GSOA
GLOBAL SATELLITE OPERATORS ASSOCIATION

GSOA response to the Ofcom consultation

Enabling mmWave spectrum for new uses

18 July 2022

GSOA recognises and appreciates the recognition provided in section 2.21-2.22 that the 28 GHz band is a core band for satellite services and is expected to grow in the UK. GSOA fully agrees that this is a core band for satellite services and agrees that the 28 GHz band should not be made available for terrestrial mobile use in the UK.

GSOA supports the use of the 26 GHz and 40 GHz band for terrestrial mobile systems in the UK in general, subject to both bands also being available for use by satellite services and subject to appropriate interference mitigation measures being implemented to ensure co-existence of mobile services and satellite services. Hence the main issue that GSOA raises in this response relates to the current and future use of the 26 GHz band (24.25-27.5 GHz) and 40 GHz (40.5-43.5 GHz) by satellite services – in particular the fixed-satellite service (FSS) - and to how compatibility with the FSS will be achieved.

Parts of both the 26 GHz and 40 GHz bands are used by FSS uplinks. This requires interference mitigation measures to be implemented on mobile systems to ensure that the aggregate interference to satellite receivers is kept to acceptable levels. Furthermore, for both bands FSS earth stations are expected to be deployed in UK and hence arrangements for sharing of the frequencies between mobile systems and earth stations will need to be established. These issues will not prevent use of the 26 GHz band or the 40 GHz band by terrestrial mobile systems, but require some technical, operational and regulatory conditions to be included in the UK authorisation framework. The various measures required have been discussed in the ITU and CEPT in the work before and since WRC-19 and hence are already well developed. The issues related to compatibility with satellite services do not seem to be identified or discussed in the consultation document, but are important to consider at an early stage.

In the case of the 26 GHz band, measures to enable sharing with satellite services are contained in Resolution 242 (WRC-19) and EU Decision 2019/784, which are copied in Attachments 1 and 2. Yellow highlight has been added to identify the particular elements that relate to sharing with satellite services. The highlighted elements lead to three types of requirement:

1. Some of the conditions relate to constraints on the power/antenna characteristics of mobile base stations, and deployment constraints, such as antenna pointing restrictions and limitation to land mobile use. Those conditions will need to be mirrored in the UK licence conditions to ensure that UK mobile deployment remains compliant to the Resolution and Decision.
2. The number of IMT base stations deployed is critical to the aggregate interference to satellite uplinks. Hence both the Resolution and Decision contain provisions related to the density of base stations and to the need for ongoing monitoring of IMT system deployment, so that an ongoing check can be made that interference to satellite uplinks will be kept to acceptable

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levels. This will require the UK mobile licences to include a reporting requirement, so that data on the number and location of base stations deployed and other characteristics can be obtained and made available.

3. The need to share some parts of the 26 GHz band with FSS earth stations, existing and new, is also recognised in the Resolution and Decision. In some cases, it may be desired to deploy earth stations in the UK, inside or close to the areas proposed for citywide licences. In other cases, it may be desired to deploy earth stations in "low density areas". This will require the need to maintain some geographic separation between earth station and mobile base station. We have not been able to identify in the consultation document details of how this shared use would be implemented, but it is likely to require at least some conditions in the mobile licences regarding sharing with earth stations.

Similarly for the 40 GHz band, there are a number of requirements related to sharing with satellite services that will need to be taken into account in the design of the UK licence and authorisation regime. Under the ITU Radio Regulation Frequency Allocations, in Region 1, the lower part of the 40 GHz band (40.5-42.5 GHz) is allocated for FSS downlinks. The upper part (42.5-43.5 GHz) is allocated for FSS uplinks. Both bands are expected to be used for coordinated earth stations under the CEPT framework. Resolution 243 (WRC-19) includes technical measures to provide a level of protection to satellite uplinks in this band and measures related to sharing with FSS earth stations. A copy is provided in Attachment 3, with yellow highlight added to help identify the elements related to sharing with satellite services.

While the EU Decision for the 40 GHz band is not yet complete, the CEPT Decision for this band (Draft ECC Decision (22)06) is currently in its approval process, and the EU Decision is likely to include elements related to sharing with satellite services that are similar to the 26 GHz band.

Taking account of Resolution 243, Draft ECC Decision (22)06 and the planned EU Decision, the 40 GHz band can be assumed to have similar requirements to the 26 GHz band, meaning that the UK licence and authorisation regime for terrestrial mobile services in the 40 GHz band will need to include:

- technical limits and deployment constraints on base stations and their antennas
- a reporting requirement for the number of base stations deployed
- licence conditions to enable sharing with FSS earth stations.

GSOA encourages Ofcom to address these issues related to sharing with satellite services with urgency in the ongoing work on developing the UK licensing and authorisation regime for the 26 GHz and 40 GHz bands.

