

ECC Newsletter August 2018

Drones and Frequencies to Fly on

As the drone industry takes off, frequency regulators and stakeholders are examining spectrum's role in realising its potential

The use of drones/unmanned aircraft systems (UAS) has grown hugely in recent years. Various analysts such as Gartner¹ expect the drone market to exceed €10bn by 2020. They say that around 3 million drone units were manufactured in 2017. As UAS technology has undergone significant development, the market for both civil and commercial drones has grown.

There are a number of challenges in fully realising the potential for growth that UAS bring with them. One of these challenges is meeting the spectrum requirements for UAS.

Spectrum for drones/UAS

When it comes to UAS, frequencies are used in a number of ways: for command and control (CC) and identification, as well as for payload transmissions (e.g. on-board cameras sending information to the ground). Communications solutions are also needed for drones-to-drones, drones-to-infrastructure and for radar sensors and optical sensors on board the drones. In addition, they are needed for distribution of positioning information in order to avoid collisions, geo-awareness about fly zone restrictions such as around airports, sensitive facilities and locations, and drones traffic management.

CEPT Workshop on Spectrum for Drones/UAS

With this in mind, CEPT held a Workshop on ‘spectrum for drones – UAS’ in sunny Copenhagen on 29-30 May 2018. The focus of the workshop was on drones which fly in circumstances where they do not need communications with air traffic control.



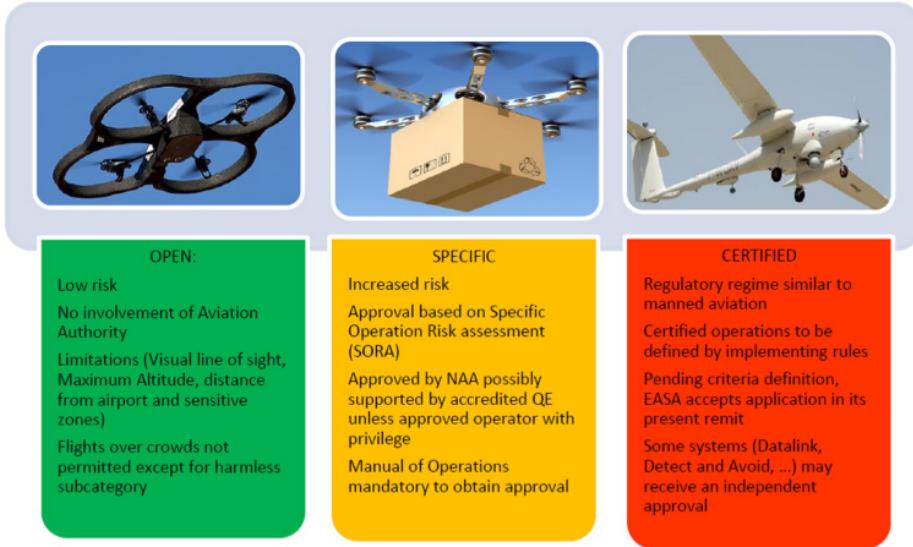
The two-day event brought together around 100 stakeholders from CEPT administrations, European organisations and associations, industry and the aviation sector to discuss the future requirements around UAS and spectrum. It was a packed schedule, with around 25 speakers delivering informative presentations across the two days, often leading to robust discussions.

The workshop heard how drones are already being used for civil and commercial use, by everyone from flying model enthusiasts to those within agriculture or the government (e.g. public protection and disaster relief). In some jurisdictions drones have already become vital tools in disaster situations. They are sent up to the sky to inspect fires, flooding damage or to drop buoys into the sea to rescue swimmers, for example. Other possible governmental applications include intervention and enforcement actions (e.g. jamming or ‘catching’ a drone or the remote control); it is clear that such actions must not harm any people.



Regulatory framework for Drones/UAS

The workshop heard from the European Aviation Safety Agency (EASA), which has new draft regulations before the EU Commission. The approach includes three categories of operations (Open, Specific and Certified) in an operation centric approach.



Frequencies for the certified category were outside of the focus of the CEPT Workshop. They are expected in bands allocated to the aeronautical mobile service.

