INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

REPORT OF

THE FIFTH MEETING OF THE SPECTRUM REVIEW WORKING GROUP (SRWG/5)

Video Tele-Conferencing (VTC)
15 March – 17 March 2021

The views expressed in this Report should be taken as those of SRWG/5 Meeting and not of the Organization.

Approved by the Meeting
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HISTORY OF THE MEETING

REPORT ON AGENDA ITEMS

LIST OF APPENDICES

LIST OF ATTACHMENTS

1. Introduction

1.1 The Fifth Meeting of the Spectrum Review Working Group (SRWG/5) of APANPIRG was held via video tele-conferencing from 15 to 17 March 2021.

2. Attendance

2.1 The meeting was attended by 109 participants from 18 States/Administrations and 3 International Organization including Australia, Bangladesh, China, Hong Kong China, Fiji, France, India, Indonesia, Lao PDR, Malaysia, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, USA, IATA, IFALPA 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. Chainan Chaisompong, Chairperson of the SRWG/5-group who extended warm welcome to all participants and expressed deep appreciation and gratitude to the efforts of all parties to make great achievements. Mr. Luo, Yi, Regional Officer CNS, also expressed welcome and thanks to the participants.

4. Officers and Secretariat

4.1 Mr. Luo, Yi, Regional Officer CNS and Ms. Soniya Nibhani, Regional Officer ANS(CNS) Implementation, ICAO Asia and Pacific Regional Office, acted as secretary for the meeting with the support of Ms. Bhabhinan Sirapongkosit, the Programme Assistant of the same office. The meeting was also assisted by Ms. Mie Utsunomiya, CNS Technical Officer and Ms. Fabiola Chouha, CNSS Programme associate and manager of the Frequency Finder tool at ICAO HQs, Montreal. Further, the meeting was also assisted by Mr. Robert Witzen who offered his expertise voluntary from Montreal, a former ICAO Officer, an expert in frequency management and main developer of Frequency Finder software tool.

5. Organization, working arrangement, language and documentation

5.1 The SRWG/5 met as a single body. The working language for the meeting was English inclusive of all documentation and this Report. A total of Fourteen (14) Working Papers, Eight (8) Information Papers, and Two (2) flimsies wereconsidered by the meeting. The List of Working, Information Papers and Flimsy is provided in **Attachment 2** to this Report**.**

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Agenda Item 1: Adoption of agenda

1.1 The provisional agenda presented in **WP/01** was adopted as agenda for the meeting. In order to accommodate presenters from France and Canada, the meeting was conducted as per the tentative programme provided in **Attachment 3** of this Report.

Agenda Item 2: Review outcomes of relevant meetings

Review of Relevant Meetings/Web-Conferences - Sec (WP/02)

2.1 This paper summarized relevant information and updates with the highlight on the outcomes of SRWG/4 reviewed by CNS SG/24 and noted by APANPIRG/31.

2.2 The CNS SG/24 meeting adopted eight (**8)** Conclusions and five (**5)** Decisions. In addition, based on the outcome of discussions on various agenda items, the CNS SG/24 meeting developed four (**4)** Draft Conclusions for consideration by APANPIRG/31 Meeting which was adopted by APANPIRG/31. The meeting noted Conclusion/Decision adopted by CNS SG/24 and also reviewed the different Conclusions and Decisions adopted by APNPIRG/31 in December 2020 of interest to the group and discussed the follow-up.

2.3 With reference to the **ACTION ITEM 24-6 of CNS SG/24** on space-based VHF Communications in 117.975-137 MHz frequency band, as requested by CNS SG/24, the Secretariat coordinated with SRWG chair, ACSICG chair and Singapore to see how to track and monitor the initiative, to take the concerns from States on a regional level. Singapore presented the latest updates to SRWG/5 on space-based VHF issue through **Flimsy 02**.

Space-based VHF Communications updates – Singapore (Flimsy/02)

2.4 The space-based VHF frequency compatibility study has commenced in International Telecommunications Union (ITU) Working Party 5B (WP5B) meetings, and the ICAO Frequency Spectrum Management Panel (FSMP) is the designated ICAO point of liaison with ITU WP 5B.

2.5 At the FSMP Working Group 11 (FSMP WG/11) meeting held from 1 to 12 March 2021, it was noted that ITU WP5B had requested for technical information pertaining to aircraft VHF and the future space-based VHF system for the purpose of the compatibility study for space-based VHF (WRC-23 Agenda Item 1.7), and Singapore also presented the latest updates on space-based VHF to FSMP WG/11.

2.6 The SRWG is the contributory body reporting through CNS SG with focus on aeronautical spectrum related issues in APAC region. 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. **ACTION ITEM 5-1**

Draft ICAO position for ITU WRC-23 - Sec (IP/02)

2.7 This paper reviewed the agenda items for the International Telecommunication Union (ITU) World Radiocommunications Conference 2023 (WRC-23) as presented in CNS SG/24 meeting. The paper discussed points of aeronautical interest and provides the ICAO Position for these agenda items.

2.8 The goal of the ICAO Position is to ensure aeronautical access to appropriately protected spectrum for Radiocommunication and Radionavigation systems that support current and future safety-of-flight applications. In particular, it describes the safety considerations necessary to ensure adequate protection against harmful interference. Support of the ICAO Position by ICAO contracting States is required to ensure that the position is supported at the WRC-23 and that aviation requirements are met.

2.9 The ICAO Position for the ITU WRC-23 was initially developed in 2020 with the assistance of the Frequency Spectrum Management Panel (FSMP) and was reviewed by the Air Navigation Commission at the seventh meeting of its 215th Session on 27 October 2020. Following the review by the Commission, it was submitted to ICAO Contracting States and relevant international organizations for comment. After a further review of the ICAO Position in light of the comments received by the Commission in April/May 2021, the ICAO Position will be reviewed and approved by the ICAO Council in June 2021.

2.10 States and international organizations are requested to make use of the ICAO Position, to the maximum extent possible, in their preparatory activities for the WRC-23 at the national level, in the activities of the regional preparatory group meetings and in the relevant meetings of the ITU, and support ICAO Position.

2.11 Australia informed the meeting that ICAO draft position has been reviewed by FSMP WG/11 from 1 March 2021 to 12 March 2021 and some changes have been made in agenda item 1.2 and 1.3 related to radio altimeter. It was informed that more information is available on FSMP WG/11 website at https://www.icao.int/safety/FSMP/Lists/Meetings/DispForm.aspx?ID=15&ContentTypeId=0x0100775D4F62D6A47C4B8092FD88410F3070.

2.12 Philippines shared the concern that most States don't respond to the State Letter. ICAO secretariat informed that it is a long standing issue regarding the low response rate of State Letter at world level, and has been addressed at council meeting on many occasions. It was proposed that after the lift of travel restriction, ICAO APAC Regional Office would host a regional preparatory meeting for WRC-23 upon coordination with ICAO HQ. **ACTION ITEM 5-2**

Updates on the Prominent List of the Outcomes of FSMP WG/11 Meeting - India (Flimsy01)

2.13 Through this flimsy, India provided updates to the meeting on the outcomes of the recent 11th Working Group Meeting FSMP/WG-11 held on 1-12 March 2021.

2.14 FSMP WG/11 discussed about the national efforts to implement broadband mobile near 4200-4400 MHz. Different State/Administrations are considering to deploy new cellular broadband technologies, such as 5G, in portions of the 3700-4200 MHz band. FSMP members expressed serious concern that these deployments may cause harmful interference to radio altimeters. FSMP agreed on the development of a State Letter to sensitize the States to ensure public and aviation safety when deciding on the implementation of cellular broadband/5G services in bands near 4200-4400 MHz. Furthermore, in order to assist further aviation study on this issue and to form a correspondence group on radio altimeters (CG-RA) was formed to collect information on a number of topics related to 5G/altimeter compatibility.

2.15 For ICAO position for WRC-23, FSMP WG/11 reviewed a consolidated list of State's responses to ICAO draft WRC-23 position and completed assisted Secretariat to develop response to those comments and some of which resulted in suggested changes to ICAO Position for WRC-23. The meeting endorsed that ICAO continue to support the use of FSS in accordance with the principles contained in the

current Resolution 155 (Rev. WRC-19) for C2 Links, where ICAO requirements can be met, while noting that other options for that function could be available. A contribution providing technical considerations concerning digital technologies for commercial aviation safety-of-life applications using Wide Band HF (WBHF) systems was discussed. The changes proposed to Chapters 7 and 8 of Volume I of the Handbook on Radio Frequency Spectrum Requirements for Civil Aviation, was approved. Draft amendments to the current Handbook Volume II developed by the NSP were also discussed and agreed.

2.16 The meeting thanked India for sharing the information. It was informed by secretariat that, as per the outcomes of FSMP WG/11 on revised Vol II of Handbook on Radio Frequency Spectrum Requirements for Civil Aviation, NAV (VHF and UHF) tool in Frequency Finder will be available.

2.17 Pakistan requested India to present some important recommendations discussed in the paper and FSMP/11. India shared that detailed information is available at the same hyperlink of paragraph 2.11 of this report.

Agenda item 3: Review the TOR and action items (WP/03)

Review the TOR and action items - Sec (WP/03)

3.1 One of the main outcomes of the SRWG/4 was to make revision of the TOR. The keynote for this revision was to conduct simulation on VHF COM frequency assignment and expand its scope of work to cover Navigation systems with highlight on GBAS implementation. The CNS SG/24 meeting adopted the proposed revision by SRWG/4 through *Decision CNS SG/24/9 (SRWG/4/4).*

3.2 The meeting reviewed TOR adopted by CNS SG/24 and further reviewed and updated the Action List provided with the paper. The revised Action list is attached in **Appendix A** to this Report.

