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| U.S. Radiocommunications SectorFact Sheet |
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| **Purpose/Objective:** The purpose of this contribution is to develop a framework for revision of Resolution 155 (Rev.WRC-19) using Resolution 169 (WRC-19) as a basis.  |
| **Abstract:** Under Resolution 171 (WRC-19) for WRC-23 Agenda Item 1.8, WP 5B is required to complete, in time for WRC-23, relevant studies of the regulatory aspects in relation to the implementation of Resolution 155 (Rev.WRC-19). It is also required to review Resolution 155 (Rev.WRC-19) taking into account the results of those studies. This contribution considers a framework for revision of Resolution 155 using the recently adopted Resolution 169 (WRC-19) for ESIMS as a framework. |

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| **Radiocommunication Study Groups** |  |
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| WORKING DOCUMENT TOWARDS A FRAMEWORK FOR REVISIONS TO RESOLUTION 155 IN SUPPORT OF STUDIES UNDER WRC-23 AGENDA ITEM 1.8 |

# 1 Introduction and Proposals

A framework to facilitate satisfying the provisions of Resolution **155 (Rev. WRC-19)** is necessary for Earth Stations on Unmanned Aircraft and for protecting radiocommunication services under WRC-23 Agenda Item 1.8. Using Resolution **155 (Rev. WRC-19)** and Resolution **169 (WRC-19)** as source material, the United States proposes that WP 5B consider the attached framework as a possible approach and example to improve the clarity and conciseness of Resolution **155 (Rev.WRC-19)**. The attached example uses Resolution **169 (WRC-19)** as its basis and incorporates provisions from Resolution **155 (Rev.WRC-19)** as required to address the UAS CNPC link specific topics.

**Attachments:** 1

RESOLUTION 155 (REV.WRC-23)

Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces\*

The World Radiocommunication Conference (XXX, 2023),

considering

*Editor’s Note*: This section to be improved with future inputs

recognizing

*a)* TBD

*b)* that, for cases of incomplete coordination under No. **9.7** of the GSO FSS network with assignments to be used by ESUA, the operation of ESUA on those assignments in the frequency bands referred to in *resolves* 1 needs to be in accordance with the provisions of No. **11.42** with respect to any recorded frequency assignment which was the basis of the unfavourable finding under No. **11.38**;

resolves

1 that, for any Earth station on board a UA (ESUA) communicating with a GSO FSS space station within the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space), or parts thereof, the following conditions shall apply:

1.1 with respect to space services in the frequency bands referred to in *resolves* 1, ESUA shall comply with the following conditions:

1.1.1 with respect to satellite networks or systems of other administrations, the ESUA characteristics shall remain within the envelope of characteristics of the Typical Earth stations associated with the satellite network with which the ESUA communicates;

1.1.2 that ESUA shall be designed and operated so as to be able to meet their required performance with interference caused by other satellite networks resulting from application of Articles **9** and **11** andthe use of ESUA shall not cause more interference and shall not claim more protection than any Typical Earth station in that GSO FSS network;

*Editor’s Note*: *Resolves* 1.1.2 merges with *resolves* 12 in RES155 (Rev.WRC-19)

1.1.3 the notifying administration of the GSO FSS network with which ESUA communicate shall ensure that the operation of ESUA complies with the coordination agreements for the frequency assignments of the Typical Earth station of the GSO FSS networks obtained under the relevant provisions of the Radio Regulations, taking into account *recognizing b)* above;

1.1*.*4 for the implementation of *resolves*1.1.1 above, the notifying administration for the GSO FSS networks with which the ESUA communicate shall, in accordance with this Resolution, send to the Radiocommunication Bureau (BR) the relevant Appendix **4** notification information related to the characteristics of the ESUA intended to communicate with those GSO FSS networks, together with the commitment that the ESUA operation shall be in conformity with the Radio Regulations, including this Resolution;

1.1.5 upon receipt of the notification information referred to in *resolves*1.1.4 above, the BR shall examine it with respect to the provisions referred to in *resolves*1.1.1 above and publish the results of such examinations in the International Frequency Information Circular (BR IFIC);

*Editor’s Note*: *Resolves* 1.1.4 and 1.1.5 address Resolves 4 of Resolution 155 (Rev.WRC-19)

1.1.6 for the protection of non-GSO FSS systems operating in the frequency bands 14-14.47 GHz and 29.5-30 GHz, ESUA communicating with GSO FSS networks shall comply with the provisions contained in Annex 2 to this Resolution;

1.2 with respect to terrestrial services in the frequency bands referred to in *resolves* 1, ESUA shall comply with the following conditions:

