AFI Regional workshop on Spectrum -Dakar, Senegal, 4-5 March 2026

Agenda Item 5 : GNSS RFI Reporting Procedures

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO Regional Officers CNS
ESAF/WACAF

Overview

01 Introduction

02 ICAO Position and guidance

03 Draft of regional GNSS RFI Procedure

01

Introduction

1. Introduction

1.1 Definitions

The International Telecommunication Union (ITU) Radio Regulations (Vol 1, Art I, Sect VII) [24] define interference as *"The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation or loss of information which could be extracted in the absence of such unwanted energy."*

Top-level harmful interference types :

1

Jamming

emissions not mimicking GNSS that block/hinder receiver acquisition/tracking.

2

Spoofing

GNSS-like emissions that can be acquired/tracked alongside or instead of genuine signals.

1. Introduction

1.2 Why GNSS RFI Reporting matters?

Potential operational impacts of GNSS RFI

- ✓ Affects PBN, ADS-B, and overall situational awareness
- ✓ Can cause:
  - False or no position, FMS off-track
  - Map shifts, wrong runway cues
  - GPWS false alerts, unnecessary go-arounds
  - Loss of datalink (CPDLC/ADS-C) and ADS-B unavailability
  - Incorrect aircraft time, ELT mislocation
  - Degraded HUD/SVS, SATCOM, and cabin Wi-Fi

Why reporting is essential?

- ✓ Timely, standardized reporting enables rapid mitigation and spectrum protection
- ✓ Regional consistency improves cross-border coordination
- ✓ Direct safety impact on navigation continuity and flight crew/ATC awareness

