*International Civil Aviation Organization*

**SECOND MEETING OF SPECTRUM REVIEW WORKING GROUP (SRWG/2)**

Bangkok, Thailand 12 – 14 May 2015

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**Agenda Item 4: Simulations with Frequency Finder**

# OUTCOMES OF THE SIMULATIONS ADDRESSING THE VHF FREQUENCY NEEDS FOR 2015-2020 AND BEYOND IN THE APAC REGION

(Presented by Secretariat)

**SUMMARY**

This paper presents the results of the simulations addressing VHF frequency needs for the APAC Region and proposes the necessary recommendations to the SRWG.

## 1. INTRODUCTION

1.1 The SRWG Task 2a ("Simulate with the global database how this this could meet the needs could be done based on 25 kHz spacing, and the new ICAO global frequency manager software tool and Handbook volume II provisions") of the SRWG is to develop recommendations for the CNS SG to address the future operational needs for VHF air/ground communication channels while avoiding, for as long as practicable, the introduction of 8.33 kHz channel spacing in the APAC Region. Task 2a is planned to be completed on 28 May 2015.

1.2 To achieve this task, an assessment of the future needs for air/ground VHF communication channels has been performed by the Secretariat, in coordination with the members of the SRWG. The assessment serves the purpose to identify if any required frequency assignment in the APAC Region for the period up to 2020 (and, as necessary, beyond) can be satisfied while continuing using 25 kHz channel spacing.

1.3 In each case, the level of congestion that can be expected in the VHF band in the timeframe 2015-2020 was also assessed and is indicated with borders.

1.4 This paper in its final issue will be the deliverable of Task 2a and Task 2b. **Appendix A** (collection of operational needs and limitations) constitutes the deliverable of Tasks 1b and 1c.

## 2. DISCUSSION

In this chapter the methodology to assess congestion is discussed, followed by the outcomes of simulations conducted for the SRWG Members.
Conclusions and recommendations conclude the chapter.

2.1 Methodology to assess congestion

2.1.1 Locations of the required frequency requirements were specified

For required frequency assignments where the locations of the stations to which the frequencies are to be assigned, a search for available frequencies was undertaken from within the relevant sub-band (pool) to which the service under consideration was allotted in the APAC Region. Frequency assignments were found in chronological order starting from the lowest frequency in the relevant sub-band. The part of the allotted sub-band that was used to find frequency assignments in this analysis was considered congested. This congestion is limited to the area of the location and may not exist in other parts of the APAC Region. In addition, a search was undertaken for the possibility to assign 10 more frequencies within the allotted sub-band. In case these 10 frequency assignments could not be found *within* the allotted sub-band, a second search was undertaken to find these 10 frequencies in other sub-bands.

Example:
For TWR frequencies, the channels available in the APAC Region are in the sub-bands 118.000 – 118.875 MHz (36 channels) and 124.3 – 124.375 MHz (4 channels).
In Singapore, at the location of Changi Airport, 11 frequency assignments for TWR could be found in the range from 118.000 – 118.725 MHz. This saturates 25 out of the 40 channels allotted for TWR services. This suggests that the pool for TWR frequencies is not congested in Singapore.

The search for additional 10 frequency assignments found only one frequency that could be assigned for TWR services in Singapore. This suggests that the pool for TWR frequencies in Singapore is becoming saturated. However, these 10 more frequencies could be found in other parts of the VHF-CM frequency band (117.975 – 137 MHz). (*For further details see the analysis of frequency requirements for Singapore*). In cases where such additional (not required) 10 frequency assignment could be found, the sub-band (pool) of frequencies for a particular service was considered to be not congested.

No locations for the required frequency assignments were specified.

When no locations for the required frequency assignments were specified, potential frequency assignments were found in a certain geographical area (e.g. India or the relevant FIR). In this case, the found frequency assignment can be used anywhere within the specified area and an actual frequency assignment to a station can be made at a later time when the precise details of the location of the station are available. When the geographical area was small compared to the size of the service under consideration, a re-use factor was determined. The re-use factor indicates how many times the found frequency can be re-used in the specified area assuming a homogenous distribution of the locations of the stations. An example is shown in Figure 3.

2.1.2 Sub-bands not considered.

In the analysis, the sub-bands 122.000 – 123.075 MHz, 123.150 – 123.425 MHz and 123.475 – 123.675 MHz were not considered as these bands are not allotted to any service in the APAC Region. It is recommended to consider introducing allotments to required services in these bands.

2.2 Simulations based on submitted requirements

To support the work of the SRWG, requirements for frequency assignments were submitted for:

- Australia
- Hong Kong China
- India
- Japan
- New Zealand
- Singapore
- Thailand

These requirements are summarized in Appendix A.
A total of 255 new frequencies were identified as needed in APAC region, including 224 in the timeframe 2015-2020, and 31 in the timeframe 2020-2025.

2.2.1 Simulations for Australia

The requirements put forward for Australia do not require further consideration by the SRWG as they will be dealt with internally within Australia.
No simulation was specifically performed.

2.2.2 Simulations for Hong Kong China

Hong Kong China requires:

- 3 TWR frequencies
- 14 ACC-L frequencies (Surveillance radar)
- 14 ACC-I frequencies (Surveillance radar)
- 2 ACC-U frequencies (Surveillance radar)
- 1 AS frequency (aerodrome surface)
- 2 CDC frequency (?)

Frequencies could be identified to satisfy these requirements as in Table 1.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ACC-I 1 | ACC-I | 123.825 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG ACC-I 2 | ACC-I | 118.875 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG ACC-I 3 | ACC-I | 124.425 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG ACC-I 4 | ACC-I | 125.475 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG ACC-I PDR 1 | ACC-I | 118.975 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 10 | ACC-I | 125.925 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 2 | ACC-I | 120.525 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 3 | ACC-I | 120.725 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 4 | ACC-I | 120.775 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 5 | ACC-I | 120.925 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 6 | ACC-I | 124.525 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 7 | ACC-I | 124.575 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 8 | ACC-I | 125.375 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-I PDR 9 | ACC-I | 125.725 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG ACC-U 1 | ACC-U | 119.375 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG ACC-U 2 | ACC-U | 120.575 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG APP-L 1 | APP-L | 119.025 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 10 | APP-L | 120.000 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 11 | APP-L | 120.200 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 12 | APP-L | 120.250 | 22D16'33'' | N | 114D08'41'' | E |

| | | | | | | |
|---|---|---|---|---|---|---|
| SRWG APP-L 13 | APP-L | 120.425 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 14 | APP-L | 120.475 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 2 | APP-L | 119.175 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 3 | APP-L | 119.225 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 4 | APP-L | 119.275 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 5 | APP-L | 119.425 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 6 | APP-L | 119.475 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 7 | APP-L | 120.675 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 8 | APP-L | 119.725 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG APP-L 9 | APP-L | 119.775 | 22D16'33'' | N | 114D08'41'' | E |
| SRWG AS | AS | 121.950 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG TWR 1 | TWR | 118.025 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG TWR 2 | TWR | 118.075 | 22D18'32'' | N | 113D54'53'' | E |
| SRWG TWR 3 | TWR | 118.125 | 22D18'32'' | N | 113D54'53'' | E |

**Table 1 – Potential frequency assignments for Hong Kong China**

The frequencies in Table 1 were found within the relevant pool for the APAC Region to which the service is allotted.

