International Civil Aviation Organization

EIGHTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION AND SURVEILLANCE SUG-GROUP (CNS SG/18) OF APANPIRG

Asia and Pacific Regional Sub-Office, Beijing, China
(21 – 25 July 2014)

Agenda Item 8: Aeronautical electromagnetic spectrum utilization

8.4) Radio spectrum management related issues – introduction of new criteria for regional VHF spectrum coordination and approach to address the new operational needs in VHF voice communications

USE OF A REFINED FREQUENCY ASSIGNMENT METHOD IN THE APAC REGION

(Presented by Secretariat)

SUMMARY

This paper presents the refined planning criteria for VHF air-ground communication systems operating in the frequency band 117.975 – 137 MHz as contained in Annex 10, Volume V, makes a comparison against the current APAC provisions, presents the ICAO tool Frequency Finder and recommends the use of both refined method and tool by the APAC Spectrum Review Working Group to address the operational needs in VHF voice communications.

1. INTRODUCTION

1.1 In 2013 ICAO has amended Annex 10, Volume V *Aeronautical Radio Frequency Utilization,* Chapter 4 *Utilization of frequencies above 30 MHz,* paragraph 4.1 *Utilization of the Frequency band 117.975 – 137 MHz.* The main purpose of this amendment was a revision of the frequency assignment planning criteria for VHF air-ground communication systems operating in the frequency band 117.9575 – 137 MHz.

1.2 Simultaneous with the amendment of Annex 10, Volume V ICAO published Volume II of the *Handbook on radio frequency spectrum requirements for civil aviation,* Doc 9718. Volume II of the Handbook on frequency assignment planning for aeronautical radio communication and navigation systems currently includes only material for the frequency assignment planning for VHF air-ground communication systems operating in the frequency band 117.975 – 137 MHz. The Handbook Volume II replaces the guidance material that was included in the previous editions of Annex 10, Volume V.

1.2.1 The material in the Handbook, Volume II provides for each Region various options to implement criteria for frequency assignment planning as adapted to the needs of each Region, while securing that these criteria provide for harmonized protection of VHF COM systems on a Global basis. Implementation of this material needs to take place as agreed within each Region.

1.3 In the APAC Region, frequency assignment planning is based on Conclusion 11/4 on the *Procedure for very high frequency (VHF) aeronautical mobile service (AMS) frequency assignments* from the ICAO Third Asia/Pacific Regional Air Navigation (ASIA/PAC/3 RAN) Meeting which was held in Bangkok from 19 April to 7 May 1993.

> **Conclusion 11/4 - Procedure for very high frequency (VHF) aeronautical mobile Service (AMS) frequency assignment**
>
> That:
>
> a) the development of the VHF AMS plan, and its subsequent documentation in relevant air navigation plan (ANP) publications, will define the numbers of VHF assignments (channels) required for the respective functions at each location without reference to discrete frequency assignment; and
>
> b) the ICAO Regional Office will continue to maintain its frequency selection and coordination role, including the maintenance and promulgation of Frequency List No. 3 at appropriate periodic intervals.

In addition, the ASIA/PAC/3 RAN Meeting agreed on a set of geographical separation for co-channel VHF assignments and the VHF Frequency utilization plan for the band 117.975 – 137 MHz. This material is discussed in the following paragraphs.

1.4 This working paper concentrates on an assessment of the revised planning criteria as per the (amended) Annex 10, Volume V and the Handbook Volume II *vis-à-vis* the planning criteria currently used in the APAC Region (as established at the ASIA/PAC/RAN 3 meeting).

1.5 Following APANPIRG Decision 17/6 to establish a Spectrum Review Working Group on 8.33 kHz channel spacing, the Spectrum Review Working Group (SRWG) met in Bangkok, Thailand from 26 to 27 June 2014. During this meeting the impacts of adopting the ICAO Handbook Volume II provisions were discussed and the following Action Items 1/2 and 1/3 were raised:

- Action Item 1/2 To provide national views to the chairman on the impacts of adopting the ICAO Handbook Volume II provisions to replace the current regional RAN provisions (WP/4 refers) (target date: 24 April 2015, all Members); and

- Action Item 1/3: Chair to combine inputs from Members into one impact analysis (target date: 12 May 2015, Paul Dowsett)

1.6 The revisions to the frequency assignment planning criteria in Annex 10 and the Handbook, Volume II took place in conjunction with developing the frequency assignment planning program Frequency Finder, including planning criteria for 8.33 kHz channel spacing. This program has implemented in full the material as is in Annex 10 as well as the various options for implementation of these planning criteria as described in the Handbook, Volume II. These options are to be applied regionally as and where considered necessary. Examples for optional use of certain functions in Frequency Finder are the use of Regional frequency allotment tables (re. § 4 below), the

use of non-uniform values for the designated operational coverage or using a geographical description (polygons) to define the areas that provide ACC and/or FIR service.

