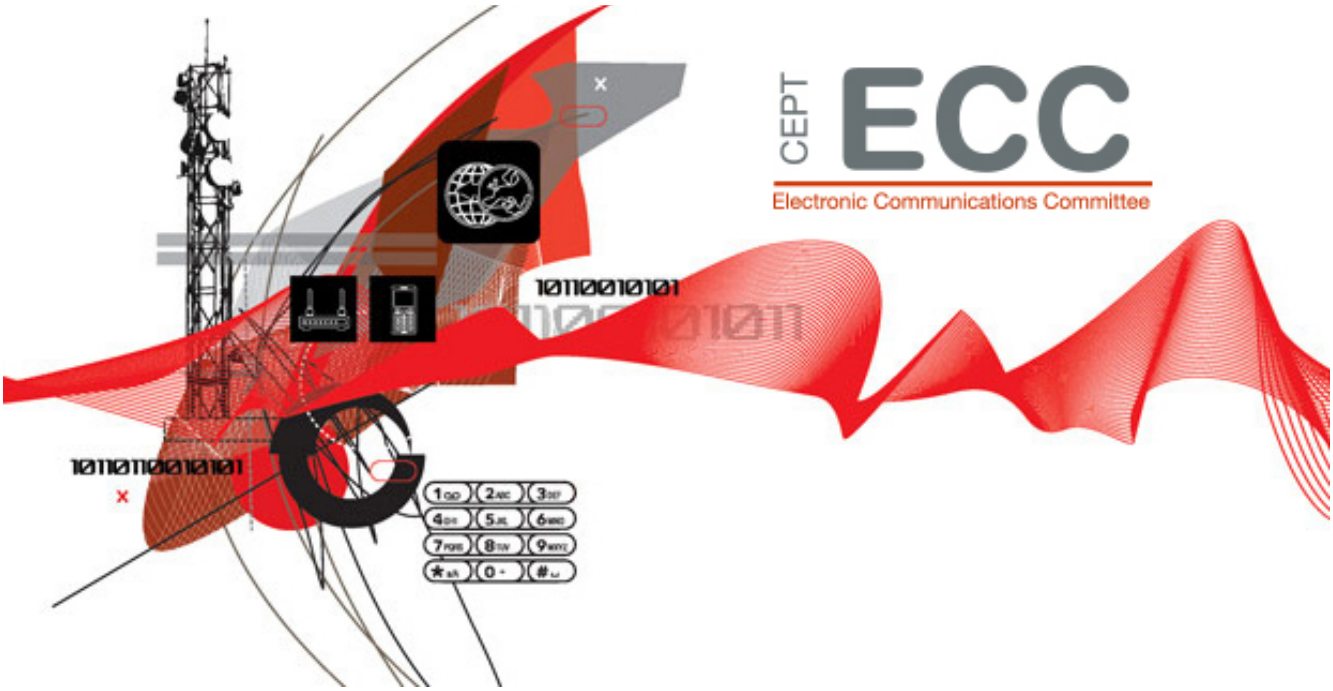


ECC Newsletter May 2021

EFIS and the ECA

A guide to EFIS and the European Common Frequency Allocation Table

The ECO had the lengthy task of compiling changes to EFIS in 2020. Here Robin Donoghue, EFIS management expert at the European Communications Office, explains the system's role in maintaining spectrum information.

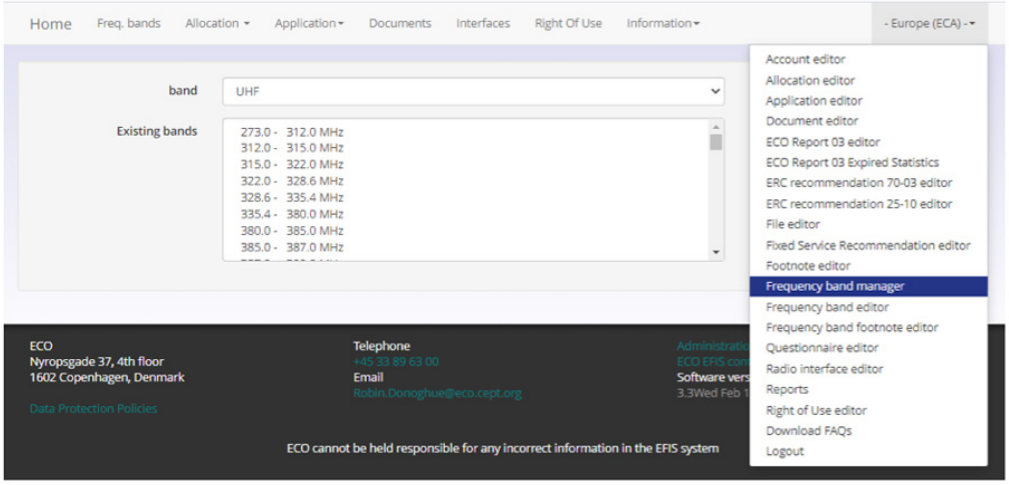
Better known as EFIS, the ECO Frequency Information System provides information regarding spectrum use in Europe. This software tool allows public access to search for frequency information of the 48 CEPT Administrations.