A further test demonstrated that there is still adequate room within these pools for at least an additional 10 frequency assignments for each service in Hong Kong (with the exception of the pool for AS (aerodrome surface communications or surface movement control).

From within the pool for AS frequencies (121.600 – 121.975 MHz) the frequency 121.950 MHz was the last frequency assignment that could be made. Two more frequency assignments in Hong Kong are possible on the frequency 121.550 MHz and 121.575 MHz as a result of the reduction of the guard band around the aeronautical emergency frequency 121.500 MHz. However, nearby airports may also require AS frequencies that affect the availability of frequency assignments for Hong Kong China. Frequency assignments from outside the pool for AS frequencies may be found to satisfy additional frequency requirements in Hong Kong China for AS communications.

2.2.3 Simulations for India

India requires:

- 50 TWR frequencies
- 30 APP-L frequencies
- 5 APP-U frequencies
- 20 ACC-U frequencies
- 25 ATIS frequencies

The needs in terms of number of frequencies are significant, and India provided the background for such needs:

- TWR New airstrips/Greenfield airports across India as per Government Policy. The requirement is to grow siginificantly over the next 5 years including B/up for TWR. Out of 50, we propose to use 25 frequencies as B/UP for both TWR and APP-L

- APP-L We expect there are needs over the next 5 years to meet proposed new Approach Control Centres vis-à-vis new airstips/Greefield airports as well as B/Up requirments

- APP-U Requirment for Mumbai Upper Area Hormonization

- ACC-U Requirment projected for Mumbai _Upper Area Hormonization. All offset carriers will be used to augment VHF coverage. Out of 20, we propose to use 10 frequencies as B/Up for both APP-U & ACC-U for existing as well as new proposal

- ATIS No B/Up will be considered

2.2.3.1 50 TWR frequencies

India requires 50 TWR frequencies to support TWR services at 25 new airports or green strips. Another set of 25 frequencies is necessary to provide backup for the (main) frequency at these 25 airports. The requirements for two airports were already met, thus remaining the need for 46 TWR frequencies in India (23 main frequencies and 23 backup frequencies). For 18 of these airports the name and location was provided. For the reaming 5 airports, their location anywhere in the territory of India (All India) is assumed in this analysis.

The analysis for finding the required 46 frequency assignments took place in two steps:

a) First 10 frequency assignments were found that can be used any location within India. This is a very conservative approach since within India each of these 10 frequencies can be re-used *within India* at between 15 – 25 locations.

b) Second for the remaining 36 frequency requirements for which locations were specified adequate frequency assignments were found.

This approach was taken to determine whether or not the required 50 TWR frequency assignments would congest or saturate the frequency pool for TWR frequencies in the APAC Region

2.2.3.1.1 TWR Frequency assignments for use in All India.

Table 2 lists 10 frequency assignments that can be used anywhere in India. These frequency assignments can be re-used in India (subject to a further compatibility analysis that secures that at the time of the actual assignment of one of these frequencies to one (or more) specified locations do not cause interference between each other in India).

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG TWR All India 1 | TWR | 118.075 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 10 | TWR | 118.575 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 2 | TWR | 118.125 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 3 | TWR | 118.175 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 4 | TWR | 118.225 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 5 | TWR | 118.275 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 6 | TWR | 118.325 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 7 | TWR | 118.375 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 8 | TWR | 118.425 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG TWR All India 9 | TWR | 118.525 | 22D25'29'' | N | 080D34'26'' | E |

**Table 2 – Frequency assignments for use in All India (TWR)**

Table 3 lists 36 frequency assignments for TWR services that can be used at the locations that were specified by India. 18 of these frequency assignments are for main use and another 18 frequency assignments are for use as back-up frequency. These are marked with “B” in Table 8.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG TWR Aranmula | TWR | 118.025 | 09D19'23'' | N | 076D41'11'' | E |
| SRWG TWR Aranmula B | TWR | 118.200 | 09D19'23'' | N | 076D41'11'' | E |
| SRWG TWR Bijapur | TWR | 118.000 | 16D46'54'' | N | 074D56'59'' | E |
| SRWG TWR Bijapur B | TWR | 118.075 | 16D46'54'' | N | 074D56'59'' | E |
| SRWG TWR Dabra, Gwalior | TWR | 118.175 | 26D00'00'' | N | 078D00'00'' | E |
| SRWG TWR Dabra, Gwalior B | TWR | 118.000 | 26D00'00'' | N | 078D00'00'' | E |
| SRWG TWR Deoghar | TWR | 118.350 | 24D26'48'' | N | 086D42'27'' | E |
| SRWG TWR Deoghar B | TWR | 118.500 | 24D26'48'' | N | 086D42'27'' | E |
| SRWG TWR Faizabad | TWR | 118.675 | 26D45'04'' | N | 082D09'18'' | E |
| SRWG TWR Faizabad B | TWR | 118.000 | 26D45'04'' | N | 082D09'18'' | E |
| SRWG TWR Gulbarga | TWR | 118.025 | 17D18'28'' | N | 076D57'29'' | E |
| SRWG TWR Gulbarga B | TWR | 118.125 | 17D18'28'' | N | 076D57'29'' | E |
| SRWG TWR Hassan | TWR | 118.025 | 13D00'57'' | N | 076D10'00'' | E |
| SRWG TWR Hassan B | TWR | 118.075 | 13D00'57'' | N | 076D10'00'' | E |
| SRWG TWR Kannur | TWR | 118.050 | 11D55'12'' | N | 075D32'53'' | E |
| SRWG TWR Kannur B | TWR | 118.125 | 11D55'12'' | N | 075D32'53'' | E |
| SRWG TWR Karaikal | TWR | 118.025 | 10D55'58'' | N | 079D49'55'' | E |
| SRWG TWR Karaikal B | TWR | 118.200 | 10D55'58'' | N | 079D49'55'' | E |
| SRWG TWR Kishangarh | TWR | 118.050 | 26D35'44'' | N | 074D49'17'' | E |
| SRWG TWR Kishangarh B | TWR | 118.150 | 26D35'44'' | N | 074D49'17'' | E |
| SRWG TWR Kushinagar | TWR | 118.025 | 26D46'12'' | N | 083D54'29'' | E |
| SRWG TWR Kushinagar B | TWR | 118.200 | 26D46'12'' | N | 083D54'29'' | E |
| SRWG TWR Meerut | TWR | 118.200 | 28D54'18'' | N | 077D40'37'' | E |
| SRWG TWR Meerut B | TWR | 118.300 | 28D54'18'' | N | 077D40'37'' | E |
| SRWG TWR Mopa | TWR | 118.150 | 15D45'12'' | N | 073D51'25'' | E |
| SRWG TWR Mopa B | TWR | 118.200 | 15D45'12'' | N | 073D51'25'' | E |
| SRWG TWR Moradabad | TWR | 118.700 | 28D49'10'' | N | 078D55'24'' | E |
| SRWG TWR Moradabad B | TWR | 118.050 | 28D49'10'' | N | 078D55'24'' | E |
| SRWG TWR Navi Mumbai | TWR | 118.025 | 18D59'40'' | N | 073D04'13'' | E |
| SRWG TWR Navi Mumbai B | TWR | 118.450 | 18D59'40'' | N | 073D04'13'' | E |
| SRWG TWR Pakyong | TWR | 118.025 | 27D13'41'' | N | 088D35'43'' | E |
| SRWG TWR Pakyong B | TWR | 118.250 | 27D13'41'' | N | 088D35'43'' | E |
| SRWG TWR Shimoga | TWR | 118.175 | 13D51'17'' | N | 075D36'38'' | E |
| SRWG TWR Shimoga B | TWR | 118.225 | 13D51'17'' | N | 075D36'38'' | E |
| SRWG TWR Shirdi | TWR | 118.300 | 19D41'19'' | N | 074D22'44'' | E |
| SRWG TWR Shirdi B | TWR | 118.475 | 19D41'19'' | N | 074D22'44'' | E |

