International Civil Aviation Organization

Twenty Sixth Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/26) of APANPIRG

Video Tele-Conference, 5 – 9 September 2022

Agenda Item 5: Aeronautical Mobile Communications Service and Aeronautical electromagnetic spectrum utilization

5.2 Review Report of the Sixth Meeting of Spectrum Review Working Group (SRWG/6);

REVIEW REPORT OF THE SIXTH MEETING OF SPECTRUM REVIEW WORKING GROUP (SRWG/6)

(Presented by the Secretariat)

SUMMARY

This paper presents the report of the Sixth Meeting of the Spectrum Review Working Group (SRWG/6) of APANPIRG, which was held via Video Tele-Conferencing (VTC) between 1-3 March 2022, for review and action.

1. INTRODUCTION

1.1 The Sixth Meeting of the Spectrum Review Working Group (SRWG/6) of APANPIRG was held via video tele-conferencing from 1-3 March 2022. The meeting was attended by 74 participants from 16 States/Administrations and 2 International Organizations.

1.2 The meeting considered Fifteen (15) Working Papers, Three (3) Information Papers and Three (3) Flimsies under Ten (10) Agenda Items. The working papers, information papers, flimsies, meeting report, and other resources of SRWG/6 are available at https://www.icao.int/APAC/Meetings/Pages/2022-SRWG6.aspx

2. DISCUSSION

Outcome of APG23-3 Meeting

2.1 The meeting reviewed the outcome of the Third Meeting of Asia Pacific Telecommunity (APT) Conference Preparatory Group (APG) for World Radiocommunication Conference 2023 (APG23-3) held on 8 – 13 November 2021. Regional Officers CNS presented the latest ICAO Position, as the result of study progressed by Frequency Spectrum Management Panel (FSMP) based on the latest International Telecommunication Union (ITU) studies. This provided an opportunity to monitor progress and status of Asia/Pacific regional preliminary views for WRC-23 to protect aeronautical spectrum and ensure ICAO Position was supported at regional forums in accordance with

APANPIRG/27 Conclusion 27/45 and to report to CNS SG and its contributory bodies on the regional preparation progress made by APG.

2.2 ICAO representatives submitted Information Document APG23-3/INF-15 on the ICAO Position for WRC-23, and participated in various sessions of drafting groups on agenda items relevant to civil aviation and provided assistance, as required, to participants from civil aviation administrations. The overall outcome of the APG23-3 is in line with the ICAO Position. The meeting was invited to note the outcome of APG23-3, including agenda items where aviation is seeking actions by WRC on VHF voice over satellite, sub-orbital vehicles, UAS CNPC links etc.

VHF COM Simulation for 2030

2.3 The Meeting reviewed the latest development in simulating the VHF COM requirements for APAC in 2030. The simulation activities of the SRWG/3 in 2015 determined that implementation of 8.33 kHz channel spacing would not be necessary until at least 2025. In order to maintain 5 years as a buffer to transition to the 8.33 kHz spacing scheme for VHF COM in APAC, a new round of simulation was deemed necessary with the target year of 2030.

2.4 According to **Decision CNS SG/24/6(SRWG/4/1)** - Frequency requirements for VHF-COM systems and ILS, VOR, DME and GBAS/VDB facilities and **Conclusion CNS SG/24/7(SRWG/4/2)** – Simulation of VHF COM Frequency requirements for next 10 years, SRWG/5 prepared the format for *Submission of Frequency Requirements for the Period 2021 – 2030*, which was circulated to member States through State Letter with Subject: Simulation of VHF COM Frequency requirements for next 10 years and Ref.: T 8/8.6 – AP058/21(CNS) on 09 April 2021.

2.5 Up to the date of the meeting, the ICAO APAC Office has received submissions from **eight** States/Administrations. With low responses to the State Letter may create an obstacle for the meaningful simulation of VHF COM Frequency requirements for the next 10 years for the APAC region and there may be a delay in formulating regional requirements on this matter, the CNS SG/25 urged delegates to take necessary action to respond to the State Letter by providing required information for simulation as early as possible.

2.6 Preliminary analysis on the States' submission revealed the challenge of uncertainty to determine the medium-term spectrum requirements for VHF communication services, in particular the specific location for using the frequency. Further analysis is being conducted with concerned States by using Frequency Finder to determine whether these requirements can be assigned with a frequency within the available 25 kHz channels. States/Administrations were invited to review and provide up-to-date information for Frequency List 3 by using Frequency Finder as the simulation result would only be meaningful provided that sufficient frequency data are given. In addition, States/Administrations were invited to report issues to the Secretariat team during this interactive process.

