International Civil Aviation Organization

THE THIRTIETH MEETING OF THE COMMUNICATIONS / NAVIGATION AND SURVEILLANCE SUB-GROUP (CNS SG/30) OF APANPIRG

Bangkok, Thailand, 06 - 10 July 2026

Agenda Item 6.2: GNSS Interference and Mitigating Measures

GNSS RADIO FREQUENCY INTERFERENCE MITIGATION AND RESILIENCE READINESS

(Presented by Indonesia)

SUMMARY

This paper presents Indonesia's national progress on mitigating Global Navigation Satellite System (GNSS) Radio Frequency Interference (RFI) in the Jakarta FIR and beyond. It reports on the significant GNSS jamming event of 8 April 2026 — affecting 44 flights operated by seven operators over a period of approximately three hours — and outlines Indonesia's multi-layered governance framework, national reporting workflow, and the status of Backup Navigation Network (BNN), Minimum Operational Network (MON), and Performance-Based Navigation (PBN) resilience measures. Looking ahead, the National ANSP is developing a GNSS RFI monitoring application that will provide autonomous, proactive interference detection and will be integrated into AirNav Indonesia's operational systems, with prototype deployment targeted for Q1 2027. The meeting is invited to note Indonesia's national mitigation framework, endorse its alignment with the regional guidance material, and encourage States and ICAO APAC to develop a regional ground-based GNSS RFI sensor network.

1. INTRODUCTION

1.1 Indonesia presents this Working Paper to report national progress in mitigating Global Navigation Satellite System (GNSS) Radio Frequency Interference (RFI) and to share operational experience, contingency planning measures, and the implementation status of the Backup Navigation Network (BNN), Minimum Operational Network (MON), and Performance-Based Navigation (PBN)-based airspace resilience measures.

1.2 The paper supports the implementation of the decision establishing the Procedures for GNSS RFI and Data Link Disruption Ad Hoc Group and provides input to the draft Asia/Pacific Regional Guidance Material for GNSS RFI and Associated Data Link Disruption Coordination and Reporting Procedures (Version 4, for comment at the 8th Meeting). Indonesia supports the regional guidance and has begun operational implementation of its key elements at the national level.

1.3 On 8 April 2026, a significant GNSS interference event occurred within the Jakarta TMA, affecting 44 flights operated by seven operators over a period of approximately three hours. This incident highlights the urgent need for standardized reporting, resilient terrestrial backup navigation, and effective cross-border coordination, all of which are addressed in this paper.

2. DISCUSSION

2.1 National Institutional Framework and Reporting Mechanism

Indonesia has established a multi-layered governance framework for GNSS RFI mitigation:

2.1.1 The National GNSS RFI Task Force is coordinated by the Directorate General of Civil Aviation (DGCA) and comprises representatives from AirNav Indonesia, the Ministry of Communications and Digital Affairs (Kemkomdigi/BALMON), the National Cyber and Crypto Agency (BSSN), and aircraft operators.

2.1.2 DGCA Indonesia has issued Circular Letter No. SE-DJPU 11 of 2026 on the Reporting and Management of Global Navigation Satellite System Radio Frequency Interference (GNSS RFI) for national aviation stakeholders. The Circular Letter establishes the reporting mechanism, defines the roles and responsibilities of stakeholders in the management of GNSS RFI reports, and provides technical guidance for the anticipation, mitigation, and handling of GNSS RFI events.

2.1.3 AirNav Indonesia utilizes EFFORT (Electronic Form for Occurrence Report), an in-house platform developed to support occurrence reporting, ADS-B performance monitoring, lost-track detection, and GNSS surveillance, together with GPSwise, a third-party subscription-based platform that provides real-time monitoring and alerting of GNSS spoofing and jamming events.

2.1.4 The national reporting workflow comprises three stages: (a) real-time pilot/controller reporting via VHF and electronic log; (b) compilation and validation by the National GNSS RFI Task Force; and (c) submission of consolidated national reports to ICAO APAC for regional trend analysis.

2.2 The 8 April 2026 Jakarta FIR GNSS Interference Event — Case Study

2.2.1 Between 0040 and 0337 UTC on 8 April 2026, suspected GNSS jamming activity affected airspace between 000° and 100° radials from CGK VOR/DME, at distances ranging from 75 NM to140 NM. Waypoints UBNUX, RUTGU, RUNOV, PRIOK, DKI, AJUNA, and BIGRU lay within or near the affected radius. The interference coincided with final approach operations for Runway 25L at Soekarno-Hatta (WIII) and departures from Runway 24 at Halim Perdanakusuma (WIHH).

