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国际民航组织 • ايكاو
INTERNATIONAL
CIVIL AVIATION
ORGANIZATION

Interference Detection And Reporting

Frequency Management WG/5

Doha- Qatar

10-11 May 2026

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Technical Officer/ CNS

ICAO

GNSS Jamming and Spoofing

Jamming is intentional broadcasting of radio signals to disrupt the GNSS services, posing a significant threat to navigation and timing applications.

Spoofing is the broadcast of GNSS-like signals that cause avionics to calculate erroneous positions and provide false guidance. This sophisticated form of interference can be particularly dangerous as it may go undetected by the receiver.

UNTERM – jamming

UNTERM - spoofing

ICAO Outreach

International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民航组织

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Ref.: E 3/5-24/54

Subject: Aviation safety concerns regarding interference to the Global Navigation Satellite System (GNSS)

Action required: a) disseminate guidance material; and b) implement recommendations, as applicable

Sir/Madam,

1. I have the honour to bring to your attention the concerning escalation of jamming spoofing activities targeting the global navigation satellite system (GNSS), which have been increasin observed recently in various regions globally. GNSS, as one of the main enablers for performance-ba navigation (PBN), provides navigation guidance for all phases of flight, from enroute through to precis approach. By providing accurate position and timing information, GNSS enables several systems critica the safety of flight.

2. Since 2003, the International Civil Aviation Organization (ICAO) has been activ developing recommendations and guidance concerning GNSS Radio Frequency Interference (RFI). I pertinent to recall ICAO Assembly Resolution A41-8, Appendix C: *Ensuring the resilience of IC CNS/ATM systems*, which serves as the latest ICAO policy on GNSS resilience.

3. To bring attention to the critical issue of GNSS interference, and to foster discussions on management of GNSS vulnerabilities and potential mitigation measures against GNSS RFI, ICAO recer convened the ICAO EUR/MID Radion Navigation Symposium from 6 to 8 February 2024 Antalya, Turkey. One important outcome of this symposium is the attached list of recommendati regarding Stakeholders' continued efforts towards ensuring safe, reliable, and resilient air navigation.

4. I would like to take this opportunity to refer to recent safety-related publications by European Union Aviation Safety Agency (EASA), Safety Information Bulletin No. 2022-02R2 and

ICAO SL on the recommendations from ICAO EUR/MID Radio NAV Symposium, Antalya, 2024

JOINT STATEMENT

by

The Secretary General of the International Telecommunication Union,

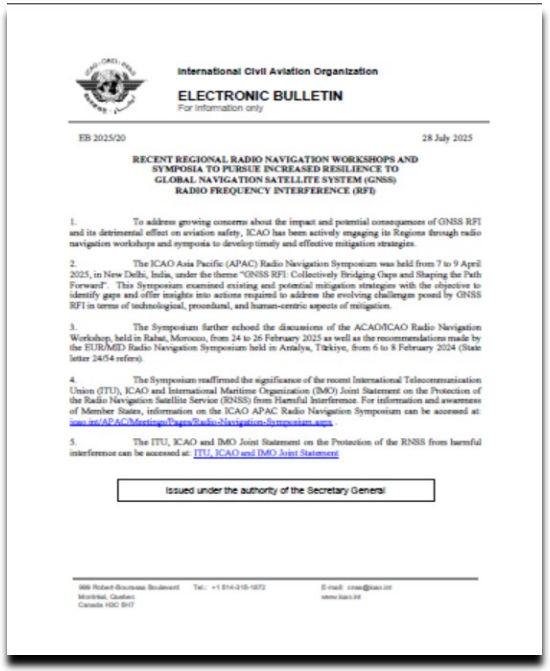
The Secretary General of the International Civil Aviation Organization,

The Secretary General of the International Maritime Organization

regarding

PROTECTION OF THE RADIO NAVIGATION SATELLITE SERVICE FROM HARMFUL INTERFERENCE

ICAO-ITU-IMO Joint Declaration to protect GNSS from Harmful interference



International Civil Aviation Organization

ELECTRONIC BULLETIN

For information only

EB 2025/20 28 July 2025

RECENT REGIONAL RADIO NAVIGATION WORKSHOPS AND SYMPOSIA TO PURSUE INCREASED RESILIENCE TO GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) RADIO FREQUENCY INTERFERENCE (RFI)

1. To address growing concerns about the impact and potential consequences of GNSS RFI and its detrimental effect on aviation safety, ICAO has been actively engaging its Regions through radio navigation workshops and symposia to develop timely and effective mitigation strategies.

