REPORT OF

THE TENTH MEETING OF THE SPECTRUM REVIEW WORKING GROUP (SRWG/10)

Bangkok, Thailand
4-6 February 2026

The views expressed in this Report should be taken as those of SRWG/10 Meeting and not of the Organization.

Approved by the Meeting
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1. Introduction

1.1 The Tenth Meeting of the Spectrum Review Working Group (SRWG/10) of APANPIRG was held in the ICAO APAC Regional Office, Bangkok, Thailand, on 4 – 6 February 2026.

2. Attendance

2.1 The Meeting was attended by **53** participants from **14** States/Administrations and **1** International Organization, including Australia, China, Hong Kong China, India, Indonesia, Japan, Lao PDR, Malaysia, Philippines, Singapore, Sri Lanka, Thailand, United States, Vietnam, and ICAO. The List of Participants is provided in **Attachment 1** to this Report.

3. Opening of the Meeting

3.1 The Meeting was opened by Mr. Arthur Kin Hei Lau, Chairperson of the SRWG, who warmly welcomed all participants and expressed appreciation for the strong engagement and collective efforts of States, Administrations, and the Secretariat in advancing regional spectrum management. He highlighted the increasing importance of protecting aviation spectrum in light of emerging technologies and interference risks, and encouraged continued collaboration to achieve practical outcomes.

3.2 Mr. Zhang De, Regional Officer CNS, also welcomed participants and thanked them for their active contributions, and acknowledged the valuable work of the VHF and HF ad hoc groups supporting the meeting.

4. Officers and Secretariat

4.1 Mr. Arthur Kin Hei Lau, Acting Senior Electronics Engineer, Civil Aviation Department, Hong Kong, China, chaired the Meeting.

4.2 Mr. Zhang De, Regional Officer CNS, acted as the Secretary of the Meeting with the support of Dr. Soniya Nibhani, Regional Officer ANS (CNS) Implementation, Ms. Xu Jian, Associate Programme Officer (CNS) Implementation and Ms. Varapan Meefuengsart, the Programme Assistant from ICAO Asia and Pacific Regional Office.

5. Organization, working arrangement, language and documentation

5.1 The SRWG/10 met as a single body. The working language for the Meeting was English inclusive of all documentation and this report. A total of **seventeen (17) Working Papers, two (2) Information Papers, and two (2) Presentations** were considered by the Meeting. The List of Papers is provided in **Attachment 2** to this Report**.**

6. Draft Conclusions, Draft Decisions and Decisions of SRWG – Definition

6.1 SRWG recorded its actions in the form of Draft Conclusions, Draft Decisions and Decisions within the following definitions:

> **Draft Conclusions** deal with matters that, according to APANPIRG's terms of reference, require the attention of States or action by the ICAO in accordance with established procedures;

Draft Decisions deal with the matters of concern only to APANPIRG and its contributory bodies; and

Decisions of the SRWG that relate solely to matters dealing with the internal working arrangements of the SRWG.

7. List of Conclusions/Decisions from SRWG/10

	Reference Number		Title of (Draft) Conclusions/Decisions
1.	Draft Conclusion SRWG/10/01	-	Asia/Pacific Regional Frequency Management Manual Edition 1.2
2.	Draft Decision SRWG/10/02	-	Revised Terms of Reference of the APAC Spectrum Review Working Group (SRWG)

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Agenda Item 1: Adoption of the Agenda

1.1 The provisional agenda presented in **WP/01** was adopted as the agenda for the Meeting.

Agenda Item 2: Review outcomes of relevant meetings

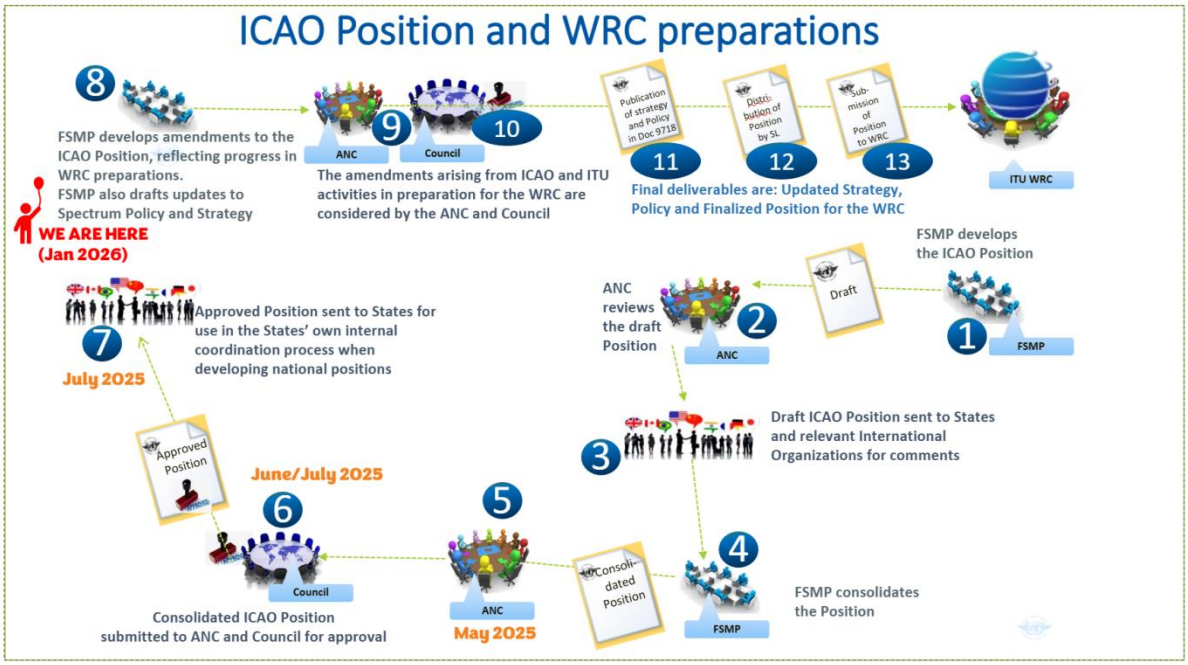
Review of Outcomes of Relevant Meetings - Secretariat (WP/02)

2.1 The paper summarized relevant information and updates with a highlight on the outcomes of SRWG/9, which was reviewed by CNS SG/29. It was stated that the CNS SG/29 Meeting adopted **five (5)** conclusions and **six (6)** decisions. In addition, based on the outcome of discussions on various agenda items, the CNS SG/29 Meeting developed **three (3)** Draft Conclusions and **one (1)** draft Decision for consideration by the APANPIRG/36, which were adopted by the APANPIRG/36 Meeting. The Meeting noted the Conclusions/Decisions adopted by the CNS SG/29 and the APANPIRG/36.

2.2 The paper also briefly summarized the outcomes of the 42nd Session of the Assembly related to aeronautical frequency spectrum for the Meeting's review.

Global Updates related to Frequency Spectrum - ICAO HQ (SP/01)

2.3 The presentation delivered by ICAO HQ shared the global developments related to Frequency Spectrum Management. It was stated that the ICAO Council, at the ninth meeting of its 235th Session held on 25 June 2025, approved the ICAO Position for ITU World Radio Communication Conference 2027 (WRC-27), and the relevant State Letter was published on 16 July 2025. The presentation also outlined in detail the process of ICAO Position development and WRC preparations as follows:



2.4 States and International Organizations were requested to consider the ICAO position as much as possible in their preparation activities for WRC-27 at the national level, in the activities of regional telecommunication organizations, and in the relevant meetings of the ITU. In addition to the first two workshops held in APAC and EUR/NAT, to promote ICAO position and increase awareness of WRC-27 agenda items related to aviation, FSMP will organize two more workshops in 2026.

2.5 Agenda items for WRC-27 that affect aeronautical safety services were introduced, including **Agenda Item 1.7**: *Study on IMT use in the frequency bands 4400-4800 MHz, 7125-8400 MHz and 14.8-15.35 GHz*, **Agenda Item 1.9**: *Update Appendix 26 in support of aeronautical mobile (OR) high frequency modernization*, **Agenda Item 1.17**: *Space Weather Sensors*, **Agenda Item 1.19**: *Primary allocations to the EESS passive in the bands 4200-4400 MHz*, and **Agenda Item 9.1**: *Urgent action by study groups in preparation for the next WRC regarding beyond-line-of-sight C2-link for RPAS.*

2.6 It was noted that the 42nd ICAO Assembly adopted several Assembly Resolutions, which include Assembly **Resolution A42-7**: *Support of the ICAO policy on radio frequency spectrum matters.* Resolution A42-7 strengthens the previous Resolution A41-7 by adding an important emphasis on the need for effective coordination between radio regulatory authorities and civil aviation authorities.

2.7 The Meeting was also informed of the upcoming Proposal for Amendments (PfAs)/deliverables from FSMP. It was noted that Volume I (Spectrum Strategy) of Doc 9718 is in the publication process and is planned to be published in Q2 2026. This amendment to Volume I of Doc 9718 includes several updates, notably enhancements to the detailed spectrum strategy and the incorporation of ICAO's position for WRC-27. The Meeting also noted the schedules of development of ICAO Position for ITU WRC-27, Space-based VHF(SB-VHF) SARPs, and radio altimeter SARPs.

2.8 The Meeting discussed the timeline for developing the ICAO Position for WRC-27, with a request from Thailand to explore the possibility of finalizing the position earlier to support regional and national preparatory processes. ICAO HQ explained that while finalization is planned for mid-2027, a draft position is expected to be available around February 2027 and shared with regional offices and relevant ITU meetings. States were encouraged to actively participate in ITU and WRC preparatory activities and coordinate closely with national radio regulatory authorities.

Agenda Item 3: Review Frequency planning requirements for the APAC Region

Agenda Item 3.1: VHF COM Frequency Allotment Plan for APAC

Proposal for Improving the Frequency Utilization Efficiency of AOC Band in APAC Region - Ad-hoc Group of VHF COM Allotment Plan Research (WP/03)

3.1 VHF COM Allotment Plan Research Ad hoc Group provided the actions taken for improving the utilization of frequency band 117.975 - 137 MHz, with a particular focus on the AOC frequency band (128.900–132.025 MHz). It was noted that while some VHF COM sub-bands were becoming saturated, parts of the AOC band remain under-utilized or used by non-AOC services, indicating inefficiencies in the current allotment plan.

3.2 The Meeting recalled that AOC frequencies were generally unprotected and could be shared among multiple operators, which allowed more efficient frequency planning compared with protected ATC assignments. However, the AOC band in the APAC region had been widely used for mixed purposes, including ANSP operations, helicopter and offshore communications, ground handling, and data link services, which reduced overall planning efficiency.

3.3 Based on Frequency Finder data as of 31 December 2025, the paper showed uneven AOC utilization across three sub-bands, which are SB1 (128.900 - 129.675MHz), SB2 (129.700 - 130.875MHz), and SB3 (130.900 - 132.025MHz), with SB2 demonstrating relatively lower AOC usage. The paper also highlighted discrepancies between actual AOC usage and registered assignments.

3.4 While concerns were expressed regarding operational impact, a flexible approach was considered preferable. Based on the analysis of AOC frequency band usage registered in FF and the

discussion of VHF COM Allotment Plan Research Ad hoc Group, the following recommendations are proposed to improve the efficiency of AOC frequency band utilization.

a) Encourage States/Administrations to complete the registration information of assigned frequencies in FF database.

b) In future frequency assignments, prioritize the usage of the AOC band in the order of SB3, SB1, SB2, while increasing the reuse times of individual frequency points within the band. This approach will provide operational flexibility for future adjustments to frequency allotment plans.

3.5 The Meeting discussed the proposed approach in the paper. It was clarified that the proposal would not affect existing frequency assignments and would apply only to future assignments. Several States expressed support for the approach, while noting the need for further clarity on AOC frequency sharing practices within the sub-bands. The Meeting noted that frequency sharing could be facilitated through registration in the FF database and coordination with the APAC Regional Office for new assignments, noting that sharing practices would depend on utilization and operational needs.

3.6 The Meeting further agreed that best practices related to AOC channel use on helicopter/oil rig communications could be shared in future meetings.

3.7 It was noted that prioritization of AOC usage for new assignments could be applied on a trial basis, with feedback to be reviewed by the VHF COM Allotment Plan Research Ad hoc Group before considering any formal inclusion in the Regional Frequency Management Manual. **ACTION ITEM 10-1**

Agenda Item 3.2: HF utilization in APAC

HF-related information for inclusion in the APAC Regional Frequency Management Manual – HF Ad Hoc Group (WP/05)

3.8 This paper presented the outcomes of the HF ad hoc group established under SRWG/7 to address HF spectrum utilization for aeronautical communications in the APAC region.

3.9 In accordance with Action Item 9-5 of SRWG/9, additional HF assignment guidance and criteria for new or modified HF spectrum use have been developed, based on ITU Radio Regulations Appendix 27 and relevant ICAO references, the HF ad hoc group prepared an initial draft of the HF section contained in Chapter 3, Sub-Chapter 3.1, HF Air-ground Communication Frequency bands, of the APAC Regional Frequency Management Manual as provided in Appendix A.

3.10 The Meeting was informed that the additional information in the sub-chapter addresses the assignment criteria for HF frequencies and the criteria for new or modified use of the HF spectrum. The assignment criteria describe the selection of appropriate HF channels based on area-based arrangements, including Major World Air Route Areas (MWARAs), Regional and Domestic Air Route Areas (RDARAs), and VOLMET areas. The criteria for new or modified HF spectrum use describe the actions available to States/Administrations when proposing new or modified use of HF frequency bands.

3.11 The additional information is based on ITU Radio Regulations (RR) Appendix 27 and relevant ICAO references. For ease of reference, it was noted that the use of the most recent edition of the ITU Radio Regulations is essential to ensure the accuracy and currency of the information. In the initial draft, grey highlighting is used to identify new insertions, while yellow highlighting indicates text extracted from the e-ANP Volume II originating from the ASIA/PAC/3 RAN Meeting documents, which, as noted in WP/15 of SRWG/8, were identified as containing certain discrepancies.

3.12 In relation to the above information, the ICAO Secretariat has circulated State Letter Ref. AN 2/1 – AP092/25 (CNS), informing that ICAO APAC is currently conducting a round of updates to the ANP, including HF-related content. It is anticipated that the revised version will reflect the latest developments once finalized.

3.13 The Meeting reviewed the additional HF information proposed by the paper and agreed to adopt it into the APAC Regional Frequency Management Manual.

3.14 The Meeting discussed the future work arrangements of the HF ad hoc group. It was observed that the key tasks assigned to the group, including the HF survey and the revision of the related regional guidance material, had been completed. The Meeting agreed that, as no further work on HF provisions is required, the HF ad hoc group is dissolved. The Meeting expressed its appreciation to Indonesia for its leadership, and to the participating States/Administrations and the Secretariat for their support to the HF ad hoc group.

Update Survey Result of the Utilization of HF Bands for Aeronautical Communication in the APAC Region - HF Ad-hoc Group (IP/02)

3.15 This paper presented an updated survey that confirmed continued use of HF spectrum for aeronautical communications in the APAC Region, consistent with findings previously reported to SRWG/9.

3.16 As of December 2025, ICAO APAC Regional Office received eighteen (18) responses from States/Administrations, including Afghanistan, Australia, Cambodia, China, Hong Kong China, Macao China, India, Indonesia, Japan, Lao PDR, Mongolia, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Singapore, and Thailand.

3.17 Key analysis of responses was shared for the following key topics:

1. States/Administration implement the HF bands between 2 850 kHz and 22 000 kHz for aeronautical purposes
2. Registration to ITU MIFR
3. Issues in assigning the HF bands to the operational condition

3.18 Based on the survey results and evaluations conducted, the ad-hoc group presented the following as conclusions.

1. Out of 29 States/Administrations, 18 responded; 15 confirmed HF usage, and 3 did not. HF bands are used not only by ANSPs but also by airlines, SAR, and others, referencing Appendix 27 of the ITU Radio Regulations. Some States/Administrations also use Appendix 26 allocations, though this band is not meant for safety-of-life services.

2. The updated survey responses reconfirm the findings presented in WP/05 (SRWG/9) that incomplete registration of HF frequency assignments in the ITU MIFR remains an outstanding issue. The continued relevance of this matter highlights the need for further attention by States/Administrations to strengthen international recognition and protection of aeronautical HF spectrum as in line with Action Item 9-2 of SRWG/9, and particularly in preparation for future World Radiocommunication Conferences (WRCs).

3.19 The Meeting noted the information and encouraged States/Administrations to register the HF in the ITU MIFR as in line with **Action Item 9-2 of SRWG/9**.

Agenda Item 3.3: Other matters

ICAO Position for the International Telecommunication Union (ITU) WRC-27-Secretariat (WP/06)

3.20 This paper presented the ICAO Position for the ITU World Radiocommunication Conference 2027 (WRC-27). The ICAO Position aims at protecting aeronautical spectrums for all radiocommunication and radionavigation systems used for ground facilities and on-board aircraft.

3.21 It was recalled that the ICAO Position had been developed to address WRC-27 agenda items of critical importance to international civil aviation, following extensive review by the Air Navigation Commission, consultation with States and international organizations, and approval by the ICAO Council. The Position had subsequently been circulated to all Contracting States through State letter E 3/5-25/65 issued by the Secretary General on 16 July 2025. The Meeting was also informed that this ICAO Position has been presented and introduced during the 2nd Meeting of the APT Conference Preparatory Group for WRC-27 (APG27-2).

3.22 The paper emphasized that radio spectrum was a scarce resource and that continued protection of aeronautical radionavigation and radiocommunication systems was essential to aviation safety and efficiency. Particular concern was expressed regarding WRC-27 Agenda Item 1.7, especially potential IMT use in bands adjacent to the radio altimeter band, which could pose serious safety risks if not adequately mitigated. Other agenda items with potential impact on aviation were also highlighted.

3.23 The paper stressed the importance of active participation by civil aviation authorities and experts in national, regional, and ITU preparatory activities. The Meeting noted ICAO Position for ITU WRC-27 and supported incorporating the material into State positions and ensuring active participation of aviation experts in national and regional WRC-27 preparatory activities.

3.24 The Meeting considered the paper and noted the importance of active State participation in ITU and WRC-27 preparatory activities to support the ICAO position, including through close coordination with national radio regulatory authorities.

3.25 Australia informed the meeting of upcoming APT and ITU Working Party activities relevant to WRC-27, and encouraged States to participate, including through remote attendance where possible.

3.26 Several States highlighted challenges in identifying the relevant ITU Study Groups and Working Parties corresponding to specific WRC-27 agenda items, particularly those addressed in the ICAO Position. The Secretariat, with the support of interested and experienced States, is invited to develop a consolidated reference table mapping the ICAO WRC-27 agenda items to the relevant ITU Study Groups and Working Parties, for the information of States and Administrations. **ACTION ITEM 10-2**

Space-Based VHF Frequency Coordination for the Asia/Pacific Region – Australia (WP/17)

3.27 This paper addressed the need to establish a frequency coordination process for Space-based VHF communications in the Asia/Pacific region. Service providers are developing experimental systems and will soon require spectrum access for testing.

3.28 It was outlined that ICAO is currently developing the necessary standards and guidance documents (expected completion mid-2026 to Q1 2027) and that two technical methods are being considered for frequency separation calculations: a geometric horizon method and a more complex radio propagation method.

3.29 The key issue is that while frequencies may appear unused in ICAO's Frequency Finder database, they could still be in operational use by states in the region. The paper proposed establishing a regional coordination process to identify available frequencies for Space-based VHF testing while protecting existing terrestrial VHF operations.

3.30 During the discussion, States sought clarification on whether the proposed coordination process was intended to address the testing phase prior to SARPs applicability or the regular operational phase. It was explained that, while coordination mechanisms would be required once space-based VHF becomes operational, there is also a need to facilitate testing and trial activities before SARPs completion, noting that testing frequencies would not require the same level of protection as operational assignments.

3.31 The Meeting agreed that further guidance from ICAO Headquarters would be essential. Taking into account the several papers on the same topic of Space-based VHF, including a paper from ICAO Headquarters (WP/08), with the additional information provided, Australia clarified that the paper was intended to initiate work on facilitating test and trial frequency requests, rather than to propose an immediate conclusion or decision. Accordingly, Australia withdrew the draft conclusion section of the paper.

3.32 The Meeting discussed a temporary regional arrangement to facilitate space-based VHF trials prior to the availability of finalized SARPs and coordination mechanisms. Under this arrangement, a State or entity initiating a trial would submit a request to the APAC Regional Office, which would coordinate with ICAO HQ to identify possible candidate frequencies. The APAC Regional Office would then notify all States within the region of the proposed trial, including relevant details such as the frequency, timing, and expected area of impact, and would coordinate the collection and resolution of any comments or concerns raised. In the absence of adverse comments, trials could proceed with close monitoring by the concerned States and the Regional Office. This temporary arrangement was agreed as an interim measure to support timely implementation of space-based VHF trials in the APAC region and will be reviewed at a later stage. **ACTION ITEM 10-3**

3.33 It was noted that the trial notifications would be distributed by email to the POC of States on frequency affairs rather than through State Letters, to ensure timely dissemination. While notifications would be sent broadly, the Meeting recognized the value of identifying the States potentially affected based on radio line-of-sight or coverage calculations, and encouraged trial initiators to provide such technical assessments to support the coordination process.

Update on Space-based VHF – Secretariat (WP/07)

3.34 The ICAO Secretariat provided an update on the development and implementation of Space-based VHF.

3.35 The Meeting was informed of the ongoing development of Standards and Recommended Practices (SARPs) in Annex 10 to support Space-based VHF. The amendment of Annex 10 Volume III — Communication Systems and Volume V — Aeronautical Radio Frequency Spectrum Utilization for Space-Based VHF is being progressed as a joint work package under both the Frequency Spectrum Management Panel (FSMP) and the Communications Panel - Data Communications Infrastructure Working Group (CP-DCIWG), with shared validation reports and impact assessments to be approved by both groups. According to the agreed timeline, panel approvals were expected in 2026, with circulation to States thereafter and a target applicability date of November 2028.

3.36 The paper highlighted the need for robust regional and inter-regional frequency coordination mechanisms, given the wide coverage of Space-based VHF systems. ICAO Headquarters and Regional Offices had initiated coordination work, including the development of draft procedures and flowcharts and enhancements to the Frequency Finder tool under its Phase 4 modernization.

3.37 It also discussed regional and inter-regional coordination mechanisms and highlighted regional considerations regarding frequency data validity, VHF channel spacing, and the potential impact of Space-based VHF on terrestrial systems.

3.38 The Meeting agreed that further guidance from ICAO Headquarters would be essential, and that any assessment of VHF channel spacing would be subject to the finalization of the Space-based VHF SARPs and the relevant criteria being developed by FSMP.

Regional and inter-regional coordination mechanism for assisting States to assign VHF aeronautical frequencies, including Space-based VHF – ICAO HQ (WP/08)

3.39 ICAO HQ provided an initial outcome of the draft coordination mechanism of SB-VHF frequencies. It was noted that the coordination procedures presented remain at an early stage of development and are provided for information only. The final version of the coordination mechanisms is expected to be implemented in the future Frequency Finder Tool.

3.40 The Meeting noted that the introduction of SB-VHF may require a fundamental shift in global aviation frequency management, moving toward a more integrated worldwide approach for inter-regional frequency assignment coordination. In this regard, ICAO HQ has initiated discussions with all relevant Regional Offices to explore practical coordination solutions to support States in managing SB-VHF frequency assignments.

3.41 The Meeting was informed that the Frequency Finder modernization is progressing through four phases, with Phase 4 adding SB-VHF. The FSMP will develop the associated planning criteria for inclusion in Volume II of Doc. 9718. These criteria are intended to be implemented in the Frequency Finder Tool to support Regional Offices and States in identifying candidate frequencies, as well as in conducting effective regional and inter-regional coordination in accordance with SARPs and without causing harmful interference.

3.42 The Meeting further noted that coordination meetings with all relevant CNS Regional Officers were held on 18 August 2025 and 16 January 2026 to analyze possible regional and inter-regional coordination methods, including arrangements for regions or States not using the Frequency Finder Tool. Draft coordination flowcharts were refined through these discussions and are expected to be incorporated into the upgraded tool.

3.43 The Meeting also noted that the existing coordination guidance in Volume II of Doc 9718 is planned to be revised to take into account SB-VHF operation. A draft proposal was attached to this WP for reference. The Meeting was informed that the draft will be further refined based on inputs from ROs, and will be presented at a future meeting. In parallel, validation of existing Frequency Finder data is ongoing across Regional Offices to ensure the accuracy of candidate frequencies prior to full deployment of the upgraded tool.

3.44 The Meeting discussed the challenges of identifying frequencies for SB-VHF trials, given that formal planning criteria from the FSMP are not yet mature. ICAO HQ explained that candidate frequencies are currently identified through close coordination between Headquarters and Regional Offices, utilizing satellite footprints and existing Frequency Finder data. It was strongly emphasized that the effectiveness of this process depends on the accuracy of the database. States were urged to ensure their data is up-to-date to prevent trial frequencies from causing interference with existing terrestrial systems.

3.45 Regarding the workflow of the modernized FF tool, ICAO HQ clarified that the notification process is intended to be semi-automated. Unlike the current manual email-based coordination, the new system will allow States to submit data and Regional Offices to receive the notification immediately after States' submission with a single click, enabling real-time coordination.

In response to suggestions from China regarding a broader State Letter process for frequency compatibility, it was noted that while administrative coordination typically occurs during the update of regional allotment plans, the FF tool serves as a technical calculation interface based on established criteria.

3.46 Australia shared its experience with SB-VHF testing, highlighting the importance of a "stop-buzzer" protocol—a contingency procedure to immediately cease operations if interference is reported. The Meeting noted that for trials to be successful, a clear coordination mechanism and a technical information template must be established. It was concluded by stressing that data integrity is the highest priority for the upcoming Phase 4 implementation, noting that a dedicated data-cleaning activity would be necessary to ensure the reliability of the new system's compatibility analysis and visualization capabilities.

Agenda Item 4: Update on Frequency Finder

The Data Quality Control - ICAO HQ (SP/02)

4.1 The presentation delivered by the HQ provided information on the VHF COM frequency database quality control for the VHF-COM module. It stated that to ensure that SB-VHF and terrestrial VHF are compatible and that SB-VHF does not cause interference to terrestrial VHF services, an accurate and consistent frequency database is required, along with the use of the Frequency Finder to achieve inter-regional coordination.

4.2 To support database quality improvement, a structured data validation exercise is being conducted using state-specific Excel files that consolidate information from States' AIPs and the COM3 frequency list in Frequency Finder. States are requested to review, confirm, and update the information contained in the sheet 1 of the Excel files, including verification of frequencies in use, completion of missing technical parameters, and clarification of service categories. Guidance was provided on how to amend the data, including handling of multiple services, determination of DOCs (refer to Volume II of Doc 9718), and identification of sensitive information.

4.3 The Meeting noted the respective responsibilities of ICAO HQ, Regional Offices, and States in completing this quality control exercise, and agreed that once finalized, the validated database would serve as the basis for the new Frequency Finder tool.

4.4 The Meeting discussed the methodology for validating FF data (COM List 3) against State AIPs. It was clarified that the quality control exercise covers not only frequency values, but also all associated operational parameters, including range, height, airport identifiers, service categories, and coverage definitions. Where data could not be reliably extracted from AIPs, States are requested to complete all missing or inconsistent fields using the provided Excel files, based on firm national information.

4.5 The Meeting noted that accurate range, height, and coverage information is critical, as discrepancies between operational practice and FF data could affect future planning criteria, including those for SB-VHF. The ICAO HQ emphasized that the validation exercise is intended to capture the most accurate operational picture possible, recognizing that existing planning criteria are conservative and that States remain best placed to confirm the correctness of operational parameters. For ACC and APP services, the use of polygons to define areas of responsibility was encouraged, and additional data fields will be provided to capture sector names and coordinates.

4.6 It was clarified that this data validation exercise is a one-time quality control process to establish a reliable dataset for migration to the upgraded FF tool. States are requested to review and amend the Excel sheets only, without updating the current FF database as part of this exercise. ICAO HQ explained that the dataset will later be consolidated and used to populate the new tool, while acknowledging that some inconsistencies may arise due to ongoing frequency assignments during the

transition period. Regional Offices were requested to inform the HQ of any new or modified frequencies to maintain alignment between current operations and the future database.

4.7 The Meeting also discussed issues related to data sensitivity and publication status. It was noted that some frequencies may be registered in FF but not yet published in AIPs due to operational considerations or national security constraints. The States were encouraged, where possible, to include all relevant frequencies in FF, including those of a sensitive nature, noting that the upgraded tool will support data visibility controls to protect sensitive information while still enabling compatibility analysis and interference prevention. The Meeting acknowledged the scale and complexity of the data quality exercise and noted that further clarification and bilateral support may be provided by ICAO as the process progresses.

Update on Frequency Finder from HQ – Secretariat (WP/09)

4.8 The working paper delivered by the HQ presented an update on the Frequency Finder (FF) tool, including recent enhancements, operational status of existing modules, and the ongoing modernization project. The paper recalled that Frequency Finder supports ICAO Regional Offices and States in the management and coordination of aeronautical frequency assignments, including COM Lists 2 and 3 and SSR Mode S II/SI codes, with functions such as interference calculation and graphical visualization.

4.9 The Meeting noted that following an IT security audit, the Frequency Finder server underwent necessary security upgrades, during which external access to the central database was restricted. As part of this process, key scripts supporting download and import/export functions were updated. A new standalone runtime version of the VHF-COM module was completed, featuring improved download speed, a modernized interface, and automatic synchronization with the central database. States were informed that standalone runtime versions for the VHF-NAV and SSR modules would be provided subsequently and that, in the interim, existing offline versions should continue to be used.

4.10 The paper outlined the modernization of the Frequency Finder application to address increasing complexity in CNS frequency planning and emerging technologies, including SB-VHF. The modernization aims to enhance cyber resilience, data presentation, real-time visualization, and platform scalability, while transitioning away from the FileMaker runtime environment.

4.11 The Meeting noted that the modernization project consists of four phases covering VHF communication systems, navigation systems, surveillance systems, and application enhancements. The final phase is expected to introduce additional capabilities such as support for SB-VHF frequency assignment, intermodulation calculation, and coverage analysis and simulation to meet future spectrum management needs.

4.12 The Meeting noted the importance of making extensive usage of the Frequency finder tool and to communicate with the Regional Office any outstanding requests that needed to be uploaded to the VHF-COM module. It is important to send to the ICAO HQs a copy of the newest entries made to the VHF-COM module in order to continue performing the data quality control discussed. Reference should be made to SP/02 of the Meeting.

Agenda Item 5: Review of Frequency Lists in the Region

Review of Frequency Lists – Secretariat (WP/10)

5.1 The ICAO Secretariat presented the status of Frequency Lists and the coordination of aeronautical frequency utilization for the region in 2025. It was reported that the ICAO Secretariat, in the past, duplicated its work on the VHF NAV module of Frequency Finder as well as on the Frequency Manager for new facility frequency planning upon request from the states. Recognizing the need to

migrate the Frequency List 2 database from Frequency Manager to Frequency Finder, the ICAO APAC Office synchronized all registered assignments on Frequency List 2 in the Frequency Manager into Frequency Finder in 2022 and has been using Frequency Finder on frequency assignments for NAV systems.

5.2 The CNS SG/28 endorsed the Draft Conclusion CNS SG/28/07 (SRWG/8/4) – Transition from the regular publication of Frequency List 2 to the global database of frequencies included in the Frequency Finder, which was adopted by APANPIRG/35 by Conclusion APANPIRG/35/9. As discussed in SRWG/8, after adopting the Draft Conclusion CNS SG/28/07 (SRWG/8/4), the ICAO APAC Regional Office stopped the regular publication of Frequency List 2. Therefore, no publication of Frequency List 2 was done in 2025.

5.3 Frequency List 2 and 3 can be accessed by the global database maintained in the Frequency Finder Tool. However, it is noted that, from August 2025, the Frequency Finder tool is undergoing a modernization process. The process was expected to be completed in 6 months; however, the process is still ongoing. This modernization process has resulted in an offline version of the Frequency Finder tool. As a result, the ICAO APAC Office faced issues conducting a simulation in the tool.

5.4 Nonetheless, the ICAO APAC Office has continued to coordinate frequency use with States, and all allocated frequencies have been saved in the local database. Once the tool is online, the local database is expected to be imported into the global database. However, it should be noted that after the Frequency Finder tool is online, some allocations may not be compatible. ICAO APAC Office will resolve such issues in coordination with affected States.

5.5 As the Frequency Finder tool is also used for SI/II code allocation, some requests were completed after August 2025 using the offline tool. However, it was observed that the SI/II code database has some missing entries from the past, and the allocated code was indeed not compatible. To resolve this issue and avoid allocating incompatible codes, currently, SI/II code allocations are not being made. The SI/II code allocation will start as soon as the issues in the current database are resolved.

5.6 In 2025, the ICAO APAC Office published Frequency List 1 (39th edition) by State Letter Ref.: T 8/8.4: AP056/25 (CNS), dated 24 April 2025. The Frequency List 1 (39th edition) can also be accessed on the ICAO APAC e-Docs webpage. The next edition (40th edition) of the ICAO APAC Frequency List 1 is planned to be published in May 2026.

5.7 It recalled the issues and requests related to Frequency List 1 Management during SRWG/9, including requesting ICAO HQ to incorporate the NDB frequency/identity assignment facility in the current FF tool. It also highlighted the need to compile resources that help understand NDB frequency/identity assignment criteria and to include the NDB frequency assignment criteria in the Asia/Pacific Regional Frequency Management Manual.

5.8 The ICAO APAC Office coordinated with ICAO Headquarters (HQ) to obtain relevant information. ICAO HQ informed that, other than the APAC region, NDB frequency assignment is not made by other regional offices, and there are no such requests to incorporate NDB frequency assignment features in the Frequency Finder Tool. As ICAO is upgrading the Frequency Finder tool and plans to launch a web-based version in the future, adding NDB to the current tool is not a priority. Therefore, there is less hope that these allocations can be made by the Frequency Finder tool in the near future.

5.9 ICAO HQ advised that some technical parameters for NDBs can be found in Annex 10, Volume I. Furthermore, it was recommended to use the EUR Doc 011 (EUR Frequency Management Manual), which contains NDB planning criteria and other relevant details (provided in **Appendix B**), and may serve as a useful reference for APAC States.

5.10 During the discussion, the ICAO Secretariat informed the Meeting that requests for NDB frequency coordination are relatively limited, averaging approximately five to six cases per year, and are concentrated in a small number of States. In this context, the Meeting discussed possible approaches to improving regional guidance on NDB assignments, taking into account the limited but recurring nature of such requests.