**Table 3 – Frequency assignments for use in India (TWR)**

The general conclusion is that the requirements for 50 [46] TWR frequencies in India does not congest the available pool of frequencies for ACC-U.

First, the found *All India* frequencies can easily be re-used 5-10 times within the large territory of India. Second, additional frequency assignments for India may be found at many locations on other frequencies in the pool for TWR frequencies. This pool is expected to provide in the area of India and adjacent countries sufficient space to accommodate future frequency requirements (e.g. beyond 2020). In the longer term, in some areas in India (e.g. around Moradabad and around 2030) frequency assignments in the pool for TWR frequencies may not be possible. In that case, sufficient frequencies outside this pool are expected to be still available.

2.2.3.2 30 APP-L frequency requirements.

No locations were provided for the location of the frequency assignments for these 30 APP-L services. Therefore the analysis was based on a re-use factor of 3 for each frequency that can be assigned for use throughout India. As shown in Figure 1 APP-L frequency assignments can be re-used in India about 7 times assuming a homogeneous distribution of the locations for these frequency assignments throughout India. Therefore, the re-use factor of three used in this analysis is considered very conservative.

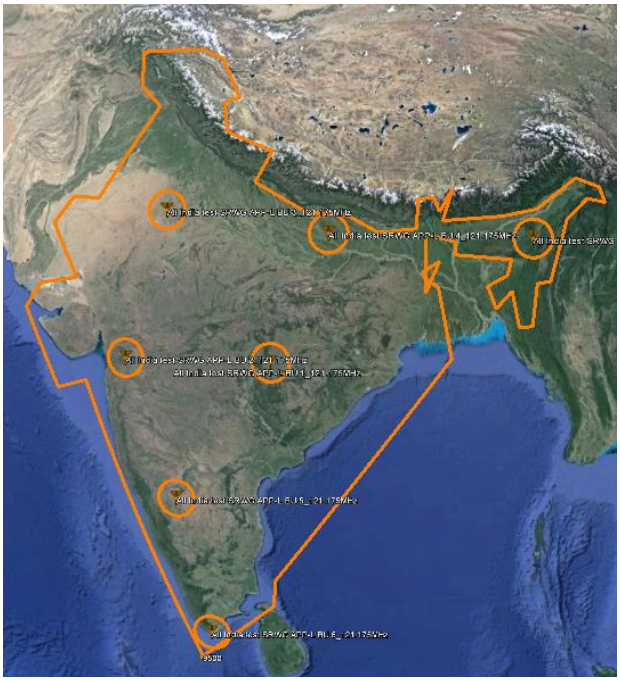

**Figure 1 – re-use of APP-L frequency assignments in India**

The 10 frequencies that could be assigned to All India were:

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG APP-L All India 1 | APP-L | 119.025 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 10 | APP-L | 120.075 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 2 | APP-L | 119.075 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 3 | APP-L | 119.175 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 4 | APP-L | 119.225 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 5 | APP-L | 119.275 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 6 | APP-L | 119.425 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 7 | APP-L | 119.475 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 8 | APP-L | 119.725 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-L All India 9 | APP-L | 120.000 | 22D25'29'' | N | 080D34'26'' | E |

**Table 4 – Frequency assignments for ATIS in All India**

*Note: When assigning these frequencies to an actual location / station a new compatibility analysis has to be performed to secure adequate protection from harmful interference between stations within India.*

These *All India* frequency assignments require only a small part of the channels available within the pool for APP-L frequencies in the APAC Region. No congestion in this pool is expected in India or adjacent countries in the near or medium future.

5 APP-U frequencies required.

5 APP-U frequencies are required at unspecified locations to support upper airspace harmonization for Mumbai. When considering the minimum separation distance between APP-U frequency assignments (672 NM) for the purpose of this analysis no re-use of the same frequency in India is assumed. Five APP-U frequencies could be identified for use at any location in India as in Table 5.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG APP-U All India 1 | APP-U | 124.225 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-U All India 2 | APP-U | 124.275 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-U All India 3 | APP-U | 124.425 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-U All India 4 | APP-U | 124.625 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG APP-U All India 5 | APP-U | 124.675 | 22D25'29'' | N | 080D34'26'' | E |

**Table 5 – Frequency assignments for APP-U in All India**

These frequency assignments fill the pool for APP-U in India for almost 50%. Enough channels are available for future requirements.

2.2.3.3 20 ACC-U frequencies required.

20 ACC-U frequencies are required in India for upper area harmonization. Out of these 20 requirements, 10 are proposed to be used as backup frequencies for APP-U, ACC-U for both existing and new proposed frequency assignments.
Due to the absence of specified locations, for the purpose of this analysis, a search for 20 frequencies that could be used anywhere in India was made. The found frequencies are in Table 6.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ACC-U All India 1 | ACC-U | 118.975 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 10 | ACC-U | 125.925 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 11 | ACC-U | 128.125 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 12 | ACC-U | 128.175 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 13 | ACC-U | 132.125 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 14 | ACC-U | 132.175 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 15 | ACC-U | 132.225 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 16 | ACC-U | 132.275 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 17 | ACC-U | 132.325 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 18 | ACC-U | 132.375 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 19 | ACC-U | 132.425 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 2 | ACC-U | 120.725 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 20 | ACC-U | 132.475 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 3 | ACC-U | 120.925 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 4 | ACC-U | 120.975 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 5 | ACC-U | 123.725 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 6 | ACC-U | 123.775 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 7 | ACC-U | 124.525 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 8 | ACC-U | 124.575 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ACC-U All India 9 | ACC-U | 125.375 | 22D25'29'' | N | 080D34'26'' | E |

**Table 6 – Frequency assignments for ACC-U for All India**

| |
|---|
| These frequency assignments require and saturate about 50% of the available channels. No congestion is expected in the pool for ACC-U frequencies in the near future in the area of India and adjacent countries. |

2.2.3.4 25 ATIS frequency assignments.