02

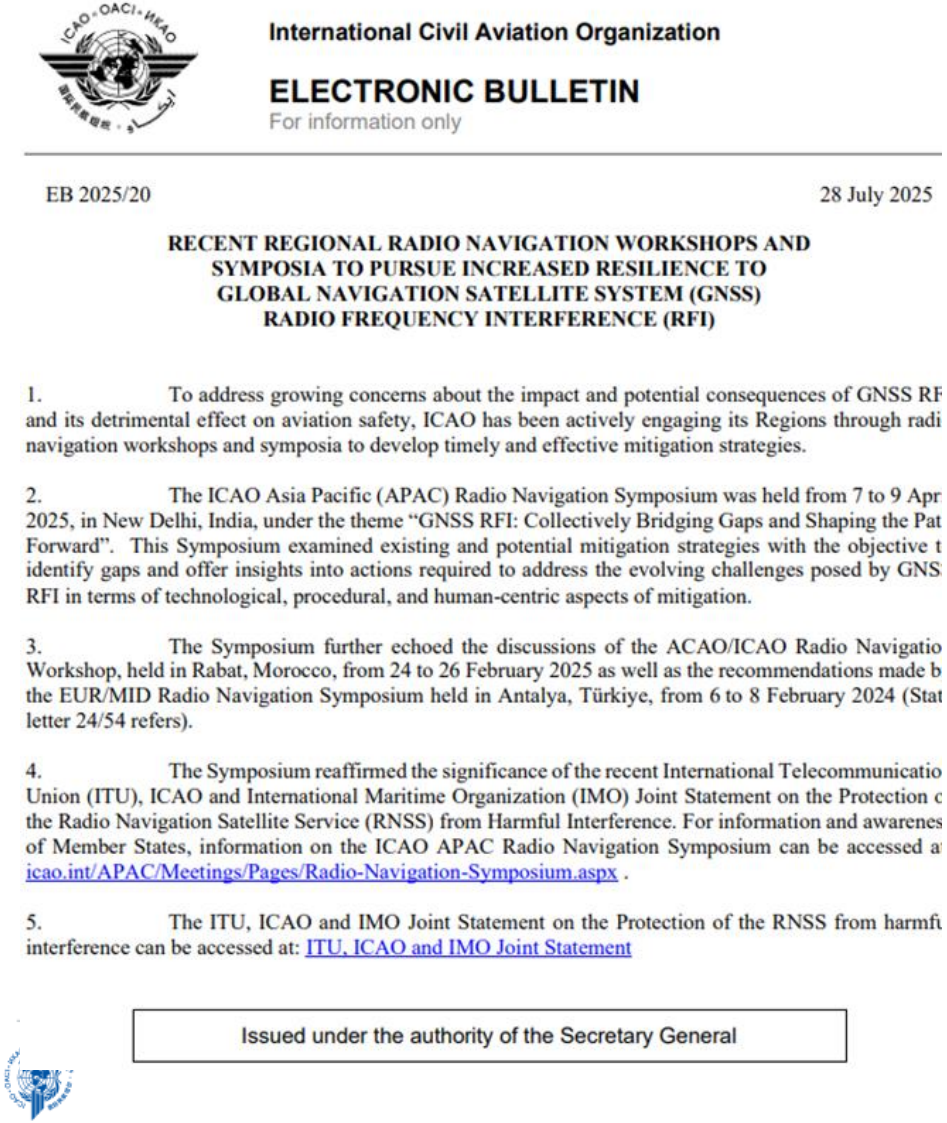
ICAO Position and guidance material

2. ICAO Position and guidance

2.1 ACAO/ICAO Radio Navigation Workshop Rabat Morocco 24-26 Feb 2025

- ✓ ESAF and WACAF participated in the ACAO/ICAO Radio Navigation Workshop (Rabat, Feb 2025).
- ✓ Key outcomes were shared at the AASPG IIM Subgroup meeting (Nairobi, Aug 2025).
- ✓ ICAO issued Electronic Bulletin EB 2025/20 (28 July 2025) summarizing regional activities, including the ACAO/ICAO Workshop.
- ✓ Bulletin includes link to ICAO APAC Symposium for further material : Recommendations-from-Radio-Navigation-Symposium.pdf

ICAO



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 RF and its detrimental effect on aviation safety, ICAO has been actively engaging its Regions through radi 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 Apr 2025, in New Delhi, India, under the theme "GNSS RFI: Collectively Bridging Gaps and Shaping the Pat Forward". This Symposium examined existing and potential mitigation strategies with the objective t identify gaps and offer insights into actions required to address the evolving challenges posed by GNS RFI in terms of technological, procedural, and human-centric aspects of mitigation.

