

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of	)	
	)	
Emission Limits for the 24.25-27.5 GHz Band	)	ET Docket No. 21-186
	)	
Use of Spectrum Bands Above 24 GHz	)	GN Docket No. 14-177
For Mobile Radio Services	)	
	)	

**COMMENTS OF THE  
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION**

Kathy Smith  
Chief Counsel

Evelyn Remaley  
Acting Assistant Secretary of Commerce for  
Communications and Information

Charles Cooper  
Associate Administrator, Office of Spectrum  
Management

National Telecommunications and  
Information Administration  
U.S. Department of Commerce  
1401 Constitution Ave, NW  
Washington, DC 20230

(202) 482-1816

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NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION**

The National Telecommunications and Information Administration (NTIA) appreciates the Commission’s issuance of the Public Notice<sup>1</sup> in the above-captioned docket seeking input on updating Part 2 and Part 30 of its rules to align with the Radio Regulations<sup>2</sup> for out-of-band emissions (OOBE) limits into the 24 GHz band as established at the 2019 World Radiocommunication Conference (WRC-19) with the support and signature of Ambassador Grace Koh, U.S. Department of State, on behalf of the United States. As the President’s principal adviser on domestic and international telecommunications policy, and also on behalf of the National Oceanic and Atmospheric Administration (NOAA), National Science Foundation (NSF), and the National Aeronautics and Space Administration (NASA), NTIA hereby expresses

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<sup>1</sup> *The Office of Engineering & Technology and the Wireless Telecommunications Bureau Seek Comment on Emission Limits for the 24.25-27.5 GHz Band*, Public Notice, DA 21-482, ET Docket No. 21-186, GN Docket No. 14-177 (rel. Apr. 26, 2021) (Public Notice).

<sup>2</sup> Radio Regulations is defined at 47 C.F.R. §2.1(b) as ITU Radio Regulations. The ITU is the International Telecommunication Union, an international organization within the United Nations System where governments and the private sector coordinate global telecom networks and services.

support for harmonizing the Commission's rules with the OOB limits adopted at WRC-19 and recommends related measures as well to expedite the deployment of conforming devices.<sup>3</sup>

NTIA urges the Commission to adopt these new rules as soon as reasonably possible. Modifying the Table of Allocations and aligning the Commission's rules with the OOB limits adopted in the Radio Regulations at WRC-19 would harmonize U.S regulations and provide important protection to extremely sensitive passive weather sensing and existing and future space-based sensing operations considered vital for ensuring the accuracy and timeliness of severe weather phenomenon (*e.g.*, hurricanes and tornados), as well as meeting the Administration's goals for climate monitoring and climatological science. The adoption of these rules will enable our nation to maintain its position as the world leader in telecommunications, enable manufacturers to produce equipment marketable across the globe, and facilitate smooth deployment of 5th Generation mobile broadband telecommunications (5G) to consumers in the United States.

**I. THE COMMISSION SHOULD ALIGN ITS RULES WITH THE WRC-19 LIMITS ON EMISSIONS FROM ACTIVE OPERATIONS IN THE 24.25-25.25 GHZ BAND INTO PASSIVE SENSING IN THE 23.6-24.0 GHZ BAND.**

To protect passive space-based sensing operations in the 23.6-24.0 GHz band, NTIA respectfully urges the Commission to harmonize its rules with the OOB limits adopted at WRC-19. Specifically, the Commission should update section 30.203 of its rules to conform

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<sup>3</sup> The recommended rule changes are set forth explicitly in the Attachment hereto.

with Table 1 of the Public Notice<sup>4</sup> and provide that, for IMT stations<sup>5</sup> operating in the 24.25-24.45 GHz or 24.75-25.25 GHz bands, the total radiated power of emissions in any 200 MHz of the 23.6-24.0 GHz passive band shall not exceed the following limits:

- -33 dBW for base stations brought into operation on or prior to September 1, 2027;
- -39 dBW for base stations brought into operation after September 1, 2027;
- -29 dBW for user equipment brought into operation on or prior to September 1, 2027;
- -35 dBW for user equipment brought into operation after September 1, 2027.<sup>6</sup>

