Indian Broadcasting
& Digital Foundation

IBDF's Response to TRAI ("Authority/TRAI") Consultation Paper on Auction of Spectrum in frequency bands identified for IMT/5G ("Consultation Paper") dated 30 Nov 2021

Opening Comments

At the outset, IBDF welcomes the process set in motion for enabling 5G services in India and is fully supportive of all steps which may need to be taken to further the earliest launch and availability of 5G services while at the same time following a due and consultative process whereby the interests of incumbent operators no less important than potential 5G operators are protected. We thank the Authority for according us an opportunity to provide our comments in respect of issues raised in the Consultation Paper related to auction of spectrum in frequency bands identified for provisioning 5G services.

IBDF notes that a Consultation Paper has been floated on the issue of 5G Spectrum, which has multiple contentious issues that have been raised by us with the Ministry of Information and Broadcasting (MIB), DoT as well as TRAI. These are issues, which have been faced in various countries where 5G spectrum has been auctioned and a series of consultations and alleviating measures including financial compensation have been provided to incumbent operators so affected by the process.

It is noted that this Consultation Paper is entirely focused on the modalities of Auction, its pricing and the allocation/ adjustment of slots within the pre-decided 5G bands which may be offered for auction and the auction pricing.

It is submitted that Indian Satellite Broadcasting sector, which has a size of INR 685[1] billion (in 2020), plays a critical role in provisioning of broadcasting services to approximately 21[2] crore TV households which include both rural and urban households. Broadcasting services are delivered through 1735[3] (includes 1731 MSOs and 4 DTH operators) registered distribution platform operators (DPOs) spread across India who are solely dependent on the C-band (3.7 – 4.2 GHz) satellite to receive the broadcast signals of 915[4] registered TV channels in a seamless manner for further distribution. C-band satellites carry broadcasting signals of 24x7 news, sports, and entertainment content to television households and terrestrial and satellite radio listeners in India and around the world, among many services, in a cost-effective manner. Given the contribution of the broadcasting sector and in consumer interest it is essential that the frequencies from 3600 to 3700 MHz be kept out of the auction of spectrum for provision of 5G services in order to ensure that a Guard Band of 100 MHz is maintained, and minimum disruption is caused to the broadcasting services. The Consultation Paper provides no opportunity in respect of issues that will arise as a result of assigning the additional 70 MHz (3600-3670) on the Broadcast and Cable TV operations.

[1] FICCI-EY M&E Report , March 2021
[2] Source: BARC India TV Universe Estimates 2020
[3] Source: TRAI's Performance Indicator Report
[4] Source: TRAI's Performance Indicator Report

While the Consultation Paper has quoted extensively from various countries and their networks on the issue of 5G usage**, it has chosen to be entirely silent on the issues of the C-Band which were considered by their respective regulators in regard to the incumbent users**. It is well known from extensive analysis by multiple agencies that a similar situation will prevail in India when due to the additional 70 MHz being allocated, the desired guard band no longer exists, except a meagre 30 MHz and 3700-3800 MHz or more will become unusable, while even the higher bands between 3800-4000 MHz may have an impact.

In so far as the Sub-700 MHz and 800 MHz bands are concerned, there are still issues which need to be considered at least as a part of consultation as to how the same impact the cable TV services which uses the band up to about 860 MHz. These issues have been reflected in previous consultations as broadcasting community responses.

The Consultation Paper provides detailed data on how the mmWave bands 24.25 to 27.5 GHz are now used extensively in networks in various countries. In such a situation it is desirable for India to give priority to these bands which are vacant rather than impinge upon the extended use of C-Band which harms incumbent operators in the C-Band and the vast M&E industry entirely dependent on the C-band transmissions. The technology in mm Wave band has moved far ahead and there is equipment and devices which use this mm Wave band.

The extended encroachment into the C-band also has impact on a number of other services such as VSATs, Global Maritime distress and Safety, Ship communications and ATM and other enterprise networks.

It is submitted that these are the issues on which public comments ought to have been invited by the TRAI in order to ascertain the best options for the country as it moves towards 5G. We urge TRAI to take a holistic view and not only the auction modalities, block sizes etc. which fall more in the domain of the DoT as the administrative organ where it is best placed to finalize and implement the administrative details.

IBDF as well as various industry bodies and associations have repeatedly and with due urgency raised the issue with the MIB, DoT and TRAI. It was anticipated that the Consultation Paper would include the relevant questions on the suitability of the 3600-3670 Band for 5G services, instead of just the demand by the DoT for granting the said frequency via option to the operators that impinges on the existing operations of broadcasters and renders many satellites partially useless for media and entertainment.

It is with this background that we are hereby once again giving our comments on the Spectrum for 5G and the related issues as they relate to broadcasters. It is submitted that **our comments not be construed to have been presented ab-initio but as those which have been pending with various authorities for over 3 years.**

Our response is limited to some of the issues / questions as mentioned in the Consultation Paper, owing to the interests of our constituency.

In view of the foregoing, the key submissions are as follows -

a) DoT should refrain from expanding the C-band spectrum from the allocated frequencies for IMT services in the National Frequency Allocation Plan 2018[5] (i.e., 3.3 – 3.6 GHz). If only a limited amount of spectrum can be released in C-band for IMT services then there are other frequency bands such as 2.3 GHz (n40), 2.6 GHz (n41) and 4.4-5 GHz (n79) which are potential substitutes in the mid-band range. It is therefore not necessary to extend the frequency for 5G deployment beyond 3.6GHz and thereby reducing the essential guard band .

b) A 100 MHz guard band in C-Band (i.e., 3.6 – 3.7 GHz) should be maintained so as to mitigate any form of interference due to provisioning of IMT services to ensure current and future C-band broadcasting services can continue to operate and thrive.

c) With the development of the new technologies, high frequencies may be considered for deployment of 5G mobile services. Internationally the focus is on the use of mm wave for 5G services. It might be better to focus on enhancing the spectrum efficiency in using the existing lower frequency bands already allocated to 2G/3G/4G/5G and develop IMT in mm wave and EHF (mainly above 30 GHz) bands.

d) Reserve frequency bands of 470-694 MHz (224 MHz) for Digital Terrestrial Services (DTT) given that vast Indian population is still dependent on terrestrial services.

e) Safeguard and protect the interest of Cable TV and broadcasting sector by not recommending the auction of sub-gigahertz band (<1 GHz) for LTE/IMT services without sufficient measures to mitigate any form of interference.

f) Adopt and assist to adopt technological enhancements to reduce the impact of 5G deployment on C-band. Such solution options are provided below in details.

Our detailed responses in respect of relevant issues are as follows -

ISSUES FOR CONSULTATION

Issues related to Quantum of Spectrum and Band Plan

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.

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.

[5] *NFAP-2018 does not allocate frequencies to 5G services beyond upper limit of 3.6 GHz.*

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.

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.

IBDF would like to state that the frequency bands of 470-694 MHz (224 MHz) must be earmarked and reserved for DTT services. Globally it has been seen for best practices that this is the minimum spectrum needed reasonable amount of Multiplexes of DTT to be made operational at different locations within the country.

In India as the DTT services were never fully opened up to the private sector, it was only Doordarshan (DD) that was operating a network of Analog and some digital transmitters in the truncated band of 470-646 MHz(176 MHz). There have been suggestions to launch DTT by licensing private entities (using DD infrastructure), however the same has never fructified for various reasons.

Notwithstanding the above, this should not be construed to assume that India's policy in regard to DTT has undergone a change and that this Spectrum of 526 to 617 MHz, which falls right in the middle of the terrestrial band should be offered for auctions for LTE/5G. This will forever close viable digital terrestrial operations in the country. Digital terrestrial services have many advantages for highly localized content which is specific to a part of the city rather than a country as via satellite.