In recent years, the need for traffic management applicable to UAS emerged in many parts of the world. This UAS traffic management system (UTM) would ensure safe operation of a large number of drones at low-altitude (especially in urban areas). As traditional air traffic management (ATM) ensures the safety of aircraft operations at high altitude, so does UTM at a lower altitude. The development of a UTM concept for Europe is called U-Space. It consists of a set of services enabling complex drone operations in all types of operational environments. The precise coexistence with ATM may need some specifications about reference points, the definition of air spaces (relationship of ATM and the U-Space), ensuring the safe coexistence of helicopters and UAS at low heights above ground, and even high altitude drones using the U-Space during take-off and landing. Some low altitude drones may need an interface with ATM in the future. Many initiatives are currently discussing this possibility.

The draft delegated act, as part of the new proposed European regulations, is limited to the open category and will define applicable technical conditions. An operation is classified in the open category as long as it complies with the relevant constraints; if not it must be classified in the specific category. There are limits around the height drones can fly (120m) and the weight they can carry (25kg) in the open category, in which beyond visual line of sight operations are clearly excluded.

In the specific category, the basic principle is that a UAS operation, before being conducted, must be approved on the basis of a risk assessment. It contains, among other requirements, electronic identification and geo-awareness, which are considered steps in the right direction for U-Space. However, the regulations will need to be complemented later

on to take U-Space into account. The delegated act will be complemented by an implementing act defining operational conditions as part of the new European regulatory approach.

These acts are expected to be published by the end of 2018 or in early 2019. They will be complemented by related standardisation initiatives. By 2021, all new drones must have the CE mark, according to the new European regulations. Radio transmitters on board drones of the open and specific categories will have to comply with requirements set out in the Radio Equipment Directive [2014/53/EU](#). The regulation will give EU Member States some flexibility in what exactly they adopt. National authorities can have specific exceptions on a national level.

[Workshop Webpage](#)

[Workshop Programme](#)

The presentations, photos and summary of the workshop are available [here](#).

Work in the ECC on Spectrum for Drones/UAS

In February 2018, the ECC published [ECC Report 268](#) on the technical and regulatory aspects and the needs for spectrum regulation when it comes to drones. Following that report and discussions at the workshop, it was found that the focus on drones in both open and specific categories seemed appropriate.

In addition, an [explanatory document](#) was approved by the WG FM of the ECC. Non-professional UAS usage should make use of frequency opportunities under general authorisations, in other words without any individual rights. The most common use is found in the 2400-2483.5 MHz and 5725-5875 MHz bands under the current regulatory conditions set out in [ERC Recommendation 70-03](#).

Other usage opportunities exist in the 433 MHz and 863-870 MHz ranges. Such opportunities are based on harmonised frequency use without restrictions ([RE Directive Class 1 equipment](#)), and use is only bound to the technical and operational conditions provided in the ERC Recommendation 70-03 and the EC Decision for SRD ([2006/771/EC as amended](#)). There are also other frequency opportunities under general authorisation schemes such as for non-specific SRD or specific ones. For example ERC Recommendation 70-03 [Annex 8](#) includes model control in the 27 MHz, 35 MHz and 40 MHz frequency ranges. Flying models do not normally use any kind of infrastructure. Market surveillance actions on imported equipment operating in frequency bands under general authorisations were also highlighted at the workshop as an important issue.

Various use cases, different spectrum needs

Usage opportunities under general authorisations are not appropriate for all drone users as the emission limits are often too low, restricting the range of operation, and there is a risk of interference from other users in such frequency bands and ultimately of insecure investments. The workshop discussed some ideas for frequency bands which could be considered to provide more reliable spectrum access and to support longer range and highly reliable CC for UAS – for both professional and governmental drone applications. In such professional or governmental use cases, individual authorisation or the equivalent is foreseen. ETSI will support this work and is preparing a new technical report describing professional UAS use cases. Professional applications may even include UAS ‘swarm’ or ‘fleet’ applications. Highly professional applications may use the aviation infrastructure used for communication, navigation, surveillance, such as VHF, GPS and automatic dependant surveillance. Intelligent Transport System technologies such as IEEE 802.11/11p/ITS G5 as well as LTE V2X) may provide solutions. Specific solutions may use e.g. PMR, PMSE, C-band, or even higher bands (PMP solutions).

