



VIL/PB/RCA/2022/001

January 10th, 2022

Advisor (Networks, Spectrum and Licensing)

Telecom Regulatory Authority of India

Mahanagar Doorsanchar Bhawan

Jawahar Lal Nehru Marg (Old Minto Road),

New Delhi – 110 002

Kind Attn: Shri Syed Tausif Abbas

Subject: Vodafone Idea's Comments to TRAI Consultation Paper on Auction of Spectrum in frequency bands identified for IMT / 5G

Reference: TRAI Consultation Paper dated 30th November 2021

Dear Sir,

This is in reference to the TRAI's consultation paper on Auction of Spectrum in frequency bands identified for IMT / 5G issued on 30th November 2021.

Please find enclosed our comments on the questions raised in the captioned consultation on 'Auction of Spectrum in frequency bands identified for IMT / 5G issued on 30th November 2021'.

In the enclosed comments, we have also mentioned a detailed valuation model formulated by us. As the model contains confidential and commercially sensitive information, we request the Authority to keep the model confidential under Regulation 3(1) of the Telecom Regulatory Authority of India (Access to Information) Regulation, 2005" dated 04.03.2005.

The model is being submitted separately through a letter, over email. A non-confidential summary of this model has been included in our enclosed comments. We request TRAI to examine the said model as part of our submissions to the above-said consultation paper.

We request your kind consideration and support on our above-mentioned submissions and comments.

Thanking you,

myvi.in

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Yours sincerely,

For Vodafone Idea Limited

P. Balaji
Chief Regulatory & Corporate Affairs Officer

Enclosed: Above stated Comments to the consultation paper

Copy to: **The Secretary, TRAI**

VII Comments to the TRAI Consultation Paper on “Auction of Spectrum in frequency bands identified for IMT / 5G”

At the outset, we are thankful to TRAI for giving us this opportunity to provide our comments to the TRAI Consultation Paper on “Auction of Spectrum in frequency bands identified for IMT/5G”. In this regard, we would like to submit our comments for Authority’s kind consideration, as follows:

Executive Summary

1. The Indian telecom industry has had to invest in new technology cycles (2G to 3G to 4G) in the last 10 years, causing a huge drain on cash-flow.
2. After 6 years of the technology cycle change to 4G, the revenues of telecom industry has now barely reached the same levels as it was 6 years back whereas the ARPU is yet to reach the same levels. As a result, the industry has seen massive losses and negative return on investments made.
3. Globally, markets that have rolled out 5G in past 3 years have not seen any significant uptick in ARPUs. Infact, some of the countries which have ARPUs lower than global average, have shown near to NIL/marginal growth in ARPUs. This indicates that customers are not willing to pay more for 5G services.
4. What it means is that for the Telecom operators, there will be an additional cycle of spend on network capex and opex without driving revenues for a fairly long time. At the moment, industry has over 700,000 4G BTSs nationwide. These would have to be augmented to provide 5G coverage. Further, due to the need for coverage at higher frequencies, densification of network would mean an additional 450,000 more sites would have to be added over next 20 to 30 years. This would put lot of cashflow pressure on operators in the first 6-7 years even if we assume the ARPU uplift due to 5G is higher than what we witnessed globally. Hence for the operators, there is further financial burden and the return on investment shifts further down the road. It therefore makes it imperative to avoid cash outflow for spectrum payments in initial years.
5. However, it is to be noted that the 5G introduction is critical for various social-economic benefits expected. The positive rub-off for country like India will be, in industries like handset (where smartphone and 5G phone sale will drive industry revenue), content (OTT players selling more on fast wireless broadband networks), manufacturing (Make in India for the world), eCommerce and in delivery of enhanced services like entertainment,

gaming, InsurTech, EdTech AgriTech, FinTech, HealthTech, delivery of Government Services, Smart Cities, Smart Governance etc.

6. This technology cycle (i.e. 5G) would drive benefits in terms of (a) economic growth, (b) revenue for the Government through GST collections from various other sectors and (c) employment growth.
7. It is relevant to note that in China it is given for free for faster roll-outs for overall economic development, instead of spectrum auction as a means of revenue generation for Government. In USA, the spectrum is given for perpetuity. The Government will earn more revenue in case spectrum is reasonable priced and faster roll out of 5G is done.
8. Therefore, the Government and Regulator should come up with an auction process that ensures following, through the existing competitive market structure (3 private + 1 PSU), for its more than 1.3 bn growing population:
 - a. Adequate competition and choice
 - b. An industry which is able to invest into 5G
 - c. Drive adoption of 5G by encouraging innovation and delivery of new services over 5G network.
9. In our view, this can be achieved by:
 - a. Having an auction which ensures all 4 TSPs get access to adequate and affordable 5G Spectrum. Given the fragile financial health (which was the core reason for telecom reforms announced few months back), ensure that TSPs cash flows are not overburdened and they are able to launch 5G at the earliest.
 - b. Facilitating RoW and fiberisation of towers. As fiberisation would take time, in the interim, bundle E&V bands for backhaul purposes (considering the high bandwidth traffic to be carried over for 5G services) along with mid band access as part of reserve price so that price discovery can happen through auction.
10. As India has moved from administrative allocation of spectrum to Auction model, there have been different pricing models used, in the past decade. All these were in a particular context of government priority and industry status at that time. There were various valuation models used in past like Producer Surplus model, Production function approach, Multiple regression, last auction determined price, technical efficiency factor, economic efficiency approach etc.
11. These models are no longer valid in present times because the objectives that drive 5G are driven by national priorities which were not in place earlier (like Make in India/Production linked Incentive program Digital India, Start-up India, 1 Trillion dollar

Digital Economy etc.). Further, the operator segment has shrunk to four operators, with significant financial stress that has prompted government to come up with telecom reforms and financial package recently.

12. This will also prevent any potential NPAs to banking sector, which has happened in the past in telecom sector.
13. In light of the above, Government and Regulator should look auction process and pricing from the perspective of: 'Cash flows of Industry basis 5G roll-out and value the 5G spectrum basis the ability of industry to generate incremental cash flows'.
14. We have formulated a detailed valuation model, which is being shared separately with the Authority, to maintain confidentiality of the business and commercial aspects involved.

A. Valuation:

1. As would be seen from the valuation model being submitted by us, based on the incremental capex and opex required and for the propensity to pay for 5G services in India, the pricing of spectrum has to be significantly lower, especially for the spectrum band which is most relevant for 5G services i.e. 3300-3670 MHz band followed by mmWave band.
2. From the valuation model being separately shared by us with TRAI, it is evident that in the Likely scenario, the business case for telecom operators at the industry level is negative. In the Optimistic scenario, it is marginally positive. It is therefore clear that the business case for the 3rd and the 4th operator are negative even in the Optimistic scenario. Please note that in the transition to 4G, ARPUs have only declined despite 6 years of launch of service in India. Global experience of 4G transition also demonstrates flat revenues. Therefore, if such a trend were to continue for telecom operators, the 1.2 mn odd sites/BTSs to be deployed will leave a big hole in the P&L and balance sheet of Indian operators running into tens of billions of US dollar.
3. The reserve price for 3300-3670 MHz band would have to be reduced by almost 90% of the earlier valuation basis which reserve price of Rs 492 crores/MHz for pan-India spectrum was recommended. Given the huge capex requirement, this level of pricing can be supported only if we assume significant revenue growth and ARPU uplift for the industry.
4. For mmWave band (24.25 GHz to 28.5 GHz), the pricing should not be more than 1% of the pricing for 3300-3670 MHz on a per MHz basis. The global trends also indicate similar

pricing considering that the mm Band is a Capacity Band and the ecosystem is in nascent stage.

B. Quantum and Caps:

1. The fastest way to roll-out 5G services is by utilizing the existing asset base of present four TSPs in terms of network presence, security clearances, 5G trials etc
2. Historically, world over and in India, it is evident that if an operator does not roll out new technology(3G, 4G, 5G) when their competitors do so, then they become competitively weaker in very short time frame.
3. Thus, given 4 player requirement for country with > 1.3 bn growing young population, a minimum of 80 MHz spectrum in 3300-3670 MHz and 1GHz-1.2 GHz spectrum in 24.25-28.5 GHz is required for a TSP to able to offer 5g services to customers and stay relevant.
4. To ensure 4 relevant operators, and given the size of spectrum availability is only 370 MHz in 3300-3670 MHz and 4.25 GHz in mmWave bands, a spectrum cap of 100 MHz in 3300-3670 MHz band and 30% in mmWave bands, becomes imperative and is recommended.
5. If more than four relevant players are deemed necessary for any reason, more spectrum has to be made available to the industry in 3300-3670 MHz spectrum band.

C. Payment Terms: In the current financial stressed situation when Government had to step in through telecom reforms, the payment terms for upcoming 5G spectrum auction have to be such that the financial stress is neither aggravated nor it nullifies the liquidity support provided by the Government through reform package. In this light, we recommend following:

- a. Zero upfront payment
- b. 6 year moratorium followed by 20 annual instalments
- c. Interest at RBI repo rate

D. Multiplier effect – 5G contribution to Policy initiatives and other sectors: The Multiplier effect on economic growth, employment growth and key policy initiatives like start-up India, make in India, digital India, will provide significant upside to Government and Nation as a whole, by allowing 4 telecom operators to rapidly set-up digital superhighways without aggravating financial stress.

Global and Indian Context – 5G

1. Global Context:

- a. **ARPU uplift in global markets after 5G launch:** On analysis of ARPU of various global markets, it is evident that 5G has not resulted into any significant uptick of ARPUs for telecom operators within 3 years. A snapshot of various global markets is given as follows:

Country	5G Launch	ARPU - 5G Luanch Quarter (USD)	ARPU - Q4 21 (USD)	CAGR (%)	No of Qtrs
USA	Q2 2019	37.81	40.26	2.5%	10
Switzerland	Q2 2019	36.6	35.76	-0.9%	10
Australia	Q2 2019	25.37	24.01	-2.2%	10
UAE	Q2 2019	24.65	23.97	-1.1%	10
Spain	Q2 2019	18.5	18.42	-0.2%	10
Italy	Q2 2019	14.13	13.68	-1.3%	10
Saudi Arabia	Q3 2019	28.21	28.24	0.0%	9
South Korea	Q4 2018	25.51	27.55	3.5%	9
Finland	Q3 2019	20.87	21.34	1.0%	9
UK	Q3 2019	21.09	20.23	-1.8%	9
Germany	Q3 2019	13.71	13.24	-1.5%	9
Hungary	Q4 2019	11.3	11.33	0.1%	8
China	Q4 2019	6.92	6.83	-0.7%	8
Canada	Q1 2020	42.92	39.69	-4.4%	7
Japan	Q1 2020	28.21	29.26	2.1%	7
Hong Kong; SAR China	Q2 2020	15.1	15.75	2.8%	6
South Africa	Q2 2020	7.01	6.96	-0.5%	6
Denmark	Q3 2020	18.3	18.24	-0.3%	5
Singapore	Q3 2020	17.46	18.17	3.2%	5
Brazil	Q3 2020	4.66	4.82	2.7%	5
France	Q4 2020	23.01	23.18	0.7%	4
Israel	Q4 2020	15.47	15.21	-1.7%	4
Greece	Q4 2020	13.48	13.35	-1.0%	4
Overall Weighetd Avg		15.27	15.58	1.0%	8.02
Overall Simple Avg		20.45	20.41	-0.1%	7.57

**Source: GSMA Intelligence database*

Above table shows that in most of the countries, the ARPU has zero or negative CAGR %, in 6 to 10 quarters of 5G launch.

