International Civil Aviation Organization

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

Video Teleconference, 1 – 3 March 2022

Agenda Item 3: VHF Com Simulation for 2030

FREQUENCY SIMULATION FOR INDIA

(Presented by the Secretariat)

SUMMARY

This paper presents the outcome of frequency simulation for India, which stemmed from the outcome of discussion in SRWG/5 WP/07. The simulation demonstrates that the frequency requirements for up to 2030 can be satisfied within the frequency band 117.975 - 137 MHz. A re-organization for the pools to which frequencies are allotted may be required. In addition, heavy congestion is expected at that time throughout most of this frequency band. It is recommended to undertake a similar analysis in 3 - 5 years from now to assess the severity of the congestion.

1. Introduction

1.1 In response to outcome of SRWG/5 discussion from its 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 has submitted the requirement for frequency assignments for VHF-COM services in the frequency band 117.975 – 137 MHz that may be required in the period up to 2030.

1.2 This paper presents an analysis of these requirements with the view to identify whether these can be satisfied in the pools that are allotted for specific services in the APAC Region when continuing to use 25 kHz channel spacing.

1.3 The availability of sufficient 25 kHz channels in the APAC Region for the next 10 years will avoid a mandatory implementation of channels with 8.33 kHz channel spacing for at least in some parts of the APAC Region. An implementation of radio equipment is in particular costly for aircraft operators.

1.4 In this analysis, which is restricted to the (large) territory of India, it is assumed that a similar amount of new frequency requirements may surface in other parts of the APAC Region. As such, the simulation may be representative for other parts of the APAC Region. An additional spectrum assessment may be useful for these parts.

1.5 The results of this analysis are expected to provide for an indication of the spectrum availability in the band 117.975 – 137 MHz for air-ground communication systems. Therefore, as

considered necessary, the analysis presented in this paper includes a review of potentially more requirements to get an indication of the severity of the future congestion that may be expected with the increased use of the RF spectrum.

1.6 As a first step, the temporary frequency assignments for the SRWG analysis performed in 2016 were removed from the COM list 3. As and when necessary, these assignments were replaced with regular frequency assignments in the period from 2016 until to date and therefore these assignments are obsolete.

2. Spectrum requirements for the period until 2030

2.1 The spectrum requirements for the period until 2030 for India are reproduced in Table 1:

Tentative frequency requirements for India for the period 2021 – 2030.				
	No. of Freq Spots	**Location**	**DOC**	**Remarks**
A	30	Greenfield Airports	CD C-5/100 Ft	Requirement is going to increase in future.
B	70	Greenfield Airports/Defence Airfields	SMC C-5/100 Ft	Including Backup. Requirement is going to increase in future.
C	180	Regional Connectivity Scheme (RCS)/Greenfield Airports/Defence Airfields	TWR C-25/040	Including Backup. The requirement is to grow significantly in near future.
D	90	RCS/Greenfield Airports/ Defence Airfields	APP C-150/450	Including Backup. To meet growing requirement of new APP Control Centres at new airstrips/Greenfield airports.
E	60	Greenfield Airports/Defence Airfields	ACC C-200/450	Including Backup. Operational coverage requirements for Upper Area Harmonization (UAH).
F	15	Green Field Airports/ Defence Airfields	ATIS C-200/450	Operational coverage requirements for UAH.

Table 1 – Requirements for frequency assignments for India for 2021 - 2030

2.2 The requirements for future frequency assignment were submitted without specific locations. In this analysis the locations of current stations for particular services were taken into consideration and an assessment was undertaken to see if the overall requirements for India could be accommodated in the frequency range 117.975 – 137 MHz *at these locations*. Initially, the capacity of the various pools which are allotted to services for use in the APAC Region were considered. In case not all requirements could be satisfied within the selected pool, other allotments (pools) were considered.