Under ECC Decision (01)03, CEPT Administrations are required to enter and maintain spectrum allocations as defined by the ITU-R, the radiocommunication sector. They also must enter and maintain spectrum applications according to the List of Searchable Applications in Annex 2 of the ECC Decision (01)03. CEPT Administrations may also enter information relating to their national radio interfaces and their Rights of Use for tradeable spectrum access.

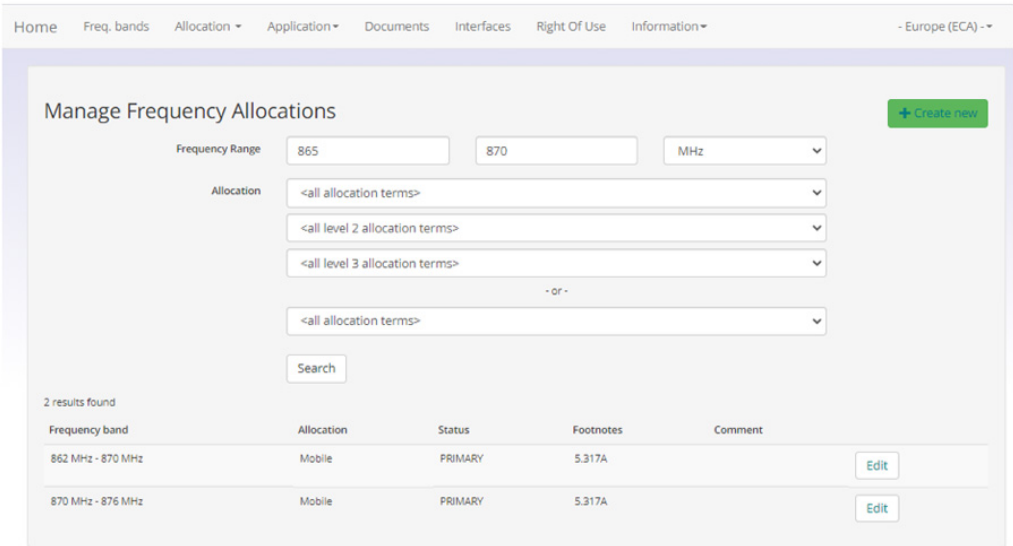
The ECO maintains the data in EFIS related to the Radio Regulations, in particular the European Table of Frequency Allocations (ECA Table).

Uploading common European frequency information and information specific to CEPT Administrations

The ECO is responsible for maintaining the common European frequency information in EFIS. When logged into the common Europe account, the Office has access to several editor functions.

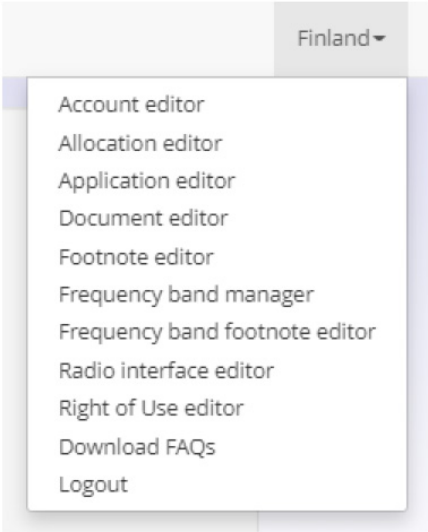


For example, selected frequency allocations can be edited.



CEPT Administrations are responsible for their own national frequency information and national implementation of ECC harmonisation measures. Within EFIS, the Administrations each have their own national password-protected log-in and access to all the necessary editors within EFIS, to keep their own information maintained.

CEPT Administrations can also ask for the assistance of the ECO in maintaining their national frequency information.



Documents created in EFIS

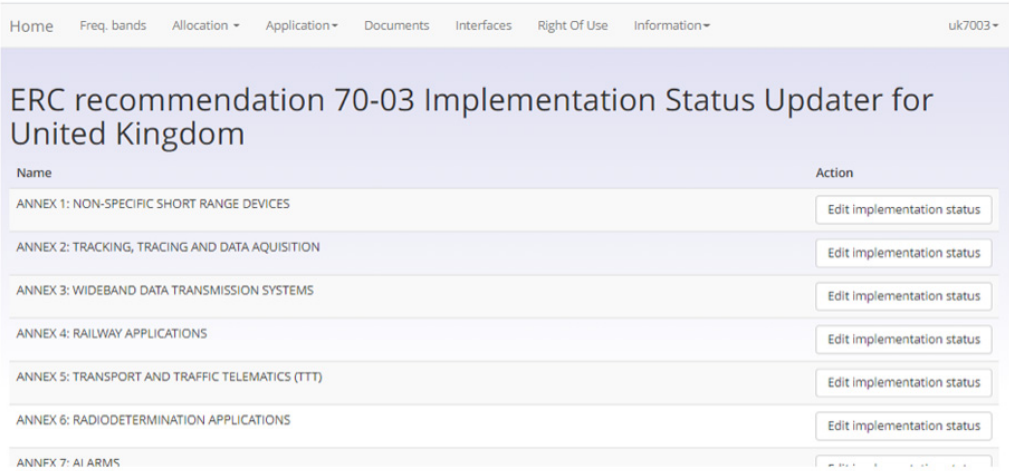
There are specific documents that are created from the data held in EFIS. This has the advantage that it completely eliminates the chance of conflicting or contradictory information being shown in the system and published documents.