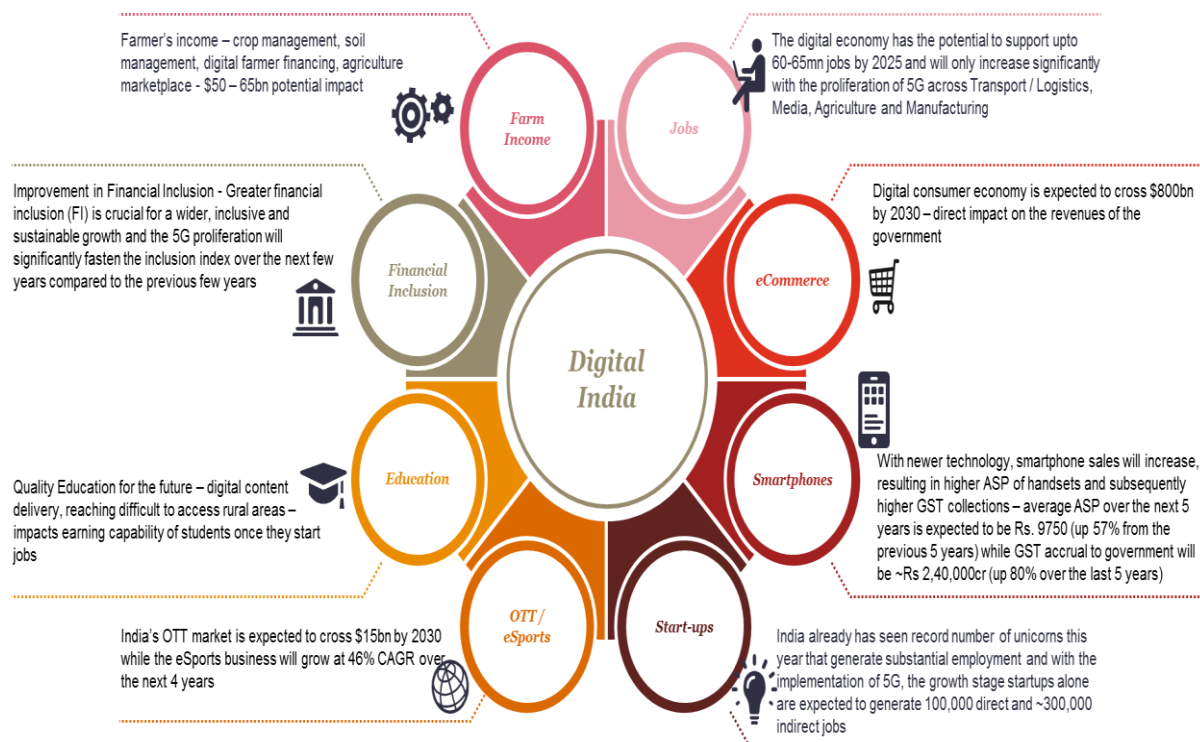
- b. Globally, it has been seen that technology change leads to growth in other sectors and for driving new age services relying on technology/communications.
- c. Juniper Research report of Aug 2021 on 'How 5G smartphones will supercharge the handset market' estimates that globally, 5G-compatible smartphones will account for over 50% of smartphone sales revenue by 2025; rising to \$337 billion from \$108 billion in 2021.

2. Indian Context

- a. **Revenue and ARPU uplift in India with 4G launch:** Telecom industry in India saw a significant revenue erosion in revenues and ARPU after launch of 4G technology in FY 2016. Both AGR and ARPU has negative CAGR for the block of FY 2016 to FY 2021, as seen from the table below:

Year	AGR (Rs cr)	ARPU (Rs)
FY15	138,566	123
FY16	154,333	128
FY17	147,306	111
FY18	116,459	82
FY19	103,308	73
FY20	121,390	87
FY21	147,527	105
CAGR FY16 - FY21	-0.9%	-3.9%

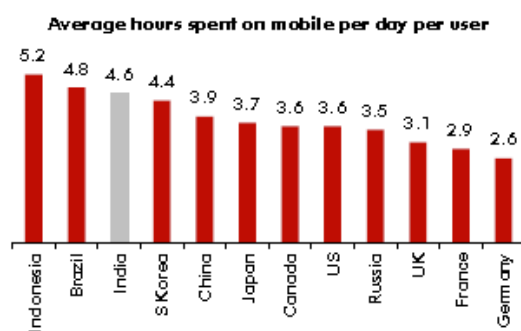
- b. **Financial health and Recovery of 4G investments:** As shown above, the revenues and ARPU has not grown in past 6 years, despite this being the period of most intense investments by the industry. That coupled with continued capex investment and large spectrum commitment, led to the present situation of the industry, where several operators had to close down because of financial stress.
- c. The financial stress in the telecom operator industry is well understood and it reached to a point where the Government has to step-in with a telecom reform package to provide large liquidity support by deferment of Government dues for a period of 4 years, in addition to various structural and procedural reforms which will be beneficial to the industry in long run.
- d. **Multiplier effect – benefits to Government and other sectors:**
- The telecom industry and adoption of technology cycles brings in critical economic multiplier that cuts across all industries and is the base of all new-age businesses like InsurTech, HealthTech, EdTech, FinTech, Mobile handset, D2C Media and Entertainment, eCommerce, FoodTech, AgriTech and lot more.
 - The telecom operators do not see the above benefits as they only provide connectivity services and this is also borne out by international experience of operators. The development of mobile broadband has clearly shown that neither the range of use cases nor the quantum of usage enhance the revenues streams of mobile operators.**



- iii. Indian council of research highlights that with newer technology like 5G, smartphone sales will increase, resulting in higher ASP of handsets as well as higher GST collections. Average ASP is expected to rise by 57% in 5 years and GST accruals to Government by 80% in same timeframe. **In the year 2015-16, the annual revenue of handset industry was INR 100,000 crores. It has already more than doubled to INR 230,000 crores p.a. and expected to be over INR 400,000 crores p.a. by 2025-26. It means that an additional INR 54,000 crores of GST would be contributed per annum entirely by the roll-out of 4G and 5G.** This excludes the multiplier effect of India becoming the manufacturing hub and export hub for handsets driving significant revenues for handset industry, Government and huge employment opportunity for Indian citizens.
- iv. GSMA has also estimated that 5G technology will contribute approx. \$450 billion to the Indian Economy in the period of 2023-2040. <https://data.gsmainelligence.com/research/research/research-2020/the-impacts-of-mmwave-5g-in-india>
- v. Rising tech awareness among farmers driven by high internet penetration and mobile connectivity, is expected to drive the Agriculture sector and along with Government initiatives, it is expected to peg the **market valuation at US\$ 30-35 billion by 2025**, according to Bain & Company's "Indian Agriculture: Ripe for Disruption" report.

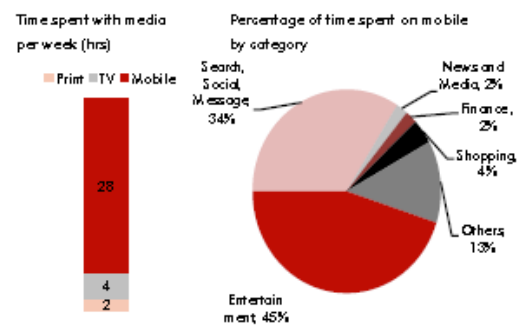
- vi. HealthTech or e-Health market is also set to boom due to the rise in internet penetration and digital transformation. According to 'India's e-health market opportunity Report 2021', the market is projected to hit **\$10.6 billion in revenue by 2025, up from \$2.5 billion in 2020**. The report says that e-pharmacy, though in a nascent stage, is expected to reach **\$4.2 billion by 2025**.
- vii. Driven on 5G, Indian connected car market is expected to reach **\$18-22 billion by 2030** including hardware, software and some services. Automotive electronics market is expected to reach **\$ 8-10 billion by 2025 with safety and ADAS systems** making the bulk of the market, where 5G and 4G as well, will play a significant role to make these successful innovations.
- viii. In manufacturing sector, the 5G based Private Network services will provide an opportunity to connect India with 'Industry Revolution'. IoT technology will play a key role in the future of Industry revolution.
- ix. India's OTT streaming industry, including video and audio, has the potential to touch **\$15 billion over the next nine years**, said a new report by independent transaction advisory firm RBSA Advisors. This would include a \$12.5 billion size for the video market and \$2.5 billion for audio. The size of the OTT market in FY20 stood at an estimated \$1.7 billion.

Exhibit 59: Indians spend more time on their mobile devices than the global audience (2020)...



Source: PwC/EY report 2021, Ambit Capital research

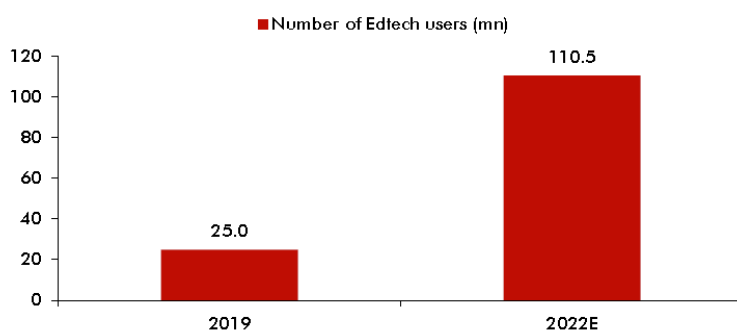
Exhibit 60: ...with majority of time being spent on entertainment where Pratilipi/Pocket Aces play



Source: Pocket Aces, Ambit Capital research

- i. The online retail market in India is expected to reach \$350 billion by 2030 from \$45-50 billion now, management consulting firm RedSeer Consulting said recently. Indian ecommerce would become the third largest market, eclipsing the more mature markets such as the UK and South Korea over the next decade.
- ii. Edtech and Fintech sector growth is also expected to be exponential, as seen from below.

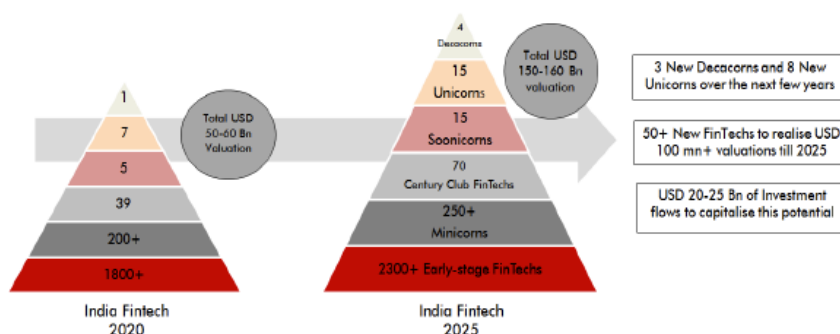
Exhibit 22: Edtech user growth is expected to be driven by increased internet penetration and spends on education and continuous learning



Source: RedSeer, Ambit Capital research

FinTech

Exhibit 50: Indian FinTech valuations are expected to be ~3x by CY25E from CY20 levels of USD50-60bn



Source: Pitchbook, Venture Intelligence, BCG, Ambit Capital research; Note: Decacorns – USD10bn+ valuation; Unicorns – USD1bn+ valuation; Soonicorns – USD0.5-1bn valuation; Century Club FinTechs – USD0.1-0.5bn valuation; Minicorns – USD1-100mn valuation; Early stage FinTechs – <USD 1mn

- e. **Past valuation approaches – Not relevant in present conditions:** In past, TRAI has considered various valuation methodologies like Producer Surplus model, Production function approach, multiple regression, last auction determined price, technical efficiency factor, economic efficiency approach etc. These valuation methodologies are not relevant in present context as:
 - i. Opportunity Cost / Producer Surplus: Value of cost savings that accrue to an existing TSP for serving a particular level of demand. This approach has the following issues:
 - a. Ignores the possibility that operators would resist increasing their network costs to meet increasing usage demand if such usage did not result in incremental revenue for them. This is particularly relevant now when the industry is already facing the issues related to servicing unprofitable usage.
 - b. Ignores the starting point of spectrum holdings. An incremental 5MHz is very different when the base is also 5MHz (thus doubling capacity) vs when the base is 50MHz (thus increasing capacity only by 10%). Yet the price/MHz remaining the same in these two scenarios implies that the producer surplus/MHz is the same in

both cases which logically will not be the case. The law of diminishing marginal utility clearly is being violated.

- c. Ignores changes in technology and data usage growing exponentially. When technology changes to meet exponentially growing data demand, sometimes the spectrum will not have the same value and even if it does, fresh capex will be required to deploy that spectrum for the new technology e.g. a producer surplus model that considered 2100 MHz cost savings for 2G in 2016 did not include the capex of refarming it for 4G in 2020.

ii. Production Function:

- a. This is a complex econometric model in a black-box mode which is difficult for operators to understand and comment upon.
- b. However, as TRAI itself notes in its recommendations dated 09.09.2013 - *“Most stakeholders have not favoured this methodology. The method has its limitations: any economic modeling involves both assumptions and a degree of abstraction. Any such model cannot possibly precisely reflect the real world.”*. Many other objections were listed under 4.23 clause of this recommendations.

- x. **Revenue Surplus: In 2015, TRAI also looked at the incremental value accruing to the operators. This is the valid approach in our opinion in so far as only the incremental value was to be considered.** However, instead of deriving the value of incremental spectrum to the operator, the total NPV of the telecom industry was considered and divided by the existing spectrum in the hands of the operators at that time. This approach is actually calculating the current value of telecom operators/MHz rather than the incremental spectrum being offered for sale in the auction. This is logically wrong to value incremental spectrum since it ignores the declining marginal utility of any input, spectrum in this case. Naturally the per MHz value of initial spectrum (which creates the business) is much higher than the per MHz value of incremental spectrum (which only sustains the business). Applying it in the current context where the requirement of spectrum is exponentially higher is compounding the error.
- xi. Technical efficiency approach has its limitation if the pricing of a spectrum band in peak commercial value is applied over the pricing of a spectrum band where ecosystem is yet to develop.
- xii. Indexation is also not the right way to determine the price of spectrum as it ignores the critical elements of demand/supply equation, competitive positions and spectrum holdings of operators, market size and revenue potential, status of global evolution of new technologies, network and device ecosystem, during an upcoming auction. That even if the previous auction successfully sold all available spectrum in a band/circle, in the next auction with fresh supply, the scarcity premium is lower and therefore, reserve prices should be set lower than the last auction’s discovered price. In case, the previous auction was unable to sell the entire available spectrum

in a band/circle, it stands to logic that the next auction should be at a significant discount to the last auctions reserve price. Finally, if there was no sale in a band/circle in the previous auction then the prices need to be dramatically slashed in the next auction.