3 Requirement for 30 Greenfield Airports and 70 Greenfield Airports/Defense Airfields

3.1 A total of 100 frequency assignments is requested with a DOC of 5 NM / 100 ft. The analysis for this requirement is reviewing the possibility to accommodate these requirements in the APAC pool for Aerodrome Surface (AS) communications (121.550 – 121.975 MHz; 18 channels)

3.2 For this analysis the current location of stations for AS communications in the COM list 3 were considered. The distribution of these facilities across the territory of India is as shown in Figure 1. The ICAO COM list 3 includes 42 assignments for AS services at 29 different locations.

Figure 1 – Location of stations for AS service.

3.3 For the purpose of the spectrum capacity analyses the number of these 29 locations for new stations was multiplied by four, resulting in a total of 116 new stations. For these stations, a search was undertaken to accommodate a frequency in the pool for AS services. The analysis took into account more than the required total of 100 frequency assignments.

3.4 Results of the analysis.

3.4.1 For 115 out of the 116 stations that were considered in the analysis a frequency could be assigned from within the pool for AS services. In this process, for each of the 29 locations, four new frequency assignments could be added.

3.4.1 A total of up to 100 frequency assignments was requested and all of these can be accommodated in the pool for AS services. It must be noted however, that these assignments cause heavy congestion or even saturation in the AS pool and, by 2030 measures may be required to increase the capacity of the spectrum capacity in the pool for AS communications. This can be arranged by making an additional allotment for AS services using 25 kHz channels or by introducing 8.33 kHz channel spacing to support this application.

3.4.2 A mitigating factor that would increase the capacity of future AS assignments could be the re-location of current frequency assignments for APP-L and APP-U away from the AS pool.

3.4.4 Another mitigating factor could be that the distribution of frequency assignments for AS services is not homogeneous throughout the territory of India. In areas with currently a low density of AS stations, more capacity is available for future frequency assignments.

4 Requirement for 180 frequency assignments for TWR services

4.1 A total of 180 frequency assignments is requested with a DOC of 25 NM / 4000 ft. The analysis for this requirement is reviewing the possibility to accommodate these requirements in the APAC pool for Tower (TWR) services.

4.2 The pool for frequencies that can be used for TWR services in the APAC Region is:

- 118.000 – 118.875 MHz; 875 kHz: 36 channels
- 124.300 – 124.375 MHz; 75 kHz: 4 channels

4.3 For this analysis, the current locations of frequency assignments for TWR communications were considered. The distribution of these facilities across the territory of India is as shown in Figure 2. The ICAO COM list 3 includes 440 frequency assignments for TWR services at 211 different locations. In the analysis, a search was undertaken if for each location a new frequency could be made available, taking into account the current use of frequencies in the pool for TWR services by India and neighboring countries.