2. The ICAO Asia Pacific (APAC) Radio Navigation Symposium was held from 7 to 9 April 2025, in New Delhi, India, under the theme "GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward". This Symposium examined existing and potential mitigation strategies with the objective to identify gaps and offer insights into actions required to address the evolving challenges posed by GNSS RFI in terms of technological, procedural, and human-centric aspects of mitigation.

3. The Symposium further echoed the discussions of the ACAO/ICAO Radio Navigation Workshop, held in Rabat, Morocco, from 24 to 26 February 2025 as well as the recommendations made by the EUR/MID Radio Navigation Symposium held in Antalya, Türkiye, from 6 to 8 February 2024 (State letter 24/54 refers).

4. The Symposium reaffirmed the significance of the recent International Telecommunication Union (ITU), ICAO and International Maritime Organization (IMO) Joint Statement on the Protection of the Radio Navigation Satellite Service (RNSS) from Harmful Interference. For information and awareness of Member States, information on the ICAO APAC Radio Navigation Symposium can be accessed at: icao.int/APAC/MeetingsPages/Radio-Navigation-Symposium.aspx .

5. The ITU, ICAO and IMO Joint Statement on the Protection of the RNSS from harmful interference can be accessed at: ITU, ICAO and IMO Joint Statement

Issued under the authority of the Secretary General

ICAO Electronic Bulletin on recommended actions from ICAO APAC Radio NAV Symposium, New Delhi, July 2025

1st ICAO Radio Navigation Symposium

- ***CAAs*** to foster collaboration with their National Spectrum Regulators regarding GNSS RFI.

- ***National Spectrum Regulators*** to locate and determine the source of reported GNSS RFI and attempt to resolve it, as appropriate. The GNSS RFI resolution may require coordination with other authorities at national or regional levels.

- ***National Spectrum Regulators*** to report frequent unresolved GNSS RFI incidents to the Radiocommunication Bureau of the International Telecommunication Union (ITU), describing GNSS RFI impact as experienced within their national borders, or as reported by their registered aircraft.

2nd ICAO Radio Navigation Symposium

- Objective 1: Minimize GNSS RFI occurrence through effective regulatory measures and enforcement.

1.1 States should:

1.1.1 ensure sufficient aviation representation in delegations of States to ITU WRC-27 preparatory meetings, to progress future improvements to ITU Resolution 676 and to ensure that future WRC updates of Radio Regulations do not adversely impact GNSS;

1.1.2 improve coordination with the military by facilitating the sharing of information on GNSS RFI testing and any relevant activities such as Counter-UAS operations;

1.1.3 possess the necessary technical capabilities to detect GNSS RFI, conduct Radio Frequency (RF) measurements, and geolocate the source of the GNSS RFI; and

1.1.4 utilise the ITU Radio Regulations (RR) escalation procedure (RR Article 15) to ensure proper resolution for incidents of GNSS RFI with cross-border impact that cannot be solved nationally or internationally through routine procedures;