The CEPT workshop heard that harmonisation of the spectrum would foster a common market and cross-border co-operation. It would also be needed for the technical solutions required under the new drones/UAS regulatory framework such as for identification and geo-awareness, and perhaps more, once the U-Space is increasingly specified.

It was agreed at the workshop that, in the future, spectrum harmonisation may indeed be needed in areas of e-identification, geo-awareness and anti-collision. The various ideas for the technical solutions have, however, not converged in standardisation, while the use of several technologies may even provide a potentially safer approach using data fusion. Hence, the precise impact and needs for new frequency opportunities for drones/UAS is not yet clear. It is expected that ECC’s WG FM will further investigate this and that a new work item will be adopted at the next WG FM meeting in September 2018.

Another solution is ‘to fly’ professional drones/UAS using existing cellular mobile networks. This can be realised either by an external LTE device attached to UAS or in future by implementing SIM-cards installed within UAS. ECC Project Team 1 has adopted a work item for a new ECC Report to discuss all aspects of relevance for use of Mobile Fixed Communications Networks (MFCN) for UAS, including the impact on networks and other operators and the ability to achieve reliable coverage, handover, roaming, and connection to many base stations.

At the workshop, there was strong interest from some industry representatives for covering payload, CC and U-Space to the extent possible through cellular networks. In the standardisation field, 3GPP is also working on a Release-15 (LTE) study item towards a technical report, while bands below 3.8 GHz are of interest, in support of UAS network services. Solutions to be addressed are not only infrastructure-based; the PC5 mode could potentially also be used for UAS in future.



For payload use of drones/UAS, this could be provided in the video PMSE bands as identified in ERC Recommendation 25-10, noting that videos from cameras is the most important payload usage of drones/ UAS. However, there could be some capacity constraints and issues about real-time solutions without too much latency use. The workshop also heard about numerous new UAS applications, all pushing for very high payload throughput.

This will be investigated further within ECC WG FM.

Further aspects for consideration

The question of needing new spectrum compatibility studies was raised at the workshop. Many spectrum compatibility and sharing studies in the past did not consider the use case ‘UAS/drone’ but rather only usage on the ground or at limited height. UAS/drones by nature can interfere and can be interfered with much easier due to their exposed location in the sky providing line-of-sight to other systems. Existing studies will be checked, as appropriate, to see if some additional studies are needed during the future investigations in ECC.

It will be up to civil aviation to define how to provide drones/UAS functionalities and their relation to U-Space in the future. Resulting possible spectrum requirements will be discussed in the ECC. This will require that the ECC will closely work together with relevant organisations and partners, which include EASA, ETSI and Eurocontrol, during the ongoing process.

Thomas Weber, Spectrum Expert, European Communications Office

¹ Gartner Inc. "[Forecast: Personal and Commercial Drones, Worldwide, 2016.](#)"

Europe gets closer to the rollout of 5G

As the Electronic Communications Committee adopts a set of deliverables that will pave the way for 5G, it demonstrates its crucial role in European spectrum management

The ECC has reached a significant breakthrough in spectrum for 5G. It has adopted a set of deliverables, which are shaping the harmonisation of the frequency bands 3.4-3.8 GHz (referred to as the 3.6 GHz band) and 24.25-27.5 GHz (referred to as the 26 GHz band) for 5G.

This significant achievement is paving the way for 5G implementation in these two frequency bands for the 48 administrations that are part of CEPT.

In a previous [newsletter article in September 2017](#) we outlined the harmonisation activities in the ECC to make these two priority bands available for 5G, as part of the CEPT roadmap for 5G. The latest milestone marks the finalisation of the main deliverables to complete these activities.

This essential step in 5G development in Europe was reached at the ECC's 48th Plenary meeting, which took place in Rome, Italy, from 2 July to 6 July 2018. It follows months of extensive studies and public consultation.

With this latest achievement, ECC has yet again demonstrated its indispensable role in European spectrum management. It provided a unique forum to all concerned stakeholders to submit proposals, express their views and finally to reach compromise on the technical challenges brought by the future coexistence between 5G systems and the current users of the spectrum within and adjacent to the 3.6 and 26 GHz bands.

