

Draft CEPT Brief on agenda item 1.5

Agenda item 1.5: “to consider spectrum requirements and possible additional spectrum allocations for aeronautical telecommand and high bit-rate aeronautical telemetry, in accordance with Resolution 230 (WRC-03)”

Issue

This agenda item covers the following issues:

- 1 considering the spectrum required to satisfy wideband aeronautical mobile telemetry requirements and associated telecommand above 3 GHz;
- 2 reviewing, with a view to upgrading to primary, secondary allocations to the mobile service in the frequency range 3-16 GHz for the implementation of wideband aeronautical telemetry and associated telecommand;
- 3 considering possible additional allocations to the mobile service, including aeronautical mobile, on a primary basis in the frequency range 3-16 GHz for the implementation of wideband aeronautical telemetry and associated telecommand;
- 4 designating existing mobile allocations between 16 and 30 GHz for wideband aeronautical telemetry and associated telecommand.

Preliminary CEPT position

Issue 1:

CEPT supports at least 105 MHz additional spectrum requirements to satisfy wideband aeronautical mobile telemetry requirements above 3 GHz. This is to satisfy *interalia* the requirements for flight testing.

Issue 2:

No secondary allocation to the mobile service in the frequency band 3 – 16 GHz has been identified by CEPT for the implementation of wideband aeronautical telemetry and associated telecommand.

Issue 3:

Due to successful results of sharing studies to accommodate spectrum requirements for telemetry, CEPT supports a primary allocation to the aeronautical mobile service in the band 5030-5091,5091-5150 and 5150-5250 MHz for telemetry applications limited to those systems for which compatibility analyses have been completed by WRC-2007 and which are specified in the Recommendation ITU-R M.[AMT 5 030-5 250 MHz].

CEPT supports hard limit per telemetry station, based on a worst case scenario for flight testing deployment, in order to protect existing services and AM(R)S proposed by Europe under agenda item 1.6.

CEPT does not support any additional AMS allocation for the use of UAVs except for UAV flight testing as it is assessed that the current MOBILE allocation below 16 GHz should be sufficient for the short term requirement. However, there is a need to support the command and control of UAVs and whilst sufficient information has not been available to deal with this at this Conference it is expected that this will be addressed at a future World Radio Conference.

CEPT supports a future agenda item, or part thereof, to study generic aeronautical telemetry systems. This could be included in the proposed WRC-2011 future agenda item for UAV.

Issue 4:

Due to the unavailability of the aeronautical technology it is assessed that the bands already allocated to mobile service above 16 GHz are not suitable for the short term telemetry requirement. Therefore the CEPT position is to not further study these bands.

CEPT views regarding the bands under consideration within ITU-R

- 4 400 – 4 940 MHz (short term): This band is a harmonized NATO band, extensively in use by NATO countries in particular for transportable radio relay systems. This band is allocated to the mobile service and may be used by wideband AMT in accordance with RR. Recent studies within ITU-R have indicated that sharing between AMT and fixed links would be difficult (separation distances of up to 450km might be required). Therefore, CEPT is of the view that this band should not be identified for AMT operation in the Radio Regulations.

- 5 030 – 5 091 MHz (short term): This is the core MLS band. The possible use of this band for wideband AMT is under the consideration.

- 5 091 – 5 150 MHz (short term): CEPT supports the use of this band for AMT.

- 5 150 – 5 250 MHz (short term): CEPT supports the use of this band for AMT.

- 5 925 – 6 700 MHz: This band is heavily used for fixed links and fixed satellite links in CEPT countries. This band is allocated to the mobile service and may be used by wideband AMT in accordance with RR. Recent studies within ITU-R have indicated that sharing between AMT and fixed links would be difficult (separation distances of up to 450km might be required). Therefore, CEPT is of the view that this band should not be identified for AMT operation in the Radio Regulations.

Background

Studies were carried out by ITU-R WP 8B and the proposal for correct definitions for aeronautical telemetry and aeronautical telecommand was introduced. It was noted that currently there is no definition in the Radio Regulations concerning either the aeronautical telecommand or the aeronautical telemetry. But it is considered that for the work related to agenda item 1.5, definitions given in articles 1.131 and 1.134 for telemetry and telecommand are sufficient.

Therefore, CEPT can accept specific definitions for aeronautical telemetry and telecommand in the Draft New Report ITU-R M.[AMT] “Operational Description of Aeronautical Telemetry” but do not support their formal insertions in the Radio Regulations.

Flight testing

The overall necessary bandwidth for civil aircraft flight testing was preliminary estimated at the level of about 60 MHz in a frequency below 7 GHz (below 5 GHz preferred). This band could be divided into five channels of 12 MHz as five aircraft could be tested simultaneously in flight. Nevertheless, the upper and the lower channels can not be separated by more than 500 MHz (approximately 10% of the carrier frequency). A subsequent study has indicated that the necessary bandwidth is 105 MHz.