In regard to sharing of the band between IMT/5G and DTT services, we would like to cite from the response of Prasar Bharti submitted in response to the TRAI consultation **on "Proliferation of Broadband through Public Wi-Fi Networks"(TRAI Consultation Paper No.14/2016)**

https://www.trai.gov.in/sites/default/files/201609080215490700243Prasar_Bharati.pdf

> *"Co-existence of Terrestrial Broadcasting with other Mobile services has been studied by ITU-R during the process of WRC-15 and it was concluded that sharing of Broadcasting (terrestrial) & IMT (Mobile service) is not possible in the UHF band 470-698 MHz band. India tried to identify this band for IMT services, however, the same was not agreed to by WRC-15. Use of UHF TV spectrum by TVWS will put undue constraint to the development of TV broadcasting in addition to the high interference potential to the existing services. Any kind of TVWS application need an extensive practical study on interference from TVWS devices to terrestrial TV receivers, which has not been even initiated in India so far".*

Moreover this will lead to a fragmentation of the Terrestrial Digital Spectrum and it would not be possible to contain interference in the two networks mutually, should Digital Terrestrial services be launched in the future.

Use of Low band for 5G in USA and other countries

It is noteworthy that the use of "Low Band" in countries such as USA has been implemented after an extensive process of creating a Digital Dividend, where all subscribers were paid to get their analog sets converted to Digital by fully funded coupons issued by the US Government. Moreover carriers which have launched in Sub 700 MHz Band (Low band) were in white spaces so created by Digital dividends and not by subsuming the entire Digital Terrestrial bands.

In India a vast population has been depending on terrestrial services which cannot be replaced by 5G due to the subscription and devices cost involved.

We understand that this band will be used primarily for IoT and M2M services due to the low bandwidths in this band and the property of the deep in-building protection that this band provides. It is submitted that the emission from such networks so designed to reach within homes is also likely to interfere in cable operations for which appropriate measures such as limit on emission power etc. should be taken.

Issue for Consultation

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

1. Comments on Potential Spectrum Use of 3300-3670 MHz for 5G Services

The entire Linear TV broadcasting industry revolves around the use of C-Band Spectrum where the downlinks by all broadcasters intended for reception by DPOs (Cable operators, MSOs, DTH operators) are in the band of 3700-4200 MHz as prescribed by the ITU and also governed by the Uplink and Downlink Guidelines by the Government of India.

As per the Uplink and Downlink Guidelines and the Cable Television Networks Regulation Act, 1995 (amended as on date), all channels that are carried by the DPOs (Cable, DTH and IPTV) must necessarily have been granted an Uplink and downlink license by the MIB and must only be downlinked by an approved satellite as mentioned in the license for carriage on the DPO system.

1.1 . Usage of Frequency Band of 3300-3670 MHz for 5G will lead to serious disruption

We had raised the matter of concern for the industry that the existing NFAP-18 was proposed to be revised post-haste to include new bands for 5G use by DOT's arm, WPC wherein bands from 3400 to 3670 MHz or even beyond till 3800 MHz may be earmarked for 5G services.

Now as a result of issuance of this Consultation Paper, it is evident that the decision to offer the entire band of 3300-3670 MHz for 5G operations has already been taken by the DoT .

This allocation of frequencies to 5G services beyond the current NFAP-18 upper limit of 3600 MHz will lead to serious disruption of Satellite services for media and broadcast in the 3700-4000 MHz band. Today over 600 licensed satellite channels over India operate in this band.

The disruption occurs due to the following reasons:

(i) The power received from satellite at receiver LNBs is much lower (~60 dB lower) than that of 5G Terrestrial signals which operate at a very heavy power level. This leads to the overloading of the LNBs of satellite Antennas and no signal can then be received.

(ii) Simultaneous use of the band by Satellite and Terrestrial 5 G services is not possible.

The above facts have been studied and confirmed by a number of International bodies.

Some of the Studies for ready reference of the authority are as follows:

(a) Rhode-Schwarz- Coexistence of 5G and satellite services in the C band
https://www.rohde-schwarz.com/in/applications/coexistence-of-5g-and-satellite-services-in-the-c-band-application-note_56280-620189.html

(b) OOBE Interference-Intelsat C-Band White Paper
https://www.intelsat.com/wp-content/uploads/2021/02/intelsat-C-band-whitepaper.pdf

(c) Role of C-Band in 5G
"Another interference-related issue that service providers may need to pay attention to is the effect of 5G base stations on the satellite receive bands. Advanced 5G features such as massive MIMO and beam steering can deliver significant power and can potentially interfere and saturate the low noise block (LNB) downconverter of the satellite antenna system and cause interference, especially if the 5G base stations are close to the satellite earth station. Therefore, it is important during the planning phase to understand the impact of 5G base stations on the satellite earth station".

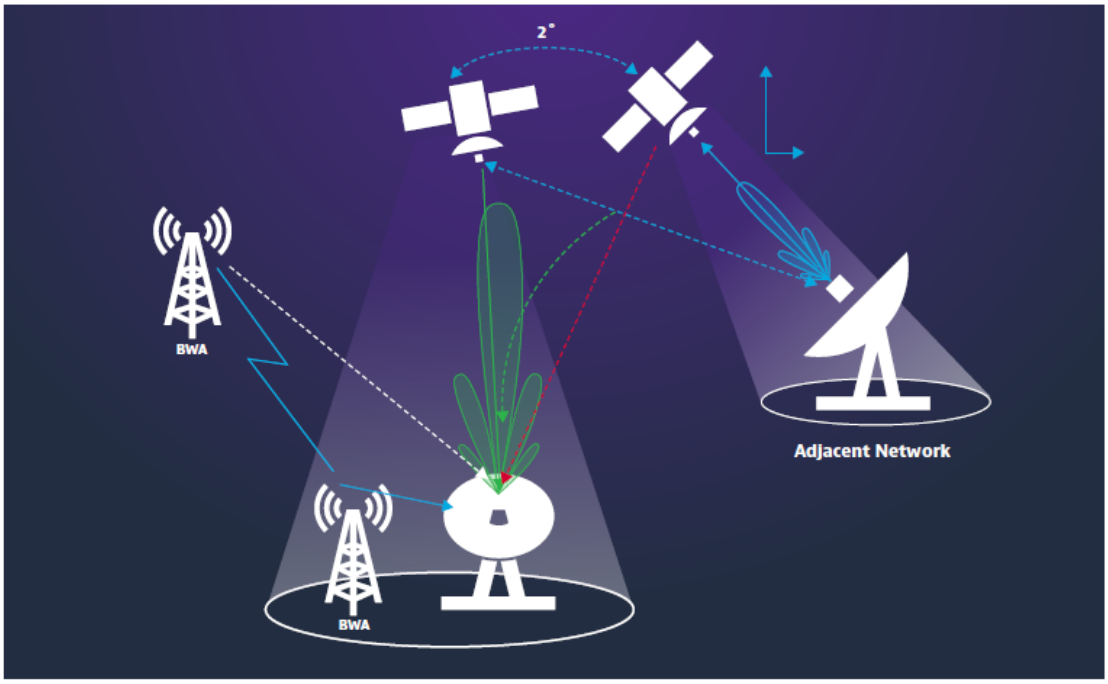


Figure: Interaction between satellite earth stations and broadband wireless nodes
https://www.viavisolutions.com/en-us/literature/role-c-band-5g-application-notes-en.pdf