1.2.1 receiving ESUA in the frequency bands 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.1 GHz (Region 2), 12.1-12.2 GHz (on the territory of the country listed in No. **5.489**), 12.2-12.5 GHz (Region 3), 12.5-12.75 GHz (on the territory of the countries listed in No. **5.494** and in Region 3) shall be operated so as to be able to accept the interference and not claim protection from terrestrial services to which the frequency band is allocated when those terrestrial services operate in accordance with the Radio Regulations;

*Editor’s Note*: *Resolves* 1.2.1 also incorporates *resolves* 11 in RES155 (Rev.WRC-19)

1.2.2 the transmitting ESUA in the frequency bands 14.0-14.3 GHz (on the territory of countries listed in No. **5.505**), 14.25-14.3 GHz (on the territory of countries listed in No. **5.508**), 14.3-14.4 GHz (Regions 1 and 3), and 14.4-14.47 GHz shall not cause harmful interference to terrestrial services to which the frequency band is allocated when those terrestrial services operate in accordance with the Radio Regulations, and Annex 3 to this Resolution shall apply;

*Editor’s Note*: *Resolves* 1.2.2 applies the language from *resolves* 14 of RES155 (rev.WRC-19)

1.2.3 higher pfd levels than those provided in Annex 3 produced by ESUA on the surface of the Earth within an administration shall be subject to the prior agreement of that administration;

*Editor’s Note*: *Resolves* 1.2.3 copied from *provision #5 from Part 2 of Annex 3* of Resolution 169 (WRC-19)

1.2.4 the provisions in this Resolution, including Annex 3, set the conditions for the purpose of protecting terrestrial services from harmful interference from ESUA in neighbouring countries in the frequency bands 14.0-14.3 GHz (on the territory of countries listed in No. **5.505**), 14.25-14.3 GHz (on the territory of countries listed in No. **5.508**), 14.3-14.4 GHz (Regions 1 and 3), and 14.4-14.47 GHz;

1.2.5 for the application of Annex 3 as referred to in *resolves* 1.2.2 and 1.2.4 above, BR shall examine the characteristics of ESUA with respect to the conformity with the power flux-density (pfd) limits on the Earth’s surface specified in Annex 3 and publish the results of such examination in the BR IFIC;

1.2.6 the notifying administrations for the GSO FSS networks with which ESUA communicate shall send to the BR a commitment that, upon receiving a report of harmful interference, the notifying administrations for the GSO FSS networks with which ESUA communicate shall follow the procedures in *resolves* 4;

1.3 that, in order to protect the radio astronomy service in the frequency band 14.47-14.5 GHz, administrations operating ESUA in accordance with this Resolution in the frequency band 14-14.47 GHz within line-of-sight of radio astronomy stations are urged to take all practicable steps to ensure that the emissions from ESUA in the frequency band 14.47-14.5 GHz do not exceed the level and percentage of data loss given in the most recent versions of Recommendations ITU-R RA.769 and ITU-R RA.1513;

*Editor’s Note*: *Resolves* 1.3 is taken from *resolves* 17 of RES155 (Rev.WRC-19)

2 that ESUA that operate in the frequency bands in *resolves* 1 are an application of the primary FSS (Fixed-Satellite Service) and separate from regulatory provisions that apply to Earth Stations in Motion (ESIM);

2.1 that the use of assignments of an FSS satellite network for UAS CNPC links shall not constrain other FSS satellite networks during the application of the provisions of Articles **9** and **11** norresult in additional coordination constraints on terrestrial services under Articles **9** and **11**;

*Editor’s Note*: *Resolves* 2.1 taken from *resolves* 9 and 10 in RES155 (Rev.WRC-19)

2.2 that ESUA using station class UG may communicate with the space station of a geostationary FSS satellite network operating in the frequency bands listed in *resolves* 1 above;

*Editor’s Note*: *Resolves* 2.2 taken from *resolves* 2 in RES155 (Rev.WRC-19) and updated with station class UG “Earth station on board unmanned aircraft communicating with a space station of a geostationary-satellite network in the fixed-satellite service for UAS CNPC links in accordance with resolves 1 of RES-155”

3 that, in order to ensure safety-of-flight operation of UAS, administrations responsible for operating ESUA shall:

*Editor’s Note*: *Resolves* 3 taken from *resolves* 13 in RES155 (Rev.WRC-19)

3.1 ensure that the use of ESUA be in accordance with international standards and recommended practices (SARPs) consistent with Article 37 of the Convention on International Civil Aviation;

3.2 take the required measures, consistent with No. **4.10,** to ensure freedom from harmful interference to ESUA operated in accordance with this Resolution;

3.3 act immediately when their attention is drawn to any such harmful interference, as freedom from harmful interference to ESUA is imperative to ensure their safe operation, taking into account *resolves* 1.2.1;