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Attachment 1

RESOLUTION 242 (WRC-19)

Terrestrial component of International Mobile Telecommunications in the frequency band 24.25-27.5 GHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

a) that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision of 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 the evolution of IMT is being studied within the ITU Radiocommunication Sector (ITU-R);

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

d) that IMT systems are now being evolved to support diverse usage scenarios such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;

e) that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;

f) that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple input, multiple output (MIMO) and beam-forming techniques, in supporting enhanced broadband;

g) 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;

h) that there is a need to protect existing services and to allow for their continued development;

i) that ITU-R has studied, in preparation for WRC-19, sharing and compatibility with services allocated in the frequency band 24.25-27.5 GHz and its adjacent band, based on characteristics available at that time, and results may change if these characteristics change;

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

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k) that the allocations of frequency bands to the Earth exploration-satellite service (EESS) (passive) are defined solely by the fundamental properties of the Earth and its atmosphere, and related measurements are beneficial and used globally and extensively in meteorology, climatology and other scientific purposes for the protection of human life and natural resources; and although EESS (passive) satellites and sensors are operated by few countries, they benefit of the whole international community and are hence to be protected on a worldwide basis;

l) that sharing studies were conducted considering applications in the land mobile service,

noting

Recommendation ITU-R M.2083, which 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) Resolutions 176 (Rev. Dubai, 2018) and 203 (Rev. Dubai, 2018) of the Plenipotentiary Conference;

c) that Resolution **750 (Rev.WRC-19)** establishes limits on unwanted emissions in the frequency band 23.6-24 GHz from IMT base stations and IMT mobile stations within the frequency band 24.25-27.5 GHz;

d) that the spurious emission limits of Recommendation ITU-R SM.329 Category B (−60 dB(W/MHz)) are sufficient to protect the EESS (passive) in the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz from the second harmonic of IMT base station emissions in the frequency band 24.25-27.5 GHz;

e) that ITU-R has conducted sharing studies between IMT and the inter-satellite service (ISS)/fixed-satellite service (FSS) (Earth-to-space) in the frequency band 24.25-27.5 GHz based on a number of baseline assumptions, (e.g. equivalent isotropically radiated power (e.i.r.p.) of 18 dB(W/200 MHz), base station densities of 1 200 per 10 000 km^2 and other deployment scenarios), as well as sensitivity analysis for some of them, and these baseline assumptions, as well as other assumptions, influence the sharing study results;

f) that the frequency bands immediately below the passive frequency band 23.6-24 GHz are not intended to be used for high-density mobile applications,

resolves

1 that administrations wishing to implement IMT consider use of the frequency band 24.25-27.5 GHz identified for IMT in No. **5.532AB**, and the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the latest relevant ITU-R Recommendations;

2 that administrations shall apply the following conditions for the frequency band 24.25-27.5 GHz:

2.1 take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency band 24.25-27.5 GHz; the mechanical pointing needs to be at or below the horizon;

2.2 as far as practicable, sites for IMT base stations within the frequency band 24.45-27.5 GHz employing values of e.i.r.p. per beam exceeding 30 dB(W/200 MHz) should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit, within line-of-sight of the IMT base station, by ±7.5 degrees;

3 that protection of EESS/space research service (SRS) earth stations in the frequency band 25.5-27 GHz and radio astronomy service (RAS) stations in the frequency band 23.6-24 GHz and coexistence between FSS earth stations in the frequency bands 24.65-25.25 GHz and 27-27.5 GHz and IMT stations should be facilitated through bilateral agreements for cross-border coordination as necessary;

4 that the operation of IMT within the frequency band 24.25-27.5 GHz shall protect existing and future EESS (passive) systems in the frequency band 23.6-24 GHz;

5 that IMT stations within the frequency range 24.25-27.5 GHz are used for applications of the land mobile service,

encourages administrations

1 to ensure that provisions for the implementation of IMT allow for the continued use of EESS, SRS and FSS earth stations and their future development;

2 to keep the antenna pattern of IMT base stations within the limits of the approximation envelope according to Recommendation ITU-R M.2101;

3 to apply the spurious emission limits of Recommendation ITU-R SM.329 Category B for the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz when making the frequency band 24.25-27.5 GHz available for IMT;

4 that for the future development of EESS (passive) in the frequency band 23.6-24 GHz, administrations should consider additional mitigation techniques (e.g. guardbands) beyond the limits specified in Resolution **750 (Rev.WRC-19)**, as appropriate,

invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment in the frequency band 24.25-27.5 GHz, taking into account the results of sharing and compatibility studies conducted in preparation for WRC-19;

2 to develop an ITU-R Recommendation on methodologies for calculating coordination zones around EESS/SRS earth stations in order to avoid harmful interference from IMT systems in the frequency band 25.5-27 GHz;

3 to develop ITU-R Recommendation(s) to assist administrations to mitigate interference from FSS earth stations into IMT stations operating in the frequency bands 24.65-25.25 GHz and 27-27.5 GHz;

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4 to update existing ITU-R Recommendations or develop a new ITU-R Recommendation, as appropriate, to provide information and assistance to the concerned administrations on possible coordination and protection measures for the RAS in the frequency band 23.6-24 GHz from IMT deployment;

5 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) and those of systems of space services on sharing and compatibility, 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 receivers,

instructs the Director of the Radiocommunication Bureau

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

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Attachment 2

COMMISSION IMPLEMENTING DECISION (EU) 2019/784

of 14 May 2019

on harmonisation of the 24,25-27,5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union

(notified under document C(2019) 3450)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) [1], and in particular Article 4(3) thereof,

Whereas:

(1) The 24,25-27,5 GHz ('26 GHz') frequency band is being studied as a candidate band for International Mobile Telecommunications for 2020 and beyond [2] (IMT-2020), which is part of the agenda of the World Radiocommunication Conference 2019 (WRC-19) [3]. IMT-2020 represents the 5G framework of radio standards developed by the Radiocommunication Sector of the International Telecommunication Union (ITU-R) based on mobile broadband technology.