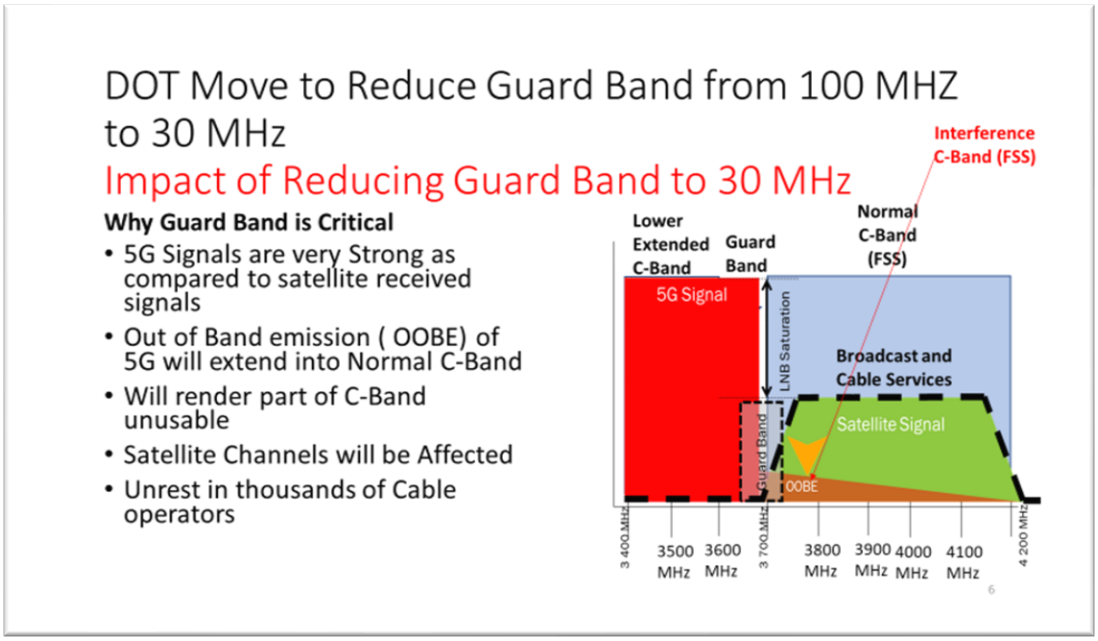
1.2 **A "solution" purportedly offered informally by the 5G interests** is that the C&S services can leave 100 MHz of spectrum and use the transponders above 3800 MHz instead of 3700 MHz. It is claimed by them that there is adequate capacity in satellite systems even if 100 MHz of the band (translating to 3 transponders of 36 MHz are used on any satellite).

However, this argument is fallacious as the LNBs will get overdriven with high terrestrial signals and irrespective of frequency bands will stop functioning.

Impact of reduction of Guard Band- Overdrive of C-Band LNBs

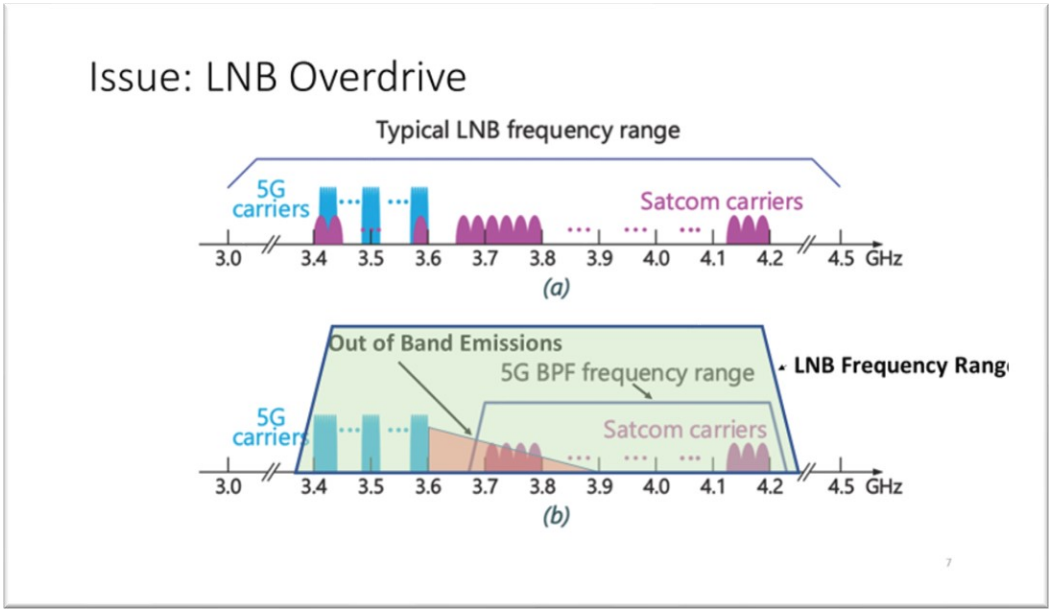
The impact of reducing the guard band of 100 MHz as recommended by TRAI as well as NFAP would be that the Out Of Band Emissions(OOBE) would fall in the regular C-Band of 3700-4200 MHz. This has two implications:

(a) Filters of 3700-4200 MHz even if used cannot filter out these out of band emissions as these fall in the 3700-4200 MHz band.



(b) LNB Overdrive

The LNBs used in Cable headends which are typically designed for 3400-3900 MHz would get overdriven (saturated) due to high terrestrial transmissions. This overdrive could have been prevented by the use of filters of 3700-4200 MHz but with OOBE falling in the pass band of filters, the interference will lead to complete loss of signals.



1.3 Announcement of trials for 5G

While the trials of 5G have been announced by the DoT, they have not taken any of the incumbent users of the C-band who have been using the satellites since over 30 years to be a

part of the trial to generate data on smooth induction of 5G. Nor has the DoT directed the use of the following devices:

(i) Emission Filters in each tower to limit transmissions to the 3300-3600 Band.

(ii) Antenna Positioning and Down-Tilting requirements.

In this connection we would like to present as a sample the Test Specifications issued by the Hong Kong Regulator (OFCA) which gave precise parameters for test, measurements and interference detection:

https://www.ofca.gov.hk/filemanager/ofca/en/content_669/tr201904_01.pdf

2. Impact Analysis of 5G Allocation of Frequencies on C-Band Satellites

An analysis of the impact of allotting 5G services beyond 3600 MHz till say 3670 MHz will be immense. While this document tries to quantify the figures, the quantification in terms of disruptions will be immense and can only be estimated.

2.1 Channels Impacted

For the purpose of this document only channels between 3600-3790 MHz have been considered. It may be seen that nearly 200 channels, including HD channels will be directly impacted. The breakup is as follows:

	Summary channels below 3800 MHz		
S.No	**Satellite Name**	**channels below 3800 MHz**	**Details**
1	GSAT-30	80	Annex-2
2	Asiasat-7	58	Annex-2
3	IS-20	45	Annex-2
4	GSAT-10	5	Annex-2
5	Other satellites	12	
	Total Channels	200	

It may be seen that about 25% of the Indian Channel universe will be directly and immediately impacted with severe disruption, while the next 50 MHz (about 100 channels) will also be affected based on-site locations even after using the filters.

The channels on foreign satellites need to be available on the very same satellites owing to the following issues:

(i) **Footprint and distribution related issues.** The distribution needs include Africa, Russia, Eastern Europe, Japan, Far East including Australia and New Zealand.

(ii) **Television Communities Overseas**

Foreign Cable and DTH operators spread out in over 140 countries of Interest in Asia Pacific, Gulf, Africa, MENA and Eastern Europe have Antennas looking at only specific satellites, which are called the TV Hot satellites. They are not willing to put up additional dishes on any new satellites just for one or two channels.

While these channels need to remain on these very satellites due to footprint as well as distribution related issues, these satellites have no capacity to move channels to any higher frequencies.

2.2 Disruption due to pandemic and provision of 5G services

There are an estimated over 230 million customers of C&S services. The entire sector has gone through very turbulent times that has made the very survival at stake due to the following reasons:

(i) **Issues faced due to COVID-19** - A lot of on ground problems have been faced during the past full year due to COVID and these issues still continue. These relate to production of films and shows, ground events, Sports with spectator attendance and a host of others. The inability to have fresh and engaging content has resulted in loss of subscriber base.