Frequency Simulation for India

2.7 The meeting presented the outcome of frequency simulation by Mr Robert Witzen for India, which stemmed from the outcome of discussion in SRWG/5 WP/07. The simulation analysed the requirements raised by India as follows:

- 100 frequencies for Aerodrome Surface (AS) communications
- 180 frequencies for Tower services
- 90 frequencies for Approach Service (APP-U)
- 60 frequencies for Area Control Services (ACC-U)
- 15 frequencies for ATIS

2.8 The simulation demonstrated that the frequency requirements requested by India for up to 2030 can be satisfied within the frequency band 117.975 - 137 MHz with certain conditions, including a re-organization for the pools to which frequencies are allotted may be required. In addition, heavy congestion is expected at that time throughout most of this frequency band. As such, a similar analysis in 3 - 5 years from now was recommended to assess the severity of the congestion.

2.9 India appreciated the effort on simulation by Mr Robert Witzen and agreed on the outcome of the simulation exercise. India also advised that the result of this simulation could be further refined to match more accurately to the actual frequency requirements by identifying more locations in the coming years. This study has set an example on the frequency planning techniques with actual situation to address the comment from Thailand that it could be difficult to estimate the future traffic growth and subsequently the need for an increase in frequency channels due to the pandemic that would have delayed the original estimated growth. It was noted that similar simulation could be applied to other APAC States as well, and in case 8.33kHz channel spacing were identified as necessary in some airspaces within this region, strategic planning as in the case of Europe could be adopted to ease the concern of investment to aircraft to enable their use of 8.33kHz channel spacing.

2.10 The meeting noted the limited discussion in the paper on more flexible use of the VHF COM Frequency Allotment Plan. Certain States also commented on restrictions and flexibility in the pooled APAC frequency allotments, the Secretariat commented that any changes to the frequency allotment plan implied the update to the Doc 9718 Vol II and modification of Frequency Finder tool, and that would be challenging but there is no room to wait further, and two relevant Action Items were proposed and endorsed in the meeting as follows:

- Review the registered frequencies from the simulation conducted in 2016 in the Frequency Finder, and remove those temporary frequencies in the Frequency Finder in the previous simulation service;

- Establish an ad-hoc group 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. This ad-hoc group will mainly work in offline mode through email list, and the Secretariat invited all interested States/Administrations to join this ad-hoc group by indicating their interest to the Secretariat

2.11 The simulated data for States is available in MS Excel format upon the request by State through the ICAO Secretariat.

Preparation for Implementation of VHF Com 8.33 kHz Channel Spacing Requirements in APAC Region by Indonesia

2.12 This paper discussed Indonesia's preparations for the implementation of VHF COM 8.33 kHz channel spacing. Indonesia has accommodated the use of 8.33 kHz channel spacing in national regulation and will be updated regarding the actual event. The implementation of this policy directly impacts the ANSP, airline operators, ground service (e.g., ground handling, VHF data link frequencies), heliport operators as main users of the VHF COM Frequency. Indonesia reported 405 frequencies allocated that have also registered with Frequency Finder. Based on a survey conducted by DGCA with the ANSP regarding the ability of the existing VHF COM facilities to operate, of all the 864 types of facilities operated, 680 (i.e. 79%) can operate at 8.33 kHz channel spacing and the rest can't be changed. In addition, to ensure all 1497 registered civil aircraft operating in Indonesia are capable of operating at 8.33 kHz, Indonesia will conduct a further survey. When 8.33 kHz channel spacing will be been implemented, some issues were identified as follows:

- Operational use will have an impact on the ATC load (phraseology) when using the 3 decimal place;
- Implementation of 8.33 kHz channel spacing will impact ANSP on replacing all the VHF COM facilities which incapable of working on that channel space;
- It is necessary to consider the impact on airlines; and
- Need to update national regulation of the use 8.33 kHz if it has been recommended by ICAO APAC next future.

2.13 The paper provided adequate information and precise presentation as a good observation on the subject of implementation of 8.33kHz channel spacing in the Region, which is one of the core agenda items of the SRWG meeting. The meeting suggested considering formulating an implementation roadmap along with the deliberation with individual States when the matter matures in future. IATA acknowledged that most of airline air transport fleet are already equipped with 8.33 kHz VHF Voice Channel Spacing. As it appears that the VHF band is expected to be congested by 2030, and considering the safety and flight efficiency role of VHF COM for flight and ATM operations, IATA suggested that the APAC region plan ahead and establish an agreement for a structured implementation plan and timeline for eventual migration to 8.33 kHz, including an accommodation strategy for non-complying aircraft.

Aeronautical Frequency Spectrum Coordination and Planning Criteria in the APAC Region

2.14 The meeting reviewed the current practices and coordination procedures for aeronautical facilities and services operating in the aeronautical frequencies bands and the evolution of planning criteria employed.

