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| **World Radiocommunication Conference (WRC-15)Geneva, 2–27 November 2015** |  |
| **INTERNATIONAL TELECOMMUNICATION UNION** |  |
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| PLENARY MEETING | **Revision 1 toAddendum 12 toDocument 61-E** |
|  | **25 October 2015** |
|  | **Original: English** |
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| Iran (Islamic Republic of) |
| Proposals for the work of the conference |
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| Agenda item 1.12 |

1.12to consider an extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz and/or 9 900-10 500 MHz, in accordance with Resolution **651 (WRC‑12)**;

Background

In the CPM Report, four methods to satisfy agenda item 1.12 have been identified:

Method A (600 MHz extension)

• **Method A1** **(option1)**: Primary EESS in 9 900-10 500 MHz;

• **Method A1 (option 2)**: same as Method A1(option 1) + a transitional period for protection of ARSS;

• **Method A2**: same as Method A1 (option 1) + pfd for protection of FS stations.

Method B (600 MHz extension)

• **Method B1**: Primary EESS in 9 200-9 300 MHz and 9 900‑10 400 MHz;

• **Method B2**: same as Method B1 + pfd for protection of FS stations.

Method C (300 MHz extension)

• Primary EESS in 9 200-9 300 MHz and 10 000-10 100 MHz, and secondary in 9 900‑10 000 MHz + pfd for protection of FS stations.

Method D (no extension)

• No change to the Radio Regulations (NOC).

This administration believes that the issue of extension of allocation to EESS (active) is to find a proper/logical balance between the needs of EESS (active) systems and the requirements of other different incumbent systems in the frequency bands under consideration.

We think that the Method C, 300 MHz extension of allocation to EESS (active), provides the above balance, with taking into account all different technical, regulatory and security aspects and Methods A and B (600 MHz extension) somehow constrain the operational flexibility and reliability of incumbent services.

In order to clarify the issue, in the following table, the differences between Method C with Methods A and B are compared.