These documents are:

- ECO Report 03 on the licensing of mobile bands in Europe;
- ECO Report 04 on the Fixed Service in Europe;
- ECC Recommendation 25-10 on Frequency Ranges for the Use of Terrestrial Audio and Video Programme Making and Special Events (PMSE) applications;
- ERC Recommendation 70-03 on Short Range Devices in Europe;
- ERC Report 25 the European Common Allocation Table (ECA Table).

Of these, CEPT Administrations have separate passworded national log-ins so that they can update and maintain the national implementation of their fixed service, PMSE and short range devices.

For example, CEPT Administrations can use their log-in to maintain the national implementation of each entry in the ERC Recommendation 70-03 for Short Range Devices.



The ECA Table

The ECA Table ERC Report 025 provides information on the current frequency allocations applicable for CEPT Administrations. The ITU-R Radio Regulations (RR) define Europe as being in Region 1. Hence, the ECA Table is set out in frequency bands as defined by the RR Region 1 allocations.

CEPT first endorsed the principle of adopting a harmonised European table of frequency allocations and applications in 2002. Before then, individual national frequency tables were the only source of allocation information.

The task of developing and maintaining the ECA Table is the responsibility of the Working Group Frequency Management (WG FM) and its EFIS Maintenance Group. However, much of this work is carried out by the ECO on behalf of WG FM.

Regularly updating the ECA Table

Normally, the ECC meets three times a year. Therefore, there may be a need to revise the ECA Table up to three times in one year, depending on whether any new or revised ECC Decisions are approved.

The ECO is permitted to make certain changes to the ECA Table without public consultation, where the change is factual. This includes listing of Harmonised Standards and references to ECC Decisions and ECC Recommendations.

However, where the amended information is of a more substantial nature, including amending the list of RR allocations applicable to Region 1 or Europe, or the amendment of RR Article 5 footnotes applicable to Europe, then a public consultation of the amendment to the ECA Table is required.

The ECA Table is intended to show common frequency allocations and applications – so it sets out the rule for adding them.

A European allocation is considered common and should be listed in the ECA Table where at least 15 CEPT Administrations have recorded in EFIS that the allocation has been made available. For RR Article 5 footnotes, the number of CEPT Administrations is at least 10.

An application can be added to the ECA Table where an ECC or EC harmonisation measure such as ECC Decision, ECC Recommendation or EU Decision harmonises the application. An application can be added when at least 10 CEPT Administrations have made available the relevant frequency band for the radio application according to EFIS. Finally, WG FM may also decide to add an application to the ECA Table.

Updating the ECA Table following the 2019 World Radiocommunication Conference (WRC-19)

The most recent amendment requiring public consultation was made following WRC-19, where several changes were made to the RR.

The changes agreed at WRC-19 represented a significant workload for the ECO. The revisions agreed at the conference included major changes around the following frequency bands;

- 50 MHz-68 MHz;
- 156.8375-161.9375 MHz;
- 1613.8-1626.5 MHz;
- 24.25-25.25 MHz;
- 40.5-42.5 GHz;
- 51.4-52.6 GHz.

There were also many substantive changes to the RR footnotes across the ECA Table, including the addition of 30 new ITU RR footnotes and two new ECA footnotes. These new and revised footnotes needed to be applied across several frequency bands. The revision also introduced a new annex to the ECA Table for receive-only Harmonised Standards. This was done in recognition of changes introduced in several CEPT Administrations following the implementation of the Radio Equipment Directive.

Following WRC-19, the ITU-R published the final acts for the revised RR in March 2020. The EFIS Maintenance Group and the ECO developed a draft revision of the ECA Table, which was approved for public consultation at the 96th WG FM meeting in June 2020. ECC subsequently approved the publication of the revised ECA Table at its meeting 54th ECC in November 2020.

Publication of the ECA Table in the ECC Document Database

Because the ECA Table is created from data held within EFIS, the process for updating the table is similar to that for making any other amendment in EFIS. For any change to a frequency band, the ECO first needs to log in to the editor for the ITU RR Region 1 and make the necessary changes. Only when this is correct can the ECO log in to the Europe editor and change the European Common allocation and footnotes. It is a hierarchical process where the European allocation must be set before any applications, ECC harmonisation measure, Harmonised Standard or comments are added.

On completion of making the editorial amendments in EFIS, the ECA Table can then be made available by the ECO in different formats. In addition to the table being directly accessible within EFIS, the ECO makes it downloadable in CSV format so that it can be easily manipulated or customised in Excel. Finally, the ECO makes the table available in pdf format, which is then made available as a dated document as ERC Report 025 in the ECO Document Database.