Protection of these space-borne passive sensors is important. Satellite passive sensors are designed to look downward toward Earth and measure the power level of naturally occurring radio emissions from molecules in the atmosphere. Very sensitive instrumentation is necessary to measure the power level of such natural signals, as they are very weak. The natural radio emissions occur at very specific frequencies, so they accordingly must be measured in specific bands.<sup>7</sup> The sensitivity of measurements and data collected in the 23.6-24.0 GHz band are recognized by the Commission and the ITU, which can be seen by existing footnotes US246<sup>8</sup>

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<sup>4</sup> See Public Notice at 3.

<sup>5</sup> As noted in the Public Notice, International Mobile Telecommunications, or “IMT”, is an international term used by the ITU to designate broadband mobile telecommunications services. See Public Notice, n.8.

<sup>6</sup> See Attachment.

<sup>7</sup> See Earth Exploration-Satellite Service Handbook (2011), ITU Radiocommunication Bureau, Chapter 5, Section 5.2.4; available at <https://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-HDB-56-2011&media=electronic>.

<sup>8</sup> U.S. Table of Frequency Allocations, US246 - No stations will be authorized to transmit in the bands 608-614 MHz, 1400-1427 MHz, 1660.5-1668.4 MHz, 2690-2700 MHz, 4990-5000 MHz, 10.68-10.70 GHz, 15.35-15.40 GHz, 23.6-24.0 GHz, 31.3-31.8 GHz, 51.4-54.25 GHz, 58.2-59.0 GHz, 64-65 GHz, 86-92 GHz, 100-102 GHz, 105-116 GHz, 164-168 GHz, 182-185 GHz and 217-231 GHz.

and RR5.340.<sup>9</sup> These footnotes recognize the right and need to ensure an interference-free environment for space-borne passive sensing in the 23.6-24.0 GHz band. NOAA, for example, uses passive sensors to collect data crucial for weather forecasting. Observed moisture data collected by passive sensing in the 23.8 GHz spectrum range serve as the basis for water vapor input to numerical weather models. These measurements are considered vital to the U.S. to ensure accuracy and timeliness of warning for disasters from severe weather, such as hurricanes and tornadoes. NASA and NOAA also use passive sensing data collected in the 23.6-24.0 GHz band for climatological science, long-term atmospheric observations, and monitoring of certain weather trends, which can portend natural disasters such as drought or landslides.

Without appropriate out-of-band emission limits on Upper Microwave Flexible Use Systems (UMFUS) operating in portions of the 24.25-25.25 GHz band, these passive sensors in the near-adjacent band at 23.6-24.0 GHz band can be rendered inoperable by harmful interference. The Commission in its Spectrum Frontiers proceedings adopted a flexible-use licensing framework for upper microwave frequencies and created a new Part 30 establishing rules and requirements for UMFUS.<sup>10</sup> In 2017, the Commission added co-primary non-federal fixed and mobile services allocations to the 24.25-25.25 GHz bands for UMFUS but explicitly acknowledged the need to protect passive sensors onboard satellites in the near-adjacent 23.6-24.0 GHz band.<sup>11</sup> The Commission at that time recognized the existence of ongoing

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<sup>9</sup> ITU Radio Regulations, RR5.340 - All emissions are prohibited.

<sup>10</sup> *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016) (*Spectrum Frontiers First Report and Order*), [https://ecfsapi.fcc.gov/file/0714115429654/FCC-16-89A1\\_Rcd.pdf](https://ecfsapi.fcc.gov/file/0714115429654/FCC-16-89A1_Rcd.pdf).