Agenda item 4: Frequency coordination process and improvement for the Asia/Pacific Region

Review of Regional Process - Sec (WP/04)

4.1 Through this paper, the secretariat presented an overview of the frequency coordination process that is being used in the APAC Region. ICAO APAC Regional Office is maintaining Frequency List 1, 2 on Frequency Manager, which is a standalone application, while the Frequency List 3 is with Frequency Finder, the free ICAO tool provided to States/Administrations and Regional Office by HQ, which is the basis for global database. Secretariat also informed that, with the support of member States, ICAO APAC Regional Office has successfully registered hundreds of frequencies submitted via e-submission to global database. This has greatly facilitated the final coordination step that is performed by the ICAO Regional Office, in terms of efficiency and accuracy.

4.2 India demonstrated good cooperation and professionalism with ICAO APAC Regional Office to support the implementation of the e-submission process for Frequency List 3. A sample from India was provided in Appendix B accompanied by Appendix C of this paper, which was used for real VHF COM registration through ICAO APAC Regional Office. Secretariat presented some administrative measures that have been implemented to improve the efficiency of the current process with the adoption of conclusion *CNS SG/24/8(SRWG/4/3) Establishment of a list of focal points responsible for the operation of Frequency Finder in States.* Frequency Finder installation status table was provided in Appendix D to the paper, which will serve as the list of focal point responsible for the operation of Frequency Finder in

respective States/Administrations. The status table updated by the meeting is provided in the **Appendix B** to this Report

4.3 ICAO holds the view that frequency assignments that have been coordinated with ICAO have priority over those that have not been coordinated. For reported interference caused by frequency implemented by States/Administrations without coordination and registration with Regional Office, it may be considered as discrepancy to the regional planning requirements, and be further identified as deficiency upon harmful impact report on international operations.

4.4 Singapore commented that data in appendix A are traditional way to file frequencies requirements with ICAO APAC Regional Office. Some stations may have small coverage. Therefore, States may need frequency requirements based on the coverage of the station. ICAO secretariat informed that Frequency Finder tool is using ICAO frequency planning criteria mentioned in Handbook on Radio Frequency Spectrum Requirements for Civil Aviation, Volume II. ICAO planning criteria estimates coverage as a circle while in practice the coverage may not be a circle. The main objectives of Frequency Finder tool are to assist ICAO Regional Offices and States to manage and coordinate aeronautical frequency assignments. In addition, it can maintain a common central frequency database.

4.5 Philippines asked why Appendix A, B, and C had different formats. ICAO secretariat informed that in APAC region for States that have not implemented Frequency Finder tool, Appendix A is the recommended template and the item listed is the minimum information required from States for Frequency List 3 coordination. States already using the Frequency Finder tool, Appendix B and C are the recommended template which India have already used for real VHF COM registration through ICAO APAC Regional Office to support the implementation of the e-submission process for Frequency List 3. Appendix D is used to provide support and assistance for administrative process between States and ICAO APAC Regional Office.

4.6 Indonesia asked if Appendix D should be send by email or by State Letter. ICAO secretariat informed that Appendix D need to be submitted by email during the meeting. However, in future if any relevant information is changed, ICAO APAC Regional Office should be informed in due course.

4.7 Mr. Robert Witzen suggested that States should bring their request to ICAO for frequency requirements with minimal formalities. However, States should use export function in Frequency Finder for an efficient coordination.

4.8 Singapore informed that current frequency coordination process with ICAO works well because planning criteria covers good coverage for each station. But some station may have low power transmission which results in much smaller coverage than that cater for in the planning criteria. In future this factor should be considered for effective frequency utilization. In such cases States are invited to provide the actual coverage of such stations. Mr. Robert Witzen informed that in frequency assignment planning power is not a parameter to be considered. Chapter-2 of Handbook on Radio Frequency Spectrum Requirements for Civil Aviation equations took spherical radio coverage for all services. Mr. Robert Witzen also informed the meeting that Frequency Finder has capabilities to enter polygons as coverage area which may be utilized in future. It is consideration of States.

4.9 India suggested to rename the ‘computer name’ column in Appendix D to ‘organization name’ and proposed that data should be entered in Frequency Finders by point of contacts of the States. This would then be further suggested to ICAO HQs to consider possibility to implement it to the Frequency Finder tool, taking into account that it considered as an item of low priority item among those that need to be amended in Frequency Finder

4.10 Australia queried about the date of release of new version of Frequency Finder which was presented by ICAO Headquarters in WP/12. Australia further asked if the computer that has Frequency Finder installed is connected to firewall, would there be a problem connecting with the server in ICAO HQ. ICAO secretariat responded that as per WP/12, once ICAO plots the interference areas in the Frequency Finder tool, and has performed enough testing to ensure the new release is error free to the extent possible, the latest version will be released to States. The meeting was also informed that ICAO APAC Regional Office has already installed new NAV demo module and it is working well. Regarding the firewall query, it was noted that as of the Frequency Finder update performed in January/February this year, the Runtime version used by States communicates with the ICAO Server using the https protocol (TCP port 443), which should be open in most firewalls. **ACTION ITEM 5-3**

Propose use of terrain data for frequency assignment planning in Frequency Finder - Thailand (WP/09)

4.11 Thailand proposed to explore the possibilities and benefits of using terrain data in Frequency Finder to increase the efficiency in frequency assignment planning for the frequency band 117.975 – 137 MHz based on the result of the analysis conducted by Thailand. Thailand has been using an additional radio frequency propagation software tool for frequency assignment planning purposes in addition to FF.

4.12 For a requirement of a new frequency to support the air traffic control operation at U-Tapao International airport, 127.200 MHz was requested to support approach control service. The frequency was found to be used in Chiang Mai, Gong Kedak (Malaysia), Kathmandu (Nepal) and Palembang Sultanate (Indonesia). The use of the frequency in Chiang Mai and Gong Kedak (Malaysia) was of concern. Co-channel compatibility for the 3 locations (U-Tapao, Chiang Mai and Gong Kedak) were performed using Frequency Finder and the software analysis tool.

4.13 The result from Frequency Finder, where terrain is not taken into account, showed an overlap in coverage for the facility in Chiang Mai and U-Tapao, making the reuse of the frequency impossible due to co-channel interference. However, when the alternative software was used, where terrain was taken into account, the overlapping coverage area between the two facilities was reduced, allowing for reuse of the frequency.

4.14 As the results indicated, there is a potential to increase the number of VHF channels for future assignment. It would be worth exploring the benefits that could be gained by including terrain data in Frequency Finder, while taking into account the cost, time and complexity involved in the modification of the software.

4.15 Indonesia asked which radio frequency propagation software tool was used by Thailand for frequency assignment planning purposes in addition to FF. Thailand informed that it is known as radio mobile software which is a freeware. ICAO secretariat reminded the meeting of the role of Frequency Finder. The meeting was informed that Frequency Finder can be considered as electronics version of Frequency List-3 managed by ICAO and a tool for frequency coordination. The need for different States may varies based on geographical location. Therefore, States may use additional tools for internal frequency requirements need and analysis. It was further reminded that Frequency Finder has a function of forced input. In cases where States are assured that no interference will result from a particular frequency assignment, the frequency can be forcibly entered into Frequency Finder after proper coordination.

4.16 ICAO secretariat was requested to inform ICAO HQs to consider the feasibility incorporating terrain data into future version of Frequency Finder. **ACTION ITEM 5-4**

Updating process of Frequency List no. 1 and 2 - Indonesia (WP/10)

4.17 Indonesia reviewed updating process and coordination procedure for aeronautical facilities and services operating in the Frequency List No. 1 and Frequency List No. 2. Indonesia described that considering the numbers of Frequency List that Indonesia have, it takes more time and effort to report all those frequencies. In general, the efficient of process to update the Frequency List is becoming crucial. Coordination and assignment for Frequency List No. 3 is already using ICAO tools named Frequency Finder. But the assignment for Frequency List No. 1 and 2 are still going through the State Letter, and the update list is published by ICAO Regional Office through the documents.

4.18 Through State Letter dated January 14th 2016, ICAO Regional Office for APAC delivered a letter regarding the Frequency List No. 1, 2 and 3. Following up that State Letter, Indonesia responded by sending an update of the Frequency List for CNS facilities through State Letter dated April 12th 2016. There were 175 frequency allocations for Frequency List No. 1, and 135 frequency allocations were for Frequency List No. 2 in that year.

4.19 On April 1st 2020 by State Letter ICAO inform State members that Frequency Lists have been updated and published through documents *Frequency List No. 1 Thirty-Fourth edition* and *Frequency List No. 2 Thirty-Third edition*. *However,* there are differences in the numbers of data from those documents compared to frequency allocation which has been reported by Indonesia in 2016. Document Frequency List No. 1 Thirty-Fourth edition is contained by 109 frequency allocations, and Frequency List No. 2 is contained by 47 frequency allocations. Accordingly, Indonesia coordinated with ICAO APAC Regional Office to clarify the issue and assure that will conduct intensely to synchronize regional data to the global database.

4.20 The secretariat informed the meeting that ICAO has always encouraged States to update Frequency List 1,2, and 3. Frequency List 2 is expected to be supported by the new version of Frequency Finder to be released. The request of Indonesia to update Frequency List 1 and 2 was in batch processing, which were delayed because of limited resources at ICAO. States were urged to update their frequency list regularly and in timely manner with the coordination with ICAO APAC Regional Office. Batch processing request is not recommended. However, ICAO secretariat informed the meeting that ICAO APAC Regional Office has already updated the Frequency List-1 for Indonesia and Frequency List-2 is being updated.

4.21 The meeting reminded that the third Asia/Pacific Regional Air Navigation (ASIA/PAC/3 RAN) Meeting, held in Bangkok from 19 April to 7 May 1993, agreed that the Frequency Lists prepared by the Asia and Pacific Regional Office will be the frequency planning documents for the Regions. The ICAO APAC Regional Office, based on the information provided for this purpose by States, will issue Frequency Lists Nos. 1, 2 and 3 at periodic intervals. ASIA/PAC/3 RAN, Conc.11/4, 11/5 and 12/9 also outlined the procedure for information provision.