2.15 On frequency coordination, States should coordinate for all frequency assignments that may affect the use of frequencies in other States. In principle, States should coordinate with the Regional Office for all frequency assignments that may affect the use of frequency assignments coordinated through the ICAO mechanism. Not doing so will ultimately result in unforeseen interference, less efficient and less flexible assignment coordination and planning in a congested environment, as there will not be any possibility of optimizing assignments to solve congestion, as well as for a chance to conduct a meaningful simulation at the regional level. As such, the following Draft Conclusion was discussed and endorsed for consideration in CNS SG/26:

<table>
<tr><td colspan="3">Draft Conclusion SRWG/6-1 - Frequency coordination for aeronautical frequency bands of 190-526.5 kHz, 108-117.975 MHz, 960 – 1215 MHz and 117.975 to 137 MHz.</td></tr>
<tr><td colspan="2">What: That, States are encouraged to coordinate with ICAO APAC Office before assigning frequencies for aeronautical services in the frequency bands of 190-526.5 kHz, 108-117.975 MHz, 960 – 1215 MHz and 117.975 to 137 MHz that may affect the use of aeronautical frequencies in other States.</td><td>Expected impact:
☐ Political / Global
☒ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To optimize the frequency assignment planning and solve congestion at regional level.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 25-Nov-22</td><td colspan="2">Status: Draft to be adopted by PIRG</td></tr>
</table>

Who:	☒Sub groups ☒APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other: -

2.16 It is essential to coordinate the use of AM(OR) frequencies with ICAO to make sure they can operate without interferences with other aircraft stations and AM(OR) service, as the ICAO is hosting the only list of these frequencies. A State also commented that clarity is still required on guidelines for coordination based on the Draft Conclusion above as the States are only encouraged to coordinate and it would become an obligatory requirement to States.

2.17 On frequency assignment and planning criteria, the meeting discussed the principles that were adopted by the ASIA/PAC/3 RAN Meeting in 1993 and they covered frequency assignments for NDB (List 1), VOR, DME and ILS (List 2), VHF COM (List 3). The latest revisions of the Handbook on Radio Frequency Spectrum Requirement for Civil Aviation (Doc 9718), Volume I and Volume II, which have been approved by the Secretary-General for publication, are to be formally published in early 2022. Subsequently, the revised planning criteria contained in the revision for compatibility assessment of frequency assignments to VHF COM systems and NAV systems (ILS, VOR, DME and GBAS/VDB) have been incorporated in the new release of the Frequency Finder tool. The following Draft Conclusion was discussed and endorsed for consideration in CNS SG/26:

<table>
<tr><td colspan="3">Draft Conclusion SRWG/6-2 - Planning Principle for aeronautical frequency bands of 108-117.975 MHz, 960 – 1215 MHz and 117.975 to 137 MHz.</td></tr>
<tr><td colspan="2">What: That, Doc 9718, Handbook on Radio Frequency Spectrum Requirements for Civil Aviation, Volume II, Second Edition – 2021, is adopted as the planning principle for aeronautical facilities and services operating in the aeronautical frequency bands of 108-117.975 MHz, 960 – 1215 MHz and 117.975 to 137 MHz in APAC.</td><td>Expected impact:
☐ Political / Global
☒ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To implement the updated ICAO provisions</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 25-Nov-22</td><td colspan="2">Status: Draft to be adopted by PIRG</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other: -</td></tr>
</table>

Outcome of Ad-Hoc Group Activities on 50 kHz Channel Spacing for VOR/ILS Operations

2.18 This paper summarized the outcome of the Ad-hoc Group activities with regard to the implementation of 50 kHz channel spacing in the frequency band 108.000-117.975 MHz for VOR/ILS operation in the APAC region. In 2021, the SRWG/5 meeting discussed the possible shortfall of VOR channels with the current 100 kHz channel spacing and agreed to explore the feasibility of the introduction of 50 kHz channel spacing for VOR and ILS/Localizer deployments in the frequency band 108.000-117.975 MHz in the APAC region. Accordingly, the meeting decided to constitute an ad-hoc group, under SRWG/5 Action Item A5-5 to 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, i.e. this meeting. An online ad-hoc meeting was held on 8th February 2022 and the ad-hoc group, led by India, produced this paper of the outcome of the discussion with a questionnaire prepared with the paper.

2.19 The challenges identified of implementing 50 kHz channel spacing are, deemed by the ad-hoc group, primarily with airspace users (airline operators) and not with ground segment. The need for active coordination between the stakeholders including ANSPs, Civil/Military and Airline Operators

(IATA) was also stressed. The ad-hoc meeting also noted that the ICAO Frequency Finder tool fully supports 50 kHz channel spacing.

2.20 The paper presented the status of coordination within India and consultation with all stakeholders including IATA and its Military Organizations. The stakeholders have consented to implementing 50 kHz channel spacing within India. It was shared that both China and Japan have already implemented 50 kHz channel spacing and they shared their experiences. To speed up the process, the online meeting agreed to circulate a questionnaire to the State and Airline Operators including IATA through an ICAO APAC State Letter. With comments raised in the meeting, the Secretariat published a questionnaire via ICAO APAC State Letter Ref.: AP068/22 (CNS) dated 28 April 2022.

