

## **Allocation and Pricing of Microwave Access (MWA) and Microwave Backbone (MWB)**

### **RF Carriers**

#### **General:**

The Radio Frequency (RF) Spectrum is a finite natural resource, which is only extended by the aid of technological evolution. With its crucial role in mobile communications, which have brought about dramatic growth of phone services in India and in other developing economies globally, large attention has been focused on the RF spectrum. Due to its limited nature, it has attained significant value – for economy as well for society at large. Optimum use of this limited and scarce resource by all users is inescapable.

Microwave frequency bands are important along with access spectrum, for the cellular mobile networks. However, it is distinctly different from other forms of spectrum. The Microwave carriers supplement the access spectrum, for the cellular network. These MWA bands as a ways of providing mobile backhaul connectivity are in addition to/alternative to fiber and copper. Like any other parts of frequency spectrum, microwave frequencies are also governed by specific propagation characteristics for different bands and this needs managing in an appropriate manner as well.

The advantage which MWA offers is it is a form of just-in-time technology with the benefit of quicker rollout. This technology provides an alternative to fiber and copper.

Links in higher frequency bands, say around 80 GHz, can satisfactorily cover a distance of less than a Km only. Also, equipment in frequency bands above 60 GHz is relatively costly at present till economies of scale become available. Hence, many governments and spectrum regulators are levying only nominal spectrum charges for the use of these bands to encourage their usage.

Even for other frequency bands, their economic valuation depends on a large number of factors.

### **Issues for Consultation**

**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.**

**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.**

<Combined Answer for 1 & 2>

Answer:

The number of Microwave Access carriers needed by an operator would depend on the total number of subscribers and traffic. Modern technologies and content like 3G and BWA generate higher amount of traffic and hence, need larger access network. It must be kept in mind that in an information highway setup, while a higher capacity technology can be substituted with a smaller capacity technology, vice-versa does not hold true.

Every operator must be allocated with a fixed bandwidth in a manner that ensures there is no possibility of any inter-operator interference as distinct chunks of spectrum are allocated in a distinct manner. Within a particular chunk of spectrum, the onus of resolving any form of interference must be placed on the operator. The operator would design the system in a manner to support the network topology put in place to aid its limited bandwidth.

Still, in the beginning, it may be possible to plan the network with 1 carrier of 28 MHz bandwidth in 13/ 15/ 18 GHz bands and 1 carrier of 56 MHz bandwidth in 21/ 26/ 28 GHz bands. Subsequently 1 carrier of 112 MHz bandwidth in 32/ 42 GHZ band and 1 carrier of 250 MHz bandwidth in 60/ 80 GHz bandwidth can be assigned to meet the growing traffic. Further, as the network and traffic grows, suitable additional carriers can be assigned, based on the justification. These groups of frequency bands display different propagation characteristics and hence, these have to be priced differently in order to encourage the operators to use all the carriers in an optimal manner to meet their network and traffic needs.

For Microwave backbone network, the OFC is used quite extensively, especially on the routes where the traffic is very heavy. Hence, one carrier in 6/ 7 GHz bands, may be enough in the beginning. With the growth of network and traffic, there may be need for one additional carrier at few places only.

**Q3. Should excess spectrum be withdrawn from existing TSPs?**

**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?**

<Combined Answer for 3 & 4>

Answer:

The existing TSPs can be asked to re-plan their network with some microwave access carriers in higher bands of 21/ 26/ 28 GHz; 32/ 42 GHz and/ or 60/ 80 GHz bands. For shorter routes, it may be possible to use higher bands and release carriers in lower bands of 13/ 15/ 18 GHz. Hence basically, it would be replacing the carriers in lower bands with those in higher bands, with larger bandwidth.

With suitable regulatory methods, all operators should be encouraged to optimally plan their network.

**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'?**

**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.**

**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?**

**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?**

<Combined Answer for 5, 6, 7 & 8>

Answer:

The TSPs need some flexibility in planning their network. Also, with growth of network, they would need to re-plan their network in a dynamic manner. 'Link-to-Link' based assignment of carriers may require extensive efforts with spectrum regulator and might result in delays. Hence, Microwave Access carriers in 13/ 15/ 18 GHz bands as well as 21/ 26/ 28 GHz bands can be assigned on exclusive basis.

Frequencies in 60/ 80 GHz bands can be assigned on 'Link-to-Link' basis as these would be needed mostly in large urban areas, where dense network and heavy traffic conditions are likely to manifest.

Regarding total number of carriers, the Questions 1 and 2 and their answers are related.

For Microwave backbone network, 1 carrier of 28 MHz bandwidth in 6/ 7 GHz bands, can be assigned on exclusive basis. If some operator is not able to plan some hops of his Microwave backbone network with one carrier and if there is full justification, the second carrier can be considered for assignment on 'Link-to-Link' basis.

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

Answer:

Various regulatory methods, including increasing spectrum pricing for successive carriers in the same group of frequency bands, can encourage/ force the TSPs to use the carriers in an optimal manner. The optimum spectrum pricing can be determined in a reiterative manner.

**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? Please justify your answer.**

<Combined Answer for 10, 11 & 12>

Answer:

An operator would usually weigh the cost benefit of having microwave over copper or fiber. We believe that a one-time upfront charge should be levied. The MWA carriers should not be seen as a revenue spinning tool by the Government. If the Government seeks to derive a market price through an auction process, it may be merited in doing so. But, there shouldn't be an AGR linkage to it. The other forms of mobile backhaul do not have an AGR linkage to it- be it copper or fiber. An AGR mechanism puts a burden for perpetuity on the service providers.

