BIF RESPONSE TO TRAI CP ON NEXT GENERATION PPDR COMMUNICATION NETWORKS

Q1: Do you consider the existing fragmented model of PPDR communication network in the country adequate to meet the present day challenges? If not, what are the deficiencies in the existing model of PPDR?

BIF Response

Minimising the impact of disasters –both man made and natural is the primary task of every civilized & developed nation. India inherently is subject to a high risk from natural and man-made disasters. In respect of natural disasters, it is vulnerable to forest fires, floods, droughts, earthquakes, tsunamis and cyclones. Additionally, the nation is also vulnerable to man-made disasters like War, terrorist attacks, and riots; Chemical, biological, radiological, and nuclear crisis besides Hijacks, train accidents, airplane crashes, shipwrecks, etc.

One of the key elements of disaster mitigation strategy is the effectiveness and robustness of the communication networks during such situations and their ability to enable rapid, effective & efficient communication from the disaster hit areas to those from where relief and rescue can be initiated. The most significant impact of natural disasters is usually the breakdown or interruption of traditional communications networks. The communication networks get entirely or partially damaged by disasters or become congested with exceptionally high levels of traffic. This adversely hampers emergency and disaster management rescue operations.

In the immediate aftermath following a disaster, the demand for communication networks increases. During that time, it is critical for rescue workers and government officials to synergise their efforts to provide relief and support to those affected. Rescue operation cannot afford to be delayed even though the responding agencies are unable to communicate with one another. In these time-sensitive and mission critical situations, even few minutes lost can mean the difference between life and death for victims in need of rescue. Therefore, it is clear that robust and efficient communications can save several lives.

Frequency and intensity of natural or man-induced disasters have also increased over the last few decades, accounting for great cost owing to life lost and destruction of infrastructure. The threats to public safety can be reduced or contained by having effective and efficient PPDR services.

Many times public safety agencies become limited in their ability to communicate and share information with other agencies. Though such agencies have communication network and technology in place to do so within their own organization, however their networks mostly are not inter-operable/compatible with the networks of other agencies. This makes the inter-department coordination a difficult and complex task. When network connections are limited/unavailable/ incompatible, effective coordination becomes further complicated, and the lack of a comprehensive communication structure can result in delays in action.

In United States of America (USA), public safety agencies have joined together to design, develop and deploy a dedicated information and communications network to support policing, criminal justice, public safety and homeland security. Inter-agency collaborative initiatives of this nature resulted in the creation of Public Protection and Disaster Relief (PPDR) communication networks.

BIF is therefore of the opinion that the existing fragmented model of PPDR communication between the agencies is highly inadequate and there is a clear need for having a dedicated, robust and risk free pan-india Disaster Management network with dedicated assigned spectrum which allows all public safety and disaster management agencies directly and indirectly connected to this area to interact with each other. The spectrum for this network should not be allowed to be shared during peaceful times and should always be fully available for use for strategic needs and purposes as defined.

Q2: In the various models described in para 2.11-2.15, in your opinion which of the model (dedicated, commercial, hybrid) will be more suitable for Indian conditions? or Is there any other alternate model which would be more suitable for Indian telecom environment? Please provide rationale for the suggested model.

BIF Response

There are several reasons why many counties across the world are moving towards adoption of commercial or hybrid model solutions to attain maximum benefit from the spectrum resource.

a) The Government has statutory obligations for the provision of national mission critical

communications (especially for PPDR). Dedicated spectrum could be required for such services. BIF is of the opinion that exclusive dedicated spectrum be earmarked in the country for mission critical services so as to build dedicated mission critical networks, While making such choices the trade-offs like loss accruing from non-commercial deployment of valuable spectrum viz-à-viz; socio-economic benefits from effective PPDR operation needs to be deliberated to arrive at the right balance.

b) Dedicated network if deployed exclusively by PPDR agencies will require huge capital investment. Further technological advancements will require periodic investments in future. It is appropriate and better to discuss and adopt affirm futuristic approach which may not become economic constraint to PPDR agencies as well as can yield commercial value.

