

Counter Comments regarding TRAI CP¹PR^{2,3}

1.Introduction: The following may please be noted:

1.1 DoT's reference letter dated 11.07.2024⁴ is 'Seeking TRAI recommendations on terms and conditions of spectrum assignment including spectrum pricing for certain satellite-based commercial **communication services.**'⁵

1.2 The letter is result of a number of communications between DoT & TRAI.

1.2.1 The said communications seriatim are as below:

(a) DoT letter No. L-14006/01/2021-NTG dated 13.09.2021 Do to **TRAI**⁶.

(i) Through this letter "TRAI was requested to provide recommendations, ***inter-alia***, on the auction of spectrum for space-based communication services."

(b) Through the letters dated 27.09.2021 and 23.11.2021⁷ "**TRAI**.....sought, inter-alia, the following information/ clarifications in respect of space based communication services from **DoT**:

(a) Details of the frequency bands and quantum of spectrum available in each band required to be put to auction and associated information in respect of space-based communication.

(b) Whether spectrum for space-based communication is being envisaged to be assigned on exclusive basis or it would be shared among multiple service licensees?

(c) Details of spectrum assignment mechanism and methodology of charging currently being followed by DoT for space-based communication services."

(c) Through the letter dated 27.11.2021⁸ "**DoT**.....informed, inter-alia, that the information in respect of space-based communication services sought by TRAI will take some time; therefore, to avoid delay in 5G roll-out, TRAI may go ahead with consultations/ recommendations on issues excluding space-based communication services referred to in DoT's reference dated 13.09.2021 and 23.09.2021. Through the said letter, DoT also mentioned that the issues related to space-based communication services may be taken up separately on the receipt of information from DoT."

(d) Through the letter No. J-19022/01/2022-SAT dated 16.08.2022⁹ **DoT** provided information with respect to space-based communication services as sought by TRAI through the letters dated 27.09.2021 and 23.11.2021. While providing the said information,

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DoT requested TRAI to provide recommendations on certain additional issues. The relevant extracts of the DoT's letter dated 16.08.2022 are given below:

(a) TRAI, through consultations, may assess the demand for space-based communication services and accordingly provide recommendations on the quantum of spectrum in each band required to be put to auction.

(b) It is envisaged to auction the space spectrum on an exclusive basis. TRAI may explore feasibility and procedure of sharing auctioned spectrum among multiple service licensees. TRAI may provide recommendations on the sharing of auctioned frequency bands between satellite networks and terrestrial networks also, the criteria for sharing and appropriate interference mitigation techniques for sharing and coexistence.

(c) In frequency bands 27.5-28.5 GHz (identified for IMT) and 28.5-29.5 GHz (being studied for Captive Non-Public Networks), TRAI may recommend a mechanism for sharing of auctioned frequency bands in which both IMT/CNPN and satellite-based services (both user terminal and Gateways) can be provided in a flexible manner.

(d) Since the service providers may require spectrum both in user link as well as in feeder link, TRAI may take inputs from the stakeholders and recommend the appropriate auction methodology so that the successful bidder gets spectrum for user link (shared with IMT in flexible) as well as feeder link.

(e) In addition, TRAI may provide any other recommendations as deemed fit for the purpose of spectrum auction in these frequency bands, including the regulatory/ technical requirements as enunciated in the **relevant provisions of the latest ITU-R Radio Regulations.**¹⁰

(e) TRAI requested DoT "through a letter dated 19.10.2022¹¹to, inter-alia, clarify that for which kind of licensed services, spectrum for space-based communication has been envisaged to be granted through auction. DoT was requested to provide information as per the following table:

<u>No.</u>	<u>Type of service</u>	<u>Whether spectrum is envisaged to be assigned through auction (Yes/No)?</u>	<u>Reasons, if any</u>
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1 Access