Review of VOR frequency assignment criteria in APAC region - India (WP/11)

4.22 India shared the experience in VOR frequency allocations and anticipated shortfall of new VOR channels. Globally, the frequency band 108 - 117.975 MHz is earmarked for ARNS and used for ILS (Localizer) and VOR operation. The GBAS and VDL Mode 4 are also implemented in this band under AM(R)S allocation. The sub-band 112- 117.975 MHz (channel spacing 100 kHz) is exclusively used for VOR deployment and the use of VOR systems is expected to be used well beyond 2030.

4.23 Presently, the frequency assignment planning for radio navigation aids (NDB/VOR/ILS) in APAC Region is based on *Conclusion 12/9 of ICAO Third Asia/Pacific Regional Air Navigation*

(ASIA/PAC/3 RAN) Meeting. VOR/ILS assignments are published by APAC Regional Office as Frequency List 2 (For the navigations facilities (VOR/DME and ILS) in the bands of 108-117.975 MHz and 960 – 1215 MHz). In India, around 164 VOR frequency assignments are already existing. Further, there are growing needs for increased number of VOR channels due to upcoming new routes, airports and rationalization of sectors in addition to defense requirements. India is facing constraints to identify suitable candidate frequencies.

4.24 India proposed consideration of following measures in APAC region to probably ease the shortfall of VOR channels:

1) The sub-band 108-111.975 (presently used for ILS localizer in the APAC region) is shared between ILS localizer and VOR in an interleaved frequency arrangement for Short range Terminal VOR.

2) Presently, the frequencies for VOR operation in the sub-band are allocated with 100 kHz channel spacing. Channel spacing of 50 kHz in the APAC Region can be considered for providing adequate number of channels.

3) The implementation of above measures requires regional agreements and APANPIRG mandate.

Introduction of 50 kHz Channel Spacing in the APAC region - Sec (IP/08)

4.25 ICAO secretariat presented material on the use of 50 kHz channels for the ILS/Localizer and VOR. Annex 10, Volume V contains certain provision on the use of the frequency band 108 – 117.975 MHz for the ILS / Localizer, the VOR and the GBAS/VDB systems, which were described in Appendix A of the paper. To date, 50 kHz channel spacing has not been introduced in the APAC (as well as the AFI, CAR, MID and SAM Regions).

4.26 For the introduction of 50 kHz channels for the Localizer and the VOR, the provisions in Annex 10 recognizes two options: General use of 50 kHz channels and restricted use of 50 kHz channels. In both cases Annex 10, volume V requires a Regional Agreement. Such a Regional Agreement can be formulated through a Conclusion from the relevant Regional Planning and Implementation Regional Group (PIRG). No such Regional Agreement has been established to date for any Region. In Europe, frequency assignment planning is solely based on 50 kHz frequency assignment planning criteria.

4.27 Considering that the implementation of 50 kHz channels has taken place in some Regions without the need for any formal Regional Agreement, it may be argued that such implementation can be agreed on a Regional level without the need for a formal Regional Agreement and considering the long period that has been elapsed since the introduction of 50 kHz channel spacing characteristics, it may be argued that general use of equipment only capable to tune to 100 kHz channels. States and possibly also IATA may provide relevant information.

4.28 Most likely, the frequency coordination of 50 kHz channels for ILS and VOR are bases on relevant provisions that were concluded at the Third Asia/Pacific RAN meeting from 1993. These criteria do not include provisions for frequency assignment planning on adjacent channels. Further clarification would support region-wide use of 50 kHz channels.

4.29 The meeting discussed IP/08 together with WP/11. India supported main points provided in IP/08, and upon request from the secretariat, China informed that they have already implemented 50 kHz channel assignments for VOR since 2014 after consultation with airlines and evaluation of ANSP readiness.

4.30 Regarding the avionics equipage status for 50 kHz channel spacing, IATA informed that air transport aircraft would not have any major issues but they need to cross check with the airlines. IATA suggested ANSPs to properly and timely coordinate with airlines related to 50 kHz channel spacing changes.

4.31 IFALPA asked the 50 kHz channel spacing was defined in 1972 then why any region has not implemented it. Mr. Robert Witzen replied that there was no operational need for this channel spacing at the time.

4.32 ICAO secretariat proposed to have an ad-hoc group to be led by India to further explore the issue along with China, and IATA. This ad-hoc group is tasked to provide the inputs to SRWG/6. Mr. Robert Witzen and Thailand presented their interest to join the group. Secretariat will coordinate with Japan to participate in ad-hoc group, and set up the discussion at a preferable time for members. **ACTION ITEM 5-5.**

Updates to Frequency Finder - Secretariat (WP/12)

4.33 Ms. Fabiola Chouha from ICAO Headquarters shared the latest updates brought to Frequency Finder. ICAO developed the program Frequency Finder as tool to assist ICAO Regional Offices and States to manage and coordinate aeronautical frequency assignments. This program combined the data base management functions for updating the ICAO COM list, the NAV and SSR list, calculation of interference areas and a geographical interface for plotting of the frequency assignments, including any interference area.

4.34 The module for the *coordination of SSR Mode S Interrogator Identifier codes* has been implemented and is in operation. The work on the development of *module for VHF navigation systems* (ILS, VOR, DME and GBAS) is near completion and is under evaluation. This module has incorporated the planning criteria for ILS, VOR and DME and GBAS based on *Annex 10 - Aeronautical Telecommunications - Volume I - Radio Navigational Aids* and the updates of the *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation (DOC 9718)*, Volume II, as recently agreed by NSP and FSMP.

4.35 The export function through e-submission in the VHF-COM was improved and introduced in VHF-NAV and can now provide the State (user) with the capabilities to provides brief instructions to the user (the State) on the next step, the State (user) can, through a dialogue box, consult the excel file prior submission to the ICAO Regional Office (RO) and the State would then follow the procedure of sending an email to the RO with the attached excel file through the email software she/he uses. This same function has also been introduced in the SSR module in order to be consistent with the two other modules.

4.36 The import function was also improved in the VHF-COM and introduced in the VHF-NAV and SSR modules to provide the RO with the possibility to select the file and upload it to the server after having saved the excel file received from the State.

4.37 Interface standardization and consistency among modules was also another important element that was implemented for the new version of Frequency finder in order to maintain the interface standardization and consistency so that all applications (modules, in case of Frequency Finder) work consistently and users can use them intuitively.

4.38 Plotting interference areas in the VHF- Navigation systems (VHF-NAV) need to also be implemented in the NAV module in order to provide States with a better approach to frequency assignment planning for NAV systems. Frequency Finder will therefore be modified to plot interference areas on the

google map, in a manner similar to the COM and SSR II modules. ICAO plans to implement this new functionality in the Frequency Finder tool before releasing the latest version to States.

4.39 Secretariat also informed the meeting about an online course development related to frequency management for civil aviation. This course will provide the background necessary to ensure that Officials from Member States are adequately prepared for the workshops by providing the necessary frequency management basics. The overall ICAO competency-based training methodology will support in this regard. It will serve as the prerequisite to the regional workshops that ICAO HQ organizes based on requests from Regional Offices and States. In addition, it will promote the frequency management knowledge to a broad, worldwide, targeted audience.

4.40 Secretariat further informed that the web-course material is currently under development, and it will be ready for launch by the end of the year 2021. Prior to the launch, the web-course will require validation by target expert audience to provide feedback on the course.

4.41 Chairperson asked whether the amendments proposed by NSP and approved by FSMP WG/11 have been incorporated into the new version of Frequency Finder. ICAO HQ informed that the revised criteria have already been implemented into the new version of Frequency Finder. It was further asked how can State express their interest to join online courses. It was informed by Ms. Fabiola that the tool will be available at the end of this year and interested States may contact Regional Officers at ICAO APAC Regional Office for course registration.

4.42 The meeting was informed that the delivery and implementation of Frequency Finder NAV module (Frequency List 2) would follow a similar practice for COM module (Frequency List 3), and the installation management of Frequency Finder in a States would be based on the coordination between ICAO APAC Regional Office and the respective CAA.

4.43 India thanked ICAO HQ for incorporation their suggestions in the past on Frequency Finder and showed their interest for new version of Frequency Finder to be released at the end of year 2021.

Frequency Assignment Planning Tool to support communication via Satellite and New Emerging Technologies- Thailand (WP/13)

4.44 Thailand proposed to have in place frequency assignment planning tool to support voice communication via satellite and emerging technologies. Providing communication in remote and oceanic areas has always been a challenge. New technologies such as High-altitude platform station (HAPS) system are now emerging that could potentially be used as a communication relay platform to provide communication between aircraft and air traffic control centres in remote areas or oceanic areas.

4.45 HAPS can cover a large area and can be continuously operated for several months. HAPS are also easily deployable stations with minimal ground network infrastructure requirements. WRC have also agreed to allocate frequencies for worldwide use by HAPS. The quality of service for voice communication for HAP is expected to be better than those of satellite. This could allow for a reduction in the separation of aircraft in remote and oceanic areas enhancing airspace efficiency and capacity.

4.46 In APAC, the procedure and software tool used to assist with frequency assignment planning have been mainly for terrestrial-based VHF communication services. As State(s) within APAC is already looking into using satellite and/or new emerging technology (HAPS), frequency assignment planning tool to support voice communication using satellite and emerging technologies as relay platform, taking into account existing VHF assignment for terrestrial-based VHF communication services is necessary. This will allow satellite and new technologies to be deployed to provide an effective

communication means for radar like service in remote and oceanic. It will allow for frequency re-use and interference free operation to existing terrestrial-based VHF communication services. This will also reduce the need to segregate portion(s) of the VHF band to terrestrial-based VHF communication services and another portion(s) to satellite-based VHF communication services in an already congested VHF band.

