ADD

RESOLUTION 220 (WRC-23)

Terrestrial component of International Mobile Telecommunications (IMT) within the frequency band 6 425-7 125 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision for global mobile access, and is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;

b) that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;

c) that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;

d) that it is assumed that only a very limited number of IMT base stations will be communicating with a positive elevation angle towards IMT indoor mobile stations;

e) that the frequency band 6 425-7 125 MHz, or parts thereof, is allocated on a primary basis to the fixed, mobile, fixed-satellite (Earth-to-space) (space-to-Earth) and space operation services (Earth-to-space);

f) that, in the frequency band 6 650-6 675.2 MHz, radio astronomy observations are carried out under No. **5.149** for measurement of methanol spectral lines;

g) that No. **5.458** states that, in the band 6 425-7 075 MHz, “passive microwave sensor measurements are carried out over the oceans. In the band 7 075-7 250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz”;

h) that existing satellite networks of the fixed-satellite service (FSS) (Earth-to-space) are used within the frequency band 6 425-7 075 MHz, or parts thereof, and their characteristics may evolve in the future;

i) that the frequency band 6 425-7 125 MHz, or parts thereof, is also used by other applications in the mobile service;

j) that the frequency band 7 100-7 155 MHz is allocated on a primary basis to the space operation services (Earth-to-space) in the Russian Federation, in accordance with No. **5.459**;

k) that the frequency band 7 145-7 190 MHz is allocated on a primary basis to the space research service (SRS) (deep space);

l) that the frequency band 6 725-7 025 MHz is included in Appendix **30B** and used to provide a plan to guarantee in practice, for all countries, equitable access to the geostationary satellite orbit (GSO) in the frequency bands of the FSS;

m) that expected equivalent isotropically radiated power (e.i.r.p.) limits have been established which require assessment for compliance in equipment conformance tests;

n) that the frequency band 6 700-7 075 MHz (space-to-Earth) is used for feeder links of non-geostationary satellite systems of the mobile-satellite service (MSS), in accordance with No. **5.458B**;

o) that the frequency band 6 425-7 075 MHz in the FSS can be used to provide feeder links in the MSS;

p) that the FSS is currently used to provide feeder links in the MSS to enhance maritime services within the frequency band 6 425-6 575 MHz,

noting

a) Resolutions **223 (Rev.WRC-23)**, **224 (Rev.WRC-23)**, **225 (Rev.WRC-23)**, **241 (Rev.WRC-23)**, **242 (Rev.WRC-23)** and **243 (Rev.WRC-23)**, which also relate to IMT;

b) that the IMT terrestrial radio interfaces as defined in Recommendations ITU-R M.1457, ITU-R M.2012 and ITU-R M.2150 are expected to evolve within the framework of the ITU Radiocommunication Sector (ITU-R) beyond those initially specified, to provide enhanced services and services beyond those envisaged in the initial implementation;

c) that Recommendation ITU-R M.2160 outlines the framework and overall objectives of the future development of IMT for 2030 and beyond;

d) that Recommendation ITU-R M.2083 provides the IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond,

recognizing

a) that the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band by any application of the services to which it is allocated;

b) that studies have shown that the protection of feeder links for the non-GSO FSS (space-to-Earth) requires the determination of protection distances ranging between a few kilometres to tens of kilometres; these protection distances are site-specific and depend on several elements, such as the propagation parameters, local terrain topography, and station and orbital parameters of the feeder links for the non-GSO FSS (space-to-Earth);

c) that studies have shown that co-channel coexistence between IMT and the fixed service can be achieved but may require cross-border coordination between countries;

d) that studies have shown that co-channel coexistence between IMT and the fixed service can be achieved but would require site-by-site coordination if IMT and the fixed service are deployed in the same or adjacent geographical areas;

e) that a later deployment of IMT may be considered by those administrations wishing to migrate the fixed service to other frequency bands,

resolves

1 that administrations wishing to implement IMT in accordance with Nos. **5.457D**, **5.457E**, and **5.457F** consider use of the frequency bands referred to in those footnotes, taking into account the most recent versions of the relevant ITU-R Recommendations;