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- 2 Internet
- 3 NLD
- 4 ILD
- 5 GMPCS
- 6 VSAT CUG (Commercial)
- 7 Captive VSAT CUG
- 8 Machine to Machine (M2M)
- 9 DTH
- 10 Teleport
- 11 DSNG
- 12 HITS
- 13 Any other relevant service
(please specify)

(f) DoT, through the letter dated 16.12.2022¹², conveyed that TRAI may provide suitable recommendations for each of the space-based **communication services after detailed examination.**

(g) "TRAI, through a letter dated 08.02.2024¹³, conveyed DoT that "the DoT's Reference requesting TRAI to provide its recommendations for auction of spectrum for space-based communication services, may require a review by DoT. Therefore, DoT is requested to provide the specific issues on which TRAI's recommendations are required on the subject."

1.3 A few observations as below are mentioned here for due consideration subsequently:

1.3.1 "level playing field" phrase is occurring '7' times in the extant CP as follows:

(a) "with terrestrial access services"¹⁴

(b) "level playing field" for enhanced participation of Non-Government Entities (NGEs) in carrying out end-to-end activities in the space domain"¹⁵.

(c) "level playing field with terrestrial access services for the following satellite-based communication services"¹⁶.

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(d) "Keeping in view the provisions of Section 4 and the First Schedule of the Telecommunications Act-2023, in terms of Section 11(1)(a) of TRAI Act 1997, TRAI is requested to provide its recommendations on terms and conditions of spectrum assignment including spectrum pricing while accounting for level playing field with terrestrial access services for the following satellite-based communication services:¹⁷

(e) Moreover, revenue-based spectrum charges takes into account the level playing field among operators of different sizes as smaller operators with lower revenues pay less and larger operators, who may generate more revenue, contribute more¹⁸.

(f)(g) It is noted that in its reference dated July 11, 2024, the Department of Telecommunications (DoT) has requested recommendations on the terms and conditions of spectrum assignment, including spectrum pricing, with consideration for ensuring a level playing field with terrestrial access services. In this context, it is essential to examine whether such a level playing field between service providers of NGSO based Fixed Satellite Services providing data communication and Internet services and GSO/NGSO based Mobile Satellite Services providing voice, text, data, and internet services. And terrestrial access service providers actually exists. Following this examination, if spectrum charges are to be levied as a percentage of AGR, the percentage previously recommended by the Authority may need to be reassessed"^{19,20}.

1.4 Radio Regulations:

(a) "TRAI is requested.....regulatory/technical requirements as enunciated in the relevant provisions Of the latest ITU-R Radio Regulations."²¹.

(b)"A variety of frequency bands can be used for providing satellite communication services." like:

"a) L-band: It ranges from 1 GHz to 2 GHz and is used for mobile satellite services (MSS) and global positioning system (GPS) navigation signals.

b) S-band: It ranges from 2 GHz to 4 GHz and is used for MSS, as well as weather and air traffic control applications.

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c) C-band: It ranges from 4 GHz to 8 GHz and is commonly used for fixed satellite services (FSS) such as television and radio broadcasting, telephony, and data transmission.

d) Ku-band: It ranges from 10 GHz to 15 GHz and is used for both FSS and MSS. It is commonly used for direct-to-home (DTH) television broadcasting and satellite internet services.

e) Ka-band: It ranges from 17 GHz to 31 GHz and is used for FSS and MSS applications. It is commonly used for high-speed broadband.

f) Q/V-band: It ranges from 37.5-51.4 GHz and is used for both FSS and MSS. It is commonly used for High-speed broadband services and in-flight connectivity^{14,22}.

(c) “**2.1.1** In the application of the Radio Regulations, the Radiocommunication Bureau uses the following units:

kHz for frequencies up to 28 000 kHz inclusive

MHz for frequencies above 28 000 kHz up to 10 500 MHz inclusive

GHz for frequencies above 10 500 MHz²²

(i) **2.2** In communications between administrations and the ITU, no names, symbols or abbreviations should be used for the various frequency bands other than those specified in No. **2.1**.”²³

1.5 Economical ‘Use of the Radio-Frequency Spectrum and of the Geostationary-Satellite and Other Satellite Orbits’²⁴

(a) ‘CHAPTER 6 – Spectrum economics’²⁵.