Minimum Coordination Distance and the Need for Coordination of Frequency Assignments

2.21 This paper described the principles to observe and calculate with examples when establishing a minimum coordination distance between VHF COM and NAV facilities. Beyond this distance, no frequency coordination is required with respect to the desired facility. In aeronautical frequency assignment planning, the receiving station that is to be protected from harmful interference is typically the aircraft when operating at the edge of the Designated Operational Coverage (DOC) at the maximum range and height. Since the DOC is not the same for all frequency assignments, the minimum separation distance has been established as the distance between the (undesired) transmitter and the location of the (desired) aircraft receiver, in each case, taking into account the parameters to the desired and the undesired stations as in the relevant ICAO Table of frequency assignments.

2.22 The meeting was invited to note that while it is not feasible to establish a single value for a minimum coordination distance because of the variables to be considered in the relevant calculations, States are invited to note that all facilities that do not meet this requirement need to be coordinated with ICAO. The meeting supplemented that while it is important to coordinate the use of frequency in order to avoid interference with other States, however, a State should be allowed to determine, based on ITU standards, other technical standards and geographical terrain whether the minimum coordination distance requirements are met. As discussed in the meeting, the Regional Guidance Material being developed will deliberately address this issue clearly.

Rationale for Placing Proper Frequency Coordination Mechanism and Framing Guidelines

2.23 This paper by India reviewed the need for placing a proper coordination mechanism and framing explicit policy guidelines for States. India informed the meeting that all their new frequency assignments have been coordinated with ICAO Regional Office before being used in order to protect the frequencies being used in India and neighbouring countries from harmful interference. However, they noted that the ICAO frequency lists do not contain the complete assignments and the assignments from many states are not fully recorded in the relevant lists. The issue was discussed during the online Ad-hoc Committee Meeting on 8, Feb 2022, with certain points as highlighted hereunder need to be addressed to give a comprehensive guidance to states for adoption:

- Clarity is required with respect to the RAN meeting conclusions and relevant Annex 10 Volume V provisions, in respect of whether the states are required to coordinate and record all the new assignments with the Regional Office or only those assignments near the border areas.

- In case the new assignments contemplated near the border areas are to be coordinated, what are the specific distances required for different services for which coordination is necessary.
- Whether the military assignments (all or near the borders) are required to be coordinated. Normally, classified assignments are not disclosed. India presently is coordinating quite a number of military assignments.
- The coordination practices followed by the states/administrations of other Regions may help to replicate in Asia/Pac region.
- Need for framing explicit guidelines to remove the ambiguity and for compliance by states may be considered.

2.24 India raised a comment on probable augmentation of the Frequency Finder tool could incorporate indication to states to coordinate or not to coordinate. Mr Robert Witzen, creator of Frequency Finder, would consider such augmentation to be incorporated into the Frequency Finder.

Implementation of 50 kHz Channel Spacing in China

2.25 This paper shared the implementation of 50 kHz channel spacing in China. Since the frequency band 108.000-117.975 MHz with 100kHz channel spacing falls short to satisfy the actual demand from the rapid development of the civil aviation industry and the substantial increase in the number of Radio Navigation Stations (RNS), CAAC decided to assign ILS Localizer and VOR frequency with 50 kHz channel spacing after consulting the domestic airlines and facility operators, and notified the specific requirements that since October 1st, 2014, all new / relocated LOCs, GPs, VORs and DMEs shall meet the followings:

- The tunable frequency spacing of LOC and VOR equipment shall at least reach 50 kHz;
- The tunable frequency spacing of GP equipment shall at least reach 150 kHz; and
- Both X and Y channel modes are applicable for the DME equipment.

2.26 To ensure safe operation, CAAC adopts the mixing condition between 50 kHz and 100 kHz channel spacing when setting the protection distance of RNSs, and refers to Annex 10, Attachment C to Volume I, paragraphs 2.6, 3.4 and 3.5 for specific details. Implementation of 50 kHz channel spacing is progressing steadily. Japan has also reported their implementation of 50kHz channel spacing for VOR and LOC, as well as X and Y channels for DME.

Latest Updates to Frequency Finder Tool

2.27 The meeting presented the latest work, enhancements and functionalities brought to the Frequency Finder tool to assist ICAO Regional Offices and States to manage and coordinate aeronautical frequency assignments in ICAO COM Lists 2 and 3 as well as SSR Mode S II/SI codes. Further Frequency Finder provides the calculation of interference areas and a geographical interface for plotting of the frequency assignments, including any interference area. Work on the development of a module for VHF/UHF navigation systems as in COM list 2 (ILS, VOR, DME and GBAS) has been completed using the frequency assignment planning criteria as per the Handbook on Radio Frequency Spectrum Requirements for Civil Aviation (Doc. 9718) Volume II which was approved in 2021.