- f. Considering Global indicators and Indian scenario, it is important to deliberate how much growth Indian operators will see from 5G technology in short term. Also, it needs to be considered that industry's financial health and investments in 4G technology also need to be secured.
- g. **Repair of Revenues and ARPU under existing 4G:** The revenues and ARPU in existing 4G also need to get repaired and go up, to provide some cushion for investment into 5G. Investment in 5G will come in terms of enhancing and further densification of networks, further fiberisation of networks and thus, it would add significant capex and opex cost burden on already financially stressed telecom operators.

3. Key Conclusions:

- a. Even with a very optimistic growth, the NPV of 5G to the industry considering revenue, capex and opex is only marginally positive. This assumes the a significant repair of 4G revenues/ARPU as a pre-requisite, which if doesn't happen, will further deteriorate the case for industry on 5G and make it unviable.
- b. Therefore, for 4-viable players, innovation and faster roll-outs of 5G networks, following is recommended:
 - i. Valuation of 3300-3670 MHz spectrum band to be reduced by around 90% of the earlier recommended price.
 - ii. Valuation of mmWave band (24.25 to 28.5 GHz) for 1 GHz maybe considered as 1% of valuation of 100 MHz of mid-band as arrived in point no. i above
 - iii. Reserve Price should be set-out at 50% of the valuation.
 - iv. Payment terms should be Zero upfront charges with 6 year moratorium and Interest at RBI repo rate for payment to be made over 20 years after end of moratorium period.
 - v. E-band for bridging the backhaul problem, by bundling with access spectrum of 3300-3670 MHz, and its pricing be considered as part of reserve price of said access spectrum.

In short, if the telecom operators are unable to do well financially, the infrastructure for 5G will not be created and the opportunity of multiplier effect on economy and larger

national objective, will be lost and that cannot be an option for India. Just like the Government has taken bold decisions of telecom reforms and PLI schemes to boost make in India, 5G should also be considered as a policy initiative by the TRAI and the Government. The Government has to take bold initiative of catalysing other Government objectives and growth of other sectors with multiplier effect, by taking a nuanced approach towards 5G spectrum valuation and auction.

Question-wise Comments

Q.1 Whether spectrum bands in the frequency range 526-617 MHz, should be put to auction in the forthcoming auction? Kindly justify your response.

VIL Comments to Q. No. 1:

1. Currently, there is no existing 3GPP ecosystem between 470 and 617 MHz. Conventional broadcasters showed interest in high-power high tower (HPHT) Single Frequency Network (SFN) support, free-to-air (i.e., SIM-less reception) and standalone DL broadcast carriers to 3GPP resulting in enhancements of LTE broadcast in Rel 14, Rel 16 and now Rel 17 including work on a band definition for 470-694 MHz, termed “5G Broadcast” from Rel 16 onwards. 3GPP Rel 17 specifications are expected to be completed in Q2, 2022. Ecosystem support would require visibility on large markets.
2. **VI thus recommends that spectrum range 526-617 MHz shall not be put up for the forthcoming auction.** The same shall be earmarked for the IMT usages and once the band plan is clear at 3GPP level, it should be put up for Auctions.

Q.2 If your answer to Q1 above is in affirmative, which band plans and duplexing configuration should be adopted in India? Kindly justify your response.

Q.3 In case your answer to Q1 is in negative, what should be the timelines for adoption of these bands for IMT? Suggestions to make these bands ready for adoption for IMT may also be made along with proper justification.

VIL Comments to Q. No. 2 and 3:

1. Ecosystems would still need to be triggered starting from the Rel.17 470-698 MHz post band definition. Guidance from administrations of large markets like India can play a decisive role in industry decisions to implement a new ecosystem. Specification work is still ongoing for Rel.17 and subsequently ecosystem developments will be critical factor in determining target timelines for deployment considerations
2. VI expect that post the band allocation and UE ecosystem triggering, it is **likely to be mid of year 2023 before the spectrum can be a usable commodity.**

Q.4 Do you agree that 600 MHz spectrum band should be put to auction in the forthcoming auction? If yes, which band plan and duplexing configuration should be adopted in India? Kindly justify your response.

VIL Comments to Q. No. 4:

1. Different options are under consideration for the 600 MHz band: the proposed APT band plans which are under evaluation and the existing band 71/n71.
2. In ITU-APT region, spectrum band plan options are under consideration based on the interest from member countries seeking to expand the available band to 2x40MHz. 3GPP investigates these options and we expect better clarity in terms of spectrum band plan and specifications over the course of the next months.
3. For the 3GPP band 71/n71 (617-698 MHz 2x 35 MHz FDD), there is an existing and evolving ecosystem supported in a wide range of devices. The band is widely allocated in North America - including USA, Canada, Mexico and Puerto Rico - and several countries in Regions 2 and 3 started or consider assigning the band 71/n71 as a genuine 5G band. Commercial networks have been already launched in the USA and Canada and. Saudi Arabia is expected to auction 2x35MHz in band 71/n71.
4. **VI recommends that N71 (617 – 698 MHz) shall be put up for the auction, while the exploration for the larger band (612–703 MHz) is being standardised. This will also assists TSPs should a new band name emerges from (612 to 703 MHz).**

Q.5 For 3300-3670 MHz frequency range, which band plan should be adopted in India? Kindly justify your response.

VIL Comments to Q. No. 5:

1. 3GPP has multiple bands covering range of the frequency between 3300-3670. Given all the band options, n78 is most suitable and covers the entire identified band with least overlap with non-IMT identified spectrum from NFAP.
2. As per latest GSA reports, > 800 devices already supports n78 and has highest share of all 5G spectrum bands from ecosystem development perspective. Majority of the 3.5GHz auctions undertaken world-wide, has range of frequencies covered through n78 spectrum band.
3. **VIL recommends that the range 3300 to 3670 MHz shall use the N78 band plan.**

Q.6 Do you agree that TDD based configuration should be adopted for 24.25 to 28.5 GHz frequency range? Kindly justify your response

VIL Comments to Q. No. 6:

1. TDD has already established itself more efficient through using common spectrum pool for both DL and UL operation without any need of the guard band which is required in FDD systems. mmWaves are expected to be deployed where very high demand of the data services and as we have observed based on internet traffic trends since 4G days, most of the data traffic is downlink centric. Hence deploying TDD spectrum will ensure efficient utilization of spectrum.
2. TDD requires less channel estimation time i.e. to estimate DL channel via uplink channel state information. This way operations like mMIMO and beamforming can be implemented very easily and efficiently.
3. Present 3GPP defined spectrum bands for frequencies >3GHz is TDD mode. Bands n257, n258 and n261 which are all covering the spectrum range between 24 - 29.5 GHz, are also TDD in configuration. The same for the n259 and n262 that cover the 40 GHz range.
4. **VI recommends using TDD based configurations for 24.25 to 28.5 GHz frequency range.**

Q.7 In case your response to Q6 is in affirmative, considering that there is an overlap of frequencies in the band plans n257 and n258, how should the band plan(s) along with its frequency range be adopted? Kindly justify your response.

VIL Comments to Q. No.7:

1. 3GPP provides flexibility for administration to choose from any band between n257, n258 and n261 in line with the national spectrum availability and deployment requirements.
2. WRC-19 covered the complete range of spectrum between 24.25 – 27.5 GHz for IMT identification, captured as n258 in 3GPP.
3. Post auction, its advised that operators are allocated contiguous spectrum in single band instead of spread across n257 and n258. To leverage the mmWave and help the handset ecosystem develop faster, it would be better to allocate the spectrum to all operators in one band first, unless there is a spill over.
4. **VI recommends considering 24.25 – 27.5 GHz as n258, and 27.5 – 28.5 GHz as n257.**
5. We further recommend that TSP(s) is allocated spectrum in the same band.
6. Industry would be able to leverage the mmWave spectrum better if all TSPs are allocated spectrum within a same band first, which will help push device ecosystem.

Q.8 Whether entire available spectrum referred by DoT in each band should be put to auction in the forthcoming auction? Kindly justify your response.

VIL comments to Q. No. 8

Yes. All available spectrum when put for auction with lower reserve prices (except spectrum from 526-617 MHz for the reasons as mentioned in comments to Q. No. 1), will incentivize the operators to purchase the spectrum and deploy it to provide the necessary services to the customers as well as assist in meeting the government's objectives of spectrum deployment. More Spectrum purchased will also ensure higher revenues to the government.

Q.9 Since upon closure of commercial CDMA services in the country, 800 MHz band is being used for provision of LTE services,

- a. Whether provision for guard band in 800 MHz band needs to be revisited?**
- b. Whether there is a need to change the block size for 800 MHz band? If yes, what should be the block size for 800 MHz band and the minimum number of blocks for bidding for existing and new entrants?**

(Kindly justify your response)

VIL Comments to Q. No. 9:

1. No change is suggested in Guard band in 800 MHz
2. For spectrum which are in use by TSPs, there is no need to change the block size for the 800 MHz, it should be kept same as previous auctions.

Q.10 Do you agree that in the upcoming auction, block sizes and minimum quantity for bidding in 700 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands, be kept same as in the last auction? If not, what should be the band-wise block sizes and minimum quantity for bidding? Kindly justify your response.

Q.11 In case it is decided to put to auction spectrum in 526-698MHz bands, what should be the optimal block size and minimum quantity for bidding? Kindly justify your response.

VIL Comments to Q. No. 10 and 11:

1. We recommend TRAI to be consistent with previous Auctions of having a harmonised approach for the sub-GHz bands like 700MHz, the 600 MHz spectrum of N71 and its variations shall be considered with a **block-size of 2x5 MHz (UL/DL)**.
2. Further, the minimum quantity for bidding for the spectrum band 617-698 MHz and 700 MHz, should be 2x10 MHz.
3. The block size for the spectrum which are in operational use in TSPs like in 900 MHz , 1800 MHz, 2100 MHz, 2300 MHz & 2500 MHz shall be kept as same as previous auctions.

Q.12 What should be optimal block size and minimum quantity for bidding in 3300-3670 MHz band? Kindly justify your response.

VIL Comments to Q. No. 12:

1. Similar to TDD spectrum like 2300 MHz & 2500 MHz, where in the block size of 10 MHz is considered and there is no minimum quantity decided, a similar approach shall be taken for the 5G services.
2. Should the regulator insists on the min spectrum size, it should be something more than the 4G allocations in TDD bands. Minimum spectrum holding of 80 MHz shall be considered.
3. **VI recommends a minimum 80 MHz of contiguous spectrum per mobile network in 3400 MHz to 3670 MHz spectrum band, with a block size to be of 10 MHz.**

Q.13 What should be optimal block size and minimum quantity for bidding in 24.25-28.5 GHz? Kindly justify your response.

VIL Comments to Q. No. 13:

1. Spectrum in the range of 1–1.2 GHz per operator would be required in mmWave of spectrum which include range 24.25 – 28.5 GHz, over a period of time. mmWave are expected to be deployed in the high traffic areas hence, require significantly higher bandwidth to provide the required extreme capacity. In line with the 3GPP defined carrier bandwidth for this frequency range.
2. mmWave is a capacity multiplier spectrum, thus it shall be ensured that parties with some allocation in other IMT bands shall only be eligible for the mmWave spectrum.

Fragmentation of the mmWave bands into non-contiguous chunks shall be avoided for proper utilisation of its capabilities.

3. VI recommends considering a block size of 100 MHz and minimum spectrum size of 800 MHz shall be considered. MmWave spectrum eligibility criterion shall include possession of other IMT spectrum.

Q.14 Whether any change is required to be made in the existing eligibility conditions for participation in Auction as specified in the NIA for the spectrum Auction held in March 2021, for the forthcoming auction? If yes, suggestions may be made in detail with justification.

and

Q.15 In your opinion, should the suggested/existing eligibility conditions for participation in Auction, be made applicable for the new spectrum bands proposed to be auctioned? If not, what should be the eligibility conditions for participating in Auction? Kindly justify your response.

