

ECC Newsletter October 2016

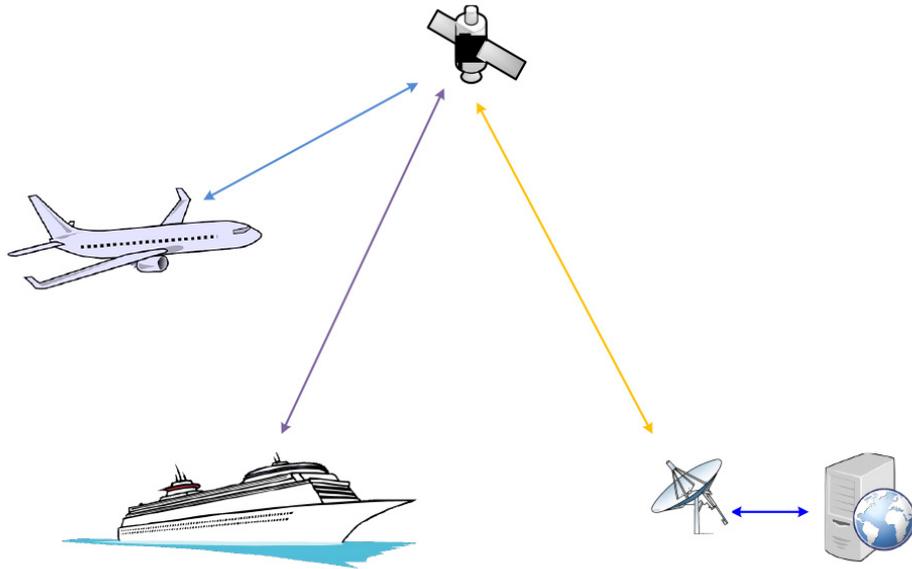
## Earth Stations in motion, new opportunity in satellite communications

The ECC has an established tradition of acting proactively in supporting and introducing new technological solutions in communications - and satellite is included in those solutions.

In recent years, there has been increasing interest and demand for broadband connectivity (both voice and data) to passengers on board moving vehicles, including aircraft, ships and trains. As technologies to provide such access have developed, so too have consumers' expectations. They desire seamless connectivity regardless of their location - whether on land, in the air or on the sea.

These systems typically use satellite links to backhaul to the wider network. The satellite components of the systems are known as Earth Stations on Mobile Platforms (ESOMPs<sup>1</sup>). A separate system is used to provide connectivity directly to the on-board end users. This system can use either mobile networks or Wi-Fi.

This article explores some of the recent regulatory developments regarding ESOMPs. The on-board component on aircraft and ships used to provide mobile data to the end users is explored in the following [article](#).



*Figure 1: Illustration of the ESOMPs/ESIM concept*

To facilitate the take up of these new innovative services, the ECC developed a regulatory framework to allow the use of ESOMPs - transmitting in the frequency band 27.5 – 30 GHz and receiving in the band 17.3 – 20.2 GHz (the frequency band is referred to as Ka-band). It took into consideration both Geostationary Satellite Orbit (GSO) and Non-Geostationary-Satellite Orbit (NGSO) systems. This regulation enabled several satellite operators to launch commercial satellite networks that support the use of ESOMPs.

Existing Fixed Satellite Service networks in the frequency bands 3 400 – 4 800 MHz and 10.7 – 14.5 GHz (C-band and Ku-band respectively) have already been used for many years to provide telecommunication services to mobile platforms such as aircraft and ships.

As demand for broadband connectivity evolves, satellite service providers started targeting higher frequency bands: 27.5 – 30 GHz for the uplink and 17.3 – 20.2 GHz for the downlink. After all, they want to meet the market demand and the resulting need for greater broadband speed, capacity and efficiency.

Various satellite operators are already making investments in this regard, accounting for several billion euros. As a result, multiple innovative satellites and constellations are either deployed already or soon to be launched.