Future revision process

The public consultation of the ECA Table has previously been made using a track changed document created by a conversion for the pdf. This had the benefit of showing the ECA table in the same formatting as the published pdf. However, it was cumbersome to edit, and it was not always clear in the marked-up version whether footnotes applied to an allocation or the whole frequency band.

In future revisions the ECO will present a version of the ECA Table for WG FM approved public consultation, which is derived from the CSV /Excel table. As a result, it will be clearer to identify where any change is needed and should significantly streamline the process of editing EFIS.

SIM-less calls to emergency services

Who you gonna call?

The policy for SIM-less calls to emergency services in CEPT countries has not changed in a decade but such calls can help save lives, says Vassil Krastev, ECO's expert in numbering and network regulation.

The ability to initiate an emergency communication to summon help in distress is recognised as a citizen's right in many countries around the world. As a result of this and as required by legislation, special arrangements are made on electronic communications networks (ECNs) to carry emergency calls.

One can call for help 24/7 from fixed and mobile phones in case of an emergency by dialling an easy-to-remember short code, for example, the single European emergency number '112' or other national emergency call numbers specified by the national regulatory authorities. The call is carried on the network with a high priority, and is free of charge to the caller.

Figure 1 Who you gonna call? [Source: deviantart.com]

While obviously not the Ghostbusters, a specially trained operator in the organisation in charge of first reception of emergency calls, the so-called Public Safety Answering Point (PSAP), will either deal with the emergency request directly or transfer the call to the most appropriate emergency service. Who they transfer the call to will depend on the national organisation of emergency services. Operators in many countries can answer the calls not only in their national language, but also in English or French, for example. If the callers do not know where they are, the operator will identify their physical location and pass it to the emergency authorities.

Some countries in Europe use the emergency number 112 only for any type of emergency, while others have different national, regional, or local numbers functioning alongside with '112'. In 2019 end-users in the EU called the single European emergency number 112 close to 150 million times. On average 73% of the calls were placed from mobile phones.

My phone says, "Emergency Calls Only / No SIM card"

To establish communication with the emergency services via a mobile phone the device must be able to connect to and register on a Public Land Mobile Network (PLMN). A PLMN has a geographical coverage area in which the base station(s) provide services (e.g., voice and data) to mobile subscribers. But how does the phone know which of the available PLMNs is its own? That kind of information, alongside others, is embedded in the Subscriber Identity Module (SIM)/Universal Subscriber Identity Module (USIM) card.

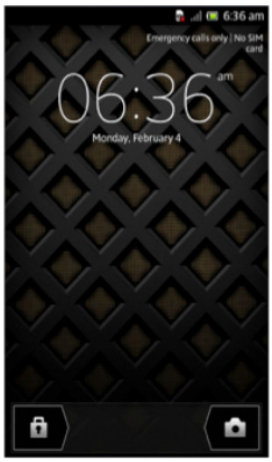


Figure 2 "Emergency calls only / No SIM card" (source: esato.com)

The SIM is used to identify and authenticate subscribers. A SIM card may contain a vast amount of information related to the subscriber, services or service provider-related information. There are two key identifiers stored on each SIM card: The International Mobile Subscriber Identity (IMSI) number and the Integrated Circuit Card Identifier (ICCID). The IMSI uniquely identifies the subscriber i.e., its account information and services. Its structure includes the Mobile Country Code (MCC), which indicates the country in which the network is located; Mobile Network Code (MNC), which identifies a network within a country; and a Mobile Subscription Identification Number (MSIN), which identifies individual subscriptions. The combination of MCC and MNC identifies the home PLMN. The second key identifier, the ICCID, is its unique serial number which identifies the physical SIM card and the SIM card issuer.

Another important number linked to the IMSI is the Mobile Subscriber Integrated Services Digital Network (MSISDN) number. Despite the long and complicated name, it is basically the mobile phone number associated with the SIM card. The pairing of MSISDN and IMSI

enables a voice call or an SMS to be sent using an MSISDN and to be routed to a specific IMSI. So, when we call a mobile phone, it is the MSISDN number of the mobile that we call, not the IMSI.

If a mobile device needs to acquire network services such as voice, data, and multimedia, the mobile device first needs to select a suitable PLMN and search for a cell (base station) within the coverage of the PLMN. After finding an available cell, it will then ‘camp’ on the cell and initiate registration.

Provisions have been made in technical specifications for a device not fitted with a SIM – a SIM-less device – to have the capability to make an emergency call. In this case it is possible for the device to register on an available network for the sole purpose of facilitating an emergency call. When a device connects to a network in this way without a SIM it is referred to as being in a "Limited Service State" (LSS).

Even a device fitted with a valid SIM which cannot find a network cell to register on can enter a LSS on an available network for other reasons including when:

- It is not possible to register on a cell on its home network because of limited or no coverage;
- In the case of international roaming, there is no roaming agreement between the home network and other available networks;
- The device is SIM-locked and, even if it is fitted with a valid SIM from another provider it cannot connect to any available network; or
- The device is fitted with a valid SIM, but it is not seated in the device correctly.