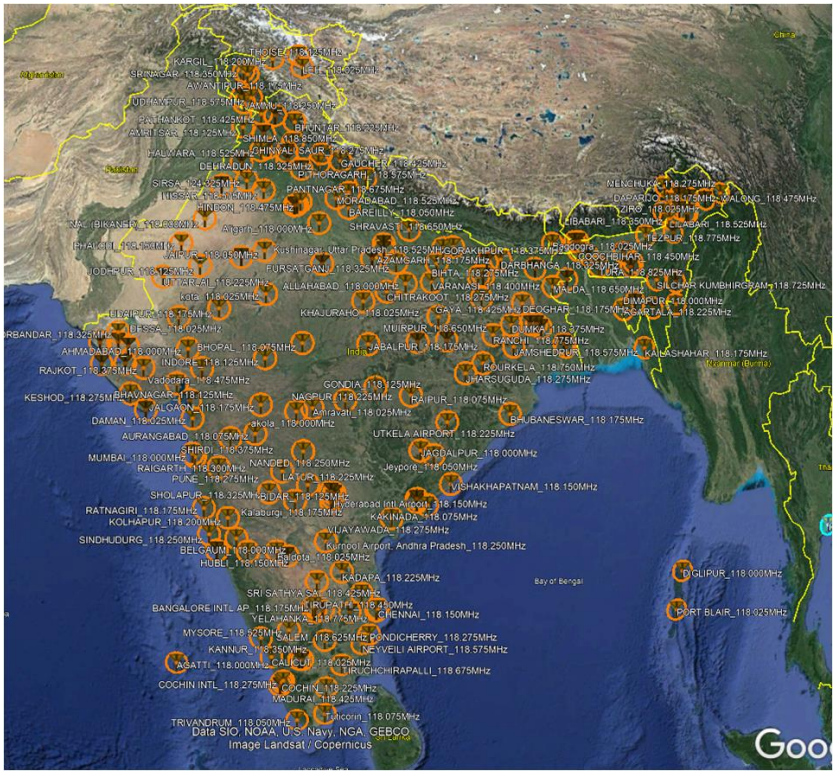

Figure 2 – Location of TWR facilities in India

4.4 Results of the analysis

4.4.1 For all of the 211 (new) stations that were considered in the analysis a frequency could be assigned from within the pool for TWR services. These frequency assignments would however saturate the band 118.000 – 118.875 MHz in India and the surrounding areas of the territory of India, leaving some room for further expansion of the use of TWR frequencies in the band 124.300 – 124.375 MHz (4 channels).

4.4.2 The results that were achieved with this analysis are expected to cause severe congestion or saturate the band 118.000 – 118.875 MHz in India and the surrounding areas of the territory of India.

Beyond 2030 additional spectrum should be made available for TWR frequencies to accommodate further growth in the spectrum use. The APAC Region may consider to use for this purpose [part of] the band 122.000 – 123.675 MHz which is currently not allotted to any service.

5 Requirement for 90 frequency assignments with a DOC of 150/450 [APP-U]

5.1 A total of 90 frequency assignments is requested with a DOC of 150 NM / 45000 ft. The analysis for this requirement is reviewing the possibility to accommodate these requirements in the APAC pool for APP-U.

5.2 The pool for frequencies that can be used for APP-U services in the APAC Region is:

- 120.300 – 120.375 MHz; 75 kHz; 4 channels
- 121.300 – 121.375 MHz; 75 kHz; 4 channels
- 124.200 – 124.275 MHz; 75 kHz; 4 channels
- 124.400 – 124.475 MHz; 75 kHz; 4 channels
- 124.600 – 124.675 MHz; 75 kHz; 4 channels
- 124.800 – 124.875 MHz; 75 kHz; 4 channels
- 125.000 – 125.075 MHz; 75 kHz; 4 channels
- 125.200 – 125.275 MHz; 75 kHz; 4 channels
- 125.400 – 125.475 MHz; 75 kHz; 4 channels
- 125.600 – 125.675 MHz; 75 kHz; 4 channels
- 125.800 – 125.875 MHz; 75 kHz; 4 channels
- 126.000 – 126.075 MHz; 75 kHz; 4 channels
- 126.300 – 126.375 MHz; 75 kHz; 4 channels

Total: 52 channels with a total bandwidth of 1.3 MHz

Note: The APAC pool for APP-U services is not shared with any other services

5.3 The analysis was considering the frequency assignments currently in the ICAO database for APP-U services. In India, a total of 58 frequency assignments for APP-U were identified. Not all of these were assigned from within the APAC pool for APP-U services. These assignments are in use at 58 different locations. These locations are spread through the territory of India as in Figure 3. These 58 stations were duplicated and added as new stations (2 times) creating a requirement for 116 stations with a DOC of 150/450 as for APP-U services.