2 that, in order to ensure protection for the FSS (Earth-to-space), and taking into account *considering d)*, the level of expected e.i.r.p. spectral density emitted by an IMT base station as a function of the vertical angle above the horizon shall not exceed the following values (No. **21.5** does not apply):

Vertical angle range $\theta_L \leq \theta < \theta_H$ (vertical angle θ above horizon)	Expected e.i.r.p. (dBm/MHz) (See NOTES 1, 2 and 3)
$0° \leq \theta < 5°$	27
$5° \leq \theta < 10°$	23
$10° \leq \theta < 15°$	19
$15° \leq \theta < 20°$	18
$20° \leq \theta < 30°$	16
$30° \leq \theta < 60°$	15
$60° \leq \theta \leq 90°$	15

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

– over horizontal angles from −180° to +180°, with the IMT base station beamforming in a specific direction within its horizontal and vertical steering range,

– over different beamforming directions within the IMT base station horizontal and vertical steering range, and

– over the specified vertical angle range $\theta_L \leq \theta < \theta_H$.

NOTE 2: An IMT base station shall comply with the specified limits on expected e.i.r.p. spectral density for all mechanical tilts with which it can be deployed, taking into account *considering m)*.

NOTE 3: See the Annex to this Resolution for additional details on how the expected e.i.r.p. can be calculated for this frequency band.

3 that administrations wishing to implement IMT in the frequency band 6 700-7 075 MHz shall ensure the protection, continued use and future development of FSS (space-to-Earth) stations through the adoption of site-specific coordination,

invites administrations

1 to take into account the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT;

2 to ensure that provisions for the implementation of IMT do not adversely affect the operation of FSS earth stations and their future development;

3 to take all practical steps to protect the radio astronomy service (RAS) from harmful interference in the frequency band 6 650-6 675.2 MHz, which covers spectral lines of importance for current astronomical investigations, in accordance with No. **5.149**,

invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment within the frequency band 6 425-7 125 MHz;

2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries;

3 to develop a Recommendation to address methods for the determination of the protection area around a non-GSO earth station in the frequency band 6 700-7 075 MHz from an IMT base station;

4 to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations/Reports, as appropriate, to provide information and assistance to the administrations concerned on possible coordination of stations in the fixed service with IMT stations in the frequency band 6 425-7 125 MHz;

5 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) on sharing and compatibility with space services, and to take into account the results of these reviews in the development and/or revision of ITU-R Recommendations/Reports addressing, *inter alia*, if necessary, applicable measures to mitigate the risk of interference into space services;

6 to develop an ITU-R Recommendation to address methods for the determination of the protection area around existing RAS stations from IMT stations in the frequency band 6 650-6 675.2 MHz;

7 to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations/Reports, as appropriate, to provide information and assistance to the administrations concerned on possible coordination of SRS (deep space) stations operating in the band 7 145-7 190 MHz with IMT stations operating in the frequency band 6 425-7 125 MHz,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

ANNEX TO RESOLUTION 220 (WRC-23)

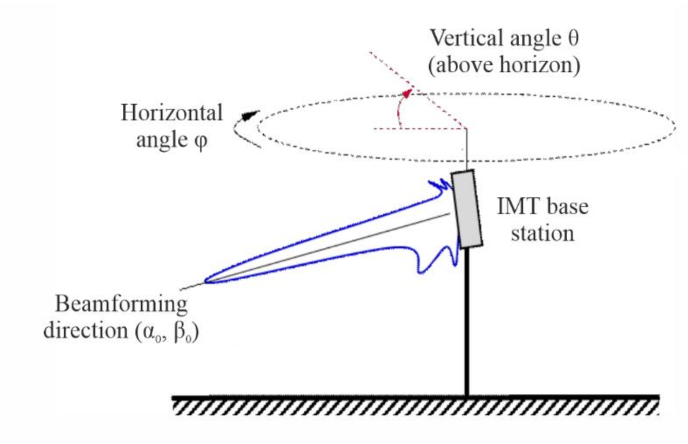
Details for the calculation of the expected equivalent isotropically radicated power of an International Mobile Telecommunications base station operating within the frequency band 6 425-7 125 MHz

