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Attending to this matter
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Sub: Ericsson Proposal on allocation of spectrum in UHF band in India

Dear Sir,

Ericsson is pleased to note that the Government of India has constituted a JTG-India under your chairmanship to develop a detailed band plan for use of UHF band in India. We believe that the decisions taken by this group will go a long way in efficient utilization of spectrum in this band.

Enclosed please find the Ericsson proposal on the allocation of spectrum in UHF band in India. Please let us know in case any clarification is needed.

Warm regards,

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Ericsson Proposal on allocation of UHF band in India

Introduction

Indian Telecom Industry is having an exponential growth for past several years, mainly due to the growth in the mobile telephony. More than 10 mn subscribers are being added every month which is highest in the world. However this growth has put additional pressure on the requirement of spectrum which is a limited resource. There is need to identify and open up new frequency bands for the mobile telephony which can be used for the future mobile growth especially in the rural areas.

UHF 700 MHz band is one of those band identified for the future growth of IMT because of the following reasons-

1. Spectrum below 1 GHz extremely useful for mobile services.
2. Better coverage characteristics ensure network deployments to cover larger areas with fewer base stations.
3. Longer range of propagation (compared to GSM 1800 MHz, 2.1 GHz or 2.5 GHz bands for 3G/BWA)
4. Reduce capital expenditure, which makes deployment in rural or high-cost regions economically viable.
    a. A Mobile Broadband network at 700 MHz would be 70% cheaper to deploy than a Mobile Broadband network at 2.1 GHz - GSMA.
    b. Two to three times as many less sites required for initial coverage at 700 MHz compared to 2.1 or 2.5 GHz
5. A target resource for rural broadband wireless access worldwide.
6. Better in-building coverage.
7. This band especially relevant for India, as majority of future growth expected from rural India.

Back Ground

Traditionally, spectrum in UHF frequency band 470 – 862 MHz has been used for analog terrestrial broadcast services. Digitization of broadcast services has made or will make portion of this frequency band available for other services in most of the countries. WRC-07 identified the 698-790 MHz band/portions of this band for IMT in several key Region 3 countries - Bangladesh, China, Korea (Rep. of), India, Japan, New Zealand, Papua New Guinea, Philippines and Singapore. WRC-07 also identified the band 698-806 MHz for IMT in Region 2, and the band 790-862 MHz for IMT in 61 Region 1 countries, with 6 other countries specifying a smaller portion of the band. Effective date of Region 1 identification is June 17, 2015 (except for countries with existing mobile allocation). WRC-07 developed WRC-11 agenda item 1.17 to consider the results of sharing studies between the mobile service and other services in the band 790-862 MHz in Regions 1 and 3, in accordance with Resolution **749 (WRC-07)**, to ensure the adequate protection of services to which the frequency band is allocated. In turn CPM11-01 created the JTG 5/6 to conduct studies in preparation for AI 1.17.

Regional scenario

Europe considerations

In Europe, Digital Dividend band is 790 – 862 MHz which is different from the US, India and most of the region 3 countries. CEPT is in the process of deliberating the band plan for 790 – 862 MHz band for IMT applications. The CEPT has adopted a Decision with a channeling plan that is currently under public consultation for approval of 2x30 MHz FDD as shown in Figure 1.

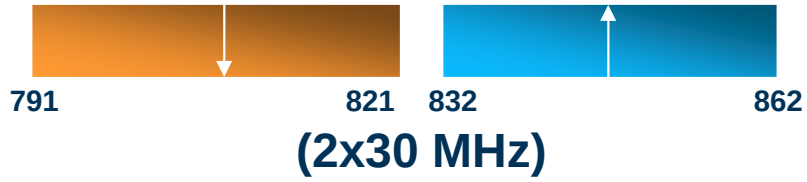

Figure 1 791 – 821 MHz D/L frequency is paired with 832 – 862 MHz U/L frequency using reversed duplex. 30 + 30 MHz FDD with 41 MHz duplex separation and 821 – 832 MHz (11 MHz) as the centre gap.