(2) According to the ITU Radio Regulations [4], the 25,25-27,5 GHz frequency band is allocated worldwide to the mobile service on a co-primary basis. The 24,25-25,25 GHz frequency band is not allocated to the mobile service in Region 1 of the ITU, which includes the European Union. That does not prevent the Union from using this frequency band for wireless broadband electronic communications services as long as it complies with international and cross-border obligations under the ITU Radio Regulations at its external borders.

(3) The Commission Communication '5G for Europe: An Action Plan' [5] ('5G action plan') sets out a coordinated Union approach to the deployment of 5G services as of 2020. The 5G action plan calls for the identification of pioneer frequency bands for the launch of 5G services by the Commission in cooperation with the Member States, taking into account the opinion of the Radio Spectrum Policy Group (RSPG).

(4) The RSPG has adopted three opinions on a strategic spectrum roadmap for 5G in Europe [6] ('RSPG Opinions'), in which it identified the 26 GHz frequency band as one pioneer band for 5G and recommended to Member States that they make a sufficiently large portion of that band, e.g. 1 GHz, available for 5G by 2020 in response to market demand.

(5) The 26 GHz frequency band provides high capacity for providing innovative wireless broadband electronic communications services with 5G technology based on small cells [7] and with a block size of 200 MHz. In accordance with the European Electronic Communications Code (EECC) [8], Member States must allow the use of at least 1 GHz of the 26 GHz frequency band by 31 December 2020 in order to facilitate 5G rollout, provided that there is clear evidence of market demand and of the absence of significant constraints for migration of existing users or band clearance. The EECC also provides that measures taken by Member States pursuant to that requirement must comply with the harmonised conditions set by technical implementing measures in accordance with the Radio Spectrum Decision.

(6) Portions of the 26 GHz frequency band are used in the Member States for terrestrial fixed wireless connections ('fixed links') including backhauling [9]. The approach to managing the co-existence between terrestrial wireless broadband electronic communications services, including next-generation or 5G, and fixed links at national level, should allow flexibility for Member States.

(7) The use of the 24,25-26,65 GHz portion of the 26 GHz frequency band for automotive short-range radars should be gradually phased out by 1 January 2022 [10]. There is a steady trend in the market development for automotive short-range radars towards new deployments in the 77-81 GHz frequency band harmonised at Union level [11]. Therefore, no co-existence issues with automotive short-range radars are identified.

(8) The 24,25-24,5 GHz portion of the 26 GHz frequency band is designated at Union level for transport and traffic telematics devices, in particular for automotive radars [12] on a non-protected and non-interference basis. There is no current or planned use of those automotive radars in the band [13], while such use increases in the 76-81 GHz frequency range.

(9) The 24,25-27 GHz portion of the 26 GHz frequency band is used for radio determination devices [14], which operate in 'underlay' mode based on ultra-wide band technology [15]. Such use should be adaptable to the evolution of use of the 26 GHz frequency band for terrestrial wireless broadband electronic communications services.

(10) Some portions of the 26 GHz frequency band are used for space and satellite services across the Member States. These services comprise within the 25,5-27 GHz range space-to-earth communications to earth stations in the Earth Exploration Satellite Service (EESS) [16], in the Space Research Service (SRS) and supporting the European Data Relay System (EDRS), as well as earth-to-space communications to satellite on-board receivers in the Fixed Satellite Service (FSS) within the 24,65-25,25 GHz range. Therefore, those space and satellite services should be appropriately protected against interference from terrestrial wireless broadband electronic communications services. They also need prospects for further development. Furthermore, the 24,45-24,75 GHz and 25,25-27,5 GHz portions of the 26 GHz frequency band are used worldwide for communications between non-geostationary and geostationary satellites in the Inter-Satellite Service (ISS), including the EDRS.

(11) Next-generation (5G) terrestrial services should be rolled out within the 26 GHz frequency band under harmonised technical conditions. These conditions should safeguard the continued operation and development of satellite earth stations (in the EESS, SRS and FSS) with frequency allocations within the band in order for earth

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stations to be authorised in the future based on transparent, objective and proportionate criteria. Those conditions should equally ensure that existing and future satellite services are unlikely to have a significant negative impact on terrestrial 5G deployment and coverage.

(12) Pursuant to Article 4(2) of the Radio Spectrum Decision, the Commission gave the European Conference of Postal and Telecommunications Administrations (CEPT) a mandate to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union, including in the 26 GHz frequency band.

(13) In response to that mandate, CEPT issued Report 68 [17] ('the CEPT Report') on 6 July 2018. This specifies harmonised technical conditions in the 26 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union, which are suitable for 5G use. Those technical conditions are consistent with 5G standardisation developments regarding channelling arrangements [18], namely channel size or duplex mode of operation, and active antenna systems and are therefore conducive to global harmonisation. They assume synchronised operation of neighbouring systems of different operators, which ensures that the spectrum is used efficiently. Unsynchronised or semi-synchronised operation of neighbouring systems requires further studies in order to develop relevant harmonised technical conditions. Such operation remains possible with geographical separation.

(14) The technical conditions provided in the CEPT Report for the use of the 26 GHz frequency band are based on the assumption of an authorisation regime based exclusively on individual rights of use, which is also conducive to ensuring appropriate co-existence with current band use. Any other authorisation framework such as general authorisation or a combined individual/general authorisation regime could require additional technical conditions in order to ensure appropriate coexistence of terrestrial systems capable of providing wireless broadband electronic communications services with other services in the band, in particular taking due account of continued deployment of FSS, EESS and SRS satellite earth stations.