In a shared commercial network, mission critical users can act only as clients or as priority users with others sharing the network. Such PPDR networks can be built, owned and operated by government-owned-and- operated networks efficiently. Re-use of the available spectrum is an inherent part of the commercial offering.

Commercial or hybrid model as discussed above can be built by inviting bids from the existing TSPs or it can be given on nomination basis to State owned TSPs viz. BSNL and MTNL since these PSUs have vast infrastructure and presence across the length and breadth of the nation which could help in minimize time to market and reduce overall deployment, operation and maintenance cost by leveraging the existing infrastructure and assets. Both, TSP and various PPDR agencies may enter into stringent SLAs for operation and maintenance of such networks. The optical fiber network of Bharat Net can play a vital role in national broadband PPDR network. In United States, a government authority (FirstNet) was created by Congress to build, operate and maintain the first high-speed, nationwide wireless broadband network dedicated to public safety which will provide a single interoperable platform for emergency and daily public safety communications. This type of a model could also be deliberated upon.

Few countries have adopted MNO-MVNO model to leverage MNO`s network to fulfill capacity and coverage (specially indoors/rural) requirements of Public safety networks while keeping the budget under control. The goal[16] of MVNO model in PPDR communication is to leverage the existing commercial mobile broadband radio infrastructure to create and operate dedicated services for the critical users. Dedicated services can deliver added value including better availability, security, quality control and better customer care than can be delivered by the

[15] http://www.firstnet.gov/about

[16] Book-Mobile Broadband Communications for Public Safety: The Road Ahead Through LTE technology **By Ramon Ferrus, Oriol Sallent**

commercial MNO individually. This model is already in place in Europe (Belgium). ASTRID, a TETRA network operator for Belgium[17] emergency and security services, launched Blue Light Mobile, a mobile broadband data service that uses three Belgian commercial networks. Blue Light Mobile enables the emergency and security services in Belgium to use the commercial 3G networks. A single subscriber identity module (SIM) card gives priority access within a secure environment to three Belgian operators, as well as 11 operators in four neighbouring countries. With Blue Light Mobile, ASTRID becomes a mobile virtual network operator (MVNO), supplying services via third-party networks. ASTRID first announced the plan in 2012. Several other TETRA operators, including Airwave in the United Kingdom, have announced similar MVNO-based broadband services since then. Such arrangements can also be explored in the regime of UL (VNO) licensing.

BIF recommends either hybrid model or the MNO-MVNO shared model for reasons mentioned above

Q3: Should PSUs be earmarked for providing nationwide broadband PPDR communication network? Please justify your answer.

BIF Response

Though entrusting Nationwide Broadband PPDR communication network to PSUs may be an option, BIF feels it may not be a desirable one keeping in view the track record of commercial service itself when you compare the PSUs with that of its competitors

Instead of entrusting to any of the commercial operators-PSU or Private, BIF feels it may be worthwhile to hand it over to a third party or a neutral agency specialized in disaster management and co-ordination like NDMA, who could borrow multiple resources from a number of operators in different regions and have both technological, geographical and network diversity to mitigate network related risks.

Q4: Will it be technically feasible and beneficial to permit PPDR trunking service roaming on public telecom networks? If yes, what challenges do you foresee in implementation of such an arrangement? Please justify your answer.

BIF Response

Given the fact that technology advancements have taken place which permit new features including Trunking service with regular roaming as in cellular networks using commercial technologies viz. LTE in the commercial spectrum bands, hence such services are now technically feasible.

