

CEPT Workshop on Spectrum for Drones / UAS

*Copenhagen
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Summary, Outcome, APs for ongoing activities

*Presented by Thomas Weber (ECO) at the ITU Regional Seminar for CIS & Europe
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Key elements / expected action points for ongoing ECC activities:

Which spectrum options to be used and under which conditions?
The workshop should provide clear guidance.

- Other areas of work in ECC are related (e.g. PMSE, SRD, MFCN, ITS).
- Questionnaire in 2015, ECC Report 268 published in 02/2018.
- Possible harmonisation benefits could be based on
 - Foster common market / market harmonisation
 - Cross-border operation
 - Unlicensed frequency bands conditions do not always fit (emission limits too low)
 - WG FM CG Drones working on 'document on frequency options'.

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Key elements / expected action points for ongoing ECC activities (cont.):

Issues:

- Suitable bands (CC and payload)?
- New harmonisation measures?
- Or use of existing opportunities?
- Satellites, radars?
- Commercial / governmental usage of drones
- Use cases, technical requirements

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Impact of EASA regulation:

- Compliance with technical requirements needed.
- State operations can opt-in.
- Some flexibility left to member states.
- Open categories only VLOS, max 120 m height, max 25 kg.
- Specific category: Standard scenarios to be developed. Big market potential for new drone related services.
- Implementing Act (operational conditions) and Delegated Act (technical conditions) - National authorities can have specific exceptions on a national level.
- Solutions for electronic ID, geo-awareness etc. to be addressed in standardisation and will require most likely a harmonised management (cross-border operation). This is linked to U-Space. The impact in terms of spectrum harmonisation is yet unclear.

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Impact of EASA regulation (cont.):

- RE-D will apply to open and specific categories.
- Work towards an European 'Drones/UAS network' of demonstrators.
- Certified category
 - Frequencies for certified RPAS are expected in bands allocated to AM(R)S and AMS(R)S (ICAO RPAS Panel) – the panel works on frequencies and existing solution in AM(R)S, such as in 5030 – 5091 MHz.
- Following ECC Report 268 and discussions at the workshop, the focus on drones in the open categories and specific category seems appropriate.

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Use of MFCN

- Work towards a new ECC Report in ECC PT1
 - Potential issues: how to operate drones in MFCN, impact on networks, impact on other operators, handover, reliable coverage (optimisations necessary), roaming, connection to many BS.
 - Timeline may need to be quicker – contribution based.
 - Mobile except aeronautical mobile allocation in some bands; may need clarifications with regard to usage by low flying drones. UAS require access like other terrestrial UE.
 - Not only infrastructure-based, also RLAN, eID via Bluetooth within up to 250 m or even 1 km. PC5 mode could potentially also be used for UAS in future?
 - First MFCN based solutions may become available in 2019-2020.
 - Use of ‘low bands’ for coverage and ‘higher bands’ for capacity.
 - MNOs see benefits: seamless, use existing infrastructure, low-cost.

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Which functionality may need to be supported?

- CC & Payload
- Consideration/idea about a UAS traffic management system (U-Space) that will track all of the unmanned aircraft in the designated area
 - Geo-awareness
 - Anti-collision (communications or sensors)
- Communications and other applications (e.g. pilot-to-pilot)
- Latency requirements
- E-identification (U1)

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Standardisation

- Need for standards
 - MFCN
 - 3GPP LTE Rel-15 (LTE) Study Item towards Technical Report (TR) 36.777 – bands below 3.8 GHz are of interest
 - The model is based on subscription/service (SIM card) from an MNO
 - Interference condition and height management in one solution
 - Non-MFCN
 - Work on ETSI Technical Report 103 373 in TC ERM TG Aero (scope: to describe professional UAS use cases) has taken some time
 - MFCN sufficient? Application of RE-D was unclear for a long time
 - Other existing harmonisation is sufficient?
- ETSI consolidated proposal (SRDoc or specs/standards) not available.