(15) The CEPT Report also provides guidance and technical conditions for the use of the 26 GHz frequency band for terrestrial wireless broadband electronic communications services, including 5G, to ensure the protection of existing space and satellite services and fixed links within the 26 GHz frequency band as well as services in adjacent bands.

(16) Co-existence between terrestrial wireless broadband electronic communications services (including 5G) and earth stations in the EESS, SRS and FSS operating in the 26 GHz frequency band can be ensured by applying, where appropriate, technical constraints to the deployment of terrestrial services in a limited geographical area around a satellite earth station. In this regard, deploying new earth stations preferably away from locations with high population density or high human activity may represent a proportionate approach to facilitating such co-existence. Moreover, CEPT has been developing technical toolkits [19] to support 5G deployment based on individual authorisation while allowing in a proportionate way the continued use of current and planned EESS/SRS receiving earth stations and FSS transmitting earth

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stations in the relevant portions of the 26 GHz frequency band. These toolkits can facilitate coexistence in fulfilling the obligations under this Decision.

(17) Coexistence between terrestrial wireless broadband electronic communications services (including 5G) and satellite receivers in the FSS and ISS, including EDRS, is currently feasible, subject to technical conditions that address the antenna elevation of wireless broadband base stations.

(18) Member States should assess the possibility of continuing to operate fixed links in the 26 GHz band based on shared spectrum use with terrestrial wireless broadband electronic communications services, including 5G, or discontinuing their operation in the band. Such an assessment should take into consideration potential mitigation techniques, and national and cross-border coordination as well as the extent of 5G deployment, subject to market demand for 5G systems, in particular in less-populated and rural areas. The possibility of shared spectrum use as a national option depends on, among other things, the availability of detailed information on the deployment of fixed links and the feasibility of assigning large blocks of contiguous spectrum to 5G systems. To that end, CEPT provides technical guidance on the co-existence between terrestrial wireless broadband electronic communications services, including 5G, and fixed links, taking into account progressive 5G deployment.

(19) Terrestrial wireless broadband electronic communications services, including 5G, in the 26 GHz frequency band should provide appropriate protection to the EESS (passive) in the 23,6-24 GHz frequency band [20]. Specific measures may be required at national level to ensure radio astronomy stations operating in the 23,6-24 GHz frequency band are protected. These measures are likely to constrain usability of the full 26 GHz band around such stations. The protection of the EESS (passive) in the 50,2-50,4 GHz and 52,6-54,25 GHz frequency bands is ensured by the existing generic spurious emission limits applying to base stations [21].

(20) The use of unmanned aerial vehicles ('UAVs') such as drones with terrestrial wireless broadband electronic communications networks that use the 26 GHz frequency band could have an impact on existing use such as satellite receivers in the FSS and ISS. As a result, connectivity from base stations to terminal stations on board UAVs should be prohibited in the 26 GHz frequency band, and only connectivity from terminal stations on board UAVs to base stations should be allowed in compliance with applicable air traffic management regulation. In this regard, the connectivity from terminal stations on board UAVs to base stations could have a significant impact on, for example, the separation distance to EESS/SRS earth stations co-using the 26 GHz band. This requires further study, which may deliver supplementary harmonised technical conditions. Using UAVs with wireless broadband electronic communications networks should not hinder the deployment of future EESS/SRS earth stations.

(21) Provision should be made for cross-border agreements between spectrum users or national administrations to ensure the implementation of this Decision in order to avoid harmful interference and improve spectrum efficiency and convergence in spectrum use.

(22) This Decision ensures that Member States take up the 26 GHz frequency band for next-generation (5G) wireless broadband electronic communications services based

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on legally binding technical conditions in accordance with CEPT Report 68 and in line with the Union's policy objectives.

(23) The notion of 'designating and making available' the 26 GHz frequency band in the context of this Decision refers to the following steps: (i) the adaptation of the national legal framework on frequency allocation to include the intended use of this band under the harmonised technical conditions set in this Decision, (ii) the initiation of all necessary measures in order to ensure coexistence with existing use in this band, to the extent necessary, (iii) the initiation of the appropriate measures, supported by the launch of a stakeholder consultation process where appropriate, in order to allow the use of this band in accordance with the applicable legal framework at Union level, including the harmonised technical conditions of this Decision.

(24) Member States should report to the Commission on the implementation of this Decision, in particular as regards the gradual introduction and development of terrestrial 5G services in the 26 GHz frequency band and any co-existence issues, to help assess its impact at Union level as well as its timely review. Such a review can also address the suitability of the technical conditions to ensure adequate protection of other services, in particular space services such as satellite receivers in the FSS and ISS, including EDRS, taking into account the development of terrestrial wireless broadband electronic communications services, including 5G.

(25) The measures provided for in this Decision are in accordance with the opinion of the Radio Spectrum Committee established by the Radio Spectrum Decision,

HAS ADOPTED THIS DECISION:

Article 1

This Decision harmonises the essential technical conditions for the availability and efficient use of the 24,25-27,5 GHz frequency band in the Union for terrestrial systems capable of providing wireless broadband electronic communications services.

Article 2

By 30 March 2020, Member States shall designate and make available on a non-exclusive basis the 24,25-27,5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services, in compliance with the essential technical conditions set out in the Annex.

Depending on the authorisation regime applied in this band, Member States shall analyse if it is necessary to impose additional technical conditions in order to ensure appropriate co-existence of terrestrial systems capable of providing wireless broadband electronic communications services with other services in the band.

