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**APT SURVEY REPORT ON**

**APPLICATION OF DIRECT BROADBAND RADIO COMMUNICATION SYSTEM BETWEEN AIR AND GROUND**

**Edition: March 2015**

**The 18th Meeting of APT Wireless Group**

**9 – 13 March 2015**

**Kyoto, Japan**

***(Source: AWG-18/OUT-23)***

**No. APT/AWG/REP-63**

**APT SURVEY REPORT ON APPLICATION OF DIRECT BROADBAND RADIO COMMUNICATION SYSTEM BETWEEN AIR AND GROUND**

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# Introduction

Demand has increased for better mobile phone and wireless local area network (LAN) access on-board aircraft. Today, several airlines have started cabin use of cellular phones with a system involving satellites. Meanwhile, the direct air-to-ground broadband radio communication system for the air passengers is developing because of low cost of capacity and short round-trip delays. This system requires constructing a network of base stations covering each flight route, while can better ensure communications bandwidth and lower communication costs. The application of this system is not only for high-speed internet service to the air passengers, but also for transmitting videos and pictures obtained by airplanes to grasp the damage in the case of disaster.

In the AWG-15 meeting, Task Group Aeronautical and Maritime under the Working Group Service and Application approved the following proposals for the benefit of improving the relevant studies carried out by APT Members:

1. To collect the information on application of direct air-to-ground broadband radio communication system by distributing a questionnaire;
2. To encourage APT Members to response to the questionnaire at time;
3. To encourage APT Members to enrich the related studies through contributing to the further AWG meeting.

This report is based on the questionnaire that is designed for administrations as well as operators and other partners to provide the information of direct air-to-ground communication.

# Questionnaire Summary

The questionnaire [1] is composed of 11 questions divided into 4 parts, composing of current situation in each country, demand and market forecast, standardization, future plans and research and development.

# Questionnaire responses

The questionnaire responses were received from the following APT members.

Table 1 Questionnaire responses

|  |  |
| --- | --- |
| No | APT member |
| 1 | Australia |
| 2 | Bangladesh |
| 3 | China |
| 4 | Japan |
| 5 | Sri Lanka |
| 6 | Thailand |
| 7 | Vietnam |
| 8 | Telstra , Australia |

# Current status

* 1. **Australia**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

Some trials of broadband wireless communications between aircraft and ground have taken place in Australia to date. However, these have all relied on spectrum bands below 2 GHz. Further trials may take place in future, possibly involving bands below 2 GHz – but recent European discussions of the bands 2 010-2 025/1 900-1 920 MHz (U/D) are also noted. A range of potential applications of such services is foreseen.

* + 1. **Type of access systems**

Use of the 3GPP IMT-Advanced (LTE) technology is envisaged to be the main method for both direct air-to-ground and possibly satellite broadband connections to aircraft.

* 1. **Bangladesh**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | Passenger Services like Live TV, Unlimited Web Surfing, Real-time E-mail with Attachments, Internet Streaming Video and Transfer of Large Files etc. | 2 Mbps or higher | More than 50% / Less than 50% / none |
| 2 | Meteorological Services | 2 Mbps or higher | More than 50% / Less than 50% / none |
| 3 | Aeronautical Info. Services like Aircraft Maintenance, Navigation Database, Flight Database, Flight Plan etc. | 2 Mbps or higher | More than 50% / Less than 50% / none |

* + 1. **Type of access systems**

Satellite link

* 1. **China**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | voice and high speed data service to air passengers in airplanes | 30Mbps-60Mbps | More than 50% |
| 2 | all kinds of aerial photo transmission | 10Mbps | More than 50% |

* + 1. **Type of access systems**

(a) Direct air-to-ground;

(b) Satellite link;

Both (a) and (b) are possible solution for these applications.

* 1. **Japan**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | High speed internet service for aircraft passengers  Personal on-demand images and videos system for aircraft passengers, which is movies, information of latest news and commercial | Above 100Mbps | More than 50% |
| 2 | Transmission of aerial survey data for disaster monitoring in emergency situations. Two types of communication method will be exit.  1. Direct communication between ait-to-ground for sensor data: Synthetic aperture radar (SAR), Optical images, Light Detection and Ranging (LiDAR) data, location data, etc.  2. Hybrid communication method: Direct communication between air-to-ground for sensor data, and Satellite link for image data | 1. 1Gbps  2.  Satellite link: 10Mbps  Direct air-to-ground: 1Gbps | Less than 50% |
| 3 | Information sharing between aircraft and back-office, such as office of airlines, about information of fault part in the aircraft, etc. Operating instruction for the recover from back-office to the aircraft. | Above 20Mbps | More than 50% |
| 4 | Data transformation for flight test , which contains flight test data, telemetry data, etc. | Above 15Mbps | Less than 50% |