India requires 25 new ATIS frequency assignments for use at unspecified locations. The analysis for assessing the capacity of the VHF COM frequency band took places along two different steps:

a) A search was made for 12 frequencies for ATIS services that could be used in All India. This approach assumes that ATIS frequencies are can be re-used twice within India. The minimum required separation distance between ATIS frequency assignments of about 530 NM and normally an ATIS frequency can be reused two or three times in India.

b) Frequency assignments for ATIS services were found at 20 specified locations provided by India and the remaining 5 frequency requirements were assumed to be satisfied with 3 frequency assignments were made for all India.

2.2.3.4.1 Search for 12 ATIS frequencies for **All India** as described in a).

Within the pool for ATIS frequencies in the APAC Region, 12 frequencies were found that can be used at any location in India. Considering a re-use factor of about two for these frequencies this could satisfy the need for ATIS frequency assignments at 25 locations in India.
Although these All India frequency assignments could be found in the pool for ATIS frequencies, with the found 12 frequency assignments the pool becomes saturated in India. This implies that within the pool for ATIS/VOLMET frequencies, no further frequency assignments in India for ATIS and VOLMET frequency can be made. However, further tests showed that such requirements can easily be satisfied in the pool for ACC-U frequencies.

2.2.3.4.2 Search for 25 ATIS frequencies in India as described in b)
Search for 3 frequency assignments for **All India** that can satisfy the requirement for 5 ATIS frequency assignments at unspecified locations. These frequencies are in Table 7.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ATIS All India 1 | ATIS | 126.225 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ATIS All India 2 | ATIS | 126.275 | 22D25'29'' | N | 080D34'26'' | E |
| SRWG ATIS All India 3 | ATIS | 126.425 | 22D25'29'' | N | 080D34'26'' | E |

**Table 7 – Frequency assignments for All India for ATIS**

Search for 20 frequency assignments for ATIS that can satisfy the requirement to provide ATIS services in India at the locations as specified by India. The found frequency assignments are in Table 8.
*Note: These locations were used for the assessment of the capacity of the pool for ATIS frequencies to satisfy the frequency requirements for India and include the locations for Durgapur and Sindhudurg.*

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ATIS Aranmula | ATIS | 126.400 | 09D19'23'' | N | 076D41'11'' | E |
| SRWG ATIS Bijapur | ATIS | 126.450 | 16D46'54'' | N | 074D56'59'' | E |
| SRWG ATIS Dabra, Gwalior | ATIS | 126.450 | 26D00'00'' | N | 078D00'00'' | E |
| SRWG ATIS Deoghar | ATIS | 126.475 | 24D26'48'' | N | 086D42'27'' | E |
| SRWG ATIS Durgapur | ATIS | 126.675 | 23D37'28'' | N | 087D14'33'' | E |
| SRWG ATIS Faizabad | ATIS | 126.625 | 26D45'04'' | N | 082D09'18'' | E |
| SRWG ATIS Gulbarga | ATIS | 126.625 | 17D18'28'' | N | 076D57'29'' | E |
| SRWG ATIS Hassan | ATIS | 126.650 | 13D00'57'' | N | 076D10'00'' | E |
| SRWG ATIS Kannur | ATIS | 126.675 | 11D55'12'' | N | 075D32'53'' | E |
| SRWG ATIS Karaikal | ATIS | 126.825 | 10D55'58'' | N | 079D49'55'' | E |
| SRWG ATIS Kishangarh | ATIS | 126.475 | 26D35'44'' | N | 074D49'17'' | E |
| SRWG ATIS Kushinagar | ATIS | 126.850 | 26D46'12'' | N | 083D54'29'' | E |
| SRWG ATIS Meerut | ATIS | 126.675 | 28D54'18'' | N | 077D40'37'' | E |
| SRWG ATIS Mopa | ATIS | 126.875 | 15D45'12'' | N | 073D51'25'' | E |
| SRWG ATIS Moradabad | ATIS | 126.825 | 28D49'10'' | N | 078D55'24'' | E |
| SRWG ATIS Navi Mumbai | ATIS | 126.200 | 18D59'40'' | N | 073D04'13'' | E |
| SRWG ATIS Pakyong | ATIS | 126.450 | 27D13'41'' | N | 088D35'43'' | E |
| SRWG ATIS Shimoga | ATIS | 127.025 | 13D51'17'' | N | 075D36'38'' | E |
| SRWG ATIS Shirdi | ATIS | 126.825 | 19D41'19'' | N | 074D22'44'' | E |
| SRWG ATIS Sindhudurg | ATIS | 127.200 | 16D00'12'' | N | 073D31'58'' | E |

**Table 8 – Frequency assignments in India for ATIS**

*Note: With this frequency assignment plan certain frequency assignments are re-used at two or three locations in India.*

2.2.3.4.3 Use of the pool for ATIS frequencies

The pool for ATIS contains 14 sub-bands of 100 kHz (4 channels). In the analysis, out of these 14 sub-bands, 4 become saturated (in some parts of India) with the above frequency assignments.

This is expected to leave room in the remaining 10 sub-bands for future use for ATIS or VOLMET requirements.

2.2.4 Simulations for Japan

Japan may need a few new frequencies after 2020. It will result from a planned restructuration of the Japan Airspace.
Consequently no new needs were put forward by Japan before 2020.

2.2.5 Simulations for New Zealand

No new needs were put forward by New Zealand before 2020.
All country and how a measure of congestion was determined, based on filling up the pool from the lower to the higher frequencies and address the not allotted frequency bands.

2.2.6 Simulations for Singapore

Singapore requires:

- 11 TWR frequencies
- 5 APP-I frequencies (Surveillance radar)
- 4 ACC-U frequencies (Surveillance radar)
- 2 ATIS frequency

Frequencies could be identified to satisfy these requirements as in Table 9.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ACC-U 1 | ACC-U | 118.925 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG ACC-U 2 | ACC-U | 118.975 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG ACC-U 3 | ACC-U | 119.350 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG ACC-U 5 | ACC-U | 119.525 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG APP-I 1 | APP-I | 119.025 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG APP-I 2 | APP-I | 119.175 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG APP-I 3 | APP-I | 119.225 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG APP-I 4 | APP-I | 119.475 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG APP-I 5 | APP-I | 119.725 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG ATIS 1 | ATIS | 126.225 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG ATIS 2 | ATIS | 126.425 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 1 | TWR | 118.125 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 10 | TWR | 118.775 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 11 | TWR | 118.825 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 2 | TWR | 118.175 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 3 | TWR | 118.300 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 4 | TWR | 118.350 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 5 | TWR | 118.425 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 6 | TWR | 118.475 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 7 | TWR | 118.525 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 8 | TWR | 118.650 | 01D21'00'' | N | 103D59'00'' | E |
| SRWG TWR 9 | TWR | 118.725 | 01D21'00'' | N | 103D59'00'' | E |

**Table 9 – Potential frequency assignments for Singapore**

These frequencies were found within the relevant pool for the APAC Region to which the service is allotted.