(ii) **Expected Disruption due to 5G -** The expected interference on channels, degradation of signals are expected to continue for a full 2 years till all mitigating measures including Filters are implemented on the ground. The inferior quality of experience caused will reduce the subscription of consumers on traditional TV thereby having long term implication and perhaps advancing the sun-set of C & S TV Industry and increasing the urban-rural divide. It would also reduce the options available for the consumers to select from for their media and entertainment needs.

3. Loss to VSAT, DSNGs, Emergency communication and Marine Services

C-Band is resistant to rain fade and other signal degradation issues due to weather, and has consequently formed a backbone of VSATs, DSNGs, Emergency communication and Marine Services. Where 5G transmitters operate in vicinity, which is expected to be ubiquitous, the interference will seriously affect these services. These terminals are in many cases proprietary and modifications with external filters etc are not possible.

4. Global Best Practices-5G Spectrum Limited to 3600 MHz

In order to avoid severe disruption many countries have adopted the base case of 5G spectrum being limited to upper limit of 3600 MHz. This has been done based on their

extensive studies after public consultations that have been well documented. Even where higher bands till 3700 MHz have been used, the following practices have been adopted:

(i) Assessment of the extent of disruption based on use of C-Band for various services.
(ii) Compensation provided to affected operators.

4.1 China

A time period of 2-4 years has been granted to operators to do the migration.

China's Ministry of Industry and Information Technology (MIIT) held the auction for 5G spectrum bands in December 2018. Country's telecom operators acquired spectrum in 2.5 GHz, 3.5 GHz and 4.8 GHz (n41, n78 and n79) bands.

China has allocated the following frequency bands for 5G in C-Band:

Band	Frequency	Auction Status	Operator
n41	2.515 - 2.675 GHz	Auctioned	China Mobile
n78	3.4 - 3.5 GHz	Auctioned	China Telecom
n78	3.5 - 3.6 GHz	Auctioned	China Unicom
n79	4.8 - 4.9 GHz	Auctioned	China Mobile

In addition in Dec 2020, China also commenced auctioning the the mmWave Bands for 5G.

4.2 Russia

In Russia, the 3.5 GHz range is not currently available for mobile networks, mainly due to its use for satellite services. An alternative under consideration is the 4.8–4.99 GHz range (the 4.8 GHz band). However, international regulation of this band for 5G is still in flux, with no certainity expected in the next three years at least. By the time of the next World Radiocommunication Conference (WRC) in 2023, it will be clearer as to whether sufficient scale has been realised to allow for affordable mass-market 5G deployments using this band. Russia has limited 5G auctions to 3600 MHz only.

5. Global Best Practices where Band beyond 3600 MHz was allocated and Disruptions

5.1 Korea is one of the countries which has auctioned spectrum till 3700 MHz. Ministry of Science and ICT auctioned spectrum licences in 3.5 GHz (3420-3700 MHz) and 28 GHz (26.5 - 28.9 GHz) in June 2018. Auction results are presented in a table below.

3GPP Band Number	Frequency Range	Duplex Mode	Bandwidth	Operator
n78	DL: 3.42-3.5 GHz UL: 3.42-3.5 GHz	TDD	80 MHz	LG Uplus
n78	DL: 3.5-3.6 GHz UL: 3.5-3.6 GHz	TDD	100 MHz	KT
n78	DL: 3.6-3.7 GHz UL: 3.6-3.7 GHz	TDD	100 MHz	SKT
n257	DL: 26.5-27.3 GHz UL: 26.5-27.3 GHz	TDD	800 MHz	KT
n257	DL: 27.3-28.1 GHz UL: 27.3-28.1 GHz	TDD	800 MHz	LG Uplus
n257	DL: 28.1-28.9 GHz UL: 28.1-28.9 GHz	TDD	800 MHz	SKT

The following facts are noteworthy:

(i) The spectrum in mmWave Bands is 800 MHz each Vs. 100 MHz in C-Band.
(ii) Korea is a special case as they do not use the satellite C-Band extensively for C&S services.

5.2 Australia -Disruptions and moving to mmWave Bands

Australia had previously allocated 3425 MHz to 3492 MHz and 3542 to 3575 MHz. In December 2018, it further allocated spectrum up to 3700 MHz (i.e 3575 to 3700 MHz). The operators of TV and other C-Band services faced severe disruption post the allocation to 5G, including the denial of services in the entire C-Band of 3700-4200 MHz.

https://www.avcomm.com.au/c-band-and-5g-interference/

Australia has now further planned to auction the mmWave bands. In April 2021, it has scheduled a spectrum tender to award high-band 5G spectrum (in the 26 GHz band), which will enable fast, high-capacity services. In the second half of 2021, the government will allocate low-band 5G spectrum (in the 850/900 MHz band), which will be key for broader geographic coverage of 5G services.

6. Auctions in mmWave Bands

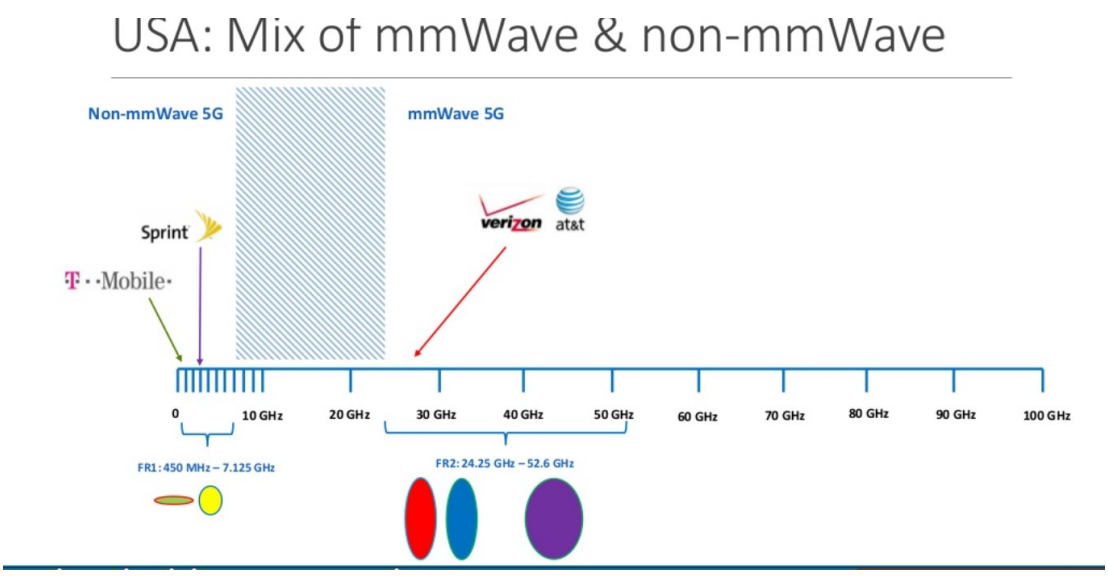
All emerging 5G leaders globally have quickly moved to auction off spectrum in the mmWave Bands. Key statistics for 5G mmWave bands are as below:

Key statistics:

- ninety-seven operators in 17 countries/territories hold public licences (many of them regional) enabling operation of 5G networks using mmWave spectrum.
- twenty-two operators are known to be already deploying 5G networks using mmWave spectrum.
- thirteen countries/territories have announced formal (date-specified) plans for assigning frequencies above 24 GHz between now and end-2021.
- eighty-four announced 5G devices explicitly support one or more of the 5G spectrum bands above 24 GHz (though note that details of spectrum support are patchy for pre-commercial devices), up from 59 at the end of November 2019. Twenty-seven of those devices are understood to be commercially available.