Recent advances in stabilised antenna technology have allowed the development of earth station antennas capable of maintaining a very stable pointing accuracy. This allows the earth station's antenna to track the wanted satellite in orbit even when the earth station is mounted on a rapidly moving platform.

This technology - sometimes used in conjunction with spread spectrum waveforms - has allowed ESOMPs to operate in accordance with characteristics similar to those of traditional uncoordinated Fixed Satellite Service earth stations located at a specific site.

With the appropriate operational controls, easily achievable thanks to today's technologies, the potential interference to neighbouring Fixed Satellite Service networks can be effectively managed, leading to performances similar to those from fixed earth stations.



*Figure 2: VR-12 antenna placed on the aeroplane*

## ESOMPs to support affordable aeronautical connectivity

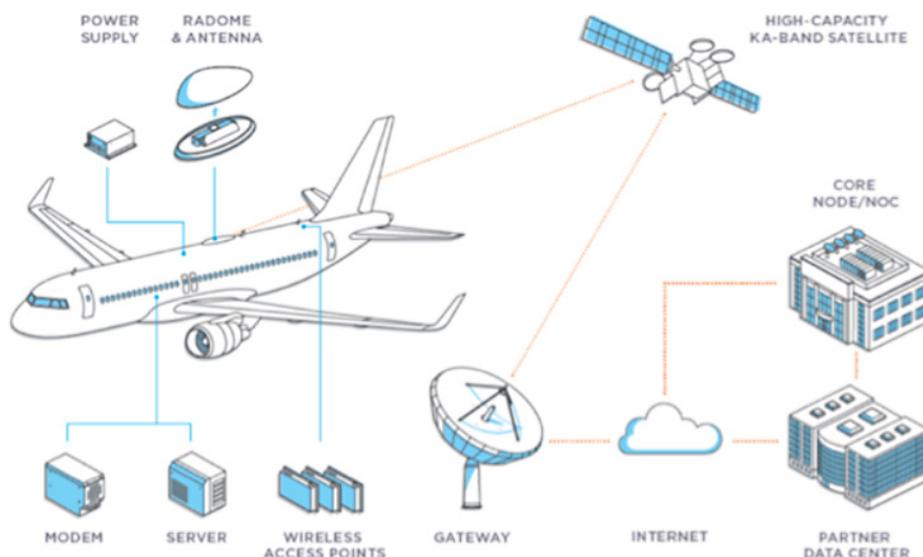
Aircraft represent one of the main “mobile platforms” on which ESOMPs can be installed. When combined with on-board access technology (Wi-Fi or mobile networks), ESOMPs allow passengers to have broadband connectivity over wide territories (such as oceans) where other technologies are not available.

Internet and voice connectivity are attractive services for aircraft passengers, as they allow them to connect to social media and communicate online with the same speed and quality they experience in their homes. Furthermore, this connectivity is increasingly being seen by airlines as a replacement for traditional in-seat, in-flight entertainment systems; passengers may directly stream entertainment data (such as a movie or a game) rather than rely on pre-loaded content that may need to be refreshed before the aircraft's departure.

With the recent change to rules regarding the use of personal electronic devices on board aircraft, passengers are now expecting to use their smartphones and tablets during all phases of flight from the moment they board the aircraft to the moment they leave, including take-off and landing.

As airlines introduce ESOMPs on their fleets, they are increasingly stressing the importance of being able to use the service for gate-to-gate operations, such as:

- Updating weather maps;
- Updating electronic flight bags (manuals for the engines and all the critical systems in the aircraft, which according to the International Civil Aviation Organisation rules must be carried by the crew for emergency cases);
- Providing scheduling information to their crews;
- Providing their passengers with re-booking information and/or gate updates for connecting flights;
- Reliably transferring aircraft system data.



*Figure 3: Operational scenario*

## ESOMPs to support affordable maritime connectivity

Requirements similar to those of an aircraft exist for passenger ships. ESOMPs are also being used to provide broadband connectivity to passengers on cruise ships and to crews on merchant vessels.