It was noted that there is still adequate room within these pools for at least an additional 10 frequency assignments in Singapore. No frequency congestion is expected in Singapore or the area surrounding Singapore. The pool for TWR frequencies may become congested in the medium term (e.g. beyond 2020-2025)

2.2.7 Simulations for Thailand

Thailand requires:

- 5 TWR frequencies
- 10 APP-I frequencies (At specified locations)
- 10 ACC-U frequencies (At specified locations)
- 22 ATIS frequency

2.2.7.1 Requirement for 5 TWR frequencies

For the requirement for 5 TWR frequencies, 6 locations were initially identified. (Chiangmai, Phuket, Udon, Pisanulok, Ubol and Hatyai)

As a first step, a search was made for available frequencies within the pool for TWR frequencies that could be used at these locations. The following frequencies could be found that are protected from harmful interference throughout the whole FIR Bangkok:
118.025, 118.075, 118.125, 118.150, 118.175, 118.225, 118.250, 118.275, 118.325 and 118.375 MHz.

This analysis is a worst case analysis since it assumes that each of the identified frequencies can be used at any point of the border of FIR Bangkok.

The found frequencies occupy the part 118.000 – 118.375 MHz from the pool for TWR frequencies which includes the bands 118.000 – 118.875 MHz and 124.300 – 124.375 MHz.

This provides an indication that for use in Thailand and adjacent countries, sufficient room is available for future TWR frequency assignments (e.g. beyond 2020).

As a second step, for each of the locations in 5.1.1.1 an assignable frequency was identified as follows:
Frequencies could be identified to satisfy these requirements as in Table 10.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG TWR Cheingmai | TWR | 118.000 | 05D48’00’’ | N | 102D29’00’’ | E |
| SRWG TWR Hatyai | TWR | 118.025 | 06D55’46’’ | N | 100D23’55’’ | E |
| SRWG TWR Phuket | TWR | 118.000 | 08D07’54’’ | N | 098D19’57’’ | E |
| SRWG TWR Pisanulok | TWR | 118.025 | 16D47’10’’ | N | 100D16’41’’ | E |
| SRWG TWR Ubol | TWR | 118.025 | 15D14’00’’ | N | 104D52’00’’ | E |
| SRWG TWR Udon | TWR | 118.000 | 17D23’10’’ | N | 102D46’38’’ | E |

**Table 10 – Potential frequency assignments for TWR in Thailand**

The requirement for 5 [6] TWR frequencies in Thailand can be satisfied with using only the two frequencies 118.000 MHz and 118.025 MHz. For information, the location of these stations is presented in Figure 2 below.

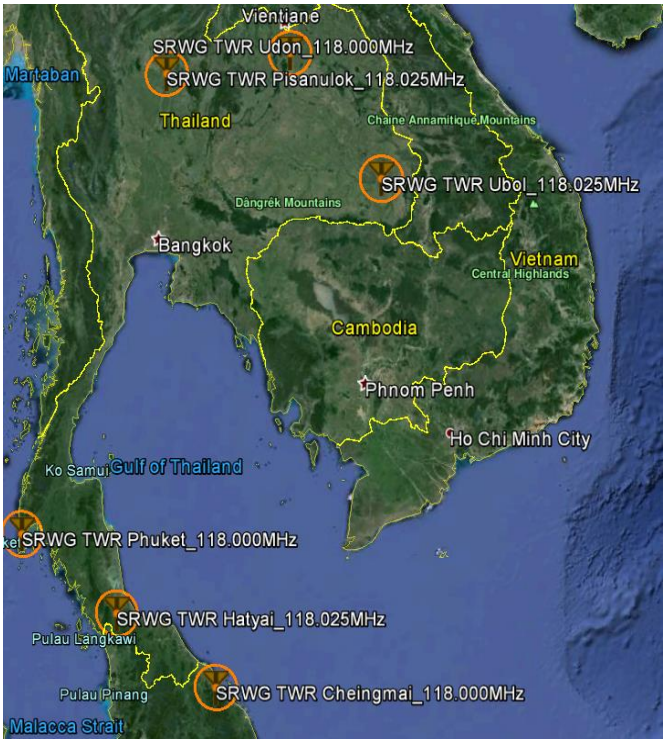


**Figure 2 – Possible TWR frequency assignments on only 118.000 MHz and 118.025 MHz in Thailand**

Requirements for backup frequencies

In a later submission Thailand requested backup frequencies for 8 stations as in Table 4. It is assumed that for these 8 stations the frequencies 118.050, 118.150, 118.400, 118.675 and 124.300 MHz were identified. Note that these frequency assignments invalidate the frequency assignments as in Table 11.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG TWR Bangkok | TWR | 118.150 | 13D41'35'' | N | 100D46'30'' | E |
| SRWG TWR Cheingmai | TWR | 118.150 | 05D48'00'' | N | 102D29'00'' | E |
| SRWG TWR Hatyai | TWR | 118.675 | 06D55'46'' | N | 100D23'55'' | E |
| SRWG TWR Phuket | TWR | 118.050 | 08D07'54'' | N | 098D19'57'' | E |
| SRWG TWR Pisanulok | TWR | 118.050 | 16D47'10'' | N | 100D16'41'' | E |
| SRWG TWR Samui | TWR | 118.150 | 09D29'55'' | N | 100D00'00'' | E |
| SRWG TWR Ubol | TWR | 118.050 | 15D14'00'' | N | 104D52'00'' | E |
| SRWG TWR Udon | TWR | 118.150 | 17D23'10'' | N | 102D46'38'' | E |

**Table 11 – Potential frequency assignments for TWR in Thailand**

All 8 frequency requirements for Thailand for TWR services could be satisfied on the identified frequencies.