3.4 use assignments associated with the FSS networks for ESUA (see Figure 1 in Annex 1), including assignments to space stations, Specific or Typical Earth stations and ESUA (see *resolves* 2.2), that have been successfully coordinated under Article **9** (including provisions identified in *resolves* 1.1.4 and 1.1.5) and recorded in the Master International Frequency Register (MIFR) with a favourable finding under Article **11,** including Nos. **11.31, 11.32** or **11.32A** where applicable, and except those assignments that have not successfully completed coordination procedures under No. **11.32** by applying Appendix **5** § 6.d.i;

3.5 ensure that real-time interference monitoring, estimation and prediction of interference risks and planning solutions for potential interference scenarios are addressed by FSS operators and UAS operators with guidance from aviation authorities;

4 that in case of harmful interference caused by any type of ESUA:

4.1 the administrations of the countries in which ESUA are authorized shall cooperate with investigations on the matter and provide, to the extent of their ability, any required information on the their operation and points of contact for such information;

4.2 the administrations of the countries in which ESUA are authorized and the notifying administrations of the GSO FSS networks with which ESUA communicate shall, jointly or individually, as the case may be, upon receipt of a reports of harmful interference, take the required action to eliminate or reduce interference to an acceptable level;

5 that the administrations responsible for the GSO FSS satellite networks with which ESUA communicate shall ensure that:

5.1 for the operation of ESUA, techniques to maintain antenna pointing accuracy with the associated GSO FSS satellites, without inadvertently tracking adjacent GSO satellites, are employed;

5.2 all necessary measures are taken so that ESUA are subject to permanent monitoring and control by network control and monitoring centre (NCMC) or equivalent facilities in order to comply with the provisions in this Resolution, and NCMC points of contact are available which are capable of receiving and acting to address any case of harmful interference and eliminate it as soon as practicable;

5.3 measures, when required, are taken to limit the operation of ESUA in the territory, including territorial waters and territorial airspace, under the jurisdiction of the administrations authorizing ESUA in accordance with the Radio Regulations;

5.4 permanent points of contact are provided for the purpose of tracing any suspected cases of harmful interference from ESUA and to immediately respond to requests from the points of contact of authorizing administrations;

6 that the application of this Resolution does not provide a regulatory status to ESUA that is different from that derived from the GSO FSS networks with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing b)* above);

*Editor’s Note*: *Resolves* 7 may potentially be deleted depending on the finalization of Recommendation ITU-R S.[GSO\_AESIM\_PFD] under study in WP 4A7 that, if the BR is unable to examine, in accordance with *resolves* 1.2.5 above, ESUA with respect to conformity with the pfd limits on the Earth’s surface specified in Annex 3, the notifying administrations shall send to the BR a commitment that the ESUA comply with those limits;

8 that the BR shall formulate a qualified favourable finding under No. **11.31** with respect to the limits contained in Annex 3, if *resolves* 7 is applied successfully, otherwise it shall formulate an unfavourable finding,

9 that the operation of ESUA within the territories, including territorial waters and territorial airspaces, of an administrations shall be carried out only if authorized by those administrations in accordance with the Radio Regulations;

*Editor’s Note*: *resolves further* addressed in *resolves* 1.2.3

instructs the Director of the Radiocommunication Bureau

*Editor’s Note*: This section to be reviewed in a future contribution

1 TBD;

invites administrations

*Editor’s Note*: This section to be reviewed in a future contribution

invites the ITU Radiocommunication Sector

*Editor’s Note*: This section to be reviewed in a future contribution

instructs the Secretary-General

*Editor’s Note*: This section to be reviewed in a future contribution

ANNEX 1 TO RESOLUTION 155 (REV.WRC-23)

**UAS CNPC links**

Figure 1

Elements of UAS architecture using the FSS

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*Editor’s Note*: This annex comes from Annex 1 to Resolution 155 (REV.WRC-19). Updates change UA ES to ESUA.

Annex 2 to Resolution 155 (rev.WRC-23)

Provisions for earth stations on board unmanned aircraft to protect non-geostationary fixed-satellite service systems in the frequency bands 14-14.7 GHz and 29.5-30 GHz

*Editor’s Note*: Annex 1 from Resolution 169 is to be reviewed and incorporate appropriate modifications to apply to both the frequency bands 14-14.7 GHz and 29.5-30 GHz and be revised as Annex 2 to Resolution 155 (REV.WRC-23)

*Editor’s Note*: This annex is deleted as it does not apply in the bands in *resolves* 1.

Annex 3 to Resolution 155 (rev.WRC-23)

Provisions for earth stations on board unmanned aircraft to protect terrestrial services in the frequency band 14-14.47 GHz

*Editor’s Note*: Annex 3 to be based on Annex 2 of Resolution 155 (Rev.WRC-19) with appropriate modifications