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| **Council Expert Group on Council Decision 482**  **First meeting – Geneva, 27-28 September 2018** |  |
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| REVIEW OF PROCEDURE B FOR COMPLEX NON-GSO SATELLITE FILINGS | |

**1. Introduction**

The Terms of Reference of the Council Expert Group on Decision 482 mandates:

“*1. To further examine Procedures B and C described in Document C18/36, while taking into account considerations contained in Documents C18/36 (Addendum 1), C18/75, C18/83 and C18/90 as well as contributions submitted to its meetings.*

*2. To focus its examination of Procedure B on the cases of complex non-GSO satellite filings and to prepare a report containing recommendations about the possible revision of Decision 482 with regard to complex non-GSO satellite filings for submission to the 2019 ITU Council for action.*”

This document aims at providing more information to the Council Expert Group on the main cost drivers of the regulatory processes associated to complex non-GSO filings.

The current structure of Decision 482 was essentially decided by Council 2005 after a number of disputed methodologies were previously tried and three years of intense work were performed by an Ad hoc Group of Council.

During Council 2005, the Finance Committee established an Ad-hoc Group on Cost Recovery for Satellite Network Filings that held 7 meetings over 5 days. This Ad-hoc Group “agreed to concentrate its efforts in reviewing and examining Document C05/29 in order to arrive to a methodology for processing charges” of satellite networks but introduced various amendments in the proposed fee values in order to achieve a consensus (e.g. due to a too small statistical base for category N3, the Ad-hoc Group proposed to retain Category N3 with cost recovery fee equivalent to that of Category N2 ; in a similar manner, the Ad-hoc Group proposed to fix the cost recovery fee for category C3 at the level of 70% of that proposed in Document C05/29 ; for notification, the Ad-hoc Group proposed to apply 70% of the fee for cases where the application of No. 11.32A was not requested, with the remaining 30% to be charged to a subsequent request, if any, for application of No. 11.32A).

Therefore this document provides an assessment based on relative comparisons to existing resources used for processing non-GSO filings.

Based on this assessment, the document suggests some possible ways forward concerning Procedure B.

**2. Procedure B as presented in Document C18/36**

The current structure of Decision 482 was essentially decided by Council 2005, on the basis of [Document C05/29](https://www.itu.int/md/S05-CL-C-0029/en) on cost recovery for the processing of satellite network filings that is referenced in the Decision (see *considering* *ebis*). At the time of Council 2005, available statistics for non-geostationary satellite systems were limited (31 filings with an average of 45 units per filing, the maximum number of units for a single filing being 576) therefore the flat fee above 100 units was understood as an average between satellite systems of similar complexity and was adopted based on the value chosen for geostationary satellite networks. Prior to the period 2013-2014, this assumption proved to be remarkably valid (in the period 2005-2012, there were 46 filings with an average of 53 units per filing, the maximum number of units for a single filing being 639). Council 2005 never envisioned the sharp increase in units occurring since 2013. Moreover, the extremely low ceiling on the processing fees encourages the unlimited creation of multiple system configurations.

On this basis, [Document C18/36](https://www.itu.int/md/S18-CL-C-0036/en) introduced Procedure B as follows:

*“(…) Procedure B would limit the flat fee to a maximum number of units (e.g. 1000 if the pre-2013/2014 period is chosen as reference). Beyond this maximum number, any supplementary unit would be charged at a value equal to the flat fee divided by the maximum number of unit (e.g. 1000). (…)”*

Such procedure would be applicable to categories C1 to C3 and N1 to N3.

It should however be noted that, according to [Document C05/29](https://www.itu.int/md/S05-CL-C-0029/en), the introduction of a ceiling in the amount that can be invoiced for satellite cost recovery was mainly based on the fact that, in absence of a ceiling, “some specific satellite network filings would continue to give rise to large number of units, resulting in invoices of very important amount that administrations would keep on not paying; the increase of overdue payments and unpaid invoices result in shortfall of treasury for the Union to be covered by other sources of funding such as assessed contributions”. Procedure B as presented in Document C18/36 does not take into account this aspect.