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

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

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

Issued under the authority of the Secretary General

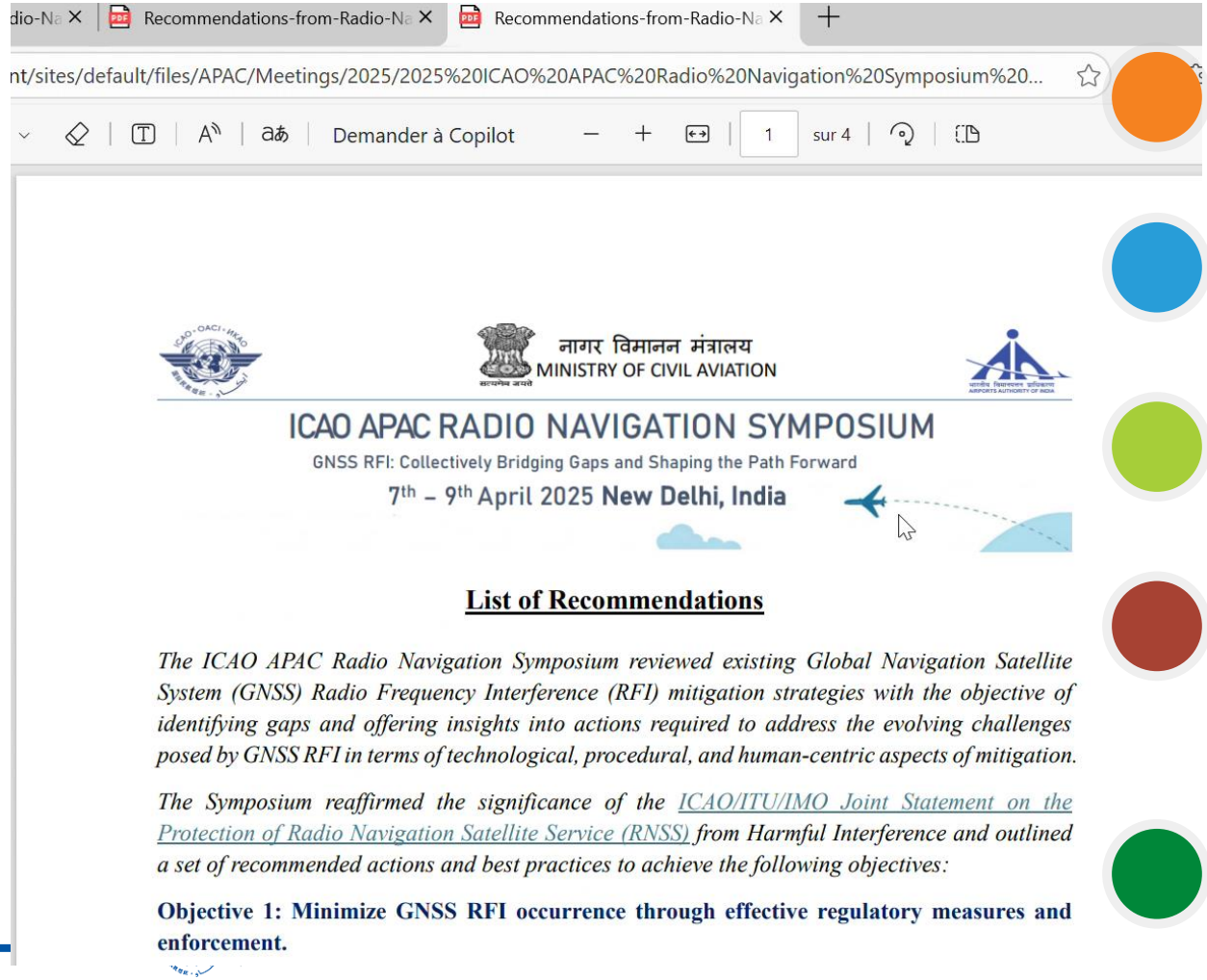
2. ICAO Position and guidance

2.2 Recommendations - Electronic Bulletin EB 2025/20 (28 July 2025)

Electronic Bulletin 2025/20 (28 July 2025) provides **a consolidated set of ICAO best practices and recommended measures developed through regional activities to address RFI**.

2. ICAO Position and guidance

For each objectives, recommendations for States and ICAO are identified



Recommendations-from-Radio-Na

Recommendations-from-Radio-Na

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नागर विमानन मंत्रालय
MINISTRY OF CIVIL AVIATION

ICAO APAC RADIO NAVIGATION SYMPOSIUM

GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward

7th – 9th April 2025 New Delhi, India

List of Recommendations

The ICAO APAC Radio Navigation Symposium reviewed existing Global Navigation Satellite System (GNSS) Radio Frequency Interference (RFI) mitigation strategies with the objective of identifying gaps and offering insights into actions required to address the evolving challenges posed by GNSS RFI in terms of technological, procedural, and human-centric aspects of mitigation.

The Symposium reaffirmed the significance of the ICAO/ITU/IMO Joint Statement on the Protection of Radio Navigation Satellite Service (RNSS) from Harmful Interference and outlined a set of recommended actions and best practices to achieve the following objectives:

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

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Objective 2: Support Air Crews in Operational Risk Reduction and Management

Objective 3: Ensure effective support to flight crews while maintaining safety

Objective 4: Ensure suitable CNS capabilities are available as required

Objective 5: Strengthen capabilities to maintain PBN and optimize operational efficiency by leveraging current technology

Objective 6: Strengthen capabilities to maintain PBN and optimize operational efficiency by leveraging current technology

