

RESOLUTION 221 (REV.WRC-07)

**Use of high altitude platform stations providing IMT in the bands
1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3
and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2**

The World Radiocommunication Conference (Geneva, 2007),

considering

- a) that the bands 1 885-2 025 MHz and 2 110-2 200 MHz are identified in No. **5.388** as intended for use on a worldwide basis for IMT, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the terrestrial and satellite components of IMT;
- b) that a high altitude platform station (HAPS) is defined in No. **1.66A** as “a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth”;
- c) that HAPS may offer a new means of providing IMT services with minimal network infrastructure as they are capable of providing service to a large footprint together with a dense coverage;
- d) that the use of HAPS as base stations within the terrestrial component of IMT is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;
- e) that, in accordance with No. **5.388** and Resolution **212 (Rev.WRC-07)***, administrations may use the bands identified for IMT, including the bands referred to in this Resolution, for stations of other primary services to which they are allocated;
- f) that these bands are allocated to the fixed and mobile services on a co-primary basis;
- g) that, in accordance with No. **5.388A**, HAPS may be used as base stations within the terrestrial component of IMT in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2. Their use by IMT applications using HAPS as base stations does not preclude the use of these bands by any station in the services to which they are allocated and does not establish priority in the Radio Regulations;
- h) that ITU-R has studied sharing and coordination between HAPS and other stations within IMT, has considered compatibility of HAPS within IMT with some services having allocations in the adjacent bands, and has approved Recommendation ITU-R M.1456;
- i) that radio interfaces of IMT HAPS are compliant with Recommendation ITU-R M.1457;
- j) that ITU-R has addressed sharing between systems using HAPS and some existing systems, particularly PCS (personal communications system), MMDS (multichannel multipoint distribution system) and systems in the fixed service, which are currently operating in some countries in the bands 1 885-2 025 MHz and 2 110-2 200 MHz;

* *Note by the Secretariat:* This Resolution was revised by WRC-15 and WRC-19.

RES221-2

k) that HAPS stations are intended to transmit in the band 2 110-2 170 MHz in Regions 1 and 3 and in the band 2 110-2 160 MHz in Region 2;

l) that administrations planning to implement a HAPS as an IMT base station may need to exchange information, on a bilateral basis, with other concerned administrations, including data items describing the HAPS characteristics in a more detailed manner than the data items currently included in Annex 1 of Appendix 4, as indicated in the Annex to this Resolution,

resolves

1 that:

1.1 for the purpose of protecting IMT mobile stations in neighbouring countries from co-channel interference, a HAPS operating as an IMT base station shall not exceed a co-channel power flux-density (pfd) of $-117 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of HAPS;

1.2 a HAPS operating as an IMT base station shall not transmit outside the frequency bands 2 110-2 170 MHz in Regions 1 and 3 and 2 110-2 160 MHz in Region 2;

1.3 in Region 2, for the purpose of protecting MMDS stations in some neighbouring countries in the band 2 150-2 160 MHz from co-channel interference, a HAPS operating as an IMT base station shall not exceed the following co-channel pfd at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of the HAPS;

- $-127 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for angles of arrival (θ) less than 7° above the horizontal plane;
- $-127 + 0.666 (\theta - 7) \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for angles of arrival between 7° and 22° above the horizontal plane; and
- $-117 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for angles of arrival between 22° and 90° above the horizontal plane;

1.4 in some countries (see No. **5.388B**), for the purpose of protecting fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference caused by a HAPS operating as an IMT base station in accordance with No. **5.388A** in neighbouring countries, the limits of **5.388B** shall apply;

2 that the limits referred to in this Resolution shall apply to all HAPS operating in accordance with No. **5.388A**;

3 that administrations wishing to implement HAPS within a terrestrial IMT system shall comply with the following:

3.1 for the purpose of protecting IMT stations operating in neighbouring countries from co-channel interference, a HAPS operating as a base station within IMT shall use antennas that comply with the following antenna pattern:

$$\begin{array}{llll} G(\psi) = G_m - 3(\psi/\psi_b)^2 & \text{dBi} & \text{for} & 0^\circ \leq \psi \leq \psi_1 \\ G(\psi) = G_m + L_N & \text{dBi} & \text{for} & \psi_1 < \psi \leq \psi_2 \\ G(\psi) = X - 60 \log(\psi) & \text{dBi} & \text{for} & \psi_2 < \psi \leq \psi_3 \\ G(\psi) = L_F & \text{dBi} & \text{for} & \psi_3 < \psi \leq 90^\circ \end{array}$$

where:

$G(\psi)$: gain at the angle ψ from the main beam direction (dBi)

G_m : maximum gain in the main lobe (dBi)

ψ_b : one-half of the 3 dB beamwidth in the plane considered (3 dB below G_m) (degrees)

L_N : near side-lobe level (dB) relative to the peak gain required by the system design, and has a maximum value of -25 dB

L_F : far side-lobe level, $G_m - 73$ dBi

$$\psi_1 = \psi_b \sqrt{-L_N/3} \quad \text{degrees}$$

$$\psi_2 = 3.745 \psi_b \quad \text{degrees}$$

$$X = G_m + L_N + 60 \log(\psi_2) \quad \text{dBi}$$

$$\psi_3 = 10^{(X-L_F)/60} \quad \text{degrees}$$

The 3 dB beamwidth ($2\psi_b$) is estimated by:

$$(\psi_b)^2 = 7442/(10^{0.1G_m}) \quad \text{degrees}^2;$$

3.2 for the purpose of protecting mobile earth stations within the satellite component of IMT from interference, a HAPS operating as an IMT base station, shall not exceed an out-of-band pfd of -165 dB(W/(m² · 4 kHz)) at the Earth's surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;

3.3 a HAPS operating as an IMT base station, in order to protect fixed stations from interference, shall not exceed the following limits of out-of-band power flux-density (pfd) at the Earth's surface in the bands 2 025-2 110 MHz:

- -165 dB(W/(m² · MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;
- $-165 + 1.75(\theta - 5)$ dB(W/(m² · MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and
- -130 dB(W/(m² · MHz)) for angles of arrival between 25° and 90° above the horizontal plane;

4 that, for facilitating consultations between administrations, administrations planning to implement a HAPS as an IMT base station shall furnish to the concerned administrations the additional data elements listed in the Annex to this Resolution, if so requested;

5 that administrations planning to implement a HAPS as an IMT base station shall notify the frequency assignment(s) by submitting all mandatory elements of Appendix 4 to the Radiocommunication Bureau for the examination of compliance with *resolves* 1.1, 1.3 and 1.4 above;

6 that, since 5 July 2003, the Bureau and administrations provisionally apply Nos. **5.388A** and **5.388B** as revised by WRC-03 for the frequency assignments to HAPS referred to in this Resolution, including those received before this date but not yet processed by the Bureau,

invites ITU-R

to develop, as a matter of urgency, an ITU-R Recommendation providing technical guidance to facilitate consultations with neighbouring administrations.

ANNEX TO RESOLUTION 221 (REV.WRC-07)

Characteristics of a HAPS operating as an IMT base station in the frequency bands given in Resolution 221 (Rev.WRC-07)

A General characteristics to be provided for the station

A.1 Identity of the station

- a)* Identity of the station
- b)* Country

A.2 Date of bringing into use

The date (actual or foreseen, as appropriate) of bringing the frequency assignment (new or modified) into use.

A.3 Administration or operating agency

Symbols for the administration or operating agency and for the address of the administration to which communication should be sent on urgent matters regarding interference, quality of emissions and questions referring to the technical operation of the station (see Article 15).

A.4 Position information of the HAPS

- a)* The nominal geographical longitude for the HAPS
- b)* The nominal geographical latitude for the HAPS
- c)* The nominal altitude for the HAPS
- d)* The planned longitudinal and latitudinal tolerance for the HAPS
- e)* The planned tolerance of altitude for the HAPS

A.5 Agreements

If appropriate, the country symbol of any administration or administration representing a group of administrations with which agreement has been reached, including where the agreement is to exceed the limits prescribed in Resolution 221 (Rev.WRC-07).

B Characteristics to be provided for each antenna beam

B.1 HAPS antenna characteristics

- a)* The maximum isotropic gain (dBi).
- b)* HAPS antenna gain contours plotted on a map of the Earth's surface.

C Characteristics to be provided for each frequency assignment for HAPS antenna beam

C.1 Frequency range

C.2 Power density characteristics of the transmission

The maximum value of the maximum power density (dB(W/MHz)), averaged over the worst 1 MHz supplied to the input of the antenna.

D Calculated pfd limit produced over any country in visibility of HAPS

The maximum pfd calculated at the Earth's surface within each administration's territory over which the HAPS may be visible and over which these calculated pfd levels exceed the limits indicated in *resolves* 1.1, 1.3 and 1.4 of Resolution **221 (Rev.WRC-07)**.