1.7 The considerations developed hereafter may constitute a valuable input to those actions and for the simulation work to be conducted by SRWG.

2. Planning criteria for VHF air-ground communication systems operating in the frequency band 117.975 – 137 MHz as contained in Annex 10, Volume V.

2.1 The main goal of the revision of Annex 10, Volume V was to remove obsolete material (in particular relating to the use of equipment designed for 50 kHz and 100 kHz channel spacing), re-organize and the provisions in the Annex and to re-locate relevant guidance material in the Handbook, Volume II. No changes of substance that would affect current use of frequencies in the band 117.975 – 137 MHz were either necessary or introduced.

2.2 Of importance with regard to frequency assignment planning are the provisions for:

a) Frequency separation
b) Frequencies for particular functions
c) Calculation of co-frequency minimum geographical separation

2.2.1 Frequency separation.

While Annex 10, Volume V stipulates that the minimum separation between assignable frequencies is 8.33 kHz, such frequency separation needs to be implemented, under special conditions, on the basis of a Regional Air Navigation Agreement (typically a Conclusion from a regional Planning and Implementation Group (PIRG). In absence of such an agreement (as is the case in the APAC Region), the minimum separation between assignable frequencies is 25 kHz.

2.2.2 Frequencies for particular functions.

2.2.2.1 Frequencies for particular functions, as agreed on a global basis, include:

a) The emergency frequency 121.500 MHz and the (reduced) guard band frequencies 121.474 and 121.525 MHz;

b) The auxiliary frequency 123.100 MHz and the guard band frequencies 123.075 MHz and 123.125 MHz;

c) The frequency 123.450 MHz for air-to-air communications (outside the range of VHF ground stations);

d) The frequency 136.925 MHz as the VDL Mode 4 Common Signaling frequency;

e) The frequency 136.975 MHz as the VDL Mode 2 Common Signaling frequency

2.2.2.2 In addition, the frequency band 121.550 MHz is reserved for ground-ground communications and the frequency band to be used for Airline Operational Control (AOC) is to be determined on a Regional basis. In the APAC Region the VHF frequency utilization plan has [implicitly] allotted the band 128.800 MHz – 132.075 MHz for AOC communications.

2.2.2.1 In addition, on a regional basis, frequencies or frequency bands can be reserved for special functions. In the APAC Region, the frequency band 136.000 – 137.000 MHz has been reserved for air-ground data link communications.

2.2.3 Calculation of co-frequency minimum geographical separation

2.2.3.1 Annex 10, Volume V, Chapter 4, paragraph 4.1.4.1 requires that

> The geographical separation between facilities operating on the same frequency shall, except where there is an operational requirement for the use of common frequencies for groups of facilities, be such that the protected service volume of one facility is separated from the protected service volume of another facility by a distance not less than that required to provide a desired to undesired signal ratio of 20 dB or by a separation distance not less than the sum of the distances to the associated radio horizon of each service volume, whichever is smaller.
>
> *The application of the minimum separation distance based on the sum of the radio horizon distance of each facility assumes that it is highly unlikely that two aircraft will be at the closest points between and at the maximum altitude of the protected service volume of each facility.*

2.2.3.2 The essence of this provision was not amended although some editorial changes were made in the current version. This provision allows for the calculation of (minimum) geographical separation distances between facilities operating on the same frequency as is further clarified in the Handbook, Volume II.

2.2.4 With regard to adjacent channel protection, Annex 10 states (paragraph 4.1.4.3):

> The geographical separation between facilities operating on adjacent channels shall be such that points at the edge of the protected service volume of each facility are separated by a distance sufficient to ensure operations free from harmful interference
>
> *Note: Guidance material covering separation distances and related system characteristics is contained in the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc. 9718).*

2.2.4.1 This paper does not further discuss adjacent frequency assignment planning criteria since it concentrates on an assessment of the revised planning criteria as per the Handbook, Volume II, In addition, it should be noted that the application of adjacent frequency assignment planning criteria in areas where the channel spacing is only 25 kHz (and no 8.33 KHz channels are being used) is under a further review by the Secretariat, in cooperation with Working Group F of the Aeronautical Communications Panel.