Recommendations-from-Radio-Navigation-Symposium.pdf

Reporting GNSS RFI to ITU

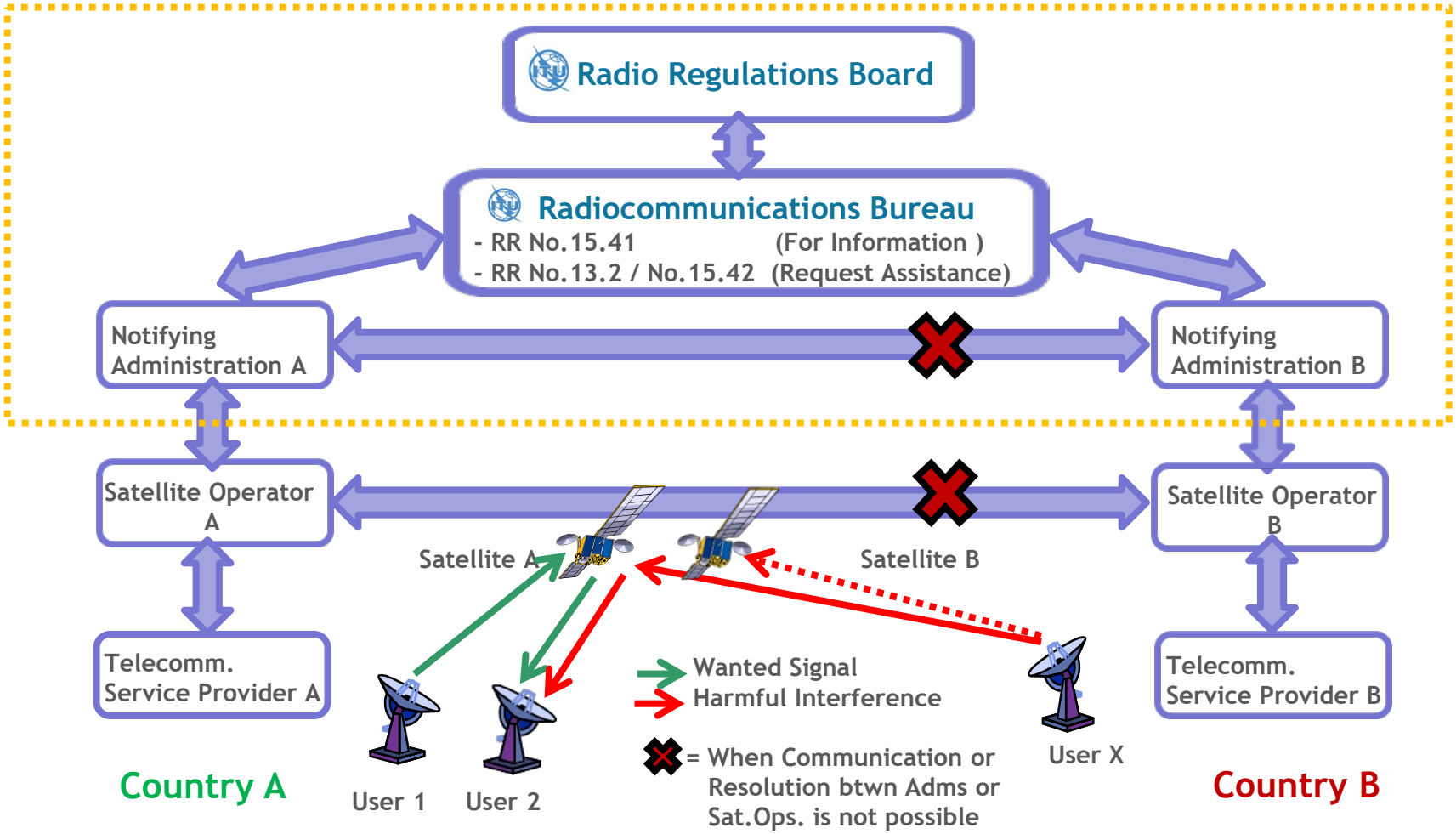
1.1.5 States should also consider submitting reports to the respective ICAO Regional Office, which can then forward those reports to the ITU Satellite Interference Reporting and Resolution System (SIRRS) for further action.