Article 3

Member States shall ensure, in compliance with the relevant technical conditions in the Annex, that the terrestrial systems referred to in Article 1 appropriately protect:

(a) systems in adjacent bands, in particular in the Earth Exploration Satellite Service (passive) and in the Radio Astronomy Service in the 23,6-24,0 GHz frequency band;

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(b) earth stations in the Earth Exploration Satellite Service and in the Space Research Service for space-to-earth communications operating within the 25,5-27,0 GHz frequency band;

(c) satellite systems for earth-to-space communications in the Fixed Satellite Service operating within the 24,65-25,25 GHz frequency band;

(d) satellite systems for inter-satellite communications operating within the 24,45-24,75 GHz and 25,25-27,5 GHz frequency bands.

Article 4

Member States may allow the continued operation of fixed links within the 24,25-27,5 GHz frequency band, if the terrestrial systems referred to in Article 1 can co-exist with such fixed links through managed shared spectrum use.

Member States shall regularly monitor the need for continuing the operation of fixed links referred to in the first subparagraph of this Article.

Article 5

Under the condition that the number and locations of new earth stations are determined as not to impose disproportionate constraints on the systems referred to in Article 1, subject to market demand, Member States shall ensure, that the continued deployment of earth stations is made possible:

— in the Earth Exploration Satellite Service (space-to-earth) or in the Space Research Service (space-to-earth) within the 25,5-27,0 GHz frequency band;

— in the Fixed Satellite Service (earth-to-space), within the 24,65-25,25 GHz frequency band.

Article 6

Member States shall facilitate cross-border coordination agreements to enable operation of the terrestrial systems referred to in Article 1, taking into account existing regulatory procedures and rights, as well as relevant international agreements.

Article 7

Member States shall report to the Commission on the implementation of this Decision by 30 June 2020.

Member States shall monitor the use of the 24,25-27,5 GHz frequency band, including the progress on co-existence between the terrestrial systems referred to in Article 1 and other systems using the band, and report their findings to the Commission upon request or at their own initiative to allow a timely review of this Decision.

Article 8

This Decision is addressed to the Member States.
Done at Brussels, 14 May 2019.

For the Commission

[1] OJ L 108, 24.4.2002, p. 1.

[2] ITU-R Resolution 238 (WRC-15) regarding potential frequency bands for the future development of International Mobile Telecommunications for 2020 (IMT-2020) and beyond.

[3] Agenda item 1.13 of WRC-19 according to ITU-R Resolution 809 (WRC-15).

[4] Link: http://www.itu.int/pub/R-REG-RR

[5] COM(2016) 588 final.

[6] Opinion on spectrum related aspects for next-generation wireless systems (5G) (RSPG16-032 final) of 9 November 2016, Second Opinion on 5G networks (RSPG18-005 final) of 30 January 2018, Opinion on 5G implementation challenges (RSPG19-007 final) of 31 January 2019.

[7] Cells with a size of up to a few hundreds of meters.

[8] Article 54 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (OJ L 321, 17.12.2018, p. 36).

[9] According to the ITU Radio Regulations in their version of 2016, the whole 26 GHz band is allocated to the Fixed Service on a co-primary basis in Europe.

[10] Pursuant to Commission Decision 2005/50/EC of 17 January 2005 on the harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community (OJ L 21, 25.1.2005, p. 15).

[11] Pursuant to Commission Decision 2004/545/EC of 8 July 2004 on the harmonisation of radio spectrum in the 79 GHz range for the use of automotive short-range radar equipment in the Community (OJ L 241, 13.7.2004, p. 66).

[12] Pursuant to Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices (OJ L 312, 11.11.2006, p. 66).

[13] In the context of Wideband Low Activity Mode applications.

[14] Such as level probing radars.

[15] Pursuant to Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (OJ L 55, 23.2.2007, p. 33).

[16] Mainly for the Copernicus programme, Eumetsat meteorological programmes and different earth observation systems.

[17] CEPT Report 68: 'Report B from CEPT to the European Commission in response to the Mandate "to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union", Harmonised technical conditions for the 24,25-27,5 GHz ("26 GHz") frequency band', link: https://www.ecodocdb.dk/document/3358.

[18] 3GPP standardisation (Release 15, TS 38.104 transposed as ETSI TS 138104) defines the 26 GHz frequency band (band n258) for use with New Radio (NR) technology based on time division duplex, and channel bandwidths of 50 MHz, 100 MHz, 200 MHz, and 400 MHz.

[19] Such as ECC Recommendation (19)01 'Technical toolkit to support the introduction of 5G while ensuring, in a proportionate way, the use of existing and planned EESS/SRS receiving earth stations in the 26 GHz band and the possibility for future deployment of these earth stations'. These toolkits provide among other things methodologies to national administrations to determine the coordination areas around the earth stations.

[20] According to the ITU Radio Regulations in their version of 2016 (see footnote 5.340), all emissions are prohibited in the 23,6-24 GHz frequency band in line with protection thresholds given in relevant ITU-R Recommendations (such as ITU-R RA.769-2 with regard to the Radio Astronomy Service).

[21] By virtue of ITU-R Recommendations.

ANNEX

TECHNICAL CONDITIONS REFERRED TO IN ARTICLES 2 AND 3

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1. Definitions

Active antenna systems (AAS) means a base station and an antenna system where the amplitude and/or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This excludes long-term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product.