5.11 The Meeting invited States to volunteer on drafting NDB-related guidance for inclusion in the APAC Regional Frequency Management Manual, and to share any national tools used for NDB frequency management. Thailand and India volunteered to draft the NDB-related content for inclusion in the APAC Regional Frequency Management Manual, and to present in the next meeting. **ACTION ITEM 10-4**

Agenda Item 6: Frequency Interference in the Region

Agenda Item 6.1: 5G and Radio Altimeter

Flight experiments using C band for Advanced Air Mobility (AAM) and studies on interference with radio altimeters – Japan (WP/04)

6.1 In November 2024, the AAM flight test was conducted at a research facility near the foot of Mt. Fuji under special approval from JCAB. The conditions included maintaining an altitude below 150 meters and using a communication frequency of 4785 MHz.

6.2 Prior to AAM flights, JCAB examined safety measures for conducting flight tests using the C-band frequencies that intended for telemetry transmission and voice communication with the ground. JCAB anticipated that the C-band signals planned for AAM, adjacent to local 5G, could potentially interfere with radio altimeters (RA) used by existing aircraft. To mitigate this risk, JCAB issued NOTAMs to alert aircraft operating in the airspace surrounding the flight test site, and at last, the C-band frequencies were not use for the AAM flights.

6.3 The Meeting was informed the need to advance legal frameworks that ensure safety without hindering the future expansion of 5G use. Since there may also be cases in participating countries where the local 5G and C-band are operated without sufficient frequency separation from radio altimeters, continued monitoring is necessary.

6.4 Participating states were requested to share their experiences with using local 5G around airports and records of interference with radio altimeters, and to fully understand the precautions when transmitting 5G signals toward the sky and to continue considering appropriate safety measures.

Agenda Item 6.2: GNSS interference

Review of Recommendation of the Radio Navigation Symposium– Secretariat (WP/11)

6.5 The ICAO APAC Radio Navigation Symposium was held in New Delhi, India, from 07–09 April 2025. The theme of the Symposium was ***GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward***.

6.6 The Symposium recalled that ICAO, in collaboration with ITU and IMO, issued a Joint Statement on the Protection of the Radio Navigation Satellite Service from harmful interference. It was shared that the ICAO/ITU/IMO statement called for five (5) key actions, which the Symposium reaffirmed and outlined a set of recommended actions and best practices containing six objectives and associated recommendations for all aviation stakeholders.

6.7 ICAO APAC Radio Navigation Symposium examined existing and potential 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.

6.8 The Symposium developed **31** recommendations on how the APAC region could enhance coordination, information sharing, and develop capabilities to address GNSS RFI. The final list of recommendations was published using Electronic Bulletin (EB2025/20) on 28 July 2025, including a link to the Symposium's webpage, for information and awareness of Member States.

6.9 The Meeting reviewed the list of Recommendations provided in **Appendix C** and agreed that they are comprehensive. It was agreed that the list will continue to be reviewed, and additional recommendations may be added in the future as the evolution warrants.

Progress Update of the Procedures for GNSS and Data Link Disruption Ad-hoc Group – Singapore (WP/12)

6.10 This paper presented the update on the progress of the work by the Procedures for GNSS and Data Link Disruption Ad Hoc Group under the ATM SG.

6.11 To facilitate the presentation of a regional overview of GNSS and data link disruptions, including trend analysis and identification of hotspot locations, the ad hoc group members were requested to submit monthly disruption-occurrence data to Indonesia, who volunteered to compile and collate the submissions. The Meeting noted that as of 30 November 2025, six States have provided disruption-occurrence data. Additionally, since very few APAC States/Administrations were members of the ad hoc group, this hindered the effective visualization of disruption-occurrence data across the APAC region.

6.12 Considering difficulties in compiling data, such as differing report templates and missing essential fields, a chapter on "Standardized Operational Reporting Mechanisms" will be included in the regional guidance document to establish a common process for coordinating and reporting GNSS RFI and data-link disruptions among air traffic controllers, pilots, airspace users, and ANSPs.

6.13 The Meeting noted the ad hoc group reviewed the recommendations from the ICAO APAC Radio Navigation Symposium (New Delhi, April 2025) that are pertinent to the scope of work defined in its ToR. The group felt no need to modify the relevant recommendations. It was noted that the list of recommendations served as input for drafting the regional guidance material.

6.14 It was added that Singapore has drafted the initial framework skeleton of the guidance material for review and feedback from the ad hoc group, which was subsequently approved at its fourth meeting on 5 January 2026. Currently, different chapters of the document are being produced, and it is expected that the draft regional guidance document will be available for review and endorsement by the ATM SG in August 2026.

6.15 It was agreed that once the regional guidance material is published, a minimum data set for reporting GNSS RFI occurrences will be provided for use by States in compiling incident reports. Accordingly, it was recommended to await the guidance before collecting GNSS RFI incidents from States/Administrations. The task of collecting the incident report will be initiated by a new ad hoc group formed under SRWG once the approved regional guidance material is available after ATM SG/14 adoption. **ACTION ITEM 10-5**

Updates on GNSS RFI matters and its future management in the APAC Region – Secretariat (WP/13)

6.16 This paper presented a compilation of ICAO provisions on the GNSS RFI topic along with key activities done in the APAC region, including the relevant 42nd ICAO Assembly Resolution, regional efforts in APAC, and a request to deliberate on the next step for future management of GNSS RFI issues in the region. The relevant discussions in the 11th Air Navigation Conference (ANConf/11) in 2003, 12th Air Navigation Conference (ANConf/12) in 2012, 14th Air Navigation Conference (ANConf/14) in 2024, the development of GNSS RFI Reporting Form and GNSS Manual (Doc 9849), Electronic Bulletin related GNSS RFI, ICAO Roadmap to address GNSS RFI, 42th Session of the Assembly were summarized.

6.17 The Meeting noted that GNSS RFI is recognized in the ICAO Global Aviation Safety Plan (GASP 2026–2028) as a precursor contributing to Global High-Risk Categories of Occurrences (G-HRCs): CFIT, MAC, and Loss of Control In-Flight (LOC-I). As these G-HRCs represent unsafe end states, mitigating RFI as a precursor is essential to prevent accidents. It was noted that the upcoming Asia Pacific Regional Aviation Safety Plan (AP-RASP) 2026-2028 will also recognize the threats posed by GNSS RFI on CFIT and MAC for the APAC region.

6.18 The Meeting noted that in APANPIRG/36, the Safety Enhancement Initiatives Working Group (SEI WG) proposed to collaborate closely with the CNS SG by WP/21. To operationalize this collaboration, SEI WG proposed the following APRAST actions aligned with the AP-RASP 2026–2028 objectives:

- In coordination with APANPIRG, **identify geographic areas of concern** and analyze the **underlying factors** specific to the **APAC region** that contribute **to GNSS RFI risk**.
- Based on this analysis, prioritize the highest-severity threats and subsequently develop focused **regional SEIs and/or RASG-APAC Safety Advisories (RSAs).**
- Develop a comprehensive, holistic understanding of Original Equipment Manufacturer **(OEM) guidance and existing regional efforts** on managing the risk of GNSS interference.
- In coordination with the appropriate APANPIRG contributing bodies, identify and implement **additional efforts to mitigate the risk of GNSS interference** within the region

6.19 In APANPIRG/36, CNS SG Secretariat supported the need for collaboration and agreed to share the proposed collaboration shared in the paper in the SRWG/10 Meeting and CNS SG/30 Meeting planned in 2026. It was informed that the progress on the proposed collaboration and its associated outcomes will be presented at the APANPIRG/37 Meeting in 2026.

6.20 It was added that during the Fourteenth Meeting of the Regional Aviation Safety Group – Asia and Pacific Regions (RASG-APAC/14) held at Bangkok, Thailand, from 28-29 November 2024, it was agreed to identify a few prioritized Action Items and to establish a suitable platform to initiate the mechanism as described in RASG-APAC/14-WP/22 and following Action Items and associated contributory bodies were identified:

Task	Air Navigation Group/ Subgroup	Safety Group/ Subgroup	Event Lead	Members	Potential Members (For Sourcing)

Identification of Mitigation actions on Large Height Deviation and APAC regional hotspots	RASMAG[1]	SEI WG[2]	RASMAG	TBD	AEROTHAI, CANSO, IATA, IFALPA, AAPA
Identification of Mitigation Actions: Turbulence Encounters	MET SG	SEI WG	MET SG	TBD	Met and ANS experts
Identification of Mitigation actions for GNSS interferences and RF Frequency spoofing	CNS SG	SEI WG	CNS SG	TBD	CNS, Safety, IATA, etc.

6.21 In RASG-APAC/14, it was agreed that the APRAST's CFIT Task Force will identify geographic areas of concern, analyze contributing factors related to operational safety in the APAC region, and prioritize threats to develop targeted safety enhancement initiatives and advisories. Additionally, the SEI WG aims to understand OEM guidance and existing efforts to manage GNSS interference, while maintaining close coordination with the CNS SG and other safety teams globally.

6.22 Thailand's Radio Regulatory Authority (Office of the National Broadcasting and Telecommunication Commission (Office of NBTC)) shared information about action taken to resolve the GNSS RFI incidents along the Thailand-Myanmar border, which had impacted aviation in Thailand. The Meeting was informed that an official letter was sent to Myanmar to request assistance to resolve the issue in September 2025, and two rounds of signal monitoring (test drive) were randomly conducted. The results from both inspections demonstrated no further interference from Myanmar.

6.23 The Meeting initiated a discussion on the need for the creation of an ad hoc group under SRWG to discuss and alleviate GNSS RFI related incidents, and identify other potential tasks that may be undertaken by this group. It was also suggested that this group discuss how it can support the SEI WG in achieving the SEI WG's intended objectives for the proposed collaboration outlined in WP/21 of APANPIRG/36. It was agreed that, to identify geographic areas of concern and analyze the underlying factors specific to the APAC region, data shared by States on GNSS RFI occurrences after the *Procedures for GNSS and Data Link Disruption Ad-hoc* Group provide guidance will be helpful.

6.24 The need to form an ad hoc group under SRWG was deliberated in detail. Based on the outcomes of the discussion, the Meeting agreed to **form an ad hoc group**. It was suggested that all States/Administrations affected by GNSS RFI should join the group.

6.25 **China, Hong Kong China, India, Indonesia, Japan, Singapore, Thailand, and the United States** volunteered to join the group. However, no State volunteered to lead the Ad-hoc Group. It was suggested to start the discussion, and the group lead can be identified in future discussions. **ACTION ITEM 10-6**

6.26 ICAO Secretariat informed that any States/Administrations willing to join the group can share their intention with the ICAO Secretariat at any stage. It was also agreed that the ICAO Secretariat will send an email to all frequency focal points in the APAC Region to share their willingness to join the group and nominate additional members for discussion. **ACTION ITEM 10-7**

Agenda Item 6.3: Other issues

[1] RASMAG: Regional Airspace Safety Monitoring Advisory Group.
[2] SEI WG: Safety Enhancement Initiative Working Group, working under direction of the RASG-APAC/APRAST. Asia Pacific Regional Aviation Safey Team (APRAST) is a sub-group of the Regional Aviation Safety Group – Asia Pacific (RASG-APAC)

6.27 There were no papers under this sub-item.

Agenda Item 7: Review of Regional Frequency Management Manual

Proposed Revisions to Asia/Pacific Regional Frequency – China (WP/14)

7.1 This paper presented revisions to the Asia/Pacific Regional Frequency Management Manual Edition 1.2, which is modified as follows:

1) In addition to the editorial amendments, change the light grey highlights that were adopted in SRWG/8 to black normal text.

2) Delete paragraph 1.1.6.1, that *Regions and States may supplement the material in Doc 9718 or use different frequency assignment planning criteria to meet regional requirements,* so as not to create conflict in understanding with paragraph 1.1.6.

3) Considering the discussion in the SRWG/8 meeting on the protection of the TIBA frequency, delete the latter half of paragraph 3.2.3, that *States/Administrations could re-allot this frequency to other services according to their own needs. However, any assignment for 128.950 MHz to other services should not impact on the airspace which have allotted or plan to allot 128.950 MHz to TIBA,* and delete the Note in Appendix C of the Manual, that the States/Administrations which have allotted or plan to allot 128.950 MHz to TIBA.

7.2 The Meeting also reviewed the revisions to the HF Air-ground Communication Frequency bands section (WP/05) and agreed to incorporate it into the Manual together with the above proposed revisions. China volunteered to undertake the necessary editorial work to merge the HF content into the consolidated manual. **ACTION ITEM 10-8**

7.3 With the aforementioned, the Meeting endorsed the following Draft Conclusion for CNS SG/30 adoption:

<table>
<tr><td colspan="3">Draft Conclusion SRWG/10/1 - Asia/Pacific Regional Frequency Management Manual Edition 1.2</td></tr>
<tr><td colspan="2">What: Asia/Pacific Regional Frequency Management Manual Edition 1.2 provided in Appendix D to this report and the outcome of the HF ad-hoc group be adopted</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: Per discussion from SRWG/10 for the Region to utilize the Manual</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 6-Feb-26</td><td colspan="2">Status: Draft to be adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☒Other: SRWG</td></tr>
</table>

Agenda Item 8: States and Regional updates

Agenda Item 8.1 Frequency Evaluation (Results of comparing FF entries with e-ANP)
Agenda Item 8.2 Need for 8.33 kHz Separation
Agenda Item 8.3 Frequency Spectrum Strategy for APAC
Agenda Item 8.4 Other relevant topics

8.1 There is no paper under the agenda.

Agenda Item 9: Review ToR and action items

Review ToR and action items of SRWG – Secretariat (WP/15)

9.1 The SRWG/9 Meeting observed that the current ToR of SRWG requires further amendments to include other tasks being taken care of by SRWG, such as working on interference issues, WRC coordination, etc.

9.2 The CNS SG/29 Meeting in 2025 agreed to defer to the SRWG to study the need for a group under CNS SG to assess and analyze the incidents shared by APAC Member States/Administrations and GNSS and Data Link Disruption Ad-Hoc Group to develop mitigation strategies, considering the global development in this domain.

9.3 Based on the above, the ICAO Secretariat, in coordination with the SRWG Chair, prepared a draft revision of the SRWG ToR, taking into account the outcomes of the SRWG/9 and CNS SG/29 meetings, as well as the expanded scope of work currently undertaken by the SRWG. In line with the guidance from SRWG/9, the draft ToR was coordinated with ICAO Headquarters, including FSMP, to ensure appropriate reflection of the regional group's role in interference-related matters and WRC coordination. The revised Terms of Reference are presented for consideration by the Meeting.

9.4 The Meeting reviewed the revised ToR of the SRWG and agreed to remove technology-specific examples and the section on deliverables, noting that SRWG is a standing working group and that its progress and outcomes are adequately monitored through action items and regular reporting mechanisms. The Meeting confirmed that the existing Objectives, Meeting, Membership, and Reporting arrangements remain appropriate.

9.5 The Meeting endorsed the following Draft Decision on the Revised Terms of Reference of the APAC Spectrum Review Working Group (SRWG), for CNS SG/30 adoption.

<table>
<tr><td colspan="3">Draft Decision SRWG/10/2 – Revised Terms of Reference of the APAC Spectrum Review Working Group (SRWG)</td></tr>
<tr><td colspan="2">What: The revised Terms of Reference provided in Appendix E be adopted.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: Need to refine the scope of work undertaken by the SRWG and include the new tasks being taken care of by the group.</td><td colspan="2">Follow-up: ☒Required from States</td></tr>
<tr><td>When: 6-Feb-26</td><td colspan="2">Status: Draft to be adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☒Other: SRWG</td></tr>
</table>

9.6 In addition, the action items were reviewed and updated. The updated Action Items List is provided in **Appendix F** to this report.

Agenda Item 10: Review of Action Items and Point of Contact (PoC) of States on frequency affairs

Review PoC of States – Secretariat (WP/16)

10.1 The paper presented the current status of PoCs of States on frequency-related affairs

for review and update. The Meeting noted that the current practice of aeronautical frequency coordination performed by the ICAO Regional Office is implemented as communication between the ICAO regional officer and the Point of Contact (POC) in different States/Administrations. The up-to-date PoC list is a basic requirement for efficient and timely coordination. The Meeting reviewed and updated the PoC list, which is provided in **Appendix G** to this report.

Agenda Item 11: Next Meeting and Any Other Business

Date for Next Meeting

11.1 The Meeting considered that the next SRWG meeting would be held for three days, tentatively planned for 24-26 February 2027. It was also noted that the meeting could be combined with a Webinar on the ICAO Position for WRC-27, currently planned for early 2027. Subject to ICAO HQ confirmation, this Webinar could be organized as a morning session within the SRWG/11 agenda to allow States to benefit from both activities in a coordinated manner. Any States/Administrations interested in hosting the Meeting may contact the ICAO APAC Office at least four months in advance. The exact dates and venue will be communicated to Member States in due course.

Closing of the Meeting

11.2 Mr. Arthur Kin Hei Lau, Chairperson of the SRWG, expressed his appreciation to all participants, Member States/Administrations, and experts for their active engagement, constructive discussions, and valuable contributions throughout the meeting. He thanked the ICAO APAC Regional Office and the Secretariat for their support in organizing and facilitating the meeting. The Chair noted the collaborative spirit demonstrated by the Group and expressed confidence that the SRWG would continue to effectively support spectrum management activities in the Asia and Pacific Region.

11.3 The ICAO Secretariat also conveyed his sincere appreciation to the Chair and all participants for their strong technical engagement and continued cooperation.

Chapter 3

AIR-GROUND COMMUNICATION FREQUENCY MANAGEMENT

3.1 HF Air-ground Communication Frequency bands

3.1.1 HF bands (between 2850 kHz and 22 000 kHz) coordination is recommended to be carried out between States. Coordination and registration of HF frequencies is undertaken by the ITU, through the Radio Regulatory Authorities in each country. ICAO does not coordinate assignments for HF frequencies. ICAO is considering developing, in parallel, a relevant ICAO list of HF frequency assignments. Pre-coordination of HF frequencies could be arranged through the ICAO ASIA/PAC Office in Bangkok. However, the national radio regulator is required to develop a proposal for the registering required frequency assignments with the ITU. Such proposals should be based on the provisions of Appendix 27 to the ITU Radio Regulations, together with the information contained in the ITU International Frequency List (IFL) taking into consideration the protection requirements for HF as contained in Appendix 27.

3.1.2 Appendix 27 to the Radio Regulations (RR) contains the frequency allotment plan for the AM(R)S in the HF bands. This appendix contains the plan for HF frequency allotments to major world air route areas and to regional and domestic air route areas as well as VOLMET areas. It also includes worldwide frequency allotments, which are for the use of aircraft operating agencies for AOC, to be assigned in accordance with RR Appendix **27**/217.

3.1.3 The technical characteristics for HF aviation equipment in Appendix 27 of the Radio Regulations, since they form part of the Radio Regulations, enjoy the same status as compulsory treaty obligations.

3.1.4 The Assignment Criteria for HF Air-ground Communication

3.1.4.1 In order to facilitate the assignment of HF bands, the first step is to define the types of areas concerned, without specifying the individual stations to which the frequencies will be assigned, whether they are used for MWARA, RDARA, VOLMET, or as part of a worldwide allotment area.

3.1.4.2 In addition to the above, it is also important to note that a given channel should not be used within the same allotment area. This measure is necessary to prevent potential interference and is consistent with the provisions of RR Appendix **27**/14. Further criteria related to channel characteristics can be found in Section II of ITU RR Appendix 27.

3.1.4.3 The comprehensive overview of area-based frequency allocation arrangements, incorporating data from ICAO-related references and ITU RR Appendix 27, is presented in Appendix X of this manual.

3.1.5 Criteria of New or Modified HF assignments

3.1.5.1 In order to have a new or modified frequency assignments, States/Administrations can coordinates with National Spectrum Authority to check the availability status in ITU MIFR, while in parallel, the request shall be submitted to the ICAO Regional Office in any format (e.g., letter, email). This action is actually in line with ITU RR Appendix **27**/19 that ICAO should be consulted in all appropriate cases relating to the operational use of HF, so ICAO could maintain the relevant ICAO Frequency List No. 4 in order to have effective and efficient in utilize the HF frequency band.

> ***27**/19 3 The International Civil Aviation Organization (ICAO) coordinates radiocommunications of the aeronautical mobile (R) service with international aeronautical operations and this Organization should be consulted in all appropriate cases in the operational use of the frequencies in the Plan.*

3.1.5.2 In cases where the Allotment Plan contained in ITU Radio Regulations Appendix 27 does not meet the operational requirements of States or Administrations, those States or Administrations may assign frequencies from areas other than those allotted to them in the Plan. Such assignments shall be subject to prior agreement between the Administrations concerned, and the coordination process shall be conducted under the auspices of ICAO. This provision refers to ITU RR Appendix **27**/20, **27**/21, and **27**/22.

> ***27**/20 It is recognized that not all the sharing possibilities have been exhausted in the allotment Plan contained in this Appendix. Therefore, in order to satisfy particular operational requirements which are not otherwise met by this allotment Plan, Administrations may assign frequencies from the aeronautical mobile (R) bands in areas other than those to which they are allotted in this Plan. However, the use of the frequencies so assigned must not reduce the protection to the same frequencies in the areas where they are allotted by the Plan below that determined by the application of the procedure defined in Part I, Section II B of this Appendix.*
>
> ***27**/21 5 When necessary to satisfy the needs of international air operations Administrations may adapt the allotment procedure for the assignment of aeronautical mobile (R) frequencies, which assignments shall then be the subject of prior agreement between Administrations affected.*
>
> ***27**/22 6 The coordination described in No. **27**/19 shall be effected where appropriate and desirable for the efficient utilization of the frequencies in question, and especially when the procedures of No. **27**/21 are unsatisfactory.*

3.1.5.3 The coordination procedure for establishing a new HF allocation may follow the process illustrated in Figure 2-1, which remains relevant considering that HF frequencies are not coordinated through the Frequency Finder system.

PART III RADIO NAVIGATION AID FREQUENCY ASSIGNMENT PLANNING CRITERIA

1 NDB and locator

1.1 General

1.1.1 A number of sub-bands in the range of 255 – 526.5 kHz (excluding 495 - 505 kHz) are allocated to aeronautical radio navigation with various status. Only the sub-band 325 - 405 kHz is allocated exclusively to the aeronautical radio navigation service, the other sub-bands being shared with other services.

1.1.1.1. As for the other users of the band, the sub-band 255 - 283.5 kHz is mainly used by broadcasting stations, while the sub-bands 283.5 - 315 kHz and 315 - 325 kHz are used by maritime beacons. The small segment 405 - 415 kHz is designated for radio direction-finding in the maritime radio navigation service, while the sub-bands in the range 415 - 526.5 kHz (excluding the segment 495 – 505 kHz) are used by the maritime mobile service, limited to radiotelegraphy.

1.1.1.2. It is noted additionally that Rradio frequency carrier systems are widely used for remote control or transmission of speech or data over segments of high-voltage overhead power lines. In some cases frequencies in the LF/MF bands are used and this has been proved to be able to affect ADF indications in aircraft at several nautical miles from the power lines.

1.1.2 Organization of Planning

1.1.2.1. In order to secure the international and the operational status of their assignments, States are required to apply the rules and procedures of the ITU Radio Regulations. This is particularly necessary for the shared sub-bands, since the ICAO EUR Table NAV is not supposed to include non-aeronautical assignments.

1.1.2.2. For assignments in the aeronautical radio navigation service, States are required to apply the ICAO EUR FMG rules and procedures.

Note 1: *Although in the shared sub-bands the FMG process is evidently partial and cannot result, if applied alone, in the required status, this process is necessary for the co-ordination of the identifications of the radio navigation aids.*

Note 2: *In the shared sub-bands, States are advised to avoid including assignments for non-aeronautical services (e.g. maritime services) in the FMG co-ordination process, as such assignments are not taken into account in compatibility assessments.*

1.1.3 References to documents:

- Annex 10, Volume I, Attachment C, paragraph 6.2.1.6 *(field strength);*
- Annex 10, Volume V, paragraph 3.2 (*general about protection, sharing and frequency congestion*);
- Annex 10, Attachment A to Volume V (*protection, receiver characteristics, filter attenuation*);
- European Region Air Navigation Plan (Doc 7754), Volume II, Part III.

1.1.4 The range can be from 10 NM (nautical miles) up to 100 NM (in some rare cases more) and the operational range is listed in the national AIP and the frequency assignment table. The maximum altitude is not specified. Co-channel separation between two transmitters shall be such that an unwanted signal is more than 15 dB below the wanted signal within the specified service area (DOC). This protection criterion is also included in the ITU Radio Regulations. The bandwidth characteristics of the airborne receiver need to be taken into account which require in principle that existing transmitters within ± 7 kHz from the frequency of the wanted station be considered.

1.1.5 In the band 325 - 405 kHz, aviation is the only user and new assignments should therefore preferably be made in this segment. Use of a segment where aeronautical radio navigation is secondary should only be considered in areas where the primary service is not used, like inland areas where the distance to any maritime station is sufficient.

1.1.6 The co-ordination of LF/MF radio navigation aids to be applied for aeronautical purposes above 526.5 kHz shall be carried out between national radio regulators, applying the relevant ITU procedures. The co-ordination of the identification of such a radio navigation aid shall be carried out between FMG members according to the rules in Part IV.

1.1.7 For normal coverage ranges (15 - 50 NM) co-ordination should, as an absolute minimum, be made with States within a radius of 300 - 400 NM. Co-ordination should also be made with the national authority responsible for protection of the maritime services if a shared band segment is to be used.

1.1.8 Information on the planning of identifications can be found in section 7.

1.2 Frequency Assignment Planning Principles

1.2.1 Wherever possible, frequencies at kHz points (i.e. integral multiples of 1 kHz) in the bands used for NDBs should be chosen to meet particular requirements. Frequency assignments at 0.5 kHz points may also be utilized, provided the full required protection can be ensured.

1.2.2 In the planning of frequency assignments, ADF receiver characteristics as specified in paragraph 3 of Attachment A to Annex 10, Volume V, should be assumed.

1.2.3 For the purpose of assessing the signal attenuation with distance, the LF/MF ground wave propagation curves agreed by the ITU-R should be used, taking into account the frequency of operation and the effect of mixed land/sea path where appropriate.

1.3 Frequency Assignment Planning Criteria

1.3.1 The protection of a NDB against interference from another NDB can be calculated using the propagation curves in Recommendation ITU-R P.368-9. These curves (known also as CCIR curves) represent the propagation characteristics of a transmitter (beacon) with an effective monopole radiated power (e.m.r.p.) of 1 kW. These curves can be adjusted to describe the propagation characteristics (field strength as a function of the distance from the beacon) of a beacon with a given coverage area. Such adjustment needs to ensure that the field strength at the edge of the coverage area is the minimum required. For aeronautical beacons this field strength is 70 μV/m or 36.9 dB (μV/m). (Ref.: Annex 10, Volume I, section 3.4 and ITU Radio Regulations Appendix 12).

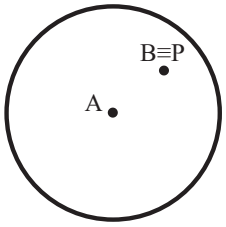
1.3.2 For frequency planning purposes, the CCIR curves for sea water and wet ground propagation are used, with the following characteristics:

Sea water:	σ = 5 S/m	Wet ground:	$\sigma = 10^{-2}$ S/m
	ε = 70		ε = 30

1.3.3 The protection ratio has to be calculated at the point P where the interference is maximum. There are two cases to consider:

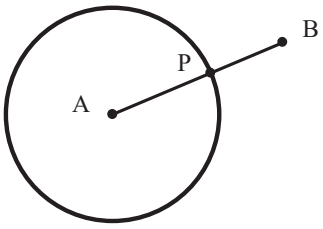
i) when the undesired beacon (B) is inside the coverage area of the desired beacon (A): at the location of that (undesired) beacon (see Figure 1)

Figure 1



ii) when the undesired beacon (B) is outside the coverage area of the desired beacon (A): at that point on the edge of the coverage area of the desired beacon closest to the undesired beacon (see Figure 2)

Figure 2



1.3.4 Calculation of the minimum protection ratio (D/U) shall ensure identification of the worst-case interference.

1.3.5 To ensure the compatibility of two beacons, it is necessary to consider successively the two cases where each of the beacons is treated as desired and the other one as undesired. In each case, the protection ratio needs to be calculated at the point of maximum interference. The lowest value of these two protection ratios is the value at risk and to be used in frequency planning.

1.3.6 Once the worst case protection ratio is known, the minimum frequency separation can be determined taking into account the ADF selectivity characteristics.

1.4 Description of the Calculations

1.4.1 As a first step, the ITU-R curves (see section 1.6) are adjusted to obtain field-strength values corresponding to the effective monopole radiated power of the beacon, necessary to obtain the minimum field strength required at the edge of coverage (36.9 dB μV/m).

Let *a* and *b* denote respectively the operational ranges of the beacons A and B.

The following symbols are additionally used:

f(R)	field strength at distance R, for e.m.r.p.= 1kW (from ITU-R curves).
$f^A(R)$	field strength for beacon A at distance R.
$f^B(R)$	field strength for beacon B at distance R.
f(*a*)	field strength f(R) at R = *a*
f(*b*)	field strength f(R) at R = *b*
$f^A(a)$; $f^B(b)$	field strengths $f^A(R)$ at R = *a* and f^B (R) at R = *b* [normally 36.9 dB μV/m].
f(1); $f^A(1)$; $f^B(1)$	field strengths f(R), $f^A(R)$ and $f^B(R)$ at R = 1 km. f(R) at R = 1 km is 109.5 dB μV/m. See also Recommendation ITU-R P.368-9.

The field strengths produced by beacons A and B at any distance R from the beacon satisfy:

$$f^A(R) = f(R) - [f(a) - 36.9] \quad (1)$$

$$f^B(R) = f(R) - [f(b) - 36.9] \quad (2)$$

Note: *In general the field strength (f(R), $f^A(R)$ or $f^B(R)$) depends not only on the path distance R (this dependence being the only explicit in the notation), but also on the frequency as well as on the geological constitution of the radio-path (proportion of sea-path over the total path distance R).*

1.4.2 Determination of the field strengths f(*a*) and f(*b*)

On considering each beacon separately, the first step is the identification of the radial along which the proportion *p* of sea-path over a total path distance equal to the range of the beacon is lowest.

On the basis of the lowest proportion *p*, the mixed-path calculation method (see section 1.5) is then applied for the determination of the quantity f(*a*) or f(*b*) and the consequent dimensioning of the output power of the beacon (see section 1.7).

1.4.3 Calculation of the protection ratio when the undesired beacon is inside the coverage area of the desired beacon (see paragraph 1.3.3 i) above). In this case the maximum level of the undesired signal that contributes to the interference of the desired signal is at the location of the transmitter of the undesired beacon.

If we assume A to be the desired beacon and B the undesired beacon, the maximum level of the undesired signal is:

$$E_U = f^B(1) = f(1) - [f(b) - 36.9]$$
$$= 109.5 - [f(b) - 36.9] \quad (3)$$

The signal level of the desired facility A at this point of maximum interference is:

$$E_D = f^A(R_s) = f(R_s) - [f(a) - 36.9] \qquad 0<R_s<a \quad (4)$$

R_s = separation distance between A and B.

The protection ratio D/U is: $E_D - E_U$ or $f^A(R_s) - f^B(1)$.

Substitution of (3) and (4) in this formula gives:

$$D/U = f(R_s) - f(a) + f(b) - 109.5 \quad (5)$$

Note: *For the application of formula (5), the quantity $f(R_s)$ at the position of the undesired beacon is determined by the application of the mixed-path calculation method (see section 1.5).*

1.4.4 Calculation of the protection ratio when the undesired beacon is outside the coverage area of the desired beacon (see paragraph 1.3.3 ii) above). In this case the maximum level of the undesired signal that contributes to the interference of the desired signal is at the location of point P in Figure 2.

At this point the signal level of the desired facility A is:

$$E_D = f^A(a^*) = f(a^*) - [f(a) - 36.9] \quad (6)$$

($f^A(a^*)$, $f(a^*)$ denote respectively the adjusted and the non-adjusted (corresponding to e.m.r.p.=1kW) field strengths at the particular point P).

The signal level of the undesired facility B at this point is:

$$E_U = f^B(R_s - a)$$
$$= f(R_s - a) - [f(b) - 36.9], \qquad a<R_s, \quad (7)$$

R_s = separation distance between beacon A and B.

The protection ratio D/U is: $E_D - E_U$ or $f^A(a^*) - f^B(R_s-a)$.

Substitution of (6) and (7) in this formula gives:

$$D/U = f(b) - f(R_s - a) + f(a^*) - f(a). \quad (8)$$

Note: *For the application of formula (8), the quantities* $f(a^*)$ *and* $f(R_s-a)$ *are determined by the application of the mixed-path calculation method (see section 1.5),* $f(a^*)$ *corresponding to the propagation path AP*, *while* $f(R_s-a)$ *corresponding to propagation path BP (see Figure 2).*

1.4.5 Formulas (5) and (8) can be used to calculate the interference from beacon B (undesired) to beacon A (desired). When the outcome of the calculations shows that the D/U is equal or greater than 15 dB, the desired beacon is protected and the beacons can operate on the same frequency. When the outcome is less than 15 dB, a frequency separation between the frequencies assigned to these beacons has to be maintained.

The required frequency-separation depends upon the calculated D/U ratio and can be taken from the following table:

D/U(dB)	frequency-separation (kHz) between desired and undesired signal
≥ 15	0
< 15 to ≥ 9	1
< 9 to ≥ (-5)	2
< (- 5) to ≥ (-20)	3
< (-20) to ≥ (-35)	4
< (-35) to ≥ (-50)	5
< (-50) to ≥ (-65)	6
< -65	7

Table 1 – Required Frequency Separation

The above relation between the D/U ratio and the required frequency-separation corresponds to the ADF-receiver selectivity curve in Annex 10, Volume V, Attachment A, paragraph 3.

Since the D/U ratio, for a combination of beacons with a range of a and b respectively, is a function of the distance between these beacons and the required frequency separation is a function of the D/U ratio, the minimum required frequency separation is a complex function of the separation distance.

1.5 Mixed Path Calculations

1.5.1. The method described below pertains to a propagation path which contains both land and sea segments.

1.5.2. Although ITU-R is, for this purpose, recommending the Millington method (reference Recommendation ITU-R P.368-9, Annex 2), a simplified method was developed and recommended to be used in calculations when mixed path conditions exist.

1.5.3. In this simplified method the calculation of the signal-level of a beacon is based upon the following formula:

$$f(R)_M = f(R)_L + \{ f(R)_S - f(R)_L \} p \qquad (9)$$

where :

$f(R)_M$ = effective field strength of a beacon with EMRP=1kW at a point P, at distance R from the beacon

$f(R)_L$ =field strength at P if the total path were over land.

$f(R)_S$ =field strength at P if the total path were over sea.

R = total path length.

p = S/R where S is the total sea-path length.

1.6 ITU-R Propagation Curves

1.6.1 The ITU-R propagation curves (known also as CCIR curves) can be found in Recommendation ITU-R P.368-9. They were generated through the application of the computer program GRWAVE, which is made available by ITU-R.