Process in case of Harmful Interference

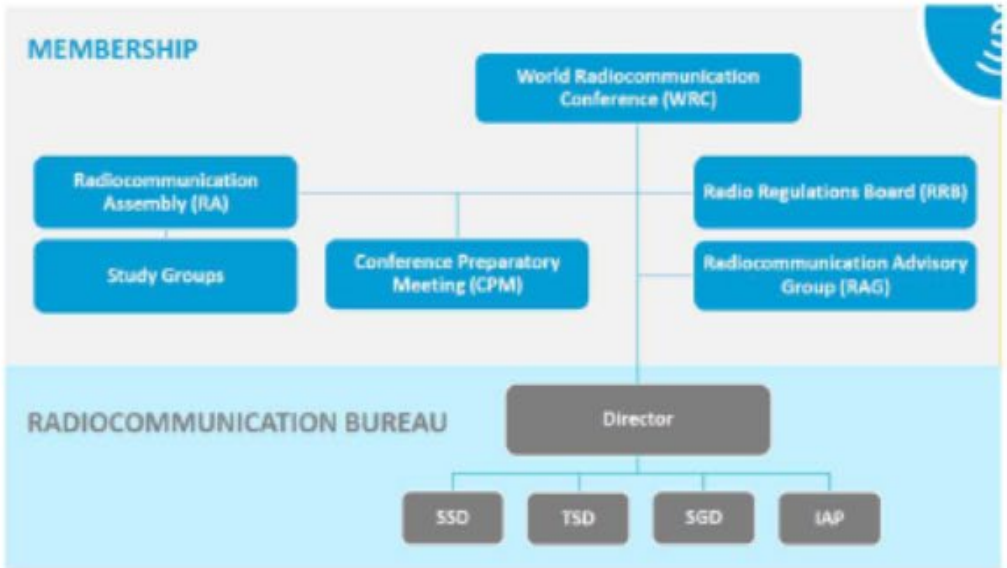
Compulsory Arbitration
(ITU Optional Protocol)
Procedure in Art.41 CV

World
Radiocommunications
Conference
(e.g. Resolution 676 (WRC-23))

Settlement of Disputes : ITU CS 56
Negotiation, Diplomatic Channels
Bi / Multi Lateral Treaties



ITU Radiocommunication Sector and Radiocommunication Bureau



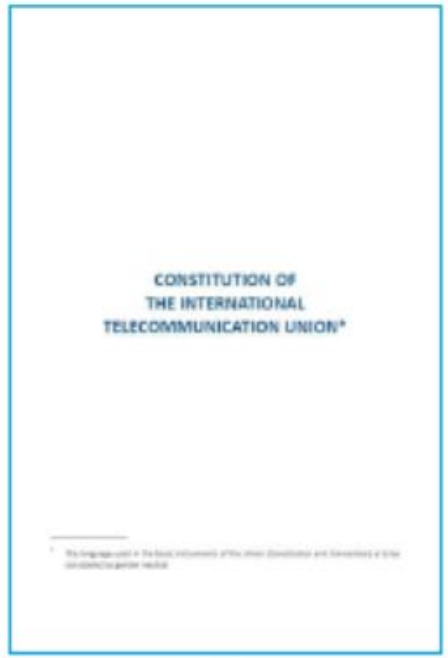
- 1992: ITU Radiocommunication Sector (ITU-R) was formed and Radio Regulations Board (RRB) was created
- ITU-R Mission:
  - Allocation of radiofrequency spectrum
  - Implementation of the Radio Regulations
  - Coordination of efforts to eliminate harmful interference
  - Elaboration of Recommendations
  - Technical assistance and capacity-building support to developing countries
- Radiocommunication Bureau (BR) serves as the specialized secretariat for the Sector.

Key ITU Constitution provisions on harmful interference

ARTICLE 45

Harmful Interference

1 All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations.


CONSTITUTION OF
THE INTERNATIONAL
TELECOMMUNICATION UNION*

ARTICLE 47

False or Deceptive Distress, Urgency, Safety or Identification Signals

201
PP-98

Member States agree to take the steps required to prevent the transmission or circulation of false or deceptive distress, urgency, safety or identification signals, and to collaborate in locating and identifying stations under their jurisdiction transmitting such signals.

Key ITU Radio Regulations provisions on harmful interference

ARTICLE 15

Interferences

Section I – Interference from Radio Stations

15.1 § 1 All stations are forbidden to carry out unnecessary transmissions, or the transmission of superfluous signals, or the transmission of false or misleading signals, or the transmission of signals without identification (except as provided for in Article **19**).