By leveraging the strengths of LTE and adding a comprehensive set of features needed for public safety communications, Mission Critical Push to Talk brings technical unity to commercial and public safety PTT communications. 3GPP has defined requirements for Mission Critical Push to Talk (MCPTT) application in LTE Release 13. The functionality from TETRA and P25 standards has also been included in LTE Release13. Through its Technnical Specifications (TS) document 3GPP TS24.380 version 13.0.2 Release 13 and ETSI TS 124 380 V13.0.2 (2016-05) on Mission Critical Push To Talk (MCPTT) media plan; protocol specification, 3GPP and ETSI has specified the media plane control protocols and interactions with the media needed to support Mission Critical Push To Talk (MCPTT).

There are various equipment vendors who are providing LTE technology today that are also able to provide critical enterprise communication services such as broadband trunking, video surveillance, data acquisition, broadband data access, emergency communications, and other broadband services on a single network. These technological innovations has enabled and made it feasible for PPDR trunking service to permit roaming on public network, Trunking service on common carrier smartphone, Interoperation between LTE and TETRA network and interconnection to 2G/3G/PSTN /IP PBX through gateway.

It is possible that a captive PPDR user in addition to using its own network can also use public networks as well, thus making much better utilization of resources. Captive PPDR networks can be integrated with public networks so when users move out of the private area to the public area, the basic trunking service (unicast) is continuously available

through the public sites. This feature can extend the PTT service nationwide over the public mobile network and is therefore extremely beneficial for the trunk mobile user. Due to the VPN channel between the PTT server and handset in the public network being already established, the encrypted data is transmitted through the public network. Therefore, issue of security of the PTT service over the public network is also taken care of.

Q5.Can frequency bands be identified exclusively for public protection and disaster relief? What are the candidate bands for PPDR operations in India?

BIF Response

PPDR agencies in India are issued license by DoT under CMRTS category, accordingly spectrum is allocated by WPC Wing of DoT in the 300 MHz or 400 MHz or 800 MHz bands as mentioned in the Table 2.4 & 2.5 below. These frequencies have adjacent channel spacing of 12.5 KHz in 300

MHz/400 MHz band and 25 KHz in 800 MHz frequency bands. Duplex spacing in 300/400 MHz band is 10 MHz and same for 800 MHz is 45 MHz. Allocation of the frequencies is made on case to case basis and depending on technology used and availability of frequency spots.

Table 2.4: Frequency band: 300 MHz or 400 MHz

Frequency band (MHz)	**Block size of spectrum allocated**	**Uses**	**IND Footnote**
338-340, 348-350	2x2 MHz	Mobile Trunk Radio for Captive networks. PMRTS on case to case basis.	IND 27

336-338, 346-348	2x2 MHz	PMRTS	
351-356, 361-366	2x5 MHz	Digital CMRTS	IND 28
356-358, 366-368	2x2 MHz		
380-389.9, 390-399.9	2x9.9 MHz	Digital PMRTS	IND 29
410-430	20 MHz		

Table 2.5: Frequency band: 800 MHz

Frequency band (MHz)	**Block size of spectrum allocated**	**Uses**	**IND Footnote**
806-811, 851-856	2x5 MHz	Mobile Trunk Radio for captive networks.PMRTS on case to case basis.	IND 40
811-814, 856-859	2x3 MHz	Digital PMRTS	IND 41
814-819, 859-864	2x5 MHz	PMRTS	IND 42
819-824, 864-869	2x5 MHz	PMRTS	IND 43

Spectrum allocation is the most important component to adopt LTE as the future technology of choice for broadband PPDR in India. An appropriate spectrum allocation can help provide greater capacity for overloaded network and dynamic reconfiguration capability to better manage load and connectivity.

A. International identification and allocation of broadband PPDR bands

The Resolution 646 (WRC-03)[20] states that for the purposes of achieving regionally harmonized frequency bands/ranges for advanced public protection and disaster relief solutions, the following identified frequency bands/ranges or parts thereof maybe considered when undertaking their national planning: 406.1-430 MHz, 440-470 MHz, 806-824/851-869 MHz, 4940-4990 MHz and 5850-5925 MHz. Additionally, it is noted in the Resolution 646 (rev.WRC-12) [21] that some countries in Region 3 (Region 3 includes India too) have also identified the bands 380-400MHz and 746-806MHz for PPDR applications.