(i) There is a mention of ‘Report ITU-R SM.2012 Economic aspects of spectrum management’ in²⁶.

(b) ITU R Study Group SG 1²⁷ deals with Spectrum Management²⁸.

(i) SG1 is divided into three WPs on different aspects of spectrum management e.g (spectrum engineering techniques, spectrum management methodologies and economic strategies and spectrum monitoring).²⁹

(ii) These three WPs are known as WP 1A, WP 1B & WP 1C³⁰.

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- (iii) India (Republic of) [WPC(DoT)] is processing contributions to WP 1B such as:
 - (x) PRELIMINARY DRAFT REVISION OF REPORT ITU-R SM.2012-6—ECONOMIC ASPECTS OF SPECTRUM MANAGEMENT
 - (y) PROPOSED MODIFICATION TO THE PRELIMINARY DRAFT NEW REPORT ITU-R SM.[SPEC-AVAILABILITY]
- (iv) GOI [DoT(WPC)] has issued an Office Memorandum for NPC (National Preparatory Committee for ITU WRC 2027).
- (x) The out come of the said meeting is **successor** volume to current RR 2024.
- (c) DoT has a full fledged Economic Research Unit (ERU) headed by Economic Advisor (DoT)³¹.
- (i) ***Inter-alia*** this unit has interaction with INTERNATIONAL entities including ITU³².

1.6. “in December 2023, the Parliament enacted a new statute namely, ‘the Telecommunication Act, 2023’³³”The Act amends and consolidates the law relating to development, expansion and operation of telecommunication services and telecommunication networks, assignment of spectrum, and for matters connected there with or incidental thereto. The section 4 (4) of the Telecommunications Act, 2023 is reproduced below:

“The Central Government shall assign spectrum for telecommunication through auction except for entries listed in the First Schedule³⁴ for which assignment shall be done by administrative process.”

Explanation. – For the purposes of this sub-section,-

(a) "administrative process" means assignment of spectrum without holding an auction;"³⁵

1. ‘(3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint and different dates may be appointed for different provisions of this Act and any reference in any such provision to the commencement of this Act shall be construed as a reference to the commencement of that provision.”³⁶

2.Conclusions: From the exposition in para **1.** &, sub paragraphs there to, the following are worth consideration:

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1. Notwithstanding the prior events the nudge for the extant CP dated 27th September 2024 can be the DoT letter dated 13-09-2021 seeking TRAI recommendations on some spectrum issue.

(a) The tangible outcome, after a long journey of almost of TWO years, is a TRAI scheduled OHD³⁷

(b) The reasons for a long gestation period between an issue related to **SPECTRUM** and its resolution are the following (in no way exhaustive but limited to extant **CP**) are worth consideration:

(i) As per para **1.1.2.1(a)** above DoT sought TRAI Recommendations on the issue related to **SPECTRUM**.

(ii) As per para **1.1.2.1(b)** above. TRAI sought some information from DoT required to provide Recommendations.

(iii) As per para **1.1.(c)** above the scope of Recommendations sought by DoT from TRAI was changed due to delay expected in supplying the earlier details sought by TRAI from DoT.

(iv) As per paras **1.1.(d)(a)(b)(c)(d)** DoT while providing the information again changed the scope of Recommendations sought.

(v) As per para **1.1.(e)** the issue of use or latest **Radio Regulations** was also mentioned.

(vi) As per para **1.1.e** TRAI sought a new set of clarifications from DoT.

(vii) As per para **1.1.(f)** above DoT reiterated its request to TRAI but for “suitable recommendations.

(viii) As per para **1.1.(g)** above TRAI requested DoT for specific issues for providing Recommendations.