| Issue | Method C advantage, in comparison to Methods A &B, as outlined in the CPM Report | Method C disadvantage, in comparison to Methods A&B, as outlined in the CPM Report | Reasons |
| --- | --- | --- | --- |
| EESS (active) Sharing with radiolocation services  | As compared to Methods A and B, Method C, provides more flexibility for administrations to continue operating and developing more reliably their **radiolocation services** without any constraints envisioned, in the unallocated frequency band 10 100‑10 500 MHz | Nothing for this issue is mentioned in the CPM Report  | In the frequency range 9-10 GHz, both radionavigation service (RNS) and radiolocation service (RLS) have primary allocation. However, the use and development of RLS have been limited by RNS in this frequency range, especially in the following frequency bands due to explicit regulatory constraints on such systems:a) In the frequency band 9 000-9 200 MHz, by ARNS and MRNS pursuant to No. **5.473A**\*,b) In the frequency band 9 300-9 500 MHz, by RNS pursuant to No. **5475B**\*\*.\*5.473A In the band 9 000-9 200 MHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, systems identified in No. **5.337** operating in the aeronautical radionavigation service, or radar systems in the maritime radionavigation service operating in this band on a primary basis in the countries listed in No. **5.471**.     (WRC-07)\*\*5.475B In the band 9 300-9 500 MHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, radars operating in the radionavigation service in conformity with the Radio Regulations. Ground-based radars used for meteorological purposes have priority over other radiolocation uses.     (WRC‑07)In the frequency range 10-10.5 GHz, no allocation currently exists for RNS, and RLS is operating more reliably since there is not any constraints from RNS.Consequently, in the frequency range 9-10.5 GHz, only the upper part, the frequency band 10-10.5 GHz, is more convenient for development of RLS, and new allocations for EESS (active) in this frequency band, shall not cause the operation of RLS with lesser reliability The following issues may somehow contradict the main intent of radiolocation services, which is to locate objects with high reliability, without any constraints, at any time and under any circumstances, and may cause the operation of RLS with lesser reliability in the frequency range 10-10.5:• All considered radiolocation radars would be affected with interference levels that significantly exceed the specified I/N threshold value of I/N = –6 dB in the worst case radar location. Probable excess would be between 29.3 dB and 74.6 dB (section 2/1.12/4.1.1.3) • Threshold maybe exceeded in any moment when SAR is over the radio horizon (section 2/1.12/4.1.1.3). It means that radars may be confronted with interference in every location and at any time, and there is no place or time that the radars are not expected to receive interference.• The percentage of time that I/Nav= –6 dB is exceeded (over 11 days), is lower than 0.005 x n, however strongly depends on radar Processing Gain (PG) (TABLE 2/1.12/4- 2). No information about PG is available in ITU (how extent radars are equipped and their ranges), consequently, how much the threshold would be decreased from 0.005 x n is not clear.• The percentage of time (0.005x n) is also linearly dependent on the number of SAR systems (n). Should the number of SAR systems (n) be small, its effect on the percentage of time would be small (e.g. n=2), otherwise the effect could be significant. There is no guarantee that the number of SAR systems (n) to be small in the future. |
| EESS sharing with fixed services  | Provides more flexibility to operate and develop more reliably **fixed services** without any probable constraints, especially stations with elevation angles near 30°, in the unallocated frequency band 10 100 10 500 MHz. | Nothing for this issue is mentioned in the CPM Report | The compatibility studies show that sharing between the EESS (active) and the FS is feasible, however, there would be degradation of performance in the situations when FS stations pointing to high elevation angles (higher than 30°) with azimuth pointing angle around 90° or 270°, due to main-beam to main-beam coupling possibilities. There may be some fixed stations with elevation angles more than 30 degrees not notified to the Bureau by administrations. This would decrease the flexibility of administrations to use and develop fixed services due to potential constraints for stations with elevation angles near 30°. |
| EESS (active) effects on RAS stations  | As compared to Method A and B, Method C, provides better protection for **radio astronomy services** by more frequency separation of RAS stations operating in the band 10.6-10.7 GHz from the out-of-band emissions of EESS (active) | Nothing for this issue is mentioned in the CPM Report | Protection of RAS could be achieved by a new Recommendation ITU‑R RS.2065 which would be incorporated by reference in RR. Proper implementation of this Recommendation needs the close cooperation of RAS and EESS operators, which by application of some complex mitigation techniques, like limiting the number of image acquisitions of areas, preventing the illumination of area surrounding the RAS stations, if practicable, remove the harmful interference from RAS stations. The application of the procedures mentioned here is costly, time consuming and rather complex. This would decrease the operational flexibility of RAS stations due to the sensitivity of these stations to the out of band emissions which may be originated by stations of EESS (active). |
| Picture resolution  | With additional allocation of 300 MHz (900 total bandwidth) to EESS (active), the spectrum requirement for SAR systems for having **picture resolution** **below 0.3 m is more or less** provided. | Method C does not provide adequate spectrum to allow for the implementation of the currently planned systems which are expected to achieve **picture** **resolution of 25 cm or better.** | In Report ITU-R RS.2274-0 (2013), the mathematical description of the relation between the transmission bandwidth and the achievable pixel resolution with SAR is provided. The range resolution of a radar system is given by:   where δ*GR* is the ground resolution, Ψ is the grazing angle, c is the velocity of light, BW is bandwidth and ρ is a ratio due to the hamming window used in SAR (e.g. 0.8).Under the assumption of a moderate weighting (Hamming-Window 0.8), the ground resolution δ*GR* can be computed for different bandwidths and different grazing angles between 35 and 70 degrees:

|  |  |  |  |
| --- | --- | --- | --- |
|         Grazing angleGroundresolution | Grazing angle Ψ=35° | Grazing angle Ψ=50° | Grazing angle Ψ= 75° |
| Ground resolutionδ*GR* for 600 MHz (cm) | 38.1 | 48.6 | 91.4 |
| Ground resolutionδ*GR* for 900 MHz (cm) | 25.4 | 32.4 | 60.9 |
| Ground resolutionδ*GR* for 1 200 MHz (cm)  | 19.1 | 24.3 | 45.7 |