VII Comments to Q. No 14 and 15

1. In addition to the existing eligibility conditions for participation in Auction as specified in the NIA for the spectrum Auction held in March 2021, Additional eligibility conditions shall be put in place to ensure/encourage that the first few years of 5G rollout in India is through operators, those who have done 5G trials, working with government, security agencies, demonstrated commitment to India use cases and in developing local ecosystem.
2. As per NIA for March 2021 auction the Eligibility criteria to participate in the Auction was:
 - (i) Any licensee that holds a UASL/ CMTS/UL with authorization for Access Services for that LSA; or
 - (ii) Any licensee that fulfils the eligibility for obtaining a Unified License*with authorization for Access Services and gives an undertaking to obtain a Unified License* for access service authorisation; or
 - (iii) Any entity that gives an undertaking to obtain a Unified License* for access service authorisation through a New Entrant Nominee as per the DoT guidelines/licence conditions can bid for the Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz & 2500 MHz Bands subject to other provisions of the Notice.
3. Such eligibility condition (to allow only the operators who participated in the 5G trials) is critical given that purpose of 5G spectrum auction is not limited to generation of revenue through spectrum sale but also to ensure that an entity acquiring the 5G spectrum will be committed towards long term investments required to realize 'Digital

India' vision. It is to be noted that in the past industry has witnessed a phase where telecom licenses were acquired by multiple companies who had no telecom experience and had limited ability to participate in building this critical infrastructure. Further, it is important to note that the availability of 5G is currently is limited to support the requirement of existing operators.

4. In case the Authority decide to allow other entities to participate for 5G spectrum auction, larger spectrum quantity should be made available, specifically in 3.3-3.6 GHz band and such entities should be subject to specific rollout obligation for the 5G spectrum acquired including mmWave spectrum.

Q.16 Is there a need to prescribe any measure to mitigate possible interference issues in 3300-3670 MHz and 24.25-28.5 GHz TDD bands or it should be left to the TSPs to manage the interference by mutual coordination and provisioning of guard bands? Kindly provide justification to your response.

VIL Comments to Q. No. 16:

1. For spectrum range 3300 – 3670 MHz, we recommend continuing with the best practices of defining frame structure prior to spectrum auction so that service providers are aware of the capacity and coverage.
2. As 5G use cases and network requirements evolve over time, operators should periodically be able to trigger a process to propose changes to the previously agreed TDD synchronization parameters at national, local, or international level; and this process should be defined prior to spectrum auction of 3300 – 3670 MHz.
3. In the case of mmWave networks, in addition to synchronization and semi-synchronization, an additional option is to allow asynchronous deployments whenever there is no reason to expect excessive interference.

Q.17 In case your response to the above question is in affirmative,
a. whether there is a need to prescribe provisions such as clock synchronization and frame structure to mitigate interference issues, as prescribed for existing TDD bands, for entire frequency holding or adjacent frequencies of different TSPs? If yes, what should be the frame structure? Kindly justify your response.
b. Any other measures to mitigate interference related issues maybe made along with detailed justification.

VIL Comments to Q. No. 17:

1. In our view, it will often be quite realistic for mmWave networks to operate in at least partially unsynchronized and independent manner. Moreover, even within the network of a single operator, it is possible to envision different mmWave clusters using different TDD configurations, and possibly adapting such configuration dynamically, depending on the time-variant DL/UL load ratio. Such arrangements could be of pivotal importance to exploit the increase in UL capacity and peak bitrates.
2. VI recommends that for 3300-3670 TSPs shall agree for a pre-defined TSS configuration and for mmWave it loosely synchronised and in case of interference it shall be managed between TSPs.

Q.18 Whether the roll-out obligations for 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz as stipulated in the NIA for last auctions held in March 2021 are appropriate? If no, what changes should be made in the roll out obligations for these bands?

VIL Comments to Q. No. 18:

Rollout obligations as stipulated in the NIA for the last auctions held in March 2021 seems to be appropriate and **does not require any changes.**

Q.19 What should be associated roll-out obligations for the allocation of spectrum in 526-698 MHz frequency bands? Should it be focused to enhance rural coverage? Kindly justify your response.

VIL Comments to Q. No. 19:

1. Since the band plan and other specifics of these bands are yet to be decided. Thus, these bands should not be subject to Roll out obligations. If the band is auctioned then it should be left to TSPs to decide the viability of this band rather than enforcing rural coverage objectives.
2. MRO objectives met in any band and technology shall be applicable for 5G services as well. For this proposes 3300 - 3670 MHz, 24.25 to 28.5 GHz, 600 MHz, 700 MHz shall be considered covered if a TSP is covering them under any technology (let's say 4G).

Q.20 What should be associated roll-out obligations for the allocation of spectrum in 3300-3670 MHz frequency band? Kindly justify your response.

VIL Comments to Q. No. 20:

1. This spectrum has Low in-building penetration and limited coverages, existing TSPs may take a balanced approach of providing coverage through available spectrum and balancing affordability, traffic demand and business viability.
2. Thus, existing TSPs shall not be subject to Rollout Obligations in this band.
3. New TSPs will need to meet the rollout criteria to be an equal play opportunity.

Q.21 What should be associated roll-out conditions for the allocation of spectrum in 24.25 to 28.5 GHz frequency range? Kindly justify your response.

VIL Comments to Q. No. 21:

1. As already indicated in the consultation paper, mmWave bands N257 & N258 is typically deployed for catering to traffic hotspots and for specialized 5G use case requiring high data speeds and lower latencies on a case by case basis.
2. Thus, these bands should not be subject to Roll out obligations.

Q.22 While assessing fulfilment of roll out obligations of a network operator, should the network elements (such BTS, BSC etc.), created by the attached VNO, be included? If yes, kindly suggest the detailed mechanism for the same. Kindly justify your response.

VIL Comments to Q. No. 22:

1. Since the VNO will be using the same spectrum resources as the network operator to augment or complement the coverage already established by its own network elements, they should be included while assessing the fulfilment of rollout obligations.
2. VNOs are not required to install their BTS, BSC etc.
3. Roaming arrangements (inter-circle and intra-circle) between operators shall also use the same principles, i.e. Rollout fulfilment of Host network shall also be passed on to the Tenant Network.

VI recommends that rollout fulfilment of Host operator shall be passed on to VNOs and any roaming agreements.

Q.23 Whether there is a need to review the spectrum cap for sub-1 GHz bands? If yes, what should be the spectrum cap for sub-1 GHz bands. Kindly justify your response.

VIL Comments to Q. No. 23:

1. There is no need to change the existing caps for sub-GHz bands for the bands already in use for 4G i.e. 800MHz and 900MHz.
2. For 5G, given the deep rural reach of mobile broadband in India, each operator will need to have between 2 x 10-20MHz of sub-GHz spectrum in the 600MHz and 700MHz bands, which has availability of 2x35MHz and 2x30MHz respectively.
3. **Therefore, we recommend that for spectrum cap purposes, the spectrum of 600MHz and 700MHz be clubbed and additionally capped at 2 x 20 MHz, to enable rural 5G by at least 4 operators.**

Q.24 Keeping in mind the importance of 3300-3670 MHz and 24.25-28.5 GHz bands for 5G, whether spectrum cap per operator specific to each of these bands should be prescribed? If yes, what should be the cap? Kindly justify your response.

VIL Comments to Q. No. 24:

3300 – 3670MHz:

1. This band is the most crucial band for launch of 5G services considering the device ecosystem and the balance between coverage and penetration.
2. It is thus imperative that the auction rules prevent hoarding / monopolization.
3. There should be at least four TSPs (3 private + 1 PSU) that are in a position to provide 5G services to the customers.
4. The minimum amount of spectrum would be at least 80 MHz for providing good quality services.
5. Considering that the available quantum is 370MHz, it would be prudent to cap the spectrum ownership at 100 MHz which will allow at least four TSPs (3 private TSPs + 1 PSU) to be competitive and work towards winning the customer through best quality 5G services.

24.25 – 28.5GHz:

1. As can be seen from global examples, there are significant capacity benefits of having mmWave spectrum bands supporting 5G services. 24.25 - 28.5 GHz (mmWave) has a lower coverage owing to higher propagation losses.
2. This spectrum should be earmarked for 5G services as this band has application in hotspot capacity augmentation and FWA services. Thus, given 4 player requirement for country with > 1.3 bn growing young population, a minimum of 80 MHz spectrum in 3300-3670 MHz and 800-1000 MHz spectrum in 24.25-28.5 GHz is required for a TSP to be able to offer 5G services to customers and stay relevant.
3. Like in the case of the 3300MHz band, to ensure adequate competition and competitiveness in delivery of services we recommend the spectrum cap for this band should be 30% of the total available spectrum in this band.
4. The cap in this band should not be part of the overall cap of spectrum and should be considered separately.
5. We recommend that operator is allocated spectrum in the same band.
6. Industry would be able to leverage the mmWave spectrum better if all TSPs are allocated spectrum within a same band first, which will help push device ecosystem.

Q.25 Whether there should be separate spectrum cap for group of bands comprising of 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands together? If yes, kindly suggest the cap along with detailed justification.

VIL Comments to Q. No. 25:

No, the existing framework suffices.

Q.26 Whether overall spectrum cap of 35% requires any change to be made? If yes, kindly suggest the changes along with detailed justification.

VIL Comments to Q. No. 26:

No change in overall spectrum cap. However the 24.25-28.5GHz band should not be included in the cap calculation as it will skew the denominator.

Q.27 For computation of overall spectrum cap of 35%, should the spectrum in 3300-3670 MHz and 24.25-28.5 GHz bands be included? Kindly justify your response.

VIL Comments to Q. No. 27:

The 3300-3670MHz band can be included in the overall 35% calculation. However the 24.25-28.5GHz band should not be included in the cap calculation as it will skew the denominator.

Q.28 Any other suggestion regarding spectrum cap may also be made with detailed justification.

VIL Comments to Q. No. 28:

1. It is imperative that for 5G network which will require huge backhaul capacity coupled with network densification, the current tower Fiberization should move from the present 35% to 85%, which will take considerable time due to inherent issues in building infrastructure and time it takes to take local permissions and disproportionate costs.
2. Alternate solution to above issue would be deployment of E/V Band for Back-haul offers a wireless fibre type option, which can mitigate the concerns of deploying fibers to 5G sites.
3. Thus, in our view, E/V band should be made available to licensed TSP, only for backhaul purposes. As, spectrum has to be auctioned as per Hon'ble Supreme Court Judgment, the best way to ensure the auctioning of E/V band is to bundle it for Back-haul purposes with 3300-3670 MHz mid-band Access spectrum. Allocation should be 2 slots of E-Band for every 40 MHz of Access. So, for 80 MHz of minimum bidding quantity of spectrum in 3300-3670 MHz, 4 slots of E-band should get bundled and allocated to winning bidder.
4. The said 4 slots of E-Band maybe considered part of reserve price of 80 MHz of Access spectrum.

Q.29 What should be the process and associated terms and conditions for permitting surrender of spectrum for future auctions? Kindly justify your response.
and

Q.30 What provisions may be created in the spectrum surrender framework so that any possible misuse by the licensees, could be avoided? Kindly justify your response.
and

Q.31 In case a TSP acquires spectrum through trading, should the period of 10 years to become eligible for surrender of spectrum, be counted from the date of original

assignment of spectrum or from the date of acquisition through spectrum trading?
Kindly justify your response.

and

Q.32 Whether provision for surrender of spectrum should also be made available for the existing spectrum holding of the TSPs? If yes, what should be the process and associated terms and conditions? Kindly justify your response.

and

Q.33 Whether spectrum surrender fee be charged from TSPs? If yes, what amount be levied as surrender fee? Kindly justify your response.

VII Comments to Q. No. 29 to 33:

1. The purchase and sale of spectrum is done basis certain assumptions by the operators and the government in terms of the potential social benefit the spectrum would help achieve, the operators ability to roll out and continue providing quality services and the revenue earning potential for the operators for the entire duration of the spectrum holding period as well as the capability of the consumers to pay for these services. These assumptions drive the reserve price the government sets and the bids the operator quotes for purchasing the spectrum.
2. However over a period of time these assumptions may not hold true due to number of reasons and it results in excess burden on the operators to continue holding the spectrum. This in turn impacts their ability to deliver quality service to the customers which hinders the government's objective of deriving maximum social benefit from the spectrum.
3. TSPs should thus be allowed to surrender spectrum after 10 years from the allotment of the spectrum. The TSPs should give 6 month notice to surrender the spectrum
4. There is significant amount of the investments to be done by the any operator, specifically while rolling out the new technology in the initial years post spectrum acquisition while the cash generation takes time. Considering above factors, in case the any operator is willing to surrender the spectrum after a period of 10 years, it would imply that such operator doesn't see any value generation from even after a period of 10 years.
5. Further, the provision of surrender should clearly reflect the amount to be charged for the pro-rata use of spectrum, any payment made by the operator prior to spectrum surrender should be adjusted from the pro-rata value and balance to be paid/ received from the operator. There should not be any liability towards such spectrum post surrender.
6. **Considering above and the advance notice period, NO surrender fee should be charged from the TSPs while surrendering spectrum.** The government has already received the pro rata payments for the utilization of the spectrum from the operator and charging any surrender fees may act as an inhibitor for the operator to surrender the spectrum.