2.2.4.2 For 25 KHz adjacent channels, the minimum separation distance is set at 10 NM between the edges of the designated operational coverage areas. Different distances apply in a mixed environment where both 25 KHz and 8.33 KHz channel spacing is being used.

3. Comparison of the geographical separation as currently used in the APAC Region and those recommended as in the Handbook, Volume II.

3.1 As pointed out in § 2, the calculation of minimum separation distances between stations operating on the same frequency was not amended. However, for the implementation of this method, the separation distances as calculated in the Handbook, Volume II provides for flexibility in minimum separation distances between dis-similar services (i.e. services with a different Designated Operational Coverage. The level of protection to these services is not changed and in line with the minimum requirement as per Annex 10.

3.1.1 With the current availability of software (such as Frequency Manager as used in the APAC Region and Frequency Finder as developed by ICAO) the implementation of the calculation of the minimum separation distance between dissimilar services has become easy. Frequency Finder calculates the minimum separation distance on a real-time basis which allows for the use of values for the designated operational coverage which differ from the uniform values as presented in Appendix A.

3.1 The frequency assignment planning as agreed at the ASIA/PAC/RAN/3 meeting provide for geographical separation distance between *similar* services only, e.g. for TWR/TWR where operating on the same frequency one TWR station is the desired station and the other TWR station is the undesired TWR station. These criteria are reproduced in Appendix A.

3.1.1 These criteria do not provide for minimum geographical separation between *dis-similar* services operating on the same frequency and, in case a frequency is assigned to both a TWR station and an APP-U station, the minimum separation distance used is 820 NM as per the table in Appendix A. This distance is calculated as two times the distance to the radio horizon for an APP-U frequency assignment (2*260 NM) plus two time the designated operational range for an APP-U frequency assignment (2*150 NM) (=820NM)

3.2 As provided for in Annex 10, Volume V and further clarified in the Handbook, Volume II, when dissimilar services are operating on the same frequency, the minimum separation distance can be calculated as the sum of the distance of the respective services to the radio horizon plus the sum of the designated operational range for each service. **When this is applied in cases where the designated operational coverage (range and height) is different, the result is smaller minimum separation distances which improves the efficiency in frequency assignment planning**. In the example as given in § 3.1..1 above the minimum geographical separation distance *between the TWR and APP-U stations* would be:

- Distance to radio horizon for TWR: 78 NM
- Distance to radio horizon for APP-U: 260 NM
- Designated operational range TWR: 25 NM
- Designated operational range APP-U: 150 NM
- Total minimum separation distance: 513 NM

Compared to the separation distance as described in § 3.1.1 (820 NM) the net gain is 307 NM in this example

3.3 A comparison of the currently used separation criteria in the APAC Region and those provided for in the Handbook Volume II is given below (as extracted from the tables in Appendices A and B)

			APAC criteria		Handbook
Air-ground communication for:	**Symbol**	**Service range (NM) and height (ft)**	**Co-channel separation (NM)**	**Co-channel separation (NM) EDGE of DOC**	**Co-channel separation (NM) EDGE of DOC**
Aerodrome Control	**TWR**	**25 / 4000**	**175 (1)**	**125 (2)**	**156 (2)**
Surface Movement Control	**SMC**	**Limits of aerodrome**	**50 (1)**	**25 (2)**	**25 (2)**
Approach Control (Upper)	**APP-U**	**150 / 45000**	**820 (1)**	**520 (2)**	**520 (2)**
Approach Control (Intermediate)	**APP-I**	**75 / 25000**	**550 (1)**	**400 (2)**	**390 (2)**
Approach Control (Lower)	**APP-L**	**50 / 12000**	**370 (1)**	**270 (2)**	**268 (2)**
Area Control or Flight Information (Upper)	**ACC-U or FIS-U**	**Specified Area (3)**	**520 (2)**	**420 (2) (3)**	**520 (2)**
Area Control (Lower)	**ACC-L**	**Specified Area /25000 (3)**	**500 (2)**	**400 (2) (3)**	**390 (2)**
VOLMET/ATIS	**VOLMET or ATIS**	**Maximum range, omni-directional / 45000**	**520 (1)**	**0 (2)**	**15 (2)**