<sup>11</sup> *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988, 10996-10997, para. 22 (2017) (*Spectrum*

international work investigating protection of these passive sensors and committed to addressing OOBE rules once these international studies were complete:

“[W]e note that ongoing international studies include analyses to determine IMT-2020 out-of-band (OOB) emission limits necessary to protect passive sensors onboard weather satellites in the 23.6-24.0 GHz band. The Commission recognizes the need to protect these passive satellite operations that provide important data necessary for weather predictions and warnings. Once the international studies have been completed, interested parties may propose revisions to the Commission’s rules as necessary for protection of weather satellites operating in the 23.6-24.0 GHz band.”<sup>12</sup>

International studies were completed, and WRC-19 established out-of-band protection limits for compatibility between Earth Exploration-Satellite Service (EESS) passive systems and relevant active services that would be implemented on a two-step basis.<sup>13</sup> The Commission now has issued a responsive Public Notice, and NTIA very much appreciates the Commission’s consideration of the WRC-19’s OOBE limits.

NTIA, on behalf of NOAA, NSF, and NASA, accordingly recommends the following revisions of Part 2 and Part 30 of the Commission’s rules to align with the Radio Regulations emission limits as signed by the U.S. and adopted at WRC-19:

- 1) Modify the applicability of the emission limits specified in Section 30.203(a) of the FCC’s rules for Upper Microwave Flexible Use Systems (UMFUS) by adding a new subsection (d) governing emission limits from stations operating in portions of the 24.25-25.25 GHz band (base stations and user equipment) to align the specified OOBE emission limits and the two-stage implementation of the OOBE limits established at WRC-19.

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*Frontiers Second Report and Order*), <https://docs.fcc.gov/public/attachments/FCC-17-152A1.pdf>.

<sup>12</sup> *Spectrum Frontiers Second Report and Order*, 32 FCC Rcd at 10997, para. 22.

<sup>13</sup> See The Final Acts WRC-19, Resolution 750 (Rev.WRC-19), Table 1 on page 485, <https://www.itu.int/pub/R-ACT-WRC.14-2019/en>.

- 2) Modify the United States Table within the Table of Allocations, Section 2.106 of the FCC's rules, for the 24.25-24.45 GHz and 24.75-25.25 GHz band segments by adding and modifying international footnote 5.338A in line with the decisions taken at WRC-19 for both the international section and the non-federal section to reflect the basis for the changes in Section 30.203;<sup>14</sup> and adding new international footnote 5.532AB in line with the decisions taken at WRC-19 for both the international section and the non-federal section to align the U.S. and international table and identify UMFUS equipment as International Mobile Telecommunications (IMT) eligible in international markets.<sup>15</sup>

The Public Notice further asked what level of emissions might be expected within the 23.6-24.0 GHz band and to what extent harmful interference would occur from new 5G deployments.<sup>16</sup> NTIA notes that the OOB limits adopted at WRC-19 followed an extensive review of international studies and other evidence. The United States contributed significantly to these international studies in light of the need to protect the important federal systems using the 23.6-24.0 GHz band that serve and inform the public as well as the substantial taxpayer investments in these systems. In developing these OOB limits, experts at WRC-19 relied on studies that evaluated the impact on passive sensors from the deployment of 5G/IMT systems. Among the impacts studied were the potential corrupt data levels for nadir-scanning<sup>17</sup> passive sensors based on the simulation of the Advanced Technology Microwave Sounder (ATMS)

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<sup>14</sup> World Radiocommunication Conference 2019 (WRC-19) Final Acts (The Final Acts WRC-19), Resolution 750 (Rev.WRC-19), Table 1 on page 485, *available at* <https://www.itu.int/pub/R-ACT-WRC.14-2019/en>.

<sup>15</sup> The Final Acts WRC-19, Frequency Allocations at 38, Resolution 242 (WRC-19) at 351-354, *available at* <https://www.itu.int/pub/R-ACT-WRC.14-2019/en>.

<sup>16</sup> Public Notice at 3.