A proposed solution is to consider the allocation of the band 5030-5250 MHz for the AERONAUTICAL MOBILE service in order to meet at least the 105 MHz bandwidth requirement.

Sharing studies have been undertaken in the band 5 030-5 250 MHz with the following current allocations ARNS (5 030-5 150 MHz), FSS (Earth-to-space feeder links) (5 091-5 250 MHz), MS except aeronautical (5 150-5 250 MHz).

Studies with AMS(R)S (5 030-5 150 MHz), FSS (space to Earth feeder links) (5 150-5 216 MHz), RDSS (space-to-Earth feeder links) (5 150-5 216 MHz), ARNS (5 150-5 250 MHz), have not been undertaken within the ITU-R as no technical parameters of systems using the bands have been provided.

Studies have also been undertaken with the AM(R)S limited to surface airport application which is proposed to be allocated in all or portions of the band 5 000-5 150 MHz at WRC-07 under Agenda item 1.6. Allocation to AMS for security applications (AS) in the band 5 091 5 150 MHz at WRC 07 is also considered under Agenda item 1.6, however studies are not yet completed.

ARNS (MLS) ↔ AMS (AMT)

The MLS (Microwave Landing System) currently operates between 5030 MHz and 5091 MHz. The future of this system between 5091-5150 is under review. The band 5091-5150 MHz is currently identified for the MLS and may be only used if MLS requirements can not be satisfied in the band 5030-5091 MHz (See Resolution 114 (WRC-03) *recognizing b*). There are presently no safety-of-life systems operating in the band 5091-5250 MHz.

The upper portion of the MLS band, 5091-5150 MHz, is also a candidate for the future Aeronautical Mobile Infrastructure including ATC exchange, AOC and security systems studied under WRC Agenda item 1.6.

Studies have shown that the compatibility between ARNS (MLS) and AMS (AMT) is proved. This compatibility requires safe distances (or output transmitter decrease or specific antenna pattern) if the transmitters are using the same channel.

As the MLS band was identified as a potential band to be used for telemetry links for airplanes under tests, a new ITU-R recommendation is under development for the computation the separation distance between the MLS station and the telemetry transmitter.

FSS (non-GSO MSS fiderlinks) ↔ AMS (AMT)

Studies with FSS and AMS for AMT concluded that 3% $\Delta T_s/T_s$ ¹ would be available for the aggregate interference caused by AMS (AM(R)S and AMS/AS for Agenda item 1.6 plus AMS/AMT for Agenda item 1.5) in the band 5 091-5 150 MHz. In the band 5 091-5 150 MHz it was shown that for an operational scenario with 21 co-frequency aircraft operating simultaneously in a single FSS receiver ground footprint the interference from AMT into the FSS receiver is below a $\Delta T_s/T_s$ of 1%.

In the band 5 150-5 250 MHz, studies with FSS and AMS for AMT concluded that (3-x)% $\Delta T_s/T_s$ would be available for the aggregate interference caused by AMS, where x is the percentage (if any) contributed by applications in the ARNS plus any applications other than MS wireless access systems (WAS) and the proposed AMT application. This portion of the interference excludes that due to MS (WAS) which are allowed 3%. In this band it was shown that for one operational scenario with 21 co-frequency aircraft operating simultaneously in a single FSS receiver ground footprint, the interference from AMT into the FSS receiver is below a $\Delta T_s/T_s$ of 1%. The difference in the interference environment, i.e., MS (WAS), in the 5 150-5 250 MHz band compared to the 5 091-5 150 MHz band, must be recognized in the apportionment of interference among the potential services sharing with the FSS.

MS (WAS) ↔ AMS (AMT)

Studies with MS (WAS) and AMT in the frequency band 5 150-5 250 MHz have confirmed the need for an I/N value of -6 dB for the protection of MS (WAS). The MS (WAS) characteristics that need to be taken into account and hence the maximum pfd limit of an AMT transmitter has yet to be agreed.

AM(R)S ↔ AMS (AMT)

Studies with AM(R)S and AMT in the frequency band 5 030-5 150 MHz have confirmed the need for an I/N value of -6 dB for the protection of a new airport surface radio local area network (RLAN), based on the IEEE standard 802.16e in Annex 3 to DN Recommendation ITU-R M.[8/167]. The AM(R)S characteristics that need to be taken into account in these studies and hence the maximum pfd limit of an AMT transmitter in the view of an airport surface radio local area network has yet to be agreed.

