International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group

Fourteenth Meeting (CNS SG/14)
(Abu Dhabi, UAE, 19 – 23 October 2025)

Agenda Item 5: Frequency Management Working Group (FM WG/4) Main Matters

GPS L5 FREQUENCY INTERFERENCE FROM DME SYSTEMS - URGENT REGULATORY ACTION REQUIRED

(Presented by IAC/IRAN)

SUMMARY

This paper presents critical findings on systematic interference between Distance Measuring Equipment (DME) and GPS L5 frequency (1176.45 MHz), revealing that sixteen DME channels (60X-75X) operate directly within the GPS L5 protected spectrum, affecting 487 facilities globally and threatening the entire GPS modernization program for aviation safety applications.

Action by the meeting is at paragraph 3.1.

REFERENCES

- ICAO Annex 10, Volume I, Aeronautical Telecommunications (7th Edition, 2018)
- GPS Interface Specification IS-GPS-705 Revision E (GPS Directorate, 2021)
- RTCA DO-229E: Minimum Operational Performance Standards for GPS/SBAS Airborne Equipment (2016).

1. INTRODUCTION

1.1 This paper presents critical findings regarding systematic interference between Distance Measuring Equipment (DME) systems and the GPS L5 frequency cantered at 1176.45 MHz The investigation, initiated following interference detection at Imam Khomeini International Airport, has revealed that sixteen DME channels (60X through 75X) operate directly within the GPS L5 protected spectrum band of 1164.45-1188.45 MHz, affecting DME facilities globally. This fundamental frequency planning conflict threatens the entire GPS modernization program and requires immediate regulatory action to protect safety-of-life aviation applications.

1.1.1 Scope of the Problem

GPS L5, designed specifically for aviation safety-of-life operations, offers enhanced power, wider 24 MHz bandwidth, and advanced signal structures for precision approach and landing operations.

However, DME facilities operating on conflicting channels transmit with peak powers of 50-1000 watts, creating received signal levels that exceed GPS L5 signals by up to thirteen orders of magnitude (127 dB). This extreme power disparity causes receiver desensitization and complete loss of L5 tracking capability in terminal areas where precision navigation is most critical.

1.1.2 Internal ICAO Annex 10 Inconsistency

A critical regulatory gap exists within ICAO Annex 10 Volume I itself. Chapter 3.7.3.1.1.8.3 explicitly protects the frequency band 1164.45-1188.45 MHz for GPS L5 signal power, stating "The L1 and L5 signal power shall be contained within ±12 MHz bands centred on the respective carrier frequencies." However, Chapter 3.5, Table A authorizes DME channels 60X-75X operating at 1173-1188 MHz - directly within this protected band. This internal contradiction within the same standard document, where Chapter 3.5 authorizes operations that Chapter 3.7 prohibits, represents a fundamental regulatory failure requiring coordinated amendment of both chapters.

2. DISCUSSION

2.1 Technical Evidence and Operational Impact

Detailed spectrum analysis at Imam Khomeini International Airport identified the airport's DME Channel 64X (1177 MHz) as the interference source, with measured power levels of -65 to -42 dBm significantly exceeding the -111 dBm interference threshold for GPS L5 receivers. The interference was confirmed through systematic facility shutdown testing and signal analysis. Global analysis reveals the conflicting channels are concentrated in the world's busiest airspace regions. In some international airports operate DME facilities on the most critical conflicting channels, specifically 63X (1176 MHz) and 64X (1177 MHz), which are within 1 MHz of the GPS L5 carrier frequency. Laboratory testing demonstrates complete loss of L5 signal tracking when DME duty cycles exceed 15%, with degraded performance at duty cycles as low as 5%.

2.2 Root Causes and Regulatory Analysis

The conflict arose from inadequate coordination between ICAO Navigation Systems Panel and GNSS Panel during GPS L5 frequency selection. While potential DME interference was discussed, the full implications of sixteen channels within GPS L5 bandwidth were not adequately addressed. Institutional separation between panels overseeing DME versus satellite navigation contributed to insufficient cross-system compatibility analysis.

2.3 Safety Implications and Implementation Requirements

The current situation creates unique transition-period safety risks as operators deploy L5-capable equipment without awareness of limitations. Intermittent interference varying with aircraft position creates unpredictable performance that may lead to inappropriate operational decisions. Loss of GPS L5 compromises aviation's long-term safety strategy for managing projected traffic doubling by 2040, forcing continued reliance on expensive ground infrastructure lacking coverage and precision for optimal airspace utilization.

Current interference mitigation techniques (pulse blanking, adaptive filtering) provide only partial solutions with significant performance penalties. Studies show pulse blanking degrades position accuracy by 20-40% and increases multipath susceptibility, problematic for Category II/III precision approaches. Advanced techniques require computational resources exceeding current aviation receiver capabilities and have not been validated for safety-critical operations.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) ICAO State Letter acknowledging incompatibility and directing cessation of new installations on conflicting channels

b) States conduct surveys identifying all affected facilities and develop preliminary transition plans

c) Publish AIP amendments and NOTAMs identifying areas where GPS L5 may be unreliable

d) Update training programs with GPS L5 limitation awareness

e) Require DME interference detection/annunciation in new L5-capable receivers;

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