However, if the regulator does seek to examine an administrative pricing mechanism based on international best practices which may be prevalent in this regard, it can explore a minuscule percentage of AGR as the basis for the pricing.

We should bring in a concept of revenue neutrality as the purpose of a MWA apparatus is to provide an alternative backhaul mechanism vis-à-vis copper/fiber. The system does not merely decay upon the access of a MWA system.

We must usher in a revenue neutrality regime, as otherwise, an operator whose revenue becomes 2x over a given period of time, would be paying a percentage of that 2x increase, even though, that 2x increase might not be attributable to the MWA carriers.

In case of 'Exclusive' assignment of these carriers, a reasonable upfront charge along with annual charges would ensure optimal use of the carriers. The link-by-link basis charging may create avoidable complexity for the spectrum regulator as well as the operators, in verifying & tallying the number of links, which vary from time to time in a dynamic manner, with new links coming up with new BTSSs and other network elements as well as some links being shifted to OFC.

Also, the upfront charge for second and subsequent MWA carriers in 13/ 15/ 18 GHz bands should be increasingly higher than the first carrier to ensure that the operator uses the available carriers to the full extent, before asking for additional carrier(s). Also, they should be encouraged to use carriers in higher frequency bands, along with carriers in lower bands of 13/ 15 / 18 GHz bands.

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

**(a) Should the spectrum be priced differently for different MW spectrum bands (6 GHz/ 7 GHz/ 13 GHz/ 15 GHz/ 18 GHz/ 21 GHz/ 26 GHz/ 28 GHz/ 32 GHz/ 42 GHz 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.**

Answer:

Microwave Access Carriers in different groups of frequency bands should be treated separately and charges should be levied separately so as to encourage the operators to move shorter links to higher frequency bands. Also, carries in progressively higher bands would need increasingly higher bandwidths. Hence, carriers in different groups of frequency bands should not be clubbed together.

Different groups of frequency bands have widely different propagation characteristics and hence, different usage in the network. It may be possible to treat the different groups for spectrum charging as:

- a) 6/ 7 GHz bands together (mostly for microwave backbone network);
- b) 13/ 15/ 18 GHz bands (for relatively longer range microwave access links);
- c) 21/ 26/ 28 GHz bands (for relatively medium range microwave access links);
- d) 32/ 42 GHz bands (for relatively short range microwave access links);
- e) 60/ 80 GHz (for very short range microwave access links)

Some other frequency bands, e.g. 23 GHz and 38 GHz bands may also be used for microwave access network. These can be clubbed with their respective groups.

The spectrum charging mechanism should be simple to implement and may be market driven, if need be.

**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?**

**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?**

<Combined Answer for 14 & 15>

Answer:

Many countries, including (the U.S., Europe and several others) have already formalized the rules and licensing infrastructure (databases etc.) for these higher frequency bands of 60 & 80 GHz. In some of these countries/ areas, the V-band (60 GHz) is unlicensed and the E-band (70-80 GHz) is lightly licensed. The rationale here is the oxygen absorption in the V-band makes it extremely unlikely that multiple links will interfere with each other, even if collocated, and therefore no licensing is required. In E-band, there is a small possibility of inter-link interference so a "lightly licensed" approach makes it easy for disparate parties to avoid each other's links.

The rules for these bands should be established as soon as possible. As soon as the disposition of these bands is clear, telecom operators can start to incorporate microwave backhaul into their network planning (and business planning and fundraising) activities. As long as the disposition of the microwave bands is unclear, then options for backhauling LTE small cell and Metro wi-fi deployments remain extremely limited (principally fiber to the device which is cost prohibitive in most scenarios).

Carriers in different groups of frequency bands should be treated separately and not clubbed together for charging purposes.

Answers for various other Questions above are also relevant in this regard.

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

Light touch or "lightly licensed" or even "unlicensed" regulation is appropriate for these bands. The high propagation loss in these bands and the associated necessity for highly directional antennas to overcome these losses mean that links at these frequencies can be densely deployed with minimal concern about interference between links. This furthermore allows many

different users to deploy and use wireless links in the same area with little or no collaboration required.

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

Answer:

A minimal charge for a geographic area (ie country or state) on a link to link assignment may be considered. This mechanism will then encourage proliferation of links, and maximize provided data rates of the links deployed. This will then enable deployment of large scale small cell and metro wifi to provide much needed, and revenue producing mobile and nomadic data services.

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

Answer:

There are a host of other related issues. Satellite back haul links would be needed for BTSSs in difficult and remote areas like islands, forests, etc. The Ku band of FSS is ideal for this, as Earth stations in this band can work with relatively smaller size dish antennae.

However, most of the satellite capacity in FSS Ku band is being used for DTH services, while the BSS Plan part of Ku band is lying idle. Hence, there is pressing need for immediately opening the use of BSS Plan part of Ku band for DTH services, so that adequate capacity in FSS Ku band is available for back haul links, for which the requirement would be growing with growing data needs. It is understood that TRAI is processing a consultation regarding DTH licenses. It would be better if this aspect can be suitably examined in the process of that consultation.