2.28 On top of the developments mentioned, two features were further enhanced and implemented in the Frequency Finder Tool. The first feature, the plotting interference contours in the VHF-NAV module on the Google Map, provided the identifiable difference in colours between different NAV systems/facilities. The second feature, a global database for Mode S II/SI code assignments, is currently is under final evaluation. This feature is capable of assessing compatibility with Mode S II codes and Mode S SI codes in accordance with proposed modifications to the

Aeronautical Surveillance Manual (DOC 9924) expected to be approved in 2022. It is expected the modified versions of Frequency Finder could be deployed during Q2/Q3 2022. The meeting was invited to make extensive usage of the Frequency finder tool for frequency coordination and provide feedback on FF tool usage, suggestions, bugs and recommendations.

2.29 The meeting was briefed on the development of online course on fundamentals of frequency management, which will be composed of three new self-study online courses to provide an overview of frequency spectrum used for aeronautical services, a familiarization with the regulations, frequency assignment planning criteria for aeronautical radio communication system and introduction of ICAO Frequency Finder tool. The meeting was informed that with Frequency Finder the channel spacing to be considered in frequency assignment planning can be set by the user (100 kHz or 50 kHz). The default channels spacing is 100 kHz for frequency assignments ending with integer numbers of 100 kHz (e.g. 114.300 MHz) and 50 kHz for frequency assignments ending with 50 kHz (e.g. 114.350 MHz).

Draft of Asia Pacific Regional Aeronautical Radio Frequency Management Guidance Material

2.30 The meeting discussed and reviewed the second edition of the draft of Asia Pacific Regional Aeronautical Radio Frequency Management Guidance Material. The guidance includes objective, scope, institutional framework, spectrum management and procedure of APAC region, air-ground communication and radio navigation aid frequency management information. Following issues for meetings' attention and discussion:

- The minimum coordination distance for radio navigation facilities;
- The minimum separation distance for Localizer and Glide Path;
- The minimum separation distance for adjacent channel of Localizer and VOR;
- Influence of Aircraft Contribution Factor on the Calculation of GBAS Protection Ratio;
- Criteria for Identifications coordination.

2.31 The Secretariat further suggested that the guidance material could be further improved by providing frequency planning criteria in easy-reading format (e.g. WP/04 of SRWG/1) for easy reference by frequency planners in CAAs or relevant authorities. The Guidance Document is a living document, which is subject to continuous review and improvement. Should there be any changes in the APAC frequency allotment plan, the Guidance Document could be updated to reflect the changes. To further proceed with the draft, the Secretariat will issue a State Letter to invite the APAC States to review and comment on the draft guidance document after further completion of the draft.

Potential Impacts from 5G Implementation on Aircraft Radio Altimeters – Outcomes in Relevant Meetings and Regional Updates

2.32 This paper reviewed the discussion in APAC after SRWG/5 about 5G implementation and potential impacts on aircraft radio altimeters, and relevant regional updates including:

- ICAO Headquarters issued a state letter on 25 March 2021 encouraging the States/Administrations to consider as a priority, public and aviation safety when deciding how to enable cellular broadband/5G services in radio frequency bands near the bands used by radio altimeters.
- Outcomes of 12th Meeting of Frequency Spectrum Management Panel Working Group (FSMP WG) including the reporting from Japan, Australia, ICCAIA and from the aviation industry, the national efforts to implement broadband mobile near 4.2-4.4GHz

and outcomes from the Correspondence Group on Radio Altimeters (CG-RA) of FSMP WG.

- Outcomes of CNS SG/25 including sharing from Hong Kong China on their established mechanism in handling the issue, the ICAO Secretariat's paper to summarise discussion from SRWG/5 and the background in APAC.
- Outcomes of RASG-APAC/11 including a summary from the ICAO Secretariat, a sharing from Singapore, co-sponsored by Bangladesh, Fiji, Indonesia, New Zealand and Thailand, on their efforts to bring about greater awareness in managing the risk posed by the potential interference to aircraft radio altimeter by 5G, and a discussion from Hong Kong China on their effort to bring the potential risk to the attention of the local industry and taken proactive actions with relevant parties, including collecting suspected occurrences from airline operators.
- The meeting was invited to note the **Conclusion RASG-APAC 11/3 —** *Potential Interference to Aircraft Radio Altimeter by 5G Telecommunications System* and **Decision RASG-APAC 11/6 —** *Potential Interference to Aircraft Radio Altimeter by 5G Telecommunications System*
- Regional and global development on the issue, including FAA issued Statements on 5G since December 2021 via https://www.faa.gov/newsroom/faa-statements-5g and Association of Southeast Asian Nations (ASEAN), based on the latest studies conducted by Global System for Mobile Communications Association (GSMA), via https://www.gsma.com/spectrum/wp-content/uploads/2019/08/GSMA_Roadmap-for-C-band-spectrum-in-ASEAN_WEB.pdf, the current plans for 5G spectrum allocation are focused mainly on the 3 300 – 3 800 MHz range. Further information related to the use of certain frequency bands for IMT-2020 (5G) in Asia-Pacific countries can be found from the several survey studies in APT Reports.