2. ICAO Position and guidance on GNSS RFI

2.2 Recommendations - Electronic Bulletin EB 2025/20 (28 July 2025) cont'd

Objective	Action (what)	Responsible (who)
1. Minimize GNSS RFI (regulation & enforcement)	Ensure robust aviation participation in WRC-27 prep; safeguard GNSS in ITU-R texts (incl. Res. 676).	**States (CAA)** with **Spectrum Authority**
	Establish military–civil coordination on tests/Counter-UAS that may affect GNSS.	**States (CAA/Defence)**
	Build/maintain detect–measure–geolocate capability for GNSS RFI.	**ANSP / Spectrum Authority**
	Use ITU RR Art.15 escalation for unresolved cross-border cases; copy ICAO RO; enable SIRRS submission.	**States / Spectrum Authority**
	Enforce against GNSS jammers; monitor online sales; public awareness (no vulnerabilities exposed).	**Regulator / Law Enforcement**
2. Support air crews in risk reduction & reporting	Consider standard RTF phraseology for GNSS-degraded ops.	**ICAO**
	Integrate GNSS RFI into fuel/alternate/dispatch planning.	**Airlines**
	Maintain pilot proficiency in conventional nav; VOR cross-checks; IRS full alignment after prior RFI.	**Airlines / OEMs**
	Streamline incident reporting (e.g., EFB form/workflow).	**Airlines / ANSPs**
	Develop an info-sharing mechanism (IATA-style) for GNSS RFI.	**Industry / Associations**
3. Ensure ATC support while maintaining safety	Staffing & sector workload tuned; monitor clearance compliance.	**ANSP / States**
	ATC readiness: provide radar vectors/clock checks; define limits to vectoring.	**ANSP**
	ATCO training: abnormal situations; clearance deviations; GNSS-degraded operations.	**ANSP**
	Identify critical TAWS areas; ensure timely climb/deconfliction advisories.	**ANSP**

2. ICAO Position and guidance on GNSS RFI

2.2 Recommendations - Electronic Bulletin EB 2025/20 (28 July 2025) cont'd

Objective	Action (what)	Responsible (who)
4. Ensure suitable CNS capabilities	Publish warnings via NOTAM/AIP/ATIS as needed.	**States / ANSP**
5. Maintain PBN & optimize efficiency (current tech)	Prevent sensor cross-contamination; augment time; deploy MMR/upgrades.	**OEMs / Airlines**
	Enable advanced RNP via DME; improve multi-DME; clarify DME interrogator criteria.	**OEMs / States / ANSP**
	Add spoofing monitors in trackers; compare ADS-B vs SSR/WAM.	**States / ANSP**
	Optimize DME network planning & coverage.	**States / ANSP**
6. Achieve robust PNT (long-term C-PNT)	Cyber risk assessment for CNS/ATM (esp. space-based); implement mitigations.	**States**
	Improve resilience via authentication, CRPA, RFI detection & downlink enhancements.	**States / Industry**
	eDME standardization and assessment of alternate PNT.	**ICAO**
	CNS evolution roadmap (ground–air–space) with spectrum efficiency as core driver.	**ICAO** (with States/Industry)
	Promote Integrated CNSS: smart integration, independent layers.	**ICAO**

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ITU WRC-23 Resolution 676

"resolves to urge 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 […] :
2.1 to encourage collaboration between spectrum regulators, enforcement authorities and RNSS stakeholders, in particular in the aeronautical and maritime domains;
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 […]
3 to report cases, as the affected administration deems appropriate, of harmful interference to the RNSS."

Mars 2025 Joint statement by ITU, ICAO, IMO (2025)

"Noting with **grave concern** the increasing number of spoofing cases"
"urges States to refrain from any form of jamming and spoofing affecting civil aviation"

Resolution 42-8 : Consolidated statement of continuing ICAO policies and practices related to a global air traffic management (ATM) system and communications, navigation, and surveillance/air traffic management (CNS/ATM) systems

Nov-Dec 2023 | **Sept 2024** | **March 2025** | **July 2025** | **Sept. 2025**

14th Air Navigation Conference report

"The conference voiced significant concerns with the recent escalation of GNSS spoofing, and the significant safety risk it poses to civil aviation"

"recommends States to provide guidance on detecting GNSS spoofing".