The largest passenger cruise ships can carry up to around 6000 passengers, and although not all of them would simultaneously use broadband Internet services, the overall connectivity requirements of a passenger ship may be far greater than the one of a single aircraft. For ships, as for airplanes, there is the requirement for managing the ship's operations (for example to transmit an engine's diagnostics or to access their corporate network) and for crew communications.

Ka-band high capacity satellites have bandwidth necessary to serve this important market.

## The European regulatory framework for ESOMPs

In recent years, a number of Fixed Satellite Service networks have been launched which operate within the frequency range 17.3-30.0 GHz. These satellites typically use small spot beams, which lead to increased efficiency of spectrum usage and allow for small user terminals' antennas. Also, the increased efficiency allows for broadband communications at costs lower than for systems available in the 10.7 – 14.5 GHz frequency band.

The ECC has adopted several decisions related to the operation of Fixed Satellite Service networks and systems within the frequency range 17.3-30.0 GHz. Studies have been carried out to identify technical and regulatory conditions required for the operation of ESOMPs in the 17.3-30.0 GHz range. Results of those studies are outlined in the [ECC Report 184](#), and became the technical basis for the development of [ECC Decision \(13\)01](#). The Decision specifies the conditions to allow the free circulation and use of ESOMPs operating within GSO satellite networks. It covers the maritime and aircraft earth stations on the territories of CEPT countries implementing that Decision.

Following the development of the GSO ESOMPs regulation, CEPT developed [ECC Report 217](#). This includes studies carried out on the technical and regulatory requirements relating to the use of land and maritime ESOMPs operating in the 17.3-30.0 GHz band with NGSO satellite networks. The ECC Report formed the basis for developing [ECC Decision \(15\)04](#), which allows for the free circulation and use of NGSO ESOMPs, including maritime earth stations.

With the deployment of new NGSO satellite constellations, ECC has recently initiated activities toward the development of relevant regulations for NGSO ESOMPs operating in the 10.7 – 14.5 GHz band.

The ECC is also reviewing its framework in order to remove unnecessary constraints (for example, the relaxation of the conditions around airfields) and to improve penetration of satellite broadband services on the market. Those modifications will

enable the possibility to provide broadband connectivity to passengers on board aircrafts via the internal Wi-Fi access even when in airport aprons or taxiways.

## WRC-15 paved the road for the future. With WRC-19 its story continued...

Progress made at the World Radiocommunications Conference in 2015 (WRC-15) brought a new word into the Radio Regulations, giving Earth Stations in Motion (*ESIMs – the ITU term for ESOMPs*) worldwide recognition. It also gave them flexibility to use existing Fixed Satellite Service satellite allocations. The work carried out at WRC-15 focussed on the bands 19.7-20.2 GHz and 29.5-30.0 GHz only.

Following a CEPT proposal, WRC-15 removed the requirement for satellite networks to be simultaneously in both the Mobile Satellite Service and Fixed Satellite Service allocations. The Resolution adopted at WRC-15 on this technology also determined those provisions needed to protect other users of the same bands (such as other satellite networks and the Fixed Service in certain countries).

It is expected that the demand for broadband communications aboard aircraft will continue to grow rapidly, leading to an increasing need for Fixed Satellite Service spectrum that can be used by Ka-band ESIMs.



*Figure 4: Forecast for the number of connected commercial aircrafts covering: Europe, North America (NAM), Latin America (LAM) and Middle East & Africa (MEA). Purple colour on the map depicts expected development and blue colour – current situation. Percentage shows year after year average estimation leading to the 2025 numbers.*

The conference in 2019 (WRC-19) will now look at extending the range of Fixed Satellite Service frequencies that may be used by ESIMs to the bands 17.7-19.7 GHz and 27.5 – 29.5 GHz. While CEPT has already developed a regulatory framework for

ESIMs operating in these bands, the need for a fully global regulatory framework has been recognised. In this context, ECC intends to actively contribute to the ITU activities to extend its framework and reach global target.