The resulting new regulatory framework means that adequate spectrum will be made available in a timely fashion, as technologies improve, to deal with 5G. In addition, the implementation of appropriate technical and regulatory provisions means that the interests of other spectrum users (satellite communications, Earth observation, military usage) are safeguarded.

Harmonised technical conditions for the 3.4-3.8 GHz band

This band is already harmonised within Europe for Mobile/Fixed Communication Networks (MFCN) through [ECC Decision \(11\)06](#). Activities have been carried out to review the harmonised technical conditions contained in this Decision to ensure their suitability for 5G. [ECC Report 281](#), with proposed updates to the technical conditions, was published in July 2018. The updates reflect the use of Active Antenna Systems (AAS) for

5G. As a follow-up activity, ECC Decision (11)06 is currently under review. A draft revision has been agreed for [public consultation](#) in July 2018. Its final adoption for publication is scheduled during the next ECC meeting in October 2018.

The move to AAS for 5G marks a fundamental change in antenna technology. It uses multiple integrated antenna elements in an array which can be dynamically controlled to steer beams towards specific users. This results in increased throughput to individual users. However, it requires changes to the way existing regulatory limits have been specified, while ensuring the ongoing coexistence with users of adjacent bands under previous limits.

In particular, ECC Report 281 studied the impact of 5G using AAS on radar operating below 3.4 GHz, as well as fixed links and fixed satellite earth stations operating above 3.8 GHz. The report concluded on suitable unwanted emission limits for AAS systems which would maintain sufficient protection of these other applications.

As reported in the previous article on 5G, there is a need to ‘de-fragment’ the existing allocations in the 3.6 GHz band in order to facilitate large contiguous blocks of bandwidth and to provide high throughput for 5G. Draft guidelines have been developed accordingly (Draft ECC Report 287 currently under finalisation) to help administrations meet this objective of re-organising the band, in which there are existing licences in many CEPT countries.

ECC Report 281 also studied the possibility of synchronisation between different operators in adjacent blocks of spectrum. The Report concluded on a set of limits applicable for synchronised operation, and a separate set of more restrictive limits applicable for unsynchronised or semi-synchronised operation, in cases where no geographic or indoor/outdoor separation is available. However, the report also noted that agreements at national level, or between adjacent operators, may provide flexibility in the implementation of these limits. Activities are ongoing to develop an ECC Report to provide guidance to administrations on how such flexibility may be implemented.

Harmonised technical conditions for the 24.25-27.5 GHz band

CEPT identified the 26 GHz band for early European harmonisation. This band provides over 3 GHz of contiguous spectrum and more favourable propagation than other higher frequency bands being considered for 5G. Compatibility and protection, as appropriate, with all existing services in the same and adjacent frequency bands needed to be addressed. As a result, ECC PT1 developed [ECC Decision \(18\)06](#), setting the harmonised conditions for the introduction of 5G in the 26 GHz band. The ECC Decision was adopted by ECC and published in July 2018.

The agreed technical conditions include specific out-of-band limits necessary to protect EESS (Earth Exploration Satellite Service - passive) in the band 23.6-24 GHz. They are used in various European Space Agency science and Earth observation programmes, the EC Copernicus programme, as well as the EUMETSAT programs. These limits were developed based on the results of extensive studies.

Within the band 25.5-27 GHz, consideration was given to existing and future meteorological EESS/SRS (Earth Exploration Satellite Service/Space Research Service) satellites that transmit raw instrument data for atmospherics physics, environmental and climatic issues to a limited number of receiving earth stations. Protection of these earth stations from 5G services in the same band requires suitable conditions to be included in national authorisations, which may include minimum separation distances between 5G base stations and EESS/SRS earth stations. ECC PT1 is developing an ECC Recommendation to address suitable measures, including the provision for future earth stations.

The band 24.65-25.25 GHz is used by a limited number of transmitting fixed-satellite service (FSS) earth stations. Studies have shown these should not cause interference to 5G in the same band. ECC PT1 is developing an ECC Recommendation to ensure current and future earth stations can continue to operate without impact to 5G.

Protection from interference in the other direction — from 5G base stations to space station receivers operating in the FSS and also within the Inter-Satellite Service (ISS) — is also shown to be achievable. To ensure this, the technical conditions include a requirement that base stations should not normally transmit with antenna beams pointing above the horizon.