<sup>17</sup> For additional information on nadir-scanning (also referred to as cross-track scanning) and conical-scanning techniques, please see ITU-R Recommendation RS.1861: <https://www.itu.int/rec/R-REC-RS.1861-0-201001-I/en>.



instrument that is flown on NOAA's Joint Polar Satellite System missions.<sup>18</sup> The potential corrupt data levels for conical-scanning passive sensors were based on the simulation of the Global Precipitation Measurement (GPM) Microwave Imager (GMI) instrument that is flown on NASA's GPM mission.<sup>19</sup>

The adverse impacts reflected in the international studies on these critical U.S. systems support Commission adoption of the WRC-19 OOB limits. The international studies relied upon at WRC-19 showed that the potential interference to the passive satellite sensors depended markedly upon the deployment density of the 5G/IMT systems. Plainly, the ultimate deployment density cannot be known *a priori* but only can be estimated presently. Recognizing that 5G/IMT deployment densities likely are to be lower in the early phases of roll-out of the 24 GHz systems, a less stringent limit was deemed acceptable for an initial period lasting until September 2027. During this initial period, the mobile industry could continue to improve the 5G/IMT equipment designs to reduce out-of-band emissions to meet the more stringent post-September-2027 limits, which were set at levels methodically expected to prevent harmful interference to passive sensors from the estimated 24 GHz deployment densities. Adoption of the WRC-19 OOB limits accordingly is recommended.

**II. THE COMMISSION SHOULD URGE OR PROVIDE INCENTIVES FOR LICENSEES TO MEET THE MORE STRINGENT WRC-19 OOB LEVELS EVEN BEFORE 2027 – AND AS SOON AS REASONABLY POSSIBLE.**

NTIA has recommended herein that the Commission harmonize its rules with the OOB limits adopted at WRC-19, and we further ask that the Commission urge licensees to comply

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<sup>18</sup> For more information on ATMS, see <https://www.jpss.noaa.gov/atms.html#>.

<sup>19</sup> For more information on GMI, see <https://gpm.nasa.gov/missions/GPM/GMI>.

with the ultimate, post-September-2027 OOB limit as soon as reasonably possible. We also ask that the Commission consider adopting measures that would incentivize licensees to deploy systems that comply with the more stringent, post-September-2027 OOB limit even before 2027. NTIA is concerned that systems deployed before September 2027 under less stringent limits could result in harmful interference to passive satellite sensors, especially where such deployments are densified.

At the ultimate OOB limit of -39 dBW/200 MHz established in the ITU Radio Regulations for 5G base station deployments *after* September 1, 2027, the studies and simulations indicate a slight impact on passive sensing in the 23.6-24.0 GHz band. Under the two-step approach adopted at WRC-19, which established an interim OOB limit (*i.e.*, before September 1, 2027) of -33 dBW/200 MHz for 5G base stations, the effectiveness of the protection of passive satellite sensors will depend on the level and rapidity of 5G deployment.<sup>20</sup>

In developing the two-step approach for the OOB limits, experts at the ITU considered that there would be gradual deployment of 5G systems in the bands at issue. They recognized that, because the number of 5G systems deployed prior to September 1, 2027 could not be predicted with certainty, it is possible that the interim OOB limits could become ineffective if 5G deployment exceeds expectations. For purposes of calculating the ultimate values for the post-2027 OOB limits, the experts at ITU based their assessment on the presumption that all 5G systems in operation would be compliant with the more stringent limits.

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<sup>20</sup> The current FCC OOB limit established in 47 CFR 30.203(a) is -13 dBm/MHz (47 C.F.R. § 30.203(a)), which is equivalent to a -20 dBW/200 MHz limit. At this current limit, harmful interference to passive systems operating in the 23.6-24.0 GHz band is expected to occur from new 5G deployments in the near adjacent 24.25 GHz band. *See, e.g.*, ITU Radio Regulations – 2020 version; Resolution 750, Table 1 at page 543.

The reality could be a bit different, which is why NTIA is requesting that the Commission take steps to help accelerate deployment of equipment that complies with the post-2027 limits. In reality, some equipment installed prior to 2027 under the less stringent limits could continue operating after 2027. Due to cost and complexity, the pre-2027 base stations will likely have a longer lifespan than the user equipment. Data loss from the passive sensors due to near-band 5G deployments accordingly would diminish slowly after 2027 rather than halt abruptly. The projected decline in impact post-2027 assumes that, as 5G equipment ages, the replacement equipment would comply with the more stringent OOB limits.