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Sense/Detect-And-Avoid – in R&D – tendency to use COTS products – technical solutions for low flying UAS/drones not mature yet

- Use of several technologies provide a potentially safer approach using data fusion
 - Operator (pilot) verifies and decides on the intervention on his display, or
 - autonomous decision
- Drones/UAS Scenarios to be described
- Detection
 - Radio communications (common drone awareness, e.g. such as in ITS or MFCN), acoustic, thermal/IR, optical, radars are all possible technical solutions; especially BVLOS operation requires system solutions
- Intervention (e.g. jamming or ‘catching’ a drone or the remote control); must not harm any people

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Professional Drones/UAS use cases

- Disaster situation
 - Forest fires, damage or accident traffic inspection, flooding, maritime rescue, large scale monitoring and situational awareness, search and rescue of persons, transport of medical/ blood, life-saving equipment, fast deployed support of communications (flying com platform/ hot spot) or providing simply light
 - Spectrum: reliable/robust frequency use, operating distance can be several km and BVLOS; future perspectives: DAA, swarms, larger devices for transport
- Scientific, transport, infrastructure, monitoring, data acquisition, tracking, spectrum monitoring, agriculture, cellular relay/ temporary coverage extensions etc. – potentially many vertical markets
- Drone ‘swarm’ or ‘fleet’ professional applications

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Unlicensed Use:

- Flying Model use focused on 2.4 GHz (CC) and 5.8 GHz (for cameras, many analogue solutions, high-gain ground Rx antennas for tracking)
- Other opportunities still used at 27 MHz, 35 MHz and 40 MHz but loose significance. Some use in 433 MHz and 868 MHz, also because some use fallback-systems.
- Requirements
 - BVLOS (e.g. behind a nearby obstacle), parallel operation of several links, Robust links, Low latency incl. real-time video
 - Models/consumer use: no infrastructure needed (PP links)
- Concern that 2.4 GHz may get overcrowded, 5.8 GHz gets also more crowded.

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Professional Use (i)

- Highly professional use may use the aviation infrastructure used for communication, navigation, surveillance, such as VHF, GPS and Automatic Dependant Surveillance.
- MFCN may provide solutions.
- ITS (802.11/11p/ITS G5 as well as LTE V2X) may provide solutions.
- Specific solutions using e.g. PMR, PMSE, C-band, even higher bands (PMP solutions), mostly based on indiv. licensing
- Other professional solutions not clear yet.
- Results of market surveillance campaign in ADCO RED in 2015 (overall compliance is modest). Some UAS/drones use license-exempt but with higher emissions than allowed.

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Professional Use (ii)

- Numerous drones applications are pushing for very high payload throughput.
- A very stable, reliable spectrum access for CC is needed.
- Small drones: advantage if CC and payload are on the same or nearby frequencies.
- Proposals were made to create a new work item in WG FM for identifying (harmonising) spectrum for UAS/drones; ETSI can be invited to support the work based on consolidated proposals and open specifications/standards.

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The 'U-Space':

- Will start with e-registration, e-identification, geo-awareness etc; may end in a sort of network with many more features rel. to the planned flight path and 'traffic awareness'
- Precise coexistence with ATM may need some specifications
 - reference points
 - Definition of air spaces (relationship of ATM and the U-Space)
 - Helicopter/drones issue at low heights above ground
 - Full or better integration may be needed
 - High altitude drones use the U-space during take-off and landing
 - Low altitude drones may need an interface with ATM in the future. Many initiatives discuss this possibility at this time.

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Need for compatibility studies?

- 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 much easier due to their exposed location in the sky.
- There was a proposal to check existing studies, as appropriate, whether some additional studies are needed.

Views from CEPT administrations, market surveillance, EC

Views from European Commission (EC):

- Commission Decision on SRDs provides spectrum designations for unlicensed use (27 MHz, 433 MHz, 863 – 870 MHz, 2,4 GHz, 5,8 GHz).
- Commission Decision on Video PMSE (2010 – 2025 MHz).
- Commission Decisions on terrestrial systems capable of providing ECS (Electronic Communications Services);
Allocations to the ‘mobile service’: 1800 MHz, 2 GHz, 3,6 GHz,
Allocations to the ‘mobile service except aeronautical mobile service’:
700 MHz, 800 MHz, 900 MHz, 2.6 GHz.
- 5G Action Plan: 5G everywhere in 2025.
- Discussions on drones started in 12/2017 in the Radio Spectrum Committee (RSC), further discussions based on developments and on views from Member States.
- Questions: unclear allocations of spectrum?, new bands for the ‘Open’ and ‘Specific’ categories.