1.6.2 The program GRWAVE was used as well for calculating the field strength values of Table 2 below for EMRP=1 kW. Field strength values at intermediate frequencies can be estimated by linear interpolation.

SEPARATION DISTANCE	BEACON RANGE	SEA 300 kHz	SEA 400 kHz	SEA 500 kHz	LAND 300 kHz	LAND 400 kHz	LAND 500 kHz
KM	NM	DB(UV/M)	DB(UV/M)	DB(UV/M)	DB(UV/M)	DB(UV/M)	DB(UV/M)
2		103.5	103.4	103.4	103.2	103	102.8
4		97.4	97.4	97.4	97.1	96.9	96.6
6		93.9	93.9	93.9	93.5	93.3	93
8		91.4	91.4	91.4	91	90.7	90.3
10		89.5	89.5	89.4	89	88.6	88.2
18.5	10	84.1	84.1	84.1	83.4	82.9	82.3
20		83.4	83.4	83.4	82.7	82.2	81.5
27.8	15	80.5	80.5	80.5	79.6	79	78.2
37	20	78	77.9	77.9	76.9	76.1	75.1
40		77.3	77.3	77.2	76.1	75.3	74.2
46.3	25	76	76	76	74.7	73.7	72.6

55.6	30	74.4	74.4	74.3	72.9	71.8	70.4
60		73.7	73.7	73.6	72.1	70.9	69.5
80		71.1	71	70.9	69.1	67.6	65.8
92.6	50	69.7	69.6	69.5	67.5	65.8	63.8
100		69	68.9	68.8	66.6	64.8	62.7
138.9	75	65.7	65.6	65.5	62.7	60.3	57.5
185.2	100	62.7	62.5	62.3	58.9	55.9	52.4
200		61.8	61.6	61.4	57.8	54.6	50.9
231.5	125	60.1	59.8	59.6	55.6	52	47.9
277.8	150	57.9	57.5	57.2	52.7	48.5	43.8
370.4	200	53.9	53.3	52.8	47.4	42.1	36.4
400		52.7	52.1	51.5	45.8	40.2	34.1
463	250	50.3	49.5	48.8	42.6	36.3	29.6
555.6	300	46.9	45.9	45	38.1	30.8	23.2
600		45.3	44.2	43.2	36	28.2	20.3
800		38.4	36.8	35.4	26.9	17.1	7.3
1000		31.8	29.7	28	18.2	6.2	-5.3
1200		25.4	22.8	20.7	9.6	-4.4	-17.8
1400		19.1	16	13.5	1.2	-14.9	-30.1
1600		12.9	9.3	6.4	-7.2	-25.3	-42.4
1800		6.7	2.7	-0.7	-15.5	-35.6	-54.5
2000		0.6	-3.9	-7.6	-23.7	-45.9	-66.6

Table 2 – 1 kW EMRP Field Strength at a Given Separation Distance

1.7 Effective Monopole Radiated Power (EMRP)

1.7.1 Pursuant to the ITU Radio Regulations (Article 28.23), the power radiated by each radio beacon shall be adjusted to the value necessary to produce the stipulated field strength (36.9 dB (μV/m)) at the limit of its operational range.

1.7.2 The EMRP is calculated not for frequency co-ordination purposes but for the determination of the transmitter output power P of the beacon which is required for the desired operational coverage. The quantities EMRP and P in dBW are related as follows:

$$P = EMRP + \text{cable and tuning losses} - Gv,$$

where Gv is the gain of the antenna with regard to a short vertical monopole. In most practical cases Gv=0dB. Cable and tuning losses, on the other hand, are usually not less than 10 dB (see also Attachment C to Annex 10, Volume I, paragraph 5 of section 6.3.2).

1.7.3 The EMRP in dBW can be calculated, using the ITU-R propagation curve for a 1 kW transmitter, as follows:

$$EMRP = 30 - [f(a) - 36.9]$$
$$= 66.9 - f(a),$$

where

30 = term for the conversion of the ITU-R propagation curves from a 1 kW transmitter to a 1Watt transmitter in order to obtain an EMRP value in dB relative to 1 Watt.

36.9 = minimum field strength in dB(μV/m) required at the edge of the coverage.

f(*a*) = field strength in dB(μV/m) at the edge of the beacon's desired coverage calculated for an EMRP of 1kW as described in paragraph 1.4.2.

1.8 Treatment of Assignments over Polygonal Areas

1.8.1. In exceptional cases, frequency assignments can be co-ordinated over polygonal areas. In such a case :

1.8.1.1. Frequency protection is accorded over the co-ordinated polygonal area.

1.8.1.2. The envisaged distance (range) between receiver and transmitting beacon is specified at co-ordination in addition to the polygonal area. This range shall not exceed the length of the maximum diagonal of the polygonal area.

1.8.1.3. The transmitting beacon can be anywhere inside the polygonal area.

1.8.2. The following instructions are provided for the calculation of the required D/U ratio involving assignments over polygonal areas (referred to henceforth as area assignments) :

1.8.3. The field strength f(a) at the range of an area assignment is calculated by considering all possible paths of length a within the polygonal area and by identifying the lowest sea-path proportion among those paths.

1.8.4. Area assignment versus circular assignment.

1.8.4.1. Protection of the area assignment

1.8.4.1.1. If the centre of the circular assignment is inside the polygon of the area assignment, formula (5) is applicable with R_s being equal to the minimum of (i) the range a of the area assignment and (ii) the maximum distance between the centre of the circular assignment and the polygon. f(R_s) can be calculated by considering the radial with the lowest sea-path proportion among those radials of length R_s from the centre of the circular assignment which end up within the polygon.

Note: *When $R_s=a$, $f(R_s)\geq f(a)$. In general $R_s=a$ does not imply $f(R_s)=f(a)$ because the minimisation of the sea-path proportion is effected over different sets of possible paths of length a.*

1.8.4.1.2. If the centre of the circular assignment is outside the polygon of the area assignment, formula (8) is applicable with R_s-a being equal to the distance between the centre of the circular assignment and its closest point on the polygon. f(a*) can be calculated by considering the radial with the lowest sea-path proportion among those radials which originate from the point on the polygon closest to the centre of the circular assignment, have length equal to the range a of the area assignment and end up within the polygon. If the distance of this point from any other point on the polygon is less than the range a, the length of the radial for the calculation of f(a*) is reduced to the maximum value of this distance.

1.8.4.2. Protection of the circular assignment

1.8.4.2.1 If the polygon of the area assignment overlaps with the coverage area of the circular assignment, formula (5) is applicable with R_s being equal to the minimum of (i) the range a of the circular assignment and (ii) the maximum distance between the centre of the circular assignment and the polygon. f(R_s) can be calculated by considering the radial with the lowest sea-path proportion among those radials of length R_s from the centre of the circular assignment which end up within the polygon.

1.84.2.2 If the polygon of the area assignment does not overlap with the coverage area of the circular assignment, formula (8) is applicable with R_s being equal to distance between the

centre of the circular assignment and its closest point on the polygon. In this case the situation is very similar to the compatibility between two circular assignments.

1.8.5. Area assignment versus area assignment

1.8.5.1 Protection of each area assignment

1.8.5.1.1 If the two polygonal areas overlap, formula (5) is applicable with R_s being equal to the minimum of (i) the range *a* of the area assignment to be protected and (ii) the maximum distance between any point in the intersection of the two polygonal areas and any other point on the polygon to be protected. $f(R_s)$ can be calculated by considering the path with the lowest sea-path proportion among all possible paths of length R_s which originate from points in the intersection of the two polygonal areas and end up within the polygon to be protected.

1.8.5.1.2 If the two polygonal areas do not overlap, formula (8) is applicable with R_s-*a* being equal to distance between the two polygons. f(*a**) can be calculated by considering the radial with the lowest sea-path proportion among those radials which originate from the point on the polygon to be protected closest to the opposite polygon, have length equal to the range *a* of the area assignment to be protected and end up within the polygon to be protected. If the distance of this point from any other point on the polygon to be protected is less than the range *a*, the length of the radial for the calculation of f(*a**) is reduced to the maximum value of this distance.

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.

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;

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.

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.

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

2.1 ICAO should consider the necessity of standardized radiotelephony phraseologies for specific scenarios. Establishing clear, standardized communications in these situations could greatly benefit both pilots and air traffic controllers, ensuring accurate and efficient responses.

2.2 Airlines and aircraft manufacturers should:

2.2.1 integrate GNSS RFI factors into fuel and alternate planning to ensure contingency measures are in place for potential navigation disruptions, including refining dispatch decisions based on aircraft equipment and ensuring the aircraft's capabilities match the expected interference conditions;

2.2.2 ensure pilots maintain proficiency in conventional navigation methods, supporting operational resilience in GNSS-degraded environments. This includes:

2.2.2.1 providing training to ensure pilots can operate effectively using conventional procedures, enabling them to fly without reliance on GNSS when necessary.

2.2.2.2 encouraging position cross-checking using VOR radials for situational awareness; and

2.2.2.3 ensure a full Inertial Reference System (IRS) alignment before departure if the aircraft experienced GNSS RFI during the previous flight, as indicated in the aircraft journey log.

2.2.3 clarify and streamline GNSS RFI reporting, potentially through Electronic Flight Bags (EFB) integration, to facilitate timely incident reporting; and

2.3 The symposium acknowledged IATA's initiative in providing the Turbulence Aware platform to support airline information sharing and encouraged the development of similar initiatives for GNSS RFI information exchange.

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

3.1 States should:

3.1.1 prioritize suitable staffing levels, sector workload planning, and continuous monitoring of compliance with clearances to ensure effective air traffic management;

3.1.2 ensure ATC readiness to provide radar vectors when requested navigational assistance in a surveillance environment, clock checks, and clearly define circumstances under which ATC may refuse vectoring;

3.1.3 ensure comprehensive ATCO training and awareness programs focusing on response to abnormal situations and clearance deviations, equipping controllers with the necessary skills to handle unexpected events effectively; and

3.1.4 identify critical areas for Terrain Awareness and Warning System (TAWS) climb and deconfliction advisories, ensuring controllers provide timely and accurate guidance to pilots.

Objective 4: Ensure suitable CNS capabilities are available as required

4.1 States should:

4.1.1 ensure timely and effective communication regarding GNSS RFI incidents. A warning could be issued via NOTAM, Aeronautical Information Publication (AIP), and/or Automatic Terminal Information Service (ATIS) as appropriate;

4.1.2 ensure ATSEP personnel receive training/awareness program on GNSS RFI detection, mitigation, and reporting. Simulation exercises and collaborative awareness programs could be implemented to enhance response capabilities and operational resilience;

4.1.3 establish a Resilient Operational Network (RON) by ensuring availability of sufficient navigation infrastructure to support continuous Performance Based Navigation (PBN) operations and by facilitating positional awareness through maintenance of a VOR/DME Network for reliable cross-checking; and

4.1.5 implement GNSS jamming and spoofing monitoring using ADS-B Out (ground-based or space-based) or Wide Area Multilateration (WAM).

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

5.1 Aircraft and avionics manufacturers should:

5.1.1 avoid cross-contamination of aircraft/avionics sensors due to GNSS RFI;

5.1.2 augment GNSS time with precision time sources to improve resilience and mitigate disruptions;

5.1.3 enhance GNSS robustness with rapidly deployable Multi-Mode Receivers (MMR) and strategic system upgrades; and

5.1.4 enable advanced RNP operations using DME through improvements to multi-DME navigation and clarifying the DME interrogator scanning and selection criteria.

5.2 States should:

5.2.1 implement spoofing monitors in surveillance trackers while conducting a comprehensive ADS-B to SSR/WAM comparison; and

5.2.2 optimise DME transponder network planning and coverage.

Objective 6: Achieve Robust Positioning, Navigation, and Timing (PNT) through long-term C-PNT development

6.1 States should:

6.1.1 conduct a comprehensive cyber risk assessment for all CNS/ATM systems, particularly space-based systems, and implement adequate mitigation measures; and

6.1.2 enhance GNSS resilience and improve cybersecurity defenses through standardization and implementation of advanced technical improvements such as authentication mechanisms, improved Controlled Reception Pattern Antennas (CRPA) for robust interference mitigation and enhanced signal reception, GNSS RFI detection systems and downlink enhancements to identify and counter GNSS RFI in real time and ensure secure and reliable data transmission across GNSS networks.

6.2 ICAO should:

6.2.1 enhance L-Band spectrum utilization through standardization of enhanced DME (eDME) and assess other candidate PNT solutions;

6.2.2 establish a balanced CNS evolution roadmap, whereas ground, air, and space capabilities should work collaboratively within a unified framework that prioritizes spectrum efficiency as the fundamental driver; and

6.2.3 emphasize the core objective of the Integrated Communication, Navigation, Surveillance and Spectrum (CNSS), transforming common mode weaknesses into strengths through smart integration while maintaining independence across ground, air, and space systems.

Asia/Pacific Regional Frequency Management Manual

Edition 1.2

International Civil Aviation Organization

AMENDMENTS

Amendments are announced in the supplements to the *Publications Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS, CORRIGENDA AND ADDENDA

AMENDMENTS		
No.	Date	Entered by
1.1	**March 7, 2024**	**ICAO APAC Regional office**
1.2	**February 6, 2026**	**ICAO APAC Regional office**

CORRIGENDA / ADDENDA		
No.	Date	Entered by

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ABBREVIATIONS

AAC	Aeronautical Administrative Communications
ACC	Area Control Centre
ADF	Automatic Direction Finder
AFIS	Aerodrome Flight Information Service
AM(R)S	Aeronautical Mobile (Route) Service
ANP	Air Navigation Plan (for APAC)
ANSP	Air Navigation Service Provider
AOC	Aeronautical Operational Control
APAC	Asia and Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APP	Approach Control Service
ARNS	Aeronautical Radionavigation Service
AS	Aerodrome Surface Communications
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Service
CAA	Civil Aviation Authority/Administration
CNS	Communications, Navigation and Surveillance
COM	Communications
CPM	Conference Preparatory Meetings (ITU)
CSC	Common Signaling Channel
D/U	Wanted/ Unwanted Signal Ratio
DME	Distance Measuring Equipment
DOC	Designated Operational Coverage
DOH	Designated Operational Height
DOR	Designated Operational Range
DVOR	Doppler VHF Omni-Directional Range
EIRP or e.i.r.p	Equivalent Isotopically Radiated Power or Effective Isotropic Radiated Power
FIS	Flight Information Service
FSMP	Frequency Spectrum Management Panel (successor of ACP WG/F (frequency))
GBAS	Ground-Based Augmentation System
GPIP	Glide Path Intersection Point
HF	High Frequency
ICAO	International Civil Aviation Organization
ICT	Information and Communication Technology
ILS	Instrument Landing System
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
LTP	Landing Threshold Point
MIFR	Master International Frequency Register (ITU)
MOPS	Minimum Operational Performance Standards
NDB	Non-directional Radio Beacon
NSP	Navigation Systems Panel (ICAO)
PAR	Precision Approach Radar
PIRGs	Planning and Implementation Groups
RR	Radio Regulations (ITU)

SARPs	Standards and Recommended Practices
SRWG	the Spectrum Review Working Group of APANPIRG
SST	The Supersonic Transport
TIBA	Traffic Information Broadcasts by Aircraft
TRD	True Radiation Direction
TWR	Aerodrome Control Tower
VDB	VHF Data Broadcast (used with GBAS)
VDL	VHF Digital Link
VHF	Very High Frequency
VOLMET	Meteorological Information for Aircraft in Flight
VOR	VHF Omnidirectional Radio Range
WRC	World Radiocommunication Conference (ITU)

Chapter 1

INTRODUCTION

This manual has been developed under a recommendation from the fourth meeting of the Spectrum Review Working Group (SRWG/4) of APANPIRG which was held via video conferencing from 09 to 10 June 2020. It is for States/Administrations in the APAC region to implement the frequency assignments in a coordinated manner with ANSP, CAA and national frequency Authorities to satisfy future operational needs or the introduction of new technologies, with emphasis on communication and navigation systems.

1.1 OBJECTIVE and SCOPE

1.1.1 Aeronautical services are recognized internationally to be prime users of radio frequencies. The civil aviation community must accordingly develop and present, as necessary, its agreed policies and its quantified and qualified statements of requirement for radio frequency spectrum to ensure the continuing availability of adequate radio spectrum and, ultimately, the ongoing viability of air navigation services throughout the world.

1.1.2 For the APAC Region, the Secretariat is developing, with the support of ICAO contracting states, materials to support frequency assignment planning in the region.

1.1.3 In accordance with above, the prime objectives of this document are:

a) to provide background information on the international spectrum management institutional framework.

b) to provide a convenient record for important frequency planning principles and coordination procedure.

c) to provide frequency assignment planning criteria to secure that aeronautical radio communication and navigation systems are protected from harmful interference on a uniform basis.

1.1.4 This manual describes general references in aeronautical frequency management of APAC region, including the introduction and relationships between the main participants, overview of the framework and process of aeronautical spectrum management, etc.

1.1.5 This manual is suitable for national authorities, telecommunication authorities (or telecommunication administrations), ATCs, aerodromes, and airlines which will manage or use aeronautical frequencies.

1.1.6 This manual is not intended to and shall not replace the relevant requirements stipulated in Annex 10 and Doc 9718. In the event of any inconsistency or conflict between this document and Annex 10 and Doc 9718, Annex 10 and Doc 9718 shall take precedence.

Chapter 2

BACKGROUND

2.1 Institutional framework

2.1.1 ITU

2.1.1.1 The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies (ICTs). To facilitate international connectivity in communications networks, ITU allocate global radio spectrum and satellite orbits to specific users, develop the technical standards that ensure networks and technologies seamlessly interconnect.

Note: Other specialized agencies, such as ICAO, would not be barred from any kind of work touching upon aeronautical telecommunications including standardization activities.

2.1.1.2 The legal framework of ITU comprises the basic instruments of the Union, which have treaty status and are binding on ITU Member States. These instruments are the Constitution and Convention of the International Telecommunication Union and the Administrative Regulations, which complement the Constitution and the Convention. The Radio Regulations (RR) form an integral part of the Administrative Regulations.

2.1.1.3 The RR include allocations, provisions on licensing, interference resolution, safety and distress procedures and other aspects. Within the RR, the finite useable radio spectrum, from approximately 8.3 kHz to 275 GHz, is allocated to user services in response to their recognized demands, and among three ITU world Regions in accordance with the major regional spectrum requirements for these services in the relevant region. To enable new technologies and changes in spectrum usage, an ITU World Radiocommunication Conference (WRC) is held every 4 years where parts of the Radio Regulations are revised and updated.

2.1.1.4 Aviation services are recognized important users of radio spectrum to create safe and expeditious conditions to support air operations. The AM(R)S, the ARNS and their satellite service counterparts are important components in the mobile and radiodetermination families of users with (normally) exclusive allocations made on a worldwide basis to ensure global harmonization. The RR are used as the framework for the relevant ICAO Annexes and the Standards and Recommended Practices (SARPs) contained therein.

2.1.2 ICAO

2.1.2.1 Pursuant to the provisions in Art 37 of the Convention on International Civil Aviation, ICAO develops Standards and Recommended Practices (SARPs) for Communication, (radio) Navigation and Surveillance (CNS) systems. These standards include technical characteristics and protection requirements to secure interference free operation of these systems and are incorporated in Annex 10.

2.1.2.2 In order to provide for more detailed guidance material on the provisions in Annex 10 for CNS systems, ICAO has developed Doc 9718. Doc 9718 is (currently) published in two parts:

- Volume I which contains material relevant to the allocation and use of aeronautical frequency bands by the ITU.
- Volume II which contains material relevant to the frequency assignment planning for CNS systems.

2.1.2.3 ICAO is accorded observer status at relevant ITU WRCs and also participates at meetings of the ITU-R study groups, including the Conference Preparatory Meetings (CPMs) which prepare the technical and regulatory basis for WRCs. Within ICAO, the necessary activity to support these ITU-generated functions exists at two levels:

a) At the worldwide level, through the work of the Air Navigation Commission, with the assistance of the FSMP (and communication divisional meetings or air navigation conferences, as required), to prepare the coordinated ICAO policies, spectrum estimates and technical inputs for ITU conferences and ITU-R study groups. The ICAO spectrum strategy, policy statements and the ICAO Position for WRCs are approved by the Council; and

b) At the regional level, by the ICAO Regional Offices, through coordination of frequency assignment plans with states/administrations, using agreed ICAO planning criteria. This activity is supported by the Regional Planning and Implementation Groups (PIRGs).

2.1.2.4 At a Regional level, Air Navigation Plans have been developed. These ANPs contain, based on Regional Air Navigation Agreements, provisions that States have agreed to apply on the use of aeronautical radio communication, navigation and surveillance systems, including material relevant to frequency assignment planning.

2.1.3 National and regional authorities

2.1.3.1 Within ITU Member States, the telecommunication authorities / administrations normally control and operate the mechanism which develops the national proposals for amending the Radio Regulations for submission to the ITU WRCs. The outcome of these discussions in the WRCs normally results in material being incorporated in the ITU Radio Regulations or in ITU-R Recommendations and subsequently being applied through national regulation by national telecommunication authorities.

2.1.3.2 To develop and maintain the ICAO Spectrum Strategy and Policy on Radio Frequency Spectrum, a coordinated aeronautical position (the ICAO Position) and other materials must be established for every ITU WRC to support the update of the ITU Radio Regulations (RR). All ICAO Contracting States and relevant international organizations are encouraged to present proposals to develop the ICAO Position.

2.1.3.3 National and international (regional) preparatory committees function as the coordination medium to which the aeronautical requirements and proposals, either from ICAO coordinated or nationally derived, are presented by the national aviation authorities for consideration.

2.1.3.4 It is essential that aeronautical participation in these national and regional activities be ensured in order to support and defend aviation requirements.

2.1.4 Relationship between ITU RR and ICAO SARPS

2.1.4.1 The Radio Regulations have treaty status, and there is an inherent obligation on States to comply, unless an exception is stated and embodied in the Final Acts of the Conference which created the regulation. Aeronautical services are obliged to operate within the framework established by the Radio Regulations.

2.1.4.2 ICAO is recognized internationally as the competent international body to coordinate a worldwide policy for the operational use of specified systems used by aviation. Furthermore, the ICAO Annexes contain procedures for regular and emergency communications that are specifically developed for aviation purposes, taking account of the operational conditions. These procedures supplement the basic requirements of the Radio Regulations for procedures in aeronautical communications.

2.1.4.3 The Radio Regulations and ICAO SARPs together thus form a complementary set of regulatory provisions without any overlap. The Radio Regulations must evolve within the general telecommunications environment with its many and diverse users of the radio frequency spectrum, while the ICAO SARPs respond to the operational safety aspects of air navigation and are developed and agreed by aviation within the ICAO organizational framework.

2.2 Spectrum coordination and management

2.2.1 General

2.2.1.1 In using frequency bands for radio services, ITU Members and ICAO Contracting States shall bear in mind that radio frequencies are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of Radio Regulations, Annex 10 to the ICAO Convention and national and regional planning.

2.2.1.2 Any new assignment or any change of frequency or other basic characteristic of an existing assignment shall be made in such a way as to avoid causing harmful interference to services rendered by stations using frequencies assigned in accordance with this manual.

2.2.1.3 Frequency assignment planning should ensure the availability and protection from harmful interference of the frequencies provided for distress and safety purposes.

2.2.2 Frequency coordination and registration

2.2.2.1 The coordination and registration of frequency assignments is the prerogative of the ITU and must be performed in accordance with procedures laid down in the Radio Regulations. Frequencies are registered in the Master International Frequency Register (MIFR) maintained at ITU Headquarters in Geneva. However, Incorporation of aeronautical frequencies in the MIFR is not subject to a technical analysis of the assignment for protecting other assignments in the COM lists from harmful interference

2.2.2.2 In exclusive aeronautical bands, actual (day-to-day) coordination of frequency assignments is being undertaken by ICAO, through the ICAO Regional Offices. The Regional Office's frequency coordination role includes the coordination with the ICAO regional offices of regions that may be affected by the proposed frequency assignments, or, if bilateral coordination is required in the region(s), the State(s)/ Administration(s) that may be affected. Agreed frequency assignment are registered by ICAO in the ICAO global frequency database.

2.2.2.3 To support this coordination, the ICAO Regional Offices have developed the necessary procedures, including the relevant frequency assignment planning criteria. Coordination of frequency assignments is taking place in close (in most cases) co-operation with the national civil aviation authorities.

2.2.2.4 Although in some cases aeronautical frequency assignments, notably those in HF and LF/MF bands, are registered with the ITU by the countries operating these services, other frequency assignments, particularly those in bands above 100 MHz, tend to be recorded only in national registers or in the ICAO Regional Air Navigation Plans. Because of this, de facto, the ICAO frequency register within ICAO forms the basis for international coordination of frequency assignment and provide the most accurate statement of frequency assignment.

2.2.2.5 This does not dispense with the more general requirement for the coordination of a frequency assignment within the ITU and the registration of this frequency assignment in the MIFR, if international protection of that assignment is necessary.

2.2.2.6 Coordination and registration of frequency assignments in the HF bands (between 2850 kHz and 22000 kHz) is only taking place through the ITU. However, ICAO is considering developing, in parallel, a relevant ICAO list of HF frequency assignments.

2.2.2.7 Coordination and registration of frequency assignments for radar stations and on-board autonomous radio navigation systems is not being coordinated through ICAO. However, in the case of assigning SSR mode S II/SI codes ICAO Regional Office performs the coordination and listing of these codes.

2.2.2.8 List of frequency bands coordinated by ICAO is given in Table 2.1.

Table 2.1 List of frequency bands

Symbols	Frequency range	Facility
LF/MF	190 – 495 kHz and 505 – 526.5 kHz	NDB and locator
VHF	108 – 117.975 MHz 117.975 – 137 MHz	ILS localizer (below 112 MHz), VOR and GBAS Air-ground communications (e.g., VDL Mode 4)
UHF	328.6 – 335.4 MHz 960 – 1215 MHz	ILS glide path DME/TACAN SSR

2.2.3 Procedure of Coordination for aeronautical frequency in APAC Region

2.2.3.1 The ICAO Third Asia/Pacific Regional Air Navigation (ASIA/PAC/3 RAN) Meeting in 1993 agreed that the ICAO APAC Regional Office would continue to maintain its frequency selection and coordination role, including the maintenance and promulgation of Frequency List Nos.1, 2 and 3 in a timely and periodic manner.

2.2.3.2 with the successful implementation of Frequency Finder, there is no more Frequency List No. 3 published by the ICAO APAC Regional Office after the 29th Edition in January 2016, and is replaced by the up-to-date database in Frequency Finder.

Note: Frequency Finder is the ICAO aeronautical radio frequency management tool for VHF COM and NAV frequency assignments (and SSR II/SI code).

2.2.3.3 The updated Frequency Lists of Nos. 1 and 2 are published on the APAC website under – CNS More Documents through secure portal of ICAO APAC website webpage, or can be downloaded from the ICAO database with Frequency Finder.

Note : ICAO APAC Office synchronized all registered assignments on Frequency List No.2 into Frequency Finder in 2022 and has been using Frequency Finder on frequency assignments for NAV systems.

2.2.3.4 Currently, States/Administrations can submit to the Regional Office their requests for new or modified frequency assignments in any format (e.g., letter, email).

a) The administrative aspects of the frequency coordination can be improved by States/Administrations using Frequency Finder to generate electronic submissions for new or modified frequency assignments. This option permits States/Administrations to check a selected frequency to satisfy any operational need and to check the compatibility of this (proposed) frequency with other frequency assignments in the Frequency List No.2 or No.3. It greatly facilitates the final coordination that is performed by the ICAO Regional Office. The electronic submission(s) as generated with Frequency Finder, in the format of an Excel file, can be sent to the ICAO Regional Office through email.

b) The second option for States/Administrations to submit to the Regional Office requests for registering new or modified frequency assignments, also by electronic means, through a locally generated Excel or Word file that follows the template as in **Appendix A**.

c) The third option is for States/Administrations to submit to the Regional Office requests for new of modified frequency assignment by letter. The preferred format of the characteristics for these submissions is in **Appendix B**.

2.2.3.5 The basic aeronautical coordination procedure is depicted as Figure 2-1.

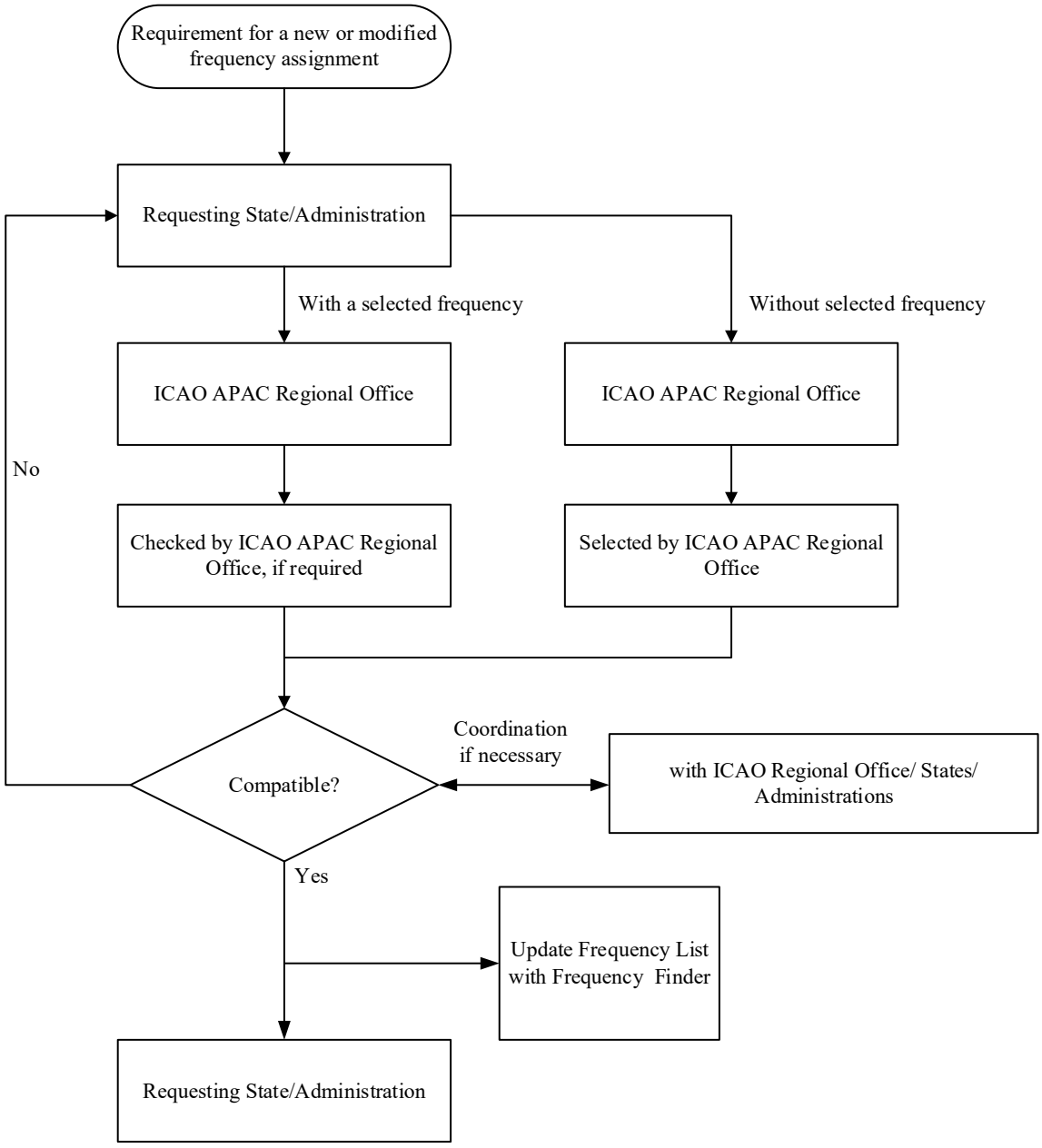


Figure 2-1 The basic aeronautical coordination procedure

Chapter 3

AIR-GROUND COMMUNICATION FREQUENCY MANAGEMENT

3.1 HF Air-ground Communication Frequency bands

3.1.1 HF bands (between 2850 kHz and 22 000 kHz) coordination is recommended to be carried out between States. Coordination and registration of HF frequencies is undertaken by the ITU, through the Radio Regulatory Authorities in each country. ICAO does not coordinate assignments for HF frequencies. ICAO is considering developing, in parallel, a relevant ICAO list of HF frequency assignments. Pre-coordination of HF frequencies could be arranged through the ICAO ASIA/PAC Office in Bangkok. However, the national radio regulator is required to develop a proposal for the registering required frequency assignments with the ITU. Such proposals should be based on the provisions of Appendix 27 to the ITU Radio Regulations, together with the information contained in the ITU International Frequency List (IFL) taking into consideration the protection requirements for HF as contained in Appendix 27.

3.1.2 Appendix 27 to the Radio Regulations (RR) contains the frequency allotment plan for the AM(R)S in the HF bands. This appendix contains the plan for HF frequency allotments to major world air route areas and to regional and domestic air route areas as well as VOLMET areas. It also includes worldwide frequency allotments, which are for the use of aircraft operating agencies for AOC, to be assigned in accordance with RR Appendix 27/217.

3.1.3 The technical characteristics for HF aviation equipment in Appendix 27 of the Radio Regulations, since they form part of the Radio Regulations, enjoy the same status as compulsory treaty obligations.

3.1.4 The Assignment Criteria for HF Air-ground Communication

3.1.4.1 To facilitate the assignment of HF bands, the first step is to define the types of areas concerned, without specifying the individual stations to which the frequencies will be assigned, whether they are used for MWARA, RDARA, VOLMET, or as part of a worldwide allotment area.

3.1.4.2 In addition to the above, it is also important to note that a given channel should not be used within the same allotment area. This measure is necessary to prevent potential interference and is consistent with the provisions of RR Appendix **27**/14. Further criteria related to channel characteristics can be found in Section II of ITU RR Appendix 27.

3.1.4.3 The comprehensive overview of area-based frequency allocation arrangements, incorporating data from ICAO-related references and ITU RR Appendix 27, is presented in **Appendix C** of this manual.

3.1.5 Criteria of New or Modified HF assignments

3.1.5.1 To have a new or modified frequency assignments, States/Administrations can coordinate with National Spectrum Authority to check the availability status in ITU MIFR, while in parallel, the request shall be submitted to the ICAO Regional Office in any format (e.g., letter, email). This action is in line with ITU RR **Appendix 27/19** that ICAO should be consulted in all appropriate cases relating to the operational use of HF, so ICAO could maintain the relevant ICAO Frequency List No. 4 to have effective and efficient in utilize the HF frequency band.