5.3.1 The distribution of APP-U stations in India is not homogeneous throughout the territory of India. Therefore, the analysis concentrates on the area where these stations are located. The location of these (58) stations is in Figure 3

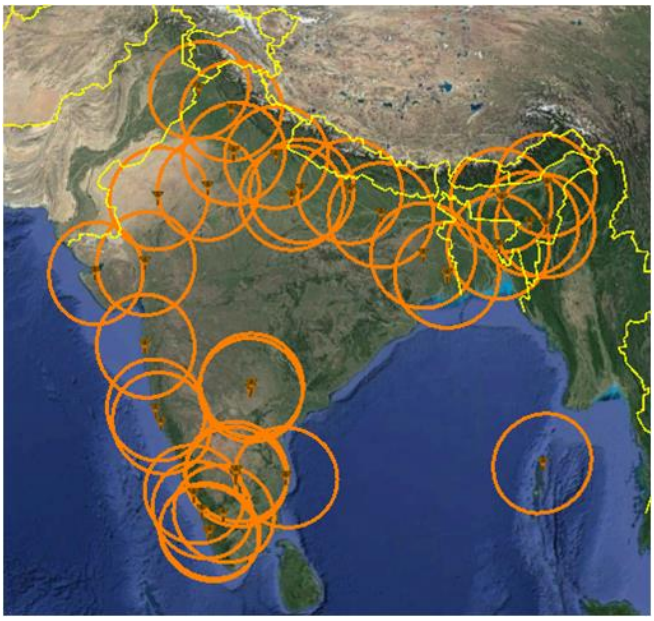

Figure 3 - Location of 58 APP-U stations in India

5.4 In the analysis, a search was undertaken whether for each of the 116 new locations a frequency could be assigned, taking into account the current use of frequencies by India and neighboring countries. Initially, the search included frequencies in the pool for APP-U services. The analysis was performed in one batch of 116 locations.
Note: For any location where no compatible frequency could be assigned, a second search was undertaken in the pool for AOC services.

5.5 Results of the analysis.

5.5.1 The search for frequency assignments in the APP-U pool showed that from the list of 116 new stations, 79 stations could be assigned a frequency from within the APP-U pool. This is 11 assignments short of the minimum 90 assignments as requested by India. These results show that the pool for APP-U frequencies in the area of India and surrounding countries will become heavily congested or even saturated.

5.5.2 A second search for assignable frequencies for APP-U services for the remaining 37 stations (out of the 116 stations that were submitted to the analysis) with a DOC of 150/450 in the pool for AOC frequencies in the following range:

- 128.900 – 132.025 MHz (125 channels; 3,125 MHz)

5.5.2.1 Taking into account the need to protect the APP-U services from harmful interference from current frequency assignments for AOC service. as registered with ICAO, these 37 requirements could be satisfied in the AOC sub-band in the range of 128.900 – 129.300 MHz. This would require a re-allotment of a part of the AOC band to APP-U. Such a re-allotment does not necessarily require a change to the current frequency assignments, as registered by ICAO, in this band at this point in time.

5.5.2.2 In the pool for AOC services, the additional 11 frequency assignments could be found within the range 128.900 – 129.250 MHz. This would satisfy the need for 90 frequency assignments with a DOC of 150/450.

5.5.2.2.1 An additional search for 26 stations that were submitted to the analysis could be found in the range up to 130.200 MHz. This may be needed to satisfy requirements for beyond 2030.

5.5.2.2.2 In the light of this analysis, it is proposed to consider:

- To re-allot the frequency band 128.900 – 129.900 MHz [128.900 – 130.400 MHz] for APP-U services
- To re-locate the stations in this band currently used for OPC to the [reduced] frequency band.

5.5.2.3 Alternatively, the part of the frequency band 122.000 – 123.675 MHz may be considered to satisfy frequency requirements than cannot be accommodated in the regular APP-U band. This band, which is not allotted to any service, has already been indicated as a potential candidate for the overflow of frequency assignments for TWR services that cannot be accommodated in the pool for TWR services.

6 Requirement for 60 Greenfield Airports/Defense Airfields with DOC 200/450 (ACC-U)

6.1 A total of 60 frequency assignments is requested with a DOC of 200 NM / 45000 ft. The analysis for this requirement is reviewing the possibility to accommodate these requirements in the APAC pool for ACC-U.