2.2.2 Impact summary as follows:

- Aircraft affected: 44 flights operated by Batik Air (19), Garuda Indonesia (12), Pelita Air Service (7), Sriwijaya Air (2), Citilink (2), Indonesia AirAsia (1), and Saudia (1).

- Avionics manifestations: predominantly ADS-B Reporting 1 & 2 intermittent faults (23 cases), with additional GPS 1 & 2 faults and combined GPS/ADS-B anomalies.

- GPSwise monitoring: 112 flights tracked in the area; 39 flights exhibited bad Navigation Integrity Category (NIC), yielding a ~35% bad-NIC ratio indicative of simultaneous multi-aircraft interference.

- ATC mitigations: suspension of PBN approaches to Runway 24 WIII; reversion to ILS Runway 25L/R; terrestrial navaid routing for inbound traffic; radar vectoring in the affected sector; pilot workload increase with aircraft reverting to IRS and DME-DME navigation.

2.2.3 Post-event actions included NOTAM/PIREP advisory issuance, intensified pilot and ATC reporting protocols, joint airworthiness investigation with affected operators, and

coordination with BALMON Kemkomdigi and BSSN for spectrum monitoring and source geolocation.

2.3 Backup Navigation Network (BNN) and Minimum Operational Network (MON)

2.3.1 Indonesia regards the BNN and MON as key elements of airspace resilience against GNSS disruption. The BNN strategy ensures continuous availability of conventional navigation infrastructure — DME/DME, VOR/DME, and ILS — to support reversion from PBN to conventional navigation operations during GNSS outages, while the MON provides a minimum terrestrial navigation capability to support continued operations when GNSS services are unavailable.

2.3.2 Current BNN/MON implementation status:
DME/DME network optimization: ongoing coverage verification for Jakarta, Surabaya, Makassar, and Denpasar to ensure RNAV 2 and RNAV 1 reversion capability on en-route and terminal segments.

- VOR/DME retention: selective retention of strategically located VOR/DME stations to support limited-RNAV applications and non-PBN aircraft.

- ILS preservation: all primary and secondary runway ends at major international airports retain ILS capability to ensure runway access during GNSS outages, in accordance with ICAO AN-Conf/14 Recommendation 2.2/2.

- MON concept: designed as an independent contingency capability, not intended for full-capacity operations but as a recovery safety net, considering aircraft equipage diversity (PBN-capable vs. legacy).

2.4 PBN Routes Design and Resilience Integration

2.4.1 The airspace structure integrates RNAV and RNP specifications, supporting flexible route spacing, parallel tracks, and direct routes to reduce track miles and enhance traffic flow.

2.4.2 Airspace reversion strategy: pre-defined transition from PBN routes to conventional ATS routes, with optimized use of DME/DME, VOR/DME, and radar vectoring, and increased separation standards as required by contingency conditions.

2.4.3 ATC contingency procedures: controller training on GNSS RFI recognition, standard radiotelephony phraseology, and fallback surveillance/communication protocols (as recommended by the ICAO APAC Radio Navigation Symposium, April 2025).

2.4.4 Flight planning integration: NOTAM and ATIS dissemination of GNSS RFI status; pre-flight briefing on conventional backup routes and alternate procedures; consideration of GNSS RFI factors in contingency fuel and alternate planning.

2.5 Alignment with Draft Asia/Pacific Regional Guidance Material (Version 4)

2.5.1 Indonesia, as an active member of the GNSS RFI and Data Link Disruption Ad Hoc Group, has reviewed the Draft Asia/Pacific Regional Guidance Material for GNSS RFI and Associated Data Link Disruption Coordination and Reporting Procedures (Version 4, for comment for the 8th Meeting) and provides the following feedback and implementation status, as follows:

- Reporting taxonomy and classification: Indonesia supports the recommended classification dimensions (type, scope/impact, severity, confidence level) and has adapted them into the national GNSS RFI reporting form aligned with ICAO Doc 9849 Appendix F.

- Operational phraseology: Indonesia concurs with the use of ‘flight crew’ and ‘controller’ consistently throughout the document. National ATC procedures already incorporate the suggested radiotelephony examples (e.g., ‘GNSS MAY BE UNRELIABLE…’) in controller training modules.

- NOTAM standardization: Indonesia supports the proposed Q-code usage (QGWLF for jamming; QGWLO for spoofing) and the harmonized Item E templates. The 8 April 2026 event was promulgated via NOTAM using an interim format; full alignment with the proposed templates will be achieved by Q3 2026.
- Cross-border coordination: Indonesia has designated national-level Points of Contact (POCs) for GNSS RFI matters at both ATS unit level and national focal point level, consistent with the draft guidance, and will submit updated POC details to ICAO APAC for inclusion in the regional contact directory.
- Non-binding nature: Indonesia notes the non-binding character of the guidance and agrees that terms ‘shall’ and ‘mandatory’ should be avoided. National regulations (CASR 170 and 172) provide the binding operational and provider framework; the regional guidance serves as harmonized best practice.