Unmanned Aerial Vehicles (UAVs)

Separately from the Aircraft testing telemetry requirements there are also needs to accommodate existing UAVs and an anticipated growth in UAV demand in the next decade.

One study showed that for an aeronautical scenario on a wide area the simultaneous use of several UAVs at different altitudes and for various civilian purposes involves an additional payload bandwidth (to those used in 2.3-2.4 GHz range) for high bit rate telemetry and telecommand links of around 700 MHz (potentially up to 1 GHz).

¹ The increase (ΔT_s) in the satellite noise temperature (T_s).

Since this need is expressed for the short term, the adapted allocation might be found below 16 GHz (below 15 GHz preferred).

UAVs require some generic mobile AMS or AMSS allocations. Some UAV will need radio spectrum for safety and regularity of flight functions which could result in the need for additional AM(R)S or AMS(R)S allocations (same functions than those of the conventional manned aircraft that requires AM(R)S or AMS(R)S allocations) which is likely to be the subject of a CEPT proposal for a future World Radio Conference agenda item. However the new AMSS allocations are not under the consideration within WRC-07 agenda item 1.5.

List of relevant documents

- Resolution 230 (WRC-03) - Consideration of mobile allocations for use by wideband aeronautical telemetry and associated telecommand
- CEPT/ERC Recommendation 62-02 E – “Harmonised frequency band for civil and military Airborne telemetry applications”
- ERC Report 25 - The European table of frequency allocations and utilisations covering the frequency range 9 kHz to 275 GHz
- Draft New Report ITU-R M.[AMT], “Operational Description of Aeronautical Telemetry.” (Annex 4 to Doc. 8B/98)
- PDNR “Method for determining coordination distances, in the 5 GHz band, between the international standard microwave landing system (MLS) stations operating in the aeronautical radionavigation service and transmitters operating in aeronautical mobile service for aeronautical telemetry and telecommand usage” (Doc. 8B/Temp/192)
- Working document towards a preliminary draft new report : “Report giving example of compatibility distances between the MLS receivers and the AMT aeronautical stations“Example of[coordination] distance determination, in the 5 GHz band, between the international standard microwave landing system (MLS) stations operating in the aeronautical radionavigation service and transmitters operating in aeronautical mobile service (AMS) to support telemetry” (Doc. 8B/ TEMP /241)
- Combined PDNReports on sharing with AMT at 5 GHz “Compatibility between proposed systems in the aeronautical mobile service and the existing fixed-satellite service in the 5 091-5150 MHz band” (doc. 8B/ TEMP /240)
- Preliminary draft new recommendation ITU-R [AMT 5 030 – 5 250 MHz] “Technical and operational requirements for aircraft stations of aeronautical mobile service limited to transmissions of telemetry for flight testing in the band 5 030-5 250 MHz” (Doc. 8B/TEMP 243)
- CPM Report (Section 1/1.5)

List of relevant ITU-R Recommendations

Proposals from outside CEPT

Regional telecommunication organisations

APT (January 2007)

APT Preliminary views

APT Administrations support the outcomes of studies under Resolution 230 (WRC-03) into the requirements for justifiable wideband aeronautical mobile telemetry (AMT) and associated telecommand spectrum above 3 GHz, and notes that considering (d) of this Resolution identifies a need to protect existing services.

Any regulatory provisions permitting the operation of AMT in an ARNS or AM(R)S band should be conditional upon the completion of rigorous and conclusive ITU-R studies first which demonstrate that sharing will not have any implications for the safety of operations of affected aviation systems.

Among the five candidate bands (4 000 - 4 940 MHz; 5 030 – 5 091 MHz; 5 091 - 5 150 MHz; 5 150 - 5 250 MHz; and 5 925 – 6 700 MHz) identified by ITU-R, APT Members are of the view that 4 400 - 4 940 MHz; 5 030 - 5 091 MHz; 5 150 - 5 250 MHz; and 5 925 - 6 700 MHz bands are not feasible for wideband aeronautical telemetry.

The need to find additional spectrum, in accordance with the provisions of Resolution 230 (WRC-03), for wideband telemetry and telecommand applications in certain geographic locations associated with the flight test of aircraft and other airframes is supported, based on the results of ITU-R studies and the adequate protection of existing and planned services with allocations already within the band.

The identification and allocation of suitable spectrum, in accordance with the provisions of Resolution 230 (WRC-03), for the safe control of Uninhabited Aerial Vehicles (flight) operations is also supported provided this does not adversely affect existing or planned services. All spectrum requirements for payload (i.e. non-flight control operations) applications should fall within the Mobile service allocation.

These allocations, to be made to the mobile or aeronautical mobile service, should in principle not be made in bands currently allocated to the aeronautical mobile (R) service (AM(R)S), the aeronautical radionavigation service (ARNS) or their satellite equivalents. If allocations are made to such bands regulatory priority shall be given to those aeronautical safety services.