> ***27/19 3 The International Civil Aviation Organization (ICAO) coordinates radiocommunications of the aeronautical mobile (R) service with international aeronautical operations and this Organization should be consulted in all appropriate cases in the operational use of the frequencies in the Plan.***

3.1.5.2 In cases where the Allotment Plan contained in ITU Radio Regulations Appendix 27 does not meet the operational requirements of States or Administrations, those States or Administrations may assign frequencies from areas other than those allotted to them in the Plan. Such assignments shall be subject to prior agreement between the Administrations concerned, and the coordination process shall be conducted under the auspices of ICAO. This provision refers to ITU RR **Appendix 27/20, 27/21, and 27/22**.

> ***27/20 It is recognized that not all the sharing possibilities have been exhausted in the allotment Plan contained in this Appendix. Therefore, in order to satisfy particular operational requirements which are not otherwise met by this allotment Plan, Administrations may assign frequencies from the aeronautical mobile (R) bands in areas other than those to which they are allotted in this Plan. However, the use of the frequencies so assigned must not***

reduce the protection to the same frequencies in the areas where they are allotted by the Plan below that determined by the application of the procedure defined in Part I, Section II B of this Appendix.

27/21 5 When necessary to satisfy the needs of international air operations Administrations may adapt the allotment procedure for the assignment of aeronautical mobile (R) frequencies, which assignments shall then be the subject of prior agreement between Administrations affected.

27/22 6 The coordination described in No. 27/19 shall be effected where appropriate and desirable for the efficient utilization of the frequencies in question, and especially when the procedures of No. 27/21 are unsatisfactory.

3.1.5.3 The coordination procedure for establishing a new HF allocation may follow the process illustrated in Figure 2-1, which remains relevant considering that HF frequencies are not coordinated through the Frequency Finder system.

3.2 VHF Air-ground Communication Frequency bands

3.2.1 The general allotment of frequency band 117.975 – 137.000 MHz shall be as shown in Table 3.1. Specific allotments to services are to be determined regionally.

Table 3.1 Allotment table of frequency band 117.975 – 137.000 MHz

Block allotment frequencies (MHz)	Worldwide utilization	Remarks
118.000 –121.450 inclusive	International and National Aeronautical Mobile Services	Specific international allotments will be determined in the light of regional agreement. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
121.500	Emergency frequency	See Annex 10, Volume V, 4.1.3.1. Channels 121.475 and 121.525 are not assignable.
121.550 –121.9917inclusive	International and National Aerodrome Surface Communications	Reserved for ground movement, pre-flight checking, air traffic services clearances, and associated operations.
122.000 –123.050 inclusive	National Aeronautical Mobile Services	Reserved for national allotments. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
123.100	Auxiliary frequency SAR	See Annex 10, Volume V, 4.1.3.4. Channels 123.075 and 123.125 are not assignable.
123.150 –123.425inclusive	National Aeronautical Mobile Services	Reserved for national allotments. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
123.450	Air-to-air communications	Reserved for air-to-air communication. Designated for use as provided for in Annex 10, Volume V, 4.1.3.2.
123.475-123.6917 inclusive	National Aeronautical Mobile Services	Reserved for national allotments. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
123.700 –129.6917 inclusive	International and National Aeronautical Mobile Services	Specific international allotments will be determined in the light of regional agreement. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
129.700 –130.8917 inclusive	National Aeronautical Mobile	Reserved for national allotments

	Services	but may be used in whole or in part, subject to regional agreement. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
130.900 –136.875 inclusive	International and National Aeronautical Mobile Services	Specific international allotments will be determined in light of regional agreement. National assignments are covered by the provisions in Annex 10, Volume V, 4.1.4.8 and 4.1.4.9.
136.900 –136.975 inclusive	International and National Aeronautical Mobile Services	Reserved for VHF air-ground data link communications.

3.2.2 In accordance with the provisions of Annex 10, the emergency channel (121.500 MHz) shall be used only for genuine emergency purposes, and where a requirement is established for the use of a frequency auxiliary to 121.500 MHz, the frequency 123.100 MHz shall be used.

3.2.3 The Thirteenth Meeting of the APANPIRG agreed to adopt a regionally protected frequency of 128.950 MHz for Traffic Information Broadcasts by Aircraft (TIBA) to permit reports and relevant supplementary information of an advisory nature to be transmitted by pilots.

3.2.4 Common signalling channels for VDL

3.2.4.1 The frequency 136.975 MHz is reserved on a worldwide basis to provide a common signalling channel (CSC) to the VHF digital link Mode 2 (VDL Mode 2).

3.2.4.2 In areas where VDL Mode 4 is implemented, the frequencies 136.925 MHz and 113.250 MHz shall be provided as common signalling channels (CSCs) to the VHF digital link Mode 4 (VDL Mode 4).

3.2.5 Frequencies should be assigned to all VHF Aeronautical Mobile Service (AMS) facilities in accordance with the principles laid out in Annex 10, Volume V and ICAO Handbook on Radio Frequency Spectrum Requirements for Civil Aviation (Doc 9718) Volumes I and II, and take into account:

(a) agreed geographical separation criteria based on 25 kHz or 8.33 kHz interleaving between channels;

(b) agreed geographical separation criteria for the implementation of VDL services;

(c) the need for maximum economy in frequency demands and in radio spectrum utilization; and

(d) a deployment of frequencies which ensures that international services are planned to be free of interference from other services using the same band.

3.2.6 The priority order to be followed in the assignment of frequencies to service is:

(a) ATS channels serving international services (ACC, APP, TWR, FIS);

(b) ATS channels serving national purposes;

(c) channels serving international VOLMET services;

(d) channels serving ATIS and PAR; and

(e) channels used for other than ATS purposes.

3.2.7 The criteria used for frequency assignment planning for VHF AMS facilities serving international requirements should, to the extent practicable, also be used to satisfy the need for national VHF AMS facilities.

3.2.8 Special provisions should be made, by agreement between the States concerned, for the sharing and the application of reduced protection of non-ATS frequencies in the national sub-bands, so as to obtain a more economical use of the available frequency spectrum consistent with operational requirements.

3.2.9 States should ensure that no air/ground frequency is utilized outside its designated operational coverage and that the stated operational requirements for coverage of a given frequency can be met for the transmission sites concerned, taking into account terrain configuration.

3.2.10 APAC region has agreed to base frequency assignment planning on 25 kHz frequency separation, according to the conclusions of ASIA/PAC/3 RAN (DOC9614), APANPIRG/26, etc. The complete regional 117.975MHz-137MHz frequency band utilization plan is shown in **Appendix D**,

3.2.11 For co-frequency assignments, the minimum geographical separation between facilities shall be such that the DOC of each facility is separated by a distance not less than:

(a) that required to provide a D/U ratio of 20 dB; or

(b) the sum of the distance to the radio horizon of the DOC area of each facility.

Alternatively, in areas where the frequency congestion is severe, a protection ratio of 14 dB can be used on the basis of a regional air navigation agreement.

3.2.12 For adjacent frequency assignments, the minimum geographical separation between facilities shall be such that points at the edge of the designated operational coverage of each facility are separated by a distance sufficient to ensure operations free from harmful interference.

Note : The edge of the DOC is at the maximum range and maximum height.

3.2.13 Services and designated operational coverage (DOC)

3.2.13.1 Frequencies for aeronautical radio communication services are (normally) implemented to satisfy the operational need for specific services. These services, and their uniform DOC areas, are as in Table 3.2.

Table 3.2 Table of uniform designated operational coverage (DOC)

Service	SYMBOL	Designated Operational Coverage (DOC)		Comments	Mode
		Range (NM)	Height (ft)		
Aerodrome					
Aerodrome control tower	TWR	25	4000	Height above ground	A/G
Aerodrome flight information service	AFIS	25	4000	Height above ground	A/G
Aerodrome surface communications	AS	Limits of aerodrome	Surface		A/G
Approach					
Precision approach radar	PAR	25	4000	Height above ground	A/G
Approach control service (lower)	APP–L	50	12000		A/G
Approach control service (intermediate)	APP–I	75	25000		A/G
Approach control service (upper)	APP–U	150	45000		A/G
En-Route					
Area control centre (lower)	ACC–L	Area	25000	Within specified area; max range155 NM	A/G
Area control centre (intermediate)	ACC-I	Area	25000	Within specified area; max range 130 NM	A/G
Area control centre (upper)	ACC–U	Area	45000	Within specified area; max range 200 NM	A/G
Flight information service (lower)	FIS-L	Area	25000	Within specified area; max range 155 NM	A/G
Flight information service or Flight information service (upper)	FIS or FIS-U	Area	45000	Within specified area; max range 200 NM	A/G
Meteorological information for aircraft in flight	VOLMET	200	45000	Maximum range 200 NM	BC
Other functions					
Automatic terminal information service	ATIS	200	45000		BC
Air-to-air	A/A	200	45000	Maximum range 200 NM	A/G
Air-to-ground	A/G	200	45000	Maximum range 200 NM	A/G
Aeronautical operational control	AOC	100	25000	Not protected; max. range 100 NM	A/G

Service	SYMBOL	Designated Operational Coverage (DOC)		Comments	Mode
		Range (NM)	Height (ft)		
Emergency	EM	N/A	N/A	No frequency coordination required	A/G
Search and rescue	SAR	N/A	N/A	No frequency coordination required	A/G
VHF En-Route General Purpose	GP	200	45000	Maximum range 200 NM	A/G

Note 1: Different DOC areas may be specified by States.
Note 2: DOC for AOC-only provided to enable compatibility assessment when frequencies for AOC are shared with air traffic control (ATC) services; different DOC may be specified.
Note 3: For area services, no frequency protection is provided outside the specified area.
Note 4: Unless specified by States, the DOC for A/A and A/G is assumed at 45 000 ft/200 NM.
Note 5:Mode: A/G: air-ground communications; BC: (ground) broadcast communications.
Note 6:No coordination of frequency assignment planning is necessary for the emergency frequency 121.500 MHz and the SAR frequency 123.100 MHz as these services are available globally at each station where this service is required.

3.2.13.2 Non-standard DOC (range and height) may be implemented as and when required. Reduced DOC, where operationally acceptable, may alleviate frequency congestion.

3.2.14 The criteria of Geographical separation

3.2.14.1 Applying the methodology as described in Handbook on Radio Frequency Spectrum Requirements for Civil Aviation (Doc 9718), Volume II, paragraph 2.8, separation distances between the edges of the designated coverage areas are show in Table 3.3.

Table 3.3 Minimum geographical co-frequency separation distances between the edges of the DOC

		VICTIM											
	Service	TWR 25/4000	AFIS 25/4000	AS Surface	APP-U 150/450	APP- I 75/250	APP-L 50/120	ACC-U Area/450	ACC-L Area/250	FIS-U Area/450	FIS- L Area/250	VOLMET 260/450	ATIS 200/450
INTERFERE	TWR	156	156		338	273	212	338	273	338	273	338	338
	AFIS	156	156		338	273	212	338	273	338	273	338	338
	AS (Note 2)			25									
	APP-U	338	338		520	455	394	520	455	520	455	520	520
	APP-I	273	273		455	390	329	325	390	455	390	455	455
	APP-L	212	212		394	329	268	394	329	394	329	394	394
	ACC-U (Note 1)	338	338		520	455	394	520	455	520	455	520	520
	ACC-L (Note 1)	273	273		455	390	329	455	390	455	390	455	455
	FIS-U (Note 1)	338	338		520	455	394	520	455	520	455	520	520
	FIS-L (Note 1)	273	273		455	390	329	455	390	455	390	455	455
	VOLMET	338	338		520	455	394	520	455	520	455	15	15
	ATIS	338	338		520	455	394	520	455	520	455	15	15

Note 1: All distances are in NM.
Note 2: Frequencies for aerodrome surface communications should be selected from the band 121.600 – 121.975 MHz. This band is reserved exclusively for aerodrome surface communications. No separation distances with other services are provided. Should it be necessary to share frequencies for AS with air/ground communication services, the minimum geographical separation distance can be calculated as shown in paragraph 2.7.2.1.1 and assuming a designated operational coverage for aerodrome surface communications of 5 NM/100 ft.

3.2.14.2 For stations operating on the first adjacent frequency with the same characteristics, a separation distance of 10 NM is to be maintained between the ground transmitter and the ground receiver. This is considered to be not a frequency assignment planning constraint but rather an implementation issue for States to consider when implementing or modifying frequency assignments. A practical measure may be to avoid assigning a first adjacent frequency to the same location.

3.2.14.3 The designated coverage for VDL Mode 2 and VDL Mode 4 facilities need to be separated from the designated coverage of a co-frequency VHF-COM voice (DSB-AM) system with at least the distance to the radio horizon of each service.

Note: This applies also to frequency assignments between VDL facilities.

3.2.14.4 Table 3.4 present the guard band (channels) between VDL operating on adjacent frequencies with other VDL or VHF COM voice (DSB-AM) systems.

Table 3.4 25 kHz guard band (channels) between DSB-AM, VDL mode 2 and VDL mode 4 (air-air)

		Interference source		
		DSB-AM	VDL 2	VDL 4
Victim	DSB-AM		1	2
	VDL 2	1	1	1
	VDL 4	2	1	1

Note: The numbers in Table are guard-bands (channels). The next frequency that can be used without frequency planning constrain is 1 channel higher (e.g., a desired DSB-AM station that is interfered by a VDL Mode 2 aircraft station requires one 25 kHz guard band. The next frequency, 50 kHz away, can be used in the same designated operational coverage without any frequency assignment planning constraint.

3.2.14.5 Table 3.5 present the guard band (channels) for VDL Mode 2, VDL Mode 4 and VHF COM voice (DSB-AM) systems, when operating with aircraft on the surface of an airport.

Table 3.5 25 kHz guard band (channels) between DSB-AM and VDL (modes 2 and 4) on the surface of an airport

		Interference source		
		DSB-AM	VDL 2	VDL 4
Victim	DSB-AM	-	4	4
	VDL 2	4	1	1
	VDL 4	4	1	1

3.2.14.6 VDL services can be deployed on channels separated by 25 kHz subject to sufficient distance separation between transmit and receive antennas of such services on the ground, which is estimated up to about 3 NM.

The VDL just contains VDL mode2 and mode4, TOA should assign the frequencies of AOC

3.2.15 Guidance on the use of backup frequencies.

3.2.15.1 Backup frequencies may be operationally required to provide an alternative air-ground communication channel in cases where an operational radio frequency is not available. Examples include: intentional interference; unintentional interference (e.g., badly designed FM broadcasting stations); stuck microphone; and phony air traffic controllers.

3.2.15.2 Implementation of backup frequencies should be limited only to the following ATC services: AS, TWR, APP, ACC, COLMET, and FIS. Other air-ground communication services such as ATIS, AFIS, A/A, A/G, GP, and AOC do not require backup communication channels.

3.2.15.3 Backup frequencies should only be implemented at aerodromes with a clear operational requirement. The number of backup frequencies for the AS, TWR, and APP should not exceed two (with a maximum of one backup frequency for TWR and one backup frequency for APP services).

3.2.15.4 Backup frequencies should not be provided when communication channels are lost due to malfunctioning of the ground infrastructure.

3.2.15.5 The assessment of the required number of backup frequencies should be kept to the minimum needed. Where possible, it should be based on experience (e.g., number of days per year that a communication channel is not available).

3.2.15.6 Where operationally feasible, arrangements should be in place to share backup frequencies either between different services (at the same ATC centre) or between different facilities (e.g., different aerodromes or different ACC/FIS from different ATC centres).

3.2.15.7 Adjacent ATS units are encouraged to make suitable arrangements to share backup frequencies where possible, operationally feasible and spectrally efficient.

3.2.15.8 In the COM list in the global table of frequency assignments, backup frequencies are identified as such.

Chapter 4

RADIO NAVIGATION AID FREQUENCY MANAGEMENT

4.1 Non-Directional Radio Beacons (NDB)

4.1.1 Frequency band – The radio frequencies assigned to NDBs shall be selected from those available in that portion of the spectrum between 190 kHz and 1 750 kHz. The coordination and registration of bands 190–495 kHz and 505– 526.5kHz take place in ICAO Regional office.

4.1.2 NDB frequency management should take into account the following:

(a) the interference protection required at the edge of the rated coverage;

(b) the application of the figures shown for typical ADF equipment;

(c) the geographical spacings and the respective rated coverages;

(d) the possibility of interference from spurious radiation generated by non-aeronautical sources (e.g., electric power services, power line communication systems, industrial radiation, etc.).

4.1.3 The 1979 World Administrative Radio Conference adopted regulations concerning the assignment of frequencies for aeronautical radio beacons operating in the LF/MF frequency bands. A minimum protection ratio (wanted/ unwanted signal ratio) of 15 dB is to be used as the basis for frequency assignment planning (RR Appendix 12).

4.1.4 The minimum value of field strength in the rated coverage of an NDB should be 70°microvolts per metre. In order to obtain a satisfactory service within the rated coverage of an NDB located in latitudes between 40°N and 50°S, a minimum value of field strength of 120 microvolts per metre would be required, except where practical experience in the operation of NDBs over several years has revealed that a minimum field strength of 70 microvolts per metre would be adequate to meet all the operational needs. In some specific areas, field strength values considerably in excess of 120 microvolts per metre would be required. Such areas are: Indonesia and Papua New Guinea, Myanmar, Malay Peninsula, Thailand, Lao People's Democratic Republic, Democratic Kampuchea, Viet Nam and Northern Australia.

Note: Based on the latest propagation and noise data available to the ITU, studies of minimum field strengths required at the boundary of the rated coverage was shown in 6.3 of Attachment C, Annex 10. Attention is called particularly to the assumptions made.

4.1.5 NDB Frequency assignments should be based on the criteria contained in Annex 10, Volume I, Chapter 3 paragraph 3.4.3 and the guidance material contained in Attachment C paragraph 6 of Annex 10, Volume I.

4.1.6 Where locators associated with ILS facilities serving opposite ends of a single runway are assigned a common frequency, provision shall be made to ensure that the facility not in operational use cannot radiate.

4.1.7 To alleviate frequency congestion problems at locations where two separate ILS facilities serve opposite ends of a single runway, the assignment of a common frequency to both of the outer locators should be permitted, and the assignment of a common frequency to both of the inner locators should be permitted, provided that:

(a) the operational circumstances permit;

(b) each locator is assigned a different identification signal; and

(c) arrangements are made whereby locators using the same frequency cannot radiate simultaneously.

4.2 Instrument Landing System (ILS)

4.2.1 Frequency band and channel spacing

4.2.1.1 Frequency band –The Localizer is operating in the frequency band 108 – 112MHz. This band is also used for VOR and GBAS/VDB systems. Localizers cannot be assigned a frequency allotted for a VOR and vice versa. The Glide Path is operating in the frequency band 328.6–335.4MHz. The Localizer and Glide Path frequencies are paired as shown in Appendix E.

4.2.1.2 Channel spacing 100 kHz – The channel spacing for the Localizer is 100 kHz and for the Glide Path is 300 kHz. The Localizer operates on odd 100 kHz channels in the VHF band.

4.2.1.3 Channel spacing 50 kHz – The use of 50 kHz channels for the localizer (and 150 kHz for the glide path) is permitted as stipulated in Annex 10, Volume V, paragraph 4.2.2.1.

Note: Such use shall not cause harmful interference to ILS receivers not capable of tuning to these (50/150 kHz) channels and is subject to the condition that the operational service to international operators using airborne equipment designed for 100 kHz channel spacing (150 kHz for the Glide Path) is not derogated.

4.2.1.4 When the ILS is associated with a DME, the DME channels must be selected as **Appendix F**. Further guidance on DME frequency assignment planning, including the ILS/DME channel pairing, is in section 4.5.

4.2.2 Designated Operational Coverage (DOC)

4.2.2.1 The horizontal Designated Operational Coverage of the Localizer and Glide Path is shown in Figure 4-1. The DOC can be extended (optional) with a range of 10 NM outside the clearance sector of the Localizer as promulgated by States/Administrations.

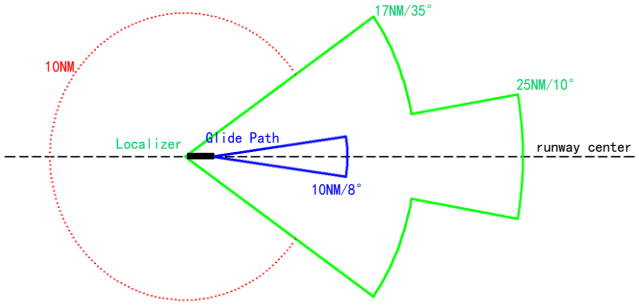


Figure 4-1. DOC of the ILS Localizer and Glide Path

4.2.2.2 The maximum protection height for the localizer DOC is 6250 ft and for the Glide Path 2500 ft. This height is relative to the elevation of the Localizer transmitter.

4.2.2.3 States/Administrations may modify the coverage to meet specific operational requirements. Unless a (modified) DOC is provided, the standard DOC as in paragraph 4.2.2.1 is used in the frequency assignment planning process.

4.2.2.4 When the ILS is associated with a DME, the DOC of the DME is typically the same as for the Localizer. However, States/Administrations may require the associated DME to provide coverage in a larger area.

Note: In practice, many frequency assignments for a DME, associated with an ILS, have a DOC of 10.000 ft/100 NM. Frequency assignment planning criteria for DME are in section 4.5.

4.2.3 The minimum field strength for a Localizer is 40 µV/m (or 32 dBµV/m or - 116 dBW) throughout the DOC. For a Glide Path the minimum field strength is 400 µV/m (or 52 dBµV/m or - 106 dBW).

4.2.4 ILS serving both ends of the same runway.

To alleviate frequency congestion problems at locations where two separate ILS facilities serve opposite ends of the same runway or different runways at the same airport, the assignment of identical ILS localizer and glide path paired frequencies should be permitted provided that:

a) the operational circumstances permit;

b) each localizer is assigned a different identification signal; and

c) arrangements are made whereby the localizer and glide path not in operational use cannot radiate.

4.2.5 Information on the planning of identifications can be found in section 4.6.

4.2.6 A compatibility assessment for potential interference that can be caused by FM broadcasting stations operating in the frequency band 87 – 108 MHz is necessary before a Localizer frequency can be put into operational use. The FM immunity performance requirements for Localizer receivers are contained in Annex 10, Volume I, paragraph 3.1.4. Additional information on the process to assess compatibility with FM broadcast stations is in Recommendation ITU-R SM.1009.

4.2.7 Frequency Assignment Planning Principles

4.2.7.1 When the main direction of radiation of the ILS system is not known, for frequency assignment planning purposes, the coverage is assumed to be omnidirectional. The localizer coverage is originated from the location of the Localizer; the Glide Path coverage is originated from the location of the Glide Path.

4.2.7.2 The criteria must be applied in respect of each localizer installation, in the sense that while of two localizers, the first may not cause interference to the use of the second, nevertheless the second may cause interference to the use of the first.

4.2.7.3 The DOC for the Localizer is much larger than that for the Glide Path. When a localizer frequency has been assigned, the associated Glide Path frequency is automatically protected from harmful interference from other co-channel ILS facilities. However, when non-co-channel Localizer frequency has been assigned, a separate adjacent channel compatibility assessment is necessary for the Glide Path frequency with regard to other nearby ILS facilities operating on adjacent Glide Path frequencies. Therefore, the frequency assignment planning for Localizer and Glide Path has to be performed separately.

4.2.7.4 In so far as the wanted and unwanted carriers may produce a heterodyne note, the protection ratio ensures that the instrumentation is not affected. However, in cases where a voice facility is used, the heterodyne note may interfere with this facility.

4.2.8 Required Distance Separations of ILS/ILS Facilities

4.2.8.1 The minimum required separation distances between the desired ILS system and potentially interfering ILS systems are based on the assumption that protection against interference is afforded to the desired signal from the undesired signal is 20 dB. This corresponds to a disturbance of not more than 15 microamperes at the limit of the service distance of the ILS.

4.2.8.2 The minimum D/U ratios requirements within the DOC and different frequency separation to protect different receivers of Localizer / Glide Path can be referred to Annex 10, Volume I, Attachment C 2.6.2.1, 2.6.2.2.

4.2.8.3 Table 4.1 provides the minimum geographical separation distances between the edge of coverage of a desired ILS facility and the location of an undesired ILS facility, established using the method in **Appendix D**.

Table 4.1 Separation distances between the edge of coverage of a desired ILS and an undesired ILS

Undesired Facility:					
Localizer (e.i.r.p. = 30 dBW)	Δf:	Distance for 100 kHz receiver (desired facility)	D/U	Distance for 50 kHz receiver (desired facility)	D/U
	0 kHz	268 NM	36 dB	268 NM	36 dB
	0 kHz	135 NM	20 dB	135 NM	20 dB
	50 kHz	94 NM	-7 dB	36 NM	-34 dB
	100 kHz	n/a	n/a	n/a	n/a
	150 kHz	9 NM	-50 dB	9 NM	-50 dB
Glide Path (e.i.r.p. = 20 dBW)	Δf:	300 kHz receiver	D/U	150 kHz receiver	D/U
	0 kHz	88 NM	36 dB	74 NM	36 dB
	0 kHz	71 NM	20 dB	58 NM	20 dB
	150 kHz	36 NM	-0 dB	11 NM	-20 dB
	300 kHz	11 NM	-20 dB	1 NM	-40 dB
	450 kHz	1 NM	-40	-	-
Localizer (e.i.r.p. = 17 dBW)	Δf:	100 kHz receiver	D/U	50 kHz receiver	D/U
	0 kHz	135 NM	36 dB	135 NM	36 dB
	0 kHz	112 NM	20 dB	112 NM	20 dB
	50 kHz	44 NM	-7 dB	10 NM	-34 dB
	100 kHz	n/a	n/a	n/a	n/a
	150 kHz	1 NM	-50 dB	1 NM	-50 dB
Glide Path	Δf:	300 kHz receiver	D/U	150 kHz receiver	D/U

(e.i.r.p. = 14 dBW)	0 kHz	88 NM	36 dB	74 NM	36 dB
	0 kHz	71 NM	20 dB	58 NM	20 dB
	150 kHz	36 NM	-0 dB	11 NM	-20 dB
	300 kHz	11 NM	-20 dB	1 NM	-40 dB
	450 kHz	1 NM	-40	- - -	- - -

4.2.8.4 In Regions where both 100 kHz and 50 kHz Localizer channels are being used (300 kHz and 150 kHz channels for the Glide Path), the protection of the Localizer is based on the protection of receivers designed for 100 kHz channel spacing.

4.2.9 Geographical separation distances between (desired) Localizer and (undesired) adjacent frequency VOR facilities is as Table 4.2.

Table 4.2 Geographical separation distances between (desired) Localizer and (undesired) VOR

VOR Tx (dBW)	ΔF (kHz)	D/U(dB)	D (NM)	Remarks
17	50	-7	72	Undesired VOR; 100 kHz receiver;
17	50	-34	15	Undesired VOR; 50 kHz receiver;
17	100	-46	5	Undesired VOR; 50/100 kHz receiver;
17	150	-50	3	Undesired VOR; 50/100 kHz receiver;
20	50	-7	80	Undesired VOR; 100 kHz receiver;
20	50	-34	19	Undesired VOR; 50 kHz receiver;
20	100	-46	7	Undesired VOR; 50/100 kHz receiver;
20	150	-50	4	Undesired VOR; 50/100 kHz receiver;
30	50	-7	107	Undesired VOR; 100 kHz receiver;
30	50	-34	36	Undesired VOR; 50 kHz receiver;
30	100	-46	16	Undesired VOR; 50/100 kHz receiver;
30	150	-50	13	Undesired VOR; 50/100 kHz receiver;

Note: ITU-R aeronautical propagation curve for the Localizer: 108 MHz, h1 = 20 ft, h2 = 6250 ft; 5% of the time. The minimum required separation distance is measured from the location of the (undesired) VOR to the closest point of the DOC of the Localizer

4.2.10 Geographical separation distance between (desired) Localizer and the location of an (undesired) GBAS/VDB as Table 4.3.

Table 4.3 Geographical separation distances between a desired Localizer and an undesired GBAS/VDB

GBAS/VDB Tx (dBW)	ΔF (kHz)	D/U(dB)	D (NM)	Remarks
17	0	26	187	
17	25	0	108	
17	50	-34	20	
17	75	-46	5	
17	100	-65	0	Planning freedom

Note: ITU-R aeronautical propagation curve for the Localizer: 108 MHz, h1 = 45 ft, h2 = 6250 ft; 5% of the time. The minimum required separation distance is measured from the location of the (undesired) GBAS/VDB to the closest point of the DOC of the Localizer

4.2.11 Practical experience in the operation of ILSs over several years has revealed that the minimum required separation distances of Annex 10, Volume I, Table C-3 can protect against interference to the desired signal. Required Localizer and Glide Path separation distances is shown in Table 4.4. These separation distances can be used in areas where the frequency congestion is severe.

Table 4.4 Required distance separations

	Frequency separation	Minimum separation between second facility and the protection point of the first facility km (NM)	
		List A	List B
Localizer	Co-channel	148(80)	148(80)
	50kHz	37(20)	9(5)
	100kHz	9(5)	0
	150kHz	0	0
	200kHz	0	0
Glide path	Co-channel	93(50)	93(50)
	150kHz	20(11)	2(1)
	300kHz	2(1)	0
	450kHz	0	0
	600kHz	0	0

List A refers to the use of localizer receivers designed for 100 kHz channel spacing coupled with glide path receivers designed for 300 kHz channel spacing.

List B refers to the use of localizer receivers designed for 50 kHz channel spacing coupled with glide path receivers designed for 150 kHz channel spacing.

Note 1. The above figures are based on the assumption of protection points for the localizer at 46 km (25 NM) distance and 1900 m (6250 ft) height and for the ILS glide path at 18.5 km (10 NM) distance and 760 m (2500 ft) height.

Note 2. States, in applying the separations shown in the table, have to recognize the necessity to site the ILS and VOR facilities in a manner which will preclude the possibility of airborne receiver error due to overloading by high unwanted signal levels when the aircraft is in the initial and final approach phases.

Note 3. States, in applying the separations shown in the table, have to recognize the necessity to site the ILS glide path facilities in a manner which will preclude the possibility of erroneous glide path indications due to reception of adjacent channel signals when the desired signal ceases to radiate for any reason while the aircraft is in the final approach phase.

Note: The application of the figures given in Table 4.4 *will only be correct within the limitations set by the assumptions. If more precise determination of separation distances is required in areas of frequency congestion, this may be determined for each facility from appropriate propagation curves, taking into account the particular directivity factors, radiated power characteristics and the operational requirements as to coverage. Where reduced separation distances are determined by taking into account directivity, etc., flight measurements at the ILS protection point and at all points on the approach path should be made wherever possible to ensure that a protection ratio of at least 20 dB is achieved in practice.*

4.3 VHF Omnidirectional Range (VOR)

4.3.1 Frequency band and channel spacing

4.3.1.1 VOR is operating in the frequency band 108–117.975MHz. Within band 108–111.975MHz, frequencies ending in either even tenths or even tenths plus a twentieth of a megahertz are used only by VOR and therefore cannot cause co-channel interference to the ILS Localizer. In areas where 50 kHz channel spacing is introduced measures are in place to avoid that no harmful adjacent channel interference is caused to the ILS Localizer.

4.3.1.2 The channel spacing is 100 kHz. The use of 50 kHz VOR channels is permitted as stipulated in Annex 10, Volume V, paragraph 4.2.3.1.

Note: The use of 50 kHz VOR channels shall not cause harmful interference to VOR receivers not capable of tuning to these channels and the operational service to international operators using airborne 100 kHz equipment is not derogated.

4.3.1.3 In aera where VDL Mode 4 is implemented, the frequency 113.250 is reserved as common signalling channel for VDL Mode 4.

4.3.1.4 VOR facilities are often associated with DME facilities. The associated DME channels shall be selected in Appendix E. Further guidance on DME frequency assignment planning, including the VOR/DME channel pairing, is in section 4.5.

Note: A separate compatibility assessment for the DME facilities associated with a VOR facility is required in all cases.

4.3.2 The designated operational coverage (DOC) of the VOR is determined through the operational requirement as promulgated by States/Administrations. In many cases the DOC is circular and can typically vary from 25 NM to approximately 200 NM and with the protected altitude up to between 10 000 feet and 45 000 feet normally, may be extended up to 60 000 feet. Protection from harmful interference is only provided within the DOC.

Note: When the VOR is associated with a DME, the DOC of the DME is typically the same as for the VOR.

4.3.3 The field strength or power density in space of VOR signals required should be 90 μV/m (39 dBμV/m) or 107 dBW/m^2 (or - 110 dBW at 118 MHz) throughout the DOC.

4.3.4 A compatibility assessment for potential interference that can be caused by FM broadcasting stations operating in the frequency band 87 – 108 MHz is necessary. The FM immunity performance requirements for VOR receivers are contained in Annex 10, Volume I, paragraph 3.3.8. Additional information on the process to assess compatibility with FM broadcast stations is in Recommendation ITU-R SM.1009.

4.3.5 Information on the planning of identifications can be found in section 4.6.

4.3.6 Protection criteria for a desired VOR and an undesired VOR or Localizer or GBAS/VDB.

4.3.6.1 Localizer and VOR facilities cannot operate on the same frequency. Adjacent channel compatibility with an (undesired) Localizer is assessed in the same way as adjacent channel interference from a VOR assessed.

4.3.6.2 The protection of VOR facilities operating on the same frequency is based on a desired to undesired (D/U) signal ratio of 20dB. This corresponds to a bearing error of less than 1 degree due to unwanted signals.

4.3.6.3 Protection requirement for a desired VOR from interference by an undesired localizer or VOR facility is contained in DOC 9718, Volume II, paragraph 3.4.

4.3.6.4 Protection criteria for a desired VOR from interference by an undesired GBAS/VDB is contained in DOC 9718, Volume II, paragraph 3.5.

4.3.6.5 Where both 100 kHz and 50 kHz VOR channels are being used, the protection of the VOR is based on the protection of receivers designed for 100 kHz channel spacing.

4.3.7 Sectorized coverage

4.3.7.1 Application of the calculation methods described above may produce incorrect results if sectorization (key-holing) is used. Figure 4-2 can be used to explain the problem:

4.3.7.2 Consider A to be the desired VOR facility and B the undesired one. The “Critical Point” is most exposed to interference from facility B because it is the point of the DOC of facility A which is nearest to transmitter B.

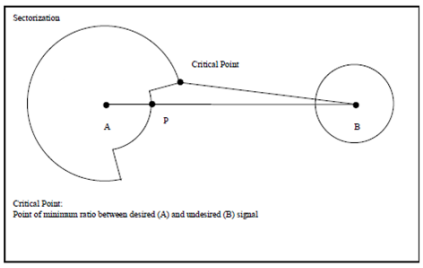


Figure 4-2 Geometry for determining the test points

4.3.8 Table 4.5 to Table 4.7 present the co- and adjacent frequency separation distance between the edge of the DOC of the (desired) VOR and the location of the (undesired) VOR or ILS-Localizer.

