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The mobile phone, mobile towers should be operated at lower frequency (at higher wavelength) rather than at higher frequency (at lower wavelength)

Syed Mahboob[*, 1], and Rizwana[2]
[1]*Department of Physics, Osmania University, Hyderabad-500007, Telangana state, India.*
[2] *Institute of Aeronautical Engineering, Dundigal, Hyderabad-500043, Telangana, India.*
**Author for correspondence (mahboob1978@yahoo.com)*

Abstract: *The mobile phones are operated at higher frequency between 600 MHz- 39 GHz. Due to higher frequency range the wavelength (spanning area) is low and is of the order of milli meter range. Since the wavelength is lower, it requires large number of towers place very nearby to each other for uninterrupted mobile signal. In the present manuscript it is suggested to operate the mobile phones at frequency of the order of milli Hz range. If operated at milli Hz range the wavelength (spanning area) would be of the order of G (10^9) meters. Then it requires lower number of towers place very far from each other. Then there will be no mobile signal problem and uninterrupted mobile signal can be provided to mobile phone users. The present manuscript also presents the probable allocation of different frequency spectrum band and its corresponding wavelength (spanning area) to different kind of services in INDIA.*

Keywords: *Mobile phone; Mobile signals; Mobile towers; Frequency; Wavelength.*

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I. Introduction:

Generally the mobile phone, mobile towers are operated at higher frequency between 600 MHz- 39 GHz. This frequency range is much higher and its wavelength is much lower. Since the wavelength is smaller there is mobile signal problem even though large number of mobile towers is used and each tower is placed nearby to each other.

Table 1 shows the allocation of different frequency spectrum band to different kind of services in INDIA [1-3]. Considering the frequency spectrum band the respective wavelength band is calculated by using formula ($\mu=c/\lambda$) and is tabulated in Table1. Here μ is the operation frequency, λ is the wavelength (also called spanning area) and c is the velocity of light and its value is equal to $3x10^8$ meters/s.

For Mobile (distress and calling) the operation frequency band is 495-505 kHz. The respective maximum and minimum wavelength is 606 mk (meters) and 594 mk (meters) (Table 1). Here m is milli and k is kilo. For mobile, fixed, broadcasting the operation frequency is 890-960 MHz (here M is mega). The respective maximum and minimum wavelength is 337 m (meters) and 312 m (meters). For mobile satellite the operation frequency is 942-960 MHz. The respective maximum and minimum wavelength is 318 m (meters) and 312 m (meters). For mobile for space operation the operation frequency is 1710-1930 MHz. The respective maximum and minimum wavelength is 175 m (meters) and 155 m (meters). In all the above different application of mobile phone the frequency is very higher and the respective wavelength is in milli meters range. Since the wavelength (spanning area) is in milli meters range, it requires large number of mobile towers and these towers should be placed at nearby to each other towers for non interrupted mobile signals. Since the wavelength is very low this results in mobile signal problem (for example out of coverage area). In the present manuscript it is suggested to use lower frequency range of the order of milli Hz for the operation of mobile phone for different application as mentioned above and in Table 1. The operation of mobile phone and towers at lower frequency range results in higher wavelength (higher spanning area) of the order of Giga meters. For the creation of lower frequency of the order of milli Hz it needs research and development work. In the present manuscript probable allocation of lower frequency range for the different kind of services and their spanning area is presented and discussed.

Table 1 Different type of services and their frequency and wavelength band.

Sr. No	Radio Service	Frequency Band	Maximum Wavelength (meters)	Minimum Wavelength (meters)
(a)	Radio Navigation	9 – 14 kHz	33.33 k	21.42 k
(b)	Mobile (Distress & Calling)	495 – 505 kHz	606 mk	594 mk
(c)	Broadcasting	526.5 – 1606.5 kHz	569 mk	186 mk
(d)	Maritime Mobile	2065 – 2107 kHz 2170–2178.5 kHz 2190.5 – 2194 kHz	145 mk 138 mk 136 mk	142 mk 137 mk 136 mk
(e)	Fixed, Mobile, Broadcasting Radio Astronomy	610 – 806 MHz	491 m	372 m
(f)	Mobile, Fixed, Broadcasting	890-960 MHz	337 m	312 m
(g)	Mobile satellite	942 – 960 MHz	318 m	312 m
(h)	Radio Location	1350 – 1400 MHz	222 m	214 m
(i)	Mobile, Fixed, Space operation, space research	1710 – 1930 MHz	175 m	155 m

In the above Table, m is Milli (10^{-3}), k is Kilo (10^{3}) and M is mega (10^{6}).