As stated in the resolution 646 (WRC-03), the public protection and disaster relief applications at that time were mostly narrow-band supporting voice and low data-rate applications, typically in channel bandwidths of 25 kHz or less; many future applications will be wideband (indicative data

rates in the order to 384-500 kbit/s) and/or broadband (indicative data rates in the order of 1-100 Mbit/s) with channel bandwidths depending on the use of spectrally efficient technologies. In times of disasters, if most terrestrial-based networks are destroyed or impaired, amateur, satellite and other non-ground-based networks may be available to provide communication services to assist in public protection and disaster relief efforts.

According to ITU, the benefits of spectrum harmonization[22], even though restricted to a regional rather than a global level, include increased potential for interoperability in PPDR activities. It is also expected to create a broader manufacturing base, leading to economies of scale and cheaper, more readily available equipment. This, in turn, will give PPDR agencies better access to enhanced system capabilities built on uniform types of equipment.

Rec. ITU-R M.1826 [23] recommended Regions 2 and 3 to consider the band 4940-4990 MHz, or parts thereof, when undertaking their national planning for broadband PPDR applications for the purposes of achieving harmonized frequency bands/ranges for PPDR.

WRC-12 approved agenda 1.3 for WRC-15 with the objective to update Resolution 646 for Broadband PPDR systems:

- *to review and revise Resolution 646 (Rev. WRC-12) for broadband public protection and disaster relief (PPDR), in accordance with Resolution 648 (WRC-12)*
- Resolution 648 (WRC-12): [24] Studies to support broadband public protection and disaster relief

The Resolution 646 (REV. WRC-15) [25] encourages administrations to consider parts of the frequency range 694-894 MHz, when undertaking their national planning for their PPDR applications, in particular broadband, in order to achieve harmonization. It further encourages

[22] www.cept.org/files/9421/Resolution%20646%20(Rev.%20WRC-12).docx

[23] https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1826-0-200710-I!!PDF-E.pdf

[24] http://www.cept.org/files/9421/ITU-R%20Resolution%20648.pdf

[25] https://www.itu.int/en/ITU-R/information/Documents/Res.646(WRC-15).pdf

administrations to also consider parts of the following regionally harmonized frequency ranges, for their PPDR applications: –

In Region 1: 380-470 MHz

In Region 3: 406.1-430 MHz, 440-470 MHz and 4 940-4 990 MHz

The other frequency previously indicated as harmonized for PPDR in the Asia-Pacific Region remain in the agreement.

Table 3.1 gives the summary of recommendations given by ITU so far for Region 3 for PPDR.

Table 3.1: Harmonized band for PPDR recommended by ITU for Region 3

Source	***Harmonized band for PPDR***	***Technology***
Resolution 646 WRC 03 , rev.WRC 12	406.1-430 MHz 440-470 MHz 806-824/851-869 MHz 4940-4990 MHz 5850-5925 MHz **For Region 3**	Narrowband
ITU-R recommendation M.1826	4940-4990 MHz **For Region3**	Broadband
Resolution 646 rev. WRC 15	694-894 MHz **Globally**	Broadband

In 2012, the 13th Meeting of the South Asian Telecommunications Regulator's Council adopted SATRC[26] guidelines on harmonized use of frequency bands for public protection and disaster relief (PPDR). The guidelines recommended the members to adopt the following harmonised frequency bands for PPDR applications:

Narrowband: 406.1-430 MHz and 440-470 MHz

Wideband: 806-824/851-869 MHz

Broadband: 4940-4990 MHz (to be reviewed in future)

[26] http://www.apt.int/SATRC-SAPIII

April 2017, Asia-Pacific Telecommunity (APT) issued a report [27] on “Harmonization of frequency ranges for use by wireless PPDR applications in Asia-Pacific region” suggesting APT administrations to consider using parts of the following frequency ranges for PPDR when undertaking their national planning for PPDR operations:

694-894 MHz, as described in table 3.2

406.1-430 MHz and 440-470 MHz, as described in table 3.3

4940-4990 MHz, as described in table 3.4

Table 3.2: Arrangements in parts of frequency range 694-894 MHz

Regional Organisation	**Frequency Arrangement Number**	**Paired arrangements**			**Usage type**	**Example of frequency arrangement**
		Mobile station transmitter (MHz)	**Base station transmitter (MHz)**	**Duplex separation (MHz)**		
APT	G3-1-1	703-748	758-803	55	Broadband	Any one or two 5+5 MHz channels or any one 10+10 MHz channel can be used for Broadband PS LTE system
APT	G3-1-2	806-824	851-869	45	Narrowband -25kHz	In this arrangement the band can be used for various narrowband and wideband fixed and mobile systems
APT	G3-1-3	806-824	851-869	45	Narrowband - 25kH; 12.5 kHz & 6.25 kHz	806-811/851-856MHz (channel bandwidth 25 kHz) 811-813.5/856-858.5MHz (the channel bandwidth 12.5 kHz) 813.5-816/858-861MHz (the channel bandwidth 6.25 kHz)

APT	G3-1-4	806-824	851-869	45	Broadband & Narrowband	The sub-band 806-813/ 851-858 MHz is used for narrowband systems with a channel bandwidth of 25 kHz; the sub-band 814-824/ 859-869 MHz is used for broadband (LTE) systems using carrier bandwidths of 5 to 10

27 http://www.aptsec.org/sites/default/files/Upload-files/AWG/APT-AWG-REP-73_APT_Report_PPDR_Spectrum_Harmonization.docx

						MHz. The sub-band 813-814/ 858-859 MHz acts as guard band between narrowband and broadband systems.
APT	G3-1-5	806-824	851-869	45	Broadband & Narrowband	In this frequency arrangement shows channel arrangement in the band for a wider broadband tuning range.
APT	G3-1-6	806-834	851-879	45	Broadband & Narrowband	The sub-band 806-823/ 851-868 MHz is used for narrowband systems with a channel bandwidth of 25 kHz; the sub-band 824-834/ 859-879 MHz is used for broadband PPDR (LTE) systems using carrier bandwidths of 5 or 10 MHz. The sub-band 821/823-824/ 866/868-869 MHz acts as guard band between narrowband and broadband systems or is used for legacy SRD devices such as RFID

Table 3.3: Arrangements in parts of frequency range 406.1-430 & 440-470 MHz

Regional Organ-isation	Frequency Arrangement Number	Paired arrangements			Usage type
		Mobile station transmitter (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
APT	R3-2-1	414.0125-414.1000	414.0125-414.1000	N/A	Narrowband
APT	R3-2-2	406.1125-411.5875	414.1125-419.5875	8	Narrowband
APT	R3-2-3	410-420	420-430	10	Narrowband
APT	R3-2-4	408.6375–410.5375	418.0875–420.0000	9.45	Narrowband 12.5 kHz
APT	R3-2-5	420.0000–430.0000	-	-	-
APT	R3-2-6	457.50625 – 459.9875	467.50625–469.9875	10 MHz	Narrowband 12.5 kHz

[20] https://www.itu.int/dms_pub/itu-r/oth/0A/0E/R0A0E00006A0001MSWE.doc

[21] www.cept.org/files/9421/Resolution%20646%20(Rev.%20WRC-12).docx

Table 3.4: Arrangements in parts of frequency range 4940-4990 MHz

Regional Organ-isation	Frequency Arrangement Number	Paired arrangements				Example of frequency arrangement
		Mobile station transmitter (MHz)	Base station transmitte r (MHz)	Duplex separati on (MHz)	Usage type	
APT	R3-3-1	4940-4990	4940-4990	N/A	Broadband	Channel width of 5MHz, 10Mhz, 20MHz

UHF band spectrum is essential to fulfill the coverage requirements. Being a lower frequency band, it has better propagation characteristics. Lower frequency band provides best range and penetration. Normally frequencies >1GHz are needed for capacity. Experience from the early adopters across the globe suggest that a mixture of lower frequencies for wide area coverage together with higher frequencies for hot-spots of activity might provide a more balanced portfolio for PPDR users.