4.47 Philippines suggested that it is too premature to asked ICAO for frequency assignment tool. Mr. Robert suggested that there is need for emerging technologies analysis which can trigger this discussion by ICAO with ITU. ICAO cannot coordinate for frequency allocations for satellite system with ITU. China also supported and said that frequency assignment process is very difficult and cannot be handled by ICAO APAC Regional Office alone in such limited resources.

4.48 The meeting recognized the value of the proposal from this paper, and requested 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. **ACTION ITEM 5-6**. The meeting also concluded to wait for the outcome of WRC-23 or relevant ICAO SARPs in place for further action on frequency assignment planning tool to support voice communication using satellite and emerging technologies.

Draft of Asia Pacific Frequency Management Guidance Material- China (WP/14)

4.49 The fourth meeting of the spectrum review working group (SRWG/4) considered the development of a regional guidance material on aeronautical frequency spectrum management for APAC States. The current 26-page draft document includes the prime objectives and scope in chapter 1, institutional framework, spectrum management and procedure for coordination of APAC Region in chapter 2, air-ground communication frequency management of HF and VHF COM in chapter 3. The draft document is contained in **Appendix C** of this Report.

4.50 Philippines and Mr. Robert Witzen, supported by the meeting, thanked China for their effort in drafting the Asia Pacific Frequency Management Guidance Material.

4.51 Pakistan asked why the document only addressed VHF COM and did not address navigation and surveillance equipment. It was informed by ICAO secretariat that a step-by-step approach was taken in drafting the guidance material this started with VHF COM and the section on NAV will be drafted. However, there will not be any surveillance part as these frequencies are universal. It was informed that **ACTION ITEM 4-7** of SRWG/4 will be continued.

Agenda Item 5: VHF Com Simulation for 2030

VHF Com Simulation for 2030 - Sec. (WP/05)

5.1 The secretariat presented a plan to simulate the VHF COM for APAC in 2030. CNS SG/24 adopted the *Conclusion CNS SG/24/7(SRWG/4/2) – Simulation of VHF COM Frequency requirements for next 10 years* to conduct a new round of simulation for VHF COM frequency assignment based on new operational requirements of States to 2030 as necessary. The primary purpose of this simulation is to determine if a congestion in the use of frequencies can be foreseen that would require the implementation of 8.33 kHz channel spacing in any parts of the APAC Region.

5.2 An up-to-date and complete Frequency List 3 is the basis of a successful simulation. States were requested to check if all frequency assignments that are in use are also registered in the Frequency

List 3. Only frequency assignments in the Frequency List 3 can be considered to be protected from harmful interference during future frequency assignment planning activities. Considering not all States have the installation of Frequency Finder, a copy of Frequency List 3 for a State is available at Regional Office upon request. The secretariat proposed that Attachment A of the paper be used to insert any frequency assignment that has not yet been submitted to the APAC Regional Office.

5.3 The meeting invited States/Administrations to submit these requirements to the APAC Regional Office by ***15 June 2021***. On the basis of requirement, the APAC Regional Office will undertake an analysis that is aimed at determining whether these requirements can be assigned a frequency within the available 25 kHz channels. In case not all frequency requirements until 2030 can be satisfied using 25 kHz channels, the SRWG is expected to develop material for the introduction of 8.33 kHz channel or other viable solution in the APAC Region or parts thereof. Based on European experience, the introduction of 8.33 kHz channel separation would require a retrofit of airborne/ground equipment.

5.4 Pakistan requested ICAO secretariat to issue a State Letter for this requirements and explain in the State Letter the requirements from States. Philippines suggested that Appendix A shall be in the format of export file in Frequency Finder. ICAO secretariat informed that some States don't have Frequency Finder. It was proposed that Mr. Robert Witzen prepare a MS Excel file that will be circulated to States along with State Letter. It was also proposed that the State Letter to be circulated should also encourage States to install Frequency Finder. 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. **ACTION ITEM 5-7**

Indian VHF Projections for 2030 Based On Future Operational Requirements and Need for Objective Review of 8.33 kHz Channel Spacing Requirements in APAC Region - India (WP/07)

5.5 India presented Indian VHF projections for 2030 based on future operational requirements and objective review to implement 8.33 kHz channel spacing in a limited manner in APAC region. India in 2014/15 had requested for considering 8.33 kHz channel spacing implementation in APAC region and perceived shortfall in the availability of new frequency channels with the current 25 kHz channel spacing. Based on the request, SRWG was constituted and had recommended some improvement measures to ease the congestion in the VHF band. It was concluded that congestion for VHF frequencies using a 25 kHz channel spacing was unlikely to happen in the APAC region until 2020.

5.6 India had projected requirement of around 130 new frequencies for the period 2015-20, whereas the actual assignments for various services are around 204 frequencies. In India, presently a total of around 1000 VHF frequencies are operational and the requirement is further expected to grow significantly in the coming years. Given the trends, 50-60 new VHF assignments per year are envisaged as of now. The total number of new frequency assignments for the period 2021-2030 in India for Civil Aviation use would be around 600, besides additional requirements for military organizations. Though the projections are for a ten-year period up to 2030, but the jump may be exponential. These new frequency requirements are going to affect the new assignments using the 25 kHz separation requiring a switch over to 8.33 kHz separation.

5.7 It may be inferred that the continuing trends predict VHF congestion over the period may be beyond 2023-25, which may necessitate the introduction of 8.33 kHz channel spacing in the APAC region at least for some States. India suggested that SRWG should deliberate and simulate a transition scenario for voice communication within APAC region from the current 25 kHz to 8.33 kHz channel spacing by taking into consideration the lead time for implementation and equipage.

5.8 Mr. Robert Witzen suggested that aircraft fleet need updates for incorporation of 8.33 kHz frequency specifications. It was suggested to do it gradually. For example, we can start with 8.33 kHz channel spacing in some areas or above a particular flight level. The meeting was further informed that in 2021 it is difficult to predict surge in the usage of frequencies. It was decided by the meeting to review the outcome of the simulation before any further action is taken

5.9 IATA suggested to have a transition plan for future. If India predicts need of 8.33 kHz spacing need in 2030, it should be done in timeline approach to ensure a buffer window for operators, normally 5 years.

5.10 Pakistan asked if India has used frequency reuse mechanism for VHF frequencies. India replied that they already have such mechanism and it is also implemented into Frequency Finder tool.

Agenda Item 6: Review POC of States on frequency affairs

Review POC for States - Sec (WP/06)

6.1 The current process for frequency coordination is based on a minimum bureaucracy when performing the frequency coordination and registration. However, due to the turnover of staff in ICAO APAC Regional Office and in civil aviation organization of States, regular review of the POC is deemed necessary.

6.2 A drafted POC list based on participant list of SRWG/4 was provided in Appendix A to the paper. It was suggested to nominate one main POC plus two associate POCs for one State/Administration which is capable to do so, to ensure the effective communication between Regional Office and the State/Administration, for normal frequency coordination and emergency coordination under unforeseeable harmful frequency interference to international operations.

6.3 The operator of Frequency Finder could be one of the POCs. Once the POC list established, only the enquiry from the POC to this Regional Office will processed in due course. The meeting discussed the paper, and provided comments and inputs to POC list provided as **Appendix D** of this Report.

6.4 Chairperson asked in which form POC is acceptable by ICAO secretariat. ICAO secretariat informed that it is acceptable in the form of email or letter as it is convenient to states. But it was encouraged to send information by email for quick action. It was informed by ICAO secretariat that many states sent email using yahoo or Gmail which are not organization email. In this case private emails should be registered by POC with ICAO. In case of any change the revised information should be send to ICAO by registered email of states with ICAO. ICAO wants to do coordination with states with minimum bureaucracy but if state wish they may send it by state letter too.

6.5 Philippines suggested to add in POC list about main and associate POC. It was informed that it will be updated after states inputs. Indonesia informed that they have sent state letter about two main POC and asked if it is acceptable. ICAO secretariat said that it is acceptable.

6.6 Australia asked if states can contact each other by the POC directly without the information to ICAO secretariat. ICAO secretariat informed that for operational issues states may contact each other directly but for frequency coordination they should go through ICAO secretariat only. It was further stated that since not all states are present in the meeting, ICAO secretariat will issue a state letter about updating the POC list by states.

6.7 Malaysia and Fiji asked that they are not in the list of POC and shared their wish to send information by email which was accepted by ICAO secretariat.

6.8 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. **ACTION ITEM 5-8**

6.9 Australia, Fiji, India, Malaysia, Republic of Korea, Thailand and USA informed that their list of POC is revised and sent to ICAO secretariat by email during the meeting.

6.10 Chairperson proposed to have a decision on this. It was informed by secretariat that CNS SG/24 has already made a decision for this and it will be followed-up by ICAO secretariat.

Agenda Item 7: State and regional updates

Actions Taken in France to Mitigate Interference into The Radio Altimeters Systems from 5G/MFCN in the band 3.4-3.8 GHz - France (WP/08)

7.1 In June 2020, ICAO secretary at HQ was brought the attention by the FSMP members a Liaison Statement informing ECC about the issue of potential interference to aeronautical Radio Altimeters operating in the 4200 - 4400 MHz frequency band, caused by IMT systems currently operating or planned to operate in the frequency band 3400 - 3800 MHz in Europe. The recent RTCA Report SC-239 raised another risk from MFCN (5G in the band 3.7-3.98 GHz) into some radio altimeters. DGAC (French Civil Aviation) and the French Aeronautical and Space Industries Group (GIFAS) considered that there is a need to have more thorough assessment of the risk of 5G interference in the frequency band 3.4-3.8 GHz and a need to clarify the assumptions to be used. Taking into account the additional concerns expressed by DGAC on the basis of the RTCA Report, some immediate measures have been defined in France until the issue can be more thoroughly studied.