This is an important distinction to make as some European countries have implemented a policy of not permitting an emergency call from a device that is SIM-less while allowing an emergency call from a device fitted with a valid SIM but in LSS for another reason.

Questions on the legislation and technical details around SIM-less calls were recently brought in front of the Court of Justice of the European Union (CJEU) in case C-417/18. On 5 September 2019, the CJEU ruled that calls to 112 from devices that are SIM-less should be located. The Court's ruling holds that the Universal Service Directive (USD) requires EU Member States, subject to technical feasibility, to ensure that the undertakings concerned make caller location information available free of charge to the authority handling emergency calls to the pan-European emergency number 112 as soon as the call reaches that authority, including in cases where the call is made from a device that is SIM-less. The Court's ruling was based on the prevailing legislation at the time.

According to the EC’s opinion in its intervention in the Court’s ruling, Article 26(2), of the USD is to be interpreted as not imposing an obligation to provide access to emergency services by dialling 112 if the call is made from a mobile device not fitted with a SIM card.

However, that provision does not preclude Member States from establishing such a provision or obligation in their national law. Where the national law provides for the possibility to call the European emergency number 112 in the absence of a SIM card, information relating to the caller location must be made available to the authority handling the emergency calls.

The ECC's Working Group Numbering and Networks (WG NaN) is engaged in its project team, NaN3 “Emergency Communications”, working on various aspects of emergency communications such as access to emergency services from electronic communications networks and services, emergency caller location information and eCall.

ECC Report 225 provides a comprehensive overview of the various methods to obtain emergency caller location information and provide that information to the PSAP.

NaN3 has recently discussed the outcome of the public consultation on draft ECC Report 324, Study of issues related to calls to emergency services from devices that are SIM-less or in Limited Service State for another reason, which is expected to be approved for publication in May 2021.

The purpose of this ECC Report is to examine the situation regarding calls to emergency services in Europe from devices that are SIM-less or from devices that are in LSS for another reason, in order to fully understand:

- What is meant, in the context of this Report, by emergency calls from devices that are SIM-less and emergency calls from devices that are in LSS for another reason and to explain how such calls work;
- How to differentiate between calls from devices that are SIM-less and calls from devices that are in LSS for another reason;
- How caller location information for such calls can be provided to the Public Safety Answering Point (PSAP); and
- To consider the technical and legal implications of the Court's ruling on the provision of caller location information for emergency calls made from devices that are SIM-less in Europe.

According to one of the draft report’s findings, there has been no change in the situation regarding calls to emergency services from devices that are SIM-less in the last 10 years. Some 21 CEPT countries allow calls from devices that are SIM-less and eight CEPT countries prohibit it. There are also no known plans by the latter to change their policies in the future.

What if the car initiates an emergency call – eCall?

The eCall is a specific type of emergency call aimed at providing swift assistance to drivers involved in a collision anywhere in Europe. eCall has been mandatory from 31 March 2018 for all "new type" cars sold in Europe.

Regulatory and technical challenges of eCall, including the provision of a sustainable numbering framework, were already introduced in two ECC Newsletter articles – eCall numbering challenge and eCall: getting ready for 2018 in 2015 and 2017, respectively.

When a crash takes place, a car fitted with an eCall device (an in-vehicle system) will automatically call the pan-European emergency number 112 and establish a voice connection towards the relevant PSAP. It is also possible to make an eCall manually by pressing a button in the vehicle. When the in-vehicle system in such a car is triggered, either automatically or manually, it tries to register on an available PLMN to establish an emergency call towards the relevant PSAP.

The eCall may be implemented in two different ways. The first is referred to as the 112-based eCall service where eCalls are directly routed to the PSAP. The 112-based eCall concept benefits from its direct prioritised emergency link to the appropriate PSAP through the existing 112 mechanisms. The 112 call over the mobile network is required to work in all European countries for free, even if no roaming agreement between the vehicle's home network and the guest network is in place.

The second is referred to as third party service supported eCall systems (TPS eCall services) where the first part of the eCall is routed to a service centre of a car manufacturer and the second part is subsequently routed by the TPS service centre to the PSAP. Private eCall provision (i.e. TPS eCall services) is based on commercial agreements among the involved actors, including mobile operators and PSAPs. 112-based eCall is mandatory while the implementation of TPS eCall is optional.

As part of the network registration process, and before call set-up, the identity of the subscriber - the IMSI - is sent to the subscriber's PLMN Home Location Register/Home Subscriber Server for authentication. Should the IMSI authentication fail for any reason then, subject to network operator and national regulatory policies, it may not be possible to establish a communication with the emergency services.

In order to provide with the above-mentioned eCall functionalities, the vehicles need facilities to communicate with the PSAP. This is carried out by means of mobile networks utilising physical SIM-cards or embedded SIMs. In order to provide the service, MSISDN and IMSI resources are needed.