(ix) During this to and fro journey of communications between DoT & TRAI “**in December 2023, the Parliament enacted a new statute** namely, ‘the Telecommunication Act, 2023’.

(a) This ***inter-alia*** has an impact on scope of Recommendations sought by DoT from TRAI in the form of the extant CP³⁸.

(b) The scope is limited to ‘spectrum for certain satellite-based commercial

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communication services.³⁹

2. The phrase '**level playing field**' crops up time & again in DoT, TRAI, Stake Holders etc. dispositions in the field of communications.

(i) However there is no definition available either in legal frame work, regulatory frame work etc. nationally, internationally having universal applicability.

(ii) But one recent example of obvious disturbing of this undefined concept is "assignment of spectrum without holding an auction"⁴⁰

3. Radio Regulations: As per paragraphs, **1.1.4** the following issues are for further consideration:

(a) The nomenclature used for some frequency bands is different from the one provided in ITU Radio Regulations.

(i) The phrase "latest ITU-R Radio Regulations"⁴¹ has been used in the extant CP.

(ii) The phrase "ITU's Radio Regulations 2020"⁴² has been used in the extant CP.

4. Economic aspects of Spectrum Management:

(a) As per para **1.1.5** & sub paras there to WPC(DoT) *inter-alia* is handling various Economic Aspects of Spectrum

(i) DoT (ERU) inter-alia has interaction with ITU.

(b)(i) "Before formulating any pricing policy for satellite-based communication services, it is essential to understand the four different types of goods as defined in economics."⁴³.

(ii) These goods are categorized based on two key characteristics:

excludability and rivalry."⁴⁴.

(iii) "According to James Buchanan's "Economic Theory of Clubs"²⁷ (1965), club goods are economic goods that are excludable and have limited rivalry."⁴⁵.

(ii) "if satellite systems are designed to operate on shared spectrum with low or no rivalry in consumption..... the spectrum used for satellite-based communications".....would exhibit the characteristics of a "club good."⁴⁶.

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"The Indian Space Policy 2023 has a vision, *inter-alia*, to enable, encourage, and develop a flourishing commercial presence in space, and use space as a driver of technology development and derived benefits in allied areas for the nation's socio-economic development."⁴⁷.

....."participation of the space industry and start-ups to achieve greater social, economic, and technological progress for the country and humanity."⁴⁸.

5. SPACE: This word has appeared many times⁴⁹ in the extant CP⁵⁰. The following few are for further consideration:

(a) The said word is occurring in the phrase '**The Department of Space**'⁵¹.

(i) This department came into being on 01-06-1972 as per time line⁵²

(ii) The work was allocated as per⁵³.

(iii) Department of Space is enshrined in AOB.⁵⁴

(iv) "IN-SPACe"(Indian National Space Promotion and Authorization Center)⁵⁵ is a single-window, independent, nodal agency that functions as an autonomous agency in the Department of Space (DOS).

6. Legal Framework: "The Telecommunication Act, 2023"⁵⁶ *per se* is not a stand alone entity but part of universal set of Legal Framework. A few observations below:

(a) GOI MINISTRY OF LAW AND JUSTICE (Legislative Department) steered the publication of the same in ~~the Gazette of India~~ ~~1920~~ for general information.

(i) It has been passed by the Parliament.⁹

(ii) It has got the accent of the President.

(iii) As per section 60(1) ' the Indian Telegraph Act, 1885, and the Indian Wireless Telegraphy Act, 1933, are hereby repealed."⁵⁷.

(x) But this change is not reflected in the **Allocation of Business Rules**.⁵⁸.

(x) In fact no amendments have been incorporated since 2001⁵⁹ though, the **Allocation of Business Rules** have been amended up to 04-04-2024⁶⁰.

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(xx) For example Telecom Commission is renamed quite sometimes back as Digital Commission but no amendment has been incorporated since then in the said **Allocation of Business Rules**⁶¹ .

