

## UNITED STATES OF AMERICA

### DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE<sup>1</sup>

**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)**;

**Background Information:** This agenda item addresses a growing demand for spectrum that is allocated for aeronautical telemetry and associated telecommand. There is a large and growing shortfall in spectrum that is necessary to conduct aeronautical telemetry. The shortfall is exacerbated by the loss of telemetry spectrum diverted to other than telemetry applications. As indicated in the responses to ITU-R Question 231/8, additional spectrum is necessary due to rapidly increasing data rates associated with the testing of new and emerging technologies. For example, newer technologies rely increasingly on high-resolution video for monitoring aircraft functions or increased use of computer based aircraft systems. Without access to additional spectrum, aeronautical development would be subject to escalating delays and costs, and the growth of aerospace industry would be impaired (including equipment manufacturers, civilian programs and test ranges, and airlines). New worldwide telemetry spectrum will aid numerous countries and the international aeronautical community, as administrations continue to support their national airlines and some administrations initiate their own test programs. Existing international allocations used for aeronautical telemetry will need to remain available.

Aeronautical mobile telemetry (“AMT”) is an application within the mobile service. Depending on the extent to which new AMT spectrum requirements can be fulfilled using primary mobile service allocations, it is important that the suitability of additional spectrum for AMT be studied. International recognition of bands suitable for AMT will not only encourage international harmonization of test equipment, but also provide assurance to Administrations that, based on technical studies conducted in the ITU-R, implementation of telemetry systems can be accomplished by those Administrations wishing to do so without disrupting other services using the bands. This will also enable manufacturers to offer prospective customers aircraft with common test equipment packages, and thus help airlines achieve additional economies in the aircraft life-cycle cost. Moreover, by establishing conditions under which AMT use of a band would be suitable, incumbent users of the spectrum can be assured that they will not experience unacceptable interference, and manufacturers and test ranges will have a measure of additional certainty for the substantial investment in range infrastructure that will be incurred in equipping to use new bands deemed suitable for AMT.

The need for additional spectrum has been studied by several administrations who indicate that as much as an additional 650 MHz may be required for aeronautical flight test telemetry. The requirement may differ depending on national and regional needs. It is not necessary to fulfill all AMT requirements in only one band. The new requirements for aeronautical telemetry are only in the air-to-ground direction inasmuch as telecommand functions (i.e., ground-to-air transmissions) can be accommodated in existing bands. In addition, this new AMT spectrum will not be used for the

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<sup>1</sup> This proposal is an additional proposal to an earlier U.S. proposal on this agenda item and this is a modified version.

protection of life and property. The latter AMT applications will continue to be accommodated in existing bands (see Nos. **5.342**, **5.343**, and **5.394** in the Radio Regulations). Hence, aeronautical mobile telemetry applications in new spectrum will not require the level of protection associated with operations in existing telemetry bands. However, the AMT application will be moving into bands, such as the 6 GHz band, that are used for critical applications such as public safety communications (including police and fire vehicle dispatch), coordinating the movement of railroad trains, controlling natural gas and oil pipelines, regulating the electric grid, and backhauling wireless telephone traffic.

ITU-R WP 8B conducted numerous studies of bands that could be used to satisfy the requirements of aeronautical telemetry applications. Available technologies, signal fading considerations, and the scope of agenda item 1.5 dictate that the new wideband AMT spectrum requirements be fulfilled in the 3 GHz to 7 GHz frequency range. With the cooperation of other responsible WPs, several bands were studied for suitability to implement AMT given the other co-primary services in the band. These are the 4 400-4 940, 5 925-6 700, and 5 091-5 150 MHz bands. Portions of these bands, such as the 5925 - 6700 MHz band, are used for public safety communications and other applications that require a high degree of protection. It is expected that the implementation of telemetry may require avoiding co-frequency operations with local services in some of the bands. This will likely mean that the spectrum requirement for AMT would be satisfied using portions of each of the bands studied and deemed suitable for AMT implementation. Suitable means, in this context, that AMT can be implemented compatibly with other co-primary services utilizing the band, assuming the implementation is in accordance with the established sharing criteria.