In USA, the FCC in July 2019 announced procedures for the largest mmWave auction. The auction started on December 10 ,2019 and included 37.6 38.6 GHz and 47.2 48.2 GHz across the US and some licenses for 38.6 40 GHz. In March 2020, it successfully completed auctions of 37 GHz, 39 GHz, and 47 GHz. FCC is considering rules for 70/80/90 GHz and has opened spectrum above 95 GHz.

While the operators in many countries relied initially on the use of Mid-band spectrum, the ultimate move has been to High bands and mmWave bands to achieve 5G speeds needed.



7. Many Alternative bands available for 5G Services

So far as 5G services are concerned, there are many bands which are available for use, while the same is not the case for Cable and Satellite Services. In fact most of the new deployments in 5G networks are in the "mmWave bands" also termed as the 5G-nr-Bands (n-258-26 GHz, n260- 39 GHz, n261-28 GHz) where very large bandwidths are available. The Consultation Paper itself details the new networks and devices available in these bands. However as these

bands require higher number of towers, there is a profit motive towards subsuming the C-Band used by C&S services. The operators are aware that they will need to eventually move to 5G-nr bands, but not before significant damage to C&S industry is done.

8. Role of Regulators in 5G induction and protection of Broadcast and Cable Services

We would like to articulate the role that the Regulators have played in every region and every country where 5G has been inducted and the measures dictated by them to ensure co-existence.

8.1 USA

One of the cases cited by 5G operators in the use of Mid C-Band 5G spectrum is that of USA where the FCC has allowed part of the C-Band spectrum to be used for 5G services (280 MHz).

New satellites need to be launched by both Intelsat and SES to operate within the limited C-Band.

US, C&S market is now mostly based on Optical fibers and land-based IP networks or OTT. This is not the case in India where broadband penetration is much lower and the availability of C&S networks (DTH and Cable) is a primary medium for education, entertainment and maintaining the entire social and cultural fabric.

It cannot be overemphasized that the use of C-Band in any manner is not a trivial matter and will impact VSATs, Financial and public health services and emergency and maritime services and that a well studied and regulated approach is essential rather than auctioning the band and leaving it to the operators to commercially exploit it as they deem fit.

8.2 Singapore

On May 7, 2020, the IMDA Singapore issued a Consultation Paper on 5G and its potential impact on incumbent users:

https://www.imda.gov.sg/-/media/Imda/Files/Regulation-Licensing-and-Consultations/Consultations/Consultation-Papers/Second-Public-Consultation-on-5G-Mobile-Services-and-Networks/Second-5G-Public-Consultation-7-May-2019-Final.pdf?la=en

The Para 65 of the consultation paper was as below:

> 65. IMDA has commissioned technical studies to assess the feasibility of 5G deployment within these bands which will determine the final amount of guard band, within 3.6 – 3.7 GHz, necessary between FSS and mobile service, and the recommended technical and operational parameters of 5G usage in the bands. In the interim, to protect the FSS (downlink) services above 3.7 GHz, IMDA is looking to implement approximately 100 MHz of guard band between the two services. Technical trials will be conducted to determine the technical feasibility of the recommended parameters (e.g., guard band, emission power limits, etc.).

As a result of the consultations, the IMDA recommended as under -

34. IMDA has assessed that where the C-band is used for 5G, FSS (downlink) users operating in the remaining parts of the C-band must take necessary preparatory steps such as retrofitting an appropriate band pass filter ("BPF"). This is to protect the signal reception of the telecommunication equipment or system receiving in the frequency range of 3.7 to 4.2 GHz band (the "FSS System") against 5G transmissions.

35. Additionally, the findings from the studies also showed that it is possible to use frequencies above 3.6 GHz for 5G services without causing harmful interference to FSS (downlink) service above 3.7 GHz. ***This would be when all FSS Systems are fitted with BPFs, which would achieve at least 45 dB rejection at a frequency of 3.65 GHz****. In this regard, all FSS Systems operating above 3.7 GHz shall have BPFs installed with similar or better specifications to provide a reasonable amount of protection to the FSS System.*

The results of the consultation are available here:

> https://www.imda.gov.sg/-/media/Imda/Files/Regulation-Licensing-and-Consultations/Consultations/Consultation-Papers/Second-Public-Consultation-on-5G-Mobile-Services-and-Networks/5G-Second-Consultation-Decision.pdf?la=en

8.3 Hong Kong (OFCA)

On 28th March 2018, the OFCA issued an order as follows:

> *S1. Taking into account views and comments received by the CA during the public consultation conducted from July to September 2017; industry feedback; and recommendations of a consultancy study on the co-existence of FSS and public mobile services operating in different parts of the 3.4 – 4.2 GHz band (commonly known as the "C-Band"), the CA decided that the primary allocation of the 3.4 – 3.7 GHz band will be changed from FSS to MS* ***with effect from 1 April 2020, thereby giving an advance notice of about two years to the affected licensees. While 200 MHz of spectrum in the 3.4 – 3.6 GHz band will be assigned for the provision of public mobile services, 100 MHz of spectrum in the 3.6 – 3.7 GHz band will be partitioned as a guard band to minimise radio interference to FSS operating in the 3.7 – 4.2 GHz band.***

The details of the order can be found here:

https://www.coms-auth.hk/filemanager/statement/en/upload/441/ca_statements20180328_en.pdf

In Nov 2020, post the spectrum auctions of the 3400 to 3600 MHz band the OFCA declared the successful bidders (China Mobile Hong Kong Company Limited, Hong Kong Telecommunications (HKT) Limited, Hutchison Telephone Company Limited and SmarTone Mobile).

https://www.ofca.gov.hk/filemanager/ofca/en/content_1168/3_5_ghz_Auction_SuccessfulBidderNotice20200116.pdf

It is submitted that Indian Broadcasters, including Prasar Bharti have in the past pointed out the issue of potential interference of any spectrum over 3600 MHz to the reception in the C-Band.

"Counter-comments of Prasar Bharati on consultation issues raised in TRAI Consultation Paper on "Proliferation of Broadband through Public Wi-Fi Networks"(TRAI Consultation Paper No.14/2016)**.**

https://www.trai.gov.in/sites/default/files/201609080215490700243Prasar_Bharati.pdf

9. **Summarizing our submission to Q5 and specifically to the use of the 3300-3670 MHz band,** the IBDF would like to state that globally it has been seen that the **induction of 5G in the mid C-Band is not a trivial matter and cannot be done without consideration of the abovesaid issues, international practices and deep involvement of incumbent operators by the Regulator. It is submitted that Telecom Service Providers and DPOs be mandatorily required to install band pass filters in order to ensure that minimum disruption to broadcasting services.**

The actions of regulators, where they have permitted the Mid-C-Band have been different in each country, based on the state of C-band Cable and satellite markets in different countries (whether on satellite, Fiber, IP or FTA Ku-Satellites), and the same model cannot be simply imported into India with the spectrum taken up, but dropping all the alleviating measures.