US considerations

In US, parts of the 698-806 MHz band have been auctioned for use to mobile communications (US700). However, due to legacy services and issues related to US internal reasons the arrangement have been segmented into two major bands with services related to mobile, high power broadcasting and public safety. The mobile arrangements as specified by 3GPP include four different arrangements as shown in Figure 2 (3GPP bands 12 (698-716/728-746 MHz), 13 (777-787/746-756 MHz), 14 (788-798/758-768 MHz), and 17 (704-716/734-746 MHz)).

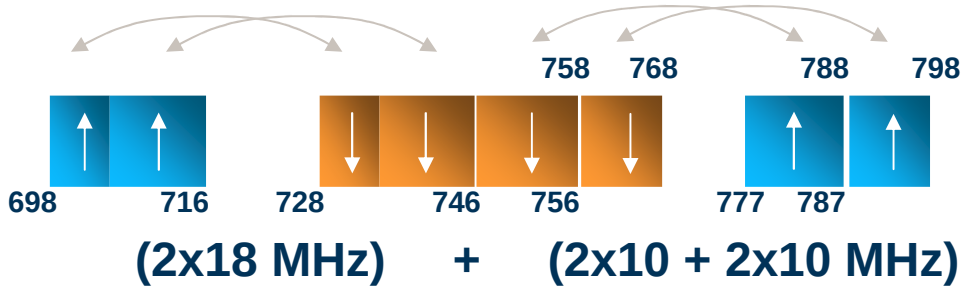

Figure 2 The four frequency bands specified in 3GPP (Bands 12, 13, 14, and 17) identified as the US700 arrangement.

The maximum use of this arrangement with specifications in 3GPP is this 2x18 MHz + 2x20 MHz. However, today the actual 3GPP implementation is limited to band 13 (primarily Verizon) and band 17 (primarily AT&T).

The US700 arrangement has some complexity and disadvantages due to the inclusion of broadcasting and public safety and division into two segments. There is a risk that other countries with the intention to follow with a “US-like arrangement” will have similar type of inclusions of services that are not mobile communications, but that are specified with somewhat different requirements that may lead to the need for “country specific” solutions, specifications, and

implementations. There is therefore a risk that a “US-like arrangement” will lead to global fragmentation of the UHF-band.

UHF spectrum scenario in India

In India, frequency band 470 – 806 MHz has been allocated to Fixed, Mobile and Broadcasting services on primary basis. Spectrum for terrestrial broadcasting services has been assigned as shown below.

UHF Band IV	470-582 MHz	14	21 to 34
UHF Band V	582-806 MHz	28	35 to 62
	806-960 MHz	---	----

*

4.21. UHF Band IV: There are 14 TV channels available in the UHF Band-IV (470 -582 MHz) with 8 MHz channel bandwidth. Doordarshan has been assigned to operate about 330 transmitters in this band. Doordarshan’s three digital TV transmitters at Kolkata, Chennai and Mumbai are also operating on an experimental basis in this band. Recently Doordarshan has started its mobile TV service in Delhi using DVB-H technology in this band at channel 26. Additionally Doordarshan has received a few more frequency assignments for the digital transmission.

*4.22. UHF Band-V: In this frequency band, there are 28 channels available with 8 MHz bandwidth in the sub-band from 582 to 806 MHz. Doordarshan has not been assigned any channel in this sub-band for analogue TV transmission. However, frequency earmarking has been made in favour of Doordarshan to operate a digital transmitter, one each for four metros. These bands (above 806 MHz) meant for TV broadcasting is shared with other users of spectrum such as fixed and mobile services for transmission of data/voice and video. For example, in UHF band V, spectrum beyond 806 MHz has been extensively assigned to cellular mobile services etc.**

*(Source – TRAI consultation paper no 9/2007)

As per the footnote IND 37 of NFAP 2008, the frequency band 585 – 806 MHz is considered for broadcasting services, IMT and BWA applications -

IND37 In the context of frequency band 585-806MHz, bearing in mind that the band is predominantly for broadcasting services which include mobile TV, requirements of IMT and Broadband Wireless Access (BWA) subject to availability of spectrum in the frequency band 698-806 MHz may be considered for coordination on case by case basis, as appropriate.

