



Overview of Spectrum Use by Flying Models

EUROPEAN MODEL FLYING UNION
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EUROPEAN MODEL FLYING UNION
Representing Model Fliers in Europe



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What is EMFU?

The EMFU is the biggest European association for aeromodeling. It represents 15 aeromodelling clubs or national aeroclubs from 13 countries representing about 130.000 pilots and is member of Europe Airsports. The EMFU was founded in spring 2017 and is located in Vienna.

The purpose of the EMFU is to support and represent the interests of model flying at the European level, in respect of all relevant regulatory matters.

For EASA the EMFU is the main partner concerning aeromodeling. One member of EMFU (DAeC / German Aero Club) is involved in the work on ETSI EN 300 328 which is the main standard for radio control systems via the membership in ISAD e.V. .



Current Frequency Ranges used

In former times in Europe mainly the 27, 35 and 40 MHz bands have been used for R/C. There also have been or are some national allocations in the 41, 72 and 433 MHz band. Due to the migration of model control to 2.4 GHz, these VHF-bands more and more lose significance but still are in use.

Today the main band for radio control and telemetry is the 2.4 GHz band. In most of the cases the telemetry system meanwhile is an integral part of the control system. But there are also standalone telemetry systems on the market that use the 2.4 GHz 868 MHz and 433 MHz band. Some systems even use the audio channel of the video link for this purpose.



Current Frequency Ranges used

Some manufacturers use a 2.4 GHz WiFi video link and an R/C system operating in the 5.8 GHz band. There are also systems using the 868 MHz band as a fallback link in case of a loss of connection of the 2.4 GHz link.

Many of the professional systems for small drones use aero modeling R/C systems operating on 2.4 GHz.



Requirements for Radio Systems used for Aeromodeling

There is a very wide variety of forms of aeromodeling with different requirements. The technology used for R/C systems has to cover all these requirements. The main radio-requirements are:

- Spectrum
 - Parallel operation of numerous systems for R/C and videolinks
 - Sufficient bandwidth for R/C and videolinks

- Range
 - BVLOS operation

- Robust radio link
 - High jamming margin
 - Resilience against reflections and polarisation changes
 - Resilience against fast changing propagation situations for high speed models



Requirements for Radio Systems used for Aeromodeling

- Sufficient number of control channels
- Telemetry
- Latency. To give an example of the latency limits see the following video from the aerea of FPV-Race.

Note: This a real time record from the onboard camera. Not time lapse!





Technology of 2.4 GHz R/C Equipment

- Frequency hoppers and/or hybrid systems using DSSS and/or FEC (i.e. Turbo Coders)
- 20 dBm EIRP
- 15 to 80 channels used
- Channel spacing 1 – 5 MHz
- OBW 300 kHz – 3 MHz
- Receiver diversity for polarisation (circular, linear)
- Bidirectional (telemetry)
- Remote programming of flight control units
- WiFi / Bluetooth implemented in high end systems for programming or monitoring



Technology of 5.8 GHz Video Equipment

- Mainly analog FM systems
- Also a few digital systems
- 14 dBm EIRP
- 4 -5 channels parallel analog channels
- Channel spacing up to 40 MHz
- OBW ~20 MHz
- Receiver diversity for polarisation (circular, linear)
- Partly ground station antenna trackers with hi-gain receive antennas
- Sound- or video channel used for telemetry
- On Screen Display



Conclusion

- Need for additional spectrum for aero modelling due to overcrowding of the 2.4 GHz band
- Inclusion of models operated in the framework of model clubs or associations in the Specific Category or §6 of the „Drone Regulation“ in new spectrum allocations with limited technical requirements.
- Within the Specific Category there is no general differentiation between commercial and non-commercial UAV. So why in radio?
- Need for low latency systems without the need for any infrastructure for radio control (point to point link)
- Need for additional spectrum for low latency video-links



Thank you for your attention

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