7. **TSPs should be allowed to surrender existing spectrum and the modalities of this surrender should be the same as those for the forthcoming auctions except that the time period should be 6 years (33% of 20 year period, in line with 33% of 30 year period for forthcoming auctions) from date of allotment of spectrum.**
8. When a TSP is surrendering spectrum, in a single 'instance' it may surrender spectrum in different bands and circles spectrum acquired in different auctions. For all such spectrum in a single instance, the pro-rated value of the balance validity of the spectrum on the date of surrender will have to be compared with the dues payable to the Government. If the net sum is negative i.e. the pro-rated value is less than the dues payable then the TSP will be required to pay the net sum to the Government at the time of the surrender. If the net sum is positive, i.e. the pro-rated value is more than the dues payable, then the TSP will have the option of either adjusting it against
a) Quarterly License fees/SUCs payable b) Annual spectrum instalments payable on account of past auctions c) Payments for future auctions d) any other payments to be made to the Government.

Q.34 Which factors are relevant in the spectrum valuation exercise and in what manner should these factors be reflected in the valuation of spectrum? Please give your inputs with detailed reasoning.

VIL Comments to Q. No. 34

Following factors should be taken into consideration in the spectrum valuation exercise:

1. **Stage of development of services:** The current stage of development of services for which spectrum is to be used should be considered in the spectrum valuation exercise. Benchmark of Spectrum which is primarily used for existing technologies with established ecosystem and commercial value of which would be at its peak in recent auctions (e.g. 1800 MHz) should not be applied to a product which is in its nascent development phase (e.g. 700 MHz and 3300-3670 MHz). The stages of both the spectrum as well as technologies deployment are entirely different and a simple technical efficiency value can't be applied to derive spectrum valuation
2. **Revenue potential:** It has been seen during 4G, new technology doesn't bring in substantial incremental revenues instead it majorly displaces revenues from existing revenue streams. This is the most critical factor and should be considered while determining the reserve price.
3. **National Benefit:** Launch of New services such as 5G is required for the benefit of society and nation at large like financial inclusion, emergence of start-ups, employment

generation etc. as we have mentioned in the preface. Spectrum is the key raw material to this provide connectivity to 1.3 billion Indians and to realise the 'Digital India' vision. However, telecom will only be one of several platform in the entire value chain. Hence, it is important that the pricing of the spectrum should be done in such a manner that left sufficient cash flows to invest in rolling out and expanding the 5G network and introduce new technologies rather than a long term burden for the operators.

4. **Low Reserve Price:** Keeping the high reserve price results in artificial barrier to get the right value of the spectrum. In 2010 spectrum auction, the winning price of the spectrum was multiple times of the reserve price, which clearly established that market will discover the right price of the spectrum and there is no need to keep the reserve price equal / closure to the perceived value of the spectrum. Hence, reserve price should be set low, kindly refer to the 5G valuation approach suggested by us in response to Q[•].
5. **Declining marginal utility of every MHz of spectrum** – In past industry has witnessed that adding new spectrum doesn't add to incremental revenue in the same proportion. The marginal revenue generation with incremental spectrum acquisition shows a declining trend, hence the technical efficiency of higher capacity throughput with new technology has practically no correlation with incremental revenues for the industry and should not be the only factor to determine the market value.
6. **Global indicators showing very high Indian spectrum prices comparatively:** Globally the prices of 5G spectrum sold have been significantly lower than the reserve price recommended by TRAI earlier for 3300-3600 MHz. In fact the reserve spectrum price in India is at 9.35x of the ADP of European countries, as is evident from the table given below at **Table-T3**.

Table-T3

Country	Euro/MHz/Pop	ARPU (Euros)	Euro/MHz/Pop/ARPU
	3500 MHz	Q1 2021	Q1 2021
Germany	0.1554	11.40	0.01362
UK	0.0683	16.96	0.00403
Greece	0.0284	11.69	0.00243
Portugal	0.0885	10.78	0.00821
Switzerland	0.0315	31.04	0.00102
Hungary	0.0035	9.91	0.00035
Spain	0.0415	16.04	0.00259
Czech	0.0179	10.67	0.00168
Ireland	0.0363	23.75	0.00153
Romania	0.0022	6.03	0.00036
Average			0.00358
India	0.04	1.24	0.03347
India / Average			9.35x

Q.35 In what manner, should the extended tenure of spectrum allotment from the existing 20 years to 30 years be accounted for in the spectrum valuation exercise? Please support your response with detailed rationale/ inputs.

VIL Comments to Q. No. 35

1. Similar to India, telecom sector of many other countries has suffered from market fragmentation and high overheads, with margins shrinking and debt rising year by year. In India, the increase in debt for the operators is primarily due to high spectrum prices.
2. One of the country i.e. Spain has extended the duration of spectrum to 40 years. It has been highlighted that extending the duration of these concessions (is) a way of guaranteeing stability, predictability and adequate return on investment for the operators. The change in legislation will allow telecommunications companies and investors better visibility on their investment in the heavily indebted sector, which requires high levels of spending to build infrastructure such as fibre optic networks.
3. The auction in which got conducted in 2021, provide spectrum with initial holding rights until 2041, with an automatic renewal for a further 20 years with no additional fees, subject to meeting license obligations. Such additional spectrum durations is to make the spectrum attractive so that mobile operators are incentivized to make the investment and the nation is benefitted with early launch of 5G services.

4. The Indian telecom industry is currently into deep financial stress and a large part of the debt is on account of spectrum liabilities, we believe that there is no rational for assigning a higher value to the spectrum due to extension duration going from 20 to 30 years in India for future auctions. It is also to be noted that the estimating the incremental value of the spectrum due to extension of life from 20 to 30 years will be considering various factors like industry ability to monetize the spectrum, competitive environment, technological advancement etc, will remain constant during the valuation period. Such exercise will imply estimating the impact of various unknown factor today and forcing industry to pay for the same. **Hence, we believe the valuation of spectrum should not be changed due to expansion of the life of spectrum.**

Q.36 What could be the likely impact of the following auction related telecom reforms announced by the Government in September 2021 on the valuation of various spectrum bands?

- a. **Rationalization of Bank Guarantees to securitize deferred annual spectrum payment instalments in future auctions**
- b. **No spectrum usage charges (SUC) for spectrum acquired in future auctions**
- c. **Removal of additional SUC of 0.5% for spectrum sharing**
- d. **Provision for surrender of spectrum**

In what manner, should the above provisions be accounted for in the valuation of spectrum? Please support your response with detailed justification.

VIL Comments to Q. No. 36

1. The telecom reforms announced by the Government in September 2021 were need of the hour keeping in view the financial stress faced by the industry and in fact these were demanded by the industry for a long time in its various communications. These reform measures are introduced to address the liquidity related issues as well as provide long term benefit to all the operators. These reforms should also encourage efficient utilization of spectrum resource via spectrum trading or surrender of spectrum if not required.
2. In our opinion, these relief measures do not have any impact on the valuation of various spectrum bands due to the following reasons:
 - a) **Rationalization of Bank Guarantees to securitize deferred annual spectrum payment instalments in future auctions:** While announcing the telecom reforms, the Government in its press release has said that

“For Auctions held henceforth, no BGs will be required to secure instalment payments. Industry has matured and the past practice of BG is no longer required.”

As this is more of a procedural reform to manage the bank exposures at the operator's end without any direct loss to DoT, this should not have any impact on valuation of spectrum in different bands.

- b) **No spectrum usage charges (SUC) for spectrum acquired in future auctions:** The National Digital Communications Policy (NDCP) provides – *“Reforming the licencing and regulatory regime to catalyse Investments and Innovation, and promote Ease of Doing Business by – Reviewing of levies and fees including LF, SUC and the definition of AGR and rationalisation of Universal Service levy.....”* .

This has been a long pending demand of the Industry for removal of the SUC and this was levied for administrative purposes.

However, the valuation methodology suggested by us for mid band 5G spectrum (3.3 -3.6 GHz), takes into account the impact of the SUC savings on entire AGR of the Industry, as there is No SUC on the incremental spectrum acquired by the Industry, while working on the 5G spectrum valuation.

- c) **Removal of additional SUC of 0.5% for spectrum sharing:** Removal of the additional SUC of 0.5% for spectrum sharing is not related to the valuation of spectrum and it should not have any impact on spectrum valuation.
- d) **Provision for surrender of spectrum:** This reform providing for surrender of spectrum after 10 years is a step in right direction. However, we have the following submission in this regard:
- i. As we have mentioned above the extension of the life should not have any implication on spectrum valuation
 - ii. There is significant amount of the investments to be done by the any operator, specifically while rolling out the new technology in the initial years post spectrum acquisition while the cash generation takes time. Hence, the NPV of the initial years is negative.

Considering above factors, in case the any operator is willing to surrender the spectrum after a period of 10 years, it would imply that such operator doesn't see any value generation from even after a period of 10 years. Hence, such provision should not have any impact on the valuation of spectrum and there should not be any fee for spectrum surrender.

Q.37 Whether the auction determined prices of March 2021 auction be taken as the value of spectrum in the respective band for the forthcoming auction in the individual LSA? Should the prices be indexed for the time gap (even if less than one year or just short of one year)? If yes, please indicate the basis/ rate at which the indexation

should be done, with reasons.

VIL Response to Q. No. 37

In our opinion, following points require consideration in this regard:

1. The price derived in any spectrum auction for any specific band depends upon various factors, including the availability and contiguity of spectrum, the demand and supply at a given time (some of the previous auctions have seen higher prices because of artificially constrained supply), the technology for which the specific spectrum band is being deployed globally and the development of ecosystem of equipment and devices etc. There is no doubt that the changes are occurring over time in the underlying demand, supply, evolution of technology, market expectations in the sector and the larger economy have important effects on auction outcomes, and the actual valuations change based on the same. Considering these, it is not right to assume that value of spectrum only increases with passage of time. Further, industry has seen that despite reduction in prices from one auction to another in many cases the spectrum remain unsold, hence there is no rationale to increase/index the spectrum prices.
2. Specifically considering the outcome of the last auction held in 2021, we believe that there is no rationale for adopting the realized/ auction determined prices achieved in the March 2021 auction for various spectrum bands as the reserve price in respective spectrum bands for the forthcoming auction for the following reasons:
 - a. **All spectrum sold in the auction were at reserve prices:** In 2021 spectrum auction, spectrum was sold at reserve prices only and there was no price increment in even a single LSA band combination. The spectrum was acquired by the operators due to various factors such as impending renewals, urgent capacity requirements, etc. However, these purchases at reserve prices in no way signify that reserve prices are an ideal benchmark for determining reserve prices for forthcoming auction.
 - b. **Spectrum unsold in all bands (except 2300 MHz):** As per annexure 3.2 'Status of Sale of Spectrum in March 2021 Auction', % of spectrum sold of spectrum put for auction in each of the bands (except some circles in 2300 MHz band and 1 circle in 1800 MHz band) was less than 100% implying that spectrum remained unsold post the auction. This clearly points to the fact that the reserve prices set were quite high thereby, a national resource such as spectrum lying unutilized.
 - c. **Value of 900 MHz decline over a period of time** - We have seen 900 MHz spectrum auction in year 2014/2015 and in the year 2021 and following table summarizes the results of these auctions

Price per MHz (Rs crore)

Sr.No.	Circles	Winning price 2014/2015	Reserve price 2021	Change 2014/2015 Vs 2021	Winning price 2021	Change RP Vs WP
1	Bihar	444	201	-54.8%	201	0.0%
2	Gujarat	673	373	-44.6%	373	0.0%
3	Himachal Pradesh	57	37	-35.6%	37	0.0%
4	Kerala	369	199	-46.1%	199	0.0%
5	North East	52	23	-55.7%	23	0.0%
6	Uttar Pradesh (East)	776	262	-66.2%	262	0.0%
7	West Bengal	208	124	-40.2%	124	0.0%
Total (a)		2,579	1,219	-52.7%	1,219	0.0%
8	Andhra Pradesh	681	417	-38.7%	0	
9	Assam	185	83	-55.1%	0	
10	Delhi	741	585	-21.0%	0	
11	Haryana	151	102	-32.5%	0	
12	Karnataka	558	238	-57.3%	0	
13	Kolkata	195	221	13.5%	0	
14	Madhya Pradesh	310	195	-37.0%	0	
15	Maharashtra	773	523	-32.3%	0	
16	Mumbai	563	691	22.7%	0	
17	Uttar Pradesh (West)	739	211	-71.4%	0	
Total (b)		4,894	3,266	-33.3%	-	
Total (a) + (b)		7,473	4,485	-40.0%		
18	Odisha	NA	86	NA	86	0.0%
19	Tamilnadu	NA	235	NA	235	0.0%
20	Punjab	361	No auction			
21	Rajasthan	709	No auction			
22	Jammu & Kashmir	NA	No auction			

It is very clear from the above that:

- i. **Indexation is not the right way to determine the price of spectrum** – Out of the 17 circles where spectrum was put to auction for 900 MHz band in both 2014/2015 and 2021 auctions, in all 17 circles the Reserve Price was significantly lower than the 2014/2015 winning prices. This reduction was recommended by TRAI itself. Despite significant cut in reserve prices, spectrum remained unsold in 10 circles and sold at reserve price only in remaining 7 circle. This clearly establishes that value of 900 MHz spectrum has declined significantly in last 6-7 years and that there is absolutely no rational to apply indexation to the reserve price or auction discovered price.
 - ii. **Value of Spectrum has declined** - In all 17 circles the reserve prices in 2021 were lower than 2014/2015.
3. It is clear from the above that the true price discovery is a function of demand and supply at the time of the auction. Hence, in our opinion, there is no case for directly adopting the realized/ auction determined prices achieved in the March 2021 auction for various spectrum bands as the reserve price in respective spectrum bands for the forthcoming auction. As mentioned above, the reserve prices shall be reduced significantly to attract interest from operators based on their commercial rationale. Also, there is absolutely no need for any indexation of value of spectrum.