Table 4.5 Minimum separation distances between desired VOR and undesired VOR or LOC

ΔF (kHz)	D/U (dB)	Tx = 17 dBW		Tx = 20 dBW		Tx=30 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired VOR at 45000 ft
0	20	147	268	150	271	160	284	50/100 kHz receiver
50	-7	120	134	123	174	133	231	100 kHz receiver

ΔF (kHz)	D/U (dB)	Tx = 17 dBW		Tx = 20 dBW		Tx=30 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired VOR at 45000 ft
50	-34	93	5	96	11	106	43	50 kHz receiver
100	-46	81	<0.5	84	<0.5	94	7	50/100 kHz receiver
150	-50	77	<0.5	80	<0.5	90	<0.5	50/100 kHz receiver

Table 4.6 Minimum separation distances between desired VOR and undesired VOR or LOC

ΔF (kHz)	D/U (dB)	Tx = 17 dBW		Tx = 20 dBW		Tx=30 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired VOR at 25000 ft
0	20	147	208	150	212	160	225	50/100 kHz receiver
50	-7	120	115	123	131	133	175	100 kHz receiver
50	-34	93	9	96	13	106	42	50 kHz receiver
100	-46	81	<0.5	84	<0.5	94	10	50/100 kHz receiver
150	-50	77	<0.5	80	<0.5	90	5	50/100 kHz receiver

Table 4.7 Minimum separation distances between desired VOR and undesired VOR or LOC

ΔF (kHz)	D/U (dB)	Tx = 17 dBW		Tx = 20 dBW		Tx=30 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired VOR at 10000 ft
0	20	147	143	150	147	160	161	50/100 kHz receiver
50	-7	120	71	123	82	133	115	100 kHz receiver
50	-34	93	10	96	14	106	29	50 kHz receiver
100	-46	81	1	84	3	94	11	50/100 kHz receiver
150	-50	77	<0.5	80	1	90	7	50/100 kHz receiver

Note1: The separation distances are between the edge of coverage for a desired VOR and the location of an undesired VOR (or Localizer) facility. The EIRP of the undesired VOR (or Localizer) is as specified in column "Tx".

Note2: ITU-R aeronautical propagation curve for 108 MHz and 5% of the time. The antenna height of the desired aircraft receiver is indicated in the "Remarks" column, and the antenna height of undesired Localizer is 6 ft, undesired VOR is 20 ft.

4.3.9 Table 4.8 presents the co- and adjacent frequency separation distance between the edge of the DOC of the (desired) VOR and the location of the (undesired) GBAS/VDB station.

Table 4.8 Distance between the edge of the DOC of the desired VOR (50 kHz receiver) from GBAS/VDB

VOR - Height (ft)	**Co-frequency** **D/U = 26 dB** **L = 153 dB**	**1st adj freq. (+/-25 kHz)** **D/U = 0 dB** **L = 126 dB**	**2nd adj freq. (+/- 50 kHz)** **D/U = - 34 dB** **L = 92 dB**	**3rd adj freq. (+/-75 kHz)** **D/U = -46 dB** **L = 87 dB**	**4th adj freq. (+/- 100 kHz)** **D/U = -65 dB** **L = 61 dB**
5 000	127 NM	80 NM	9 NM	5 NM	Frequency assignment planning freedom
10 000	161 NM	111 NM	8 NM	5 NM	
15 000	186 NM	135 NM	8 NM	4 NM	
20 000	206 NM	155 NM	8 NM	3 NM	
25 000	225 NM	172 NM	8 NM	2 NM	
30 000	242 NM	189 NM	7 NM	Frequency assignment planning freedom	
35 000	237 NM	203 NM	6 NM		
40 000	271 NM	217 NM	5 NM		
45 000	284 NM	228 NM	3 NM		
50 000	297 NM	242 NM	Planning freedom		
60 000	320 NM	264 NM			

Note 1: With minimum separation distances less than 0.5 NM frequency assignment planning freedom is assumed.

Note 2: Separation distances ≤ 5 NM may be considered as operational insignificant.

Note3: ITU-R aeronautical propagation curve for 108 MHz and 5% of the time. The antenna height of undesired GBAS/VDB is 45 ft.

4.4 Ground Based Augmentation System (GBAS)

4.4.1 The GNSS ground-based augmentation system (GBAS) VHF data broadcast (VDB) frequency band is 108 to 117.975MHz. The lowest assignable frequency is 108.025 MHz and the highest assignable frequency is 117.950 MHz, the channel spacing is 25 kHz.

4.4.2 Designated Operational Coverage (DOC)

4.4.2.1 The minimum DOC required for a GBAS VDB to provide approach services is as shown in Figure 4-3.

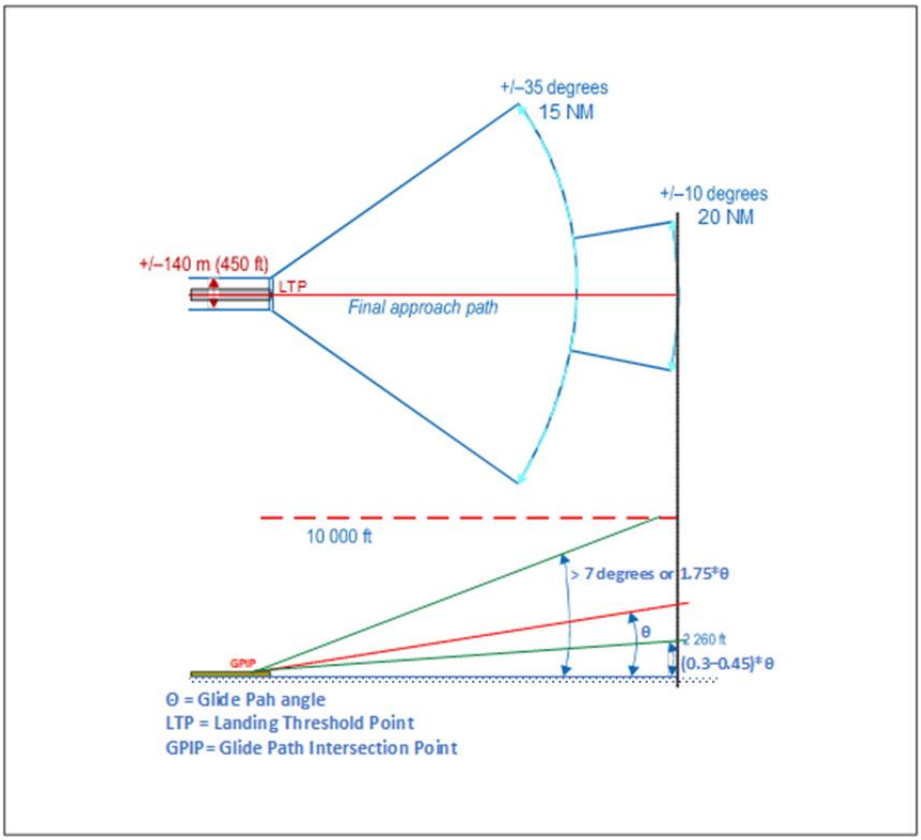


Figure 4-3 Minimum required DOC of GBAS

4.4.2.2 For GBAS approaches supported by the minimum DOC, the vertical coverage is limited by a plane that extends from the glide path interception point (GPIP) with an angle of 0.3 times the glide path angle. For a glide path of 3 degrees, this angle is 0.9 degrees. At 20 NM, this plane is 2 260 ft above the earth. The upper limit of the coverage to be used for frequency assignment planning for this case is 10.000 ft above the runway threshold.

4.4.2.3 Typically, the DOC for GBAS VDB facilities is referenced to the location and the elevation of the threshold of the runway. However, in cases where such information is not available, the coverage may be referenced to the location of the VDB transmitter. In this case, considering the offset of the VDB transmitter from the runway threshold, for frequency assignment planning purposes, the DOC of the GBAS should be extended by 3 NM from the location of the VDB transmitter or the aerodrome reference point (ARP), in which case a circular coverage may need to be considered or assumed.

4.4.2.4 Figure 4-3 presents the minimum approach DOC, States/Administrations may specify an extended DOC based on the operational requirements. More information on establishing the DOC is in Annex 10, Volume I, Attachment D, paragraph 7.3.

4.4.2.5 It is recommended to assume a single omnidirectional coverage that encompasses all GBAS DOCs at an airport, if feasible. At a particular airport the set of GBAS DOC that are supported may include one or multiple GBAS DOC at all runways or a subset of runways. Furthermore, each GBAS DOC may be described either by the minimum DOC according to Figure 4 3 or by an extended DOC as specified by the GBAS service provider. When frequency coordination is not feasible assuming single omnidirectional coverage, it may be feasible to protect coverage only in the GBAS DOC's.

4.4.3 GBAS/VDB positioning service EIRP

4.4.3.1 The EIRP for the GBAS/VDB when providing the approach service is typically 17dBW (50 W) to provide service down to about 2 000 ft at the lower edge of the DOC.

4.4.3.2 The EIRP for the GBAS/VDB when providing the positioning service is in Table 4.9.

Table 4.9 Typical EIRP for GBAS/VDB positioning service

Range (NM)	EIRP (dBW)	EIRP (W)
50	14	25
100	20	100
150	23	200
200	26	400

Note: The EIRP of a GBAS/VDB system shall be provided as Peak Envelope Power. Since MOPS specify the output power to be measured as mean power over a bit-sequence in the preamble, care must be taken that the PEP is used for calculation.

4.4.4 For frequency assignment planning purposes, it is assumed the field strength of the desired corresponds to the minimum field strength, as defined in Annex10, Volume I, throughout the designated operational coverage. The minimum field strength is 215 μV/m (-99 dBW/m2) which is equivalent to a power level at the aircraft antenna output of -102 dBW with an ideal isotropic antenna (for the horizontal component of the GBAS/VDB signal). The maximum field strength is (SIS max) 0.879 V/m (– 27 dBW/m^2 when converted to power flux density or –29 dBW when converted to power at the output of an isotropic antenna).

4.4.5 For use in civil aviation, the GBAS signal is horizontally polarized. The value for cross polarization isolation between horizontal and vertical polarization assumed to be 10 dB.

4.4.6 The risk of interference from FM broadcasting stations in the band 87 – 108 MHz caused by unwanted emissions into the aeronautical band or generated in the airborne receiver should be taken into account. The relevant Recommendation for GBAS is ITU-R SM.1841.

4.4.7 Information on the planning of identifications can be found in section 4.6.

4.4.8 Besides the frequency, co-ordination must also take into account reference path data selectors (RPDS) and reference station data selectors (RSDS) and time slots. More information on the use and coordination of RPDSs and RSDSs is in Annex 10, Volume I, Appendix B. However as these are currently not planned to be used in the APAC Region, no relevant planning criteria have been developed yet.

4.4.9 Protection requirements

4.4.9.1 Protection requirements for GBAS/VDB receivers.

The GBAS/VDB receiver shall be capable to achieve a message failure rate of not more than one failed message per 1000 data messages. The D/U ratios in Table 4.10 will meet this requirement.

Table 4.10 Co- and adjacent channel protection requirements for GBAS/VDB receivers

Frequency offset	**VDB/VDB**	**VDB/VOR**	**VDB/ILS**	**VDB/VHF-COM**
Co-frequency	26 dB	26 dB	26 dB	n/a
+/- 25 kHz	-18 dB	0 dB	0 dB	n/a
+/- 50 kHz	-43 dB	-34 dB	-34 dB	-32 dB
+/- 58.33 kHz	n/a	n/a	n/a	-38 dB
+/- 66.66 kHz	n/a	n/a	n/a	-41 dB
+/- 75 kHz	-46 dB	-46 dB	-46 dB	-45 dB
+/- 83.33 kHz	n/a	n/a	n/a	-47 dB
+/- 91.66 kHz	n/a	n/a	n/a	-49 dB
+/- 100 kHz	-46 dB	-46 dB	-46 dB	-51 dB
+/–975 kHz	-46 dB	-46 dB	-46 dB	-51 dB
≥ 1000 kHz	-46 dB	-60 dB	-60 dB	-77 dB

4.4.9.2 For the calculation of the minimum geographical separation distance between a desired GBAS VDB facility and an undesired GBAS VDB (or localizer, VOR or VDL Mode 4) facility, the generic model described in Appendix D, need to be applied.

4.4.10 The separation distances between desired and undesired GBAS stations in Table 4.11 were calculated for desired GBAS facilities providing approach services.

Table 4.11 Minimum separation distances between desired and undesired GBAS stations

Frequency offset	D/U (dB)	L (dB)	Distance from DOC of desired station to undesired station	Distance between the GBAS stations
0 (Co- channel)	26	145	149 NM	172 NM
25 kHz	-18	101	24 NM	47 NM
50 kHz	-43	76	0 NM	0 NM
Δf ≥ 75 kHz	-46	73	0 NM	0 NM

Note: It's assumed that the GBAS VDB is within 3 miles of all runway ends supported by the GBAS and that all runway ends are supported by the minimum approach DOC illustrated in Figure 4-3.

4.4.11 The calculation of the minimum separation distances between the edge of coverage (DOC) of a desired GBAS VDB facility and the location of an undesired VOR or Localizer in Table 4.12.

Table 4.12 Minimum separation distances between the DOC of the desired GBAS and the location of the undesired VOR or localizer

D/U (dB)	VOR or localizer (17dBW)			VOR (27dBW)		VOR (30dBW)	
	L(dB) 5%	VOR Distance (NM)	Localizer Distance (NM)	L(dB) 5%	VOR Distance (NM)	L(dB) 5%	VOR Distance (NM)
26 (Δf = 0 kHz)	145	149	149	155	163	156	201
0 (Δf = 25 kHz)	119	68	38	129	101	132	111
-34 (Δf = 50 kHz)	85	4	4	95	13	98	17
-46 (Δf = 75 kHz)	73	0	0	83	3	86	4
-46 (Δf = 100 kHz)	73	0	0	83	3	86	4
-46 (Δf = 975 kHz)	73	0	0	83	3	86	4
-60 (Δf ≥ 1000 kHz)	59	0	0	69	0	72	0

Note：The parameters used in the calculations below are:
Height of the antenna of the (undesired) VOR is 20 ft above local terrain.
Height of the antenna of the (undesired) Localizer) is 6 ft above local terrain.
Height of the (desired) VDB aircraft is 10.000 ft.
ITU-R aeronautical propagation curves (Recommendation P.528-4) for 112 MHz, 5% of the time

4.4.12 Interference from VHF-COM signals

4.4.12.1 On-board compatibility

No frequency assignment planning constraints have been identified to secure the compatibility between the on-board transmission of VHF-COM signals and the reception of GBAS/VDB signals on the same aircraft.

4.4.12.2 Air-to-air interference can be expected as in Table 4.13.

Table 4.13 Minimum separation distances between aircraft

ΔF (kHz)	D/U	10dBW		14 dBW		17dBW		20 dBW	
		L (dB)	D(NM)	L (dB)	D(NM)	L (dB)	D(NM)	L (dB)	D(NM)
50	–32 dB	80	1.5	84	2	87	3	91	4.5
58.3	–38 dB	74	0.6	78	1	81	1	84	2
66.6	–41 dB	71	0.4	75	0.7	78	1	81	3
75	–45 dB	67	0.3	71	0.4	74	0.6	77	0.9
83.3	–47 dB	65	0.2	69	0.3	72	0.5	75	0.7
91.6	–49 dB	63	0.1	67	0.3	70	0.4	73	0.5
100	–51 dB	61	0.1	65	0.2	68	0.3	71	0.4
125	-46 dB	47	0	61	0.1	64	0.2	67	0.2

The minimum separation distances as in Table 4.13 were calculated assuming isotropic antennas on board the desired and the undesired aircraft. Taking into account that the effect of the actual antenna diagram of the VHF-COM and the GBAS/VDB antenna as well as the transient effect of air-to-air interference, at a frequency separation greater than 100 kHz no air-to-air interference is expected.

Note: An aircraft EIRP. of 20 dBW (100 W) is not normally used. For aircraft EIRP. of 17dBW (50 W) or less, a minimum frequency separation between the aircraft VHF-COM and the GBAS/VDB receiver of 50 kHz may be recommended.

4.4.12.3 Ground-to-air interference

At short distances, as shown in Table 4.13, interference from a VHF-Ground facility can be expected when the EIRP of the ground station is between 14 dBW (25W) to 20 dBW (100W). Maintaining a minimum frequency separation of 100 kHz between the assigned GBAS/VDB and VHF-COM frequency would avoid such interference. One option is to ensure in the frequency assignment planning process that a guard band of 100 kHz is introduced which would exclude the frequencies between 117.900 – 117.975 MHz to be used for GBAS/VDB.

Note: This condition seems to be extremely conservative. Taking into account the actual antenna diagram and the geography of short distances to the (interfering) VHF COM station, is may be sufficient to only exclude the frequency 117.950 MHz from being assigned to a GBAS/VDB station.

4.4.13 Airborne Contribution Factor

4.4.13.1 In extreme cases where the assumptions as in paragraph 4.4.9 cannot be applied or are not offering the GBAS/VDB compatibility calculations for GBAS versus GBAS, Localizer and VOR facilities may include the use of the Airborne Contribution Factor (ACF). This will require larger protection distances between the desired GBAS/VDB and the undesired GBAS/VDB, Localizer and VOR and, in the case of adjacent channel interference, over a range of plus/minus 1 MHz. In this case it may be difficult if not impossible to find a proper GBAS/VDB frequency that can be assigned and, in return, such a frequency assignment will prohibit in a large area the addition of new VOR or Localizer facilities.

4.4.13.2 The airborne contribution factor compensates for antenna gain variations in the horizontal plane (between the direction of the desired versus the undesired transmitter) and on-board transmission line loss variation (between the frequency of the desired and undesired signal). The airborne contribution factor can be calculated with 15 + Min (6, 6 x frequency offset (in kHz) /1 000) with a maximum frequency offset of 1 000 kHz.

4.4.13.3 Table 4.14 contains requirements for GBAS VDB receivers accounting for ACF.

Table 4.14 Co- and adjacent channel protection requirements for GBAS/VDB; signal-in-space

Frequency offset	**VDB/VDB**	**VDB/VOR**	**VDB/ILS**	**VDB/VHF-COM**
Co-frequency	41 dB	41 dB	41 dB	n/a
+/- 25 kHz	-3 dB	15 dB	15 dB	n/a
+/- 50 kHz	-27 dB	-18 dB	-18 dB	
+/- 58.33 kHz	n/a	n/a	n/a	
+/- 66.66 kHz	n/a	n/a	n/a	
+/- 75 kHz	-30 dB	-30 dB	-30 dB	
+/- 83.33 kHz	n/a	n/a	n/a	
+/- 91.66 kHz	n/a	n/a	n/a	
+/- 100 kHz				
+/- 975 kHz	-25 dB	-25 dB	--25 dB	
≥ 1000 kHz	-25 dB	-39 dB	-39 dB	

4.5 Distance Measuring Equipment (DME)

4.5.1 Frequency band and channel spacing

4.5.1.1 The DME operates on paired interrogation and reply frequencies (each combination of these frequencies is a "channel") in the frequency band 960 – 1215 MHz. A number of these channels are in turn paired with ILS or VOR frequencies. The DME channelling arrangement is shown in Appendix D.

Note: The frequency band 960 – 1215 MHz is also used for TACAN. TACAN operates with the same channeling scheme as the DME and can be paired with a VOR (VOR/TAC). From the frequency assignment planning point of view TACAN is equivalent to DME.

4.5.1.2 The spacing between DME channels is 1MHz. DME X and Y channels with the same channel number use the same interrogator frequency but with different pulse coding. The reply frequency for the X and Y channel is different as well as the pulse coding. The Y channels reuse the reply frequencies within the interrogation frequency block (1025 – 1150 MHz).

4.5.2 The Designated Operational Coverage (DOC) of the DME is normally as promulgated by States/Administrations. When the DME is associated with an ILS or a VOR, the DOC of the DME is normally not less than the DOC of the ILS or VOR.

4.5.3 The peak equivalent isotopically radiated power shall not be less than that required to ensure a peak pulse power density of -89 dBW/m^2 under all operational weather conditions at any point within coverage. Minus 111 dBW at the antenna corresponds to a power flux density of -89 dBW/m^2 at the mid-band frequency.

4.5.4 Information on the planning of identifications can be found in section 4.6.

4.5.5 Protection requirements

Notes: For frequency planning purposes,

1) There is no difference between DME/N and DME/P.

2) TACAN facilities are treated in the same way as DME stations.

3) No criteria are defined for DME/W and DME/Z.

4.5.5.1 The necessary desired to undesired (D/U) signal ratios needed to protect the desired transponder reply signal at an airborne receiver from the various co-frequency/adjacent frequency, same code/different code, undesired transponder reply signal combinations that may exist.

4.5.5.2 The prerequisite for any D/U calculation to be valid is that the minimum signal of the (desired) DME (-111 dBW) at the aircraft antenna is achieved at all points throughout the coverage.

4.5.5.3 In making an assignment, each DME facility must be treated as the desired source with the other acting as the undesired. If both satisfy their unique D/U requirement, then the channel assignment may be made. This “reverse” check is necessary if the DME facilities being considered radiate with different EIRP or have a different DOC.

4.5.5.4 To each X or Y DME channel corresponds a specific reply frequency within the band 960 - 1215 MHz. X and Y DME channels do not have reply frequencies in common. Hence, for the protection of the desired transponder replies from other co-channel transponder replies, it is sufficient to consider only DME facilities with the same channel designation (including the pulse code). However, for DME facilities operating on Y channels, the reply frequency may be the same as the interrogator frequency of another DME X facility.

4.5.5.5 For co-channel assignments, the D/U signal ratio should be at least 8 dB throughout the service volume.

4.5.5.6 For Adjacent frequency assignments, the minimum required D/U ratio within the operational service volume shall be in accordance with the values given in Table 4.15.

The following values are assumed for the adjacent-channel emissions of the transponder (P_u):

200 mW (-7 dBW) on the first adjacent frequency;

2 mW (-27 dBW) on the second adjacent frequency.

Table 4.15 Protection criteria for the DME Ground Station (Interrogator)

Type of assignment	A	B
Co-frequency:		
Same pulse code	8	8
Different pulse code	8	-43
First adjacent frequency:		
Same pulse code	- (P_u - 1)	-42
Different pulse code	- (P_u + 7)	-75
Second adjacent frequency:		
Same pulse code	- (P_u + 19)	-75
Different pulse code	- (P_u + 27)	-75

Note 1: The D/U ratios in column A protect those DME/N interrogators operating on X or Y channels. Column A applies to decoder rejection of 6 microseconds.

Note 2: The D/U ratios in column B protect those DME/N or DME/P interrogators utilizing discrimination in conformance with 3.5.5.3.4.2 and 3.5.5.3.4.3 of Chapter 3, Annex 10, Volume I and providing a decoder rejection conforming to 3.5.5.3.5 of Chapter 3. Annex 10, Volume I

Note 3: Pu is the peak effective radiated power of the undesired signal in dBW.

Note 4: The frequency protection requirement is dependent upon the antenna patterns of the desired and undesired facility and the EIRP of the undesired facility.

Note 5: In assessing adjacent channel protection, the magnitude of D/U ratio in column A should not exceed the magnitude of the value in column B.

4.5.5.7 Separation requirement for DME reply frequencies which are separated by 63MHz. The channel assignment plan for DME is such that the transponder reply frequency for each Y channel is the same as the interrogation frequency of another DME channel. When the reply frequency of one DME matches the interrogation frequency of a second DME, a minimum separation distance of 15 NM (28km) between these (ground) facilities would be required, in general.

4.5.5.8 Table 4.16 to Table 4.18 present the co- and adjacent frequency separation distance between the edge of the DOC of the (desired) DME and the location of the (undesired) DME.

Table 4.16 Minimum separation distances between desired DME and undesired DME

ΔF (MHz)	D/U (dB)	Tx = 27 dBW		Tx = 30 dBW		Tx=37 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired DEM at 45000 ft
0	8	146	256	149	260	156	265	co-channel
1	8	112	3	112	3	112	3	first adjacent channel
63			15		15		15	

Table 4.17 Minimum separation distances between desired DME and undesired DME

ΔF (MHz)	D/U (dB)	Tx = 27 dBW		Tx = 30 dBW		Tx=37 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired DME at 25000 ft
0	8	146	197	149	200	156	204	co-channel
1	8	112	6	112	6	112	6	first adjacent channel
63			15		15		15	

Table 4.18 Minimum separation distances between desired DME and undesired DME

ΔF (MHz)	D/U (dB)	Tx = 27 dBW		Tx = 30 dBW		Tx=37 dBW		Remarks
		L (dB)	D (NM)	L (dB)	D (NM)	L (dB)	D (NM)	Desired DME at 10000 ft
0	8	146	131	149	133	156	137	co-channel
1	8	112	5	112	5	112	5	first adjacent channel
63			15		15		15	

Note1: The separation distances are between the edge of coverage for a desired DME and the location of an undesired DME. The EIRP of the undesired DME is as specified in column "Tx".

Note2: ITU-R aeronautical propagation curve for 1080 MHz and 5% of the time. The antenna height of the desired aircraft receiver is indicated in the "Remarks" column, and the antenna height of undesired DME is20 ft.

4.5.6 Sectorized DOC of the DME.

4.5.6.1 Similar to VOR (as described in section 4.3), the DME DOC may be sectorized (instead of circular). In this case, compatibility of the DME with other DME assignments needs to be assured at the critical point which is the closest point of the DOC of the desired DME (with sectorized DOC) and any potential interfering DME transponder.

4.5.7 Use of directional antenna.

4.5.7.1 When omnidirectional DOC is not required, the use of a DME with directional antenna is encouraged, subject to the proviso that the operational requirements for the service to be provided by this facility are met. In Particular, they are useful for the replacement of ILS marker beacons. The directional DME could provide a means to mitigate frequency congestion.

4.5.7.2 The compatibility of DMEs with directional antennas can be examined basically along the same lines as those developed for omnidirectional DME. However, because of the variable antenna gain of a DME with directional antenna, the value of the quantity K (EIRP of the desired minus the EIRP of the undesired facility) in the above formulas depends in general on the position of the airborne receiver. It is noted in particular that because of the orientation of a DME with directional antenna, the minimum D/U value is not necessarily attained along the direct line connecting desired and undesired facilities, as opposed to the case of compatibility between omnidirectional DME.

4.5.7.3 In the presence of at least one DME with directional antenna, the following method should be applied. At first an appropriate number of points is selected along the edge of the DOC of the desired DME, regardless of the type of its antenna. Subsequently at all such points the required D/U criteria are checked. Compatibility is ensured if at all such points the required D/U criteria are met.

4.6 Identifications of Radio Navigation Aids

4.6.1 Identifications of navigation aids shall be so composed, if possible, as to facilitate association with the name of the point in plain language. The Table 4.19 provides an overview of the requirements which have to be taken into account for identifications.

Table 4.19 The requirements have to be taken into account for identifications

Facility	Identification	Remarks
NDB and Locator	2 or 3 letters of the International Morse Code.	
ILS	2 or 3 letters of the International Morse Code which may be preceded by the letter I.	Transmitted by the localizer.
ILS/DME	ILS: 2 or 3 letters of the International Morse Code which may be preceded by the letter I. DME: Identical to associated ILS.	Associated DME identification signal.
VOR	2 or 3 letters of the International Morse Code.	
VOR/DME (VOR/TACAN also called VORTAC)	VOR: 2 or 3 letters of the International Morse Code. DME: Identical to associated VOR.	Associated DME identification signal.
DME (TACAN)	Letters and numerals of the International Morse Code.	Independent DME identification signal for stand-alone DME facility.
GBAS	4 characters (Only upper-case letters, numeric digits and IA-5 “space” are used. The rightmost character is transmitted first. For a three-character GBAS ID, the rightmost (first transmitted) character shall be IA-5 “space”.)	The GBAS ID is normally identical to the location indicator at the nearest aerodrome

4.6.2 The identification TST is reserved for radio navigation facilities on test and should not be used for other purposes.

4.6.3 Coded identification shall not be duplicated within 1 100 km (600 NM) of the location of the radio navigation aid concerned, except as noted hereunder.

Note: When two radio navigation aids operating in different bands of the frequency spectrum are situated at the same location, their radio identifications are normally the same.

4.6.4 States/Administrations’ requirements for identifications shall be notified to the Regional Offices for coordination.

Appendix A

TEMPLATE FOR AN EXCEL OR WORD FILE THAT CAN BE USED FOR ELECTRONIC SUBMISSION OF ONE (OR MORE) NEW OR MODIFIED FREQUENCY ASSIGNMENTS FOR NAV SYSTEMS TO THE REGIONAL OFFICE

Essential characteristics should to be included in the submission to the Regional Office:

Country	
Location	
Latitude	
Longitude	
Frequency	
Channel	
VHFDOC	
VHFPwr	
DMEDOC	
DMEPwr	
Cat	
Remarks	
TRD	

In the table, the following format should be used:

Country — Country name as per ICAO directory

Location — Name of the location of the NAV facility

Latitude — Latitude in the format xxDyy'zz'' (e.g. 32D44'55'')

Longitude — Longitude in the format xxxDyy'zz'' (e.g.054D55'56'')

Facility — Select one of the following facilities

- ILS
- ILS/DME
- VOR
- VOR/DME
- DME
- TACAN
- GBAS

Frequency — xxx.yyy (e.g. 109.200 or 113.450) [MHz]

A frequency can be proposed by a State or selected by the Regional Office and is subject to a compatibility assessment with or frequency assignments in the COM list 2

Channel — DME channel (e.g. 36X or 45Y)

VHFDOC — xxx/yyy e.g. 200/250 — xxx is the range of the coverage (e.g. 200 is 200 NM); yyy is the height (FL) of the coverage (e.g. 250 is FL 250 or 25000ft)

DMEDOC — xxx/yyy e.g. 200/250 — xxx is the range of the DME coverage (e.g. 200 is 200 NM); yyy is the height (FL) of the DME coverage (e.g. 250 is FL 250 or 25000ft)

Remarks — Optional, as provided by the State

Cat — Category; either ICAO or NAT

VHFPwr — As provided by the State

DMEPwr — As provided by the State

Note: The values for VHFPwr and DMEPwr are for the effective isotopically radiated power (e.i.r.p) of the relevant facility. In the absence of such information, the following values are assumed in the frequency assignment planning process:

ILS/Localizer	30 dBW	
ILS/DME	27 dBW (e.i.r.p for the associated DME)	
VOR	Range <50 NM	e.i.r.p 17 dBW
	Range 50 – 100 NM	e.i.r.p 20 dBW
	Range 100 – 150 NM	e.i.r.p 23 dBW
	Range > 150 NM	e.i.r.p 30 dBW
VOR/DME	Range <50 NM	e.i.r.p 27 dBW (landing DME)
	Range 150 -150 NM	e.i.r.p 30 dBW (terminal DME
	Rnage >150 NM	e.i.r.p 37 dBW (en route DME)
DME only	as for DME associated with VOR.	

Note: The e.i.r.p values for DME apply also for TACAN facilities

TRD Runway azimuth

Note: If no TRD, circler coverage assumed.

Appendix B

PREFERRED FORMAT OF THE CHARACTERISTICS OF SUBMISSIONS

Reference of submission:

Date:

Subject: Application for xx, at xx (location name)

Contact information of the civil aviation authority of States

Suggested basic information of a submission:

Function of the proposed assignments,

Details of the facility: VHF-COM, ILS, VOR, GBAS, DME,

Frequency Range (if request RO for proposal) or proposed frequency,

Transmit Power (EIRP) and DOC,

Latitude/Longitude:

Minimum information required with reference to the following screenshot:

Country, Location, Latitude/Longitudes, Service.