ECC's WG NaN provided guidance to administrations on the assignment and use of numbering resources for eCall and how to address concerns of PSAPs, original equipment manufacturers and operators regarding regulatory certainty on the use of numbers for eCall in a 2017 ECC Recommendation on numbering for eCall.

In December, WG NaN amended the foresaid ECC Recommendation with an Annex that provides a central reference point for all electronic communications network operators and service providers in Europe seeking information on numbering ranges used for eCall. The Annex will be updated periodically as required and published in the ECO Documentation Database (https://docdb.cept.org).

As already mentioned above, emergency calls from SIM-less devices are prohibited in several European countries so the eCall in-vehicle system should always have a SIM card.

To sum up

The policy situation regarding calls to emergency services from devices that are SIM-less has not been changed in the last 10 years. Future policy changes to permit SIM-less calls to emergency services remain uncertain as some CEPT countries face a high number of false calls or hoax calls. In the second-hand market for mobile handsets, it is well-known that the functionality of the handset is tested by making an emergency call. This practice is discouraged by regulators and is one of the main reasons for some countries blocking access to emergency services from SIM-less devices.

Network-provided location information is available to the emergency services in countries which permit calls to 112 from SIM-less devices.

According to the CJEU court ruling, where calls to emergency services from SIM-less devices are supported in a Member State of the EU, caller location information must also be provided to the emergency services with the call, if technically feasible. However, the EC's opinion states that a Member State of the EU is, in principle, free to decide whether or not to permit calls to emergency services from devices that are SIM-less.

Currently available and potential future technical solutions for the provision of caller location information should be examined to determine if it would be feasible to improve the accuracy and reliability of caller location information for emergency calls from SIM-less devices and for emergency calls from devices in LSS for another reason.

Depending on the solution for PSAPs, receiving the IMEI and IMSI may also be useful if one of these parameters can be used to access the operator databases containing location information.

For emergency calls from SIM-less devices or from devices in LSS for another reason, handset-provided location information cannot currently be sent to the emergency services by SMS (as an MSISDN is required) or by HTTPS (as a data connection is required).

PMSE

How spectrum is essential for an increasingly switched-on world

PMSE is a vital component for the creation of audio and video content so spectrum requirements must be met to make sure it thrives, writes Zeljko Tabakovic, spectrum expert at the ECO.

Considering recent experiences with adapting to the new normal, we are increasingly surrounded by a virtual reality environment and immersed by different kinds of connected devices such as cameras, screens, microphones and speakers. We are interacting with the world through these devices and our media habits are rapidly changing.

Recent research shows that screen time increased by more than 30% over the past year and led to almost a 60% increase in the amount of content we watch. With less social contact we are consuming more content but also creating and sharing audio and video streams with our friends, families and colleagues.

Leaving aside societal, environmental and health care aspects we can investigate what is going on behind the scenes of creating content and related technical context. Programme Making and Special Events (PMSE) is an enabler for the creation of audio and video content which is broadcast and consumed globally using a variety of platforms.

The PMSE industry is one of the crucial pillars behind professional equipment for the culture and creative industry, and is looking for solutions to the availability of radio frequency spectrum for advanced wireless applications. PMSE content capture is at the start of the supply and value chains for a wide range of products, consequently expected to provide the highest quality possible - see Figure 1. Producers and programme makers take steps to ensure the quality and robustness of content capture and delivery.

PMSE encapsulates a multitude of different services such as services ancillary to programme-making, services ancillary to broadcasting; electronic news gathering, and outside broadcasting and applications. These services are used in meetings, conferences, cultural and education activities, trade fairs, local entertainment, sport, religious and other public or private events. There are three main groups of PMSE equipment:

- audio PMSE – the most commonly used audio PMSE applications are wireless microphones (handheld and body worn) and in-ear monitors;
- video PMSE;
- PMSE service links – PMSE equipment that is used for transmission for production.