2.2.7.2 Requirements for 12 AFIS Main frequency assignments and 12 AFIS Standby frequency assignments

For these frequency assignments, Thailand had specified the location of the stations and the frequency that needs to be assigned to these stations.
The AFIS frequency assignments as requested are displayed in Table 12.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG AFIS Buri Ram M | AFIS | 119.05 | 15D13'46'' | N | 103D15'04'' | E |
| SRWG AFIS Buri Ram SB | AFIS | 118.45 | 15D13'46'' | N | 103D15'04'' | E |
| SRWG AFIS Chon Buri M | AFIS | 118.65 | 12D41'00'' | N | 100D50'00'' | E |
| SRWG AFIS Chon Buri SB | AFIS | 118.85 | 12D41'00'' | N | 100D50'00'' | E |
| SRWG AFIS Karnjanaburi M | AFIS | 119.05 | 15D04'24'' | N | 098D36'38'' | E |
| SRWG AFIS Karnjanaburi SB | AFIS | 118.45 | 15D04'24'' | N | 098D36'38'' | E |
| SRWG AFIS Loei M | AFIS | 119.05 | 17D26'21'' | N | 101D43'19'' | E |
| SRWG AFIS Loei SB | AFIS | 118.45 | 17D26'21'' | N | 101D43'19'' | E |
| SRWG AFIS Mae Hong Son M | AFIS | 119.05 | 19D18'04'' | N | 097D58'29'' | E |
| SRWG AFIS Mae Hong Son SB | AFIS | 118.45 | 19D18'04'' | N | 097D58'29'' | E |
| SRWG AFIS Nan Nakhon Sot M | AFIS | 119.05 | 18D48'28'' | N | 100D47'00'' | E |
| SRWG AFIS Nan Nakhon Sot SB | AFIS | 118.45 | 18D48'28'' | N | 100D47'00'' | E |
| SRWG AFIS Narathiwat M | AFIS | 118.65 | 06D31'12'' | N | 101D44'36'' | E |
| SRWG AFIS Narathiwat SB | AFIS | 118.85 | 06D31'12'' | N | 101D44'36'' | E |
| SRWG AFIS Payao M | AFIS | 119.05 | 19D31'38'' | N | 100D18'35'' | E |
| SRWG AFIS Payao SB | AFIS | 118.45 | 19D31'38'' | N | 100D18'35'' | E |
| SRWG AFIS Phuket M | AFIS | 118.65 | 08D06'38'' | N | 098D18'45'' | E |
| SRWG AFIS Phuket SB | AFIS | 118.85 | 08D06'38'' | N | 098D18'45'' | E |
| SRWG AFIS Samui M | AFIS | 118.65 | 09D29'55'' | N | 100D00'00'' | E |

| | | | | | | |
|---|---|---|---|---|---|---|
| SRWG AFIS Samui SB | AFIS | 118.85 | 09D29'55'' | N | 100D00'00'' | E |
| SRWG AFIS Tak M | AFIS | 119.05 | 18D48'26'' | N | 100D47'00'' | E |
| SRWG AFIS Tak SB | AFIS | 118.45 | 18D48'26'' | N | 100D47'00'' | E |
| SRWG AFIS Trang M | AFIS | 118.65 | 18D48'26'' | N | 100D47'00'' | E |
| SRWG AFIS Trang SB | AFIS | 118.85 | 18D48'26'' | N | 100D47'00'' | E |

**Table 12 – Frequency assignments for AFIS (main and standby)**

Note: In Table 5 *M = Main* frequency assignment and *SB = Standby* frequency assignment.
With the exception of the frequency 119.050 For Mae Hon Song and 118.450 for Payo all frequency assignments are compatible with the APAC COM list.

The frequency 119.050 MHz at Payo is not compatible with the frequency assignment to Puer in China (margin is 6 NM)

The frequency 119.050 MHz at Mae Hon Song is not compatible with the frequency assignment to Agartala (APP-U) in India (margin is 48 NM). The predicted areas where interference may be expected are displayed in Figure 3.


**Figure 3 – Interference areas for Argartala (India) and Puer (China).**

*Note: the white shaded areas within the coverage for each station aer the ereas where interference may be expected.*

2.2.7.3 Requirement for 22 ATIS frequency assignments.

For these frequency assignments, Thailand had specified the location of the stations as well as the frequency that needs to be assigned to these stations.
The AFIS frequency assignments together with the assigned frequency as requested are displayed in Table 13.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ATIS Bangkok | ATIS | 127.65 | 13D41'33'' | N | 100D45'00'' | E |
| SRWG ATIS Buri Ram | ATIS | 127.05 | 15D13'46'' | N | 103D15'04'' | E |
| SRWG ATIS Chiang Rai | ATIS | 127.85 | 19D57'08'' | N | 099D52'58'' | E |
| SRWG ATIS Chumpon | ATIS | 128.45 | 10D42'40'' | N | 099D21'42'' | E |
| SRWG ATIS Hua Hin | ATIS | 126.8 | 12D38'10'' | N | 099D57'05'' | E |
| SRWG ATIS Khon Kaen | ATIS | 126.85 | 16D28'00'' | N | 102D47'01'' | E |
| SRWG ATIS Lampang | ATIS | 128.65 | 18D16'16'' | N | 099D30'15'' | E |
| SRWG ATIS Loei | ATIS | 126.25 | 17D26'21'' | N | 101D43'19'' | E |
| SRWG ATIS Mae Hong Son | ATIS | 127.45 | 19D18'04'' | N | 097D58'29'' | E |
| SRWG ATIS Mae Sot | ATIS | 126.65 | 16D41'59'' | N | 098D32'42'' | E |
| SRWG ATIS Nakhon Phanom | ATIS | 128.85 | 17D23'07'' | N | 104D38'29'' | E |
| SRWG ATIS Nakhon Ratchasima | ATIS | 126.6 | 14D58'50'' | N | 102D06'00'' | E |
| SRWG ATIS Nan | ATIS | 128.05 | 18D48'28'' | N | 100D47'00'' | E |
| SRWG ATIS Narathiwat | ATIS | 126.475 | 06D31'12'' | N | 101D44'36'' | E |
| SRWG ATIS Petchabun | ATIS | 127.075 | 16D40'33'' | N | 101D11'42'' | E |
| SRWG ATIS Phitsa Nulok | ATIS | 127.4 | 16D46'23'' | N | 100D16'56'' | E |
| SRWG ATIS Phrae | ATIS | 126.45 | 18D07'54'' | N | 100D09'52'' | E |
| SRWG ATIS Ranong | ATIS | 127.425 | 09D46'39'' | N | 098D35'07'' | E |
| SRWG ATIS Roi Et | ATIS | 128.275 | 16D07'00'' | N | 103D46'25'' | E |
| SRWG ATIS Sakon Nakhon | ATIS | 128.25 | 17D11'43'' | N | 104D07'07'' | E |
| SRWG ATIS Ubon Ratchatani | ATIS | 128.2 | 15D15'05'' | N | 104D52'13'' | E |
| SRWG ATIS Udon Thani | ATIS | 127.6 | 17D23'11'' | N | 102D47'13'' | E |

**Table 13 – Frequency assignments for ATIS in Thailand**

These frequency assignments are compatible with all frequency assignments in the APAC Regional COM list. Some incompatibilities may exist as a result of co-frequency assignments that are being considered for use in "All India" as part of the simulation to satisfy the frequency requirements from India.

No congestion in the frequency pool for ATIS frequency assignments in the APAC region is detected.

2.2.7.4 Requirement for 10 APP-U frequency assignments.

Initially, a test was performed to find 10 frequencies that could be assigned to stations at any location in Thailand. For this test the compatibility of frequency assignments within the FIR Bangkok was tested. In this worst-case analysis, 10 frequencies were identified in the range from 120.325 – 125.225 MHz. (120.325, 121.325, 121.350, 121.375, 124.225, 124.275, 124.475, 124.625, 125.075 and 125.225 MHz).