* + 1. **Type of access systems**

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

|  |  |  |
| --- | --- | --- |
|  | Access system | Information of (c) |
| 1 | a, b |  |
| 2 | a, b |  |
| 3 | a |  |
| 4 | a |  |

* 1. **Sri Lanka**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | Not decided |  | More than 50% / Less than 50% / none |
| 2 | Not decided |  | More than 50% / Less than 50% / none |
|  |  |  | More than 50% / Less than 50% / none |

* 1. **Thailand**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

No broadband radio communication application (2 GHz and above) is currently being used by Aeronautical radio of Thailand limited

* 1. **Vietnam**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

N/A

* + 1. **Type of access systems**

(a) Direct air-to-ground;

(b) Satellite link;

* 1. **Telstra , Australia**
     1. **Broadband radio communication applications using above 2 GHz in an airplane**

While several trials of direct air-ground wireless broadband connection with aircraft have recently been undertaken in Australia, all these trials have relied on frequency bands below 2 GHz. These trials have generally focused on providing broadband Internet and other broadband data applications (email, text, and multimedia information, etc) to passengers and crew aboard commercial and general aviation aircraft. However, Telstra is aware of preliminary discussions emerging in Europe concerning consideration of the frequency band 2010-2025/1900-1920 MHz (for ground-to-aircraft/aircraft-to-ground use, respectively).

* + 1. **Type of access systems**

Telstra has not yet developed any specific views on the alternative methods of access for providing broadband Internet to aircraft.

# Future plan

* 1. **Australia**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

Not at this time.

* + 1. **Frequency allocation information**

|  |  |  |
| --- | --- | --- |
| ***Frequency range MHz*** | ***Service*** | ***Application*** |
| 1 900-1 980 | MS | 3G cellular systems |
| 1 980-2 110 | FS, EESS, SRS, SOS | Various |
| 2 110-2 170 | MS | 3G cellular systems |
| 2 170-2 290 | MS, FS, EESS, SRS, SOS | TVOB, Aero mobile telemetry |
| 2 290-2 300 | FS, MS, SRS | Radio astronomy |
| 2 300-2 400 | FS | Various |
| 2 400-2 483 | MS, FS | Unlicensed – mainly Wi-Fi |
| 2 483-2 500 |  | Various satellite |

* + 1. **Suitable frequency allocation**

Australia has not commenced any formal consideration of air-to-ground applications and spectrum planning – so is not in a position to offer proposals. Australia is interested to participate in APT discussions and review options proposed.

* 1. **Bangladesh**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

No

* + 1. **Suitable frequency allocation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | Passenger Services, Meteorological Services etc. | 2.4 GHz  FDD 2\*10 MHz  Or TDD 20 MHz | The system can operate with variable BWs in any sub-band within the relevant frequency range. |
| 2 | Passenger Services, Meteorological Services etc. | 5.8 GHz  FDD 2\*10 MHz  Or TDD 20 MHz | The system can operate with variable BWs in any sub-band within the relevant frequency range. |

* 1. **China**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

No

* + 1. **Suitable frequency allocation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | high-speed data/video transmission between air and ground | unknown | The direct air-to-ground broadband radio communication is beginning to be studied. The suitable frequency bands are not known yet. |

* 1. **Japan**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

Yes (Some frequency bands have potential to be allocated to this system)

* + 1. **Frequency allocation information**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 | 40GHz band |  | Broadband communication in aircraft cabin  Personal on-demand images and videos system for aircraft passengers  Transmission of aerial survey data for disaster monitoring in emergency situations |

* + 1. **Suitable frequency allocation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | Personal on-demand images and videos system for aircraft passengers  (Answered by Manufacturer and Airline) | 40GHz band | Using the frequency range of 40GHz bands has a potential for broadband communication.  The communication speed of 100Mbps was confirmed through the results of verification test, which it enables the application. |
| 2 | Transmission of aerial survey data for disaster monitoring in emergency situations, which contains synthetic aperture radar (SAR) data, optical images, Light Detection and Ranging (LiDAR) data, location data, etc.  (Answered by Manufacturer, private company and organization monitoring disaster area in emergency situations) | 40GHz band | Using the frequency range of 40GHz bands has a potential for broadband communication.  In disaster situations, high speed communication is necessary for transformation of survey data and images.  The communication speed of 100Mbps was confirmed through the results of verification test, which it enables the application. |
| 3 | Telemetry systems for flight test and low-gravity test  (Answered by aerospace company repairing and manufacturing aircraft, research institution) | 40GHz band | Using the frequency range of 40GHz bands has a potential for broadband communication.  The communication speed of 100Mbps was confirmed through the results of verification test, which it enables the application. |