3.Issues for Consultation

Q1. Which frequency band(s)/ range(s) should be considered for the assignment to NGSO based Fixed Satellite Services for providing data communication and Internet service?

Please provide a detailed response separately for the user link and feeder link.

Q2. Which frequency band(s)/ range(s) should be considered for the assignment to GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet service.

Please provide a detailed response separately for the user link and feeder link.

Q3. What should be the maximum period of assignment of spectrum for - (c) NGSO based Fixed Satellite Services for providing data communication and Internet services, and (d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response along with international practice in this regard.

Q4. For assigning spectrum for NGSO-based communication services, whether every ITU filing should be treated as a separate satellite system? Please provide a detailed response along with international practice in this regard.

Q5. Whether the provisions of ITU-RR are sufficient to resolve interference related challenges and coordination issues? If not, what additional conditions should be prescribed while assigning frequency spectrum for -

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services; and

(b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and internet services?

Please provide a detailed response along with international practice in this regard.

(Q6. For satellite earth station gateways of different satellite systems operating in the same frequency range, whether there is a need to prescribe a protection distance or any other measures to avoid interference from each other–

(a) Between the gateways of GSO and NGSO systems; and

(b) Between the gateways of NGSO systems?

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If yes, please provide a detailed response along with international practice in this regard.
along with international practice in this regard.

Q7. In case the spectrum assigned for satellite gateway links is also assigned to terrestrial networks such as Fixed Service, IMT etc., what protection distance or criterion should be included in the terms and conditions of the assignment of spectrum for satellite gateway links to avoid any interference to/ from terrestrial networks? Please provide a detailed response along with international practice in this regard.

Q8. In case the spectrum assigned to the satellite user link is also assigned to terrestrial networks such as Fixed Service, what criterion should be included in the terms and conditions of the assignment of spectrum for satellite user links to avoid any interference to/ from terrestrial networks? Please provide a detailed response along with international practice in this regard.

Q9. Whether there is a need to prescribe any conditions to mitigate the risk of scarcity of satellite gateway sites? If yes, please provide a detailed response along with international practice in this regard.

Q10. In addition to the roll-out conditions recommended by TRAI for satellite-based Telecommunication Service Authorisation through its recommendations on the Framework for Service Authorisations to be Granted Under the Telecommunications Act, 2023 dated 18.09.2024, whether there is a need to impose certain additional roll-out obligations for the assignment of frequency spectrum for –

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services;

(b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services?

Please provide a detailed response along with international practice in this regard.

Q11. Whether there is a need to introduce a provision for surrender of frequency spectrum prior to the expiry of the period of validity of spectrum assigned for -

(c) NGSO based Fixed Satellite Services for providing data communication and Internet services;

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(d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? If yes, what should be the process, and associated terms and conditions such as minimum period of spectrum holding, notice period, surrender fee, etc.

Please provide a detailed response with justifications.

Q12. Whether there is a need to prescribe timelines for processing the applications for the assignment of frequency spectrum for-

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services;

(b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services?

Please provide a detailed response with justifications.

Q13. Whether there are any other suggestions related to assignment of spectrum for-

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services;

(b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services?

Please provide a detailed response with justifications.

Q14. Should spectrum charges for NGSO-based FSS providing data communication and Internet services, be levied:

i. On a per MHz basis, ii. On a percentage of Adjusted Gross Revenue (AGR) basis, or
iii. Through some other methodology? Please provide a detailed justification for your answer.

Q15. In case it is decided that spectrum charges for NGSO-based FSS providing data communication and Internet services should be levied on a per MHz basis, should these charges be calculated based on:

i. The Department of Telecommunications (DoT) order dated December 11, 2023, or
ii. An alternative approach (please specify)? Please provide a detailed justification to support your answer.