According to the above table, the minimum precision of pictures for 900 MHz bandwidth would be 25.4 cm, not much difference to 19.1 cm for 1 200 MHz bandwidth, which provides more or less the requirements mentioned in Report ITUR-R RS.2274-0  |
| Security aspects of extension of allocation to EESS (active)  | Nothing mentioned in the CPM Report  | Nothing mentioned in the CPM Report | With Methods A and B, the picture precision would be increased to about 19 cm. From the strategically and security point of view, pictures with 19 cm precision would adversely affect the security of sensitive and strategic locations in all countries covered by such high resolution EESS.Regarding the above, the scope and objectives of SAR systems with such a high degree of resolutions which assumes the bandwidth larger than 600 MHz is quite considering since it may contradict the purpose and objectives of Resolution 174 (Guadalajara 2010) “Risk of illicit use of information and communication technology”.This issue was discussed at PP 2014 in Bussan, Republic of Korea, and Resolution174 PP‑10 was modified to reflect such situation. During the adoption of the modified Resolution 174, it was indicated in the minutes of Plenary that WRC-15, in dealing with agenda 1.12, needs to take such sensitivity and security aspects of Earth exploration-satellite (active) service into account in its deliberations. |
| Category of allocation to EESS (active) | Nothing mentioned in the CPM Report | Nothing mentioned in the CPM Report | In method C, in the frequency band 9 900-10 000 MHz, the category of allocation to EESS is secondary, while it is primary in the Methods A and B. Should the EESS (active) has primary allocation in the frequency band 9 900-10 000 MHz, since fixed services are secondary in this frequency band, new constraint would be put on fixed services.Consequently, the type of allocation for EESS (active) in this frequency band could inevitably be secondary similar to the type of allocation in the lower adjacent frequency band 9 800‑9 900 MHz, as it is decided in WRC-07.It is worth noting that EESS (active) has been successfully operating within the frequency band 9 300-9 900 MHz since WRC-07, and no difficulty has been reported with regard to its secondary allocation in the frequency band 9 800-9 900 MHz  |

Radiolocation and radionavigation services, and to a certain extent fixed services are heavily used by many administrations in the bands under consideration. However, few SAR systems are planned to operate in the frequency bands under consideration. This great imbalance between the numbers of systems requires that the present operational flexibility and reliability of existing services should not be touched or diluted, even trivial, by new entrant SAR systems.

Considering the above table, all the advantages that will be achieved with Method C,

• not touching the present operational flexibility and reliability of heavily used existing services (RLS, RAS and FS) in the unallocated frequency band 10 100-10 500 MHz, while, these highly important performance parameters may be diluted in Methods A and B, due to uncertainties in present PG of existing radars and the number of future EESS systems, the probability to receive interference by RLS systems at any time and any place, interference to FS stations with elevation angles near 30 degrees, and

• not putting new constraints on secondary fixed services in the frequency band 9 900-10 000 MHz by allocating the EESS (active) as secondary service in this frequency band,

in contrast to the only partial disadvantage of this Method,

• not achieving the picture resolution of better than 25 cm (although, the minimum picture resolution of 25 cm, more or less provides the requirements mentioned in Report ITU-R RS.2274-0),

concludes us what we achieve with Method C as compared to Methods A and B, is far beyond what we lose in this Method.

Iran's proposal

This administration prefers Method D (no extension) due to heavy and extensive use of radiolocation, radionavigation, and fixed services in our country, however, in order to provide the legitimate civil applications of EESS (active) and reasonable spectrum requirements of new generation SAR systems, could also consider Method C (300 MHz extension).

NOC IRN/61A12/1

ARTICLE 5

Frequency allocations

**Reasons:** This administration prefers Method D (no extension) due to heavy and extensive use of radiolocation, radionavigation, and fixed services in our country.

SUP IRN/61A12/2

RESOLUTION 651 (WRC‑12)

Possible extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz
and/or 9 900-10 500 MHz

**Reasons:** This resolution is no longer required.

In case that the Conference decide to accept Method C:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD IRN/61A12/3

8 500-10 000 MHz

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| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 9 200-9 300 EARTH EXPLORATION-SATELLITE (active) ADD 5.A112 RADIOLOCATION MARITIME RADIONAVIGATION 5.472 5.473 5.474 ADD 5.B112 ADD 5.C112 ADD 5.D112 |
| ... |
| 9 800-9 900 RADIOLOCATION Earth exploration-satellite (active) Fixed Space research (active) 5.477 5.478 5.478A 5.478B ADD 5.F112 |
| 9 900-10 000 RADIOLOCATION Earth exploration-satellite (active) ADD 5.A112 Fixed 5.477 5.478 5.479 ADD 5.C112 ADD 5.F112 |

**Reasons:** Provides an additional 300 MHz allocation to the EESS (active) for high resolution SARs as requested by Resolution 651 (WRC-12), taking into account that with such additional allocation (900 MHz total) picture resolution below 0.3 m is more or less provided.