Satellite operators see an appropriate framework for ESIMs in the Ka-band as an important step due to the much greater amount of frequencies available and relatively uncrowded orbital arc. It will assist in providing broadband connectivity to the benefit of passengers on board moving vehicles.

**Stella Lyubchenko, Spectrum Expert, European Communications Office, assisted by experts involved in the activities of ECC project teams [FM44](#) and [CPG-PTB](#)**

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<sup>1</sup> ESOMPS are also known as Earth Stations in Motion (ESIMs) in the International Telecommunications Union (ITU) framework

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# The changing face of travel

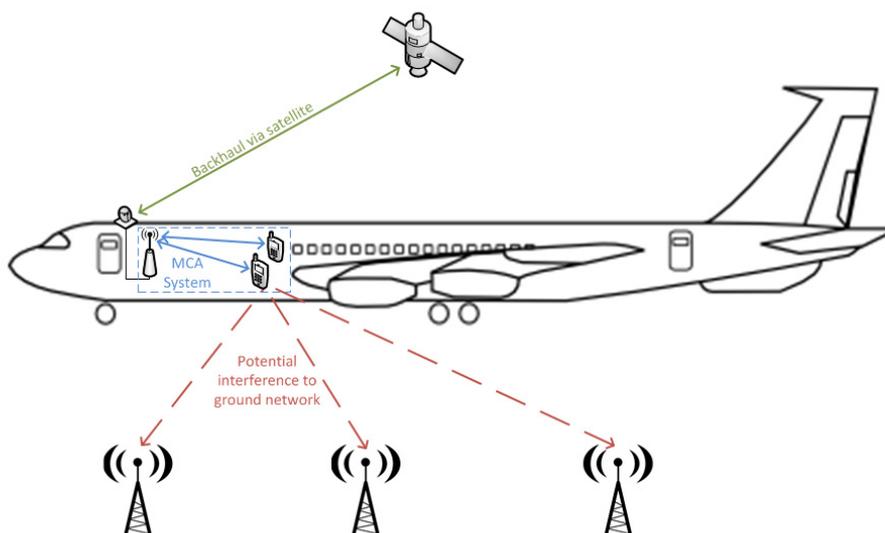
As consumer demands evolve in line with rapidly-changing technological innovations, access to these technologies is required. One area where this is particularly visible is in the increasing demand for voice and data connectivity via mobile networks to end-users on aircrafts and passenger ships.

In recognition of this demand, the ECC has been working to simplify the regulatory framework to allow for improved access to these technologies.

To provide mobile network access to an aircraft or a vessel, a local on-board low-power base station, known as a "picocell", provides connectivity to the end users, using a standard mobile frequency band. A satellite link using a different frequency band is typically used to connect to the wider telephony network, as described in the [previous article](#).

## Mobile communications on-board aircraft (MCA)

Allowing the use of mobile-user equipment on board an aircraft creates a potential issue of interference to the mobile network on the ground. This is due to the fact that an aircraft at high altitude typically has line of sight visibility to several ground-based base stations. Any mobile devices which receive a signal from these base stations on the ground could attempt to transmit at maximum power, thus causing potential interference to the wider ground network. This is illustrated below.



*Figure 1: Overview of MCA system and interference risk to ground networks*

For this reason, the existing ECC regulations ([ECC Decision \(06\)07](#)) recommend the use of a "network control unit" (NCU) – effectively a legal "jamming" device – on board the aircraft to block access to all mobile frequencies apart from those in use by the picocell on the aircraft.

Mobile devices that are connected to the picocell transmit at a low power because the separation distance is short, and so they do not cause a risk of interference. A NCU is required unless it can be demonstrated that the aircraft fuselage provides sufficient protection from interference to ground networks.