2.6 Timeline and Next Steps toward CNS SG/30 and ATM/SG/14

Indonesia’s planned timeline for finalizing national GNSS RFI mitigation measures and regional contribution is as follows:

By 5 June 2026: Submit updated draft regional guidance comments to the SRWG GNSS RFI Ad-hoc Group.

- By 15 June 2026: Submit Working Paper for CNS SG/30 endorsement (this paper).
- By July 2026: Finalize national GNSS RFI reporting form and online platform specifications, leveraging EFFORT/GPS Wise infrastructure.
- By August 2026: Complete DME/DME coverage verification for Jakarta and Surabaya TMAs.

2.7 GNSS RFI Monitoring Application — Building Proactive Detection Capability

2.7.1 AirNav Indonesia is developing a dedicated GNSS Radio Frequency Interference (RFI) monitoring application to enhance the current reporting-based approach, which relies primarily on pilot and air traffic controller (ATC) reports following GNSS interference events. The application will provide autonomous, proactive, ground-based detection and monitoring capabilities integrated into AirNav Indonesia's operational systems, enabling earlier identification and assessment of interference activity.

2.7.2 The application is designed with two core capabilities:
Continuous automated signal monitoring — Ground-based GNSS receiver stations at key aerodromes and en-route locations will continuously monitor signal quality indicators, including carrier-to-noise density ratio (C/N0) and satellite tracking metrics. The system will generate alerts when anomalies consistent with jamming or spoofing are detected, providing an independent detection capability that complements airborne and air traffic controller reports.

- Geospatial RFI correlation and situational awareness — Signal quality anomalies detected by ground-based GNSS monitoring stations, including carrier-to-noise density ratio (C/N0) degradation and satellite-count loss, will be correlated across geographically distributed sites. When multiple nearby stations exhibit similar degradation patterns, the system will automatically identify and flag suspected regional interference events, providing

controllers and operational personnel with timely situational awareness of the affected area and the severity of the disruption.

2.7.3 This proactive detection approach directly addresses the identified limitation of the current reporting model — namely, that interference events are reported only after a flight crew detects a cockpit anomaly and establishes voice contact with ATC, resulting in delays of several minutes during which other aircraft in the affected volume may remain uninformed. By decoupling RFI detection from airborne observation, the application will enable earlier protective actions: proactive NOTAM, timely reversion to non-GNSS approach procedures, and improved data quality for post-event ICAO APAC trend reporting.

2.7.4 The design specification for the monitoring application is expected to be completed by Q4 2026, with prototype deployment targeted for the first quarter of 2027. Technical collaboration with ICAO and regional partners on sensor specifications, data exchange formats, and integration with the proposed regional GNSS RFI monitoring framework would be welcomed.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper regarding Indonesia's national GNSS RFI mitigation framework, the 8 April 2026 Jakarta FIR incident, and the status of BNN/MON/PBN resilience implementation;

b) endorse Indonesia's alignment with the Draft Asia/Pacific Regional Guidance Material for GNSS RFI and Associated Data Link Disruption Coordination and Reporting Procedures (Version 4);

c) encourage States to designate national and ATS-level Points of Contact for GNSS RFI coordination, maintain up-to-date regional contact directories, and establish formal cross-border communication protocols; and

d) encourage States/Administrations and ICAO APAC to explore the development of ground-based, autonomous GNSS RFI monitoring systems that provide proactive interference detection independent of pilot or controller reports, and to share technical specifications and operational experience with a view to establishing a regional GNSS RFI sensor network.

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APPENDIX A
KNOWN GNSS RFI EVENTS — INDONESIA (as of May 2026)

Nr	Date (UTC)	Latitude	Longitude	Type	Source / Flight
1	21 Nov 2025 03:35	00°41'41"N	127°08'12"E	Lost signal	SJY693
2	21 Nov 2025 05:40	04°36'07"N	132°03'34"E	Lost signal	LNI949 & PK-OFI
3	22 Nov 2025 06:47	06°47'22"N	122°26'52"E	Lost signal	MDX373
4	22 Nov 2025 06:47	06°47'22"N	122°26'52"E	Lost signal	GIA683 & BTK6191
5	8 Apr 2026 00:40–03:37	CGK area	CGK area	Suspected jamming	44 flights (multi-operator)