* 1. **Sri Lanka**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

not yet decided

* 1. **Thailand**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

No

* 1. **Vietnam**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

No

* + 1. **Suitable frequency allocation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | Broadband internet access | 5 725 – 5 850 | No co-allocated with Aeronautical Services |

* 1. **Telstra , Australia**
     1. **Allocation plan for the direct air-to-ground broadband radio communication system**

Telstra is not aware of any frequency planning efforts underway in Australia in relation to direct air-to-ground broadband communication systems. However, as noted above, Telstra is aware of preliminary discussions emerging in Europe concerning consideration of the frequency band 2010-2025/1900-1920 MHz (ground-to-aircraft/aircraft-to-ground use, respectively). Other frequency band options (above and below 2 GHz) may also be under early consideration in other areas/groups.

* + 1. **Frequency allocation information**

Telstra offers no response.

* + 1. **Suitable frequency allocation**

Telstra offers no response, at this time.

# Development

* 1. **Australia**
     1. **Current development status**

Several proof-of-concept trials have been undertaken to date in Australia, and further such trials may be in planning – but associated organizations have not yet made any public statements

* + 1. **Information about frequency, bandwidth, data transfer rate and target application**

N/A

* + 1. **Plan or interest for making international standardization**

Yes - International standardization and harmonization of direct air-to-ground broadband radio communication systems may result in an equipment market in Australia in the future.

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

At the present time, it is not yet clear whether sufficient commercial opportunity is foreseen in direct air-to-ground broadband communications with aircraft.

* 1. **Bangladesh**
     1. **Current development status**

No

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

Yes

* 1. **China**
     1. **Current development status**

No

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

Yes

* 1. **Japan**
     1. **Current development status**

Yes

* + 1. **Information about frequency, bandwidth, data transfer rate and target application**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 | 40GHz | Around 100MHz | Around 100Mbps | Broadband communication in aircraft cabin and high-speed train  Transmission of aerial survey data for disaster monitoring in emergency situations |

* + 1. **Plan or interest for making international standardization**

Yes

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

Yes

* 1. **Sri Lanka**
     1. **Current development status**

No

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

not yet

* 1. **Thailand**
     1. **Current development status**

No

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

No

* 1. **Vietnam**
     1. **Current development status**

No

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

Yes

* 1. **Telstra , Australia**
     1. **Current development status**

Telstra highlights that several trials of direct air-ground wireless broadband connection with aircraft have recently been undertaken in Australia, all these trials have relied on frequency bands below 2 GHz. These trails have generally focused on providing broadband Internet and other broadband data applications (email, text, and multimedia information, etc) to passengers and crew aboard commercial and general aviation aircraft.

* + 1. **Information about frequency, bandwidth, data transfer rate and target application**

Telstra offers no response at this time.

* + 1. **Plan or interest for making international standardization**

Yes

* + 1. **Plan of developing the direct air-to-ground broadband radio communication system in the future**

Telstra can offer no response at this time.

# Others

* 1. **Australia**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

Australia does not at this time have a high-speed land based transport network.

* + 1. **Any other information and studies** **that are beneficial to share among APT countries**

Australia is not aware of any additional information or studies to contribute to this process.

* 1. **Bangladesh**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

No

* 1. **China**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

Yes, there is also demand for data service and internet access in high-speed train, bus and subway. Experiment of mobile wifi has been carried out in some bus and high-speed train routes.

* + 1. **Any other information and studies** **that are beneficial to share among APT countries**

The related issues of direct air-to-ground broadband radio communication system, such as frequency, bandwidth and applications, are still at research stage. We will keep updating progress and information in the future.

* 1. **Japan**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

Yes

Broadband communication system between ground and high-speed train using millimetre wave band can be thought for the operation of the train in the future.

* + 1. **Any other information and studies** **that are beneficial to share among APT countries**

Japanese system of broadband radio communication system between air and ground is described in working document towards preliminary draft new report of the possible radio services and applications on-board aircraft and vessels.

The outline of the Japanese system is described in Annex 3 of a new report ITU-R M. 2282-0 - Systems for public mobile communications with aircraft, which was approved on November 2013.

* 1. **Sri Lanka**

N/A

* 1. **Thailand**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

Yes, we plan to implement high-speed train with high-speed mobile (GSM-R, LTE-R) subject to the result of the compatibility studies with existing services.

* 1. **Vietnam**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

Yes.

Mobile data communication service for high-speed train, car, bus to provide transportation-dispatching operations, customer internet access.