The NCU is required to operate in all mobile frequency bands other than the frequency used by the MCA system, to prevent devices from connecting to the ground networks. The MCA system should also be switched off during take-off and landing below altitudes of 3000 m (when the seatbelt light is on).

The first ECC regulations adopted in 2006 allowed usage of GSM (2G) services in the 1800 MHz frequency band. MCA systems have been in use by some airlines in Europe since 2008. In 2013, the regulations were extended to allow usage of UMTS (3G) in the 2.1 GHz band, and LTE (4G) in the 1800 MHz band. Today, 2-3% of the 30,000 daily commercial flights in Europe are equipped with MCA.

As more bands are regularly being opened up for mobile usage in Europe, NCUs need to be regularly updated, with a lengthy aviation certification process required for each new band. The European Commission (EC) recently tasked CEPT to conduct studies to determine if the use of the NCU could be made optional, in order to make it easier to deploy MCA systems.

The ECC conducted compatibility studies to assess the probability of interference in both directions (from the aircraft to the ground network and vice versa). The studies concluded that for LTE and GSM systems, an NCU is not necessary to prevent interference to and from ground networks. However for UMTS systems, the studies show that there is a risk of interference to ground networks. ^

The studies will shortly be published in CEPT Report 63, which is in the final stage of approval. The report recommends that NCUs should not be mandatory, with the exception of frequency bands where UMTS is operating on the ground (e.g. the 900 MHz and 2.1 GHz bands), where the existing requirements still apply.

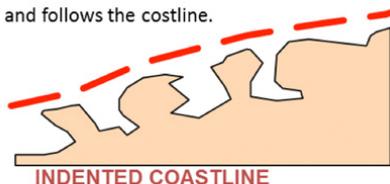
The final CEPT Report 63 will be sent to the EC to recommend that the relevant regulations be updated in line with these conclusions.

## Mobile communications on vessels (MCV)

Providing mobile connectivity to consumers on vessels such as passenger ferries and cruise ships presents similar challenges to those on aircraft. In this case it is necessary to ensure interference does not occur to land-based networks when a ship is near to the shore. This is achieved by specifying exclusion zones around a “baseline” where MCV systems should be switched off. The baseline is defined in relevant international law, and varies depending on the type of coastline, as illustrated below.

**Low water baseline:**

The baseline is drawn at the lowest tide water mark and follows the coastline.



**Straight baseline:**

Used when coastline is deeply indented or a fringe of islands exists along the coast.



**Archipelagic baseline/water:**

Applies to a nation consisting of a group of island. Straight baselines are drawn from the outermost islands and enclosed waters being national waters.



**Bays and gulfs:**

The water area must be greater than that of a semicircle with a diameter equal to the length of distance across the mouth. The baseline across the mouth may not exceed 24 nautical miles

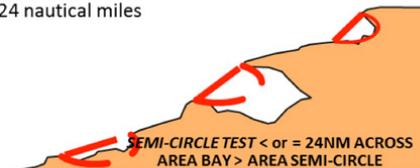


Figure 2: Definition of baseline

The size of the exclusion zones are specified in the regulations based on the results of compatibility studies, and vary between 2-4 nautical miles depending on the system in use.

The regulations also specify additional constraints on usage, including limitations on the maximum transmit power from mobile devices connected to the MCV system – this is particularly important to protect against interference from outdoor mobile devices on the deck of a ship, as illustrated below.