Synchronised operation means operation of two or more different time division duplex (TDD) networks, where simultaneous uplink (UL) and downlink (DL) transmissions do not occur, that is at any given moment in time either all networks transmit in downlink or all networks transmit in uplink. This requires the alignment of all DL and UL transmissions for all TDD networks involved as well as synchronising the beginning of the frame across all networks.

Unsynchronised operation means operation of two or more different TDD networks, where at any given moment in time at least one network transmits in DL while at least one network transmits in UL. This might happen if the TDD networks either do not align all DL and UL transmissions or do not synchronise at the beginning of the frame.

Semi-synchronised operation means operation of two or more different TDD networks, where part of the frame is consistent with synchronised operation, while the remaining portion of the frame is consistent with unsynchronised operation. This requires the adoption of a frame structure for all TDD networks involved, including slots where the UL/DL direction is not specified, as well as synchronising the beginning of the frame across all networks.

Total radiated power (TRP) is a measure of how much power a composite antenna radiates. It equals the total conducted power input into the antenna array system less any losses in the antenna array system. TRP means the integral of the power transmitted in different directions over the entire radiation sphere as shown in the formula:

$$TRP \stackrel{\text{def}}{=} \frac{1}{4\pi} \int_0^{2\pi} \int_0^{\pi} \mathrm{P}(\vartheta,\varphi) \sin(\vartheta)\, d\vartheta d\varphi$$

where P(θ,φ) is the power radiated by an antenna array system in direction (θ,φ) given by the formula:

$P(\theta,\varphi) = P_{Tx} g(\theta,\varphi)$

where P_{Tx} denotes the conducted power (measured in Watts), which is input into the array system, and g(θ,φ) denotes the array systems directional gain along the (θ, φ) direction.

2. General Parameters

1. The duplex mode of operation in the 24,25-27,5 GHz frequency band shall be time division duplex.
2. The assigned block size shall be a multiple of 200 MHz. A smaller block size of 50 MHz or 100 MHz or 150 MHz, adjacent to the assigned block of another spectrum user, is also possible to ensure efficient use of the full frequency band.

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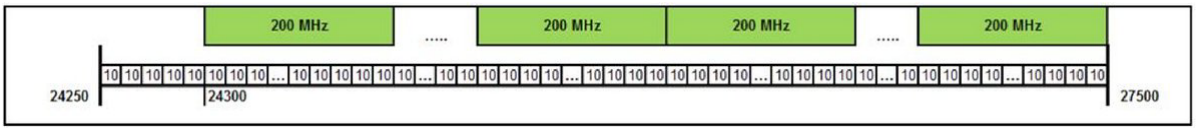
3. The upper frequency limit of an assigned block shall be aligned with or spaced at a multiple of 200 MHz from the upper band edge of 27,5 GHz. If a block is smaller than 200 MHz according to paragraph 2 or needs to be offset to accommodate existing uses, this offset shall be a multiple of 10 MHz.
4. The technical conditions contained in this Annex are essential to address the mutual coexistence of terrestrial systems capable of providing wireless broadband electronic communication services and the coexistence of such systems with systems in the Earth Exploration Satellite Service (passive) in the form of limits on unwanted emissions into the 23,6-24 GHz frequency band as well as with space station receivers in the form of restrictions on the elevation of the main beam of the AAS of an outdoor base station. Additional measures may be required at a national level to ensure coexistence with other services and applications (1).
5. Use of the 24,25-27,5 GHz frequency band for communications with unmanned aerial vehicles shall be limited to the communication link from the terminal station on board the unmanned aerial vehicle to a base station of the terrestrial wireless broadband electronic communications network.
6. Base station and terminal station transmission within the 24,25-27,5 GHz frequency band shall be in compliance with the block edge mask in this Annex.

Figure 1 provides an example of a possible channelling arrangement.

Figure 1

Example of a channelling arrangement within the 24,25-27,5 GHz frequency band



3. Technical conditions for base stations — Block Edge Mask

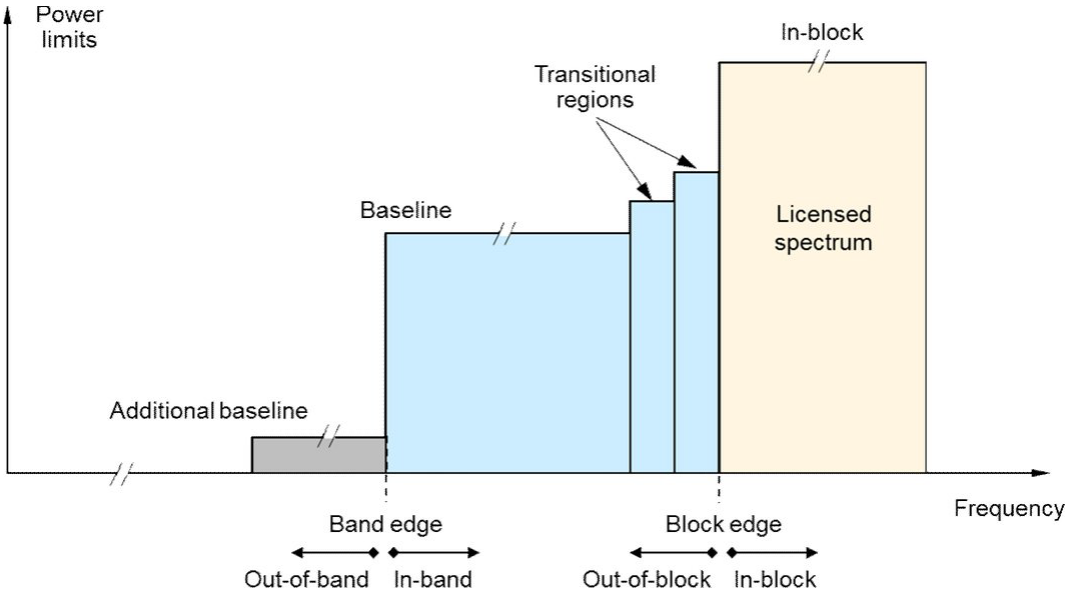
The technical parameters for base stations, called block edge mask (BEM) set out in this section, are an essential component of the conditions necessary to ensure coexistence between neighbouring wireless broadband electronic communications networks in the absence of bilateral or multilateral agreements between operators of such neighbouring networks. Operators of wireless broadband electronic communications services in the 24,25-27,5 GHz band may agree, on a bilateral or multilateral basis, less stringent technical parameters provided that they continue to comply with the technical conditions applicable for the protection of other services, applications or networks and with their cross-border obligations. Member States shall ensure that those less stringent technical parameters can be used by agreement among all affected parties.