* + 1. **Any other information and studies** **that are beneficial to share among APT countries**

N/A

* 1. **Telstra , Australia**
     1. **Demand for using broadband radio communication to any other high-speed mobile object**

Telstra can offer no response at this time.

* + 1. **Any other information and studies** **that are beneficial to share among APT countries**

Telstra can offer no response at this time.

# Summary

This survey report summarized data collected from APT countries based on their responses to "NEW QUESTIONNAIRE ON APPLICATION OF DIRECT BROADBAND RADIO COMMUNICATION SYSTEM BETWEEN AIR AND GROUND (AWG-15/OUT-22)" [1]. The gathered information included current usage, demand and market forecast, standardization, guidelines, future plans and research and development status for direct broadband radio communication system between air and ground.

The results of this survey shows that most of the countries and organization have the plan to develop this system between air and ground and some experiments have already done in some organizations. Furthermore, not only the air cabin use but also high-speed train, automobile, bus, etc. have demands for broadband radio communication.

REFERENCES

[1] Working Group Service and Applications, AWG-15/OUT-22 “NEW QUESTIONNAIRE ON APPLICATION OF DIRECT BROADBAND RADIO COMMUNICATION SYSTEM BETWEEN AIR AND GROUND” 30 August, 2013.

Annex 1: Response to the questionnaire from Australia

Annex 2: Response to the questionnaire from Bangladesh

Annex 3: Response to the questionnaire from China

Annex 4: Response to the questionnaire from Japan

Annex 5: Response to the questionnaire from Sri Lanka

Annex 6: Response to the questionnaire from Thailand

Annex 7: Response to the questionnaire from Vietnam

Annex 8: Response to the questionnaire from Telstra , Australia

ANNEX 1 RESPONSE TO THE QUESTIONNAIRE FROM AUSTRALIA

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Australian Communications and Media Authority

Name of contact person : Chris Worley

Postal Address :

Phone : 612 6219 5239

Email Address : Christopher.Worley@acma.gov.au

My Administration/Institution/Company is:

1. Regulator (1) √
2. Operator (2)
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country?

**Answer:** Some trials of broadband wireless communications between aircraft and ground have taken place in Australia to date. However, these have all relied on spectrum bands below 2 GHz. Further trials may take place in future, possibly involving bands below 2 GHz – but recent European discussions of the bands 2 010-2 025/1 900-1 920 MHz (U/D) are also noted. A range of potential applications of such services is foreseen.

1. Which type of access systems do you suggest for these applications?

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

**Answer:** Use of the 3GPP IMT-Advanced (LTE) technology is envisaged to be the main method for both direct air-to-ground and possibly satellite broadband connections to aircraft.

1. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system?

**Answer:** Not at this time.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |
| --- | --- | --- |
| ***Frequency range MHz*** | ***Service*** | ***Application*** |
| 1 900-1 980 | MS | 3G cellular systems |
| 1 980-2 110 | FS, EESS, SRS, SOS | Various |
| 2 110-2 170 | MS | 3G cellular systems |
| 2 170-2 290 | MS, FS, EESS, SRS, SOS | TVOB, Aero mobile telemetry |
| 2 290-2 300 | FS, MS, SRS | Radio astronomy |
| 2 300-2 400 | FS | Various |
| 2 400-2 483 | MS, FS | Unlicensed – mainly Wi-Fi |
| 2 483-2 500 |  | Various satellite |

1. What frequency do you think suitable for the system usage with respect to each application assumed in your country?

**Answer:** Australia has not commenced any formal consideration of air-to-ground applications and spectrum planning – so is not in a position to offer proposals. Australia is interested to participate in APT discussions and review options proposed.

1. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system?

**Answer:** Several proof-of-concept trials have been undertaken to date in Australia, and further such trials may be in planning – but associated organisations have not yet made any public statements.

1. N/A
2. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system?

**Answer:** Yes - International standardisation and harmonisation of direct air-to-ground broadband radio communication systems may result in an equipment market in Australia in the future.

1. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future?

**Answer:** At the present time, it is not yet clear whether sufficient commercial opportunity is foreseen in direct air-to-ground broadband communications with aircraft.

1. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.?

**Answer:** Australia does not at this time have a high-speed land based transport network.

1. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries.

**Answer:** Australia is not aware of any additional information or studies to contribute to this process.

ANNEX 2: RESPONSE TO THE QUESTIONNAIRE FROM BANGLADESH

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Bangladesh Telecommunication Regulatory

Commission (BTRC)

Name of contact person : Shiblee Imtiaz

Postal Address : IEB Bhaban, Ramna, Dhaka-1000.