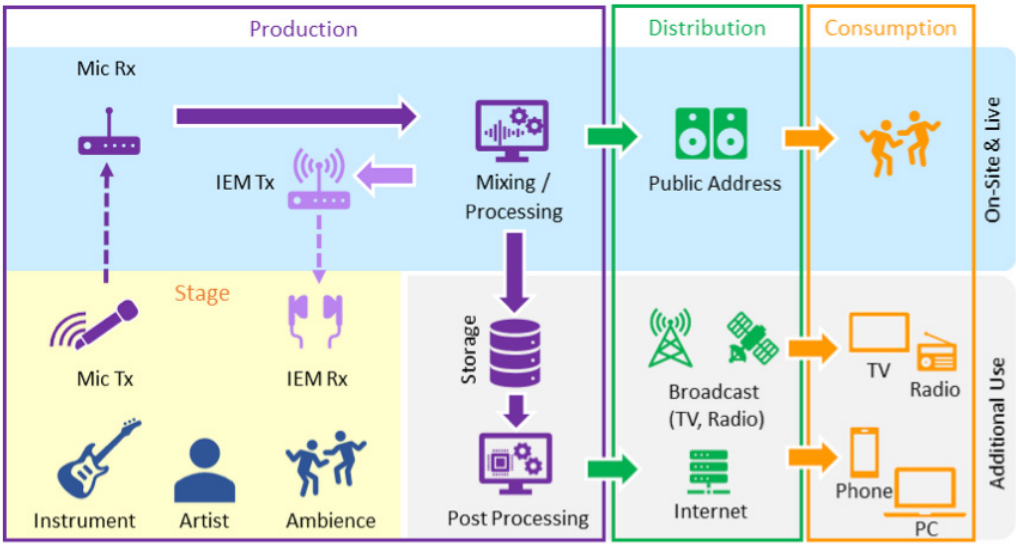


Figure 1: From capture to consumption, ECC Report 323

In recent years, available spectrum for PMSE applications has been reduced. This is because some parts of the spectrum, previously used by PMSE, have been allocated to other services. Sharing frequency spectrum between different services has been more demanding due to ever emerging new wireless applications.

During two past ITU World Radiocommunication Conference cycles, UHF radiofrequency spectrum primarily used for television broadcasting distribution and audio PMSE applications changed frequency allocation and were re-purposed to other services. On the other hand, new bands for audio PMSE were identified by CEPT and are now included in ERC Recommendation 25-10 and ERC Recommendation 70-03, Annex 10. These include 1350-1400 MHz and 1518-1525 MHz. Currently, WRC-23 Agenda item 1.5 is reviewing the spectrum use and spectrum needs of existing services in 470-960 MHz which also considers PMSE frequency use in this band.

On the other hand, there is a trend of increasing demand for content production and consumption. There is greater need for higher quality, much more connected and synchronised devices and interactive content.

Availability of PMSE equipment is making production more affordable and reachable not just to the professional users – widespread use of mobile devices and unmanned aircraft systems enable new user applications. There is also diversification of services and new forms of media and applications, including streaming services, rich content sporting events, user generated content, social networks, and sharing and exchange of audiovisual content. We are also seeing developments which will possibly increase future spectrum needs for PMSE. These include different augmented reality applications, co-operative media production, distributed performance, new mobile applications, interactive video games, and so on.

In assessing regular spectrum requirements for PMSE, it must be borne in mind that PMSE demand is either at permanent sites or is time and location specific. A number of PMSE uses, in particular those of news gathering, happen at unpredictable times and locations and necessitate a very rapid response time. In such cases, it is very important that the delay and the procedures for frequency co-ordination and licensing are limited to the minimum.

On the other hand, some of the PMSE uses, such as outside broadcasting, are normally planned in advance of an event. In that aspect availability of sufficient and adequate frequency spectrum for PMSE applications should be ensured, taking into account future needs and fundamental impact of the PMSE to the creative industry. These aspects are reflected in ECC Strategic Plan for the period 2020-2025 where two of the major topics address PMSE. They are also reflected at the EU level with several documents adopting harmonisation legislation and opinion on a long-term strategy on PMSE spectrum requirements facing future needs.

In February 2021, ECC Report 323 on spectrum use and future spectrum requirements for PMSE was published. It was developed within Project Team FM 51, and includes recent advances and trends in PMSE, and provides updated information, accompanying analysis and conclusions of ECC Report 204.

Frequency ranges for the use of terrestrial audio and video PMSE are available in ERC Recommendation 25-10. The ECO Frequency Information System (EFIS) tool provides harmonised information relating to spectrum use in Europe and information on national conditions for audio and video PMSE applications as illustrated in Figure 2.

The use of PMSE equipment may not be fully harmonised across the CEPT countries due to divergent national frequency plans and differing PMSE requirements. Within the tuning range, the use of PMSE radio equipment is limited to the range of frequencies identified nationally within that country and will be operated in accordance with the related national regulatory conditions and requirements. Within each tuning range, CEPT countries may assign specific sub-bands or particular frequencies for PMSE links subject to availability, actual demand and sharing arrangements with primary services using those bands.

