have regulatory requirements on the definition and use of borders.

Moreover, the network should have knowledge of the specific policy to apply in each of the areas where the network provides services.

In order to determine whether maritime or aeronautical regulations apply, the network may also have to know the context of a UE (e.g. whether it is a ship or plane).

Based on UE location and/or context, the UE should be able to operate following regulatory policies that apply in that specific location and/or context (e.g. not to transmit in an exclusion area where transmission is not permitted.)

Annex A:
Change history

Change history								
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**	
2020-09	SA1#91-e	S1-203278				TR Skeleton for 5G Extra Territorial 5G systems	0.1.0	
2020-09	SA1#91-e	S1-203079				TR Scope	0.1.0	
2020-09	SA1#91-e	S1-203023				TR Overview	0.1.0	
2020-09	SA1#91-e	S1-203023				TR Section 2 (References) 3 (Definitions) & 5 (Overview of territories)	0.1.0	
2020-11	SA1#92-e	S1-204405				TR Section 7.2 (Regulatory implications for UEs in border regions)	0.2.0	
2020-11	SA1#92-e	S1-204406				TR Section 6.2 (PWS) and Section 2 (References)	0.2.0	
2020-11	SA1#92-e	S1-204410				TR Section 6.3 (Charging & Billing) and Section 2 (References)	0.2.0	
2020-11	SA1#92-e	S1-204407				TR Section 6.4 (Emergency Calls) and Section 2 (References)	0.2.0	
2020-11	SA1#92-e	S1-204408				TR Section 6.5 (Lawful Intercept) and Section 2 (References)	0.2.0	
2020-11	SA1#92-e	S1-204323				TR Section 6.6 (Data Retention Policy) and Section 2 (References)	0.2.0	
2020-11	SA1#92-e	S1-204324				TR Section 6.7 (Network Access) and Section 2 (References)	0.2.0	
2021-03	SA1#93-e	S1-210117				TR Section 5.5 (Aeronautical Areas)	0.3.0	
2021-03	SA1#93-e	S1-210413				TR Section 5.6 (Extraterritorial Areas)	0.3.0	
2021-03	SA1#93-e	S1-210414				TR Section 7.3 (Communication Regulation in Vessels)	0.3.0	
2021-03	SA1#93-e	S1-210415				TR Section 8.2 (Network selection with extraterroriality)	0.3.0	
2021-05	SA1#94-e	S1-211317				TR Title	0.4.0	
2021-05	SA1#94-e	S1-211414				TR Section 1 (Scope) & 2 (Overview)	0.4.0	
2021-05	SA1#94-e	S1-211415				TR Section 7.3 (Regulatory implications for UEs in Vessels)	0.4.0	
2021-05	SA1#94-e	S1-211416				TR Sections 5.3, 7.4 and 8.4 (Exclusion areas)	0.4.0	
2021-05	SA1#94-e	S1-211417				TR 7.5 (Regulatory implications for UEs in Extraterritorial Areas)	0.4.0	
2021-05	SA1#94-e	S1-211418				TR 7.6 (Regulatory implications for UEs Migrating between Areas)	0.4.0	
2021-05	SA1#94-e	S1-211419				TR 9.1 (Introduction)	0.4.0	
2021-09	SA1#95-e	S1-213132				TR Section 7.4 Regulatory implications for UEs in Exclusion Areas TR Section 8.3 Network access and Exclusion Areas	0.5.0	
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