**3. Procedure B as presented in Annex 1 to Document C18/36(Add.1) and in Document C18/90**

Under the proposed Procedure B as contained in Document C18/36, there would be no upper bound to the proposed cost recovery fee increase. ITU-R Working Party 4A therefore proposed a mechanism “to limit the Cost Recovery fee as the number of units becomes very large” and suggested that “the Bureau may wish to consider a new second breakpoint number of units, where filings with more units than this new second breakpoint number do not incur any further increases in their Cost Recovery fee, in order to provide the similar benefits to the filing administrations as the current flat fee at 100 units provides. A graphical comparison of the current Cost Recovery, Procedure B, and WP 4A’s new second breakpoint are shown below in Figure 1.”

Figure 1

Graphical Comparison of Cost Recoveries

100

flat

fee

Units

CR Fee

start

fee

Now

break

point

100

flat

fee

Units

CR Fee

start

fee

Procedure B

corresponding

new upper

bound

CR Fee

Units

WP 4A

new second

breakpoint

The remaining part of this document is based on this version of Procedure B.

**4. Main cost drivers specific to complex non-GSO filings**

Noting that complex non-GSO filings are almost always subject to coordination under Section II of Article 9, their processing involves the following process, which is similar to GSO satellite networks:

1. Validation of data with respect to requirement in Appendix 4
2. Regulatory examination (including conformity check with Table of Frequency Allocation) under RR No. 9.35/11.31
3. Establishment of applicable coordination requirements under RR No. 9.36 (only for those networks that are subject to coordination), as appropriate
4. Capture of the results of examination and publication in a BRIFIC under No. 9.38

**4.1. Validation of data**

Non-GSO satellite networks have additional data elements specified in Appendix 4 of the Radio Regulations compared to GSO satellite networks (orbital elements, phase angles of each satellite within each orbital plane, links between beams and orbits/satellites, orientation angles of beams, satellite antenna gain and spreading loss as a function of elevation angle, maximum and average beam peak eirp, etc.), which adds to the complexity of the coordination examination.

For those non-GSO satellite networks that are subject to epfd limits contained in Article 22, even more orbital parameters are required, including whether the space station uses station-keeping to maintain a repeating ground track, and if the space station uses station-keeping to maintain a repeating ground track, the time in seconds that it takes for the constellation to return to its starting position, i.e. such that all satellites are in the same location with respect to the Earth and each other, specific precession rate etc.. In addition, several additional parameters are required for the calculation of epfd limits, such as the pfd/eirp masks, information on the exclusion zone etc. Procedure C is specifically addressing this issue.

Along with these additional data requirements, administrations often submit large amount of descriptions in the form of notes from administrations, for which the Bureau has to analyse, examine and translate for the publication in the special sections. Therefore the time required for the treatment for completeness and correctness of these complex non-geostationary satellite systems is significantly different.

As noted by ITU-R Working Party 4A, “[t]he standardization of the information required under RR Appendix 4 is essential to the efficient treatment of the submissions. The BR reported that many administrations provide additional information (last paragraph in section 2.2) which is labour intensive to process; it needs to be determined whether this data can be submitted to the BR in standard electronic form. One possible way to reach this standardization would be to ask the BR to report on efficiencies that would minimize their effort by introducing new RR Appendix 4 items to capture additional data typically provided by administrations. This leads to reducing the complexity of those submissions and making their evaluation more efficient and streamlined.”

In preparing the draft CPM report on WRC-19 agenda item 7, ITU-R Working Party 4A has considered a number of changes related to Appendix 4, which have the potential to standardize input data on the long-term (noting that the Final Acts of WRC-19 are likely to come into force on 1st January 2021). This has led Working Party 4A to include several issues under WRC-19 agenda item 7. If they are adopted by WRC-19, the Bureau will then incorporate them into a new version of the SNS database, which will be available in time for the entry into force of the Final Acts. Such changes have the potential to reduce on the long-term the time spent in validating data of complex non-GSO filings. In the meantime, however, these complexities may lead to increased processing time for complex non-GSO filings, which, in turn, may impact the overall processing queue of all satellite networks subject to coordination since they are treated according to their order of arrival.