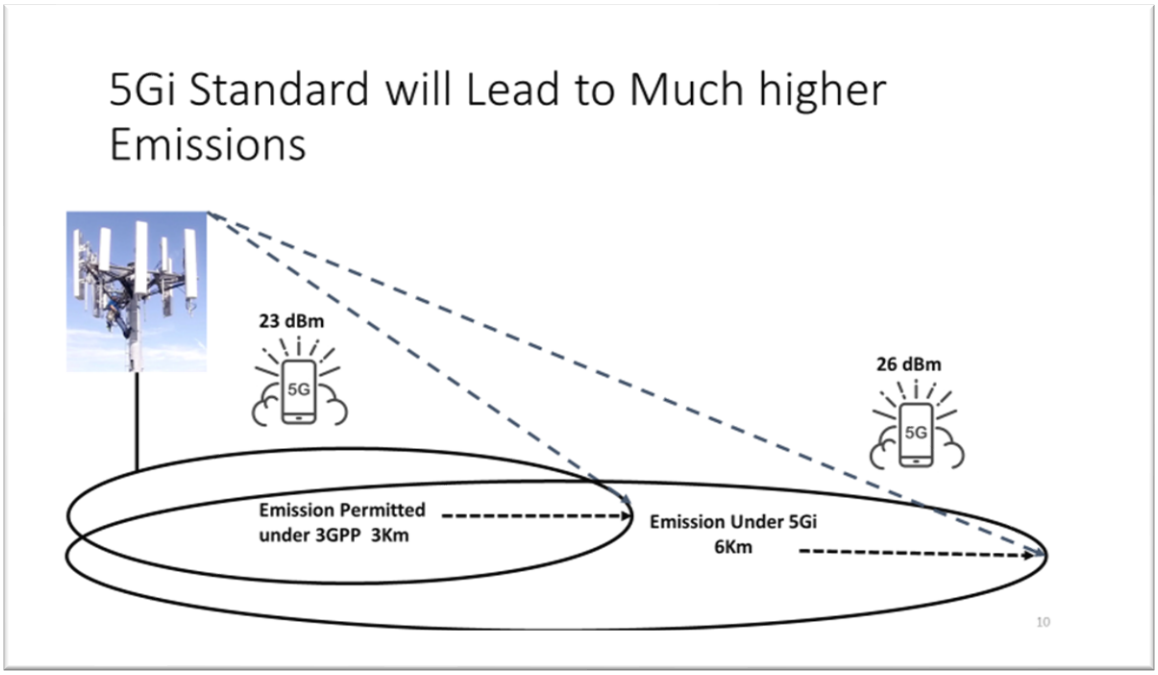
It is beyond any doubt that C-Band would be severely affected in India necessitating a coordinated induction of 5G driven by the regulator.

10. Technology to be used in 5G Networks

We do not find any detailed questions on the Technology to be used in 5G networks, even though, many of the network characteristics will be including interference in adjacent networks and in incumbent networks such as those of broadcasters will be determined on the specific technology and emission characteristics.

Our response here is in relation to potential interference in C-Band networks. **Impact of the use of 5Gi technology with higher Transmit powers as permitted by 3GPP.**

Interference between 5G terrestrial and satellite systems has been reported/ anticipated worldwide even with the use of standard 3GPP emission radios.



The use of hitherto untested 5Gi technology in relation to interference with C-Band networks with much higher emission powers and coverage radius will impact the C&S systems unless a guard band of 100 MHz is maintained and requisite mitigating measures are taken.

Issues for consideration in mmWave Bands

24.25 to 28.5 GHz band

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

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.

At the outset, IBDF would like to provide its views on the approach of the Authority in considering the proposed band, where the DoT has pre-decided that this band will be used for 5G and that the present Consultation Paper is only seeking the modalities of the 3GPP plan to be adopted in this band, rather than a consultation on the band itself. To put it unambiguously the WRC and NFAP approved bands for 5G are in the band called 26 GHz while the satellite Services (GEO-HTS and LEO) use the 28 GHz band. The current proposal is to take away a further 1 GHz band from the 28 GHz band and make it available for 5G, even when it is known that satellite and Terrestrial services cannot co-exist in the 28 GHz band. The reason for the same is that the power received on earth from such satellites is a million times lower than a high powered 5G transmit cluster, thereby overloading any LNAs which may be operational in the vicinity and far away.

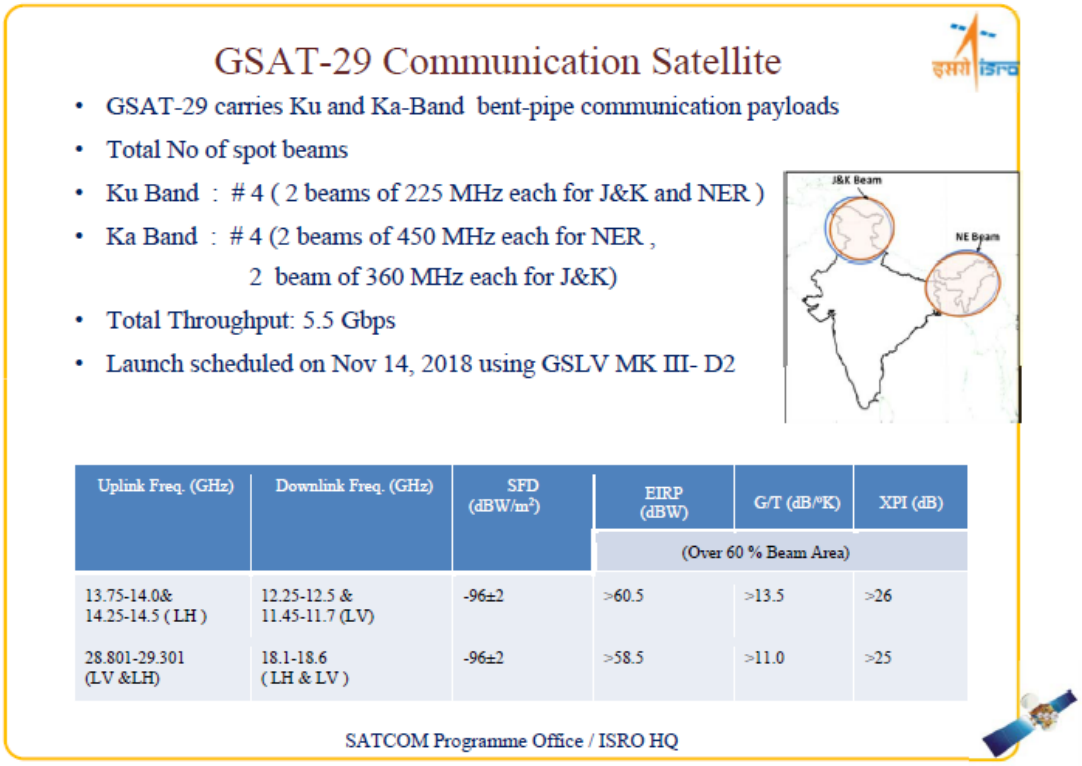
> *"2.34 DoT through its reference dated 13th September 2021 has,* ***for the first time proposed to include 24.25 – 28.5 GHz band amongst the bands to be auctioned in the forthcoming auction****. DoT has also informed that 24.25 to 28.5 GHz band will be used exclusively for IMT/5G except certain portion of this frequency range at 5 locations at Delhi, Shadnagar (Hyderabad), Khambaliya (Gujarat), Hut Bay (A&N Islands) and Tirunelveli (Tamil Nadu) with protection distance of 2.7 Km".*

IBDF notes that while the 3GPP has recommended the 26 GHZ band, a higher band (28 GHz) is now being considered based on what was implemented in USA, Japan and South Korea, as elaborated in Para 2.35 of the Consultation Paper.

2.35 While in WRC-19, 24.25 – 27.5 GHz has been identified for IMT, some of the countries such as USA, Japan, Korea have also opened up 28 GHz band (26.5 – 29.5 GHz) for IMT/5G. However, Europe has decided to go for 26 GHz band. Therefore, the ecosystem is getting developed in both these bands.

IBDF would like to state that the use of these higher bands reaching up-to 28.5GHz (or beyond) will impact India's HTS and Spot Beam satellites which have been launched or are under launch such as GSAT-20.

As an example, we would like to cite the case of the GSAT-29 satellite launched on 14th Nov 2018, which uses the bands of 28-29 GHz and is critical for J&K and the North East.



As per NFAP 2018, the bands of 24.5 to 28.5 have multiple uses and are critical for the use of HTS satellites over India, which will also be used by the constituents of IBDF.