6.2 The pool for frequencies that can be used for ACC-U services in the APAC Region is as in 5.2.1. This pool is shared with frequencies for ACC-L which has a (standard) DOC of 150/450.

6.2.1 The pool for ACC-U frequencies is:

- 118.900 – 118.975 MHz; 75 kHz; 4 channels
- 119.300 – 119.375 MHz; 75 kHz; 4 channels
- 120.500 – 120.575 MHz; 75 kHz; 4 channels
- 120.700 – 120.775 MHz; 75 kHz; 4 channels
- 120.900 – 120.975 MHz; 75 kHz; 4 channels
- 123.700 – 123.775 MHz; 75 kHz; 4 channels
- 124.500 – 124.575 MHz; 75 kHz; 4 channels
- 125.300 – 125.375 MHz; 75 kHz; 4 channels
- 125.700 – 125.775 MHz; 75 kHz; 4 channels
- 125.900 – 125.975 MHz; 75 kHz; 4 channels
- 128.100 – 128.175 MHz; 75 kHz; 4 channels
- 132.100 – 134.500 MHz; 2400 kHz; 96 channels

The total spectrum for ACC-U frequency assignments (shared with ACC-L) is 3.5MHz.

6.3 Methodology used in the analysis

6.3.1 The analysis was using the frequency assignments currently in the ICAO database for ACC-U services. In India, a total of 208 frequency assignments for ACC-U were identified. Not all of these were assigned from within the APAC pool for ACC-U services. These 208 assignments are in use at 26 different locations. These locations are spread throughout the territory of India as in Figure 4.

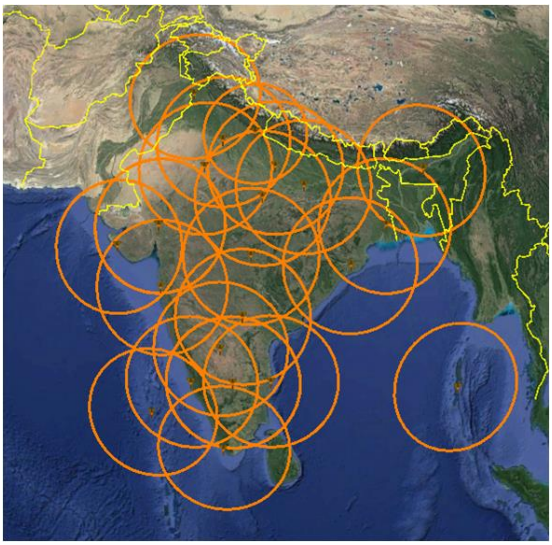

Figure 4 – Location of ACC-U stations in India

6.4 Results of the analysis

6.4.1 A search was undertaken whether for each of the 26 locations a frequency could be assigned, taking into account the current use of frequencies by India and neighboring countries in the APAC APP-U pool. The analysis was performed in three batches for 26 locations, resulting in a search for 78 frequency assignments. In total, in these three batches 77 frequency assignments could be made, in the pool for ACC-U services, 16 more than required.

6.5 A search for frequency assignments for a fourth batch of 26 locations was undertaken to assess to congestion in the ACC-U pool. With this search, only 6 frequency assignments could be found, indicating a severe congestion of saturation of the pool for ACC_U services when more frequency assignments are required. In any case, the results show that with satisfying the 60 requirements s requested by India, the pool for ACC-U becomes seriously congested.

6.5.1 With the fourth batch, only 6 additional frequency assignments could be found in the areas as shown in Figure 5. This search for frequency assignments as only undertaken to assess the level of congestion in the ACC-U pool and is not directly relevant to the original request from India. This would mean that most of the area of India becomes saturated with frequency assignments from within the current pool for ACC-U frequency assignments.