Phone : +88 0155 2202886

Email Address : shiblee@btrc.gov.bd

My Administration/Institution/Company is:

1. Regulator (1) √
2. Operator (2)
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country? There may be some types of applications which require high-speed wireless connection such as high-speed internet service to air passengers, data transfer of aerial photograph, synthetic aperture radar (SAR), laser measurement data, aviation-related data, flight experiments data, live broadcast system for the helicopter, and etc. Please describe your expectations or specific use cases, and provide necessary data transfer rate and estimates of future market size.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | Passenger Services like Live TV, Unlimited Web Surfing, Real-time E-mail with Attachments, Internet Streaming Video and Transfer of Large Files etc. | 2 Mbps or higher | More than 50% / Less than 50% / none |
| 2 | Meteorological Services | 2 Mbps or higher | More than 50% / Less than 50% / none |
| 3 | Aeronautical Info. Services like Aircraft Maintenance, Navigation Database, Flight Database, Flight Plan etc. | 2 Mbps or higher | More than 50% / Less than 50% / none |

1. Which type of access systems do you suggest for theses applications?

(a) Direct air-to-ground;

**√** (b) Satellite link;

(c) Any other type. (Please clarify the type.)

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system? (Yes / No)? **No**

If you answered “Yes” to **Question 3** above, please answer the **Question 4**.

If you answered “No” to **Question 3** above, please answer the **Question 5**.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 |  |  |  |
|  |  |  |  |

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | Passenger Services, Meteorological Services etc. | 2.4 GHz  FDD 2\*10 MHz  Or TDD 20 MHz | The system can operate with variable BWs in any sub-band within the relevant frequency range. |
| 2 | Passenger Services, Meteorological Services etc. | 5.8 GHz  FDD 2\*10 MHz  Or TDD 20 MHz | The system can operate with variable BWs in any sub-band within the relevant frequency range. |

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system? (Yes / No). **No**

If you answered “Yes” to **Question 6** above, please answer the **Question 7 and Question 8**.

If you answered “No” to **Question 6** above, please answer the **Question 9**.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system? (Yes / No)
2. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes / No) **Yes**
3. **Others**
4. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.? **No**. If you answer “Yes”, please provide the information of the usage.
5. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries

ANNEX 3: RESPONSE TO THE QUESTIONNAIRE FROM CHINA

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Radio Regulatory Bureau, MIIT, P.R.China

Name of contact person : DING JIAXIN

Postal Address : No.80 Bei Lishi Road, Xicheng District, Beijing 100037, P.R. China

Phone : +86-10-68009084

Email Address : dingjiaxin@srrc.org.cn

My Administration/Institution/Company is:

1. Regulator (1)
2. Operator (2)
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country? There may be some types of applications which require high-speed wireless connection such as high-speed internet service to air passengers, data transfer of aerial photograph, synthetic aperture radar (SAR), laser measurement data, aviation-related data, flight experiments data, live broadcast system for the helicopter, and etc. Please describe your expectations or specific use cases, and provide necessary data transfer rate and estimates of future market size.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | voice and high speed data service to air passengers in airplanes | 30Mbps-60Mbps | More than 50% |
| 2 | all kinds of aerial photo transmission | 10Mbps | More than 50% |
|  |  |  |  |

1. Which type of access systems do you suggest for these applications?

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

Both (a) and (b) are possible solution for these applications.

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system? (Yes / No)?

If you answered “Yes” to **Question 3** above, please answer the **Question 4**.

If you answered “No” to **Question 3** above, please answer the **Question 5**.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 |  |  |  |
|  |  |  |  |

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | high-speed data/video transmission between air and ground | unknown | The direct air-to-ground broadband radio communication is beginning to be studied. The suitable frequency bands are not known yet. |
| 2 |  |  |  |
|  |  |  |  |

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system? (Yes / No).

If you answered “Yes” to **Question 6** above, please answer the **Question 7 and Question 8**.

If you answered “No” to **Question 6** above, please answer the **Question 9**.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system? (Yes / No)
2. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes / No)
3. **Others**
4. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.? If you answer “Yes”, please provide the information of the usage.

Yes, there is also demand for data service and internet access in high-speed train, bus and subway. Experiment of mobile wifi has been carried out in some bus and high-speed train routes.

1. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries

The related issues of direct air-to-ground broadband radio communication system, such as frequency, bandwidth and applications, are still at research stage. We will keep updating progress and information in the future.