The United States is engaged in a concerted national effort to be the world leader in 5G and is promoting policies aimed at rapid 5G growth, wide geographic deployment of 5G, and extensive 5G innovation. As a consequence of our national priorities regarding 5G, the likelihood of successful and rapid deployment of 5G throughout the United States is not only significant but desired. As such, encouraging manufacturers, suppliers, innovators, entrepreneurs, standards bodies, and service providers to meet the -39 dBW/200 MHz OOB limit as soon as possible is critical to ensuring U.S. leadership in 5G and protecting vital weather and earth observation data obtained from satellite-based passive sensors.

Accordingly, NTIA suggests that a new subsection (d)(2) be added to Section 30.203 to urge licensees to meet the more stringent levels as soon as possible, and that a new NG footnote be added to the Non-Federal Table of the US Table of Allocations encouraging early adoption of the 2027 OOB limits. Additionally, NTIA respectfully suggests that the Commission consider adopting any other suitable incentive that it finds might accelerate deployment of equipment compliant with post-2027 limits. Such incentives could prove to be important if equipment and services are deployed more quickly than anticipated.

**III. THE COMMISSION SHOULD CLARIFY THAT BASE STATION AND USER EQUIPMENT MODIFIED OR REPLACED AFTER SEPTEMBER 1, 2027 MUST COMPLY WITH THE MORE STRINGENT POST-2027 OOB LIMITS.**

The WRC-19 OOB regulations allow systems deployed prior to September 1, 2027 to continue to comply with the less-stringent interim levels after that date. However, there arguably is some ambiguity regarding which OOB limits would apply after a system is modified or equipment is replaced. NTIA respectfully suggests that the Commission forestall any ambiguity by revising the Part 30 rules and clarifying that base stations or user equipment modified or replaced after September 1, 2027 must comply with the post-2027 OOB levels. This clarification will ensure that modifications to or replacements of legacy equipment installed during early 5G deployments will not continue to be a potential source of interference to passive satellite sensors.

Early adoption in the U.S. of the more stringent limits, along with a domestic requirement that equipment modified or replaced after September 1, 2027 must comply with the stringent OOB limits, would help establish a market for 5G equipment in the 24 GHz band that meets the stringent standards, enhance U.S. leadership, and provide opportunities for economies of scale that benefits manufacturers.

**IV. LICENSEES SHOULD AFFIRMATIVELY ADDRESS INTERFERENCE THEY ARE FOUND TO CAUSE TO PASSIVE SATELLITE SENSING.**

NTIA requests that wireless licensees found to cause harmful interference to passive satellite sensing in the 23.6-24.0 GHz band due to exceeding OOB limits be required, at a minimum, to comply with the post-2027 OOB levels or, if necessary, to take other corrective actions. This is particularly important as aggregate 5G deployments increase throughout the United States.

**V. THE WRC-19 OOBE LIMITS FOR THE 23.6-24.0 GHZ BAND SHOULD APPLY BROADLY TO ALL MOBILE SYSTEMS (AND NOT JUST TO IMT).**

There is sufficient evidence available to permit the Commission to apply the WRC-19 OOBE limits broadly to all mobile systems instead of restricting the limits only to the IMT systems that were the focus at WRC-19. The Public Notice explained that the Commission's rules allow licensees to deploy fixed or mobile services, but that the WRC-19 OOBE limits apply only to IMT, which is a mobile application.<sup>21</sup> The Public Notice accordingly asked how the FCC should determine to what devices the WRC-19 OOBE limits apply.<sup>22</sup>

The international studies relied upon at WRC-19 focused on IMT – an application of the mobile service. The studies showed that device and deployment density, along with pointing angles toward the satellite, are the predominate factors in causing interference to the passive satellite sensors. These factors are common to all mobile systems and are not unique to IMT, so applying the WRC-19 OOBE limits broadly to all mobile systems would be warranted.