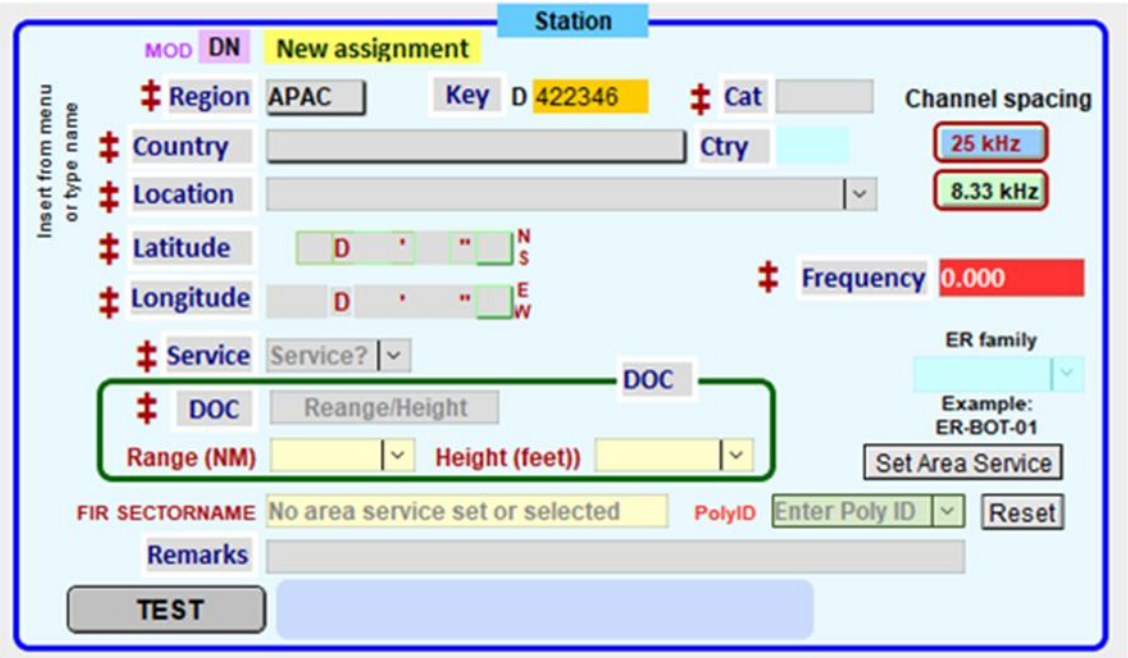


Fig. 1 VHF COM

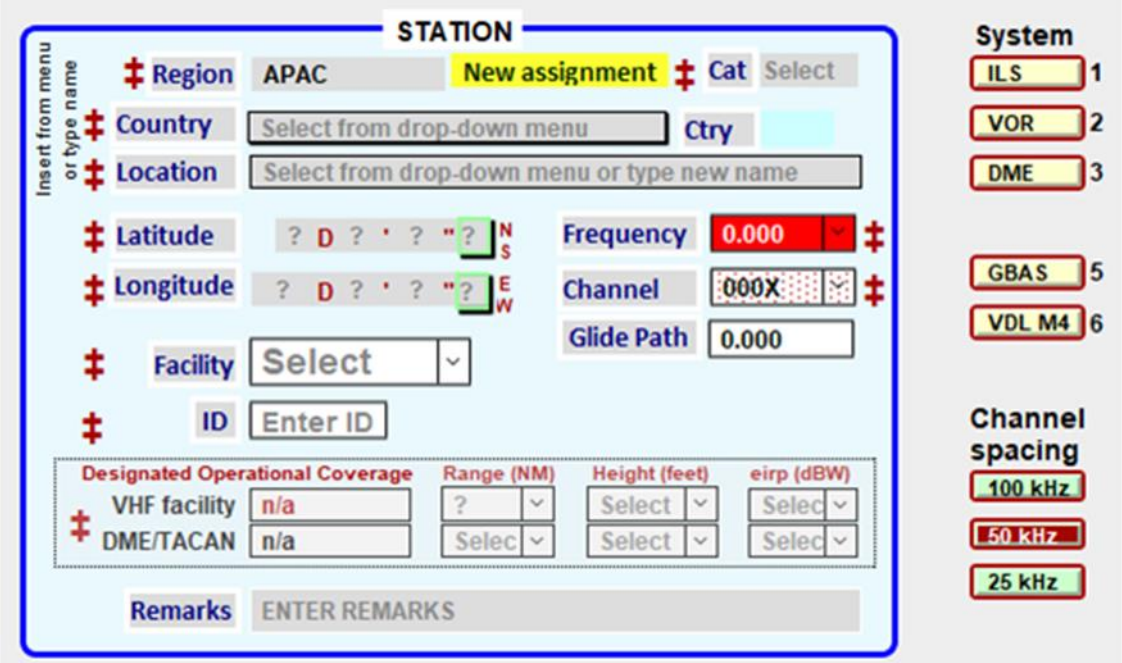
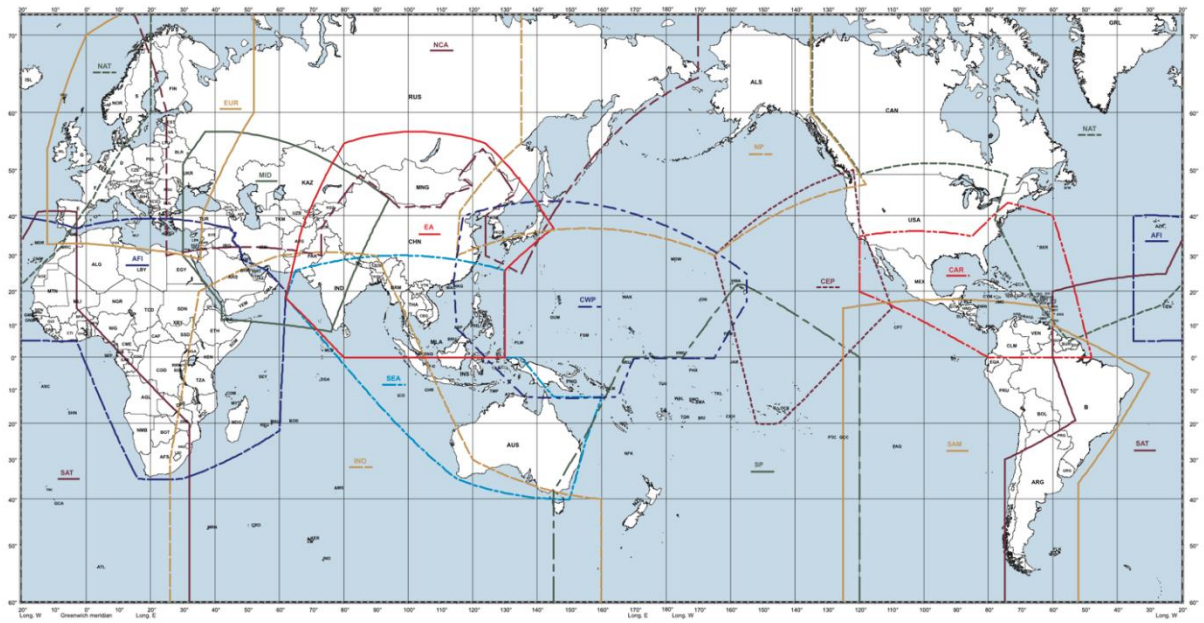

STATION
Insert from menu or type name
Region
APAC
New assignment
Cat
Select
Country
Select from drop-down menu
Ctry
Location
Select from drop-down menu or type new name
Latitude
? D ? ' ? " ?
N S
Longitude
? D ? ' ? " ?
E W
Frequency
0.000
Channel
000X
Glide Path
0.000
Facility
Select
ID
Enter ID
Designated Operational Coverage
Range (NM)
Height (feet)
eirp (dBW)
VHF facility
n/a
DME/TACAN
n/a
Remarks
ENTER REMARKS
System
ILS 1
VOR 2
DME 3
GBAS 5
VDL M4 6
Channel spacing
100 kHz
50 kHz
25 kHz

Fig. 2 VHF NAV

Appendix C

THE OVERVIEW OF THE AREA-BASED ARRANGEMENTS FOR HF ALLOTMENTS IN APAC REGION

1. A major world air route area (MWARA), in accordance to the RR Appendix 27/4, is an area embracing a certain number of Major World Air Routes, which generally follow the same traffic pattern and are so related geographically that the same frequency families may logically be applied. For further reference, the global boundaries of MWARA areas are presented in Part II of Appendix 27 to the ITU Radio Regulations. With regard to the Asia and Pacific region, the corresponding boundaries are illustrated in Fig. 3 below, for ease of understanding and regional context.



Notes:

AFI	AFRICA	NAT	NORTH ATLANTIC	The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by ITU. The map delineates the aeronautical areas only for the purpose of radiocommunications in the aeronautical mobile (R) service.	
CAR	CARIBBEAN	NCA	NORTH CENTRAL ASIA		
CEP	CENTRAL EAST PACIFIC	NP	NORTH PACIFIC		
CWP	CENTRAL WEST PACIFIC	SAM	SOUTH AMERICA		
EA	EAST ASIA	SAT	SOUTH ATLANTIC		
EUR	EUROPE	SEA	SOUTH EAST ASIA		
INO	INDIAN OCEAN	SP	SOUTH PACIFIC		
MID	MIDDLE EAST				

Fig. 3 Allotment area for MWARA in APAC Region

2. According to the ICAO Asia and Pacific (APAC) Regional Office, as indicated on page III-58 of the APAC eANP Volume II, the Table of HF frequencies and their ICAO network designators illustrates the existing sectorized sub-networks. These sub-networks may be utilized by States as a reference in determining HF frequency allocations for MWARA operations. The distribution of allocated frequency channels across the Asia-Pacific region is outlined as follows:

2.1. Major World Air Route Area – CENTRAL EAST PACIFIC (MWARA-CEP)

In accordance to the ITU RR Appendix 27/86, the boundary is described as follows:

From the point 50° N 122° W through the points 38° N 120° W, 15° N 110° W, 20° S 145° W, 20° S 152° W, 30° N 165° W, to the point 50° N 122° W.

List of frequencies based on ITU RR Appendix 27/213:

2 869 kHz	3 413 kHz	4 657 kHz	5 547 kHz
5 574 kHz	6 673 kHz	8 843 kHz	10 057 kHz
11 282 kHz	13 300 kHz	17 904 kHz	

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

CEP-1	3 413	4 657	5 574	8 843
	10 057	13 354	17 904	
CEP-2	2 869	4 657	5 547	6 673
	11 282	13 288	17 904	

Location Indicator and Name of Location		HF en-route family
PHZH	Honolulu	CEP

2.2. Major World Air Route Area – CENTRAL WEST PACIFIC (MWARA-CWP)

In accordance to the ITU RR Appendix **27**/87, the boundary is described as follows:

From the point 40° N 117° E through the points 25° N 155° W, 17° N 155° W, 00° 165° W, 00° 170° E, 12° S 165° E, 12° S 136° E, 09° N 115° E, 23° N 114° E, to the point 40° N 117° E.

List of frequencies based on ITU RR Appendix **27**/213:

2 998 kHz	3 455 kHz	4 666 kHz	5 652 kHz
5 661 kHz	6 532 kHz	6 562 kHz	8 903 kHz
10 081 kHz	11 384 kHz	13 300 kHz	17 904 kHz

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

CWP-1	3 455	6 532	8 903	10 081
	13 300	17 904		
CWP-2	2 998	4 666	8 903	10 081
	11 384	13 300	17 904	

Location Indicator and Name of Location		HF en-route family
ZSHA	Shanghai	CWP
RCSS	Taibei	CWP
VHHK	Hong Kong	CWP
ZKKK	Pyongyang	CWP
RORG	Naha	CWP
RJDG	Fukuoka	CWP
RJTG	Tokyo	CWP
ANAU	Nauru	CWP
AYPY	Port Moresby	CWP
RPHI	Manila	CWP
RKRR	Incheon	CWP
PHZH	Honolulu	CWP

2.3. Major World Air Route Area – INDIAN OCEAN (MWARA-INO)

In accordance to the ITU RR Appendix 27/89, the boundary is described as follows:

From the South Pole through the points 30° S 26° E, 20° N 35° E, 30° N 60° E, 30° N 90° E, 30° S 120° E, 40° S 160° E to the South Pole.

List of frequencies based on ITU RR Appendix 27/213:

3 476 kHz	5 634 kHz	8 879 kHz	13 306 kHz
17 961 kHz			

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

INO-1	3 476	5 634	8 879	13 306
	17 961			

Location Indicator and Name of Location		HF en-route family
YPPM	Perth	INO1
VABF	Mumbai (FIC)	INO
VCCC	Colombo	INO

2.4. Major World Air Route Area – MIDDLE EAST (MWARA-MID)

In accordance to the ITU RR Appendix 27/90, the boundary is described as follows:

From the point 51° N 30° E through the points 57° N 37° E, 50° N 80° E, 44° N 94° E, 08° N 76° E, 11° 45′ N 42° E, 16° N 42° E, 30° N 30° E, to the point 51° N 30° E.

List of frequencies based on ITU RR Appendix 27/213:

2 944 kHz	2 992 kHz	3 467 kHz	3 473 kHz
4 669 kHz	5 658 kHz	5 667 kHz	6 625 kHz
6 631 kHz	8 918 kHz	8 951 kHz	10 018 kHz
11 375 kHz	13 288 kHz	13 312 kHz	17 961 kHz

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

MID-2	3 467	5 658	10 018	13 288

Location Indicator and Name of Location		HF en-route family
OAKB	Kabul	MID 2
ZWUQ	Urumqi	MID 2
VIDF	Delhi	MID 2
VABF	Mumbai (FIC)	MID 2
VNSM	Kathmandu	MID 2
OPKR	Karachi	MID 2
OPLR	Lahore	MID 2

2.5. Major World Air Route Area – NORTH CENTRAL ASIA (MWARA-NCA)

In accordance to the ITU RR Appendix 27/92, the boundary is described as follows:

From the North Pole through the points 75° N 10° E, 60° N 25° E, 30° N 25° E, 30° N 73° E, 37° N 73° E, 49° N 85° E, 42° N 97° E, 42° N 110° E, 45° N 113° E, 46° 30′ N 120° E, 49° N 116° E, 54° N 123° E, 45° N 133° E, 40° N 124° E, 30° N 124° E, 25° N 135° E, 65° N 170° W, to the North Pole.

List of frequencies based on ITU RR 27/213:

3 004 kHz	3 019 kHz	4 678 kHz	5 646 kHz
5 664 kHz	6 592 kHz	10 096 kHz	13 303 kHz
13 315 kHz	17 958 kHz		

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

NCA-3	3 004	5 664	10 039	13 303
	17 958			

Location Indicator and Name of Location		HF en-route family
ZKKK	Pyongyang	NCA 3
ZMUB	Ulaan Baatar	NCA 3
RKRR	Incheon	NCA 3

2.6. Major World Air Route Area – NORTH PACIFIC (MWARA-NP)

In accordance to the ITU RR 27/93, the boundary is described as follows:

From the North Pole through the points 60° N 135° W, 47° N 118° W, 30° N 165° W, 30° N 115° E, 41° N 116° E, 55° N 135° E to the North Pole.

List of frequencies based on ITU RR Appendix 27/213:

2 932 kHz	5 628 kHz	6 655 kHz	6 661 kHz
10 048 kHz	11 330 kHz	13 300 kHz	17 904 kHz

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

NP	2 932	6 655	8 951	10 048
	11 330	13 273	17 904	

Location Indicator and Name of Location		HF en-route family
ZBPE	Beijing	NP
ZSHA	Shanghai	NP
RJDG	Fukuoka	NP
RJTG	Tokyo	NP
PHZH	Honolulu	NP

2.7. Major World Air Route Area – SOUTH EAST ASIA (MWARA-SEA)

In accordance to the ITU RR Appendix **27**/97, the boundary is described as follows:

From the point 26° N 130° E, through the points 00° 130° E, 00° 135° E, 12° S 145° E, 12° S 160° E, 25° S 155° E, 40° S 150° E, 35° S 115° E, 18° N 62° E, 26° N 65° E, to the point 26° N 130° E.

List of frequencies based on ITU RR **27**/213:

3 470 kHz	3 485 kHz	5 649 kHz	5 655 kHz
6 556 kHz	8 942 kHz	10 066 kHz	11 396 kHz
13 309 kHz	13 318 kHz	17 907 kHz	

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

SEA-1A	3 491	6 556	10 066	
SEA-1B	3 470	5 670	11 285	13 318
	17 907			
SEA-2	3 485	5 649	5 655	8 942
	11 297	11 396	13 306	17 907
SEA-3	3 470	6 556	11 396	13 318
	17 907			

Location Indicator and Name of Location		HF en-route family
YPXM	Chistmas Is	SEA

YPDN YPPN	Darwin Perth	SEA SEA 3
VGHS	Dhaka	SEA 1A
VGFR	PARO/Paro	SEA 1A
VDPP	Phnom-Penh	SEA 2
ZGZU ZPKM ZGSY	Guangzhou Kunming Sanya	SEA 1A SEA 1A SEA
VHHK	Hong Kong	SEA 2
VOMF VECF	Chennai Kolkata	SEA 1B SEA 1A
WADZ WIIZ WIMZ WAAZ	Bali Jakarta Medan Ujungpandang	SEA 3 SEA 3 SEA 1B SEA 3
VLVT	Vientiane	SEA 2
WBFC WMFC	Johor Bahru Kuala Lumpur	SEA 1 SEA 1B, SEA 2
VYYY	Yangon	SEA 1A
VNSM	Kathmandu	SEA 1A
RPHI	Manila	SEA 2
WSJC	Singapore	SEA 2, SEA 3
VCCC	Colombo	SEA 1B
VVNB VVTS	Ha Noi Hi Chi Minh	SEA 2 SEA 2

2.8. Major World Air Route Area – SOUTH PACIFIC (MWARA-SP)

In accordance to the ITU RR Appendix 27/98, the boundary is described as follows:

From the South Pole through the points 38° S 145° E, 00° 167° E, 00° 175° W, 22° N 158° W, 22° N 156° W, 00° 120° W to the South Pole.

List of frequencies based on ITU RR **27/213**:

3 467 kHz	5 559 kHz	5 643 kHz	8 867 kHz
10 084 kHz	11 327 kHz	13 300 kHz	17 904 kHz

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

SP	3 476	5 559	5 643	8 867
	8 879	13 261	17 904	

Location Indicator and Name of Location		HF en-route family
NCRG NFFN	Avarua/Rorotonga Nadi	SP SP
NTTT	Tahiti	SP
NGTA	Tarawa/Bonriki Int'l.	SP
NZZP	Auckland	SP
NSFA	Faleolo	SP
NFTF	Fua'amotu Int'l.	SP
NGFU	Funafuti Int'l.	SP
PHZH	Honolulu	SP

2.9. Major World Air Route Area – EAST ASIA (MWARA-EA)

In accordance to the ITU RR Appendix 27/99, the boundary is described as follows:

From the point 55° N 124° E through the points 37° N 145° E, 26° N 130° E, 00° 130° E, 00° 80° E, 18° N 62° E, 37° N 67° E, 55° N 80° E to the point 55° N 124° E.

List of frequencies based on ITU RR Appendix 27/213:

3 016 kHz	3 485 kHz	3 491 kHz	5 655 kHz

5 670 kHz	6 571 kHz	8 897 kHz	10 042 kHz
11 396 kHz	13 297 kHz	13 303 kHz	13 309 kHz
17 907 kHz			

Furthermore, the HF allocations derived from the APAC eANP Volume II are distributed across this Sub-Area as follows:

EA-1	3 016	6 571	8 897	10 042
	13 297			
EA-2	3 485	5 655	11 396	13 309
	17 907			

Location Indicator and Name of Location		HF en-route family
ZBPE	Beijing	EA 1
ZGZU	Guangzhou	EA 1
ZPKM	Kunming	EA 1
ZGSY	Sanya	EA
ZSHA	Shanghai	EA 1
ZYSH	Shenyang	EA 1
ZWUQ	Urumqi	EA 1
ZKKK	Pyongyang	EA 1, EA 2
ZMUB	Ulaan Baatar	EA 1, EA 2

3. A Regional and Domestic Air Route Area (RDARA), in accordance to the RR Appendix 27/6, is defined as an area encompassing a number of air routes. Regional and Domestic Air Routes are those utilizing the Aeronautical Mobile (R) Service that do not fall under the definition of a Major World Air Route, which refers to long-distance routes of an essentially international nature, extending through more than one country and requiring long-range communication facilities.

4. The description of the boundaries of the RDARAs can be found in Article 2 of Appendix 27 to the ITU Radio Regulations. For ease of understanding and to provide regional context, the RDARA boundaries applicable to the Asia and Pacific region are illustrated in Fig. 4 below.

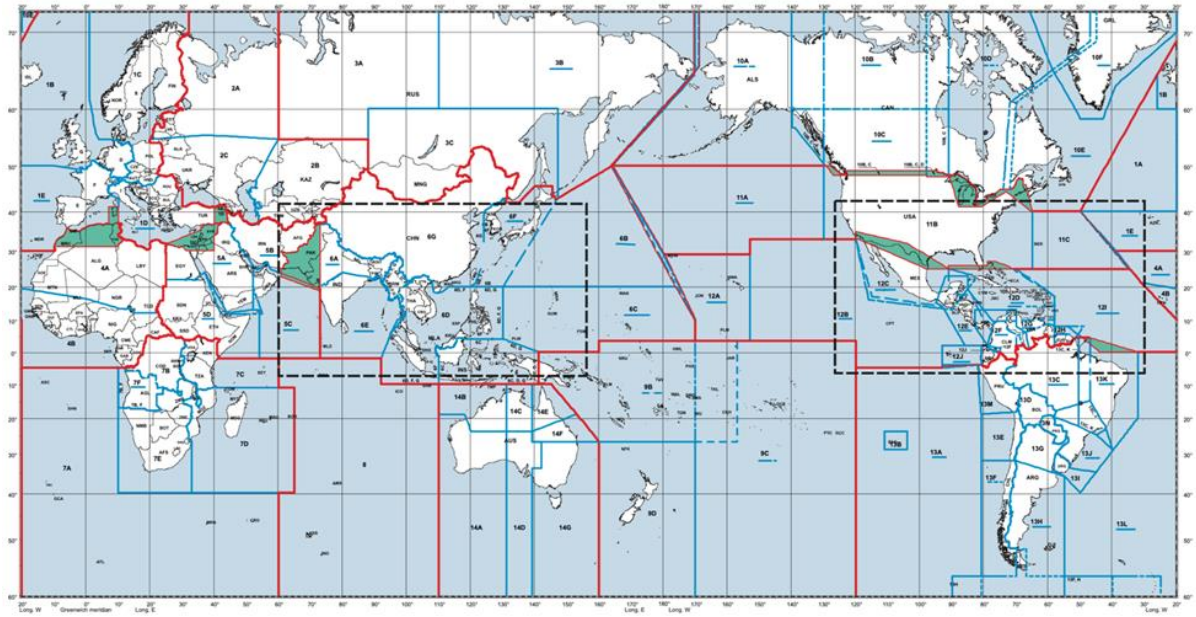


Fig. 4 Allotment area for RDARA in APAC Region

5. The specific allocations of frequency channels for each area of RDARA are determined as follows:

5.1. Sub-Area 3C

In Accordance to the ITU RR Appendix 27/113, the boundary is described as follows:

From the point 60° N 88° E to the intersection of Mongolia-China-the Russian Federation borders at approximately 49° N 88° E. Along the borders between Mongolia and China, and the Russian Federation and China, to the coast. Between the territorial waters of the Russian Federation and Japan to the point 43° N 147° E. Then through the point 60° N 147° E to the point 60° N 88° E.

List of frequencies based on ITU RR Appendix 27/213:

2851 kHz	2860 kHz	2866* kHz	2878 kHz
2905 kHz	2950 kHz	2974 kHz	2980 kHz
2986 kHz	3404 kHz	3410 kHz	3419 kHz
3425 kHz	3452 kHz	4684 kHz	5484 kHz
5514 kHz	5562 kHz	5568 kHz	5586 kHz
5637 kHz	5643 kHz	6550 kHz	6556 kHz
6595 kHz	6658 kHz	6664 kHz	6670 kHz
8837 kHz	8852 kHz	8894 kHz	8915 kHz
10039 kHz	11291 kHz	11303 kHz	11324 kHz
11378 kHz			

From the frequency list of Sub-area 3C above, there is a remark on one frequency, which may be interpreted as follows:

i. C001/3C: Restricted to daytime only, in the sub-area 3C.
List of frequencies based on ITU RR 27/218:

2866* kHz

5.2. Sub-Area 5B

In Accordance to the ITU RR Appendix 27/119, the boundary is described as follows:

Fom the point 41° N 40° E to 37° N 40° E. Thence east along the borders between Türkiye and Syrian Arab Republic and Türkiye and Iraq, and along the border between Iraq and the Islamic Republic of Iran to the point 30° N 49° E. Thence along the middle of the Gulf through the points 26° N 52° E and 24° N 60° E, to Mumbai. Then to 37° N 73° E. Then east along the border between Afghanistan and Pakistan, then west along the northern borders of Afghanistan and the Islamic Republic of Iran, to the Caspian Sea. Then along the northern border of the Islamic Republic of Iran and Türkiye to close the sub-area at 41° N 40° E.

List of frequencies based on ITU RR Appendix 27/213:

2911 kHz	2968 kHz	3431 kHz	3488 kHz
5577 kHz	5583 kHz	6544 kHz	6664 kHz
8822 kHz	8915 kHz	11288 kHz	

5.3. Sub-Area 5C

In Accordance to the ITU RR Appendix 27/120, the boundary is described as follows:

From the point 26° N 52° E, and through the points 13° N 52° E, 13° N 54° E, 02° S 54° E, 02° S 73° E, to Mumbai. Then to 24° N 60° E. Then along the middle of the Gulf to 26° N 52° E.

List of frequencies based on ITU RR Appendix 27/213:

2905 kHz	3452 kHz	5583 kHz	6544 kHz
8822 kHz			

5.4. RDARA-6

In Accordance to the ITU RR Appendix 27/122, the boundary is described as follows:

From approximately 49° N 88° E, eastward along the border between China and the following countries: the Russian Federation, Kazakhstan, Kyrgyzstan, Tajikistan and Afghanistan. Then along the border between Afghanistan and Pakistan, and the Islamic Republic of Iran and Pakistan to the point 23° N 61° E. Thence to Mumbai. Then along the 73° E meridian to the point 02° S 73° E, and through the points 02° S 92° E, 10° S 92° E, 10° S 141° E, 00° 141° E, 00° 160° E, 03° 30′ N 160° E, 03° 30′ N 170° W, 10° N 170° W, 50° N 164° E, to the point 43° N 147° E. Thence west between the territorial waters of Japan and the Russian Federation and along the north-eastern and northern border of China to approximately 49° N 88° E.

List of frequencies based on ITU RR Appendix 27/213:

8 840 kHz	11 381 kHz	13 291 kHz	17 943 kHz

5.5. Sub-Area 6A

In accordance to the ITU RR Appendix 27/123, the boundary is described as follows:

From the point 37° N 75° E, along the border between Pakistan and Afghanistan, and the Islamic Republic of Iran and Pakistan to the point 23° N 61° E. Thence to Mumbai. From Mumbai to 24° N 80° E. Thence to Calcutta. Thence along the coast of Bangladesh and Myanmar to reach the border between Myanmar and Thailand. North along this border and that between Myanmar and Lao (P.D.R.). Thence along the border between China and Myanmar. Thence westward along the southern border of China to the point 37° N 75° E.

List of frequencies based on ITU RR Appendix 27/213:

2872 kHz	2923 kHz	2947 kHz	3001 kHz
3479 kHz	4657* kHz	4675 kHz	5484 kHz
5580 kHz	5601 kHz	6607 kHz	6613 kHz
6658 kHz	8891 kHz	8906 kHz	8948 kHz
10006 kHz	10051 kHz	10081* kHz	11321 kHz
11357 kHz			

From the frequency list of Sub-area 6A above, there are a remarks on two frequencies, which may be interpreted as follows:

i. C001/6A: Restricted to daytime only, in the area 6A.
List of frequencies based on ITU RR Appendix **27**/218:

4657* kHz

ii. C006/6A: Use limited to east of 75° E.
List of frequency based on ITU RR Appendix **27**/218:

10081* kHz

5.6. Sub-Area 6B

In accordance to the ITU RR Appendix 27/124, the boundary is described as follows:

From the point 39° 49′ 41″ N 124° 10′ 06″ E, through the points 39° 31′ 51″ N 124° 06′ 31″ E, 39° N 124° E to the point 32° 30′ N 124° E. Between the point 32° 30′ N 124° E and the point 25° N 123° E, the limit of this Sub-Area is undefined. From the point 25° N 123° E, through the points 21° N 121° 30′ E, 20° N 120° E, 20° N 176° W, 50° N 164° E, 43° N 147° E, thence west between the territorial waters of Japan and the Russian Federation and along the border between the Dem. People's Rep. of Korea and the Russian Federation, and then the border between China and the Dem. People's Rep. of Korea, to the point 39° 49′ 41″ N 124° 10′ 06″ E.

List of frequencies based on ITU RR Appendix 27/213:

2857 kHz	2920 kHz	3479 kHz	3488 kHz
5502 kHz	5595 kHz	5625 kHz	6607 kHz
6613 kHz	6619 kHz	8864 kHz	8885 kHz
10021 kHz	10093 kHz	11339 kHz	11366 kHz
17955 kHz			

5.7. Sub-Area 6C

In accordance to the ITU RR Appendix **27**/125, the boundary is described as follows:

From the point 20° N 130° E through the point 04° N 130° E to 04° N 118° E. Thence along the southern borders of Sabah and Sarawak to the coast and then southward along the west coast of Borneo to the 110° E meridian. Thence along 110° E meridian to the point 10° S 110° E. Thence through the points 10° S 141° E, 00° 141° E, 00° 160° E, 03° 30′ N 160° E, 03° 30′ N 170° W, 10° N 170° W, 20° N 176° W to 20° N 130° E.

List of frequencies based on ITU RR Appendix **27**/213:

2 881 kHz	2 956 kHz	3 473 kHz	4 651 kHz
5 550 kHz	5 580 kHz	6 544 kHz	6 631 kHz
8 834 kHz	8 918 kHz	10 015 kHz	

5.8. Sub-Area 6D

In accordance to the ITU RR Appendix **27**/126, the boundary is described as follows:

From the junction of the borders of China, India and Myanmar, south along the India-Myanmar and Bangladesh-Myanmar borders to the Bay of Bengal. Along the coast of Myanmar to its southernmost point, then to Weh Island (off the north coast of Sumatra). Then to the point 02° S 92° E, and through the point 10° S 92° E to 10° S 110° E. Then eastward to 10° S 141° E extending northward to 00° 141° E and then to 04° N 130° E through the point 20° N 130° E to 20° N 113° E. Thence, south around the Island of Hainan, and along the border between China, Viet Nam, the Lao (P.D.R.) and Myanmar, to close the Sub-Area at the junction of the borders of China, India and Myanmar.

List of frequencies based on ITU RR Appendix **27**/213:

2 866 kHz	2 884 kHz	3 416 kHz	5 490 kHz
5 520 kHz	5 568 kHz	5 574 kHz	5 631 kHz
5 631 kHz	6 550 kHz	6 568 kHz	6 577 kHz
6 595 kHz	8 882 kHz	8 957 kHz	11 309 kHz
11 372 kHz			

5.9. Sub-Area 6E

In accordance to the ITU RR Appendix **27**/127, the boundary is described as follows:

From the point 20° N 73° E, and through the points 02° S 73° E, 02° S 92° E, through Weh Island (off the north coast of Sumatra) to 10° N 97° E. Thence along the coasts of Myanmar, Bangladesh and India to Calcutta. Then through the points 24° N 80° E to 20° N 73° E.

List of frequencies based on ITU RR Appendix **27**/213:

2854 kHz	2872 kHz	2917 kHz	3001 kHz
3443 kHz	4657* kHz	4675 kHz	5514 kHz
5526 kHz	5550 kHz	6583 kHz	6655 kHz
6661 kHz	8861* kHz	8906 kHz	8909 kHz
10036 kHz	10051 kHz	10084 kHz	11357 kHz
11363 kHz			

From the frequency list of Sub-area 6E above, there are a remarks on two frequencies, which may be interpreted as follows:

i. C001/6E: Restricted to daytime only, in the area 6E.
List of frequencies based on ITU RR Appendix **27**/218:

4657* kHz

ii. C011/6E: In area 6E, use is limited to south of 20° N.
List of frequencies based on ITU RR **27**/218:

8861* kHz

5.10. Sub-Area 6F

In accordance to the ITU RR Appendix **27**/128, the boundary is described as follows:

From the point 25° N 123° E, 21° N 121° 30′ E, 20° N 120° E, 20° N 113° E, thence south around the Island of Hainan and along China-Viet Nam, China-Lao (P.D.R.) and China-Myanmar borders to the junction of the borders of China, India and Myanmar, south along the India-Myanmar and Bangladesh-Myanmar borders to the Bay of Bengal. Along the coast of Myanmar to its southernmost point then to Weh Island (off the north coast of Sumatra). Then to the point 02° S 92° E and through the point 10° S 92° E to 10° S 110° E. Then northward along 110° E meridian, thence along the boundary of Sub-Area 6C to the points 20° N 130° E, 43° N 147° E, thence westward between the territorial waters of Japan and the Russian Federation and along the border between the Dem. People's Rep. of Korea and the Russian Federation, then the border between China and the Dem. People's Rep. of Korea, to the points 39° 49′ 41″ N 124° 10′ 06″ E, 39° 31′ 51″ N 124° 06′ 31″ E, 39° N 124° E, then to the point 32° 30′ N 124° E.

Between the points 32° 30′ N 124° E and 25° N 123° E, the limit of this Sub-Area is undefined.

List of frequencies based on ITU RR Appendix **27**/213:

2 926 kHz	2 941 kHz	3 434 kHz	3 440 kHz
5 496 kHz	5 508 kHz	6 526 kHz	6 667 kHz
8 864 kHz	8 939 kHz	10 060 kHz	11 279 kHz
11 366 kHz			

5.11. Sub-Area 6G

In accordance to the ITU RR Appendix **27**/129, the boundary is described as follows:

From the point 32° 30′ N 124° E northward to 39° N 124° E, 39° 31′ 51″ N 124° 06′ 31″ E then to 39° 49′ 41″ N 124° 10′ 06″ E on the border between China and the Dem. People's Rep. of Korea. Then along the border of China to the junction of the border with India and Myanmar. Thence southward along the India-Myanmar and Bangladesh-Myanmar borders to the Bay of Bengal. Along the coast of Myanmar to its southernmost point. Then to Weh Island (off the north coast of Sumatra). Then to the point 02° S 92° E and through the point 10° S 92° E to 10° S 110° E. Then eastward to 10° S 141° E extending northward to 00° 141° E and then to 04° N 130° E through the point 20° N 130° E to 20° N 120° 40′ E. Thence northward to the points 21° N 121° 30′ E and 25° N 123° E.

Between the points 25° N 123° E and the point 32° 30′ N 124° E, the limit of this Sub-Area is undefined.

List of frequencies based on ITU RR Appendix **27**/213:

2 869* kHz	2 875* kHz	2 890 kHz	2 896* kHz
2 899 kHz	2 902* kHz	2 911* kHz	2 917* kHz
2 938 kHz	2 953 kHz	2 962 kHz	2 968* kHz
2 971 kHz	2 977 kHz	2 983 kHz	2 989 kHz
2 995 kHz	3 413* kHz	3 422* kHz	3 431* kHz
3 437 kHz	3 446 kHz	3 449* kHz	3 464 kHz
3 482 kHz	4 651* kHz	4 663* kHz	4 669* kHz
4 672* kHz	4 690* kHz	4 696* kHz	5 481 kHz
5 487 kHz	5 493* kHz	5 499* kHz	5 505* kHz
5 511* kHz	5 517* kHz	5 523 kHz	5 547 kHz
5 553 kHz	5 559 kHz	5 565 kHz	5 571 kHz
5 577 kHz	5 583 kHz	5 592 kHz	5 598 kHz
5 604 kHz	5 610 kHz	5 616 kHz	5 622 kHz
5 628* kHz	5 634* kHz	5 640* kHz	6 529 kHz
6 535 kHz	6 541 kHz	6 547 kHz	6 553 kHz
6 559 kHz	6 565 kHz	6 574 kHz	6 580 kHz
6 586 kHz	6 598 kHz	6 604 kHz	6 610 kHz
6 616 kHz	6 622 kHz	6 628 kHz	6 634 kHz
6 649 kHz	6 652 kHz	6 673 kHz	6 682 kHz
8 816 kHz	8 825 kHz	8 831 kHz	8 843 kHz
8 858 kHz	8 867 kHz	8 870* kHz	8 873 kHz
8 888* kHz	8 912* kHz	8 960 kHz	10 018* kHz
10 054* kHz	10 063* kHz	11 276* kHz	11 282* kHz
11 288 kHz	11 294* kHz	11 300* kHz	11 306 kHz
11 315 kHz	11 369 kHz	13 270 kHz	13 276 kHz
17 913 kHz			

From the frequency list of Sub-area 6G above, there are remarks on 35 frequencies, which may be interpreted as follows:

i. C001/6G**:** Restricted to daytime only, in the area 6G.
List of frequencies based on ITU RR Appendix **27**/213**:**

3 422* kHz	3 449* kHz	4 651* kHz	4 663* kHz
4 669* kHz	4 672* kHz	4 690* kHz	4 696* kHz

ii. C002/6G: In area 6G, operation is restricted to east of 95° E.
List of frequencies based on ITU RR Appendix 27/213**:**

5 493* kHz	5 499* kHz	5 511* kHz
5 517* kHz	5 634* kHz	5 640* kHz
11 276* kHz	11 294* kHz	11 300* kHz

iii. C004/6G: Use limited to east of 110° E.
List of frequencies based on ITU RR Appendix **27**/218**:**

3 422* kHz	3 449* kHz	8 870* kHz	8 912* kHz
10 054* kHz	10 063* kHz		

iv. C009/6G: In area 6G, use limited to east of 110° E and south of 25° N.
List of frequencies based on ITU RR Appendix **27**/218**:**

2 869* kHz	2 875* kHz	2 896* kHz	2 902* kHz
2 968* kHz	3 413* kHz	3 431* kHz	8 888* kHz

5.12. RDARA-9

In accordance to the ITU RR Appendix **27**/138, the boundary is described as follows:

From the South Pole along the 160° E meridian to 27° S. Then through the points 19° S 153° E, 10° S 145° E, 10° S 141° E, 00° 141° E, 00° 160° E, 03° 30′ N 160° E, 03° 30′ N 120° W. Then along the 120° W meridian to the South Pole.