Q.38 If the answer to the above question is in negative, whether the valuation for respective spectrum bands be estimated on the basis of the various valuation approaches/methodologies being followed by the Authority in the previous recommendations, including for those bands (in an LSA) for which either no bids were received, or spectrum was not offered for auction?

VII Comments to Q. No. 38

- 4. Past valuation approaches – Not relevant in present conditions:** In past, TRAI has considered various valuation methodologies like Producer Surplus model, Production function approach, Multiple regression, last auction determined price, technical efficiency factor, economic efficiency approach etc. These valuation methodologies are not relevant in present context as:
5. Opportunity Cost / Producer Surplus: Value of cost savings that accrue to an existing TSP for serving a particular level of demand. This approach has the following issues:
- a. Ignores the possibility that operators would resist increasing their network costs to meet increasing usage demand if such usage did not result in incremental revenue for them. This is particularly relevant now when the industry is already facing the issues related to servicing unprofitable usage.
 - b. Ignores the starting point of spectrum holdings. An incremental 5MHz is very different when the base is also 5MHz (thus doubling capacity) vs when the base is 50MHz (thus increasing capacity only by 10%). Yet the price/MHz remaining the same in these two scenarios implies that the producer surplus/MHz is the same in both cases which logically will not be the case. The law of diminishing marginal utility clearly is being violated.
 - c. Ignores changes in technology and data usage growing exponentially. When technology changes to meet exponentially growing data demand, sometimes the spectrum will not have the same value and even if it does, fresh capex will be required to deploy that spectrum for the new technology e.g. a producer surplus model that considered 2100 MHz cost savings for 2G in 2016 did not include the capex of refarming it for 4G in 2020.
6. Production Function:
- a. This is a complex econometric model in a black-box mode which is difficult for operators to understand and comment upon.
 - b. However, as TRAI itself notes in its recommendations dated 09.09.2013 - *“Most stakeholders have not favoured this methodology. The method has its limitations: any economic modeling involves both assumptions and a degree of abstraction. Any such model cannot possibly precisely reflect the real world.”*. Many other objections were listed under 4.23 clause of this recommendations.

7. **Revenue Surplus: In 2015, TRAI also looked at the incremental value accruing to the operators. This is the valid approach in our opinion in so far as only the incremental value was to be considered.** However, instead of deriving the value of incremental spectrum to the operator, the total NPV of the telecom industry was considered and divided by the existing spectrum in the hands of the operators at that time. This approach is actually calculating the current value of telecom operators/MHz rather than the incremental spectrum being offered for sale in the auction. This is logically wrong to value incremental spectrum since it ignores the declining marginal utility of any input, spectrum in this case. Naturally the per MHz value of initial spectrum (which creates the business) is much higher than the per MHz value of incremental spectrum (which only sustains the business). Applying it in the current context where the requirement of spectrum is exponentially higher is compounding the error.
8. Technical efficiency approach has its limitation if the pricing of a spectrum band in peak commercial value is applied over the pricing of a spectrum band where ecosystem is yet to develop.
9. Indexation is also not the right way to determine the price of spectrum as it ignores the critical elements of demand/supply equation, competitive positions and spectrum holdings of operators, market size and revenue potential, status of global evolution of new technologies, network and device ecosystem, during an upcoming auction. That even if the previous auction successfully sold all available spectrum in a band/circle, in the next auction with fresh supply, the scarcity premium is lower and therefore, reserve prices should be set lower than the last auction's discovered price. In case, the previous auction was unable to sell the entire available spectrum in a band/circle, it stands to logic that the next auction should be at a significant discount to the last auctions reserve price. Finally, if there was no sale in a band/circle in the previous auction then the prices need to be dramatically slashed in the next auction.

Q.39 Whether the method followed by the Authority in the Recommendations dated 01.08.2018 of considering auction determined prices of the auctions held in the previous two years be continued, or the prices revealed in spectrum auctions conducted earlier than two years may also be taken into account? Kindly justify your response.

VIL Comments to Q. No. 39

Same as comments to Q. No. 37 and Q. No. 38

Q.40 Whether the valuation exercise be done every year in view of the Government's intention to have an annual calendar for auction of spectrum?

Please support your response with detailed justification.

VIL Comments to Q. No. 40

In our opinion, there is no need to do a valuation exercise every year in view of the Government's intention to have an annual calendar for auction of spectrum. One year is a very short period to warrant any change in the Auction Determined Prices of last conducted auctions.

The valuation exercise should be done only in the following scenarios:

1. **If there is any significant change in the industry structure:** In case where there is a significant change in Industry structure in terms of level of competition, introduction new technology or set of products and services, notable technological advancements etc.
2. **If a new spectrum frequency is put to auction or new technology is being introduced or no price discovery has happened till date:** Only for the cases where a spectrum frequency is put to auction or there was no price discovery in the earlier spectrum auctions for a particular LSA band combination, there may be a need for a valuation exercise be done.

Hence, in our opinion, there is no need to do a valuation exercise other than the couple of scenarios as highlighted above and broad principles put forward in Q38 shall be applied to arrive at spectrum pricing for the next auction.

Q.41 Whether there is a need to bring any change in the valuation approaches/ methodologies followed by the Authority for spectrum valuation exercises in view of the changing dynamics in the telecom sector largely due to the usage of various spectrum bands by the TSPs in a technologically neutral manner? If yes, please provide suggestions along with a detailed justification about the methodology.

VIL Comments to Q. No. 41

1. The reserve prices, in the past, were determined by TRAI on the basis of following broad principles:
 - a. Value of savings/opportunity cost for an operator
 - b. Past auction price for the same band or technical efficiency factor applied for another spectrum band.

2. The above approach / methodologies applied by TRAI in past were relevant for established technologies/bands but are not relevant in the current scenario to determine the value of spectrum where new technology / band to be deployed. Detailed comments in this regard are given in comments to Q. No. 37 and 38 above.
3. 5G is expected to create significant social-economic benefits like financial inclusion, emergence of start-ups, employment generation etc. All these will add to government revenue while telecom will be acting only as a platform in this entire value chain.
4. Hence, pricing for 5G should be looked at considering following:
 - a. DCF of incremental cash flow to the industry, adjusting for the incremental opex and capex, to determine the perceived value of 5G.
 - b. Reserve price should be 50% of the above value as 5G ecosystem is still developing.
 - c. Industry's paying capacity (looking at the past auctions) especially of the 3rd / 4th operator in the industry. Currently, the industry is not at the same financial stability level as past and hence paying capability is further reduced.
 - d. The 3rd highest spending operator in every auction has not spent at an average more than Rs 10,000cr in the last 4 auctions, as is evident from the table given below at **Table-T4**.

Table-T4

Operator	2010	2012 / 13	2014	2015	2016	2021
Jio	12,784	-	10,974	10,078	13,672	57,123
Bharti	30,944	6,248	19,294	36,982	18,863	18,699
Vi	17,386	3,038	30,360	56,267	33,077	1,993

- e. Global Benchmarks at price/MHz/Pop adjusted for ARPU, as provided above at **Table-T3**, in comments to Q. No. 34

Q.42 In your opinion, what could be the possible reasons for the relative lack of interest for the spectrum in the 2500 MHz band? Could this be attributed to technological reason(s) such as development of network/device ecosystem or availability of substitute spectrum bands or any other reasons(s)? Please support your response with detailed justification.

VII Comments to Q. No. 42

In our opinion, following are the main reasons for lack of interest in 2500 MHz band:

1. **High reserve prices:** In 2016 recommendations TRAI recommended the reserve price of the spectrum in 2500 MHz band equal to the spectrum in 2300MHz band. Further, in 2018 recommendations, TRAI made use of 2016 recommended reserve prices in case spectrum was offered but could not be sold in October 2016 auction, and the auction determined prices revealed in October 2016 auction, duly indexed for LSAs where auction took place. Hence, it can be said that the proper price discovery has not been made yet.
2. Pricing of this band should be reviewed considering that none of the offered spectrum in the last auction was sold. We recommend a 70% reduction in reserve price considered for March 2021 auction.
3. **Harmonization of 2500 MHz spectrum :** It is important to have contiguous spectrum for MBB services, In current circumstances having two dis-continuous blocks (separated by 80 MHz) of spectrum increases the capex cost, reduces the spectrum efficiency and makes it un-viable to use for efficient 5G services.

Q.43 Whether the March 2021 auction determined prices be used as one possible valuation for the spectrum in 2300 MHz band for the current valuation exercise? If yes, should these prices be indexed for the time gap and at what rate? Please justify your response.

VII Comments to Q. No. 43

1. In our opinion, March 2021 auction determined prices may be used as one possible valuation for the spectrum in 2300 MHz band for the current valuation exercise as the entire spectrum put to auction was sold.
2. However, as mentioned earlier, there is absolutely no case for indexing these prices for time gap.

Q.44 Whether auction determined prices of October 2016 (i.e. for the auction held earlier than two years) be used as one possible valuation for the spectrum in 2500 MHz band for the current valuation exercise? If yes, should these prices be indexed for the time gap and at what rate? Please justify.
and

Q.45 Whether the value of the spectrum in 2300 MHz/ 2500 MHz bands should be derived by relating it to the value of spectrum in any other band by using technical efficiency

factor? If yes, which band and what rate of efficiency factor should be used? If no, then which alternative method should be used for its valuation? Please justify your response with rationale and supporting studies, if any.

VIL Comments to Q. No. 44 and 45

1. During the previous recommendations TRAI took a view that the auction revealed prices in the preceding two years would be reasonable to be considered for the purpose of valuation in the present exercise.
2. In case of 2500 MHz band, for the March 2021 auction, prices were based on auction determined prices of October 2016 (i.e. for the auction held earlier than two years) the spectrum was put to auction in 12 LSAs in March 2021 auction but it remained entirely unsold.
3. This clearly indicates that the prices of October 2016 auction is not the correct benchmark to be applied for valuation of spectrum of 2500 MHz band.
4. **In our view, considering that none of the spectrum put to auction in 12 LSAs could be sold in last auction, a price reduction of at least 70% shall be made in the reserve prices considered for March 2021 auction while performing the valuation of 2500 MHz band.**

Q.46 In your opinion, what could be the possible reasons for the relative lack of interest for the spectrum in the 700 MHz band? Could this be attributed to technological reason(s) such as development of network/device ecosystem or availability of substitute spectrum bands or any other reasons(s)?
and

Q.47 Whether the value of spectrum in 700 MHz band be derived by relating it to the value of other spectrum bands by using a technical efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your views with rationale and supporting studies, if any.
and

Q.48 If your response to the above question is in negative, what other valuation approach(es) be adopted for the valuation of 700 MHz spectrum band? Please support your response with detailed methodology.

VIL Comments to Q. No. 46 to 48

In our opinion the main reason for the relative lack of interest for the spectrum in the 700 MHz band is very high valuation of spectrum slow development of the overall 5G ecosystem

at that time, and high capital investment required for rolling out the 5G services using this spectrum.

Keeping in mind the above factors, in our opinion, prices of spectrum in 700 MHz band should be suitably adjusted and reduced.