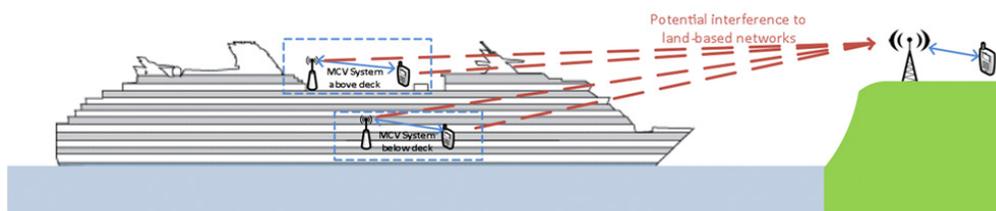


Figure 3: MCV system and risk of interference

The original ECC framework for MCV was published in 2008 in [ECC Decision \(08\)08](#), based on the results of compatibility studies in [ECC Report 122](#), and was presented to the EC in [CEPT Report 28](#) in 2009, in response to a mandate to CEPT on this issue. This framework allowed for GSM (2G) MCV systems to be deployed in the 900 MHz and 1800 MHz frequency bands.

In 2015, the ECC conducted new compatibility studies to determine the feasibility of extending MCV services to other frequency bands and newer technologies including UMTS (3G) and LTE (4G). The studies concluded that the existing regulatory conditions were enough to provide protection, as long as certain network conditions are met. ECC Decision (08)08 was updated accordingly to allow for the use of UMTS in the 2.1 GHz band, and LTE in 1800 MHz and 2.6 GHz.

The EC issued a second mandate to CEPT in 2015 on MCV in these frequency bands. This was addressed in CEPT Report 62, which was published in June 2016. The resulting update of the EC regulations is in the final stages of approval.

## Improved access for end users

The recent changes the ECC has made to the regulatory framework for MCA and MCV will provide operators of such services with more flexibility to deploy mobile networks using a wider range of technologies. This, in turn, will help to improve access to voice and data services for end users while travelling on aircraft or on passenger ships. It will provide extended coverage and higher data speeds on more journeys – changing the overall experience for travellers worldwide.

**Peter Faris, Spectrum Expert, European Communications Office**

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# Public Protection and Disaster Relief



Public protection and disaster relief took centre stage at a joint ETSI-CEPT workshop in September. The CEPT's Electronic Communications Committee (ECC) held the joint workshop, entitled "Public Protection and Disaster Relief (PPDR) - Regulatory Changes and New Opportunities for Broadband PPDR (BB-PPDR)". The event took place on 29 September at ETSI's headquarters in France. About 100 people attended.

## Background

The first seeds for the workshop were sown in October 2015 when the ECC adopted [Report 218](#). This addresses spectrum options for the implementation of BB-PPDR networks and services in CEPT countries - in the 400 and 700 MHz frequency ranges. The Report proposed the concept of "flexible harmonisation" to enable an efficient implementation of BB-PPDR within the CEPT area (see the [ECC Newsletter](#) from November 2015 on BB-PPDR). [ECC Decision \(16\)02](#), published in June 2016, also addressed BB-PPDR spectrum in the 450 – 470 and 700 MHz ranges.



## Objectives

The one-day workshop provided a platform for all relevant parties, including: those in the standardisation and manufacturing industry; PPDR organisations (authorities, service providers); spectrum regulators; PPDR users (police fire brigade, ambulance services), and Ministries of Interior. It gave them the opportunity to collaborate and exchange views on BB-PPDR issues.

The main objective of the workshop was to inform the audience about the latest situation on BB-PPDR, identify required future activities in various areas (standardisation, national implementation, regulation), and to consider the interdependencies between those areas.

## Challenges

From start to finish, the workshop was packed with useful information. It provided an overview on existing achievements in CEPT/ECC on Broadband PPDR, and it looked at the history dating from the publication of the original ETSI system reference document to the adoption of ECC Decision (16)02 (ETSI-CEPT/ECC collaboration process).

Attendees were provided with information on the existing standardisation activities, and agreed standards and specifications, as well as already agreed work items, in support of the CEPT initiative in 3GPP and ETSI. An interesting discussion followed.

In addition, standard conformance and interoperability was noted to be very important for BB-PPDR. This is especially the case when seen under the flexible harmonisation concept for BB-PPDR as decided by CEPT/ECC.