2.33 As agreed in CNS SG/25, Member States would monitor the impact of 5G on radio altimeters in their States/Administration about the safety and frequency spectrum issues. Member States CAA and airworthiness office may collect all relevant information and past issues reported, if any, and inform RASG-APAC of any significant concern. The issues related to frequency spectrum may be brought to the attention of the CNS section of the ICAO APAC Office for further coordination with RASG-APAC and ICAO Headquarters.

5G Interference to Aircraft Radio Altimeters – IATA and Thailand

2.34 The meeting discussed recent lessons learned concerning the deployment of 5G telecommunication networks and outlines recommendations to mitigate the potential risks to flight safety by 5G deployments. The collective global aviation community, including ICAO, IATA, IFALPA, RTCA, FAA and other State Aviation Regulators of Australia, Canada, France, South Africa, Thailand, and the United Arab Emirates, has formally recognized and expressed safety concerns arising from the potentially harmful interference to radio altimeters (4.2-4.4 GHz) deployed on all types of civil aircraft that could result from the deployment of 5G telecommunications systems in the adjacent frequency band (3.7–3.98 GHz). Without appropriate mitigation, this harmful interference poses a risk to aviation operations across all ICAO regions, including APAC.

2.35 The meeting also reviewed the risk mitigation strategies and next steps for implementation. ICAO High-Level Conference on COVID-19 (HLCC) recommended the risk mitigation measures of 5G implementation to safety-critical radio altimeter functions. As a minimum, actions and regulatory measures need to be taken and put in place to safeguard the use of radio altimeters. Some States/regions, e.g. Japan, Australia, Canada, Europe, have set an example by cooperating with 5G network providers about the provision of location information for their stations, as

well as details of the transmission characteristics required. It cited that maintaining current safety levels for aircraft, passengers and flight crews must be States' / governments' highest priority. States should ensure that every frequency allocation/assignment is comprehensively studied and is well proven not to adversely impact aviation safety and efficiency, and States must provide the necessary leadership and act as a fair facilitator to ensure open and positive information sharing between the two industries and national aviation and telecommunication regulators.

2.36 The meeting was invited to review and acknowledge the safety concerns and potential operational impacts of 5G telecommunication system deployment to radio altimeter, and in this regard, to consider incorporating "C-Band mobile telecommunications interference impact on aviation operations" into the ToR of the SRWG, to request ICAO APAC office to consider issuing a State letter to States within the Asia/Pacific Region in a similar manner to the NACC letter; and to consider adopting actions taken by some States to mitigate 5G interference and suggest additional actions as necessary and appropriate. This paper also requested ANSPs and aviation safety regulators to brief relevant government and telecommunication regulatory/management agencies about the potential impact of 5G deployment on aviation safety, and propose necessary provisions for the spectrum auctioning/allotting process that will ensure the radio altimeter frequency is free from harmful interference at and around airports.

2.37 To address these proposed actions above, the Secretariat first introduced the original ToR of SRWG on studying necessary work for introducing 8.33kHz channel spacing and later included the topic of frequency spectrum planning. Due to the cross-domain and multi-facet nature of the issue involving frequency spectrum and flight safety, the ICAO recommended that the terms of reference of SRWG remains unchanged but the concern raised by IATA and Thailand could be addressed through a dedicated Agenda Item for discussion at future meetings as the need arises.

2.38 The Secretariat informed the meeting that the issue was well discussed in RASG-APAC/11 meeting with one Conclusion and one Decision addressing 5G interference to radio altimeter. A separate State Letter from APAC will be issued based on the outcome from RASG-APAC/11 after coordination with ICAO HQ. Philippines supplemented that ICAO HQ is preparing a State Letter or Electronic bulletin to be issued in 2022, hence APAC Region would not need to issue its own State Letter on the same subject right now. The Secretariat invited IATA to review and make improvements existing Action Item to adequately address the concerned raised, which APAC States were informed *to take necessary follow up action at the regional level, to support CAAs working with State's spectrum regulators to avoid the future safety issues on radio altimeter due to 5G implementatio*n.

2.39 Considering the two RASG-APAC/11 Conclusion/Decision, i.e. **Conclusion RASG-APAC 11/3 —** *Potential Interference to Aircraft Radio Altimeter by 5G Telecommunications System* and **Decision RASG-APAC 11/6 —** *Potential Interference to Aircraft Radio Altimeter by 5G Telecommunications System,* have already covered the scope of the Draft Conclusion proposed by IATA and Thailand, it would be a duplication of effort should the same issue be under APANPIRG that have already been addressed under RASG-APAC. The Secretariat explained that despite the two RASG-APAC/11 outcomes endorsed, it depends on the effectiveness of how these RASG-APAC/11 Conclusion/Decision actually cover the concern on the issue in the Region, which could be further reviewed at future RASG-APAC meetings.