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Views from CEPT administrations, market surveillance, EC

Views from CEPT administrations:

- Specific frequencies for UAS / drones not defined in national frequency tables.
- Illegal use because of too restrictive power limits.
- CEPT should work on identification/harmonisation of spectrum for drones:
 - Different spectrum for CC and payload?
 - Suitability of MFCN for drones?
 - Regulatory challenges in the scope of 5G
- Suitability of MFCN (ECS)? for professional drones, because of:
 - exclusion of 'mobile aeronautical service',
 - MFCN planned for land coverage (down-tilt of antennas, steerable antennas in 5G),
 - MFCN at 2.6 GHz: coexistence with radars within 2.7 – 2.9 GHz.

Views from CEPT administrations, market surveillance, EC

Views from CEPT administrations (cont.):

- Market demand for dedicated band(s) for professional drones?
- Possible bands for future studies (for discussion):
 - 1880 – 1900 MHz (DECT use to be considered) for governmental drones;
 - 1900 – 1920 MHz (coexistence with MFCN above 1920 MHz) for professional and governmental drones;
 - 5000 – 5010 MHz (e.g. for low power LOS drones) for professional drones.
- Market surveillance actions on imported equipment (operating in unauthorised bands).

What next ? Use of cellular networks for drones

- **Strong interest from some industry representatives for covering payload, C2 and U-Space to the extent possible through cellular networks (MFCN).**
- **Work item in ECC (ECC/PT1) seems to cover all aspects :**
 - **Operators/industry will manage solutions to limit the impact on their own cellular network**
 - **Need to address adjacent blocks and adjacent services, when relevant**
 - **Need to address potential cross-border issue**
 - **The result of the WI will provide the necessary conditions to operate drones over MFCN networks (without prejudice of U-Space considerations)**
- **Actions:**
 - **to define under which spectrum technical conditions, where appropriate, operators may operate drones on MFCN networks;**
 - **to clarify what could be restrictions for drones in using bands allocated to the 'mobile service except aeronautical mobile service'.**

What next ? Civil aviation requirement

- **U-Space concept is under development outside CEPT, additional input to CEPT/ECC is needed from aviation organisations.**
- **Functionalities which may require spectrum harmonisation:**
 - **E-Identification**
 - **Geo-awareness**
 - **Anti-collision**
 - **Other ?**
- **Civil aviation will need to define how to provide these functionalities and possible spectrum requirement**
- **Action: CEPT and relevant organisations (EASA, Eurocontrol, ETSI, ...) should cooperate with each other during the ongoing process.**

What next ? Other needs

- **The concept of "professional" drones may be questionable but several spectrum needs are emerging**
- **Spectrum currently used in license-exempt bands has some drawbacks**
 - **Many bands (i.e. 5 GHz) are not available for drones operations**
 - **Risk of 2.4 GHz and 5.8 GHz becoming overcrowded**
 - **Power restrictions limit the range of operation and the reliability**
 - **Some drones operations may require a more reliable framework, e.g. by individually and/or temporarily licensing of spectrum**

What next ? Other needs

- **The current work items in WG FM covers these elements, and focus may be brought to:**
 - **Relaxation of the indoor restriction for the band 5150-5250 MHz (outcome on AI 1.16 of WRC-19 on WAS/RLANs in 5150 MHz - 5925 MHz may have an impact)?**
 - **Provide a solution for more reliable and longer range CC for drones (also by taking into account the band 1900-1920 MHz).**
 - **To recognise specific needs for governmental drones.**
 - **To recognise the possibility of using some relevant PMSE bands for payload (e.g. Video).**

- **WG FM will review the Work Item based on the outcome of the Workshop.**

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Thank you very much

Link to presentations:

<https://cept.org/ecc/cept-workshop-on-spectrum-for-drones-uas/>

The workshop outcome will be discussed in ECC, WG FM and ECC PT1. It is planned to publish an article in the ECC Newsletter.

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