



TVR/VIL/066
5 May 2014

Shri Sanjeev Banzal

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Dear Sir,

**TRAI CONSULTATION PAPER ON ALLOCATION AND PRICING OF MICROWAVE ACCESS (MWA) AND
MICROWAVE BACKBONE (MWB) RF CARRIERS**

Please find enclosed our comments on the TRAI Consultation Paper on Allocation and Pricing of Microwave Access (MWA) and Microwave Backbone (MWB) RF Carriers dated 28th March'2014.

We hope that our submissions will merit your kind consideration and support.

Kind regards,

Sincerely yours,

T. V. Ramachandran
Resident Director
Regulatory Affairs and Government Relations

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5 May'2014

VODAFONE RESPONSE TO TRAI CONSULTATION PAPER ON ALLOCATION AND PRICING OF MICROWAVE ACCESS (MWA) AND MICROWAVE BACKBONE (MWB) RF CARRIERS

INTRODUCTION

Vodafone welcomes this Consultation Paper.

We first wish to emphasize that the requirement of Microwave carriers is critical to rollout as soon as the RF access spectrum is allocated post auction and hence should be treated as an essential resource. Microwave is a complementary facility for enabling the expeditious rollout of networks using the RF access spectrum, which is anyways auctioned.

The auction route is not proposed since the availability of MWA carriers is adequate and can be further augmented, if other frequency bands in 6-42 GHz are also explored and opened up for use. Due to its high availability and nature of the requirement, MWA spectrum can be allocated on exclusive basis.

As regards MWB, although the availability is limited, the requirement is not very high since it is used for city to city backhaul and hence two carriers for each TSP will suffice. Further, this can continue to be allocated link by link on non-exclusive basis as being done presently to cater to many TSPs in any service area. Thus here too, the auction route is not desirable as this spectrum is not being given on an exclusive basis.

The formula based approach proposed by the Authority has serious shortcomings and can lead to anomalous results.

We suggest that given that MW is in the nature of an infrastructure that is critical for rollout, the Authority may like to consider recommending that the charges for this should be sufficient only to cover the costs of administration and regulation of this resource.

In the alternative, we advocate that the current system of allocation and pricing of MW carriers based on administrative pricing on AGR basis should continue being simple and unambiguous. However there is a need to review the rates downwards as we are paying huge spectrum usage charges as percentage of AGR which keep increasing with the ever growing revenues of TSPs.

At the very least, the charges should be retained at November 2002 rates, which were bilaterally agreed between the industry and DoT.

There is an immediate need to open the E band to cater to the backhaul requirements for advance technologies like LTE/LTE-A requiring high bandwidths. This band should be lightly licensed with nominal fixed charging on a link by link basis and should not be priced like conventional MWA/MWB.

We strongly submit that no recommendation should be made that adversely impacts existing operations/allocations.



RESPONSE TO ISSUES RAISED BY TRAI

Q1. How many total Microwave Access and Backbone (MWA/MWB) carriers should be assigned to a TSP deploying:

- a. 2G technology only.
- b. 3G technology only.
- c. BWA technology only.
- d. Both 2G and 3G technologies.
- e. 2G and BWA technologies.
- f. 2G, 3G and BWA technologies.

Please give rationale & justification for your answer.