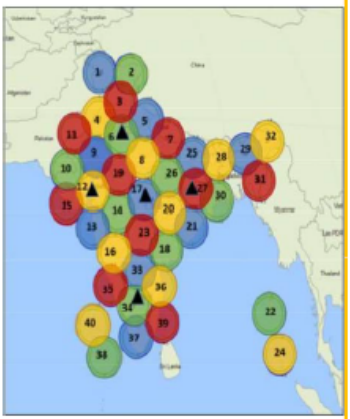
25.5-29.1 GHz

Allocation to Radiocommunication Services			
Region 1	**Region 2**	**Region 3**	**India**
25.5-27	EARTH EXPLORATION-SATELLITE (space-to Earth) 5.536B FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A		**25.5-27** EARTH EXPLORATION-SATELLITE (space-to Earth) 5.536B IND 35 FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) Standard frequency and time signal-satellite (Earth-to-space) 5.536A
27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE	**27-27.5** FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE		**27-27.5** FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE
27.5-28.5	FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 MOBILE 5.538 5.540		**27.5-28.5** FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 MOBILE 5.538 5.540
28.5-29.1	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540		**28.5-29.1** FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540

In case of the GSAT-20 satellite, which is slated to be launched in early 2022, the user as well as Gateway links are Ka x Ka and there will be interference if the 5G bands extend in the 28 GHz band.

GSAT-20 Payload

- Ka-band Payload with 40 user beams and 5 hub beams
- Hub locations: Delhi, Ahmedabad, Nagpur, Ranchi, Bangalore
- User Spectrum: 1.0 GHz x 2 Polarization (4 color scheme), Ka-Band
- Hub Spectrum: 2 GHz x 2Polarization, KaBand
- 500 MHz per user beam
- EIRP : 64 dBW/beam (Over 60 % beam area)
- G/T : 16 dB/K (Over 60 % beam area)



	U/L Frequency	D/L Frequency
User Links	29.5 - 30.5 GHz	19.7 – 20.7 GHz
Gateway Links	27.5 - 29.5 GHz	17.7 – 19.7 GHz

SATCOM Programme Office / ISRO HQ

We note that certain areas are excluded for a range of 2.7 KM to protect the gateways in the proposed allocation plan, but the same will make the system still prone to interferences and limit for all time in future the location of HTS and Spot beam satellites in India.

HTS Satellites in the KA Bands

The IBDF is gravely concerned in ceding additional spectrum in the 28 GHz band to 5G mobile services as it predetermines the future use of private HTS satellites over India. As Indian space policy opens up to use of Non-ISRO HTS satellites, there needs to be an opportunity for such players to be able to deploy their systems over India as well, and not get excluded by a pre-determined policy of DoT which spares the GSAT-20 satellite with a Gateway isolation but pre-commits the satellite broadband plan to 5G for all time in future.

In this connection the IBDF would like to draw attention of the Authority to the remarks of Telesat Canada in relation to its Lightspeed Network which was furnished to the Regulator in New Zealand on the identical question of allocation of 28 GHz band to 5G(Comments of Telesat in response to the consultation 24 – 30 GHz use in New Zealand Discussion Document - April 2021 , Submitted 4 June 2021):

> In general, Telesat is aligned to some of RSM's preliminary views in the discussion document, particularly on the allocation of the 28 GHz for Fixed Satellite Services ("FSS") for both geostationary and non-geostationary satellite constellations, with IMT allocation in the 26 GHz band.

Q8 How do you see our proposal of the 28 GHz band allocation?

> Telesat is in agreement with the RSM for the full allocation of the entire 28 GHz band for satellite use, including ESIM and NGSO satellite constellations providing broadband services.
>
> As per Telesat's reply for Q6 and as the RSM has rightfully mentioned on page 17 of the Discussion Document, there is indeed sufficient spectrum for MNOs in the 26 GHz band. Also, with a clear decision of allocating 26 GHz for IMT and 28 GHz for satellite services, the RSM would enable New Zealand to reap the benefits of both mobile equipment availability in the 26 GHz band while still supporting the heavy investments made by satellite operators in the 28 GHz worldwide.
>
> Hence, Telesat is strongly supportive of the **exclusive allocation** for satellite use in the 28 GHz band.

The details of the response of Telesat can be found here:

https://www.rsm.govt.nz/assets/Uploads/documents/consultations/2021-24-30-ghz-use-in-new-zealand/telesat-response-to-24-30-ghz-use-in-nz.pdf

It is evident that there is a conflict with the HTS satellite systems, the New Space Policy for permitting foreign satellite systems and the future of HTS broadband in India in the allocation of 28 GHz band for 5G/LTE.

It will not be out of place to mention that the band of 27.5-28.5 GHz has been allocated for LEO systems by both FCC and OFCOM. As such the intimation by the DoT on allocating this band for 5G is inappropriate as it precludes another class of broadband in India and the Authority needs to open full consultations for the 28 GHz band, which should also demonstrate how India's space assets already launched and those yet to be made available by private and public operators will remain protected.

Issues for Consultation

698-806 MHz (Upper UHF Band)

526-698 MHz band (Lower UHF Band)

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

IBDF would like to provide the following response:

The announcement in April 2016 that all available spectrum in the 700 MHz band (Upper UHF Band) will be auctioned was countered by the Cable industry as it would herald serious problems for the C&S sector in India.

Cable TV services have been using the spectrum up to about 800 MHz in both analog and digital implementation and Cable Internet is one of the preferred medium for urban and rural broadband.

Before announcing the plans of auction, the TRAI had floated a consultation paper in 2015 for determining the reserve price in various bands, and stakeholders in Cable TV and media industry have raised serious apprehensions of such a step.

Impact on the C&S Industry and Digitalization Plans-Upper UHF Band

The band identified is APT700 band plan (698-806 MHz) with FDD based 2x45 MHz frequency arrangement. In essence, there is a spectrum band of 108 MHz (698-806) MHz which TRAI has proposed be adopted for use of LTE and be auctioned. The problem is that the use of these very bands is critical for Cable TV and rural broadband, to be delivered by LCOs and MSOs as recommended by the TRAI.

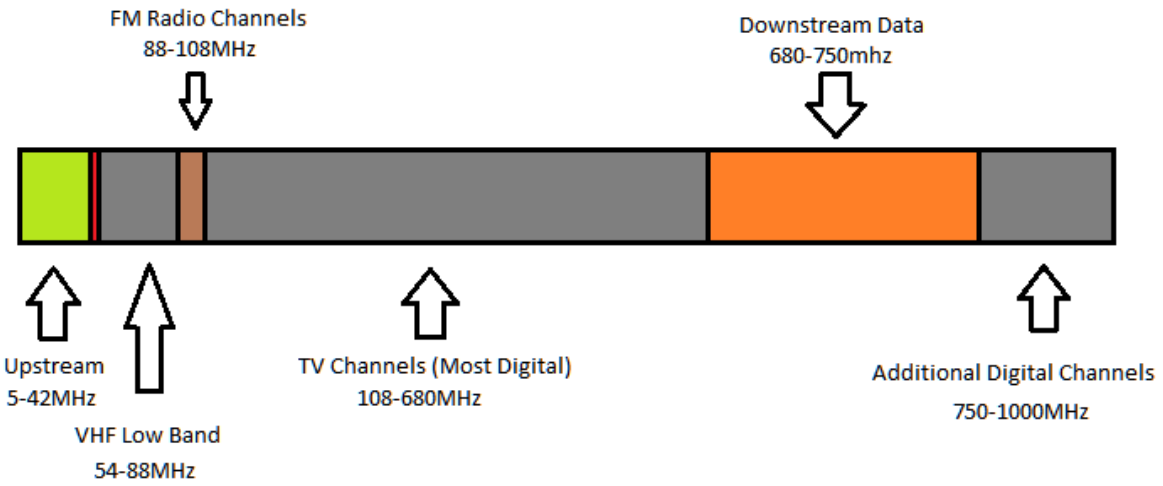
The 700 MHz is called the upper UHF band, and, the band in various countries has only been given after following a due process of consultation **and providing alternative transmission mechanisms and safeguards for the Digital, Analog and cable TV Transmissions in these respective countries.**

The VHF, UHF and upper UHF bands which span from 300 MHz to 850 MHz are extensively used for Cable TV in India which remains coaxial or hybrid coaxial especially in last mile and in rural areas. The frequencies in these bands are fully used for broadband and digital TV.