Co-existence with fixed links operating in the same band needs to be addressed at national level. ECC PT1 is developing an ECC Report to provide guidance to administrations with options to facilitate sharing.

Similarly to the 3.6 GHz case, ECC PT1 is also developing guidance for administrations on options for unsynchronised and semi-synchronised use in the 26 GHz band.

EC Mandate on 5G

In December 2016, the European Commission issued a Mandate to CEPT to harmonise technical conditions for the development of EU-wide 5G equipment. The Mandate addresses the same bands identified in the CEPT roadmap (3.6 GHz and 26 GHz), so there is a link to the harmonisation activities within ECC as outlined above. ECC PT1 has developed two CEPT Reports on harmonisation measures: [CEPT Report 67](#) on 3.6 GHz and [CEPT Report 68](#) on 26 GHz. The Reports reflect the updated technical conditions for 3.6 GHz in ECC Decision (11)06 and the new technical conditions for 26 GHz in ECC

Decision (18)06 respectively. They were sent to the EC in July 2018 and form the basis of future considerations within the Radio Spectrum Committee for the development of relevant EC regulations in the two bands.

Next steps on the application of the CEPT roadmap for 5G

ECC will continue to work on 5G spectrum regulation in Europe through the application of the CEPT Roadmap for 5G, which it is working towards for the benefit of the 48 CEPT administrations.

The 5G Roadmap has identified the need to assess possibilities for 5G in other bands below 3 GHz which are already harmonised for use by mobile. These bands would provide the benefit of wider coverage for 5G in rural areas, while the higher frequency bands will be mainly used to provide high capacity in urban and suburban areas. ECC has agreed that the existing harmonisation framework in the 700 MHz and 800 MHz is already suitable for 5G, since AAS will not be deployed in these bands due to constraints on antenna size. ECC PT1 is undertaking work in the 900 MHz, 1.8 GHz, 2.1 GHz and 2.6 GHz bands to allow for the use of AAS in these bands while ensuring compatibility with existing services in adjacent bands is maintained. Similarly to the 3.6 GHz case, updates to the relevant ECC Decisions may be required.

In addition, ECC is also reviewing the existing cross-border co-ordination framework in relevant bands to ensure it is ‘5G ready’.

At the global level, ECC is working on preparation for 5G spectrum bands at the 2019 World Radiocommunication Conference (WRC-19, which will be held in October and November next year. Agenda Item 1.13 of WRC-19 focusses on candidate bands for possible IMT (International Mobile Telecommunications) identification in the ‘millimetre wave’ range above 24 GHz. Such an identification would allow for global harmonisation for 5G, and a range of bands are already being studied. ECC PT1 has recently agreed to support IMT identification in the 26 GHz band, based on the agreed technical conditions in ECC Decision (18)06, as well as two other bands - 40.5-43.5 GHz and 66-71 GHz. This preparation work will continue until mid-2019 when the CEPT positions on all bands will be finalised for the conference.

Peter Faris, Spectrum Expert, European Communications Office
Bruno Espinosa, Deputy Director, European Communications Office

European harmonisation of L-band spectrum for mobile

CEPT has been working to provide additional spectrum for mobile in the L-band (1427-1518 GHz). Steve Green, Chairman of ECC PT1, summarises the activities undertaken to develop the new harmonisation measures.

Introduction

Since WRC-15, CEPT has developed a number of harmonisation measures for the L-band mobile spectrum identified for International Mobile Telecommunications. This built on the work done before WRC-15 on harmonisation of 1452-1492 MHz for mobile supplemental downlink.

WRC-15 and initial technical studies

In late 2015 the World Radiocommunication Conference (WRC-15) identified 1427-1452 MHz and 1492-1518 MHz for IMT. These bands are extensions to the core 1452-1492 MHz supplemental downlink band that was originally harmonised in ECC Decision (13)03.

After WRC-15, ECC PT1 was given the task of producing harmonised technical conditions including band plans for these extension bands. There were a number of strands to this work.