Microwave Access

- a. The total number of MWA carriers required for any Network will depend on various factors as explained below:
 - **Capacity per site/Network Topology-** The capacity per site, which will vary with type of services offered, has a significant impact on the requirement for microwave. Also, the network can be designed as star, mesh, ring, daisy chain etc. and each will have different requirements for the number of carriers.
 - **Hub density-** Hub density refers to the total number of microwave links originating from one hub site. A higher number of links originating from one site will require higher number of microwave carriers to maintain the threshold degradation at less than 3 dB and availability of 99.999%. For example, VIL has around 5- 8% sites with 10-14 microwave links originating from single Hub site. In Metros/major cities, the average number of BSC /RNC sites are 70 + and average links originating from these BSC sites are 15+ or even more as 2-3 BSC's are collocated thus requiring more number of carriers.
 - **Interference-** This is a key factor in the deployment of MW carriers for quality of service to the customers. The network has to be designed in a manner that no interference is experienced while deploying the different carriers at certain locations specially the hub locations/ dense areas and thus the requirement of more carriers. For example in Metros/Major cities, where generally average inter site and hop distance is 200 meters, there is a high possibility of interference.
 - **Number of links per MW carrier/Frequency Reuse-** Although technically 4 links per MW carrier can be originated from one site but due to practical scenario on ground such as suboptimal angular separation, Line of Sight (LoS) limitations, uneven site distribution and geographical restrictions on hub sites creations etc. achieving the same in practice for all available carriers is not possible.
 - **Mobile Network Density-** Mobile network density refers to the number of sites in a geographical area. Higher network density leads to higher number of microwave hops deployment per unit area. To cover same geographical area different number of cell sites is required depending on RAN spectrum, technology and clutter.



- **Fibre penetration-** One alternative to MW is OFC but in city like Mumbai the OFC build cost of per Km is around INR 8.5 million, which is very high. Not only is fibre RoW expensive, more often than not, permissions to dig is just not given. Further due to multiplicity of agencies digging up without any coordination, often leads to OFC cuts. Hence demand for MW carriers for reliability. However, OFC is being deployed for MW for intercity connectivity wherever possible.
- b. As is evident from the above, we believe that given the multiplicity of factors that can determine the requirement of MWA carriers and the fact that TSPs are offering a mix of various technologies and services in different bands, it would be incorrect to link the allocation to choice of technology.
 - c. There is no 'one size fits all' assignment of microwave slots for operators. The factors determining operators individual requirements listed above will *vary by operator*, so specifying an assignment by operator type/technology (2G only, 3G only etc.) will invariably result in insufficient microwave capacity for some, and excess carriers for others.
 - d. Also, given the adequate availability of MWA carriers as identified by the Authority in the Consultation Paper as also the further MWA carriers available in other bands such as 26 GHz,28 GHz,32 GHz,38GHz,42GHz, etc that are used in other countries, we believe that there is no need to *a priori* limit the number of MWA carriers that should be assigned per TSP.
 - e. Please also see response to Q2. below

Microwave Backbone

- f. As regards the MWB carriers, given the limited availability of carriers in this band, the fact that they are deployed to carry backhaul from city to city and that these are used in an intermittent and non-exclusive way throughout the service areas, we believe that there is a need to ensure at least 2 carriers per TSP to take care of the basic minimum requirements for interference free network.

Q2. How many MWA/MWB carriers need to be assigned to TSPs in case of 2G, 3G and BWA at the start of their services [i.e. at beginning of rolling of services]. Please justify your answer.

- a. It is first submitted that the number of carriers allocated to TSPs have never been linked to technology and have always been allocated on technology neutral basis. We believe that this practice should continue.
- b. As submitted hereinabove, the requirement for MWA will depend on a number of factors. However, as an initial requirement the Authority may like to recommend the number of MWA carriers based on the Category/type of Circle.
- c. Based on the past experience of the existing operators, the initial allocation may be set at 4 carriers in Metro & A circles, 3 carriers in B circles and 2 carriers in C circles, which should be sufficient to meet their requirements for MWA.
- d. Please note that the above is only by way of an initial allocation. The requirement for more MWA carriers can be expected to arise soon after the initial stages given the high growth being witnessed especially in data services.



- e. Allocation of additional carriers should be based on technical justification, as per existing practice and could take into account the various factors highlighted above.
- f. For MWB, one carrier in the initial stage should suffice. However, the TSP may be given the choice to also take the second carrier at the initial stage itself given their business plans, expected growth in data services, etc.

Q3. Should excess spectrum be withdrawn from existing TSPs?