Table 1 – Comparison of APAC and Handbook separation distances between similar services
(1) Distance between Stations
(2) Distance between limits of service areas
(3) The table of geographical separation distances as used in the APAC Region provides for the designated operational coverage being in the specified area plus 50 NM (creating a buffer zone of 50 NM around the specified area). In the comparison in table 1 this buffer zone has been removed, thus reducing the minimum separation between the service areas with 2*50 NM (=100NM).

3.3.1 In general, the minimum geographical separation distances between the edges of the designated operational coverage areas as are currently used in the APAC Region for *similar* services are in the same order of magnitude.
Exceptions are:

1. For the TWR service, the minimum separation distance as calculated with the methodology in the Handbook Volume II is about 30 NM larger (more conservative).

2. For the ACC-U service, the minimum separation distance as calculated with the methodology in the Handbook Volume II is about 100 NM larger (more conservative).

3.3.3.1. Since the calculations leading to the minimum separation distances as in use in the APAC Region cannot be traced, no explanation can be given to these differences.

3.3.2. With regard to note 3 to Table 1 is should be noted that the use of a buffer zone around area services (only) is not generally required or recommended. It places in most cases unnecessary constraints and reduces efficiency in frequency assignment planning.

4. Regional Allotment Tables.

4.1 In all Regions (different) allotment tables have been developed and, with the exception of the EUR Region, are applied in frequency assignment planning. These are briefly discussed in the Handbook, Volume II, § 2.4.2 and reproduced in Appendices B and C of the Handbook, Volume II.

4.2 The main purpose of these allotment tables is to place frequency assignments for (more or less) similar services in the same sub-band of the frequency band 117.975 – 137 MHz. In this case, the regional planning criteria, which provide for separation distances between the same or similar types of service can be applied. The use of these allotment tables simplifies frequency assignment planning which is in particular useful if all aspects for assigning a frequency need to be considered by hand.

4.3 One of the negative effects of using allotment tables for frequency assignment planning is that certain sub-bands may become congested while other sub-bands may have ample space for accommodating new frequency assignments. With the availability of modern computer programs for doing the complex calculations to assess the compatibility of the new or modified frequency assignment, the use of an allotment plan which allows for specific services to be only assigned a frequency in a dedicated sub-band is in principle no longer required.

4.4 In the Handbook, Volume II, it is recognized that [some] Regions may wish to continue using the Regional allotment table as the preferred choice for making frequency assignments. However, the Handbook Volume II also stipulates that Regions are encouraged that, when a specific frequency assignment cannot be made within the dedicated sub-band, other frequency bands may be considered.

4.5 The use of an allotment table has specific benefits in the following cases:

4.5.1 Aerodrome Surface communications. The efficiency in making frequency assignments for aerodrome surface communications (which essentially is for ground-ground communications) is improved if frequency assignments are concentrated in a sub-band. Annex 10 has designated the sub-band 121.550 – 121.975 MHz for this purpose).

4.5.2 Unprotected services.

4.5.2.1 Placing un-protected services such as Airline Operational Control in a dedicated sub-band improves on the efficiency in frequency assignment planning. Co-frequency sharing of an unprotected service with a protected service normally provides frequency protection to the unprotected service as well. The same applies for other categories of unprotected services.

4.5.3 Air-ground data link communications.

4.5.3.1 Typically air-ground data link provides for communications over the whole Region (or over large parts of it). Placing frequency assignments for air-ground data link in a special sub-band (or on a single frequency for use in the whole of the Region) improves not only the efficiency in air-ground data link communications but also in frequency assignment planning for these stations.

4.6 Over time, when frequency assignment planning is making a more efficient use of computers and software, the use of these allotment tables became less of a requirement. Using computer programs for assigning frequencies allows for more complex calculations to be performed through a computer, rather than by hand.

4.6.1 As an example, in Figure 1 four APP-U stations have been assigned the same frequency (in the sub-band allotted for APP-U services). This leaves a gap in the area in between these four ACC-U that can be used for assigning the same frequency to a TWR station. Making a non-restrictive use of the frequency allotment table assists in improving efficiency in frequency assignment planning. In principle, using an allotment table as guidance (rather than a strict rule) for selecting frequency assignments is fully acceptable.