A BEM is an emission mask that defines power levels as a function of frequency relative to the edge of a block of spectrum assigned to an operator. It consists of several elements as shown in Table 1. The baseline power limit ensures that the spectrum of other operators is protected. The additional baseline power limit (out-of-band limit) ensures that the spectrum for services and applications outside the 24,25-27,5 GHz frequency band is protected. The transitional region power limit enables a roll-off of power levels from the in-block to the baseline power limit and ensures co-existence with other operators in adjacent blocks.

Figure 2 shows a general BEM applicable to the 26 GHz frequency band.

Figure 2

Illustration of a block edge mask



No harmonised in-block power limit is specified. Tables 2 and 3 assume synchronised operation. Unsynchronised or semi-synchronised operation also necessitates the geographical separation of neighbouring networks. Tables 4 and 6 specify out-of-band power limits for base stations and terminal stations respectively to ensure the protection of the Earth Exploration Satellite Service (EESS) (passive) in the 23,6-24,0 GHz frequency band. Table 5 provides an additional technical condition for base stations to facilitate co-existence with satellite systems in the earth-to-space Fixed Satellite Service (FSS) and in the Inter-Satellite Service (ISS).

Table 1

Definition of BEM elements

BEM element	Definition
In-block	Assigned spectrum block for which the BEM is derived.
Baseline	Spectrum within the 24,25-27,5 GHz frequency band used for terrestrial wireless broadband electronic communications services, not including the operator's block under consideration and corresponding transitional regions.
Transitional region	Spectrum adjacent to an operator's block.
Additional baseline	Spectrum within bands adjacent to the 24,25-27,5 GHz frequency band, where specific power limits apply with respect to other services or applications.

Table 2

Base station transitional region power limit for synchronised operation

Frequency range	Maximum TRP	Measurement bandwidth
Up to 50 MHz below or above an operator's block	12 dBm	50 MHz

Explanatory note

The limit ensures coexistence between wireless broadband electronic communications networks in adjacent block(s) within the 26 GHz frequency band and in synchronised operation.

Table 3

Base station baseline power limit for synchronised operation

Frequency range	Maximum TRP	Measurement bandwidth
Baseline	4 dBm	50 MHz

Explanatory note

The limit ensures coexistence between wireless broadband electronic communications networks in non-adjacent blocks within the 26 GHz frequency band and in synchronised operation.

Table 4

Base station additional baseline power limit

Frequency range	Maximum TRP	Measurement bandwidth
23,6-24,0 GHz	– 42 dBW	200 MHz

Explanatory note

The out-of-band limit applies to the maximum emissions in the 23,6-24,0 GHz band for the protection of the EESS (passive) in all stipulated modes of base station operation (that is to say maximum in-band power, electrical pointing, carrier configurations).

Table 5

Additional condition applying to AAS outdoor base stations

Requirement on elevation of the main beam of AAS outdoor base stations

When deploying such base stations, it shall be ensured that each antenna is normally transmitting only with the main beam pointing below the horizon and in addition the antenna shall have mechanical pointing below the horizon except when the base station is only receiving.

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Explanatory note

The condition applies to the protection of space station receivers such as in the FSS (earth-to-space) and in the ISS.

4. Technical conditions for terminal stations

Table 6

Terminal station additional baseline power limit

Frequency range	Maximum TRP	Measurement bandwidth
23,6-24,0 GHz	– 38 dBW	200 MHz

Explanatory note

The out-of-band limit applies to the maximum emissions in the 23,6-24,0 GHz frequency band for the protection of the EESS (passive) for all stipulated modes of terminal station operation (that is to say maximum in-band power, electrical pointing, carrier configurations).

[1] Such as radio astronomy services.