- a. It is first submitted that there is no excess spectrum, as alleged. All MW spectrum has been allocated as per applicable DoT guidelines.
- b. After the initial allocation, all additional microwave spectrum has been allocated to TSPs based on demonstration of full justification for the same. There is thus no excess spectrum/allocation as is being wrongly contended.
- c. Also the MW spectrum has been fully utilized to carry out extensive rollouts. Any withdrawal of MW spectrum will adversely impact rollout and quality of services and harm the achievement of national telecom objectives.
- d. Further, given that going forward, there is a growing proliferation of broadband services which entail higher capacities and additional MWA carriers there will be a requirement to further augment rather than restrict the MWA allocations.
- e. It may also be noted that the charges for existing allocations and thereby the allocations themselves, are governed/protected by the Order of the Ld. TDSAT that set aside the DoT Orders dated November 2006 and November 2008 in its Order dated 22 Apr-2010 in Petition No.122 of 2007. Although the DoT has challenged this Order before the Hon'ble Supreme Court, the Court has admitted the matter, but has not granted any stay to DoT.
- f. **In view of the above also, we believe that it may not be appropriate to interfere with the existing allocations.**

Q4. If yes, what should be the criteria for withdrawal of excess allocation of MWA and MWB carriers, if any, allocated to the existing service providers?

- a. Does not arise in view of the above.

Q5. What should be the preferred basis of assignment of MWA/MWB carriers to the TSPs i.e. 'exclusive basis assignment' or 'link-to-link based assignment'?

Microwave Access

- a. Any attempt to assign MWA on a link by link assignment basis will be both cumbersome and impractical for WPC due to the requirement of effective co-ordination for huge numbers of MWA links that are deployed by the TSPs. For example, the Vodafone Metro network in Delhi has 5,700 MWA links. If this is multiplied by the number of operators in a service area, it is evident that the task of trying to assign or regulate on a link by link basis would be clearly huge and impractical requiring a



colossal amount of coordination by WPC including maintenance of database and managing interference. Further any incorrect coordination may result in interference issues, hence affecting the Quality of service.

- b. In view of the above, we submit that the preferred basis of assignment of MWA should continue to be on an exclusive basis – this would be simple, unambiguous, easy to implement as well as regulate.

Microwave Backbone

- c. However in the case of MWB, the available number of carriers for assignment are limited (only 8 in 6 GHz and 5 in 7 GHz). Moreover links deployed are few in numbers being mostly used for inter-city backhaul thus the coordination by WPC will be easy for interference and subsequent assignment to various operators. Further, these are assigned to a large number of TSPs in any Service Area on a non-exclusive basis.
- d. In view of the above, we believe that it would be desirable to continue assignment of MWB on a link by link basis.

Q6. In case 'exclusive basis' assignment is preferred, whether MWA and MWB carriers should be assigned administratively or through auction. Please comment with full justifications.

- a. We first wish to emphasize that the requirement of Microwave carriers is critical to rollout as it is required as soon as the Access spectrum is allocated post auction and hence should be treated as an essential resource, in the nature of an infrastructure.
- b. It is access spectrum that is a scarce resource that needs to be auctioned. It may be further noted that an auction method for assigning spectrum is relevant /desirable when
 - There is a demand supply mismatch – i.e. the demand is higher than the supply and therefore auctions become the preferred method for allocation of resources in a fair and transparent manner
 - The frequencies are assigned on an exclusive basis
- c. As we have pointed out above, there is ample availability of MWA carriers in the 13, 18 and 21 GHz as is evident from Table 3.1 of the Consultation Paper. Out of the total 2090 carriers, only 810 carriers have been assigned and balance 1280 carriers are available with WPC. The other frequency bands namely 26 GHz, 28GHz, 32 GHz and 42 GHz in 6-42 GHz range which are used in other countries for MWA but not being assigned for MW links in mobile network in India may also be explored to take care of the ever growing mobile broadband network traffic which will require additional MWA carriers in future.
- d. Similarly, in the case of MWB, although the spectrum availability is limited, these allocations are made on a non-exclusive basis.
- e. In view of the above, we submit that auction is not the correct or relevant approach for assignment of either MWA or MWB carriers spectrum.



- f. It may also not be out of place to point out that the Hon'ble Supreme Court in Order dated 27 September 2012 in Special Reference No.1 of 2012 has also held that auction is just one of the several price mechanisms and it cannot be held to be the only constitutionally recognised method for alienation of natural resources.
- g. In view of the above, we submit that **MWA and MWB carriers should continue to be assigned administratively and not through auction.**

Q7. In case 'link-to-link basis' assignment is preferred, how the carrier assignment for different links should be carried out, particularly in nearby locations?