7.2 Three immediate preliminary measures have been decided for the protection of radio altimeters. It includes implementation of only downward tilt, take measures to avoid grating lobes as far as practicable, and special protection zones applied to all IFR aerodromes and to some helicopter platforms. In phase two from February 2021, it was decided to limit applications of mitigation techniques only to airport with runway CAT II or/and CAT III, also to heliports previously identified. The negative tilt remains applicable to all base stations until practical tests show there is no risk for them. DGAC established an OPS directive or safety information for the attention of French companies flying abroad. EASA, EUROCONTROL and DGAC will collaborate together on this topic. A virtual workshop "5G – Potential interference on Low Range Radio Altimeters" was organized on February 25th. 2021. Besides this DGAC plan to attend PT1 and EASA Workshop. In collaboration with the ANFR, Airbus, mobile operators and DGAC, flight tests are under study to measure and record the 5G signal received at aircraft level.

7.3 France concluded that although DGAC has received a lot of support from the aeronautical world, there is no much involvement of other European CAAs. The Japanese mitigations have shown that France is not alone in the world, but this situation will not be sustainable without active support from European countries.

7.4 China asked if category 1, 2, and 3 described in the paper represent runway categories or radio altimeter categories. France clarified that the definitions are as defined in RTCA document as category of radio altimeter. Category 1 of radio altimeter is for commercial aircrafts, category 2 is for business jet or

regional aircrafts, while category 3 is for helicopters. China further requested from France to share the data of the study. France agreed to share the study data except the restricted ones. Furthermore, China asked how 3.4 GHz can interfere with radio altimeter. France replied that radio altimeter manufacture have provided information related to this to EASA. Chairperson proposed to discuss further matters offline.

7.5 Australia thanked France for the useful information and expressed their intention to work with France for the preparation of technical framework on 5G licensing so that appropriate document can be prepared without harmful specifications for radio altimeter.

Protection of interference to radio altimeters from 5G applications in the Asia-pacific - Boeing Australia (IP/03)

7.6 5G technology applications has an ability to transmit vast amounts of data across multiple devices. It requires many base station installations and greater RF coverage. The 5G broader spectrum is in C Band and Radio altimeters are allocated to the nearby 4 200-4 400 MHz frequency band. The radio altimeter is a critical component to an aircraft's operations and safety and the only sensor onboard an aircraft providing a direct measurement of the aircraft's clearance over the terrain or other obstacles (above ground level (AGL)). The higher power and widespread terrestrial usage of 5G applications can cause harmful interference to the operation of aviation radio altimeters in the adjacent frequency band.

7.7 ICAO in June 2020 issued a Liaison Statement to the ECC by raising concern on 5G emissions and Radio Altimeters in the frequency band 4200- 4400 MHz. On 8 October 2020 the RTCA released the white paper on Assessment of C-Band Mobile Telecommunications Interference Impact on Low Range Radar Altimeter Operations. In response to the RTCA Report various actions taken by spectrum regulators and international agencies. The French Radio Regulator established a two-level action plan including implementing precautionary zones around airports of civil aviation. The European Radio Regulators agreed to establish a draft Working Item that calls for compatibility studies between 5G in the 3 400-3 800 MHz frequency range with radio altimeters in the 4 200-4 400 MHz frequency band. Australian spectrum regulators proposed their re-planning of the 3 700-4 200 MHz frequency range. EASA published a Continuation Airworthiness Review Item (CARI) 'Investigation into vulnerability of Radio Altimeter to interference from 5G Telecommunications Base Stations.' The New Zealand Civil Aviation Authority released a safety message to operators on 17 November 2020 'Do not use 5G devices inflight if you have a radar altimeter'. The Canadian regulator, Innovation, Science and Economic Development (ISED) proposes to allow terrestrial 5G up to 3 980 MHz and then apply a 220 MHz separation band to protect radio altimeters. The General Civil Aviation Authority (GCAA), United Arab Emirates (UAE) published Safety Alert 2021-01, Requirements to mitigate 5G Interference Operational Risks.

7.8 Boeing Stated that it is global issue and consequently necessary to address this risk for the Asia-Pacific region. Boeing asked the cooperation of ICAO Asia-Pacific administrations in the dissemination of the information to support airworthiness authorities and inform operators with respect to the impact of this issue. ICAO regional administrations are encouraged to work with respective national spectrum regulators to build awareness, recommend temporary precautionary mitigation measures and collaborate with 5G operators to share technical characteristics and consider adoption of temporary limitations.

7.9 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. **ACTION ITEM 5-9**

Status report radio frequency interference in the band 117.975 – 137 MHz- Thailand (IP/04)

7.10 Thailand presented a status report on the current interference situation in the band 117.975 – 137 MHz in Thailand. Radio frequency interferences from unlicensed FM community radio stations have been one of the major issues affecting the safety of aircraft operating into Thailand into major and high traffic density airports. The interference has often resulted in the pilot being unable to communicate or obtain instructions from the air traffic controllers on the ground. FM radio transmitter could be easily and cheaply built 'in-house'.

7.11 The FM community radio stations were competing with each other to gain a larger audience by increasing their transmitter power and mounting their antennas high to boost the coverage area. The Office of the National Broadcasting and Telecommunication Commission (NBTC), the telecommunication regulator, collaborated with Aeronautical Radio of Thailand (AEROTHAI) to resolve the interference issue. The core strategy was stakeholder engagement. This encompassed a range of activities such as advising and providing consultation on technical issues, educating the radio stations owners on the effect of radio interference on aircraft operations, and air navigation safety zone declaration. A database of radio stations located around the airport was created to contact station owners for prompt remedial action. Spare frequencies were also assigned by NBTC to AEROTHAI. The number of interferences from 2016 to 2020 was provided in a graph which indicated that after measures were implemented there is a downward trend to the number of interferences.

7.12 Mr. Robert Witzen asked if the interference incidents reported in the paper were resulted from the complaints received from pilots or from monitoring staffs. Thailand responded that the interference incidents were resulted from both.

7.13 Indonesia asked how do Thailand handles such type of cases. If there are some law enforcement rules in Thailand related to this. Thailand replied that there is legislation in force. In addition, Thailand informed the meeting that an online tool was developed with NBTC to monitor and report interference. If there is interference occurrence it is reported directly to NBTC via this online tool.

7.14 India shared that FSMP is studying the interference from non-aeronautical sources and requested to share the information to FSMP. Thailand informed the meeting that these interference occurrences have been addressed by NBTC. India further asked if interference reported were only for VHF or for ILS/VOR too. Thailand confirmed that interferences were reported for both.

Protection of Instrument Landing System (ILS) critical and sensitive areas in three-dimensional and ILS facility performance category requirements - Hong Kong, China (IP/05)

7.15 Hong Kong, China shared their observations on potential impacts of departing aircraft on arriving aircraft under runway mixed-mode operation with respect to LOC signal fluctuations. Annex 10 Vol. I Attachment C concerning guidance in protection of ILS CA/SA, the guidance focuses on protection in 2D instead of 3D. In July 2018, ICAO published in the 7th Edition of Annex 10 Vol. I, Attachment C, Paragraph 2.1.9.5, highlighting the need for States to extend protection of the ILS Critical and Sensitive Areas (CA/SA) from two-dimensional (2D) (horizontal) context to volumes.

7.16 There were cases reported by pilots of arriving aircraft at the Hong Kong International Airport (HKIA) that there were Localizer (LOC) signal fluctuations when departing aircraft on the same runway flied over the LOC antenna which occurred during single runway mixed-mode operation. States/Administrations are invited to note the importance of extending protection of ILS CA/SA from 2D (horizontal) context to 3D, especially for LOC.

7.17 It has been presented in a WP/21 and discussed in the CNS SG/24 of APANPIRG. In the meeting, Australia echoed the observations and views expressed by Hong Kong. In view of the significance in the protection of ILS CA/SA in 3D, CNS SG/24 adopted the ***Conclusion CNS SG/24/11*** *Protection of ILS Critical and Sensitive Areas in Three Dimensional* and ICAO APAC Regional Office forwarded the WP/21 and its presentation file to secretary of the ICAO NSP for consideration by Conventional Nav-aids and Testing Working Group (CNTWG).

7.18 ICAO secretariat asked if Hong Kong has observed such types of fluctuation in Localizer signal due to helicopters in addition to the departing aircrafts with heavy wake turbulence. Hong Kong China informed the meeting that there was no observed Localizer fluctuation due to helicopter operations at Hong Kong International Airport.

Analysis of GPS signals interference based on QAR data - China (IP/06)

7.19 China introduced a new initiative in detecting and positioning the source of GPS Radio Frequency Interferences. China described that the use of QAR data analysis has achieved positive results.

7.20 GPS is one of the main and important GNSS for the civil aviation. In order to detect and identify the sources of GPS radio frequency interferences effectively, CAAC used the quick access recorder (QAR) data collected by the Flight Operational Quality Assurance (FOQA) station. CAAC FOQA station processes and analyzes more than 16,000 flights and more than 150GB QAR data every day. The data analysis service of this system has significantly improved the flight operational quality and safety supervision capability of CAAC.

7.21 CAAC verified and confirmed that the special monitoring of GPS signal interference could be done on the Boeing B737NG, B757, Airbus A320 series and A330. China presented example of Boeing 737NG. CAAC processed and analyzed parameters at appear/end time of GPS signals unused and other parameters of multiple flights. Those parameters have been applied to GPS signal interference source positioning and daily interference incident monitoring in many airports.

7.22 In 2020, the QAR data analysis application had been identified and located dozens of GPS interference sources such as GPS signal jammer installed in parking lots or personal vehicles.

7.23 Philippines requested if the data gathered were from Chinese airlines only or other airlines were also taken into consideration for the study. China confirmed that the data were gathered from Chinese airlines only. Philippines asked further about the type of equipment used to gather the data. China informed that it is QAR or WQAR, a type of flight data recorder which records such flight data.