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Attachment 3

RESOLUTION 243 (WRC-19)

Terrestrial component of International Mobile Telecommunications in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

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

b) that adequate and timely availability of spectrum and supporting regulatory provisions are essential to realize the objectives in Recommendation ITU-R M.2083;

c) that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;

d) that IMT systems are now being evolved to provide diverse usage scenarios and applications such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;

e) that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;

f) that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple-input and multiple-output (MIMO) and beam-forming techniques, in supporting enhanced broadband;

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

h) that the ITU Radiocommunication Sector (ITU-R) has studied, in preparation for WRC-19, sharing and compatibility with services allocated in the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz and their adjacent frequency bands, based on the characteristics available at that time, and the results may change if these characteristics change;

i) 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;

j) that there is a need to protect existing services and to allow for their continued development;

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

l) that the use of this frequency band by the mobile service for IMT is intended for land mobile service use and sharing studies were conducted based on that assumption,

noting

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

b) that Report ITU-R M.2320 addresses future technology trends of terrestrial IMT systems;

c) that Report ITU-R M.2370 addresses trends impacting future IMT traffic growth beyond the year 2020 and estimates global traffic demand for the period 2020 to 2030;

d) that Resolution **143 (Rev.WRC-19)** establishes the guidelines for the implementation of high-density applications in the fixed-satellite service (HDFSS) in frequency bands identified for these applications,

recognizing

a) that timely availability of wide and contiguous blocks of spectrum is important to support the development of IMT;

b) Resolutions 176 (Rev. Dubai, 2018) and 203 (Rev. Dubai, 2018) of the Plenipotentiary Conference;

c) the identification of HDFSS in the space-to-Earth direction in the frequency bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions, 40.5-42 GHz in Region 2 and 47.5-47.9 GHz in Region 1 (see No. **5.516B**);

d) that No. **5.149** applies for the purpose of protecting the radio astronomy service (RAS) in the frequency band 42.5-43.5 GHz, which is allocated on a primary basis;

e) that the frequency band 47.2-48.2 GHz is allocated to the fixed, mobile and fixed-satellite services, including planned non-geostationary-satellite (non-GSO) uplinks,

resolves

1 that administrations wishing to implement IMT consider use of the frequency band 37-43.5 GHz, or portions thereof, and the frequency band 47.2-48.2 GHz, identified for IMT in No. **5.550B** and No. **5.553B**, and the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT taking into account the latest relevant ITU-R Recommendations;

2 that, in order to ensure coexistence between IMT in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz as identified by this conference in Article **5** and other services to which the frequency band is allocated, including the protection of these other services, administrations shall apply the following condition(s):

2.1 in order to protect the Earth exploration satellite service (EESS) (passive) in the frequency band 36-37 GHz, the following unwanted emissions of IMT stations operating in the frequency band 37-40.5 GHz apply as specified in Table 1 below:

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TABLE 1

Frequency band for the EESS (passive)	Frequency band for IMT stations	Unwanted emission mean power for IMT stations[1]	Recommended limits for IMT stations[1]
36-37 GHz	37-40.5 GHz	−43 dB(W/MHz) and −23 dB(W/GHz) within the frequency band 36-37 GHz	−30 dB(W/GHz)

[1] The unwanted emission power level is considered in terms of total radiated power (TRP). The TRP is to be understood here as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.

2.2 protection of space research service (SRS) earth stations in the frequency band 37-38 GHz and RAS stations in the frequency band 42.5-43.5 GHz from IMT stations should be facilitated through bilateral agreements for cross-border coordination as necessary;

2.3 protection of and coexistence with fixed-satellite service (FSS) earth stations within the frequency ranges 37.5-43.5 GHz and 47.2-48.2 GHz should be facilitated through bilateral agreements for cross-border coordination as necessary;

2.4 take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency bands 42.5-43.5 GHz and 47.2-48.2 GHz; the mechanical pointing needs to be at or below the horizon;

2.5 as far as practicable, sites for IMT base stations in the frequency bands 42.5-43.5 GHz and 47.2-48.2 GHz employing values of equivalent isotropically radiated power (e.i.r.p.) per beam exceeding 30 dB(W/200 MHz) should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit, within line-of-sight of the IMT base station, by ±7.5 degrees;

3 that IMT stations within the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz are used for applications of the land mobile service,

invites administrations

to ensure that, when considering the spectrum to be used for IMT, due attention is paid to the need for spectrum for ubiquitous earth stations at unspecified points, as well as those used for gateways, taking into account spectrum identified in the frequency bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions, 40.5-42 GHz in Region 2 and 47.5-47.9 GHz in Region 1 for the HDFSS as per No. **5.516B**,

encourages administrations

1 to ensure that provisions for the implementation of IMT allow for the continued development of EESS, SRS, FSS and broadcasting-satellite service (BSS) earth stations and RAS stations and their future development;

2 to keep the antenna pattern of IMT base stations within the limits of the approximation envelope according to Recommendation ITU-R M.2101,

encourages administrations of Region 1

to consider implementing IMT in the frequency band 40.5-43.5 GHz in order to better accommodate the needs of other services below 40.5 GHz, taking into account protection of the FSS within the frequency band 37.5-40.5 GHz in Region 1,

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invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz, taking into account the results of sharing and compatibility studies conducted in preparation for WRC-19;

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

3 to develop an ITU-R Recommendation on methodologies for calculating coordination zones around SRS earth stations in order to avoid harmful interference from IMT systems in the frequency band 37-38 GHz;

4 to develop ITU-R Reports and Recommendations, as appropriate, to assist administrations in ensuring coexistence between IMT and BSS and FSS, including HDFSS as per No. **5.516B**, within the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz, as appropriate;

5 to develop a new ITU-R Recommendation, as appropriate, to provide information and assistance to the concerned administrations on possible coordination and protection measures for the RAS in the frequency band 42.5-43.5 GHz from IMT deployment;

6 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) and those of systems of space services on sharing and compatibility, 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 receivers,

instructs the Director of the Radiocommunication Bureau

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

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