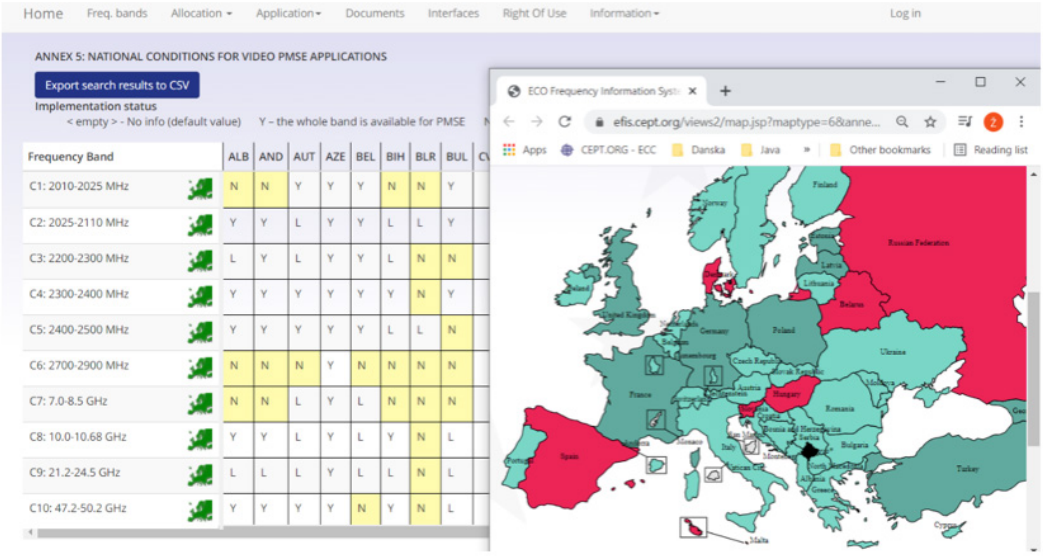


Figure 2: Extract from EFIS illustrating national conditions for video PMSE in ERC/Rec 25-10

The Project Team FM51 has been tasked with preparing the update of ERC Recommendation 25-10 which will include recent technological advances and changes in frequency ranges and national conditions for audio and video PMSE applications.

Requirements of the PMSE applications

There are many totally different use cases and a wide range of PMSE equipment use, making it difficult to find a common denominator for determining requirements for different applications. Quality, adequate data rate, low latency synchronicity, mobility and reliability of the radio link are fundamental to PMSE users. For PMSE productions the commercial pressures on users are significant as there is no opportunity for recovery, and so the tolerance for disturbance to the quality of service is extremely low. Peak demand for PMSE is usually temporarily and locally limited, such as big music festivals or sporting events or where several events are co-located at the same time. However, peak demand may also appear in various permeant locations where there is a high density of longer-term PMSE in use, such as cultural districts, sporting arenas, broadcasting facilities and studio complexes. Figure 3 illustrates requirements needed for some of the audio and video applications using PMSE equipment. Note that requirements can vary a lot depending on the specific application and event considered.

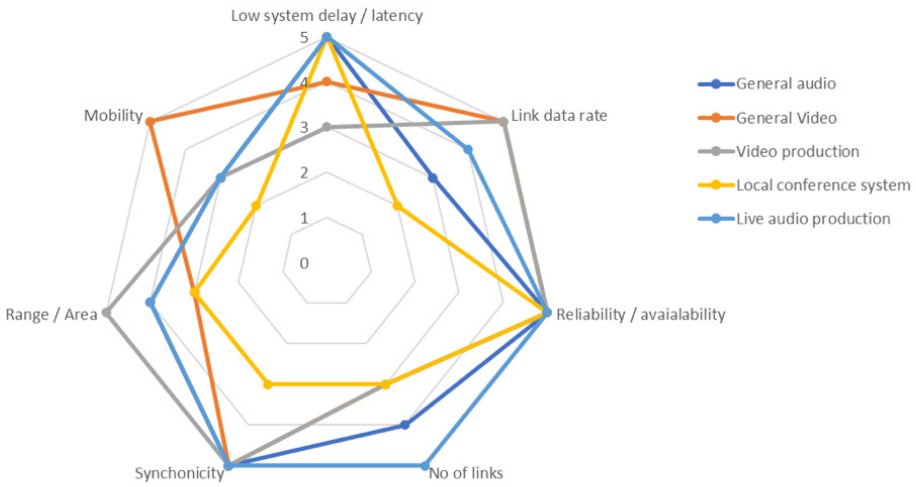


Figure 3: Illustration of technical requirements for different PMSE applications

Audio: Audio PMSE applications require very low latency and system delay, moderate data rates, high communication service availability and system reliability. Live audio production requires high level of synchronicity of all mobile devices service area, and there could be large number of links needed. For PMSE equipment there is demand by wireless microphone and IEM users for more audio channels and clean, interference-free spectrum, as well as for higher audio quality. Wireless microphone and IEM use enables artists at live music events to move freely around a large stage unencumbered by trailing wires.

Video: For video PMSE applications there are requirements for high quality of service and data rates. Very high communication service availability and system reliability, low to moderate latency and system delay, high data rates, high communication service availability and system reliability are also needed. For video productions and sporting events there are requirements for high level of mobility and high level of synchronicity of all mobile devices service area. There could be a large number of links needed. Developments in wireless camera technology have also greatly improved portability allowing a multitude of cameras to be spread around a stage or studio, providing the producer with multiple views to switch between or from which to edit and compile footage. In live televised sport, small cameras are placed right in the middle of the action to offer audiences and production teams immersive point-of view camera angles, for example, on racing cars in F1 and the World Rally Championship, or on bicycle seat posts in the Tour de France.

PMSE is an essential component for the creation of audio and video content, which is broadcast, distributed, exchanged and consumed globally using a variety of platforms. Looking at current trends we are more and more surrounded by different connected wireless devices, we are consuming more content but also creating and sharing between our peers, while new applications and forms are constantly emerging leaving new technical challenges

to PMSE. Currently there are several projects developing and investigating technologies for different PMSE applications. It is important for the PMSE industry to address all of these technical challenges and for regulators to ensure enough frequency resources, sharing conditions and adequate licensing regimes for addressing current and future needs of PMSE applications.