15.28 § 20 Recognizing that transmissions on distress and safety frequencies and frequencies used for the safety and regularity of flight (see Article **31** and Appendix **27**) require absolute international protection and that the elimination of harmful interference to such transmissions is imperative, administrations undertake to act immediately when their attention is drawn to any such harmful interference. (WRC-07)

2nd ICAO Radio Navigation Symposium

1.2 Radio regulatory authorities of States need to step up enforcement against GNSS jamming transmitters (GPS Jammers) while educating the public about their illegality, without unintentionally exposing system vulnerabilities. Law enforcement should monitor and act against online marketplaces selling such devices. Additionally, making the ownership of GPS jammers illegal will help authorities confiscate them more effectively and strengthen regulatory control.

1.3 All stakeholders need to contribute to the development of further ICAO guidance to strengthen the link between air operator reports, air navigation services provider (ANSP) confirmation, and spectrum regulator engagement. The coordination and reporting processes must be efficient and simplified to ensure timely and effective management

ICAO/ITU/IMO Joint Declaration

- THEREFORE, ITU, ICAO, and IMO jointly and urgently call on their respective Member States to:

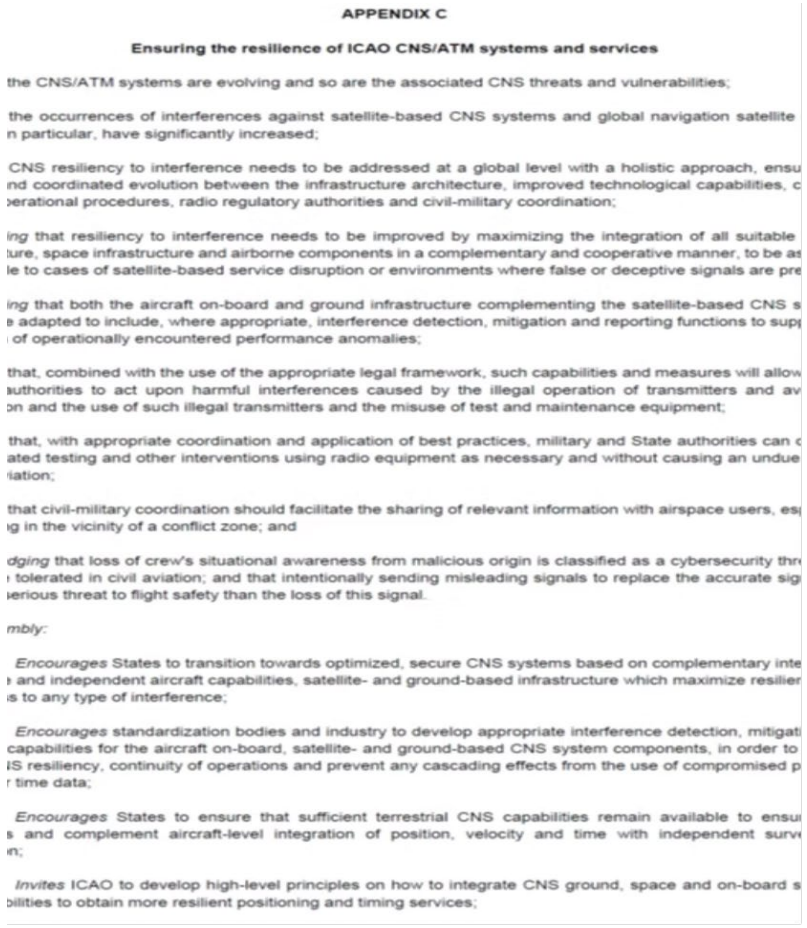
……..

d) increase collaboration between radio regulatory, civil aviation, maritime, defense and enforcement authorities; and

e) report cases of harmful interference affecting RNSS to the appropriate telecommunication, aeronautical and maritime authorities,

ICAO 42nd Assembly Resolution

Complete



APPENDIX C

Ensuring the resilience of ICAO CNS/ATM systems and services

the CNS/ATM systems are evolving and so are the associated CNS threats and vulnerabilities;

the occurrences of interferences against satellite-based CNS systems and global navigation satellite
n particular, have significantly increased;