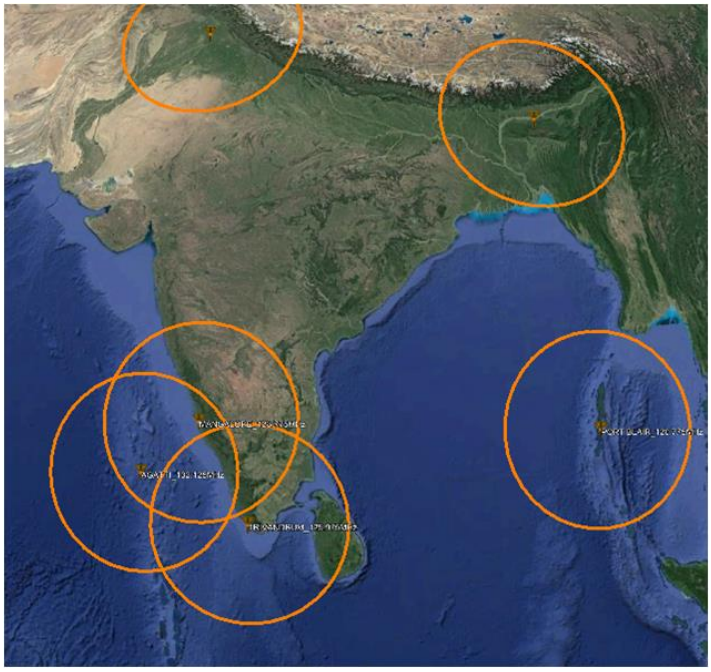

Figure 5 – Frequency assignments that could be found in the fourth batch in the ACC-U pool.

6.6 When considering the (severe) congestion in the ACC-U pool it is proposed to consider to extend this pool into (parts of) the frequency band 136.000 – 137.000 MHz. This frequency band has to date only very limited assignments for VDL. To improve the efficiency of VDL assignments, the introduction of a channel plan for VDL is proposed that takes, in an efficient manner, into account the need for a one channel guard band between VDL frequency assignments. This may become necessary when VDL is used for ATC data communications

7 Requirement for 15 Greenfield Airports/Defense Airfields with DOC ATIS 200/450.

7.1 A total of 15 frequency assignments is requested for ATIS with a DOC of 200 NM / 45000 ft. The analysis for this requirement is reviewing the possibility to accommodate these requirements in the APAC pool for VOLMET/ATIS.

7.2 The pool for frequencies that can be used for ATIS services in the APAC Region is as in 7.2.1. This pool is shared with frequencies for VOLMET which has a (standard) DOC of 150/450. Both services provide for a broadcast service.

7.2.1 The pool for ATIS frequencies is:

- 126.200 – 126.275
- 126.400 – 126.475
- 126.600 – 126.475
- 126.800 – 126.875
- 127.000 – 127.075
- 127.200 – 127.275
- 127.400 – 127.475

- 127.600 – 127.675
- 127.800 – 127.875
- 128.000 – 128.875
- 128.200 – 128.275
- 128.400 – 128.475
- 128.600 – 128.675
- 128.800 – 128.875

Total 56 channels.

7.3. Locations considered for ATIS frequency assignments.

7.3.1 In the ICAO COM list 3, 96 frequency assignments for ATIS are registered. Although the requirement from India states that 16 new assignments would be required by 2030, an analysis was performed to search for 30 frequency assignments from the list of 96 current ATIS frequency assignments as shown in Figure 6

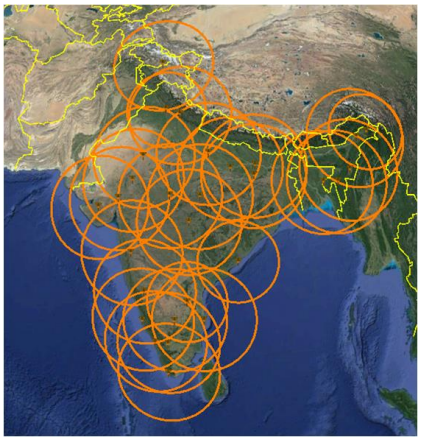

Figure 6 – Location of ATIS stations as used in the spectrum capacity analysis

7.3.1 The 20 stations used in the analysis could be easily assigned a frequency in a small part of the pool for VOLMET/ATIS frequency assignments.