The Commission's Public Notice asks by extension whether the WRC-19 OOBE limits should apply to point-to-point and point-to-multipoint equipment licensed under the UMFUS.<sup>23</sup> Although the Public Notice observed that existing point-to-point microwave links in the adjacent 21.2-23.6 GHz band do not appear to cause harmful interference to the passive sensors in the 23.6-24.0 GHz band,<sup>24</sup> it also recognized that the OOBE limits produced at WRC-19 were for IMT and not fixed service. In addition, as the distinction between fixed and mobile services in

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<sup>21</sup> Public Notice at 4.

<sup>22</sup> *Id.*

<sup>23</sup> *Id.*

<sup>24</sup> *Id.*, n.20.

5G/IMT services could become blurred, it would be increasingly difficult to identify attributing sources of interference. As such, NTIA requests that the Commission consider the following provisions:

- **Fixed Services Should Comply with WRC-19 OOB Limits** – The two-step approach should apply as well.
- **Fixed Service Non-Compliance with WRC-19 OOB Limits** – Fixed services that cannot comply with the WRC-19 OOB limits, or cannot meet the phasing approach, should be constricted to operate with no greater than 0 degree antenna uptilts.
- **Additional Studies and Assessments** – Recognizing that the focus of the WRC-19 OOB studies focused on IMT and not fixed services, NTIA believes the issue merits explicit study – perhaps jointly by the Commission and NTIA – before sufficient confidence can be gained to possibly relax rules proposed here that would be applied to point-to-point and point-to-multipoint service.

## **VI. MEASUREMENTS SHOULD BE PERFORMED USING TOTAL RADIATED POWER.**

The Public Notice inquires whether conductive power methodology also should be included as an alternative means for equipment certification as conformity to current UMFUS rules and section 30.203.<sup>25</sup> As adopted at WRC-19, the established OOB limits are based on the review of multiple studies utilizing total radiated power (TRP). Although conductive power methodologies may be useful, they presently are less understood than TRP. Consistent with the rules adopted at WRC-19, NTIA recommends that measurements are to be performed solely utilizing the TRP methodology.

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<sup>25</sup> *Id.* at 4.

For the foregoing reasons, NTIA respectfully recommends that the Commission align its rules with the WRC-19 limits on OOB within the 23.6-24.0 GHz bands and make the further changes suggested in the attachment.

Respectfully submitted,



Kathy Smith  
Chief Counsel

Evelyn Remaley  
Acting Assistant Secretary of Commerce  
for Communications and Information

Charles Cooper, Associate Administrator  
Steve Molina, Deputy Associate Administrator  
Scott Patrick, Executive Director  
Office of Spectrum Management

Derek Khlopin, Senior Advisor

National Telecommunications  
and Information Administration  
U.S. Department of Commerce  
1401 Constitution Ave, NW  
Washington, DC 20230  
(202) 482-1816

June 28, 2021

Attachment with proposals to implement the WRC-19 decisions on 24.25-27.5 GHz and requested rule changes in the FCC Part 2 and Part 30 rules.

## ATTACHMENT

### Proposals to implement the WRC-19 decisions on 24.25-27.5 GHz

#### 1) Proposed modification of CFR § 30.203 (in blue)

##### § 30.203 Emission limits.

(a) **Except for (d) below**, the conductive power or the total radiated power of any emission outside a licensee's frequency block shall be  $-13$  dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be  $-5$  dBm/MHz or lower.

##### (b)

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

(c) For fixed point-to-point and point-to-multipoint limits see [§ 30.404](#).

(d) (1) For licensees operating in the 24.25-24.45 GHz or 24.75-25.25 GHz bands, the total radiated power of emissions in any 200 MHz of the 23.6-24.0 GHz passive band shall not exceed the following limits:

(i)  $-33$  dBW for base stations brought into operation on or prior to September 1, 2027;

(ii)  $-39$  dBW for base stations brought into operation after September 1, 2027;

(iii)  $-29$  dBW for user equipment brought into operation on or prior to September 1, 2027;

(iv)  $-35$  dBW for user equipment brought into operation after September 1, 2027.