Electronic Bulletin on 28 July 2025 (EB 2025/20)

to circulate the summary of discussions of the regional activities and recommendations related to GNSS RFI

The Assembly :
- "Urges States to apply necessary measures to avoid the commercialization/proliferation, purchase, possession and the use of illegal transmitters such as jammers[…] ;
- Urges States to ensure close collaboration […] to ensure that the spectrum used by all CNS systems, and GNSS in particular, is free from harmful interference;
- Urges States to refrain from any form of jamming, or spoofing affecting civil aviation;
- Urges States to coordinate and notify […] in case of military or other State-authorized security or defence-related operations or training, potentially causing any form of jamming, or spoofing affecting civil aviation;
- Urges States and operators, when assessing the interference risks associated with conflict zones, to consider that the use of satellite-based CNS systems can potentially be impacted beyond those zones.

2. ICAO Position and guidance on GNSS RFI

GNSS Manual (ICAO DOC 9849)

Fifth Edition, 2025

- ✓ **Chapter 5: GNSS Vulnerability**
  - ✓ unintentional, intentional, spoofing classifications and their impacts on receivers, spectrum regulations, ionosphere, solar activities and troposphere effects)
- ✓ **Chapter 7: Implementation of GNSS-based services**
  - 7.11 and 7.12: GNSS status notification & anomaly reporting
  - 7.13: GNSS vulnerability: mitigating the impact on operators
- ✓ **Appendix F: GNSS Radio Frequency Interference Mitigation Plan**

2. ICAO Position and guidance on GNSS RFI

Appendix F

GNSS RADIO FREQUENCY INTERFERENCE MITIGATION PLAN

1. INTRODUCTION

1.1 Concerns over GNSS vulnerability, such as those discussed in Chapter 5 of this manual, wer re-emphasized at the Twelfth Air Navigation Conference in 2012, which approved the following recommendation to State (*Report of the Twelfth Air Navigation Conference*, (AN-Conf/12, Doc 10007) refers):

Recommendation 6/8 – Planning for mitigation of global navigation satellite system vulnerabilities

That States:

a) assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspac and apply, as necessary, recognized and available mitigation methods;

b) provide effective spectrum management and protection of global navigation satellite system (GNSS frequencies to reduce the likelihood of unintentional interference or degradation of GNSS performanc

c) report to ICAO cases of harmful interference to global navigation satellite system that may have a impact on international civil aviation operations;

d) develop and enforce a strong regulatory framework governing the use of global navigation satellit system repeaters, pseudolites, spoofers and jammers;

[…]

1.2 Following the concern expressed at the 40th Session of the ICAO Assembly by Finland on behalf European States, by Saudi Arabia, and jointly by the International Federation of Air Traffic Controllers' Association (IFATCA), the International Federation of Air Line Pilots' Associations (IFALPA) and the International Air Transpo Association (IATA), a state letter (2020/089) was issued including the following recommendations regarding mitigation GNSS interference:

a) implement appropriate mitigation measures as contained in this manual as a matter of high priority an report progress and any difficulties to ICAO;

b) reinforce civil-military collaboration regarding global navigation satellite system (GNSS) testing an other activities, which may impact satellite-based communications, navigation and surveillance (CNS systems, and caution, to the maximum extent possible, to protect the safety of civil aircraft during militar exercises and operations;

c) establish and ensure appropriate frequency regulations are in place and maintained to protect allocate GNSS frequencies from harmful interference in line with International Telecommunication Union (ITU) Radio Regulations;

Attachment to Appendix F

REPORTING OF GNSS RFI

1. INTRODUCTION

This attachment provides guidance on reporting cases of GNSS outages that are suspected to be due to RFI. Normally GNSS outage or anomaly reports should be filed with the State where the outage occurred. Section 2 of this attachmen includes two reporting forms that can be used for that purpose. Section 3 contains guidance on reporting to ICAO abnorma cases in which the State or States concerned cannot resolve the anomaly locally or bilaterally.

2. EXAMPLE FORMS FOR GNSS RFI REPORTING TO STATES

In order to compile a comprehensive threat picture, as discussed in Section 6 of this appendix, and facilitate coordinatio as described in Chapter 7, 7.12.4, it is advisable to ensure that reporting from all relevant sources is collected by a singl entity at the State or regional level. Two examples of reporting forms are provided in this section. One is intended for us by ATS personnel, the other for use by pilots. The forms list all the information that could be helpful in resolving outage c anomaly reports. These example forms may be integrated into a State's Safety Data Collection and Processing Syste (SDCPS) or, alternatively, be used in an independent reporting system (in case a State or international organizatio justifies this solution offers better results).