List of frequencies based on ITU RR Appendix **27**/213:

4 696 kHz	5 583 kHz	6 553 kHz	8 846 kHz
8 852 kHz	10 018 kHz	11 339 kHz	

5.13. Sub-Area 9B

In accordance to the ITU RR Appendix **27**/139, the boundary is described as follows:

From the point 00° 141° E through points 10° S 141° E, 10° S 145° E, 27° S 160° E, 27° S 157° W, 03° 30′ N 157° W, 03° 30′ N 160° E, 00° 160° E to the point 00° 141° E.

List of frequencies based on ITU RR Appendix **27**/213:

2 860 kHz	2 905 kHz	2 929* kHz	3 401* kHz
3 419 kHz	3 425 kHz	3 476* kHz	4 660 kHz
5 484 kHz	5 508 kHz	5 523 kHz	5 565 kHz
6 538 kHz	6 547 kHz	6 598 kHz	6 622 kHz
8 819 kHz	8 837 kHz	8 861 kHz	8 906 kHz
10 009 kHz	10 024 kHz	10 039 kHz	11 393 kHz

From the frequency list of Sub-area 9B above, there are a remarks on 3 frequencies, which may be interpreted as follows:

i. C001/9B: Restricted to daytime only, in the area 9B.
List of frequencies based on ITU RR **27**/218**:**

2 929* kHz	3 401* kHz	3 476* kHz

5.14. Sub-Area 9C

In accordance to the ITU RR Appendix **27**/140, the boundary is described as follows:

From the South Pole along the 170° W meridian to 03° 30' N. Then through the point 03° 30' N 120° W and along the 120° W meridian to the South Pole.

List of frequencies based on ITU RR Appendix **27**/213:

2851 kHz	3404 kHz	3461 kHz	4675 kHz
5481 kHz	6580 kHz	8873 kHz	10042 kHz
11279 kHz	11312 kHz		

5.15. Sub-Area 9D

In accordance to the ITU RR Appendix **27**/141, the boundary is described as follows:

From the South Pole along the 160° E meridian to 27° S. Then through the point 27° S 170° W and along the 170° W meridian to the South Pole.

List of frequencies based on ITU RR **27**/213:

3016 kHz	3404 kHz	5592 kHz	6535 kHz
8873 kHz	11312 kHz		

5.16. RDARA-14

In accordance to the ITU RR Appendix **27**/179, the boundary is described as follows:

From the South Pole along the 110° E meridian to 10° S. Then through the points 10° S 145° E, 19° S 153° E, 27° S 160° E. Then along the 160° E meridian to the South Pole.

List of frequencies based on ITU RR Appendix **27**/213:

2851 kHz	2878 kHz	3446 kHz	3461 kHz
3479 kHz	5526 kHz	5604 kHz	6580 kHz
6628 kHz	8822 kHz	8855 kHz	8870 kHz
10045 kHz	10087 kHz	11360 kHz	13264 kHz
17946 kHz			

5.17. Sub-Area 14A

In accordance to the ITU RR Appendix **27**/180, the boundary is described as follows:

From the South Pole along the 110° E meridian to 19° S. Then through the points 19° S 118° E, 24° S 120° E, 24° S 131° E. Then along the 131° E meridian to the South Pole.

List of frequencies based on ITU RR Appendix **27**/213:

2950 kHz	3413 kHz	4678* kHz	6547 kHz
6553 kHz	8816 kHz	8894 kHz	

From the frequency list of Sub-area 14A above, there is a remarks on one frequency, which may be interpreted as follows:

i. C001/14A: Restricted to daytime only, in the sub-area 14A.
List of frequencies based on ITU RR **27**/218**:**

4678* kHz

5.18. Sub-Area 14B

In Accordance to the ITU RR Appendix **27**/181, the boundary is described as follows:

From the point 19° S 110° E to the point 10° S 110° E, thence through 10° S 131° E, 24° S 131° E, 24° S 120° E, 19° S 118° E to the point 19° S 110° E.

List of frequencies based on ITU RR Appendix **27**/213:

3488 kHz	4684* kHz	6535 kHz	6604 kHz
6673 kHz	8900 kHz	8954 kHz	

From the frequency list of Sub-area 14B above, there's a remarks on one frequency, which may be interpreted as follows:

i. C001/14B: Restricted to daytime only, in the area 14B.
List of frequencies based on ITU RR Appendix **27**/218**:**

4684* kHz

5.19. Sub-Area 14C

In accordance to the ITU RR Appendix **27**/182, the boundary is described as follows:

From the point 24° S 131° E to the point 10° S 131° E, thence through 10° S 139° E, 24° S 139° E to the point 24° S 131° E.

List of frequencies based on ITU RR Appendix **27**/213:

2887 kHz	3452 kHz	4684* kHz	6541 kHz
6586 kHz	8885 kHz	8912 kHz	

From the frequency list of Sub-area 14C above, there is a remarks on one frequency, which may be interpreted as follows:

i. C001/14B: Restricted to daytime only, in the area 6G.
List of frequencies based on ITU RR Appendix **27**/218**:**

4684* kHz

5.20. Sub-Area 14D

In accordance to the ITU RR Appendix **27**/183, the boundary is described as follows:

From the South Pole along the 131° E meridian to 24° S, then through the points 24° S 139° E, 27° S 139° E, 27° S 142° E, 34° S 142° E, 34° S 139° E. Then along the 139° E meridian to the South Pole.

List of frequencies based on ITU RR Appendix **27**/213:

2950 kHz	3407 kHz	4693* kHz	5481 kHz
6559 kHz	6574 kHz	8843 kHz	8858 kHz

From the frequency list of Sub-area 14D above, there is a remark on one frequency, which may be interpreted as follows:

i. C001/14D: Restricted to daytime only, in the area 14D.
List of frequencies based on ITU RR Appendix **27**/218**:**

4693* kHz

5.21. Sub-Area 14E

In accordance to the ITU RR Appendix **27**/184, the boundary is described as follows:

From the point 24° S 139° E along the 139° E meridian to 10° S, then through the points 10° S 145° E, 19° S 153° E to the point 24° S 139° E.

List of frequencies based on ITU RR Appendix **27**/213:

3413 kHz	6565 kHz	6616 kHz	8891 kHz

8945 kHz			

5.22. Sub-Area 14F

In accordance to the ITU RR Appendix 27/185, , the boundary is described as follows:

From the point 27° S 139° E along the 139° E meridian to 24° S, then through the points 19° S 153° E, 27° S 160° E to the point 27° S 139° E.

List of frequencies based on ITU RR Appendix **27**/213:

3 488 kHz	6 526 kHz	6 610 kHz	8 825 kHz
8 831 kHz			

5.23. Sub-Area 14G

In accordance to the ITU RR Appendix **27**/186, the boundary is described as follows:

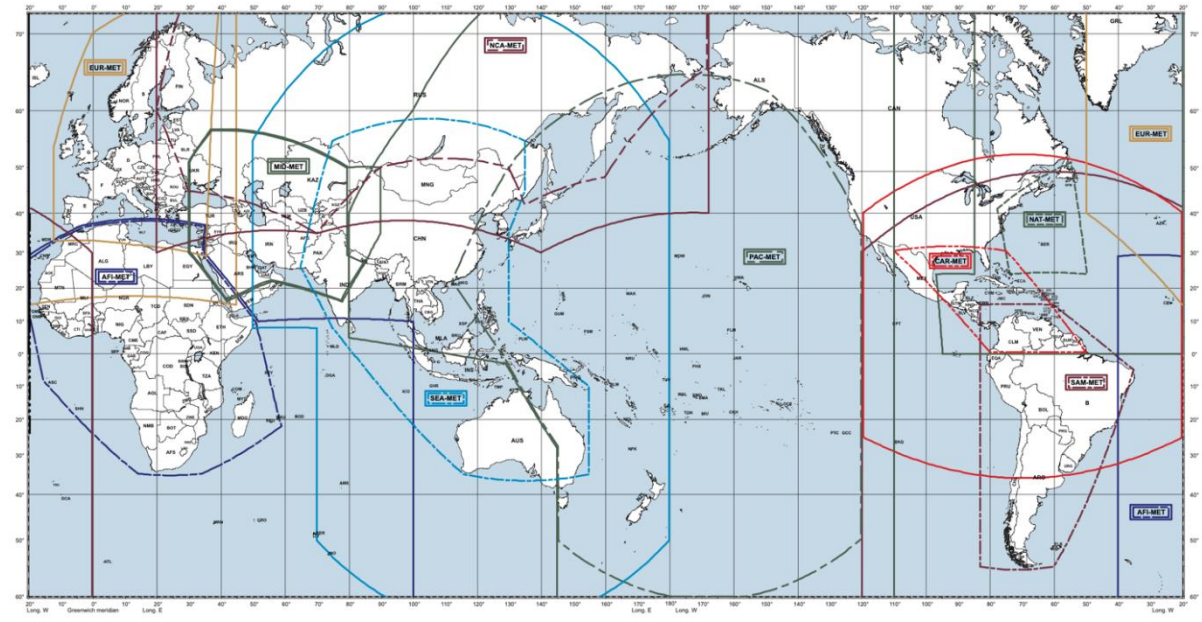
From the South Pole along the 139° E meridian to 34° S, then through the points 34° S 142° E, 27° S 142° E, 27° S 160° E. Then along the 160° E meridian to the South Pole.

List of frequencies based on ITU RR Appendix **27**/213:

2 869 kHz	2 944 kHz	4 678* kHz	5481 kHz
5550 kHz	5580 kHz	8876 kHz	8957 kHz

6. The VOLMET area is divided into two segments: the allotment area and the reception area. As specified in ITU RR Appendix 27/7, the allotment area comprises all points where an HF broadcast facility might be required to operate on a family of frequencies common to the area. On the other hand, as referenced in ITU RR Appendix 27/8, the reception area is defined as an area within which aircraft should be capable of receiving broadcasts from VOLMET stations located in the allotment area.

7. The following provides the overview of the VOLMET areas in the Asia-Pacific region based on Article 3 of Appendix 27 ITU RR, which describes the boundaries of the VOLMET allotment areas and VOLMET reception areas.



Notes:

AFI-MET	AFRICA-INDIAN OCEAN	NCA-MET	NORTH CENTRAL ASIA
CAR-MET	CARIBBEAN	PAC-MET	PACIFIC
EUR-MET	EUROPE	SAM-MET	SOUTH AMERICA
MID-MET	MIDDLE EAST	SEA-MET	SOUTH EAST ASIA
NAT-MET	NORTH ATLANTIC		

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by ITU. The map delineates the aeronautical areas only for the purpose of radiocommunications in the aeronautical mobile (R) service.

Fig. 5 Allotment area for VOLMET in APAC Region

8. In detail, the frequency allocation for each area of VOLMET is governed as follows:

a) OLMET Area - SOUTH EAST ASIA (SEA-MET)

In accordance to the ITU RR Appendix **27**/199 and **27**/200, the boundaries are described as follows:

The SEA-MET allotment area is defined by a line drawn from the point 55° N 75° E, through the points 55° N 135° E, 45° N 135° E, 35° N 130° E, 10° N 130° E, 10° S 155° E, 35° S 155° E, 35° S 116° E, 08° N 75° E, 26° N 65° E, to the point 55° N 75° E.

The SEA-MET reception area is defined by a line drawn from the point 55° N 50° E, through the points 55° N 180°, 50° S 180°, 50° S 70° E, 08° N 70° E, 08° N 50° E, to the point 55° N 50° E.

List of frequencies based on ITU RR Appendix **27**/213**:**

2 965 kHz	3 458 kHz	5 673 kHz	6 676 kHz
8 849 kHz	11 387 kHz	13 285 kHz	

b) VOLMET Area - MIDDLE EAST (MID-MET)

In accordance to the ITU RR Appendix **27**/193 and **27**/194, the boundaries are described as follows:

The MID-MET allotment area is defined by a line drawn from the point 50° N 80° E, through the points 29° N 80° E, 27° N 85° E, 16° N 78° E, 22° N 56° E, 16° N 42° E, 30° N 30° E, 51° N 30° E, 57° N 37° E, to the point 50° N 80° E.

The MID-MET reception area is defined by a line drawn from the point 50° N 80° E, through the points 50° N 90° E, 35° N 90° E, 27° N 85° E, 16° N 78° E, 22° N 56° E, 16° N 42° E, 30° N 30° E, 51° N 30° E, 57° N 37° E, to the point 50° N 80° E.

List of frequencies based on ITU RR Appendix **27**/213**:**

2 956 kHz	5 589 kHz	8 945 kHz	11 393 kHz

c) VOLMET Area - PACIFIC (PAC-MET)

In accordance to the ITU RR Appendix **27**/197 and **27**/198, the boundaries are described as follows:

The PAC-MET allotment area is defined by a line drawn from the point 52° N 132° E, through the points 63° N 149° W, 38° N 120° W, 50° S 120° W, 50° S 145° E, 28° S 145° E, 03° S 129° E, 22° N 112° E to the point 52° N 132° E.

The PAC-MET reception area is defined by a line drawn from the point 60° N 100° E through the points 75° N 160°W, 75° N 110° W, 65° S 110° W, 65° S 145° E, 28° S 145° E, 03° S 129° E, 05° N 80° E, 40° N 80° E, to the point 60° N 100° E.

List of frequencies based on ITU RR Appendix **27**/213**:**

2 863 kHz	6 679 kHz	8 828 kHz	13 282 kHz

d) VOLMET Area - NORTH CENTRAL ASIA (NCA-MET)

In accordance to the ITU RR Appendix **27**/195 and **27**/196, the boundaries are described as follows:

The NCA-MET allotment area is defined by a line drawn from the point 76° N 32° E, through the points 80° N 90° E, 75° N 168° W, 66° N 168° W, 48° N 160° E, 42° N 135° E, 50° N 130° E, 50° N 90° E, 35° N 70° E, 45° N 30° E, 60° N 20° E, to the point 76° N 32° E.

The NCA-MET reception area is defined by a line drawn from the North Pole, through the points 40° N 168° W, 30° N 140° E, 35° N 70° E, 30° N 20° E, to the North Pole.

Referring to the coordinates above, the areas for the allotment and reception are illustrated as follows:

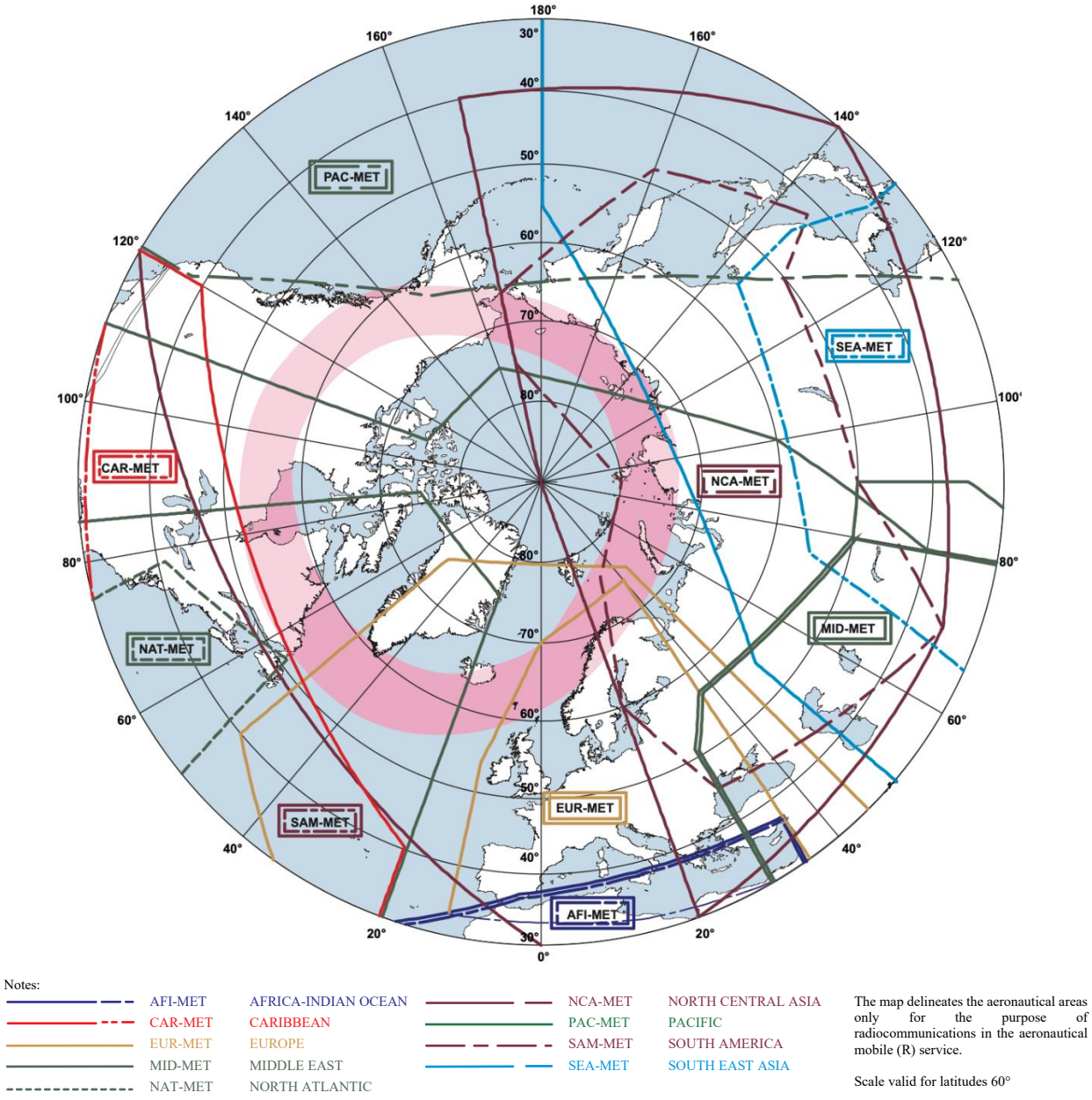


Fig. 6 Illustration of the Allotment and Reception Area for NCA-MET

List of frequencies based on ITU RR Appendix **27**/213**:**

3 461 kHz	4 663 kHz	5 676 kHz	10 090 kHz
13 279 kHz			

Appendix D

REGIONAL 117.975-137MHz FREQUENCY ALLOTMENT PLAN

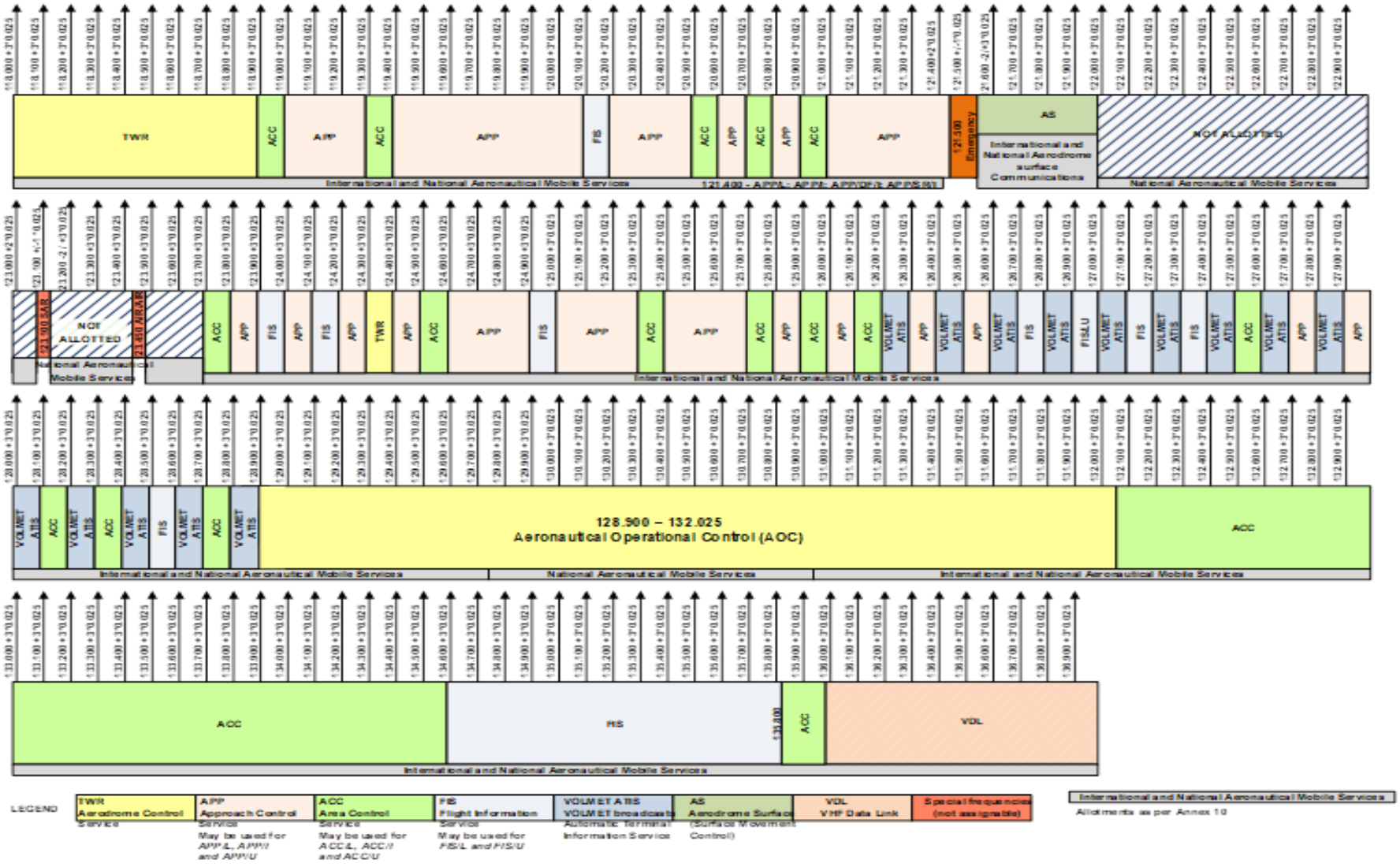
Function	Frequencies (MHz)
TWR 118.000-118.875MHz 124.300-124.375MHz	118.000 118.025 118.050 118.075 118.100 118.125 118.150 118.175 118.200 118.225 118.250 118.275 118.300 118.325 118.350 118.375 118.400 118.425 118.450 118.475 118.500 118.525 118.550 118.575 118.600 118.625 118.650 118.675 118.700 118.725 118.750 118.775 118.800 118.825 118.850 118.875 124.300 124.325 124.350 124.375
AS 121.550-121.975MHz	121.550 121.575 121.600 121.625 121.650 121.675 121.700 121.725 121.750 121.775 121.800 121.825 121.850 121.875 121.900 121.925 121.950 121.975
APP 119.000-119.275MHz 119.400-120.075MHz 120.200-120.475MHz	119.500 119.525 119.550 119.575 119.600 119.625 119.650 119.675 119.800 119.825 119.850 119.875 119.900 119.925 119.950 119.975
120.600-120.675MHz 120.800-120.875MHz 121.000-121.450MHz 123.800-123.875MHz 124.000-124.075MHz 124.200-124.275MHz 124.400-124.475MHz 124.600-124.875MHz 125.000-125.275MHz 125.400-125.675MHz 125.800-125.875MHz 126.000-126.075MHz 126.300-126.375MHz 126.500-126.575MHz 127.700-127.775MHz 127.900-127.975MHz	119.100 119.125 119.150 119.175 119.200 119.225 119.250 119.275 119.400 119.425 119.450 119.475 119.700 119.725 119.750 119.775 120.000 120.025 120.050 120.075 120.200 120.225 120.250 120.275 120.400 120.425 120.450 120.475 120.600 120.625 120.650 120.675 120.800 120.825 120.850 120.875 121.000 121.025 121.050 121.075 121.100 121.125 121.150 121.175 121.200 121.225 121.250 121.275 121.400 121.425 121.450 123.800 123.825 123.850 123.875 124.000 124.025 124.050 124.075 124.700 124.725 124.750 124.775 125.100 125.125 125.150 125.175 125.500 125.525 125.550 125.575 126.500 126.525 126.550 126.575 127.700 127.725 127.750 127.775 127.900 127.925 127.950 127.975
	120.300 120.325 120.350 120.375 121.300 121.325 121.350 121.375 124.200 124.225 124.250 124.275 124.400 124.425 124.450 124.475 124.600 124.625 124.650 124.675

	124.800 124.825 124.850 124.875 125.000 125.025 125.050 125.075 125.200 125.225 125.250 125.275 125.400 125.425 125.450 125.475 125.600 125.625 125.650 125.675 125.800 125.825 125.850 125.875 126.000 126.025 126.050 126.075 126.300 126.325 126.350 126.375
ACC 118.900-118.975MHz 119.300-119.375MHz 120.500-120.575MHz	126.100 126.125 126.150 126.175 127.500 127.525 127.550 127.575 128.300 128.325 128.350 128.375 128.700 128.725 128.750 128.775
120.700-120.775MHz 120.900-120.975MHz 123.700-123.775MHz 124.500-124.575MHz 125.300-125.375MHz 125.700-125.775MHz 125.900-125.975MHz 126.100-126.175MHz 127.500-127.575MHz 128.100-128.175MHz 128.300-128.375MHz 128.700-128.775MHz 132.050-134.575MHz 135.825-135.975MHz	118.900 118.925 118.950 118.975 119.300 119.325 119.350 119.375 120.500 120.525 120.550 120.575 120.700 120.725 120.750 120.775 120.900 120.925 120.950 120.975 123.700 123.725 123.750 123.775 124.500 124.525 124.550 124.575 125.300 125.325 125.350 125.375 125.700 125.725 125.750 125.775 125.900 125.925 125.950 125.975 128.100 128.125 128.150 128.175 132.050* 132.075* 132.100 132.125 132.150 132.175 132.200 132.225 132.250 132.275 132.300 132.325 132.350 132.375 132.400 132.425 132.450 132.475 132.500 132.525 132.550 132.575 132.600 132.625 132.650 132.675 132.700 132.725 132.750 132.775 132.800 132.825 132.850 132.875 132.900 132.925 132.950 132.975 133.000 133.025 133.050 133.075 133.100 133.125 133.150 133.175 133.200 133.225 133.250 133.275 133.300 133.325 133.350 133.375 133.400 133.425 133.450 133.475 133.500 133.525 133.550 133.575 133.600 133.625 133.650 133.675 133.700 133.725 133.750 133.775 133.800 133.825 133.850 133.875 133.900 133.925 133.950 133.975 134.000 134.025 134.050 134.075 134.100 134.125 134.150 134.175 134.200 134.225 134.250 134.275 134.300 134.325 134.350 134.375 134.400 134.425 134.450 134.475 134.500 134.525* 134.550* 134.575* 135.825* 135.850* 135.875* 135.900* 135.925* 135.950* 135.975*
FIS 120.100-120.175MHz 123.900-123.975MHz	120.100 120.125 120.150 120.175 123.900 123.925 123.950 123.975 124.100 124.125 124.150 124.175

124.100-124.175MHz 124.900-124.975MHz 126.700-126.775MHz 126.900-126.975MHz 127.100-127.175MHz 127.300-127.375MHz 128.500-128.575MHz 134.600-135.800MHz	124.900 124.925 124.950 124.975 126.700 126.725 126.750 126.775 126.900 126.925 126.950 126.975 127.100 127.125 127.150 127.175 127.300 127.325 127.350 127.375 128.500 128.525 128.550 128.575 134.600 134.625 134.650 134.675 134.700 134.725 134.750 134.775 134.800 134.825 134.850 134.875 134.900 134.925 134.950 134.975 135.000 135.025 135.050 135.075 135.100 135.125 135.150 135.175 135.200 135.225 135.250 135.275 135.300 135.325 135.350 135.375 135.400 135.425 135.450 135.475 135.500 135.525 135.550 135.575 135.600 135.625 135.650 135.675 135.700 135.725 135.750 135.775 135.800
VOLMET/ATIS 126.200-126.275MHz 126.400-126.475MHz 126.600-126.675MHz 126.800-126.875MHz 127.000-127.075MHz 127.200-127.275MHz 127.400-127.475MHz 127.600-127.675MHz 127.800-127.875MHz 128.000-128.075MHz 128.200-128.275MHz 128.400-128.475MHz 128.600-128.675MHz 128.800-128.875MHz	126.200 126.225 126.250 126.275 126.400 126.425 126.450 126.475 126.600 126.625 126.650 126.675 126.800 126.825 126.850 126.875 127.000 127.025 127.050 127.075 127.200 127.225 127.250 127.275 127.400 127.425 127.450 127.475 127.600 127.625 127.650 127.675 127.800 127.825 127.850 127.875 128.000 128.025 128.050 128.075 128.200 128.225 128.250 128.275 128.400 128.425 128.450 128.475 128.600 128.625 128.650 128.675 128.800 128.825 128.850 128.875
AOC	128.900-132.025(Except 128.950MHz)
DATA LINK	136.000-136.975
AIR-TO-AIR	123.450 128.950 (TIBA)
NOT ALLOTED	122.000-123.675(Except 123.100MHz, 123.450MHz)

*: Adopted by SRWG/8.

graphical presentation Of Regional 117.975-137MHz frequency Allotment plan



Appendix E

GENERIC CALCULATION METHOD FOR GEOGRAPHICAL SEPARATION DISTANCES

a. For the calculation of minimum separation distances with a (desired) facility and an (undesired) facility the generic model as described in Chapter 1 of DOC 9718 has been established.

b. To establish minimum geographical separation distances between a desired facility and an undesired facility, the following parameters are used:

a) The minimum received desired power Pd of the desired facility (dBW).
b) D/U ratio. The prerequisite for any D/U calculation to be valid is that the minimal receive power is achieved at all points throughout the coverage.
c) EIRP of the undesired facility Tx (dBW).
d) Designated operational range of the desired facility.
e) ITU-R aeronautical propagation curve for 5% of the time.

c. The generic method establishes the minimum geographical separation distance between the edge of the DOC of the desired facility and undesired facility. This distance provides for the transmission loss (attenuation) of the undesired signal to a level that meets the D/U requirement for the desired signal, L = Tx -Pd + D/U. This distance is obtained with using the relevant (frequency) ITU propagation curve applicable for the maximum height of the DOC of the desired facility and the site elevation of the undesired facility.

d. When the minimum distance from the edge of coverage from the desired facility to the undesired facility has been established, the station-to-station separation distance can be obtained by adding the DOR to the minimum distance from the edge of coverage to the undesired facility.

e. These steps need to be undertaken in the reverse direction whereby the desired facility becomes the undesired facility and the undesired facility becomes the desired facility. The maximum distance between the two processes determine the minimum separation between the two facilities.

