



Competitive Exams: Science and Technology Spectrum

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Spectrum

1. The word 'natural resource' brings to our mind environmental elements like water, land, minerals and petroleum products. One may stretch it to clear air. But no one so far even thought that an intangible and abstract entity called spectrum could be a natural resource. And that too with an adjective 'scarce' like any other resource.
2. Since the last four or five years a realization has come about the spectrum being scarce and insufficient for our ever expanding needs and hence precious.

What is Spectrum?

1. Spectrum is a distribution of frequencies in a wave or a ray. The most popular example of a spectrum is the rainbow. The visible light from the sunrays is comprised of seven colour from violet to red in the famous sequence VIBGYOR.

Radio Waves

1. A significant part of the EM Spectrum is occupied by radio ways. They are a versatile tool and can perform very wide nature of duties for man. Different types of radio broadcasts medium wave, short wave, FM and satellite radio, radars for traffic control and weather prediction, wireless communication for police and armed forces, conventional television, Cable TV, radio operated toys, robotics, microwave cooking and cordless phones are the traditional applications of these waves.
2. They are expanding but at a moderate rate. But applications like mobile phones, Global Positioning systems (GPS), satellite TV, Bluetooth etc are newer applications and are expanding at a fast pace.
3. Which frequency is suitable for a particular application, depends upon the nature of application, its sensitivity to directionally, the distance between the instrument and the source etc. These waves have four different categories of penetration. Upto 2 Giga Hertz we have radio waves that can go through building structures/walls and television, which are to be used indoors, obvious contenders for a place in this segment are mobile phones.
4. The second category is semi-penetrating, which can manage some penetration but not through heavy structures or dense objects. They also do not need to have direct line-of-sight access. Here a narrow band around 2.4 GHz is used for domestic services like cooking, cardless phones, Bluetooth etc.

Shortage of Frequency

1. Mobile telephony is allotted a nominally wide band of frequencies at two or three spots on the spectrum, viz at 400 MHz, 800 MHz and at 1900 MHz.
2. Now this requires higher speed of data transfer, otherwise the song will shutter and pictures will appear in jerks. While 16 kbps (kilo bytes per second) speed is all right for voice content, songs need 128 kbps and data (like picture) may require even 1000kbps i.e.. 1 Mbps.
3. Faster data transfer needs a wider frequency band, that is, a broader slice on the spectrum line.
4. Unfortunately, this spectrum is not like currency notes than can be printed as done during deficit financing.
5. There are two solutions to this scarcity administrative and technical. As part of the administrative solution the government has requested the defence ministry to vacate some frequencies that were earlier allotted to them. They can move over to other frequencies or change the technology itself by using fibre optic cable networks. Such cables are delicate to handle in addition to the cost factor.
6. The technical solution to use the spectrum more efficiently by sending more information using the same width of the frequency band. That is what 3G technology is all about:

2G and 3G

1. There is no part of the spectrum that can be called 2G or 3G. Thus, strictly speaking, the word '2G Spectrum' is a misnomer. These letters denote the generations of the cell phone technology. Similar usage exists in computer technology where 1G, 2G and 3G indicate progressively advanced generations of technology of the equipment/process.
2. In the first generation telephony we had analog exchanges. In the 2G or second generation the voice was transmitted in digital form, it is called duplex system because the line on which two persons are talking gets dedicated to that pair of talkers. To use the line more efficiently, more people should be able to use the same line simultaneously. Around the turn of this millennium, 3G technology came that permits this, among other things.
3. Compared to voice, the data comes in a more interrupted manner. It comes in bursts. There can be gaps between bursts. 3G uses this gap to push data from the other users. For this, the data is broken down into small packets and sent. At the destination these packets from respective users are joined appropriately to make a complete message (which can be a song, a picture or just a voice talk.)
4. Of course better results require better frequency bandwidth. Against a 2G line needing 30 to 200 kHz, a 3G requires to 20 MHz of bandwidth. But it carries more traffic too. Some of

the other issues like incompatibility between various techniques and standards in 2G technology are also addressed in 3G. Sustainability:

5. For all natural resources that are limited in supply, the issue of use within the sustainability boundaries always exists. The radio frequency spectrum too has this issue thought it is not a consumable item. Demand for the bandwidths for various applications is increasing and mobile telephony is the leading consumer.

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