ITU-R studies have determined conditions under which aeronautical mobile telemetry for flight test purposes can be implemented in these bands without adversely affecting the operation of existing systems and allocated services. The ability to implement AMT in some areas and in some portions of the bands may be restricted based on deployment density of other co-primary service stations, such as the Fixed Service (FS) stations, in the same vicinity. In cases where AMT operations could impact Radio Astronomy observatories, it may be possible to arrange AMT time-sharing with those observatories to enable AMT use of the 4 825-4 835 MHz band.

In the past, terms such as “designated” or “identified” have been used in the Radio Regulations with respect to certain technologies and bands to encourage technology implementation on a worldwide basis without making the use by administrations mandatory and without establishing any priority of use. Since the spectrum requirements and the conditions under which AMT will be implemented can vary by administration, an approach is proposed to simply indicate the suitability of certain bands for the implementation of AMT based on compatibility studies. This approach provides valuable information while maximizing the flexibility of implementing AMT. A finding that spectrum is suitable for AMT implementation inherently would not establish any priority of use or preclude use of the bands by other co-primary services.

Any authorization of AMT operations within these bands would be decided by individual administrations, and would be specifically limited to testing of aircraft at designated flight test areas in the air-to-ground direction within those individual countries. According to No. **5.444** of the Radio Regulations, the 5 091-5 150 MHz band is to be used by the MLS (Microwave Landing System) with precedence given to this international standard system. However, the band 5 091-5 150 MHz is not yet in use by MLS.

The 5 091-5 150 MHz band is already allocated to the aeronautical radionavigation service (ARNS) on a primary basis in all Regions and is also allocated to the fixed-satellite service (FSS) (Earth-to-space)

on a primary basis. This FSS allocation is limited to feeder links of non-geostationary mobile-satellite systems in the mobile-satellite service and is subject to coordination under No. **9.11A**. Test aircraft are not intended to use ground-to-air transmissions in this ARNS band. Administrations are also considering the band 5 091-5 150 MHz under agenda item 1.6 for allocation to the aeronautical mobile (R) service. Studies have shown that AMT can share with both the FSS and the possible AM(R)S system in the band 5 091-5 150 MHz.

Use of the 4 400-4 940 MHz, 5 925-6 700 MHz, and 5 091-5 150 MHz bands for aeronautical telemetry is subject to coordination with FSS earth stations in accordance with Article **9** of the ITU Radio Regulations.

ITU-R studies have not adequately demonstrated that aeronautical telemetry or telecommand applications could share spectrum with other uses in the band 5 150 MHz-5 250 MHz.

### **Proposal**

#### **USA/ /01 ADD**

**5.[441A]** The bands 4 400-4 940 MHz and 5 925-6 700 MHz are suitable for the implementation of aeronautical mobile telemetry applications for flight testing by aircraft stations. The provisions of No. **1.83** apply. Any such use does not preclude the use of these bands by other mobile service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority in the Radio Regulations. Resolution [**AMT4-6GHz**] shall apply.

**Reasons:** A footnote as above could be used to satisfy a portion of the 650 MHz spectrum requirement. The advantage of such a footnote is that it merely states that the bands are suitable and that, via the provisions of Resolution [**AMT4-6GHz**], AMT for flight testing could share spectrum while not precluding the use of the bands by other co-primary services.

#### **USA/ /02 ADD**

**5.[444C]** The band 5 091-5 150 MHz is also allocated to the aeronautical mobile service, limited to flight test telemetry transmissions by aircraft stations. The provisions of No. **1.83** apply. Any such use does not preclude the use of this band by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. Resolution [**AMT5GHz**] shall apply.

**Reasons:** This allocation is necessary for implementation of AMT in the band 5 091-5 150 MHz. The footnote will ensure that the allocation to AMS is limited to air-to-ground flight test telemetry only, while not precluding the use of the bands by other co-primary services. Resolution [**AMT5GHz**] specifies the sharing conditions in the band.

#### **USA/ /03 MOD**

**5.442** In the bands ~~4 825-4 835 MHz~~ and 4 950-4 990 MHz, the allocation to the mobile service is restricted to the mobile, except aeronautical mobile, service. In the band 4 825-4 835 MHz, applications in the aeronautical mobile service are limited to aeronautical mobile telemetry for flight testing in the air-to-ground direction. Resolution [AMT4-6GHz] shall apply.