Appendix F

AIRING OF ILS/VOR/DME CHANNELS

Source: Annex 10, Volume 1, Table A			DME parameters					
			Interrogation				Reply	
				Pulse codes				
Channel pairing					DME/P mode			
DME channel number	VHF frequency MHz	GS frequency MHz	Frequency MHz	DME/N µs	Initial approach µs	Final approach µs	Frequency MHz	Pulse codes µs
* 1X	–	–	1 025	12	–	–	962	12
** 1Y	–	–	1 025	36	–	–	1 088	30
* 2X	–	–	1 026	12	–	–	963	12
** 2Y	–	–	1 026	36	–	–	1 089	30
* 3X	–	–	1 027	12	–	–	964	12
** 3Y	–	–	1 027	36	–	–	1 090	30
* 4X	–	–	1 028	12	–	–	965	12
** 4Y	–	–	1 028	36	–	–	1 091	30
* 5X	–	–	1 029	12	–	–	966	12
** 5Y	–	–	1 029	36	–	–	1 092	30
* 6X	–	–	1 030	12	–	–	967	12
** 6Y	–	–	1 030	36	–	–	1 093	30
* 7X	–	–	1 031	12	–	–	968	12
** 7Y	–	–	1 031	36	–	–	1 094	30
* 8X	–	–	1 032	12	–	–	969	12
** 8Y	–	–	1 032	36	–	–	1 095	30
* 9X	–	–	1 033	12	–	–	970	12
** 9Y	–	–	1 033	36	–	–	1 096	30
* 10X	–	–	1 034	12	–	–	971	12
** 10Y	–	–	1 034	36	–	–	1 097	30
* 11X	–	–	1 035	12	–	–	972	12
** 11Y	–	–	1 035	36	–	–	1 098	30
* 12X	–	–	1 036	12	–	–	973	12
** 12Y	–	–	1 036	36	–	–	1 099	30

*	13X	–	–	1 037	12	–	–	974	12
**	13Y	–	–	1 037	36	–	–	1 100	30
*	14X	–	–	1 038	12	–	–	975	12
**	14Y	–	–	1 038	36	–	–	1 101	30
*	15X	–	–	1 039	12	–	–	976	12
**	15Y	–	–	1 039	36	–	–	1 102	30
*	16X	–	–	1 040	12	–	–	977	12
**	16Y	–	–	1 040	36	–	–	1 103	30
?	17X	108		1 041	12	–	–	978	12
	17Y	108.05		1 041	36	36	42	1 104	30
	18X	108.1	334.7	1 042	12	12	18	979	12
	18Y	108.15	334.55	1 042	36	36	42	1 105	30
	19X	108.2		1 043	12	–	–	980	12
	19Y	108.25		1 043	36	36	42	1 106	30
	20X	108.3	334.1	1 044	12	12	18	981	12
	20Y	108.35	333.95	1 044	36	36	42	1 107	30
	21X	108.4		1 045	12	–	–	982	12
	21Y	108.45		1 045	36	36	42	1 108	30
	22X	108.5	329.9	1 046	12	12	18	983	12
	22Y	108.55	329.75	1 046	36	36	42	1 109	30
	23X	108.6		1 047	12	–	–	984	12
	23Y	108.65		1 047	36	36	42	1 110	30
	24X	108.7	330.5	1 048	12	12	18	985	12
	24Y	108.75	330.35	1 048	36	36	42	1 111	30
	25X	108.8		1 049	12	–	–	986	12
	25Y	108.85		1 049	36	36	42	1 112	30
	26X	108.9	329.3	1 050	12	12	18	987	12
	26Y	108.95	329.15	1 050	36	36	42	1 113	30
	27X	109		1 051	12	–	–	988	12
	27Y	109.05		1 051	36	36	42	1 114	30
	28X	109.1	331.4	1 052	12	12	18	989	12
	28Y	109.15	331.25	1 052	36	36	42	1 115	30
	29X	109.2		1 053	12	–	–	990	12

29Y	109.25		1 053	36	36	42	1 116	30
30X	109.3	332.0	1 054	12	12	18	991	12
30Y	109.35	331.85	1 054	36	36	42	1 117	30
31X	109.4		1 055	12	–	–	992	12
31Y	109.45		1 055	36	36	42	1 118	30
32X	109.5	332.6	1 056	12	12	18	993	12
32Y	109.55	332.45	1 056	36	36	42	1 119	30
33X	109.6		1 057	12	–	–	994	12
33Y	109.65		1 057	36	36	42	1 120	30
34X	109.7	333.2	1 058	12	12	18	995	12
34Y	109.75	333.05	1 058	36	36	42	1 121	30
35X	109.8		1 059	12	–	–	996	12
35Y	109.85		1 059	36	36	42	1 122	30
36X	109.9	333.8	1 060	12	12	18	997	12
36Y	109.95	333.65	1 060	36	36	42	1 123	30
37X	110		1 061	12	–	–	998	12
37Y	110.05		1 061	36	36	42	1 124	30
38X	110.1	334.4	1 062	12	12	18	999	12
38Y	110.15	334.25	1 062	36	36	42	1 125	30
39X	110.2		1 063	12	–	–	1 000	12
39Y	110.25		1 063	36	36	42	1 126	30
40X	110.3	335.0	1 064	12	12	18	1 001	12
40Y	110.35	334.85	1 064	36	36	42	1 127	30
41X	110.4		1 065	12	–	–	1 002	12
41Y	110.45		1 065	36	36	42	1 128	30
42X	110.5	329.6	1 066	12	12	18	1 003	12
42Y	110.55	329.45	1 066	36	36	42	1 129	30
43X	110.6		1 067	12	–	–	1 004	12
43Y	110.65		1 067	36	36	42	1 130	30
44X	110.7	330.2	1 068	12	12	18	1 005	12
44Y	110.75	330.05	1 068	36	36	42	1 131	30
45X	110.8		1 069	12	–	–	1 006	12
45Y	110.85		1 069	36	36	42	1 132	30

	46X	110.9	330.8	1 070	12	12	18	1 007	12
	46Y	110.95	330.65	1 070	36	36	42	1 133	30
	47X	111		1 071	12	–	–	1 008	12
	47Y	111.05		1 071	36	36	42	1 134	30
	48X	111.1	331.7	1 072	12	12	18	1 009	12
	48Y	111.15	331.55	1 072	36	36	42	1 135	30
	49X	111.2		1 073	12	–	–	1 010	12
	49Y	111.25		1 073	36	36	42	1 136	30
	50X	111.3	332.3	1 074	12	12	18	1 011	12
	50Y	111.35	332.15	1 074	36	36	42	1 137	30
	51X	111.4		1 075	12	–	–	1 012	12
	51Y	111.45		1 075	36	36	42	1 138	30
	52X	111.5	332.9	1 076	12	12	18	1 013	12
	52Y	111.55	332.75	1 076	36	36	42	1 139	30
	53X	111.6		1 077	12	–	–	1 014	12
	53Y	111.65		1 077	36	36	42	1 140	30
	54X	111.7	333.5	1 078	12	12	18	1 015	12
	54Y	111.75	333.35	1 078	36	36	42	1 141	30
	55X	111.8		1 079	12	–	–	1 016	12
	55Y	111.85		1 079	36	36	42	1 142	30
	56X	111.9	331.1	1 080	12	12	18	1 017	12
	56Y	111.95	330.95	1 080	36	36	42	1 143	30
	57X	112		1 081	12	–	–	1 018	12
	57Y	112.05		1 081	36	–	–	1 144	30
	58X	112.1		1 082	12	–	–	1 019	12
	58Y	112.15		1 082	36	–	–	1 145	30
	59X	112.2		1 083	12	–	–	1 020	12
	59Y	112.25		1 083	36	–	–	1 146	30
**	60X	–		1 084	12	–	–	1 021	12
**	60Y	–		1 084	36	–	–	1 147	30
**	61X	–		1 085	12	–	–	1 022	12
**	61Y	–		1 085	36	–	–	1 148	30
**	62X	–		1 086	12	–	–	1 023	12
**	62Y	–		1 086	36	–	–	1 149	30

**	63X	–	1 087	12	–	–	1 024	12
**	63Y	–	1 087	36	–	–	1 150	30
**	64X	–	1 088	12	–	–	1 151	12
**	64Y	–	1 088	36	–	–	1 025	30
**	65X	–	1 089	12	–	–	1 152	12
**	65Y	–	1 089	36	–	–	1 026	30
**	66X	–	1 090	12	–	–	1 153	12
**	66Y	–	1 090	36	–	–	1 027	30
**	67X	–	1 091	12	–	–	1 154	12
**	67Y	–	1 091	36	–	–	1 028	30
**	68X	–	1 092	12	–	–	1 155	12
**	68Y	–	1 092	36	–	–	1 029	30
**	69X	–	1 093	12	–	–	1 156	12
**	69Y	–	1 093	36	–	–	1 030	30
	70X	112.3	1 094	12	–	–	1 157	12
**	70Y	112.35	1 094	36	–	–	1 031	30
	71X	112.4	1 095	12	–	–	1 158	12
**	71Y	112.45	1 095	36	–	–	1 032	30
	72X	112.5	1 096	12	–	–	1 159	12
**	72Y	112.55	1 096	36	–	–	1 033	30
	73X	112.6	1 097	12	–	–	1 160	12
**	73Y	112.65	1 097	36	–	–	1 034	30
	74X	112.7	1 098	12	–	–	1 161	12
**	74Y	112.75	1 098	36	–	–	1 035	30
	75X	112.8	1 099	12	–	–	1 162	12
**	75Y	112.85	1 099	36	–	–	1 036	30
	76X	112.9	1 100	12	–	–	1 163	12
**	76Y	112.95	1 100	36	–	–	1 037	30
	77X	113	1 101	12	–	–	1 164	12
**	77Y	113.05	1 101	36	–	–	1 038	30
	78X	113.1	1 102	12	–	–	1 165	12
**	78Y	113.15	1 102	36	–	–	1 039	30
	79X	113.2	1 103	12	–	–	1 166	12

**	79Y	113.25	1 103	36	–	–	1 040	30
	80X	113.3	1 104	12	–	–	1 167	12
	80Y	113.35	1 104	36	36	42	1 041	30
	81X	113.4	1 105	12	–	–	1 168	12
	81Y	113.45	1 105	36	36	42	1 042	30
	82X	113.5	1 106	12	–	–	1 169	12
	82Y	113.55	1 106	36	36	42	1 043	30
	83X	113.6	1 107	12	–	–	1 170	12
	83Y	113.65	1 107	36	36	42	1 044	30
	84X	113.7	1 108	12	–	–	1 171	12
	84Y	113.75	1 108	36	36	42	1 045	30
	85X	113.8	1 109	12	–	–	1 172	12
	85Y	113.85	1 109	36	36	42	1 046	30
	86X	113.9	1 110	12	–	–	1 173	12
	86Y	113.95	1 110	36	36	42	1 047	30
	87X	114	1 111	12	–	–	1 174	12
	87Y	114.05	1 111	36	36	42	1 048	30
	88X	114.1	1 112	12	–	–	1 175	12
	88Y	114.15	1 112	36	36	42	1 049	30
	89X	114.2	1 113	12	–	–	1 176	12
	89Y	114.25	1 113	36	36	42	1 050	30
	90X	114.3	1 114	12	–	–	1 177	12
	90Y	114.35	1 114	36	36	42	1 051	30
	91X	114.4	1 115	12	–	–	1 178	12
	91Y	114.45	1 115	36	36	42	1 052	30
	92X	114.5	1 116	12	–	–	1 179	12
	92Y	114.55	1 116	36	36	42	1 053	30
	93X	114.6	1 117	12	–	–	1 180	12
	93Y	114.65	1 117	36	36	42	1 054	30
	94X	114.7	1 118	12	–	–	1 181	12
	94Y	114.75	1 118	36	36	42	1 055	30
	95X	114.8	1 119	12	–	–	1 182	12
	95Y	114.85	1 119	36	36	42	1 056	30

96X	114.9	1 120	12	–	–	1 183	12
96Y	114.95	1 120	36	36	42	1 057	30
97X	115	1 121	12	–	–	1 184	12
97Y	115.05	1 121	36	36	42	1 058	30
98X	115.1	1 122	12	–	–	1 185	12
98Y	115.15	1 122	36	36	42	1 059	30
99X	115.2	1 123	12	–	–	1 186	12
99Y	115.25	1 123	36	36	42	1 060	30
100X	115.3	1 124	12	–	–	1 187	12
100Y	115.35	1 124	36	36	42	1 061	30
101X	115.4	1 125	12	–	–	1 188	12
101Y	115.45	1 125	36	36	42	1 062	30
102X	115.5	1 126	12	–	–	1 189	12
102Y	115.55	1 126	36	36	42	1 063	30
103X	115.6	1 127	12	–	–	1 190	12
103Y	115.65	1 127	36	36	42	1 064	30
104X	115.7	1 128	12	–	–	1 191	12
104Y	115.75	1 128	36	36	42	1 065	30
105X	115.8	1 129	12	–	–	1 192	12
105Y	115.85	1 129	36	36	42	1 066	30
106X	115.9	1 130	12	–	–	1 193	12
106Y	115.95	1 130	36	36	42	1 067	30
107X	116	1 131	12	–	–	1 194	12
107Y	116.05	1 131	36	36	42	1 068	30
108X	116.1	1 132	12	–	–	1 195	12
108Y	116.15	1 132	36	36	42	1 069	30
109X	116.2	1 133	12	–	–	1 196	12
109Y	116.25	1 133	36	36	42	1 070	30
110X	116.3	1 134	12	–	–	1 197	12
110Y	116.35	1 134	36	36	42	1 071	30
111X	116.4	1 135	12	–	–	1 198	12
111Y	116.45	1 135	36	36	42	1 072	30
112X	116.5	1 136	12	–	–	1 199	12
112Y	116.55	1 136	36	36	42	1 073	30

	113X	116.6	1 137	12	–	–	1 200	12
	113Y	116.65	1 137	36	36	42	1 074	30
	114X	116.7	1 138	12	–	–	1 201	12
	114Y	116.75	1 138	36	36	42	1 075	30
	115X	116.8	1 139	12	–	–	1 202	12
	115Y	116.85	1 139	36	36	42	1 076	30
	116X	116.9	1 140	12	–	–	1 203	12
	116Y	116.95	1 140	36	36	42	1 077	30
	117X	117	1 141	12	–	–	1 204	12
	117Y	117.05	1 141	36	36	42	1 078	30
	118X	117.1	1 142	12	–	–	1 205	12
	118Y	117.15	1 142	36	36	42	1 079	30
	119X	117.2	1 143	12	–	–	1 206	12
	119Y	117.25	1 143	36	36	42	1 080	30
	120X	117.3	1 144	12	–	–	1 207	12
	120Y	117.35	1 144	36	–	–	1 081	30
	121X	117.4	1 145	12	–	–	1 208	12
	121Y	117.45	1 145	36	–	–	1 082	30
	122X	117.5	1 146	12	–	–	1 209	12
	122Y	117.55	1 146	36	–	–	1 083	30
	123X	117.6	1 147	12	–	–	1 210	12
	123Y	117.65	1 147	36	–	–	1 084	30
	124X	117.7	1 148	12	–	–	1 211	12
**	124Y	117.75	1 148	36	–	–	1 085	30
	125X	117.8	1 149	12	–	–	1 212	12
**	125Y	117.85	1 149	36	–	–	1 086	30
	126X	117.9	1 150	12	–	–	1 213	12
**	126Y	117.95	1 150	36	–	–	1 087	30

* These channels are reserved exclusively for national allotments.

** These channels may be used for national allotment on a secondary basis.

The primary reason for reserving these channels is to provide protection for the secondary surveillance radar (SSR) system.

108.0 MHz is not scheduled for assignment to ILS service. The associated DME operating channel No. 17X may be assigned for emergency use. The reply frequency of channel No. 17X (i.e. 978 MHz) is also utilized for the operation of the universal access transceiver (UAT). Standards and Recommended Practices for UAT are found in Annex 10, Volume III, Part I, Chapter 12.

Presentation of the initial proposal:

1.The *Background* and *Comments* are provided in *italic text*.

2.The text of the proposed amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

a) ~~Text to be deleted is shown with a line through it.~~	text to be deleted
b) New text to be inserted is highlighted with grey shading.	new text to be inserted
c) ~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

REVISED TERMS OF REFERENCE OF
ASIA AND PACIFIC
SPECTRUM REVIEW WORKING GROUP (APAC SRWG)

~~Consists of objectives and deliverables as follows:~~
The primary objective of SRWG is to assess regional spectrum requirements, support efficient frequency planning and assignment for aeronautical communication and navigation systems, and provide technical coordination and advice to States in alignment with ICAO spectrum strategy and policies.

The Objectives of the APAC SRWG are to:

(a) conduct regular spectrum capacity and requirements assessment for the APAC Region to accommodate current operational requirements and future implementation of aeronautical communication and navigation ~~system~~ systems, as stipulated in the Global Air Navigation Plan (GANP) and/or consistent with Frequency Spectrum Management Panel (FSMP) work on emerging technologies ~~(such as space-based VHF),~~ and identify potential spectrum-related gaps or constraints at the regional level;

(b) ~~develops~~ develop an approach, supported by new tools and criteria being introduced at ICAO global level, to ~~enhanced~~ enhance possibilities of frequency assignments for communication (VHF air-ground communication) and navigation systems (ILS, VOR, DME and GBAS/VDB), taking into account the need for regional harmonization and coordination with adjacent regions;

(c) support the development, maintenance and periodic review of regional frequency-related tools and databases, including but not limited to frequency lists, NDB database and the Frequency Finder, in coordination with States and ICAO Secretariat as appropriate;

(d) develop, maintain and review a high-level implementation plan and guidance material(s) for States/Administrations in the APAC region to implement the frequency assignments in a coordinated manner with ANSP, CAA and national radio regulatory Authorities to satisfy future operational needs or the introduction of new technologies, ~~with emphasis on communication and navigation systems, till 2030~~ and support follow-up actions to facilitate harmonized implementation;

(e) monitor and assess radio frequency interference (RFI) issues in the region, and coordinate with other working groups of APANPIRG/RASG-APAC, if needed, on effective monitoring and deriving mitigation measures;

(f) facilitate alignment with the ICAO Position through regional coordination and information sharing, ensuring that aeronautical interests are unified and effectively represented in WRC processes; and

(g) be based on the above, ~~develops~~ develop recommendation(s) to address the current limitations and future operational spectrum needs in the region, in a manner consistent with ICAO global provisions and regional priorities. ~~and current limitations.~~

~~**Deliverables / Outputs to meet the Objectives:**~~

~~To meet the above objectives, the SRWG will produce the following outputs as required and periodically, in accordance with regional operational needs and technological developments:~~

~~(a) Progress report to APANPIRG CNS Sub-Group on ongoing activities and identified issues addressing progress on the deliverables;~~

~~(b) Requirement/Capacity Assessments as necessary;~~

~~(c) Regional frequency planning material and guidance High-level frequency assignment plan and Guidance Material(s) for communication (VHF air-ground communication) and navigation systems (ILS, VOR, DME, NDB and GBAS/VDB); until 2030; and~~

~~(d) Recommendation(s) and technical approaches addressing spectrum efficiency, interference mitigation on solutions to current limitation and future operational needs; and .~~

~~(e) Updates and maintenance outputs related to regional frequency-related tools and databases (e.g. Frequency Finder, frequency lists), as applicable.~~

~~**Timeframe for Deliverables:**~~

~~The timeframe for the review of the deliverables by APANPIRG CNS Sub-Group are as follows:~~

~~Deliverable (a) – from 2020 onward;~~
~~Deliverable (b) – from 2020 onwards;~~
~~Deliverable (c) – first guidance material in 2022; and~~
~~Deliverable (d) – from 2020 onwards (recurring deliverable(s)/based on the outcome of (b) and (c))~~

Meeting:

The APAC SRWG shall convene annually with at least one face-to-face meeting per year, which is supplemented by teleconference meetings (e.g. MS Teams, ZOOM or WebEx) as appropriate.
The APAC SRWG may establish ad-hoc task groups, as required, to address specific technical issues, with defined deliverables and timelines.

Membership:

All APAC member States/Administrations providing ANS in the Asia and Pacific Regions. APAC members should nominate Subject Matter Experts from Civil Aviation Authorities, ANSPs, and other organizations preferably experts involved in aeronautical frequency and/or spectrum management to participate in the Working Group.

The Working Group would also invite representatives of International Organizations recognized by the ICAO Council as representing important civil aviation interests, to participate in its work in a consultative capacity.

Reporting:

The SRWG will present its report to APANPIRG through the CNS Sub-group.

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Reference	Who	What	Due date	Status
A 4-1		Australia informed the meeting about its use of Common Traffic Advisor Frequency (CTAF). A CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The meeting noted the need of Australia to implement Frequency Finder in supporting CTAF service, and ICAO is urged to explore the solution with Frequency Finder's function to meet the requirements for CTAF		Close
A 4-2		An interference report was received from air navigation service provider on frequency 124.900 MHz implemented at Manado, Sulawesi. The frequency experienced interference with Manila, Philippines. The meeting noted that the reported interference was predicted by Frequency Finder and the use of the graphical display that Frequency Finder generated was further explained. Initially, Indonesia acknowledges this will most likely change the frequency assignment for Manado, Sulawesi		Close
A 4-3		The meeting noted the research and outcomes in IP/7 and IP/10, and encouraged States/Administration to continue the exploration on the spectrum capacity to accommodate GBAS/VDB and report the recommendations back to the SRWG for further review by the NSP, as necessary		Close
A 4-4		The meeting encouraged States/Administrations to share experience in using VHF COM function of Frequency Finder in various regional CNS events		Close
A 4-5	All	States to provide ICAO Regional Office with information of all facilities that are in operation to improve the currency of Frequency lists	~~30-Mar-21~~	Close

Reference	Who	What	Due date	Status
A 4-7	All, Robert Witzen	Create ad hoc group to draft Table of Content first, then develop the regional guidance material on aeronautical frequency spectrum management in a shared way by States.	~~31/03/2023~~ **CNS SG/27**	Close
A4-8	Robert Witzen, All	to run new VHF COM simulations	**End-2023**	Close
A5-1	ICAO	The meeting discussed the point-of-contact of SRWG to track and monitor and to take the suggestions for improvement as well as concerns on the space-based VHF issue, and ICAO secretariat was requested to take this role whether the information be provided by Singapore on a voluntary basis, updates from an FSMP WG meeting, from States or from other appropriate sources		Close
A5-2	ICAO	To host a regional WRC-23 preparatory meeting upon coordination with ICAO HQ after lifting of travel restriction.	~~31/12/2022~~ **13-14 Feb 23**	Close
A5-3	ICAO	To resolve firewall query of Australia for FF installation and use.		Close
A5-4	ICAO	To inform ICAO HQ to consider the feasibility incorporating terrain data into future version of Frequency Finder	SRWG/7	Close

Reference	Who	What	Due date	Status
A5-5	ICAO, India, Thailand, China, Japan, Mr. Robert Witzen	Ad-hoc group led by India to further explore the issue of 50 kHz channel spacing in the frequency band 108-117.975 MHz for ILS (LOC)/VOR operations and provide the inputs to SRWG/6. To coordinate with Japan to participate in ad-hoc group.	~~31/03/2022~~ **SRWG/7**	Close
A5-6	ICAO	To take appropriate follow up action to improve the awareness on the potential of emerging technologies and the necessity to consider the development of software tool like Frequency Finder to support the frequency assignment planning at regional office in future.	~~SRWG/7~~	Completed
A5-7	ICAO	ICAO secretariat will issue State Letter with clear actions and guidance for States to submit necessary data for VHF simulation, as a response to the Conclusion CNS SG/24/7		Completed
A5-8	ICAO	USA suggested to create a POC for all CNS matters as it is for ATM and compile them in APANPIRG POC. ICAO secretariat appreciated the suggestion and decided to take necessary action for that.		Completed

Reference	Who	What	Due date	Status
A5-9	ICAO	France shared observation that in addition to French mitigation, Japan has also implemented mitigations by using less power of 5G base station. It was informed by France that as per ITU there is no regulation for power limit from the base station. ICAO was requested to take necessary follow up action at regional level, to support CAAs working with State's spectrum regulators to avoid the future safety issues on radio altimeter due to 5G implementation.		Completed
A5-10	ICAO	to conduct a **in-person** workshop **for Frequency Finder** ~~after new release of FF along~~ ~~with online course proposed by ICAO HQ for new release of FF is available~~	~~SRWG/7~~ **Tentatively October 2023**	Close
A6-1	ICAO, SRWG	Recommended to undertake an analysis on VHF COM simulation in 3 - 5 years from now (2025-2028) to assess the severity of the congestion	2025-2028	Open
A6-2	ICAO	Review the registered frequencies from the simulation conducted in 2016 in the Frequency Finder, and remove those temporary frequencies in the Frequency Finder in previous simulation service	SRWG/7	Close

Reference	Who	What	Due date	Status
A6-3	ICAO	Establish an ad-hoc group (in offline mode through email list) to review the VHF COM Frequency Allotment Plan for APAC in terms of effective use of frequencies in the region, including the review of non-safety critical frequency use. **(superceded by A7-1)**	SRWG/7	Close
A6-4	ICAO	Publish questionnaire for APAC states for possible introduction of 50 kHz channel spacing in the APAC region via State Letter from ICAO APAC Regional Office (follow up of A5-5)	SRWG/7	Close
A6-5	ICAO	Probable augmentation of the Frequency Finder tool to incorporate indication to States to coordinate or not to coordinate	SRWG/7	Close
A6-6	China, ICAO	To summarize the revised planning principle/criteria in the format used in WP04 of SRWG/1	SRWG/7	Close
A6-7	ICAO	State Letter on updated Guidance Material to invite APAC States for review and comments ~~(Follow-up of A4-7)~~ **(Superceded by A7-2)**	SRWG/7	Close

Reference	Who	What	Due date	Status
~~A5-9~~ **A6-8**	ICAO	Administrations of Member States in APAC region would take proactive measures (~~necessary follow-up actions~~) in line with FSMP at national and regional level, to ~~support CAAs~~ work with National telecommunication regulators to prevent and monitor any impact of 5G to Radio Altimeters (~~avoid the future safety issues on radio altimeter due to 5G implementation~~).	~~SRWG/7~~	Ongoing
~~A6-3~~ **A7-1**	China as Rapporteur and Mr Robert Witzen as Advisor with participation from volunteering States/Administration, ICAO	Ad-hoc Expert group led by China to address issues identified in current frequency allotment plan. Tasks of this group: - Study the allotment plan; - Analyze the real use of allotment registered in FF; - Understand the current situation; - Identify existing issues and rooms for improvement; - Develop suggestions in both technical and administrative perspectives; - Explore the potential in reallocating sub-bands/pools; - Produce a survey on the usage of TIBA in the Region; and - Review content of Guidance Material ~~(as discussed in WP08)~~	SRWG/8	Close

Reference	Who	What	Due date	Status
A7-2	ICAO	After circulating to APAC States for review of Guidance Material, ad-hoc group to review virtually the material	CNS SG/27	Close
A7-3	Indonesia as Rapporteur with participation from volunteering States/Administration, ICAO	Ad-hoc group rapported by Indonesia to share the experience in this Region on handling HF resource utilization and provide recommendations, produce a survey on the usage of HF in the Region, review eANP Vol II relevant tables, review outcomes from former ICAO meetings, and suggestions to Agenda Item 1.9 in WRC-23 if deemed necessary.	SRWG/8	Close

Reference	Who	What	Due date	Status
A8-1	ICAO, States/Administrations	The States/Administrations that intend to use or is using VHF frequencies for Satellite-based VHF experimental systems during the period of time that the relevant SARPs and planning criteria are being developed and before operational deployment, should inform ICAO of their use. ICAO shall inform all States in APAC through frequency spectrum POC to ensure that all States are aware and monitor for any possible interference it may cause to VHF terrestrial systems. States/Administrations should also inform ICAO of any interference due to VHF Satellite-based experimental systems. And, in the event of interference, the correction action should be taken as soon as practicable.	SRWG/9	Close
A8-2	ICAO, States/Administrations	The Secretariat will notify the ANB CNSS about the updates of the regional VHF COM Allotment Plan to ensure the Frequency Finder tool incorporates the latest revisions. Member States/Administrations are requested to review and update the frequencies uploaded in the Frequency Finder (FF), ensuring the database remains current.	SRWG/9	Close
A8-3	ICAO, HF Ad-hoc group with Indonesia as Rapporteur	The ad-hoc group refines the survey on the Utilization of HF Spectrum Frequency bands in the Operation of Aeronautical Communications and the New Table with HF Frequency Assignments in the APAC Region, ensuring that they are clear and comprehensive enough to collect information effectively from States and facilitate their responses. The Secretariat disseminate the revised survey and updated table through a State Letter once the revisions have been finalized.	SRWG/9	Close

Reference	Who	What	Due date	Status
A8-4	States/Administrations	The States/Administrations register all aeronautical frequencies for NDB and AOC on oil rigs with ICAO APAC Office, share the best practices in States/Administrations to regional forum, e.g. SRWG, and nominate experts to support and participate in the Seminar for the frequency use for oil rigs.	SRWG/9	Close
A8-5	SRWG	Recognizing that certain refinements are required for new paragraphs concerning HF, TIBA, backup frequency, and GBAS, the meeting agreed to adopted this revision as Edition 1.1 with clear presentation for the proposed amendments to differentiate the status of text as original, agreed, to be determined (TBD). The SRWG will discuss and review the pertinent paragraphs in future meetings.	SRWG/9	Close
9-1	VHF Ad-hoc Group Australia, Bhutan, China (lead), Hong Kong China, Indonesia, India, Japan, Lao PDR, Philippines, Republic of Korea, Singapore, Thailand, United States and IATA	The VHF ad-hoc group formed in SRWG/7 to review the VHF COM Frequency Allotment Plan for APAC in terms of effective use of frequencies in the region will discuss the proposal along with other potential ways for effective utilization of the VHF COM Frequency band, including the AOC band in APAC region. The ad-hoc group will share its report at the next SRWG meeting	SRWG/10	Close
9-2	States/Administrations	States/Administrations that have not registered HF allocations in the Master International Frequency Register (MIFR) should register themselves as a priority.	SRWG/10	Close

Reference	Who	What	Due date	Status
9-3	States/Administrations	States/Administrations should update the HF Network Designators table in the ICAO APAC e-ANP Vol. II following the latest ITU framework (ITU Radio Regulations Appendix 27).	SRWG/10	Close
9-4	States/Administrations	States/Administrations not responding to the survey provided in ICAO APAC State Letter Ref.: T 8/8.1: AP094/24 (CNS) should respond to the survey	SRWG/10	Close
9-5	HF Ad-hoc Group Australia, China, India, Indonesia, Singapore, Thailand	For the proposal for the inclusion of the HF allotment plan information presented in both WP/15 of SRWG/8 and this WP/05 of SRWG/9 to into the Asia/Pacific Regional Aeronautical Radio Frequency Guidance Material, it was agreed the HF ad-hoc group will draft the content and present it in the SRWG/10 meeting for further deliberation and review	SRWG/10	Close
9-6	ICAO Secretariat	ICAO Secretariat will share the proposed modifications requested in the FF tool in SRWG/9 report in section 5.3 with ICAO HQ and share HQ responses with them in the next Meeting of the SRWG	SRWG/10	Close
9-7	ICAO Secretariat	ICAO HQ incorporate the NDB frequency/identity assignment facility in the current FF tool. The Meeting requested that the ICAO Secretariat share this message with ICAO HQ and update the Meeting on the response	SRWG/10	Close
9-8	ICAO Secretariat	If ICAO can help to get detailed NDB frequency assignment criteria, APAC States/Administrations may explore the alternate ways to do such assignments in the future. The ICAO Secretariat was requested to coordinate with ICAO HQ and compile the resources that help understand NDB frequency/identity assignment criteria	SRWG/10	Close

Reference	Who	What	Due date	Status
9-9	China, Singapore, ICAO	Another action item was formulated to share further updates with the SRWG/10 meeting for other proposed changes highlighted in yellow in the Asia/Pacific Regional Frequency Management Manual v1.1, which require more deliberation	SRWG/10	Close
9-10	ICAO Secretariat	India suggested adding NDB frequency assignment criteria in the Asia/Pacific Regional Aeronautical Radio Frequency Management Guidance Material if it is available in any ICAO documents. The Meeting noted that currently, there is no information on resources that can provide this information. However, the ICAO Secretariat will try to search for this information from other reference materials.	SRWG/10	Close
9-11	States/Administrations	Before deciding on the next round of simulation, it is imperative that the FF database is up to date with the entry of all frequencies being used by States. It is because an accurate database would support the precision of the prediction of APAC frequency needs after the simulation. Therefore, all States/Administrations were requested to assess the FF tool and check for inconsistencies with their local database, if any, against Aeronautical Information Publication (AIP). It was also advised to remove frequencies that are registered but not being used. In addition, it was suggested that other details such as range, power transmission, etc., be corrected	SRWG/10	Close
9-12	ICAO Secretariat	The ICAO Secretariat was requested to coordinate with the FSMP secretary to find out the tentative timelines of space-based VHF SARPs publication, as it will affect the VHF allocation plan for APAC and, hence, the simulation	SRWG/10	Close

Reference	Who	What	Due date	Status
9-13	ICAO Secretariat, SRWG chair	ICAO Secretary, with the chair, would revise the ToR and present the draft of the revised ToR in the SRWG/10 meeting for consideration	SRWG/10	Close
9-14	States/Administrations	it is imperative to first collect some incident reports from APAC States/Administrations. It was suggested that States/Administrations share their incident report and its details in the SRWG/10 Meeting. Based on inputs from reports from States/Administrations, the need to form an ad-hoc group will be deliberated in the SRWG/10 Meeting	SRWG/10	Close
9-15	ICAO Secretariat, SRWG chair	The ICAO Secretariat was recommended to coordinate with other ad-hoc groups formed in the region for GNSS RFI matters and understand their scope of work. It will help to avoid duplication of efforts. ICAO Secretariat will share information in SRWG/10 Meeting	SRWG/10	Close
10-1	States/Administrations, ICAO Secretariat, VHF COM Allotment Plan Research Ad hoc Group	Prioritization of AOC usage for new assignments could be applied on a trial basis, with feedback to be reviewed by the VHF COM Allotment Plan Research Ad hoc Group before considering any formal inclusion in the Regional Frequency Management Manual.	SRWG/11	Open
10-2	ICAO Secretariat	The Secretariat, with the support of interested and experienced States, is invited to develop a consolidated reference table mapping the ICAO WRC-27 agenda items to the relevant ITU Study Groups and Working Parties, for the information of States and Administrations.	SRWG/11	Open

Reference	Who	What	Due date	Status
10-3	States/Administrations, ICAO Secretariat	Implement a temporary regional arrangement to facilitate space-based VHF trials prior to the availability of finalized SARPs and coordination mechanisms. Under this arrangement, a State or entity initiating a trial would submit a request to the APAC Regional Office, which would coordinate with ICAO HQ to identify possible candidate frequencies. The APAC Regional Office would then notify all States within the region of the proposed trial, including relevant details such as the frequency, timing, and expected area of impact, and would coordinate the collection and resolution of any comments or concerns raised. In the absence of adverse comments, trials could proceed with close monitoring by the concerned States and the Regional Office. This temporary arrangement was agreed as an interim measure to support timely implementation of space-based VHF trials in the APAC region and will be reviewed at a later stage.	SRWG/11	Open
10-4	Thailand, India	Thailand and India volunteered to draft the NDB-related content for inclusion in the APAC Regional Frequency Management Manual, and to present in the next meeting.	SRWG/11	Open
10-5	GNSS RFI Ad-hoc Group	Once the regional guidance material is published, a minimum data set for reporting GNSS RFI occurrences will be provided for use by States in compiling incident reports. Accordingly, it was recommended to await the guidance before collecting GNSS RFI incidents from States/Administrations. The task of collecting the incident report will be initiated by a new ad hoc group formed under SRWG once the approved regional guidance material is available after ATM SG/14 adoption	SRWG/11	Open

Reference	Who	What	Due date	Status
10-6	GNSS RFI Ad hoc group	GNSS RFI Ad hoc group will commence its discussions, and the group lead will be identified at a later stage.	SRWG/11	Open
10-7	ICAO Secretariat	the ICAO Secretariat will send an email to all frequency focal points in the APAC Region to share their willingness to join the GNSS ad hoc group and nominate additional members for discussion.	SRWG/11	Open
10-8	China, Indonesia, ICAO Secretariat	China volunteered to undertake the necessary editorial work to merge the HF content into the consolidated Asia/Pacific Regional Frequency Management Manual v1.2.	CNS SG/30	Open

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LIST OF WORKING/INFORMATION PAPERS

WP/IP/SP Number	Agenda	Subject	Presented by
		WORKING PAPERS	
WP/01	1	Provisional Agenda	Secretariat
WP/02	2	Review of Outcomes of Relevant Meetings	Secretariat
WP/03	3.1	Proposal for Improving the Frequency Utilization Efficiency of AOC Band in APAC Region	China, on behalf of the VHF Ad-hoc Group
WP/04	6.1	Flight experiments using C band for Advanced Air Mobility (AAM) and studies on interference with radio altimeters	Japan
WP/05	3.2	HF-related information for inclusion in the APAC Regional Frequency Management Manual	Indonesia, on behalf of the HF Ad-hoc Group
WP/06	3.3	ICAO Position for the International Telecommunication Union (ITU) WRC-27	Secretariat
WP/07	3.3	Update on Space-based VHF	Secretariat
WP/08	3.3	Regional and inter-regional coordination mechanism for assisting States to assign VHF aeronautical frequencies, including Space-based VHF	ICAO HQ
WP/09	4	Updates on FF from HQ	ICAO HQ
WP/10	5	Review of Frequency Lists	Secretariat
WP/11	6.2	Review of Recommendations of the Radio Navigation Symposium	Secretariat
WP/12	6.2	Progress Update of the Procedures for GNSS and Data Link Disruption Ad Hoc Group	Singapore
WP/13	6.2	Global Updates on GNSS RFI Matters and Proposal for Discussion on Future Management of GNSS RFI Issues in the APAC Region	Secretariat
WP/14	7	Proposed Revisions to Asia/Pacific Regional Frequency Management Manual	China
WP/15	9	Review ToR and Action Items of SRWG	Secretariat
WP/16	10	Review PoC of States	Secretariat
WP/17	3.3	Space-Based VHF Frequency Coordination for the Asia/Pacific Region	Australia
		INFORMATION PAPERS	
IP/01	1	Meeting Bulletin	Secretariat

WP/IP/SP Number	Agenda	Subject	Presented by
IP/02	3.2	Update Survey Result of the Utilization of HF Bands for Aeronautical Communication in the APAC Region	Indonesia, on behalf of the HF Ad-hoc Group
		PRESENTATIONS	
SP/01	2	Global Updates related to Frequency Spectrum	ICAO HQ
SP/02	4	The Data Quality Control	ICAO HQ

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