For these frequency assignments, Thailand had specified the location of 5 stations. In the analysis below it was assumed that each of these locations requires two APP-U frequency assignments.
The APP-U frequency assignments together with the assigned frequency as requested are displayed in Table 14.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG APP-U Bangkok 1 | APP-U | 120.325 | 13D41'33'' | N | 100D45'00'' | E |
| SRWG APP-U Bangkok 2 | APP-U | 120.375 | 13D41'33'' | N | 100D45'00'' | E |
| SRWG APP-U Chiang Mai 1 | APP-U | 121.325 | 18D46'00'' | N | 098D57'45'' | E |
| SRWG APP-U Chiang Mai 2 | APP-U | 121.375 | 18D46'00'' | N | 098D57'45'' | E |
| SRWG APP-U Phuket 1 | APP-U | 121.300 | 08D07'54'' | N | 098D17'59'' | E |
| SRWG APP-U Phuket 2 | APP-U | 121.350 | 08D07'54'' | N | 098D17'59'' | E |
| SRWG APP-U Samui 1 | APP-U | 124.225 | 09D29'55'' | N | 100D00'00'' | E |
| SRWG APP-U Samui 2 | APP-U | 124.275 | 09D29'55'' | N | 100D00'00'' | E |
| SRWG APP-U Udon 1 | APP-U | 124.400 | 17D23'10'' | N | 102D46'38'' | E |
| SRWG APP-U Udon 2 | APP-U | 124.475 | 17D23'10'' | N | 102D46'38'' | E |

**Table 14 – Frequency assignments for APP-U in Thailand**

2.2.7.5 Requirement for 10 ACC-U frequency assignments.

Initially, a test was performed to find 10 frequencies that could be assigned to stations at any location in Thailand. For this test the compatibility of frequency assignments within the FIR Bangkok was tested. In this worst-case analysis, 10 frequencies were identified in the range from 120.325 – 125.225 MHz. (119.325, 133.000, 133.075, 133.125, 132.575, 132.625, 132.675, 132.725, 132.825 and 132.925 MHz). This test demonstrates that the found frequencies do not congest the pool for ACC-U frequencies. Additional ACC-U frequencies can be found in the range 133 – 136 MHz

For these frequency assignments, Thailand had specified the location of 5 stations. In the analysis below it was assumed that each of these locations requires two APP-U frequency assignments.
The ACC-U frequency assignments together with the assigned frequency as requested are displayed in Table 15.

| Location | Service | Frequency | CoordLat | NS | CoordLong | WE |
|---|---|---|---|---|---|---|
| SRWG ACC-U Bangkok 1 | ACC-U | 119.325 | 13D41'33'' | N | 100D45'00'' | E |
| SRWG ACC-U Bangkok 2 | ACC-U | 120.525 | 13D41'33'' | N | 100D45'00'' | E |
| SRWG ACC-U Chiang Mai 1 | ACC-U | 119.350 | 18D46'00'' | N | 098D57'45'' | E |
| SRWG ACC-U Chiang Mai 2 | ACC-U | 125.975 | 18D46'00'' | N | 098D57'45'' | E |
| SRWG ACC-U Phuket 1 | ACC-U | 118.950 | 08D07'54'' | N | 098D17'59'' | E |
| SRWG ACC-U Phuket 2 | ACC-U | 119.375 | 08D07'54'' | N | 098D17'59'' | E |
| SRWG ACC-U Samui 1 | ACC-U | 120.725 | 09D29'55'' | N | 100D00'00'' | E |
| SRWG ACC-U Samui 2 | ACC-U | 120.775 | 09D29'55'' | N | 100D00'00'' | E |
| SRWG ACC-U Udon 1 | ACC-U | 132.575 | 17D23'10'' | N | 102D46'38'' | E |
| SRWG ACC-U Udon 2 | ACC-U | 132.625 | 17D23'10'' | N | 102D46'38'' | E |

**Table 15 – Frequency assignments for APP-U in Thailand**

The results of the analysis are similar as for the analysis that was based on finding frequency assignments for All Thailand. While frequencies below 132.700 MHz may no longer be available for ACC-U in Thailand, additional requirements can be met in the band above 132.700 MHz. This is because of the large coordination area for ACC-U frequency assignments and the resulting limited or virtually non-existing potential to re-use the same frequency in Thailand.

The conclusion for the case of Thailand is that the requirements for 10 ACC-U frequencies in Thailand do not congest the available pool of frequencies for ACC-U. This pool is expected to provide in the area of Thailand and adjacent countries sufficient space to accommodate future frequency requirements (e.g. beyond 2020).

## 2.3 Conclusions and recommendations

### 2.3.1 Conclusions

An important new mechanism was borne with the SRWG work: the strategic planning of VHF frequencies, and associated reservation of new VHF frequencies. Furthermore, the Frequency Finder and global database are now equipped (polygons, reserved frequencies) to continue to plan and assign the future frequencies, even though a further refinement of the polygons (from countries down to FIRs) for certain areas potentially congested in the future may be needed at a later stage.
In terms of risk of congestion, the pool identified by SRWG is expected to provide sufficient space to accommodate future frequency requirements (e.g. beyond 2020).
Unless significant needs are unexpectedly raised by States not contributing to the SRWG, it is therefore possible to keep using the 25 KHz spacing scheme throughout APAC region, provided that a planning mechanism is consistently used by the APAC Region.
This mechanism will ensure that:

- frequencies planned for a use in the next 5 years timeframe are protected meanwhile. The protection includes protection from interference with neighboring regions as all the planning exercise was done using the new global database.

- The principle of first come first served is replaced by an overall planning giving visibility on the spectrum use, and providing equity in the allocation of spectrum.

This should encourage all APAC States to contribute to the mechanism of planning.

### 2.3.2 Recommendations

While the reserved frequencies are protected, their effective use should start after tactical assignment coordinated with the ICAO Regional Office.
In parallel a tactical assignment can always be done with the ICAO Regional Office but should be avoided as much as possible. It decreases the efficiency of the strategic planning and puts uselessly pressure on State, operator and ICAO Regional Office.
A revision of the frequency plan (as attached in Attachment A) should be done on an annual basis for a 5-years sliding window so as to plan and mitigate any spectrum congestion sufficiently beforehand.
Considering the above, the following Draft Conclusion is proposed:

> **Draft Conclusion X/X - Strategic planning and tactical use of VHF frequencies in the APAC Region from 2015 onwards**
>
> That, considering the simulations conducted by SRWG on the basis of the needs submitted showed that congestion in the APAC region for VHF frequencies using a 25 kHz channel spacing was unlikely to happen until 2020, and the necessity to continue using 25 kHz channel spacing as long as possible,
>
> 1/ all APAC States should contribute to the strategic planning of VHF frequencies (planned use and release) for a 5-years sliding window so as to detect and mitigate any spectrum congestion sufficiently beforehand and optimize the efficiency of the available spectrum;

2/ While the frequencies reserved as a result of strategic planning are protected, their effective use should start after tactical assignment coordinated with the ICAO Regional Office

3/ The tactical coordination of frequencies without any prior strategic planning should be avoided as much as possible; and

4/ Both strategic planning and tactical assignment should be done using the ICAO global tool Frequency Finder.

## 3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) consider the draft conclusion developed in para2.2;

c) consider allotting sub-bands 122.000 – 123.075 MHz, 123.150 – 123.425 MHz and 123.475 – 123.675 MHz required services in the APAC Region; and

d) discuss any relevant matters as appropriate.