Operation of ILS/DMEs Using the Same Frequency but Different Identifiers at Beijing Daxing International Airport - China (IP/07)

7.24 China introduced the operation of ILS/DMEs using the same frequency with different identifiers at Beijing Daxing International Airport, as a possible way to improve frequency utilization efficiency. According to Annex10 to the Convention on International Civil Aviation, the Localizer and Glide

Path transmitter frequencies of an ILS must be paired, and frequencies must be assigned from the 40 paired frequencies. The frequency protection shall be carried out according to Appendix C of Annex 10 and Doc 9718 to avoid mutual interference between frequencies.

7.25 Beijing Daxing International Airport has three north-south runways and one east-west runway. Due to the shortage of radio frequency resources, for the three north-south runways, the ILS/DMEs at both ends of each runway use the same frequency with different identifiers. By installing an interlock system, it is ensured that if one direction ILS/DME is in operation, the other remains shut-down simultaneously. China introduced the measures were adopted to adapt to this operation mode. Such as what to do for the daily operation and the routine maintenance, how to do the information notification. And China notified that when switching directions, the navigation signal continuity is interrupted, and air traffic control needs to optimize and adjust procedures so as to adapt to this operation mode.

7.26 The operation mode of ILS/DMEs using the same frequency with different identifiers plays a very positive role in utilization efficiency of radio frequency. Relevant measures should be adopted to ensure the reliability of daily operation.

7.27 Mr. Robert shared that the interference and coordination range for localizer is very small, therefore frequency congestion would not be an issue. The issue will be more decrease if 50 kHz channel spacing is used.

7.28 China clarified that China had implemented 50 kHz channel spacing for ILS/VOR.

Agenda Item 8: Next meeting and any other business

Date and Venue for the Next Meeting

8.1 ICAO secretary asked about the need of frequency finder workshop in face to face mode. It was informed that it could not happened last year due to travel restrictions. It was further informed that if workshop will have conducted, it will be with the support of ICAO HQ and instructors from Montreal. Australia and Philippines supported the face to face workshop. It was agreed by the meeting that workshop will be conducted after new release of Frequency Finder by ICAO along with online course proposed by ICAO HQ for new release of Frequency Finder is available. **ACTION ITEM 5-10**

8.2 The meeting recognized the need to organize a face to face meeting in 2022 to review the outcome of simulations for States and progress the tasks listed in the Terms of Reference.

8.3 Next meetings were tentatively scheduled as follows:

1) 5-day workshop on Frequency Finder (Advanced training), 2022.
2) SRWG/6 – 1- 3 March 2022.

Note of appreciation

8.4 The meeting thanked Mr. Robert Witzen for his continuous support to SRWG and spectrum related activities particularly in supporting this meeting remotely from Canada.

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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	
A 4-4	All	Experience sharing on Frequency Finder use	30-Mar-21	Open		In progress	
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	Open		Under coordination subject to the pandemic situation	
A 4-7	All, Robert Witzen	Creat 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.	30-Mar-22	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	20-May-21	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	Open			
A5-2	ICAO	to host a regional WRC-23 preparatory meeting upon coordination with ICAO HQ after lifting of travel restriction.	22-Nov-21	Open			
A5-3	ICAO	to resolve firewall query of Australia for FF installation and use.	31-Mar-21	Open			
A5-4	ICAO	to inform ICAO HQ to consider the feasibility incorporating terrain data into future version of Frequency Finder	30-Apr-21	Open			
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			

Reference	Who	What	Due date	Status	Completed on	Result	Comment
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.	31-Mar-22	Open			
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	Open			
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	Open			
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.	31-Mar-22	Open			
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	31-Mar-22	Open			

FREQUENCY FINDER INSTALLATION STATUS IN APAC

No.	States/ Administrations	FF Installed?	FF version	Organization name	Contact	Remark
1	Australia	Yes	FF2020.06R	AsA	Spencer.Robinson@AirservicesAustralia.com	
2	China	Yes	FF2020.04R	CAAC	zhangjia@caac.gov.cn	
3	India	Yes	FF2020.04R	AAI	Freq Mgmt, CHQ afsmcnschq@AAI.AERO	
4	Indonesia	Yes	FF2020.04R	DGCA-INS	Abdul Aziz azizsabdul@gmail.com	
5	Malaysia	Yes	FF2020.04R	CAAM	Syahroni Bin Chek Rus syahroni@caam.gov.my	
6	Thailand	Yes	FF2020.04R	CAAT	Mr. Chavalit Ithiapa chavalit.i@caat.or.th	

SRWG/5
Appendix C to the Report

International Civil Aviation Organization

Asia Pacific Frequency Management Guidance Material

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			CORRIGENDA / ADDENDA		
No.	Date	Entered by	No.	Date	Entered by

TABLE OF CONTENTS

GLOSSARY

SYMBOLS AND UNITS

ABBREVIATIONS

CNS	Communication, Navigation and Surveillance
DME	Distance Measuring Equipment
DVOR	Doppler VHF Omni-Directional Range
ICAO	The International Civil Aviation Organization
ITU	International Telecommunication Union
ILS	Instrument Landing System
SARPs	Standards And Recommended Practices
VHF	Very High Frequency

DEFINITIONS

1. The explanation to the type of service/functions

ACC-L	Area control service for flights up to FL 250
ACC-SR-I	Surveillance radar area control service up to FL 250
ACC-SR-U	Surveillance radar area control service up to FL 450
ACC-U	Area control service for flights up to FL 450
AD	Within limits of aerodrome
AFIS	Aerodrome flight information services
APP-L	Approach control service for flights below FL120
APP-I	Approach control service for flights below FL 250
APP-PAR	Precision approach radar service up to FL 40
APP-SR-I	Surveillance radar approach control service up to FL 250
APP-SR-L	Surveillance radar approach control service up to FL 120
APP-SR-LU	Surveillance radar approach control service up to FL 450
APP-U	Approach control service for flights up to FL 450
ATIS	Automatic terminal information service
CD	Clearance delivery
DF	Direction finding
ER	Requirement to utilize extended range technique, RCAG or repeater stations
RCAG	Remote controlled air-ground communication
FIR	Flight information region
FIS-L	Flight information service for flights up to FL 250
FIS-U	Flight information service for flights between FL 250 and FL 450
RCAG	Remote controlled air-ground communication
SMC	Surface movement control up to limits of aerodrome
TWR	Aerodrome control service
VOLMET	VOLMET broadcasts

2. Primary and secondary services

1）In the box of the Table in Section IV of ITU Radio Regulations, a band is indicated as allocated to more than one service, either on a worldwide or Regional basis, such services are listed in the following order:

- Services the names of which are printed in “capitals” are called “primary” services;
- Services the names of which are printed in “normal characters” are called “secondary” services.

2）Additional remarks shall be printed in normal characters (example: MOBILE except aeronautical mobile).

3）Stations of a secondary service:

- shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;
- cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;
- can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

4）Where a band is indicated in a footnote of the Table as allocated to a service “on a secondary basis” in an area smaller than a Region, or in a particular country, this is a secondary service.

5）Where a band is indicated in a footnote of the Table as allocated to a service “on a primary basis”, in an area smaller than a Region, or in a particular country, this is a primary service only in that area or country.

□□□□□□

Chapter 1

INTRODUCTION

This guidance material 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

1.1.1 Aeronautical services are recognized internationally to be prime users of radio frequencies. [Doc 9718 I chapter 1 1.2] 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. [Doc 9718 I chapter 1 1.4]

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

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

(a) to provide background information on the APAC Region's spectrum management institutional framework. [Doc 9718 volume 1 2.3.d]

(b) to provide a convenient record for important frequency management material, such as the criteria applied in the planning of radio frequency assignments. [Doc 9718 1 2.3.c]

(c) to provide updated frequency assignment planning criteria to secure [be sure] that aeronautical radio communication and navigation systems are protected from harmful interference on a uniform basis. [Doc 9718 II Background and purpose]

1.2 Scope

1.2.1 This guidance material describes general reference [information] 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.

1.2.2 This document is suitable for national authorities, telecommunication authorities (or telecommunication administrations), ATCs, aerodromes, and airlines which will manage~~ment~~ and use aeronautical frequencies.

Chapter 2

Background

2.1 Institutional framework

2.1.1 ITU

2.1.1.1 International Telecommunication Union (ITU) as a specialized agency in the field of telecommunications, embraces all aspects of telecommunications, whether by line or by radio transmission, has authority to set standards for systems, technical parameters and procedures. [Doc 9718 volume 1 3.1]

Note: However, 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 A prime and highly important area for aviation concerns the regulation and use of the radio frequency spectrum for which ITU is the international body. [Doc 9718 volume 1 3.1] In addition, the agreements made under its auspices for these matters and incorporated in the Final Acts of World Radio communication Conferences (WRCs) which are held every four years. [Doc 9718 volume 1 3.2]

2.1.1.3 The internationally agreed regulation of the radio frequency spectrum is provided through the ITU Radio Regulations (RR), [Doc 9718 volume 1 3.3] which include allocations, provisions on licensing, interference resolution, safety and distress procedures and other aspects. Within the Radio Regulations, 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. [Doc 9718 volume 1 3.3]

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 addition to the material in Anne 10, on 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.

2.1.2.3 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.

2.1.2.4 ICAO coordinates the input to ITU discussions on aeronautical radio frequency spectrum matters. The necessary activity to support these ITU-generated functions exists at two levels: [Doc 9718 volume 1 5.3]

(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, using agreed ICAO planning criteria. This activity is supported by the Regional Planning and Implementation Groups (PIRGs).