8. Conclusions

8.1 Requirement for 100 frequency assignments with a DOC of 5 NM/100 ft.

8.1.1 This requirement can be accommodated in the current pool for AS services. However, a large part of this pool may become heavily congested or saturated within the territory of India. Consideration should be given to increase this pool for use after 2030.

8.1.2 Increased capacity within the pool for AS services can be achieved with re-locating frequency assignments in this pool for other non-AS services to another frequency band or pool.

8.2 Requirement for 180 TWR frequency assignments with a DOC of 25 NM/ 4000 ft.

8.2.1 This requirement can be accommodated in the current pool for TWR services. However, most of this pool will become saturated with these frequency assignments.

8.2.2 Consideration should be given to increase this pool after 2030. Re-allotting [part of] the pool *Not Allotted* (122.000 – 123.675 MHz) for this purpose.

8.3 Requirement for 90 frequency assignments with a DOC of 150 NM / 45000 ft (APP-U)

8.3.1 From the requirement for 90 frequency assignments 79 could be accommodated in the current pool for APP-U services. The remaining 11 frequency assignments could be accommodated in a (small) part of the pool for AOC services. To accommodate more frequency assignments, a larger part of the pool for AOC services would be required.

8.3.1 These spectrum requirements for APP-U services would saturate the pool for APP-U and future requirements (after 2030) may need to be accommodated in other parts of the aeronautical frequency band 117.975 – 137.000 MHz.

8.4 Requirement for 60 frequency assignments with a DOC for ACC-U (200 NM / 45000 ft)

8.4.1 This requirement can be accommodated in the current pool for ACC-U services. However, this pool will become heavily congested, taking in particular into account that a similar increase in frequency use may be found in countries adjacent to India.

8.4.2 Consideration should be given to introduce an allotment for ACC-U services in the band 136.000 – 137.000 MHz after 2030.

8.4.2.1 In case around 2030 the use of the frequency band 117.975 – 137.000 MHz becomes heavily congested, this band may be the first candidate to introduce 8.33 kHz channel spacing, in particular for air operations above FL 320 – FL 350.

8.5 Requirements for 15 ATIs frequencies with DOC of 200 NM/ 45000 ft.

8.5.1 This requirement can be accommodated easily in the current pool for ATIS services.

9. End notes

9.1 Until about 2030 the requirements brought forward by India can be satisfied within the frequency band 117.975 – 137 MHz using equipment that is designed for 25 kHz frequency separation. The analysis as presented however does not take into account an increase in the use of this band in countries adjacent to India. When the increase in adjacent countries is significant, the potential for satisfying all of the requirements from India is reduced. This is manifested in particular for aeronautical services with a large DOC that includes higher flight levels.

9.2 A new review of the spectrum requirements is proposed to take place between 3 -5 years from now. Such a review should take into consideration the actual number of new frequency assignments that would be placed into operation use at that time, as well as provide for a better opportunity to assess the spectrum requirements for a period of up to five years from that time

9.3 The analysis is valid under the assumptions or conditions with which it was performed. Changing these may give different results. Overall, it is expected that this may not necessarily significantly change the end results as presented.

9.4 Proposed changes to the current allotment plan should be considered after the results of a more detailed analysis are available. The results of such analyses may support the size of the frequency bands to be re-allotted.

10. ACTION BY THE MEETING

10.1 The meeting is invited to:

a) note the information contained in this paper;

b) agree to undertake an updated spectrum capacity analysis for the APAC Region around 2025 – 2027; and

c) discuss any relevant matter as appropriate.

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