The Council Expert Group is invited to discuss whether the regular cost recovery fee structure should take into account the current lack of standardisation of some input data.

**4.2. Regulatory examination**

Two main technical examinations have to be carried out when examining complex non-GSO filings under No. 9.35/11.31, i.e. examining compliance with limits contained in Article 21 on the one hand and in Article 22 on the other hand.

**4.2.1. Examination of limits contained in Article 21**

For GSO satellite networks, the power flux-density (pfd) is calculated from a unique orbital longitude towards the Earth’s surface at a varying angles of arrival to determine the pfd excess for each frequency assignment.

This would be to some extent similar in the case of a non-GSO satellite network, if it had only one altitude for all satellites across all planes. One non-GSO satellite would then be sufficient to compute pfd levels for the entire constellation. However, when non-GSO satellite networks have more than one altitude within the constellation, pfd calculations need to be performed for each of the different altitudes. If there is a pfd excess for one altitude, an unfavourable finding has to be given for this case, which imply that the beam would need to be split in order to correctly represent the relationship between orbits and beams and that groups will also have to be split in order to give findings to the frequency assignments accordingly.

Furthermore, some of the larger non-GSO satellite networks received had an unprecedented scale of complexity in terms of varying altitude and beam configuration which went beyond the capacity of the corresponding tables in the SNS database and had to be treated manually using other means, especially concerning modifications to coordination requests of non-GSO satellite networks.

In addition, when the non-GSO satellite network is notified with a single orbital altitude, it is still possible to specifically indicate which orbital planes or even distinct satellites will be operating with specific beams. In terms of regulatory examination, the work carried out to take into consideration such specific beam/orbit links may involve complexity levels similar to that of an examination of a non-GSO satellite network having different orbital altitudes.

Noting that, in the past, the orbital configuration of non-GSO filings was rather simple, the pfd examination was performed manually. However, in light of the increase of complexity of non-GSO filings, the Bureau is developing an internal tool to render the pfd examination process more automated.

**4.2.2. Examination of limits contained in Article 22**

This issue is specifically addressed by the proposed Procedure C.

**4.3. Establishment of applicable coordination requirements**

Based on Appendix 5, coordination under Nos. 9.12, 9.12A and 9.13 (as well as No. 9.21/B) is simply triggered by frequency overlap, therefore, as long as the number of groups contained in complex non-GSO filings remains limited, the increase in orbital complexity will not lead to an increase of workload to establish coordination requirements.

However, in order to identify the list of administrations for coordination and agreement seeking under Nos. 9.14 or 9.21, the visibility of the non-GSO satellite network in respect of terrestrial services has to be determined. This factor depends on the combination of inclination angle and the altitude of the non-GSO satellites. Hence, the increased number of unique inclination angles in combination with altitudes contributes to the increased complexity in examination of non-GSO satellite networks.

**4.4. Capture of the results of examination and publication**

The complexity in capturing the results of examination is essentially driven by the number of different groups contained in the non-GSO satellite network following the splits that are necessary to distinguish between frequency assignments receiving favourable or unfavourable findings.

**5. Additional issue specific to complex non-GSO filings**

Finally, a specific issue related to complex non-GSO filings concerns their impact on the overall receivability, examination and publication process, because they require at all stages additional computing resources, increased human analysis and sometimes even software updates.

Procedure B could therefore also focus on the need to ensure that a form of upper bound to the units contained in non-GSO filings is established. This could be the purpose of the second ceiling that is suggested in section 3. If this approach is followed, the value of the ceiling would be determined on the basis of the added resources need to examine satellite networks above a certain threshold. Noting that 96.02% of the submissions are below 25000 units and 98.67% below 100000 units (see Annex), these two values could be used as the two breakpoints.