2.40 The meeting was further informed that the issue regarding the potential interference from 5G implementation to RA has been communicated and brought for attention by ICAO APAC Regional Officer to the ITU Regional Radiocommunication Seminar 2020 for Asia & Pacific held on 28 October 2020, as well as to the Twenty-Sixth Meeting of the Regional Interagency Working Group

(IAWG) on Information and Communication Technology (ICT) held on 17 January 2022, which was hosted by International Telecommunication Union and co-organized by APT and UNESCAP.

2.41 Further to comment from IATA on no cases received in APAC Region, and the enquiry on the procedure to report any cases of suspected interference issue, the Secretariat reminded that States/Administrations and industry provide feedback to RASG-APAC and APANPIRG, and its sub-groups, on reports of interference from 5G networks as detailed in Decision RASG-APAC/11/6. China commented that the risk of potential interference from 5G implementation to RA could vary depending on the parameters implemented, including Base Station transmitting power, antenna location, antenna tilts and, especially, frequency spectrum used by 5G etc. Further research work could be done to determine how to avoid the potential interference from 5G, the results of which could be discussed in high-level meetings, e.g. FSMP.

Radio Altimeters and 5G Administration C-Band Deployment – United States

2.42 The flimsy reviewed the synopsis, intra-agency and industry coordination on the 5G deployment, and actions taken by Federal Aviation Administration (FAA) via Airworthiness Notices (AD), Alternative Methods of Compliance (AMOC) and NOTAMs. The FAA expressed that they believe the expansion of 5G C-band and aviation will safely co-exist. The FAA continues to work closely with the Federal Communications Commission (FCC) and wireless companies, and they are making progress toward safely implementing the 5G C-band expansion. They are confident with the ongoing collaboration we will reach this shared goal.

2.43 The flimsy introduced relevant ADs issued, as well as the AMOC process which allows anyone to propose to the FAA an alternative method of compliance or a change in the compliance time, if the proposal provides an acceptable level of safety. To date, the FAA issued 21 5G C-band-related AMOCs for airplanes in commercial service. In addition, NOTAMs will be maintained to identify locations with 5G C-band base station deployments. Further information could be referred to the FAA website as introduced in the flimsy.

Outcome of FSMP WG/13 on Radio Altimeter Issues

2.44 The meeting reviewed the outcome of the Thirteenth Working Group Meeting of the Frequency Spectrum Management Panel (FSMP-WG/13), held between 21-25 February 2022, on potential interference to Radio Altimeter from 5G for information and reference by the meeting. Under its Agenda Item 4 - Radio Altimeter issues, the following papers were discussed:

- Report from correspondence group on radio altimeters (CG-RA) - *IP03*
- National efforts to implement broadband mobile near 4200-4400 MHz
  - Mitigation measures - *WP03, WP16, IP02, IP04*
  - Safety Cases/Compatibility Analyses

2.45 The meeting was invited to note FSMP-WG/13 *IP/03*, which is the best overall fact-finding reference available today, while *IP/04* is more of a simplified "executive-level" briefing style text, they are provided in Appendices A and B to the paper respectively for easy reference.
The secretariat also suggested the RTCA Technical Webinar: *Interference Risk on Radar Altimeters from Planned 5G Telecommunication* as a good reference at YouTube.

Update on Space-based VHF – Singapore

2.46 This paper updated the meeting on the progress of Space-based VHF discussions at International Telecommunications Union (ITU) Working Party 5B (WP 5B) and ICAO Frequency Spectrum Management Panel (FSMP) working group meetings. With the support of ICAO and the

different Regional Groups of the ITU, the space-based VHF frequency allocation was formally accepted as an agenda item for World Radiocommunication Conference 2023 (WRC-23). Currently, the space-based VHF frequency compatibility study is still ongoing in ITU WP 5B meetings, and the FSMP is the designated ICAO point of liaison with ITU WP 5B.

2.47 The paper reviewed the three documents updated in the recent ITU WP 5B meeting held from 29 November to 10 December 2021 including a Liaison Statement (LS) to ICAO to update the progress of space-based VHF studies and to seek clarifications, in particular, on VHF data link (VDL) Mode 2, a Working document towards a Preliminary Draft New Report (PDNR) detailing the technical studies and assessments of space-based studies, and a Working document towards a Draft Conference Preparatory Meeting (CPM) report that details the proposed regulatory changes for WRC-23. The paper also shared a document from FSMP WG/13 IP/06 regarding the initial outcomes of the technical studies and test/validations performed by a European initiative called VOICE, a project to perform a proof of concept (POC) for a satellite-based CNS technology in a real operational environment. The POC will also include satellite relay of VHF voice and data.

2.48 As the activities within the ITU WP5B and the FSMP are intensifying as WRC23 draws nearer, to ensure aviation interests are safeguarded, the meeting was invited to support the agenda items as advised by ICAO Assembly Resolution A38-6 (*Support of the ICAO Policy on radio frequency spectrum matters*); and submit additional questions, if any, to FSMP through ICAO Regional Office.