Q6: If wideband/broadband PPDR is to be implemented in India, what quantum of spectrum will be needed for such solution for PPDR?

BIF Response

A. PPDR Spectrum requirement calculation

In order to evaluate the amount of required spectrum and to plan efficient use of spectrum, assessments are usually made by PPDR agencies and organizations on the operational and tactical requirements of PPDR operations in the different scenarios.

ITU in its report ITU-R M.2377-0[31] on "Radio-communication objectives and requirement for Public Protection and Disaster Relief" provides broad objectives and requirements of PPDR applications, ranging from narrowband through wideband and broadband. Report ITU-R M.2291[32] provides the capabilities of IMT technologies to meet the requirements of applications supporting broadband PPDR operations.

Many studies have substantiated the spectrum needs for mobile broadband PPDR

applications in different countries across the world. The United Arab Emirates' telecommunication regulatory authority (TRA) also conducted a PPDR spectrum study[33] that concluded that using LTE technology together with the potential availability of higher power user equipment, PPDR use could in theory be supported in as little as 2x5 MHz of spectrum, an allowance of 2x10 MHz would allow for reasonable future growth. However, this has to be in the same band and a mixture of lower frequencies (e.g. 700 MHz or 800 MHz) for wide area coverage together with higher frequencies (e.g. 2300 or 2600 MHz) for hot-spots of activity might provide a more balanced portfolio for PPDR users.

According to ECC Report 199[34] titled User requirements and spectrum needs for future European broadband PPDR systems,[35]

- At least 10 MHz is required for the terrestrial network uplink. With 10 MHz made available, many but not all of the scenarios can be accommodated.
- At least 10 MHz will also be required for the terrestrial network downlink. With 10 MHz made available, most of the scenarios which utilized individual calls can be accommodated. All scenarios can be accommodated in a 10 MHz downlink where group calls are optimally used.

A study released in June 2013 [36] considered eight Asian countries, namely, Australia, China, Indonesia, Malaysia, New Zealand, Singapore, South Korea and Thailand. The study supports that a minimum of 10 MHz for broadband PPDR is required on the basis of the opportunity cost argument.

Despite the differences across some of these estimates, reserving a minimum of 2x10 MHz for mobile broadband PPDR is becoming the prevailing option, though excluding additional

[33] http://www.lstelcom.com/fileadmin/content/marketing/spectrum/LS_Spectrum_2014-1_CriticalCommunications_en.pdf

[34] http://www.erodocdb.dk/docs/doc98/official/pdf/ECCRep199.pdf

[35] This analysis does not incorporate the demands for voice call, air to ground (except some limited uplink included in some scenarios), or Direct Mode Operation. These will require additional or separate spectrum.

[36] http://trpc.biz/wp-content/uploads/PPDR-_Report_16-May-2013_FINAL-2.pdf

country allocations to meet specific needs.

For broadband PPDR, South Korea and United States have allocated 2x10 MHz in 700 MHz band. Thailand has allocated 2x10 MHz in 800 MHz. UAE has allocated 2x10 MHz (for PPDR application) and 5 MHz (for direct mode operation) in 700 MHz band. Australia has allocated 10 MHz in 800 MHz band and 50 MHz in 4.9 GHz band. France has allocated 2x5 MHz and 2x3 MHz in 700 MHz band.

It is pertinent to mention that India has so far not allocated a dedicated spectrum for broadband PPDR. In general, lower frequencies give better performance, so the lowest common commercial frequency, around the 700 MHz/800 MHz band, is most suitable.