The Council Expert group is invited to consider the statistics shown in Annex to determine the most appropriate break point. On this basis, the Radiocommunication Bureau will be in a position to assess the added ressources needed to process non-GSO filings beyond the second breakpoint.

Annex

Examples and statistics related to Procedure B

Examples and statistics about the possible application of modified Procedure B have been computed based on the coordination requests and notifications of non-geostationary satellite systems published between 2007 and August 2018.

**Cases of coordination requests**: 226 submissions have been published during the abovementioned period.

55 (resp. 25, 7) submissions have exceeded 1000 (resp. 10000, 50000) units:

| **ADM** | **SATELLITE NAME** | **DATE OF RECEIPT** | **COST RECOVERY CATEGORY** | **UNITS** | **ORIGINAL INVOICE (CHF)** |
| --- | --- | --- | --- | --- | --- |
| G | O3B-B | 03.02.2011 | C1 | 2244 | 20560 |
| CAN | CANPOL | 07.04.2012 | C2 | 3213 | 24620 |
| G | L5 | 14.09.2013 | C1 | 3235 | 20560 |
| CAN | CANPOL-2 | 22.11.2013 | C2 | 3459 | 24620 |
| G | L5 | 06.12.2013 | C1 | 2720 | 20560 |
| G | L5 | 27.06.2014 | C1 | 3884 | 20560 |
| NOR | ASK-1 | 18.11.2014 | C2 | 6687 | 24620 |
| F | MCSAT-2 HEO-1 | 25.11.2014 | C1 | 102564 | 20560 |
| F | MCSAT-2 LEO-1 | 25.11.2014 | C1 | 150444 | 20560 |
| F | MCSAT-2 LEO-2 | 25.11.2014 | C1 | 44352 | 20560 |
| F | MCSAT-2 MEO-1 | 25.11.2014 | C1 | 211680 | 20560 |
| F | MCSAT-2 MEO-2 | 25.11.2014 | C1 | 69552 | 20560 |
| F | MCSAT-2 HEO | 01.12.2014 | C1 | 17664 | 20560 |
| CAN | COMMSTELLATION | 02.12.2014 | C1 | 3760 | 20560 |
| F | MCSAT LEO | 03.12.2014 | C1 | 3760 | 20560 |
| LIE | 3ECOM-1 | 10.12.2014 | C1 | 10624 | 20560 |
| F | MCSAT-2 MEO-1 | 12.12.2014 | C1 | 96390 | 20560 |
| NOR | STEAM-1 | 27.12.2014 | C1 | 10782 | 20560 |
| NOR | STEAM-2 | 27.12.2014 | C1 | 24420 | 20560 |
| CAN | CANPOL-2 | 06.01.2015 | C1 | 1608 | 20560 |
| G | L5 | 18.01.2015 | C1 | 4300 | 20560 |
| G | O3B-C | 10.03.2015 | C1 | 198953 | 20560 |
| LIE | 3ECOM-3 | 18.03.2015 | C1 | 10752 | 20560 |
| F | ES-SAT-2 | 03.04.2015 | C2 | 35883 | 24620 |
| CYP | ANDROMEDA-A | 30.04.2015 | C1 | 3826 | 20560 |
| NOR | NORSAT-H1 | 01.06.2015 | C2 | 8733 | 24620 |
| CAN | 102 | 27.11.2015 | C1 | 3810 | 20560 |
| F | MCSAT-2 LEO-2 | 14.12.2015 | C1 | 8064 | 20560 |
| F | AST-NG-C-3 | 20.06.2016 | C2 | 1504 | 24620 |
| NOR | SE-6-HEO-1 | 09.08.2016 | C1 | 9480 | 20560 |
| NOR | SE-6-HEO-1A | 09.08.2016 | C1 | 10216 | 20560 |
| NZL | APOG | 10.12.2016 | C1 | 1728 | 20560 |
| G | THEO | 22.12.2016 | C1 | 4404 | 20560 |
| HOL | HOL-MG-A006 | 29.12.2016 | C2 | 70603 | 24620 |
| SLM | SI-SAT-KURUKURU | 30.12.2016 | C2 | 5589 | 24620 |
| G | O3B-C | 01.01.2017 | C1 | 7561 | 20560 |
| NOR | STEAM-2B | 01.01.2017 | C1 | 10722 | 20560 |
| USA | USASAT-NGSO-3A-R | 01.01.2017 | C1 | 10842 | 20560 |
| USA | USASAT-NGSO-3B-R | 01.01.2017 | C1 | 14724 | 20560 |
| USA | USASAT-NGSO-3C | 01.01.2017 | C1 | 10830 | 20560 |
| USA | USASAT-NGSO-3D | 01.01.2017 | C1 | 13842 | 20560 |
| USA | USASAT-NGSO-3E | 01.01.2017 | C1 | 10830 | 20560 |
| USA | USASAT-NGSO-3F | 01.01.2017 | C1 | 13842 | 20560 |
| CAN | CANPOL-3 | 09.02.2017 | C2 | 1515 | 24620 |
| F | ZIP | 22.03.2017 | C1 | 2142 | 20560 |
| G | THEME | 29.03.2017 | C1 | 2007 | 20560 |
| G | L5 | 13.06.2017 | C1 | 3074 | 20560 |
| USA | USASAT-NGSO-4 | 24.08.2017 | C1 | 2017 | 20560 |
| F | AST-NG-C-4 | 05.10.2017 | C2 | 2608 | 24620 |
| F | EB-SAT-LEO-1B | 21.12.2017 | C2 | 3386 | 24620 |
| F | EB-SAT-LEO-1 | 21.12.2017 | C2 | 3386 | 24620 |
| CHN | SPACEWAY | 28.12.2017 | C1 | 9293 | 20560 |
| CAN | KELYPSIS | 19.01.2018 | C2 | 18278 | 24620 |
| LUX | LUX-N1-2 | 06.02.2018 | C1 | 11440 | 20560 |
| F | MCSAT-2 HEO | 17.10.2017 | C1 | 14900 | 20560 |