Microwave Backbone

- a. As submitted above, carrier assignment on link to link basis has been recommended only for MWB on account of the limited use and non-exclusive allocations.
- b. Carrier assignment on a **link-to-link basis will** require coordination by WPC for any interference with the existing operating links of other TSPs. For this the operator should be required to provide the deployment details like the Geo coordinates of the connected sites, the link distance, power transmitted and the frequency spot to be deployed etc. WPC checks with the existing data base of other operators in nearby locations for any overlap/interference analysis and accordingly assigns the link. In case of any interference issues, the solutions like use of different polarisation, alternate link paths, etc are proposed.

Q8. Considering the fact that different TSPs may require additional carriers at different point of time, what should be the assignment criteria for allocation of additional carriers for MWA and MWB?

Microwave access

- a. As submitted above, the requirement for additional MWA carriers will depend upon a number of factors.
- b. It is therefore suggested that these continue to be assigned based on technical justification being demonstrated by the TSP.as is the present practice.

Microwave Backbone

- c. As explained above, two carriers for MWB are sufficient. These may be given upfront or otherwise, as per the choice of the TSP.

Q9. How can it be ensured that spectrum carriers assigned are used optimally and the TSPs are encouraged to move towards the OFC?

- a. We would like to first submit that given that MW is in the nature of an infrastructure that is critical for rollout, the Authority may like to consider recommending that the charges for this should be sufficient only to cover the costs of administration and regulation of this resource.



- b. However, in the alternative, we believe that the current system of graded AGR may continue to ensure optimal utilization of MW allocations.
- c. However, the rates need to be reviewed downwards on account of the sharp increase in the charges on account of the exponential growth in the revenues of the TSPs over the years.
- d. At the very least, we submit that the charges prescribed in 2002 (which were also bilaterally settled between the industry and the Government) should continue to be applicable.
- e. It may be noted that the charges for both MWA and MWB are governed by the TDSAT Order dated 22 Apr-2010 in Petition 122 of 2007 which set aside the DoT Circulars dated November 2006 and November 2008 and restored the charges as prescribed by the DoT in April 2002 that were a subject matter of a bilateral agreement between the TSPs and DoT.
- f. It is submitted that any change in the pricing can only be as agreed by both parties and cannot be unilaterally thrust upon the TSPs.

Q10. Should an upfront charge be levied on the assignment of MWA or MWB carriers, apart from the annual spectrum charges?

Q11. What should be the pricing mechanism for MWA and MWB carriers? Should the annual spectrum charges be levied as a percentage of AGR or on link-by-link basis or a combination of the two?

Q12. In case of percentage AGR based pricing, is there any need to change the existing slabs prescribed by the DoT in 2006 and 2008?

- a. We believe that there is no case or basis for any upfront charge. It is reiterated that MWA and MWB are essential for rollout and in the nature of infrastructure that is packaged with RF access spectrum to facilitate rollout.
- b. The 2006 and 2008 rates have been set aside by the TDSAT Order dated 22 Apr-2010 in Petition 122 of 2007 which restored the charges as agreed to by the DoT and the industry in April 2002. Any change in the pricing of MWA/MWB can only be as agreed by both parties and cannot be unilaterally thrust upon the TSPs.
- c. As submitted above, the charges should only cover the costs of administration and regulation of this resource, failing which these should continue to be levied on an AGR basis, with a possible downward reduction in the rates, as agreed in 2002.

Q13. In case link-by-link based charging mechanism is adopted then:

(a) Should the spectrum be priced differently for different MW spectrum bands (6GHz/7GHz/13GHz/15GHz/18GHz/21GHz/26GHz/28GHz/32GHz/42GHz etc)? If yes, by what formula should these be charged?



(b) What are the factors (viz as mentioned in para 3.22), that should appear in the formula? Please elaborate each and every factor suggested.