Q.49 Whether the valuation of the 3300-3670 MHz spectrum band should be derived from value of any other spectrum band by using technical efficiency factor? If yes, what rate of efficiency factor should be used? If no, which other method(s) should be used for its valuation? Please justify your response with rationale and supporting documents, if any.

VIL Comments to Q. No. 49

1. During earlier consultations on spectrum pricing held by TRAI, it has been recommended that pricing for 3300 MHz-3670 MHz should be equal to 30% of 1800 MHz, we have submitted some global examples whereby its pricing was coming around 2% of 1800 MHz.
2. **Stage of development of services:** In our view, the current stage of development of services for which spectrum is to be used should be considered in the spectrum valuation exercise. Benchmark of Spectrum which is primarily used for existing technologies with established ecosystem and commercial value of which would be at its peak in recent auctions (e.g. 1800 MHz) should not be applied to 3300-3670 MHz spectrum which is in its nascent development phase. The national objectives to be achieved through these bands/technologies, stages of both the spectrum as well as technologies deployment are entirely different and a simple technical efficiency value can't be applied to derive spectrum valuation.
3. Any high valuation will discourage any participation from the operators in this band (3300-3670 MHz) which is considered crucial for rollout of 5G services.
4. **In our opinion, the prices of spectrum in 3300 MHz-3670 MHz band shall be made as per the valuation method submitted by us, the value of the spectrum should be at best 10% of earlier valuation done by TRAI. Further, the reserve price should be 50% of the value derived instead of 80% applied by TRAI.**
5. At Q. No. 41, we have provided our comments on other valuation methodology which can be used for valuation of spectrum from 3300-3670 MHz and same may please be read as part of this response as well.
6. Further, as mentioned in comments to Q. No 28 above, 4 slots of E-Band maybe considered part of reserve price of 80 MHz of Access spectrum in 3300-3670 MHz.

We are providing detailed valuation model separately to arrive at the valuation of spectrum from 3300-3670 MHz, as it contains confidential and business sensitive information. A non-confidential summary of the said valuation model is given below herewith:

Non-confidential summary from Valuation model

5G spectrum valuation (3300-3670 MHz band)

Over a period of last 7 years (since launch of 4G in 2016), the industry has seen significant revenue erosion, clearly reflecting with the AGR for FY21 being lower than AGR of FY16. The industry currently is at a junction, where extraction from the existing investments including large spectrum commitments is extremely critical. The recent pricing move by the private operators is a step in the right direction, however we believe, industry needs to have few more rounds of price increase before the ARPU and revenues reach to a level which allow the industry to generate sufficient return on the investments already made and encourage further investments.

Considering the above factors, we believe that **the industry has to grow significantly in next 5 to 6 years**. This is critical as any incremental value extraction due to introduction of new technology will not be possible otherwise and Industry revenues may see negative/muted growth inspite of 5G launch, as was the case for 4G. In such scenario, there is no point in evaluating what could be the value of 5G spectrum.

We believe the Discounting the incremental cashflow to the industry, during the tenure of spectrum, should be the basis for valuing the 5G spectrum. We have attempted to determine the incremental cashflow to the industry basis the following approach –

- A. Industry revenue growth without 5G** – as mentioned above, we believe, this is the most critical factor to determine the incremental value from 5G
- The subscriber base will continue to see yearly addition of for the next few years more rapidly and then taper down.
 - Broadband subscriber base penetration will increase in the next decade before tapering
 - Industry likely to see price correction.
 - Industry ARPU (at AGR) to improve to over Rs 200 driven by price increase and higher broadband penetration

B. Incremental Cash flow to Industry with 5G Revenue

- We expect 5G uptake to be faster than 4G, driven by faster 5G rollout by operators
- These 5G subscribers to pay higher ARPU even if evidence not seen from global launch and India's 4G experience.
- Upside to the enterprise revenue due to newer use cases

Opex and Capex

- Basis the current understanding of the 5G capex and after assuming some benefit due to large scale rollout.
- Capex for the new 5G site includes radio, transport and core
- Opex of 5G site assessed considering the requirements of higher energy.

Other Items

- As a part of Reform package, government has announcement that there will not be any SUC for the spectrum auction in future. We have considered the saving of ~1.9% on account of new spectrum acquisition by the industry in the 3300-3670 MHz band.

Value of 5G spectrum (3300-3670 MHz band)

- Basis above methodology, there is not a positive value for 5G spectrum for the Industry, inspite of considering 30 years of discounted cashflow
- Only with significant APRU paid by the 5G customers can we get a value which translates into ~90% discount to the 5G pricing recommended by the TRAI earlier.
- We have consistently witnessed a 10 year technology cycle in the mobile telecom industry: 2G in the 90s, 3G in the 00s, 4G in the 10s and 5G in the 20s. There is no reason to believe that the pace of change is going to slow down. So while we value the spectrum over 30 years, the cost of ref-arming to 6G/7G is not included. Therefore, we believe the reserve price should be not be fixed at higher than 50% of value derived.
- Further, a large part of this value is linked to the repair of the industry in next few years. If such scenario doesn't pan out than 5G value will always remain negative.

Comparison with international benchmarking – In addition to above DCF approach, we have considered the spectrum prices available for 3300-3670 MHz band in various countries and adjusted that for MHz, Population as well as ARPU to compare the same with the reserve pricing in Indian context. The below table provides details of the same:

Country	Euro/MHz/Pop	ARPU (Euros)	Euro/MHz/Pop/ARPU
	3500 MHz	Q1 2021	Q1 2021
Germany	0.1554	11.40	0.01362
UK	0.0683	16.96	0.00403
Greece	0.0284	11.69	0.00243
Portugal	0.0885	10.78	0.00821
Switzerland	0.0315	31.04	0.00102
Hungary	0.0035	9.91	0.00035
Spain	0.0415	16.04	0.00259
Czech	0.0179	10.67	0.00168
Ireland	0.0363	23.75	0.00153
Romania	0.0022	6.03	0.00036
Average			0.00358
India	0.04	1.24	0.03347
India / Average			9.35x

As may be seen from the above table, the pricing of 3300-3670 MHz band spectrum in India is working out to be ~ 9.35x of the international average. This further substantiates the argument for a significant price reduction in 3300-3670 MHz band being put to auction.

Q.50 In case you are of the opinion that frequencies in the range 526-698 MHz should be put to auction in the forthcoming spectrum auction, whether the value of 526-698 MHz be derived by using technical efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your suggestions.

VII Comments to Q. No. 50

1. TRAI in its 'Consultation Paper on Auction of Spectrum in frequency bands identified for IMT/5G' has mentioned that "On examination of the band plans defined by 3GPP, it appears that no band plans have been defined so far for 526-582 MHz and 582-617 MHz bands. Thus, ecosystem for IMT is not available in these bands. In the frequency range 526-698 MHz, ITU/3GPP band plan and ecosystem for IMT are available only in 617-698 MHz band...." As can be seen the ecosystem for frequencies in 526-698 plan is not developed or is at nascent stage of development.
2. Also, in case of India, the spectrum in 700 MHz band which has been put to auction in last 2 auctions of 2016 and 2021 has entirely remained unsold due to high prices, less developed ecosystem at that time and high capital investment requirements.

3. In our opinion, Spectrum in 526-617 MHz frequencies should not be put to auction in the forthcoming spectrum auction. Further, the Spectrum in the range 617-698 MHz should have pricing same as of 700 MHz spectrum.

Q.51 If your response to the above question is in negative, which other valuation approach(es) should be adopted for the valuation of these spectrum bands? Please support your suggestions with detailed methodology, related assumptions and any other relevant factors.

VIL Comments to Q. No. 51

We do not have any additional suggestions. Our submissions on valuation to be considered have been indicated at various places in our responses

Q.52 Whether the value of spectrum in 24.25 - 28.5 GHz band be derived by relating it to the value of other bands by using technical efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your suggestions.
and

Q.53 If your response to the above question is in negative, which other valuation approaches should be adopted for the valuation of these spectrum bands? Please support your suggestions with detailed methodology, related assumptions and other relevant factors.

VIL Comments to Q. No. 52 and 53

1. As can be seen from global examples, there are significant capacity benefits off having mmWave spectrum bands supporting 5G services.
2. 24.2-28.5 GHz (mmWave) has a lower coverage owing to higher propagation losses. This spectrum should be earmarked for 5G services as this band has application in hotspot capacity augmentation and FWA services
3. Being very high frequency band, 24.25 – 28.5 GHz band will be used mainly to enhance the network capacity in capacity hotspots or FWA applications. Considering the fact that 24.25 – 28.5 GHz band will provide smaller outdoor coverage and suitable for deployment only at hotspot locations to improve customer experience has to be reasonably priced
4. User equipment (UE) ecosystem is practically non-existent in India presently and it is in early stages in global market. This would need push from DoT and Industry to have large scale devices with mmWave capabilities along with mid-band band support.

5. Considering the propagation characteristics and utility of this band as well as global indicators, its reserve price should not be more than 1% of reserve price of 3300-3670 MHz spectrum.

Q.54 Whether international benchmarking by comparing the auction determined price in countries where auctions have been concluded be used for arriving at the value of these new bands? If yes, then what methodology can be followed in this regard? Please explain.

and

Q.55 For international benchmarking, whether normalization techniques be used for arriving at the valuation of these new bands in the Indian context? If yes, please justify your response with rationale /literature, if any.

VIL Comments to Q. No. 54 and 55

1. In comments to Q. No. 49, we have provided detailed valuation methodology for the spectrum in 3300-3670 MHz. We recommend the same should be used for determining prices for spectrum in 3300-3670 MHz spectrum.
2. The international benchmarking needs to be seen from Indian context and to be normalized through economic factors like ARPU, for giving a reference to the pricing. However, the valuation model as mentioned above should be used.
3. **Global indicators showing very high Indian spectrum prices comparatively:** Globally the prices of 5G spectrum sold have been significantly lower than the reserve price recommended by TRAI earlier for 3300-3600 MHz. In fact the reserve spectrum price in India is at 9.35x of the ADP of European countries, as is evident from the table given below at **Table-T3**.

Q.56 Whether a common methodology/ approach should be used for valuation of all sub-1 GHz bands, which are currently planned for IMT? If yes, suggest which methodology/ approach should be used. Please give your views along with supporting reasoning and documents/ literature, if any.

VIL Comments to Q. No. 56

Yes, the current methodology with some reduction in reserve prices maybe continued to ensure consistency of cost structure in order to provide coverage of voice services across technologies.

Q.57 Whether the extrapolated ADP based on a time-series analysis, may be considered as the valuation itself or some normalization may be performed taking into account the financial, economic and other parameters pertaining to a particular auction? If yes, which factors should be considered and what methodology should be followed?

VIL Comments to Q. No. 57

Our comments have been mentioned under above comments to Q. No. 37 and 38.

Q.58 Whether the value arrived at by using any single valuation approach for a particular spectrum band should be taken as the appropriate value of that band? If yes, please suggest which single approach/ method should be used. Please justify your response.
and

Q.59 In case your response to the above question is negative, will it be appropriate to take the average valuation (simple mean) of the valuations obtained through the different approaches attempted for valuation of a particular spectrum band, or some other approach like taking weighted mean, median etc. should be followed? Please justify your response.

VIL Comments to Q. No. 58 and 59

Our comments have been mentioned under above comments to Q. No. 37, 38 and 40 as well as Q. No. 49 for spectrum in 3300-3670 MHz.

Q.60 Is there any valuation approach other than those discussed above or any international auction experience/ approach that could be used for arriving at the valuation of spectrum for 700 MHz/ 800 MHz/ 900 MHz/ 1800 MHz/ 2100 MHz/ 2300 MHz/ 2500 MHz/ 3300-3670 MHz/ 24.25 - 28.5 GHz/ 526 - 698 MHz bands? Please support your suggestions with a detailed methodology and related assumptions.

VIL Comments to Q. No. 60

Our submissions on approach to be followed have been indicated at various places in our responses.

Q.61 Should the reserve price be taken as 80% of the valuation of spectrum? If not, then what ratio should be adopted between the reserve price for the auction and the

valuation of the spectrum in different spectrum bands and why?