Example form for use by ATS personnel

GNSS RFI REPORTING FORM FOR USE BY ATS PERSONNEL	
Originator of report	
Organization	

GNSS RFI REPORTING FORM FOR USE BY ATS PERSONNEL	
Description of interference	
Source of initial interference report	[ ] Pilot [ ] Engineer/technician [ ] Other
Observability of the interference	Interference was noticeable: [ ] only on board the aircraft (flying, not on the ground) [ ] only on the ground (aircraft parked/taxiing) or by means of ground detection systems available [ ] both

GNSS RFI REPORTING FORM FOR USE BY PILOTS	
Name/surname	
Phone number	
E-mail	
Date and time of report	
Description of interference	
Reported failure and operational impact	[ ] Total loss of navigation capabilities [ ] Need to change the navigation procedure [ ] Inability to fly RNP and request for radar vectoring [ ] Inability to fly a GNSS-based approach (GLS, SLS) [ ] GNSS fault (1 or 2) [ ] TAWS/EGPWS warnings or loss of terrain and surface functionalities [ ] Loss of ADS-B [ ] Wind and ground speed wrong presentations [ ] Aircraft clock anomaly [ ] Loss of situational awareness (SVS, flight deck display of traffic information) [ ] Loss of communication functions (CPDLC, ACARS) [ ] AHRS failure [ ] Map shift [ ] Other: ___
Used GNSS contingency procedure	[ ] Request for radar vectoring [ ] Switch to another mean of navigation (for example, DME/DME, VOR/DME, ILS) [ ] Diversion to another airport [ ] Missed approach [ ] Use of alternate means for communication (for example, VHF) [ ] Other: ___
Affected GNSS element	[ ] GPS [ ] GLONASS [ ] GALILEO

03

Draft of regional GNSS RFI Reporting Procedure

3. DRAFT REGIONAL AFI GNSS RFI REPORTING PROCEDURE (1/2)

The ACAO/ICAO Radio Navigation Workshop, held in Morocco in February 2026 developed a draft regional reporting procedure to be further reviewed by the relevant regional groups before being submitted for endorsement by the PIRG (for AFI Region AASPG)

AFI GNSS RFI REPORTING PROCEDURE

3. DRAFT REGIONAL AFI GNSS RFI REPORTING PROCEDURE (1/2)

AFI GNSS RFI REPORTING PROCEDURE

Pilot

- inform ATCO of suspected GNSS interference during flight operations
- To complete the GNSS interference reporting form, and submit to the respective
- ICAO Regional Office through IATA (MENA)

Controllers

- To inform other pilot(s) about potential GNSS RFI and logs the occurrence and notify CNS staff.

CAA CNS

- To coordinate with the national Telecommunications regulator to localize the source of interference and initiate resolution actions.

3. DRAFT REGIONAL AFI GNSS RFI REPORTING PROCEDURE (1/2)

AFI GNSS RFI REPORTING PROCEDURE

National Telecommunication regulator

- Support ANSP to localize and eliminate the source of interference
- If interference extends beyond borders, national Telecommunication regulators coordinate with adjacent regulator following ITU procedures for cross-border resolution.

States and ANSPs

- are encouraged to have the capability to monitor the GNSS RFI and provide early alert to pilots
- Assess recurring incidents and take preventive measures to mitigate future occurrences.
- If a State fails to resolve frequent interference, they mut notify respective ICAO regional office and ITU for further action.

3. DRAFT REGIONAL AFI GNSS RFI REPORTING PROCEDURE (1/2)

AFI GNSS RFI REPORTING PROCEDURE

ICAO Regional Office:

- Assesses all incident reports received from States or aviation stakeholders.
- Notify the States responsible for originating the interference to locate and implement safeguards to prevent recurrence.
- Escalates unresolve issues to the ITU in accordance with the Memorandum of Cooperation (MoC).

Thank You

ICAO