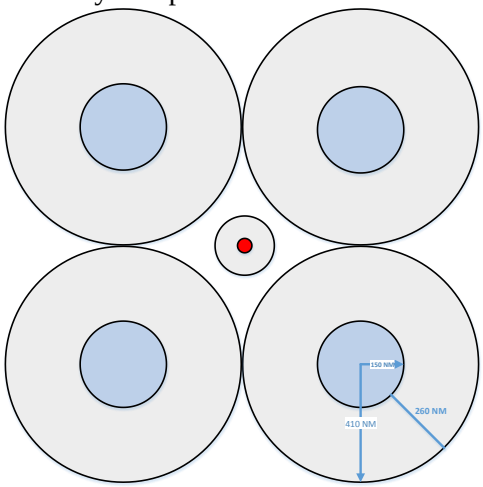

Figure 1 Assigning both TWR and APP-U on the same frequency in a limited geographical area

4.7 Should it be agreed to abolish the current allotment table in full, consideration needs to be given to the need for sub-bands as pointed out in §4.5.

4.8 The current allotment plan for the APAC Regions (but also for other Regions) has been implemented in Frequency Finder. Frequency Finder also offers the option to assign frequencies for services that are not in accordance with the allotment plan. This option can be used in cases where suitable frequency assignments cannot be found within the relevant sub-band.

4.8.1 With regard to the continued use of the frequency allotment table, a revision of the current allotment plan may be considered to spread frequency assignments more evenly over the whole range of the VHF band 117.975 – 137 MHz. In general, continued use of an allotment plan is recommended, taking into account in particular the observations in §4.5.

5. Area services

5.1 The table of geographical separation for co-channel VHF assignments as per ASIA/PAC/RAN/3 (Re. Appendix A) as well as the table of minimum co-frequency geographical separation distances as per the Handbook, Volume II (Appendix B) specify that for ACC (L and U) as well as for FIR (L and U) that frequency protection is to be provided throughout the specified area. For these services (so-called area services) the designated operational coverage is typically described through a polygon that contains the geographical coordinates of the boundary of the area services.

5.2 In the absence of information on the boundaries for these area services, frequency assignment planning in all Regions (except the EUR Region) is based on the maximum range that can be obtained from the location of a ground station (that is providing an area service).

5.2.1 This method of frequency assignment planning results in the protection of a frequency assignment outside the boundary of the intended area which decreases efficiency in the frequency assignment plan since no such protection is necessary. In addition, for larger area services, the frequency assignment may not necessarily provide protection throughout the relevant area.

5.2.2 Until now, this method of frequency assignment planning satisfied the regional needs for frequency assignments and may continue to do so in particular in areas where no congestion is expected. However, with the increase in air traffic in some sub-regions in the APAC Region, more refined frequency assignment planning may be necessary with the view to meet the requirements for such sub-regions.

5.3 Example of the positive effect when providing protection throughout an area for which the boundaries are described with a polygon

5.3.1 In this example interference between Gwangju (FIS-U) in the Republic of Korea and Guangzhou (ACC-U for Shantou) both operating on the frequency 123.400 MHz is considered.

5.3.1.1 Figure 2 displays on the map the areas where interference is predicted (the minimum separation distance between the circular coverage areas is about 310 NM; the minimum separation distances between the edges of the coverage areas should be 520 NM (see the table in Appendix B). The interfered areas are presented with a white shaded background