II. Results and discussion:

It is known that wavelength (λ) is inversely proportional to frequency (μ) and the relation equating this is (μ=c/λ) where c is velocity of light.

Generally the mobile phone, mobile towers are operated at higher frequency between 600 MHz- 39 GHz.

In the present case the operating frequency is between 600 MHz- 39 GHz therefore there is frequent mobile signal problem even though the mobile towers are placed nearby and even though there are large number of towers.

Higher is the frequency lower is the wavelength (spanning area), lower is the wavelength lower is the spanning area. Higher is the frequency lower is the wavelength higher will be the number of towers required. The each tower should be placed nearby to other towers.

Lower is the frequency higher is the wavelength, higher is the wavelength higher is the spanning area, higher is the spanning area, it requires lower number of towers at appropriate gap between each towers.

Using above relation, the spanning area (wavelength) (λ) for μ=600MHz frequency is equal to $3x10^{8}$ (meters/s)/600M Hz=0.5 meters. For frequency higher than 600 MHz the spanning area or wavelength is much lower than 0.5 meters. The mobile phone towers should be placed very nearby and the number of towers required should be in very large numbers.

If the mobile phone, mobile towers are operated at lower frequency for example at 1 milli Hz (mHz) then the spanning area or the wavelength is $3x10^{8}$ (meters/s)/1 mHz = $3x10^{11}$ meters (300 G meters)..

Table 2 Different type of services and their probable frequency band and wavelength.

Sr. No	Radio Service	Probable Frequency Band	Probable Maximum Wavelength (meters)	Probable Minimum Wavelength (meters)
(a)	Radio Navigation	1 -10 mHz	300 G	30 G
(b)	Mobile (Distress & Calling)	11-20 mHz	27.27 G	15 G
(c)	Broadcasting	21-30 mHz	14.28 G	10 G
(d)	Maritime Mobile	31-40 mHz	9.67 G	7.5 G
(e)	Fixed, Mobile, Broadcasting Radio Astronomy	41-50 mHz	7.31 G	6 G
(f)	Mobile, Fixed, Broadcasting	51-60 mHz	5.88 G	5E9
(g)	Mobile satellite	61-70 mHz	4.91 G	4.28 G
(h)	Radio Location	71-80 mHz	4.22 G	3.75 G
(i)	Mobile, Fixed, Space operation, space research	81-90 mHz	3.70 G	3.33 G

In the above Table, m is Milli (10^{-3}), G is Giga (10^{9}).

Table 2 shows the probable allocation of frequency spectrum band to different kind of services and its corresponding wavelength (spanning area). For Mobile (distress and calling) if one allocate the operation frequency band in the range 11-20 mHz. The respective maximum and minimum wavelength would be 27.27 G (meters) and 15 G (meters) (Table 2). For mobile, fixed, broadcasting if one allocate the operation frequency band in the range 51-50 mHZ. The respective maximum and minimum wavelength would be 5.88 G (meters)

and 5 G (meters). For mobile satellite if one allocate the operation frequency band in the range 61-70 mHz. The respective maximum and minimum wavelength would be 4.91 G (meters) and 4.28 G (meters). For mobile for space application if one allocate the operation frequency band in the range 81-90 mHz. The respective maximum and minimum wavelength is 3.70 G (meters) and 3.33 G (meters).

If the spanning area or the wavelength is large of the order of G meters then the number of towers required would be much lower and the each tower can be placed at larger gap distance. If operated at lower frequency or higher wavelength then there will be no mobile signal problem. For creation of frequency of the order of milli Hz (wavelength of the order of G meters) range it needs research and development work. If successful uninterrupted mobile signals can be provided to mobile users

III. Conclusions:

Generally the operation frequency band of mobile phones is 600 MHz- 39 GHz. Because of higher frequency range the wavelength (spanning area) is of the order of milli meters range. Due to lower wavelength, large number of towers place at nearby to each other is required for uninterrupted mobile phone signals. If the frequency band in the range of milli Hz is allocated to different kind of services then the wavelength would be of the order of G (10^9) meters range. Then there will be no mobile signal problem as lower number of towers are required which are placed very far to each other. The probable allocation of different frequency spectrum band and its corresponding wavelength (spanning area) to different kind of services in INDIA is presented. In this direction research and development work is needed for creation of milli Hz frequency and G meters wavelength (spanning area). If successful then there will be no mobile phone signal problem and uninterrupted mobile signal can b e provided to mobile phone users..

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