With nearly 800 channels including HD channels and 50-100 Mbps of broadband delivered to homes, the use of the spectrum till 850 MHz is an essential need for the cable TV industry.

Why use of the Bands for LTE will impact Cable TV & Internet

With high power transmission in LTE environment, the Cable networks, which are mostly Coaxial and over ground, will face severe interference. The typical usage of the frequency allocation in a cable network is divided between Analog channels, Digital channels and broadband carriers for Upstream and downstream use.



Irrespective of the exact plan used on the Cable, the use of 688-806 MHz directly interferes with the data carried on Cable, and in addition interferes with Digital and Analog TV channels.

The Current Proposal of DoT and now under consultation by TRAI 526-698 MHz band (Lower UHF Band) directly interferes with the prime lower UHF band for carriage of TV channels.

TRAI in its recommendations on "Delivering Broadband Quickly" in April 2015 has well recognized the role of MSOs and cable operators in the delivery of high quality broadband via cable networks. It has also given recommendations on License free frequency use, which can also cable networks to also provide Wi-Fi over much larger areas.

Issues for Consultation

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

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

IBDF has already provided responses in regard to the very allocation of 5G spectrum in the 3600-3670 MHz band in our detailed responses above and we suggest that India sticks to the 2018 NFAP band of 3300-3600 MHz, and that too with emission filters used at headends and Antenna down-tilting for 5G towers to be mandatorily installed by Telecom service providers and DPOs for WPC should give its recommendations.

In regard to the minimum quantity and block sizes we would like to observe that by extending bands beyond those recommended by 3GPP, TRAI is seeking comments which will make Indian allocations span more than one band and will take the spectrum usage allocation in unchartered territory in so far as 3GPP is concerned (3GPP Release 15 of December, 2017, and ITU IMT-2020 definition).

Issues for Consultation

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.

It is submitted that a Guard Band of 100 MHz be maintained and the band of 3300- 3600 MHz be utilised for provision of 5G services. This will ensure minimum disruption to broadcasting services and will help in mitigating interference issues. In addition, it should also be made mandatory that all uplink in the C-band from 3300MHz to 3600MHz (assuming that frequencies beyond 3600MHz will not be deployed for 5G services) must carry CARRIER ID (CID) as per specifications - ETSI TS 103 129 V1.1.2 (2014-03).

Issues for Consultation

Questions 14 -15 to 17 - 73

The above questions pertain to methodologies for pricing of spectrum in different bands, auction methodology including block sizes and avoidance of Interference amongst operators, for which IBDF would not like to offer its comments.

Closing Comments

In our closing comments, the IBDF would like to suggest that the present Consultation Paper may be modified and reissued to include the questions which seek consultation on the use of the bands and the impact on incumbent operators as well as existing services. We suggest that the following types of questions be included:

(i) Consultations on the proposed use of various bands including the Sub 700, C-Bands and the 26 and 28 GHz bands

(ii) Whether new bands which have been auctioned in the US such 36 and 47 GHz which will be used by providers such a Starlink should be opened in India and on what terms

(iii) Whether instead of impinging on the C-band and the 28 GHz band (reduction by 1 GHz), new bands as in vogue and auctioned in other countries above 36 GHz should be used and if so whether they should be auctioned now.

(iv) Whether there is a need to set a framework to seek vacation of certain bands where it is believed to be essential and if so to seek consultations on the mechanism of compensation, creation of alternative infra and setting a time frame for such proposed migrations.

(v) Whether the 5G tests announced in March 2021 and now running for nearly 9 months have yielded any results which can be shared by the operators and to share the primary data with a view to seek public comments

(vi) Whether the devices infrastructure and availability in the 36 GHz and higher bands would be a constraint, or otherwise

(vii) Whether there is real need to impinge on the 28 GHz band when the results of auction in the 26 GHz band are not known in terms of its demand and pick up.

The IBDF notes with regret that the current Consultation Paper seeks only one solution for all bands and all applications which is 5G. This includes:

(a) Digital Terrestrial Transmission to be subsumed by 5G
(b) C-Band M&E services to be curtailed severely by 5G
(c) 28 GHz band services of HTS satellites and LEO systems to be gravely impacted by 5G

It would so appear, without any experience of 5G in India, that it has now been predetermined that 5G would serve the needs of all applications, services and that it would be a mass service and that all other types of services need not be maintained in so far as spectrum use is concerned.

However past experience shows that this could be far from true. The previous auctions of CDMA, which was very highly rated as a future technology for India came to a slow death and the spectrum was then allowed to be alternatively used for other services. Next came the well advertised reservation of Spectrum for WiMax services which was believed to be the final solution for rural broadband due to its high resilience to transmission impairment and wide bandwidths. However the 2.3 and 3.3 GHz spectrum reserved for this had to be reframed as such systems barely exist today. It is not unlikely that new technologies will replace 5G which include 6G and satellite mobile. However the current auction process will impose a certain set of operators on India as owners of spectrum for 40 years or more and thus predetermine who should be able to implement future services or otherwise.

In addition, IBDF recommends that the following steps be initiated to reduce the impact of 5G deployment on C-band.

1. Since the C-band frequencies planned for provision of 5G services are up to 3670MHz, it is suggested that use of appropriate Band Pass Filters (BPF) by the DPOs (Cable, DTH,

IPTV and HITS operators) per downlink chain for receiving the satellite TV signals be made mandatory. Since the 5G test information would be available with the Authority and DoT, based on the said data the specifications of the BPF can be prescribed. This will help the DPO's to procure the correct BPF and install them at the earliest.

2. With the allocation of certain C-band frequencies, earlier used for Television services, to 5G to support the deployment and growth of 5G, it can be considered that transponders with downlink frequencies higher than 3700MHz only would be used for Television services. This would mean lower availability of C-band transponder capacity. In view of the same it is submitted that use of foreign satellites be allowed without seeking any clarification / justification from the broadcaster intending to use the foreign satellite for their TV channel broadcast needs.

3. For the same reason of lesser transponder capacity available, it is suggested that newer compression technology such as HEVC or H.265 be approved on a fast track basis, as these technologies use lower transponder capacity without any reduction in the quality of the Television channels. As an example, for a transponder of 36MHz, and using HEVC, the new compression technology, at least 15 HD channels or at least 50 SD channels can be uplinked easily against the present 7 HD channels or 40SD channels. This means an increase of 20% more channels per transponder within the C-band range of 3800GHz to 4200GHz.

4. It is suggested that to encourage the migration to compression technologies such as HEVC, tax holidays be provisioned for the next 5 years for such equipment. Additionally regulatory requirements for such HEVC deployments be processed on fast track (eg.: permission for migration or launch of channels using HEVC technology).

5. Modulation techniques with 3/4 FEC are presently used for TV channel uplink to satellite. This provides an approx. data rate of 61Mbps for DVB-S2 modulation on a 36MHz transponder. To optimize the use of the available satellite capacity for TV channel distribution, it is suggested that TRAI should mandate use of a minimum of 3m TVRO (downlink dishes) by the DPOs so that higher efficient FEC technologies can be used such as 5/6FEC. With 5/6 FEC, the data rate would increase to approx. 70Mbps on the same 36MHz transponder, resulting in improving the transponder capacity utilization by approx. 35% for HD and 12% for SD (if 5/6 FEC and HEVC is adopted).

Implementation of both the above suggestions will help to a very large extent to ease out the immediate shortfall of transponder capacity.