There is already a move to shift the terrestrial TV transmission from analogue to digital mode across the world. Doordarshan is also in the process of planning for up gradation of its 14 analog TV Channels transmission to digital TV transmission. The requirement for spectrum for digital terrestrial transmission is to be met within the broadcasting bands. Moreover, during the transition period from analog to digital terrestrial transmission, the spectrum requirements will increase. Existing analogue TV channel requires 8 MHz carrier for transmission where as 3-8 TV channels can be accommodated in one 8 MHz carriers in digital TV transmission. It means that with most conservative calculation, Doordarshan would require at the most 4 more 8 MHz carriers to accommodate existing 14 TV Channels for simultaneous transmission of digital TV and analogue TV during the transition period. This requirement can be met by assigning 4x 8 MHz =32 MHz of spectrum in 582 – 614 MHz band.

Requirement of spectrum for terrestrial Mobile TV broadcasting services and private digital transmission could be met in frequency band 614 – 698 MHz band.

The possibility to use the 698-806 MHz band for mobile communications provides a rare opportunity for providing cost efficient wireless solutions for high data-rates. To be able to provide mobile broadband access to contiguous spectrum blocks is a basic requirement, but in addition using frequencies below 1 GHz will also allow for cost efficient coverage by mobile systems giving the unique opportunity to provide mobile broadband to rural areas affordable to all and thus assisting in reducing the digital divide.

There is a significant opportunity that access to the 698-806 MHz band that exists and thus it is extremely important that the decisions when developing a harmonized arrangement for this band so that it is possible for the mobile industry (operators and manufacturers) to provide low cost mobile access. This is possible through harmonized and large-enough blocks of spectrum to operators that can provide necessary mobile access to end-users yet considering existing services in neighbouring bands.

It is important to develop an arrangement that is capable of providing a spectrum efficient solution, with large contiguous blocks. Large contiguous blocks would facilitate a true mobile broadband experience. It is also important to develop an arrangement that is free of constraints caused by legacy issues of previous use; however, careful considerations of continued use of other radiocommunication services in adjacent bands is needed.

Opportunities with a 2x50 MHz spectrum efficient and contiguous arrangement

The most efficient solution in the band 698-806 is a 2x50 MHz arrangement as shown in Figure 3.

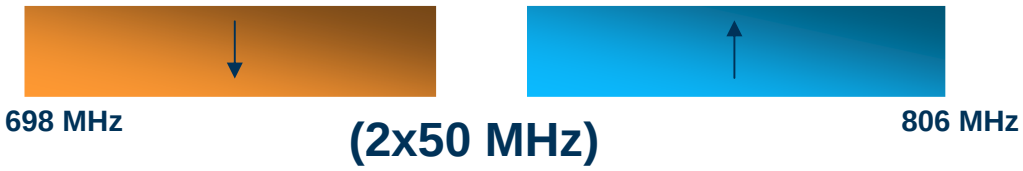

Figure 3. A 2x50 MHz arrangement between 698-806 MHz with an 8 MHz gap between downlink and uplink directions

From an implementation point of view, the sources of this contribution are proposing to do this in a "dual split duplexer arrangement" according to Figure 4 below.