At the lower end, the technical conditions for protection of the adjacent passive band (1400-1427 MHz) needed to be built in to the overall harmonisation measures. These had been agreed during WRC-15 in a revision of Resolution 750, which is included in Volume 3 of the Radio Regulations. At the upper end, technical conditions for compatibility with adjacent band use of the mobile satellite service needed to be studied.

Technical studies on adjacent band compatibility at 1518 MHz had started in CEPT in September 2014, in the framework of CPG preparations for WRC-15. Following the Conference, the work moved into ECC PT1. The studies looked at a number of different scenarios, including use of land mobile satellite, maritime mobile satellite and aeronautical mobile satellite terminals in the adjacent band. They included minimum coupling loss and statistical analysis. These studies culminated in the publication of ECC Report 263 in March 2017, which concludes on the base station unwanted emission limits and MSS receiver blocking characteristics needed for compatibility in all scenarios.

The studies in ECC Report 263 were subsequently introduced into ITU-R to assist in the adjacent band compatibility studies being carried out in Working Party 4C and Working Party 5D.

Harmonisation work

In November 2016, when ECC Report 263 had been agreed for public consultation, ECC asked ECC PT1 to embark on work to develop an ECC Decision for harmonised technical conditions in 1427-1452 MHz and 1492-1518 MHz. The conditions at the 1427 MHz and 1518 MHz boundaries would be based on results of existing technical studies in ECC Report 263; in the rest of the band, ECC asked ECC PT1 to make the most benefit of the existing harmonisation in 1452-1492 MHz. The studies would be documented in an ECC Report, which would sit alongside the ECC Decision and explain how the technical conditions were derived.

Shortly after the initial task from ECC, the European Commission issued a mandate to CEPT on technical studies in the same frequency bands, with the aim of revising Commission Implementing Decision (EU) 2015/750.

ECC Report 269 was published in November 2017 alongside CEPT Report 65 and ECC Decision (17)06. This applied the existing block edge masks from 1452-1492 MHz across the entire range. The key features are:

- Blocks in multiples of 5 MHz, running from 1427-1518 MHz
- Unwanted emission limits below 1427 MHz in line with WRC Resolution 750
- Maximum power

Since the band plan was based on multiples of 5 MHz extending out from the 1452-1492 MHz core band, the lower boundary was set at 1427 MHz and the upper boundary was set at 1517 MHz. There was some extra work to be done with the existing technical conditions below 1452 MHz and above 1492 MHz. In countries that do not use the expansion bands, the existing out-of-band limit to protect adjacent services would still be required but countries that make the band immediately below 1452 MHz available for MFCN would not need to apply the existing out-of-band limits at that frequency. Similarly, countries that make the band immediately above 1492 MHz available for MFCN would not need the existing out-of-band limits at that frequency. A revision was therefore made to ECC Decision (13)03 to clarify this point.

Additional studies on adjacent band blocking

During the preparation of ECC Report 269 and ECC Decision (17)06 the satellite industry informed CEPT that some L-band mobile satellite receivers did not meet the blocking performance requirements that were included in ECC Report 263 and that the requirements in the ETSI harmonised standards were not aligned with the values in that Report. Since

this was a receiver blocking issue it would not affect the conclusion of unwanted emission limits for base station equipment in the harmonised technical conditions, but it meant that some further analysis would be needed on solutions that could be implemented according to national requirements for protection of particular locations where it is necessary to use L-band MSS terminals. This analysis is currently taking place in ECC PT1 with participation from a wide range of satellite, maritime and aeronautical stakeholders and has involved CEPT in communication with ICAO, IMO and Eurocontrol. It is expected that the draft report will be ready for ECC public consultation later this year.

Final reflections

The participants in ECC PT1 managed to complete the harmonisation work very rapidly and to a high quality. They made use of existing analysis, drawing on ECC Decision (13)03 and lessons learned in the development of ECC Report 263, even creating a draft CEPT Report for the Commission from scratch and readying it for ECC to approve for public consultation in a single meeting.

The technical framework for use of the 1.4 GHz band is now available in the updated ECC Decision (13)03 and new ECC Decision (17)06. This puts CEPT countries in a very good position to be leading on roll-out of mobile broadband services in this global band, while affording flexibility to adapt to their national needs.

Steve Green, ECC PT1 Chairman