This annex outlines the theoretical calculation of the expected equivalent isotropically radiated power (e.i.r.p.) of an International Mobile Telecommunications (IMT) base station for assessing the compliance of IMT base station equipment with the limit on expected e.i.r.p.

The e.i.r.p. of an IMT base station in the horizontal (azimuth) direction $-\pi \leq \varphi \leq \pi$ and vertical (elevation) direction $0 \leq \theta \leq \pi/2$ above the horizon can be written as $P(\theta, \varphi; \alpha, \beta)$. The parameters α and β are the horizontal and vertical beamforming directions, i.e. the angles towards which the base station electronically steers a beam. These are illustrated in Figure 1 below.

FIGURE 1

Illustration of horizontal (azimuth) angle, vertical (elevation) angle and beamforming directions



The expected e.i.r.p. $\bar{P}_{\theta_L \theta_H}$ of an IMT base station within a vertical angle range $\theta_L \leq \theta < \theta_H$ can be calculated by averaging the e.i.r.p. $P(\theta, \varphi; \alpha, \beta)$ of the base station as follows:

1) **Averaging over beamforming directions for a given vertical angle θ_0 and horizontal angle φ_0: for an AAS base station within a given horizontal and vertical steering range,** a sufficient sampling of N beamforming directions (α_n, β_n) $n = 1 \dots N$ is necessary to allow an accurate averaging of the expected e.i.r.p.

The beamforming directions (α_n, β_n) have a uniform statistical angular distribution within the steering range of the IMT base station. In other words:

$$P_1(\theta_0, \varphi_0) = \sum_{n=1}^{N} w_n P(\theta_0, \varphi_0; \alpha_n, \beta_n)$$

where w_n refers to the weight for the n^{th} beamforming direction, i.e. the fraction of the steering range represented by the n^{th} beamforming direction. For example, $w_n = 1/N$ in the case that N uniform equispaced beams are assumed in the azimuth and elevation, respectively, and where each beam covers an equal range of angles.

The set of base station configurations over which the base station complies with the limits on expected e.i.r.p. (for example, power of steering range as one of the parameters) shall be declared and the BS shall be used within one of these configurations.

The set of e.i.r.p. values used to calculate the expected e.i.r.p. for each vertical angle range shall be a mathematical summation of both polarization states of the IMT base station antenna with no polarization discrimination.

For a non-AAS base station, $P_1(\theta_0, \varphi_0) = P(\theta_0, \varphi_0; \alpha_1, \beta_1)$ where $\alpha_1 = 0$ and β_1 is the electrical tilt.

It is noted that the compliance with the limits on expected e.i.r.p. should be limited to a defined range of electrical tilts.

2) **Averaging over horizontal and vertical angles**: the expected e.i.r.p. is then calculated by averaging the results of step 1 over horizontal angles φ from $-\pi$ to $+\pi$ with respect to the base station horizontal boresight, and vertical angles θ within vertical angle range $\theta_L \leq \theta < \theta_H$ with respect to the horizon. In other words:

$$\bar{P}_{\theta_L \theta_H} = \frac{1}{2\pi(\sin\theta_H - \sin\theta_L)} \int_{\theta_L}^{\theta_H} \int_{-\pi}^{\pi} P_1(\theta, \varphi)\cos(\theta) d\varphi d\theta$$

The averaging processes in steps 1 and 2 shall allow for accurate averaging of the expected e.i.r.p. (e.g. to the confidence interval of 95%).