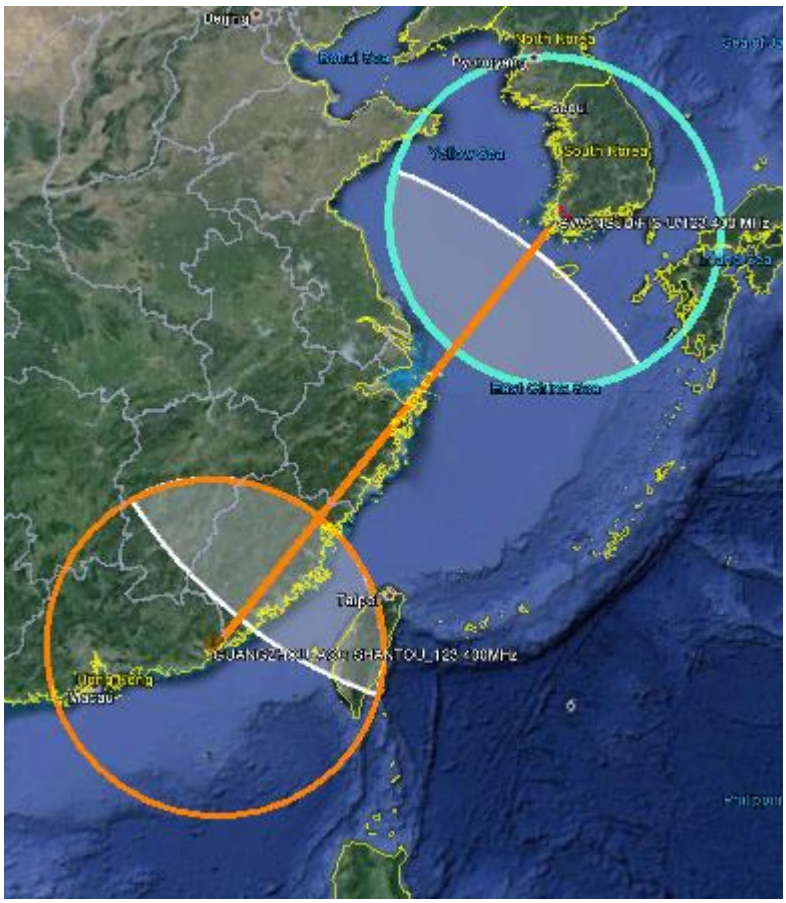

Figure 2 – Interference areas as calculated for circular FIS /ACC services

Figure 3 displays the interfered areas when both frequency assignments are associated with the respective FIR area:

- For the station at Gwangju in the Republic of Korea FIR Incheon
- For the station at Guangzhou in China the FIR Guangzhou.