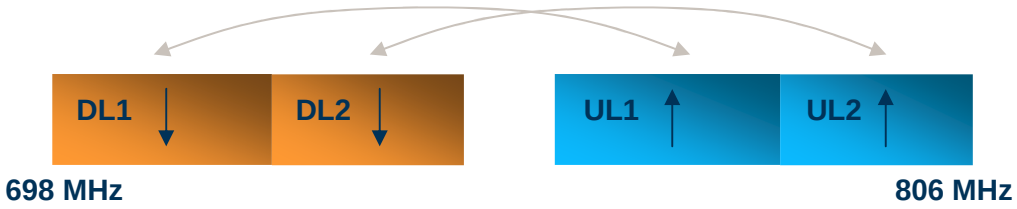

Figure 4. A solution with dual duplexers having the same duplex distance that could be of same or different sizes (DL1 paired with UL1 and DL2 paired with UL2)

There are several advantages with this arrangement. The 2x50 MHz arrangement will minimize the risk of unfavorable fragmentation of the UHF-band for mobile broadband usages. As such, this will minimize the complexity of the terminals. It utilizes the largest amount of the available 108 MHz in the 698-806 MHz band. Due to the two adjacent duplex arrangements, the gap between DL (downlink) and UL (uplink) blocks can be made smaller than the duplex gap(s) in some other FDD arrangements.

In India, the most probable service is high power broadcasting below frequency 698 MHz. To avoid and limit interference between broadcasting and mobile services it has been acknowledged that a reversed duplex arrangement is preferred. If the DL is not placed next to the 698 MHz frequency there is a need for a sufficient guardband at the 698 MHz border. In European discussions of the guard band between broadcast and mobile at 790 MHz frequency border, it is concluded in the CEPT Report 23 [1] that at least an 8 MHz guard band would be required between digital broadcast (DVB-T) and mobile UL (IMT). Therefore it is suggested to reverse the duplex transmission arrangement also for a harmonized APT arrangement.

In India, there is use of PMRTS, mobile systems, etc, in the band 806-824 MHz paired with 851-869 MHz, with uplink in the lower band. It is thus important that the proposed arrangement have an uplink close to the 806 MHz frequency border.

The proposed arrangement can handle the wider carrier bandwidths that may be of interest for operators in India. Such dual-duplexer arrangement can be implemented by current standard filter technology and no state-of-art filter design is needed. This would minimize the cost and complexity of equipments.

The 2x50 MHz arrangement would promote the whole band for mobile use in a very spectrum efficient way.

The 8 MHz gap between UL and DL blocks will put requirements on the terminals to avoid UE-UE interference. The BS-BS interference can be handled by additional filtering using conventional technologies. Related to UE-UE interference, with 10 MHz and narrower channel bandwidths the 8 MHz gap seems usable without special arrangements. About 20 dB duplexer attenuation is enough in the worst case and typical emission levels have clear margin to the specification limit. In order to deploy 15-20 MHz carrier bandwidths channels in the proposed arrangement with an 8 MHz gap, some additional measures may be needed. For example, by suitable “in-band filter arrangements” 10 MHz (or narrower) channels could be used adjacent to the 8MHz gap and for the wider bandwidths of 15 MHz or 20 MHz, they should be implemented away from this 8 MHz gap.

Proposal

This document proposes an implementation of a spectrum arrangement for the India and possible other parts of the world that could provide for harmonized and cost efficient deployments of mobile broadband systems in the band 698 – 862 MHz.

It is therefore proposed that India along with other APT countries should urgently develop a harmonized arrangement for APT countries that would consist of:

- a spectrum efficient 2x50 MHz arrangement out of the available 108 MHz in the frequency band 698-806 MHz and a small gap of 8 MHz between uplink and downlink blocks
- dual-duplexer solution
- reversed duplex arrangement for better co-existence with adjacent radiocommunication services.

This document also proposes that in India, the requirement of spectrum for terrestrial Mobile broadcasting services and DTT be met within the frequency band 582 – 698 MHz.

Mix of FDD and TDD allocation in the band must be avoided due to following reasons –

- to avoid interference between operators
- to avoid worse wide area coverage performance of TDD as compared to FDD
- to avoid guard band issues in the band as well as towards services in neighboring bands