2.1.3 National and regional authorities

2.1.3.1 Within ITU Member States, the telecommunication authorities (or telecommunication administrations) normally control and operate the mechanism which develops the national proposals for amending the Radio Regulations (RR) for submission to the ITU WRCs. [Doc 9718 volume 1 3.4]

2.1.3.2 National and regional preparatory committees function is the coordination medium to which the aviation requirements, either ICAO or regional official coordinated or nationally derived, are presented by the national aviation authorities for consideration. [Modify from Doc 9718 volume 1 3.4]

2.1.3.3 It is essential that aeronautical participation in these national and regional activities be ensured in order to support and defend aviation requirements. [Doc 9718 volume 1 3.4]

2.1.4 Relationship between ITU RR and other material and ICAO SARPS

2.1.4.1 Aviation services are recognized important users of radio spectrum to create safe and expeditious conditions to support air operations. The aeronautical mobile (route) service (AM(R)S), the aeronautical radio navigation service (ARNS) and their satellite service counterparts are important components in the mobile and radio determination families of users with (normally) exclusive allocations made on a worldwide basis to ensure global harmonization. Worldwide allocations enable international standardization of equipment and systems to support safe and global air traffic. ITU Radio Regulations (RR) are used as the framework for the relevant ICAO Annexes and the Standards and Recommended Practices (SARPs) contained therein. [Doc 9718 volume 1 3.5]

2.1.4.2 ICAO is recognized internationally as the competent international body to coordinate a worldwide policy for the operational use of the specified systems. 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. [Doc 9718 volume 1 4.4.3]

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. [Doc 9718 volume 1 4.4.4]

2.2 Spectrum coordination and management

2.2.1 General

2.2.1.1 In using frequency bands for radio services, Members 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 these regulations of Radio Regulations, Annex 10 to the ICAO Convention and national and regional planning. [RR 0.3]

2.2.1.2 Frequency assignment should ensure that stations of a secondary service shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date. [RR 5.29]

2.2.1.3 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 guidance material. [RR 4.3]

2.2.1.4 Frequency assignment should ensure the availability and protection from harmful interference of the frequencies provided for distress and safety purposes. [RR 0.7]

2.2.2 Frequency coordination and registration [doc 9718 volume 1 4.5]

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.

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.

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 most cases) 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 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.

2.2.2.5 However, it 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 however NOT being coordinated through ICAO.

2.2.2.8 List of frequency bands coordinated by ICAO is given in Table 1

Table 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
UHF	328.6 – 335.4 MHz 960 – 1215 MHz	ILS glide path DME

2.2.3 Procedure for Coordination of aeronautical frequency

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.

Note: with the successful implementation of Frequency Finder, there was no more Frequency List No. 3 published by the ICAO APAC Regional Office after the 29th Edition in January 2016, 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.

2.2.3.2 The Thirty-first Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/31) in 2020 agreed that the database in Frequency Finder is visible to all Frequency Finder users. And the maintenance and promulgation of Frequency List Nos. 1 and 2 are still being conducted by the Regional Office in a timely and periodic manner. It proposes to request States to update specific characteristics for NAV facilities in the Frequency List No. 2 as well as to secure that the information in the Frequency Lists is up-to-date.

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

2.2.3.4 Currently, states can submit to the Regional Office their requests for new or modified frequency assignments in any format (e.g. letter, email). [SRWG4 WP2 2.3]

(a) The administrative aspects of the frequency coordination can be improved by States using Frequency Finder to generate electronic submissions for new or modified frequency assignments. This option permits States 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.3. It greatly facilitates the final coordination that is performed by the ICAO Regional Office. The electronic submission(s), in the format of an Excel file, can be sent to the ICAO Regional Office through email.

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

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

[Note: More details to this paragraph]

1. *flow chart,*
2. *International Coordination conditions, such as the distance between stations and country boundary,*
3. *Etc.*

Chapter 3

Aeronautical Frequency Management

3.1 Air-ground Communication Frequency

3.1.1 HF Air-ground Communication Frequency bands

3.1.1.1 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. [srwg1 wp04 2.3] ICAO is considering developing, in parallel, a relevant ICAO list of HF frequency assignments. [9718 volume 1 4.5.4] Pre-coordination of HF frequencies could be arranged through the ICAO ASIA/PAC Office in Bangkok. However, national radio regulator is required to develop a proposal for the required assignments. 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 (ILS) taking into consideration the protection requirements for HF as contained in Appendix 27. [srwg1 wp04]

3.1.1.2 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 27/217. [9718 4.2.6]

3.1.1.3 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. [9718 4.6]

3.1.2 VHF Air-ground Communication Frequency bands

3.1.2.1 General allotment of frequency band 117.975 – 137.000 MHz shall be as shown in Table 2.

Table 2 Allotment table

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.
121.500	Emergency frequency	
121.550 –121.9917inclusive	International and National Aerodrome Surface Communications	Reserved for national allotments
122.000 –123.050 inclusive	National Aeronautical Mobile Services	Reserved for national allotments
123.100	Auxiliary frequency SAR	
123.150 –123.6917inclusive	National Aeronautical Mobile Services	Reserved for national allotments
123.450	Air-to-air communications	Reserved for air-to-air communication
123.700 –129.6917 inclusive	International and National Aeronautical Mobile Services	Specific international allotments will be determined in the light of regional agreement.
129.700 –130.8917 inclusive	National Aeronautical Mobile Services	Reserved for national allotments but may be used in whole or in part, subject to regional agreement,
130.900 –136.875 inclusive	International and National	Specific international

	Aeronautical Mobile Services	allotments will be determined in light of regional agreement.
136.900 –136.975 inclusive	International and National Aeronautical Mobile Services	Reserved for VHF air-ground data link communications.

3.1.2.2 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,

3.1.2.3 Common signalling channels for VDL

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

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

3.1.2.4 In the frequency band 117.975 – 137.000 MHz, the frequencies used for National Aeronautical Mobile Services, unless worldwide or regionally allotted to this specific purpose, shall be so deployed that no harmful interference is caused to facilities in the International Aeronautical Mobile Services.

3.1.2.5 Minimum separation between assignable frequencies in the aeronautical mobile (R) service shall be 8.33 kHz (see Annex 10, Volume V, 4.1.2.2). APAC Region has agreed to base frequency assignment planning on 25 kHz frequency separation. The APAC frequency allotment plans as in Table 3.

Table 3 APAC Regional frequency allotment plans

Function	Frequencies/Bands(MHz)
TWR	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
SMC	**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-PAR	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
APP-L, APP-I, APP/DF I, APP/SR-	119.000 119.025 119.050 119.075 119.100 119.125 119.150 119.175 119.200 119.225 119.250 119.275 119.400 119.425 119.450 119.475 119.700 119.725 119.750 119.775 120.000 120.025 120.050 120.075 120.200 120.225 120.250 120.275 120.400 120.425 120.450 120.475 120.600 120.625 120.650 120.675

	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
APP-U	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-L or ACC/SR-L	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
ACC-U ACC-LU	118.900 118.925 118.950 118.975 119.300 119.325 119.350 119.375 120.500 120.525 120.550 120.575 120.700 120.725 120.750 120.775 120.900 120.925 120.950 120.975 123.700 123.725 123.750 123.775 124.500 124.525 124.550 124.575 125.300 125.325 125.350 125.375 125.700 125.725 125.750 125.775 125.900 125.925 125.950 125.975 128.100 128.125 128.150 128.175 132.100 132.125 132.150 132.175 132.200 132.225 132.250 132.275 132.300 132.325 132.350 132.375 132.400 132.425 132.450 132.475 132.500 132.525 132.550 132.575 132.600 132.625 132.650 132.675 132.700 132.725 132.750 132.775 132.800 132.825 132.850 132.875 132.900 132.925 132.950 132.975 133.000 133.025 133.050 133.075 133.100 133.125 133.150 133.175 133.200 133.225 133.250 133.275

	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
FIS - LU	120.100 120.125 120.150 120.175 123.900 123.925 123.950 123.975 124.100 124.125 124.150 124.175 124.900 124.925 124.950 124.975 126.700 126.725 126.750 126.775 126.900 126.925 126.950 126.975 127.100 127.125 127.150 127.175 127.300 127.325 127.350 127.375 128.500 128.525 128.550 128.575
FIS-U (GPS)	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
AOC	128.900 128.925 128.950 128.975 129.000 129.025 129.050 129.075 129.100 129.125 129.150 129.175 129.200 129.225 129.250 129.275 129.300 129.325 129.350 129.375 129.400 129.425 129.450 129.475 129.500 129.525 129.550 129.575 129.600 129.625 129.650 129.675 129.700 129.725 129.750 129.775 129.800 129.825 129.850 129.875 129.900 129.925 129.950 129.975 130.000 130.025 130.050 130.075 130.100 130.125 130.150 130.175 130.200 130.225 130.250 130.275 130.300 130.325 130.350 130.375 130.400 130.425 130.450 130.475 130.500 130.525 130.550 130.575 130.600 130.625 130.650 130.675

	130.700 130.725 130.750 130.775 130.800 130.825 130.850 130.875 130.900 130.925 130.950 130.975 131.000 131.025 131.050 131.075 131.100 131.125 131.150 131.175 131.200 131.225 131.250 131.275 131.300 131.325 131.350 131.375 131.400 131.425 131.450 131.475 131.500 131.525 131.550 131.575 131.600 131.625 131.650 131.675 131.700 131.725 131.750 131.775 131.800 131.825 131.850 131.875 131.900 131.925 131.950 131.975 132.000 132.025
VOLMET/ATIS	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
DATA LINK	136.900 136.925 136.950 136.975
AIR-TO-AIR	123.450

3.1.2.6 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. [APAC ANP VOLII 2.41]

3.1.2.7 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. [APAC ANP VOLII 2.42]

3.1.2.8 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. [APAC ANP VOLII 2.43]

3.1.2.9 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. [APAC ANP VOLII 2.44]

3.1.2.10 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. [APAC ANP VOLII 2.45]