ANNEX 4: RESPONSE TO THE QUESTIONNAIRE FROM JAPAN

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Mobile Satellite Division, Radio Department, Telecommunications Bureau, Ministry of Internal Affairs and Communications

Name of contact person : Toshiyuki Obata

Postal Address : 2-1-2 Kasumigaseki, Chiyoda-ku, Tokyo, 100-8926, JAPAN

Phone : +81-3-5253-5902

Email Address : promotion.radio@ml.soumu.go.jp

My Administration/Institution/Company is:

1. Regulator (1)
2. Operator (2)
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country? There may be some types of applications which require high-speed wireless connection such as high-speed internet service to air passengers, data transfer of aerial photograph, synthetic aperture radar (SAR), laser measurement data, aviation-related data, flight experiments data, live broadcast system for the helicopter, and etc. Please describe your expectations or specific use cases, and provide necessary data transfer rate and estimates of future market size.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | High speed internet service for aircraft passengers  Personal on-demand images and videos system for aircraft passengers, which is movies, information of latest news and commercial | Above 100Mbps | More than 50% |
| 2 | Transmission of aerial survey data for disaster monitoring in emergency situations. Two types of communication method will be exit.  1. Direct communication between ait-to-ground for sensor data: Synthetic aperture radar (SAR), Optical images, Light Detection and Ranging (LiDAR) data, location data, etc.  2. Hybrid communication method: Direct communication between air-to-ground for sensor data, and Satellite link for image data | 1. 1Gbps  2.  Satellite link: 10Mbps  Direct air-to-ground: 1Gbps | Less than 50% |
| 3 | Information sharing between aircraft and back-office, such as office of airlines, about information of fault part in the aircraft, etc. Operating instruction for the recover from back-office to the aircraft. | Above 20Mbps | More than 50% |
| 4 | Data transformation for flight test , which contains flight test data, telemetry data, etc. | Above 15Mbps | Less than 50% |

1. Which type of access systems do you suggest for these applications?

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

|  |  |  |
| --- | --- | --- |
|  | Access system | Information of (c) |
| 1 | a, b |  |
| 2 | a, b |  |
| 3 | a |  |
| 4 | a |  |

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system? (Yes / No)?

Yes (Some frequency bands have potential to be allocated to this system)

If you answered “Yes” to **Question 3** above, please answer the **Question 4**.

If you answered “No” to **Question 3** above, please answer the **Question 5**.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 | 40GHz band |  | Broadband communication in aircraft cabin  Personal on-demand images and videos system for aircraft passengers  Transmission of aerial survey data for disaster monitoring in emergency situations |

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | Personal on-demand images and videos system for aircraft passengers  (Answered by Manufacturer and Airline) | 40GHz band | Using the frequency range of 40GHz bands has a potential for broadband communication.  The communication speed of 100Mbps was confirmed through the results of verification test, which it enables the application. |
| 2 | Transmission of aerial survey data for disaster monitoring in emergency situations, which contains synthetic aperture radar (SAR) data, optical images, Light Detection and Ranging (LiDAR) data, location data, etc.  (Answered by Manufacturer, private company and organization monitoring disaster area in emergency situations) | 40GHz band | Using the frequency range of 40GHz bands has a potential for broadband communication.  In disaster situations, high speed communication is necessary for transformation of survey data and images.  The communication speed of 100Mbps was confirmed through the results of verification test, which it enables the application. |
| 3 | Telemetry systems for flight test and low-gravity test  (Answered by aerospace company repairing and manufacturing aircraft, research institution) | 40GHz band | Using the frequency range of 40GHz bands has a potential for broadband communication.  The communication speed of 100Mbps was confirmed through the results of verification test, which it enables the application. |

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system? (Yes / No).

Yes

If you answered “Yes” to **Question 6** above, please answer the **Question 7 and Question 8**.

If you answered “No” to **Question 6** above, please answer the **Question 9**.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 | 40GHz | Around 100MHz | Around 100Mbps | Broadband communication in aircraft cabin and high-speed train  Transmission of aerial survey data for disaster monitoring in emergency situations |

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system? (Yes / No)

Yes

1. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes / No)

Yes

1. **Others**
2. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.? If you answer “Yes”, please provide the information of the usage.

Yes

Broadband communication system between ground and high-speed train using millimetre wave band can be thought for the operation of the train in the future.

1. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries

Japanese system of broadband radio communication system between air and ground is described in working document towards preliminary draft new report of the possible radio services and applications on-board aircraft and vessels.

The outline of the Japanese system is described in Annex 3 of a new report ITU-R M. 2282-0 - Systems for public mobile communications with aircraft, which was approved on November 2013.