- a. We are not in favour of link by link charging for MW spectrum and submit that the charges should only cover the costs of administration and regulation of this resource. In the alternative, these should continue to be charged on AGR basis. We strongly submit that there is a case for downward reduction, in view of the exponential increase in the revenues of TSPs. At the very least, the rates as agreed in 2002, should be continued with.
- b. We also believe that there is no justification to set a price separately for different MW bands. This has also not been the approach followed by DoT in the past.
- c. We are also not in favour of formula based charging. It is respectfully submitted that the formula proposed by the Authority as below has serious shortcomings

$$R = (\sqrt{M}) * W * C * A * S * P * B$$

Where:

P = the factor for discounting based on population density

B = the factor for discounting based on band of deployment

It is submitted that both factors lead to anomalous results:

$$P = 0.5 \times \left(1 - \frac{\text{population density}}{2,000} \right)$$

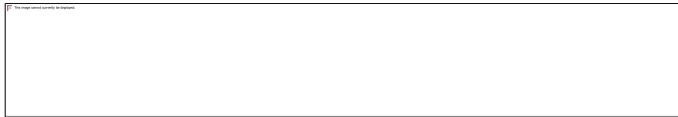
In areas with higher population density—which are therefore more ‘valuable’ and also more amenable to OFC deployment—the charges will be lower, all else held constant. In the table below we compare the factor P for a range districts from the one with the lowest population density (Dibang Valley in Arunachal) to the one with the highest population density (excluding Metros and other large cities) Mahe.

District	Dibang	Jaisalmer	Kalahandi	Vadodara	Aligarh	Atappuzha	Sheohar	Varanasi	Mahe
Pop. Density	1	17	199	551	1,007	1501	1882	2,399	4,659
P	0.500	0.496	0.450	0.362	0.248	0.125	.0295	-.100	-0.665

It is clear that this formula yields illogical results: the charges will be higher in Jaisalmer compared with Sheohar by a factor of **17 times**, when Jaisalmer should have lower charges. As per the above, in districts with a population density higher than more than the (arbitrary) number of 2,000, the DoT will pay the



operator to use the link!? In contrast, the charges (\$ per kHz) for fixed point-to-point licenses in Australia vary by population density; they are higher in high density areas (see Annexure 3.1, page 163 of the consultation document).



This formula again yields the anomalous results, the higher bands will have higher charges (see the table below).

Band (MHz)	7000	13000	15000	18000	21000	V band 57000	E band 71000
B	0.100	0.250	0.300	0.375	0.450	1.350	1.700

Clearly, a per link price that rises with centre frequency is illogical and to charge 17 times more for the E-band versus the 7GHz channel on a per MHz basis when allocations in E-band will be 9 times greater (250MHz versus 28Mz) is absurd. It may be noted that the Ofcom formula referred to in the consultation (see Annexure 3.2, page 164) has charges *decreasing* with the increase in centre frequency.

Q14. Should the option of assignment of MWA carriers in all the spectrum bands in 6-42 GHz range be explored in line with other countries? What are the likely issues in its assignment MWA carriers in these additional spectrum bands?

- a. Yes. The reach of the additional bands due to the higher frequency bands is one of the key considerations for allocation. As in other countries, option for other bands needs to be evaluated, typically 26GHz, 28GHz, 32GHz and 42GHz spectrum for a point to point and multipoint solutions considering small cell /WiFi deployments in metro regions. The higher frequency bands are not suitable for rural deployments due to free space loss issues limiting hop lengths. Opening up 8-13 GHz bands especially for rural deployments would help cover larger rural population at affordable costs. These bands would be unsuitable for larger urban/metro deployments due to wider beam width's leading to interference issues. Opening of the allocation in these bands will off-load the burden on present 13/15/23 GHz spectrum for MWA backhaul.
- b. Mentioned below is the list of frequency bands that are not allocated, with suggested per channel BW if it allocated as a carrier (Channel BW taken from channelization plan recommended by ITU and has fairly wide deployments in Europe and other mature markets with availability of equipment manufacturers supporting these bands).