APT Members do not support the identification of the band 6725-7025 MHz for aeronautical mobile telemetry because this band is part of the frequency bands used in Appendix 30 B which is a world-wide treaty binding agreement (these bands are currently used or will be used for infrastructure telecommunication networks e.g RASCOM

APT Members support an allocation to the aeronautical mobile service (AMS) in the band 5 091 - 5 150 MHz for aeronautical mobile telemetry (AMT) for flight testing under the conditions that:

- a) adequate protection is provided to existing and planned usage of aeronautical radionavigation service (ARNS) and fixed-satellite service (FSS) allocations; and

- b) the AM(R)S allocation shall take precedence over the use of the band by AMT if an allocation is made to aeronautical mobile (R) service (AM(R)S) under WRC 07 Agenda item 1.6 in this band.

CITEL (October 2006)

Brazil, Canada, Uruguay and US are of the view that there is no need for additional RR Article 1 definitions of AMT or UAV. These administrations are also of the view that no spectrum requirements for telecommand need to be considered under this agenda item.

Brazil, Canada and US propose to allocate 5 091-5 150 MHz to aeronautical mobile service to support AMT.

Dominican Republic and US agree that 4400-4940 MHz and 5925-6700 MHz bands are suitable for AMT. Conversely, Brazil's position is that 4400-4940 MHz and 5925-6700 MHz bands are not suitable for AMT. Additionally, the US proposes that the band 5150-5250 MHz is not suitable for AMT (i.e., NOC in 5150-5250 MHz).

RCC Preliminary view:

In identifying the bands for aeronautical telemetry and telecommand it is necessary first of all to consider the bands already allocated to the mobile service on the primary basis. The decision on an additional usage of any band for the aeronautical telemetry and telecommand shall be taken based on well founded requirements, including the ICAO requirements.

It is proposed to revise No.5.342, in order to clarify provisions of the Radio Regulations on application of the aeronautical mobile service systems in the 1429-1535 MHz band not only for aeronautical telemetry, but also for telecommand applications.

In order to use the band 1429-1535 MHz not only for the aeronautical telemetry, but also for telecommand it is proposed to revise No.5.342.

The band 5091-5150 MHz may be considered as a «candidate» band for wideband aeronautical telemetry and associated telecommand if the relevant ITU-R Recommendations on sharing with microwave landing system (MLS) are developed.

International organisations

ICAO Position (Doc. ECC/CPG07/PT3(05)043)

To support the allocation of suitable spectrum for non-safety related aeronautical telemetry and associated telecommand systems and applications, in the bands between 3 – 30 GHz, in accordance with the provisions of Resolution 230 (WRC-03). These allocations, to be made to the mobile or aeronautical mobile service, should, in principle, not be made in bands currently allocated to the aeronautical mobile (R) service (AM(R)S), the aeronautical radionavigation service (ARNS) or their satellite equivalents. This also applies to the non-safety related requirements for aeronautical telemetry and associated telecommand applications for UAVs.

To support the development of regulatory text to accommodate new service definitions, if required.

To support the continued use and protection of frequency bands currently designated for the use by aeronautical telemetry.

Note.— ICAO is currently studying, through the relevant expert panels, if additional allocations to the aeronautical mobile service, for the purpose of aeronautical telemetry, can be made in the band 5 091 - 5 150 MHz. Based on the results of these studies, the ICAO Council may agree on amending the ICAO Position with regard to these allocations.

NATO (February 2007)

NATO Military Position:

- (a) The identification of suitable spectrum for aeronautical telemetry and the associated aeronautical telecommand is supported.
- (b) Existing essential military spectrum use must be adequately safeguarded.

Regional organisations

European Aviation Spectrum frequency consultation group (European Aeronautical Common Position) (Doc. ECC/CPG07/PT3(06) 012):

To support the proposals addressing the need for additional bandwidth for wideband telemetry and telecommand in the bands 5091-5150 MHz. Any such additional allocation must not impede implementation of MLS and new AM(R)S systems.

The core MLS bands 5030-5091 must be reserved for MLS.

To support the identification and allocation of suitable spectrum for UAV operations provided they do not adversely affect existing or planned aeronautical systems.

Actions to be taken

- 1) complete drafting PDNR ITU-R M[AMT 5030-5250 MHz];
- 2) complete drafting PDNR ITU-R M[MLS-AMS] (taking AI1.6 into account);
- 3) complete drafting PDN Report [AMS-FSS] (taking AI1.6 into account);
- 4) complete EMC study between AMS/AMT and AMS/AS (taking AI1.6 into account)