ANNEX 5: RESPONSE TO THE QUESTIONNAIRE FROM SRI LANKA

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Telecom Regulatory Commission of   
Sri lanka

Name of contact person : E.L.K. Dissanayake

Postal Address :

Phone :

Email Address : erandika@trc.gov.lk

My Administration/Institution/Company is:

1. Regulator (1) √
2. Operator (2)
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country? There may be some types of applications which require high-speed wireless connection such as high-speed internet service to air passengers, data transfer of aerial photograph, synthetic aperture radar (SAR), laser measurement data, aviation-related data, flight experiments data, live broadcast system for the helicopter, and etc. Please describe your expectations or specific use cases, and provide necessary data transfer rate and estimates of future market size.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
| 1 | Not decided |  | More than 50% / Less than 50% / none |
| 2 | Not decided |  | More than 50% / Less than 50% / none |
|  |  |  | More than 50% / Less than 50% / none |

1. Which type of access systems do you suggest for theses applications?

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system? (Yes / No)? not yet decided

If you answered “Yes” to **Question 3** above, please answer the **Question 4**.

If you answered “No” to **Question 3** above, please answer the **Question 5**.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 |  |  |  |
|  |  |  |  |

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 |  |  |  |
| 2 |  |  |  |
|  |  |  |  |

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system? (Yes / No). **No**

If you answered “Yes” to **Question 6** above, please answer the **Question 7 and Question 8**.

If you answered “No” to **Question 6** above, please answer the **Question 9**.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
|  |  |  |  |  |

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system? (Yes / No)
2. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes / No) **not yet**
3. **Others**
4. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.? If you answer “Yes”, please provide the information of the usage.
5. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries

ANNEX 6: RESPONSE TO THE QUESTIONNAIRE FROM THAILAND

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Ministry of Information and Communication Technology (MICT)

Name of contact person :

Postal Address : 120 Moo 3, 6-9 Floor The Government Complex Commenmorating His Majesty, Chaeng Watthana Road, Thung Song Hong, Khet Laksi, Bangkok 10210

Phone :

Email Address :

My Administration/Institution/Company is:

1. Regulator (1)
2. Operator (2) √
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country? There may be some types of applications which require high-speed wireless connection such as high-speed internet service to air passengers, data transfer of aerial photograph, synthetic aperture radar (SAR), laser measurement data, aviation-related data, flight experiments data, live broadcast system for the helicopter, and etc. Please describe your expectations or specific use cases, and provide necessary data transfer rate and estimates of future market size.

No broadband radio communication application (2 GHz and above) is currently being used by Aeronautical radio of Thailand limited

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. Which type of access systems do you suggest for theses applications?

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system? (Yes / No)? No

If you answered “Yes” to **Question 3** above, please answer the **Question 4**.

If you answered “No” to **Question 3** above, please answer the **Question 5**.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 |  |  |  |
|  |  |  |  |

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 |  |  |  |
| 2 |  |  |  |
|  |  |  |  |

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system? (Yes / No). **No**

If you answered “Yes” to **Question 6** above, please answer the **Question 7 and Question 8**.

If you answered “No” to **Question 6** above, please answer the **Question 9**.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
|  |  |  |  |  |

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system? (Yes / No)
2. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes / No) **No**
3. **Others**
4. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.? If you answer “Yes”, please provide the information of the usage.

**Yes, we plan to implement high-speed train with high-speed mobile (GSM-R, LTE-R) subject to the result of the compatibility studies with existing services.**

1. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries

ANNEX 7: RESPONSE TO THE QUESTIONNAIRE FROM VIETNAM

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Authority of Radio Frequency Management

Name of contact person : Mr. Bui Ha Long

Postal Address : 115 Tran Duy Hung, Cau Giay Dist, Ha Noi, Viet Nam

Phone : +84 – 4 – 35564870

Email Address : longbh@rfd.gov.vn

My Administration/Institution/Company is:

1. Regulator (1) 🗹
2. Operator (2)
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country? There may be some types of applications which require high-speed wireless connection such as high-speed internet service to air passengers, data transfer of aerial photograph, synthetic aperture radar (SAR), laser measurement data, aviation-related data, flight experiments data, live broadcast system for the helicopter, and etc. Please describe your expectations or specific use cases, and provide necessary data transfer rate and estimates of future market size.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Data transfer rate** | **Future market size**  **(Percentage of all airplanes in your country, which will use each application)** |
|  |  |  |  |

1. Which type of access systems do you suggest for theses applications?

(a) Direct air-to-ground;

(b) Satellite link;

~~(c) Any other type. (Please clarify the type.)~~

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system? (~~Yes~~ / No)? No

If you answered “Yes” to **Question 3** above, please answer the **Question 4**.

If you answered “No” to **Question 3** above, please answer the **Question 5**.