S. No	Frequency Band	Per Channel BW Suggested	Issues
1	8 GHz	29.65	1. Can only be used for long distance link (As a Backbonelink) 2. Wider Beam width Prone to interference.
2	11 GHz	40	1. More Rain Attenuation. 2. Wider Beam width hence not suitable to plan in Metro cities, will lead to more interference as shorter hop length.
3	13 GHz	28	
4	26 GHz	112	1. Highest Rain Attenuation. 2. Suitable to plan for shorter hop but not in rural area where links are planned with more hop length due to more free space loss.
5	28 GHz	112	
6	32 GHz	112	
7	38GHz	140	
8	42GHz	112	

Q15. In your opinion, what is the appropriate time for considering assignment of MWA carriers in higher frequency bands viz. E-band and V-band?

- a. We submit that the E-band spectrum should be assigned to TSPs at the earliest, considering the fact that LTE and BWA demands significantly higher (tune of 5-10 times) bandwidth per site, which cannot be fulfilled by MW at present carrier options (13/15/23/28GHz). Currently, these spectrum bands are required in metro and class 'A' cities where we see predominant deployment of LTE and BWA as reaching with fibre at sites for backhaul is an expensive and time consuming option. Also considering the quality factor of the network, sites with 100Mbps+ bandwidth are required to be in high availability category with fibre being the most susceptible option for cuts. Small cell and WiFi deployments have further imposed demands on the backhaul networks which support NLOS reach and sustainable throughputs.
- b. It may be noted that the V band however, has issues related to rain fade and oxygen absorption making it tougher for specific geographies and applications.

Q16. Should E-band be fully regulated or there should be light touch regulations?

- a. Due to the extremely wide channels needed in E-band, varying from 250 MHz to 1000 MHz, there are not enough channels that can be given to the TSPs on an exclusive basis.
- b. However, since E band casts very narrow beams which allow for the deployment of multiple independent links in close proximity and E-Band links are going to be implemented in urban short overlays over the existing microwave structure, this band can therefore be assigned on a non-exclusive basis.
- c. In view of the possibility for non-exclusive use and the minimal inter link interference on account of the pencil beam microwave, we recommend that a light touch regulatory approach may be adopted for this spectrum. The Authority may recommend that TSPs register the links with WPC and self-coordinated for interference on the basis of the centralized data base available on the WPC web site.



- d. As the Authority has noted, most countries have also gone for a Light Licensing approach for E-band. India too, should follow this global practice.
- e. V-Band should be un-licensed and free to use in the very short distances that it can be used due to the combination of Oxygen absorption and rain attenuation.

Q17. What charging/pricing mechanism would be appropriate for these bands?

- a. Since E-Band links are going to be implemented in urban short overlays over the existing microwave structure, initial deployments will contribute only to part of the operator revenues, therefore AGR based pricing cannot be practically implemented, as it will result with a too high cost per link when one calculates the circle AGR versus the number of links to be deployed. Per link licensing seems to be the only way to benefit from the high re-usability of the spectrum. Low pricing is needed in order to encourage the usage of this spectrum and this spectrum should not be priced like conventional MWA/MWB.
- b. To attract the TSPs to use this band, the initial pricing of the band should be kept as low as possible. It is even suggested that initially the pricing should be such that it covers only the administrative costs. Also automatic SACFA clearance should be permitted.
- c. For V-Band, we recommend allocation of the whole 57-64GHz band (beyond what was proposed in IND-80) in order to offer a wide band as existing in other countries, with free of charge pricing, as appropriate for unlicensed bands.

Q18. Apart from Q1-Q17, stakeholders are requested to bring out any other issue, which needs to be examined, with justification

Following additional points are requested for consideration:

- (a) WPC should examine the availability of spectrum in bands <10 GHz for MWB requirements especially for rural areas due to limited availability of carriers in 6 and 7 GHz. (there are only 5 carriers in 7 GHz and 8 in 6 GHz, most of them being held by BSNL)
- (b) Opening of KA band (satellite band) to deploy advanced cellular networks in remote locations since there is capacity crunch in the existing C & KU bands.
- (c) Opening of spectrum bands in Point to Multipoint technologies viz. LMDS etc. in 10.5, 26 and 28 GHz band.

**New Delhi
5 May 2014**