Review of Point-Of-Contact (POC)

2.49 The meeting reviewed the current status of POCs of States on frequency-related affairs for review and update. ICAO APAC Office issued a State Letter Ref.: T 8/8.9 - AP057/21(CNS) with Subject*: Focal Point for Frequency Coordination* on 08 April 2021, to remind Administrations to revise and update the POC on frequency affairs. The updated POC list for Frequency Affairs is provided with the meeting report.

Review of Action Items

2.50 The meeting to review the action items. The updated Action Items List is provided in **Appendix A** to this paper.

Date and Venue for the Next Meeting

2.51 The Secretariat informed the meeting that the date for the next meeting would be coordinated with the Chair, all APAC States and relevant international organizations three months before the date of the meeting. The date would likely be after the FSMP WG meeting as per the usual arrangement.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;
b) adopt Draft Conclusions defined in paragraphs **2.15 and 2.17**;
c) note the updated action list in **Appendix A**; and
d) discuss any relevant matter as appropriate.

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Reference	Who	What	Due date	Status	Completed on	Result	Comment
~~A 2-7~~	~~All~~	~~to check consistency between global database and frequency list 3~~	~~on going~~			Information in orignal Frequency List3 now kept and updated in FF	Note: Transition of COM list 2 in pprogress
~~A 4-4~~	~~All~~	~~Experience sharing on Frequency Finder use~~	~~30-Mar-21~~	~~Open~~		~~In progress~~	~~Sharing tests on SSR module to start soon. Work on test plan for COM and NAV ongoing~~
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	Open		In progress	
~~A 4-6~~	~~ICAO~~	~~Frequency Finder workshop on COM module, and new NAV Module (Mode S SSR II Code module as necessary).~~	~~30-Mar-21~~	~~Closed~~		~~Under coordination subject to the pandemic situation~~	~~See my comments on Action Item A5/10~~
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-Mar-23	Open		CAAC volunteered to share a draft and lead the adhoc group. Decided to be contined in SRWG/5.	1.follow up VTC on 3 July. 2. Ad hoc drafting group meeting with CAAC on 10 July
A4-8	Robert Witzen, All	to run new VHF COM simulations	31-Mar-23	Open		To be conducted with required raw data submission from States/Administration	
~~A5-1~~	~~ICAO, States~~	~~ICAO secretariat acts as a 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 whether the information be provided by Singapore on a voluntary basis, updates from an FSMP WG meeting, from States or from other appropriate sources~~	~~21-Mar-22~~	~~Ongoing~~			
A5-2	ICAO	to host a regional WRC-23 preparatory meeting upon coordination with ICAO HQ after lifting of travel restriction.	31-Dec-22	Open			
A5-3	ICAO	to resolve firewall query of Australia for FF installation and use.	31-Mar-21	Open			Already replied during report
A5-4	ICAO	to inform ICAO HQ to consider the feasibility incorporating terrain data into future version of Frequency Finder	SRWG/7	Open			

Reference	Who	What	Due date	Status	Completed on	Result	Comment
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-Mar-22	Open			Completed with the paperfrom India.
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	Open			~~Currently a new technology~~ implemented in FF is using GBAS/VDB Ongoing stuies in NSP and FSMP are on LDACS in the DMEband
~~A5-7~~	~~ICAO~~	~~to issue a 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~~	~~31-Mar-21~~	~~Closed~~			SL Ref.: T 8/8.6 –AP058/21(CNS), 09 April 2021, Subject: Simulation of VHF COM Frequency requirements for next 10 years
~~A5-8~~	~~ICAO, States~~	~~to create a POC for all CNS matters as it is for ATM and compile them in APANPIRG POC.~~	~~31-Dec-21~~	~~Ongoing~~			AP057/21(CNS), 08 April 2021, Subject: Focal Point for Frequency Coordination
~~A5-9~~	~~ICAO~~	~~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.~~ (Action Item 5-9 was superceded by Action Item 6-8 recorded in SRWG/6)	~~SRWG/6~~	~~Open~~			~~HQ SL: Ref.: SP 74/1-21/22, 25 March 2021, Subject: Potential safety concerns regarding interference to radio~~
A5-10	ICAO	to conduct a workshop after new release of FF along with online course proposed by ICAO HQ for new release of FF is available	SRWG/7	Open			planned? A workshop F2F is necessary as part of the User Acceptance Test.
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	Open			

Reference	Who	What	Due date	Status	Completed on	Result	Comment
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.	SRWG/7	Open			
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)	30-Apr-22	Open			
A6-5	ICAO	Probable augmentation of the Frequency Finder tool to incorporate indication to States to coordinate or not to coordinate	SRWG/7	Open			
A6-6	China, ICAO	To summarize the revised planning principle/criteria in the format used in WP04 of SRWG/1	SRWG/7	Open			
A6-7	ICAO	State Letter on updated Guidance Material to invite APAC States for review and comments (Follow-up of A4-7)	SRWG/7	Open			
~~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	Open			HQ SL: Ref.: SP 74/1-21/22, 25 March 2021, Subject: Potential safety concerns regarding interference to radio altimeters