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Q16. If it is decided that spectrum charges for NGSO-based FSS providing data communication and Internet services should be levied on a percentage of AGR basis:

- i. What should be the appropriate percentage of AGR?
- ii. Should a minimum spectrum charge be specified to address the issue of inefficient utilization of spectrum? If yes, what methodology may be used to determine the amount of the minimum spectrum charge?
- iii. Is there an alternative approach that could be followed to address the issue of inefficient spectrum utilization? Please provide a detailed justification for your answers.

Q17. Considering the Adjusted Gross Revenue (AGR) based charging methodology currently followed for Commercial VSAT and in view of the enhanced scope of the Satellite service authorisation, what should be the spectrum charge, as a percentage of AGR, that should be levied on GSO-based FSS? Or, Should some alternative spectrum charging methodology be used for determining spectrum charges for GSO-based FSS? Please provide a detailed justification for your answer.

Q18. Should spectrum charges for GSO and NGSO-based MSS that provide voice, text, data, and Internet services be levied:

- i. On a per MHz basis,
- ii. On a percentage of AGR basis, or
- iii. Through some other methodology? Please provide a detailed justification for your answer.

Q19. If it is determined that spectrum charges for GSO/NGSO-based MSS providing voice, text, data, and Internet services should be levied on a per MHz basis, should these charges be calculated based on:

- i. The Department of Telecommunications (DoT) order dated December 11, 2023, or
- ii. An alternative approach (please specify)?

Please provide a detailed justification to support your answer.

Q20. If it is decided that spectrum charges for GSO/NGSO-based MSS providing voice, text, data, and Internet services should be levied on a percentage of AGR basis:

- i. What should be the appropriate percentage?

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ii. Should a minimum spectrum charge be specified to address the issue of inefficient utilization of spectrum? If yes, what methodology may be used to determine the amount of the minimum spectrum charge?

iii. Is there an alternative approach that could be followed to address the issue of inefficient spectrum utilization?

Please provide a detailed justification for your answers.

Q21. Whether there are any other issues/suggestions relevant to the spectrum charging for:

i. NGSO/GSO based FSS providing data communication and Internet services.

ii. NGSO/GSO based MSS providing voice, text, data, and Internet services.

The response may be submitted with proper explanation and justification.

AnsQ21. Q1 to Q 13 & Q14 to Q 20 are two distinct set of questions. But because of implicit relationships between the two, here are no specific answers individually but collectively the following is submitted for kind consideration:

(a) Delay in providing Recommendations to original CP⁶² in its current *avatar*⁶³ is lack of availability of data with TRAI and DoT as ans when needed for processing notwithstanding other reasons like intermittent in scope, change in legal framework framework etc.

(i) The attributes of data needed are primary three areas of **SPECTRUM** Management viz;⁶⁴ which inter-alia includes 'Economic aspects of **Spectrum Management**'⁶⁵.

(ii) TRAI has also reiterated this Economic aspect in the extant CP⁶⁶.

(b) Possible spectrum resources are:

NFAP based on RR 2024 Edition and

Roadmap for use of Radio Frequency Spectrum in India during next 10 years

Roadmap for use of Radio Frequency Spectrum in India during next 10 years

(i) DoT (**WPC**) has initiated action for:

(x) latest NFAP vide No. T- 11012 /03/2024-ISR dated 01-05-2024. Target is all over.

(xx) DoT(**WPC**) has issued a memorandum vide No. J-19045/019/2024-SAT Dated 10-10-2024 to assign spectrum on provisional basis to Licenses using authorised NGSO constellations.

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(c) 'independent, nodal agency that functions as an autonomous agency in the Department of Space (DOS)⁶⁷.