1. Please provide the frequency allocation information above 2 GHz for application.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Comments**  **( for example application)** |
| 1 |  |  |  |

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Application** | **Frequency**  **[MHz]** | **Reason** |
| 1 | Broadband internet access | 5 725 – 5 850 | No co-allocated with Aeronautical Services |

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system? (~~Yes~~ / No). No

If you answered “Yes” to **Question 6** above, please answer the **Question 7 and Question 8**.

If you answered “No” to **Question 6** above, please answer the **Question 9**.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Frequency**  **[MHz]** | **Bandwidth**  **[MHz]** | **Data transfer rate** | **Target application** |
| 1 |  |  |  |  |

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system? (Yes / No)
2. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes ~~/ No~~) Yes
3. **Others**
4. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.? If you answer “Yes”, please provide the information of the usage.

* Yes.
* Mobile data communication service for high-speed train, car, bus to provide transportation-dispatching operations, customer internet access.

1. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries

* N/A

ANNEX 8: RESPONSE TO THE QUESTIONNAIRE FROM TELSTRA , AUSTRALIA

1. **Administration/Institution/Company Information and Profile**

Name of the Administration/Institution/Company : Telstra Corporation Ltd

Name of contact person : Stewart Wallace

Postal Address : Level 11, 35 Collins Street, Melbourne, Victoria, Australia

Phone : +61 (3) 8649 2893

Email Address : [stewart.j.wallace@team.telstra.com](mailto:stewart.j.wallace@team.telstra.com)

My Administration/Institution/Company is:

1. Regulator (1)
2. Operator (2) ⌧
3. Vendor (3)
4. Others (4)  <please describe your answer here>
5. **Questions**
6. **Current status**
7. What kinds of broadband radio communication applications using above 2 GHz in an airplane are expected in your country?

ANS: While several trials of direct air-ground wireless broadband connection with aircraft have recently been undertaken in Australia, all these trials have relied on frequency bands ***below*** 2 GHz. These trials have generally focused on providing broadband Internet and other broadband data applications (email, text, and multimedia information, etc) to passengers and crew aboard commercial and general aviation aircraft. However, Telstra is aware of preliminary discussions emerging in Europe concerning consideration of the frequency band 2010-2025/1900-1920 MHz (for ground-to-aircraft/aircraft-to-ground use, respectively).

1. Which type of access systems do you suggest for these applications?

(a) Direct air-to-ground;

(b) Satellite link;

(c) Any other type. (Please clarify the type.)

ANS: Telstra has not yet developed any specific views on the alternative methods of access for providing broadband Internet to aircraft.

1. **Future plan**
2. Frequency allocation for the direct air-to-ground broadband radio communication system should be taken a proper care, because the system may affect other systems. In your country, is there any planned frequency allocation above 2 GHz for the direct air-to-ground broadband radio communication system?

**ANS**: Telstra is not aware of any frequency planning efforts underway in Australia in relation to direct air-to-ground broadband communication systems. However, as noted above, Telstra is aware of preliminary discussions emerging in Europe concerning consideration of the frequency band 2010-2025/1900-1920 MHz (ground-to-aircraft/aircraft-to-ground use, respectively). Other frequency band options (above and below 2 GHz) may also be under early consideration in other areas/groups.

1. Please provide the frequency allocation information above 2 GHz for application.

ANS: Telstra offers no response.

1. Suitable frequency for the direct air-to-ground broadband radio communication system may relate to technology, application, and regulatory aspects. What frequency do you think suitable for the system usage with respect to each application assumed in your country? Please provide the frequency information above 2 GHz for each application including reasons.

ANS: Telstra offers no response, at this time.

1. **Current development status**
2. Currently, is there any organization in your country, which is developing the direct air-to-ground broadband radio communication system?

ANS: Telstra highlights that several trials of direct air-ground wireless broadband connection with aircraft have recently been undertaken in Australia, all these trials have relied on frequency bands ***below*** 2 GHz. These trails have generally focused on providing broadband Internet and other broadband data applications (email, text, and multimedia information, etc) to passengers and crew aboard commercial and general aviation aircraft.

1. Please provide the information about frequency, bandwidth and data transfer rate which is used for the development, and target application.

ANS: Telstra offers no response at this time.

1. Do you have plan or interest for making international standardization of the direct air-to-ground broadband radio communication system?

ANS: Yes

1. Is there any plan of developing the direct air-to-ground broadband radio communication system in the future? (Yes / No)

ANS: Telstra can offer no response at this time.

1. **Others**
2. Do you have the demand for using broadband radio communication to any other high-speed mobile object, such as high-speed train, etc.?

ANS: Telstra can offer no response at this time.

1. Please provide any other direct air-to-ground broadband radio communication system information and studies that are beneficial to share among APT countries.

ANS: Telstra can offer no response at this time.

\_\_\_\_\_\_\_\_\_\_\_