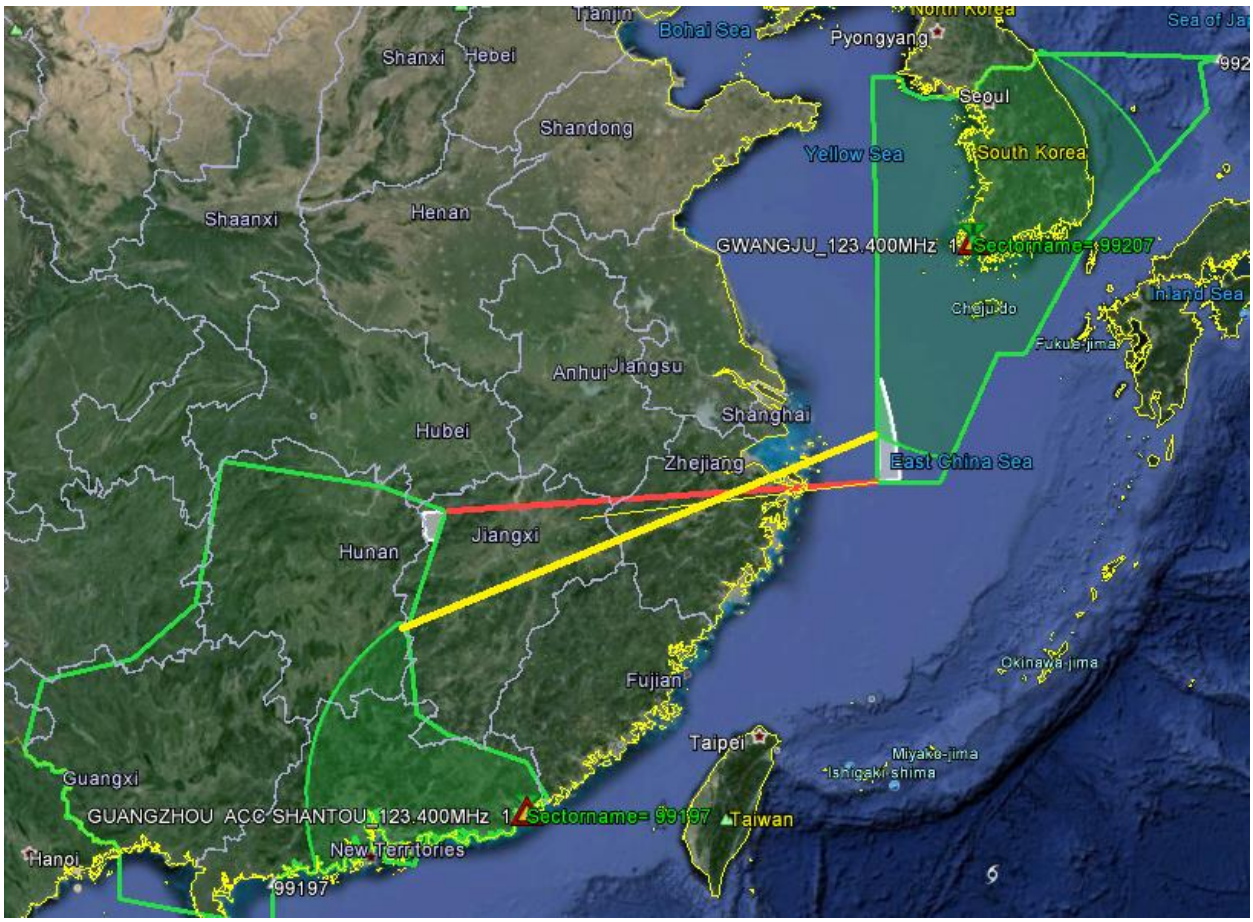

Figure 3 – Interference areas as calculated for polygons for the FIS and ACC services

The red line in Figure 3 connects the closest points between the FIR areas and, when aircraft are operating at the same time at (or near) these closest points, co-frequency interference is predicted. However, the respective aircraft operate in this case outside the coverage of the respective ground stations which implies that in practice in this situation no interference is experienced.

The yellow line, which connects the closest points at the (actual) coverage of the ground stations on the border of the FIR areas is for a distance of 560 NM and in practice no interference is expected in this case.

However, since in the current frequency assignment plan for the APAC Regions both areas are protected from harmful interference with the exception of the two small white shaded areas in Figure 3, in particular for the station at Guangzhou coverage of the frequency 123.400 MHz can be improved with the addition of extended range ground stations. In this case, protection of such extended coverage is already provided.

With regard to the (relatively small) interference areas showed in Figure 3, it should be noted that the frequency assignment planning parameters are rather conservative. The planning parameters assume a maximum protected coverage of 45000 ft. while most (civil) aircraft do not operate above 40000 ft. (about 12 km). In addition, the assumed maximum operating range for the ground station (260 NM) is probably not met and the Handbook, Volume 2 recommend using an operational range for a ground station of up to 80% of the distance to the radio horizon. This would bring in the example the designated operational range to about 200 NM (instead of 260 NM).

5.4 Effect of using polygons to describe the protected area

Positive effects when using polygons for area services include:

- Full protection throughout the area. Even if current station(s) do not provide full coverage;
- Implementation of extended range stations to improve VHF coverage does not require frequency coordination;
- Presentation on the map shows the area and the [actual] coverage at maximum altitude of DOC;
- Presentation on the map shows the [actual] interference area. The acceptance/non-acceptance can be reviewed on the basis of the operational requirement; and
- Efficient frequency assignment planning may be improved since no protection from harmful interference is provided outside the specified area.

Negative effects when using polygons for area services include:

- Full protection throughout the area may not be required in which case the efficiency of frequency assignment planning is adversely affected;
- Significant work on full implementation of the use of specified areas is foreseen (although such implementation can also take place gradually on a case-by-case basis; and
- A positive effect on improved frequency assignment planning not noticeable for ACC or FIS areas which are large compared to the assumed coverage of the ground station (which is up to the radio horizon)

5.4.1 In case the use of specified areas is being considered in the APAC Region, States need to supply ICAO with the relevant coordinates for these areas as well as when modifying the sectorization of their airspace. .

5.5 Frequency Finder has implemented the option for using specified areas to describe the designated operational coverage for are services. Data has been included for FIR sectors.
Note: Frequency Finder has also implemented a mechanism whereby air-routes can be presented on the map to assist in identifying whether potential interference is expected along an established air route. Further integration of this (and possible other data available in ICAO) is being considered.

5.6 Currently the implementation of the use of specified areas in frequency assignment planning in the APAC Region is not considered or recommended. However, further work is on-going in determining if this method of frequency assignment planning provides (significant) benefits for the APAC Region. The Spectrum Review Working Group (SRWG) is studying this matter in conjunction with its other activities.