The following table shows the percentages of complex non-GSO coordination requests:

| **Number of units** | **Number of filings having less than the number of units** | **Percentage** |
| --- | --- | --- |
| 1000 | 172 | 76.11% |
| 2000 | 176 | 77.88% |
| 3000 | 182 | 80.53% |
| 4000 | 193 | 85.40% |
| 5000 | 195 | 86.28% |
| 6000 | 196 | 86.73% |
| 7000 | 197 | 87.17% |
| 8000 | 198 | 87.61% |
| 9000 | 200 | 88.50% |
| 10000 | 202 | 89.38% |
| 11000 | 210 | 92.92% |
| 12000 | 211 | 93.36% |
| 14000 | 212 | 93.81% |
| 15000 | 214 | 94.69% |
| 18000 | 215 | 95.13% |
| 19000 | 216 | 95.58% |
| 25000 | 217 | 96.02% |
| 36000 | 218 | 96.46% |
| 45000 | 219 | 96.90% |
| 70000 | 220 | 97.35% |
| 71000 | 221 | 97.79% |
| 97000 | 222 | 98.23% |
| 103000 | 223 | 98.67% |
| 151000 | 224 | 99.12% |
| 199000 | 225 | 99.56% |
| 212000 | 226 | 100.00% |

**Cases of notifications**: 403 submissions have been published from 2007 until end of August 2018

Two submissions have exceeded 1000 units:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ADM** | **STATION** | **Date of receipt** | **Cost recovery category** | **Units** | **Original invoice (CHF)** | **Procedure B (CHF)** |
| G | O3B-A | 07.10.2014 | N1 | 1684 | 30910 | 52052.44 |
| G | O3B-B | 05.02.2016 | N1 | 1684 | 30910 | 52052.44 |