3.1.2.11 The criteria of Geographical separation used for Co-channel VHF assignments [Frequency list 03]
[Note: TBD]

AIR - GROUND COMMUNICATION FOR	SYMBOL	SERVICE RANGE NM	SERVICE HEIGHT m/ft	CO-CHANNEL SEPARATION NM
Aerodrome Control	TWR	25	1200/4000	175[1]
Surface Movement Control	SMC	limits of aerodrome	Surface	50[1]
Approach Control (upper)	APP-U	150	13700/45000	820[1]
Approach Control (intermediate)	APP-I	75	7600/25000	550[1]
Approach Control (lower)	APP-L	50	3650/12000	370[1]
Area Control or Flight Information (upper)	ACC-U or FIS-U	Specified area plus 50 NM	13700/45000 or 19800/65000 [3]	520[2] 630[2]
Area Control (lower)	ACC-L or ACC-SR-L	Specified area plus 50 NM	7600/25000	500[2]
Area Control or Flight Information (extended range)	ACC - ER or FIS - ER	to be specified	13700/45000 or 19800/65000[3]	1000[1] 1200[1]
VOLMET/ATIS	VOLMET or ATIS	omni - directional	13700/45000 or 19800/65000[3]	520[1] 600[1]

1 Distance between stations
2 Distance between limits of service areas
3 If required for SST operations

3.2 Navigation frequency management

3.2.1 Non-Directional Radio Beacons (NDB)

TBD

3.2.2 Instrument Landing System (ILS)

TBD

3.2.3 Doppler Very High Frequency Omni-Directional Range (DVOR)

TBD

3.2.4 Distance Measuring Equipment (DME/TACAN)

TBD

3.2.5 GBAS

TBD

3.2.6 IDENTICAL SIGNAL

TBD

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.	

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

TRD	Runway azimuth

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: Manufacturer & Model (if possible),

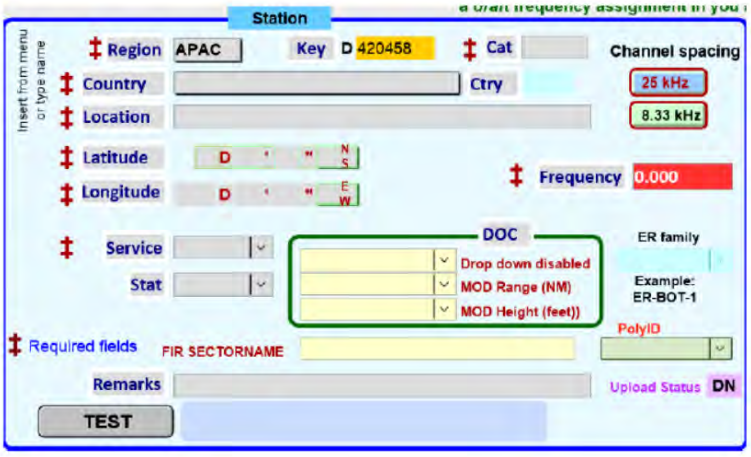
Frequency Range (if request RO for proposal) or proposed frequency,

Transmit Power or DOC

Latitude/Longitude:

Minimum information required with reference to the following screenshot:

Country, Location, Latitude/Longitudes, Service.



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LIST OF WORKING/INFORMATION PAPERS

WP/IP No.	Agenda Item	Subject	Presented by
		LIST OF WORKING PAPERS	
WP/01	1	Provisional Agenda	Secretariat
WP/02	2	Review of Relevant Meetings/Web-conferences	Secretariat
WP/03	3	Review of ToR and Action List	Secretariat
WP/04	4	Review of Regional Process	Secretariat
WP/05	5	VHF COM Simulation for 2030	Secretariat
WP/06	6	Review POC of States	Secretariat
WP/07	7	Indian VHF Projections for 2030 Based on Future Operational Requirements and Need for Objective Review of 8.33 KHz Channel Spacing Requirements in APAC Region	India
WP/08	7	Actions Taken in France to Mitigate Interference into the Radio Altimeters Systems from 5G/MFCN in the Band 3.4-3.8 GHz	DSNA, France
WP/09	4	Propose Use of Terrain Data for Frequency Assignment Planning in Frequency Finder	Thailand
WP/10	4	Updating Process of Frequency List No. 1 and 2	Indonesia
WP/11	4	Review of VOR Frequency Assignment Criteria in APAC Region	India
WP/12	4	Updates to Frequency Finder	Secretariat
WP/13	4	Frequency Assignment Planning Tool to Support Communication via Satellite and New Emerging Technologies	Thailand
WP/14	4	Draft of Asia Pacific Frequency Management Guidance Material	China
		LIST OF INFORMATION PAPERS	
IP/01		Meeting Information	Secretariat
IP/02	2	Draft ICAO Position for ITU WRC-23	Secretariat

WP/IP No.	Agenda Item	Subject	Presented by
IP/03	7	Protection of Interference to Radio Altimeters from 5G Applications in the Asia-Pacific	Boeing Australia Holdings
IP/04	7	Status Report Radio Frequency Interference in the Band 117.975 – 137 MHz	Thailand
IP/05	7	Protection of Instrument Landing System (ILS) Critical and Sensitive areas in Three-Dimensional	Hong Kong, China
IP/06	7	Analysis of GPS Signals Interference Based on QAR Data	China
IP/07	7	Operation of ILS/DMES Using the Same Frequency with Different Identifiers at Beijing Daxing International Airport	China
IP/08	4	Introduction of 50 kHz Channel spacing in the APAC Region	Secretariat
		FLIMSY	
Flimsy 01	2	Updates on the Prominent Gist of the Outcomes of FSMP WG/11 Meeting	India
Flimsy 02	2	Proposal to address Para. 2.19 from SRWG/5 – WP/02	Secretariat

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The Fifth Meeting of the Spectrum Review Working Group (SRWG/5)				
Video Tele-Conference, 15 March, 2021 – 17 March 2021(Max 3.5 hrs. /day, UTC+7)				
	09:00 -09:30	***09:30-10:30***		***10:45 - 12:00***
Mon. 15 March **(Day-1)**	***Session 1 (Opening Session):*** **30 min** ➢ *Opening Remarks by Mr. Chainan Chaisompong, Chairperson of the SRWG/5-group* ➢ *Opening Remarks by Mr. Luo Yi, Secretary of the SRWG/5-group* ➢ *Introduction of participants* ➢ *Administrative information* **Note:** *1) Please use IP/01- VIDEO TELE-CONFERENCE BULLETIN for guidance to join the meeting.* *2) Download meeting documents from following here.*	***Session 2:*** **60 min** **Agenda Item 1: Adoption of the Agenda** ➢ *WP/01 - Provisional Agenda - Sec* **Agenda Item 2: Review outcomes of relevant meetings** ➢ *WP/02 - Outcomes of relevant meetings – Sec* ➢ *IP/02- Draft ICAO position for ITU WRC-23-Sec* **Agenda Item 3: Review the TOR and action items** ➢ *WP/03 – Review the TOR and action items – Sec* **Agenda Item 7: State and regional updates** ➢ *IP/04- Status report radio frequency interference in the band 117.975 – 137 MHz- Thailand*		***Session 3:*** **75 min** **Agenda Item 7: State and regional updates** ➢ *IP/05- Protection of Instrument Landing System (ILS) critical and sensitive areas in three-dimensional and ILS facility performance category requirements- Hong Kong, China* ➢ *IP/06- Analysis of GPS signals interference based on QAR data- China* ➢ *IP/07- Operation of ILS/DMEs Using the Same Frequency but Different Identifiers at Beijing Daxing International Airport- China* ➢ *WP/08- Actions Taken in France to Mitigate Interference into The Radio Altimeters Systems from 5G/MFCN in the band 3.4-3.8 GHz- France* ➢ *IP/03- Protection of interference to radio altimeters from 5G applications in the Asia-pacific- Boeing Australia*

The Fifth Meeting of the Spectrum Review Working Group (SRWG/5)			
Video Tele-Conference, 15 March, 2021 – 17 March 2021(Max 3.5 hrs. /day, UTC+7)			
	08:00- 09:30		***09:45- 11:00***
Tue. 16 March (Day-2)	***Session 4:*** **90 min** **Agenda Item 4: Frequency coordination process and improvement for the Asia/Pacific Region** ➢ *WP/04- Review of Regional Process-Sec* ➢ *WP/12- Updates to Frequency Finder- Sec* ➢ *WP/09- Propose use of terrain data for frequency assignment planning in frequency finder- Thailand* ➢ *WP/10- Updating process of frequency list no. 1 and 2- Indonesia* ➢ *IP/08- Introduction of 50 kHz Channel spacing in the APAC Region- Sec*		***Session 5:*** **75 min** **Agenda Item 4: Frequency coordination process and improvement for the Asia/Pacific Region** ➢ *WP/11- Review of VOR frequency assignment criteria in APAC region- India* ➢ *WP/13-Frequency Assignment Planning tool to support communication via Satellite and New Emerging Technologies- Thailand.* ➢ *WP/14 Draft of Asia Pacific Frequency Management Guidance Material- China* **Agenda Item 5: VHF Com Simulation for 2030** ➢ *WP/05- VHF Com Simulation for 2030- Sec* ➢ *WP/07- Indian VHF Projections for 2030 Based On Future Operational Requirements and Need for Objective Review of 8.33 KHz Channel Spacing Requirements in APAC Region- India*

The Fifth Meeting of the Spectrum Review Working Group (SRWG/5)			
Video Tele-Conference, 15 March, 2021 – 17 March 2021(Max 3.5 hrs. /day, UTC+7)			
	08:00- 09:00	***1 hour***	***10:00- 11:00***
Tue. 17 March (Day-3)	***Session 6:*** **60 min** **Agenda Item 6: Review POC of States on frequency affairs** ➢ *WP/06- Review POC for States-Secretariat* **Agenda Item 8: Next meeting and any other business** ➢ *Date and Venue for the Next Meeting*		***Session 7:*** **60 min** ➢ *Meeting report*

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