6. Conclusions

6.1 The revised frequency assignment planning material in the Handbook, Volume II provides for increased efficiency and flexibility in frequency assignment planning since it allows for more precisely calculating minimum separation distances between dis-similar services (stations) operating on the same frequency. In addition, non-uniform values for the designated operational coverage can be used, thus tailoring this coverage more precisely to the actual operational needs. The table provided in Appendix B contains the minimum separation distances that can be applied in these cases. More information can be found in the Handbook Volume II, § 2.7 and § 2.8.

6.2 Considering the amendment of Annex 10, Volume V *Aeronautical Radio Frequency Utilization,* Chapter 4 *Utilization of frequencies above 30 MHz,* paragraph 4.1 *Utilization of the Frequency band 117.975 – 137 MHz published in 2013 and* Volume II of the *Handbook on radio frequency spectrum requirements for civil aviation,* Doc 9718 and the need for an improved efficiency in managing the assignments in the VHF band stemming from increasing operational demand, the SRWG would take benefit to study the new operational needs following the "radio horizon method" as per Annex 10, Volume V, paragraph 4.1.4.1. With respect to the method for implementing frequency assignment planning criteria as contained in the *Handbook on radio frequency spectrum requirements for civil aviation, Volume II,* the following applies:

1) The uniform designated operational coverage (DOC) as per Table 2-5 recognizing that other values for the DOC may be required to meet specific operational requirements

2) The separation distances (co-frequency) as per Table 2-9 are applied where appropriate

6.2.1 The regional allotment plan for the APAC Region, as contained in the Handbook, Volume II is applied except in cases where no suitable frequency can be assigned to satisfy a requirement.

6.3 There would also great benefits to adopt Frequency Finder and the global database as the sole reliable and secured tool for managing the frequency spectrum wordwide such as improved interregional coordination of frequencies and a more efficient frequency spectrum management.

6.4 However Frequency Finder should be made reliable and secured to become the frequency management tool, with appropriate ICAO resources, which may take more time.

6.5 Meanwhile, Frequency Finder can be used for the SRWG work and guidance developed above may constitute a valuable input to actions and simulation work to be conducted by SRWG.

7. ACTION BY THE MEETING

7.1 The meeting is invited to:

a) note the information contained in this paper;

b) discuss the relevance of this guidance contained therein and Frequency Finder tool for the simulation work of SRWG and make appropriate recommendations to the APANPIRG; and

c) discuss any relevant matters as appropriate.

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Appendix A
Geographical separation for co-channel VHF assignments as per ASIA/PAC/RAN/3

Air-ground communication for:	Symbol	Service range (NM)	Service Height (ft)	Co-channel separation (NM)	Co-channel separation (NM) EDGE of DOC
Aerodrome Control	TWR	25	4000	175 (1)	125 (2)
Surface Movement Control	SMC	Limits of aerodrome	surface	50 (1)	25 (2)
Approach Control (Upper)	APP-U	150	45000	820 (1)	520 (2)
Approach Control (Intermediate)	APP-I	75	25000	550 (1)	400 (2)
Approach Control (Lower)	APP-L	50	12000	370 (1)	270 (2)
Area Control or Flight Information (Upper)	ACC-U or FIS-U	Specified Area plus 50 NM	45000	520 (2)	520 (2)
Area Control (Lower)	ACC-L	Specified Area plus 50 NM	25000	500 (2)	500 (2)
Area Control or Flight Information (Extended Range)	ACC-ER or FIS-ER	To be specified	45000	1000 (1)	480 (2)
VOLMET/ATIS	VOLMET or ATIS	Omni-directional	45000	520 (1)	0 (2)

Notes:
(1) Distance between Stations

(2) Distance between limits of service areas
Separation distance for SST (Super Sonic Transport) operations are omitted in this table.

The column Co-channel separation (NM) EDGE OF DOC was added to compare the separation distance (between the edges of the respective designated operational coverage) as per the APAC table with Table 2-9 in the Handbook Volume II as reproduced in Appendix B.

Appendix B

Minimum co-frequency geographical separation distances between the edges of the designated operational coverage. ***All distances in NM.***

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

Note 1: All distances are in NM and between the edges of the respective designated operational coverage.

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

Source: Handbook Volume 2; Table 2-9.