MOD IRN/61A12/4

10-11.7 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 10-10.1EARTH EXPLORATION- SATELLITE (active) 5.A112FIXEDMOBILERADIOLOCATIONAmateur | 10-10.1EARTH EXPLORATION- SATELLITE (active) 5.A112RADIOLOCATIONAmateur | 10-10.1EARTH EXPLORATION- SATELLITE (active) 5.A112FIXEDMOBILERADIOLOCATIONAmateur |
| 5.479 ADD 5.C112 ADD 5.E112 ADD 5.F112 | 5.479 5.480 ADD 5.C112ADD 5.E112 ADD 5.F112 | 5.479 ADD 5.C112 ADD 5.E112 ADD 5.F112 |
| 10.1-10.45FIXEDMOBILERADIOLOCATIONAmateur | 10.1-10.45RADIOLOCATIONAmateur | 10.1-10.45FIXEDMOBILERADIOLOCATIONAmateur |
|  | 5.480 |  |

**Reasons:** Provides an additional 300 MHz allocation to the EESS (active) for high resolution SARs as requested by Resolution 651 (WRC-12), taking into account that with such additional allocation (900 MHz total) picture resolution below 0.3 m is more or less provided.

ADD IRN/61A12/5

5.A112 The use of the frequency bands 9 200-9 300 MHz and 9 900-10 100 MHz by the Earth exploration-satellite (active) service is limited to systems requiring a necessary bandwidth greater than 600 MHz that cannot be fully accommodated within the 9 300-9 900 MHz frequency band.     (WRC‑15)

**Reasons:** To limit the number of systems as well as the duration of transmission of SAR systems in the extension frequency band.

ADD IRN/61A12/6

5.B112 In the frequency band 9 200-9 300 MHz, stations in the Earth exploration-satellite (active) service shall not cause harmful interference to, nor claim protection from, stations of the radionavigation and radiolocation services.     (WRC‑15)

**Reasons:** The EESS (active) primary allocation is made secondary with regard to the RLS and RNS allocations in this frequency band, to ensure protection of stations of these services from harmful interference.

ADD IRN/61A12/7

5.C112 Space stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU‑R RS.2066‑0.     (WRC‑15)

**Reasons:** It ensures protection of RAS stations in the frequency band 10.6-10.7 GHz.

ADD IRN/61A12/8

5.D112 Space stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU‑R RS.2065‑0.     (WRC‑15)

**Reasons:** It ensures protection of SRS systems in the frequency band 8 400-8 500 MHz.

ADD IRN/61A12/9

5.E112 In the frequency band 10 000-10 100 MHz, stations in the Earth exploration-satellite (active) service shall not cause harmful interference to, nor claim protection from, stations of the radiolocation service.     (WRC‑15)

**Reasons:** The EESS (active) primary allocation is made secondary with regard to the RLS allocations in this frequency band, to ensure protection of stations of these services from harmful interference.

ADD IRN/61A12/10

5.F112 In order to protect the systems of the fixed service the power flux-density values produced on the surface of the Earth by a space station of the Earth exploration-satellite (active) service shall not exceed the following values:

 −129 dB(W/m2) in 1 MHz, for 0° ≤ α ≤ 5°;

 −113 dB(W/m2) in 1 MHz, for 5° < α ≤ 6°;

 −112 + 25 ⋅ log(α − 5) dB(W/m2) in 1 MHz, for 6° < α ≤ 53°;

 −69.6 dB(W/m2) in 1 MHz, for α > 53°;

in any 1 MHz of the frequency band 9 800-10 100 MHz for the indicated angle of arrival α, assuming free-space propagation conditions.

**Reasons:** It ensures protection of FS stations in the frequency band 9 800-10 100 MHz.

SUP IRN/61A12/11

RESOLUTION 651 (WRC‑12)

Possible extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz
and/or 9 900-10 500 MHz

**Reasons:** The extension by 300 MHz has been approved by WRC-15.

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