ETSI outlined the support and tools available in the ETSI Centre for Testing & Interoperability. In fact, work in this area for BB-PPDR protocol conformance and interoperability specifications is already on-going, and it will also include 'plug-testing' in the future. This news was welcomed at the workshop, and several countries indicated that they see the need for standardised solutions supported by multiple vendors.

It didn't end there. Other issues of interest included a discussion around the feasibility of linking the BB-PPDR network to government IT networks and BB-PPDR terminals roaming on commercial mobile networks.

Status reports and national case studies from various countries (France, Nordic countries, United Kingdom) were also presented. Roadmaps and the main expected challenges were reported to give a good overview of what can be expected for national

implementation of BB-PPDR networks:

- In France, a national framework is in place for the roll-out of BB-PPDR in the 700 MHz range (2x3 MHz and 2x5 MHz). In addition, France confirmed its interest in 450-470 MHz;
- In the United Kingdom, BB-PPDR services will be provided by a commercial operator;
- For all countries, migration concepts are needed for moving towards BB-PPDR. For early BB-PPDR adopters, this may even include using 'pre-standards' before some publicly available specifications become available;
- Some countries will not auction parts of the 700 MHz spectrum for public mobile networks but use the spectrum for BB-PPDR. At the same time, some countries consider using commercial 'hardened' networks for BB-PPDR services;
- There are some considerations to find synergies with other networks with 'mission critical communications', e.g. in the energy and transport sectors.

The workshop also provided a platform for industry and stakeholder associations to provide their perspective. This allowed some reflection on the CEPT spectrum harmonisation approach and standardisation activities. It also identified challenges which are still to be solved:

- The uplink block 698-703 MHz is challenging because of the limit for the protection of the terrestrial broadcasting. Filtering may solve this challenge, while power reduction or bandwidth reduction would impact the coverage (seen as a key issue at the workshop) of the BB-PPDR service;
- Increasing power for some BB-PPDR user equipment (e.g. gateways or within commercial mobile network operations) would require new studies for European harmonised solutions;
- Standardisation activities in 3GPP will follow the demand, and so the optional arrangements for BB-PPDR in 450-470 MHz still need to materialise;
- Future technologies such as 5G could be of interest for some PPDR applications, and may also be used for some applications under alternative frequency arrangements (e.g. NB-IoT with 200 kHz for surveillance applications).

## Outcome of the Workshop

There was a lot discussed over the course of the day, but one of the main conclusions of the workshop was around the BB-PPDR regulatory harmonisation approach. Attendees agreed that technical conditions must be adequately covered and specified

in detail in the future ETSI harmonised European Standard. Indeed, ETSI has already set up a work item for this.

Further ETSI standards and specifications to achieve interoperability and cross-border communication are also planned. This work includes the clear identification of the areas for which solutions are still outstanding or still need to progress. Those ‘under progress’ concern some frequency arrangements and associated technical conditions set out in ECC Decision (16)02, which may need inclusion or reflection of the technical conditions in the respective 3GPP specifications.

The workshop gave attendees an insight into the options for the national choice of the most suitable implementation model, and into the selection of the relevant frequency ranges based on the existing European regulatory framework provided by ECC Decision (16)02 for BB-PPDR. The outcome of the workshop will support the ongoing activities in the area of standardisation (ETSI, 3GPP).

*The [presentations](#) are available, as well as the closing remarks including a more detailed [first summary](#), as presented by Mr Thomas Weilacher, Chairman of CEPT ECC/WGFM, and Dr Michael Sharpe, Director Spectrum and Equipment Regulation, ETSI.*

*For further information about PPDR activities in the ECC, contact Mr Thomas Weber ([thomas.weber@eco.cept.org](mailto:thomas.weber@eco.cept.org)) from the European Communications Office, or consult the CEPT/ECC PPDR [topic webpage](#).*

**Thomas Weber, Spectrum Expert, European Communications Office**

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