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# APPENDIX A

SRWG/2 – WP/03
Agenda Item 4
08/04/15

| State/Administration | Service concerned | Number of new frequencies | Release of frequencies | Location | Time Horizon | Justification: airspace or routes creation/restructuration, new facilities,etc | Remarks |
|---|---|---|---|---|---|---|---|
| Australia | TWR | 5 | None | New/Existing Control Towers | 2014-2019 | New Control Towers | Over the next 5 years we expect to need up to 5 new tower frequencies for use at towers for new SMC (Split) or ACD Functions - We use our own internal system for analysis and use of frequencies - there are no issues expected as these will be low power (10W) No coordination required with ICAO or Neighbour Agencies |
| Australia | APP-L | 5 | None | Approach Services to New/Existing Towers | 2014-2019 | As part of our (Surveillance Approach for Regional Airports Projects) We may install some additonal VHF for use as Regional APP Service | Over the next 5 years we expect to need up to 5 new approach frequencies for use at regional towers - We use our own internal system for analysis and use of frequencies - there are no issues expected as these will be low power (10W) No coordination required with ICAO or Neighbour Agencies |
| Australia | ACC-L | 10 | None | Western Australia - Locations to be determined by project and Operational Coverage Requirements | 2014-2019 | Review of Airspace over Western Australia may be required with respect to operations into mining areas - Operational Requirements to be defined and examined | Over the next 5 years we expect to need up to 5 new Area frequencies for use in the Northern / Southern FIR (Brisbane/Melbourne Centre) - We use our own internal system for analysis and use of frequencies - there are no issues expected - No coordination required with ICAO or Neighbour Agencies |
| Hong Kong China | ACC-SR-I | 4 | 0 | Hong Kong (22°18'32" N 113°54'53" E) | 2015-2020 | For new Terminal radar control position | |
| Hong Kong China | TWR | 1 | 0 | Hong Kong (22°18'32" N 113°54'53" E) | 2015-2020 | For new TWR position for apron expansion | |
| Hong Kong China | ACC-SR-I | 10 | 0 | Hong Kong (22°16'33" N 114°08'41" E) | 2020-2025 | For PDR Operations 2020 | |
| Hong Kong China | APP-SR-L | 14 | 0 | Hong Kong (22°16'33" N 114°08'41" E) | 2020-2025 | For PDR Operations 2020 | |
| Hong Kong China | ACC-SR-U | 2 | 0 | Hong Kong (22°16'33" N 114°08'41" E) | 2020-2025 | For PDR Operations 2020 | |
| Hong Kong China | TWR | 2 | 0 | Hong Kong (22°18'32" N 113°54'53" E) | 2020-2025 | For 3rd Runway | |
| Hong Kong China | SMC | 1 | 0 | Hong Kong (22°18'32" N 113°54'53" E) | 2020-2025 | For 3rd Runway | |
| Hong Kong China | CDC | 2 | 0 | Hong Kong (22°18'32" N 113°54'53" E) | 2020-2025 | For 3rd Runway | |
| India | TWR | 50 | 0 | New Control Towers | 2015-2020 | New Airstrips/Green Field Airports | New airstrips/Greenfield airports across India as per Government Policy. The requirement is to grow siginificantly over the next 5 years including B/up for TWR. Out of 50, we propose to use 25 frequencies as B/UP for both TWR and APP-L |
| India | APP-L | 30 | 0 | Approach Services to New Airports | 2015-2020 | New Airstrips/Green Field as well as Existing Airports | We expect there are needs over the next 5 years to meet proposed new Approach Control Centres vis-à-vis new airstips/Greefield airports as well as B/Up requirments |
| India | APP-U | 5 | 0 | Operational coveragae requirements to supplement upper area hormonization | 2015-2020 | Due to introduction of primary radars at many airports, additonal VHFs for enhanced terminal APP Surveillance Service | Requirment for Mumbai Upper Area Hormonization |
| India | ACC-U | 20 | 0 | Operational coveragae requirements for upper area hormonization | 2015-2020 | Upper Area Hormonization as a result of airspace harmonization plan over Indian FIR | Requirment projected for Mumbai _Upper Area Hormonization. All offset carriers will be used to augment VHF coverage. Out of 20, we propose to use 10 frequencies as B/Up for both APP-U & ACC-U for existing as well as new proposal |
| India | ATIS | 25 | 0 | New airstrips/ Greenfield airports | 2015-2020 | Requirements New Airstrips/Greefield airports | No B/Up will be considered |
| Japan | | 0 | | | 2015-2020 | | Japan may need a few new frequencies after 2020.<br><br>It will be a result of restructure in the Japan Airspace |
| New Zealand | | 0 | | | 2015-2023 | Possible airspace changes | |
| New Zealand | | | 2 ? | | 2015-2023 | Increasing use of offset frequencies -<br>Release of frequencies to be confirmed by NZ | |
| Singapore | TWR | 11 | None | New/Existing Control Towers -<br>Estimated location? | 2014-2019 | New Control Towers | Over the next 5 years we are expecting to have 2 new ATC control towers for new runways and ramp control areas, to support the establishement of new passengers terminals. |
| Singapore | APP-SR-I | 5 | None | Approach Services into Changi | 2014-2019 | Re-sectorisation of APP services | Over the next 5 years we expect to need up to 5 new approach frequencies for use at APP services due to re-sectorisation. |
| Singapore | ACC-U | 4 | None | ACC | 2014-2019 | Re-sectorisation of ACC services | Over the next 5 years we expect to need up to 4 new area frequencies due to re-sectorisation. |
| Singapore | ATIS | 2 | None | Changi | 2014-2019 | Establishment of new ATIS services for Changi and Seletar Aerdromes | Over the next 5 years we are expecting to establish new ATIS services for Changi and Seletar Aerodromes |
| Thailand | ACC-U | 10 | | Bangkok,Cheingmai ,Phuket,Samui,Udon | 2015 | Backup Frequency | |
| Thailand | APP-U | 10 | | Bangkok,Cheingmai ,Phuket,Samui,Udon | 2015 | Backup Frequency | |
| Thailand | TWR | 5 | | Cheingmai ,Phuket,Udon , Pisanulok,Ubol,Hatyai | 2015 | Backup Frequency | |
| Thailand | AFIS | | 2 | Maehongson,Tak,Payao ,Nan,Trang,Narathiwas, Loei,Burirum,Samui,Chonburi,Karnjanaburi,Phuket | 2015 | Low Level Aircraft Advisory | |
| Thailand | ATIS | 22 | | Bangkok,PHETCHABUN,CHUMPHON,CHIANG RAI,NAN,BURI RAM,ROI ET,SAKON NAKHON,NARATHIWAT,RANONG,LAMPANG,PHRAE,KHON KAEN,UDON THANI,UBON RATCHATHANI,PHITSANULOK,NAKHON RATCHASIMA,LOEI,Mae Sot,MAE HONG SON,Hua Hin | 2015 | Automatic terminal information service | For replace ATIS from old NDB Station which will be obsolid in neraly 2015 |
| | **Total** | **255** | **2** | | | | |