VIL Comments to Q. No. 61

We are of the opinion that reserve price for 5G spectrum should be kept at 50% of the value as determined. Following are the key considerations:

- 1. High reserve prices prevents wide participation:** Keeping a high percentage as reserve price has resulted in a low participation in the last concluded auction and resulted in unsold spectrum being left with the government. All spectrum was sold at its reserve prices and there was not a single instance of demand being higher than spectrum put to auction in any of the Spectrum band LSA combination. In fact, except 2300 MHz band, there were only 3 cases of LSA band combinations where demand was equal to supply. This all points out towards the fact that keeping a high % of valuation as reserve prices low participation by the operators. The same can be seen from the Annexure 3.2 the TRAI in its Consultation Paper where the figures are as follows:

Spectrum Band	No Bid	Demand is less than the supply	Demand is equal to supply	Demand is greater than supply (In any of the rounds)
700 MHz	22	0	0	0
800 MHz	3	19	0	0
900 MHz	7	10	2	0
1800 MHz	1	20	1	0
2100 MHz	16	3	0	0
2300 MHz	0	6	16	0
2500 MHz	12	0	0	0

- 2. Level of maturity:** Keeping a high percentage as reserve price for the spectrum bands such as 1800 MHz still may be argued as the ecosystem for these bands have been fairly developed globally. However, for spectrum in 526-698 MHz, 700 MHz, 2500 MHz, 3300-3670 MHz and 24.25-28.5 GHz bands where the ecosystem is still developing and in some cases it is in a very nascent stage of development, there is absolutely no case of keeping a high percentage i.e. 80% as reserve price. A fair price discovery needs to take place for these spectrum bands and keeping a high reserve price will discourage participation and in turn will make a fair and market determined price discovery a very difficult task.
- 3. Artificial Barrier:** Keeping the high reserve price results in artificial barrier to get the right value of the spectrum. In 2010 spectrum auction, the winning price of the spectrum was

multiple times of the reserve price, which clearly established that market will discover the right price of the spectrum and there is no need to keep the reserve price equal / closure to the perceived value of the spectrum

Q.62 Whether the realized/ auction determined prices achieved in the March 2021 auction for various spectrum bands can be directly adopted as the reserve price in respective spectrum bands for the forthcoming auction? If yes, should these prices be indexed for the time gap since the auction held in March 2021 and at which rate the indexation should be done?

VIL Comments to Q. No. 62

Same as response to Q37 above.

Q.63 Should the method followed by DoT in the previous auction in respect of collecting bid amount from the successful bidder in case spectrum is not available in a part of the LSA be followed in the forthcoming auction? Please justify your response in detail.

VIL Comments to Q. No. 63

We do not have any recommendation. DoT may follow the method followed in the previous auctions in respect of collecting bid amount from the successful bidder in case spectrum is not available in a part of the LSA.

Q.64 What percentage rate of upfront payment should be fixed in case of each spectrum band?

and

Q.65 What should be the applicable period of moratorium for deferred payment option?
and

Q.66 How many instalments should be fixed to recover the deferred payment?

VIL Comments to Q. No. 64 to 66

In the current scenario, the terms of payment is equally important as the reserve prices. Keeping in mind the financial stress faced by the industry, the payment terms for spectrum acquired in the auction shall be such that it supports both investments as well as network deployment in the initial years in place of revenue collection. Significant amount of capital expenditure will be required for introduction of new technologies such as 5G as well as enhancement of coverage in uncovered areas.

In the recent reform package, Government has also acknowledge the same by announcing a moratorium/ deferment for upto four years on the dues for the spectrum purchased in past auctions.

In view of the above, we recommend following payment terms for the forthcoming auction:

1. **No upfront payment so that the operators can invest in the network rollout**
2. **Moratorium for first 6 years**
3. **Spectrum payment at the end of year i.e. starting first from end of 7th year till 25th year, in equal instalments**
4. **Interest as per RBI repo rate.**

As spectrum license would be for 30 years, the Government would be able to recover 100% of the payment in 25th year itself.

Q.67 What rate of discount should be used while exercising pre-payment/deferred payment option, in order to ensure that the net present value of payment/ bid amount is protected?

Please support your suggestions for Q64 to Q67 with proper justifications.

VIL Comments to Q. No. 67

1. In the current scenario, Marginal Cost of Funds based Lending Rates (MCLR) is widely used benchmark rate.
2. However considering the financial stress in the sector and need for spectrum to move towards 5G deployment, **we suggest the interest rate should be equal to RBI's Repo-rate and should be used as the discount rate while exercising pre-payment/deferred payment option**, in order to ensure that the net present value of payment/ bid amount is protected.

Q.68 To facilitate the TSPs to meet the demand for Private Cellular Networks, whether any change(s) in the licensing/policy framework, are required to be made. If yes, what changes are required to be made? Kindly justify your response.
and

Q.69 To meet the demand for spectrum in globally harmonized IMT bands for private captive networks, whether the TSPs should be permitted to give access spectrum on lease to an enterprise (for localized captive use), for a specific duration and

geographic location? Kindly justify your response.

and

Q.70 In case spectrum leasing is permitted,

- a. Whether the enterprise be permitted to take spectrum on lease from more than one TSPs?**
- b. What mechanism may be prescribed to keep the Government informed about such spectrum leasing i.e., prior approval or prior intimation?**
- c. What timeline should be prescribed (in number of days) before the tentative date of leasing for submitting a joint request by the TSPs along with the enterprise, for approval/intimation from/to the Government?**
- d. Whether the spectrum leasing guidelines should prescribe duration of lease, charges for leasing, adherence of spectrum cap provisions, roll out obligations, compliance obligations. If yes, what terms and conditions should be prescribed?**
- e. What other associated terms and conditions may be prescribed?**
- f. Any other suggestion relevant to leasing of spectrum may also be made in detail.**

(Kindly justify your response)

VII Comments to Q. No. 68 to 70

1. It is imperative to mention that TSPs support requirements across sectors, enterprise categories and diverse use-cases. TSPs work with enterprises to deliver innovation, deployment & operations scale along with security requirements.
2. Most of benefits of 5G can be delivered through a range of technical and commercial alternatives that do not require spectrum to be set aside. For example, 5G capabilities with slicing, dynamically configurable resources, low latency etc. help to support diverse industry needs over public networks.
3. Also, it is important to understand that whether the use cases of private networks can be dealt only through reserved spectrum or through any alternate technological means. There are alternate technological means available with mobile network operators to support such use cases like through network slicing, spectrum sub-leasing etc. 5G spectrum is attractive to TSPs only when it is able to fulfill its needs of eMBB, mMtc & uRLLC, which implies that TSPs shall be able to provide and monetise the Industry 4.0 applications.
4. An enabling framework should be created to support such alternate technological means instead of reserving the spectrum for isolated private networks leading to inefficient utilization.
5. Further, setting the right conditions to favour 4G/5G solutions to be adopted by verticals can include approaches where cooperation between mobile operators and access seekers is incentivised.

6. Even today, several enterprises are asking Operators to use their 4G spectrum assets to provide Private LTE networks as they want TSPs to use their expertise to provide communications networks while they focus on their core enterprise business and its digitalization.

VI recommends that Enterprise customers to work with TSPs, to lease the spectrum from the TSPs or the services from TSPs for their purposes.

Q.71 Whether some spectrum should be earmarked for localized private captive networks in India? Kindly justify your response and

Q.72 In case it is decided to earmark some spectrum for localized private captive networks, whether some quantum of spectrum be earmarked (dedicatedly) from the spectrum frequencies earmarked for IMT services and/or spectrum frequencies earmarked for non-IMT services on location-specific basis (which can coexist with cellular-based private captive networks on shared basis)? Kindly justify your response with reasons.

and

Q.73 In case it is decided to earmark some quantum of spectrum for private captive networks, either on exclusive or shared basis, then

- a. Spectrum under which band(s) (or frequency range) and quantum of spectrum be earmarked for Private Network in each band? Inputs may be provided considering both dedicated and shared spectrum (between geographically distinct users) scenarios.
- b. What should be the eligibility conditions for assignment of such spectrum to private entities?
- c. What should be the assignment methodology, tenure of assignment and its renewal, roll-out obligations?
- d. What should be the pricing mechanism for assignment of spectrum in the band(s) suggested for private entities for localized captive use and what factors should be considered for arriving at valuation of such spectrum?
- e. What should be the block size and spectrum cap for different spectrum band(s) suggested in response to point (a) above.
- f. What should be the broad framework for the process of
 - (i) Filing application(s) by enterprise at single location, enterprise at multiple locations, Group of companies.
 - (ii) payment of spectrum charges,
 - (iii) assignment of frequencies,
 - (iv) monitoring of spectrum utilization,
 - (v) timeline for approvals,
 - (vi) Any other
- g. Any other suggestion on the related issues may also be made with details.

(Kindly justify your response with reasons)

VII Comments to Q. No. 71 to 73:

1. At the outset, its important to firstly ascertain the utilization levels of present unlicensed band in 5GHz. Till this is known, it would be just wish list of few entities to get this precious and finite resource through unlicensed mode at free/cheap costs, whereas operators would be committing huge sums of money through auction, for the same precious and finite resource.
2. The real question is not whether someone has a “non-traditional” but plausible use for the spectrum but rather whether the social value of that use is greater than the social value that could be derived from another use (e.g. for national mobile network use).
3. The question is that giving someone the right to use the spectrum denies someone else the right to use it. So, for example, allocating spectrum to local licences and private networks denies this spectrum to the hundreds of millions that use mobile public networks.
4. Some European countries have reserved spectrum (like Germany) however, there has not been encouraging output or utilizations. Further, it lead to inadequate spectrum with less than 300 MHz of spectrum to be allocated to four MNOs.
5. Countries like UK have considered such examples and analyzed opportunity cost of reserving such spectrum for isolated private networks v/s national mobile operators serving millions of consumers. It has been arrived upon that opportunity cost is far higher than the value such private network creates in the society.
6. Any exclusive reservation of spectrum for private networks in core bands lead to unavailability of adequate spectrum availability for 5G mobile networks, deterioration of network quality and experience. Some of these large scale disadvantages of exclusive reservation of spectrum for private networks, is given as follows:
 - a. Inefficient utilisation of a scarce resource, from National utilization across all sectors and sizes of enterprises to only specific fixed locations.
 - b. Limit availability and innovation capability to Enterprises who can afford to build and operate exclusive private networks thereby creating an inequity.
 - c. Impact success of 5G with lesser spectrum availability for national rollout.
 - d. Increased complexity of spectrum management for interference mitigation
 - e. Challenges in meeting compliance management including security and privacy, by private entities and also challenges in supervising the said compliance by Licensor and/or Regulator.

- f. Ultra-low cost of spectrum encouraging entry of fly-by-night type of entities.
7. Reservation of spectrum for private networks purposes should not be considered in frequency bands where demand is high else, it can lead to creation of inadequate spectrum supply and holdings.
 8. For allocation of any spectrum to private network unless there is real case of value addition being more than the same in mobile networks, through a detailed cost benefit analysis.
 9. It is imperative that there should firstly be an audit of utilization of existing spectrum in unlicensed bands, to ascertain seriousness of entities seeking reserved spectrum for private networks.
 10. Additionally, Private local use cases would have concerns of quality of services, security, privacy, customer rights, technical standards, dependency on very few vendors etc.
 11. If they are supported without detailed analysis and robust framework, it may convey inappropriate sense of trust and reliability to enterprises at large. The probability of these concerns would get accentuated if such private networks are to be deployed in sensitive sectors/enterprises.
 12. There is no case for examining its pricing as there is no rationale for reserving any spectrum for private use. If there is value behind private use cases, then spectrum should be obtained from open auctions.
 13. **VI recommends that:**
 - a. **There shall not be any specific spectrum reservations exclusively for private networks.**
 - b. **It shall be left to TSPs & Enterprises to engage on the same and find a best suited, workable and win-win model for the specific needs of an enterprise.**
 - c. **There should be an extensive utilization audit of the spectrum in existing unlicensed band, before moving forward on any proposal to further reserve any spectrum for unlicensed entities.**

Q.74 What steps need to be taken to facilitate identification, development and proliferation of India specific 5G use cases for different verticals for the benefit of the economy and citizens of the Country? Kindly provide detailed response with rational.

VIL Comments to Q. No. 74:

1. We recommend the approach of developing eco-systems amongst TSPs and cross-industry to collaborate for innovation and creation of new services for Enterprises along with the business models for the same.
2. We believe that Digital Transformation, Business Processes Automation, Industry 4.0 with 4G/5G require knowledge and deep domain expertise across multiple facets for solutions which is likely to be beyond the capabilities of any single organization.
3. Further, commercial viability will require standardization to enable scalability for deployment and operations which should get addressed through such eco-systems.
4. It is also important to note that this is an evolving space and hence a need not to be prescriptive so that innovation is not constrained. Therefore, there could be multiple facets or forms of this eco-system, some examples of which are outlined below:
 - a. Telco and Enterprise collaborating to develop a solution to an enterprise specific use-case for Enterprise own-use.
 - b. Telco and a System Integrators/Enterprises collaborating to develop solution(s) for Industry/vertical specific use case(s) which is then taken to the market as per the commercial model agreed between the parties.
 - c. Telco and Industry forums eco-systems for exploring industry issues, requirements, standardizations etc. Thereafter, interested parties align to innovate and develop the solutions and then compete in the market.
 - d. Innovation labs which provide infrastructure and testing capabilities for innovators / entrepreneurs to develop and test their solutions.

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