**Reasons:** This modification to No. **5.442** exempts AMT from the aeronautical mobile exclusion.

**USA/ /04 MOD**

**2 700-4 800 MHz**

Allocation to services		
Region 1	Region 2	Region 3
....		
<b>4 400-4 500</b>	FIXED MOBILE <b>ADD</b> 5.[441A]	
<b>4 500-4 800</b>	FIXED FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE <b>ADD</b> 5.[441A]	
....		

**4 800-5 570 MHz**

Allocation to services		
Region 1	Region 2	Region 3
....		
<b>4 800-4 990</b>	FIXED MOBILE <b>MOD</b> 5.442 <b>ADD</b> 5.[441A] Radio astronomy 5.149 5.339 5.443	
<b>5 030-5 150</b>	AERONAUTICAL RADIONAVIGATION 5.367 5.444 5.444A <b>ADD</b> 5.[444C]	
....		

**5 570-7 250 MHz**

Allocation to services		
Region 1	Region 2	Region 3
....		
<b>5 925-6 700</b>	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE <b>ADD</b> 5.[441A] 5.149 5.440 5.458	
....		

**Reasons:** The appropriate modifications to the table of allocations have been made to reflect proposals 1 through 3.

**USA/ /05 NOC**

**4 800-5 570 MHz**

<b>Allocation to services</b>		
<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>
<b>5 150-5 250</b>	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B 5.446 5.447 5.447B 5.447C	

**Reasons:** The aeronautical telecommand and high bit-rate aeronautical telemetry is not compatible with the existing services allocated in band 5150-5250 MHz.

USA/ /06 ADD

DRAFT RESOLUTION [AMT4-6GHZ] (WRC-07)

**Use of the bands 4 400-4 940 MHz and 5 925-6 700 MHz by an aeronautical mobile telemetry application in the mobile service**

The World Radiocommunication Conference (Geneva, 2007),

*considering*

- a) that studies have been conducted within the ITU-R concerning the sharing and compatibility of aeronautical mobile telemetry for flight testing with other services in the bands 4 400-4 940 and 5 925-6 700 MHz;
- b) that the bands 4 400-4 940 MHz and 5 925-6 700 MHz are suitable for the implementation of aeronautical mobile telemetry applications for flight test purposes, when the criteria in resolves 2 are used;
- c) that spectrum efficiency is enhanced in situations where new applications can be implemented compatibly in bands that are heavily occupied;

*recognizing*

- a) that the bands 4 400-4 500 MHz and 4 800-4 940 MHz are allocated to the fixed and mobile services on a primary basis;
- b) that the band 4 500-4 800 MHz is allocated to the fixed, fixed-satellite (space-to-Earth), and mobile services on a co-primary basis;
- c) that the band 4 825-4 835 MHz is allocated to the radio astronomy service on a primary basis in Argentina, Australia and Canada (see **No 5.443**), and that the band 4 800-4 990 MHz is allocated to the radio astronomy on a secondary basis worldwide and that **No 5.149** applies;
- d) that **No. 5.442 (MOD)** applies to aeronautical mobile telemetry for flight testing operations in the band 4 825-4 835 MHz;
- e) that the band 5 925-6 700 MHz is allocated to the fixed, fixed-satellite (Earth-to-space), and mobile services on a co-primary basis;
- f) that the use of the bands 4 500-4 800 MHz (space-to-Earth) by the fixed-satellite service shall be in accordance with the provisions of Appendix **30B** (see **No 5.441**);

g) that provisions for the coordination of terrestrial and space services exist in the Radio Regulations;

*noting*

a) that the criteria used and assumptions made in sharing studies between aeronautical mobile telemetry flight test applications and other services are only applicable to this specific case,

*resolves*

1 that administrations take into account that the bands 4 400-4 940 MHz and 5 925-6 700 MHz are suitable for the implementation of aeronautical mobile telemetry applications for flight testing;

2 that administrations implementing aeronautical mobile telemetry for flight test purposes, shall utilize the criteria set forth below:

- transmissions limited to aircraft stations only, see No. **1.83** ;
- the peak e.i.r.p. shall not exceed -2.2 dBW/MHz;
- limit transmissions to designated flight test areas, where flight test areas are airspace designated by Administrations for flight testing within their territories;
- if operation of AMT aircraft stations are planned within 500 km of the territory of an administration in which the band 4 825 - 4 835 MHz is allocated to Radio Astronomy on a primary basis (see No. **5.443**), consult with that administration to determine whether any special measures are needed to prevent interference to their Radio Astronomy observations;
- in the bands 4 400-4 940 MHz and 5 925-6 700 MHz, bilateral coordination for transmitting AMT aircraft station with respect to receiving fixed or mobile stations must be effected if the AMT aircraft station will operate within 450 km of the receiving fixed or mobile stations of another administration. The following procedure should be used to establish whether fixed or mobile service receiver within 450 km of the flight test area will receive an acceptable level of interference:
  - Determine if the receiving fixed or mobile station's antenna main beam axis, out to a distance of 450 km from the fixed service receiver, passes within 12 km of the designated area used by transmitting AMT aircraft stations, where this distance is measured orthogonally from the main beam axis projection on the earth's surface to the nearest boundary of the projection of the flight test area on the earth's surface;
  - If the main beam axis does not intersect the flight test area or any point within the 12 km offset, the interference could be accepted. Otherwise further bi-lateral coordination discussions would be needed.

USA/ /07 ADD

DRAFT RESOLUTION [AMT5GHZ]

**Use of the band 5 091-5 150 MHz by the aeronautical mobile service for the implementation of aeronautical mobile telemetry applications**

The World Radiocommunication Conference (Geneva, 2007),

*considering*

- a) the allocation of the frequency band 5 030-5 150 MHz to the aeronautical radionavigation service;
- b) the allocation of the 5 091 - 5 150 MHz band to the fixed-satellite (FSS) (Earth-to-space), which is limited to feeder links of non-geostationary satellite (non-GSO) systems in the mobile-satellite service (MSS) services;
- c) that the band 5 000-5 150 MHz is also allocated to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. **9.21**;
- d) that this conference has allocated the 5 091-5 150 MHz band to the aeronautical mobile service (AMS), limited to air-to-ground flight test telemetry applications,

*recognizing*

- a) that spectrum efficiency is enhanced in situations where new applications can be implemented compatibly in heavily occupied bands;
- b) that studies have been conducted within the ITU-R concerning the sharing and compatibility of aeronautical mobile telemetry (AMT) for flight testing with other services in the band 5 091-5 150 MHz;
- c) that precedence is to be given to the microwave landing system (MLS) in accordance with No. **5.444** in the frequency band 5 030-5 150 MHz;

*noting*

- a) that ITU-R studies describe methods in ITU-R Report M.[AMS-FSS] for ensuring compatibility and sharing between the AMS and FSS operating in the band 5 091-5 150 MHz that result in interference from AMT aircraft stations transmissions to the fixed-satellite service spacecraft receivers of no more than 1%  $\Delta T_{\text{satellite}}/T_{\text{satellite}}$ ;
- b) that methods to facilitate sharing between MLS and AMS are contained in ITU-R Recommendation [MLS-AMS];

*resolves*

1 that administrations take account that the band 5 091-5 150 MHz has been allocated to AMS, limited to implementation of aeronautical mobile telemetry applications for flight test purposes, based on the ITU studies referred to in *notings a) and b)* above;

2 that administrations choosing to implement aeronautical mobile telemetry for flight test purposes in the band 5 091-5 150 MHz shall utilize the criteria set forth below:

- limit transmissions to aircraft stations only, see No. **1.83**;
- transmissions limited to designated flight test areas, where flight test areas are airspace designated by Administrations for flight test within their territories;
- limit the aggregate of any interference from AMT aircraft stations to the fixed-satellite service spacecraft receivers to no more than 3%  $\Delta T_{\text{satellite}}/T_{\text{satellite}}$ ;
- bi-laterally coordinate with administrations operating Microwave Landing Systems and whose territory is located with the distance "D" of the AMT flight area, where "D" is determined by the following equation:

$$D = 10^{[127.55 - 20 \log(f) + E]/20}$$

where:

D is the distance separation (km) triggering the coordination;

f is the minimum frequency (MHz) used by the AMT system; and

E is the peak equivalent isotropically radiated power density (dBW in 150 kHz) of the aircraft transmitter.

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