CNS resiliency to interference needs to be addressed at a global level with a holistic approach, ensu
nd coordinated evolution between the infrastructure architecture, improved technological capabilities, c
erational procedures, radio regulatory authorities and civil-military coordination;

ing that resiliency to interference needs to be improved by maximizing the integration of all suitable
ure, space infrastructure and airborne components in a complementary and cooperative manner, to be as
le to cases of satellite-based service disruption or environments where false or deceptive signals are pre

ing that both the aircraft on-board and ground infrastructure complementing the satellite-based CNS s
adapted to include, where appropriate, interference detection, mitigation and reporting functions to sup
of operationally encountered performance anomalies;

that, combined with the use of the appropriate legal framework, such capabilities and measures will allow
authorities to act upon harmful interferences caused by the illegal operation of transmitters and av
on and the use of such illegal transmitters and the misuse of test and maintenance equipment;

that, with appropriate coordination and application of best practices, military and State authorities can c
ated testing and other interventions using radio equipment as necessary and without causing an undue
iation;

that civil-military coordination should facilitate the sharing of relevant information with airspace users, es
g in the vicinity of a conflict zone; and

dging that loss of crew's situational awareness from malicious origin is classified as a cybersecurity thr
tolerated in civil aviation; and that intentionally sending misleading signals to replace the accurate sig
erious threat to flight safety than the loss of this signal.

mbly:

Encourages States to transition towards optimized, secure CNS systems based on complementary inte
and independent aircraft capabilities, satellite- and ground-based infrastructure which maximize resilier
s to any type of interference;

Encourages standardization bodies and industry to develop appropriate interference detection, mitigat
capabilities for the aircraft on-board, satellite- and ground-based CNS system components, in order to
S resiliency, continuity of operations and prevent any cascading effects from the use of compromised p
time data;

Encourages States to ensure that sufficient terrestrial CNS capabilities remain available to ensu
and complement aircraft-level integration of position, velocity and time with independent surv
n;

Invites ICAO to develop high-level principles on how to integrate CNS ground, space and on-board s
bilities to obtain more resilient positioning and timing services;

Resolution A42-8, Appendix C

(Updated Resolution A41-8)

ICAO Policy on GNSS Resilience

-

urges States to apply necessary measures to avoid the commercialization/proliferation, ***purchase, possession****, and the use of illegal transmitters such as jammers ….:*

Approval of RESOLUTION 676 (WRC-23)

Due to the escalation of jamming and spoofing of GNSS observed in recent years, **aviation experts supported by ICAO expert groups developed a draft Resolution**, **which resulted in the approval of a new ITU Resolution [RESOLUTION 676] (WRC-23) on the "Prevention and mitigation of harmful interference to the radionavigation-satellite service (RNSS) in the frequency bands 1 164 – 1 215 MHz and 1 559 – 1 610 MHz"**.

The Resolution urges administrations

1. **to apply necessary measures to avoid the proliferation, circulation and operation of unauthorized transmitters that cause or have the potential to cause harmful interference to RNSS systems**……
2. **to take the following actions to prevent and mitigate harmful interference affecting the RNSS...**…. without prejudice to the right of administrations to deny access to the RNSS, for security or defence purposes:

   …

   2.2 **to encourage cooperation between aeronautical, maritime and security authorities, as well as spectrum regulators**, as appropriate, to address interference risks to RNSS systems that may stem from the activities of these security authorities;

3. **to report cases, as the affected administration deems appropriate, of harmful interference to the RNSS…**

Action by the meeting

- *The meeting is invited to:*

1- Urge Member States to strengthen collaboration with their national radio regulatory authorities in the areas of:

a) detecting, geo-locating, mitigating, and reporting harmful interference;

b) enhancing law enforcement measures and regulatory frameworks to prohibit the importation, possession, purchase, manufacture, and use of illegal transmitters, such as jammers and spoofers.

Action by the meeting

2- Encourage the exchange of best practices, experiences, and technical expertise among Member States;

3- encourage States to report the unresolved interference case to ITU though ICAO MID Office;and

4- urge States to enhance the capacity of technical staff to effectively detect, identify, investigate, and report harmful interference;and

5- discuss means to implement articles and recommendations related to spectrum management mentioned in this presentation.

Thank You

ICAO