(2) Notwithstanding that the more stringent emission limits specified in (d)(1)(ii) and (iv) are not mandatory until September 1, 2027, licensees are encouraged to comply with the 2027 emission limits as soon as practicable.

(3)(i) A base station authorized to operate at  $-33$  dBW that is modified or replaced after September 1, 2027 must comply with (d)(1)(ii);

(ii) User equipment authorized to operate at  $-29$  dBW that is modified or replaced after September 1, 2027 must comply with (d)(1)(iv).



## 2) Proposed modifications to Sections 2.104 and 2.105 (in blue)

Table of Frequency Allocations			24.25-27.5 GHz (SHF/EHF)		Page 54-55
International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
24.25-24.45 FIXED MOBILE except aeronautical mobile 5.338A 5.532AB	24.25-24.45 FIXED 5.532AA MOBILE except aeronautical mobile 5.338A 5.532AB RADIONAVIGATION	24.25-24.45 FIXED MOBILE 5.338A 5.532AB RADIONAVIGATION	24.25-24.45	24.25-24.45 FIXED MOBILE 5.338A 5.532AB NGxxx	RF Devices (15) Upper Microwave Flexible Use (30)
24.45-24.65 FIXED INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB	24.45-24.65 FIXED 5.532AA INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB RADIONAVIGATION 5.533	24.45-24.65 FIXED INTER-SATELLITE MOBILE 5.338A 5.532AB RADIONAVIGATION 5.533	24.45-24.65 INTER-SATELLITE RADIONAVIGATION 5.533		RF Devices (15) Satellite Communications (25)
24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB	24.65-24.75 FIXED 5.532AA INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB RADIOLOCATION- SATELLITE (Earth-to-space)	24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE 5.338A 5.532AB 5.533	24.65-24.75 INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)		
24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B MOBILE except aeronautical mobile 5.338A 5.532AB	24.75-25.25 FIXED 5.532AA FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE except aeronautical mobile 5.338A 5.532AB	24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE 5.338A 5.532AB	24.75-25.25	24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) NG65 MOBILE 5.338A 5.532AB NGxxx	RF Devices (15) Satellite Communications (25) Upper Microwave Flexible Use (30)
25.25-25.5 FIXED 5.534A INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB Standard frequency and time signal-satellite (Earth-to-space)			25.25-25.5 FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to- space)	25.25-25.5 Inter-satellite 5.536 Standard frequency and time signal-satellite (Earth-to- space)	RF Devices (15)
25.5-27 EARTH EXPLORATION-SATELLITE (space-to-Earth) 5.536B FIXED 5.534A INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space)  5.536A			25.5-27 EARTH EXPLORATION- SATELLITE (space-to- Earth) FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space- to-Earth) Standard frequency and time signal-satellite (Earth-to- space) 5.536A US258	25.5-27 SPACE RESEARCH (space-to-Earth) Inter-satellite 5.536 Standard frequency and time signal-satellite (Earth-to- space)  5.536A US258	
27-27.5 FIXED	27-27.5 FIXED 5.534A		27-27.5 FIXED	27-27.5 Inter-satellite 5.536	

INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB	FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE 5.338A 5.532AB	INTER-SATELLITE 5.536 MOBILE		
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**MOD**

**5.338A** In the frequency bands 1350-1400 MHz, 1427-1452 MHz, 22.55-23.55 GHz, 24.25-27.5 GHz, 30-31.3 GHz, 49.7-50.2 GHz, 50.4-50.9 GHz, 51.4-52.4 GHz, 52.4-52.6 GHz, 81-86 GHz and 92-94 GHz, Resolution 750 (Rev.WRC-19) applies. (WRC-19)

**ADD**

**5.532AB** The frequency band 24.25-27.5 GHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution 242 (WRC-19) applies. (WRC-19)

**ADD**

**NGxxx** In the band 24.25-27.5 GHz, stations in the mobile service are encouraged to migrate existing equipment to the tighter emission limits specified in §30.203 as soon as practicable, but no later than September 1, 2027.