There are few potential 3GPP bands[37] those could also be considered for adoption. One of them is 450 MHz existing 3GPP Band 31 and potential new 3GPP Band 68. There can be a common pool of spectrum for National Disaster Management planning, consider globally harmonized LTE bands (B14/26/27/28/31/68) for Disaster Management (DM) broadband services on PAN India basis. During severe incidents all agencies can switch to DM frequencies.

There is a need to clearly identify the bands as well as the quantum of spectrum for broadband PPDR communication keeping in mind the global ecosystem development for PPDR communication in those bands.

Q7.What is the cost and benefits tradeoff envisaged for public protection and disaster relief viz-a-viz commercial value of spectrum?

BIF Response

In order to make better utilization of spectrum resource and also unlock its economic value to certain extent, many countries across the world are moving towards adoption of commercial based or hybrid solutions to attain maximum benefit from the spectrum resource.

[37] The detail of the 3GPP LTE bands are given in Annexure II

[31] http://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2377-2015-PDF-E.pdf

[32] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2291-2013-PDF-E.pdf

The Government has statutory obligations for the provision of national mission critical communications (especially for PPDR). Dedicated spectrum could be required for such services. Therefore, one of the key issues that need to be deliberated is whether there should be exclusive dedicated spectrum earmarked in the country for mission critical services. Choosing to build dedicated mission critical networks, dedicated spectrum may be necessary – which is an additional financial burden, if the opportunity costs are factored into.

While making such choices the trade-offs like loss accruing from non-commercial deployment of valuable spectrum viz-à-viz; socio-economic benefits from effective PPDR operation needs to be deliberated to arrive at the right balance.

a) The market value of the spectrum and economic circumstances may force a rethink of the affordability of a dedicated network over the next few years.
b) Dedicated network if deployed exclusively by PPDR agencies will require huge capital investment. Further technological advancements will require periodic investments in future.
c) It is appropriate and better to discuss and adopt affirm futuristic approach which may not become economic constraint to PPDR agencies as well as can yield commercial value.
d) Re-use of the available spectrum is an inherent part of the commercial offering.
e) Commercial or hybrid model as discussed above can be built by inviting bids from the existing TSPs or it can be given on nomination basis to State owned TSPs viz. BSNL and MTNL since these PSUs have vast infrastructure and presence across the length and breadth of the nation which could help in minimize time to market and reduce overall deployment, operation and maintenance cost by leveraging the existing infrastructure and assets.
f) Few countries have adopted MNO-MVNO model to leverage MNO`s network to fulfill capacity and coverage (specially indoors/rural) requirements of Public safety networks while keeping the budget under control. The goal[16] of MVNO model in PPDR communication is to leverage the existing commercial mobile broadband radio infrastructure to create and operate dedicated services for the critical users.
g) Dedicated services can deliver added value including better availability, security, quality control and better customer care than can be delivered by the commercial MNO individually. This model is already in place in Europe (Belgium). ASTRID, a TETRA

network operator for Belgium[17] emergency and security services, launched Blue Light Mobile, a mobile broadband data service that uses three Belgian commercial networks. Blue Light Mobile enables the emergency and security services in Belgium to use the commercial 3G networks. A single subscriber identity module (SIM) card gives priority access within a secure environment to three Belgian operators, as well as 11 operators in four neighbouring countries. With Blue Light Mobile, ASTRID becomes a mobile virtual network operator (MVNO), supplying services via third-party networks. ASTRID first announced the plan in 2012. Several other TETRA operators, including Airwave in the United Kingdom, have announced similar MVNO-based broadband services since then. Such arrangements can also be explored in the regime of UL (VNO) licensing.

Q8: **Do you suggest any other workable option that can be adopted?**

BIF Response

All the suggested options are mentioned above

Q9. **Please give your comments on any related matter not covered in this consultation paper.**

BIF Response : No Comments

15 http://www.firstnet.gov/about

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