4. Suggestions

Based on the disposition in various paragraphs the following is submitted for kind consideration:

1. DoT(WPC) may expedite issuing latest NFAP based on ITU R Edition 2024.
2. Roadmap for use of Radio Frequency Spectrum.
3. The legal Framework of reference '67' may be placed in public domain.
4. Spectrum Management DoT(WPC) division
 - (i) One dealing with Govt.
 - (ii) Second dealing with Non Govt.
5. All aspects of present CP may be examined in DoT as there is big pool of expertise in:
 - (i) Finance
 - (ii) Accounts
 - (iii) Economic Aspect (a full fledged is in place in DoT headed by an Economic Advisor) (Spectrum Management)

5. References

1. https://traai.gov.in/sites/default/files/CP_27092024.pdf
2. https://traai.gov.in/sites/default/files/PR_No.68of2024.pdf
3. https://traai.gov.in/sites/default/files/PR_No.76of2024.pdf
4. Annexure-1.3 of supra '1'.
5. Para '1.13' of supra '1'.
6. Annexure 1.1 of supra '1'.
7. para 1.2 of supra '1'.

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8. Para 1.3 of supra '1'.
9. Annexure 1.2 of supra '1'.
10. Para 1.4(e) page '7/91' of supra '1'.
11. Para 1.7 of supra '1'.
12. Para 1.8 of supra '1'.
13. Para 1.12 of supra '1'.
14. Para '4.' page '11/91' of supra '1'.
15. Para '2.41.' page '27-28' of supra '1'.
16. Para 3.1 page '29/91' of supra '1'.
17. Para 4.7 page '54/91' of supra '1'.
18. Para 4.18 page '58/91' of supra '1'.
19. Para 4.19 page '58/91' of supra '1'.
20. Para 4.29 page '58/91' of supra '1'.
21. Para 2.15 page '17/91' of supra '1'.
22. page '35/464' of **Articles Radio Regulations Edition 2024 ITU.**

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23. *ibid.*
24. Para '4.1' page '52/91' of *supra* '1'.
25. Pages '171/333-198/333' of ITU R Handbook on National Spectrum Management
Edition of 2015
26. Page '198/333' of ITU R Handbook on National Spectrum Management
Edition of 2015.
27. page 25/52 of https://ntiprit.gov.in/pdf/itu/itu_intro.pdf
28. *ibid.*
29. <https://www.itu.int/en/ITU-R/study-groups/rsg1/Pages/default.aspx>
30. Para *supra* **1**.1.5.(b)(i).
31. <https://dot.gov.in/directory>
32. <https://dot.gov.in/economic-research-unit-eru-0>
33. <https://egazette.gov.in/WriteReadData/2023/250880.pdf>
34. section 4.(4) *ibid.*
35. section 4.(4)(a) of *supra* '31'.
36. section 1.(3) page '1/26) of *supra* '31'.
37. para 1.9 page 9/91 of *supra* '1'.

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38. supra '4'.

39. Para C.1.14 page '11/91' of supra '1'.

40. supra "33".

41. para 1.4 page '7/91' of supra '1'.

42. para 2.22,2.23 page '20/91' of supra '1'.

43. Para 4.3 page '52/90' of supra '1'.

44. ibid.

45. Para 4.3 page '52/90' of supra "1'.

46. ibid.

47. para 2.41 pages "(27-28)/91' of supra '1'.

48. para 2.41 page "2891" of supra '1'.

49. [('4' times on page '5'+ '8' times on page '6' + "10' times on page '7'+ '4' times on page '8'+ '3' times on page '9'+ '3' times on page '10'+ '1' time on page '12'+ '2' times on page '14'+ '2' times on page '18'+ '1' time on page '19'+ '4' times on page '20'+ '3' times on page '21'+ '2' times on page '22'+ '2' times on page '24'+ '2' times on page '25'+ '4' times on page '27'+ '10' times on page '28'+ '10' times on page '31'+ '6' times on page '32'+ '2' times on page '35' on page '35'+ '1' time on page '36'+ '1' time on page '37'+ '4' times on page '38'+ '3' times on page '39'+ '2' times '43'+ '1' time on page '53'+ '1' time on page '54')=96)].

50. supra '1'.

